

DEM-OPA-SO-1A Demonstration Fixture

1 Description

The DEM-OPA-SO-1A demonstration fixture is a generic, unpopulated printed circuit board (PCB) for single operational amplifiers in SO-8 packages. [Figure 1](#) shows the package pinouts supported by this PCB. For more information on any individual op amps, as well as good PCB layout techniques, see the individual amplifier data sheets.

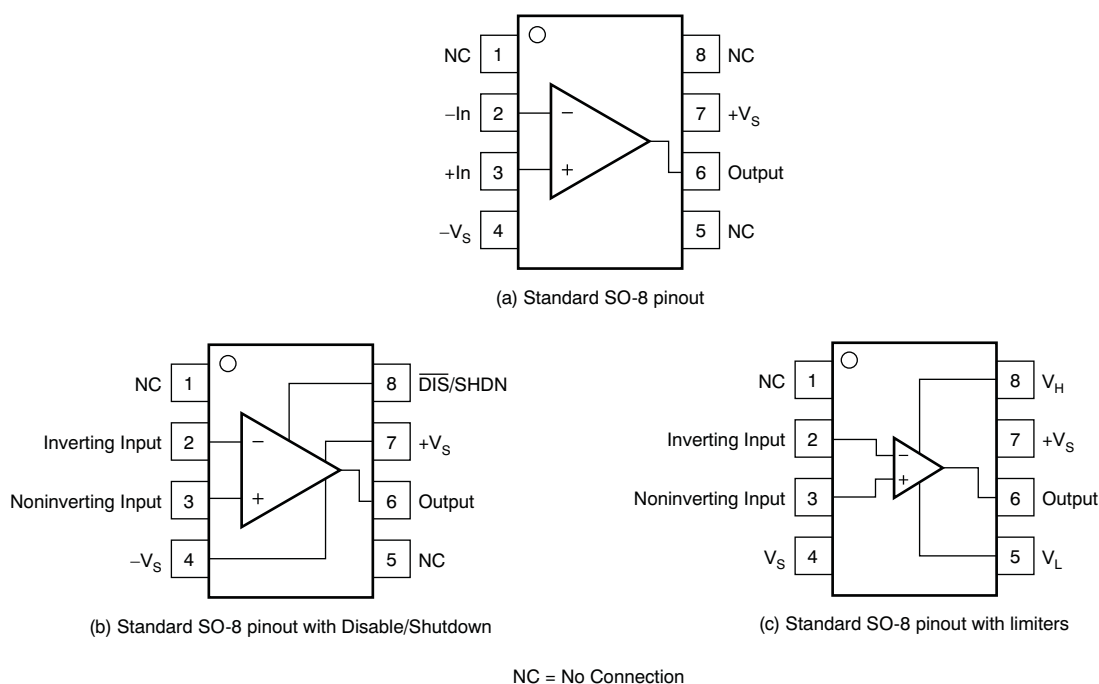


Figure 1. SO Package Pinout, Top View

As seen in [Figure 1](#), this generic board supports these major variations: (a) standard SO-8 pinout; (b) standard SO-8 pinout with disable/shutdown; and (c) standard SO-8 pinout with limiters.

2 Circuit

The circuit schematic in [Figure 2](#) shows the connections for all possible components. Each configuration uses only some of the components.



Components that have RF performance similar to the ones listed in [Table 1](#) may be substituted. C₁ and C₂ need a larger voltage rating for ±15V dual supplies.

PART	DESCRIPTION
C ₁ , C ₂	Tantalum Chip Capacitor, SMD EIA Size 3528, 20V
C ₃ – C ₇	Multilayer Ceramic Chip Capacitor, SMD 1206, 50V
J ₁ – J ₄	SMA or SMB Board Jack (Amphenol 901-144-8)
L ₁ , L ₂	EMI-Suppression Ferrite Chip, SMD 1206 (Steward LI 1206 B 900 R)
P ₁	Terminal Block, 3.5mm Centers (On-Shore Technology ED555/3DS)
R ₁ – R ₁₃	Metal Film Chip Resistor, SMD 1206, 1/8Ω

R_1 and R_7 set the I/O impedance, R_2 through R_6 set the gain, and C_1 through C_5 are supply bypass capacitors. C_3 is optional; it adds a bypass between the supplies that improves distortion performance for some models. L_1 and L_2 are ferrite chips that can reduce interactions with the power supply at high frequencies. If not desired, they can be replaced with 0Ω resistors. R_8 through R_{13} , C_6 and C_7 are optional components that support op amps with special functions.

For single-supply operation, do not connect L_2 ; otherwise, the $-V_S$ input to P_1 would be at ground potential.

Op Amp with Standard SO-8 Pinout—These op amps have the pinout shown in [Figure 1a](#). [Table 2](#) shows typical values used for these parts. To select component values for your specific op amp (especially R_6), consult its data sheet.

Table 2. Op Amp with Standard SO-8 Pinout⁽¹⁾

COMPONENT	DUAL-SUPPLY (G = +2)	DUAL-SUPPLY (G = -1)	SINGLE- SUPPLY (G = +1)
R_1	49.9 Ω	57.6 Ω	49.9 Ω
R_2	10.0 Ω	Open	10.0 Ω
R_3	Open	10.0 Ω	Open
R_4	Open	402 Ω	Open
R_5	402 Ω	Open	Open
R_6	402 Ω	402 Ω	402 Ω
R_7	49.9 Ω	49.9 Ω	49.9 Ω
$R_8 - R_{13}$	Open	Open	Open
C_1	2.2 μ F	2.2 μ F	2.2 μ F
C_2	2.2 μ F	2.2 μ F	Open
C_3	0.01 μ F	0.01 μ F	Open
C_4	0.1 μ F	0.1 μ F	0 Ω
C_5	0.1 μ F	0.1 μ F	0.1 μ F
C_6, C_7	Open	Open	Open

⁽¹⁾ The values and gains shown will not work for all op amps. See the data sheet to select proper values. The I/O impedances are 50 Ω .

Op Amp with Standard SO-8 Pinout and Disable/SHDN—For op amps that disable the output when high, [Table 3](#) shows different ways to set up the voltage for pin 8 using R_8 , R_9 and C_7 . Use the values listed in [Table 2](#) for the other components, except for the changes shown in [Table 4](#); note that these are all single-supply configurations.

Table 3. Disable Pin

CONFIGURATION	R_8	C_9
External Source	Open	49.9 Ω
On	Open	0 Ω
Off	0 Ω	Open

Table 4. Changes

COMPONENT	SINGLE-SUPPLY (G = +2)	SINGLE-SUPPLY (G = -1)	SINGLE-SUPPLY (G = +1)
C_4	0 Ω	0 Ω	0 Ω

For op amps that disable the output when low, [Table 5](#) shows different ways to set up the voltage on pin 8 using R_8 , R_9 and C_7 . Refer to [Table 2](#) for the other component values.

Table 5. Disable Pin

CONFIGURATION	R_8	R_9	C_7
External Source	Open	49.9 Ω	Open
On	Open	Open	0.1 μ F
Off	Open	0 Ω	Open

Op Amp with Standard SO-8 Pinout and Limiters—A VLA (Voltage Limiting Amplifier) has two inputs (V_H and V_L in [Table 2](#)) which limit the output voltage swing. [Table 6](#) shows different ways to set up pin 5 and pin 8 voltages using $R_8 - R_{13}$ and $C_5 - C_7$. Use the values listed in [Table 2](#) for the other components.

Note that this board would require modification for a single-supply circuit. In dual-supply applications, using R_{10} instead of R_8 makes V_H negative, and using R_{13} instead of R_{11} makes V_L positive.

Table 6. Limiting Pins

COMPONENT	DUAL-SUPPLY (G = +2)	DUAL-SUPPLY (G = -1)	SINGLE-SUPPLY (G = +1)
R_8	3.01k Ω	3.01k Ω	549 Ω
R_9	1.91k Ω	1.91k Ω	1.58k Ω
R_{11}	3.01k Ω	3.01k Ω	Open
R_{12}	1.91k Ω	1.91k Ω	549 Ω
R_{13}	Open	Open	1.58k Ω
$C_5 - C_7$	0.1 μ F	0.1 μ F	0.1 μ F

4 Board Layout

This demonstration fixture is a two-layer PCB. It uses a ground plane on the bottom, and signal and power traces on the top. The ground plane has been opened up around op amp pins sensitive to capacitive loading. Power-supply traces are laid out to keep current loop areas to a minimum. The SMA (or SMB) connectors may be mounted either vertically or horizontally.

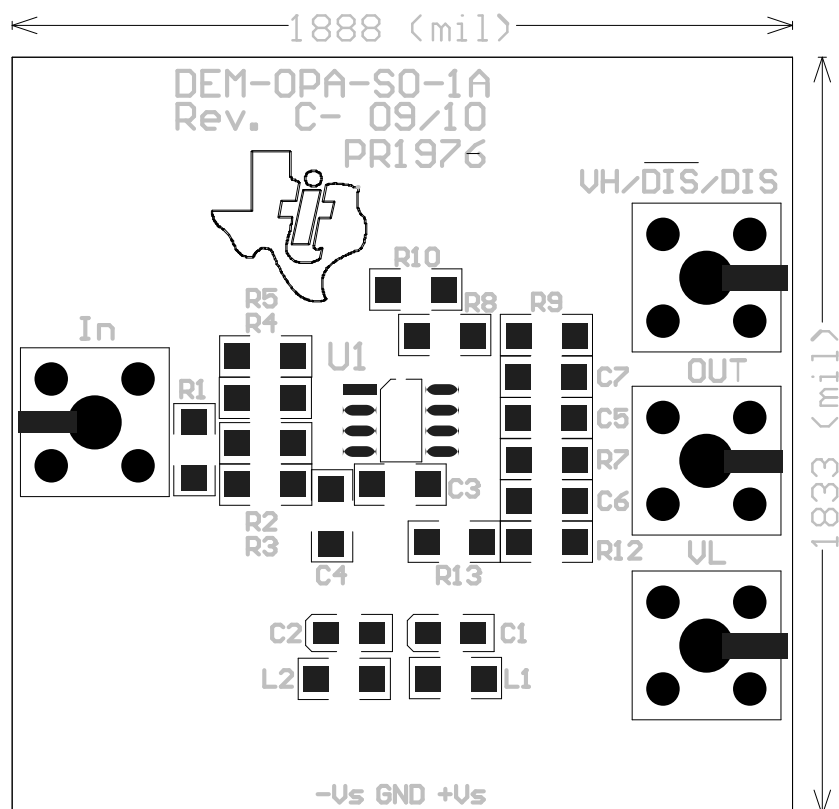
The location and type of capacitors used for power-supply bypassing are crucial to high-frequency amplifiers. The tantalum capacitors, C_1 and C_2 , do not need to be as close to pins 7 and 4 on your PCB, and may be shared with other amplifiers.

See the individual op amp data sheet for more information on proper board layout techniques and component selection.

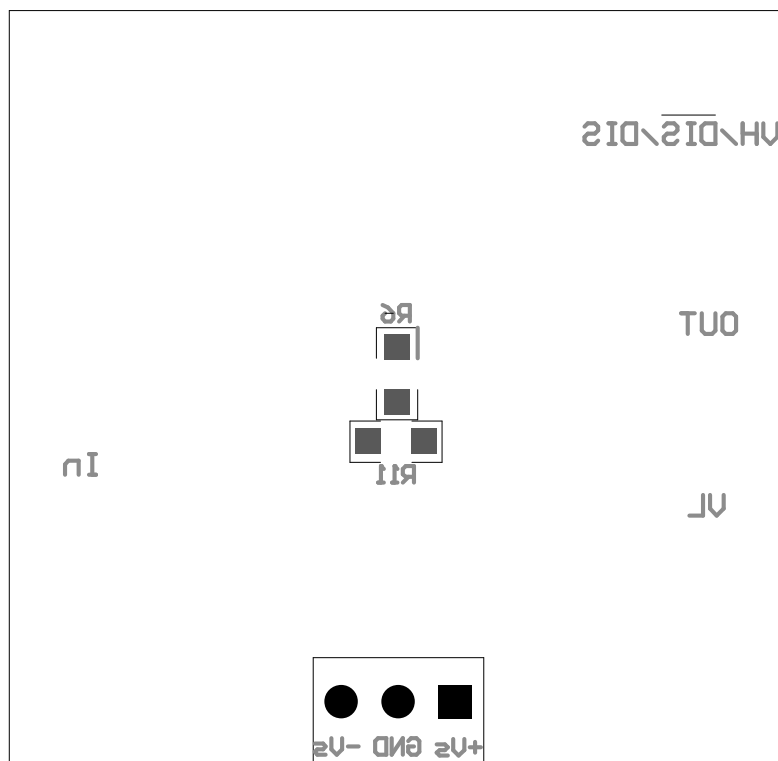
5 Measurement Tips

This demonstration fixture and the component values shown are designed to operate in a 50 Ω environment. Most data sheet plots are obtained in this manner. Change the component values for different input and output impedance levels.

Do not use high-impedance probes; they represent a heavy capacitive load to the op amps, and will alter the amplifier response. Instead, use low impedance ($\leq 500\Omega$) probes with adequate bandwidth. The probe input capacitance and resistance set an upper limit on the measurement bandwidth. If a high-impedance probe must be used, place a 100 Ω resistor on the probe tip to isolate its capacitance from the circuit.



(a) Component Side Silkscreen and Metal (top view)



(b) Ground Plane Side Silkscreen and Metal (bottom view)

Figure 3. DEM-OPA-SO-1A Demonstration Board Layout

Revision History

Changes from A Revision (March 2006) to B Revision	Page
• Fixed typo in Figure 2	2
• Changed Figure 3	6

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

FCC Warning

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

EVALUATION BOARD/KIT IMPORTANT NOTICE

Texas Instruments (TI) provides the enclosed product(s) under the following conditions:

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. Persons handling the product(s) must have electronics training and observe good engineering practice standards. As such, the goods being provided are not intended to be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety and environmental measures typically found in end products that incorporate such semiconductor components or circuit boards. This evaluation board/kit does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and therefore may not meet the technical requirements of these directives or other related directives.

Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge.

EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

TI currently deals with a variety of customers for products, and therefore our arrangement with the user **is not exclusive**.

TI assumes **no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein**.

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please contact the TI application engineer or visit www.ti.com/esh.

No license is granted under any patent right or other intellectual property right of TI covering or relating to any machine, process, or combination in which such TI products or services might be or are used.

EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of $\pm 15\text{V}$ and the output voltage range of -15V to $+15\text{V}$.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's Guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative.

During normal operation, some circuit components may have case temperatures greater than $+50^\circ\text{C}$. The EVM is designed to operate properly with certain components above $+50^\circ\text{C}$ as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2009, Texas Instruments Incorporated