

CLC5506 Evaluation Board

National Semiconductor
Application Note 1138
Lynn Barbosa
August 1999



CLC5506 Evaluation Board

The CLC5506PCASM is a fully assembled and tested evaluation module for CLC5506 Gain Trim Amplifier. The evaluation module simplifies the task of making frequency response and noise figure performance evaluation of the CLC5506 Gain Trim Amplifier (GTA).

The evaluation circuit is carefully designed and laid out on an FR4 printed circuit board (part number: CLC730102). Refer to Figure 1 for the schematic diagram of the CLC5506PCASM.

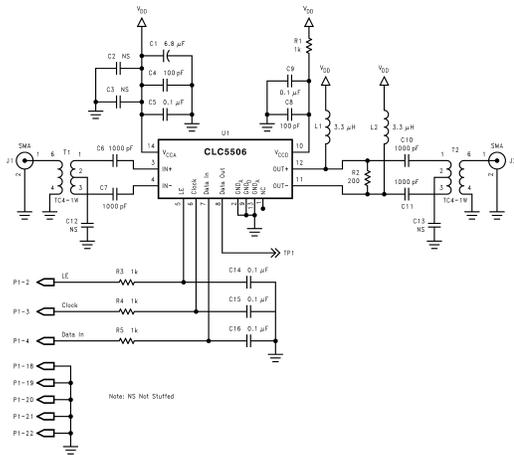


FIGURE 1. CLC5506PCASM Schematic Diagram

The differential input impedance of CLC5506 between pins IN_+ and IN_- is 200Ω . The differential output impedance between pins OUT_+ and OUT_- is set to 200Ω by resistor R2. Two 4:1 impedance ratio transformers (T1 and T2) are used for wide band matching to a single ended 50Ω system to simplify evaluation. The $3.3\mu H$ inductor at L1 and L2 are used as RF chokes for the open collector outputs. Resistor R1 and V_{CCD} is used to reduce noise cross-talk between the V_{CCA} and V_{CCD} . The low pass RC networks (R3, R4, R5 and C14, C15, C16) at LE, Clock and Data In pins are used to reduce AC feed-through to the RF circuitry.

Windows-95/98/NT GTA control software, developed by National Semiconductor can be used to send control data to the CLC5506 Gain Trim Amplifier. This software along with the CLC5506 Datasheet can be downloaded from National Semiconductor Corporation Web site at <http://www.national.com>.

Figure 2, shows the typical test setup block diagram for the measurement of frequency response parameters.

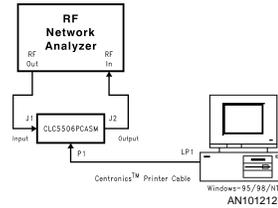


FIGURE 2. Test Setup Block Diagram for Frequency Response Measurement

Figure 3, shows the typical test setup block diagram for the measurement of noise figure parameter. A RF noise source was used. During the noise figure measurement, the Centronics™ printer cable connected to P1 should be disconnected from the evaluation module and removed from the measurement area to reduce PC EMI noise pick-up.

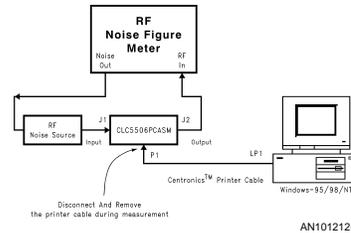


FIGURE 3. Test Setup Block Diagram for Noise figure Measurement

RF transformers T1 and T2 have intrinsic losses, the actual RF performance of the CLC5506 per se, could be calculated by accounting for T1 and T2 losses in the evaluation module. Refer to Table 1 for correction factor for gain measurement and noise figure measurement based on typical losses measured on the transformers specified in Table 2.

Centronics is a trademark of Centronics

AN-1138

TABLE 1. Gain and Noise Figure Correction Factor

Frequency (MHz)	Gain Measurement Correction Factor (dB)	Noise Figure Measurement Correction Factor (dB)
50	1.6	0.8
60	1.6	0.8
70	1.6	0.8
80	1.7	0.85
90	1.7	0.85
100	1.7	0.85
110	1.7	0.85
120	1.8	0.9
130	1.8	0.9
140	1.8	0.9
150	1.8	0.9
160	1.8	0.9
170	1.8	0.9
180	1.9	0.95
190	1.9	1.9
200	1.9	1.9
210	1.9	0.95
220	2.0	1.0
230	2.0	1.0
240	2.0	1.0
250	2.0	1.0
260	2.1	1.05
270	2.1	1.05
280	2.2	1.1
290	2.2	1.1
300	2.2	1.1
310	2.2	1.1
320	2.3	1.15
330	2.3	1.15
340	2.3	1.15
350	2.4	1.2
360	2.4	1.2
370	2.5	1.25
380	2.5	1.25
390	2.5	1.25
400	2.5	1.25
500	3.8	1.9
600	4.4	2.2

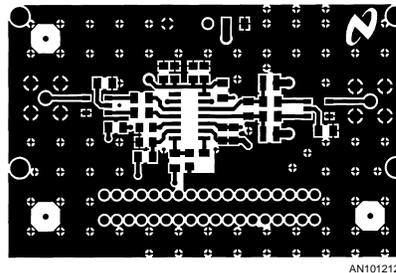
TABLE 2. Bill of Materials for CLC5506PCASM

Reference	Description	Part No. or Note	Distributor	Qty.
T1,2	Transformer	Mini-Circuits TC4-1W	Mini-Circuits	2
P1	Connector	Norcomp, TT57-LE40360	DigiKey/ 1036RF-ND	1
J1,2	SMA connector	Femal Right Angle PCB Mount	DigiKey/ ARFX1232-ND	2
C4,8	Cap, 100pF, 5%	0805 SMD package	Generic	3
C6,7,10,11	Cap, 1000pF, 10%	1206 SMD package	Generic	4
C5,9,14,15,16	Cap, 0.1µF, 20%	0805 SMD Package	Generic	6
C1	Cap, 6.8µF, Tant., 16V	3528 SMD package	Generic	1
R1,3,4,5	Res 1K, 5%, 1/8W	1206 SMD Package	Generic	4
R2	REs, 200, 5%, 1/8W	1206 SMD Package	Generic	1
L1,2	Inductor, 3.3µH	1008 SMD Package	CoilCraft	2
VCC, GND	Single Header	0.1" header	Generic	2
U1	CLC5506IM PCB	14-PIN SOIC CLC730102	National Semi National Semi	1 1

For insertion gain measurement of the frequency response, the correction factor is the total insertion loss of T1 and T2. This correction factor shall be added back to the insertion gain reading of network analyzer to get the actual gain performance of CLC5506.

For the noise figure measurement, the correction factor is the insertion loss of T1 (or half the total loss of T1 and T2). This correction factor shall be deducted from the noise figure reading of noise figure meter.

Figure 4 and Figure 5 on the following page, illustrate the top and bottom side layout of the CLC730102. Figure 6, also on the following page, is the assembly drawing of CLC5506PCASM.



AN101212-6

FIGURE 4. CLC730102 (Top Side)

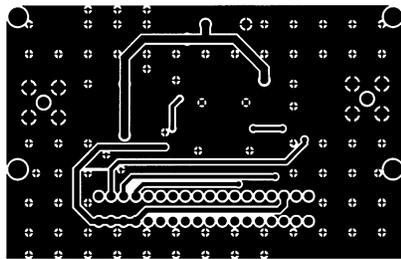


FIGURE 5. CLC730102 PCB (Bottom Side)

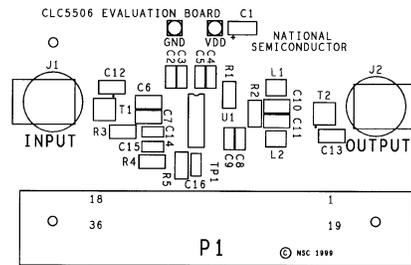


FIGURE 6. CLC5506PCASM
Component Layout (Top Side)

In order to achieve the same performance as specified in the CLC5506 datasheet, components should be chosen from the bill of material attached and installed per Figure 6.

LIFE SUPPORT POLICY

NATIONAL'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT AND GENERAL COUNSEL OF NATIONAL SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



National Semiconductor Corporation
Americas
Tel: 1-800-272-9959
Fax: 1-800-737-7018
Email: support@nsc.com

www.national.com

National Semiconductor Europe

Fax: +49 (0) 1 80-530 85 86
Email: europe.support@nsc.com
Deutsch Tel: +49 (0) 1 80-530 85 85
English Tel: +49 (0) 1 80-532 78 32
Français Tel: +49 (0) 1 80-532 93 58
Italiano Tel: +49 (0) 1 80-534 16 80

National Semiconductor Asia Pacific Customer Response Group

Tel: 65-2544466
Fax: 65-2504466
Email: sea.support@nsc.com

National Semiconductor Japan Ltd.

Tel: 81-3-5639-7560
Fax: 81-3-5639-7507