



SGM8925/7

110kHz, 6.4 μ A, Rail-to-Rail Output CMOS Operational Amplifiers

PRODUCT DESCRIPTION

The SGM8925 and SGM8927 are low power, low offset voltage and rail-to-rail output voltage feedback amplifiers. They have a wide output voltage swing, and take the minimum operating supply voltage down to 1.6V. The maximum recommended supply voltage is 5.5V.

The SGM8925 and SGM8927 provide 110kHz bandwidth at a low current consumption of 6.4 μ A. Very low input bias currents of 1pA enable these amplifiers to be used for integrators, photodiode amplifiers, and piezoelectric sensors. Rail-to-rail output is useful to designers for buffering ASIC in single-supply systems.

Applications for these amplifiers also include safety monitoring, portable equipment, battery and power supply control, signal conditioning and interfacing for transducers in very low power systems.

The SGM8925 single is available in Green SOT-23-5, SC70-5, MSOP-8 and SOIC-8 packages. The SGM8927 single with shutdown is available in Green SOT-23-6, MSOP-8 and SOIC-8 packages. They are specified over the extended -40°C to +85°C temperature range.

FEATURES

- **Low Offset Voltage: 0.6mV (MAX)**
- **Rail-to-Rail Output**
- **Unity Gain Stable**
- **Gain-Bandwidth Product: 110kHz**
- **Supply Voltage Range: 1.6V to 5.5V**
- **Low Supply Current: 6.4 μ A (TYP)**
- **Small Packaging:**
 - SGM8925 Available in Green SOT-23-5, SC70-5, SOIC-8 and MSOP-8 Packages**
 - SGM8927 Available in Green SOT-23-6, SOIC-8 and MSOP-8 Packages**

APPLICATIONS

ASIC Input or Output Amplifier
Sensor Interface
Piezoelectric Transducer Amplifier
Medical Instrumentation
Mobile Communication
Audio Output
Portable Systems
Smoke Detectors
Mobile Telephone
Notebook PC
PCMCIA Cards
Battery-Powered Equipment



PACKAGE/ORDERING INFORMATION

MODEL	ORDER NUMBER	SPECIFIED TEMPERATURE RANGE	PACKAGE DESCRIPTION	PACKAGE OPTION	MARKING INFORMATION
SGM8925	SGM8925YC5G/TR	-40°C to +85°C	SC70-5	Tape and Reel, 3000	SACXX
	SGM8925AYN5G/TR	-40°C to +85°C	SOT-23-5	Tape and Reel, 3000	SADXX
	SGM8925BYC5G/TR	-40°C to +85°C	SC70-5	Tape and Reel, 3000	ST9XX
	SGM8925BYN5G/TR	-40°C to +85°C	SOT-23-5	Tape and Reel, 3000	SAEXX
	SGM8925YS8G/TR	-40°C to +85°C	SOIC-8	Tape and Reel, 2500	SGM 8925YS8 XXXXX
	SGM8925YMS8G/TR	-40°C to +85°C	MSOP-8	Tape and Reel, 3000	SGM8925 YMS8 XXXXX
SGM8927	SGM8927YN6G/TR	-40°C to +85°C	SOT-23-6	Tape and Reel, 3000	SAFXX
	SGM8927YS8G/TR	-40°C to +85°C	SOIC-8	Tape and Reel, 2500	SGM 8927YS8 XXXXX
	SGM8927YMS8G/TR	-40°C to +85°C	MSOP-8	Tape and Reel, 3000	SGM8927 YMS8 XXXXX

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

MARKING INFORMATION

SY Y X X

— Date code - Month ("A" = Jan. "B" = Feb. ... "L" = Dec.)

— Date code - Year ("A" = 2010, "B" = 2011 ...)

— Chip I.D.

For example: SACCA (2012, January)

ABSOLUTE MAXIMUM RATINGS

Supply Voltage, +V _S to -V _S	6V
Input Common Mode Voltage Range	(-V _S) - 0.1V to (+V _S) - 1.3V
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.....	4000V
MM	400V

NOTE:

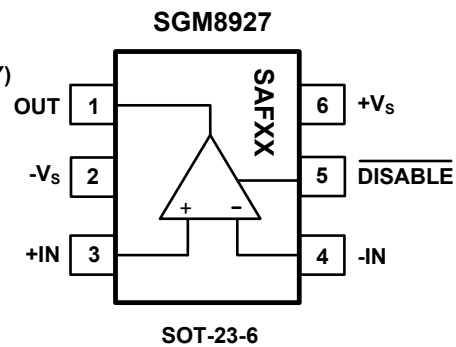
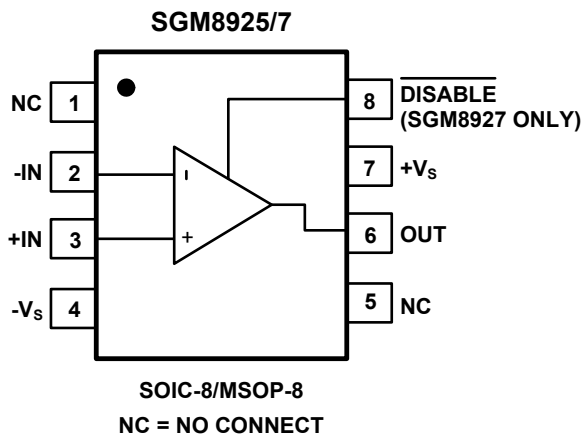
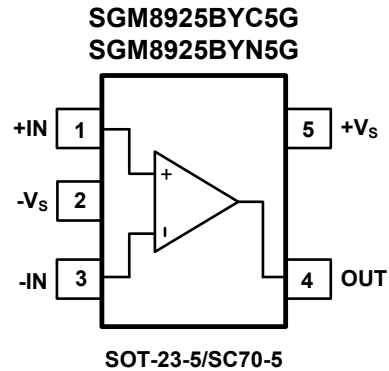
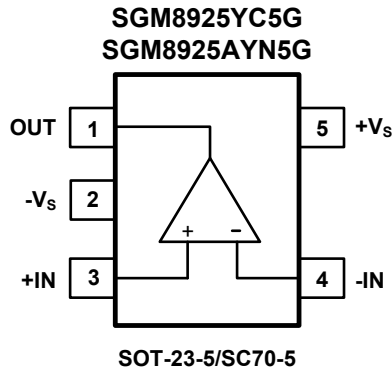
Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure 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)



NOTE: The location of pin 1 on the SOT-23-6 is determined by orienting the package marking as shown.

ELECTRICAL CHARACTERISTICS: $V_S = +5V$ (At $T_A = +25^\circ\text{C}$, $V_{OUT} = V_S/2$, unless otherwise noted.)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
DC PERFORMANCE						
Input Offset Voltage (V _{OS})	V _{CM} = V _S /2			0.13	0.6	mV
		SGM8925YC5G only			0.75	
Input Offset Voltage Drift (ΔV _{OS} /ΔT)				2.5		μV/°C
Open-Loop Voltage Gain (A _{OL})	R _L = 100kΩ to V _S /2, V _{OUT} = 0.05V to 4.95V			93		dB
	R _L = 10kΩ to V _S /2, V _{OUT} = 0.15V to 4.85V		80	88		
	-40°C ≤ T _A ≤ +85°C		78			
INPUT CHARACTERISTICS						
Common Mode Rejection Ratio (CMRR)	V _{CM} = -0.1V to 3.7V		70	85		dB
	-40°C ≤ T _A ≤ +85°C		68			
OUTPUT CHARACTERISTICS						
Output Voltage Swing from Rail	R _L = 10kΩ to V _S /2			21	36	mV
	-40°C ≤ T _A ≤ +85°C				40	
	R _L = 2kΩ to V _S /2			80	100	mV
	-40°C ≤ T _A ≤ +85°C				110	
Output Short-Circuit Current (I _{SC})	R _L = 10Ω to V _S /2		29	36		mA
	-40°C ≤ T _A ≤ +85°C		23			
POWER-DOWN (SGM8927 ONLY)						
Logic Low Voltage (V _{IL})					0.8	V
Logic High Voltage (V _{IH})			2			
POWER SUPPLY						
Quiescent Current (I _Q)	I _{OUT} = 0mA			6.4	11.5	μA
	-40°C ≤ T _A ≤ +85°C				13.5	
Supply Current when Disabled (SGM8927 Only)				0.1	1.5	μA
Power Supply Rejection Ratio (PSRR)	V _S = +1.6V to +5.5V, V _{CM} = 0.3V		64	77		dB
	-40°C ≤ T _A ≤ +85°C		62			
DYNAMIC PERFORMANCE						
Gain-Bandwidth Product (GBP)	R _L = 100kΩ, C _L = 100pF, V _{CM} = 2.5V			110		kHz
Slew Rate (SR)	V _{CM} = 2.5V			0.04		V/μs
NOISE PERFORMANCE						
Input Voltage Noise (e _n)	f = 1kHz			105		nV/√Hz

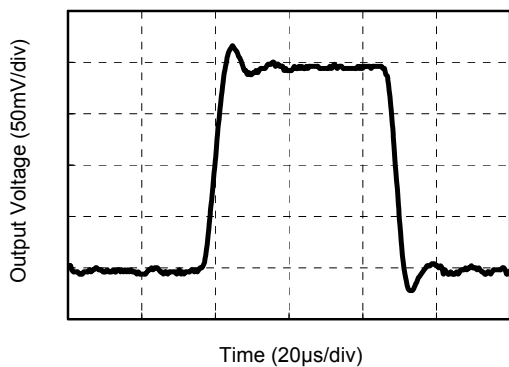
ELECTRICAL CHARACTERISTICS: $V_S = +1.6V$ (At $T_A = +25^\circ\text{C}$, $V_{CM} = 0.3V$, $V_{OUT} = V_S/2$, unless otherwise noted.)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
DC PERFORMANCE						
Input Offset Voltage (V _{OS})				0.28	0.6	mV
	SGM8925YC5G only				0.75	
Input Offset Voltage Drift (ΔV _{OS} /ΔT)				1.8		μV/°C
Open-Loop Voltage Gain (A _{OL})	R _L = 100kΩ to V _S /2, V _{OUT} = 0.05V to 1.55V			99		dB
	R _L = 10kΩ to V _S /2, V _{OUT} = 0.15V to 1.45V		80	91		
	-40°C ≤ T _A ≤ +85°C		78			
INPUT CHARACTERISTICS						
Common Mode Rejection Ratio (CMRR)	V _{CM} = -0.1V to 0.3V		65	78		dB
	-40°C ≤ T _A ≤ +85°C		62			
OUTPUT CHARACTERISTICS						
Output Voltage Swing from Rail	R _L = 10kΩ to V _S /2			13	25	mV
	-40°C ≤ T _A ≤ +85°C				30	
	R _L = 2kΩ to V _S /2			63	87	mV
	-40°C ≤ T _A ≤ +85°C				95	
Output Short-Circuit Current (I _{SC})	R _L = 10Ω to V _S /2		0.5	2.6		mA
		SGM8925YC5G only	0.35			
	-40°C ≤ T _A ≤ +85°C			0.3		
POWER-DOWN (SGM8927 ONLY)						
Logic Low Voltage (V _{IL})					0.4	V
Logic High Voltage (V _{IH})			1.1			
POWER SUPPLY						
Quiescent Current (I _Q)	I _{OUT} = 0mA			5.8	10.5	μA
	-40°C ≤ T _A ≤ +85°C				13	
Supply Current when Disabled (SGM8927 Only)				0.1	1.5	μA
DYNAMIC PERFORMANCE						
Gain-Bandwidth Product (GBP)	R _L = 100kΩ, C _L = 100pF			110		kHz
Slew Rate (SR)				0.04		V/μs
NOISE PERFORMANCE						
Input Voltage Noise (e _n)	f = 1kHz			105		nV/√Hz

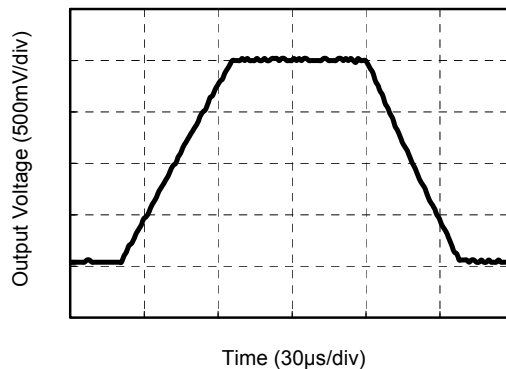
TYPICAL PERFORMANCE CHARACTERISTICS

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

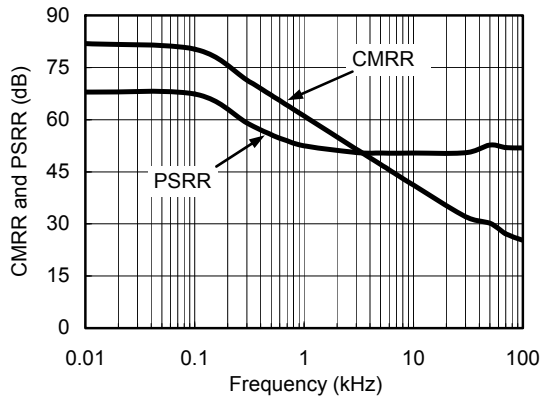
Small Signal Step Response



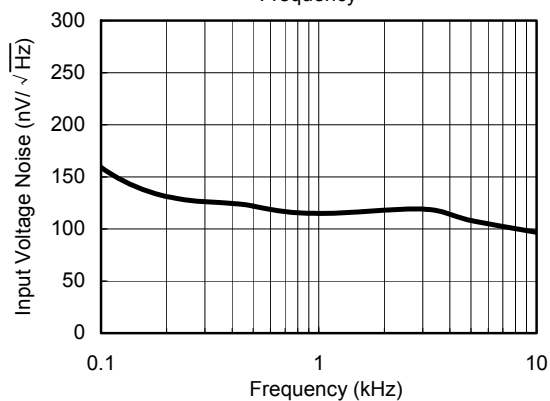
Large Signal Step Response



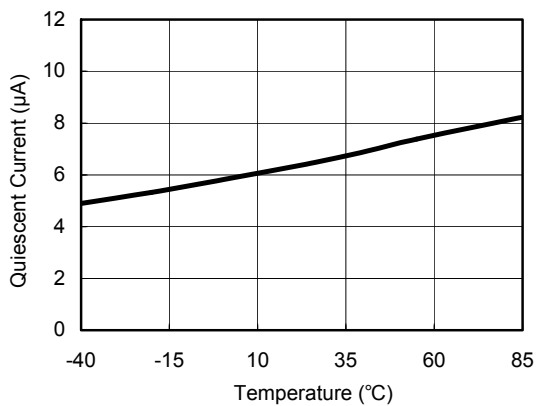
CMRR and PSRR vs. Frequency



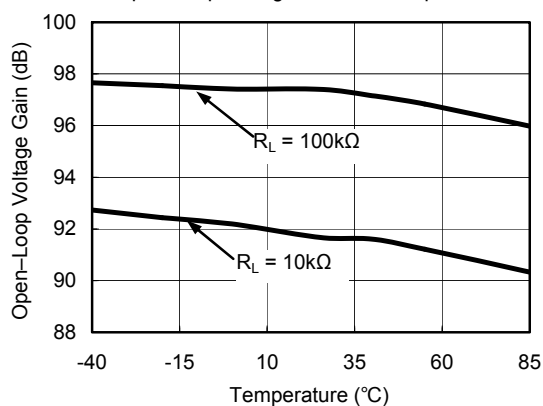
Input Voltage Noise Spectral Density vs. Frequency



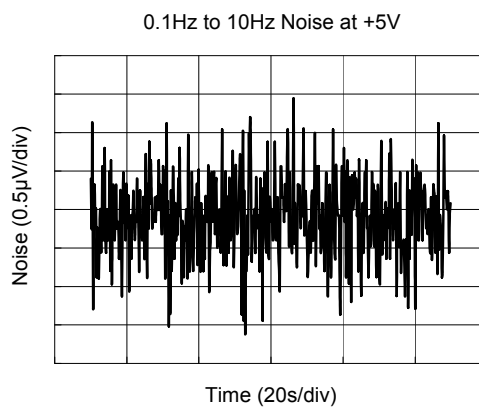
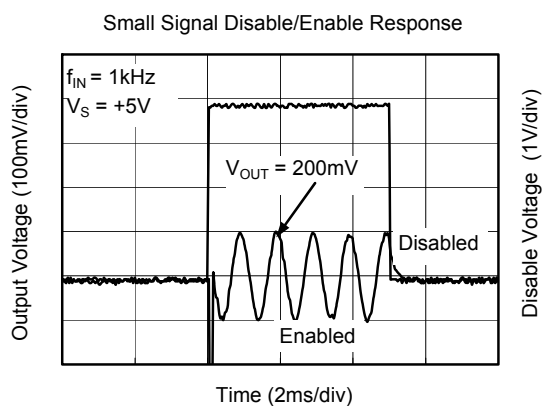
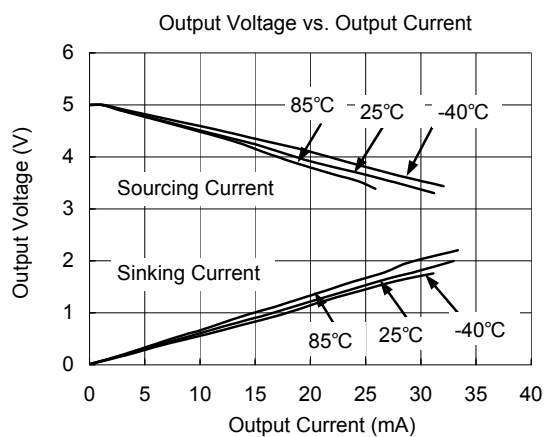
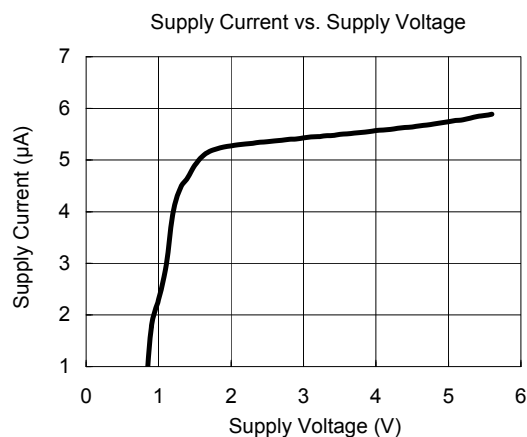
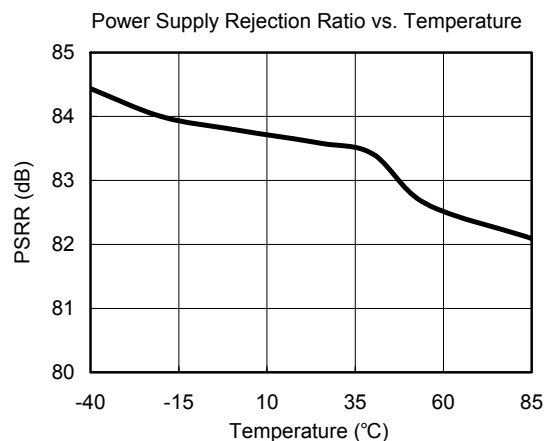
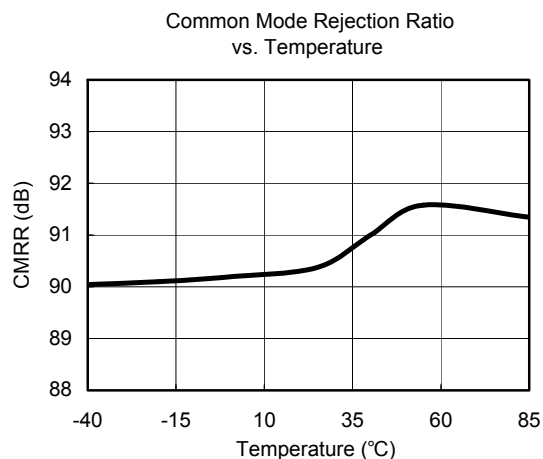
Quiescent Current vs. Temperature



Open-Loop Voltage Gain vs. Temperature

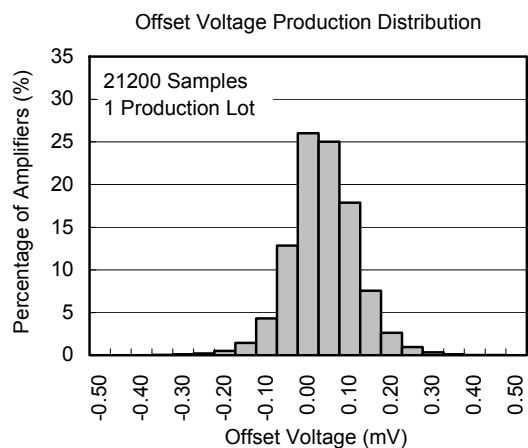
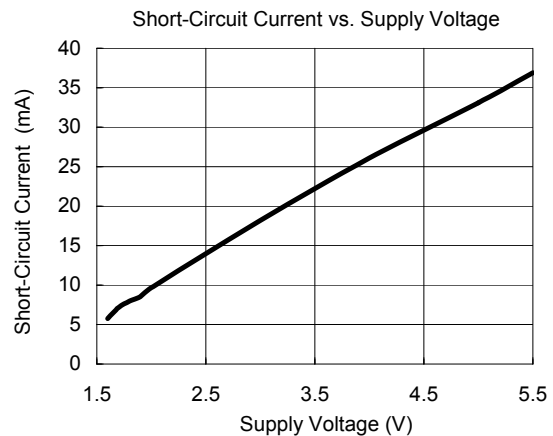
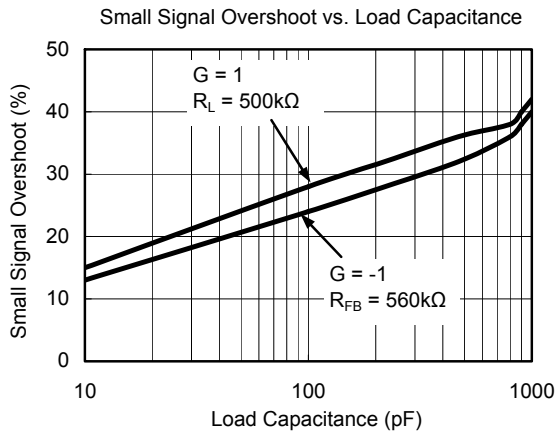


TYPICAL PERFORMANCE CHARACTERISTICS

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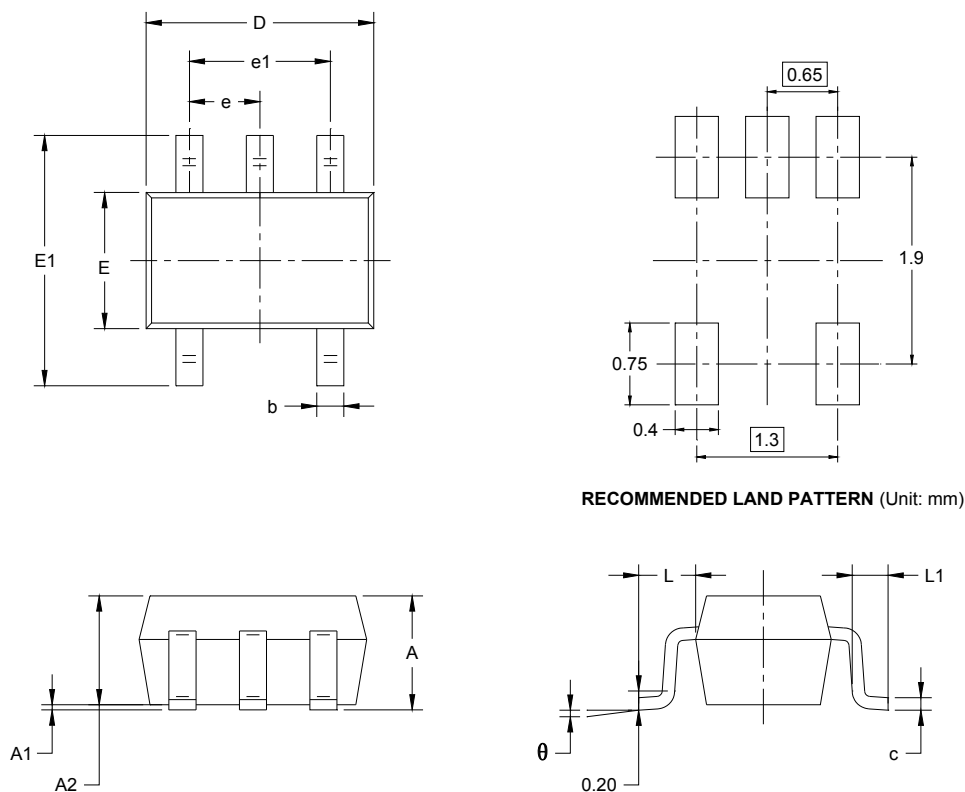
TYPICAL PERFORMANCE CHARACTERISTICS

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



PACKAGE OUTLINE DIMENSIONS

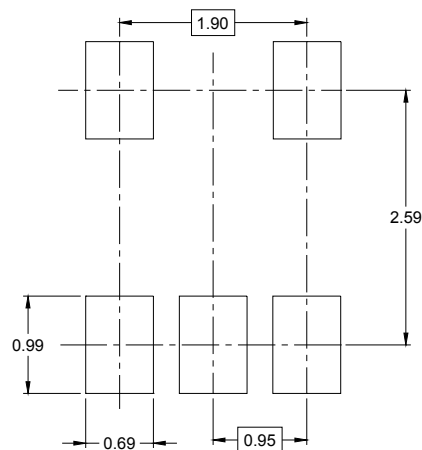
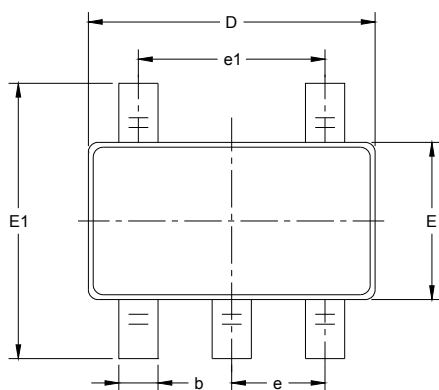
SC70-5



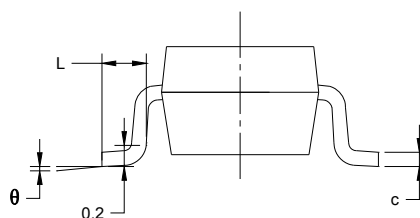
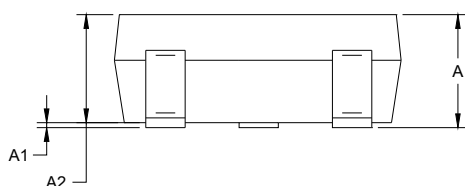
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.65 TYP		0.026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

PACKAGE OUTLINE DIMENSIONS

SOT-23-5



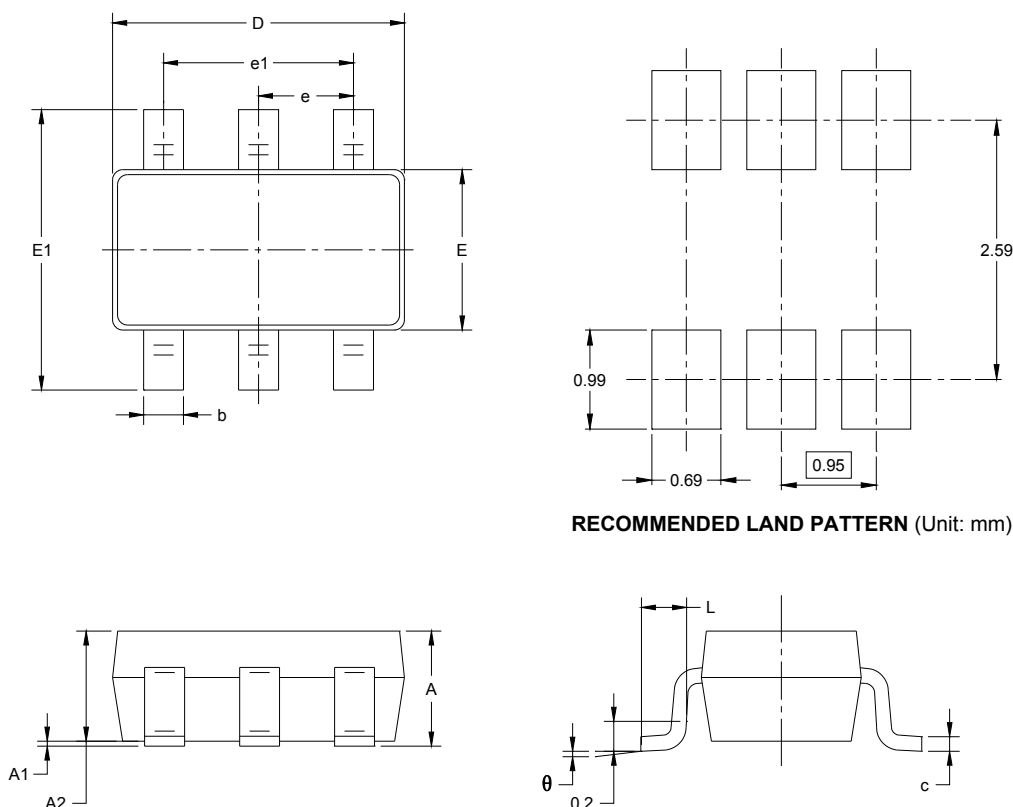
RECOMMENDED LAND PATTERN (Unit: mm)



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

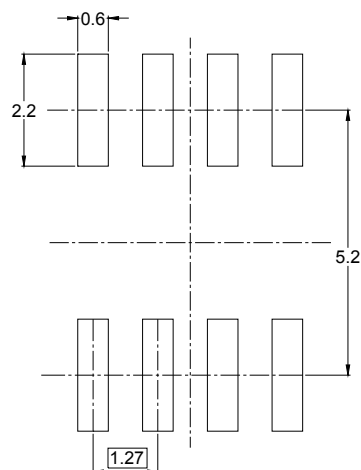
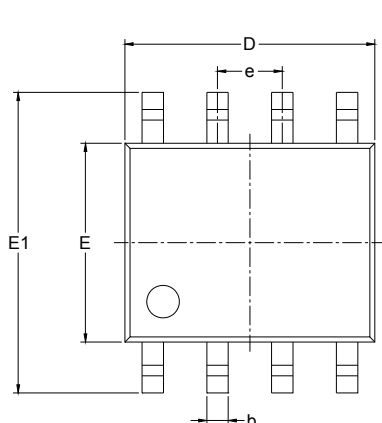
SOT-23-6



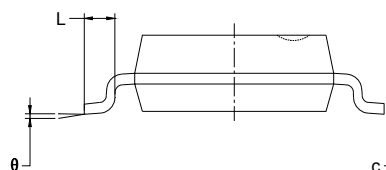
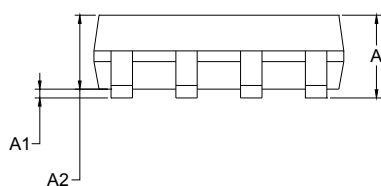
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037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



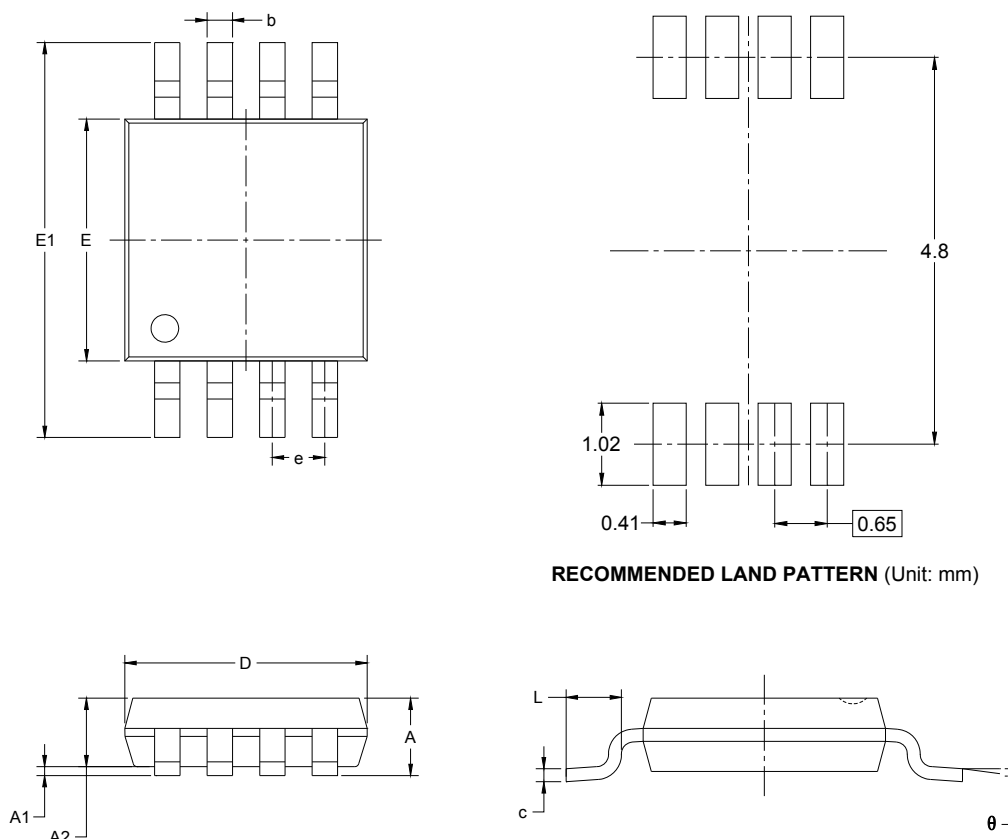
RECOMMENDED LAND PATTERN (Unit: mm)



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

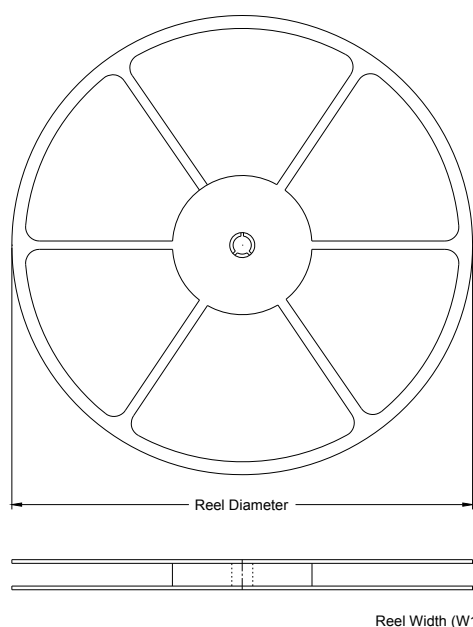
MSOP-8



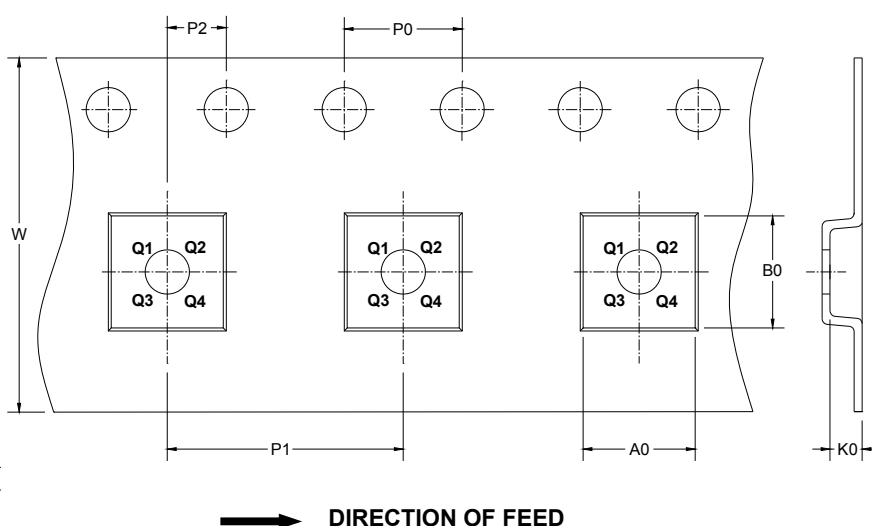
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650 BSC		0.026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

TAPE AND REEL INFORMATION

REEL DIMENSIONS



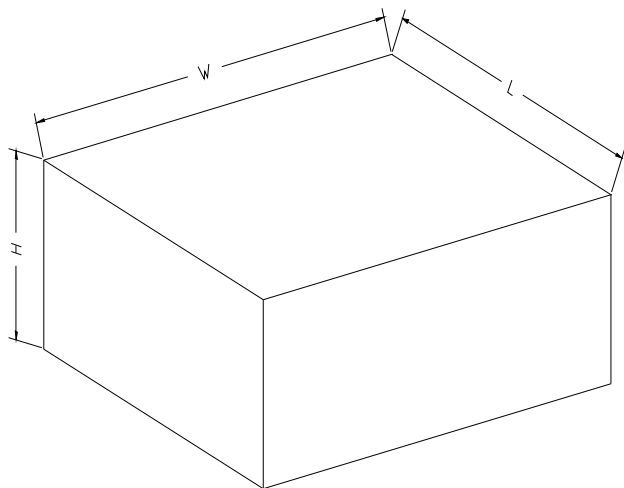
TAPE DIMENSIONS



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	3.2	3.2	1.4	4.0	4.0	2.0	8.0	Q3
SOT-23-6	7"	9.5	3.17	3.23	1.37	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	6.4	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