PHILIPS

Devices for optoelectronics

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Data handbook

PHILIPS

Electronic components and materials

Semiconductors

Part 8 September 1983

Photosensitive diodes and transistors

Light emitting diodes

Displays

Photocouplers

Infrared sensitive devices

Photoconductive devices

SEMICONDUCTORS

PART 8 — SEPTEMBER 1983

DEVICES FOR OPTOELECTRONICS

DATA HANDBOOK SYSTEM

Our Data Handbook System is a comprehensive source of information on electronic components, subassemblies and materials; it is made up of four series of handbooks each comprising several parts.

ELECTRON TUBES	BLUE
SEMICONDUCTORS	RED
INTEGRATED CIRCUITS	PURPLE
COMPONENTS AND MATERIALS	GREEN

The several parts contain all pertinent data available at the time of publication, and each is revised and reissued periodically.

Where ratings or specifications differ from those published in the preceding edition they are pointed out by arrows. Where application information is given it is advisory and does not form part of the product specification.

If you need confirmation that the published data about any of our products are the latest available, please contact our representative. He is at your service and will be glad to answer your inquiries.

ELECTRON TUBES (BLUE SERIES)

The blue series of data handbooks is comprised of the following parts:

SEMICONDUCTORS (RED SERIES)

The red series of data handbooks is comprised of the following parts:

S1 **Diodes**
Small-signal germanium diodes, small-signal silicon diodes, voltage regulator diodes($<$ 1,5 W), voltage reference diodes, tuner diodes, rectifier diodes

S2 **Power diodes, thyristors, triacs**
Rectifier diodes, voltage regulator diodes ($>$ 1,5 W), rectifier stacks, thyristors, triacs

S3 **Small-signal transistors**

S4 **Low-frequency power transistors and hybrid IC modules**

S5 **Field-effect transistors**

S6 **R.F. power transistors and modules**

S7 **Microminiature semiconductors for hybrid circuits**

S8 **Devices for optoelectronics**
Photosensitive diodes and transistors, light-emitting diodes, displays, photocouplers, infrared sensitive devices, photoconductive devices.

S9 Taken into handbook T11 of the blue series

S10 **Wideband transistors and wideband hybrid IC modules**

INTEGRATED CIRCUITS (PURPLE SERIES)

The purple series of data handbooks is comprised of the following parts:

IC1 **Bipolar ICs for radio and audio equipment**

IC2 **Bipolar ICs for video equipment**

IC3 **ICs for digital systems in radio, audio and video equipment**

IC4 **Digital integrated circuits**
CMOS HE4000B family

IC5 **Digital integrated circuits — ECL**
ECL10 000 (GX family), ECL100 000 (HX family), dedicated designs

IC6 **Professional analogue integrated circuits**

IC7 **Signetics bipolar memories**

IC8 **Signetics analogue circuits**

IC9 **Signetics TTL logic**

IC10 **Signetics Integrated Fuse Logic (IFL)**

IC11 **Microprocessors, microcomputers and peripheral circuitry**

COMPONENTS AND MATERIALS (GREEN SERIES)

The green series of data handbooks is comprised of the following parts:

C1 **Assemblies for industrial use**
PLC modules, PC20 modules, HNIL FZ/30 series, NORbits 60-, 61-, 90-series, input devices, hybrid ICs

C2 **Television tuners, video modulators, surface acoustic wave filters**

C3 **Loudspeakers**

C4 **Ferroxcube potcores, square cores and cross cores**

C5 **Ferroxcube for power, audio/video and accelerators**

C6 **Electric motors and accessories**
Permanent magnet synchronous motors, stepping motors, direct current motors

C7 **Variable capacitors**

C8 **Variable mains transformers**

C9 **Piezoelectric quartz devices**
Quartz crystal units, temperature compensated crystal oscillators, compact integrated oscillators, quartz crystal cuts for temperature measurements

C10 **Connectors**

C11 **Non-linear resistors**
Voltage dependent resistors (VDR), light dependent resistors (LDR), negative temperature coefficient thermistors (NTC), positive temperature coefficient thermistors (PTC)

C12 **Variable resistors and test switches**

C13 **Fixed resistors**

C14 **Electrolytic and solid capacitors**

C15 **Film capacitors, ceramic capacitors**

C16 **Piezoelectric ceramics, permanent magnet materials**

INDEX OF TYPE NUMBERS

Data Handbooks S1 to S10

The inclusion of a type number in this publication does not necessarily imply its availability.

type no.	book	section	type no.	book	section	type no.	book	section
AA119	S1	GD	BAS19	S7/S1	Mm/SD	BB109G	S1	T
AAZ15	S1	GD	BAS20	S7/S1	Mm/SD	BB112	S1	T
AAZ17	S1	GD	BAS21	S7/S1	Mm/SD	BB119	S1	T
AAZ18	S1	GD	BAT17	S7/S1	Mm/T	BB130	S1	T
BA220	S1	SD	BAT18	S7/S1	Mm/T	BB204B	S1	T
BA221	S1	SD	BAT81	S1	T	BB204G	S1	T
BA223	S1	T	BAT82	S1	T	BB212	S1	T
BA243	S1	T	BAT83	S1	T	BB405B	S1	T
BA244	S1	T	BAT85	S1	T	BB405G	S1	T
BA280	S1	T	BAV10	S1	SD	BB417	S1	T
BA314	S1	Vrg	BAV18	S1	SD	BB809	S1	T
BA315	S1	Vrg	BAV19	S1	SD	BB909A	S1	T
BA316	S1	SD	BAV20	S1	SD	BB909B	S1	T
BA317	S1	SD	BAV21	S1	SD	BBY31	S7/S1	Mm/T
BA318	S1	SD	BAV45	S1	Sp	BBY40	S7/S1	Mm/T
BA379	S1	T	BAV70	S7/S1	Mm/SD	BC107	S3	Sm
BA423	S1	T	BAV99	S7/S1	Mm/SD	BC108	S3	Sm
BA481	S1	T	BAW56	S7/S1	Mm/SD	BC109	S3	Sm
BA482	S1	T	BAW62	S1	SD	BC146	S3	Sm
BA483	S1	T	BAX12	S1	SD	BC177	S3	Sm
BA484	S1	T	BAX12A	S1	SD	BC178	S3	Sm
BAS11	S1	SD	BAX14	S1	SD	BC179	S3	Sm
BAS16	S7/S1	Mm/SD	BAX18	S1	SD	BC200	S3	Sm
BAS17	S7/S1	Mm/Vrg	BB105B	S1	T	BC264A	S5	FET
BAS18	S1	SD	BB105G	S1	T	BC264B	S5	FET

FET = Field-effect transistors
GD = Germanium diodes
Mm = Microminiature semiconductors for hybrid circuits
SD = Small-signal diodes
Sm = Small-signal transistors
Sp = Special diodes
T = Tuner diodes
Vrg = Voltage regulator diodes

type no.	book	section	type no.	book	section	type no.	book	section
BC264C	S5	FET	BC868	S7	Mm	BCY71	S3	Sm
BC264D	S5	FET	BC869	S7	Mm	BCY72	S3	Sm
BC327;A	S3	Sm	BCF29;R	S7	Mm	BCY78	S3	Sm
BC328	S3	Sm	BCF30;R	S7	Mm	BCY79	S3	Sm
BC337;A	S3	Sm	BCF32;R	S7	Mm	BCY87	S3	Sm
BC338	S3	Sm	BCF33;R	S7	Mm	BCY88	S3	Sm
BC368	S3	Sm	BCF70;R	S7	Mm	BCY89	S3	Sm
BC369	S3	Sm	BCF81;R	S7	Mm	BD131	S4	P
BC375	S3	Sm	BCV71;R	S7	Mm	BD132	S4	P
BC376	S3	Sm	BCV72;R	S7	Mm	BD135	S4	P
BC546	S3	Sm	BCW29;R	S7	Mm	BD136	S4	P
BC547	S3	Sm	BCW30;R	S7	Mm	BD137	S4	P
BC548	S3	Sm	BCW31;R	S7	Mm	BD138	S4	P
BC549	S3	Sm	BCW32;R	S7	Mm	BD139	S4	P
BC550	S3	Sm	BCW33;R	S7	Mm	BD140	S4	P
BC556	S3	Sm	BCW60*	S7	Mm	BD201	S4	P
BC557	S3	Sm	BCW61*	S7	Mm	BD202	S4	P
BC558	S3	Sm	BCW69;R	S7	Mm	BD203	S4	P
BC559	S3	Sm	BCW70;R	S7	Mm	BD204	S4	P
BC560	S3	Sm	BCW71;R	S7	Mm	BD226	S4	P
BC635	S3	Sm	BCW72;R	S7	Mm	BD227	S4	P
BC636	S3	Sm	BCW81;R	S7	Mm	BD228	S4	P
BC637	S3	Sm	BCW89;R	S7	Mm	BD229	S4	P
BC638	S3	Sm	BCX17;R	S7	Mm	BD230	S4	P
BC639	S3	Sm	BCX18;R	S7	Mm	BD231	S4	P
BC640	S3	Sm	BCX19;R	S7	Mm	BD233	S4	P
BC807	S7	Mm	BCX20;R	S7	Mm	BD234	S4	P
BC808	S7	Mm	BCX51	S7	Mm	BD235	S4	P
BC817	S7	Mm	BCX52	S7	Mm	BD236	S4	P
BC818	S7	Mm	BCX53	S7	Mm	BD237	S4	P
BC846	S7	Mm	BCX54	S7	Mm	BD238	S4	P
BC847	S7	Mm	BCX55	S7	Mm	BD291	S4	P
BC848	S7	Mm	BCX56	S7	Mm	BD292	S4	P
BC849	S7	Mm	BCX70*	S7	Mm	BD293	S4	P
BC850	S7	Mm	BCX71*	S7	Mm	BD294	S4	P
BC856	S7	Mm	BCY56	S3	Sm	BD295	S4	P
BC857	S7	Mm	BCY57	S3	Sm	BD296	S4	P
BC858	S7	Mm	BCY58	S3	Sm	BD329	S4	P
BC859	S7	Mm	BCY59	S3	Sm	BD330	S4	P
BC860	S7	Mm	BCY70	S3	Sm	BD331	S4	P

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RFP = R.F. power transistors and modules
Sm = Small-signal transistors
WBT = Wideband hybrid IC transistors

RFP = R.F. power transistors and modules
RT = Tripler
Sm = Small-signal transistors
ThM = Thyristor Modules
WBM = Wideband hybrid IC modules
WBT = Wideband hybrid IC transistors

type no.	book	section	type no.	book	section	type no.	book	section
BLY88A	S6	RFP	BSR30	S7	Mm	BSV78	S5	FET
BLY88C	S6	RFP	BSR31	S7	Mm	BSV79	S5	FET
BLY89A	S6	RFP	BSR32	S7	Mm	BSV80	S5	FET
BLY89C	S6	RFP	BSR33	S7	Mm	BSV81	S5	FET
BLY90	S6	RFP	BSR40	S7	Mm	BSW66A	S3	Sm
BLY91A	S6	RFP	BSR41	S7	Mm	BSW67A	S3	Sm
BLY91C	S6	RFP	BSR42	S7	Mm	BSW68A	S3	Sm
BLY92A	S6	RFP	BSR43	S7	Mm	BSX19	S3	Sm
BLY92C	S6	RFP	BSR50	S3	Sm	BSX20	S3	Sm
BLY93A	S6	RFP	BSR51	S3	Sm	BSX45	S3	Sm
BLY93C	S6	RFP	BSR52	S3	Sm	BSX46	S3	Sm
BLY94	S6	RFP	BSR56	S7	Mm	BSX47	S3	Sm
BLY97	S6	RFP	BSR57	S7	Mm	BSX59	S3	Sm
BPF10	S8	PDT	BSR58	S7	Mm	BSX60	S3	Sm
BPF24	S8	PDT	BSR60	S3	Sm	BSX61	S3	Sm
BPW22A	S8	PDT	BSR61	S3	Sm	BSY95A	S3	Sm
BPW50	S8	PDT	BSR62	S3	Sm	BT136*	S2	Tri
BPX25	S8	PDT	BSS38	S3	Sm	BT137*	S2	Tri
BPX29	S8	PDT	BSS50	S3	Sm	BT138*	S2	Tri
BPX40	S8	PDT	BSS51	S3	Sm	BT139*	S2	Tri
BPX41	S8	PDT	BSS52	S3	Sm	BT149*	S2	Th
BPX42	S8	PDT	BSS60	S3	Sm	BT151*	S2	Th
BPX71	S8	PDT	BSS61	S3	Sm	BT152*	S2	Th
BPX72	S8	PDT	BSS62	S3	Sm	BT153	S2	Th
BPX95C	S8	PDT	BSS63;R	S7	Mm	BT154	S2	Th
BR100/03	S2	Th	BSS64;R	S7	Mm	BT155*	S2	Th
BR101	S3	Sm	BSS68	S3	Sm	BTV24*	S2	Th
BRY39	S3	Sm	BST15	S7	Mm	BTV34*	S2	Tri
BRY56	S3	Sm	BST16	S7	Mm	BTV58*	S2	Th
BRY61	S7	Mm	BST50	S7	Mm	BTW23*	S2	Th
BRY62	S7	Mm	BST51	S7	Mm	BTW30S*	S2	Th
BSR12;R	S7	Mm	BST52	S7	Mm	BTW31W*	S2	Th
BSR13;R	S7	Mm	BST60	S7	Mm	BTW38*	S2	Th
BSR14;R	S7	Mm	BST61	S7	Mm	BTW40*	S2	Th
BSR15;R	S7	Mm	BST62	S7	Mm	BTW42*	S2	Th
BSR16;R	S7	Mm	BSV15	S3	Sm	BTW43*	S2	Tri
BSR17;R	S7	Mm	BSV16	S3	Sm	BTW45*	S2	Th
BSR17A;R	S7	Mm	BSV17	S3	Sm	BTW47*	S2	Th
BSR18;R	S7	Mm	BSV52;R	S7	Mm	BTW58*	S2	Th
BSR18A;R	S7	Mm	BSV64	S3	Sm	BTW63*	S2	Th

* = series
FET = Field-effect transistors
Mm = Microminiature semiconductors for hybrid circuits
PDT = Photodiodes or transistors
RFP = R.F. power transistors and modules
Sm = Small-signal transistors
Th = Thyristors
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* = series
Th = Thyristors
Tri = Triacs
P = Low-frequency power transistors
R = Rectifier diodes
Vrg = Voltage regulator diodes
Vrf = Voltage reference diodes

* = series
D = Displays
GD = Germanium diodes
LED = Light emitting diodes
Mm = Microminiature semiconductors for hybrid circuits
Ph = Photoconductive devices
PhC = Photocouplers
WBM = Wideband hybrid IC modules
TS = Transient suppressor diodes
Vrf = Voltage reference diodes
Vrg = Voltage regulator diodes

Ar = Arrays
FET = Field-effect transistors
I = Infrared devices
P = Low-frequency power transistors
R = Rectifier diodes
RFP = R.F. power transistors and modules
SD = Small-signal diodes
Sm = Small-signal transistors
St = Rectifier stacks
Vrf = Voltage reference diodes
WBT = Wideband hybrid IC transistors
WBM = Wideband hybrid IC modules

A = Accessories
DH = Diecast heatsinks
FET = Field-effect transistors
HE = Heatsink extrusions
I = Infrared devices
RFP = R.F. power transistors and modules
Sm = Small-signal transistors
Ph = Photoconductive devices

GENERAL

Rating systems
Letter symbols
Definitions for optoelectronic devices
General safety recommendations optoelectronic devices

RATING SYSTEMS

The rating systems described are those recommended by the International Electrotechnical Commission (IEC) in its Publication 134.

DEFINITIONS OF TERMS USED

Electronic device. An electronic tube or valve, transistor or other semiconductor device.

Note
This definition excludes inductors, capacitors, resistors and similar components.

Characteristic. A characteristic is an inherent and measurable property of a device. Such a property may be electrical, mechanical, thermal, hydraulic, electro-magnetic, or nuclear, and can be expressed as a value for stated or recognized conditions. A characteristic may also be a set of related values, usually shown in graphical form.

Bogey electronic device. An electronic device whose characteristics have the published nominal values for the type. A bogey electronic device for any particular application can be obtained by considering only those characteristics which are directly related to the application.

Rating. A value which establishes either a limiting capability or a limiting condition for an electronic device. It is determined for specified values of environment and operation, and may be stated in any suitable terms.

Note
Limiting conditions may be either maxima or minima.

Rating system. The set of principles upon which ratings are established and which determine their interpretation.

Note
The rating system indicates the division of responsibility between the device manufacturer and the circuit designer, with the object of ensuring that the working conditions do not exceed the ratings.

ABSOLUTE MAXIMUM RATING SYSTEM

Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type as defined by its published data, which should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment.

The equipment manufacturer should design so that, initially and throughout life, no absolute maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, equipment control adjustment, load variations, signal variation, environmental conditions, and variations in characteristics of the device under consideration and of all other electronic devices in the equipment.

DESIGN MAXIMUM RATING SYSTEM

Design maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the electronic device under consideration.

The equipment manufacturer should design so that, initially and throughout life, no design maximum value for the intended service is exceeded with a bogey device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, variation in characteristics of all other devices in the equipment, equipment control adjustment, load variation, signal variation and environmental conditions.

DESIGN CENTRE RATING SYSTEM

Design centre ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under normal conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device in average applications, taking responsibility for normal changes in operating conditions due to rated supply voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all electronic devices.

The equipment manufacturer should design so that, initially, no design centre value for the intended service is exceeded with a bogey electronic device in equipment operating at the stated normal supply voltage.

LETTER SYMBOLS FOR TRANSISTORS AND SIGNAL DIODES

based on IEC Publication 148

LETTER SYMBOLS FOR CURRENTS, VOLTAGES AND POWERS

Basic letters

The basic letters to be used are:

I, i = current
V, v = voltage
P, p = power.

Lower-case basic letters shall be used for the representation of instantaneous values which vary with time.
In all other instances upper-case basic letters shall be used.

Subscripts

A, a	Anode terminal
(AV), (av)	Average value
B, b	Base terminal, for MOS devices: Substrate
(BR)	Breakdown
C, c	Collector terminal
D, d	Drain terminal
E, e	Emitter terminal
F, f	Forward
G, g	Gate terminal
K, k	Cathode terminal
M, m	Peak value
O, o	As third subscript: The terminal not mentioned is open circuited
R, r	As first subscript: Reverse. As second subscript: Repetitive. As third subscript: With a specified resistance between the terminal not mentioned and the reference terminal.
(RMS), (rms)	R.M.S. value
S, s	As first or second subscript: Source terminal (for FETS only) As second subscript: Non-repetitive (not for FETS) As third subscript: Short circuit between the terminal not mentioned and the reference terminal
X, x	Specified circuit
Z, z	Replaces R to indicate the actual working voltage, current or power of voltage reference and voltage regulator diodes.

Note: No additional subscript is used for d.c. values.

Upper-case subscripts shall be used for the indication of:

a) continuous (d.c.) values (without signal)
Example I_B

b) instantaneous total values
Example i_B

c) average total values
Example $I_{B(AV)}$

d) peak total values
Example I_{BM}

e) root-mean-square total values
Example $I_{B(RMS)}$

Lower-case subscripts shall be used for the indication of values applying to the varying component alone:

a) instantaneous values
Example i_b

b) root-mean-square values
Example $I_{b(rms)}$

c) peak values
Example I_{bm}

d) average values
Example $I_{b(av)}$

Note: If more than one subscript is used, subscript for which both styles exist shall either be all upper-case or all lower-case.

Additional rules for subscripts

Subscripts for currents

Transistors: If it is necessary to indicate the terminal carrying the current, this should be done by the first subscript (conventional current flow from the external circuit into the terminal is positive).

Examples: I_B, i_B, i_b, I_{bm}

Diodes: To indicate a forward current (conventional current flow into the anode terminal) the subscript F or f should be used; for a reverse current (conventional current flow out of the anode terminal) the subscript R or r should be used.

Examples: I_F, I_R, i_F, $I_{f(rms)}$

Subscripts for voltages

Transistors: If it is necessary to indicate the points between which a voltage is measured, this should be done by the first two subscripts. The first subscript indicates the terminal at which the voltage is measured and the second the reference terminal or the circuit node. Where there is no possibility of confusion, the second subscript may be omitted.

Examples: V_{BE}, v_{BE}, v_{be}, V_{bem}

Diodes: To indicate a forward voltage (anode positive with respect to cathode), the subscript F or f should be used; for a reverse voltage (anode negative with respect to cathode) the subscript R or r should be used.

Examples: V_F, V_R, v_F, V_{rm}

Subscripts for supply voltages or supply currents

Supply voltages or supply currents shall be indicated by repeating the appropriate terminal subscript.

Examples: V_{CC}, I_{EE}

Note: If it is necessary to indicate a reference terminal, this should be done by a third subscript

Example : V_{CCE}

Subscripts for devices having more than one terminal of the same kind

If a device has more than one terminal of the same kind, the subscript is formed by the appropriate letter for the terminal followed by a number; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

Examples: I_{B2} = continuous (d.c.) current flowing into the second base terminal

V_{B2-E} = continuous (d.c.) voltage between the terminals of second base and emitter

Subscripts for multiple devices

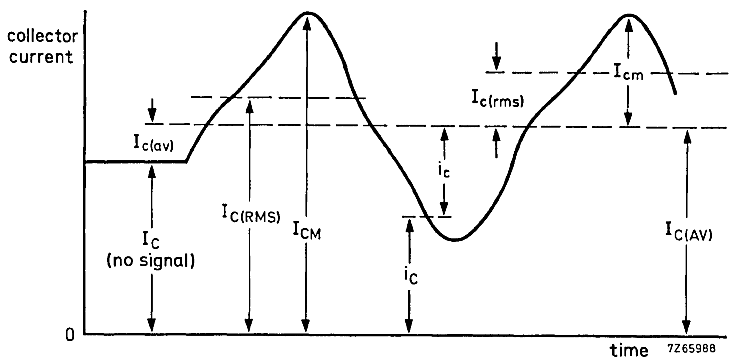
For multiple unit devices, the subscripts are modified by a number preceding the letter subscript; in the case of multiple subscripts, hyphens may be necessary to avoid misunderstanding.

Examples: I_{2C} = continuous (d.c.) current flowing into the collector terminal of the second unit

V_{1C-2C} = continuous (d.c.) voltage between the collector terminals of the first and the second unit.

Application of the rules

The figure below represents a transistor collector current as a function of time. It consists of a continuous (d.c.) current and a varying component.



LETTER SYMBOLS FOR ELECTRICAL PARAMETERS

Definition

For the purpose of this Publication, the term "electrical parameter" applies to four-pole matrix parameters, elements of electrical equivalent circuits, electrical impedances and admittances, inductances and capacitances.

Basic letters

The following is a list of the most important basic letters used for electrical parameters of semiconductor devices.

B, b = susceptance; imaginary part of an admittance

C = capacitance

G, g = conductance; real part of an admittance

H, h = hybrid parameter

L = inductance

R, r = resistance; real part of an impedance

X, x = reactance; imaginary part of an impedance

Y, y = admittance;

Z, z = impedance;

Upper-case letters shall be used for the representation of:

a) electrical parameters of external circuits and of circuits in which the device forms only a part;

b) all inductances and capacitances.

Lower-case letters shall be used for the representation of electrical parameters inherent in the device (with the exception of inductances and capacitances).

Subscripts

General subscripts

The following is a list of the most important general subscripts used for electrical parameters of semiconductor devices:

F, f = forward: forward transfer
I, i (or 1) = input
L, l = load
O, o (or 2) = output
R, r = reverse; reverse transfer
S, s = source

Examples: Z_S, h_f, h_F

The upper-case variant of a subscript shall be used for the designation of static (d.c.) values.

Examples : h_{FE} = static value of forward current transfer ratio in common-emitter configuration (d.c. current gain)

R_E = d.c. value of the external emitter resistance.

Note: The static value is the slope of the line from the origin to the operating point on the appropriate characteristic curve, i.e. the quotient of the appropriate electrical quantities at the operating point.

The lower-case variant of a subscript shall be used for the designation of small-signal values.

Examples: h_{fe} = small-signal value of the short-circuit forward current transfer ratio in common-emitter configuration

$Z_e = R_e + jX_e$ = small-signal value of the external impedance

Note: If more than one subscript is used, subscripts for which both styles exist shall either be all upper-case or all lower-case

Examples: h_{FE}, y_{RE}, h_{fe}

Subscripts for four-pole matrix parameters

The first letter subscript (or double numeric subscript) indicates input, output, forward transfer or reverse transfer

Examples: h_i (or h_{11})
h_o (or h_{22})
h_f (or h_{21})
h_r (or h_{12})

A further subscript is used for the identification of the circuit configuration. When no confusion is possible, this further subscript may be omitted.

Examples: h_{fe} (or h_{21e}), h_{FE} (or h_{21E})

Distinction between real and imaginary parts

If it is necessary to distinguish between real and imaginary parts of electrical parameters, no additional subscripts should be used. If basic symbols for the real and imaginary parts exist, these may be used.

Examples: $Z_i = R_i + jX_i$

$y_{fe} = g_{fe} + jb_{fe}$

If such symbols do not exist or if they are not suitable, the following notation shall be used:

Examples: Re (h_{ib}) etc. for the real part of h_{ib}
Im (h_{ib}) etc. for the imaginary part of h_{ib}

DEFINITIONS FOR OPTOELECTRONIC DEVICES ACCORDING TO IEC 306

DEFINITIONS AND UNITS OF RADIATION AND LIGHT QUANTITIES

Radiant flux, radiant power ϕ, P, (ϕ_e)

This is the power emitted, transferred or received as radiation, i.e. the radiant energy (dQ_e) emitted per second.

$$\phi_e = \frac{dQ_e}{dt} \qquad \text{unit: watt, W}$$

Radiant intensity I_e, I

For a source of given direction, the radiant intensity is the radiant power leaving the source, or an element of the source, in an element of solid angle (Ω) containing the given direction, divided by that element of solid angle.

$$I_e = \frac{d\phi_e}{d\Omega} \qquad \text{unit: watt per steradian, W/sr}$$

Irradiance E, (E_e)

At a point on a surface, the irradiance is the radiant power incident on an element of the surface containing the point divided by the area (A) of that element.

$$E = \frac{d\phi_e}{dA} \qquad \text{unit: watt per square metre, W/m}^2$$

Light

This is radiation capable of stimulating the eye. Exceptions to this definition are made where necessary in the data sheets, e.g. dark and light currents of a phototransistor and light rise time of a near-infrared light emitting diode.

Luminous flux ϕ, (ϕ_v)

The luminous flux $d\phi$ of a source of luminous intensity I_v in an element of solid angle of $d\Omega$, is given by:

$$d\phi = I_v.d\Omega \qquad \text{unit: lumen, lm}$$

Lumen

This is the luminous flux radiating from a point source of uniform luminous intensity of 1 candela, contained within a solid angle of 1 steradian.

$$1\ \text{lm} = 1\ \text{cd.sr}$$

Luminous intensity I_v, (I)

For a source of given direction, the luminous intensity is the luminous flux leaving the source, or an element of the source, in an element of solid angle (Ω) containing the given direction, divided by that element of solid angle.

$$I_v = \frac{d\phi_v}{d\Omega} \qquad \text{unit: candela, cd}$$

Candela

This is the luminous intensity, in the perpendicular direction, of a surface of 1/600 000 square metre of a black body at the temperature of freezing platinum under a pressure of 101 325 pascal.

Illuminance E_v, (E)

At a point on a surface, the illuminance is the luminous flux incident on an element of the surface containing the point, divided by the area (A) of that element.

$$E_v = \frac{d\phi_v}{dA} \qquad \text{unit: lux, lx}$$

Lux lx

This is the illumination produced when 1 lumen of flux falls on a surface of area 1 square metre. It will be seen that an illumination of 1 lx is produced on a area of 1 square metre at a distance of 1 metre from a point source of 1 candela.

Distribution temperature T_d

This is the temperature of a black body at which the spectral radiation distribution of the radiator under consideration, in a given wavelength range, is proportional or approximately proportional to the spectral radiation distribution of the black body. If the wavelength range given includes visible radiation, then the distribution temperature corresponds to the colour temperature.

Colour temperature T_c

The colour temperature of a radiator is the temperature of a black body which has the same, or approximately the same, spectral radiation distribution in the visible range as the radiator under consideration.

DEFINITIONS OF ELECTRICAL QUANTITIES

Photocurrent I_{ph}

This is the change in output current from the photocathode due to incident radiation.

Dark current I_d

This is the current flowing in a photoelectric device in the absence of illumination.

Dark current equivalent radiation E_d

This is the incident radiation required to give a d.c. signal output current equal to the dark current.

Quantum efficiency

This is the ratio of the number of emitted photoelectrons to the number of incident photons. Quantum efficiency (Q.E.) at a given wavelength of incident radiation may be calculated as follows:

$$Q.E. = \frac{\text{constant} \times S_k}{\lambda}$$

where S_k = spectral sensitivity (A/W) at wavelength λ
λ = wavelength of incident radiation (nm)

constant $= \frac{hc}{e} = 1{,}24 \times 10^3$ W.nm/A
h = Planck's constant ($6{,}6256 \times 10^{-34}$ js)
c = velocity of electromagnetic waves in vacuo = $2{,}997925 \times 10^8$ m/s
e = elementary charge = $1{,}60210 \times 10^{-19}$ coulomb or $4{,}80298 \times 10^{-19}$ e.s.u.

Saturation voltage V_{CEsat}

This is the lowest operating voltage which causes no change in photocurrent when this voltage is increased with constant radiation.

Saturation current I_{CEsat}

This is the output current of a photosensitive device which is not changed by an increase of either:

a. the irradiance under constant operating conditions, or,
b. the operating voltage under constant irradiance.

Thermal resistance

This is the ratio of temperature rise to power dissipation or

$$R_{th\ j\text{-}a} = \frac{T_j - T_{amb}}{P_{tot}}$$

The thermal resistance is also the reciprocal of the derating factor.

Pulsed operation

Under these conditions higher peak power dissipation is possible. In general, the shorter the pulse and lower the frequency, the lower is the temperature that the junction reaches.

By analogy with thermal resistance:

$$Z_{th\ j\text{-}a} = \frac{T_j - T_{amb}}{P_{tot}}$$

DEFINITIONS OF SENSITIVITY

These definitions apply more directly to photocathode sensitivity. For devices in which it is necessary to define the anode (overall) sensitivity, the signal output current should be considered instead of the photocurrent.

Actinity of radiation Z

This is the ratio of the sensitivity to a given radiation to the sensitivity to a reference radiation.

Radiant sensitivity S_R

This may be expressed as either:

a. the ratio of the photocurrent of the device to the incident radiant power, expressed in amperes per watt (A/W), or,
b. the ratio of the photocurrent of the device to the incident irradiance, expressed in amperes per watt per square metre ($A/W/m^2$).

Absolute spectral sensitivity $s(\lambda)$

This is the radiant sensitivity for monochromatic radiation of a stated wavelength.

Relative spectral sensitivity $s(\lambda)_{rel}$

This is the ratio of the radiant sensitivity at a particular wavelength to the radiant sensitivity at a reference wavelength, usually the wavelength of maximum reponse.

Note
For non-linear detectors, it is necessary to refer to constant photocurrent at all wavelengths.

Luminous sensitivity S_L

This may be expressed as either:

a. the ratio of the photocurrent of the device to the incident luminous flux, expressed in amperes per lumen (A/lm), or,
b. the ratio of the photocurrent of the device to the incident illuminance, expressed in amperes per lux (A/lx).

Dynamic sensitivity S_D

Under stated operating conditions, this is the ratio of the variation of the photocurrent of the device to the initiating small variation in the incident radiant or luminous power.

Note
Distinction is made between luminous dynamic sensitivity and radiant sensitivity.

Spectral sensitivity characteristics

This is the relationship, usually shown in graphical form, between the wavelength and the absolute or relative spectral sensitivity.

Absolute spectral sensitivity characteristics

This is the relationship, usually shown in graphical form, between the wavelength and the absolute spectral sensitivity.

Relative spectral sensitivity characteristics

This is the relationship between wavelength and the relative spectral sensitivity.

Quantum efficiency characteristic

This is the relationship, usually shown in graphical form, between the wavelength and the quantum efficiency.

DEFINITIONS OF TIME QUANTITIES

Rise time t_r

This is the time required for the photocurrent to rise from a stated low percentage to a stated higher percentage of the maximum value when a steady state of radiation is instantaneously applied. It is usual to consider the 10% and 90% levels (see Figs 1 and 2).

Fall time t_f

This is the time required for the photocurrent to fall from a stated high percentage to a stated lower percentage of the maximum value when the steady state of radiation is instantaneously removed.

It is usual to consider the 90% and 10% levels (see Figs 1 and 2).

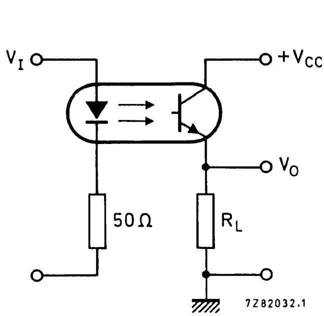


Fig. 1 Switching circuit.

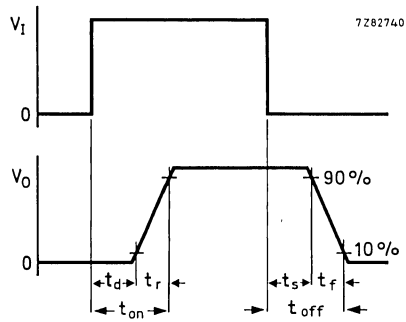


Fig. 2 Waveforms.

DEFINITIONS AND UNITS OF INFRARED SENSITIVE DEVICES

Emissivity

This is the ratio of the radiant exitance of a thermal radiator to that of a black body radiator at the same temperature.

Absolute refractive index n

This is the ratio of the velocity of light in vacuo to that in a particular medium. For most practical purposes the velocity of light in vacuo can be replaced by that in air.

Detectivity

This is the signal-to-noise ratio per unit radiant power. Thus it is the reciprocal of the N.E.P. Care must be exercised when considering detectivity as this term has also been used in the definitions of D*.

unit: 1/watts (1/W)

D*

This is an independent figure of merit which is defined as the r.m.s. signal-to-noise ratio in a 1 Hz bandwidth per unit r.m.s. incident radiant power per square root of detector area. Unless otherwise stated, it is assumed that the detector field of view is hemispherical (2 π steradian).

unit: $cm\sqrt{Hz}/W$

Wave number

This is the reciprocal of the wavelength in centimetres. $(\frac{1}{\lambda})$

N.E.P. (Noise Equivalent Power)

This is the r.m.s. value of the incident, chopped, radiant power necessary to produce an r.m.s. signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth $V/\sqrt{Hz}$.

unit: $W/\sqrt{Hz}$

Responsivity

This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped, radiant power.

unit: V/W

Noise equivalent irradiation

This is the value of incident radiation which, when modulated in a stated manner, produces a signal output power equal to the noise power, both of which are in a stated bandwidth.

Radiance L_e

This is the radiant intensity (I_e) at a point on a surface and in a given direction, of an element of that surface, divided by the area of the orthogonal projection of the element on a plane perpendicular to the given direction.

unit: watt per steradian square metre, W/sr.m^2

Radiant exitance (radiant emittance) M_e

At a point on a surface, this is the radiant power leaving an element of that surface, divided by the area of the element.

$$M_e = \frac{d\phi_e}{dA}$$ unit: watt per square metre, W/m^2

Luminous exitance (luminous emittance) M_v

At a point on a surface, this is the luminous flux leaving an element of that surface, divided by the area of that element.

$$M_v = \frac{d\phi_v}{dA}$$ unit: lumen per square metre, lm/m^2

Luminance L_v

This is the luminous intensity (I_v) at a point on a surface and in a given direction, of an element of that surface divided by the area of the orthogonal projection of the element on a plane perpendicular to the given direction.

unit: candela per square metre, cd/m^2

Steradian sr (see Fig. 3)

This is the solid angle subtended at the centre of a sphere by an element of the surface area equal to the square of the radius of the sphere. There are, therefore, 4π steradians in a complete sphere.

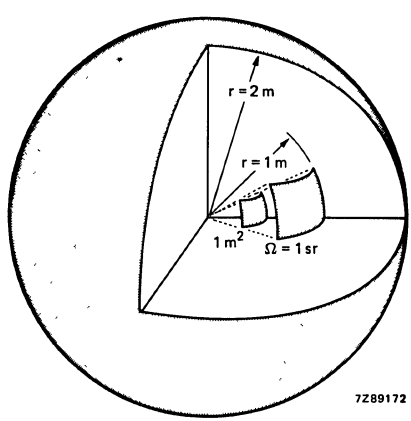


Fig. 3.

GENERAL SAFETY RECOMMENDATIONS
OPTOELECTRONIC DEVICES

1. GENERAL

When properly used and handled, optoelectronic devices do not constitute a risk to health or environment. Modern high technology materials have been used in the manufacture of these devices to ensure optimum performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the devices are heated to destruction and it is important that the following recommendations are observed.

Care should be taken to ensure that all personnel who may handle, use or dispose of these products are aware of the necessary precautions.

Individual product data sheets will indicate whether any specific hazards are likely to be present.

2. DISPOSAL

These devices should be disposed of in accordance with the relevant legislation; in the United Kingdom disposal should therefore be carried out in accordance with the Deposit of Poisonous Waste Act 1972 and the Control of Pollution Act 1974, or with the latest legislation.

3. FIRE

Optoelectronic devices themselves, when used within the specified limits, do not present a fire hazard.

Devices can contain arsenic, beryllium, cadmium, lead, mercury, selenium, tellurium or similar hazardous materials or compounds, which, if exposed to high temperatures may emit toxic or noxious fumes.

Most packaging materials are flammable and care should be taken in the disposal of such materials, some of which will emit toxic fumes if burned.

4. HANDLING

Care must be exercised with those devices incorporating glass or plastic. If these devices are broken, precautions must be taken against the following hazards that may arise:

- Broken glass or ceramic. Protective clothing such as gloves should be worn.
- Contamination from toxic materials and vapours. In particular, skin contact and inhalation must be avoided.
- Access to live contacts which may be at high potential. Devices must be isolated from the mains supply prior to their removal.

5. BERYLLIUM COMPOUNDS

Beryllium oxide dust is toxic if inhaled or if particles enter a cut or an abrasion. At all times avoid handling beryllium oxide ceramics; if they are touched, the hands must be washed thoroughly with soap and water. Do nothing to beryllium oxide ceramics that may produce dust or fumes.

Care should be taken upon eventual disposal that they are not thrown out with general industrial waste. Users seeking disposal of devices incorporating beryllium oxide ceramics should first take advice from the manufacturer's service department.

This potential hazard is present at all times from receipt to disposal of devices.

6. CADMIUM COMPOUNDS

Cadmium compounds are toxic. In the event of accidental breakage, cadmium dust may be released. Gloves should be worn and the dust should be mopped up with a damp cloth. Upon disposal, the cloth should be sealed in a plastic bag and the hands washed thoroughly with soap and water.

Controlled disposal of devices containing cadmium compounds should be conducted in the open air or in a well ventilated area.
Inhalation of cadmium dust must be avoided.

This potential hazard is present, if breakage occurs, at all times from receipt to disposal of devices.

7. OTHER COMPOUNDS

Other compounds, such as those containing arsenic, indium, lead, lithium, selenium, tantalum, tellurium etc., may be toxic by ingestion or inhalation.

The above information and recommendations are given in good faith and are in accordance with the best knowledge and opinion available at the date of the compilation of the data sheets.

PHOTOSENSITIVE DIODES AND TRANSISTORS

SILICON AVALANCHE PHOTODIODE FOR FIBRE-OPTIC COMMUNICATIONS

Type 1 Silicon avalanche photodiode in a hermetically sealed modified TO-18 envelope coupled directly to a graded-index optical quartz glass fibre.

The device features high coupling and quantum efficiency, extremely fast response time and very low noise characteristics. The characteristics of this photodiode make it useful in a wide variety of applications in fibre-optic communications as well as in laser detection, ranging, high-sensitivity measurements, high-speed switching and transit-time measurements.

Type 2 A separate silicon avalanche (photo) diode in a hermetically "dark sealed" TO-18 envelope, to be used as a reference diode, with corresponding "dark electrical" behaviour.

QUICK REFERENCE DATA

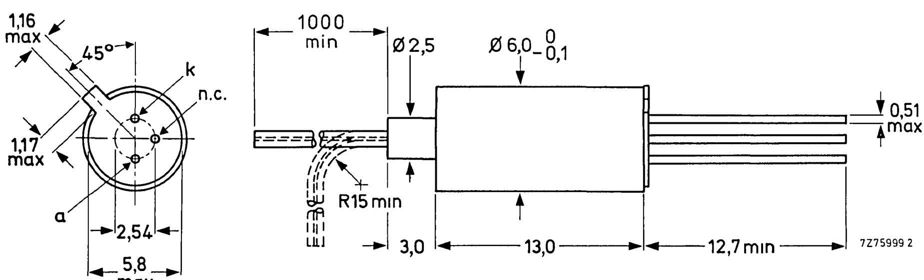
Reverse dark avalanche breakdown voltage $I_{R(D)} = 1\ \mu A$	$V_{(BR)R}$	typ.	200	V
Reach-through voltage	$V_{(RT)R}$	typ.	140	V
Dark reverse current $V_{R(D)} = 0,8\ V_{(BR)R}$	$I_{R(D)}$	typ.	5	nA
Wavelength at peak response	λ_{pk}	typ.	800	nm
Quantum efficiency $V_R > V_{(RT)R}$; $\lambda = 800$ nm	η_λ	typ.	90	%
Responsivity $V_R > V_{(RT)R}$; $\lambda = 800$ nm; $M = 100$	R	typ.	60	A/W
Diode capacitance $V_{R(D)} > V_{(RT)R}$	C_d	typ.	1,3	pF
Pulse response FWHM $M = 50$ to 100	σ	typ.	0,44	ns
Effective noise factor (see page 26)	k_{eff}	typ.	0,02	
Diameter active area	ϕ		350	μm

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-18 (modified).

Anode connected to case.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Forward current (d.c.)	I_F	max.	10 mA
Total power dissipation up to T_{amb} = 90 °C	P_{tot}	max.	100 mW
Storage temperature			
Avalanche photodiode with fibre	T_{stg}		0 to +90 °C
Reference diode	T_{stg}		−25 to +125 °C
Junction temperature	T_j	max.	125 °C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	350 °C/W
From junction to case	$R_{th\ j\text{-}c}$	=	100 °C/W

CHARACTERISTICS (measured on crystal)

T_j = 25 °C

Dark reverse currents $V_{R(D)} = 0{,}8\ V_{(BR)R}$; surface	$I_{R(D)}$	typ. <	5 nA 30 nA
$V_{R(D)} = 0{,}8\ V_{(BR)R}$; bulk (unmultiplied)	$I_{R(D)b}$	typ.	20 pA
Reverse dark avalanche breakdown voltage $I_{R(D)} = 1\ \mu A$	$V_{(BR)R}$	typ.	200 V 165 to 245 V
Reach-through voltage	$V_{(RT)R}$	typ.	140 V
Forward voltage I_F = 1 mA	V_F	typ.	600 mV
Temperature coefficient of reverse voltage at M = 100	$\frac{\Delta V_R}{T_{amb}}$	typ.	0,6 V/°C
Wavelength at peak response	λ_{pk}	typ.	800 nm
Multiplication operating range	M		20 to 120
Responsivity $V_R > V_{(RT)R}$; λ = 800 nm; M = 100	R	typ.	60 A/W
Quantum efficiency $V_R > V_{(RT)R}$; λ = 800 nm	$\eta\lambda$	typ.	90 %
Effective noise factor (see page 26) Excess noise factor $F \approx 2 + k_{eff}$ M−1/M up to M = 120	k_{eff}	typ. <	0,020 0,025
Noise equivalent power M = 50; η = 0,90; λ = 800 nm $I_{R(D)d}$ = 20 pA; k_{eff} = 0,02	N.E.P.	typ.	$7{,}6 \times 10^{-15}$ W/$\sqrt{}$Hz
Diode capacitance (≈ 0,7 pF TO-18 envelope included) $V_{R(D)} > V_{(RT)R}$	C_d	typ.	1,3 pF
Pulse response FWHM* M = 50 to 100; λ = 850 nm; R_L = 50 Ω $\sigma_{opt} \approx$ 100 ps FWHM	σ	typ.	0,44 ns

* FWHM means full width half maximum.

OPTICAL DATA

Graded-index optical quartz glass fibre

Numerical aperture on-axis	NA	typ.	0,21
			0,20 to 0,22
Core diameter	ϕ_{core}	typ.	50 μm
			48 to 52 μm
Cladding diameter	$\phi_{cladding}$	typ.	125 μm
			123 to 127 μm
Primary coating thickness		typ.	5 μm
Secondary coating diameter	$\phi_{coating}$	typ.	0,9 mm
Coupling efficiency	$\eta_{coupling}$	>	85 %

Note 1

$\eta_{a.p.d.} = \eta_{\lambda} \times \eta_{coupling}$
η_{λ} = quantum efficiency

$\eta_{coupling}$ = optical coupling efficiency for the assembled envelope, from the free end of the avalanche photodiode fibre to the active area of the crystal.

Note 2

On special request the same crystals on TO-18 headers can be delivered with flat or lens windows. Also optical glass-fibres of deviating specifications can be mounted (e.g. ϕ_{core} = 50 μm; $\phi_{cladding}$ = 100 μm).

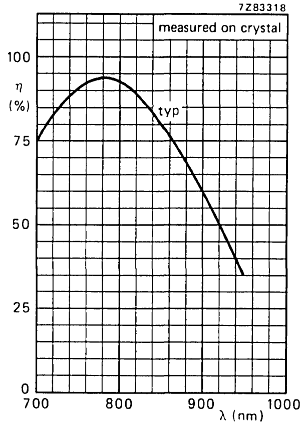


Fig. 2 Quantum efficiency versus wavelength; $V_R > V_{(RT)R}$.

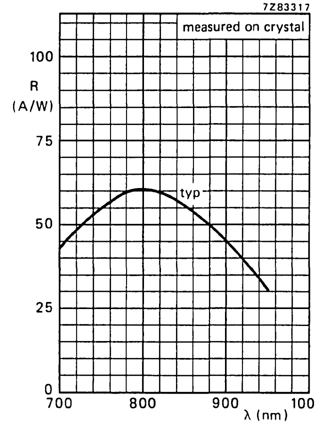


Fig. 3 Responsivity (M = 100) versus wavelength; $V_R > V_{(RT)R}$.

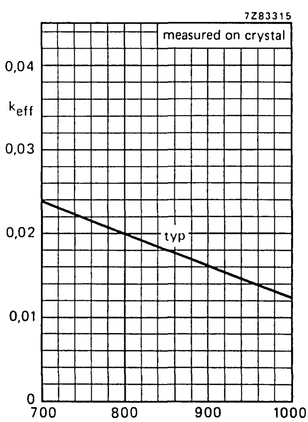


Fig. 4 Effective noise factor versus wavelength.

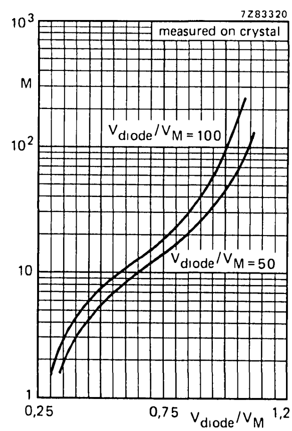


Fig. 5 Multiplication versus normalized voltage.

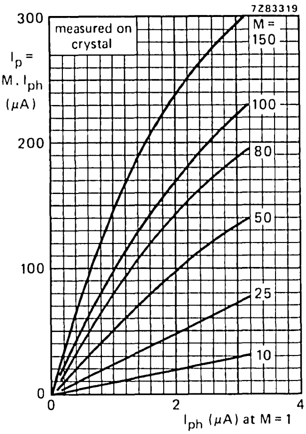


Fig. 6 Multiplied photocurrent versus primary photocurrent; typical values.

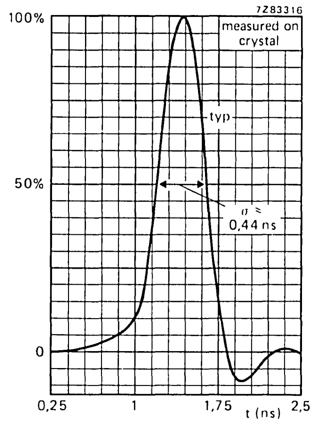


Fig. 7 Pulse response on a lightpulse $\sigma_{opt} \approx$ 100 ps FWHM versus time; λ = 850 nm; M = 50 to 100.

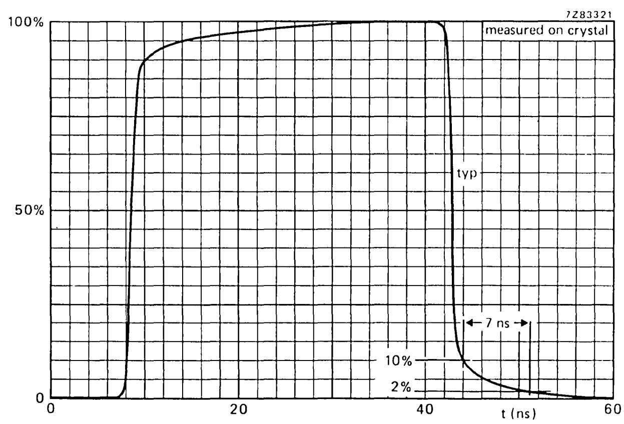


Fig. 8 Step response versus time; λ = 850 nm; M = 50.

Explanation of the effective noise factor (k_{eff}), noise equivalent power (N.E.P.) and signal to noise ratio (S/N).

The excess noise factor F is expressed by $F = \frac{\langle M^2 \rangle}{\langle M \rangle^2}$ in which:

$\langle M^2 \rangle$ = the mean square gain
$\langle M \rangle^2$ = the average gain squared

$\langle M^2 \rangle > \langle M \rangle^2$.

F is the ratio of the actual noise to that which would exist when all generated pairs are multiplied by exactly M.

$F \approx 2 + k_{eff} M - \frac{1}{M}$ in which:

k_{eff}, the effective noise factor, is a weighted ionization rate ratio of holes and electrons.

The mean square noise current for the avalanche photodiode is given by

$\langle i_n^2 \rangle = 2\,qB \left\{ M^2 F\,(I_b + I_{ph}) + I_s \right\} \approx 2\,qBM^2 F I_{ph}$ in which:

q = electronic charge 1,602 x 10^{-19} (C)
B = bandwidth (Hz)
I_b = $I_{R(D)b}$ bulk dark reverse current; M = 1 (unmultiplied); (A)
I_{ph} = photocurrent; M = 1 (unmultiplied); (A)
I_s = surface dark reverse current; (A).

$$\text{N.E.P. } (W/\sqrt{Hz}) = \frac{\text{noise current without signal, } I_{ph} = 0\ (A/\sqrt{Hz})}{\text{responsivity } (A/W)}$$

$$\text{N.E.P. } (W/\sqrt{Hz}) = \frac{i_n/\sqrt{B}\ (\text{without signal, } I_{ph} = 0);\ (A/\sqrt{Hz})}{R_m\ (A/W)}$$

$$S/N = \frac{\text{responsivity } (A/W) \times \text{N.E.P. } (W/\sqrt{Hz})}{\text{noise current without signal, } I_{ph} = 0\ (A/\sqrt{Hz})} = 1$$

$$S/N = \frac{R_m\ (A/W) \times \text{N.E.P. } (W/\sqrt{Hz})}{i_n/\sqrt{B}\ (\text{without signal, } I_{ph} = 0);\ (A/\sqrt{Hz})} = 1$$

$$R_m = \frac{m}{100} \times R_{M = 100}$$

SILICON PHOTODIODE FOR FIBRE-OPTIC COMMUNICATIONS

Photo p-i-n diode in hermetic TO-46 encapsulation, designed for fibre-optic transmissions over short and medium distances, mainly for military and industrial applications.

It is optimized to be coupled with a 200 μm core diameter fibre and to be used in combination with the CQF24 emitter.

The crystal is electrically isolated from the case.

QUICK REFERENCE DATA

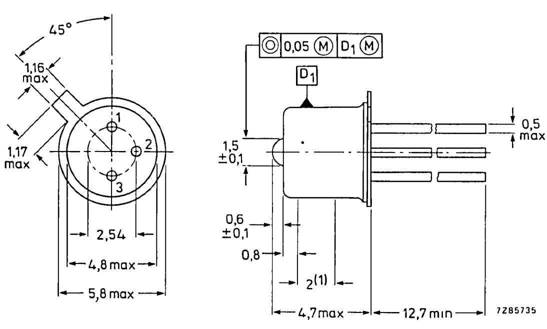
Continuous reverse voltage	V_R	max.	50 V
Dark reverse current at V_R = 10 V	$I_{R(D)}$	max.	0,8 nA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Diode capacitance at V_R = 10 V	C_d	max.	3 pF
Spectral sensitivity at V_R = 10 V; λ = 830 nm	s_λ	min.	0,3 A/W

MECHANICAL DATA

Dimensions in mm

Fig. 1.

Pinning:
1 = anode
2 = cathode
3 = case



(1) Case diameter over this length is 4,7 (+ 0,05; −0,1) mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	50 V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300 mW
Junction temperature	T_j	max.	150 °C
Operating temperature	T_{op}		−55 to +125 °C
Storage temperature	T_{stg}		−65 to +150 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a printed circuit	$R_{th\ j\text{-}a}$	typ.	400 K/W
		max.	500 K/W
From junction to case	$R_{th\ j\text{-}c}$	typ.	100 K/W
		max.	150 K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Dark reverse current at V_R = 10 V	$I_{R(D)}$	max.	0,8 nA
Spectral sensitivity at V_R = 10 V; λ = 830 nm	s_λ	min.	0,3 A/W
		typ.	0,4 A/W
Wavelength at peak response	λ_{pk}	typ.	750 nm
Diode capacitance at V_R = 10 V	C_d	typ.	2 pF
		max.	3 pF
Switching times at V_R = 10 V; R_L = 50 Ω (10%-90%)	t_r	max.	1 ns
	t_f	max.	1 ns
Light photocurrent, when coupled to a fibre-glass rod with NA = 0,2 and ϕ core = 200 μm and at a distance d = 0,7 mm (see Fig. 2) at V_R = 10 V; λ = 830 nm; P_{opt} = 100 μW	I_R	typ.	25 μA

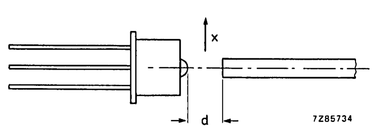


Fig. 2 Distance d and lateral displacement x.

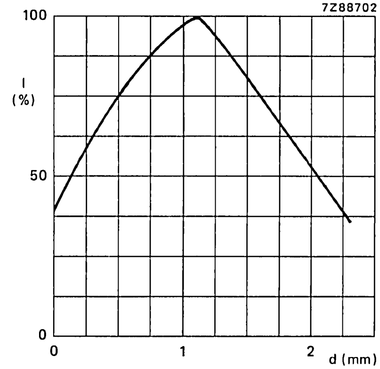


Fig. 3.

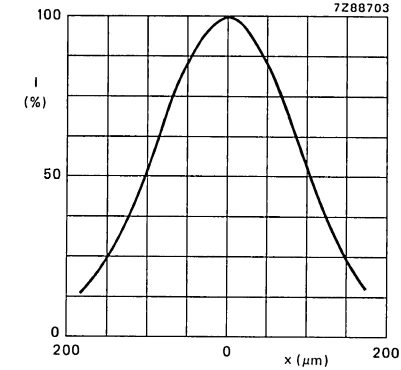


Fig. 4.

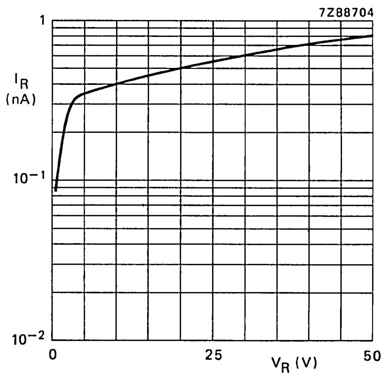


Fig. 5 T_{amb} = 25 °C.

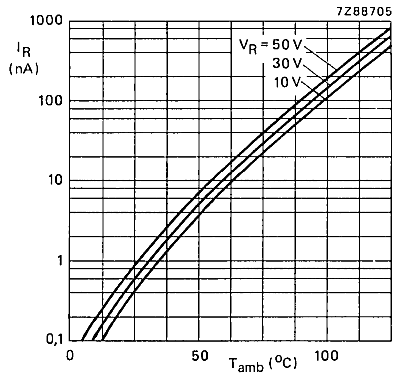


Fig. 6.

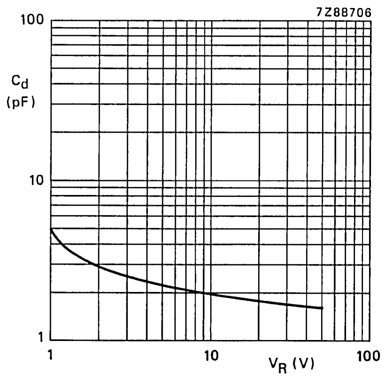


Fig. 7 f = 1 MHz; T_{amb} = 25 °C.

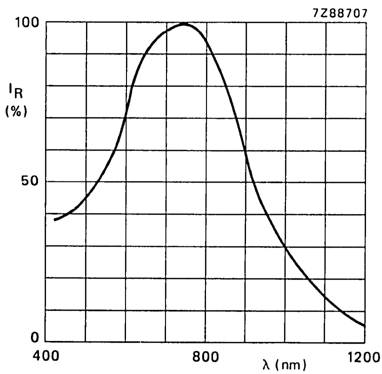


Fig. 8 V_R = 10 V; T_{amb} = 25 °C.

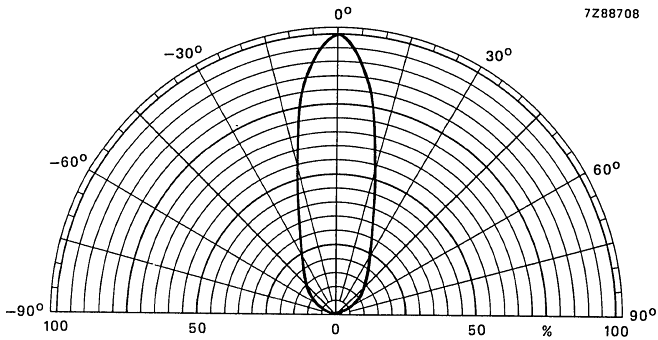


Fig. 9.

SILICON PHOTOTRANSISTOR

N-P-N silicon phototransistor in epoxy resin encapsulation intended for optical coupling and encoding. The base is inaccessible. Combination with LED CQY58A is recommended.

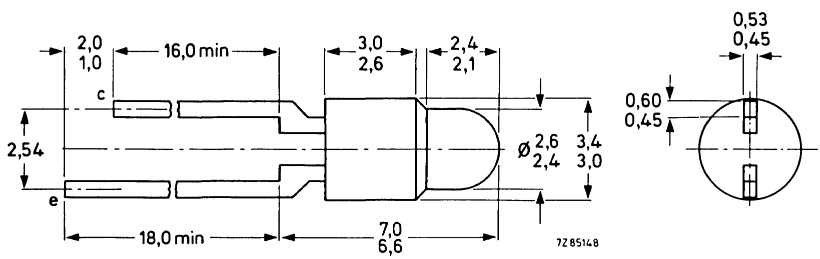
QUICK REFERENCE DATA

Collector-emitter voltage		V_{CEO}	max.	50	V
Collector current (d.c.)		I_C	max.	25	mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	100	mW
Collector dark current V_{CE} = 30 V; E = 0		$I_{CEO(D)}$	<	100	nA
Collector light current V_{CE} = 5 V; E_e = 1 mW/cm^2; λ_{pk} = 930 nm	BPW22A-I	$I_{CEO(L)}$	>	1,5	mA
	BPW22A-II	$I_{CEO(L)}$	>	5	mA
Wavelength at peak response		λ_{pk}	typ.	800	nm

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-53D.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage	V_{CEO}	max.	50 V
Emitter-collector voltage	V_{ECO}	max.	7 V
Collector current			
d.c.	I_C	max.	25 mA
peak value	I_{CM}	max.	50 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	100 mW
Storage temperature	T_{stg}	−55 to + 100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature			
> 3,5 mm from the body; t_{sld} < 7 s	T_{sld}	max.	240 °C

THERMAL RESISTANCE

From junction to ambient, device mounted on printed-circuit board	$R_{th\ j\text{-}a}$	=	750 °C/W

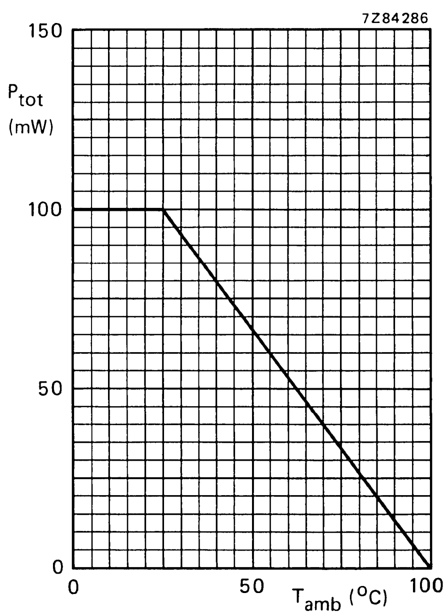


Fig. 2 Power derating curve versus ambient temperature.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Collector dark current				
V_{CE} = 30 V; E = 0		$I_{CEO(D)}$	<	100 nA
Collector light current				
V_{CE} = 5 V; E_e = 1 mW/cm²; λ_{pk} = 930 nm	**BPW22A-I**	$I_{CEO(L)}$		1,5 to 8 mA
	BPW22A-II	$I_{CEO(L)}$		5 to 25 mA
Collector-emitter saturation voltage				
I_C = 1 mA; E_e = 1 mW/cm²; λ_{pk} = 930 nm		V_{CEsat}	<	0,4 V
Wavelength at peak response		λ_{pk}	typ.	800 nm
Bandwidth at half height		$B_{50\%}$	typ.	400 nm
Beamwidth between half sensitivity directions		$\alpha_{50\%}$	typ.	± 20°
Switching times (see Figs 3, 4, 9 and 10)				
I_{Con} = 2 mA; V_{CC} = 5 V; R_E = 100 Ω; T_{amb} = 25 °C				
turn-on time		t_{on}	typ.	3 μs
turn-off time		t_{off}	typ.	3 μs
I_{Con} = 2 mA; V_{CC} = 5 V; R_E = 1 kΩ; T_{amb} = 25 °C				
turn-on time		t_{on}	typ.	12,0 μs
turn-off time		t_{off}	typ.	12,5 μs

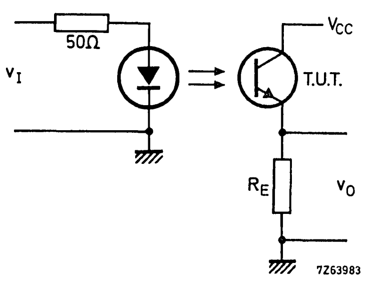


Fig. 3 Switching circuit with light emitting diode CQY58A. T.U.T. = BPW22A.

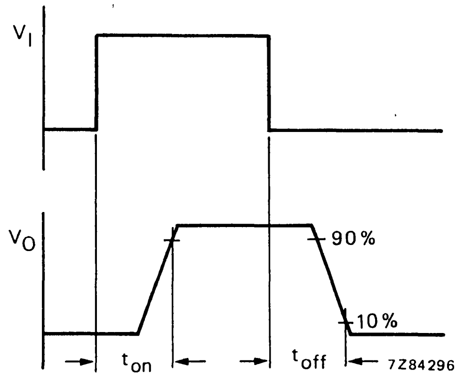


Fig. 4 Input and output switching waveforms.

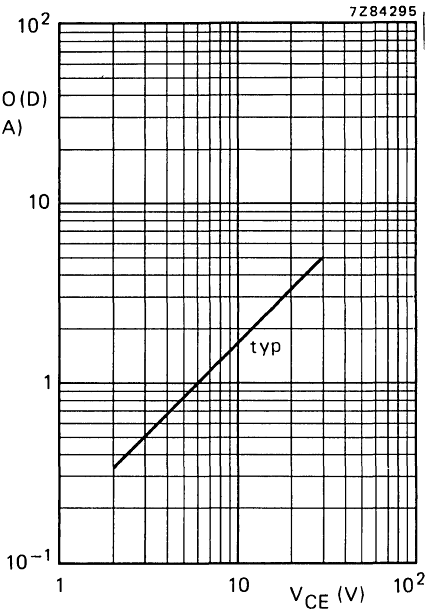


Fig. 5 E = 0; T_j = 25 °C.

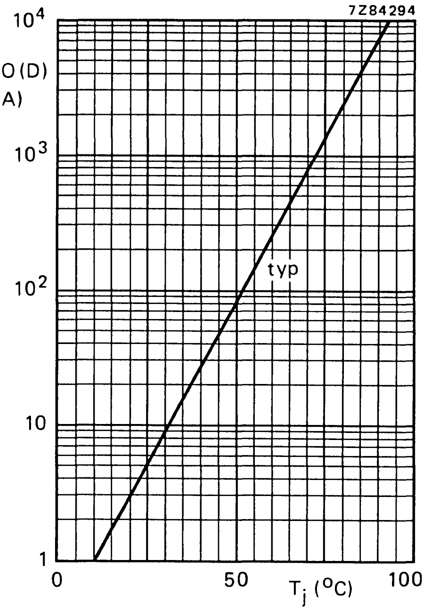


Fig. 6 E = 0; V_{CE} = 30 V.

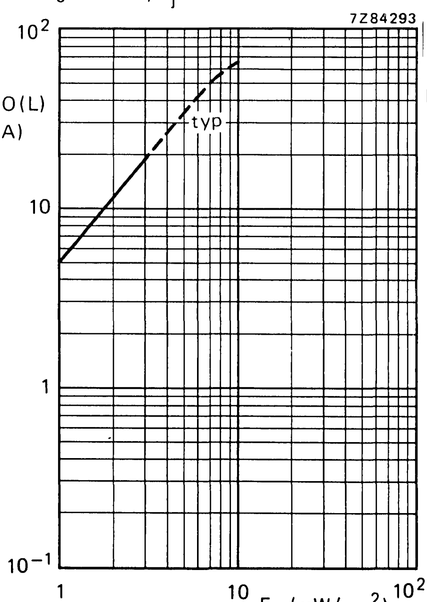


Fig. 7 GaAs source: λ_{pk} = 930 nm; V_{CE} = 5 V; T_j = 25 °C.

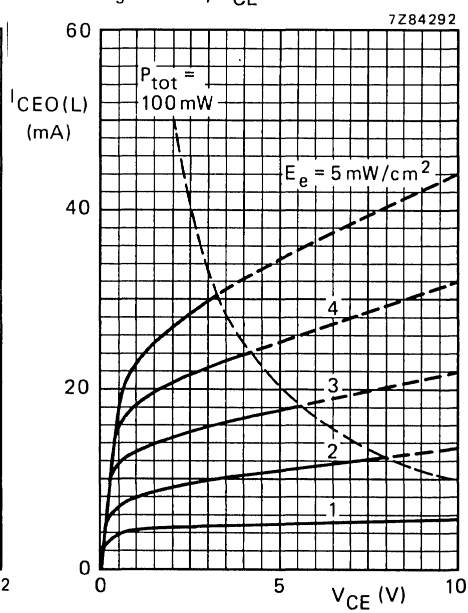


Fig. 8 λ_{pk} = 930 nm; T_j = 25 °C; typical values.

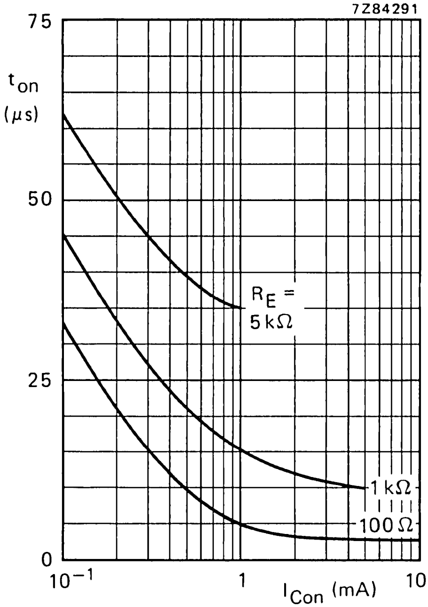


Fig. 9 V_{CC} = 5 V; T_{amb} = 25 °C; typical values; see also Figs 3 and 4.

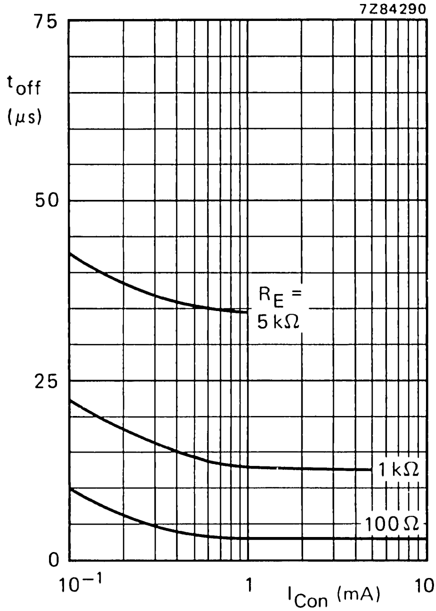


Fig. 10 V_{CC} = 5 V; T_{amb} = 25 °C; typical values; see also Figs 3 and 4.

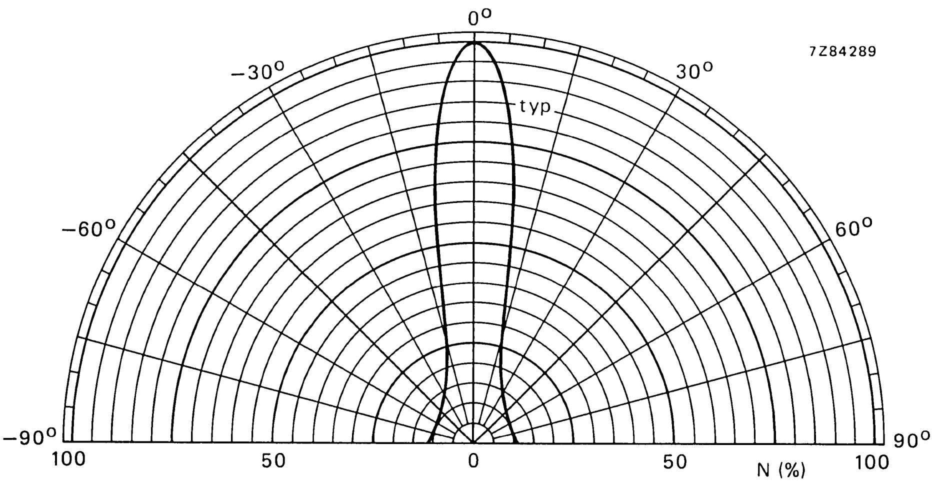


Fig. 11.

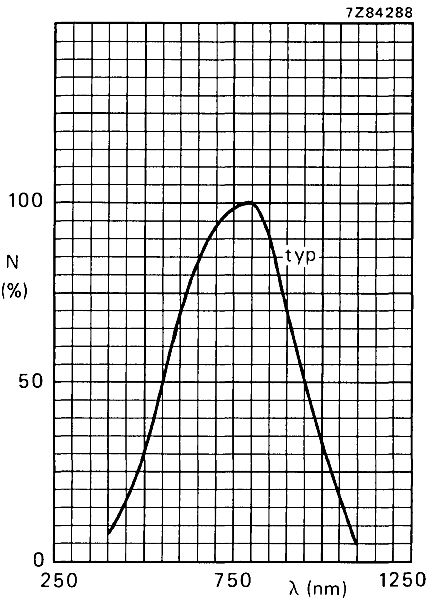


Fig. 12 Spectral response.

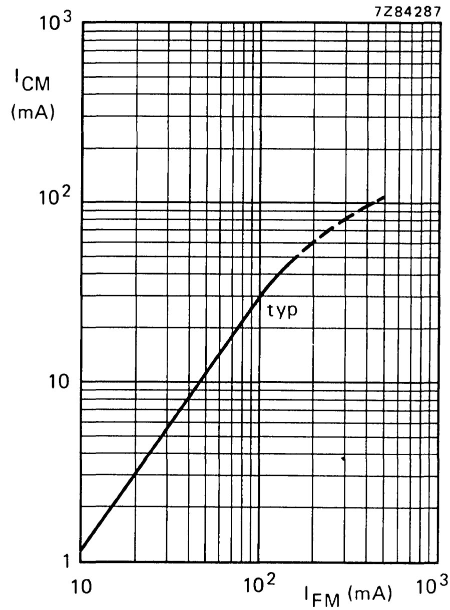


Fig. 13 V_{CE} = 5 V; t_p (I_{FM}) = 10 μs; T = 1 ms; d* = 10 mm; T_{amb} = 25 °C.

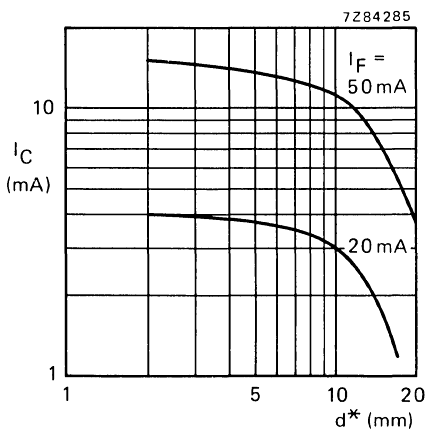


Fig. 14 V_{CE} = 5 V; T_{amb} = 25 °C; typical values.

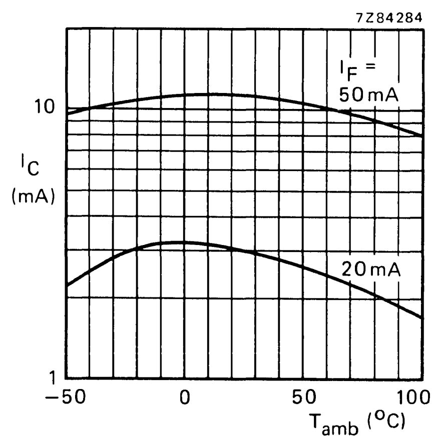


Fig. 15 V_{CE} = 5 V; d* = 10 mm; typical values.

* d = shortest free distance of mechanical on-axis when BPW22A is coupled with CQY58A.

SILICON PHOTO P-I-N DIODE

Silicon photo p-i-n diode in a plastic envelope with an infrared filter.

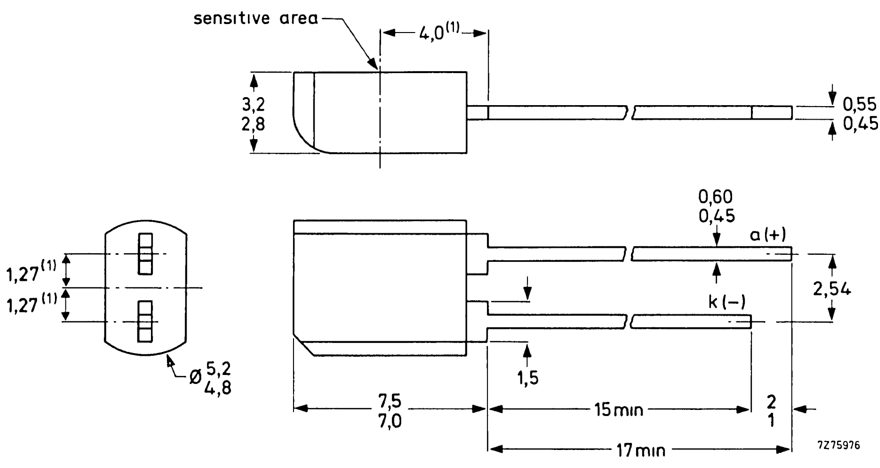
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	32	V
Total power dissipation up to T_{amb} = 47,5 °C	P_{tot}	max.	150	mW
Junction temperature	T_j	max.	100	°C
Dark reverse current V_R = 10 V; E_e = 0	$I_{R(D)}$	<	30	nA
Light reverse current V_R = 5 V; E_e = 1 mW/cm²; λ = 930 nm	$I_{R(L)}$	>	30	μA
Wavelength at peak response V_R = 5 V	λ_{pk}	typ.	930	nm
Sensitive area	A	typ.	5	mm²

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-67.



(1) Reference for the positional tolerance of the sensitive area.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	32	V
Total power dissipation up to T_{amb} = 47,5 °C	P_{tot}	max.	150	mW
Storage temperature	T_{stg}	−30 to + 100		°C
Junction temperature	T_j	max.	100	°C
Lead soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max.	260	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	350	°C/W

CHARACTERISTICS

$T_j = 25$ °C

Dark reverse current $V_R = 10$ V; $E_e = 0$	$I_{R(D)}$	typ.	2	nA
		<	30	nA
Light reverse current $V_R = 5$ V; $E_e = 1$ mW/cm²; λ = 930 nm	$I_{R(L)}$	>	30	μA
		typ.	45	μA
Reverse voltage $I_R = 0{,}1$ mA; $E_e = 0$	V_R	>	32	V
Wavelength at peak response $V_R = 5$ V	λ_{pk}	typ.	930	nm
Diode capacitance $V_R = 3$ V	C_d	typ.	17	pF
		<	30	pF
$V_R = 0$	C_d	typ.	50	pF
Light switching times (see Figs 2 and 3) Rise time and fall time $V_{KK} = 10$ V; $R_A = 1$ kΩ	t_r, t_f	typ.	50	ns

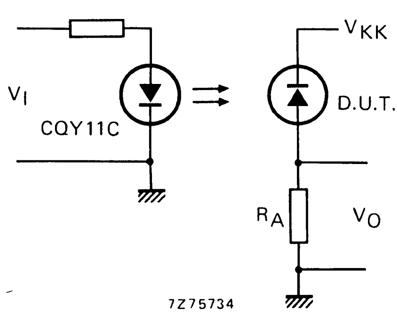


Fig. 2 Switching circuit.

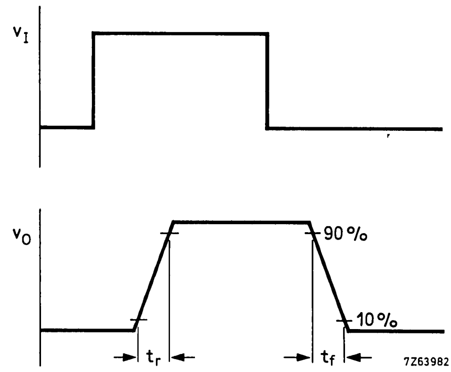


Fig. 3 Input and output switching waveforms.

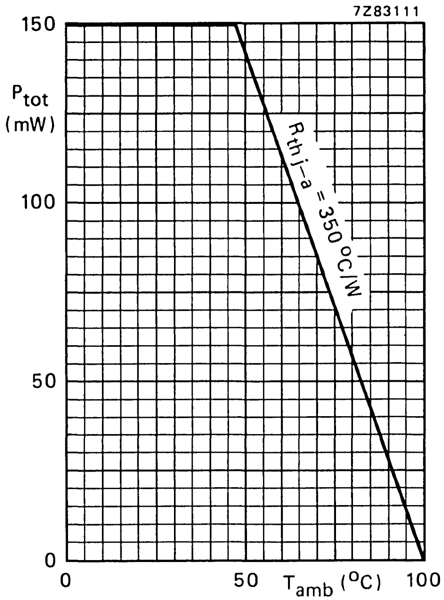


Fig. 4 Maximum permissible power dissipation as a function of temperature.

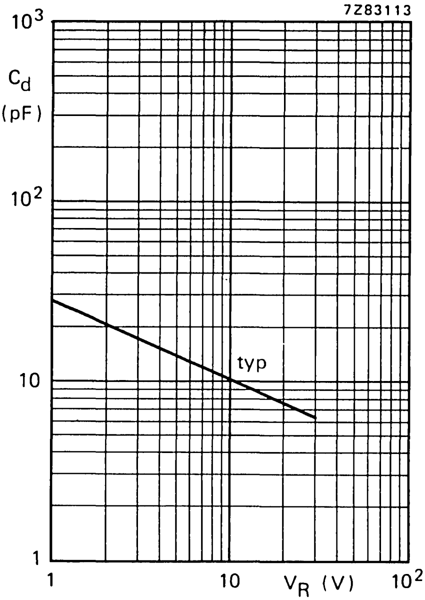


Fig. 5 T_{amb} = 25 °C.

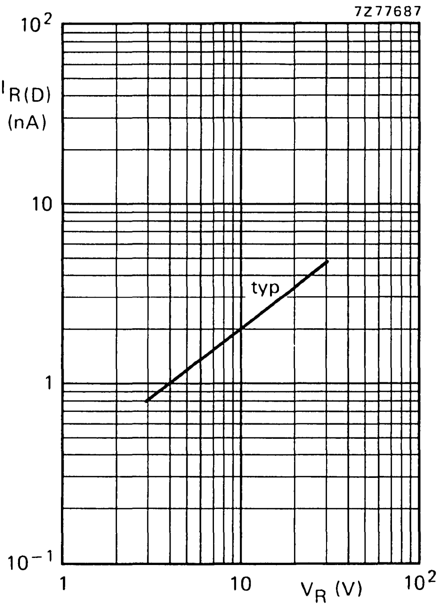


Fig. 6 E = 0; T_{amb} = 25 °C.

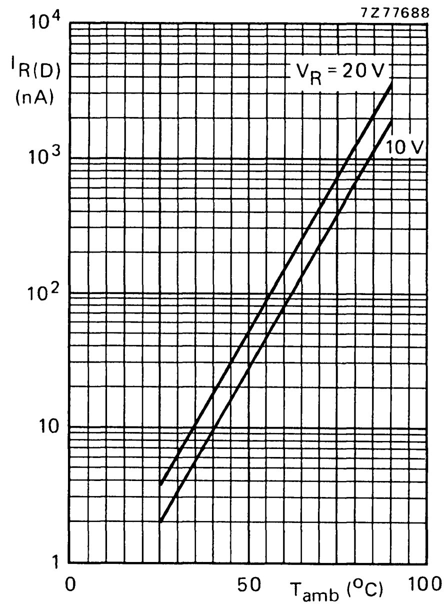


Fig. 7 E = 0; typical values.

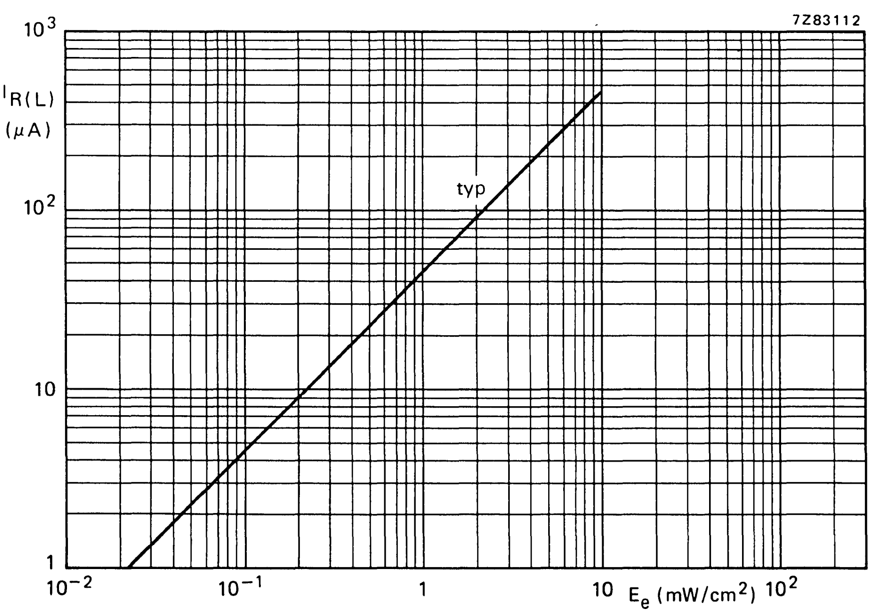


Fig. 8 V_R = 5 V; λ = 930 nm; T_{amb} = 25 °C.

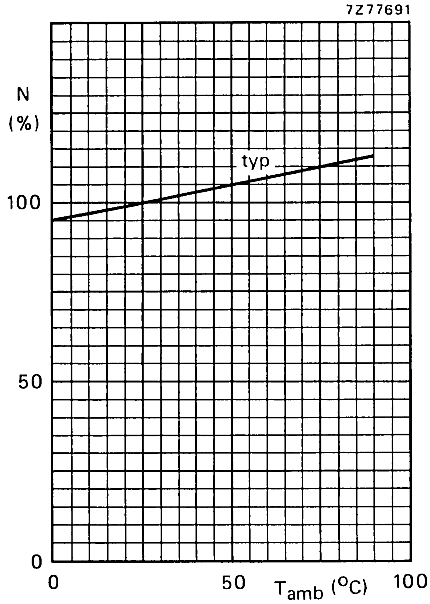


Fig. 9 E_e = 1 mW/cm²; λ = 930 nm.

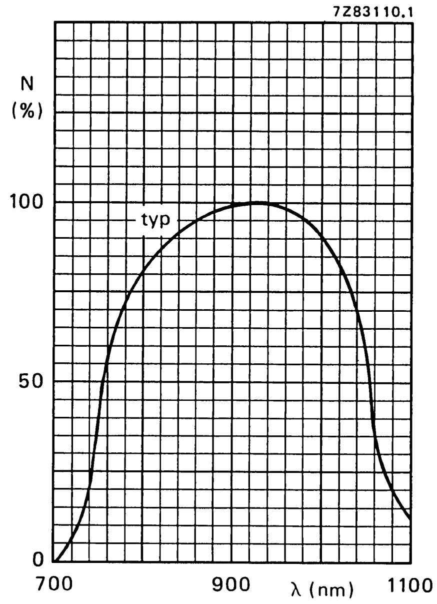


Fig. 10 V_R = 5 V; T_{amb} = 25 °C.

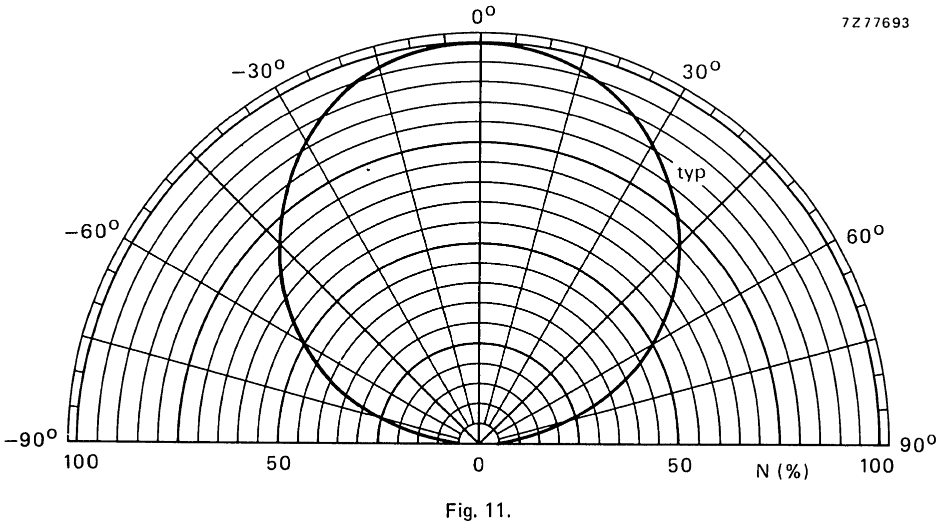


Fig. 11.

SILICON PLANAR EPITAXIAL PHOTOTRANSISTORS

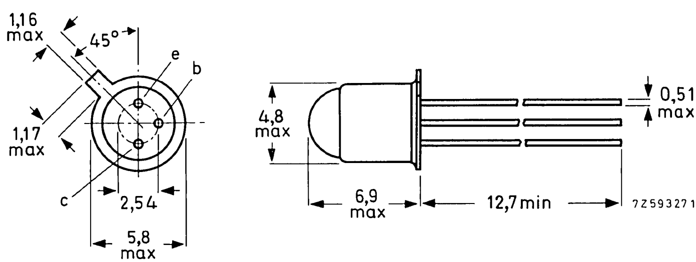
General purpose n-p-n silicon phototransistors in TO-18.
The BPX25 has a lens, the BPX29 has a plane window.

QUICK REFERENCE DATA					
Collector-emitter voltage (open base)	V_{CEO}	max.	32		V
Collector current (peak value)	I_{CM}	max.	200		mA
Junction temperature	T_j	max.	150		^oC
Collector dark current $I_B = 0$; $V_{CE} = 24$ V	$I_{CEO(D)}$	<	500		nA
			BPX25	BPX29	
Collector light current $I_B = 0$; $V_{CE} = 6$ V; at 1000 lx	$I_{CEO(L)}$	typ.	13	0, 8	mA
Wavelength at peak response	λ_{pk}	typ.	800		nm

MECHANICAL DATA Dimensions in mm

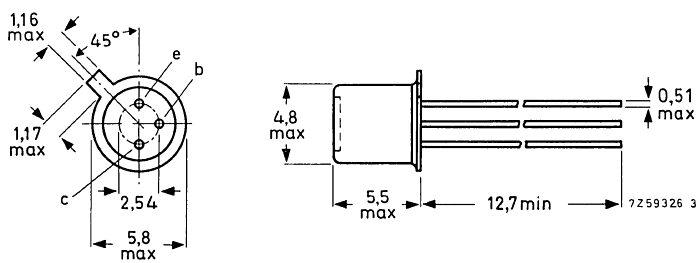
BPX25

TO-18, except for lens
Collector connected to case



BPX29

TO-18, except for window
Collector connected to case



RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

Collector-base voltage (open emitter)	V_{CBO}	max.	32	V
Collector-emitter voltage (open base)	V_{CEO}	max.	32	V
Emitter-base voltage (open collector)	V_{EBO}	max.	5	V

Current

Collector current (d.c.)	I_C	max.	100	mA
Collector current (peak value)	I_{CM}	max.	200	mA

Power dissipation

Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	300	mW

Temperatures

Storage temperature	T_{stg}	−65 to + 150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0,4	°C/mW
From junction to case	$R_{th\ j\text{-}c}$	=	0,15	°C/mW

CHARACTERISTICS T_{amb} = 25 °C unless otherwise specified

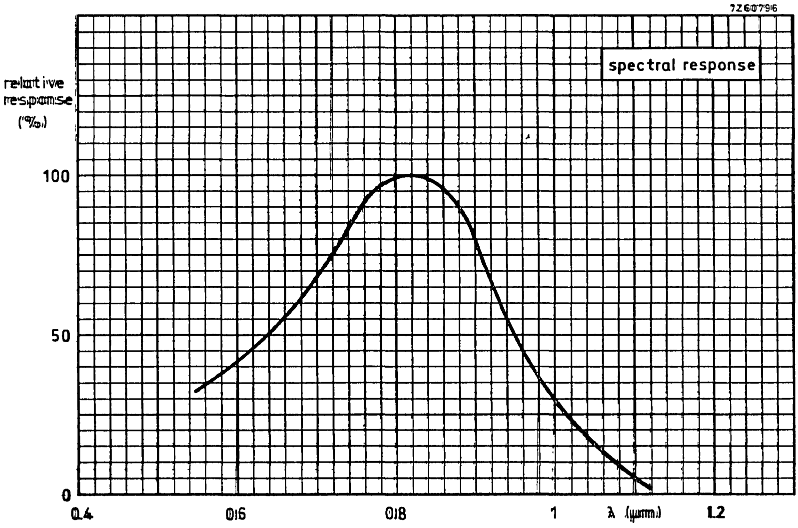
Collector dark current

I_B = 0; V_{CE} = 24 V	$I_{CEO(D)}$	typ.	100	nA
		<	500	nA
I_B = 0; V_{CE} = 24 V; T_{amb} = 100 °C	$I_{CEO(D)}$	typ.	15	µA
		<	100	µA

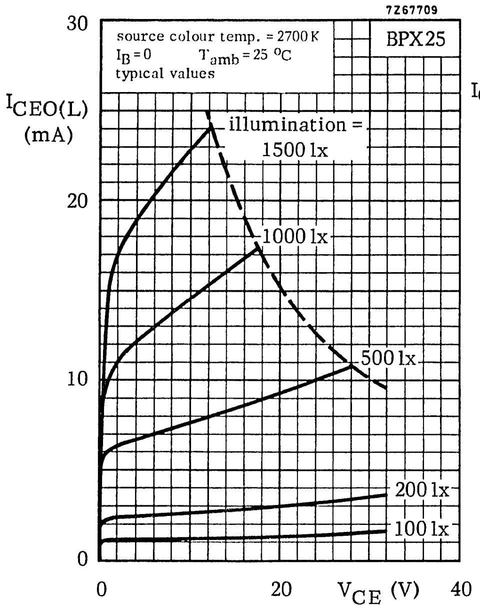
			BPX25	BPX29	
Collector light current					
I_B = 0; V_{CE} = 6 V; tungsten filament lamp source with T_c = 2700 K; E_v = 1000 lx (7,7 mW/cm²)	$I_{CEO(L)}$	>	5	0,25	mA
		typ.	13	0,8	mA
D.C. current gain					
I_C = 2 mA; V_{CE} = 6 V	h_{FE}	typ.	500	500	
Cut-off frequency					
Source: modulated GaAs; 0,4 mW/cm²; Load: optimum (50 Ω); V_{CE} = 24 V	f_{co}	typ.	200	150	kHz

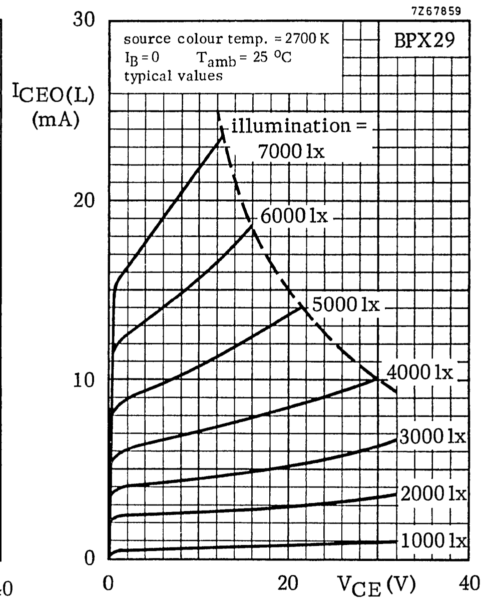
CHARACTERISTICS (continued)

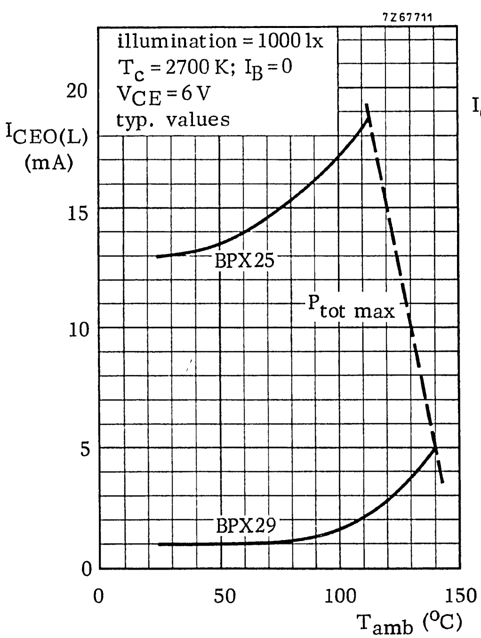
			BPX25	BPX29	
Switching times 1)					
Delay time	t_d	typ.	1,0	2,5	µs
		<	3,0	5,0	µs
Rise time	t_r	typ.	1,5	2,5	µs
		<	3,0	5,0	µs
Storage time	t_s	typ.	0,2	0,2	µs
		<	0,4	0,4	µs
Fall time	t_f	typ.	1,5	3,5	µs
		<	4,0	8,0	µs
Wavelength at peak response	λ_{pk}	typ.	800	800	nm

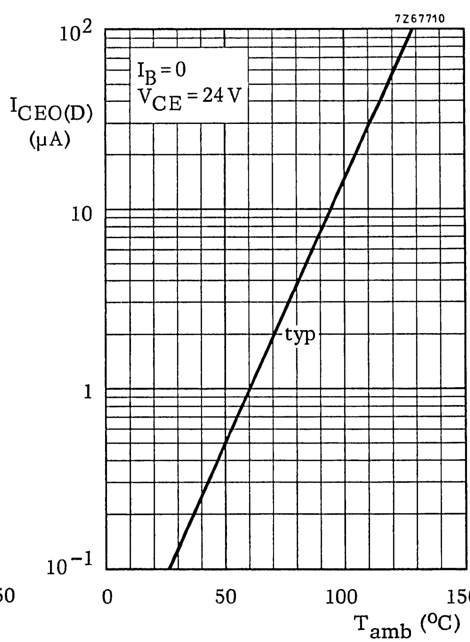


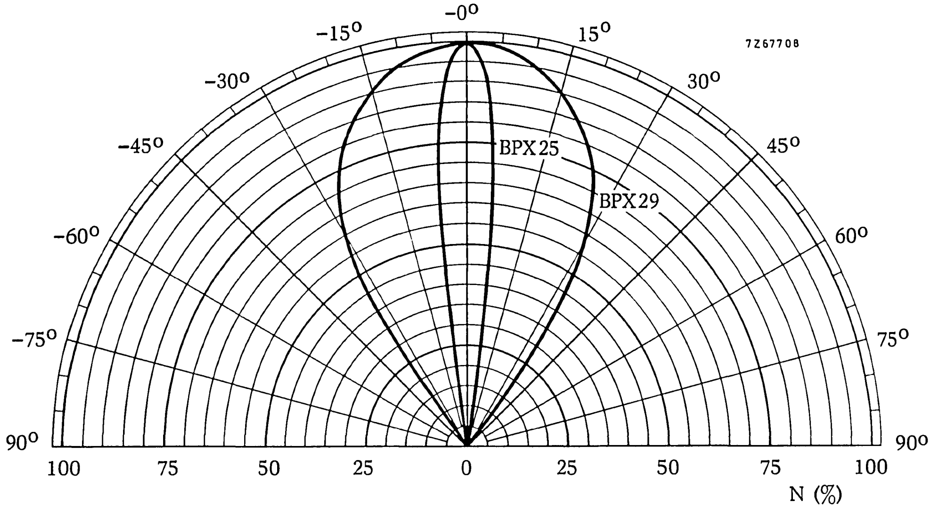
1) Source: modulated GaAs: 0,4 mW/cm^2
Load: optimum (50 Ω)
V_{CE} = 24 V
Improved switching times can be obtained by a quiescent bias current.
I.e. I_B = 2 µA: t_d < 0,2 µs.


7Z67709
source colour temp. = 2700 K
I_B = 0 T_{amb} = 25 °C
typical values
BPX25
$I_{CEO(L)}$ (mA)
illumination = 1500 lx
1000 lx
500 lx
200 lx
100 lx
30
20
10
0
0
20
40
V_{CE} (V)


7Z67859
source colour temp. = 2700 K
I_B = 0 T_{amb} = 25 °C
typical values
BPX29
$I_{CEO(L)}$ (mA)
illumination = 7000 lx
6000 lx
5000 lx
4000 lx
3000 lx
2000 lx
1000 lx
30
20
10
0
0
20
40
V_{CE} (V)


7Z67711
illumination = 1000 lx
T_c = 2700 K; I_B = 0
V_{CE} = 6 V
typ. values
$I_{CEO(L)}$ (mA)
BPX25
$P_{tot\ max}$
BPX29
20
15
10
5
0
0
50
100
150
T_{amb} (°C)


7Z67710
I_B = 0
V_{CE} = 24 V
$I_{CEO(D)}$ (μA)
typ
10^2
10
1
10^{-1}
0
50
100
150
T_{amb} (°C)


-0°
-15°
15°
7Z67708
-30°
30°
-45°
45°
BPX25
BPX29
-60°
60°
-75°
75°
90°
90°
100
75
50
25
0
25
50
75
100
N (%)

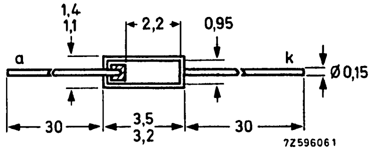
SILICON PLANAR PHOTODIODE

Unencapsulated photodiode for general purpose applications.

QUICK REFERENCE DATA				
Reverse voltage	V_R	max.	18	V
Luminous sensitivity V_R = 15 V; E = 1000 lx	N	typ.	14	nA/lx
Dark reverse current at V_R = 15 V	I_d	<	0,5	µA
Wavelength at peak response	λpk	typ.	800	nm

MECHANICAL DATA

Dimensions in mm



Slice thickness 0,27 mm

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltage				
Reverse voltage	V_R	max.	18	V
Currents				
Forward current	I_F	max.	5	mA
Dark reverse current	I_R	max.	2	mA
Temperatures				
Storage temperature	T_{stg}	-65 to + 125		°C
Junction temperature	T_j	max.	125	°C

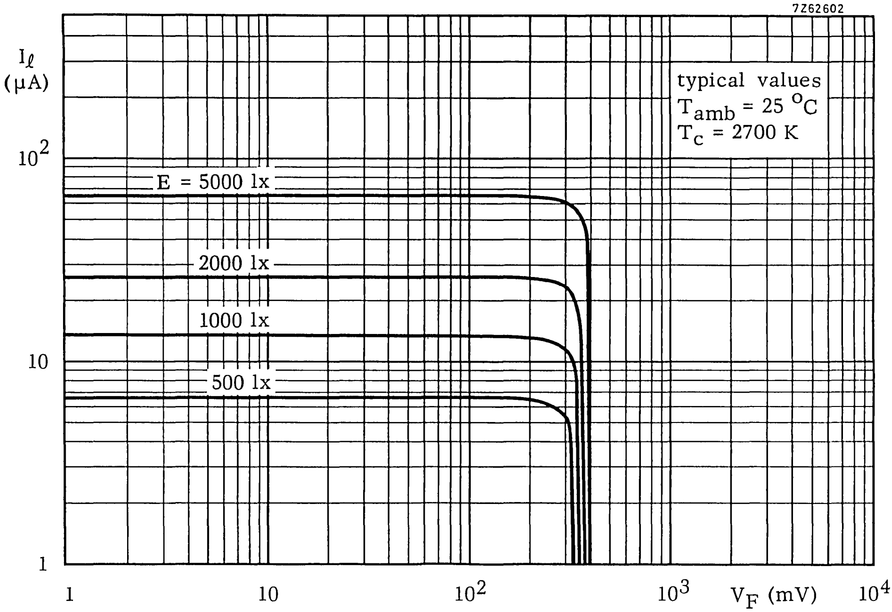
THERMAL RESISTANCE

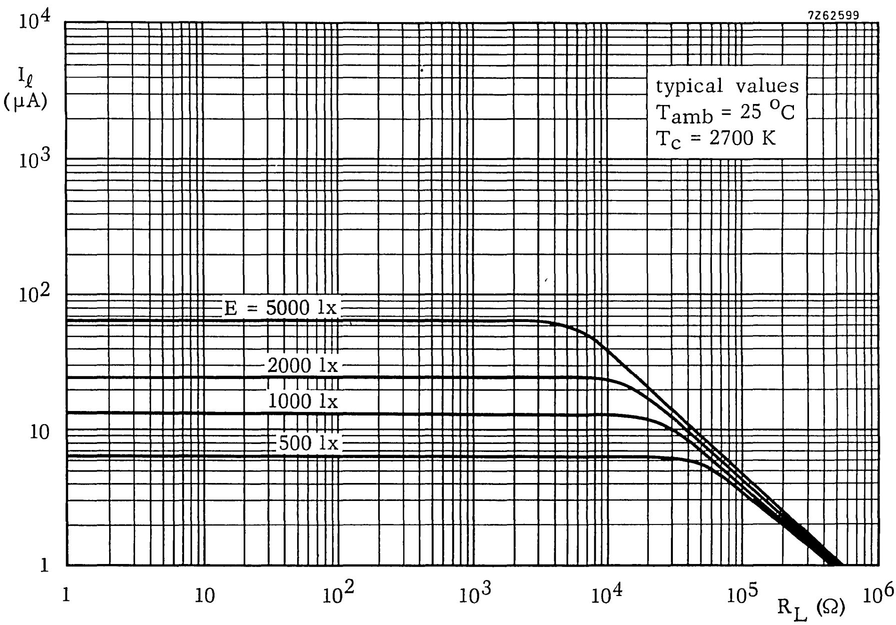
From junction to ambient in free air	$R_{th\ j-a}$	=	0,5	°C/mW

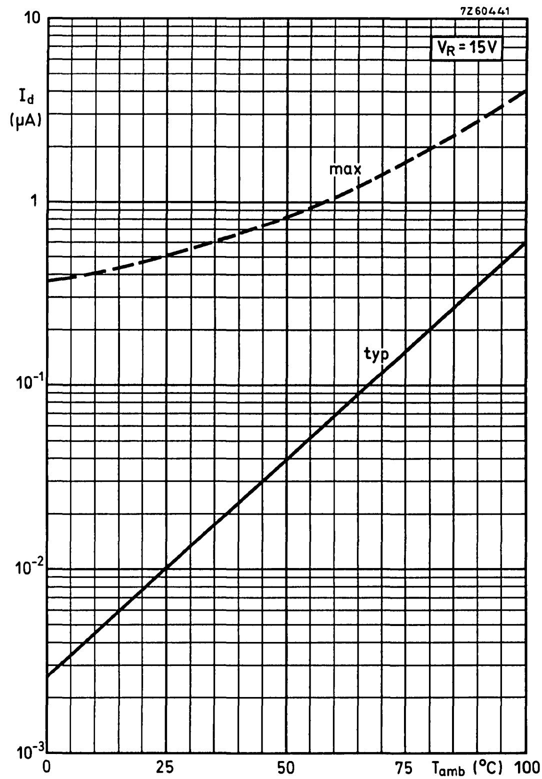
CHARACTERISTICS T_{amb} = 25 °C unless otherwise specified

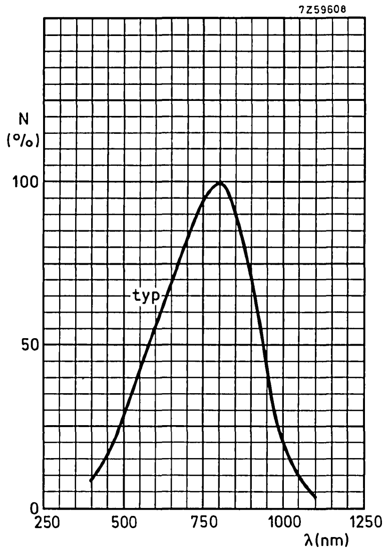
Dark reverse current				
V_R = 15 V	I_d	typ.	0,01	µA
		<	0,5	µA
V_R = 15 V; T_{amb} = 100 °C	I_d	typ.	0,6	µA
		<	4,0	µA
Photovoltaic mode				
E = 1000 lx; T_c = 2700 K (equivalent to 7,7 mW/cm^2)				
Light reverse current; V = 0	I_1	>	10	µA
		typ.	13	µA
Forward voltage; I = 0	V_F	>	330	mV
		typ.	350	mV
Luminous sensitivity with external voltage [1]				
V_R = 15 V; E = 1000 lx; T_c = 2700 K (equivalent to 7,7 mW/cm^2)	N	>	10,5	nA/lx
		typ.	14	nA/lx
Wavelength at peak response	λ_{pk}	typ.	800	nm
Diode capacitance; f = 500 kHz				
V_R = 15 V	C_d	typ.	90	pF
V_R = 0	C_d	typ.	300	pF
Cut-off frequency (modulated GaAs source)	f_{co}	typ.	500	kHz

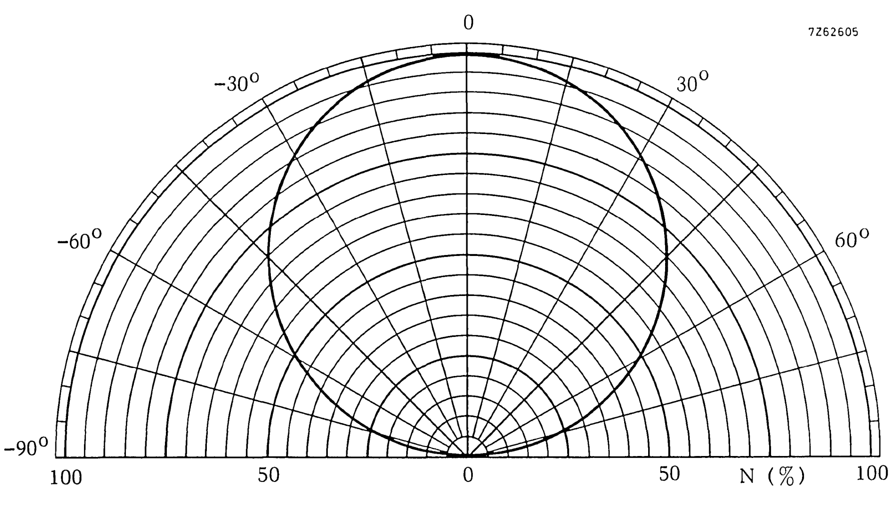
[1] The value of light current increases with temperature by an amount approximately equal to the increase in dark current.


7Z62602
I_ℓ (μA)
typical values
T_{amb} = 25 °C
T_c = 2700 K
E = 5000 lx
2000 lx
1000 lx
500 lx
V_F (mV)
1
10
10^2
10^3
10^4


7Z62599
I_ℓ (μA)
typical values
T_{amb} = 25 °C
T_c = 2700 K
E = 5000 lx
2000 lx
1000 lx
500 lx
R_L (Ω)
1
10
10^2
10^3
10^4
10^5
10^6


7Z60441
$V_R = 15V$
I_d (μA)
10
1
10^{-1}
10^{-2}
10^{-3}
max
typ
0
25
50
75
T_{amb} (°C)
100


7Z59608
N
(%)
100
50
0
250
500
750
1000
1250
λ(nm)
typ


0
7Z62605
-30°
30°
-60°
60°
-90°
90°
100
50
0
50
N (%)
100

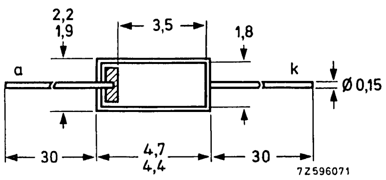
SILICON PLANAR PHOTODIODE

Unencapsulated photodiode for general purpose applications.

QUICK REFERENCE DATA				
Reverse voltage	V_R	max.	18	V
Luminous sensitivity V_R = 15 V; E = 1000 lx	N	typ.	40	nA/lx
Dark reverse current at V_R = 15 V	I_d	<	1	µA
Wavelength at peak response	λ_{pk}	typ.	800	nm

MECHANICAL DATA

Dimensions in mm



Slice thickness 0,27 mm

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltage

Reverse voltage	V_R	max.	18	V

Currents

Forward current	I_F	max.	10	mA
Dark reverse current	I_R	max.	5	mA

Temperatures

Storage temperature	T_{stg}	−65 to + 125		°C
Junction temperature	T_j	max.	125	°C

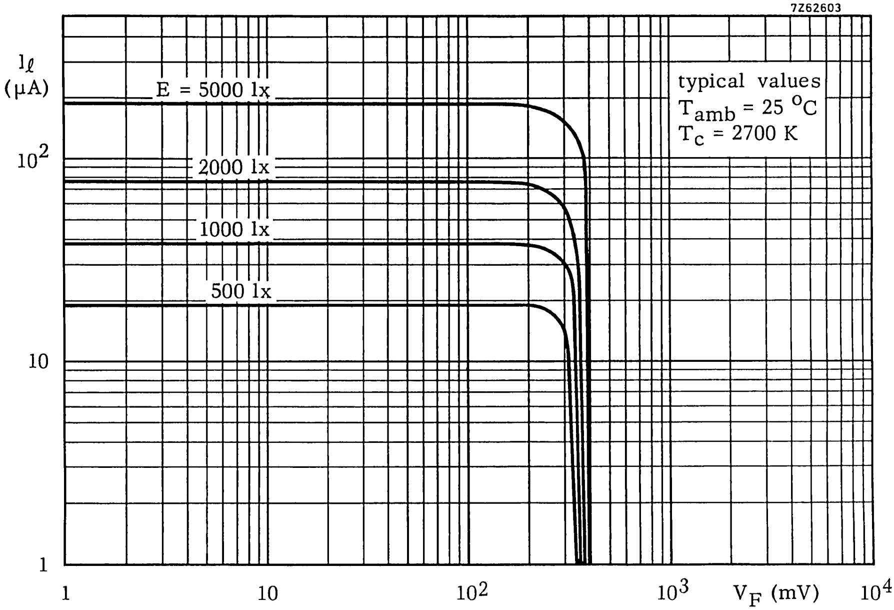
THERMAL RESISTANCE

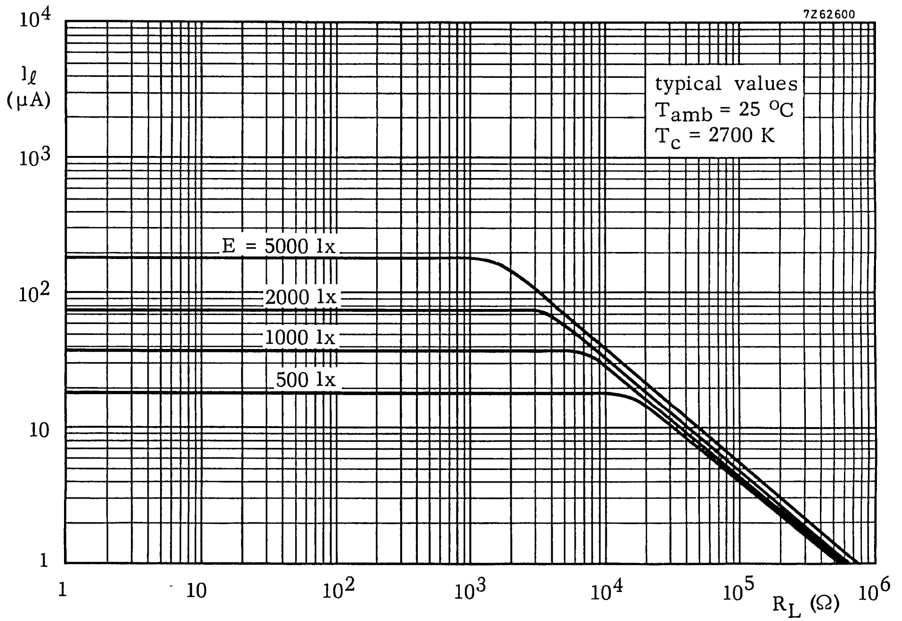
From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0,5	°C/mW

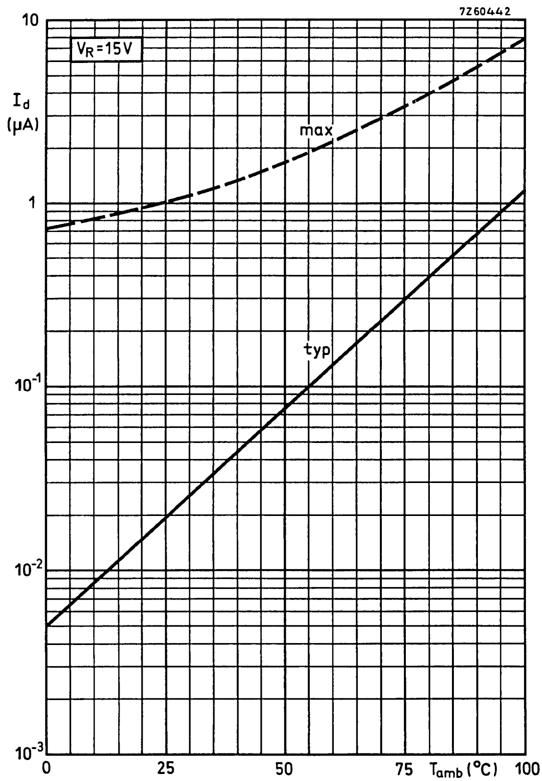
CHARACTERISTICS T_{amb} = 25 °C unless otherwise specified

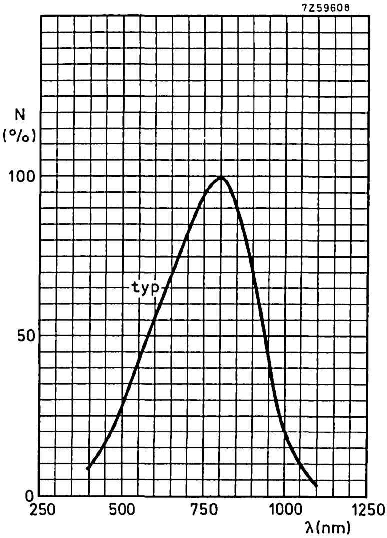
Dark reverse current				
V_R = 15 V	I_d	typ.	0,02	μA
		<	1,0	μA
V_R = 15 V; T_{amb} = 100 °C	I_d	typ.	1,2	μA
		<	8,0	μA
Photovoltaic mode				
E = 1000 lx; T_c = 2700 K (equivalent to 7,7 mW/cm²)				
Light reverse current; V = 0	I_l	>	30	μA
		typ.	38	μA
Forward voltage; I = 0	V_F	>	330	mV
		typ.	350	mV
Luminous sensitivity with external voltage [1]				
V_R = 15 V; E = 1000 lx; T_c = 2700 K (equivalent to 7,7 mW/cm²)	N	>	31	nA/lx
		typ.	40	nA/lx
Wavelength at peak response	λ_{pk}	typ.	800	nm
Diode capacitance; f = 500 kHz				
V_R = 15 V	C_d	typ.	250	pF
V_R = 0	C_d	typ.	800	pF
Cut-off frequency (modulated GaAs source)	f_{co}	typ.	500	kHz

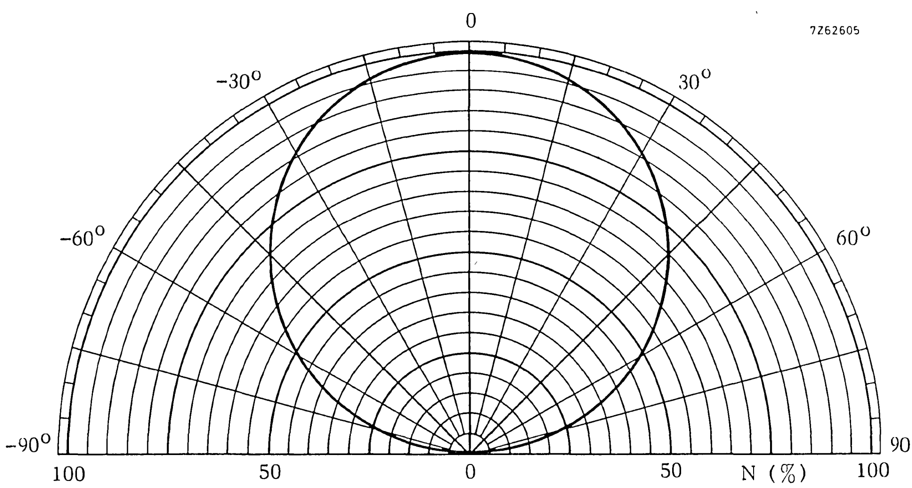
[1]) The value of light current increases with temperature by an amount approximately equal to the increase in dark current.


7Z62603
I_ℓ (μA)
E = 5000 lx
2000 lx
1000 lx
500 lx
typical values
T_{amb} = 25 °C
T_c = 2700 K
1
10
10^2
1
10
10^2
10^3
V_F (mV)
10^4


7Z62600
I_ℓ (μA)
E = 5000 lx
2000 lx
1000 lx
500 lx
typical values
T_{amb} = 25 °C
T_c = 2700 K
1
10
10^2
10^3
10^4
1
10
10^2
10^3
10^4
10^5
R_L (Ω)
10^6


7Z60442
$V_R = 15V$
I_d (μA)
10
1
10^{-1}
10^{-2}
10^{-3}
max
typ
0
25
50
75
T_{amb} (°C)
100


7Z59608
N
(%)
100
50
0
250
500
750
1000
1250
λ(nm)
typ


0
7Z62605
-30°
30°
-60°
60°
-90°
90°
100
50
0
50
N (%)
100

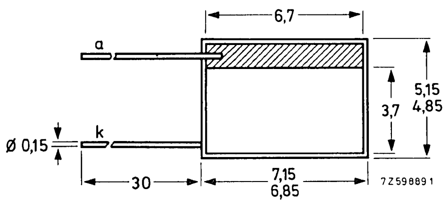
SILICON PLANAR PHOTODIODE

Unencapsulated photodiode for general purpose applications.

QUICK REFERENCE DATA				
Reverse voltage	V_R	max.	12	V
Luminous sensitivity V_R = 10 V; E = 1000 lx	N	typ.	150	nA/lx
Dark reverse current at V_R = 10 V	I_d	<	5	µA
Wavelength at peak response	λ_{pk}	typ.	800	nm

MECHANICAL DATA

Dimensions in mm



Slice thickness 0,27 mm

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltage				
Reverse voltage	V_R	max.	12	V
Currents				
Forward current	I_F	max.	50	mA
Dark reverse current	I_R	max.	20	mA
Temperatures				
Storage temperature	T_{stg}	−65 to +125		°C
Junction temperature	T_j	max.	125	°C

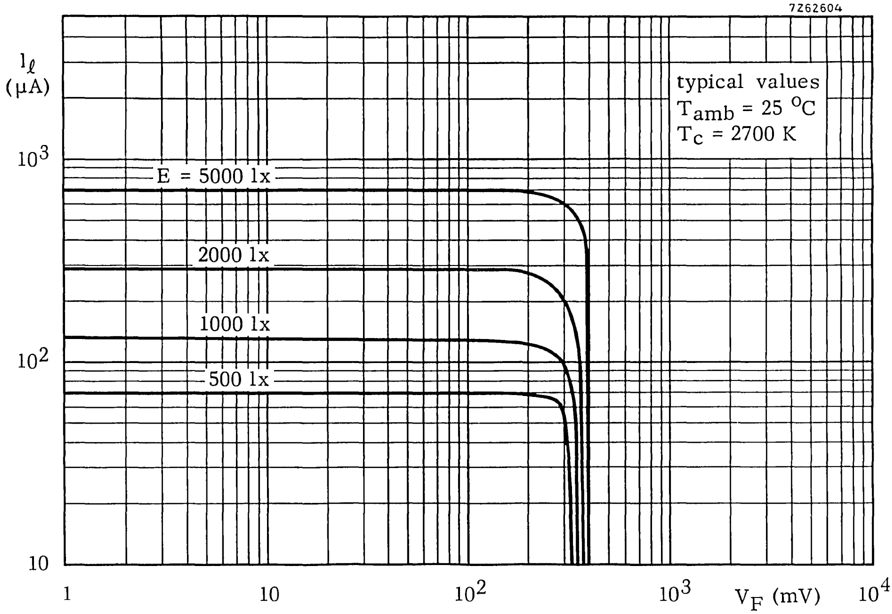
THERMAL RESISTANCE

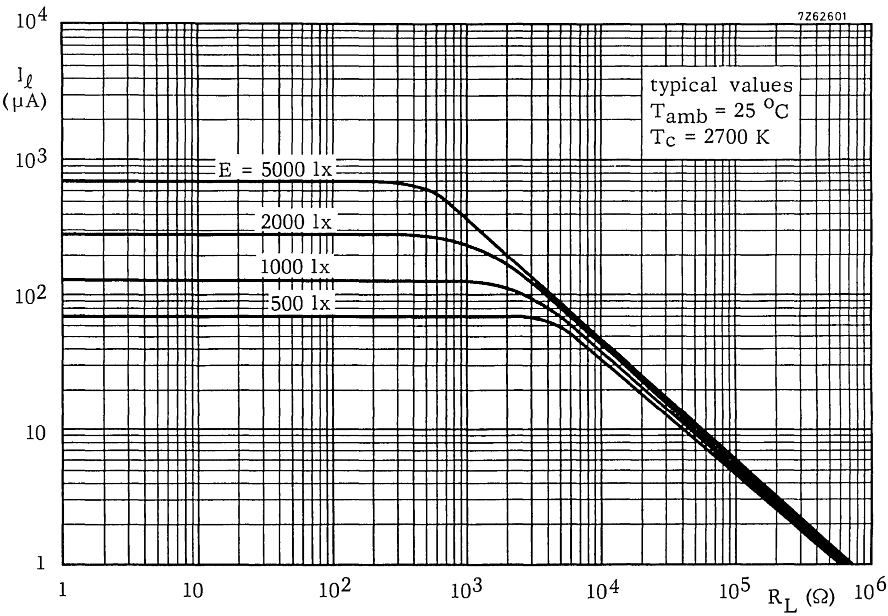
From junction to ambient in free air	$R_{th\ j-a}$	=	0,3	°C/mW

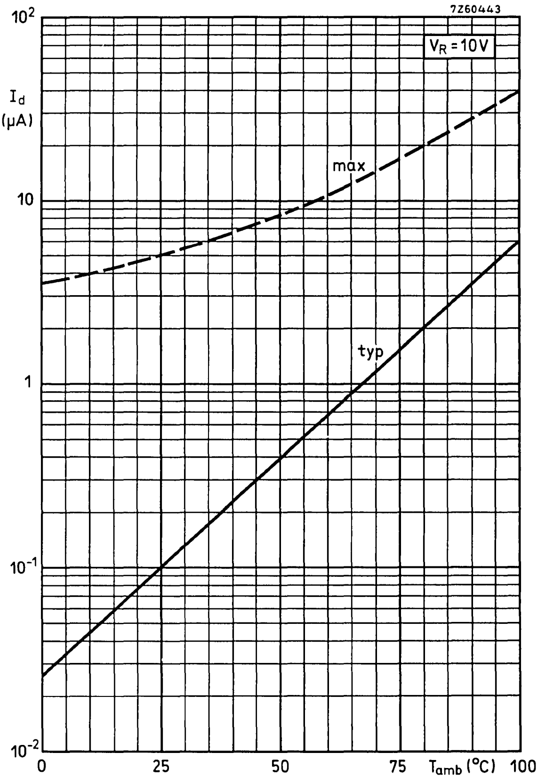
CHARACTERISTICS T_{amb} = 25 °C unless otherwise specified

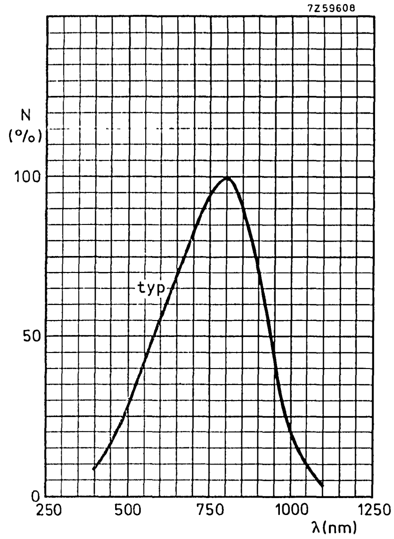
Dark reverse current				
V_R = 10 V	I_d	typ.	0,1	µA
		<	5,0	µA
V_R = 10 V; T_{amb} = 100 °C	I_d	typ.	6,0	µA
		<	40	µA
Photovoltaic mode				
E = 1000 lx; T_c = 2700 K (equivalent to 7,7 mW/cm²)				
Light reverse current; V = 0	I_l	>	110	µA
		typ.	140	µA
Forward voltage; I = 0	V_F	>	330	mV
		typ.	350	mV
Luminous sensitivity with external voltage [1]				
V_R = 10 V; E = 1000 lx; T_c = 2700 K (equivalent to 7,7 mW/cm²)	N	>	120	nA/lx
		typ.	150	nA/lx
Wavelength at peak response	λ_{pk}	typ.	800	nm
Diode capacitance; f = 500 kHz				
V_R = 10 V	C_d	typ.	1000	pF
V_R = 0	C_d	typ.	3000	pF
Cut-off frequency (modulated GaAs source)	f_{co}	typ.	500	kHz

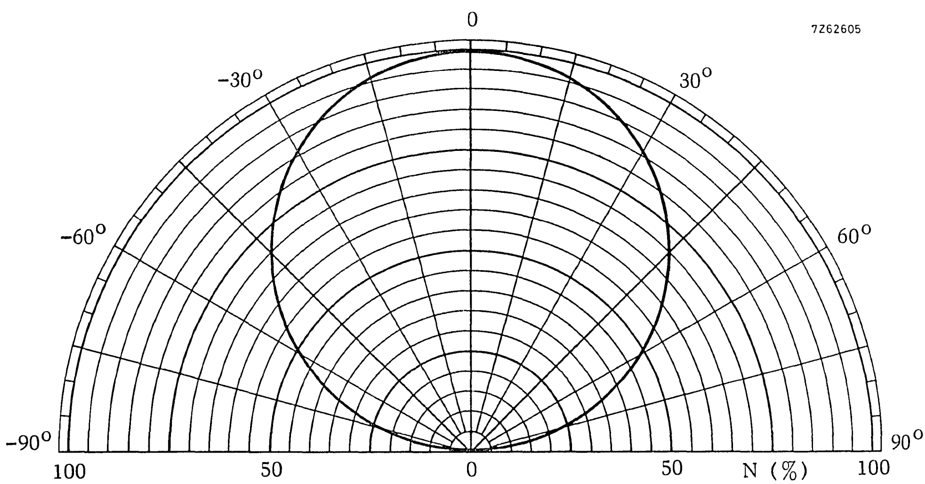
[1]) The value of light current increases with temperature by an amount approximately equal to the increase in dark current.


7Z62604
I_ℓ (µA)
typical values
T_{amb} = 25 °C
T_c = 2700 K
E = 5000 lx
2000 lx
1000 lx
500 lx
V_F (mV)
10
10^2
10^3
1
10
10^2
10^3
10^4


7Z62601
I_ℓ (µA)
typical values
T_{amb} = 25 °C
T_c = 2700 K
E = 5000 lx
2000 lx
1000 lx
500 lx
R_L (Ω)
1
10
10^2
10^3
10^4
1
10
10^2
10^3
10^4
10^5
10^6


7Z60443
V_R = 10 V
I_d (μA)
max
typ
10^2
10
1
10^{-1}
10^{-2}
0
25
50
75
T_{amb} (°C)
100


7Z59608
N
(%)
100
50
0
250
500
750
1000
1250
λ(nm)
typ


0
7Z62605
-30°
30°
-60°
60°
-90°
90°
100
50
0
50
N (%)
100

PHOTOTRANSISTOR

General purpose n-p-n silicon phototransistor with a glass lens. Inaccessable base.

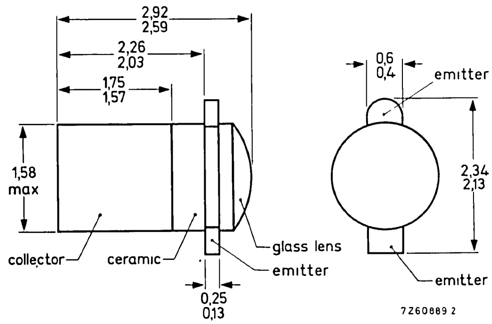
QUICK REFERENCE DATA

Collector-emitter voltage		V_{CEO}	max.	50 V
Collector current (d.c.)		I_C	max.	20 mA
Junction temperature		T_j	max.	150 °C
Collector dark (cut-off) current $V_{CE} = 30$ V		I_d	<	25 nA
Collector light (cut-off) current $V_{CE} = 5$ V; $E_e = 20$ mW/cm^2	**BPX71**	I_ℓ		0,5 to 15 mA
	BPX71-203	I_ℓ		4 to 8 mA
	BPX71-204	I_ℓ		7 to 15 mA
Wavelength at peak response		λ_{pk}	typ.	800 nm
Angle between half-sensitivity directions		$\alpha_{50\%}$	typ.	40°

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-71A (DO-31).



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage	V_{CEO}	max.	50 V
Emitter-collector voltage	V_{ECO}	max.	7 V
Collector current			
d.c.	I_C	max.	20 mA
(peak value); $t_p \leq 50\ \mu s$; $\delta \leq 0{,}1$	I_{CM}	max.	50 mA
Total power dissipation			
up to $T_{amb} = 50\ ^oC$	P_{tot}	max.	50 mW
up to $T_{mb} = 55\ ^oC$	P_{tot}	max.	100 mW
Storage temperature	T_{stg}	−65 to + 150	^oC
Junction temperature	T_j	max.	150 ^oC

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	2000 $^oC/W$
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	950 $^oC/W$

CHARACTERISTICS

$T_{amb} = 25\ ^oC$ unless otherwise specified

Collector dark (cut-off) current				
$V_{CE} = 30$ V		I_d	<	25 nA
$V_{CE} = 30$ V; $T_{amb} = 100\ ^oC$		I_d	<	100 μA
Collector light (cut-off) current				
$V_{CE} = 5$; tungsten filament lamp source with colour temperature 2856 K				
$E_e = 4{,}75$ mW/cm^2		I_ℓ	typ.	1 mA
$E_e = 20$ mW/cm^2	**BPX71**	I_ℓ		0,5 to 15 mA
	BPX71-203	I_ℓ		4 to 8 mA
	BPX71-204	I_ℓ		7 to 15 mA

CHARACTERISTICS (continued)

Breakdown voltages

Collector-emitter voltage				
$E = 0$; $I_C = 0,5$ mA	$V_{(BR)CEO}$	>	50	V
Emitter-collector voltage				
$E = 0$; $I_C = 0,1$ mA	$V_{(BR)ECO}$	>	7	V

Collector-emitter light saturation voltage

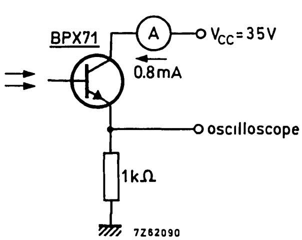
$I_C = 0,4$ mA; $E_e = 20$ mW/cm^2; $T_c = 2856$ K	V_{CEsat}	typ.	150	mV
		<	400	mV

Wavelength at peak response	λ_{pk}	typ.	800	nm
Bandwidth at half height	$B_{50\%}$	typ.	400	nm

Switching times

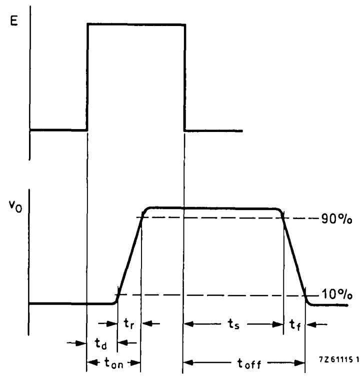
$I_{Con} = 0,8$ mA; $V_{CC} = 35$ V; $R_L = 1$ kΩ

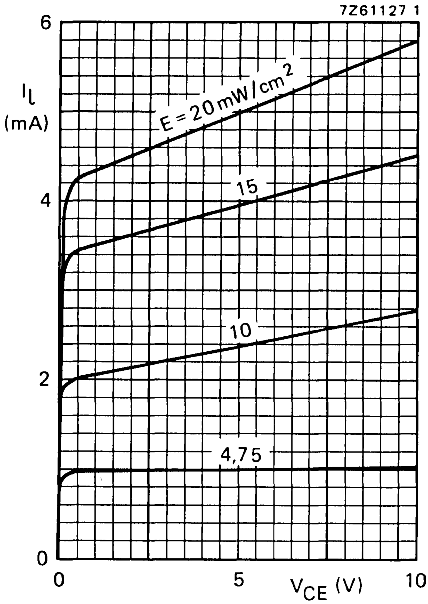
Delay time	t_d	typ.	2,0	µs
		<	20	µs
Rise time	t_r	typ.	3,0	µs
		<	30	µs
Storage time	t_s	typ.	0,1	µs
		<	2,0	µs
Fall time	t_f	typ.	2,5	µs
		<	20	µs



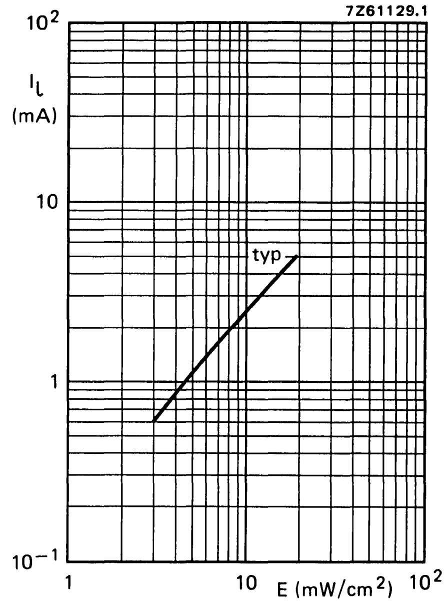
Light input pulse:

$t_r = t_f = 20$ ns
$t_p = 20$ µs
$f = 500$ Hz
$\lambda = 800$ nm

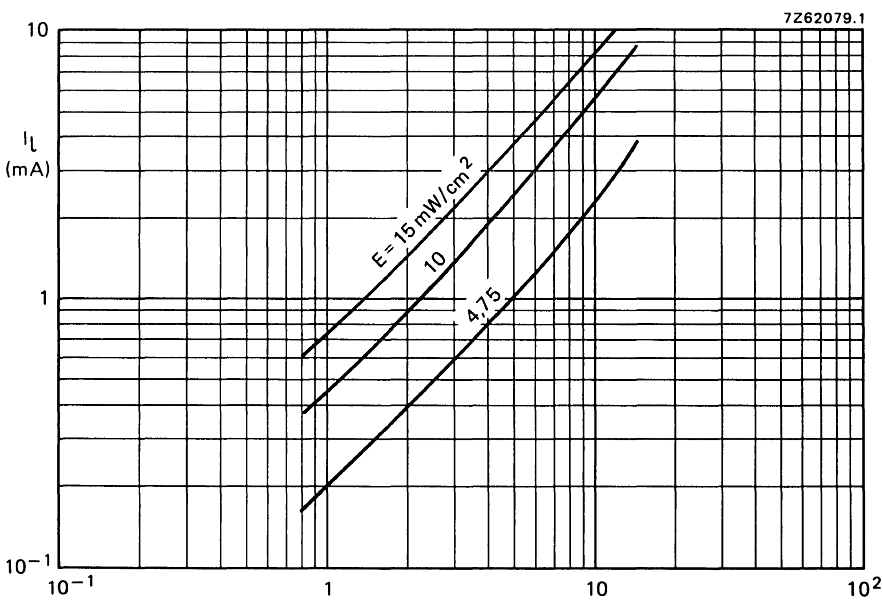




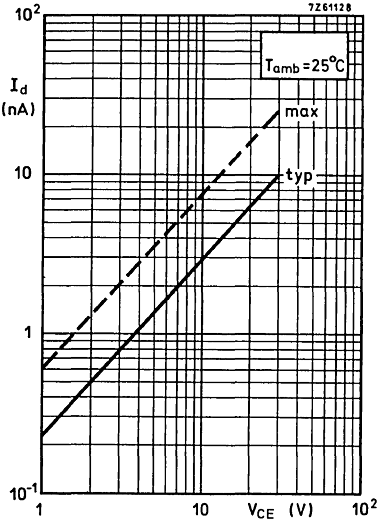
Typical values; T_{amb} = 25 °C.

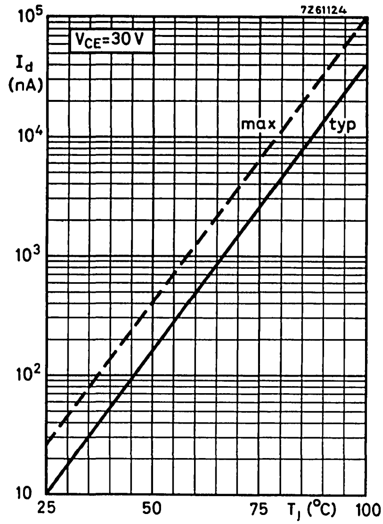


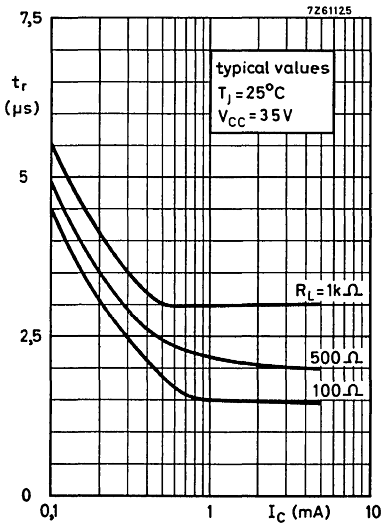
V_{CE} = 5 V; T_{amb} = 25 °C.

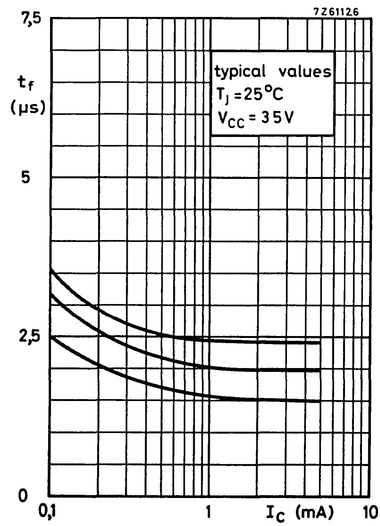


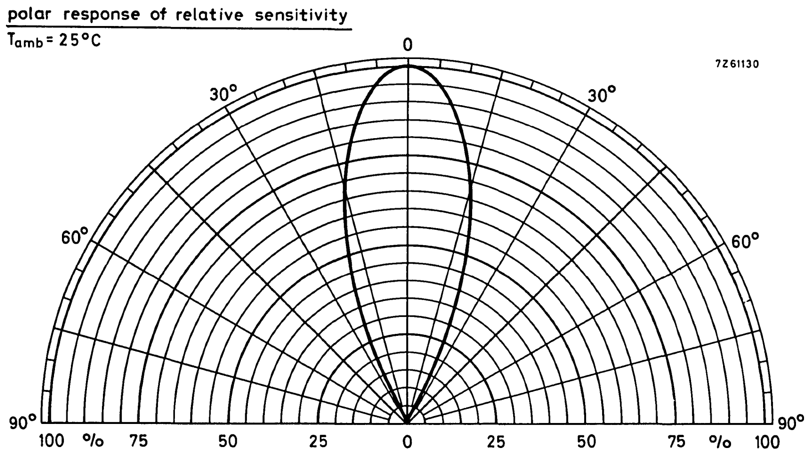
V_{CE} = 5 V; T_{amb} = 25 °C.

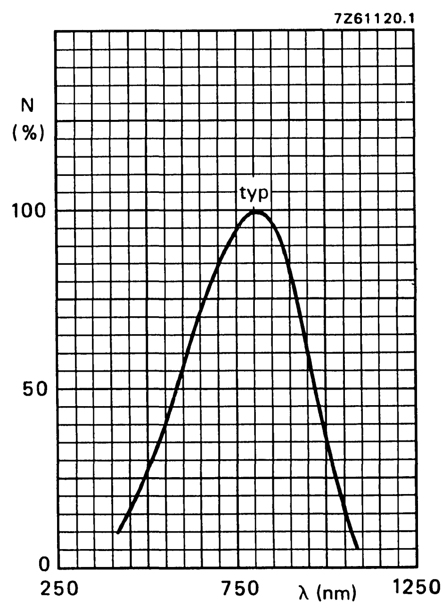

7Z61128
I_d (nA)
T_{amb} = 25°C
max
typ
10^2
10
1
10^{-1}
1
10
V_{CE} (V)
10^2


7Z61124
V_{CE} = 30 V
I_d (nA)
max
typ
10^5
10^4
10^3
10^2
10
25
50
75
T_j (°C)
100


7Z61125
t_r (μs)
typical values
T_j = 25°C
V_{CC} = 35 V
R_L = 1 kΩ
500 Ω
100 Ω
7,5
5
2,5
0
0,1
1
I_C (mA)
10


7Z61126
t_f (μs)
typical values
T_j = 25°C
V_{CC} = 35 V
7,5
5
2,5
0
0,1
1
I_C (mA)
10


polar response of relative sensitivity
T_{amb} = 25 °C
7Z61130
0
30°
30°
60°
60°
90°
90°
100 % 75 50 25 0 25 50 75 % 100


7Z61120.1
N
(%)
100
50
0
typ
250
750
λ (nm)
1250

PHOTOTRANSISTOR

General purpose n-p-n silicon phototransistor with a plastic lens.

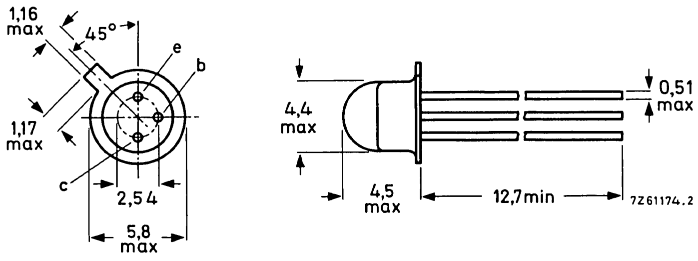
QUICK REFERENCE DATA

Collector-emitter voltage (open base)		V_{CEO}	max.	30 V
Collector current (d.c.)		I_C	max.	25 mA
Junction temperature		T_j	max.	125 °C
Collector dark (cut-off) current V_{CE} = 20 V		I_d	<	100 nA
Collector light (cut-off) current V_{CE} = 5 V; E_V = 1000 lx (E_e = 4,75 mW/cm²)	**BPX72**	I_ℓ		500 to 3000 μA
	BPX72D	I_ℓ		850 to 2000 μA
	BPX72E	I_ℓ		1400 to 3000 μA
	BPX72F	I_ℓ		2400 to 5000 μA
Wavelength at peak response		λ_{pk}	typ.	800 nm
Angle between half-sensitivity directions		$\alpha_{50\%}$	typ.	120°

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-70A.



Maximum lead diameter is guaranteed only for 12,7 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-base voltage (open emitter)	V_{CBO}	max.	40 V
Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Emitter-collector voltage (open base)	V_{ECO}	max.	6 V
Collector current			
d.c.	I_C	max.	25 mA
(peak value); $t_p \leqslant 50\ \mu s$; $\delta \leqslant 0{,}1$	I_{CM}	max.	50 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	180 mW
Storage temperature	T_{stg}	−40 to +125 °C	
Junction temperature	T_j	max.	125 °C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	550 °C/W

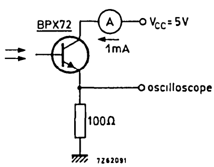
CHARACTERISTICS

$I_B = 0$; T_{amb} = 25 °C unless otherwise specified

Collector dark (cut-off) current				
V_{CE} = 20 V		I_d	typ.	10 nA
			<	100 nA
V_{CE} = 20 V; T_j = 100 °C		I_d	typ.	10 μA
			<	100 μA
Collector light (cut-off) current				
V_{CE} = 5 V; tungsten filament lamp source with colour temperature 2856 K				
E_v = 1000 lx (E_e = 4,75 mW/cm²)	**BPX72**	I_ℓ		500 to 3000 μA
	BPX72D	I_ℓ		850 to 2000 μA
	BPX72E	I_ℓ		1400 to 3000 μA
	BPX72F	I_ℓ		2400 to 5000 μA
E_v = 2500 lx (E_e = 12 mW/cm²)		I_ℓ	typ.	3000 μA

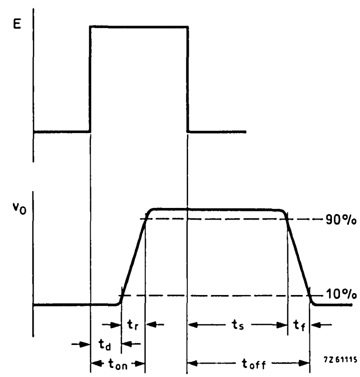
CHARACTERISTICS (continued)

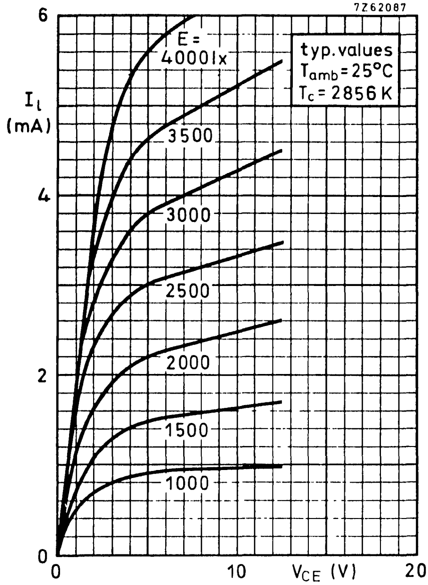
Breakdown voltages				
Collector-base voltage $E = 0$; $I_C = 0,1$ mA	$V_{(BR)CBO}$	>	40	V
Collector-emitter voltage $E = 0$; $I_C = 1$ mA	$V_{(BR)CEO}$	>	30	V
Emitter-collector voltage $E = 0$; $I_C = 0,1$ mA	$V_{(BR)ECO}$	>	6	V
Collector capacitance				
$I_E = I_e = 0$; $V_{CB} = 20$ V	C_c	typ.	3,5	pF
Wavelength at peak response	λ_{pk}	typ.	800	nm
Bandwidth at half height	$B_{50\%}$	typ.	300	nm
Switching times				
$I_{Con} = 1$ mA; $V_{CC} = 5$ V; $R_L = 100\ \Omega$				
Delay time	t_d	typ. <	3,0 6,0	µs µs
Rise time	t_r	typ. <	6,0 20	µs µs
Storage time	t_s	typ. <	1,5 3,0	µs µs
Fall time	t_f	typ. <	4,0 20	µs µs

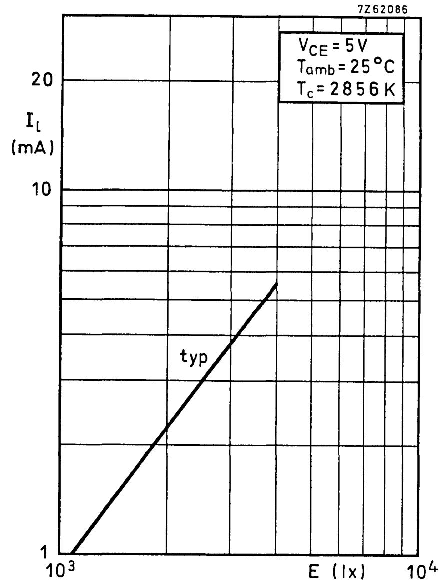


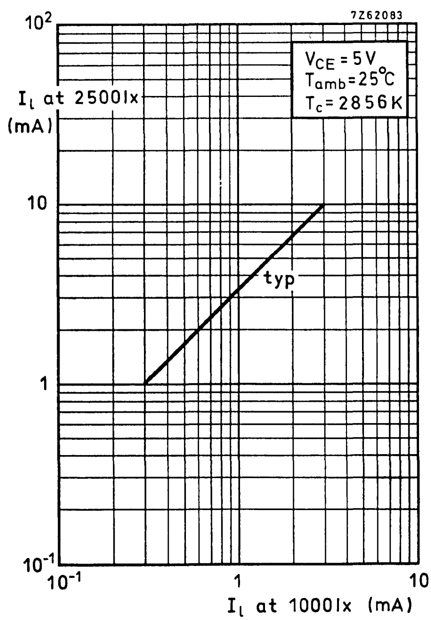
Light input pulse:

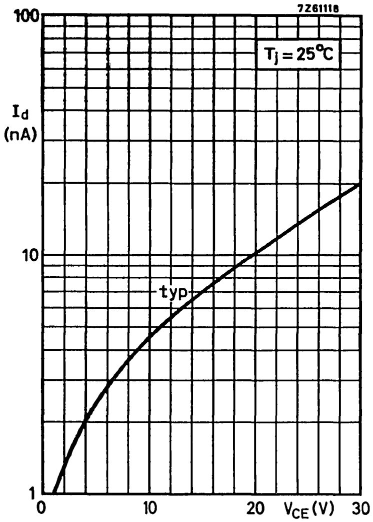
$t_r = t_f =$ 20 ns
$t_p =$ 20 µs
$f =$ 500 Hz
$\lambda =$ 800 nm

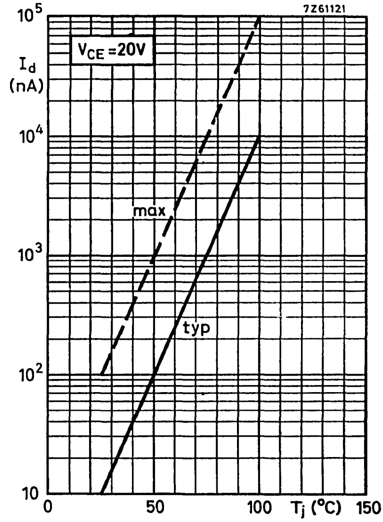


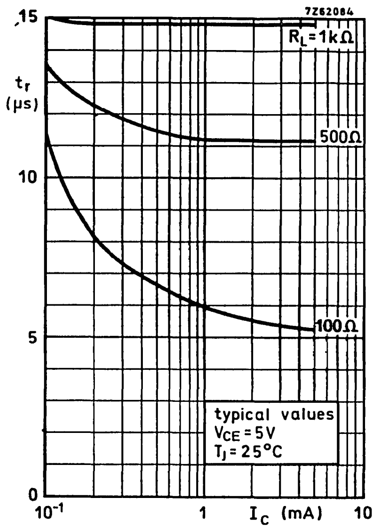

7Z62087
typ. values
T_{amb} = 25 °C
T_c = 2856 K
I_l (mA)
E = 4000 lx
3500
3000
2500
2000
1500
1000
V_{CE} (V)
0
10
20
2
4
6

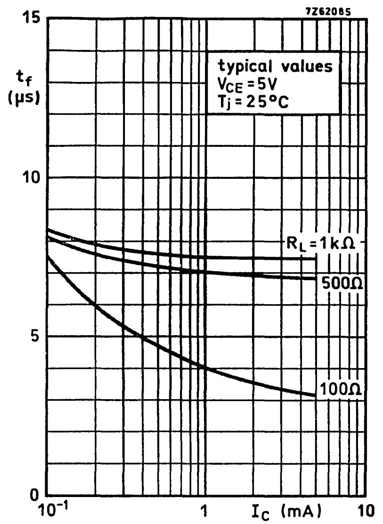

7Z62086
V_{CE} = 5 V
T_{amb} = 25 °C
T_c = 2856 K
I_l (mA)
typ
E (lx)
10^3
10^4
1
10
20


7Z62083
V_{CE} = 5 V
T_{amb} = 25 °C
T_c = 2856 K
I_l at 2500 lx (mA)
typ
I_l at 1000 lx (mA)
10^{-1}
1
10
10^2


7Z61118
$T_j = 25°C$
I_d (nA)
typ
V_{CE} (V)

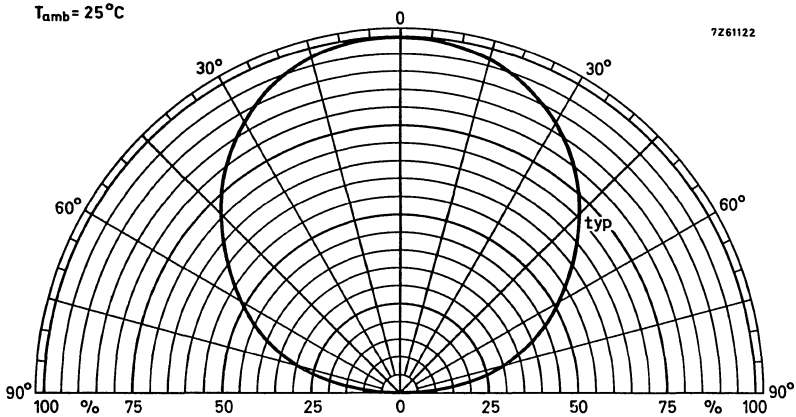

7Z61121
$V_{CE} = 20V$
I_d (nA)
max
typ
T_j (°C)

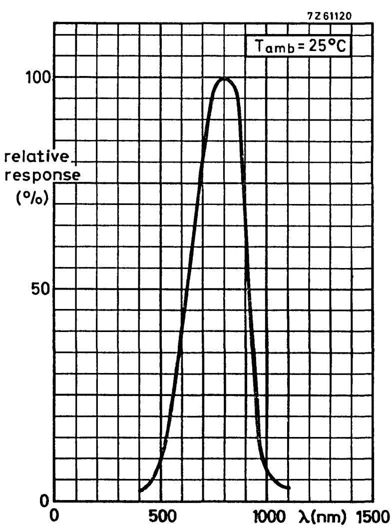

7Z62084
t_r (μs)
$R_L = 1 kΩ$
500Ω
100Ω
typical values
$V_{CE} = 5V$
$T_j = 25°C$
I_C (mA)

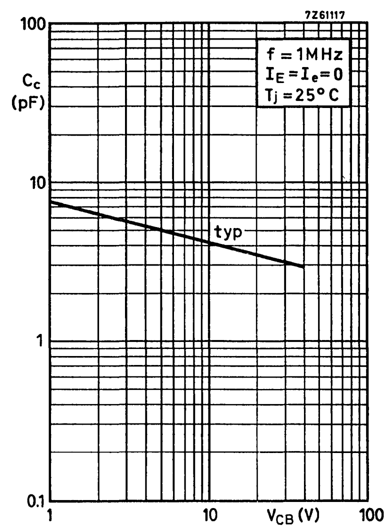

7Z62085
t_f (μs)
typical values
$V_{CE} = 5V$
$T_j = 25°C$
$R_L = 1 kΩ$
500Ω
100Ω
I_C (mA)

polar response of relative sensitivity

$T_{amb} = 25\,^{\circ}C$







SILICON PLANAR EPITAXIAL PHOTOTRANSISTOR

N-P-N phototransistor designed for use as detector. Clear epoxy encapsulation.

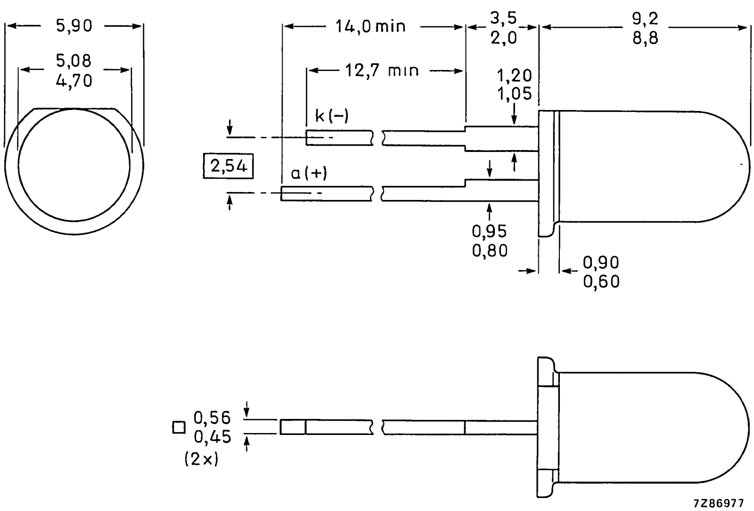
QUICK REFERENCE DATA

Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Collector current (d.c.)	I_C	max.	25 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	100 mW
Collector light (cut-off) current V_{CE} = 5 V; E = 1 mW/cm²; λ = 930 nm	$I_{CEO(L)}$	>	3 mA
Wavelength at peak response	λ_{pk}	typ.	800 nm

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-63A.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Collector-emitter voltage (open base)	V_{CEO}	max.	30	V
Emitter-collector voltage (open base)	V_{ECO}	max.	5	V
Collector current (d.c.)	I_C	max.	25	mA
Collector current (peak value) $t_p = 50\ \mu s$; $\delta = 0,1$	I_{CM}	max.	50	mA
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	100	mW
Storage temperature	T_{stg}	−40 to	+100	^oC
Junction temperature	T_j	max.	100	^oC
Lead soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max.	240	^oC

THERMAL RESISTANCE

From junction to ambient	$R_{th\ j\text{-}a}$	=	750	$^oC/W$
From junction to ambient, device mounted on a printed-circuit board	$R_{th\ j\text{-}a}$	=	500	$^oC/W$

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Collector dark (cut-off) current $V_{CE} = 20$ V		$I_{CEO(D)}$	<	100	nA
Collector light (cut-off) current* $V_{CE} = 5$ V; $E = 1\ mW/cm^2$; $\lambda = 930$ nm	**BPX95C-1**	$I_{CEO(L)}$		3 to 15	mA
	BPX95C-2	$I_{CEO(L)}$	>	10	mA
Collector-emitter saturation voltage* $I_C = 2$ mA; $E = 1\ mW/cm^2$; $\lambda = 930$ nm		V_{CEsat}	<	0,4	V
Wavelength at peak response		λ_{pk}	typ.	800	nm
Bandwidth at half height		$B_{50\%}$	typ.	400	nm
Angle between half-sensitivity directions		$\alpha_{50\%}$	typ.	20^o	
Receiving area			typ.	1	mm^2

* Measured with a tungsten linear filament lamp and an interference filter at $\lambda = 930$ nm.

Switching times (see Figs 2, 3, 4 and 5)

I_{Con} = 2 mA; V_{CC} = 5 V; R_E = 100 Ω; T_{amb} = 25 °C

Light current turn-on time	t_{on}	typ.	3 μs
Light current turn-off time	t_{off}	typ.	3 μs

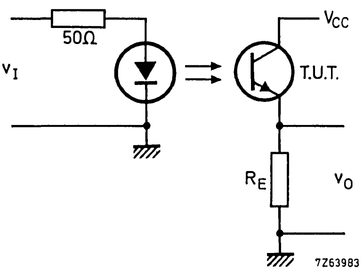


Fig. 2 Switching circuit.

Pulse generator:
f = 500 Hz
t_p = 20 μs
$t_r = t_f$ = 20 ns

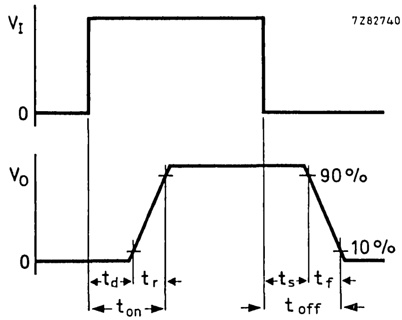


Fig. 3 Input and output switching waveforms.

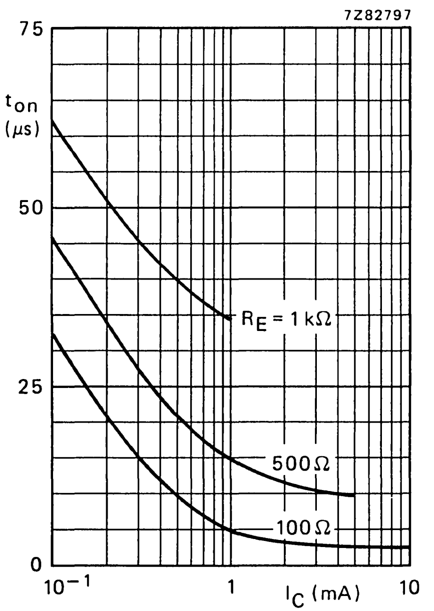


Fig. 4 V_{CC} = 5 V; T_{amb} = 25 °C; typ. values.

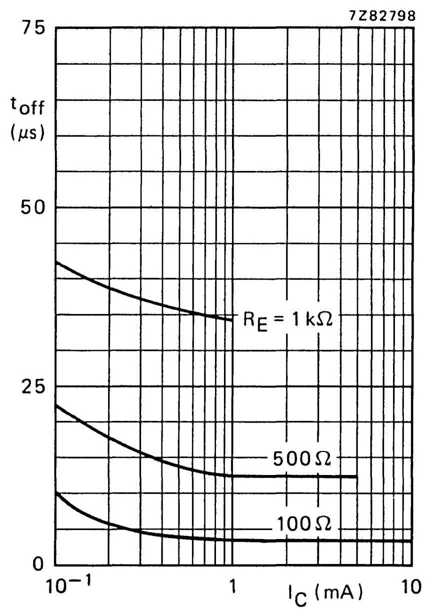


Fig. 5 V_{CC} = 5 V; T_{amb} = 25 °C; typ. values.

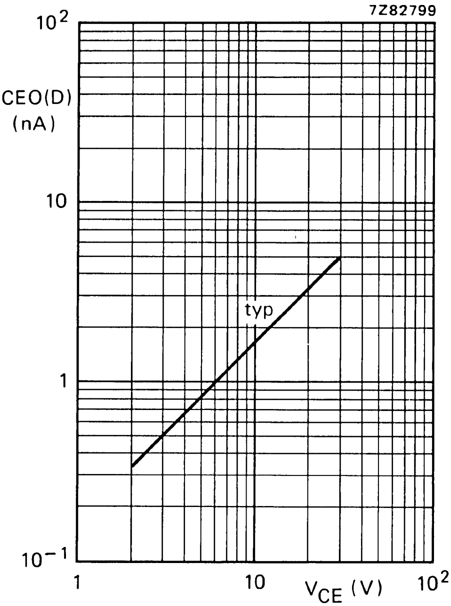


Fig. 6 $T_j = 25\ ^oC$.

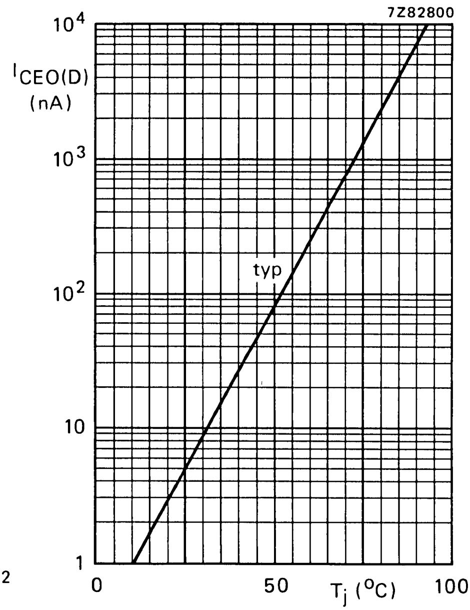


Fig. 7 $V_{CE} = 30$ V.

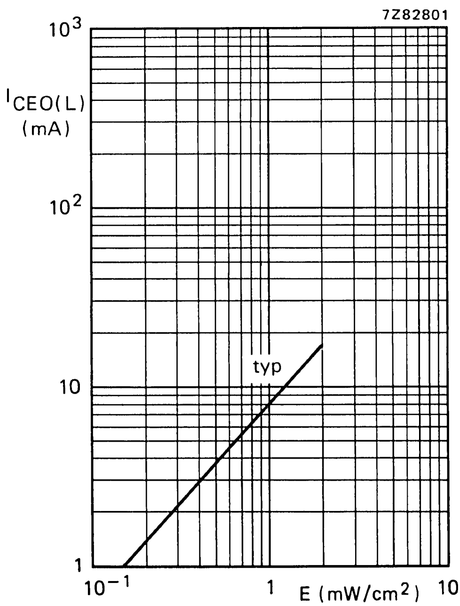


Fig. 8 $V_{CE} = 5$ V; $\lambda = 930$ nm; $T_j = 25\ ^oC$.

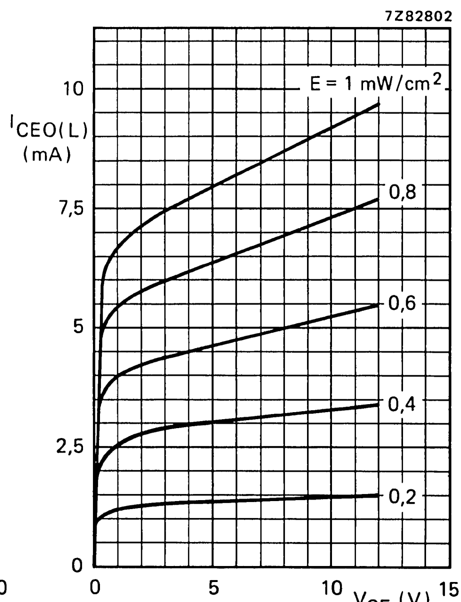


Fig. 9 $\lambda = 930$ nm; $T_j = 25\ ^oC$; typ. values.

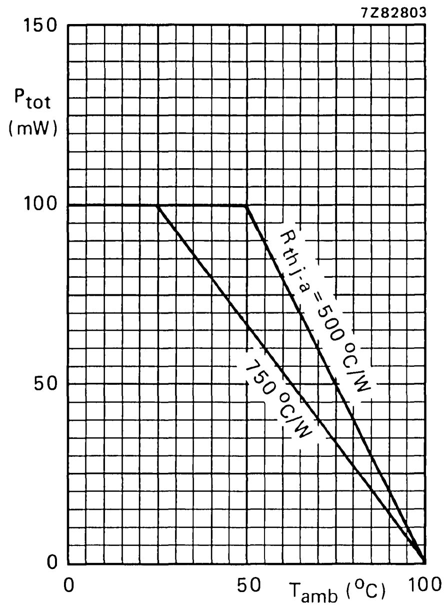


Fig. 10 Total power dissipation as a function of ambient temperature.

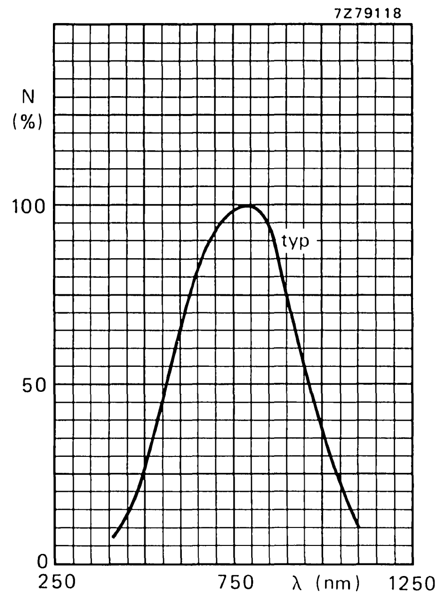


Fig. 11 Spectral response.

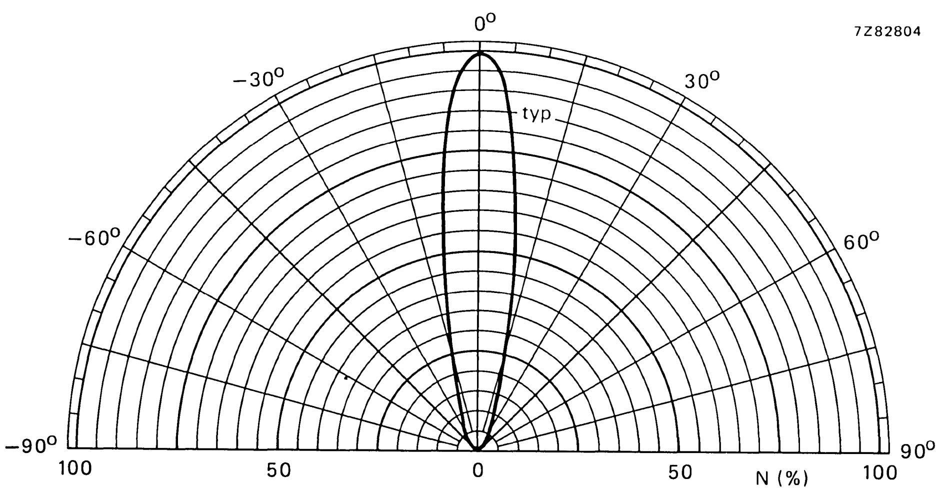
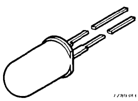
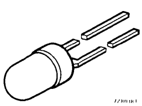
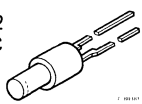
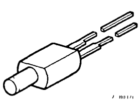
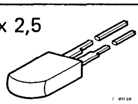
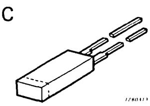


Fig. 12.

LIGHT EMITTING DIODES
AND SELECTION GUIDE

Selection guide for LEDs (visible light) grouped according to light families

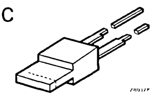
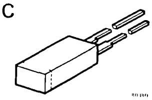
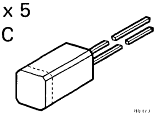
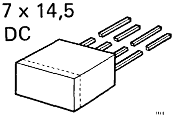
OUTLINE INDICATION dimensions in mm	item no.	type number	light colour	λ_{peak} nm	$\alpha_{50\%}$	V_F at I_F = 10 mA V	I_F max. mA	package: colour/ diffusor
ϕ 5	1▲	CQX24	hyper-red	650	25°	1,75	100	transparent
	2▲	CQX54	super-red	630	25°	2,1	30	transparent
	3▲	CQX64	super-green	565	25°	2,1	60	transparent
	4▲	CQX74	yellow	590	25°	2,1	30	transparent
	5▲	CQW24	hyper-red	650	60°	1,75	100	red/diff
	6	CQX51	super-red	630	60°	2,1	30	red/diff
SOD-63	7▲	CQY24B	standard-red	650	60°	1,6	50	red/diff
	8	CQY94	green	560	60°	2,1	30	green/diff
	9▲	CQY94B	super-green	565	60°	2,1	60	green/diff
	10▲	CQY96	yellow	590	60°	2,1	30	yellow/diff
ϕ 3	11	CQW54	hyper-red	650	60°	1,75	60	red/diff
	12	CQW51	super-red	630	60°	2,1	30	red/diff
	13	CQY54A	standard-red	650	60°	1,6	50	red/diff
	14	CQY95B	super-green	565	60°	2,1	60	green/diff
SOD-53E	15	CQY97A	yellow	590	60°	2,1	30	yellow/diff
ϕ 2 DC 	16	CQW20A	hyper-red	650	100°	1,75	60	red DC
	17	CQW21	super-green	565	100°	2,1	60	green DC
SOD-79	18	CQW22	yellow	590	100°	2,1	30	yellow DC
ϕ 2 DC  SOD-78	19	CQT11	bi-colour	see item 46				
5 x 2,5 	20	CQX10	super-red	630	50°	2,1	30	red/diff
	21	CQX11	super-green	565	50°	2,1	60	green/diff
SOD-65	22	CQX12	yellow	590	50°	2,1	30	yellow/diff
5 x 2,5 DC	23▲	CQW10A	hyper-red	650	100°	1,75	100	dark red
	24▲	CQW10	super-red	630	100°	2,1	30	red
	25▲	CQW11A	super-green	565	100°	2,1	60	green
	26▲	CQW12	yellow	590	100°	2,1	30	yellow
	27▲	CQW10B	super-red	630	100°	2,1	30	dark red
SOD-76	28▲	CQW11B	super-green	565	100°	2,1	60	dark green
	29▲	CQW12B	yellow	590	100°	2,1	30	dark yellow

▲ indicates availability of a long lead (25 mm) version; in that case letter L is added to the type number e.g. CQX24L.

DC double cast product (with diffusing zone), flat top.

existing I_V classes in mcd at I_F = 10 mA									
0,5	0,7–1,6	1,0–2,2	1,6–3,5	3,0–7,0	5–12	10–22	16–35	30–70	50–120
							I* > 20	II* > 50	III* > 100
						X* > 12			
						X* > 12			
						X* > 12			
				I* > 4,0	II* > 7,5				
			I*	II	III				
	I*	II	III	IV*	For these classes I_F = 20 mA				
	I*	II	III	IV*					
	I*		III	IV	V*				
	I*		III	IV	V*				
				X* > 4,0	V	VI	VII*		
	X*								
	X*	II	III*	For these classes I_F = 20 mA					
	X*		III	IV	V*				
	X*		III	IV	V*				
	X*								
X*									
X*									
	I*	II	III	IV*					
	I*	II	III	IV*					
	I*	II	III	IV*					
		X*	III	IV					
X*		II	III						
X*		II	III						
X*		II	III						
X*		II	III						
X*		II	III						
X*		II	III						

X class without classification number; basic type number used only, e.g. CQX54.
* class without maximum I_V value; minimum I_V level specified only.

OUTLINE INDICATION dimensions in mm	item no.	type number	light colour	λ_{peak} nm	$\alpha_{50\%}$	V_F at $I_F = 10$ mA V	I_F max. mA	package: colour/ diffusor
5 x 1 DC  SOD-75	30▲	CQV60A	hyper-red	650	110°	1,75	100	red
	31▲	CQV60	super-red	630	110°	2,1	30	red
	32▲	CQV61A	super-green	565	110°	2,1	60	green
	33▲	CQV62	yellow	590	110°	2,1	30	yellow
5 x 3 DC  SOD-77	34▲	CQV70A	hyper-red	650	100°	1,75	100	red
	35▲	CQV70	super-red	630	100°	2,1	30	red
	36▲	CQV71A	super-green	565	100°	2,1	60	green
	37▲	CQV72	yellow	590	100°	2,1	30	yellow
5 x 5 DC  SOD-74	38	CQV80AL	hyper-red	650	100°	1,75	100	red
	39	CQV80L	super-red	630	100°	2,1	30	red
	40	CQV81L	super-green	565	100°	2,1	60	green
	41	CQV82L	yellow	590	100°	2,1	30	yellow
7 x 14,5 DC  SOD-73	42	CQN10	hyper-red	650	100°	1,75	100	red
	43	CQN11	super-green	565	100°	2,1	60	green
5 x 3 SOD-77	45	CQT10	hyper-red	650	110°	1,75	100	transp. DC
			super-green	565		2,1	60	
ϕ 2 SOD-78	46	CQT11	hyper-red	650	110°	1,75	100	transp. DC
			super-green	565		2,1	60	
5 x 1 SOD-75	47	CQT12	hyper-red	650	110°	1,75	100	transp. DC
			super-green	565		2,1	60	

▲ indicates availability of long lead (25 mm) version; in that case letter L is added to the type number e.g. CQX24L.

DC double cast product (with diffusing zone), flat top.

existing I_V classes in mcd at I_F = 10 mA									
0,5	0,7–1,6	1,0–2,2	1,6–3,5	3,0–7,0	5–12	10–22	16–35	30–70	50–120
		X*	III	IV					
X*		II	III						
X*		II	III						
X*		II	III						
		X*	III	IV					
X*		II	III						
X*		II	III	IV					
X*		II	III						
		X*	III	IV					
X*		II	III						
X*		II	III						
X*		II	III						
			X* > 2						
			X* > 2	For this class I_F = 20 mA					
		X*							
		X*	For this class I_F = 20 mA						
		X*							
		X*	For this class I_F = 20 mA						
		X*							
		X*	For this class I_F = 20 mA						

X class without classification number; basic type number used only, e.g. CQX54.
* class without maximum I_V value; minimum I_V level specified only.

GaAlAs LIGHT EMITTING DIODE

Infrared light emitting diode in hermetic TO-46 encapsulation, designed for fibre-optic transmissions over short and medium distances, mainly for military and industrial applications.

It is optimized to be coupled with a 200 μm core diameter fibre and to be used in combination with the BPF24 receiver.

The crystal is electrically isolated from the case.

QUICK REFERENCE DATA

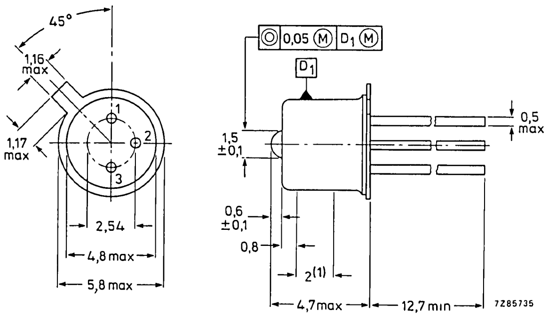
Continuous reverse voltage	V_R	max.	3 V
Forward current (d.c.)	I_F	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW
Optical power coupled into fibre (ϕ core = 200 μm and NA = 0,2) at I_F = 100 mA	ϕ_e	min.	200 μW
Switching times at I_F = 100 mA	t_r	typ.	10 ns
	t_f	typ.	10 ns
Wavelength at peak emission	λ_{pk}	typ.	830 nm

MECHANICAL DATA

Dimensions in mm

Fig. 1.

Pinning:
1 = anode
2 = cathode
3 = case



(1) Case diameter over this length is 4,7 (+ 0,05; –0,1) mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	3	V
Forward current	I_F	max.	100	mA
Forward current (peak) $t = 10\ \mu s$; $\delta = 0,1$	I_{FM}	max.	300	mA
Total power dissipation up to $T_{amb} = 25\ ^oC$ device mounted on a printed circuit	P_{tot}	max.	250	mW
Junction temperature	T_j	max.	150	^oC
Operating temperature	T_{op}		−55 to +125	^oC
Storage temperature	T_{stg}		−65 to +150	^oC

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a printed circuit	$R_{th\ j\text{-}a}$	typ.	400	K/W
		max.	500	K/W
From junction to case	$R_{th\ j\text{-}c}$	typ.	100	K/W
		max.	150	K/W

CHARACTERISTICS

$T_{amb} = 25\ ^oC$ unless otherwise specified

Forward voltage at $I_F = 100$ mA	V_F	typ.	2,2	V
		max.	2,5	V
Reverse current at $V_R = 3$ V	I_R	max.	100	μA
Radiant power coupled into fibre at $I_F = 100$ mA, ϕ core = 200 μm, NA = 0,2 } see notes 1 and 2	ϕ_e	min.	200	μW
		typ.	400	μW
Radiant intensity at $I_F = 100$ mA	I_e	min.	5	mW/sr
Wavelength at peak emission	λ_{pk}	min.	800	nm
		typ.	830	nm
		max.	880	nm
Bandwidth at half height	$B_{50\%}$	typ.	40	nm
Switching times at $I_{Fon} = 100$ mA	t_r	typ.	10	ns
		max.	15	ns
	t_f	typ.	10	ns
		max.	15	ns

NOTES

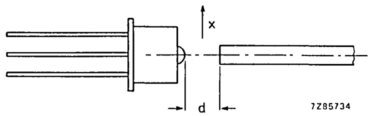


Fig. 2 Distance d and lateral displacement x.

1. For this measurement the device is shifted along its 3 axes, so that the maximum power is coupled into the fibre.

   If the device is adjusted in front of the geometrical axis of the same fibre with distance d = 0,7 mm, P_{min} = 100 μW.

2. For a different core diameter $\phi_x \leqslant 200\ \mu m$: $\dfrac{P_{inj(x)}}{P_{inj(200)}} = \left(\dfrac{\phi_x}{200}\right)^2$

   For a different numerical aperture $NA_x \leqslant 0{,}2$: $\dfrac{P_{inj(x)}}{P_{inj(0,2)}} = \left(\dfrac{NA_x}{0{,}2}\right)^2$

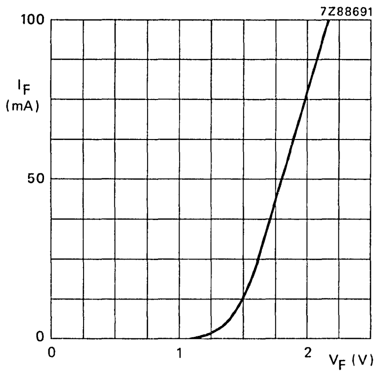


Fig. 3 $T_{amb} = 25\ ^{o}C$.

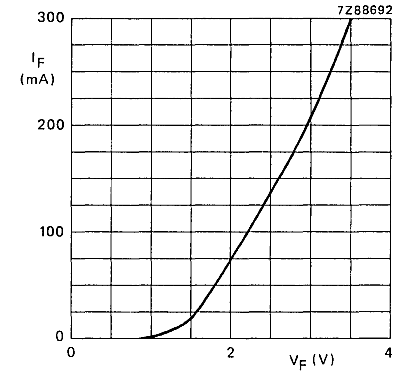


Fig. 4 $T_{amb} = 25\ ^{o}C$; $T_{on} = 10\ \mu s$; $\delta = 0,1$.

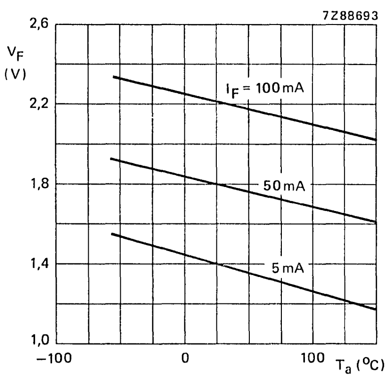


Fig. 5.

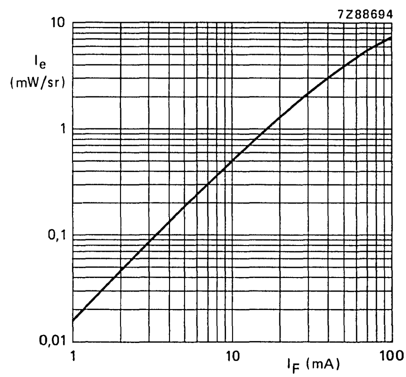


Fig. 6 $T_{amb} = 25\ ^{o}C$.

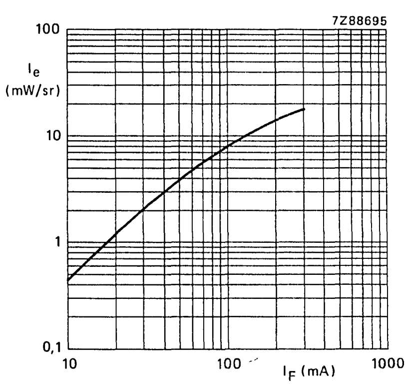


Fig. 7 $T_{amb} = 25\ ^{o}C$; $T_{on} = 10\ \mu s$; $\delta = 0,01$.

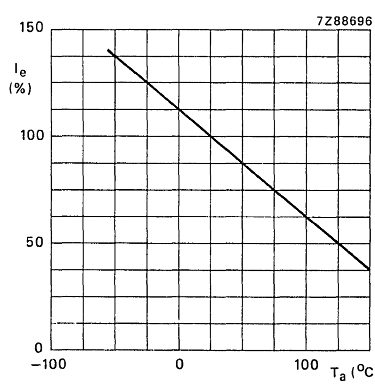


Fig. 8.

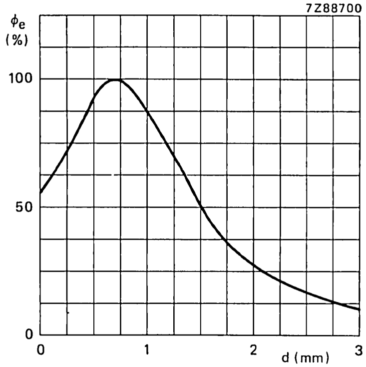


Fig. 9 See notes 1 and 2.

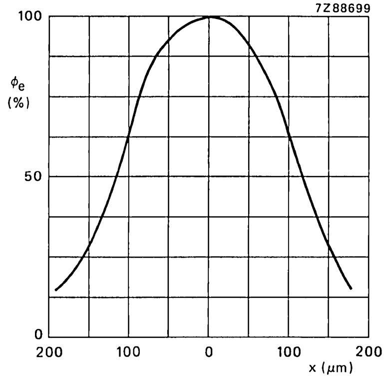


Fig. 10 Distance d = 700 μm.
See notes 1 and 2.

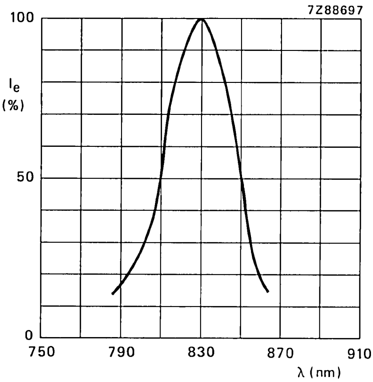


Fig. 11 I_F = 100 mA; T_{amb} = 25 °C.

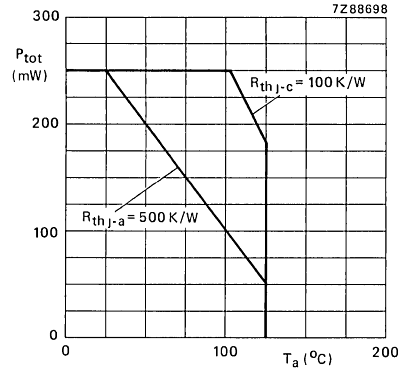


Fig. 12.

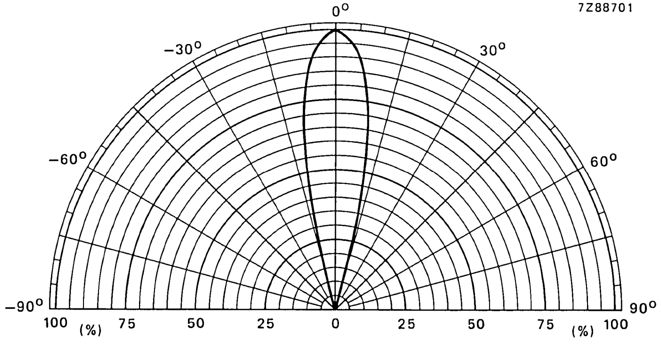


Fig. 13.

DOUBLE HETEROSTRUCTURE AlGaAs LASER

The CQL10A is designed for reading applications such as: video-audio disc applications, optical memories, security systems, etc.

This device is mounted in an hermetic SOT-148 encapsulation specifically designed for easy alignment in an optical read or write system. The copper heatsink is circular and precision engineered with a diameter accuracy of +0, −9 μm. Laser-stripe and mechanical axis coincide within 50 μm.

The CQL10A is standard equipped with a photo p-i-n diode, optically coupled to the rear emitting facet of the laser. This fast responding (less than 20 ns) photodiode can be used as a sensor to control the laser radiant output level. The ultra-flat top window (flat within two fringes) guarantees an unperturbed beam wavefront.

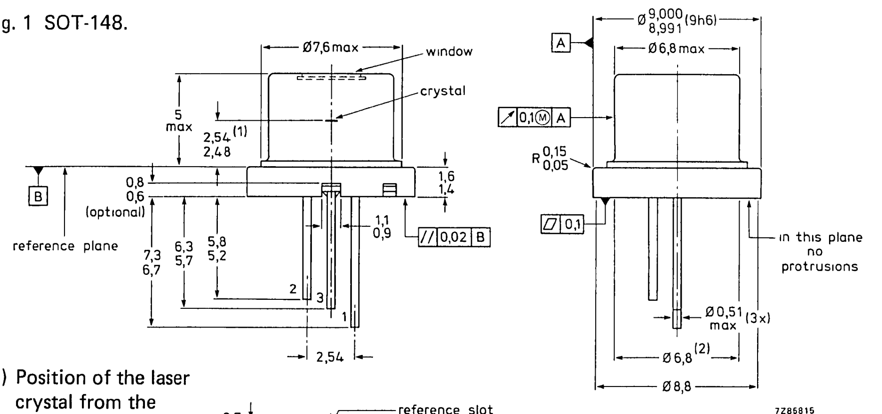
QUICK REFERENCE DATA

Threshold current at T_c = 30 °C	I_{th}	typ.	65 mA
C.W. radiant output power up to T_c = 60 °C	ϕ_e	typ.	5 mW
Wavelength at peak emission	λ_{pk}	typ.	820 nm

MECHANICAL DATA

Dimensions in mm

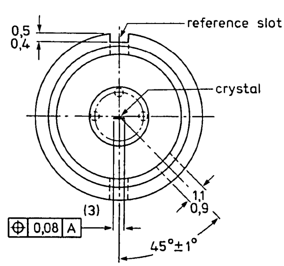
Fig. 1 SOT-148.

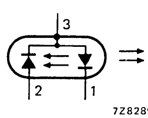


(1) Position of the laser crystal from the reference plane.

(2) Within the plane of ϕ 6,8 protrusions and irregularities are permitted.

(3) The positional accuracy of the laser stripe with respect to the flange diameter.





LASER

The double heterostructure stripe laser operates in single transverse, multiple longitudinal mode (TE_{00}) over the full power range. The structure is designed to operate C.W. 5 mW up to relatively high temperatures (60 °C case temperature) and a wavelength of 820 nm which makes reading standard Video Long Play records and compact discs (DAD) a possible application.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Radiant output power	ϕ_e	max.	10	mW
Reverse voltage	V_R	max.	1	V
Temperatures *(both laser and photodiode)*				
C.W. operation	T_c	−20 to	+60	°C
storage	T_{stg}	−55 to	+100	°C

CHARACTERISTICS

Threshold current				
at T_c = 30 °C	I_{th}	typ.	65	mA
at T_c = 60 °C			90	mA
Operating current				
ϕ_e = 5 mW; T_c = 30 °C	I_{op}	typ.	85	mA
		max.	120	mA
ϕ_e = 5 mW; T_c = 60 °C	I_{op}	typ.	120	mA
		max.	160	mA
Recommended operating radiant output power up to T_c = 60 °C	ϕ_e	typ.	5	mW
Forward voltage drop up to T_c = 60 °C; ϕ_e = 5 mW	V_F	typ.	2,5	V
Wavelength at peak emission; ϕ_e = 5 mW; T_c = 30 °C	λ_{pk}	typ.	820	nm
Spectral width at half height; ϕ_e = 5 mW	$\Delta\lambda$	typ.	4	nm
Far-field angle at half-intensity directions (FWHM)				
perpendicular to the junction plane	$\alpha_{50\%}(\perp)$	typ.	50	°
parallel to the junction plane	$\alpha_{50\%}(\parallel)$	typ.	35	°
Near-field width at half-intensity directions (FWHM)	$\delta_{50\%}$	typ.	6-7	µm
Astigmatism (distance between focal lines)	A_D	typ.	15	µm
Series resistance	R_S	typ.	5	Ω
Differential efficiency at ϕ_e = 2 mW	ϵ	typ.	0,15	W/A
Spontaneous emission at I_{th}	ϕ_{spon}	typ.	0,5	mW
Turn-on/turn-off time (above threshold)	t_{on}/t_{off}	typ.	1	ns
Degradation rate; T_c = 60 °C; ϕ_e = 5 mW	$\frac{1}{I_{op}} \cdot \frac{dI_{op}}{dT}$	typ.	5	%/Kh
Temperature coefficient of wavelength	$\frac{d\lambda_{pk}}{dT}$	typ.	0,25	nm/K
Temperature coefficient of I_{th}	$\frac{I}{I_{th}} \cdot \frac{dI_{th}}{dT}$	typ.	1	%/K
Thermal resistance from junction to case	$R_{th\,j\text{-}c}$	typ.	50	K/W

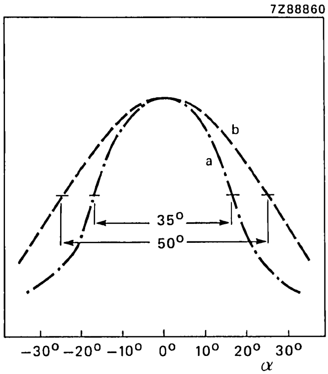


Fig. 2 Far-field pattern.
a. parallel to the junction plane.
b. perpendicular to the junction plane.

PHOTODIODE

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	30 V

CHARACTERISTICS

Luminous sensitivity at V_R = 15 V	N	typ.	0,5 A/W
Dark reverse current at V_R = 15 V	$I_{R(D)}$	max.	10 nA
Capacitance at V_R = 0	C_d	max.	5 pF
Monitor diode current at V_R = 15 V	$I_{R(L)}$		150-400 μA/mW

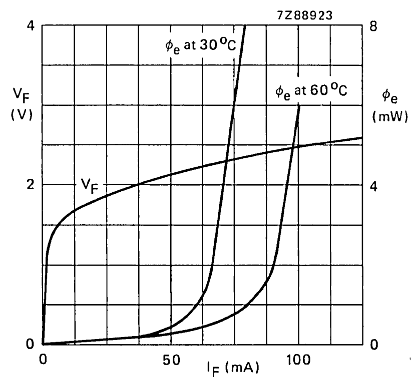


Fig. 3 Forward voltage drop (V_F) and radiant output power (ϕ_e) of laser diode as a function of forward current; typ. values.

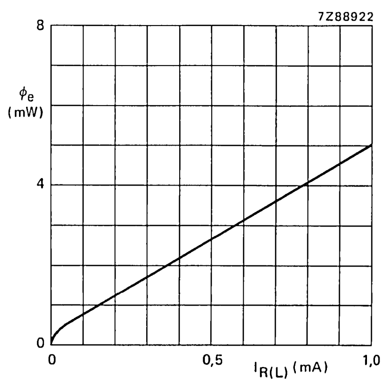
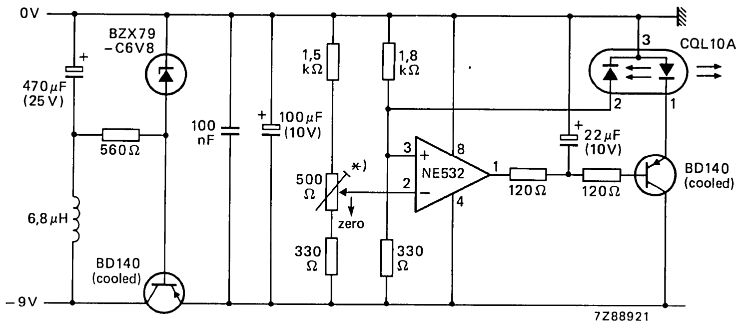


Fig. 4 Radiant output power (ϕ_e) as a function of monitor current of photodiode; V_R (photodiode) = 15 V; typ. values.



* Ten-turn. Zero position is at 0,58 revolution. Each revolution is equivalent to 500 μA monitor diode current. Adjust from zero position.

Fig. 5 Recommended control circuit for continuous operation.

OPERATING PRECAUTIONS

Semiconductor lasers in general are easily damaged by overdriving and electrical transients. Electrically, the laser diode is a very reliable device and can easily withstand current surges of several amperes. Optically, however, the laser diode is more susceptible to damage because of the extremely high optical flux density passing through both facets, while in operation. By overdriving or transients to the laser, even for pulses in the nanosecond region, the optical flux density can rise to unacceptable values (10 to 100 MW/cm^2), causing gradual or catastrophic degradation of the laser facets. Current transients should therefore be carefully avoided; they can substantially decrease the laser life time.

CAUTION

Aluminium gallium arsenide lasers emit radiation which is invisible to the human eye. When in use, do not look directly into the device. Direct viewing of laser light at close ranges, especially in conjunction with collimating lenses, may cause eye damage.

The device falls within safety class 3B of the international standard code.

COLLIMATOR PEN

The collimator pen CQL13 is used for reading applications such as: data retrieval, video-audio disc applications, optical memories, security systems etc.

The pen is mounted in a non-hermetic encapsulation, specifically designed for easy alignment in an optical read or write system, and consists of a lens system and a laser device. The lens system collimates the diverging laser light. The wavefront quality is diffraction limited. A cylindrical lens is used for correction of the astigmatism of the laser.
The housing is circular and precision manufactured with a diameter accuracy between + 0 and −11 μm.

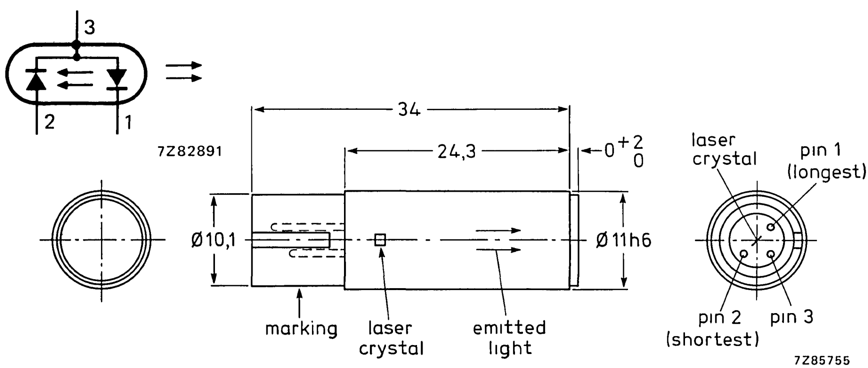
QUICK REFERENCE DATA

Output power ϕ_e		2	mW
Current at output power ϕ_e = 2 mW and temperature of 60 °C	<	175	mA
Wavelength at peak emission λ_{pk}	typ.	790	nm
Wavefront form of bundle (non-convergent) divergence	<	0,3	mrad

MECHANICAL DATA

Dimensions in mm

Fig. 1.



Mass	max. 8 g
Concentricity	angle between the mechanical and optical axis ⩽ 10 mrad
Marking	type number CQL13 and serial number
Mounting	on a p.c. board by means of a specifically designed connector
Accessories	the pen is supplied with a connector
WARNING	THE LASER AND CONSEQUENTLY THE COLLIMATOR PEN HAS POSITIVE POLARITY ON THE CASE.

CHARACTERISTICS

Measuring conditions

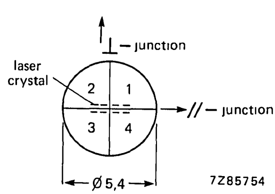
Climatological	relative humidity 5–90%, atmospheric pressure. Housing temperature of the pen 5–60 °C
Electrical	d.c. operation, optical feedback drive and protection against transients
Optical	only the radiation in a bundle with a diameter of 5,4 mm is relevant

Optical data

Output power	ϕ_e	max. 2 mW (see Fig. 4)
Spectral		
wavelength	λ	790 ± 10 nm
bandwidth	$\Delta\lambda$	< 4 nm (see note)
wavelength	$\Delta\lambda/\Delta T$	approx. 0,25 nm/K
Bundle properties		
dimension		ϕ 5,4 mm
wavefront form		plane, non-convergent divergence < 0,3 mrad
aberrations		variance of wavefront with respect to the Gaussian reference sphere is less than $\lambda^2/300$
polarization		plane
polarization ratio		typ. 35 : 1
Intensity distribution		
transversal mode		TE_{00}-fundamental
longitudinal mode		see note
symmetry		variation of optical power in the four quadrants (see Fig. 2) typ. 20%
ripple		local value of the intensity < 15% of the smooth value
filling ratio I_{rim}/I_{max}		> 0,17

Note: the number of longitudinal modes is related to the spectral width.

Fig. 2.



Electrical data

Current at ϕ_e = 2 mW and T_h = 60 °C	⩽ 175 mA
Drive voltage V_d	⩽ 5 V
Resistance between collimator pen and connector at 10 mA, max. 20 mV_{pp} and 1 kHz	⩽ 12 mΩ

PHOTODIODE (see Fig. 5)

RATINGS

Reverse voltage	V_R	≤	30 V

CHARACTERISTICS

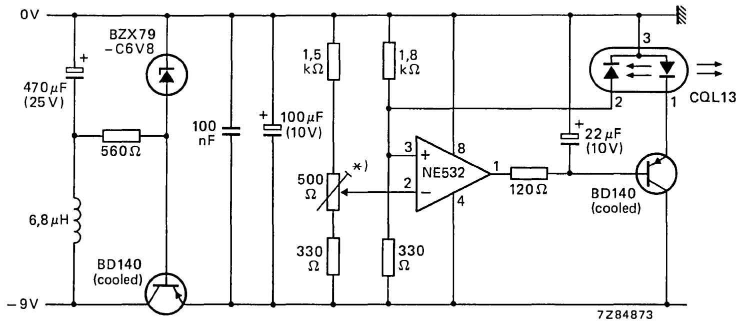
Monitor diode sensitivity (ratio of photodiode current to optical power emitted by collimator pen) at ϕ_e = 2 mW			0,1 A/W
Dark reverse current at V_R = 15 V	$I_{R(D)}$	<	10 nA
Capacitance at V_R = 0	C_d	<	5 pF

ENVIRONMENTAL TESTS

The device meets all specifications mentioned below 2 hours after each test. During these tests the collimator pen is not operating.

test	in accordance with	conditions
Rapid change of temperature	IEC 68-2-14, test Na	−25 °C to 25 °C to 70 °C to 25 °C; duration of each exposure 30 min and 10 cycles in total
Dry heat	IEC 68-2-2, test Bc	Temperature: 70 °C Duration: 7 days
Cold	IEC 68-2-1 test Aa	Temperature: −25 °C Duration: 7 days
Damp heat, steady state	IEC 68-2-3 test Ca	Temperature: 40 °C Relative humidity (R.H.): 90–95% Duration: 42 days
Damp heat, cyclic	IEC 68-2-30 test Db	Temperature/R.H. 45 °C/100% (12 h) to 25 °C/ 85% (12 h Duration of one cycle: 24 hours Number of cycles: 42
Vibration	IEC 68-2-6 test Db	Frequency range: 10–55 Hz Amplitude: 0,75 mm Duration: 6 hours (2 h in each of directions)
Shock	IEC 68-2-27 test Ea	Pulse shape: half-sine Pulse duration: 11 ms Peak acceleration: 981 m/s^2 Number of shocks: 10 in each of 3 directions
Bump	IEC 68-2-29 test Eb	Pulse duration: 6 ms Peak acceleration: 390 m/s^2 Number of bumps: 1000 Axes of direction: 6

Cleaning test — The cylinder lens at the side of the long conjugate is cleaned 100x with a small piece of cotton wool, soaked in a 45–95% solution of ethyl-alcohol in water, attached to the end of a small stick.



* Ten-turn. Zero position is at 0,58 revolution. Each revolution is equivalent to 500 μA monitor diode current.

Fig. 3 Recommended control circuit.

OPERATING PRECAUTIONS

Semiconductor lasers in general are easily damaged by overdriving and transients. Electrically, the laser diode is a very reliable device and can easily withstand current surges of several amperes. Optically, however, the diode laser is more susceptible to damage because of the extremely high optical flux density passing through both facets, while in operation. By overdriving or transients to the laser, even for pulses in the nanosecond region, the optical flux density can rise to unacceptable values (10 to 100 MW/cm^2), causing gradual or catastrophic degradation of the laser facets.
Current transients should therefore be carefully avoided; they decrease the laser life time.

CAUTION

Aluminium gallium arsenide lasers emit radiation which is invisible to the human eye. When in use, do not look directly into the device. Direct viewing of laser light at close ranges, especially in conjunction with collimating lenses, may cause eye damage.

The device meets the requirements of safety class 3B of the international standard code.

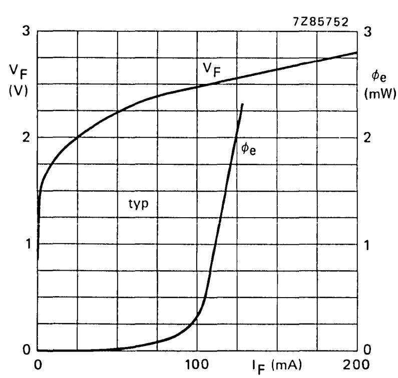


Fig. 4 $T_h = 60\ ^oC$.

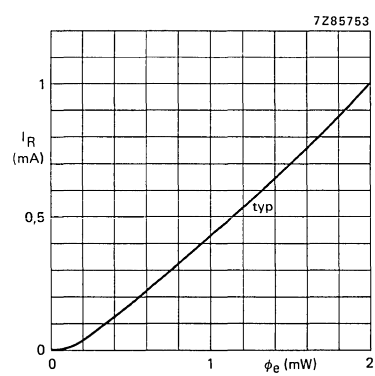


Fig. 5 $V_R = 15$ V.

COLLIMATOR PEN

The collimator pen CQL13A is used for reading applications such as: data retrieval, video-audio disc applications, optical memories, security systems etc.

The pen is mounted in a non-hermetic encapsulation, specifically designed for easy alignment in an optical read or write system, and consists of a lens system and a laser device. The lens system collimates the diverging laser light. The wavefront quality is diffraction limited. A cylindrical lens is used for correction of the astigmatism of the laser.
The housing is circular and precision manufactured with a diameter accuracy between + 0 and −11 μm.

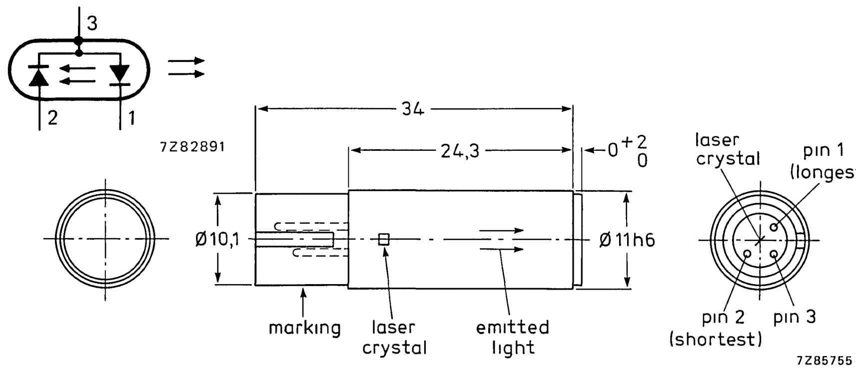
QUICK REFERENCE DATA

Output power ϕ_e		2	mW
Current at output power ϕ_e = 2 mW and temperature of 60 °C	<	175	mA
Wavelength at peak emission λ_{pk}	typ.	820	nm
Wavefront form of bundle (non-convergent) divergence	<	0,3	mrad

MECHANICAL DATA

Dimensions in mm

Fig. 1.



Mass	max. 8 g
Concentricity	angle between the mechanical and optical axis ⩽ 10 mrad
Marking	type number CQL13A and serial number
Mounting	on a p.c. board by means of a specifically designed connector
Accessories	the pen is supplied with a connector
WARNING	THE LASER AND CONSEQUENTLY THE COLLIMATOR PEN HAS POSITIVE POLARITY ON THE CASE.

CHARACTERISTICS

Measuring conditions

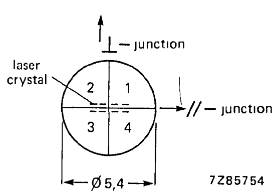
Climatological	relative humidity 5–90%, atmospheric pressure. Housing temperature of the pen 5–60 °C
Electrical	d.c. operation, optical feedback drive and protection against transients
Optical	only the radiation in a bundle with a diameter of 5,4 mm is relevant

Optical data

Output power	ϕ_e	max. 2 mW (see Fig. 4)
Spectral		
wavelength	λ	820 ± 10 nm
bandwidth	$\Delta\lambda$	$<$ 4 nm (see note)
wavelength drift	$\Delta\lambda/\Delta T$	approx. 0,25 nm/K
Bundle properties		
dimension		ϕ 5,4 mm
wavefront form		plane, non-convergent divergence $<$ 0,3 mrad
aberrations		variance of wavefront with respect to the Gaussian reference sphere is less than $\lambda^2/300$
polarization		plane
polarization ratio		typ. 35 : 1
Intensity distribution		
transversal mode		TE_{00}-fundamental
longitudinal mode		see note
symmetry		variation of optical power in the four quadrants (see Fig. 2) typ. 20%
ripple		local value of the intensity $<$ 15% of the smooth value
filling ratio I_{rim}/I_{max}		$>$ 0,17

Note: the number of longitudinal modes is related to the spectral width.

Fig. 2.



Electrical data

Current at ϕ_e = 2 mW and T_h = 60 °C	⩽ 175 mA
Drive voltage V_d	⩽ 5 V
Resistance between collimator pen and connector at 10 mA, max. 20 mV_{pp} and 1 kHz	⩽ 12 mΩ

PHOTODIODE (see Fig. 5)

RATINGS

Reverse voltage	V_R	≤	30 V

CHARACTERISTICS

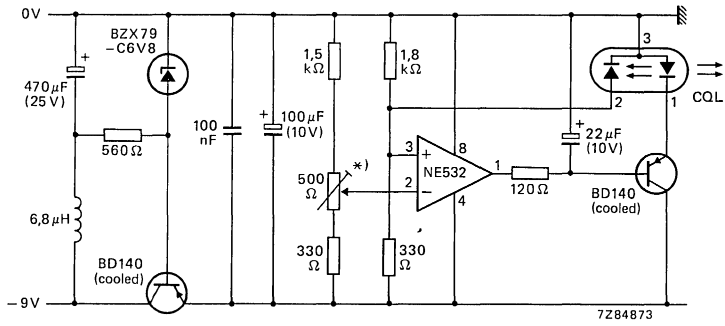
Monitor diode sensitivity (ratio of photodiode current to optical power emitted by collimator pen) at ϕ_e = 2 mW			0,1 A/W
Dark reverse current at V_R = 15 V	$I_{R(D)}$	<	10 nA
Capacitance at V_R = 0	C_d	<	5 pF

ENVIRONMENTAL TESTS

The device meets all specifications mentioned below 2 hours after each test. During these tests the collimator pen is not operating.

test	in accordance with	conditions
Rapid change of temperature	IEC 68-2-14, test Na	–25 °C to 25 °C to 70 °C to 25 °C; duration of each exposure 30 min and 10 cycles in total
Dry heat	IEC 68-2-2, test Bc	Temperature: 70 °C Duration: 7 days
Cold	IEC 68-2-1 test Aa	Temperature: –25 °C Duration: 7 days
Damp heat, steady state	IEC 68-2-3 test Ca	Temperature: 40 °C Relative humidity (R.H.): 90–95% Duration: 42 days
Damp heat, cyclic	IEC 68-2-30 test Db	Temperature/R.H. 45 °C/100% (12 h) to 25 °C/ 85% (12 h) Duration of one cycle: 24 hours Number of cycles: 42
Vibration	IEC 68-2-6 test Db	Frequency range: 10–55 Hz Amplitude: 0,75 mm Duration: 6 hours (2 h in each of directions)
Shock	IEC 68-2-27 test Ea	Pulse shape: half-sine Pulse duration: 11 ms Peak acceleration: 981 m/s² Number of shocks: 10 in each of 3 directions
Bump	IEC 68-2-29 test Eb	Pulse duration: 6 ms Peak acceleration: 390 m/s² Number of bumps: 1000 Axes of direction: 6

Cleaning test — The cylinder lens at the side of the long conjugate is cleaned 100x with a small piece of cotton wool, soaked in a 45–95% solution of ethyl-alcohol in water, attached to the end of a small stick.



* Ten-turn. Zero position is at 0,58 revolution. Each revolution is equivalent to 500 μA monitor diode current.

Fig. 3 Recommended control circuit.

OPERATING PRECAUTIONS

Semiconductor lasers in general are easily damaged by overdriving and transients. Electrically, the laser diode is a very reliable device and can easily withstand current surges of several amperes. Optically, however, the diode laser is more susceptible to damage because of the extremely high optical flux density passing through both facets, while in operation. By overdriving or transients to the laser, even for pulses in the nanosecond region, the optical flux density can rise to unacceptible values (10 to 100 MW/cm^2), causing gradual or catastrophic degradation of the laser facets.
Current transients should therefore be carefully avoided; they decrease the laser life time.

CAUTION

Aluminium gallium arsenide lasers emit radiation which is invisible to the human eye. When in use, do not look directly into the device. Direct viewing of laser light at close ranges, especially in conjunction with collimating lenses, may cause eye damage.

The device meets the requirements of safety class 3B of the international standard code.

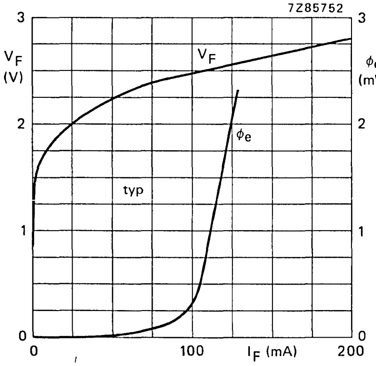


Fig. 4 $T_h = 60\ ^oC$.

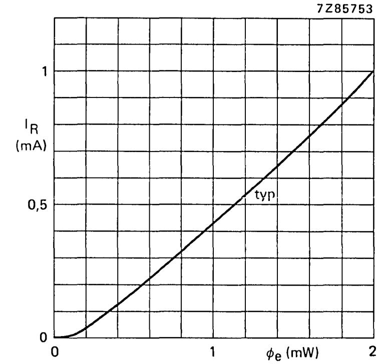


Fig. 5 $V_R = 15$ V.

COLLIMATOR PEN

The collimator pen CQL13C is used for reading applications such as: data retrieval, video-audio disc applications, optical memories, security systems etc.

The pen is mounted in a non-hermetic encapsulation, specifically designed for easy alignment in an optical read or write system, and consists of a lens system and a laser device. The lens system collimates the diverging laser light. The wavefront quality is diffraction limited. A cylindrical lens is used for correction of the astigmatism of the laser.
The housing is circular and precision manufactured with a diameter accuracy between + 0 and −11 μm.

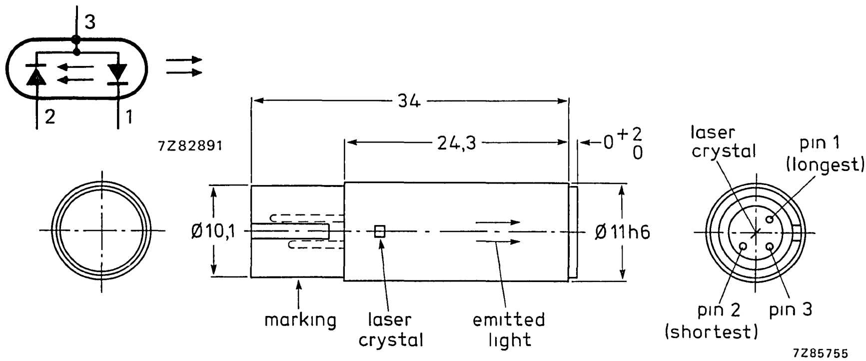
QUICK REFERENCE DATA

Output power	ϕ_e		2	mW
Current at output power ϕ_e = 2 mW and temperature of 60 °C		<	175	mA
Wavelength at peak emission	λ_{pk}	typ.	870	nm
Wavefront form of bundle (non-convergent) divergence		<	0,3	mrad

MECHANICAL DATA

Dimensions in mm

Fig. 1.



Mass	max. 8 g
Concentricity	angle between the mechanical and optical axis ⩽ 10 mrad
Marking	type number CQL13C and serial number
Mounting	on a p.c. board by means of a specifically designed connector
Accessories	the pen is supplied with a connector
WARNING	THE LASER AND CONSEQUENTLY THE COLLIMATOR PEN HAS POSITIVE POLARITY ON THE CASE.

CHARACTERISTICS

Measuring conditions

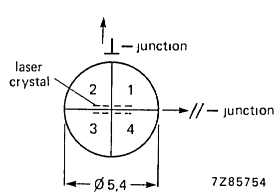
Climatological	relative humidity 5—90%, atmospheric pressure. Housing temperature of the pen 5—60 °C
Electrical	d.c. operation, optical feedback drive and protection against transients
Optical	only the radiation in a bundle with a diameter of 5,4 mm is relevant

Optical data

Output power	ϕ_e	max. 2 mW (see Fig. 4)
Spectral		
wavelength	λ	870 ± 10 nm
bandwidth	$\Delta\lambda$	< 4 nm (see note)
wavelength drift	$\Delta\lambda/\Delta T$	approx. 0,25 nm/K
Bundle properties		
dimension		ϕ 5,4 mm
wavefront form		plane, non-convergent divergence < 0,3 mrad
aberrations		variance of wavefront with respect to the Gaussian reference sphere is less than $\lambda^2/300$
polarization		plane
polarization ratio		typ. 35 : 1
Intensity distribution		
transversal mode		TE_{00}-fundamental
longitudinal mode		see note
symmetry		variation of optical power in the four quadrants (see Fig. 2) typ. 20%
ripple		local value of the intensity < 15% of the smooth value
filling ratio I_{rim}/I_{max}		> 0,17

Note: the number of longitudinal modes is related to the spectral width.

Fig. 2.



Electrical data

Current at ϕ_e = 2 mW and T_h = 60 °C	≤ 175 mA
Drive voltage V_d	≤ 5 V
Resistance between collimator pen and connector at 10 mA, max. 20 mV_{pp} and 1 kHz	≤ 12 mΩ

PHOTODIODE (see Fig. 5)

RATINGS

Reverse voltage	V_R	≤	30 V

CHARACTERISTICS

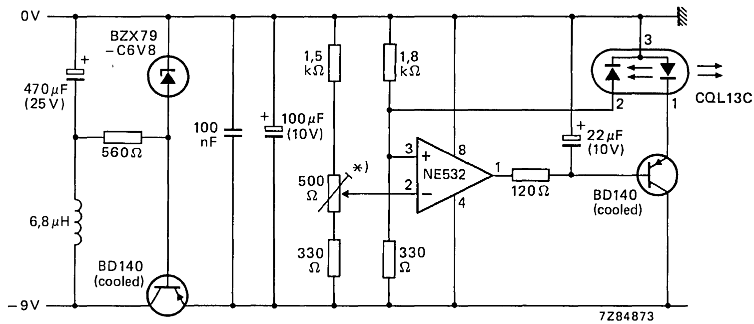
Monitor diode sensitivity (ratio of photodiode current to optical power emitted by collimator pen) at ϕ_e = 2 mW			0,1 A/W
Dark reverse current at V_R = 15 V	$I_{R(D)}$	<	10 nA
Capacitance at V_R = 0	C_d	<	5 pF

ENVIRONMENTAL TESTS

The device meets all specifications mentioned below 2 hours after each test. During these tests the collimator pen is not operating.

test	in accordance with	conditions
Rapid change of temperature	IEC 68-2-14, test Na	−25 °C to 25 °C to 70 °C to 25 °C; duration of each exposure 30 min and 10 cycles in total
Dry heat	IEC 68-2-2, test Bc	Temperature: 70 °C Duration: 7 days
Cold	IEC 68-2-1 test Aa	Temperature: −25 °C Duration: 7 days
Damp heat, steady state	IEC 68-2-3 test Ca	Temperature: 40 °C Relative humidity (R.H.): 90–95% Duration: 42 days
Damp heat, cyclic	IEC 68-2-30 test Db	Temperature/R.H. 45 °C/100% (12 h) to 25 °C/ 85% (12 h) Duration of one cycle: 24 hours Number of cycles: 42
Vibration	IEC 68-2-6 test Db	Frequency range: 10–55 Hz Amplitude: 0,75 mm Duration: 6 hours (2 h in each of directions)
Shock	IEC 68-2-27 test Ea	Pulse shape: half-sine Pulse duration: 11 ms Peak acceleration: 981 m/s^2 Number of shocks: 10 in each of 3 directions
Bump	IEC 68-2-29 test Eb	Pulse duration: 6 ms Peak acceleration: 390 m/s^2 Number of bumps: 1000 Axes of direction: 6

Cleaning test — The cylinder lens at the side of the long conjugate is cleaned 100x with a small piece of cotton wool, soaked in a 45–90% solution of ethyl-alcohol in water, attached to the end of a small stick.



* Ten-turn. Zero position is at 0,58 revolution. Each revolution is equivalent to 500 μA monitor diode current.

Fig. 3 Recommended control circuit.

OPERATING PRECAUTIONS

Semiconductor lasers in general are easily damaged by overdriving and transients. Electrically, the laser diode is a very reliable device and can easily withstand current surges of several amperes. Optically, however, the diode laser is more susceptible to damage because of the extremely high optical flux density passing through both facets, while in operation. By overdriving or transients to the laser, even for pulses in the nanosecond region, the optical flux density can rise to unacceptible values (10 to 100 MW/cm^2), causing gradual or catastrophic degradation of the laser facets.
Current transients should therefore be carefully avoided; they decrease the laser life time.

CAUTION

Aluminium gallium arsenide lasers emit radiation which is invisible to the human eye. When in use, do not look directly into the device. Direct viewing of laser light at close ranges, especially in conjunction with collimating lenses, may cause eye damage.

The device meets the requirements of safety class 3B of the international standard code.

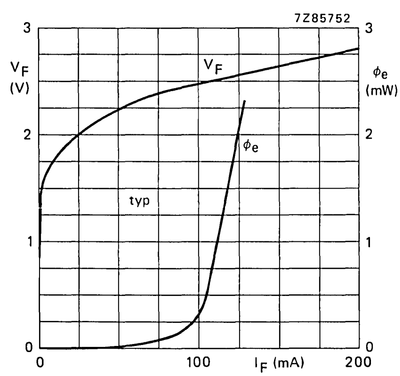


Fig. 4 T_h = 60 °C.

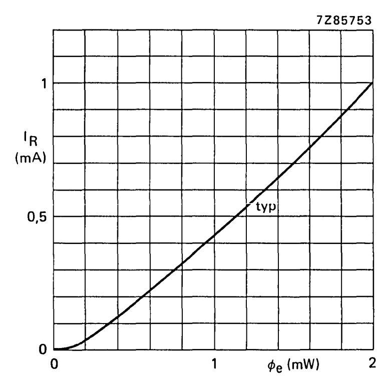


Fig. 5 V_R = 15 V.

COLLIMATOR PEN

The collimator pen CQL14A is used for writing applications such as: data retrieval (as used in optical memories), video disc applications, laser printers etc.

The pen is mounted in a non-hermetic encapsulation, specifically designed for easy alignment in an optical read or write system, and consists of a lens system and a laser device. The lens system collimates the diverging laser light. The wavefront quality is diffraction limited. A cylindrical lens is used for correction of the astigmatism of the laser.
The housing is circular and precision manufactured with a diameter accuracy between + 0 and −11 μm.

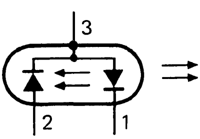
QUICK REFERENCE DATA

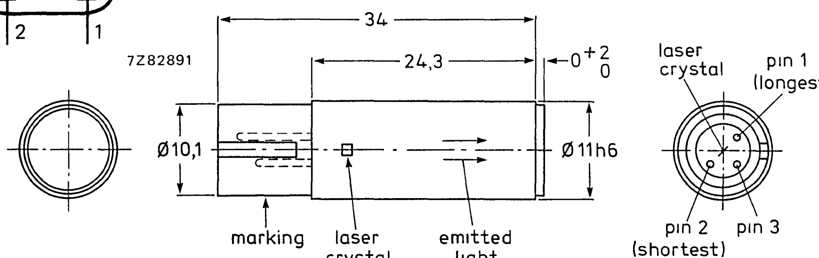
Output peak power at t_p = 60 ns and δ = 0,1	ϕ_e		20	mW
Current at output power ϕ_e = 20 mW and temperature of 60 °C		$\leqslant$	500	mA
Wavelength at peak emission	λ_{pk}	typ.	820	nm
Wavefront form of bundle (non-convergent) divergence		<	0,3	mrad

MECHANICAL DATA

Dimensions in mm

Fig. 1.





Mass	max. 8 g
Concentricity	angle between the mechanical and optical axis $\leqslant$ 10 mrad
Marking	type number CQL14A and serial number
Mounting	on a p.c. board by means of a specifically designed connector
Accessories	the pen is supplied with a connector
WARNING	THE LASER AND CONSEQUENTLY THE COLLIMATOR PEN HAS POSITIVE POLARITY ON THE CASE.

CHARACTERISTICS

Measuring conditions

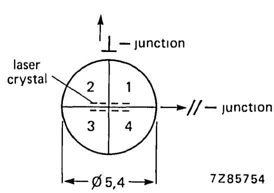
Climatological	relative humidity 5–90%, atmospheric pressure. Housing temperature of the pen 5–60 °C
Electrical	current modulation; repetition frequency 1,3 MHz; pulse length 60 ns at FWHM; rise and fall time < 20 ns at 500 mA
Optical	only the radiation in a bundle with a diameter of 5,4 mm is relevant

Optical data

Output peak power	ϕ_e	max. 20 mW (t_p = 60 ns; δ = 0,1)
Spectral		
wavelength	λ	820 ± 10 nm
bandwidth	$\Delta\lambda$	< 3 nm
wavelength drift	$\Delta\lambda/\Delta T$	approx. 0,25 nm/K
Bundle properties		
dimension		ϕ 5,4 mm
wavefront form		plane, non-convergent, divergence < 0,3 mrad
aberrations		variance of wavefront with respect to the Gaussian reference sphere is less than $\lambda^2/300$
polarization		plane
polarization ratio		typ. 35 : 1
Intensity distribution		
transversal mode		TE_{00}-fundamental
longitudinal mode		see note
symmetry		variation of optical power in the four quadrants (see Fig. 2) typ. 20%
ripple		local value of the intensity < 15% of the smooth value

Note: the number of longitudinal modes is related to the spectral width.

Fig. 2.



Electrical data

Current at ϕ_e = 20 mW and T_h = 60 °C	⩽ 500 mA
Drive voltage V_d	⩽ 5 V
Capacitance	< 10 pF
Resistance between collimator pen and connector at 10 mA, max. 20 mV_{pp} and 1 kHz	⩽ 12 mΩ

PHOTODIODE

RATINGS

Reverse voltage	V_R	⩽	30 V

CHARACTERISTICS

Monitor diode sensitivity (ratio of photodiode current to optical power emitted by collimator pen) at ϕ_e = 20 mW			0,1 A/W
Dark reverse current at V_R = 15 V	$I_{R(D)}$	<	10 nA
Capacitance at V_R = 0	C_d	<	5 pF

ENVIRONMENTAL TESTS

The device meets all specifications mentioned below 2 hours after each test. During these tests the collimator pen is not operating.

test	in accordance with	conditions
Rapid change of temperature	IEC 68-2-14, test Na	−25 °C to 25 °C to 70 °C to 25 °C; duration of each exposure 30 min and 10 cycles in total
Dry heat	IEC 68-2-2, test Bc	Temperature: 70 °C Duration: 7 days
Cold	IEC 68-2-1 test Aa	Temperature: −25 °C Duration: 7 days
Damp heat, steady state	IEC 68-2-3 test Ca	Temperature: 40 °C Relative humidity (R.H.): 90–95% Duration: 42 days
Damp heat, cyclic	IEC 68-2-30 test Db	Temperature/R.H. 45 °C/100% (12 h) to 25 °C/ 85% (12 h) Duration of one cycle: 24 hours Number of cycles: 42
Vibration	IEC 68-2-6 test Db	Frequency range: 10–55 Hz Amplitude: 0,75 mm Duration: 6 hours (2 h in each of directions)
Shock	IEC 68-2-27 test Ea	Pulse shape: half-sine Pulse duration: 11 ms Peak acceleration: 981 m/s^2 Number of shocks: 10 in each of 3 directions
Bump	IEC 68-2-29 test Eb	Pulse duration: 6 ms Peak acceleration: 390 m/s^2 Number of bumps: 1000 Axes of direction: 6

Cleaning test — The cylinder lens at the side of the long conjugate is cleaned 100x with a small piece of cotton wool, soaked in a 45–95% solution of ethyl-alcohol in water, attached to the end of a small stick.

OPERATING PRECAUTIONS

Semiconductor lasers in general are easily damaged by overdriving and transients. Electrically, the laser diode is a very reliable device and can easily withstand current surges of several amperes. Optically, however, the diode laser is more susceptible to damage because of the extremely high optical flux density passing through both facets, while in operation. By overdriving or transients to the laser, even for pulses in the nanosecond region, the optical flux density can rise to unacceptible values (10 to 100 MW/cm^2), causing gradual or catastrophic degradation of the laser facets.
Current transients should therefore be carefully avoided; they decrease the laser life time.

CAUTION

Aluminium gallium arsenide lasers emit radiation which is invisible to the human eye. When in use, do not look directly into the device. Direct viewing of laser light at close ranges, especially in conjunction with collimating lenses, may cause eye damage.

The device meets the requirements of safety class 3B of the international standard code.

COLLIMATOR PEN

The collimator pen CQL14B is used for writing applications such as: data retrieval (as used in optical memories), video disc applications, laser printers etc.

The pen is mounted in a non-hermetic encapsulation, specifically designed for easy alignment in an optical read or write system, and consists of a lens system and a laser device. The lens system collimates the diverging laser light. The wavefront quality is diffraction limited. A cylindrical lens is used for correction of the astigmatism of the laser.
The housing is circular and precision manufactured with a diameter accuracy between + 0 and −11 μm.

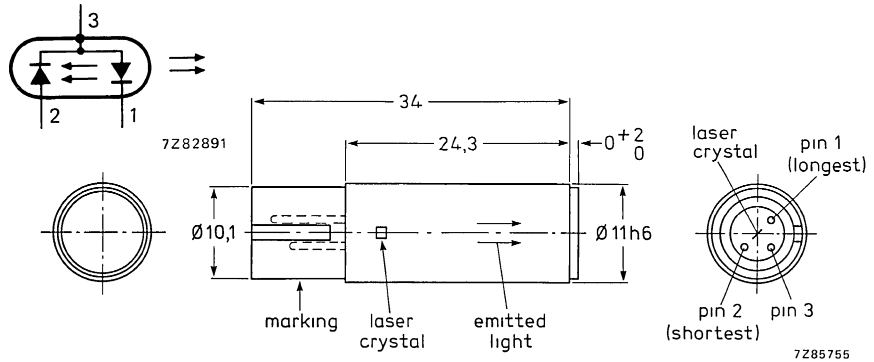
QUICK REFERENCE DATA

Output peak power at t_p = 60 ns and δ = 0,1	ϕ_e		20	mW
Current at output power ϕ_e = 20 mW and temperature of 60 °C		≤	500	mA
Wavelength at peak emission	λ_{pk}	typ.	850	nm
Wavefront form of bundle (non-convergent) divergence		<	0,3	mrad

MECHANICAL DATA

Dimensions in mm

Fig. 1.



Mass	max. 8 g
Concentricity	angle between the mechanical and optical axis ≤ 10 mrad
Marking	type number CQL14B and serial number
Mounting	on a p.c. board by means of a specifically designed connector
Accessories	the pen is supplied with a connector
WARNING	THE LASER AND CONSEQUENTLY THE COLLIMATOR PEN HAS POSITIVE POLARITY ON THE CASE.

CHARACTERISTICS

Measuring conditions

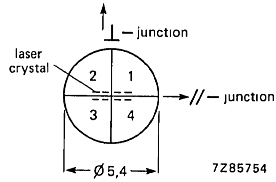
Climatological	relative humidity 5–90%, atmospheric pressure. Housing temperature of the pen 5–60 °C
Electrical	current modulation; repetition frequency 1,3 MHz; pulse length 60 ns at FWHM; rise and fall time < 20 ns at 500 mA
Optical	only the radiation in a bundle with a diameter of 5,4 mm is relevant

Optical data

Output peak power	ϕ_e	max. 20 mW (t_p = 60 ns; δ = 0,1)
Spectral		
wavelength	λ	850 ± 10 nm
bandwidth	$\Delta\lambda$	< 3 nm
wavelength drift	$\Delta\lambda/\Delta T$	approx. 0,25 nm/K
Bundle properties		
dimension		ϕ 5,4 mm
wavefront form		plane, non-convergent, divergence < 0,3 mrad
aberrations		variance of wavefront with respect to the Gaussian reference sphere is less than $\lambda^2/300$
polarization		plane
polarization ratio		typ. 35 : 1
Intensity distribution		
transversal mode		TE_{00}-fundamental
longitudinal mode		see note
symmetry		variation of optical power in the four quadrants (see Fig. 2) typ. 20%
ripple		local value of the intensity < 15% of the smooth value

Note: the number of longitudinal modes is related to the spectral width.

Fig. 2.



Electrical data

Current at ϕ_e = 20 mW and T_h = 60 °C	⩽ 500 mA
Drive voltage V_d	⩽ 5 V
Capacitance	< 10 pF
Resistance between collimator pen and connector at 10 mA, max. 20 mV_{pp} and 1 kHz	⩽ 12 mΩ

PHOTODIODE

RATINGS

Reverse voltage	V_R	⩽	30 V

CHARACTERISTICS

Monitor diode sensitivity (ratio of photodiode current to optical power emitted by collimator pen) at ϕ_e = 20 mW			0,1 A/W
Dark reverse current at V_R = 15 V	$I_{R(D)}$	<	10 nA
Capacitance at V_R = 0	C_d	<	5 pF

ENVIRONMENTAL TESTS

The device meets all specifications mentioned below 2 hours after each test. During these tests the collimator pen is not operating.

test	in accordance with	conditions
Rapid change of temperature	IEC 68-2-14, test Na	−25 °C to 25 °C to 70 °C to 25 °C; duration of each exposure 30 min and 10 cycles in total
Dry heat	IEC 68-2-2, test Bc	Temperature: 70 °C Duration: 7 days
Cold	IEC 68-2-1 test Aa	Temperature: −25 °C Duration: 7 days
Damp heat, steady state	IEC 68-2-3 test Ca	Temperature: 40 °C Relative humidity (R.H.): 90–95% Duration: 42 days
Damp heat, cyclic	IEC 68-2-30 test Db	Temperature/R.H. 45 °C/100% (12 h) to 25 °C/ 85% (12 h) Duration of one cycle: 24 hours Number of cycles: 42
Vibration	IEC 68-2-6 test Db	Frequency range: 10–55 Hz Amplitude: 0,75 mm Duration: 6 hours (2 h in each of directions)
Shock	IEC 68-2-27 test Ea	Pulse shape: half-sine Pulse duration: 11 ms Peak acceleration: 981 m/s^2 Number of shocks: 10 in each of 3 directions
Bump	IEC 68-2-29 test Eb	Pulse duration: 6 ms Peak acceleration: 390 m/s^2 Number of bumps: 1000 Axes of direction: 6

Cleaning test — The cylinder lens at the side of the long conjugate is cleaned 100x with a small piece of cotton wool, soaked in a 45–95% solution of ethyl-alcohol in water, attached to the end of a small stick.

OPERATING PRECAUTIONS

Semiconductor lasers in general are easily damaged by overdriving and transients. Electrically, the laser diode is a very reliable device and can easily withstand current surges of several amperes. Optically, however, the diode laser is more susceptible to damage because of the extremely high optical flux density passing through both facets, while in operation. By overdriving or transients to the laser, even for pulses in the nanosecond region, the optical flux density can rise to unacceptible values (10 to 100 MW/cm^2), causing gradual or catastrophic degradation of the laser facets.
Current transients should therefore be carefully avoided; they decrease the laser life time.

CAUTION

Aluminium gallium arsenide lasers emit radiation which is invisible to the human eye. When in use, do not look directly in to the device. Direct viewing of laser light at close ranges, especially in conjunction with collimating lenses, may cause eye damage.

The device meets the requirements of safety class 3B of the international standard code.

LIGHT EMITTING DIODE

The CQN10 is a hyper-red light emitting block. The SOD-73 envelope is a block (7 mm x 14,5 mm) containing 2 GaAlAs diodes and has long leads. The diodes are encapsulated in a transparent resin with a medium-red coloured diffusing zone cast on the top.

This so-called Word Illumination Block (WIB) is designed to illuminate small texts in equipment. Because of its high light intensity and large (7 x 14,5) light diffusing surface it is very suitable for special indicator purposes, for example, in cars, white goods, power switches etc., and in applications where only low currents are available.

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	5	V
Forward current (d.c.)	I_F	max.	60	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	360	mW
Junction temperature	T_j	max.	100	°C
Luminous intensity I_F = 10 mA	I_v	min.	2	mCd
Wavelength at peak emission	λ_{pk}	typ.	650	nm
Beamwidth between half-intensity directions	$\alpha_{50\%}$	typ.	110	°

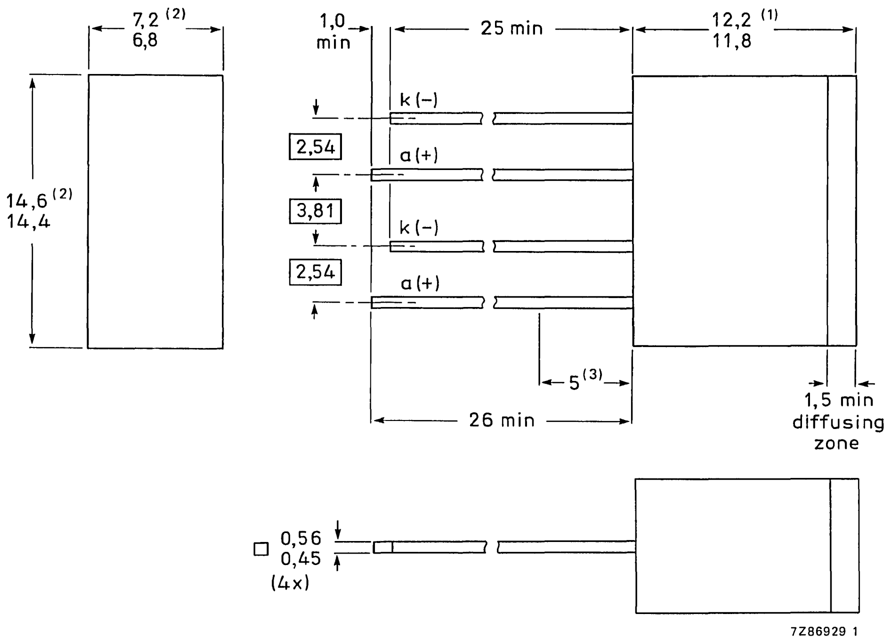
MECHANICAL DATA

SOD-73 (see page 122)

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-73.



Notes

1. The seating plane is defined when the device is mounted over an aperture of 12,6 mm x 5,2 mm
2. Max. value including plastic burrs
3. Solderability not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	5	V
Forward current				
d.c.	I_F	max.	60	mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1	A
peak value; t_{on} = 20 μs; δ = 0,01	I_{FM}	max.	500	mA
Total power dissipation up to T_{amb} = 25 ^oC	P_{tot}	max.	360	mW
Storage temperature	T_{stg}	−55 to	+85	^oC
Junction temperature	T_j	max.	100	^oC
Lead soldering temperature				
$>$ 5 mm from the plastic body; $t_{sld} < 7$ s	T_{sld}	max.	260	o

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	210	K/W

DEVELOPMENT SAMPLE DATA

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage (per diode) I_F = 10 mA	V_F	typ. max.	1,75 V 2,2 V
Reverse current (per diode) V_R = 5 V	I_R	max.	100 μA
Beamwidth between half-intensity directions	$\alpha_{50\%}$	typ.	110 °
Bandwidth at half height	$B_{50\%}$	typ.	20 nm
Wavelength at peak emission	λ_{pk}	typ.	650 nm
Luminous intensity I_F = 10 mA	I_v	min.	2 mCd
Capacitance (per diode)	C_d	typ.	60 pF

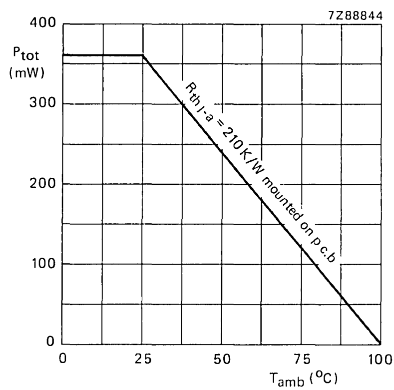


Fig. 2.

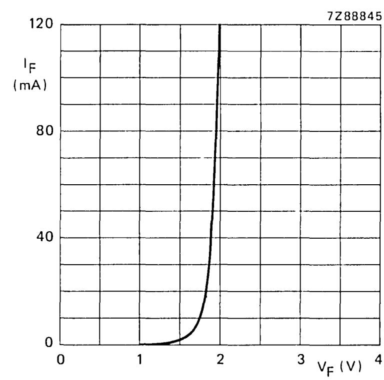


Fig. 3 T_{amb} = 25 °C; typ. values.

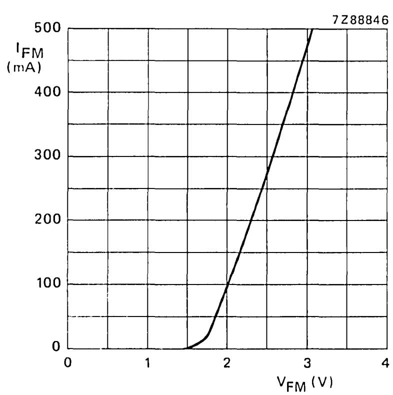


Fig. 4 t_{on} = 20 μs; δ = 0,01; T_{amb} = 25 °C; typ. values.

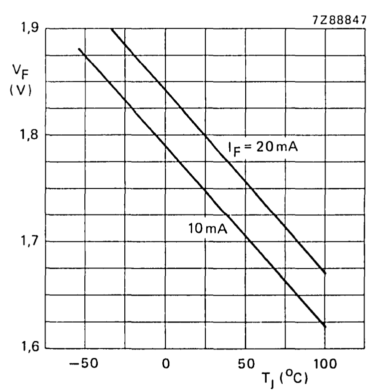


Fig. 5 Value per diode; typ. values.

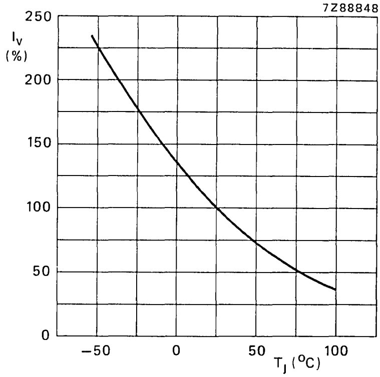


Fig. 6 I_F = 10 mA; typ. values.

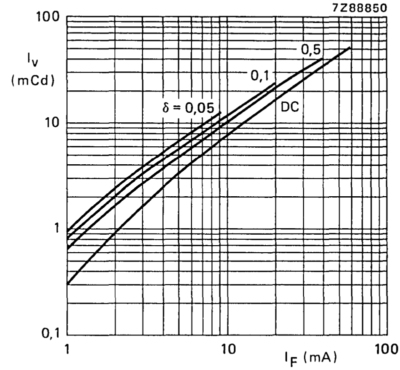


Fig. 7 t_p = 50 μs; typ. values.

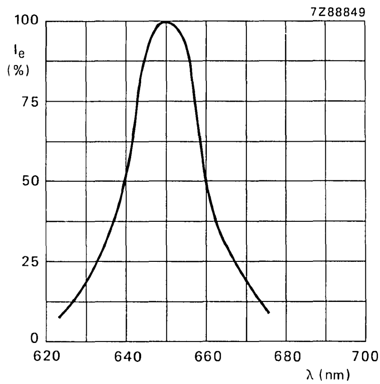


Fig. 8 I_F = 10 mA; T_{amb} = 25 °C; typ. values.

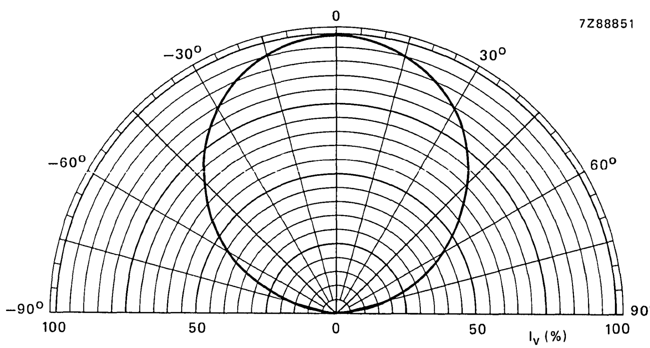


Fig. 9 Typical values.

LIGHT EMITTING DIODE

The CQN11 is a super-green light emitting block. The SOD-73 envelope is a block (7 mm x 14,5 mm) containing 2 GaP diodes and has long leads. The diodes are encapsulated in a transparent resin with an extra medium-green coloured diffusing zone cast on the top.

This so-called Word Illumination Block (WIB) is designed to illuminate small texts in equipment. Because of its high light intensity and large (7 x 14,5) light diffusing surface it is very suitable for special indicator purposes, for example, in cars, white goods, power switches etc. and in applications where only low currents are available.

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	5	V
Forward current (d.c.)	I_F	max.	60	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	360	mW
Junction temperature	T_j	max.	100	°C
Luminous intensity I_F = 20 mA	I_v	min.	2	mCd
Wavelength at peak emission	λ_{pk}	typ.	565	nm
Beamswitch between half-intensity directions	$\alpha_{50\%}$	typ.	110	°

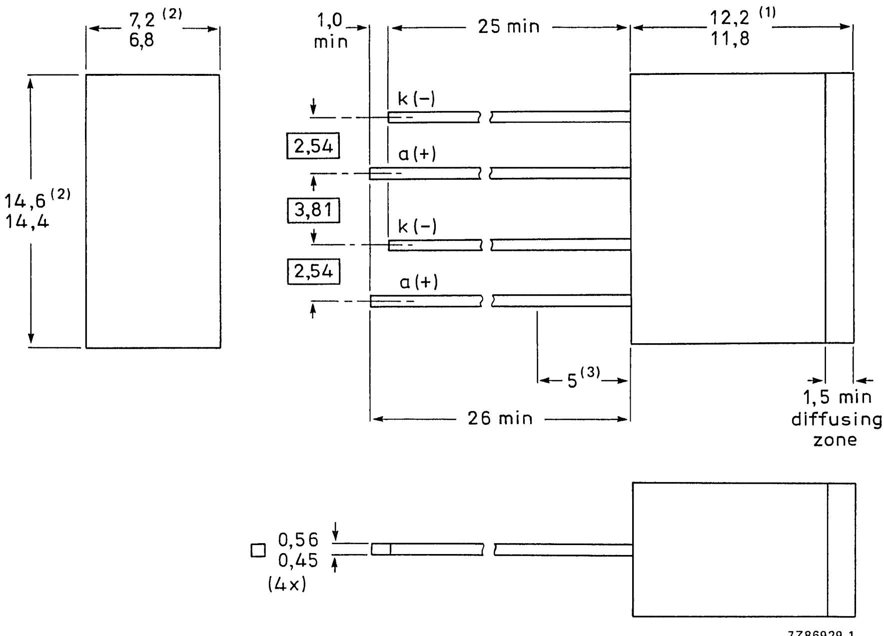
MECHANICAL DATA

SOD-73 (see page 126)

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-73.



Notes

1. The seating plane is defined when the device is mounted over an aperture of 12,6 mm x 5,2 mm
2. Max. value including plastic burrs
3. Solderability not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	5 V
Forward current			
d.c.	I_F	max.	60 mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_{on} = 1 ms; δ = 0,33	I_{FM}	max.	150 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	360 mW
Storage temperature	T_{stg}	−55 to	+85 °C
Junction temperature	T_j	max.	100 °C
Lead soldering temperature			
> 5 mm from the plastic body; t_{sld} < 7 s	T_{sld}	max.	260 °

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	210 K/W

DEVELOPMENT SAMPLE DATA

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage (per diode) I_F = 20 mA	V_F	typ. max.	2,1 V 3,0 V
Reverse current (per diode) V_R = 5 V	I_R	max.	100 μA
Beamwidth between half-intensity directions	$\alpha_{50\%}$	typ.	110 °
Bandwidth at half height	$B_{50\%}$	typ.	30 nm
Wavelength at peak emission	λ_{pk}	typ.	565 nm
Luminous intensity I_F = 20 mA	I_v	min.	2 mCd
Capacitance (per diode)	C_d	typ.	35 pF

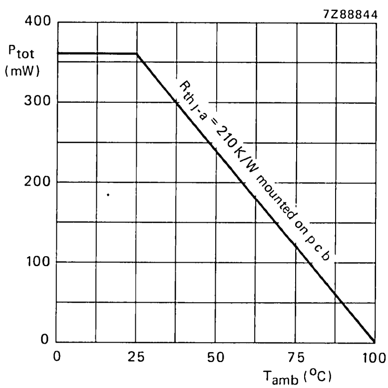


Fig. 2.

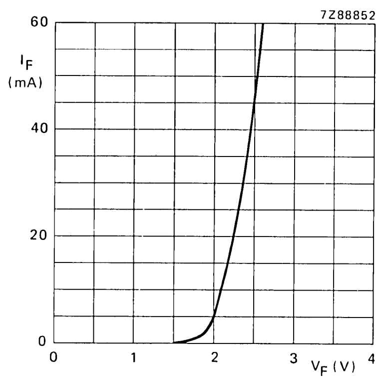


Fig. 3 T_{amb} = 25 °C; typ. values.

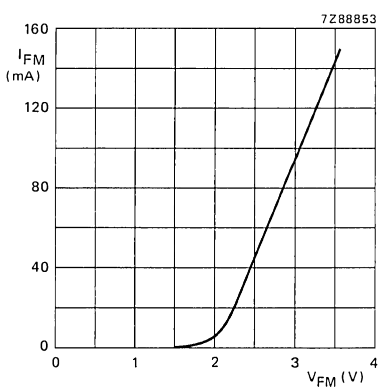


Fig. 4 t_{on} = 20 μs; δ = 0,01; T_{amb} = 25 °C.
T_{amb} = 25 °C; typ. values.

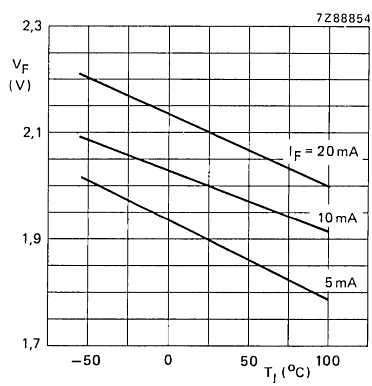


Fig. 5 Value per diode; typ. values.

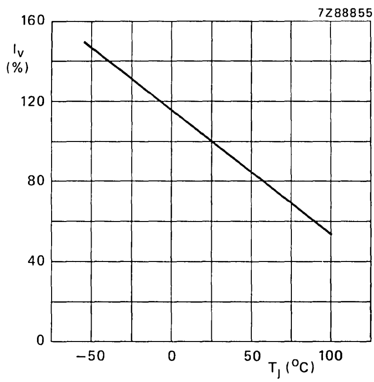


Fig. 6 I_F = 20 mA; typ. values.

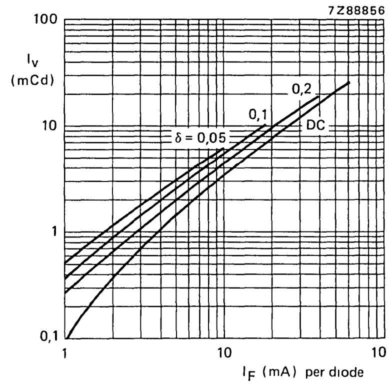


Fig. 7 t_p = 50 μs; typ. values.

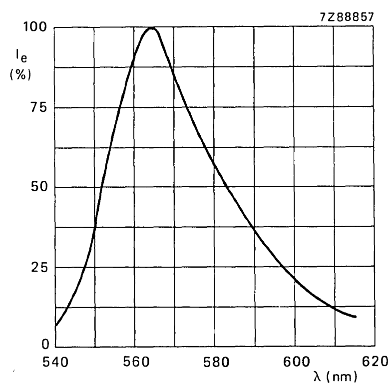


Fig. 8 I_F = 20 mA; T_{amb} = 25 °C; typ. values.

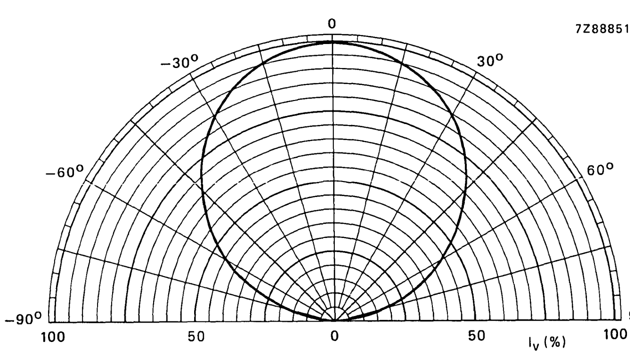


Fig. 9 Typical values.

LIGHT EMITTING DIODE

Solid-state rectangular lamp of 3 mm x 5 mm which emits hyper-red light (GaAlAs) or super-green light (GaP) depending on the polarity of the current.

The CQT10 has a SOD-77A outline and is encapsulated in a transparent resin with a diffusing zone cast on the top. Because of its SOD-77 envelope it can be used in configurations together with the CQV70 LED family. The bicolour function gives this light emitting device special application possibilities e.g.

- as level sensor overdrive indicator
- as zero point indicator
- as tuning indicator

QUICK REFERENCE DATA

Forward current (d.c.)			
red	I_F	max.	100 mA
green			60 mA
Total power dissipation up to T_{amb} = 35 °C	P_{tot}	max.	180 mW
Junction temperature	T_j	max.	100 °C
Luminous intensity			
red at I_F = 10 mA; green at I_F = 20 mA	I_v	min.	1 mcd
Wavelength at peak emission			
red	λ_{pk}	typ.	650 nm
green			565 nm
Beamwidth between half-intensity directions in the plane of the leads	$\alpha_{50\%}$	typ.	110 °

MECHANICAL DATA

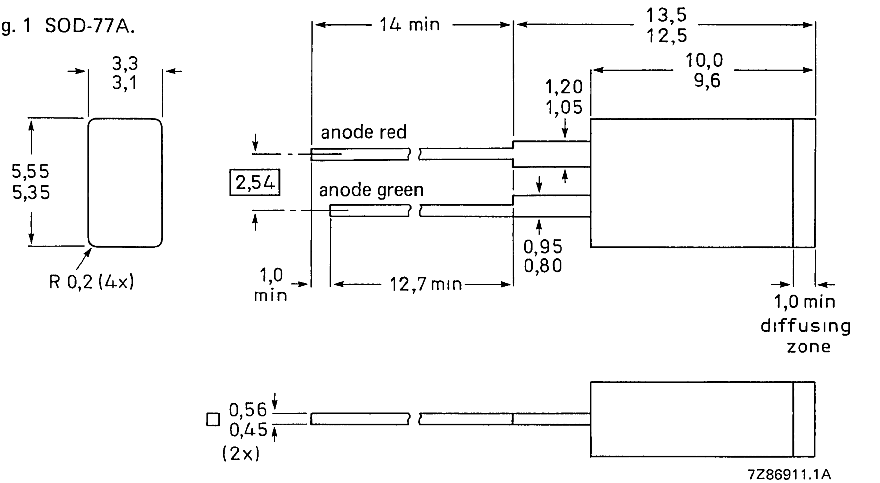
Dimensions in mm

SOT-77A (see page 130)

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-77A.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Forward current (d.c.)			
red	I_F	max.	100 mA
green			60 mA
Forward current			
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_{on} = 1 ns; δ = 0,33	I_{FM}	max.	150 mA
Total power dissipation up to T_{amb} = 35 °C	P_{tot}	max.	180 mW
Junction temperature	T_j	max.	100 °C
Storage temperature	T_{stg}	−55 to +100 °C	
Lead soldering temperature $>$ 1,5 mm from the seating plane; $t_{sld} < 7$ s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Forward voltage			
red at I_F = 10 mA	V_F	typ.	1,75 V
		max.	2,2 V
green at I_F = 20 mA	V_F	typ.	2,1 V
		max.	3,0 V
Beamwidth between half-intensity directions at I_F = 10 mA (in the plane of the leads)	$\alpha_{50\%}$	typ.	110 °

CHARACTERISTICS (continued)

Wavelength at peak emission			
at I_F = 10 mA			
red	λ_{pk}	typ.	650 nm
green			565 nm
Capacitance			
at V = 0; f = 1 MHz	C_d	typ.	90 pF
Luminous intensity			
red at I_F = 10 mA	I_v	min.	1,0 mcd
green at I_F = 20 mA		typ.	1,5 mcd

DEVELOPMENT SAMPLE DATA

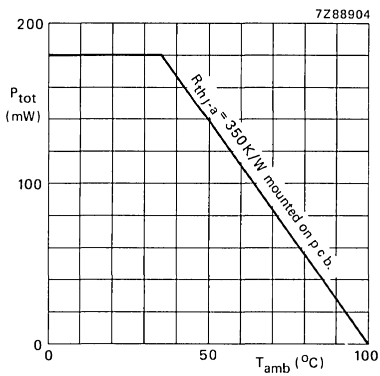


Fig. 2.

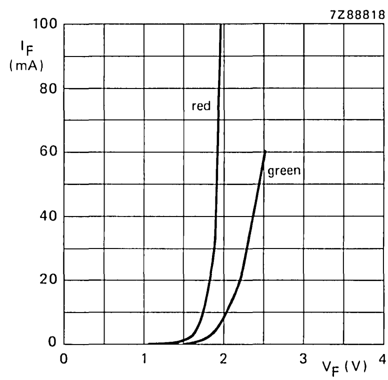


Fig. 3 T_{amb} = 25 °C; typ. values.

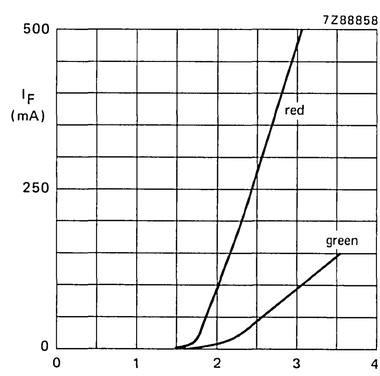


Fig. 4 t_{on} = 20 μs; δ = 0,01; T_{amb} = 25 °C; typ. values.

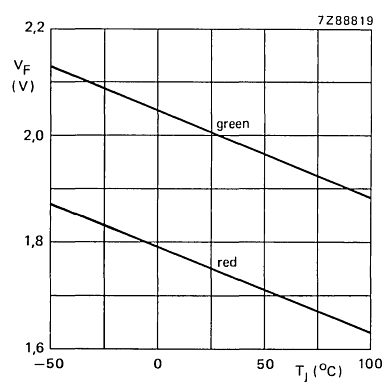


Fig. 5 I_F = 10 mA; typ. values.

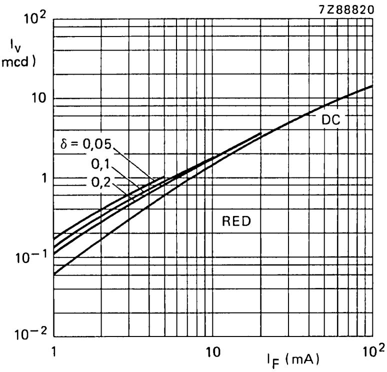


Fig. 6 t_p = 50 μs; typ. values.

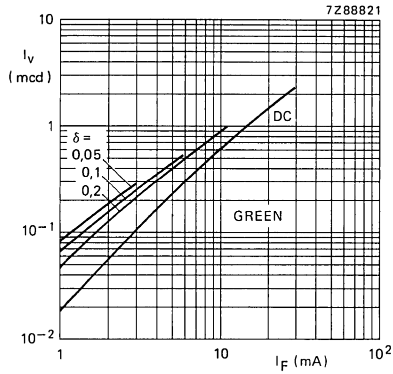


Fig. 7 t_p = 50 μs; typ. values.

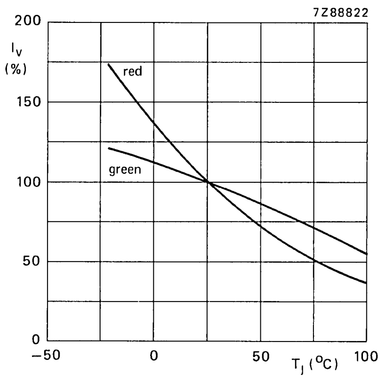


Fig. 8 Typical values.

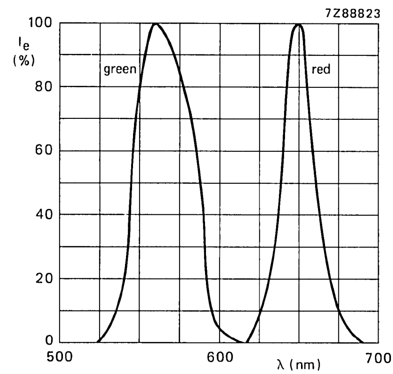


Fig. 9 I_F = 10 mA; typ. values.

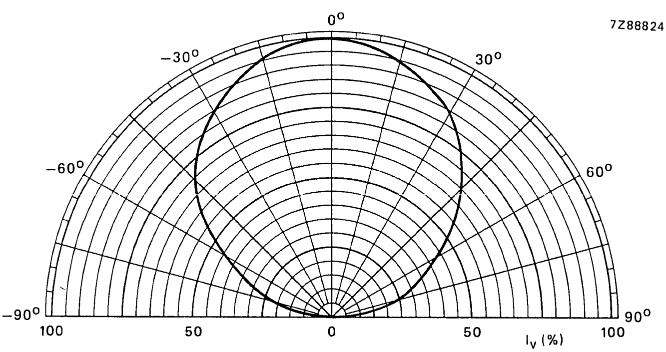


Fig. 10 I_F = 10 mA; typ. values.

LIGHT EMITTING DIODE

Solid-state lamp with diameter of 2 mm, which emits either hyper-red light (GaAlAs) or super-green light (GaP) depending on the polarity of the current.

The CQT11 has a SOD-78 outline and is encapsulated in a transparent resin with a diffusing zone cast on the top. Because of its 2 mm diameter it can be used in configurations together with the CQW20 LED family. The bicolour function gives this light emitting device special application possibilities such as:

- level sensor overdrive indicator
- zero point indicator
- tuning indicator

QUICK REFERENCE DATA

Forward current (d.c.)			
red	I_F	max.	100 mA
green	I_F	max.	60 mA
Total power dissipation up to T_{amb} = 35 °C	P_{tot}	max.	180 mW
Junction temperature	T_j	max.	100 °C
Luminous intensity			
red at I_F = 10 mA; green at I_F = 20 mA	I_v	min.	1 mcd
Wave length at peak emission			
red	λ_{pk}	typ.	650 nm
green	λ_{pk}	typ.	565 nm
Beamwidth between half-intensity directions	$\alpha_{50\%}$	typ.	110 °

MECHANICAL DATA

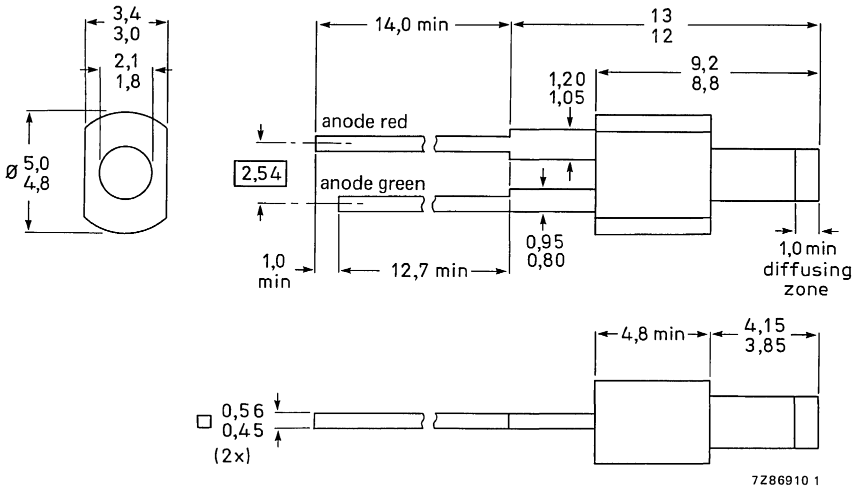
Dimensions in mm

SOD-78 (see page 134)

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-78.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Forward current (d.c.) red	I_F	max.	100 mA
green			60 mA
Forward current peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_{on} = 1 ms; δ = 0,33	I_{FM}	max.	150 mA
Total power dissipation up to T_{amb} = 35 °C	P_{tot}	max.	180 mW
Junction temperature	T_j	max.	100 °C
Storage temperature	T_{stg}		−55 to +100 °C
Lead soldering temperature > 1,5 mm from the seating plane; t_{sld} < 7 s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Forward voltage

red at I_F = 10 mA	V_F	typ.	1,75 V
		max.	2,2 V
green at I_F = 20 mA	V_F	typ.	2,1 V
		max.	3,0 V

CHARACTERISTICS (continued)

Beamwidth between half-intensity directions at I_F = 10 mA	$\alpha_{50\%}$	typ.	110 °
Wavelength at peak emission at I_F = 10 mA			
red	λ_{pk}	typ.	650 nm
green		typ.	565 nm
Capacitance at V = 0; f = 1 MHz	C_d	typ.	90 pF
Luminous intensity			
red at I_F = 10 mA	I_v	min.	1,0 mcd
green at I_F = 20 mA		typ.	1,5 mcd

DEVELOPMENT SAMPLE DATA

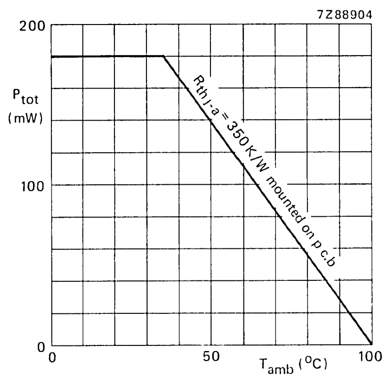


Fig. 2.

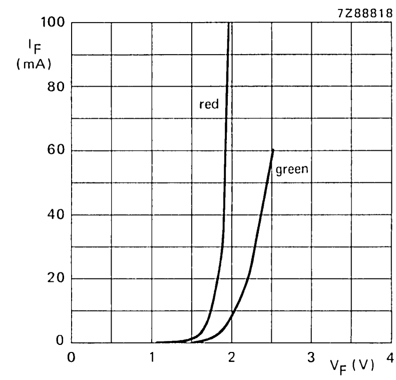


Fig. 3 T_{amb} = 25 °C; typ. values.

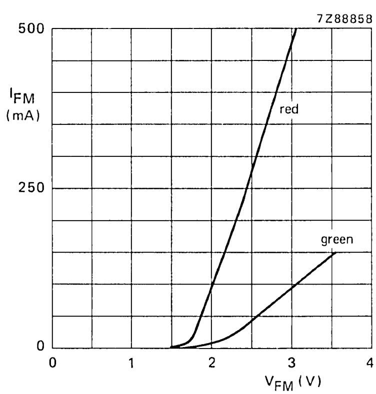


Fig. 4 t_{on} = 20 μs; δ = 0,01; T_{amb} = 25 °C; typ. values.

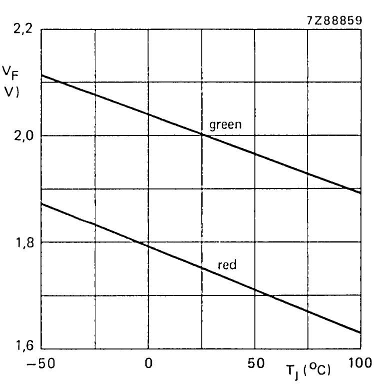


Fig. 5 I_F = 10 mA; typ. values.

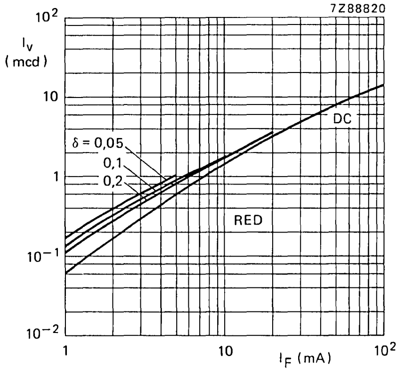


Fig. 6 $t_p = 50\ \mu s$; typ. values.

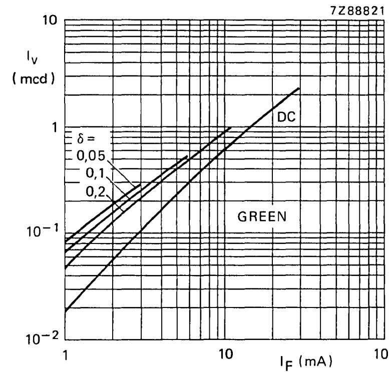


Fig. 7 $t_p = 50\ \mu s$; typ. values.

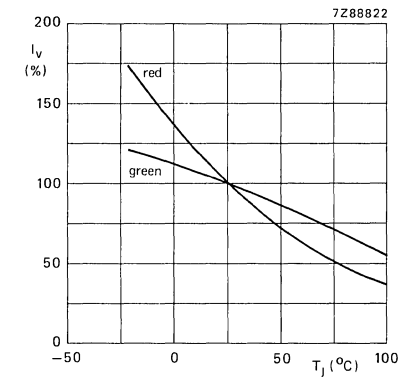


Fig. 8 Typical values.

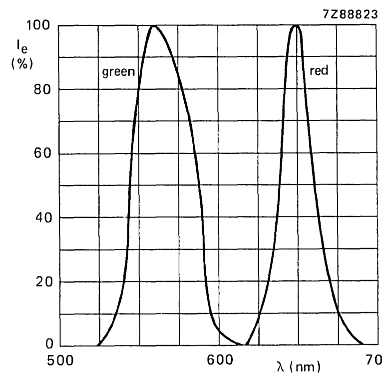


Fig. 9 $I_F = 10$ mA; typ. values.

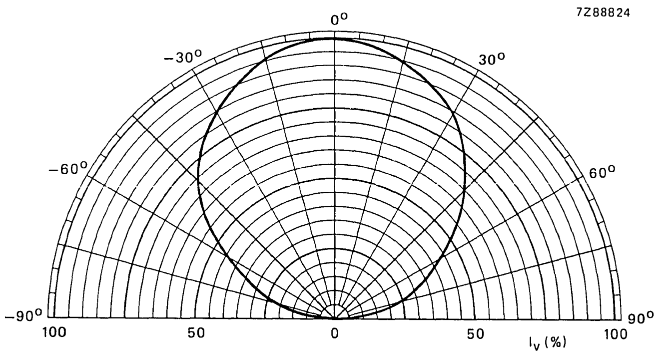


Fig. 10 $I_F = 10$ mA; typ. values.

LIGHT EMITTING DIODE

Solid-state rectangular lamp of 1 mm x 5 mm which emits either hyper-red light (GaAlAs) or super-green light (GaP) depending on the polarity of the current.

The CQT12 has a SOD-75A2 outline and is encapsulated in a transparent resin with a diffusing zone cast on the top. Because of its SOD-75 envelope it can be used in configurations together with the CQV60 LED family e.g. the LED array RTC 907. The bicolour function gives this light emitting device special application possibilities e.g.

- as level sensor overdrive indicator
- as zero point indicator
- as tuning indicator

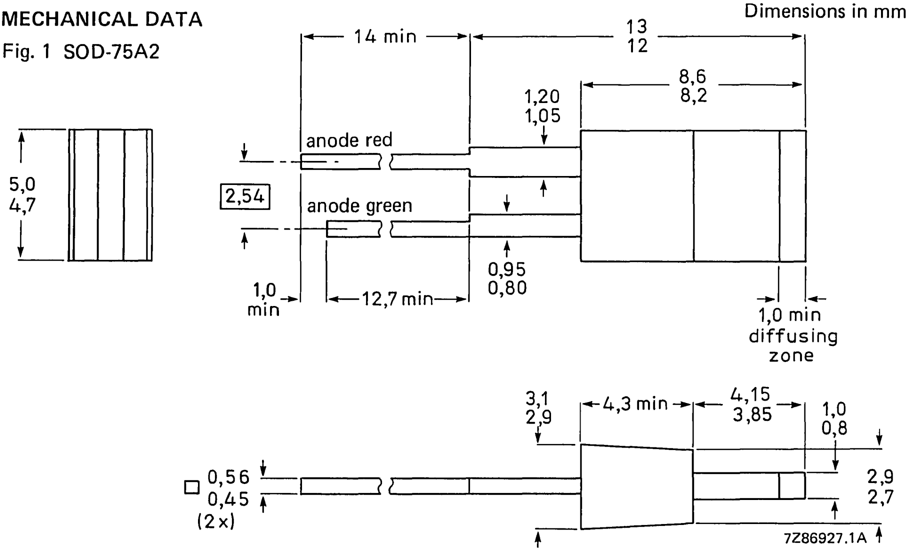
QUICK REFERENCE DATA

Forward current (d.c.)			
red	I_F	max.	100 mA
green			60 mA
Total power dissipation up to T_{amb} = 35 °C	P_{tot}	max.	180 mW
Junction temperature	T_j	max.	100 °C
Luminous intensity			
red at I_F = 10 mA; green at I_F = 20 mA	I_V	min.	1 mcd
Wavelength at peak emission			
red	λ_{pk}	typ.	650 nm
green			565 nm
Beamwidth between half-intensity directions in the plane of the leads	$\alpha_{50\%}$	typ.	110 °

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-75A2



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Forward current (d.c.)			
red	I_F	max.	100 mA
green	I_F	max.	60 mA
Forward current			
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_{on} = 1 ms; δ = 0,33	I_{FM}	max.	150 mA
Total power dissipation up to T_{amb} = 35 °C	P_{tot}	max.	180 mW
Junction temperature	T_j	max.	100 °C
Storage temperature	T_{stg}		−55 to +100 °C
Lead soldering temperature > 1,5 mm from the seating plane; t_{sld} < 7 s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_{amb} = 25 °C unless otherwise specified

Forward voltage			
red at I_F = 10 mA	V_F	typ.	1,75 V
		max.	2,2 V
green at I_F = 20 mA	V_F	typ.	2,1 V
		max.	3,0 V
Beamwidth between half-intensity directions at I_F = 10 mA (in the plane of the leads)	$\alpha_{50\%}$	typ.	110 °
Wavelength at peak emission at I_F = 10 mA			
red	λ_{pk}	typ.	650 nm
green	λ_{pk}	typ.	565 nm
Capacitance at V = 0; f = 1 MHz	C_d	typ.	90 pF
Luminous intensity			
red at I_F = 10 mA	I_v	min.	1,0 mcd
green at I_F = 20 mA	I_v	typ.	1,5 mcd

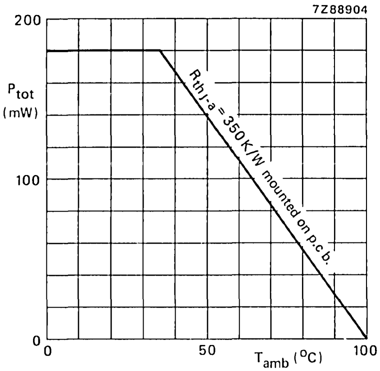


Fig. 2.

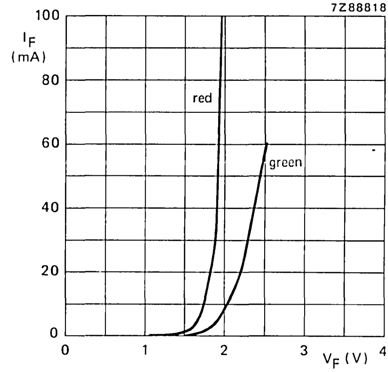


Fig. 3 T_{amb} = 25 °C; typical values.

DEVELOPMENT SAMPLE DATA

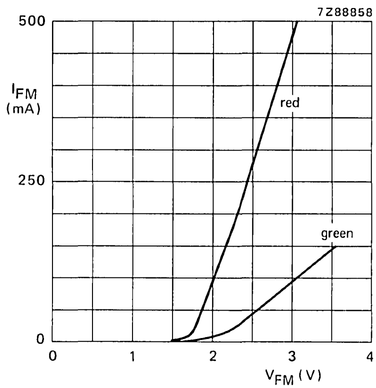


Fig. 4 t_{on} = 20 μs; δ = 0,01; T_{amb} = 25 °C; typical values.

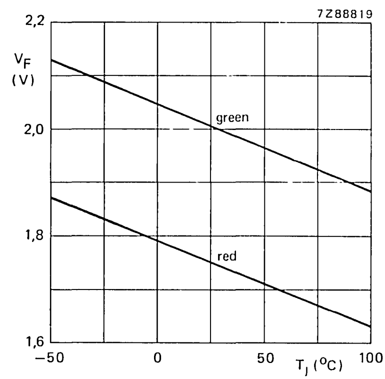


Fig. 5 I_F = 10 mA; typical values.

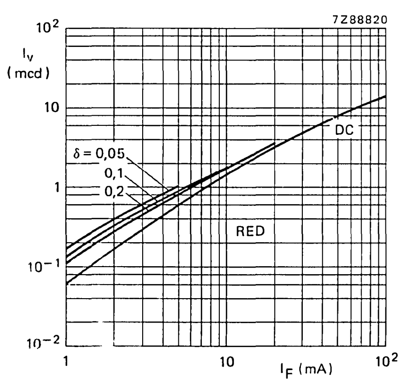


Fig. 6 t_p = 50 μs; typical values.

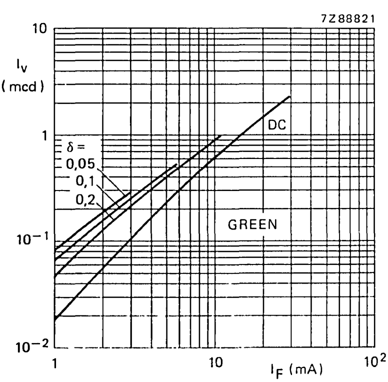


Fig. 7 t_p = 50 μs; typical values.

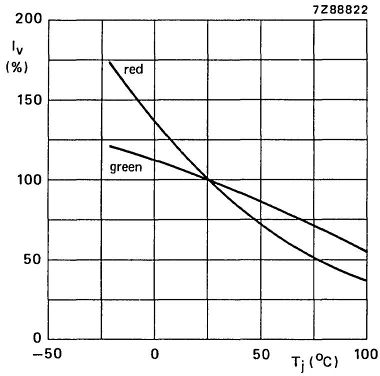


Fig. 8 Typical values.

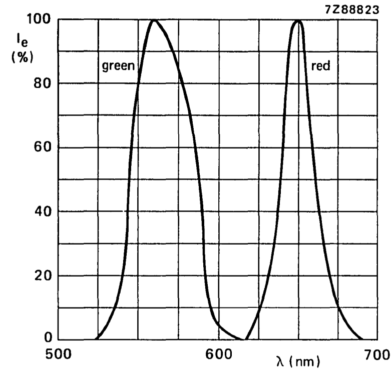


Fig. 9 I_F = 10 mA; typical values.

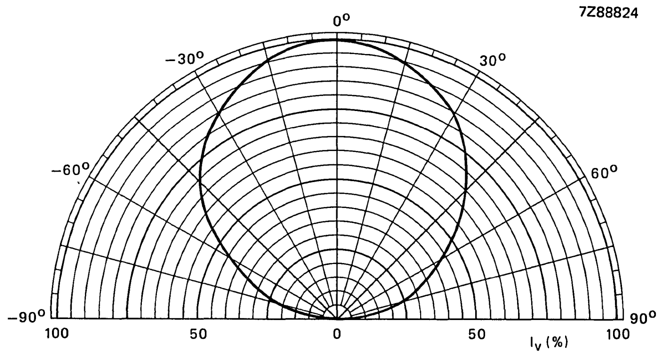


Fig. 10 I_F = 10 mA; typical values.

LIGHT EMITTING DIODES

Rectangular light emitting diode of 1 mm x 5 mm which emits super-red light (GaPAs) when forward biased. The CQV60 and CQV60L have a SOD-75 outline and are encapsulated in a medium-red coloured resin with a diffusing zone cast on the top. These LEDs when stacked in the array RTC901 (or in combination with other SOD-75 LEDs) can be used e.g. as a level indicator.

The CQV60L is equal to the CQV60A but has long leads and no seating plane.

QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.		5	V
Forward current (d.c.)		I_F	max.		30	mA
Total power dissipation up to T_{amb} = 65 °C		P_{tot}	max.		90	mW
Junction temperature		T_j	max.		100	°C
Luminous intensity						
I_F = 10 mA	CQV60(L)	I_V	min.		0,5	mcd
	CQV60(L)-II	I_V	1,0	to	2,2	mcd
	CQV60(L)-III	I_V	1,6	to	3,5	mcd
Wavelength at peak emission I_F = 10 mA		λ_{pk}	typ.		630	nm
Beamwidth between half-intensity directions in the plane of the leads		$\alpha_{50\%}$	typ.		110	°

MECHANICAL DATA

Dimensions in mm

Fig. 1a SOD-75A2.
CQV60

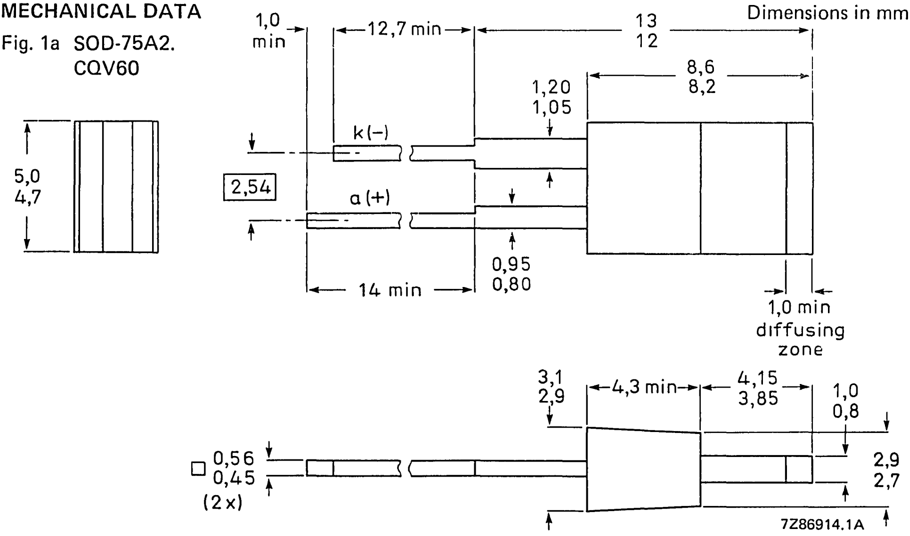
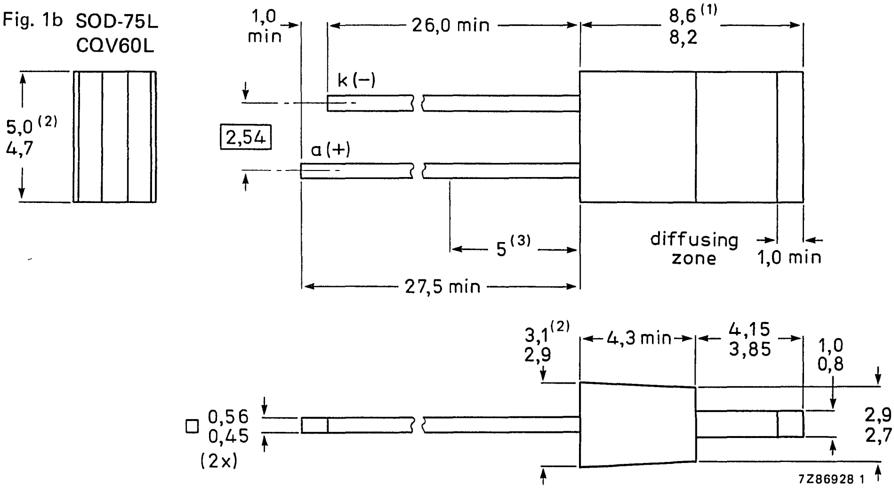


Fig. 1b SOD-75L CQV60L



Notes

1. Dimension measured when the device is seated in a gauge with 2 holes of 0,80 mm diameter and 2,54 mm apart.
2. For the maximum value including plastic burrs.
3. Solderability is not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5 V
Forward current			
d.c.	I_F	max.	30 mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_{on} = 1 ms; δ = 0,33	I_{FM}	max.	60 mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	90 mW
Storage temperature	T_{stg}	−55 to +100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature at t_{sld} < 7 s; > 1,5 mm from the seating plane for CQV60; > 5 mm from the plastic body for CQV60L	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 10 mA	V_F	typ.	2,1 V
		max.	3,0 V

Reverse current					
$V_R = 5$ V		I_R	max.	100	μA
Beamwidth between half-intensity directions					
in the plane of the leads		$\alpha_{50\%}$	typ.	110	°
Bandwidth at half height		$B_{50\%}$	typ.	45	nm
Wavelength at peak emission					
$I_F = 10$ mA		λ_{pk}	typ.	630	nm
Luminous intensity					
$I_f = 10$ mA	CQV60(L)	I_v	min.	0,5	mcd
	CQV60(L)-II	I_v	1,0 to	2,2	mcd
	CQV60(L)-III	I_v	1,6 to	3,5	mcd
Diode capacitance					
$V_R = 0$; f = 1 MHz		C_d	typ.	35	pF

DEVELOPMENT SAMPLE DATA

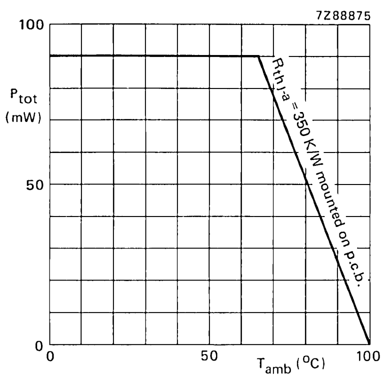


Fig. 2.

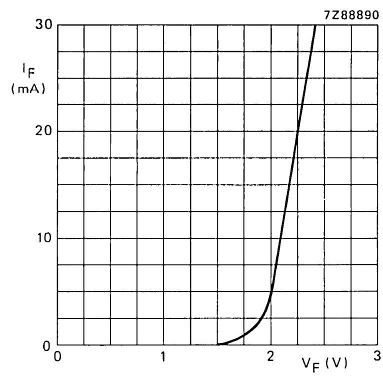


Fig. 3 $T_{amb} = 25$ °C; typ. values.

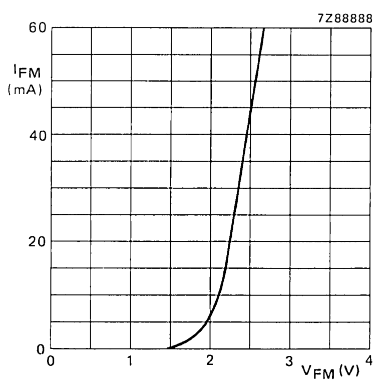


Fig. 4 $t_{on} = 50$ μs; $\delta = 0{,}01$;
$T_{amb} = 25$ °C; typ. values.

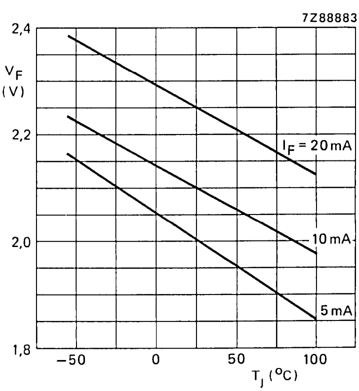


Fig. 5 Typical values.

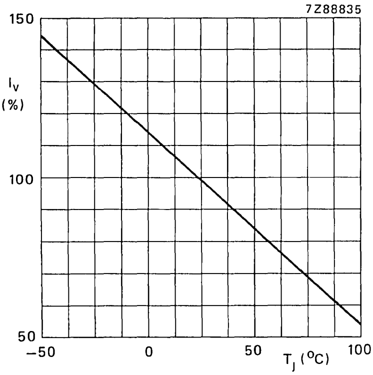


Fig. 6 I_F = 10 mA; typ. values.

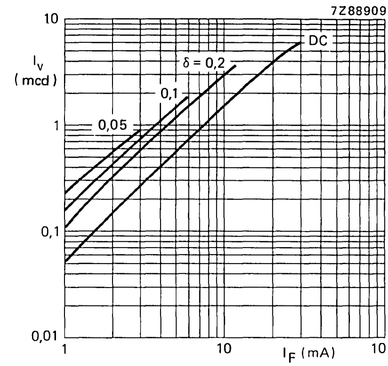


Fig. 7 t_p = 50 μs; typ. values.

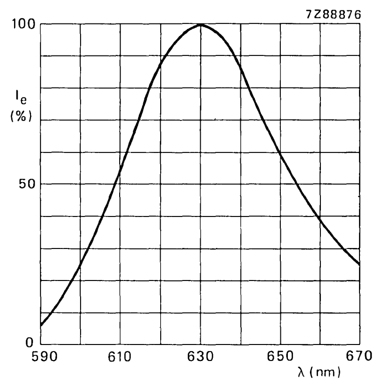


Fig. 8 Typical values.

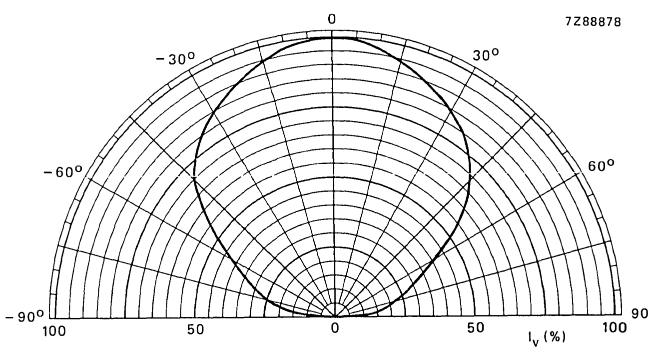


Fig. 9 Typical values.

LIGHT EMITTING DIODES

Rectangular light emitting diode of 1 mm x 5 mm which emits hyper-red light (GaAlAs) when forward biased.

The CQV60A and CQV60AL have a SOD-75 outline and are encapsulated in a medium-red coloured resin with a diffusing zone cast on the top. These LEDs when stacked in the array RTC907 (in combination with other SOD-75 LEDs) can be used e.g. as a level indicator.

Because of the high light intensity the CQV60A(L) is very suitable in those applications where only very low currents are available and because of its high $I_{F\,max}$ it can be used for high I_V applications.

The CQV60AL is equal to the CQV60A but has long leads and no seating plane.

QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5 V
Forward current (d.c.)		I_F	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	250 mW
Junction temperature		T_j	max.	100 °C
Luminous intensity				
I_F = 10 mA	CQV60A(L)	I_V	min.	1,0 mcd
	CQV60A(L)-III	I_V		1,6 to 3,5 mcd
	CQV60A(L)-IV	I_V		3,0 to 7,0 mcd
Wavelength at peak emission				
I_F = 10 mA		λ_{pk}	typ.	650 nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	110 °

MECHANICAL DATA

Dimensions in mm

Fig. 1a SOD-75A2
CQV60A

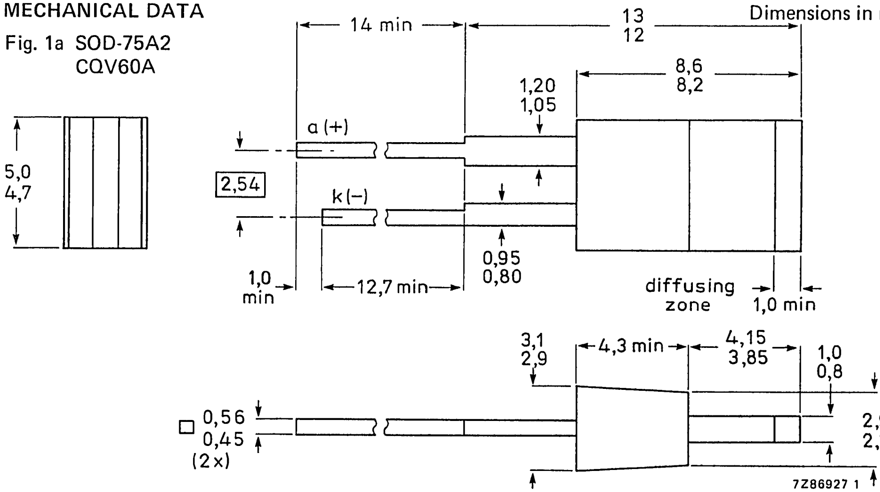
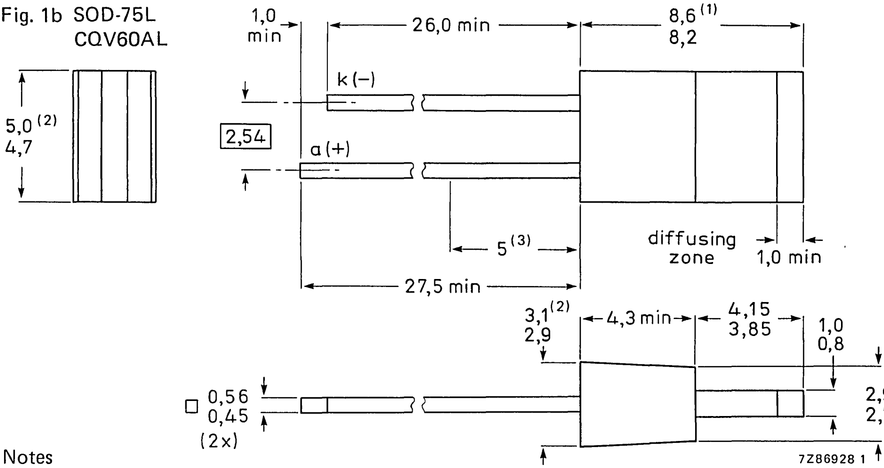


Fig. 1b SOD-75L
CQV60AL



Notes

1. Dimension measured when the device is seated in a gauge with 2 holes of 0,80 mm diameter 2,54 mm apart.
2. For the maximum value: including plastic burrs.
3. Solderability is not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5 V
Forward current			
d.c.	I_F	max.	100 mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_{on} = 20 μs; δ = 0,01	I_{FM}	max.	500 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	250 mW
Storage temperature	T_{stg}	−55 to +100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature at $t_{sld} < 7$ s > 1,5 mm from the seating plane for CQV60A > 5 mm from the plastic body for CQV60AL	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 10 mA	V_F	typ. max.	1,75 V 2,20 V
Reverse current V_R = 5 V	I_R	max.	100 μA

Beamwidth between half-intensity directions in the plane of the leads		$\alpha_{50\%}$	typ.	110 °
Bandwidth at half height		$B_{50\%}$	typ.	20 nm
Wavelength at peak emission I_F = 10 mA		λ_{pk}	typ.	650 nm
Luminous intensity I_F = 10 mA	CQV60A(L)	I_v	min.	1,0 mcd
	CQV60A(L)-III	I_v		1,6 to 3,5 mcd
	CQV60A(L)-IV	I_v		3,0 to 7,0 mcd
Diode capacitance V_R = 0; f = 1 MHz		C_d	typ.	60 pF

DEVELOPMENT SAMPLE DATA

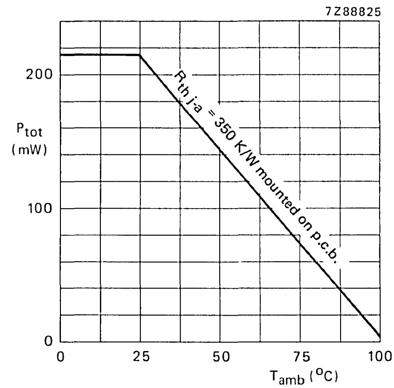


Fig. 2.

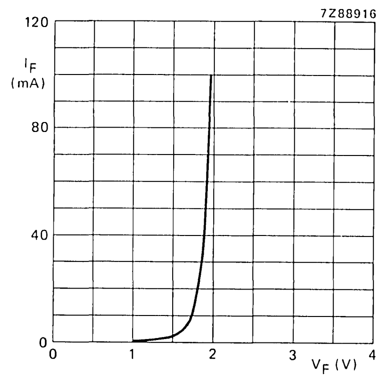


Fig. 3 T_{amb} = 25 °C; typ. values.

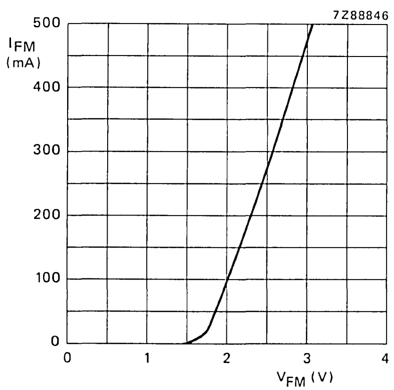


Fig. 4 t_{on} = 20 μs; δ = 0,01; T_{amb} = 25 °C; typ. values.

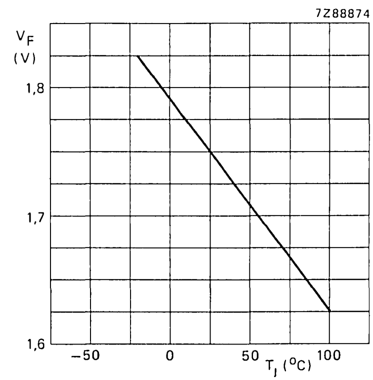


Fig. 5 I_F = 10 mA; typ. values.

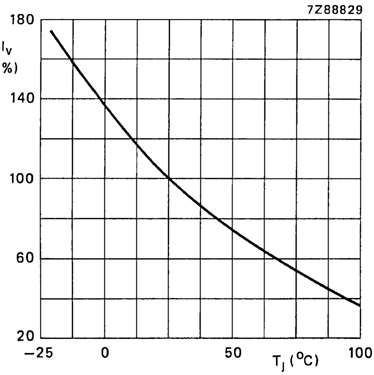


Fig. 6 Typical values.

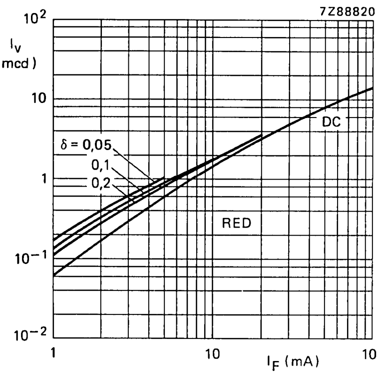


Fig. 7 t_p = 50 μs; typ. values.

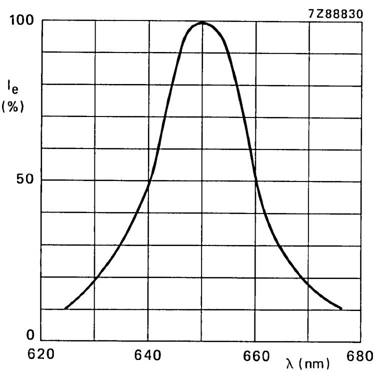


Fig. 8 I_F = 10 mA; T_{amb} = 25 °C; typ. values.

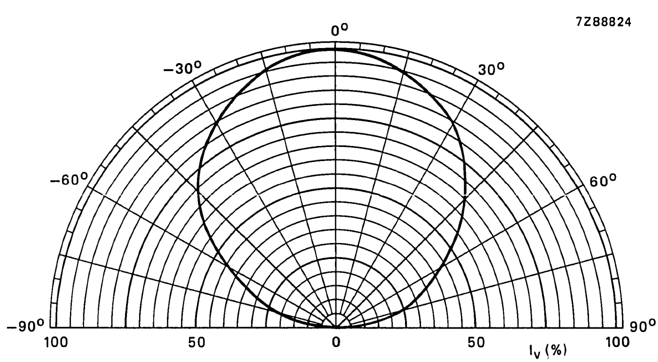


Fig. 9 Typical values.

LIGHT EMITTING DIODES

Rectangular light emitting diodes of 1 mm x 5 mm which emit super-green light (GaP) when forward biased.

The CQV61A and CQV61AL have a SOD-75 outline and are encapsulated in a medium-green coloured resin with a diffusing zone cast on the top. These LEDs, when stacked in the array RTC902, or in combination with other SOD-75 LEDs in the array RTC907, can be used e.g. as a level indicator.

The CQV61AL is equal to the CQV61A but has long leads and no seating plane.

QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.		5	V
Forward current (d.c.)		I_F	max.		60	mA
Total power dissipation up to T_{amb} = 35 °C		P_{tot}	max.		180	mW
Junction temperature		T_j	max.		100	°C
Luminous intensity						
I_F = 10 mA	CQV61A(L)	I_v	min.		0,5	mcd
	CQV61A(L)-II	I_v	1,0	to	2,2	mcd
	CQV61A(L)-III	I_v	1,6	to	3,5	mcd
Wavelength at peak emission I_F = 10 mA		λ_{pk}	typ.		565	nm
Beamwidth between half-intensity directions in the plane of the leads		$\alpha_{50\%}$	typ.		110	°

MECHANICAL DATA

Dimensions in mm

Fig. 1a SOD-75A1.
CQV61A

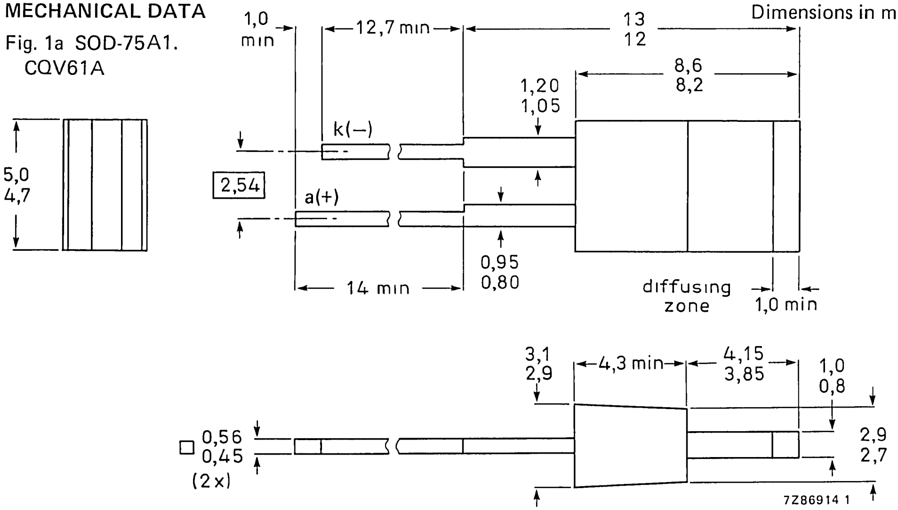
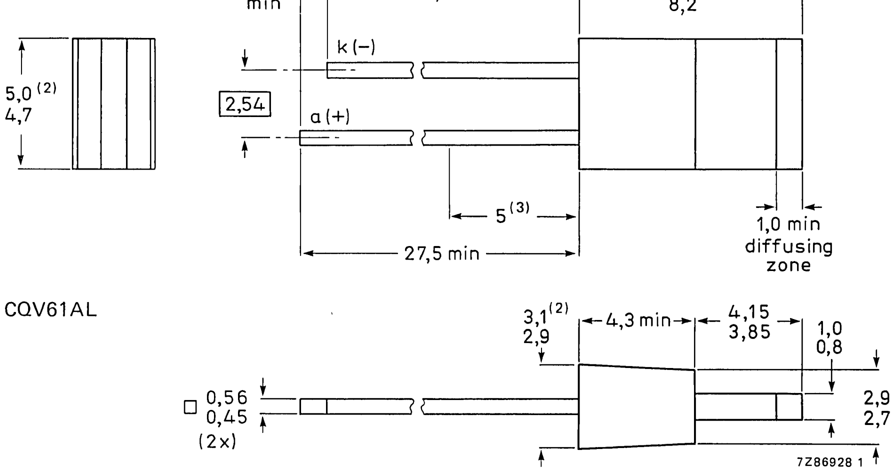


Fig. 1b SOD-75L.
CQV61AL



Notes

1. Measured when the device is seated in a gauge with 2 holes 0,80 mm diameter and 2,54 mm apart.
2. Maximum value including burrs.
3. Solderability not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5 V
Forward current			
d.c.	I_F	max.	60 mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_{on} = 1 ms; δ = 0,33		max.	150 mA
Total power dissipation up to T_{amb} = 35 °C	P_{tot}	max.	180 mW
Storage temperature	T_{stg}	−55 to +100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature at $t_{sld} < 7$ s			
> 1,5 mm from the seating plane for CQV61A	T_{sld}	max.	260 °C
> 5 mm from the plastic body for CQV61AL			

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage			
I_F = 10 mA	V_F	typ.	2,1 V
		max.	3,0 V

Reverse current $V_R = 5$ V		I_R	max.	100 μA
Beamwidth between half-intensity directions in the plane of the leads; $I_F = 10$ mA		$\alpha_{50\%}$	typ.	110 °
Bandwidth at half height		$B_{50\%}$	typ.	30 nm
Wavelength at peak emission $I_F = 10$ mA		λ_{pk}	typ.	565 nm
Luminous intensity $I_F = 10$ mA	CQV61A(L)	I_v	min.	0,5 mcd
	CQV61A(L)-II	I_v	1,0 to	2,2 mcd
	CQV61A(L)-III	I_v	1,6 to	3,5 mcd
Diode capacitance $V_R = 0$; f = 1 MHz		C_d	typ.	35 pF

DEVELOPMENT SAMPLE DATA

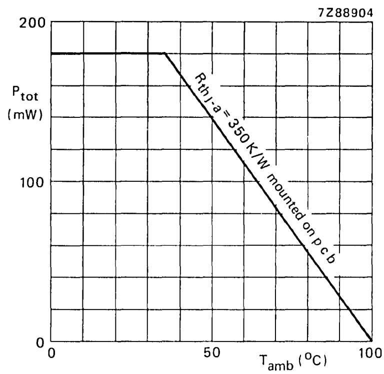


Fig. 2.

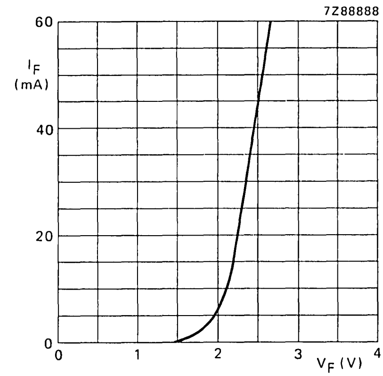


Fig. 3 T_{amb} = 25 °C; typical values.

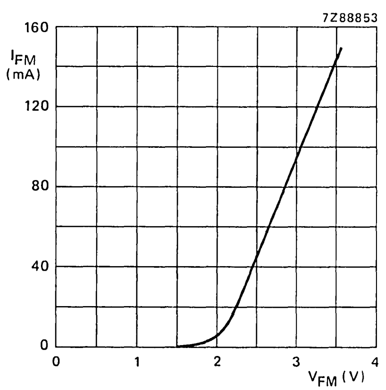


Fig. 4 t_{on} = 50 μs; δ = 0,01; T_{amb} = 25 °C; typical values.

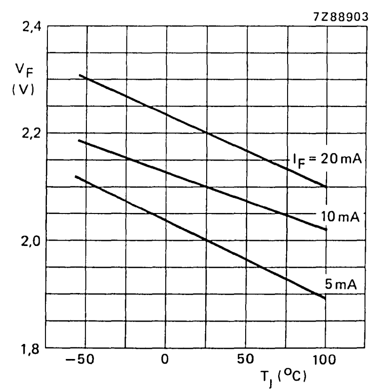


Fig. 5 Typical values.

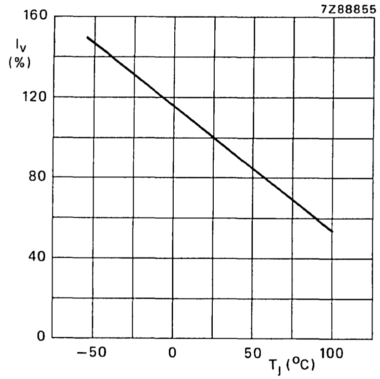


Fig. 6 Typical values.

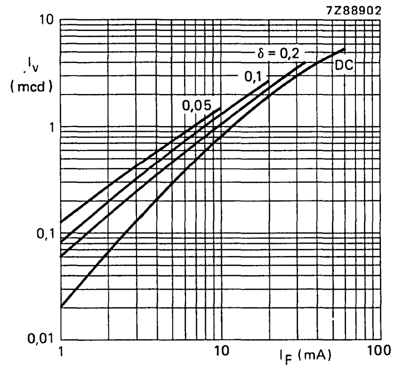


Fig. 7 t_p = 50 μs; typical values.

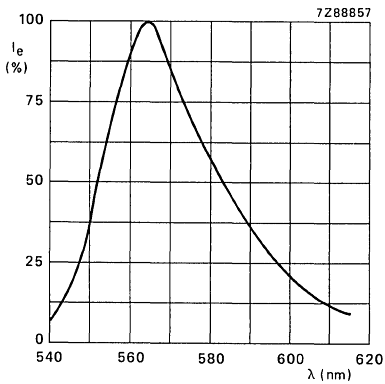


Fig. 8 I_F = 10 mA; typical values.

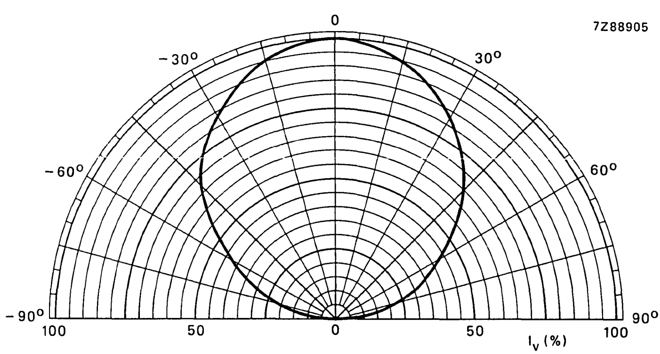


Fig. 9 Typical values.

LIGHT EMITTING DIODES

Rectangular light emitting diodes of 1 mm x 5 mm which emits yellow light (GaPAs) when forward biased.
The CQV62 and CQV62L have a SOD-75 outline and are encapsulated in a medium-yellow coloured resin with a diffusing zone cast on the top. When stacked in the array RTC903 or in combination with other SOD-75 LEDs in the array RTC907 these LEDs can be used, for instance, as a level indicator.
The CQV62L is equal to the CQV62 but has long leads and no seating plane.

QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5	V
Forward current (d.c.)		I_F	max.	30	mA
Total power dissipation up to T_{amb} = 65 °C		P_{tot}	max.	90	mW
Junction temperature		T_j	max.	100	°C
Luminous intensity					
I_F = 10 mA	CQV62(L)	I_V	min.	0,5	mcd
	CQV62-II(L)	I_V		1,0 to 2,2	mcd
	CQV62-III(L)	I_V		1,6 to 3,5	mcd
Wavelength at peak emission					
I_F = 10 mA		λ_{pk}	typ.	590	nm
Beamwidth between half-intensity directions in the plane of the leads		$\alpha_{50\%}$	typ.	110	°

MECHANICAL DATA

Dimensions in mm

Fig. 1a SOD-75A1.
CQV62

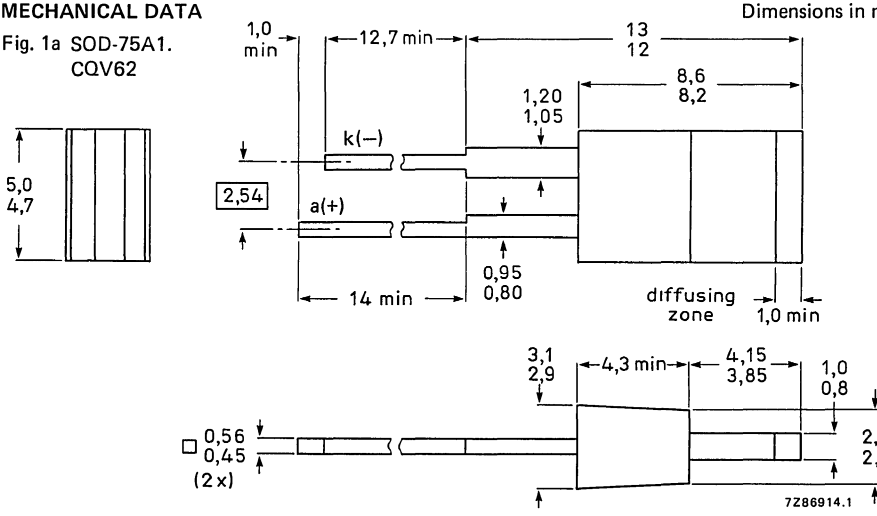
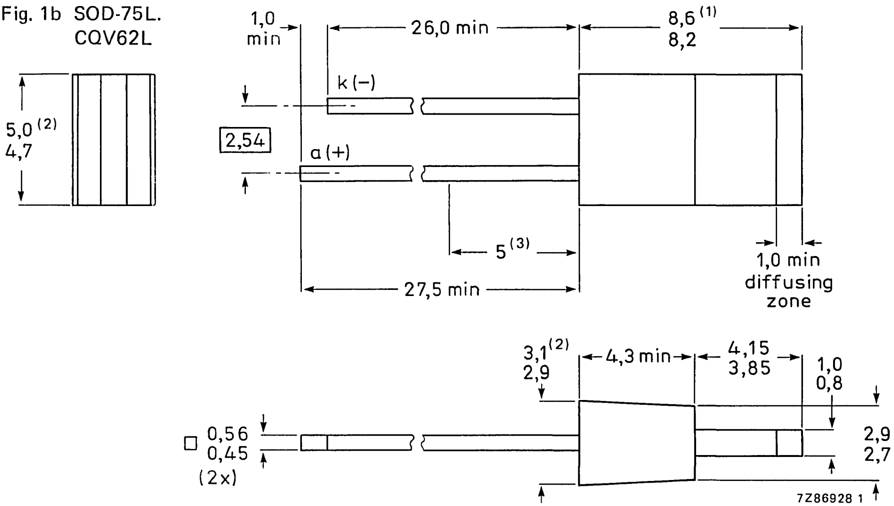


Fig. 1b SOD-75L.
CQV62L



Note 1: Dimension measured when the device is seated in a gauge with 2 holes of 0,80 mm diameter 2,54 mm apart.
Note 2: For the maximum value: including plastic burrs.
Note 3: Solderability is not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5 V
Forward current			
d.c.	I_F	max.	30 mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_p = 1 ms; δ = 0,33	I_{FM}	max.	60 mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	90 mW
Storage temperature	T_{stg}	−55 to + 100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature at t_{sld} < 7 s > 1,5 mm from the seating plane for CQV62 > 5 mm from the plastic body for CQV62L	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 10 mA	V_F	typ. max.	2,1 V 3,0 V

Reverse current $V_R = 5$ V		I_R	max.	100	μA
Beamwidth between half-intensity directions in the plane of the leads; $I_F = 10$ mA		$\alpha_{50\%}$	typ.	110	^{o}
Bandwidth at half height		$B_{50\%}$	typ.	40	nm
Wavelength at peak emission $I_F = 10$ mA		λ_{pk}	typ.	590	nm
Luminous intensity $I_F = 10$ mA	CQV62(L)	I_v	min.	0,5	mcd
	CQV62-II(L)	I_v		1,0 to 2,2	mcd
	CQV62-III(L)	I_v		1,6 to 3,5	mcd
Diode capacitance $V_R = 0$; f = 1 MHz		C_d	typ.	35	pF

DEVELOPMENT SAMPLE DATA

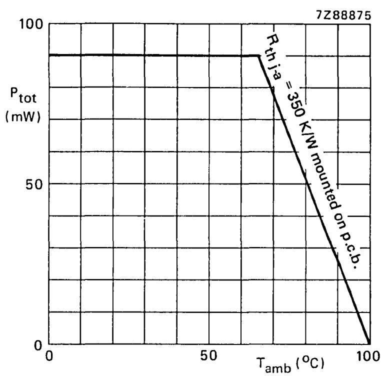


Fig. 2.

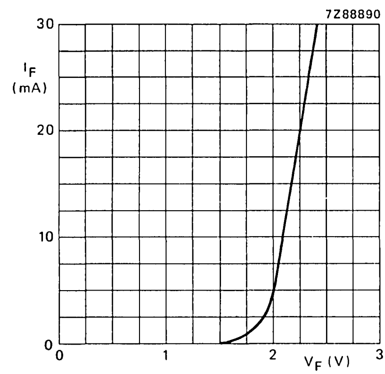


Fig. 3 $T_{amb} = 25$ ^oC; typical values.

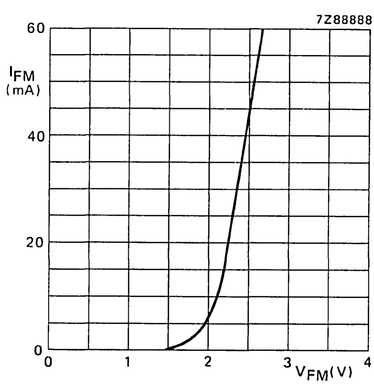


Fig. 4 $t_{on} = 50$ μs; $\delta = 0{,}01$; $T_{amb} = 25$ ^oC; typical values.

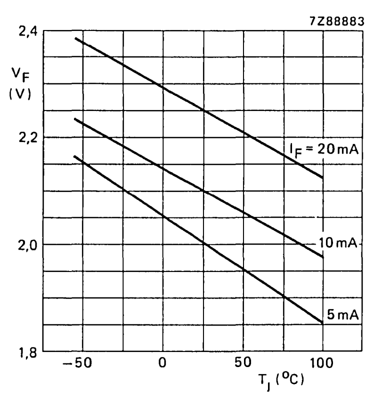


Fig. 5 Typical values.

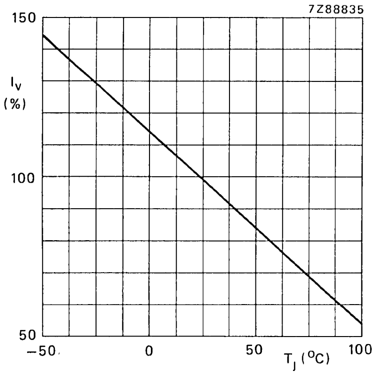


Fig. 6 I_F = 10 mA; typical values.

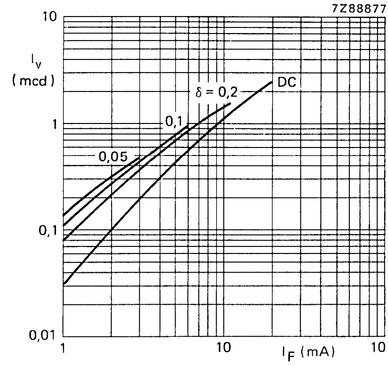


Fig. 7 t_p = 50 μs; typical values.

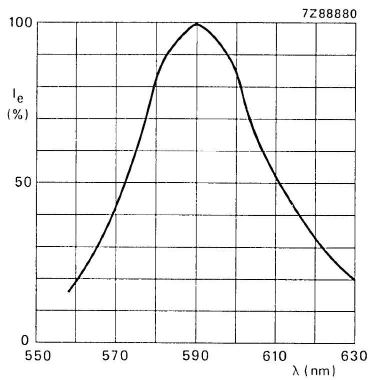


Fig. 8 Typical values.

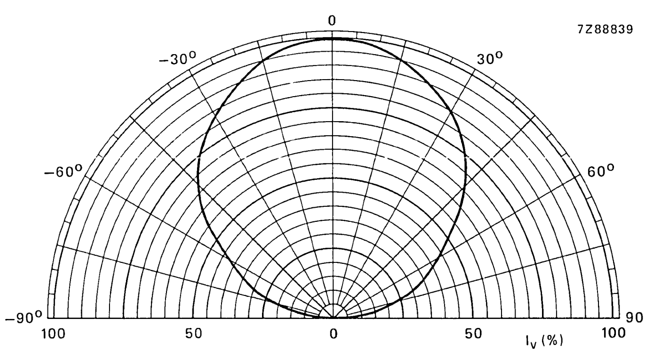


Fig. 9 Typical values.

LIGHT EMITTING DIODES

Rectangular light emitting diodes of 3 mm x 5 mm which emit super-red light (GaPAs) when forward biased. The CQV70 (and CQV70L) has a SOD-77 envelope and is encapsulated in a medium-red coloured resin with a diffusing zone cast on the top.

When stacked in an array these SOD-77 LEDs can be used e.g. as a level indicator. The CQV70L is similar to the CQV70 but has long leads and has no seating plane.

QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5	V
Forward current (d.c.)		I_F	max.	30	mA
Total power dissipation up to T_{amb} = 65 °C		P_{tot}	max.	90	mW
Junction temperature		T_j	max.	100	°C
Luminous intensity					
I_F = 10 mA	CQV70(L)	I_v	min.	0,5	mcd
	CQV70(L)-II	I_v	1,6 to	2,2	mcd
	CQV70(L)-III	I_v	1,6 to	3,5	mcd
Wavelength at peak emission					
I_F = 10 mA		λ_{pk}	typ.	630	nm
Beamwidth between half-intensity directions					
in the plane of the leads; I_F = 10 mA		$\alpha_{50\%}$	typ.	100	°

MECHANICAL DATA

Dimensions in mm

Fig. 1a SOD-77A1.
CQV70

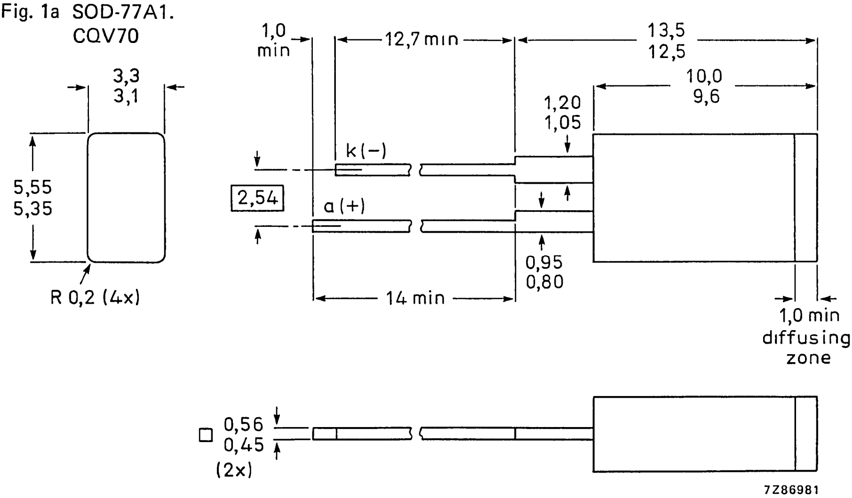
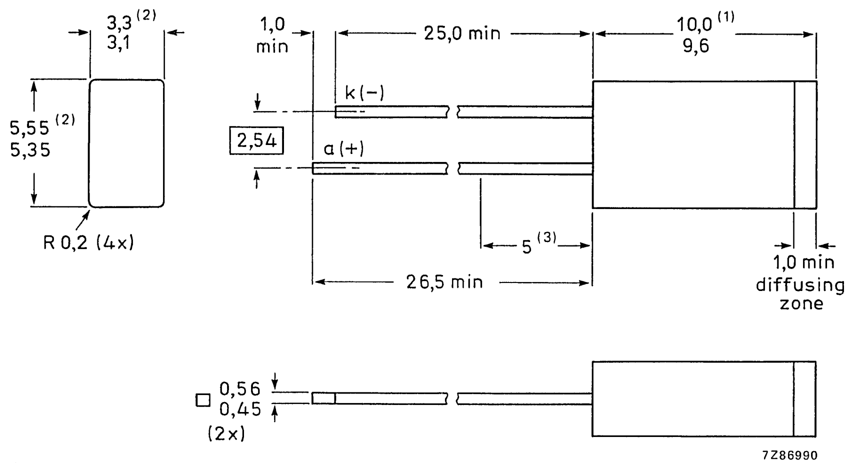


Fig. 1b SOD-77L.
CQV70L



Notes

1. Measured when the device is seated in a gauge with 2 holes 0,80 mm in diameter and 2,54 mm apart.
2. Maximum value including plastic burrs.
3. Solderability not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5 V
Forward current			
d.c.	I_F	max.	30 mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_{on} = 1 ms; δ = 0,33	I_{FM}	max.	60 mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	90 mW
Storage temperature	T_{stg}	−55 to + 100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature at t_{sld} < 7 s			
> 1,5 mm from the seating plane for CQV70	T_{sld}	max.	260 °C
> 5 mm from the plastic body for CQV70L	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage			
I_F = 10 mA	V_F	typ.	2,1 V
		max.	3,0 V

Reverse current $V_R = 5$ V		I_R	max.		100 μA
Beamwidth between half-intensity directions in the plane of the leads; $I_F = 10$ mA		$\alpha_{50\%}$	typ.		100 °
Bandwidth at half height		$B_{50\%}$	typ.		30 nm
Wavelength at peak emission $I_F = 10$ mA		λ_{pk}	typ.		630 nm
Luminous intensity $I_F = 10$ mA	CQV70(L)	I_v	min.		0,5 mCd
	CQV70(L)-II	I_v	1,0	to	2,2 mCd
	CQV70(L)-III	I_v	1,6	to	3,5 mCd
Diode capacitance $V_R = 0$; f = 1 MHz		C_d	typ.		35 pF

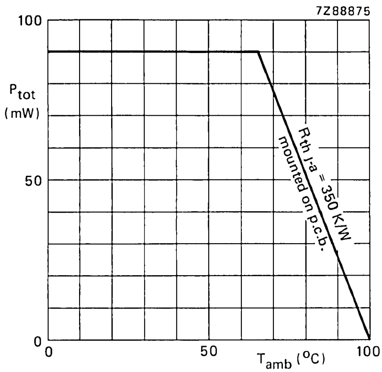


Fig. 2.

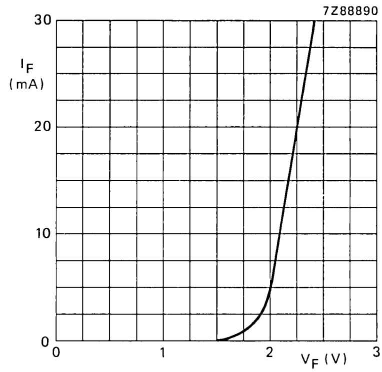


Fig. 3 T_{amb} = 25 °C; typical values.

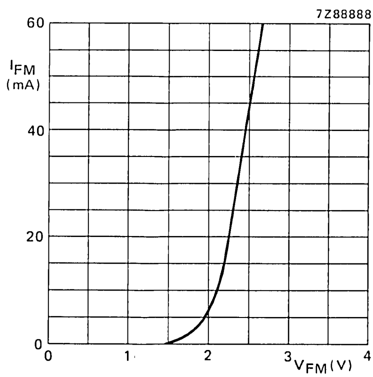


Fig. 4 t_{on} = 50 μs; δ = 0,01; T_{amb} = 25 °C; typical values.

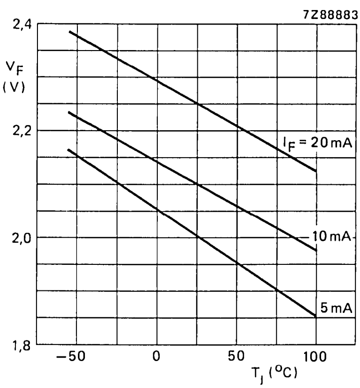


Fig. 5 Typical values.

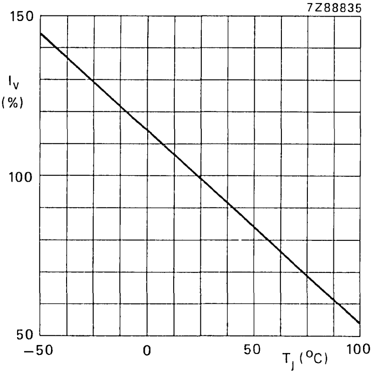


Fig. 6 I_F = 10 mA; typical values.

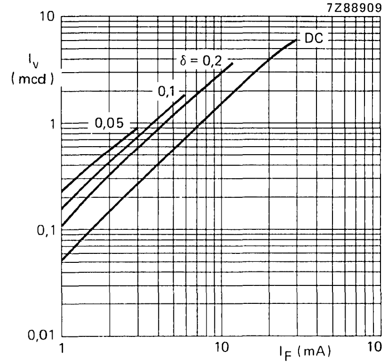


Fig. 7 t_p = 50 μs; typical values.

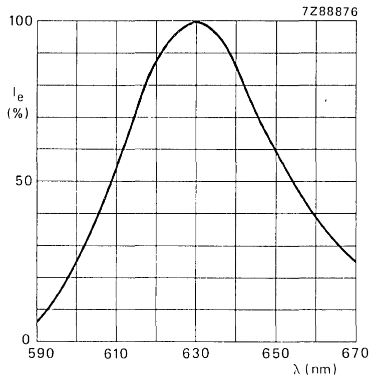


Fig. 8 I_F = 10 mA; T_{amb} = 25 °C; typical values.

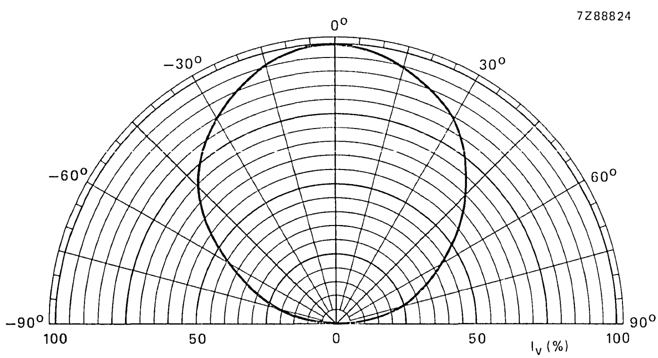


Fig. 9 Typical values.

LIGHT EMITTING DIODES

Rectangular light emitting diode of 3 mm x 5 mm which emits hyper-red light (GaAlAs) when forward biased. The CQV70A has a SOD-77 envelope and is encapsulated in a medium-red coloured resin with a diffusing zone cast on the top. Because of its high luminous intensity the CQV70A is very suitable in applications where only low currents are available and because of its high I_{Fmax} it can be used in high I_V applications.

These SOD-77 LEDs when stacked in an array can be used e.g. as a level indicator. The CQV70 AL is similar to the CQV70A but has long leads and has no seating plane.

QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.		5	V
Forward current (d.c.)		I_F	max.		100	mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.		215	mW
Junction temperature		T_j	max.		100	°C
Luminous intensity						
I_F = 10 mA	CQV70A(L)	I_V	min.		1,0	mcd
	CQV70A(L)-III	I_V	1,6	to	3,5	mcd
	CQV70A(L)-IV	I_V	3,0	to	7,0	mcd
Wavelength at peak emission						
I_F = 10 mA		λ_{pk}	typ.		650	nm
Beamwidth between half-intensity directions in the plane of the leads; I_F = 10 mA		$\alpha_{50\%}$	typ.		100	°

MECHANICAL DATA

Dimensions in mm

Fig. 1a SOD-77A2.
CQV70A

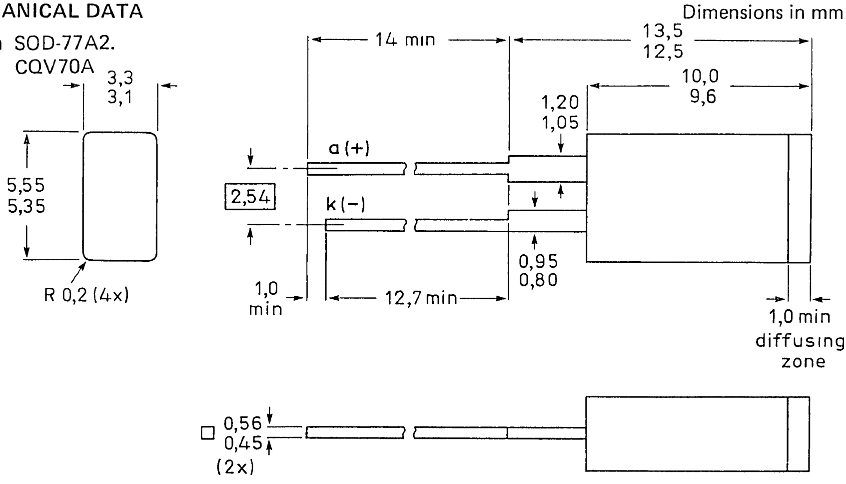
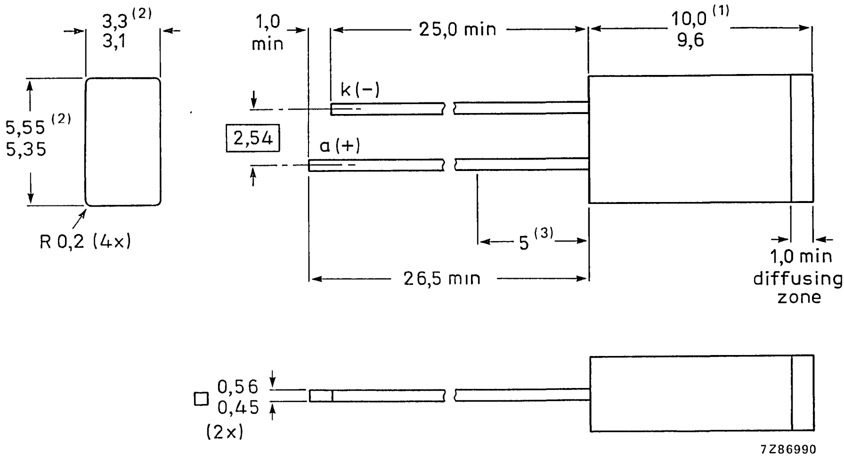


Fig. 1b SOT-77L.
CQV70AL



Notes

1. Measured when the device is seated in a gauge with 2 holes of 0,80 mm diameter and 2,54 mm apart.
2. Maximum value including plastic burrs.
3. Solderability not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5 V
Forward current			
d.c.	I_F	max.	100 mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_{on} = 20 μs; δ = 0,01	I_{FM}	max.	500 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	215 mW
Storage temperature	T_{stg}		−55 to +100 °C
Junction temperature	T_j	max.	100 °C
Lead soldering temperature at t_{sld} < 7 s > 1,5 mm from the seating plane for CQV70A > 5 mm from the plastic body for CQV70AL	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 10 mA	V_f	typ.	1,75 V
		max.	2,2 V

Reverse current					
V_R = 5 V		I_R	max.		100 μA
Beamwidth between half-intensity directions					
I_F = 10 mA		$\alpha_{50\%}$	typ.		100 °
Bandwidth at half height		$B_{50\%}$	typ.		20 nm
Wavelength at peak emission					
I_F = 10 mA		λ_{pk}	typ.		650 nm
Luminous intensity					
I_F = 10 mA	CQV70A(L)	I_v	min.		1,0 mcd
	CQV70A(L)-III	I_v	1,6	to	3,5 mcd
	CQV70A(L)-IV	I_v	3,0	to	7,0 mcd
Diode capacitance					
V_R = 0; f = 1 MHz		C_d	typ.		60 pF

DEVELOPMENT SAMPLE DATA

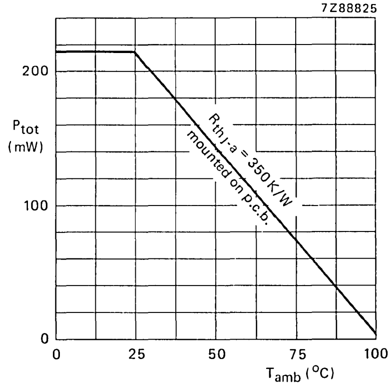


Fig. 2.

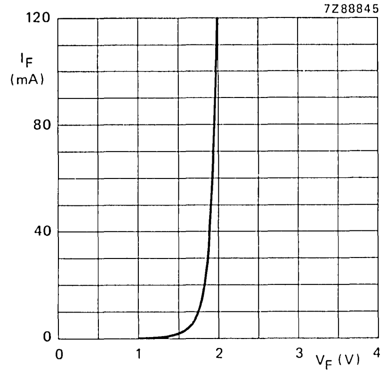


Fig. 3 T_{amb} = 25 °C; typ. values.

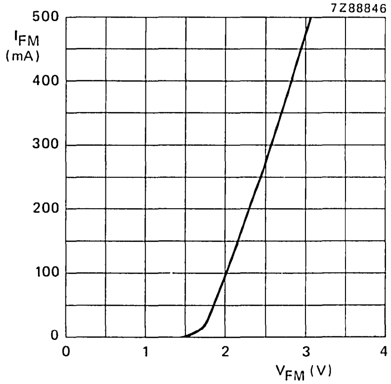


Fig. 4 t_{on} = 20 μs; δ = 0,01; typ. values.

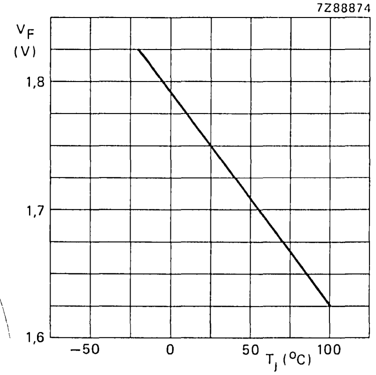


Fig. 5 I_F = 10 mA; typ. values.

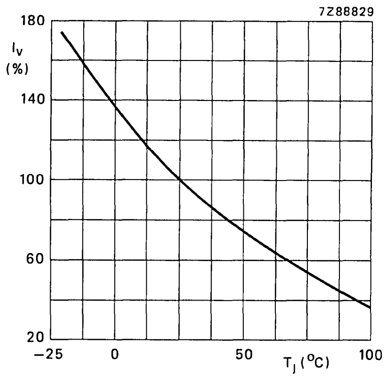


Fig. 6 Typical values.

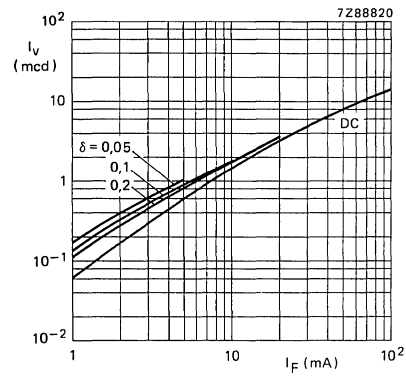


Fig. 7 t_p = 50 μs; typ. values.

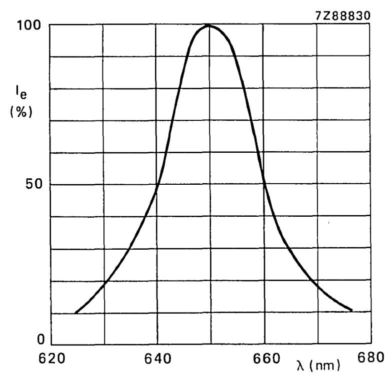


Fig. 8 I_F = 10 mA; T_{amb} = 25 °C; typ. values.

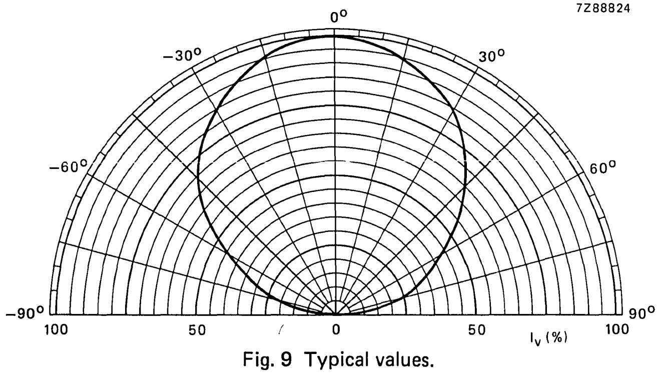


Fig. 9 Typical values.

LIGHT EMITTING DIODES

Rectangular light emitting diodes of 3 mm x 5 mm which emit super-green light when forward biased. The CQV71A(L) has a SOD-77 envelope and is encapsulated in a medium-green coloured resin with a diffusing zone cast on the top.

When stacked in an array these LEDs with other SOD-77 LEDs can be used e.g. as a level indicator.

The CQV71AL is similar to the CQV71A but has long leads and has no seating plane.

QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.			5	V
Forward current (d.c.)		I_F	max.			60	mA
Total power dissipation up to T_{amb} = 35 °C		P_{tot}	max.			180	mW
Junction temperature		T_j	max.			100	°C
Luminous intensity							
I_F = 10 mA	CQV71A(L)	I_V	min.			0,5	mcd
	CQV71A(L)-II	I_V		1,0	to	2,2	mcd
	CQV71A(L)-III	I_V		1,6	to	3,5	mcd
	CQV71A(L)-IV	I_V		3	to	7	mcd
Wavelength at peak emission							
I_F = 10 mA		λ_{pk}	typ.			565	nm
Beamwidth between half-intensity directions							
in the plane of the leads; I_F = 10 mA		$\alpha_{50\%}$	typ.			100	°

MECHANICAL DATA

Dimensions in mm

Fig. 1a SOD-77A1.
CQV71A

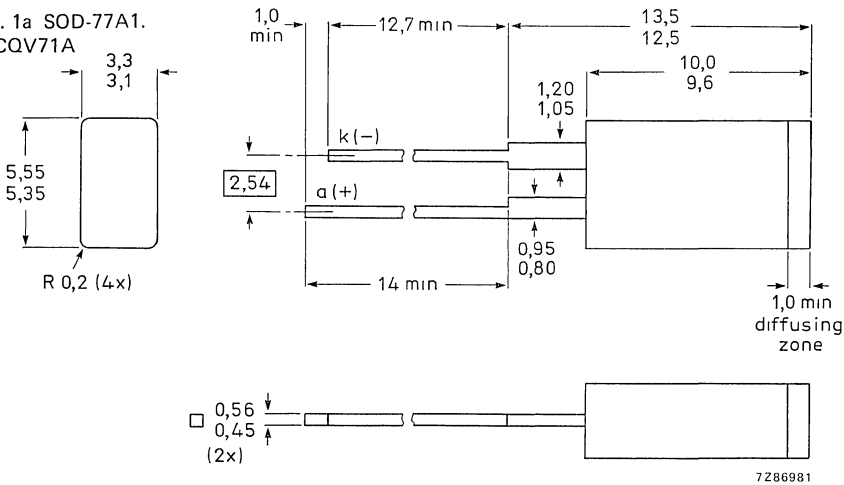
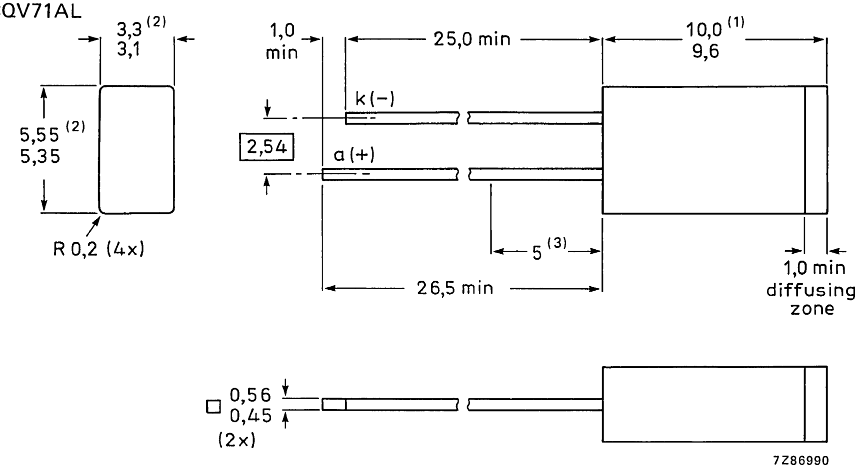


Fig. 1b SOD-77L.
CQV71AL



Notes

1. Measured when the device is seated in a gauge with 2 holes 0,80 mm diameter and 2,54 mm apart.
2. Maximum value including burrs.
3. Solderability not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5 V
Forward current			
d.c.	I_F	max.	60 mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_{on} = 1 ms; δ = 0,01	I_{FM}	max.	150 mA
Total power dissipation up to T_{amb} = 35 °C	P_{tot}	max.	180 mW
Storage temperature	T_{stg}	−55 to +100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature at $t_{sld} < 7$ s; > 1,5 mm from the seating plane for CQV71A; > 5 mm from the plastic body for CQV71AL	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 10 mA	V_F	typ.	2,1 V
		max.	3,0 V

Reverse current $V_R = 5$ V		I_R	max.	100 μA
Beamwidth between half-intensity directions in the plane of the leads; $I_F = 10$ mA		$\alpha_{50\%}$	typ.	100 °
Bandwidth at half height		$B_{50\%}$	typ.	30 nm
Wavelength at peak emission $I_F = 10$ mA		λ_{pk}	typ.	565 nm
Luminous intensity $I_F = 10$ mA	CQV71A(L)	I_v	min.	0,5 mcd
	CQV71A(L)-II	I_v	1,0 to	2,2 mcd
	CQV71A(L)-III	I_v	1,6 to	3,5 mcd
	CQV71A(L)-IV	I_v	3 to	7 mcd
Diode capacitance $V_R = 0$; f = 1 MHz		C_d	typ.	35 pF

DEVELOPMENT SAMPLE DATA

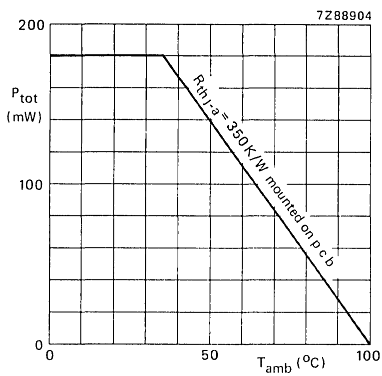


Fig. 2.

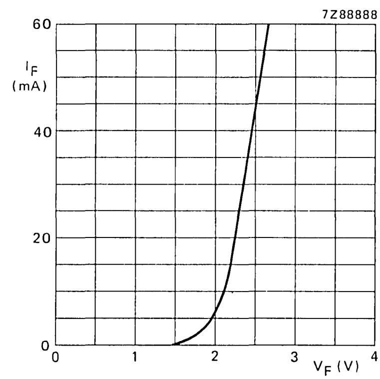


Fig. 3 $T_{amb} = 25$ °C; typical values.

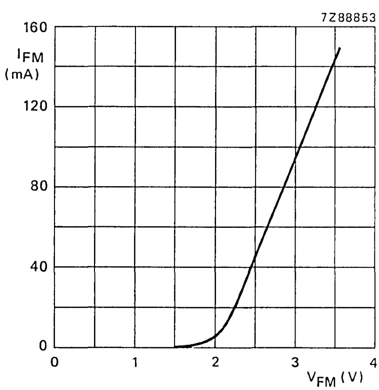


Fig. 4 $t_{on} = 1$ ms; $\delta = 0{,}01$; $T_j = 25$ °C; typical values.

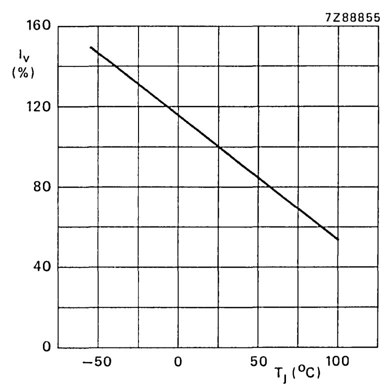


Fig. 5 Typical values.

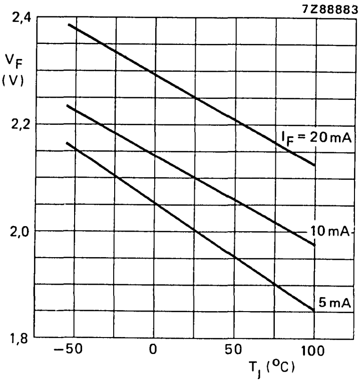


Fig. 6 I_F = 10 mA; typical values.

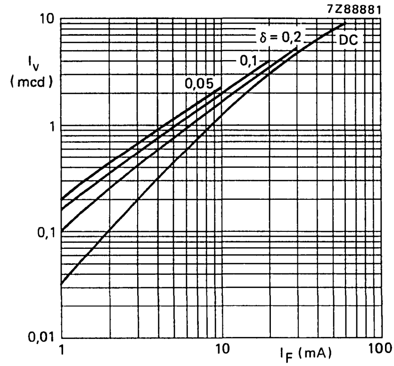


Fig. 7 t_p = 50 μs; typical values.

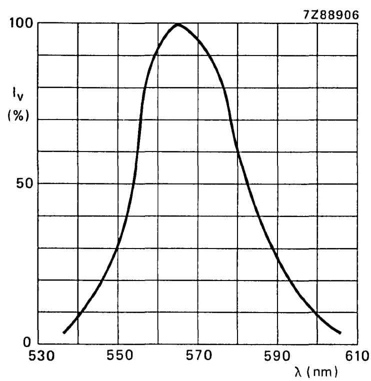


Fig. 8 Typical values.

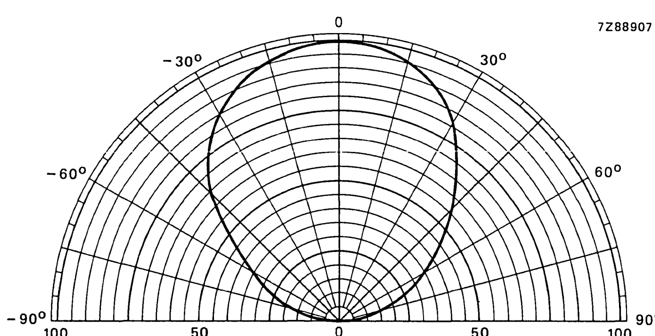


Fig. 9 Typical values.

LIGHT EMITTING DIODES

Rectangular light emitting diodes of 3 mm x 5 mm which emit yellow light when forward biased. The CQV72 (and CQV72L) has a SOD-77 envelope and is encapsulated in a medium-yellow coloured resin with a diffusing zone cast on the top.

When stacked in an array these SOD-77 LEDs can be used e.g. as a level indicator. The CQV72L is similar to the CQV72 but has long leads and has no seating plane.

QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5	V
Forward current (d.c.)		I_F	max.	30	mA
Total power dissipation up to T_{amb} = 65 °C		P_{tot}	max.	90	mW
Junction temperature		T_j	max.	100	°C
Luminous intensity					
I_F = 10 mA	CQV72(L)	I_v	min.	0,5	mcd
	CQV72(L)-II	I_v	1,0 to	2,2	mcd
	CQV72(L)-III	I_v	1,6 to	3,5	mcd
Wavelength at peak emission					
I_F = 10 mA		λ_{pk}	typ.	590	nm
Beamwidth between half-intensity directions in the plane of the leads; I_F = 10 mA		$\alpha_{50\%}$	typ.	100	°

MECHANICAL DATA

Dimensions in mm

Fig. 1a SOD-77A1.
CQV72

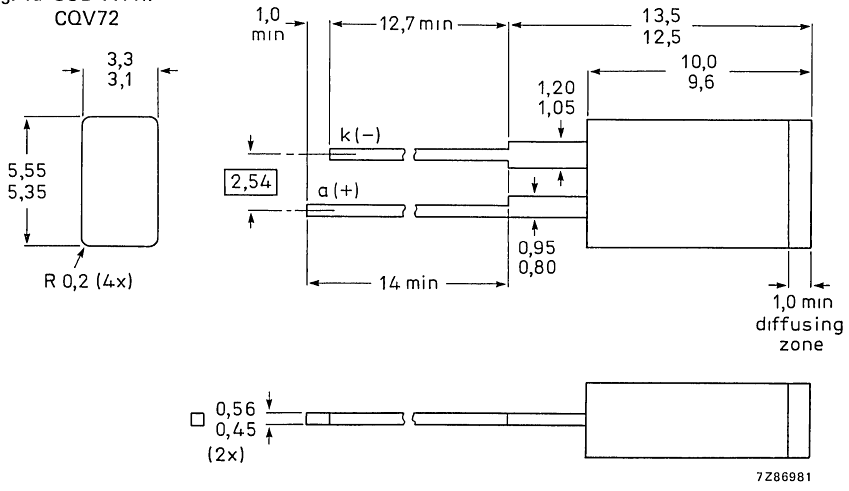
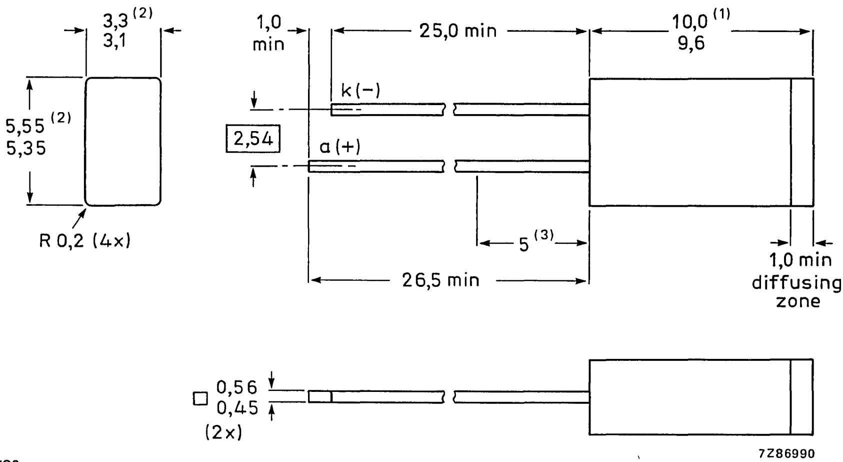


Fig. 1b SOD-77L.
CQV72L



Notes

1. Measured when the device is seated in a gauge with 2 holes 0,80 mm in diameter and 2,54 mm apart.
2. Maximum value including plastic burrs.
3. Solderability not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5	V
Forward current				
d.c.	I_F	max.	30	mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1	A
peak value; t_{on} = 1 ms; δ = 0,33	I_{FM}	max.	60	mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	90	mW
Storage temperature	T_{stg}	−55 to	+100	°C
Junction temperature	T_j	max.	100	°C
Lead soldering temperature at t_{sld} < 7 s > 1,5 mm from the seating plane for CQV72 > 5 mm from the plastic body for CQV72L	T_{sld}	max.	260	°C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage				
I_F = 10 mA	V_F	typ.	2,1	V
		max.	3,0	V

Reverse current $V_R = 5$ V		I_R	max.	100	μA
Beamwidth between half-intensity directions in the plane of the leads; $I_F = 10$ mA		$\alpha_{50\%}$	typ.	100	^{o}
Bandwidth at half height		$B_{50\%}$	typ.	30	nm
Wavelength at peak emission $I_F = 10$ mA		λ_{pk}	typ.	590	nm
Luminous intensity $I_F = 10$ mA	CQV72(L)	I_v	min.	0,5	mCd
	CQV72(L)-II	I_v	1,0 to	2,2	mCd
	CQV72(L)-III	I_v	1,6 to	3,5	mCd
Diode capacitance $V_R = 0$; f = 1 MHz		C_d	typ.	35	pF

DEVELOPMENT SAMPLE DATA

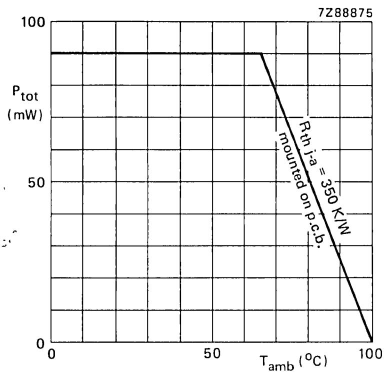


Fig. 2.

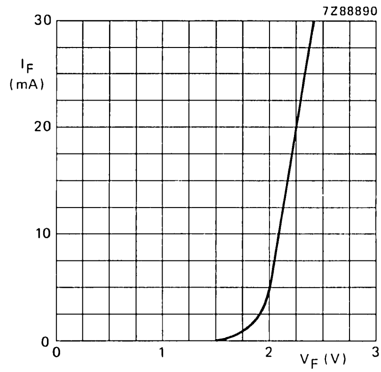


Fig. 3 $T_{amb} = 25$ ^{o}C; typ. values.

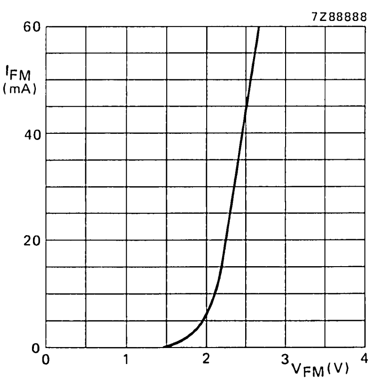


Fig. 4 $t_{on} = 50$ μs; $\delta = 0{,}01$; $T_{amb} = 25$ ^{o}C; typ. values.

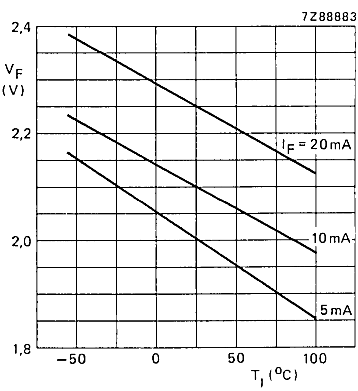


Fig. 5 Typical values.

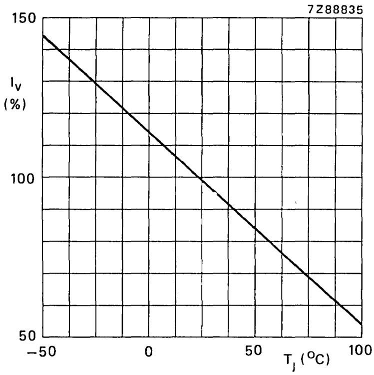


Fig. 6 I_F = 10 mA; typ. values.

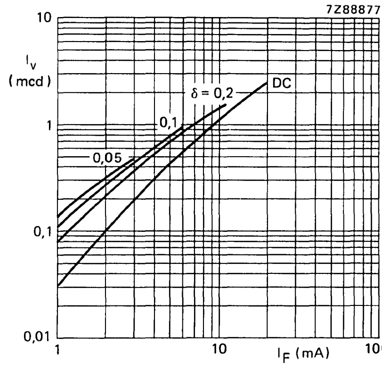


Fig. 7 t_p = 50 μs; typ. values.

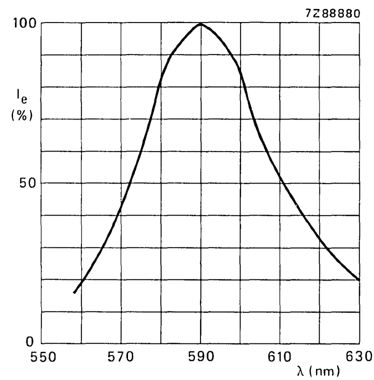


Fig. 8 Typical values.

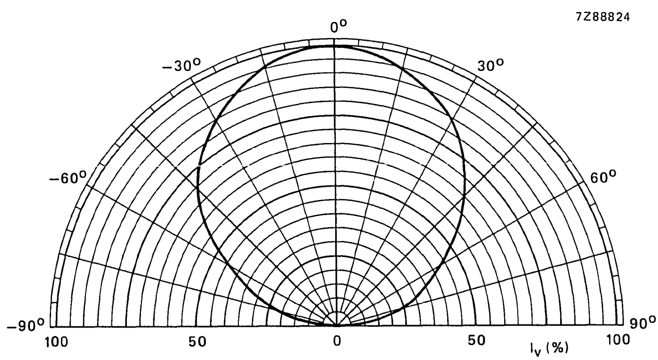


Fig. 9 Typical values.

LIGHT EMITTING DIODE

Rectangular light emitting diode of 5 mm x 5 mm which emits super-red light when forward biased. The CQV80L has a SOD-74L envelope and is encapsulated in a transparent resin with a medium-red coloured diffusing zone cast on the top.
These SOD-74 LEDs are very suitable for surface illumination, for example in information boards, score boards, moving advertisement and electronic game applications.
The CQV80L has long leads and has no seating plane.

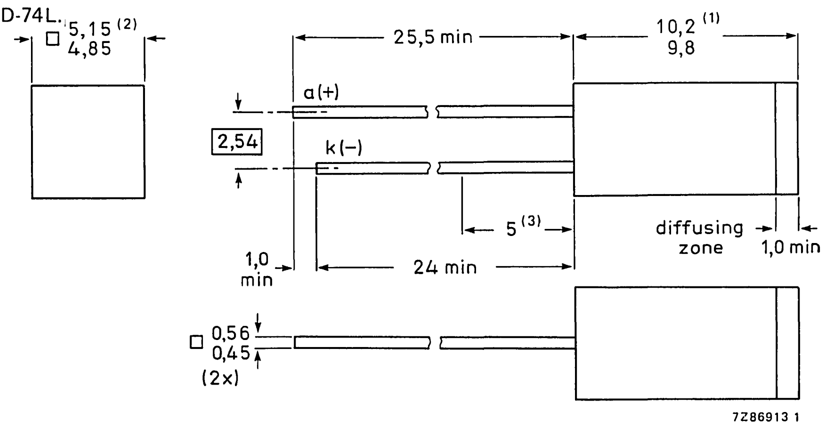
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5	V
Forward current (d.c.)		I_F	max.	30	mA
Total power dissipation up to T_{amb} = 65 °C		P_{tot}	max.	90	mW
Junction temperature		T_j	max.	100	°C
Luminous intensity					
I_F = 10 mA	CQV80L	I_v	min.	0,5	mcd
	CQV80L-II	I_v	1,0 to	2,2	mcd
	CQV80L-III	I_v	1,6 to	3,5	mcd
Wavelength at peak emission					
I_F = 10 mA		λ_{pk}	typ.	630	nm
Beamwidth between half-intensity directions					
I_F = 10 mA		$\alpha_{50\%}$	typ.	100	°

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-74L.



Notes

1. Measured when the device is seated in a gauge with 2 holes 0,80 mm in diameter and 2,54 mm apart.
2. Maximum value including plastic burrs.
3. Solderability not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5 V
Forward current			
d.c.	I_F	max.	30 mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_{on} = 1 ms; δ = 0,33	I_{FM}	max.	60 mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	90 mW
Storage temperature	T_{stg}	−55 to +100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature > 5,0 mm from the plastic body; t_{std} < 7 s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 10 mA		V_F	typ.	2,1 V
		V_F	max.	3,0 V
Reverse current V_R = 5 V		I_R	max.	100 μA
Beamwidth between half-intensity directions I_F = 10 mA		$\alpha_{50\%}$	typ.	100 °
Bandwidth at half height		$B_{50\%}$	typ.	45 nm
Wavelength at peak emission I_F = 10 mA		λ_{pk}	typ.	630 nm
Luminous intensity I_F = 10 mA	CQV80L	I_v	min.	0,5 mcd
	CQV80L-II	I_v	1,0 to	2,2 mcd
	CQV80L-III	I_v	1,6 to	3,5 mcd
Diode capacitance V_R = 0; f = 1 MHz		C_d	typ.	35 pF

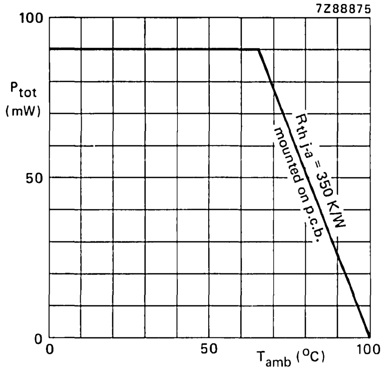


Fig. 2.

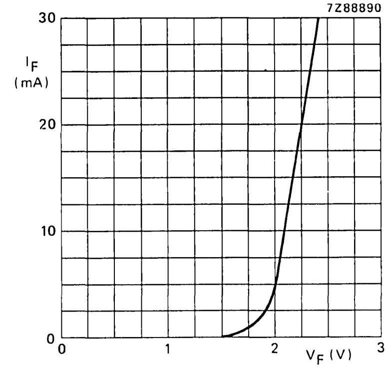


Fig. 3 T_{amb} = 25 °C; typ. values.

DEVELOPMENT SAMPLE DATA

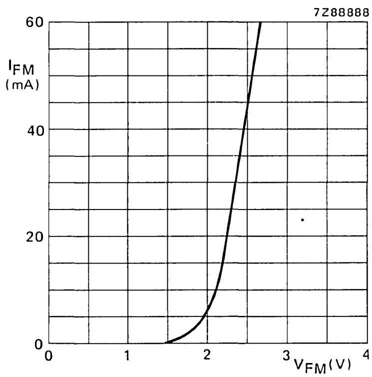


Fig. 4 t_{on} = 50 μs; δ = 0,01; T_{amb} = 25 °C; typ. values.

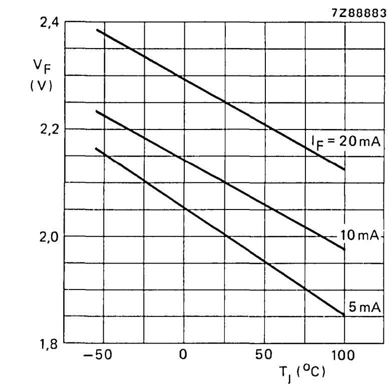


Fig. 5 Typical values.

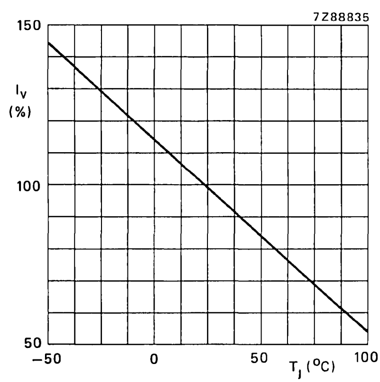


Fig. 6 I_F = 10 mA; typ. values.

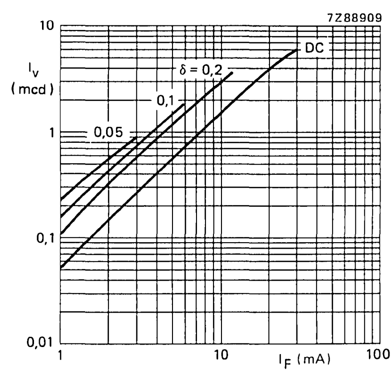


Fig. 7 t_p = 50 μs; typ. values.

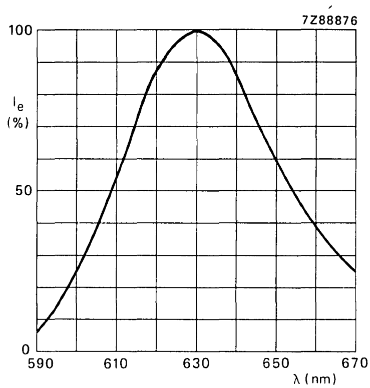


Fig. 8 Typical values.

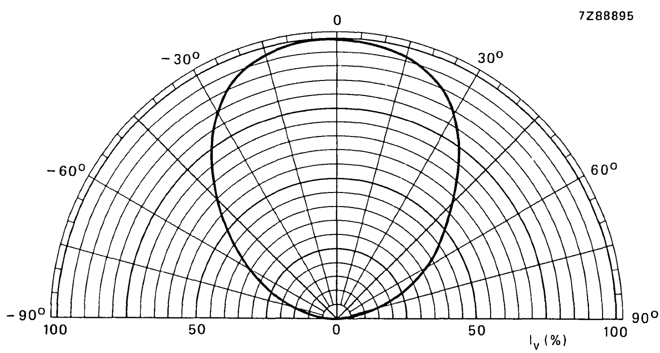


Fig. 9 Typical values.

LIGHT EMITTING DIODE

Rectangular light emitting diode of 5 mm x 5 mm which emits hyper-red light (GaAlAs) when forward biased. The CQV80AL has a SOD-74L envelope and is encapsulated in a transparent resin with a medium-red coloured diffusing zone cast on the top. The CQV80AL has long leads but has no seating plane.

This LED is very suitable for surface illumination, for example in information boards, score boards, moving advertisements and electronic games applications. Because of its high light intensity the CQV80AL is also very suitable in applications where only very low currents are available and because of its high I_{Fmax} it can be used in high I_v applications.

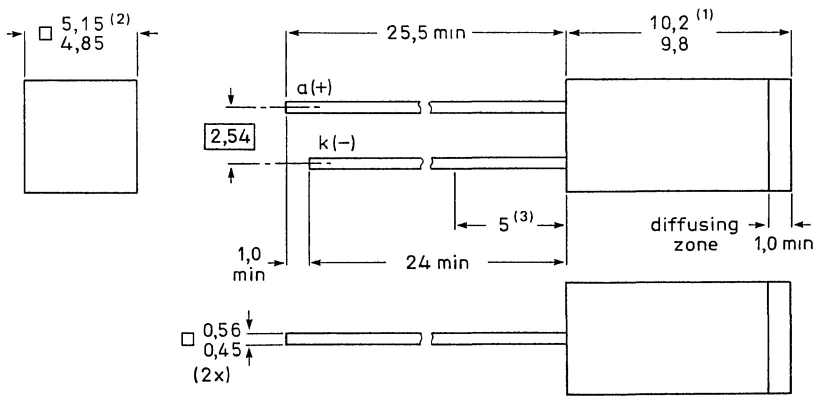
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5	V
Forward current (d.c.)		I_F	max.	100	mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	215	mW
Junction temperature		T_j	max.	100	°C
Luminous intensity					
I_F = 10 mA	CQV80AL	I_v	min.	1,0	mcd
	CQV80AL-III	I_v	1,6 to	3,5	mcd
	CQV80AL-IV	I_v	3,0 to	7,0	mcd
Wavelength at peak emission					
I_F = 10 mA		λ_{pk}	typ.	650	nm
Beamwidth between half-intensity directions					
I_F = 10 mA		$\alpha_{50\%}$	typ.	100	°

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-74L.



Notes

1. Measured when the device is seated in a gauge with 2 holes 0,80 mm diameter and 2,54 mm apart.
2. Maximum value including plastic burrs.
3. Solderability not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5 V
Forward current			
d.c.	I_F	max.	100 mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_{on} = 20 μs; δ = 0,01	I_{FM}	max.	500 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	215 mW
Storage temperature	T_{stg}	−55 to +100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature			
> 5,0 mm from the plastic body; t_{sld} < 7 s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage				
I_F = 10 mA		V_F	typ.	1,75 V
			max.	2,2 V
Reverse current				
V_R = 5 V		I_R	max.	100 μA
Beamwidth between half-intensity directions				
I_F = 10 mA		$\alpha_{50\%}$	typ.	100 °
Bandwidth at half height		$B_{50\%}$	typ.	20 nm
Wavelength at peak emission				
I_F = 10 mA		λ_{pk}	typ.	650 nm
Luminous intensity				
I_F = 10 mA	CQV80AL	I_V	min.	1,0 mcd
	CQV80AL-III	I_V	1,6 to	3,5 mcd
	CQV80AL-IV	I_V	3,0 to	7,0 mcd
Diode capacitance				
V_R = 0; f = 1 MHz		C_d	typ.	60 pF

DEVELOPMENT SAMPLE DATA

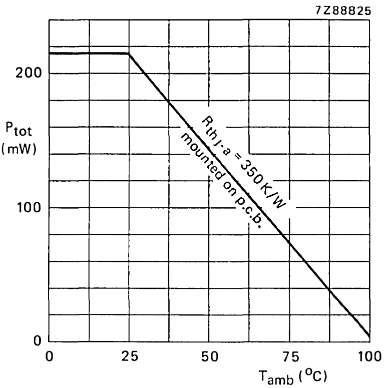


Fig. 2.

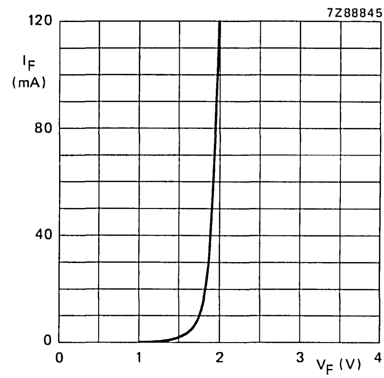


Fig. 3 T_{amb} = 25 °C; typ. values.

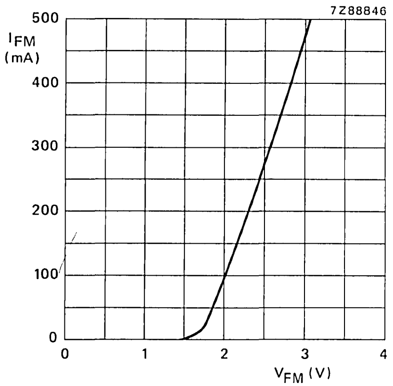


Fig. 4 t_{on} = 20 μs; δ = 0,01;
T_{amb} = 25 °C; typ. values.

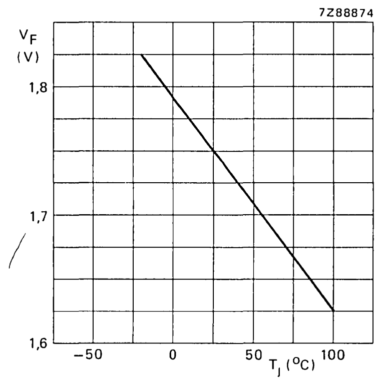


Fig. 5 I_F = 10 mA; typ. values.

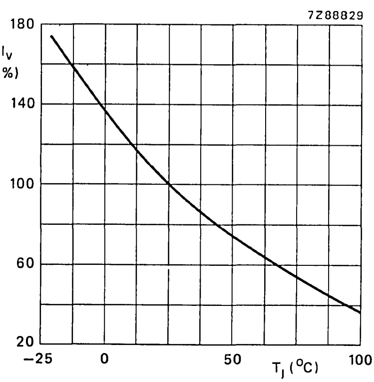


Fig. 6 Typical values.

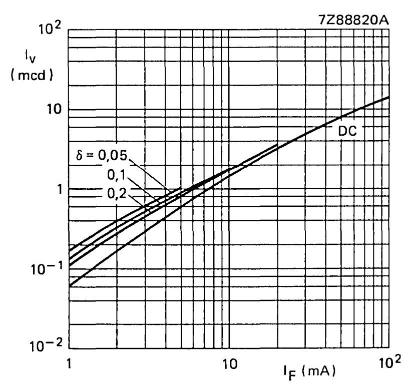


Fig. 7 t_p = = 50 μs; typ. values.

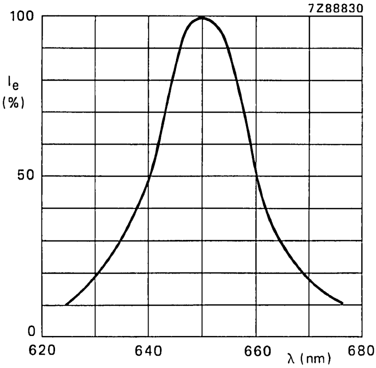


Fig. 8 I_F = 10 mA; T_{amb} = 25 °C; typ. values.

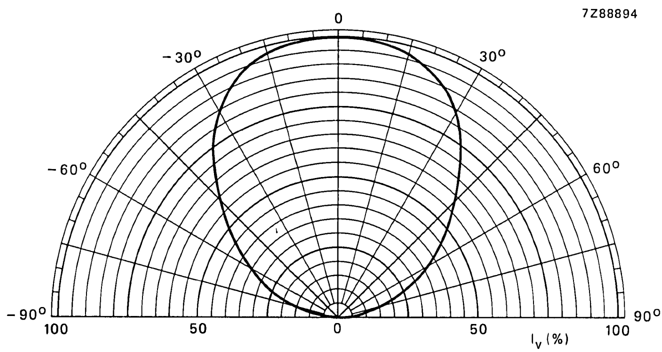


Fig. 9 Typical values.

LIGHT EMITTING DIODE

Rectangular light emitting diode of 5 mm x 5 mm which emits super-green light (GaP) when forward biased. The CQV81L has a SOD-74L envelope and is encapsulated in a transparent resin with a medium-green coloured diffusing zone cast on the top. This LED has long leads and no seating plane.

These SOD-74 LEDs are very suitable for surface illumination, for example in information boards, score boards, moving advertisement and electronic game applications.

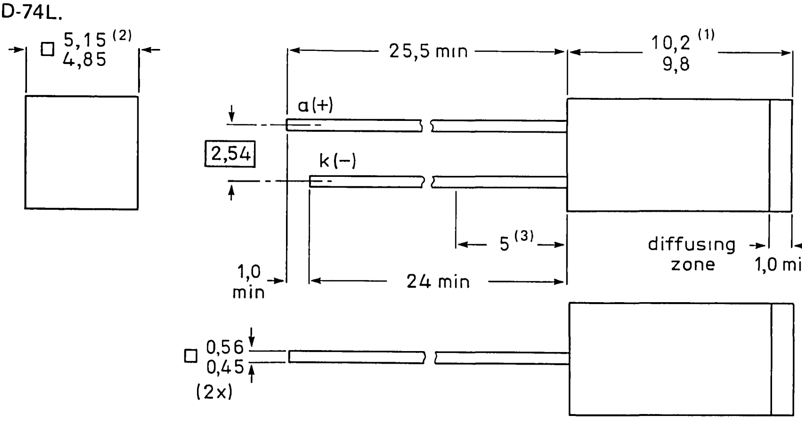
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5	V
Forward current (d.c.)		I_F	max.	60	mA
Total power dissipation up to T_{amb} = 35 °C		P_{tot}	max.	180	mW
Junction temperature		T_j	max.	100	°C
Luminous intensity					
I_F = 10 mA	CQV81L	I_V	min.	0,5	mcd
	CQV81L-II	I_V	1,0 to	2,2	mcd
	CQV81L-III	I_V	1,6 to	3,5	mcd
Wavelength at peak emission					
I_F = 10 mA		λ_{pk}	typ.	565	nm
Beamwidth between half-intensity directions					
I_F = 10 mA		$\alpha_{50\%}$	typ.	100	°

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-74L.



Notes

1. Measured when the device is seated in a gauge with 2 holes 0,80 mm diameter 2,54 mm apart.
2. Maximum value including plastic burrs.
3. Solderability not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5 V
Forward current			
d.c.	I_F	max.	60 mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_{on} = 1 ms; δ = 0,33	I_{FM}	max.	150 mA
Total power dissipation up to T_{amb} = 35 °C	P_{tot}	max.	180 mW
Storage temperature	T_{stg}	−55 to +100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature > 5,0 mm from the plastic body; t_{sld} < 7 s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage				
I_F = 10 mA		V_F	typ.	2,1 V
		V_F	max.	3,0 V
Reverse current				
V_R = 5 V		I_R	max.	100 μA
Beamwidth between half-intensity directions				
I_F = 10 mA		$\alpha_{50\%}$	typ.	100 °
Bandwidth at half height		$B_{50\%}$	typ.	30 nm
Wavelength at peak emission				
I_F = 10 mA		λ_{pk}	typ.	565 nm
Luminous intensity				
I_F = 10 mA	CQV81L	I_v	min.	0,5 mcd
	CQV81L-II	I_v	1,0 to	2,2 mcd
	CQV81L-III	I_v	1,6 to	3,5 mcd
Diode capacitance				
V_R = 0; f = 1 MHz		C_d	typ.	35 pF

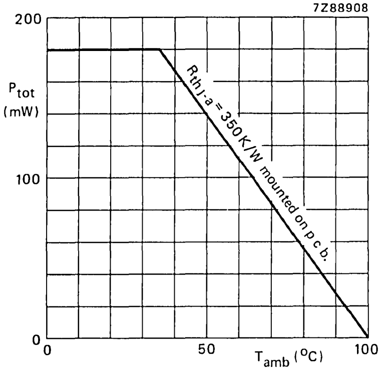


Fig. 2.

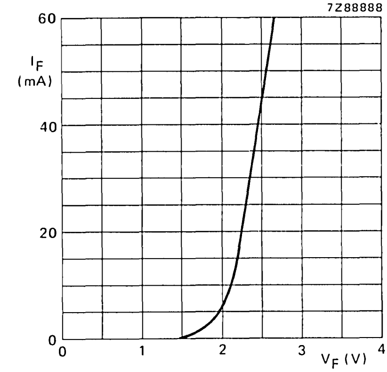


Fig. 3 T_{amb} = 25 °C; typical values.

DEVELOPMENT SAMPLE DATA

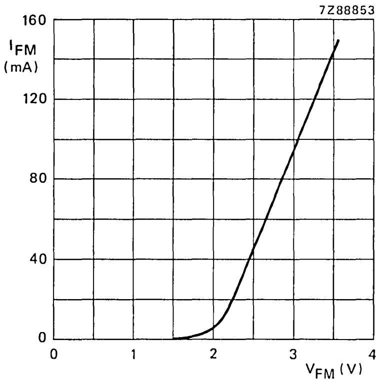


Fig. 4 t_{on} = 50 μs; δ = 0,01;
T_{amb} = 25 °C; typical values.

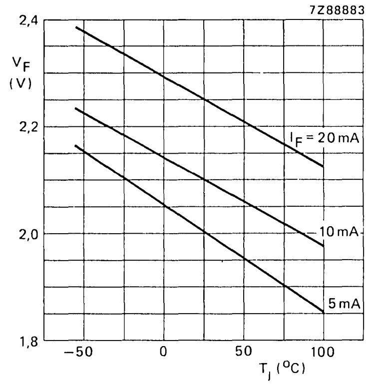


Fig. 5 Typical values.

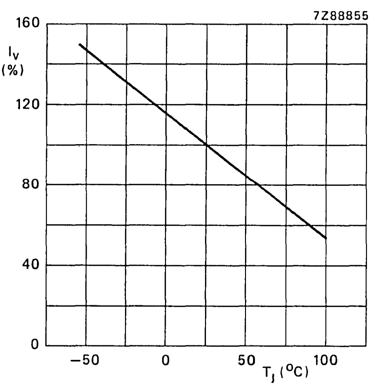


Fig. 6 I_F = 10 mA; typical values.

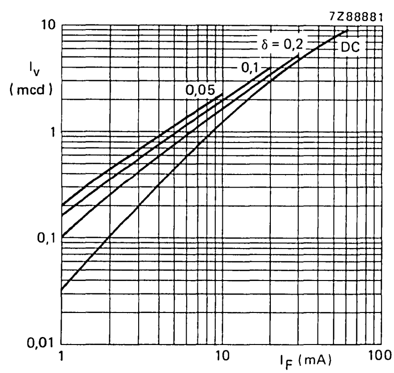


Fig. 7 t_p = 50 μs; typical values.

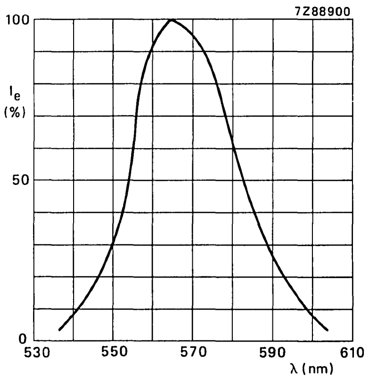


Fig. 8 Typical values.

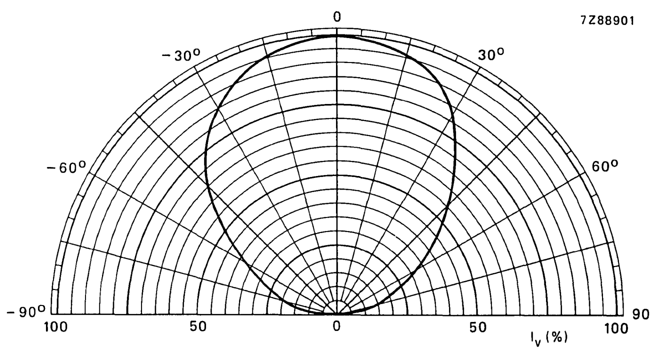


Fig. 9 Typical values.

LIGHT EMITTING DIODE

Rectangular light emitting diode of 5 mm x 5 mm which emits yellow light (GaPAs) when forward biased. The CQV82L has a SOD-74L envelope and is encapsulated in a transparent resin with a medium-yellow coloured diffusing zone cast on the top. These SOD-74 LEDs are very suitable for surface illumination, for example in information boards, score boards, moving advertisement and electronic game applications.

The CQV82L has long leads and has no seating plane.

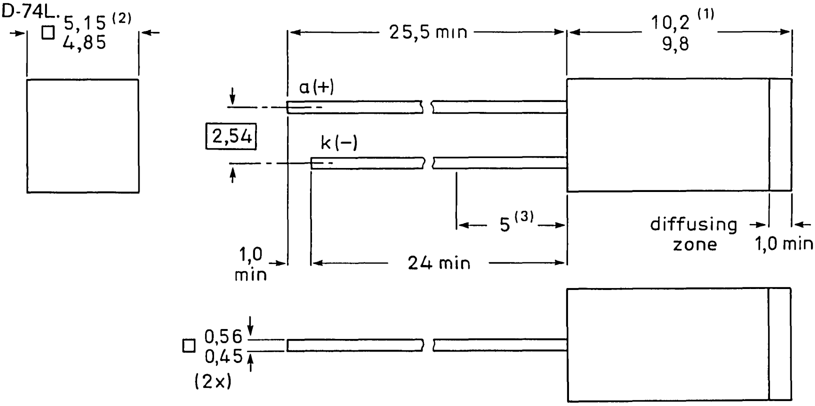
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5	V
Forward current (d.c.)		I_F	max.	30	mA
Total power dissipation up to T_{amb} = 65 °C		P_{tot}	max.	90	mW
Junction temperature		T_j	max.	100	°C
Luminous intensity					
I_F = 10 mA	CQV82L	I_V	min.	0,5	mcd
	CQV82L-II	I_V	1,0 to	2,2	mcd
	CQV82L-III	I_V	1,6 to	3,5	mcd
Wavelength at peak emission					
I_F = 10 mA		λ_{pk}	typ.	590	nm
Beamwidth between half-intensity directions					
I_F = 10 mA		$\alpha_{50\%}$	typ.	100	°

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-74L.



Notes

1. Measured when the device is seated in a gauge with 2 holes 0,80 mm diameter and 2,54 mm apart.
2. Maximum value including plastic burrs.
3. Solderability not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5	V
Forward current				
d.c.	I_F	max.	30	mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1	A
peak value; t_{on} = 1 ms; δ = 0,33	I_{FM}	max.	60	mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	90	mW
Storage temperature	T_{stg}	−55 to +100		°C
Junction temperature	T_j	max.	100	°C
Lead soldering temperature $>$ 5,0 mm from the plastic body; $t_{sld} < 7$ s	T_{sld}	max.	260	°C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage		V_F	typ.		2,1	V
		V_F	max.		3,0	V
Reverse current V_R = 5 V		I_R	max.		100	μA
Beamwidth between half-intensity directions I_F = 10 mA		$\alpha_{50\%}$	typ.		100	°
Bandwidth at half height		$B_{50\%}$	typ.		40	nm
Wavelength at peak emission I_F = 10 mA		λ_{pk}	typ.		590	nm
Luminous intensity I_F = 10 mA	CQV82L	I_v	min.		0,5	mcd
	CQV82L-II	I_v	1,0	to	2,2	mcd
	CQV82L-III	I_v	1,6	to	3,5	mcd
Diode capacitance V_R = 0; f = 1 MHz		C_d	typ.		35	pF

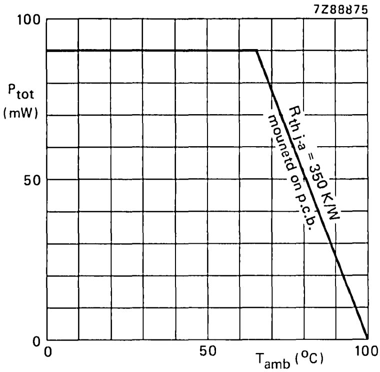


Fig. 2.

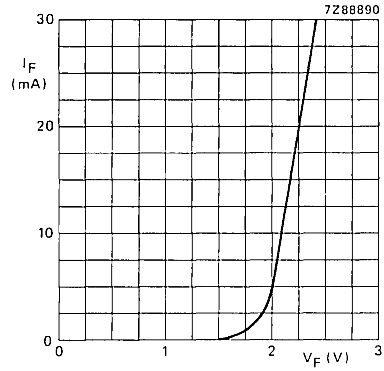


Fig. 3 Typical values.

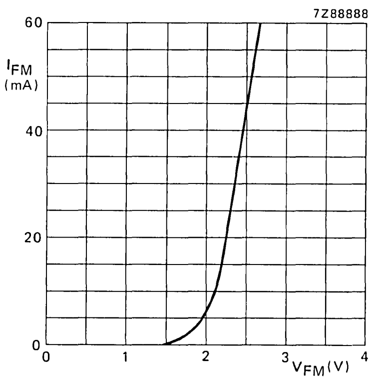


Fig. 4 t_{on} = 50 μs; δ = 0,01; T_{amb} = 25 °C; typ. values.

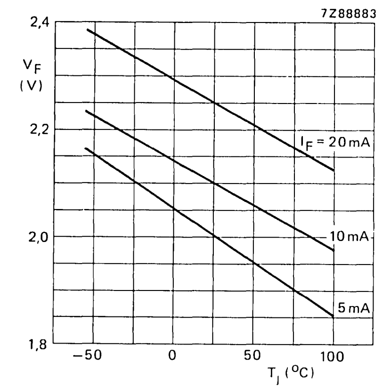


Fig. 5 Typical values.

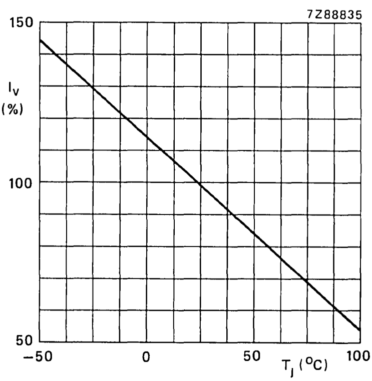


Fig. 6 I_F = 10 mA; typ. values.

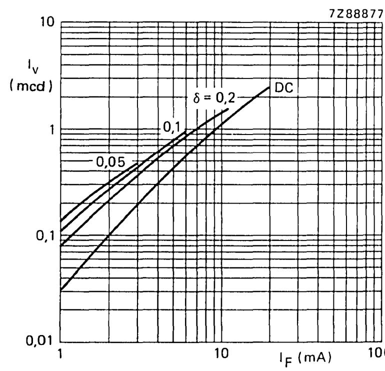


Fig. 7 t_p = 50 μs; typ. values.

DEVELOPMENT SAMPLE DATA

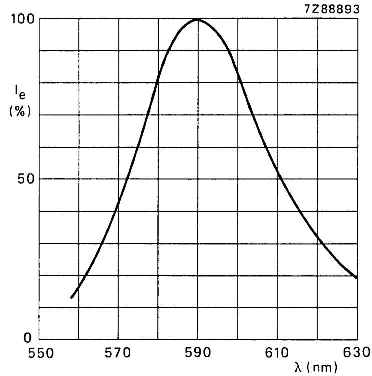


Fig. 8 Typical values.

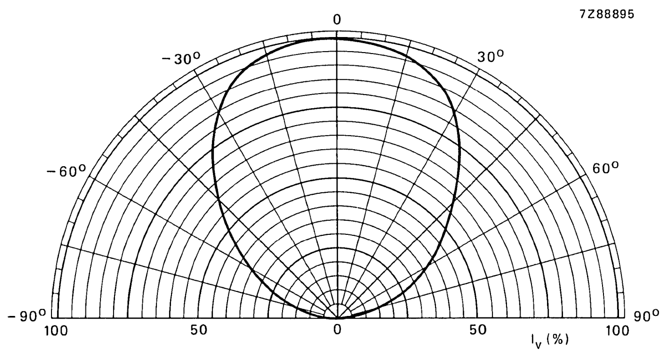


Fig. 9 Typical values.

LIGHT EMITTING DIODES

The CQW10 and CQW10B are 2,5 mm x 5 mm rectangular light emitting diodes which emit super-red light (GaPAs) when forward biased.

These LEDs have a SOD-76 envelope and are encapsulated in a medium-red resin (CQW10 and CQW10L) and a dark-red coloured resin for the CQW10B and CQW10BL. An extra diffusing zone has been cast on the top, with a stronger diffusor for the B-types.

The CQW10L and CQW10BL (SOD-76L envelope) have no seating plane but have long leads and are in all other respects similar to the CQW10 and CQW10B.

When stacked in an array these SOD-76 LEDs can be used, for example, as level indicators.

QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5	V
Forward current (d.c.)		I_F	max.	30	mA
Total power dissipation up to T_{amb} = 65 °C		P_{tot}	max.	90	mW
Junction temperature		T_j	max.	100	°C
Luminous intensity					
I_F = 10 mA	CQW10(L)/CQW10B(L)	I_V	min.	0,5	mCd
	CQW10(L)/CQW10B(L)-II	I_V	1,0 to	2,2	mCd
	CQW10(L)/CQW10B(L)-III	I_V	1,6 to	3,5	mCd
Wavelength at peak emission					
I_F = 10 mA		λ_{pk}	typ.	630	nm
Beamwidth between half-intensity directions					
I_F = 10 mA		$\alpha_{50\%}$	typ.	100	°

MECHANICAL DATA

Dimensions in mm

Fig. 1a SOD-76A.
CQW10
CQW10B

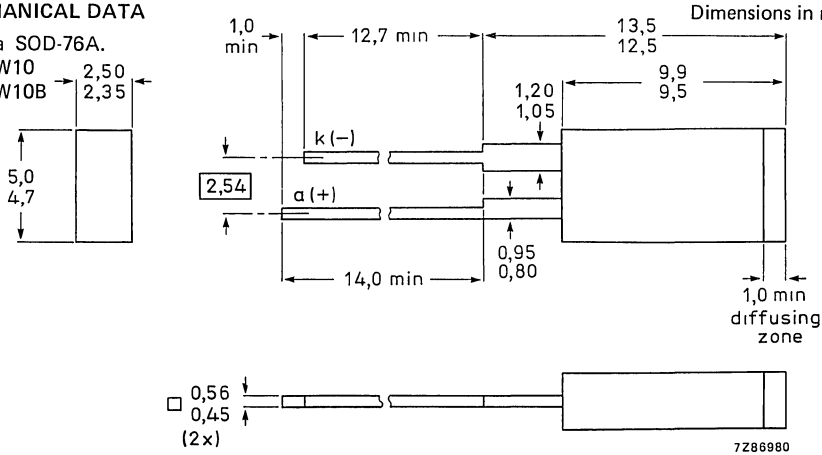
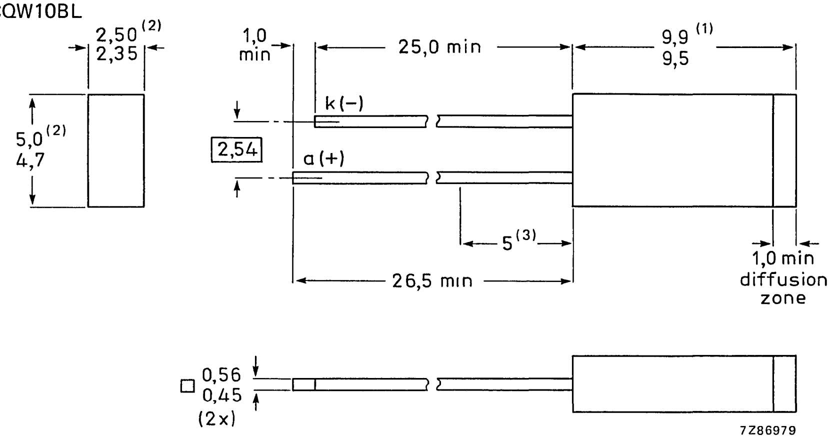


Fig. 1b SOD-76L.
CQW10L
CQW10BL



Notes

1. Measured when the device is seated in a gauge with 2 holes 0,80 mm diameter and 2,54 mm apart.
2. Maximum value including burrs.
3. Solderability not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	5 V
Forward current			
d.c.	I_F	max.	30 mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_{on} = 1 ms; δ = 0,33	I_{FM}	max.	60 mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	90 mW
Storage temperature	T_{stg}	−55 to +100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature; $t_{sld} < 7$ s > 1,5 mm from the seating plane for CQW10/10B > 5 mm from the plastic body for CQW10L/10BL	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 10 mA	V_F	typ. max.	2,1 V 3,0 V

Reverse current					
V_R = 5 V		I_R	max.		100 μA
Beamwidth between half-intensity directions					
I_F = 10 mA		$\alpha_{50\%}$	typ.		100 °
Bandwidth at half height		$B_{50\%}$	typ.		45 nm
Wavelength at peak emission					
I_F = 10 mA		λ_{pk}	typ.		630 nm
Luminous intensity					
I_F = 10 mA	CQW10(L)/CQW10B(L)	I_V	min.		0,5 mCd
	CQW10(L)/CQW10B(L)-II	I_V	1,0	to	2,2 mCd
	CQW10(L)/CQW10B(L)-III	I_V	1,6	to	3,5 mCd
Diode capacitance					
V_R = 0; f = 1 MHz		C_d	typ.		35 pF

DEVELOPMENT SAMPLE DATA

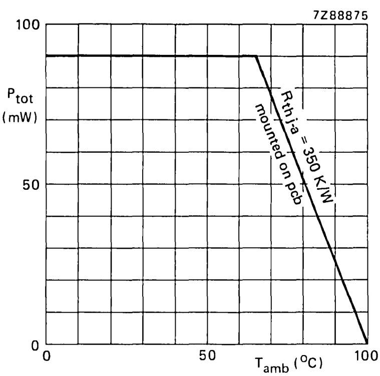


Fig. 2.

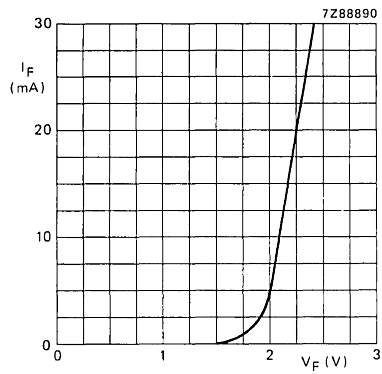


Fig. 3 T_j = 25 °C; typ. values.

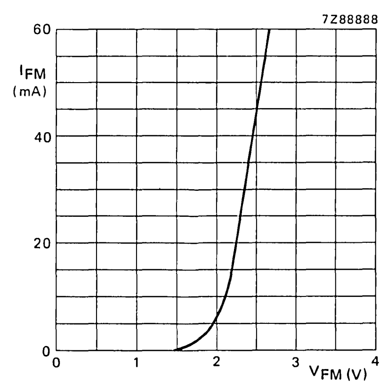


Fig. 4 t_{on} = 50 μs; δ = 0,01;
T_j = 25 °C; typ. values.

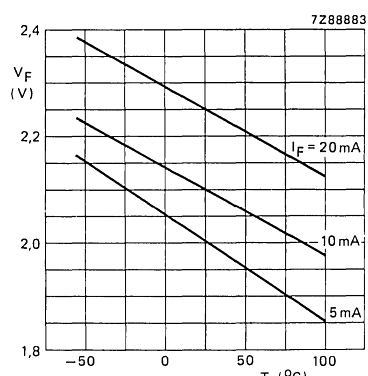


Fig. 5 Typical values.

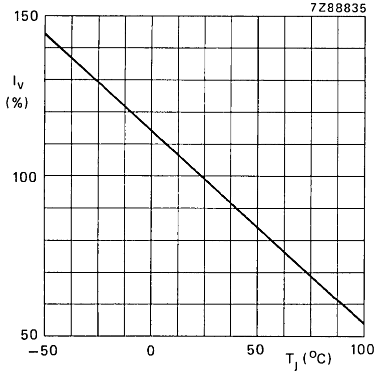


Fig. 6 I_F = 10 mA; typ. values.

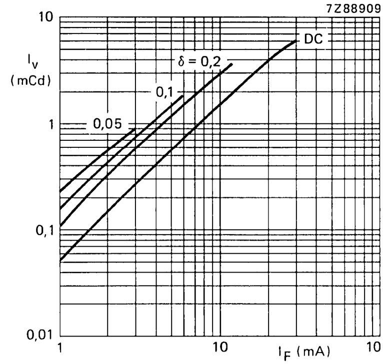


Fig. 7 t_p = 50 μs; typ. values.

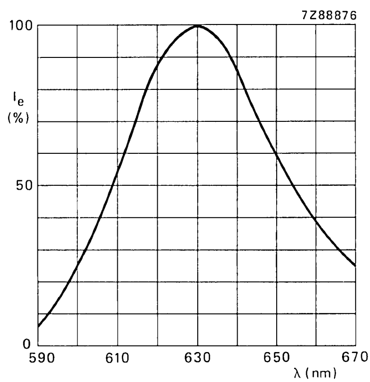


Fig. 8 I_F = 10 mA; typ. values.

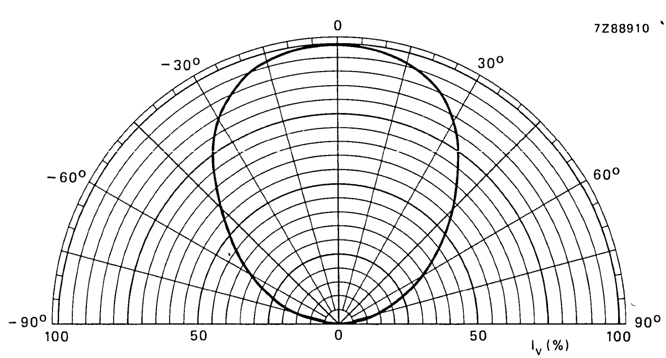


Fig. 9 Typical values.

LIGHT EMITTING DIODES

The CQW10A(L) is a 2,5 mm x 5 mm rectangular light emitting diode which emits hyper-red light (GaAlAs) when forward biased.

The CQW10A has a SOD-76B envelope and is encapsulated in a red coloured resin with a strong diffusing zone cast on the top.

The CQW10AL (in SOD-76L envelope) is the long-lead version of the CQW10A without seating plane, but in all respects similar to the CQW10A.

When stacked in an array these SOD-76 LEDs can be used, for example, as a level indicator. Because of its high light intensity the CQW10A(L) is very suitable in applications where only low currents are available and because of its high $I_{F\,max}$ it can be used for high I_V applications.

QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.		5	V
Forward current (d.c.)		I_F	max.		100	mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.		215	mW
Junction temperature		T_j	max.		100	°C
Luminous intensity I_F = 10 mA	CQW10A(L)		min.		1,0	mcd
	CQW10A(L)-III	I_v	1,6	to	3,5	mcd
	CQW10A(L)-IV		3,0	to	7,0	mcd
Wavelength at peak emission I_F = 10 mA		λ_{pk}	typ.		650	nm
Beamwidth between half-intensity directions I_F = 10 mA; in the plane of the leads		$\alpha_{50\%}$	typ.		100	°

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-76B.
CQW10A

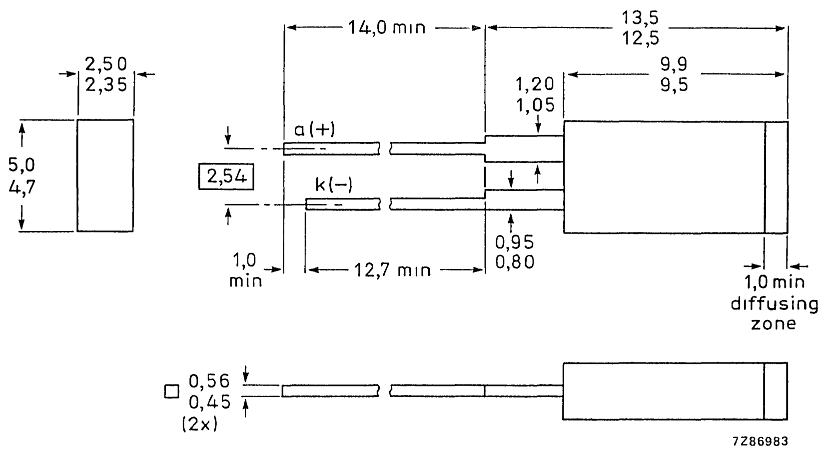
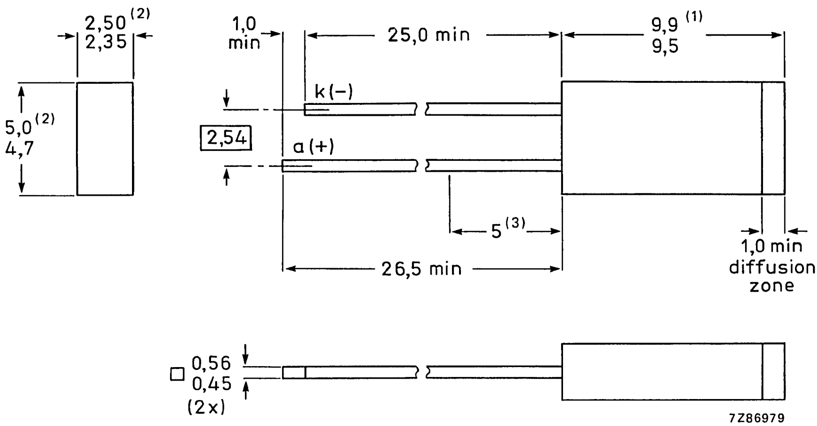


Fig. 1b SOD-76L.
CQW10AL



Notes

1. Measured when the device is seated in a gauge with 2 holes 0,80 mm diameter and 2,54 mm apart.
2. Maximum value including burrs.
3. Solderability not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	5 V
d.c.	I_F	max.	100 mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_{on} = 20 μs; δ = 0,01	I_{FM}	max.	500 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	215 mW
Storage temperature	T_{stg}	−55 to +100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature; $t_{sld} < 7$ s > 1,5 mm from the seating plane for CQW10A > 5 mm from the seating plane for CQW10AL	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 10 mA	V_F	typ. max.	1,75 V 2,2 V
Reverse current V_R = 5 V	I_R	max.	100 μA

Beamwidth between half-intensity directions I_F = 10 mA		$\alpha_{50\%}$	typ.		100	o
Bandwidth at half height		$B_{50\%}$	typ.		20	nm
Wavelength at peak emission I_F = 10 mA		λ_{pk}	typ.		650	nm
Luminous intensity I_F = 10 mA	CQW10A(L)		min.		1,0	mcd
	CQW10A(L)-III	I_v	1,6	to	3,5	mcd
	CQW10A(L)-IV		3,0	to	7,0	mcd
Diode capacitance V_R = 0; f = 1 MHz		C_d	typ.		60	pF

DEVELOPMENT SAMPLE DATA

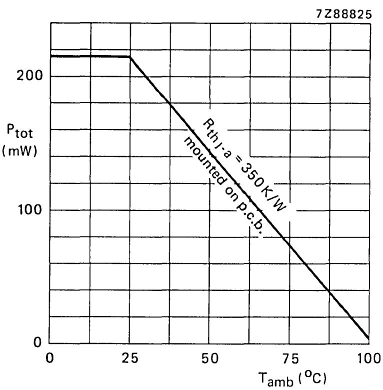


Fig. 2 Typical values.

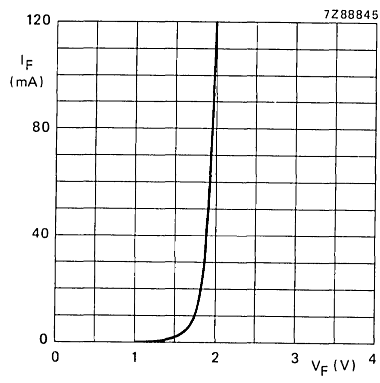


Fig. 3 T_{amb} = 25 °C; typ. values.

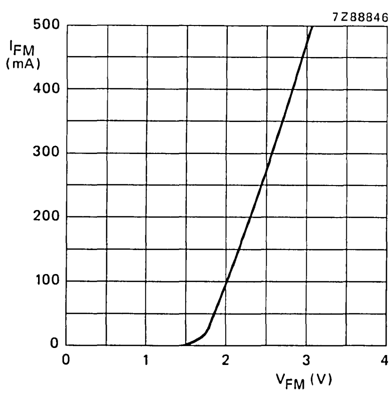


Fig. 4 t_{on} = 20 μs; δ = 0,01; typ. values.

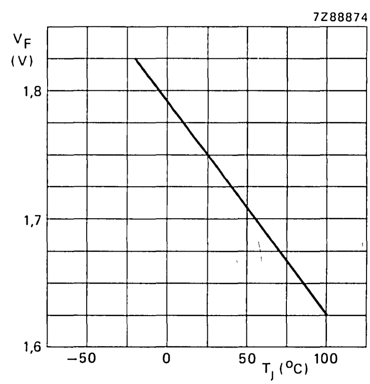


Fig. 5 I_F = 10 mA; typ. values.

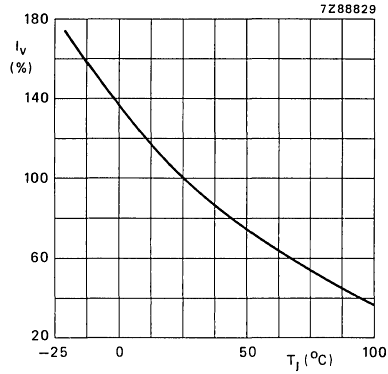


Fig. 6 Typical values.

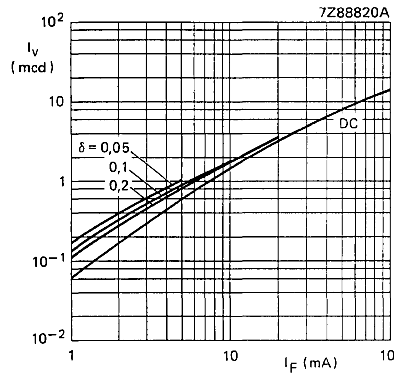


Fig. 7 t_p = 50 μs; typ. values.

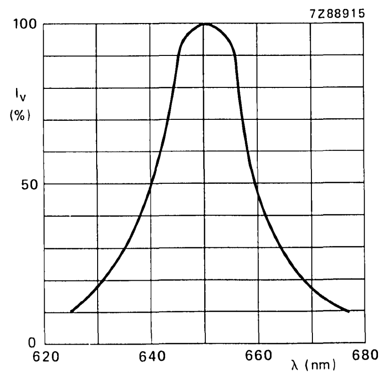


Fig. 8 I_F = 10 mA; T_{amb} = 25 °C; typ. values.

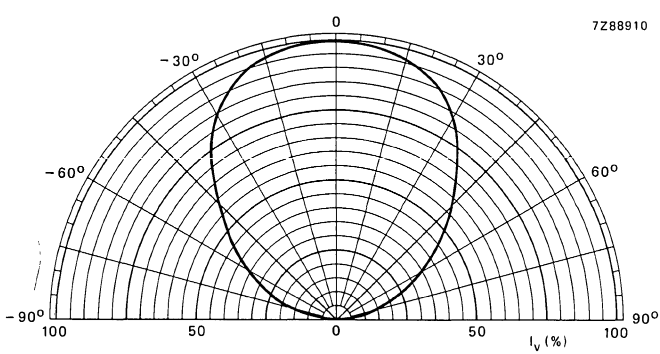


Fig. 9 Typical values.

LIGHT EMITTING DIODES

The CQW11A and CQW11B are 2,5 mm x 5 mm rectangular light emitting diodes which emit super-green light (GaP) when forward biased.

These LEDs have a SOD-76 envelope and are encapsulated in a medium-green resin for the CQW11A(L) and a dark-green coloured resin for the CQW11B(L). An extra diffusing zone has been cast on the top, with a stronger diffusor for the B-types.

The CQW11AL and CQW11BL (SOD-76L envelope) have no seating plane but have long leads and are in all other respects similar to the CQW11A and CQW11B.

When stacked in an array these SOD-76 LEDs can be used, for example, as level indicators. They can resist higher forward currents when a higher luminous intensity is wanted and because the CQW11A/11B is easily deliverable in high I_V classes this LED is very suitable in those applications where only low currents are available.

QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.		5	V
Forward current (d.c.)		I_F	max.		60	mA
Total power dissipation up to T_{amb} = 35 °C		P_{tot}	max.		180	mW
Junction temperature		T_j	max.		100	°C
Luminous intensity						
I_F = 10 mA	CQW11A(L)/CQW11B(L)	I_V	min.		0,5	mCd
	CQW11A(L)/CQW11B(L)-II	I_V	1,0	to	2,2	mCd
	CQW11A(L)/CQW11B(L)-III	I_V	1,6	to	3,5	mCd
Wavelength at peak emission						
I_F = 10 mA		λ_{pk}	typ.		565	nm
Beamwidth between half-intensity directions						
I_F = 10 mA		$\alpha_{50\%}$	typ.		100	°

MECHANICAL DATA

Dimensions in mm

Fig. 1a SOD-76A.
CQW11A
CQW11B

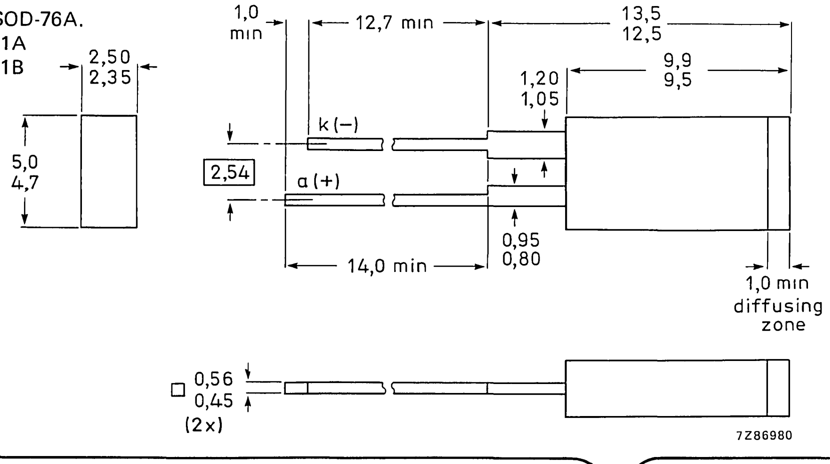
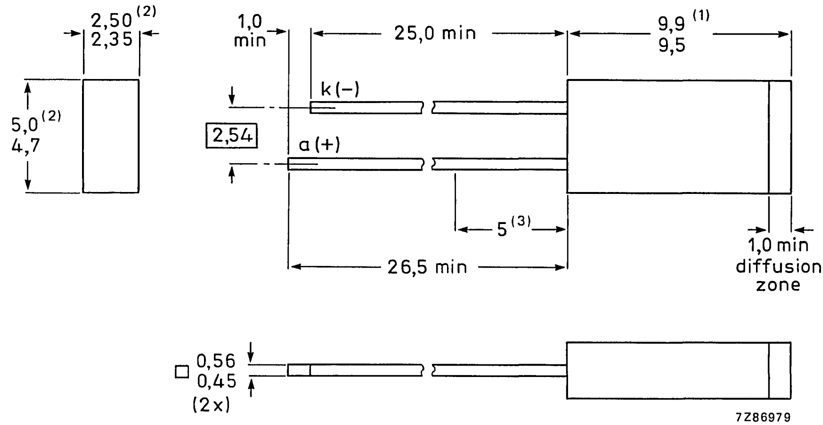


Fig. 1b SOD-76L.
CQW11AL
CQW11BL



Notes

1. Measured when the device is seated in a gauge with 2 holes 0,80 mm diameter and 2,54 mm apart.
2. Maximum value including burrs.
3. Solderability not guaranteed with this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	5 V
Forward current			
d.c.	I_F	max.	60 mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_{on} = 1 ms; δ = 0,33	I_{FM}	max.	150 mA
Total power dissipation up to T_{amb} = 35 °C	P_{tot}	max.	180 mW
Storage temperature	T_{stg}	−55 to +100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature; $t_{sld} < 7$ s > 1,5 mm from the seating plane (CQW11A/11B) > 5 mm from the plastic body (CQW11AL/11BL)	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage			
I_F = 10 mA	V_F	typ.	2,1 V
		max.	3,0 V

Reverse current			
$V_R = 5$ V	I_R	max.	100 μA
Beamwidth between half-intensity directions			
$I_F = 10$ mA	$\alpha_{50\%}$	typ.	100 °
Bandwidth at half height	$B_{50\%}$	typ.	30 nm
Wavelength at peak emission			
$I_F = 10$ mA	λ_{pk}	typ.	565 nm
Luminous intensity			
$I_F = 10$ mA CQW11A(L)/CQW11B(L)	I_v	min.	0,5 mCd
CQW11A(L)/CQW11B(L)-II	I_v	1,0 to	2,2 mCd
CQW11A(L)/CQW11B(L)-III	I_v	1,6 to	3,5 mCd
Diode capacitance			
$V_R = 0$; f = 1 MHz	C_d	typ.	35 pF

DEVELOPMENT SAMPLE DATA

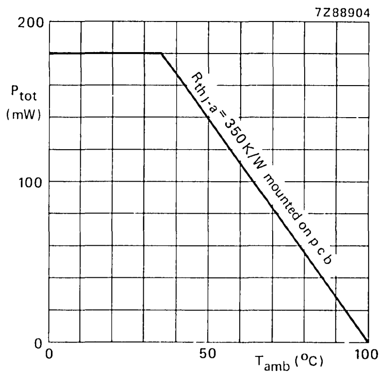


Fig. 2.

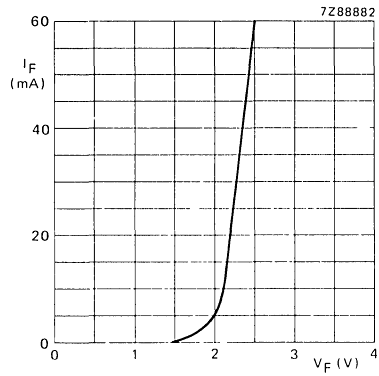


Fig. 3 $T_j = 25$ °C; typ. values.

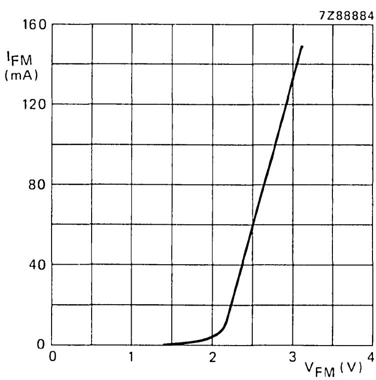


Fig. 4 $t_{on} = 1$ ms; $\delta = 0,33$; $T_{amb} = 25$ °C; typ. values.

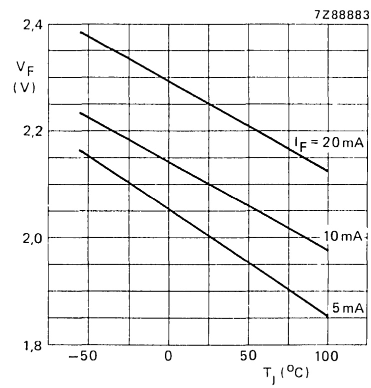


Fig. 5 Typical values.

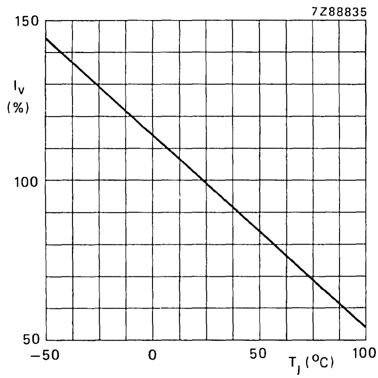


Fig. 6 I_F = 10 mA; typ. values.

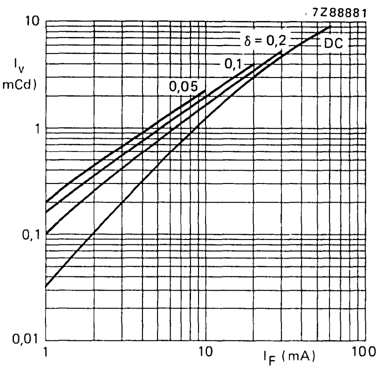


Fig. 7 t_p = 50 μs; typ. values.

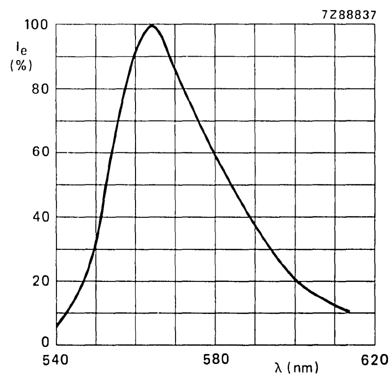


Fig. 8 I_F = 10 mA; T_{amb} = 25 °C; typ. values.

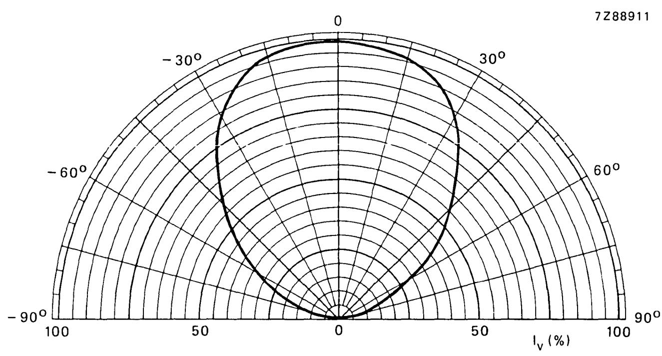


Fig. 9 Typical values.

LIGHT EMITTING DIODES

The CQW12 and CQW12B are 2,5 mm x 5 mm rectangular light emitting diodes which emit yellow light when forward biased.

The CQW12 and CQW12B have a SOD-76A envelope and the CQW12L and CQW12BL have a SOD-76L envelope. The CQW12 and CQW12L are encapsulated in a medium-yellow resin and the CQW12B and CQW12BL in a slightly dark-yellow resin. Both have a diffusing zone cast on the top, with a stronger diffusor for the B-types.

The CQW12L and CQW12BL(SOD-76L envelope) have no seating plane but have long leads and are in all other respects similar to the CQW12 and CQW12B respectively.

When stacked in an array these SOD-76 LEDs can be used, for example, as level indicators.

QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.		5 V
Forward current (d.c.)		I_F	max.		30 mA
Total power dissipation up to T_{amb} = 65 °C		P_{tot}	max.		90 mW
Junction temperature		T_j	max.		100 °C
Luminous intensity					
I_F = 10 mA	CQW12(L)/CQW12B(L)	I_V	min.		0,5 mCd
	CQW12(L)/CQW12B(L)-II	I_V	1,0	to	2,2 mCd
	CQW12(L)/CQW12B(L)-III	I_V	1,6	to	3,5 mCd
Wavelength at peak emission					
I_F = 10 mA		λ_{pk}	typ.		590 nm
Beamwidth between half-intensity directions					
I_F = 10 mA; in the plane of the leads		$\alpha_{50\%}$	typ.		100 °

MECHANICAL DATA

Dimensions in mm

Fig. 1a SOD-76A.
CQW12
CQW12B

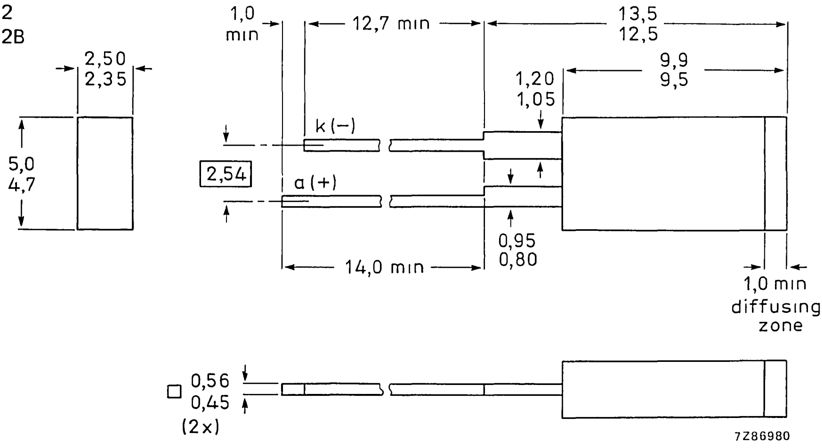
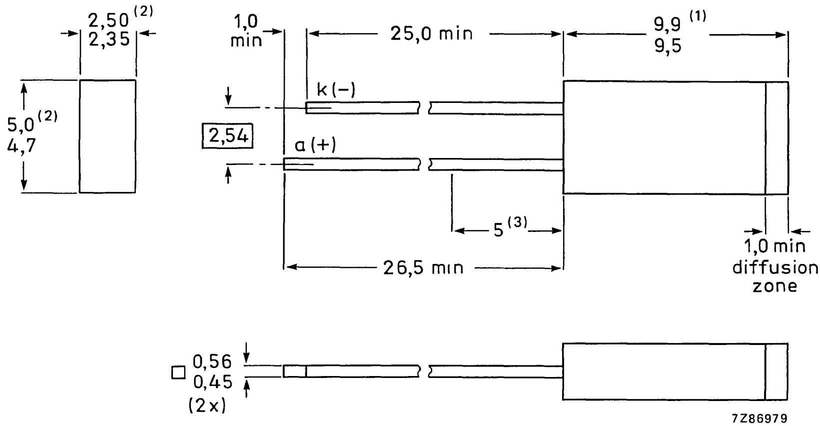


Fig. 1b SOD-76L.
CQW12L
CQW12BL



Notes

1. Measured when the device is seated in a gauge with 2 holes 0,80 mm diameter and 2,54 mm apart.
2. Maximum value including burrs.
3. Solderability not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	5 V
Forward current			
d.c.	I_F	max.	30 mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_{on} = 1 ms; δ = 0,33	I_{FM}	max.	60 mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	90 mW
Storage temperature	T_{stg}	−55 to +100	°C
Junction temperature	T_j	max.	100 °C
Lead soldering temperature; $t_{sld} < 7$ s; > 1,5 mm from the seating plane for CQW12/12B; > 5 mm from the plastic body for CQW12L/12BL	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage			
I_F = 10 mA	V_F	typ.	2,1 V
		max.	3,0 V

Reverse current						
$V_R = 5$ V		I_R	max.		100	μA
Beamwidth between half-intensity directions						
$I_F = 10$ mA		$\alpha_{50\%}$	typ.		100	o
Bandwidth at half height		$B_{50\%}$	typ.		40	nm
Wavelength at peak emission						
$I_F = 10$ mA		λ_{pk}	typ.		630	nm
Luminous intensity						
$I_F = 10$ mA	CQW12(L)/CQW12B(L)	I_v	min.		0,5	mCd
	CQW12(L)/CQW12B(L)-II	I_v	1,0	to	2,2	mCd
	CQW12(L)/CQW12B(L)-III	I_v	1,6	to	3,5	mCd
Diode capacitance						
$V_R = 0$; f = 1 MHz		C_d	typ.		35	pF

DEVELOPMENT SAMPLE DATA

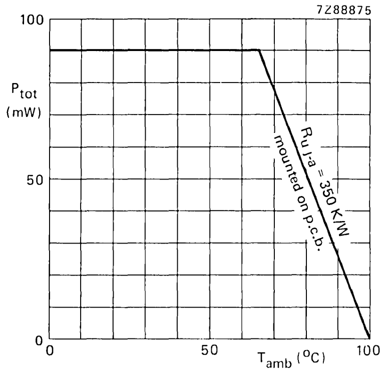


Fig. 2.

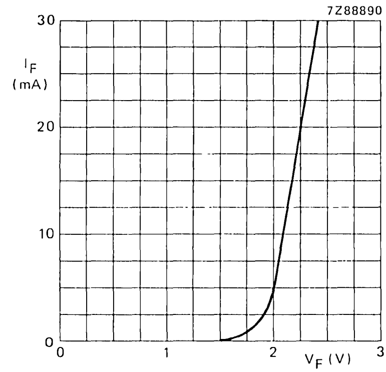


Fig. 3 T_j = 25 °C; typ. values.

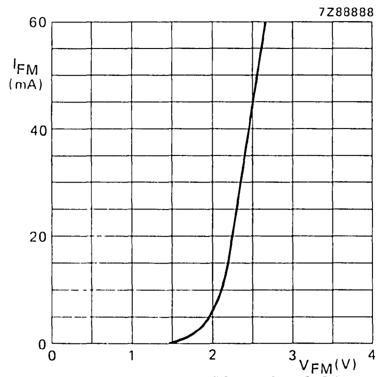


Fig. 4 $t_{on} = 50\ \mu s$; $\delta = 0{,}01$;
T_j = 25 °C.; typ. values.

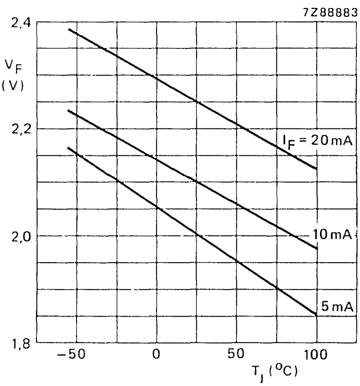


Fig. 5 Typical values.

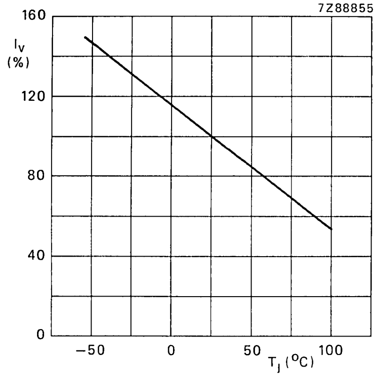


Fig. 6 I_F = 10 mA; typ. values.

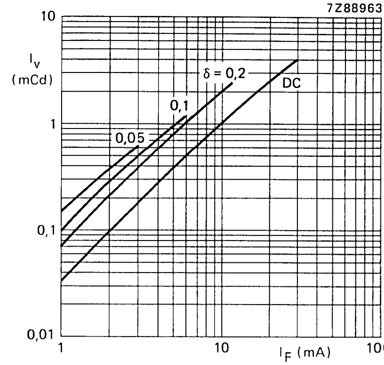


Fig. 7 t_p = 50 μs; typ. values.

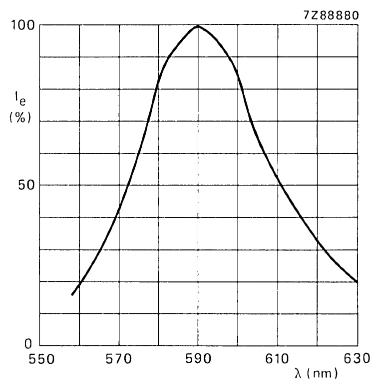


Fig. 8 Typical values.

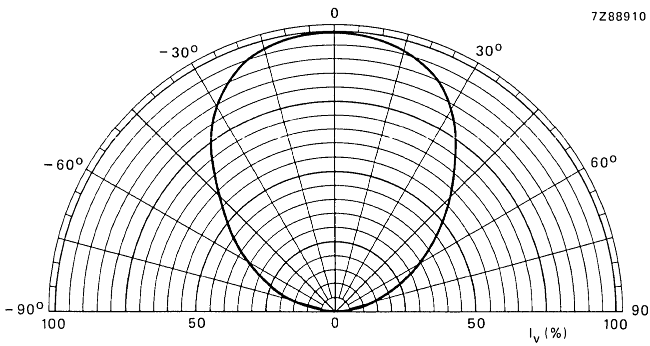


Fig. 9 Typical values.

LIGHT EMITTING DIODE

Circular light emitting diode with diameter of 2 mm which emits hyper-red light (GaAlAs) when forward biased.

The CQW20A has a SOD-79 outline and is encapsulated in a medium-red coloured resin with an extra diffusing zone cast on the top. This LED is very suitable for small indicator functions and in applications where only low currents are available.

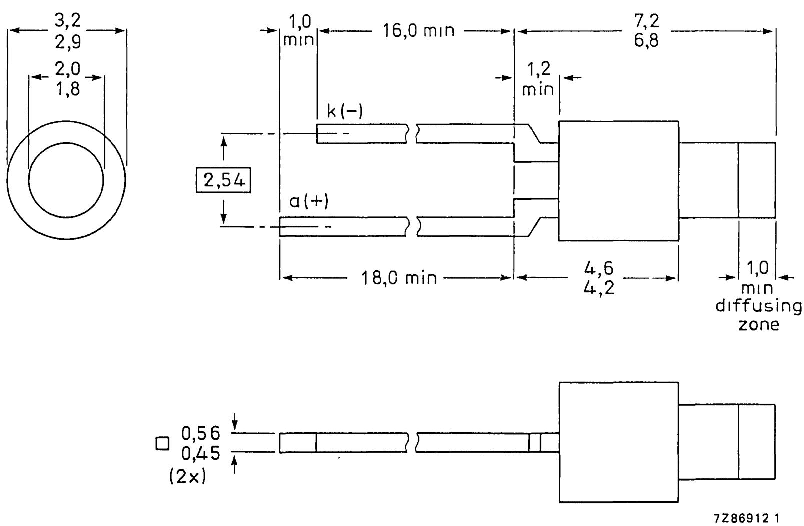
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	5 V
Forward current (d.c.)	I_F	max.	60 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	150 mW
Junction temperature	T_j	max.	100 °C
Luminous intensity I_F = 10 mA	I_v	min. typ.	1,0 mCd 1,5 mCd
Wavelength at peak emission	λ_{pk}	typ.	650 nm
Beamwidth between half-intensity directions	$\alpha_{50\%}$	typ.	110 °

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-79.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5 V
Forward current			
d.c.	I_F	max.	60 mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_{on} = 20 μs; δ = 0,01	I_{FM}	max.	500 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	150 mW
Storage temperature	T_{stg}	−55 to +100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature			
$>$ 1,5 mm from the seating plane; $t_{sld} < 7$ s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient			
when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	500 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage			
I_F = 4 mA	V_F	typ.	1,65 V
I_F = 10 mA	V_F	typ.	1,75 V
		max.	2,20 V
Reverse current			
V_R = 5 V	I_R	max.	100 μA
Beamwidth between half-intensity directions			
I_F = 10 mA	$\alpha_{50\%}$	typ.	110 °
Bandwidth at half height	$B_{50\%}$	typ.	20 nm
Wavelength at peak emission	λ_{pk}	typ.	650 nm
Luminous intensity			
I_F = 10 mA	I_v	min.	1,0 mCd
		typ.	1,5 mCd
Diode capacitance			
V_R = 0; f = 1 MHz	C_d	typ.	60 pF

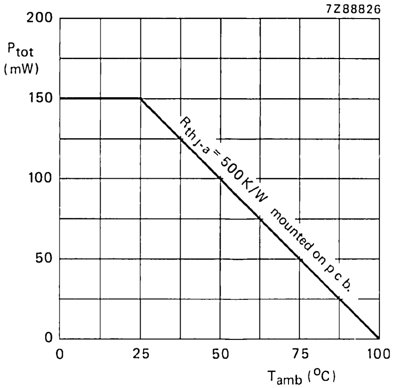


Fig. 2.

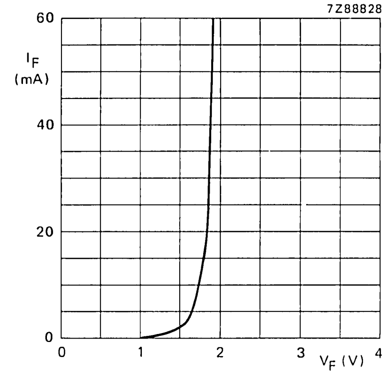


Fig. 3 T_{amb} = 25 °C; typ. values.

DEVELOPMENT SAMPLE DATA

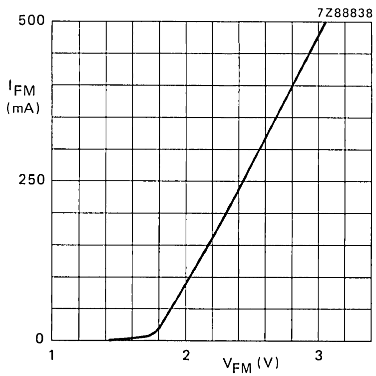


Fig. 4 t_{on} = 20 μs; δ = 0,01; T_{amb} = 25 °C; typ. values.

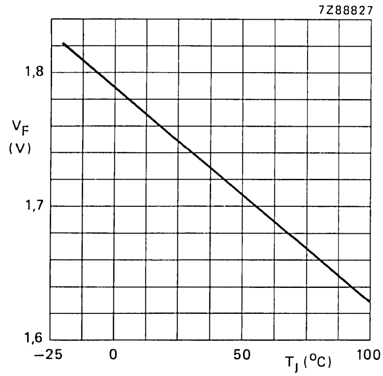


Fig. 5 I_F = 10 mA; typ. values.

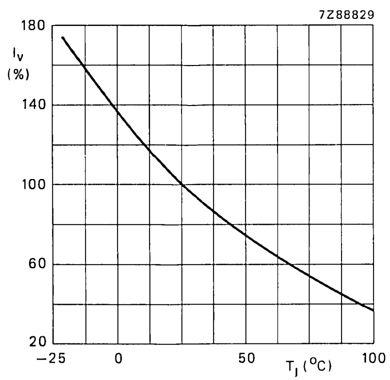


Fig. 6 Typical values.

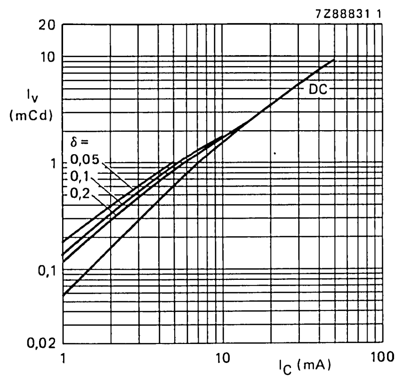


Fig. 7 t_p = 50 μs; typ. values.

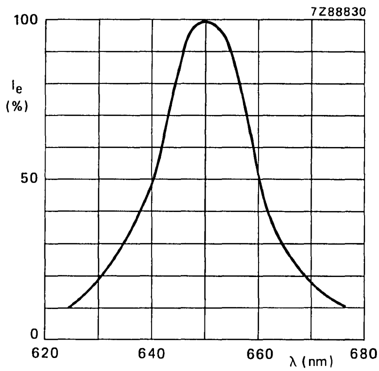


Fig. 8 I_F = 10 mA; T_{amb} = 25 °C; typ. values.

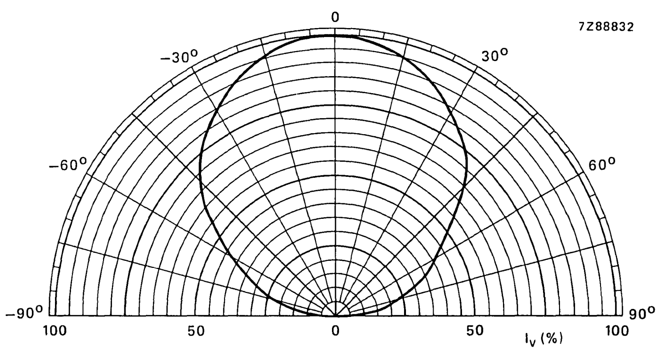


Fig. 9 I_F = 10 mA; typ. values.

LIGHT EMITTING DIODE

Circular light emitting diode with diameter of 2 mm which emits super-green light (GaP) when forward biased.

The CQW21 has a SOD-79 outline and is encapsulated in a medium-green coloured resin with a diffusing zone cast on the top. This LED is very suitable for very small indicator functions and can resist higher forward currents when a higher luminous intensity is wanted. In the near future the CQW21 is easily deliverable in high I_V classes and is therefore very suitable in those applications where only low currents are available.

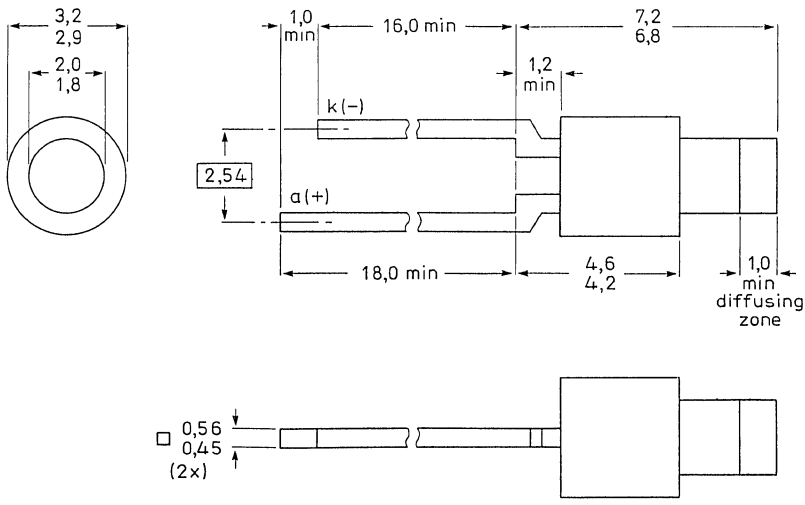
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	5	V
Forward current (d.c.)	I_F	max.	60	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	150	mW
Junction temperature	T_j	max.	100	°C
Luminous intensity I_F = 10 mA	I_V	min.	0,5	mcd
Wavelength at peak emission	λ_{pk}	typ.	565	nm
Beamwidth between half-intensity directions	$\alpha_{50\%}$	typ.	100	°

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-79



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5	V
Forward current				
d.c.	I_F	max.	60	mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1	A
peak value; t_{on} = 1 ms; δ = 0,33	I_{FM}	max.	150	mA
Total power disspation up to T_{amb} = 25 °C	P_{tot}	max.	150	mW
Storage temperature	T_{stg}	−55 to +100		°C
Junction temperature	T_j	max.	100	°C
Lead soldering temperature > 1,5 mm from the seating plane; t_{sld} < 7 s	T_{sld}	max.	260	°C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	500	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 10 mA	V_F	typ.	2,1	V
		max.	3,0	V
Reverse current V_R = 5 V	I_R	max.	100	μA
Beamwidth between half-intensity directions	$\alpha_{50\%}$	typ.	100	°
Bandwidth at half height	$B_{50\%}$	typ.	30	nm
Wavelength at peak emission	λ_{pk}	typ.	565	nm
Luminous intensity I_F = 10 mA	I_v	min.	0,5	mcd
		typ.	1,5	mcd

DEVELOPMENT SAMPLE DATA

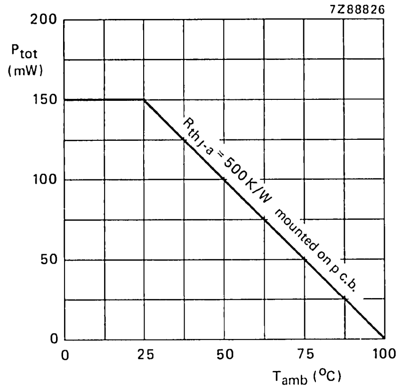


Fig. 2.

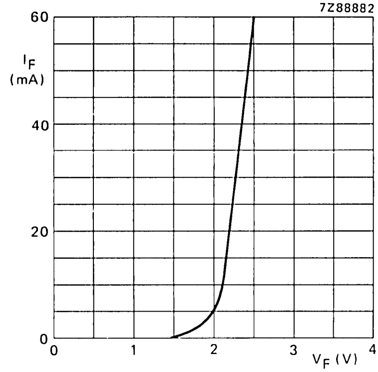


Fig. 3 T_{amb} = 25 °C; typ. values.

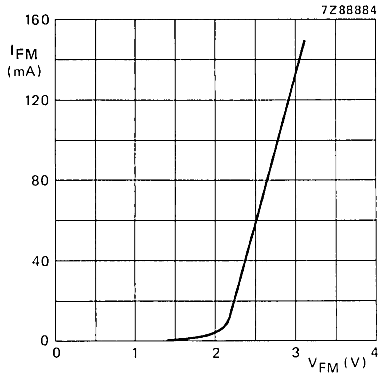


Fig. 4 t_{on} = 1 ms; δ = 0,33;
T_{amb} = 25 °C; typ. values.

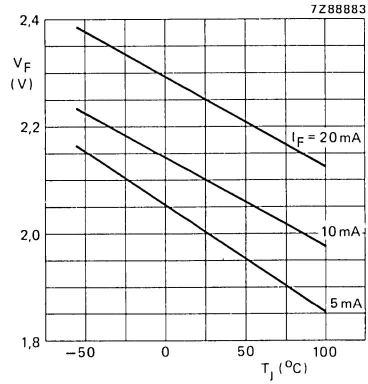


Fig. 5 Typical values.

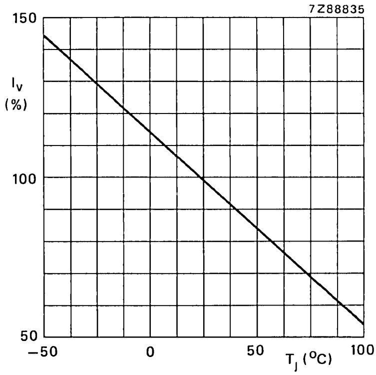


Fig. 6 Typical values.

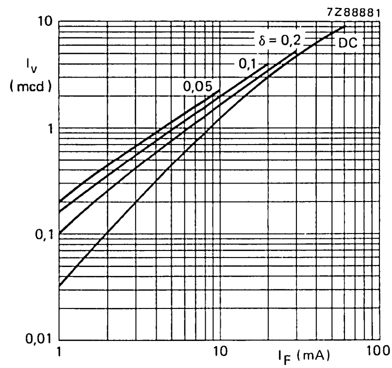


Fig. 7 t_p = 50 μs; typ. values.

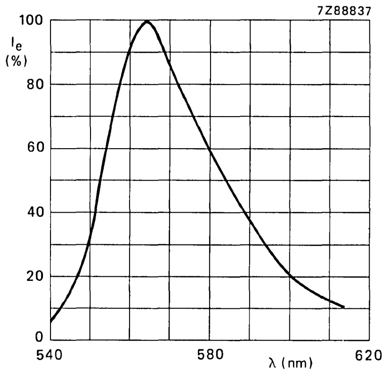


Fig. 8 I_F = 10 mA; typ. values.

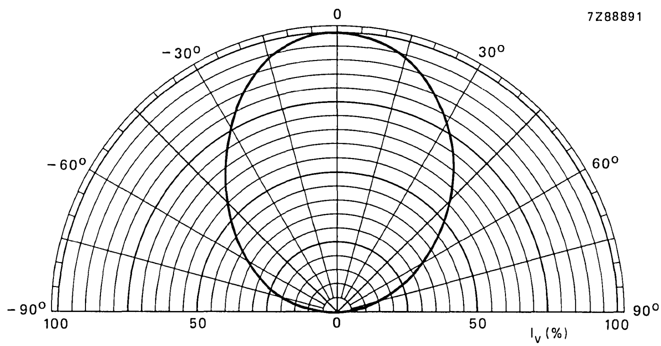


Fig. 9 Typical values.

LIGHT EMITTING DIODE

Circular light emitting diode with diameter of 2 mm which emits yellow light (GaAsP) when forward biased.
The CQW22 has a SOD-79 outline and is encapsulated in a medium-yellow coloured resin with a diffusing zone cast on the top.
This LED is very suitable for very small indicator functions.

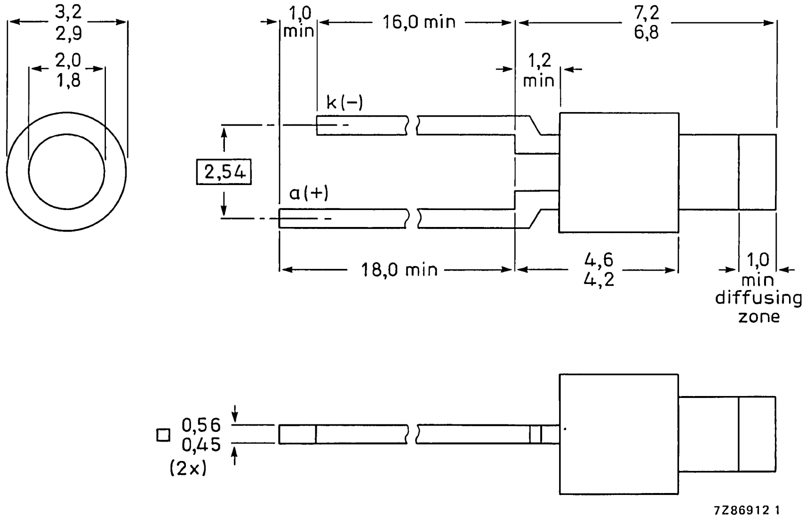
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	5	V
Forward current (d.c.)	I_F	max.	30	mA
Total power dissipation up to T_{amb} = 55 °C	P_{tot}	max.	90	mW
Junction temperature	T_j	max.	100	°C
Luminous intensity I_F = 20 mA	I_v	min. typ.	0,5 1,5	mCd mCd
Wavelength at peak emission	λ_{pk}	typ.	590	nm
Beamwidth between half-intensity directions	$\alpha_{50\%}$	typ.	110	°

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-79.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5 V
Forward current			
d.c.	I_F	max.	30 mA
peak value; t_p = 1 µs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_{on} = 1 ms; δ = 0,33	I_{FM}	max.	60 mA
Total power dissipation up to T_{amb} = 55 °C	P_{tot}	max.	90 mW
Storage temperature	T_{stg}	−55 to + 100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature $>$ 1,5 mm from the seating plane; $t_{sld} < 7$ s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	500 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 20 mA	V_F	typ.	2,1 V
		max.	3,0 V
Reverse current V_R = 5 V	I_R	max.	100 µA
Diode capacitance	C_d	typ.	35 pF
Beamwidth between half-intensity directions I_F = 20 mA	$\alpha_{50\%}$	typ.	110 °
Bandwidth at half height	$B_{50\%}$	typ.	40 nm
Wavelength at peak emission	λ_{pk}	typ.	590 nm
Luminous intensity I_F = 20 mA	I_v	typ.	0,5 mCd
		typ.	1,5 mCd

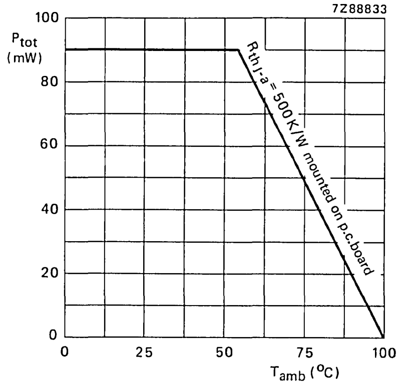


Fig. 2.

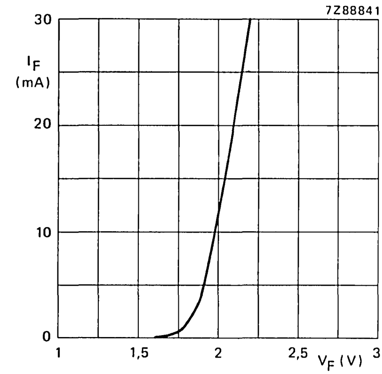


Fig. 3 T_{amb} = 25 °C; typical values.

DEVELOPMENT SAMPLE DATA

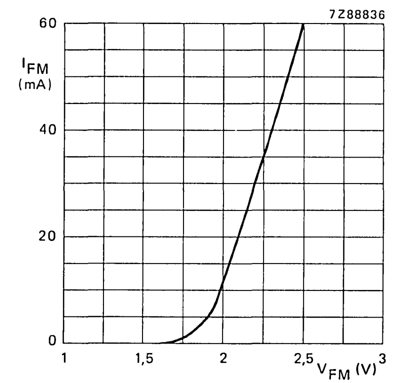


Fig. 4 t_{on} = 1 ms; δ = 0,33;
T_{amb} = 25 °C; typical values.

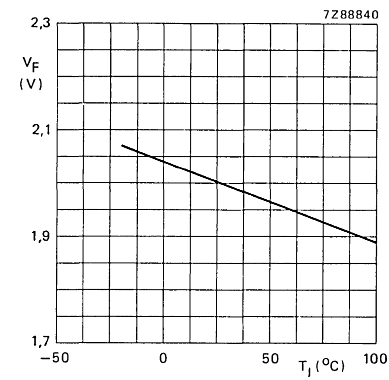


Fig. 5 I_F = 10 mA; typical values.

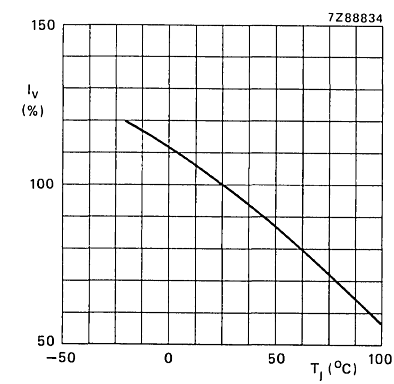


Fig. 6 Typical values.

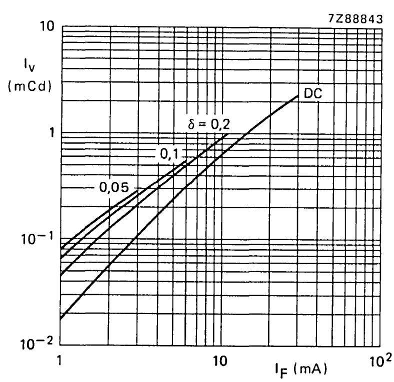


Fig. 7 t_p = 50 μs; typical values.

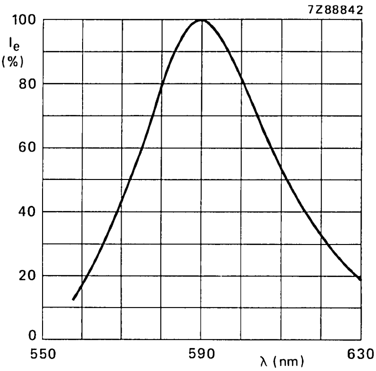


Fig. 8 Typical values.

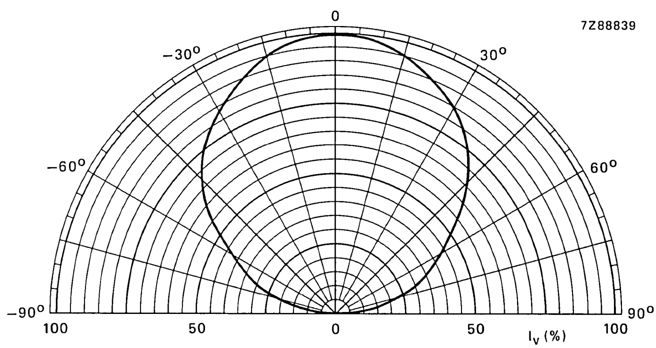


Fig. 9 Typical values.

LIGHT EMITTING DIODES

Circular light emitting diodes with diameter of 5 mm which emit hyper-red (GaAlAs) light when forward biased. The CQW24 and CQW24L have a SOD-63 outline and are encapsulated in a medium-red coloured diffusing resin.

Because of its high light intensity the CQW24 (and CQW24L) is also very suitable in applications where only low currents are available.

The CQW24L is the long-lead version of the CQW24 and has no seating plane but is in all other respects equal to the CQW24.

QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5	V
Forward current (d.c.)		I_F	max.	100	mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	215	mW
Junction temperature		T_j	max.	100	°C
Luminous intensity I_F = 10 mA	CQW24(L)-I	I_v	min.	4	mCd
	CQW24(L)-II	I_v	min.	7,5	mCd
Wavelength at peak emission		λ_{pk}	typ.	650	nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	60	°

MECHANICAL DATA

Dimensions in mm

Fig. 1a SOD-63A.
CQW24

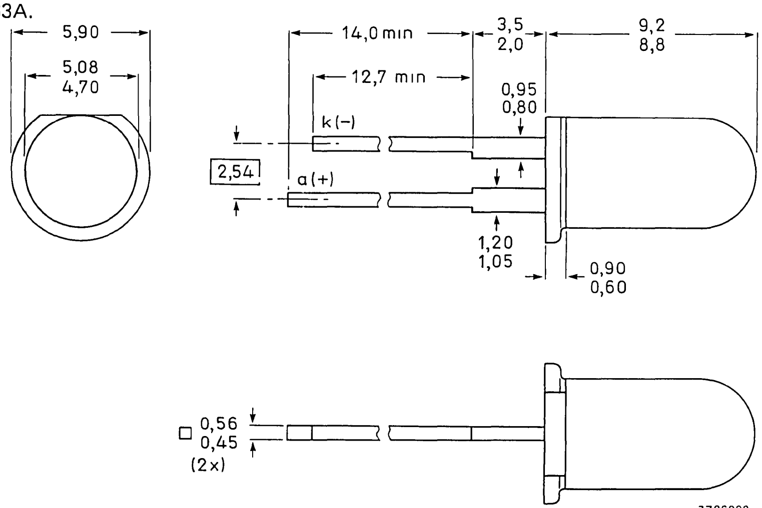
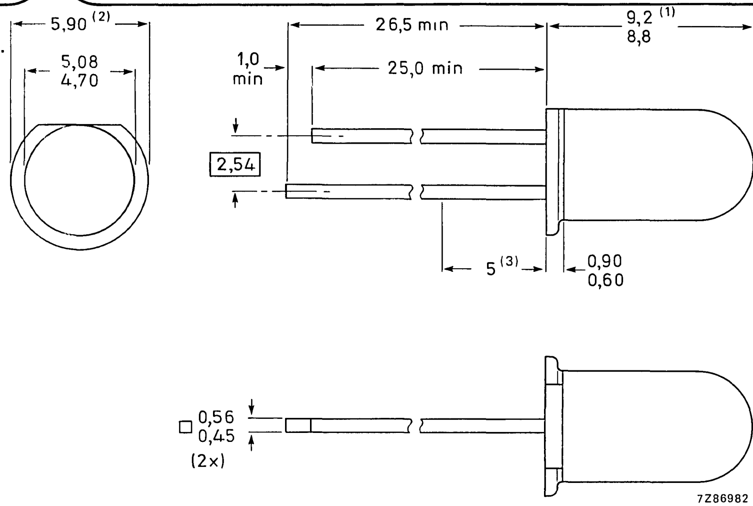


Fig. 1b SOD-63L.
CQW24L



(1) Measured when the device is seated in a gauge with 2 holes 0,80 mm diameter 2,54 mm apart.
(2) Maximum value including burrs.
(3) Solderability not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5	V
Forward current d.c.	I_F	max.	100	mA
Forward current peak value; t_p = 1 μs; f = 300 Hz peak value; t_{on} = 20 μs; δ = 0,01	I_{FM}	max. max.	1 500	A mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	215	mW
Storage temperature	T_{stg}	−55 to	+100	°C
Junction temperature	T_j	max.	100	°C
Lead soldering temperature: t_{sld} < 7 s > 1,5 mm from the seating plane for CQW24 > 5 mm from the plastic body for CQW24L	T_{sld}	max.	260	°C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 4 mA	V_F	typ.	1,65	V
I_F = 10 mA	V_F	typ. max.	1,75 2,2	V V
I_F = 50 mA	V_F	typ.	1,9	V

Reverse current				
$V_R = 5$ V		I_R	max.	100 μA
Bandwidth between half-intensity directions				
$I_F = 10$ mA		$\alpha_{50\%}$	typ.	60 °
Bandwidth at half height		$B_{50\%}$	typ.	20 nm
Wavelength at peak emission				
$I_F = 10$ mA; $T_{amb} = 25$ °C		λ_{pk}	typ.	650 nm
Luminous intensity				
$I_F = 4$ mA	CQW24(L)-I	I_v	typ.	3 mCd
	CQW24(L)-II		typ.	6 mCd
$I_F = 10$ mA	CQW24(L)-I	I_v	min.	4 mCd
			typ.	10 mCd
	CQW24(L)-II	I_v	min.	7,5 mCd
			typ.	15 mCd
$I_F = 50$ mA	CQW24(L)-I	I_v	typ.	55 mCd
	CQW24(L)-II		typ.	75 mCd
Diode capacitance				
$V_R = 0$; f = 1 MHz		C_d	typ.	60 pF

DEVELOPMENT SAMPLE DATA

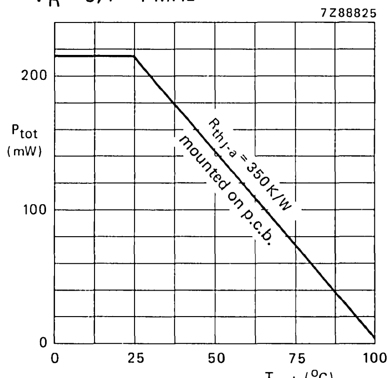


Fig. 2.

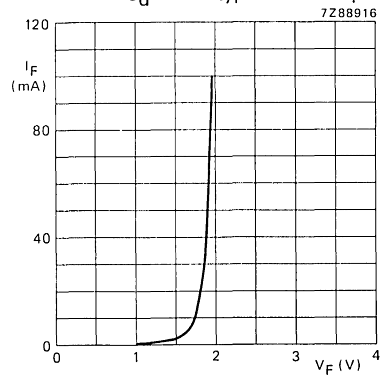


Fig. 3 $T_{amb} = 25$ °C; typ. values.

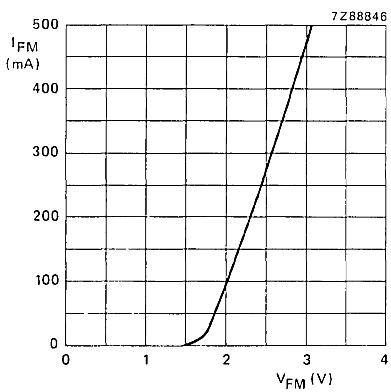


Fig. 4 $t_{on} = 20$ μs; $\delta = 0{,}01$; $T_{amb} = 25$ °C; typ. values.

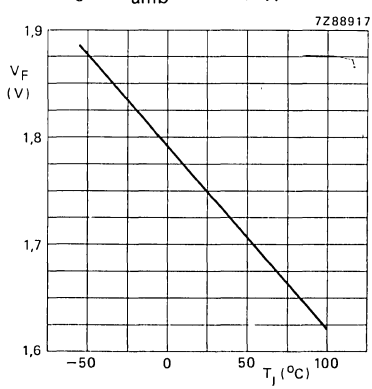


Fig. 5 $I_F = 10$ mA; typ. values.

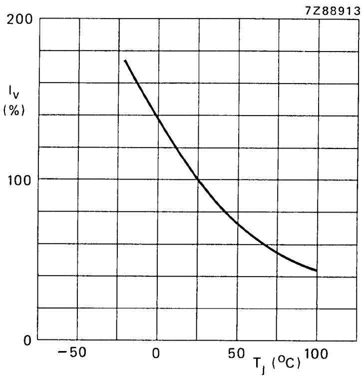


Fig. 6 Typ. values.

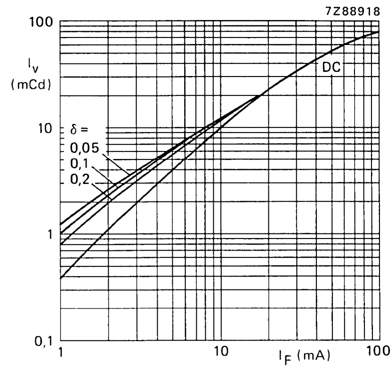


Fig. 7 t_p = 50 μs; typ. values.

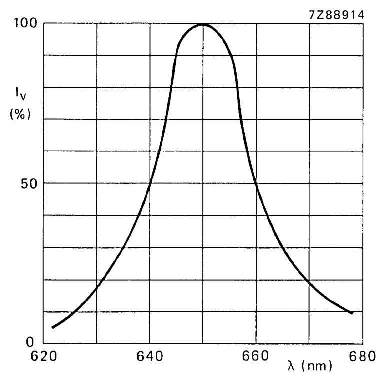


Fig. 8 I_F = 10 mA; T_{amb} = 25 °C; typ. values.

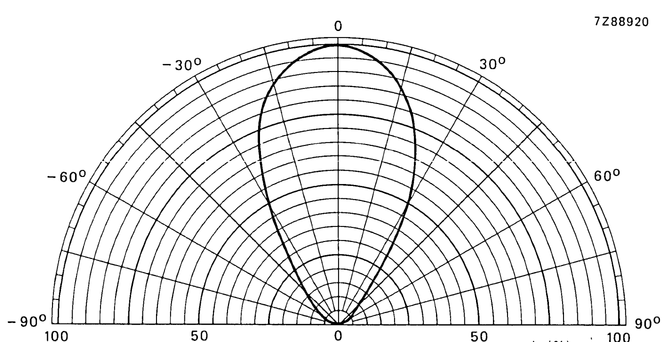


Fig. 9 Typ. values.

LIGHT EMITTING DIODE

Circular light emitting diode with diameter of 3 mm which emits hyper-red light (GaAlAs) when forward biased.

The CQW54 has a SOD-53E outline and is encapsulated in a medium-red coloured diffusing resin.

Because of its high light intensity this LED is also very suitable in applications where only low currents are available.

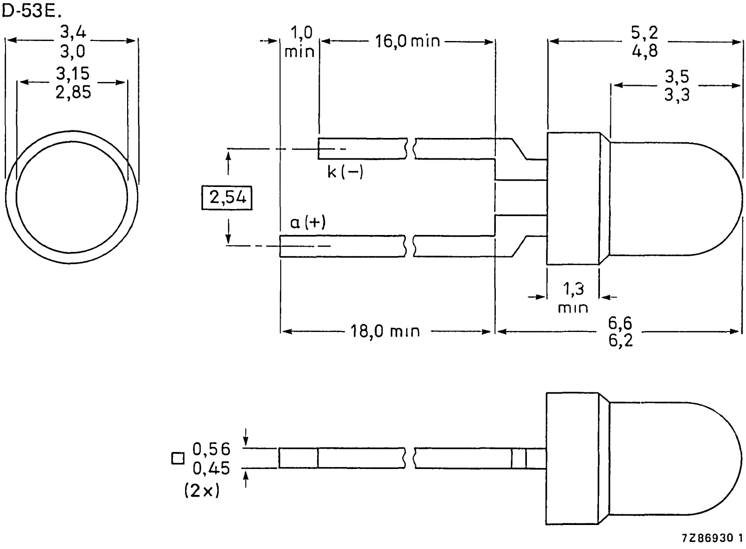
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.		5	V
Forward current (d.c.)		I_F	max.		60	mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.		150	mW
Junction temperature		T_j	max.		100	°C
Luminous intensity						
I_F = 10 mA	CQW54	I_V	min.		4	mcd
	CQW54-V	I_V	5	to	12	mcd
	CQW54-VI	I_V	10	to	22	mcd
	CQW54-VII	I_V	min.		16	mcd
Wavelength at peak emission						
I_F = 10 mA		λ_{pk}	typ.		650	nm
Beamwidth at half-intensity directions		$\alpha_{50\%}$	typ.		60	°

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-53E.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5	V
Forward current				
d.c.	I_F	max.	60	mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1	A
peak value; t_{on} = 20 μs; δ = 0,01	I_{FM}	max.	500	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	150	mW
Storage temperature	T_{stg}	−55 to +100		°C
Junction temperature	T_j	max.	100	°C
Lead soldering temperature > 1,5 mm from the seating plane; t_{sld} < 7 s	T_{sld}	max.	260	°C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	500	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage					
I_F = 4 mA		V_F	typ.	1,65	V
I_F = 10 mA		V_F	typ.	2,1	V
			max.	3,0	V
Reverse current					
V_R = 5 V		I_R	max.	100	μA
Beamwidth between half-intensity directions					
I_F = 10 mA		$\alpha_{50\%}$	typ.	60	°
Bandwidth at half height		$B_{50\%}$	typ.	20	nm
Wavelength at peak emission					
I_F = 10 mA		λ_{pk}	typ.	650	nm
Luminous intensity					
I_F = 4 mA	CQW54	I_v	typ	2	mcd
	CQW54-V	I_v	typ.	3	mcd
	CQW54-VI	I_v	typ.	6	mcd
	CQW54-VII	I_v	typ.	7	mcd
I_F = 10 mA	CQW54	I_v	min.	4	mcd
			typ.	5	mcd
	CQW54-V	I_v	5 to	12	mcd
			typ.	8	mcd
	CQW54-VI	I_v	10 to	22	mcd
			typ.	15	mcd
	CQW54-VII	I_v	min.	16	mcd
			typ.	18	mcd
I_F = 50 mA	CQW54	I_v	typ.	25	mcd
	CQW54-V	I_v	typ.	40	mcd
	CQW54-VI	I_v	typ.	75	mcd
	CQW54-VII	I_v	typ.	90	mcd

DEVELOPMENT SAMPLE DATA

Diode capacitance
$V_R = 0$; $f = 1$ MHz | C_d | typ. | 60 pF

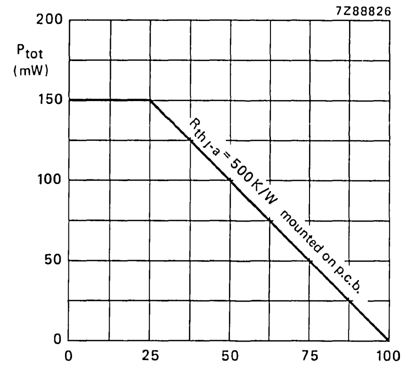


Fig. 2. T_{amb} (°C)

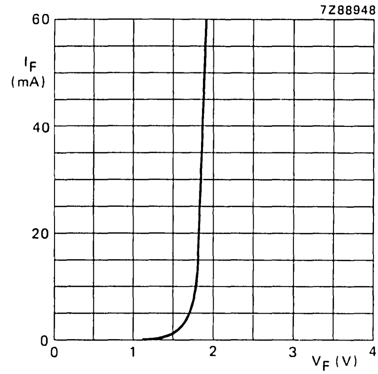


Fig. 3 T_{amb} = 25 °C; typ. values.

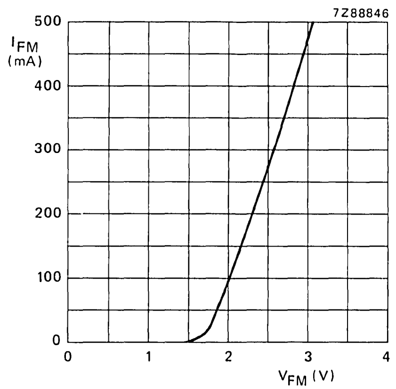


Fig. 4 t_{on} = 20 µs; δ = 0,01; T_{amb} = 25 °C; typ. values.

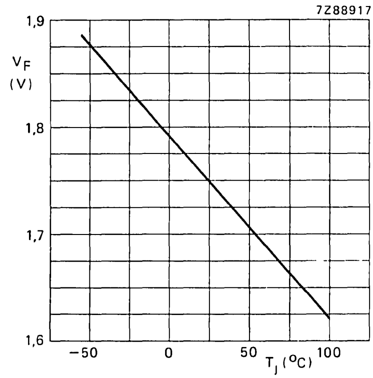


Fig. 5 I_F = 10 mA; typ. values.

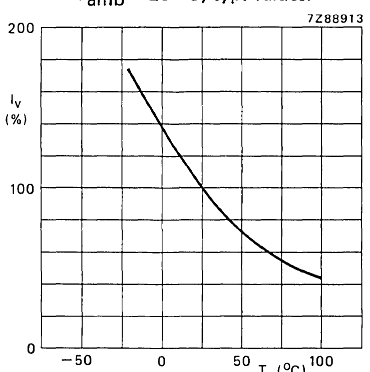


Fig. 6 Typical values.

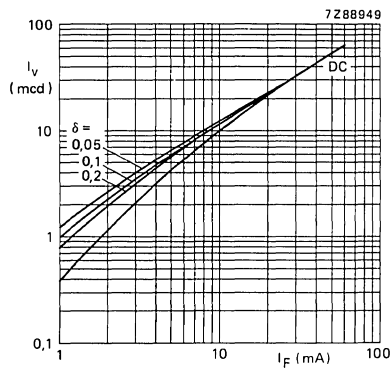


Fig. 7 t_p = 50 µs; typ. values.

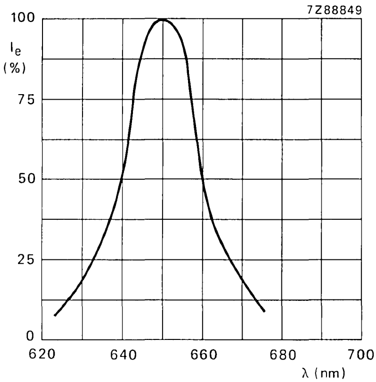


Fig. 8 I_F = 10 mA; T_{amb} = 25 °C; typ. values.

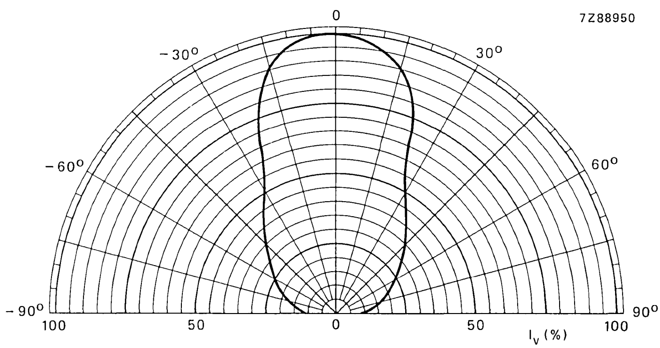


Fig. 9 Typical values.

LIGHT EMITTING DIODE

Light emitting diode in a flat plastic stackable envelope with rectangular lens (2,5 mm x 5 mm). The CQX10 emits visible super-red light (GaAsP), when forward biased.

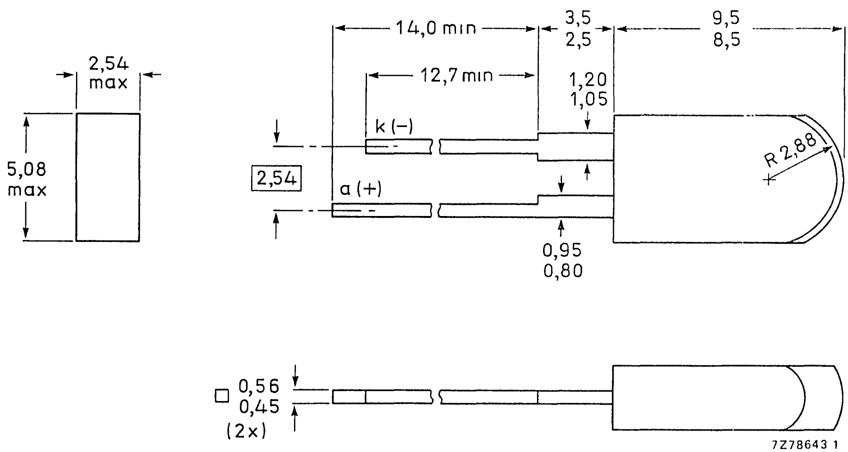
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5	V
Forward current (d.c.)		I_F	max.	30	mA
Total power dissipation up to T_{amb} = 65 °C		P_{tot}	max.	90	mW
Luminous intensity (on-axis)					
I_F = 10 mA	CQX10-I	I_v	min.	0,7	mcd
	CQX10-II	I_v		1,0 to 2,2	mcd
	CQX10-III	I_v		1,6 to 3,5	mcd
	CQX10-IV	I_v	min.	3,0	mcd
Wavelength at peak emission		λ_{pk}	typ.	630	nm
Beamwidth between half-intensity directions in the plane of the connections		$\alpha_{50\%}$	typ.	50°	

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-65.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	5	V
Forward current (d.c.)	I_F	max.	30	mA
Forward current				
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1000	mA
peak value; t_{on} = 1 ms; δ = 0,33	I_{FM}	max.	60	mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	90	mW
Storage temperature	T_{stg}		−55 to + 100	°C
Junction temperature	T_j	max.	100	°C
Lead soldering temperature up to the seating plane; t_{sld} < 7 s	T_{sld}	max.	260	°C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a printed-circuit board	$R_{th\ j\text{-}a}$	=	350	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage					
I_F = 10 mA		V_F	typ.	2,1	V
			<	3	V
Reverse current					
V_R = 5 V		I_R	<	100	μA
Beamwidth between half-intensity directions					
in the plane of the connections		$\alpha_{50\%}$	typ.	50	°
in the plane perpendicular to the connections		$\alpha_{50\%}$	typ.	40	°
Bandwidth at half height		$B_{50\%}$	typ.	45	nm
Wavelength at peak emission		λ_{pk}	typ.	630	nm
Luminous intensity (on-axis)					
I_F = 10 mA	CQX10-I	I_V	min.	0,7	mcd
	CQX10-II	I_V		1,0 to 2,2	mcd
	CQX10-III	I_V		1,6 to 3,5	mcd
	CQX10-IV	I_V	min.	3,0	mcd
Diode capacitance					
V_R = 0; f = 1 MHz		C_d	typ.	35	pF

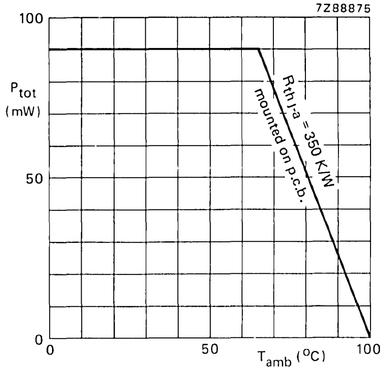


Fig. 2.

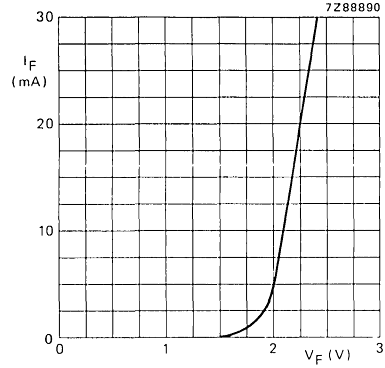


Fig. 3 T_{amb} = 25 °C; typ. values.

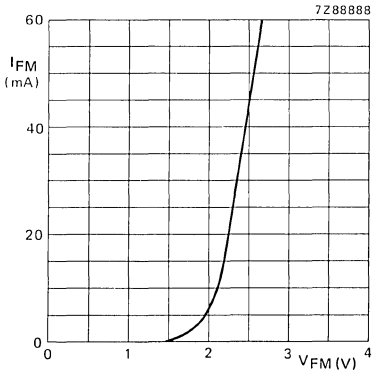


Fig. 4 t_{on} = 50 μs; δ = 0,01; T_{amb} = 25 °C; typ. values.

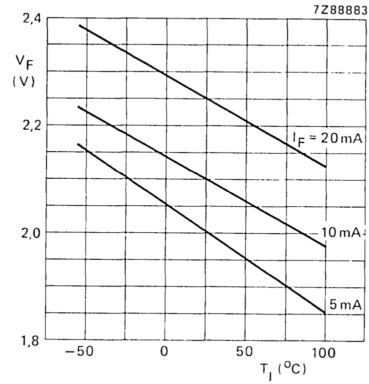


Fig. 5 Typical values.

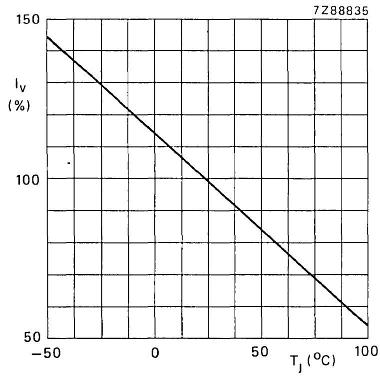


Fig. 6 I_F = 10 mA; typ. values.

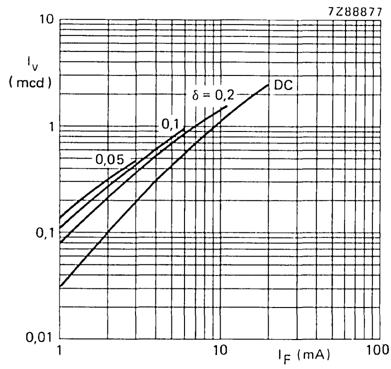


Fig. 7 t_p = 50 μs; typ. values.

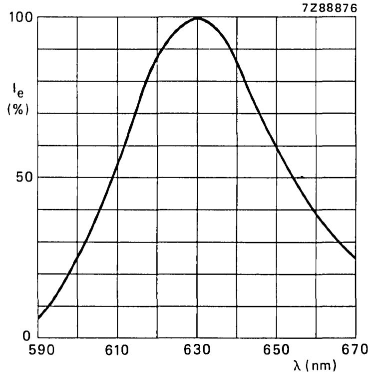


Fig. 8 Typical values.

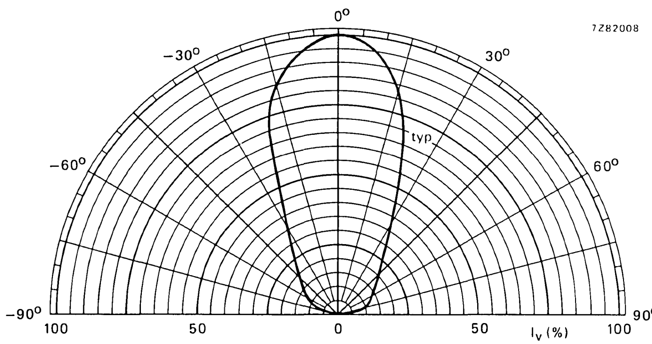


Fig. 9 Spatial distribution in the plane of the connections; typ. values.

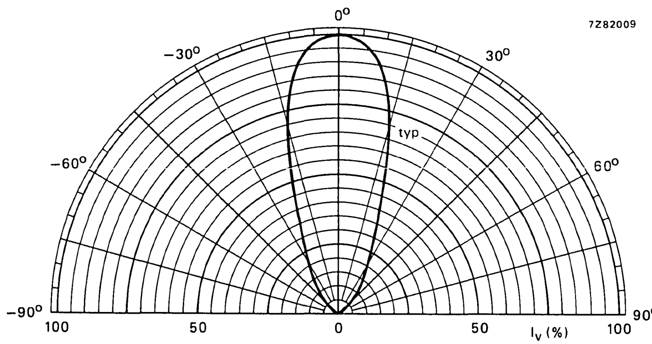


Fig. 10 Spatial distribution in the plane perpendicular to the connections; typ. values.

LIGHT EMITTING DIODE

Light emitting diodes in flat plastic stackable envelopes with rectangular lens (2,5 mm x 5 mm).
The CQX11 emits visible super-green light (GaP) when forward biased.

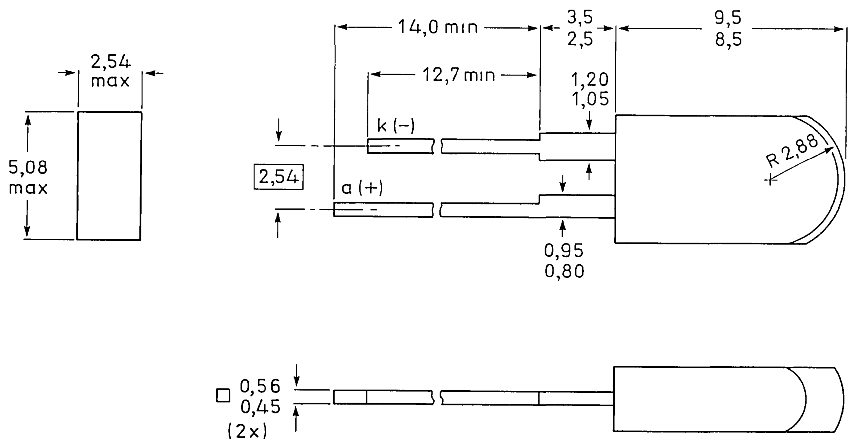
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5	V
Forward current (d.c.)		I_F	max.	60	mA
Total power dissipation up to T_{amb} = 35 °C		P_{tot}	max.	180	mW
Luminous intensity (on-axis)					
I_F = 10 mA	**CQX11-I**	I_V	min.	0,7	mCd
	CQX11-II	I_V		1,0 to 2,2	mCd
	CQX11-III	I_V		1,6 to 3,5	mCd
	CQX11-IV	I_V	min.	3,0	mCd
Wavelength at peak emission		λ_{pk}	typ.	565	nm
Beamwidth between half-intensity directions in the plane of the connections		$\alpha_{50\%}$	typ.	50	°

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-65.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5 V
Forward current			
d.c.	I_F	max.	60 mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_{on} = 1 ms; δ = 0,33	I_{FM}	max.	150 mA
Total power dissipation up to T_{amb} = 35 °C	P_{tot}	max.	180 mW
Storage temperature	T_{stg}	−55 to + 100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature up to the seating plane; t_{sld} < 7 s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 10 mA		V_F	typ.	2,1 V
			max.	3,0 V
Reverse current V_R = 5 V		I_R	max.	100 μA
Beamwidth between half-intensity directions				
in the plane of the connections		$\alpha_{50\%}$	typ.	50 °
in the plane perpendicular to the connections		$\alpha_{50\%}$	typ.	40 °
Bandwidth at half height		$B_{50\%}$	typ.	30 nm
Wavelength at peak emission I_F = 10 mA		λ_{pk}	typ.	565 nm
Luminous intensity (on-axis) I_F = 10 mA	**CQX11-I**	I_v	min.	0,7 mCd
	CQX11-II	I_v		1,0 to 2,2 mCd
	CQX11-III	I_v		1,6 to 3,5 mCd
	CQX11-IV	I_v	min.	3,0 mCd
Diode capacitance V_R = 0; f = 1 MHz		C_d	typ.	35 pF

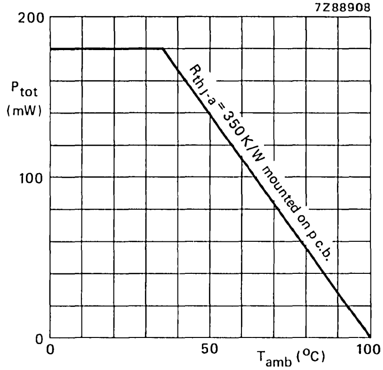


Fig. 2.

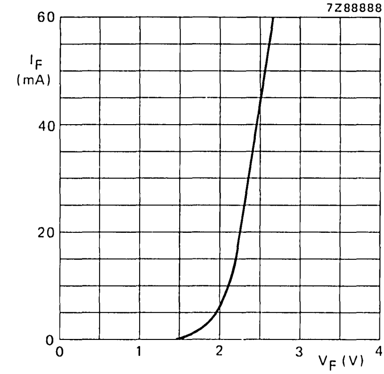


Fig. 3 T_{amb} = 25 °C; typical values.

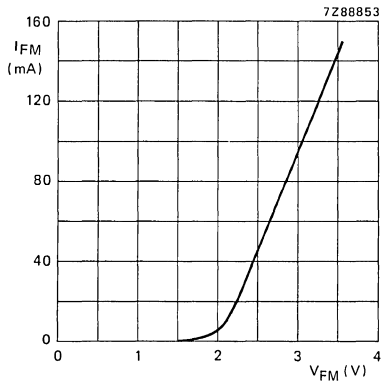


Fig. 4 t_{on} = 50 μs; δ = 0,01; T_{amb} = 25 °C; typical values.

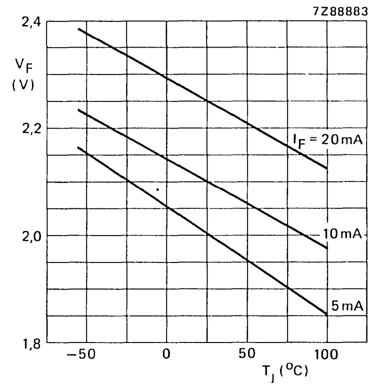


Fig. 5 Typical values.

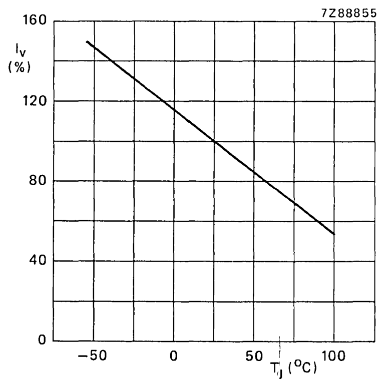


Fig. 6 I_F = 10 mA; typical values.

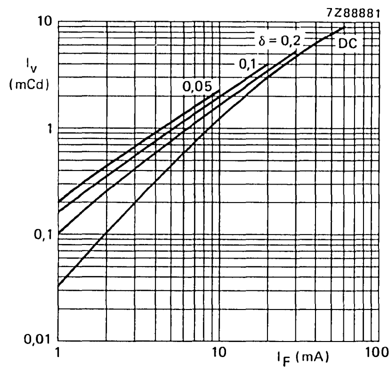


Fig. 7 t_p = 50 μs; typical values.

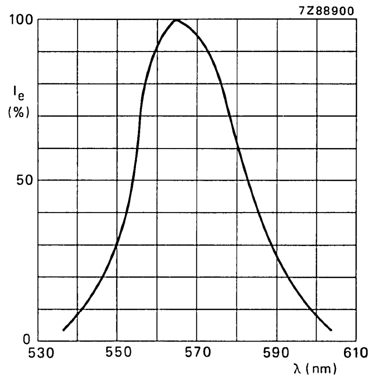


Fig. 8 Typical values.

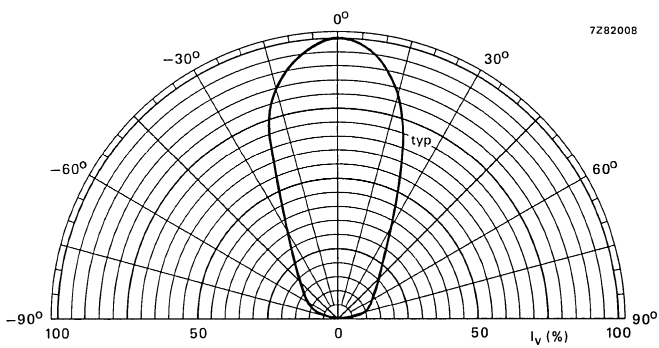


Fig. 9 Spatial distribution in the plane of the connections; typical values.

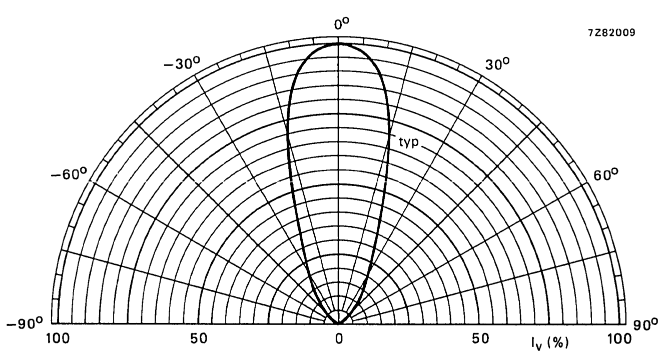


Fig. 10 Spatial distribution in the plane perpendicular to the connections; typical values.

LIGHT EMITTING DIODE

Light emitting diodes in flat plastic stackable envelopes with rectangular lens (2,5 mm x 5 mm).
The CQX12 emits visible yellow light (GaAsP) when forward biased.

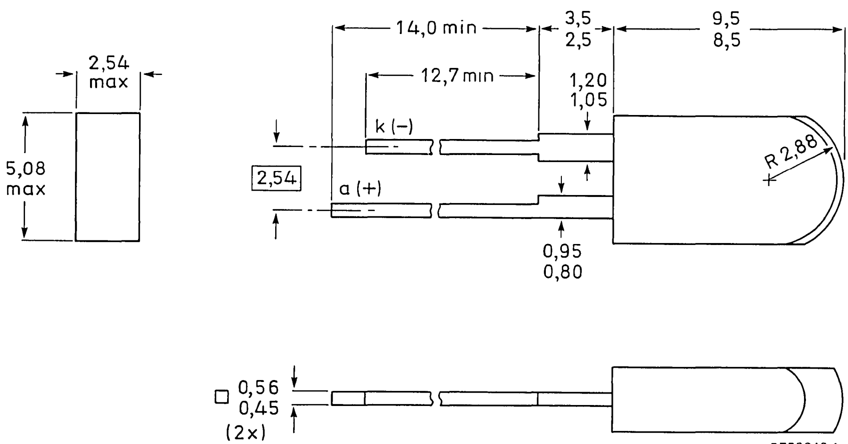
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5	V
Forward current (d.c.)		I_F	max.	30	mA
Total power dissipation up to T_{amb} = 65 °C		P_{tot}	max.	90	mW
Luminous intensity (on-axis)					
I_F = 10 mA	**CQX12-I**	I_V	min.	0,7	mcd
	CQX12-II	I_V		1,0 to 2,2	mcd
	CQX12-III	I_V		1,6 to 3,5	mcd
	CQX12-IV	I_V	min.	3,0	mcd
Wavelength at peak emission		λ_{pk}	typ.	590	nm
Beamwidth between half-intensity directions in the plane of the connections		$\alpha_{50\%}$	typ.	50	°

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-65.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5 V
Forward current			
d.c.	I_F	max.	30 mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_{on} = 1 ms; δ = 0,33	I_{FM}	max.	60 mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	90 mW
Storage temperature	T_{stg}	−55 to + 100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature up to the seating plane; t_{sld} < 7 s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 10 mA		V_F	typ.	2,1 V
			max.	3,0 V
Reverse current V_R = 5 V		I_R	max.	100 μA
Beamwidth between half-intensity directions				
in the plane of the connections		$\alpha_{50\%}$	typ.	50 °
in the plane perpendicular to the connections		$\alpha_{50\%}$	typ.	40 °
Bandwidth at half height		$B_{50\%}$	typ.	40 nm
Wavelength at peak emission I_F = 10 mA		λ_{pk}	typ.	590 nm
Luminous intensity (on-axis) I_F = 10 mA	**CQX12-I**	I_v	min.	0,7 mcd
	CQX12-II	I_v		1,0 to 2,2 mcd
	CQX12-III	I_v		1,6 to 3,5 mcd
	CQX12-IV	I_v	min.	3,0 mcd
Diode capacitance V_R = 0; f = 1 MHz		C_d	typ.	35 pF

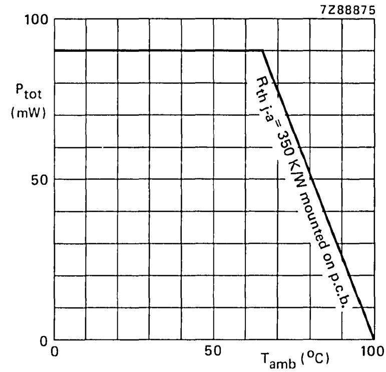


Fig. 2.

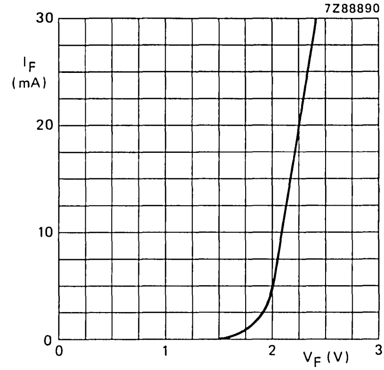


Fig. 3 Typical values.

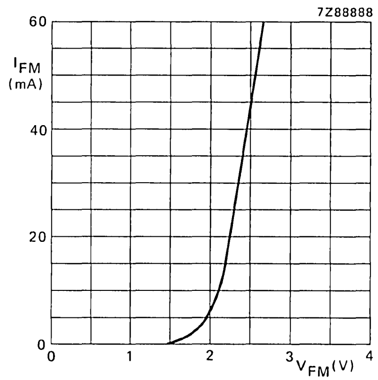


Fig. 4 t_{on} = 50 μs; δ = 0,01;
T_{amb} = 25 °C; typical values.

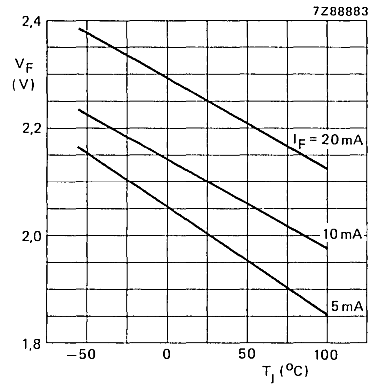


Fig. 5 Typical values.

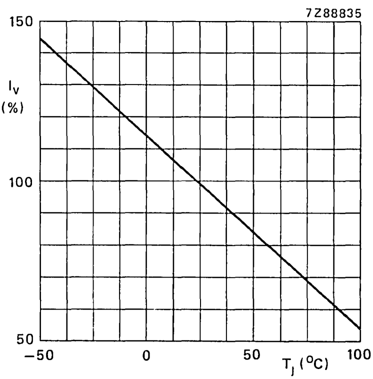


Fig. 6 I_F = 10 mA; typical values.

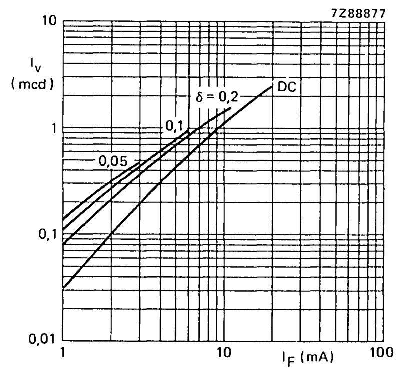


Fig. 7 t_p = 50 μs; typical values.

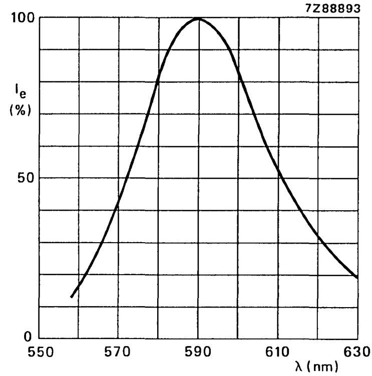


Fig. 8 Typical values.

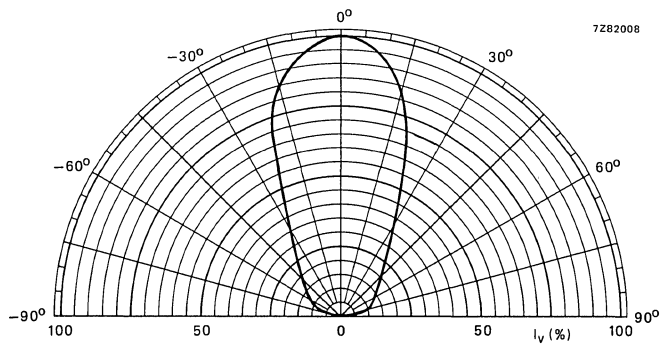


Fig. 9 Spatial distribution in the plane of the connections; typical values.

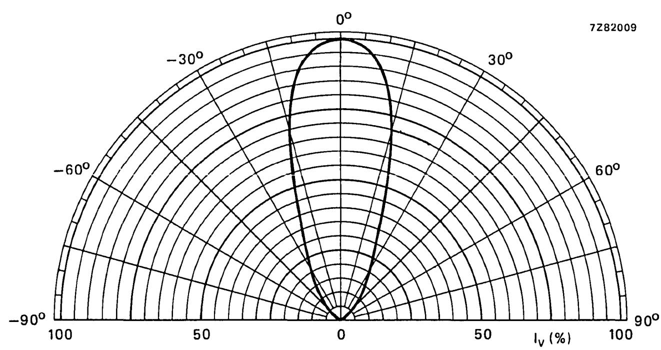


Fig. 10 Spatial distribution in the plane perpendicular to the connections; typical values.

LIGHT EMITTING DIODES

Circular light emitting diodes with diameter of 5 mm which emit a narrow beam hyper-red (GaAlAs) light when forward biased. The CQX24 and CQX24L have a SOD-63 outline and are encapsulated in a transparent non-diffusing resin.

Because of its very high light intensity the CQX24 (and CQX24L) is very suitable in applications where only low currents are available and because this type can withstand high forward currents it is extremely suitable for very high luminous intensity applications.

The CQX24L is the long-lead version of the CQX24 and has no seating plane but is in all other respects equal to the CQX24.

QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5	V
Forward current (d.c.)		I_F	max.	100	mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	215	mW
Junction temperature		T_j	max.	100	°C
Luminous intensity					
I_F = 10 mA	CQX24(L)-I	I_V	min.	20	mCd
	CQX24(L)-II	I_V	min.	50	mCd
	CQX24(L)-III	I_V	min.	100	mCd
Wavelength at peak emission		λ_{pk}	typ.	650	nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	24	°

MECHANICAL DATA

Dimensions in mm

Fig. 1a SOD-63B.
CQX24

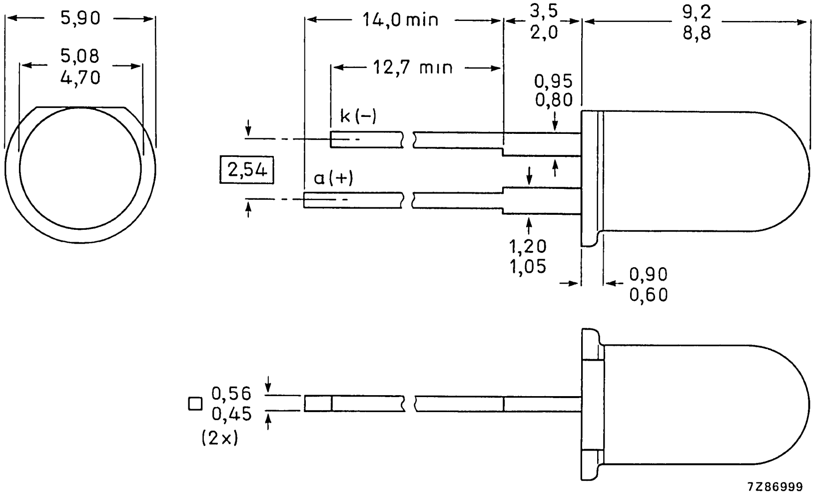
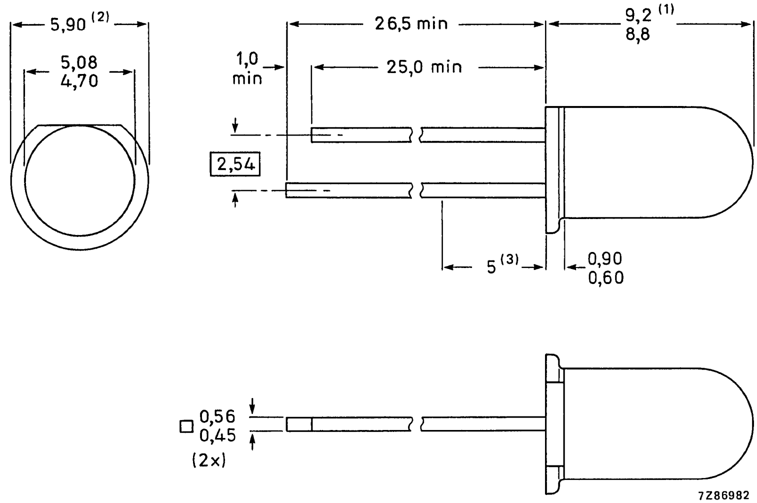


Fig. 1b SOD-63L.
CQX24L



(1) Measured when the device is seated in a gauge with 2 holes 0,80 mm diameter and 2,54 mm apart.
(2) Maximum value including burrs.
(3) Solderability not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5 V
Forward current d.c.	I_F	max.	100 mA
Forward current peak value; t_p = 1 μs; f = 300 Hz peak value; t_{on} = 20 μs; δ = 0,01	I_{FM}	max. max.	1 A 500 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	215 mW
Storage temperature	T_{stg}	−55 to +100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature; t_{sld} < 7 s > 1,5 mm from the seating plane for CQX24 > 5 mm from the plastic body for CQX24L	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 10 mA	V_F	typ.	1,75 V
I_F = 50 mA	V_F	typ. max.	1,9 V 2,5 V

Reverse current					
$V_R = 5$ V		I_R	max.	100	μA
Beamwidth between half-intensity directions					
$I_F = 10$ mA		$\alpha_{50\%}$	typ.	24	°
Bandwidth at half height		$B_{50\%}$	typ.	20	nm
Wavelength at peak emission					
$I_F = 10$ mA; $T_{amb} = 25$ °C		λ_{pk}	typ.	650	nm
Luminous intensity					
$I_F = 4$ mA	CQX24(L)-I	I_V	typ.	16	mCd
	CQX24(L)-II	I_V	typ.	35	mCd
	CQX24(L)-III	I_V	typ.	50	mCd
$I_F = 10$ mA	CQX24(L)-I	I_V	min.	20	mCd
			typ.	40	mCd
	CQX24(L)-II	I_V	min.	50	mCd
			typ.	80	mCd
	CQX24(L)-III	I_V	min.	100	mCd
			typ.	120	mCd
$I_F = 50$ mA	CQX24(L)-I	I_V	typ.	200	mCd
	CQX24(L)-II	I_V	typ.	400	mCd
	CQX24(L)-III	I_V	typ.	600	mCd
Diode capacitance					
$V_R = 0$; f = 1 MHz		C_d	typ.	35	pF

DEVELOPMENT SAMPLE DATA

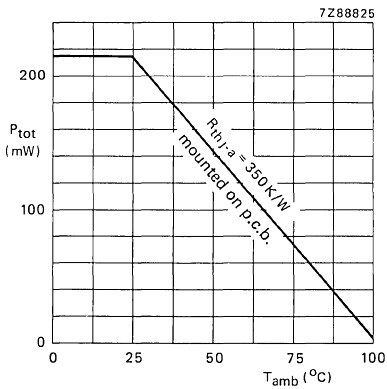


Fig. 2.

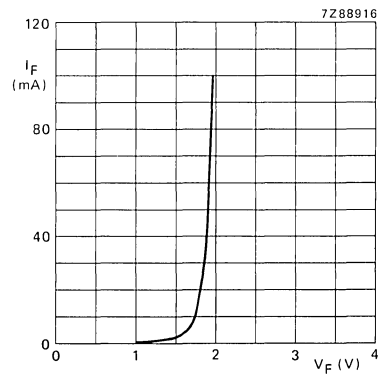


Fig. 3 $T_{amb} = 25$ °C; typ. values.

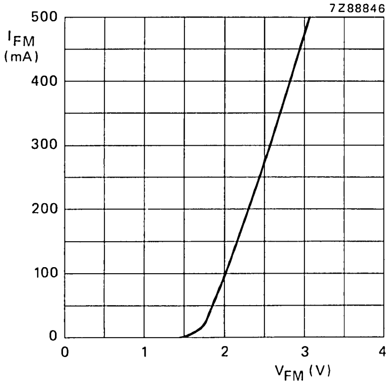


Fig. 4 t_{on} = 20 μs; δ = 0,01; T_{amb} = 25 °C; typ. values.

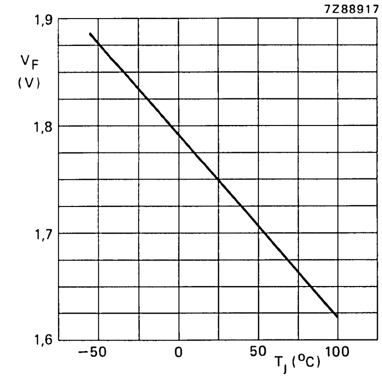


Fig. 5 I_F = 10 mA; typ. values.

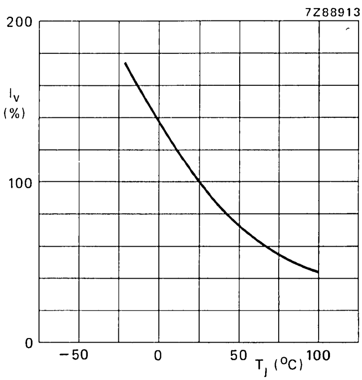


Fig. 6 Typ. values.

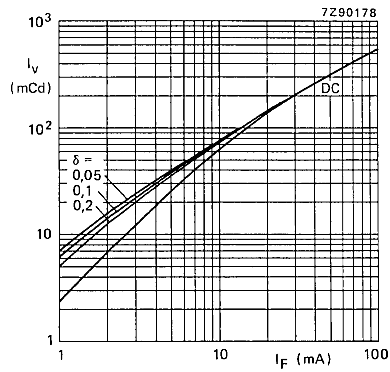


Fig. 7 t_p = 50 μs; typ. values.

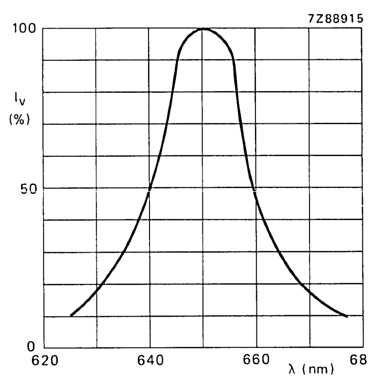


Fig. 8 I_F = 10 mA; T_{amb} = 25 °C; typ. values.

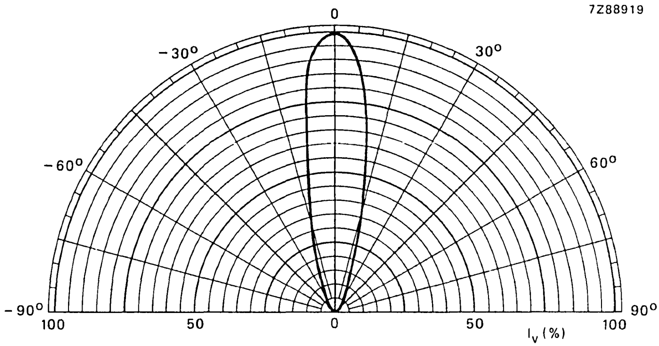


Fig. 9.

HIGH-EFFICIENCY GaAsP RED LIGHT EMITTING DIODE

Gallium arsenide phosphide light emitting diode which emits visible super-red light. Red, light-diffusing plastic envelope.

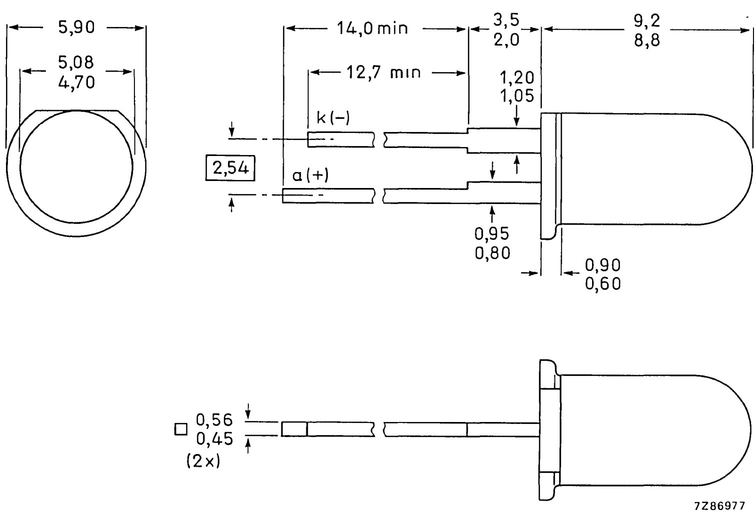
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	3	V
Forward current (d.c.)		I_F	max.	20	mA
Total power dissipation up to T_{amb} = 55 °C		P_{tot}	max.	60	mW
Luminous intensity (on-axis) at I_F = 10 mA	**CQX51-I**	I_V	min.	1,6	mCd
	CQX51-II	I_V	3 to	7	mCd
	CQX51-III	I_V	5 to	11	mCd
Wavelength at peak emission		λ_{pk}	typ.	630	nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	55°	

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-63A.



Accessories for panel mounting (panel thickness < 4 mm)

Plastic clip and ring
black type RTC757
colourless type RTC758

Hole diameter
6,4 mm for panel thickness < 3 mm
6,5 mm for panel thickness > 3 mm

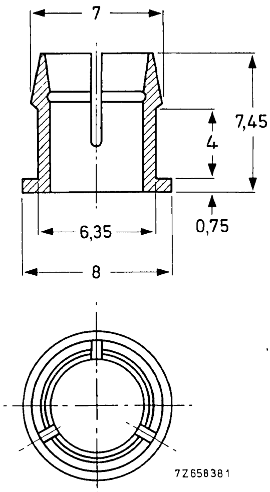


Fig. 2.

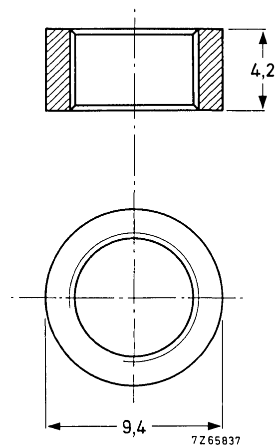


Fig. 3.

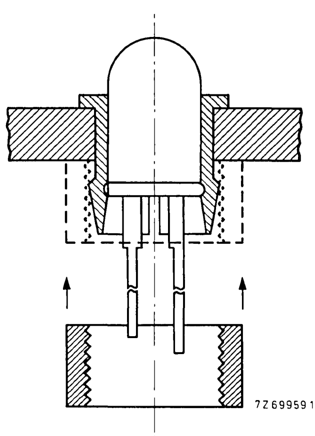


Fig. 4.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	3 V
Forward current (d.c.)	I_F	max.	20 mA
Forward current (peak value)			
t_p = 1 ms; δ = 0,33	I_{FM}	max.	60 mA
t_p = 1 μs ; f = 300 Hz	I_{FM}	max.	1000 mA
Total power dissipation up to T_{amb} = 55 °C	P_{tot}	max.	60 mW
Storage temperature	T_{stg}	−55 to + 100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature			
> 1,5 mm from the seating plane; t_{sld} < 7 s	T_{sld}	max.	230 °C

THERMAL RESISTANCE

From junction to ambient

in free air	$R_{th\ j\text{-}a}$	=	750 K/W
mounted on a printed-circuit board	$R_{th\ j\text{-}a}$	=	500 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage				
I_F = 10 mA		V_F	typ.	2,1 V
			<	3 V
Reverse current				
V_R = 3 V		I_R	<	100 μA
Diode capacitance				
V_R = 0; f = 1 MHz		C_d	typ.	35 pF
Luminous intensity (on-axis)				
I_F = 10 mA	**CQX51-I**	I_V	min.	1,6 mCd
	CQX51-II	I_V		3 to 7 mCd
	CQX51-III	I_V		5 to 11 mCd
Wavelength at peak emission		λ_{pk}	typ.	630 nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	55°

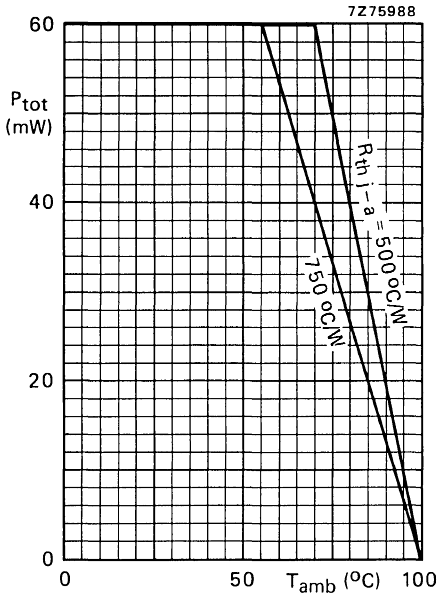


Fig. 5 Maximum permissible power dissipation as a function of ambient temperature.

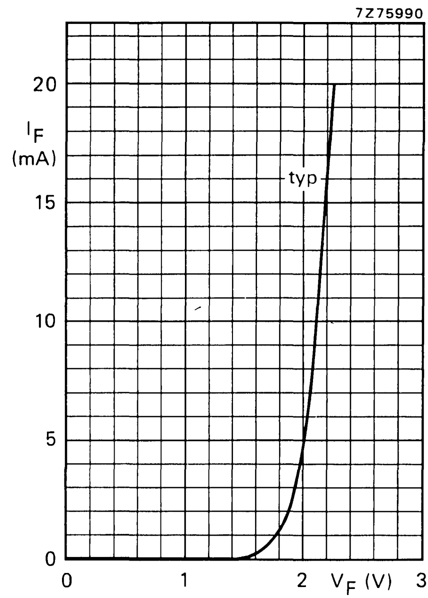


Fig. 6 T_j = 25 °C.

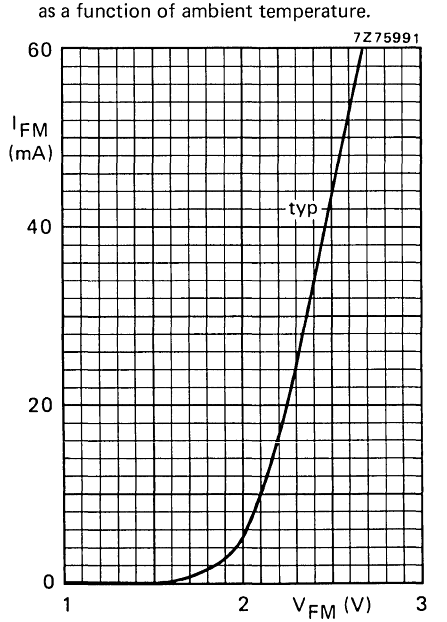


Fig. 7 t_p = 50 μs; T = 5 ms; T_j = 25 °C.

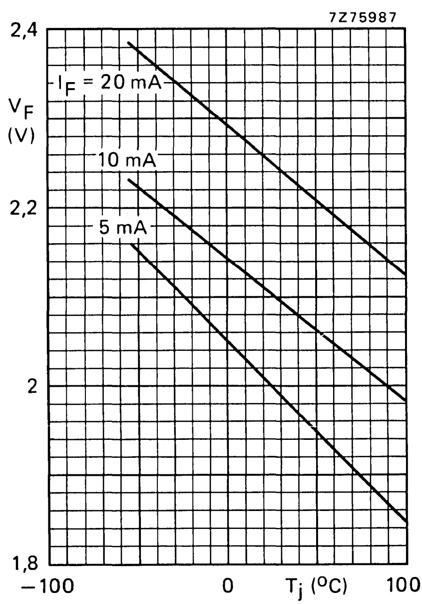


Fig. 8 Typical values.

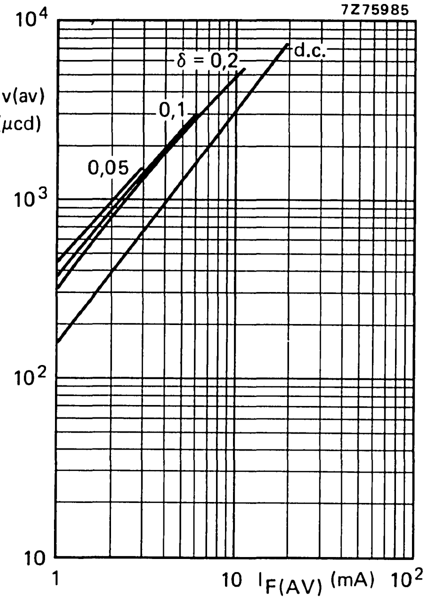


Fig. 9 Typical values; $T_j = 25\ ^oC$.

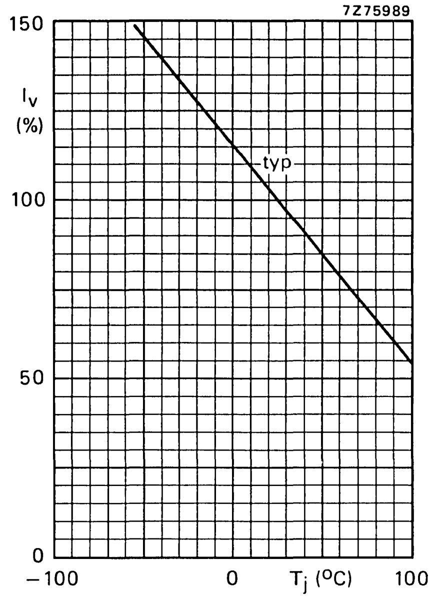


Fig. 10 $I_F = 10$ mA.

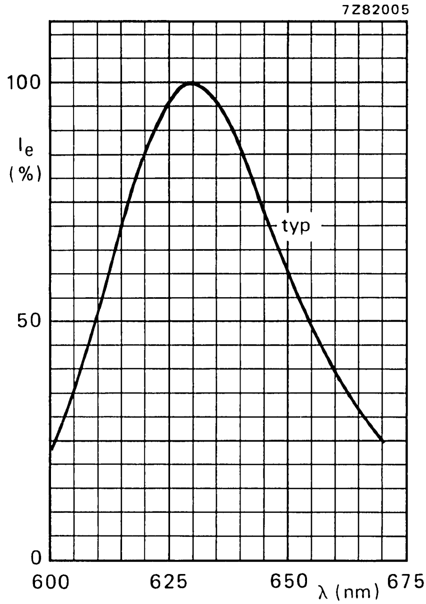

7Z82005
100
I_e
(%)
typ
50
0
600
625
650
λ (nm)
675

Fig. 11.

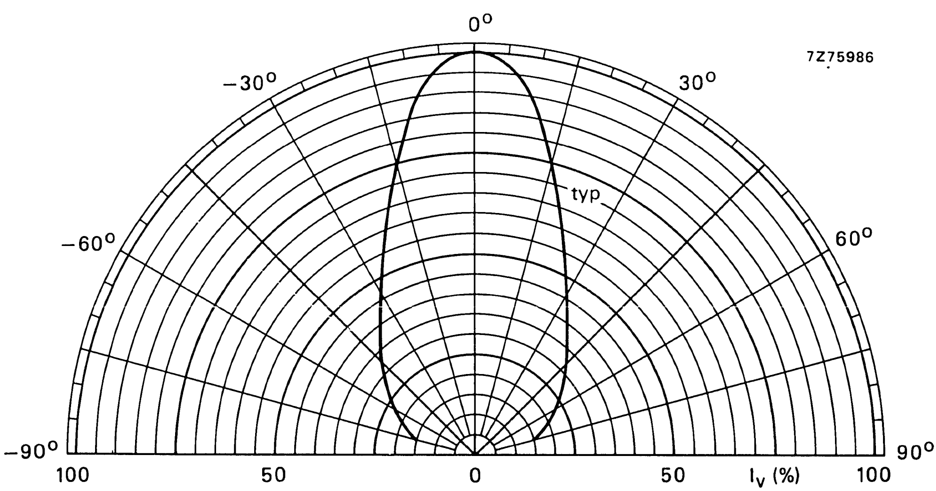

0°
7Z75986
−30°
30°
typ
−60°
60°
−90°
90°
100
50
0
50
I_v (%)
100

Fig. 12.

LIGHT EMITTING DIODES

Circular light emitting diodes with diameter of 5 mm which emit a narrow-beam super-red (GaAsP) light when forward biased.

The CQX54 and CQX54L have a SOD-63 outline and are encapsulated in a transparent non-diffusing resin.

The CQX54L is the long-lead version of the CQX54 and has no seating plane but is in all other respects equal to the CQX54.

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	5 V
Forward current (d.c.)	I_F	max.	30 mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	90 mW
Junction temperature	T_j	max.	100 °C
Luminous intensity I_F = 10 mA	I_V	min.	15 mCd
		typ.	20 mCd
Wavelength at peak emission	λ_{pk}	typ.	630 nm
Beamwidth between half-intensity directions	$\alpha_{50\%}$	typ.	20 °

MECHANICAL DATA

Dimensions in mm

Fig. 1a SOD-63A.
CQX54

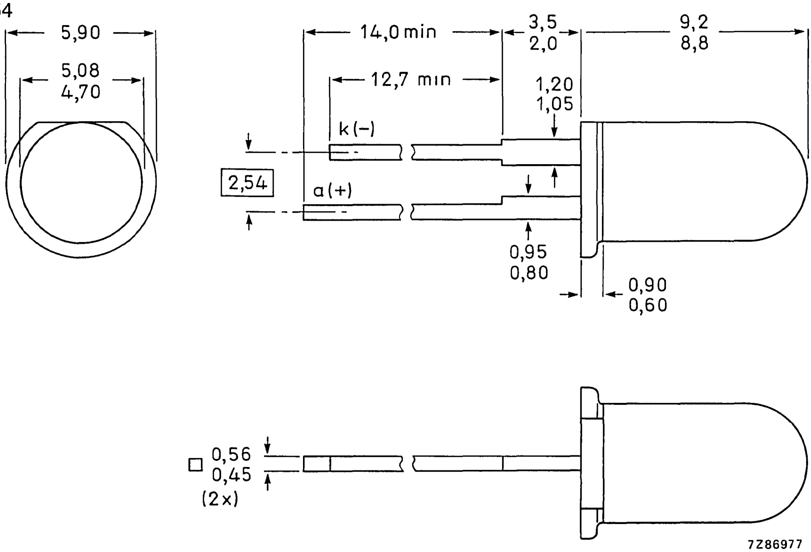
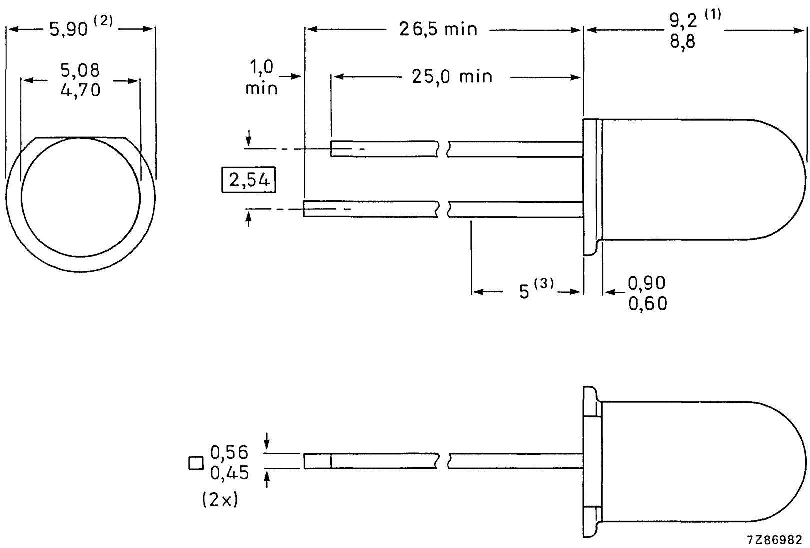


Fig. 1b SOD-63L.
CQX54L



Notes

1. Dimension measured when the device is seated in a gauge with 2 holes of 0,80 mm diameter and 2,54 mm apart.
2. For the maximum value including plastic burrs.
3. Solderability is not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5 V
Forward current d.c.	I_F	max.	30 mA
Forward current peak value; t_p = 1 μs; f = 300 Hz peak value; t_p = 1 ms; δ = 0,33	I_{FM}	max.	1 A 60 mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	90 mW
Storage temperature	T_{stg}		−55 to + 100 °C
Junction temperature	T_j	max.	100 °C
Lead soldering temperature > 1,5 mm from the seating plane; t_{sld} < 7 s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\,j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 10 mA	V_F	typ.	2,1 V
		max.	3,0 V
Reverse current V_R = 5 V	I_R	max.	100 μA
Beamwidth between half-intensity directions	$\alpha_{50\%}$	typ.	20 °
Bandwidth at half height	$B_{50\%}$	typ.	30 nm
Wavelength at peak emission	λ_{pk}	typ.	565 nm
Luminous intensity I_F = 10 mA	I_v	min.	15 mCd
		typ.	20 mCd
Diode capacitance V_R = 0; f = 1 MHz	C_d	typ.	35 pF

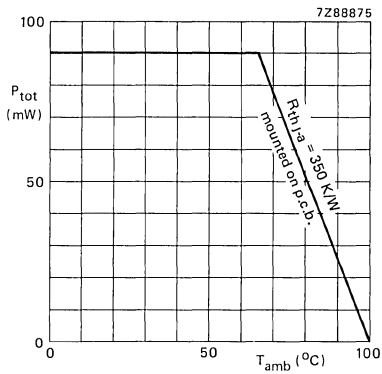


Fig. 2.

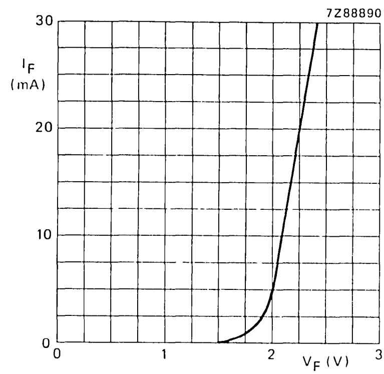


Fig. 3 T_{amb} = 25 °C; typ. values.

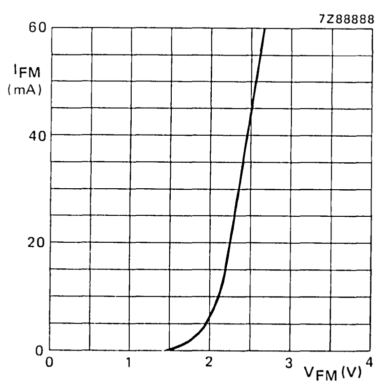


Fig. 4 t_{on} = 50 μs; δ = 0,01; T_{amb} = 25 °C; typ. values.

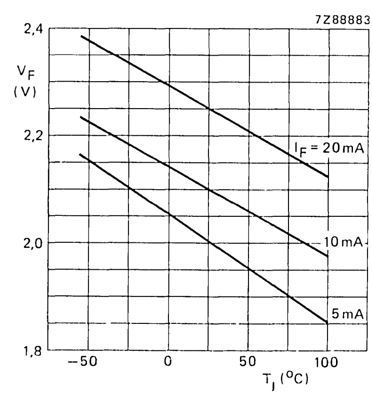


Fig. 5 Typical values.

DEVELOPMENT SAMPLE DATA

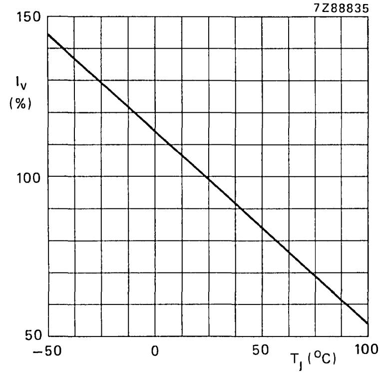


Fig. 6 Typical values.

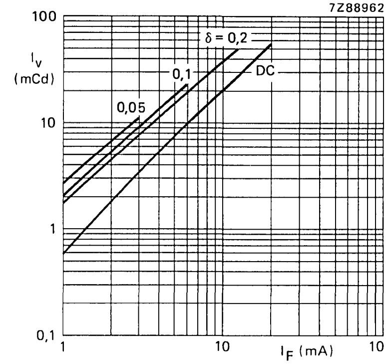


Fig. 7 $t_p = 50\ \mu s$; typ. values.

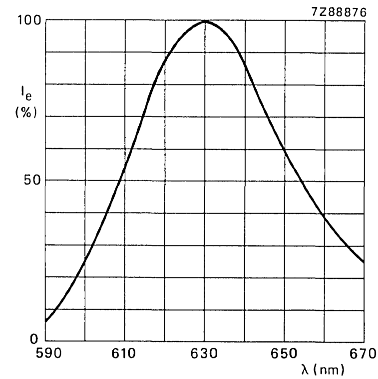


Fig. 8 Typical values.

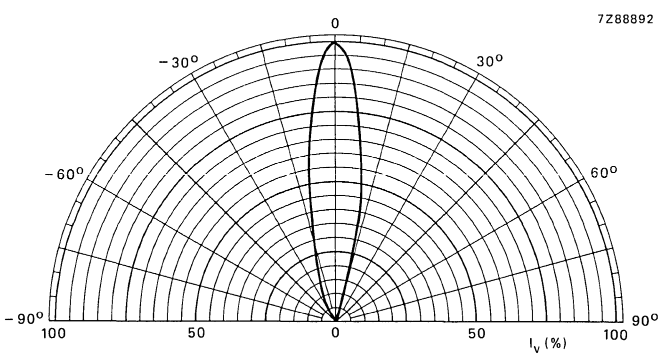


Fig. 9 $I_F = 10$ mA; typ. values.

LIGHT EMITTING DIODES

Circular light emitting diodes with diameter of 5 mm which emit a super-green (GaP) narrow light beam when forward biased.

The CQX64 and CQX64L have a SOD-63 outline and are encapsulated in a transparent non-diffusing resin. Because of its resistance to high forward currents the CQX64 (and CQX64L) is very suitable in applications where a high luminous intensity is wanted, but also very suitable in those applications where only low currents are available.

The CQX64L is the long-lead version of the CQX64 and has no seating plane but is in all other respects equal to the CQX64.

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	5	V
Forward current (d.c.)	I_F	max.	60	mA
Total power dissipation up to T_{amb} = 35 °C	P_{tot}	max.	180	mW
Junction temperature	T_j	max.	100	°C
Luminous intensity I_F = 10 mA	I_V	min.	15	mCd
Wavelength at peak emission	λ_{pk}	typ.	565	nm
Beamwidth between half-intensity directions	$\alpha_{50\%}$	typ.	20	°

MECHANICAL DATA

Dimensions in mm

Fig. 1a SOD-63A.

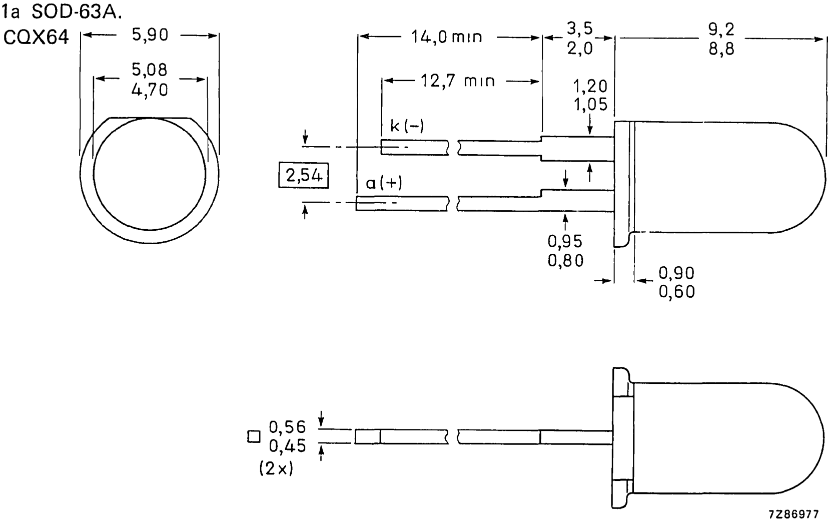
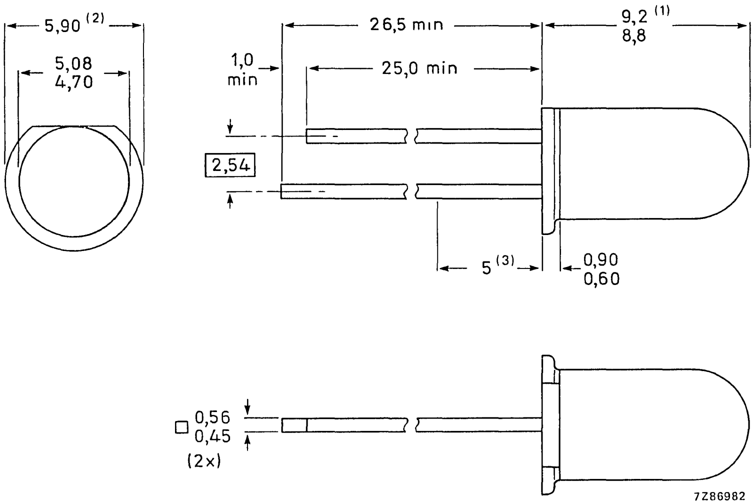


Fig. 1b SOD-63L.
CQX64L



Notes

1. Measured when the device is seated in a gauge with holes 0,80 mm diameter and 2,54 mm apart.
2. Maximum value including plastic burrs.
3. Solderability not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5 V
Forward current d.c.	I_F	max.	60 mA
Forward current peak value; t_p = 1 μs; f = 300 Hz peak value; t_p = 1 ms; δ = 0,33	I_{FM}	max. max.	1 A 150 mA
Total power dissipation up to T_{amb} = 35 ^oC	P_{tot}	max.	180 mW
Storage temperature	T_{stg}	−55 to +100	^oC
Junction temperature	T_j	max.	100 ^oC
Lead soldering temperature; $t_{sld} < 7$ s $>$ 1,5 mm from the seating plane for CQX64 $>$ 5 mm from the plastic body for CQX64L	T_{sld}	max.	260 ^oC

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_j = 25 ^oC unless otherwise specified

Forward voltage I_F = 10 mA	V_F	typ. max.	2,1 V 3,0 V
Reverse current V_R = 5 V	I_R	max.	100 μA

Beamwidth between half-intensity directions	$\alpha_{50\%}$	typ.	20 °
Bandwidth at half height	$B_{50\%}$	typ.	30 nm
Wavelength at peak emission	λ_{pk}	typ.	565 nm
Luminous intensity I_F = 10 mA	I_v	min. typ.	15 mCd 20 mCd
Diode capacitance V_R = 0; f = 1 MHz	C_d	typ.	35 pF

DEVELOPMENT SAMPLE DATA

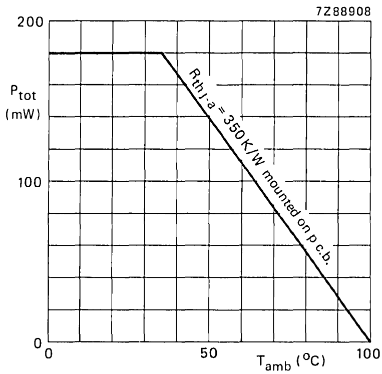


Fig. 2.

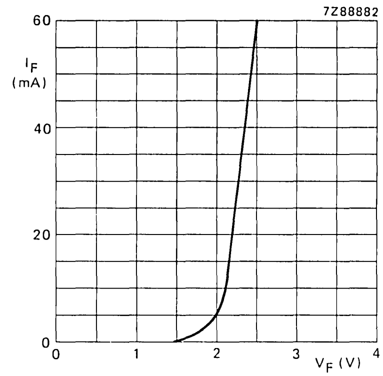


Fig. 3 T_{amb} = 25 °C; typ. values.

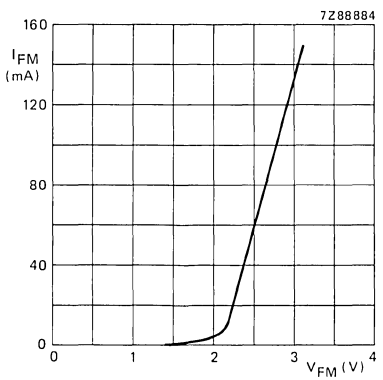


Fig. 4 t_{on} = 1 ms; δ = 0,33; T_{amb} = 25 °C; typ. values.

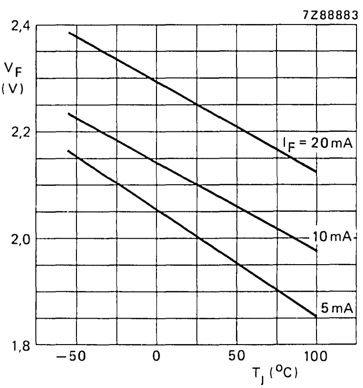


Fig. 5 Typical values.

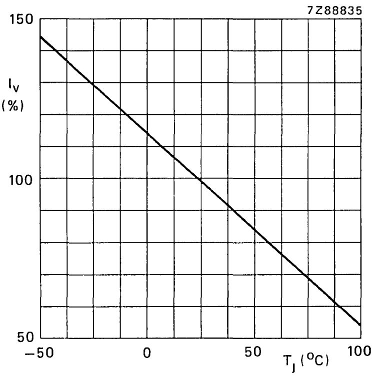


Fig. 6 Typical values.

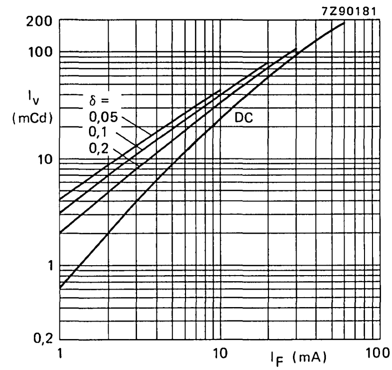


Fig. 7 t_p = 50 μs; typ. values.

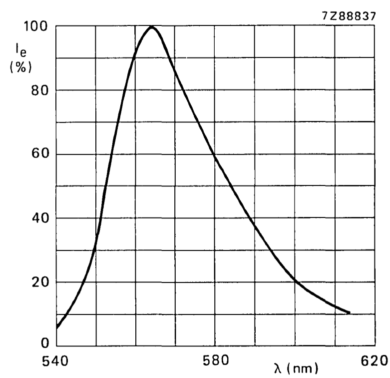


Fig. 8 I_F = 10 mA; typ. values.

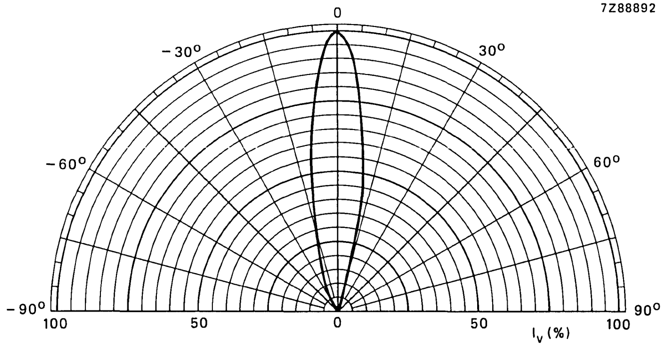


Fig. 9 I_F = 10 mA; typ. values.

LIGHT EMITTING DIODES

Circular light emitting diodes with diameter of 5 mm which emit a narrow-beam yellow (GaPAs) light when forward biased.

The CQX74 and CQX74L have a SOD-63 outline and are encapsulated in a transparent non-diffusing resin. The CQX74Y is equal but has a yellow-coloured non-diffusing resin.

The CQX74L is the long-lead version of the CQX74 and has no seating plane but is in all other respects equal to the CQX74.

QUICK REFERENCE DATA

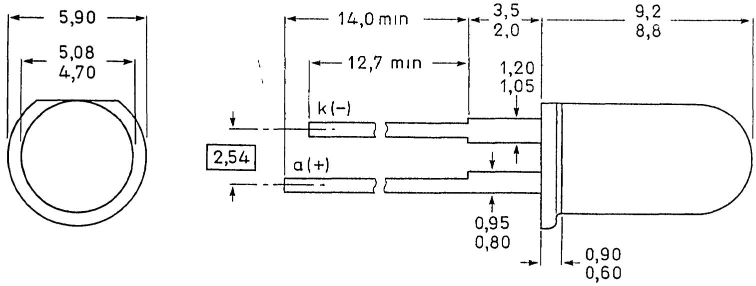
Continuous reverse voltage	V_R	max.	5	V
Forward current (d.c.)	I_F	max.	30	mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	90	mW
Junction temperature	T_j	max.	100	°C
Luminous intensity I_F = 10 mA	I_v	min. typ.	15 20	mcd mcd
Wavelength at peak emission	λ_{pk}	typ.	590	nm
Beamwidth between half-intensity directions	$\alpha_{50\%}$	typ.	20	°

MECHANICAL DATA

Dimensions in mm

Fig. 1a SOD-63A.

CQX74/74Y



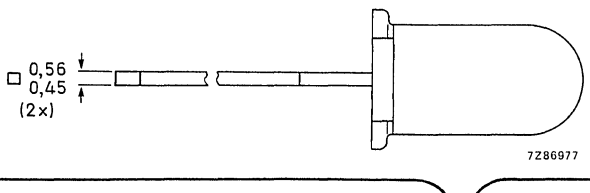
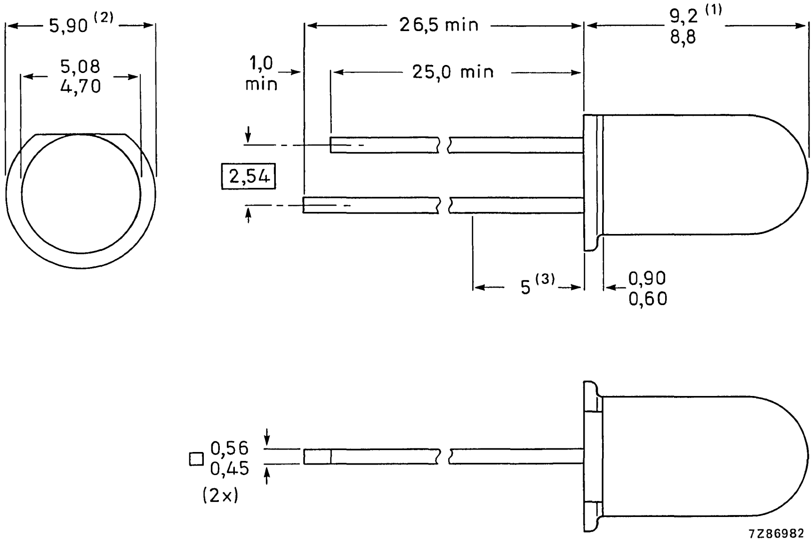


Fig. 1b SOD-63L.
CQX74L



(1) Measured when the device is seated in a gauge with 2 holes 0,80 mm diameter and 2,54 mm apart.
(2) Maximum value including burrs.
(3) Solderability not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5 V
Forward current d.c.	I_F	max.	30 mA
Forward current peak value; t_p = 1 μs; f = 300 Hz peak value; t_{on} = 1 ms; δ = 0,33	I_{FM}	max. max.	1 A 60 mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	90 mV
Storage temperature	T_{stg}	−55 to	+100 °C
Junction temperature	T_j	max.	100 °C
Lead soldering temperature; t_{sld} < 7 s > 1,5 mm from the seating plane for CQX74/74Y > 5 mm from the plastic body for CQX74L	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 10 mA	V_F	typ. / max.	2,1 V / 3,0 V
Reverse current V_R = 5 V	I_R	max.	100 μA
Beamwidth between half-intensity directions I_F = 10 mA	$\alpha_{50\%}$	typ.	20 °
Bandwidth at half height	$B_{50\%}$	typ.	40 nm
Wavelength at peak emission I_F = 10 mA	λ_{pk}	typ.	590 nm
Luminous intensity I_F = 10 mA	I_v	min. / typ.	15 mCd / 20 mCd
Diode capacitance V_R = 0; f = 1 MHz	C_d	typ.	35 pF

DEVELOPMENT SAMPLE DATA

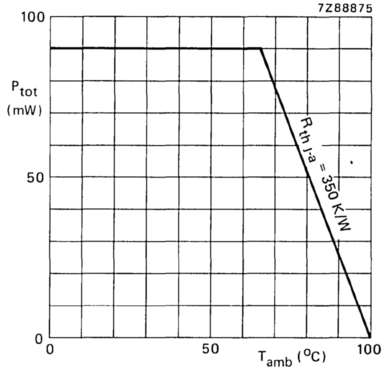


Fig. 2.

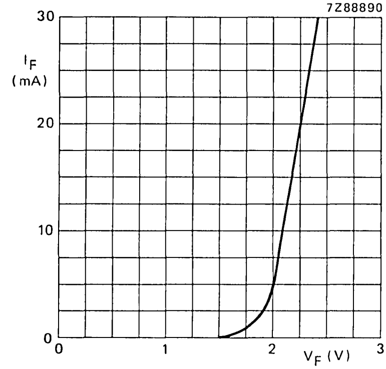


Fig. 3 T_j = 25 °C; typ. values.

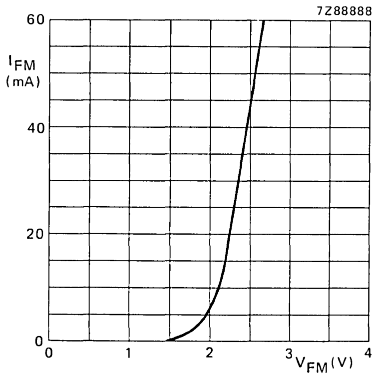


Fig. 4 t_{on} = 50 μs; δ = 0,01;
T_{amb} = 25 °C; typ. values.

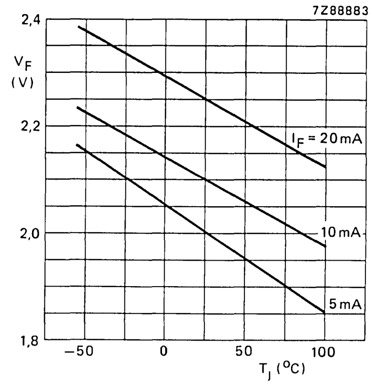


Fig. 5 Typical values.

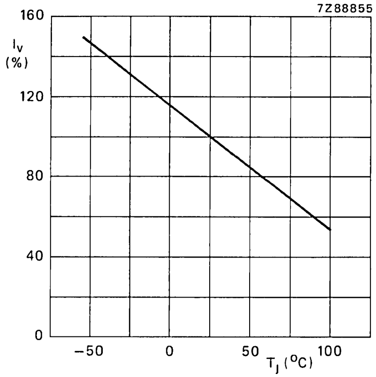


Fig. 6 I_F = 10 mA; typ. values.

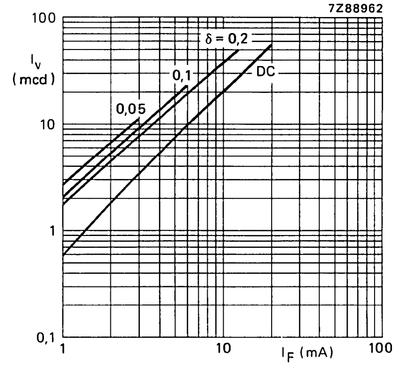


Fig. 7 t_p = 50 μs; typ. values.

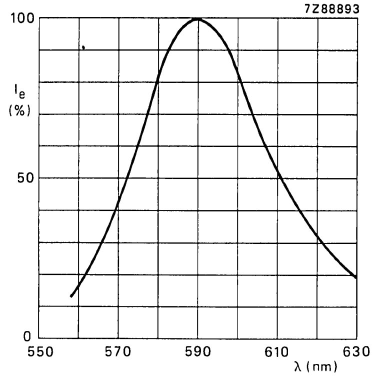


Fig. 8 Typical values.

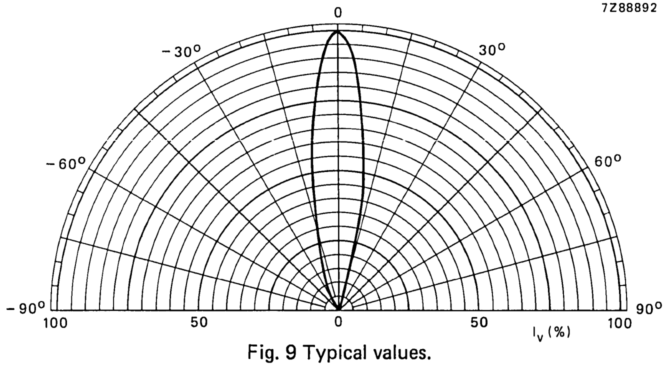


Fig. 9 Typical values.

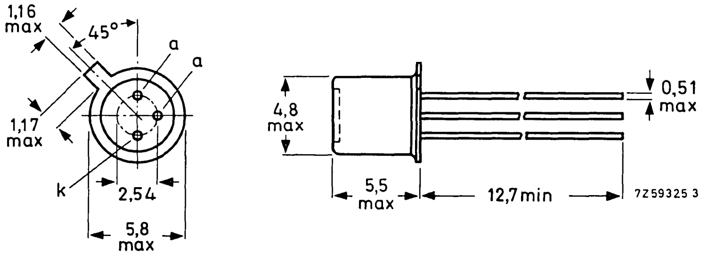
GaAs LIGHT EMITTING DIODE

Gallium arsenide light emitting diode intended for optical coupling and encoding. It emits radiation in the near infrared when forward biased. The diode is provided with a flat glass window.

QUICK REFERENCE DATA				
Continuous reverse voltage	V_R	max.	2	V
Forward current (d.c.)	I_F	max.	30	mA
Forward current (peak value) t_p = 100 μs; δ = 0,1	I_{FM}	max.	200	mA
Total power dissipation up to T_{amb} = 95 °C	P_{tot}	max.	50	mW
Total radiant power at I_F = 20 mA	ϕ_e	>	60	μW
		typ.	100	μW
Radiant intensity (on-axis) at I_F = 20 mA	I_e	typ.	64	μW/sr
Light rise time at $I_{F\,on}$ = 20 mA	t_r	<	100	ns
Light fall time at $I_{F\,on}$ = 20 mA	t_f	<	100	ns
Wavelength at peak emission	λ_{pk}	typ.	880	nm
Thermal resistance from junction to ambient	$R_{th\,j-a}$	=	0,6	°C/mW

MECHANICAL DATA Dimensions in mm

TO-18, except for window



Max. lead diameter is guaranteed only for 12,7 mm

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltage				
Continuous reverse voltage	V_R	max.	2	V
Current				
Forward current (d. c.)	I_F	max.	30	mA
Forward current (peak value) t_p = 100 μs; δ = 0, 1	I_{FM}	max.	200	mA
Power dissipation				
Total power dissipation up to T_{amb} = 95 °C	P_{tot}	max.	50	mW
Temperature				
Storage temperature	T_{stg}		−55 to + 150	°C
Operating junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0, 6	°C/mW
From junction to case	$R_{th\ j\text{-}c}$	=	0, 22	°C/mW

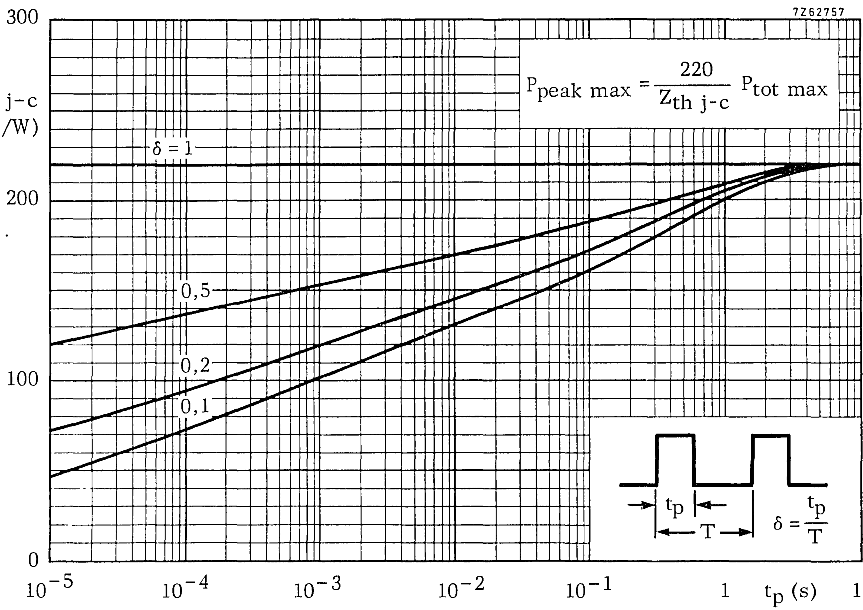
CHARACTERISTICS T_{amb} = 25 °C unless otherwise specified

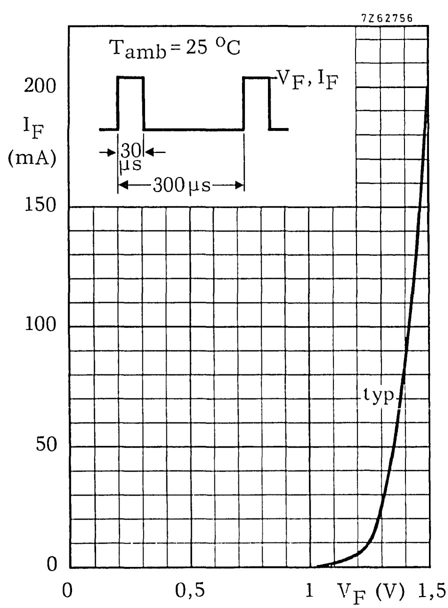
Forward voltage at I_F = 30 mA	V_F	typ.	1, 3	V
		<	1, 6	V
I_{FM} = 0, 2 A	V_F	typ.	1, 5	V
Reverse current at V_R = 2 V	I_R	<	0, 5	mA
Diode capacitance at f = 1 MHz; V_R = 0	C_d	typ.	65	pF

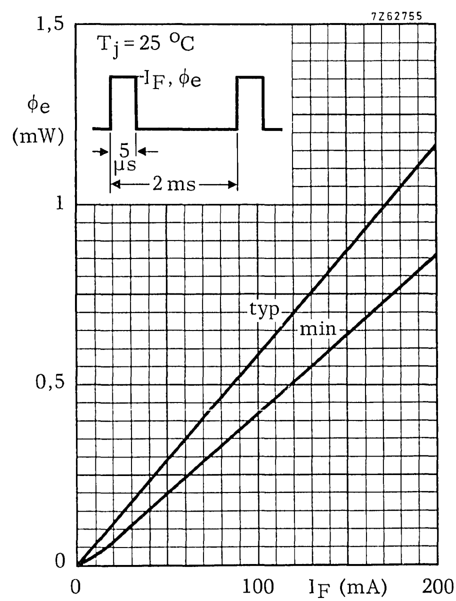
CHARACTERISTICS (continued) T_{amb} = 25 °C unless otherwise specified

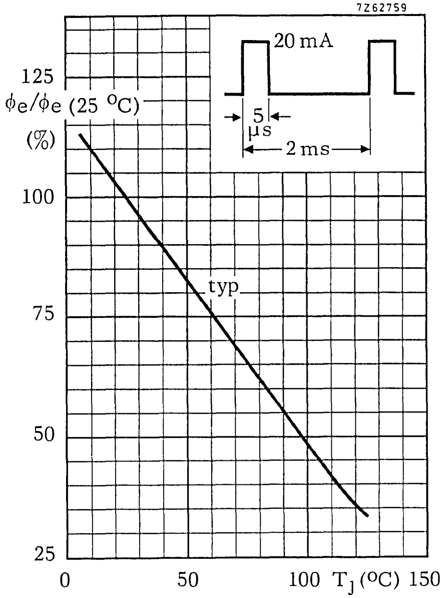
Radiant output power at I_F = 20 mA	ϕ_e	>	60	μW
		typ.	100	μW
I_F = 20 mA; T_j = 100 °C	ϕ_e	typ.	50	μW
I_F = 200 mA [1]	ϕ_e	typ.	1, 16	mW
Radiant intensity (on-axis) at I_F = 20 mA	I_e	typ.	64	μW/sr
Radiance at I_F = 20 mA	L_e	typ.	1, 6	mW/mm^2sr
I_F = 200 mA [1]	L_e	typ.	15	mW/mm^2sr
Emissive area	A_e	typ.	0, 04	mm^2
Wavelength at peak emission	λ_{pk}	typ.	880	nm
Bandwidth at half height	$\Delta\lambda$	typ.	40	nm
Light rise time at I_{Fon} = 20 mA	t_r	typ.	30	ns
		<	100	ns
Light fall time at I_{Fon} = 20 mA	t_f	typ.	30	ns
		<	100	ns

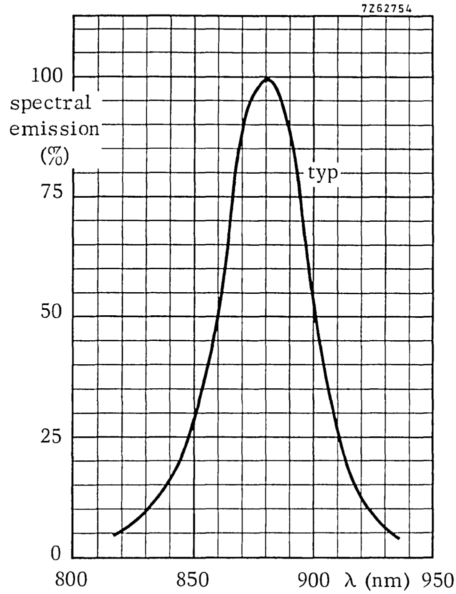
[1] t_p = 100 μs; δ = 0, 1.

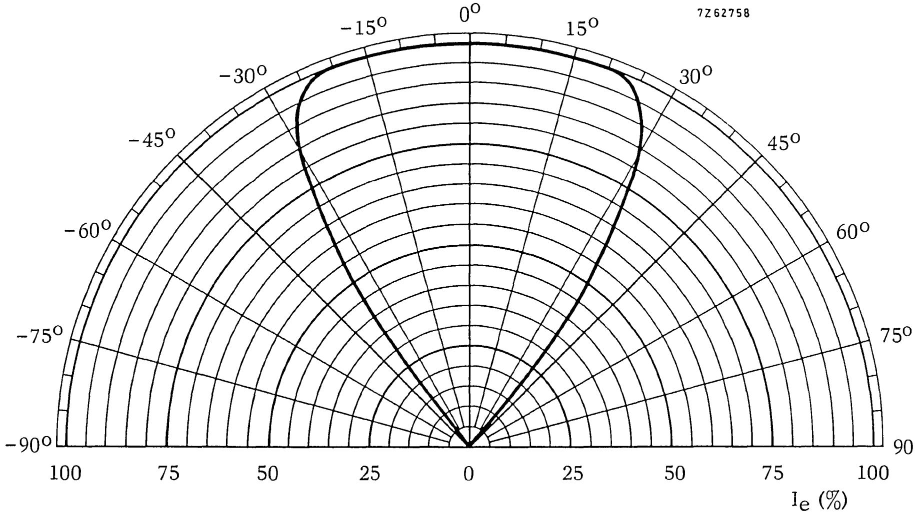

7Z62757
300
200
100
0
Zth j-c
(°C/W)
δ = 1
0,5
0,2
0,1
Ppeak max = 220 / Zth j-c Ptot max
tp
T
δ = tp / T
10−5
10−4
10−3
10−2
10−1
1
tp (s)
10


7Z62756
Tamb = 25 °C
VF, IF
30 µs
300 µs
200
150
100
50
0
IF
(mA)
typ
0
0,5
1
VF (V)
1,5


7Z62755
Tj = 25 °C
IF, φe
5 µs
2 ms
1,5
1
0,5
0
φe
(mW)
typ
min
0
100
IF (mA)
200


7Z62759
20 mA
5 μs
2 ms
125
ϕ_e/ϕ_e (25 °C)
(%)
100
typ
75
50
25
0
50
100
T_J (°C)
150


7Z62754
100
spectral emission
(%)
75
typ
50
25
0
800
850
900
λ (nm)
950


7Z62758
0°
-15°
15°
-30°
30°
-45°
45°
-60°
60°
-75°
75°
-90°
90°
100
75
50
25
0
25
50
75
100
I_e (%)

GALLIUM ARSENIDE LIGHT EMITTING DIODE

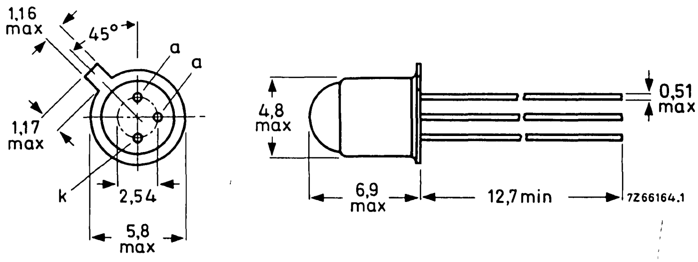
Gallium arsenide light emitting diode intended for optical coupling and encoding. It emits radiation in the near infrared when forward biased. Suitable for combination with photo-transistor BPX25 or BPX72.

QUICK REFERENCE DATA				
Continuous reverse voltage	V_R	max.	2	V
Forward current (d.c.)	I_F	max.	30	mA
Forward current (peak value)	I_{FM}	max.	200	mA
Total power dissipation up to T_{amb} = 95 °C	P_{tot}	max.	50	mW
Total radiant power at I_F = 20 mA	ϕe	typ.	50	μW
Radiant intensity (on-axis) at I_F = 20 mA	I_e	typ.	1,25	mW/sr
Light rise time at I_{Fon} = 20 mA	t_r	<	100	ns
Light fall time at I_{Fon} = 20 mA	t_f	<	100	ns
Wavelength at peak emission	λ_{pk}	typ.	880	nm
Thermal resistance from junction to ambient	$R_{th\ j-a}$	=	0,6	°C/mW

MECHANICAL DATA

Dimensions in mm

TO-18, except for lens



RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltage				
Continuous reverse voltage	V_R	max.	2	V
Current				
Forward current (d.c.)	I_F	max.	30	mA
Forward current (peak value) t_p = 100 μs; δ = 0,1	I_{FM}	max.	200	mA
Power dissipation				
Total power dissipation up to T_{amb} = 95 °C	P_{tot}	max.	50	mW
Temperature				
Storage temperature	T_{stg}		−55 to + 150	°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j-a}$	=	0,6	°C/mW
From junction to case	$R_{th\ j-c}$	=	0,22	°C/mW

CHARACTERISTICS T_{amb} = 25 °C unless otherwise specified

Forward voltage				
I_F = 30 mA	V_F	typ.	1,3	V
		<	1,6	V
I_{FM} = 200 mA	V_F'	typ.	1,5	V
Reverse current				
V_R = 2 V	I_R	<	0,5	mA
Diode capacitance				
V_R = 0; f = 20 MHz	C_d	typ.	25	pF
Total radiant power				
I_F = 20 mA	ϕ_e	typ.	50	μW
Radiant intensity (on-axis)				
I_F = 20 mA	I_e	typ.	1,25	mW/sr

CHARACTERISTICS (continued)

Mean irradiance

on a receiving area with D = 2 mm at a distance a = 10 mm and at I_F = 20 mA, measured as below	E_e	>	0,28	mW/cm^2
		typ.	0,50	mW/cm^2 [1]

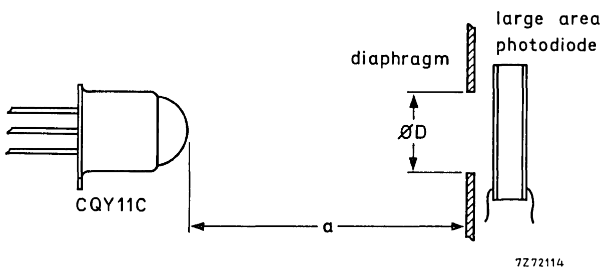
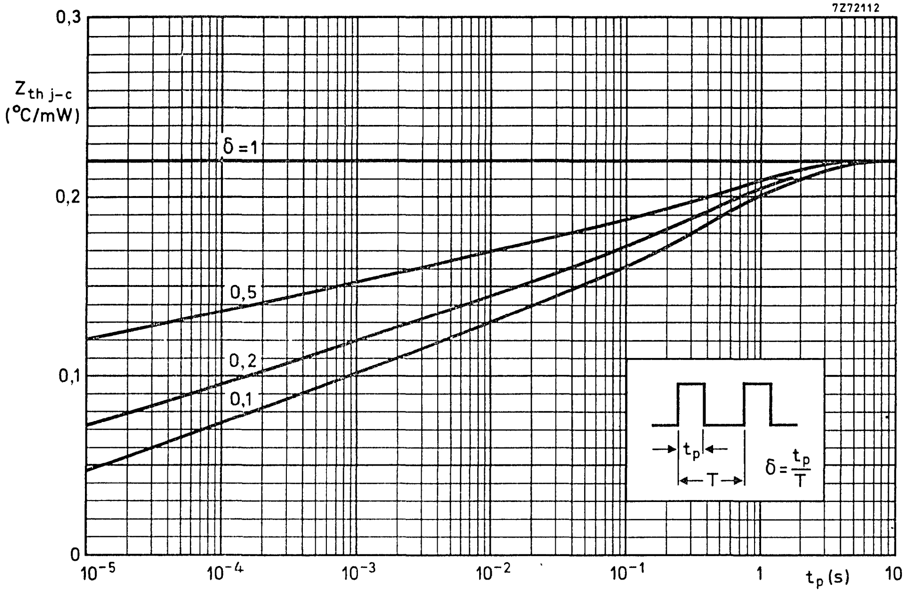
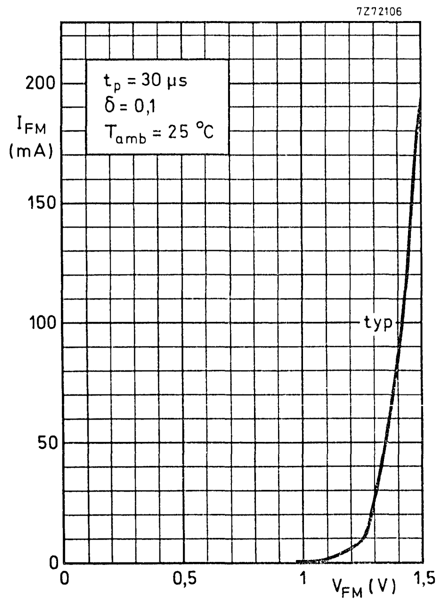


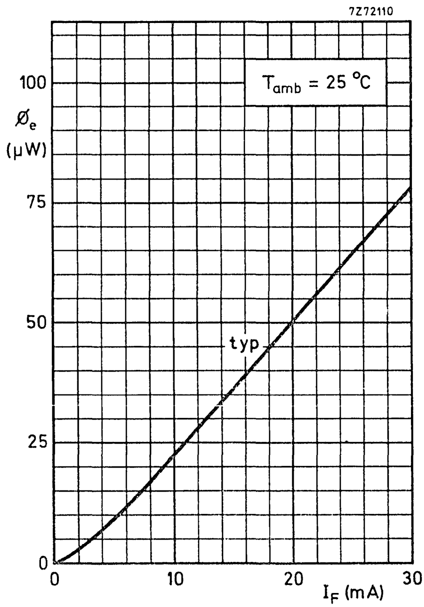
Fig. 1

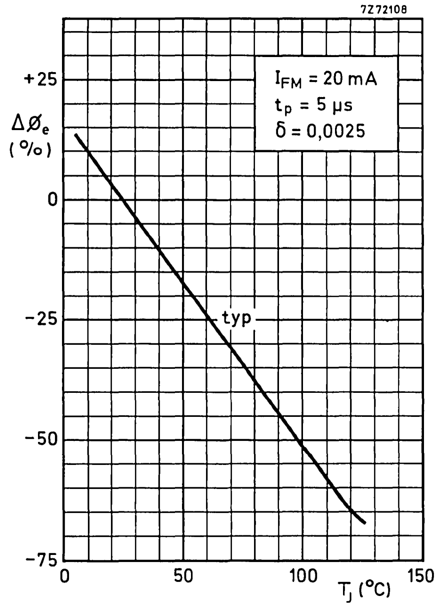
Decrease of radiant power with temperature	$\frac{\Delta\phi e}{\Delta T_j}$	typ.	0,7	%/°C
Cross section of the radiant beam				
between 0 to 10 mm from the lens	A_{beam}	typ.	7	mm^2
Angle between optical and mechanical axis			6°	
Wavelength at peak emission	λ_{pk}	typ.	880	nm
Bandwidth at half height	$B_{50\%}$	typ.	40	nm
Light rise time at I_{Fon} = 20 mA	t_r	typ.	30	ns
		<	100	ns
Light fall time at I_{Fon} = 20 mA	t_f	typ.	30	ns
		<	100	ns

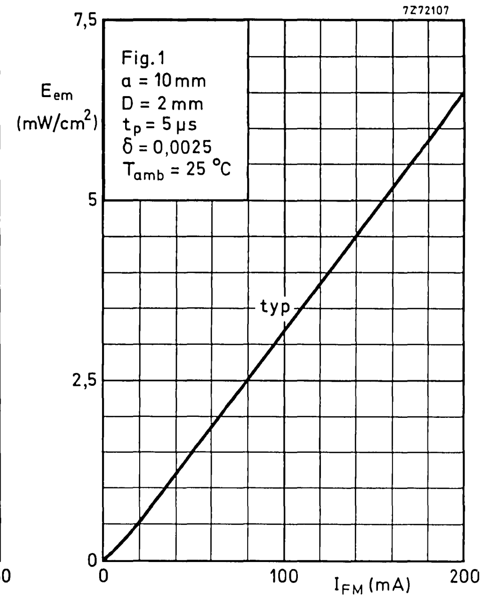
[1]) This corresponds typically with $I_{CEO(L)}$ = 0,4 mA in a phototransistor BPX25 and with 200 µA in a phototransistor BPX72.

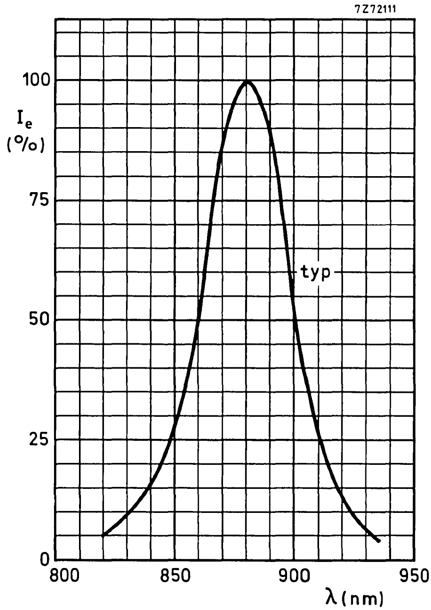

7Z72112
0,3
Zth j-c
(°C/mW)
δ = 1
0,2
0,5
0,2
0,1
0,1
0
tp
T
δ = tp/T
10−5
10−4
10−3
10−2
10−1
1
tp (s)
10

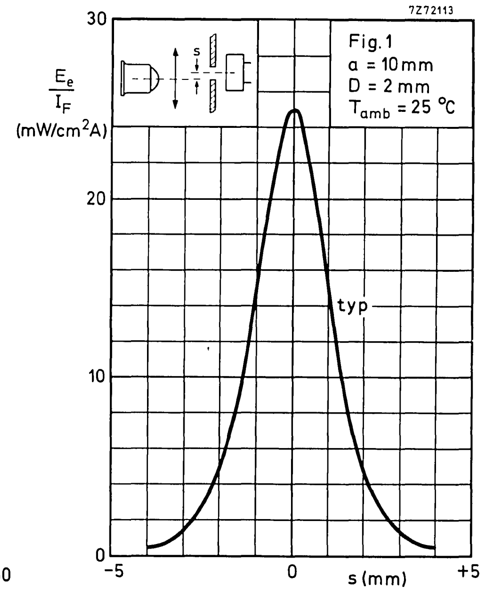

7Z72106
200
IFM
(mA)
150
100
50
0
tp = 30 μs
δ = 0,1
Tamb = 25 °C
typ
0
0,5
1
VFM (V)
1,5

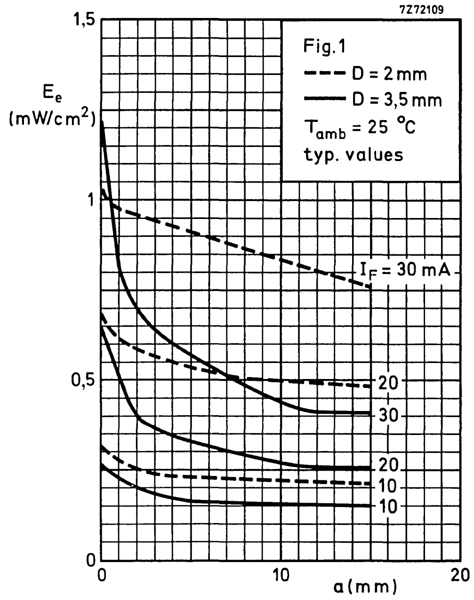

7Z72110
100
Øe
(μW)
75
50
25
0
Tamb = 25 °C
typ
0
10
20
IF (mA)
30

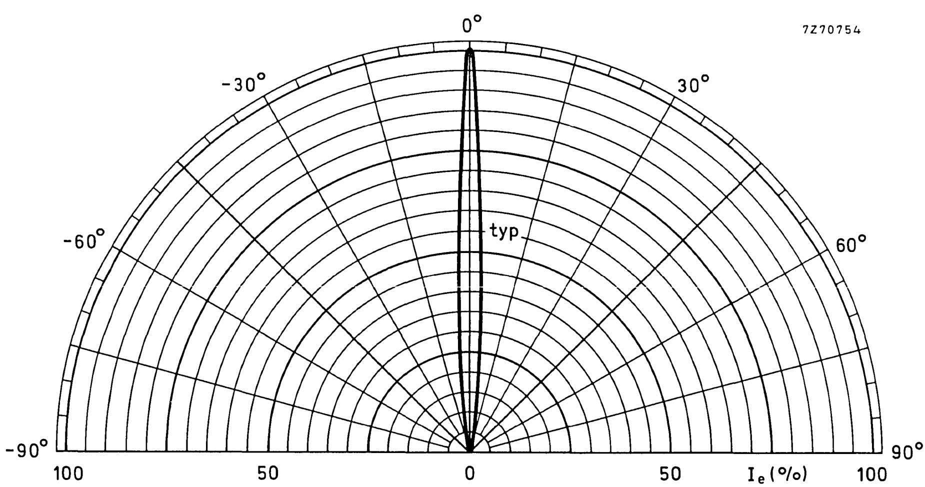

7Z72108
I_{FM} = 20 mA
t_p = 5 μs
δ = 0,0025
+25
$\Delta Ø_e$
(%)
0
−25
−50
−75
typ
0
50
100
150
T_j (°C)


7Z72107
7,5
E_{em}
(mW/cm²)
Fig. 1
a = 10 mm
D = 2 mm
t_p = 5 μs
δ = 0,0025
T_{amb} = 25 °C
5
2,5
0
typ
0
100
200
I_{FM} (mA)


7Z72111
100
I_e
(%)
75
50
25
0
typ
800
850
900
950
λ (nm)


7Z72113
30
$\frac{E_e}{I_F}$
(mW/cm²A)
s
Fig. 1
a = 10 mm
D = 2 mm
T_{amb} = 25 °C
20
10
0
typ
−5
0
s (mm)
+5


7Z72109
Fig.1
D = 2 mm
D = 3,5 mm
T_{amb} = 25 °C
typ. values
E_e (mW/cm²)
1,5
1
0,5
0
I_F = 30 mA
20
30
20
10
10
0
10
20
a (mm)


7Z70754
0°
-30°
30°
-60°
60°
-90°
90°
typ
100
50
0
50
I_e (%)
100

LIGHT EMITTING DIODES

Circular light emitting diodes with diameter of 5 mm which emit standard red light when forward biased.

The CQY24B and CQY24BL have a SOD-63 outline and are encapsulated in a medium-red diffusing resin. Together with the types CQY94B(L) and CQY96(L) they form one family.

The CQY24BL is the long-lead version of the CQY24B and has no seating plane but is in all other respects equal to the CQY24B.

QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.		5	V
Forward current (d.c.)		I_F	max.		50	mA
Total power dissipation up to T_{amb} = 65 °C		P_{tot}	max.		100	mW
Junction temperature		T_j	max.		100	°C
Luminous intensity						
I_F = 20 mA	CQY24B(L)-I	I_v	min.		0,7	mCd
	CQY24B(L)-II	I_v	1,0	to	2,2	mCd
	CQY24B(L)-III	I_v	1,6	to	3,5	mCd
	CQY24B(L)-IV	I_v	min.		3,0	mCd
Wavelength at peak emission		λ_{pk}	typ.		650	nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.		60	°

MECHANICAL DATA

Dimensions in mm

Fig. 1a SOD-63A.

CQY24B

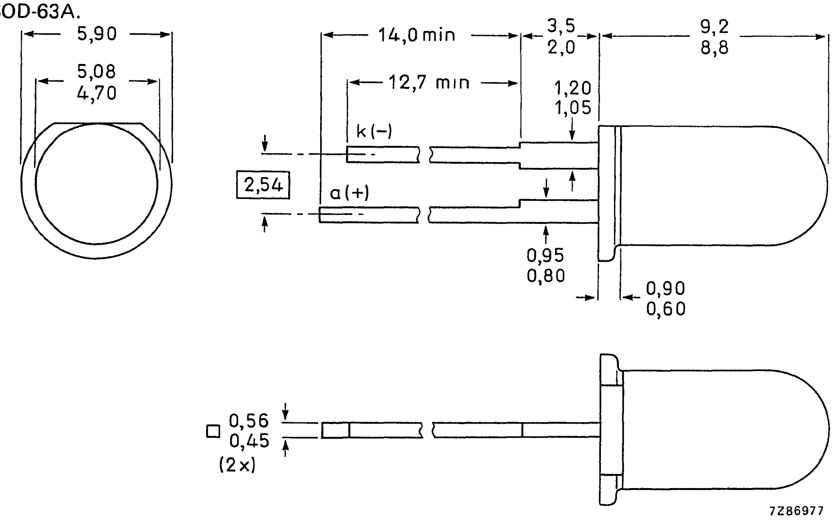
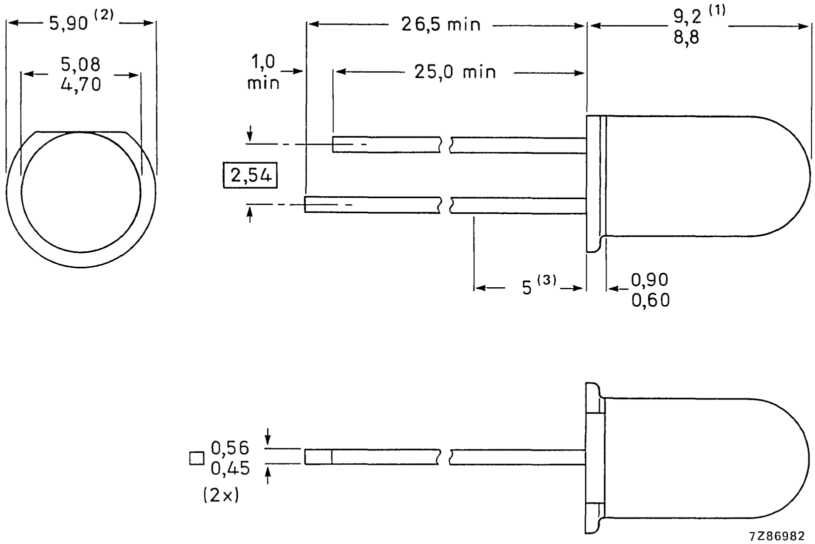


Fig. 1b SOD-63L.
CQY24BL



(1) Measured when the device is seated in a gauge with 2 holes 0,80 mm in diameter and 2,54 mm between the holes.
(2) Maximum value including burrs.
(3) Solderability not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	5 V
Forward current d.c.	I_F	max.	50 mA
Forward current peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_p = 10 μs; f = 1000 Hz	I_{FM}	max.	100 mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	100 mW
Storage temperature	T_{stg}	−55 to +100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature; t_{sld} < 7 s > 1,5 mm from the seating plane for CQY24B > 5 mm from the plastic body for CQY24BL	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	max.	500 K/W
mounted on a p.c.b.	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage					
I_F = 20 mA		V_F	typ.		1,7 V
			max.		2,0 V
Negative temperature coefficient of V_F					
I_F = 20 mA		$\frac{-\Delta V_F}{\Delta T_j}$	typ.		1,6 mV/°C
I_F = 2 mA		$\frac{-\Delta V_F}{\Delta T_j}$	typ.		2,0 mV/°C
Reverse current					
V_R = 5 V		I_R	max.		100 μA
Beamwidth between half-intensity directions					
I_F = 10 mA		$\alpha_{50\%}$	typ.		60 °
Bandwidth at half height		$B_{50\%}$	typ.		20 nm
Wavelength at peak emission					
I_F = 10 mA		λ_{pk}	typ.		650 nm
Luminous intensity (on axis)	CQY24B(L)-I	I_v	min.		0,7 mCd
	CQY24B(L)-II	I_v	1,0	to	2,2 mCd
	CQY24B(L)-III	I_v	1,6	to	3,5 mCd
	CQY24B(L)-IV	I_v	min.		3,0 mCd
Diode capacitance					
V_R = 0; f = 1 MHz		C_d	typ.		60 pF

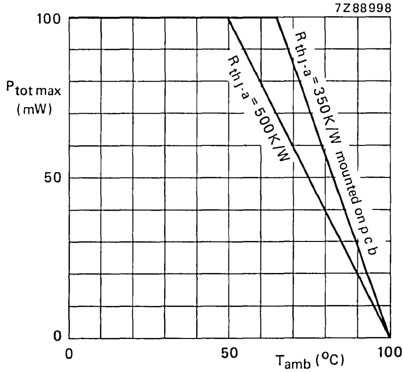


Fig. 2.

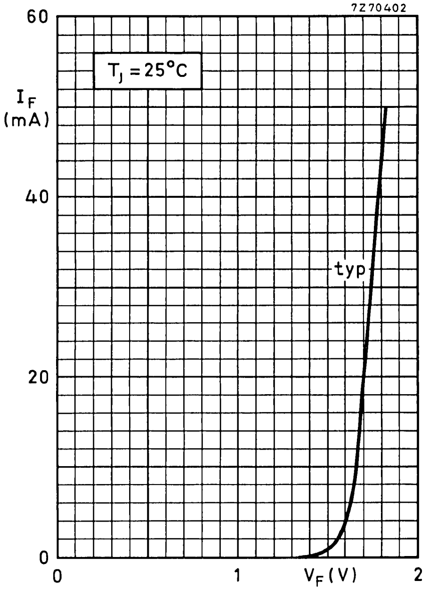


Fig. 3.

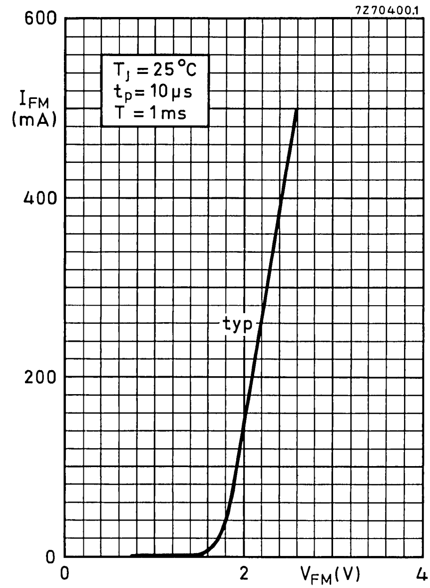


Fig. 4.

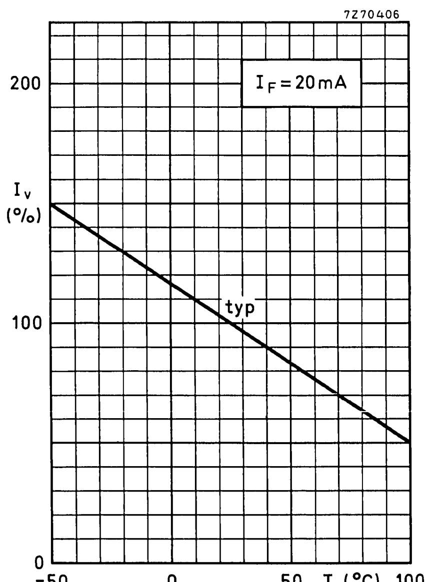


Fig. 5.

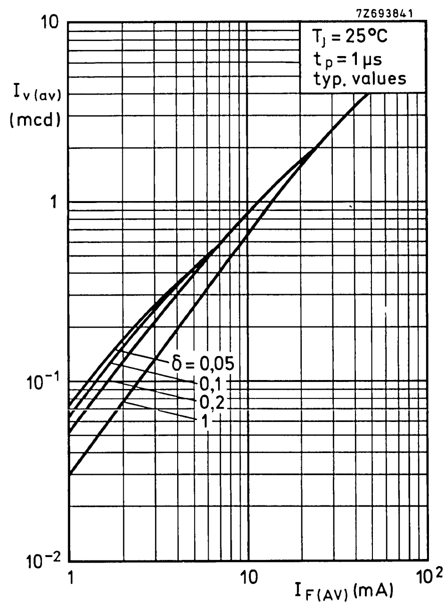


Fig. 6.

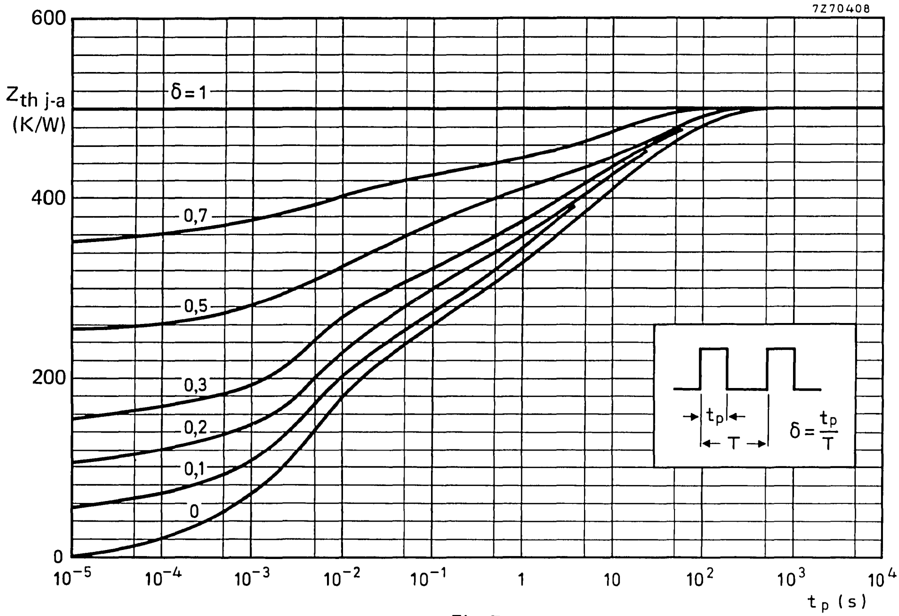


Fig. 7.

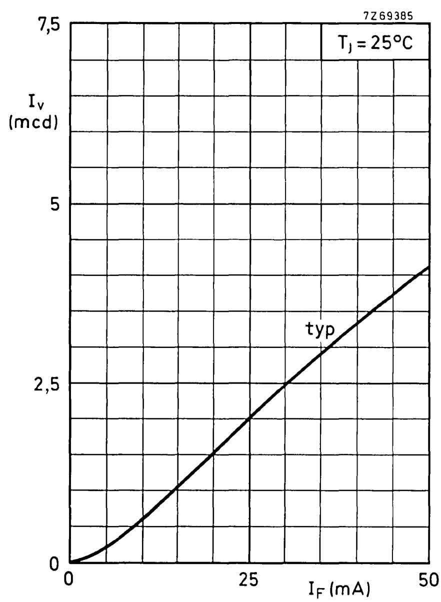


Fig. 8.

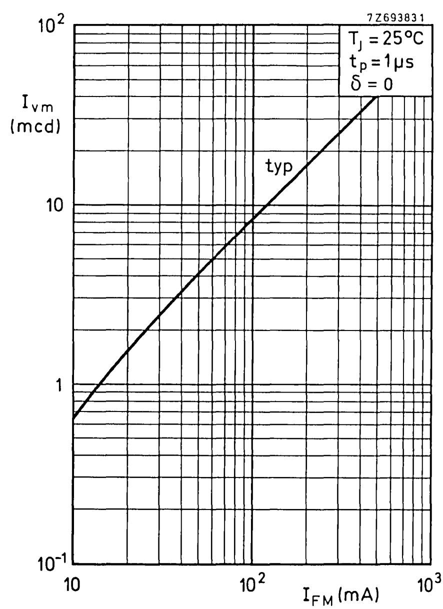


Fig. 9.

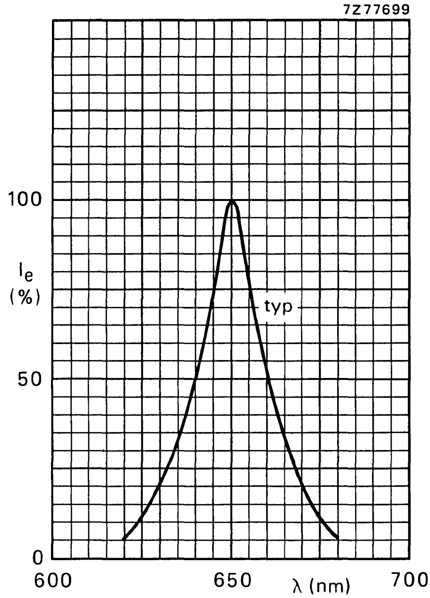

7Z77699
100
I_e
(%)
typ
50
0
600
650
λ (nm)
700

Fig. 10.

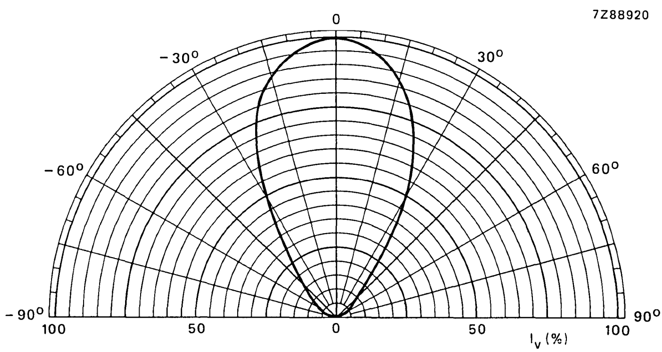

0
7Z88920
−30°
30°
−60°
60°
−90°
90°
100
50
0
50
100
I_v (%)

Fig. 11.

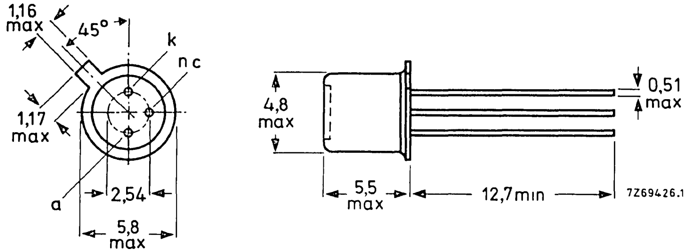
GaAs LIGHT EMITTING DIODES

Epitaxial gallium arsenide light emitting diodes intended for optical coupling and encoding. They emit radiation in the near infrared when forward biased. Envelopes like TO-18. Suitable for combination with phototransistors BPX25 and BPX72.

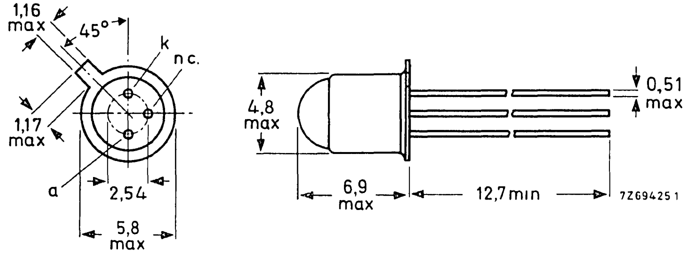
QUICK REFERENCE DATA					
Continuous reverse voltage		V_R	max.	2	V
Forward current (d.c.)		I_F	max.	100	mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	150	mW
Radiant intensity (on-axis) at I_F = 50 mA	CQY49B	I_e	>	0,3	mW/sr
	CQY49C	I_e	>	3	mW/sr
Wavelength at peak emission		λ_{pk}	typ.	930	nm
Thermal resistance from junction to ambient		$R_{th\ j-a}$	=	0,665	°C/mW

MECHANICAL DATA Dimensions in mm

CQY49B : TO-18 except for window



CQY49C : TO-18 except for lens



RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltage

Continuous reverse voltage	V_R	max.	2	V

Current

Forward current (d.c.)	I_F	max.	100	mA
Forward current (peak value) $t_p < 10$ μs; $\delta < 0,01$	I_{FM}	max.	1	A

Power dissipation

Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	150	mW

Temperature

Storage temperature	T_{stg}	−40 to +100		^oC
Operating junction temperature	T_j	max.	125	^oC
Lead soldering temperature > 1,5 mm from the body; $t_{sld} < 10$ s	T_{sld}	max.	260	^oC

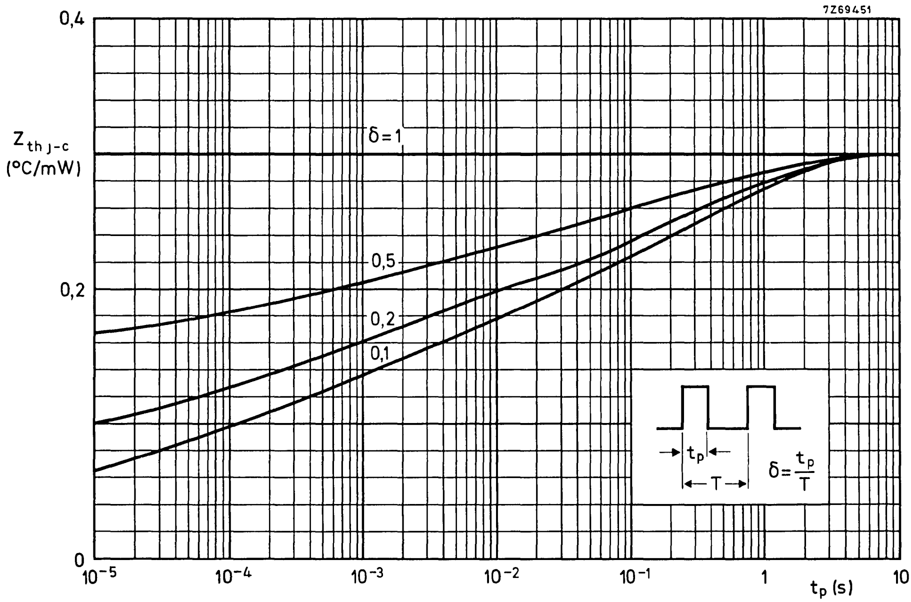
THERMAL RESISTANCE

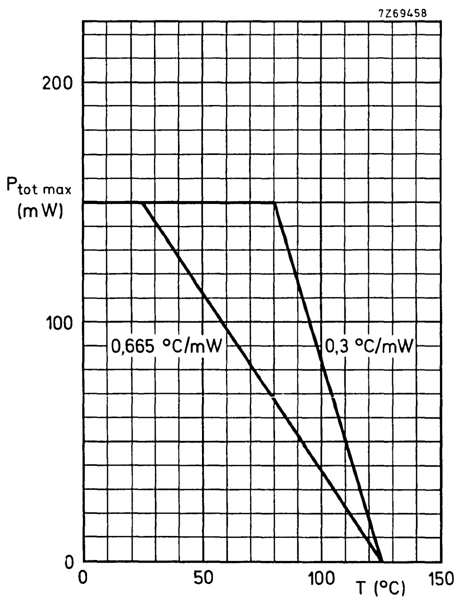
From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	0,665	$^oC/mW$
From junction to case	$R_{th\ j\text{-}c}$	=	0,3	$^oC/mW$

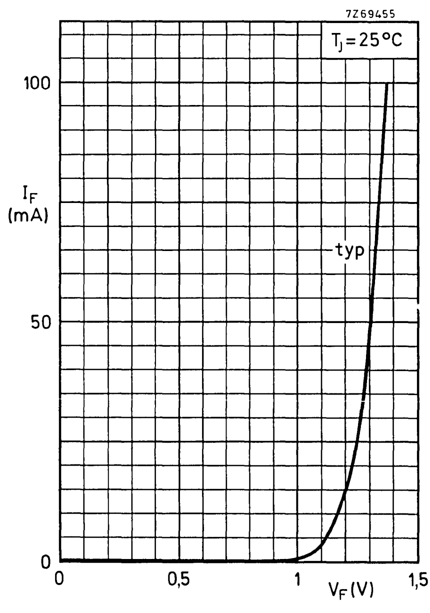
CHARACTERISTICS

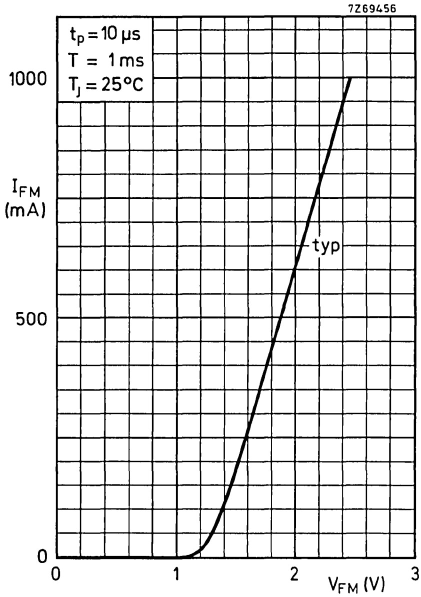
T_j = 25 °C unless otherwise specified

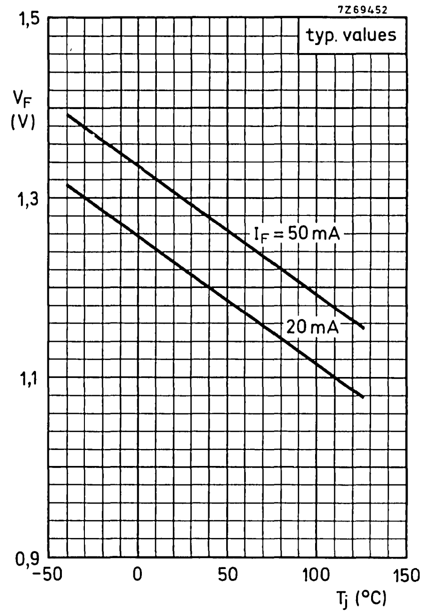
			CQY49B	CQY49C	
Forward voltage at I_F = 50 mA	V_F	typ.	1,3		V
		<	1,5		V
Reverse current at V_R = 2 V	I_R	<	100		μA
Diode capacitance V_R = 0; f = 1 MHz	C_d	typ.	55		pF
Radiant intensity (on-axis) at I_F = 50 mA	I_e	>	0,3	3	mW/sr
		typ.	0,5	5	mW/sr
Wavelength at peak emission	λ_{pk}	typ.	930		nm
Bandwidth at half height	$B_{50\%}$	typ.	50		nm
Beamwidth between half-intensity directions	$\alpha_{50\%}$	typ.	80°	15°	
Angle between optical and mechanical axis		typ.	–	6°	
Switching times I_{Fon} = 50 mA; t_p = 2 μs; f = 45 kHz					
Light rise time	t_r	typ.	600		ns
Light fall time	t_f	typ.	350		ns

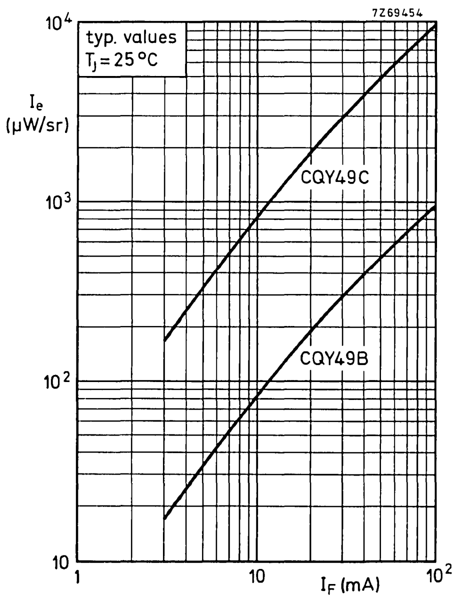

7Z69451
0,4
0,2
0
$Z_{th\ j-c}$
(°C/mW)
δ = 1
0,5
0,2
0,1
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
10
t_p (s)
t_p
T
$\delta = \frac{t_p}{T}$

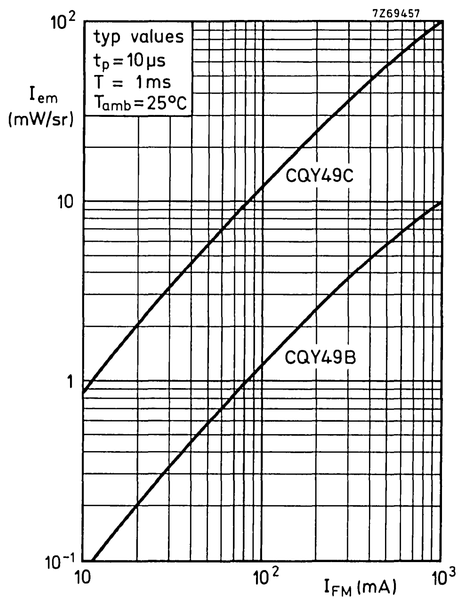

7Z69458
200
100
0
$P_{tot\ max}$
(mW)
0,665 °C/mW
0,3 °C/mW
0
50
100
150
T (°C)

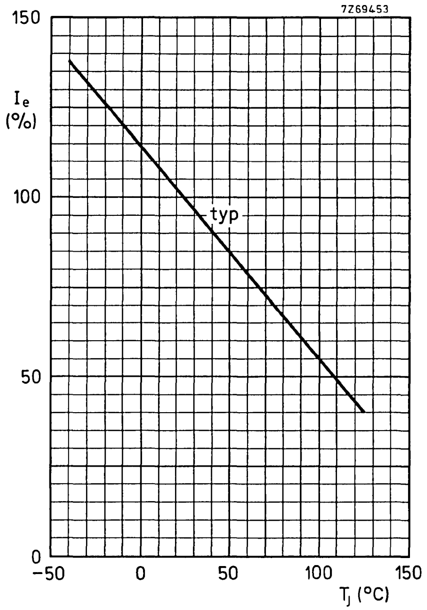

7Z69455
$T_j = 25\ °C$
100
50
0
I_F
(mA)
typ
0
0,5
1
1,5
V_F (V)

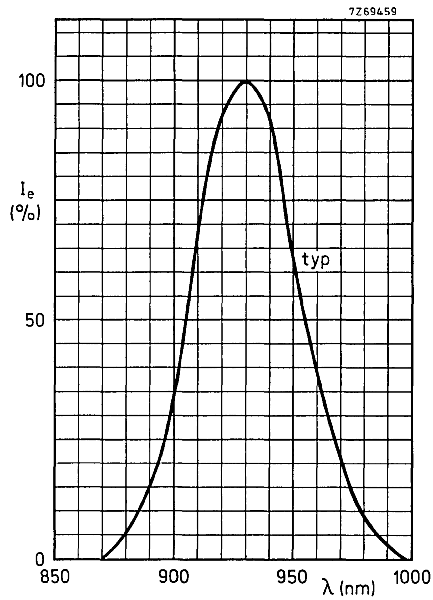

7Z69456
$t_p = 10\ \mu s$
T = 1 ms
$T_j = 25\ °C$
I_{FM} (mA)
1000
500
0
typ
0
1
2
3
V_{FM} (V)

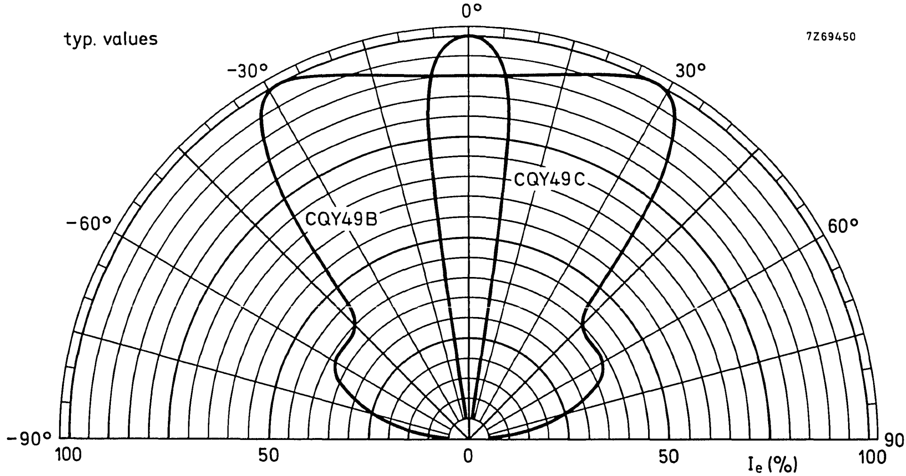

7Z69452
typ. values
V_F (V)
1,5
1,3
1,1
0,9
$I_F = 50$ mA
20 mA
−50
0
50
100
150
T_j (°C)


7Z69454
typ. values
$T_j = 25\ °C$
I_e (μW/sr)
10^4
10^3
10^2
10
CQY49C
CQY49B
1
10
10^2
I_F (mA)


7Z69457
typ values
$t_p = 10\ \mu s$
T = 1 ms
$T_{amb} = 25\ °C$
I_{em} (mW/sr)
10^2
10
1
10^{-1}
CQY49C
CQY49B
10
10^2
10^3
I_{FM} (mA)


7Z69453
150
I_e
(%)
100
typ
50
0
−50
0
50
100
150
T_j (°C)


7Z69459
100
I_e
(%)
typ
50
0
850
900
950
λ (nm)
1000


typ. values
0°
7Z69450
−30°
30°
CQY49C
CQY49B
−60°
60°
−90°
90°
100
50
0
50
100
I_e (%)

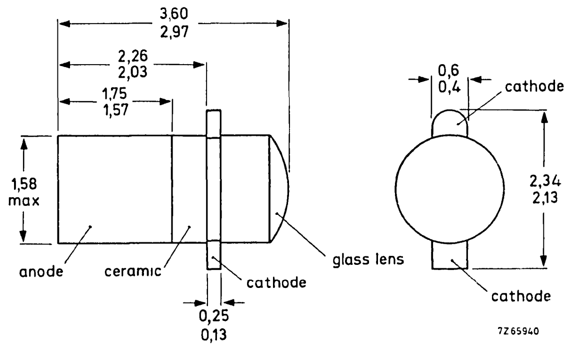
GaAs LIGHT EMITTING DIODES

Gallium arsenide light emitting diodes which emit near-infrared light when forward biased. Ceramic-metal envelope with glass lens like BPX71, suitable for matrix layout on printed circuit boards. In conjunction with BPX71 also suitable for punched card reading.

QUICK REFERENCE DATA					
Continuous reverse voltage	V_R	max.	2		V
Forward current (d.c.)	I_F	max.	100		mA
Total power dissipation up to T_{amb} = 25 °C mounted on printed circuit board	P_{tot}	max.	150		mW
			CQY50	CQY52	
Total radiant power at I_F = 20 mA	ϕ_e	>	160	400	µW
Radiant intensity (on-axis) at I_F = 20 mA	I_e	>	180	450	µW/sr
Wavelength at peak emission	λ_{pk}	typ.	930		nm

MECHANICAL DATA Dimensions in mm

DO-31 except for length



RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltage				
Continuous reverse voltage	V_R	max.	2	V
Current				
Forward current (d.c.)	I_F	max.	100	mA
Forward current (peak value) t_p = 10 μs; δ = 0,01	I_{FM}	max.	500	mA
Temperature				
Storage temperature	T_{stg}		−65 to +150	^oC
Operating junction temperature	T_j	max.	125	^oC
Power dissipation				
Total power dissipation up to T_{amb} = 25 ^oC device mounted on p.c. board [1]	P_{tot}	max.	150	mW

THERMAL RESISTANCE

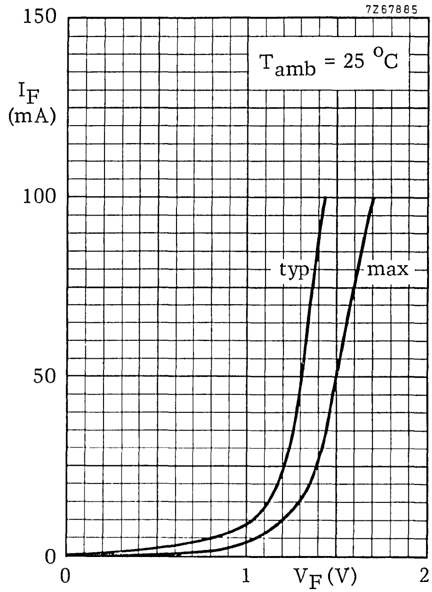
From junction to ambient, device mounted on p.c. board [1]	$R_{th\ j\text{-}a}$	=	0,66	$^oC/mW$

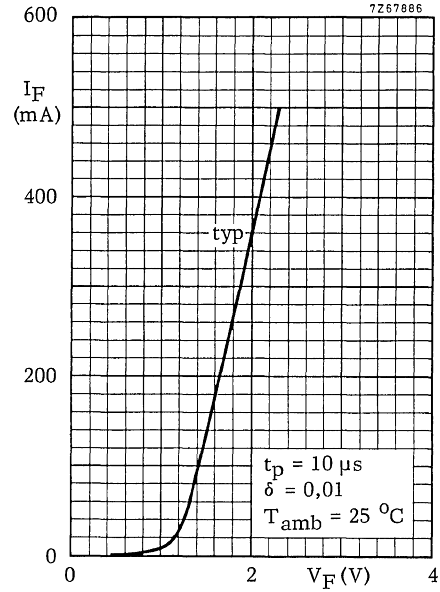
[1]) With copper islands of 6 x 2 mm on both sides of 1,6 mm glass-epoxy printed circuit board; thickness of copper 35 μm.

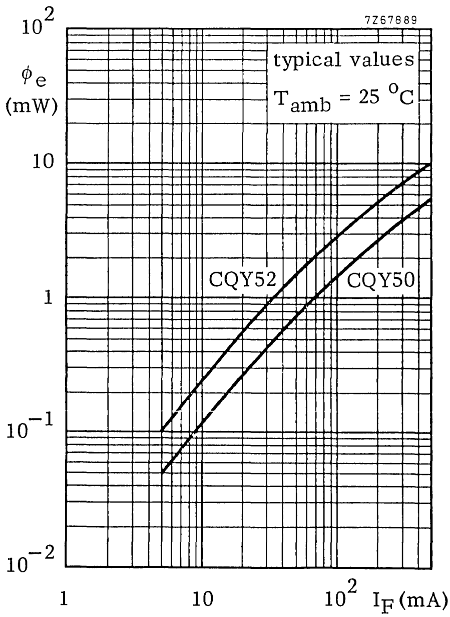
CHARACTERISTICS

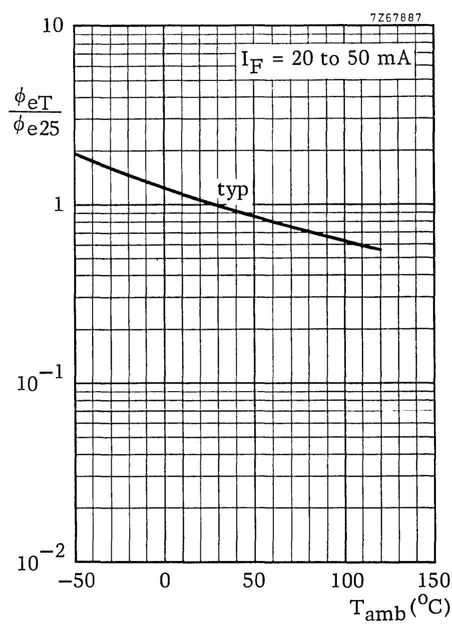
T_{amb} = 25 °C unless otherwise specified

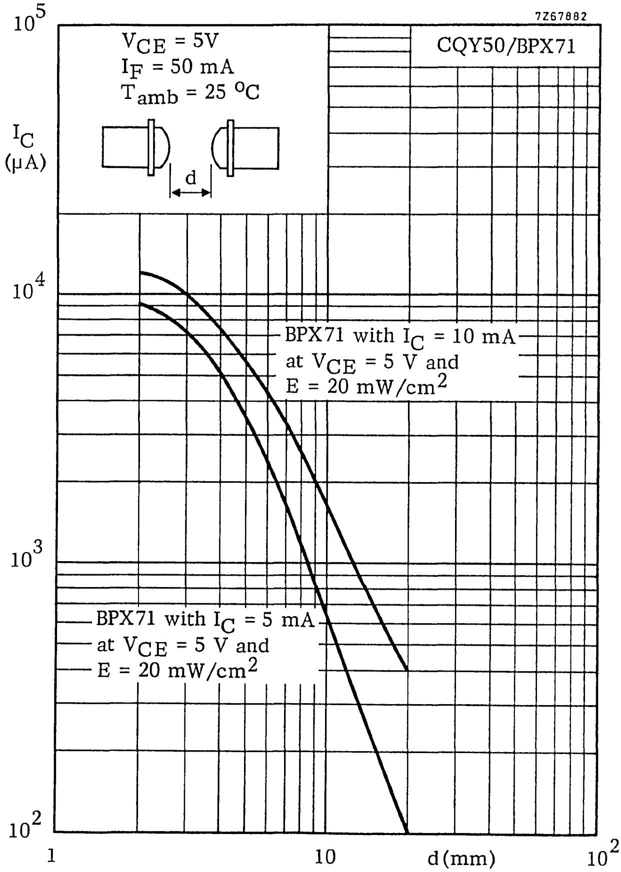
			CQY50	CQY52	
Forward voltage					
I_F = 50 mA	V_F	typ.	1,3	1,3	V
		<	1,5	1,5	V
I_F = 500 mA; t_p = 10 µs; δ = 0,01	V_F	typ.	2,3	2,3	V
Reverse current					
V_R = 2 V	I_R	<	100	100	µA
Diode capacitance					
V_R = 0; f = 1 MHz	C_d	typ.	45	45	pF
Total radiant power					
I_F = 20 mA	ϕ_e	>	160	400	µW
I_F = 50 mA	ϕ_e	typ.	700	1500	µW
Radiant intensity (on-axis)					
I_F = 20 mA	I_e	>	180	450	µW/sr
Wavelength at peak emission	λ_{pk}	typ.	930	930	nm
Bandwidth at half height	$B_{50\%}$	typ.	40	40	nm
Beamwidth between half-intensity directions	$\alpha_{50\%}$	typ.	35°	35°	
Switching times					
I_{Fon} = 20 mA; t_p = 2 μs; f = 45 kHz					
Light rise time	t_r	typ.	600	600	ns
Light fall time	t_f	typ.	350	350	ns

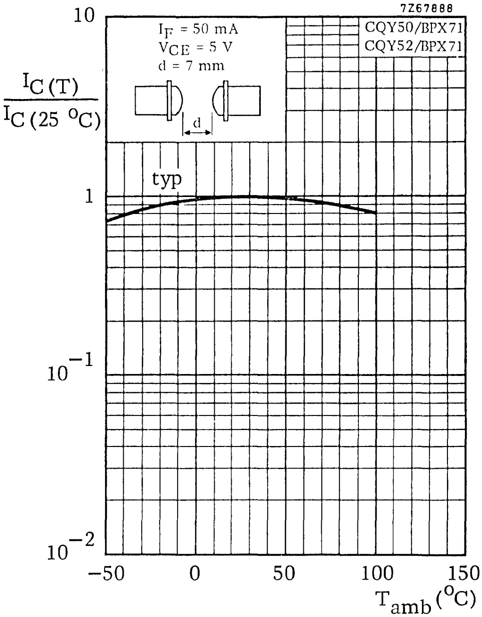

7Z67885
150
100
50
0
I_F
(mA)
T_{amb} = 25 °C
typ
max
0
1
V_F (V)
2

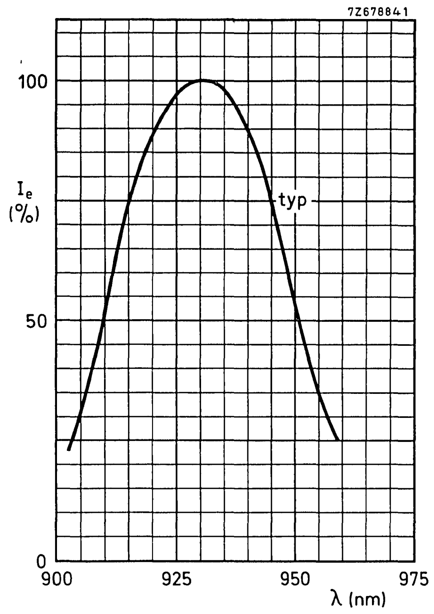

7Z67886
600
400
200
0
I_F
(mA)
typ
t_p = 10 μs
δ = 0,01
T_{amb} = 25 °C
0
2
V_F (V)
4

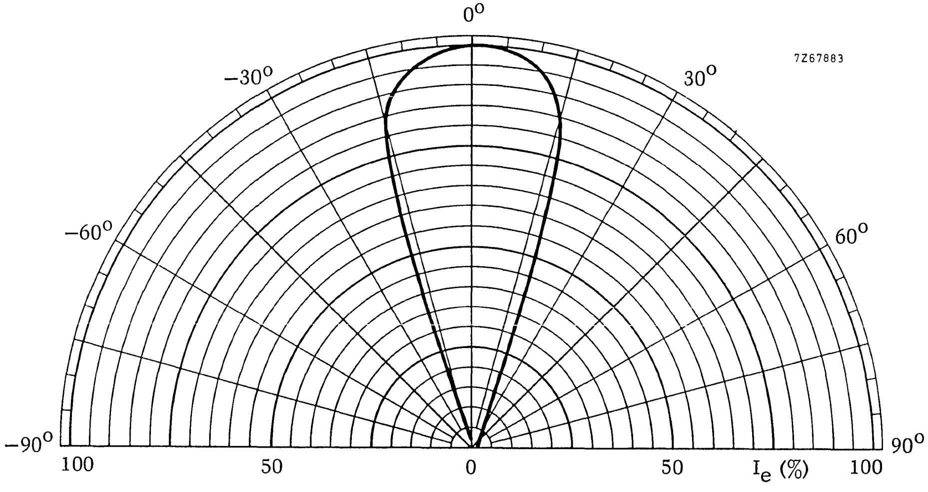

7Z67889
10^2
10
1
10^{-1}
10^{-2}
ϕ_e
(mW)
typical values
T_{amb} = 25 °C
CQY52
CQY50
1
10
10^2
I_F (mA)


7Z67887
10
1
10^{-1}
10^{-2}
$\frac{\phi_{eT}}{\phi_{e25}}$
I_F = 20 to 50 mA
typ
−50
0
50
100
150
T_{amb} (°C)


7Z67882
CQY50/BPX71
V_{CE} = 5V
I_F = 50 mA
T_{amb} = 25 °C
d
I_C
(μA)
10^5
10^4
10^3
10^2
BPX71 with I_C = 10 mA
at V_{CE} = 5 V and
E = 20 mW/cm^2
BPX71 with I_C = 5 mA
at V_{CE} = 5 V and
E = 20 mW/cm^2
1
10
d(mm)
10^2


7Z67888
10
I_F = 50 mA
V_{CE} = 5 V
d = 7 mm
d
CQY50/BPX71
CQY52/BPX71
$\frac{I_{C(T)}}{I_{C(25\ ^oC)}}$
typ
1
10^{-1}
10^{-2}
−50
0
50
100
150
T_{amb} (°C)


7Z678841
100
I_e (%)
typ
50
0
900
925
950
975
λ (nm)


0°
7Z67883
−30°
30°
−60°
60°
−90°
90°
100
50
0
50
I_e (%)
100

LIGHT EMITTING DIODE

Circular light emitting diode with diameter of 3 mm which emits standard red light (GaAsP) when forward biased.

The CQY54A has a SOD-53E outline and is encapsulated in a medium-red coloured diffusing resin.

Together with the CQY95B and the CQY97A the CQY54A forms one light-intensity family.

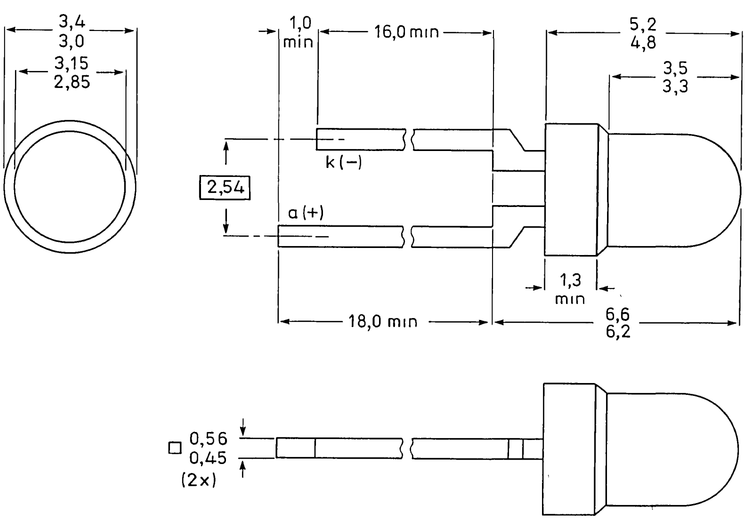
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5 V
Forward current (d.c.)		I_F	max.	50 mA
Total power dissipation up to T_{amb} = 55 °C		P_{tot}	max.	90 mW
Junction temperature		T_j	max.	100 °C
Luminous intensity				
I_F = 20 mA	CQY54A	I_v	min.	0,5 mCd
	CQY54A-I		0,7 to	1,6 mCd
	CQY54A-II		1,0 to	2,2 mCd
	CQY54A-III		min.	1,6 mCd
Wavelength at peak emission				
I_F = 20 mA		λ_{pk}	typ.	650 nm
Beamwidth at half-intensity directions				
I_F = 20 mA		$\alpha_{50\%}$	typ.	60 °

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-53E.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5 V
Forward current			
d.c.	I_F	max.	50 mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
Total power dissipation up to T_{amb} = 55 °C	P_{tot}	max.	90 mW
Storage temperature	T_{stg}	−55 to +100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature			
> 1,5 mm from the seating plane; t_{sld} < 7 s	T_{sld}	max;	260 °C

THERMAL RESISTANCE

From function to ambient			
when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	500 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

I_F = 20 mA		V_F	typ.	1,7 V
			max.	2,0 V
Reverse current				
V_R = 3 V		I_R	max.	100 μA
Beamwidth between half-intensity directions				
I_F = 20 mA		$\alpha_{50\%}$	typ.	60 °
Bandwidth at half height		$B_{50\%}$	typ.	20 nm
Wavelength at peak emission				
I_F = 20 mA		λ_{pk}	typ.	650 nm
Luminous intensity				
I_F = 20 mA	CQY54A	I_v	min.	0,5 mCd
	CQY54A-I		0,2 to	1,6 mCd
	CQY54A-II		1,0 to	2,2 mCd
	CQY54A-III		min.	1,6 mCd
Diode capacitance				
V_R = 0; f = 1 MHz		C_d	typ.	60 pF

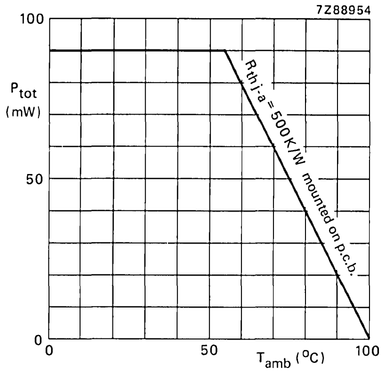


Fig. 2.

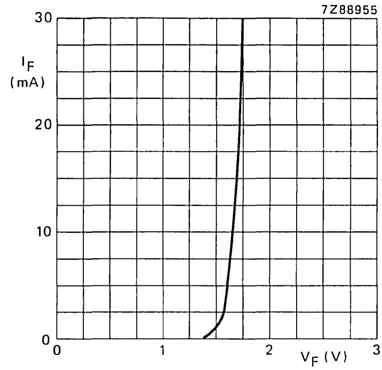


Fig. 3 T_j = 25 °C; typ. values.

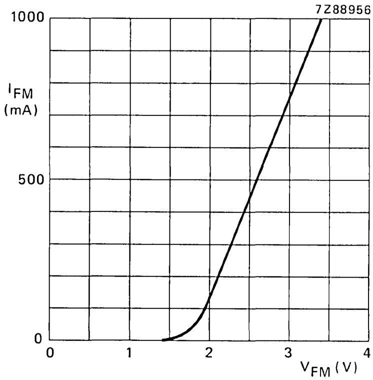


Fig. 4 Typical values.

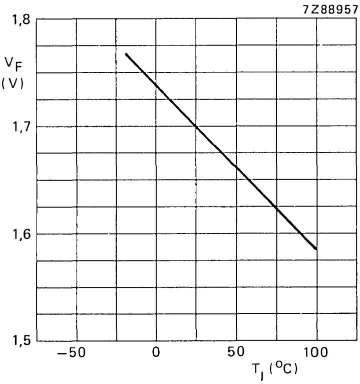


Fig. 5 I_F = 20 mA; typ. values.

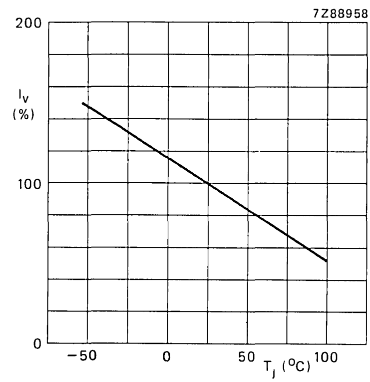


Fig. 6 I_F = 20 mA; typ. values.

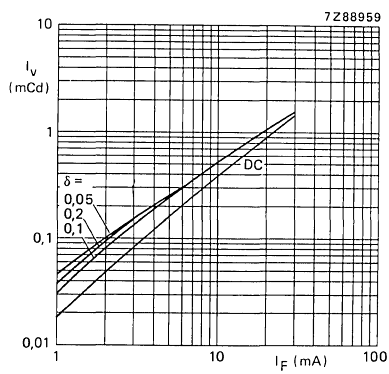


Fig. 7 t_p = 50 μs; T_j = 25; typ. values.

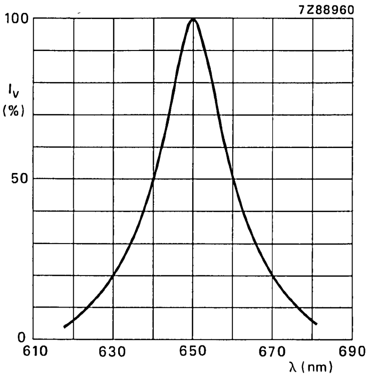


Fig. 8 Typical values.

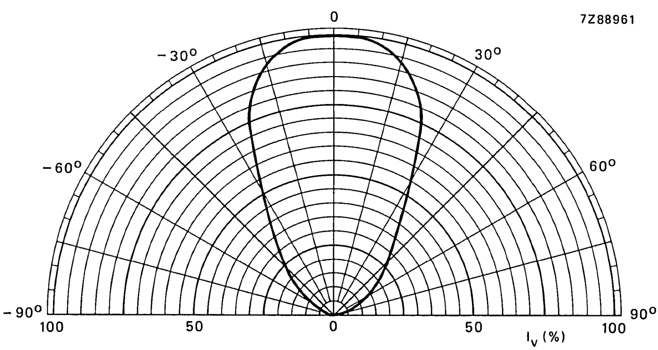


Fig. 9 Typical values.

GaAs LIGHT EMITTING DIODE

Diffused planar light emitting diode intended for optical coupling and encoding. It emits radiation in the near infrared when forward biased. Infrared translucent epoxy encapsulation (dark blue). Combination with phototransistor BPW22A is recommended.

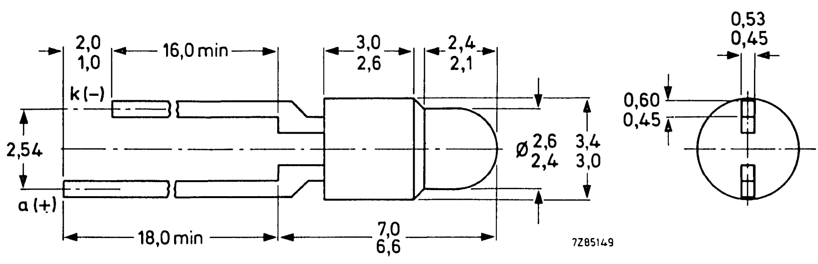
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	5	V
Forward current (d.c.)	I_F	max.	50	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	100	mW
Radiant intensity (on-axis) at I_F = 20 mA	I_e	>	1	mW/sr
Wavelength at peak emission	λ_{pk}	typ.	930	nm

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-53D.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	5	V
Forward current				
d.c.	I_F	max.	50	mA
(peak value); t_p = 10 μs; δ = 0,01	I_{FM}	max.	200	mA
Total power dissipation up to T_{amb} = 25 °C (see Fig. 2)	P_{tot}	max.	100	mW
Storage temperature	T_{stg}	−55 to + 100		°C
Junction temperature	T_j	max.	100	°C
Lead soldering temperature				
> 3,5 mm from the body; t_{sld} < 7 s	T_{sld}	max.	260	°C

THERMAL RESISTANCE

From junction to ambient, device mounted on a printed-circuit board	$R_{th\ j\text{-}a}$	=	750	°C/W

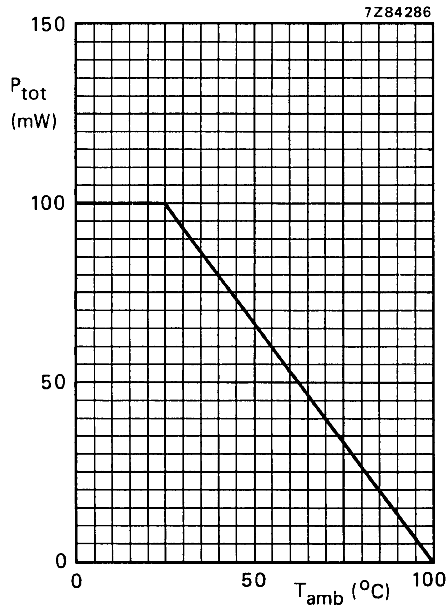


Fig. 2 Power derating curve versus ambient temperature.

CHARACTERISTICS

$T_j = 25\ ^oC$

Forward voltage $I_F = 20$ mA		V_F	typ.	1,2	V
			<	1,5	V
Reverse current $V_R = 5$ V		I_R	<	100	μA
Diode capacitance $V_R = 0$; f = 1 MHz		C_d	typ.	40	pF
Total radiant power $I_F = 20$ mA		ϕ_e	typ.	1	mW
Radiant intensity (on-axis) $I_F = 20$ mA	**CQY58A-I***	I_e	>	1	mW/sr
			<	5	mW/sr
	CQY58A-II*	I_e	>	3	mW/sr
Wavelength at peak emission		λ_{pk}	typ.	930	nm
Bandwidth at half height		$B_{50\%}$	typ.	50	nm
Beamwidth between half-intensity directions $I_F = 20$ mA		$\alpha_{50\%}$	typ.	± 10°	
Switching times $I_{Fon} = 20$ mA					
Light rise time		t_r	typ.	3	μs
Light fall time		t_f	typ.	3	μs

* CQY58A (without class indication) has a radiant intensity (I_e) of 2,2 to 3,45 mW/sr.

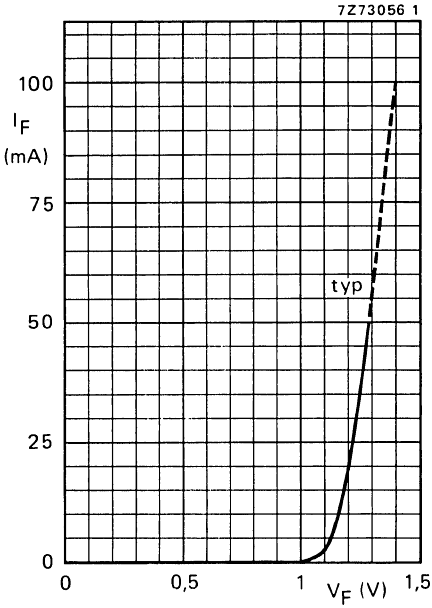


Fig. 3 T_{amb} = 25 °C.

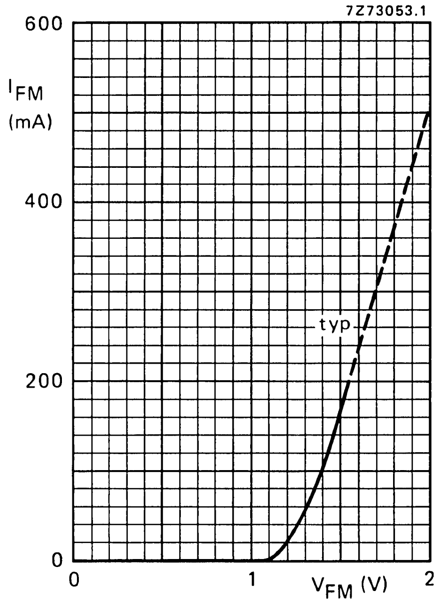


Fig. 4 t_p = 10 μs; T = 1 ms; T_{amb} = 25 °C.

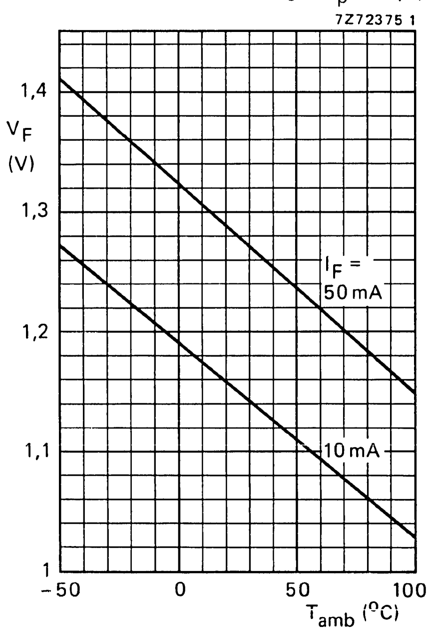


Fig. 5 Typical values.

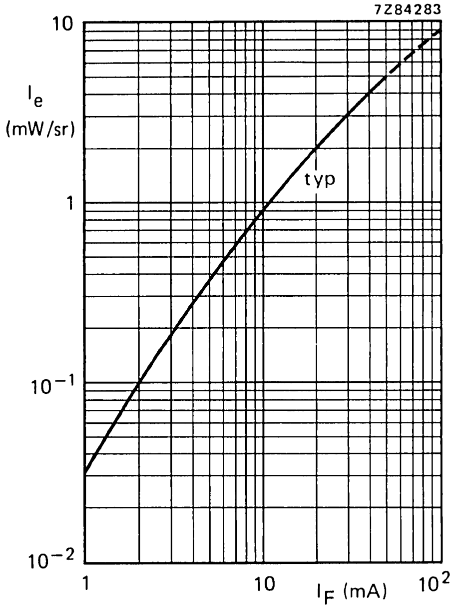


Fig. 6 T_{amb} = 25 °C.

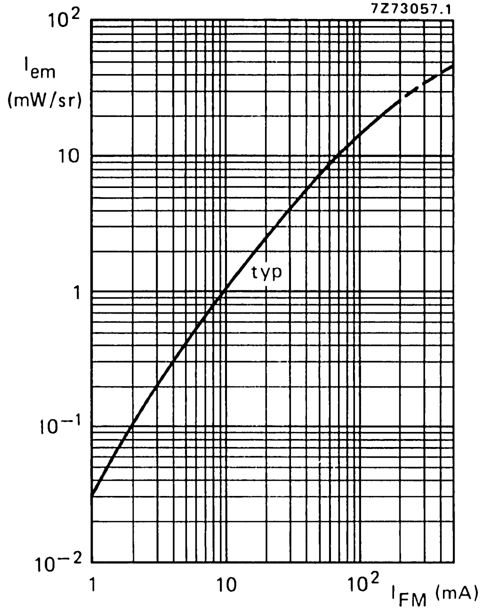


Fig. 7 t_p = 10 μs; T = 1 ms; T_{amb} = 25 °C.

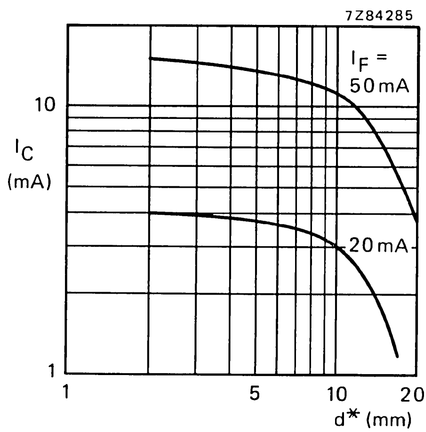


Fig. 8 V_{CE} = 5 V; T_{amb} = 25 °C; typical values.

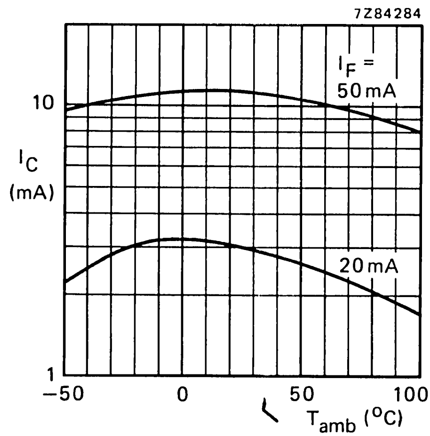


Fig. 9 V_{CE} = 5 V; d* = 10 mm; typical values.

* d = shortest free distance of mechanical on-axis when BPW22A is coupled with CQY58A.

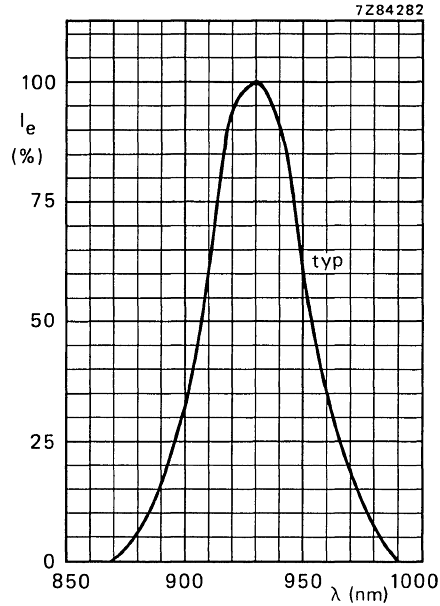


Fig. 10 Spectral response.

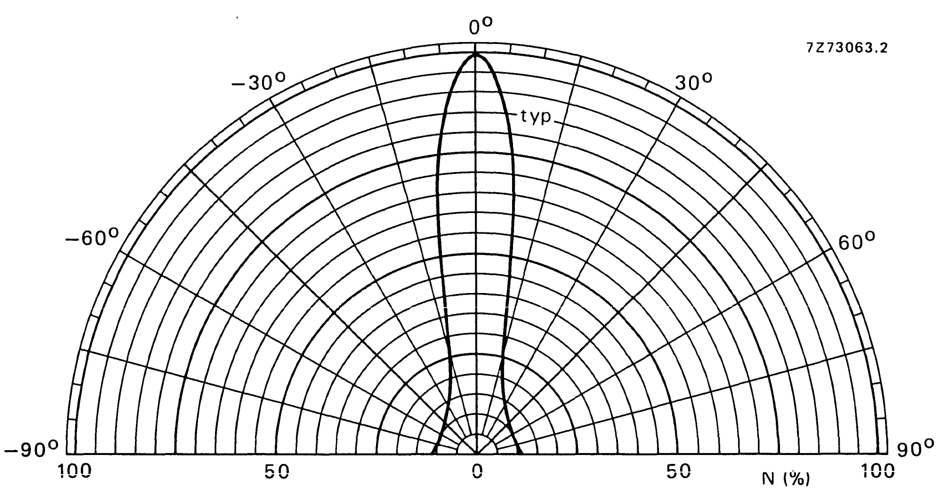


Fig. 11.

GaAs LIGHT EMITTING DIODE

Epitaxial gallium arsenide light emitting diode intended for remote-control applications. It emits radiation in the near infrared when forward biased. Infrared translucent epoxy encapsulation (dark blue).

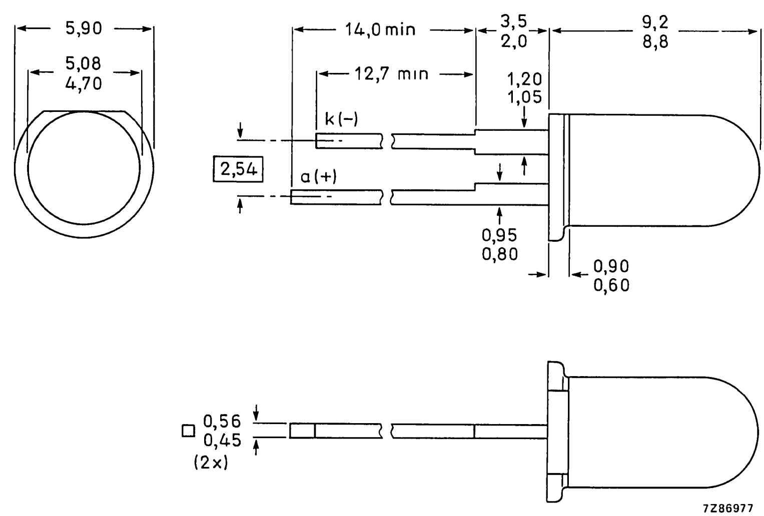
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5	V
Forward current (d.c.)		I_F	max.	130	mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	215	mW
Junction temperature		T_j	max.	100	°C
Radiant intensity (on-axis) at I_F = 100 mA	**CQY89A**	I_e	>	9	mW/sr
	CQY89A-I	I_e		9 to 20	mW/sr
	CQY89A-II	I_e	>	15	mW/sr
Wavelength at peak emission		λ_{pk}	typ.	930	nm

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-63A.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	5	V
Forward current (d.c.)	I_F	max.	130	mA
Forward current (peak value) $t_p \leqslant 50\ \mu s$; $\delta = 0{,}05$	I_{FM}	max.	1000	mA
Non-repetitive peak forward current ($t_p \leqslant 10\ \mu s$)	I_{FSM}	max.	2500	mA
Total power dissipation up to $T_{amb} = 25\ ^oC$	P_{tot}	max.	215	mW
Storage temperature	T_{stg}	−55 to + 100		^oC
Junction temperature	T_j	max.	100	^oC
Lead soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max.	260	^oC

THERMAL RESISTANCE

From junction to ambient mounted on a printed-circuit board	$R_{th\ j\text{-}a}$	=	350	K/W

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise specified

Forward voltage $I_F = 100$ mA		V_F	typ.	1,4	V
			<	1,6	V
$I_{FM} = 1500$ mA; $t_p = 20\ \mu s$; $\delta = 0{,}033$		V_{FM}	typ.	2,4	V
Reverse current $V_R = 5$ V		I_R	<	100	μA
Diode capacitance $V_R = 0$; f = 1 MHz		C_d	typ.	40	pF
Total radiant power $I_F = 100$ mA		ϕ_e	>	7	mW
			typ.	12	mW
Decrease of radiant power with temperature $I_F = 100$ mA		$\frac{\Delta\phi_e}{\Delta T_j}$	typ.	1	%/K
Radiant intensity (on-axis) $I_F = 100$ mA	**CQY89A**	I_e	>	9	mW/sr
			typ.	15	mW/sr
→	**CQY89A-I**	I_e		9 to 20	mW/sr
	CQY89A-II	I_e	>	15	mW/sr
Wavelength at peak emission $I_F = 100$ mA		λ_{pk}	typ.	930	nm
Bandwidth at half height $I_F = 100$ mA		$B_{50\%}$	typ.	50	nm
Beamwidth between half-intensity directions $I_F = 100$ mA		$\alpha_{50\%}$	typ.	40^o	

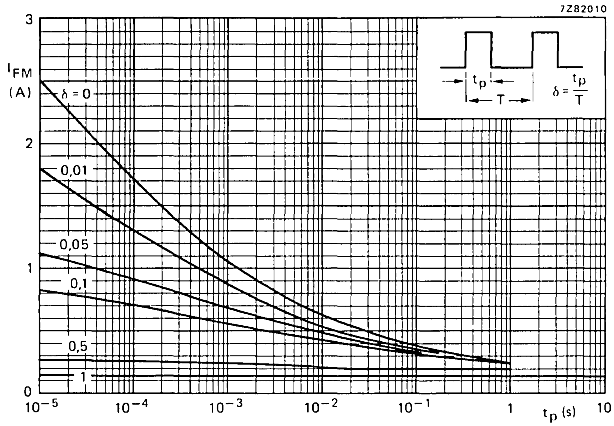


Fig. 2 T_{amb} = 25 °C; $T_{j\ peak}$ = 100 °C.

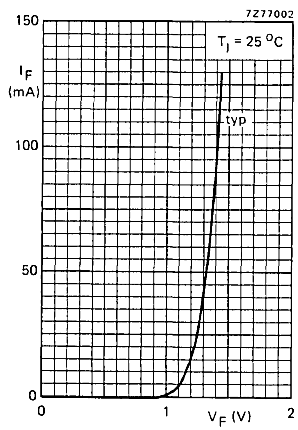


Fig. 3.

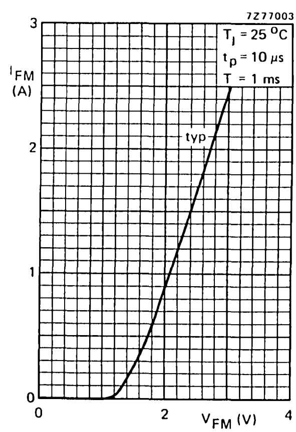


Fig. 4.

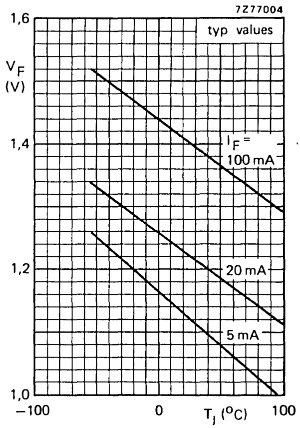


Fig. 5.

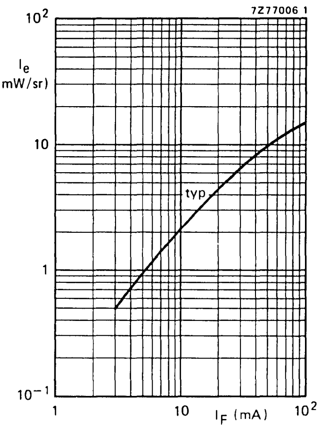


Fig. 6 T_j = 25 °C.

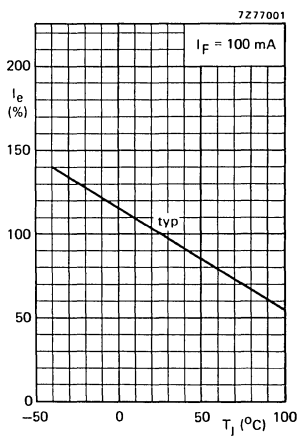


Fig. 7.

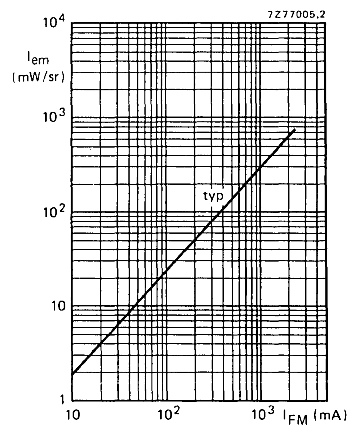


Fig. 8 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms.

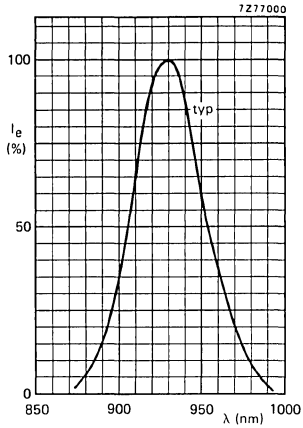

7Z77000
100
I_e
(%)
50
0
850
900
950
1000
λ (nm)
typ

Fig. 9.

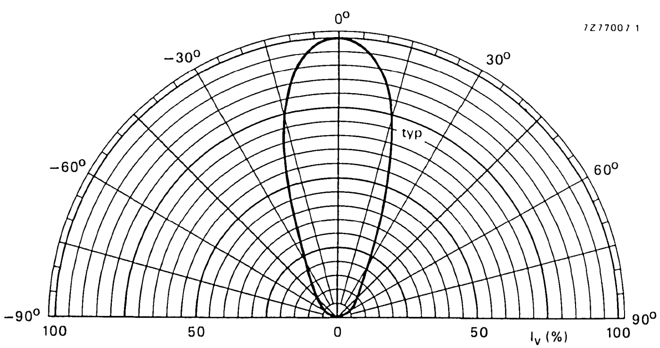

7Z77007.1
0°
−30°
30°
−60°
60°
−90°
90°
100
50
0
50
100
I_v (%)
typ

Fig. 10.

LIGHT EMITTING DIODE

Circular light emitting diode with diameter of 5 mm which emits green light (GaP) when forward biased.

The CQY94 has a SOD-63A outline and is encapsulated in a medium-green diffusing resin. This device will eventually be replaced by the CQY94B which has a super-green crystal, which has a better yield in the higher I_V classes.

The CQY94 forms one family with the CQY24B and the CQY96.

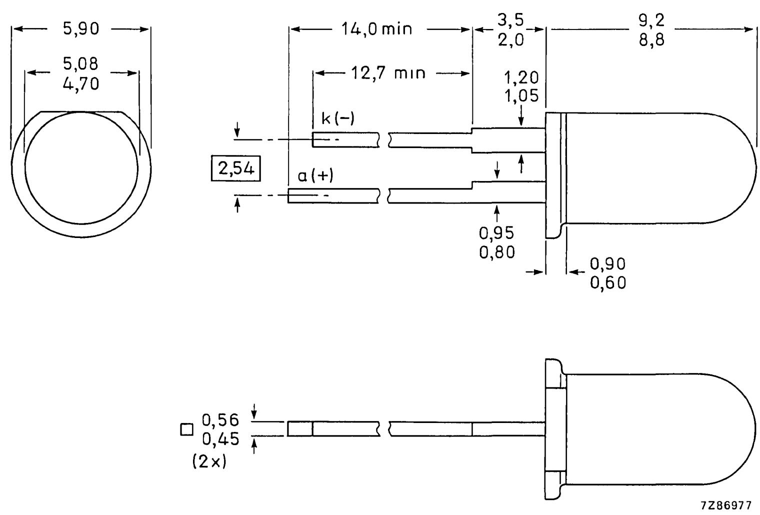
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5	V
Forward current (d.c.)		I_F	max.	30	mA
Total power dissipation up to T_{amb} = 65 °C		P_{tot}	max.	90	mW
Junction temperature		T_j	max.	100	°C
Luminous intensity					
I_F = 10 mA	CQY94-I	I_v	min.	0,7	mcd
	CQY94-II	I_v	1,0 to	2,2	mcd
	CQY94-III	I_v	1,6 to	3,5	mcd
	CQY94-IV	I_v	min.	3,0	mcd
Wavelength at peak emission		λ_{pk}	typ.	560	nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	60	°

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-63A.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5 V
Forward current d.c.	I_F	max.	30 mA
Forward current peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_{on} = 1 ms; δ = 0,33	I_{FM}	max.	60 mA
Total power dissipation up to T_{amb} = 65 °C	P_{tot}	max.	90 mW
Storage temperature	T_{stg}	−55 to +100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature > 1,5 mm from the seating plane; t_{sld} < 7 s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c.b.	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 10 mA		V_F	typ.	2,1 V
		V_F	max.	3,0 V
Reverse current V_R = 5 V		I_R	max.	100 μA
Beamwidth between half-intensity directions I_F = 10 mA		$\alpha_{50\%}$	typ.	60 °
Bandwidth at half height		$B_{50\%}$	typ.	30 nm
Wavelength at peak emission I_F = 10 mA		λ_{pk}	typ.	560 nm
Luminous intensity I_F = 10 mA	CQY94-I	I_v	min.	0,7 mcd
	CQY94-II	I_v	1,0 to	2,2 mcd
	CQY94-III	I_v	1,6 to	3,5 mcd
	CQY94-IV	I_v	min.	3,0 mcd
Diode capacitance V_R = 0; f = 1 MHz		C_d	typ.	35 pF

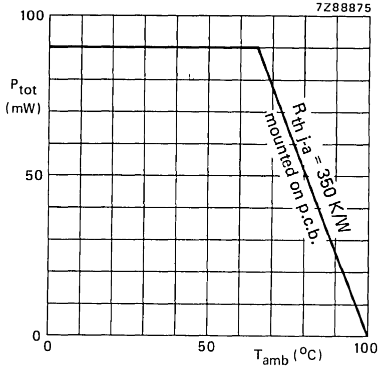


Fig. 2.

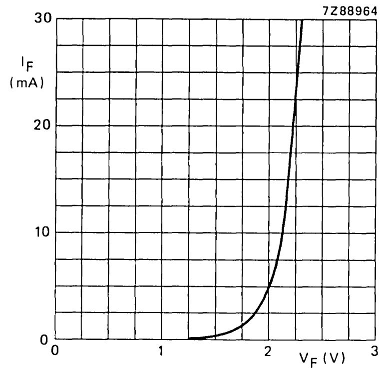


Fig. 3 T_{amb} = 25 °C; typ. values.

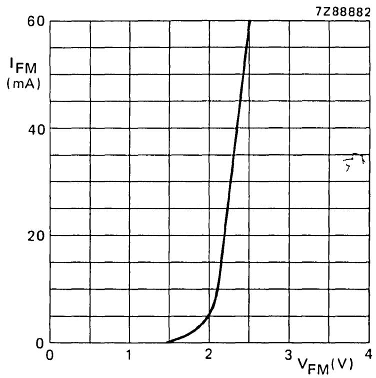


Fig. 4 T_{amb} = 25 °C; t_{on} = 1 ms; δ = 0,33; typ. values.

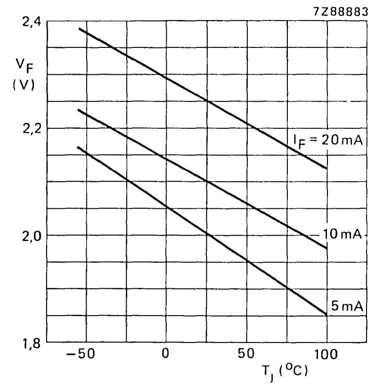


Fig. 5 Typical values.

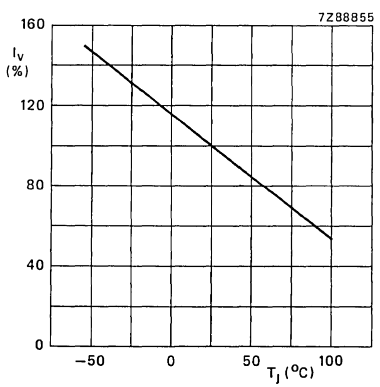


Fig. 6 I_F = 10 mA; typ. values.

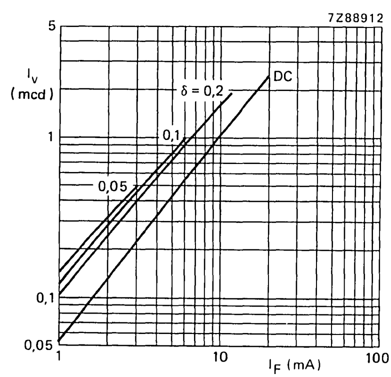


Fig. 7 t_p = 50 μs; typ. values.

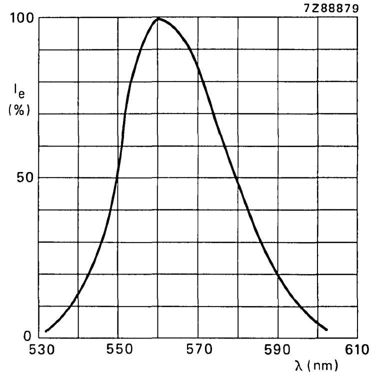


Fig. 8 Typical values.

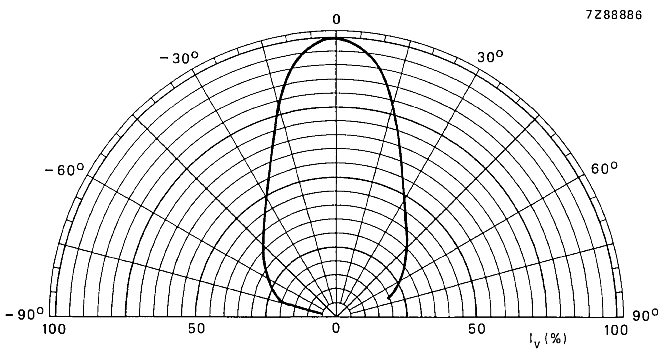


Fig. 9 Typical values.

LIGHT EMITTING DIODES

Circular light emitting diodes with diameter of 5 mm which emit super-green (GaP) light when forward biased.

The CQY94B and CQY94BL have a SOD-63 outline and are encapsulated in a medium-green diffusing resin. Because of its resistance to high forward currents the CQY94B (and CQY94BL) is very suitable in applications where a high luminous intensity is wanted. This type is easily deliverable in high I_V classes and therefore very suitable in those applications where only low currents are available.
The CQY94BL is the long-lead version of the CQY94B and has no seating plane but is in all other respects equal to the CQY94B.

QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.		5	V
Forward current (d.c.)		I_F	max.		60	mA
Total power dissipation up to T_{amb} = 35 °C		P_{tot}	max.		180	mW
Junction temperature		T_j	max.		100	°C
Luminous intensity						
I_F = 10 mA	CQY94B(L)	I_V	min.		0,7	mCd
	CQY94B(L)-III	I_V	1,6	to	3,5	mCd
	CQY94B(L)-IV	I_V	3,0	to	7,0	mCd
	CQY94B(L)-V	I_V	min.		5,0	mCd
Wavelength at peak emission		λ_{pk}	typ.		565	nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.		60	°

MECHANICAL DATA

Dimensions in mm

Fig. 1a SOD-63A.

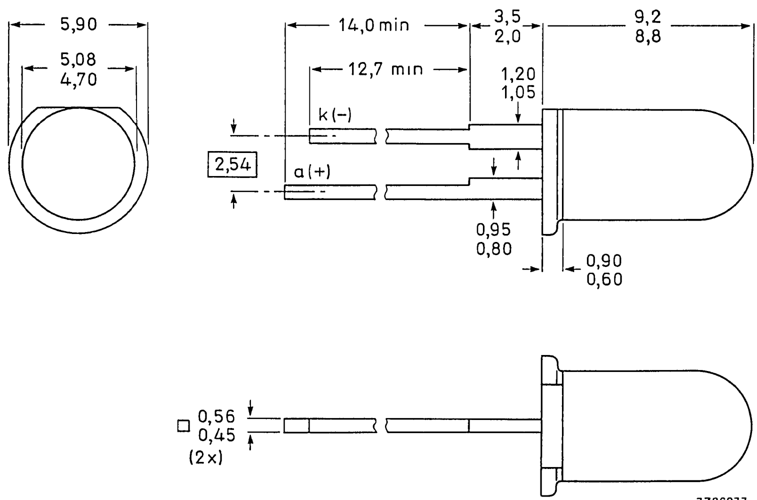
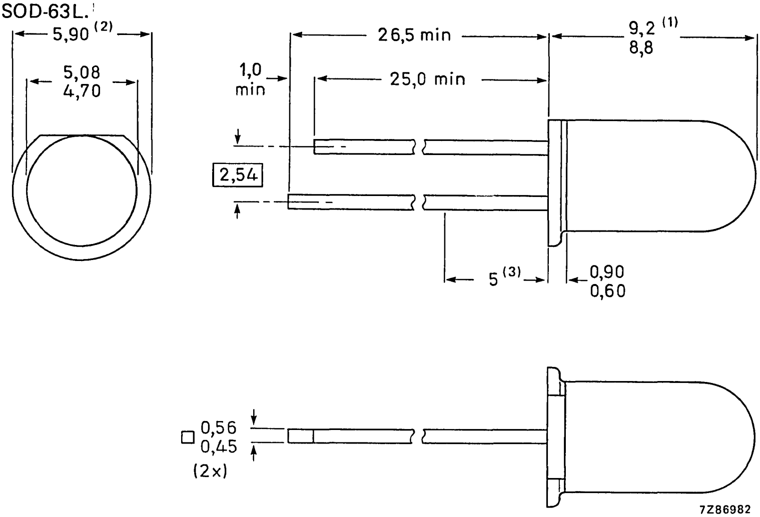


Fig. 1b SOD-63L.



(1) Measured when the device is seated in a gauge with 2 holes 0,80 mm diameter 2,54 mm apart.
(2) Maximum value including burrs.
(3) Solderability not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5 V
Forward current d.c.	I_F	max.	60 mA
Forward current peak value; t_p = 1 μs; f = 300 Hz peak value; t_p = 1 ms; δ = 0,33	I_{FM}	max.	1 A 150 mA
Total power dissipation up to T_{amb} = 35 °C	P_{tot}	max.	180 mW
Storage temperature	T_{stg}	−55 to +100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature at t_{sld} < 7 s > 1,5 mm from the seating plane for CQY94B > 5 mm from the plastic body for CQY94BL	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	350 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 10 mA	V_F	typ. max.	2,1 V 3,0 V
Reverse current V_R = 5 V	I_R	max.	100 μA

Beamwidth between half-intensity directions					
I_F = 10 mA		$\alpha_{50\%}$	typ.	60	o
Bandwidth at half height		$B_{50\%}$	typ.	30	nm
Wavelength at peak emission					
I_F = 10 mA		λ_{pk}	typ.	565	nm
Luminous intensity					
I_F = 10 mA	CQY94B(L)	I_v	min.	0,7	mCd
	CQY94B(L)-III	I_v	1,6 to	3,5	mCd
	CQY94B(L)-IV	I_v	3,0 to	7,0	mCd
	CQY94B(L)-V	I_v	min.	5,0	mCd
Diode capacitance					
V_R = 0; f = 1 MHz		C_d	typ.	35	pF

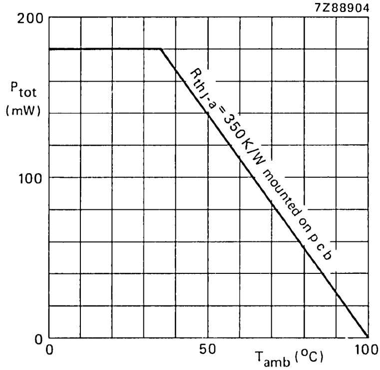


Fig. 2.

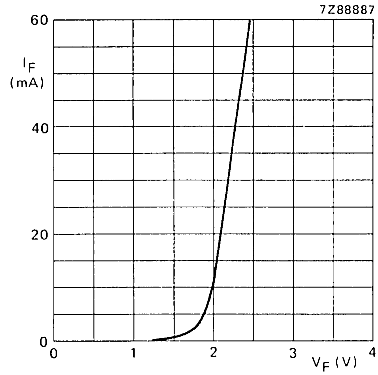


Fig. 3 T_{amb} = 25 °C; typ. values.

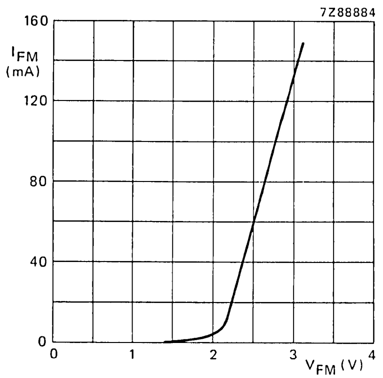


Fig. 4 t_{on} = 1 ms; δ = 0,33;
T_{amb} = 25 °C; typ. values.

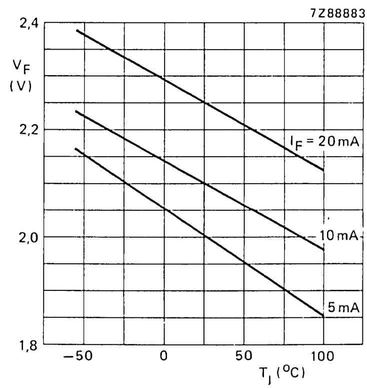


Fig. 5 Typical values.

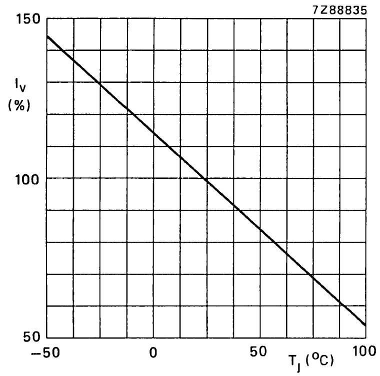


Fig. 6 Typical values.

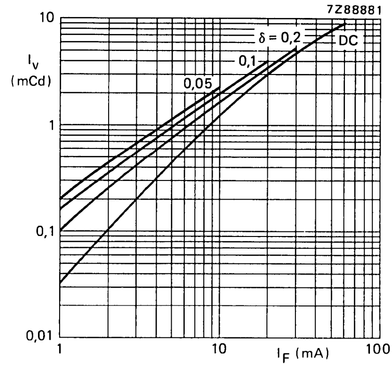


Fig. 7 $t_p = 50\ \mu s$; typ. values.

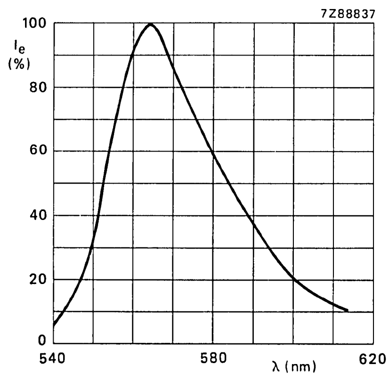


Fig. 8 $I_F = 10$ mA; typ. values.

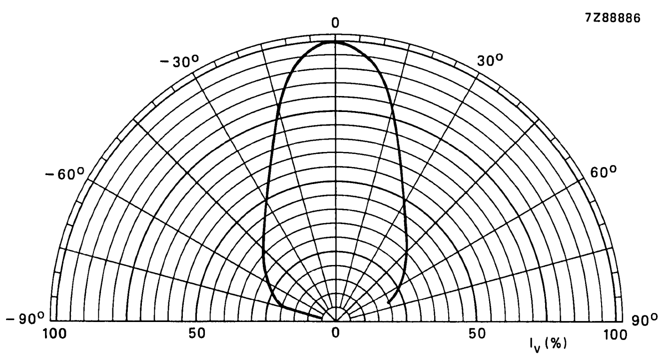


Fig. 9 $I_F = 10$ mA; typ. values.

LIGHT EMITTING DIODE

Circular light emitting diode with diameter of 3 mm which emits super-green light (GaP) when forward biased.

The CQY95B has a SOD-53 outline and is encapsulated in a medium-green coloured resin.
This LED can resist higher forward currents when a higher luminous intensity is wanted. Because the CQY95B is easily deliverable in high I_V classes it is very suitable in those applications where only low currents are available.

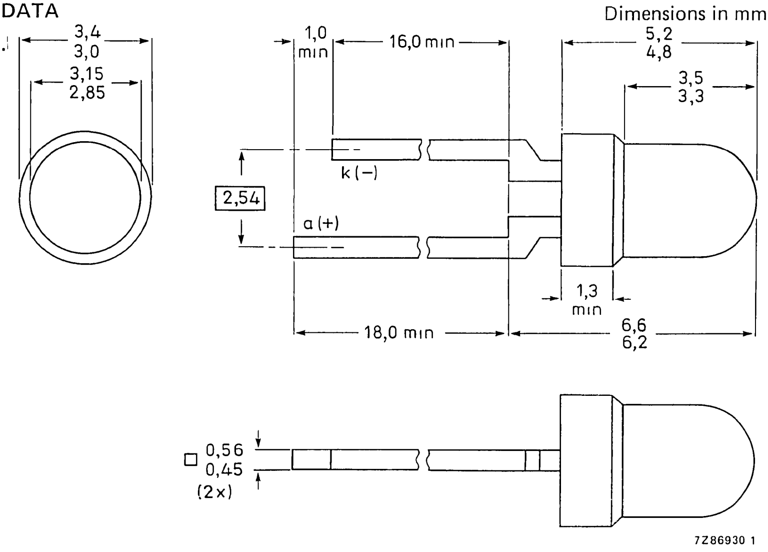
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5	V
Forward current (d.c.)		I_F	max.	60	mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	150	mW
Junction temperature		T_j	max.	100	°C
Luminous intensity					
I_F = 10 mA	CQY95B	I_V	min.	0,7	mCd
	CQY95B-III	I_V	1,6 to	3,5	mCd
	CQY95B-IV	I_V	3,0 to	7,0	mCd
	CQY95B-V	I_V	min.	5,0	mCd
Wavelength at peak emission		λ_{pk}	typ.	565	nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	60	°

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-53E.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5 V
Forward current			
d.c.	I_F	max.	60 mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1 A
peak value; t_{on} = 1 ms; δ = 0,33	I_{FM}	max.	150 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	150 mW
Storage temperature	T_{stg}	−55 to +100 °C	
Junction temperature	T_j	max.	100 °C
Lead soldering temperature > 1,5 mm from the seating plane; t_{sld} < 7 s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	500 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 10 mA		V_F	typ.		2,1 V
			max.		3,0 V
Reverse current V_R = 5 V		I_R	max.		100 μA
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.		60 °
Bandwidth at half height		$B_{50\%}$	typ.		30 nm
Wavelength at peak emission		λ_{pk}	typ.		565 nm
Luminous intensity I_F = 10 mA	CQY95B	I_v	min.		0,7 mCd
	CQY95B-III	I_v	1,6	to	3,5 mCd
	CQY95B-IV	I_v	3,0	to	7,0 mCd
	CQY95B-V	I_v	min.		5,0 mCd
Diode capacitance V = 0; f = 1 MHz		C_d	typ.		35 pF

DEVELOPMENT SAMPLE DATA

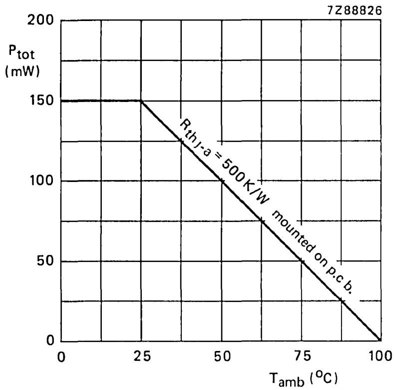


Fig. 2.

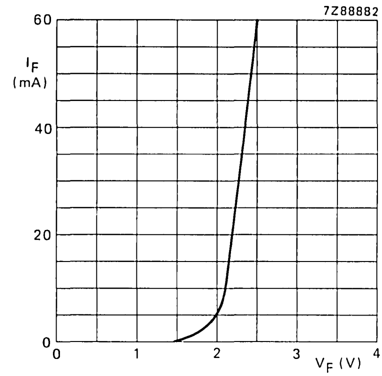


Fig. 3 T_{amb} = 25 °C; typ. values.

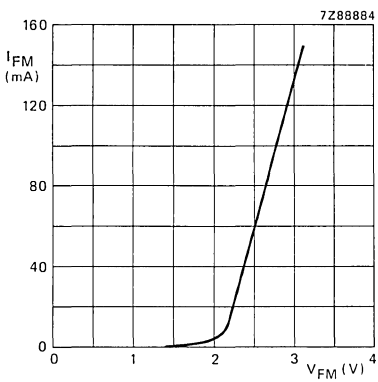


Fig. 4 t_{on} = 1 ms; δ = 0,33; T_{amb} = 25 °C; typ. values.

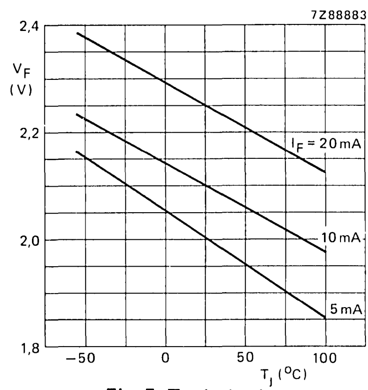


Fig. 5 Typical values.

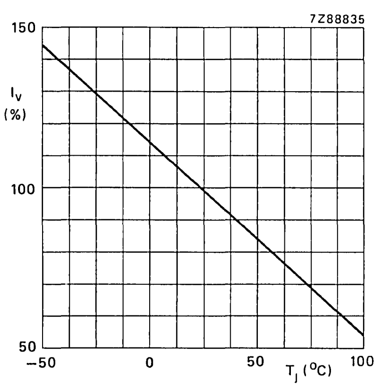


Fig. 6 Typical values.

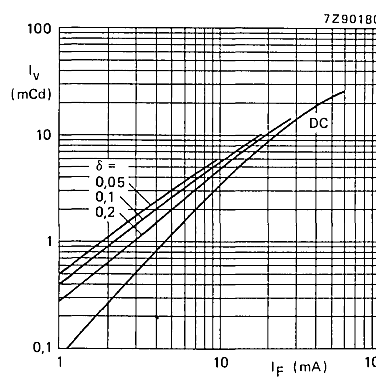


Fig. 7 t_p = 50 μs; typ. values.

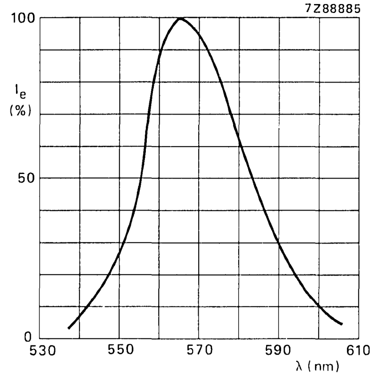


Fig. 8 I_F = 10 mA; typ. values.

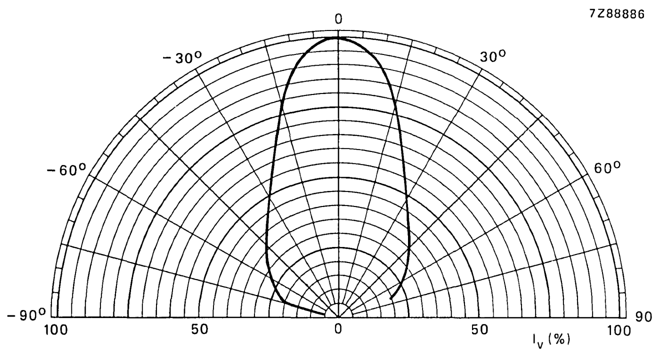


Fig. 9 Typical values.

LIGHT EMITTING DIODES

Circular light emitting diodes with diameter of 5 mm which emit yellow (GaAsP) light when forward biased.

The CQY96 and CQY96L have a SOD-63 outline and are encapsulated in a yellow diffusing resin.

The CQY96L is the long-lead version of the CQY96 and has no seating plane but is in all other respects equal to the CQY96.

QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.	5	V
Forward current (d.c.)		I_F	max.	30	mA
Total power dissipation up to T_{amb} = 65 °C		P_{tot}	max.	90	mW
Junction temperature		T_j	max.	100	°C
Luminous intensity (on-axis)					
I_F = 10 mA	**CQY96(L)-I**	I_V	min.	0,7	mCd
	CQY96(L)-III	I_V	1,6 to	3,5	mCd
	CQY96(L)-IV	I_V	3,0 to	7,0	mCd
	CQY96(L)-V	I_V	min.	5,0	mCd
Wavelength at peak emission		λ_{pk}	typ.	590	nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	60	°

MECHANICAL DATA

Dimensions in mm

Fig. 1a SOD-63A.
CQY96

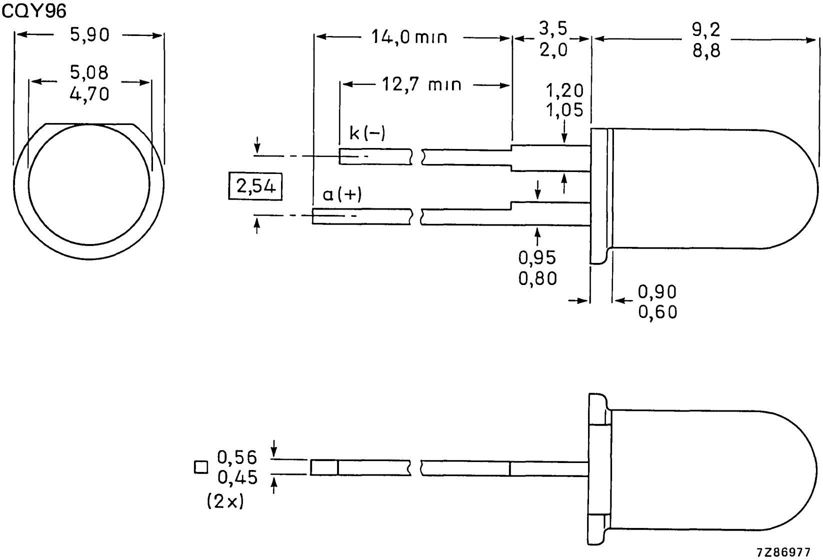
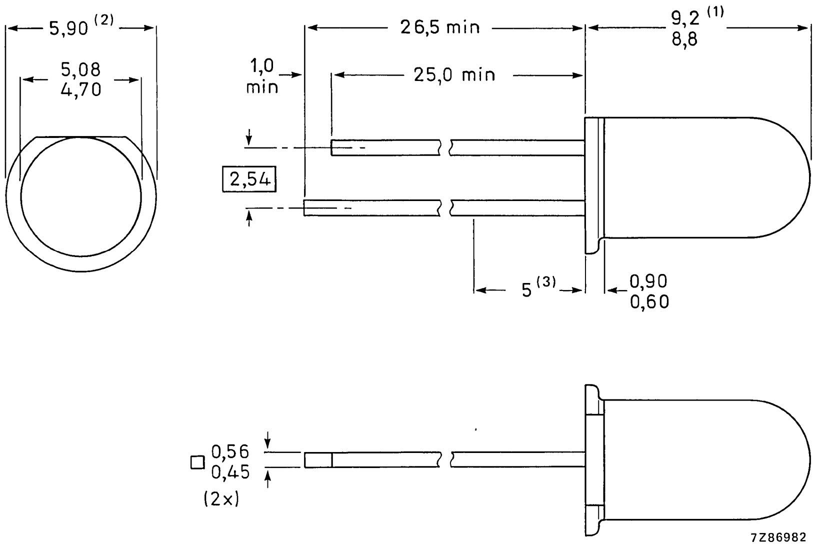


Fig. 1b SOD-63L.
CQY96L



Notes

1. Measured when the device is seated in a gauge with 2 holes 0,80 mm diameter 2,54 mm apart.
2. Maximum value including burrs.
3. Solderability not guaranteed within this zone due to tie-bar cropping.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	5	V
Forward current (d.c.)	I_F	max.	30	mA
Forward current (peak value)				
$t_p < 1$ µs; $f < 300$ Hz	I_{FM}	max.	1	A
$t_p < 1$ ms; $\delta = 0{,}33$	I_{FM}	max.	60	mA
Total power dissipation up to $T_{amb} = 65$ °C	P_{tot}	max.	90	mW
Storage temperature	T_{stg}	−55 to + 100		°C
Junction temperature	T_j	max.	100	°C
Lead soldering temperature at $t_{sld} < 7$ s > 1,5 mm from the seating plane for CQY96 > 5 mm from the plastic body for CQY96L	T_{sld}	max.	260	°C

THERMAL RESISTANCE

From junction to ambient				
in free air	$R_{th\ j\text{-}a}$	=	500	K/W
mounted on a printed board	$R_{th\ j\text{-}a}$	=	350	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 10 mA		V_F	typ.	2,1	V
			max.	3	V
Reverse current V_R = 3 V		I_R	max.	100	μA
Diode capacitance V_R = 0; f = 1 MHz		C_d	typ.	35	pF
Luminous intensity (on-axis) I_F = 10 mA	**CQY96(L)-I**	I_v	min.	0,7	mCd
	CQY96(L)-III	I_v	1,6 to	3,5	mCd
	CQY96(L)-IV	I_v	3,0 to	7,0	mCd
	CQY96(L)-V	I_v	min.	5,0	mCd
Wavelength at peak emission		λ_{pk}	typ.	590	nm
Bandwidth at half height		$B_{50\%}$	typ.	40	nm
Beamwidth between half-intensity directions		$\alpha_{50\%}$	typ.	60	°

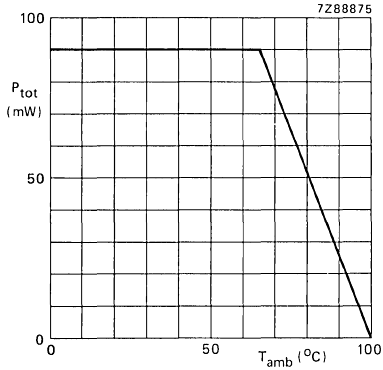


Fig. 2.

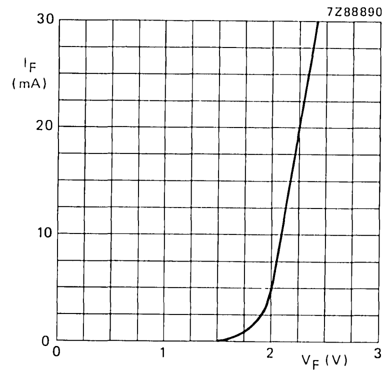


Fig. 3 T_{amb} = 25 °C; typ. values.

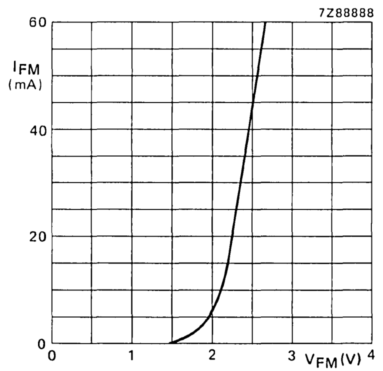


Fig. 4 t_{on} = 1 ms; δ = 0,33; T_{amb} = 25 °C; typ. values.

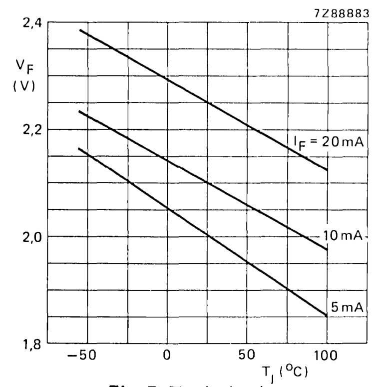


Fig. 5 Typical values.

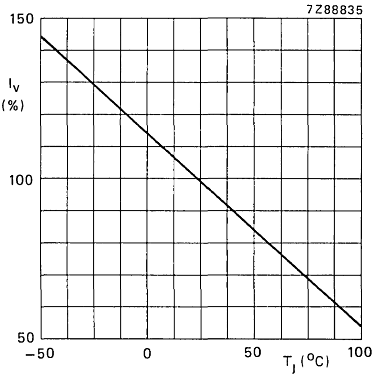


Fig. 6 Typical values.

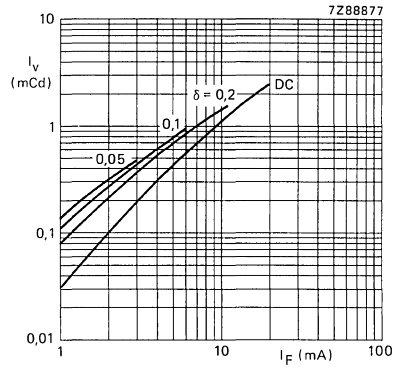


Fig. 7 t_p = 50 μs; typ. values.

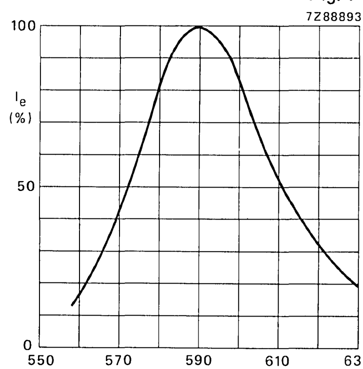


Fig. 8 Typical values.

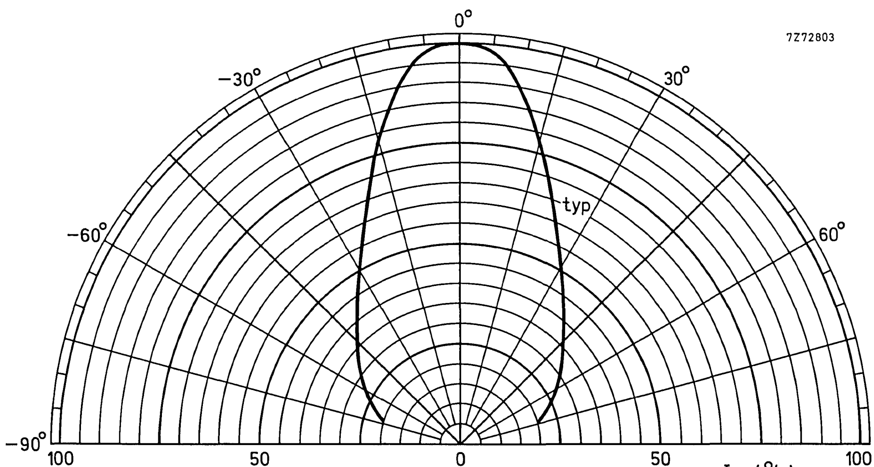


Fig. 9 Typical values.

LIGHT EMITTING DIODE

Circular light emitting diode with diameter of 3 mm which emits yellow light (GaPAs) when forward biased.

The CQY97A has a SOD-53E envelope and is encapsulated in a medium-yellow coloured diffusing resin.

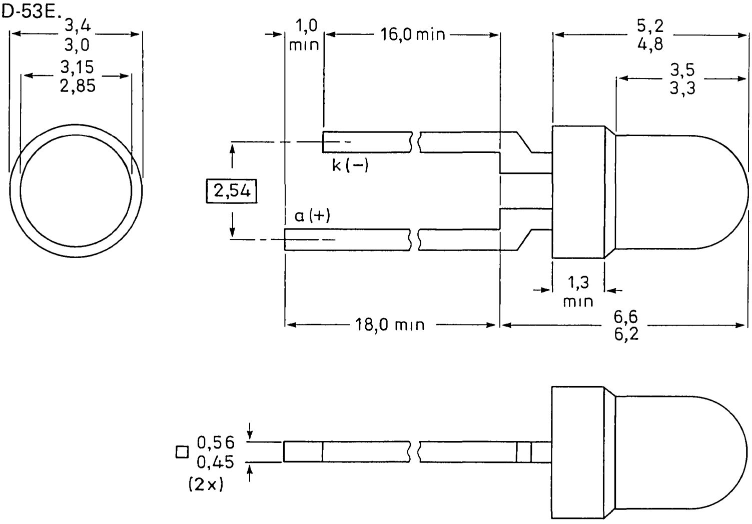
QUICK REFERENCE DATA

Continuous reverse voltage		V_R	max.		5	V
Forward current (d.c.)		I_F	max.		30	mA
Total power dissipation up to T_{amb} = 55 °C		P_{tot}	max.		90	mW
Junction temperature		T_j	max.		100	°C
Luminous intensity						
I_F = 10 mA	CQY97A	I_V	min.		0,7	mCd
	CQY97A-III	I_V	1,6	to	3,5	mCd
	CQY97A-IV	I_V	3,0	to	7,0	mCd
	CQY97A-V	I_V	min.		5,0	mCd
Wavelength at peak emission						
I_F = 10 mA		λ_{pk}	typ.		590	nm
Beamwidth at half-intensity directions		$\alpha_{50\%}$	typ.		60	°

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-53E.



RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	5	V
Forward current				
d.c.	I_F	max.	30	mA
peak value; t_p = 1 μs; f = 300 Hz	I_{FM}	max.	1	A
peak value; t_p = 1 ms; δ = 0,33	I_{FM}	max.	60	mA
Total power dissipation up to T_{amb} = 55 °C	P_{tot}	max.	90	mW
Storage temperature	T_{stg}	−55 to + 100		°C
Junction temperature	T_j	max.	100	°C
Lead soldering temperature > 1,5 mm from the seating plane; t_{sld} < 7 s	T_{sld}	max.	260	°C

THERMAL RESISTANCE

From junction to ambient when the device is mounted on a p.c. board	$R_{th\ j\text{-}a}$	max.	500	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 10 mA		V_F	typ.	2,1	V
		V_F	max.	3,0	V
Reverse current V_R = 5 V		I_R	max.	100	μA
Beamwidth between half-intensity directions I_F = 10 mA		$\alpha_{50\%}$	typ.	60	°
Bandwidth at half height		$B_{50\%}$	typ.	40	nm
Wavelength at peak emission I_F = 10 mA		λ_{pk}	typ.	590	nm
Luminous intensity (class division) I_F = 10 mA	CQY97A	I_v	min.	0,7	mCd
	CQY97A-III	I_v	1,6 to	3,5	mCd
	CQY97A-IV	I_v	3,0 to	7,0	mCd
	CQY97A-V	I_v	min.	5,0	mCd
Diode capacitance V_R = 0; f = 1 MHz		C_d	typ.	35	pF

DEVELOPMENT SAMPLE DATA

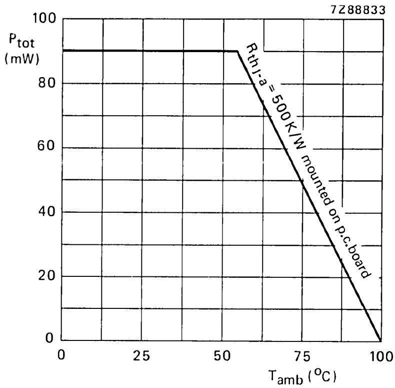


Fig. 2.

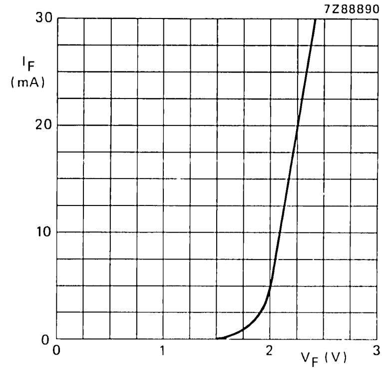


Fig. 3 T_j = 25 °C; typ. values.

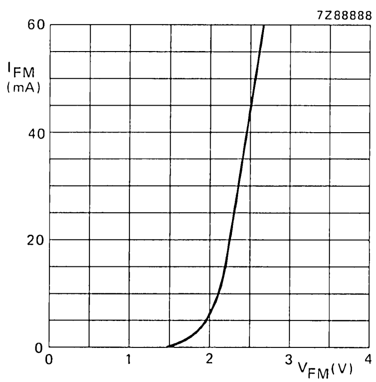


Fig. 4 t_p = 50 μs; δ = 0,01; T_{amb} = 25 °C; typ. values.

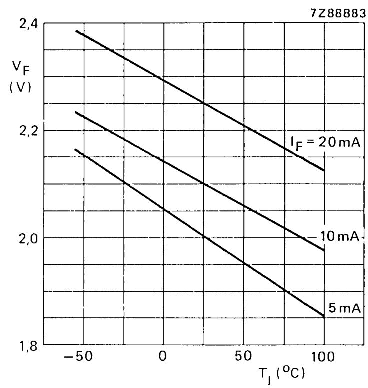


Fig. 5 Typical values.

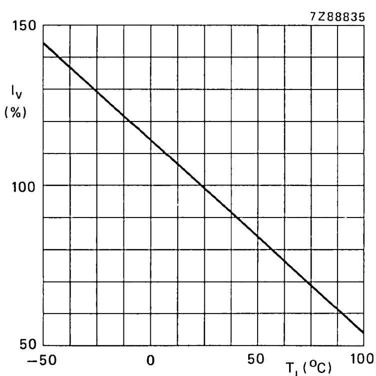


Fig. 6 Typical values.

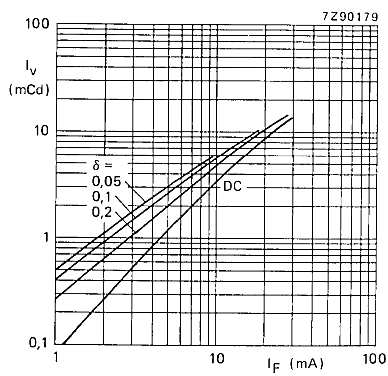


Fig. 7 T_j = 25 °C; typ. values.

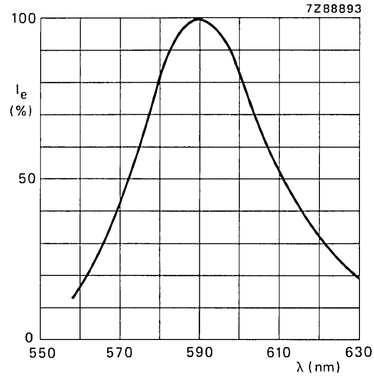


Fig. 8 Typical values.

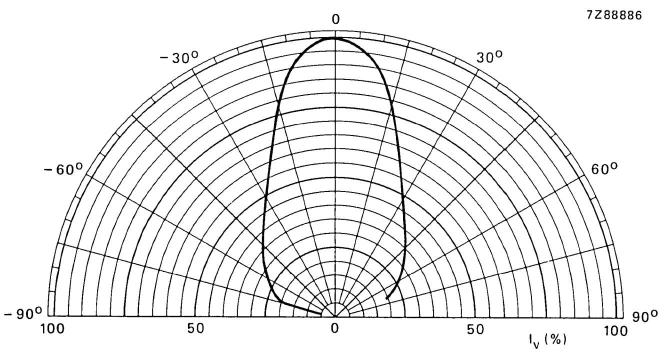


Fig. 9 Typical values.

TWELVE SEGMENTS BAR GRAPH DISPLAY

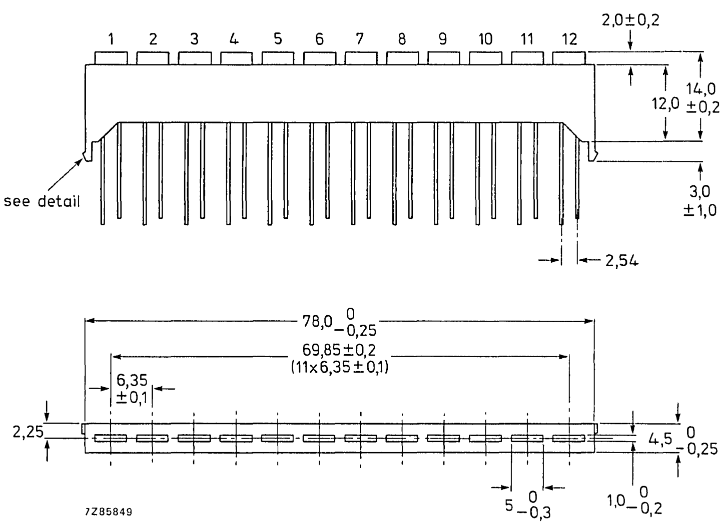
The RTC901 to 904 series are 12 segments bar graph LED displays with separate anode and cathodes for each light segment. The bar graph array consists of 12 pieces of rectangular LED of the family CQV60 assembled in a plastic bar (holder).

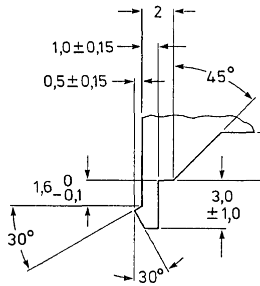
RTC901 = 12 CQV60 (super-red)
RTC902 = 12 CQV61A (super-green)
RTC903 = 12 CQV62 (yellow)
RTC904 = mix in any colour upon request (RTC907 = empty array)

Intensity matching in the array < 2 : 1.
Ratings and characteristics see CQV60..

MECHANICAL DATA

Dimensions in mm





DETAIL

DOUBLE HETEROSTRUCTURE AlGaAs DIODE LASER WITH FIBRE PIGTAIL

The 375CQY/B is an AlGaAs double heterostructure semiconductor laser designed for high speed (560 Mbits/s), long distance, optical communications and CATV systems.

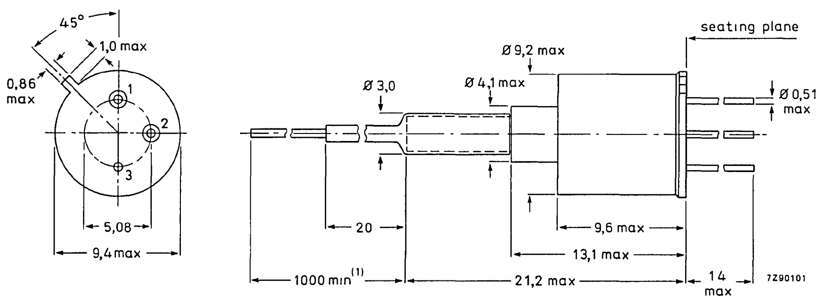
The diode laser, emitting in the 850 nm transmission window of silica optical fibres, is mounted in a specifically designed hermetic encapsulation (modified TO-5). The 375CQY/B is standard equipped with a fast-responding photodiode optically coupled to the rear facet of the laser for monitoring the laser radiant output power. A silica graded index optical fibre pigtail is coupled to the front facet of the laser.

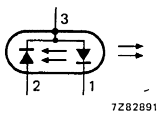
For application in long-distance optical telecommunication, the silicon avalanche photodiode BPF10 (368BPY) is recommended as the photo-detector at the receiving end of the optical transmission section.

MECHANICAL DATA

Dimensions in mm

Fig. 1.





LASER

The double heterostructure laser, with very narrow stripe, operates in a stable single transverse mode (TE_{00}) over the full power range and in several longitudinal modes. This results in a rather short coherence length, which is advantageous in suppressing modal noise and optical feedback effects.

The structure is designed to operate at a radiant output level of up to 3 mW in the fibre, up to relatively high case temperatures (60 °C) and at an emission wavelength of 850 nm (at which wavelength the absorption of high-quality silica fibres is low).

All lasers have been subjected to a burn-in test at a radiant output level from the laser facet of 5 mW at a case temperature of 60 °C.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Radiant output power from fibre pigtail	ϕ_e	max.	5 mW
Reverse voltage	V_R	max.	1 V

CHARACTERISTICS

Threshold current			
T_c = 30 °C	I_{th}	typ.	90 mA
T_c = 60 °C	I_{th}	typ. max.	120 mA 150 mA
Radiant output power from fibre pigtail			
T_c = 60 °C	ϕ_e	typ.	3 mW
Forward voltage drop			
ϕ_e = 3 mW	V_F	typ.	2,5 V
Wavelength at peak emission	λ_{pk}	typ.	850 nm
Spectral width at half intensity	$\Delta\lambda$	typ.	3 nm
Rise time, fall time			
laser biased near I_{th}	t_r, t_f	typ.	0,5 ns
Degradation rate			
T_c = 60 °C; ϕ_e = 3 mW	$\frac{1}{I_{th}} \cdot \frac{dI_{th}}{dt}$	typ.	5 %/Kh
Spectrum at ϕ_e = 1 mW (FWHM)		typ.	6 longitudinal modes
Extinction ratio at ϕ_e = 3 mW			1:10
Temperature coefficient of wavelength	$\frac{d\lambda_{pk}}{dT}$	typ.	0,25 nm/K
Temperature coefficient of I_{th}	$\frac{1}{I_{th}} \cdot \frac{dI_{th}}{dt}$	typ.	1 %/K
Differential efficiency			
(stimulated emission)	ϵ	typ.	0,1 mW/mA

PHOTODIODE

Reverse voltage	V_R	max.		30	V
Luminous sensitivity $V_R = 15$ V	N	typ.		0,5	A/W
Dark reverse current $V_R = 15$ V	I_{RD}	max.		10	nA
Capacitance $V_R = 0$	C_d	max.		5	pF
Monitor diode current	I_R	100	to	300	μA/mW

FIBRE PIGTAIL

Graded index silica rubber		min.	typ.	max.	
numerical aperture on axis	NA	0,20	0,21	0,22	
core diameter	ϕ_{core}	48	50	52	μm
cladding diameter	ϕ_{clad}	123	125	127	μm
primary coating thickness	ϕ_{pc}		5		μm
secondary coating diameter	ϕ_{sc}		500		μm

Options: Other fibre for pigtail may be made available.
Other wavelengths are available and are specified by adding a suffix to the type number:

no suffix	=	780-810	nm
suffix A	=	810-840	nm
suffix B	=	840-860	nm
suffix C	=	860-880	nm

Options may be subject to surcharge.

TEMPERATURES (total assembly)

C.W. operation	T_{op}	0	to	60	°C
Storage	T_{stg}	−40	to	+125	°C
Thermal resistance junction to case	$R_{th\ j\text{-}c}$	typ.		45	K/W

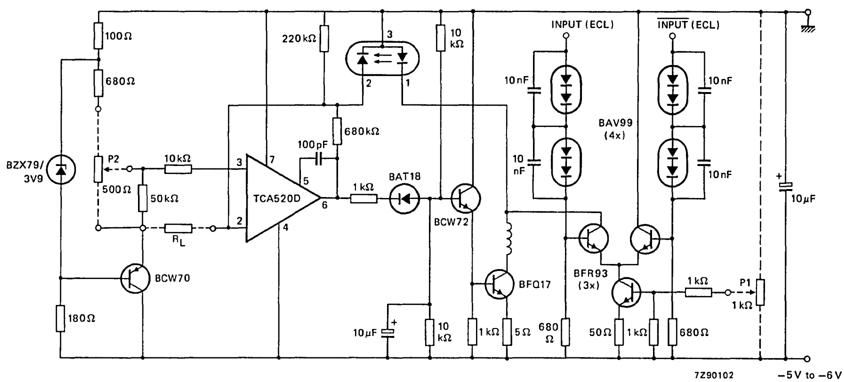


Fig. 2 Typical modulation circuit with ECL logic input and control of average optical power output. Data rate > 200 Mbits/s.

P_1 sets the peak-peak modulation current.
P_2 sets the laser bias current.
R_L determines maximum mean value of optical output power.
1-2-3 laser connections.

Note: If single ECL drive is applied, the other input shall be connected to the ECL threshold level (−1,35 V).

OPERATING PRECAUTIONS

Semiconductor lasers in general are easily damaged by overdriving and electrical transients. Electrically, the laser diode is a very reliable device and can easily withstand current surges of several amperes. Optically, however, the laser diode is more susceptible to damage because of the extremely high optical flux density passing through both facets while in operation. By overdriving or transients to the laser, even for pulses to the nanosecond region, the optical flux density can rise to unacceptable values (10 to 100 MW/cm^2), causing gradual or catastrophic degradation of the laser facets. Current transients should therefore be carefully avoided; they decrease the life time of the laser.

CAUTION

Aluminium gallium arsenide lasers emit radiation which is invisible to the human eye. When in use, do not look directly into the device. Direct viewing of laser light at close range to the fibre pigtail end, may cause eye damage.

The device falls within the safety class 3B the international standard code.

Note: Each laser is accompanied with an individual test sheet, showing the P_{opt}-I_{op} characteristic and the monitor current for a given optical output power.

DOUBLE HETEROSTRUCTURE AlGaAs LASER DIODE WITH FIBRE PIGTAIL

The 497CQF/A is an AlGaAs double heterostructure semiconductor laser made in index guiding structure. The device is designed for high-speed long distance, optical communications and data transmissions.

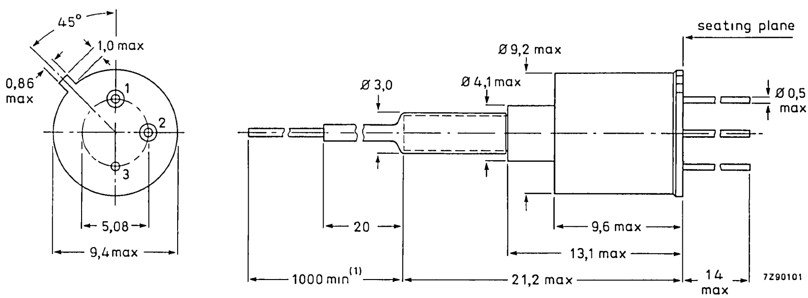
The diode laser, emitting in the 835 nm transmission window of silica optical fibres, is mounted in a specifically designed hermetic encapsulation (modified TO-5). The 497CQF/A is standard equipped with a fast-responding photodiode optically coupled to the rear facet of the laser for monitoring the laser radiant output power. A silica graded index optical fibre pigtail is coupled to the front facet of the laser.

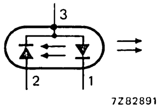
For application in long-distance optical telecommunication, the silicon avalanche photodiode BPF10 (368BPY) is recommended as the photo-detector at the receiving end of the optical transmission section.

MECHANICAL DATA

Dimensions in mm

Fig. 1.





LASER

The double heterostructure laser AlGaAs laser is made by index guiding technology and provides single transverse mode as well as single longitudinal mode operation. This technology gives rise to a large spectral purity, large extinction ratio and is free of self-pulsations.

The structure is designed to operate at a radiant output level of up to 2 mW in the fibre, up to relatively high case temperatures (60 °C) and at an emission wavelength of 835 nm (at which wavelength the absorption of high-quality silica fibres is low).

All lasers have been subjected to a burn-in test at a radiant output level from the laser facet of 4 mW at a case temperature of 60 °C.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Radiant output power from fibre pigtail	ϕ_e	max.	4	mW
Reverse voltage	V_R	max.	1	V

CHARACTERISTICS

Threshold current T_c = 30 °C	I_{th}	typ.	70	mA
T_c = 60 °C	I_{th}	typ.	100	mA
		max.	130	mA
Radiant output power from fibre pigtail T_c = 60 °C	ϕ_e	typ.	2	mW
Forward voltage drop ϕ_e = 2 mW	V_F	typ.	2,0	V
Wavelength at peak emission	λ_{pk}	typ.	835	nm
Spectral width at half intensity	$\Delta\lambda$	typ.	0,5	nm
Rise time, fall time laser biased near I_{th}	t_r, t_f	typ.	0,5	ns
Degradation rate T_c = 60 °C; ϕ_e = 3 mW	$\frac{1}{I_{th}} \cdot \frac{dI_{th}}{dt}$	typ.	3	%/Kh
Temperature coefficient of wavelength	$\frac{d\lambda_{pk}}{dT}$	typ.	0,25	nm/K
Temperature coefficient of threshold current	$\frac{1}{I_{th}} \cdot \frac{dI_{th}}{dT}$	typ.	1	%/K
Differential efficiency (stimulated emission)	ϵ	typ.	0,2	mW/mA
Extinction ratio ϕ_e = 4 mW		typ.	1:25	
Spectral purity (90% of output radiant power)		single longitudinal mode		

PHOTODIODE

Reverse voltage	V_R	max.	30	V
Luminous sensitivity $V_R = 15$ V	N	typ.	0,5	A/W
Dark reverse current $V_R = 15$ V	I_{RD}	max.	10	nA
Capacitance $V_R = 0$	C_d	max.	5	pF
Monitor diode current	I_R	100 to	300	μA/mW

FIBRE PIGTAIL

Graded index silica rubber		min.	typ.	max.	
numerical aperture on axis	NA	0,20	0,21	0,22	
core diameter	ϕ_{core}	48	50	52	μm
cladding diameter	ϕ_{clad}	123	125	127	μm
primary coating thickness	ϕ_{pc}		5		μm
secondary coating diameter	ϕ_{sc}		500		μm

Options: Other fibre for pigtail may be accommodated.
Other wavelengths are available and are specified by adding a suffix to the type number:

no suffix	=	780-810	nm
suffix A	=	810-840	nm
suffix B	=	840-860	nm
suffix C	=	860-880	nm

Options may be subject to surcharge.

TEMPERATURES (total assembly)

C.W. operation	T_{op}		0 to 60	°C
Storage	T_{stg}		−40 to +125	°C
Thermal resistance from junction to case	$R_{th\ j\text{-}c}$	typ.	45	K/W

DEVELOPMENT SAMPLE DATA

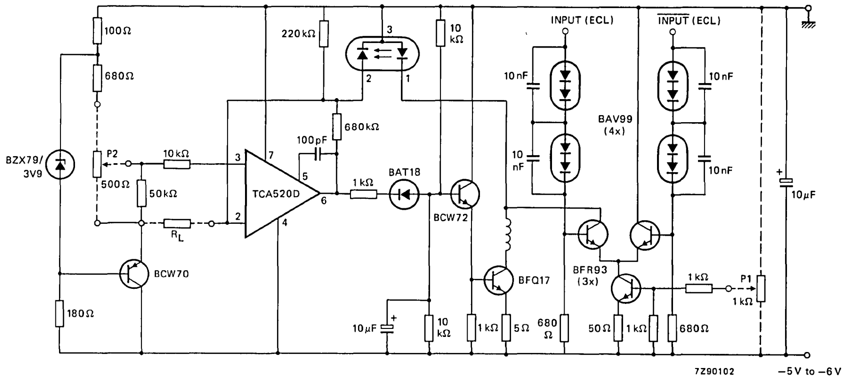


Fig. 2 Typical modulation circuit with ECL logic input and control of average optical power output. Data rate > 200 Mbits/s.

P_1 sets the peak-peak modulation current.
P_2 sets the laser bias current.
R_L determines maximum mean value of optical output power.
1-2-3 laser connections.

Note: If single ECL drive is applied, the other input shall be connected to the ECL threshold level (−1,35 V).

OPERATING PRECAUTIONS

Semiconductor lasers in general are easily damaged by overdriving and electrical transients. Electrically, the laser diode is a very reliable device and can easily withstand current surges of several amperes. Optically, however, the laser diode is more susceptible to damage because of the extremely high optical flux density passing through both facets while in operation. By overdriving or transients to the laser, even for pulses in the nanosecond region, the optical flux density can rise to unacceptable values (10 to 100 MW/cm^2), causing gradual or catastrophic degradation of the laser facets. Current transients should therefore be carefully avoided; they decrease the life time of the laser.

CAUTION

Aluminium gallium arsenide lasers emit radiation which is invisible to the human eye. When in use, do not look directly into the device. Direct viewing of laser light at close range to the fibre pigtail end, may cause eye damage.

The device falls within the safety class 3B of the international standard code.

Note: Laser is accompanied with an individual test sheet, showing the P_{opt}-I_{op} characteristic and the monitor current for a given optical output power.

DOUBLE HETEROSTRUCTURE AlGaAs LASER

The 498CQL is an AlGaAs double heterostructure diode laser made in index guiding technology and is designed for reading applications such as: video-audio disc applications, optical memories, security systems, etc.

This device is mounted in an hermetic SOT-148 encapsulation specifically designed for easy alignment in an optical read or write system. The copper heatsink is circular and precision engineered with a diameter accuracy of +0, −9 μs. Laser stripe and mechanical axis coincide within 50 μm.

The 498CQL is standard equipped with a photo p-i-n diode, optically coupled to the rear emitting facet of the laser. This fast responding (less than 20 ns) photodiode can be used as a sensor to control the laser radiant output level. The ultra-flat top window (flat within two fringes) guarantees an unperturbed beam wavefront.

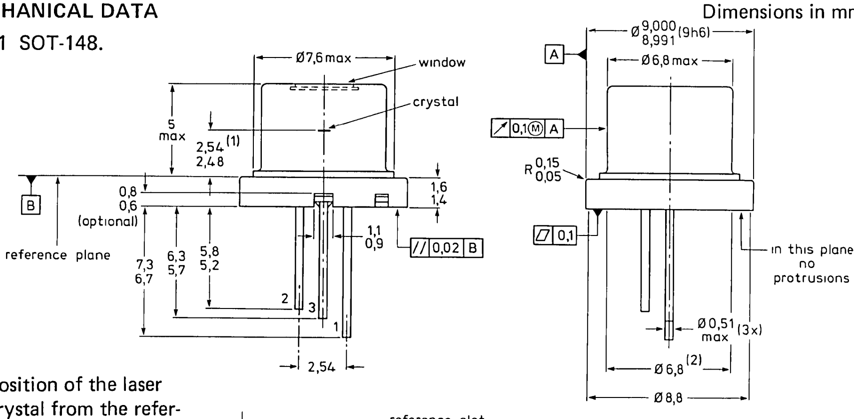
QUICK REFERENCE DATA

Threshold current at T_c = 30 °C	I_{th}	typ.	50 mA
C.W. radiant output power up to T_c = 60 °C	ϕ_e	typ.	5 mW
Wavelength at peak emission	λ_{pk}	typ.	840 nm

MECHANICAL DATA

Dimensions in mm

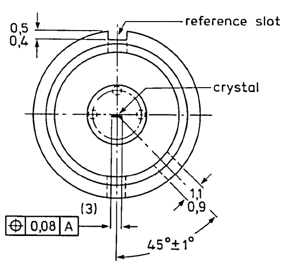
Fig. 1 SOT-148.

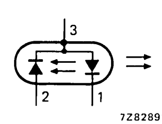


(1) Position of the laser crystal from the reference plane.

(2) Within the plane of 6,8 diameter, protrusions and irregularities are permitted.

(3) Positional accuracy of the laser stripe with respect to the flange diameter.





LASER

The double heterostructure stripe laser is made by index guiding technology and operates in single transverse as well in single longitudinal mode over the full power range. This structure gives rise to large spectral purity, large coherence length and is free of self-pulsations.

The structure is designed to operate C.W. 5 mW up to relatively high temperatures (60 °C case temperature) with a wavelength of 840 nm which makes reading standard Video Long Play records and compact discs (DAD) a possible application.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Radiant output power	ϕ_e	max.	10 mW
Reverse voltage	V_R	max.	1 V
Temperatures			
C.W. operation	T_c		−20 to +60 °C
storage	T_{stg}		−55 to +100 °C

CHARACTERISTICS

Threshold current			
at T_c = 30 °C	I_{th}	typ.	50 mA
at T_c = 60 °C	I_{th}	typ.	75 mA
Operating current			
ϕ_e = 5 mW; T_c = 30 °C	I_{op}	typ.	80 mA
		max.	110 mA
ϕ_e = 5 mW; T_c = 60 °C	I_{op}	typ.	110 mA
		max.	145 mA
Recommended operating radiant output power up to T_c = 60 °C	ϕ_e	typ.	5 mW
Forward voltage drop up to T_c = 60 °C, ϕ_e = 5 mW	V_F	typ.	2,0 V
Wavelength at peak emission, ϕ_e = 5 mW; T_c = 30 °C	λ_{pk}	typ.	840 nm
Spectral width at half height, ϕ_e = 5 mW	$\Delta\lambda$	typ.	0,5 nm
Far-field angle at half-intensity directions (FWHM)			
perpendicular to the junction plane	$\alpha_{50\%}(\perp)$	typ.	35 °
parallel to the junction plane	$\alpha_{50\%}(\parallel)$	typ.	15 °
Series resistance	R_S	typ.	3 Ω
Differential efficiency at ϕ_e = 2 mV	ϵ	typ.	0,20 W/A
Spontaneous emission at I_{th}	ϕ_{spon}	typ.	0,2 mW
Turn-on/turn-off time (above threshold)	t_{on}/t_{off}	typ.	1 ns
Degradation rate, T_c = 60 °C; ϕ_e = 5 mW	$\frac{1}{I_{op}} \cdot \frac{dI_{op}}{dT}$	typ.	3 %/Kh
Temperature coefficient of wavelength	$\frac{d\lambda_{pk}}{dT}$	typ.	0,25 nm/K
Temperature coefficient of I_{th}	$\frac{1}{I_{th}} \cdot \frac{dI_{th}}{dT}$	typ.	1 %/K
Thermal resistance from junction to case	$R_{th\ j\text{-}c}$	typ.	50 K/W

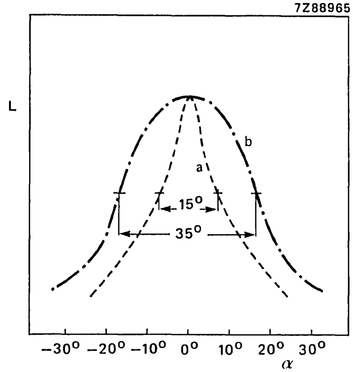


Fig. 2 Far-field pattern.
a. parallel to the junction plane.
b. perpendicular to the junction plane.

DEVELOPMENT SAMPLE DATA

PHOTODIODE

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Reverse voltage	V_R	max.	30 V

CHARACTERISTICS

Luminous sensitivity at V_R = 15 V	N	typ.	0,5 A/W
Dark reverse current at V_R = 15 V	$I_{R(D)}$	max.	10 nA
Capacitance at V_R = 0	C_d	max.	5 pF
Monitor diode current at V_R = 15 V	$I_{R(L)}$		150-400 µA/mW

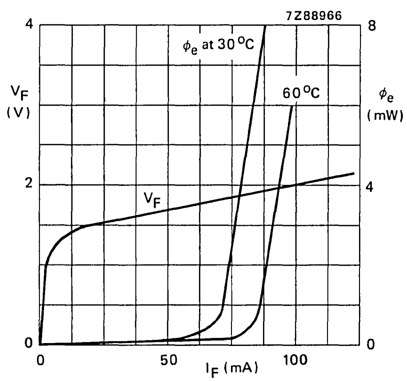


Fig. 3 Forward voltage drop (V_F) and radiant output power (ϕ_e) of laser diode as a function of forward current; typ. values.

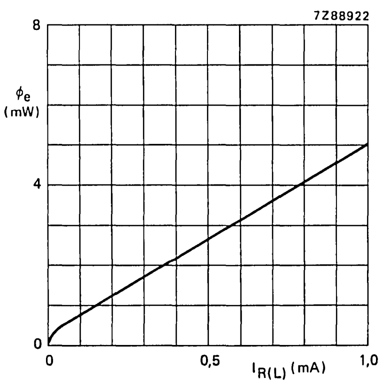
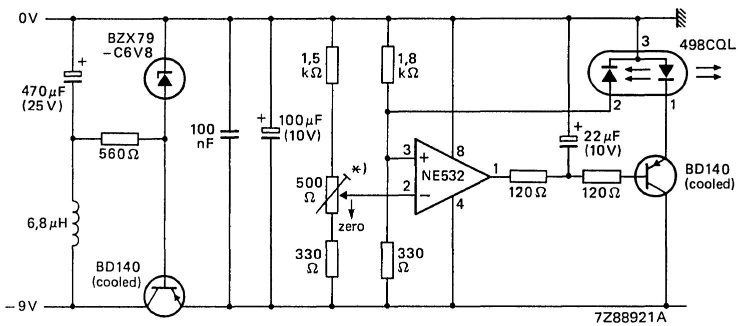


Fig. 4 Radiant output power (ϕ_e) as a function of monitor current of photodiode; V_R (photodiode) = 15 V; typ. values.



* Ten turn. Zero position is at 0,58 revolution. Each revolution is equivalent to 500 μA monitor diode current. Adjust from zero position.

Fig. 5 Recommended control circuit for continuous operation.

OPERATING PRECAUTIONS

Semiconductor lasers in general are easily damaged by over-driving and electrical transients. Electrically, the laser diode is a very reliable device and can easily withstand current surges of several amperes. Optically, however, the diode laser is more susceptible to damage because of the extremely high optical flux density passing through both facets, while in operation. By over-driving or transients to the laser, even for pulses in the nanosecond region, the optical flux density can rise to unacceptible values (10 to 100 MW/cm^2), causing gradual or catastrophic degradation of the laser facets. Current transients should therefore be carefully avoided; they can substantially decrease the laser life time.

CAUTION

Aluminium gallium arsenide lasers emit radiation which is invisible to the human eye. When in use, do not look directly into the device. Direct viewing of laser light at close ranges, especially in conjunction with collimating lenses, may cause eye damage.

The device falls within safety class 3B of the international standard code.

DISPLAYS

1½-DIGIT RED LED DISPLAY

The display has the following features:

- One and a half 12,7 mm (½") high red colour digits readout display.
- GaP type red light emitting crystal with low power consumption.
- Series connection for low current consumption.
- Wide operating segment current (d.c.) range from 1 mA to 20 mA.
- Each segment performs a diffused and uniform display with high contrast through filtering function of lens cap.
- Highly legible arabic numerals with wide viewing angle.
- Solid state reliability and long operational life.
- The SAB3064 is recommended as driver circuit.

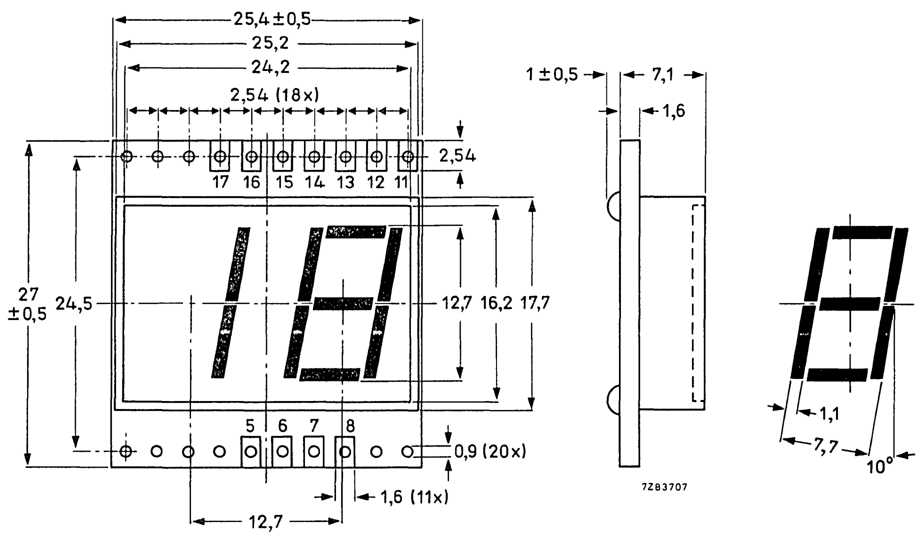
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	3	V
Forward current (d.c.) per segment	I_F	max.	20	mA
Luminous intensity (of segment, normal to surface) I_F = 5 mA	I_v	typ.	100	μcd
Wavelength at peak emission	λ_{pk}	typ.	700	nm

MECHANICAL DATA

Dimensions in mm

Fig. 1.



NOTE

Tolerance ± 0,25 mm unless otherwise specified.

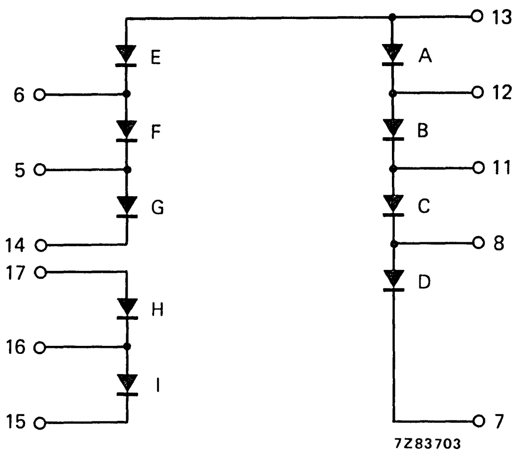


Fig. 2 Circuit diagram.

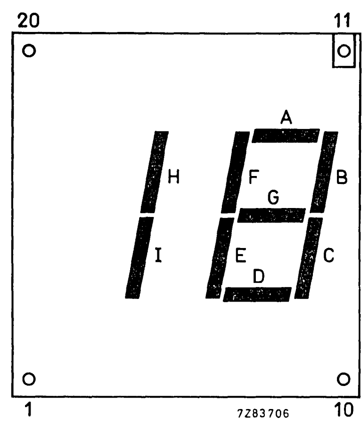


Fig. 3 Indication of segments per digit.
(See also terminal connection table below).

TERMINAL CONNECTION TABLE (see Figs 1, 2 and 3)

address	segment	cathode terminal number	anode terminal number
unit digit	A	12	13
	B	11	12
	C	8	11
	D	7	8
	E	6	13
	F	5	6
	G	14	5
10 s digit	H	16	17
	I	15	16

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	3	V
Forward current (d.c.) per segment	I_F	max.	20	mA
Storage temperature	T_{stg}		−40 to + 75	°C
Operating junction temperature	T_j		−20 to + 60	°C
Soldering temperature at 3 mm from reflector edge; $t_{sld} \leq 3$ s	T_{sld}	max.	260	°C

CHARACTERISTICS (single segment)

T_{amb} = 25 °C

Forward voltage I_F = 10 mA	V_F	typ.	2,0	V
			1,7 to 2,3	V
Reverse current V_R = 3 V	I_R	<	5	µA
Luminous intensity (normal to surface) I_F = 5 mA	I_v	typ.	100	µcd
I_F = 10 mA	I_v	>	100	µcd
		typ.	160	µcd
Intensity matching ratio I_F = 5 mA		<	2,5	
Wavelength at peak emission I_F = 5 mA	λ_{pk}	typ.	700	nm
Bandwidth at half height I_F = 5 mA	$B_{50\%}$	typ.	100	nm

DEVELOPMENT SAMPLE DATA

NOTES

Avoid immersing the whole display in liquid.

Avoid contact with chlorinated solvents. Recommended cleaning solvents for flux and stain contamination, Freon TE or TF and methyl alcohol.

Except for the printed-wiring board, avoid heating the display above 75 °C.

2-DIGIT SUPER-RED LED DISPLAYS

The displays have the following features:

- Two 12,7 mm (½") high super-red colour digits readout display.
- Configuration in dynamic multiplex drive connections.
- Wide operating segment current (d.c.) range from 1 mA to 20 mA.
- Each segment performs a diffused and uniform display with high contrast through filtering function of lens cap.
- Highly legible arabic numerals with wide viewing angle.
- Solid state reliability and long operational life.

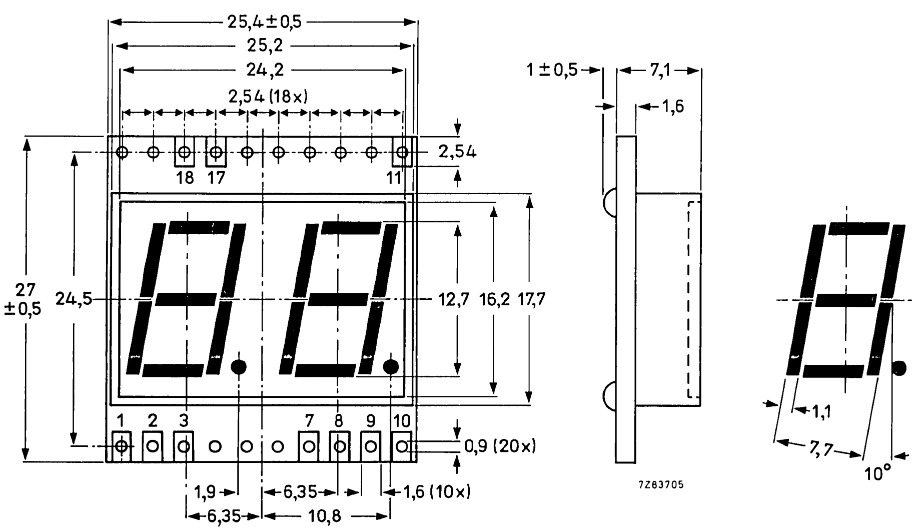
QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	3	V
Forward current (d.c.) per segment	I_F	max.	20	mA
Luminous intensity (of segment, normal to surface) $I_F = 5$ mA	I_v	typ.	50	μcd
Wavelength at peak emission	λ_{pk}	typ.	630	nm

MECHANICAL DATA

Dimensions in mm

Fig. 1.



NOTE
Tolerance ± 0,25 mm unless otherwise specified.

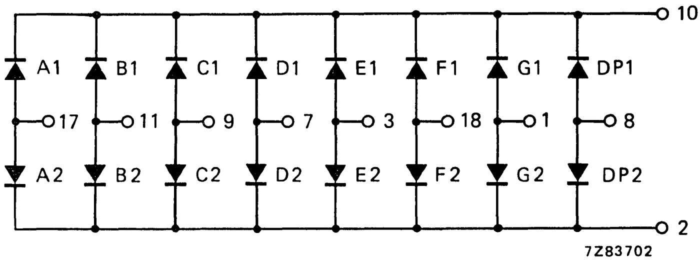


Fig. 2a Circuit diagram **CQ216X** (common cathode).

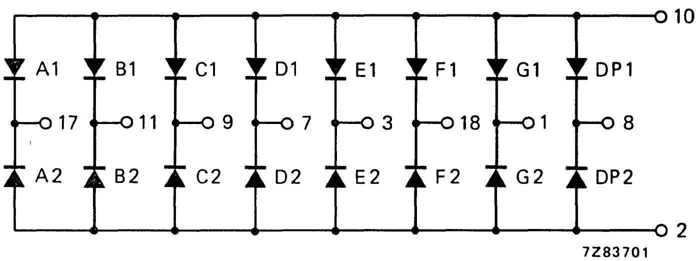


Fig. 2b Circuit diagram **CQ216Y** (common anode).

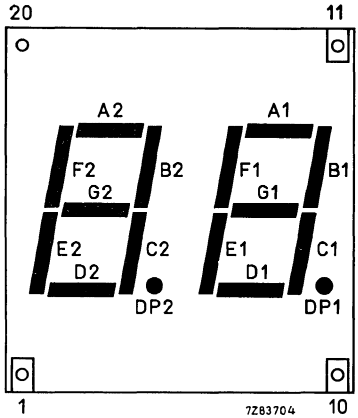


Fig. 3 Indication of segments per digit. (See also connection table on next page.)

DEVELOPMENT SAMPLE DATA

TERMINAL CONNECTION TABLE (see Figs 1, 2a, 2b and 3)

address	segment	terminal number	address	segment	terminal number
	A2	17		A1	17
	B2	11		B1	11
	C2	9		C1	9
	D2	7		D1	7
10s digit	E2	3	unit digit	E1	3
	F2	18		F1	18
	G2	1		G1	1
	DP2	8		DP1	8
	common	2		common	10

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	3 V
Forward current (d.c.) per segment	I_F	max.	20 mA
Storage temperature	T_{stg}		−40 to + 75 °C
Operating junction temperature	T_j		−20 to + 60 °C
Soldering temperature at 3 mm from reflector edge; $t_{sld} \leqslant 3$ s	T_{sld}	max.	260 °C

CHARACTERISTICS (single segment)

$T_{amb} = 25\ ^oC$

Forward voltage $I_F = 10$ mA	V_F	typ.	1,9 V
			1,6 to 2,2 V
Reverse current $V_R = 3$ V	I_R	<	5 μA
Luminous intensity (normal to surface) $I_F = 5$ mA	I_v	typ.	50 μcd
$I_F = 10$ mA	I_v	>	70 μcd
		typ.	100 μcd
Intensity matching ratio $I_F = 5$ mA		<	2,5
Wavelength at peak emission $I_F = 5$ mA	λ_{pk}	typ.	630 nm
Bandwidth at half height $I_F = 5$ mA	$B_{50\%}$	typ.	100 nm

NOTES

Avoid immersing the whole display in liquid.

Avoid contact with chlorinated solvents. Recommended cleaning solvents for flux and stain contamination, Freon TE or TF and methyl alcohol.

Except for the printed-wiring board, avoid heating the display above 75 °C.

4-DIGIT LED CLOCK DISPLAYS

The displays, primarily designed for applications where compactness is of prime importance, have the following features:

- Four 15 mm high red colour digit readout clock display.
- Common anode or cathode configuration for use in static drive connections.
- Wide operating segment current (d.c.) range from 5 mA to 20 mA.
- Each segment performs a diffused and uniform display with high contrast.
- Display with dull surface free from undesirable glare or reflections.
- Highly legible arabic numerals with wide viewing angle.
- Display format available for 12 or 24 hours.
- Solid state reliability and long operational life.

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	3 V
Forward current (d.c.) per segment	I_F	max.	20 mA
Luminous intensity (of segment, normal to surface) I_F = 5 mA	I_v	typ.	200 μcd
Wavelength at peak emission	λ_{pk}	typ.	700 nm

7Z85306

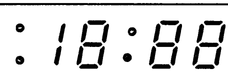
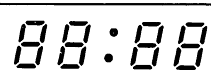
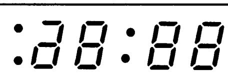
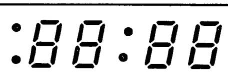
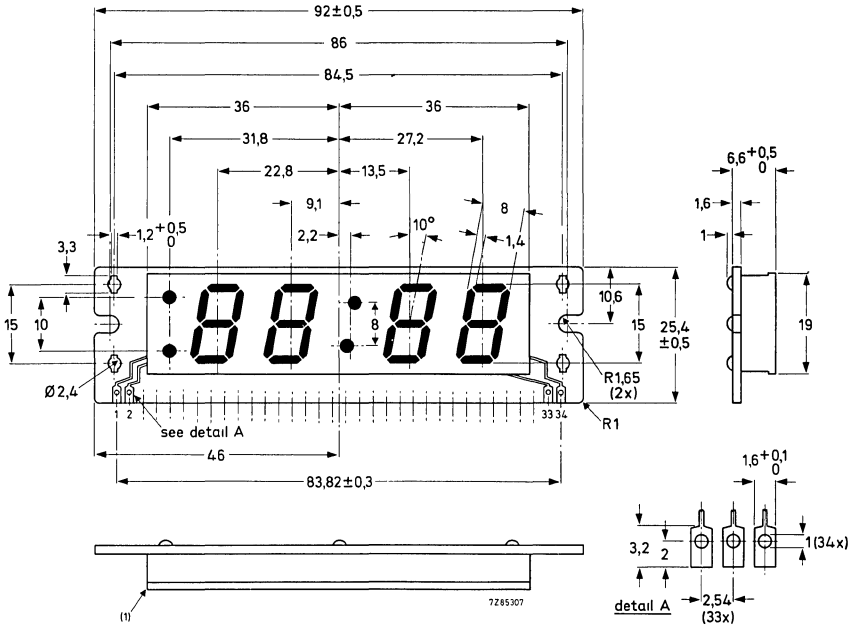
TYPE NUMBER		FULLY DISPLAYED FONT
common cathode	common anode	
CQ327	CQ327R	
CQ330	CQ330R	
CQ331	CQ331R	
CQ332	CQ332R	

Fig. 1.

MECHANICAL DATA

Dimensions in mm

Fig. 2.



(1) Slip-out tolerance with light diffusing film and reflector is + 0,5 mm at each side.

NOTE
Tolerance ± 0,25 mm unless otherwise specified.

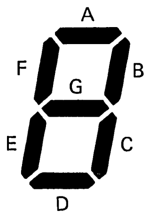


Fig. 3 Indication of segments per digit. (See also Fig. 2 and terminal connection table.)

TERMINAL CONNECTION TABLE (see Figs 2 and 3)

terminal number	address		CQ327 CQ327R	CQ330 CQ330R	CQ331 CQ331R	CQ332 CQ332R
1	common		common for all segments, colon and dots			
2	p.m. dot		c	n.c.	c	c
3	a.m. dot		c	n.c.	c	c
4	A	10s hour digit	n.c.	c	c	c
5	F		n.c.	c	n.c.	c
6	G		n.c.	c	c	c
7	E		n.c.	c	c	c
8	D		n.c.	c	c	c
9	C		c	c	c	c
10	B		c	c	c	c
11	F	unit hour digit	c	c	c	c
12	G		c	c	c	c
13	A		c	c	c	c
14	B		c	c	c	c
15	E		c	c	c	c
16	D		c	c	c	c
17	C		c	c	c	c
18	upper dot of colon		c	c	c	c
19	lower dot of colon		c	c	c	c
20	F	10s minute digit	c	c	c	c
21	G		c	c	c	c
22	A		c	c	c	c
23	B		c	c	c	c
24	D		c	c	c	c
25	E		c	c	c	c
26	C		c	c	c	c
27	F	unit minute digit	c	c	c	c
28	G		c	c	c	c
29	A		c	c	c	c
30	B		c	c	c	c
31	E		c	c	c	c
32	D		c	c	c	c
33	C		c	c	c	c
34	common		common for all segments, colon and dots			

DEVELOPMENT SAMPLE DATA

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	3	V
Forward current (d.c.) per segment	I_F	max.	20	mA
Storage temperature	T_{stg}		−40 to + 75	°C
Operating junction temperature	T_j		−20 to + 60	°C
Soldering temperature at 3 mm from reflector edge; $t_{sld} \leqslant 3$ s	T_{sld}	max.	260	°C

CHARACTERISTICS (single segment)

$T_{amb} = 25$ °C

Forward voltage $I_F = 10$ mA	V_F	typ.	2,0	V
			1,7 to 2,3	V
Reverse current $V_R = 3$ V	I_R	<	5	µA
Luminous intensity (normal to surface) $I_F = 5$ mA	I_v	typ.	200	µcd
$I_F = 10$ mA	I_v	>	200	µcd
		typ.	400	µcd
Intensity matching ratio $I_F = 5$ mA		<	2,5	
Wavelength at peak emission $I_F = 5$ mA	λ_{pk}	typ.	700	nm
Bandwidth at half height $I_F = 5$ mA	$B_{50\%}$	typ.	100	nm

NOTES
Avoid immersing the whole display in liquid.
Avoid contact with chlorinated solvents. Recommended cleaning solvents for flux and stain contamination, Freon TE or TF and methyl alcohol.
Except for the printed-wiring board, avoid heating the display above 75 °C.

4-DIGIT LED CLOCK DISPLAYS

The displays, with the overall dimensions 33,5 mm x 90 mm, have the following features:

- Four 15 mm high red colour digit readout clock display.
- Common anode or cathode configuration for use in static drive connections.
- Wide operating segment current (d.c.) range from 5 mA to 20 mA.
- Each segment performs a diffused and uniform display with high contrast through filtering function of lens cap.
- Highly legible arabic numerals with wide viewing angle.
- Display format available for 12 or 24 hours.
- Solid state reliability and long operational life.

QUICK REFERENCE DATA

Continuous reverse voltage	V_R	max.	3 V
Forward current (d.c.) per segment	I_F	max.	20 mA
Luminous intensity (of segment, normal to surface) I_F = 5 mA	I_v	typ.	100 μcd
Wavelength at peak emission	λ_{pk}	typ.	700 nm

7Z75887.1

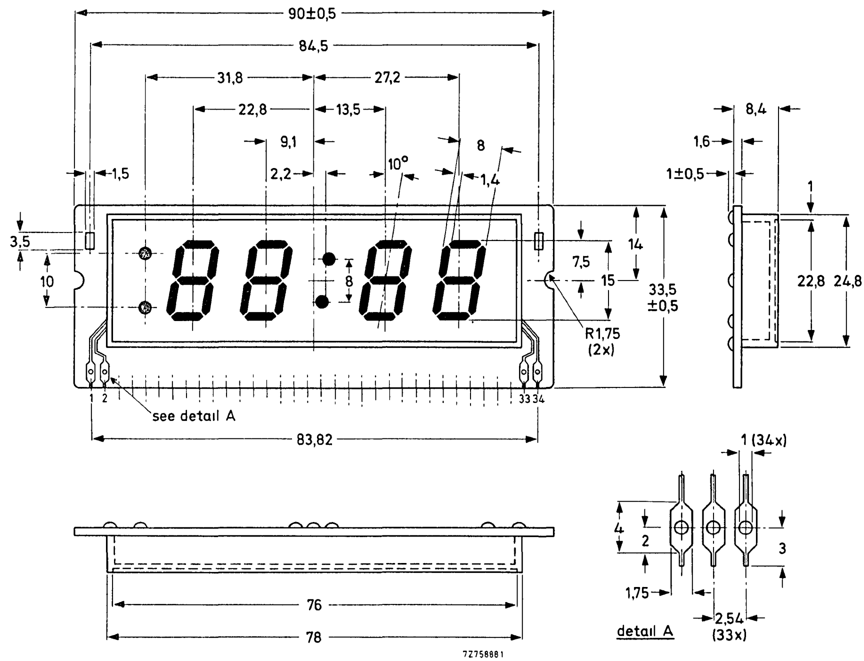
TYPE NUMBER		FULLY DISPLAYED FONT
common cathode	common anode	
CQ427	CQ427R	:18:88
CQ430	CQ430R	88:88
CQ431	CQ431R	:28:88
CQ432	CQ432R	:88:88

Fig. 1.

MECHANICAL DATA

Dimensions in mm

Fig. 2.



NOTE
Tolerance ± 0,25 mm unless otherwise specified.

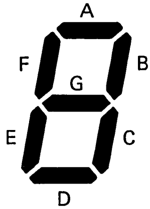


Fig. 3 Indication of segments per digit. (See also Fig. 2 and terminal connection table.)

TERMINAL CONNECTION TABLE (see Figs 2 and 3)

terminal number	address		CQ427 CQ427R	CQ430 CQ430R	CQ431 CQ431R	CQ432 CQ432R
1	common		common for all segments, colon and dots			
2	p.m. dot		c	n.c.	c	c
3	a.m. dot		c	n.c.	c	c
4	A	10s hour digit	n.c.	c	c	c
5	F		n.c.	c	n.c.	c
6	G		n.c.	c	c	c
7	E		n.c.	c	c	c
8	D		n.c.	c	c	c
9	C		c	c	c	c
10	B		c	c	c	c
11	F	unit hour digit	c	c	c	c
12	G		c	c	c	c
13	A		c	c	c	c
14	B		c	c	c	c
15	E		c	c	c	c
16	D		c	c	c	c
17	C		c	c	c	c
18	upper dot of colon		c	c	c	c
19	lower dot of colon		c	c	c	c
20	F	10s minute digit	c	c	c	c
21	G		c	c	c	c
22	A		c	c	c	c
23	B		c	c	c	c
24	D		c	c	c	c
25	E		c	c	c	c
26	C		c	c	c	c
27	F	unit minute digit	c	c	c	c
28	G		c	c	c	c
29	A		c	c	c	c
30	B		c	c	c	c
31	E		c	c	c	c
32	D		c	c	c	c
33	C		c	c	c	c
34	common		common for all sefments, colon and dots			

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Continuous reverse voltage	V_R	max.	3 V
Forward current (d.c.) per segment	I_F	max.	20 mA
Storage temperature	T_{stg}	−40 to + 75	°C
Operating junction temperature	T_j	−20 to + 60	°C
Soldering temperature at 3 mm from reflector edge; $t_{sld} \leq 3$ s	T_{sld}	max.	260 °C

CHARACTERISTICS (single segment)

$T_{amb} = 25\ ^\circ C$

Forward voltage $I_F = 10$ mA	V_F	typ.	2,0 V
			1,7 to 2,3 V
Reverse current $V_R = 3$ V	I_R	<	5 µA
Luminous intensity (normal to surface) $I_F = 5$ mA	I_v	typ.	100 µcd
$I_F = 10$ mA	I_v	>	100 µcd
		typ.	160 µcd
Intensity matching ratio $I_F = 5$ mA		<	2,5
Wavelength at peak emission $I_F = 5$ mA	λ_{pk}	typ.	700 nm
Bandwidth at half height $I_F = 5$ mA	$B_{50\%}$	typ.	100 nm

NOTES

Avoid immersing the whole display in liquid.

Avoid contact with chlorinated solvents. Recommended cleaning solvents for flux and stain contamination, Freon TE or TF and methyl alcohol.

Except for the printed-wiring board, avoid heating the display above 75 °C.

PHOTOCOUPLERS

HIGH-VOLTAGE PHOTOCOUPLER

Optically coupled isolator consisting of an infrared emitting GaAs diode and a silicon n-p-n phototransistor without accessible base.

Features of this product:

- very high isolation voltage of 10 kV (d.c.).
- working voltage of 10 kV (d.c.).

QUICK REFERENCE DATA

Diode				
Continuous reverse voltage	V_R	max.	5	V
Forward current				
d.c.	I_F	max.	100	mA
(peak value); t_p = 10 μs; δ = 0,1	I_{FM}	max.	1000	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	100	mW
Transistor				
Collector-emitter voltage (open base)	V_{CEO}	max.	30	V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	100	mW
Photocoupler				
Output/input d.c. current transfer ratio				
I_F = 10 mA; V_{CE} = 0,4 V; (I_B = 0)	I_C/I_F	>	0,2	
Collector cut-off current (dark)				
V_{CC} = 10 V; working voltage (d.c.) = 10 kV				
diode: I_F = 0 (see also Fig. 4)	I_{CEW}	<	200	nA
Isolation voltage (d.c.)	V_{IO}	>	10	kV

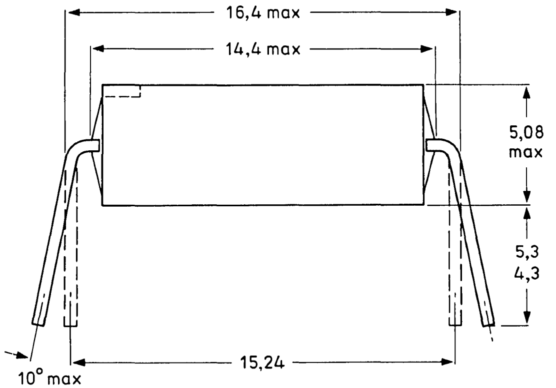
MECHANICAL DATA

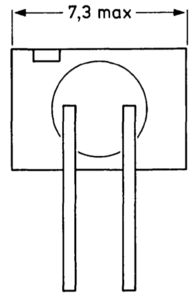
See Fig. 1.

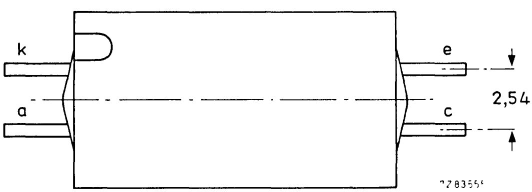
MECHANICAL DATA

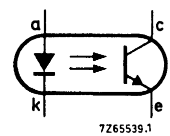
Dimensions in mm

Fig. 1.









RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage	V_R	max.	5	V
Forward current				
d.c.	I_F	max.	100	mA
(peak value); t_p = 10 μs; δ = 0,1	I_{FM}	max.	1000	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	100	mW

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	30	V
Emitter-collector voltage (open base)	V_{ECO}	max.	7	V
Collector current				
d.c.	I_C	max.	25	mA
peak value	I_{CM}	max.	50	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	100	mW

Photocoupler

Storage temperature	T_{stg}	−55 to + 100	^{o}C
Junction temperature	T_j	max. 100	^{o}C
Lead soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max. 260	^{o}C

THERMAL RESISTANCE

From junction to ambient in free air

diode	$R_{th\ j\text{-}a}$	= 750	$^{o}C/W$
transistor	$R_{th\ j\text{-}a}$	= 750	$^{o}C/W$

CHARACTERISTICS

$T_j = 25\ ^{o}C$ unless otherwise specified

Diode

Forward voltage $I_F = 10$ mA	V_F	typ.	1,2	V
		<	1,5	V
Reverse current $V_R = 5$ V	I_R	<	100	µA

Transistor

Collector cut-off current (dark) $V_{CE} = 10$ V	I_{CEO}	typ.	5	nA
		<	50	nA

Photocoupler ($I_B = 0$)*

Output/input d.c. current transfer ratio $I_F = 10$ mA; $V_{CE} = 0,4$ V	I_C/I_F	>	0,2	
Collector-emitter saturation voltage $I_F = 10$ mA; $I_C = 2$ mA	V_{CEsat}	typ.	0,4	V
Isolation voltage, d.c. value	V_{IO}	>	10	kV
Capacitance between input and output $I_F = 0$; $V = 0$; $f = 1$ MHz	C_{io}	typ.	1	pF
Insulation resistance between input and output $\pm V_{IO} = 1$ kV	r_{IO}	>	10^{11}	Ω
		typ.	10^{12}	Ω

* Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.

Switching times (see Figs 2 and 3)
I_{Con} = 2 mA; V_{CC} = 20 V; R_L = 100 Ω

Rise time	t_r	typ.	3 μs
Fall time	t_f	typ.	2,5 μs

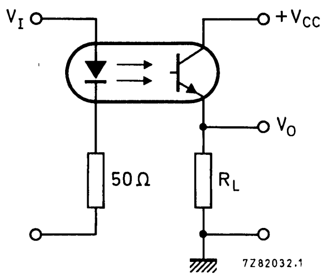


Fig. 2 Switching circuit.

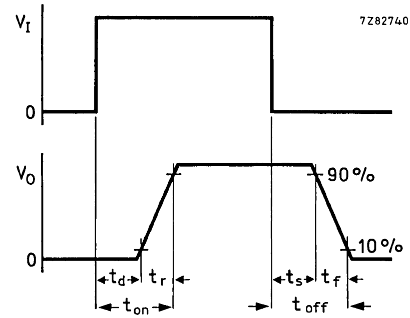


Fig. 3 Waveforms.

Collector cut-off current (dark) see Fig. 4
V_{CC} = 10 V; working voltage (d.c.) = 10 kV — I_{CEW} < 200 nA*

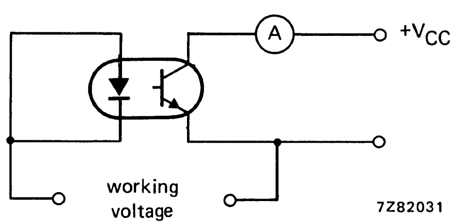


Fig. 4.

* As quality assurance (on a sample basis), these parameters are covered by a 1000 h reliability test.

DEVELOPMENT SAMPLE DATA

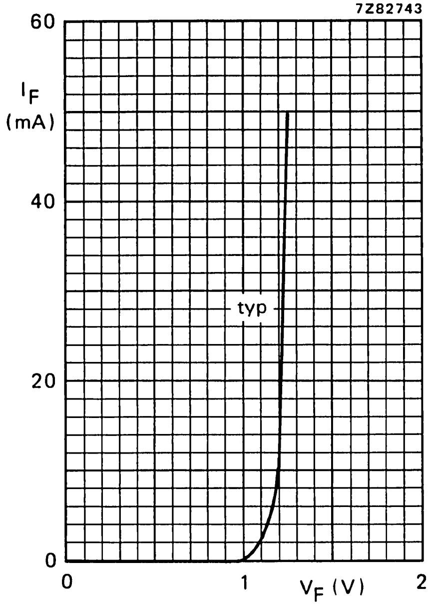


Fig. 5 T_j = 25 °C.

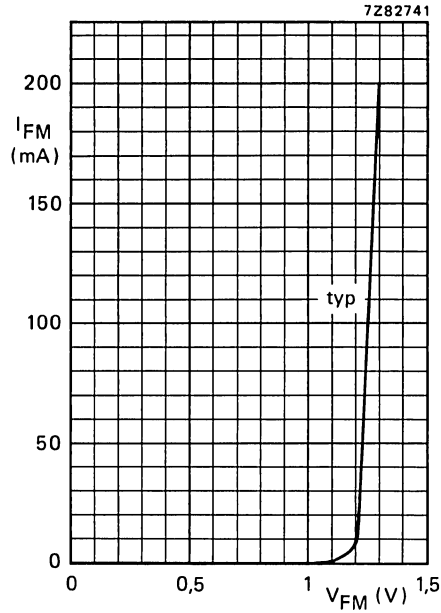


Fig. 6 T_{amb} = 25 °C; t_p = 10 µs; T = 1 ms.

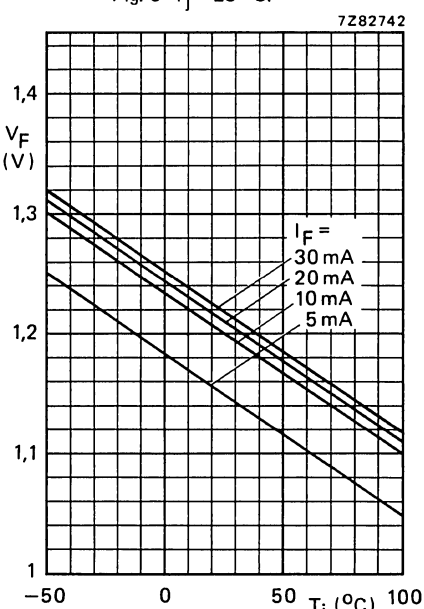


Fig. 7 Typical values.

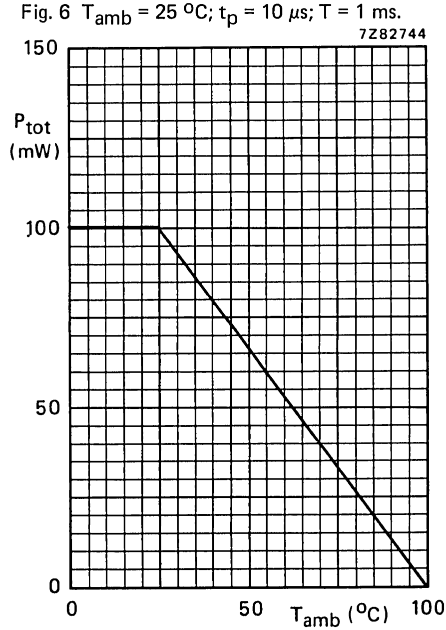


Fig. 8 Power derating curve for diode and transistor versus ambient temperature.

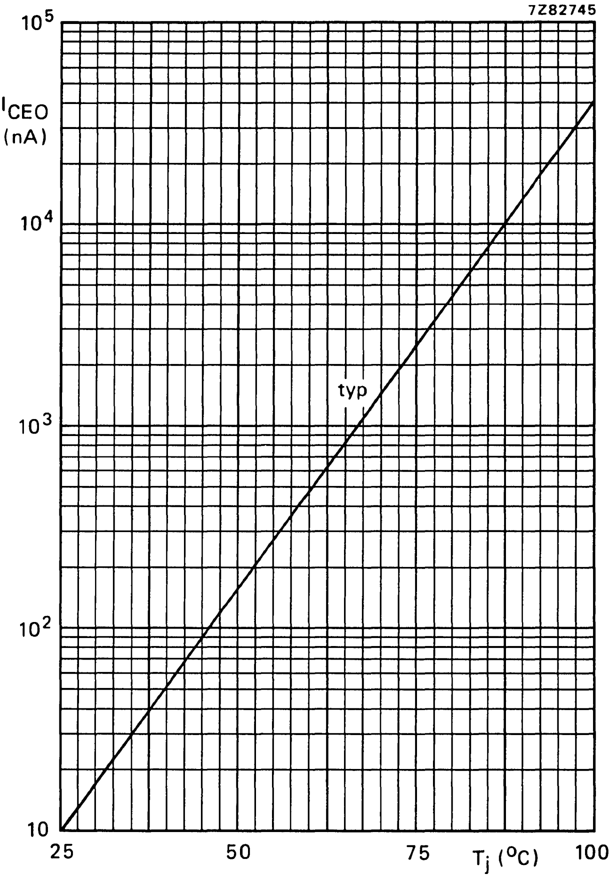


Fig. 9 $I_F = 0$; $V_{CE} = 20$ V.

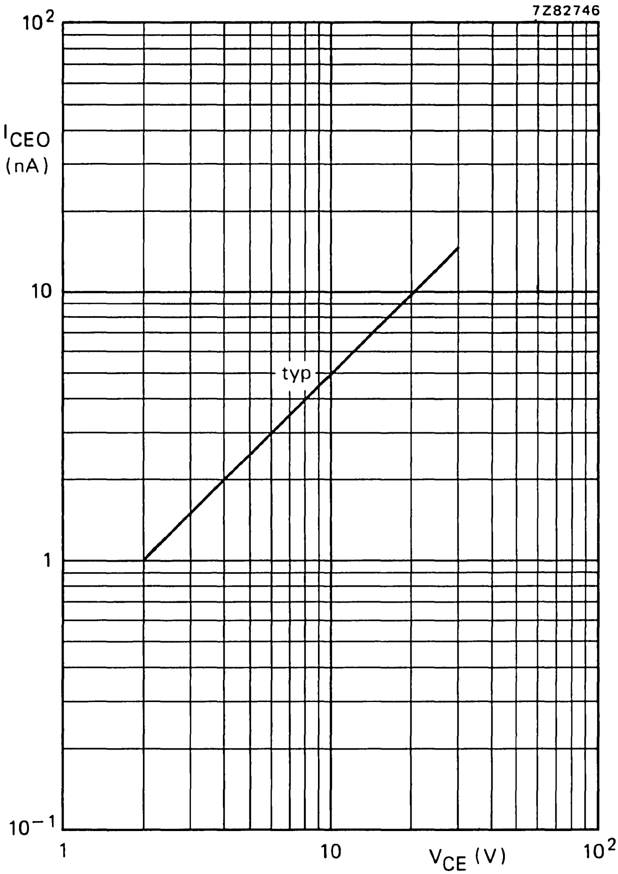


Fig. 10 $I_F = 0$; $T_j = 25\ ^oC$.

DEVELOPMENT SAMPLE DATA

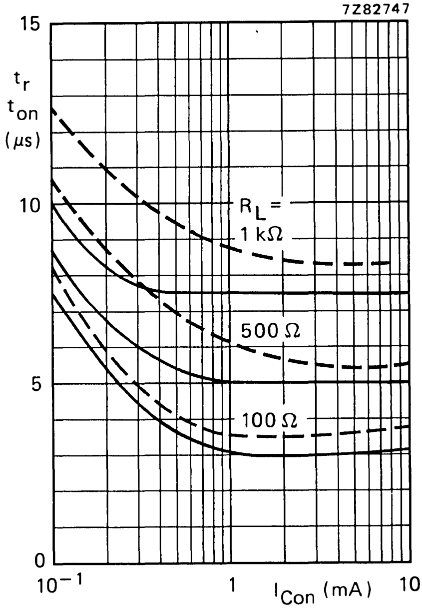


Fig. 11 —— t_r; – – – t_{on}; $I_B = 0$;
$V_{CC} = 20$ V; $T_{amb} = 25$ °C; typical values.
See also Fig. 13.

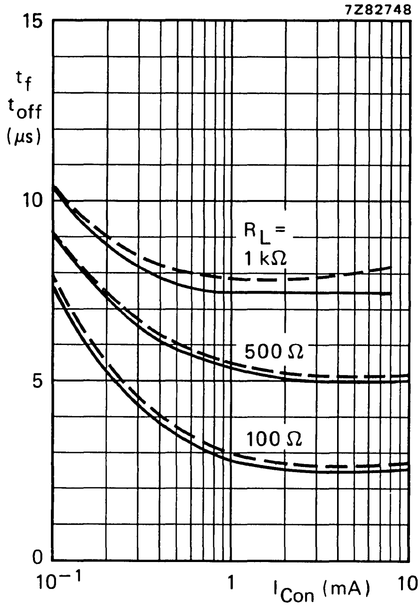


Fig. 12 —— t_f; – – – t_{off}; $I_B = 0$;
$V_{CC} = 20$ V; $T_{amb} = 25$ °C; typical values.
See also Fig. 13.

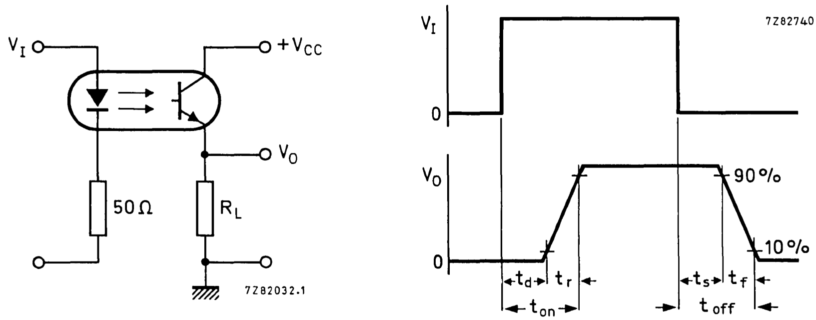


Fig. 13 Switching circuit and waveforms.

PHOTOCOUPLERS

Optically coupled isolators consisting of an infrared emitting GaAs diode and a silicon n-p-n phototransistor with accessible base. Plastic envelopes. Suitable for TTL integrated circuits.

Features of these products:

- high output/input d.c. current transfer ratio;
- low saturation voltage;
- high isolation voltage of 3 kV (r.m.s.) and 4,4 kV (d.c.);
- working voltage 1,5 kV.

QUICK REFERENCE DATA

Diode				
Continuous reverse voltage		V_R	max.	3 V
Forward current				
d.c.		I_F	max.	100 mA
(peak value); t_p = 10 μs; δ = 0,1		I_{FM}	max.	3000 mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	200 mW
Transistor				
Collector-emitter voltage (open base)		V_{CEO}	max.	30 V
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	200 mW
Photocoupler				
Output/input d.c. current transfer ratio				
I_F = 10 mA; V_{CE} = 0,4 V; (I_B = 0)	**CNX35**	I_C/I_F	>	0,4
	CNX36	I_C/I_F	>	0,8
Collector cut-off current (dark)				
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV				
diode: I_F = 0 (see also Fig. 2)		I_{CEW}	<	200 nA
Isolation voltage (d.c.)				
t = 1 min		V_{IO}	>	4,4 kV

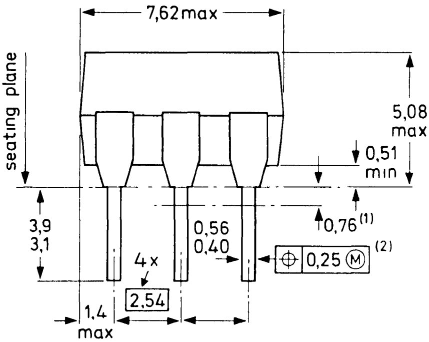
MECHANICAL DATA

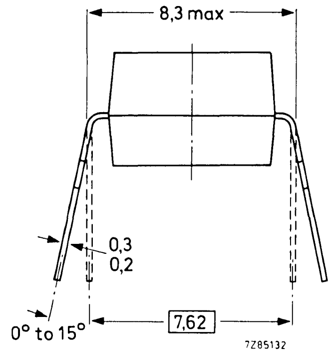
SOT-90 (see Fig. 1)

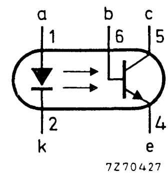
MECHANICAL DATA

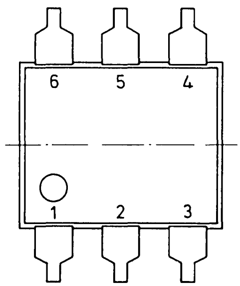
Dimensions in mm

Fig. 1 SOT-90.









⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) Lead spacing tolerances apply from seating plane to the line indicated.

(2) Centre-lines of all leads are within ± 0,125 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ± 0,25 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage	V_R	max.	3	V
Forward current				
d.c.	I_F	max.	100	mA
(peak value); t_p = 10 μs; δ = 0,1	I_{FM}	max.	3000	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	30	V
Collector-base voltage (open emitter)	V_{CBO}	max.	70	V
Emitter-collector voltage (open base)	V_{ECO}	max.	7	V
Collector current (d.c.)	I_C	max.	100	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	mW

Photocoupler

Storage temperature	T_{stg}		−55 to + 150 °C
Operating junction temperature	T_j	max.	125 °C
Lead soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient in free air			
diode	$R_{th\ j\text{-}a}$	=	500 °C/W
transistor	$R_{th\ j\text{-}a}$	=	500 °C/W
From junction to ambient, device mounted on a printed-circuit board			
diode	$R_{th\ j\text{-}a}$	=	400 °C/W
transistor	$R_{th\ j\text{-}a}$	=	400 °C/W

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Diode

Forward voltage $I_F = 10$ mA		V_F	typ.	1,15 V
			<	1,5 V
Reverse current $V_R = 3$ V		I_R	<	10 µA

Transistor (diode: $I_F = 0$)

Collector cut-off current (dark) $V_{CE} = 10$ V		I_{CEO}	typ.	2 nA
			<	50 nA
$V_{CE} = 10$ V; $T_{amb} = 70$ °C		I_{CEO}	<	10 µA
$V_{CB} = 10$ V		I_{CBO}	<	20 nA

Photocoupler ($I_B = 0$)*

Output/input d.c. current transfer ratio $I_F = 10$ mA; $V_{CE} = 5$ V		I_C/I_F	typ.	1,5
$I_F = 10$ mA; $V_{CE} = 0,4$ V	CNX35	I_C/I_F		0,4 to 1,6
	CNX36	I_C/I_F	>	0,8
Collector-emitter saturation voltage $I_F = 10$ mA; $I_C = 2$ mA		V_{CEsat}	typ.	0,15 V
$I_F = 10$ mA; $I_C = 4$ mA		V_{CEsat}	typ.	0,19 V
Isolation voltage, d.c. value **		V_{IO}	>	4,4 kV

* Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.

** Tested with a d.c. voltage for 1 minute between shorted input leads and shorted output leads.

Collector cut-off current (light) at T_{amb} = 0 °C to 70 °C			
V_F = 0,8 V; V_{CE} = 15 V	$I_{CE(L)}$	<	15 μA
I_F = 2 mA; V_{CE} = 0,4 V	$I_{CE(L)}$	>	150 μA
Collector capacitance at f = 1 MHz			
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ.	4,5 pF
Capacitance between input and output			
I_F = 0; V = 0; f = 1 MHz	C_{io}	typ.	0,6 pF
Insulation resistance between input and output			
± V_{IO} = 1 kV	r_{IO}	>	10^{10} Ω
		typ.	10^{12} Ω
Switching times (see Figs 2 and 3)			
I_{Con} = 2 mA; V_{CC} = 5 V; R_L = 100 Ω			
Turn-on time	t_{on}	typ.	3 μs
Turn-off time	t_{off}	typ.	3 μs
I_{Con} = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ			
Turn-on time	t_{on}	typ.	12 μs
Turn-off time	t_{off}	typ.	12,5 μs

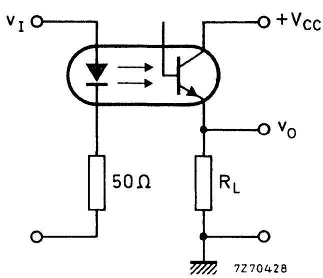


Fig. 2 Switching circuit.

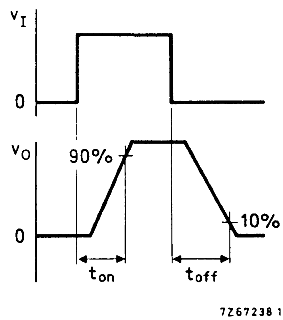


Fig. 3 Waveforms.

Collector cut-off current (dark) see Fig. 4			
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV	I_{CEW}	<	200 nA *
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV; T_j = 70 °C	I_{CEW}	<	100 μA *

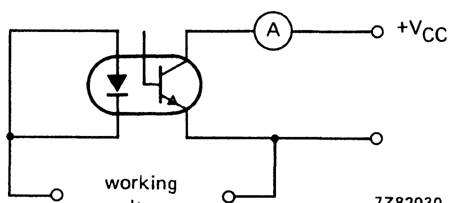


Fig. 4.

*As quality assurance (on a sample basis), these parameters are covered by a 1000 h reliability test.

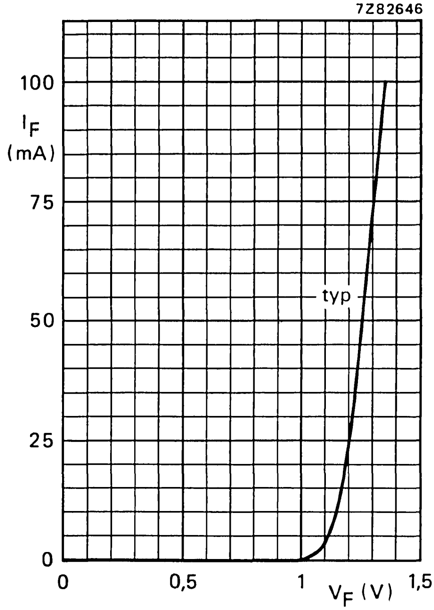


Fig. 5 T_{amb} = 25 °C.

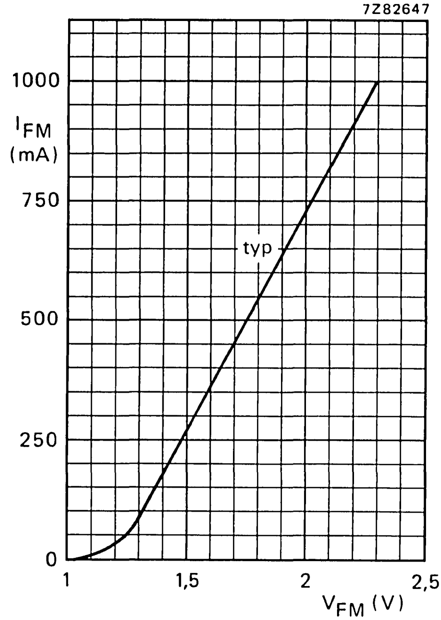


Fig. 6 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms.

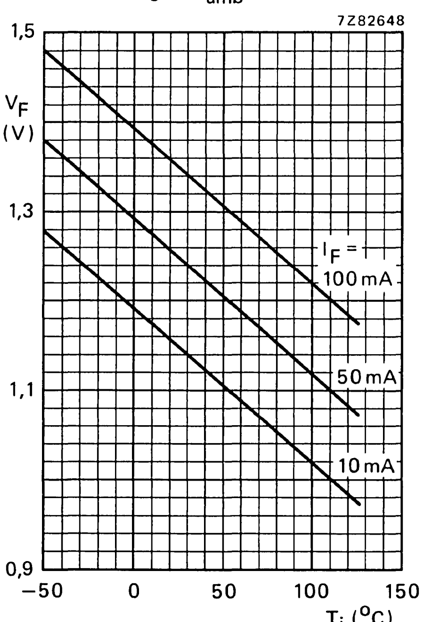


Fig. 7 Typical values.

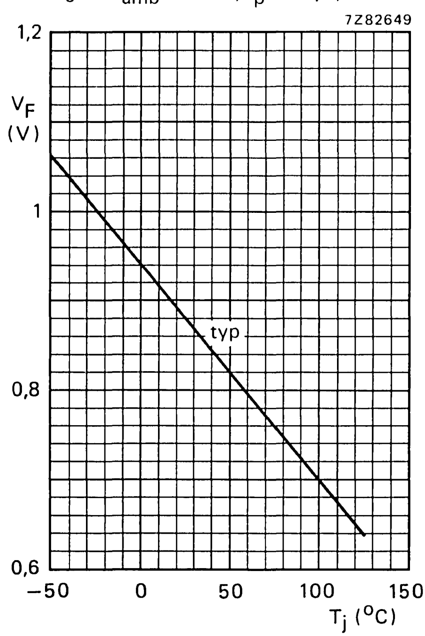


Fig. 8 I_F = 50 μA.

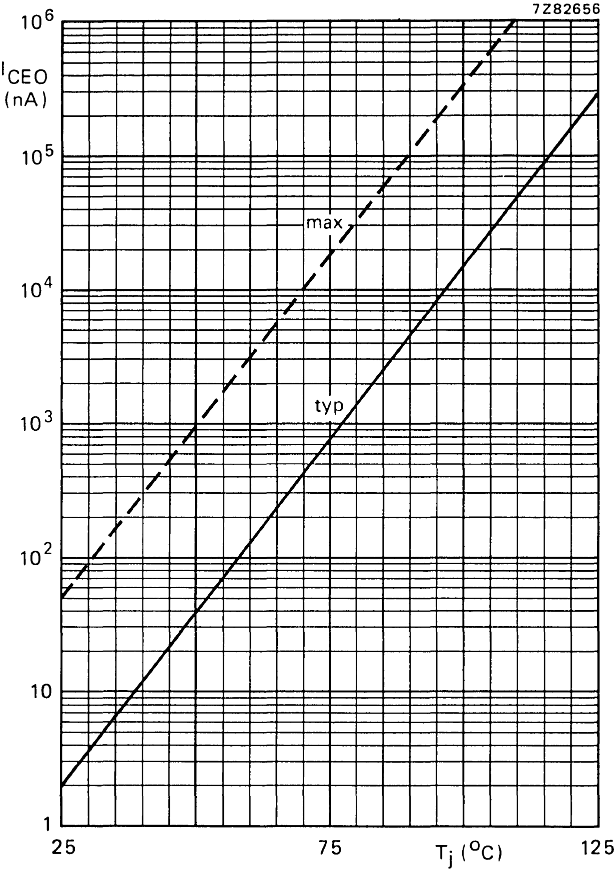


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V.

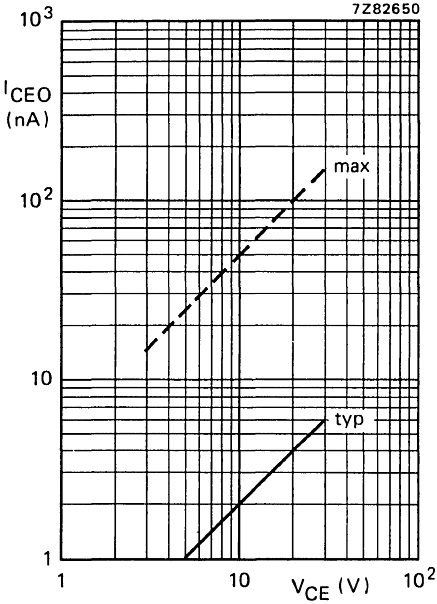


Fig. 10 $I_F = 0$; $T_j = 25\ ^oC$.

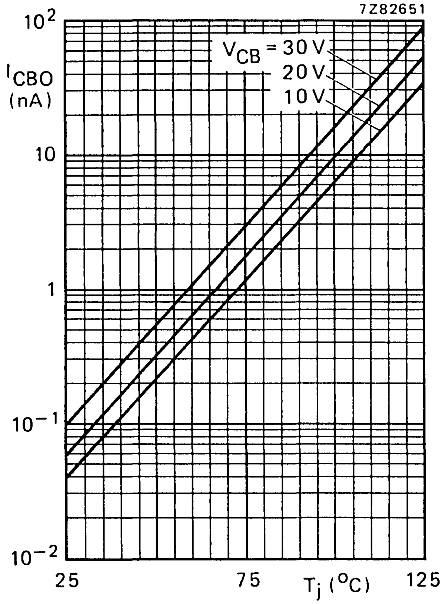


Fig. 11 Typical values.

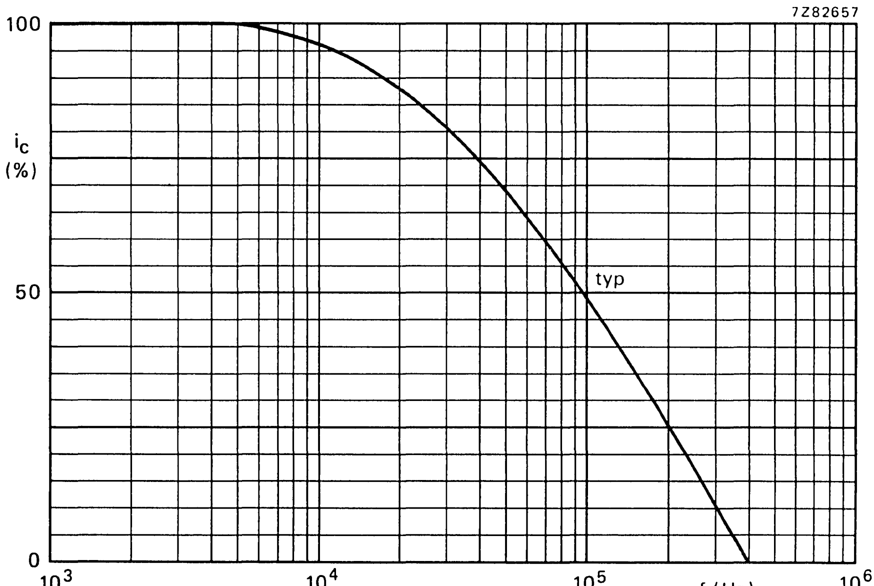


Fig. 12 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1$ kΩ; $T_{amb} = 25\ ^oC$.

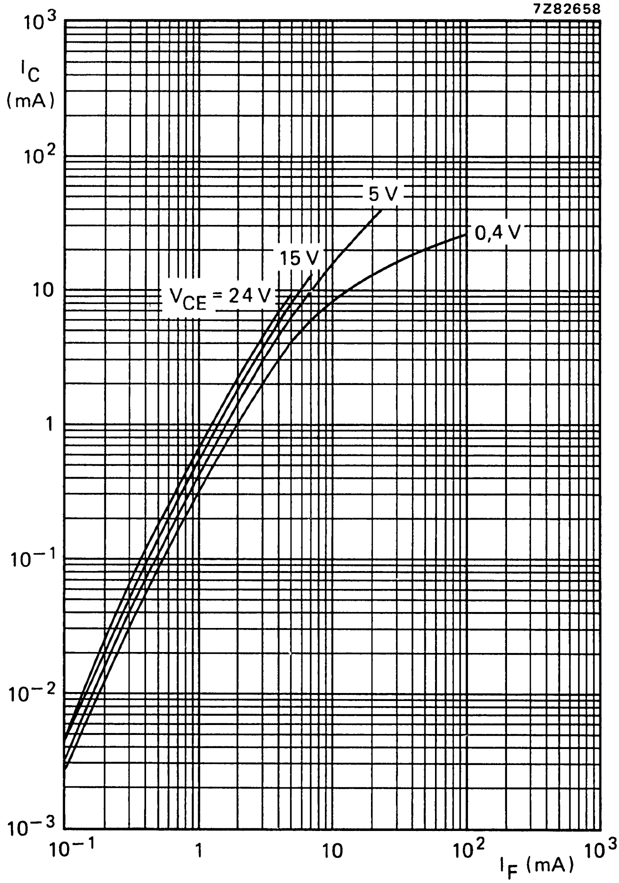


Fig. 13 T_{amb} = 25 °C, typical values.

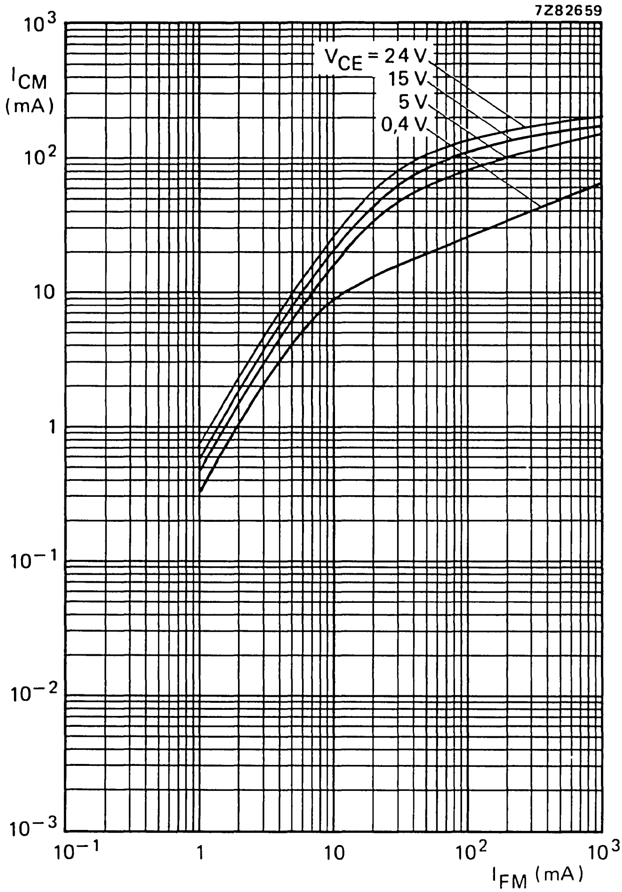


Fig. 14 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms; typical values.

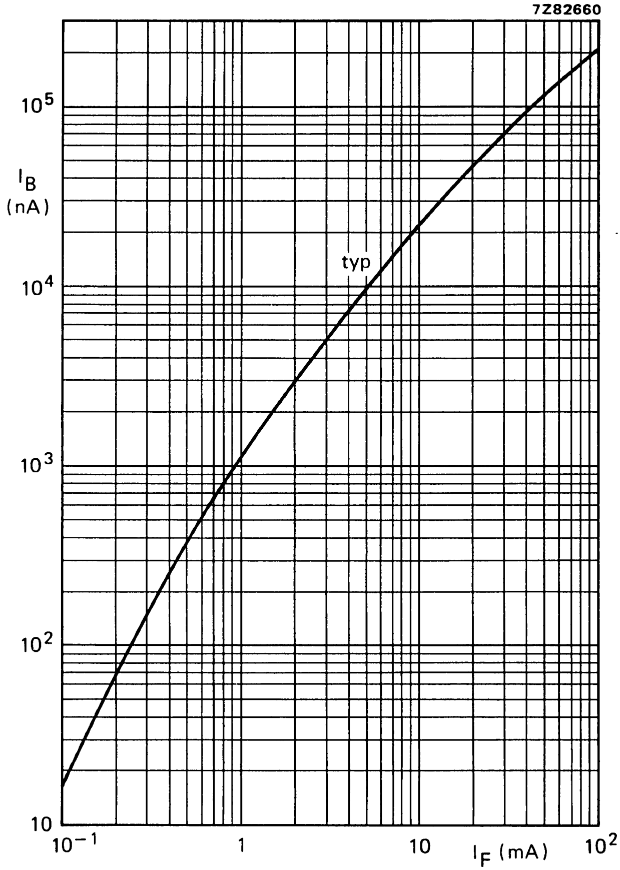


Fig. 15 V_{CB} = 5 V; T_{amb} = 25 °C.

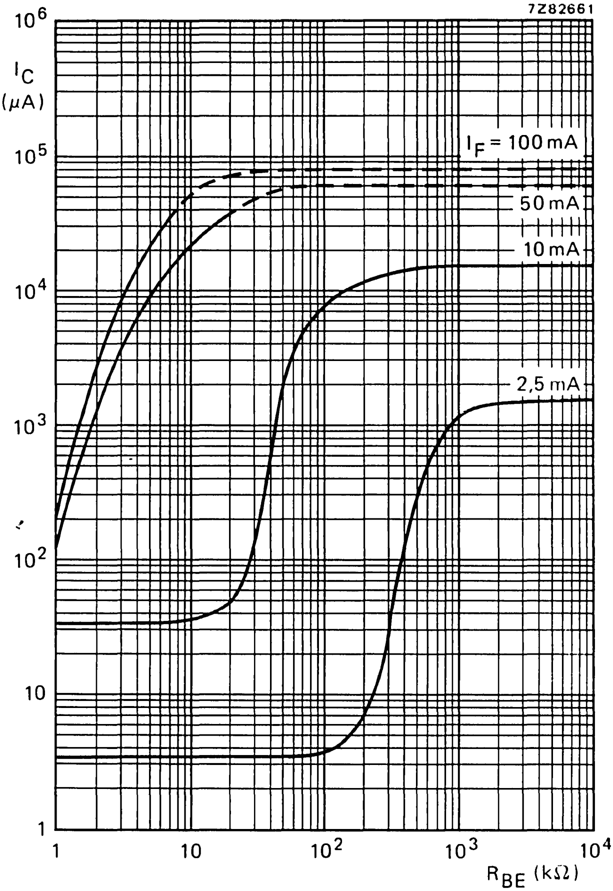


Fig. 16 $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

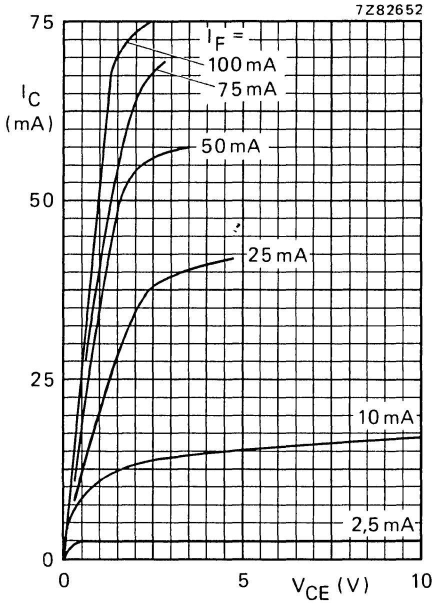


Fig. 17 T_{amb} = 25 °C; typical values.

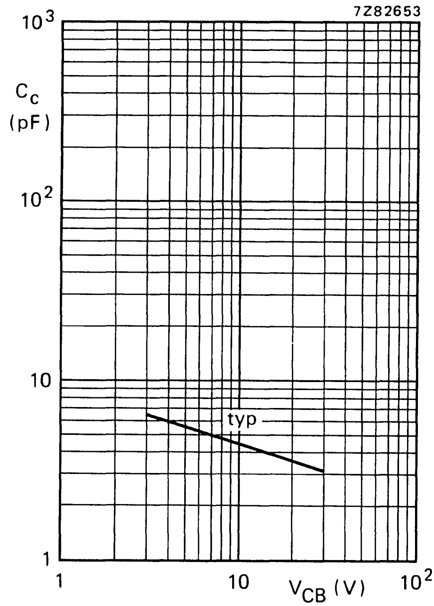


Fig. 18 f = 1 MHz; T_{amb} = 25 °C.

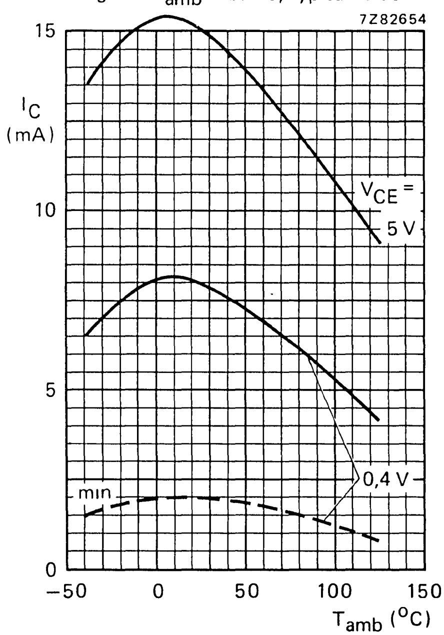


Fig. 19 I_B = 0; I_F = 10 mA; ——— typ. values.

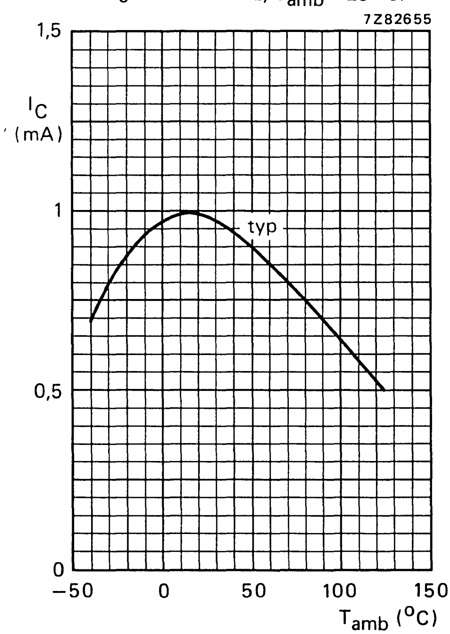


Fig. 20 I_F = 2 mA; V_{CE} = 0,4 V.

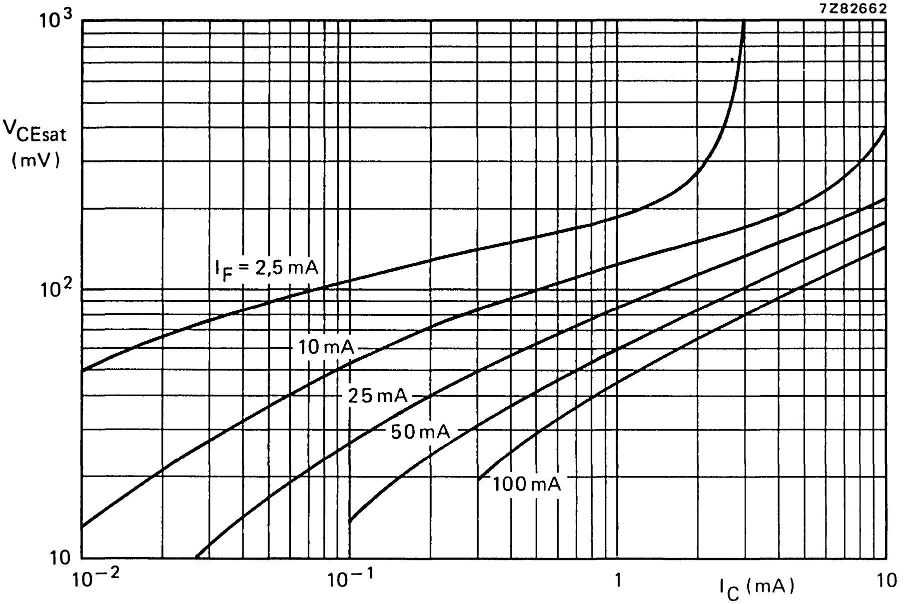


Fig. 21 $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

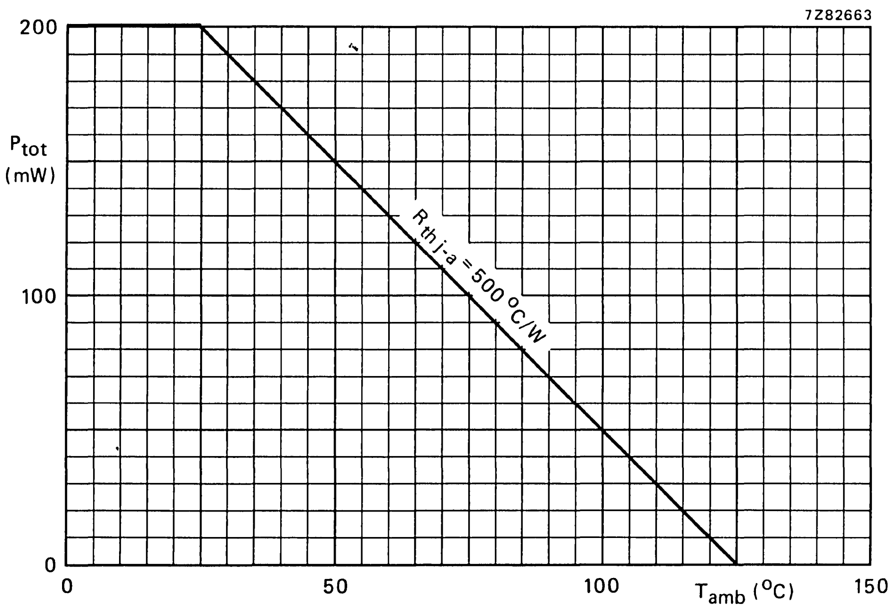


Fig. 22 Max. permissible power dissipation for diode and transistor versus ambient temperature.

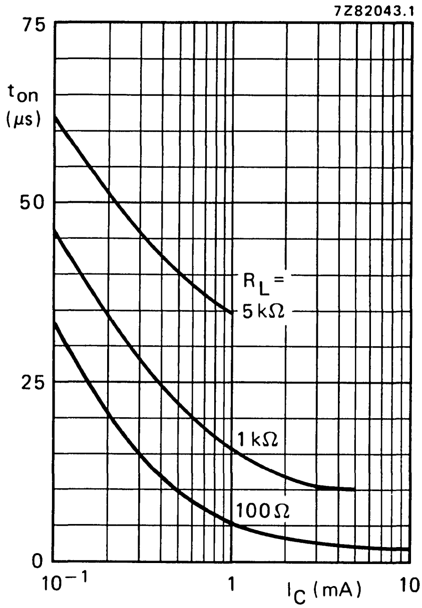


Fig. 23 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See also Fig. 25.)

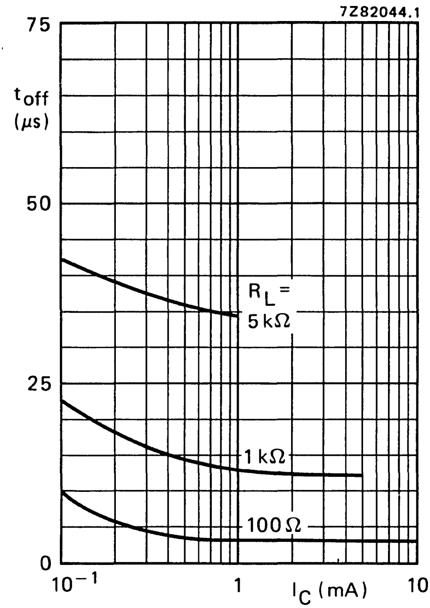


Fig. 24 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See also Fig. 25.)

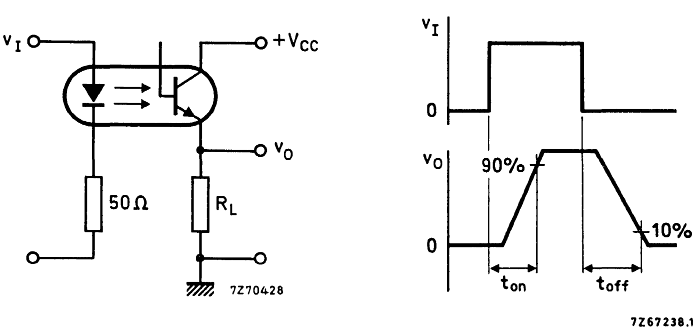


Fig. 25 Switching circuit and waveforms.

HIGH-VOLTAGE PHOTOCOUPLER

The CNX37 is a photocoupler consisting of an infrared emitting GaAs diode and a silicon n-p-n phototransistor in a dual-in-line (DIL) envelope.

Features

- high current transfer ratio and a low saturation voltage suitable for use with TTL integrated circuits
- high degree of a.c. and d.c. insulation (3,9 kV r.m.s. and 5,3 kV d.c.)
- working voltage of 2,5 kV (d.c.)

QUICK REFERENCE DATA

Diode				
Continuous reverse voltage	V_R	max.	3	V
Forward current				
d.c.	I_F	max.	100	mA
peak value; t_{on} = 10 μs; δ = 0,01	I_{FM}	max.	3	A
Total power dissipation up to T_{amb} = 45 °C when mounted on a p.c.b.	P_{tot}	max.	200	mW
Transistor				
Collector-emitter voltage (open base)	V_{CEO}	max.	30	V
Total power dissipation up to T_{amb} = 45 °C when mounted on a p.c.b.	P_{tot}	max.	200	mW
Photocoupler				
Output/input d.c. current transfer ratio I_F = 10 mA; V_{CE} = 5 V	I_C/I_F	min.	1,5	
Collector cut-off current (dark) V_{CC} = 10 V; working voltage (d.c.) = 2,5 kV I_F (diode) = 0 (see note 1)	I_{CEW}	max.	200	nA
Test isolation voltage (d.c.) t = 1 min (see note 2)	V_{IO}	max.	5,3	kV

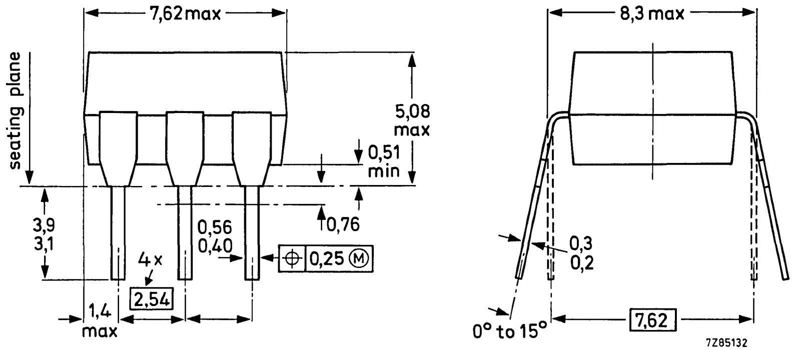
MECHANICAL DATA

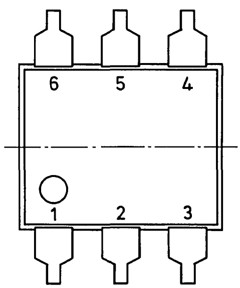
See Fig. 1.

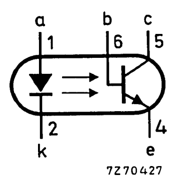
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-90B.







RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage	V_R	max.	3 V
Forward current			
d.c.	I_F	max.	100 mA
peak value; t_{on} = 10 μs; δ = 0,01	I_{FM}	max.	3 A
Total power dissipation up to T_{amb} = 45 °C when mounted on a p.c.b.	P_{tot}	max.	200 mW

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Collector-base voltage (open emitter)	V_{CBO}	max.	70 V
Emitter-collector voltage	V_{ECO}	max.	7 V
Collector current (d.c.)	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 45 °C when mounted on a p.c.b.	P_{tot}	max.	200 mW

Photocoupler			
Storage temperature	T_{stg}		−55 to + 150 °C
Junction temperature	T_j	max.	125 °C
Soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient in free air			
diode	$R_{th\ j\text{-}a}$	max.	500 K/W
transistor	$R_{th\ j\text{-}a}$	max.	500 K/W
From junction to ambient when mounted on p.c.b.			
diode	$R_{th\ j\text{-}a}$	max.	400 K/W
transistor	$R_{th\ j\text{-}a}$	max.	400 K/W

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Diode			
Forward voltage $I_F = 10$ mA	V_F	typ.	1,15 V
		max.	1,50 V
Reverse current	I_R	max.	10 μA
Transistor			
Collector-emitter breakdown voltage $I_C = 1$ mA	$V_{(BR)CEO}$	min.	30 V
Collector-base breakdown voltage $I_C = 0,1$ mA	$V_{(BR)CBO}$	min.	70 V
Emitter-collector breakdown voltage $I_E = 0,1$ mA	$V_{(BR)ECO}$	min.	7 V
Collector cut-off current (dark); diode $I_F = 0$			
$V_{CE} = 10$ V	I_{CEO}	typ.	2 nA
		max.	50 nA
$V_{CE} = 10$ V; $T_{amb} = 70$ °C	I_{CEO}	max.	10 μA
$V_{CB} = 10$ V	I_{CBO}	max.	20 nA

DEVELOPMENT SAMPLE DATA

Photocoupler

Output/input d.c. current transfer ratio			
I_F = 10 mA; V_{CE} = 0,4 V	I_C/I_F	min.	0,4
I_F = 10 mA; V_{CE} = 5 V	I_C/I_F	typ.	1,5
Collector cut-off current (light)			
T_{amb} = 0 to 70 °C; V_F = 0,8 V; V_{CE} = 15 V	$I_{CE(L)}$	max.	15 μA
I_F = 2 mA; V_{CE} = 0,4 V	$I_{CE(L)}$	min.	150 μA
Collector-emitter saturation voltage			
I_F = 10 mA; I_C = 2 mA	V_{CEsat}	typ.	0,15 V
		max.	0,40 V
I_F = 10 mA; I_C = 4 mA	V_{CEsat}	typ.	0,19 V
		max.	0,40 V
Test isolation voltage, d.c. value			
t = 1 min (see note 2)	V_{IO}	max.	5,3 kV
Output capacitance			
V_{CB} = 10 V; f = 1 MHz	C_c	typ.	4,5 pF
Capacitance between input and output			
V = 0; f = 1 MHz	C_{io}	typ.	0,6 pF
Insulation resistance between input and output			
V_{IO} = ± 1000 V	R_{IO}	min.	10^{10} Ω
		typ.	10^{12} Ω
Switching times (see Figs 2 and 3)			
Turn-on time			
I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω	t_{on}	typ.	3 μs
I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ		typ.	12 μs
Turn-off time			
I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω	t_{off}	typ.	3 μs
I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ		typ.	12,5 μs

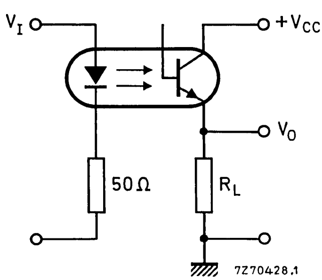


Fig. 2 Switching circuit.

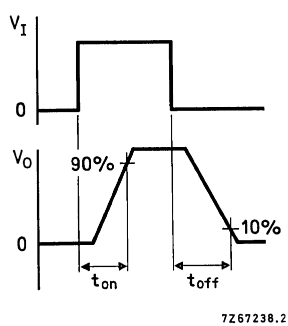


Fig. 3 Waveforms.

Note 1:

Collector cut-off current (dark) at
working voltage V_W = 2,5 kV (d.c. value);

V_{CC} = 10 V; T_j = 25 °C	I_{CEW}	max.	200 nA*
V_{CC} = 10 V; T_j = 70 °C		max.	100 μA*

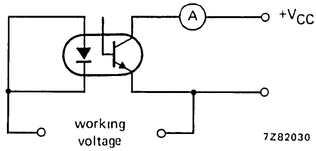


Fig. 4.

* The two parameters are tested on a sample basis for 1000 h.

Note 2:

A test voltage of 5,3 kV (d.c.) is applied between the shorted diode leads and the shorted transistor leads for 1 min.

DEVELOPMENT SAMPLE DATA

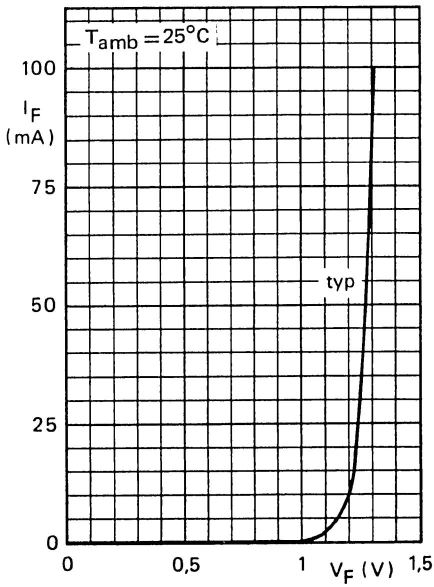


Fig. 5.

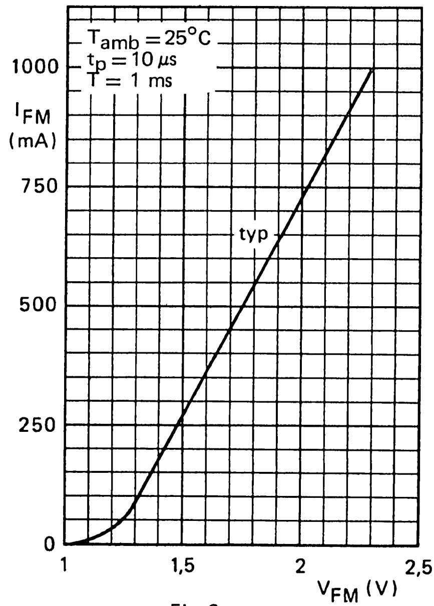


Fig. 6.

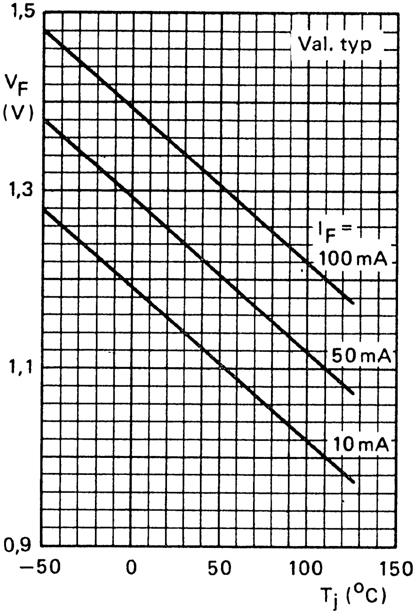


Fig. 7.

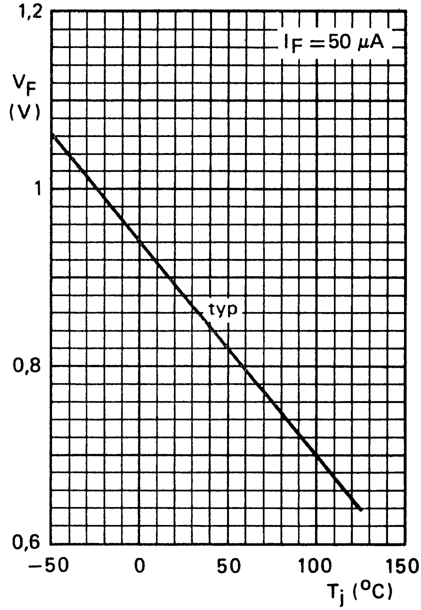


Fig. 8.

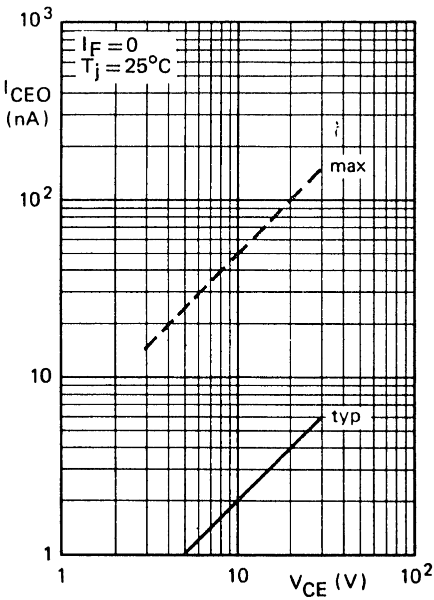


Fig. 9.

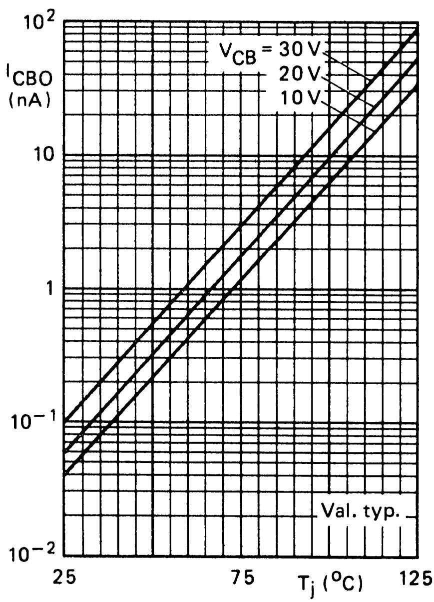


Fig. 10.

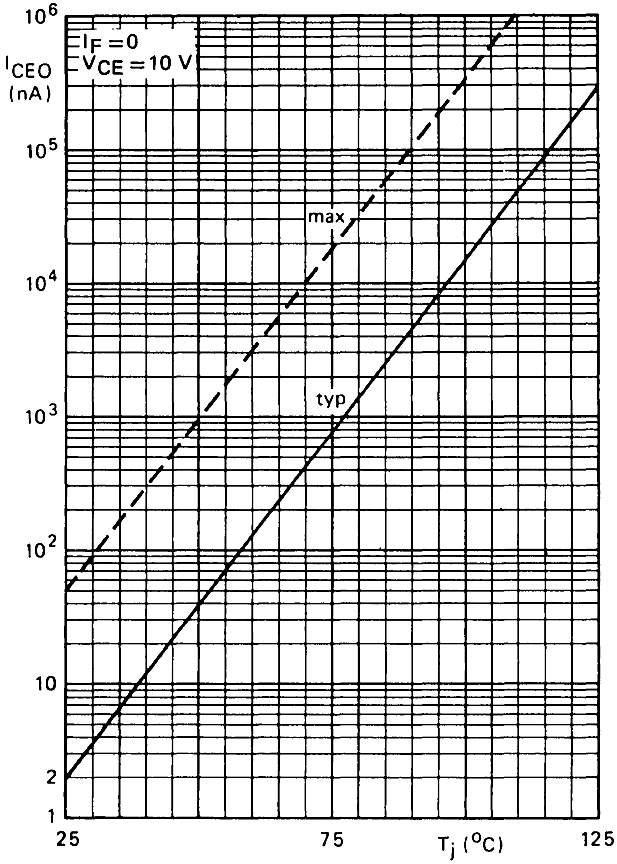

10^6
$I_F = 0$
$V_{CE} = 10$ V
I_{CEO}
(nA)
10^5
max
10^4
typ
10^3
10^2
10
2
1
25
75
T_j (°C)
125

Fig. 11.

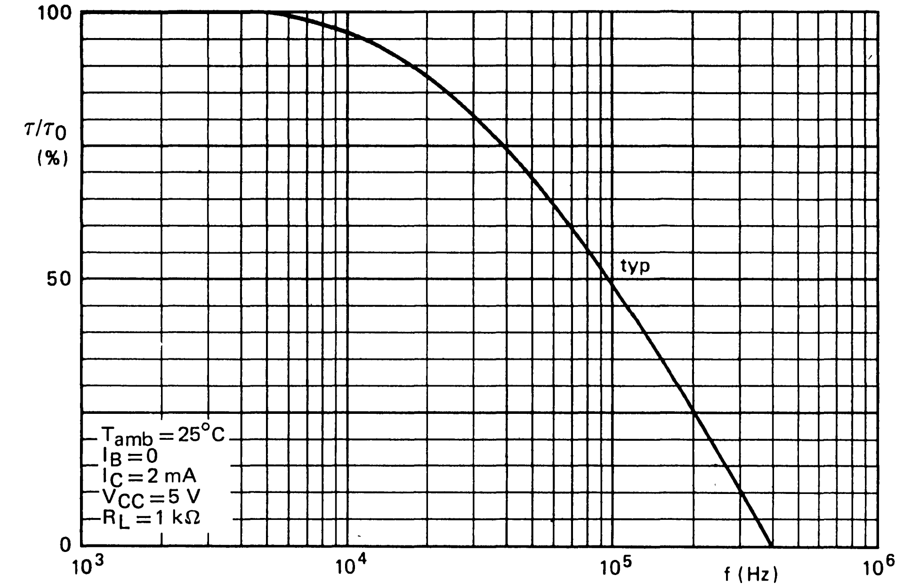

100
τ/τ0
(%)
50
0
typ
Tamb = 25°C
IB = 0
IC = 2 mA
VCC = 5 V
RL = 1 kΩ
10^3
10^4
10^5
f (Hz)
10^6

Fig. 12.

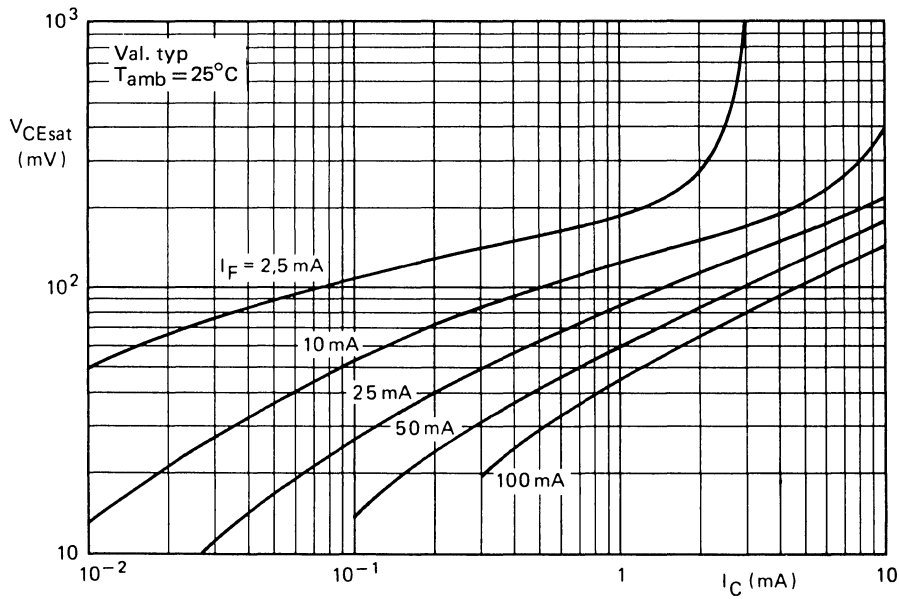

10^3
Val. typ
Tamb = 25°C
VCEsat
(mV)
10^2
10
IF = 2,5 mA
10 mA
25 mA
50 mA
100 mA
10^-2
10^-1
1
IC (mA)
10

Fig. 13.

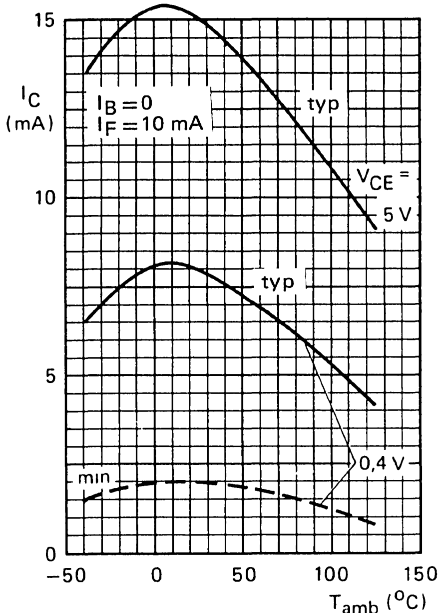


Fig. 14.

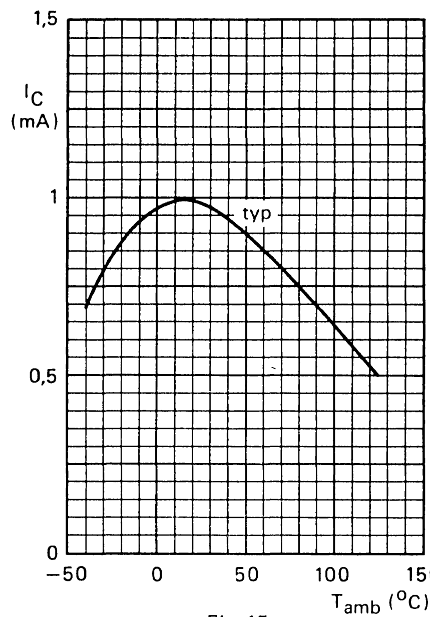


Fig. 15.

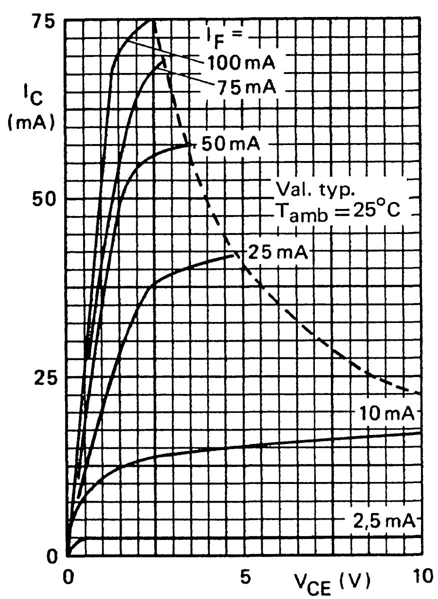


Fig. 16.

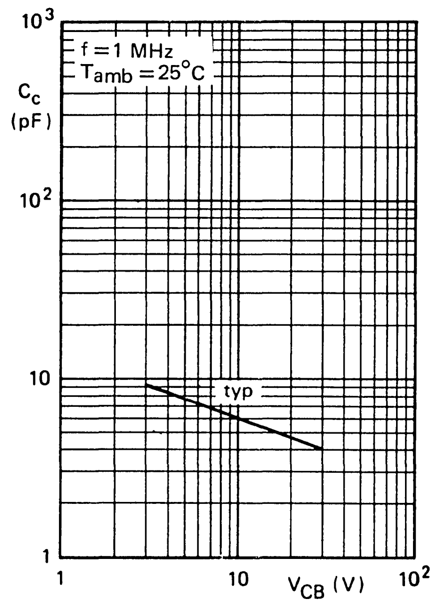
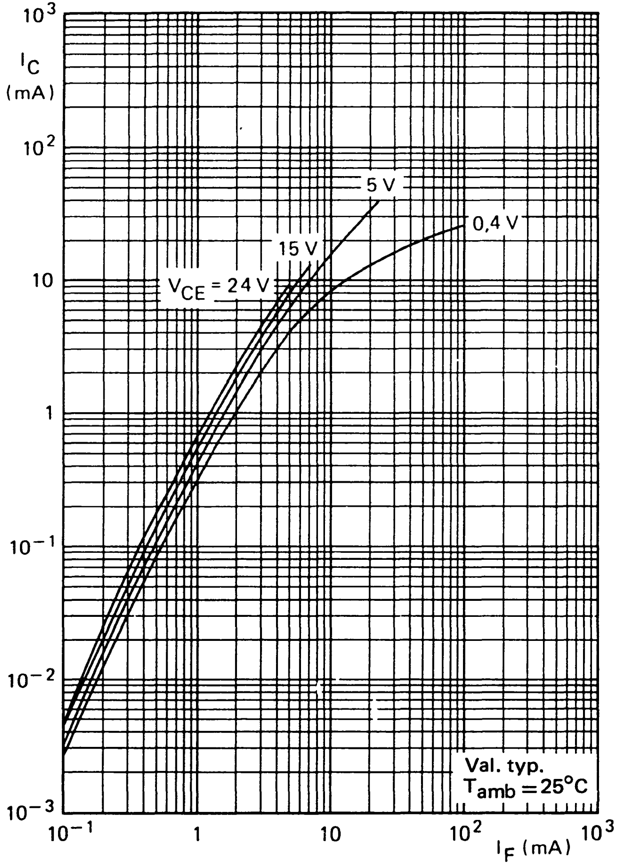
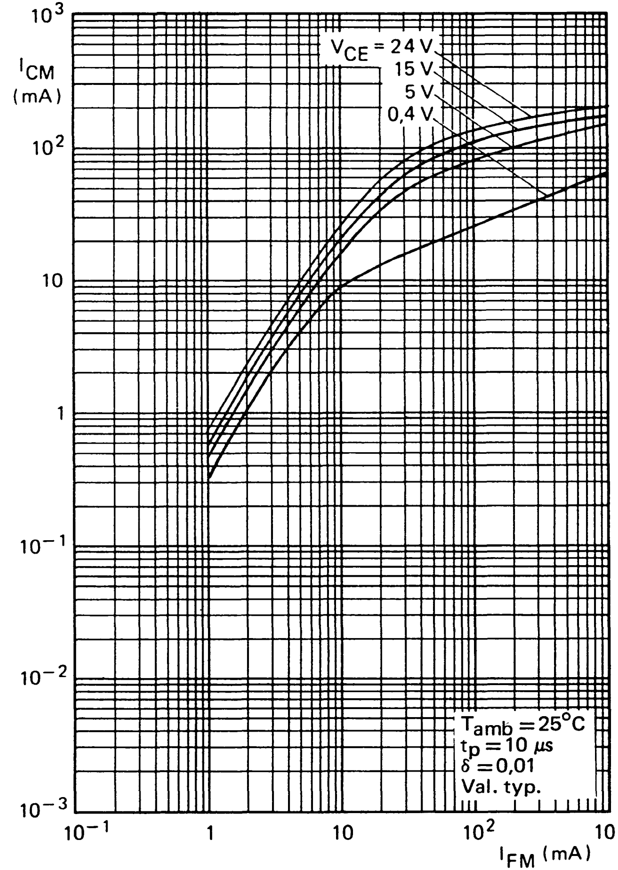


Fig. 17.



I_C (mA)
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
5 V
0,4 V
15 V
V_{CE} = 24 V
Val. typ.
$T_{amb} = 25°C$
10^{-1}
1
10
10^2
10^3
I_F (mA)

Fig. 18.



I_{CM} (mA)
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
V_{CE} = 24 V
15 V
5 V
0,4 V
$T_{amb} = 25°C$
$t_p = 10\ \mu s$
$\delta = 0{,}01$
Val. typ.
10^{-1}
1
10
10^2
10^3
I_{FM} (mA)

Fig. 19.

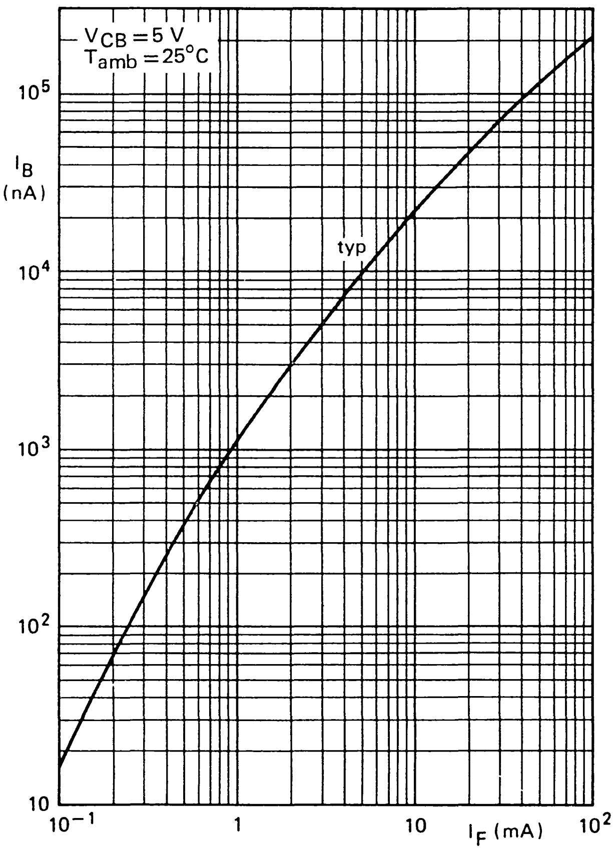

$V_{CB} = 5$ V
$T_{amb} = 25$°C
I_B (nA)
typ
10^5
10^4
10^3
10^2
10
10^{-1}
1
10
10^2
I_F (mA)

Fig. 20.

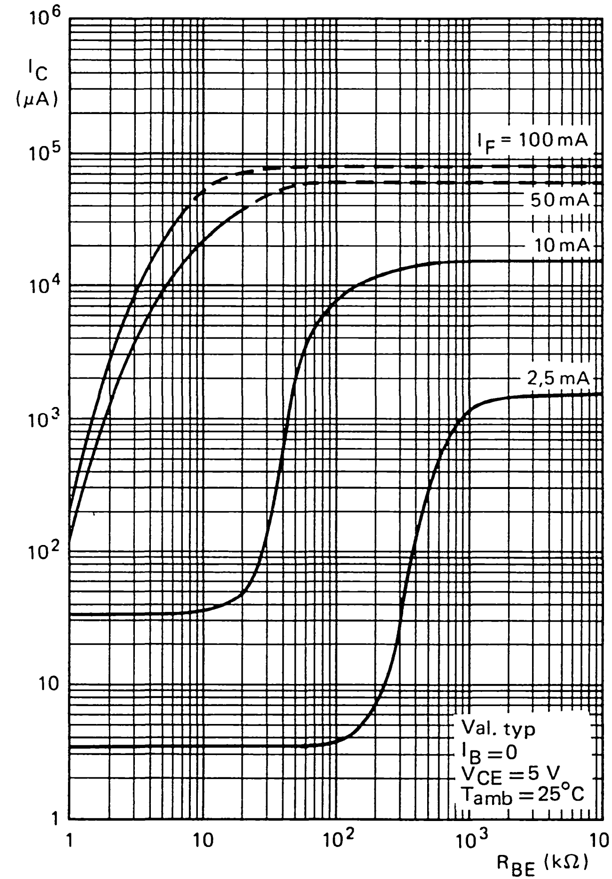

I_C (μA)
I_F = 100 mA
50 mA
10 mA
2,5 mA
Val. typ
$I_B = 0$
$V_{CE} = 5$ V
$T_{amb} = 25$°C
10^6
10^5
10^4
10^3
10^2
10
1
1
10
10^2
10^3
10^4
R_{BE} (kΩ)

Fig. 21.

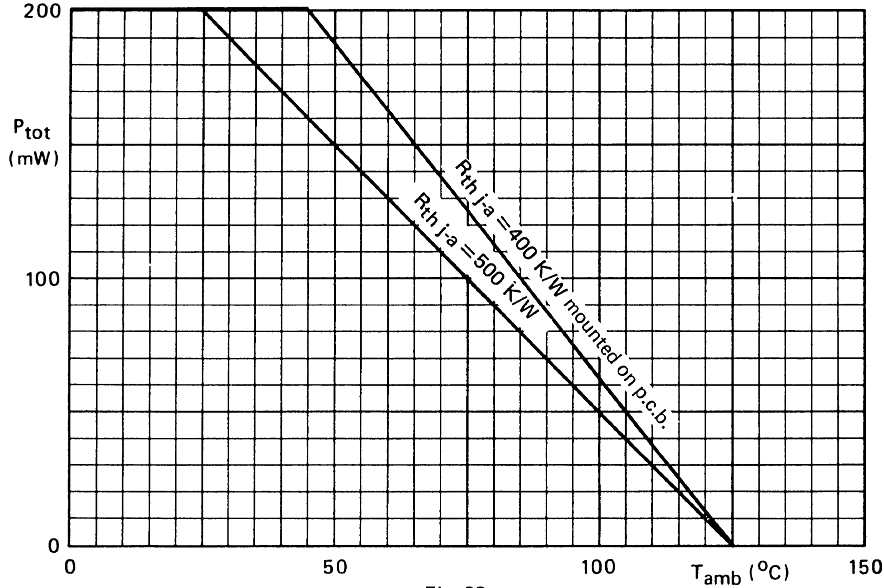


Fig. 22.

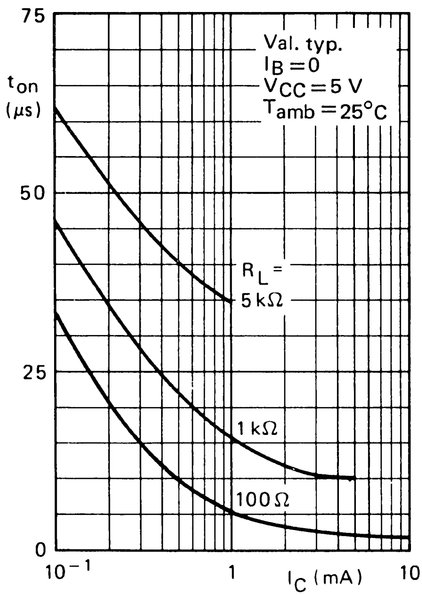


Fig. 23.

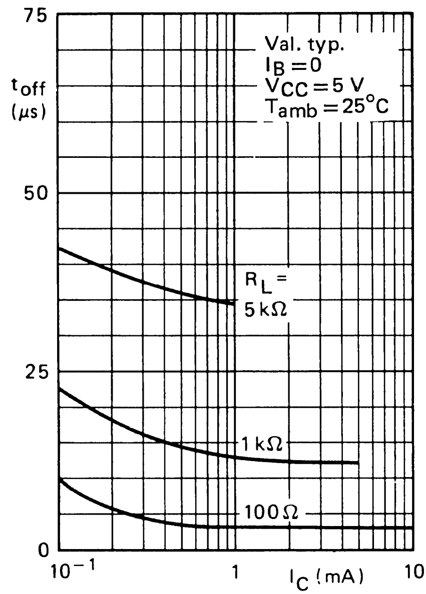


Fig. 24.

See Figs 2 and 3 in connection with Figs 23 and 24.

PHOTOCOUPLER

Optically coupled isolator consisting of an infrared emitting GaAs diode and a silicon n-p-n phototransistor with accessible base. Plastic envelope. Suitable for TTL integrated circuits.

Features of these products:

- high output/input d.c. current transfer ratio;
- low saturation voltage;
- high isolation voltage of 3 kV (r.m.s.) and 4,3 kV (d.c.);
- working voltage 1,5 kV.

QUICK REFERENCE DATA

Diode			
Continuous reverse voltage	V_R	max.	3 V
Forward current			
d.c.	I_F	max.	100 mA
(peak value); t_p = 10 μs; δ = 0,1	I_{FM}	max.	1000 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	150 mW
Transistor			
Collector-emitter voltage (open base)	V_{CEO}	max.	80 V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW
Photocoupler			
Output/input d.c. current transfer ratio			
I_F = 10 mA; V_{CE} = 10 V; (I_B = 0)	I_C/I_F		0,7 to 2,1
Collector cut-off current (dark)			
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV diode; I_F = 0 (see also Fig. 4)	I_{CEW}	$<$	200 nA
Isolation voltage (d.c.)			
t = 1 min	V_{IO}	$>$	4,3 kV

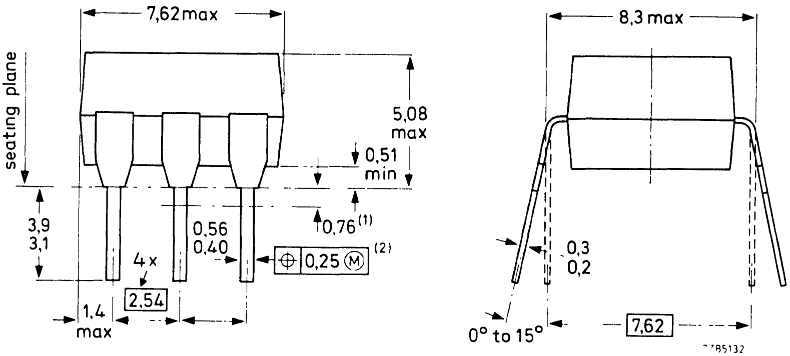
MECHANICAL DATA

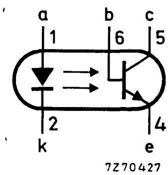
SOT-90 (see Fig. 1).

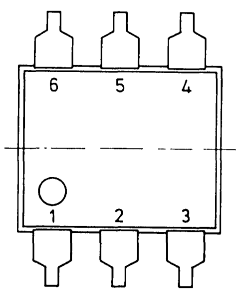
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-90.







⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) Lead spacing tolerances apply from seating plane to the line indicated.

(2) Centre-lines of all leads are within ±0,125 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,25 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode			
Continuous reverse voltage	V_R	max.	3 V
Forward current			
d.c.	I_F	max.	100 mA
(peak value); t_p = 10 μs; δ = 0,1	I_{FM}	max.	1000 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	150 mW
Transistor			
Collector-base voltage (open emitter)	V_{CBO}	max.	120 V
Collector-emitter voltage (open base)	V_{CEO}	max.	80 V
Emitter-collector voltage (open base)	V_{ECO}	max.	7 V
Collector current (d.c.)	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW

Photocoupler

Storage temperature	T_{stg}	−55 to +150	°C
Operating junction temperature	T_j	max. 125	°C
Lead soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max. 260	°C

THERMAL RESISTANCE

From junction to ambient in free air			
diode	$R_{th\ j\text{-}a}$	= 650	°C/W
transistor	$R_{th\ j\text{-}a}$	= 500	°C/W
From junction to ambient, device mounted on a printed-circuit board			
diode	$R_{th\ j\text{-}a}$	= 600	°C/W
transistor	$R_{th\ j\text{-}a}$	= 400	°C/W

CHARACTERISTICS

$T_j = 25$ °C unless otherwise specified

Diode

Forward voltage $I_F = 10$ mA	V_F	typ.	1,2	V
		<	1,5	V
Reverse current $V_R = 3$ V	I_R	<	10	μA

Transistor (diode: $I_F = 0$)

Collector cut-off current (dark) $V_{CE} = 10$ V	I_{CEO}	typ.	5	nA
		<	50	nA
$V_{CE} = 10$ V; $T_{amb} = 70$ °C	I_{CEO}	<	10	μA
$V_{CB} = 10$ V; $T_{amb} = 25$ °C	I_{CBO}	<	20	nA

Photocoupler ($I_B = 0$) *

Output/input d.c. current transfer ratio $I_F = 10$ mA; $V_{CE} = 10$ V	I_C/I_F		0,7 to 2,1	
$I_F = 16$ mA; $V_{CE} = 0,4$ V	I_C/I_F	>	0,5	
Collector-emitter saturation voltage $I_F = 16$ mA; $I_C = 2$ mA	V_{CEsat}	typ.	0,2	V
		<	0,4	V
Isolation voltage, d.c. value **	V_{IO}	>	4,3	kV

* Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.

** Tested with a d.c. voltage for 1 minute between shorted input leads and shorted output leads.

Collector capacitance at f = 1 MHz $I_E = I_e = 0$; $V_{CB} = 10$ V	C_c	typ.	6 pF
Capacitance between input and output $I_F = 0$; V = 0; f = 1 MHz	C_{io}	typ.	0,6 pF
Insulation resistance between input and output $\pm V_{IO} = 1$ kV	r_{IO}	> typ.	10^{10} Ω 10^{12} Ω
Switching times (see Figs 2 and 3) $I_{Con} = 4$ mA; $V_{CC} = 5$ V; $R_L = 100$ Ω			
Turn-on time	t_{on}	typ.	5 μs
Turn-off time	t_{off}	typ.	5 μs

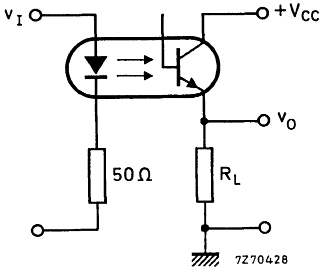


Fig. 2 Switching circuit.

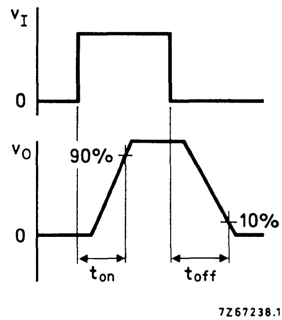


Fig. 3 Waveforms.

Collector cut-off current (dark) see Fig. 4 $V_{CC} = 10$ V; working voltage (d.c.) = 1,5 kV	I_{CEW}	<	200 nA *
$V_{CC} = 10$ V; working voltage (d.c.) = 1,5 kV; $T_j = 70$ °C	I_{CEW}	<	100 μA *

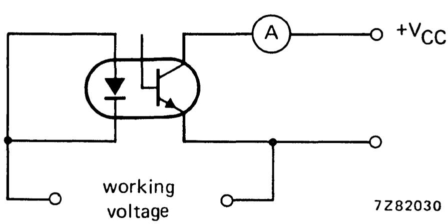


Fig. 4.

* As quality assurance (on a sample basis), these parameters are covered by a 1000 h reliability test.

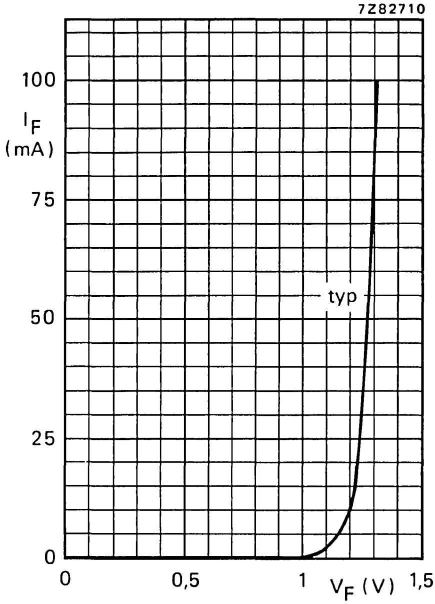


Fig. 5 T_{amb} = 25 °C.

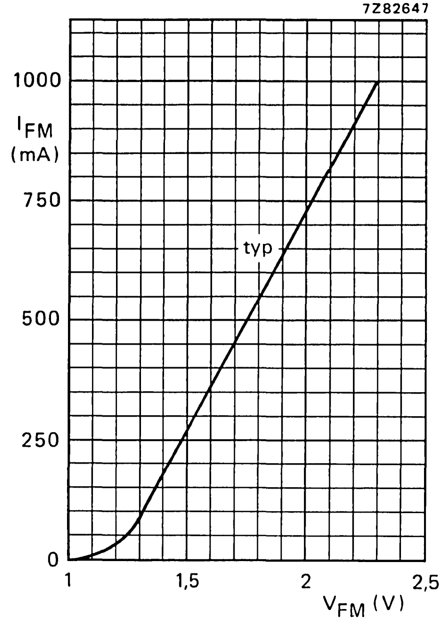


Fig. 6 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms.

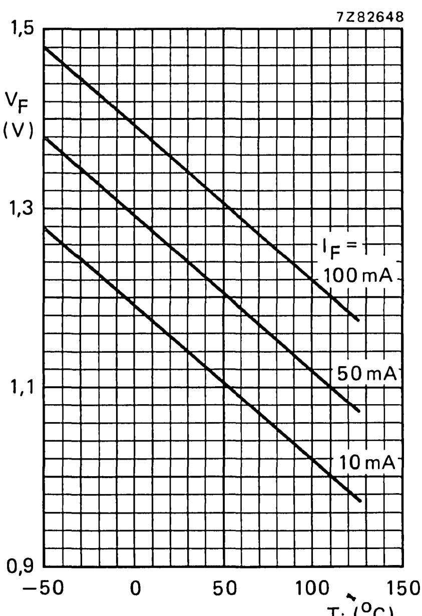


Fig. 7 Typical values.

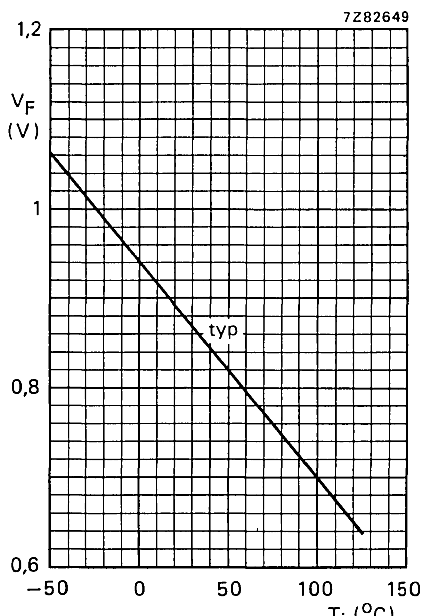


Fig. 8 I_F = 50 μA.

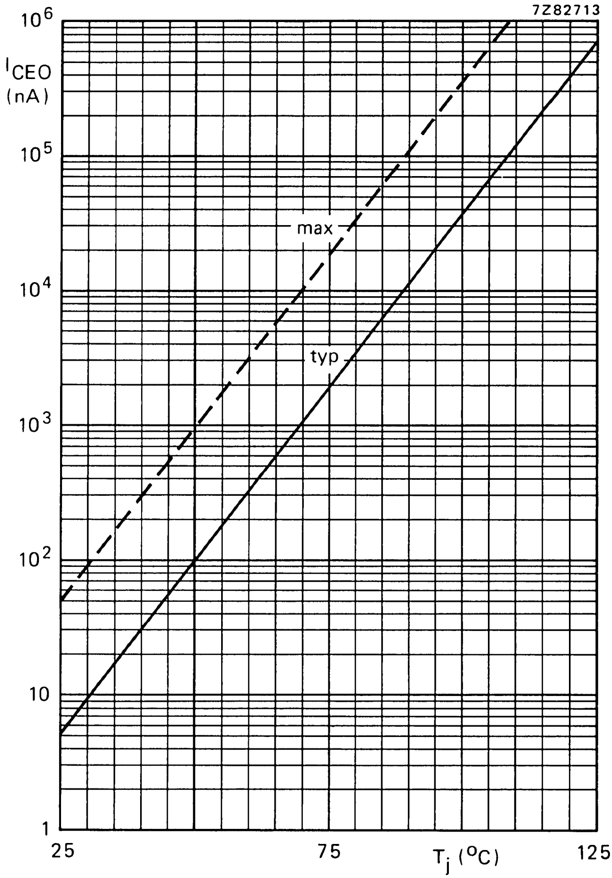


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V.

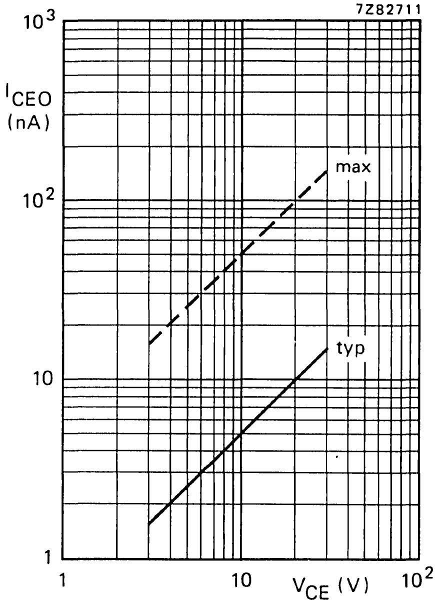


Fig. 10 $I_F = 0$; $T_j = 25\ ^oC$.

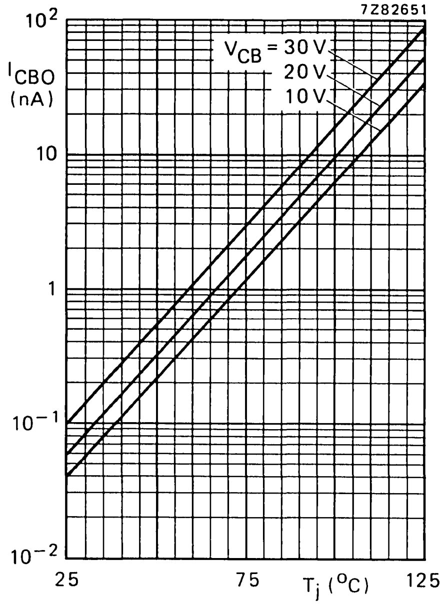


Fig. 11 Typical values.

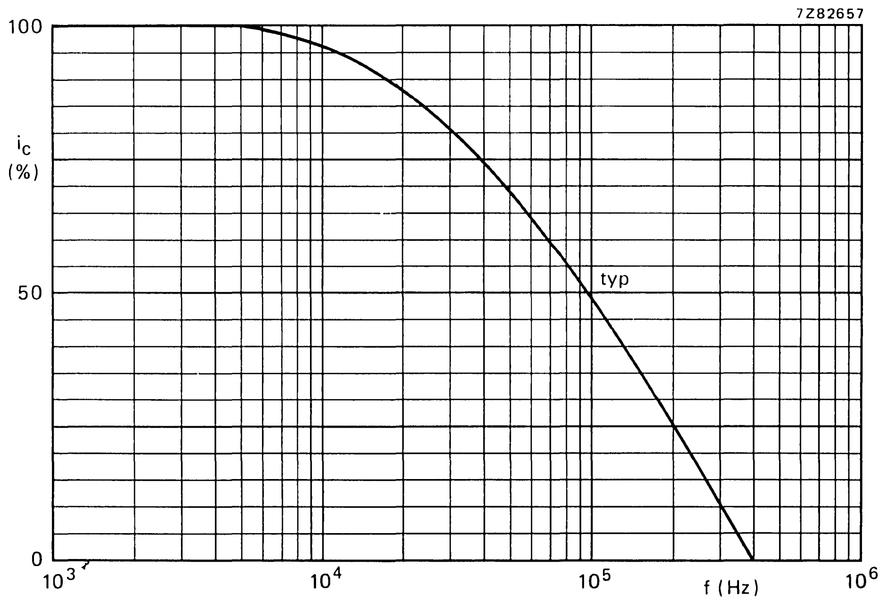


Fig. 12 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1$ kΩ; $T_{amb} = 25\ ^oC$.

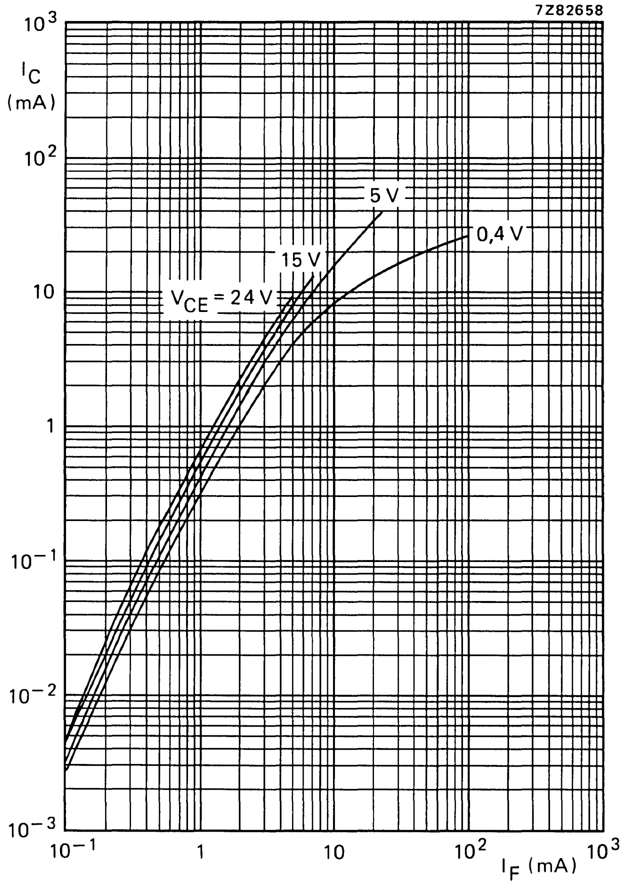


Fig. 13 T_{amb} = 25 °C, typical values.

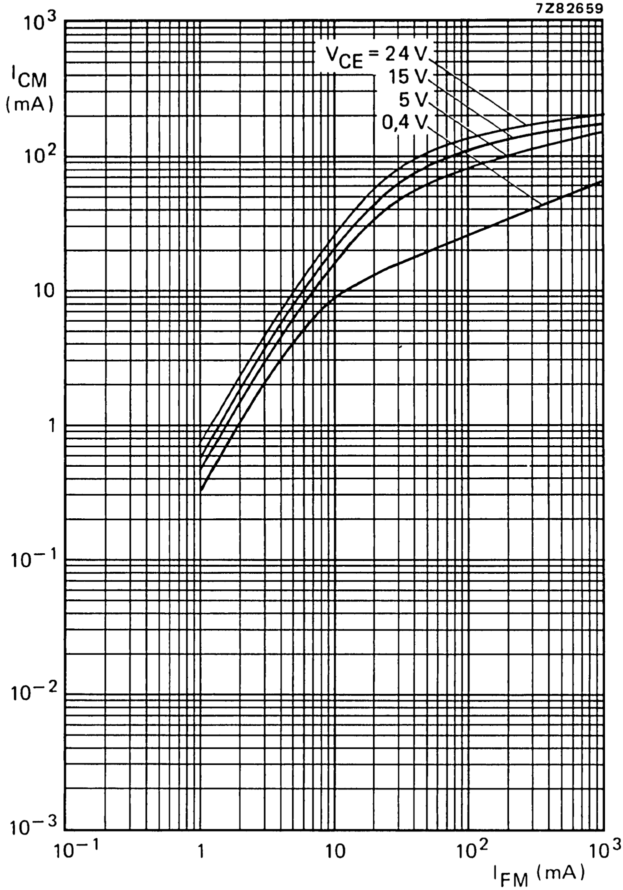


Fig. 14 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms; typical values.

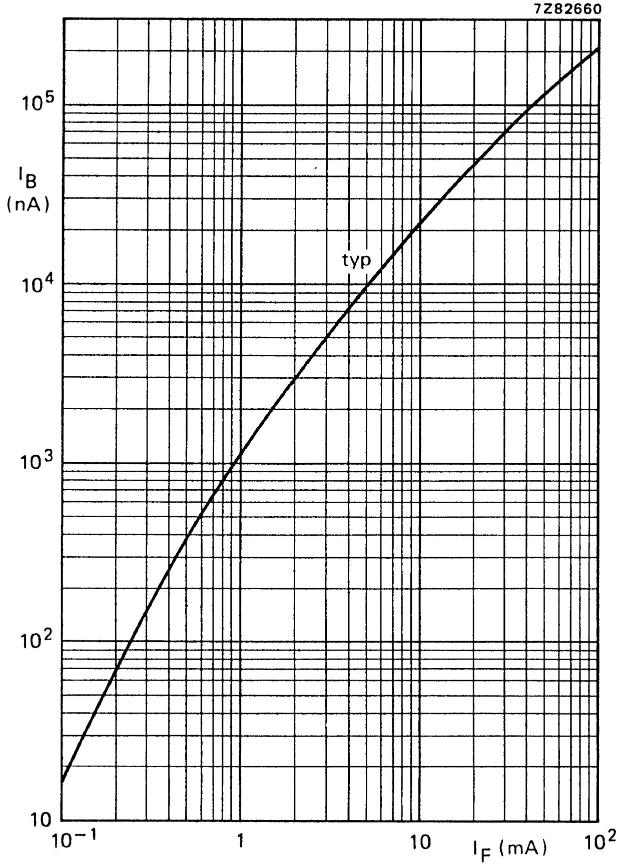


Fig. 15 V_{CB} = 5 V; T_{amb} = 25 °C.

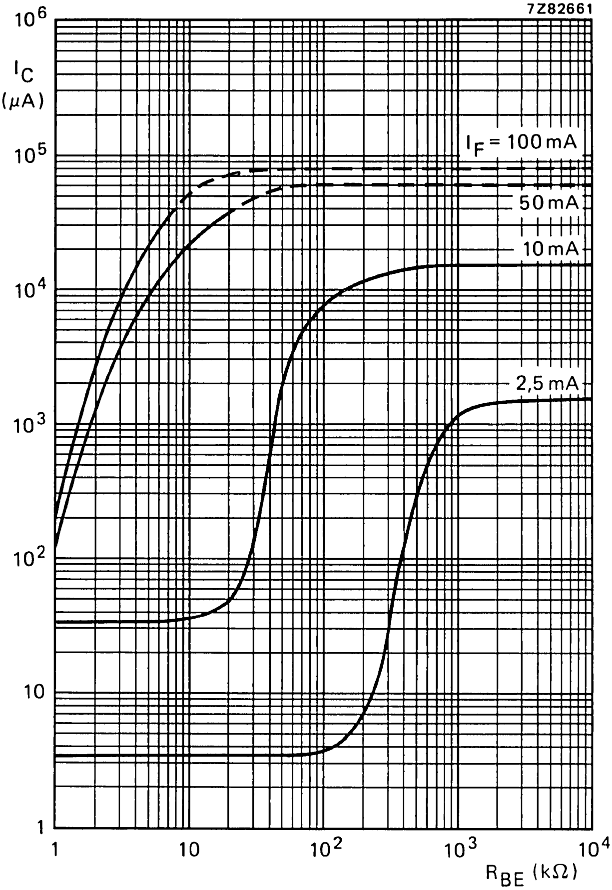


Fig. 16 $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

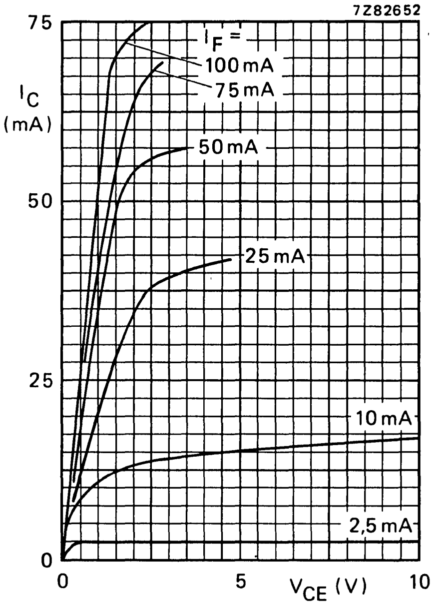


Fig. 17 T_{amb} = 25 °C; typical values.

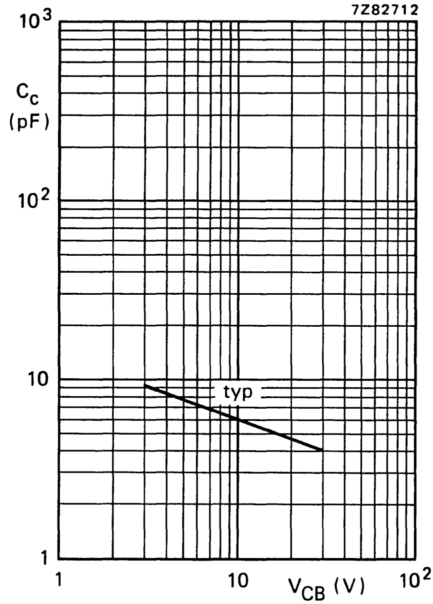


Fig. 18 f = 1 MHz; T_{amb} = 25 °C.

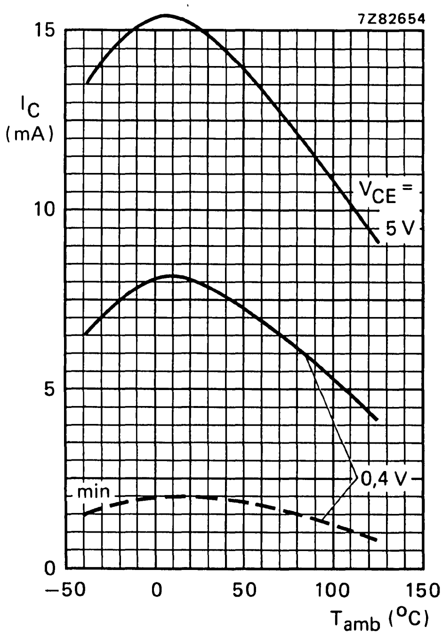


Fig. 19 I_B = 0; I_F = 10 mA; ——— typ. values.

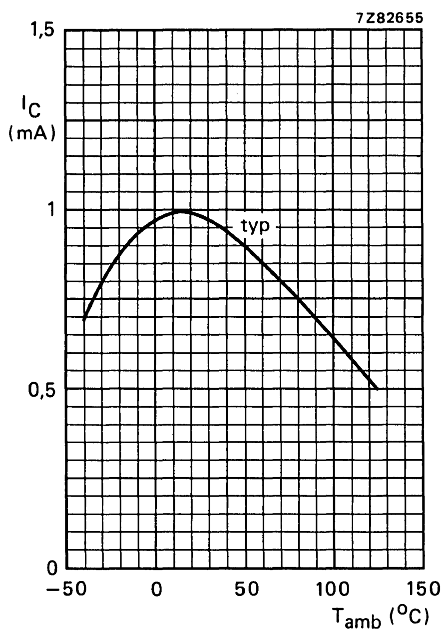


Fig. 20 I_F = 2 mA; V_{CE} = 0,4 V.

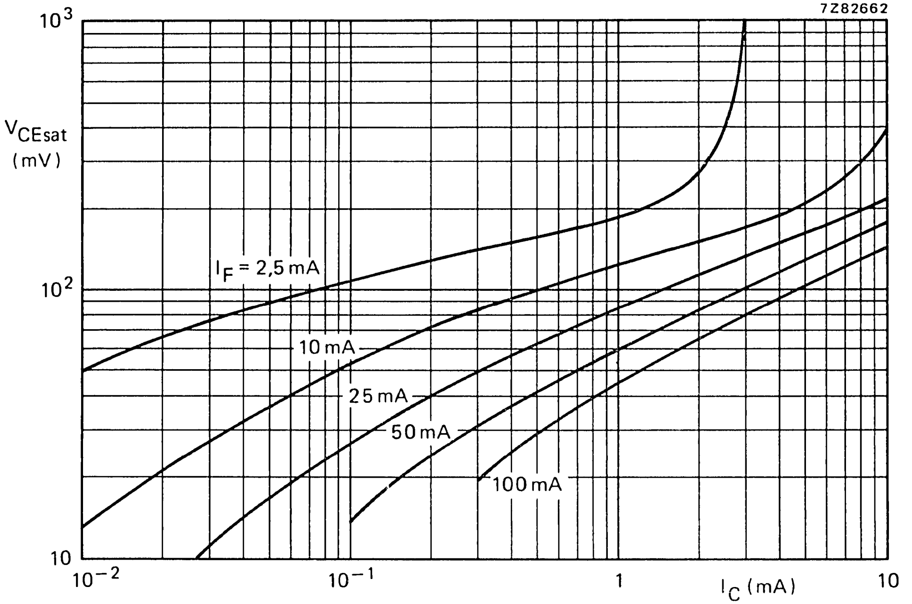


Fig. 21 $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

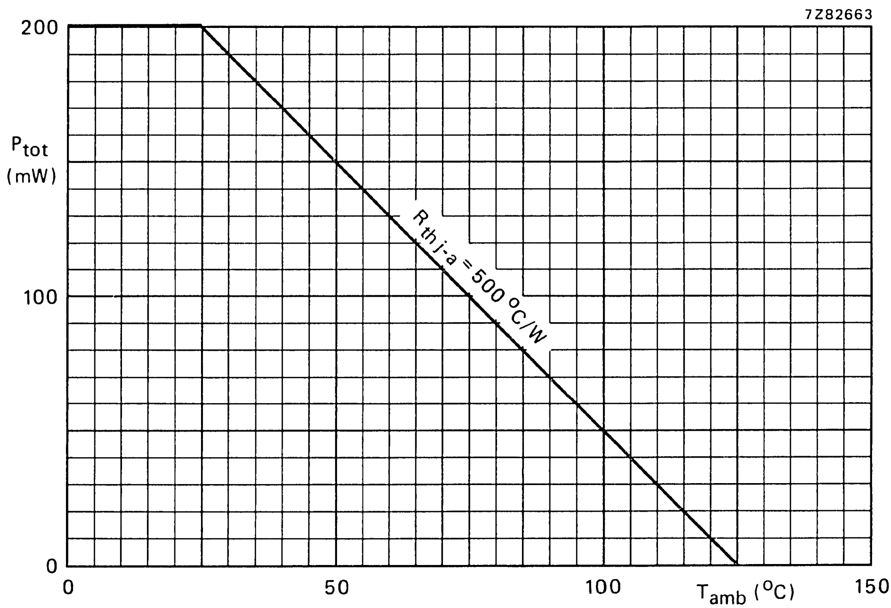


Fig. 22 Max. permissible power dissipation for total device versus ambient temperature.

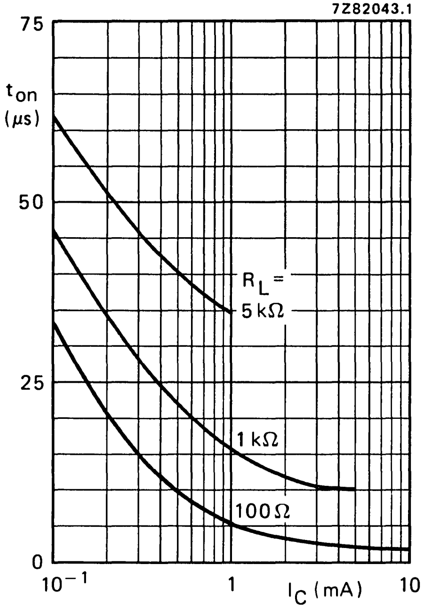


Fig. 23 I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typical values. (See also Fig. 25))

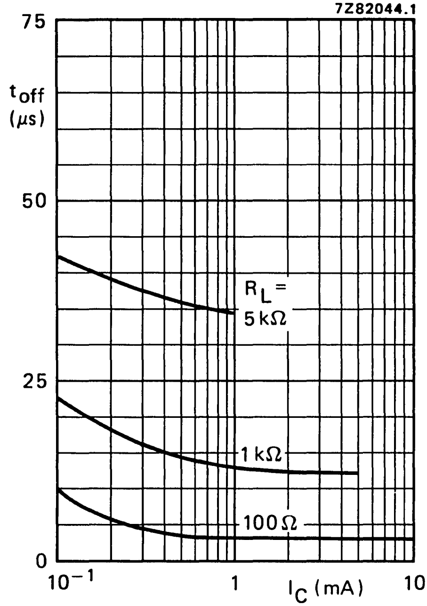


Fig. 24 I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typical values. (See also Fig. 25.)

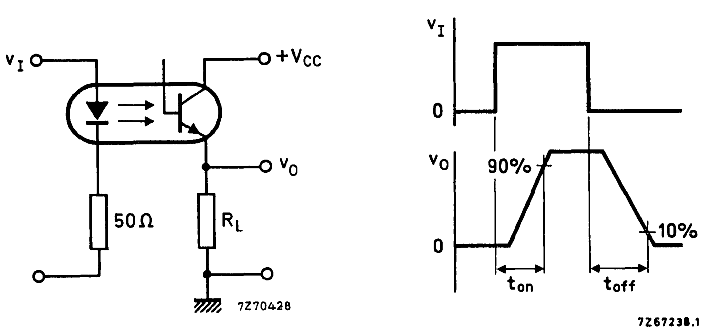


Fig. 25 Switching circuit and waveforms.

HIGH-VOLTAGE OPTOCOUPLER

The CNX44 is an optocoupler hermetically sealed in a metal envelope. It has a high reliability and can be used under severe conditions such as in military or industrial applications.

An outstanding characteristic is the high common-mode rejection ratio.

QUICK REFERENCE DATA

Diode			
Continuous reverse voltage	V_R	max.	3 V
Forward current			
d.c.	I_F	max.	100 mA
peak value; t_{on} = 10 μs; δ = 0,01	I_{FM}	max.	3 A
Total power dissipation up to T_{amb} = 75 °C mounted on a p.c.b.	P_{tot}	max.	150 mW
Transistor			
Collector-emitter voltage (open base)	V_{CEO}	max.	50 V
Total power dissipation up to T_{amb} = 75 °C mounted on a p.c.b.	P_{tot}	max.	150 mW
Photocoupler			
Output/input d.c. current transfer ratio			
I_F = 10 mA; V_{CE} = 0,4 V	I_C/I_F	min.	0,3
Collector cut-off current (dark)			
V_{CE} = 15 V; working voltage (d.c.) = 1,0 kV; I_F (diode) = 0 (see note)	I_{CEW}	max.	200 nA
Test isolation voltage (d.c.)	V_{IO}	max.	1 kV
Common-mode rejection ratio			
I_C = 2 mA; f = 10 kHz (see Fig. 2)	CM_{RR}	typ.	–85 dB

MECHANICAL DATA

See Fig. 1.

MECHANICAL DATA Dimensions in mm

Fig. 1 SOT-104C.

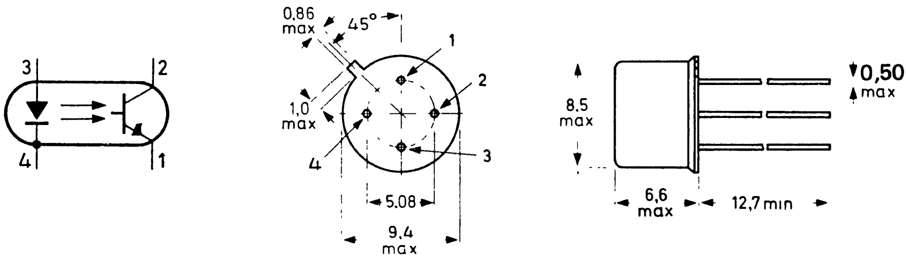


Fig. 1.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage	V_R	max.	3 V
Forward current			
d.c.	I_F	max.	100 mA
peak value; t_{on} = 10 μs; δ = 0,01	I_{FM}	max.	3 A

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	50 V
Emitter-collector voltage	V_{ECO}	max.	7 V
Collector current (d.c.)	I_C	max.	100 mA

Photocoupler

Storage temperature	T_{stg}		−65 to + 150 °C
Operating ambient temperature	T_{amb}		−55 to + 125 °C
Total power dissipation of diode and transistor up to T_{amb} = 75 °C	P_{tot}	max.	300 mW

THERMAL RESISTANCE

From junction to ambient when mounted on p.c.b.

diode	$R_{th\,j\text{-}a}$	max.	330 K/W
transistor	$R_{th\,j\text{-}a}$	max.	330 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage			
I_F = 10 mA	V_F	typ. max.	1,15 V 1,30 V
I_F = 2 mA; T_{amb} = 0 to 70 °C	V_F	max.	1,20 V
Reverse current			
V_R = 3 V	I_R	typ. max.	1 μA 100 μA

Transistor

Collector-emitter breakdown voltage			
I_C = 1 mA	$V_{(BR)CEO}$	min.	50 V
Emitter-collector breakdown voltage			
I_E = 0,1 mA	$V_{(BR)ECO}$	min.	7 V
Collector cut-off current (dark); diode I_F = 0			
V_{CE} = 20 V	I_{CEO}	typ. max.	5 nA 100 nA
V_{CE} = 20 V; T_{amb} = 70 °C	I_{CEO}	max.	10 μA
D.C. current gain			
I_C = 10 mA; V_{CE} = 5 V	h_{FE}	typ.	600

Photocoupler

Collector current			
I_F = 10 mA; V_{CE} = 0,4 V	I_C	min. typ.	3 mA 6 mA
I_F = 10 mA; V_{CE} = 5 V	I_C	typ.	10 mA
Switching times (see Figs 4 and 5)			
I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω	t_{on} t_{off}	typ. typ.	5 μs 5 μs
Collector cut-off current (dark) at working voltage V_W = 1 kV (d.c. value);			
V_{CC} = 15 V; T_j = 25 °C (see note) V_{CC} = 15 V; T_j = 70 °C (see note)	I_{CEW}	max. max.	200 nA 50 μA
Test isolation voltage (d.c. value) between shorted input and shorted output terminals	V_{IO}	max.	1 kV
Capacitance between input and output			
V = 0; f = 1 MHz	C_{IO}	typ.	1 pF
Insulation resistance between input and output			
V_{IO} = 500 V	R_{IO}	min. typ.	100 GΩ 1000 GΩ
Common-mode rejection ratio (see Fig. 2)			
I_C = 2 mA; f = 10 kHz	CM_{RR}	typ.	−85 dB

DEVELOPMENT SAMPLE DATA

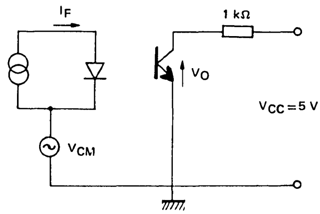


Fig. 2.

Note (see Fig. 3):

Collector cut-off current (dark) at working voltage V_W = 1 kV (d.c. value);			
V_{CC} = 10 V; T_j = 25 °C	I_{CEW}	max.	200 nA*
V_{CC} = 10 V; T_j = 70 °C		max.	50 μA*

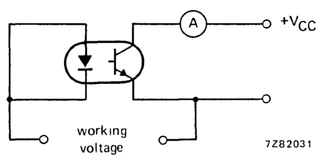


Fig. 3 V_W = 1 kV (d.c.); V_{CC} = 10 V.

* The two parameters are tested on a sample basis for 1000 h.

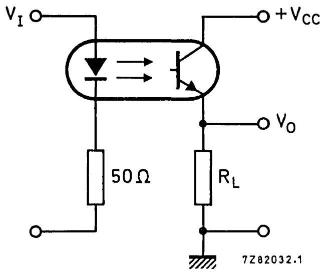


Fig. 4.

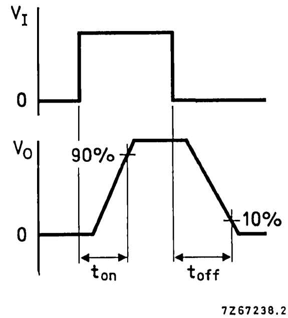


Fig. 5.

DEVELOPMENT SAMPLE DATA

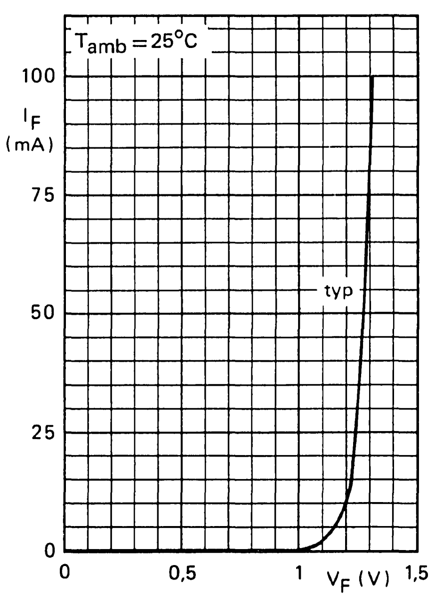


Fig. 6.

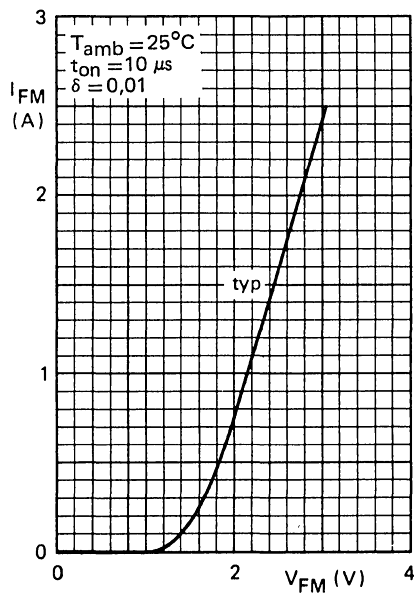


Fig. 7.

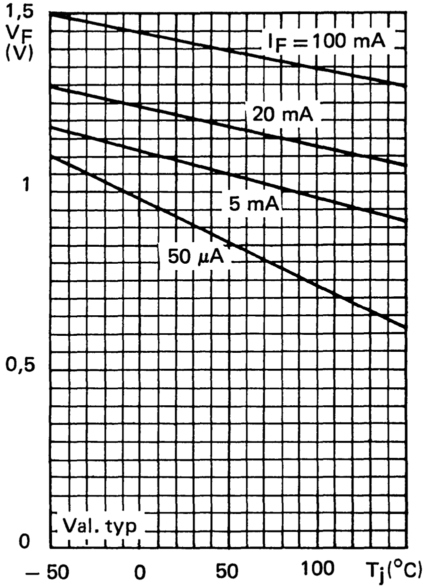


Fig. 8.

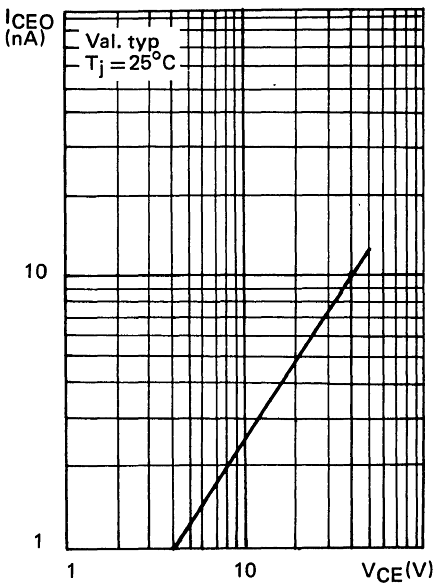


Fig. 9.

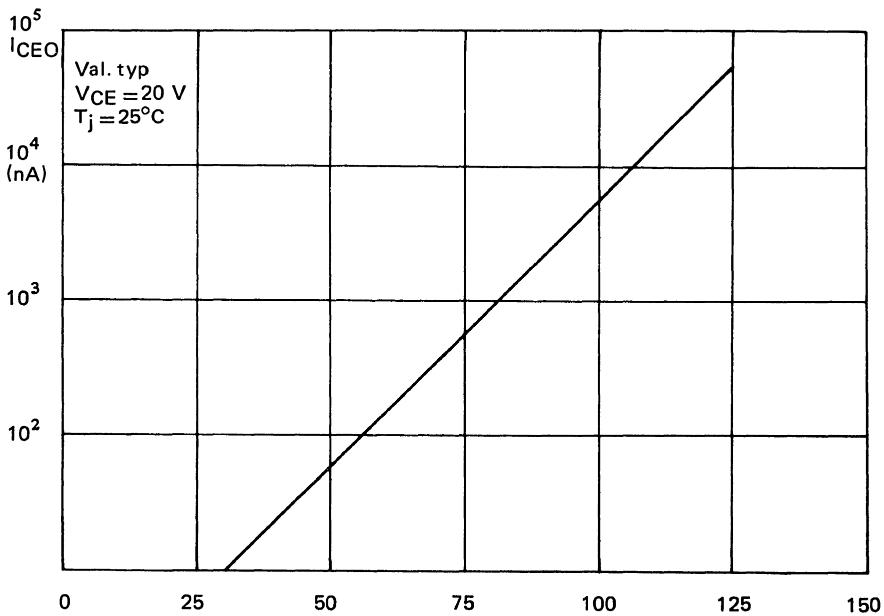


Fig. 10.

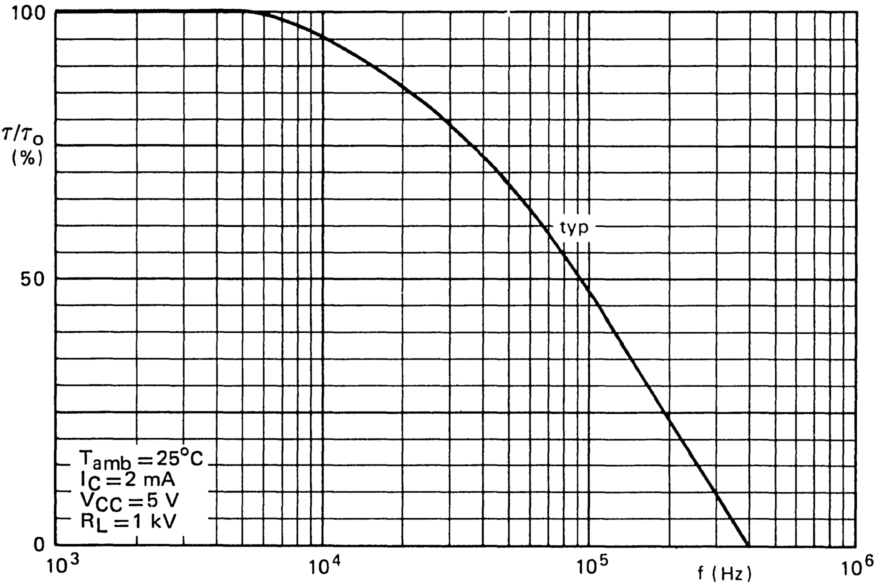


Fig. 11.

DEVELOPMENT SAMPLE DATA

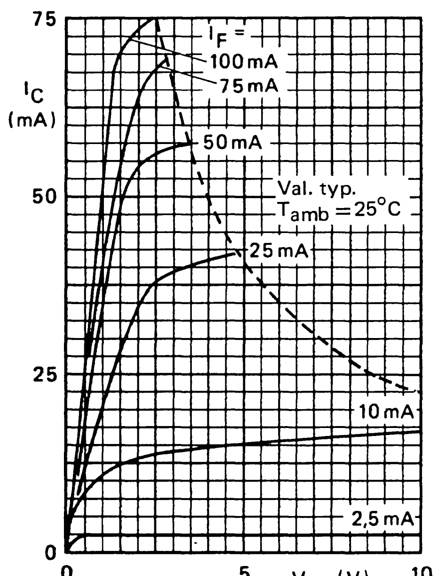


Fig. 12.

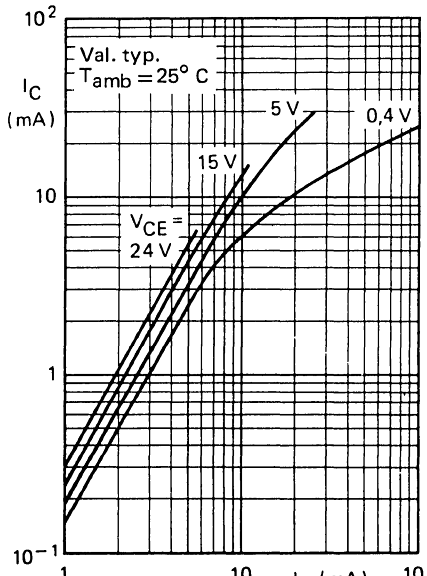


Fig. 13.

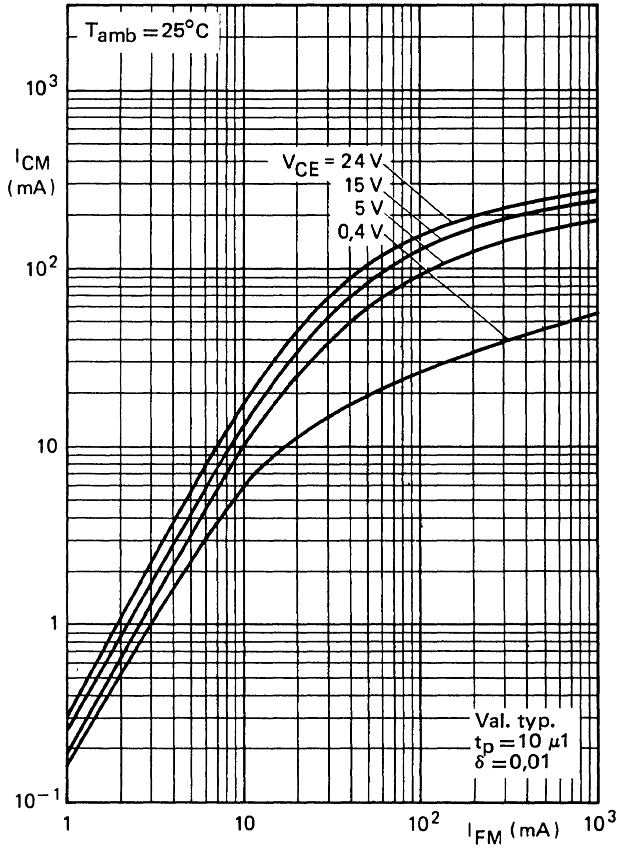

$T_{amb} = 25°C$
I_{CM} (mA)
10^3
10^2
10
1
10^{-1}
$V_{CE} = 24$ V
15 V
5 V
0,4 V
Val. typ.
$t_p = 10\ \mu$1
$\delta = 0,01$
1
10
10^2
I_{FM} (mA)
10^3

Fig. 14.

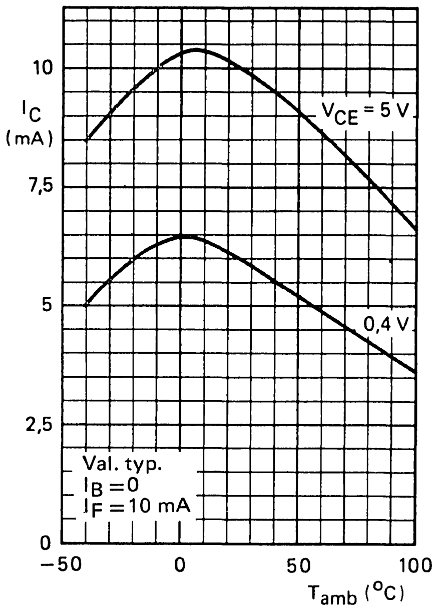


Fig. 15.

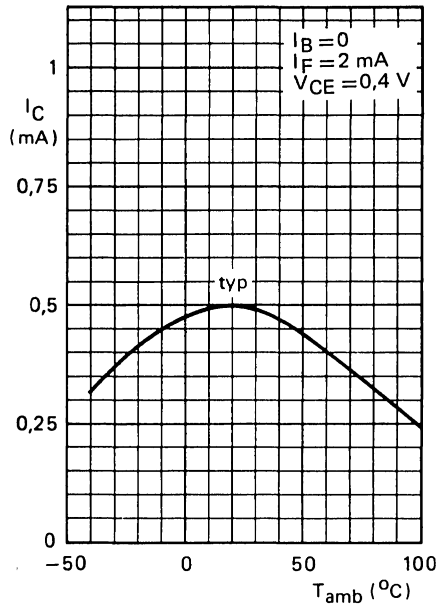


Fig. 16.

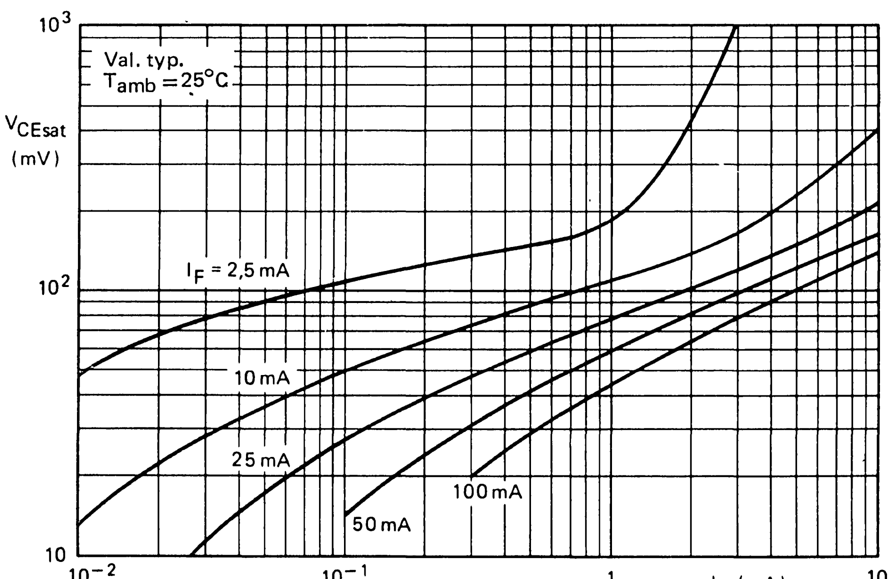


Fig. 17.

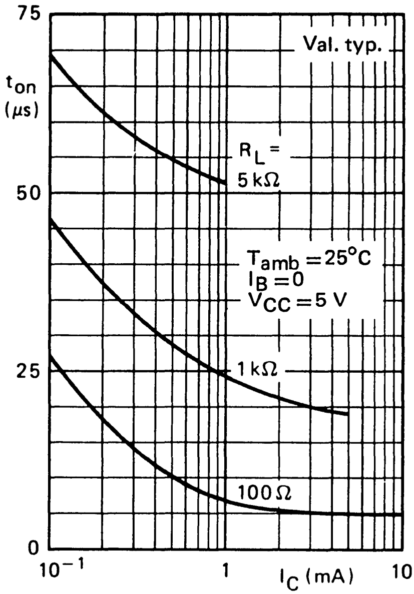


Fig. 18.

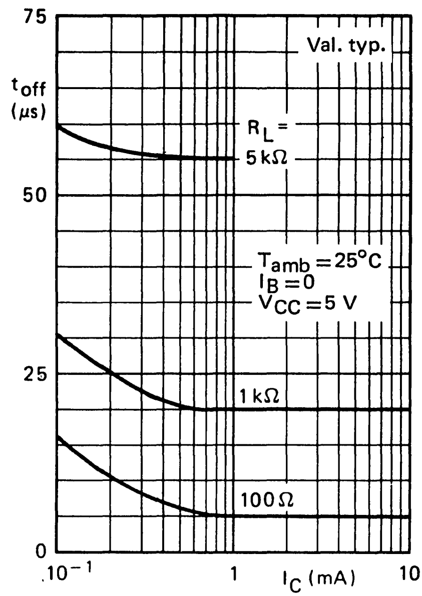


Fig. 19.

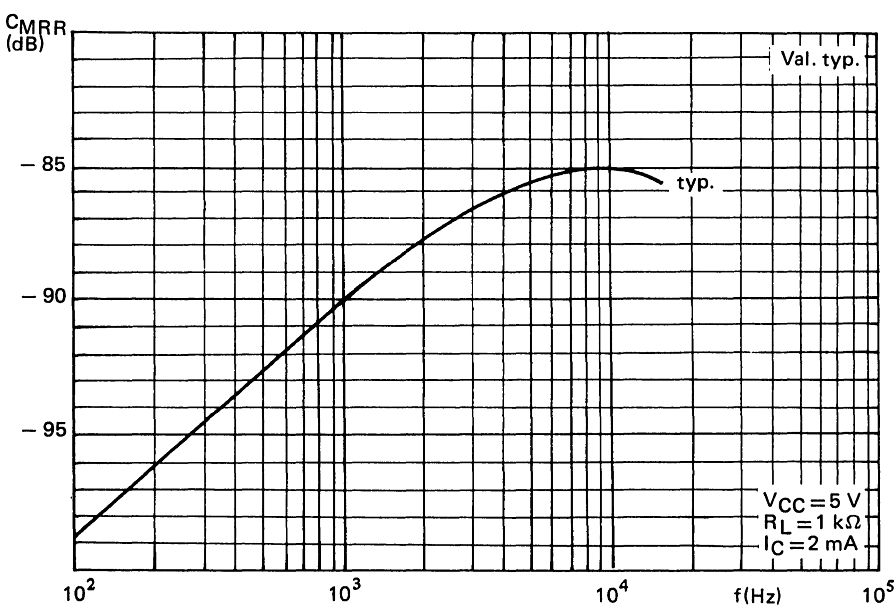


Fig. 20.

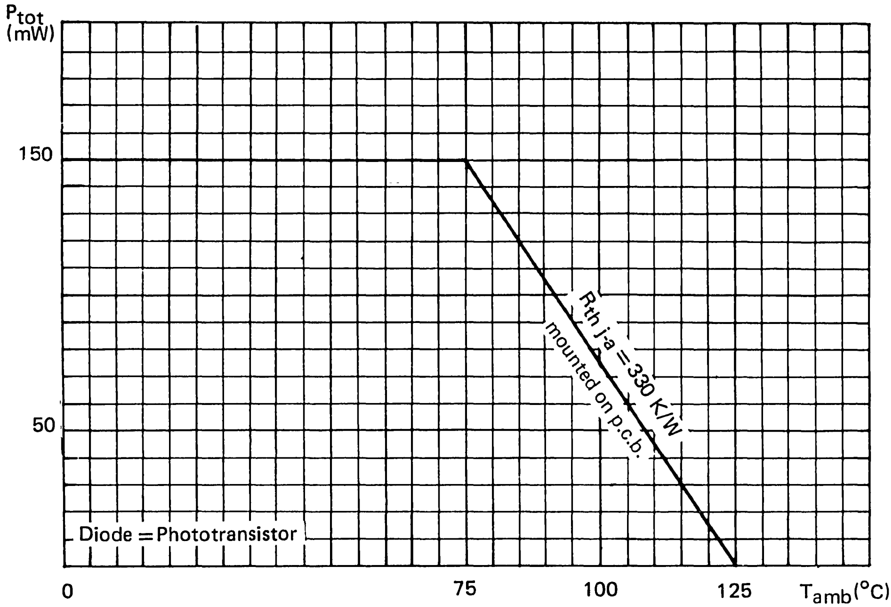


Fig. 21.

DEVELOPMENT SAMPLE DATA

PHOTOCOUPLER

Opto-isolator comprising an infrared emitting GaAs diode and a silicon n-p-n Darlington phototransistor with accessible base. Plastic 6-lead dual-in line (DIL) envelope.

Features:

- very high output/input d.c. current transfer ratio;
- high isolation voltage of 3 kV (r.m.s.) and 4,4 kV (d.c.);
- working voltage 1,5 kV.

QUICK REFERENCE DATA

Diode			
Continuous reverse voltage	V_R	max.	3 V
Forward current			
d.c.	I_F	max.	100 mA
(peak value); t_p = 10 μs; δ = 0,1	I_{FM}	max.	3 A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW
Transistor			
Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW
Photocoupler			
Output/input d.c. current transfer ratio			
I_F = 1 mA; V_{CE} = 1 V; (I_B = 0)	I_C/I_F	min.	5
Collector cut-off current (dark)			
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV diode: I_F = 0 (see also Fig. 2)	I_{CEW}	max.	1 μA
Isolation voltage (d.c.)			
t = 1 min	V_{IO}	max.	4,4 kV

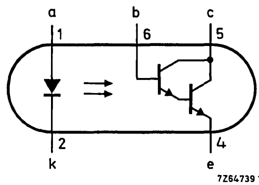
MECHANICAL DATA

SOT-90B (see Fig. 1).

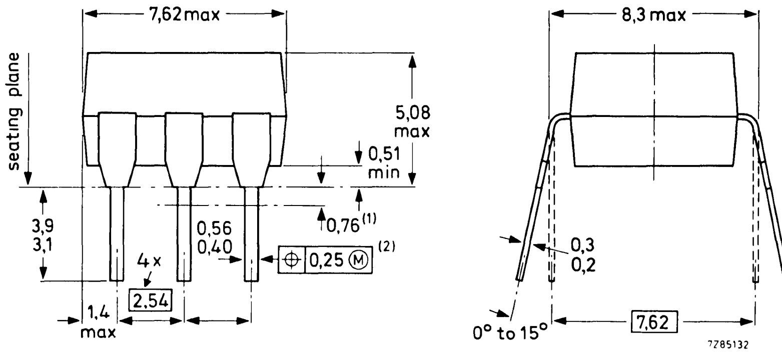
MECHANICAL DATA

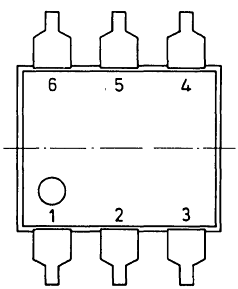
Dimensions in mm

Fig. 1 SOT-90B.



3 = n.c.





⊕ Positional accuracy.

Ⓜ Maximum material condition.

(1) Lead spacing tolerances apply from seating plane to the line indicated.

(2) Centre-lines of all leads are within ±0,125 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,25 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage	V_R	max.	3 V
Forward current			
d.c.	I_F	max.	100 mA
(peak value); t_p = 10 μs; δ = 0,1	I_{FM}	max.	3 A
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW
Junction temperature	T_j	max.	125 °C

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	30 V
Collector-base voltage (open emitter)	V_{CBO}	max.	30 V
Emitter-collector voltage (open base)	V_{ECO}	max.	6 V
Collector current (d.c.)	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW
Junction temperature	T_j	max.	125 °C

Photocoupler

Storage temperature	T_{stg}	−55 to +125 °C	
Lead soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient in free air diode and transistor	$R_{th\ j\text{-}a}$	=	500 K/W
From junction to ambient, device mounted on a printed-circuit board diode and transistor	$R_{th\ j\text{-}a}$	=	400 K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage I_F = 10 mA	V_F	typ.	1,15 V
		max.	1,3 V
Reverse current V_R = 3 V	I_R	max.	10 μA

Transistor (diode; I_F = 0)

Collector cut-off current (dark) V_{CE} = 10 V	I_{CEO}	typ.	20 nA
		max.	100 nA
V_{CB} = 10 V	I_{CEO}	max.	20 nA

Photocoupler (I_B = 0)*

Output/input d.c. current transfer ratio

I_F = 0,5 mA; V_{CE} = 1 V	I_C/I_F	min.	3,5
I_F = 1,0 mA; V_{CE} = 1 V	I_C/I_F	min.	5
I_F = 10 mA; V_{CE} = 1 V	I_C/I_F	min.	6

* Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.

Collector cut-off current (dark) see Fig. 2			
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV	I_{CEW}	max.	1 μA*
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV; T_j = 70 °C	I_{CEW}	max.	1000 μA*
Collector-emitter saturation voltage			
I_F = 5 mA; I_C = 10 mA	V_{CEsat}	max.	1 V
Isolation voltage, d.c. value*	V_{IO}	max.	4,4 kV**
Collector capacitance at f = 1 MHz			
$I_E = I_e$ = 0; V_{CB} = 10 V	C_c	typ.	4,5 pF
Capacitance between input and output			
I_F = 0; V = 0; f = 1 MHz	C_{io}	typ.	0,6 pF
Insulation resistance between input and output			
$\pm V_{IO}$ = 1 kV	r_{IO}	min.	10^{10} Ω
		typ.	10^{12} Ω
Switching times (see Figs 3 and 4)			
I_{Fon} = 1 mA; V_{CC} = 5 V; R_E = 100 Ω; R_{BE} = 1 MΩ	t_{on}	typ.	5 μs
	t_{off}	typ.	30 μs
I_{Fon} = 10 mA; V_{CC} = 5 V; R_E = 1 kΩ; R_{BE} = 10 MΩ	t_{on}	typ.	50 μs
	t_{off}	typ.	250 μs

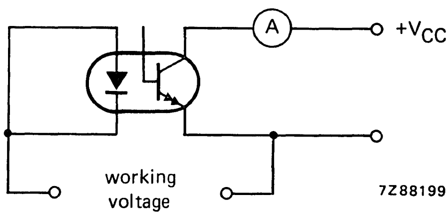


Fig. 2.

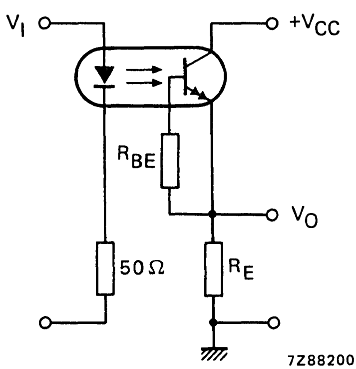


Fig. 3 Switching circuit.

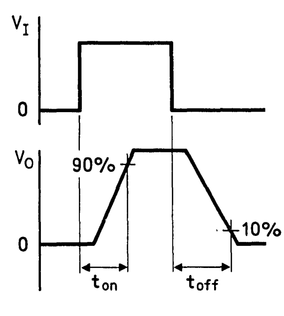


Fig. 4 Waveforms.

* As quality assurance (on a sample basis), these parameters are covered by a 1000 h reliability test.
** Tested with a d.c. voltage for 1 minute between shorted input leads and shorted output leads.

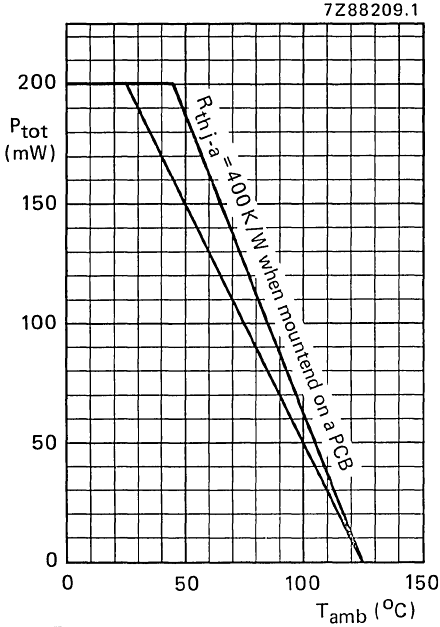


Fig. 5 Power derating curve for diode and transistor as a function of temperature.

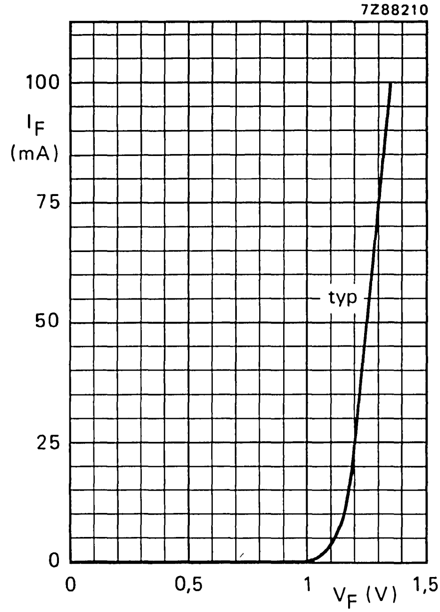


Fig. 6 T_{amb} = 25 °C.

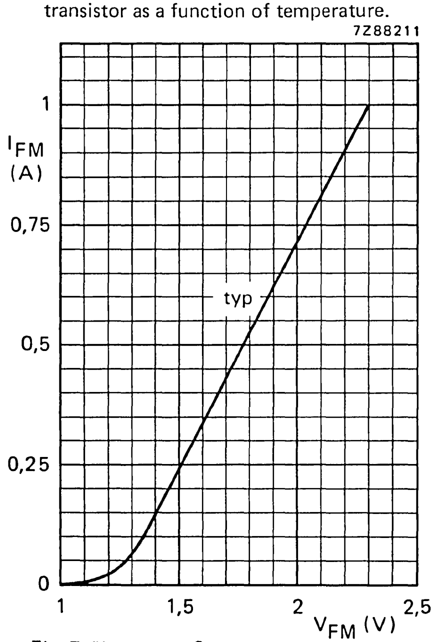


Fig. 7 T_{amb} = 25 °C; t_p = 10 μs; δ = 0,01.

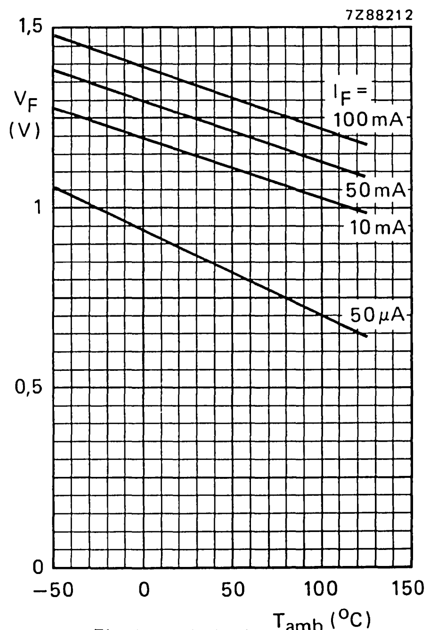


Fig. 8 Typical values.

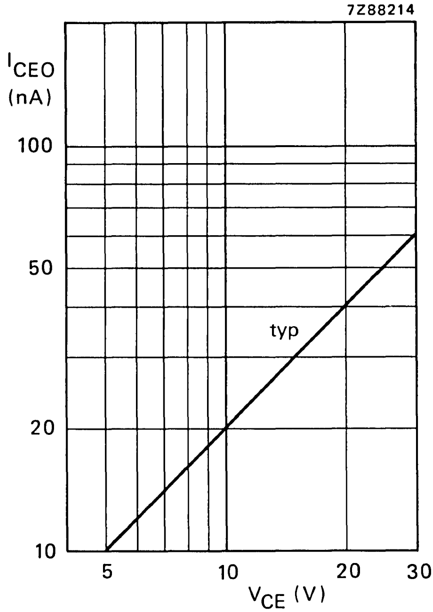


Fig. 9 $I_F = 0$; $T_j = 25\ ^oC$.

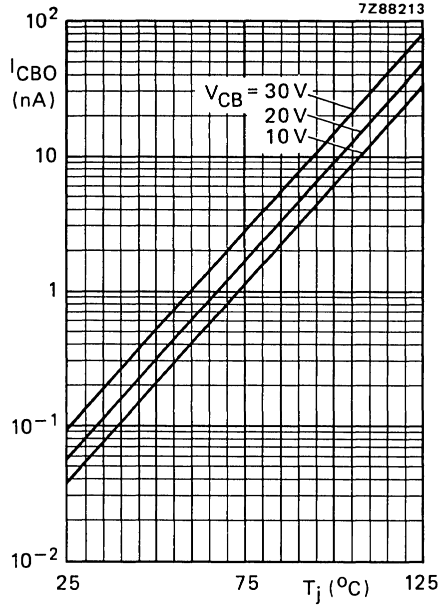


Fig. 10 Typical values.

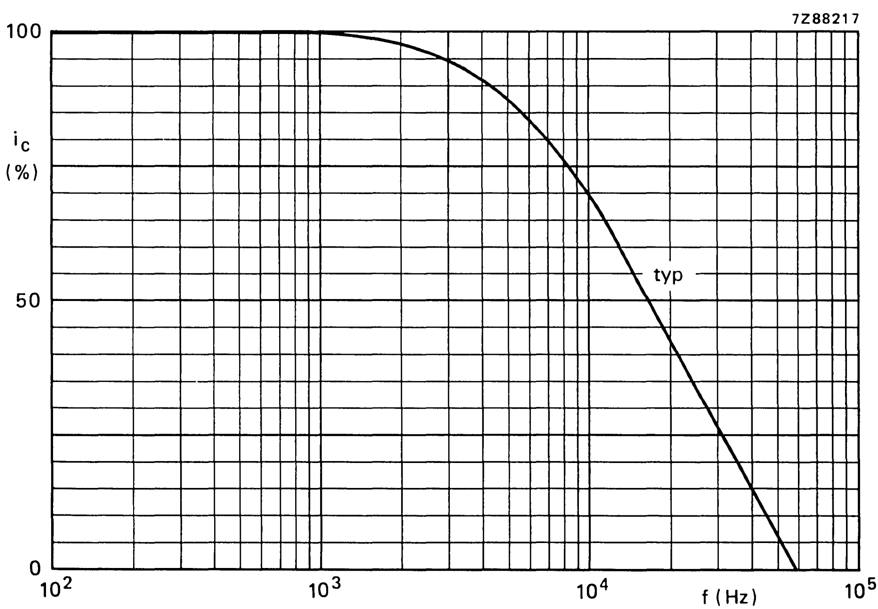


Fig. 11 $I_C = 10$ mA; $V_{CC} = 5$ V; $R_E = 100\ \Omega$; $R_{BE} = 1\ M\Omega$; see also Fig. 4.

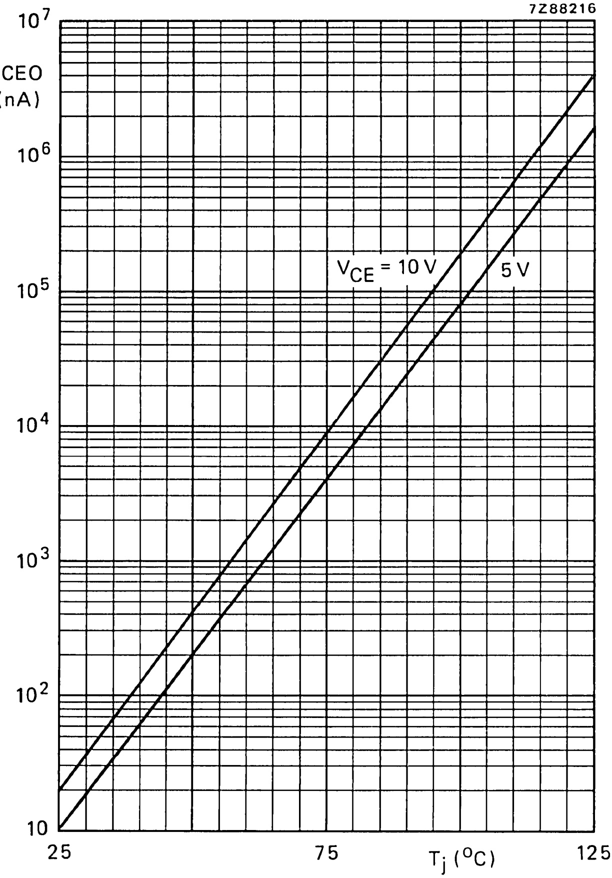


Fig. 12 $I_F = 0$; typical values.

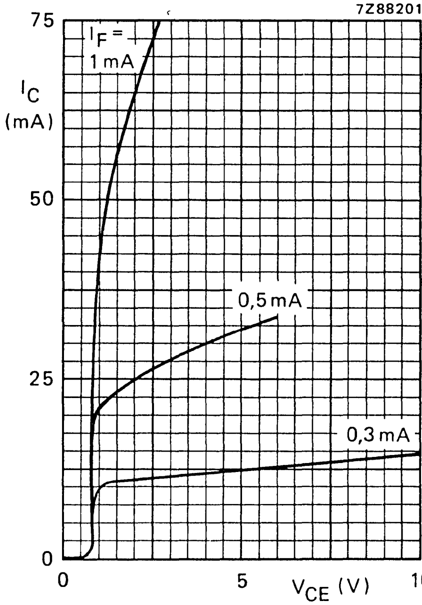


Fig. 13 Typical values; $I_B = 0$; $T_j = 25\ ^oC$.

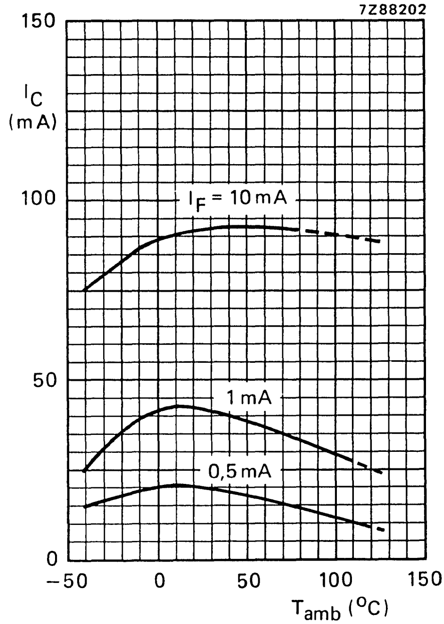


Fig. 14 Typical values; $I_B = 0$; $V_{CE} = 1$ V.

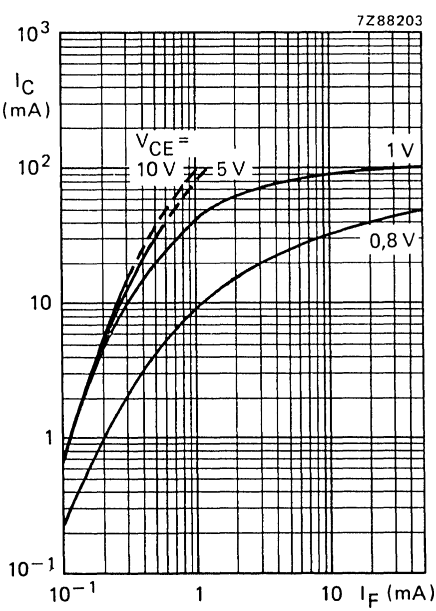


Fig. 15 Typical values; $I_B = 0$; $T_{amb} = 25\ ^oC$.

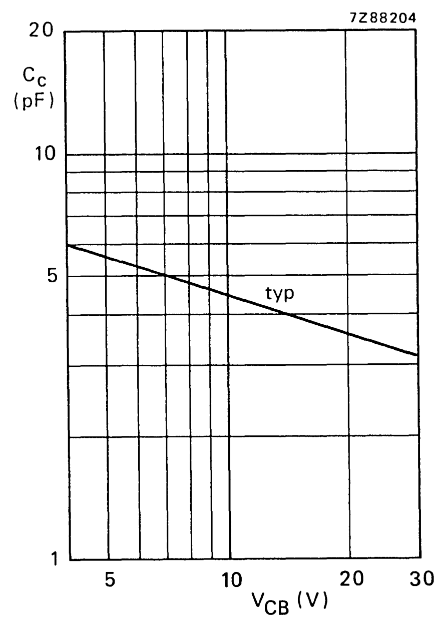


Fig. 16 $I_E = I_e = 0$; f = 1 MHz; $T_{amb} = 25\ ^oC$.

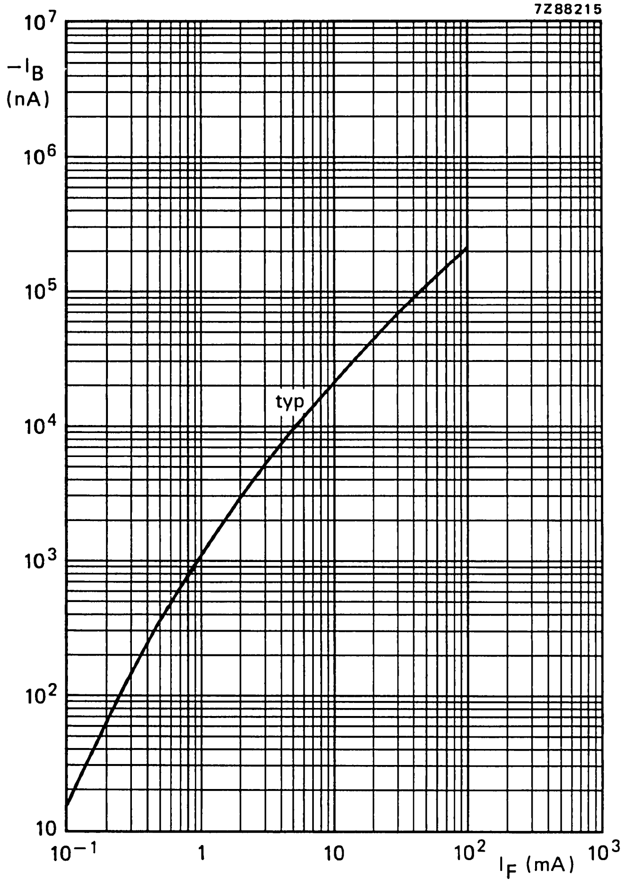


Fig. 17 $I_E = 0$; $V_{CB} = 5$ V; $T_{amb} = 25$ °C.

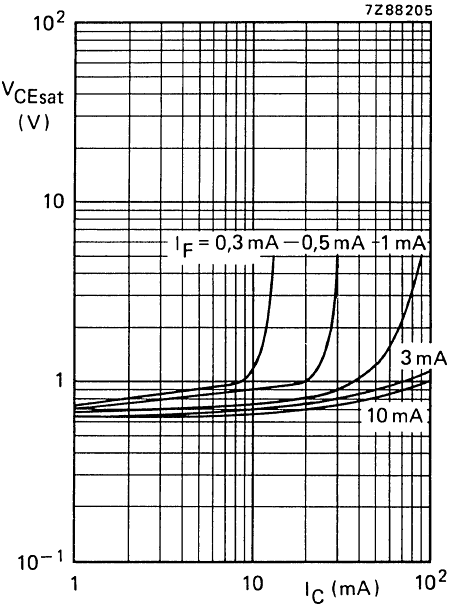


Fig. 18 Typical values; $I_B = 0$; $T_{amb} = 25\ ^oC$.

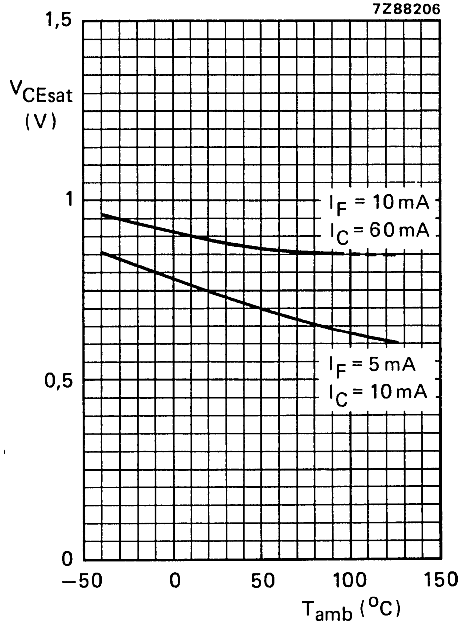


Fig. 19 Typical values; $I_B = 0$.

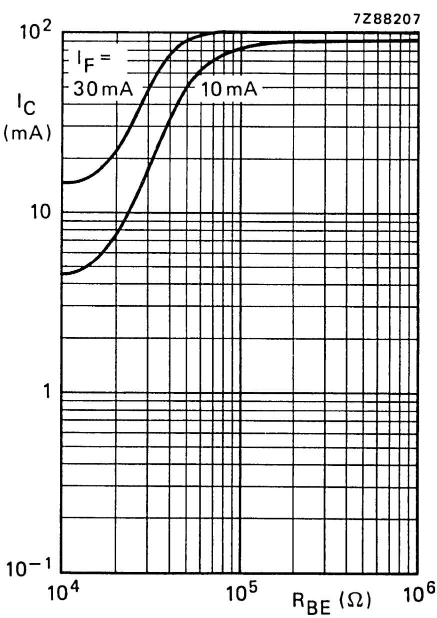


Fig. 20 Typ. values; $V_{CE} = 1$ V; $T_{amb} = 25\ ^oC$.

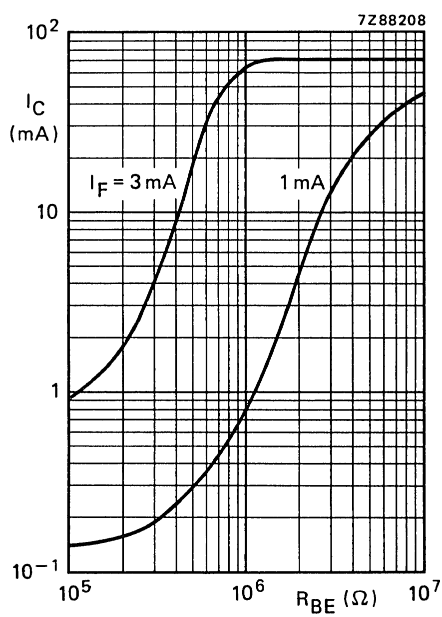


Fig. 21 Typ. values; $V_{CE} = 1$ V; $T_{amb} = 25\ ^oC$.

HIGH-VOLTAGE PHOTOCOUPLER

The CNX62 is a photocoupler consisting of an infrared emitting GaAs diode and a silicon n-p-n photo-transistor in a dual-in-line (DIL) plastic envelope.

Features

- high current transfer ratio and a low saturation voltage suitable for use with TTL integrated circuits
- high degree of a.c. and d.c. insulation (3750 V r.m.s. and 5300 V d.c.)
- working voltage of 2,5 kV (d.c.)

QUICK REFERENCE DATA

Diode				
Continuous reverse voltage	V_R	max.	3	V
Forward current				
d.c.	I_F	max.	100	mA
peak value; t_{on} = 10 μs; δ = 0,01	I_{FM}	max.	3	A
Total power dissipation up to T_{amb} = 45 °C when mounted on a p.c.b.	P_{tot}	max.	200	mW
Transistor				
Collector-emitter voltage (open base)	V_{CEO}	max.	50	V
Total power dissipation up to T_{amb} = 45 °C when mounted on a p.c.b.	P_{tot}	max.	200	mW
Photocoupler				
Output/input d.c. current transfer ratio I_F = 10 mA; V_{CE} = 4 V	I_C/I_F	min.	0,4	
Collector cut-off current (dark) V_{CC} = 10 V; working voltage (d.c.) = 2,5 kV I_F (diode) = 0 (see note 1)	I_{CEW}	max.	200	nA
Collector-emitter saturation voltage I_F = 10 mA; I_C = 4 mA	V_{CEsat}	max.	0,4	V
Test isolation voltage (d.c.) t = 1 min (see note 2)	V_{IO}	max.	5,3	kV

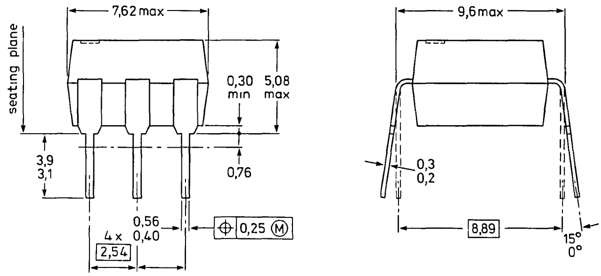
MECHANICAL DATA

See Fig. 1.

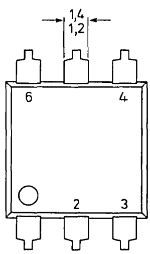
MECHANICAL DATA

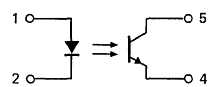
Dimensions in mm

Fig. 1 SOT-174.



7Z85851A





7Z92143

The base is not connected.

Fig. 1.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage	V_R	max.	3 V
Forward current			
d.c.	I_F	max.	100 mA
peak value; t_{on} = 10 μs; δ = 0,01	I_{FM}	max.	3 A
Total power dissipation up to T_{amb} = 45 °C when mounted on a p.c.b.	P_{tot}	max.	200 mW

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	50 V
Emitter-collector voltage	V_{ECO}	max.	7 V
Collector current (d.c.)	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 45 °C when mounted on a p.c.b.	P_{tot}	max.	200 mW

Photocoupler

Storage temperature	T_{stg}	−55 to +150	°C
Junction temperature	T_j	max. 125	°C
Soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max. 260	°C

THERMAL RESISTANCE

From junction to ambient in free air			
diode	$R_{th\ j\text{-}a}$	max. 500	K/W
transistor	$R_{th\ j\text{-}a}$	max. 500	K/W
From junction to ambient when mounted on p.c.b.			
diode	$R_{th\ j\text{-}a}$	max. 400	K/W
transistor	$R_{th\ j\text{-}a}$	max. 400	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage I_F = 10 mA	V_F	typ. 1,15 max. 1,50	V V
Reverse current V_R = 3 V	I_R	max. 10	μA

Transistor

Collector-emitter breakdown voltage I_C = 1 mA	$V_{(BR)CEO}$	min. 50	V
Emitter-collector breakdown voltage I_E = 0,1 mA	$V_{(BR)ECO}$	min. 7	V
Collector cut-off current (dark); diode I_F = 0			
V_{CE} = 10 V	I_{CEO}	typ. 2 max. 50	nA nA
V_{CE} = 10 V; T_{amb} = 70 °C	I_{CEO}	max. 10	μA

Photocoupler

Output/input d.c. current transfer ratio			
I_F = 10 mA; V_{CE} = 0,4 V	I_C/I_F	min. 0,4 typ. 0,8	
I_F = 10 mA; V_{CE} = 5 V	I_C/I_F	typ. 1,5	
Collector cut-off current (light)			
$T_{amb} \leq 70$ °C; V_F = 0,8 V; V_{CE} = 15 V	$I_{CE(L)}$	max. 15	μA
$T_{amb} \leq 70$ °C; I_F = 2 mA; V_{CE} = 0,4 V	$I_{CE(L)}$	min. 150	μA
Collector-emitter saturation voltage			
I_F = 10 mA; I_C = 2 mA	V_{CEsat}	typ. 0,15 max. 0,40	V V
I_F = 10 mA; I_C = 4 mA	V_{CEsat}	typ. 0,19 max. 0,40	V V

DEVELOPMENT SAMPLE DATA

Photocoupler (continued)

Collector cut-off current (dark) at working voltage V_W = 2,5 kV (d.c. value); V_{CC} = 10 V; T_j = 25 °C (see note 1)	I_{CEW}	max.	200 nA
V_{CC} = 10 V; T_j = 70 °C (see note 1)	I_{CEW}	max.	100 μA
Test isolation voltage, d.c. value t = 1 min (see note 2)	V_{IO}	max.	5,3 kV
Capacitance between input and output V = 0; f = 1 MHz	C_{io}	typ.	0,6 pF
Insulation resistance between input and output V_{IO} = ± 1000 V	R_{IO}	min.	10^{10} Ω
	R_{IO}	typ.	10^{12} Ω
Switching times (see Figs 2 and 3)			
Turn-on time			
I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω	t_{on}	typ.	3 μs
I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ	t_{on}	typ.	12 μs
Turn-off time			
I_C = 2 mA; V_{CC} = 5 V; R_L = 100 Ω	t_{off}	typ.	3 μs
I_C = 2 mA; V_{CC} = 5 V; R_L = 1 kΩ	t_{off}	typ.	12,5 μs

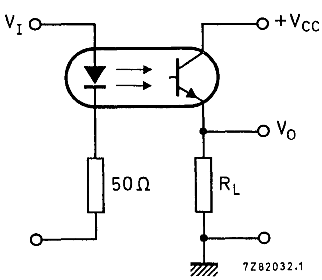


Fig. 2 Switching circuit.

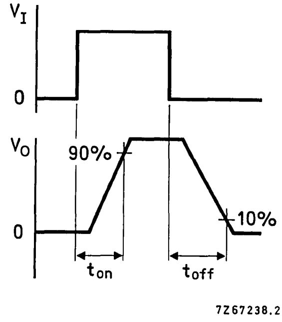


Fig. 3 Waveforms.

Note 1 (see Fig. 4):

Collector cut-off current (dark) at working voltage V_W = 2,5 kV (d.c. value); V_{CC} = 10 V; T_j = 25 °C	I_{CEW}	max.	200 nA*
V_{CC} = 10 V; T_j = 70 °C	I_{CEW}	max.	100 μA*

* The two parameters are tested on a sample basis for 1000 h.

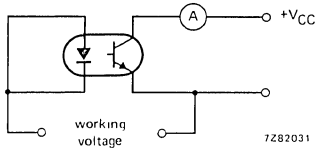


Fig. 4.

Note 2:
A test voltage of 5,3 kV (d.c.) is applied between the shorted diode leads and the shorted transistor leads for 1 min.

DEVELOPMENT SAMPLE DATA

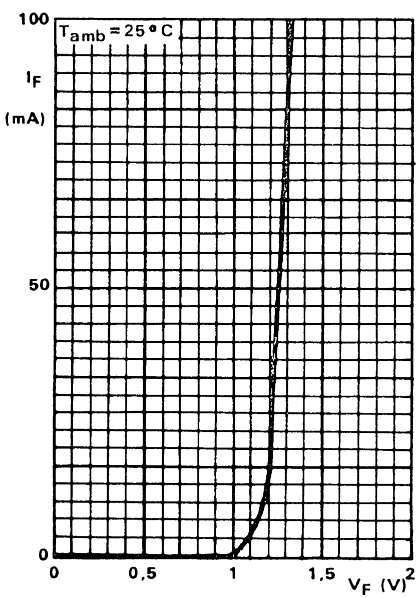


Fig. 5.

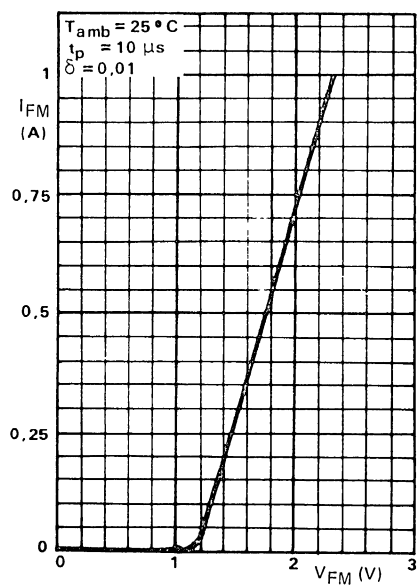


Fig. 6.

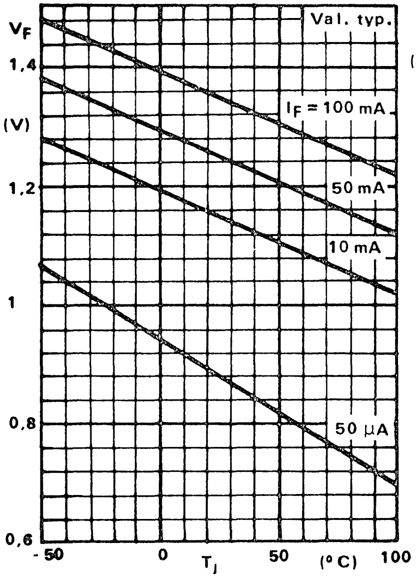


Fig. 7.

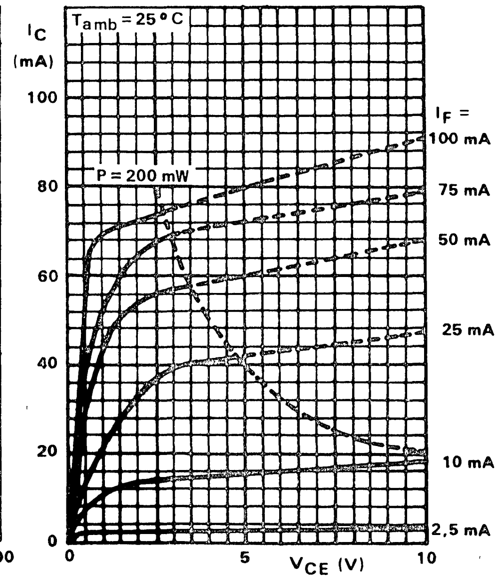


Fig. 8.

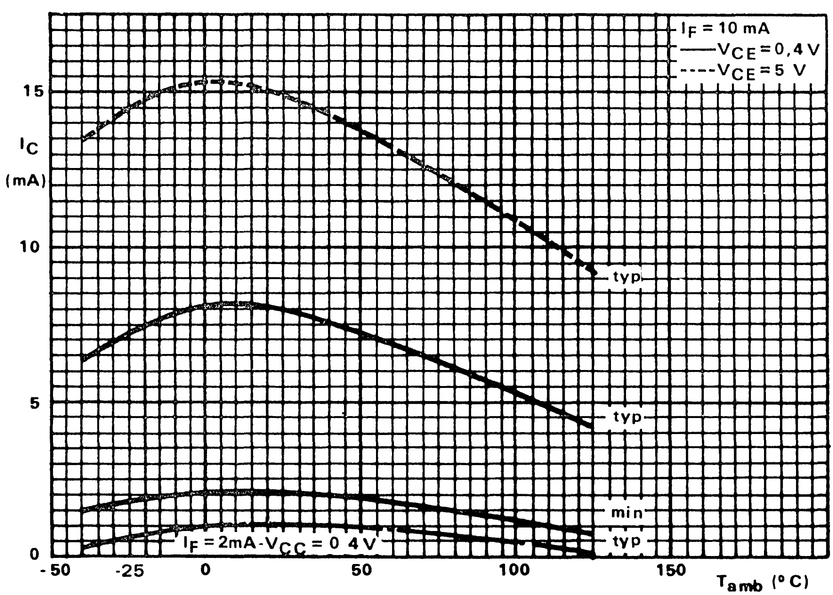


Fig. 9.

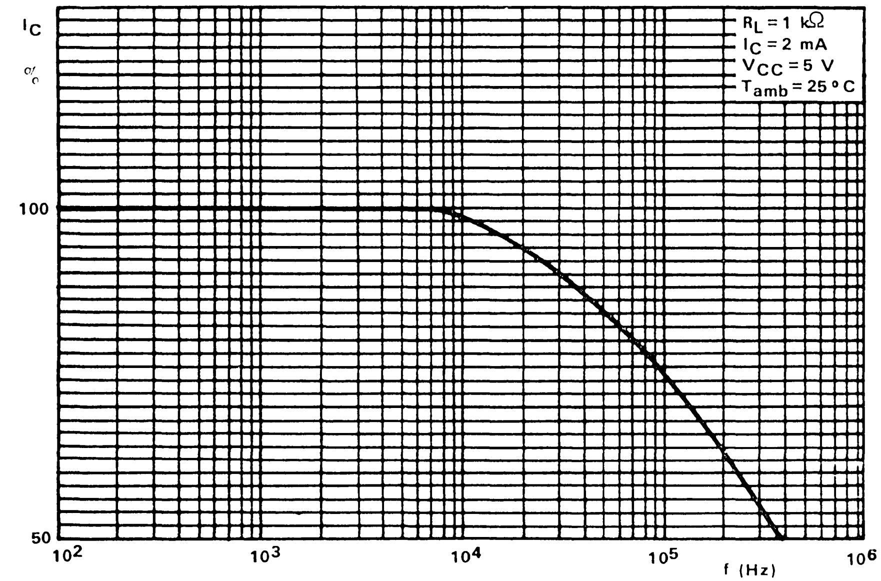

I_C
%
100
50
$R_L = 1\ k\Omega$
$I_C = 2\ mA$
$V_{CC} = 5\ V$
$T_{amb} = 25\ °C$
10^2
10^3
10^4
10^5
10^6
f (Hz)

Fig. 10.

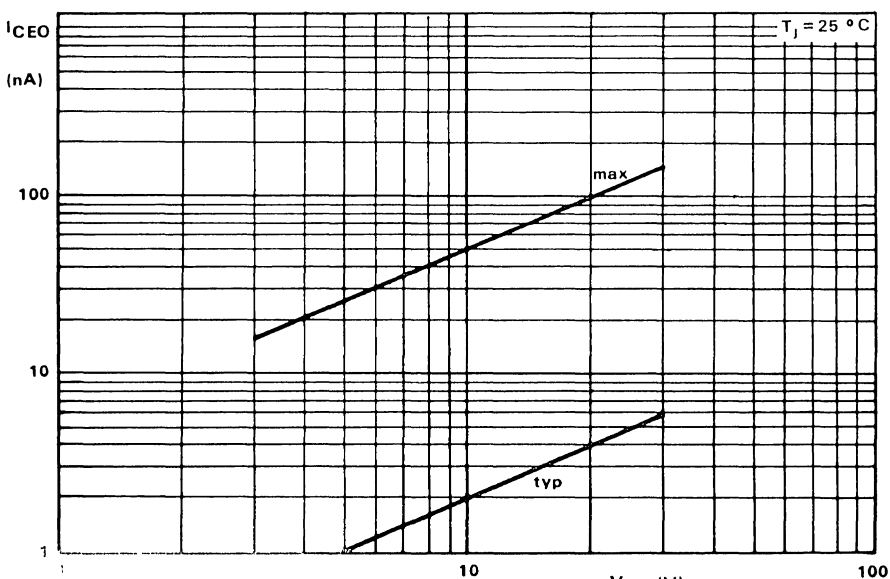

I_{CEO}
(nA)
$T_j = 25\ °C$
100
10
1
max
typ
1
10
100
V_{CE} (V)

Fig. 11.

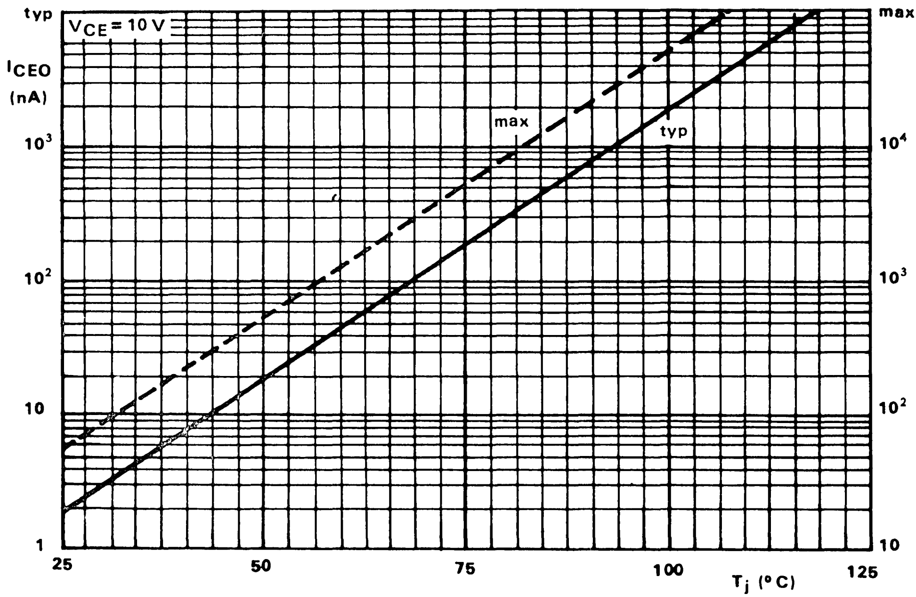

typ
max
V_{CE} = 10 V
I_{CEO} (nA)
10^3
10^2
10
1
10^4
10^3
10^2
10
max
typ
25
50
75
100
125
T_j (°C)

Fig. 12.

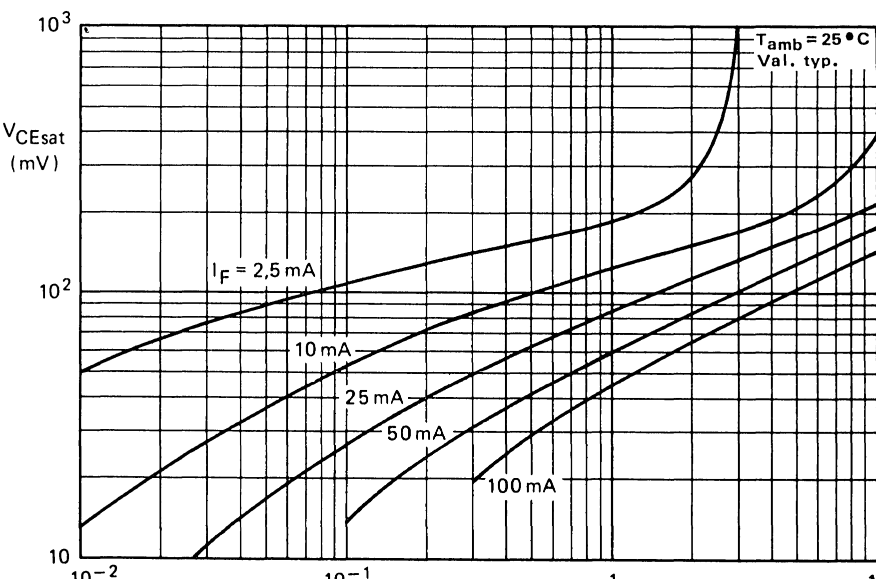

10^3
10^2
10
V_{CEsat} (mV)
T_{amb} = 25 °C
Val. typ.
I_F = 2,5 mA
10 mA
25 mA
50 mA
100 mA
10^{-2}
10^{-1}
1
10
I_C (mA)

Fig. 13.

DEVELOPMENT SAMPLE DATA

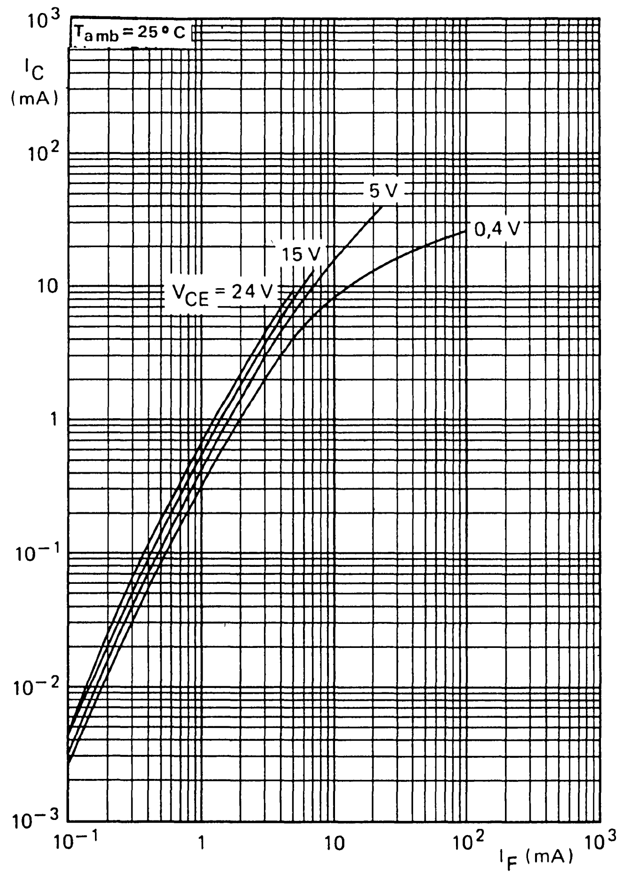
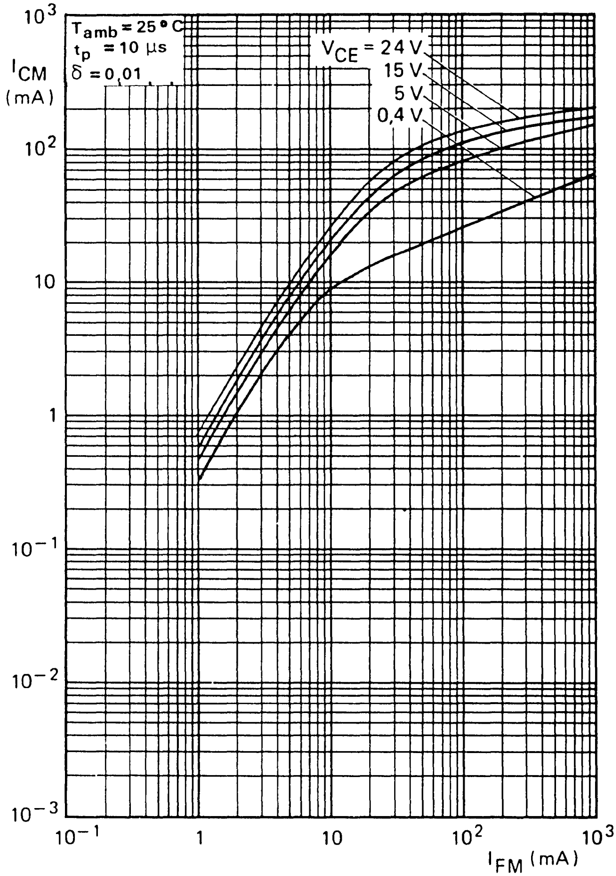


Fig. 14.



$T_{amb} = 25\,°C$
$t_p = 10\ \mu s$
$\delta = 0,01$
I_{CM} (mA)
$V_{CE} = 24$ V
15 V
5 V
0,4 V
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-1}
1
10
10^2
10^3
I_{FM} (mA)

Fig. 15.

DEVELOPMENT SAMPLE DATA

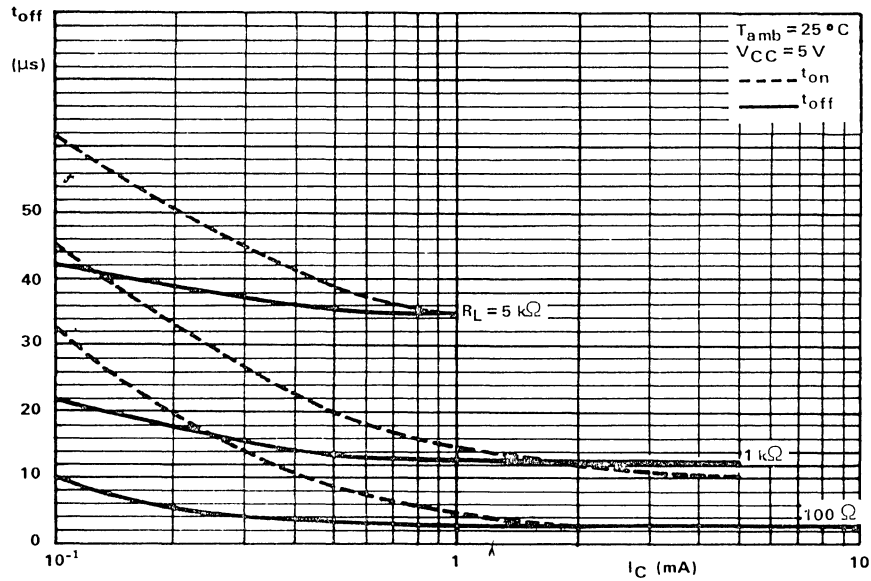


Fig. 16.

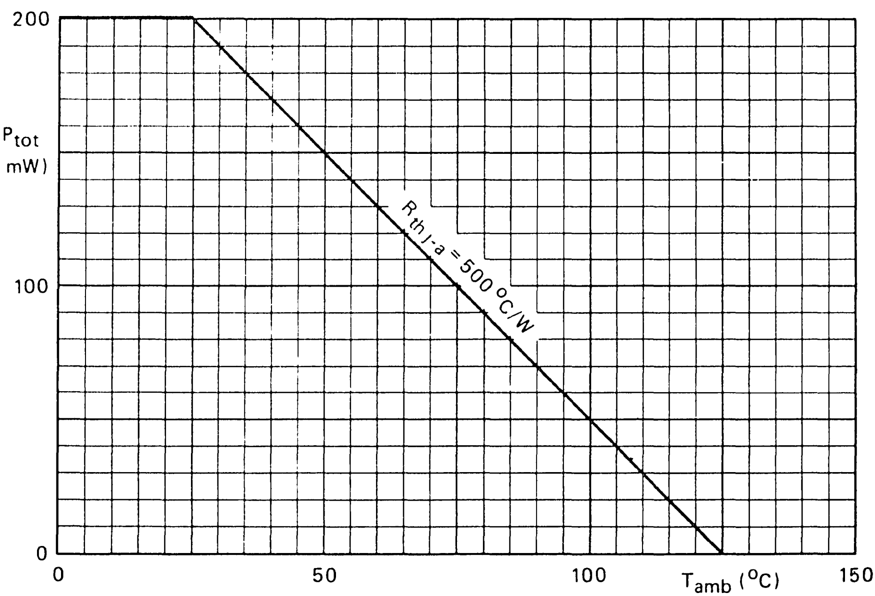


Fig. 17.

PHOTOCOUPLER

Optically coupled isolator consisting of an infrared emitting GaAs diode and a silicon n-p-n phototransistor with accessible base. Hermetically encapsulated in a metal envelope. The CNY50 is intended for professional applications.

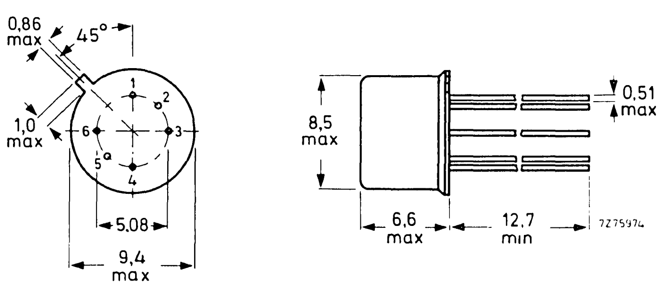
QUICK REFERENCE DATA

Diode					
Continuous reverse voltage		V_R	max.	3	V
Forward current					
d.c.		I_F	max.	100	mA
(peak value); t_p = 300 μs; δ = 0,02		I_{FM}	max.	3000	mA
Total power dissipation up to T_{amb} = 75 °C		P_{tot}	max.	150	mW
Transistor					
Collector-emitter voltage (open base)		V_{CEO}	max.	35	V
Total power dissipation up to T_{amb} = 75 °C		P_{tot}	max.	150	mW
Photocoupler					
Output/input d.c. current transfer ratio					
I_F = 10 mA; V_{CE} = 0,4 V; (I_B = 0)	**CNY50-1**	I_C/I_F	>	0,25	
	CNY50-2	I_C/I_F	>	0,40	
Collector cut-off current (dark)					
V_{CC} = 15 V; working voltage (d.c.) = 1 kV					
diode: I_F = 0 (see also Fig. 2)		I_{CEW}	<	200	nA
Isolation voltage(d.c.)		V_{IO}	>	1	kV

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-104B.



Pinning

1 emitter
2 base
3 collector
4 anode
5 internal connection
6 cathode

Maximum lead diameter guaranteed only for 12,7 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage	V_R	max.	3	V
Forward current				
d.c.	I_F	max.	100	mA
(peak value); t_p = 300 μs; δ = 0,02	I_{FM}	max.	3000	mA
Total power dissipation up to T_{amb} = 75 °C (see Fig. 2)	P_{tot}	max.	150	mW
Operating junction temperature	T_j	max.	125	°C

Transistor

Collector-base voltage (open emitter)	V_{CBO}	max.	70	V
Collector-emitter voltage (open base)	V_{CEO}	max.	35	V
Emitter-collector voltage (open base)	V_{ECO}	max.	7	V
Collector current (d.c.)	I_C	max.	100	mA
Total power dissipation up to T_{amb} = 75 °C	P_{tot}	max.	150	mW
Operating junction temperature	T_j	max.	125	°C

Photocoupler

Total power dissipation up to T_{amb} = 75 °C	P_{tot}	max.	300	mW
Storage temperature	T_{stg}		−65 to + 150	°C
Operating ambient temperature	T_{amb}		−40 to + 85	°C

THERMAL RESISTANCE

From junction to ambient in free air				
diode	$R_{th\ j\text{-}a}$	=	330	°C/W
transistor	$R_{th\ j\text{-}a}$	=	330	°C/W

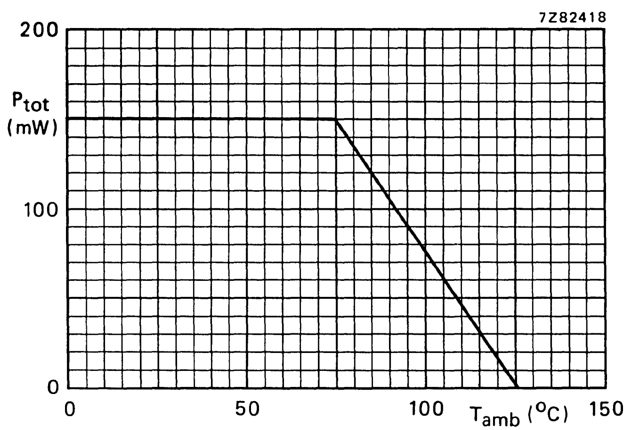


Fig. 2 Power/temperature derating curve for diode and transistor.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode				
Forward voltage				
I_F = 2 mA; T_{amb} = 0 °C to 70 °C		V_F	<	1,2 V
I_F = 10 mA		V_F	typ. < 	1,15 V 1,50 V
Reverse current				
V_R = 3 V		I_R	typ. <	1 μA 100 μA
Diode capacitance				
V_R = 0; f = 1 MHz		C_d	typ.	75 pF
Transistor (diode: I_F = 0)				
Collector-base breakdown voltage				
open emitter; I_C = 0,1 mA		$V_{(BR)CBO}$	>	70 V
Collector-emitter breakdown voltage				
open base; I_C = 1 mA		$V_{(BR)CEO}$	>	35 V
Emitter-collector breakdown voltage				
open base; I_E = 0,1 mA		$V_{(BR)ECO}$	>	7 V
Collector cut-off current (dark)				
I_E = 0; V_{CB} = 10 V		I_{CBO}	<	20 nA
I_B = 0; V_{CE} = 20 V		I_{CEO}	typ. <	5 nA 100 nA
I_B = 0; V_{CE} = 20 V; T_{amb} = 70 °C		I_{CEO}	<	10 μA
D.C. current gain				
I_C = 10 mA; V_{CE} = 5 V		h_{FE}	typ.	600
Photocoupler (I_B = 0)*				
Collector cut-off current (light)				
V_F = 0,8 V; V_{CE} = 15 V; T_{amb} = 0 °C to 70 °C	**CNY50-1**	I_C	<	15 μA
I_F = 2 mA; V_{CE} = 0,4 V; T_{amb} = 0 °C to 70 °C	**CNY50-2**	I_C	<	150 μA
Output/input d.c. current transfer ratio				
I_F = 10 mA; V_{CE} = 0,4 V	**CNY50-1**	I_C/I_F	typ.	0,4 0,25 to 1,0
	CNY50-2	I_C/I_F	typ.	0,8 0,40 to 1,6
Collector cut-off current (dark) see Fig. 3				
V_{CC} = 15 V; working voltage (d.c.) = 1 kV				
T_j = 25 °C		I_{CEW}	<	200 nA
T_j = 70 °C		I_{CEW}	<	100 μA

* Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.

Isolation voltage, d.c. value measured between shorted input leads and shorted output leads	V_{IO}	>	1 kV
Capacitance between input and output $I_F = 0$; $V = 0$; $f = 1$ MHz	C_{io}	typ.	1 pF
Insulation resistance between input and output $\pm V_{IO} = 500$ V	r_{IO}	>	100 GΩ
		typ.	1000 GΩ

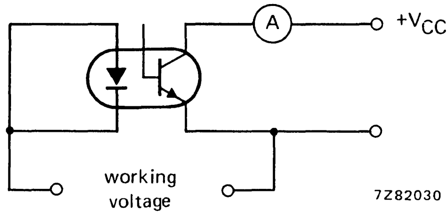


Fig. 3.

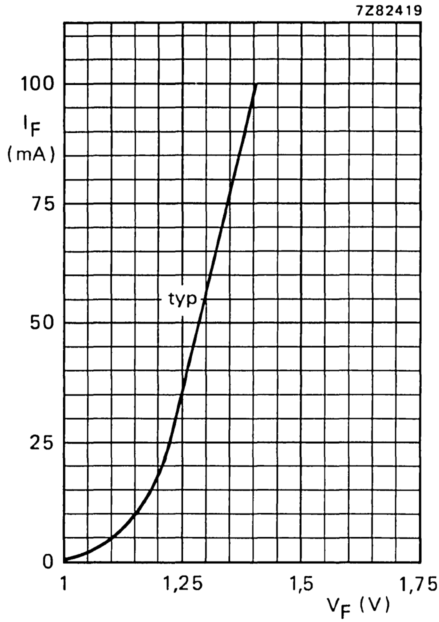


Fig. 4 T_{amb} = 25 °C.

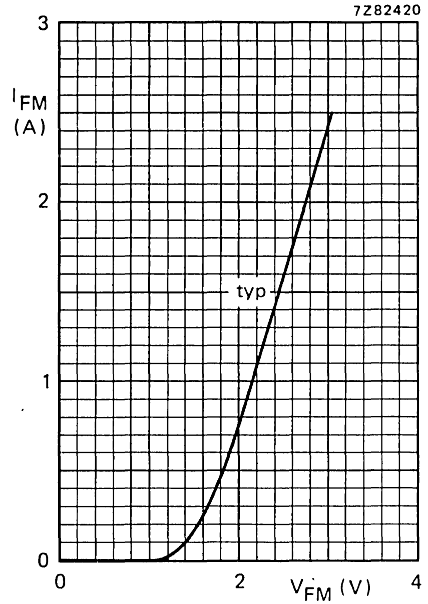


Fig. 5 T_{amb} = 25 °C; t_p = 10 μs; δ = 0,01.

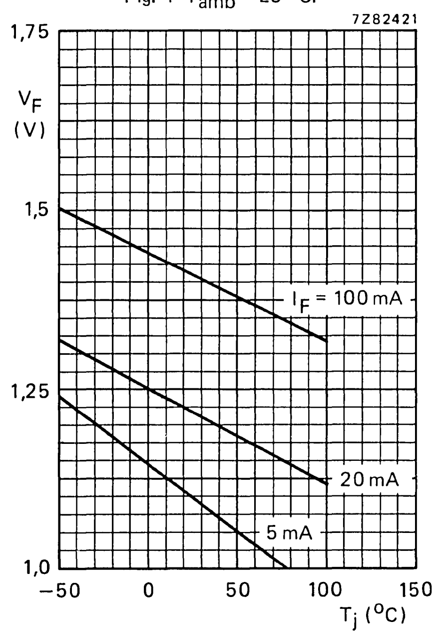


Fig. 6 Typical values.

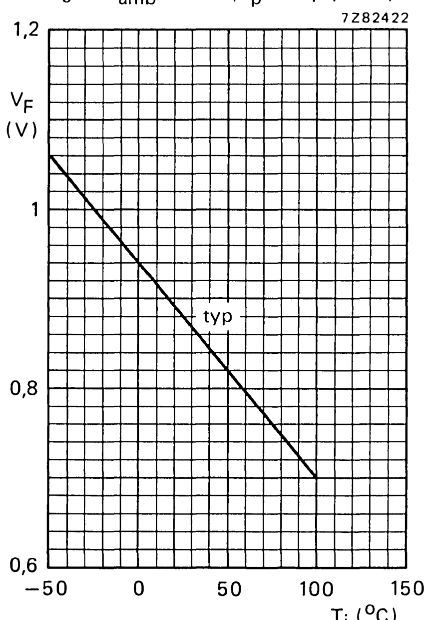


Fig. 7 I_F = 50 μA.

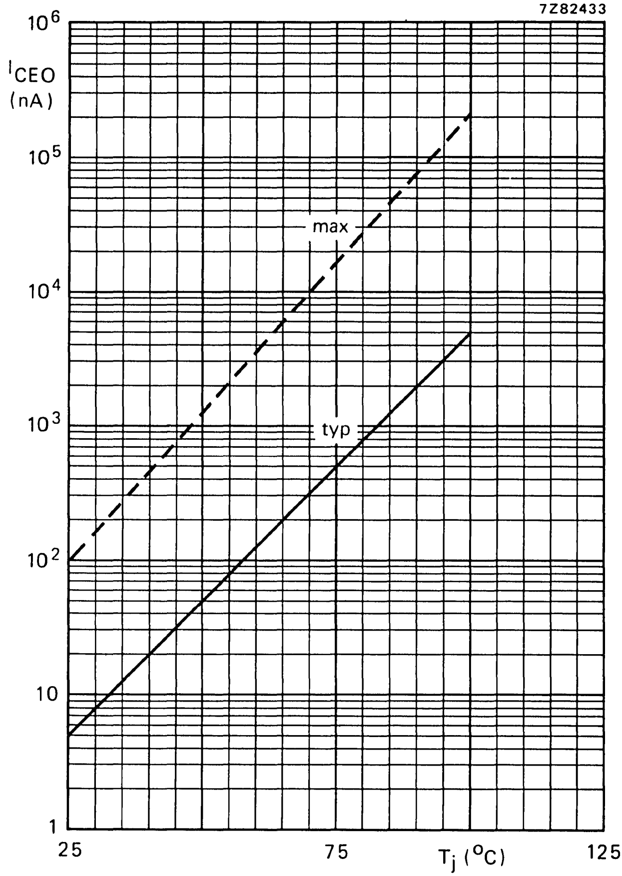


Fig. 8 $I_F = 0$; $V_{CE} = 20$ V.

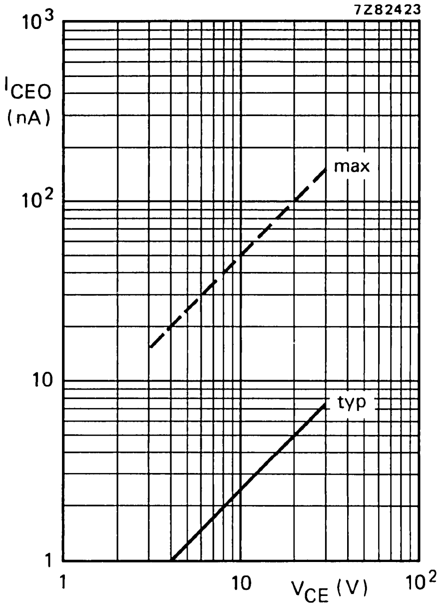


Fig. 9 $I_F = 0$; $T_j = 25\ ^oC$.

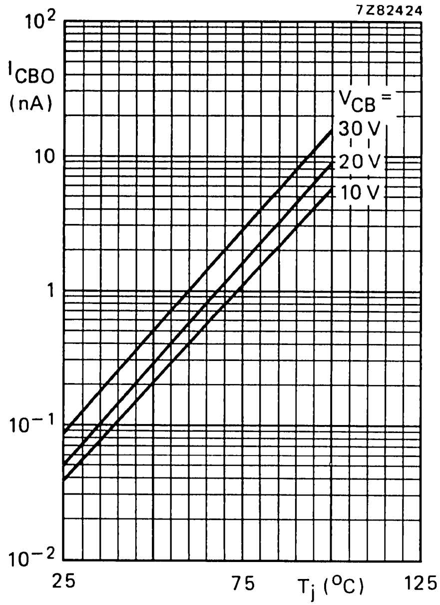


Fig. 10 $I_F = 0$; typical values.

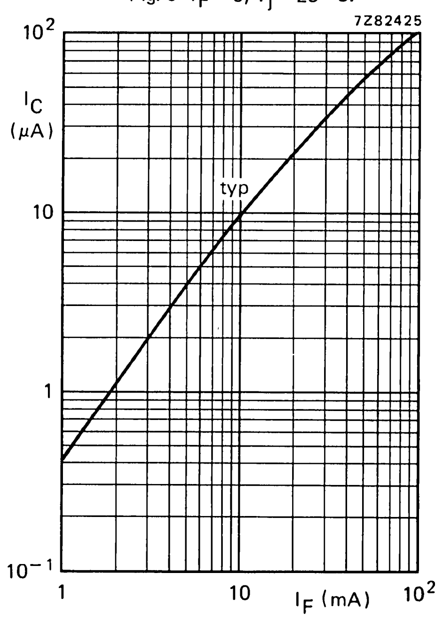


Fig. 11 $I_E = 0$; $V_{CB} = 5$ V; $T_{amb} = 25\ ^oC$.

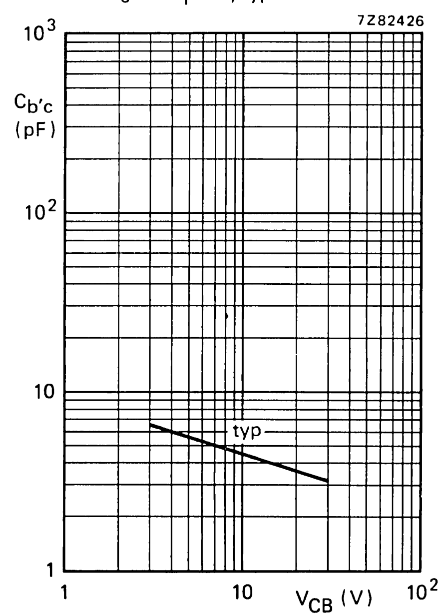


Fig. 12 f = 1 MHz; $T_{amb} = 25\ ^oC$.

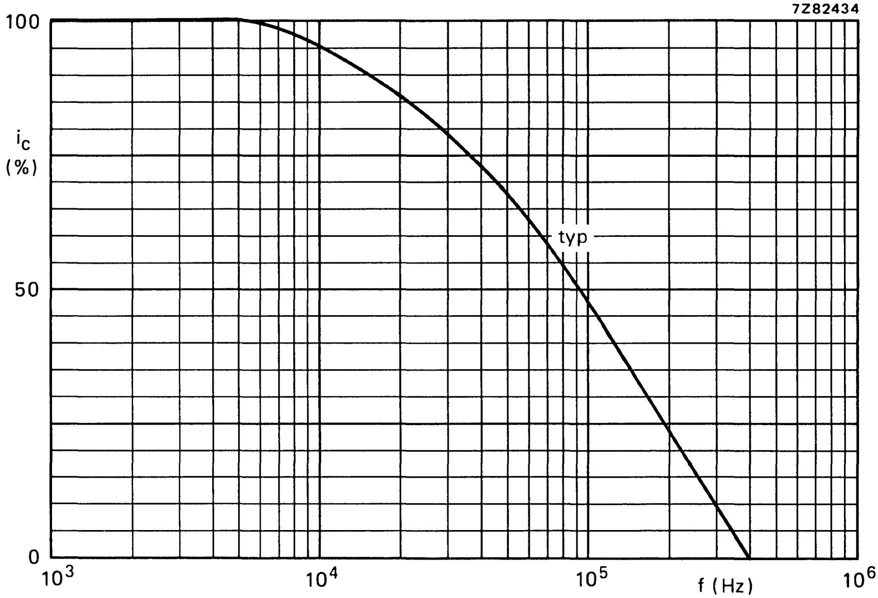


Fig. 13 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1$ kΩ; $T_{amb} = 25$ °C.

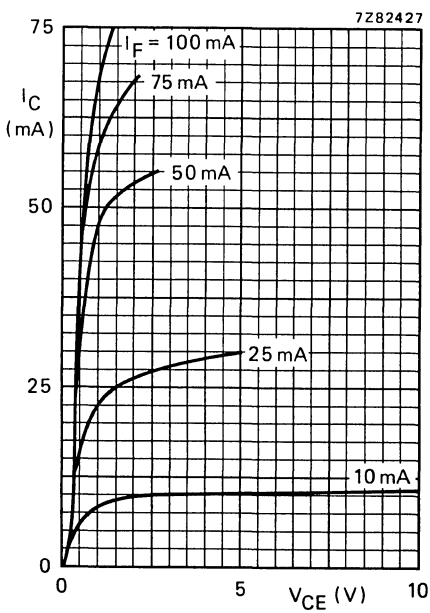


Fig. 14 $T_{amb} = 25$ °C; typical values.

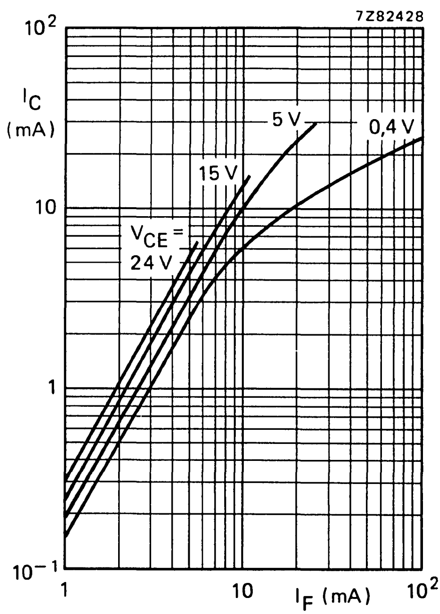


Fig. 15 $T_{amb} = 25$ °C; typical values.

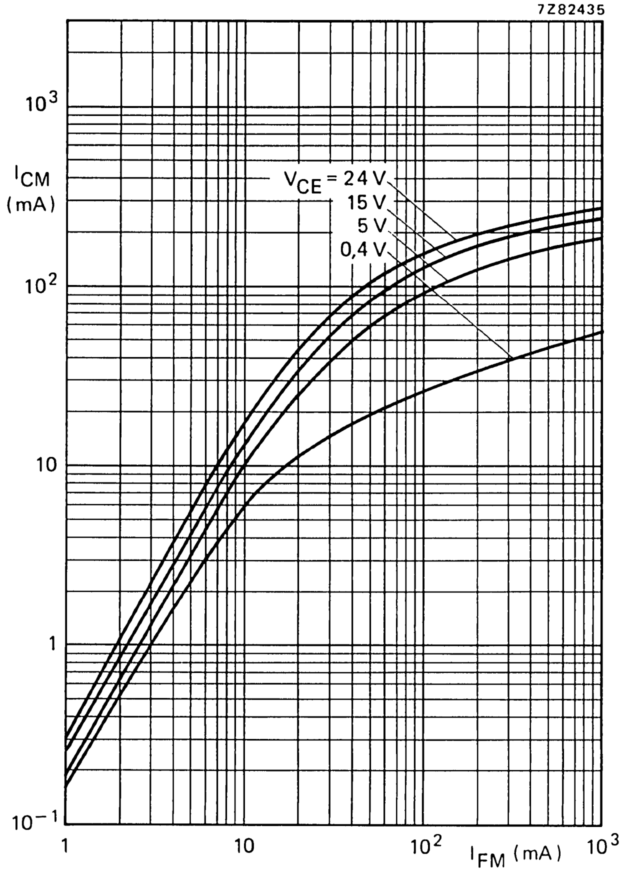


Fig. 16 T_{amb} = 25 °C; t_p = 10 μs; δ = 0,01; typical values.

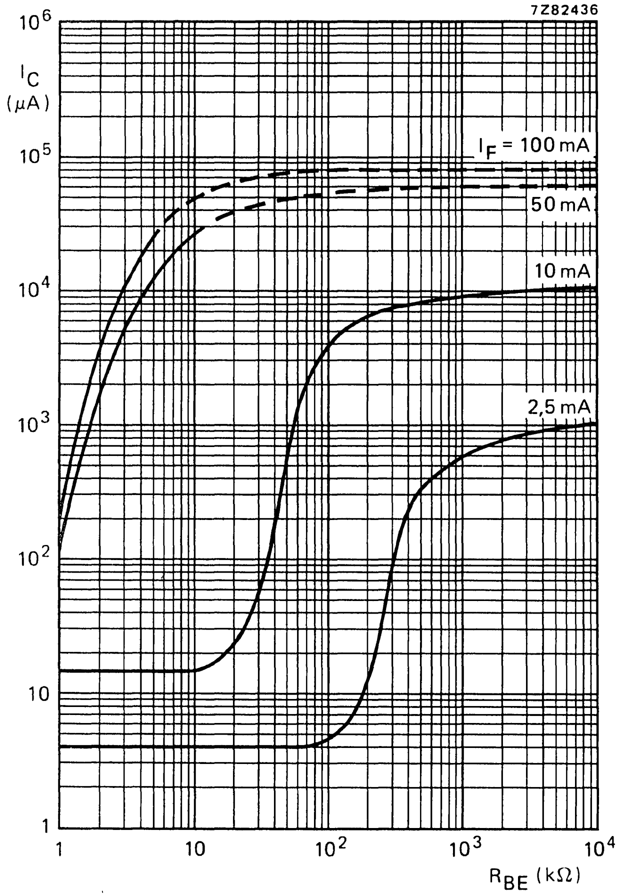


Fig. 17 $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

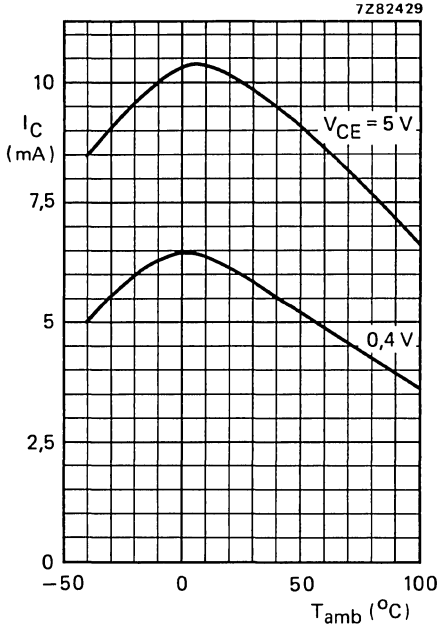


Fig. 18 $I_B = 0$; $I_F = 10$ mA; typical values.

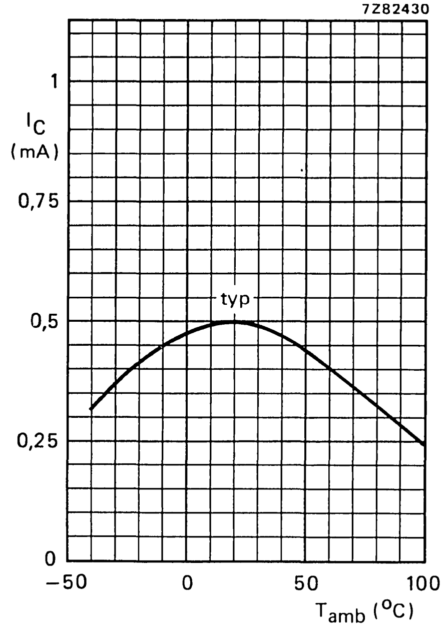


Fig. 19 $I_B = 0$; $I_F = 2$ mA; $V_{CE} = 0,4$ V.

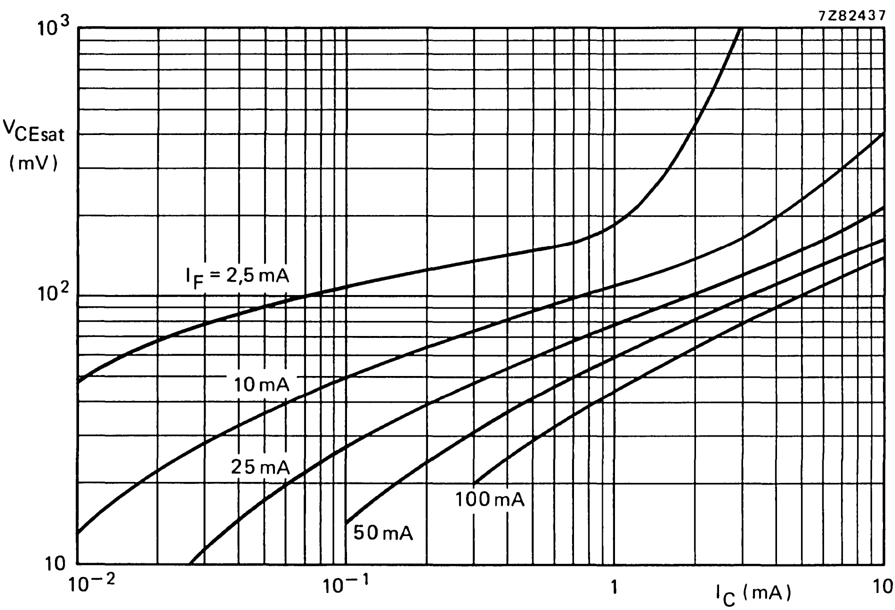


Fig. 20 $I_B = 0$; $T_{amb} = 25$ °C; typical values.

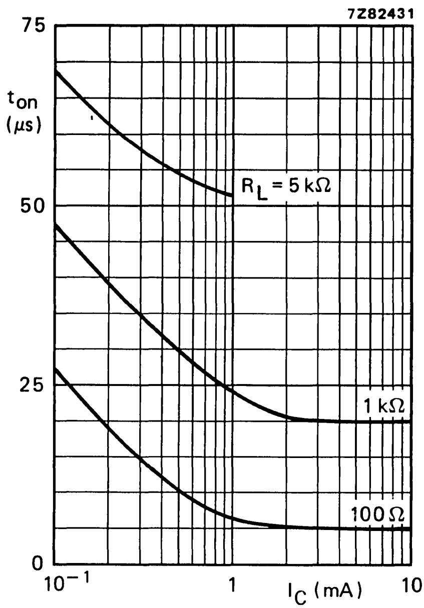


Fig. 21 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See Fig. 23).

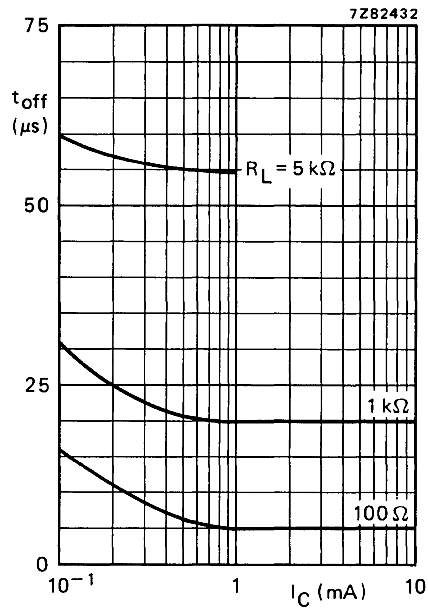


Fig. 22 $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See Fig. 23).

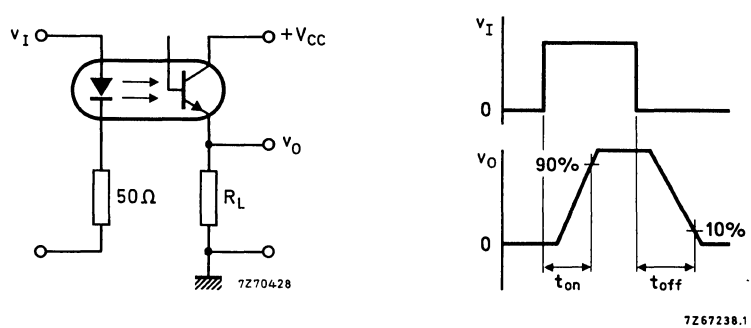


Fig. 23 Switching circuit and waveforms.

PHOTOCOUPLERS

Optically coupled isolators consisting of an infrared emitting GaAs diode and a silicon n-p-n phototransistor with accessible base. Plastic envelopes. Suitable for TTL integrated circuits.

Features of these products:

- high output/input d.c. current transfer ratio;
- low saturation voltage;
- high isolation voltage
  CNY52 3,75 kV (r.m.s.) and 5,3 kV (d.c.);
  CNY53 3 kV (r.m.s.) and 4,3 kV (d.c.);
- working voltage 1,5 kV.

QUICK REFERENCE DATA

			CNY52	CNY53	
Diode					
Continuous reverse voltage	V_R	max.	3	3	V
Forward current					
d.c.	I_F	max.	100	100	mA
(peak value); t_p = 10 μs; δ = 0,1	I_{FM}	max.	1000	1000	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	150	150	mW
Transistor					
Collector-emitter voltage (open base)	V_{CEO}	max.	50	30	V
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200	200	mW
Photocoupler					
Output/input d.c. current transfer ratio					
I_F = 10 mA; V_{CE} = 0,4 V; (I_B = 0)	I_C/I_F	>	0,25	0,50	
Collector cut-off current (dark)					
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV					
diode: I_F = 0 (see also Fig. 2)	I_{CEW}	<	200	200	nA
Isolation voltage (d.c.)					
t = 1 min	V_{IO}	>	5,3	4,3	kV

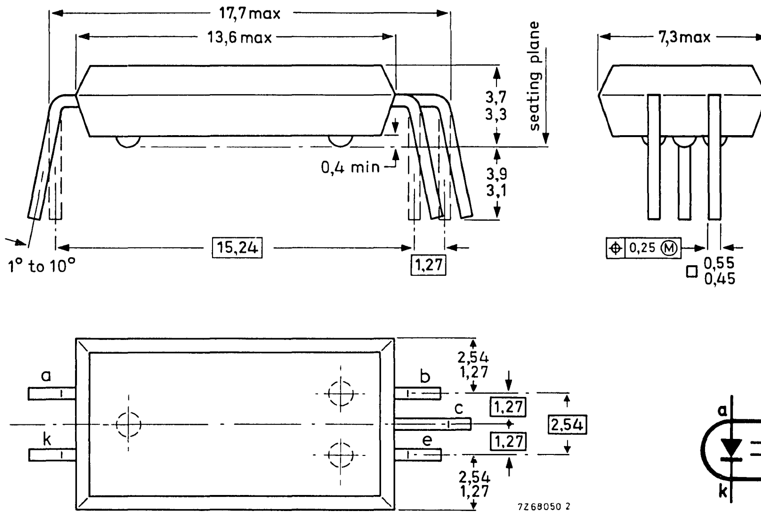
MECHANICAL DATA

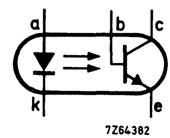
SOT-91A (see Fig. 1)

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-91A.





⊕ Positional accuracy.

Ⓜ Maximum material condition.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage		V_R	max.	3 V
Forward current				
d.c.		I_F	max.	100 mA
(peak value); t_p = 10 μs; δ = 0,1		I_{FM}	max.	1000 mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	150 mW
Operating junction temperature		T_j	max.	125 °C

Transistor

Collector-emitter voltage (open base)	**CNY52**	V_{CEO}	max.	50 V
	CNY53	V_{CEO}	max.	30 V
Collector-base voltage (open emitter)		V_{CBO}	max.	50 V
Emitter-collector voltage (open base)		V_{ECO}	max.	7 V

Collector current (d.c.)	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW
Operating junction temperature	T_j	max.	125 °C

Photocoupler

Storage temperature	T_{stg}		−55 to +150 °C
Lead soldering temperature up to the seating plane; t_{sld} < 10 s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient in free air			
diode	$R_{th\ j\text{-}a}$	=	0,65 °C/mW
transistor	$R_{th\ j\text{-}a}$	=	0,5 °C/mW
From junction to ambient, device mounted on a printed-circuit board			
diode	$R_{th\ j\text{-}a}$	=	0,6 °C/mW
transistor	$R_{th\ j\text{-}a}$	=	0,4 °C/mW

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage I_F = 10 mA		V_F	typ.	1,2 V
			<	1,5 V
Reverse current V_R = 3 V		I_R	<	10 μA

Transistor (diode: I_F = 0)

Collector cut-off current (dark) V_{CE} = 10 V		I_{CEO}	typ.	5 nA
			<	100 nA
V_{CE} = 10 V; T_{amb} = 70 °C		I_{CEO}	<	10 μA
V_{CB} = 10 V		I_{CBO}	<	20 nA

Photocoupler (I_B = 0)*

Output/input d.c. current transfer ratio I_F = 10 mA; V_{CE} = 0,4 V	**CNY52**	I_C/I_F	>	0,25
			typ.	0,50
	CNY53	I_C/I_F	>	0,5
			typ.	1,0
Collector cut-off current (dark) see Fig. 2 V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV		I_{CEW}	<	200 nA
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV; T_j = 70 °C		I_{CEW}	<	100 μA

* Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.

Parameter	Symbol		CNY52	CNY53	Unit
Collector-emitter saturation voltage I_F = 10 mA; I_C = 2 mA	V_{CEsat}	typ.	0,17	–	V
		<	0,40	–	V
I_F = 10 mA; I_C = 4 mA	V_{CEsat}	typ.	–	0,17	V
		<	–	0,40	V
Isolation voltage, d.c. value*	V_{IO}	>	5,3	4,3	kV
Capacitance between input and output I_F = 0; V = 0; f = 1 MHz	C_{io}	typ.	0,6	0,6	pF
Insulation resistance between input and output $\pm V_{IO}$ = 1 kV	r_{IO}	>	10^{10}	10^{10}	Ω
		typ.	10^{12}	10^{12}	Ω
Switching times (see Figs 3 and 4) I_{Con} = 2 mA; V_{CC} = 5 V; R_L = 100 Ω					
Turn-on time	t_{on}	typ.	3	–	μs
Turn-off time	t_{off}	typ.	3	–	μs
I_{Con} = 4 mA; V_{CC} = 5 V; R_L = 100 Ω					
Turn-on time	t_{on}	typ.	–	5	μs
Turn-off time	t_{off}	typ.	–	5	μs

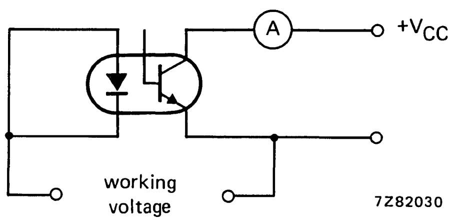


Fig. 2.

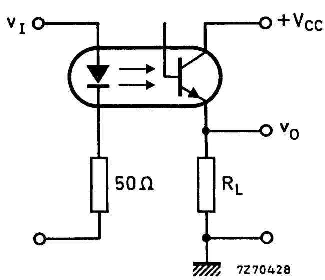


Fig. 3 Switching circuit.

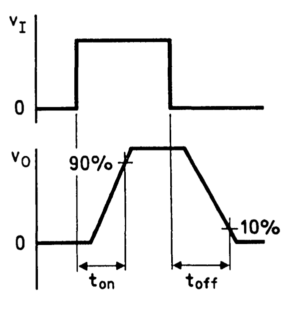


Fig. 4 Waveforms.

* Tested with a d.c. voltage for 1 minute between shorted input leads and shorted output leads.

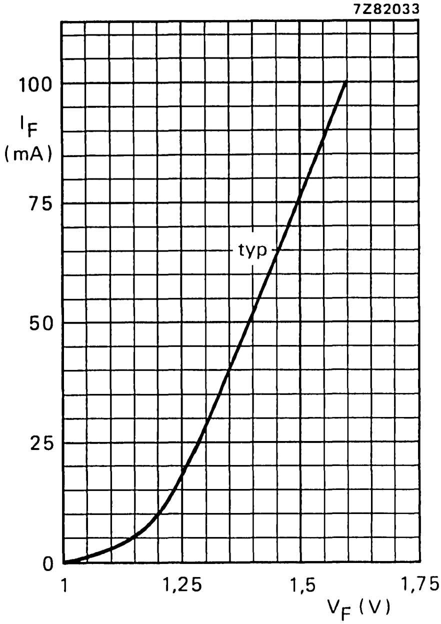


Fig. 5 T_{amb} = 25 °C.

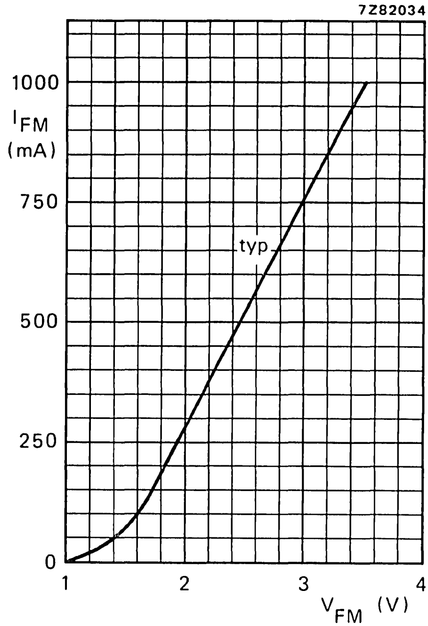


Fig. 6 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms.

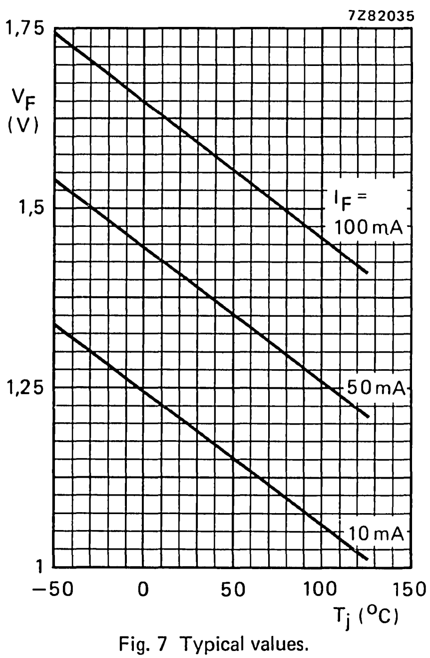


Fig. 7 Typical values.

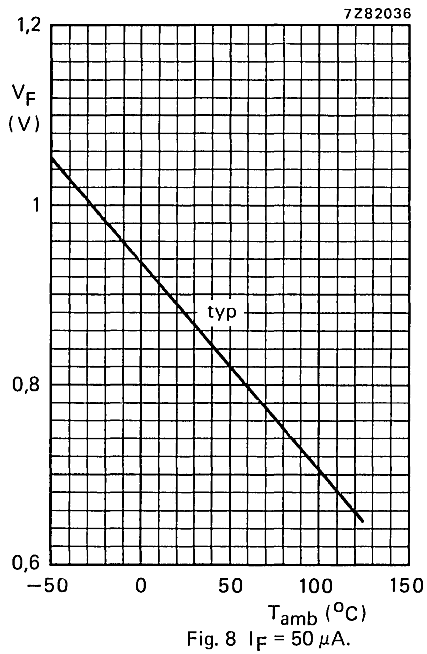


Fig. 8 I_F = 50 μA.

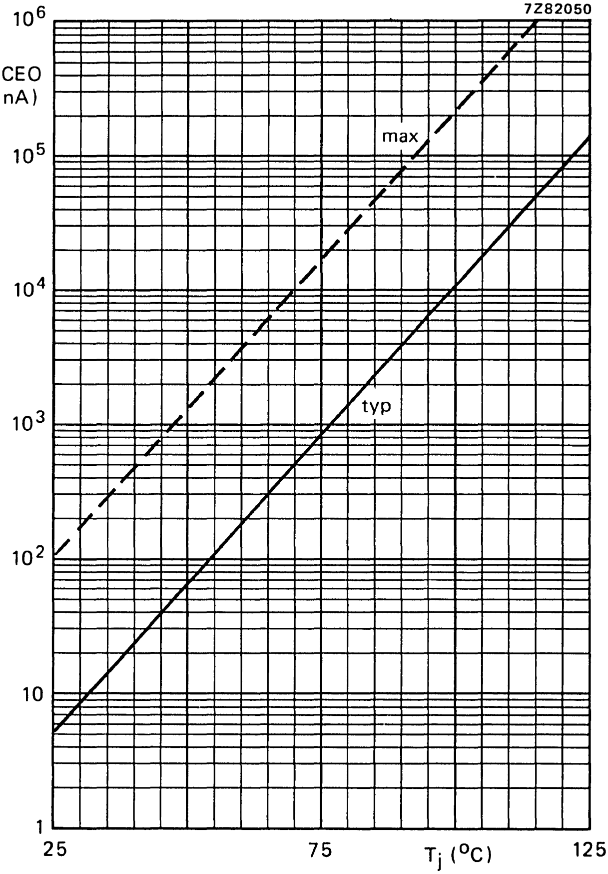


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V.

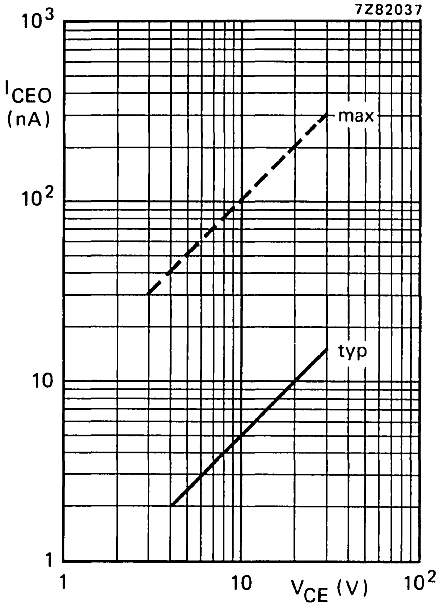


Fig. 10 $I_F = 0$; $T_j = 25\ ^oC$.

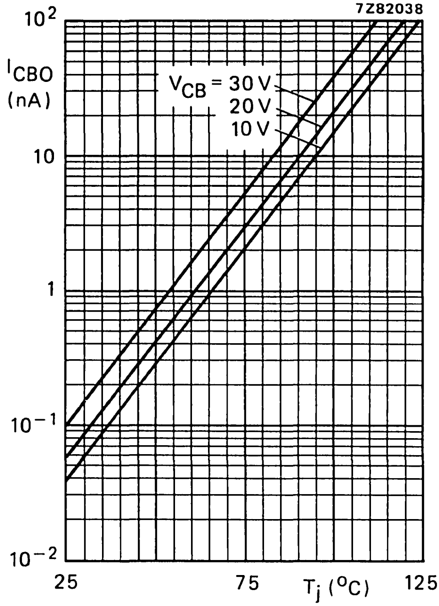


Fig. 11 $I_F = 0$; Typical values.

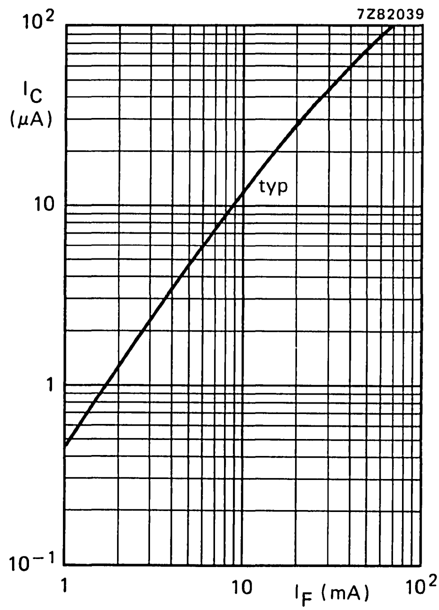


Fig. 12. $I_E = 0$; $V_{CB} = 5$ V; $T_{amb} = 25\ ^oC$.

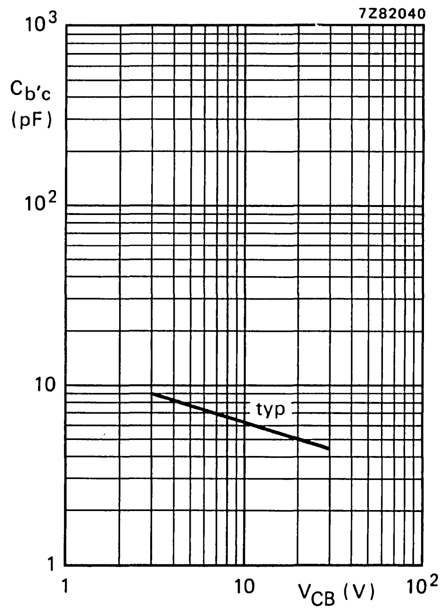


Fig. 13 f = 1 MHz; $T_j = 25\ ^oC$.

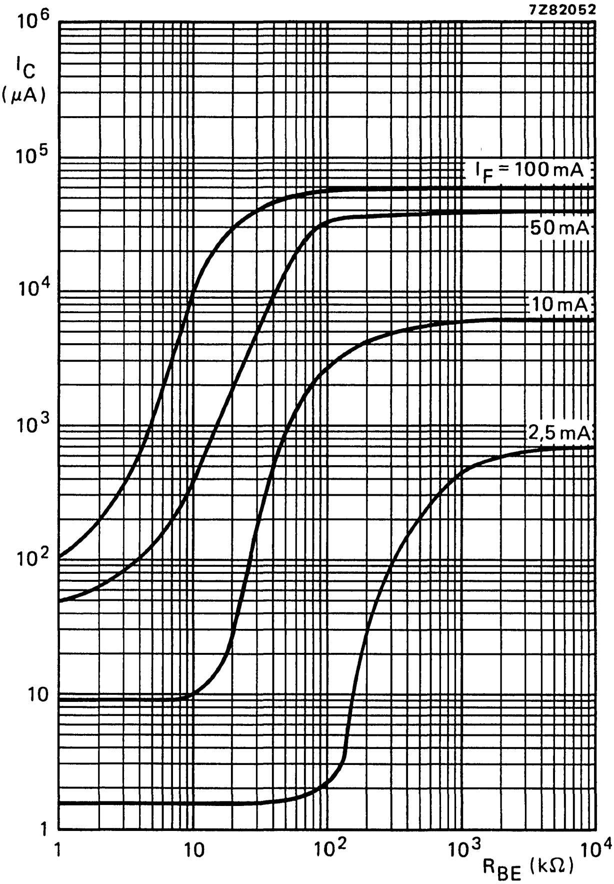


Fig. 14 **CNY52**; $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25\ ^oC$; typical values.

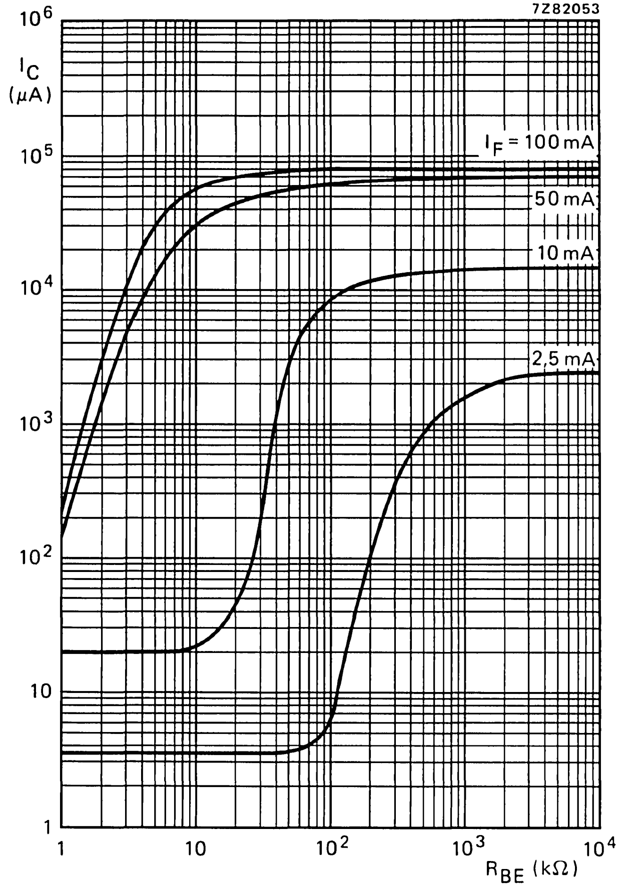


Fig. 15 **CNY53**; $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

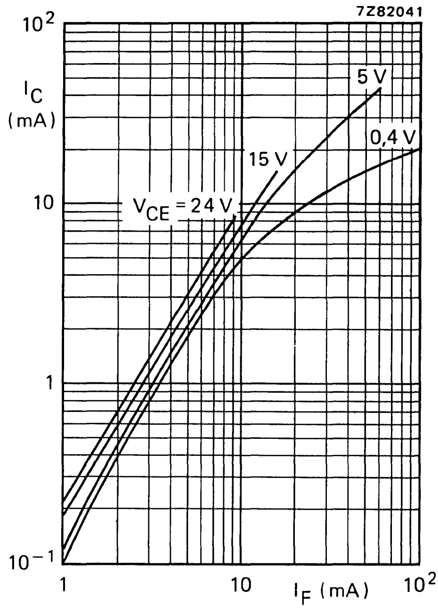


Fig. 16 **CNY52**; T_{amb} = 25 °C; typical values.

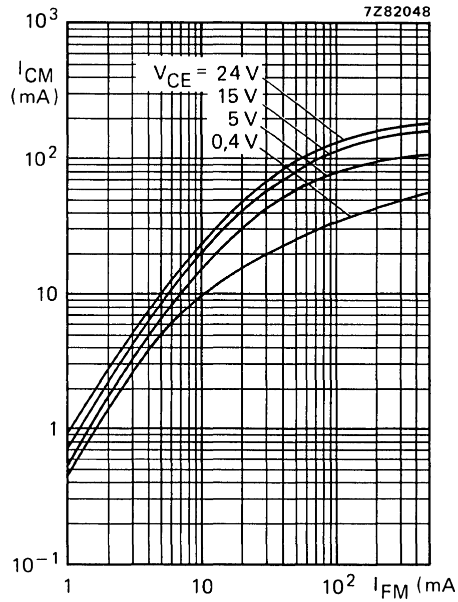


Fig. 17 **CNY53**; T_{amb} = 25 °C; t_p = 10 µs; T = 1 ms; typical values.

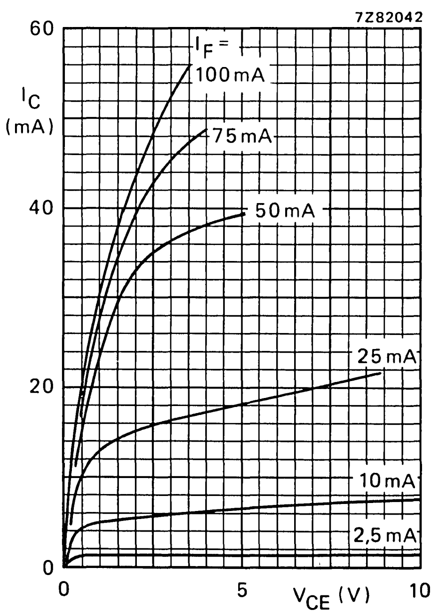


Fig. 18 **CNY52**; T_{amb} = 25 °C; typical values.

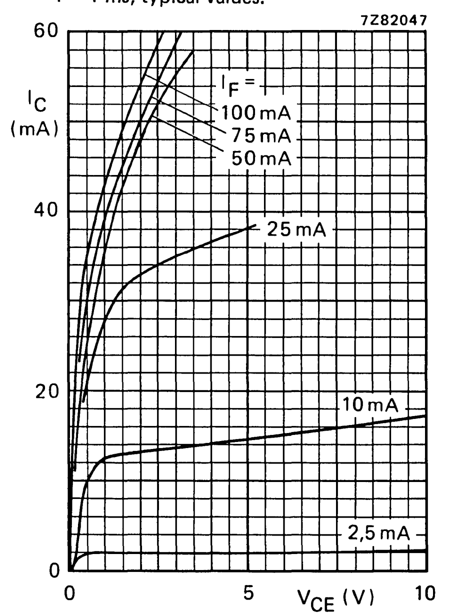


Fig. 19 **CNY53**; T_{amb} = 25 °C; Typical values.

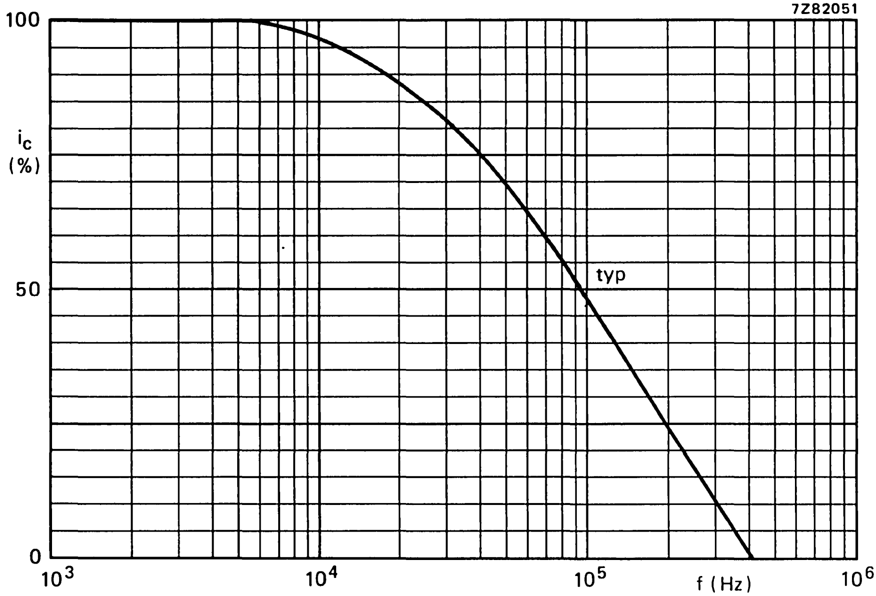


Fig. 20 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1$ kΩ; $T_{amb} = 25$ °C.

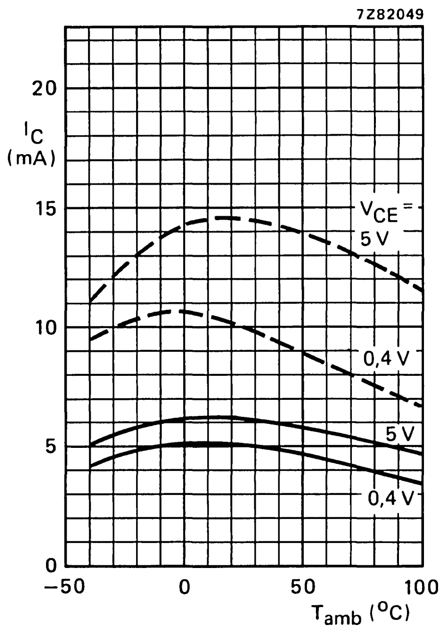


Fig. 21 —— **CNY52**; --- **CNY53**; $I_B = 0$; $I_F = 10$ mA; typical values.

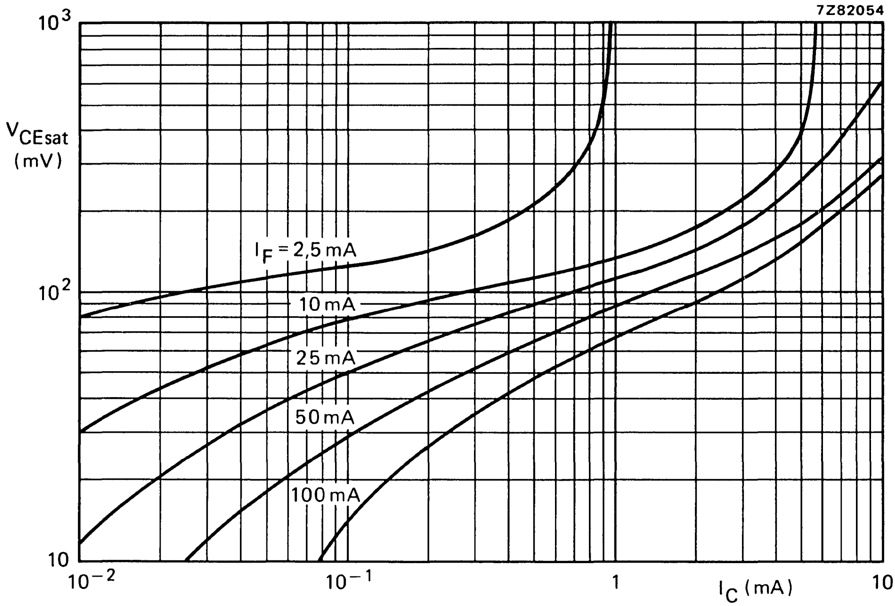


Fig. 22 **CNY52**; $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

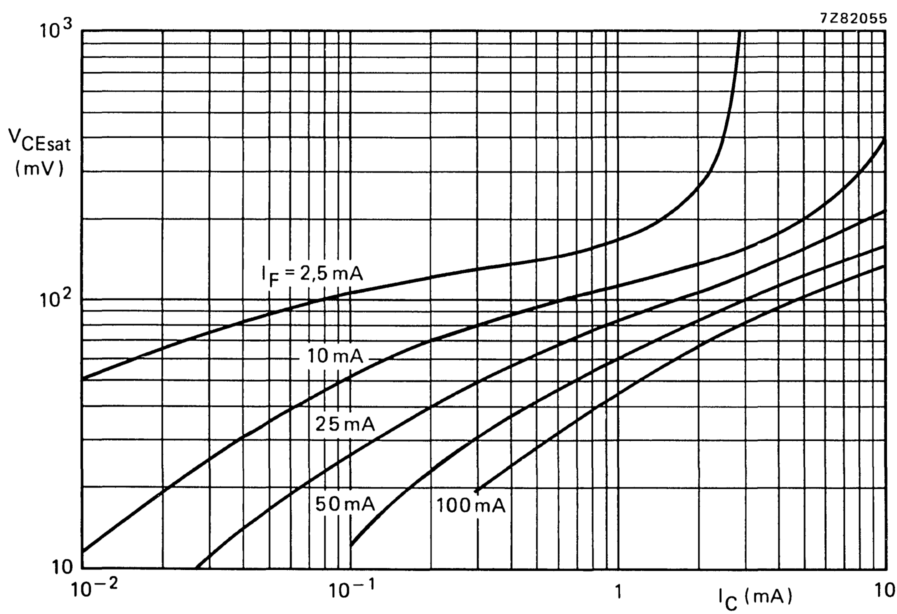


Fig. 23 **CNY53**; $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

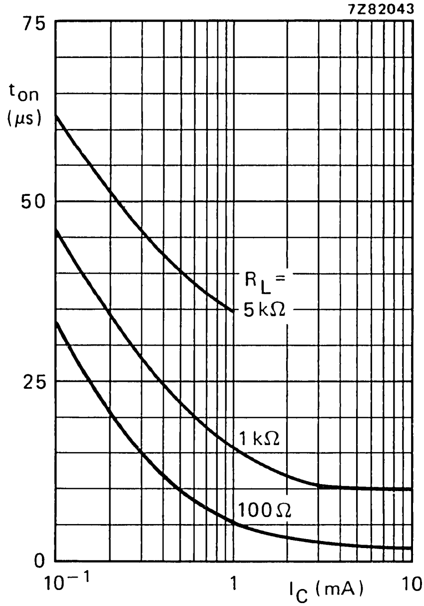


Fig. 24 **CNY52**; $I_B = 0$; $V_{CC} = 5$ V;
$T_{amb} = 25$ °C; typical values.
(See also Fig. 26.)

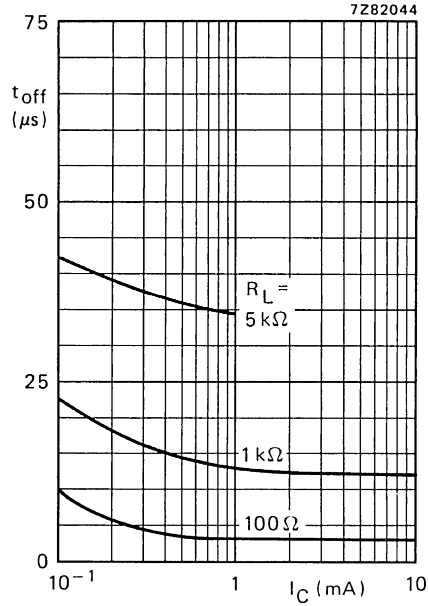


Fig. 25 **CNY52**; $I_B = 0$; $V_{CC} = 5$ V;
$T_{amb} = 25$ °C; typical values.
(See also Fig. 26.)

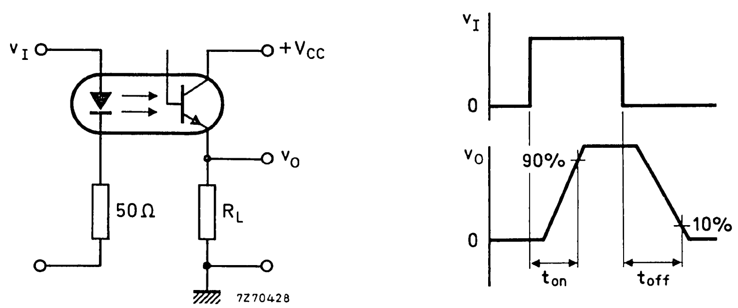


Fig. 26 Switching circuit and waveforms.

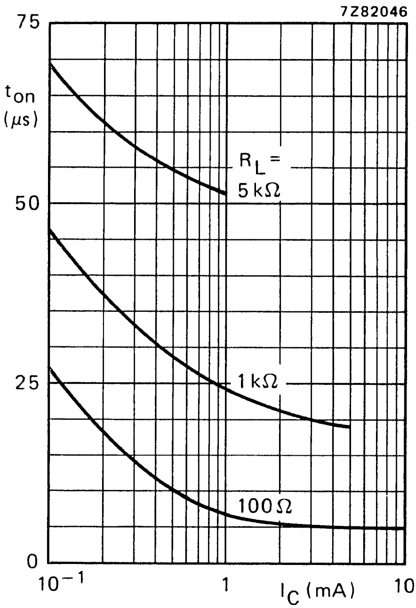


Fig. 27 **CNY53**; I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typical values. (See also Fig. 29.)

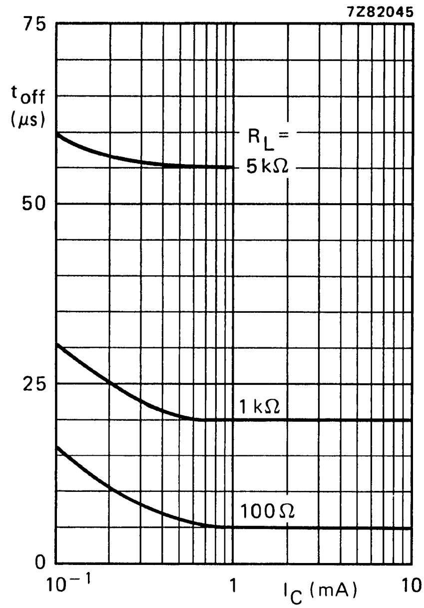


Fig. 28 **CNY53**; I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typical values. (See also Fig. 29.)

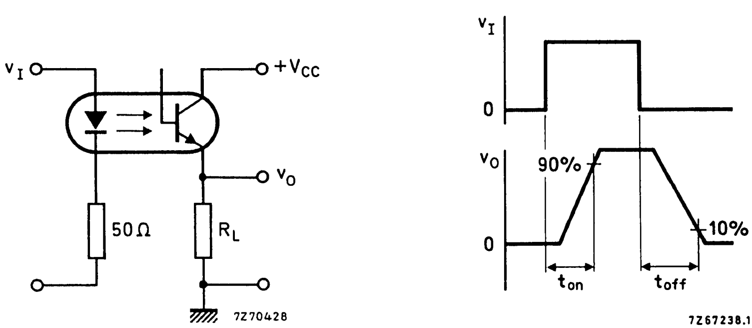


Fig. 29 Switching circuit and waveforms.

PHOTOCOUPLERS

Optically coupled isolators consisting of an infrared emitting GaAs diode and a silicon n-p-n phototransistor with accessible base. Plastic envelopes. Suitable for TTL integrated circuits.

Features of these products:

- high output/input d.c. current transfer ratio;
- low saturation voltage;
- high isolation voltage of 3 kV (r.m.s.) and 4,3 kV (d.c.);
- working voltage 1,5 kV.

QUICK REFERENCE DATA

Diode				
Continuous reverse voltage		V_R	max.	3 V
Forward current				
d.c.		I_F	max.	100 mA
(peak value); t_p = 10 μs; δ = 0,1		I_{FM}	max.	1000 mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	150 mW
Transistor				
Collector-emitter voltage (open base)		V_{CEO}	max.	30 V
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	200 mW
Photocoupler				
Output/input d.c. current transfer ratio I_F = 10 mA; V_{CE} = 0,4 V; (I_B = 0)	**CNY57**	I_C/I_F	>	0,2
	CNY57A	I_C/I_F	>	0,4
Collector cut-off current (dark) V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV diode: I_F = 0 (see also Fig. 2)		I_{CEW}	<	200 nA
Isolation voltage (d.c.) t = 1 min		V_{IO}	>	4,3 kV

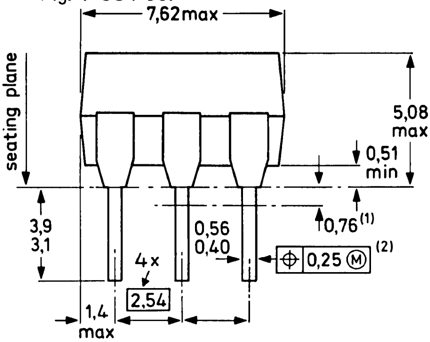
MECHANICAL DATA

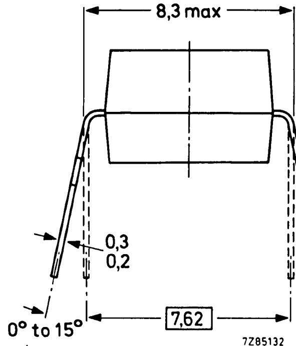
SOT-90 (see Fig. 1)

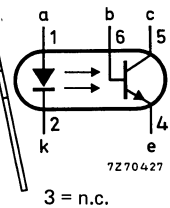
MECHANICAL DATA

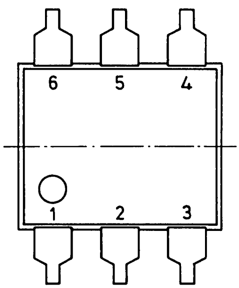
Dimensions in mm

Fig. 1 SOT-90.









⊕ Positional accuracy.

Ⓜ Maximum material condition.

(1) Lead spacing tolerances apply from seating plane to the line indicated.

(2) Centre-lines of all leads are within ± 0,125 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ± 0,25 mm.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage	V_R	max.	3	V
Forward current				
d.c.	I_F	max.	100	mA
(peak value); t_p = 10 μs; δ = 0,1	I_{FM}	max.	1000	mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	150	mW
Operating junction temperature	T_j	max.	125	°C

Transistor

Collector-emitter voltage (open base)	V_{CEO}	max.	30	V
Collector-base voltage (open emitter)	V_{CBO}	max.	50	V
Emitter-collector voltage (open base)	V_{ECO}	max.	7	V

Collector current (d.c.)	I_C	max.	100 mA
Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW
Operating junction temperature	T_j	max.	125 °C

Photocoupler

Storage temperature	T_{stg}		−55 to + 150 °C
Lead soldering temperature up to the seating plane; $t_{sld} < 10$ s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient in free air			
diode	$R_{th\ j\text{-}a}$	=	0,65 °C/mW
transistor	$R_{th\ j\text{-}a}$	=	0,5 °C/mW
From junction to ambient, device mounted on a printed-circuit board			
diode	$R_{th\ j\text{-}a}$	=	0,6 °C/mW
transistor	$R_{th\ j\text{-}a}$	=	0,4 °C/mW

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage				
I_F = 10 mA		V_F	typ.	1,2 V
			<	1,5 V
Reverse current				
V_R = 3 V		I_R	<	10 μA

Transistor (diode: I_F = 0)

Collector cut-off current (dark)				
V_{CE} = 10 V		I_{CEO}	typ.	5 nA
			<	100 nA
V_{CE} = 10 V; T_{amb} = 70 °C		I_{CEO}	<	10 μA
V_{CB} = 10 V		I_{CBO}	<	20 nA

Photocoupler (I_B = 0)*

Output/input d.c. current transfer ratio				
I_F = 10 mA; V_{CE} = 0,4 V	CNY57	I_C/I_F	typ.	0,5
				0,2 to 0,8
	CNY57A	I_C/I_F	>	0,4
			typ.	1,0
Collector cut-off current (dark) see Fig. 2				
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV		I_{CEW}	<	200 nA
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV; T_j = 70 °C		I_{CEW}	<	100 μA

* Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.

			CNY57	CNY57A	
Collector-emitter saturation voltage					
I_F = 10 mA; I_C = 2 mA	V_{CEsat}	typ.	0,17	–	V
		<	0,40	–	V
I_F = 10 mA; I_C = 4 mA	V_{CEsat}	typ.	–	0,17	V
		<	–	0,40	V
Isolation voltage, d.c. value*	V_{IO}	>	4,3	4,3	kV
Capacitance between input and output					
I_F = 0; V = 0; f = 1 MHz	C_{io}	typ.	0,6	0,6	pF
Insulation resistance between input and output					
$\pm V_{IO}$ = 1 kV	r_{IO}	>	10^{10}	10^{10}	Ω
		typ.	10^{12}	10^{12}	Ω
Switching times (see Figs 3 and 4)					
I_{Con} = 2 mA; V_{CC} = 5 V; R_L = 100 Ω					
Turn-on time	t_{on}	typ.	3	–	μs
Turn-off time	t_{off}	typ.	3	–	μs
I_{Con} = 4 mA; V_{CC} = 5 V; R_L = 100 Ω					
Turn-on time	t_{on}	typ.	–	5	μs
Turn-off time	t_{off}	typ.	–	5	μs

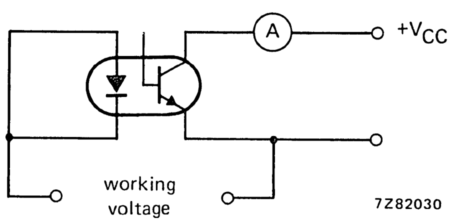


Fig. 2.

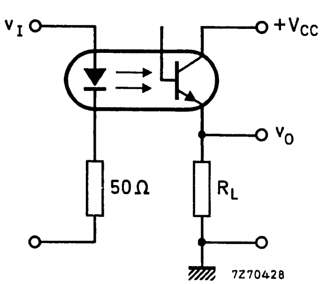


Fig. 3 Switching circuit.

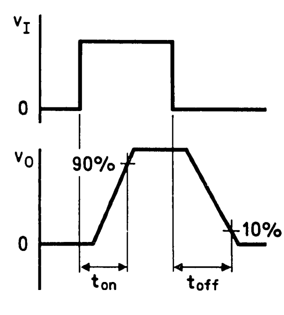


Fig. 4 Waveforms.

* Tested with a d.c. voltage for 1 minute between shorted input leads and shorted output leads.

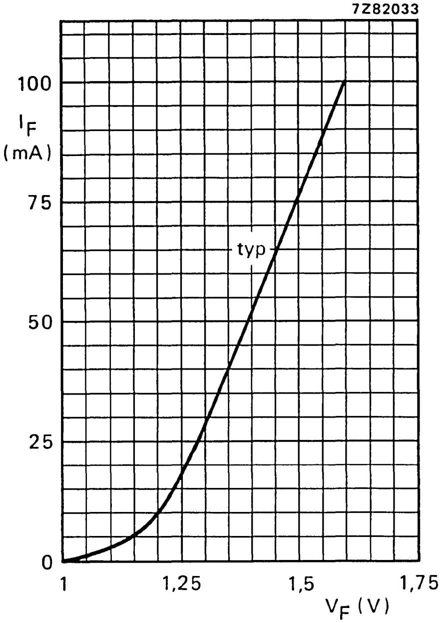


Fig. 5 T_{amb} = 25 °C.

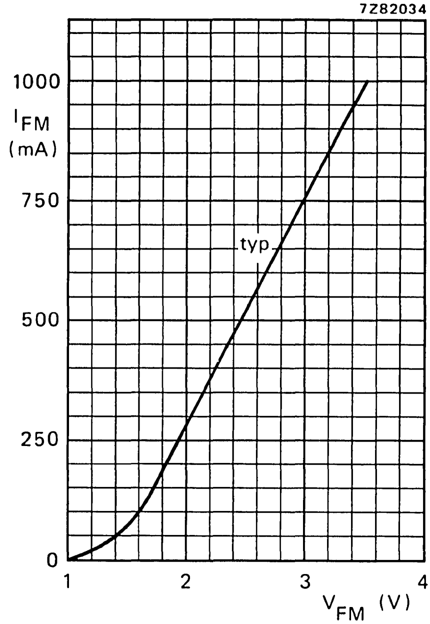


Fig. 6 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms.

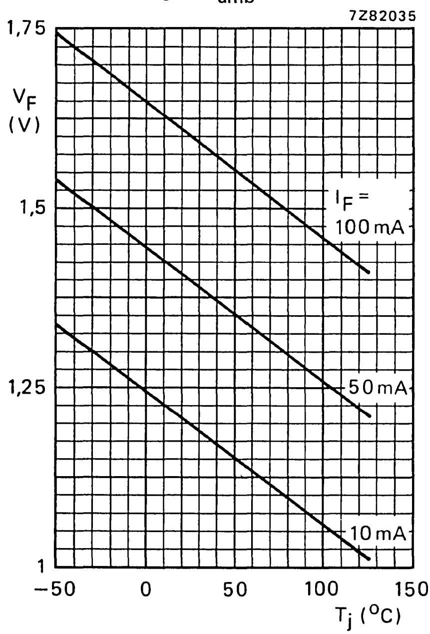


Fig. 7 Typical values.

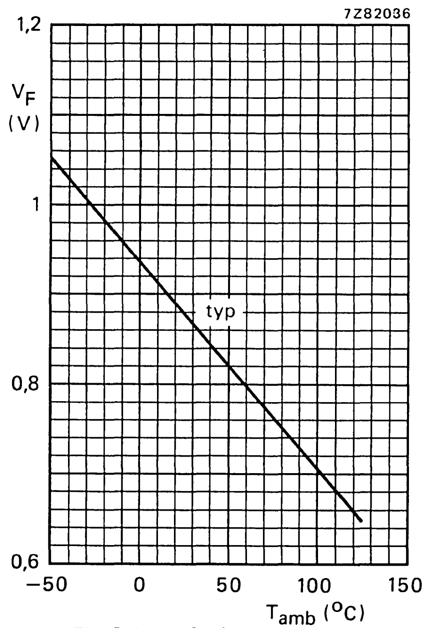


Fig. 8 I_F = 50 μA.

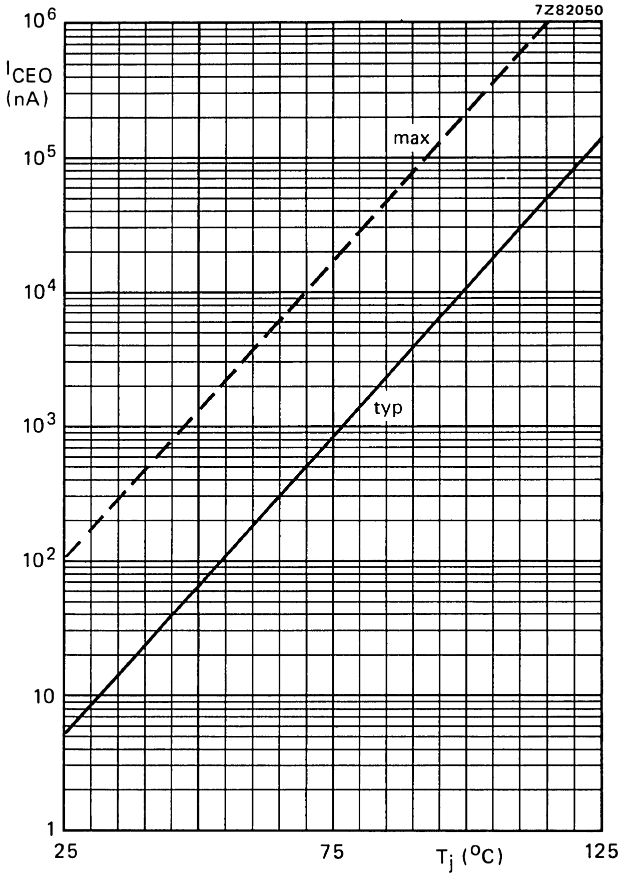


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V.

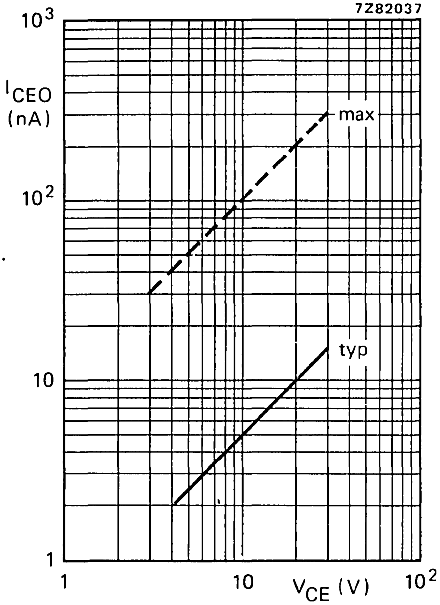


Fig. 10 $I_F = 0$; $T_j = 25$ °C.

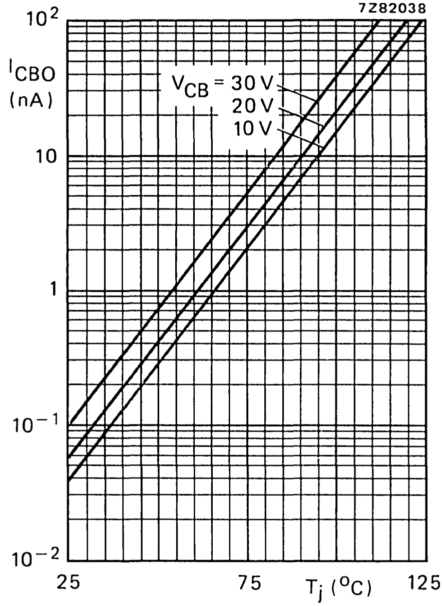


Fig. 11 $I_F = 0$; typical values.

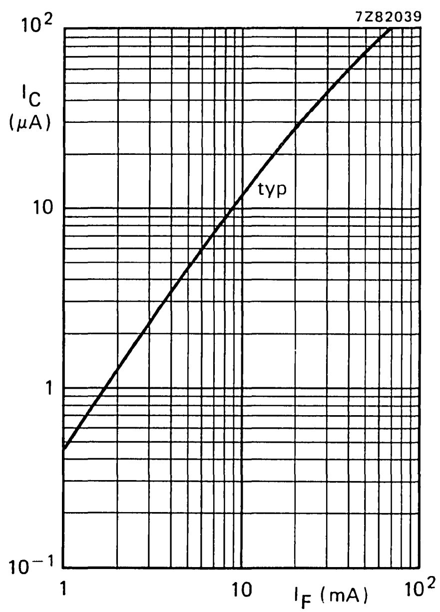


Fig. 12 $I_E = 0$; $V_{CB} = 5$ V; $T_{amb} = 25$ °C.

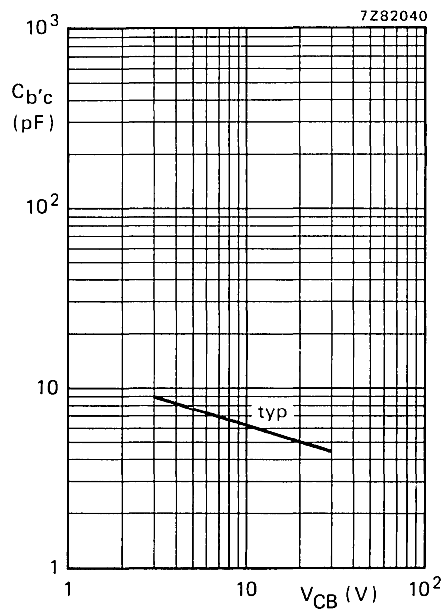


Fig. 13 f = 1 MHz; $T_j = 25$ °C.

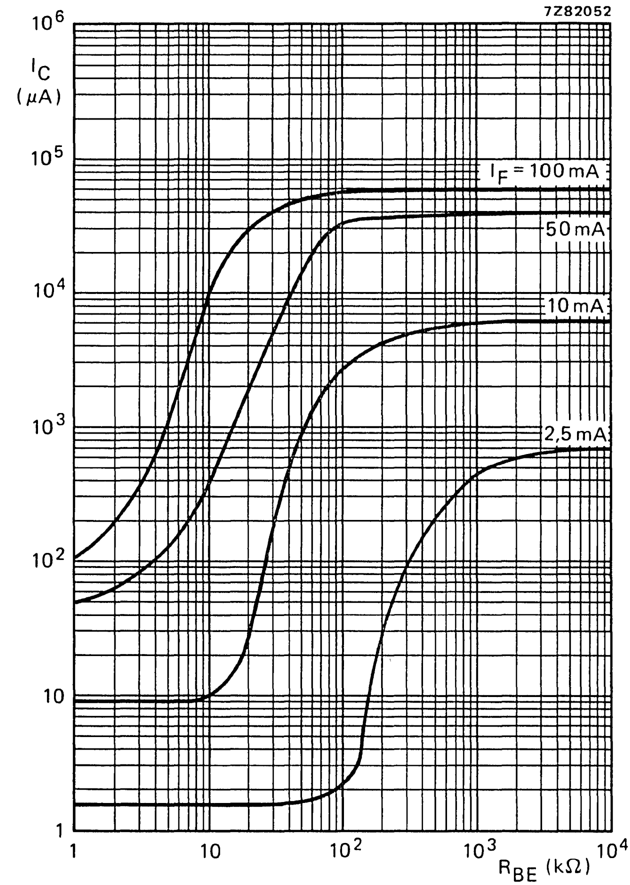


Fig. 14 **CNY57**; $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

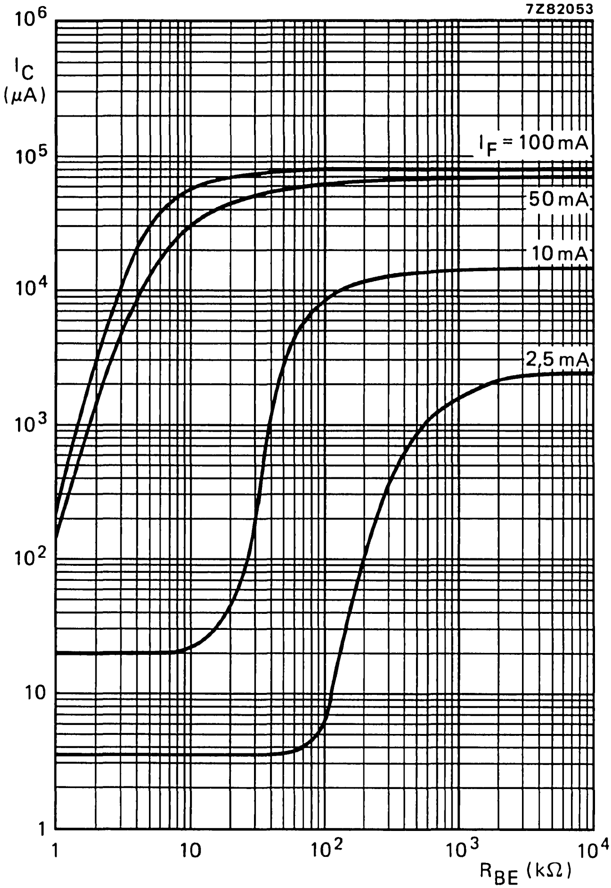


Fig. 15 **CNY57A**; $I_B = 0$; $V_{CE} = 5$ V; $T_{amb} = 25$ °C; typical values.

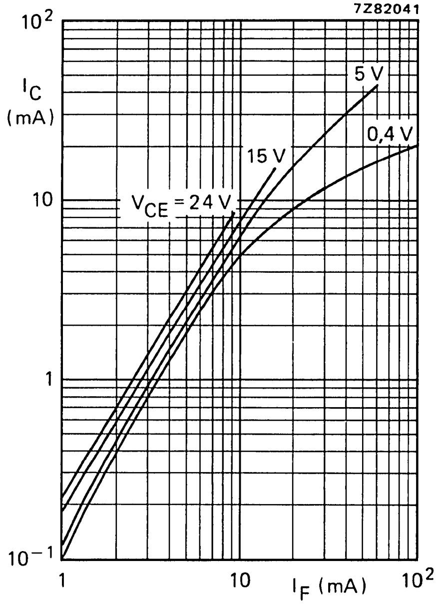


Fig. 16 **CNY57;** T_{amb} = 25 °C; typical values.

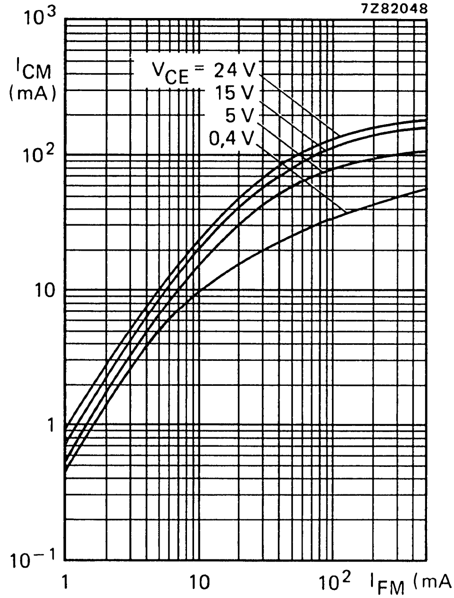


Fig. 17 **CNY57A;** T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms; typical values.

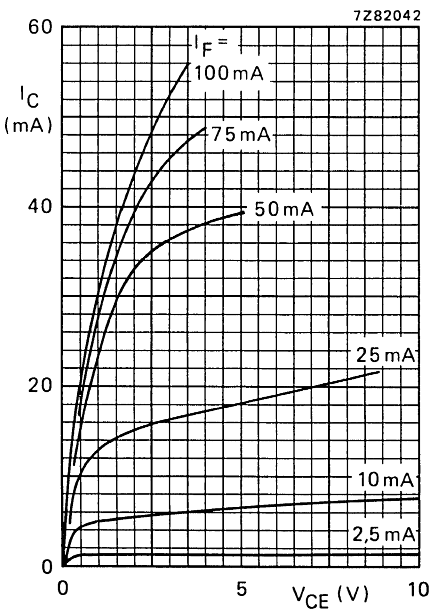


Fig. 18 **CNY57;** T_{amb} = 25 °C; typical values.

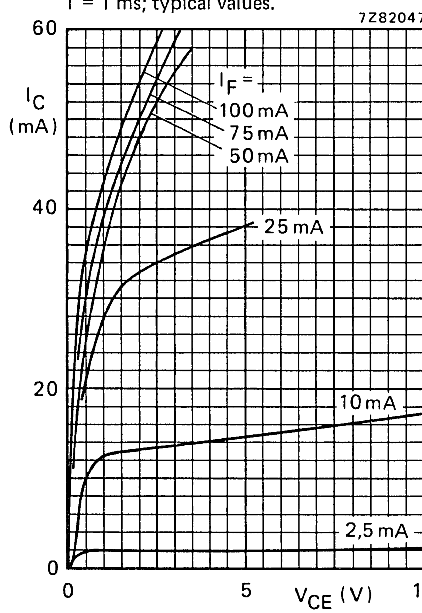


Fig. 19 **CNY57A;** T_{amb} = 25 °C; typical values.

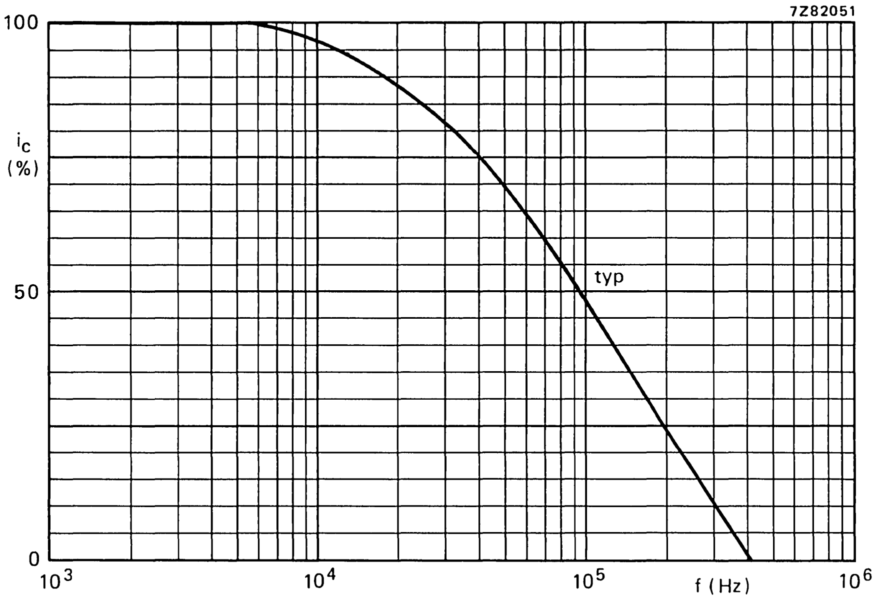


Fig. 20 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1$ kΩ; $T_{amb} = 25$ °C.

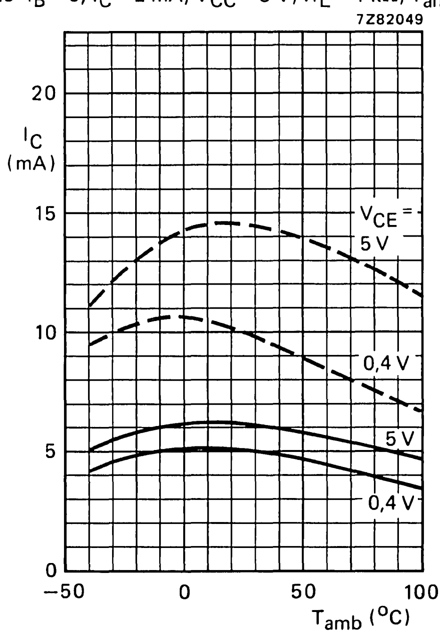


Fig. 21 ——— **CNY57;** – – – **CNY57A;** $I_B = 0$; $I_F = 10$ mA; typical values.

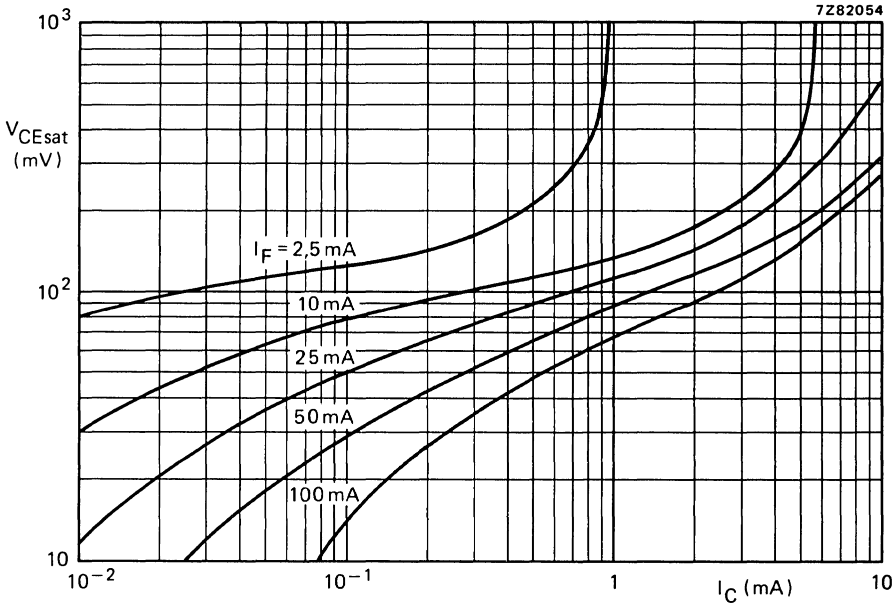


Fig. 22 **CNY57**; $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

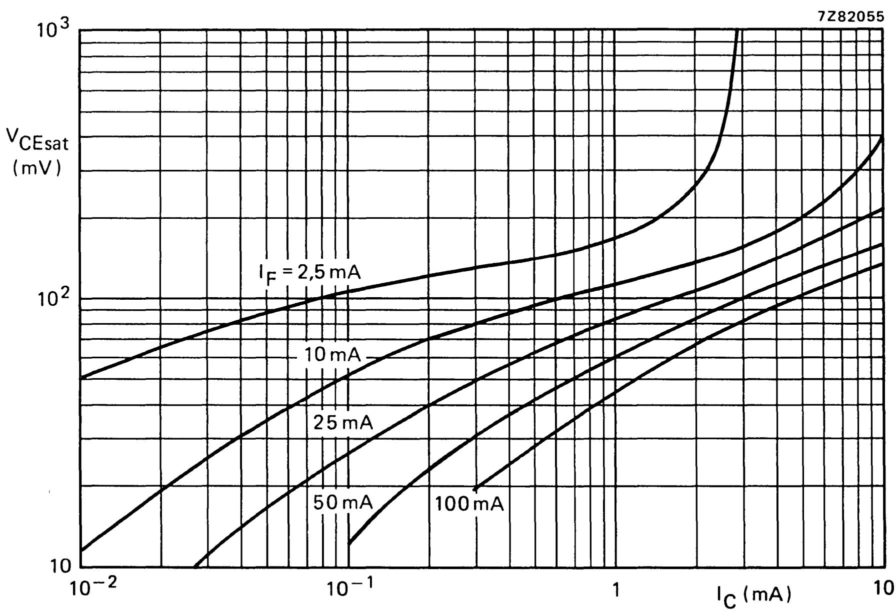


Fig. 23 **CNY57A**; $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

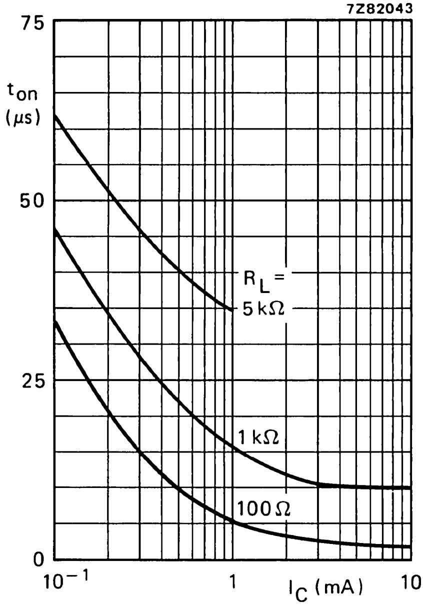


Fig. 24 **CNY57;** $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See also Fig. 26.)

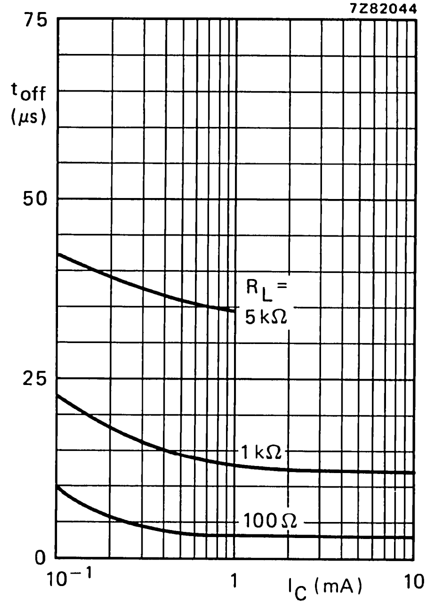


Fig. 25 **CNY57;** $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See also Fig. 26.)

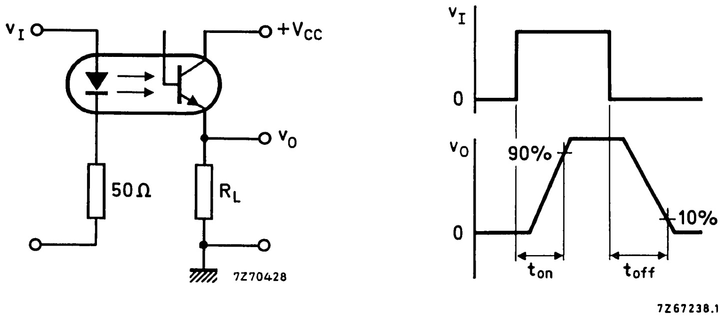


Fig. 26 Switching circuit and waveforms.

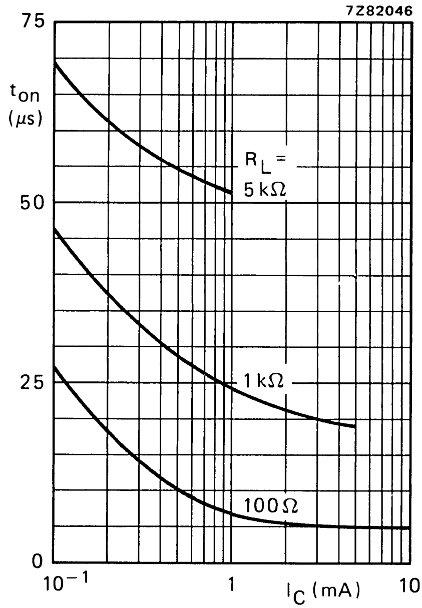


Fig. 27 **CNY57A**; $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See also Fig. 29.)

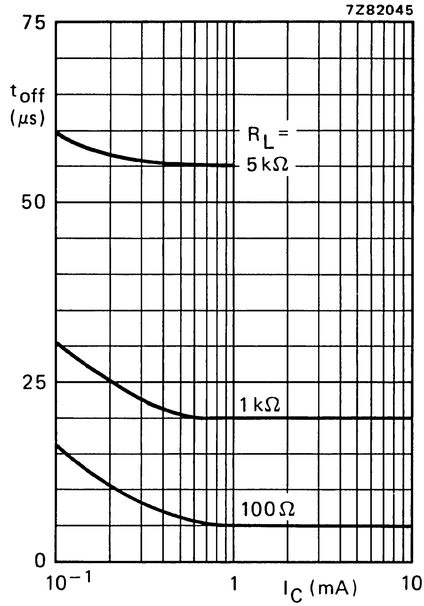


Fig. 28 **CNY57A**; $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See also Fig. 29.)

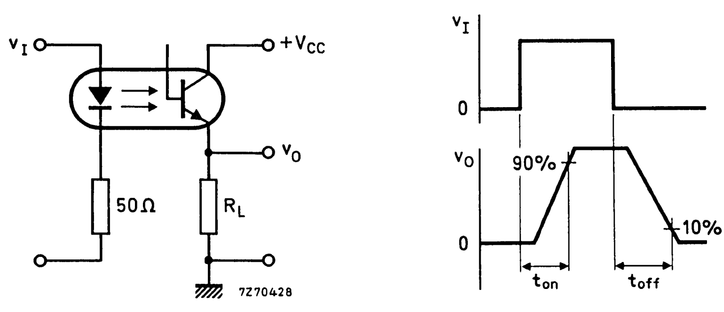


Fig. 29 Switching circuit and waveforms.

PHOTOCOUPLERS

Optically coupled isolators consisting of an infrared emitting GaAs diode and a silicon n-p-n phototransistor without accessible base. Plastic envelopes. Suitable for TTL integrated circuits.

Features of these products:

- high output/input d.c. current transfer ratio;
- low saturation voltage;
- a high isolation voltage
  CNY62 3,75 kV (r.m.s.) and 5,3 kV (d.c.);
  CNY63 3 kV (r.m.s.) and 4,3 kV (d.c.);
- working voltage 1,5 kV.

QUICK REFERENCE DATA

			CNY62	CNY63	
Diode					
Continuous reverse voltage	V_R	max.	3	3	V
Forward current					
d.c.	I_F	max.	100	100	mA
(peak value); t_p = 10 μs; δ = 0,1	I_{FM}	max.	1000	1000	mA
Total power dissipation up to T_{amb} = 25 ^oC	P_{tot}	max.	150	150	mW
Transistor					
Collector-emitter voltage (open base)	V_{CEO}	max.	50	30	V
Total power dissipation up to T_{amb} = 25 ^oC	P_{tot}	max.	200	200	mW
Photocoupler					
Output/input d.c. current transfer ratio					
I_F = 10 mA; V_{CE} = 0,4 V; (I_B = 0)	I_C/I_F	>	0,25	0,50	
Collector cut-off current (dark)					
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV diode: I_F = 0 (see also Fig. 2)	I_{CEW}	<	200	200	nA
Isolation voltage (d.c.)					
t = 1 min	V_{IO}	>	5,3	4,3	kV

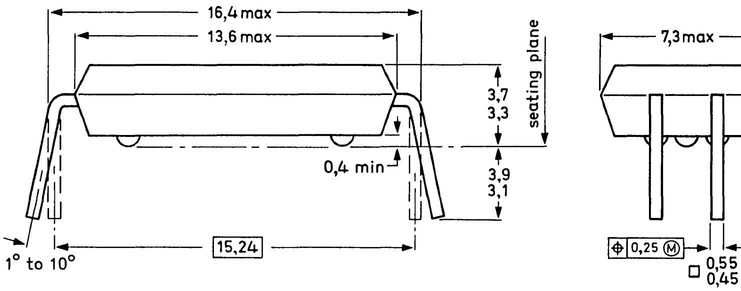
MECHANICAL DATA

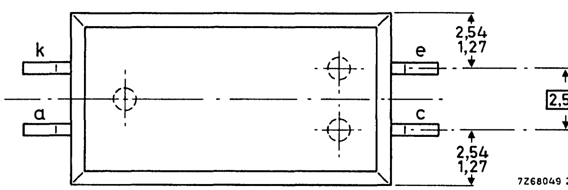
SOT-91B (see Fig. 1)

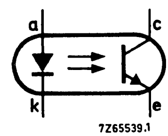
MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-91B.







⊕ Positional accuracy.

Ⓜ Maximum material condition.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Diode

Continuous reverse voltage		V_R	max.	3 V
Forward current				
d.c.		I_F	max.	100 mA
(peak value); t_p = 10 μs; δ = 0,1		I_{FM}	max.	1000 mA
Total power dissipation up to T_{amb} = 25 °C		P_{tot}	max.	150 mW
Operating junction temperature		T_j	max.	125 °C

Transistor

Collector-emitter voltage (open base)	CNY62	V_{CEO}	max.	50 V
	CNY63	V_{CEO}	max.	30 V
Emitter-collector voltage (open base)		V_{ECO}	max.	7 V
Collector current (d.c.)		I_C	max.	100 mA

Total power dissipation up to T_{amb} = 25 °C	P_{tot}	max.	200 mW
Operating junction temperature	T_j	max.	125 °C

Photocoupler

Storage temperature	T_{stg}		−55 to +150 °C
Lead soldering temperature up to the seating plane; t_{sld} < 10 s	T_{sld}	max.	260 °C

THERMAL RESISTANCE

From junction to ambient in free air			
diode	$R_{th\ j\text{-}a}$	=	0,65 °C/mW
transistor	$R_{th\ j\text{-}a}$	=	0,5 °C/mW
From junction to ambient, device mounted on a printed-circuit board			
diode	$R_{th\ j\text{-}a}$	=	0,6 °C/mW
transistor	$R_{th\ j\text{-}a}$	=	0,4 °C/mW

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Diode

Forward voltage I_F = 10 mA	V_F	typ.	1,2 V
		<	1,5 V
Reverse current V_R = 3 V	I_R	<	10 µA

Transistor (diode: I_F = 0)

Collector cut-off current (dark) V_{CE} = 10 V	I_{CEO}	typ.	5 nA
		<	100 nA
V_{CE} = 10 V; T_{amb} = 70 °C	I_{CEO}	<	10 µA

Photocoupler (I_B = 0)*

Output/input d.c. current transfer ratio I_F = 10 mA; V_{CE} = 0,4 V	CNY62	I_C/I_F	>	0,25
			typ.	0,50
	CNY63	I_C/I_F	>	0,5
			typ.	1,0
Collector cut-off current (dark) see Fig. 2				
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV		I_{CEW}	<	200 nA
V_{CC} = 10 V; working voltage (d.c.) = 1,5 kV; T_j = 70 °C		I_{CEW}	<	100 µA

* Where the phototransistor receives light from the diode the O (for open base) has been omitted from the symbols.

			CNY62	CNY63	
Collector-emitter saturation voltage I_F = 10 mA; I_C = 2 mA	V_{CEsat}	typ.	0,17	–	V
		<	0,40	–	V
I_F = 10 mA; I_C = 4 mA	V_{CEsat}	typ.	–	0,17	V
		<		0,40	V
Isolation voltage, d.c. value*	V_{IO}	>	5,3	4,3	kV
Capacitance between input and output I_F = 0; V = 0; f = 1 MHz	C_{io}	typ.	0,6	0,6	pF
Insulation resistance between input and output $\pm V_{IO}$ = 1 kV	r_{IO}	>	10^{10}	10^{10}	Ω
		typ.	10^{12}	10^{12}	Ω
Switching times (see Figs 3 and 4) I_{Con} = 2 mA; V_{CC} = 5 V; R_L = 100 Ω					
Turn-on time	t_{on}	typ.	3	–	μs
Turn-off time	t_{off}	typ.	3	–	μs
I_{Con} = 4 mA; V_{CC} = 5 V; R_L = 100 Ω					
Turn-on time	t_{on}	typ.	–	5	μs
Turn-off time	t_{off}	typ.	–	5	μs

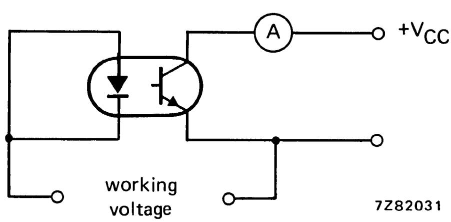


Fig. 2.

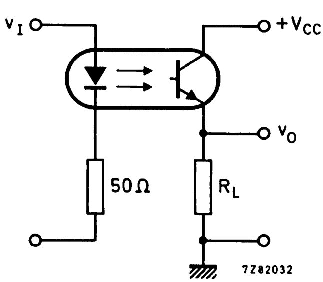


Fig. 3 Switching circuit.

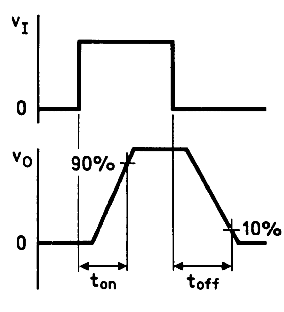


Fig. 4 Waveforms.

* Tested with a d.c. voltage for 1 minute between shorted input leads and shorted output leads.

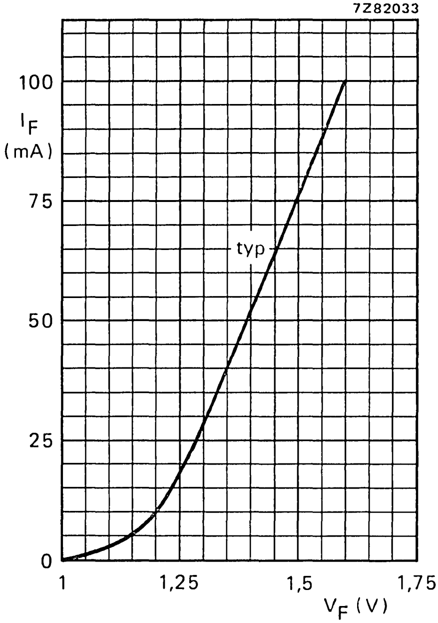


Fig. 5 T_{amb} = 25 °C.

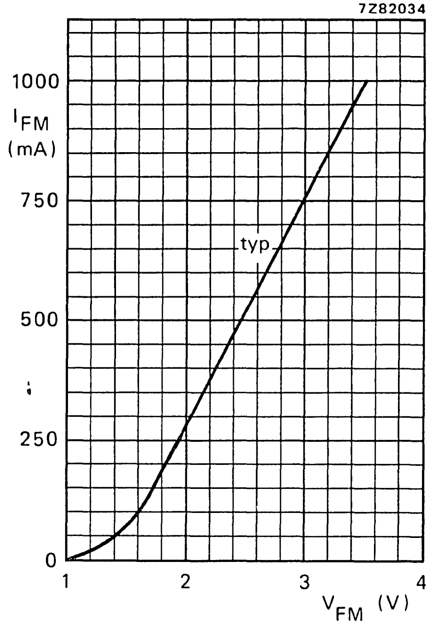


Fig. 6 T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms.

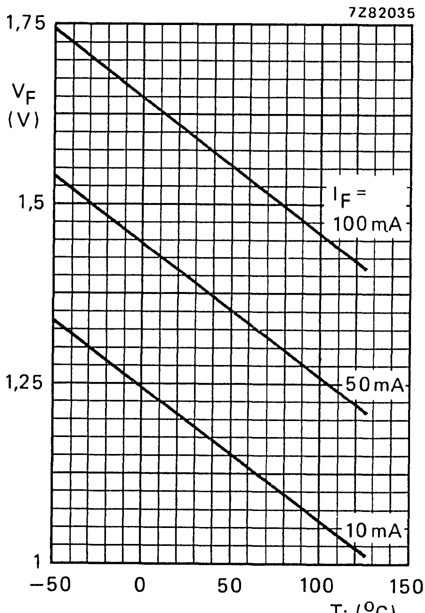


Fig. 7 Typical values.

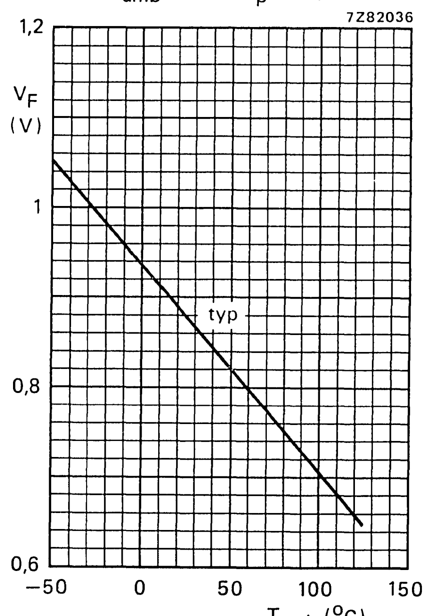


Fig. 8 I_F = 50 μA.

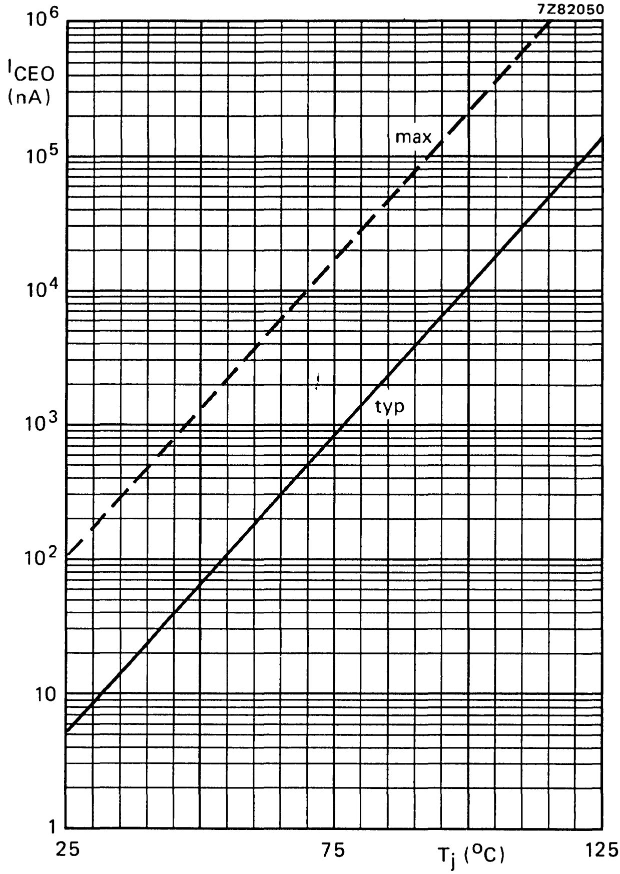


Fig. 9 $I_F = 0$; $V_{CE} = 10$ V.

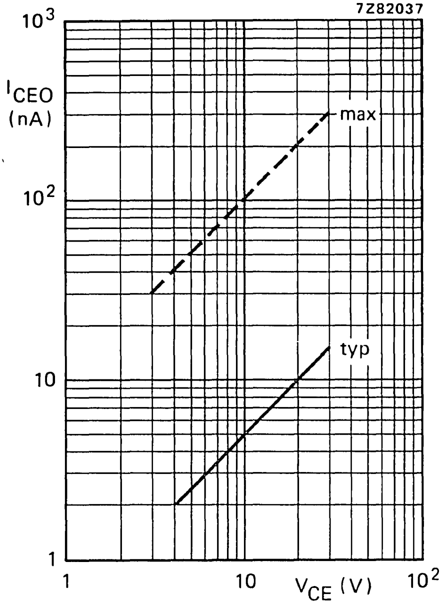


Fig. 10 $I_F = 0$; $T_j = 25\ ^oC$.

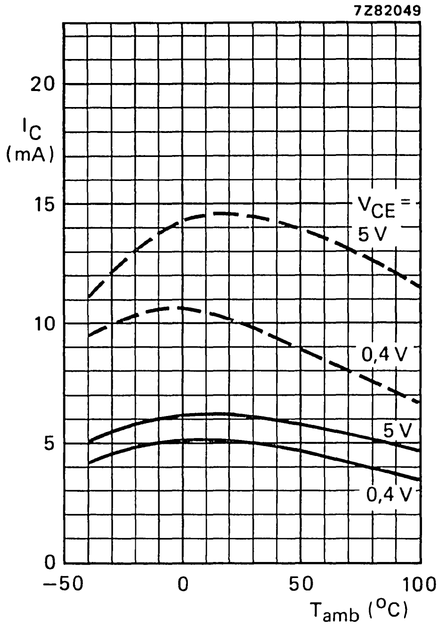


Fig. 11 $I_B = 0$; $I_F = 10$ mA;
—— **CNY62**; – – – **CNY63**; typical values.

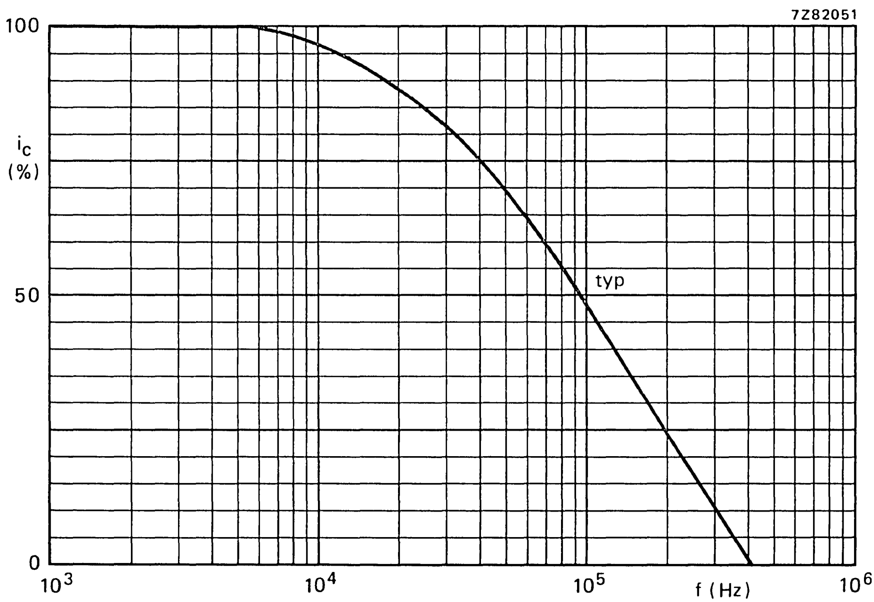


Fig. 12 $I_B = 0$; $I_C = 2$ mA; $V_{CC} = 5$ V; $R_L = 1$ kΩ; $T_{amb} = 25\ ^oC$.

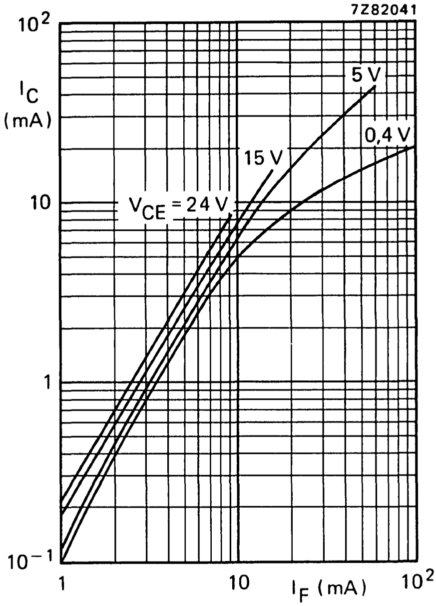


Fig. 13 **CNY62**; T_{amb} = 25 °C; typical values.

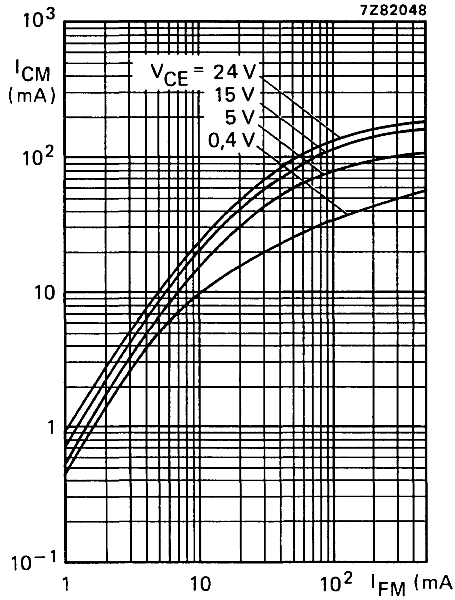


Fig. 14 **CNY63**; T_{amb} = 25 °C; t_p = 10 μs; T = 1 ms; typical values.

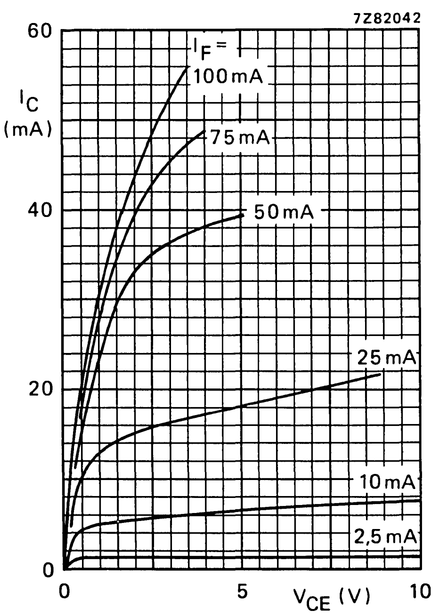


Fig. 15 **CNY62**; T_{amb} = 25 °C; typical values.

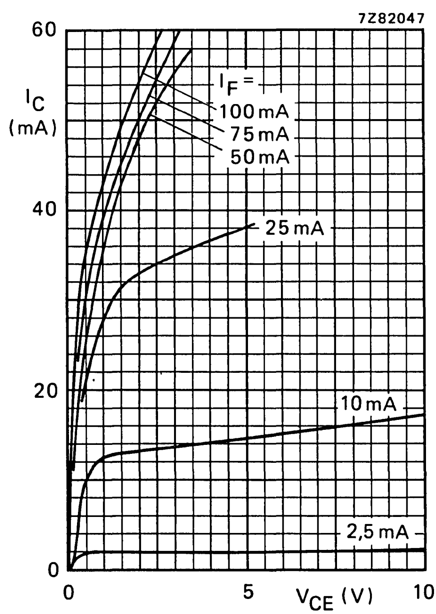


Fig. 16 **CNY63**; T_{amb} = 25 °C; typical values.

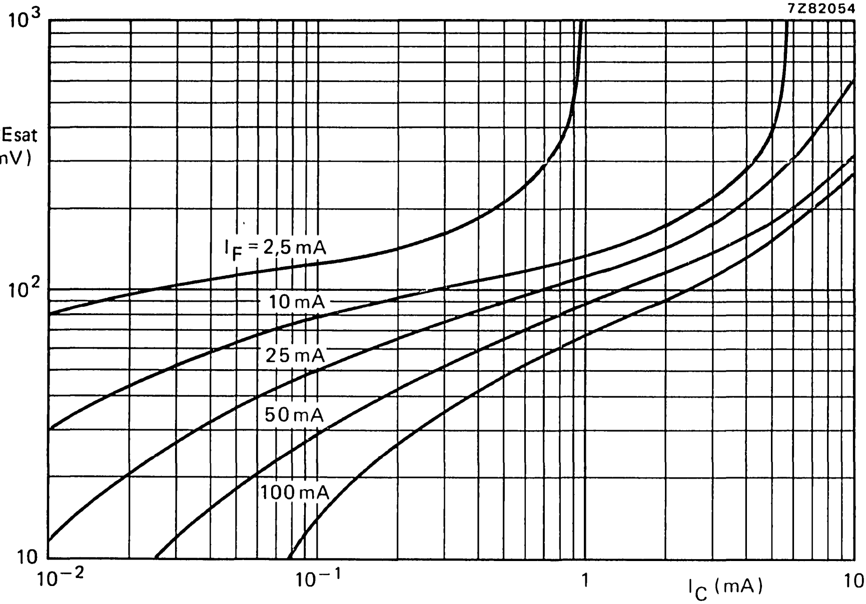


Fig. 17 **CNY62;** $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

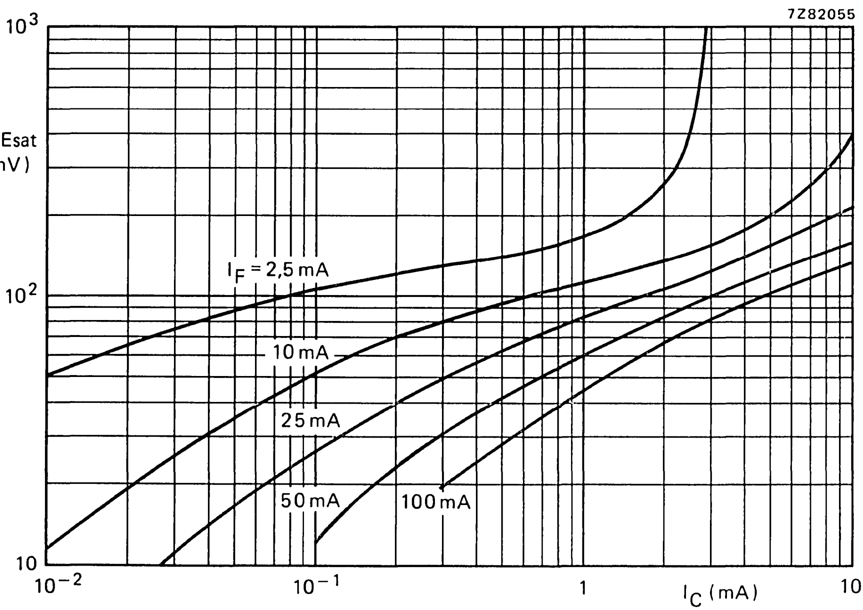


Fig. 18 **CNY63**; $I_B = 0$; $T_{amb} = 25\ ^oC$; typical values.

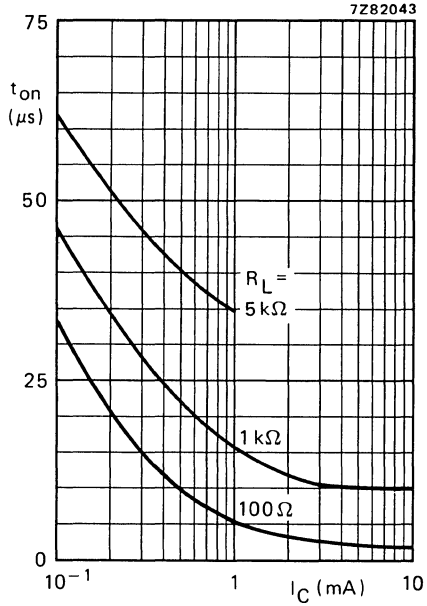


Fig. 19 **CNY62;** I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typical values. (See also Fig. 21.)

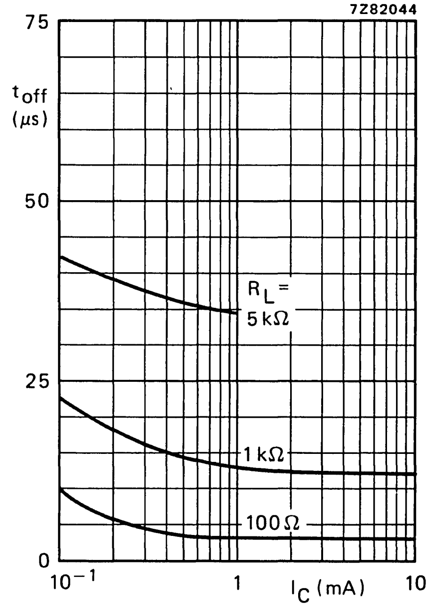


Fig. 20 **CNY62;** I_B = 0; V_{CC} = 5 V; T_{amb} = 25 °C; typical values. (See also Fig. 21.)

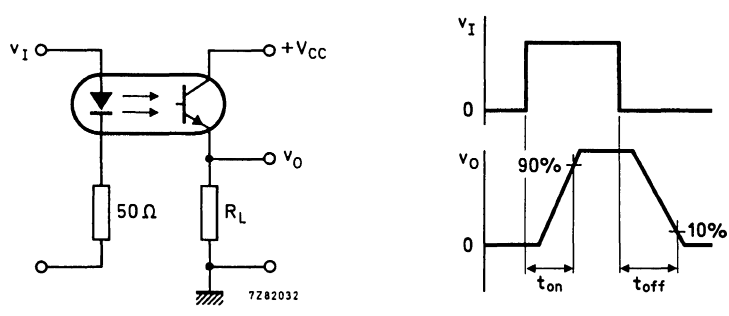


Fig. 21 Switching circuit and waveforms.

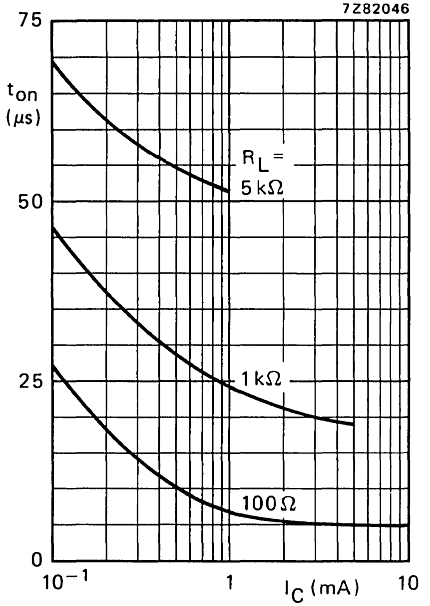


Fig. 22 **CNY63**; $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See also Fig. 24.)

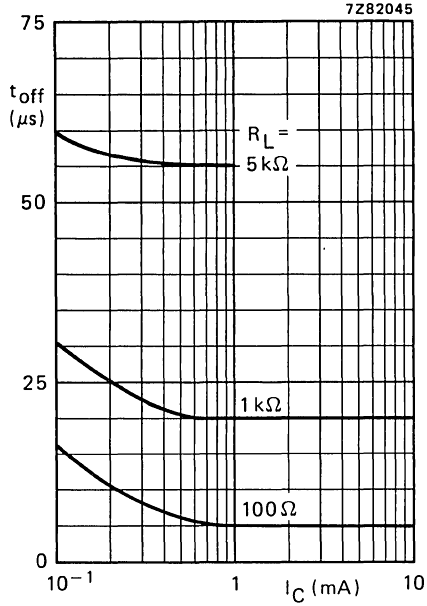


Fig. 23 **CNY63**; $I_B = 0$; $V_{CC} = 5$ V; $T_{amb} = 25$ °C; typical values. (See also Fig. 24.)

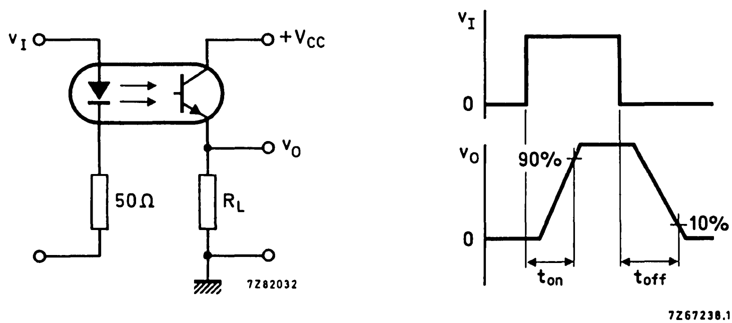


Fig. 24 Switching circuit and waveforms.

INFRARED SENSITIVE DEVICES

SINGLE ELEMENT PYROELECTRIC INFRARED DETECTORS

This is an infrared sensitive device, combined with a pre-amplifier which is stabilized to overcome d.c. saturation due to thermal changes. It is sealed in a low-profile TO-5 can.

QUICK REFERENCE DATA

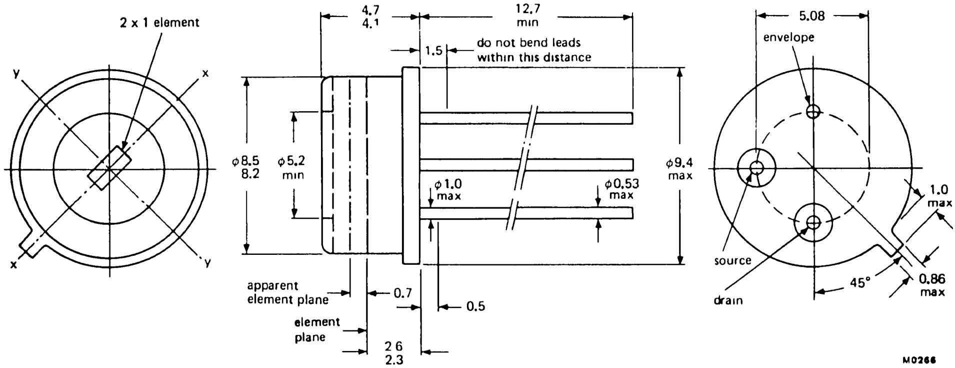
		RPY86	RPY87	
Spectral Response		6.5 ± 0.5 to > 14	1.0 to > 15	μm
Responsivity		(10 μm, 10)	(6 μm, 10)	
	typ.	600	500	VW^{-1}
Noise Equivalent Power (N.E.P.),		(10 μm, 10, 1)	(6 μm, 10, 1)	
	typ.	0.9×10^{-9}	1.05×10^{-9}	$WHz^{-1/2}$
Element dimensions		2 x 1		mm
Field of View	typ.	110		degrees
Operating voltage		9		V
Optimum operating frequency range		0.1 to 1000		Hz

This data must be read in conjunction with GENERAL SAFETY RECOMMENDATIONS – OPTOELECTRONIC DEVICES

MECHANICAL DATA

Dimensions in mm

SOT-49E (low profile TO-5)



PRODUCT SAFETY

Modern high technology materials have been used in the manufacture of this device to ensure high performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the device is heated to destruction. Disposal of large quantities should therefore be carried out in accordance with the latest local legislation.

SOLDERING

1. When making soldered connections to the leads, a thermal shunt should be used.
2. It is essential that any mains operated soldering iron should be both screened and earthed. Failure to observe these precautions could lead to the introduction of line voltage and possible damage to the device.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Supply voltage	max.	30	V
Temperature, operating	max.	+100	°C
	min.	−40	°C
Temperature, storage	max.	+100	°C
	min.	−40	°C
Lead soldering temperature, ⩾ 6 mm from header, t_{sld} ⩽ 3 s	max.	+350	°C

CHARACTERISTICS (at 25 ± 3 °C and with recommended circuit)

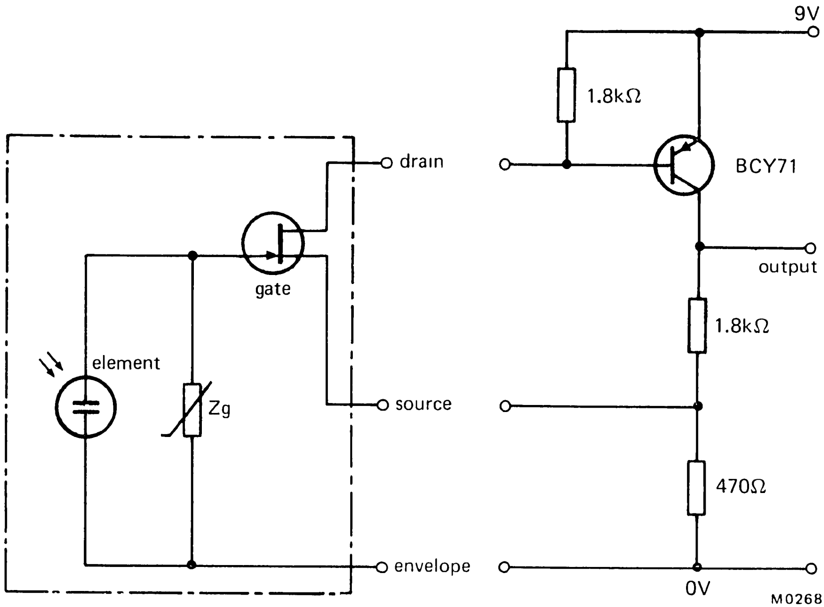
RPY86		min.	typ.	max.	
Spectral Response		6.5 ± 0.5	–	> 14	μm
Responsivity (10 μm, 10)	notes 1 and 4	450	600	–	VW^{-1}
N.E.P. (10 μm, 10, 1)	notes 1 and 4	–	0.9×10^{-9}	3×10^{-9}	$WHz^{-1/2}$
Field of view	note 2	–	110	–	degrees
Operating voltage	note 3	8	9	10	V

RPY87					
Spectral Response		1	–	> 15	μm
Responsivity (500 K, 10) or (6 μm, 10)	notes 1 and 4	400	500	–	VW^{-1}
N.E.P. (500 K, 10, 1) or (6 μm, 10, 1)	notes 1 and 4	–	1.05×10^{-9}	3×10^{-9}	$WHz^{-1/2}$
Field of View	note 2	–	110	–	degrees
Operating voltage	note 3	8	9	10	V

Notes

1. These characteristics apply throughout the spectral response range.
2. Field of view to 50% of the maximum responsivity level.
3. The detector will operate outside the quoted range but may have a degraded performance.
4. For performance as a function of frequency and temperature, see pages 6 to 9.

RECOMMENDED CIRCUIT



OPERATING NOTES

1. The case potential must not be allowed to become positive with respect to the other two terminals.
2. It is inadvisable to operate the detector at mains related frequencies.
3. To avoid the possibility of optical microphony, the detector must be firmly mounted
4. An increase in temperature of the element will produce a negative going signal at the output.
5. Use recommended circuit for low noise operation.
6. For simplicity of operation, a source follower may be used where noise is not a problem. This may be achieved with a 22 kΩ resistor between source and envelope with the positive supply taken to the drain terminal. This will give a voltage gain of approximately 0.9.

DEFINITIONS

1. Responsivity VW^{-1}

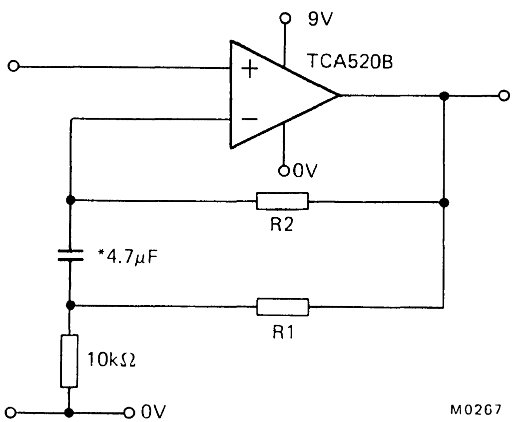
   This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped radiant power.

2. N.E.P. (Noise Equivalent Power), $WHz^{-1/2}$

   This is the r.m.s. value of the incident, chopped radiant power necessary to produce an r.m.s. signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth $VHz^{-1/2}$

RECOMMENDED CIRCUIT

1. Optional additional stage for extra gain



Recommended component value for various gains

Gain x	R_1 kΩ	R_2 MΩ
50	560	5.6
20	220	2.2
10	100	1.0

*this capacitor must be a low leakage type e.g. our 344 series.

2. Temperature slew

The FET used with a pyroelectric detector requires a gate leakage resistor to earth in parallel with the element. This stabilizes its working point. The pyroelectric voltage appearing across this resis is proportional to the rate of change of temperature.
To ensure a low level of noise current from this resistor, its value should be of the order of 3×10^{10} Ω. When the temperature slew rate is 1 °C/minute, the pyroelectric voltage produce 1 volt. In a system which is designed to sense microvolts, this is almost certain to cause overl any a.c. signal superimposed on this d.c. shift will be lost.
Our detectors incorporate a bleed system which acts progressively on the d.c. shift caused temperature slew. The law is logarithmic.
Thus a slew rate of 0.1 °C/minute may produce on offset across the sensing element of 200 millivolts, 1 °C/minute 280 millivolts and 10 °C/minute 360 millivolts.

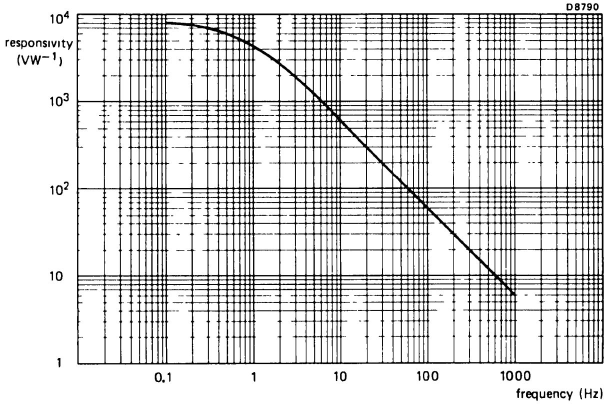
MECHANICAL AND ENVIRONMENTAL STANDARDS

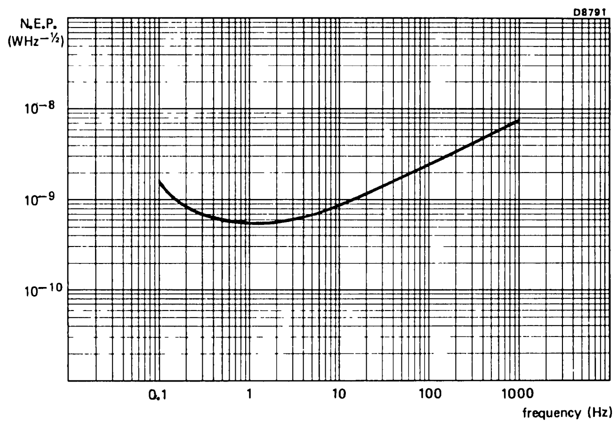
As part of the Quality Assurance programme, the detectors are assessed at regular intervals against the requirements of the following IEC standards. The frequency of testing and the limits and conditions for the pre- and post-test measurements are based on those stipulated for the CECC 50 000 series of approved transistors.

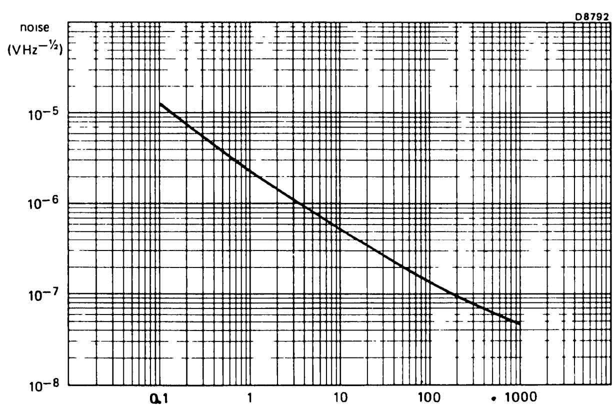
	Test		Severity	Duration	Note
IEC 68-2-3	Ca	Damp Heat, steady state	+40 °C, 95% RH	168 hours	1
68-2-20	Ta	Solderability	+235 °C, 1.5 mm from header	5 seconds	1
68-2-21	Ub	Lead Fatigue	4 cycles	–	1
68-2-1	A	Low Temperature Storage	–40 °C	2000 hours	2
68-2-2	Ba	High Temperature Storage	+100 °C	2000 hours	2
68-2-14	Nb	Change of Temperature	–40 °C to +100 °C	10 cycles	2
68-2-6	Fc (B4)	Vibration, swept frequency	125 Hz to 2kHz 196 ms^{-2}	2 h in each orientation	2
68-2-7	Ga	Acceleration, steady state	196000 m^{-2}	60 seconds	2
68-2-27	Ea	Shock	14700 ms^{-2}	3 pulses 6 orientations	2
68-2-20	Tb	Resistance to Solder Heat	+350 °C, 6 mm from header	3 seconds	3

Notes

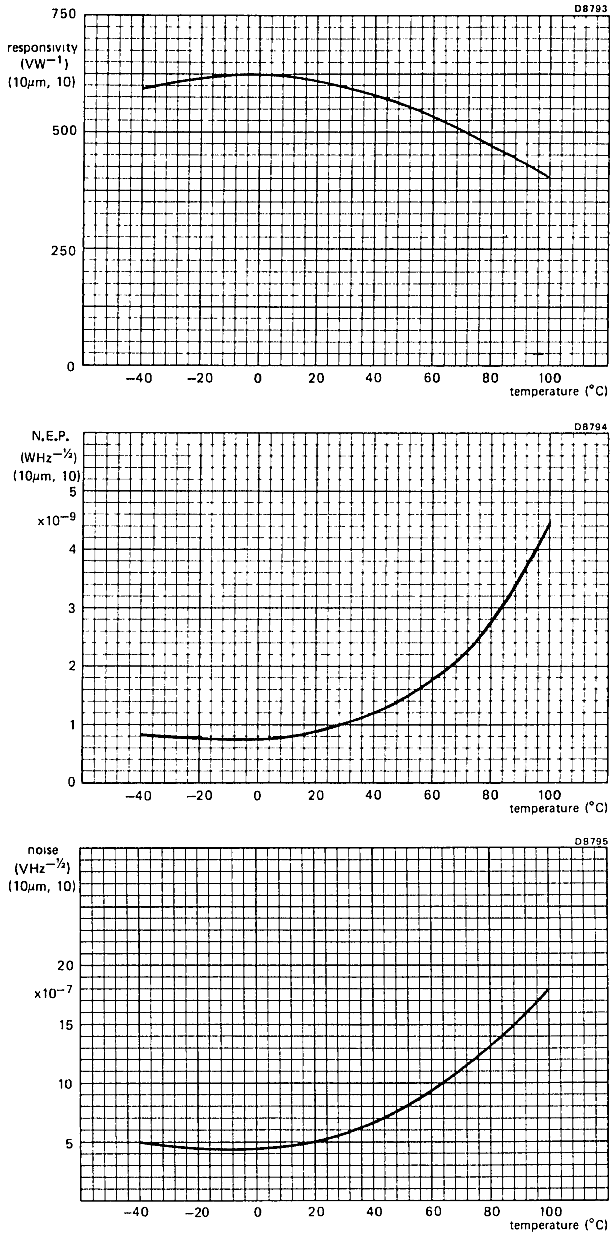
1. The detectors are checked on a production batch release principle at approximately weekly intervals. This is equivalent to Group B.
2. The detectors are checked at quarterly intervals. This is equivalent to Group C.
3. This is an annual check.



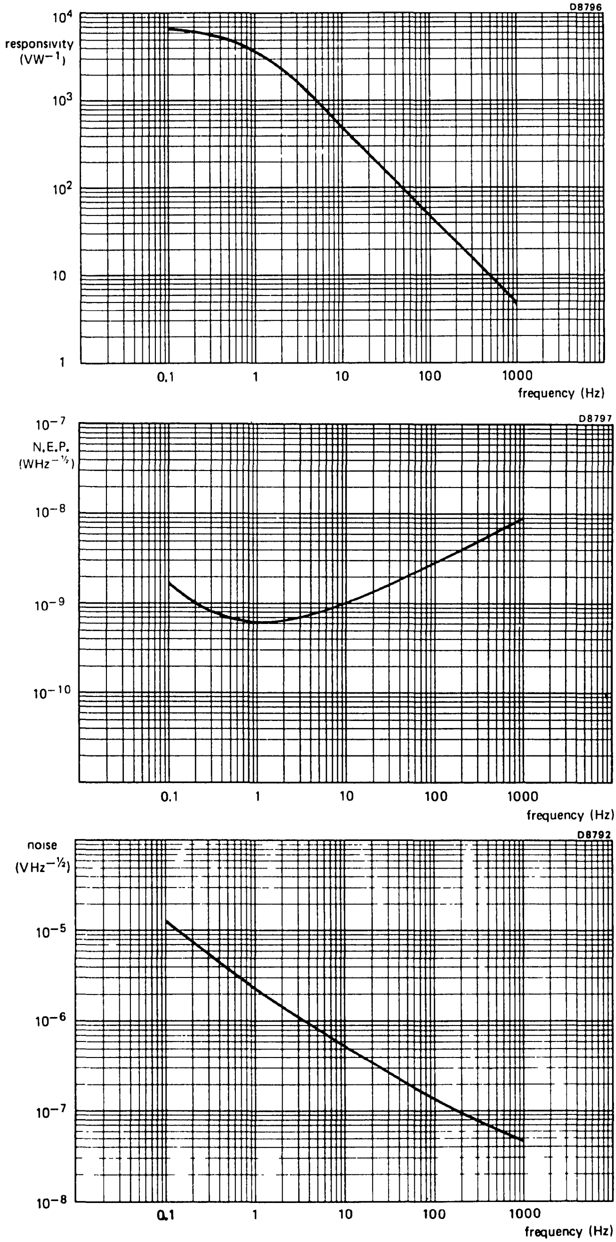




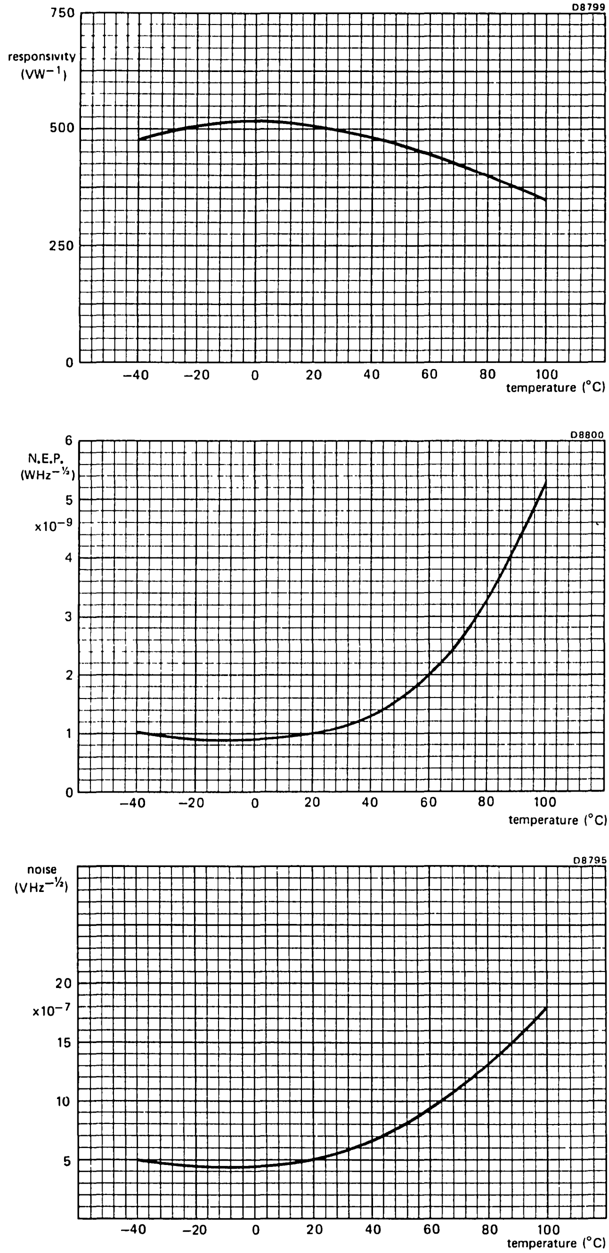
RPY86, typical Responsivity, N.E.P., and Noise as functions of Frequency



RPY86, typical Responsivity, N.E.P., and Noise as functions of Temperature

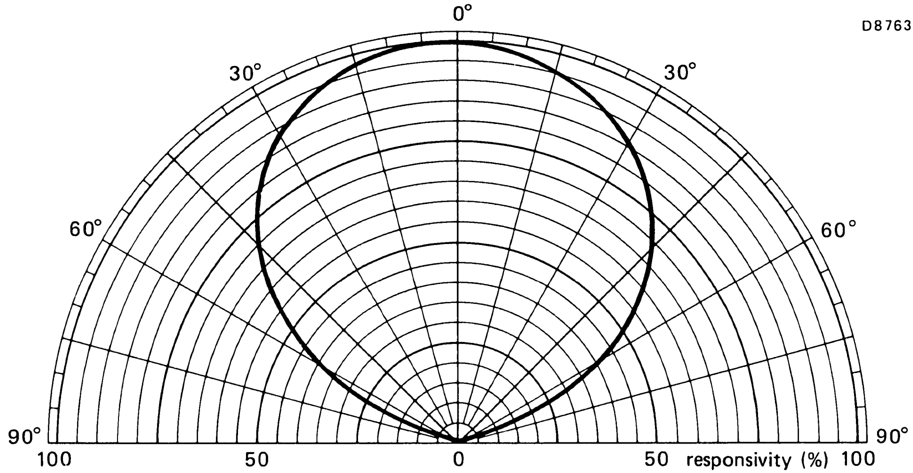


RPY87, typical Responsivity, N.E.P., and Noise as functions of Frequency

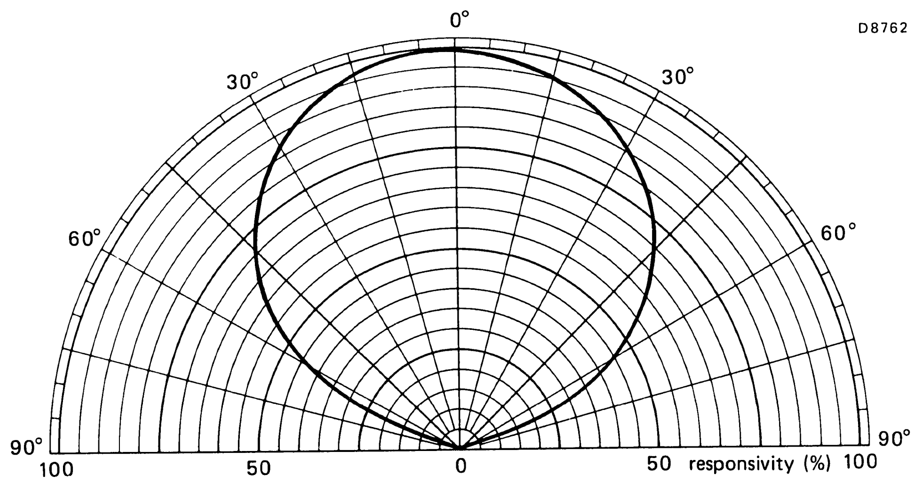


RPY87, typical Responsivity, N.E.P., and Noise as functions of Temperature

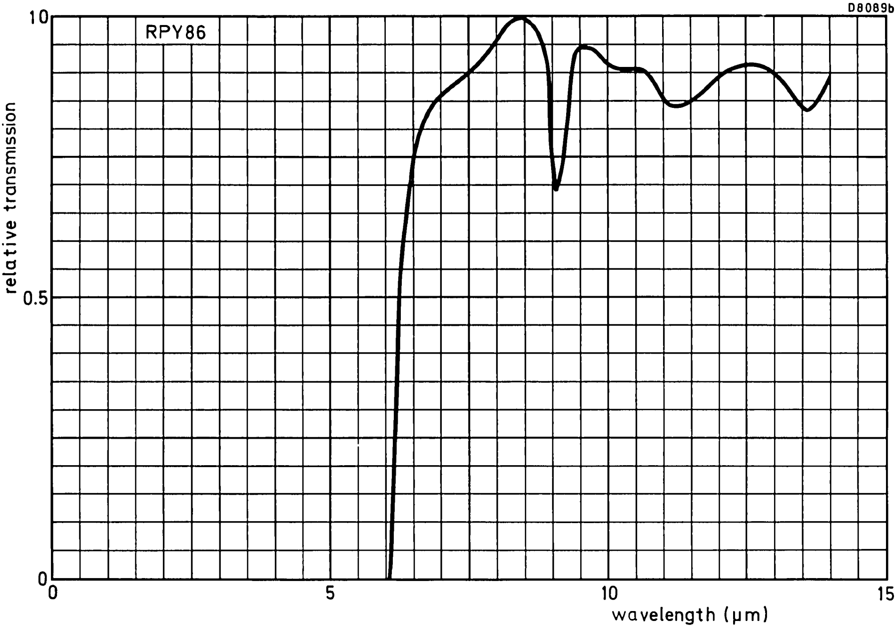
POLAR DIAGRAMS

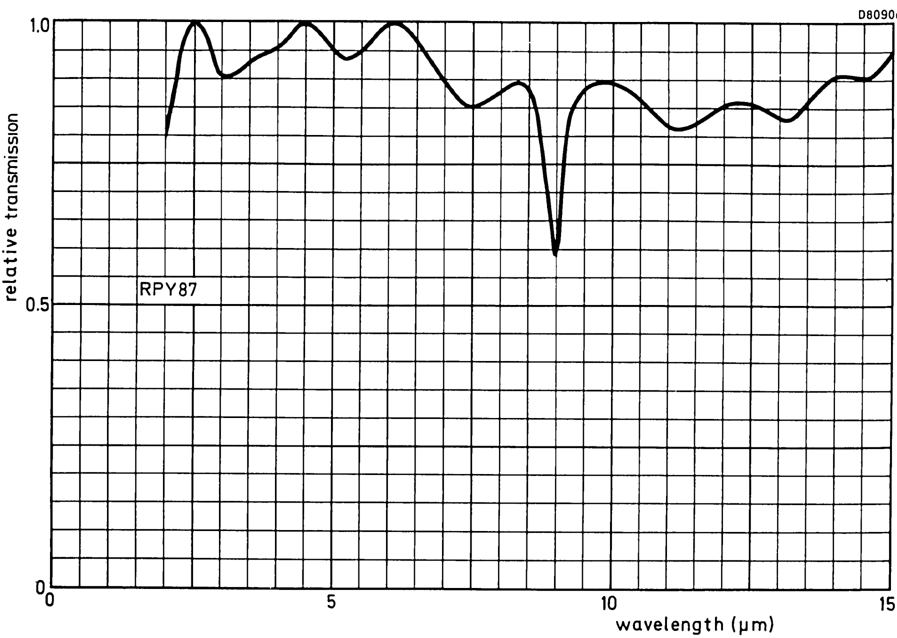


Typical Field of View in x-x plane (see Mechanical Data)



Typical Field of View in y-y plane (see Mechanical Data)





Typical normalized window transmission characteristics

SINGLE ELEMENT PYROELECTRIC INFRARED DETECTORS

This is an infrared sensitive device, combined with a pre-amplifier which is stablized to overcome d.c. saturation due to thermal changes. It is sealed in a low-profile TO-5 can.

QUICK REFERENCE DATA

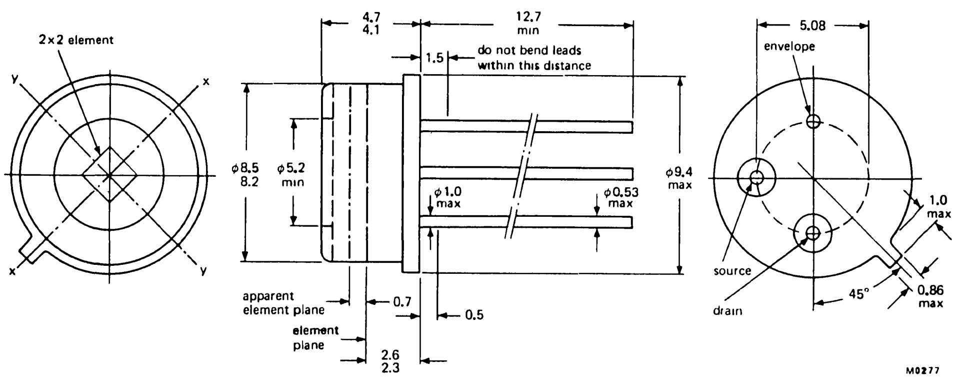
		RPY88	RPY89	
Spectral Response		6.5 ± 0.5 to > 14	1.0 to > 15	μm
Responsivity		(10 μm, 10)	(6 μm, 10)	
	typ.	300	250	VW^{-1}
Noise Equivalent Power (N.E.P.),		(10 μm, 10, 1)	(6 μm, 10, 1)	
	typ.	1.65×10^{-9}	2.0×10^{-9}	$WHz^{-1/2}$
Element dimensions		2 x 2		mm
Field of View	typ.	110		degrees
Operating voltage		9		V
Optimum operating frequency range		0.1 to 1000		Hz

This data must be read in conjunction with GENERAL SAFETY RECOMMENDATIONS – OPTOELECTRONIC DEVICES

MECHANICAL DATA

Dimensions in mm

SOT-49E (low profile TO-5)



PRODUCT SAFETY

Modern high technology materials have been used in the manufacture of this device to ensure high performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the device is heated to destruction. Disposal of large quantities should therefore be carried out in accordance with the latest local legislation.

SOLDERING

1. When making soldered connections to the leads, a thermal shunt should be used.
2. It is essential that any mains operated soldering iron should be both screened and earthed. Failure to observe these precautions could lead to the introduction of line voltage and possible damage to the device.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Supply voltage	max.	30	V
Temperature, operating	max.	+100	°C
	min.	−40	°C
Temperature, storage	max.	+100	°C
	min.	−40	°C
Lead soldering temperature, ⩾ 6 mm from header, t_{sld} ⩽ 3 s	max.	+350	°C

CHARACTERISTICS (at 25 ± 3 °C and with recommended circuit)

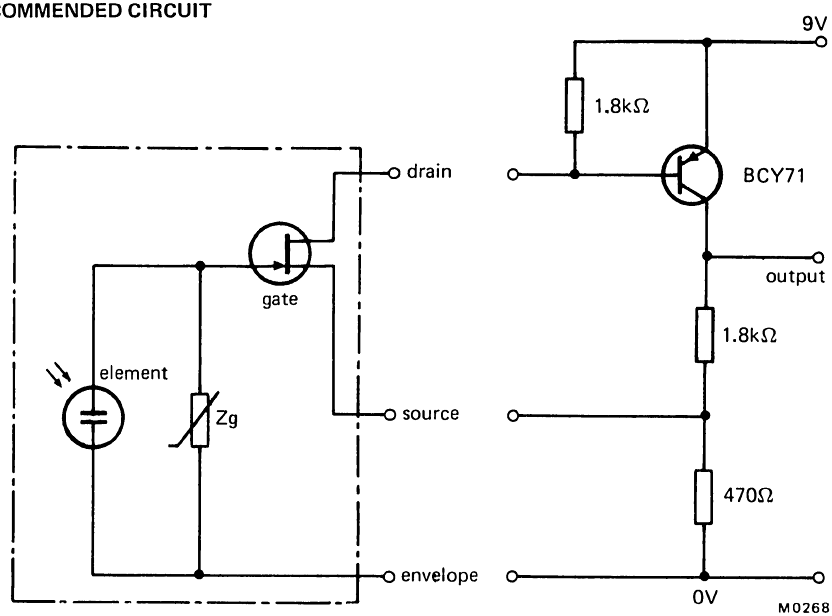
RPY88		min.	typ.	max.	
Spectral Response		6.5 ± 0.5	–	> 14	µm
Responsivity (10 µm, 10)	notes 1 and 4	225	300	–	VW^{-1}
N.E.P. (10 µm, 10, 1)	notes 1 and 4	–	1.65×10^{-9}	3×10^{-9}	$WHz^{-½}$
Field of View	note 2	–	110	–	degrees
Operating voltage	note 3	8	9	10	V

RPY89		min.	typ.	max.	
Spectral Response		1	–	> 15	µm
Responsivity (500 K, 10) or (6 µm, 10)	notes 1 and 4	200	250	–	VW^{-1}
N.E.P. (500 K, 10, 1) or (6 µm, 10, 1)	notes 1 and 4	–	2.0×10^{-9}	3×10^{-9}	$WHz^{-½}$
Field of View	note 2	–	110	–	degrees
Operating voltage	note 3	8	9	10	V

Notes

1. These characteristics apply throughout the spectral response range.
2. Field of view to 50% of the maximum responsivity level.
3. The detector will operate outside the quoted range but may have a degraded performance.
4. For performance as a function of frequency and temperature, see pages 6 to 9.

RECOMMENDED CIRCUIT



OPERATING NOTES

1. The case potential must not be allowed to become positive with respect to the other two terminals.
2. It is inadvisable to operate the detector at mains related frequencies.
3. To avoid the possibility of optical microphony, the detector must be firmly mounted
4. An increase in temperature of the element will produce a negative going signal at the output.
5. Use recommended circuit for low noise operation.
6. For simplicity of operation, a source follower may be used where noise is not a problem. This may be achieved with a 22 kΩ resistor between source and envelope with the positive supply taken to the drain terminal. This will give a voltage gain of approximately 0.9.

DEFINITIONS

1. Responsivity VW^{-1}

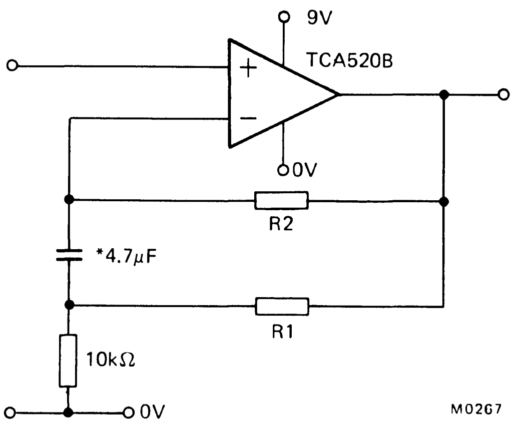
   This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped radiant power.

2. N.E.P. (Noise Equivalent Power), $WHz^{-1/2}$

   This is the r.m.s. value of the incident, chopped radiant power necessary to produce an r.m.s. signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth $VHz^{-1/2}$.

APPLICATION INFORMATION

1. Optional additional stage for extra gain



Recommended component values for various gains

Gain x	R_1 kΩ	R_2 MΩ
50	560	5.6
20	220	2.2
10	100	1.0

*this capacitor must be a low leakage type e.g. our 344 series.

2. Temperature slew

The FET used with a pyroelectric detector requires a gate leakage resistor to earth in parallel with the element. This stabilizes its working point. The pyroelectric voltage appearing across this resistor is proportional to the rate of change of temperature.
To ensure a low level of noise current from this resistor, its value should be of the order of 3×10^{10} Ω. When the temperature slew rate is 1 °C/minute, the pyroelectric voltage produced is 1 volt. In a system which is designed to sense microvolts, this is almost certain to cause overload and any a.c. signal superimposed on this d.c. shift will be lost.
Our detectors incorporate a bleed system which acts progressively on the d.c. shift caused by temperature slew. The law is logarithmic.
Thus a slew rate of 0.1 °C/minute may produce on offset across the sensing element of 200 millivolts, 1 °C/minute 280 millivolts and 10 °C/minute 360 millivolts.

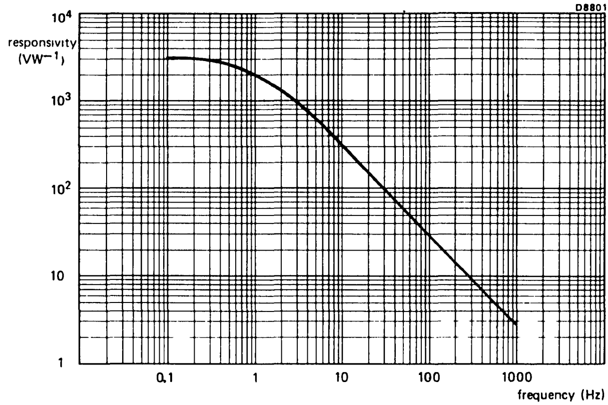
MECHANICAL AND ENVIRONMENTAL STANDARDS

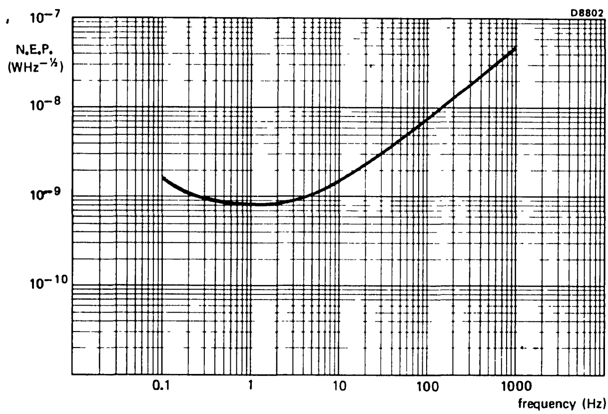
As part of the Quality Assurance programme, the detectors are assessed at regular intervals against the requirements of the following IEC standards. The frequency of testing and the limits and conditions for the pre- and post-test measurements are based on those stipulated for the CECC 50 000 series of approved transistors.

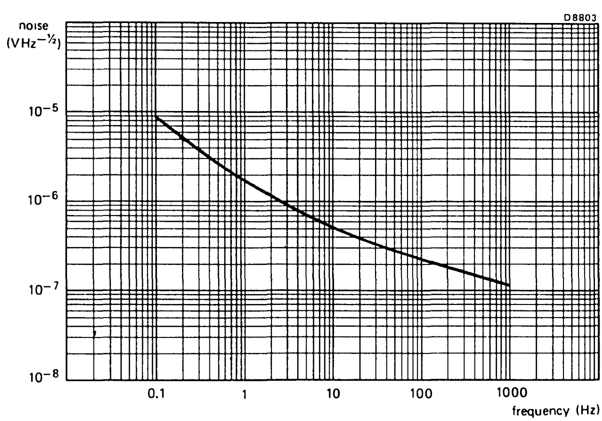
	Test		Severity	Duration	Note
IEC 68-2-3	Ca	Damp Heat, steady state	+40 °C, 95% RH	168 hours	1
68-2-20	Ta	Solderability	+235 °C, 1.5 mm from header	5 seconds	1
68-2-21	Ub	Lead Fatigue	4 cycles	–	1
68-2-1	A	Low Temperature Storage	–40 °C	2000 hours	2
68-2-2	Ba	High Temperature Storage	+100 °C	2000 hours	2
68-2-14	Nb	Change of Temperature	–40 °C to +100 °C	10 cycles	2
68-2-6	Fc (B4)	Vibration, swept frequency	125 Hz to 2 kHz 196 ms^{-2}	2 h in each orientation	2
68-2-7	Ga	Acceleration, steady state	196000 ms^{-2}	60 seconds	2
68-2-27	Ea	Shock	14700 ms^{-2}	3 pulses 6 orientations	2
68-2-20	Tb	Resistance to Solder Heat	+350 °C, 6 mm from header	3 seconds	3

Notes

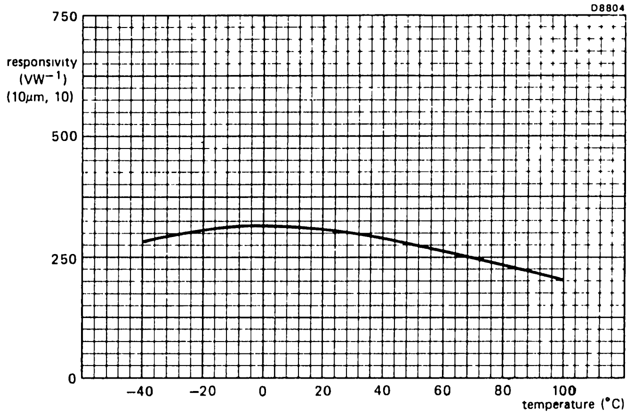
1. The detectors are checked on a production batch release principle at approximately weekly intervals. This is equivalent to Group B.
2. The detectors are checked at quarterly intervals. This is equivalent to Group C.
3. This is an annual check.

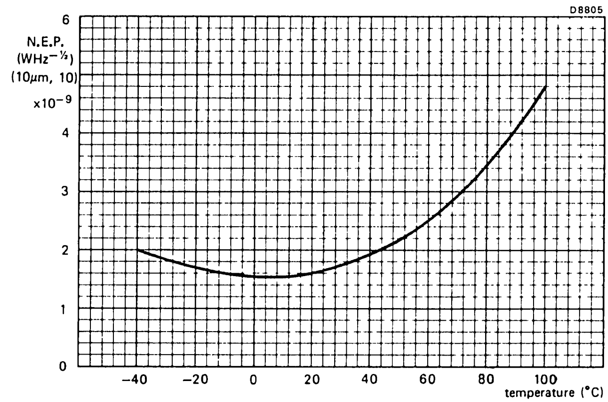


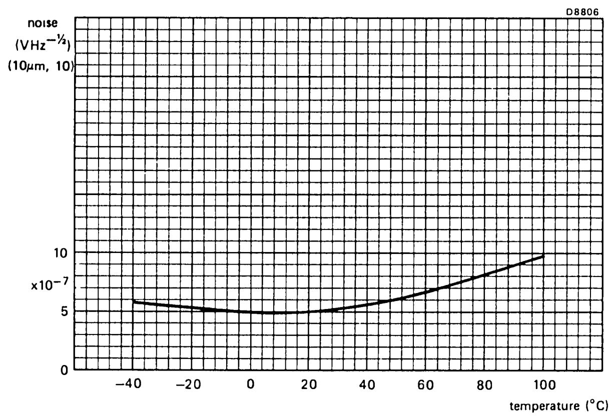




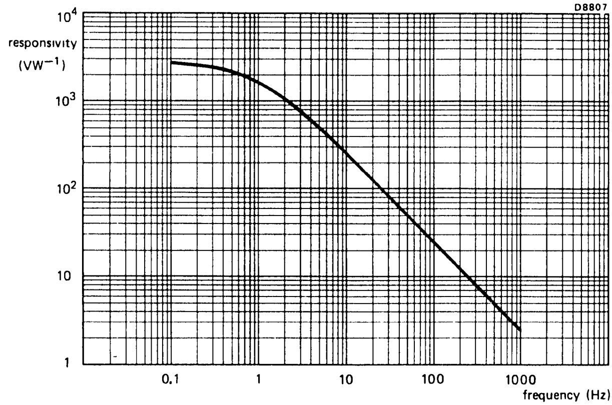
RPY88, typical Responsivity, N.E.P., and Noise as functions of Frequency

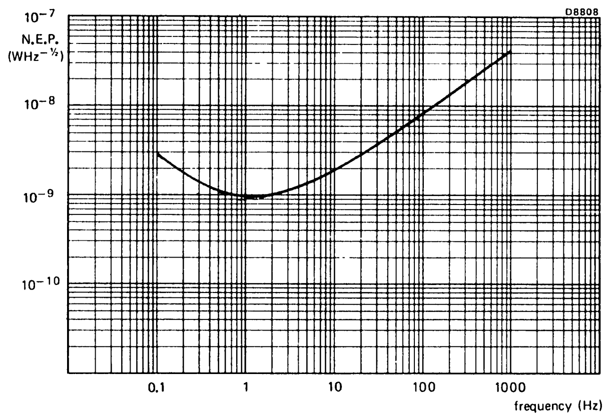


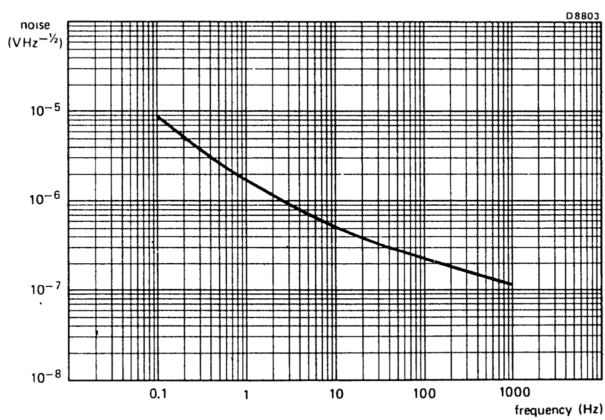




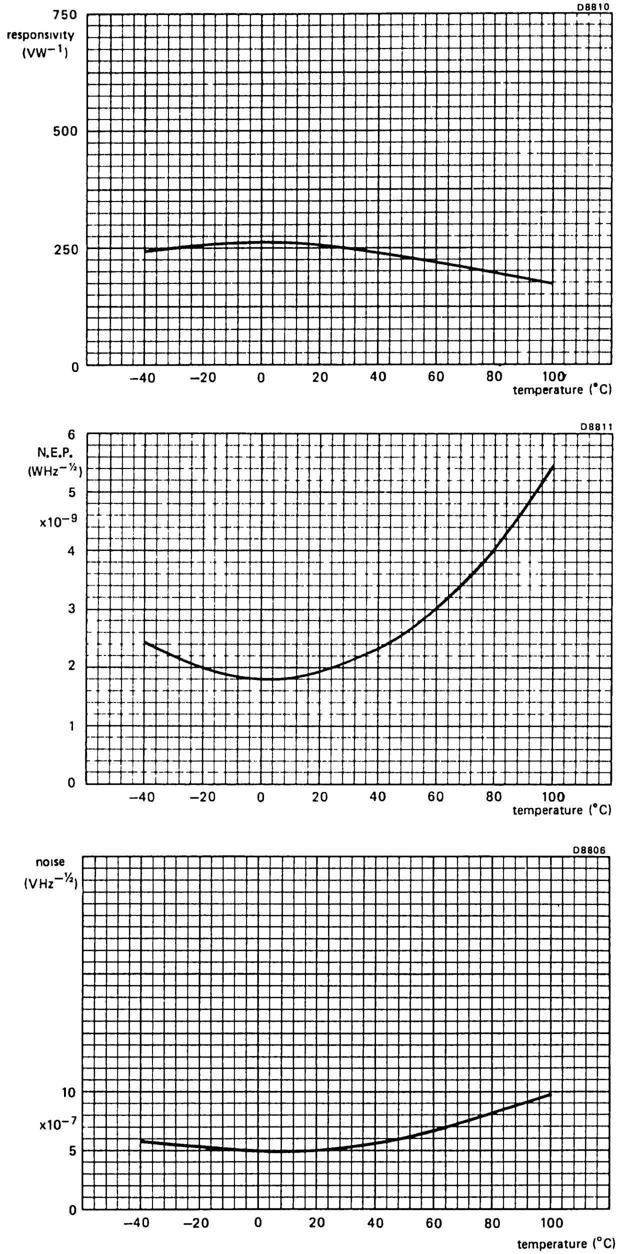
RPY88, typical Responsivity, N.E.P., and Noise as functions of Temperature





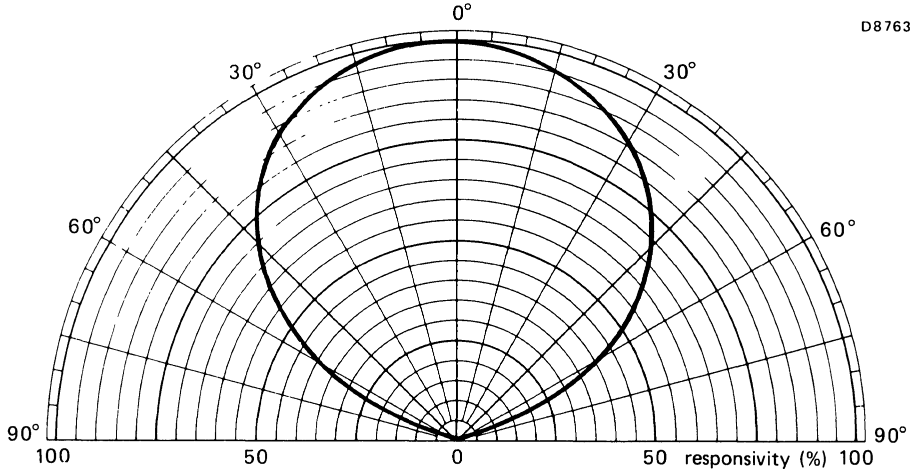


RPY89. typical Responsivity, N.E.P., and Noise as functions of Frequency

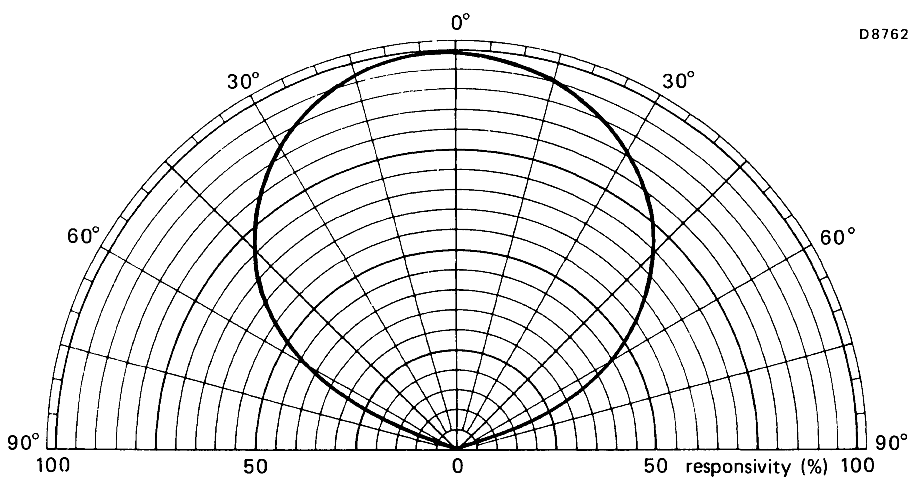


RPY89, typical Responsivity, N.E.P., and Noise as functions of Temperature

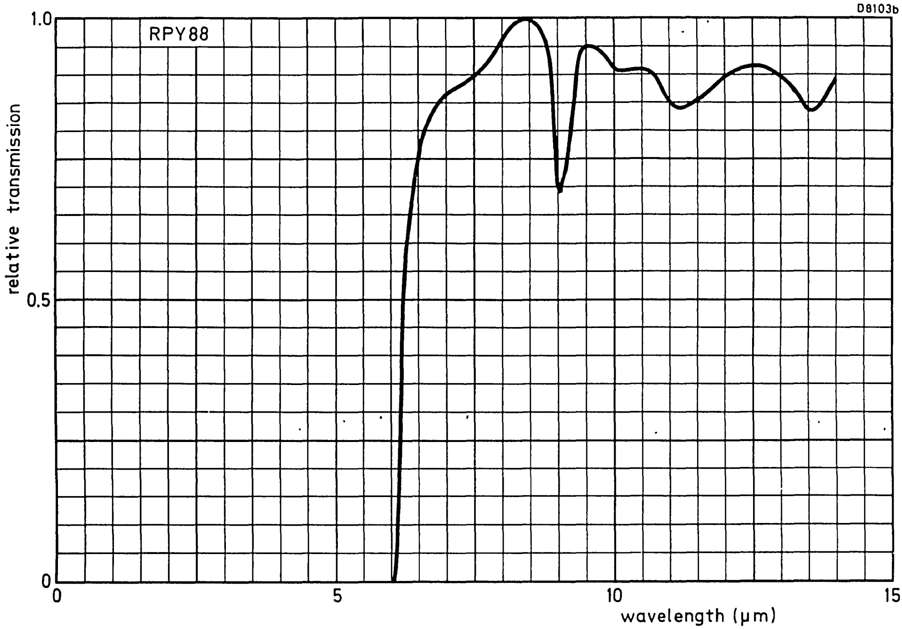
POLAR DIAGRAMS

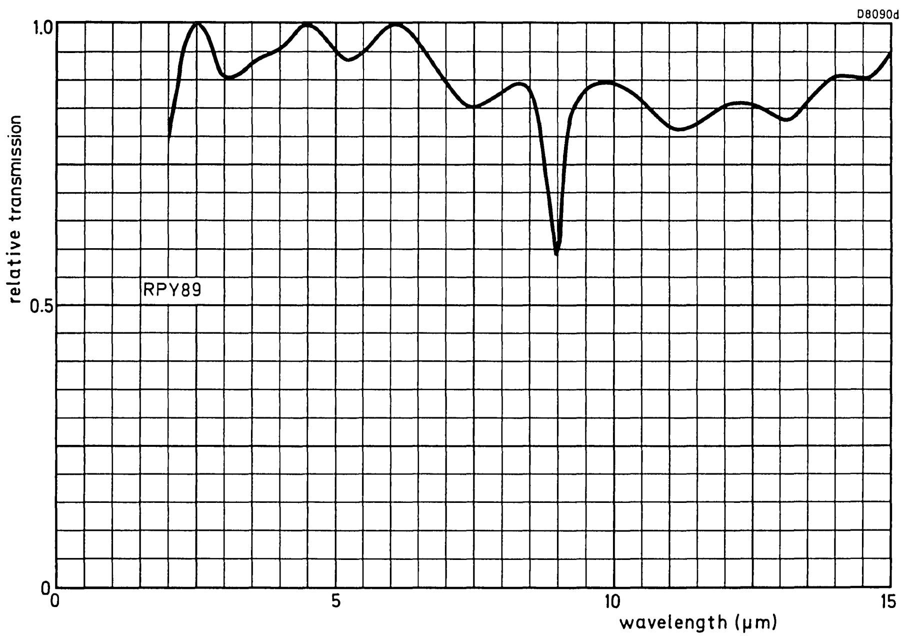


Typical Field of View in x-x plane (see Mechanical Data)



Typical Field of View in y-y plane (see Mechanical Data)





Typical normalized window transmission characteristics

LATGS PYROELECTRIC INFRARED DETECTORS

This series of pyroelectric infrared detectors is designed to replace conventional bolometers. The sensitive material is L-alanine doped triglycine sulphate* (LATGS) which operates at room temperature and has a good broadband performance. Each device has a 2.0 x 0.5 mm sensitive area and is available with a selection of window materials giving a range of spectral performance. A pre-amplifer with short circuit protection is incorporated.

QUICK REFERENCE DATA

	Window material	Spectral response μm	Window description
RPY90A	caesium iodide	1 to 70	transparent, hygroscopic, soft
RPY90C	KRS-5	1 to 40	non-hygroscopic, toxic
RPY90D	silicon (AR coated – optimized for 8 to 14 μm use).	1.2 to 15	non-hygroscopic
RPY90E	sapphire	1 to 6.5	transparent, non-hygroscopic

N.E.P.** (500K, 10, 1)	RPY90A	typ.	1.0×10^{-10}	$WHz^{-½}$
Responsivity (500K, 10)	RPY90A	typ.	8.0×10^{3}	VW^{-1}
Recommended operating voltage			9	V
Operating frequency range			10 to 1000	Hz
Optimum operating temperature range			–20 to +45	^{o}C
Field of view			> 60	degrees

This data must be read in conjunction with GENERAL SAFETY RECOMMENDATIONS – OPTOELECTRONIC DEVICES

PRODUCT SAFETY

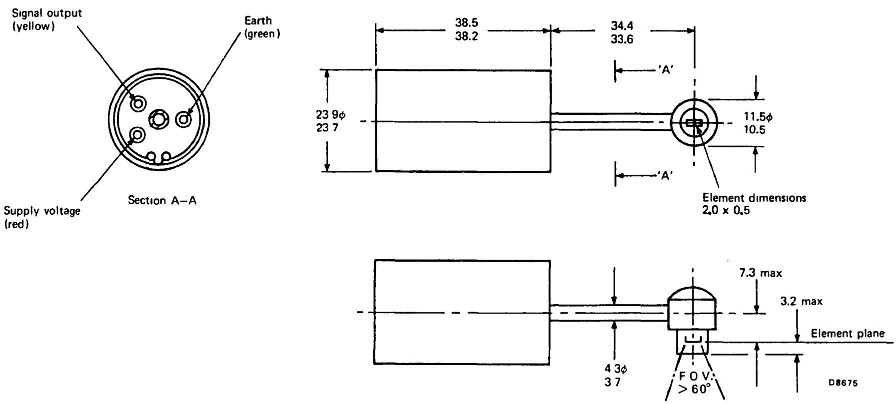
Modern high technology materials have been used in the manufacture of this device to ensure high performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the device is heated to destruction. Disposal of large quantities should therefore be carried out in accordance with the Deposit of Poisonous Waste Act 1972 and the Control of Pollution Act 1974, or with the latest legislation.

* LATGS cuts off below $\lambda = 1$ μm, where incident energy is no longer absorbed.

** Noise Equivalent Power

MECHANICAL DATA

Dimensions in mm



Three female connectors are supplied with each device to fit Sealectro feed throughs type no. FT SM 14.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Supply voltage	max.	+18	V
Supply current	max.	10	mA
Ambient operating temperature		−20 to +45	°C
Storage temperature		−20 to +55	°C

CHARACTERISTICS at T_{amb} = 20 °C, using a 500 K black body source

		RPY90A	C	D	E		
N.E.P. (500 K, 10, 1)	typ.	1.0	1.3	1.6	3.0	$\times 10^{-10}$	$WHz^{-1/2}$
	<	1.5	2.0	2.4	4.5	$\times 10^{-10}$	$WHz^{-1/2}$
Responsivity (500 K, 10)*	typ.	8.0	6.2	5.0	2.7	$\times 10^{3}$	VW^{-1}
Noise per unit bandwidth at 10 Hz	typ.	0.8	0.8	0.8	0.8		$\mu VHz^{-1/2}$
Output voltage (d.c.level)	>	2	2	2	2		V
	typ.	3	3	3	3		V
	<	8	8	8	8		V
Output impedance	<	4	4	4	4		kΩ
Element dimensions		all types: 2.0 x 0.5					mm
Field of view		all types: > 60					degrees
Operating voltage range		all types: 8 to 10					V
Supply current		all types: up to 10					mA

*These detectors can also be supplied with an integral frequency compensated amplifier similar to that described under Application Information. This would, for example, increase the responsivity by up to x 100 with an amplifier designed to give a flat response to 20 Hz.

OPERATING NOTES

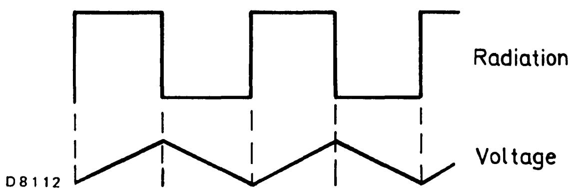
1. The detector is supplied with a black plastic cap to protect the window. This cap must be removed before operation.
2. The shape of the electrical output waveform is the integral of the incident radiation waveform.
3. It is inadvisable to operate the detector at mains related frequencies.
4. To avoid the possibility of optical microphony, the detector must be firmly mounted.
5. An increase in temperature of the element will produce a negative going signal at the output.
6. Provided that the operating voltage does not exceed 10 V, the maximum time for the output to be short-circuited (to the supply or common rail) is unlimited.

DEFINITIONS

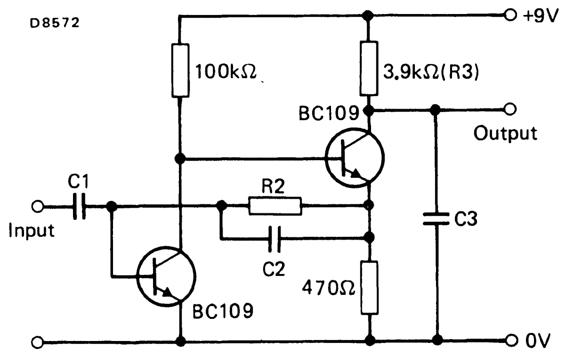
1. N.E.P. (Noise Equivalent Power), $WHz^{-1/2}$
   This is the r.m.s. value of the incident, chopped, radiant power necessary to produce an r.m.s. signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth $VHz^{-1/2}$.
2. Responsivity VW^{-1}
   This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped, radiant power.

APPLICATION INFORMATION

1. The pyroelectric element may be considered as a capacitor whose charge state changes with temperature. It also behaves as a normal capacitor, i.e. its voltage changes with charge. Thus a change of temperature results in a change of voltage. It can be seen that, for a given change in amplitude of incident radiation, the resulting change in temperature will decrease as the chopping frequency increases. Thus the voltage change will also decrease with frequency. In addition, there is a 90° phase lag between the thermal and electrical signals. The voltage signal therefore becomes the integral of the radiation signal.



2. Frequency compensating amplifier
The following circuit is designed to be connected directly to the detector output and may be used to compensate for the falling responsivity characteristic with frequency. It is a simple 'virtual earth' amplifier which uses a series input capacitor to provide increasing current through the feedback resistor R_2 with increasing frequency. The time constants R_2 C_2 and R_3 C_3 are chosen to coincide with R_1 C_1, where R_1 is the output impedance of the detector ($<$4.0 kΩ).

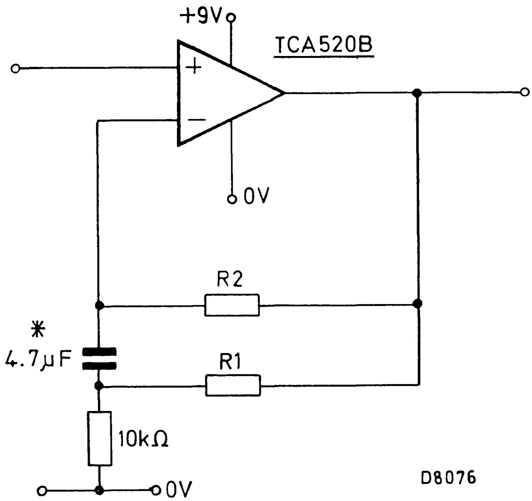


The table below gives recommended component values for various roll-off frequencies (approx. −3 dB point).

Frequency Hz	C_1 C_3 nF	R_2 kΩ	C_2 nF
30	680	330	10
300	68	220	1.5
600	33	330	0.47
1500	15	68	1.0
3000	15	82	0.47
4500	4.7	68	0.33

With this circuit the original shape of the radiation waveform is restored at the output for chopping frequencies sensibly lower than the roll-off frequency.

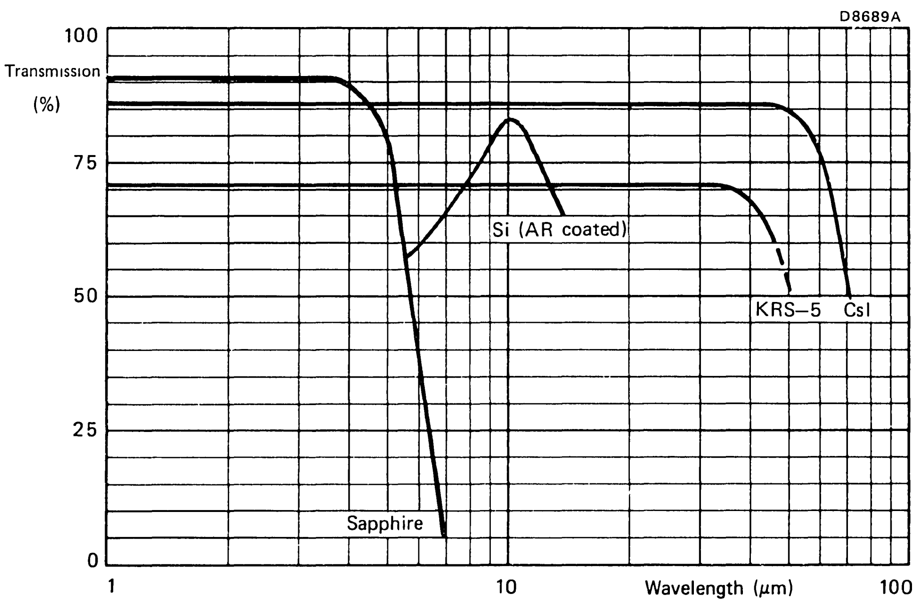
3. Additional stage for extra gain which may be connected directly to the detector output or to the output of the frequency compensating amplifier.



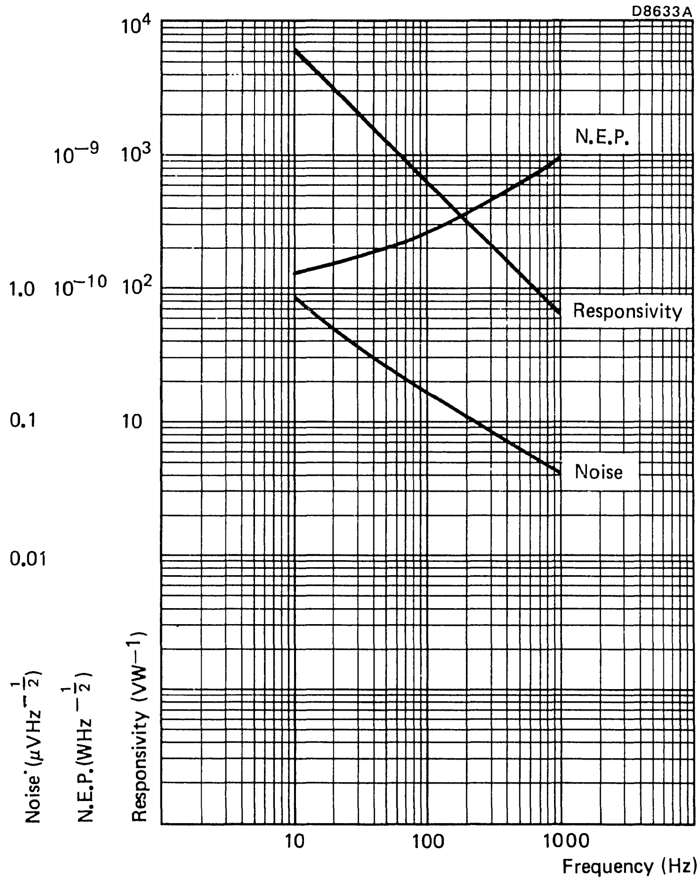
Recommended component values for various gains

Gain x	R_1 kΩ	R_2 MΩ
50	560	5.6
20	220	2.2
10	100	1.0

*this capacitor must be a low leakage type, e.g. our 344 series

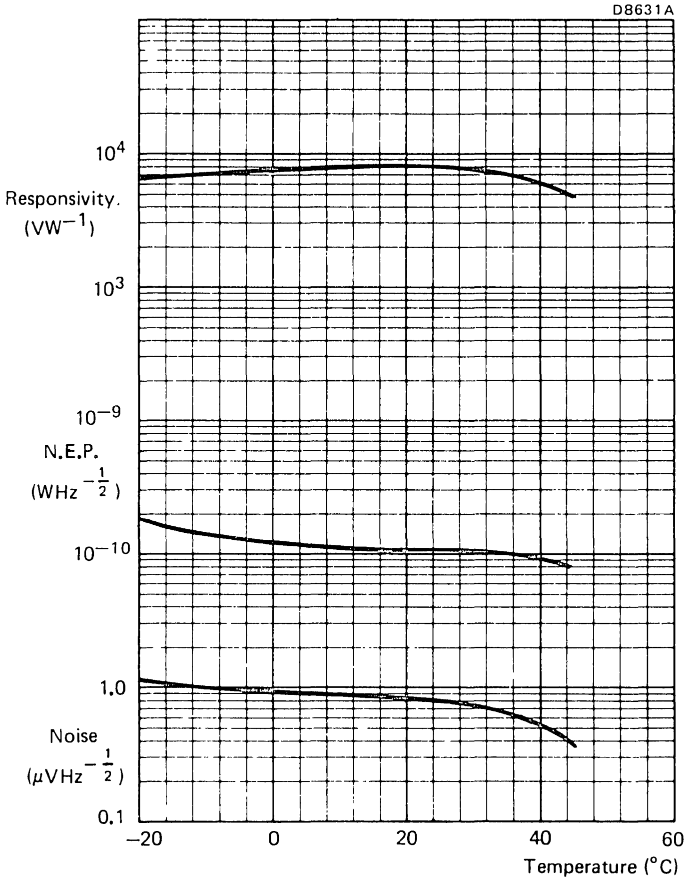


Typical window transmission characteristics.



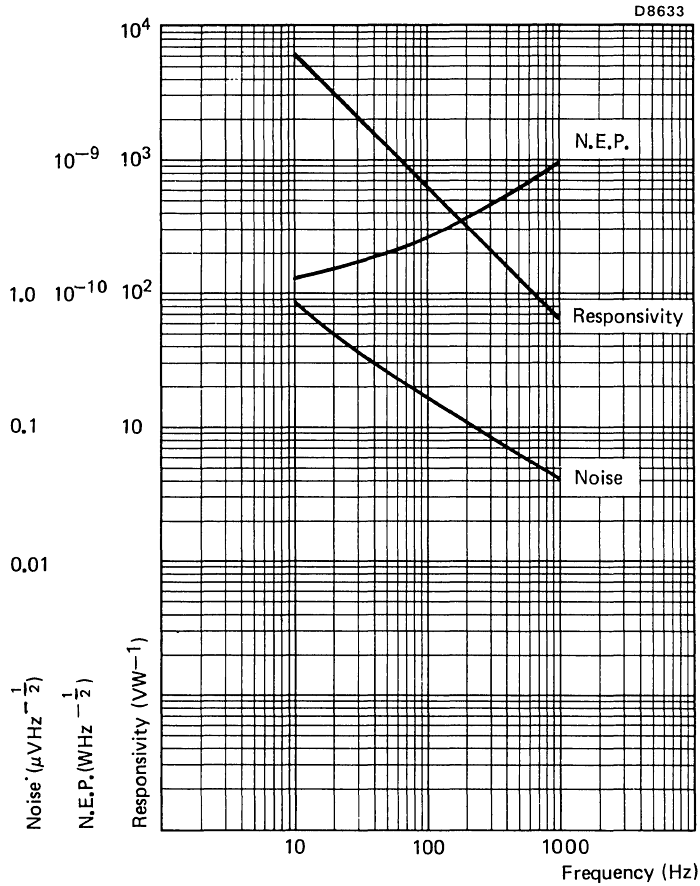
RPY90A

Typical 500 K black body performance as a function of frequency



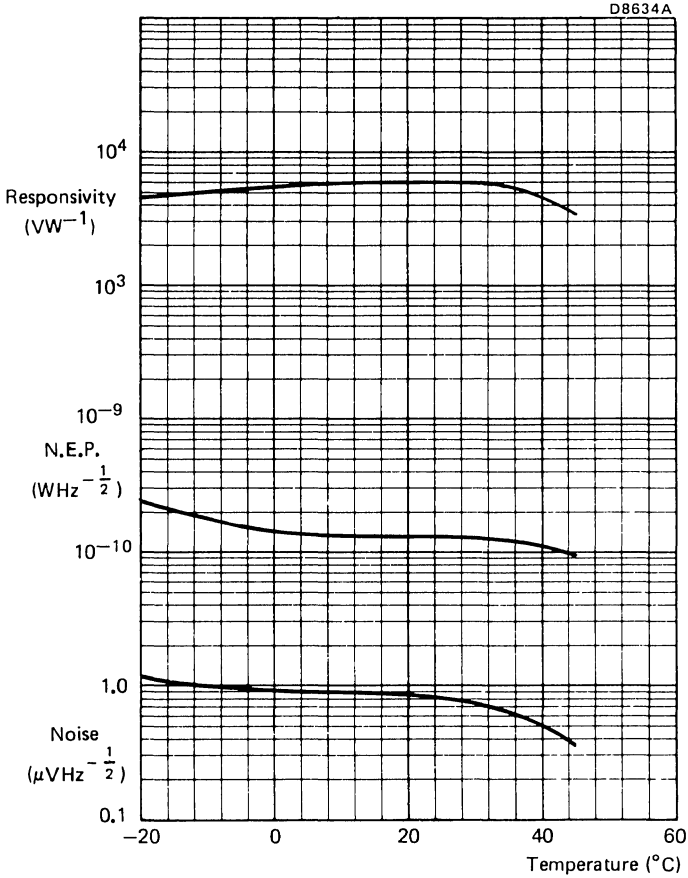
RPY90A

Typical 500 K black body performance as a function of temperature



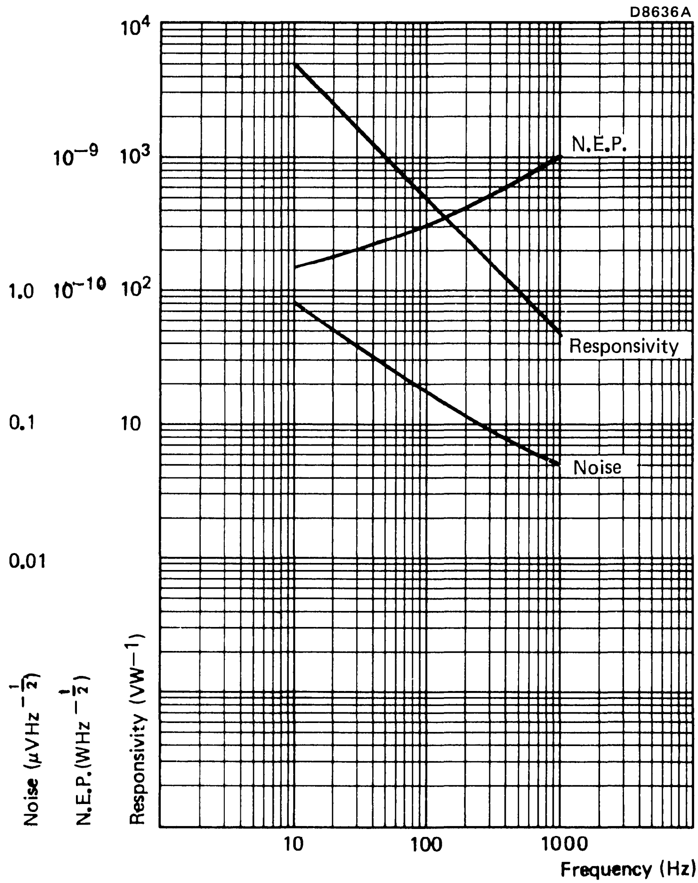
RPY90C

Typical 500 K black body performance as a function of frequency



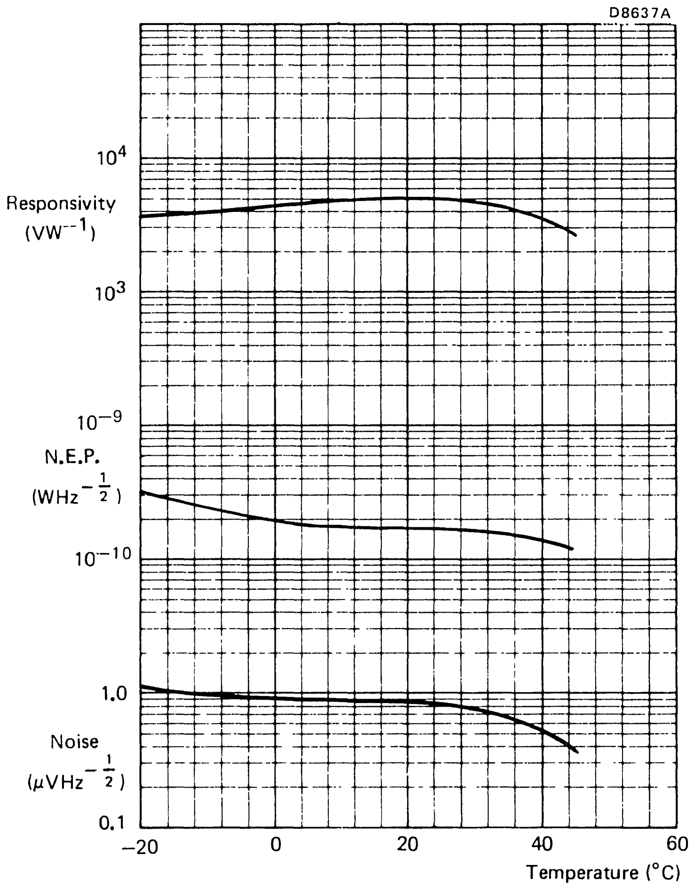
RPY90C

Typical 500 K black body performance as a function of temperature



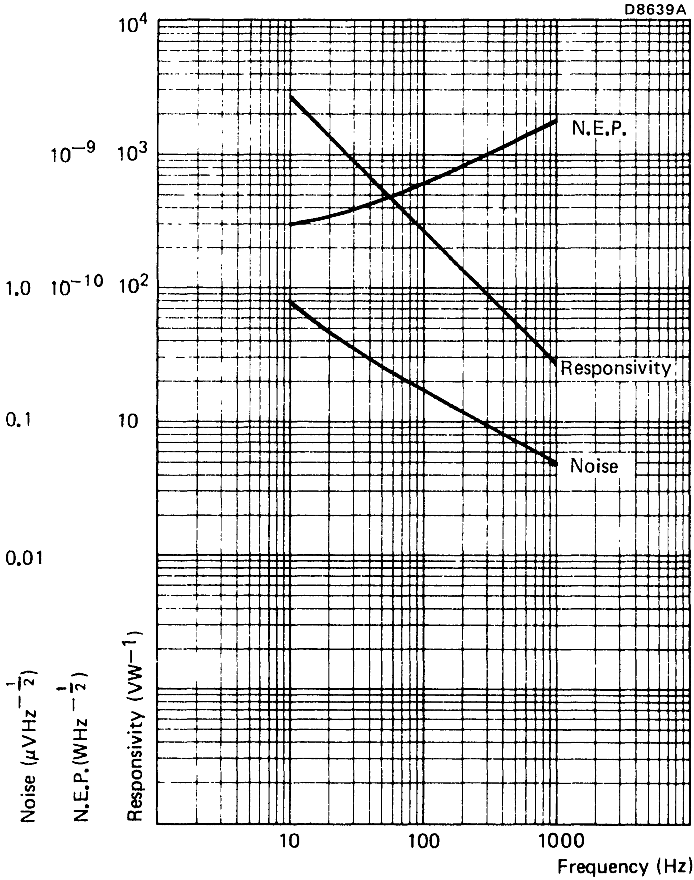
RPY90D

Typical 500 K black body performance as a function of frequency



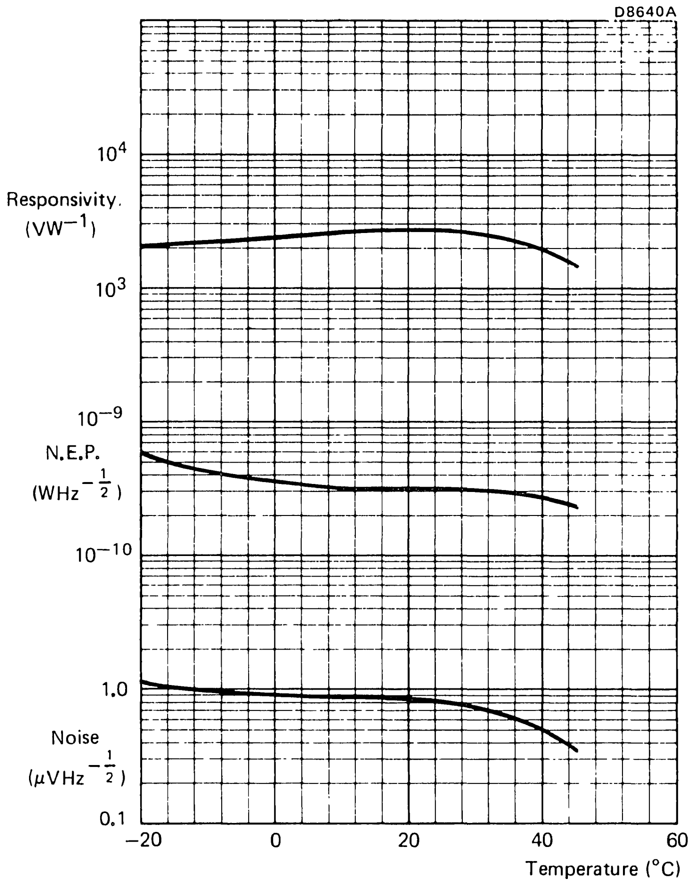
RPY90D

Typical 500 K black body performance as a function of temperature



RPY90E

Typical 500 K black body performance as a function of frequency



RPY90E

Typical 500K black body performance as a function of temperature

LATGS PYROELECTRIC INFRARED DETECTORS

This series of pyroelectric infrared detectors is designed to replace conventional bolometers. The sensitive material is L-alanine doped triglycine sulphate* (LATGS) which operates at room temperature and has a good broadband performance. Each device has a 2.75 x 1.25 mm sensitive area and is available with a selection of window materials giving a range of spectral performance. A pre-amplifier with short circuit protection is incorporated.

QUICK REFERENCE DATA

	Window material	Spectral response μm	Window description
RPY91A	caesium iodide	1 to 70	transparent, hygroscopic, soft
RPY91C	KRS-5	1 to 40	non-hygroscopic, toxic
RPY91D	silicon (AR coated—optimized for 8 to 14 μm use).	1.2 to 15	non-hygroscopic
RPY91E	sapphire	1 to 6.5	transparent, non-hygroscopic

N.E.P.** (500K, 10, 1)	RPY91A	typ.	1.5×10^{-10}	$WHz^{-1/2}$
Responsivity (500K, 10)	RPY91A	typ.	6.5×10^{3}	VW^{-1}
Recommended operating voltage			9	V
Operating frequency range			10 to 1000	Hz
Optimum operating temperature range			−20 to +45	°C
Field of view			> 60	degrees

This data must be read in conjunction with GENERAL SAFETY RECOMMENDATIONS – OPTOELECTRONIC DEVICES

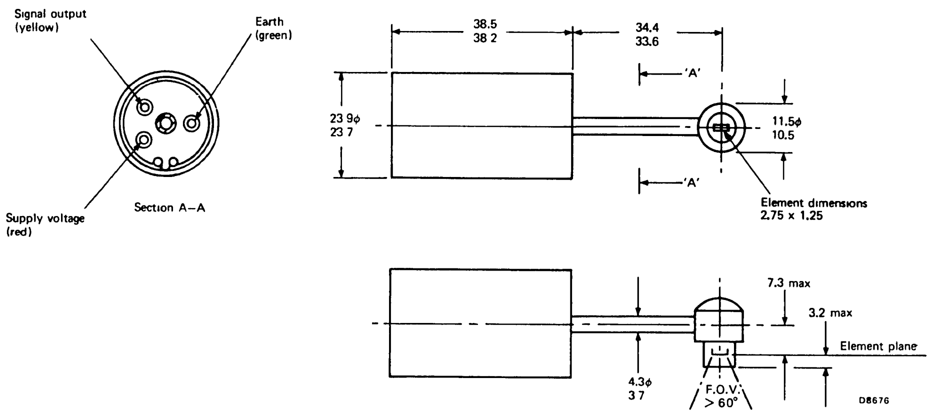
PRODUCT SAFETY

Modern high technology materials have been used in the manufacture of this device to ensure high performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the device is heated to destruction. Disposal of large quantities should therefore be carried out in accordance with the Deposit of Poisonous Waste Act 1972 and the Control of Pollution Act 1974, or with the latest legisation.

* LATGS cuts off below λ = 1 μm, where incident energy is no longer absorbed.

** Noise Equivalent Power

MECHANICAL DATA Dimensions in mm



Three female connectors are supplied with each device to fit Sealectro feed throughs type no. FT SM 14.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Supply voltage	max.	+18	V
Supply current	max.	10	mA
Ambient operating temperature		−20 to +45	°C
Storage temperature		−20 to +55	°C

CHARACTERISTICS at T_{amb} = 20 °C, using a 500 K black body source

		RPY91A	C	D	E		
N.E.P. (500 K, 10, 1)	typ.	1.5	2.0	2.5	4.5	$\times 10^{-10}$	$WHz^{-1/2}$
	<	3.0	4.0	5.0	9.0	$\times 10^{-10}$	$WHz^{-1/2}$
Responsivity (500 K, 10)*	typ.	6.5	5.0	4.0	2.3	$\times 10^{3}$	VW^{-1}
Noise per unit bandwidth at 10 Hz	typ.	1.0	1.0	1.0	1.0		$\mu VHz^{-1/2}$
Output voltage (d.c. level)	>	4	4	4	4		V
	typ.	6	6	6	6		V
	<	8	8	8	8		V
Output impedance	<	4	4	4	4		kΩ
Element dimensions		all types: 2.75 x 1.25					mm
Field of view		all types: > 60					degrees
Operating voltage range		all types: 8 to 10					V
Supply current		all types: up to 10					mA

*These detectors can also be supplied with an integral frequency compensated amplifier similar to that described under Application Information. This would, for example, increase the responsivity by up to x 100 with an amplifier designed to give a flat response to 20 Hz.

OPERATING NOTES

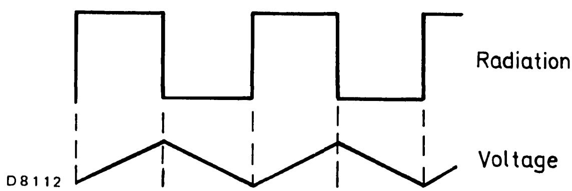
1. The detector is supplied with a black plastic cap to protect the window. This cap must be removed before operation
2. The shape of the electrical output waveform is the integral of the incident radiation waveform.
3. It is inadvisable to operate the detector at mains related frequencies.
4. To avoid the possibility of optical microphony, the detector must be firmly mounted.
5. An increase in temperature of the element will produce a negative going signal at the output.
6. Provided that the operating voltage does not exceed 10 V, the maximum time for the output to be short-circuited (to the supply or common rail) is unlimited.

DEFINITIONS

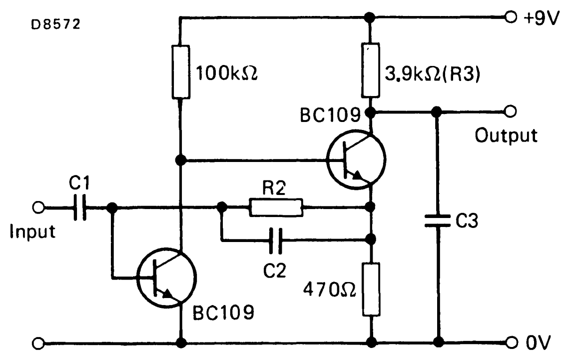
1. N.E.P. (Noise Equivalent Power) $WHz^{-1/2}$
   This is the r.m.s. value of the incident, chopped, radiant power necessary to produce an r.m.s. signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth $VHz^{-1/2}$.
2. Responsivity VW^{-1}
   This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped, radiant power.

APPLICATION INFORMATION

1. The pyroelectric element may be considered as a capacitor whose charge state changes with temperature. It also behaves as a normal capacitor, i.e. its voltage changes with charge. Thus a change of temperature results in a change of voltage. It can be seen that, for a given change in amplitude of incident radiation, the resulting change in temperature will decrease as the chopping frequency increases. Thus the voltage change will also decrease with frequency. In addition, there is a 90° phase lag between the thermal and electrical signals. The voltage signal therefore becomes the integral of the radiation signal.



2. Frequency compensating amplifier
The following circuit is designed to be connected directly to the detector output and may be used to compensate for the falling responsivity characteristic with frequency. It is a simple 'virtual earth' amplifier which uses a series input capacitor to provide increasing current through the feedback resistor R_2 with increasing frequency. The time constants $R_2\ C_2$ and $R_3\ C_3$ are chosen to coincide with $R_1\ C_1$, where R_1 is the output impedance of the detector (< 4.0 kΩ).

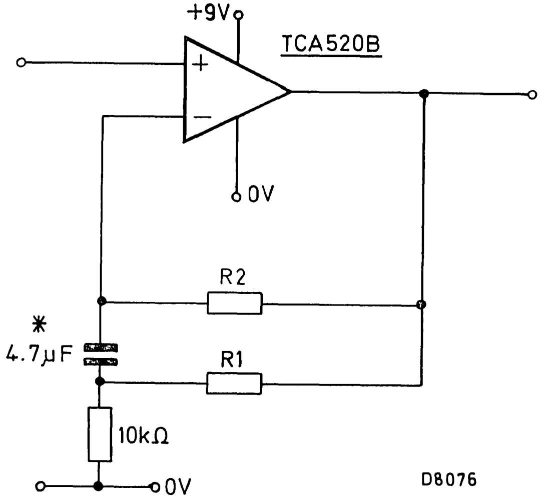


The table below gives recommended component values for various roll-off frequencies (approx. −3 dB point).

Frequency Hz	C_1 C_3 nF	R_2 kΩ	C_2 nF
30	680	330	10
300	68	220	1.5
600	33	330	0.47
1500	15	68	1.0
3000	15	82	0.47
4500	4.7	68	0.33

With this circuit the original shape of the radiation waveform is restored at the output for chopping frequencies sensibly lower than the roll-off frequency.

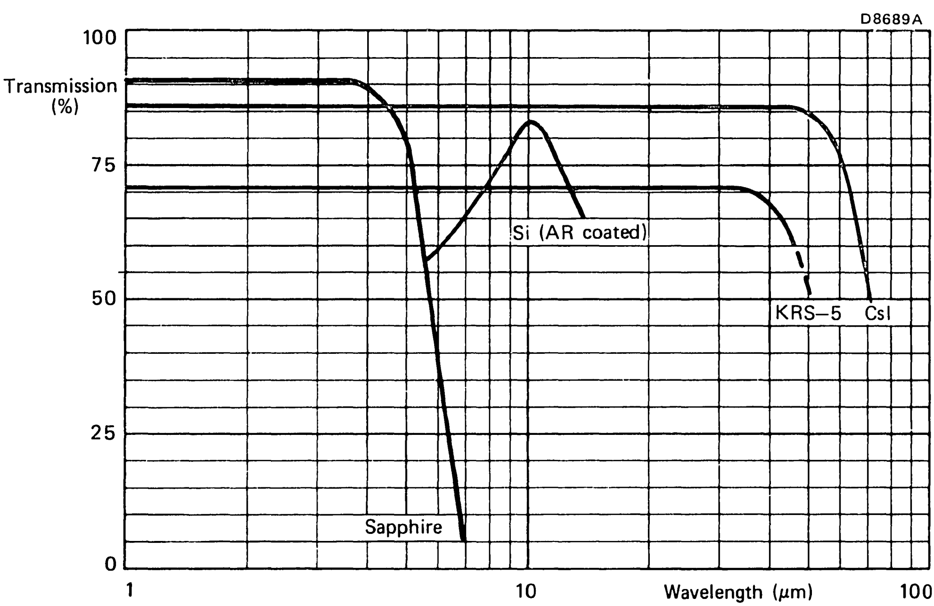
3. Additional stage for extra gain which may be connected directly to the detector output or to the output of the frequency compensating amplifer.



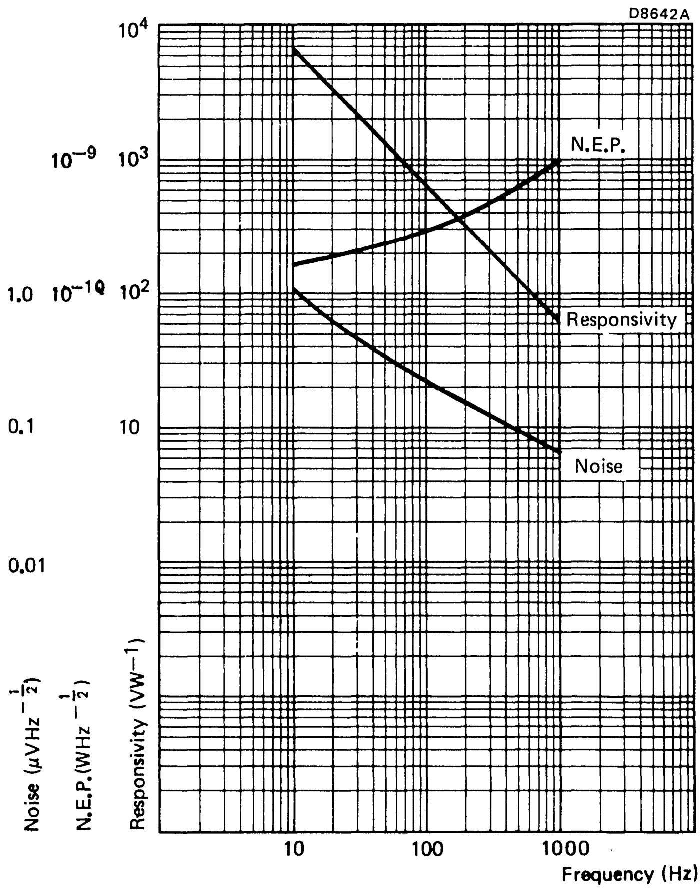
Recommended component values for various gains

Gain x	R_1 kΩ	R_2 MΩ
50	560	5.6
20	220	2.2
10	100	1.0

*this capacitor must be a low leakage type, e.g. our 344 series

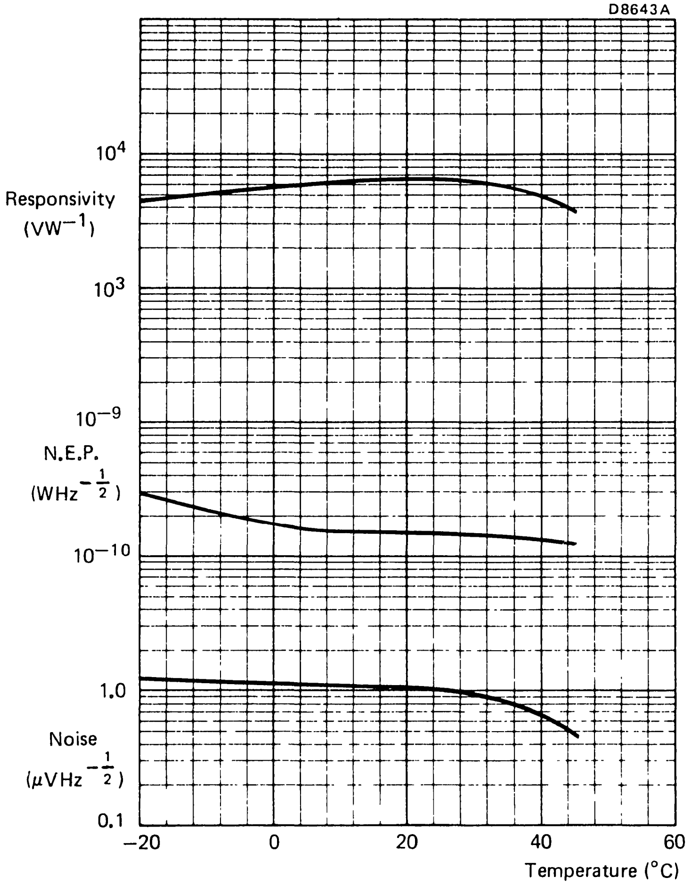


Typical window transmission characteristics.



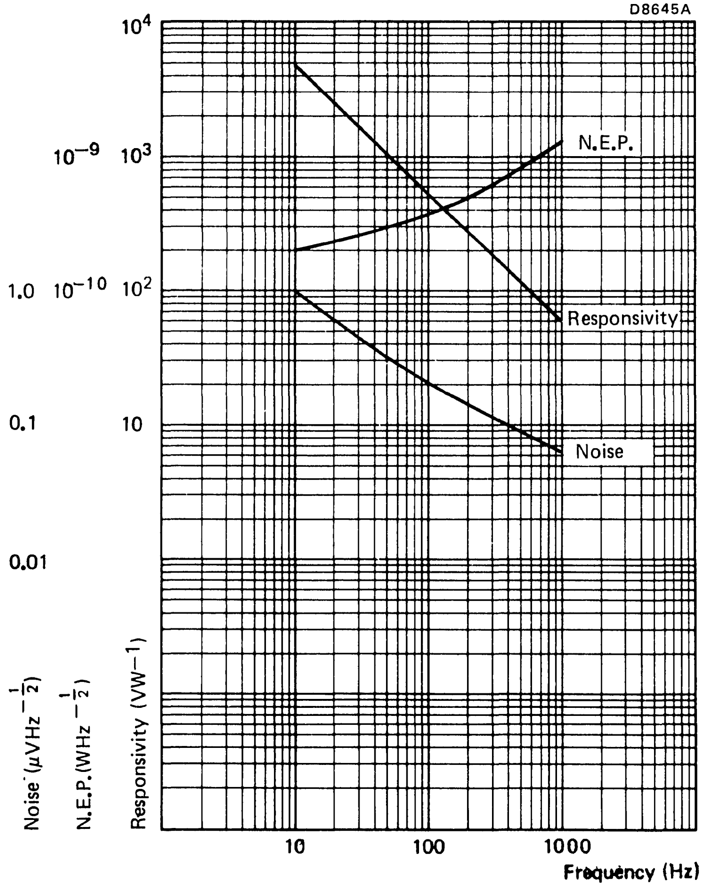
RPY91A

Typical 500K black body performance as a function of frequency



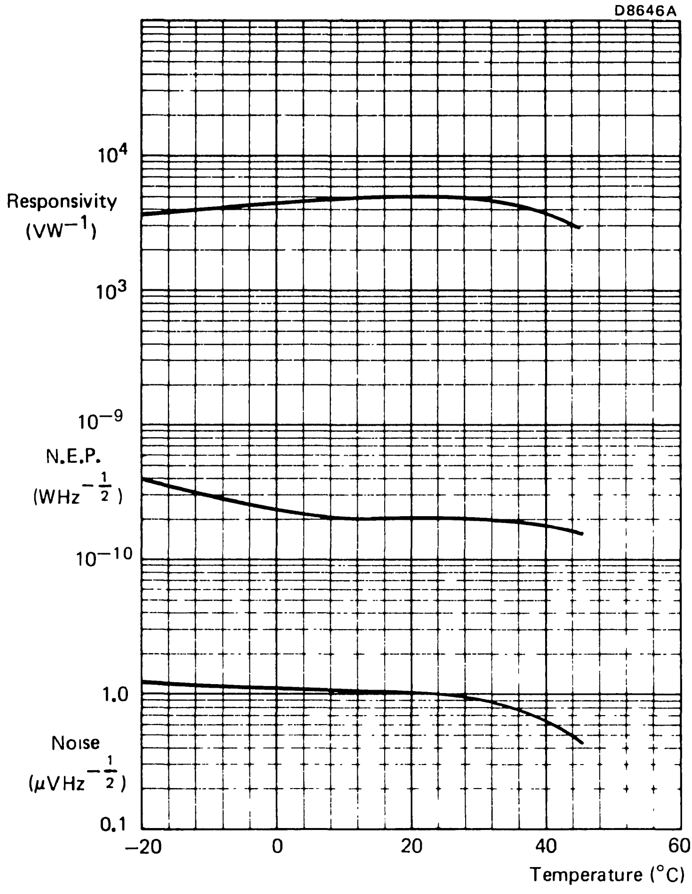
RPY91A

Typical 500K black body performance as a function of temperature



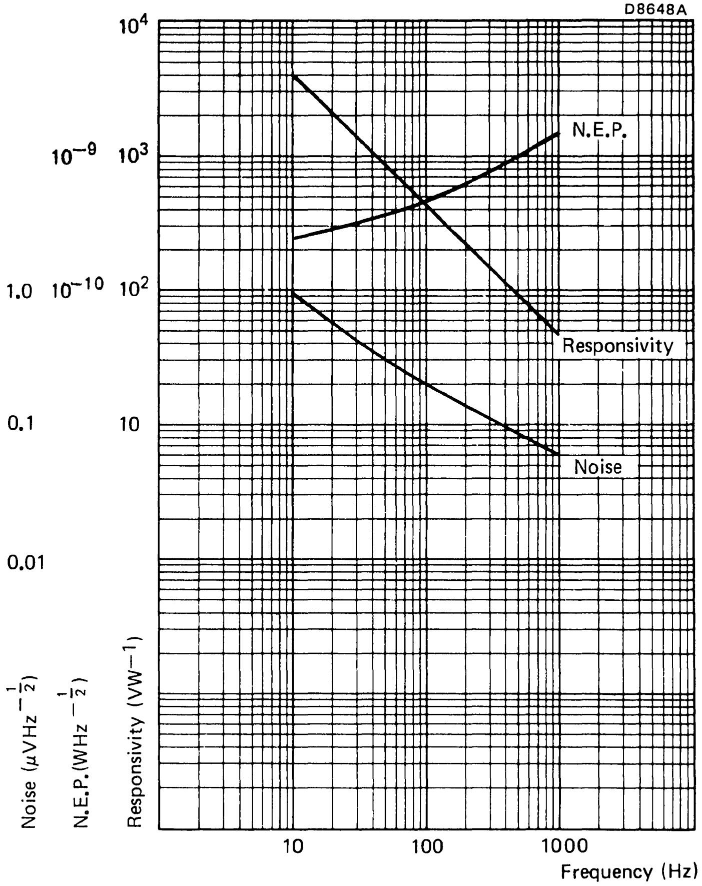
RPY91C

Typical 500K black body performance as a function of frequency



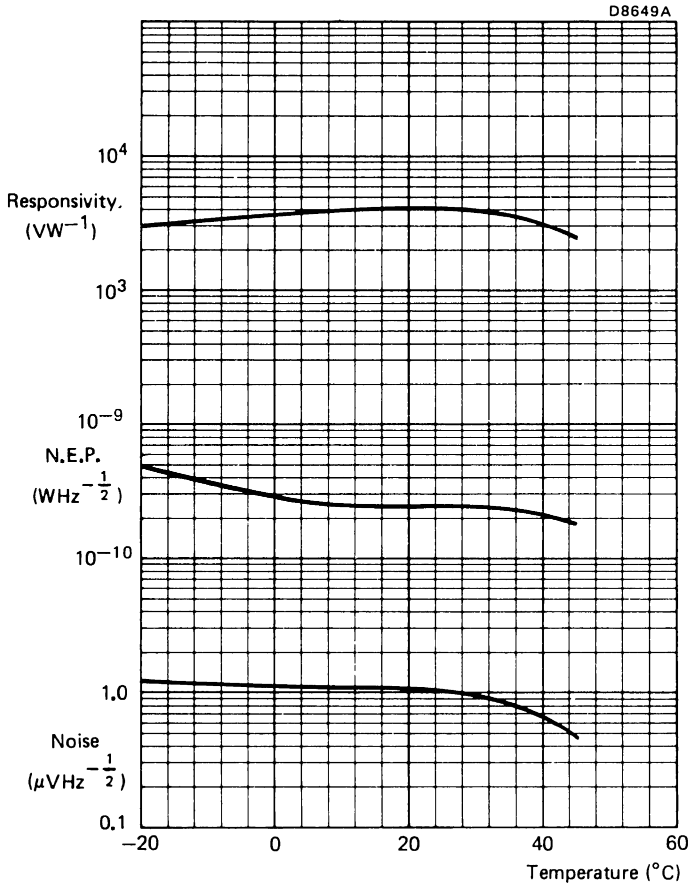
RPY91C

Typical 500K black body performance as a function of temperature



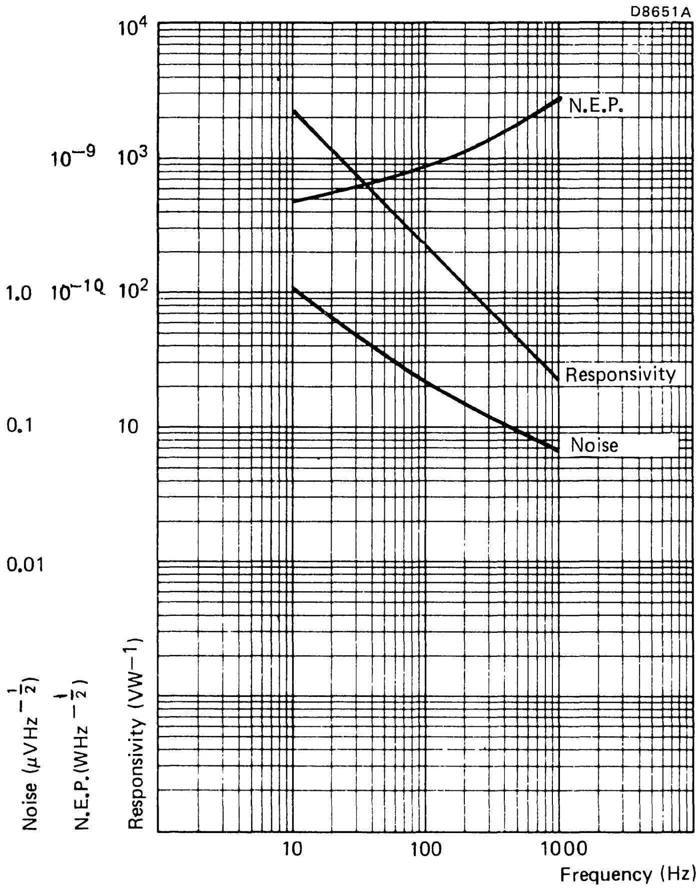
RPY91D

Typical 500K black body performance as a function of frequency



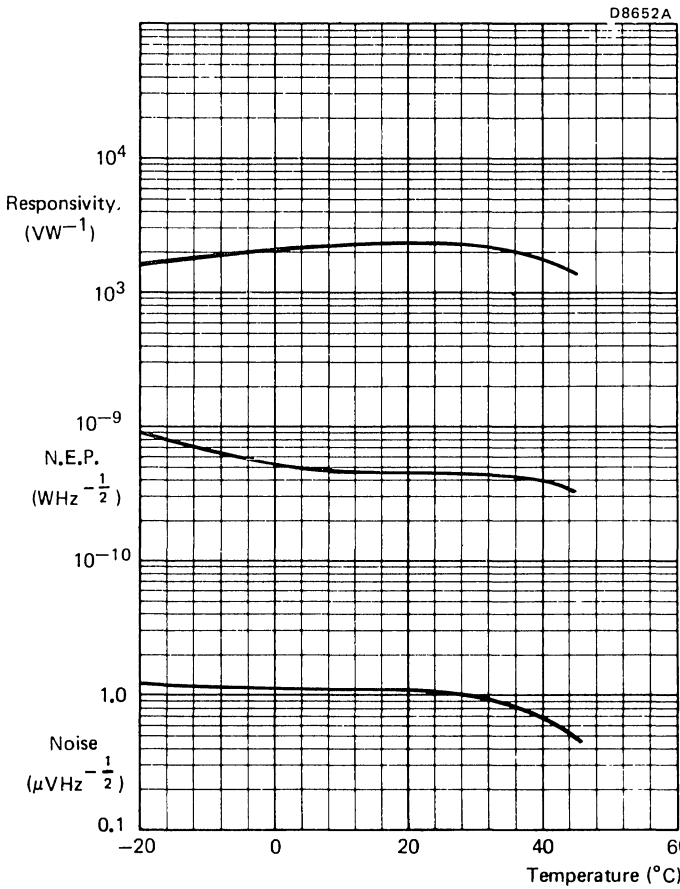
RPY91D

Typical 500K black body performance as a function of temperature



RPY91E

Typical 500K black body performance as a function of frequency



RPY91E

Typical 500K black body performance as a function of temperature

DUAL ELEMENT PYROELECTRIC INFRARED DETECTOR

This is an infrared sensitive device specifically designed for passive IR intruder alarms. It has differentially connected dual elements, combined with a single impedance converting amplifier to provide immunity from common mode signals such as those generated by variations in ambient temperature, background radiation and acoustic noise.
The detector will give an output signal only when radiation falling on the elements is unbalanced as in a focused system.
It is sealed in a low profile TO-5 can with a window optically coated to restrict the response to wavelengths greater than 6.5 μm.

QUICK REFERENCE DATA

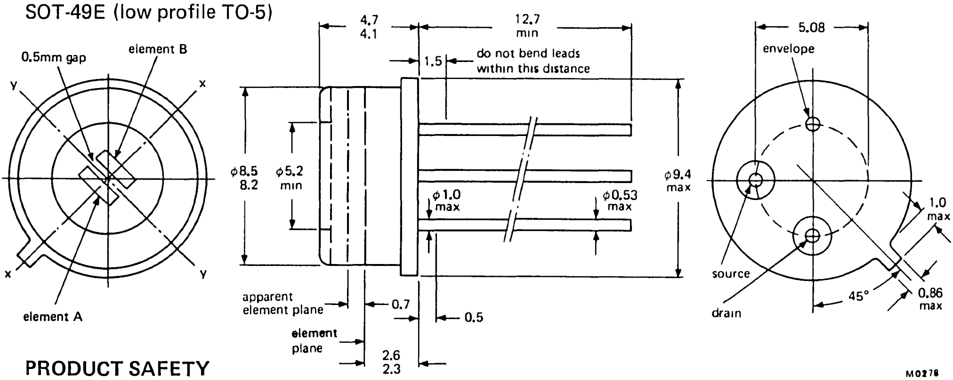
Spectral Response		6.5 ± 0.5 to > 14	μm
Responsivity (10 μm, 10), each element	typ.	800	VW^{-1}
Noise Equivalent Power (N.E.P.), (10 μm, 10, 1), each element	typ.	1.4×10^{-9}	$WHz^{-1/2}$
Element dimensions, each element		2 x 0.75	mm
Element separation		0.5	mm
Field of View in horizontal plane (x-x)	typ.	120	degrees
Operating voltage		9	V
Optimum operating frequency range		0.1 to 1000	Hz

This data must be read in conjunction with GENERAL SAFETY RECOMMENDATIONS – OPTOELECTRONIC DEVICES

MECHANICAL DATA

Dimensions in mm

SOT-49E (low profile TO-5)



PRODUCT SAFETY

Modern high technology materials have been used in the manufacture of this device to ensure high performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the device is heated to destruction. Disposal of large quantities should therefore be carried out in accordance with the latest local legislation.

SOLDERING

1. When making soldered connections to the leads, a thermal shunt should be used.
2. It is essential that any mains operated soldering iron should be both screened and earthed. Failure to observe these precautions could lead to the introduction of line voltage and possible damage to the device.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Supply voltage	max.	30	V
Temperature, operating	max.	+50	°C
	min.	−40	°C
Temperature, storage	max.	+70	°C
	min.	−40	°C
Lead soldering temperature, ⩾ 6 mm header, t_{sld} ⩽ 3s	max.	+350	°C

CHARACTERISTICS (at T_{amb} = 25 ± 3 °C and with recommended circuit)

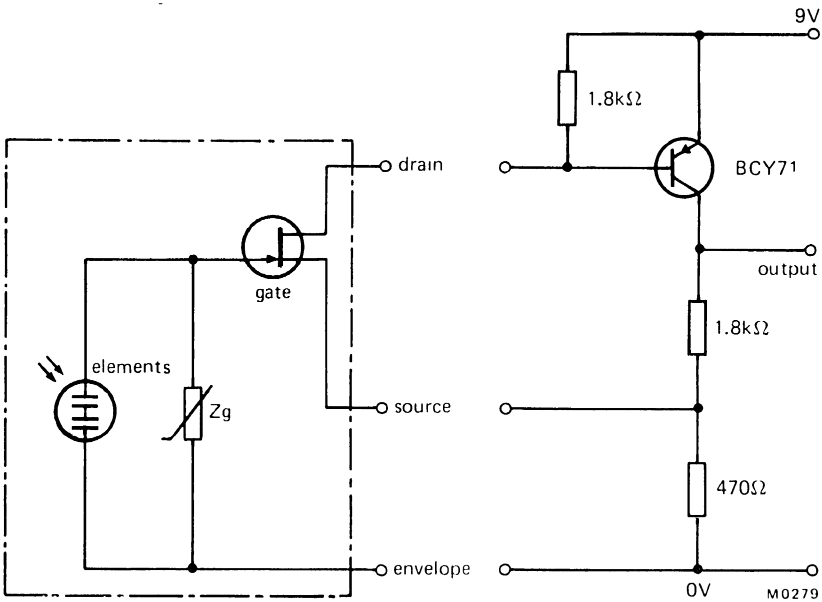
		min.	typ.	max.	
Spectral Response		6.5 ± 0.5	–	> 14	μm
Responsivity (10 μm, 10)	notes 1 and 5	605	800	–	VW^{-1}
N.E.P. (10 μm, 10, 1)	notes 1 and 5	–	1.4×10^{-9}	3×10^{-9}	$WHz^{-½}$
Element matching	note 2	–	±4	±20	%
Field of View (x-x plane)	note 3	–	120	–	degrees
Operating voltage	note 4	8	9	10	V

Notes

1. Each element. These characteristics apply throughout the spectral response range.
2. With both elements equally irradiated, the matching of the element signals is derived from:–

   $\frac{\Delta S}{½ (S_A + S_B)}$ x 100, where S_A and S_B are the signals of the two elements and ΔS is the signal with both elements irradiated.
3. Field of view to 50% of the maximum responsivity level.
4. The detector will operate outside the quoted range but may have a degraded performance.
5. For performance as a function of frequency and temperature see pages 6 and 7.

RECOMMENDED CIRCUIT



OPERATING NOTES

1. The case potential must not be allowed to become positive with respect to the other two terminals.
2. It is inadvisable to operate the detector at mains related frequencies.
3. To avoid the possibility of optical microphony, the detector must be firmly mounted.
4. An increase in temperature of element A will produce a negative going signal at the output. For element B, the corresponding output will be positive going.
5. Use recommended circuit for low noise operation.
6. For simplicity of operation, a source follower may be used where noise is not a problem. This may be achieved with a 22 kΩ resistor between source and envelope with the positive supply taken to the drain terminal. This will give a voltage gain of approximately 0.9.

DEFINITIONS

1. Responsivity VW^{-1}

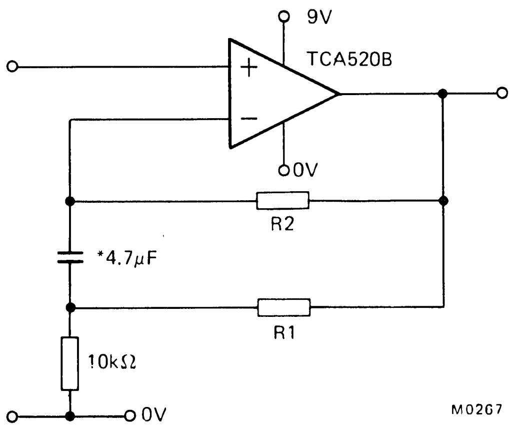
   This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped radiant power.

2. N.E.P. (Noise Equivalent Power), $WHz^{-\frac{1}{2}}$

   This is the r.m.s. value of the incident, chopped radiant power necessary to produce an r.m.s. signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth $VHz^{-\frac{1}{2}}$.

APPLICATION INFORMATION

Optional additional stage for extra gain



Recommended component values for various gains

Gain x	R_1 kΩ	R_2 MΩ
50	560	5.6
20	220	2.2
10	100	1.0

*this capacitor must be a low leakage type e.g. our 344 series.

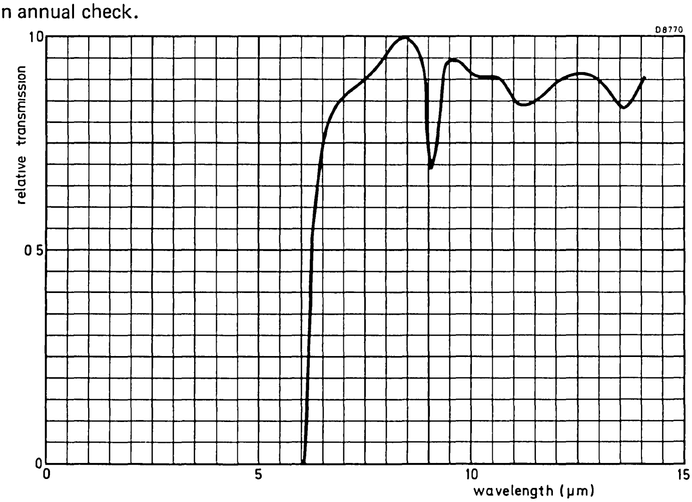
MECHANICAL AND ENVIRONMENTAL STANDARDS

As part of the Quality Assurance programme, the detectors are assessed at regular intervals against the requirements of the following IEC standards. The frequency of testing and the limits and conditions for the pre- and post-test measurements are based on those stipulated for the CECC 50 000 series of approved transistors.

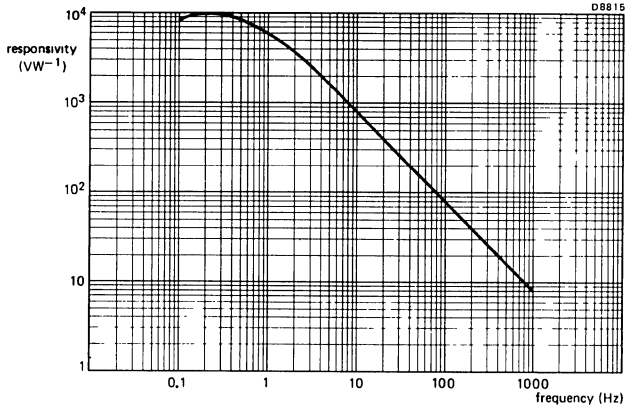
	Test		Severity	Duration	Note
IEC 68-2-3	Ca	Damp Heat, steady state	+40 °C, 95% RH	168 hours	1
68-2-20	Ta	Solderability	+235 °C, 1.5 mm from header	5 seconds	1
68-2-21	Ub	Lead Fatigue	4 cycles	–	1
68-2-1	A	Low Temperature Storage	–40 °C	2000 hours	2
68-2-2	Ba	High Temperature Storage	+70 °C	2000 hours	2
68-2-14	Nb	Change of Temperature	–40 °C to +70 °C	10 cycles	2
68-2-6	Fc (B4)	Vibration, swept frequency	125 Hz to 2 kHz 196 ms^{-2}	2 h in each orientation	2
68-2-7	Ga	Acceleration, steady state	196000 ms^{-2}	60 seconds	2
68-2-27	Ea	Shock	14700 ms^{-2}	3 pulses 6 orientations	2
68-2-20	Tb	Resistance to Solder Heat	+350 °C, 6 mm from header	3 seconds	3

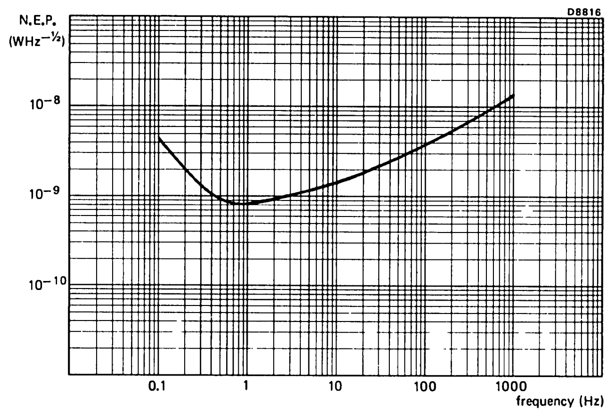
Notes

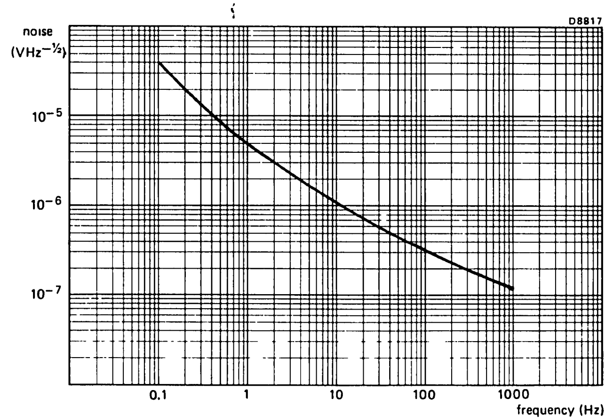
1. The detectors are checked on a production batch release principle at approximately weekly intervals. This is equivalent to Group B.
2. The detectors are checked at quarterly intervals. This is equivalent to Group C.
3. This is an annual check.



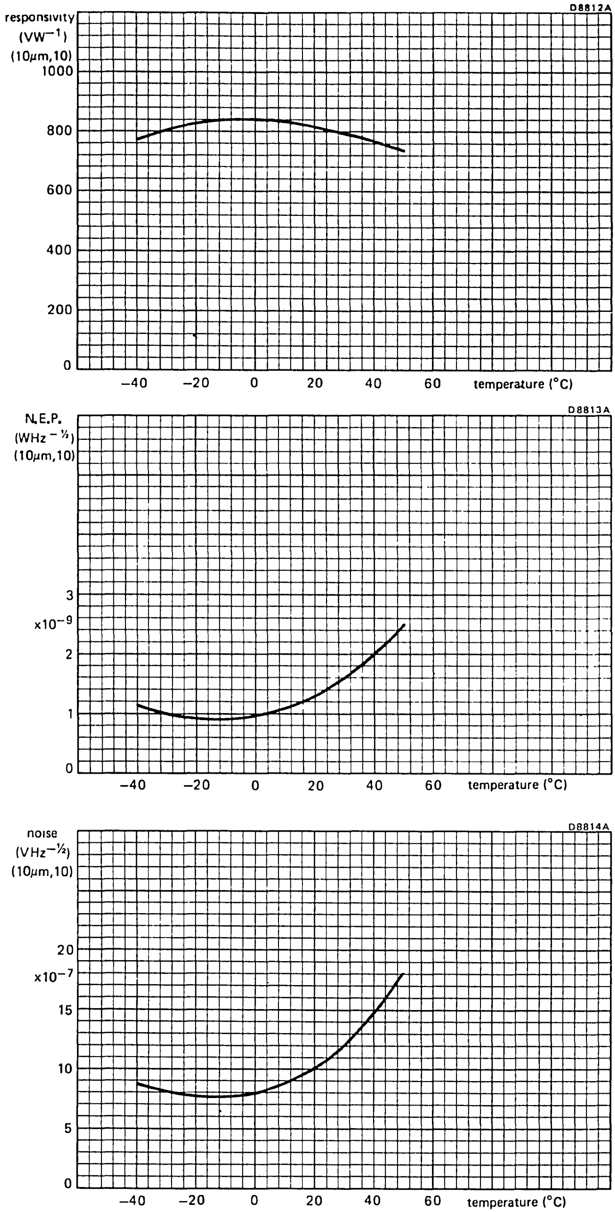
Typical normalized window transmission characteristic





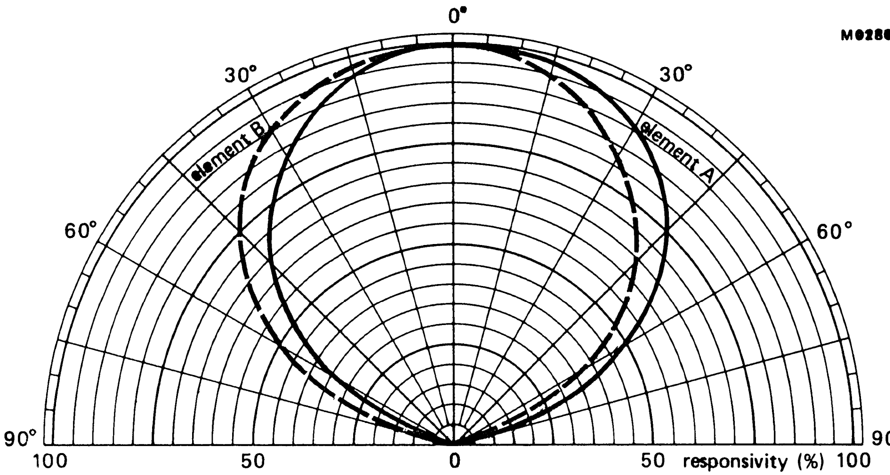


Typical Responsivity, N.E.P., and Noise as functions of Frequency
(one element screened)

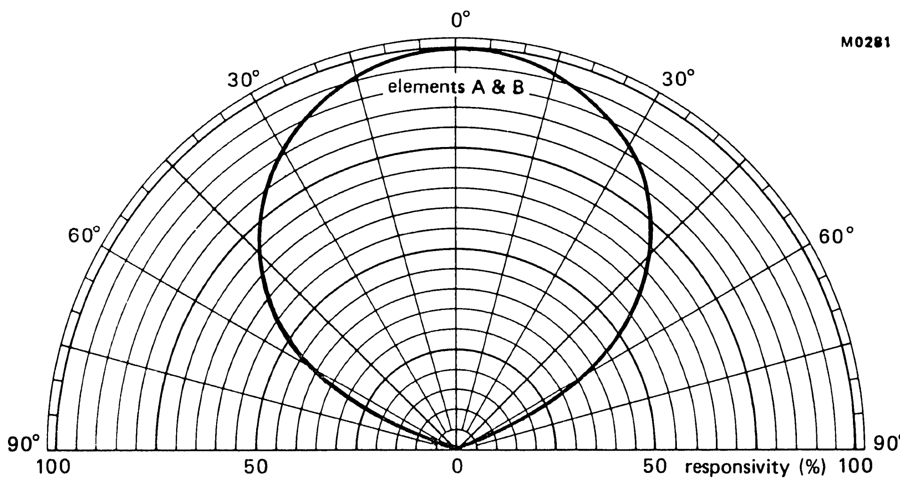


Typical Responsivity, N.E.P., and Noise as functions of Temperature
(one element screened)

POLAR DIAGRAMS



Typical Field of View in x-x plane (see Mechanical Data)



Typical Field of View in y-y plane (see Mechanical Data)

DUAL ELEMENT PYROELECTRIC INFRARED DETECTOR

This is an infrared sensitive device specifically designed for passive IR intruder alarms. It has differentially connected dual elements, with wide separation, combined with a single impedance converting amplifier to provide immunity from common mode signals such as those generated by variations in ambient temperature, background radiation and acoustic noise.
The detector will give an output signal only when the radiation falling on the elements is unbalanced as in a focused system.
It is sealed in a low profile TO-5 can with a window optically coated to restrict the response to wavelengths greater than 6.5 μm.

QUICK REFERENCE DATA

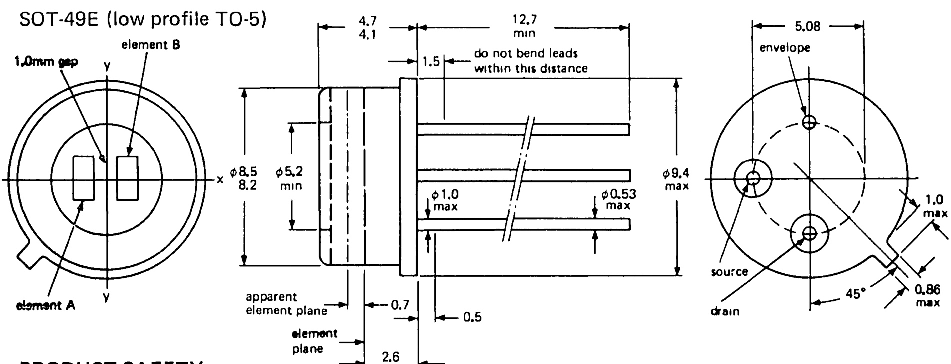
Spectral Response		6.5 ± 0.5 to > 14	μm
Responsivity (10 μm, 10), each element	typ.	650	VW^{-1}
Noise Equivalent Power (N.E.P.) (10 μm, 10, 1), each element	typ.	1.5×10^{-9}	$WHz^{-1/2}$
Element dimensions, each element		2 x 1	mm
Element separation		1.0	mm
Field of View in horizontal plane (x-x)	typ.	130	degrees
Operating voltage		9	V
Optimum operating frequency range		0.1 to 1000	Hz

This data must be read in conjunction with GENERAL SAFETY RECOMMENDATIONS – OPTOELECTRONIC DEVICES

MECHANICAL DATA

Dimensions in mm

SOT-49E (low profile TO-5)



PRODUCT SAFETY

Modern high technology materials have been used in the manufacture of this device to ensure high performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the device is heated to destruction. Disposal of large quantities should therefore be carried out in accordance with the latest local legislation.

SOLDERING

1. When making soldered connections to the leads, a thermal shunt should be used.
2. It is essential that any mains operated soldering iron should be both screened and earthed. Failure to observe these precautions could lead to the introduction of line voltage and possible damage to the device.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Supply voltage	max.	30	V
Temperature, operating	max.	+50	°C
	min.	−20	°C
Temperature, storage	max.	+50	°C
	min.	−20	°C
Lead soldering temperature, ⩾ 6 mm from header, t_{sld} ⩽ 3 s	max.	+350	°C

CHARACTERISTICS (at T_{amb} = 25 °C ± 3 °C and with recommended circuit).

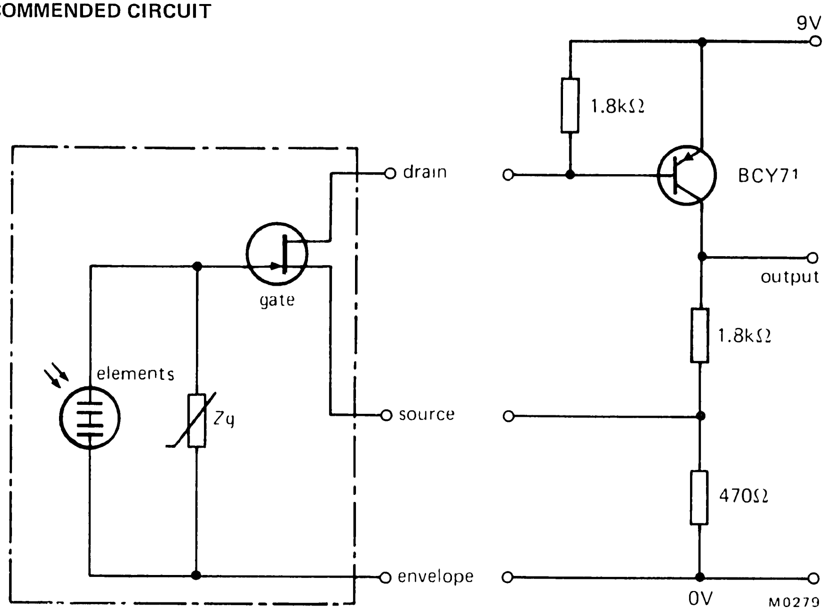
		min.	typ.	max.	
Spectral Response		6.5 ± 0.5	—	> 14	μm
Responsivity (10 μm, 10)	note 1	450	650	—	VW^{-1}
N.E.P. (10 μm, 10, 1)	note 1	—	1.5×10^{-9}	6×10^{-9}	$WHz^{-½}$
Element matching	note 2	—	—	± 20	%
Field of View (x-x plane)	note 3	—	130	—	degrees
Operating voltage	note 4	8	9	10	V

Notes

1. Each element. These characteristics apply throughout the spectral response range.
2. With both elements irradiated, the matching of the element signals is derived from:—

   $\frac{\Delta S}{½ (S_A + S_B)}$ x 100, where S_A and S_B are the signals of the two elements and ΔS is the signal with both elements irradiated.
3. Field of view to 50% of the maximum responsivity level.
4. The detector will operate outside the quoted range but may have a degraded performance.
5. For performance as a function of frequency and temperature see pages 6 and 7.

RECOMMENDED CIRCUIT



OPERATING NOTES

1. The case potential must not be allowed to become positive with respect to the other two terminals.
2. It is inadvisable to operate the detector at mains related frequencies.
3. To avoid the possibility of optical microphony, the detector must be firmly mounted.
4. An increase in temperature of element A will produce a positive going signal at the output. For element B, the corresponding output will be negative going.
5. Use recommended circuit for low noise operation.
6. For simplicity of operation, a source follower may be used where noise is not a problem. This may be achieved with a 22 kΩ resistor between source and envelope with the positive supply taken to the drain terminal. This will give a voltage gain of approximately 0.9.

DEFINITIONS

1. Responsivity VW^{-1}

   This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped radiant power.

2. N.E.P. (Noise Equivalent Power), $WHz^{-\frac{1}{2}}$

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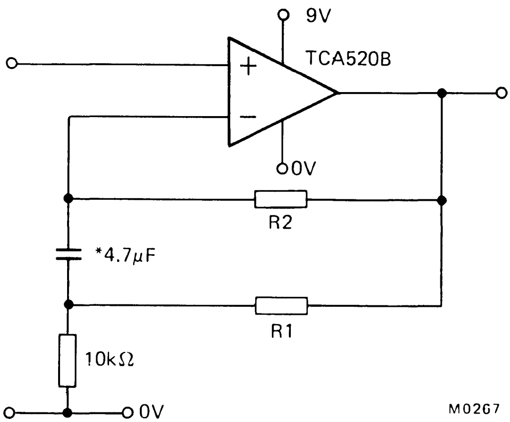
APPLICATION INFORMATION

Optional additional stage for extra gain



Recommended component value for various gains

Gain x	R_1 kΩ	R_2 MΩ
50	560	5.6
20	220	2.2
10	100	1.0

*this capacitor must be a low leakage type e.g. our 344 series.

.MECHANICAL AND ENVIRONMENTAL STANDARDS

As part of the Quality Assurance programme, the detectors are assessed at regular intervals against the requirements of the following IEC standards. The frequency of testing and the limits and conditions for the pre- and post-test measurements are based on those stipulated for the CECC 50 000 series of approved transistors.

	Test		Severity	Duration	Note
IEC 68-2-3	Ca	Damp Heat, steady state	+40 °C, 95% RH	168 hours	1
68-2-20	Ta	Solderability	+235 °C, 1.5 mm from header	5 seconds	1
68-2-21	Ub	Lead Fatigue	4 cycles	–	1
68-2-1	A	Low Temperature Storage	−20 °C	2000 hours	2
68-2-2	Ba	High Temperature Storage	+50 °C	2000 hours	2
68-2-14	Nb	Change of Temperature	−20 °C to +50 °C	10 cycles	2
68-2-6	Fc (B4)	Vibration, swept frequency	125 Hz to 2 kHz 196 ms^{-2}	2 h in each orientation	2
68-2-7	Ga	Acceleration, steady state	196000 ms^{-2}	60 seconds	2
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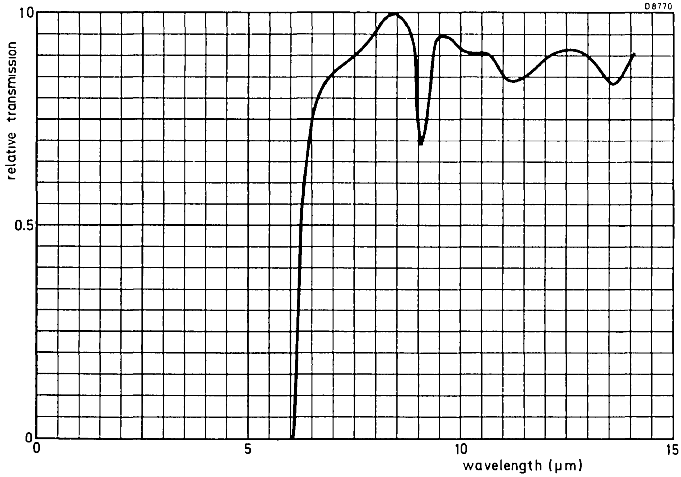
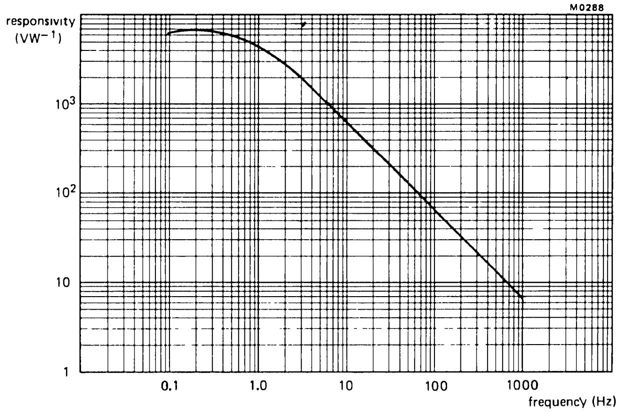
68-2-20	Tb	Resistance to Solder Heat	+350 °C, 6 mm from header	3 seconds	3

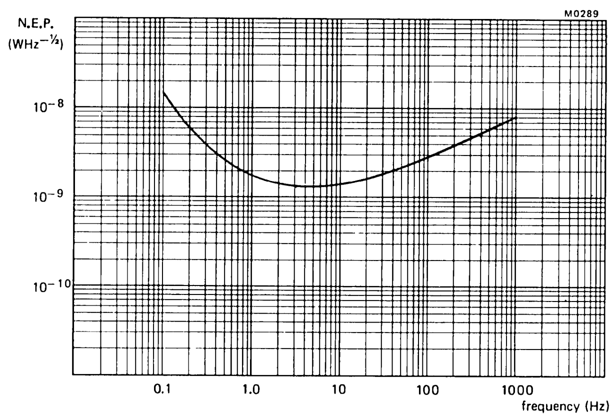
Notes

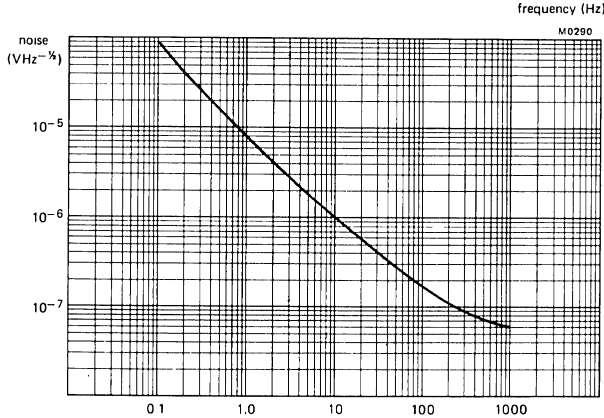
1. The detectors are checked on a production batch release principle at approximately weekly intervals. This is equivalent to Group B.
2. The detectors are checked at quarterly intervals. This is equivalent to Group C.
3. This is an annual check.



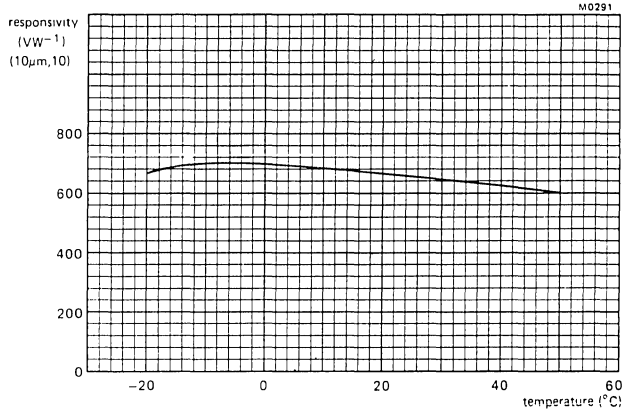
Typical normalized window transmission characteristic

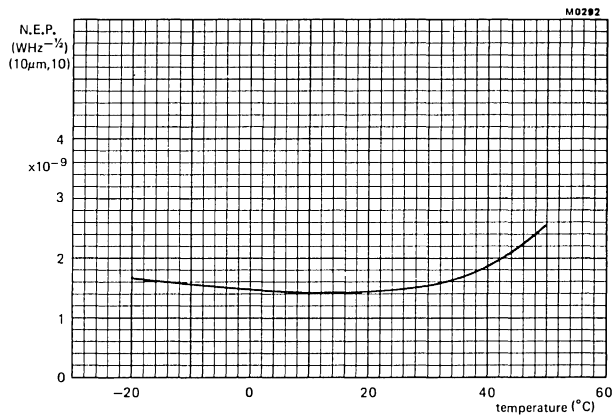


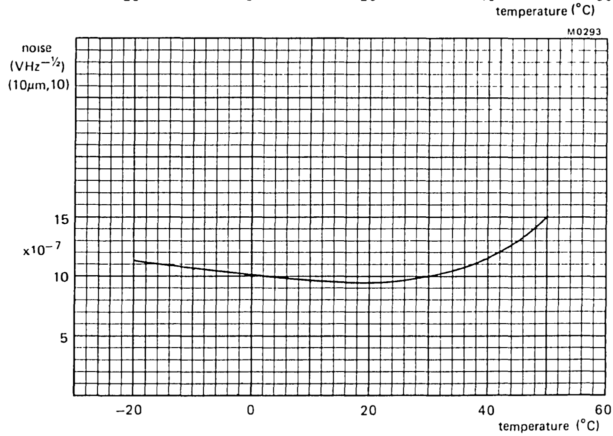




Typical Responsivity, N.E.P., and Noise as functions of Frequency
(one element screened)

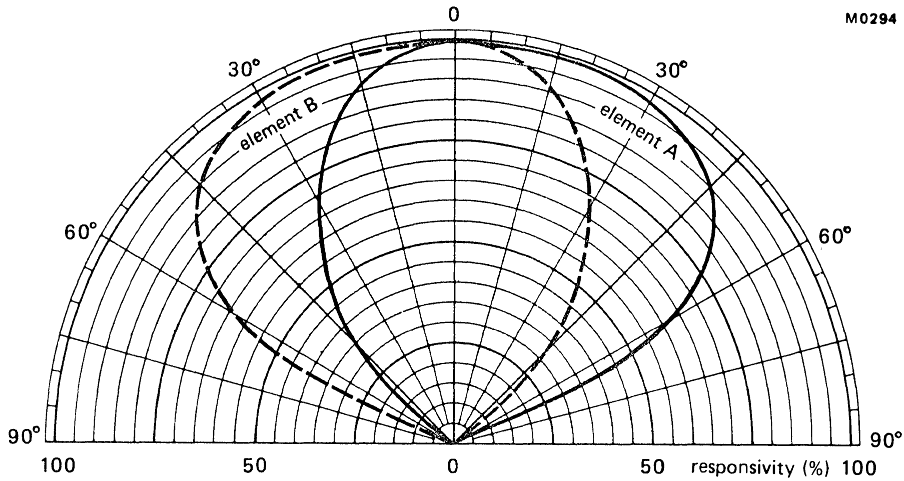




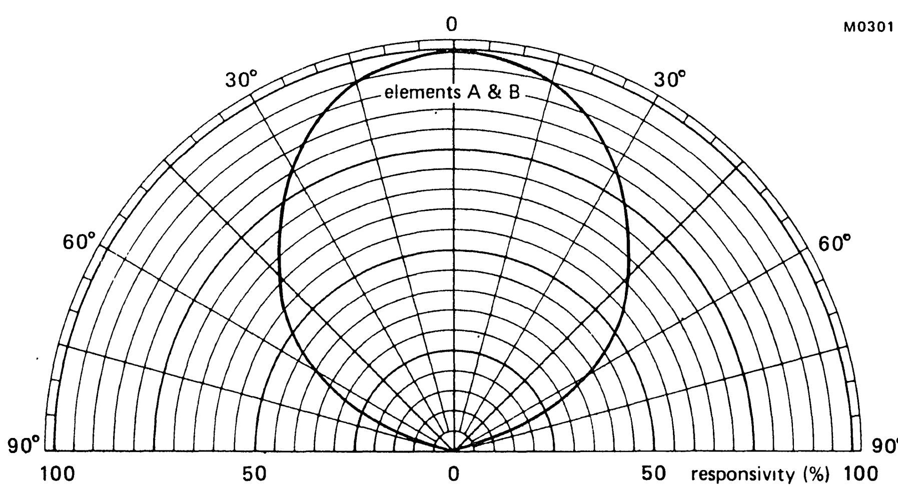


Typical Responsivity, N.E.P., and Noise as functions of Temperature
(one element screened)

POLAR DIAGRAMS



Typical Field of View in x-x plane (see Mechanical Data)



Typical Field of View in y-y plane (see Mechanical Data)

DUAL ELEMENT PYROELECTRIC INFRARED DETECTOR

This is an infrared sensitive device specifically designed for passive IR intruder alarms. It has differentially connected dual elements, with wide separation, combined with a single impedance converting amplifier to provide immunity from common mode signals such as those generated by variations in ambient temperature, background radiation and acoustic noise.
The detector will give an output signal only when the radiation falling on the elements is unbalanced as in a focused system.
It is sealed in a low profile TO-5 can with a window optically coated to restrict the response to wavelengths greater than 6.5 μm.

QUICK REFERENCE DATA

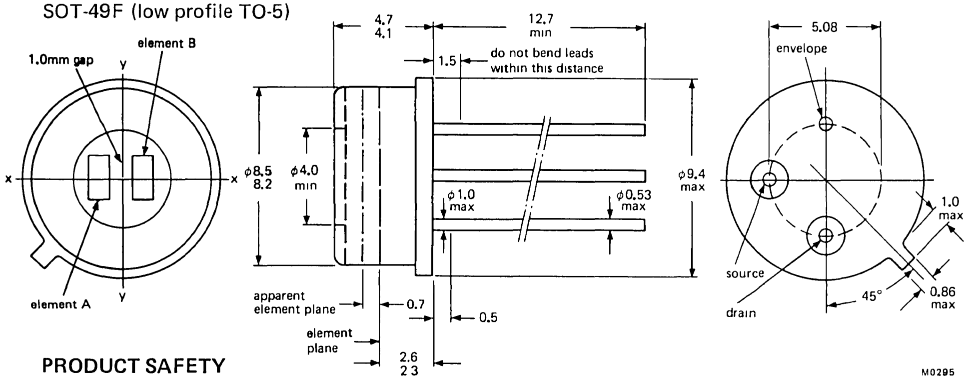
Spectral Response		6.5 ± 0.5 to > 14	μm
Responsivity (10 μm, 10), each element	typ.	450	VW^{-1}
Noise Equivalent Power (N.E.P.) (10 μm, 10, 1), each element	typ.	2.1×10^{-9}	$WHz^{-½}$
Element dimensions, each element		2 x 1	mm
Element separation		1.0	mm
Field of View in horizontal plane (x-x)	typ.	110	degrees
Operating voltage		9	V
Optimum operating frequency range		0.1 to 1000	Hz

This data must be read in conjunction with GENERAL SAFETY RECOMMENDATIONS – OPTOELECTRONIC DEVICES

MECHANICAL DATA

Dimensions in mm

SOT-49F (low profile TO-5)



PRODUCT SAFETY

Modern high technology materials have been used in the manufacture of this device to ensure high performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the device is heated to destruction. Disposal of large quantities should therefore be carried out in accordance with the latest local legislation.

SOLDERING

1. When making soldered connections to the leads, a thermal shunt should be used.
2. It is essential that any mains operated soldering iron should be both screened and earthed. Failure to observe these precautions could lead to the introduction of line voltage and possible damage to the device.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Supply voltage	max.	30	V
Temperature, operating	max.	+50	°C
	min.	−20	°C
Temperature, storage	max.	+50	°C
	min.	−20	°C
Lead soldering temperature $\geqslant$ 6 mm from header, $t_{sld} \leqslant 3$ s	max.	+350	°C

CHARACTERISTICS (at T_{amb} = 25 °C ± 3 °C and with recommended circuit)

		min.	typ.	max.	
Spectral Response		6.5 ± 0.5	–	> 14	μm
Responsivity (10 μm, 10)	note 1	265	450	–	VW^{-1}
N.E.P. (10 μm, 10, 1)	note 2	–	2.1×10^{-9}	6×10^{-9}	$WHz^{-½}$
Element matching	note 2	–	–	± 20	%
Field of View (x-x plane)	note 3	–	110	–	degrees
Operating voltage	note 4	8	9	10	V

Notes

1. Each element. These characteristics apply throughout the spectral response range.
2. With both elements irradiated, the matching of the element signals is derived from:—

   $\frac{\Delta S}{½\,(S_A + S_B)} \times 100$, where S_A and S_B are the signals of the two elements and ΔS is the signal with both elements irradiated.
3. Field of view to 50% of the maximum responsivity level.
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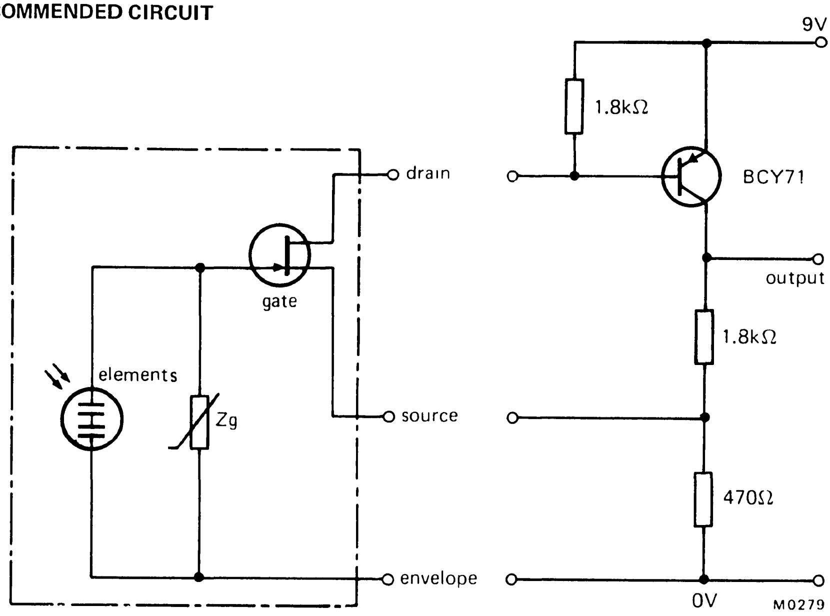
5. For performance as a function frequency and temperature see pages 6 and 7.

RECOMMENDED CIRCUIT



OPERATING NOTES

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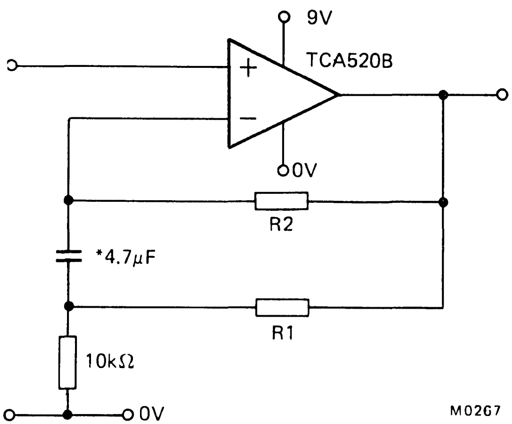
APPLICATION INFORMATION

Optional additional stage for extra gain



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68-2-1	A	Low Temperature Storage	–20 °C	2000 hours	2
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68-2-6	Fc (B4)	Vibration, swept frequency	125 Hz to 2 kHz 196 ms^{-2}	2 h in each orientation	2
68-2-7	Ga	Acceleration, steady state	196000 ms^{-2}	60 seconds	2
68-2-27	Ea	Shock	14700 ms^{-2}	3 pulses 6 orientations	2
68-2-20	Tb	Resistance to Solder Heat	+350 °C, 6 mm from header	3 seconds	3

Notes

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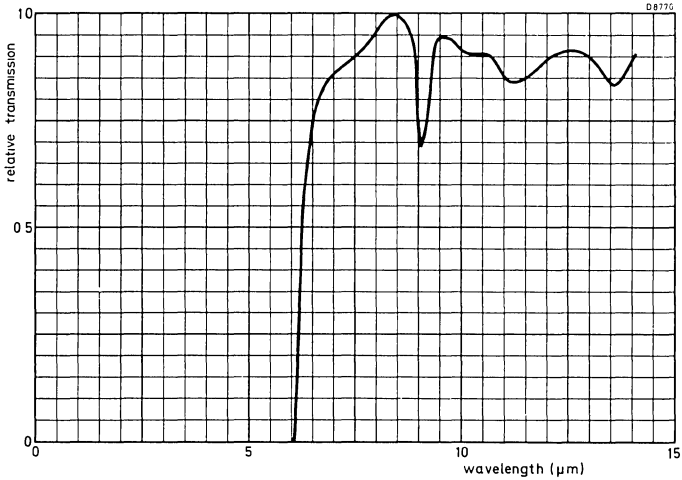
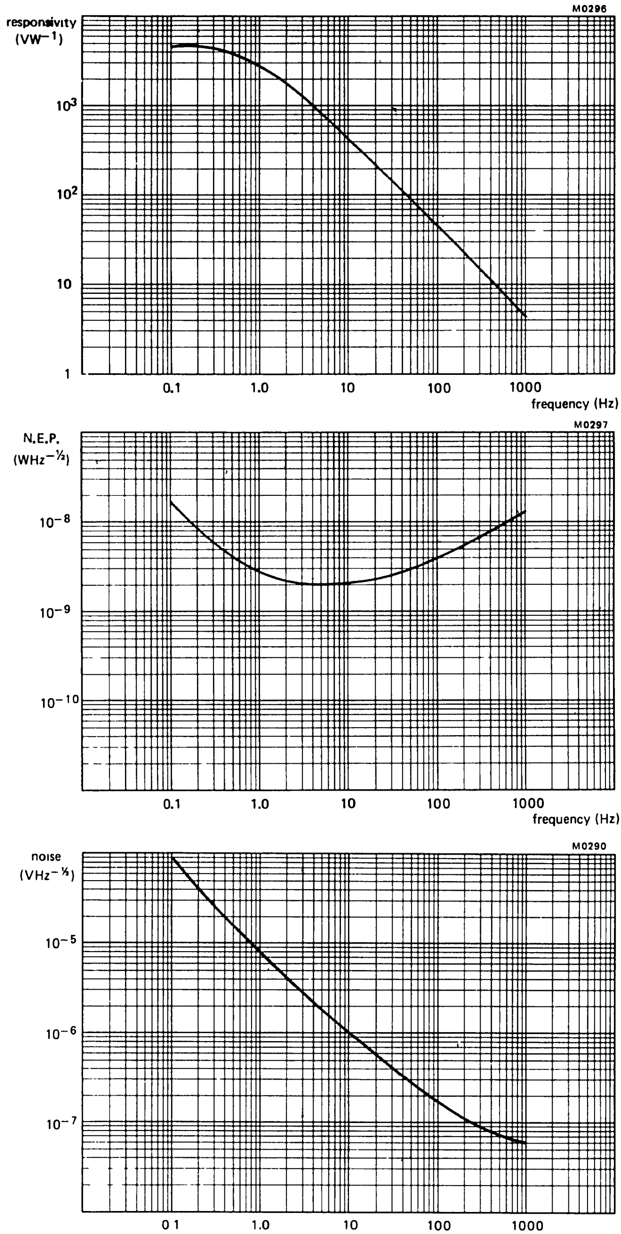
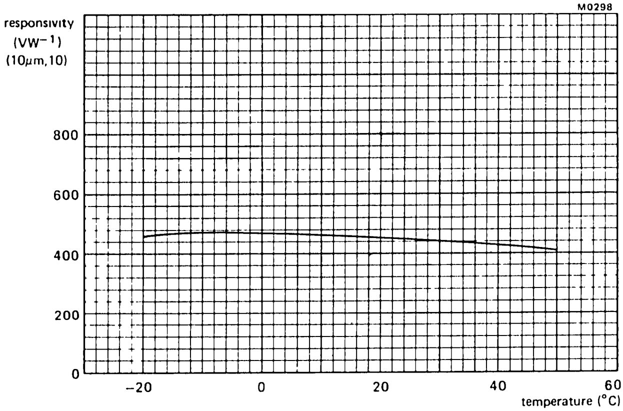
3. This is an annual check.

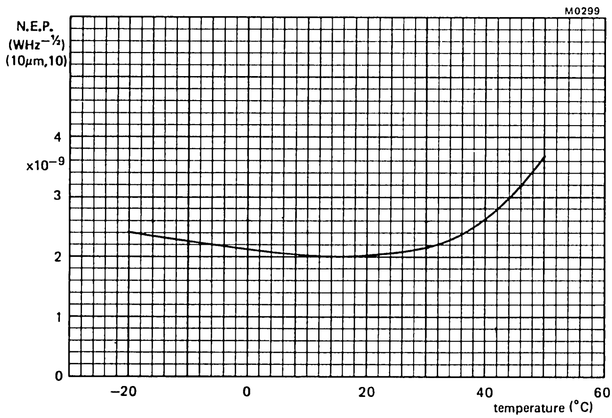


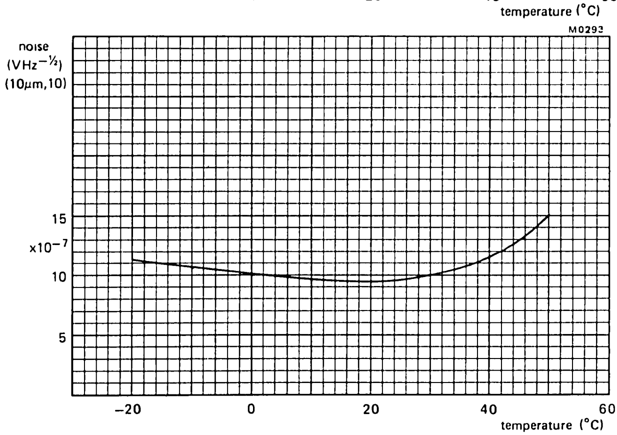
Typical normalized window transmission characteristic



Typical Responsivity, N.E.P., and Noise as functions of Frequency
(one element screened)

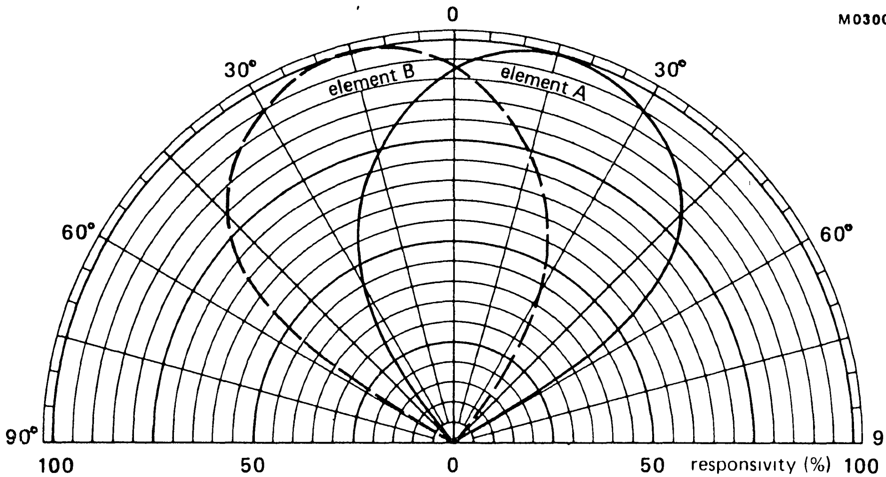




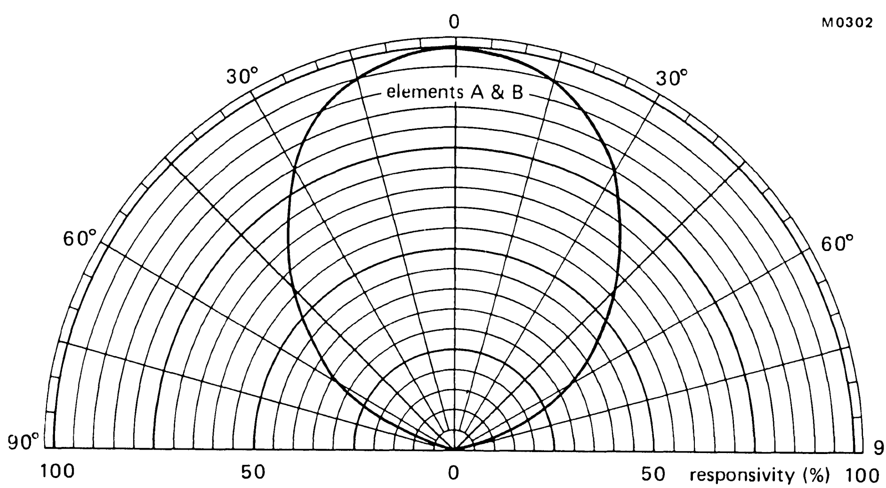


Typical Responsivity, N.E.P., and Noise as functions of Temperature
(one element screened)

POLAR DIAGRAMS



Typical Field of View in x-x plane (see Mechanical Data)



Typical Field of View in y-y plane (see Mechanical Data)

SINGLE ELEMENT PYROELECTRIC INFRARED DETECTOR

This is an infrared sensitive device, combined with a pre-amplifier which is stabilized to overcome d.c. saturation due to thermal changes. It is sealed in a low-profile TO-5 can.

QUICK REFERENCE DATA

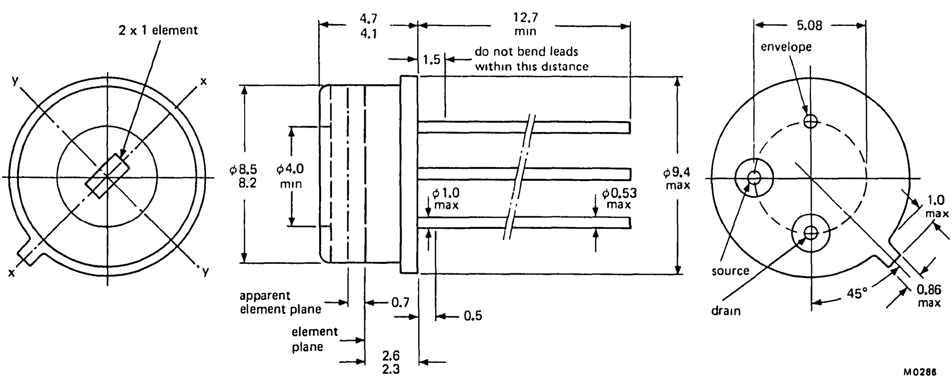
Spectral Response		6.5 ± 0.5 to > 14	μm
Responsivity, (10 μm, 10)	typ.	130	VW^{-1}
Noise Equivalent Power (N.E.P.), (10 μm, 10, 1)	typ.	3.5×10^{-9}	$WHz^{-½}$
Element dimensions		2 x 1	mm
Field of view	typ.	105	degrees
Operating voltage		9	V
Optimum operating frequency range		0.1 to 1000	Hz

This data must be read in conjunction with GENERAL SAFETY RECOMMENDATIONS – OPTOELECTRONIC DEVICES

MECHANICAL DATA

Dimensions in mm

SOT-49F (low profile TO-5)



PRODUCT SAFETY

Modern high technology materials have been used in the manufacture of this device to ensure high performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the device is heated to destruction. Disposal of large quantities should therefore be carried out in accordance with the latest local legislation.

SOLDERING

1. When making soldered connections to the leads, a thermal shunt should be used.
2. It is essential that any mains operated soldering iron should be both screened and earthed. Failure to observe these precautions could lead to the introduction of line voltage and possible damage to the device.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134)

Supply voltage	max.	30	V
Temperature, operating	max.	+60	°C
	min.	−40	°C
Temperature, storage	max.	+70	°C
	min.	−40	°C
Lead soldering temperature, ≥ 6 mm from header, $t_{sld} \leq 3$ s	max.	+350	°C

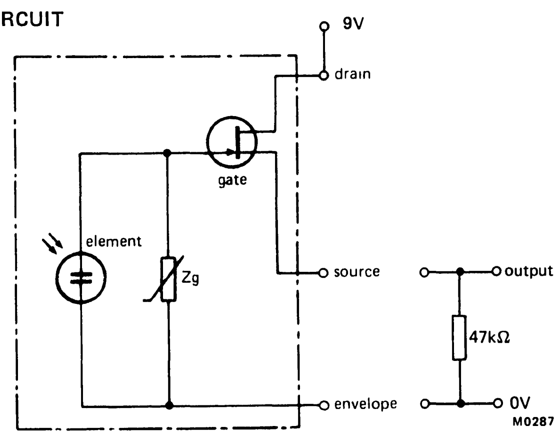
CHARACTERISTICS (at T_{amb} = 25 ± 3 °C and with recommended circuit).

		min.	typ.	max.	
Spectral Response		6.5 ± 0.5	–	> 14	µm
Responsivity (10 µm, 10)	notes 1 and 4	95	130	–	VW^{-1}
N.E.P. (10 µm, 10, 1)	notes 1 and 4	–	3.5×10^{-9}	9×10^{-9}	$WHz^{-1/2}$
Field of View,	note 2	–	150	–	degrees
Operating voltage	note 3	8	9	10	V

Notes

1. These characteristics apply throughout the spectral response range.
2. Field of view to 50% of the maximum responsivity level.
3. The detector will operate outside the quoted range but may have a degraded performance.
4. For performance as a function of frequency and temperature, see pages 4 and 5.

RECOMMENDED CIRCUIT



OPERATING NOTES

1. The case potential must not be allowed to become positive with respect to the other two terminals.
2. It is inadvisable to operate the detector at mains related frequencies.
3. To avoid the possibility of optical microphony, the detector must be firmly mounted.
4. An increase in temperature of the element will produce a negative going signal at the output.

DEFINITIONS

1. Responsivity VW^{-1}

   This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped radiant power.

2. N.E.P. (Noise Equivalent Power), $WHz^{-1/2}$

   This is the r.m.s. value of the incident, chopped radiant power necessary to produce an r.m.s. signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth $VHz^{-1/2}$.

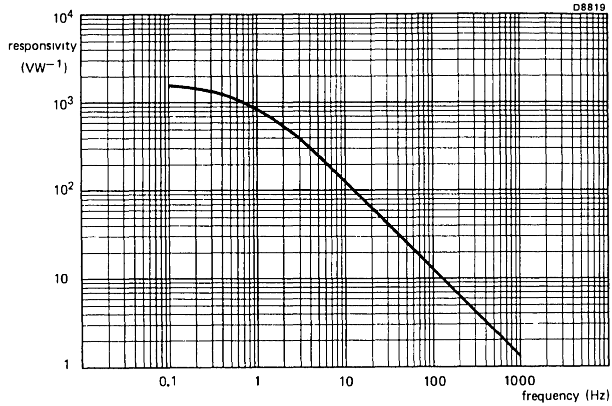
MECHANICAL AND ENVIRONMENTAL STANDARDS

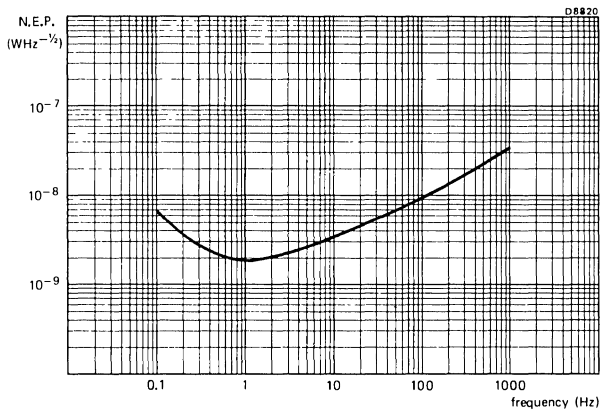
As part of the Quality Assurance programme, the detectors are assessed at regular intervals against the requirements of the following IEC standards. The frequency of testing and the limits and conditions for the pre-and post-test measurements are based on those stipulated for the CECC 50 000 series of approved transistors.

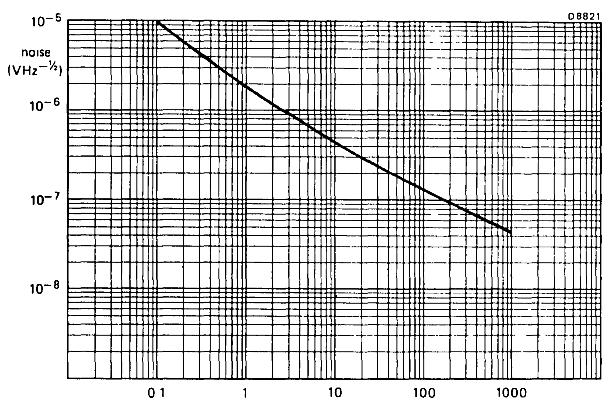
	Test		Severity	Duration	Note
IEC 68-2-3	Ca	Damp Heat, steady state	+40 °C, 95% RH	168 hours	1
68-2-20	Ta	Solderability	+235 °C, 1.5 mm from header	5 seconds	1
68-2-21	Ub	Lead Fatigue	4 cycles	–	1
68-2-1	A	Low Temperature Storage	–40 °C	2000 hours	2
68-2-2	Ba	High Temperature Storage	+70 °C	2000 hours	2
68-2-14	Nb	Change of Temperature	–40 °C to +70 °C	10 cycles	2
68-2-6	Fc (B4)	Vibration, swept frequency	125 Hz to 2 kHz $196\ ms^{-2}$	2 h in each orientation	2
68-2-7	Ga	Acceleration, steady state	$196000\ ms^{-2}$	60 seconds	2
68-2-27	Ea	Shock	$14700\ ms^{-2}$	3 pulses 6 orientations	2
68-2-20	Tb	Resistance to Solder Heat	+350 °C, 6 mm from header	3 seconds	3

Notes

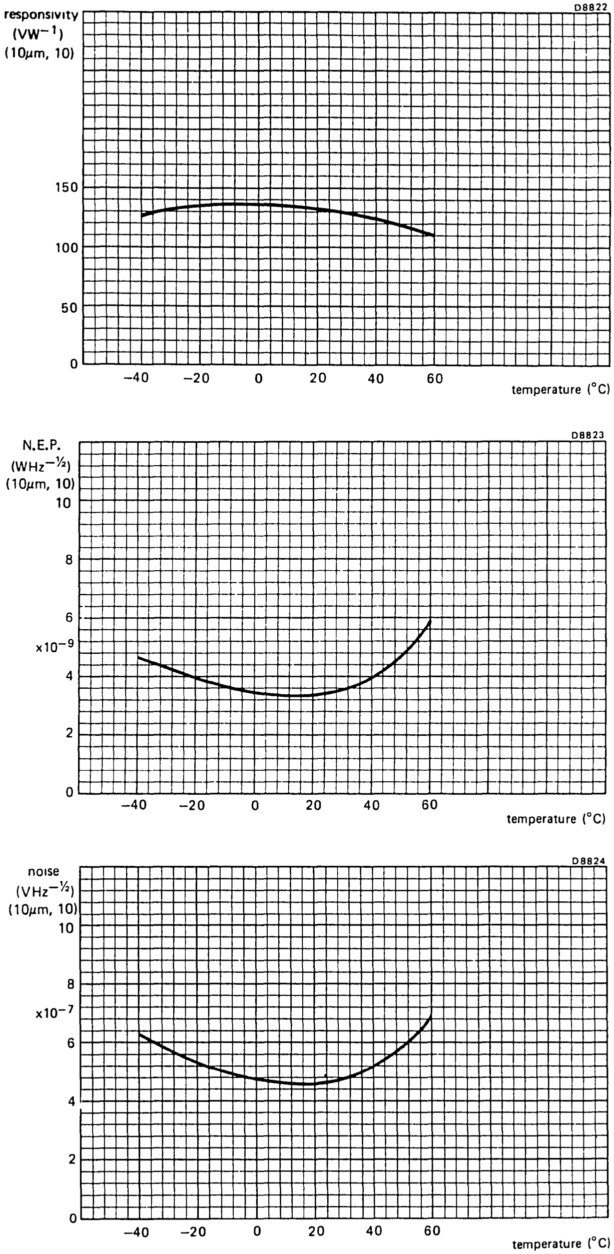
1. The detectors are checked on a production batch release principle at approximately weekly intervals. This is equivalent to Group B.
2. The detectors are checked at quarterly intervals. This is equivalent to Group C.
3. This is an annual check.





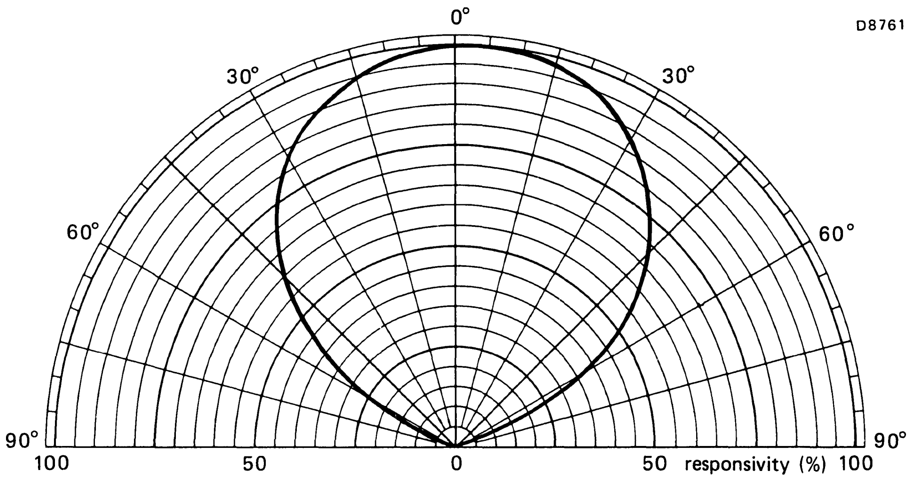


Typical Responsivity, N.E.P., and Noise as functions of Frequency

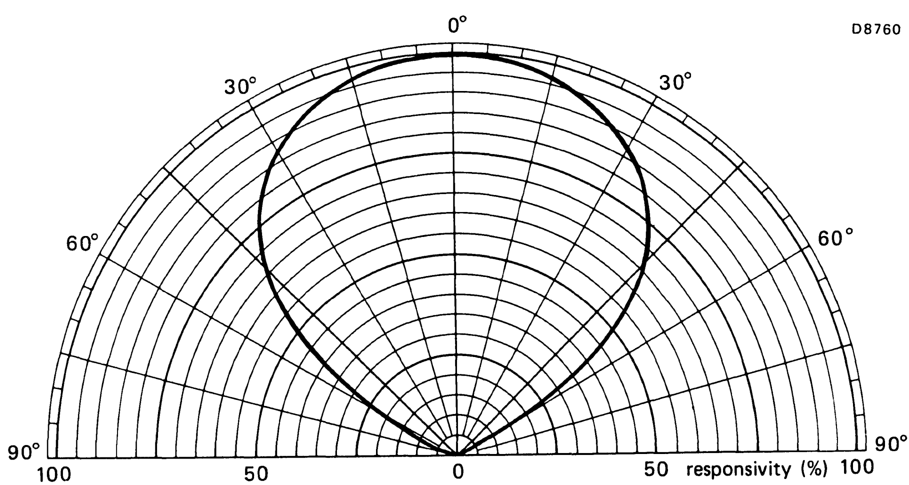


Typical Responsivity, N.E.P., and Noise as functions of Temperature

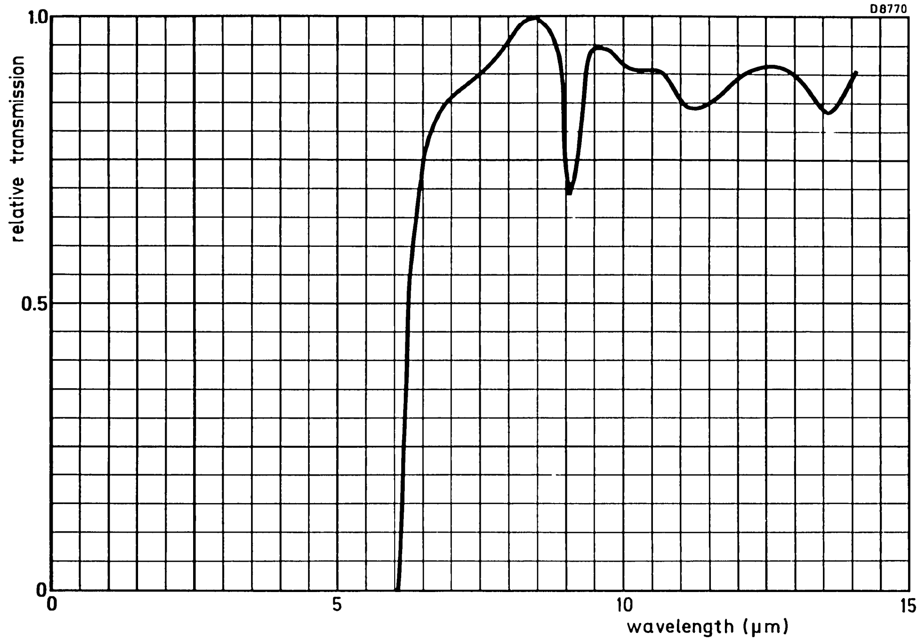
POLAR DIAGRAMS



Typical Field of View in x-x plane (see Mechanical Data)



Typical Field of View in y-y plane (see Mechanical Data)



Typical normalized window transmission characteristic

DUAL ELEMENT PYROELECTRIC INFRARED DETECTOR

This is an infrared sensitive device specifically designed for battery operated passive infrared movement sensors such as intruder alarms and light switches. It has differentially connected dual elements which provide immunity from common mode signals such as those generated by variations in ambient temperature, background radiation and acoustic noise. The wide separation of the elements makes this detector compatible with most optical systems. The dual elements are combined with a single impedance converting amplifier, which is specially designed to function from low voltage supplies with low current consumption. The detector will give an output signal only when the radiation falling on the elements is unbalanced, as in a focused system. It is sealed in a low profile TO-5 can with a window optically coated to restrict the response to wavelengths greater than 6.5 μm.

QUICK REFERENCE DATA

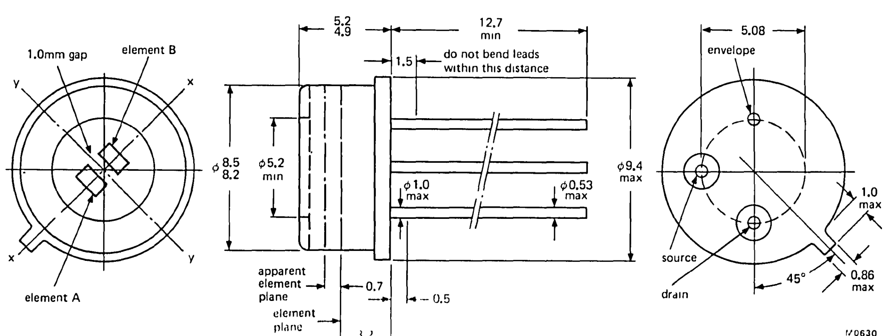
Spectral Response		6.5 ± 0.5 to > 14	μm
Responsivity (10 μm, 10), each element (see circuit 1)	typ.	150	VW^{-1}
Responsivity (10 μm, 10), each element (see circuit 2)	*typ.*	*720*	*VW^{-1}*
Noise Equivalent Power (N.E.P.) (10 μm, 10, 1), each element	typ.	1.5×10^{-9}	$WHz^{-1/2}$
Element dimensions, each element	nom.	2.1 × 0.9	mm
Element separation	nom.	1.0	mm
Field of View in horizontal plane (x-x)	typ.	130	degrees
Operating voltage	min.	3	V
Optimum operating frequency range		0.1 to 20	Hz

This data must be read in conjunction with GENERAL SAFETY RECOMMENDATIONS – OPTOELECTRONIC DEVICES

MECHANICAL DATA

Dimensions in mm

SOT-49H (TO-5 variant)



PRODUCT SAFETY

Modern high technology materials have been used in the manufacture of this device to ensure high performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the device is heated to destruction. Disposal of large quantities should therefore be carried out in accordance with the latest local legislation.

SOLDERING

1. When making soldered connections to the leads, a thermal shunt should be used.
2. It is essential that any mains operated soldering iron used should be both screened and earthed. Failure to observe these precautions may lead to the introduction of line voltages and possible damage to the device.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134).

Supply voltage	30	V
Temperature, operating range	–40 to +70	°C
Temperature, storage range	–55 to +85	°C
Lead soldering temperature, ⩾6 mm from header, t_{sld} ⩽3 s max.	+350	°C

OPERATING CONDITIONS

		min.	max.	
Voltage	note 5	3	10	V
Frequency	note 5	0.1	20	Hz

OPERATING NOTES

1. The case potential must not be allowed to become positive with respect to the other two terminals.
2. It is inadvisable to operate the detector at mains related frequencies.
3. To avoid the possibility of optical microphony, the detector must be firmly mounted.
4. An increase in temperature of element A will produce a negative going signal at the output. For element B, the corresponding output will be positive going.
5. The detector will operate outside the quoted range but may have a degraded performance.

CHARACTERISTICS (at T_{amb} = 25 °C ± 3 °C and with recommended circuit 1).

		min.	typ.	max.	
Spectral Response		6.5 ± 0.5	–	> 14	μm
Responsivity (10 μm, 10)	note 1	100	150	–	VW^{-1}
Responsivity (10 μm, 10)	*note 4*	–	*720*	–	VW^{-1}
N.E.P. (10 μm, 10, 1)	note 1	–	1.5×10^{-9}	6×10^{-9}	$WHz^{-½}$
Element matching	note 2	–	–	± 20	%
Field of View (x-x plane)	note 3	–	130	–	degrees
Quiescent current		–	10	–	μA
Element dimensions			2.1 × 0.9 nominal		mm
Element separation			1.0 nominal		mm

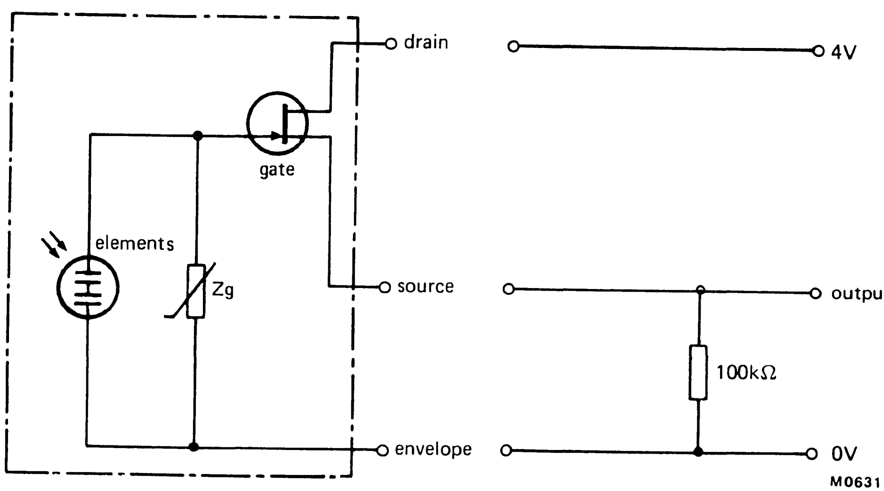
Notes

1. Each element. These characteristics apply throughout the spectral response range.
2. With both elements irradiated, the matching of the element signals is derived from:–

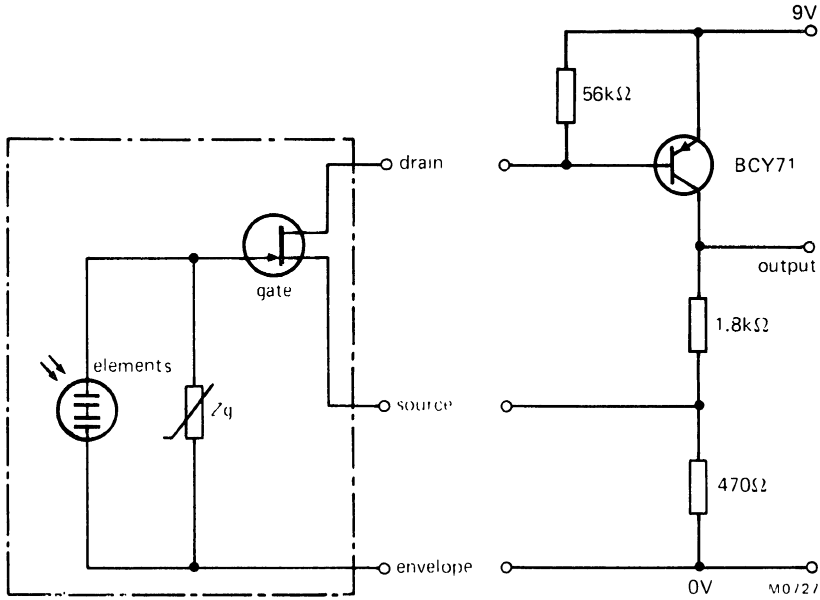
$$\frac{\Delta S}{\frac{1}{2}(S_A + S_B)} \times 100$$

where S_A and S_B are the signals of the two elements and ΔS is the signal with both elements irradiated.
3. Field of view to 50% of the maximum responsivity level.
4. The RPY97 has been specified in conjunction with a source follower circuit with a typical gain of 0.9. For comparison with the RPY93, RPY94 and RPY95 dual element detectors, the alternative circuit shown should be used. This explains the difference in responsivity levels.

CIRCUIT 1 (RECOMMENDED)



CIRCUIT 2 (ALTERNATIVE, X5 GAIN)



DEFINITIONS

1. Responsivity VW^{-1}

   This is the ratio of the r.m.s. signal in volts to the r.m.s. value of the incident, chopped radiant power.

2. N.E.P. (Noise Equivalent Power), $WHz^{-1/2}$

   This is the r.m.s. value of the incident, chopped radiant power necessary to produce an r.m.s. signal to r.m.s. noise ratio of unity. The r.m.s. noise refers to the value calculated for unit square root bandwidth $VHz^{-1/2}$.

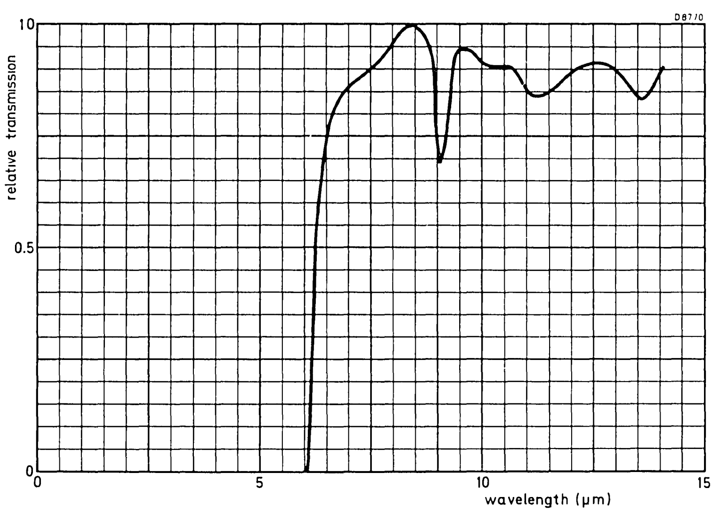
MECHANICAL AND ENVIRONMENTAL STANDARDS

As part of the Quality Assurance programme, the detectors are assessed at regular intervals against the requirements of the following IEC standards. The frequency of testing and the limits and conditions for the pre- and post-test measurements are based on those stipulated for the CECC 50 000 series of approved transistors.

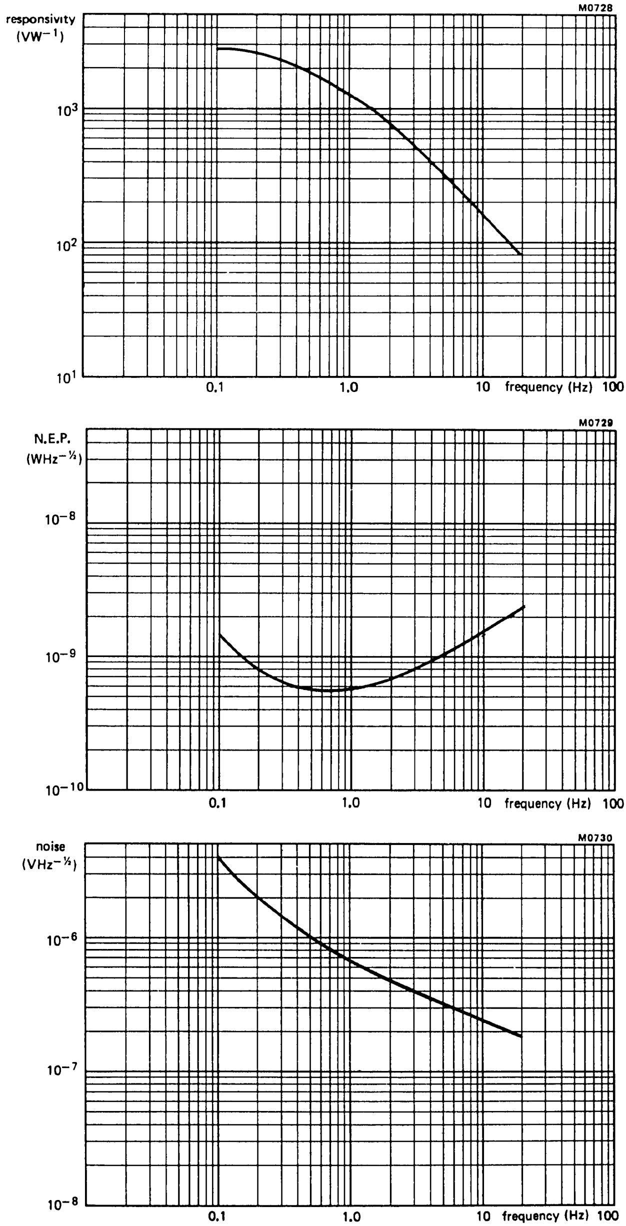
Test			Severity	Duration	Note
IEC 68-2-3	Ca	Damp Heat, steady state	+40 °C, 95% RH	168 hours	1
68-2-20	Ta	Solderability	+235 °C, 1.5 mm from header	5 seconds	1
68-2-21	Ub	Lead Fatigue	4 cycles	–	1
68-2-1	Aa	Low Temperature Storage	–55 °C	2000 hours	2
68-2-2	Ba	High Temperature Storage	+85 °C	2000 hours	2
68-2-14	Nb	Change of Temperature	–55 °C to +85 °C	10 cycles	2
68-2-6	Fc (B4)	Vibration, swept frequency	125 Hz to 2 kHz 196 ms^{-2}	2 h in each orientation	2
68-2-7	Ga	Acceleration, steady state	196000 ms^{-2}	60 seconds	2
68-2-27	Ea	Shock	14700 ms^{-2}	3 pulses 6 orientations	2
68-2-20	Tb	Resistance to Solder Heat	+350 °C, 6 mm from header	3 seconds	3

Notes

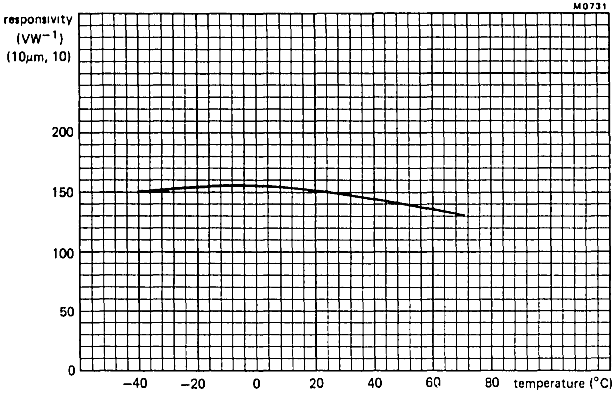
1. The detectors are checked on a production batch release principle at approximately weekly intervals. This is equivalent to Group B.
2. The detectors are checked at quarterly intervals. This is equivalent to Group C.
3. This is an annual check.

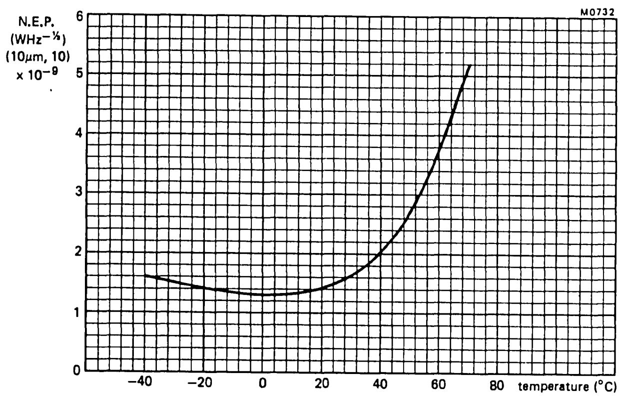


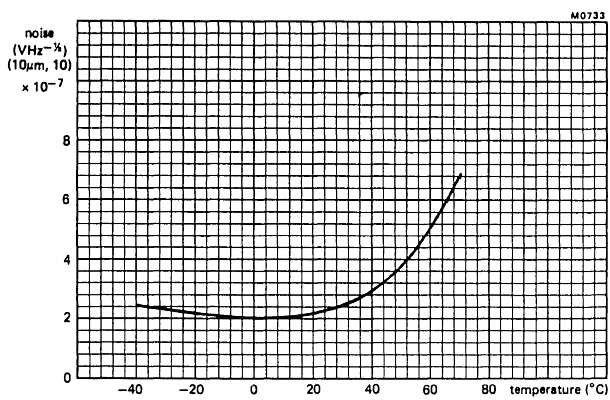
Typical normalized window transmission characteristic



Typical Responsivity, N.E.P., and Noise as functions of Frequency
(one element screened)

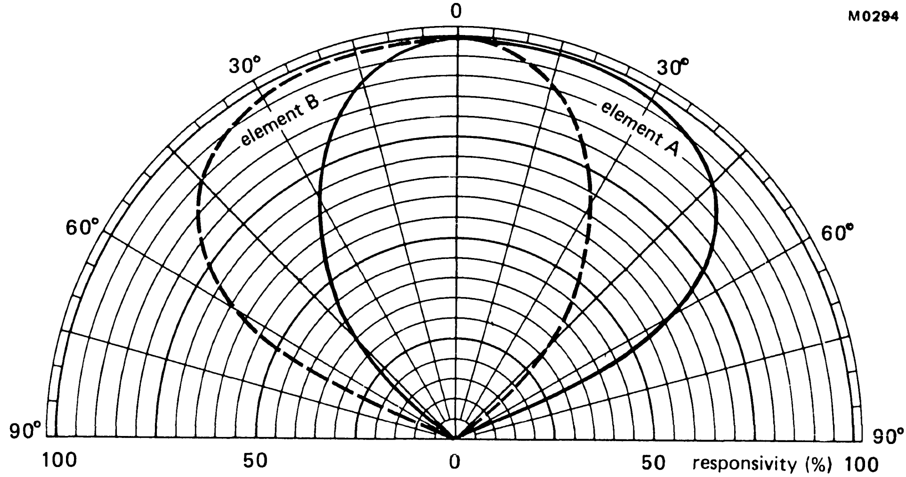




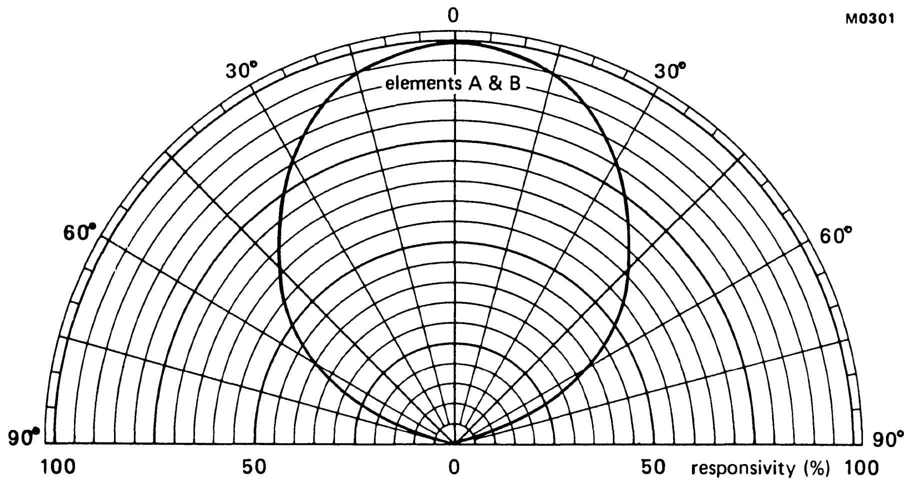


Typical Responsivity, N.E.P., and Noise as functions of Temperature
(one element screened)

POLAR DIAGRAMS



Typical Field of View in x-x plane (see Mechanical Data)



Typical Field of View in y-y plane (see Mechanical Data)

PHOTOCONDUCTIVE DEVICES

LIST OF SYMBOLS

Cell voltage	V
Cell current	I
Illumination current	I_l
Initial illumination current	I_{lo}
Equilibrium illumination current	I_{le}
Dark current	I_d
Initial dark current	I_{do}
Equilibrium dark current	I_{de}
Illumination resistance	r_l
Initial illumination resistance	r_{lo}
Equilibrium illumination resistance	r_{le}
Dark resistance	r_d
Initial dark resistance	r_{do}
Equilibrium dark resistance	r_{de}
Current rise time	t_{ri}
Current decay time	t_{fi}
Pulse duration	t_p
Averaging time	t_{av}
Pulse repetition rate	p_{rr}
Illumination sensitivity	N
Illumination response	γ
Voltage response	α
Ambient temperature	T_{amb}
Thermal resistance	R_{th}
Temperature of CdS tablet	T_{tablet}
Colour temperature	T_c (T_K)
Dissipation	P
Illumination	E
Initial drift	D_o
Peak value (subscript)	M

GENERAL OPERATIONAL RECOMMENDATIONS PHOTOCONDUCTIVE DEVICES

1. GENERAL

1.1 These application directions are valid for all types of photoconductive cells, unless otherwise stated on the individual technical data sheets.

1.2 A photoconductive device is a light-sensitive device whose resistance varies with the illumination on the device.

1.3 Where the term illumination is used in the following sections it shall be taken to mean the radiant energy which is normally used to excite the device.

1.4 Also in the following sections, history is taken to mean the duration of the specified conditions plus a sufficient description of previous conditions.

2. OPERATING CHARACTERISTICS

2.1 The data given on the individual technical data sheets are based on the devices being uniformly illuminated.

2.2 The illumination resistance is the ratio of the voltage across the device to the current through the device when illumination is applied to the device.

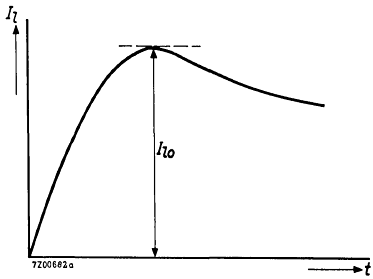
2.2.1 For a particular set of conditions the equilibrium illumination resistance is the illumination resistance after such a time under these conditions that the rate of change of the illumination resistance is less than 1% per 5 minutes.

2.2.2 For a particular set of conditions the initial illumination resistance is the first virtually constant value of the illumination resistance after a period of storage or other operating conditions.
The initial-illumination resistance usually occurs after a few seconds under the specified conditions.

2.3 The illumination current is the current which passes when a voltage and illumination are applied to the device.

2.3.1 For a particular set of conditions the equilibrium illumination current is the illumination current after such a time under these conditions that the rate of change of the illumination current is less than 1% per 5 minutes.

2.3.2 For a particular set of conditions the initial illumination current is the first virtually constant value of the illumination current after a period of storage or other operating conditions.
The initial illumination current usually occurs after a few seconds under the specified conditions.



2.4 The dark resistance is the resistance of the device in the absence of illumination.

2.4.1 For a particular set of conditions the equilibrium dark resistance is the dark resistance after such a time under these conditions that the rate of change of the dark resistance is less than 2% per 5 minutes.

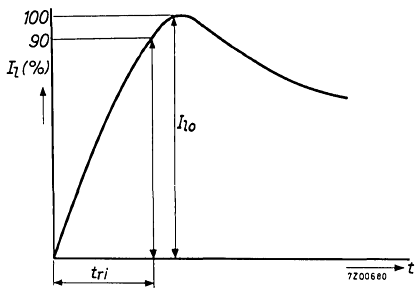
2.4.2 For a particular set of conditions the initial dark resistance is the dark resistance after a specified time under these conditions following a specified history.

2.5 The dark current is the current which passes when a voltage is applied to the device in the absence of illumination.

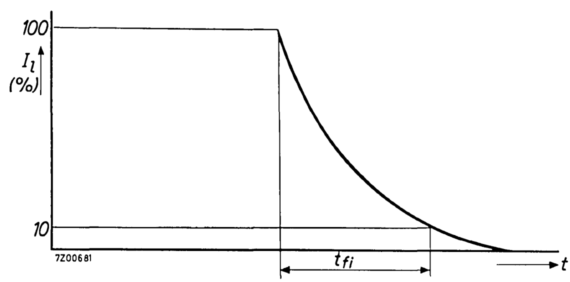
2.5.1 For a particular set of conditions the equilibrium dark current is the dark current after such a time under these conditions that the rate of change of the dark current is less than 2% per 5 minutes.

2.5.2 For a particular set of conditions the initial dark current is the dark current after a specified time under these conditions immediately following a specified history.

2.6.1 For a particular set of conditions and history the current rise time is the time taken for the current through the device to rise to 90% to its initial illumination current measured from the instant of starting the illumination.



2.6.2 For a particular set of conditions and history the current decay time is the time taken for the current through the device to fall to 10% of its value at the instant of stopping the illumination, measured from that instant.



2.7 The illumination sensitivity is the quotient of illumination current by the incident illumination.

2.8 The illumination resistance (current) temperature response is the relationship between the illumination resistance (current) and the ambient temperature of the device under constant illumination and voltage conditions.

2.9 For a particular set of conditions the initial drift is the difference between the equilibrium and initial illumination current, expressed as a percentage of the initial illumination current.

2.10 The illumination response is the relationship between the initial illumination resistance and the illumination, defined as $\frac{\Delta \log r_{lo}}{\Delta \log E}$

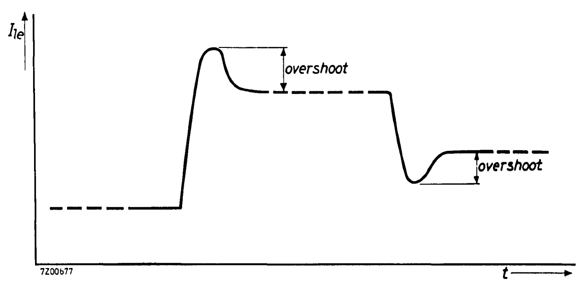
3. THERMAL DATA

3.1 Ambient temperature. The ambient temperature of a device is the temperature of the surrounding air of that device in its practical situation, which means that other elements in the same space or apparatus must have their normal maximum dissipation and that the same apparatus envelope must be used. This ambient temperature can normally be measured by using a mercury thermometer the mercury container of which has been blackened, placed at a distance of 5 mm from the envelope in the horizontal plane through the centre of the effective area of the CdS tablet.
It shall be exposed to substantially the same radiant energy as that incident on the CdS tablet.

3.2 The thermal resistance of a device is defined as the temperature difference between the hottest point of the device and the dissipating medium, divided by the power dissipated in the device.

4. OPERATIONAL NOTES

4.1 When a photoconductive device is subjected to a change of operating conditions there may be a transient change of current in excess of that due to the difference between the equilibrium illumination currents. This transient change is called overshoot.



4.2 Direct sunlight irradiation should be avoided.

5. MOUNTING

5.1 If no restrictions are made on the individual published data sheets, the device may be mounted in any position.

5.2 Most of the photoconductive devices may be soldered directly into the circuit, which is indicated on the individual published data sheets. However, the heat conducted to the seal of the device should be kept to a minimum by the use of a thermal shunt. If not otherwise indicated, the device may be dip-soldered at a solder temperature of 240 °C for a maximum of 10 seconds up to a point 5 mm from the seals.

6. STORAGE

It is recommended that the devices be stored in the dark. At any rate direct sunlight irradiation should be avoided.

7. LIMITING VALUES

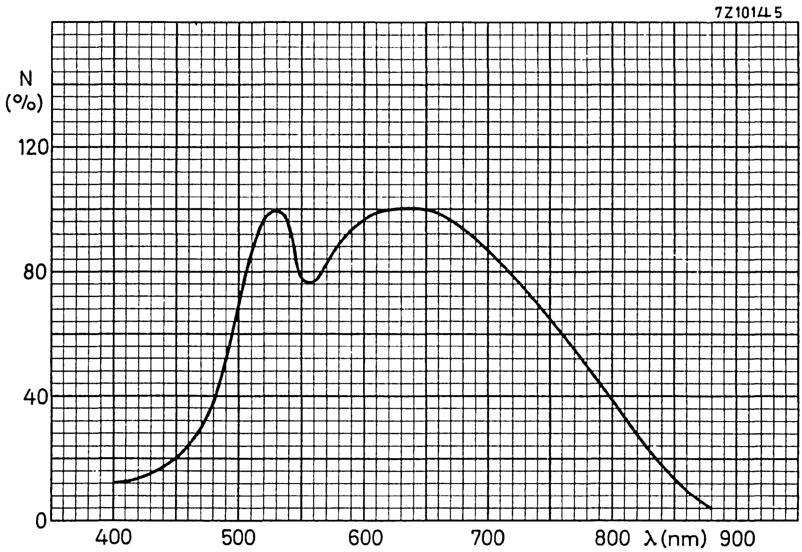
The limiting values of photoconductive devices are given in the absolute maximum rating system.

8. OUTLINE DIMENSIONS

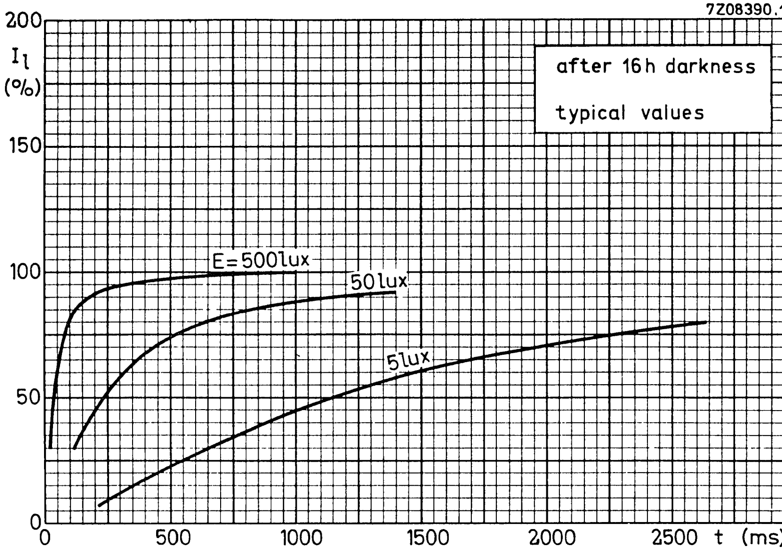
The outline dimensions are given in mm.

9. MECHANICAL ROBUSTNESS

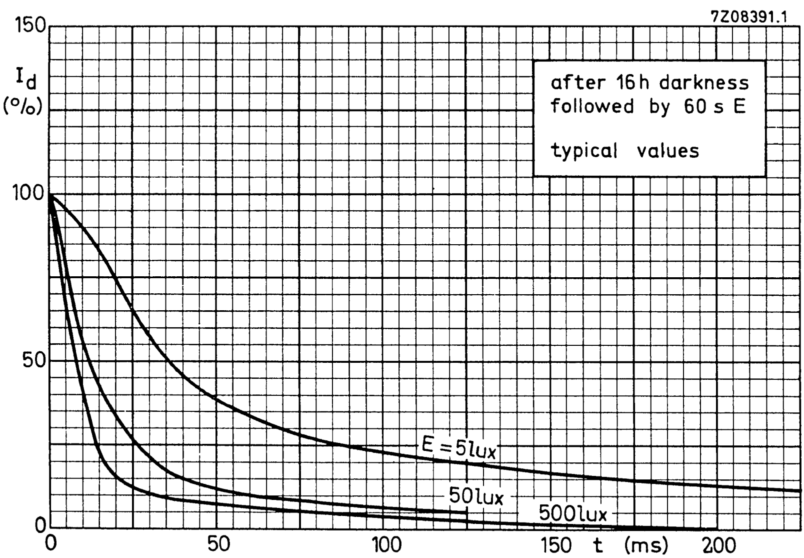
The conditions for shock and vibration given on the individual data sheets are intended only to give an indication of the mechanical quality of the device. It is not advisable to subject the device to such conditions.



Type D response curve



Current rise curves for cells with type D response curve



Current decay curves for cells with type D response curve

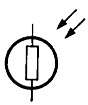
CADMIUM SULPHIDE PHOTOCONDUCTIVE CELLS

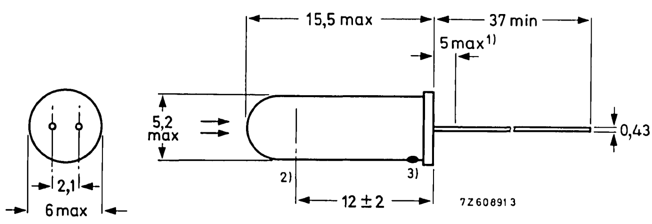
Top sensitive cadmium sulphide photoconductive cells in hermetically sealed all-glass envelope intended for on-off applications such as flame failure circuits, and for automatic brightness and contrast control in television receivers.
The cells are shock and vibration resistant.

QUICK REFERENCE DATA				
Power dissipation at T_{amb} = 25 °C	P	max.	70	mW
Cell voltage, d.c. and repetitive peak	V	max.	350	V
Cell resistance at 50 lx, 2700 K colour temperature, ORP60	r_{lo}	typ.	60	kΩ
ORP66	r_{lo}	<	55	kΩ
Spectral response, current rise and decay curves			type D	
Outline dimensions		max.	6 dia. x 15,5	mm

MECHANICAL DATA

Dimensions in mm





Soldering

The cell may be soldered directly into the circuit but heat conducted to the tablet should be kept to a minimum by the use of a thermal shunt. The cell may be dip-soldered at a solder temperature of 240 °C for maximum 10 s up to a point 5 mm from the seals.

1) Not tinned.
2) Sensitive surface.
3) Blue dot on ORP66.

ELECTRICAL DATA

General

The electrical properties of CdS cells are dependent on many factors such as illumination, colour temperature of the light source, voltage, current, temperature, total time of operation in the circuit and time of operation during the last 24 hours prior to the measurement. The following basic characteristics are therefore only check points of the electrical properties of these devices measured with defined values of the various conditions and at delivery.

Basic characteristics at T_{amb} = 25 °C, illumination with colour temperature of 2700 K and at delivery

			ORP60	ORP66	
Initial dark resistance measured at 300 V d.c. applied via 1 MΩ, 20 s after switching off the illumination	r_{do}	>	200	200	MΩ [1]
Initial illumination resistance measured at 30 V d.c., illumination = 50 lx, after 16 hrs in darkness [2]		>	37,5	-	kΩ
	r_{lo}	typ.	60	-	kΩ
		<	150	55	kΩ
Equilibrium illumination resistance measured at 30 V d.c., illumination = 50 lx, after 15 min under the measuring conditions		>	37,5	-	kΩ
	r_{le}	typ.	75	-	kΩ
		<	190	90	kΩ
Negative temperature response of illumination resistance		typ.	0,2		%/°C
		<	0,5		%/°C
Voltage response $\frac{\text{r at 0,5 V d.c.}}{\text{r at 30 V d.c.}}$	α	typ.	1,5		

[1]) The spread of the dark resistance is large and values higher than 1000 MΩ are possible for the initial dark resistance.

[2]) After 16 hours in darkness changes in the CdS material are still occurring but have only insignificant effect on the illumination resistance.

CADMIUM SULPHIDE PHOTOCONDUCTIVE CELLS

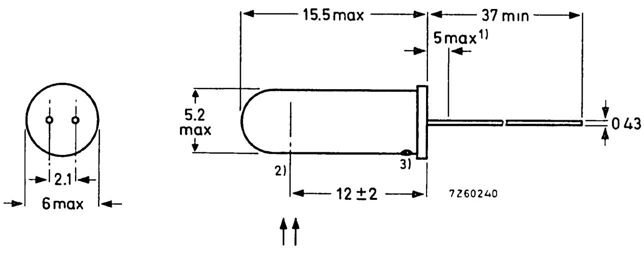
Side sensitive cadmium sulphide photoconductive cells in hermetically sealed all-glass envelope intended for on-off applications such as flame failure circuits, and for automatic brightness and contrast control in television receivers.
The cells are shock and vibration resistant.

QUICK REFERENCE DATA

			ORP61	ORP62
Power dissipation at T_{amb} = 25 °C	P	max.	70	100 mW
Cell voltage, d.c. and repetitive peak	V	max.	350	350 V
Cell resistance at 50 lx, 2700 K colour temperature	r_{lo}	typ.	60	45 kΩ
Spectral response, current rise and decay curves			type D	
Outline dimensions		max.	6 dia. x 15,5 mm	

MECHANICAL DATA

Dimensions in mm



Soldering

The cell may be soldered directly into the circuit but heat conducted to the tablet should be kept to a minimum by the use of a thermal shunt. The cell may be dipsoldered at a solder temperature of 240 °C for maximum 10 s up to a point 5 mm from the seals.

1) Not tinned
2) Centre of sensitive area
3) ORP61 brown dot; ORP62 red dot.

ELECTRICAL DATA

General

The electrical properties of CdS cells are dependent on many factors such as illumination, colour temperature of the light source, voltage, current, temperature, total time of operation in the circuit and time of operation during the last 24 hours prior to the measurement. The following basic characteristics are therefore only check points of the electrical properties of these devices measured with defined values of the various conditions and at delivery.

Basic characteristics at T_{amb} = 25 °C, illumination with colour temperature of 2700 K and at delivery.

			ORP61	ORP62	
Initial dark resistance measured at 300 V d.c. applied via 1 MΩ, 20 s after switching off the illumination	r_{do}	>	200	150	MΩ [1]
Initial illumination resistance measured at 30 V d.c., illumination = 50 lx, after 16 hrs in darkness [2]	r_{lo}	>	37,5	30	kΩ
		typ.	60	45	kΩ
		<	150	100	kΩ
Equilibrium illumination resistance measured at 30 V d.c., illumination = 50 lx, after 15 min under the measuring conditions	r_{le}	>	37,5	30	kΩ
		typ.	75	60	kΩ
		<	190	170	kΩ
Negative temperature response of illumination resistance		typ.	0,2	0,2	%/°C
		<	0,5	0,5	%/°C
Voltage response $\frac{\text{r at 0,5 V d.c.}}{\text{r at 30 V d.c.}}$	α	typ.	1,5	1,4	

1) The spread of the dark resistance is large and values higher than 1000 MΩ are possible for the initial dark resistance.

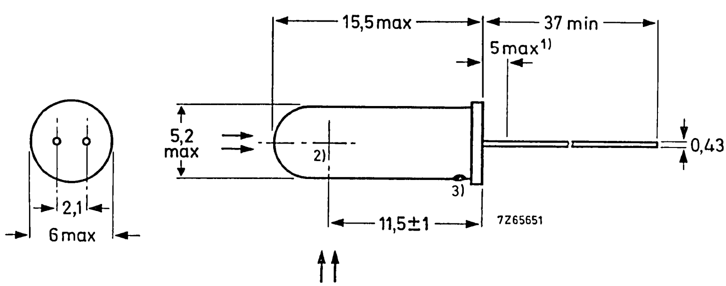
2) After 16 hours in darkness changes in the CdS material are still occurring but have only insignificant effect on the illumination resistance.

CADMIUM SULPHIDE PHOTOCONDUCTIVE CELLS

Top and side sensitive cadmium sulphide photoconductive cells in hermetically sealed all-glass envelope intended for on-off applications such as flame failure circuits, and for automatic brightness and contrast control in television receivers.
The cells are shock and vibration resistant.

QUICK REFERENCE DATA				
Power dissipation at T_{amb} = 25 °C	P	max.	100	mW
Cell voltage, d.c. and repetitive peak	V	max.	350	V
Cell resistance at 50 lx,				
2700 K colour temperature, ORP68	r_{lo}	typ.	64	kΩ
ORP69	r_{lo}	typ.	30	kΩ
Spectral response, current rise and decay curves			type D	
Outline dimensions		max.	6 dia. x 15,5	mm

MECHANICAL DATA Dimensions in mm



Soldering

The cell may be soldered directly into the circuit but heat conducted to the tablet should be kept to a minimum by the use of a thermal shunt. The cell may be dipsoldered at a solder temperature of 240 °C for maximum 10 s up to a point 5 mm from the seals.

1) Not tinned.
2) Centre of sensitive area.
3) ORP68: gray dot; ORP69: white dot.

ELECTRICAL DATA

General

The electrical properties of CdS cells are dependent on many factors such as illumination, colour temperature of the light source, voltage, current, temperature, total time of operation in the circuit and the time of operation during the last 24 hours prior to the measurement. The following basic characteristics are therefore only check points of the electrical properties of these devices measured with defined values of the various conditions and at delivery.

Basic characteristics at T_{amb} = 25 °C, illumination with colour temperature of 2700 K and at delivery

			ORP68	ORP69	
Initial dark resistance measured with 300 V d.c. applied via 1 MΩ, 20 s after switching off the illumination	r_{do}	>	150	100	MΩ [1]
Initial illumination resistance measured at 30 V d.c., illumination = 50 lx, after 16 h in darkness [2] [3]	r_{lo}	>	30	20	kΩ
		typ.	46	30	kΩ
		<	100	60	kΩ
Equilibrium illumination resistance measured at 30 V d.c., illumination = 50 lx, after 15 min under the measuring conditions	r_{le}	>	30	27	kΩ
		typ.	60	46	kΩ
		<	170	115	kΩ
Negative temperature response of illumination resistance		typ.	0,2		%/°C
		<	0,5		%/°C
Voltage response $\frac{\text{r at 0,5 V d.c.}}{\text{r at 30 V d.c.}}$		typ.	1,4		

1) The spread of the dark resistance is large and values higher than 1000 MΩ are possible for the initial dark resistance.
2) After 16 hours in darkness changes in the CdS material are still occurring but have only insignificant effect on the illumination resistance.
3) Measured at top sensitivity.

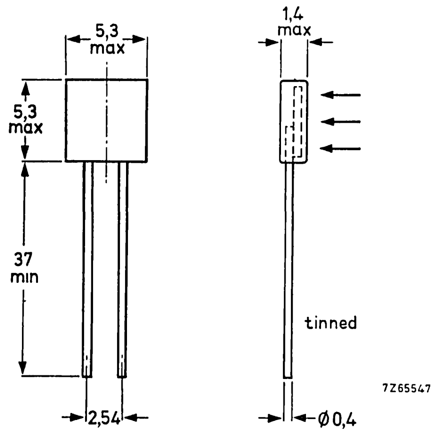
CADMIUM SULPHIDE PHOTOCONDUCTIVE DEVICE

Cadmium sulphide photoconductive device with side sensitivity in plastic encapsulation. The device consists of two cells connected in series and is intended for general applications.

QUICK REFERENCE DATA				
Power dissipation at $T_{amb} \leq 25\ ^oC$	P		100	mW
Voltage, d.c. and repetitive peak	V	max.	50	V
Resistance at 50 lux, T_c = 2700 ^oK	r_{l_0}		600	Ω
Wavelengths at 50% sensitivity	λ		500 and 675	nm
Outline dimensions		max.	5,3 x 5,3 x 1,4	mm

MECHANICAL DATA

Dimensions in mm



Soldering

The device may be soldered direct into the circuit but heat conducted to the tablet should be kept to a minimum by the use of a thermal shunt.
It may be dip-soldered at a solder temperature of 270 ^oC for a maximum of 2 s up to a point 6 mm from the envelope.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC134)

Cell voltage, d.c. and repetitive peak	V	max.	50	V
Cell voltage, p_{rr} ≤ once per minute, t_p ≤ 5 ms	V_M	max.	100	V
Power dissipation, t_{av} = 0,5 s, T_{amb} ≤ 25 °C	P	max.	100	mW
Cell current, d.c. and repetitive peak	I	max.	25	mA
Ambient temperature, storage and operating	T_{amb}	min.	−40	°C
storage	T_{stg}	max.	+50	°C
Temperature of CdS tablet	T_{tablet}	max.	+70	°C

THERMAL RESISTANCE

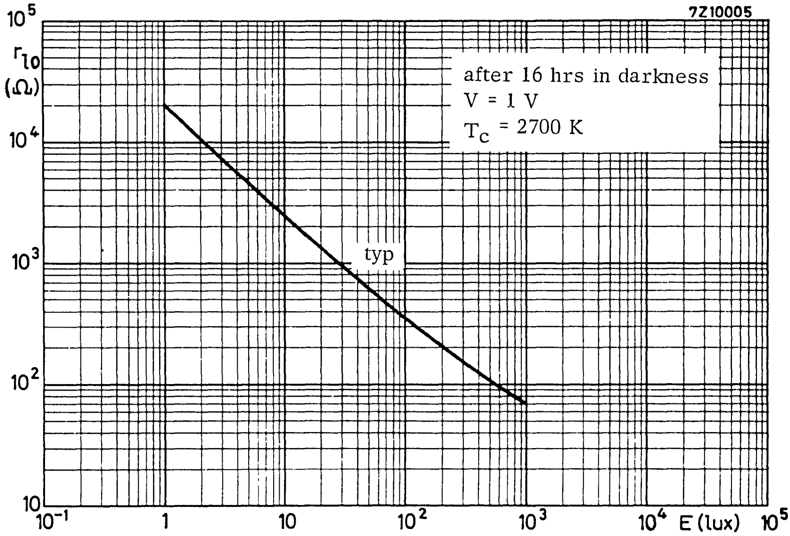
Thermal resistance from CdS tablet to ambient	$R_{th\ t\text{-}a}$	=	0,45	°C/mW

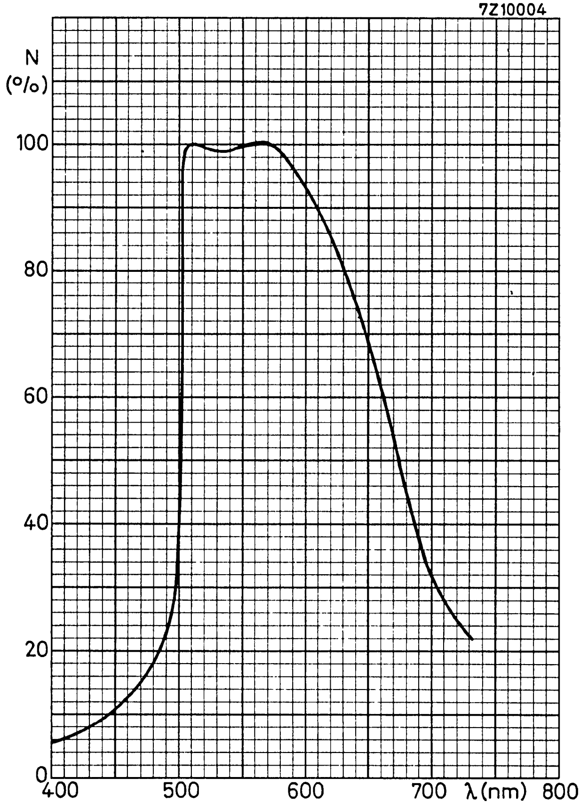
CHARACTERISTICS

Initial dark resistance, measured with 50 V d.c. applied via 1 MΩ, 20 s after switching off the illumination	r_{do}	>	200	kΩ
Initial ilumination resistance measured at 1 V d.c., illumination 50 lx, T_c = 2700 K	r_{lo}	typ.	0,6	kΩ
			0,35-1,4	kΩ
Initial drift	D_o	typ.	0	%
F_{4700} (= $\frac{r_l \text{ at } 4700 \text{ K}}{r_l \text{ at } 2856 \text{ K}}$ at constant illumination and using a Davis-Gibson filter)		typ.	1,2	

OPERATING NOTES

1. The device consits of two photoconductive cells connected in series. The resistance of the device is mainly governed by the resistance of that cell receiving the lower luminous flux.
   If it is required for any application that the device is partly shaded, the shadow line should be perpendicular to the axis of the device.
2. For optimum heat dissipation use the shortest permissible lead length.


7Z10005
10^5
r_{10}
(Ω)
10^4
10^3
10^2
10
10^{-1}
1
10
10^2
10^3
10^4
E (lux)
10^5
after 16 hrs in darkness
V = 1 V
T_c = 2700 K
typ


7Z10004
N
(%)
100
80
60
40
20
0
400
500
600
700
λ (nm)
800

PHOTOCONDUCTIVE CELL

Lead sulphide, chemically deposited, photoconductive cell recommended for room temperature operation. It is encapsulated in a hermetically sealed envelope similar to TO-5, with an end-viewing window. It incorporates a germanium filter to cut off radiation at wavelengths below 1.5 μm.

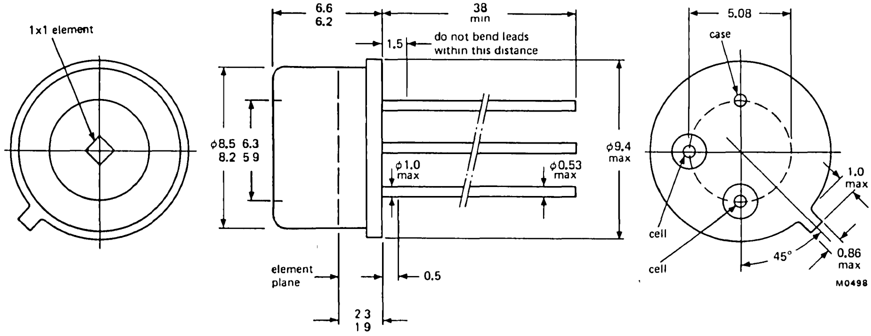
QUICK REFERENCE DATA

Wavelength range at maximum response		1.8 to 2.2	μm
Operating temperature		20	^oC
Current responsivity (2.0 μm, 800)	typ.	2500	mAW^{-1}
Voltage responsivity (2.0 μm, 800)	typ.	6×10^5	VW^{-1}
D* (2.0 μm, 800, 1)	min.	1.0×10^{10}	$cmHz^{1/2}W^{-1}$
Time constant	typ.	250	μs
Sensitive area		1.0 X 1.0	mm

This data must be read in conjunction with GENERAL SAFETY RECOMMENDATIONS – OPTOELECTRONIC DEVICES

MECHANICAL DATA

SOT-49/1 (similar to TO-5) Dimensions in mm



PRODUCT SAFETY

Modern high technology materials have been used in the manufacture of this device to ensure high performance. Some of these materials are toxic in certain circumstances. Mechanical or electrical damage is unlikely to give rise to any hazard, but toxic vapours may be generated if the device is heated to destruction. Disposal of large quantities should therefore be carried out in accordance with the latest local legislation.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Power dissipation (note 2)	P	max.	20	mW
Storage temperature range	T_{stg}		−20 to +50	°C
Ambient operating temperature range	T_{amb}		−20 to +50	°C

CHARACTERISTICS T_{amb} = 20 °C (see notes)

Wavelength range at maximum response		1.8 to 2.2	μm
Spectral response range (see page 5)		1.5 to 2.9	μm
Cell resistance	min.	100	kΩ
	typ.	240	kΩ
Time constant (note 3)	typ.	250	μs
Field of view	typ.	70	deg

BLACK BODY PERFORMANCE

Current responsivity (500K, 800)	min.	10	mAW^{-1}
	typ.	25	mAW^{-1}
Voltage responsivity (500K, 800)	typ.	6×10^3	VW^{-1}
D* (500K, 800, 1)	min.	1.0×10^8	$cmHz^{½}W^{-1}$
	typ.	2.3×10^8	$cmHz^{½}W^{-1}$
N.E.P. (500K, 800, 1)	max.	1.0×10^{-9}	$WHz^{-½}$

MONOCHROMATIC PERFORMANCE (2.0 μm radiation)

Current responsivity (2.0 μm, 800)	min.	1000	mAW^{-1}
	typ.	2500	mAW^{-1}
Voltage responsivity (2.0 μm, 800)	typ.	6×10^5	VW^{-1}
D* (2.0 μm, 800, 1)	min.	1.0×10^{10}	$cmHz^{½}W^{-1}$
	typ.	2.3×10^{10}	$cmHz^{½}W^{-1}$
N.E.P. (2.0 μm, 800, 1)	max.	1.0×10^{-11}	$WHz^{-½}$

The above characteristics should be used in conjunction with the following notes.

1. Test conditions

The cell is operated at a temperature of 20 °C. The sensitive element is situated at a distance of 264 mm from a black body source limited by an aperture of 3 mm diameter.
The radiation path is interrupted at 800 Hz by a chopper blade at ambient temperature. Under these conditions the r.m.s. power at the element (chopping factor 2.2) is 4.5 $\mu W\ cm^{-2}$.
A bias voltage of 24 V is applied to the cell. Measurements of the detector output are made using a low value resistive load, followed by a current pre-amplifier, as shown in figure 1. The output is fed into an amplifier tuned to 800 Hz with a bandwidth of 50 Hz.
The figures in brackets, which follow responsivity, D* and N.E.P. refer to the test conditions, for example, D* (2.0 μm, 800, 1) denotes monochromatic radiation incident on the detector of wavelength 2.0 μm, modulation frequency 800 Hz and electronic bandwidth of 1 Hz.
The characteristics shown in the data for D* and N.E.P. are normalized to 1 Hz bandwidth. This means that with the 50 Hz bandwidth recommended for the test amplifier (figure 1), D* will be $\sqrt{50}$ higher than the normalized value and, conversely, N.E.P. will be reduced by the same factor. (See following definitions of D* and N.E.P.).

D* and N.E.P.

These are figures of merit for the materials of detectors and are fully discussed in most textbooks on infrared. D* is derived from the expression:

$$D^* = \frac{\frac{I_s}{I_n} \times \left(A\,(\Delta f)\right)^{1/2}}{W}$$

where
I_s = Signal current
I_n = Noise current
A = Detector area
(Δf) = Bandwidth of measuring amplifier
W = Radiation power incident on detector sensitive element (r.m.s. value in watts)

The Noise Equivalent Power (N.E.P.) is related to D* by the expression:

$$\text{N.E.P.} = \frac{A^{1/2}}{D^*}$$

2. Variation of performance with bias

Both signal and noise vary with bias in this type of cell. At bias levels at which the cell dissipation is less than 2.5 mW the maximum level of D* is maintained. At higher levels of dissipation the noise increases more rapidly than the signal so that although the responsivity increases, D* falls. The maximum responsivity typically occurs at a dissipation level of 10 mW, beyond which element heating takes place with a consequent reduction in responsivity.

Variation of performance with temperature/life

The quoted values are those which may be expected after storage or operation up to 20 °C. These values may change after storage or operation at temperatures up to the absolute maximum temperature of 50 °C.

3. Time constant

The detector time constant figure is based on the response to a step function of incident radiation. The quoted time indicates the interval between the moment of application and the output pulse reaching 63% of its peak value.

4. Recommended operating conditions

A suitable circuit is shown in Fig. 1. With this mode of operation, the signal is the short-circuit current, which is related to the open-circuit cell voltage by the expression:

$$V_{oc} = I_{sc} \times R_{cell}$$

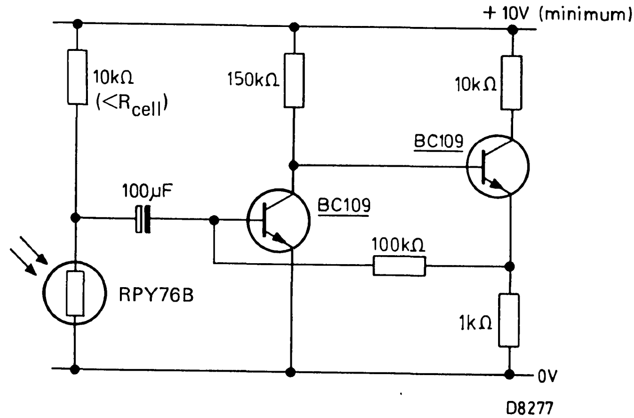
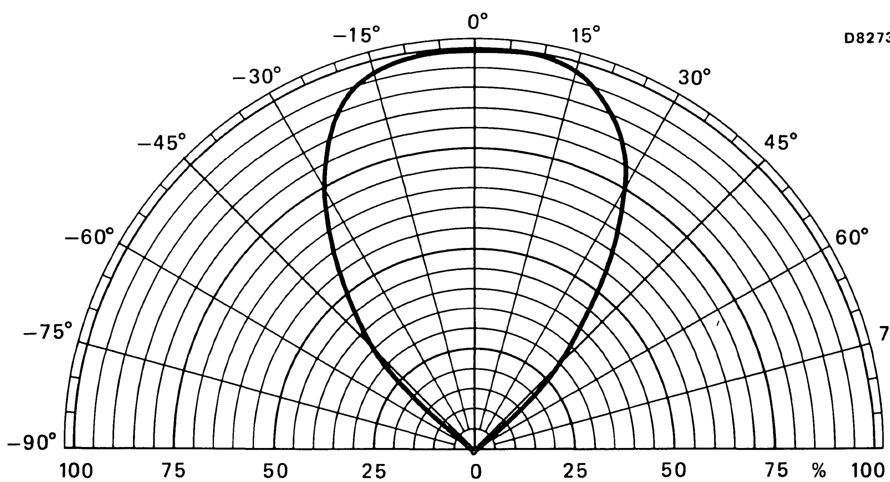
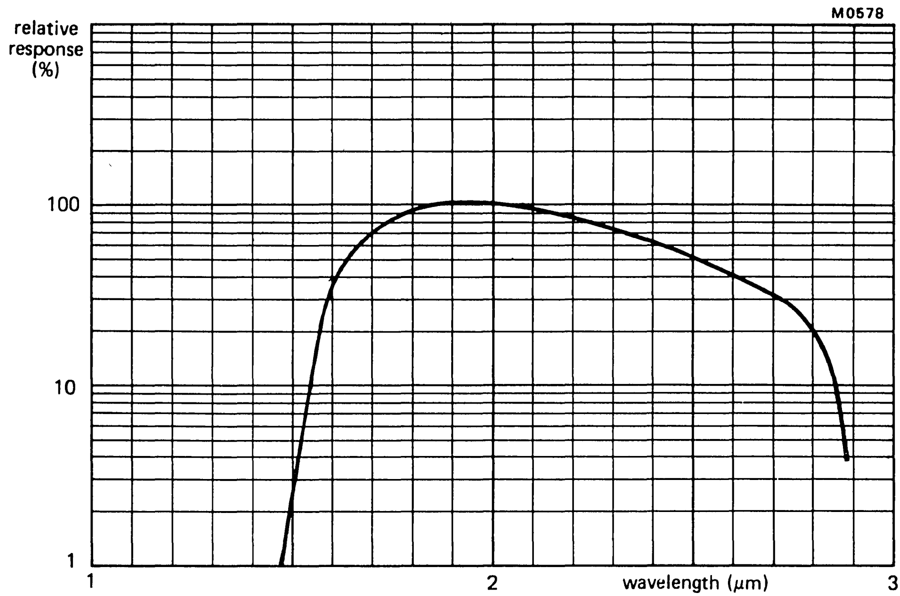


Fig.1



Typical polar response of relative sensitivity



Typical relative spectral response

DEVELOPMENT SAMPLE DATA

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