



**THE DATASHEET OF
LMH730216**



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.

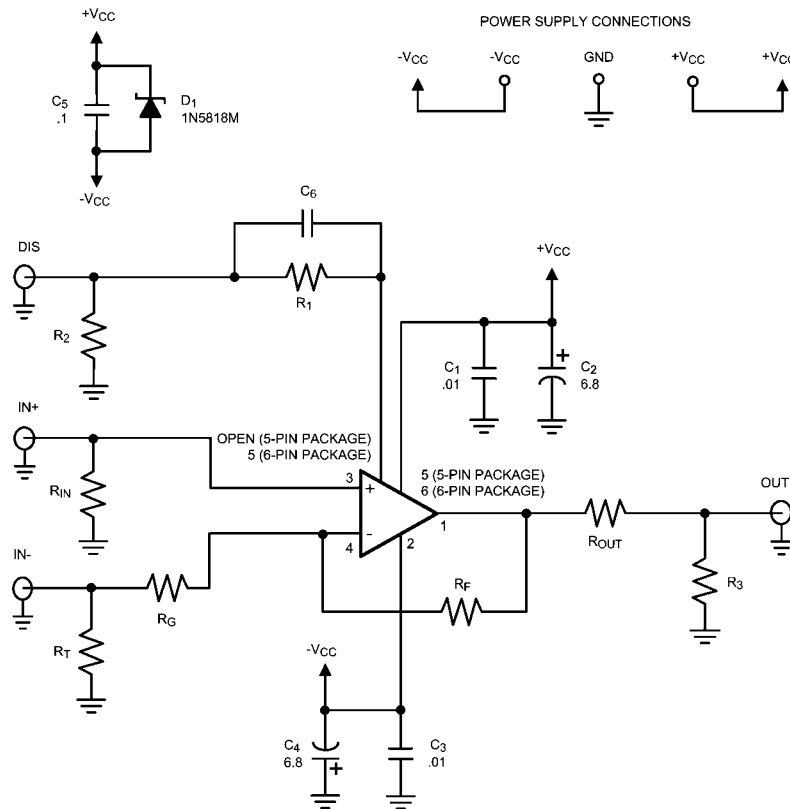


FIGURE 1. SOT-23 and SC-70 Schematic

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

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:

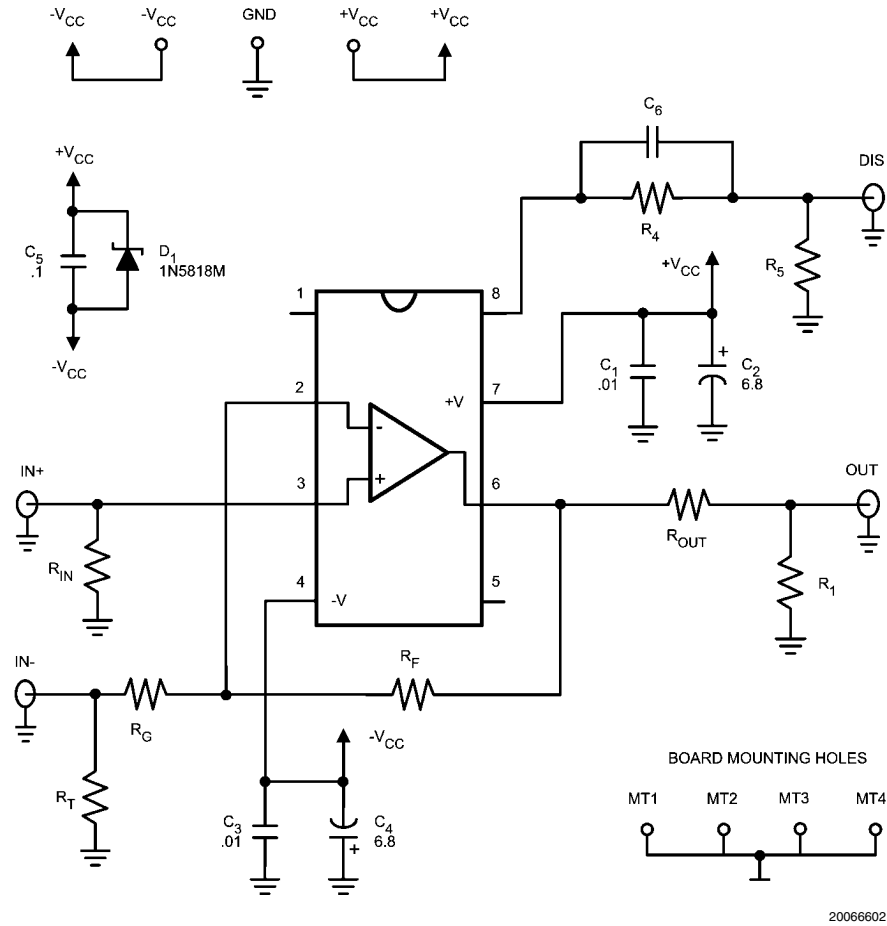
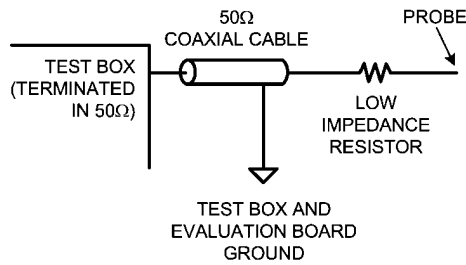


FIGURE 2. SOIC Schematic



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

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.

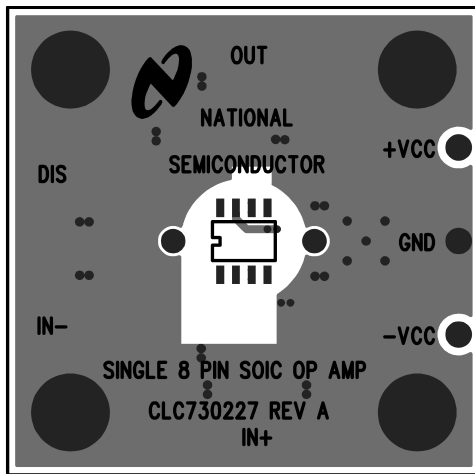
The disable trace has provisions for input termination. There are also pads for series resistance and capacitance for programmable gain parts. See part datasheets for suggested values.

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.

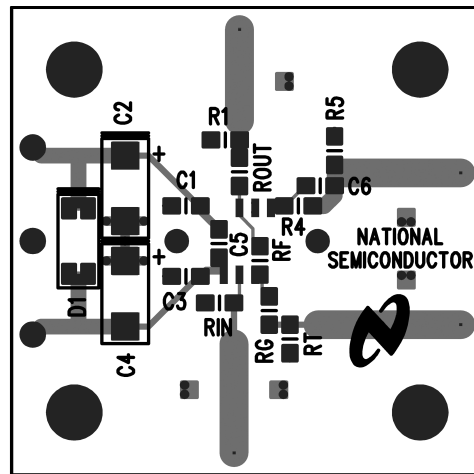
Do not use normal oscilloscope probes to test these circuits. The capacitive loading will change circuit performance drastically. Instead use low impedance resistive divider probes of 100 to 500Ω. See Figure 3 for a sample resistive probe. The Low impedance resistor should be 50-450Ω. The ground connection 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.

National Semiconductor Layer1 Silk



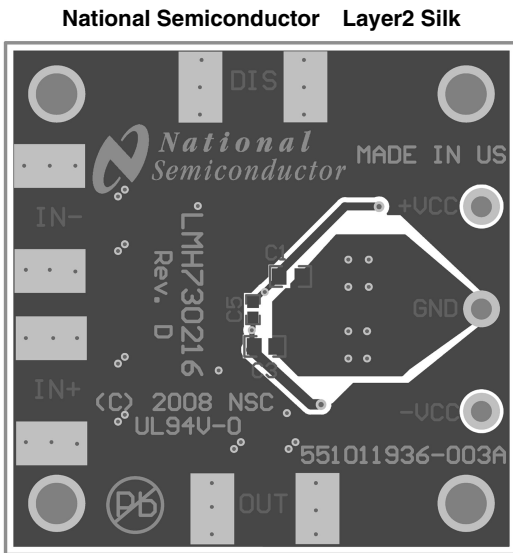
20066604

National Semiconductor Layer2 Silk

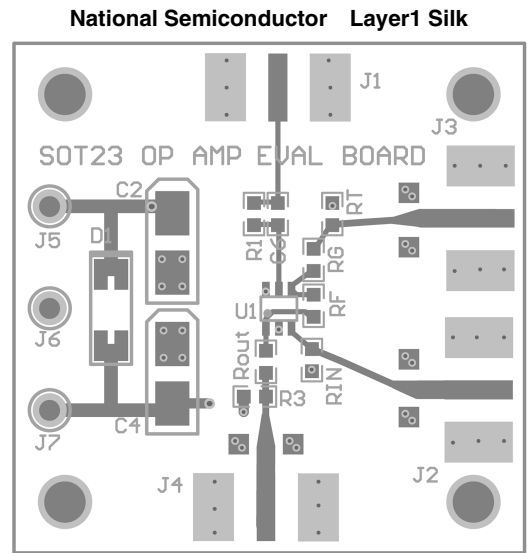


20066605

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

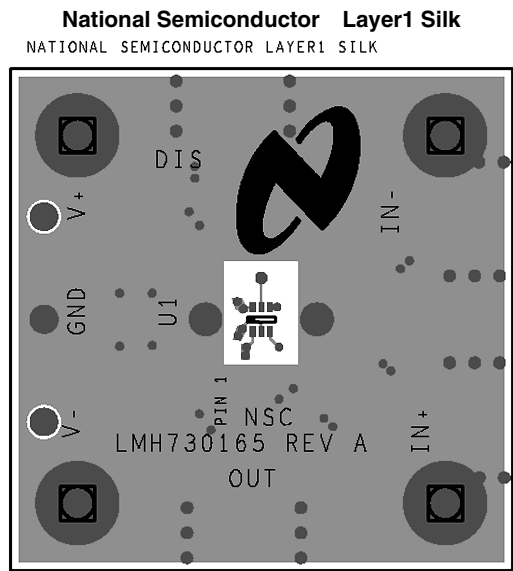


20066610

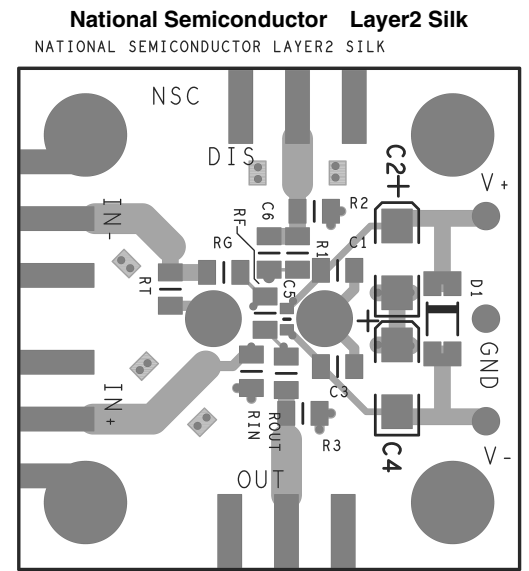


20066611

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



20066608



20066609

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

Notes

For more National Semiconductor product information and proven design tools, visit the following Web sites at:

Products		Design Support	
Amplifiers	www.national.com/amplifiers	WEBENCH® Tools	www.national.com/webench
Audio	www.national.com/audio	App Notes	www.national.com/appnotes
Clock and Timing	www.national.com/timing	Reference Designs	www.national.com/refdesigns
Data Converters	www.national.com/adc	Samples	www.national.com/samples
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
Serial Digital Interface (SDI)	www.national.com/sdi	Mil/Aero	www.national.com/milaero
Temperature Sensors	www.national.com/tempsensors	Solar Magic®	www.national.com/solarmagic
Wireless (PLL/VCO)	www.national.com/wireless	Analog University®	www.national.com/AU

THE CONTENTS OF THIS DOCUMENT ARE PROVIDED IN CONNECTION WITH NATIONAL SEMICONDUCTOR CORPORATION ("NATIONAL") PRODUCTS. NATIONAL MAKES NO REPRESENTATIONS OR WARRANTIES WITH RESPECT TO THE ACCURACY OR COMPLETENESS OF THE CONTENTS OF THIS PUBLICATION AND RESERVES THE RIGHT TO MAKE CHANGES TO SPECIFICATIONS AND PRODUCT DESCRIPTIONS AT ANY TIME WITHOUT NOTICE. NO LICENSE, WHETHER EXPRESS, IMPLIED, ARISING BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED BY THIS DOCUMENT.

TESTING AND OTHER QUALITY CONTROLS ARE USED TO THE EXTENT NATIONAL DEEMS NECESSARY TO SUPPORT NATIONAL'S PRODUCT WARRANTY. EXCEPT WHERE MANDATED BY GOVERNMENT REQUIREMENTS, TESTING OF ALL PARAMETERS OF EACH PRODUCT IS NOT NECESSARILY PERFORMED. NATIONAL ASSUMES NO LIABILITY FOR APPLICATIONS ASSISTANCE OR BUYER PRODUCT DESIGN. BUYERS ARE RESPONSIBLE FOR THEIR PRODUCTS AND APPLICATIONS USING NATIONAL COMPONENTS. PRIOR TO USING OR DISTRIBUTING ANY PRODUCTS THAT INCLUDE NATIONAL COMPONENTS, BUYERS SHOULD PROVIDE ADEQUATE DESIGN, TESTING AND OPERATING SAFEGUARDS.

EXCEPT AS PROVIDED IN NATIONAL'S TERMS AND CONDITIONS OF SALE FOR SUCH PRODUCTS, NATIONAL ASSUMES NO LIABILITY WHATSOEVER, AND NATIONAL DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY RELATING TO THE SALE AND/OR USE OF NATIONAL PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

LIFE SUPPORT POLICY

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

Life support devices or systems are devices 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. A critical component is any component in 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 and the National Semiconductor logo are registered trademarks of National Semiconductor Corporation. All other brand or product names may be trademarks or registered trademarks of their respective holders.

Copyright© 2008 National Semiconductor Corporation

For the most current product information visit us at www.national.com



National Semiconductor Americas Technical Support Center
 Email: support@nsc.com
 Tel: 1-800-272-9959

National Semiconductor Europe Technical Support Center
 Email: europe.support@nsc.com
 German Tel: +49 (0) 180 5010 771
 English Tel: +44 (0) 870 850 4288

National Semiconductor Asia Pacific Technical Support Center
 Email: ap.support@nsc.com

National Semiconductor Japan Technical Support Center
 Email: jpn.feedback@nsc.com

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

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

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

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI 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 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. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

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

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

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 Mobile 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 Home Page

e2e.ti.com







Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2012, Texas Instruments Incorporated

Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

-  [View LMH730216](#) on WIN SOURCE
-  [Texas Instruments](#) Information

Optimize Your Supply Chain with WIN SOURCE Solutions

-  Global Sourcing Solution
-  Obsolete Management
-  Cost Control Management
-  Shortage Management
-  Alternative Solution
-  Excess Inventory Management