# CLC44X Evaluation Boards

## Part Number CLC730055, CLC730060, CLC730076

August 1997

To aid in the evaluation of the CLC440, CLC446, and CLC449 series of wide bandwidth parts, National Semiconductor has created the evaluation boards for the 8-pin DIP, SOIC, and MSOP respectively. All evaluation boards are optimized for use with high quality surface-mount resistors and capacitors for obtaining the best high frequency response.

### I. Basic Component Selection

The evaluation boards are laid out for a non-inverting gain of 2V/V using low-parasitic surface-mount resistors and capacitors. The CLC44X very high frequency amplifiers can be sensitive to component parasitics that may alter AC performance especially in the high frequency domain. Small adjustments in $R_f$ and/or R. are recommended to shape the final desired frequency response.

For CFB (the CLC446, and CLC449), increasing $R_f$ from its recommended value will band limit the device's frequency response, while decreasing Rf from its recommended value will peak frequency response. However, substantially decreasing the feedback resistor of a current-feedback amp from its recommended value may cause a part to oscillate. Application note OA-13 "Current-Feedback Amplifier Loop-Gain Analysis and Performance Enhancements" of the data book elaborates on the selection of feedback resistors and their influence on AC performance.

For VFB (the CLC440), increasing both/either $R_f$ and $R_g$ from recommended values may cause high frequency peaking. Decreasing both/either $R_f$ and $R_g$ may help decrease high frequency peaking (without causing oscillations).

### II. Basic Connections & Operation

Both the DIP and SOIC evaluation boards provide for input and output signal connections through SMA connectors. These SMAs are connected to the non-inverting input pin (pin 3) and the $R_{out}$ resistor as shown in Figure 1. The recommended feedback resistor value for the CLC44X series is 250Ω. The appropriate gain setting resistor ($R_g$) is calculated with Eq. 1.

$$A_v = 1 + \frac{R_f}{R_g} \quad \text{Eq. 1} \qquad (\text{for } A_v = +2\ R_f = R_g = 250\Omega)$$

The $R_{out}$ resistor, of Figure 1, should always be inserted between pin 6 and the output SMA when driving coaxial cable or capacitive loads. The plot in the typical performance section labeled "Settling Time vs. Capacitive Load" of the data sheets should be used to determine the optimum resistor value for $R_{out}$ when driving coax or capacitive loads. This optimal resistance improves settling time for pulse-type applications and increases stability.

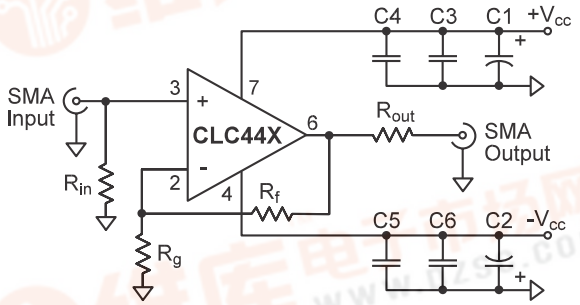



**Figure 1: Schematic for 73055/60/76 Eval. Boards**

Although no DC trim network was included on the evaluation board, OA-07 has specific circuits to correct DC offsets.

Power-supply bypassing capacitors perform a very important function for the CLC44X series and should not be omitted when evaluating these amplifiers. The bypass capacitors not only provide a low impedance current path at the supply pin, but also provide high frequency filtering on the power supply traces. C1 and C2 of Figure 1 should be quality 6.8µF tantalum capacitors. C3 and C4 should be quality 0.01µF ceramic capacitors. C4 and CS should be quality 500pF ceramic capacitors.

The use of standard dip sockets is not recommended for the CLC44X series DIP amplifiers. These sockets may severely degrade AC performance and may cause oscillations. The 730055 PDIP evaluation board will easily accommodate flush-mount socket pins when socketing is necessary. The printed circuit board device holes are sized for Cambion P/N 450-2598 socket pins or their equivalent.

### III. Printed Circuit Board Layout Considerations

The evaluation boards have been carefully laid out to optimize the performance of the CLC44X series. The ground plane on the evaluation boards was removed near the sensitive nodes (pins 2, 3, 6) to reduce parasitic capacitances between these nodes and the ground plane. Trace lengths were also minimized to reduce series inductances associated with all components and all nodes.

The CLC44X series is sensitive to the parasitics on traces. This sensitivity includes capacitive coupling from trace to power and trace to ground planes. If leaded components are used, then a low inductive resistor supplied by Precision Resistor Products or its equivalent is highly recommended. In all instances surface-mount components are recommended over leaded components.

## IV. Measurement Hints

If 50Ω coax and 50Ω $R_{in}/R_{out}$ resistors are used, many of the typical performance plots found in the data sheets for the CLC44X's are reproducible.



When SMA connectors and cables are not available to evaluate the CLC44X series, normal oscilloscope probes should not be used. Alternatively low impedance probes, of 100 to 500Ω, should be used. If a low impedance probe is not available, then a section of 50Ω coaxial cable and a low impedance resistor may be used. Connect one end of coax's center to a test measurement box terminated in 50Ω and the other end of the cable's center conductor to the low impedance resistor. The open side of the low impedance resistor is now a probe. The ground shield of the cable should be connected to evaluation board ground and test box ground. This cable/resistor probe forms a voltage attenuator between the resistor and the 50Ω termination resistance of the test box. This method allows measurements to be performed directly on the output pin of the amplifier (pin 6). Since the CLC44X series has large bandwidths, measurement equipment should have sufficient bandwidth to accurately measure pulse and frequency responses of the CLC44X series.

## V. Parts List for Evaluation Boards

Evaluation Board Parts List - Use the device data sheets with the discussion and examples shown here to select component values.

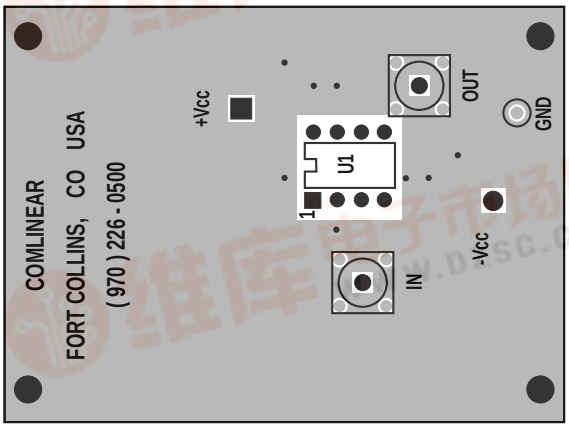
I/O connectors (both board styles):

-SMA (straight) Amphenol 901 -144
-SMA (right-angled) Amphenol 901-143

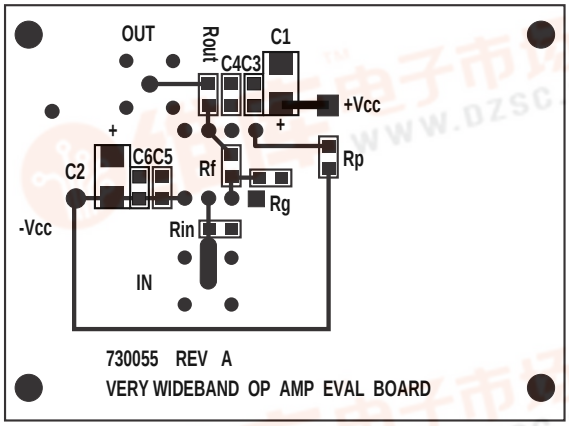
Resistors - 1206 surface-mount type.
Capacitors - Bypassing - 1206 surface-mount type.
Tantalum - TE - Series from Panasonic.

Precision Resistive Products, Inc., Highway 61 South, Mediapolis, Iowa (319) 394-9131.

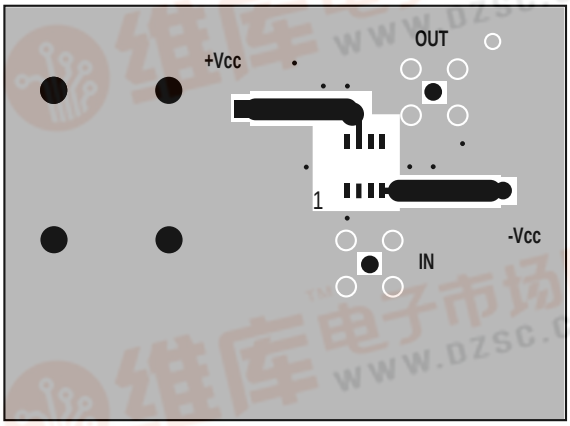
**PDIP - Top Side**



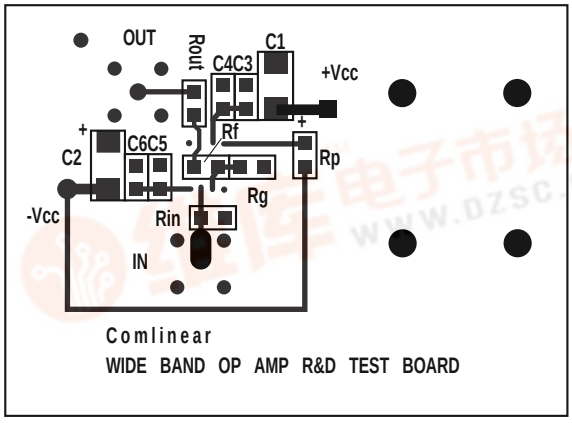

**PDIP - Bottom Side**



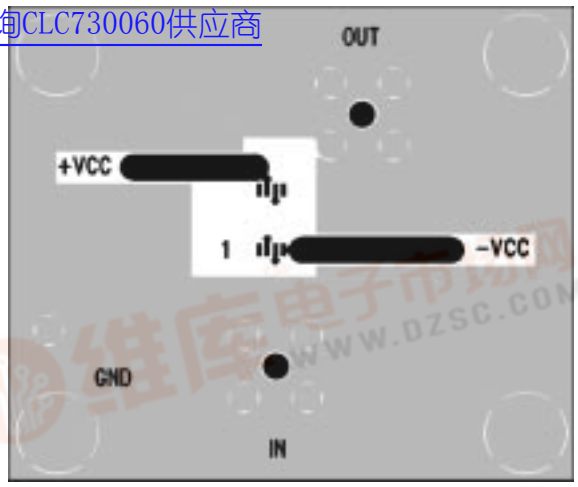

**SOIC - Top Side**



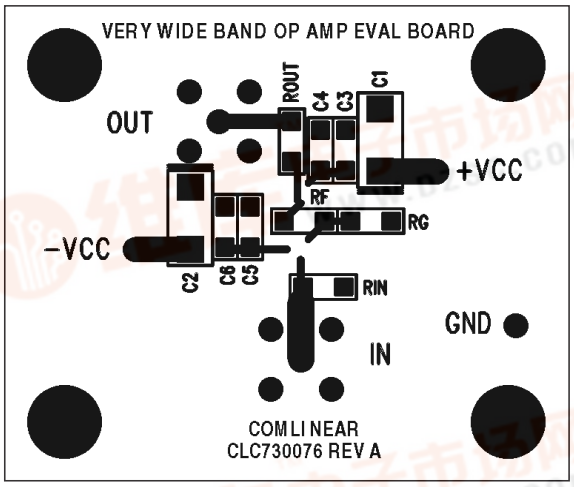

**SOIC - Bottom Side**



**MSOP - Top Side**




**MSOP - Bottom Side**



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