# SGM2240xQ
# Automotive, 1A, Low Dropout Positive Fixed and Adjustable Voltage Regulator

## GENERAL DESCRIPTION

The SGM2240xQ is a low dropout positive voltage regulator. It is capable of supplying 1A output current with typical dropout voltage of 1.25V. The operating input voltage range is from 2.7V to 20V. The fixed output voltage range is from 1.5V to 12V and adjustable output voltage range is from 1.25V to 18V.

Other features include current limit and thermal shutdown protection. The SGM2240xQ is suitable for various automotive applications.

This device is AEC-Q100 qualified (Automotive Electronics Council (AEC) standard Q100 Grade 1) and it is suitable for automotive applications.

The SGM2240xQ is available in Green SOT-223-3 and TO-252-2A packages. It operates over an operating temperature range of -40℃ to +125℃.

## FEATURES

- **AEC-Q100 Qualified for Automotive Applications**
  **Device Temperature Grade 1**
  **$T_A$ = -40℃ to +125℃**
- **Operating Input Voltage Range: 2.7V to 20V**
- **Fixed Output from 1.5V to 12V**
- **Adjustable Output from 1.25V to 18V**
- **1A Output Current**
- **Output Voltage Accuracy: ±1% at +25℃**
- **Low Dropout Voltage: 1.25V (TYP) at 1A**
- **Can Start Up when the Output Voltage is Negative**
- **Current Limiting and Thermal Protection**
- **Stable with Small Case Size Ceramic Capacitors**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in Green SOT-223-3 and TO-252-2A Packages**

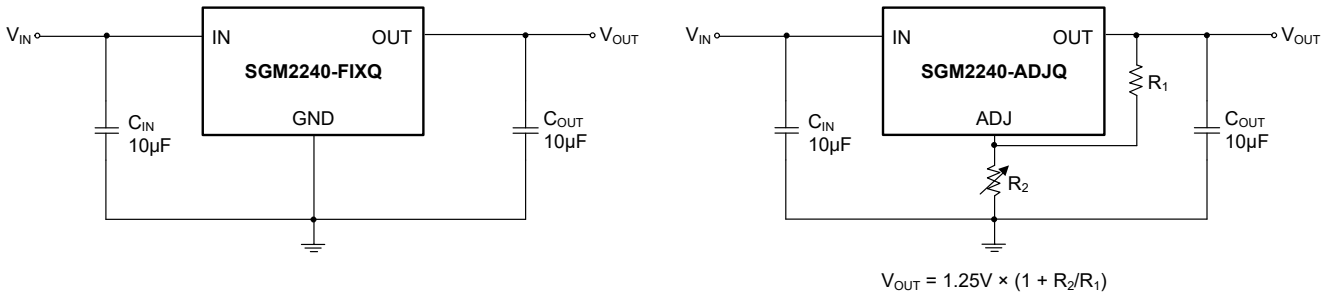
## APPLICATIONS

Automotive Applications

Consumer and Industrial Equipment Regulation

代理商 威尔迈 www.visvie.com
联系电话 138 2526 5270

## TYPICAL APPLICATION




**Fixed Voltage Typical Application Circuit** **Adjustable Voltage Typical Application Circuit**

**Figure 1. Typical Application Circuits**

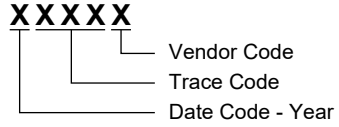
# PACKAGE/ORDERING INFORMATION

| MODEL | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKING OPTION |
|---|---|---|---|---|---|
| SGM2240-1.5Q | SOT-223-3 | -40℃ to +125℃ ($T_A$) | SGM2240-1.5QKC3G/TR | 14G<br>XXXXX | Tape and Reel, 2500 |
| SGM2240-1.8Q | SOT-223-3 | -40℃ to +125℃ ($T_A$) | SGM2240-1.8QKC3G/TR | 14H<br>XXXXX | Tape and Reel, 2500 |
| SGM2240-2.5Q | SOT-223-3 | -40℃ to +125℃ ($T_A$) | SGM2240-2.5QKC3G/TR | 14I<br>XXXXX | Tape and Reel, 2500 |
| SGM2240-2.8Q | SOT-223-3 | -40℃ to +125℃ ($T_A$) | SGM2240-2.8QKC3G/TR | 14J<br>XXXXX | Tape and Reel, 2500 |
| SGM2240-2.85Q | SOT-223-3 | -40℃ to +125℃ ($T_A$) | SGM2240-2.85QKC3G/TR | 14K<br>XXXXX | Tape and Reel, 2500 |
| SGM2240-3.0Q | SOT-223-3 | -40℃ to +125℃ ($T_A$) | SGM2240-3.0QKC3G/TR | 14L<br>XXXXX | Tape and Reel, 2500 |
| SGM2240-3.3Q | SOT-223-3 | -40℃ to +125℃ ($T_A$) | SGM2240-3.3QKC3G/TR | 0RK<br>XXXXX | Tape and Reel, 2500 |
| SGM2240-5.0Q | SOT-223-3 | -40℃ to +125℃ ($T_A$) | SGM2240-5.0QKC3G/TR | 0RL<br>XXXXX | Tape and Reel, 2500 |
| SGM2240-12Q | SOT-223-3 | -40℃ to +125℃ ($T_A$) | SGM2240-12QKC3G/TR | 14M<br>XXXXX | Tape and Reel, 2500 |
| SGM2240-ADJQ | SOT-223-3 | -40℃ to +125℃ ($T_A$) | SGM2240-ADJQKC3G/TR | 0RJ<br>XXXXX | Tape and Reel, 2500 |
| SGM2240-1.5Q | TO-252-2A | -40℃ to +125℃ ($T_A$) | SGM2240-1.5QOC2G/TR | 14OOC2<br>XXXXX | Tape and Reel, 2500 |
| SGM2240-1.8Q | TO-252-2A | -40℃ to +125℃ ($T_A$) | SGM2240-1.8QOC2G/TR | 14POC2<br>XXXXX | Tape and Reel, 2500 |
| SGM2240-2.5Q | TO-252-2A | -40℃ to +125℃ ($T_A$) | SGM2240-2.5QOC2G/TR | 14QOC2<br>XXXXX | Tape and Reel, 2500 |
| SGM2240-2.8Q | TO-252-2A | -40℃ to +125℃ ($T_A$) | SGM2240-2.8QOC2G/TR | 14ROC2<br>XXXXX | Tape and Reel, 2500 |
| SGM2240-2.85Q | TO-252-2A | -40℃ to +125℃ ($T_A$) | SGM2240-2.85QOC2G/TR | 14SOC2<br>XXXXX | Tape and Reel, 2500 |
| SGM2240-3.0Q | TO-252-2A | -40℃ to +125℃ ($T_A$) | SGM2240-3.0QOC2G/TR | 14TOC2<br>XXXXX | Tape and Reel, 2500 |
| SGM2240-3.3Q | TO-252-2A | -40℃ to +125℃ ($T_A$) | SGM2240-3.3QOC2G/TR | 0RMOC2<br>XXXXX | Tape and Reel, 2500 |
| SGM2240-5.0Q | TO-252-2A | -40℃ to +125℃ ($T_A$) | SGM2240-5.0QOC2G/TR | 0RNOC2<br>XXXXX | Tape and Reel, 2500 |
| SGM2240-12Q | TO-252-2A | -40℃ to +125℃ ($T_A$) | SGM2240-12QOC2G/TR | 14UOC2<br>XXXXX | Tape and Reel, 2500 |
| SGM2240-ADJQ | TO-252-2A | -40℃ to +125℃ ($T_A$) | SGM2240-ADJQOC2G/TR | 0ULOC2<br>XXXXX | Tape and Reel, 2500 |

## MARKING INFORMATION

NOTE: XXXXX = Date Code, Trace Code and Vendor Code.

**SOT-223-3/TO-252-2A**




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

Input to Output Voltage ..... 24V
Package Thermal Resistance
SOT-223-3, $\theta_{JA}$ ..... 67℃/W
SOT-223-3, $\theta_{JB}$ ..... 21℃/W
SOT-223-3, $\theta_{JC(TOP)}$ ..... 50℃/W
SOT-223-3, $\theta_{JC(BOT)}$ ..... 21℃/W
TO-252-2A, $\theta_{JA}$ ..... 39℃/W
TO-252-2A, $\theta_{JB}$ ..... 14℃/W
TO-252-2A, $\theta_{JC(TOP)}$ ..... 48℃/W
TO-252-2A, $\theta_{JC(BOT)}$ ..... 12℃/W
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility (1) (2)
HBM ..... ±3000V
CDM ..... ±1000V

NOTES:

1. For human body model (HBM), all pins comply with AEC-Q100-002 specification.

2. For charged device model (CDM), all pins comply with AEC-Q100-011 specification.

## RECOMMENDED OPERATING CONDITIONS

Input Voltage Range ..... 2.7V to 20V
Input Effective Capacitance, $C_{IN}$ ..... 2.2μF (MIN)
Output Effective Capacitance, $C_{OUT}$ ..... 2.2μF to 200μF
Capacitor Equivalent Series Resistance, ESR ... 1mΩ to 2.2Ω
Operating Ambient Temperature Range ..... -40℃ to +125℃
Operating Junction Temperature Range ..... -40℃ to +150℃

## 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

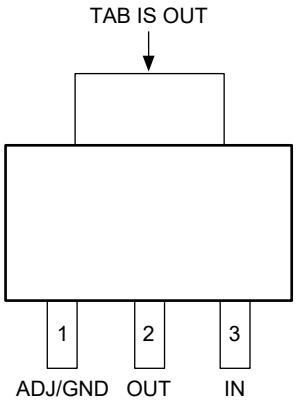
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance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

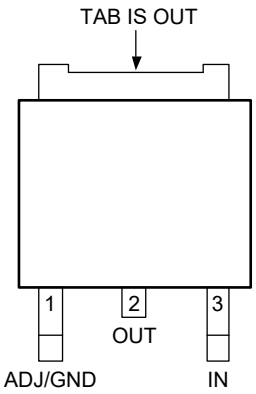
## PIN CONFIGURATIONS

**SGM2240xQ (TOP VIEW)**




**SOT-223-3**

**SGM2240xQ (TOP VIEW)**




**TO-252-2A**

## PIN DESCRIPTION

| PIN | | NAME | FUNCTION |
|---|---|---|---|
| SOT-223-3 | TO-252-2A | | |
| 1 | 1 | ADJ | Feedback Voltage Input Pin (adjustable output voltage version only). 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. |
| | | GND | Ground (fixed output voltage version only). |
| 2, TAB | 2, TAB | OUT | Regulator Output Pin. It is recommended to use a ceramic capacitor with effective capacitance in the range of 2.2μF to 200μF to ensure stability. This ceramic capacitor should be placed as close as possible to OUT pin. |
| 3 | 3 | IN | Input Supply Voltage Pin. It is recommended to use a 4.7μF 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. |

## FUNCTIONAL BLOCK DIAGRAMS

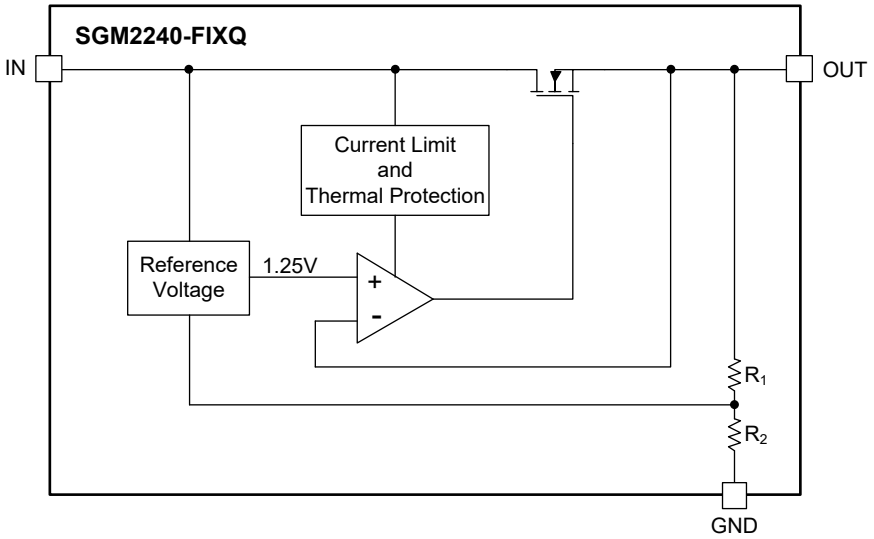



**Figure 2. Internal Block Diagram of Fixed Output Voltage**

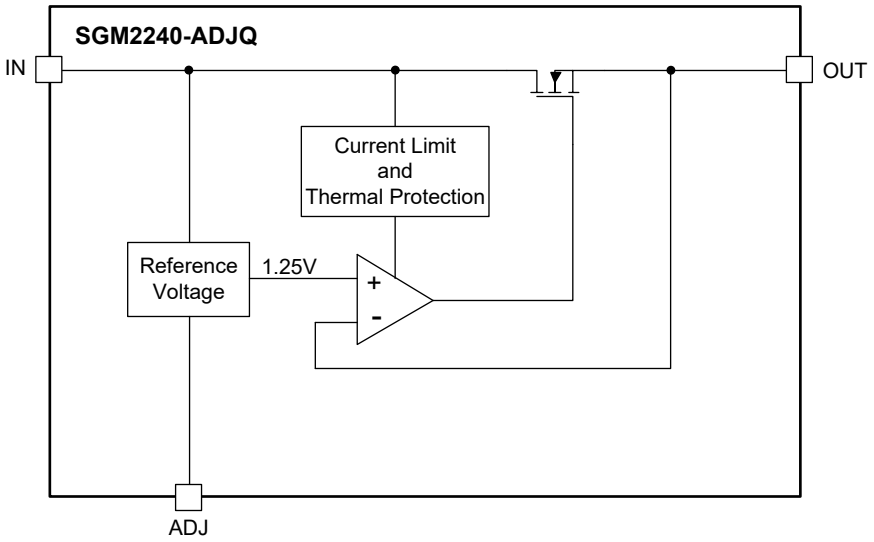



**Figure 3. Internal Block Diagram of Adjustable Output Voltage**

# ELECTRICAL CHARACTERISTICS

($C_{IN}$ = 10μF, $C_{OUT}$ = 10μF, $T_J$ = -40℃ to +125℃ (1), typical values are at $T_J$ = +25℃, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| Input Voltage Range | $V_{IN}$ | | | 2.7 | | 20 | V |
| Output Voltage Accuracy (SGM2240-FIXQ) | $V_{OUT}$ | ($V_{IN}$ - $V_{OUT}$) = 1.4V, $I_{OUT}$ = 0mA, $T_J$ = +25℃ | | -1 | | +1 | % |
| | | ($V_{IN}$ - $V_{OUT}$) = 1.4V, $I_{OUT}$ = 0mA to 1A | | -2 | | +2 | |
| | | $V_{IN}$ = ($V_{OUT}$ + 1.4V) to 20V, $I_{OUT}$ = 0mA | | -2 | | +2 | |
| Reference Voltage (SGM2240-ADJQ) | $V_{ADJ}$ | ($V_{IN}$ - $V_{OUT}$) = 1.4V, $I_{OUT}$ = 5mA, $T_J$ = +25℃ | | 1.238 | 1.25 | 1.262 | V |
| | | ($V_{IN}$ - $V_{OUT}$) = 1.4V, $I_{OUT}$ = 5mA to 1A | | 1.225 | | 1.275 | |
| | | $V_{IN}$ = ($V_{OUT}$ + 1.4V) to 20V, $I_{OUT}$ = 5mA | | 1.225 | | 1.275 | |
| Adjust Pin Current | $I_{ADJ}$ | $V_{IN}$ = 20V, $I_{OUT}$ = 5mA, SGM2240-ADJQ | | | 22 | 35 | μA |
| Adjust Pin Current Change | $\Delta I_{ADJ}$ | ($V_{IN}$ - $V_{OUT}$) = 1.4V, $I_{OUT}$ = 5mA to 1A, SGM2240-ADJQ | | | 0.3 | 1 | μA |
| | | $V_{IN}$ = ($V_{OUT}$ + 1.4V) to 20V, $I_{OUT}$ = 5mA, SGM2240-ADJQ | | | 0.3 | 1 | |
| Line Regulation | $\Delta V_{OUT}/V_{OUT}$ | $V_{IN}$ = ($V_{OUT}$ + 1.4V) to 20V, $I_{OUT}$ = 5mA, SGM2240-ADJQ | | | 0.01 | 0.3 | % |
| | | $V_{IN}$ = ($V_{OUT}$ + 1.4V) to 20V, $I_{OUT}$ = 0mA, SGM2240-FIXQ | | | 0.01 | 0.3 | |
| Load Regulation | $\Delta V_{OUT}/V_{OUT}$ | ($V_{IN}$ - $V_{OUT}$) = 1.4V, $I_{OUT}$ = 5mA to 1A, SGM2240-ADJQ | | | 0.01 | 0.4 | % |
| | | ($V_{IN}$ - $V_{OUT}$) = 1.4V, $I_{OUT}$ = 0mA to 1A, SGM2240-FIXQ | | | 0.01 | 0.4 | |
| Dropout Voltage (2) | $V_{DROP}$ | $I_{OUT}$ = 100mA | | | 1.05 | 1.20 | V |
| | | $I_{OUT}$ = 500mA | | | 1.15 | 1.30 | |
| | | $I_{OUT}$ = 800mA | | | 1.21 | 1.37 | |
| | | $I_{OUT}$ = 1A | | | 1.25 | 1.40 | |
| Output Current Limit | $I_{LIMIT}$ | ($V_{IN}$ - $V_{OUT}$) = 5V, $\Delta V_{OUT}$ = 5% | | 1.0 | 1.45 | | A |
| | | ($V_{IN}$ - $V_{OUT}$) = 20V, $V_{OUT}$ = 0V | | 0.2 | 0.45 | | |
| Minimum Load Current (3) | $I_{OUT_MIN}$ | $V_{IN}$ = 20V, SGM2240-ADJQ | | | 2 | 5 | mA |
| Supply Pin Current | $I_Q$ | $V_{IN}$ = 20V, $I_{OUT}$ = 0mA, SGM2240-FIXQ | | | 2.2 | 5 | mA |
| Start-Up Time | $t_{STR}$ | From assertion of $V_{IN}$ to $V_{OUT}$ = 95% × $V_{OUT(NOM)}$ | | | 0.45 | 1.2 | ms |
| Temperature Stability | $S_T$ | | | | 0.4 | | % |
| Power Supply Ripple Rejection | PSRR | $\Delta V_{RIPPLE}$ = $3V_{P-P}$, ($V_{IN}$ - $V_{OUT}$) = 3V, $I_{OUT}$ = 500mA, $f_{RIPPLE}$ = 120Hz, $C_{OUT}$ = 10μF | SGM2240-ADJQ | | 76 | | dB |
| | | | $V_{OUT(NOM)}$ = 3.3V | | 67 | | |
| | | | $V_{OUT(NOM)}$ = 5.0V | | 64 | | |
| | | | $V_{OUT(NOM)}$ = 12V | | 56 | | |
| Output Voltage Noise | $e_n$ | f = 10Hz to 10kHz, $I_{OUT}$ = 1A | | | 0.0035 | | % |
| Thermal Regulation | | 30ms Pulse, $T_J$ = +25℃ | | | 0.002 | 0.02 | %/W |
| Long Term Stability | $S_t$ | 1000Hrs End Point Measurement, $T_J$ = +125℃ | | | 0.1 | | % |
| Thermal Shutdown Temperature | $T_{SHDN}$ | | | | 180 | | ℃ |
| Thermal Shutdown Hysteresis | $\Delta T_{SHDN}$ | | | | 25 | | ℃ |

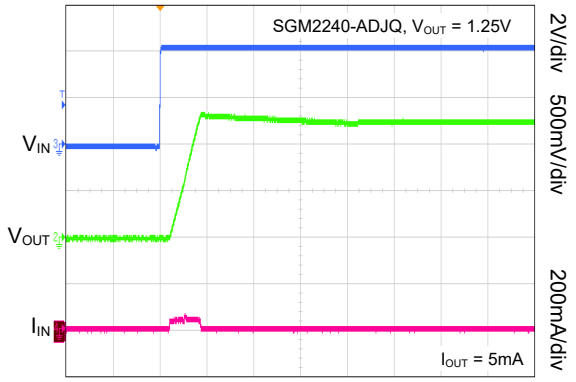
NOTES:

1. Tested under pulse load conditions, so $T_J \approx T_A$.
2. The dropout voltage is defined as the difference between $V_{IN}$ and $V_{OUT}$ when $V_{OUT}$ falls to ($V_{OUT(NOM)}$ - 100mV).
3. The minimum output current required to maintain regulation.

## TYPICAL PERFORMANCE CHARACTERISTICS

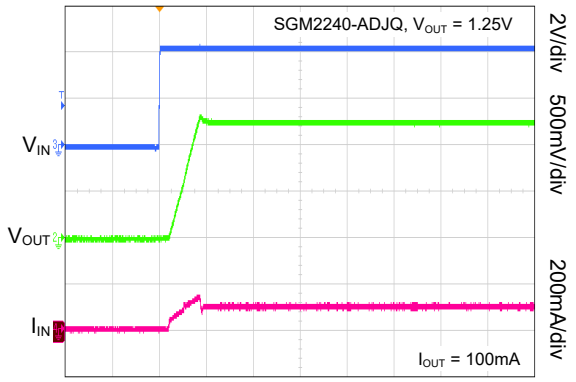
$T_J$ = +25℃, ($V_{IN}$ - $V_{OUT}$) = 3V, $C_{IN}$ = 10μF, $C_{OUT}$ = 10μF (ceramic capacitor), unless otherwise noted.

VIN Power-Up Output Waveform



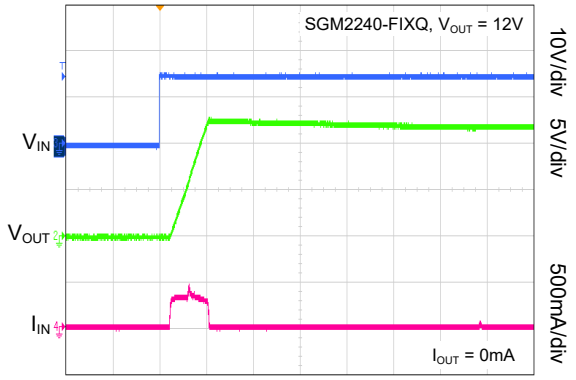

Time (500μs/div)

VIN Power-Up Output Waveform



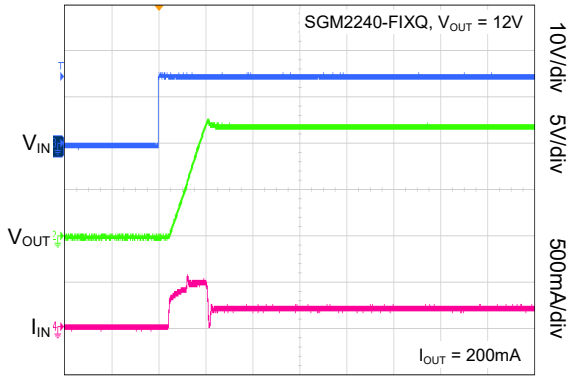

Time (500μs/div)

VIN Power-Up Output Waveform



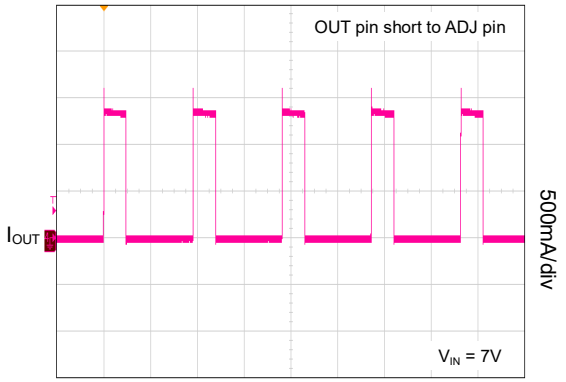

Time (500μs/div)

VIN Power-Up Output Waveform



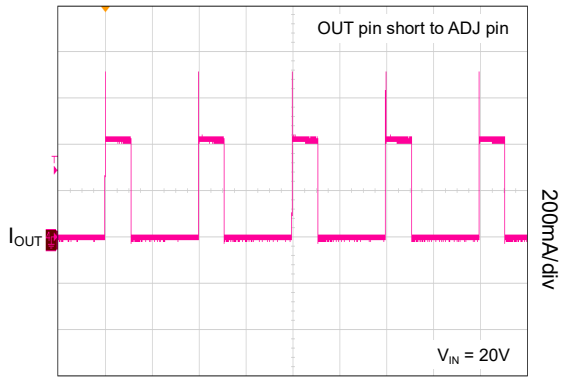

Time (500μs/div)

Thermal Protection




Time (2ms/div)

Thermal Protection

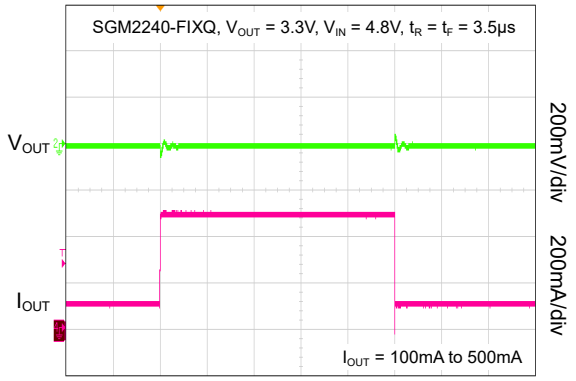



Time (2ms/div)

## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

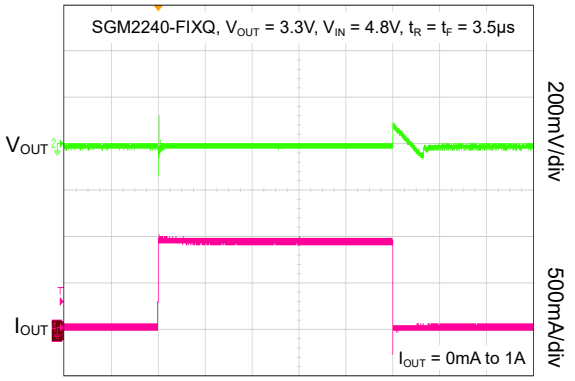
$T_J$ = +25℃, ($V_{IN}$ - $V_{OUT}$) = 3V, $C_{IN}$ = 10μF, $C_{OUT}$ = 10μF (ceramic capacitor), unless otherwise noted.

Load Transient Response



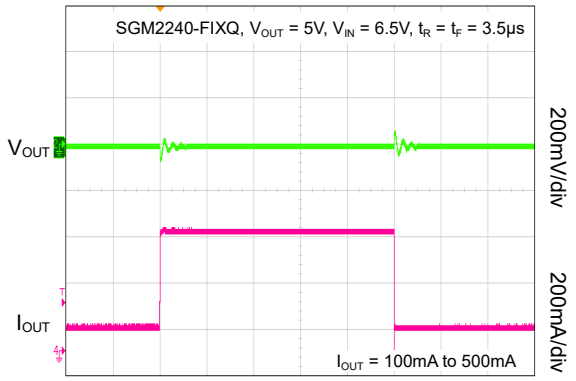

Time (200μs/div)

Load Transient Response



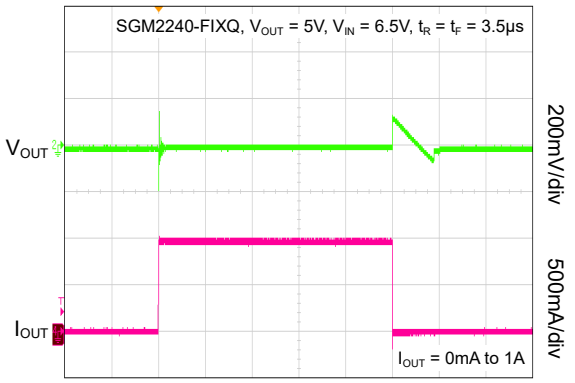

Time (1ms/div)

Load Transient Response



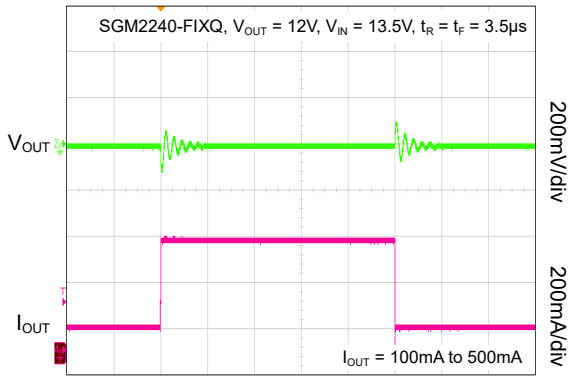

Time (200μs/div)

Load Transient Response



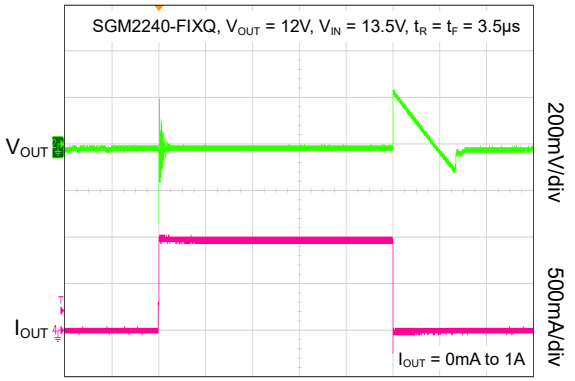

Time (1ms/div)

Load Transient Response




Time (200μs/div)

Load Transient Response

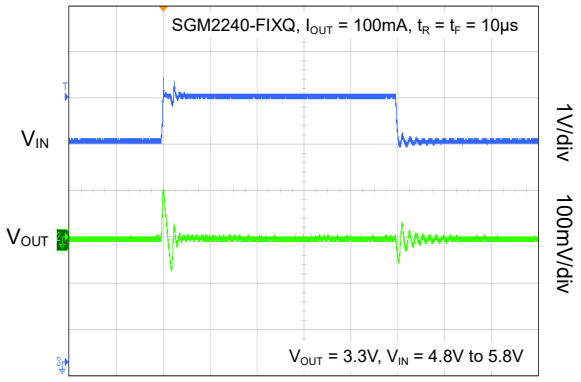



Time (1ms/div)

## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

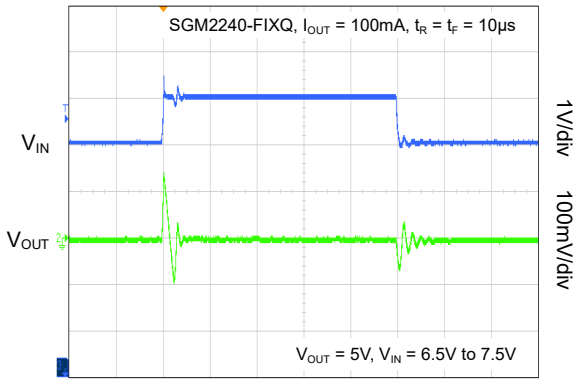
$T_J$ = +25℃, ($V_{IN}$ - $V_{OUT}$) = 3V, $C_{IN}$ = 10μF, $C_{OUT}$ = 10μF (ceramic capacitor), unless otherwise noted.

Line Transient Response



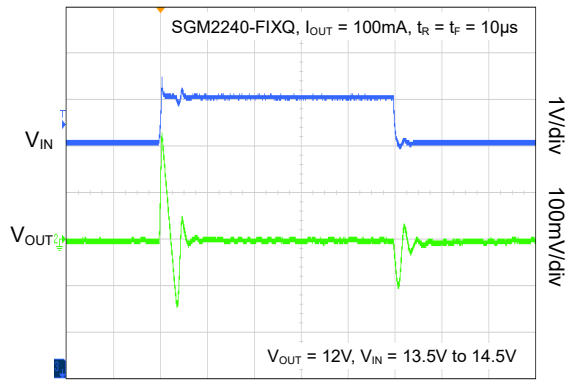

Time (100μs/div)

Line Transient Response



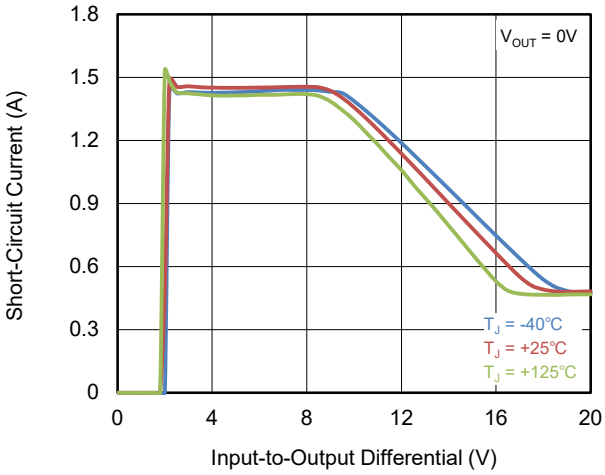

Time (100μs/div)

Line Transient Response

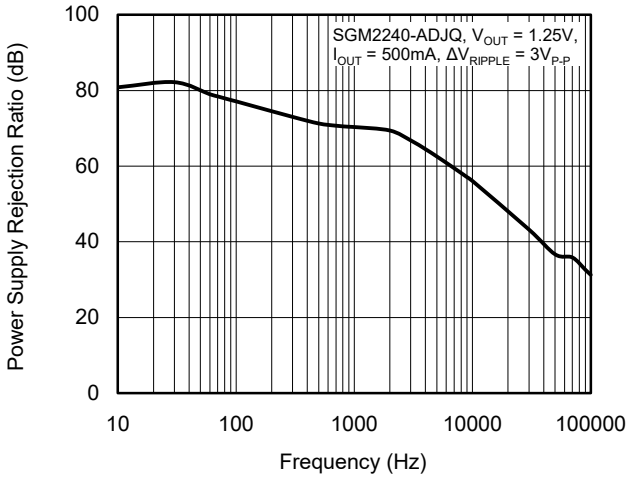



Time (100μs/div)

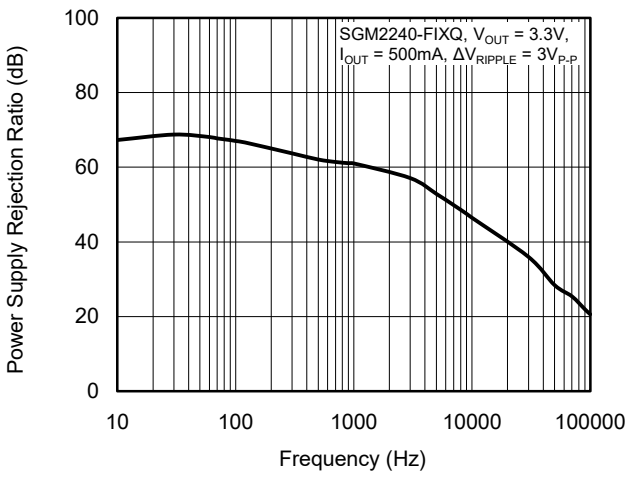
Short-Circuit Current vs. Input-to-Output Differential




Power Supply Rejection Ratio vs. Frequency



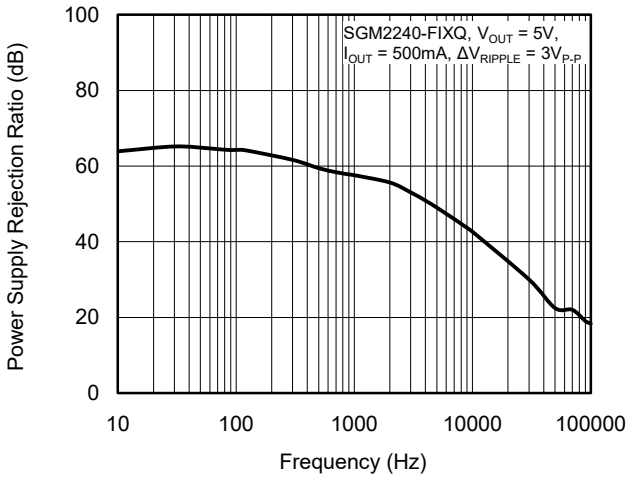

Power Supply Rejection Ratio vs. Frequency



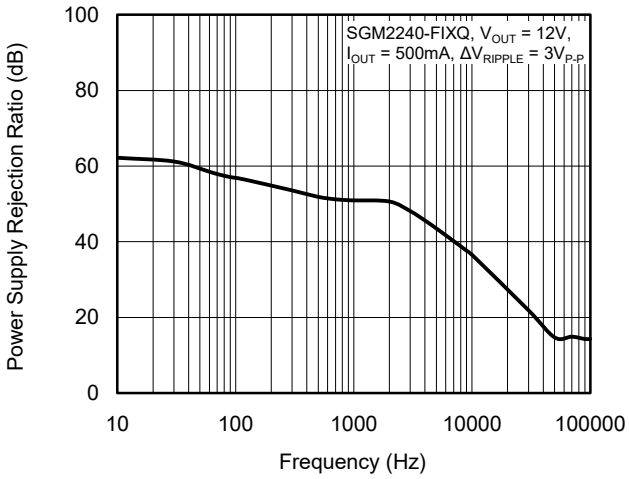
## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

$T_J$ = +25℃, ($V_{IN}$ - $V_{OUT}$) = 3V, $C_{IN}$ = 10μF, $C_{OUT}$ = 10μF (ceramic capacitor), unless otherwise noted.

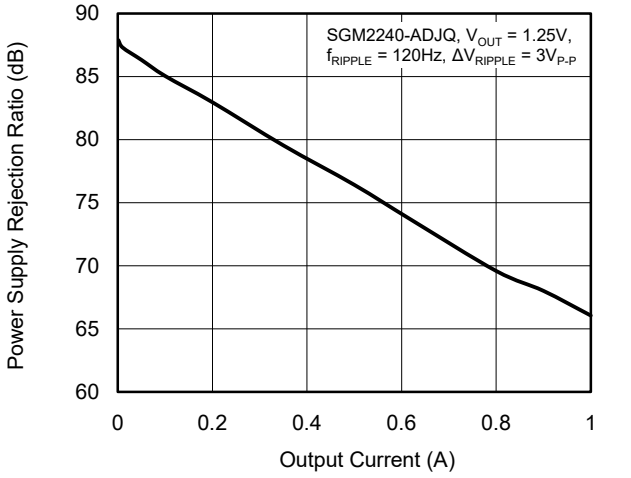
Power Supply Rejection Ratio vs. Frequency



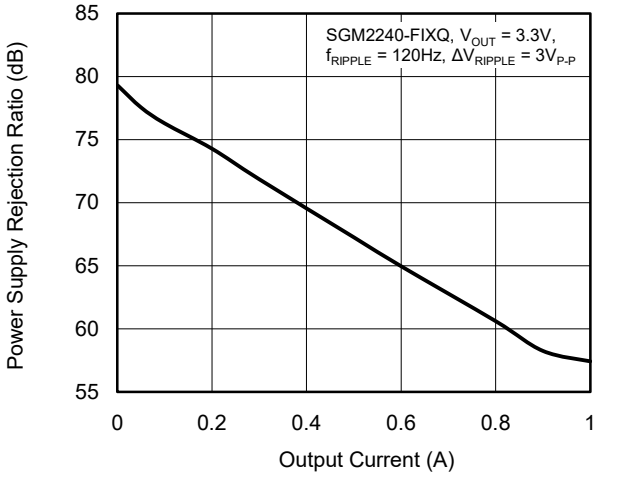

Power Supply Rejection Ratio vs. Frequency



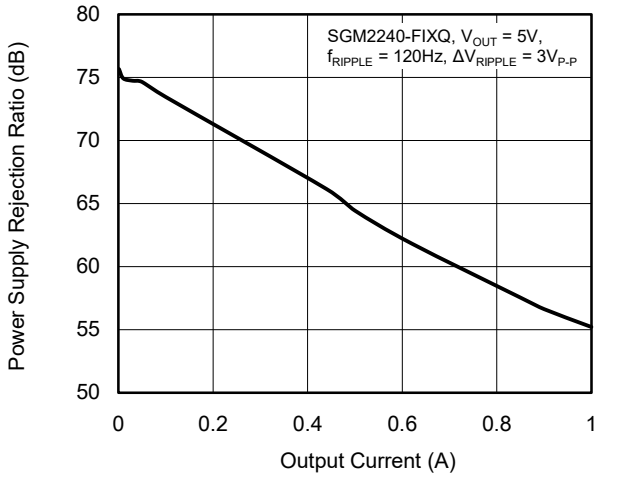

Power Supply Rejection Ratio vs. Output Current



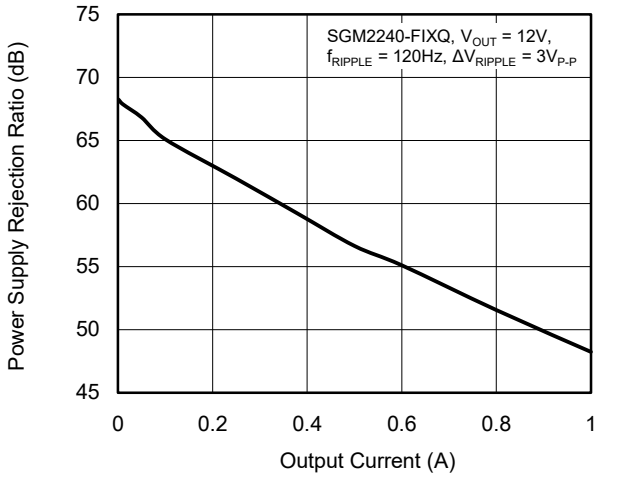

Power Supply Rejection Ratio vs. Output Current




Power Supply Rejection Ratio vs. Output Current



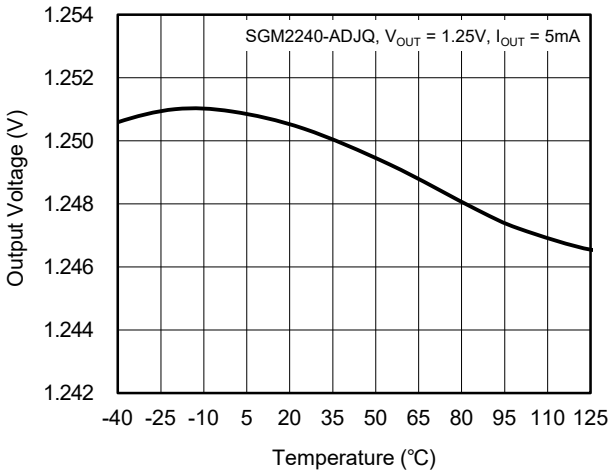

Power Supply Rejection Ratio vs. Output Current



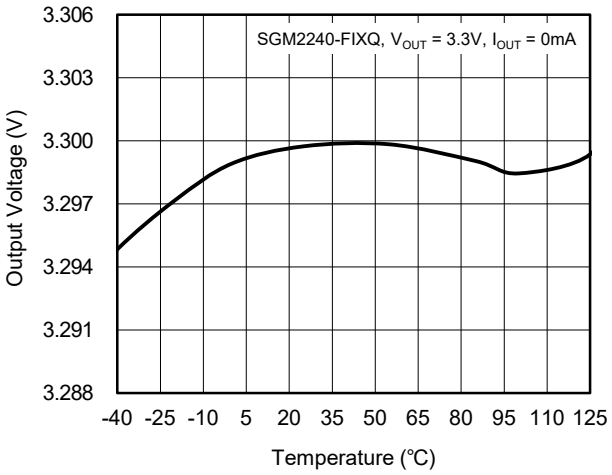
## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

$T_J$ = +25℃, ($V_{IN}$ - $V_{OUT}$) = 3V, $C_{IN}$ = 10μF, $C_{OUT}$ = 10μF (ceramic capacitor), unless otherwise noted.

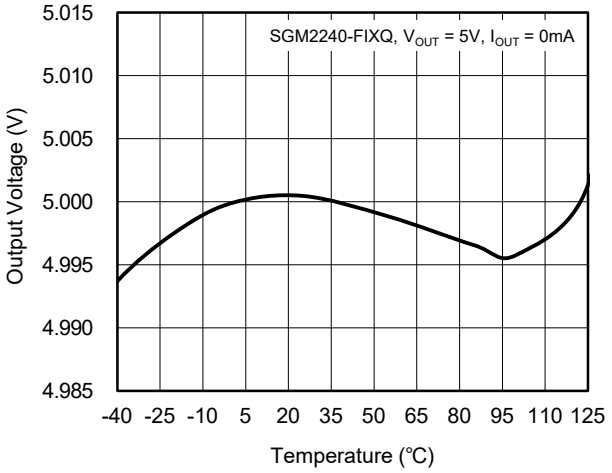
Output Voltage vs. Temperature



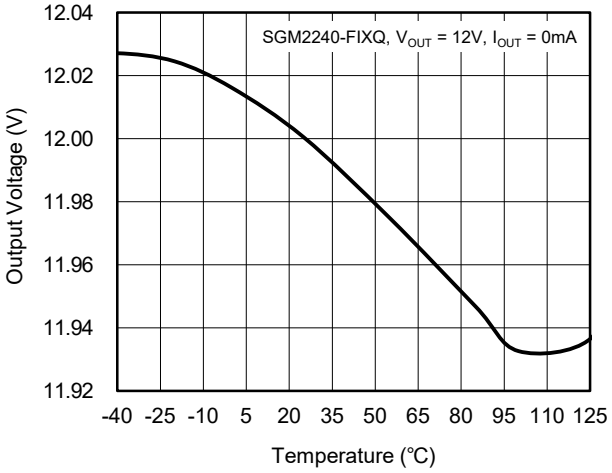

Output Voltage vs. Temperature



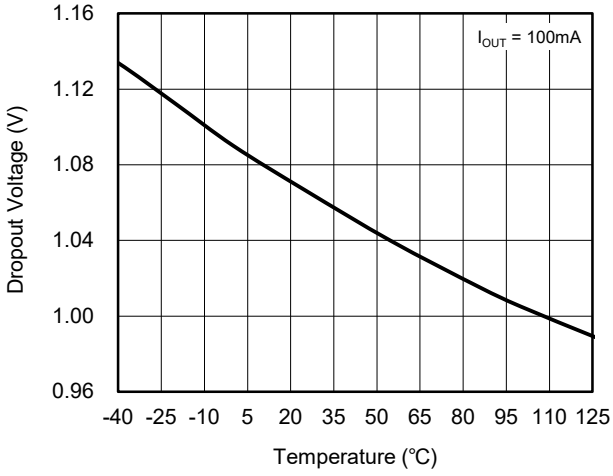

Output Voltage vs. Temperature



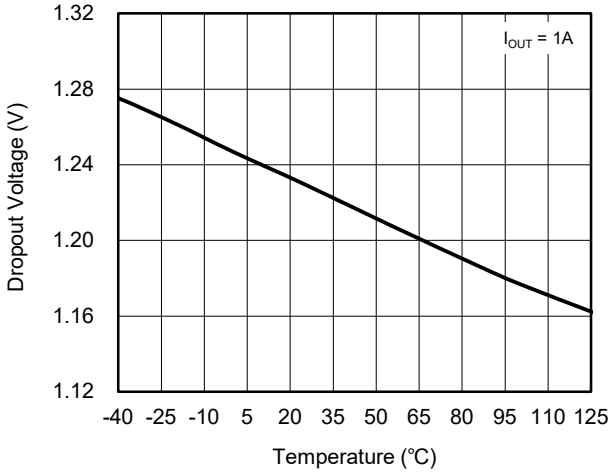

Output Voltage vs. Temperature




Dropout Voltage vs. Temperature



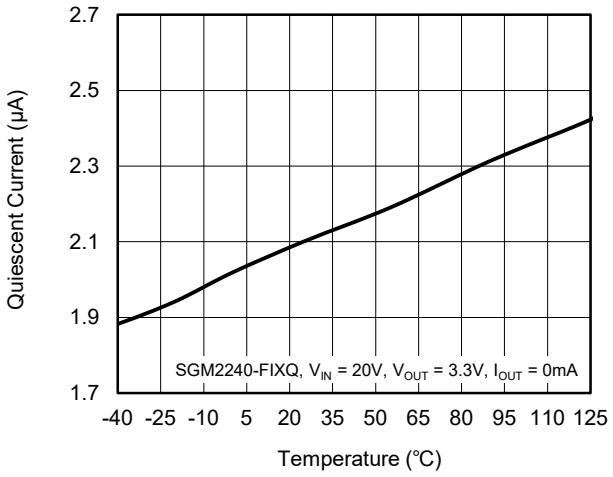

Dropout Voltage vs. Temperature



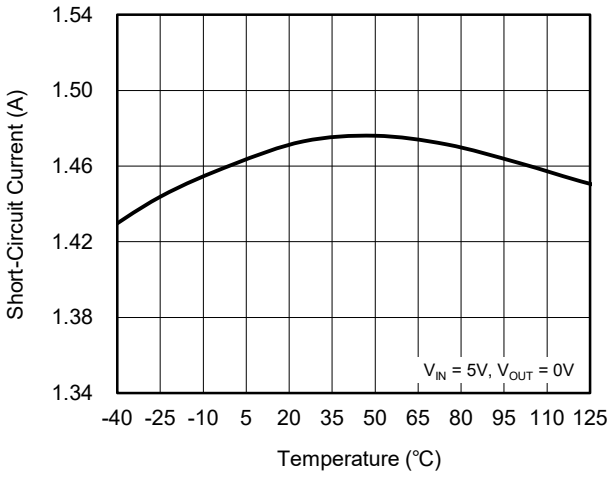
## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

$T_J$ = +25℃, ($V_{IN}$ - $V_{OUT}$) = 3V, $C_{IN}$ = 10μF, $C_{OUT}$ = 10μF (ceramic capacitor), unless otherwise noted.

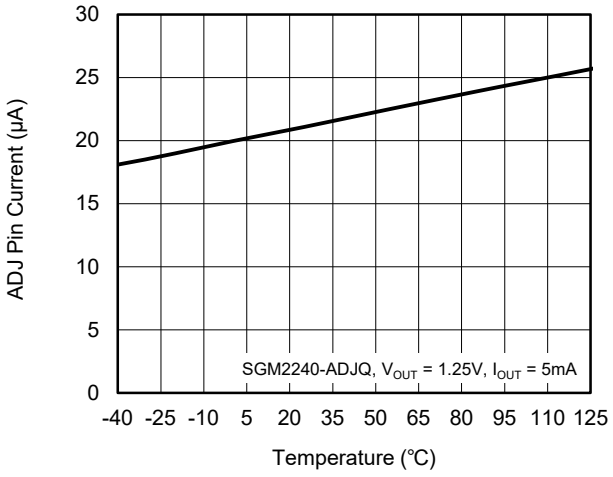
Quiescent Current vs. Temperature



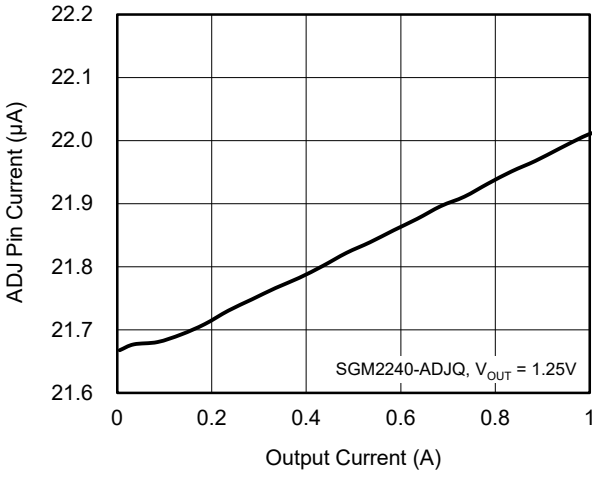

Short-Circuit Current vs. Temperature



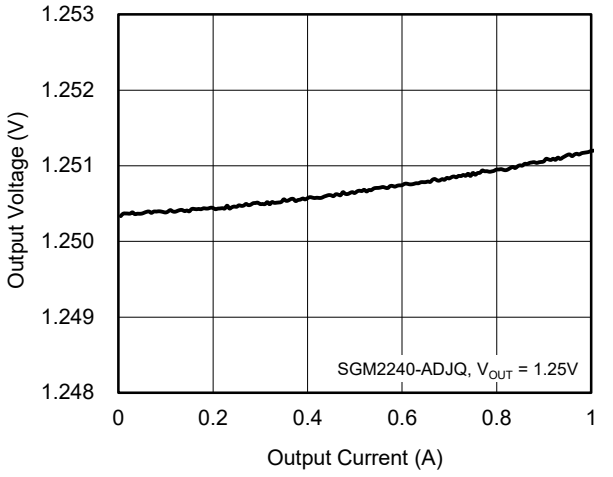

ADJ Pin Current vs. Temperature



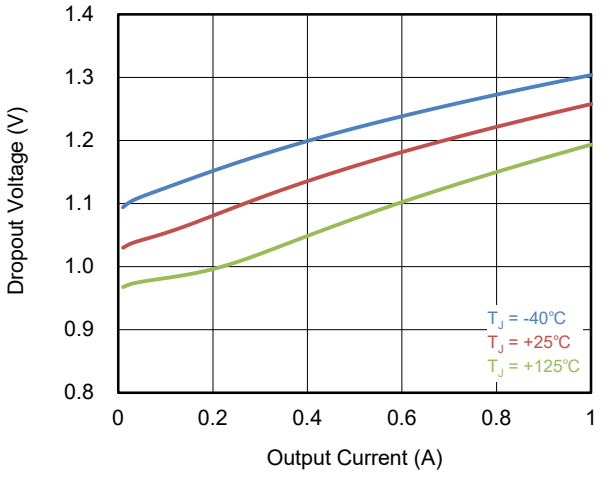

ADJ Pin Current vs. Output Current




Output Voltage vs. Output Current



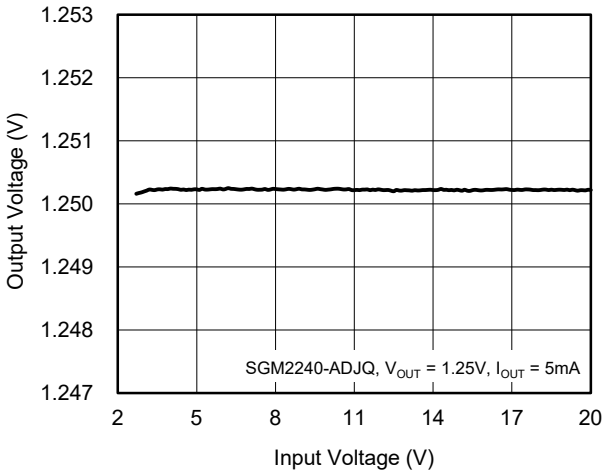

Dropout Voltage vs. Output Current



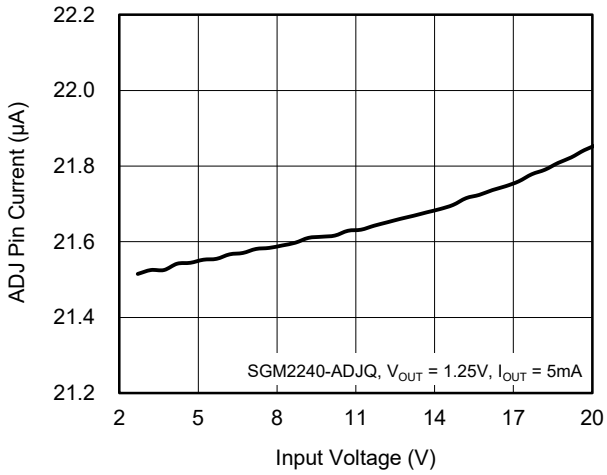
## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

$T_J$ = +25℃, ($V_{IN}$ - $V_{OUT}$) = 3V, $C_{IN}$ = 10μF, $C_{OUT}$ = 10μF (ceramic capacitor), unless otherwise noted.

Output Voltage vs. Input Voltage




ADJ Pin Current vs. Input Voltage



# APPLICATION INFORMATION

The SGM2240xQ is a low noise, high current and low dropout LDO and provides 1A 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 SGM2240xQ useful in a variety of applications. The SGM2240xQ provides protection functions for output overload, output short-circuit condition and overheating.

## 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. 4.7μF 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. For $C_{OUT}$ with larger capacitance, it is recommended to choose the larger capacitance $C_{IN}$.

## 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 4 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.

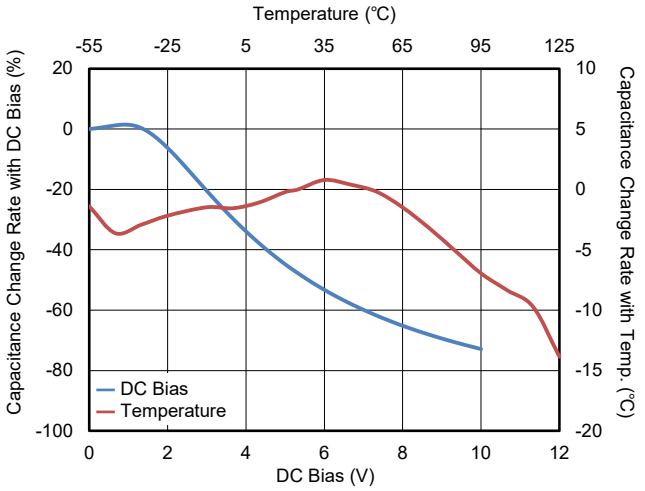


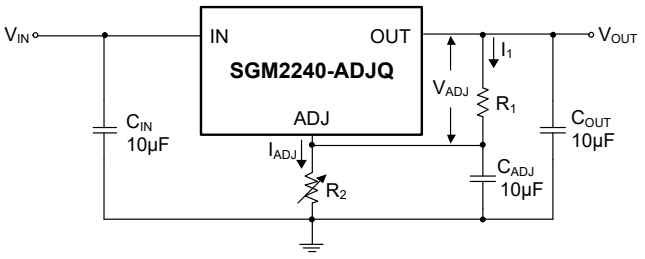

**Figure 4. Capacitance vs. DC Bias and Temperature Characteristics**

The SGM2240xQ requires an output capacitor with effective capacitance in the range of 2.2μF to 200μF with an ESR of 2.2Ω or less. Additionally, $C_{OUT}$ with larger capacitance and lower ESR will help increase the high frequency PSRR and improve the load transient response.

## Adjustable Regulator

The output voltage of the SGM2240-ADJQ can be adjusted from 1.25V to 18V. The ADJ pin will be connected to two external resistors as shown in Figure 5.

The PSRR and noise of adjustable LDO circuit can be modified slightly to levels close to that of the unity-gain LDO. The adjustment terminal can be bypassed to ground with a capacitor ($C_{ADJ}$). The impedance of the $C_{ADJ}$ should be equal to or less than $R_2$ at the desired frequency.




$V_{OUT} = V_{ADJ} \times (1 + R_2/R_1) + I_{ADJ} \times R_2$, $I_1 = V_{ADJ}/R_1$
But $I_{ADJ}$ is far less than $I_1$, so $V_{OUT} = V_{ADJ} \times (1 + R_2/R_1)$.
Where $V_{OUT}$ is output voltage and $V_{ADJ}$ = 1.25V.

**Figure 5. Adjustable Output Voltage Application**

# APPLICATION INFORMATION (continued)

## Output Current Limit and Short-Circuit Protection

The current limiting circuit reduces the output current as the input-to-output differential increases after 2ms of power-on. The current limit is reduced from 1.45A to 0.45A when ($V_{IN}$ - $V_{OUT}$) is greater than about 18V.

During normal start-up, the input-to-output differential is small since the output follows the input. But, if the output is shorted, then the recovery involves a large input-to-output differential. Sometimes during this condition the current limiting circuit is slow in recovering. If the limited current is too low to develop a voltage at the output, the voltage will stabilize at a lower level. Under these conditions it may be necessary to recycle the power of the regulator in order to get the smaller differential voltage and thus adequate start-up conditions.

## Reverse Current Protection

The SGM2240-ADJQ doesn't incorporates reverse current protection circuit, must add protection diodes prevents current flow backwards through the pass element when the output voltage is greater than the input voltage.

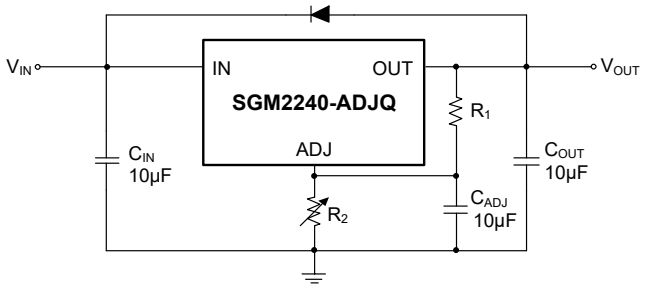



**Figure 6. Reverse Protection Reference Design**

## Thermal Shutdown

When the die temperature exceeds the threshold value of thermal shutdown, the SGM2240xQ will be in shutdown state and it will remain in this state until the die temperature decreases to +155℃.

## Power Dissipation ($P_D$)

Power dissipation ($P_D$) of the SGM2240xQ 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 SGM2240xQ 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:

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

## Layout Guidelines

To get good PSRR, low output noise and high transient response performance, the input and output bypass capacitors must be placed as close as possible to the IN pin and OUT pin separately.

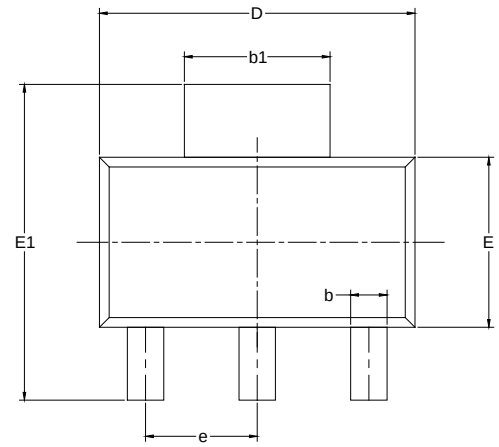
# REVISION HISTORY

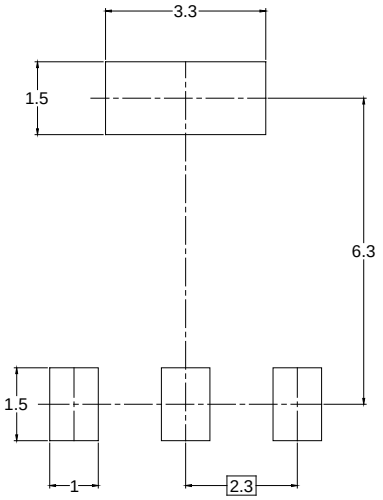
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| Changes from Original (OCTOBER 2024) to REV.A | Page |
|---|---|
| Changed from product preview to production data | All |

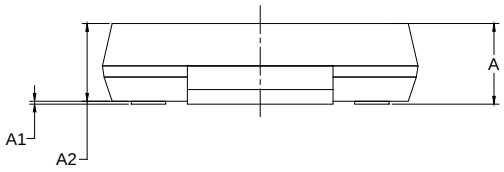
# PACKAGE OUTLINE DIMENSIONS

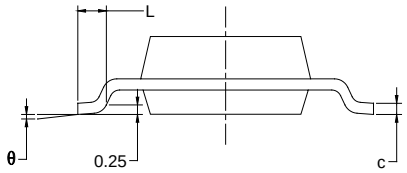
## SOT-223-3




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



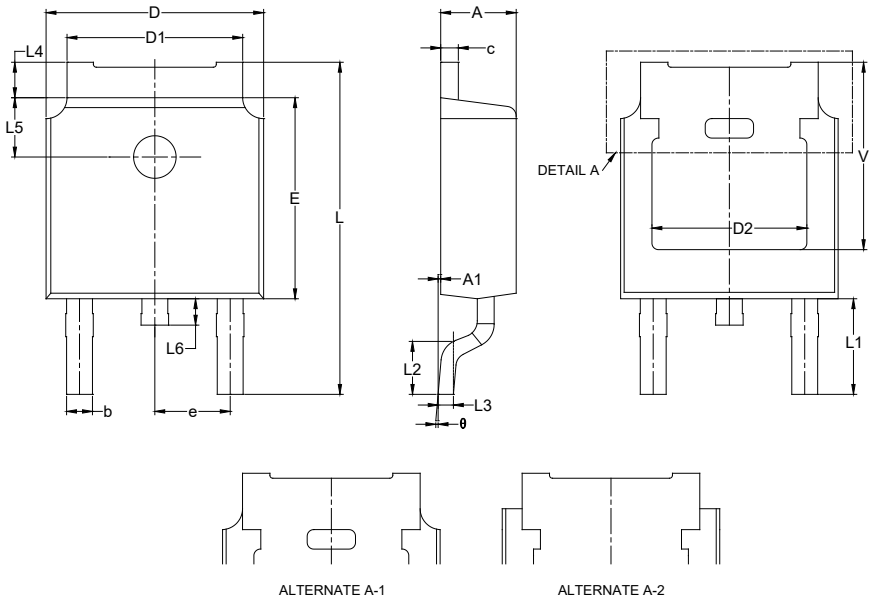




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | | 1.800 | | 0.071 |
| A1 | 0.020 | 0.100 | 0.001 | 0.004 |
| A2 | 1.500 | 1.700 | 0.059 | 0.067 |
| b | 0.660 | 0.840 | 0.026 | 0.033 |
| b1 | 2.900 | 3.100 | 0.114 | 0.122 |
| c | 0.230 | 0.350 | 0.009 | 0.014 |
| D | 6.300 | 6.700 | 0.248 | 0.264 |
| E | 3.300 | 3.700 | 0.130 | 0.146 |
| E1 | 6.700 | 7.300 | 0.264 | 0.287 |
| e | 2.300 BSC | | 0.091 BSC | |
| L | 0.750 | | 0.030 | |
| θ | 0° | 10° | 0° | 10° |

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

# PACKAGE OUTLINE DIMENSIONS

## TO-252-2A



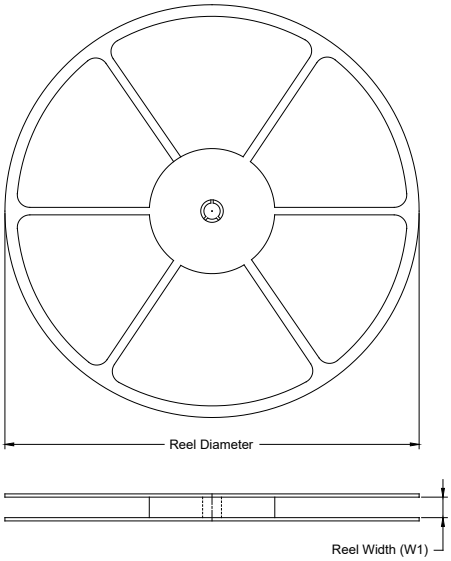

**DETAIL A**

| Symbol | Dimensions In Millimeters | | |
|---|---|---|---|
| | MIN | MOD | MAX |
| A | 2.184 | - | 2.388 |
| A1 | 0.000 | - | 0.127 |
| b | 0.635 | - | 0.889 |
| c | 0.457 | - | 0.889 |
| D | 6.350 | - | 6.731 |
| D1 | 4.953 | - | 5.461 |
| D2 | 4.318 | - | 5.500 |
| E | 5.969 | - | 6.223 |
| e | 2.286 BSC | | |
| L | 9.398 | - | 10.414 |
| L1 | 2.900 REF | | |
| L2 | 1.397 | - | 1.778 |
| L3 | 0.508 BSC | | |
| L4 | 0.889 | - | 1.270 |
| L5 | 1.800 REF | | |
| L6 | 0.600 | - | 1.106 |
| V | 5.150 | - | 5.650 |
| θ | 0° | - | 10° |

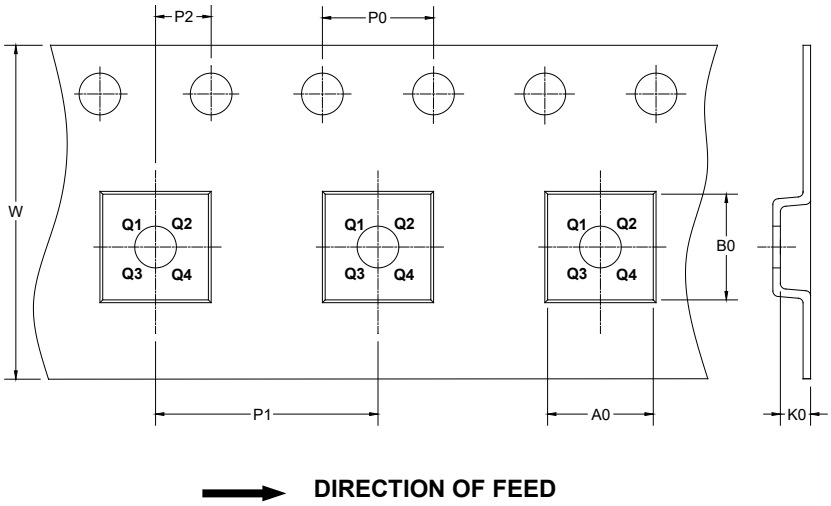
NOTES:
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC TO-252.

# TAPE AND REEL INFORMATION

### REEL DIMENSIONS




### TAPE DIMENSIONS



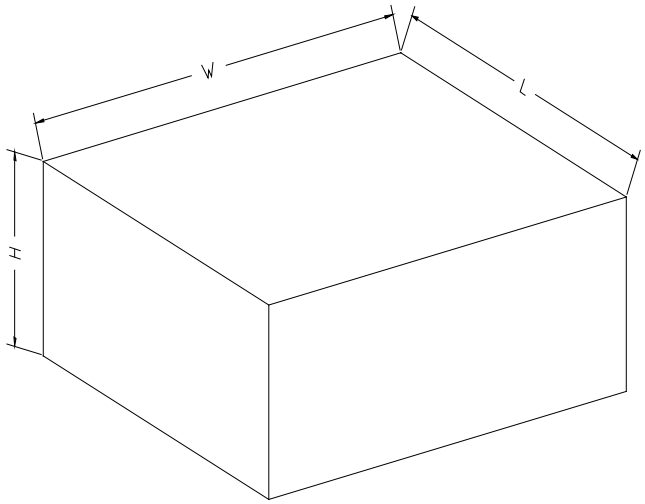

NOTE: The picture is only for reference. Please make the object as the standard.

## 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-223-3 | 13" | 12.4 | 6.55 | 7.25 | 1.90 | 4.0 | 8.0 | 2.0 | 12.0 | Q3 |
| TO-252-2A | 13" | 16.4 | 6.90 | 10.50 | 2.70 | 4.0 | 8.0 | 2.0 | 16.0 |  |

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 |
|---|---|---|---|---|
| 13″ | 386 | 280 | 370 | 5 |

DD0002