SGM8271/2/4
High Voltage Rail-to-Rail Output Operational Amplifiers

GENERAL DESCRIPTION

The SGM8271 (single), SGM8272 (dual) and SGM8274 (quad) are high voltage operational amplifiers that are designed to offer a wide input common mode voltage range and output voltage swing. These devices can operate from ±2.25V to ±18V dual power supplies or from +4.5V to +36V single supplies.

The devices feature high slew rate, low input bias and offset current, low offset voltage and low offset-voltage temperature coefficient.

The SGM8271/2/4 are specified over the extended -40℃ to +125℃ temperature range. The SGM8271 single is available in Green SOT-23-5, MSOP-8 and SOIC-8 packages. The SGM8272 dual is available in Green SOIC-8 and MSOP-8 packages. The SGM8274 quad is available in Green SOIC-14 and TSSOP-14 packages.

FEATURES

- **Low Power Consumption: 150μA/Amplifier**
- **Wide Input Common Mode Voltage Range**
- **Low Input Bias and Offset Currents**
- **Output Short-Circuit Protection**
- **Rail-to-Rail Output**
- **High Input Impedance**
- **Low Offset Voltage: 3mV (MAX)**
- **High Slew Rate: 7V/μs**
- **Small Packaging:**
  SGM8271 Available in Green SOT-23-5, MSOP-8 and SOIC-8
  SGM8272 Available in Green MSOP-8 and SOIC-8
  SGM8274 Available in Green TSSOP-14 and SOIC-14

APPLICATIONS

High Impedance Sensors
Photodiode Amplifier
Precision Instrumentation
Phase-Locked Loop Filters
High End, Professional Audio
DAC Output Amplifier
ATE
Medical

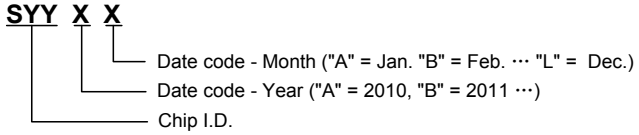
PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM8271	SOT-23-5	-40℃ to +85℃	SGM8271AYN5G/TR	SBDXX	Tape and Reel, 3000
	SOT-23-5	-40℃ to +85℃	SGM8271BYN5G/TR	SG5XX	Tape and Reel, 3000
	MSOP-8	-40℃ to +85℃	SGM8271YMS8G/TR	SGM8271 YMS8 XXXXX	Tape and Reel, 3000
	SOIC-8	-40℃ to +85℃	SGM8271YS8G/TR	SGM 8271YS8 XXXXX	Tape and Reel, 2500
	SOIC-8	-40℃ to +125℃	SGM8271XS8G/TR	SGM 8271XS8 XXXXX	Tape and Reel, 2500
SGM8272	MSOP-8	-40℃ to +85℃	SGM8272YMS8G/TR	SGM8272 YMS8 XXXXX	Tape and Reel, 3000
	SOIC-8	-40℃ to +85℃	SGM8272YS8G/TR	SGM 8272YS8 XXXXX	Tape and Reel, 2500
	SOIC-8	-40℃ to +125℃	SGM8272XS8G/TR	SGM 8272XS8 XXXXX	Tape and Reel, 2500
SGM8274	SOIC-14	-40℃ to +85℃	SGM8274YS14G/TR	SGM8274YS14 XXXXX	Tape and Reel, 2500
	SOIC-14	-40℃ to +125℃	SGM8274XS14G/TR	SGM8274XS14 XXXXX	Tape and Reel, 2500
	TSSOP-14	-40℃ to +85℃	SGM8274YTS14G/TR	SGM8274 YTS14 XXXXX	Tape and Reel, 3000

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: SBDCA (2012, January)

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
Differential Input Voltage..... 1.5V
Storage Temperature Range .....-65℃ to +150℃
Junction Temperature .....+150℃
Operating Temperature Range .....-40℃ to +125℃
Lead Temperature (Soldering 10sec) .....+260℃
ESD Susceptibility
HBM.....4000V
MM (SGM8271/2) 150V
MM (SGM8274) 300V

NOTE:
1. Proper power-supply sequencing is recommended for the CMOS device. Always sequence V_S on first, followed by the inputs and outputs.

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

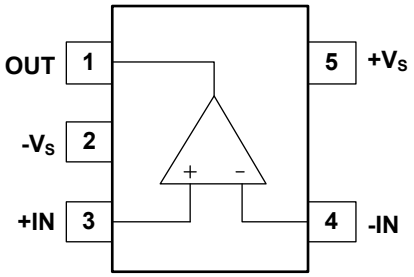
This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance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

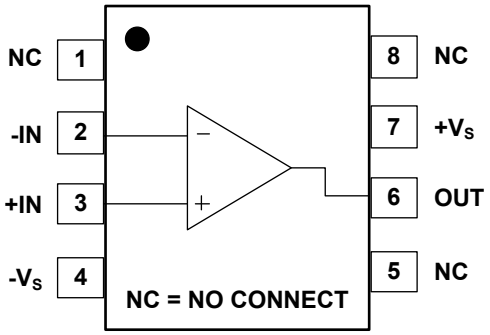
PIN CONFIGURATIONS

SGM8271AYN5G



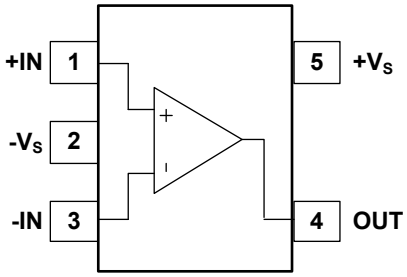
SOT-23-5

SGM8271



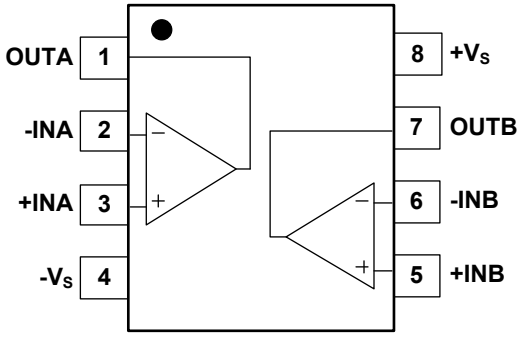
SOIC-8/MSOP-8

SGM8271BYN5G



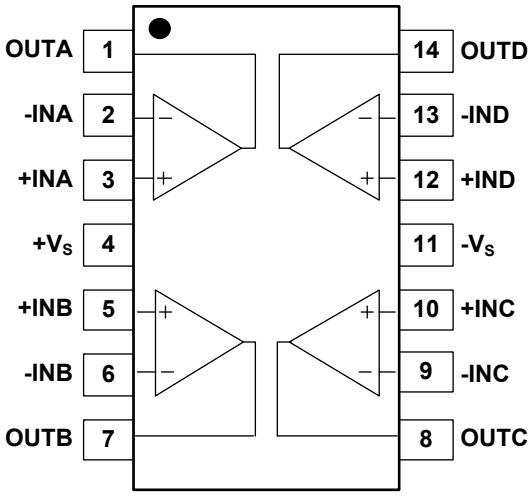
SOT-23-5

SGM8272



SOIC-8/MSOP-8

SGM8274



TSSOP-14/SOIC-14

ELECTRICAL CHARACTERISTICS

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

PARAMETER		CONDITIONS	SGM8271/2/4					
			TYP	MIN/MAX OVER TEMPERATURE				
			+25℃	+25℃	-40℃ to 85℃	-40℃ to 125℃	UNITS	MIN/MAX
Input Offset Voltage (V_{OS})		V_{CM} = +2.5V	0.6	3.0	3.8	3.9	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	70	dB	MIN
Output Voltage Swing from Rail	V_{OH}	R_L = 10kΩ	16	39	43	46	mV	MAX
	V_{OL}	R_L = 10kΩ	14	30	34	38	mV	MAX
Output Short-Circuit Current (I_{SC})	Sink	R_L = 10Ω	46.2	34.1	21.5	11.0	mA	MIN
	Source	R_L = 10Ω	44.4	30.5	20.7	12.3		
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	60	dB	MIN
Power Supply Rejection Ratio (PSRR)		V_S = +4.5V to +36V	103	82	80	78	dB	MIN
Quiescent Current/Amplifier		I_{OUT} = 0A	144	275	309	329	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
Channel-to-Channel Crosstalk		f = 1MHz	-80				dB	TYP
Slew Rate (SR)	Up	V_{OUT} = $2V_{PP}$ step, C_L = 100pF, A_V = 1	5				V/μs	TYP
	Down	V_{OUT} = $2V_{PP}$ step, C_L = 100pF, A_V = 1	5				V/μs	TYP
Overload Recovery Time (ORT)	Up	V_{IN} × Gain = V_S	2.0				μs	TYP
	Down	V_{IN} × Gain = V_S	4.0					
Settling Time (t_S)		C_L = 100pF, A_V = 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} = $2V_{PP}$, f = 1kHz, A_V = 1, R_L = 600Ω	0.018				%	TYP
		V_{OUT} = $2V_{PP}$, f = 1kHz, A_V = 1, R_L = 2kΩ	0.009					

ELECTRICAL CHARACTERISTICS (continued)

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

PARAMETER		CONDITIONS	SGM8271/2/4					
			TYP	MIN/MAX OVER TEMPERATURE				
			+25℃	+25℃	-40℃ to 85℃	-40℃ to 125℃	UNITS	MIN/MAX
Input Offset Voltage (V_{OS})		V_{CM} = 0V	0.6	3.0	3.8	3.9	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	76	dB	MIN
Output Voltage Swing from Rail	V_{OH}	R_L = 10kΩ	28	67	73	79	mV	MAX
	V_{OL}	R_L = 10kΩ	23	39	47	62	mV	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	66	dB	MIN
Quiescent Current/Amplifier		I_{OUT} = 0A	145	276	311	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
Channel-to-Channel Crosstalk		f = 1MHz	-80				dB	TYP
Slew Rate (SR)	Up	V_{OUT} = $2V_{PP}$ step, C_L = 100pF, A_V = 1	6				V/μs	TYP
	Down	V_{OUT} = $2V_{PP}$ step, C_L = 100pF, A_V = 1	4				V/μs	TYP
Overload Recovery Time (ORT)	Up	V_{IN} × Gain = V_S	1.5				μs	TYP
	Down	V_{IN} × Gain = V_S	2.5					
Settling Time (t_S)		C_L = 100pF, A_V = 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} = $2V_{PP}$, f = 1kHz, A_V = 1, R_L = 600Ω	0.018				%	TYP
		V_{OUT} = $2V_{PP}$, f = 1kHz, A_V = 1, R_L = 2kΩ	0.009					

ELECTRICAL CHARACTERISTICS (continued)

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

PARAMETER		CONDITIONS	SGM8271/2/4					
			TYP	MIN/MAX OVER TEMPERATURE				
			+25℃	+25℃	-40℃ to 85℃	-40℃ to 125℃	UNITS	MIN/MAX
Input Offset Voltage (V_{OS})		V_{CM} = 0V	0.6	3.0	3.8	3.9	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	80	dB	MIN
Output Voltage Swing from Rail	V_{OH}	R_L = 10kΩ	67	174	193	210	mV	MAX
	V_{OL}	R_L = 10kΩ	63	102	124	148	mV	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	66	dB	MIN
Quiescent Current/Amplifier		I_{OUT} = 0A	150	286	320	337	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
Channel-to-Channel Crosstalk		f = 1MHz	-80				dB	TYP
Slew Rate (SR)	Up	V_{OUT} = 2V_{PP} step, C_L = 100pF, A_V = 1	7				V/μs	TYP
	Down	V_{OUT} = 2V_{PP} step, C_L = 100pF, A_V = 1	4				V/μs	TYP
Overload Recovery Time (ORT)	Up	V_{IN} × Gain = V_S	0.5				μs	TYP
	Down	V_{IN} × Gain = V_S	1.0					
Settling Time (t_S)		C_L = 100pF, A_V = 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_{PP}, f = 1kHz, A_V = 1, R_L = 600Ω	0.018				%	TYP
		V_{OUT} = 2V_{PP}, f = 1kHz, A_V = 1, R_L = 2kΩ	0.009					

ELECTRICAL CHARACTERISTICS (continued)

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

PARAMETER		CONDITIONS	SGM8271/2/4					
			TYP	MIN/MAX OVER TEMPERATURE				
			+25℃	+25℃	-40℃ to 85℃	-40℃ to 125℃	UNITS	MIN/MAX
Input Offset Voltage (V_{OS})		V_{CM} = 0V	0.6	3.0	3.8	3.9	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	82	dB	MIN
Output Voltage Swing from Rail	V_{OH}	R_L = 10kΩ	81	208	231	251	mV	MAX
	V_{OL}	R_L = 10kΩ	73	119	146	172	mV	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	69	dB	MIN
Quiescent Current/Amplifier		I_{OUT} = 0A	157	299	332	352	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
Channel-to-Channel Crosstalk		f = 1MHz	-80				dB	TYP
Slew Rate (SR)	Up	V_{OUT} = 2V_{PP} step, C_L = 100pF, A_V = 1	7				V/μs	TYP
	Down	V_{OUT} = 2V_{PP} step, C_L = 100pF, A_V = 1	4				V/μs	TYP
Overload Recovery Time (ORT)	Up	V_{IN} × Gain = V_S	0.5				μs	TYP
	Down	V_{IN} × Gain = V_S	1.0					
Settling Time (t_S)		C_L = 100pF, A_V = 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_{PP}, f = 1kHz, A_V = 1, R_L = 600Ω	0.018				%	TYP
		V_{OUT} = 2V_{PP}, f = 1kHz, A_V = 1, R_L = 2kΩ	0.009					

TYPICAL APPLICATION CIRCUITS

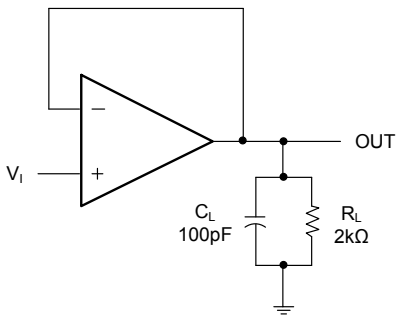


Figure 1

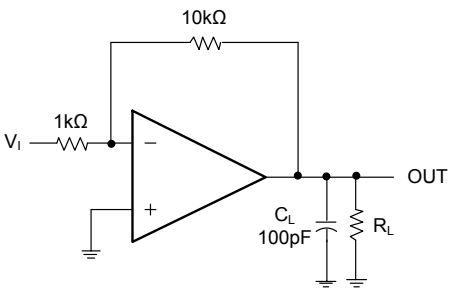


Figure 2

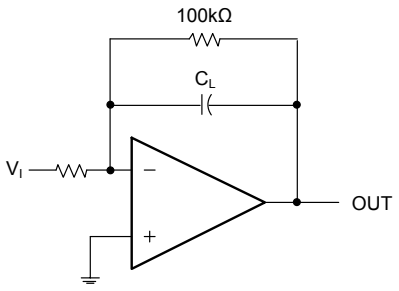
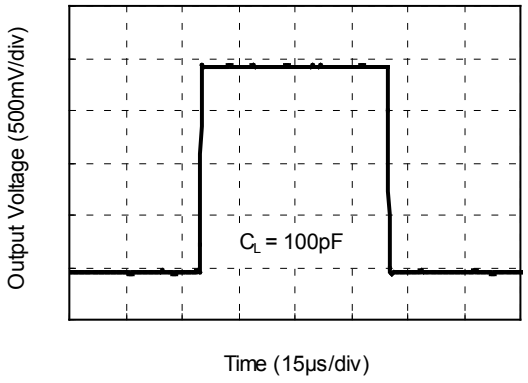


Figure 3

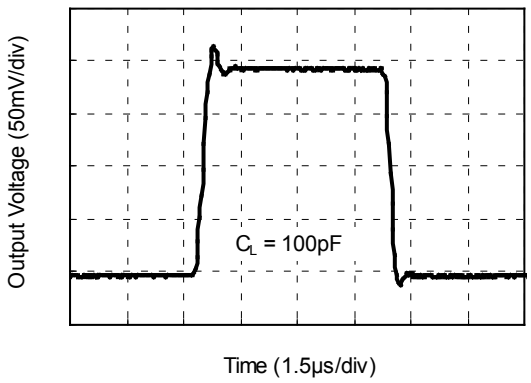
TYPICAL PERFORMANCE CHARACTERISTICS

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

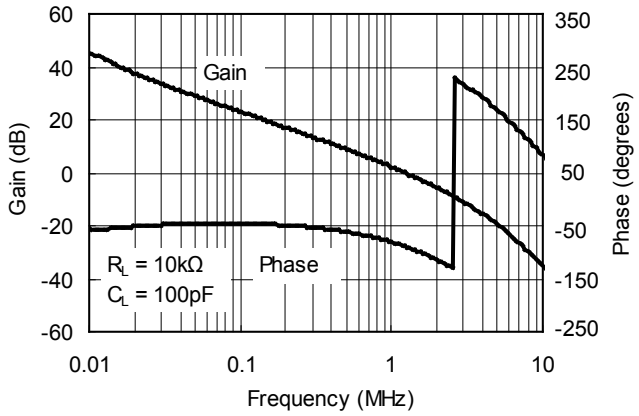
Large Signal Step Response



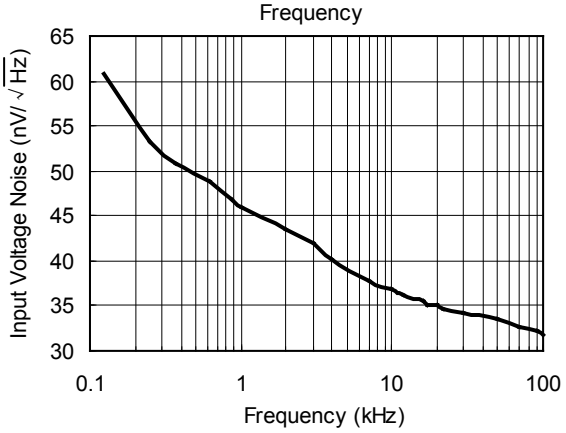
Small Signal Step Response



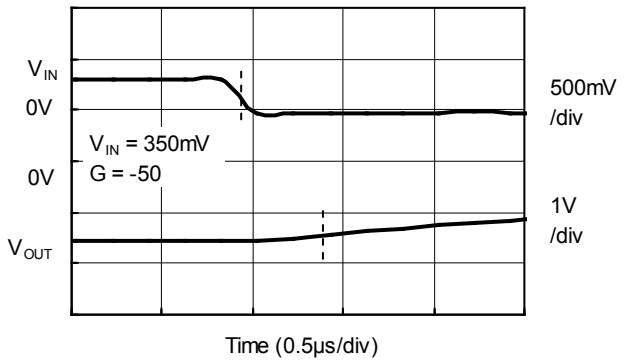
Gain and Phase vs. Frequency



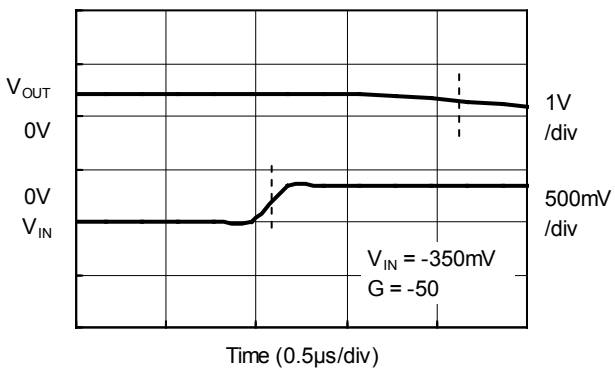
Input Voltage Noise Spectral Density vs. Frequency



Negative Overload Recovery Time

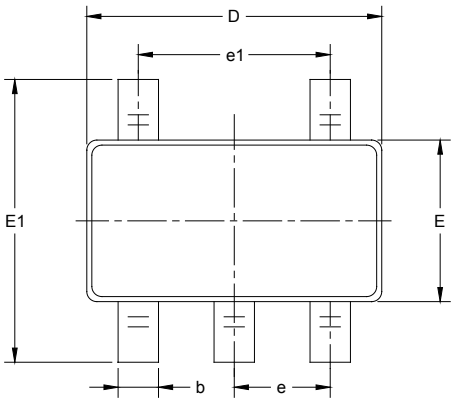


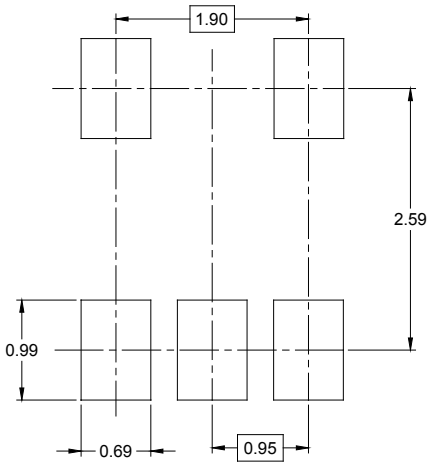
Positive Overload Recovery Time



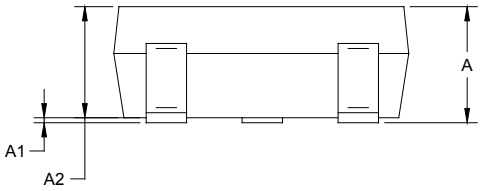
PACKAGE OUTLINE DIMENSIONS

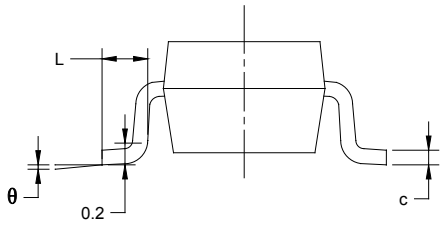
SOT-23-5





RECOMMENDED LAND PATTERN (Unit: mm)

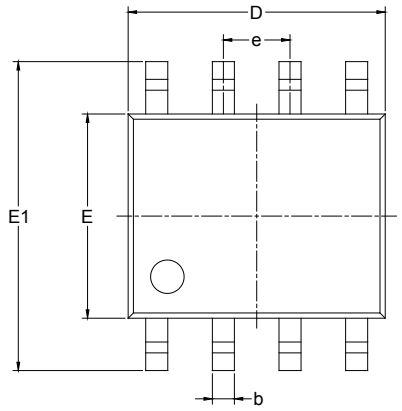


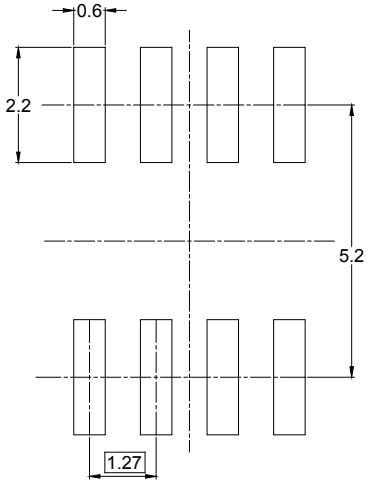


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037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

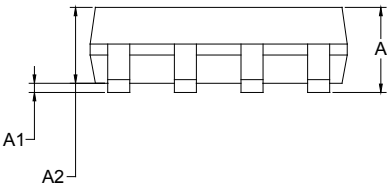
PACKAGE OUTLINE DIMENSIONS

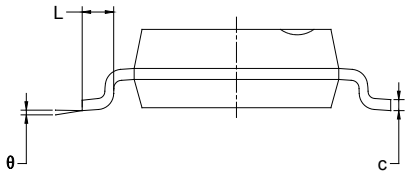
SOIC-8





RECOMMENDED LAND PATTERN (Unit: mm)

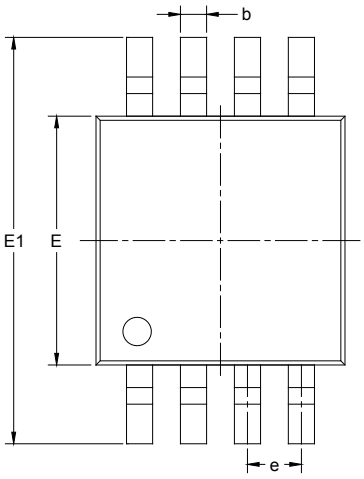


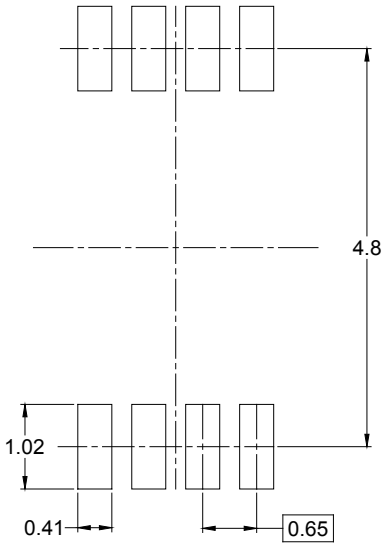


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050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

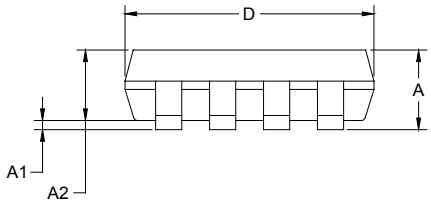
PACKAGE OUTLINE DIMENSIONS

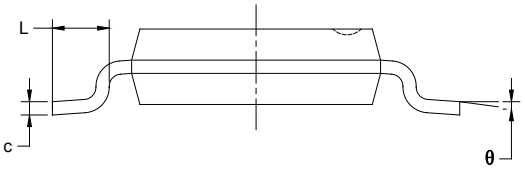
MSOP-8





RECOMMENDED LAND PATTERN (Unit: mm)

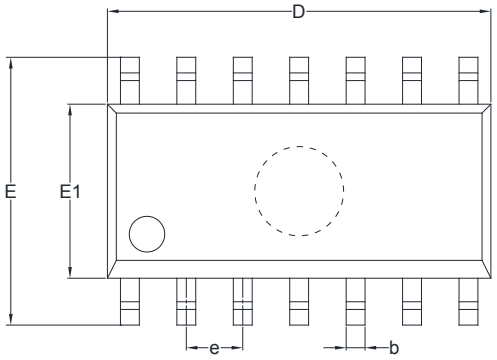


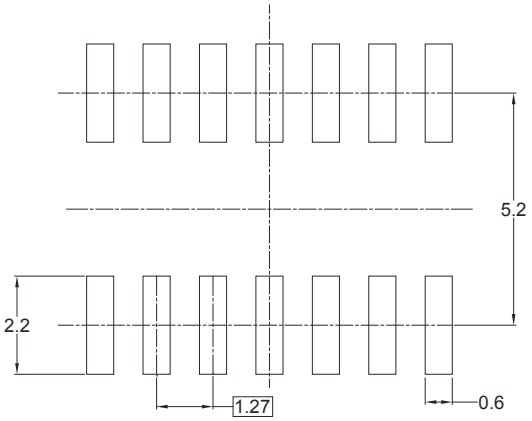


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650 BSC		0.026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

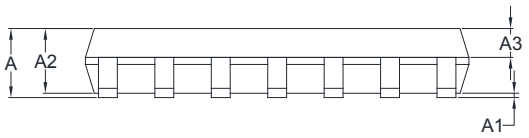
PACKAGE OUTLINE DIMENSIONS

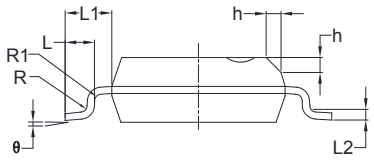
SOIC-14





RECOMMENDED LAND PATTERN (Unit: mm)

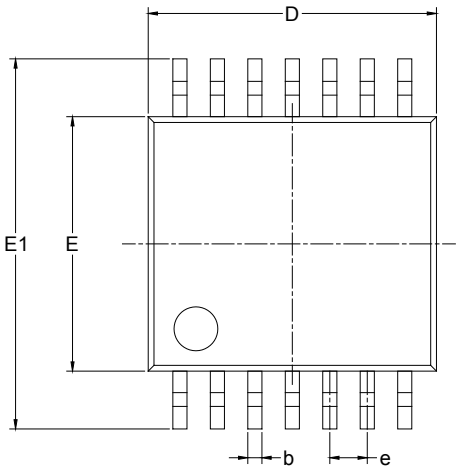


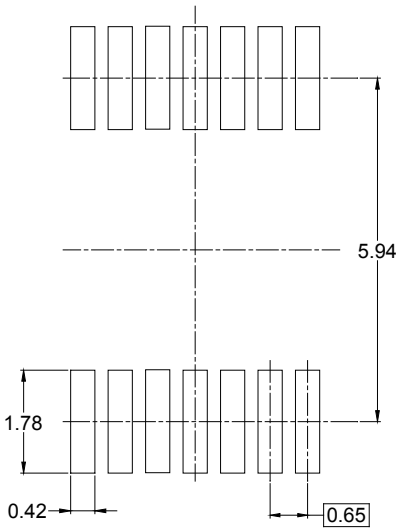


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
A2	1.25	1.65	0.049	0.065
A3	0.55	0.75	0.022	0.030
b	0.36	0.49	0.014	0.019
D	8.53	8.73	0.336	0.344
E	5.80	6.20	0.228	0.244
E1	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
L	0.45	0.80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

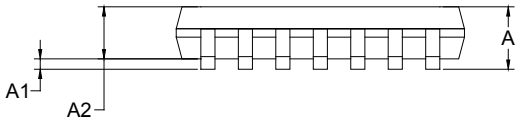
PACKAGE OUTLINE DIMENSIONS

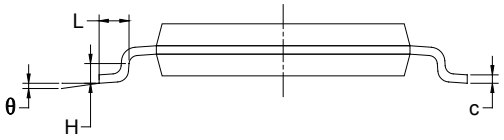
TSSOP-14





RECOMMENDED LAND PATTERN (Unit: mm)

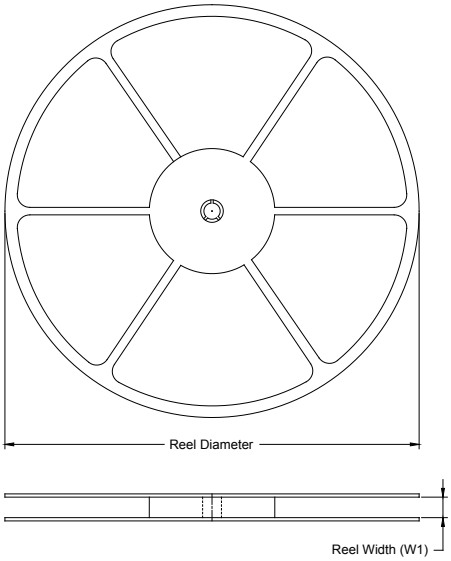




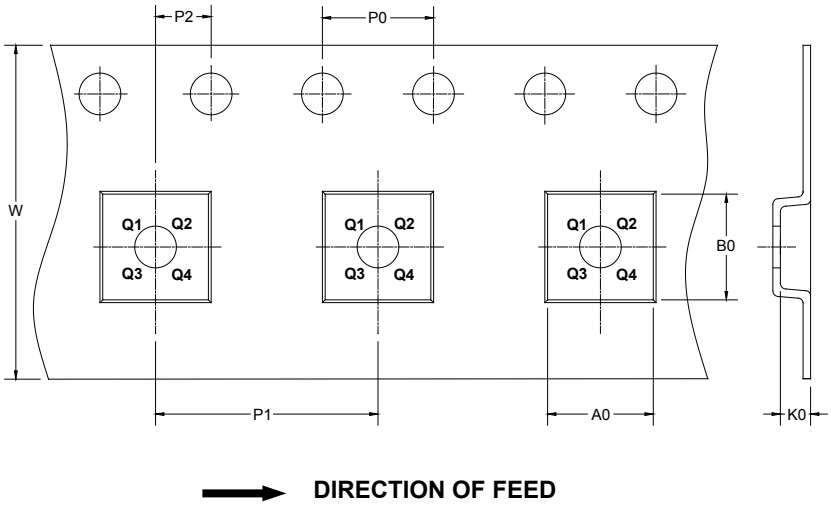
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.200		0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.050	0.031	0.041
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	4.860	5.100	0.191	0.201
E	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650 BSC		0.026 BSC	
L	0.500	0.700	0.02	0.028
H	0.25 TYP		0.01 TYP	
θ	1°	7°	1°	7°

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



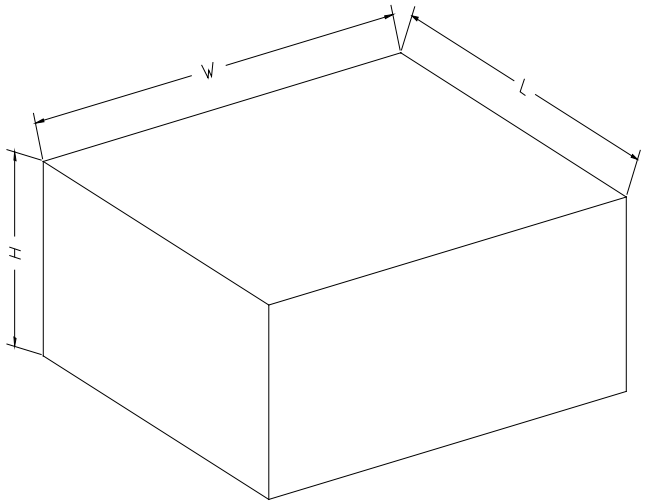
NOTE: The picture is only for reference. Please make the object as the standard.

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
TSSOP-14	13″	12.4	6.95	5.60	1.20	4.0	8.0	2.0	12.0	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