



SGM8951/2

110kHz, Rail-to-Rail Input and Output Operational Amplifiers

PRODUCT DESCRIPTION

The SGM8951 (single) and SGM8952 (dual) are high-performance CMOS operational amplifiers optimized for low supply operation. These amplifiers are designed to operate on single supplies from 1.8V to 5.5V. Applications include sensor amplification and signal conditioning in battery-powered systems.

The SGM8951/2 offer excellent CMRR without the crossover distortion associated with traditional complimentary input stages. This results in excellent linearity performance. The input common mode range includes both the negative and positive supplies.

The SGM8951/2 provide excellent overall performance. They exhibit low offset, making these devices an excellent choice for high quality, low voltage or battery powered systems.

SGM8951 single is available in Green SOT-23-5 and SOIC-8 packages. The SGM8952 dual is available in Green SOIC-8 and MSOP-8 packages. The SGM8951/2 are specified over the extended -40 °C to +85 °C temperature range.

FEATURES

- Rail-to-Rail Input and Output
- Supply Voltage Range: 1.8V to 5.5V
- Low Input Offset Voltage: 0.2mV (TYP)
- Gain-Bandwidth Product: 110kHz
- Low Supply Current:
 - SGM8951 26 μ A (TYP)
 - SGM8952 34 μ A (TYP)
- Small Packaging:
 - SGM8951 Available in SOT-23-5 and SOIC-8 Packages
 - SGM8952 Available in MSOP-8 and SOIC-8 Packages

APPLICATIONS

Data Acquisition
Process Control
Active Filters
Test Equipment
Mobile Phone
Audio Processing
Video Processing
Headphone Amplifier
Portable Equipment
Broadband Communications



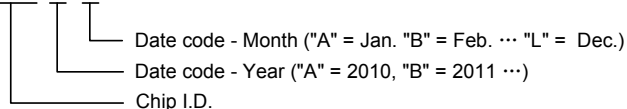
PACKAGE/ORDERING INFORMATION

MODEL	ORDER NUMBER	PACKAGE DESCRIPTION	PACKAGE OPTION	MARKING INFORMATION
SGM8951	SGM8951YN5G/TR	SOT-23-5	Tape and Reel, 3000	SBEXX
	SGM8951YS8G/TR	SOIC-8	Tape and Reel, 2500	SGM 8951YS8 XXXXX
SGM8952	SGM8952YMS8G/TR	MSOP-8	Tape and Reel, 3000	SGM8952 YMS8 XXXXX
	SGM8952YS8G/TR	SOIC-8	Tape and Reel, 2500	SGM 8952YS8 XXXXX

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

MARKING INFORMATION

SBE X X



For example: SBECA (2012, January)

ABSOLUTE MAXIMUM RATINGS

Supply Voltage, +V _S to -V _S	6V
Voltage at Input/Output Pins.....(-V _S) - 0.3V to (+V _S) + 0.3V	
Common Mode Input Voltage Range	
.....(-V _S) - 0.1V to (+V _S) + 0.1V	
Storage Temperature Range.....	-65°C to +150°C
Junction Temperature	150°C
Operating Temperature Range.....	-40°C to +85°C
Lead Temperature (Soldering 10sec)	
.....	260°C
ESD Susceptibility	
HBM.....	8000V
MM	400V

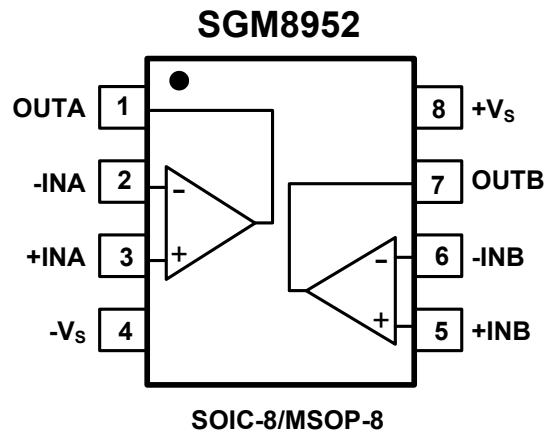
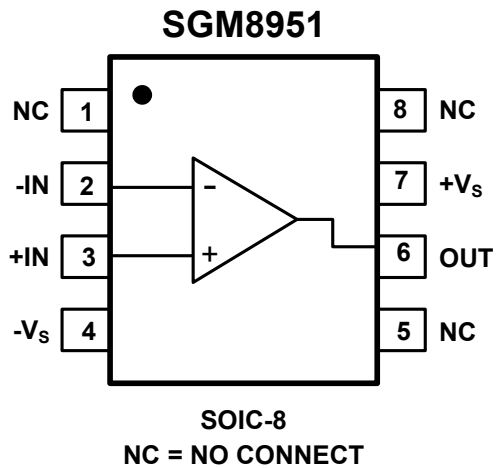
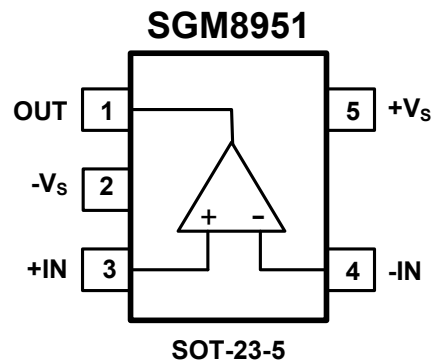
NOTE

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

CAUTION

This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. 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 very small parametric changes could cause the device not to meet its published specifications.

SGMICRO reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact SGMICRO sales office to get the latest datasheet.

PIN CONFIGURATIONS (TOP VIEW)

ELECTRICAL CHARACTERISTICS: $V_S = +5V$ (At $T_A = +25^\circ C$, $R_L = 100k\Omega$ connected to $V_S/2$ and $V_{OUT} = V_S/2$, unless otherwise noted.)

PARAMETER		CONDITIONS	MIN	TYP	MAX	UNITS
DC PERFORMANCE						
Input Offset Voltage (V _{OS})		V _{CM} = V _S /2		0.2	0.8	mV
		-40°C ≤ T _A ≤ +85°C			1.2	
Open-Loop Voltage Gain (A _{OL})		R _L = 10kΩ, V _{OUT} = 0.15V to 4.85V	78	90		dB
		-40°C ≤ T _A ≤ +85°C	73			
		R _L = 100kΩ, V _{OUT} = 0.05V to 4.95V		92		
INPUT CHARACTERISTICS						
Input Common Mode Voltage Range (V _{CM})			-0.1		5.1	V
Common Mode Rejection Ratio (CMRR)		V _{CM} = -0.1V to 5.1V	77	92		dB
		-40°C ≤ T _A ≤ +85°C	73			
OUTPUT CHARACTERISTICS						
Output Voltage Swing from Rail		R _L = 2kΩ, V _{CM} = V _S /2		78	94	mV
		-40°C ≤ T _A ≤ +85°C			103	
		R _L = 10kΩ, V _{CM} = V _S /2		16	28	
		-40°C ≤ T _A ≤ +85°C			33	
Output Short-Circuit Current (I _{SC})		R _L = 10Ω to V _S /2	25	32		mA
		-40°C ≤ T _A ≤ +85°C	17			
POWER SUPPLY						
Operating Voltage Range			1.8		5.5	V
Quiescent Current	SGM8951	I _{OUT} = 0mA, V _{CM} = V _S /2		26	35	μA
		-40°C ≤ T _A ≤ +85°C			39	
	SGM8952	I _{OUT} = 0mA, V _{CM} = V _S /2		34	48	
		-40°C ≤ T _A ≤ +85°C			55	
DYNAMIC PERFORMANCE ⁽¹⁾						
Gain-Bandwidth Product (GBP)		C _L = 100pF, R _L = 100kΩ		110		kHz
Slew Rate		V _{OUT} = 2V _{PP} , A _V = 1		45		V/ms
NOISE/DISTORTION PERFORMANCE						
Voltage Noise Density (e _n)		f = 1kHz		115		nV/√Hz
Voltage Noise		f = 0.1Hz to 10Hz		3.5		μV _{P-P}

ELECTRICAL CHARACTERISTICS: $V_S = +1.8V$ (At $T_A = +25^\circ\text{C}$, $R_L = 100\text{k}\Omega$ connected to $V_S/2$ and $V_{OUT} = V_S/2$, unless otherwise noted.)

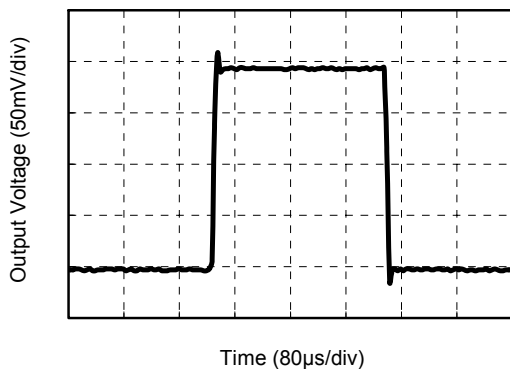
PARAMETER		CONDITIONS	MIN	TYP	MAX	UNITS
DC PERFORMANCE						
Input Offset Voltage (V _{OS})	V _{CM} = V _S /2			0.3	0.9	mV
	-40°C ≤ T _A ≤ +85°C				1.25	
Open-Loop Voltage Gain (A _{OL})	R _L = 10kΩ, V _{OUT} = 0.15V to 1.65V		83	100		dB
	-40°C ≤ T _A ≤ +85°C		80			
	R _L = 100kΩ, V _{OUT} = 0.05V to 1.75V			107		dB
INPUT CHARACTERISTICS						
Input Common Mode Voltage Range (V _{CM})			-0.1		1.9	V
Common Mode Rejection Ratio (CMRR)	V _{CM} = -0.1V to 1.9V		73	89		dB
	-40°C ≤ T _A ≤ +85°C		70			
OUTPUT CHARACTERISTICS						
Output Voltage Swing from Rail	R _L = 2kΩ, V _{CM} = V _S /2			49	69	mV
	-40°C ≤ T _A ≤ +85°C				76	
	R _L = 10kΩ, V _{CM} = V _S /2			11	23	
	-40°C ≤ T _A ≤ +85°C				28	
Output Short-Circuit Current (I _{SC})	R _L = 10Ω to V _S /2		0.9	4		mA
	-40°C ≤ T _A ≤ +85°C		0.5			
POWER SUPPLY						
Quiescent Current	SGM8951	V _{CM} = V _S /2, I _{OUT} = 0mA		22	30	μA
		-40°C ≤ T _A ≤ +85°C			34	
	SGM8952	V _{CM} = V _S /2, I _{OUT} = 0mA		30	43	
		-40°C ≤ T _A ≤ +85°C			49	
Power Supply Rejection Ratio (PSRR)	V _S = +1.8V to +5.5V, V _{CM} = 0.5V		74	80		dB
	-40°C ≤ T _A ≤ +85°C		70			
DYNAMIC PERFORMANCE ⁽¹⁾						
Gain-Bandwidth Product (GBP)		C _L = 100pF, R _L = 100kΩ		100		kHz
Slew Rate		V _{OUT} = 1V _{PP} , A _V = 1		40		V/ms
NOISE/DISTORTION PERFORMANCE						
Voltage Noise Density (e _n)		f = 1kHz		115		nV/√Hz
Voltage Noise		f = 0.1Hz to 10Hz		3.5		μV _{P-P}

NOTE 1: Correct power supply bypassing is very important for optimizing SGM8951/2 performance. A $0.1\mu\text{F}$ and a $10\mu\text{F}$ capacitors are always used to bypass V_S pin of SGM8951/2. Please place these two capacitors as close to the SGM8951/2 V_S pin as possible. A large ground plane is also needed to ensure optimum performance.

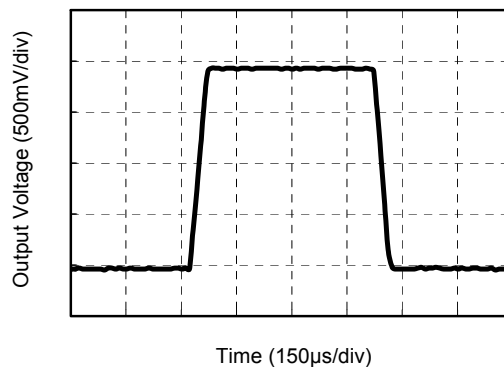
TYPICAL PERFORMANCE CHARACTERISTICS

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

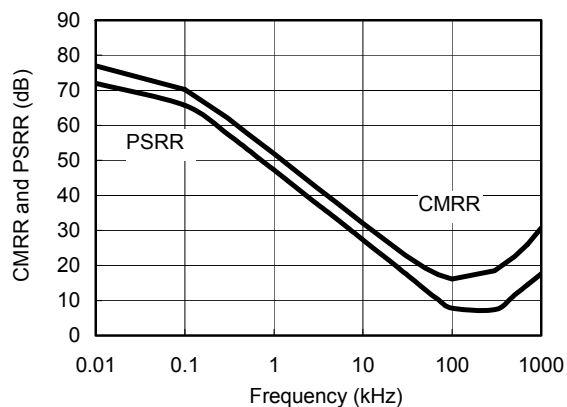
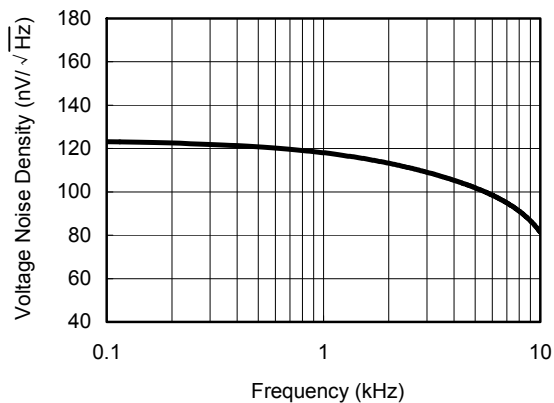
Small Signal Step Response



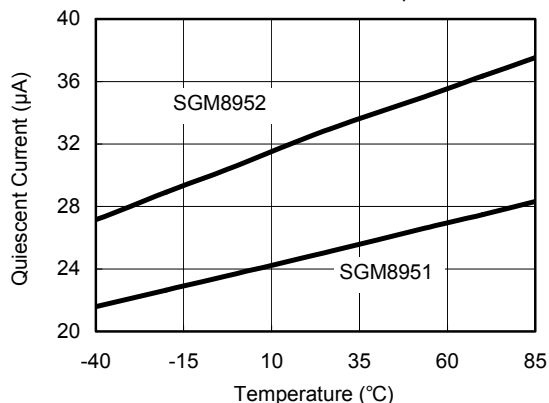
Large Signal Step Response



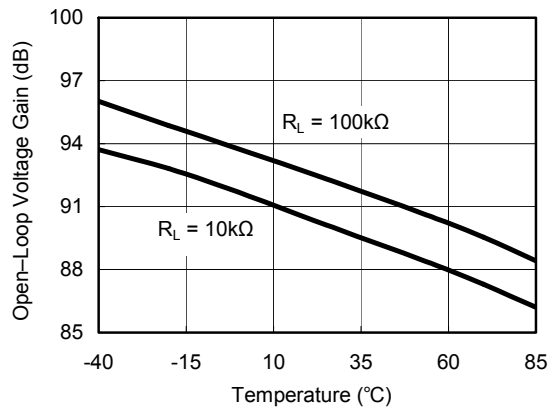
CMRR and PSRR vs. Frequency

Voltage Noise Spectral Density
vs. Frequency

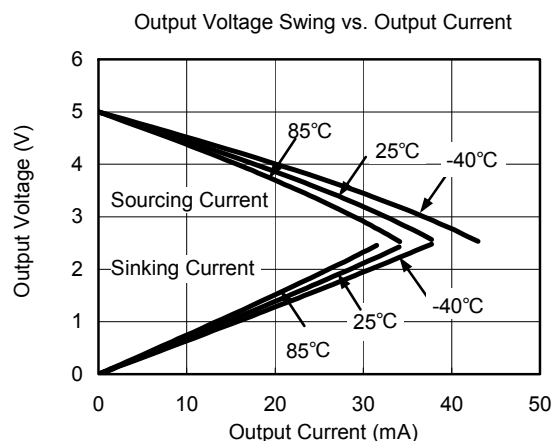
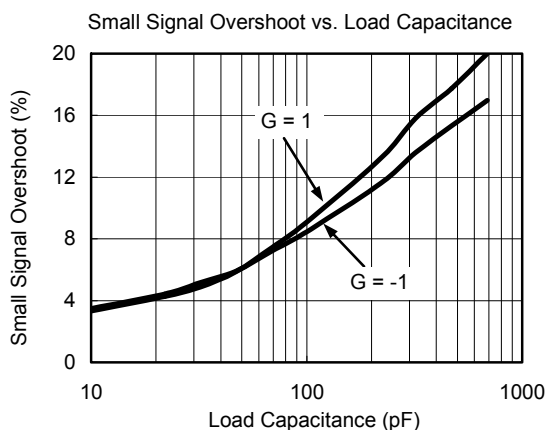
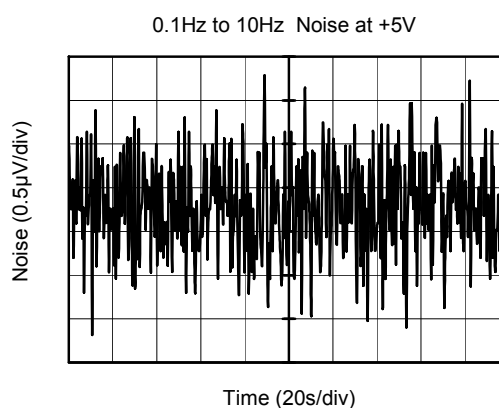
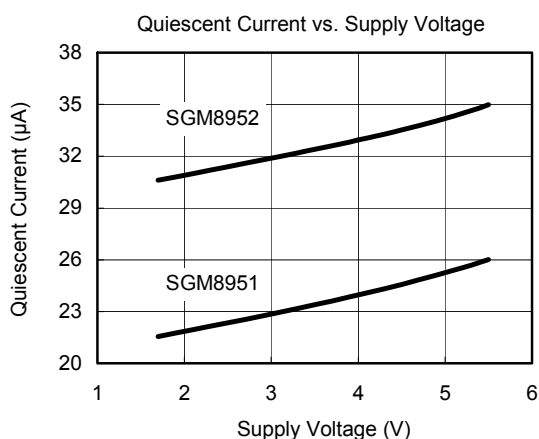
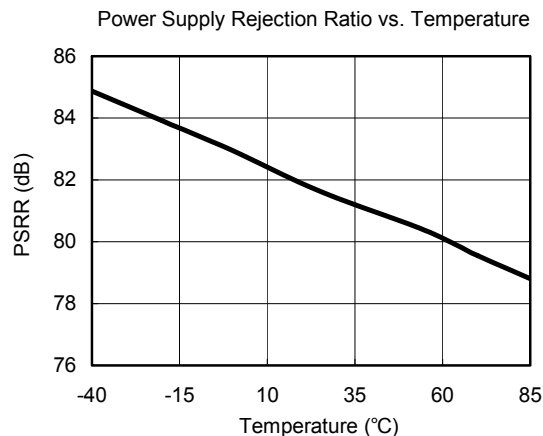
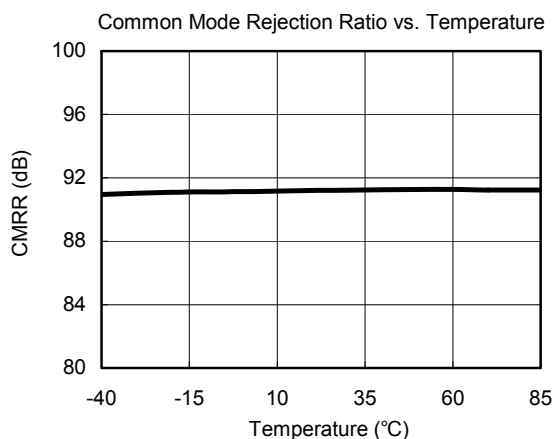
Quiescent Current vs. Temperature



Open-Loop Voltage Gain vs. Temperature

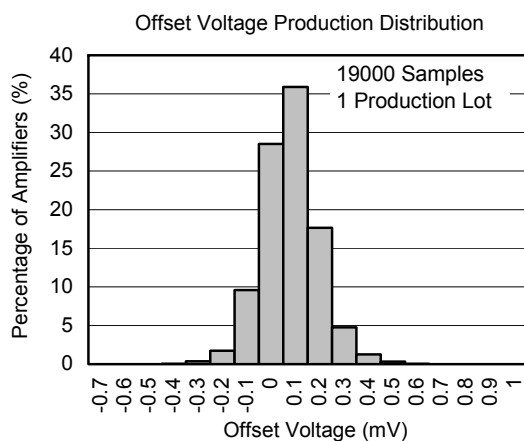


TYPICAL PERFORMANCE CHARACTERISTICS

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

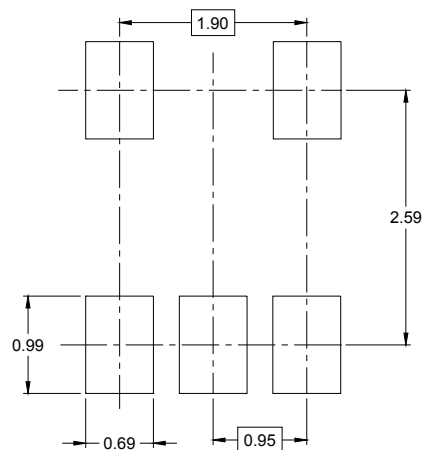
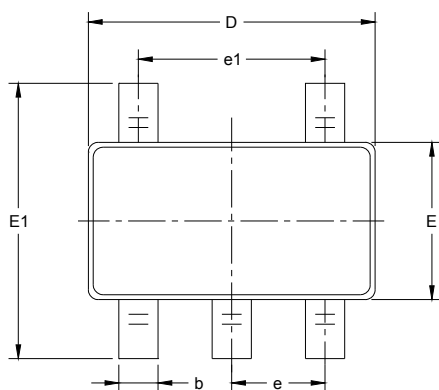
TYPICAL PERFORMANCE CHARACTERISTICS

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

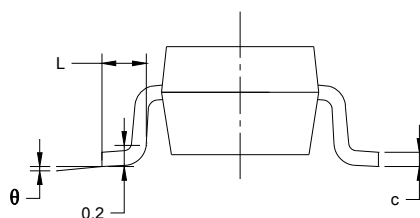
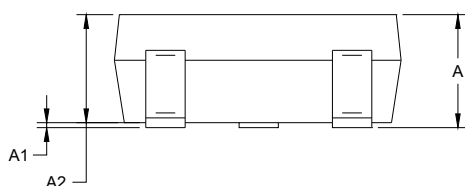


PACKAGE OUTLINE DIMENSIONS

SOT-23-5



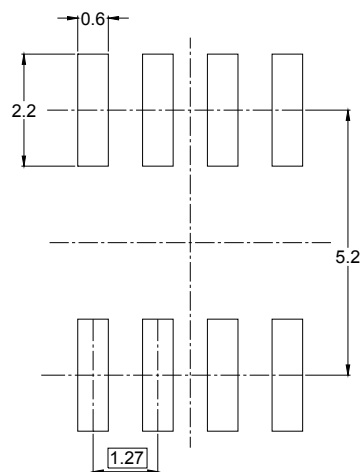
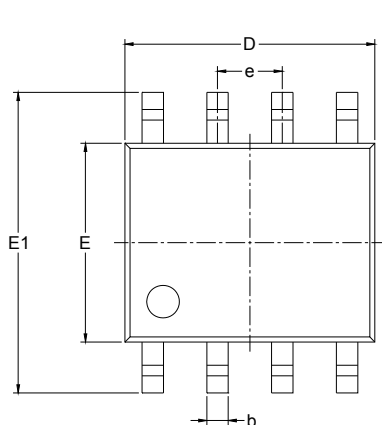
RECOMMENDED LAND PATTERN (Unit: mm)



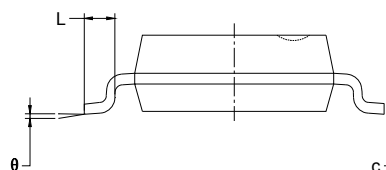
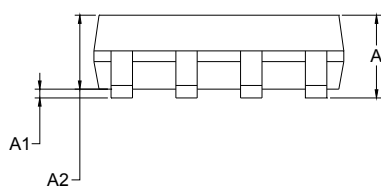
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037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

PACKAGE OUTLINE DIMENSIONS

SOIC-8



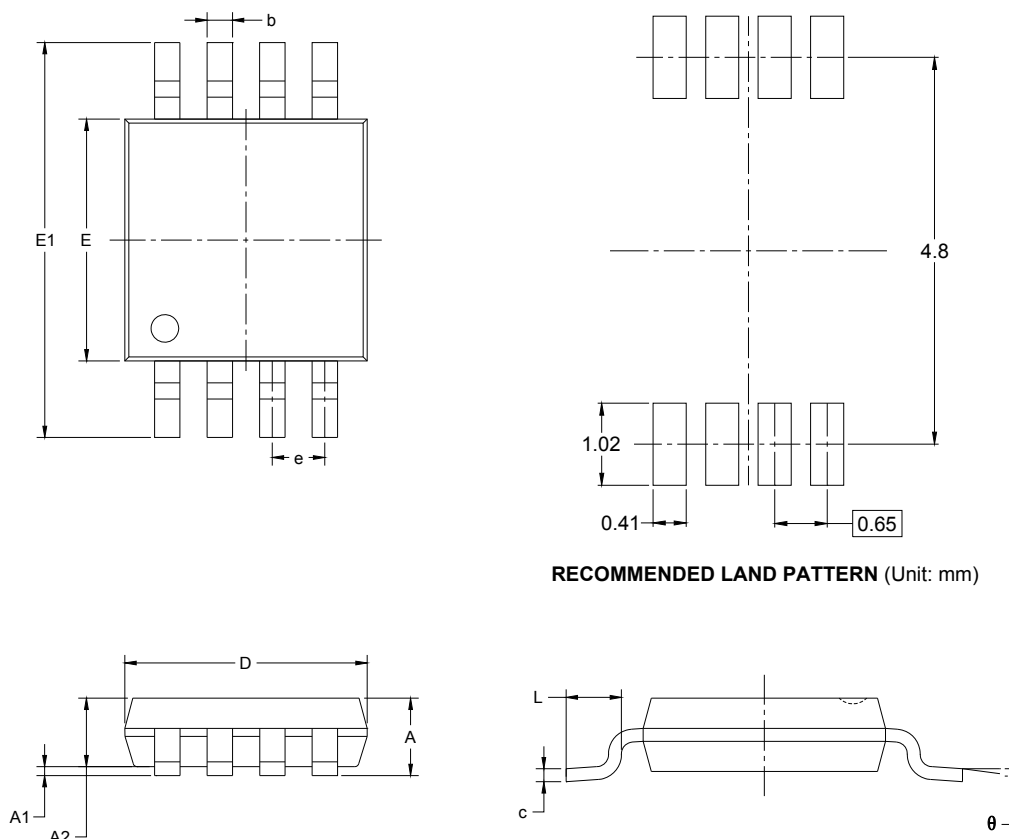
RECOMMENDED LAND PATTERN (Unit: mm)



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
θ	0°	8°	0°	8°

PACKAGE OUTLINE DIMENSIONS

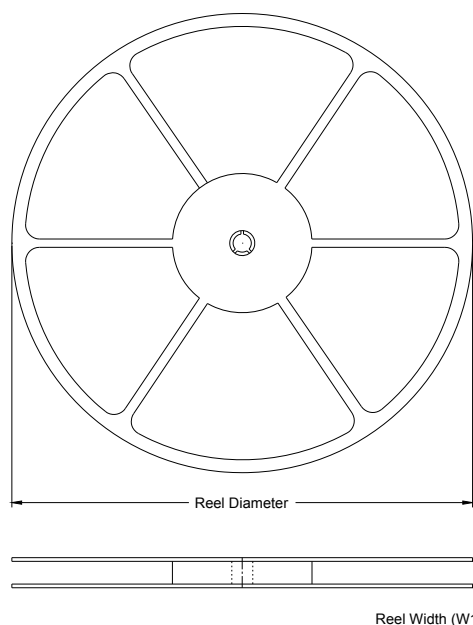
MSOP-8



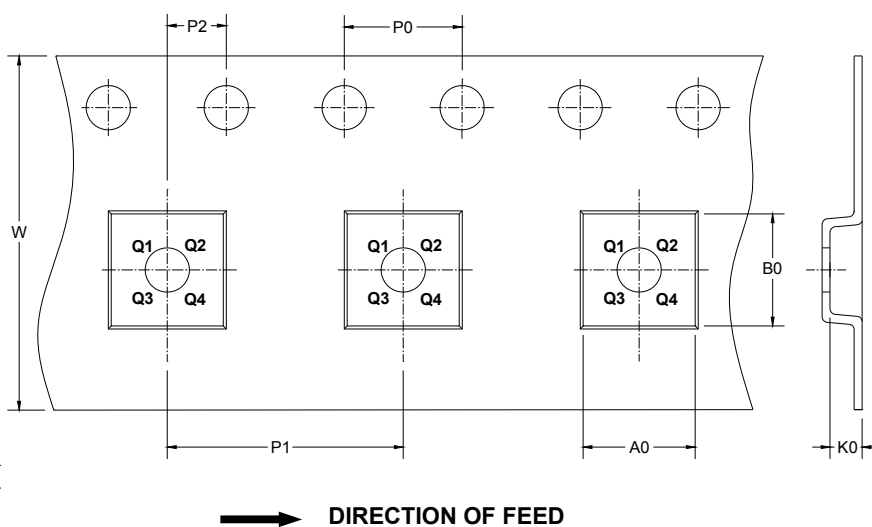
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650 BSC		0.026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

TAPE AND REEL INFORMATION

REEL DIMENSIONS



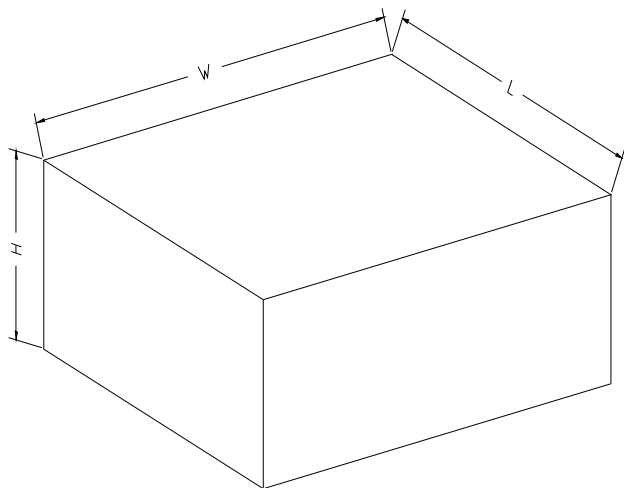
TAPE DIMENSIONS



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	3.17	3.23	1.37	4.0	4.0	2.0	8.0	Q3
SOIC-8	13"	12.4	6.4	5.4	2.1	4.0	8.0	2.0	12.0	Q1
MSOP-8	13"	12.4	5.2	3.3	1.5	4.0	8.0	2.0	12.0	Q1

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