



AN–1138 CLC5506 Evaluation Board

1 Basic Description

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

The evaluation circuit is carefully designed and laid out on an FR4 printed circuit board (PCB) (part number: CLC730102). For the schematic diagram of the CLC5506PCASM, see [Figure 1](#).



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 Texas Instruments can be used to send control data to the CLC5506 Gain Trim Amplifier. This software along with the *CLC5506 Gain Trim Amplifier (GTA) Data Sheet* ([SNOS456](#)) can be downloaded from Texas Instruments web site at <http://www.ti.com>.

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

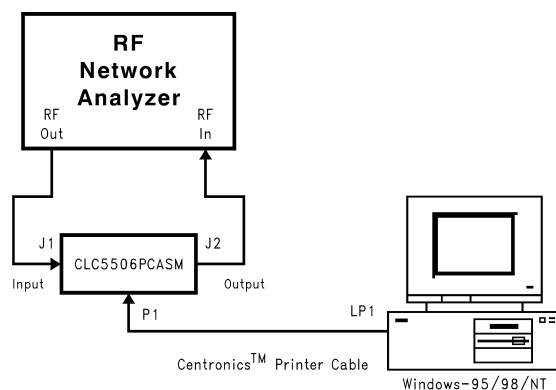


Figure 2. Test Setup Block Diagram for Frequency Response Measurement

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.

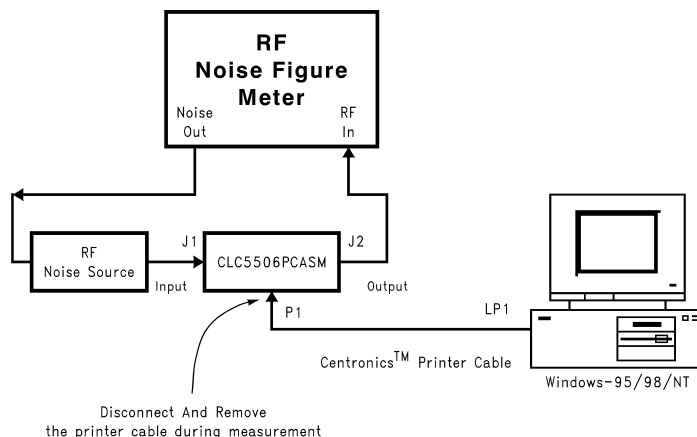


Figure 3. Test Setup Block Diagram for Noise Figure Measurement

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. For correction factor for gain measurement and noise figure measurement based on typical losses measured on the transformers specified in [Table 2](#), see [Table 1](#).

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

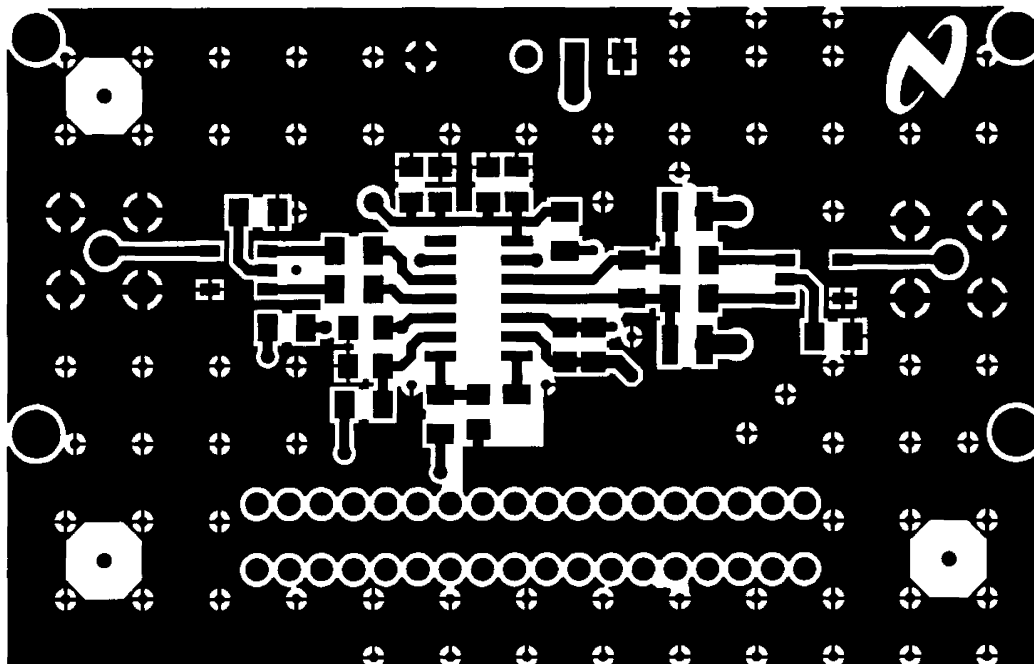
Table 2. Bill of Materials for CLC5506PCASM

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

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)

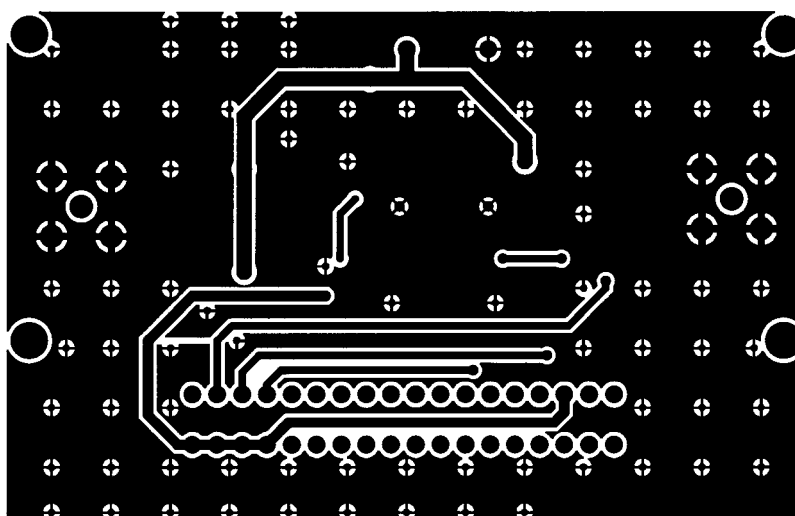


Figure 5. CLC730102 PCB (Bottom Side)

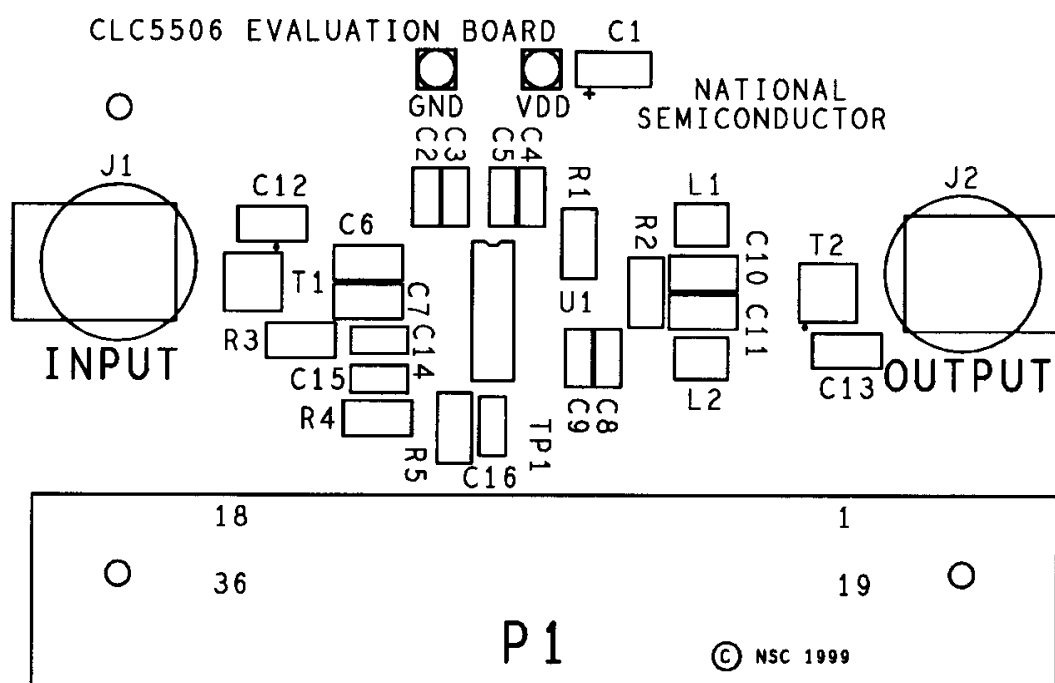


Figure 6. CLC5506PCASM Component Layout (Top Side)

In order to achieve the same performance as specified in the *CLC5506 Gain Trim Amplifier (GTA) Data Sheet* ([SNOS456](#)), components should be chosen from the bill of material attached and installed per [Figure 6](#).

NOTE: The circuits included in this application report have been tested with Texas Instruments parts that may have been obsoleted and/or replaced with newer products. To find the appropriate replacement part for the obsolete device, see the *CLC to LMH Conversion Table* ([SNOA428](#)).

2 References

- CLC5506 Gain Trim Amplifier (GTA) Data Sheet ([SNOS456](#))
- CLC to LMH Conversion Table ([SNOA428](#))

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

Products

Audio	www.ti.com/audio
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DLP® Products	www.dlp.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
OMAP Applications Processors	www.ti.com/omap
Wireless Connectivity	www.ti.com/wirelessconnectivity

Applications

Automotive and Transportation	www.ti.com/automotive
Communications and Telecom	www.ti.com/communications
Computers and Peripherals	www.ti.com/computers
Consumer Electronics	www.ti.com/consumer-apps
Energy and Lighting	www.ti.com/energy
Industrial	www.ti.com/industrial
Medical	www.ti.com/medical
Security	www.ti.com/security
Space, Avionics and Defense	www.ti.com/space-avionics-defense
Video and Imaging	www.ti.com/video

TI E2E Community

e2e.ti.com