



SGM8271/SGM8272/SGM8274 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 $\pm 2.25V$ to $\pm 18V$ dual power supplies or from 4.5V to 36V single supply.

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 $-40^{\circ}C$ to $+125^{\circ}C$ 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: 150 μ A/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/ μ s**
- **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 Sensor
Photodiode Amplifier
Precision Instrumentation
Phase-Locked Loop Filter
High End, Professional Audio
DAC Output Amplifier
ATE
Medical

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
Junction Temperature.....	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10s).....	+260°C
ESD Susceptibility	
HBM.....	4000V
MM (SGM8271/2)	150V
MM (SGM8274)	300V

RECOMMENDED OPERATING CONDITIONS

Operating Temperature Range	-40°C to +125°C
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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 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

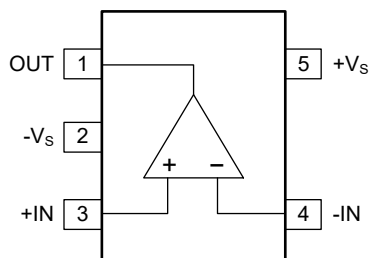
This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance 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, or specifications without prior notice.

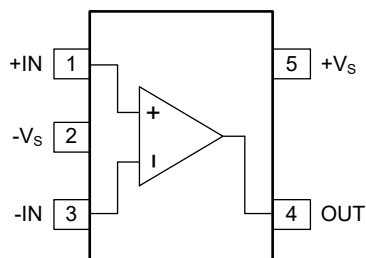
PIN CONFIGURATIONS

SGM8271AYN5G (TOP VIEW)



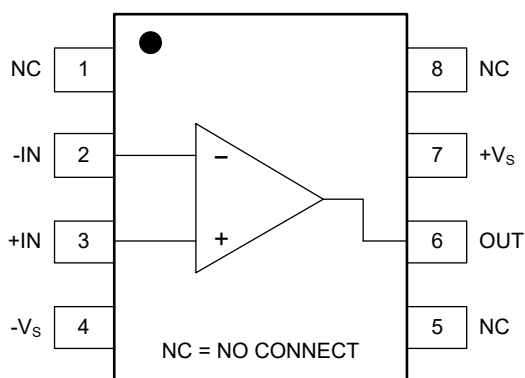
SOT-23-5

SGM8271BYN5G (TOP VIEW)



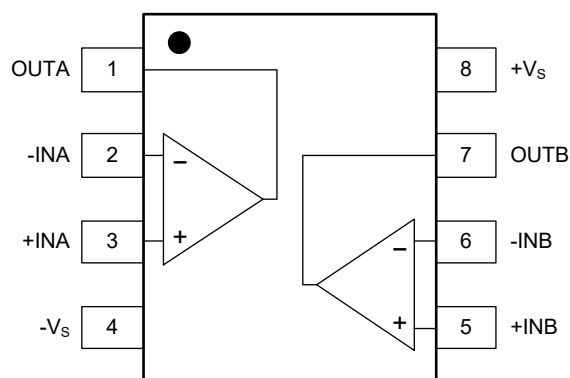
SOT-23-5

SGM8271 (TOP VIEW)



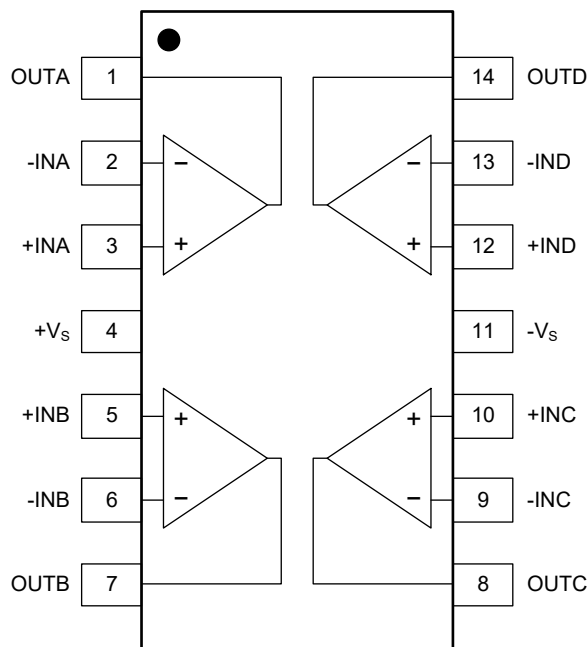
SOIC-8/MSOP-8

SGM8272 (TOP VIEW)



SOIC-8/MSOP-8

SGM8274 (TOP VIEW)



SOIC-14/TSSOP-14

ELECTRICAL CHARACTERISTICS

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

PARAMETER	CONDITIONS	SGM8271/2/4						
		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})	$V_{CM} = 2.5V$	0.6	3.0	3.8	3.9	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/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 $V_{OUT} = 2V_{P-P}$ step, $C_L = 100pF$, $A_V = 1$	5				$V/\mu s$	TYP	
	Down $V_{OUT} = 2V_{P-P}$ step, $C_L = 100pF$, $A_V = 1$	5				$V/\mu s$	TYP	
Overload Recovery Time (ORT)	Up $V_{IN} \times G = V_S$	2.0				μs	TYP	
	Down $V_{IN} \times G = V_S$	4.0						
Settling Time (t_s)	$C_L = 100pF$, $A_V = 1$, 200mV output step	2				μs	TYP	
Input 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)	$V_{OUT} = 2V_{P-P}$, $f = 1kHz$, $A_V = 1$, $R_L = 600\Omega$	0.018				%	TYP	
	$V_{OUT} = 2V_{P-P}$, $f = 1kHz$, $A_V = 1$, $R_L = 2k\Omega$	0.009						

ELECTRICAL CHARACTERISTICS (continued)

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

PARAMETER	CONDITIONS	SGM8271/2/4						
		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})	$V_{CM} = 0V$	0.6	3.0	3.8	3.9	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})		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 $V_{OUT} = 2V_{P-P}$ step, $C_L = 100pF$, $A_V = 1$	6				$V/\mu s$	TYP	
	Down $V_{OUT} = 2V_{P-P}$ step, $C_L = 100pF$, $A_V = 1$	4				$V/\mu s$	TYP	
Overload Recovery Time (ORT)	Up $V_{IN} \times G = V_S$	1.5				μs	TYP	
	Down $V_{IN} \times G = V_S$	2.5						
Settling Time (t_s)	$C_L = 100pF$, $A_V = 1$, 200mV output step	2				μs	TYP	
Input 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)	$V_{OUT} = 2V_{P-P}$, $f = 1kHz$, $A_V = 1$, $R_L = 600\Omega$	0.018				%	TYP	
	$V_{OUT} = 2V_{P-P}$, $f = 1kHz$, $A_V = 1$, $R_L = 2k\Omega$	0.009						

ELECTRICAL CHARACTERISTICS (continued)

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

PARAMETER	CONDITIONS	SGM8271/2/4						
		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})	$V_{CM} = 0V$	0.6	3.0	3.8	3.9	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})		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				$^\circ$	TYP	
Channel-to-Channel Crosstalk	$f = 1MHz$	-80				dB	TYP	
Slew Rate (SR)	Up $V_{OUT} = 2V_{P-P}$ step, $C_L = 100pF$, $A_V = 1$	7				$V/\mu s$	TYP	
	Down $V_{OUT} = 2V_{P-P}$ step, $C_L = 100pF$, $A_V = 1$	4				$V/\mu s$	TYP	
Overload Recovery Time (ORT)	Up $V_{IN} \times G = V_S$	0.5				μs	TYP	
	Down $V_{IN} \times G = V_S$	1.0						
Settling Time (t_s)	$C_L = 100pF$, $A_V = 1$, 200mV output step	2				μs	TYP	
Input 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)	$V_{OUT} = 2V_{P-P}$, $f = 1kHz$, $A_V = 1$, $R_L = 600\Omega$	0.018				%	TYP	
	$V_{OUT} = 2V_{P-P}$, $f = 1kHz$, $A_V = 1$, $R_L = 2k\Omega$	0.009						

ELECTRICAL CHARACTERISTICS (continued)

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

PARAMETER	CONDITIONS	SGM8271/2/4						
		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})	$V_{CM} = 0V$	0.6	3.0	3.8	3.9	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})		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				$^\circ$	TYP	
Channel-to-Channel Crosstalk	$f = 1MHz$	-80				dB	TYP	
Slew Rate (SR)	Up $V_{OUT} = 2V_{P-P}$ step, $C_L = 100pF$, $A_V = 1$	7				$V/\mu s$	TYP	
	Down $V_{OUT} = 2V_{P-P}$ step, $C_L = 100pF$, $A_V = 1$	4				$V/\mu s$	TYP	
Overload Recovery Time (ORT)	Up $V_{IN} \times G = V_S$	0.5				μs	TYP	
	Down $V_{IN} \times G = V_S$	1.0				μs	TYP	
Settling Time (t_s)	$C_L = 100pF$, $A_V = 1$, 200mV output step	2				μs	TYP	
Input Voltage Noise Density (e_n)	$f = 20kHz$, $V_{CM} = 0V$	29				nV/\sqrt{Hz}	TYP	
	$f = 1kHz$, $V_{CM} = 0V$	43				nV/\sqrt{Hz}	TYP	
Total Harmonic Distortion + Noise (THD+N)	$V_{OUT} = 2V_{P-P}$, $f = 1kHz$, $A_V = 1$, $R_L = 600\Omega$	0.018				%	TYP	
	$V_{OUT} = 2V_{P-P}$, $f = 1kHz$, $A_V = 1$, $R_L = 2k\Omega$	0.009				%	TYP	

TYPICAL APPLICATION CIRCUITS

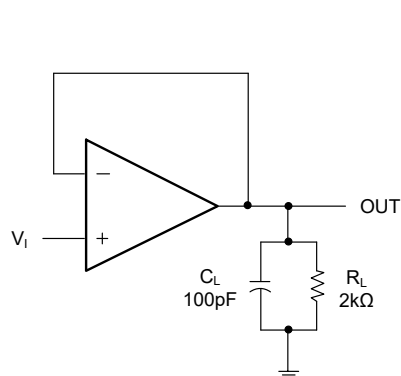


Figure 1

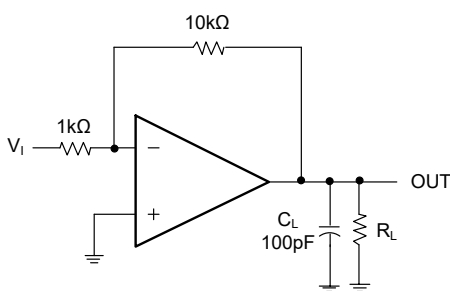


Figure 2

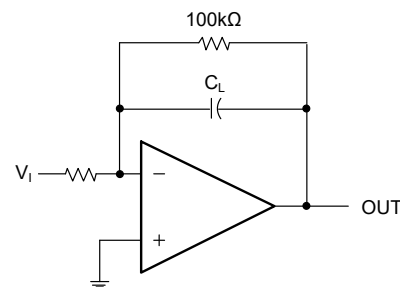
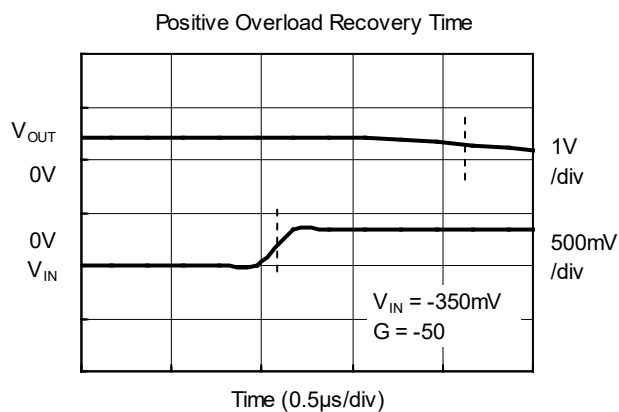
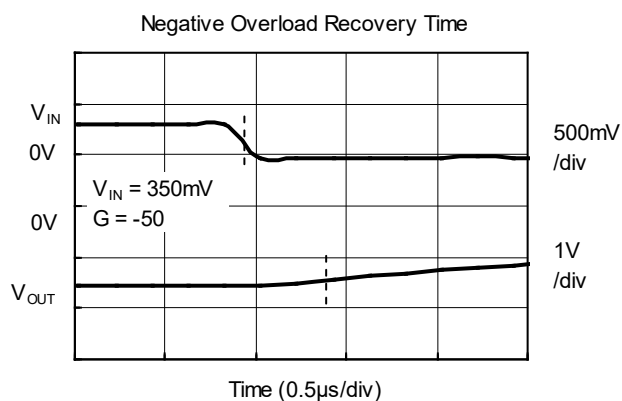
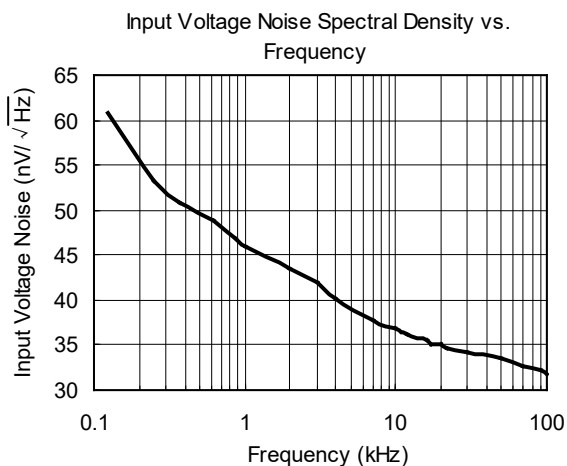
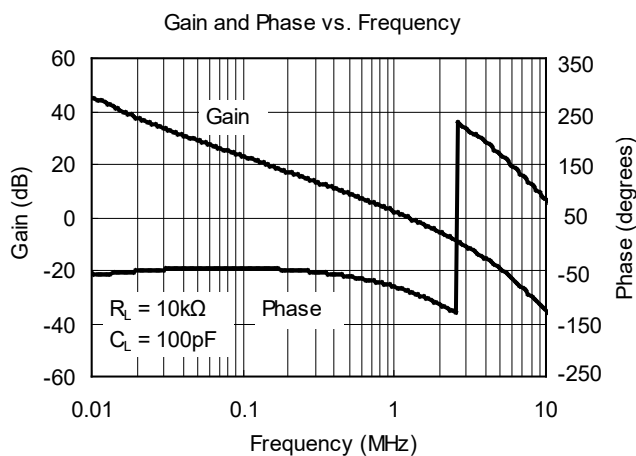
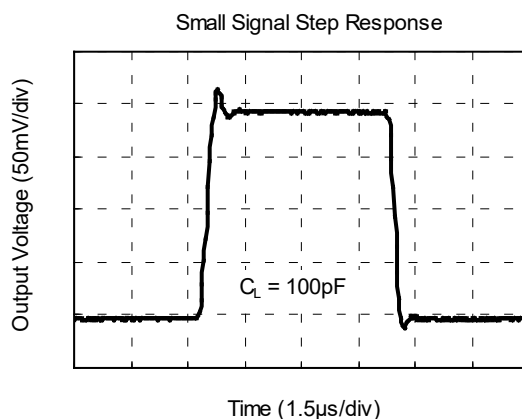
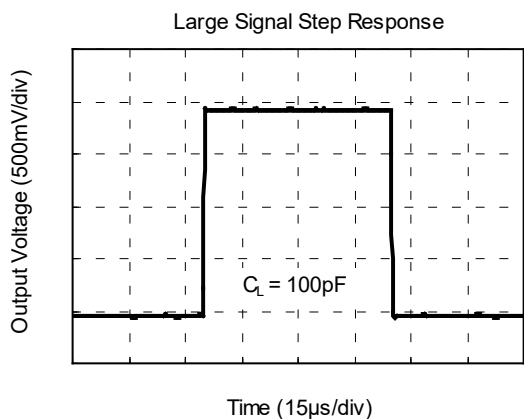


Figure 3

TYPICAL PERFORMANCE CHARACTERISTICS

At $V_s = \pm 15V$, $R_L = 2k\Omega$ connected to $0V$, unless otherwise noted.



REVISION HISTORY

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

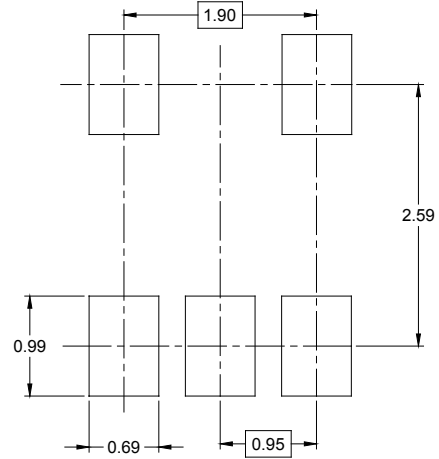
JANUARY 2017 – REV.A.1 to REV.A.2	Page
Added Differential Input Voltage	3

JANUARY 2016 – REV.A to REV.A.1	Page
Changed CMRR minimum at $V_S = 5V, \pm 5V$	5~6
Deleted Output Current (I_{OUT}) conditions	6~8
Updated SOIC-14 and TSSOP-14 packages	14~15
Deleted differential voltage	1

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

PACKAGE OUTLINE DIMENSIONS

SOT-23-5



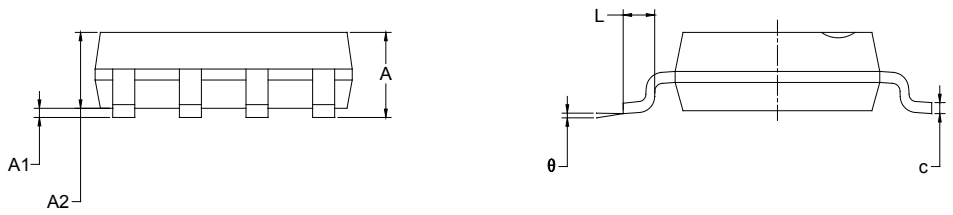
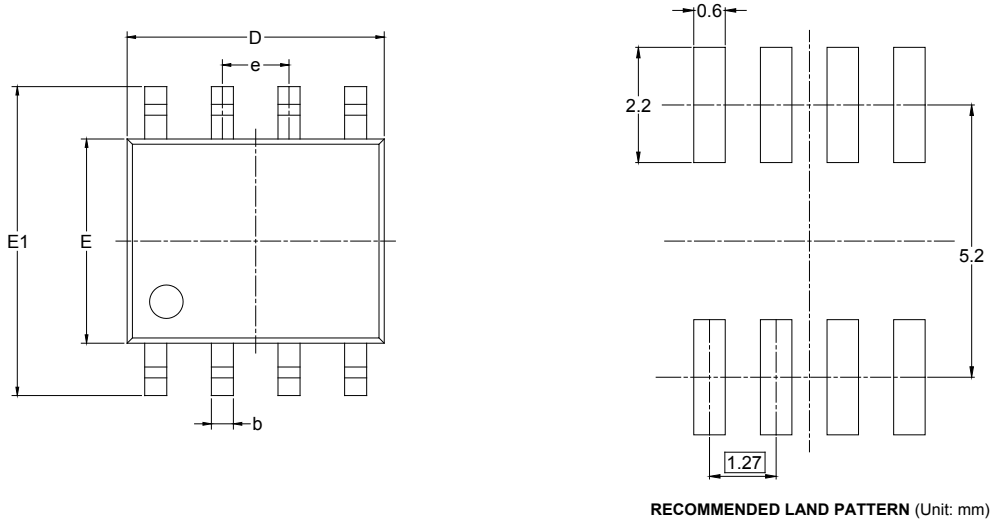
RECOMMENDED LAND PATTERN (Unit: mm)



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°

PACKAGE OUTLINE DIMENSIONS

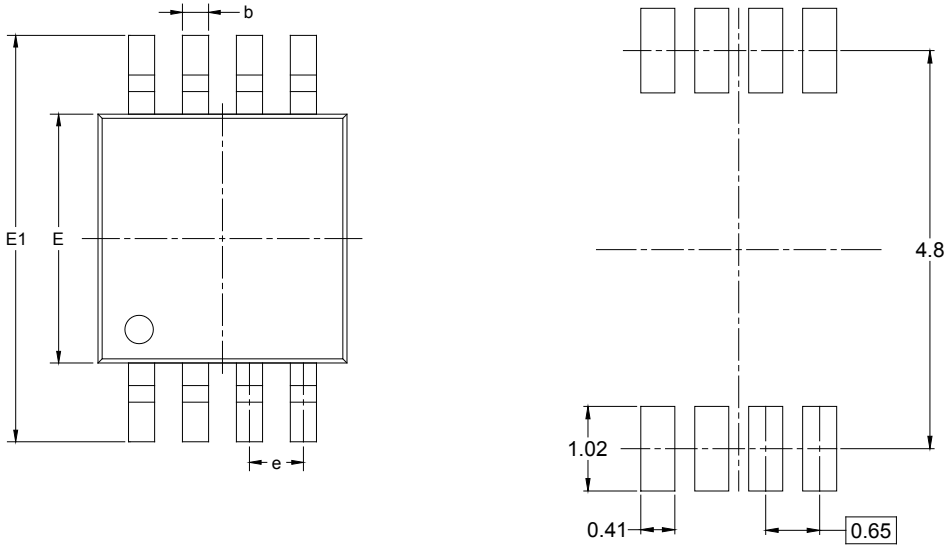
SOIC-8



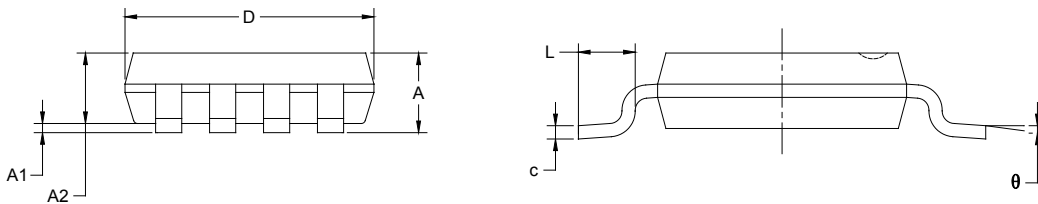
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050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

PACKAGE OUTLINE DIMENSIONS

MSOP-8



RECOMMENDED LAND PATTERN (Unit: mm)

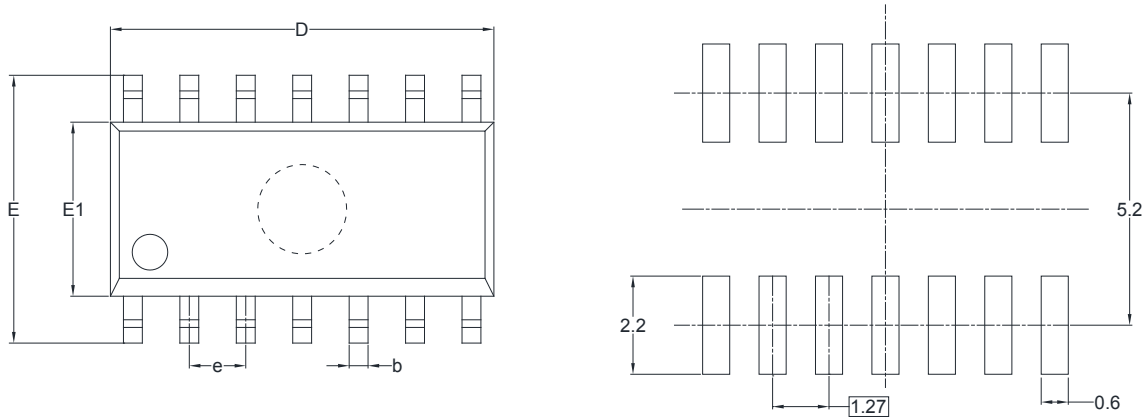


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650 BSC		0.026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

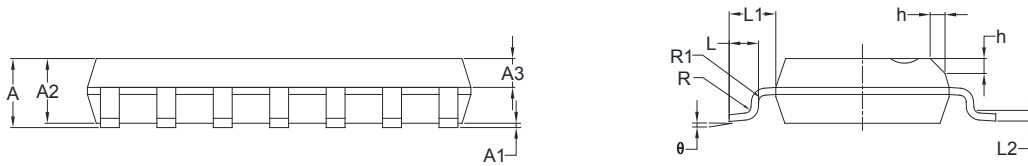
PACKAGE INFORMATION

PACKAGE OUTLINE DIMENSIONS

SOIC-14



RECOMMENDED LAND PATTERN (Unit: mm)

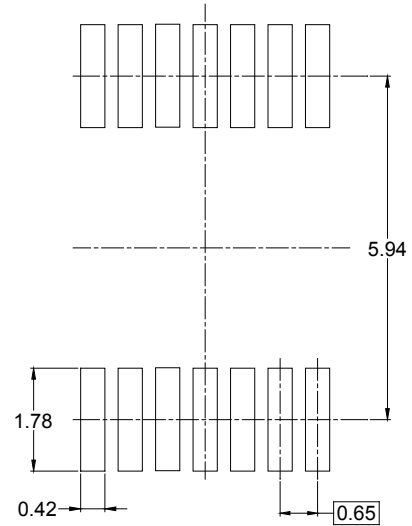
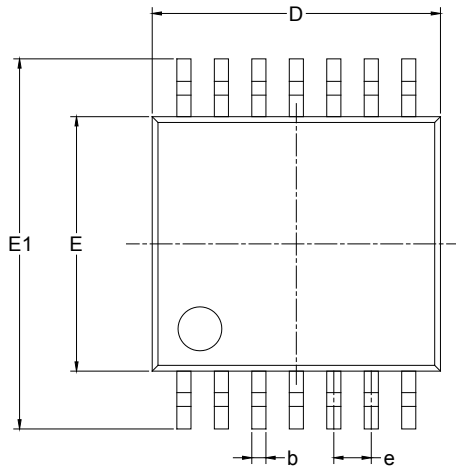


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
A2	1.25	1.65	0.049	0.065
A3	0.55	0.75	0.022	0.030
b	0.36	0.49	0.014	0.019
D	8.53	8.73	0.336	0.344
E	5.80	6.20	0.228	0.244
E1	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
L	0.45	0.80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

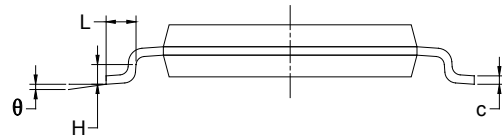
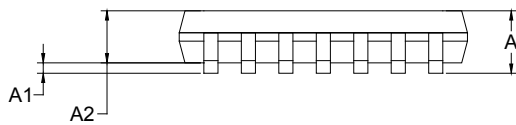
PACKAGE INFORMATION

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°

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
TSSOP-14	13"	12.4	6.95	5.60	1.20	4.0	8.0	2.0	12.0	Q1

D20001

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

DD0002