

# CLC5506 Evaluation Board

National Semiconductor  
Application Note 1138  
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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.

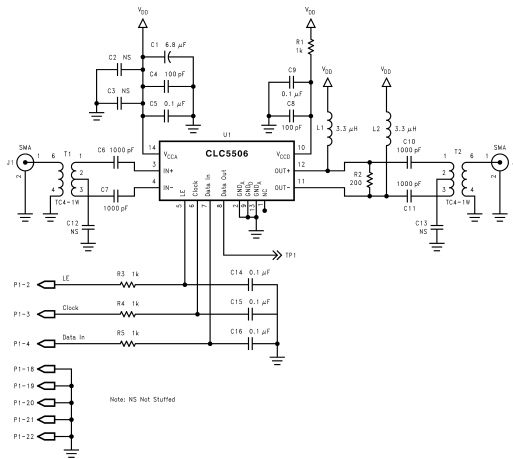


FIGURE 1. CLC5506PCASM Schematic Diagram

The differential input impedance of CLC5506 between pins  $IN_+$  and  $IN_-$  is  $200\Omega$ . The differential output impedance between pins  $OUT_+$  and  $OUT_-$  is set to  $200\Omega$  by resistor R2. Two 4:1 impedance ratio transformers (T1 and T2) are used for wide band matching to a single ended  $50\Omega$  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.

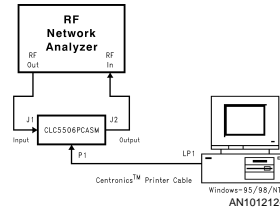


FIGURE 2. Test Setup Block Diagram for Frequency Response Measurement

*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.

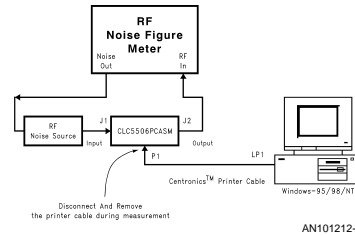


FIGURE 3. Test Setup Block Diagram for Noise figure Measurement

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*.

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**TABLE 1. Gain and Noise Figure Correction Factor**

<b>Frequency (MHz)</b>	<b>Gain Measurement Correction Factor (dB)</b>	<b>Noise Figure Measurement Correction Factor (dB)</b>
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.

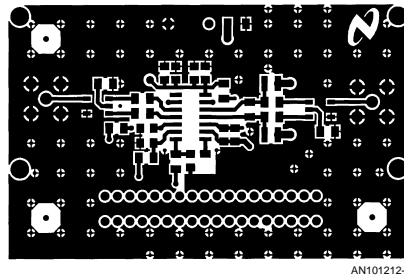


FIGURE 4. CLC730102 (Top Side)

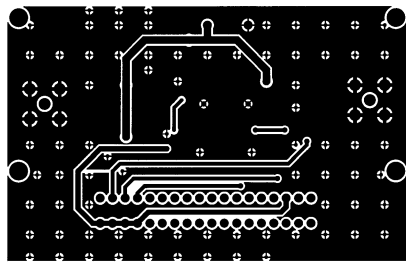


FIGURE 5. CLC730102 PCB (Bottom Side)

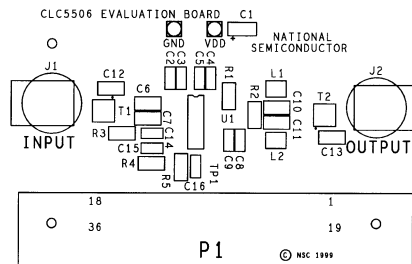


FIGURE 6. CLC5506PCASM  
Component Layout (Top Side)

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.

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