



SGM8295-1/SGM8295-2/SGM8295-4 9MHz, Low Noise, High Voltage, Precision Operational Amplifiers

GENERAL DESCRIPTION

The SGM8295-1/2/4 are a family of single, dual and quad operational amplifiers, which are optimized for high voltage, low noise and low offset voltage operation. These devices can operate from 3.6V to 36V single supply or from $\pm 1.8V$ to $\pm 18V$ dual supplies, while consuming only 1.5mA quiescent current per amplifier.

They exhibit a high gain-bandwidth product of 9MHz and a slew rate of 8V/ μs . The output swing is rail-to-rail with heavy loads. These specifications make the operational amplifiers appropriate for various applications.

The SGM8295-1 is available in Green SOT-23-5 and SOIC-8 packages. The SGM8295-2 is available in Green SOIC-8 and MSOP-8 packages. The SGM8295-4 is available in a Green SOIC-14 package. They are specified over the extended $-40^{\circ}C$ to $+125^{\circ}C$ temperature range.

FEATURES

- **Low Noise:** $4.5nV/\sqrt{Hz}$
- **Input Offset Voltage:** 250 μV (MAX)
- **Low Bias Current:** $\pm 1nA$ (TYP)
- **High Gain-Bandwidth Product:** 9MHz
- **High Slew Rate:** 8V/ μs
- **High Open-Loop Gain:** 130dB at $V_S = \pm 15V$
- **High PSRR:** 145dB
- **Settling Time to 0.1% with 1V Step:** 1 μs
- **Overload Recovery Time:** 10 μs
- **Rail-to-Rail Output**
- **Supply Voltage Range:**
3.6V to 36V or $\pm 1.8V$ to $\pm 18V$
- **Input Common Mode Voltage Range:**
 $(-V_S) + 1.5V$ to $(+V_S) - 2V$
- **Low Supply Current:** 1.5mA/Amplifier (TYP)
- **$-40^{\circ}C$ to $+125^{\circ}C$ Operating Temperature Range**
- **Small Packaging:**
SGM8295-1 Available in Green SOT-23-5 and SOIC-8 Packages
SGM8295-2 Available in Green SOIC-8 and MSOP-8 Packages
SGM8295-4 Available in a Green SOIC-14 Package

APPLICATIONS

Sensors
Audio
Active Filters
A/D Converters
Communications
Test Equipment
Cellular and Cordless Phones
Laptops and PDAs
Photodiode Amplification

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM8295-1	SOT-23-5	-40°C to +125°C	SGM8295-1XN5G/TR	G62XX	Tape and Reel, 3000
	SOIC-8	-40°C to +125°C	SGM8295-1XS8G/TR	SGM 82951XS8 XXXXX	Tape and Reel, 2500
SGM8295-2	SOIC-8	-40°C to +125°C	SGM8295-2XS8G/TR	SGM 82952XS8 XXXXX	Tape and Reel, 2500
	MSOP-8	-40°C to +125°C	SGM8295-2XMS8G/TR	SGM82952 XMS8 XXXXX	Tape and Reel, 4000
SGM8295-4	SOIC-14	-40°C to +125°C	SGM8295-4XS14G/TR	SGM82954XS14 XXXXX	Tape and Reel, 2500

MARKING INFORMATION

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

SOT-23-5

YYY X X

Date Code - Month
Date Code - Year
Serial Number

SOIC-8/MSOP-8/SOIC-14

XXXXX

Vendor Code
Date Code - Week
Date Code - Year

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) - 0.3V to (+V_S) + 0.3V
Junction Temperature +150°C
Storage Temperature Range -65°C to +150°C
Lead Temperature (Soldering, 10s) +260°C
ESD Susceptibility
HBM 4000V
MM 200V
CDM 1000V

RECOMMENDED OPERATING CONDITIONS

Supply Voltage Range 3.6V to 36V
Operating Temperature Range -40°C to +125°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.

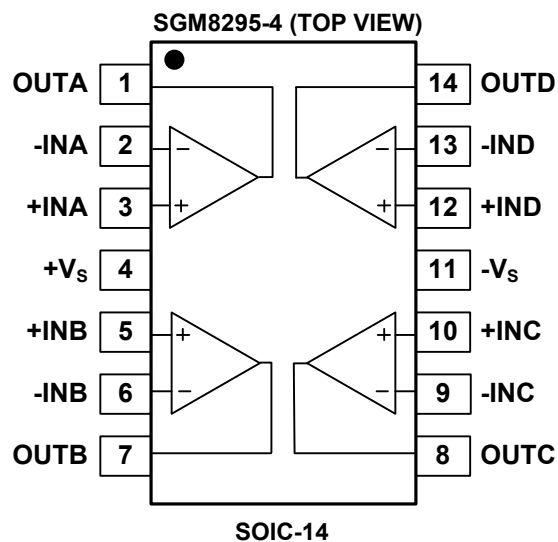
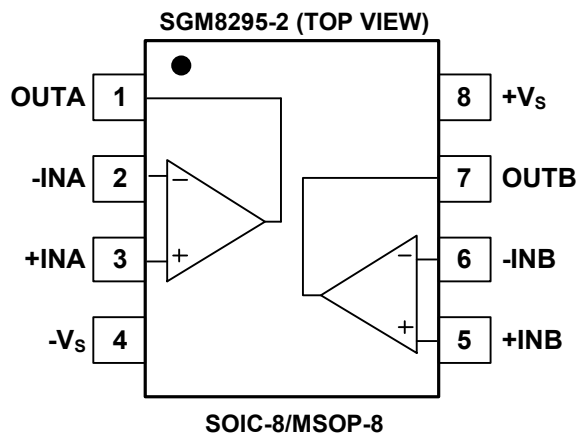
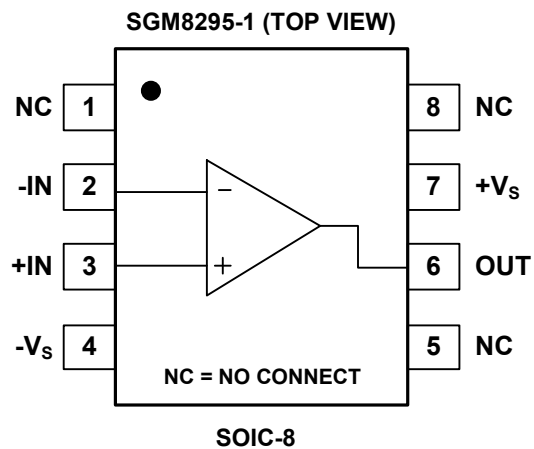
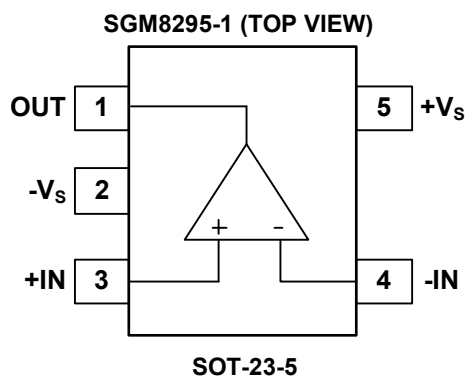
ESD SENSITIVITY CAUTION

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 CONFIGURATIONS



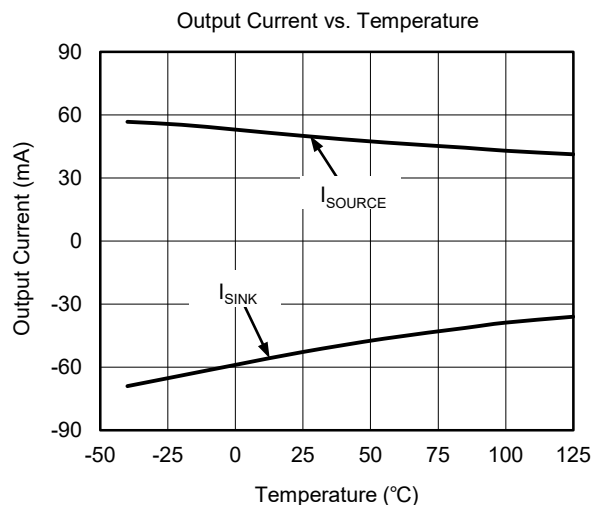
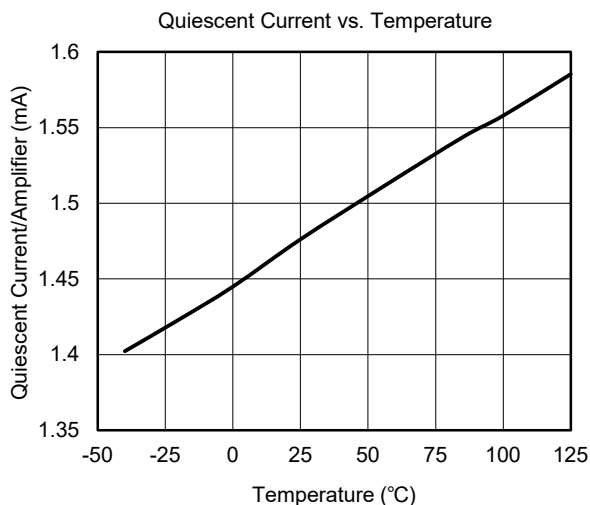
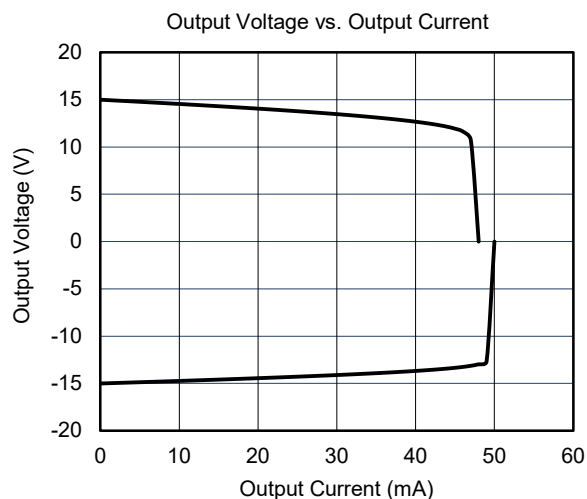
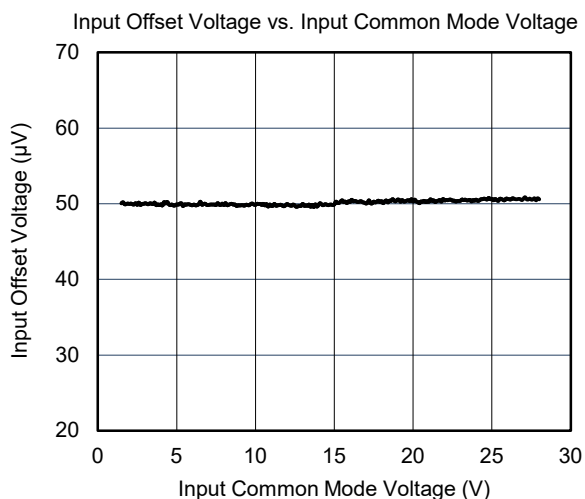
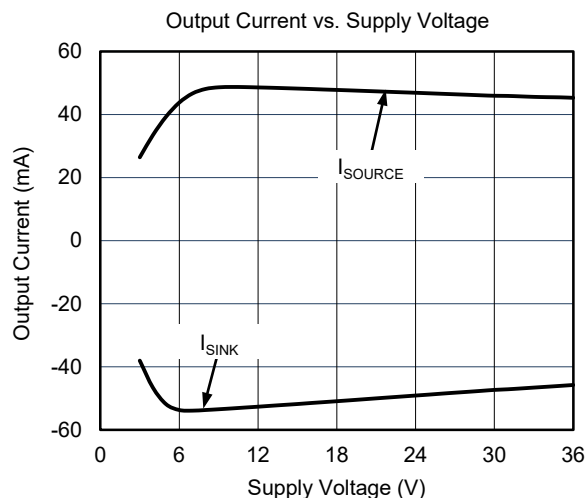
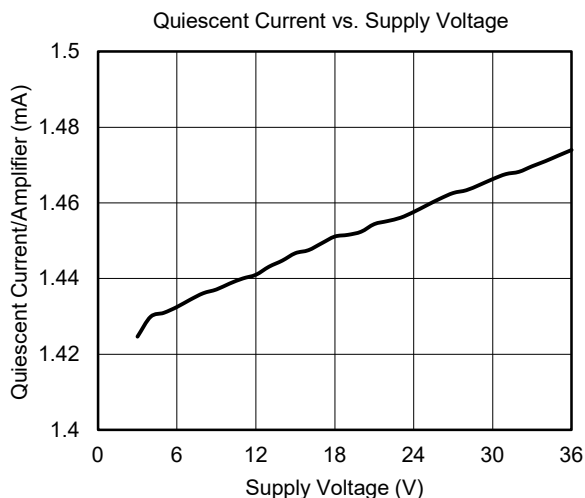
ELECTRICAL CHARACTERISTICS

(At $T_A = +25^\circ\text{C}$, $V_S = \pm 5\text{V}$ to $V_S = \pm 15\text{V}$, $V_{CM} = 0\text{V}$, $V_{OUT} = 0\text{V}$ and R_L connected to 0V , Full = -40°C to $+125^\circ\text{C}$, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Input Characteristics							
Input Offset Voltage	V _{OS}		+25°C		50	250	μV
			Full			360	
Input Bias Current	I _B	V _{CM} = V _S /2	+25°C		±1	±17	nA
			Full			±52	
Input Offset Current	I _{OS}	V _{CM} = V _S /2	+25°C		±1	±21	nA
			Full			±45	
Input Common Mode Voltage Range	V _{CM}		Full	(-V _S) + 1.5		(+V _S) - 2	V
Common Mode Rejection Ratio	CMRR	(-V _S) + 1.5V ≤ V _{CM} ≤ (+V _S) - 2V	+25°C	112	140		dB
			Full	110			
Open-Loop Voltage Gain	A _{OL}	V _S = ±5V, V _{OUT} = ±2.5V, R _L = 10kΩ	+25°C	118	135		dB
			Full	116			
		V _S = ±15V, V _{OUT} = ±10V, R _L = 10kΩ	+25°C	124	140		
			Full	122			
		V _S = ±5V, V _{OUT} = ±2.5V, R _L = 2kΩ	+25°C	108	130		
			Full	106			
		V _S = ±15V, V _{OUT} = ±10V, R _L = 2kΩ	+25°C	118	130		
			Full	110			
Input Offset Voltage Drift	ΔV _{OS} /ΔT		Full		0.4		μV/°C
Output Characteristics							
Output Voltage Swing from Rail	V _{OUT}	V _S = ±15V, R _L = 10kΩ	+25°C		65	95	mV
			Full			125	
		V _S = ±15V, R _L = 2kΩ	+25°C		310	450	
			Full			600	
Output Short-Circuit Current	I _{SC}		+25°C	±28	±50		mA
Power Supply							
Operating Voltage Range	V _S		Full	3.6		36	V
Quiescent Current/Amplifier	I _Q	I _{OUT} = 0mA	+25°C		1.5	2	mA
			Full			2.2	
Power Supply Rejection Ratio	PSRR	V _S = 3V to 38V	+25°C	121	145		dB
			Full	119			
Dynamic Performance							
Gain-Bandwidth Product	GBP	V _{OUT} = 100mV _{P-P} , R _L = 2kΩ	+25°C		9		MHz
Slew Rate	SR	R _L = 2kΩ	+25°C		8		V/μs
Settling Time to 0.1%	t _S	V _{IN} = 1V Step, R _L = 2kΩ, G = +1	+25°C		1		μs
Overload Recovery Time		R _L = 2kΩ, V _{IN} × G = V _S	+25°C		10		μs
Phase Margin	φ _O	V _{OUT} = 100mV _{P-P} , R _L = 2kΩ, C _L = 10pF	+25°C		45		°
Total Harmonic Distortion + Noise	THD+N	V _{IN} = 1V _{RMS} , G = +1, R _L = 2kΩ, f = 1kHz	+25°C		0.0001		%
Noise							
Input Voltage Noise		f = 0.1Hz to 10Hz	+25°C		280		nV _{P-P}
Input Voltage Noise Density	e _n	f = 1kHz	+25°C		4.5		nV/√Hz
Input Current Noise Density	i _n	f = 1kHz	+25°C		2		pA/√Hz

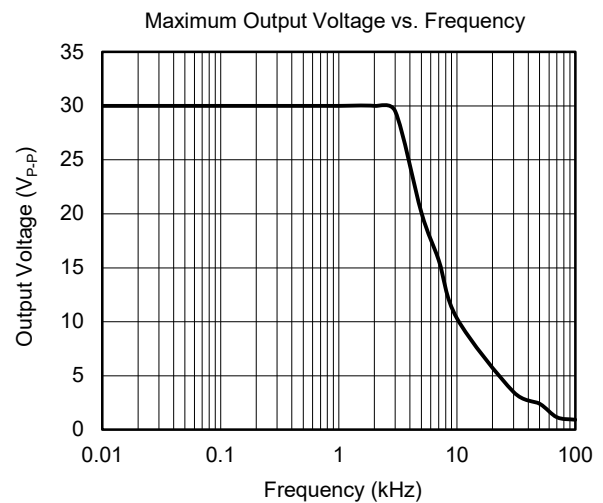
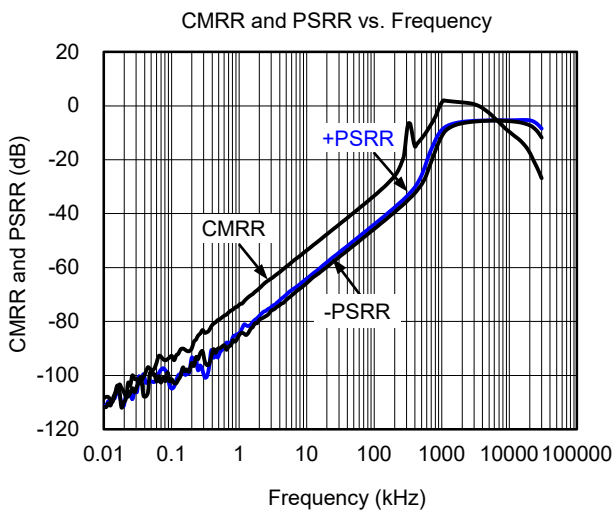
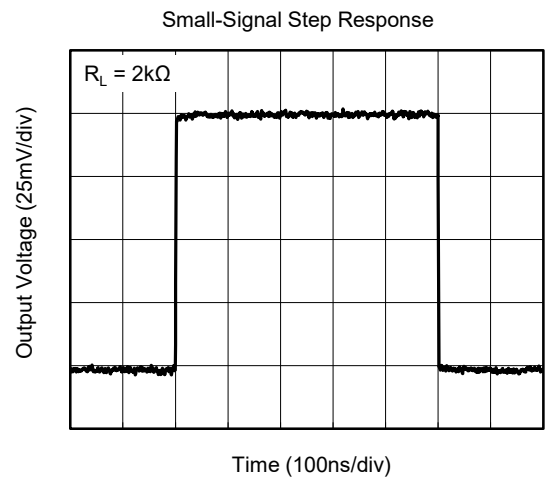
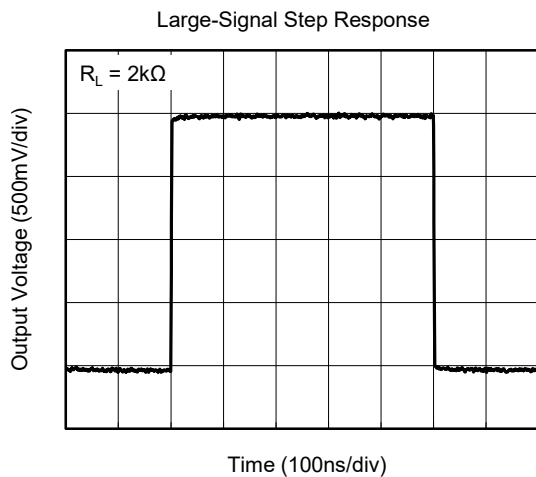
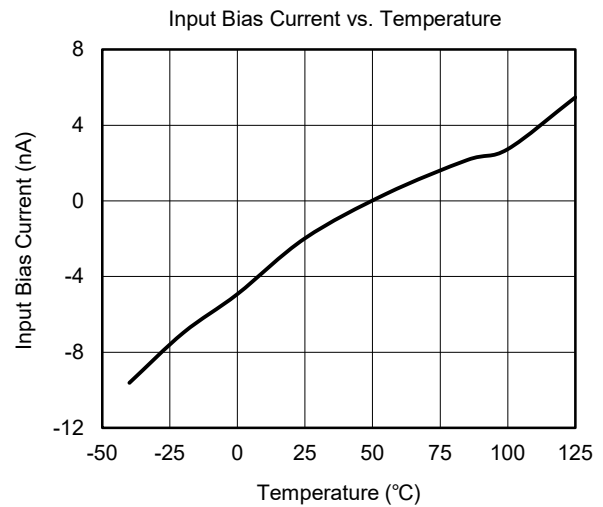
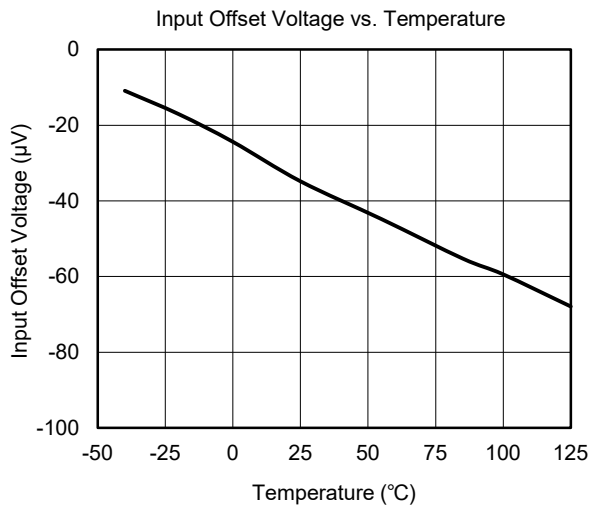
TYPICAL PERFORMANCE CHARACTERISTICS

At $T_A = +25^\circ\text{C}$ and $V_S = \pm 15\text{V}$, unless otherwise noted.



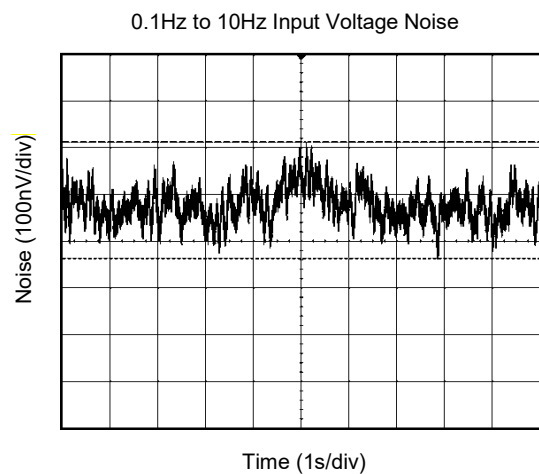
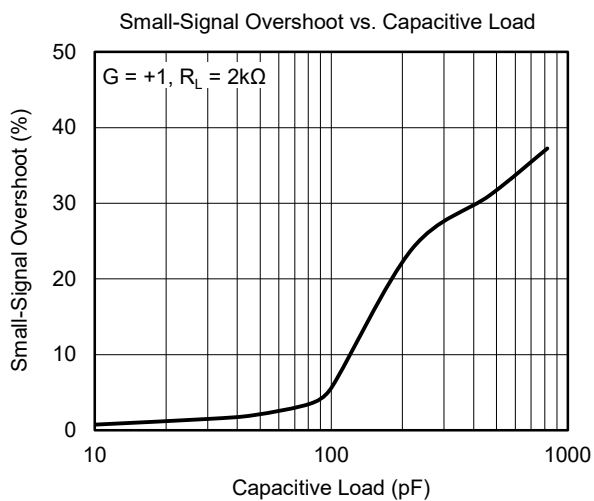
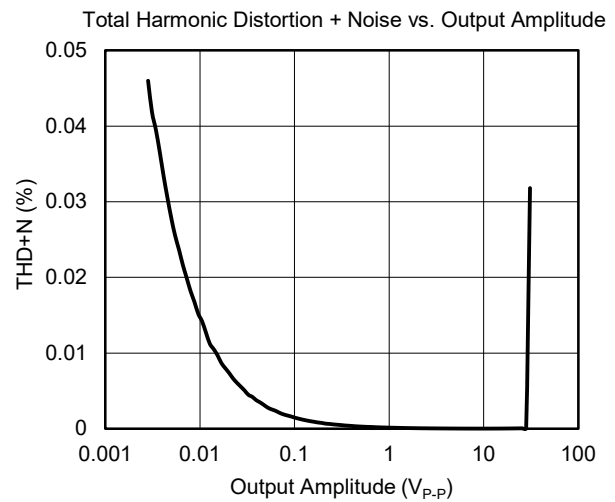
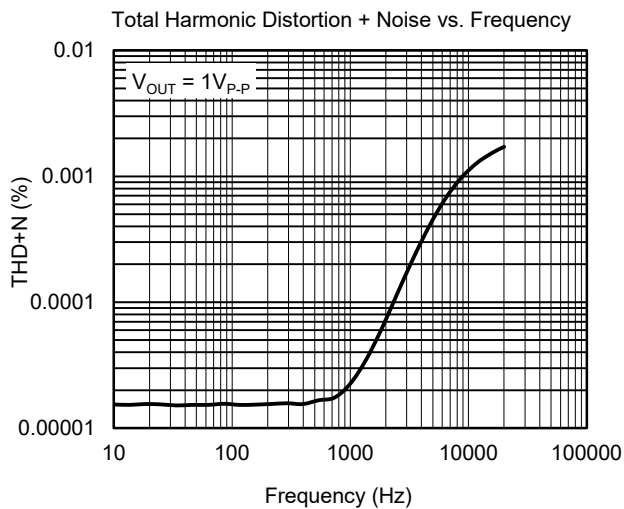
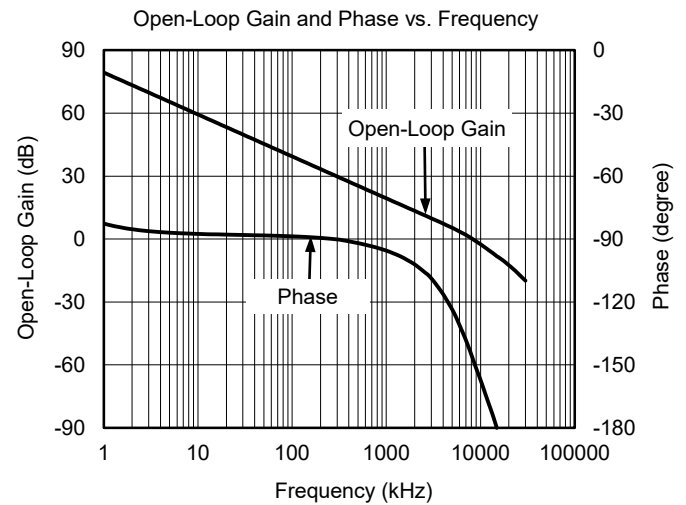
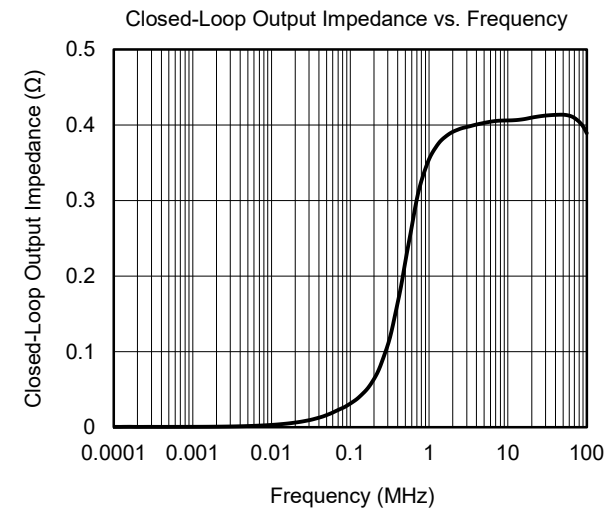
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

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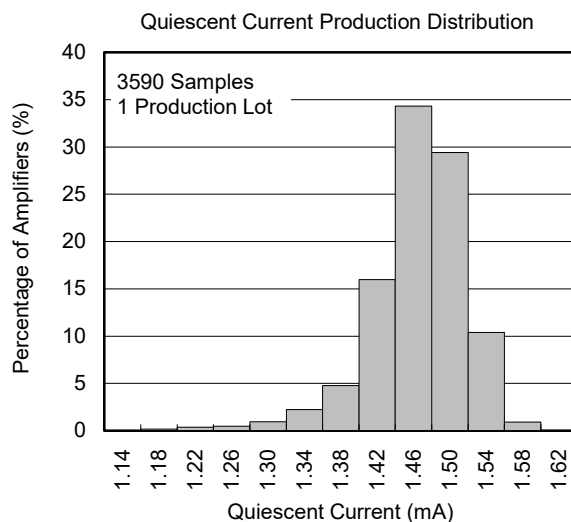
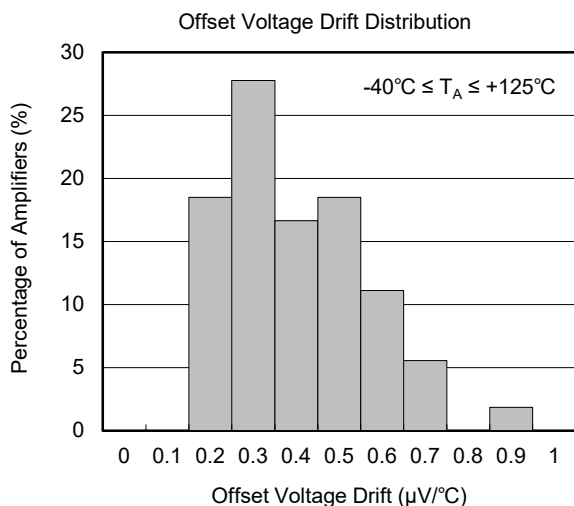
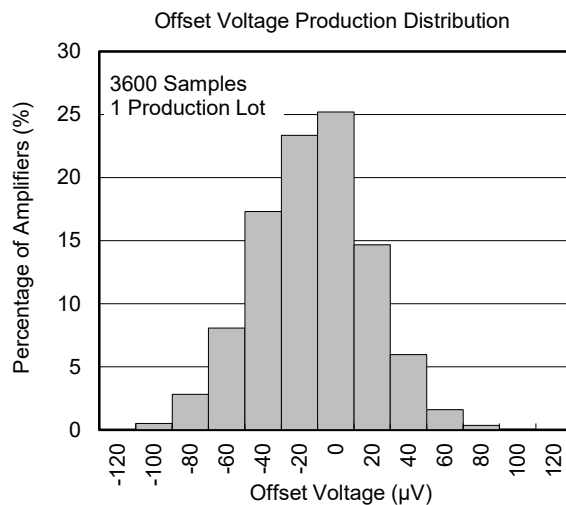
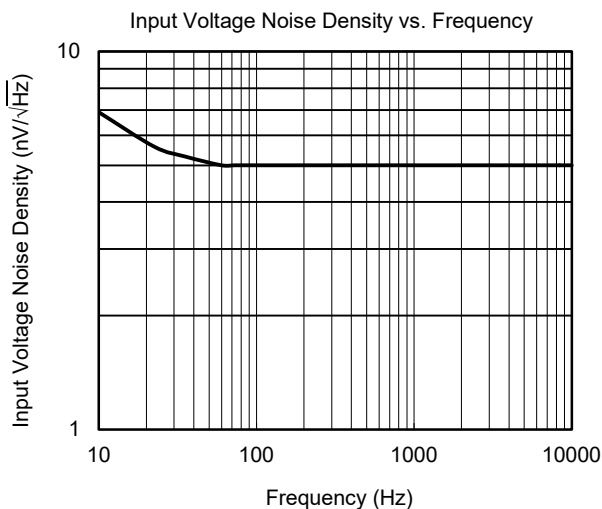
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At $T_A = +25^\circ\text{C}$ and $V_S = \pm 15\text{V}$, unless otherwise noted.



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At $T_A = +25^\circ\text{C}$ and $V_S = \pm 15\text{V}$, unless otherwise noted.



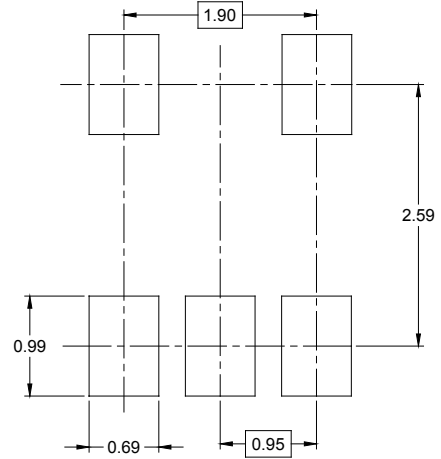
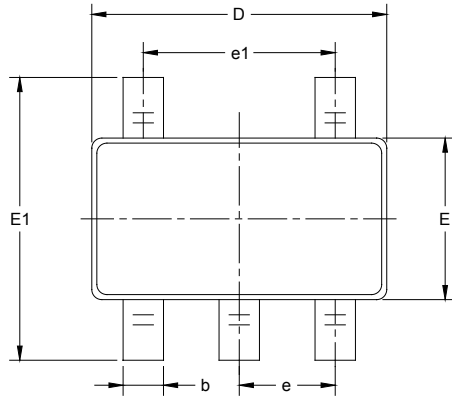
REVISION HISTORY

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

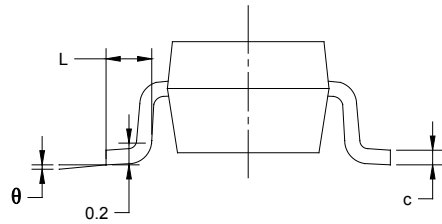
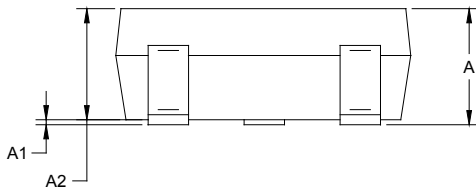
AUGUST 2017 – REV.A to REV.A.1	Page
Updated open-loop gain and phase vs. frequency.....	7
Changes from Original (AUGUST 2017) to REV.A	Page
Changed from product preview to production data.....	All

PACKAGE OUTLINE DIMENSIONS

SOT-23-5



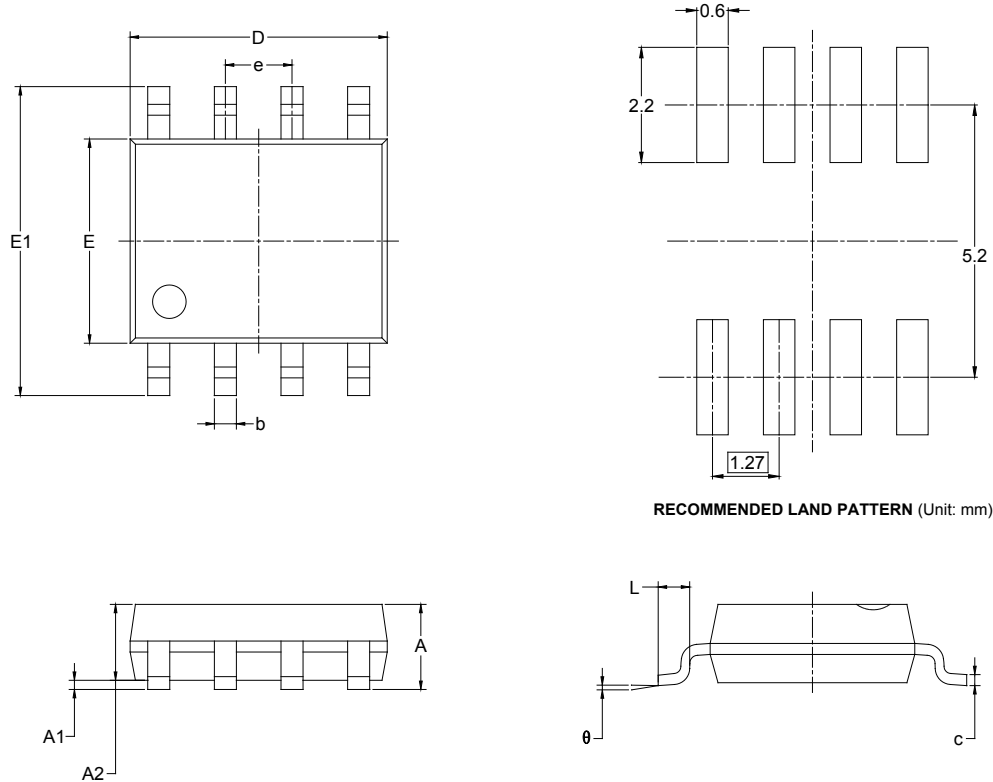
RECOMMENDED LAND PATTERN (Unit: mm)



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 OUTLINE DIMENSIONS

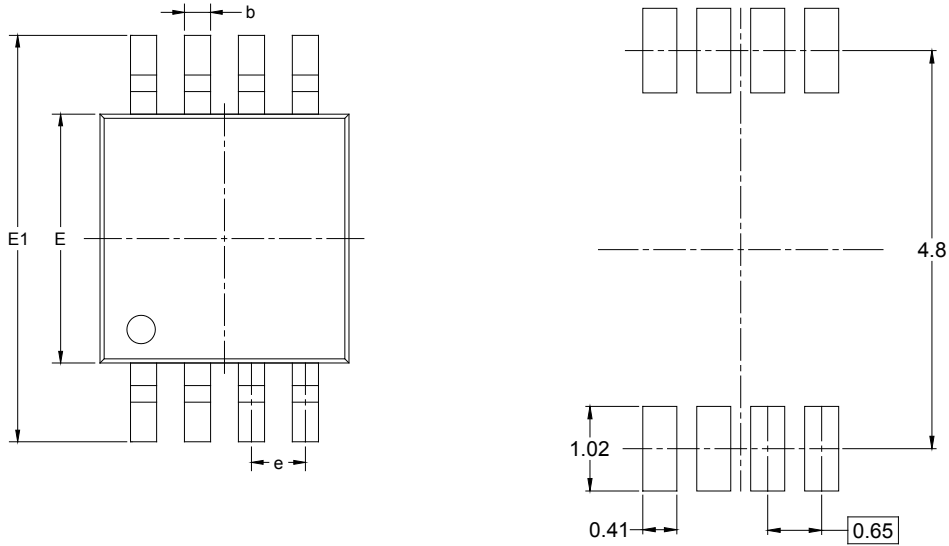
SOIC-8



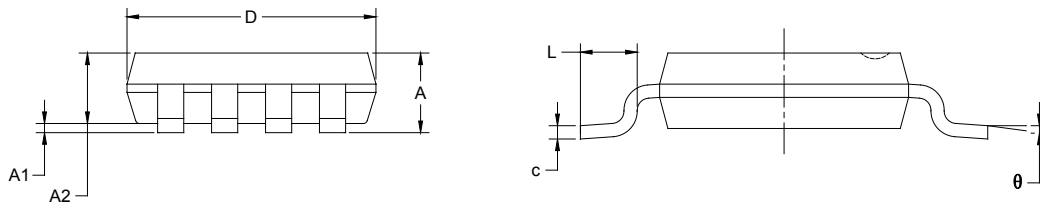
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050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

PACKAGE OUTLINE DIMENSIONS

MSOP-8



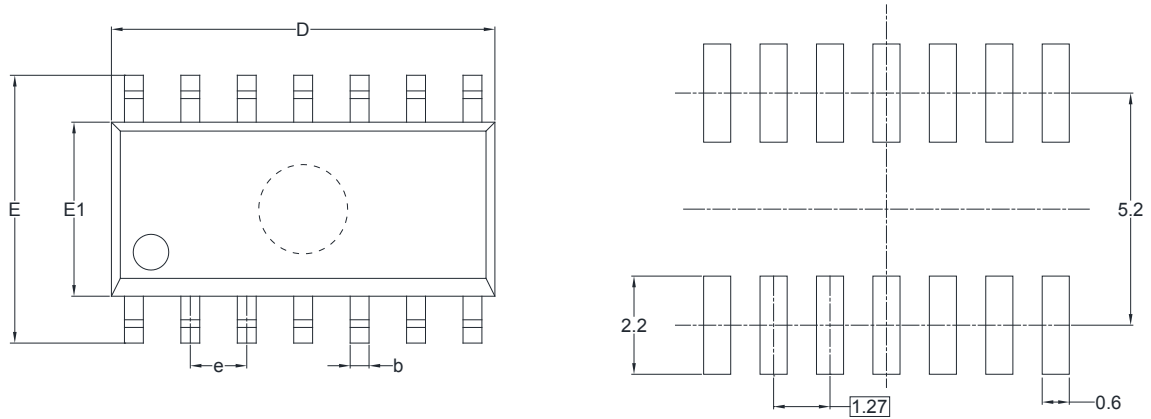
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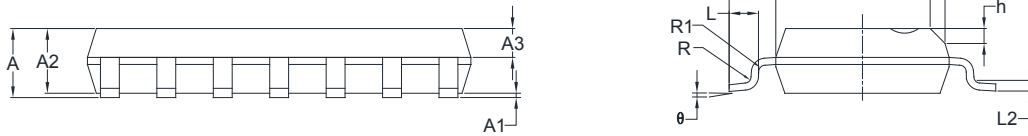
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	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650 BSC		0.026 BSC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

PACKAGE OUTLINE DIMENSIONS

SOIC-14



RECOMMENDED LAND PATTERN (Unit: mm)

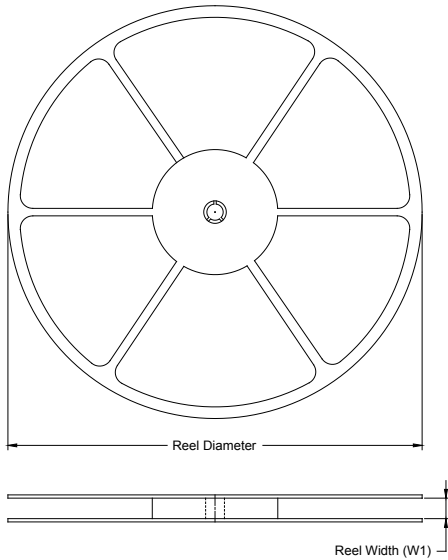


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
A2	1.25	1.65	0.049	0.065
A3	0.55	0.75	0.022	0.030
b	0.36	0.49	0.014	0.019
D	8.53	8.73	0.336	0.344
E	5.80	6.20	0.228	0.244
E1	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
L	0.45	0.80	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°

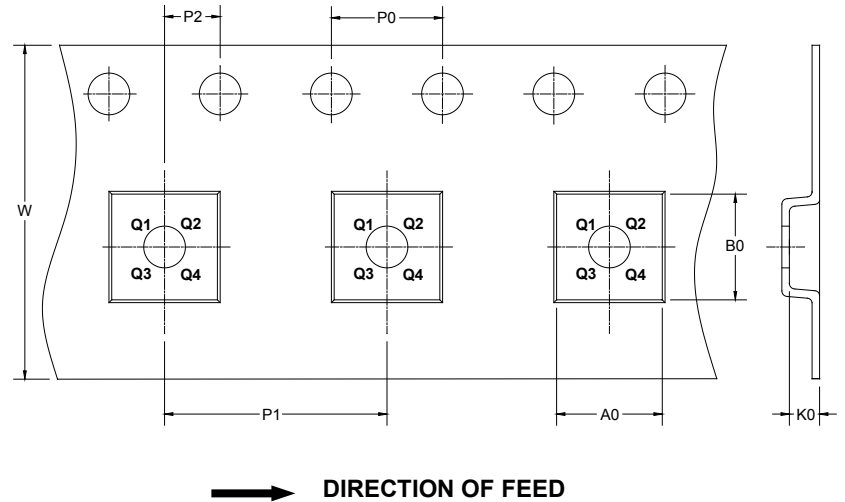
PACKAGE INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



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

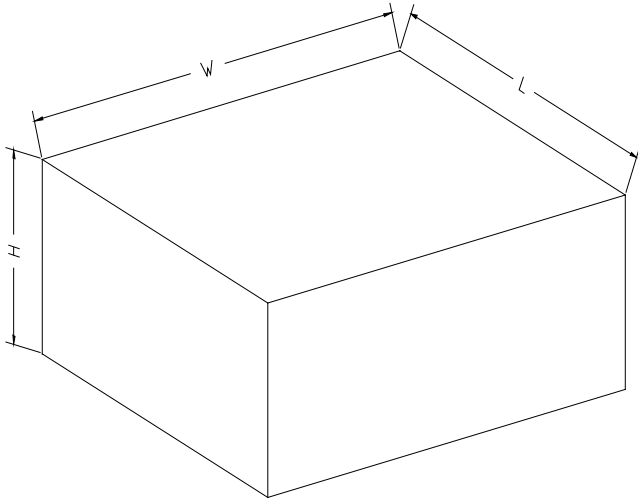
KEY PARAMETER LIST OF TAPE AND REEL

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
SOIC-8	13"	12.4	6.40	5.40	2.10	4.0	8.0	2.0	12.0	Q1
MSOP-8	13"	12.4	5.20	3.30	1.50	4.0	8.0	2.0	12.0	Q1
SOIC-14	13"	16.4	6.60	9.30	2.10	4.0	8.0	2.0	16.0	Q1

DD0001

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
13"	386	280	370	5

DD00002