intel®

MCS4
Microcomputer Kit

MCS4 KIT A

MCS™-4 — INTEL'S LOWEST COST MICROCOMPUTER. IDEAL FOR PROTOTYPE OR LOW VOLUME PRODUCTION.

The MCS-4 is a microprogrammable computer set designed for applications such as test systems, peripherals, terminals, billing machines, measuring systems, numeric and process control. The 4004 CPU, 4003 SR, and 4002 RAM are standard building blocks.

The 4008 and 4009 are a pair of interface devices which expand the capabilities of Intel's MCS-4 microcomputer set. Now standard Intel PROMs, ROMs and RAMs may be used for the program memory of the MCS-4.

MCS-4 systems interface easily with switches, keyboards, displays, teletypewriters, printers, readers, A-D converters and other popular peripherals.

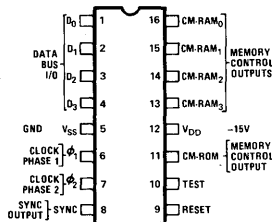A system built with the MCS-4 microcomputer set can have up to 4K x 8 bit ROM words, 1280 x 4 bit RAM characters and 128 I/O lines without requiring any interface logic. By adding a few simple gates the MCS-4 can have up to 48 RAM and ROM packages in any combination, and 192 I/O lines.

The MCS-4 has a very powerful instruction set that allows both binary and decimal arithmetic. It includes conditional branching, jump to subroutine, and provides for the efficient use of ROM look-up tables by indirect fetching.
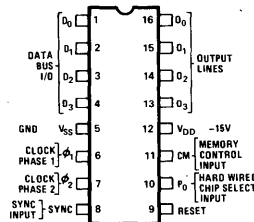
The Intel MCS-4 microcomputer set (4002/3/4/8/9 and 4702A) are fabricated with Silicon Gate Technology. This low threshold technology allows the design and production of higher performance MOS circuits and provides a higher functional density on a monolithic chip than conventional MOS technologies.

- **Programmable General Purpose Microcomputer**
- **4-Bit Parallel CPU with 46 Instructions**
- **Instruction Set includes Conditional Branching, Jump to Subroutine and Indirect Fetching**
- **Binary and Decimal Arithmetic Modes**
- **Program Storage in 4702A Reprogrammable PROM Simulates 4001 ROM**
- **2-Phase Dynamic Operation**
- **10.8 Microsecond Instruction Cycle**
- **CPU Directly Compatible with MCS-4 ROMs and RAMs Using 4008/4009 Standard Memory and I/O Interface Set**
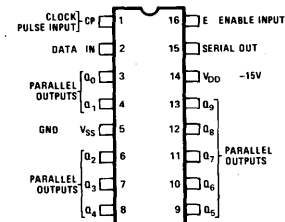- **Easy Expansion—One CPU can Directly Drive up to 32,768 Bits of ROM and up to 5120 Bits of RAM**

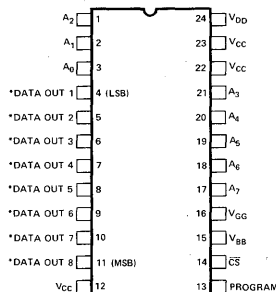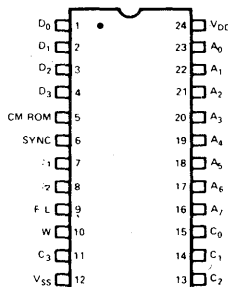### 4004 CPU

```
          ┌──┬──┬──┐
   D₀ □    1      16 □ CM-RAM₀
DATA D₁ □  2      15 □ CM-RAM₁  MEMORY
BUS                              CONTROL
I/O  D₂ □  3      14 □ CM-RAM₂  OUTPUTS
   D₃ □    4      13 □ CM-RAM₃
GND Vss □  5      12 □ V_DD  -15V
CLOCK
PHASE 1 Φ₁ □ 6    11 □ CM-ROM  MEMORY CONTROL OUTPUT
CLOCK
PHASE 2 Φ₂ □ 7    10 □ TEST
SYNC
OUTPUT SYNC □ 8    9 □ RESET
```

4002 RAM

```
          ┌──┬──┬──┐
   D₀ □    1      16 □ O₀
DATA D₁ □  2      15 □ O₁   OUTPUT
BUS                         LINES
I/O  D₂ □  3      14 □ O₂
   D₃ □    4      13 □ O₃
GND Vss □  5      12 □ V_DD  -15V
CLOCK
PHASE 1 Φ₁ □ 6    11 □ CM  MEMORY CONTROL INPUT
CLOCK
PHASE 2 Φ₂ □ 7    10 □ P₀  HARD WIRED CHIP SELECT INPUT
SYNC
INPUT SYNC □ 8     9 □ RESET
```

4003SR

```
              ┌──┬──┬──┐
CLOCK
PULSE INPUT CP □ 1    16 □ E ENABLE INPUT
DATA IN □      2      15 □ SERIAL OUT
PARALLEL O₀ □  3      14 □ V_DD  -15V
OUTPUTS O₁ □   4      13 □ O₉
GND Vss □      5      12 □ O₈
PARALLEL O₂ □  6      11 □ O₇  PARALLEL OUTPUTS
OUTPUTS O₃ □   7      10 □ O₆
   O₄ □        8       9 □ O₅
```

4702A ROM

```
          ┌──┬──┬──┐
   A₂ □    1      24 □ V_DD
   A₁ □    2      23 □ V_CC
   A₀ □    3      22 □ V_CC
*DATA OUT 1 □ 4 (LSB) 21 □ A₃
*DATA OUT 2 □ 5      20 □ A₄
*DATA OUT 3 □ 6      19 □ A₅
*DATA OUT 4 □ 7      18 □ A₆
*DATA OUT 5 □ 8      17 □ A₇
*DATA OUT 6 □ 9      16 □ V_GG
*DATA OUT 7 □ 10     15 □ V_BB
*DATA OUT 8 □ 11 (MSB) 14 □ C̄S̄
   Vcc □    12      13 □ PROGRAM
```

*THIS PIN IS THE DATA INPUT LEAD DURING PROGRAMMING.

4008

```
          ┌──┬──┬──┐
   D₀ □    1  •   24 □ V_DD
   D₁ □    2      23 □ A₀
   D₂ □    3      22 □ A₁
   D₃ □    4      21 □ A₂
CM ROM □   5      20 □ A₃
SYNC □     6      19 □ A₄
   -1 □    7      18 □ A₅
   -2 □    8      17 □ A₆
   F L □    9      16 □ A₇
   W □     10     15 □ C₀
   C₃ □    11     14 □ C₁
   Vss □   12     13 □ C₂
```

4009

```
          ┌──┬──┬──┐
   D₅ □    1  •   24 □ V_DD
   D₆ □    2      23 □ D₀
   D₇ □    3      22 □ D₁
   D₈ □    4      21 □ D₂
   D'₁ □   5      20 □ D₃
   D₂ □    6      19 □ I/O₀
   D₃ □    7      18 □ I/O₁
   D₄ □    8      17 □ I/O₂
   IN □    9      16 □ I/O₃
   OUT □   10     15 □ CM-ROM
   SYNC □  11     14 □ O₁
   Vss □   12     13 □ O₂
```

SYSTEM INTERCONNECT

DUAL ONE SHOT
9602

7400

HC-18/U
(XTAL)
5.185 MHZ

74H04

9316

NAT'L
MH
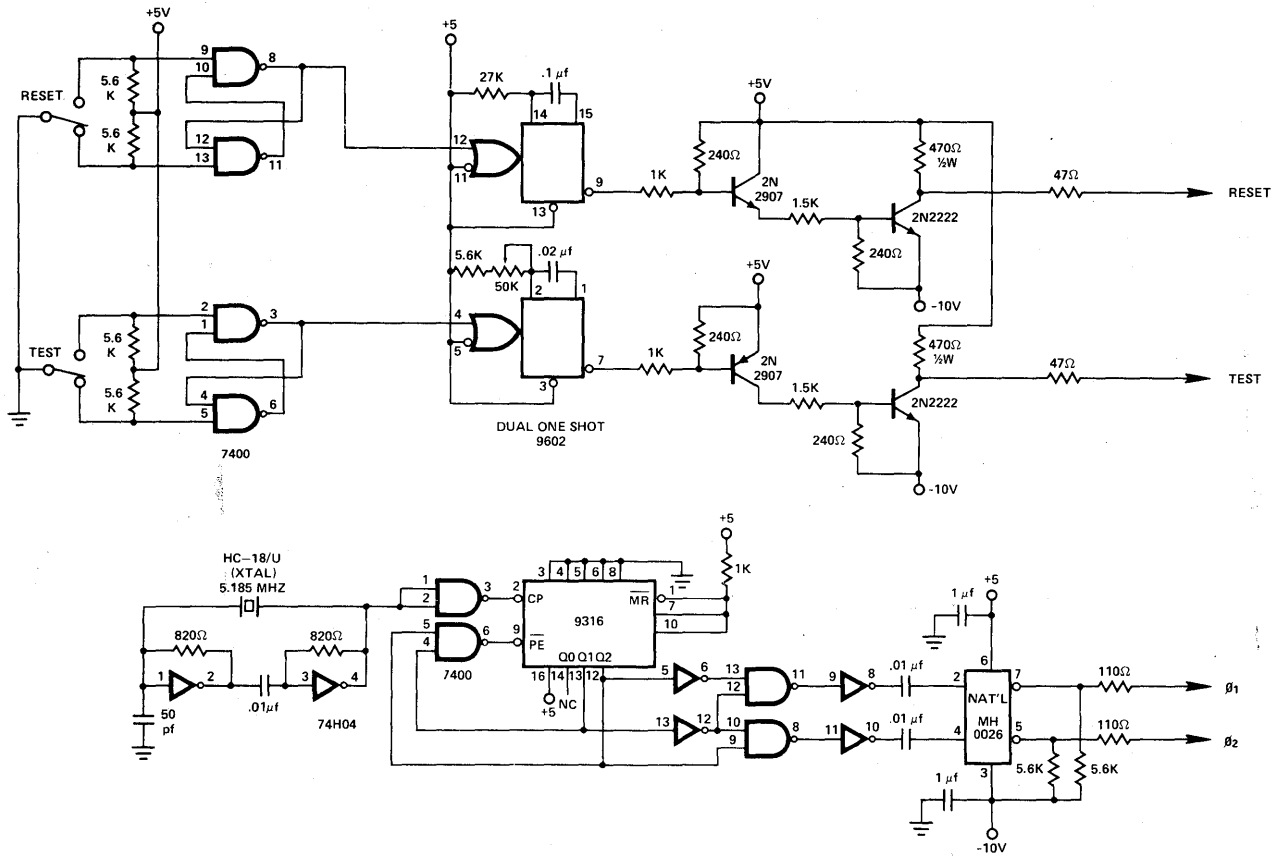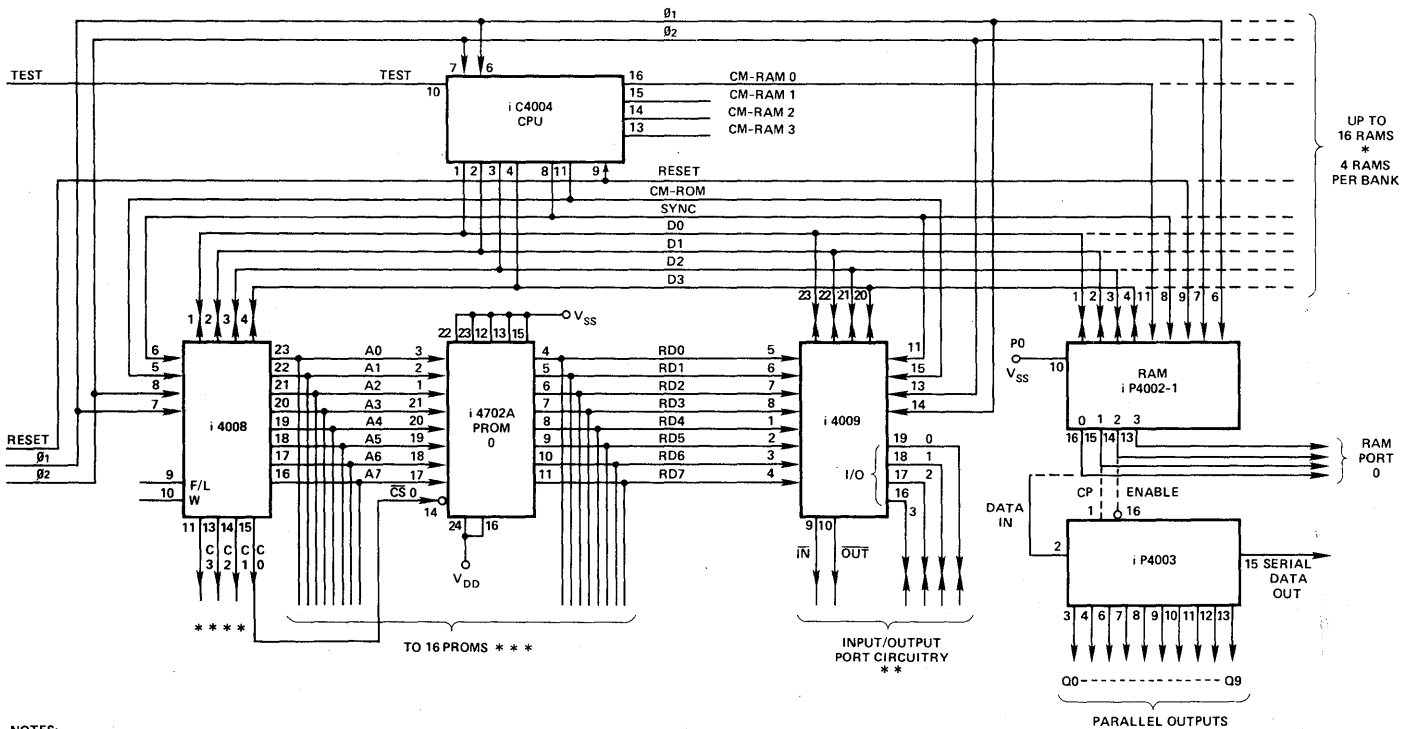0026
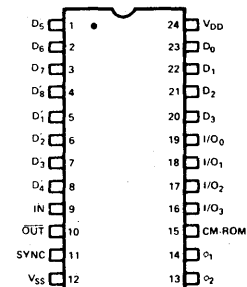
SUGGESTED CLOCK DRIVER, TEST AND RESET CIRCUITRY

NOTES:
* CONSULT MCS 4 USER'S MANUAL.
** SEE 4008/4009 DATA SHEET.
*** SEE 4702A DATA SHEET.
**** THESE LINES MAY BE DECODED
FOR UP TO 16 PROMS.

$(V_{SS} = +5V \pm 5\%; V_{DD} = -10V \pm 5\%)$