



# SGM8957-1/SGM8957-2

## High Precision, Low Power, Rail-to-Rail I/O, CMOS Operational Amplifiers

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### GENERAL DESCRIPTION

The single SGM8957-1 and dual SGM8957-2 are low power, high precision CMOS operational amplifiers, which can operate from 1.8V to 5.5V single supply or from  $\pm 0.9V$  to  $\pm 2.75V$  dual power supplies, while consuming only 20 $\mu A$  quiescent current per amplifier. The SGM8957-1/2 support rail-to-rail input and output operation. The input common mode voltage range is 100mV beyond the rails, and the output swings within 14mV of the rails.

The SGM8957-1/2 feature high impedance inputs, a 25 $\mu V$  maximum input offset voltage and zero-drift over time and temperature. These devices are designed to provide optimal performance in low voltage and low power systems. These specifications make the operational amplifiers appropriate for a wide range of applications requiring high precision, such as driving ADCs with high linearity.

The SGM8957-1 is available in Green SOT-23-5, SC70-5 and SOIC-8 packages. The SGM8957-2 is available in Green SOIC-8, MSOP-8 and TDFN-3 $\times$ 3-8L packages. They are specified over  $-40^{\circ}C$  to  $+125^{\circ}C$  temperature range.

### FEATURES

- **Low Offset Voltage: 25 $\mu V$  (MAX)**
- **Low 0.1Hz to 10Hz Noise: 2 $\mu V_{P-P}$**
- **Integrated RFI Filter**
- **Rail-to-Rail Input and Output**
- **Support Single or Dual Power Supplies:  
1.8V to 5.5V or  $\pm 0.9V$  to  $\pm 2.75V$**
- **Quiescent Current: 20 $\mu A$ /Amplifier (TYP)**
- **$-40^{\circ}C$  to  $+125^{\circ}C$  Operating Temperature Range**
- **Small Packaging:  
SGM8957-1 Available in Green SOT-23-5, SC70-5  
and SOIC-8 Packages  
SGM8957-2 Available in Green SOIC-8, MSOP-8  
and TDFN-3 $\times$ 3-8L Packages**

### APPLICATIONS

Temperature Measurements  
Medical Instrumentation  
Transducer Applications  
Electronic Scales  
Handheld Test Equipment  
Battery-Powered Instruments

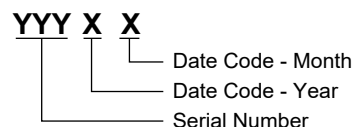
**PACKAGE/ORDERING INFORMATION**

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM8957-1	SOT-23-5	-40°C to +125°C	SGM8957-1XN5G/TR	SYBXX	Tape and Reel, 3000
	SC70-5	-40°C to +125°C	SGM8957-1XC5G/TR	SYCXX	Tape and Reel, 3000
	SOIC-8	-40°C to +125°C	SGM8957-1XS8G/TR	SGM 89571XS8 XXXXX	Tape and Reel, 2500
SGM8957-2	SOIC-8	-40°C to +125°C	SGM8957-2XS8G/TR	SGM 89572XS8 XXXXX	Tape and Reel, 2500
	MSOP-8	-40°C to +125°C	SGM8957-2XMS8G/TR	SGM89572 XMS8 XXXXX	Tape and Reel, 4000
	TDFN-3x3-8L	-40°C to +125°C	SGM8957-2XTDB8G/TR	SGM 09DB XXXXX	Tape and Reel, 4000

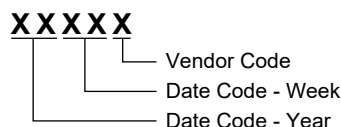
**MARKING INFORMATION**

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

**SOT-23-5/SC70-5**



**SOIC-8/MSOP-8/TDFN-3x3-8L**



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.....6V
- Input Common Mode Voltage Range  
..... (-Vs) - 0.3V to (+Vs) + 0.3V
- Junction Temperature.....+150°C
- Storage Temperature Range ..... -65°C to +150°C
- Lead Temperature (Soldering, 10s).....+260°C
- ESD Susceptibility
- HBM.....4000V
- MM.....400V
- CDM ..... 1000V

**RECOMMENDED OPERATING CONDITIONS**

- Specified Voltage Range .....1.8V to 5.5V
- Operating Temperature Range .....-40°C to +125°C

**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.

**ESD SENSITIVITY CAUTION**

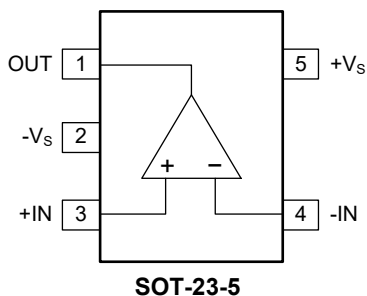
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance 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.

**DISCLAIMER**

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

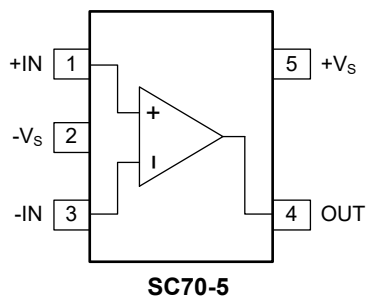
**PIN CONFIGURATIONS**

**SGM8957-1 (TOP VIEW)**



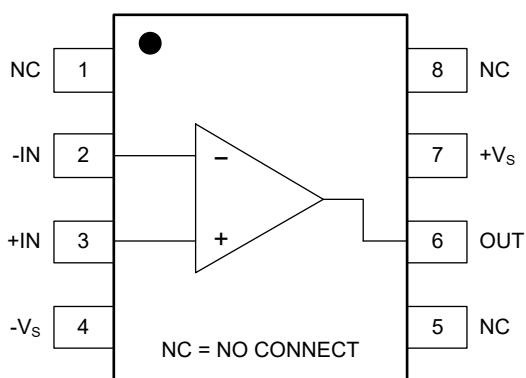
**SOT-23-5**

**SGM8957-1 (TOP VIEW)**



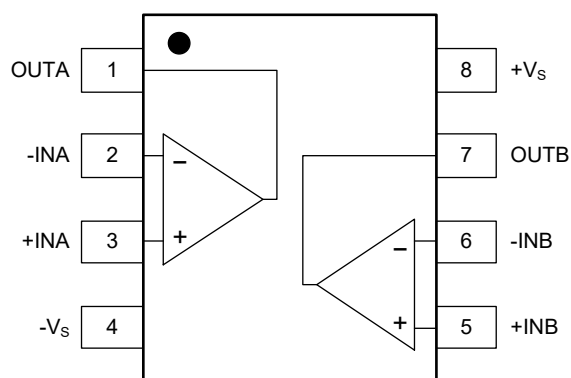
**SC70-5**

**SGM8957-1 (TOP VIEW)**



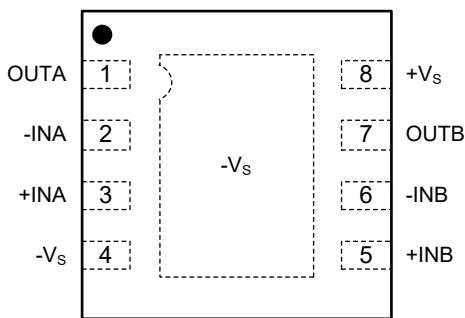
**SOIC-8**

**SGM8957-2 (TOP VIEW)**



**SOIC-8/MSOP-8**

**SGM8957-2 (TOP VIEW)**



**TDFN-3x3-8L**

NOTE: For TDFN-3x3-8L package, exposed pad can be connected to -Vs or left floating.

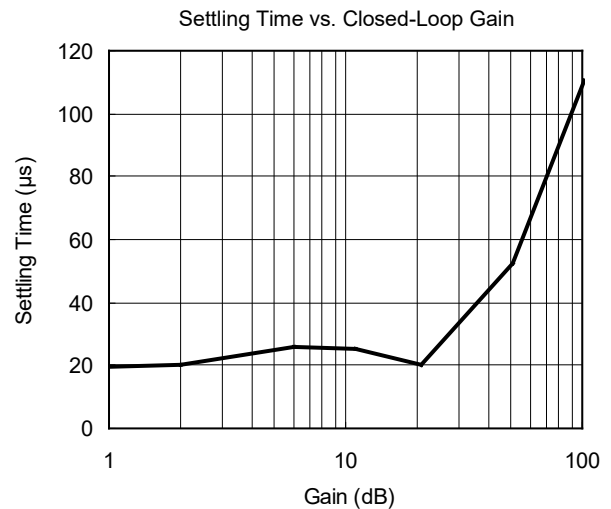
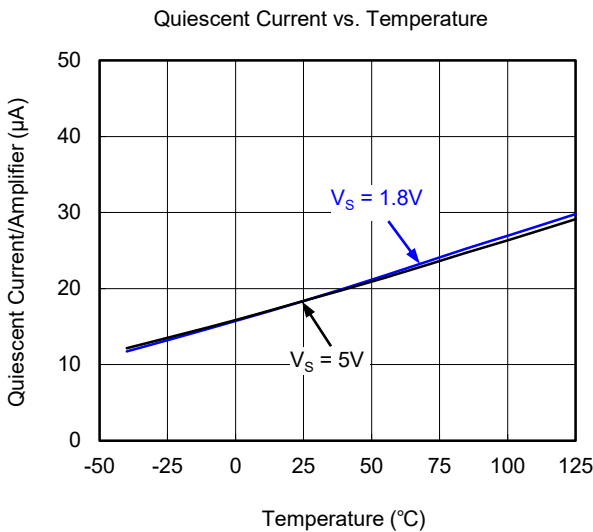
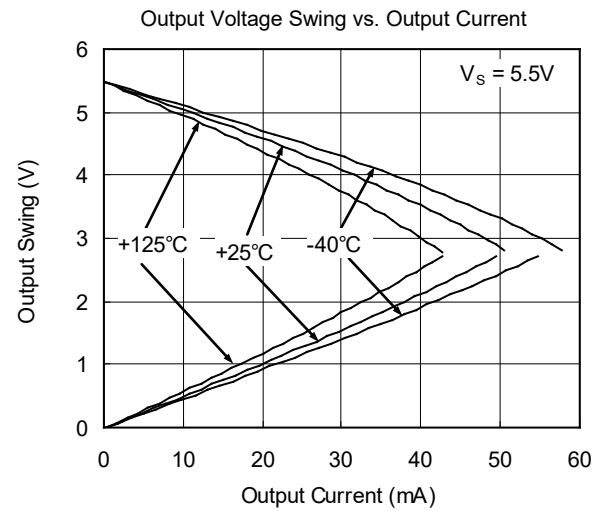
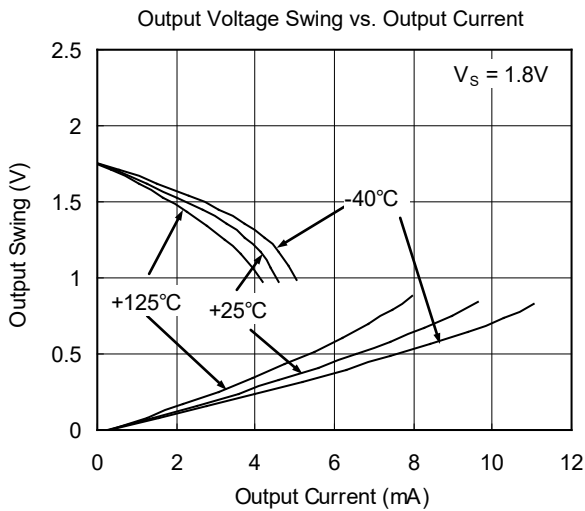
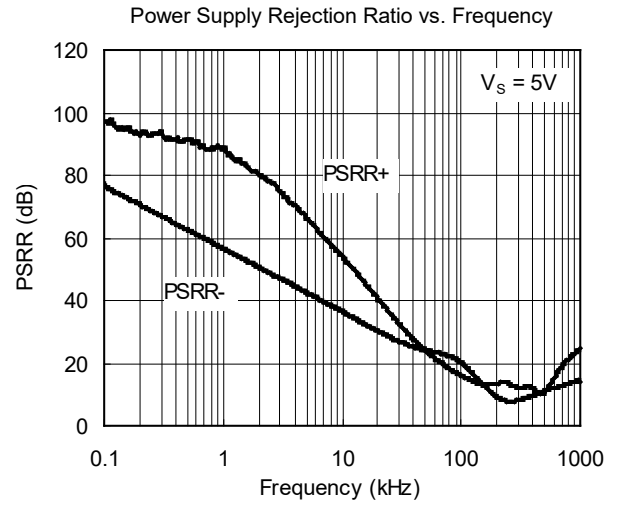
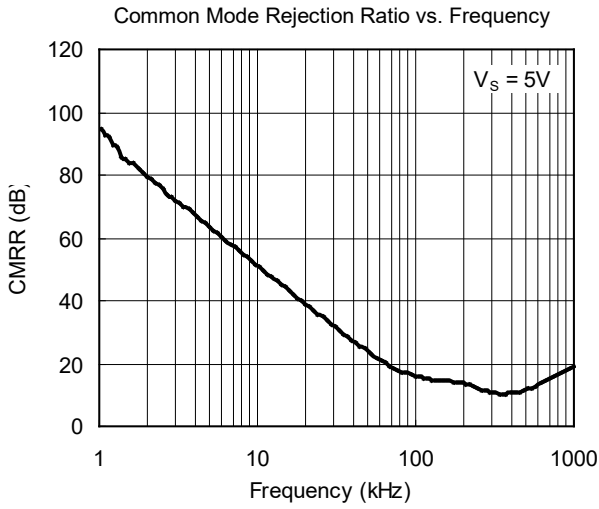
**ELECTRICAL CHARACTERISTICS**

(At  $T_A = +25^\circ\text{C}$ ,  $V_S = 1.8\text{V}$  to  $5.5\text{V}$ ,  $V_{CM} = V_S/2$ ,  $V_{OUT} = V_S/2$  and  $R_L = 10\text{k}\Omega$  to  $V_S/2$ , Full =  $-40^\circ\text{C}$  to  $+125^\circ\text{C}$ , unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
<b>Input Characteristics</b>							
Input Offset Voltage	$V_{OS}$	$V_S = 5\text{V}$	+25°C		14	25	$\mu\text{V}$
			Full			55	
Input Offset Voltage Drift	$\Delta V_{OS}/\Delta T$		Full		0.08		$\mu\text{V}/^\circ\text{C}$
Input Bias Current	$I_B$		+25°C		130		pA
Input Common Mode Voltage Range	$V_{CM}$		+25°C	$(-V_S) - 0.1$		$(+V_S) + 0.1$	V
Common Mode Rejection Ratio	CMRR	$(-V_S) - 0.1\text{V} < V_{CM} < (+V_S) + 0.1\text{V}$	+25°C	89	100		dB
			Full	85			
Open-Loop Voltage Gain	$A_{OL}$	$(-V_S) + 0.1\text{V} < V_{OUT} < (+V_S) - 0.1\text{V}$ $R_L = 10\text{k}\Omega$	+25°C	95	121		dB
			Full	94			
<b>Input Impedance</b>							
Differential			+25°C		$10^9$		$\Omega$
Common Mode			+25°C		$10^9$		$\Omega$
<b>Output Characteristics</b>							
Output Voltage Swing from Rail		$R_L = 10\text{k}\Omega$	+25°C		14	25	mV
			Full			27	
Output Short-Circuit Current	$I_{SC}$	$V_S = 1.8\text{V}$	+25°C		6		mA
		$V_S = 5\text{V}$	+25°C		60		
Open-Loop Output Impedance		$f = 350\text{kHz}$ , $I_{OUT} = 0$	+25°C		1		k $\Omega$
<b>Power Supply</b>							
Specified Voltage Range	$V_S$		Full	1.8		5.5	V
Power Supply Rejection Ratio	PSRR	$V_S = 1.8\text{V}$ to $5.5\text{V}$	+25°C		4	20	$\mu\text{V}/\text{V}$
			Full			25	
Quiescent Current/Amplifier	$I_Q$	$I_{OUT} = 0$	+25°C		20	37	$\mu\text{A}$
			Full			48	
Turn-On Time		$V_S = 5\text{V}$	+25°C		220		$\mu\text{s}$
<b>Dynamic Performance</b>							
Gain-Bandwidth Product	GBP	$C_L = 100\text{pF}$	+25°C		350		kHz
Slew Rate	SR	$G = +1$	+25°C		0.18		V/ $\mu\text{s}$
<b>Noise</b>							
Input Voltage Noise		$f = 0.1\text{Hz}$ to $10\text{Hz}$	+25°C		2		$\mu\text{V}_{P-P}$

**TYPICAL PERFORMANCE CHARACTERISTICS**

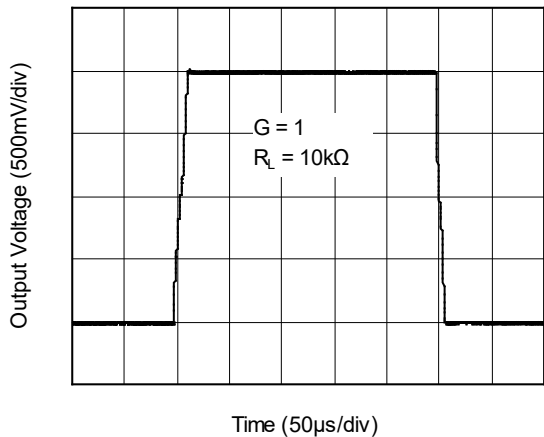
At  $T_A = +25^\circ\text{C}$ ,  $V_S = 5\text{V}$  and  $C_L = 0\text{pF}$ , unless otherwise noted.



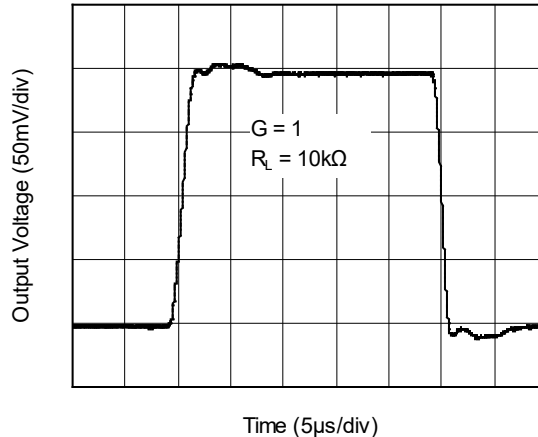
**TYPICAL PERFORMANCE CHARACTERISTICS (continued)**

At  $T_A = +25^\circ\text{C}$ ,  $V_S = 5\text{V}$  and  $C_L = 0\text{pF}$ , unless otherwise noted.

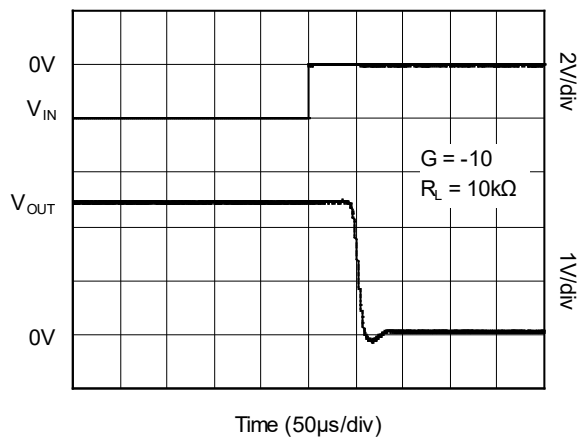
Large-Signal Step Response



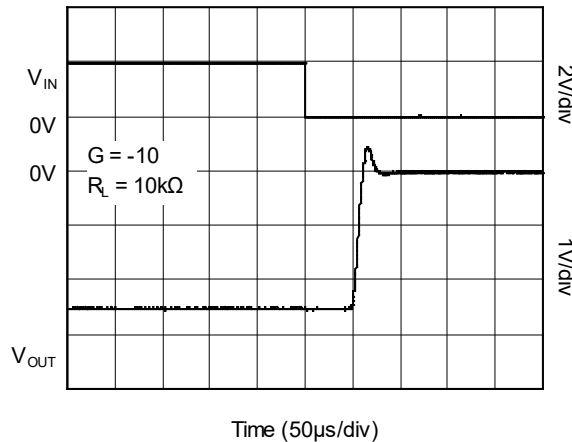
Small-Signal Step Response



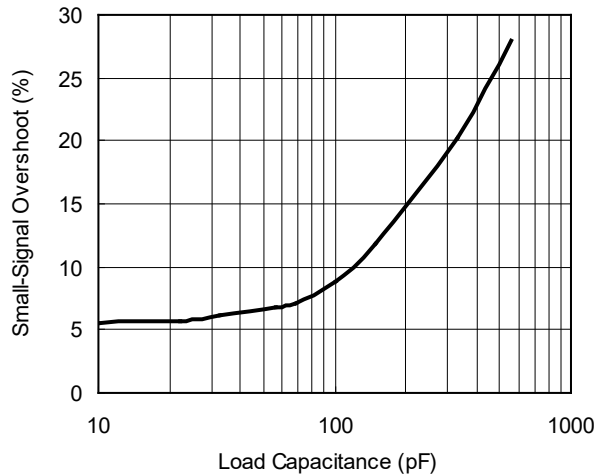
Positive Over-Voltage Recovery



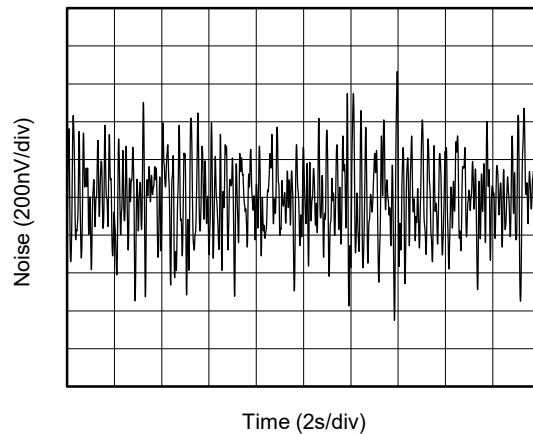
Negative Over-Voltage Recovery



Small-Signal Overshoot vs. Load Capacitance

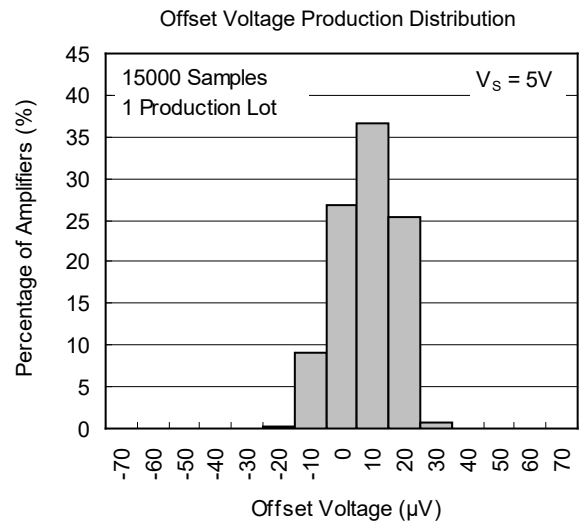
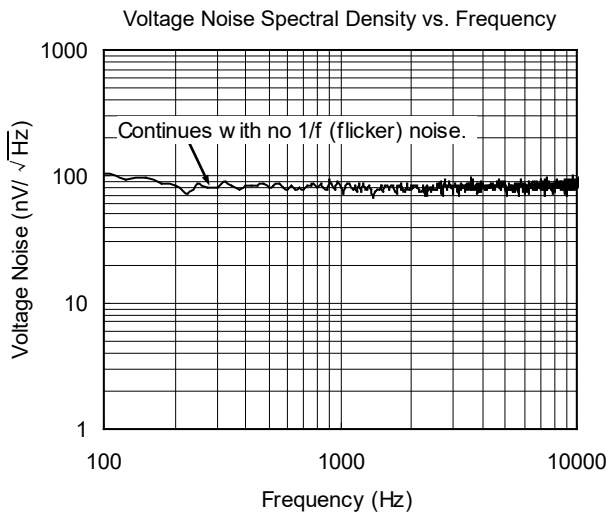


0.1Hz to 10Hz Noise



**TYPICAL PERFORMANCE CHARACTERISTICS (continued)**

At  $T_A = +25^\circ\text{C}$ ,  $V_S = 5\text{V}$  and  $C_L = 0\text{pF}$ , unless otherwise noted.



## **REVISION HISTORY**

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

<b>OCTOBER 2020 – REV.A.2 to REV.A.3</b>	<b>Page</b>
Updated Typical Performance Characteristics section .....	6
Deleted Achieving Output Swing to the Operational Amplifier Negative Rail section .....	8

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<b>OCTOBER 2016 – REV.A.1 to REV.A.2</b>	<b>Page</b>
Changed Typical Performance Characteristics section .....	5

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<b>APRIL 2016 – REV.A to REV.A.1</b>	<b>Page</b>
Added SOIC-8 and MSOP-8 packages .....	All

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<b>Changes from Original (SEPTEMBER 2015) to REV.A</b>	<b>Page</b>
Changed from product preview to production data .....	All

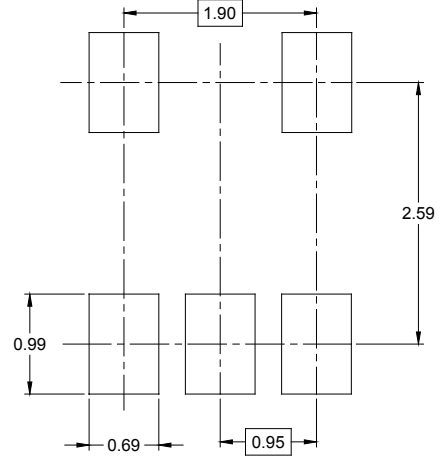
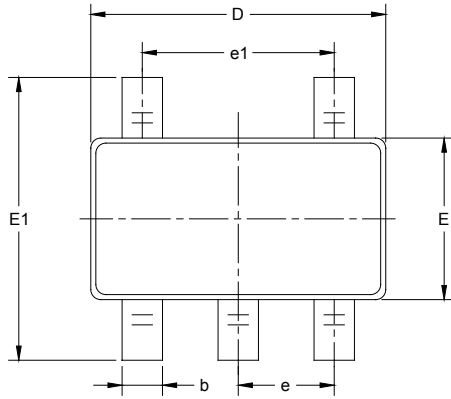
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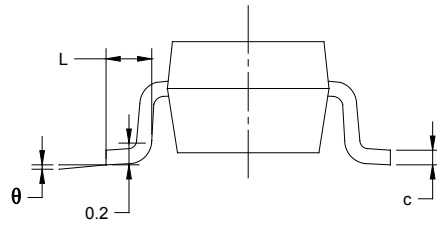
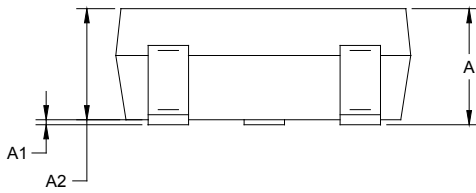
# PACKAGE INFORMATION

## PACKAGE OUTLINE DIMENSIONS

### SOT-23-5



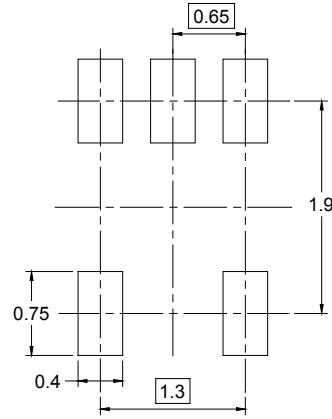
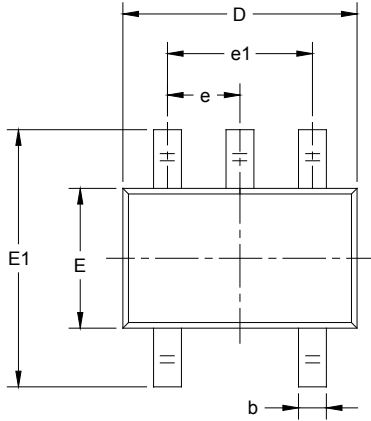
RECOMMENDED LAND PATTERN (Unit: mm)



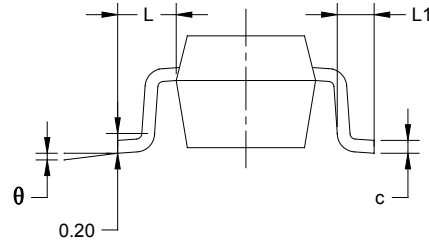
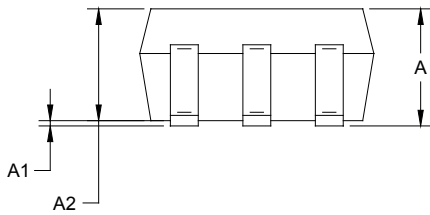
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 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

SC70-5



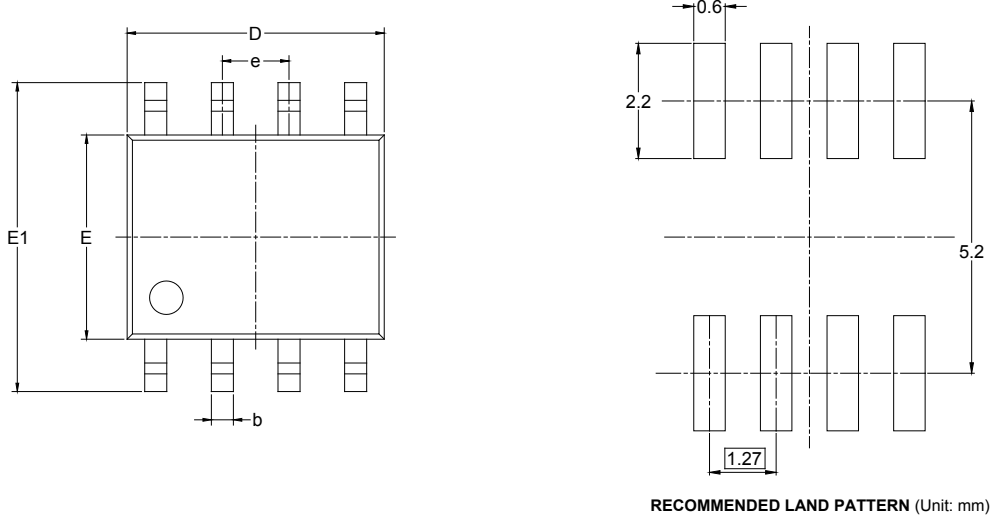
RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.65 TYP		0.026 TYP	
e1	1.300 BSC		0.051 BSC	
L	0.525 REF		0.021 REF	
L1	0.260	0.460	0.010	0.018
$\theta$	0°	8°	0°	8°

PACKAGE OUTLINE DIMENSIONS

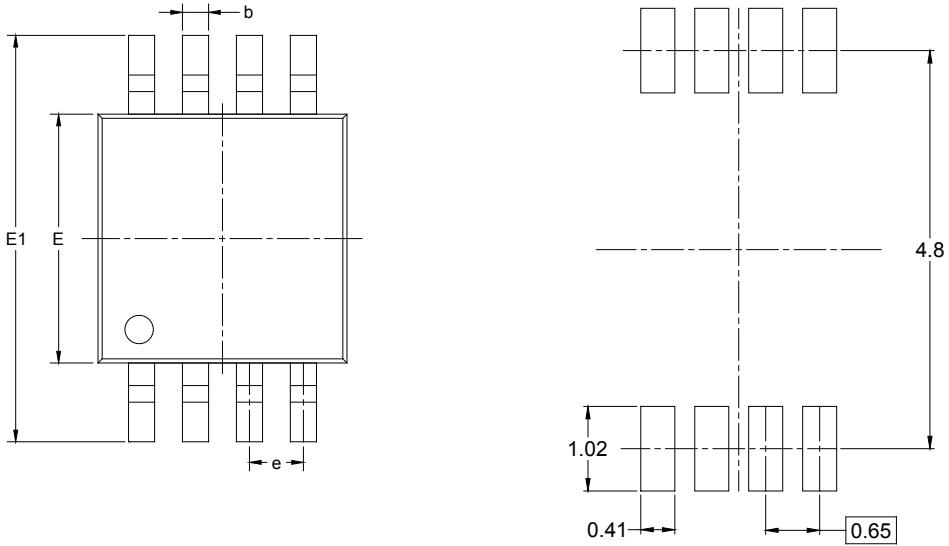
SOIC-8



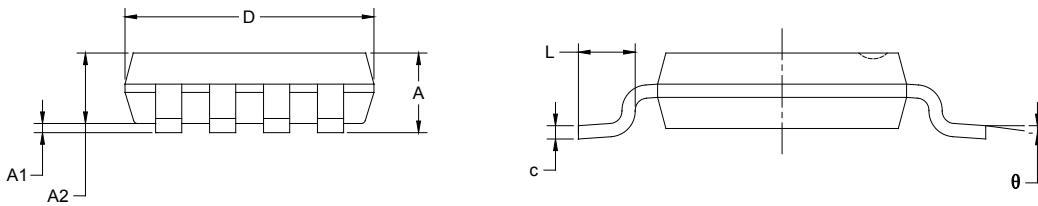
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050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

PACKAGE OUTLINE DIMENSIONS

MSOP-8



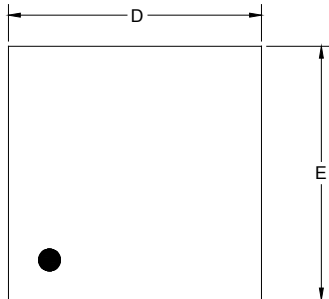
RECOMMENDED LAND PATTERN (Unit: mm)



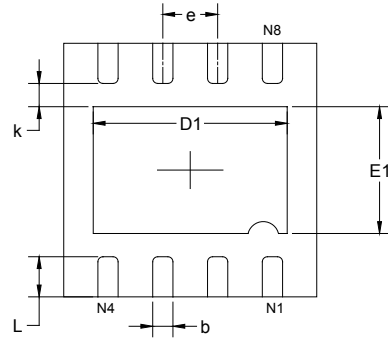
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650 BSC		0.026 BSC	
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

PACKAGE OUTLINE DIMENSIONS

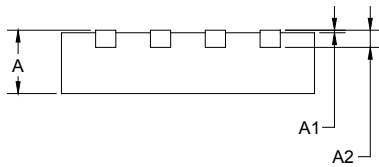
TDFN-3x3-8L



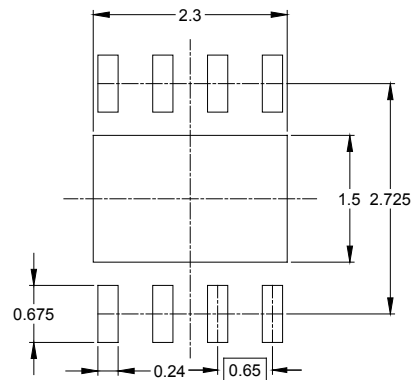
TOP VIEW



BOTTOM VIEW



SIDE VIEW



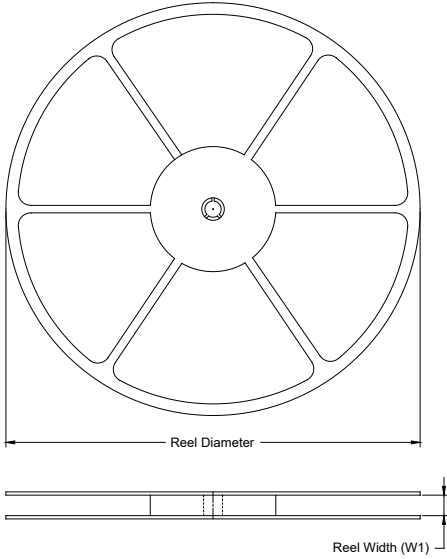
RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203 REF		0.008 REF	
D	2.900	3.100	0.114	0.122
D1	2.200	2.400	0.087	0.094
E	2.900	3.100	0.114	0.122
E1	1.400	1.600	0.055	0.063
k	0.200 MIN		0.008 MIN	
b	0.180	0.300	0.007	0.012
e	0.650 TYP		0.026 TYP	
L	0.375	0.575	0.015	0.023

# PACKAGE INFORMATION

## 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
SC70-5	7"	9.5	2.25	2.55	1.20	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
MSOP-8	13"	12.4	5.20	3.30	1.50	4.0	8.0	2.0	12.0	Q1
TDFN-3×3-8L	13"	12.4	3.35	3.35	1.13	4.0	8.0	2.0	12.0	Q1

D20001

# 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

DD0002