



# SGM8922

## 12.7MHz, Dual Rail-to-Rail Output Operational Amplifier

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### PRODUCT DESCRIPTION

The SGM8922 is a dual, rail-to-rail output operational amplifier that is optimized and fully specified for 5V operation. High output current allows low load impedances to be driven.

The SGM8922 has a wide input common mode voltage range and output voltage swing, running at single supply voltage from 3V to 5.5V.

The SGM8922 provides excellent overall performance. It exhibits low noise, distortion, low offset and high output current capability, making this device an excellent choice for high quality, low voltage or battery operated audio systems.

The SGM8922 is offered in Green MSOP-8, TSSOP-8 and SOIC-8 packages and ESD (HBM) reaches 8kV. It is specified over the extended -40°C to +125°C temperature range.

### FEATURES

- **Rail-to-Rail Output**
- **Low Noise: 6nV/√Hz**
- **Low Distortion**
- **High Output Voltage Swing: 4.73V (with 100mA Output Current)**
- **Low Output Voltage Swing: 0.24V (with 100mA Output Current)**
- **Supply Voltage Range: 3V to 5.5V**
- **Low Input Offset Voltage: 0.9mV (MAX, SGM8922A)**
- **Gain-Bandwidth Product: 12.7MHz**
- **Slew Rate: 6.8V/μs**
- **Low Supply Current 3mA/Amplifier (TYP)**
- **Small Packaging: Available in Green MSOP-8, TSSOP-8 and SOIC-8 Packages**

### APPLICATIONS

Data Acquisition  
Process Control  
Active Filters  
Test Equipment  
Mobile Phone  
Audio Processing  
Video Processing  
Headphone Amplifier  
Portable Equipment  
Broadband Communications  
A-to-D Driver  
D-to-A Driver

**PACKAGE/ORDERING INFORMATION**

| MODEL    | PIN-PACKAGE | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKAGE OPTION      |
|----------|-------------|-----------------------------|-----------------|-----------------|---------------------|
| SGM8922  | MSOP-8      | -40°C to +85°C              | SGM8922YMS8/TR  | SGM8922YMS8     | Tape and Reel, 3000 |
|          | SOIC-8      | -40°C to +85°C              | SGM8922YS8/TR   | SGM8922YS8      | Tape and Reel, 2500 |
|          | TSSOP-8     | -40°C to +85°C              | SGM8922YTS8/TR  | SGM8922YTS8     | Tape and Reel, 4000 |
|          | SOIC-8      | -40°C to +125°C             | SGM8922XS8/TR   | SGM8922XS8      | Tape and Reel, 2500 |
| SGM8922A | MSOP-8      | -40°C to +85°C              | SGM8922AYMS8/TR | SGM8922YMS8     | Tape and Reel, 3000 |
|          | SOIC-8      | -40°C to +85°C              | SGM8922AYS8/TR  | SGM8922YS8      | Tape and Reel, 2500 |
|          | SOIC-8      | -40°C to +125°C             | SGM8922AXS8/TR  | SGM8922XS8      | Tape and Reel, 2500 |

**ABSOLUTE MAXIMUM RATINGS**

Supply Voltage, +V<sub>S</sub> to -V<sub>S</sub> .....6V  
 Common Mode Input Voltage..... -0.1V to 3.8V  
 Storage Temperature Range.....-65°C to +150°C  
 Junction Temperature .....150°C  
 Operating Temperature Range.....-40°C to +125°C  
 Package Thermal Resistance @ T<sub>A</sub> = +25°C  
 SOIC-8, θ<sub>JA</sub>.....82°C/W  
 MSOP-8, θ<sub>JA</sub>..... 105°C/W  
 TSSOP-8, θ<sub>JA</sub>.....108°C/W  
 Lead Temperature (Soldering 10sec)  
 .....260°C  
 ESD Susceptibility  
 HBM.....8000V  
 MM.....400V

**NOTE:**

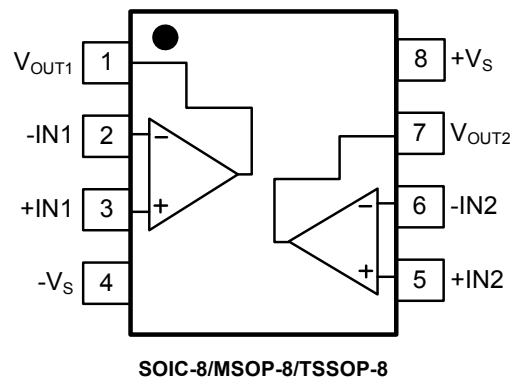
Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

**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.

SGMICRO reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact SGMICRO sales office to get the latest datasheet.

**PIN CONFIGURATIONS (TOP VIEW)**



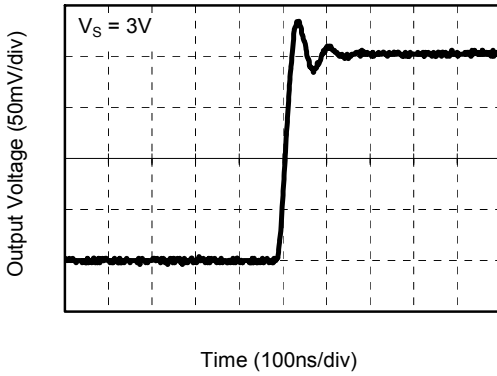
**ELECTRICAL CHARACTERISTICS:  $V_S = +5V$** (At  $T_A = +25^\circ\text{C}$ ,  $R_L = 600\Omega$  connected to  $V_S/2$ , unless otherwise noted.)

| PARAMETER                                    | CONDITIONS  | SGM8922     |                          |                      |                       |                              |       |             |
|--|---|-------------|--------------------------|----------------------|-----------------------|------------------------------|-------|-------------|
|  |   | TYP         | MIN/MAX OVER TEMPERATURE |                      |                       |                              | UNITS | MIN<br>/MAX |
|  |   | +25°C       | +25°C                    | -40°C<br>to<br>+85°C | -40°C<br>to<br>+125°C |                              |       |             |
| <b>DYNAMIC PERFORMANCE</b>                   |   |             |                          |                      |                       |                              |       |             |
| Gain-Bandwidth Product (GBP)                 | $R_L = 600\Omega$   | 12.7        |                          |                      |                       | MHz                          | TYP   |             |
| Slew Rate                                    | $2V_{PP}$ step, $A_V = 1$   | 6.8         |                          |                      |                       | V/ $\mu\text{s}$             | TYP   |             |
| Crosstalk                                    | $f = 1\text{kHz}$   | -120        |                          |                      |                       | dB                           | TYP   |             |
| <b>NOISE/DISTORTION PERFORMANCE</b>          |   |             |                          |                      |                       |                              |       |             |
| Total Harmonic Distortion + Noise (THD+N)    | $V_{OUT} = 2V_{PP}$ , $f = 1\text{kHz}$ ,<br>$A_V = 1$ , $R_L = 600\Omega$  | 0.003       |                          |                      |                       | %                            | TYP   |             |
| Input Voltage Noise ( $e_n$ )                | $f = 1\text{kHz}$   | 6           |                          |                      |                       | nV/ $\sqrt{\text{Hz}}$       | TYP   |             |
| Phase Margin                                 | $R_L = 600\Omega$ , $C_L = 100\text{pF}$                                    | 45          |                          |                      |                       | degree                       | TYP   |             |
| <b>DC PERFORMANCE</b>                        |   |             |                          |                      |                       |                              |       |             |
| Input Offset Voltage ( $V_{OS}$ )            |   |             |                          |                      |                       |                              |       |             |
| SGM8922                                      |   |             | 3                        | 4.2                  | 5                     | mV                           | MAX   |             |
| SGM8922A                                     |   |             | 0.9                      | 1.8                  | 2.6                   | mV                           | MAX   |             |
| Input Offset Voltage Drift                   |   | 1.6         |                          |                      |                       | $\mu\text{V}/^\circ\text{C}$ | TYP   |             |
| Open-Loop Gain ( $A_{OL}$ )                  | $R_L = 600\Omega$ , $V_{OUT} = 0.15\text{V}$ to $4.85\text{V}$              | 109         | 86                       | 80                   | 75                    | dB                           | MIN   |             |
|  | $R_L = 10\text{k}\Omega$ , $V_{OUT} = 0.05\text{V}$ to $4.95\text{V}$       | 104         | 84                       | 75                   | 70                    | dB                           | MIN   |             |
| <b>INPUT CHARACTERISTICS</b>                 |   |             |                          |                      |                       |                              |       |             |
| Input Common Mode Voltage Range ( $V_{CM}$ ) | $V_S = 5\text{V}$   | -0.1 to 3.8 |                          |                      |                       | V                            | TYP   |             |
| Common Mode Rejection Ratio (CMRR)           | $V_S = 5.5\text{V}$ , $V_{CM} = -0.1\text{V}$ to $3.8\text{V}$              | 108         | 60                       | 56                   | 51                    | dB                           | MIN   |             |
| <b>OUTPUT CHARACTERISTICS</b>                |   |             |                          |                      |                       |                              |       |             |
| Output Voltage Swing from Rails              |   |             |                          |                      |                       |                              |       |             |
| High Output Voltage Swing ( $V_{OH}$ )       | $I_{OUT} = 100\text{mA}$  | 4.73        | 4.20                     | 4.10                 | 4                     | V                            | MIN   |             |
| Low Output Voltage Swing ( $V_{OL}$ )        | $I_{OUT} = -100\text{mA}$   | 0.24        | 0.45                     | 0.56                 | 0.68                  | V                            | MAX   |             |
| Output Short Circuit Current                 |   |             | 300                      |                      |                       | mA                           | MAX   |             |
| <b>POWER SUPPLY</b>                          |   |             |                          |                      |                       |                              |       |             |
| Operating Voltage Range                      |   |             | 3                        | 3                    | 3                     | V                            | MIN   |             |
|  |   |             | 5.5                      | 5.5                  | 5.5                   | V                            | MAX   |             |
| Quiescent Current (per Amplifier)            | $I_{OUT} = 0\text{mA}$  | 3           | 3.9                      |                      |                       | mA                           | MAX   |             |
| Power Supply Rejection Ratio (PSRR)          | $V_S = +2.5\text{V}$ to $+5.5\text{V}$ ,<br>$V_{CM} = (-V_S) + 0.5\text{V}$ | 80          | 60                       | 56                   | 51                    | dB                           | MIN   |             |

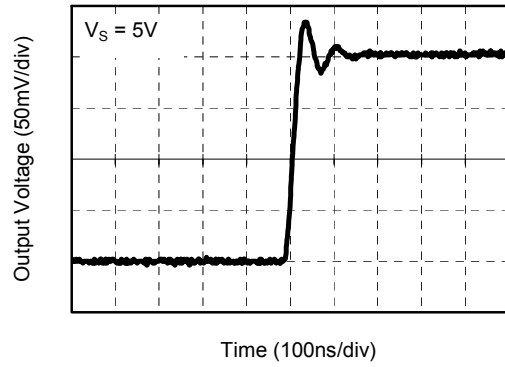
TYPICAL PERFORMANCE CHARACTERISTICS

At  $T_A = +25^\circ\text{C}$ ,  $A_v = +1$ ,  $C_L = 100\text{pF}$  and  $R_L = 600\Omega$ , unless otherwise noted.

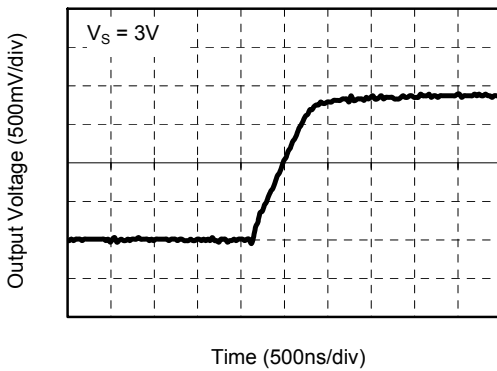
Small Signal Step Response



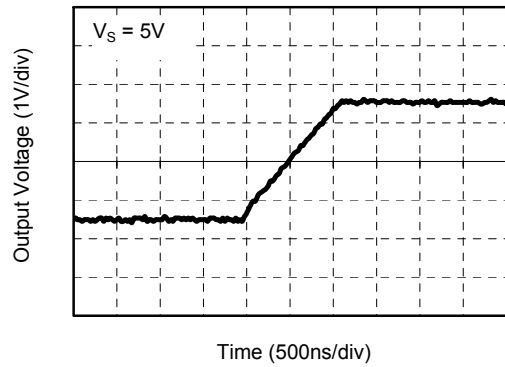
Small Signal Step Response



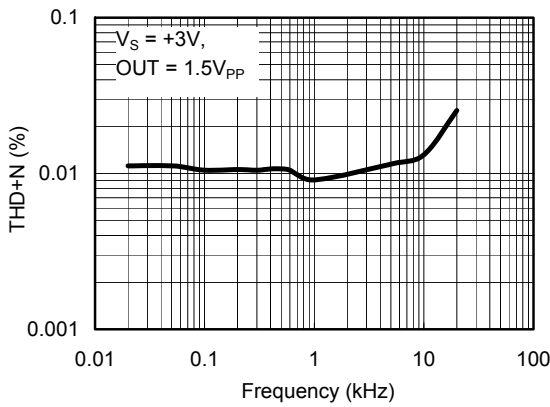
Large Signal Step Response



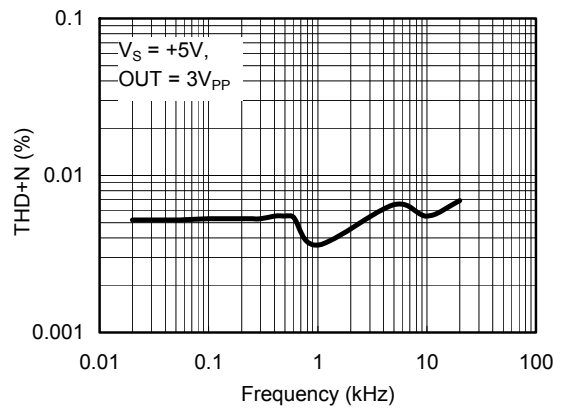
Large Signal Step Response



THD+N vs. Frequency

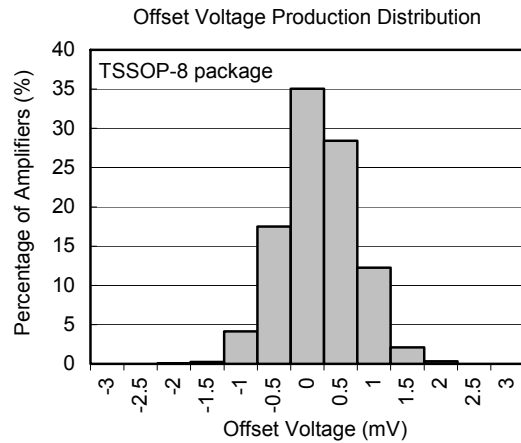
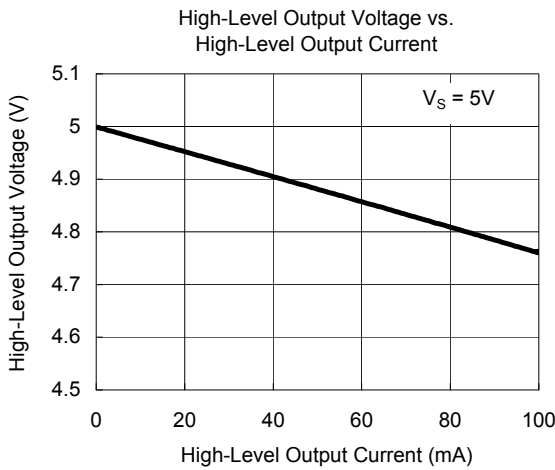
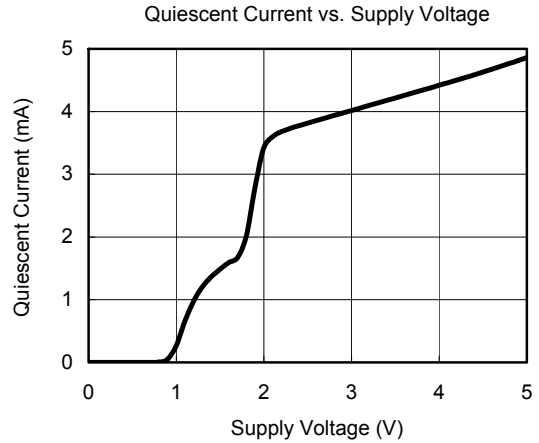
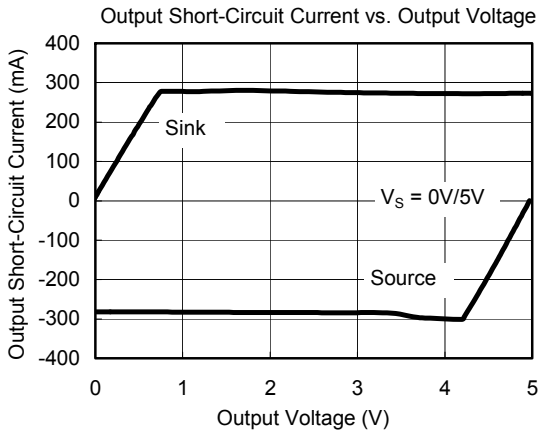


THD+N vs. Frequency



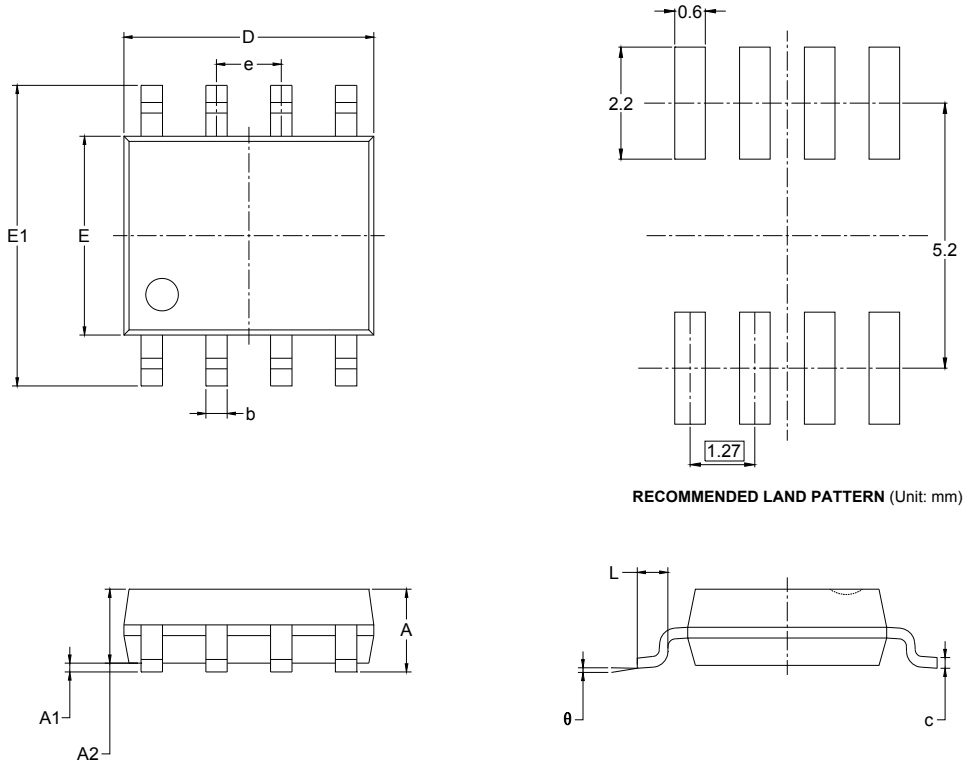
TYPICAL PERFORMANCE CHARACTERISTICS

At  $T_A = +25^\circ\text{C}$ ,  $A_v = +1$ ,  $C_L = 100\text{pF}$  and  $R_L = 600\Omega$ , unless otherwise noted.



PACKAGE OUTLINE DIMENSIONS

SOIC-8

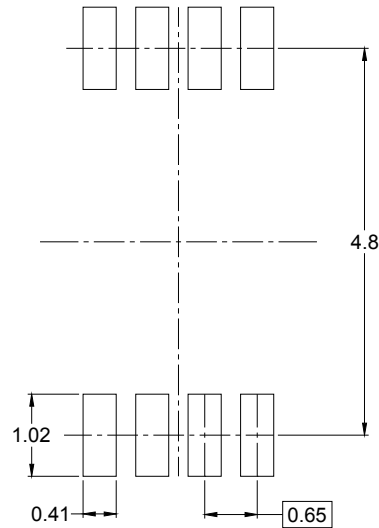
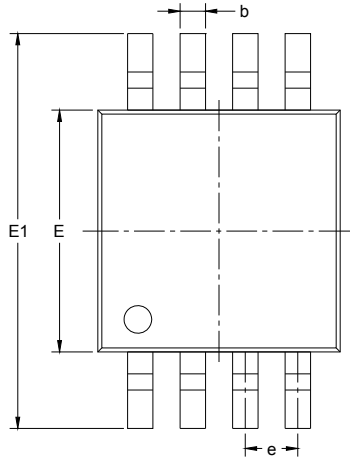


RECOMMENDED LAND PATTERN (Unit: mm)

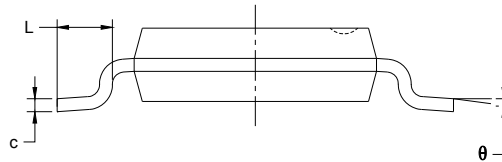
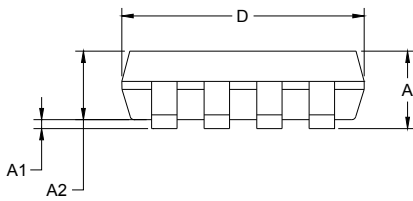
| Symbol   | Dimensions In Millimeters |       | Dimensions In Inches |       |
|----------|---------------------------|-------|----------------------|-------|
|          | MIN                       | MAX   | MIN                  | MAX   |
| A        | 1.350                     | 1.750 | 0.053                | 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 |
| $\theta$ | 0°                        | 8°    | 0°                   | 8°    |

PACKAGE OUTLINE DIMENSIONS

MSOP-8



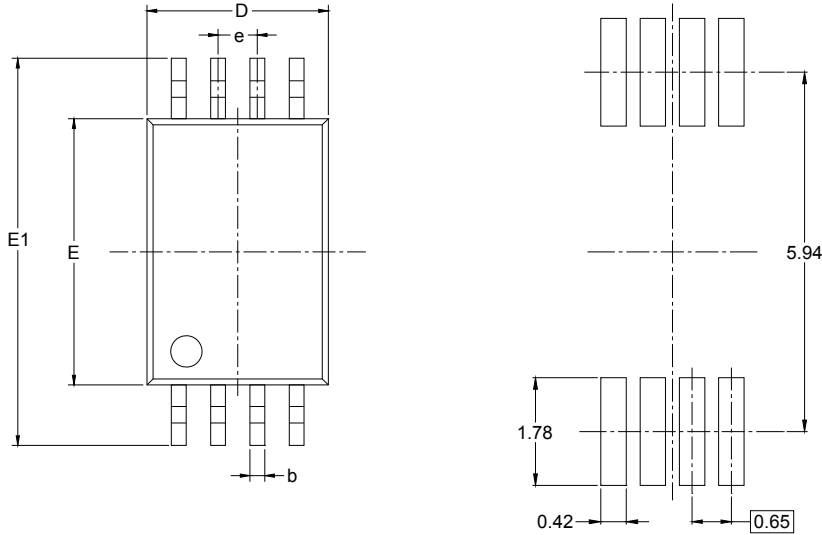
RECOMMENDED LAND PATTERN (Unit: mm)



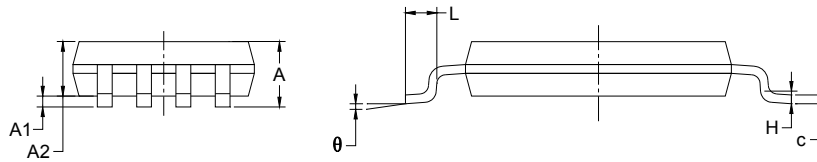
| Symbol | Dimensions<br>In Millimeters |       | Dimensions<br>In Inches |       |
|--------|------------------------------|-------|-------------------------|-------|
|        | MIN                          | MAX   | MIN                     | MAX   |
| A      | 0.820                        | 1.100 |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

TSSOP-8



RECOMMENDED LAND PATTERN (Unit: mm)

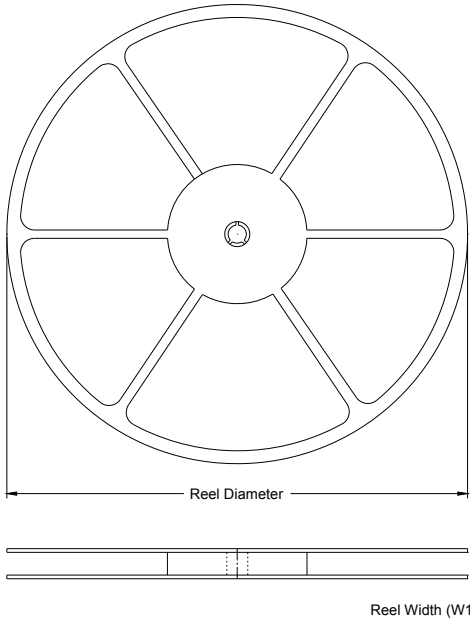


| Symbol | Dimensions<br>In Millimeters |       | Dimensions<br>In Inches |       |
|--------|------------------------------|-------|-------------------------|-------|
|        | MIN                          | MAX   | MIN                     | MAX   |
| A      |                              | 1.100 |                         | 0.043 |
| A1     | 0.050                        | 0.150 | 0.002                   | 0.006 |
| A2     | 0.800                        | 1.000 | 0.031                   | 0.039 |
| b      | 0.190                        | 0.300 | 0.007                   | 0.012 |
| c      | 0.090                        | 0.200 | 0.004                   | 0.008 |
| D      | 2.900                        | 3.100 | 0.114                   | 0.122 |
| 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°    |

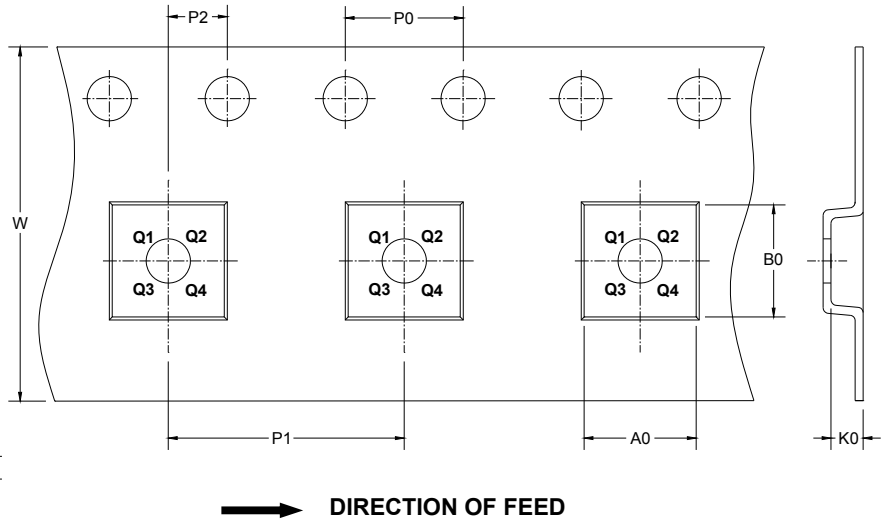


TAPE AND REEL INFORMATION

REEL DIMENSIONS



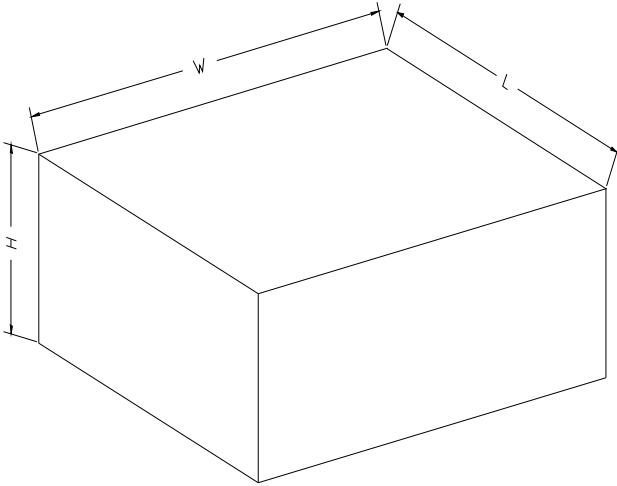
TAPE DIMENSIONS



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 |
|--------------|---------------|--------------------|---------|---------|---------|---------|---------|---------|--------|---------------|
| SOIC-8       | 13"           | 12.4               | 6.4     | 5.4     | 2.1     | 4.0     | 8.0     | 2.0     | 12.0   | Q1            |
| MSOP-8       | 13"           | 12.4               | 5.2     | 3.3     | 1.5     | 4.0     | 8.0     | 2.0     | 12.0   | Q1            |
| TSSOP-8      | 13"           | 12.4               | 6.76    | 3.3     | 1.8     | 4.0     | 8.0     | 2.0     | 12.0   | Q1            |

**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 |
|-----------|-------------|------------|-------------|--------------|
| 13"       | 386         | 280        | 370         | 5            |