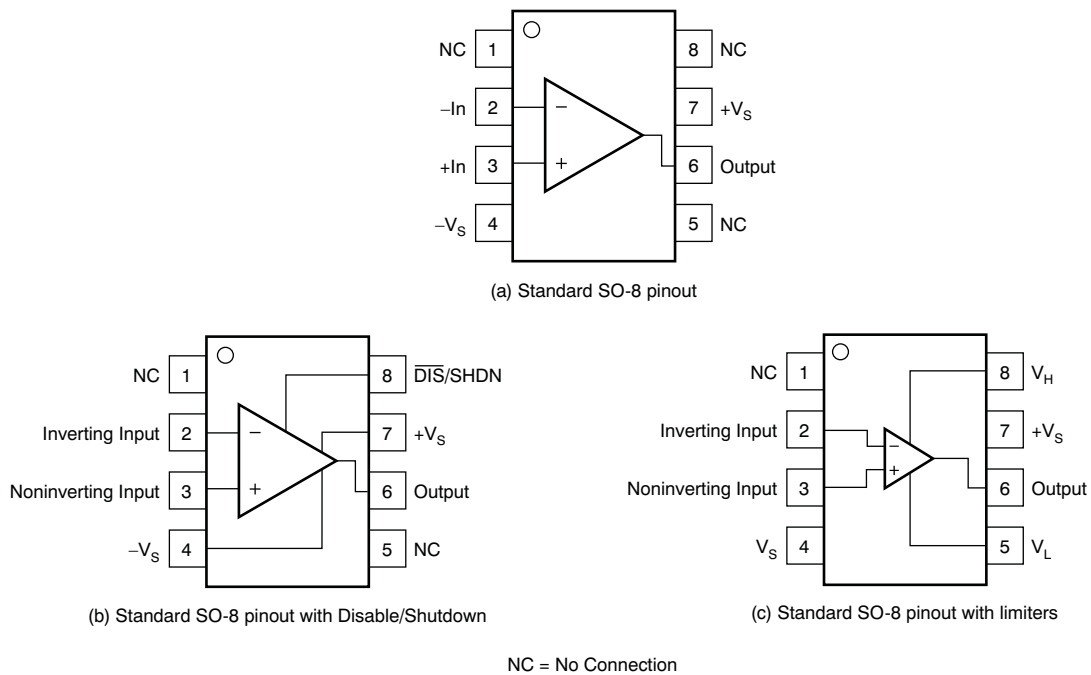


## **DEM-OPA-SO-1A Demonstration Fixture**

### **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.

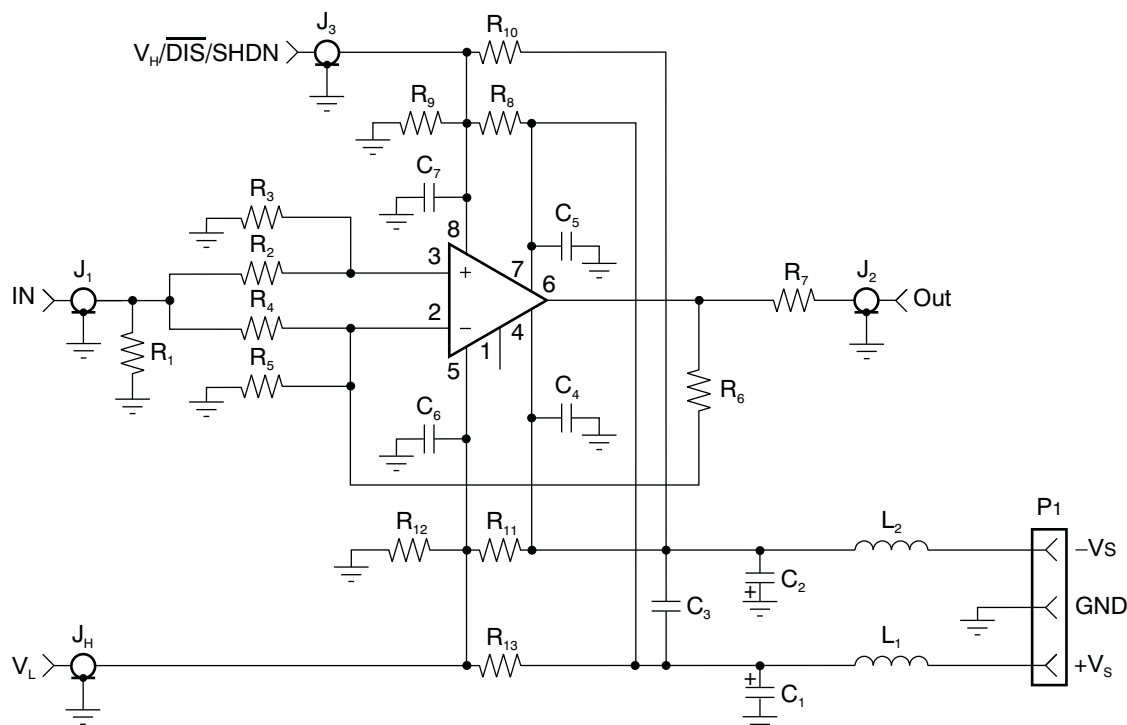


**Figure 1. SO Package Pinout, Top View**

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  $\pm 15V$  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, 1/8 $\Omega$

$R_1$  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  $0\Omega$  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<sup>(1)</sup>**

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

<sup>(1)</sup> 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 $\Omega$ .

**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 $\Omega$
On	Open	0 $\Omega$
Off	0 $\Omega$	Open

**Table 4. Changes**

COMPONENT	SINGLE-SUPPLY (G = +2)	SINGLE-SUPPLY (G = -1)	SINGLE-SUPPLY (G = +1)
$C_4$	0 $\Omega$	0 $\Omega$	0 $\Omega$

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 $\Omega$	Open
On	Open	Open	0.1 $\mu$ F
Off	Open	0 $\Omega$	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 $\Omega$	3.01k $\Omega$	549 $\Omega$
$R_9$	1.91k $\Omega$	1.91k $\Omega$	1.58k $\Omega$
$R_{11}$	3.01k $\Omega$	3.01k $\Omega$	Open
$R_{12}$	1.91k $\Omega$	1.91k $\Omega$	549 $\Omega$
$R_{13}$	Open	Open	1.58k $\Omega$
$C_5 - C_7$	0.1 $\mu$ F	0.1 $\mu$ F	0.1 $\mu$ 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.

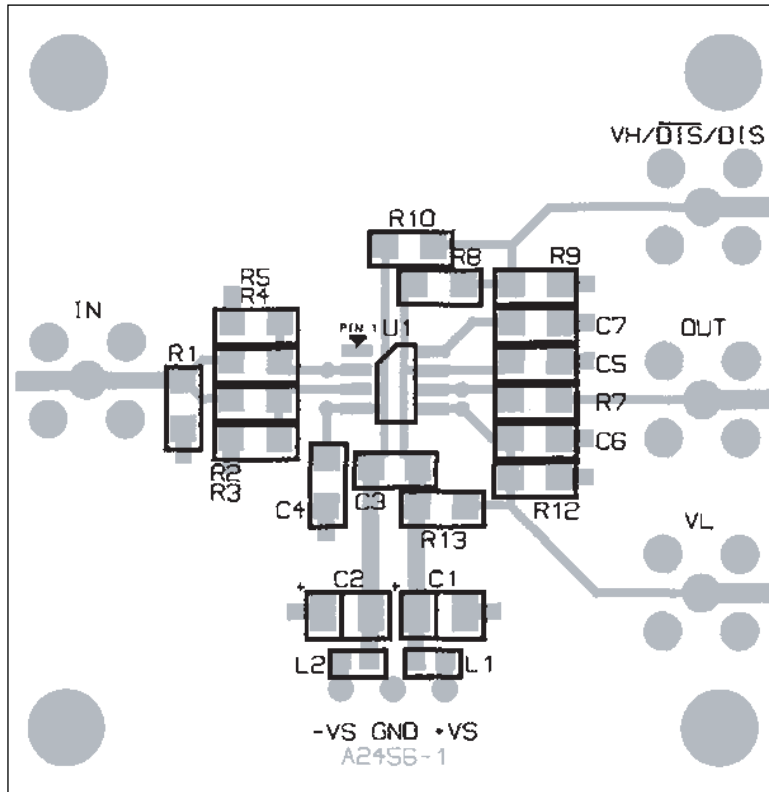
The location and type of capacitors used for power-supply bypassing are crucial to high-frequency amplifiers. The tantalum capacitors,  $C_1$  and  $C_2$ , do not need to be as close to pins 7 and 4 on your PCB, and may be shared with other amplifiers.

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

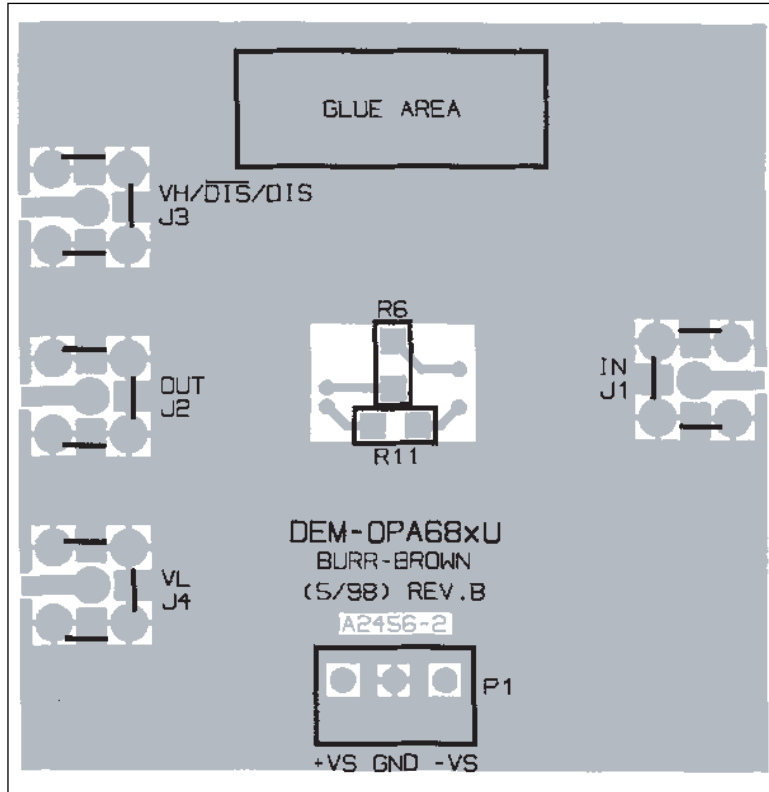
## 5 Measurement Tips

This demonstration fixture and the component values shown are designed to operate in a  $50\Omega$  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  $100\Omega$  resistor on the probe tip to isolate its capacitance from the circuit.



(a) Component Side Silkscreen and Metal



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

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

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