



SGM8256-1/SGM8256-2/SGM8256-4

1.5MHz, High Voltage, High Precision, Low Noise, Rail-to-Rail I/O Operational Amplifiers

GENERAL DESCRIPTION

The SGM8256-1/2/4 are a family of single, dual and quad operational amplifiers, which are optimized for low noise, high precision and high voltage operation. These devices can operate from 4.5V to 36V single supply. They provide rail-to-rail input and output operation.

The SGM8256-1/2/4 offer a low offset voltage of $\pm 18\mu\text{V}$ (MAX) and a low bias current. The combination of characteristics makes them good choices for temperature measurements, pressure and position sensors, strain gauge amplifiers and medical instrumentation, or any other 4.5V to 36V applications requiring precision, long-term stability and low drifting.

The SGM8256-1 is available in Green SOT-23-5 and SOIC-8 packages. The SGM8256-2 is available in Green SOIC-8 and MSOP-8 packages. The SGM8256-4 is available in Green SOIC-14 and TSSOP-14 packages. They are rated over the -40°C to $+125^{\circ}\text{C}$ temperature range.

FEATURES

- Low Offset Voltage: $\pm 3\mu\text{V}$ (TYP), $\pm 18\mu\text{V}$ (MAX)
- 0.1Hz to 10Hz Noise: $0.5\mu\text{V}_{\text{P-P}}$
- Input Voltage Noise Density: $27\text{nV}/\sqrt{\text{Hz}}$ at 1kHz
- Open-Loop Voltage Gain: 155dB (TYP)
- CMRR:
 - ♦ 137dB (TYP)
 - ♦ 41dB (TYP) at 1MHz
- PSRR: 160dB (TYP)
- Gain-Bandwidth Product: 1.5MHz
- Overload Recovery Time: 2.6 μs
- Rail-to-Rail Input and Output
- Supply Voltage Range: 4.5V to 36V
- Low Quiescent Current:
 - ♦ SGM8256-1: 300 μA (TYP)
 - ♦ SGM8256-2/4: 250 μA /Amplifier (TYP)
- -40°C to $+125^{\circ}\text{C}$ Operating Temperature Range
- Small Packaging:
 - SGM8256-1 Available in Green SOT-23-5 and SOIC-8 Packages
 - SGM8256-2 Available in Green SOIC-8 and MSOP-8 Packages
 - SGM8256-4 Available in Green SOIC-14 and TSSOP-14 Packages

APPLICATIONS

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

SGM8256-1 1.5MHz, High Voltage, High Precision, Low Noise, SGM8256-2/SGM8256-4 Rail-to-Rail I/O Operational Amplifiers

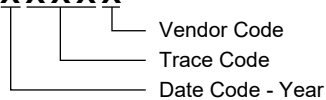
PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM8256-1	SOT-23-5	-40°C to +125°C	SGM8256-1XN5G/TR	24B XXXXXX	Tape and Reel, 3000
	SOIC-8	-40°C to +125°C	SGM8256-1XS8G/TR	SGM 82561XS8 XXXXXX	Tape and Reel, 4000
SGM8256-2	SOIC-8	-40°C to +125°C	SGM8256-2XS8G/TR	SGM 82562XS8 XXXXXX	Tape and Reel, 4000
	MSOP-8	-40°C to +125°C	SGM8256-2XMS8G/TR	SGM2TB XMS8 XXXXXX	Tape and Reel, 4000
SGM8256-4	SOIC-14	-40°C to +125°C	SGM8256-4XS14G/TR	SGM82564XS14 XXXXXX	Tape and Reel, 2500
	TSSOP-14	-40°C to +125°C	SGM8256-4XTS14G/TR	SGM82564 XTS14 XXXXXX	Tape and Reel, 4000

MARKING INFORMATION

NOTE: XXXXX = Date Code, Trace Code and Vendor Code.

XXXXX



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.

SGM8256-1 1.5MHz, High Voltage, High Precision, Low Noise, SGM8256-2/SGM8256-4 Rail-to-Rail I/O Operational Amplifiers

ABSOLUTE MAXIMUM RATINGS

Supply Voltage, $+V_S$ to $-V_S$	40V
Input Voltage Range	$(-V_S) - 0.3V$ to $(+V_S) + 0.3V$
Common Mode Voltage Range	$(-V_S) - 0.1V$ to $(+V_S) + 0.1V$
Differential Input Voltage Range	$-V_S$ to $+V_S$
Package Thermal Resistance	
SOT-23-5, θ_{JA}	148.7°C/W
SOT-23-5, θ_{JB}	28.2°C/W
SOIC-8, θ_{JA}	136.8°C/W
SOIC-8, θ_{JB}	78.3°C/W
MSOP-8, θ_{JA}	135.2°C/W
MSOP-8, θ_{JB}	77.2°C/W
SOIC-14, θ_{JA}	76.4°C/W
SOIC-14, θ_{JB}	32.7°C/W
TSSOP-14, θ_{JA}	91.3°C/W
TSSOP-14, θ_{JB}	54.1°C/W
Junction Temperature	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10s)	+260°C
ESD Susceptibility ^{(1) (2)}	
HBM	±6000V
CDM	±1000V

NOTES:

1. For human body model (HBM), all pins comply with ANSI/ESDA/JEDEC JS-001 specifications.
2. For charged device model (CDM), all pins comply with ANSI/ESDA/JEDEC JS-002 specifications.

RECOMMENDED OPERATING CONDITIONS

Operating Voltage Range	4.5V to 36V
Operating Temperature Range	-40°C to +125°C

NOTE: The power-on time of $+V_S$ should be greater than 35μs from 0V to 36V.

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.

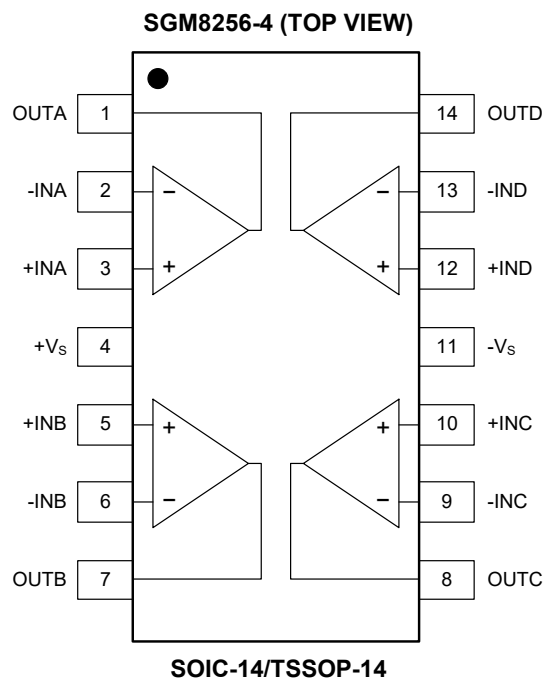
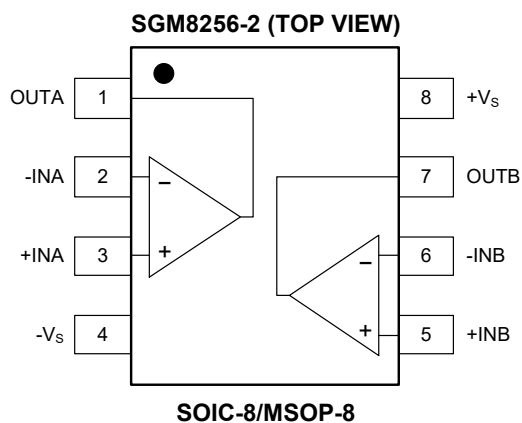
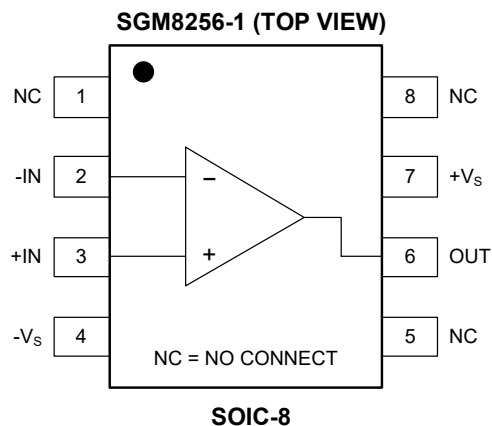
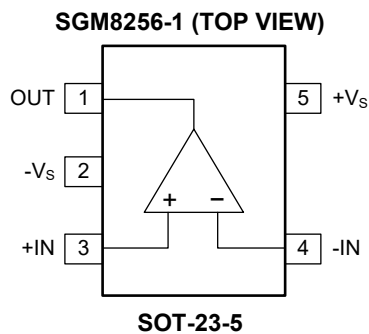
ESD SENSITIVITY CAUTION

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



SGM8256-1 1.5MHz, High Voltage, High Precision, Low Noise, SGM8256-2/SGM8256-4 Rail-to-Rail I/O Operational Amplifiers

PIN CONFIGURATIONS

Table 1. SGM8256-1 Pin Description

PIN		NAME	TYPE	FUNCTION
SOT-23-5	SOIC-8			
1	6	OUT	O	Output.
2	4	-V _S	—	Negative Power Supply.
3	3	+IN	I	Non-Inverting Input.
4	2	-IN	I	Inverting Input.
5	7	+V _S	—	Positive Power Supply.
—	1, 5, 8	NC	—	No Internal Connection.

NOTE: I = input, O = output.

Table 2. SGM8256-2 Pin Description

PIN		NAME	TYPE	FUNCTION
SOIC-8/MSOP-8				
1		OUTA	O	Output of Amplifier A.
2		-INA	I	Inverting Input of Amplifier A.
3		+INA	I	Non-Inverting Input of Amplifier A.
4		-V _S	—	Negative Power Supply.
5		+INB	I	Non-Inverting Input of Amplifier B
6		-INB	I	Inverting Input of Amplifier B.
7		OUTB	O	Output of Amplifier B.
8		+V _S	—	Positive Power Supply.

NOTE: I = input, O = output.

Table 3. SGM8256-4 Pin Description

PIN		NAME	TYPE	FUNCTION
SOIC-14/TSSOP-14				
1		OUTA	O	Output of Amplifier A.
2		-INA	I	Inverting Input of Amplifier A.
3		+INA	I	Non-Inverting Input of Amplifier A.
4		+V _S	—	Positive Power Supply.
5		+INB	I	Non-Inverting Input of Amplifier B
6		-INB	I	Inverting Input of Amplifier B.
7		OUTB	O	Output of Amplifier B.
8		OUTC	O	Output of Amplifier C.
9		-INC	I	Inverting Input of Amplifier C.
10		+INC	I	Non-Inverting Input of Amplifier C.
11		-V _S	—	Negative Power Supply.
12		+IND	I	Non-Inverting Input of Amplifier D.
13		-IND	I	Inverting Input of Amplifier D.
14		OUTD	O	Output of Amplifier D.

NOTE: I = input, O = output.

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ELECTRICAL CHARACTERISTICS

($V_S = \pm 2.25V$ to $\pm 18V$, $V_{CM} = 0V$ and $R_L = 10k\Omega$ connected to $0V$, Full = $-40^\circ C$ to $+125^\circ C$, typical values are at $T_A = +25^\circ C$, unless otherwise noted.)

PARAMETER		CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Input Characteristics							
Input Offset Voltage (V _{OS})			+25°C		±3	±18	μV
			Full			±25	
Input Offset Voltage Drift (ΔV _{OS} /ΔT)			Full		15		nV/°C
Input Bias Current (I _B)			+25°C		±150	±400	pA
			0°C to +85°C			±600	
			Full			±9	nA
Input Offset Current (I _{OS})			+25°C		±250	±1100	pA
			0°C to +85°C			±1350	
			Full			±4.5	nA
Input Common Mode Voltage Range (V _{CM})			Full	(-V _S) - 0.1		(+V _S) + 0.1	V
Common Mode Rejection Ratio ⁽¹⁾ (CMRR)		V _S = 5V, V _{CM} = (-V _S) - 0.1V to (+V _S) + 0.1V	+25°C	104	120		dB
			Full	101			
		V _S = 5V, V _{CM} = (-V _S) - 0.1V to (+V _S) - 3V	+25°C	110	130		
			Full	107			
		V _S = 36V, V _{CM} = (-V _S) - 0.1V to (+V _S) + 0.1V	+25°C	116	137		
			Full	110			
		V _S = 36V, V _{CM} = (-V _S) - 0.1V to (+V _S) - 3V	+25°C	120	152		
			Full	117			
Open-Loop Voltage Gain (A _{OL})		V _S = ±2.25V, V _{OUT} = ±2V	+25°C	121	135		dB
			Full	118			
		V _S = ±18V, V _{OUT} = ±17.5V	+25°C	130	155		
			Full	127			
Output Characteristics							
Output Voltage Swing from Rail (V _{OUT})		V _S = ±2.25V	+25°C		10	20	mV
			Full			27	
		V _S = ±18V	+25°C		77	110	
			Full			150	
Output Short-Circuit Current (I _{SC})		V _S = ±2.25V	+25°C	±20	±30		mA
		V _S = ±18V	+25°C	±22	±35		
Power Supply							
Operating Voltage Range (V _S)			Full	4.5		36	V
Quiescent Current /Amplifier (I _Q)	SGM8256-1	I _{OUT} = 0A	+25°C		300	420	μA
			Full			450	
	SGM8256-2/4		+25°C		250	370	
			Full			400	
Power Supply Rejection Ratio ⁽¹⁾ (PSRR)		V _S = 4.5V to 36V	+25°C	132	160		dB
			Full	129			

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

SGM8256-1 1.5MHz, High Voltage, High Precision, Low Noise, SGM8256-2/SGM8256-4 Rail-to-Rail I/O Operational Amplifiers

ELECTRICAL CHARACTERISTICS (continued)

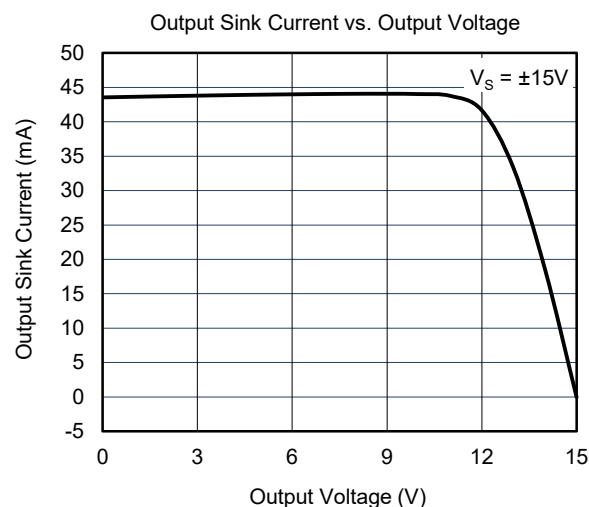
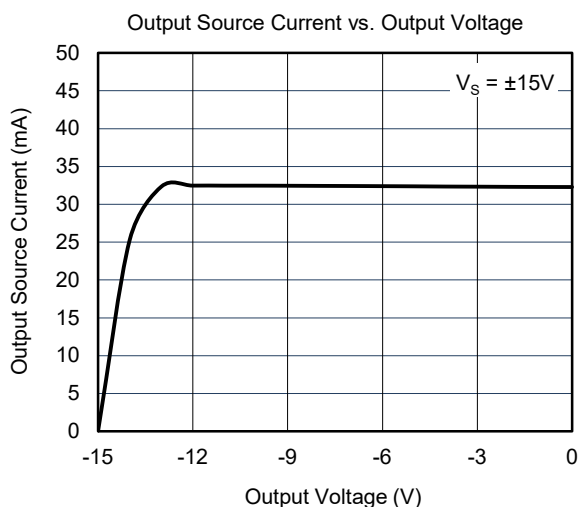
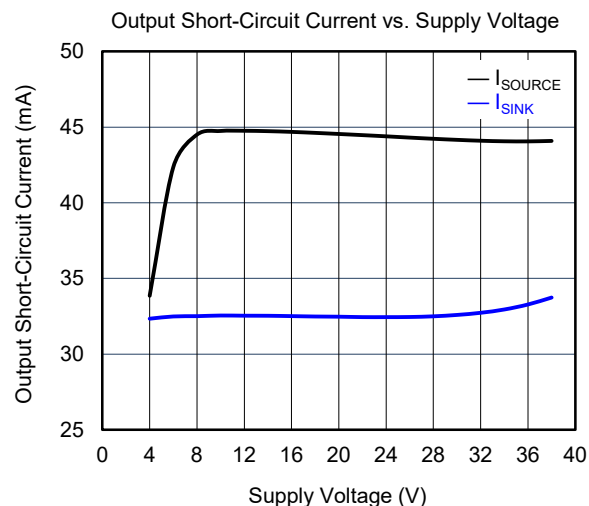
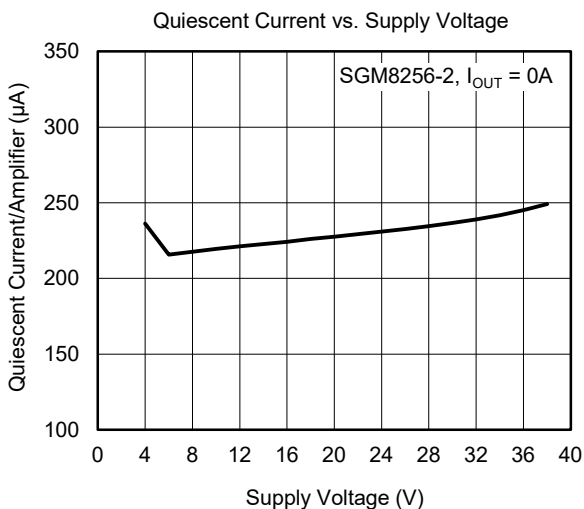
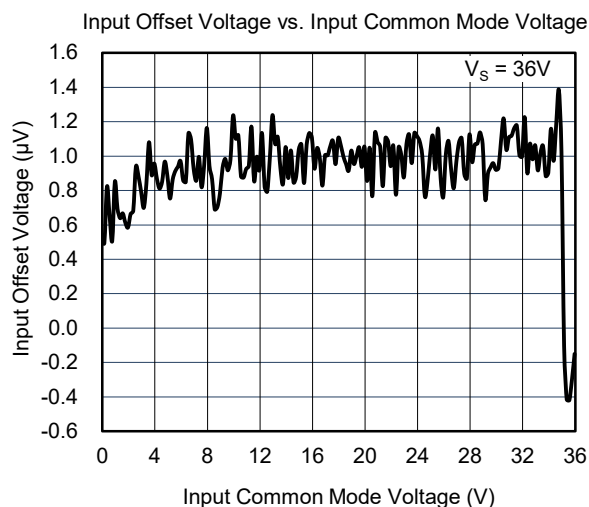
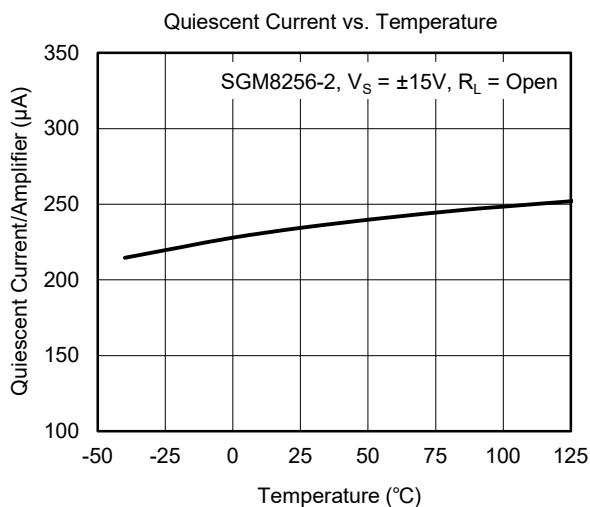
($V_S = \pm 2.25V$ to $\pm 18V$, $V_{CM} = 0V$ and $R_L = 10k\Omega$ connected to $0V$, Full = $-40^\circ C$ to $+125^\circ C$, typical values are at $T_A = +25^\circ C$, unless otherwise noted.)

PARAMETER		CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Dynamic Performance							
Gain-Bandwidth Product (GBP)		$V_{OUT} = 100mV_{P-P}$, $G = +1000$, $C_L = 10pF$	$+25^\circ C$		1.6		MHz
		$V_{OUT} = 100mV_{P-P}$, $G = +1$, $C_L = 10pF$	$+25^\circ C$		1.5		
Phase Margin (ϕ_o)		$C_L = 100pF$	$+25^\circ C$		50		$^\circ$
Slew Rate (SR)	SGM8256-1/2	$V_S = \pm 18V$, $V_{OUT} = 10V_{P-P}$	$+25^\circ C$		1.1		V/ μs
	SGM8256-4		$+25^\circ C$		0.6		
Common Mode Rejection Ratio (CMRR)		$f = 1MHz$	$+25^\circ C$		41		dB
Settling Time (t_s)	To 0.1%	$V_{IN} = 1V$ step	$+25^\circ C$		18		μs
	To 1%		$+25^\circ C$		10		
Overload Recovery Time		$V_{IN} \times G > V_S$	$+25^\circ C$		2.6		μs
Total Harmonic Distortion + Noise (THD+N)		$V_{IN} = 2V_{P-P}$, $G = +1$, $f = 1kHz$	$+25^\circ C$		0.0004		%
Noise							
Input Voltage Noise		$f = 0.1Hz$ to $10Hz$	$+25^\circ C$		0.5		μV_{P-P}
Input Voltage Noise Density (e_n)		$f = 0.1kHz$	$+25^\circ C$		27		nV/ $\sqrt{Hz}$
		$f = 1kHz$	$+25^\circ C$		27		
		$f = 10kHz$	$+25^\circ C$		33		

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TYPICAL PERFORMANCE CHARACTERISTICS

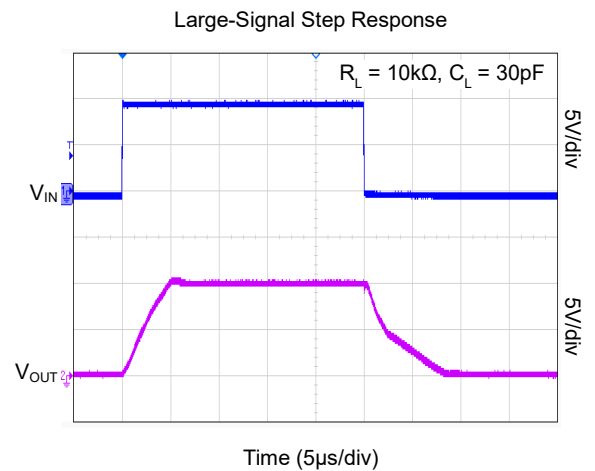
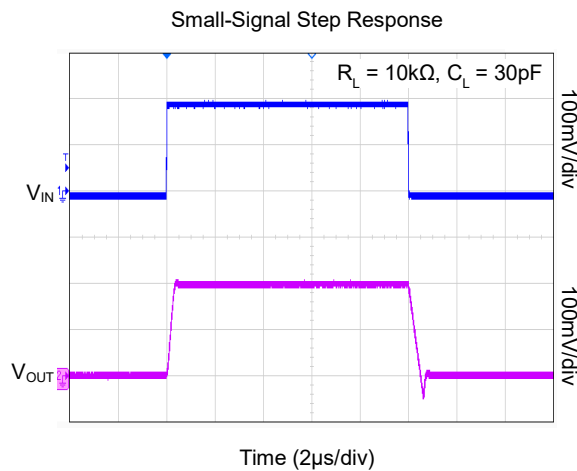
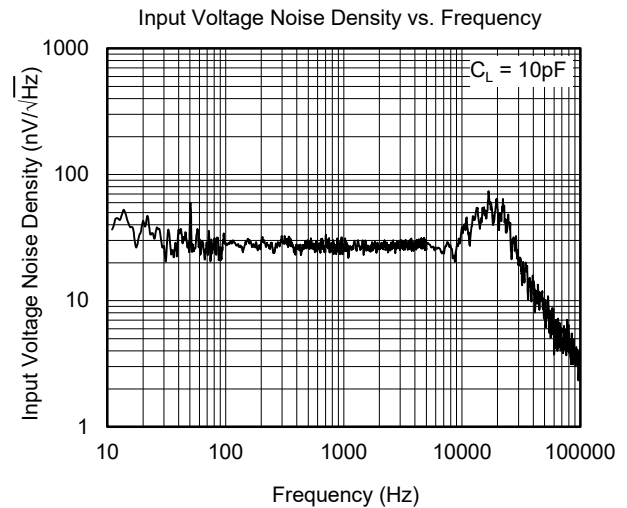
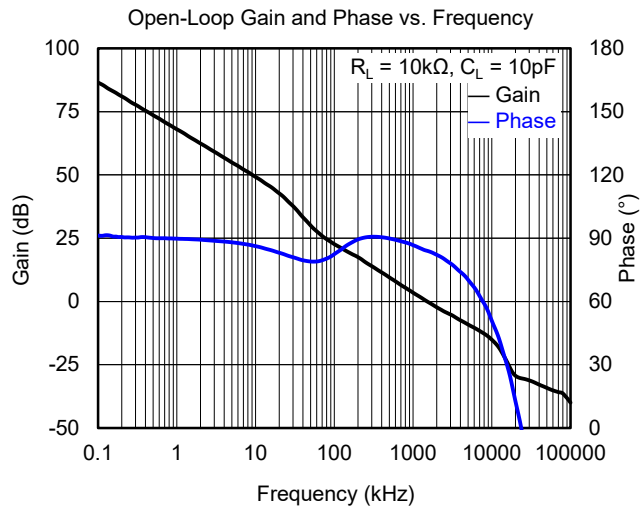
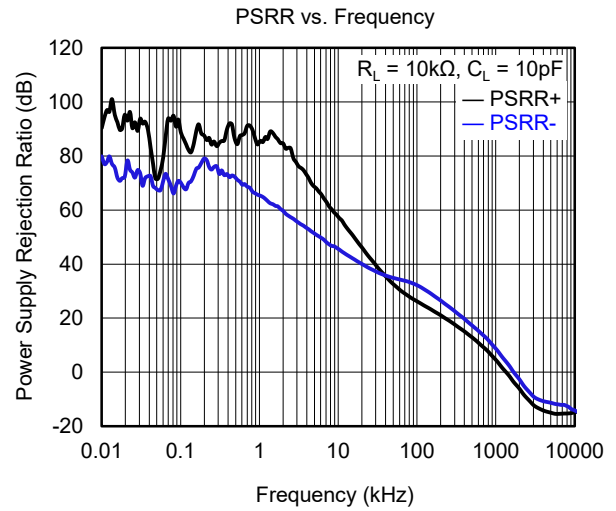
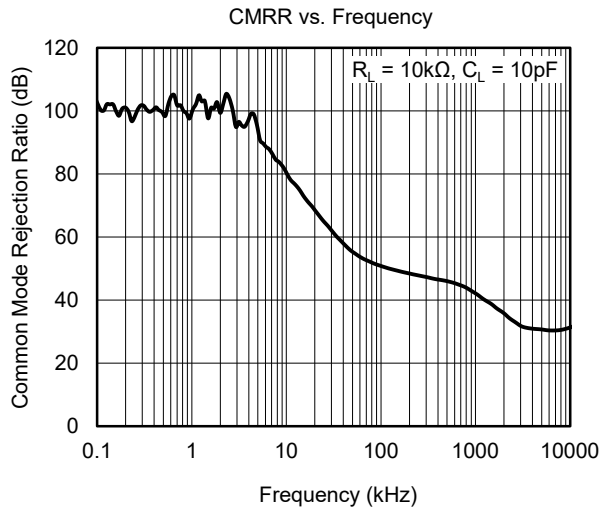
At $T_A = +25^\circ\text{C}$, $V_S = \pm 18\text{V}$, unless otherwise noted.



SGM8256-1 1.5MHz, High Voltage, High Precision, Low Noise, SGM8256-2/SGM8256-4 Rail-to-Rail I/O Operational Amplifiers

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

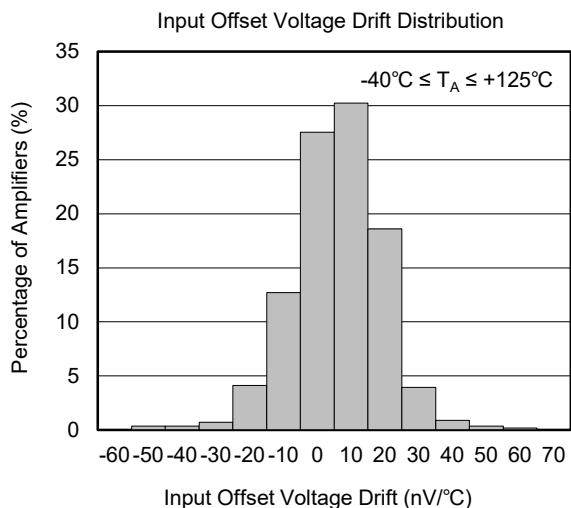
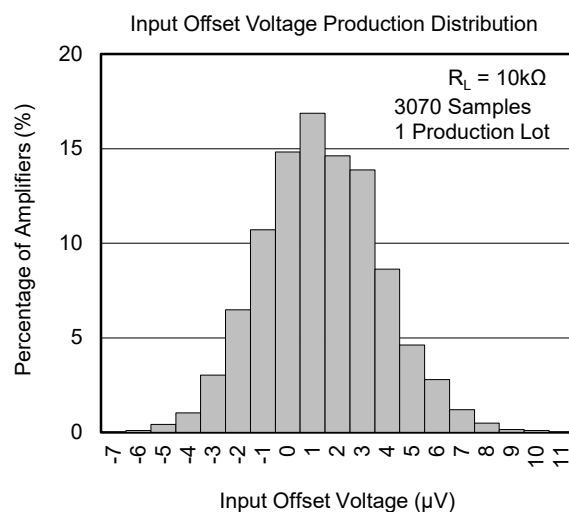
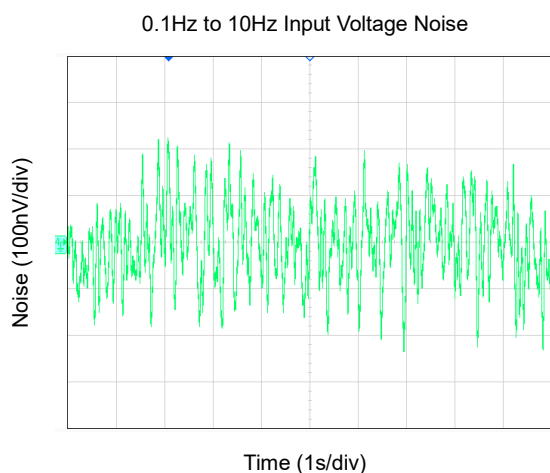
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SGM8256-1 1.5MHz, High Voltage, High Precision, Low Noise, SGM8256-2/SGM8256-4 Rail-to-Rail I/O Operational Amplifiers

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At $T_A = +25^\circ\text{C}$, $V_S = \pm 18\text{V}$, unless otherwise noted.



APPLICATION INFORMATION

Rail-to-Rail Input

When SGM8256-1/2/4 work at the power supply between 4.5V and 36V, the input common mode voltage range is from $(-V_S) - 0.1V$ to $(+V_S) + 0.1V$. In Figure 1, the ESD diodes between the inputs and the power supply rails will clamp the input voltage so that it does not exceed the rails.

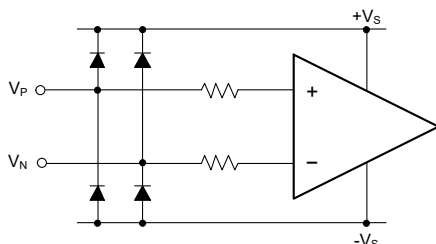


Figure 1. Input Equivalent Circuit

Rail-to-Rail Output

The SGM8256-1/2/4 support rail-to-rail output operation. In single power supply application, for example, when $+V_S = 36V$, $-V_S = GND$, 10k Ω load resistor is tied from OUT pin to ground, the typical output swing range is from 0V to 35.923V.

Driving Capacitive Loads

The SGM8256-1/2/4 are unity-gain stable with heavy capacitive load. If greater capacitive load must be driven in application, the circuit in Figure 2 can be used. In this circuit, the IR drop voltage generated by R_{ISO} is compensated by feedback loop.

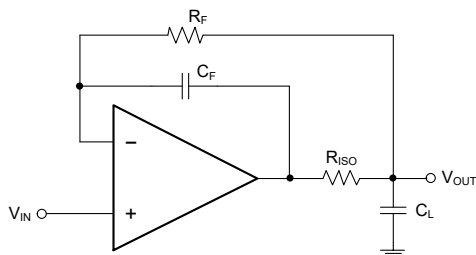


Figure 2. Circuit to Drive Heavy Capacitive Load

Power Supply Decoupling and Layout

A clean and low noise power supply is very important in amplifier circuit design. Besides of input signal noise, the power supply is one of important source of noise to the amplifier through $+V_S$ and $-V_S$ pins. Power supply bypassing is an effective method to clear up the noise at power supply, and the low impedance path to ground of decoupling capacitor will bypass the noise to GND. In application, 10 μF ceramic capacitor paralleled with 0.1 μF or 0.01 μF ceramic capacitor is used in Figure 3. The ceramic capacitors should be placed as close as possible to $+V_S$ and $-V_S$ power supply pins.

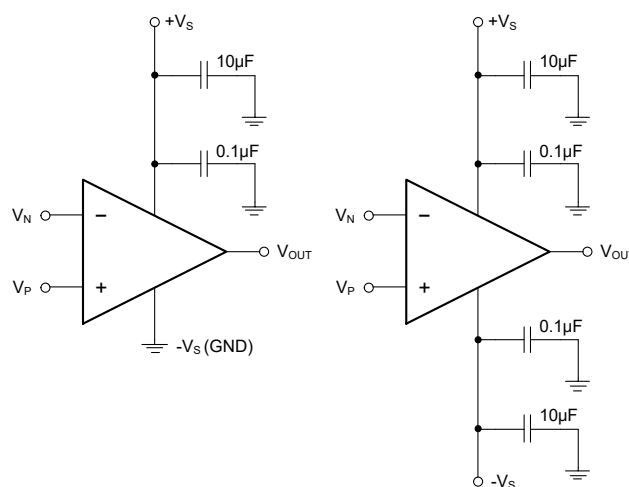


Figure 3. Amplifier Power Supply Bypassing

Grounding

In low speed application, one node grounding technique is the simplest and most effective method to eliminate the noise generated by grounding. In high speed application, the general method to eliminate noise is to use a complete ground plane technique, and the whole ground plane will help distribute heat and reduce EMI noise pickup.

Reduce Input-to-Output Coupling

To reduce the input-to-output coupling, the input traces must be placed as far away from the power supply or output traces as possible. The sensitive trace must not be placed in parallel with the noisy trace in the same layer. They must be placed perpendicularly in different layers to reduce the crosstalk. These PCB layout techniques will help to reduce unwanted positive feedback and noise.

APPLICATION INFORMATION (continued)

Typical Application Circuits

Difference Amplifier

The circuit in Figure 4 is a design example of classical difference amplifier. If $R_4/R_3 = R_2/R_1$, then $V_{OUT} = (V_P - V_N) \times R_2/R_1 + V_{REF}$.

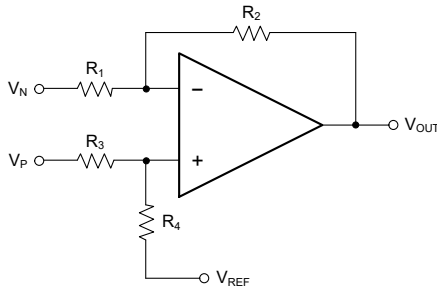


Figure 4. Difference Amplifier

High Input Impedance Difference Amplifier

The circuit in Figure 5 is a design example of high input impedance difference amplifier. The added amplifiers at the input are used to increase the input impedance and eliminate drawback of low input impedance in Figure 4.

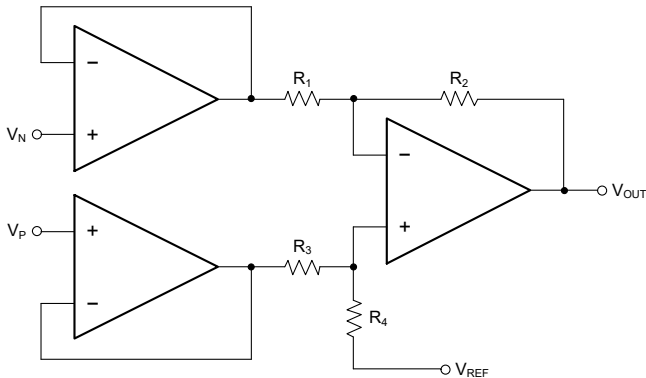


Figure 5. High Input Impedance Difference Amplifier

Active Low-Pass Filter

The circuit in Figure 6 is a design example of active low-pass filter, the DC gain is equal to $-R_2/R_1$ and the -3dB corner frequency is equal to $1/(2\pi R_2 C)$. In this design, the filter bandwidth must be less than the bandwidth of the amplifier, and the resistor values must be selected as low as possible to reduce ringing or oscillation generated by the parasitic parameters in PCB layout.

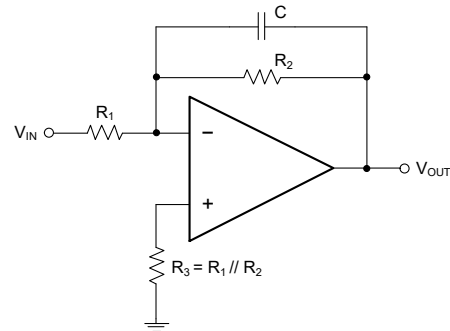


Figure 6. Active Low-Pass Filter

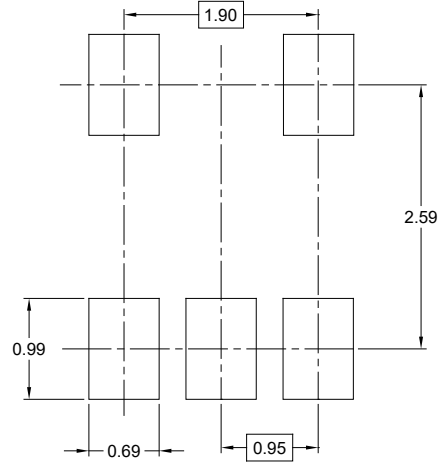
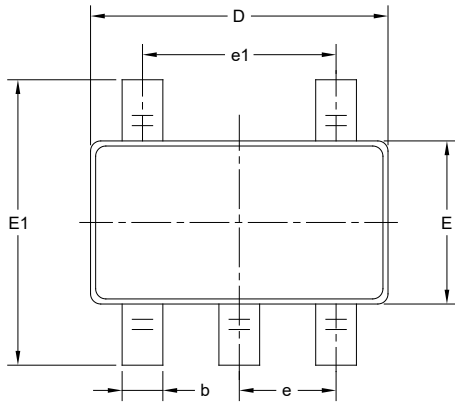
REVISION HISTORY

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

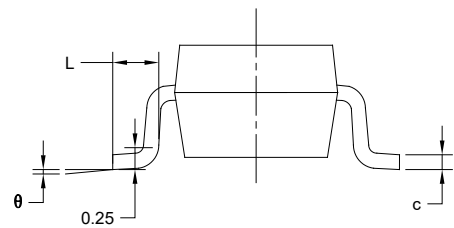
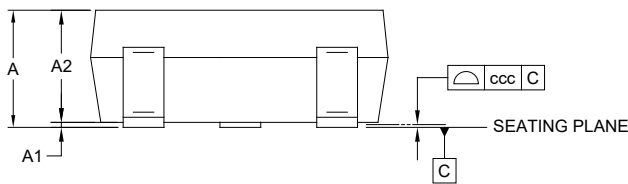
Changes from Original to REV.A (OCTOBER 2026)	Page
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PACKAGE OUTLINE DIMENSIONS

SOT-23-5



RECOMMENDED LAND PATTERN (Unit: mm)



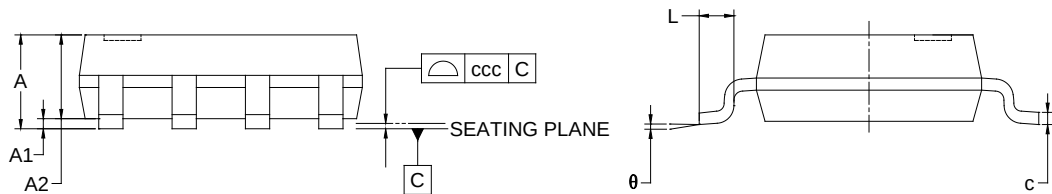
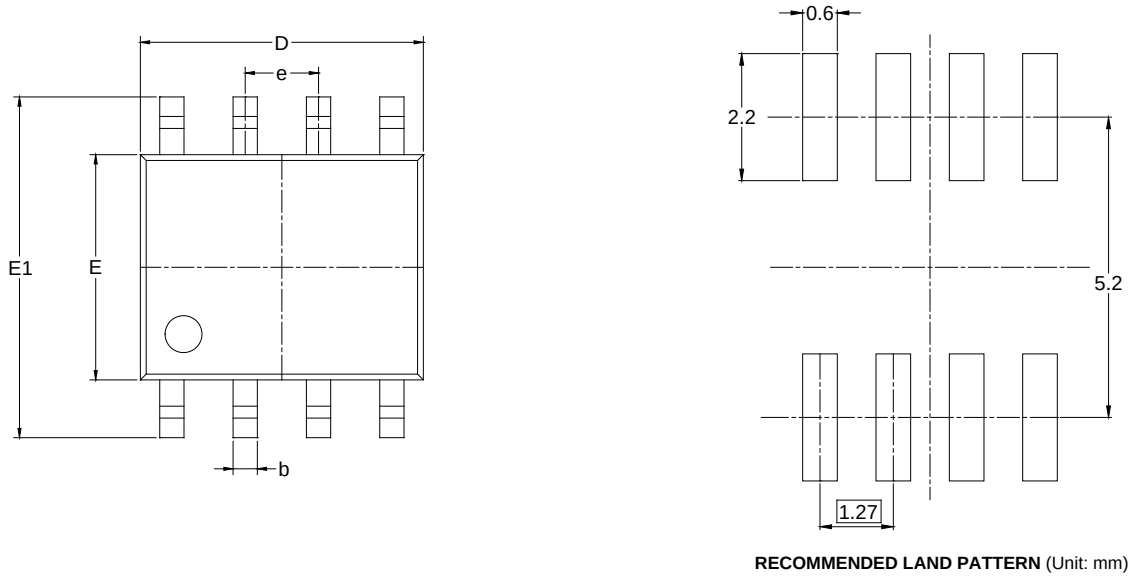
Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	-	-	1.450
A1	0.000	-	0.150
A2	0.900	-	1.300
b	0.300	-	0.500
c	0.080	-	0.220
D	2.750	-	3.050
E	1.450	-	1.750
E1	2.600	-	3.000
e	0.950 BSC		
e1	1.900 BSC		
L	0.300	-	0.600
θ	0°	-	8°
ccc	0.100		

NOTES:

1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MO-178.

PACKAGE OUTLINE DIMENSIONS

SOIC-8



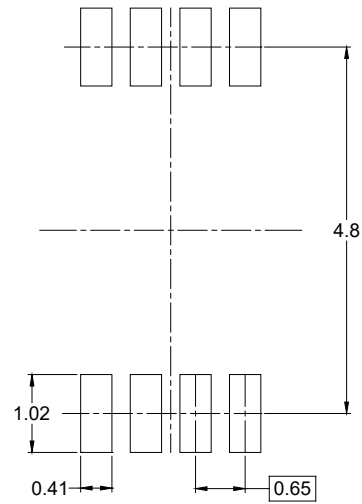
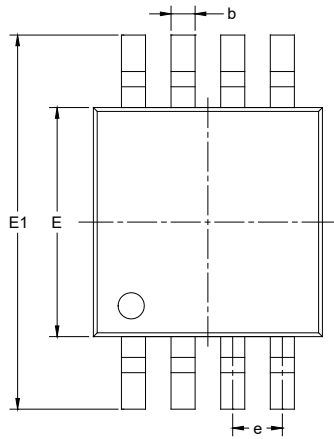
Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	1.350	-	1.750
A1	0.100	-	0.250
A2	1.350	-	1.550
b	0.330	-	0.510
c	0.170	-	0.250
D	4.700	-	5.100
E	3.800	-	4.000
E1	5.800	-	6.200
e	1.270 BSC		
L	0.400	-	1.270
θ	0°	-	8°
ccc	0.100		

NOTES:

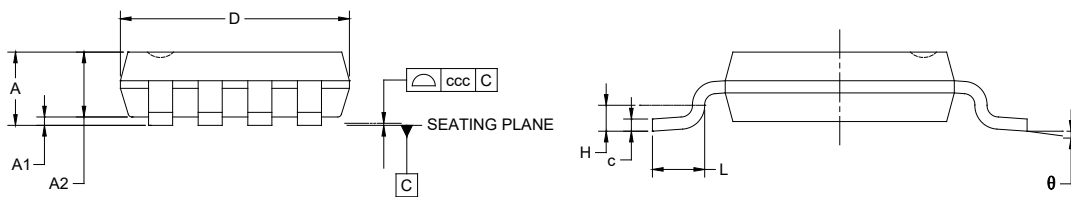
1. This drawing is subject to change without notice.
2. This dimension does not include mold flash, protrusions or gate burrs. Mold flash, protrusions or gate burrs shall not exceed 0.15mm per side.
3. Reference JEDEC MS-012.

PACKAGE OUTLINE DIMENSIONS

MSOP-8



RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	-	-	1.100
A1	0.000	-	0.150
A2	0.750	-	0.950
b	0.220	-	0.380
c	0.080	-	0.230
D	2.800	-	3.200
E	2.800	-	3.200
E1	4.650	-	5.150
e	0.650 BSC		
L	0.400	-	0.800
H	0.250 TYP		
θ	0°	-	8°
ccc	0.100		

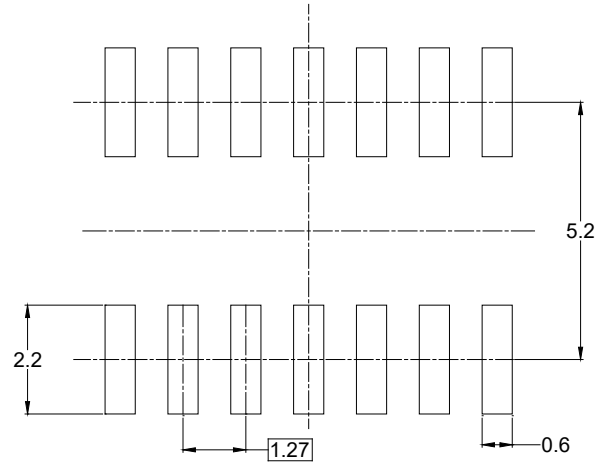
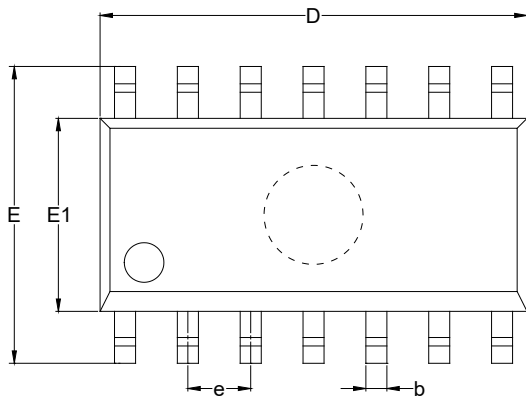
NOTES:

1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MO-187.

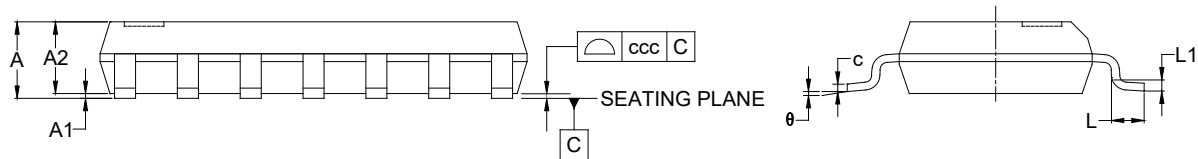
PACKAGE INFORMATION

PACKAGE OUTLINE DIMENSIONS

SOIC-14



RECOMMENDED LAND PATTERN (Unit: mm)



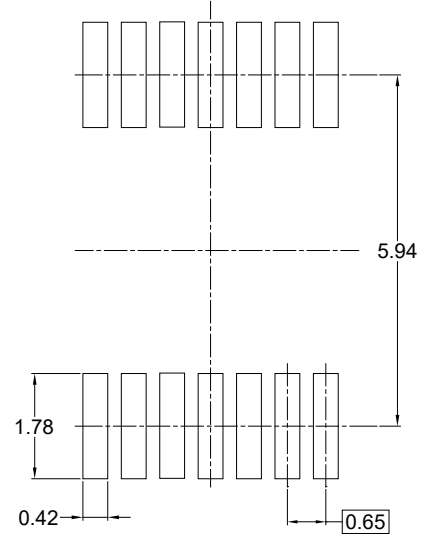
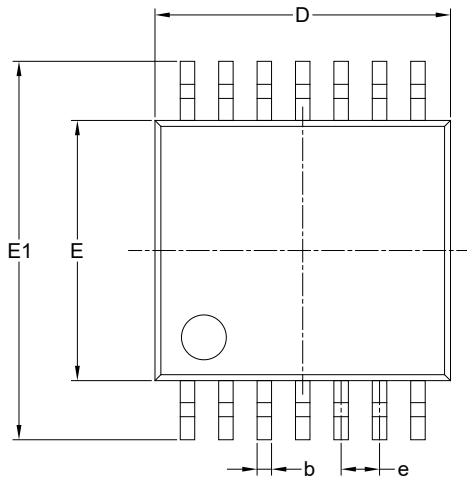
Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	-	-	1.750
A1	0.100	-	0.250
A2	1.250	-	-
b	0.310	-	0.510
c	0.100	-	0.250
D	8.450	-	8.850
E	5.800	-	6.200
E1	3.800	-	4.000
e	1.270 BSC		
L	0.400	-	1.270
L1	0.250 TYP		
θ	0°	-	8°
ccc	0.100		

NOTES:

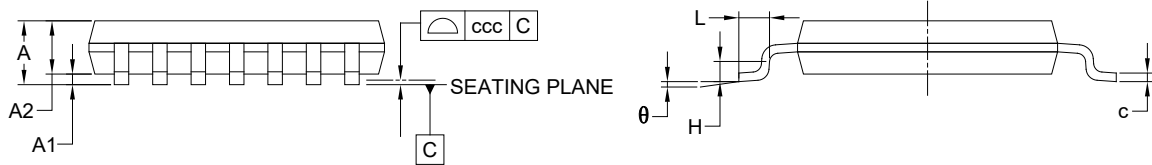
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MS-012.

PACKAGE OUTLINE DIMENSIONS

TSSOP-14



RECOMMENDED LAND PATTERN (Unit: mm)



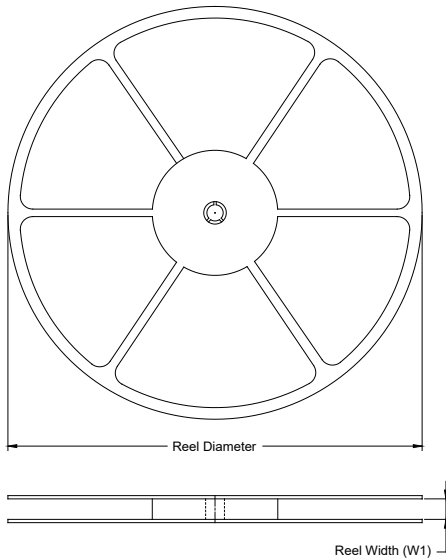
Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	-	-	1.200
A1	0.050	-	0.150
A2	0.800	-	1.050
b	0.190	-	0.300
c	0.090	-	0.200
D	4.860	-	5.100
E	4.300	-	4.500
E1	6.200	-	6.600
e	0.650 BSC		
L	0.450	-	0.750
H	0.250 TYP		
θ	0°	-	8°
ccc	0.100		

NOTES:

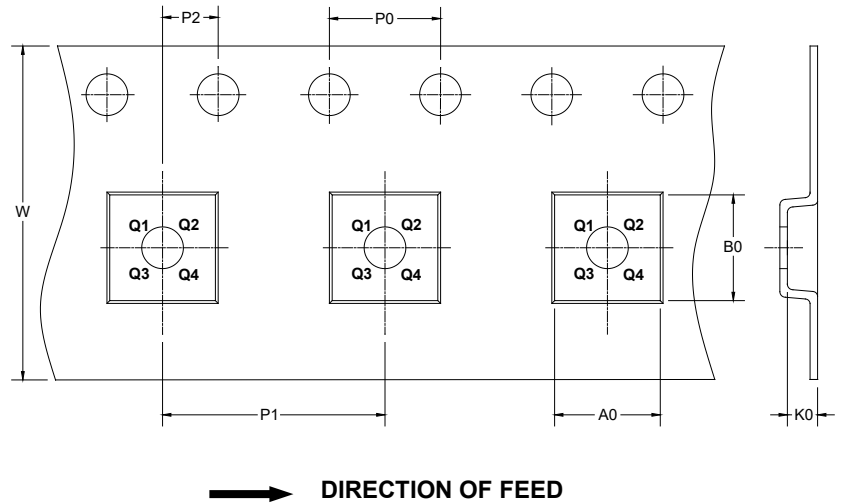
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MO-153.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



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

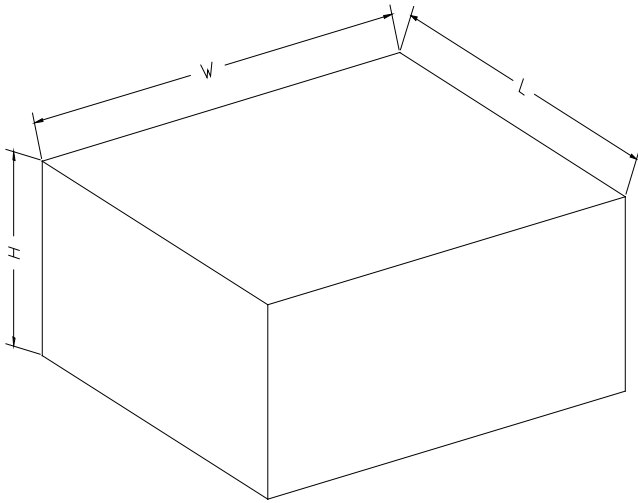
KEY PARAMETER LIST OF TAPE AND REEL

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	6.80	5.40	1.50	4.0	8.0	2.0	12.0	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

DD0002