



# SGM8275-1/SGM8275-2 600kHz, Low Noise, High Voltage, Precision Operational Amplifiers

## GENERAL DESCRIPTION

The SGM8275-1/2 are a family of single and dual operational amplifiers, which are optimized for high voltage, low noise and low offset voltage operation. These devices can operate from 3.6V to 36V single supply or from  $\pm 1.8V$  to  $\pm 18V$  dual power supplies, while consuming 0.75mA quiescent current per amplifier.

The SGM8275-1/2 feature a 150 $\mu V$  maximum input offset voltage. The output swing is rail-to-rail with heavy loads. They exhibit a gain-bandwidth product of 600kHz and a slew rate of 3V/ $\mu s$ . These specifications make the operational amplifiers appropriate for various applications.

The SGM8275-1 is available in a Green SOT-23-5 package. The SGM8275-2 is available in a Green SOIC-8 package. They are specified over the extended  $-40^{\circ}C$  to  $+125^{\circ}C$  temperature range.

## FEATURES

- **Low Offset Voltage:** 35 $\mu V$  (TYP), 150 $\mu V$  (MAX)
- **Low Bias Current:**  $\pm 1nA$  (TYP)
- **High Open-Loop Voltage Gain:** 130dB at  $V_S = \pm 15V$
- **High PSRR:** 135dB
- **Gain-Bandwidth Product:** 600kHz
- **Low Noise:** 8.5nV/ $\sqrt{Hz}$  at 1kHz
- **Rail-to-Rail Output**
- **Supply Voltage Range:**  
3.6V to 36V or  $\pm 1.8V$  to  $\pm 18V$
- **Input Common Mode Voltage Range:**  
 $(-V_S) + 1.5V$  to  $(+V_S) - 2V$
- **Low Quiescent Current:** 0.75mA/Amplifier (TYP)
- **$-40^{\circ}C$  to  $+125^{\circ}C$  Operating Temperature Range**
- **Small Packaging:**  
SGM8275-1 Available in a Green SOT-23-5 Package  
SGM8275-2 Available in a Green SOIC-8 Package

## APPLICATIONS

Sensors  
Audio  
Active Filters  
A/D Converters  
Communications  
Test Equipment  
Cellular and Cordless Phones  
Laptops and PDAs  
Photodiode Amplification

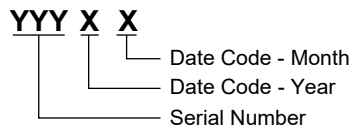
**PACKAGE/ORDERING INFORMATION**

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM8275-1	SOT-23-5	-40°C to +125°C	SGM8275-1XN5G/TR	G05XX	Tape and Reel, 3000
SGM8275-2	SOIC-8	-40°C to +125°C	SGM8275-2XS8G/TR	SGM 82752XS8 XXXXX	Tape and Reel, 2500

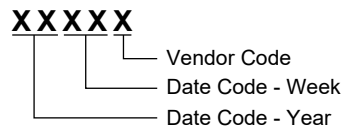
**MARKING INFORMATION**

NOTE: XX = Date Code. XXXXX = Date Code and Vendor Code.

**SOT-23-5**



**SOIC-8**



Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

**ABSOLUTE MAXIMUM RATINGS**

- Supply Voltage, +V<sub>S</sub> to -V<sub>S</sub> ..... 40V
- Input Common Mode Voltage Range ..... (-V<sub>S</sub>) - 0.3V to (+V<sub>S</sub>) + 0.3V
- Junction Temperature ..... +150°C
- Storage Temperature Range ..... -65°C to +150°C
- Lead Temperature (Soldering, 10s) ..... +260°C
- ESD Susceptibility
- HBM ..... 4000V
- CDM ..... 1000V

**ESD SENSITIVITY CAUTION**

This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

**RECOMMENDED OPERATING CONDITIONS**

- Supply Voltage Range ..... 3.6V to 36V
- Operating Temperature Range ..... -40°C to +125°C

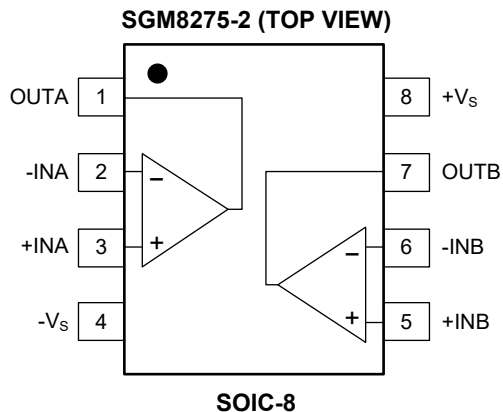
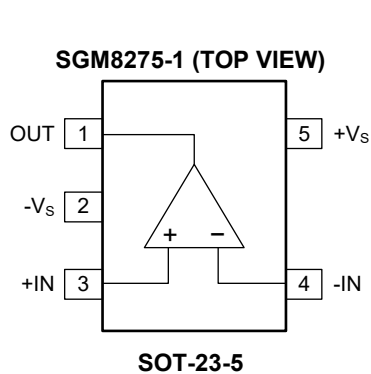
**DISCLAIMER**

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

**OVERSTRESS CAUTION**

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

**PIN CONFIGURATIONS**



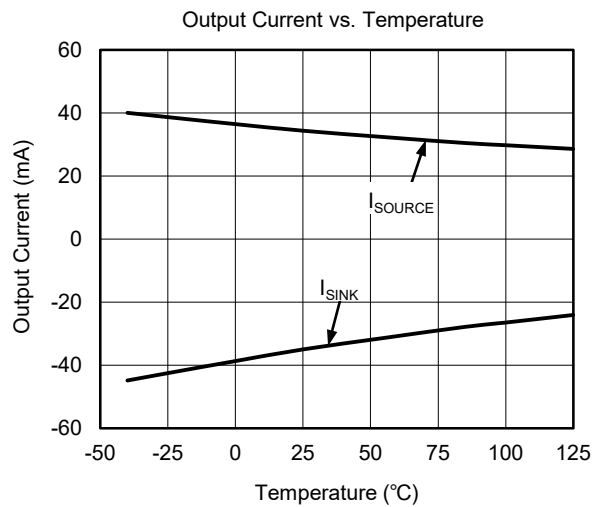
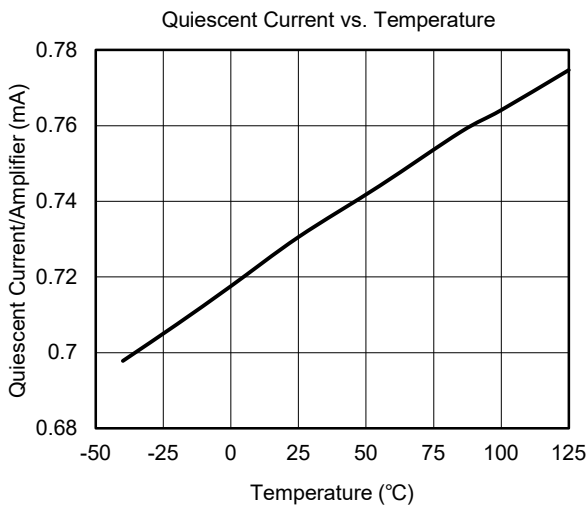
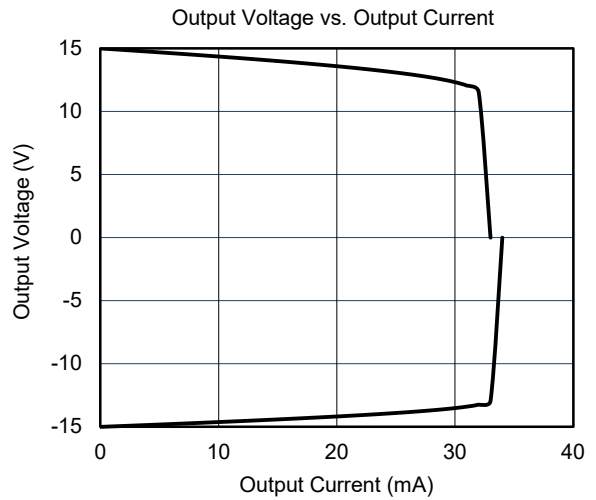
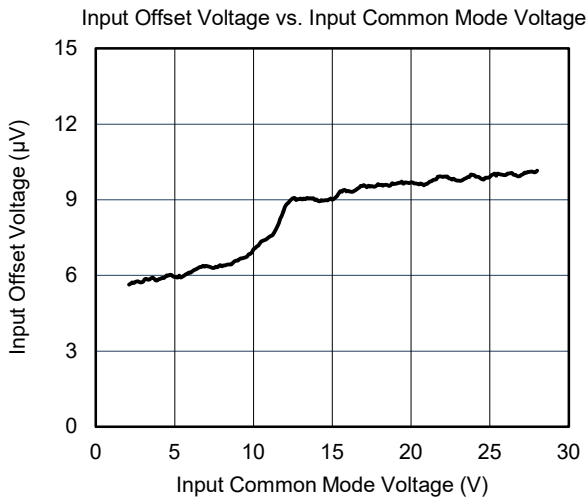
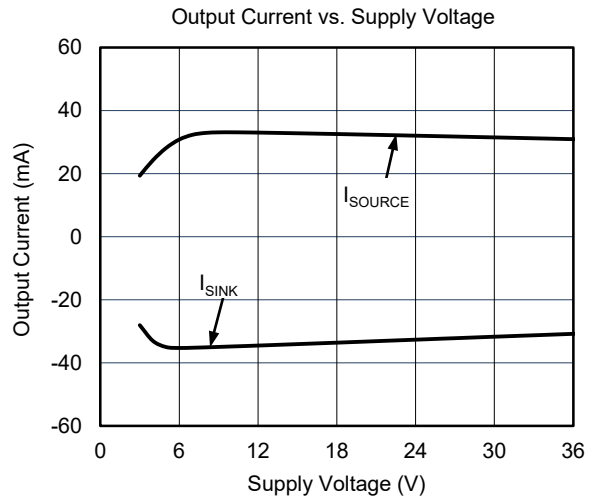
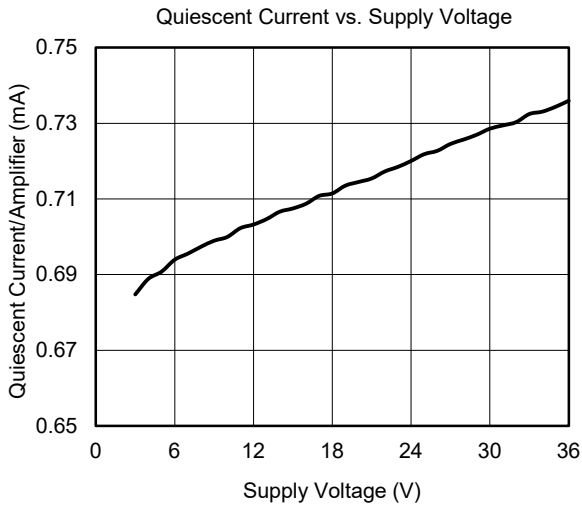
**ELECTRICAL CHARACTERISTICS**

( $V_S = \pm 5V$  to  $\pm 15V$ ,  $V_{CM} = 0V$  and  $R_L = 2k\Omega$  connected to  $0V$ , Full =  $-40^\circ C$  to  $+125^\circ C$ , typical values are at  $T_A = +25^\circ C$ , unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
<b>Input Characteristics</b>							
Input Offset Voltage	$V_{OS}$		+25°C		35	150	$\mu V$
			Full			250	
Input Offset Voltage Drift	$\Delta V_{OS}/\Delta T$		Full		0.3		$\mu V/^\circ C$
Input Bias Current	$I_B$		+25°C		$\pm 1$	$\pm 12$	nA
			Full			$\pm 60$	
Input Offset Current	$I_{OS}$		+25°C		$\pm 1$	$\pm 12$	nA
			Full			$\pm 35$	
Input Common Mode Voltage Range	$V_{CM}$		Full	$(-V_S) + 1.5$		$(+V_S) - 2$	V
Common Mode Rejection Ratio	CMRR	$(-V_S) + 1.5V \leq V_{CM} \leq (+V_S) - 2V$	+25°C	120	140		dB
			Full	115			
Open-Loop Voltage Gain	$A_{OL}$	$V_S = \pm 5V, V_{OUT} = \pm 2.5V, R_L = 10k\Omega$	+25°C	115	135		dB
			Full	112			
		$V_S = \pm 15V, V_{OUT} = \pm 10V, R_L = 10k\Omega$	+25°C	120	135		
			Full	117			
		$V_S = \pm 5V, V_{OUT} = \pm 2.5V, R_L = 2k\Omega$	+25°C	110	124		
			Full	105			
		$V_S = \pm 15V, V_{OUT} = \pm 10V, R_L = 2k\Omega$	+25°C	120	130		
			Full	112			
<b>Output Characteristics</b>							
Output Voltage Swing from Rail		$V_S = \pm 15V, R_L = 10k\Omega$	+25°C		90	120	mV
			Full			165	
		$V_S = \pm 15V, R_L = 2k\Omega$	+25°C		450	600	
			Full			820	
Output Short-Circuit Current	$I_{SC}$	$V_S = \pm 15V$	+25°C	$\pm 21$	$\pm 34$		mA
<b>Power Supply</b>							
Operating Voltage Range	$V_S$		Full	3.6		36	V
Quiescent Current/Amplifier	$I_Q$	$I_{OUT} = 0A$	+25°C		0.75	0.9	mA
			Full			1	
Power Supply Rejection Ratio	PSRR	$V_S = 3V$ to $38V$	+25°C	123	135		dB
			Full	120			
<b>Dynamic Performance</b>							
Gain-Bandwidth Product	GBP	$V_{OUT} = 100mV_{P-P}, C_L = 10pF$	+25°C		600		kHz
Phase Margin	$\phi_O$	$V_{OUT} = 100mV_{P-P}, C_L = 10pF$	+25°C		60		°
Slew Rate	SR	$R_L = 2k\Omega$	+25°C		3		V/ $\mu s$
Settling Time to 0.1%	$t_s$	$V_{IN} = 1V$ step, $G = +1$	+25°C		3.5		$\mu s$
Overload Recovery Time		$V_{IN} \times G = V_S$	+25°C		1.5		$\mu s$
Total Harmonic Distortion + Noise	THD+N	$V_{IN} = 1V_{RMS}, G = +1, f = 1kHz$	+25°C		0.0008		%
<b>Noise</b>							
Input Voltage Noise		$f = 0.1Hz$ to $10Hz$	+25°C		300		$nV_{P-P}$
Input Voltage Noise Density	$e_n$	$f = 1kHz$	+25°C		8.5		$nV/\sqrt{Hz}$
Input Current Noise Density	$i_n$	$f = 1kHz$	+25°C		1.5		$pA/\sqrt{Hz}$

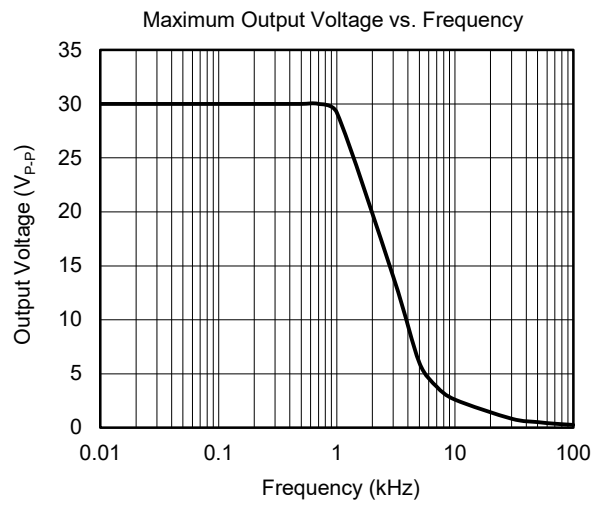
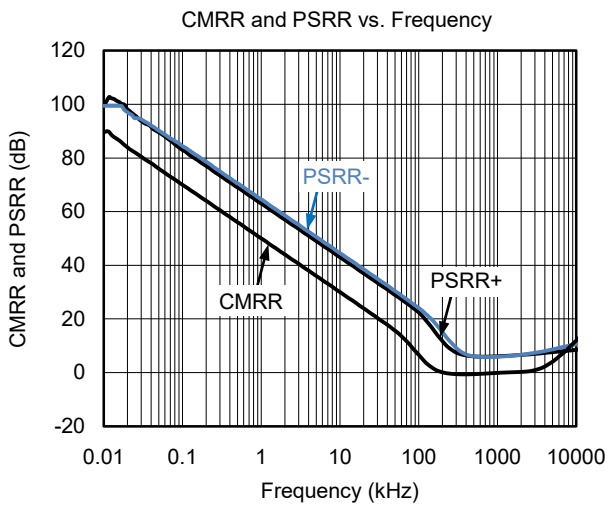
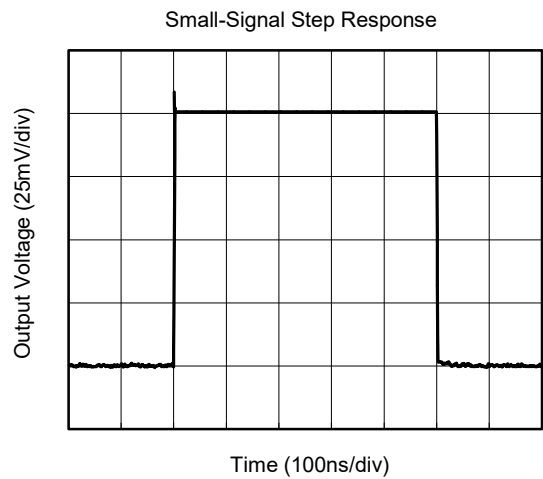
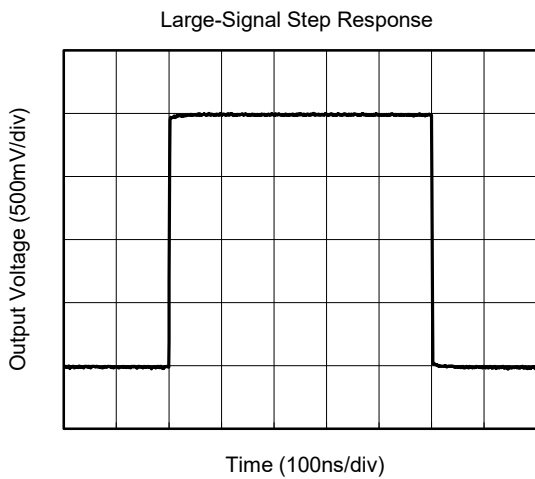
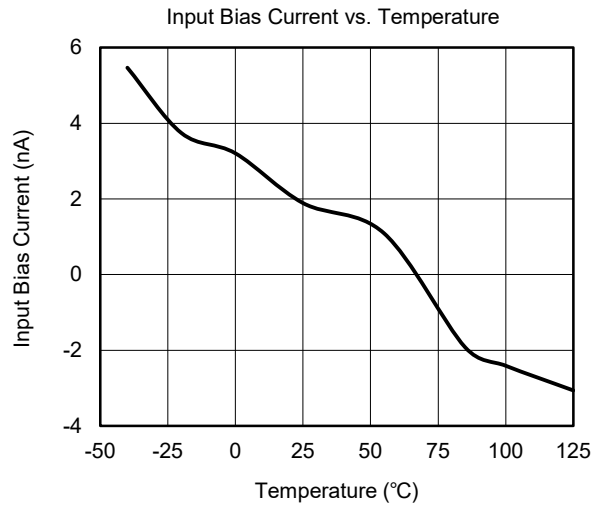
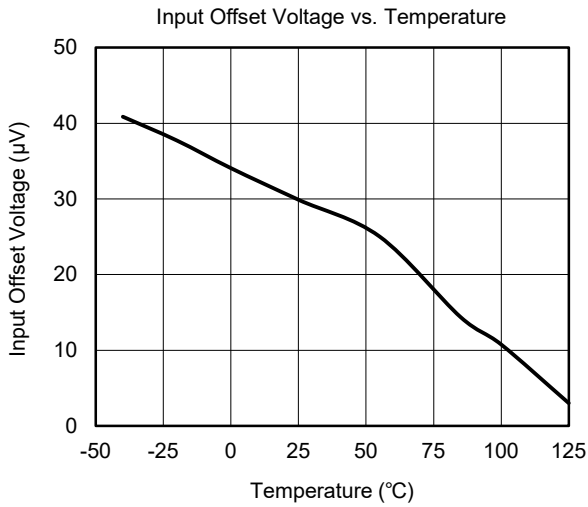
**TYPICAL PERFORMANCE CHARACTERISTICS**

At  $T_A = +25^\circ\text{C}$ ,  $V_S = \pm 15\text{V}$  and  $R_L = 2\text{k}\Omega$ , unless otherwise noted.



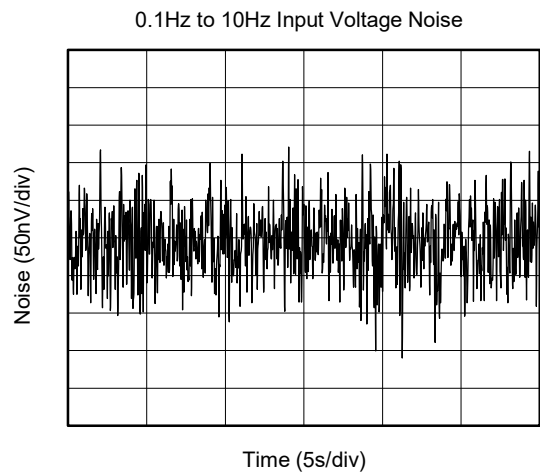
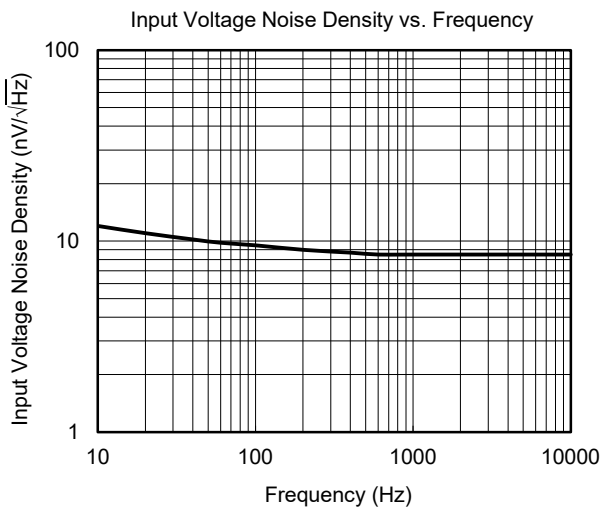
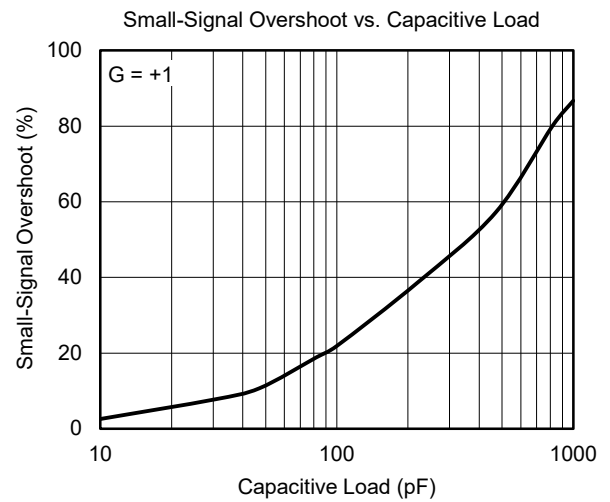
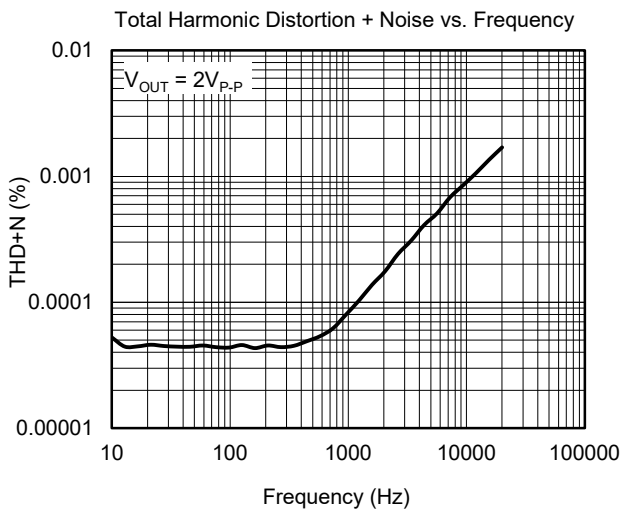
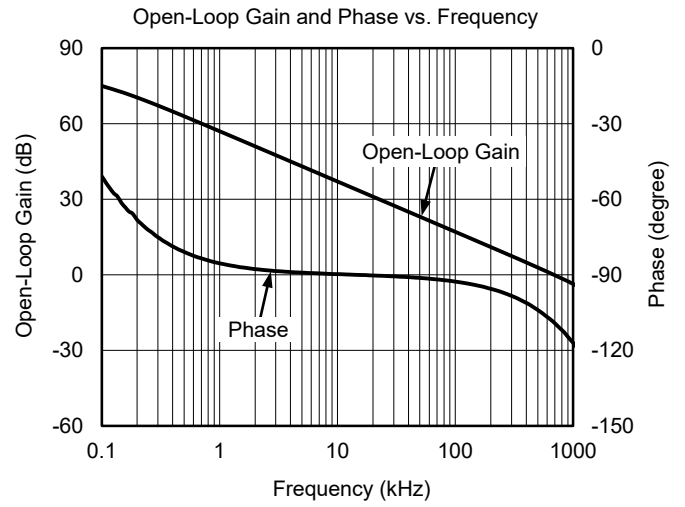
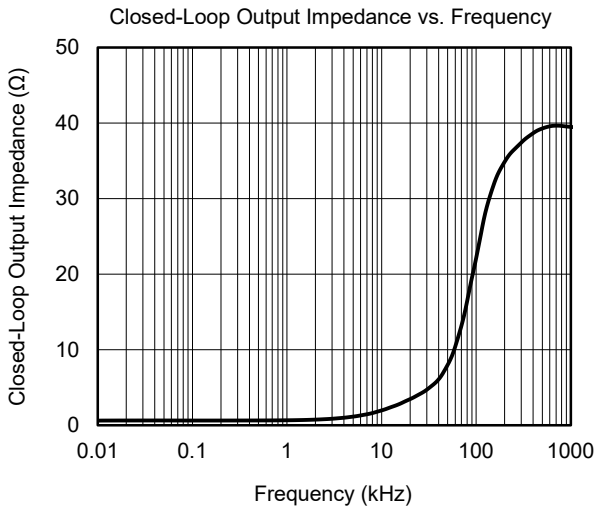
**TYPICAL PERFORMANCE CHARACTERISTICS (continued)**

At  $T_A = +25^\circ\text{C}$ ,  $V_S = \pm 15\text{V}$  and  $R_L = 2\text{k}\Omega$ , unless otherwise noted.



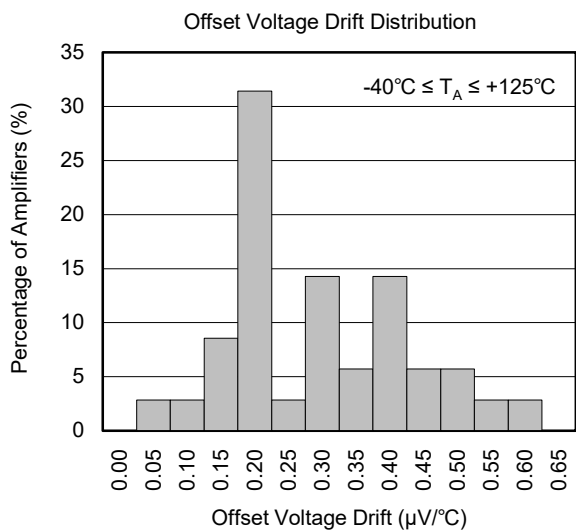
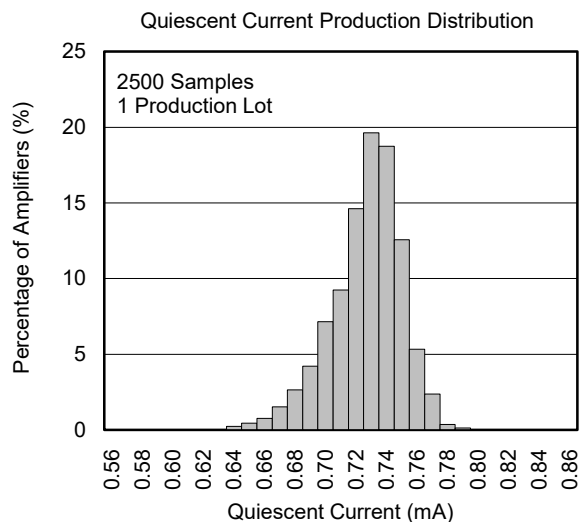
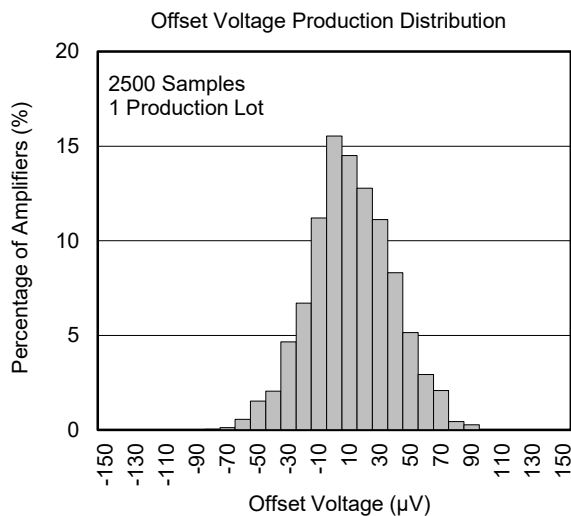
**TYPICAL PERFORMANCE CHARACTERISTICS (continued)**

At  $T_A = +25^\circ\text{C}$ ,  $V_S = \pm 15\text{V}$  and  $R_L = 2\text{k}\Omega$ , unless otherwise noted.



**TYPICAL PERFORMANCE CHARACTERISTICS (continued)**

At  $T_A = +25^\circ\text{C}$ ,  $V_S = \pm 15\text{V}$  and  $R_L = 2\text{k}\Omega$ , unless otherwise noted.

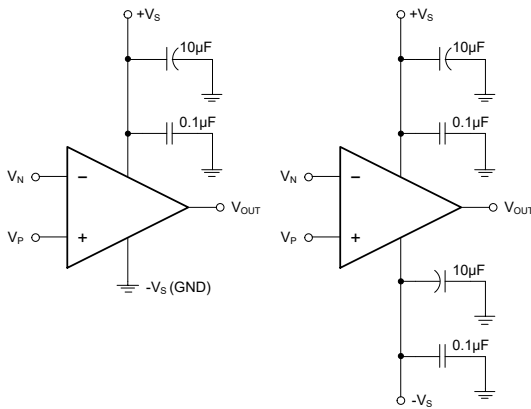




**APPLICATION INFORMATION**

**Power Supply Decoupling and Layout**

A clean and low noise power supply is very important in amplifier circuit design, besides of input signal noise, the power supply is one of important source of noise to the amplifier through +V<sub>S</sub> and -V<sub>S</sub> pins. Power supply bypassing is an effective method to clear up the noise at power supply, and the low impedance path to ground of decoupling capacitor will bypass the noise to GND. In application, 10μF ceramic capacitor paralleled with 0.1μF or 0.01μF ceramic capacitor is used in Figure 1. The ceramic capacitors should be placed as close as possible to +V<sub>S</sub> and -V<sub>S</sub> power supply pins.



**Figure 1. Amplifier Power Supply Bypassing**

**Grounding**

In low speed application, one node grounding technique is the simplest and most effective method to eliminate the noise generated by grounding. In high speed application, the general method to eliminate noise is to use a complete ground plane technique, and the whole ground plane will help distribute heat and reduce EMI noise pickup.

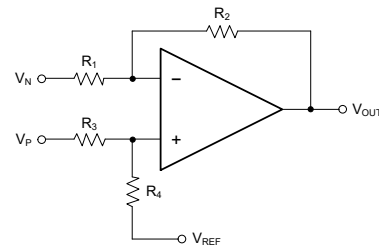
**Reduce Input-to-Output Coupling**

To reduce the input-to-output coupling, the input traces must be placed as far away from the power supply or output traces as possible. The sensitive trace must not be placed in parallel with the noisy trace in same layer. They must be placed perpendicularly in different layers to reduce the crosstalk. These PCB layout techniques will help to reduce unwanted positive feedback and noise.

**Typical Application Circuits**

**Difference Amplifier**

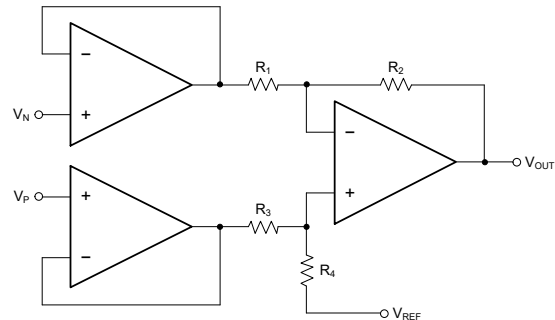
The circuit in Figure 2 is a design example of classical difference amplifier. If  $R_4/R_3 = R_2/R_1$ , then  $V_{OUT} = (V_P - V_N) \times R_2/R_1 + V_{REF}$ .



**Figure 2. Difference Amplifier**

**High Input Impedance Difference Amplifier**

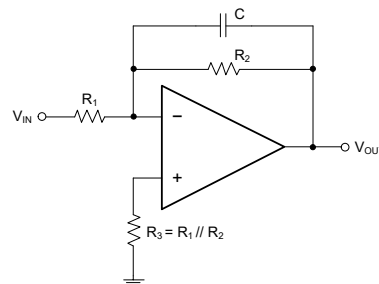
The circuit in Figure 3 is a design example of high input impedance difference amplifier, the added amplifiers at the input are used to increase the input impedance and eliminate drawback of low input impedance in Figure 2.



**Figure 3. High Input Impedance Difference Amplifier**

**Active Low-Pass Filter**

The circuit in Figure 4 is a design example of active low-pass filter, the DC gain is equal to  $-R_2/R_1$  and the -3dB corner frequency is equal to  $1/2\pi R_2 C$ . In this design, the filter bandwidth must be less than the bandwidth of the amplifier, the resistor values must be selected as low as possible to reduce ringing or oscillation generated by the parasitic parameters in PCB layout.



**Figure 4. Active Low-Pass Filter**

## **REVISION HISTORY**

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

### **Changes from Original (MAY 2021) to REV.B**

**Page**

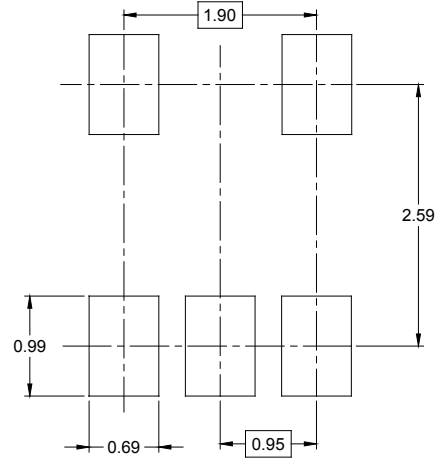
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PACKAGE OUTLINE DIMENSIONS

SOT-23-5



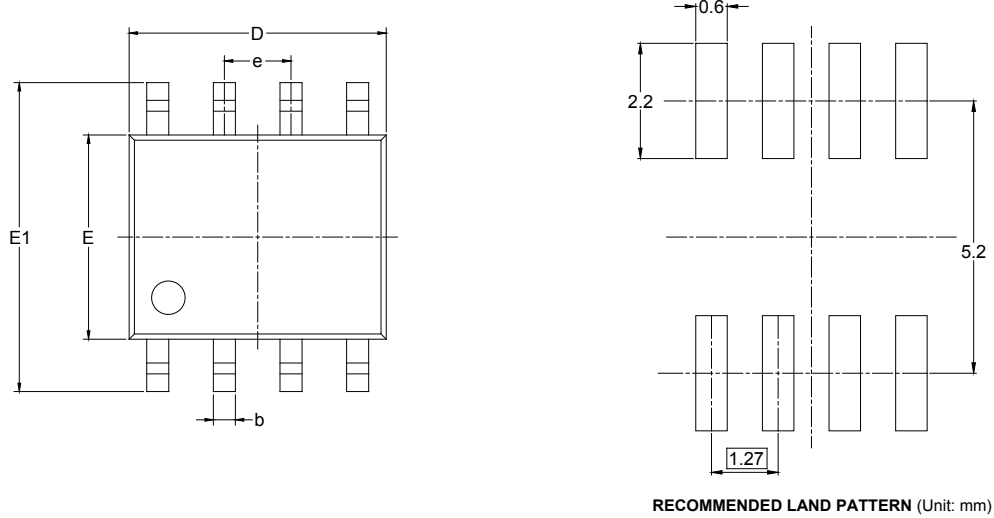
RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
$\theta$	0°	8°	0°	8°

PACKAGE OUTLINE DIMENSIONS

SOIC-8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050 BSC	
L	0.400	1.270	0.016	0.050
$\theta$	0°	8°	0°	8°

## TAPE AND REEL INFORMATION

### REEL DIMENSIONS



### TAPE DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

### KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOT-23-5	7"	9.5	3.20	3.20	1.40	4.0	4.0	2.0	8.0	Q3
SOIC-8	13"	12.4	6.40	5.40	2.10	4.0	8.0	2.0	12.0	Q1

D00001

# PACKAGE INFORMATION

## CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

## KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
7" (Option)	368	227	224	8
7"	442	410	224	18
13"	386	280	370	5

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