



SGM8291/2/4

High Voltage Rail-to-Rail Output Operational Amplifiers

GENERAL DESCRIPTION

The SGM8291 (single), SGM8292 (dual) and SGM8294 (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 $\pm 2.25\text{V}$ to $\pm 18\text{V}$ dual power supplies or from $+4.5\text{V}$ to $+36\text{V}$ single supplies.

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

The SGM8291/2/4 are specified over the extended -40°C to $+125^\circ\text{C}$ temperature range. The SGM8291 single is available in Green SOT-23-5, MSOP-8 and SOIC-8 packages. The SGM8292 dual is available in Green SOIC-8 and MSOP-8 packages. The SGM8294 quad is available in Green SOIC-14 and TSSOP-14 packages.

APPLICATIONS

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

FEATURES

- **Low Power Consumption: $150\mu\text{A}/\text{Amplifier}$**
- **Low Offset Voltage: 1.5mV (MAX)**
- **Wide Input Common Mode and Differential Voltage Ranges**
- **Low Input Bias and Offset Currents**
- **Output Short-Circuit Protection**
- **Rail-to-Rail Output**
- **High Input Impedance**
- **High Slew Rate: $7\text{V}/\mu\text{s}$**
- **Small Packaging:**
 - SGM8291 Available in SOT-23-5, MSOP-8 and SOIC-8 Packages**
 - SGM8292 Available in MSOP-8 and SOIC-8 Packages**
 - SGM8294 Available in TSSOP-14 and SOIC-14 Packages**



PACKAGE/ORDERING INFORMATION

MODEL	ORDER NUMBER	SPECIFIED TEMPERATURE RANGE	PACKAGE DESCRIPTION	PACKAGE OPTION	MARKING INFORMATION
SGM8291	SGM8291AYN5G/TR	-40°C to +85°C	SOT-23-5	Tape and Reel, 3000	SCEXX
	SGM8291BYN5G/TR	-40°C to +85°C	SOT-23-5	Tape and Reel, 3000	SG6XX
	SGM8291YMS8G/TR	-40°C to +85°C	MSOP-8	Tape and Reel, 3000	SGM8291 YMS8 XXXXX
	SGM8291YS8G/TR	-40°C to +85°C	SOIC-8	Tape and Reel, 2500	SGM 8291YS8 XXXXX
SGM8292	SGM8292YMS8G/TR	-40°C to +85°C	MSOP-8	Tape and Reel, 3000	SGM8292 YMS8 XXXXX
	SGM8292YS8G/TR	-40°C to +85°C	SOIC-8	Tape and Reel, 2500	SGM 8292YS8 XXXXX
	SGM8292XS8G/TR	-40°C to +125°C	SOIC-8	Tape and Reel, 2500	SGM 8292XS8 XXXXX
SGM8294	SGM8294YS14G/TR	-40°C to +85°C	SOIC-14	Tape and Reel, 2500	SGM8294YS14 XXXXX
	SGM8294YTS14G/TR	-40°C to +85°C	TSSOP-14	Tape and Reel, 3000	SGM8294 YTS14 XXXXX

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

MARKING INFORMATION

SYX X X

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

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

— Chip I.D.

For example: SCECA (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
Storage Temperature Range.....	-65°C to +150°C
Junction Temperature	150°C
Operating Temperature Range.....	-40°C to +125°C
Lead Temperature (Soldering 10sec)	260°C
ESD Susceptibility	
HBM.....	4000V
MM (SGM8291/2).....	150V
MM (SGM8294).....	200V

CAUTION

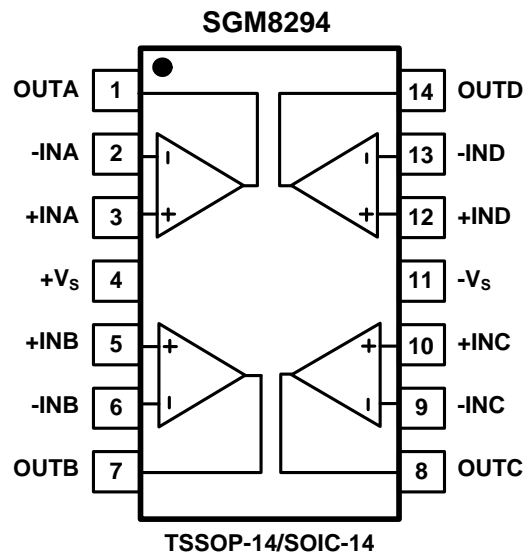
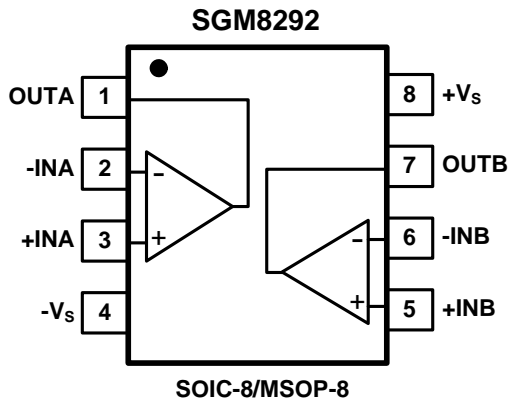
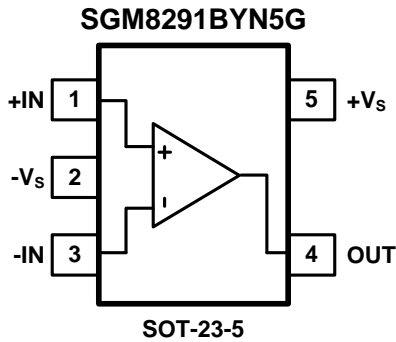
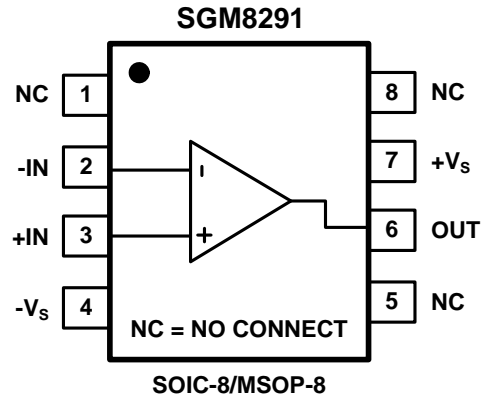
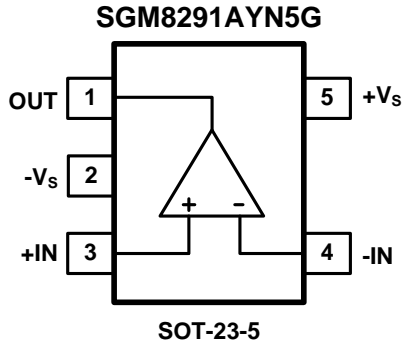
This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance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

NOTES:

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

PIN CONFIGURATIONS (TOP VIEW)



ELECTRICAL CHARACTERISTICS: $V_S = +5V$ (At $R_L = 2k\Omega$ connected to +2.5V, unless otherwise noted.)

PARAMETER	CONDITIONS	SGM8291/2/4						
		TYP	MIN/MAX OVER TEMPERATURE				UNITS	MIN/ MAX
		+25°C	+25°C	-40°C to 85°C	-40°C to 125°C			
Input Offset Voltage (V_{OS})	$V_{CM} = +2.5V$	0.3	1.5	2.4	2.75	mV	MAX	
Input Offset Voltage Drift ($\Delta V_{OS}/\Delta T$)		3				$\mu V/^\circ C$	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 $+4.5V$, $R_L = 5k\Omega$	86	75	72	70	dB	MIN	
Output Voltage Swing from Rail	V_{OH} $R_L = 10k\Omega$	16	39	43	46	mV	MAX	
	V_{OL} $R_L = 10k\Omega$	14	30	34	38	mV	MAX	
Output Short-Circuit Current (I_{SC})	Sink $R_L = 10\Omega$	46.2	34.1	21.5	11.0	mA	MIN	
	Source $R_L = 10\Omega$	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 (per 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				$^\circ$	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 $V_{IN} \times Gain = V_S$	2.0				μs	TYP	
	Down $V_{IN} \times Gain = V_S$	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)	$V_{OUT} = 2V_{PP}$, $f = 1kHz$, $A_V = 1$, $R_L = 600\Omega$	0.018				%	TYP	
	$V_{OUT} = 2V_{PP}$, $f = 1kHz$, $A_V = 1$, $R_L = 2k\Omega$	0.009						

ELECTRICAL CHARACTERISTICS: $V_S = \pm 5V$ (At $R_L = 2k\Omega$ connected to 0V, unless otherwise noted.)

PARAMETER	CONDITIONS	SGM8291/2/4						
		TYP	MIN/MAX OVER TEMPERATURE				UNITS	MIN/ MAX
		+25°C	+25°C	-40°C to 85°C	-40°C to 125°C			
Input Offset Voltage (V_{OS})	$V_{CM} = 0V$	0.3	1.5	2.4	2.75	mV	MAX	
Input Offset Voltage Drift ($\Delta V_{OS}/\Delta T$)		3				$\mu V/^\circ C$	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 $+4.5V$, $R_L = 5k\Omega$	93	81	78	76	dB	MIN	
Output Voltage Swing from Rail	V_{OH} $R_L = 10k\Omega$	28	67	73	79	mV	MAX	
	V_{OL} $R_L = 10k\Omega$	23	39	47	62	mV	MAX	
Output Current (I_{OUT})	$R_L = 10k\Omega$	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 (per 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				$V/\mu s$	TYP	
	Down $V_{OUT} = 2V_{PP}$ step, $C_L = 100pF$, $A_V = 1$	4				$V/\mu s$	TYP	
Overload Recovery Time (ORT)	Up $V_{IN} \times Gain = V_S$	1.5				μs	TYP	
	Down $V_{IN} \times Gain = V_S$	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)	$V_{OUT} = 2V_{PP}$, $f = 1kHz$, $A_V = 1$, $R_L = 600\Omega$	0.018				%	TYP	
	$V_{OUT} = 2V_{PP}$, $f = 1kHz$, $A_V = 1$, $R_L = 2k\Omega$	0.009						

ELECTRICAL CHARACTERISTICS: $V_S = \pm 15V$ (At $R_L = 2k\Omega$ connected to 0V, unless otherwise noted.)

PARAMETER	CONDITIONS	SGM8291/2/4						
		TYP	MIN/MAX OVER TEMPERATURE				UNITS	MIN/ MAX
		+25°C	+25°C	-40°C to 85°C	-40°C to 125°C			
Input Offset Voltage (V_{OS})	$V_{CM} = 0V$	0.3	1.5	2.4	2.75	mV	MAX	
Input Offset Voltage Drift ($\Delta V_{OS}/\Delta T$)		3				$\mu V/^\circ C$	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 $+14.5V$, $R_L = 5k\Omega$	100	85	82	80	dB	MIN	
Output Voltage Swing from Rail	V_{OH} $R_L = 10k\Omega$	67	174	193	210	mV	MAX	
	V_{OL} $R_L = 10k\Omega$	63	102	124	148	mV	MAX	
Output Current (I_{OUT})	$R_L = 10k\Omega$	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 (per 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				$V/\mu s$	TYP	
	Down $V_{OUT} = 2V_{PP}$ step, $C_L = 100pF$, $A_V = 1$	4				$V/\mu s$	TYP	
Overload Recovery Time (ORT)	Up $V_{IN} \times Gain = V_S$	0.5				μs	TYP	
	Down $V_{IN} \times Gain = V_S$	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)	$V_{OUT} = 2V_{PP}$, $f = 1kHz$, $A_V = 1$, $R_L = 600\Omega$	0.018				%	TYP	
	$V_{OUT} = 2V_{PP}$, $f = 1kHz$, $A_V = 1$, $R_L = 2k\Omega$	0.009						

ELECTRICAL CHARACTERISTICS: $V_S = \pm 18V$ (At $R_L = 2k\Omega$ connected to 0V, unless otherwise noted.)

PARAMETER	CONDITIONS	SGM8291/2/4						
		TYP	MIN/MAX OVER TEMPERATURE				UNITS	MIN/ MAX
		+25°C	+25°C	-40°C to 85°C	-40°C to 125°C			
Input Offset Voltage (V_{OS})	$V_{CM} = 0V$	0.3	1.5	2.4	2.75	mV	MAX	
Input Offset Voltage Drift ($\Delta V_{OS}/\Delta T$)		3				$\mu V/^\circ C$	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 $+17.5V$, $R_L = 5k\Omega$	101	87	84	82	dB	MIN	
Output Voltage Swing from Rail	V_{OH} $R_L = 10k\Omega$	81	208	231	251	mV	MAX	
	V_{OL} $R_L = 10k\Omega$	73	119	146	172	mV	MAX	
Output Current (I_{OUT})	$R_L = 10k\Omega$	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 (per 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				$^\circ$	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				$V/\mu s$	TYP	
	Down $V_{OUT} = 2V_{PP}$ step, $C_L = 100pF$, $A_V = 1$	4				$V/\mu s$	TYP	
Overload Recovery Time (ORT)	Up $V_{IN} \times Gain = V_S$	0.5				μs	TYP	
	Down $V_{IN} \times Gain = V_S$	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)	$V_{OUT} = 2V_{PP}$, $f = 1kHz$, $A_V = 1$, $R_L = 600\Omega$	0.018				%	TYP	
	$V_{OUT} = 2V_{PP}$, $f = 1kHz$, $A_V = 1$, $R_L = 2k\Omega$	0.009						

TYPICAL APPLICATION CIRCUITS

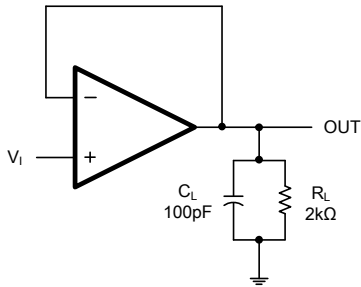


Figure 1

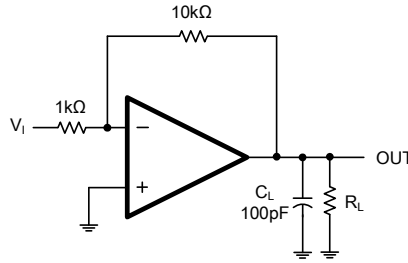


Figure 2

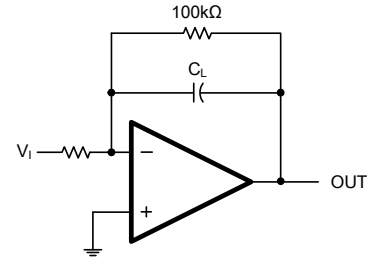
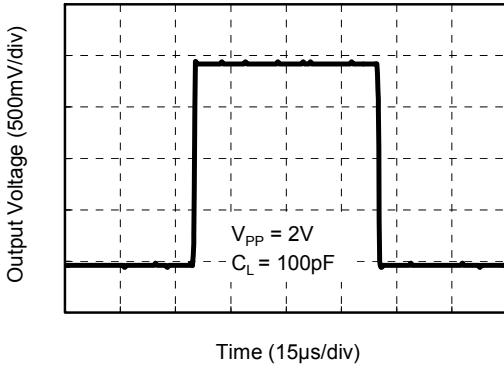


Figure 3

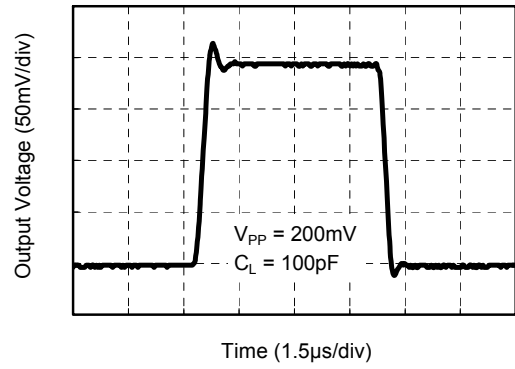
TYPICAL PERFORMANCE CHARACTERISTICS

At $T_A = +25^\circ\text{C}$, $V_S = \pm 15\text{V}$, $R_L = 2\text{k}\Omega$ connected to 0V, unless otherwise noted.

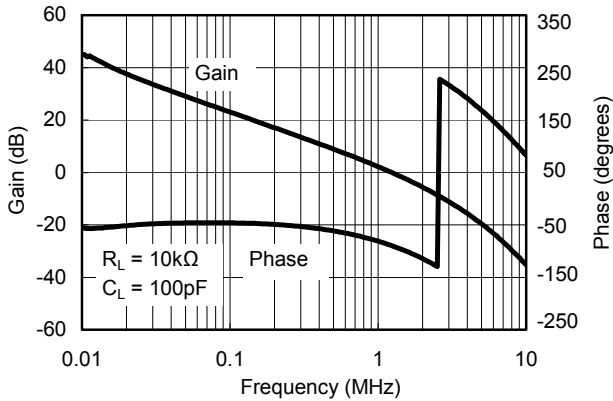
Large Signal Step Response



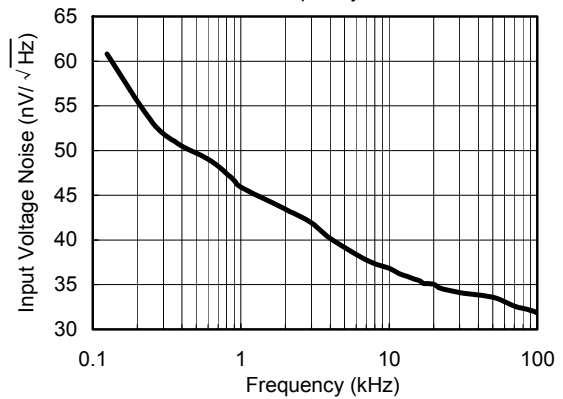
Small Signal Step Response



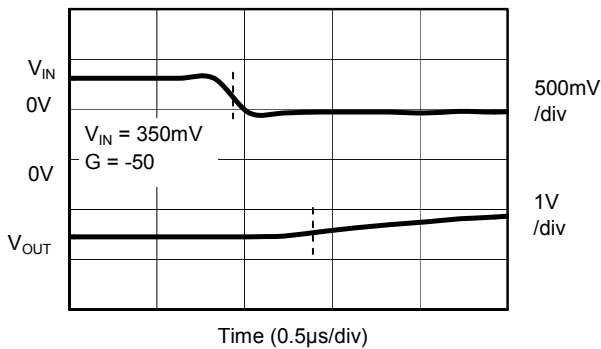
Gain and Phase vs. Frequency



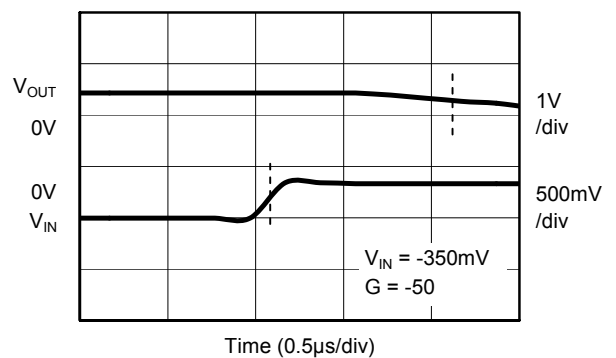
Input Voltage Noise Spectral Density vs. Frequency



Negative Overload Recovery Time

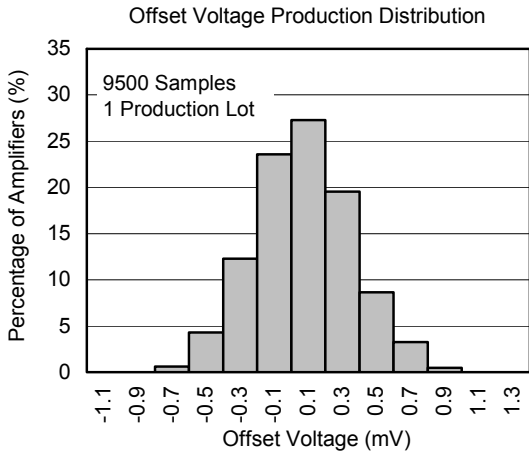


Positive Overload Recovery Time



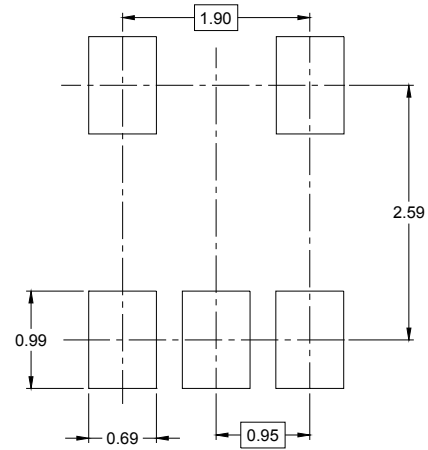
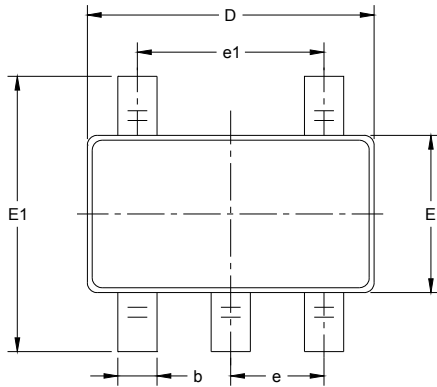
TYPICAL PERFORMANCE CHARACTERISTICS

At $T_A = +25^\circ\text{C}$, $V_S = \pm 15\text{V}$, $R_L = 2\text{k}\Omega$ connected to 0V , unless otherwise noted.

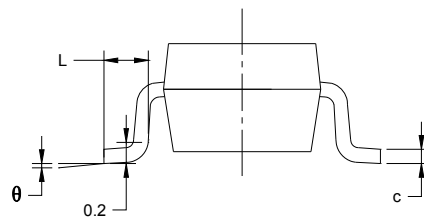
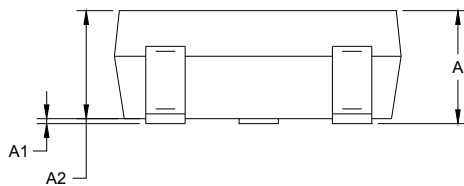


PACKAGE OUTLINE DIMENSIONS

SOT-23-5



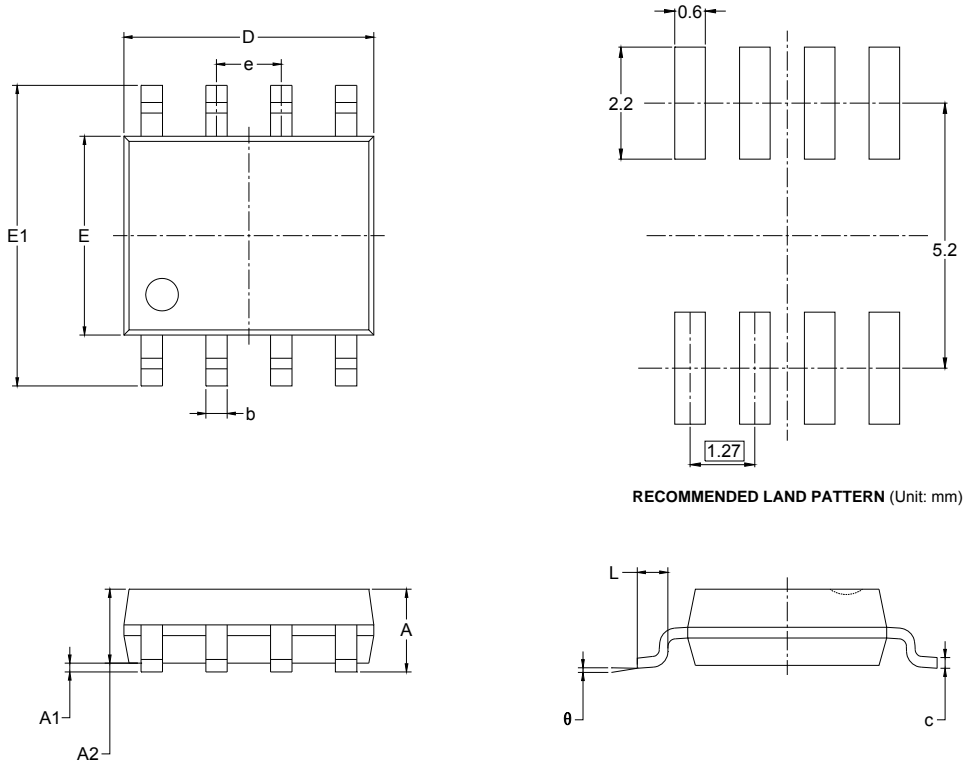
RECOMMENDED LAND PATTERN (Unit: mm)



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

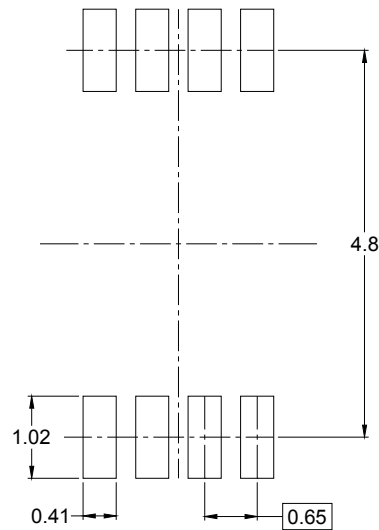
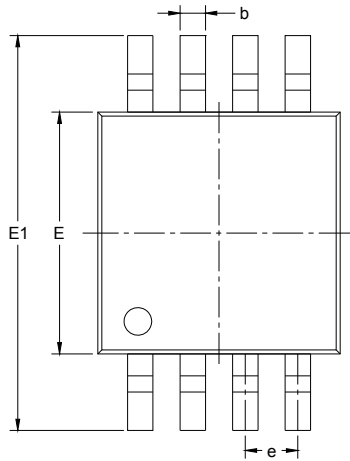


RECOMMENDED LAND PATTERN (Unit: mm)

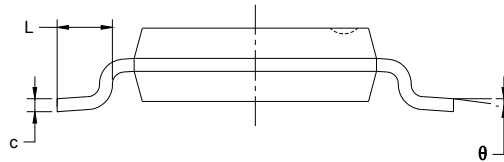
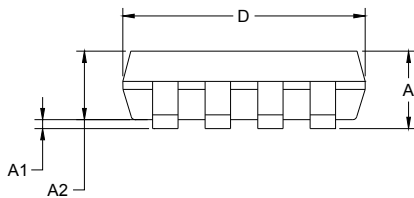
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050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

PACKAGE OUTLINE DIMENSIONS

MSOP-8



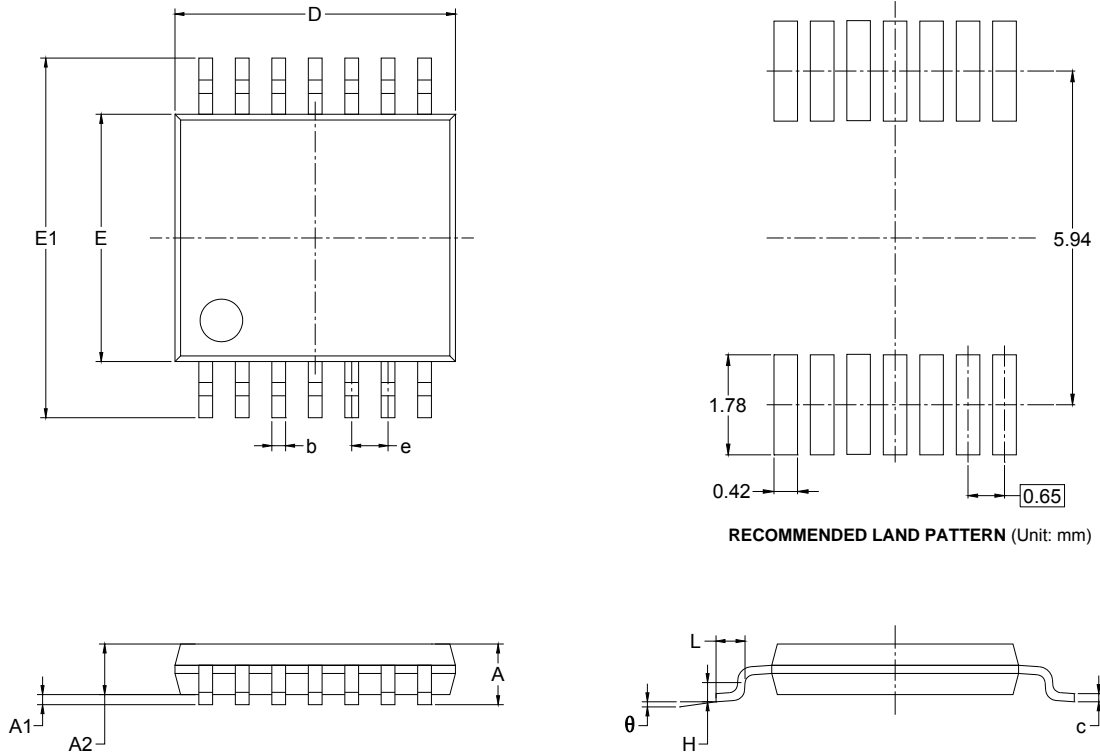
RECOMMENDED LAND PATTERN (Unit: mm)



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

TSSOP-14

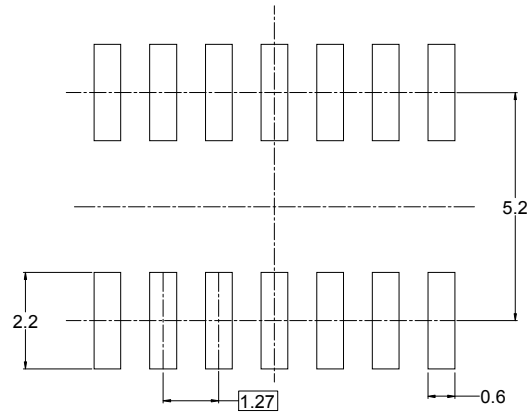
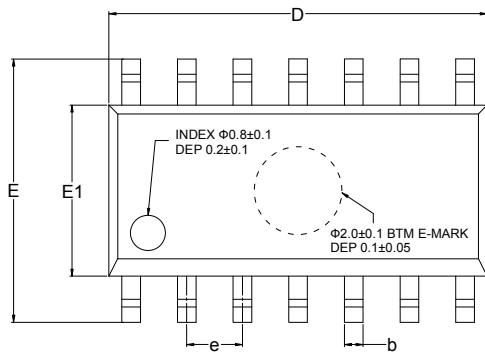


RECOMMENDED LAND PATTERN (Unit: mm)

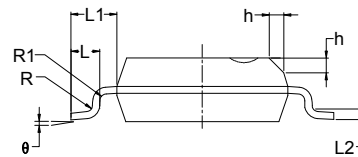
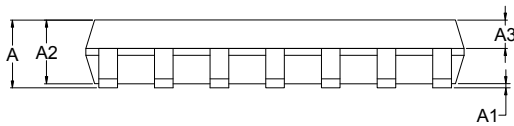
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.100		0.043
A1	0.050	0.150	0.002	0.006
A2	0.800	1.000	0.031	0.039
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	4.900	5.100	0.193	0.201
E	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650 BSC		0.026 BSC	
L	0.500	0.700	0.02	0.028
H	0.25 TYP		0.01 TYP	
θ	1°	7°	1°	7°

PACKAGE OUTLINE DIMENSIONS

SOIC-14



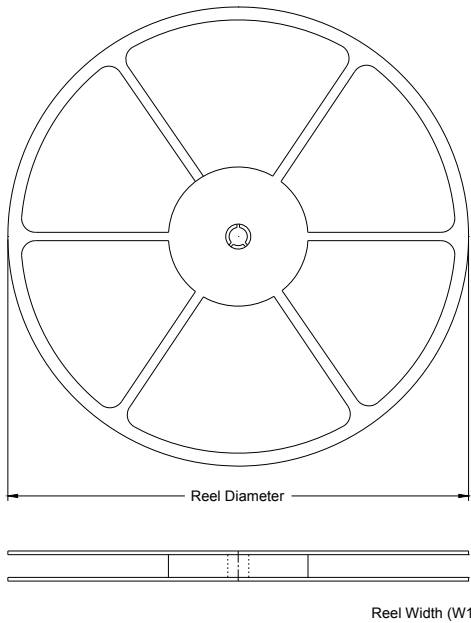
RECOMMENDED LAND PATTERN (Unit: mm)



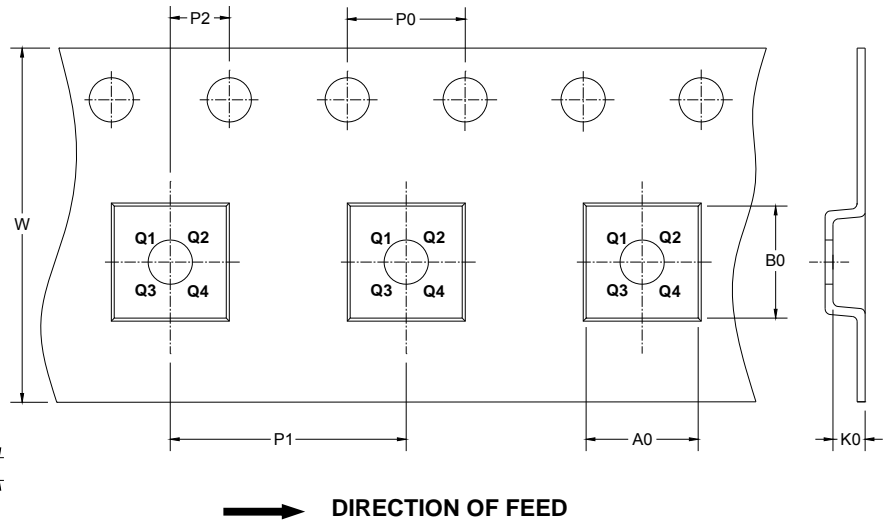
Symbol	Dimensions In Millimeters			Dimensions In Inches		
	MIN	MOD	MAX	MIN	MOD	MAX
A	1.35		1.75	0.053		0.069
A1	0.10		0.25	0.004		0.010
A2	1.25		1.65	0.049		0.065
A3	0.55		0.75	0.022		0.030
b	0.36		0.49	0.014		0.019
D	8.53		8.73	0.336		0.344
E	5.80		6.20	0.228		0.244
E1	3.80		4.00	0.150		0.157
e	1.27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



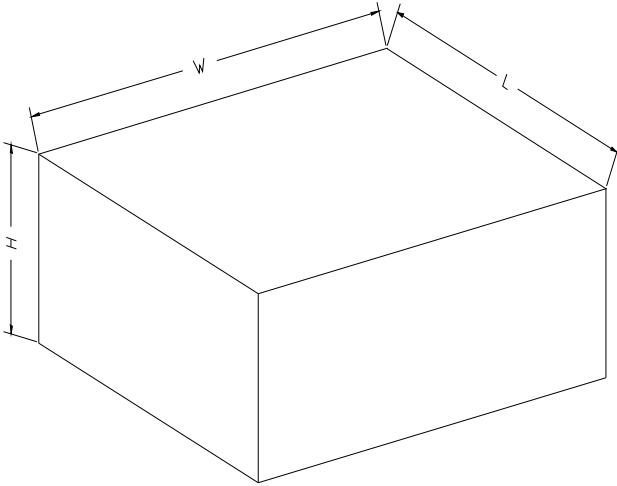
TAPE DIMENSIONS



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
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
TSSOP-14	13"	12.4	6.95	5.6	1.2	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