



SGM8061/SGM8062/SGM8063

500MHz, Rail-to-Rail Output, CMOS Operational Amplifiers

GENERAL DESCRIPTION

The SGM8061 (single), SGM8062 (dual) and SGM8063 (single with shutdown) are low cost, high speed, voltage feedback amplifiers. These devices can operate from 2.5V to 5.5V single supply, and consume 8.2mA low quiescent current per amplifier. And, the supply current of SGM8063 is only 75 μ A in power-down mode. So SGM8063 is suitable for battery-powered equipment and portable devices, which require low power dissipation. The SGM8061/2/3 provide a wide input common mode voltage range and rail-to-rail output voltage swing.

These devices are designed to provide optimal performance in all aspects. They exhibit a wide bandwidth of 500MHz ($G = +1$) and a 0.1dB gain flatness of 130MHz ($G=+1$). The short settling time and low distortion make the operational amplifiers appropriate for buffering high speed ADC and DAC.

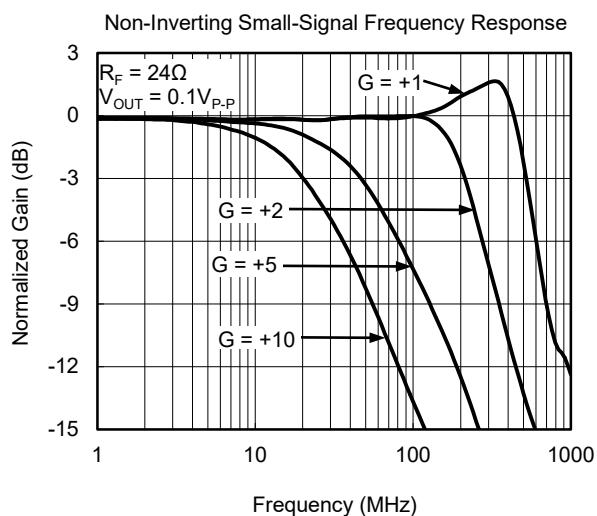
The SGM8061 is available in Green SOT-23-5 and SOIC-8 packages. The SGM8062 is available in Green SOIC-8 and MSOP-8 packages. The SGM8063 is available in Green SOT-23-6 and SOIC-8 packages. They are specified over the extended -40°C to +125°C temperature range.

APPLICATIONS

Professional Video
Photodiode Preamplifier
ADC
Filter
Imaging
Hand Set
DVD
Base Station

FEATURES

- Low Cost
- High Speed:
 - 3dB Bandwidth ($G = +1$): 500MHz
 - Slew Rate: 420V/ μ s
 - Settling Time to 0.1% with 2V Step: 16ns
- Excellent Video Performance ($R_L = 150\Omega$, $G = +2$):
 - 0.1dB Gain Flatness: 80MHz
 - Diff Gain Error: 0.015%
 - Diff Phase Error: 0.05°
- Input Offset Voltage: 8mV (MAX)
- Input Voltage Range: -0.2V to 3.8V with $V_S = 5V$
- Rail-to-Rail Output
- Supply Voltage Range: 2.5V to 5.5V
- Low Supply Current:
 - 8.2mA/Amplifier (TYP)
 - 75 μ A Shutdown Current for SGM8063
- -40°C to +125°C Operating Temperature Range
- Small Packaging:
 - SGM8061 Available in Green SOT-23-5 and SOIC-8 Packages
 - SGM8062 Available in Green MSOP-8 and SOIC-8 Packages
 - SGM8063 Available in Green SOT-23-6 and SOIC-8 Packages



PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM8061	SOT-23-5	-40°C to +125°C	SGM8061XN5/TR	8061	Tape and Reel, 3000
	SOIC-8	-40°C to +125°C	SGM8061XS/TR	SGM8061XS XXXXX	Tape and Reel, 2500
SGM8062	MSOP-8	-40°C to +125°C	SGM8062XMS/TR	SGM8062 XMS XXXXX	Tape and Reel, 3000
	SOIC-8	-40°C to +125°C	SGM8062XS/TR	SGM8062XS XXXXX	Tape and Reel, 2500
SGM8063	SOT-23-6	-40°C to +125°C	SGM8063XN6/TR	8063	Tape and Reel, 3000
	SOIC-8	-40°C to +125°C	SGM8063XS/TR	SGM8063XS XXXXX	Tape and Reel, 2500

MARKING INFORMATION

NOTE: 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.

ABSOLUTE MAXIMUM RATINGS

Supply Voltage, $+V_S$ to $-V_S$	6V
Input Common Mode Voltage Range	($-V_S$) - 0.3V to ($+V_S$) + 0.3V
Package Thermal Resistance @ $T_A = +25^\circ C$	
SOT-23-5, θ_{JA}	190°C/W
SOT-23-6, θ_{JA}	190°C/W
SOIC-8, θ_{JA}	125°C/W
MSOP-8, θ_{JA}	155°C/W
Junction Temperature	+150°C
Storage Temperature Range.....	-65°C to +150°C
Lead Temperature (Soldering, 10s)	+260°C
ESD Susceptibility	
HBM.....	1000V
MM.....	400V

RECOMMENDED OPERATING CONDITIONS

Operating Voltage Range.....	2.5V to 5.5V
Operating Temperature Range	-40°C to +125°C

OVERSTRESS CAUTION

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

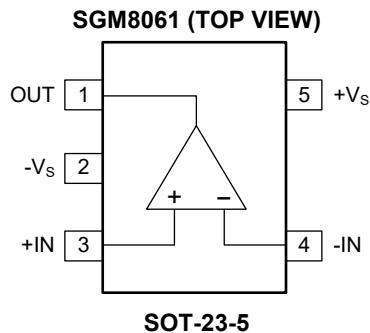
ESD SENSITIVITY CAUTION

This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

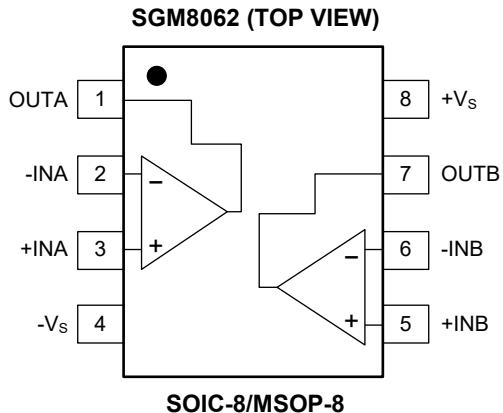
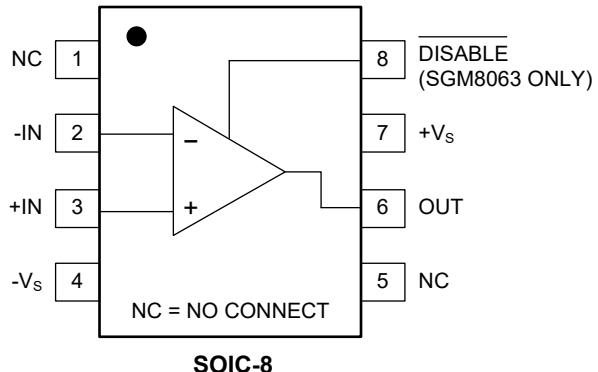
DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

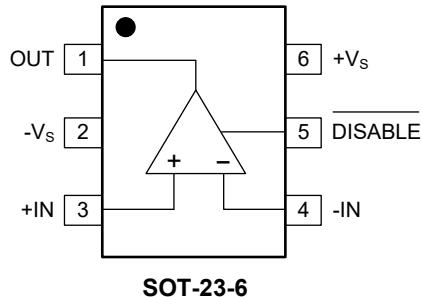
PIN CONFIGURATIONS



SGM8061/SGM8063 (TOP VIEW)



SGM8063 (TOP VIEW)



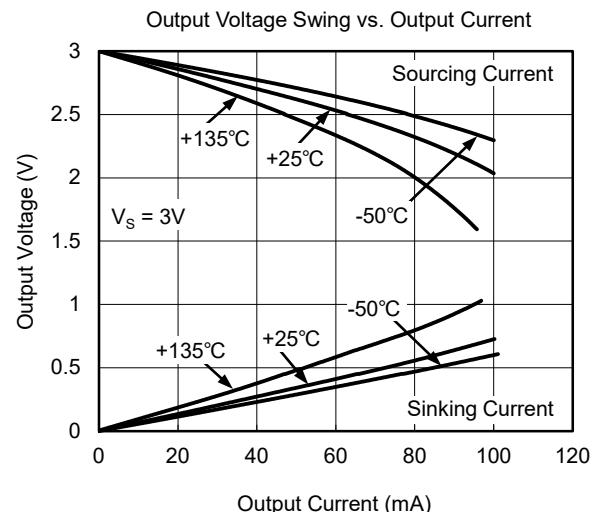
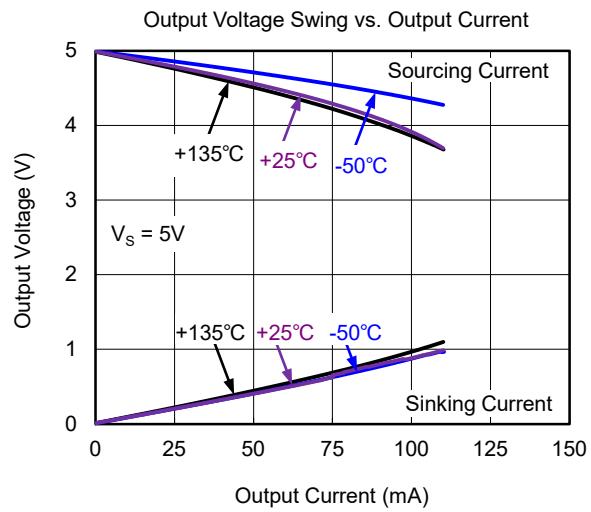
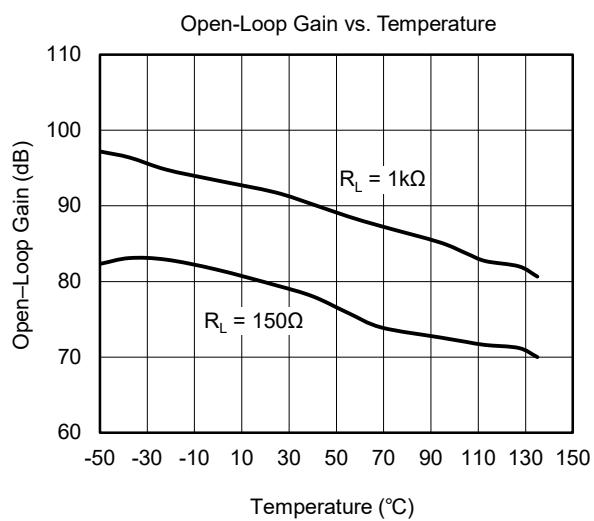
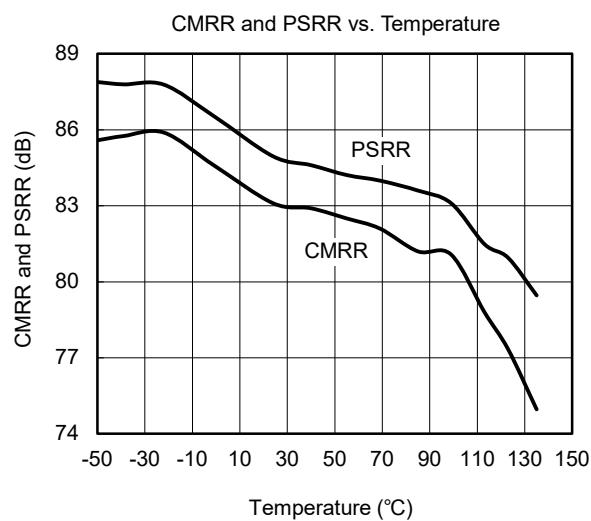
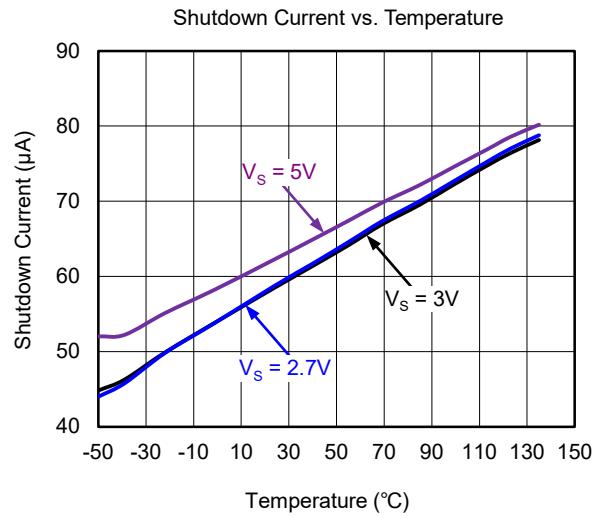
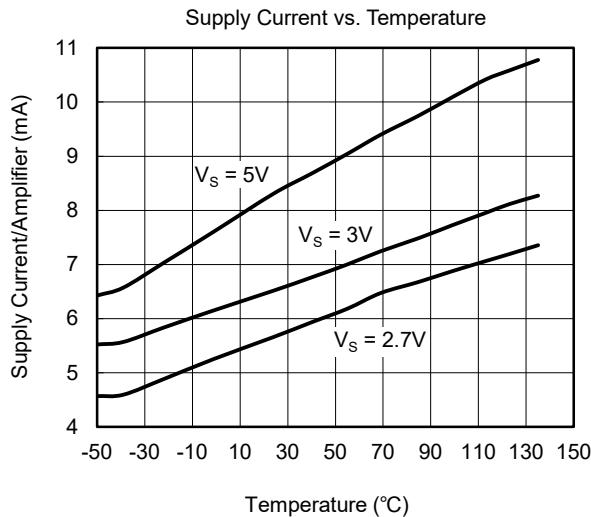
ELECTRICAL CHARACTERISTICS

($V_S = 5V$, $G = +2$, $R_F = 402\Omega$, $R_L = 150\Omega$, unless otherwise noted.)

PARAMETER	CONDITIONS	SGM8061/2/3						
		TYP		MIN/MAX OVER TEMPERATURE				
		+25°C	+25°C	0°C to +70°C	-40°C to +85°C	-40°C to +125°C	UNITS	MIN /MAX
Dynamic Performance								
-3dB Small-Signal Bandwidth	$G = +1$, $V_{OUT} = 0.1V_{P-P}$, $R_F = 24\Omega$, $G = +1$, $V_{OUT} = 0.1V_{P-P}$, $R_F = 24\Omega$, $R_L = 1k\Omega$ $G = +2$, $V_{OUT} = 0.1V_{P-P}$, $R_L = 50\Omega$ $G = +2$, $V_{OUT} = 0.1V_{P-P}$, $R_L = 150\Omega$ $G = +2$, $V_{OUT} = 0.1V_{P-P}$, $R_L = 1k\Omega$ $G = +2$, $V_{OUT} = 0.1V_{P-P}$, $R_L = 10k\Omega$ $G = +10$, $R_L = 150\Omega$ $G = +10$, $R_L = 1k\Omega$	500 550 130 210 250 420 200 230				MHz	TYP	
Gain-Bandwidth Product	$G = +1$, $V_{OUT} = 0.1V_{P-P}$, $R_F = 24\Omega$ $G = +2$, $V_{OUT} = 0.1V_{P-P}$, $R_F = 330\Omega$	130 80					MHz	TYP
Slew Rate	$G = +1$, 2V Output step $G = +2$, 2V Output step $G = +2$, 4V Output step	320/-370 350/-320 420/-390					V/ μ s	TYP
Rise-and-Fall Time	$G = +2$, $V_{OUT} = 0.2V_{P-P}$, 10% to 90%	4					ns	TYP
Settling Time to 0.1%	$G = +2$, $V_{OUT} = 2V_{P-P}$, 10% to 90%	4.5					ns	TYP
Overload Recovery Time	$G = +2$, 2V Output step $V_{IN} \cdot G = +V_S$	16 6.2					ns	TYP
Noise/Distortion Performance							nV/ $\sqrt{\text{Hz}}$	TYP
Input Voltage Noise Density	$f = 1\text{MHz}$	5.6					%	TYP
Differential Gain Error (NTSC)	$G = +2$, $R_L = 150\Omega$	0.015					degree	TYP
Differential Phase Error (NTSC)	$G = +2$, $R_L = 150\Omega$	0.05						TYP
DC Performance								
Input Offset Voltage (V_{os})		± 2	± 8	± 8.5	± 9	± 9.3	mV	MAX
Input Offset Voltage Drift		3					$\mu\text{V}/^\circ\text{C}$	TYP
Input Bias Current (I_B)		6					pA	TYP
Input Offset Current (I_{os})		2					pA	TYP
Open-Loop Gain (A_{OL})	$V_{OUT} = 0.3V$ to $4.7V$, $R_L = 150\Omega$ $V_{OUT} = 0.2V$ to $4.8V$, $R_L = 1k\Omega$	80 104	75 90	75 90	74 89	70 80	dB	MIN MIN
Input Characteristics							V	TYP
Input Common Mode Voltage Range (V_{CM})		-0.2 to 3.8					dB	MIN
Common Mode Rejection Ratio (CMRR)	$V_{CM} = -0.1V$ to $3.5V$	80	66	65	64	62		
Output Characteristics								
Output Voltage Swing from Rail	$R_L = 150\Omega$ $R_L = 1k\Omega$	0.12 0.03					V	TYP
Output Current		120	100	98	93	87	V	TYP
Closed-Loop Output Impedance	$f < 100\text{kHz}$	0.015					mA	MIN
							Ω	TYP
Power-Down Disable (SGM8063 Only)								
Turn-On Time		50					ns	TYP
Turn-Off Time		44					ns	TYP
DISABLE Voltage-Off			0.8				V	MAX
DISABLE Voltage-On			2				V	MIN
Power Supply								
Operating Voltage Range			2.5 5.5	2.7 5.5	2.7 5.5	2.7 5.5	V	MIN MAX
Quiescent Current/Amplifier Supply Current when Disabled (SGM8063 only)		8.2 75	10 120	10.3 127	10.5 130	11 139	mA μA	MAX MAX
Power Supply Rejection Ratio (PSRR)	$\Delta V_S = 2.7V$ to $5.5V$, $V_{CM} = (-V_S) + 0.5V$	80	66	66	65	63	dB	MIN

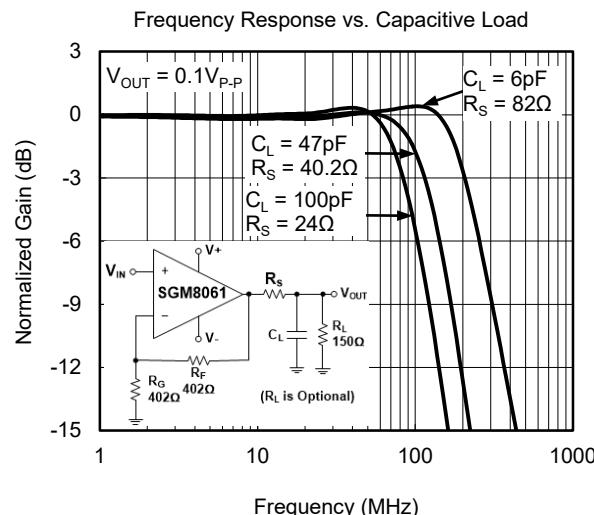
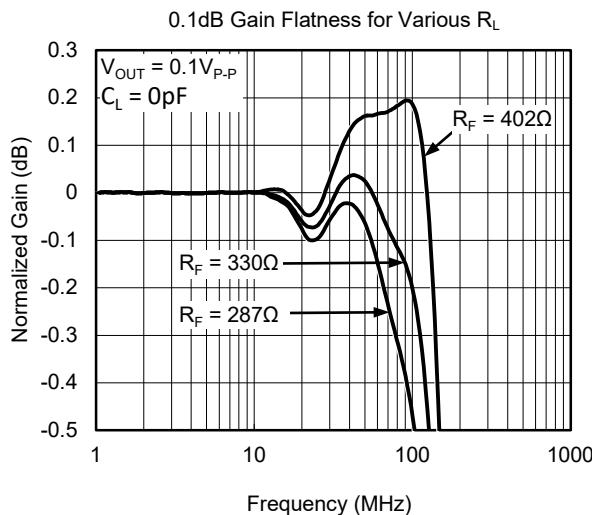
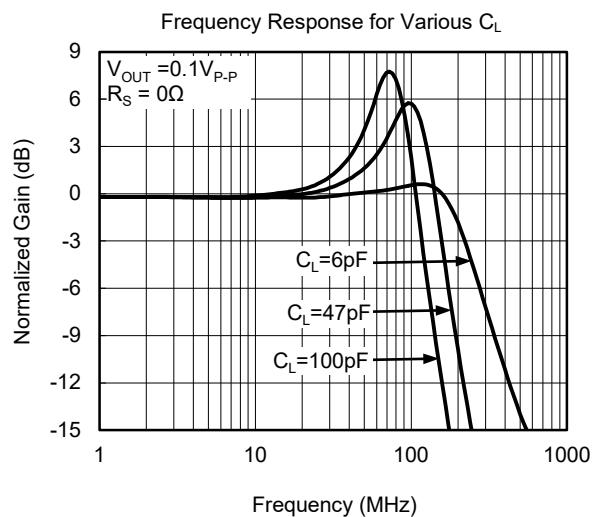
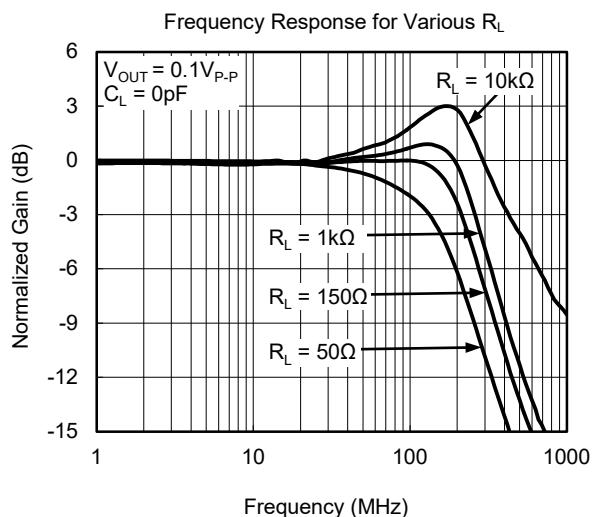
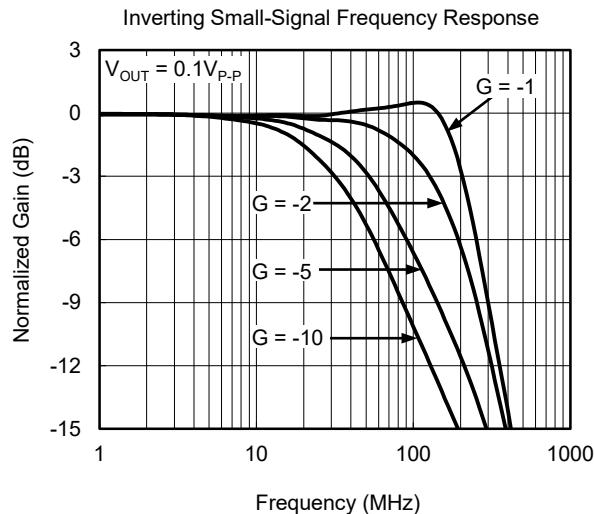
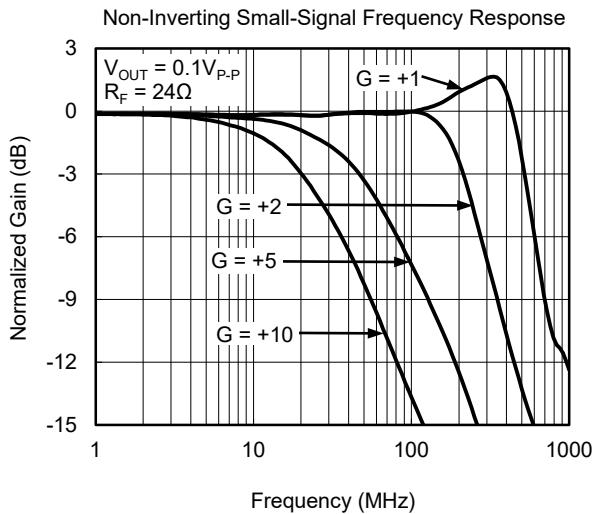
TYPICAL PERFORMANCE CHARACTERISTICS

At $T_A = +25^\circ\text{C}$, $V_S = 5\text{V}$, $G = +2$, $R_F = 402\Omega$, $R_G = 402\Omega$, and $R_L = 150\Omega$ connected to $V_S/2$, unless otherwise noted.



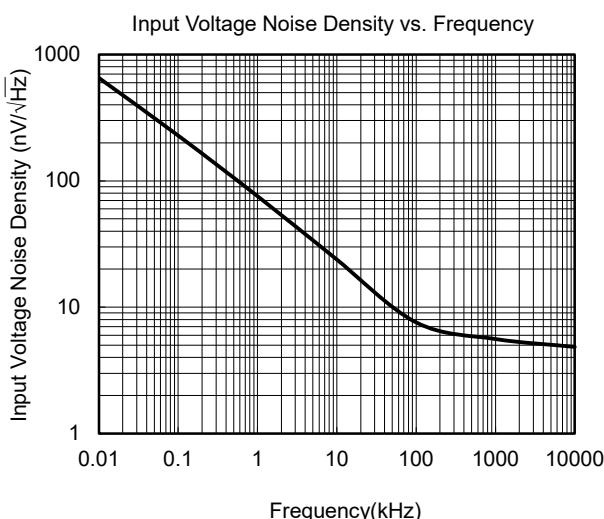
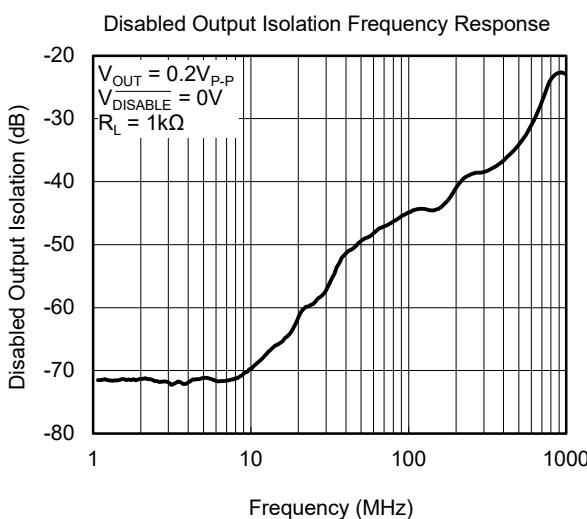
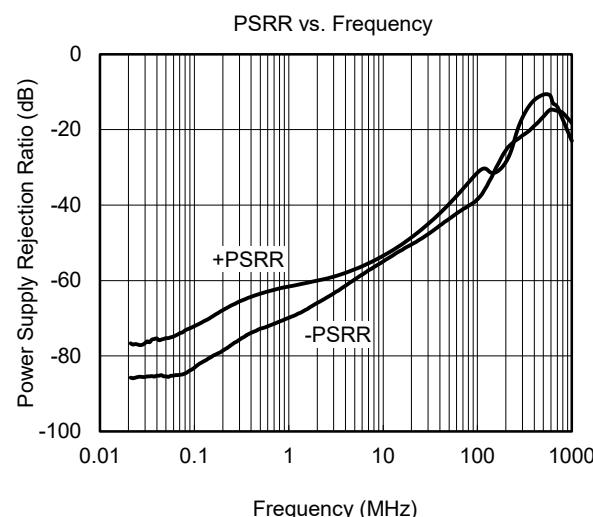
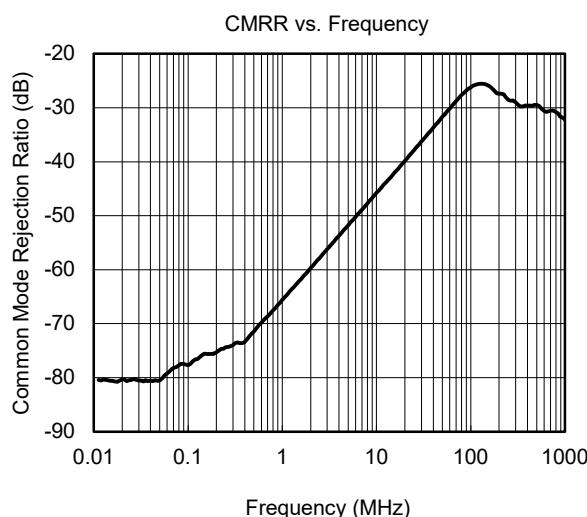
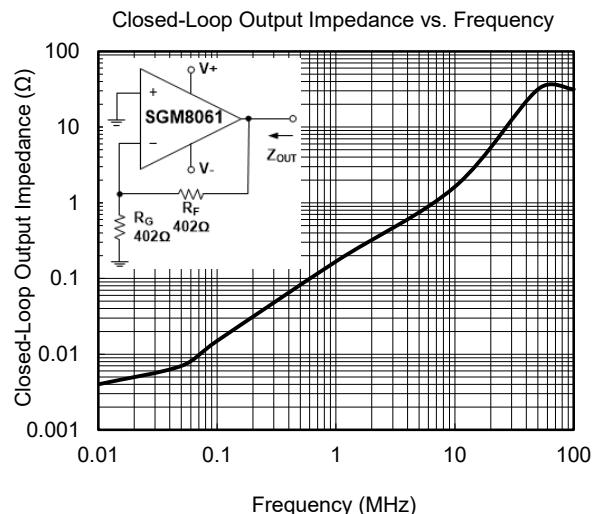
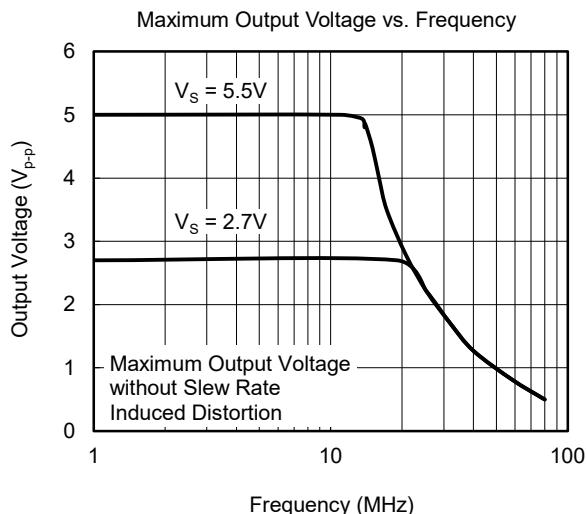
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At $T_A = +25^\circ\text{C}$, $V_S = 5\text{V}$, $G = +2$, $R_F = 402\Omega$, $R_G = 402\Omega$, and $R_L = 150\Omega$ connected to $V_S/2$, unless otherwise noted.



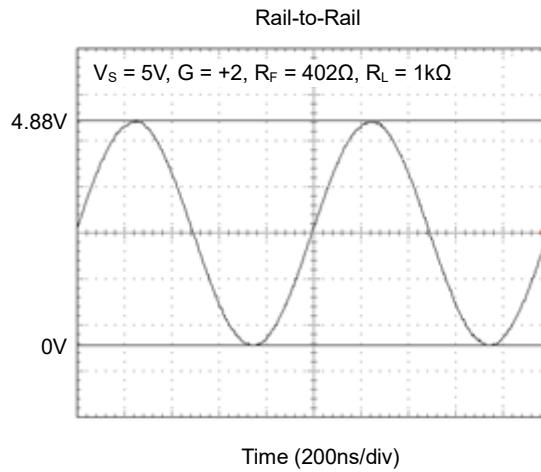
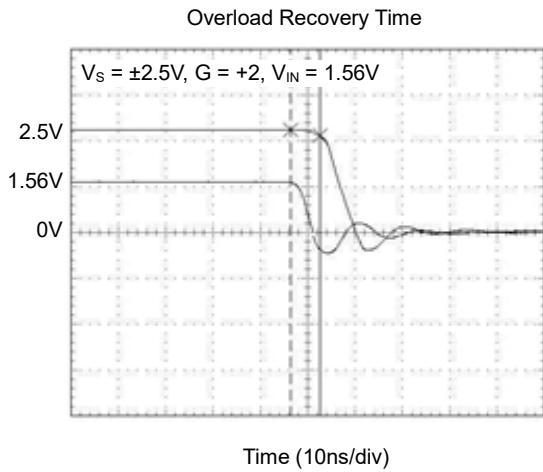
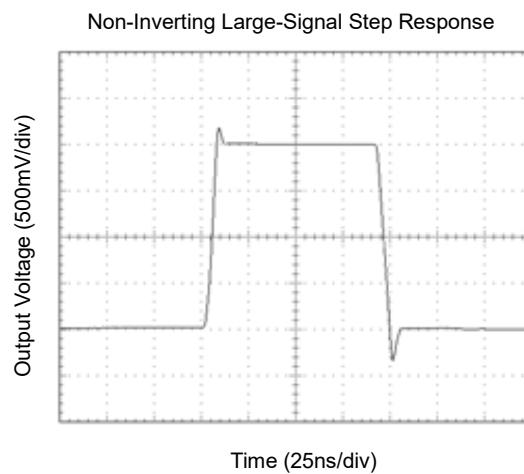
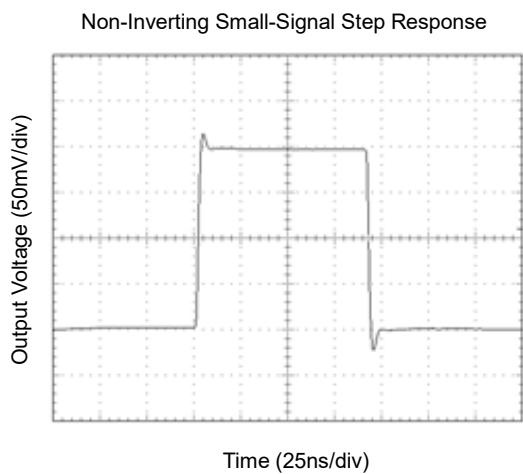
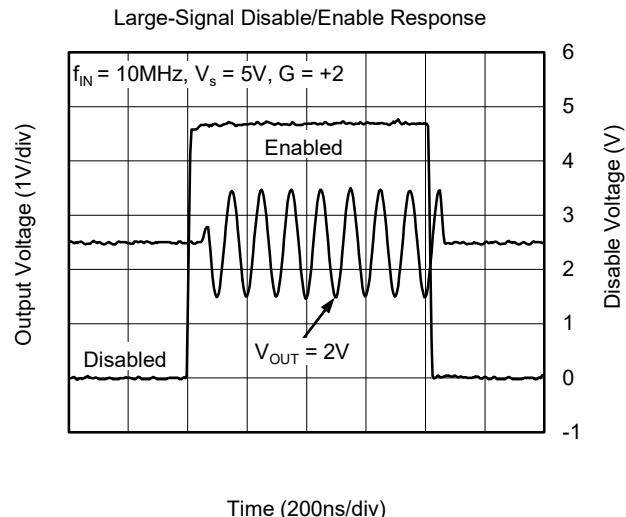
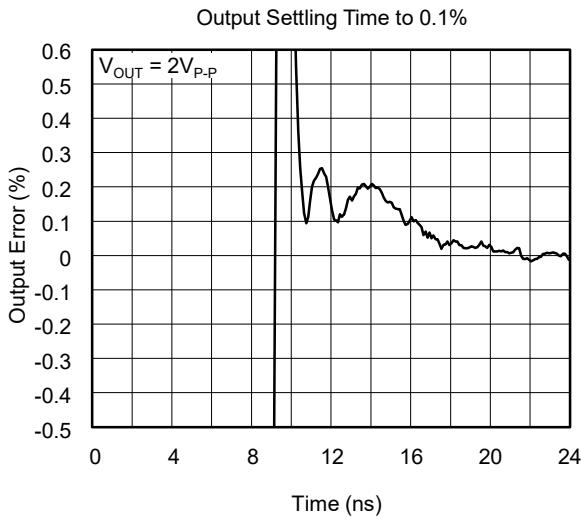
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At $T_A = +25^\circ\text{C}$, $V_S = 5\text{V}$, $G = +2$, $R_F = 402\Omega$, $R_G = 402\Omega$, and $R_L = 150\Omega$ connected to $V_S/2$, unless otherwise noted.



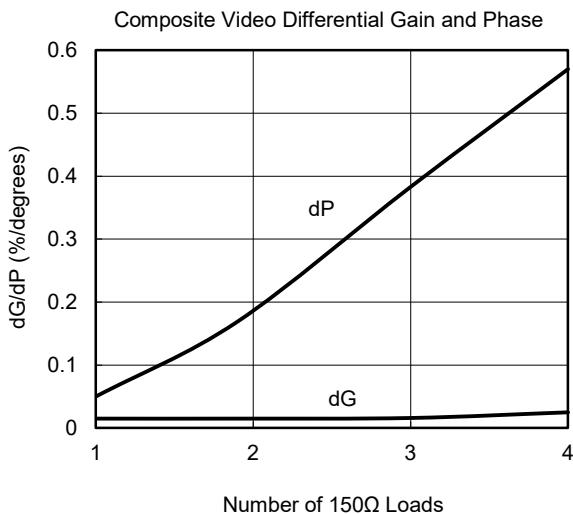
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At $T_A = +25^\circ\text{C}$, $V_S = 5\text{V}$, $G = +2$, $R_F = 402\Omega$, $R_G = 402\Omega$, and $R_L = 150\Omega$ connected to $V_S/2$, unless otherwise noted.



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At $T_A = +25^\circ\text{C}$, $V_S = 5\text{V}$, $G = +2$, $R_F = 402\Omega$, $R_G = 402\Omega$, and $R_L=150\Omega$ connected to $V_S/2$, unless otherwise noted.



APPLICATION INFORMATION

Rail-to-Rail Output

The SGM8061/2/3 support rail-to-rail output operation. In single power supply application, for example, when $+V_S = 5V$, $-V_S = GND$, $1k\Omega$ load resistor is tied from OUT pin to ground, the typical output swing range is from 0.03V to 4.97V.

Driving Capacitive Loads

The SGM8061/2/3 are designed for driving heavy capacitive load with unity-gain stable. If greater capacitive load must be driven in application, the circuit in Figure 1 can be used. In this circuit, the IR drop voltage generated by R_{ISO} is compensated by feedback loop.

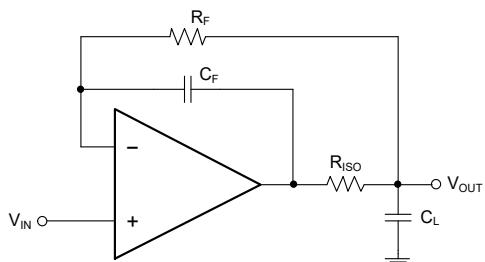


Figure 1. Circuit to Drive Heavy Capacitive Load

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 amplifiers 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, $10\mu F$ ceramic capacitor paralleled with $0.1\mu F$ or $0.01\mu F$ ceramic capacitor is used in Figure 2. The ceramic capacitors should be placed as close as possible to $+V_S$ and $-V_S$ power supply pins.

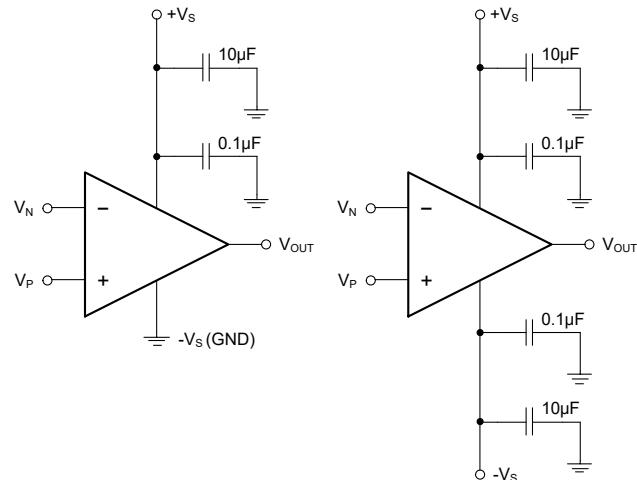


Figure 2. Amplifier Power Supply Bypassing

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

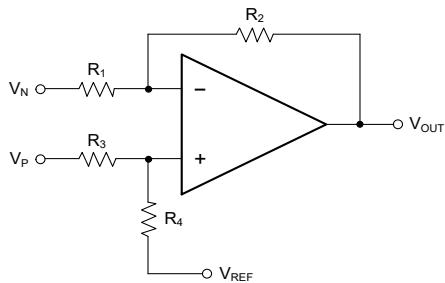


Figure 3. Difference Amplifier

Active Low-Pass Filter

The circuit in Figure 4 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.

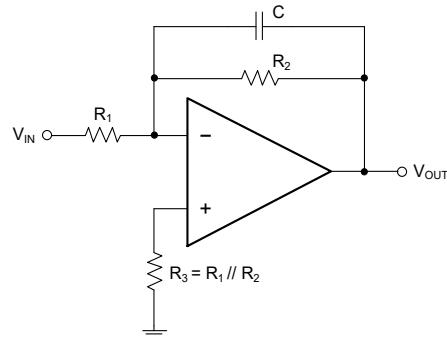


Figure 4. Active Low-Pass Filter

Driving Video

The SGM8061/2/3 can be used in video applications as shown in Figure 5.

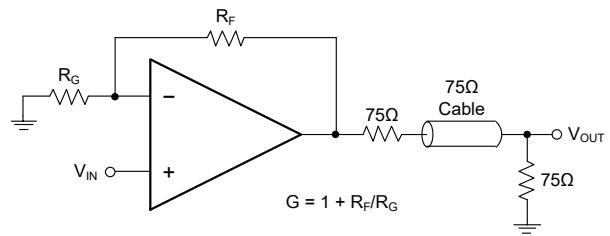


Figure 5. Typical Video Driving

REVISION HISTORY

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

JANUARY 2019 – REV.A.1 to REV.A.2	Page
Added MSOP-8 Package.....	All
Changed Absolute Maximum Ratings section.....	2
Changed Driving Capacitive Loads section.....	10

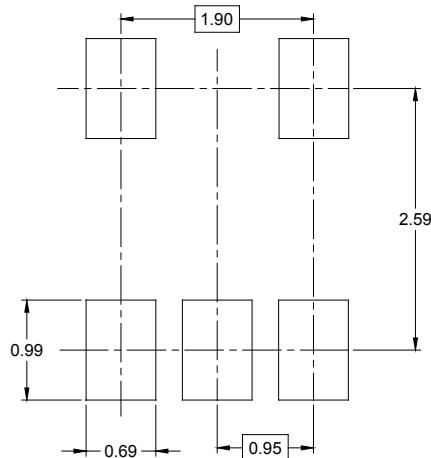
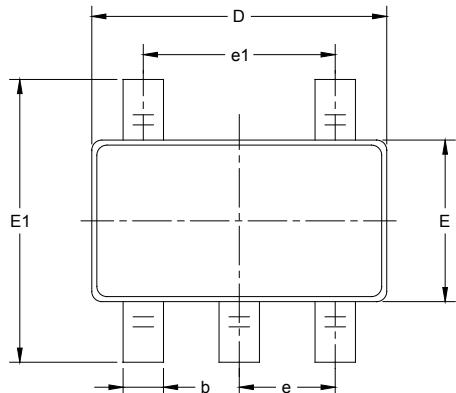
MAY 2011 – REV.A to REV.A.1	Page
Changed Package name	All

Changes from Original (NOVEMBER 2006) to REV.A	Page
Changed from product preview to production data.....	All

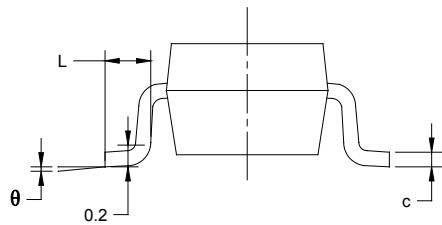
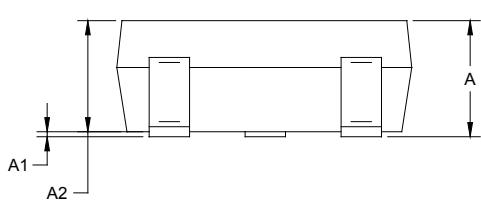
PACKAGE INFORMATION

PACKAGE OUTLINE DIMENSIONS

SOT-23-5



RECOMMENDED LAND PATTERN (Unit: mm)

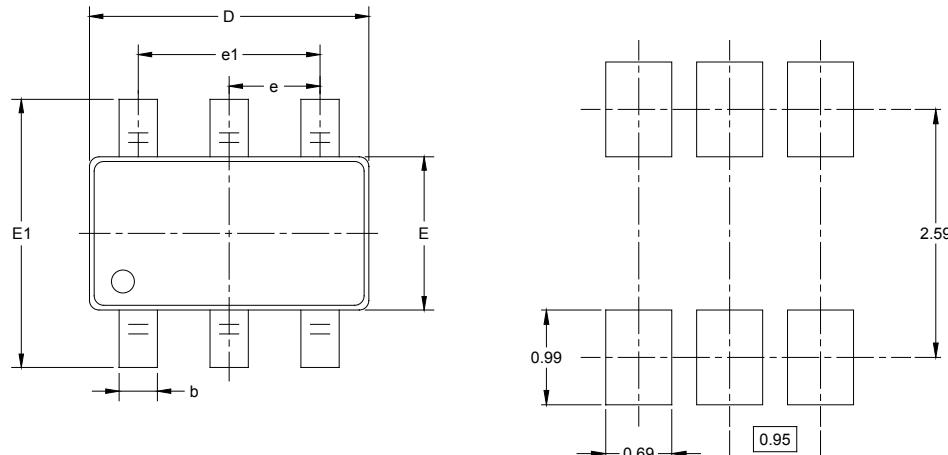


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037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

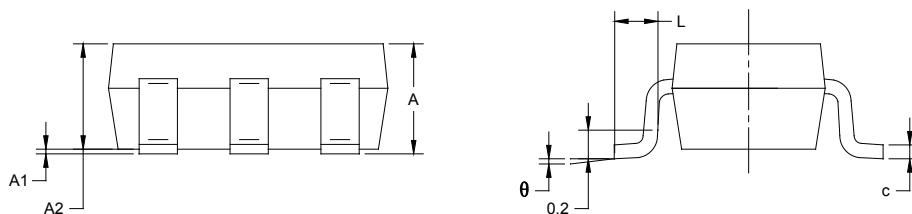
PACKAGE INFORMATION

PACKAGE OUTLINE DIMENSIONS

SOT-23-6



RECOMMENDED LAND PATTERN (Unit: mm)

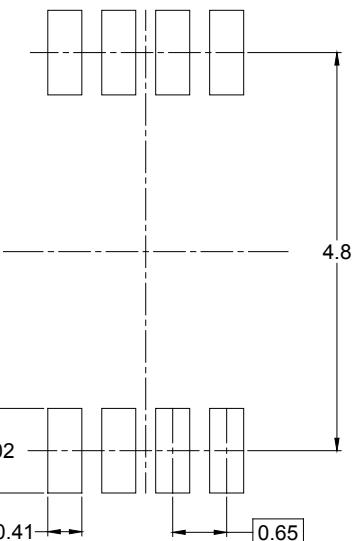
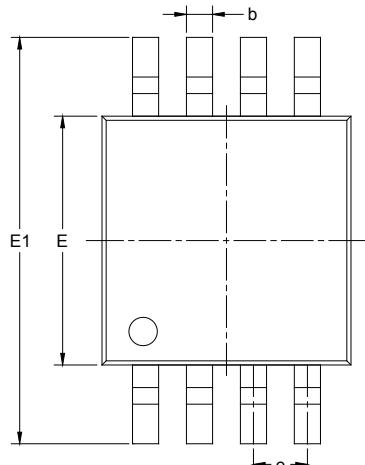


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037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

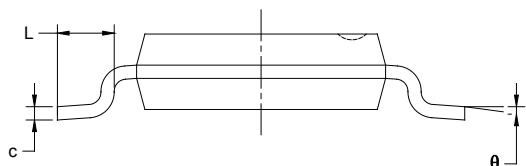
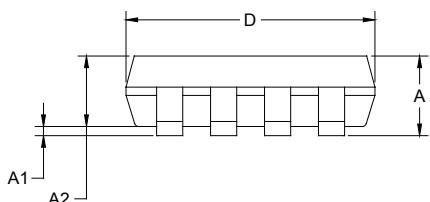
PACKAGE INFORMATION

PACKAGE OUTLINE DIMENSIONS

MSOP-8



RECOMMENDED LAND PATTERN (Unit: mm)

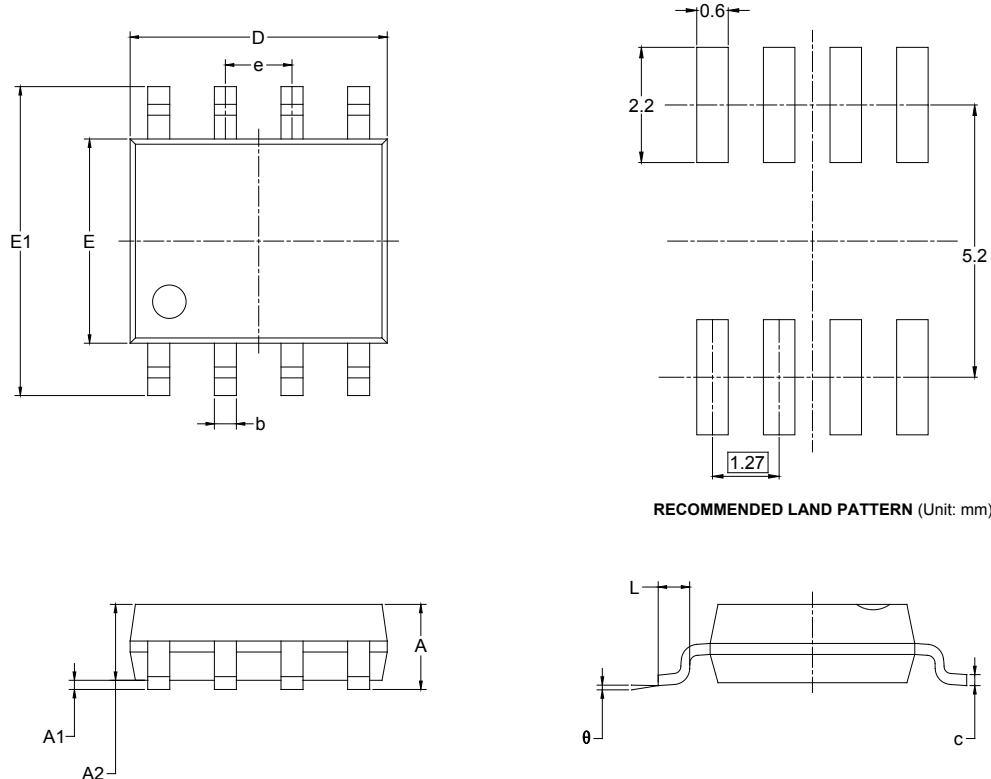


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650 BSC		0.026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

PACKAGE INFORMATION

PACKAGE OUTLINE DIMENSIONS

SOIC-8



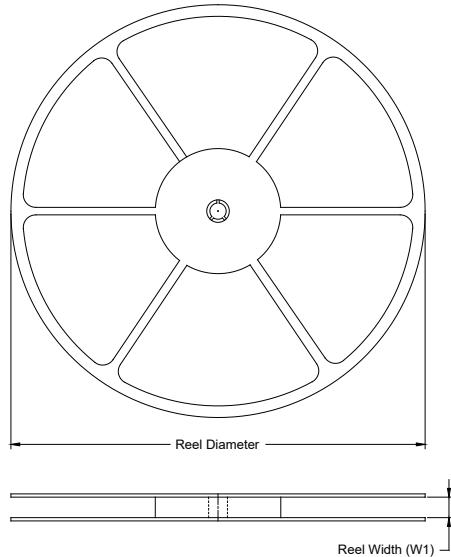
RECOMMENDED LAND PATTERN (Unit: mm)

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°

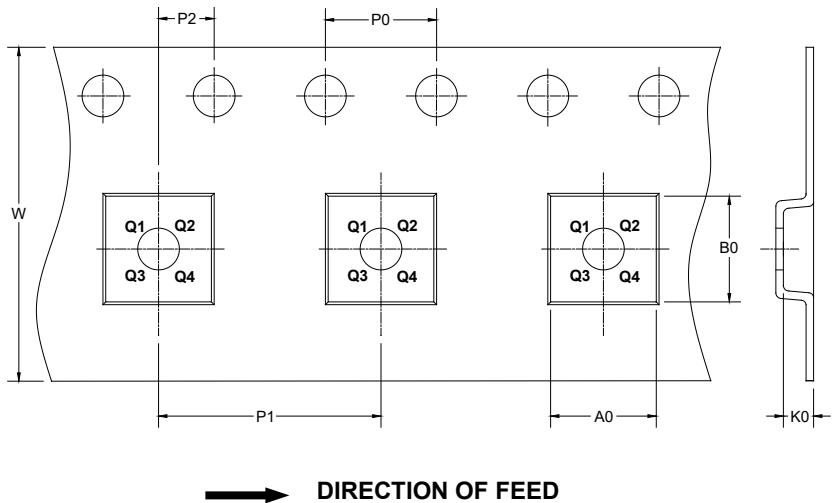
PACKAGE INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



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

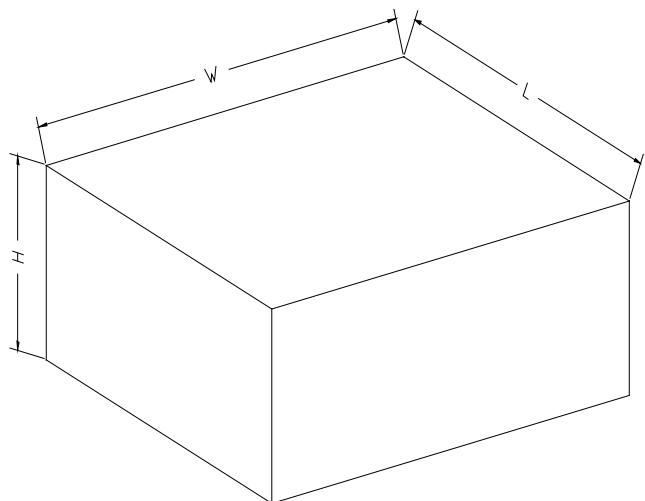
KEY PARAMETER LIST OF TAPE AND REEL

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
SOT-23-6	7"	9.5	3.17	3.23	1.37	4.0	4.0	2.0	8.0	Q3
MSOP-8	13"	12.4	5.20	3.30	1.50	4.0	8.0	2.0	12.0	Q1
SOIC-8	13"	12.4	6.40	5.40	2.10	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