# SGM2203C
# 150mA, Low Quiescent Current, General Purpose, High Voltage Regulator

## GENERAL DESCRIPTION

The SGM2203C is a general purpose high voltage and low power consumption linear regulator. It is capable of supplying 150mA output current. The operating input voltage is up to 36V. The fixed output voltage range is from 3.0V to 12V.

Other features include current limit and thermal shutdown protection.

The SGM2203C is available in Green SOT-23, SOT-23-5 and SOT-89-3 packages. It operates over an operating temperature range of -40℃ to +125℃.

## FEATURES

- **High Input Voltage: Up to 36V**
- **Fixed Output from 3.0V to 12V**
- **150mA Output Current**
- **Low Dropout Voltage**
- **Low Power Consumption: 4.2μA (TYP)**
- **Low Temperature Coefficient**
- **Current Limiting and Thermal Protection**
- **Stable with Small Case Size Ceramic Capacitors**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in Green SOT-23, SOT-23-5 and SOT-89-3 Packages**

## APPLICATIONS

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

## TYPICAL APPLICATION

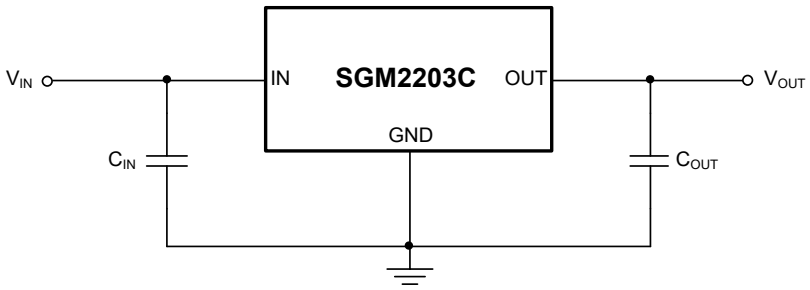



**Figure 1. Typical Application Circuit**

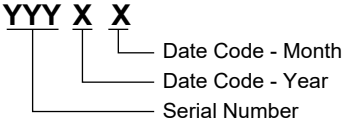
# PACKAGE/ORDERING INFORMATION

| MODEL | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKING OPTION |
|---|---|---|---|---|---|
| SGM2203C-3.3 | SOT-23 | -40℃ to +125℃ | SGM2203C-3.3XN3LG/TR | SW9XX | Tape and Reel, 3000 |
| SGM2203C-5.0 | SOT-23 | -40℃ to +125℃ | SGM2203C-5.0XN3LG/TR | SWBXX | Tape and Reel, 3000 |
| SGM2203C-3.3 | SOT-23-5 | -40℃ to +125℃ | SGM2203C-3.3XN5G/TR | GE0XX | Tape and Reel, 3000 |
| SGM2203C-3.6 | SOT-23-5 | -40℃ to +125℃ | SGM2203C-3.6XN5G/TR | 24WXX | Tape and Reel,3000 |
| SGM2203C-5.0 | SOT-23-5 | -40℃ to +125℃ | SGM2203C-5.0XN5G/TR | GJ9XX | Tape and Reel, 3000 |
| SGM2203C-3.3 | SOT-23-5 (L-Type) | -40℃ to +125℃ | SGM2203C-3.3XN5LG/TR | 1EXXX | Tape and Reel, 3000 |
| SGM2203C-3.0 | SOT-89-3 | -40℃ to +125℃ | SGM2203C-3.0XK3G/TR | 1PMXX | Tape and Reel, 2500 |
| SGM2203C-3.3 | SOT-89-3 | -40℃ to +125℃ | SGM2203C-3.3XK3G/TR | SWDXX | Tape and Reel, 2500 |
| SGM2203C-3.6 | SOT-89-3 | -40℃ to +125℃ | SGM2203C-3.6XK3G/TR | SWFXX | Tape and Reel, 2500 |
| SGM2203C-5.0 | SOT-89-3 | -40℃ to +125℃ | SGM2203C-5.0XK3G/TR | SWEXX | Tape and Reel, 2500 |
| SGM2203C-5.75 | SOT-89-3 | -40℃ to +125℃ | SGM2203C-5.75XK3G/TR | CG3XX | Tape and Reel, 2500 |
| SGM2203C-12 | SOT-89-3 | -40℃ to +125℃ | SGM2203C-12XK3G/TR | G3FXX | Tape and Reel, 2500 |
| SGM2203C-3.0 | SOT-89-3 (L-Type) | -40℃ to +125℃ | SGM2203C-3.0XK3LG/TR | SX0XX | Tape and Reel, 2500 |
| SGM2203C-3.3 | SOT-89-3 (L-Type) | -40℃ to +125℃ | SGM2203C-3.3XK3LG/TR | G75XX | Tape and Reel, 2500 |
| SGM2203C-5.0 | SOT-89-3 (L-Type) | -40℃ to +125℃ | SGM2203C-5.0XK3LG/TR | SX1XX | Tape and Reel, 2500 |

## MARKING INFORMATION

NOTE: XX = Date Code.

**SOT-23/SOT-23-5/SOT-89-3/SOT-89-3 (L-Type)/SOT-23-5 (L-Type)**




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

IN to GND ..... -0.3V to 44V
OUT to GND, $V_{OUT}$ ≤ 5.75V ..... -0.3V to MIN ($V_{IN}$ + 0.3V, 6V)
OUT to GND, $V_{OUT}$ > 5.75V ..... -0.3V to MIN ($V_{IN}$ + 0.3V, 15V)
Package Thermal Resistance
SOT-23, $\theta_{JA}$ ..... 252.4℃/W
SOT-23, $\theta_{JB}$ ..... 92.9℃/W
SOT-23, $\theta_{JC}$ ..... 142.4℃/W
SOT-23-5, $\theta_{JA}$ ..... 204.8℃/W
SOT-23-5, $\theta_{JB}$ ..... 87.5℃/W
SOT-23-5, $\theta_{JC}$ ..... 134.1℃/W
SOT-23-5 (L-Type), $\theta_{JA}$ ..... 175.3℃/W
SOT-23-5 (L-Type), $\theta_{JB}$ ..... 55.8℃/W
SOT-23-5 (L-Type), $\theta_{JC}$ ..... 100.9℃/W
SOT-89-3, $\theta_{JA}$ ..... 70.8℃/W
SOT-89-3, $\theta_{JB}$ ..... 25.1℃/W
SOT-89-3, $\theta_{JC}$ ..... 101.5℃/W
SOT-89-3 (L-Type), $\theta_{JA}$ ..... 110℃/W
SOT-89-3 (L-Type), $\theta_{JB}$ ..... 64.3℃/W
SOT-89-3 (L-Type), $\theta_{JC}$ ..... 131.1℃/W
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility (1) (2)
HBM ..... ±4000V
CDM ..... ±1000V

NOTES:

1. For human body model (HBM), all pins comply with ANSI/ESDA/JEDEC JS-001 specifications.

2. For charged device model (CDM), all pins comply with ANSI/ESDA/JEDEC JS-002 specifications.

## RECOMMENDED OPERATING CONDITIONS

Input Voltage Range ..... 2.7V to 36V
Input Effective Capacitance, $C_{IN}$ ..... 0.05μF (MIN)
Output Effective Capacitance, $C_{OUT}$ ..... 1μF to 10μF
Operating Junction Temperature Range ..... -40℃ to +125℃

## 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

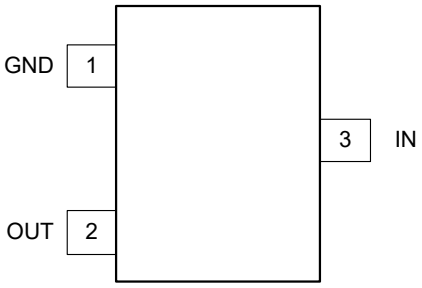
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance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

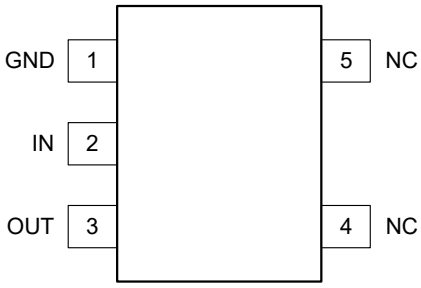
## PIN CONFIGURATIONS

SGM2203C (TOP VIEW)



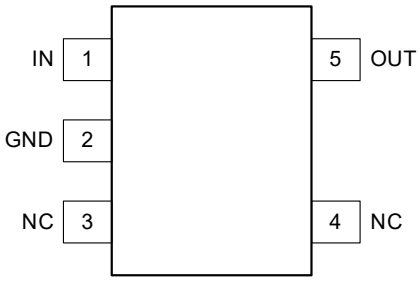

SOT-23

SGM2203C (TOP VIEW)



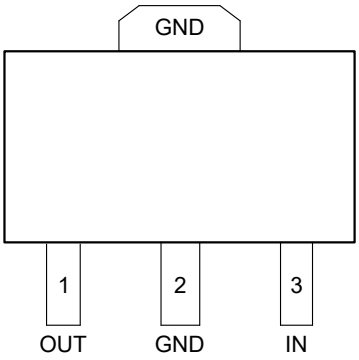

SOT-23-5

SGM2203C (TOP VIEW)



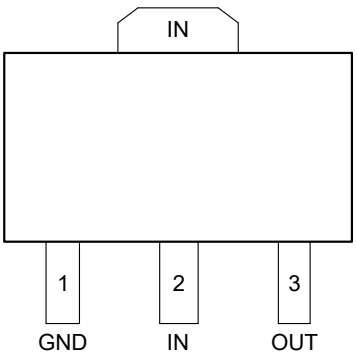

SOT-23-5 (L-Type)

SGM2203C (TOP VIEW)




SOT-89-3

SGM2203C (TOP VIEW)




SOT-89-3 (L-Type)

## PIN DESCRIPTION

| PIN | | | | | NAME | FUNCTION |
|---|---|---|---|---|---|---|
| SOT-23 | SOT-23-5 | SOT-23-5 (L-Type) | SOT-89-3 | SOT-89-3 (L-Type) | | |
| 1 | 1 | 2 | 2 | 1 | GND | Ground. |
| 2 | 3 | 5 | 1 | 3 | OUT | Regulator Output Pin. It is recommended to use an output capacitor with effective capacitance in the range of 1μF to 10μF to ensure stability. The capacitor should be located very close to this pin. |
| 3 | 2 | 1 | 3 | 2 | IN | Regulator Input Pin. Up to 36V input voltage. It is recommended to use a 0.1μF or larger ceramic capacitor from IN pin to ground to get good power supply decoupling. This ceramic capacitor should be placed as close as possible to IN pin. |
| – | 4,5 | 3, 4 | – | – | NC | No Connection. |

## FUNCTIONAL BLOCK DIAGRAM

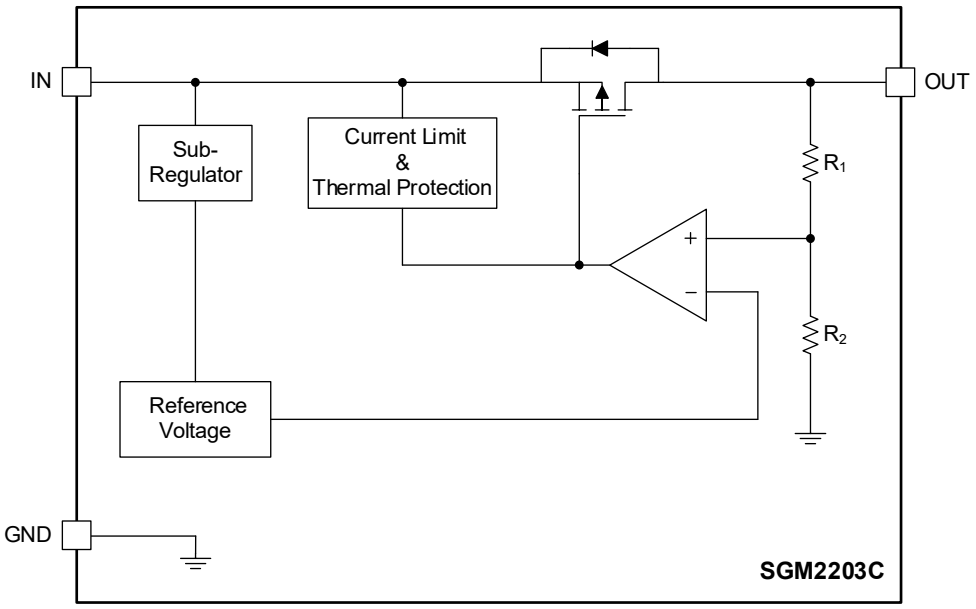



**Figure 2. Internal Block Diagram**

## ELECTRICAL CHARACTERISTICS

($V_{IN}$ = ($V_{OUT(NOM)}$ + 2V) or 4V (whichever is greater), $C_{IN}$ = 1μF, $C_{OUT}$ = 1μF, $T_J$ = -40℃ to +125℃, typical values are at $T_J$ = +25℃, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| Input Voltage Range | $V_{IN}$ | $V_{OUT}$ < 3.3V | | 2.7 | | 32 | V |
| | | $V_{OUT}$ ≥ 3.3V | | 2.7 | | 36 | |
| Output Voltage Accuracy | $V_{OUT}$ | $I_{OUT}$ = 1mA | $T_J$ = +25℃ | -3 | | +3 | % |
| | | | $T_J$ = -40℃ to +125℃ | -3.5 | | +3.5 | |
| Line Regulation | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$ | $V_{IN}$ = ($V_{OUT}$ + 2V) to 36V, $I_{OUT}$ = 1mA, $V_{OUT}$ < 3.3V | $T_J$ = +25℃ | | 0.005 | 0.012 | %/V |
| | | | $T_J$ = -40℃ to +125℃ | | | 0.02 | |
| | | $V_{IN}$ = ($V_{OUT}$ + 2V) to 36V, $I_{OUT}$ = 1mA, $V_{OUT}$ ≥ 3.3V | $T_J$ = +25℃ | | 0.005 | 0.012 | |
| | | | $T_J$ = -40℃ to +125℃ | | | 0.02 | |
| Load Regulation | $\Delta V_{OUT}$ | $V_{IN}$ = ($V_{OUT}$ + 2V) or 4V, $I_{OUT}$ = 1mA to 150mA | $T_J$ = +25℃ | | 10 | 25 | mV |
| | | | $T_J$ = -40℃ to +125℃ | | | 40 | |
| Dropout Voltage (1) | $V_{DROP}$ | $I_{OUT}$ = 150mA | $T_J$ = +25℃ | | 1300 | 1850 | mV |
| | | | $T_J$ = -40℃ to +125℃ | | | 2700 | |
| Output Current Limit | $I_{LIMIT}$ | $V_{OUT}$ = 90% × $V_{OUT(NOM)}$ | $T_J$ = +25℃ | 150 | 260 | | mA |
| | | | $T_J$ = -40℃ to +125℃ | 70 | | | |
| Ground Pin Current | $I_{GND}$ | No load | $T_J$ = +25℃ | | 4.2 | 5.5 | μA |
| | | | $T_J$ = -40℃ to +125℃ | | | 7.5 | |
| | | $I_{OUT}$ = 50mA | | | 4.2 | | |
| Power Supply Rejection Ratio | PSRR | $V_{OUT}$ = 3.3V, $I_{OUT}$ = 10mA | f = 217Hz | | 55 | | dB |
| | | | f = 1kHz | | 40 | | |
| Output Voltage Temperature Coefficient (2) | $\frac{\Delta V_{OUT}}{\Delta T_J \times V_{OUT}}$ | $V_{IN}$ = $V_{OUT}$ + 2V or 4V, $I_{OUT}$ = 1mA, $T_J$ = -40℃ to +125℃ | | | 68 | | ppm/℃ |
| Thermal Shutdown Temperature | $T_{SHDN}$ | $T_J$ rising | | | 150 | | ℃ |
| Thermal Shutdown Hysteresis | $\Delta T_{SHDN}$ | Hysteresis | | | 20 | | ℃ |

NOTES:

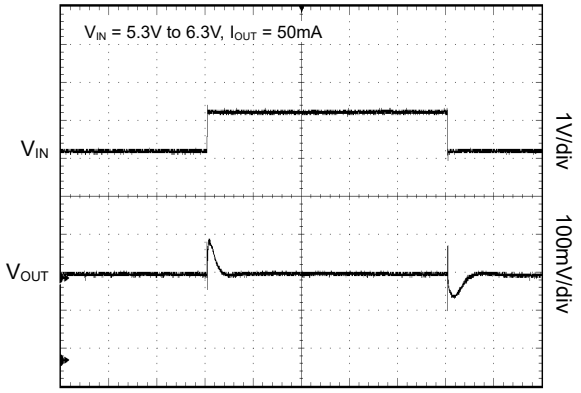
1. The dropout voltage is defined as $V_{IN}$ - $V_{OUT}$, when $V_{OUT}$ is 95% of the value of $V_{OUT}$ for $V_{IN}$ = $V_{OUT}$ + 2V.
2. Output voltage temperature coefficient is defined as the worst-case voltage change divided by the total temperature range.

## TYPICAL PERFORMANCE CHARACTERISTICS

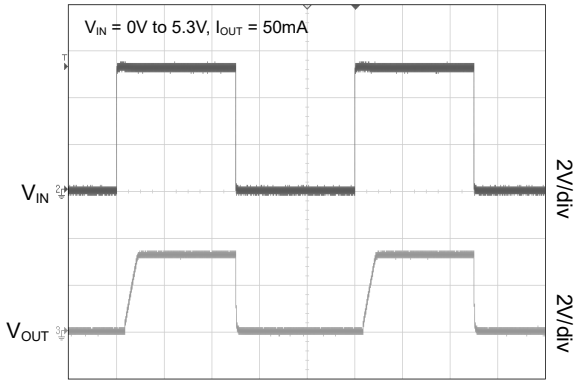
$T_A$ = +25℃, $V_{IN}$ = 5.3V, $V_{OUT}$ = 3.3V, $C_{IN}$ = 1μF, $C_{OUT}$ = 1μF, unless otherwise noted.

Load-Transient Response

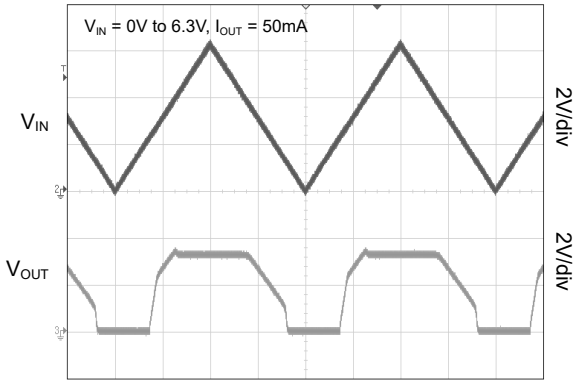

Line-Transient Response



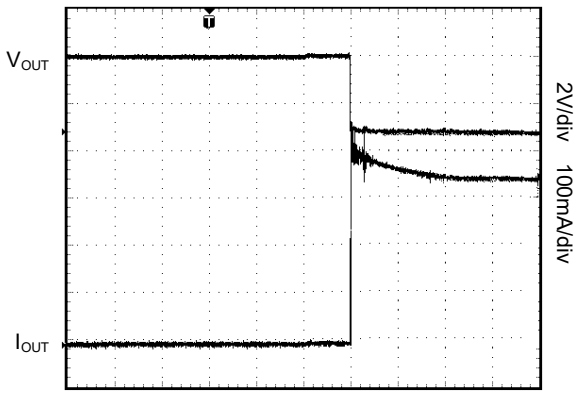

Power-Up/Power-Down Output Waveform



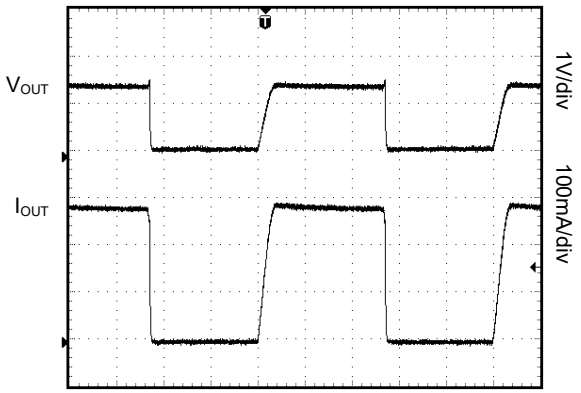

Power Ramp-Up/Ramp-Down Output Waveform




Output Short Waveform



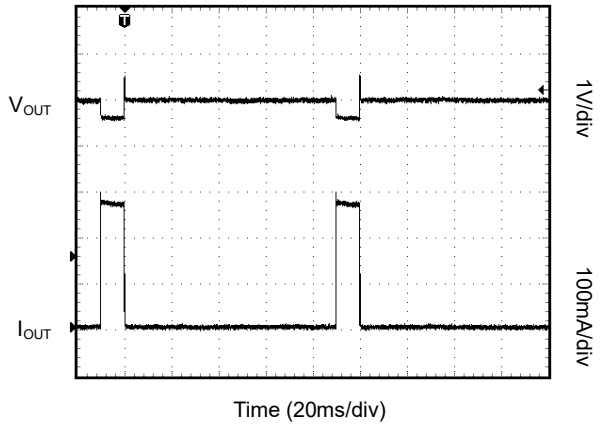

Thermal Protection Waveform



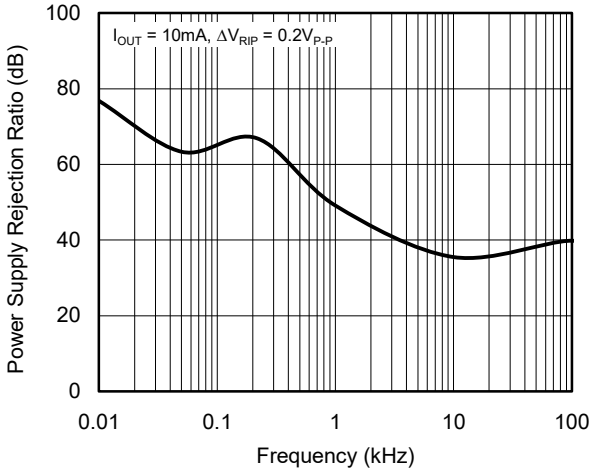
## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

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

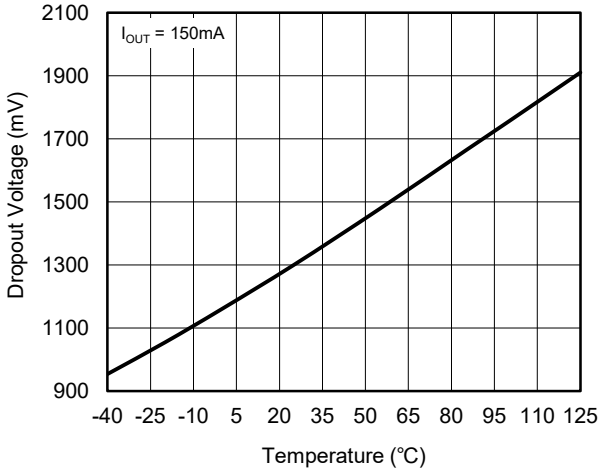
Pulse Load Current Output Waveform



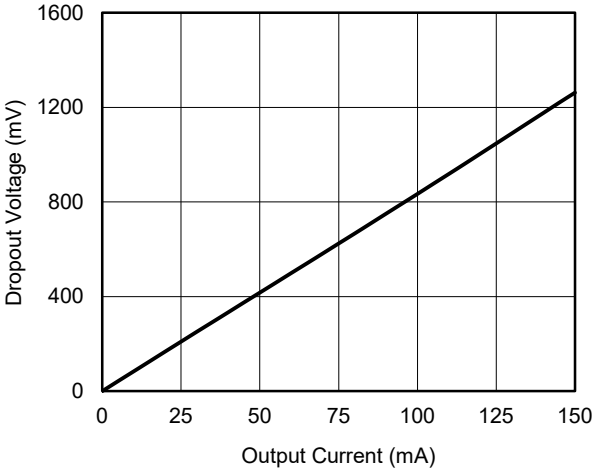

Power Supply Rejection Ratio vs. Frequency



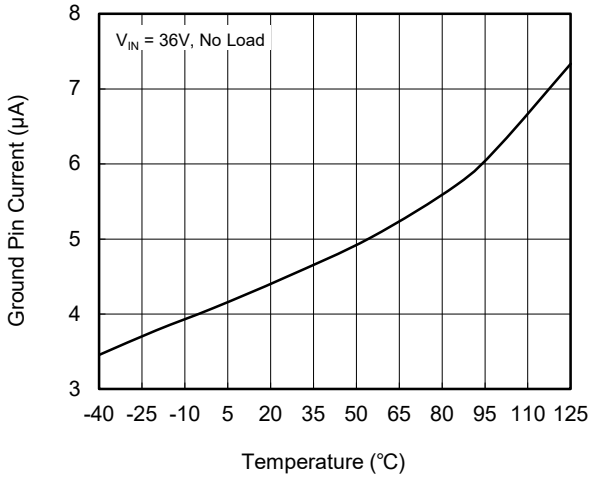

Dropout Voltage vs. Temperature



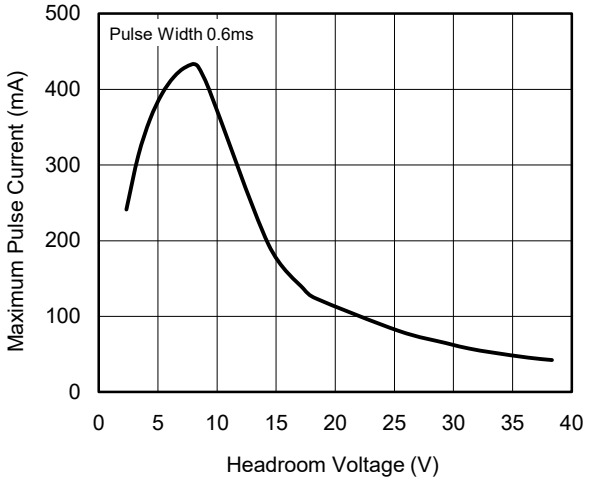

Dropout Voltage vs. Output Current




Ground Pin Current vs. Temperature



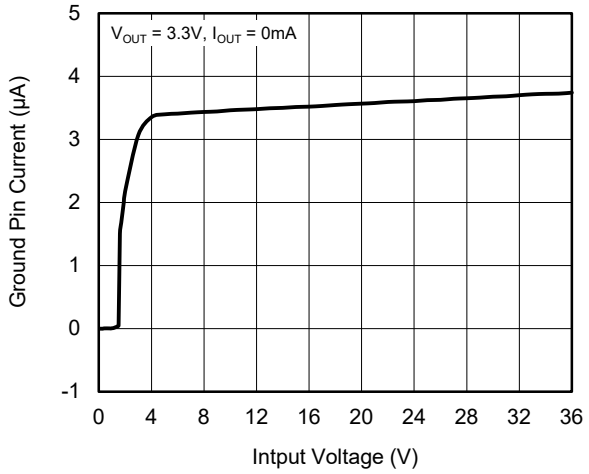

Maximum Pulse Current vs. Headroom Voltage



## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

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

Ground Pin Current vs. Input Voltage



# APPLICATION INFORMATION

The SGM2203C is a high voltage and low power consumption linear regulator and provides 150mA output current. The high performance also makes the SGM2203C useful in a variety of applications.

## Dropout Voltage and $V_{IN}$

The SGM2203C features low dropout voltage due to low $R_{DS(ON)}$ PMOSFET power transistor. For Linear regulator, when ($V_{IN}$ - $V_{OUT}$) < dropout voltage ($V_{DROP}$), the PMOSFET power transistor will be turned on like a switch and the parameter of linear regulator, such as PSRR, load and input transient responses, will be degraded so much. To get good performance in application, the $V_{IN}$ must be larger than ($V_{OUT}$ + $V_{DROP}$).

## 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. 0.1μF or larger 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 ($C_{OUT}$)

One or more output capacitors are required to maintain the stability of the LDO, and the output capacitors should be placed as close as possible to the OUT pin. In addition, in order to obtain the best transient performance, it is recommended to use X7R and X5R ceramic capacitors as output capacitors. Ceramic capacitors have low equivalent series resistance (ESR), excellent temperature and DC bias characteristics. However, it cannot be ignored that the effective capacitance of ceramic capacitors is affected by temperature, DC bias and package size.

For example, Figure 3 shows the capacitance and DC bias and temperature characteristics of 0805, 10V, 10μF±10%, X7R capacitor. Therefore, it is necessary to evaluate whether the effective capacitance of the output capacitor can meet the stability requirements of the LDO in practical applications. In general, a capacitor in higher voltage rating and a larger package exhibits better stability, and the effective capacitance can be obtained from the manufacturer datasheet.

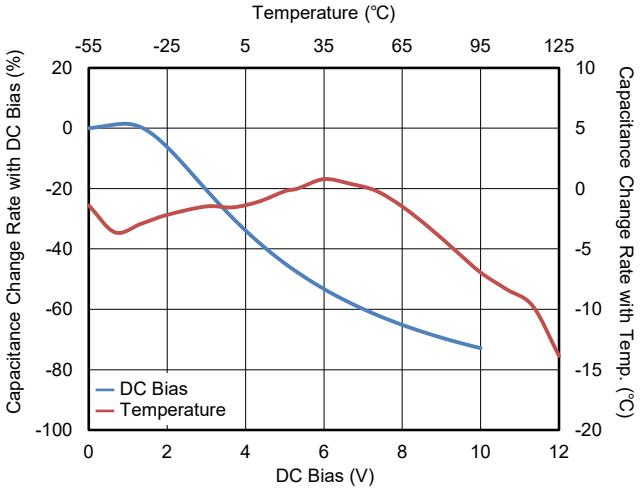



**Figure 3. Capacitance vs. DC Bias and Temperature Characteristics**

The SGM2203C requires a minimum effective capacitance of 1μF for $C_{OUT}$ to ensure stability. Additionally, $C_{OUT}$ with larger capacitance and lower ESR will help increase the high frequency PSRR and improve the load transient response.

## No-Load Stability

The SGM2203C can maintain stability without output load (except internal voltage divider).

## Reverse Current Protection

The PMOS power transistor has an inherent body diode. This body diode will be forward biased when $V_{OUT}$ > $V_{IN}$. When $V_{OUT}$ > $V_{IN}$, the reverse current flowing from the OUT pin to the IN pin will damage the SGM2203C. If reverse current protection function is needed in application, the circuit in Figure 4 is good solution to provide reverse current protection.

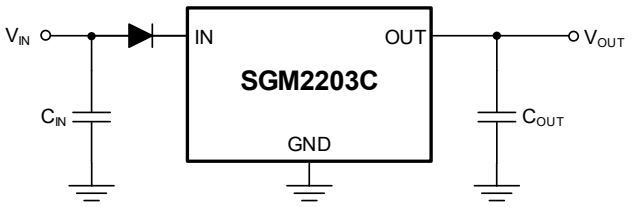



**Figure 4. Reverse Protection Reference Circuit**

# APPLICATION INFORMATION (continued)

## Start-Up for Negative Biased Output

If the output is negative biased ($V_{OUT}$ < -0.3V) during SGM2203C starts up, the chip may not start up well due to parasitic effects. Please ensure that the output is greater than -0.3V under all conditions in application. If negatively biased output is expected in the application, a Schottky diode can be added between the OUT pin and GND pin in Figure 5, this circuit will guarantee $V_{OUT}$ < -0.3V and SGM2203C will start up well.

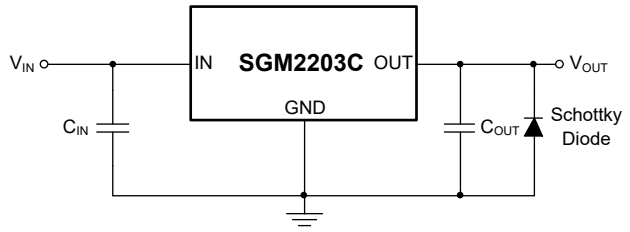



**Figure 5. Start Up Design for Negative Biased Output**

## Thermal Shutdown

When the die temperature exceeds the threshold value of thermal shutdown, the SGM2203C will be in shutdown state and it will remain in this state until the die temperature decreases to +130℃.

## Power Dissipation ($P_D$)

Power dissipation ($P_D$) of the SGM2203C can be calculated by the equation $P_D = (V_{IN} - V_{OUT}) \times I_{OUT}$. The maximum allowable power dissipation ($P_{D(MAX)}$) of the SGM2203C is affected by many factors, including the difference between junction temperature and ambient temperature ($T_{J(MAX)} - T_A$), package thermal resistance from the junction to the ambient environment ($\theta_{JA}$), the rate of ambient airflow and PCB layout. $P_{D(MAX)}$ can be approximated by the following equation:

$$P_{D(MAX)} = (T_{J(MAX)} - T_A)/\theta_{JA} \quad (1)$$

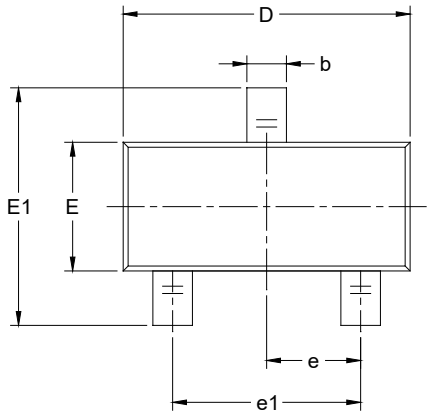
# REVISION HISTORY

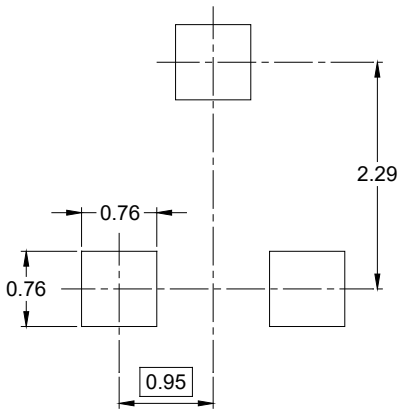
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| Changes from Original to REV.A (JULY 2025) | Page |
|---|---|
| Changed from product preview to production data | All |

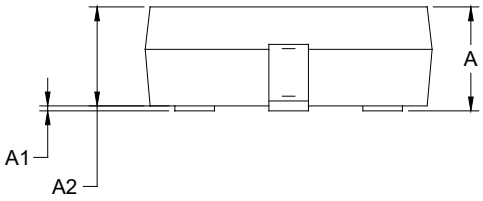
# PACKAGE OUTLINE DIMENSIONS

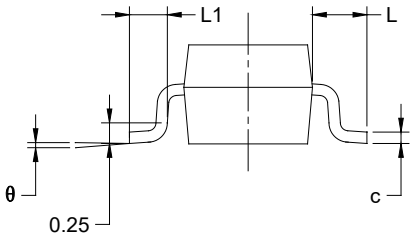
## SOT-23




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



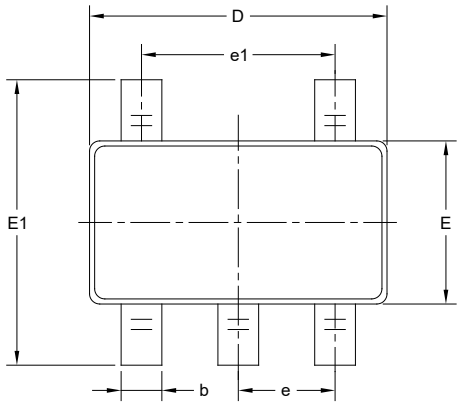



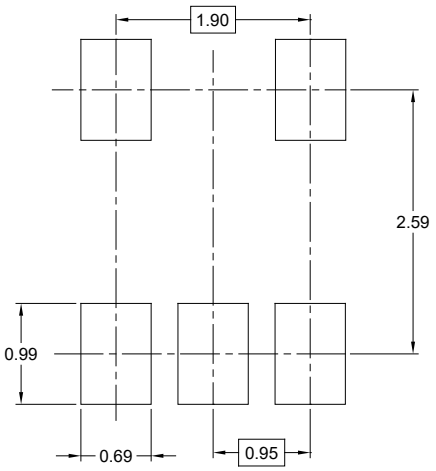

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 0.89 | 1.12 | 0.035 | 0.044 |
| A1 | 0.01 | 0.10 | 0.000 | 0.004 |
| A2 | 0.88 | 1.02 | 0.035 | 0.040 |
| b | 0.30 | 0.50 | 0.012 | 0.020 |
| c | 0.08 | 0.20 | 0.003 | 0.008 |
| D | 2.80 | 3.04 | 0.110 | 0.120 |
| E | 1.20 | 1.40 | 0.047 | 0.055 |
| E1 | 2.10 | 2.64 | 0.083 | 0.104 |
| e | 0.95 BSC | | 0.037 BSC | |
| e1 | 1.90 BSC | | 0.075 BSC | |
| L | 0.54 REF | | 0.021 REF | |
| L1 | 0.40 | 0.60 | 0.016 | 0.024 |
| θ | 0° | 8° | 0° | 8° |

NOTES:
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

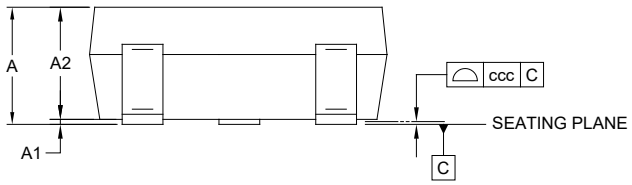
# PACKAGE OUTLINE DIMENSIONS

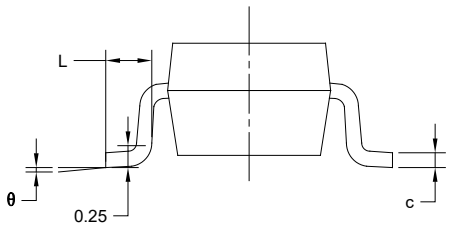
## SOT-23-5




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



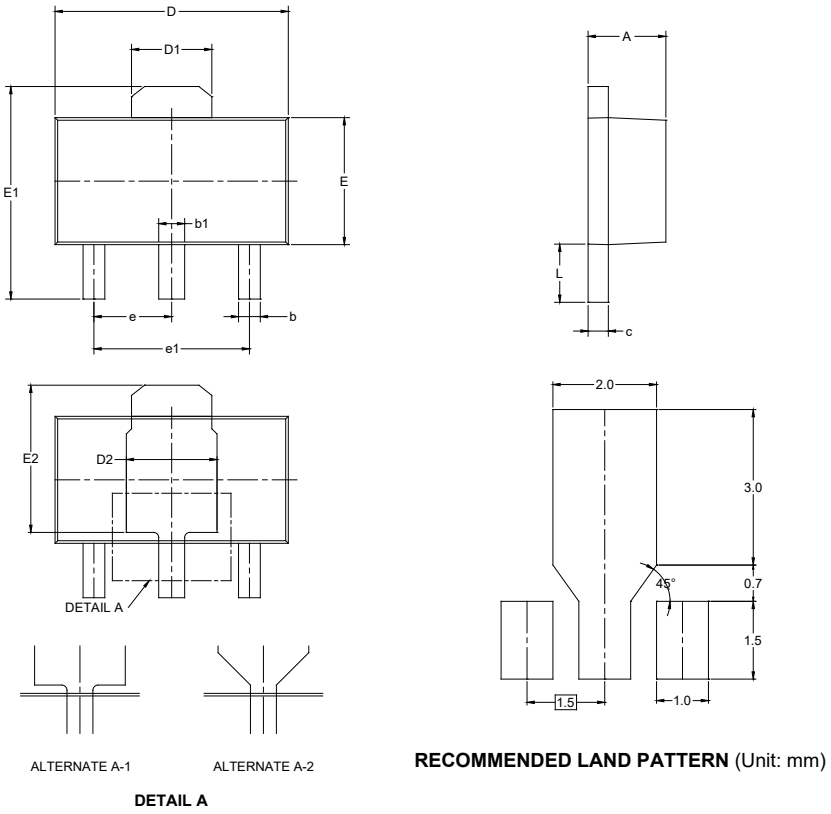




| Symbol | Dimensions In Millimeters | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | - | - | 1.450 |
| A1 | 0.000 | - | 0.150 |
| A2 | 0.900 | - | 1.300 |
| b | 0.300 | - | 0.500 |
| c | 0.080 | - | 0.220 |
| D | 2.750 | - | 3.050 |
| E | 1.450 | - | 1.750 |
| E1 | 2.600 | - | 3.000 |
| e | 0.950 BSC | | |
| e1 | 1.900 BSC | | |
| L | 0.300 | - | 0.600 |
| θ | 0° | - | 8° |
| ccc | 0.100 | | |

NOTES:
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MO-178.

# PACKAGE OUTLINE DIMENSIONS

## SOT-89-3




**DETAIL A**

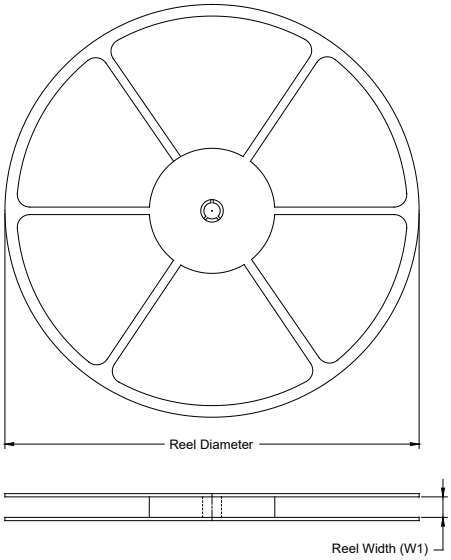
**RECOMMENDED LAND PATTERN** (Unit: mm)

| Symbol | Dimensions In Millimeters | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 1.400 | - | 1.600 |
| b | 0.320 | - | 0.520 |
| b1 | 0.400 | - | 0.580 |
| c | 0.350 | - | 0.440 |
| D | 4.400 | - | 4.600 |
| D1 | 1.550 REF | | |
| D2 | 1.750 REF | | |
| E | 2.300 | - | 2.600 |
| E1 | 3.940 | - | 4.250 |
| E2 | 2.840 REF | | |
| e | 1.500 BSC | | |
| e1 | 3.000 BSC | | |
| L | 0.900 | - | 1.200 |

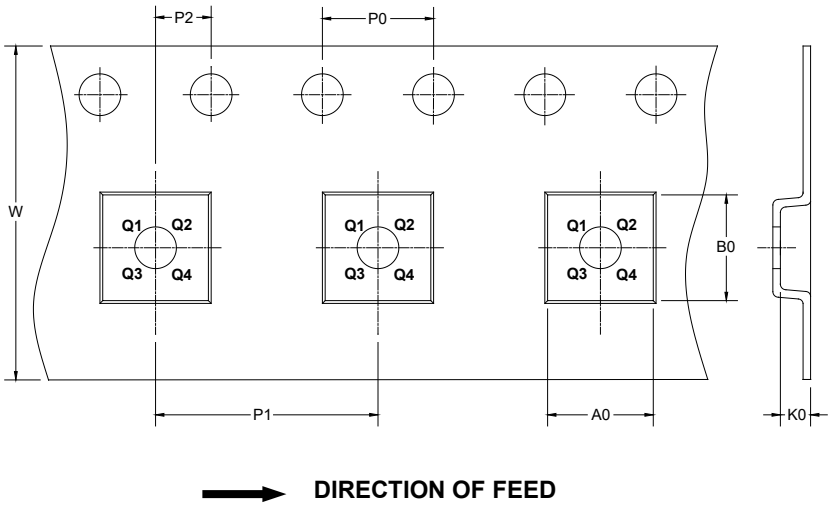
NOTES:
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC TO-243.

# TAPE AND REEL INFORMATION

### REEL DIMENSIONS




### TAPE DIMENSIONS



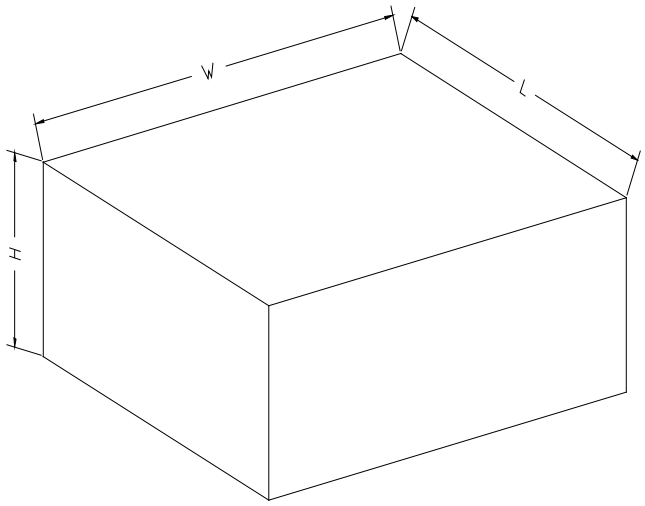

NOTE: The picture is only for reference. Please make the object as the standard.

## 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 | 7" | 9.5 | 3.15 | 2.77 | 1.22 | 4.0 | 4.0 | 2.0 | 8.0 | Q3 |
| SOT-23-5 | 7" | 9.5 | 3.20 | 3.20 | 1.40 | 4.0 | 4.0 | 2.0 | 8.0 | Q3 |
| SOT-89-3 | 13" | 13.2 | 4.85 | 4.45 | 1.85 | 4.0 | 8.0 | 2.0 | 12.0 | 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 |
| 13″ | 386 | 280 | 370 | 5 |

DD0002