

GENERAL DESCRIPTION

The SGM2201 is a high voltage and low dropout voltage linear regulator. It is capable of supplying 150mA output current. The operating input voltage is up to 36V. The output voltage can be adjusted from 0.8V to 13.2V by using external resistors.

Other features include logic-controlled shutdown mode current limit and thermal shutdown protection.

The SGM2201 is available in Green TSOT-23-5 and TDFN-2×3-8L packages. It is rated over the -40°C to +85°C temperature range.

FEATURES

- **Input Voltage Range: 2.7V to 36V**
- **Adjustable Output from 0.8V to 13.2V**
- **150mA Guaranteed Output Current**
- **Output Voltage Accuracy: ±2.5% at +25°C**
- **Low Dropout Voltage**
- **Low Power Consumption: 4.2µA (TYP)**
- **Thermal Shutdown Protection**
- **Output Current Limit**
- **-40°C to +85°C Operating Temperature Range**
- **Available in Green TSOT-23-5 and TDFN-2×3-8L Packages**

APPLICATIONS

- Palmtops
- High-Power Boost Applications
- Power Source for Battery-Powered Equipment
- Home Electric/Electronic Appliances

TYPICAL APPLICATION

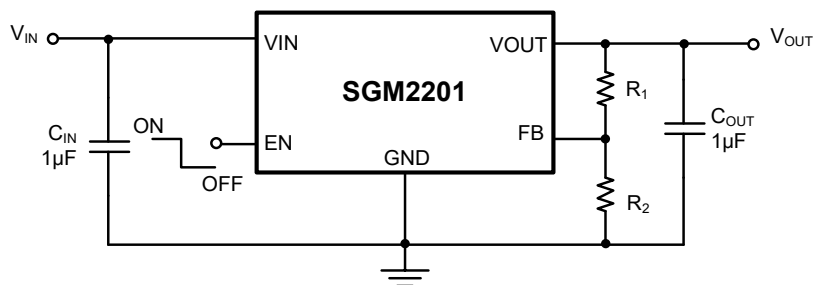


Figure 1. Typical Application Circuit

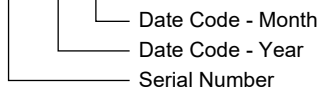
PACKAGE/ORDERING INFORMATION

| MODEL | V _{OUT} (V) | PACKAGE DESCRIPTION | ORDERING NUMBER | MARKING INFORMATION | PACKAGE OPTION |
|---------|----------------------|---------------------|----------------------|---------------------|---------------------|
| SGM2201 | Adjustable | TSOT-23-5 | SGM2201-ADJYTN5G/TR | SVDXX | Tape and Reel, 3000 |
| | Adjustable | TDFN-2×3-8L | SGM2201-ADJYTDC8G/TR | SXE XXXX | Tape and Reel, 3000 |

MARKING INFORMATION

NOTE: XX = Date Code.

YYY X X



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

| | |
|--|---|
| VIN, EN to GND | -0.3V to 44V |
| VOU _T to GND | -0.3V to Min(V _{IN} + 0.3V, 15V) |
| FB to GND | -0.3V to Min(V _{IN} + 0.3V, 6V) |
| Power Dissipation, P _D @ T _A = +25°C | |
| TSOT-23-5 | 0.510W |
| TDFN-2×3-8L | 1.563W |
| Package Thermal Resistance | |
| TSOT-23-5, θ _{JA} | 245°C/W |
| TDFN-2×3-8L, θ _{JA} | 80°C/W |
| Junction Temperature | +150°C |
| Storage Temperature Range | -65°C to +150°C |
| Lead Temperature (Soldering, 10s) | +260°C |
| ESD Susceptibility | |
| HBM | 4000V |
| MM | 200V |
| CDM | 1000V |

RECOMMENDED OPERATING CONDITIONS

| | |
|-----------------------------|----------------|
| Input Voltage Range | 2.7V to 36V |
| 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.

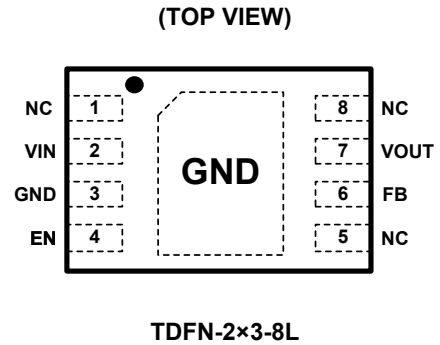
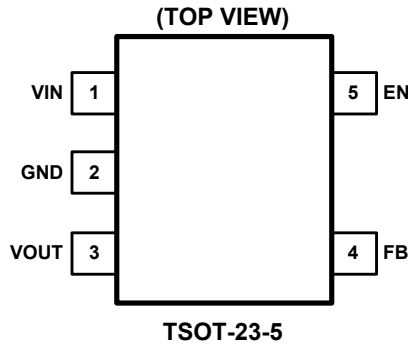
ESD SENSITIVITY CAUTION

This integrated circuit can be damaged 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



PIN DESCRIPTION

| PIN | | NAME | FUNCTION |
|-----------|-------------|------|--|
| TSOT-23-5 | TDFN-2x3-8L | | |
| 1 | 2 | VIN | Input Supply Voltage Pin. It is recommended to use a 1μF or larger ceramic capacitor from VIN pin to ground. This ceramic capacitor should be placed as close as possible to VIN pin. |
| 2 | 3 | GND | Ground. |
| 3 | 7 | VOUT | Regulator Output Pin. It is recommended to use a ceramic capacitor with effective capacitance in the range of 1μF to 10μF to get good power supply decoupling. This ceramic capacitor should be placed as close as possible to VOUT pin. |
| 4 | 6 | FB | Feedback Voltage Input Pin. Connect this pin to the midpoint of an external resistor divider to adjust the output voltage. Place the resistors as close as possible to this pin. |
| 5 | 4 | EN | Enable Pin. Drive EN high to turn on the regulator. Drive EN low to turn off the regulator. |
| – | 1, 5, 8 | NC | Not Connected. |
| – | Exposed Pad | GND | Exposed Pad. Connect it to GND internally. Connect it to a large ground plane to maximize thermal performance; this pad is not an electrical connection point. |

ELECTRICAL CHARACTERISTICS

(V_{IN} = 15V, V_{EN} = 2V, C_{IN} = C_{OUT} = 1μF, Full = -40°C to +85°C, typical values are at T_A = +25°C, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | TEMP | MIN | TYP | MAX | UNITS |
|--|---|--|-----------|-------|-------|------|--------|
| Input Voltage | V _{IN} | V _{OUT} < 3.3V | Full | 2.7 | | 32 | V |
| | | V _{OUT} ≥ 3.3V | Full | 2.7 | | 36 | |
| Output Voltage Accuracy | | I _{OUT} = 1mA | +25°C | -2.5 | | 2.5 | % |
| Feedback Voltage | V _{FB} | V _{FB} = V _{OUT} , I _{OUT} = 1mA | +25°C | | 0.8 | | V |
| FB Input Current | I _{FB} | V _{FB} = 0.9V | Full | -15 | | 15 | nA |
| Ground Pin Current | | No load | +25°C | | 4.2 | 5.4 | μA |
| | | | Full | | | 6.5 | |
| | | I _{OUT} = 50mA | +25°C | | 4.2 | | |
| Maximum Output Current | | V _{IN} = V _{OUT} + 2V or 4V, whichever is greater | +25°C | 150 | | | mA |
| Dropout Voltage ⁽²⁾ | V _{DROP} | I _{OUT} = 150mA, V _{OUT} ≥ 2.5V | +25°C | | 1300 | 1840 | mV |
| | | | Full | | | 2380 | |
| Line Regulation | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$ | V _{FB} = V _{OUT} = 0.8V, V _{IN} = 4V to 32V, I _{OUT} = 1mA | +25°C | | 0.005 | 0.01 | %/V |
| Load Regulation | ΔV _{OUT} | V _{FB} = V _{OUT} = 0.8V, V _{IN} = 4V, I _{OUT} = 1mA to 150mA | +25°C | | 2 | 6 | mV |
| Power Supply Rejection Ratio | PSRR | V _{OUT} = 3.3V, I _{OUT} = 10mA | f = 217Hz | +25°C | | 55 | dB |
| | | | f = 1kHz | +25°C | | 40 | |
| Output Voltage Temperature Coefficient | $\frac{\Delta V_{OUT}}{\Delta T_A \times V_{OUT}}$ | V _{IN} = V _{OUT} + 2V or 4V, I _{OUT} = 1mA | Full | | 35 | | ppm/°C |
| Shutdown | | | | | | | |
| EN Input Threshold | V _{IH} | V _{IN} = 2.7V to 36V | Full | 1.2 | | | V |
| | V _{IL} | | Full | | | 0.4 | |
| EN Input Bias Current | I _{BH} | V _{EN} = V _{IN} | Full | | 0.02 | 1 | μA |
| | I _{BL} | V _{EN} = 0V | Full | -1 | | 1 | |
| Shutdown Supply Current | I _{Q(SHDN)} | V _{EN} = 0V | +25°C | | 1.5 | 2 | μA |
| Start-Up Time ⁽²⁾ | t _{STR} | No load | +25°C | | 5 | | ms |
| R _{ON} of Discharge MOSFET | | V _{IN} = 2.7V, V _{EN} = 0V, I _{OUT} = -1mA | +25°C | | 75 | | Ω |
| Thermal Protection | | | | | | | |
| Thermal Shutdown Temperature | T _{SHDN} | | | | 150 | | °C |
| Thermal Shutdown Hysteresis | ΔT _{SHDN} | | | | 20 | | °C |

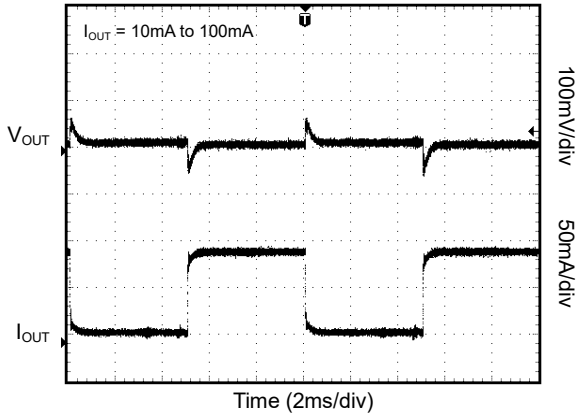
NOTES:

- The dropout voltage is defined as V_{IN} - V_{OUT}, when V_{OUT} is 95% of the value of V_{OUT} for V_{IN} = V_{OUT} + 2V.
- Time needed for V_{OUT} to reach 90% of final value.

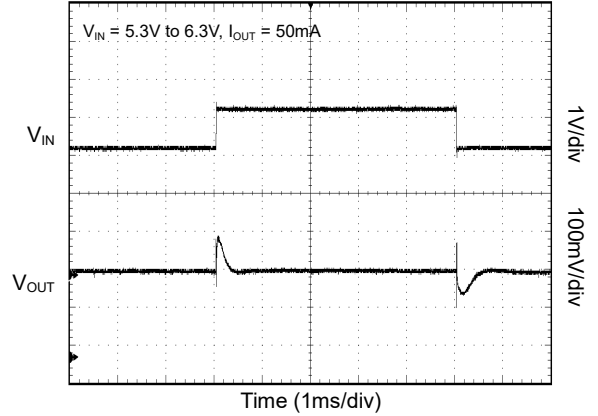
TYPICAL PERFORMANCE CHARACTERISTICS

$V_{IN} = 5.3V$, $V_{EN} = 2V$, $V_{OUT} = 3.3V$, $C_{IN} = C_{OUT} = 1\mu F$, $T_A = +25^\circ C$, unless otherwise noted.

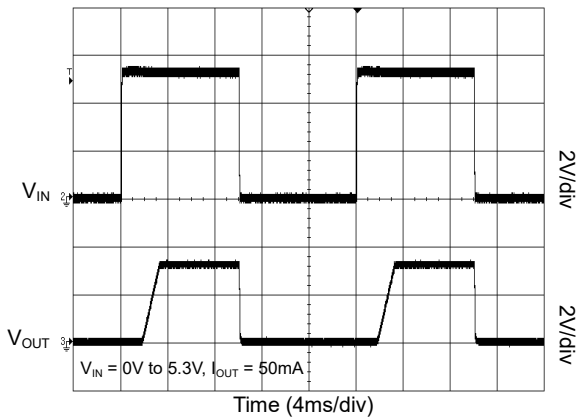
Load-Transient Response



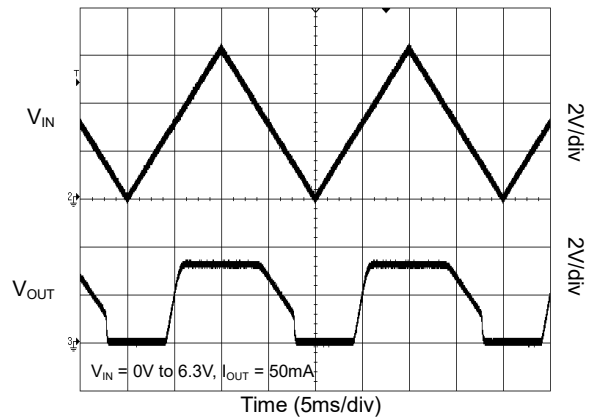
Line-Transient Response



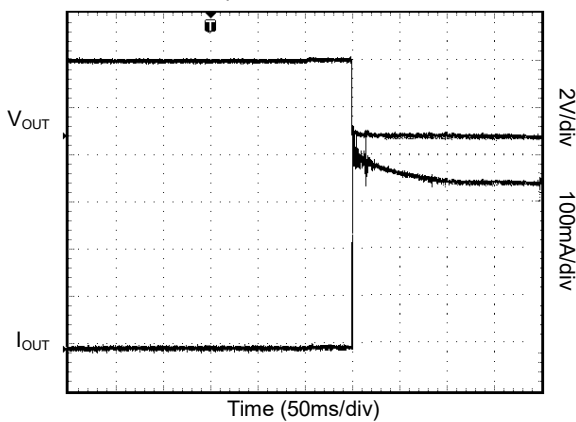
Power-Up/Power-Down Output Waveform



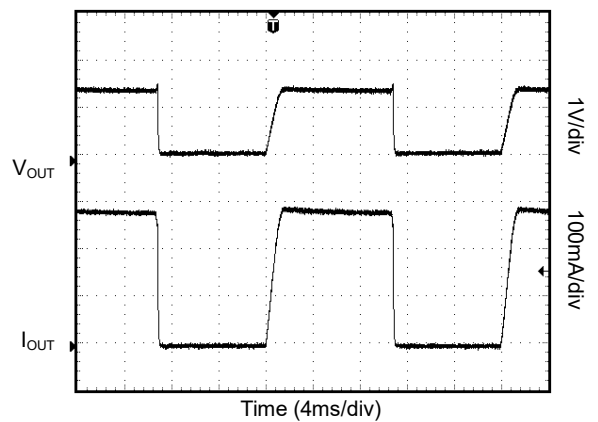
Power Ramp-Up/Ramp-Down Output Waveform



Output Short Waveform

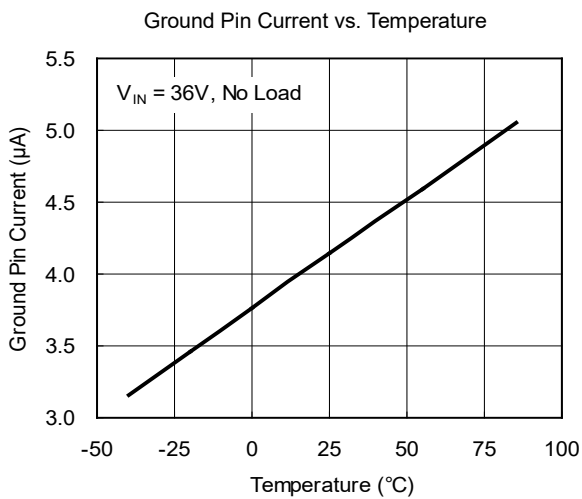
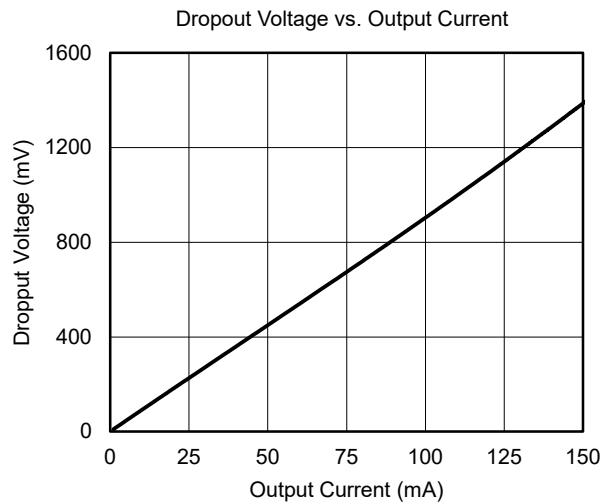
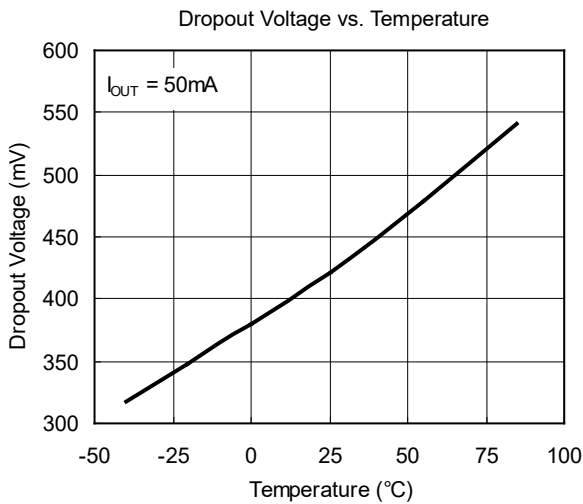
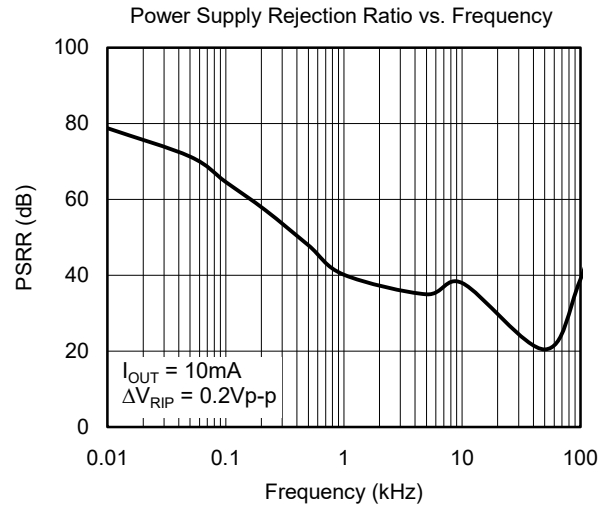
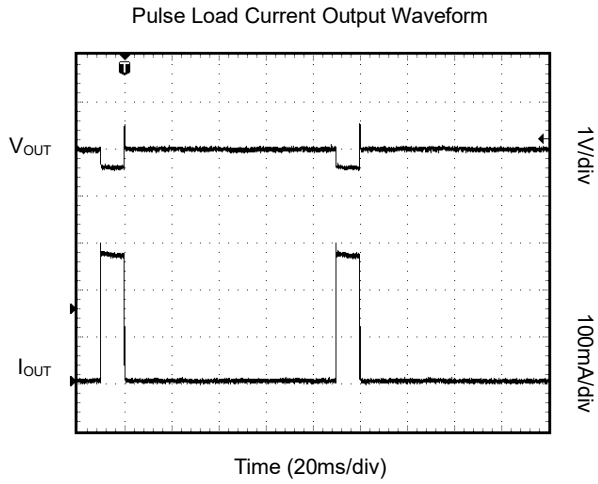


Thermal Protection Waveform



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

$V_{IN} = 5.3V$, $V_{EN} = 2V$, $V_{OUT} = 3.3V$, $C_{IN} = C_{OUT} = 1\mu F$, $T_A = +25^\circ C$, unless otherwise noted.



APPLICATION INFORMATION

The SGM2201 is a high input voltage and low dropout LDO and provides 150mA output current. These features make the device a reliable solution to solve many challenging problems in the generation of clean and accurate power supply. The high performance also makes the SGM2201 useful in a variety of applications.

The SGM2201 provides an EN pin as an external chip enable control to enable/disable the device. When the regulator is in shutdown state, the shutdown current consumes as low as 0.02μA (TYP).

Input Capacitor Selection (C_{IN})

The input decoupling capacitor should be placed as close as possible to the IN pin for ensuring the device stability. A 1μF to 10μF X7R or X5R ceramic capacitor is selected to get good dynamic performance.

When V_{IN} is required to provide large current instantaneously, a large effective input capacitor is required. Multiple input capacitors can limit the input tracking inductance. Adding more input capacitors is available to restrict the ringing and to keep it below the device absolute maximum ratings.

Output Capacitor Selection (C_{OUT})

The output decoupling capacitor should be placed as close as possible to the OUT pin. A 1μF to 10μF X7R or X5R ceramic capacitor is selected to get good dynamic performance. For ceramic capacitor, temperature, DC bias and package size will change the effective capacitance, so enough margin of C_{OUT} must be considered in design. Additionally, C_{OUT} with larger capacitance and lower ESR will help increase the high frequency PSRR and improve the load transient response.

Enable Operation

The EN pin of the SGM2201 is used to enable/disable the device and to deactivate/activate the output automatic discharge function.

When the EN pin voltage is lower than 0.4V, the device is in shutdown state. There is no current flowing from

V_{IN} to V_{OUT} pins. In this state, the automatic discharge transistor is active to discharge the output voltage through a 75Ω (TYP) resistor.

When the EN pin voltage is higher than 1.2V, the device is in active state. The output voltage is regulated to expected value and the automatic discharge transistor is turned off.

Adjustable Regulator

The output voltage of the SGM2201 can be adjusted from 0.8V to 13.2V. The FB pin will be connected to two external resistors as shown in Figure 2. The output voltage is determined by the following equation:

$$V_{OUT} = V_{FB} \times \left(1 + \frac{R_1}{R_2} \right) \quad (1)$$

where:

V_{OUT} is output voltage and V_{FB} is the internal voltage reference, V_{FB} = 0.8V.

One parallel capacitor (C₁) with R₁ can be used to improve the feedback loop stability and PSRR, increase the transient response and reduce the output noise. Use R₂ = 2MΩ to maintain a 0.4μA minimum load.

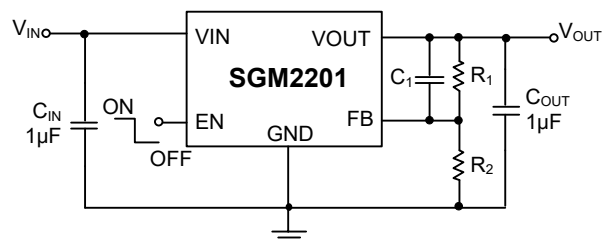


Figure 2. Adjustable Output Voltage Application

Thermal Shutdown

The SGM2201 can detect the temperature of die. When the die temperature exceeds the threshold value of thermal shutdown, the SGM2201 will be in shutdown state and it will remain in this state until the die temperature decreases to +130°C.

REVISION HISTORY

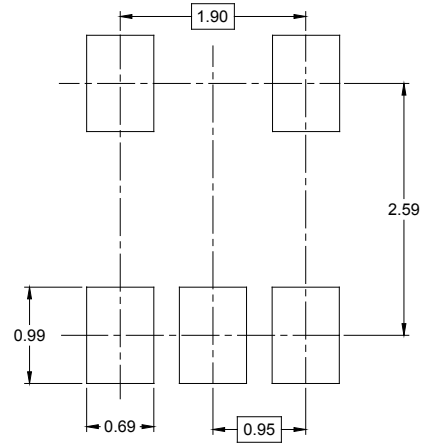
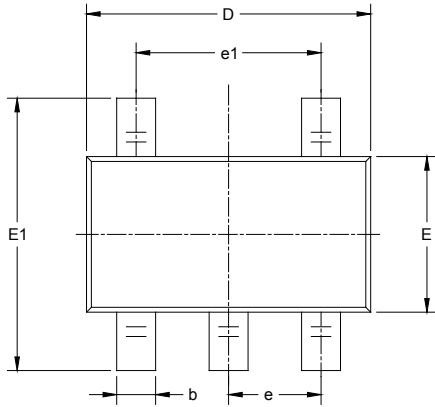
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (APRIL 2017) to REV.A

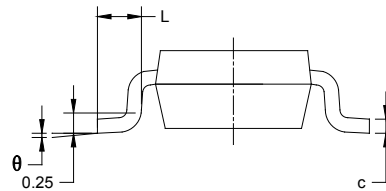
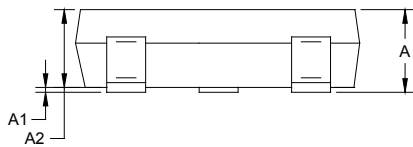
Changed from product preview to production data..... All

PACKAGE OUTLINE DIMENSIONS

TSOT-23-5



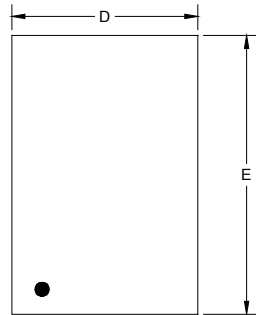
RECOMMENDED LAND PATTERN (Unit: mm)



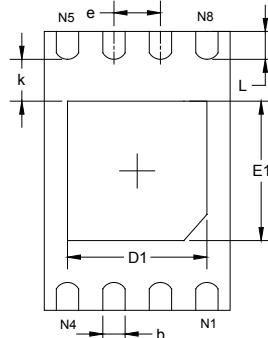
| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|----------|------------------------------|-------|-------------------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.700 | 0.900 | 0.028 | 0.035 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 0.700 | 0.800 | 0.028 | 0.031 |
| b | 0.350 | 0.500 | 0.014 | 0.020 |
| c | 0.080 | 0.200 | 0.003 | 0.008 |
| D | 2.820 | 3.020 | 0.111 | 0.119 |
| E | 1.600 | 1.700 | 0.063 | 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 OUTLINE DIMENSIONS

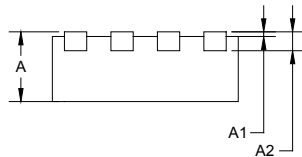
TDFN-2x3-8L



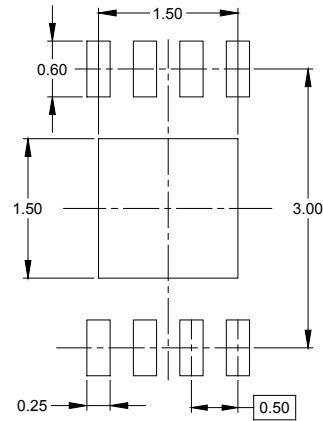
TOP VIEW



BOTTOM VIEW



SIDE VIEW

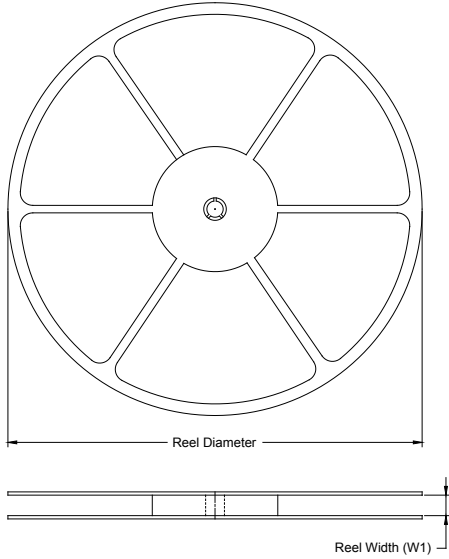


RECOMMENDED LAND PATTERN (Unit: mm)

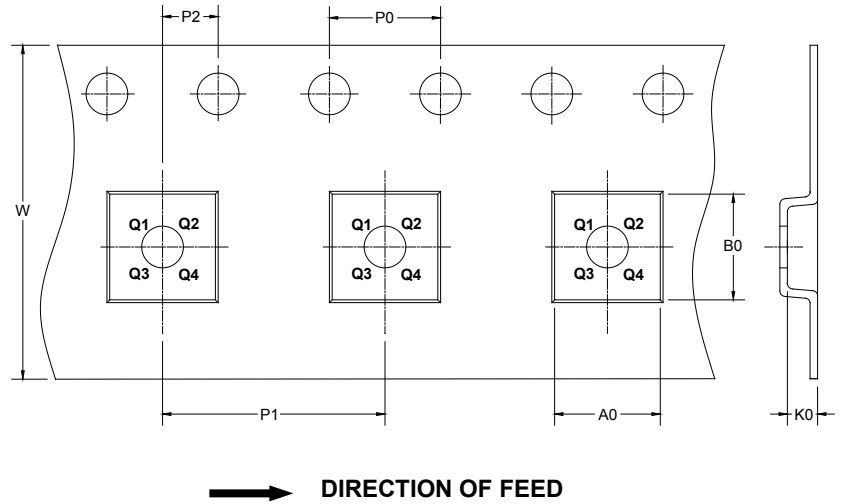
| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|------------------------------|-------|-------------------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.700 | 0.800 | 0.028 | 0.031 |
| A1 | 0.000 | 0.050 | 0.000 | 0.002 |
| A2 | 0.203 REF | | 0.008 REF | |
| D | 1.924 | 2.076 | 0.076 | 0.082 |
| D1 | 1.400 | 1.600 | 0.055 | 0.063 |
| E | 2.924 | 3.076 | 0.115 | 0.121 |
| E1 | 1.400 | 1.600 | 0.055 | 0.063 |
| k | 0.200 MIN | | 0.008 MIN | |
| b | 0.200 | 0.300 | 0.008 | 0.012 |
| e | 0.500 TYP | | 0.020 TYP | |
| L | 0.224 | 0.376 | 0.009 | 0.015 |

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 |
|--------------|---------------|--------------------|---------|---------|---------|---------|---------|---------|--------|---------------|
| TSOT-23-5 | 7" | 9.5 | 3.17 | 3.10 | 1.10 | 4.0 | 4.0 | 2.0 | 8.0 | Q3 |
| TDFN-2×3-8L | 7" | 9.5 | 2.30 | 3.30 | 1.10 | 4.0 | 4.0 | 2.0 | 8.0 | Q2 |

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 |

DD0002