

# SGM8301/SGM8302/SGM8304

## 100MHz, High Voltage, Rail-to-Rail Output Amplifiers

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### 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 targeting 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 supply. The input common mode 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 Supply 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 Box  
Video Surveillance System  
Analog-to-Digital Converter Interface  
CCD Imaging System  
Digital Camera

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# SGM8301/SGM8302 SGM8304

# 100MHz, High Voltage, Rail-to-Rail Output Amplifiers

## PACKAGE/ORDERING INFORMATION

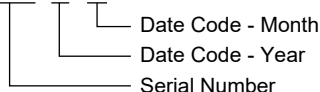
| MODEL   | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER  | PACKAGE MARKING           | PACKING OPTION      |
|---------|---------------------|-----------------------------|------------------|---------------------------|---------------------|
| SGM8301 | SOT-23-5            | -40°C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

## MARKING INFORMATION

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

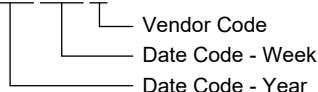
### SOT-23-5

YYY X X



### SOIC-8/MSOP-8/SOIC-14/TSSOP-14

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.

## **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                                                  |
| 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                                                |
| Junction Temperature                                 | +150°C                                                 |
| 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 |
|-----------------------------|----------------|

## **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**

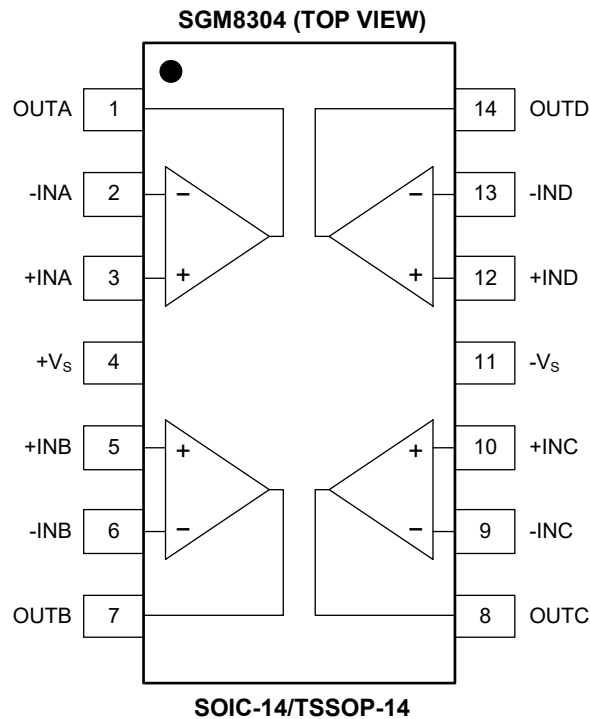
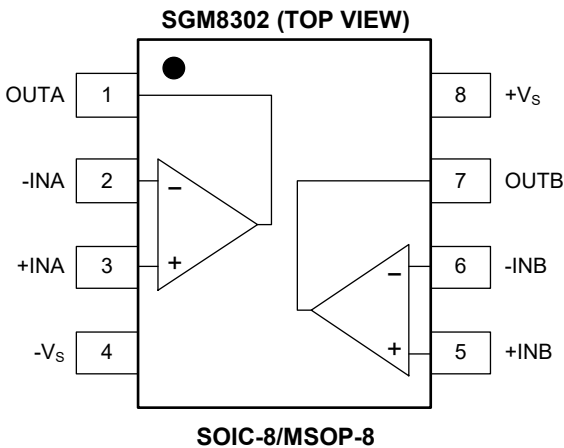
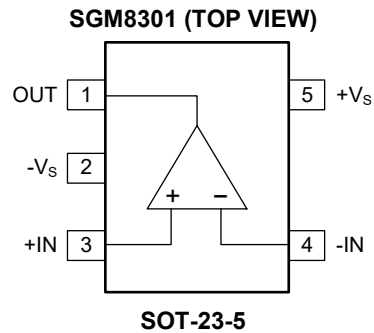
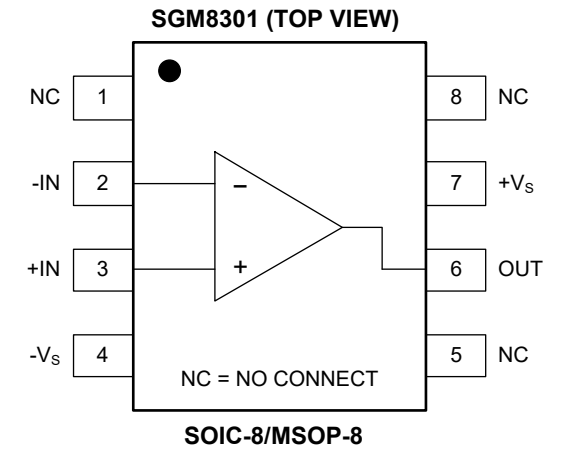
This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance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

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PIN CONFIGURATIONS



## ELECTRICAL CHARACTERISTICS

( $V_S = 5V$ ,  $V_{CM} = V_S/2$ ,  $V_{OUT} = V_S/2$  and  $R_L = 100\Omega$  to  $V_S/2$ , typical values are at  $T_A = +25^\circ C$ , unless otherwise noted.)

| PARAMETER                                                                | CONDITIONS                                            | MIN   | TYP   | MAX  | UNITS  |
|--------------------------------------------------------------------------|-------------------------------------------------------|-------|-------|------|--------|
| DC Performance                                                           |                                                       |       |       |      |        |
| 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   |      |        |
|                                                                          | R <sub>L</sub> = 10Ω to ground, source                |       | 75    |      |        |
| AC Performance                                                           |                                                       |       |       |      |        |
| 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>0.1dBLS</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   |      | °      |

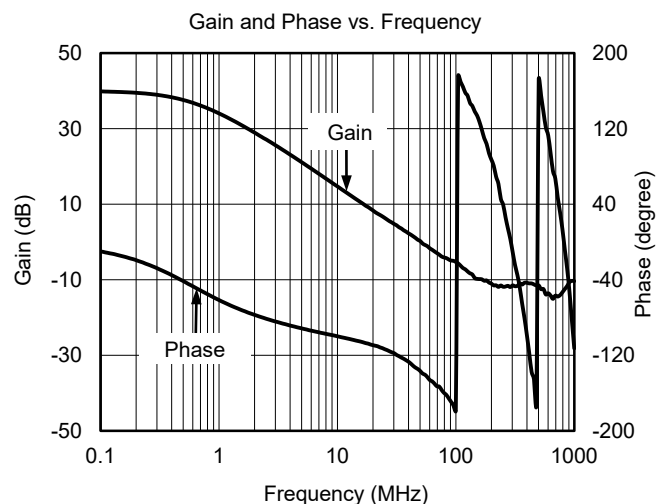
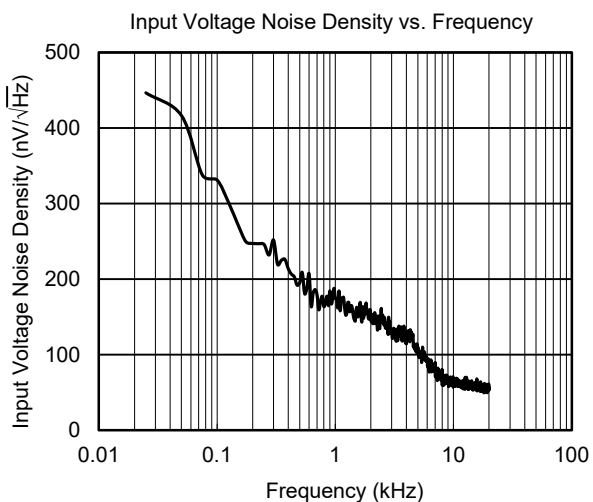
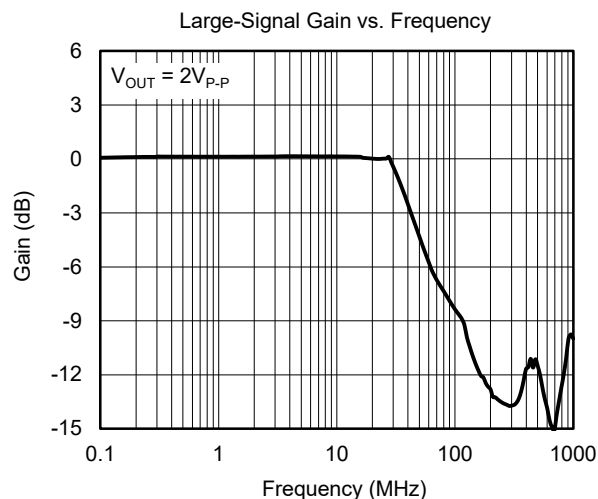
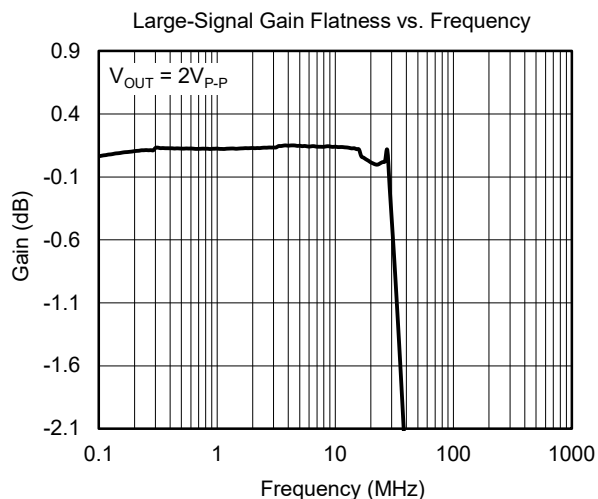
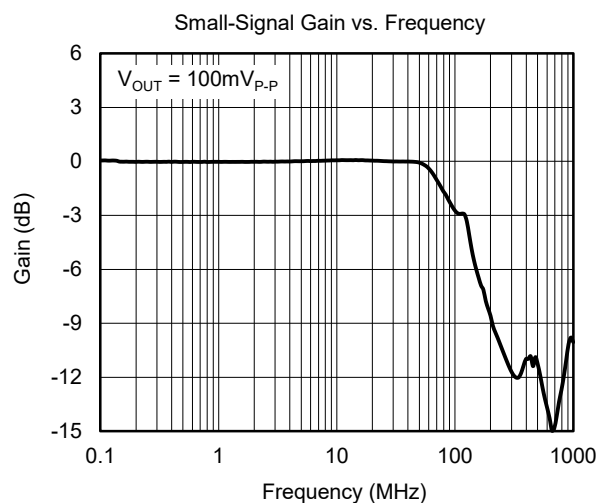
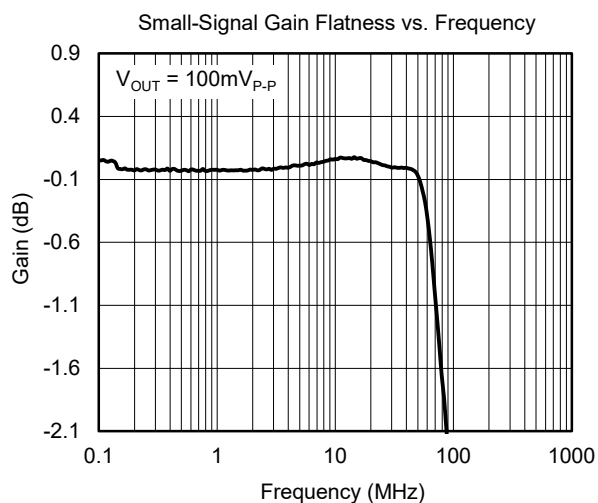
## ELECTRICAL CHARACTERISTICS (continued)

( $V_S = \pm 6V$ ,  $V_{CM} = 0V$ ,  $V_{OUT} = 0V$  and  $R_L = 100\Omega$  to ground, typical values are at  $T_A = +25^\circ C$ , unless otherwise noted.)

| PARAMETER                                                                | CONDITIONS                                             | MIN   | TYP  | MAX  | UNITS  |
|--------------------------------------------------------------------------|--------------------------------------------------------|-------|------|------|--------|
| DC Performance                                                           |                                                        |       |      |      |        |
| 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   |      |        |
| AC Performance                                                           |                                                        |       |      |      |        |
| 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

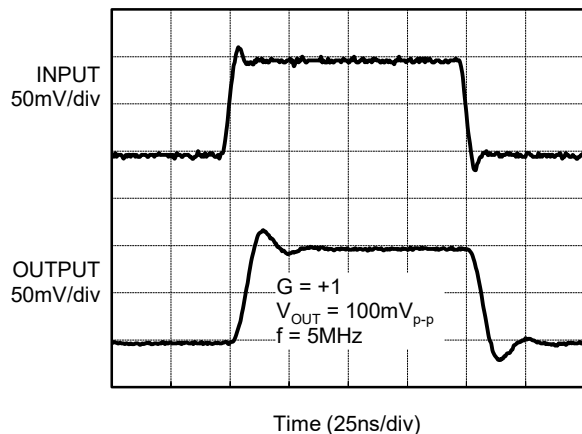
At  $T_A = +25^\circ\text{C}$ ,  $+V_S = 5\text{V}$ ,  $-V_S = -5\text{V}$ ,  $V_{CM} = 0\text{V}$  and  $R_L = 100\Omega$  to GND, unless otherwise noted.



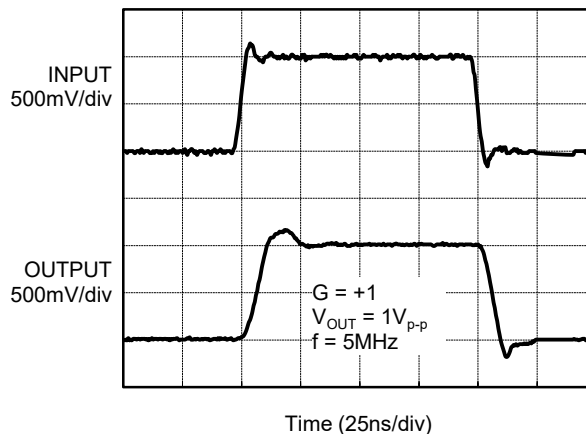
## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

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

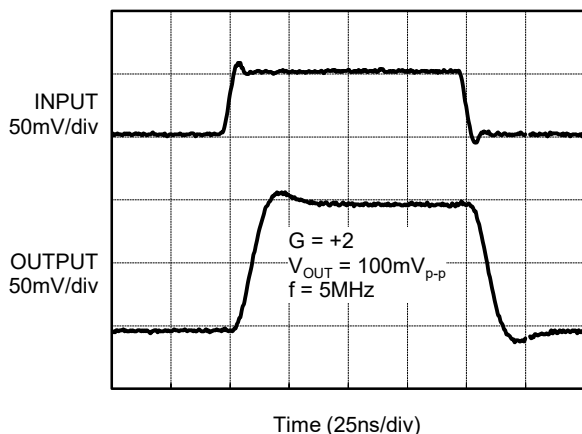
Small-Signal Pulse Response



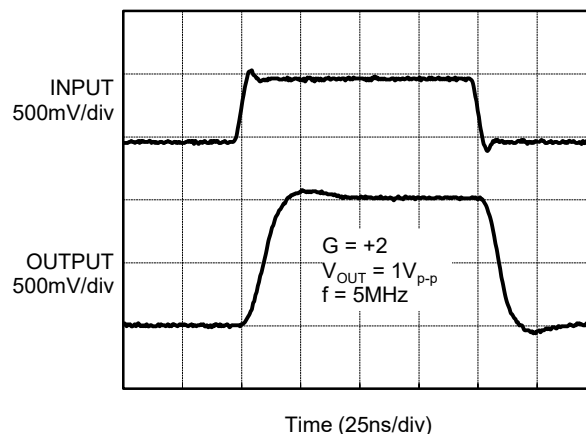
Large-Signal Pulse Response



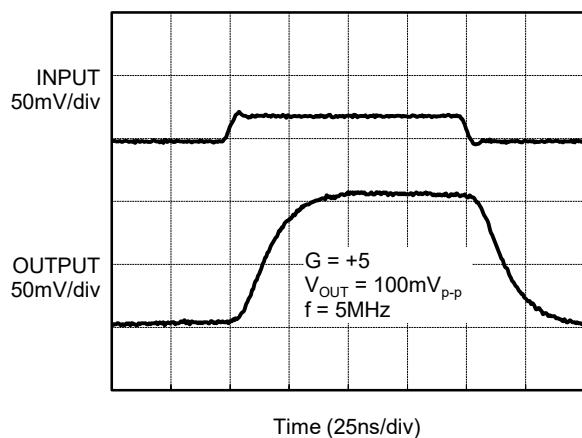
Small-Signal Pulse Response



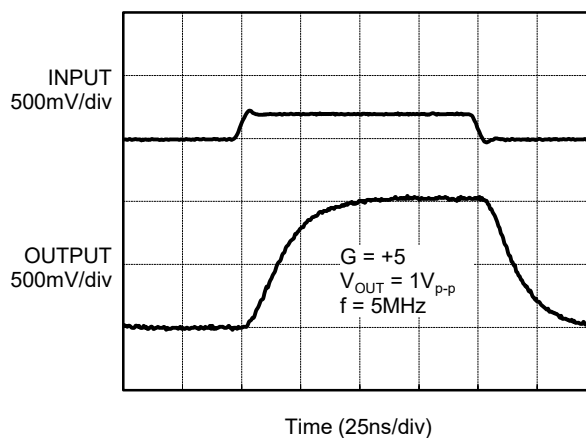
Large-Signal Pulse Response



Small-Signal Pulse Response

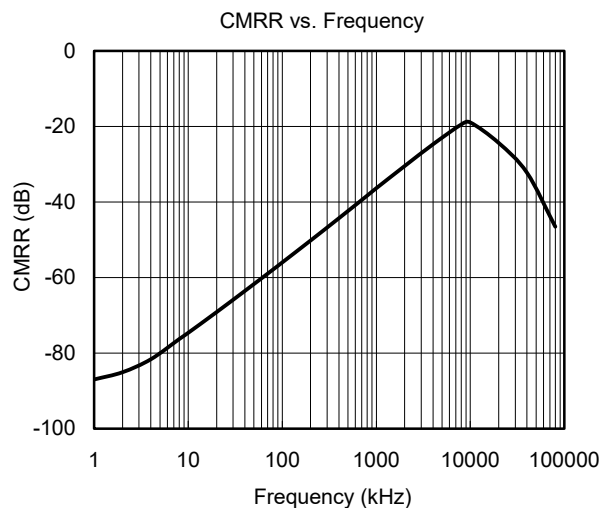
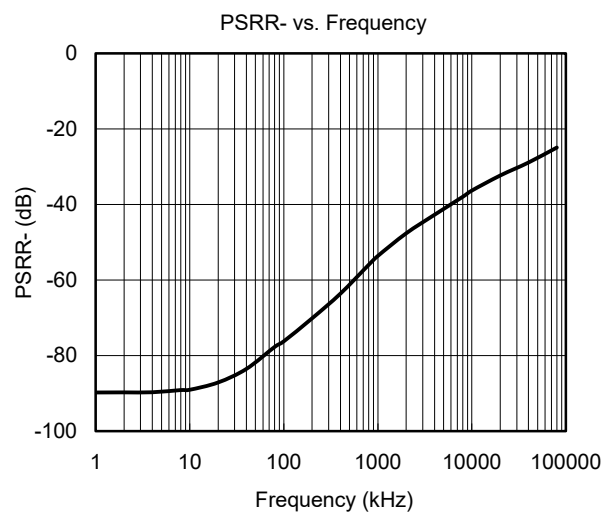
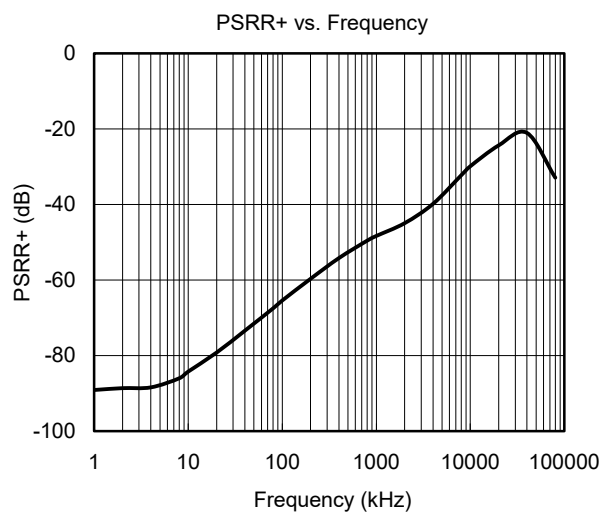


Large-Signal Pulse Response

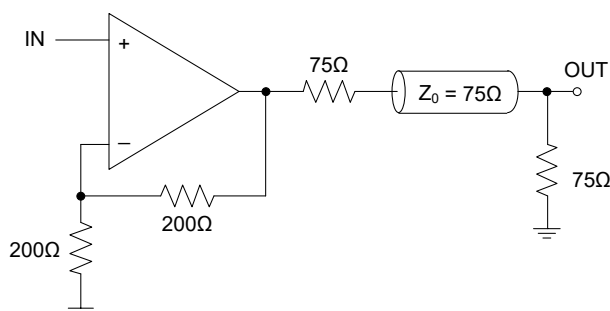


## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

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  $\pm 2.25V$  to  $\pm 6V$  supplies. Bypass each supply with a  $0.1\mu F$  capacitor as close to the pin as possible. It is recommended to use 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 a constant impedance board is used, 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  $90^\circ$  turns; round all corners.

## REVISION HISTORY

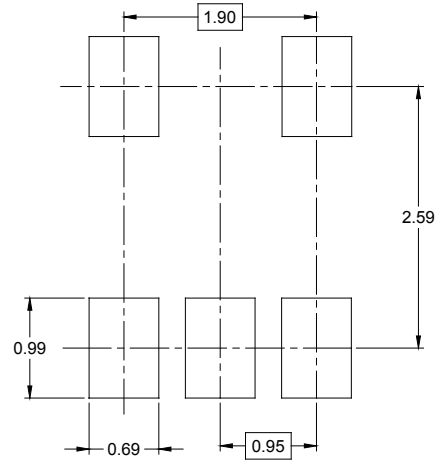
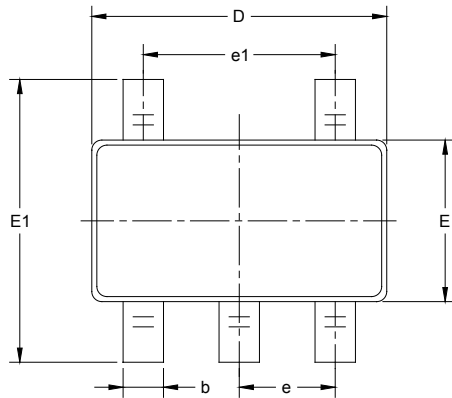
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| JUNE 2017 – REV.A.2 to REV.A.3                                  |  | Page  |
|-----------------------------------------------------------------|--|-------|
| Added Package Thermal Resistance.....                           |  | 3     |
| MAY 2013 – REV.A.1 to REV.A.2                                   |  | Page  |
| Changed supply voltage range from 5V to 12V to 4.5V to 12V..... |  | 1, 9  |
| JANUARY 2013 – REV.A to REV.A.1                                 |  | Page  |
| Added Tape and Reel Information section .....                   |  | 15~16 |
| Changes from Original (JULY 2012) to REV.A                      |  | Page  |
| Changed from product preview to production data.....            |  | All   |

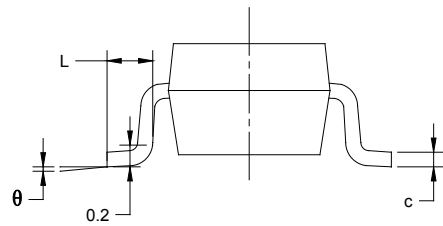
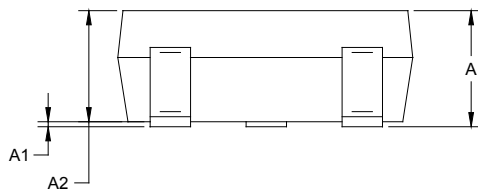
## PACKAGE INFORMATION

### PACKAGE OUTLINE DIMENSIONS

#### SOT-23-5



RECOMMENDED LAND PATTERN (Unit: mm)

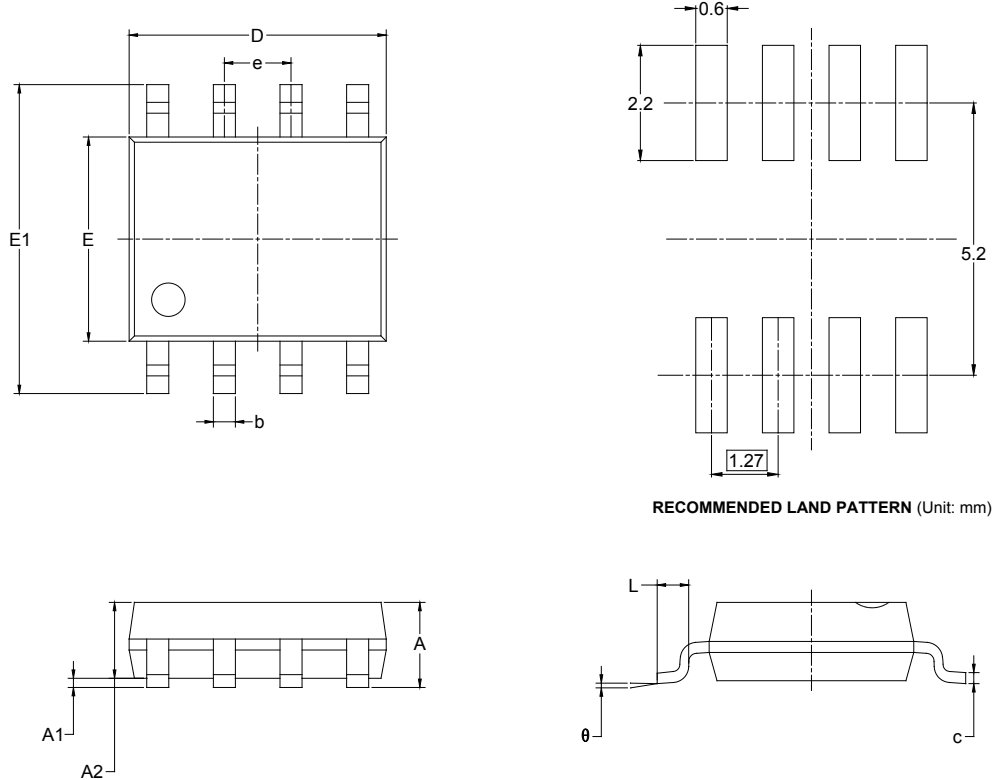


| Symbol   | Dimensions<br>In Millimeters |       | Dimensions<br>In Inches |       |
|----------|------------------------------|-------|-------------------------|-------|
|          | MIN                          | MAX   | MIN                     | MAX   |
| A        | 1.050                        | 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 INFORMATION

### PACKAGE OUTLINE DIMENSIONS

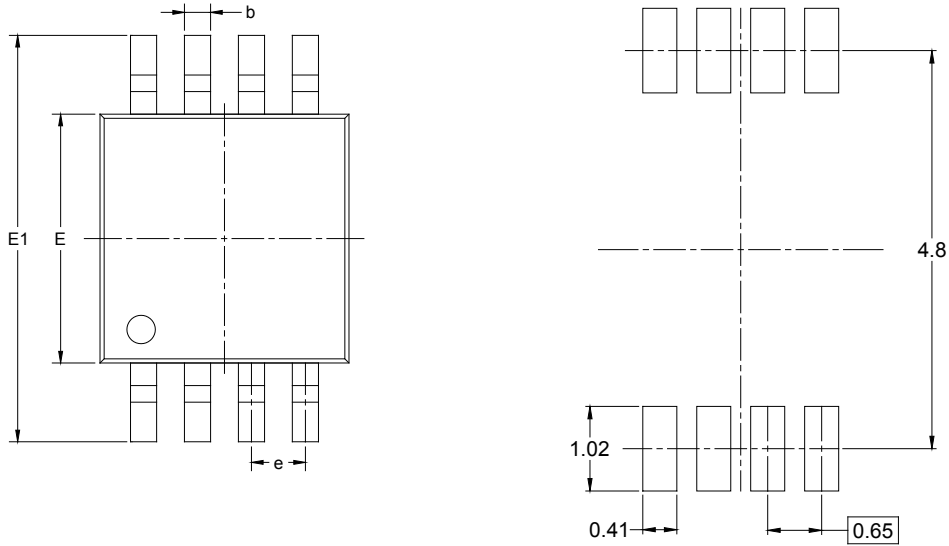
#### SOIC-8



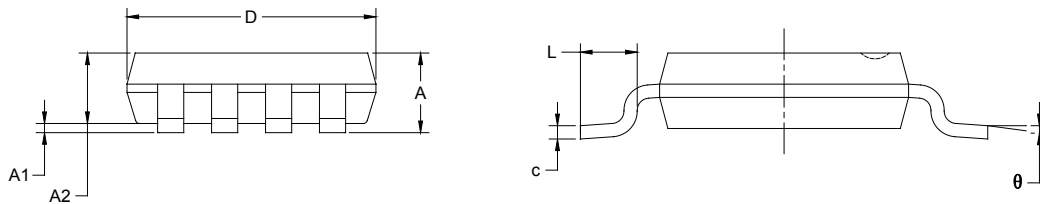
| Symbol | Dimensions<br>In Millimeters |       | Dimensions<br>In Inches |       |
|--------|------------------------------|-------|-------------------------|-------|
|        | MIN                          | MAX   | MIN                     | MAX   |
| A      | 1.350                        | 1.750 | 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)

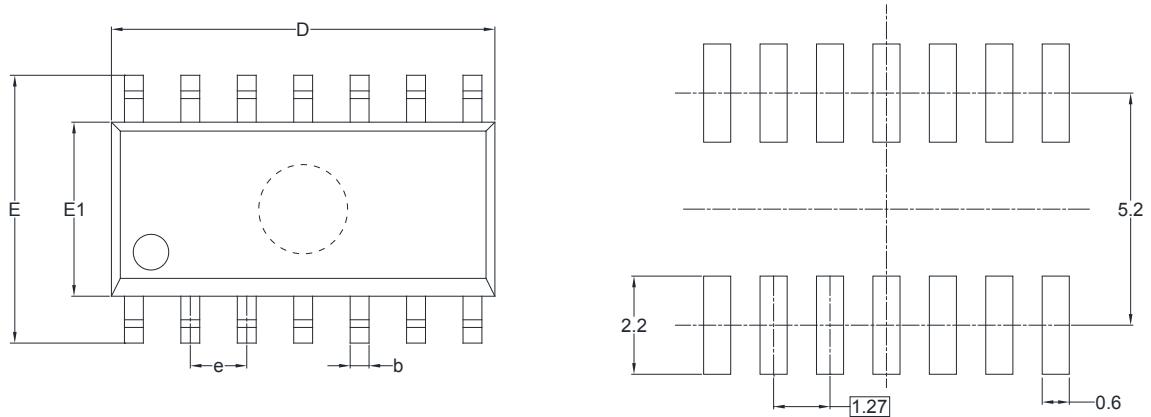


| Symbol | Dimensions<br>In Millimeters |       | Dimensions<br>In Inches |       |
|--------|------------------------------|-------|-------------------------|-------|
|        | MIN                          | MAX   | MIN                     | MAX   |
| A      | 0.820                        | 1.100 | 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°    |

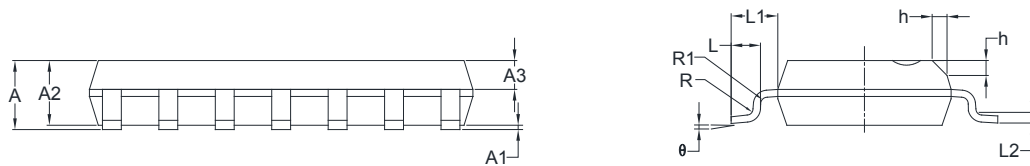
## PACKAGE INFORMATION

### PACKAGE OUTLINE DIMENSIONS

#### SOIC-14



RECOMMENDED LAND PATTERN (Unit: mm)

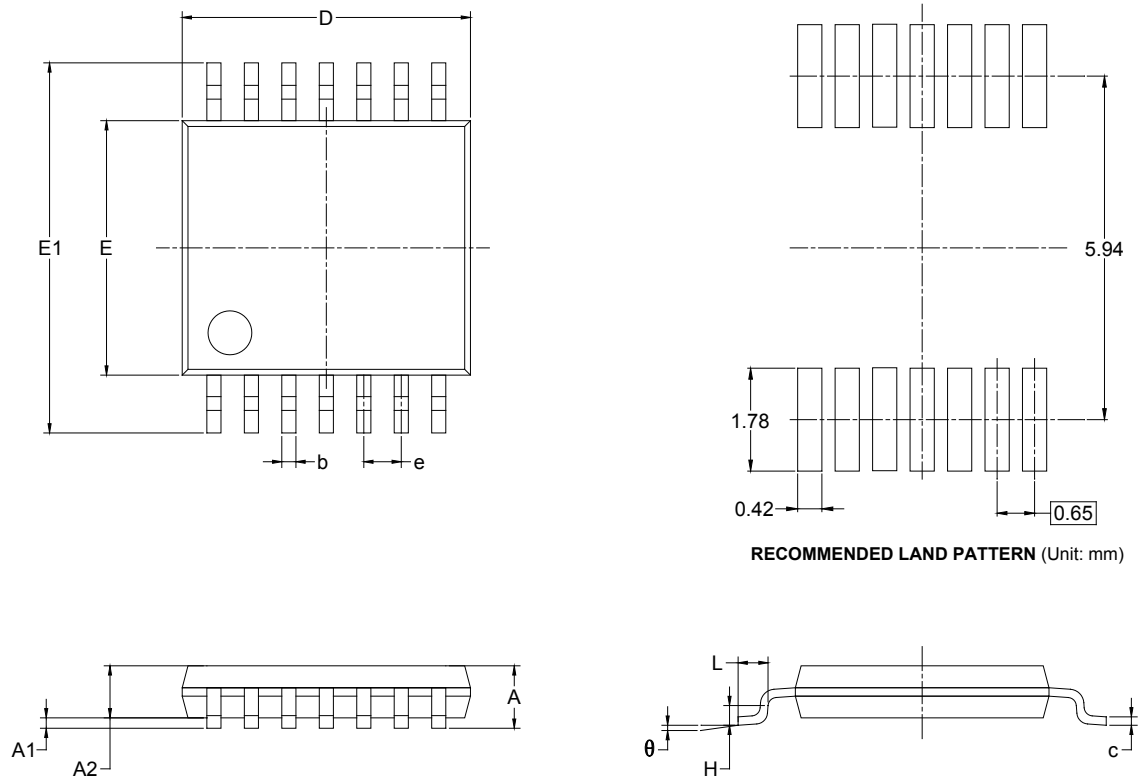


| Symbol   | Dimensions<br>In Millimeters |      | Dimensions<br>In Inches |       |
|----------|------------------------------|------|-------------------------|-------|
|          | MIN                          | MAX  | MIN                     | MAX   |
| A        | 1.35                         | 1.75 | 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 |
| $\theta$ | 0°                           | 8°   | 0°                      | 8°    |

## PACKAGE INFORMATION

### PACKAGE OUTLINE DIMENSIONS

#### TSSOP-14

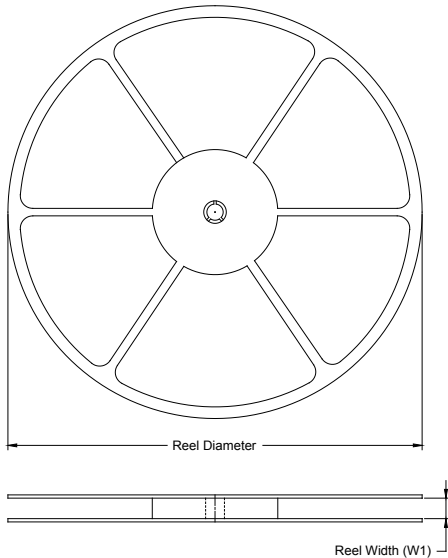


| Symbol | Dimensions<br>In Millimeters |       | Dimensions<br>In Inches |       |
|--------|------------------------------|-------|-------------------------|-------|
|        | MIN                          | MAX   | MIN                     | MAX   |
| A      |                              | 1.200 |                         | 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°    |

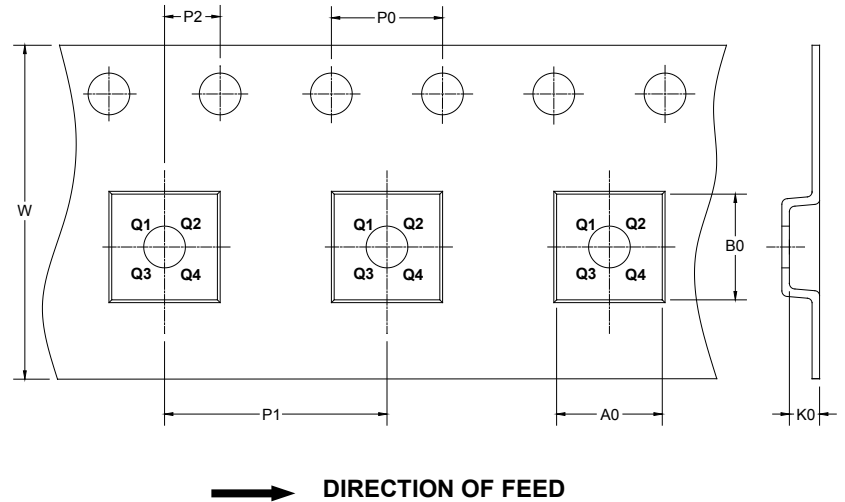
## PACKAGE INFORMATION

### TAPE AND REEL INFORMATION

#### REEL DIMENSIONS



#### TAPE DIMENSIONS



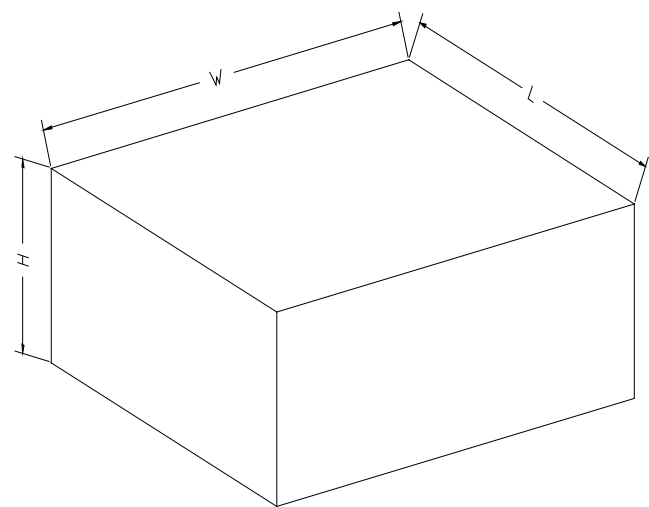
NOTE: The picture is only for reference. Please make the object as the standard.

#### 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            |

DD0001

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            |

DD00002