



SGM8040S-1

550nA, Rail-to-Rail I/O, High Precision Operational Amplifier

GENERAL DESCRIPTION

The SGM8040S-1 is a single, high precision operational amplifier which can operate from 1.4V to 5.5V single supply, while consuming only 550nA quiescent current. It is capable of rail-to-rail input and output. Therefore, the SGM8040S-1 is suitable for use in portable instrumentation and battery-powered equipment.

The SGM8040S-1 is unity-gain stable, and features an 11kHz gain-bandwidth product. It is designed to provide optimal performance in low-frequency systems, when monitoring battery current and conditioning sensor signal.

The SGM8040S-1 is available in a Green SOT-23-5 package. It operates over an ambient temperature range of -40°C to +85°C.

FEATURES

- **Low Quiescent Current:** 550nA (TYP)
- **Low Offset Voltage:** 420μV (MAX)
- **Unity-Gain Stable**
- **Gain-Bandwidth Product:** 11kHz (TYP)
- **Rail-to-Rail Input and Output**
- **Supply Voltage Range:** 1.4V to 5.5V
- **-40°C to +85°C Operating Temperature Range**
- **Available in a Green SOT-23-5 Package**

APPLICATIONS

Battery-Powered Equipment
Temperature Measurements
Tollbooth Tags
Wearable Devices

TYPICAL APPLICATION

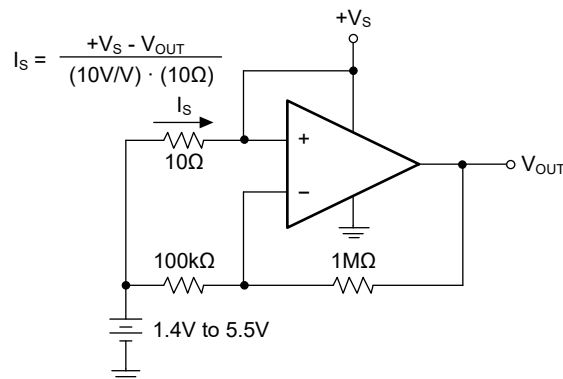


Figure 1. High-side Battery Current Sensor

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM8040S-1	SOT-23-5	-40°C to +85°C	SGM8040S-1YN5G/TR	MD6XX	Tape and Reel, 3000

MARKING INFORMATION

NOTE: XX = Date Code.

YYY X X
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 Date Code - Month
 Date Code - Year
 Serial Number

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
 Analog Inputs (V_{IN+} , V_{IN-}) $(-V_S) - 0.3V$ to $(+V_S) + 0.3V$
 Differential Input Voltage $|(-V_S) - (+V_S)|$
 Junction Temperature +150°C
 Storage Temperature Range -65°C to +150°C
 Lead Temperature (Soldering, 10s) +260°C
 ESD Susceptibility
 HBM 8000V
 MM 400V
 CDM 1000V

RECOMMENDED OPERATING CONDITIONS

Operating Temperature Range -40°C to +85°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

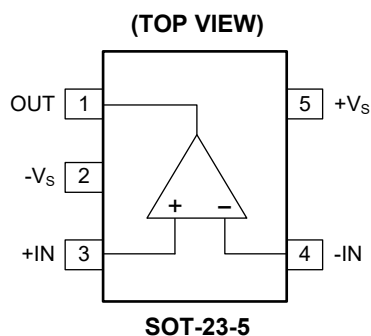
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions.

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 CONFIGURATION



ELECTRICAL CHARACTERISTICS

(At $T_A = +25^\circ\text{C}$, Full = -40°C to $+85^\circ\text{C}$, $V_S = \pm 0.7\text{V}$ to $\pm 2.75\text{V}$ and $R_L = 1\text{M}\Omega$ ⁽¹⁾ connected to 0V, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
DC Electrical Characteristics							
Input Offset Voltage	V _{OS}	V _{CM} = 0V	+25°C		200	420	μV
			Full			660	
Input Offset Voltage Drift	ΔV _{OS} /ΔT		Full		1		μV/°C
Input Bias Current	I _B	V _{CM} = 0V	+25°C		±10	±200	pA
Input Offset Current	I _{OS}	V _{CM} = 0V	+25°C		±10	±300	pA
Input Common Mode Voltage Range	V _{CM}		Full	(-V _S) - 0.1		(+V _S) + 0.1	V
Common Mode Rejection Ratio	CMRR	V _S = ±2.5V, (-V _S) - 0.1V < V _{CM} < (+V _S) + 0.1V	+25°C	82	92		dB
			Full	76			
		V _S = ±2.5V, 0 < V _{CM} < (+V _S) + 0.1V	+25°C	76	86		
			Full	70			
		V _S = ±2.5V, (-V _S) - 0.1V < V _{CM} < 0	+25°C	90	110		
			Full	86			
Open-Loop Voltage Gain	A _{OL}	V _S = ±0.7V, (-V _S) + 0.1V < V _{OUT} < (+V _S) - 0.1V, R _L = 50kΩ	+25°C	88	110		dB
			Full	85			
		V _S = ±2.5V, (-V _S) + 0.1V < V _{OUT} < (+V _S) - 0.1V, R _L = 50kΩ	+25°C	102	120		
			Full	94			
Output Voltage Swing from Rail		R _L = 50kΩ	+25°C		3	9	mV
			Full			10	
Output Short-Circuit Current	I _{SC}	V _S = ±0.7V	+25°C		2		mA
		V _S = ±2.5V	+25°C	8	18		
Supply Voltage	V _S		Full	1.4		5.5	V
Quiescent Current	I _Q		+25°C		550	850	nA
			Full			900	
Power Supply Rejection Ratio	PSRR	V _S = 1.4V to 5.5V	+25°C	86	104		dB
			Full	82			
AC Electrical Characteristics							
Gain-Bandwidth Product	GBP	C _L = 60pF	+25°C		11		kHz
Slew Rate	SR	V _S = ±0.7V, V _{OUT} = 1V _{P-P} , G = +1	+25°C		2		V/ms
		V _S = ±1.25V, V _{OUT} = 1V _{P-P} , G = +1	+25°C		3.5		
		V _S = ±2.5V, V _{OUT} = 2V _{P-P} , G = +1	+25°C		4		
Input Voltage Noise		f = 0.1Hz to 10Hz	+25°C		5		μV _{P-P}
Input Voltage Noise Density	e _n	f = 1kHz	+25°C		180		nV/√Hz
Input Current Noise Density	i _n	f = 1kHz	+25°C		300		fA/√Hz

NOTE: 1. Refer to Figure 2 and Figure 3.

TEST CIRCUITS

Figure 2 and Figure 3 show the AC and DC test circuits.

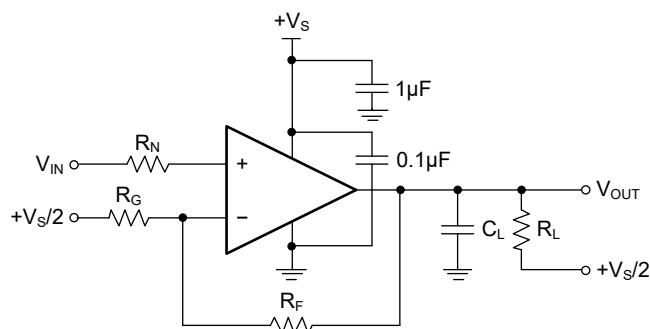


Figure 2. AC and DC Test Circuit for Most Non-Inverting Gain Configurations

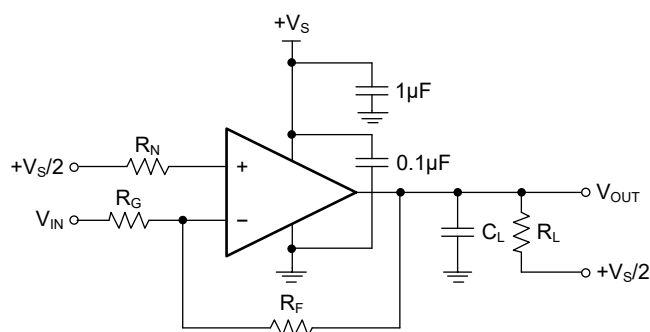
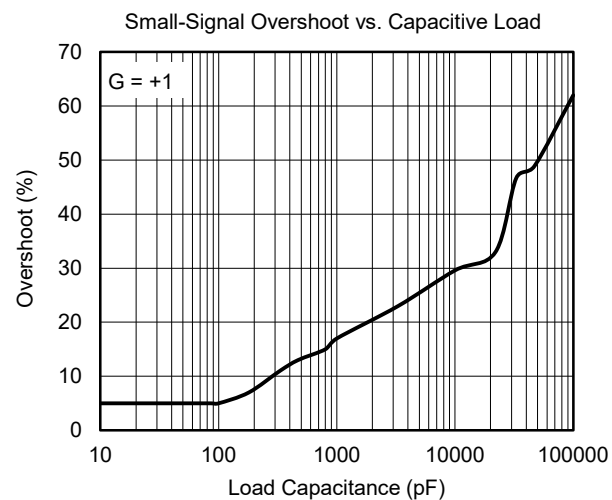
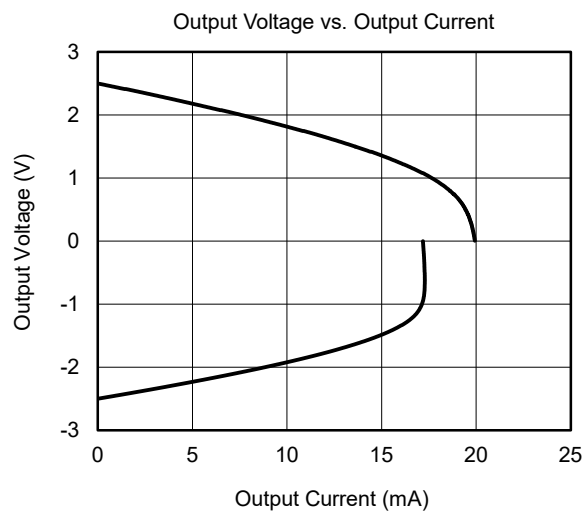
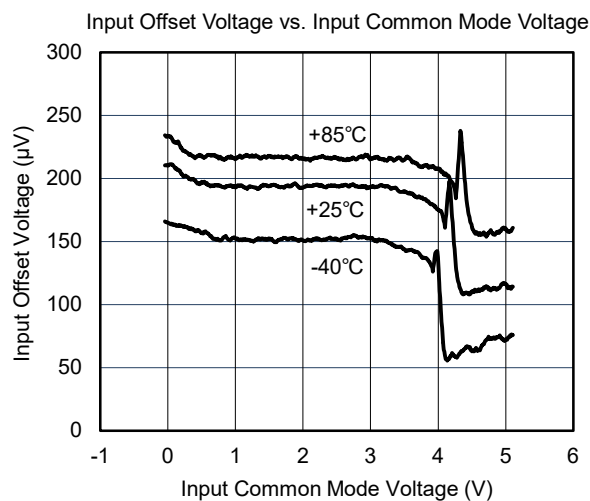
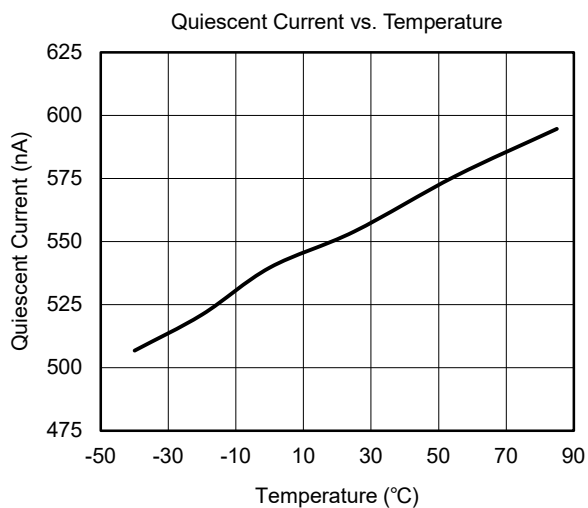
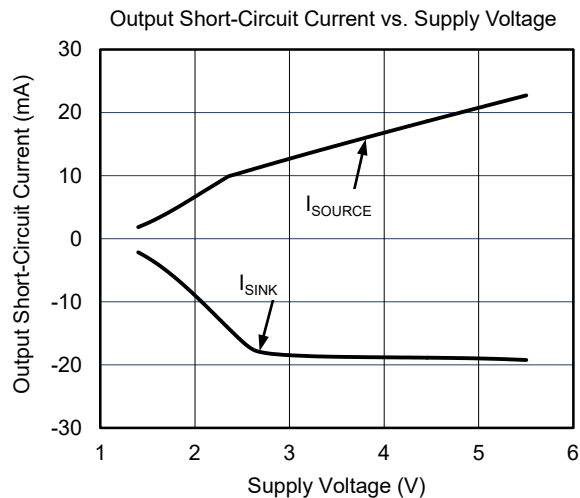
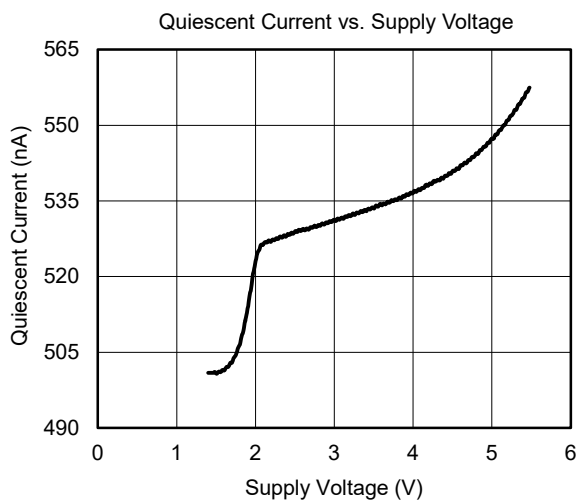


Figure 3. AC and DC Test Circuit for Most Inverting Gain Configurations

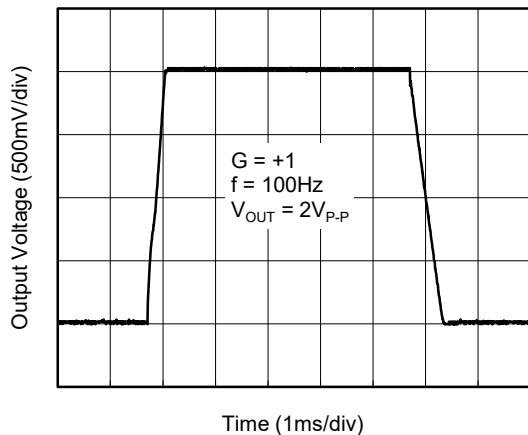
TYPICAL PERFORMANCE CHARACTERISTICS

At $T_A = +25^\circ\text{C}$, $V_S = 5\text{V}$, $R_L = 1\text{M}\Omega$, unless otherwise noted.

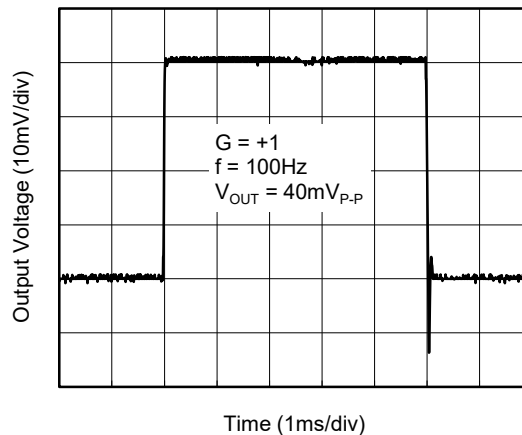
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At $T_A = +25^\circ\text{C}$, $V_S = 5\text{V}$, $R_L = 1\text{M}\Omega$, unless otherwise noted.

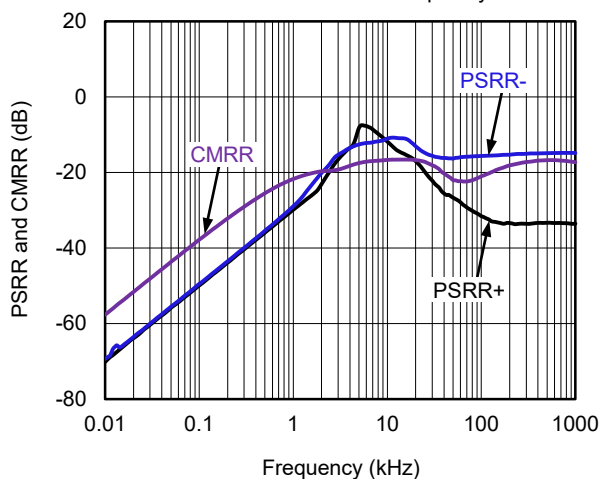
Large-Signal Step Response



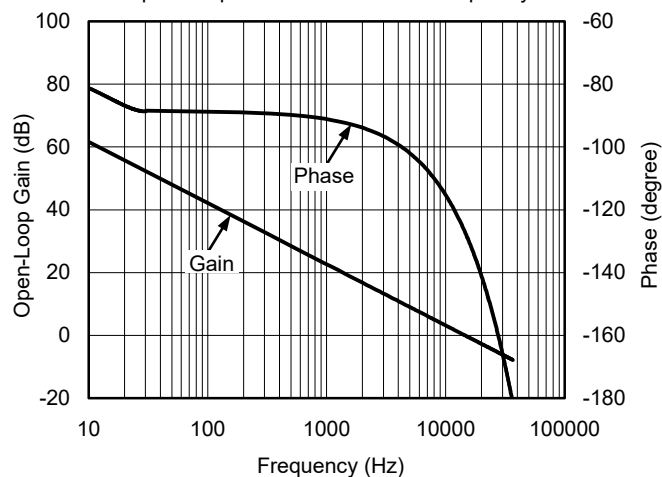
Small-Signal Step Response



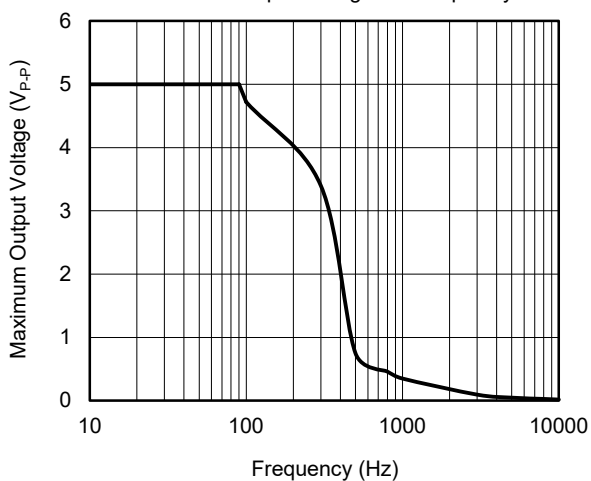
CMRR and PSRR vs. Frequency



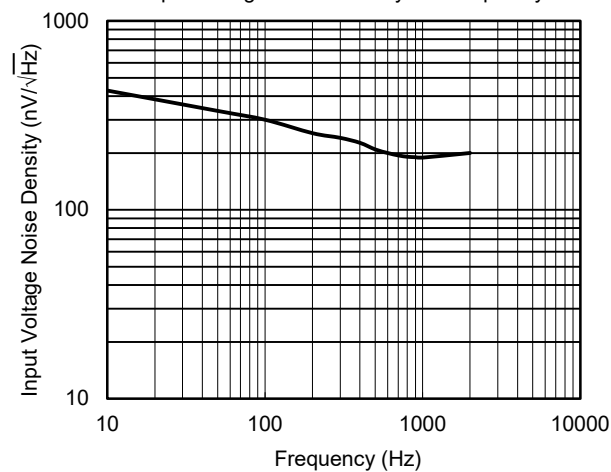
Open-Loop Gain and Phase vs. Frequency



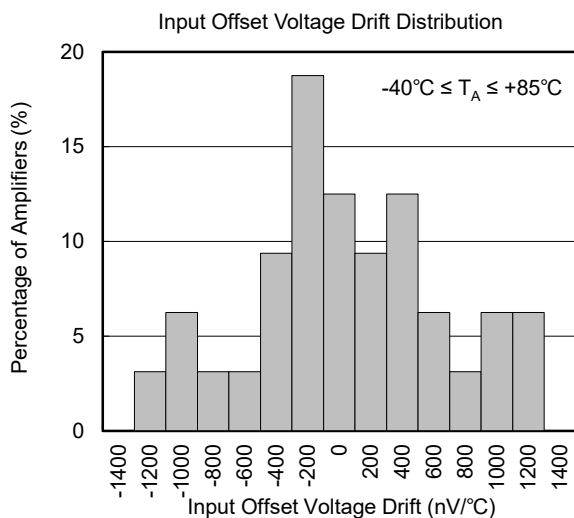
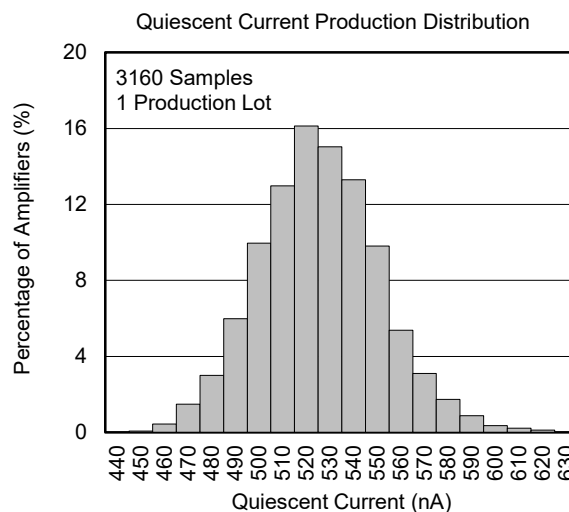
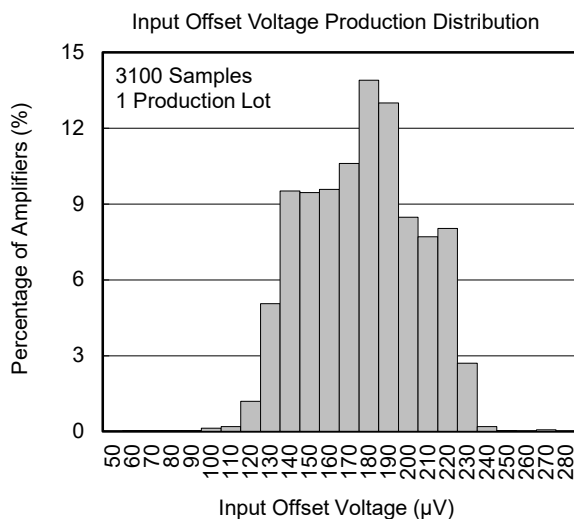
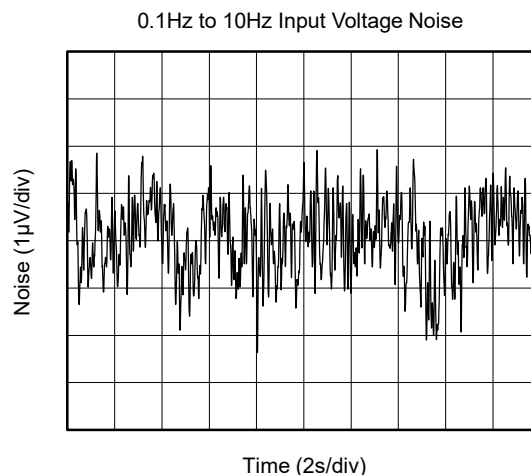
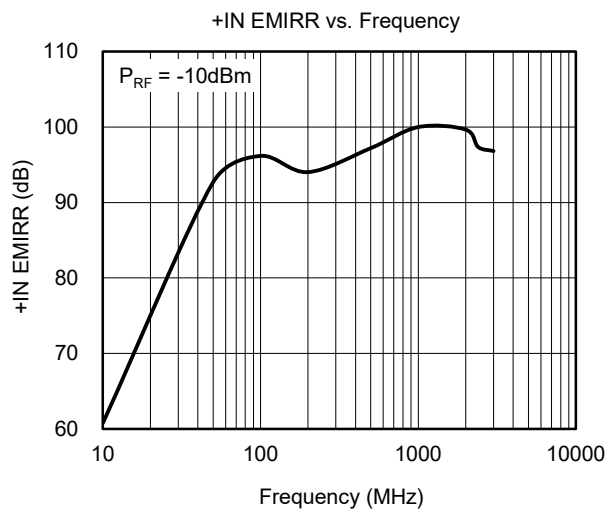
Maximum Output Voltage vs. Frequency



Input Voltage Noise Density vs. Frequency



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At $T_A = +25^\circ\text{C}$, $V_S = 5\text{V}$, $R_L = 1\text{M}\Omega$, unless otherwise noted.

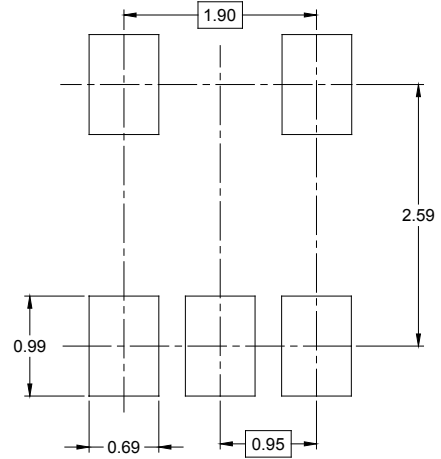
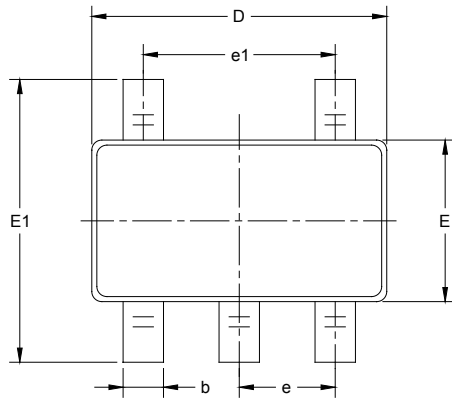
REVISION HISTORY

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

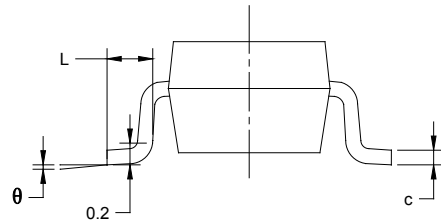
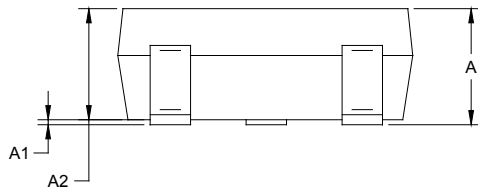
Changes from Original (NOVEMBER 2018) to REV.A	Page
Changed from product preview to production data.....	All

PACKAGE OUTLINE DIMENSIONS

SOT-23-5



RECOMMENDED LAND PATTERN (Unit: mm)

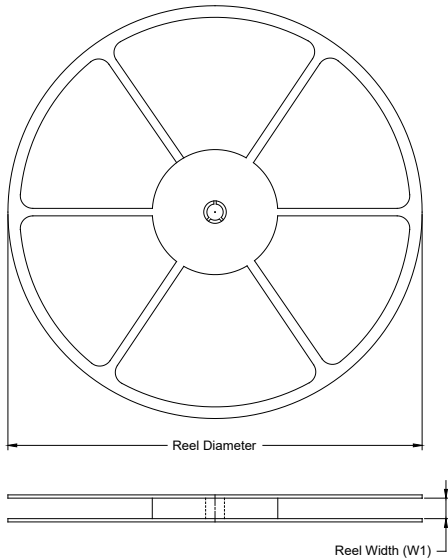


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037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

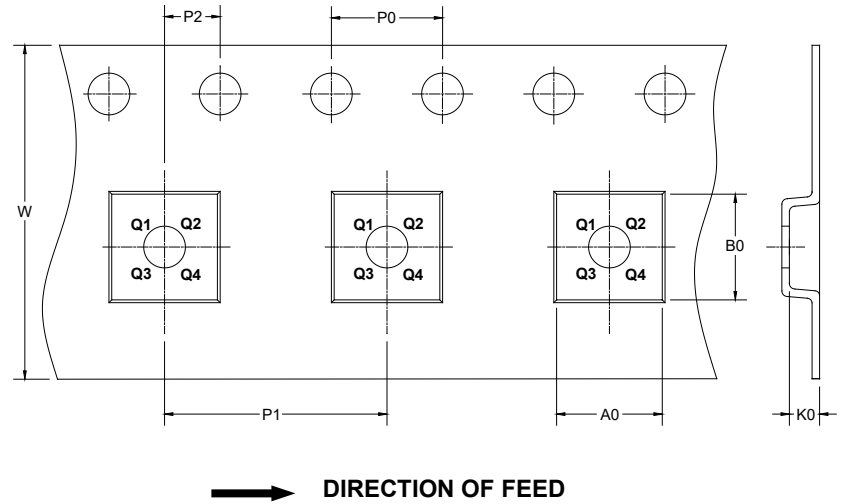
PACKAGE INFORMATION

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

DD00001

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

DD0002