

LMH730227/LMH730216/LMH730165 Single High Speed Op Amp Evaluation Boards (SOIC, SOT-23, and SC-70)

The LMH730227, LMH730216 and LMH730165 evaluation boards are designed to aid in the characterization of National Semiconductor's High Speed monolithic amplifiers.

- LMH730227 — SOIC packages
- LMH730216 — SOT-23 packages
- LMH730165 — SC-70 packages

Use the evaluation boards as a guide for high frequency layout and as a tool to aid in device testing and characterization.

The evaluation boards accommodate general purpose amplifiers, as well as amplifiers with the following features:

- Supply current adjustment via external Resistor
- Output disable

The evaluation board schematic is shown below. Refer to the product data sheets for recommendations for component values.

BASIC OPERATION

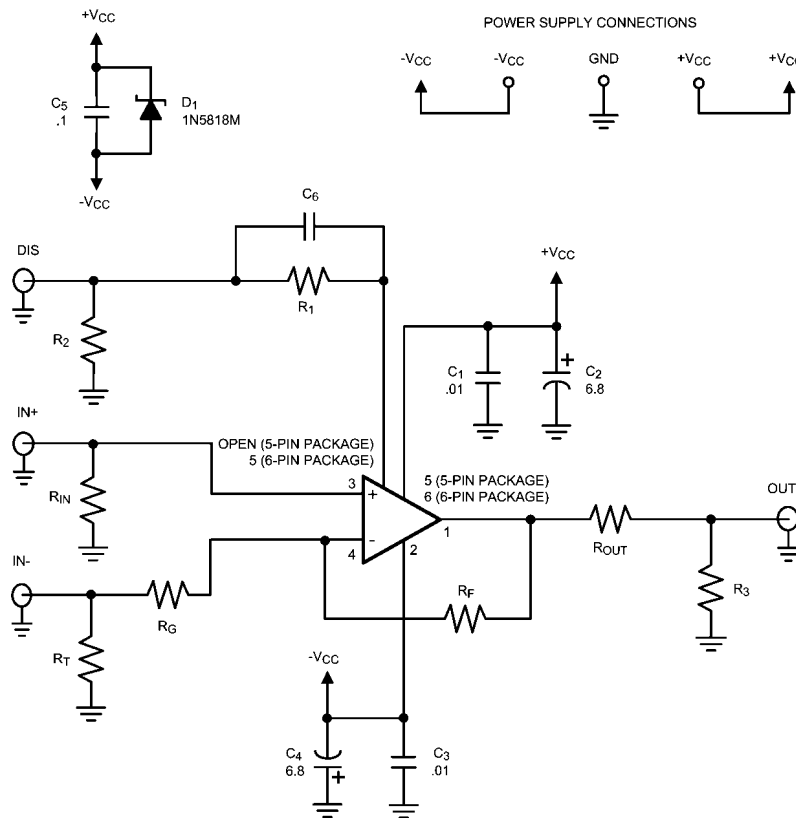
These boards have identical circuit configurations and are designed to accommodate both non-inverting and inverting operation. By changing R_T or R_{IN} and R_{OUT} different input and output impedances can be matched. The SMA connectors and board traces are optimized for 50Ω operation, however other impedances can be matched as shown below.

$$\text{Inverting Gain} = R_F/R_G \quad (\text{Input Resistance} = R_T \parallel R_G)$$

$$\text{Non Inverting Gain} = 1 + R_F/(R_G + R_T) \\ (\text{Input Resistance} = R_{IN})$$

(R_T may be set to zero for non inverting operation)

For current feedback operational amplifiers be careful to use appropriate values of R_F . In addition the required value of R_G will limit choices for input impedance with Inverting gains.



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FIGURE 1. SOT-23 and SC-70 Schematic

LAYOUT CONSIDERATIONS

Printed circuit board layout and supply bypassing play major roles in determining high frequency performance. When de-

signing your own board use these evaluation boards as a guide and follow these steps to optimize high frequency performance:

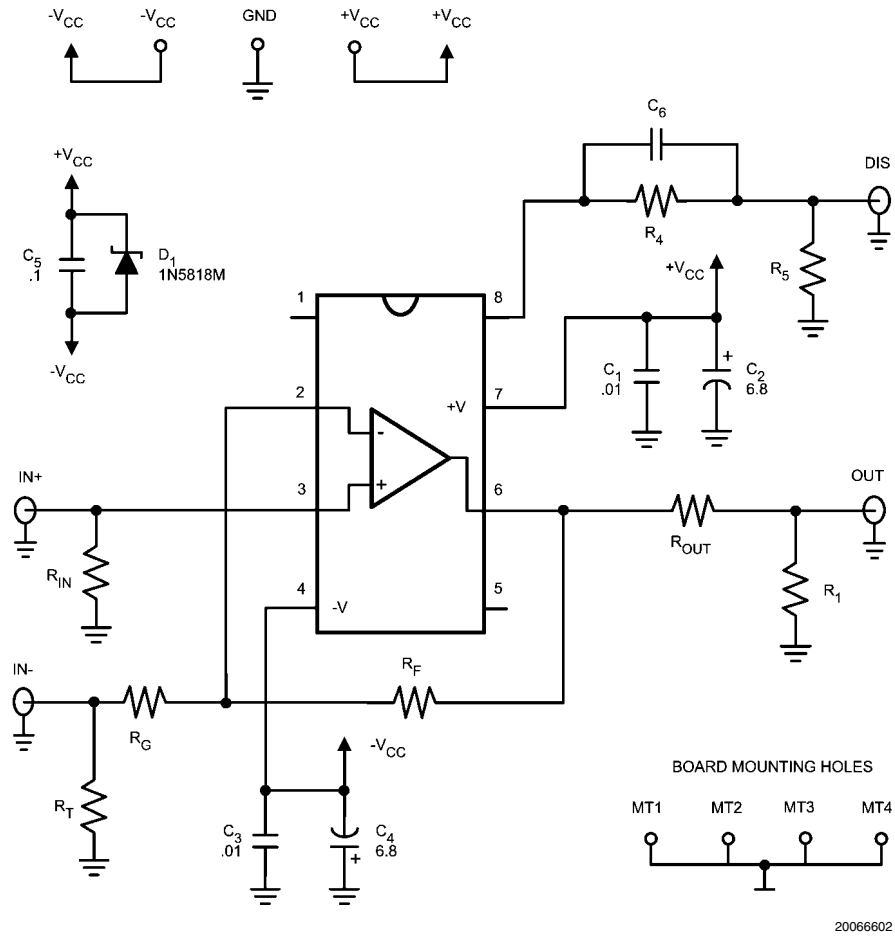
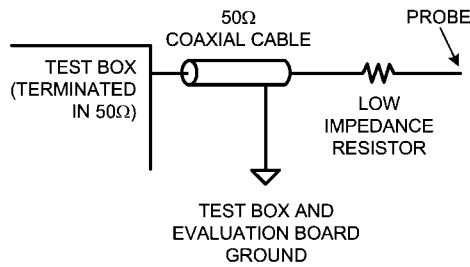


FIGURE 2. SOIC Schematic



$$\text{PROBE ATTENUATION} = \frac{50}{R + 50}$$

FIGURE 3. Probe Schematic

1. Use a ground plane
2. Include large (~6.8μF) capacitors on both supplies.
3. Near the device use .01μF ceramic capacitors from both supplies to ground C₁, C₃.
4. Near the device use a .1μF ceramic capacitor between the supplies C₅.
5. Remove the ground and power planes from under and around the part, especially the input and output pins.
6. Minimize all trace lengths.
7. Use terminated transmission lines for long traces.
8. High-speed disable/enable operation requires that the enable pin be treated as a signal input.

Diode D₁ is to protect the device from reverse polarity supply connections and will not be necessary for most designs.

Capacitor C₅ is necessary for best Harmonic Distortion performance. If C₅ is not used increase the values of C₁ and C₃ to .1μF.

R_{IN}, R_T and R_{OUT} are all impedance matching resistors. R_{IN} and R_{OUT} should be equal to the desired input/output impedance. R_T || R_G should equal the desired inverting input impedance. Note that with current feedback op amps, the optimum value of R_F and R_G is determined by the desired gain

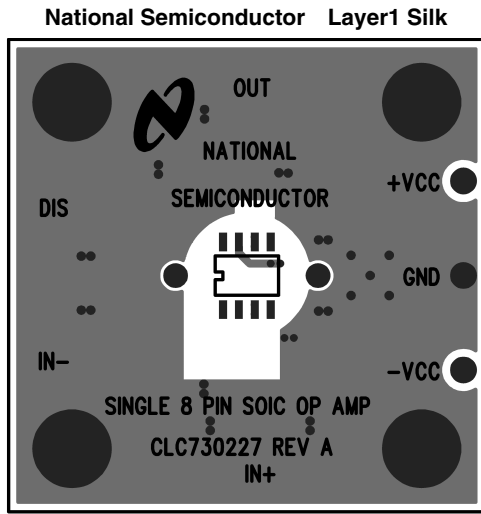
and raising R_G to obtain higher input impedance may require compromising device performance at large values of inverting gain.

The disable trace has provisions for input termination. There are also pads for series resistance and capacitance for programmable gain parts. See part datasheets for suggested values.

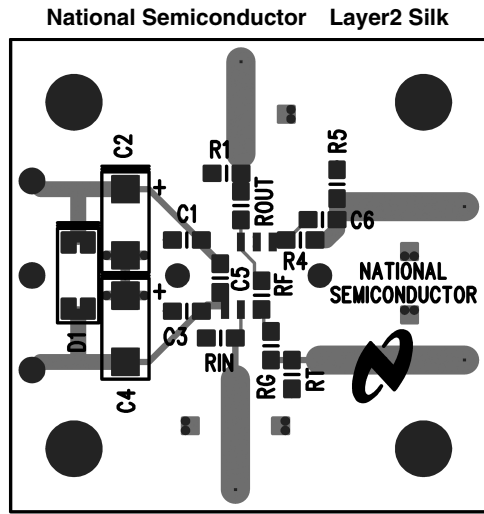
Sample artwork for National's Evaluation boards is included below.

The board is designed for 50Ω input and output connections into coaxial cables. For other impedances the terminating resistors can be modified to help match different impedances.

Do not use normal oscilloscope probes to test these circuits. The capacitive loading will change circuit performance drastically. Instead use low impedance resistive divider probes of 100 to 500Ω. See *Figure 3* for a sample resistive probe. The Low impedance resistor should be 50-450Ω. The ground connection should be as short as possible (~1/2"). Even with careful use of these probes results should be considered preliminary until verified with controlled impedance measurements. Even the best probes will interfere with circuit operation to some degree. Also, conductors, fingers etc. near the device will change measurement results.



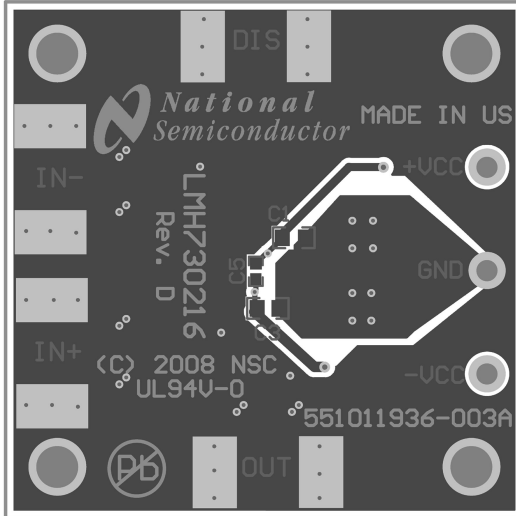
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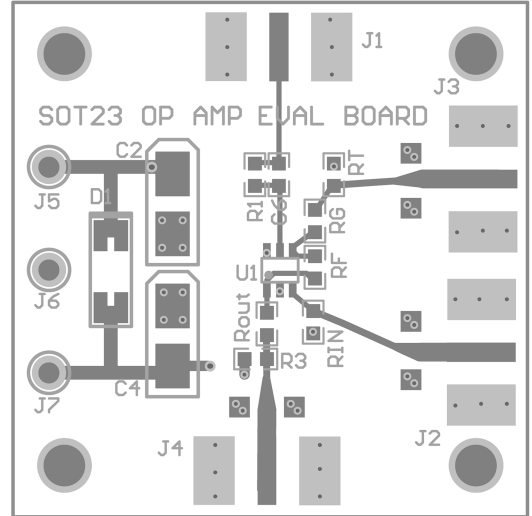
SOIC Board Layout (Actual size = 1.5" x 1.5"). The boards may be marked as CLC730227 or LMH730227

National Semiconductor Layer2 Silk



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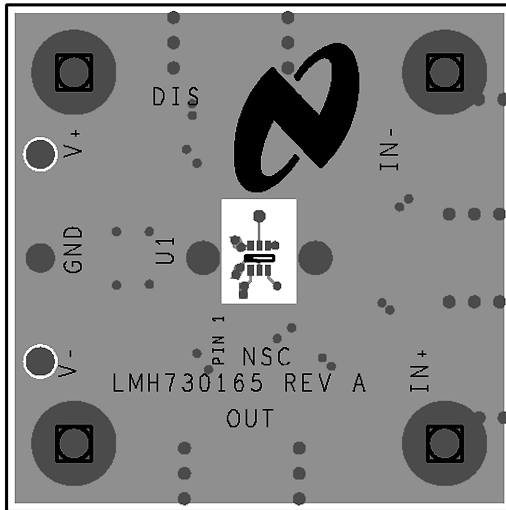
National Semiconductor Layer1 Silk



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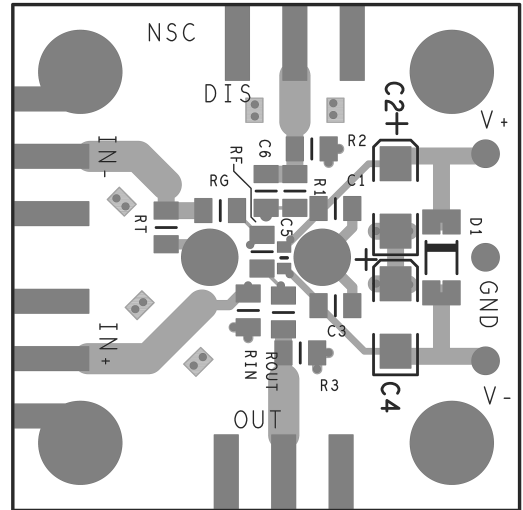
SOT-23 Board Layout (Actual size = 1.5" x 1.5").

National Semiconductor Layer1 Silk
NATIONAL SEMICONDUCTOR LAYER1 SILK



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National Semiconductor Layer2 Silk
NATIONAL SEMICONDUCTOR LAYER2 SILK



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SC-70 Board Layout (Actual size = 1.5" x 1.5")

Notes

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Interface	www.national.com/interface	Eval Boards	www.national.com/evalboards
LVDS	www.national.com/lvds	Packaging	www.national.com/packaging
Power Management	www.national.com/power	Green Compliance	www.national.com/quality/green
Switching Regulators	www.national.com/switchers	Distributors	www.national.com/contacts
LDOs	www.national.com/ldo	Quality and Reliability	www.national.com/quality
LED Lighting	www.national.com/led	Feedback/Support	www.national.com/feedback
Voltage Reference	www.national.com/vref	Design Made Easy	www.national.com/easy
PowerWise® Solutions	www.national.com/powerwise	Solutions	www.national.com/solutions
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