



# SGM8301/2/4 100MHz, High Voltage, Rail-to-Rail Output Amplifiers

## GENERAL DESCRIPTION

The SGM8301 (single), SGM8302 (dual) and SGM8304 (quad) are unity gain stable devices that combine high speed performance and rail-to-rail outputs. These devices are targeted for applications where an input or an output is exposed to the outside world, such as video and communications.

These devices can operate from  $\pm 2.25\text{V}$  to  $\pm 6\text{V}$  dual power supplies or from 4.5V to 12V single supplies. The common mode input voltage range extends to the negative power-supply rail (ground in single-supply applications).

The SGM8301/2/4 consume only 8.5mA of quiescent supply current per amplifier while achieving a 100MHz -3dB bandwidth, 56MHz small signal bandwidth for -0.1dB gain flatness, and a 155V/ $\mu\text{s}$  slew rate.

The SGM8301 single is available in Green SOT-23-5, MSOP-8 and SOIC-8 packages. The SGM8302 dual is available in Green SOIC-8 and MSOP-8 packages. The SGM8304 quad is available in Green SOIC-14 and TSSOP-14 packages. The SGM8301/2/4 are specified over the extended  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  temperature range.

## FEATURES

- **4.5V to 12V Single Supplies or  $\pm 2.25\text{V}$  to  $\pm 6\text{V}$  Dual Power Supplies**
- **High Speed**  
**100MHz -3dB Bandwidth**  
**56MHz -0.1dB Gain Flatness**  
**155V/ $\mu\text{s}$  Slew Rate**
- **Rail-to-Rail Output**
- **Low Differential Gain/Phase: 0.02%/0.02°**
- **High Output Drive: 103mA**
- **$-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  Operating Temperature Range**
- **Small Packaging:**  
**SGM8301 Available in SOT-23-5, SOIC-8 and MSOP-8**  
**SGM8302 Available in MSOP-8 and SOIC-8**  
**SGM8304 Available in SOIC-14 and TSSOP-14**

## APPLICATIONS

Video Line Driver  
Video-on-Demand  
Set-Top Boxes  
Surveillance Video Systems  
Analog-to-Digital Converter Interface  
CCD Imaging Systems  
Digital Cameras

**PACKAGE/ORDERING INFORMATION**

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM8301	SOIC-8	-40°C to +85°C	SGM8301YS8G/TR	SGM 8301YS8 XXXXX	Tape and Reel, 2500
	MSOP-8	-40°C to +85°C	SGM8301YMS8G/TR	SGM8301 YMS8 XXXXX	Tape and Reel, 3000
	SOT-23-5	-40°C to +85°C	SGM8301YN5G/TR	SA6XX	Tape and Reel, 3000
SGM8302	SOIC-8	-40°C to +85°C	SGM8302YS8G/TR	SGM 8302YS8 XXXXX	Tape and Reel, 2500
	MSOP-8	-40°C to +85°C	SGM8302YMS8G/TR	SGM8302 YMS8 XXXXX	Tape and Reel, 3000
SGM8304	SOIC-14	-40°C to +85°C	SGM8304YS14G/TR	SGM8304YS14 XXXXX	Tape and Reel, 2500
	TSSOP-14	-40°C to +85°C	SGM8304YTS14G/TR	SGM8304 YTS14 XXXXX	Tape and Reel, 3000

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

Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

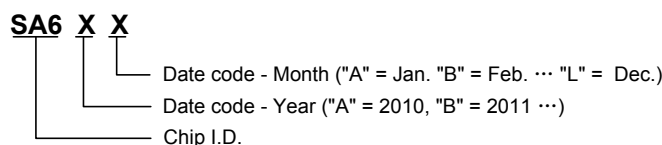
**ABSOLUTE MAXIMUM RATINGS**

Supply Voltage (+V <sub>S</sub> to -V <sub>S</sub> )	-0.3V to 13.2V
IN <sub>+</sub> , IN <sub>-</sub> , OUT	(-V <sub>S</sub> ) - 0.3V to (+V <sub>S</sub> ) + 0.3V
Differential Input Voltage	±2.5V
Junction Temperature	+150°C
Package Thermal Resistance @ T <sub>A</sub> = +25°C	
SOT-23-5, θ <sub>JA</sub>	232°C/W
SOIC-8, θ <sub>JA</sub>	160°C/W
MSOP-8, θ <sub>JA</sub>	216°C/W
SOIC-14, θ <sub>JA</sub>	120°C/W
TSSOP-14, θ <sub>JA</sub>	154°C/W
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10s)	+260°C
ESD Susceptibility	
HBM (SGM8301/4)	3000V
HBM (SGM8302)	2000V
MM	250V

**RECOMMENDED OPERATING CONDITIONS**

Operating Temperature Range	-40°C to +85°C
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**MARKING INFORMATION**



For example: SA6CA (2012, January)

**OVERSTRESS CAUTION**

Stresses beyond those listed may cause permanent damage to the device. Functional operation of the device at these or any other conditions beyond those indicated in the operational section of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

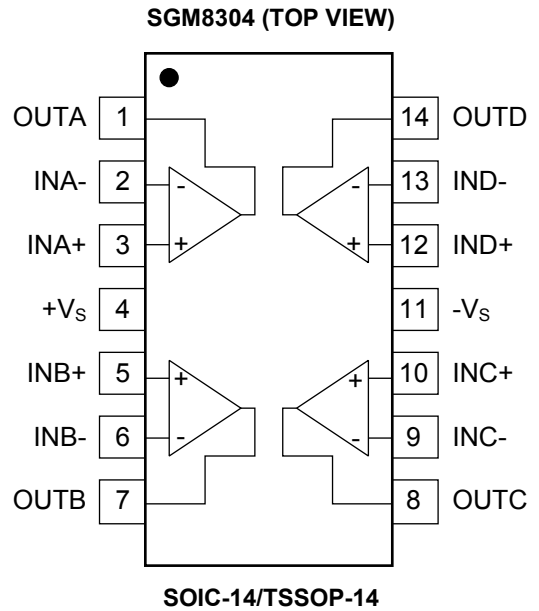
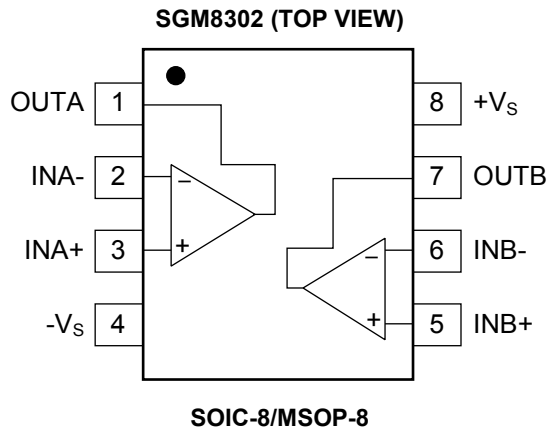
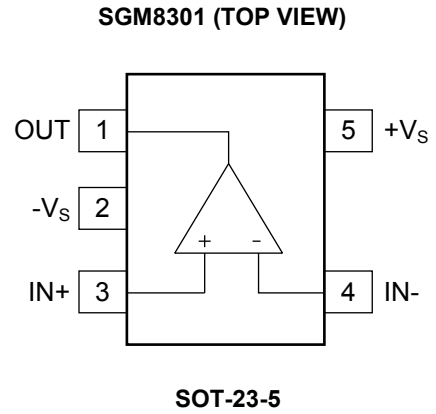
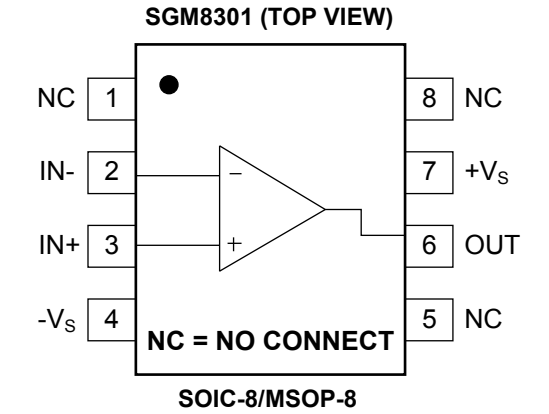
**ESD SENSITIVITY CAUTION**

This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

**DISCLAIMER**

SG Micro Corp reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time.

PIN CONFIGURATIONS



## ELECTRICAL CHARACTERISTICS

(V<sub>S</sub> = 5V, V<sub>CM</sub> = V<sub>S</sub>/2, V<sub>OUT</sub> = V<sub>S</sub>/2 and R<sub>L</sub> = 100Ω to V<sub>S</sub>/2, typical values are at T<sub>A</sub> = +25°C, unless otherwise noted.)

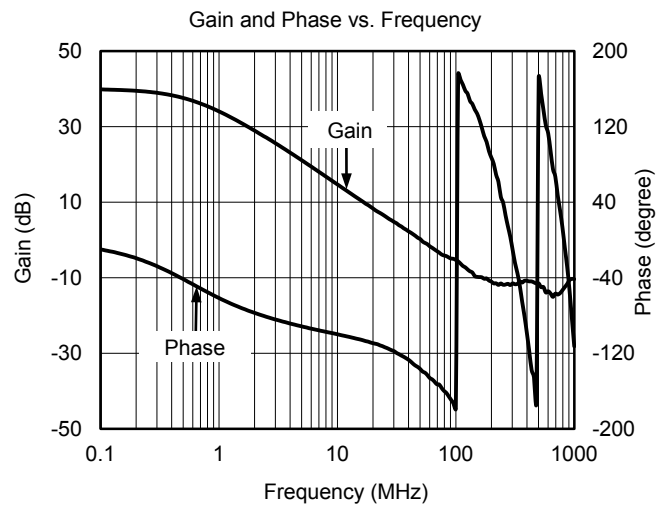
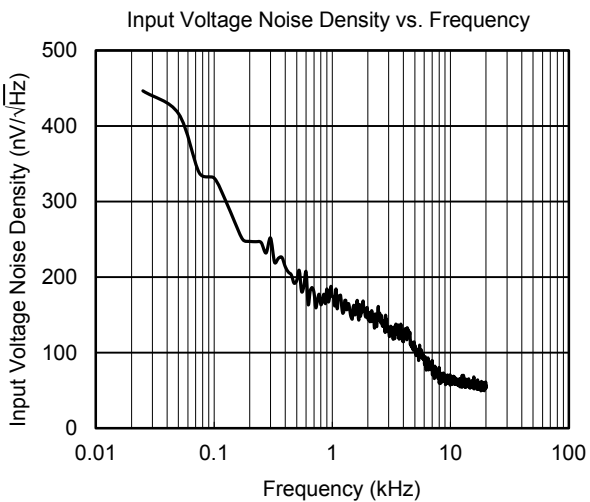
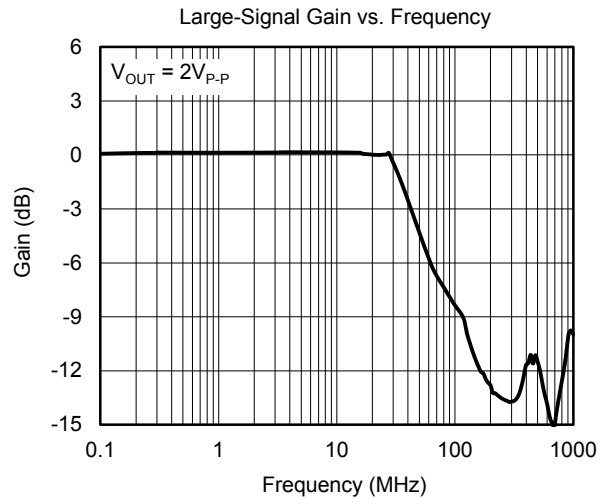
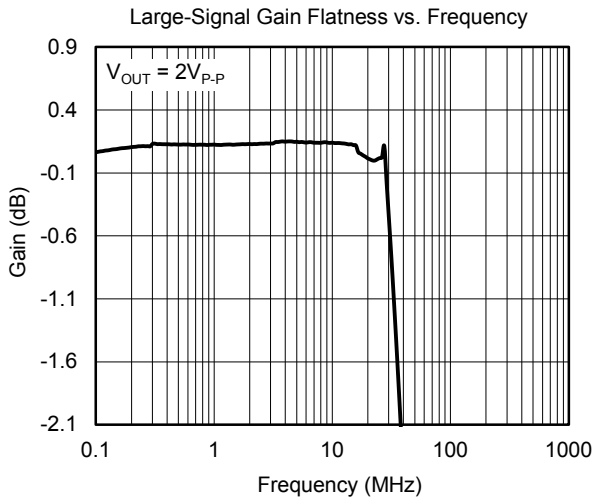
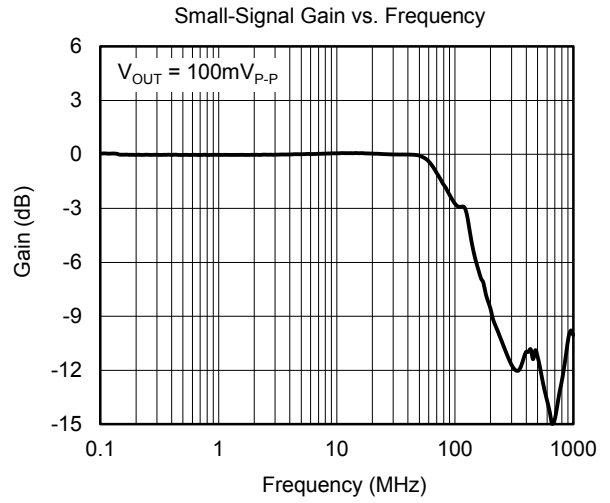
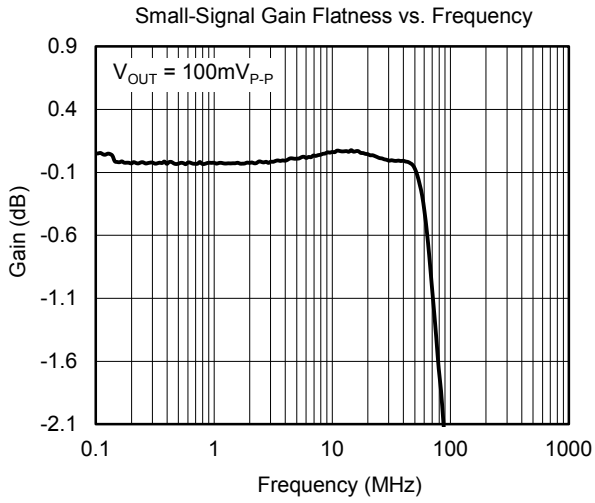
PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
<b>DC PERFORMANCE</b>					
Quiescent Current/Amplifier (I <sub>Q</sub> )	I <sub>OUT</sub> = 0mA		7.5	10.2	mA
Input Offset Voltage (V <sub>OS</sub> )		-18	5	18	mV
	T <sub>A</sub> = -40°C to +85°C	-21.5		21.5	
Input Offset Voltage Drift (ΔV <sub>OS</sub> /ΔT)			12		μV/°C
Open-Loop Gain (A <sub>OL</sub> )	R <sub>L</sub> = 50Ω, 1.3V ≤ V <sub>OUT</sub> ≤ 3.7V		88		dB
	R <sub>L</sub> = 150Ω, 0.6V ≤ V <sub>OUT</sub> ≤ 4.4V	82	100		
	R <sub>L</sub> = 2kΩ, 0.4V ≤ V <sub>OUT</sub> ≤ 4.6V	85	105		
Power Supply Rejection Ratio (PSRR)	V <sub>S</sub> = 4.5V to 13.2V	65	80		dB
Common Mode Rejection Ratio (CMRR)	V <sub>CM</sub> = -0.1V to 2.75V	58	75		dB
High Output Voltage Swing from Rail (V <sub>OH</sub> )	R <sub>L</sub> = 2kΩ to V <sub>S</sub> /2		60	115	mV
	R <sub>L</sub> = 150Ω to V <sub>S</sub> /2		405	517	
	R <sub>L</sub> = 75Ω to V <sub>S</sub> /2		700		
	R <sub>L</sub> = 75Ω to ground		1.515		V
Low Output Voltage Swing from Rail (V <sub>OL</sub> )	R <sub>L</sub> = 2kΩ to V <sub>S</sub> /2		33	49.5	mV
	R <sub>L</sub> = 150Ω to V <sub>S</sub> /2		340	428	
	R <sub>L</sub> = 75Ω to V <sub>S</sub> /2		600		
	R <sub>L</sub> = 75Ω to ground		3.2		
Output Current (I <sub>OUT</sub> )	R <sub>L</sub> = 75Ω to V <sub>S</sub> , sink	39.5	50		mA
	R <sub>L</sub> = 75Ω to ground, source	37	47		
Output Short Circuit Current (I <sub>SC</sub> )	R <sub>L</sub> = 10Ω to V <sub>S</sub> , sink		100		mA
	R <sub>L</sub> = 10Ω to ground, source		75		
<b>AC PERFORMANCE</b>					
Small-Signal -3dB Bandwidth (BW <sub>SS</sub> )	G = +1		110		MHz
Large-Signal -3dB Bandwidth (BW <sub>LS</sub> )	G = +1		51		
Small-Signal Bandwidth for -0.1dB Gain Flatness (BW <sub>0.1dBSS</sub> )	G = +1		52		
Large-Signal Bandwidth for -0.1dB Gain Flatness (BW <sub>0.1dBS</sub> )	G = +1		32		
Gain-Bandwidth Product (GBP)	G = +100		57		MHz
Phase Margin (PM)	G = +100		44		°
Channel-to-Channel Crosstalk	V <sub>IN</sub> = 200mV <sub>P-P</sub> , f = 1kHz		106		dB
Overload Recovery Time (ORT)	f = 1kHz		115		ns
Input Voltage Noise Density (e <sub>n</sub> )	f = 1kHz		175		nV/√Hz
	f = 10kHz		65		
Slew Rate (SR) Up	f = 1kHz, 2V <sub>P-P</sub> output		115		V/μs
Slew Rate (SR) Down	f = 1kHz, 2V <sub>P-P</sub> output		140		V/μs
Settling Time to 0.1% (t <sub>s</sub> )	f = 1kHz, 2V <sub>P-P</sub> output		65		ns
Rise/Fall Time (t <sub>r</sub> /t <sub>f</sub> )	f = 1kHz, V <sub>OUT</sub> = 100mV <sub>P-P</sub>		7.8		ns
Differential Gain Error (DG)	NTSC		0.09		%
Differential Phase Error (DP)	NTSC		0.4		°

**ELECTRICAL CHARACTERISTICS (continued)**(V<sub>S</sub> = ±6V, V<sub>CM</sub> = 0V, V<sub>OUT</sub> = 0V and R<sub>L</sub> = 100Ω to ground, typical values are at T<sub>A</sub> = +25°C, unless otherwise noted.)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
<b>DC PERFORMANCE</b>					
Quiescent Current/Amplifier (I <sub>Q</sub> )	I <sub>OUT</sub> = 0mA		8.5	11.3	mA
Input Offset Voltage (V <sub>OS</sub> )		-18	5	18	mV
	T <sub>A</sub> = -40°C to +85°C	-21.5		21.5	
Input Offset Voltage Drift (ΔV <sub>OS</sub> /ΔT)			11		μV/°C
Open-Loop Gain (A <sub>OL</sub> )	R <sub>L</sub> = 150Ω, -4.5V ≤ V <sub>OUT</sub> ≤ 4.5V	85	94		dB
	R <sub>L</sub> = 2kΩ, -4.9V ≤ V <sub>OUT</sub> ≤ 4.9V	90	110		
Common Mode Rejection Ratio (CMRR)	V <sub>CM</sub> = -6.1V to 3.75V	66	82		dB
High Output Voltage Swing from Rail (V <sub>OH</sub> )	R <sub>L</sub> = 2kΩ to ground		90	147	mV
	R <sub>L</sub> = 150Ω to ground		760	956	
Low Output Voltage Swing from Rail (V <sub>OL</sub> )	R <sub>L</sub> = 2kΩ to ground		87	116	mV
	R <sub>L</sub> = 150Ω to ground		888	1080	
Output Current (I <sub>OUT</sub> )	R <sub>L</sub> = 75Ω to V <sub>S</sub>	71	103		mA
	R <sub>L</sub> = 75Ω to -V <sub>S</sub>	53	90		
<b>AC PERFORMANCE</b>					
Small-Signal -3dB Bandwidth (BW <sub>SS</sub> )	G = +1		100		MHz
Large-Signal -3dB Bandwidth (BW <sub>LS</sub> )	G = +1		44		
Small-Signal Bandwidth for -0.1dB Gain Flatness (BW <sub>0.1dBSS</sub> )	G = +1		56		
Large-Signal Bandwidth for -0.1dB Gain Flatness (BW <sub>0.1dBLS</sub> )	G = +1		30		
Gain-Bandwidth Product (GBP)	G = +100		60		MHz
Phase Margin (PM)	G = +100		42		°
Channel-to-Channel Crosstalk	V <sub>IN</sub> = 200mV <sub>P-P</sub> , f = 1kHz		106		dB
Overload Recovery Time (ORT)	f = 1kHz		54		ns
Input Voltage Noise Density (e <sub>n</sub> )	f = 1kHz		174		nV/√Hz
	f = 10kHz		65		
Slew Rate (SR) Up	f = 1kHz, 2V <sub>P-P</sub> output		145		V/μs
Slew Rate (SR) Down	f = 1kHz, 2V <sub>P-P</sub> output		155		V/μs
Settling Time to 0.1% (t <sub>s</sub> )	f = 1kHz, 2V <sub>P-P</sub> output		84		ns
Rise/Fall Time (t <sub>r</sub> /t <sub>f</sub> )	f = 1kHz, V <sub>OUT</sub> = 100mV <sub>P-P</sub>		7.5		ns
Differential Gain Error (DG)	NTSC		0.02		%
Differential Phase Error (DP)	NTSC		0.02		°

**TYPICAL PERFORMANCE CHARACTERISTICS**

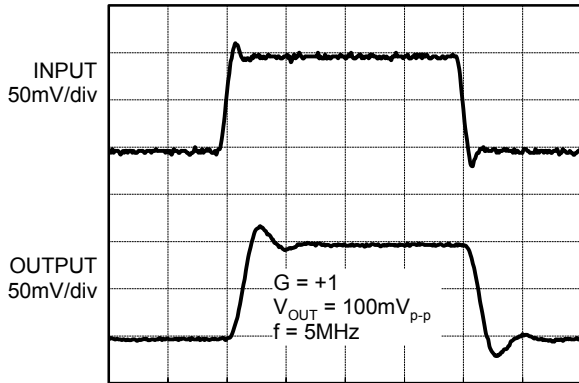
At  $T_A = +25^\circ\text{C}$ ,  $+V_S = 5\text{V}$ ,  $-V_S = -5\text{V}$ ,  $V_{CM} = 0\text{V}$  and  $R_L = 100\Omega$  to GND, unless otherwise noted.



**TYPICAL PERFORMANCE CHARACTERISTICS (continued)**

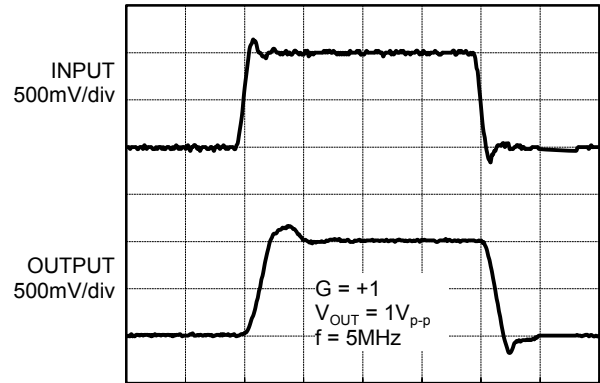
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Small-Signal Pulse Response



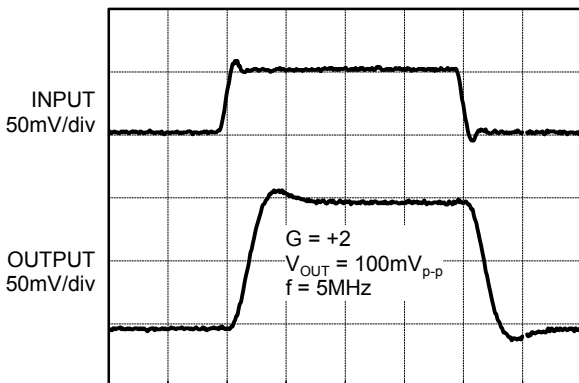
Time (25ns/div)

Large-Signal Pulse Response



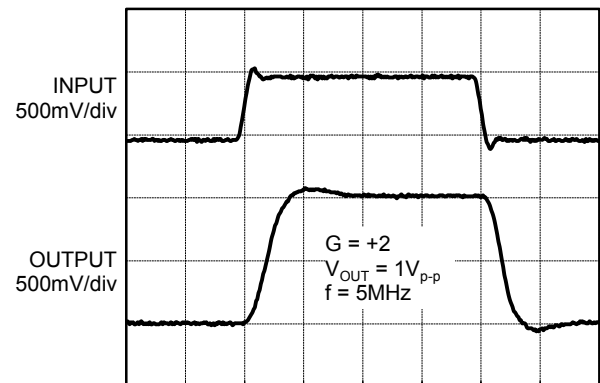
Time (25ns/div)

Small-Signal Pulse Response



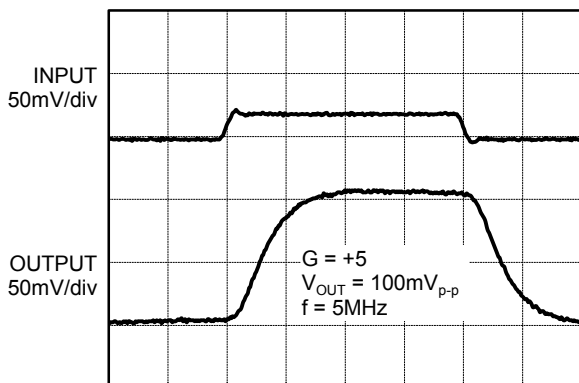
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Large-Signal Pulse Response



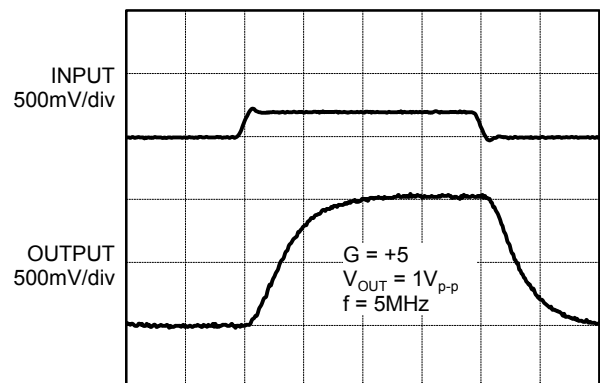
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Small-Signal Pulse Response



Time (25ns/div)

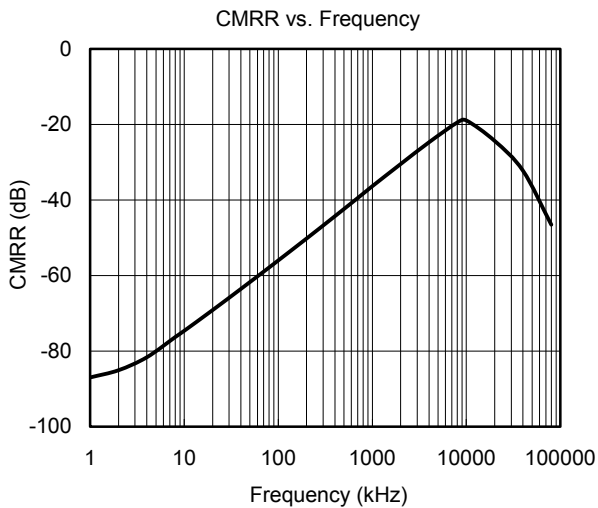
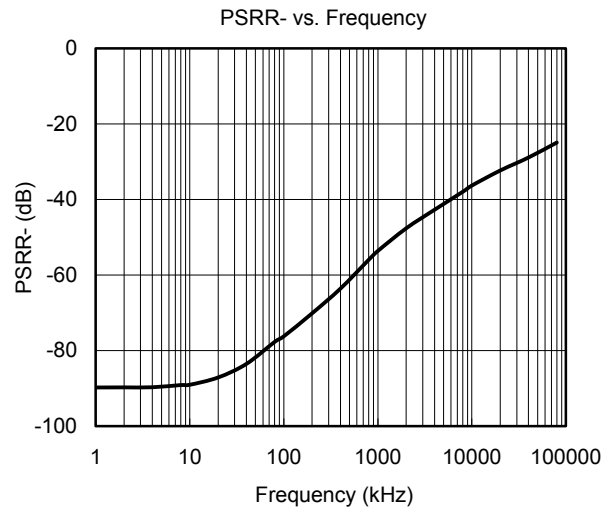
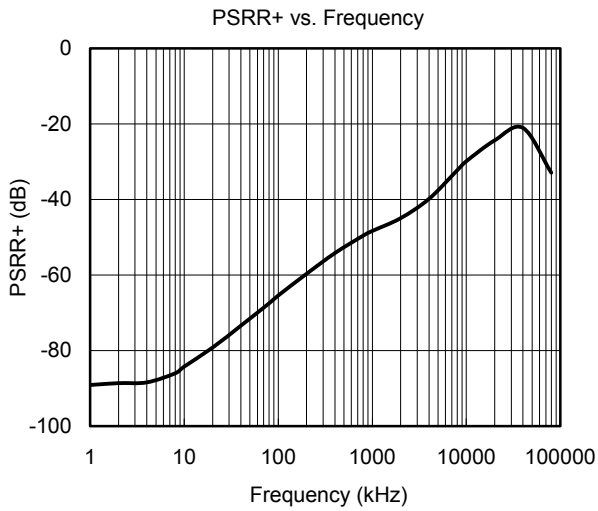
Large-Signal Pulse Response



Time (25ns/div)

**TYPICAL PERFORMANCE CHARACTERISTICS (continued)**

At  $T_A = +25^\circ\text{C}$ ,  $+V_S = 5\text{V}$ ,  $-V_S = -5\text{V}$ ,  $V_{CM} = 0\text{V}$  and  $R_L = 100\Omega$  to GND, unless otherwise noted





TYPICAL APPLICATION CIRCUIT

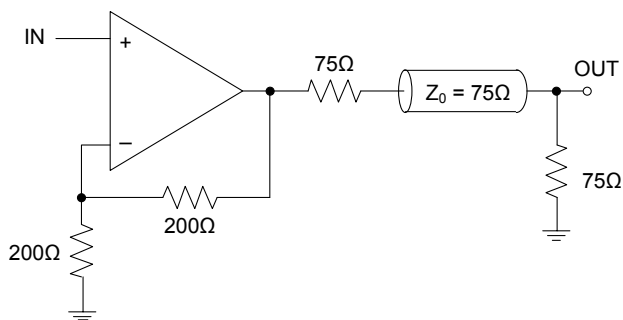


Figure 1. Video Line Driver

APPLICATION

Layout and Power Supply Bypassing

The SGM8301/2/4 operate from single 4.5V to 12V or from dual ±2.25V to ±6V supplies. Bypass each supply with a 0.1µF capacitor as close to the pin as possible. SGMC recommends using micro-strip and stripline techniques to obtain full bandwidth. To ensure that the PC board does not degrade the amplifier’s performance, design it for a frequency greater than 1GHz. Pay careful attention to inputs and outputs to avoid large parasitic capacitance. Whether or not you use a constant impedance board, observe the following design guidelines:

- Do not use wire-wrap boards; they are too inductive.
- Do not use IC sockets; they increase parasitic capacitance and inductance.
- Use surface-mount instead of through-hole components for better, high frequency performance.
- Use a PC board with at least two layers; it should be as free from voids as possible.
- Keep signal lines as short and as straight as possible. Do not make 90° turns; round all corners.

REVISION HISTORY

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

JUNE 2017 – REV.A.2 to REV.A.3

Added Package Thermal Resistance ..... 2

MAY 2013 – REV.A.1 to REV.A.2

Changed supply voltage range from 5V to 12V to 4.5V to 12V ..... 1, 9

JANUARY 2013 – REV.A to REV.A.1

Added Tape and Reel Information section ..... 15~16

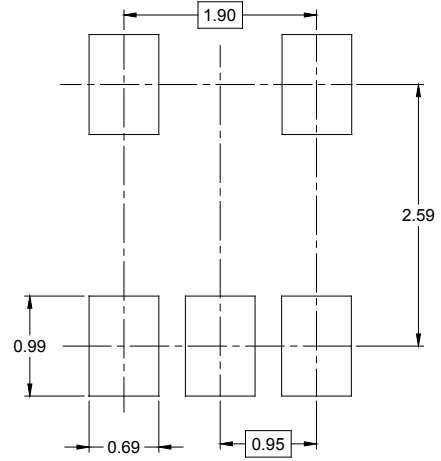
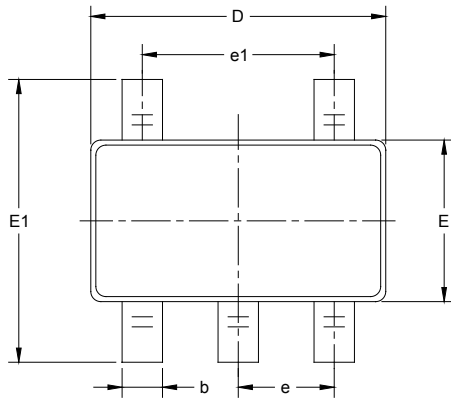
Changes from Original (JULY 2012) to REV.A

Changed from product preview to production data ..... All

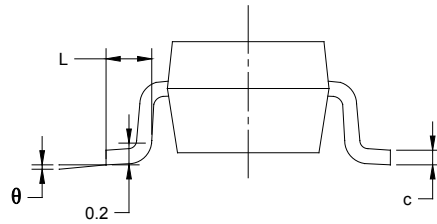
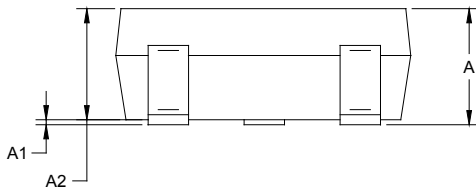
# PACKAGE INFORMATION

## PACKAGE OUTLINE DIMENSIONS

### SOT-23-5



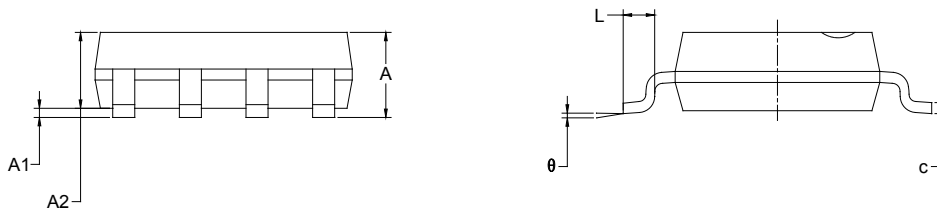
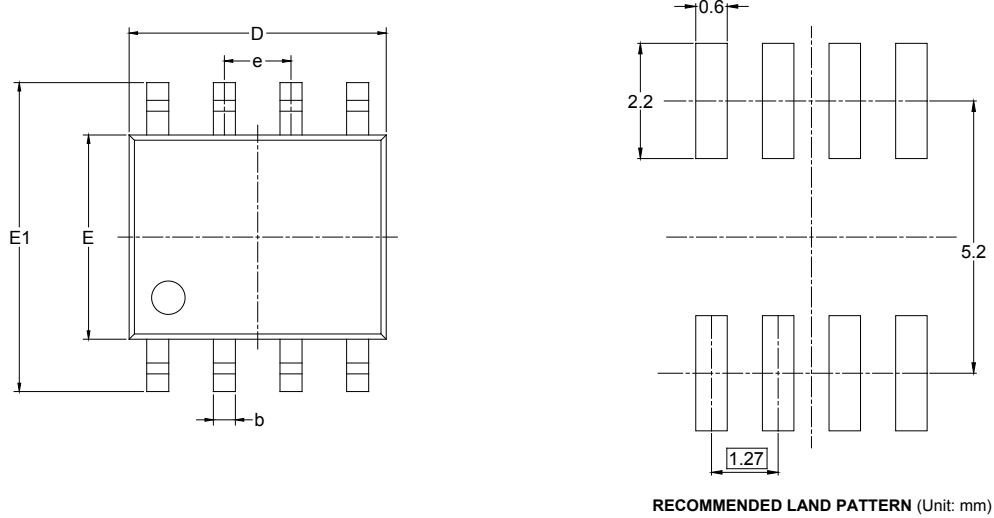
RECOMMENDED LAND PATTERN (Unit: mm)



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
$\theta$	0°	8°	0°	8°

PACKAGE OUTLINE DIMENSIONS

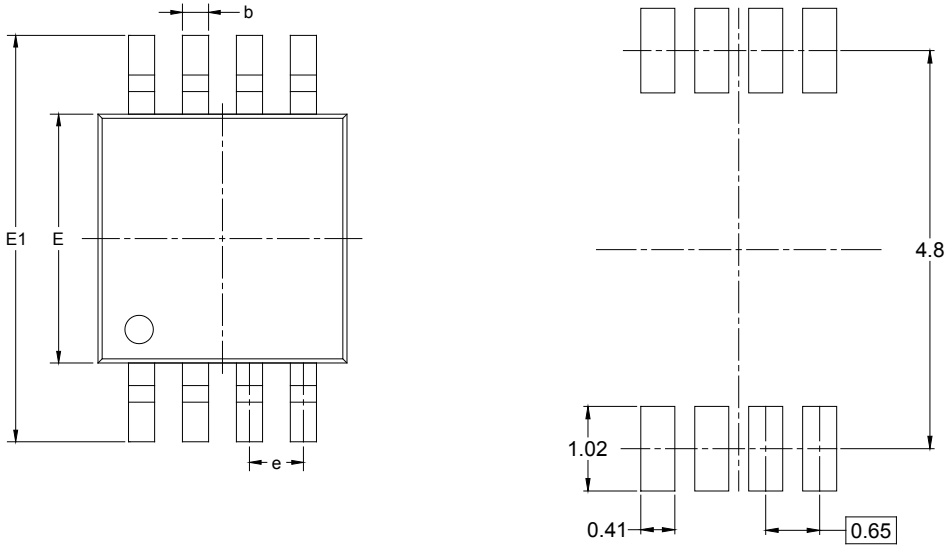
SOIC-8



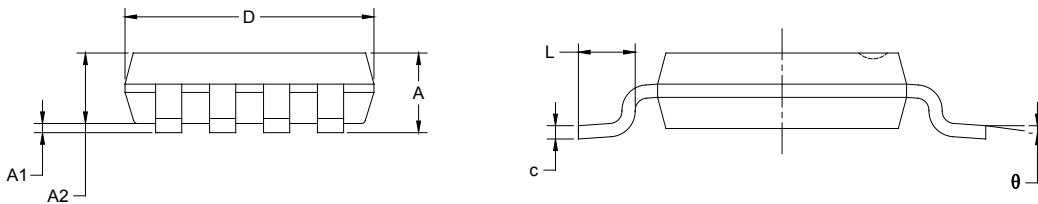
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050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

PACKAGE OUTLINE DIMENSIONS

MSOP-8



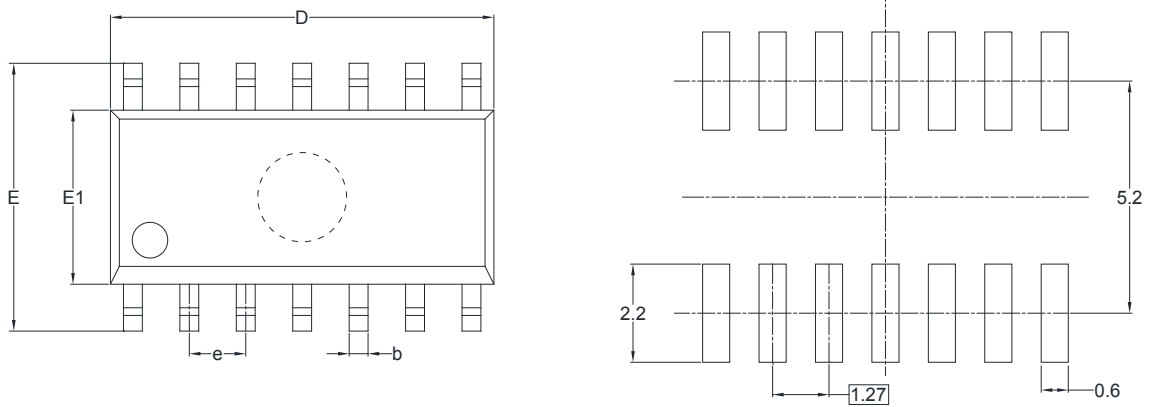
RECOMMENDED LAND PATTERN (Unit: mm)



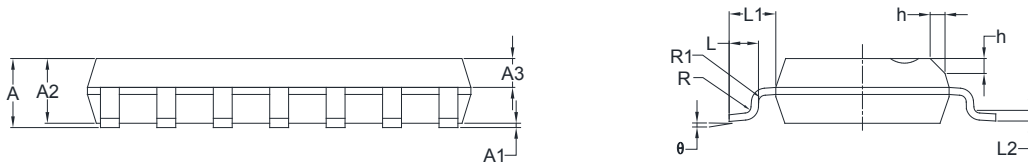
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
e	0.650 BSC		0.026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

PACKAGE OUTLINE DIMENSIONS

SOIC-14



RECOMMENDED LAND PATTERN (Unit: mm)

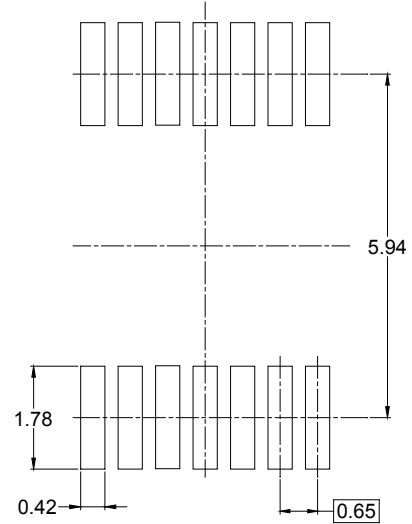
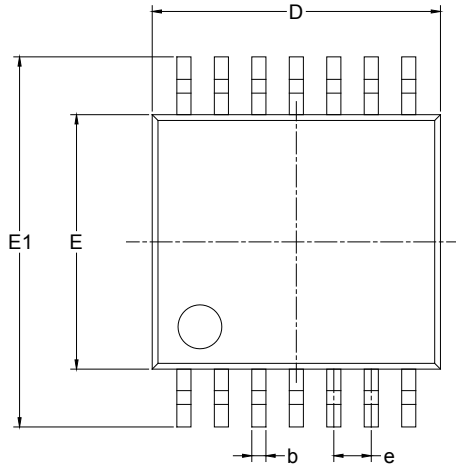


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.35	1.75	0.053	0.069
A1	0.10	0.25	0.004	0.010
A2	1.25	1.65	0.049	0.065
A3	0.55	0.75	0.022	0.030
b	0.36	0.49	0.014	0.019
D	8.53	8.73	0.336	0.344
E	5.80	6.20	0.228	0.244
E1	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
L	0.45	0.80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

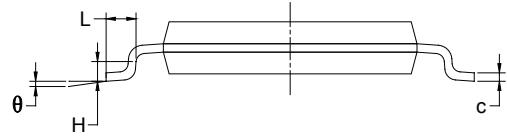
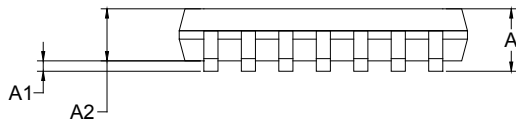
# PACKAGE INFORMATION

## PACKAGE OUTLINE DIMENSIONS

### TSSOP-14



RECOMMENDED LAND PATTERN (Unit: mm)

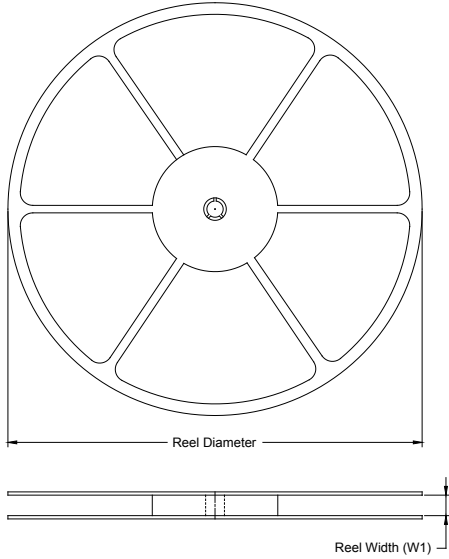


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.200		0.047
A1	0.050	0.150	0.002	0.006
A2	0.800	1.050	0.031	0.041
b	0.190	0.300	0.007	0.012
c	0.090	0.200	0.004	0.008
D	4.860	5.100	0.191	0.201
E	4.300	4.500	0.169	0.177
E1	6.250	6.550	0.246	0.258
e	0.650 BSC		0.026 BSC	
L	0.500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

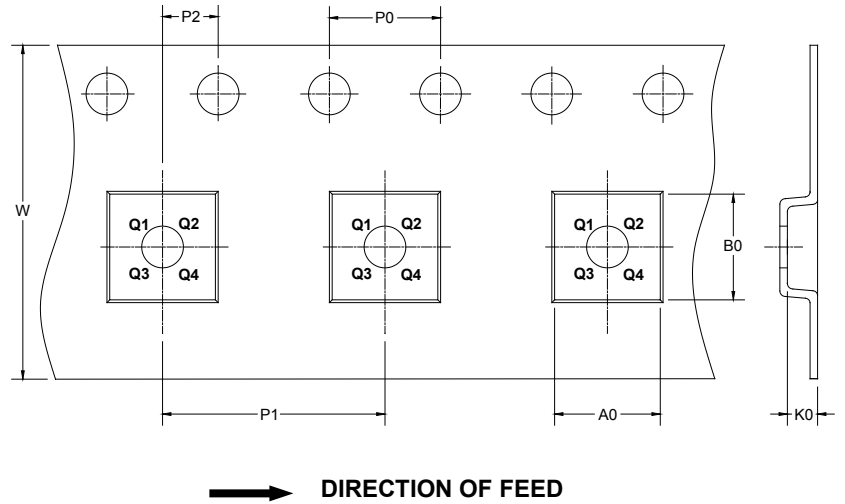
# PACKAGE INFORMATION

## 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