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.

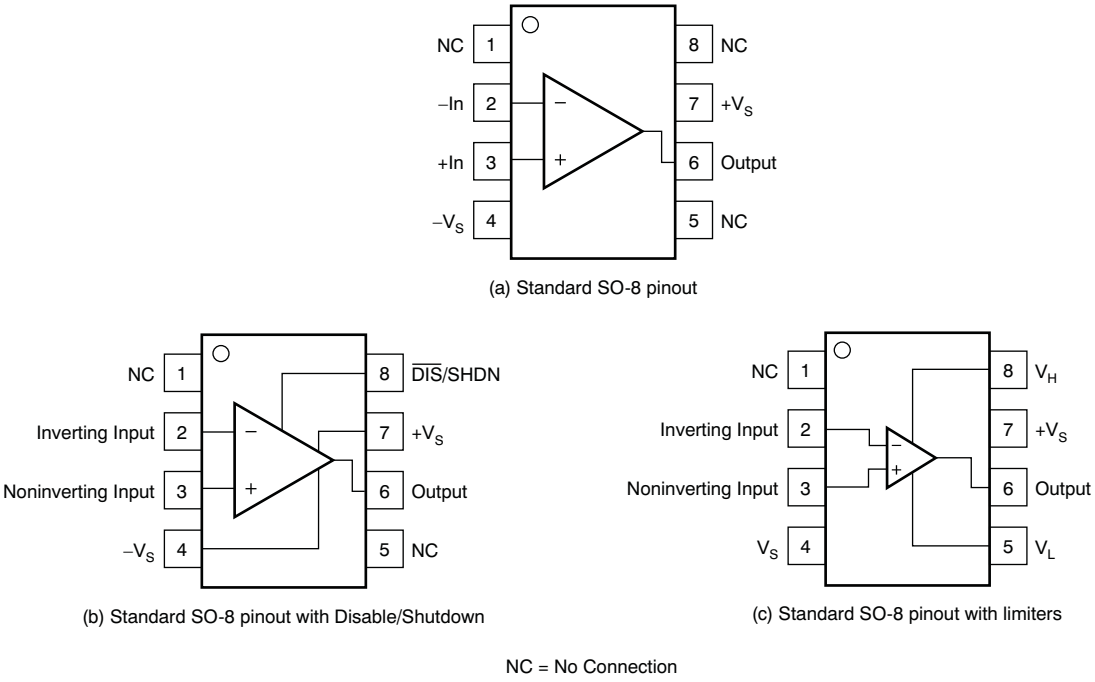


Figure 1. SO Package Pinout, Top View

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.

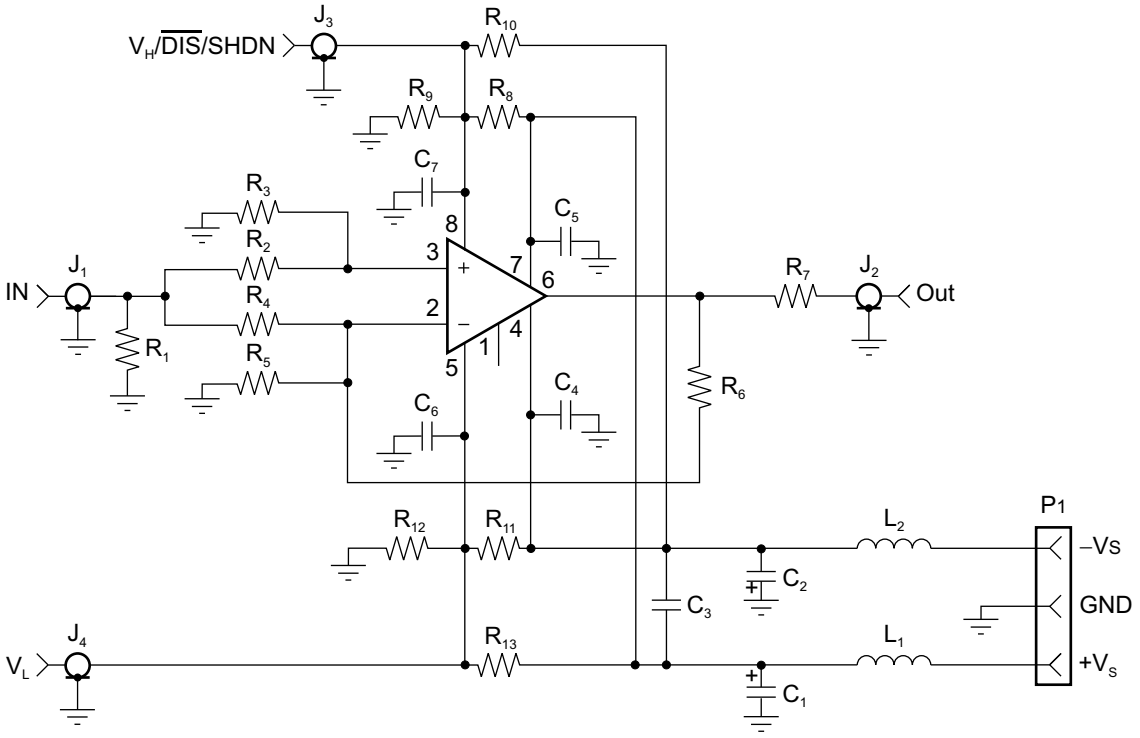


Figure 2. Schematic for DEM-OPA-SO-1A

3 Components

Components that have RF performance similar to the ones listed in Table 1 may be substituted. C_1 and C_2 need a larger voltage rating for ±15V dual supplies.

Table 1. Component Descriptions

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	49.9Ω	57.6Ω	49.9Ω
R_2	10.0Ω	Open	10.0Ω
R_3	Open	10.0Ω	Open
R_4	Open	402Ω	Open
R_5	402Ω	Open	Open
R_6	402Ω	402Ω	402Ω
R_7	49.9Ω	49.9Ω	49.9Ω
$R_8 – R_{13}$	Open	Open	Open
C_1	2.2μF	2.2μF	2.2μF
C_2	2.2μF	2.2μF	Open
C_3	0.01μF	0.01μF	Open
C_4	0.1μF	0.1μF	0Ω
C_5	0.1μF	0.1μF	0.1μF
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 50Ω.

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	49.9Ω
On	Open	0Ω
Off	0Ω	Open

Table 4. Changes

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

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	49.9Ω	Open
On	Open	Open	0.1µF
Off	Open	0Ω	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	3.01kΩ	3.01kΩ	549Ω
R_9	1.91kΩ	1.91kΩ	1.58kΩ
R_{11}	3.01kΩ	3.01kΩ	Open
R_{12}	1.91kΩ	1.91kΩ	549Ω
R_{13}	Open	Open	1.58kΩ
$C_5 – C_7$	0.1µF	0.1µF	0.1µF

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.

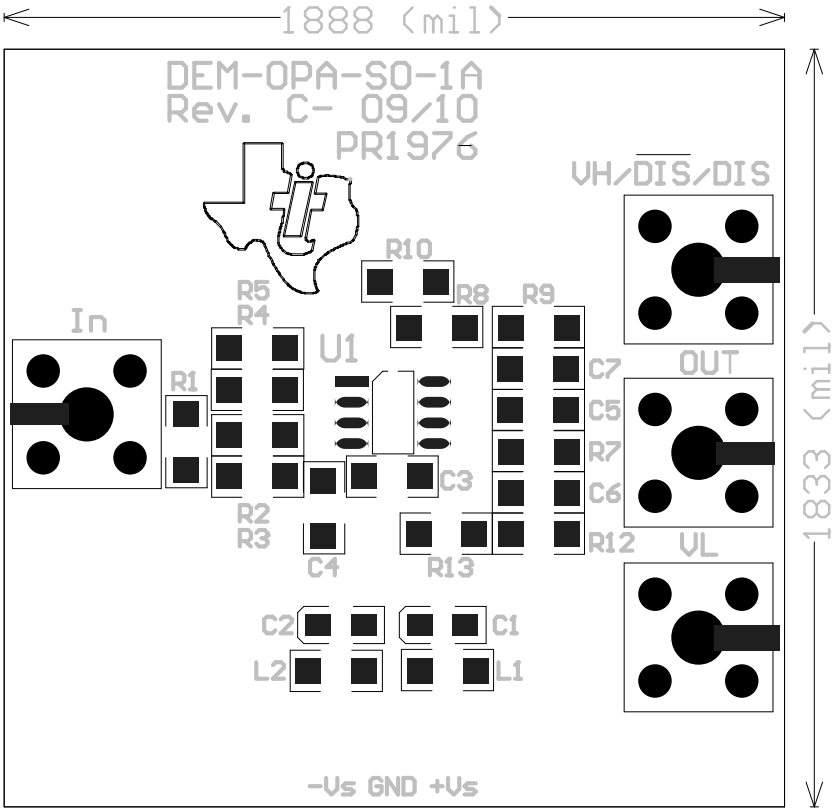
The location and type of capacitors used for power-supply bypassing are crucial to high-frequency amplifiers. The tantalum capacitors, C_1 and C_2, do not need to be as close to pins 7 and 4 on your PCB, and may be shared with other amplifiers.

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

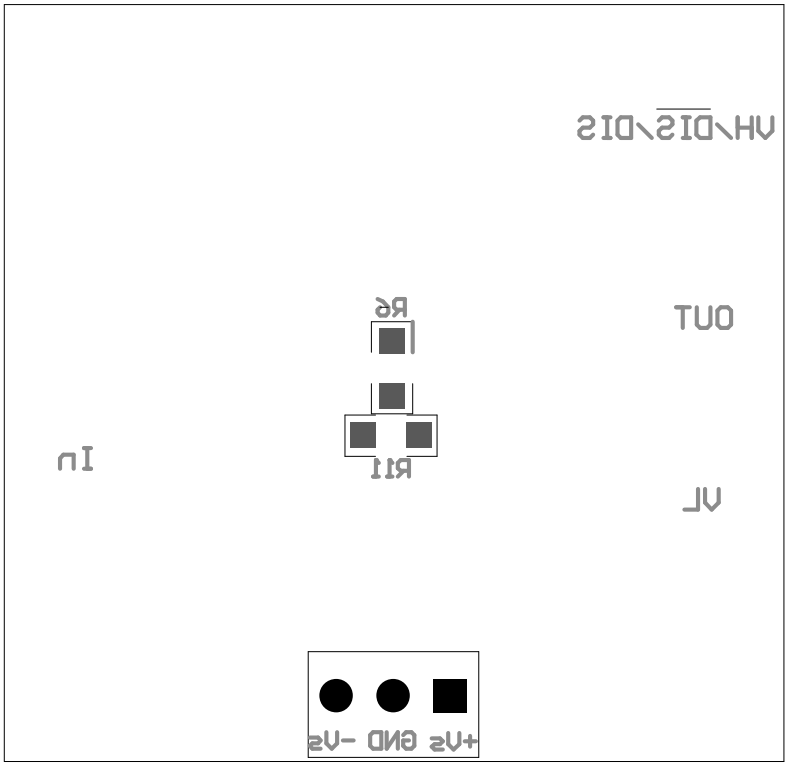
5 Measurement Tips

This demonstration fixture and the component values shown are designed to operate in a 50Ω 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 (≤ 500Ω) 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 100Ω 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.

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During normal operation, some circuit components may have case temperatures greater than +50°C. The EVM is designed to operate properly with certain components above +50°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.

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