SGM8255-1/SGM8255-2/SGM8255-4
9MHz, High Voltage, High Precision, Low Noise, Rail-to-Rail Output Operational Amplifiers

GENERAL DESCRIPTION

The SGM8255-1 (single), SGM8255-2 (dual) and SGM8255-4 (quad) are rail-to-rail output, low noise and high precision operational amplifiers which have low input offset voltage, and bias current. They are guaranteed to operate from 4.5V to 36V single supply.

The rail-to-rail output swing provided by the SGM8255-1/2/4 makes both high-side and low-side sensing easy. The combination of characteristics makes the SGM8255-1/2/4 good choices for temperature, position and pressure sensors, medical equipment and strain gauge amplifiers, or any other 4.5V to 36V application requiring precision and long term stability.

The SGM8255-1/2/4 are rated over the -40℃ to +125℃ temperature range. The single SGM8255-1 is available in the Green SOT-23-5, SC70-5, SOIC-8 and MSOP-8 packages. The dual SGM8255-2 is available in the Green SOIC-8 and MSOP-8 packages. The quad SGM8255-4 is available in the Green SOIC-14 package.

FEATURES

- **Low Offset Voltage: 20μV (MAX)**
- **Rail-to-Rail Output Swing**
- **4.5V to 36V Single Supply Operation**
- **Voltage Gain: 133dB (TYP)**
- **PSRR: 141dB (TYP)**
- **CMRR: 112dB (TYP)**
- **0.1Hz to 10Hz Noise: 0.48μV_{P-P}**
- **25nV/$\sqrt{Hz}$ Voltage Noise Density at 1kHz**
- **Gain-Bandwidth Product: 9MHz**
- **Low Supply Current: 800μA/Amplifier (TYP)**
- **Overload Recovery Time: 0.7μs**
- **-40℃ to +125℃ Operating Temperature Range**
- **Small Packaging:**
  SGM8255-1 Available in Green SOT-23-5, SC70-5, SOIC-8 and MSOP-8 Packages
  SGM8255-2 Available in Green SOIC-8 and MSOP-8 Packages
  SGM8255-4 Available in Green SOIC-14 Package

APPLICATIONS

Temperature Measurements
Pressure Sensors
Precision Current Sensing
Electronic Scales
Strain Gauge Amplifiers
Medical Instrumentation
Thermocouple Amplifiers
Handheld Test Equipment

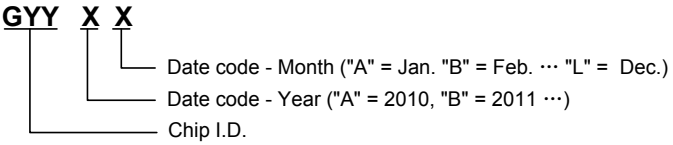
PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM8255-1	SOT-23-5	-40℃ to +125℃	SGM8255-1AXN5G/TR	G13XX	Tape and Reel, 3000
	SC70-5	-40℃ to +125℃	SGM8255-1XC5G/TR	G7AXX	Tape and Reel, 3000
	SOT-23-5	-40℃ to +125℃	SGM8255-1BXN5G/TR	G7BXX	Tape and Reel, 3000
	MSOP-8	-40℃ to +125℃	SGM8255-1XMS8G/TR	SGM82551 XMS8 XXXXX	Tape and Reel, 4000
	SOIC-8	-40℃ to +125℃	SGM8255-1XS8G/TR	SGM 82551XS8 XXXXX	Tape and Reel, 2500
SGM8255-2	SOIC-8	-40℃ to +125℃	SGM8255-2XS8G/TR	SGM 82552XS8 XXXXX	Tape and Reel, 2500
	MSOP-8	-40℃ to +125℃	SGM8255-2XMS8G/TR	SGM82552 XMS8 XXXXX	Tape and Reel, 4000
SGM8255-4	SOIC-14	-40℃ to +125℃	SGM8255-4XS14G/TR	SGM82554XS14 XXXXX	Tape and Reel, 2500

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

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.

MARKING INFORMATION



For example: G13FA (2015, January)

ABSOLUTE MAXIMUM RATINGS

Supply Voltage 40V
Input Voltage ..... $-V_S$ to $(+V_S)$ + 0.1V
Differential Input Voltage ..... -1V to +1V
Storage Temperature Range ..... -65℃ to +150℃
Junction Temperature ..... +150℃
Lead Temperature (Soldering 10 sec) ..... +260℃
ESD Susceptibility
HDM 4000V
MM 200V
CDM 1000V

RECOMMENDED OPERATING CONDITIONS

Input Voltage Range ..... 4.5V to 36V
Operating Temperature Range ..... -40℃ to +125℃

OVERSTRESS CAUTION

Stresses beyond those listed may cause permanent damage to the device. Functional operation of the device at these or any other conditions beyond those indicated in the operational section of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

ESD SENSITIVITY CAUTION

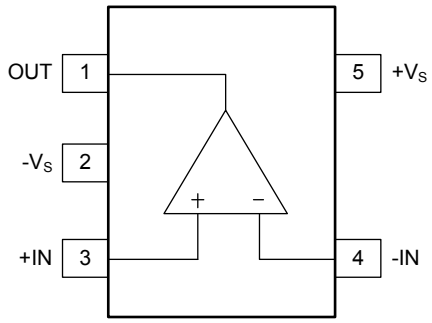
This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance 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.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time.

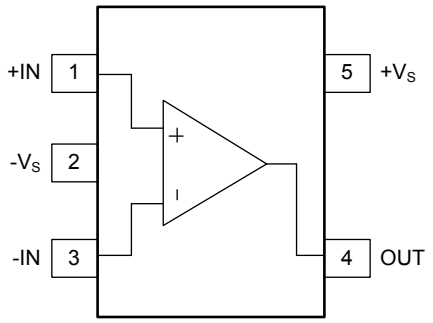
PIN CONFIGURATIONS

SGM8255-1A (TOP VIEW)



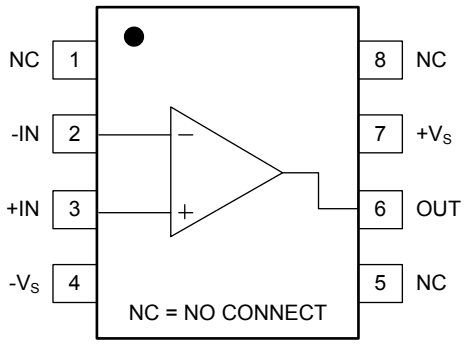
SOT-23-5/SC70-5

SGM8255-1B (TOP VIEW)



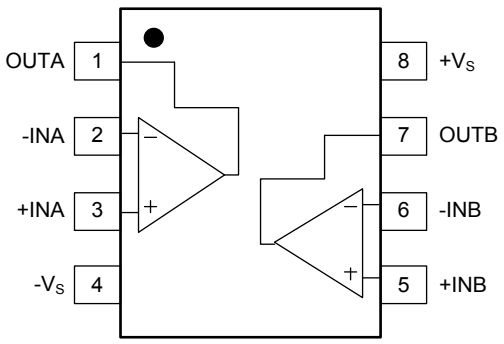
SOT-23-5

SGM8255-1 (TOP VIEW)



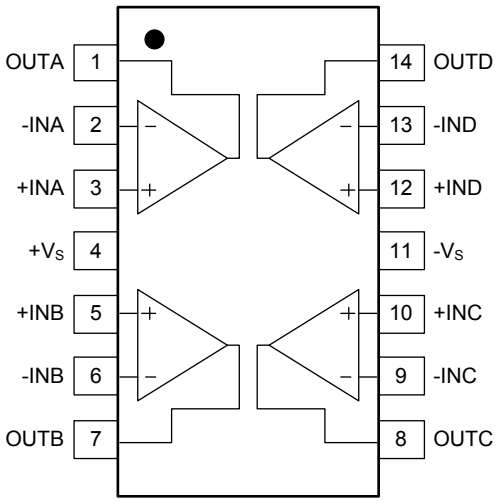
SOIC-8/MSOP-8

SGM8255-2 (TOP VIEW)



SOIC-8/MSOP-8

SGM8255-4 (TOP VIEW)



SOIC-14

ELECTRICAL CHARACTERISTICS

(V_S = 5V, V_{CM} = 2.5V, V_O = 2.5V, T_A = +25℃, unless otherwise noted.)

PARAMETER		CONDITIONS	MIN	TYP	MAX	UNITS
INPUT CHARACTERISTICS						
Input Offset Voltage (V_{OS})		V_{CM} = V_S/2		7	20	μV
Input Bias Current (I_B)				200		pA
Input Offset Current (I_{OS})				200		pA
Input Voltage Range			0		3.5	V
Common Mode Rejection Ratio (1) (CMRR)		V_{CM} = 0V to V_S - 1.5V	94	112		dB
		-40℃ ≤ T_A ≤ +125℃	92			
Large Signal Voltage Gain (A_{VO})		V_{CM} = V_S/2, R_L = 10kΩ	112	133		dB
		-40℃ ≤ T_A ≤ +125℃	110			
OUTPUT CHARACTERISTICS						
Output Voltage High (V_{OH})		V_{CM} = V_S/2, R_L = 10kΩ to V_S/2		33	54	mV
		-40℃ ≤ T_A ≤ +125℃			67	
Output Voltage Low (V_{OL})		V_{CM} = V_S/2, R_L = 10kΩ to V_S/2		10	18	mV
		-40℃ ≤ T_A ≤ +125℃			25	
Short Circuit Current Limit	I_{SOURCE}	V_{CM} = V_S/2, R_L = 10Ω to V_S/2	14	20		mA
		-40℃ ≤ T_A ≤ +125℃	10			
	I_{SINK}	V_{CM} = V_S/2, R_L = 10Ω to V_S/2	39	55		mA
		-40℃ ≤ T_A ≤ +125℃	23			
POWER SUPPLY						
Power Supply Rejection Ratio (1) (PSRR)		V_S = 4V to 38V, V_{CM} = V_S/2	122	141		dB
		-40℃ ≤ T_A ≤ +125℃	120			
Quiescent Current/Amplifier (I_Q)		V_{CM} = V_S/2, I_O = 0		800	1120	μA
		-40℃ ≤ T_A ≤ +125℃			1490	
DYNAMIC PERFORMANCE						
Gain-Bandwidth Product (GBP)		R_F = 10kΩ, -R_G = 100Ω, A_V = +100, C_L =10pF, V_{CM} = V_S/2		9.1		MHz
Slew Rate (SR)	Up	f = 1kHz, V_{OUT} = 2V_{p-p} Step, R_L = 10kΩ, C_L = 100pF, A_V = +1		5		V/μs
	Down			3		
Settling Time	Up	C_L = 100pF, A_V = +1, 200mV Output Step		0.7		μs
	Down			0.7		
Overload Recovery Time	Up	V_{IN} × Gain = V_S, R_F = 10kΩ, -R_G = 200Ω, A_V = -50, V_{IN} = 200mV		0.7		μs
	Down			0.8		
Total Harmonic Distortion + Noise (THD + N)		V_{OUT} = 2V_{p-p}, f = 1kHz, A_V = +1, R_F = 10kΩ, R_{IN} = 10Ω		0.0004		%
NOISE PERFORMANCE						
Voltage Noise (e_n p-p)		0.1Hz to 10Hz		0.48		$μV_{P-P}$
Voltage Noise Density (e_n)		f = 0.1kHz, V_{CM} = V_S/2		24		$nV/\sqrt{Hz}$
		f = 1kHz, V_{CM} = V_S/2		25		
		f = 10kHz, V_{CM} = V_S/2		27		

NOTE 1: PSRR and CMRR are affected by the matching between external gain-setting resistor ratios.

ELECTRICAL CHARACTERISTICS (continued)

(V_S = 30V, V_{CM} = 15V, V_O = 15V, T_A = +25℃, unless otherwise noted.)

PARAMETER		CONDITIONS	MIN	TYP	MAX	UNITS
INPUT CHARACTERISTICS						
Input Offset Voltage (V_{OS})		V_{CM} = V_S/2		7	19	μV
Input Bias Current (I_B)				200		pA
Input Offset Current (I_{OS})				200		pA
Input Voltage Range			0		28.5	V
Common Mode Rejection Ratio (1) (CMRR)		V_{CM} = 0V to V_S - 1.5V	110	133		dB
		-40℃ ≤ T_A ≤ +125℃	108			
Large Signal Voltage Gain (A_{VO})		V_{CM} = V_S/2, R_L = 10kΩ	126	147		dB
		-40℃ ≤ T_A ≤ +125℃	122			
Input Offset Voltage Drift ($\Delta V_{OS}/\Delta_T$)				28		nV/℃
OUTPUT CHARACTERISTICS						
Output Voltage High (V_{OH})		V_{CM} = V_S/2, R_L = 10kΩ to V_S/2		174	227	mV
		-40℃ ≤ T_A ≤ +125℃			283	
Output Voltage Low (V_{OL})		V_{CM} = V_S/2, R_L = 10kΩ to V_S/2		46	69	mV
		-40℃ ≤ T_A ≤ +125℃			102	
Short Circuit Current Limit	I_{SOURCE}	V_{CM} = V_S/2, R_L = 10Ω to V_S/2	45	68		mA
	I_{SINK}	V_{CM} = V_S/2, R_L = 10Ω to V_S/2	45	70		mA
POWER SUPPLY						
Power Supply Rejection Ratio (1) (PSRR)		V_S = 4V to 38V, V_{CM} = V_S/2	122	141		dB
		-40℃ ≤ T_A ≤ +125℃	120			
Quiescent Current/Amplifier (I_Q)		V_{CM} = V_S/2, I_O = 0		830	1150	μA
		-40℃ ≤ T_A ≤ +125℃			1530	
DYNAMIC PERFORMANCE						
Gain-Bandwidth Product (GBP)		R_F = 10kΩ, -R_G = 100Ω, A_V = +100, C_L =10pF, V_{CM} = V_S/2		9.2		MHz
Slew Rate (SR)	Up	f = 1kHz, V_{OUT} = 2V_{p-p} Step, R_L = 10kΩ, C_L = 100pF, A_V = +1		5.6		V/μs
	Down			3.3		
Settling Time	Up	C_L = 100pF, A_V = +1, 200mV Output Step		0.6		μs
	Down			0.6		
Overload Recovery Time	Up	V_{IN} × Gain = V_S, R_F = 10kΩ, -R_G = 100Ω, A_V = -100, V_{IN} = 400mV		0.3		μs
	Down			0.5		
Total Harmonic Distortion + Noise (THD + N)		V_{OUT} = 2V_{p-p}, f = 1kHz, A_V = +1, R_F = 10kΩ, R_{IN} = 10Ω		0.0003		%
NOISE PERFORMANCE						
Voltage Noise (e_n p-p)		0.1Hz to 10Hz		0.48		μV_{P-P}
Voltage Noise Density (e_n)		f = 0.1kHz, V_{CM} = V_S/2		24		$nV/\sqrt{Hz}$
		f = 1kHz, V_{CM} = V_S/2		25		
		f = 10kHz, V_{CM} = V_S/2		27		

NOTE 1: PSRR and CMRR are affected by the matching between external gain-setting resistor ratios.

ELECTRICAL CHARACTERISTICS (continued)

(V_S = 36V, V_{CM} = 18V, V_O = 18V, T_A = +25℃, unless otherwise noted.)

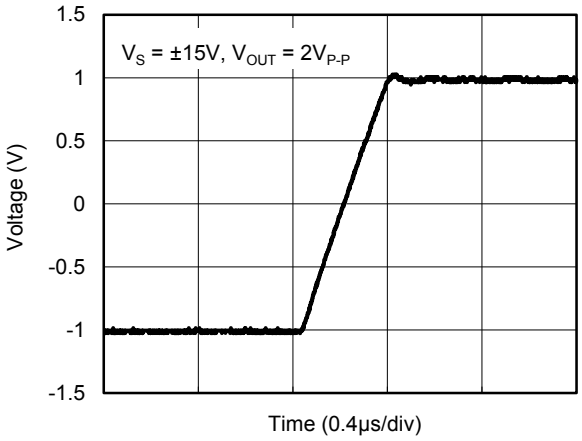
PARAMETER		CONDITIONS	MIN	TYP	MAX	UNITS
INPUT CHARACTERISTICS						
Input Offset Voltage (V_{OS})		V_{CM} = V_S/2		7	19	μV
Input Bias Current (I_B)				200		pA
Input Offset Current (I_{OS})				200		pA
Input Voltage Range			0		34.5	V
Common Mode Rejection Ratio (1) (CMRR)		V_{CM} = 0V to V_S - 1.5V	112	136		dB
		-40℃ ≤ T_A ≤ +125℃	110			
Large Signal Voltage Gain (A_{VO})		V_{CM} = V_S/2, R_L = 10kΩ	126	147		dB
		-40℃ ≤ T_A ≤ +125℃	122			
OUTPUT CHARACTERISTICS						
Output Voltage High (V_{OH})		V_{CM} = V_S/2, R_L = 10kΩ to V_S/2		210	274	mV
		-40℃ ≤ T_A ≤ +125℃			337	
Output Voltage Low (V_{OL})		V_{CM} = V_S/2, R_L = 10kΩ to V_S/2		55	82	mV
		-40℃ ≤ T_A ≤ +125℃			120	
Short Circuit Current Limit	I_{SOURCE}	V_{CM} = V_S/2, R_L = 10Ω to V_S/2	45	68		mA
	I_{SINK}	V_{CM} = V_S/2, R_L = 10Ω to V_S/2	44	70		mA
POWER SUPPLY						
Power Supply Rejection Ratio (1) (PSRR)		V_S = 4V to 38V, V_{CM} = V_S/2	122	141		dB
		-40℃ ≤ T_A ≤ +125℃	120			
Quiescent Current/Amplifier (I_Q)		V_{CM} = V_S/2, I_O = 0		870	1200	μA
		-40℃ ≤ T_A ≤ +125℃			1570	
DYNAMIC PERFORMANCE						
Gain-Bandwidth Product (GBP)		R_F = 10kΩ, -R_G = 100Ω, A_V = +100, C_L =10pF, V_{CM} = V_S/2		9.3		MHz
Slew Rate (SR)	Up	f = 1kHz, V_{OUT} = 2V_{p-p} Step, R_L = 10kΩ, C_L = 100pF, A_V = +1		5.7		V/μs
	Down			5.4		
Settling Time	Up	C_L = 100pF, A_V = +1, 200mV Output Step		0.6		μs
	Down			0.6		
Overload Recovery Time	Up	V_{IN} × Gain = V_S, R_F = 10kΩ, -R_G = 100Ω, A_V = -100, V_{IN} = 400mV		0.3		μs
	Down			0.5		
Total Harmonic Distortion + Noise (THD + N)		V_{OUT} = 2V_{p-p}, f = 1kHz, A_V = +1, R_F = 10kΩ, R_{IN} = 10Ω		0.0003		%
NOISE PERFORMANCE						
Voltage Noise (e_n p-p)		0.1Hz to 10Hz		0.48		$μV_{P-P}$
Voltage Noise Density (e_n)		f = 0.1kHz, V_{CM} = V_S/2		24		$nV/\sqrt{Hz}$
		f = 1kHz, V_{CM} = V_S/2		25		
		f = 10kHz, V_{CM} = V_S/2		27		

NOTE 1: PSRR and CMRR are affected by the matching between external gain-setting resistor ratios.

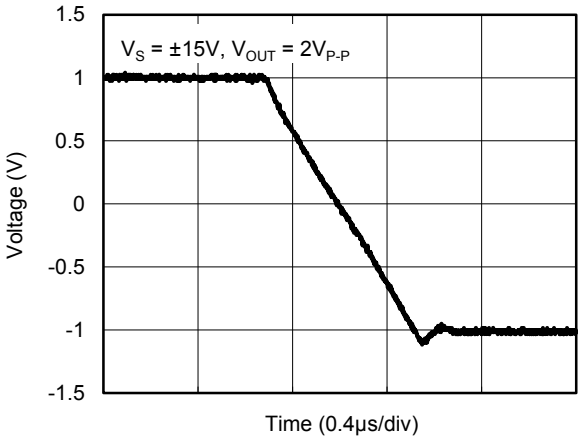
TYPICAL PERFORMANCE CHARACTERISTICS

V_S = ±15V, R_L = 10kΩ, at T_A = +25℃, unless otherwise noted.

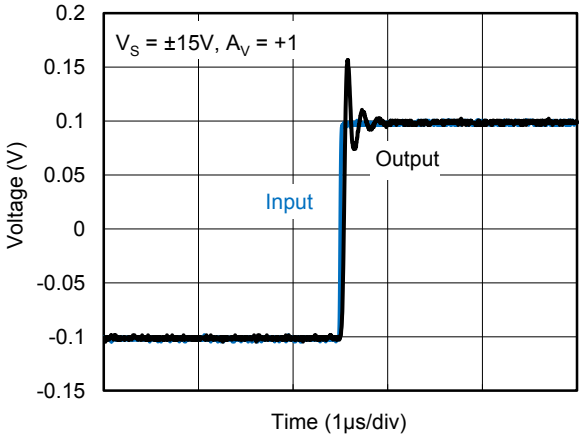
Slew Rate (UP)



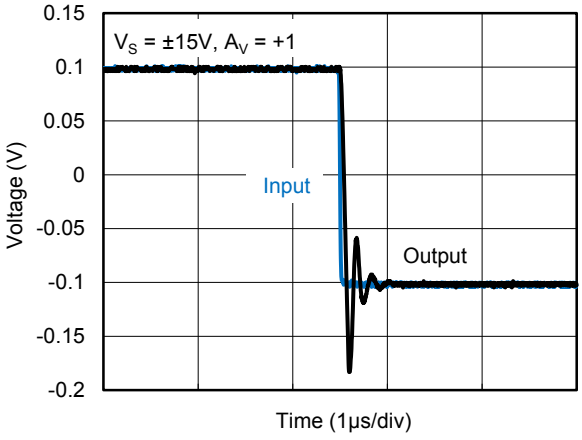
Slew Rate (DOWN)



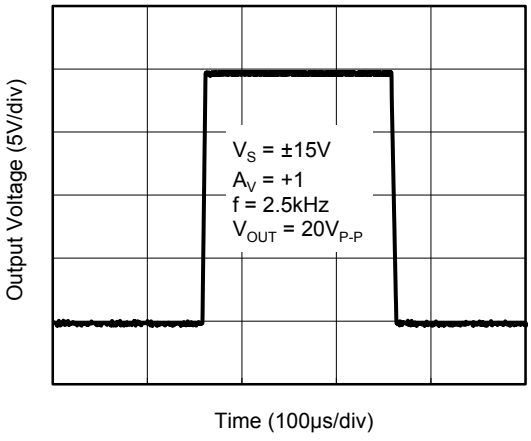
Positive Settling Time



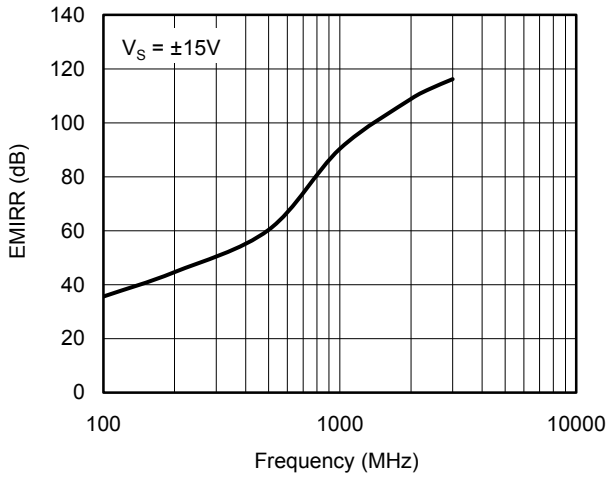
Negative Settling Time



Large Signal Step Response



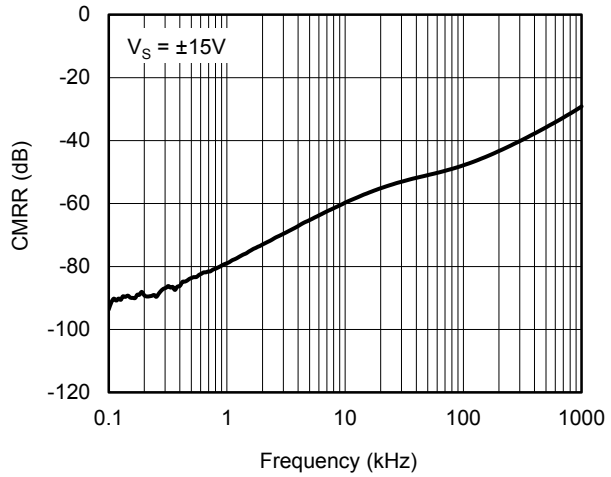
EMIRR vs. Frequency



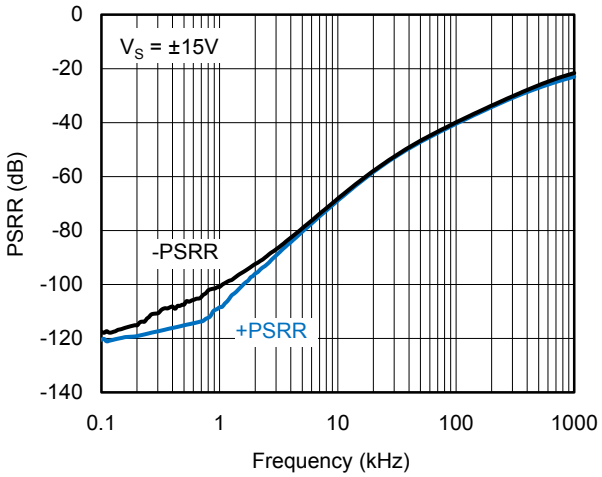
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

V_S = ±15V, R_L = 10kΩ, at T_A = +25℃, unless otherwise noted.

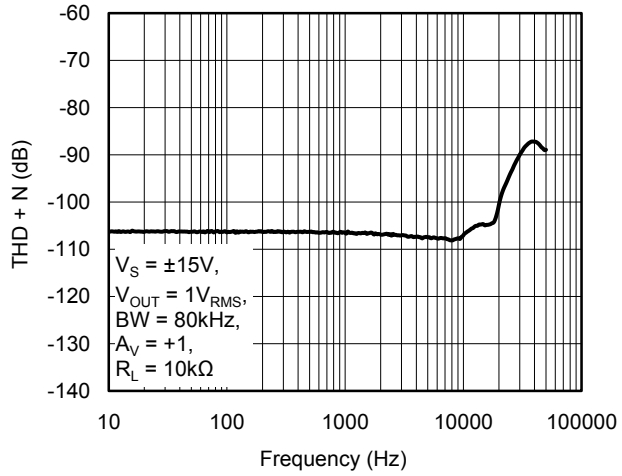
Common Mode Rejection Ratio vs. Frequency



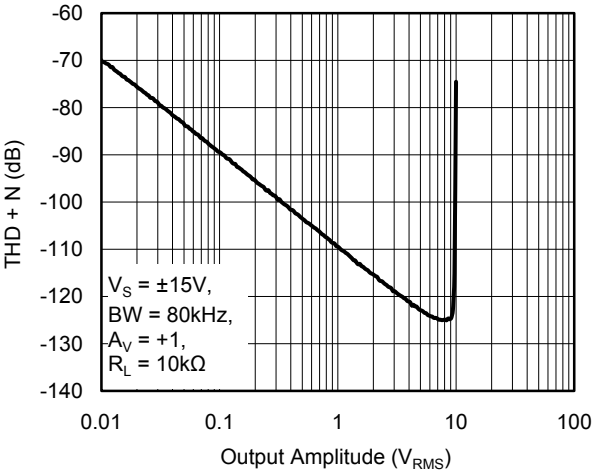
Power Supply Rejection Ratio vs. Frequency



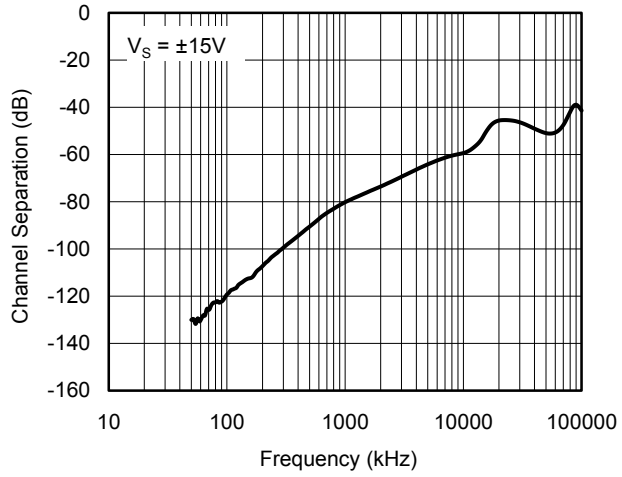
THD + N vs. Frequency



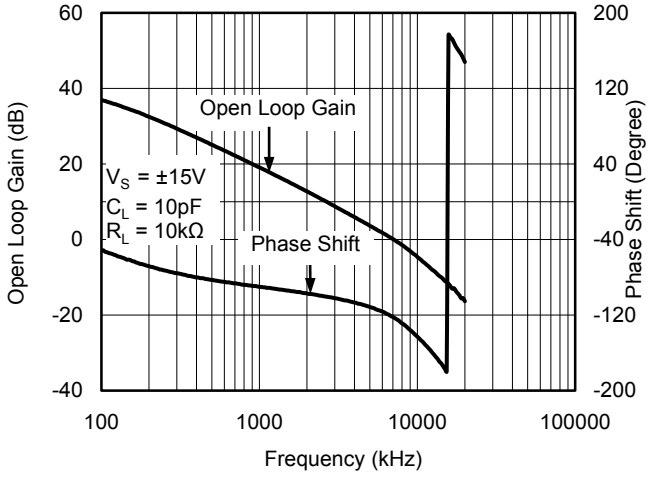
THD + N vs. Output Amplitude



Channel Separation vs. Frequency



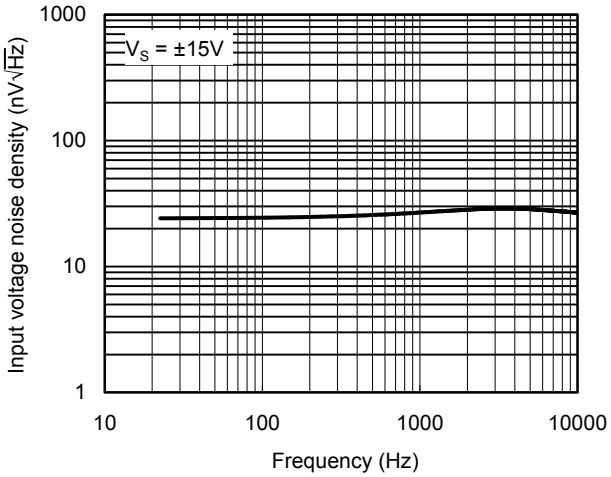
Open Loop Gain and Phase Shift vs. Frequency



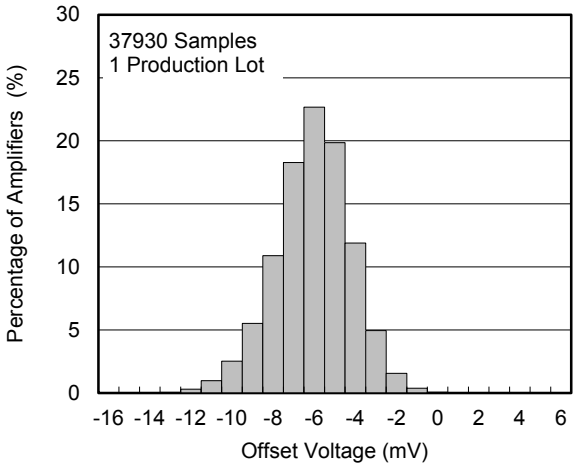
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

V_S = ±15V, R_L = 10kΩ, at T_A = +25℃, unless otherwise noted.

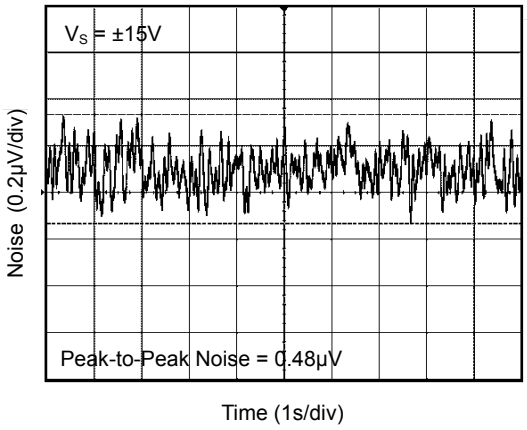
Input Voltage Noise Density vs. Frequency



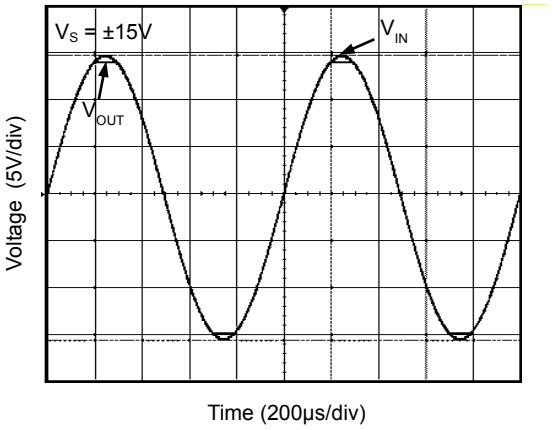
Offset Voltage Production Distribution



0.1Hz to 10Hz Noise

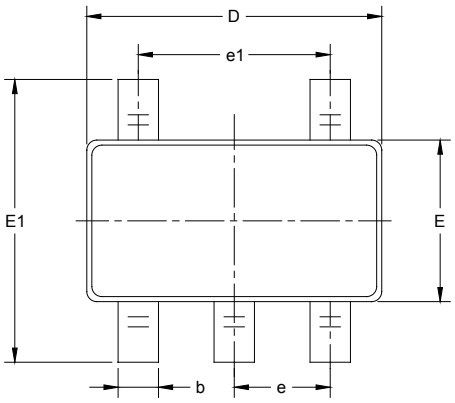


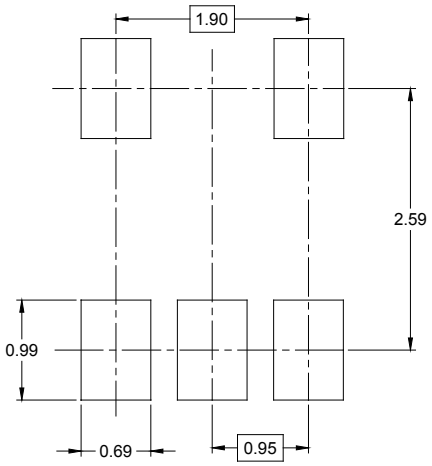
No Phase Reversal



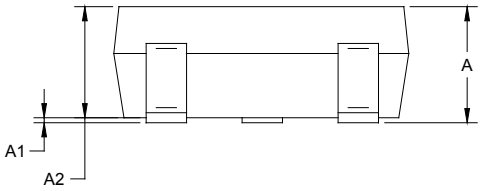
PACKAGE OUTLINE DIMENSIONS

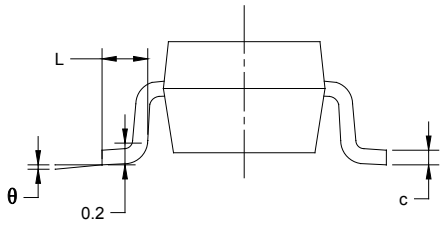
SOT-23-5





RECOMMENDED LAND PATTERN (Unit: mm)

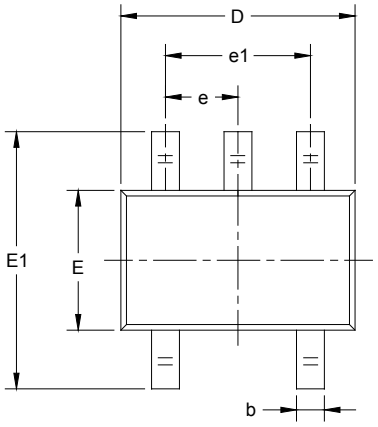


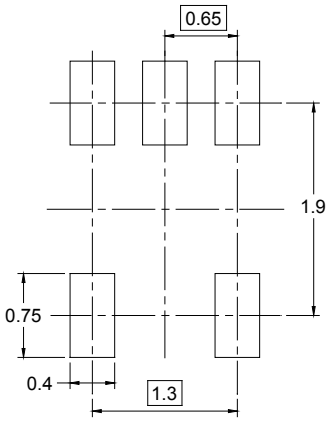


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037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

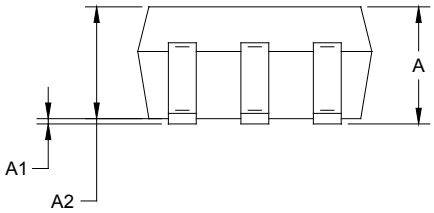
PACKAGE OUTLINE DIMENSIONS

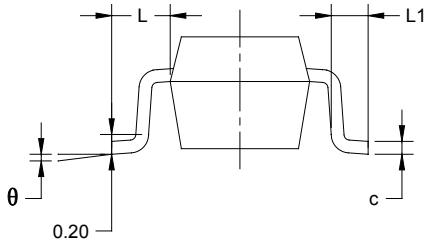
SC70-5





RECOMMENDED LAND PATTERN (Unit: mm)

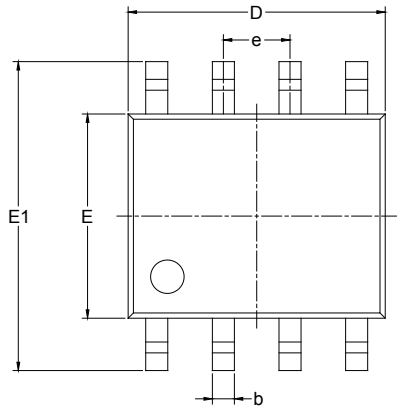


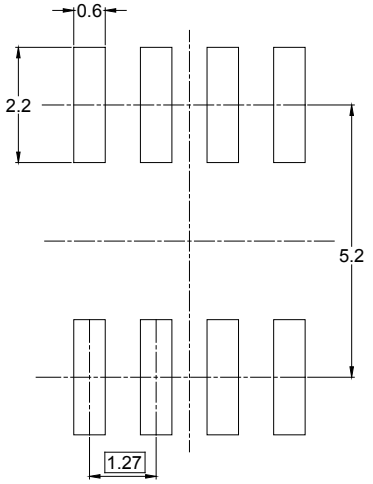


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.65 TYP		0.026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

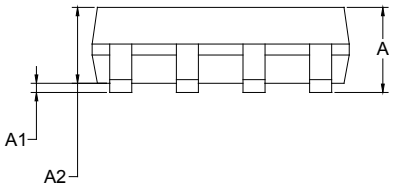
PACKAGE OUTLINE DIMENSIONS

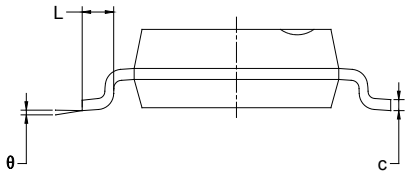
SOIC-8





RECOMMENDED LAND PATTERN (Unit: mm)

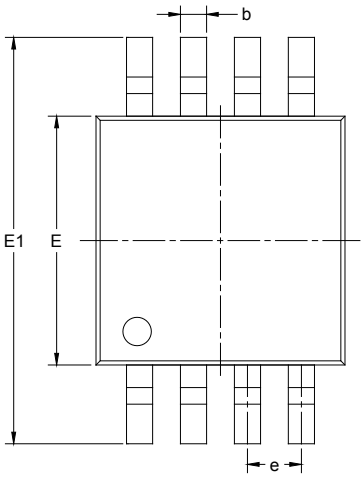


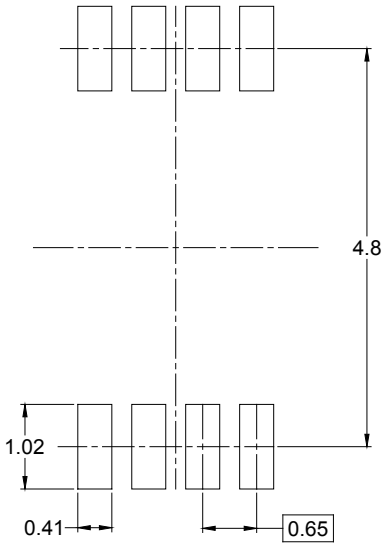


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050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

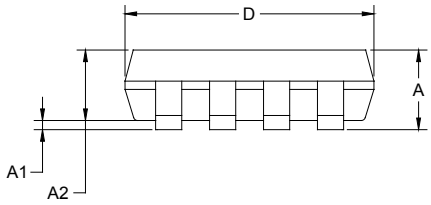
PACKAGE OUTLINE DIMENSIONS

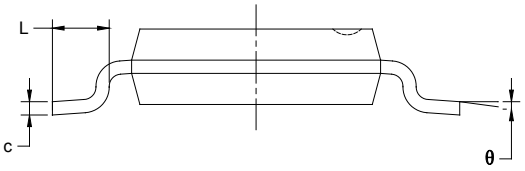
MSOP-8





RECOMMENDED LAND PATTERN (Unit: mm)

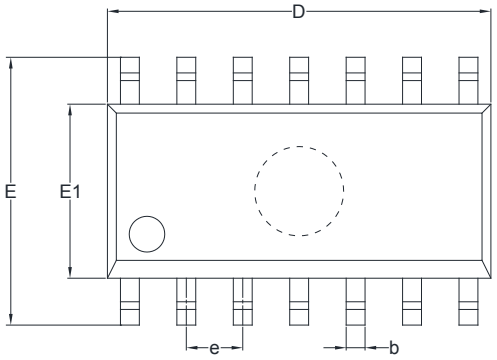


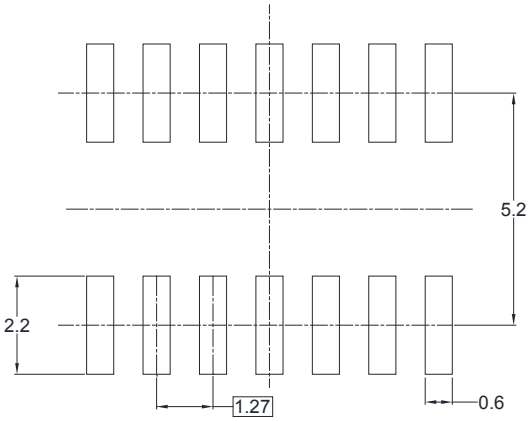


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650 BSC		0.026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

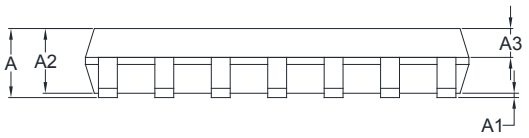
PACKAGE OUTLINE DIMENSIONS

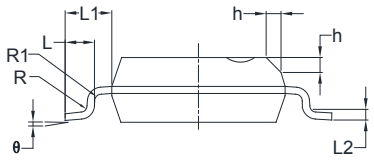
SOIC-14





RECOMMENDED LAND PATTERN (Unit: mm)

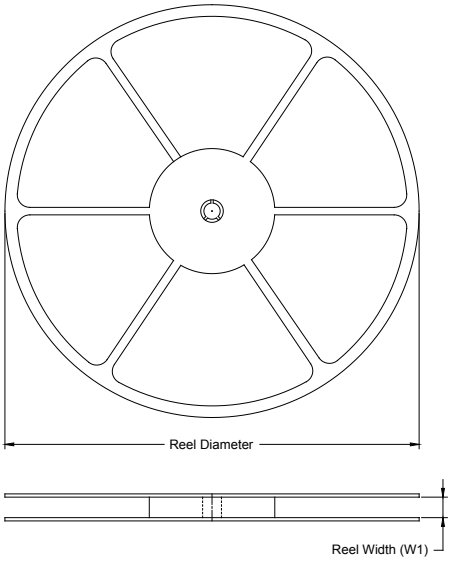




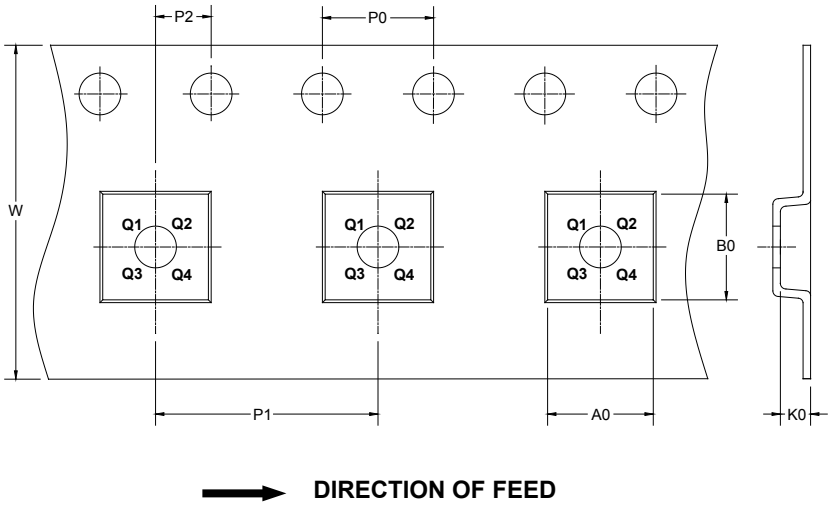
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
A2	1.25	1.65	0.049	0.065
A3	0.55	0.75	0.022	0.030
b	0.36	0.49	0.014	0.019
D	8.53	8.73	0.336	0.344
E	5.80	6.20	0.228	0.244
E1	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
L	0.45	0.80	0.018	0.032
L1	1.04 REF		0.040 REF	
L2	0.25 BSC		0.01 BSC	
R	0.07		0.003	
R1	0.07		0.003	
h	0.30	0.50	0.012	0.020
θ	0°	8°	0°	8°

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



DIRECTION OF FEED

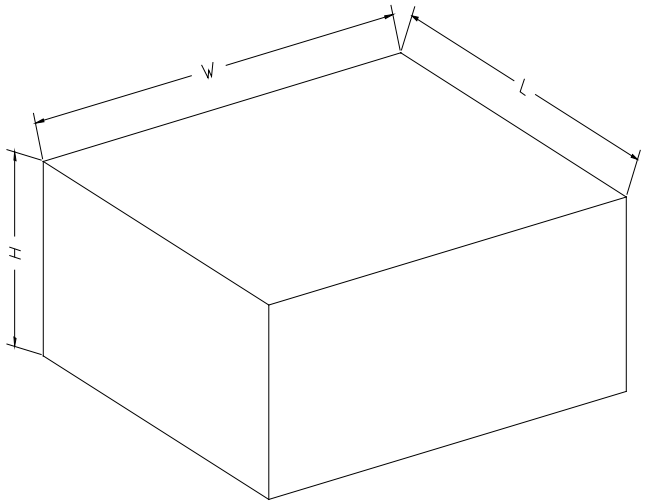
NOTE: The picture is only for reference. Please make the object as the standard.

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
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
SOIC-14	13″	16.4	6.6	9.3	2.1	4.0	8.0	2.0	16.0	Q1

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
13″	386	280	370	5

DD0002