SGM8290
High Voltage Rail-to-Rail Output Operational Amplifier

GENERAL DESCRIPTION

The SGM8290 is a single, high precision operational amplifier, which is optimized for high voltage operation from 4.5V to 36V single supply or ±2.25V to ±18V dual power supplies. It provides a wide input common mode voltage range and rail-to-rail output voltage swing.

Furthermore, the SGM8290 provides high slew rate, low bias current, low offset current, low offset voltage and low offset voltage drift.

The SGM8290 is available in a Green SOT-23-5 package. It is specified over the extended -40℃ to +85℃ temperature range.

FEATURES

- **Low Offset Voltage: 1.5mV (MAX)**
- **Low Input Bias Current**
- **Low Input Offset Current**
- **Wide Input Common Mode Voltage Range**
- **High Input Impedance**
- **Output Short-Circuit Protection**
- **Rail-to-Rail Output**
- **High Slew Rate: 7V/μs**
- **Low Quiescent Current: 150μA**
- **Available in a Green SOT-23-5 Package**

APPLICATIONS

High Impedance Sensor
Photodiode Amplifier
Professional Audio Instrument
DAC Output Amplifier
Medical Equipment
Test Equipment
Active Filter
Precision Instrument

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM8290	SOT-23-5	-40℃ to +85℃	SGM8290YN5G/TR	SG6XX	Tape and Reel, 3000

MARKING INFORMATION

NOTE: XX = Date Code.

YYY X X
- 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, $+V_S$ to $-V_S$ 40V
Input Common Mode Voltage Range
..... $(-V_S)$ - 0.1V to $(+V_S)$ - 1.5V
Input/Output Voltage Range ..... $(-V_S)$ - 0.3V to $(+V_S)$ + 0.3V
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM 4000V
MM 150V

RECOMMENDED OPERATING CONDITIONS

Operating Temperature Range ..... -40℃ to +85℃

NOTE:
1. It is recommended that CMOS device adopts the proper power supply sequence. Always sort the V_S first, followed by the inputs and outputs.

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

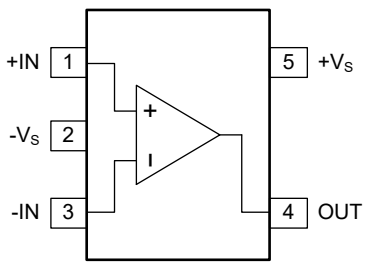
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance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

(TOP VIEW)



SOT-23-5

ELECTRICAL CHARACTERISTICS

(V_S = +5V, R_L = 2kΩ connected to 2.5V, unless otherwise noted.)

PARAMETER		CONDITIONS	TYP	MIN/MAX OVER TEMPERATURE			
			+25℃	+25℃	-40℃ to +85℃	UNITS	MIN/ MAX
Input Offset Voltage (V_{OS})		V_{CM} = 2.5V	0.5	1.5	2.4	mV	MAX
Input Offset Voltage Drift ($\Delta V_{OS}/\Delta T$)			3			μV/℃	TYP
Input Bias Current (I_B)			20			pA	TYP
Input Offset Current (I_{OS})			20			pA	TYP
Open-Loop Voltage Gain (A_{OL})		V_{OUT} = 0.5V to 4.5V, R_L = 5kΩ	86	75	72	dB	MIN
Output Voltage Swing from Rail	V_{OH}	R_L = 10kΩ	16	39	43	mV	MAX
	V_{OL}	R_L = 10kΩ	14	30	34		MAX
Output Short-Circuit Current (I_{SC})	Sink	R_L = 10Ω	46.2	34.1	21.5	mA	MIN
	Source	R_L = 10Ω	44.4	30.5	20.7		
Input Common Mode Voltage Range (V_{CM})			-0.1 to 3.5			V	TYP
Common Mode Rejection Ratio (CMRR)		V_{CM} = -0.1V to 3.5V	84	67	62	dB	MIN
Power Supply Rejection Ratio (PSRR)		V_S = 4.5V to 36V	103	82	80	dB	MIN
Quiescent Current		I_{OUT} = 0A	144	275	309	μA	MAX
Gain-Bandwidth Product (GBP)		C_L = 100pF, V_{CM} = 2.5V	1.4			MHz	TYP
Gain Margin		C_L = 100pF, V_{CM} = 2.5V	-10			dB	TYP
Phase Margin		C_L = 100pF, V_{CM} = 2.5V	50			°	TYP
Slew Rate (SR)	Up	V_{OUT} = 2V_{P-P} step, C_L = 100pF, G = 1	5			V/μs	TYP
	Down	V_{OUT} = 2V_{P-P} step, C_L = 100pF, G = 1	5				TYP
Overload Recovery Time (ORT)	Up	V_{IN} × G = V_S	2.0			μs	TYP
	Down	V_{IN} × G = V_S	4.0				
Settling Time (t_S)		C_L = 100pF, G = 1, 200mV output step	2			μs	TYP
Voltage Noise Density (e_n)		f = 20kHz, V_{CM} = 2.5V	30			nV/$\sqrt{Hz}$	TYP
		f = 1kHz, V_{CM} = 2.5V	45				
Total Harmonic Distortion + Noise (THD+N)		V_{OUT} = 2V_{P-P}, f = 1kHz, G = 1, R_L = 600Ω	0.018			%	TYP
		V_{OUT} = 2V_{P-P}, f = 1kHz, G = 1, R_L = 2kΩ	0.009				

ELECTRICAL CHARACTERISTICS (continued)

(V_S = ±5V, R_L = 2kΩ connected to 0V, unless otherwise noted.)

PARAMETER		CONDITIONS	TYP	MIN/MAX OVER TEMPERATURE			
			+25℃	+25℃	-40℃ to +85℃	UNITS	MIN/MAX
Input Offset Voltage (V_{OS})		V_{CM} = 0V	0.5	1.5	2.4	mV	MAX
Input Offset Voltage Drift ($\Delta V_{OS}/\Delta T$)			3			μV/℃	TYP
Input Bias Current (I_B)			20			pA	TYP
Input Offset Current (I_{OS})			20			pA	TYP
Open-Loop Voltage Gain (A_{OL})		V_{OUT} = -4.5V to 4.5V, R_L = 5kΩ	93	81	78	dB	MIN
Output Voltage Swing from Rail	V_{OH}	R_L = 10kΩ	28	67	73	mV	MAX
	V_{OL}	R_L = 10kΩ	23	39	47		MAX
Output Current (I_{OUT})			60			mA	TYP
Input Common Mode Voltage Range (V_{CM})			-5.1 to 3.5			V	TYP
Common Mode Rejection Ratio (CMRR)		V_{CM} = -5.1V to 3.5V	92	75	68	dB	MIN
Quiescent Current		I_{OUT} = 0A	145	276	311	μA	MAX
Gain-Bandwidth Product (GBP)		C_L = 100pF, V_{CM} = 0V	1.4			MHz	TYP
Gain Margin		C_L = 100pF, V_{CM} = 0V	-10			dB	TYP
Phase Margin		C_L = 100pF, V_{CM} = 0V	50			°	TYP
Slew Rate (SR)	Up	V_{OUT} = 2V_{P-P} step, C_L = 100pF, G = 1	6			V/μs	TYP
	Down	V_{OUT} = 2V_{P-P} step, C_L = 100pF, G = 1	4				TYP
Overload Recovery Time (ORT)	Up	V_{IN} × G = V_S	1.5			μs	TYP
	Down	V_{IN} × G = V_S	2.5				
Settling Time (t_S)		C_L = 100pF, G = 1, 200mV output step	2			μs	TYP
Voltage Noise Density (e_n)		f = 20kHz, V_{CM} = 0V	30			nV/$\sqrt{Hz}$	TYP
		f = 1kHz, V_{CM} = 0V	45				
Total Harmonic Distortion + Noise (THD+N)		V_{OUT} = 2V_{P-P}, f = 1kHz, G = 1, R_L = 600Ω	0.018			%	TYP
		V_{OUT} = 2V_{P-P}, f = 1kHz, G = 1, R_L = 2kΩ	0.009				

ELECTRICAL CHARACTERISTICS (continued)

(V_S = ±15V, R_L = 2kΩ connected to 0V, unless otherwise noted.)

PARAMETER		CONDITIONS	TYP	MIN/MAX OVER TEMPERATURE			
			+25℃	+25℃	-40℃ to +85℃	UNITS	MIN/MAX
Input Offset Voltage (V_{OS})		V_{CM} = 0V	0.5	1.5	2.4	mV	MAX
Input Offset Voltage Drift ($\Delta V_{OS}/\Delta T$)			3			μV/℃	TYP
Input Bias Current (I_B)			20			pA	TYP
Input Offset Current (I_{OS})			20			pA	TYP
Open-Loop Voltage Gain (A_{OL})		V_{OUT} = -14.5V to 14.5V, R_L = 5kΩ	100	85	82	dB	MIN
Output Voltage Swing from Rail	V_{OH}	R_L = 10kΩ	67	174	193	mV	MAX
	V_{OL}	R_L = 10kΩ	63	102	124		MAX
Output Current (I_{OUT})			60			mA	TYP
Input Common Mode Voltage Range (V_{CM})			-15.1 to 13.5			V	TYP
Common Mode Rejection Ratio (CMRR)		V_{CM} = -15.1V to 13.5V	95	79	71	dB	MIN
Quiescent Current		I_{OUT} = 0A	150	286	320	μA	MAX
Gain-Bandwidth Product (GBP)		C_L = 100pF, V_{CM} = 0V	1.4			MHz	TYP
Gain Margin		C_L = 100pF, V_{CM} = 0V	-10			dB	TYP
Phase Margin		C_L = 100pF, V_{CM} = 0V	50			°	TYP
Slew Rate (SR)	Up	V_{OUT} = $2V_{P-P}$ step, C_L = 100pF, G = 1	7			V/μs	TYP
	Down	V_{OUT} = $2V_{P-P}$ step, C_L = 100pF, G = 1	4				TYP
Overload Recovery Time (ORT)	Up	V_{IN} × G = V_S	0.5			μs	TYP
	Down	V_{IN} × G = V_S	1.0				
Settling Time (t_S)		C_L = 100pF, G = 1, 200mV output step	2			μs	TYP
Voltage Noise Density (e_n)		f = 20kHz, V_{CM} = 0V	29			nV/√Hz	TYP
		f = 1kHz, V_{CM} = 0V	43				
Total Harmonic Distortion + Noise (THD+N)		V_{OUT} = $2V_{P-P}$, f = 1kHz, G = 1, R_L = 600Ω	0.018			%	TYP
		V_{OUT} = $2V_{P-P}$, f = 1kHz, G = 1, R_L = 2kΩ	0.009				

ELECTRICAL CHARACTERISTICS (continued)

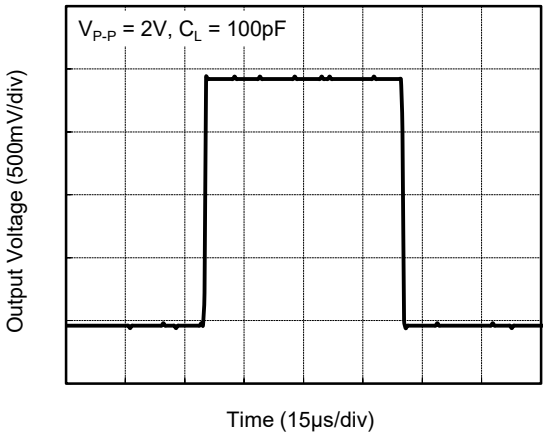
(V_S = ±18V, R_L = 2kΩ connected to 0V, unless otherwise noted.)

PARAMETER		CONDITIONS	TYP	MIN/MAX OVER TEMPERATURE			
			+25℃	+25℃	-40℃ to +85℃	UNITS	MIN/MAX
Input Offset Voltage (V_{OS})		V_{CM} = 0V	0.5	1.5	2.4	mV	MAX
Input Offset Voltage Drift ($\Delta V_{OS}/\Delta T$)			3			μV/℃	TYP
Input Bias Current (I_B)			20			pA	TYP
Input Offset Current (I_{OS})			20			pA	TYP
Open-Loop Voltage Gain (A_{OL})		V_{OUT} = -17.5V to 17.5V, R_L = 5kΩ	101	87	84	dB	MIN
Output Voltage Swing from Rail	V_{OH}	R_L = 10kΩ	81	208	231	mV	MAX
	V_{OL}	R_L = 10kΩ	73	119	146		MAX
Output Current (I_{OUT})			60			mA	TYP
Input Common Mode Voltage Range (V_{CM})			-18.1 to 16.5			V	TYP
Common Mode Rejection Ratio (CMRR)		V_{CM} = -18.1V to 16.5V	91	78	72	dB	MIN
Quiescent Current		I_{OUT} = 0A	157	299	332	μA	MAX
Gain-Bandwidth Product (GBP)		C_L = 100pF, V_{CM} = 0V	1.4			MHz	TYP
Gain Margin		C_L = 100pF, V_{CM} = 0V	-10			dB	TYP
Phase Margin		C_L = 100pF, V_{CM} = 0V	50			°	TYP
Slew Rate (SR)	Up	V_{OUT} = 2V_{P-P} step, C_L = 100pF, G = 1	7			V/μs	TYP
	Down	V_{OUT} = 2V_{P-P} step, C_L = 100pF, G = 1	4				TYP
Overload Recovery Time (ORT)	Up	V_{IN} × G = V_S	0.5			μs	TYP
	Down	V_{IN} × G = V_S	1.0				
Settling Time (t_S)		C_L = 100pF, G = 1, 200mV output step	2			μs	TYP
Voltage Noise Density (e_n)		f = 20kHz, V_{CM} = 0V	29			nV/$\sqrt{Hz}$	TYP
		f = 1kHz, V_{CM} = 0V	43				
Total Harmonic Distortion + Noise (THD+N)		V_{OUT} = 2V_{P-P}, f = 1kHz, G = 1, R_L = 600Ω	0.018			%	TYP
		V_{OUT} = 2V_{P-P}, f = 1kHz, G = 1, R_L = 2kΩ	0.009				

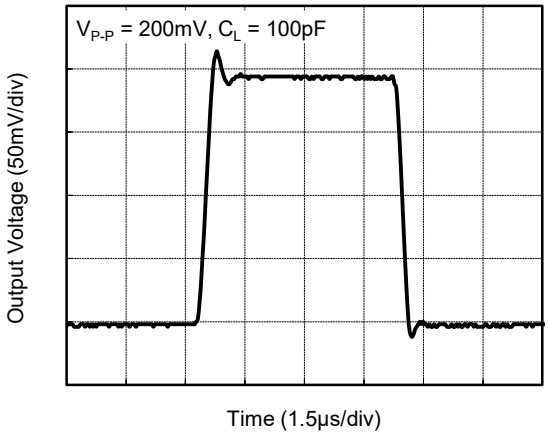
TYPICAL PERFORMANCE CHARACTERISTICS

At T_A = +25℃, V_S = ±15V, R_L = 2kΩ connected to 0V, unless otherwise noted.

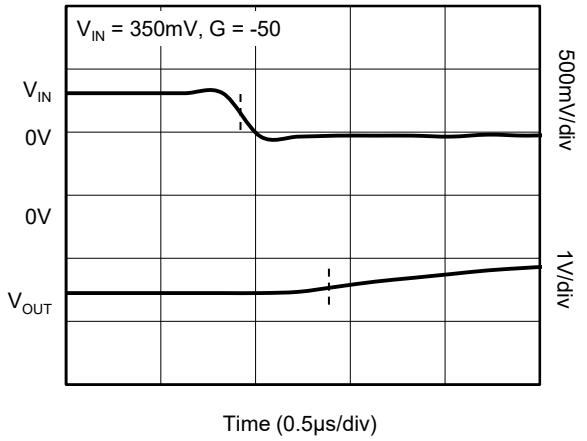
Large-Signal Step Response



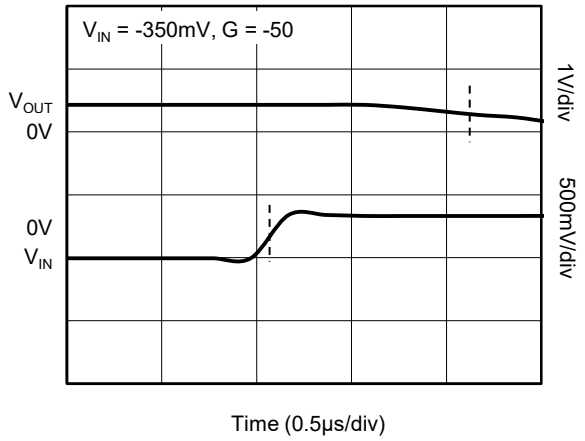
Small-Signal Step Response



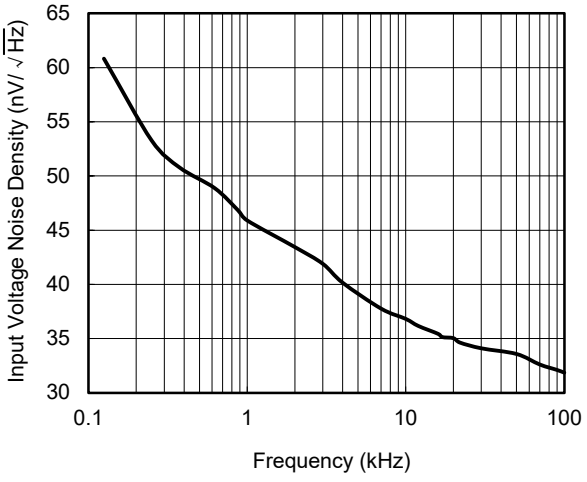
Negative Overload Recovery



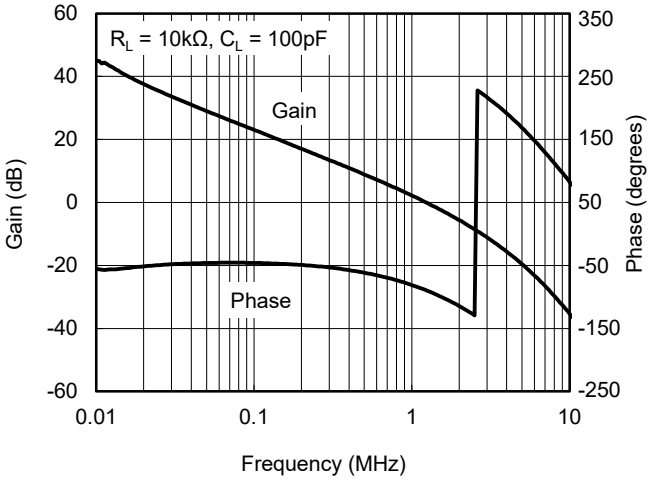
Positive Overload Recovery



Input Voltage Noise Density vs. Frequency

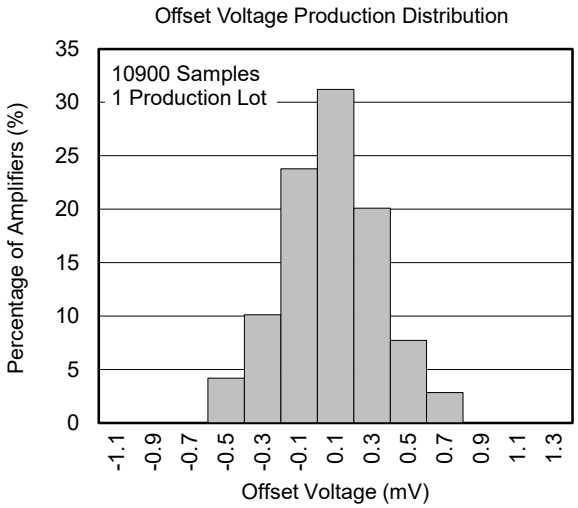


Gain and Phase vs. Frequency



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At T_A = +25℃, V_S = ±15V, R_L = 2kΩ connected to 0V, unless otherwise noted.



TYPICAL APPLICATION CIRCUITS

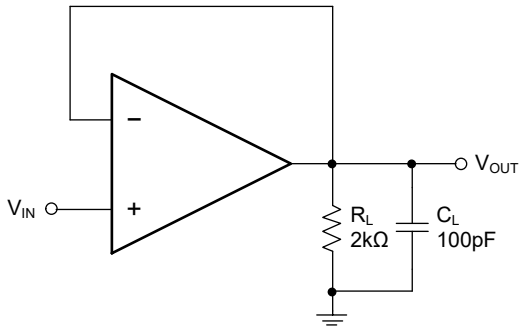


Figure 1

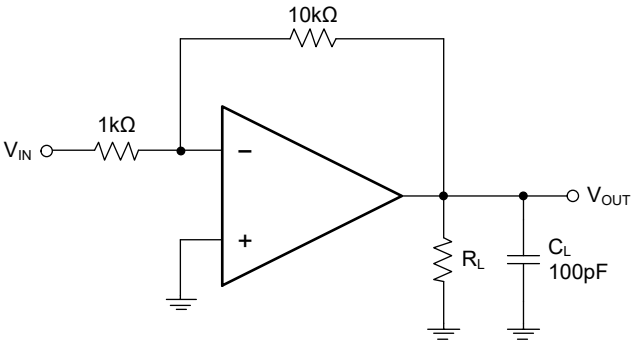


Figure 2

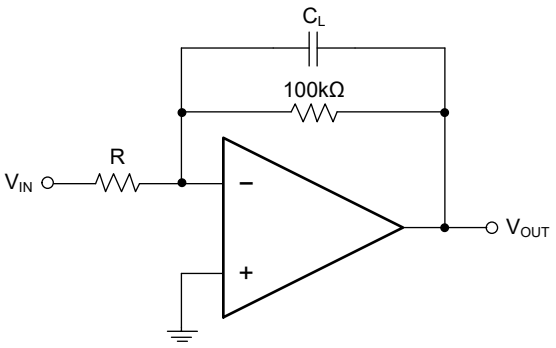


Figure 3

REVISION HISTORY

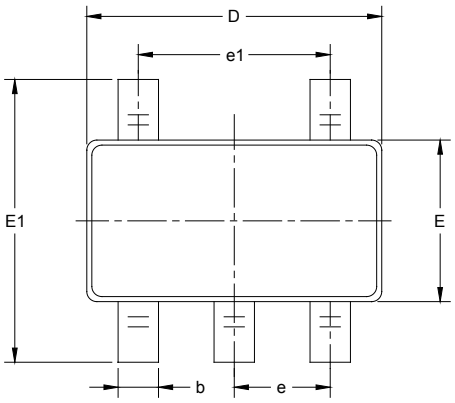
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

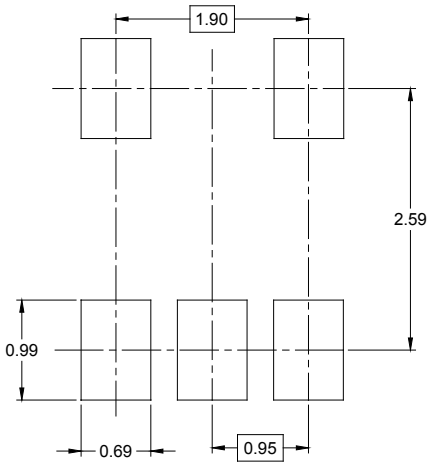
JANUARY 2016 – REV.A to REV.A.1	Page
Updated Electrical Characteristics section	3~6
Updated Features section	1

Changes from Original (DECEMBER 2012) to REV.A	Page
Changed from product preview to production data	All

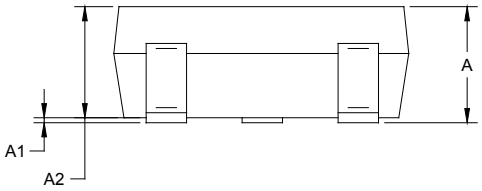
PACKAGE OUTLINE DIMENSIONS

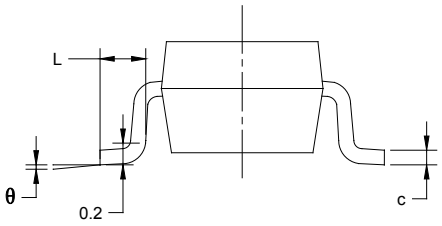
SOT-23-5





RECOMMENDED LAND PATTERN (Unit: mm)

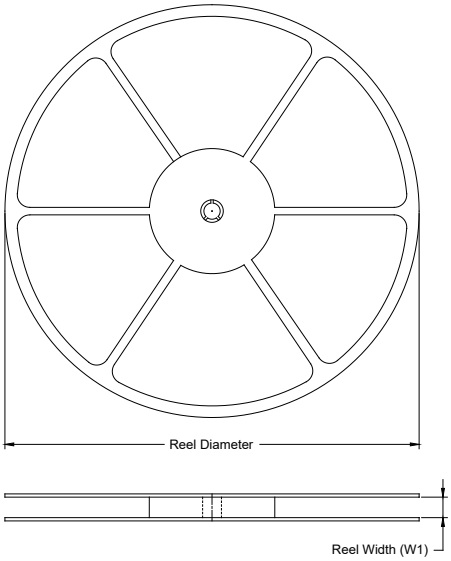




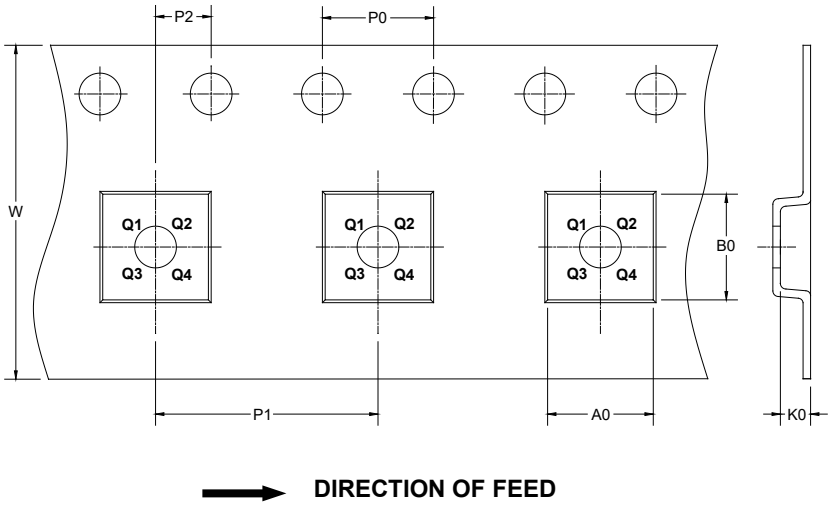
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037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

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



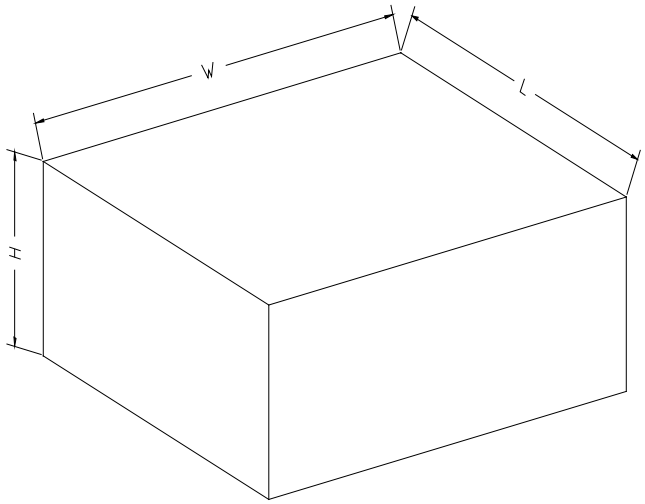
NOTE: The picture is only for reference. Please make the object as the standard.

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

DD0001

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