# SGM2202
# 150mA, High PSRR, High Voltage Regulator

## GENERAL DESCRIPTION

The SGM2202 series is a set of low power high voltage regulators implemented in CMOS technology which can provide 150mA output current. The device allows input voltage as high as 36V. The SGM2202 series is available in adjustable and several fixed output voltages. CMOS technology ensures low dropout voltage and low quiescent current.

Although designed primarily as fixed voltage regulators, the device can be used with external components to obtain variable output voltages.

The SGM2202 series is available in Green SOT-23-5 and SOT-23-6 packages. It operates over an ambient temperature range of -40℃ to +85℃.

## FEATURES

- **Low Power Consumption**
- **150mA Nominal Output Current**
- **Low Dropout Voltage**
- **High PSRR**
- **Low Temperature Coefficient**
- **High Input Voltage (up to 36V)**
- **Output Voltage Accuracy: ±2.5%**
- **Fixed Output Voltages: 2.5V, 2.8V, 3.0V, 3.3V and 5.0V**
- **Adjustable Output Voltages: 0.8V to 13.2V**
- **-40℃ to +85℃ Operating Temperature Range**
- **Available in Green SOT-23-5 and SOT-23-6 Packages**

## APPLICATIONS

Battery-Powered Equipment
Communication Equipment
Audio/Video Equipment

## TYPICAL APPLICATION

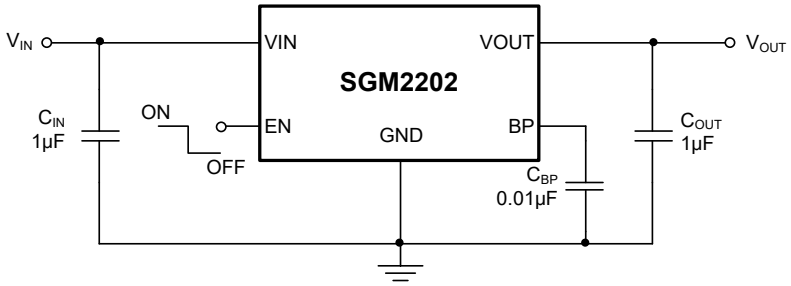



**Figure 1. Fixed Voltage Typical Application Circuit**

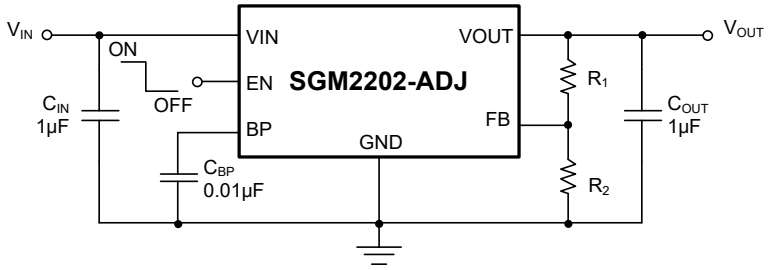


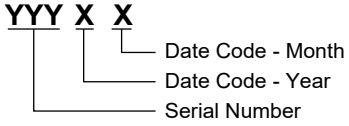

**Figure 2. Adjustable Voltage Typical Application Circuit**

# PACKAGE/ORDERING INFORMATION

| MODEL | $V_{OUT}$ (V) | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKING OPTION |
|---|---|---|---|---|---|---|
| SGM2202-2.5 | 2.5 | SOT-23-5 | -40℃ to +85℃ | SGM2202-2.5YN5G/TR | G1DXX | Tape and Reel, 3000 |
| SGM2202-2.8 | 2.8 | SOT-23-5 | -40℃ to +85℃ | SGM2202-2.8YN5G/TR | SX5XX | Tape and Reel, 3000 |
| SGM2202-3.0 | 3.0 | SOT-23-5 | -40℃ to +85℃ | SGM2202-3.0YN5G/TR | SX6XX | Tape and Reel, 3000 |
| | | SOT-23-5 (L-Type) | -40℃ to +85℃ | SGM2202-3.0YN5LG/TR | G12XX | Tape and Reel, 3000 |
| SGM2202-3.3 | 3.3 | SOT-23-5 | -40℃ to +85℃ | SGM2202-3.3YN5G/TR | SX8XX | Tape and Reel, 3000 |
| SGM2202-5.0 | 5.0 | SOT-23-5 | -40℃ to +85℃ | SGM2202-5.0YN5G/TR | G3DXX | Tape and Reel, 3000 |
| SGM2202-ADJ | Adjustable | SOT-23-6 | -40℃ to +85℃ | SGM2202-ADJYN6G/TR | SVFXX | Tape and Reel, 3000 |

## MARKING INFORMATION

NOTE: XX = Date 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

VIN, EN to GND ..... -0.3V to 44V
VOUT to GND ..... -0.3V to Min($V_{IN}$ + 0.3V, 15V)
BP, FB to GND ..... -0.3V to Min($V_{IN}$ + 0.3V, 6V)
Power Dissipation, $P_D$ @ $T_A$ = +25℃
SOT-23-5, SOT-23-5 (L-Type) ..... 0.517W
SOT-23-6 ..... 0.558W
Package Thermal Resistance
SOT-23-5, SOT-23-5 (L-Type), $\theta_{JA}$ ..... 242℃/W
SOT-23-6, $\theta_{JA}$ ..... 224℃/W
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM ..... 4000V
MM ..... 150V
CDM ..... 1000V

## RECOMMENDED OPERATING CONDITIONS

Input Voltage Range ..... 2.7V to 36V
Operating Temperature Range ..... -40℃ to +85℃

## 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

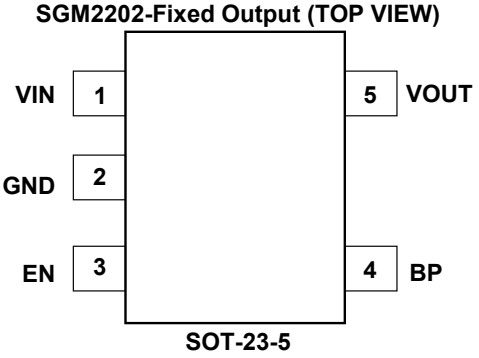
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance 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.

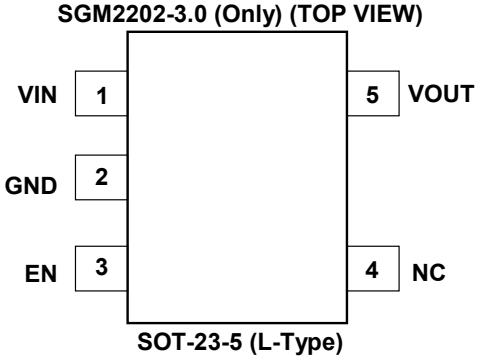
## PIN CONFIGURATIONS

SGM2202-Fixed Output (TOP VIEW)



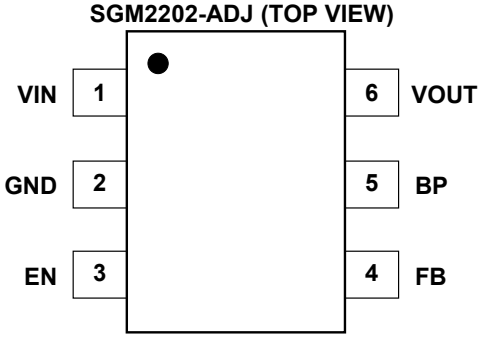

SOT-23-5

SGM2202-3.0 (Only) (TOP VIEW)




SOT-23-5 (L-Type)

SGM2202-ADJ (TOP VIEW)




SOT-23-6

## PIN DESCRIPTION

| PIN | | | NAME | FUNCTION |
|---|---|---|---|---|
| SOT-23-5 | SOT-23-5 (L-Type) | SOT-23-6 | | |
| 1 | 1 | 1 | VIN | Regulator Input. Up to 36V input voltage. At least 1μF supply bypass capacitor is recommended. |
| 2 | 2 | 2 | GND | Ground. |
| 3 | 3 | 3 | EN | Shutdown Input. Connect to VIN pin for normal operation. |
| – | – | 4 | FB | Feedback Pin (adjustable voltage version only). This is used to set the output voltage of the device. |
| 4 | – | 5 | BP | Reference-Noise Bypass Pin. Bypass with a low-leakage 0.01μF ceramic capacitor for reduced noise at the output. |
| – | 4 | – | NC | Not Connected. |
| 5 | 5 | 6 | VOUT | Regulator Output. Recommended output capacitor range: 1μF to 10μF. |

## ELECTRICAL CHARACTERISTICS

($V_{IN}$ = 15V, $V_{EN}$ = 2V, $C_{IN}$ = $C_{OUT}$ = 1μF, $C_{BP}$ = 0.01μF, Full = -40℃ to +85℃, typical values are at $T_A$ = +25℃, 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℃ | -2.5 | | 2.5 | % |
| Feedback Voltage | $V_{FB}$ | SGM2202-ADJ, $V_{FB}$ = $V_{OUT}$, $I_{OUT}$ = 1mA | | +25℃ | | 0.8 | | V |
| FB Input Current | $I_{FB}$ | SGM2202-ADJ, $V_{FB}$ = 0.9V | | Full | -15 | | 15 | nA |
| Ground Pin Current | | No load | | +25℃ | | 4.2 | 5.4 | μA |
| | | | | Full | | | 6.5 | |
| | | $I_{OUT}$ = 50mA | | +25℃ | | 4.2 | | |
| Maximum Output Current (1) | | $V_{IN}$ = $V_{OUT}$ + 2V or 4V, whichever is greater | | +25℃ | 150 | | | mA |
| Dropout Voltage (2) | $V_{DROP}$ | $I_{OUT}$ = 150mA, $V_{OUT}$ ≥ 2.5V | | +25℃ | | 1300 | 1840 | mV |
| | | | | Full | | | 2380 | |
| Line Regulation | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$ | $V_{IN}$ = $V_{OUT}$ + 2V or 4V to 32V, $I_{OUT}$ = 1mA | $V_{OUT}$ < 3.3V | +25℃ | | 0.005 | 0.01 | %/V |
| | | $V_{IN}$ = $V_{OUT}$ + 2V to 36V, $I_{OUT}$ = 1mA | $V_{OUT}$ ≥ 3.3V | +25℃ | | 0.005 | 0.01 | |
| Load Regulation | $\Delta V_{OUT}$ | $V_{IN}$ = $V_{OUT}$ + 2V or 4V, $I_{OUT}$ = 1mA to 150mA | | +25℃ | | 10 | 24 | mV |
| Power Supply Rejection Ratio | PSRR | $V_{OUT}$ = 3.3V, $I_{OUT}$ = 10mA | f = 217Hz | +25℃ | | 55 | | dB |
| | | | f = 1kHz | +25℃ | | 40 | | |
| Output Voltage Temperature Coefficient (3) | $\frac{\Delta V_{OUT}}{\Delta T_A \times V_{OUT}}$ | $V_{IN}$ = $V_{OUT}$ + 2V or 4V, $I_{OUT}$ = 1mA | | Full | | 35 | | ppm/℃ |
| **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℃ | | 1.5 | 2 | μA |
| Start-Up Time (4) | $t_{STR}$ | No load | | +25℃ | | 5 | | ms |
| $R_{ON}$ of Discharge MOSFET | | $V_{IN}$ = 2.7V, $V_{EN}$ = 0V, $I_{OUT}$ = -1mA | | +25℃ | | 75 | | Ω |
| **Thermal Protection** | | | | | | | | |
| Thermal Shutdown Temperature | $T_{SHDN}$ | | | | | 150 | | ℃ |
| Thermal Shutdown Hysteresis | $\Delta T_{SHDN}$ | | | | | 20 | | ℃ |

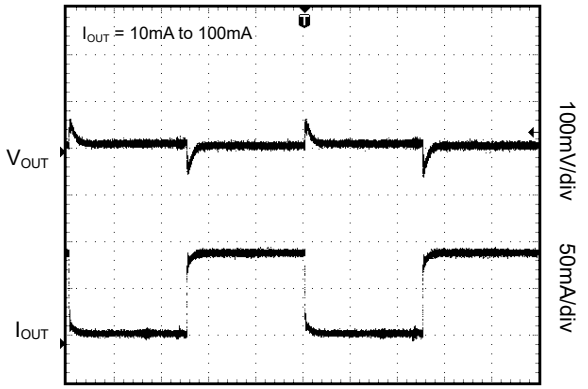
NOTES:

1. Maximum output current is affected by the PCB layout, size of metal trace, the thermal conduction path between metal layers, ambient temperature and the other environment factors of system. Attention should be paid to the dropout voltage when $V_{IN}$ < $V_{OUT}$ + $V_{DROP}$.
2. 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.
3. Output voltage temperature coefficient is defined as the worst-case voltage change divided by the total temperature range.
4. Time needed for $V_{OUT}$ to reach 90% of final value.

## TYPICAL PERFORMANCE CHARACTERISTICS

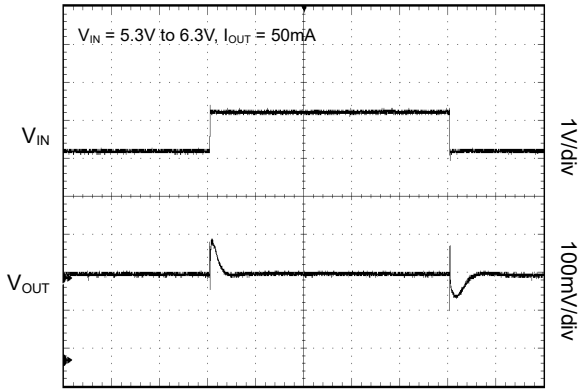
$T_A$ = +25℃, $V_{IN}$ = 5.3V, $V_{EN}$ = 2V, $V_{OUT}$ = 3.3V, $C_{IN}$ = $C_{OUT}$ = 1μF, $C_{BP}$ = 0.01μF, unless otherwise noted.

Load-Transient Response



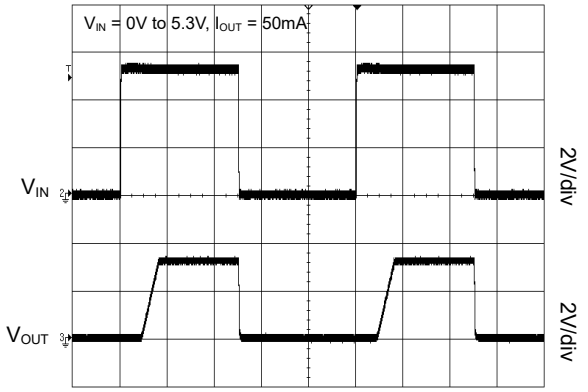

Time (2ms/div)

Line-Transient Response



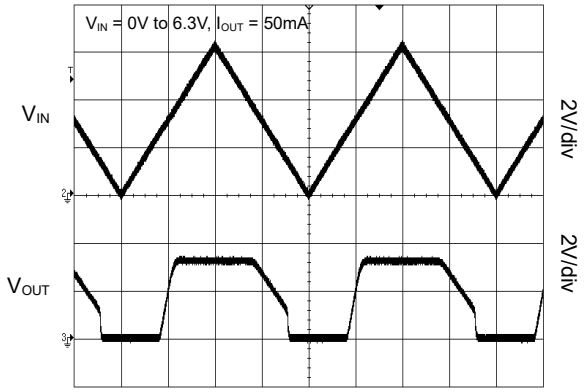

Time (1ms/div)

Power-Up/Power-Down Output Waveform



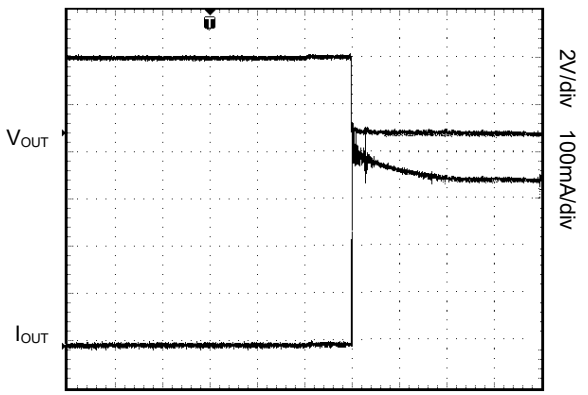

Time (4ms/div)

Power Ramp-Up/Ramp-Down Output Waveform



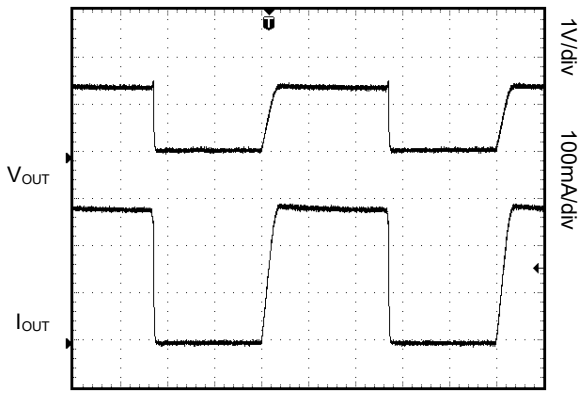

Time (5ms/div)

Output Short Waveform




Time (50ms/div)

Thermal Protection Waveform

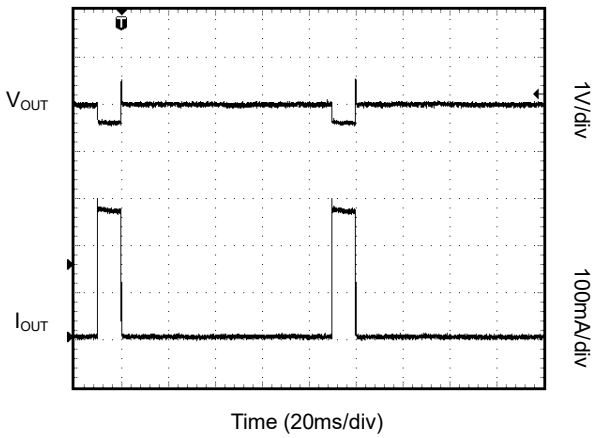



Time (4ms/div)

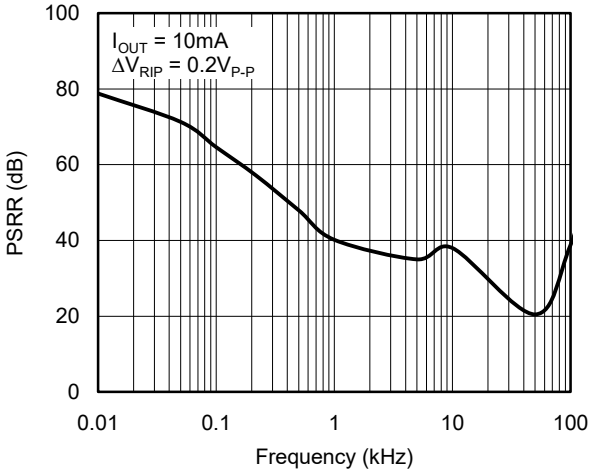
## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

$T_A$ = +25℃, $V_{IN}$ = 5.3V, $V_{EN}$ = 2V, $V_{OUT}$ = 3.3V, $C_{IN}$ = $C_{OUT}$ = 1μF, $C_{BP}$ = 0.01μF, unless otherwise noted.

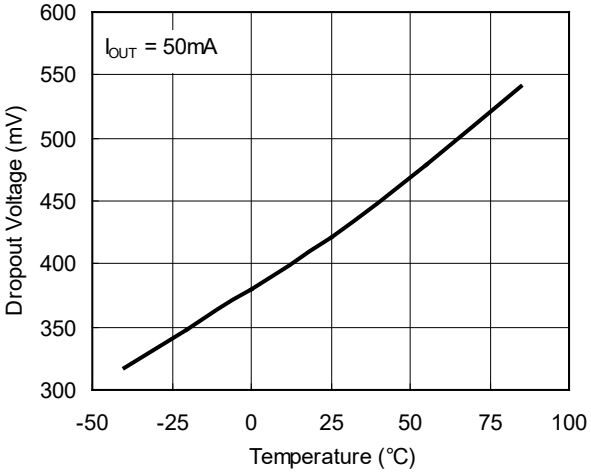
Pulse Load Current Output Waveform



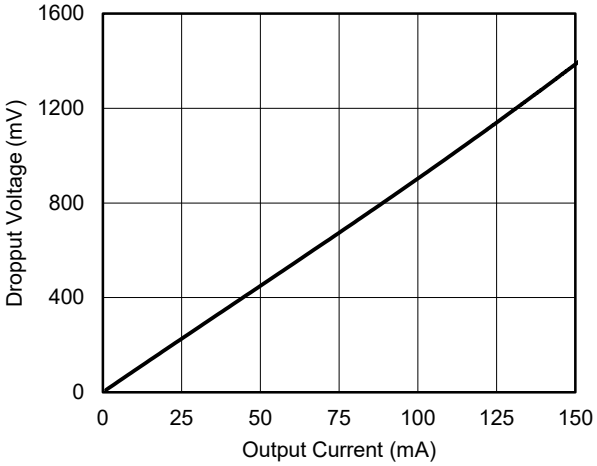

Power Supply Rejection Ratio vs. Frequency



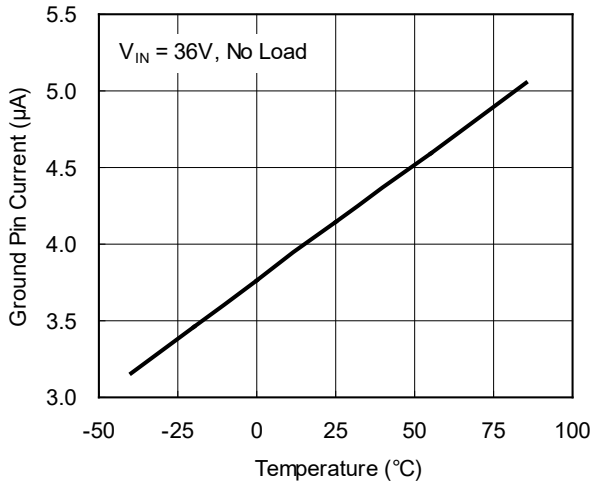

Dropout Voltage vs. Temperature




Dropout Voltage vs. Output Current




Ground Pin Current vs. Temperature



# DETAILED DESCRIPTION

The SGM2202 series is a linear regulator designed primarily for high input voltage applications. The SGM2202 series is available in several fixed output voltages and adjustable from 0.8V to 13.2V with a simple resistor divider. The maximum output current is dependent on the package's maximum power dissipation for a given temperature.

CMOS technology ensures low dropout voltage and low quiescent current.

The SGM2202 adjustable voltage version uses external feedback, allowing the user to set the output voltage with an external resistor divider. The typical FB pin voltage is 0.8V.

The IC enters shutdown mode when EN is low. In shutdown mode, the pass transistor and control circuitry are turned off, reducing the supply current to < 2μA. Connect EN to VIN for automatic startup.

# APPLICATION INFORMATION

## Setting the Output Voltage

Set the output voltage of the SGM2202 adjustable voltage version by using a resistor divider as shown:

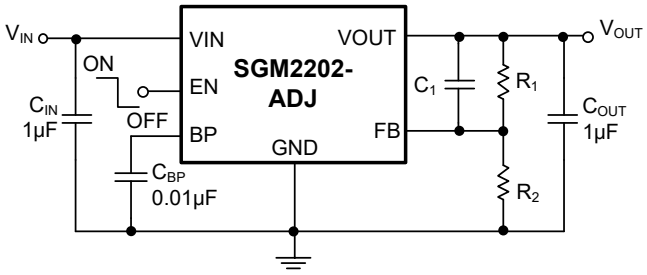



**Figure 3. SGM2202-ADJ with External Resistor Divider**

Choose $R_2$ = 2MΩ to maintain a 0.4μA minimum load. Calculate the value for $R_1$ using the following equation:

$$R_1 = R_2 \times \left( \frac{V_{OUT}}{0.8V} - 1 \right)$$

## Input Capacitor and Output Capacitor

For proper operation, place a ceramic capacitor ($C_{IN}$) between 1μF and 10μF between the input pin and ground. Larger values in this range will help improve line transient response.

For stable operation, use a ceramic capacitor ($C_{OUT}$) between 1μF and 10μF. Larger values in this range will help improve load transient response and reduce noise. Output capacitors of other dielectric types may be used, but are not recommended as their capacitance can deviate greatly from their rated value over temperature.

## Thermal Considerations

When the junction temperature is too high, the thermal protection circuitry sends a signal to the control logic that will shutdown the IC. The IC will restart when the temperature has sufficiently cooled down.

The maximum power dissipation is dependent on the thermal resistance of the case and the circuit board, the temperature difference between the die junction and the ambient air, and the rate of air flow.

# REVISION HISTORY

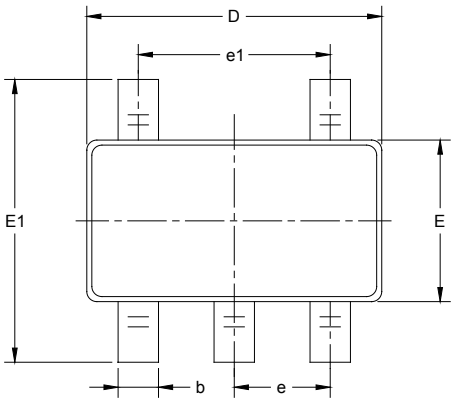
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

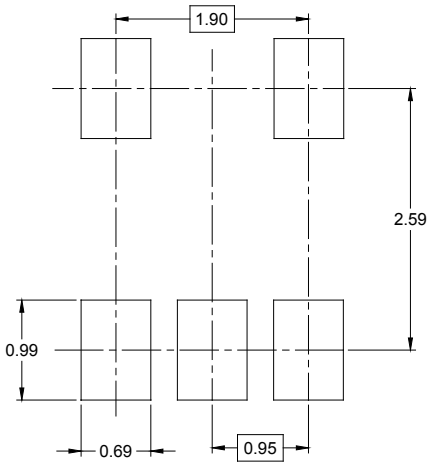
| OCTOBER 2020 – REV.A.1 to REV.A.2 | Page |
|---|---|
| Updated Package/Ordering Information section | 2 |

| Changes from Original (APRIL 2017) to REV.A | Page |
|---|---|
| Changed from product preview to production data | All |

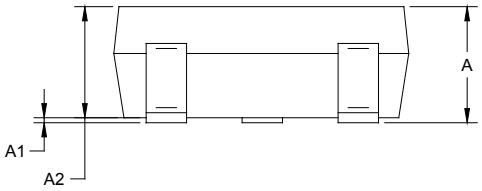
# PACKAGE OUTLINE DIMENSIONS

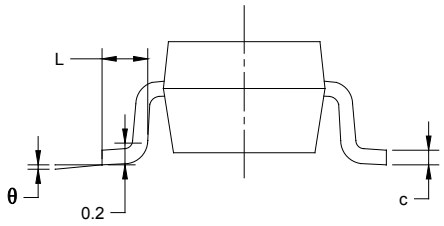
## SOT-23-5




**RECOMMENDED LAND PATTERN** (Unit: mm)

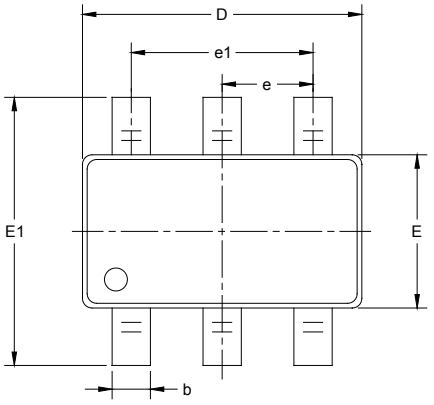


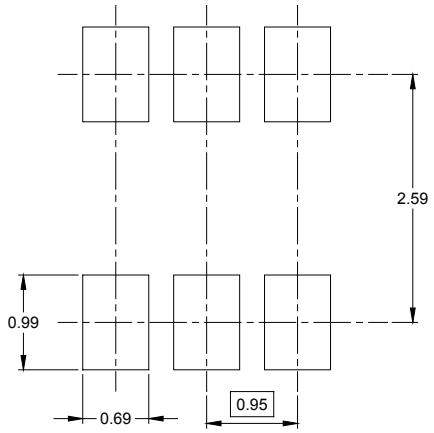




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 1.050 | 1.250 | 0.041 | 0.049 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 1.050 | 1.150 | 0.041 | 0.045 |
| b | 0.300 | 0.500 | 0.012 | 0.020 |
| c | 0.100 | 0.200 | 0.004 | 0.008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

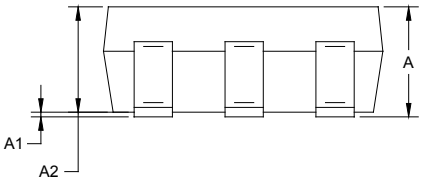
# PACKAGE OUTLINE DIMENSIONS

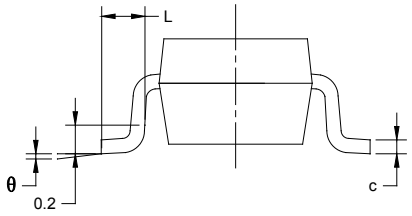
## SOT-23-6




**RECOMMENDED LAND PATTERN** (Unit: mm)

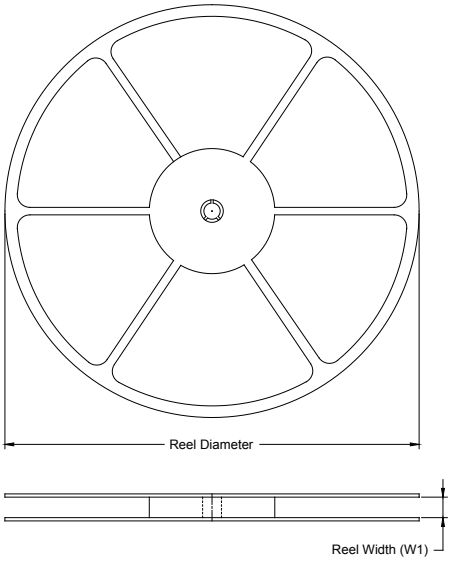


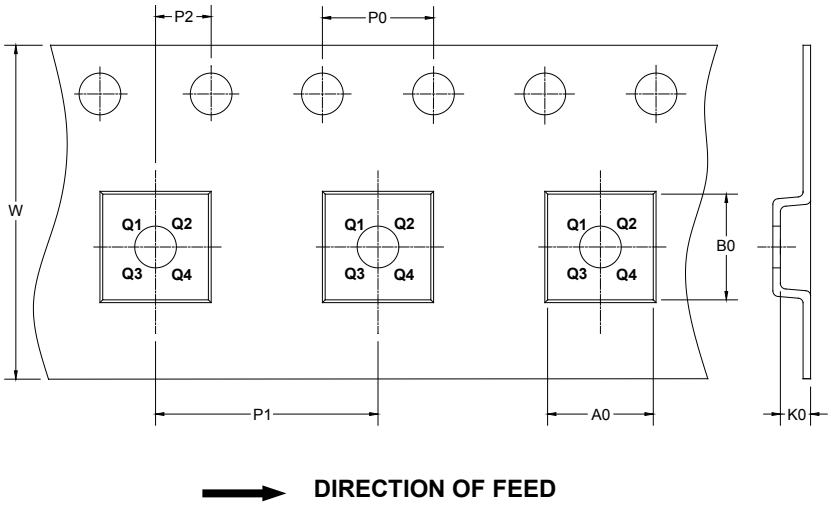

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 1.050 | 1.250 | 0.041 | 0.049 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 1.050 | 1.150 | 0.041 | 0.045 |
| b | 0.300 | 0.500 | 0.012 | 0.020 |
| c | 0.100 | 0.200 | 0.004 | 0.008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

# TAPE AND REEL INFORMATION

### REEL DIMENSIONS




### TAPE DIMENSIONS



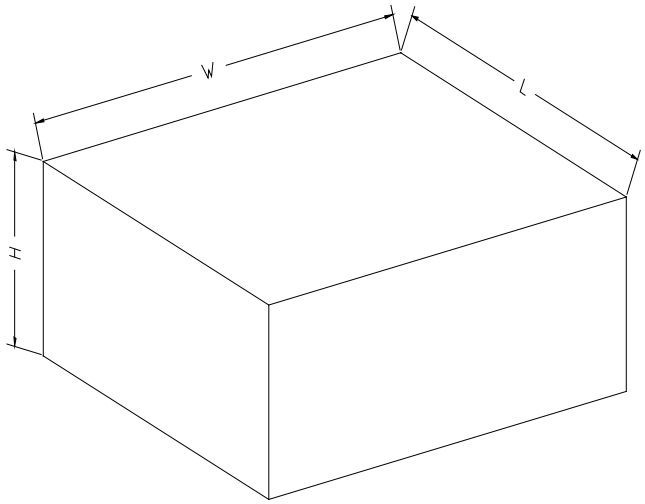

NOTE: The picture is only for reference. Please make the object as the standard.

## KEY PARAMETER LIST OF TAPE AND REEL

| Package Type | Reel Diameter | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | P1 (mm) | P2 (mm) | W (mm) | Pin1 Quadrant |
|---|---|---|---|---|---|---|---|---|---|---|
| SOT-23-5 | 7″ | 9.5 | 3.20 | 3.20 | 1.40 | 4.0 | 4.0 | 2.0 | 8.0 | Q3 |
| SOT-23-6 | 7″ | 9.5 | 3.17 | 3.23 | 1.37 | 4.0 | 4.0 | 2.0 | 8.0 | Q3 |

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 |

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