# SGM2239
# 40V, 300mA, Low Quiescent Current and Low Dropout Voltage Linear Regulator

## GENERAL DESCRIPTION

The SGM2239 is a high voltage, low quiescent current and low dropout voltage linear regulator. It is capable of supplying 300mA output current with typical dropout voltage of 900mV. The operating input voltage range is from 2.5V to 40V and output voltage range is from 1.215V to 39V.

Other features include current limit and thermal shutdown protection. The SGM2239 is suitable for various applications.

The SGM2239 is available in Green TDFN-2×2-6AL and TDFN-3×3-8JL packages. It operates over an operating temperature range of -40℃ to +125℃.

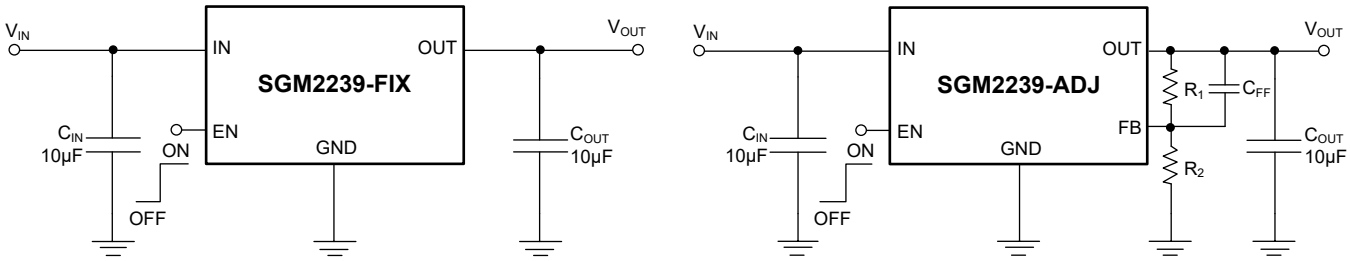
## FEATURES

- **Operating Input Voltage Range: 2.5V to 40V**
- **Enable Pin Accept Voltages Higher than the Supply Voltage and up to 40V**
- **Fixed Output from 1.8V to 12V**
- **Adjustable Output from 1.215V to 39V**
- **300mA Output Current**
- **Output Voltage Accuracy: ±1% at +25℃**
- **Low Quiescent Current: 3.2μA (TYP)**
- **Low Dropout Voltage:**
  **900mV (TYP) at 300mA, $V_{OUT}$ = 5.0V**
- **Current Limiting and Thermal Protection**
- **With Output Automatic Discharge**
- **Stable with Small Case Size Ceramic Capacitors**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in Green TDFN-2×2-6AL and TDFN-3×3-8JL Packages**

## APPLICATIONS

Industrial Equipment
Battery-Powered Equipment
Medical Equipment

## TYPICAL APPLICATION




**Fixed Output Voltage Version** **Adjustable Output Voltage Version**

**Figure 1. Typical Application Circuits**

## PACKAGE/ORDERING INFORMATION

| MODEL | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKING OPTION |
|---|---|---|---|---|---|
| SGM2239-1.8 | TDFN-2×2-6AL | -40℃ to +125℃ | SGM2239-1.8XTDI6G/TR | 22V<br>XXXX | Tape and Reel, 3000 |
| SGM2239-2.5 | TDFN-2×2-6AL | -40℃ to +125℃ | SGM2239-2.5XTDI6G/TR | 22W<br>XXXX | Tape and Reel, 3000 |
| SGM2239-3.0 | TDFN-2×2-6AL | -40℃ to +125℃ | SGM2239-3.0XTDI6G/TR | 22X<br>XXXX | Tape and Reel, 3000 |
| SGM2239-3.3 | TDFN-2×2-6AL | -40℃ to +125℃ | SGM2239-3.3XTDI6G/TR | 22Y<br>XXXX | Tape and Reel, 3000 |
| SGM2239-3.6 | TDFN-2×2-6AL | -40℃ to +125℃ | SGM2239-3.6XTDI6G/TR | 22Z<br>XXXX | Tape and Reel, 3000 |
| SGM2239-4.2 | TDFN-2×2-6AL | -40℃ to +125℃ | SGM2239-4.2XTDI6G/TR | 230<br>XXXX | Tape and Reel, 3000 |
| SGM2239-5.0 | TDFN-2×2-6AL | -40℃ to +125℃ | SGM2239-5.0XTDI6G/TR | 231<br>XXXX | Tape and Reel, 3000 |
| SGM2239-8.0 | TDFN-2×2-6AL | -40℃ to +125℃ | SGM2239-8.0XTDI6G/TR | 232<br>XXXX | Tape and Reel, 3000 |
| SGM2239-9.0 | TDFN-2×2-6AL | -40℃ to +125℃ | SGM2239-9.0XTDI6G/TR | 233<br>XXXX | Tape and Reel, 3000 |
| SGM2239-12 | TDFN-2×2-6AL | -40℃ to +125℃ | SGM2239-12XTDI6G/TR | 234<br>XXXX | Tape and Reel, 3000 |
| SGM2239-ADJ | TDFN-2×2-6AL | -40℃ to +125℃ | SGM2239-ADJXTDI6G/TR | 235<br>XXXX | Tape and Reel, 3000 |
| SGM2239-1.8 | TDFN-3×3-8JL | -40℃ to +125℃ | SGM2239-1.8XTHI8G/TR | SGM<br>236THI<br>XXXXX | Tape and Reel, 4000 |
| SGM2239-2.5 | TDFN-3×3-8JL | -40℃ to +125℃ | SGM2239-2.5XTHI8G/TR | SGM<br>237THI<br>XXXXX | Tape and Reel, 4000 |
| SGM2239-3.0 | TDFN-3×3-8JL | -40℃ to +125℃ | SGM2239-3.0XTHI8G/TR | SGM<br>238THI<br>XXXXX | Tape and Reel, 4000 |
| SGM2239-3.3 | TDFN-3×3-8JL | -40℃ to +125℃ | SGM2239-3.3XTHI8G/TR | SGM<br>1S2THI<br>XXXXX | Tape and Reel, 4000 |
| SGM2239-3.6 | TDFN-3×3-8JL | -40℃ to +125℃ | SGM2239-3.6XTHI8G/TR | SGM<br>239THI<br>XXXXX | Tape and Reel, 4000 |
| SGM2239-4.2 | TDFN-3×3-8JL | -40℃ to +125℃ | SGM2239-4.2XTHI8G/TR | SGM<br>23ATHI<br>XXXXX | Tape and Reel, 4000 |
| SGM2239-5.0 | TDFN-3×3-8JL | -40℃ to +125℃ | SGM2239-5.0XTHI8G/TR | SGM<br>1S3THI<br>XXXXX | Tape and Reel, 4000 |
| SGM2239-8.0 | TDFN-3×3-8JL | -40℃ to +125℃ | SGM2239-8.0XTHI8G/TR | SGM<br>23BTHI<br>XXXXX | Tape and Reel, 4000 |
| SGM2239-9.0 | TDFN-3×3-8JL | -40℃ to +125℃ | SGM2239-9.0XTHI8G/TR | SGM<br>23CTHI<br>XXXXX | Tape and Reel, 4000 |

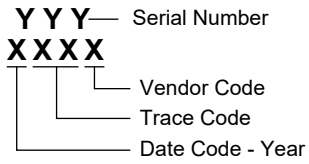
## PACKAGE/ORDERING INFORMATION (continued)

| MODEL | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKING OPTION |
|---|---|---|---|---|---|
| SGM2239-12 | TDFN-3×3-8JL | -40℃ to +125℃ | SGM2239-12XTHI8G/TR | SGM<br>23DTHI<br>XXXXX | Tape and Reel, 4000 |
| SGM2239-ADJ | TDFN-3×3-8JL | -40℃ to +125℃ | SGM2239-ADJXTHI8G/TR | SGM<br>1S4THI<br>XXXXX | Tape and Reel, 4000 |

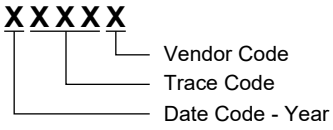
### MARKING INFORMATION

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

**TDFN-2×2-6AL**




**TDFN-3×3-8JL**




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, EN to GND ..... -0.3V to 45V
OUT to GND ..... -0.3V to 45V
FB to GND ..... -0.3V to 45V
Package Thermal Resistance
TDFN-2×2-6AL, $\theta_{JA}$ ..... 62.9℃/W
TDFN-2×2-6AL, $\theta_{JB}$ ..... 28.9℃/W
TDFN-2×2-6AL, $\theta_{JC(TOP)}$ ..... 77.8℃/W
TDFN-2×2-6AL, $\theta_{JC(BOT)}$ ..... 11.6℃/W
TDFN-3×3-8JL, $\theta_{JA}$ ..... 50.2℃/W
TDFN-3×3-8JL, $\theta_{JB}$ ..... 22.5℃/W
TDFN-3×3-8JL, $\theta_{JC(TOP)}$ ..... 52.2℃/W
TDFN-3×3-8JL, $\theta_{JC(BOT)}$ ..... 11℃/W
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility (1) (2)
HBM ..... ±6000V
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

Supply Voltage Range, $V_{IN}$ ..... 2.5V to 40V
Enable Input Voltage Range ..... 0V to 40V
Input Effective Capacitance, $C_{IN}$ ..... 0.5μF (MIN)
Output Effective Capacitance, $C_{OUT}$ ..... 1μF to 100μF
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

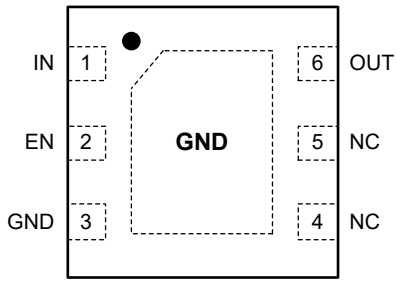
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance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

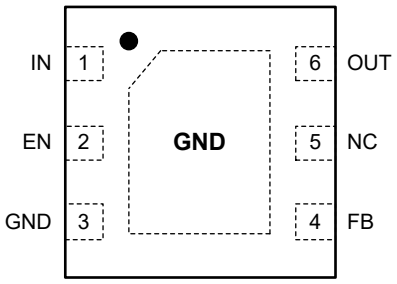
## PIN CONFIGURATIONS

SGM2239-FIX (TOP VIEW)



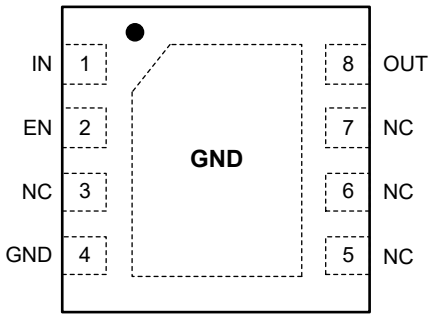

TDFN-2×2-6AL

SGM2239-ADJ (TOP VIEW)



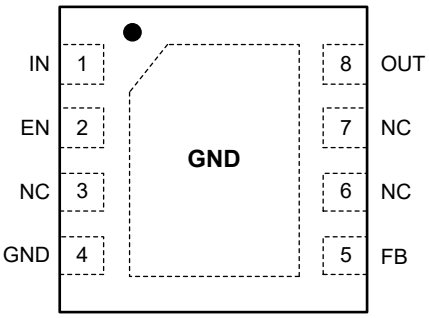

TDFN-2×2-6AL

SGM2239-FIX (TOP VIEW)




TDFN-3×3-8JL

SGM2239-ADJ (TOP VIEW)




TDFN-3×3-8JL

## PIN DESCRIPTION

| PIN | | NAME | FUNCTION |
|---|---|---|---|
| TDFN-2×2-6AL | TDFN-3×3-8JL | | |
| 1 | 1 | IN | Input Supply Voltage Pin. It is recommended to use a 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. |
| 2 | 2 | EN | Enable Pin. Drive EN high to turn on the regulator. Drive EN low to turn off the regulator. |
| 3 | 4 | GND | Ground. |
| 4 | 5 | FB | Feedback Voltage Input Pin (adjustable 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. |
| | | NC | No Connection (Fixed Version Only). |
| 6 | 8 | OUT | Regulator Output Pin. It is recommended to use a ceramic capacitor with effective capacitance in the range of 1μF to 100μF to ensure stability. This ceramic capacitor should be placed as close as possible to OUT pin. |
| 5 | 3, 6, 7 | NC | No Connection. |
| Exposed Pad | 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. |

## FUNCTIONAL BLOCK DIAGRAMS

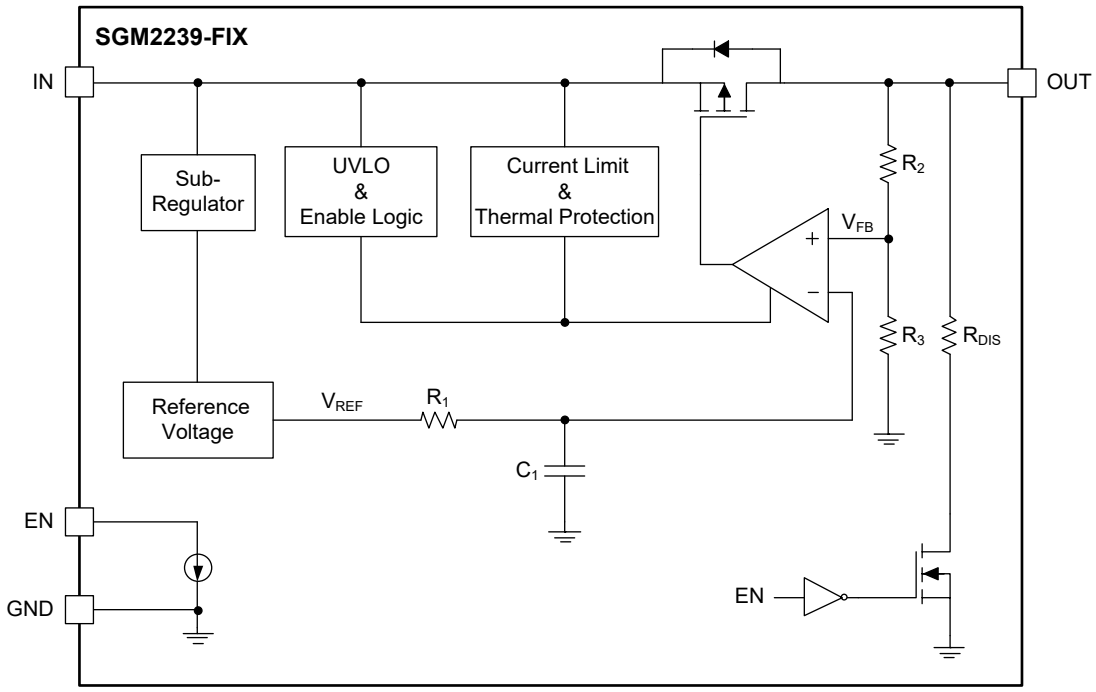



**Figure 2. Block Diagram of Fixed Output Version**

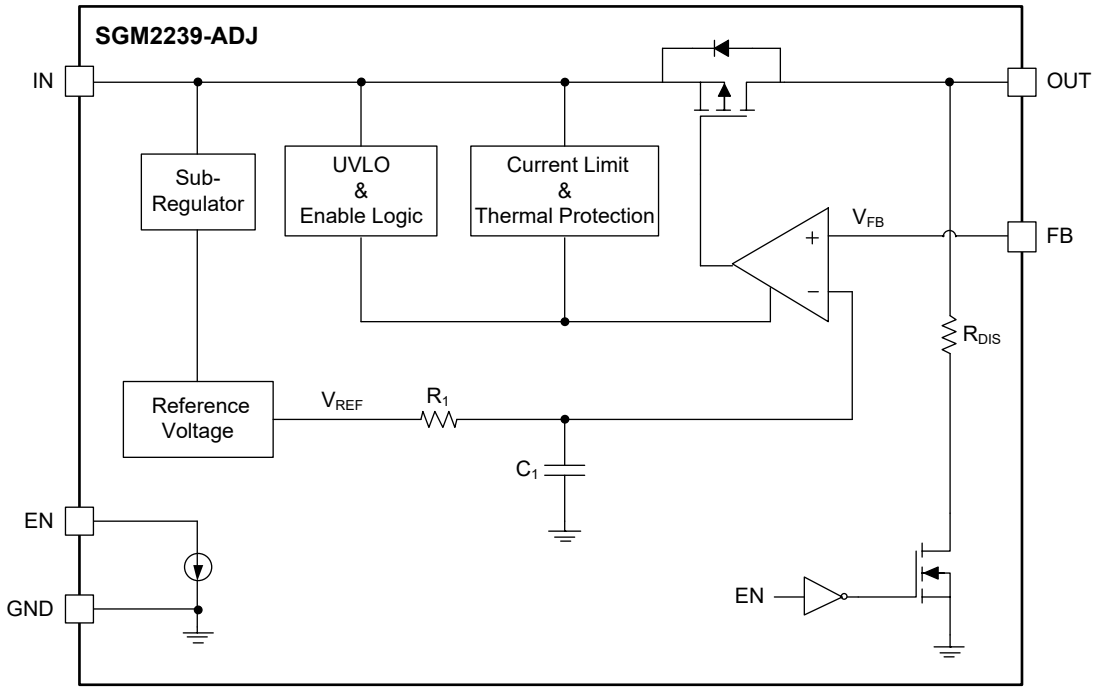



**Figure 3. Block Diagram of Adjustable Output Version**

## ELECTRICAL CHARACTERISTICS

($V_{IN}$ = $V_{OUT(NOM)}$ + 2V, $C_{IN}$ = 10μF, $C_{OUT}$ = 10μF, $C_{FF}$ = 0nF, $T_J$ = -40℃ to +125℃ (1), typical values are at $T_J$ = +25℃, unless otherwise noted.)

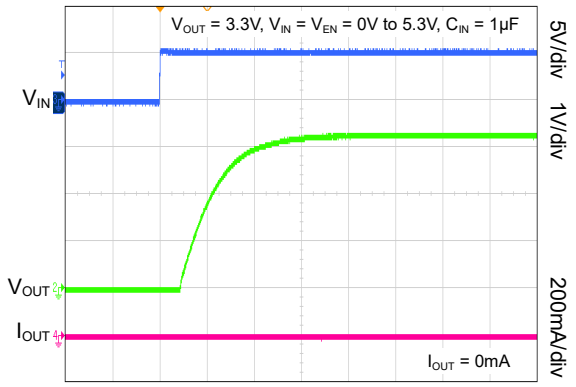
| PARAMETER | SYMBOL | CONDITIONS | | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| Input Voltage Range | $V_{IN}$ | | | 2.5 | | 40 | V |
| Output Voltage Range | $V_{OUT}$ | | | 1.215 | | 39 | V |
| Output Voltage Accuracy | $V_{OUT}$ | $V_{IN}$ = ($V_{OUT(NOM)}$ + 2V) to 40V, $I_{OUT}$ = 1mA | $T_J$ = +25℃ | -1 | | +1 | % |
| | | | $T_J$ = -40℃ to +125℃ | -2 | | +1.5 | |
| Feedback Voltage | $V_{FB}$ | $V_{IN}$ = ($V_{OUT(NOM)}$ + 2V) to 40V, $I_{OUT}$ = 1mA | $T_J$ = +25℃ | 1.203 | 1.215 | 1.227 | V |
| | | | $T_J$ = -40℃ to +125℃ | 1.191 | 1.215 | 1.233 | |
| FB Pin Input Current | $I_{FB}$ | $V_{FB}$ = 1.3V | | | 0.1 | 100 | nA |
| Under-Voltage Lockout | $V_{UVLO}$ | $V_{IN}$ rising | | | 2.1 | 2.48 | V |
| Line Regulation | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$ | $V_{IN}$ = ($V_{OUT(NOM)}$ + 2V) to 40V, $I_{OUT}$ = 0.1mA | | | 0.0002 | 0.02 | %/V |
| Load Regulation | $\frac{\Delta V_{OUT}}{\Delta I_{OUT} \times V_{OUT}}$ | $I_{OUT}$ = 0.1mA to 300mA | | | 0.0002 | 0.005 | %/mA |
| Dropout Voltage | $V_{DROP}$ | $V_{OUT(NOM)}$ ≥ 1.8V, $V_{OUT}$ = 95% × $V_{OUT(NOM)}$, $I_{OUT}$ = 300mA | | | 900 | 2200 | mV |
| Output Current Limit | $I_{LIMIT}$ | $V_{IN}$ = $V_{OUT}$ + 4V, $V_{OUT}$ = 90% × $V_{OUT(NOM)}$ | | 300 | 755 | | mA |
| Short-Circuit Current Limit | $I_{SHORT}$ | $V_{IN}$ = $V_{OUT(NOM)}$ + 3V, $V_{OUT}$ =0V | | | 265 | | mA |
| Ground Pin Current | $I_{GND}$ | $I_{OUT}$ = 0mA | | | 3.2 | 8 | μA |
| | | $I_{OUT}$ = 300mA | | | 125 | 260 | |
| Shutdown Supply Current | $I_{SHDN}$ | $V_{EN}$ = 0V, $V_{IN}$ = 2.5 to 40V | | | 0.3 | 1.5 | μA |
| EN Pin High-Level Input Voltage | $V_{IH}$ | $V_{IN}$ = 2.5 to 40V | | 1.8 | | 40 | V |
| EN Pin Low-Level Input Voltage | $V_{IL}$ | $V_{IN}$ = 2.5 to 40V | | 0 | | 1 | V |
| EN Pin Input Current | $I_{EN}$ | $V_{EN}$ = 0V, $V_{IN}$ = 40V | | | 5 | 500 | nA |
| | | $V_{EN}$ = 40V, $V_{IN}$ = 40V | | | 50 | 1000 | |
| Output Discharge Resistance | $R_{DIS}$ | $V_{EN}$ = 0V | | | 215 | | Ω |
| Turn-On Time | $t_{ON}$ | From assertion of $V_{EN}$ to $V_{OUT}$ = 90% × $V_{OUT(NOM)}$ | $V_{OUT(NOM)}$ = 1.215V | | 0.8 | 1.4 | ms |
| | | | $V_{OUT(NOM)}$ = 2.5V | | 0.9 | 1.5 | |
| | | | $V_{OUT(NOM)}$ = 3.3V | | 1.0 | 1.6 | |
| | | | $V_{OUT(NOM)}$ = 5.0V | | 1.3 | 2.2 | |
| | | | $V_{OUT(NOM)}$ = 12V | | 2.8 | 4.4 | |
| Power Supply Ripple Rejection | PSRR | $V_{IN}$ = 2.5V, $V_{OUT}$ = 1.215V, $I_{OUT}$ = 10mA, $C_{OUT}$ = 4.7μF | f = 100Hz | | 61 | | dB |
| | | | f = 1kHz | | 45 | | |
| | | | f = 100kHz | | 40 | | |
| | | $V_{IN}$ = 5.3V, $V_{OUT}$ = 3.3V, $I_{OUT}$ = 10mA, $C_{OUT}$ = 4.7μF | f = 100Hz | | 61 | | |
| | | | f = 1kHz | | 45 | | |
| | | | f = 100kHz | | 45 | | |
| Output Voltage Noise | $e_n$ | $I_{OUT}$ = 10mA, $C_{OUT}$ = 4.7μF, f = 10Hz to 100kHz | $V_{OUT}$ = 1.215V | | 55 | | $\mu V_{RMS}$ |
| | | | $V_{OUT}$ = 3.3V | | 105 | | |
| Thermal Shutdown Temperature | $T_{SHDN}$ | $T_J$ rising | | | 160 | | ℃ |
| Thermal Shutdown Hysteresis | $\Delta T_{SHDN}$ | Hysteresis | | | 20 | | ℃ |

NOTE:
1. Tested under pulse load conditions, so $T_J \approx T_A$.

## TYPICAL PERFORMANCE CHARACTERISTICS

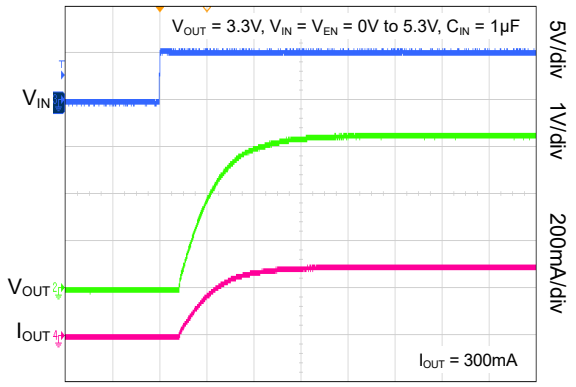
$T_J$ = +25℃, $V_{EN}$ = $V_{IN}$, $C_{IN}$ = 10μF, $C_{OUT}$ = 10μF, $C_{FF}$ = 0nF, unless otherwise noted.

$V_{IN}$ Power-Up Response



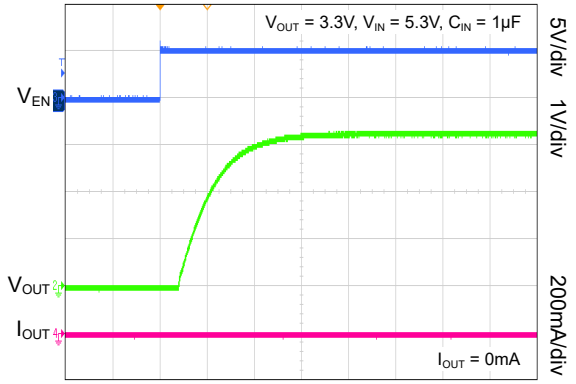

Time (500μs/div)

$V_{IN}$ Power-Up Response



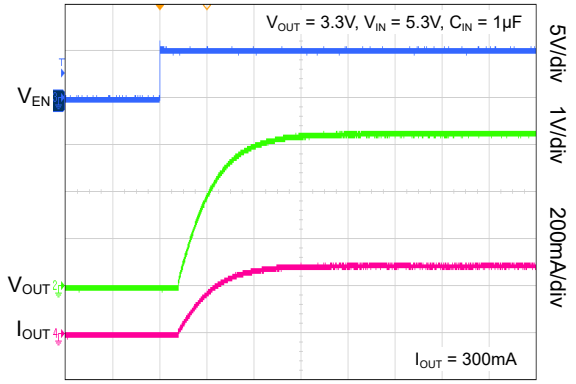

Time (500μs/div)

Enable Turn-On Response



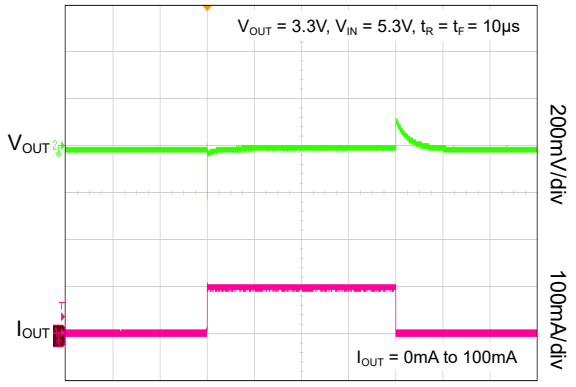

Time (500μs/div)

Enable Turn-On Response



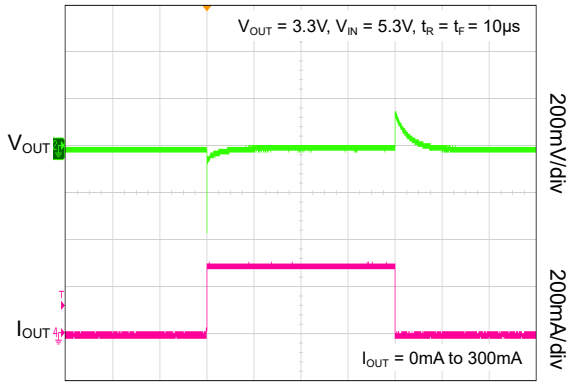

Time (500μs/div)

Load Transient Response




Time (50ms/div)

Load Transient Response

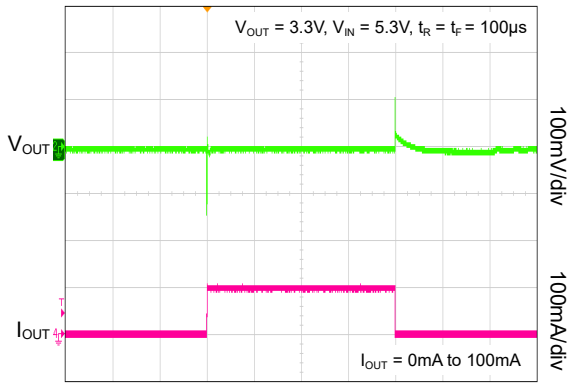



Time (50ms/div)

## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

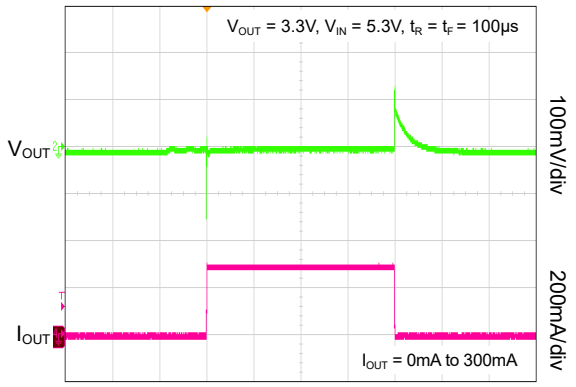
$T_J$ = +25℃, $V_{EN}$ = $V_{IN}$, $C_{IN}$ = 10μF, $C_{OUT}$ = 10μF, $C_{FF}$ = 0nF, unless otherwise noted.

Load Transient Response



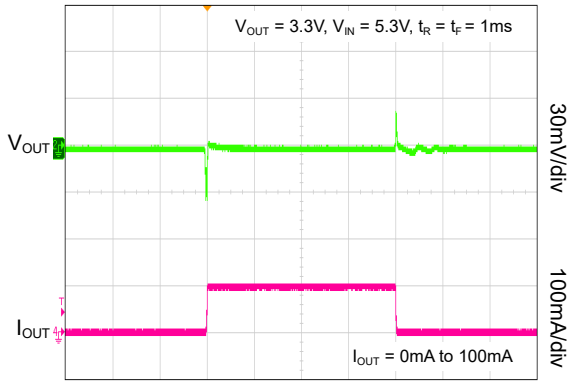

Time (50ms/div)

Load Transient Response



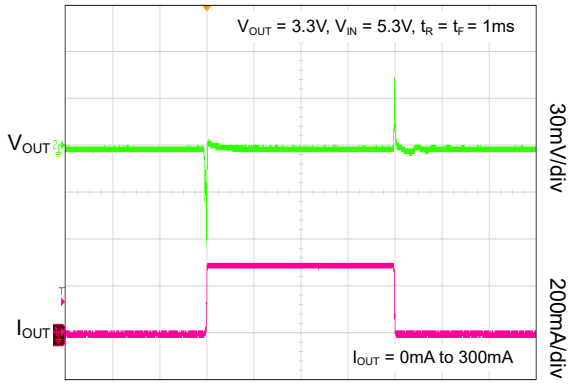

Time (50ms/div)

Load Transient Response



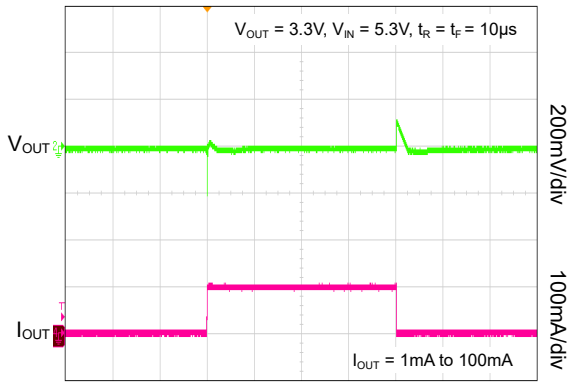

Time (50ms/div)

Load Transient Response



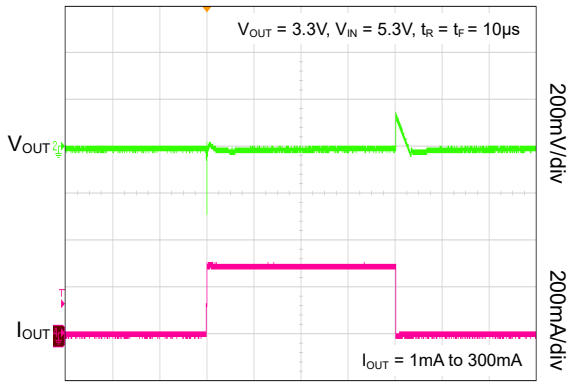

Time (50ms/div)

Load Transient Response




Time (5ms/div)

Load Transient Response

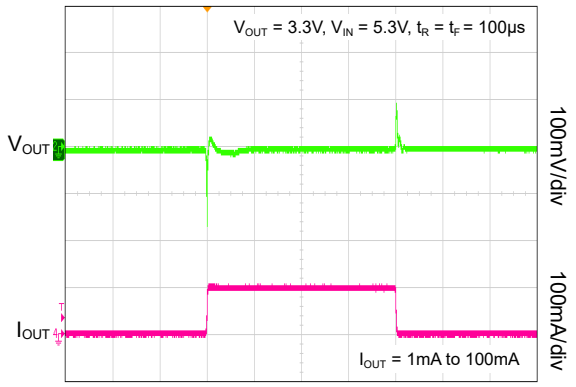



Time (5ms/div)

## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

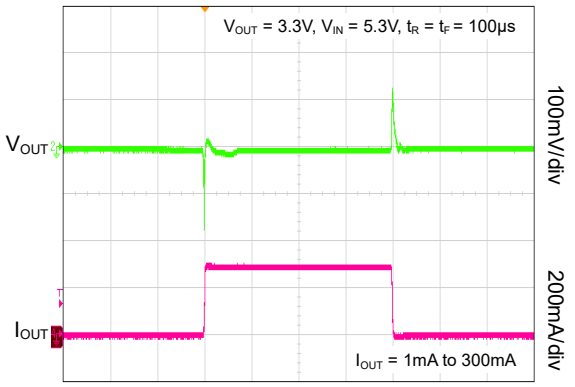
$T_J$ = +25℃, $V_{EN}$ = $V_{IN}$, $C_{IN}$ = 10μF, $C_{OUT}$ = 10μF, $C_{FF}$ = 0nF, unless otherwise noted.

Load Transient Response



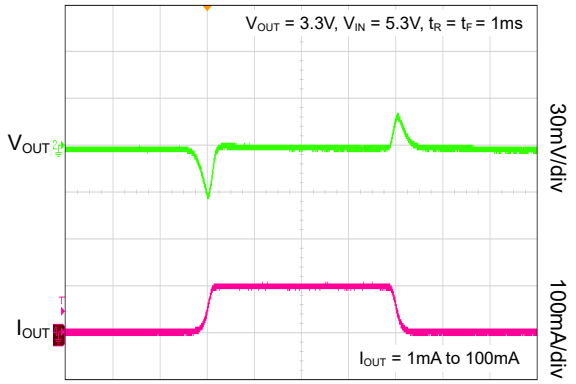

Time (5ms/div)

Load Transient Response



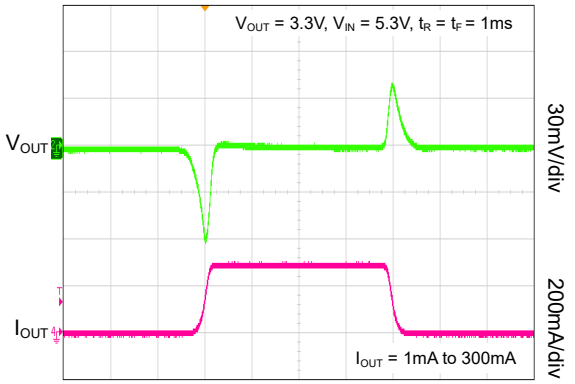

Time (5ms/div)

Load Transient Response



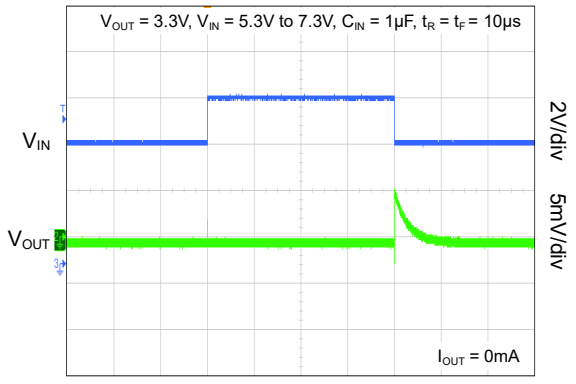

Time (5ms/div)

Load Transient Response



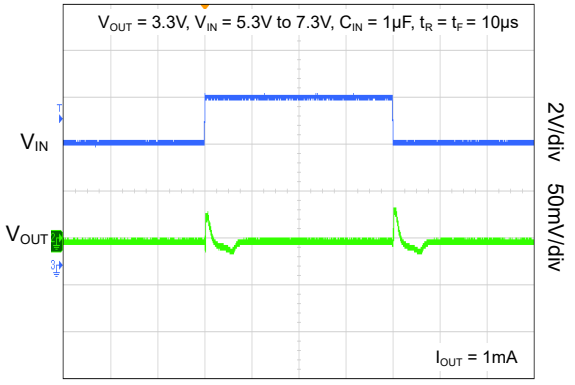

Time (5ms/div)

Line Transient Response




Time (50ms/div)

Line Transient Response

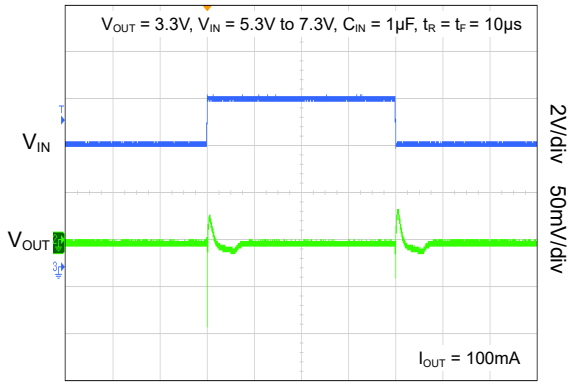



Time (5ms/div)

## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

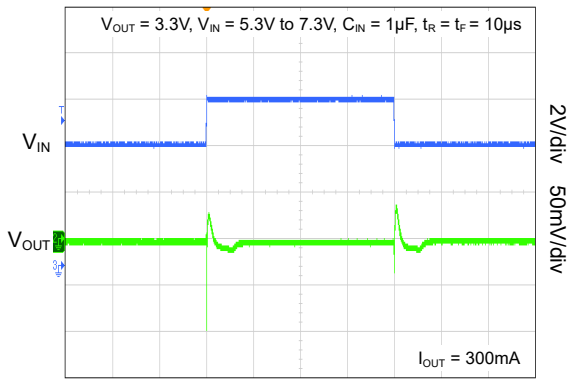
$T_J$ = +25℃, $V_{EN}$ = $V_{IN}$, $C_{IN}$ = 10μF, $C_{OUT}$ = 10μF, $C_{FF}$ = 0nF, unless otherwise noted.

Line Transient Response



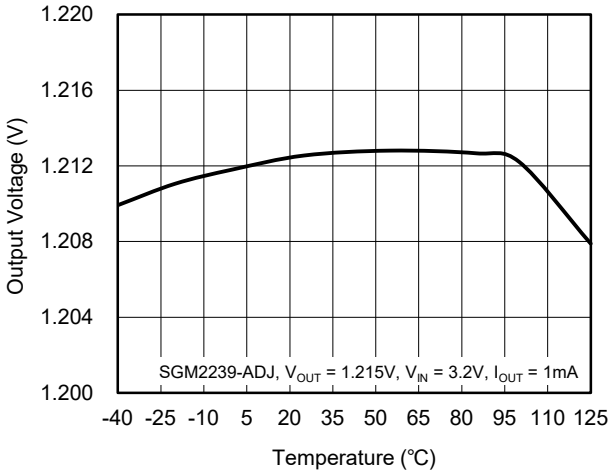

Time (5ms/div)

Line Transient Response

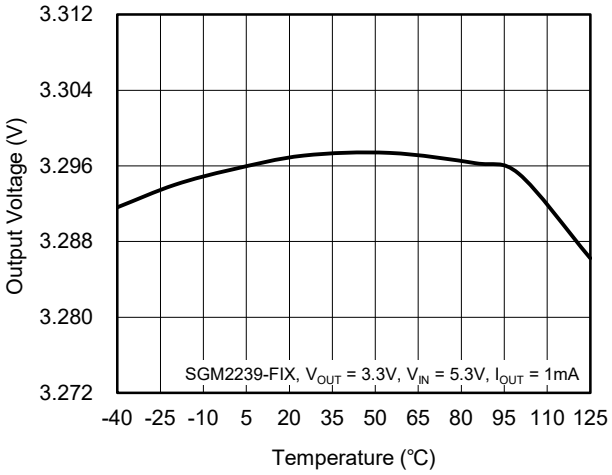



Time (5ms/div)

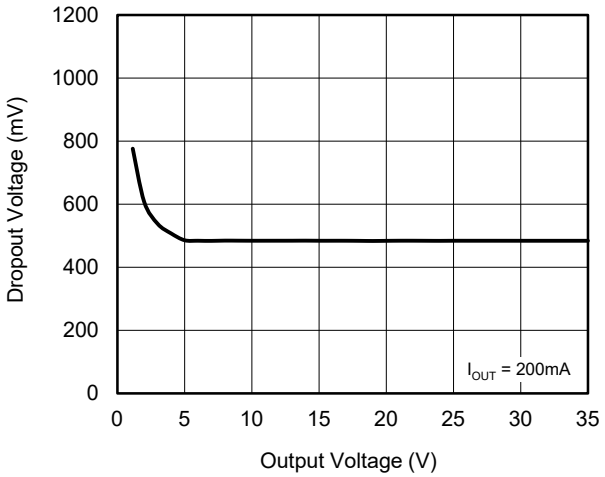
Output Voltage vs. Temperature



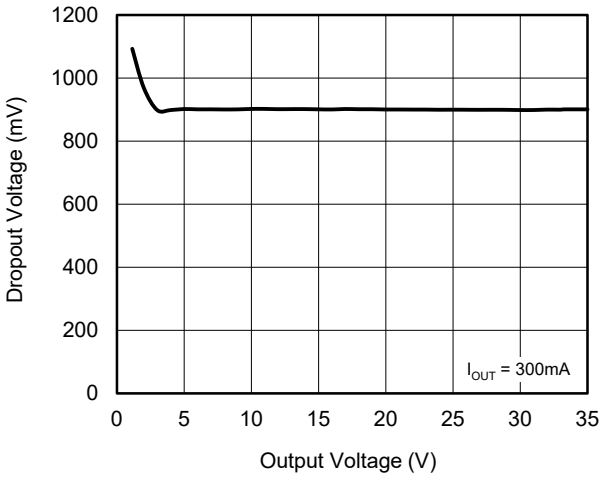

Output Voltage vs. Temperature




Dropout Voltage vs. Output Voltage



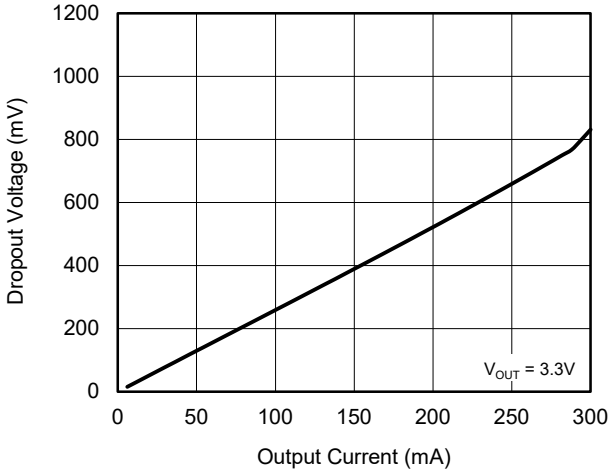

Dropout Voltage vs. Output Voltage



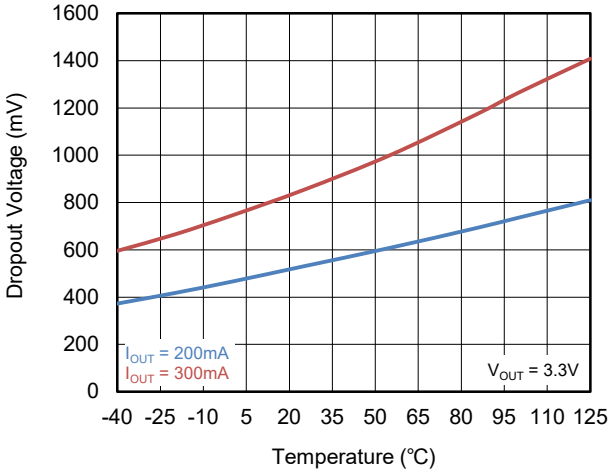
## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

$T_J$ = +25℃, $V_{EN}$ = $V_{IN}$, $C_{IN}$ = 10μF, $C_{OUT}$ = 10μF, $C_{FF}$ = 0nF, unless otherwise noted.

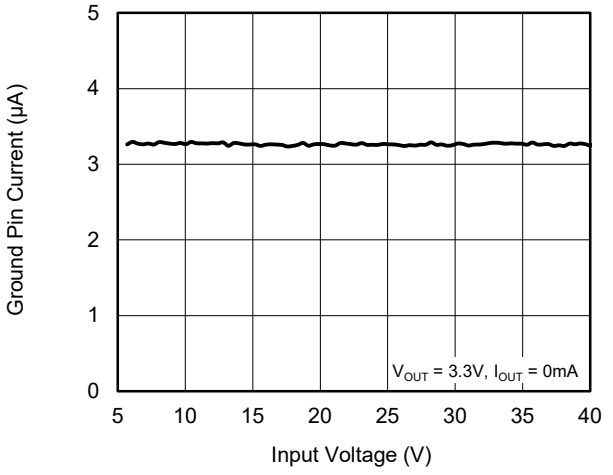
Dropout Voltage vs. Output Current



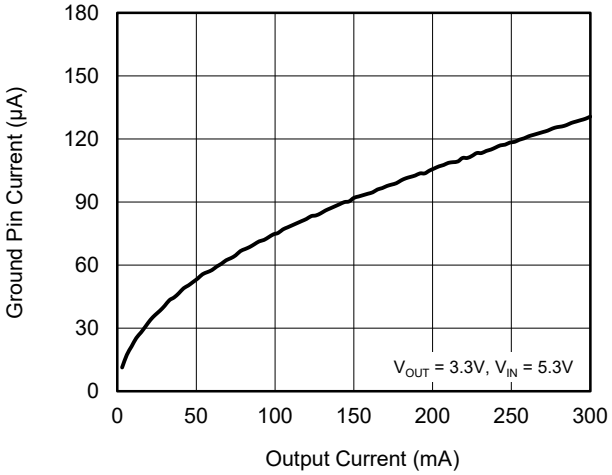

Dropout Voltage vs. Temperature



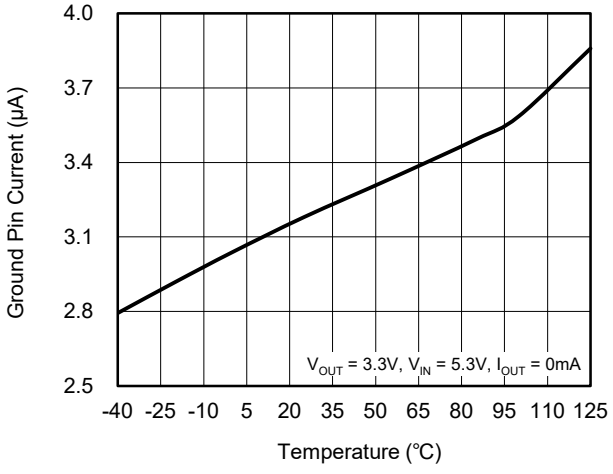

Ground Pin Current vs. Input Voltage



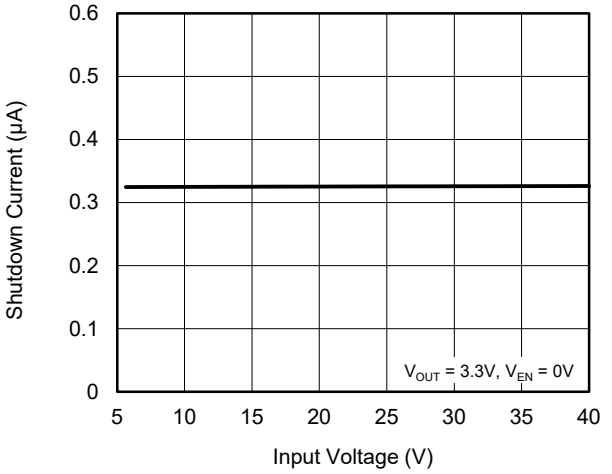

Ground Pin Current vs. Output Current




Ground Pin Current vs. Temperature



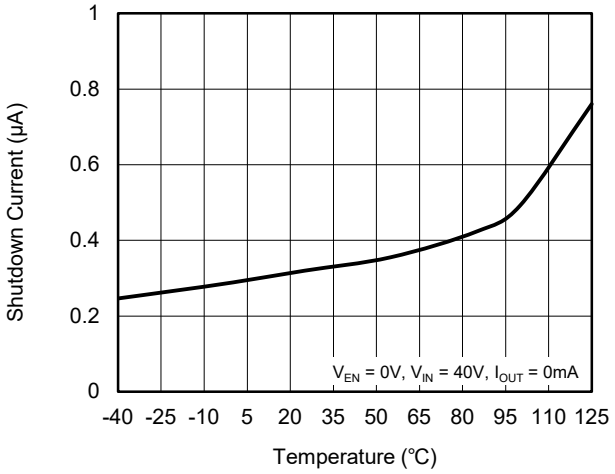

Shutdown Current vs. Input Voltage



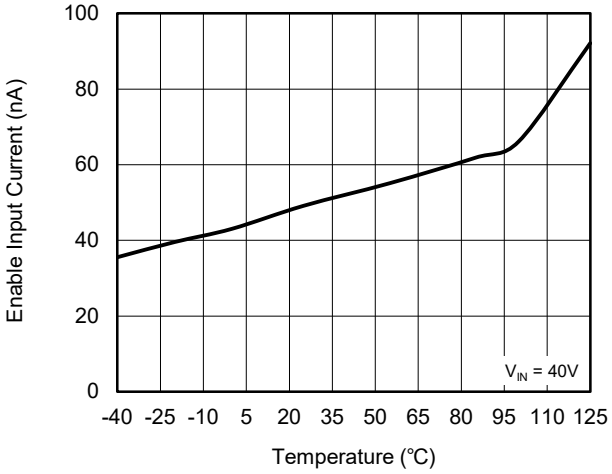
## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

$T_J$ = +25℃, $V_{EN}$ = $V_{IN}$, $C_{IN}$ = 10μF, $C_{OUT}$ = 10μF, $C_{FF}$ = 0nF, unless otherwise noted.

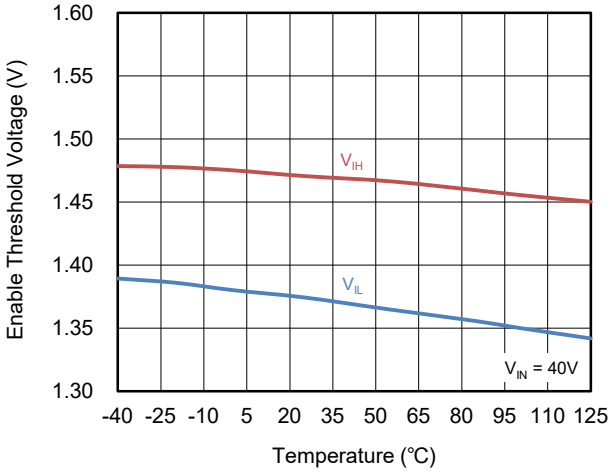
Shutdown Current vs. Temperature



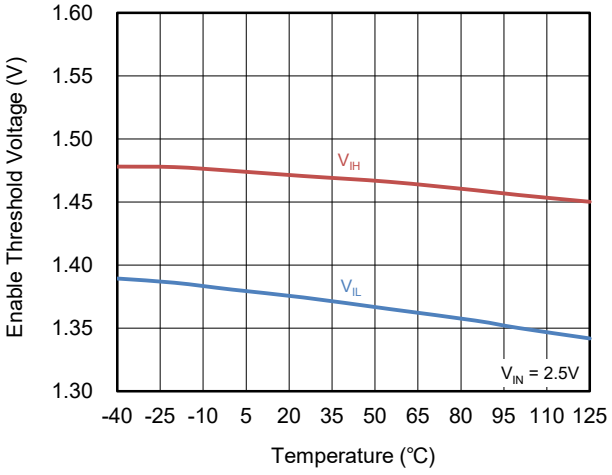

Enable Input Current vs. Temperature



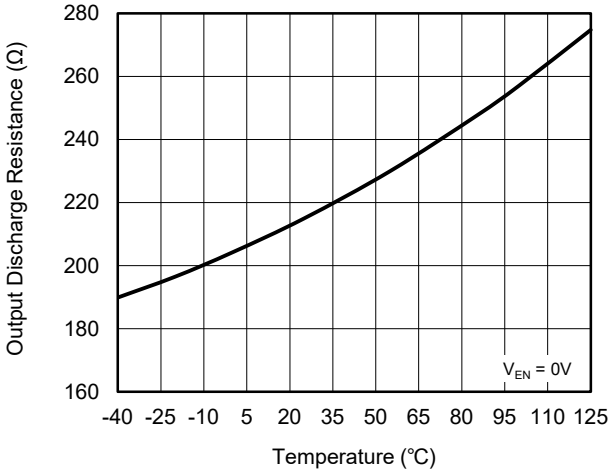

Enable Threshold Voltage vs. Temperature



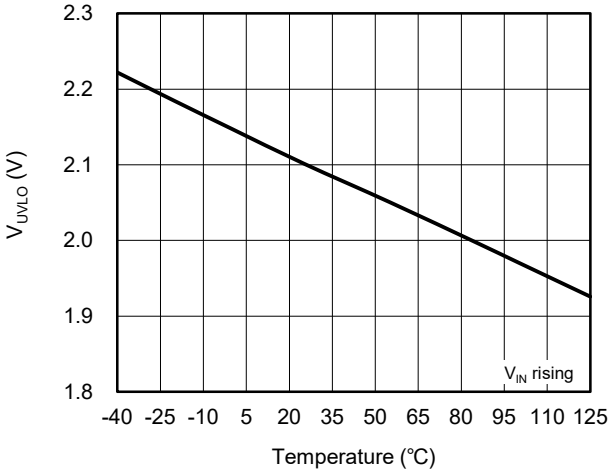

Enable Threshold Voltage vs. Temperature




Output Discharge Resistance vs. Temperature



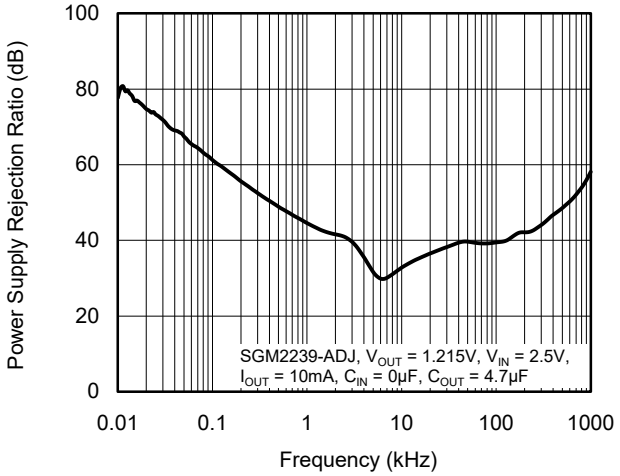

$V_{UVLO}$ vs. Temperature



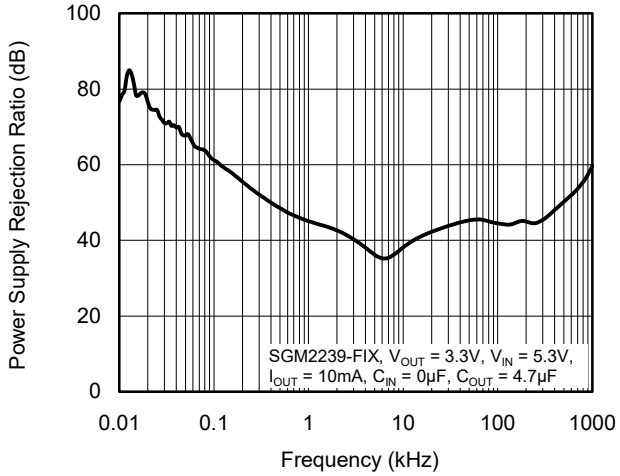
## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

$T_J$ = +25℃, $V_{EN}$ = $V_{IN}$, $C_{IN}$ = 10μF, $C_{OUT}$ = 10μF, $C_{FF}$ = 0nF, unless otherwise noted.

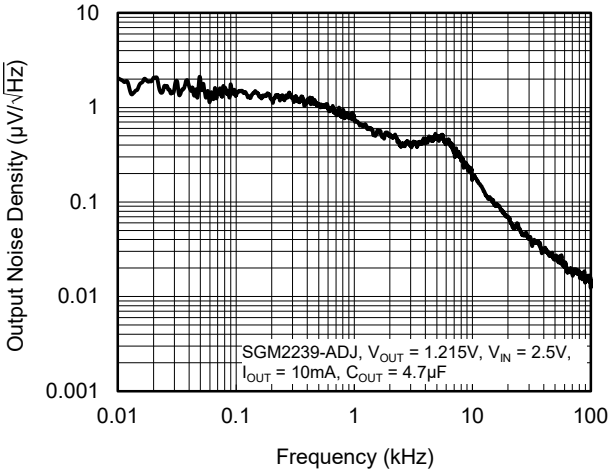
Power Supply Rejection Ratio vs. Frequency



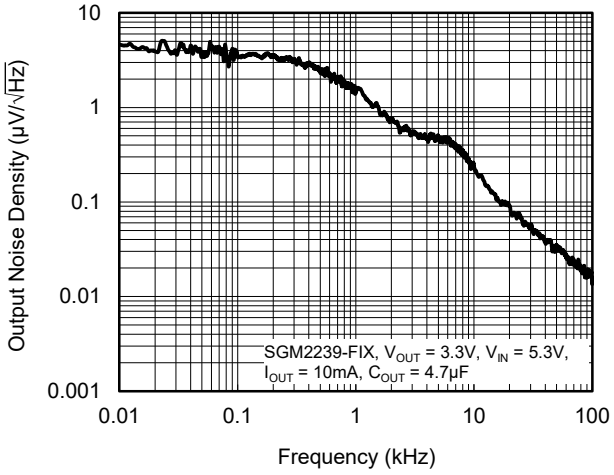

Power Supply Rejection Ratio vs. Frequency




Output Noise Density vs. Frequency




Output Noise Density vs. Frequency



# APPLICATION INFORMATION

The SGM2239 is a high voltage, low quiescent current and low dropout LDO and provides 300mA 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 SGM2239 useful in a variety of applications. The SGM2239 provides protection functions for output overload and overheating.

## Input Capacitor Selection ($C_{IN}$)

The input decoupling capacitor should be placed as close as possible to the IN pin to ensure the device stability. 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. 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.

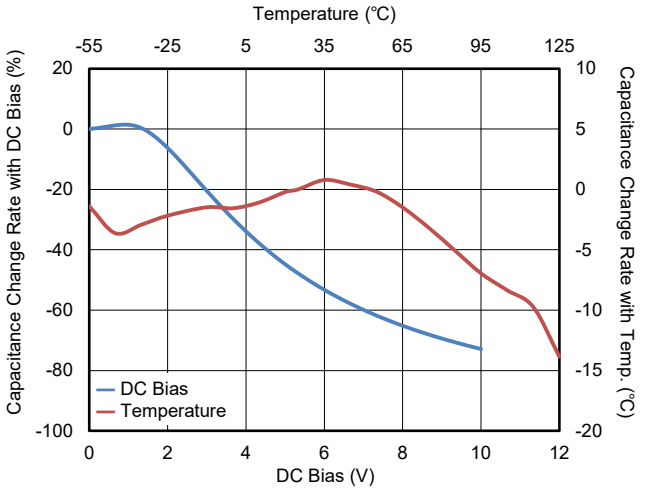



**Figure 4. Capacitance vs. DC Bias and Temperature Characteristics**

The SGM2239 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.

## Adjustable Regulator

The output voltage of the SGM2239-ADJ can be adjusted from 1.215V to 39V. The FB pin will be connected to two external resistors as shown in Figure 5. 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, $V_{FB}$ = 1.215V. One parallel capacitor ($C_{FF}$) with $R_1$ can be used to improve the feedback loop stability and PSRR, increase the transient response and reduce the output noise. $R_1$ and $R_2$ can be calculated for any output voltage range using equation 1. Choose $R_2$ ≤ 1MΩ to maintain a 1.215μA minimum load.

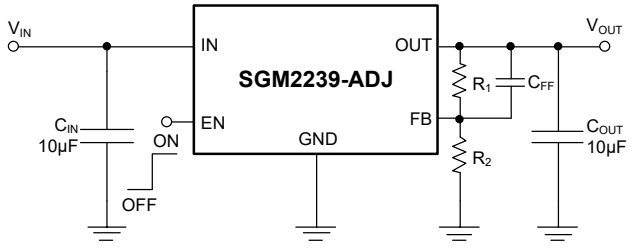



**Figure 5. Adjustable Output Voltage Application**

# APPLICATION INFORMATION (continued)

## Enable Operation

The EN pin of the SGM2239 is used to enable/disable the device and to deactivate/activate the output automatic discharge function.

When the EN pin voltage is lower than 1V, the device is in shutdown state. There is no current flowing from IN to OUT pins. In this state, the automatic discharge transistor is active to discharge the output voltage through a 215Ω (TYP) resistor.

When the EN pin voltage is higher than 1.8V, the device is in active state. The output voltage is regulated to the expected value and the automatic discharge transistor is turned off.

## Reverse Current Protection

The power transistor has an inherent body diode. This body diode will be forward biased when $V_{OUT}$ > ($V_{IN}$ + 0.3V). When $V_{OUT}$ > ($V_{IN}$ + 0.3V), the reverse current flowing from the OUT pin to the IN pin will damage the SGM2239. If $V_{OUT}$ > ($V_{IN}$ + 0.3V) event would happen in system, one external Schottky diode will be added between OUT pin and IN pin in circuit design to protect the SGM2239.

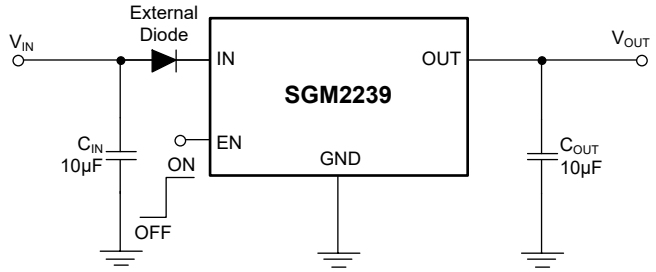



**Figure 6. Reverse Protection Reference Design**

## Output Current Limit Protection

When overload events happen, the output current is internally limited to 755mA (TYP). When the OUT pin is shorted to ground, the output current is internally limited to 265mA (TYP).

## Thermal Shutdown

When the die temperature exceeds the threshold value of thermal shutdown, the SGM2239 will be in shutdown state and it will remain in this state until the die temperature decreases to +140℃.

## Power Dissipation ($P_D$)

Power dissipation ($P_D$) of the SGM2239 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 SGM2239 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:

$$P_{D(MAX)} = (T_{J(MAX)} - T_A)/\theta_{JA} \quad (2)$$

## 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.

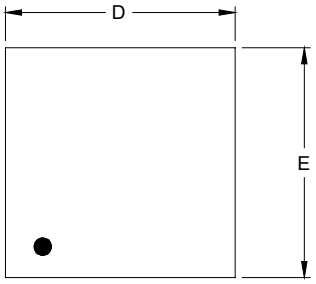
# REVISION HISTORY

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

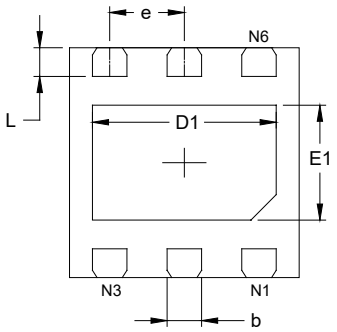
| Changes from Original (MAY 2025) to REV.A | Page |
|---|---|
| Changed from product preview to production data | All |

# PACKAGE OUTLINE DIMENSIONS

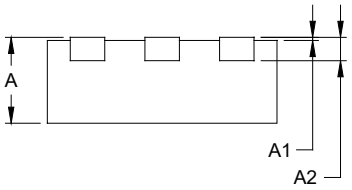
## TDFN-2×2-6AL



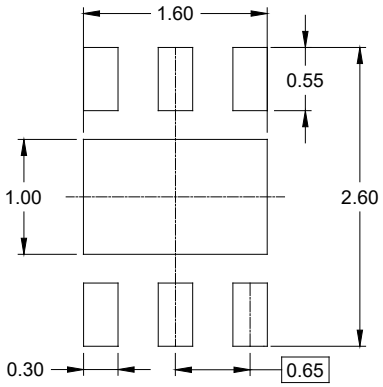

TOP VIEW




BOTTOM VIEW




SIDE VIEW



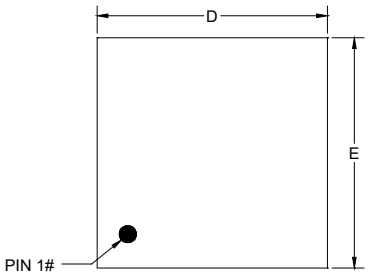

**RECOMMENDED LAND PATTERN** (Unit: mm)

| 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 | 1.900 | 2.100 | 0.075 | 0.083 |
| D1 | 1.500 | 1.700 | 0.059 | 0.067 |
| E | 1.900 | 2.100 | 0.075 | 0.083 |
| E1 | 0.900 | 1.100 | 0.035 | 0.043 |
| b | 0.250 | 0.350 | 0.010 | 0.014 |
| e | 0.650 BSC | | 0.026 BSC | |
| L | 0.174 | 0.326 | 0.007 | 0.013 |

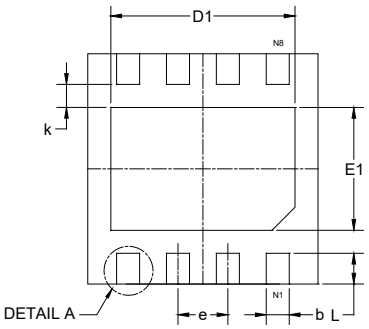
NOTE: This drawing is subject to change without notice.

# PACKAGE OUTLINE DIMENSIONS

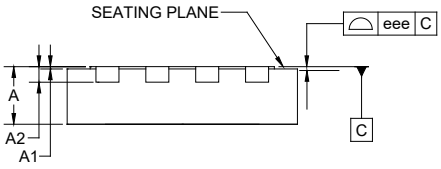
## TDFN-3×3-8JL



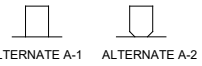

**TOP VIEW**



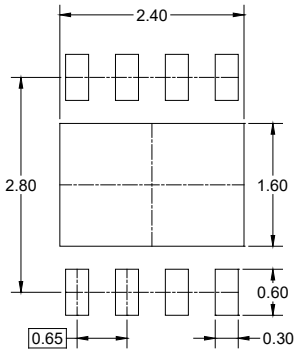

**BOTTOM VIEW**




**SIDE VIEW**




**DETAIL A**
ALTERNATE TERMINAL CONSTRUCTION



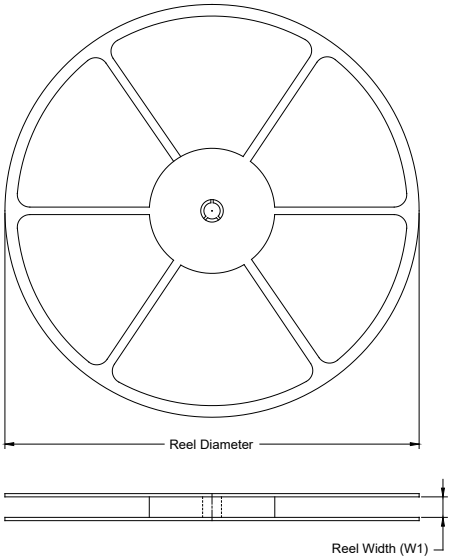

**RECOMMENDED LAND PATTERN** (Unit: mm)

| Symbol | Dimensions In Millimeters | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 0.700 | - | 0.800 |
| A1 | 0.000 | - | 0.050 |
| A2 | 0.203 REF | | |
| b | 0.250 | - | 0.350 |
| D | 2.900 | - | 3.100 |
| D1 | 2.300 | - | 2.500 |
| E | 2.900 | - | 3.100 |
| E1 | 1.500 | - | 1.700 |
| e | 0.650 BSC | | |
| k | 0.300 REF | | |
| L | 0.300 | - | 0.500 |
| eee | 0.080 | | |

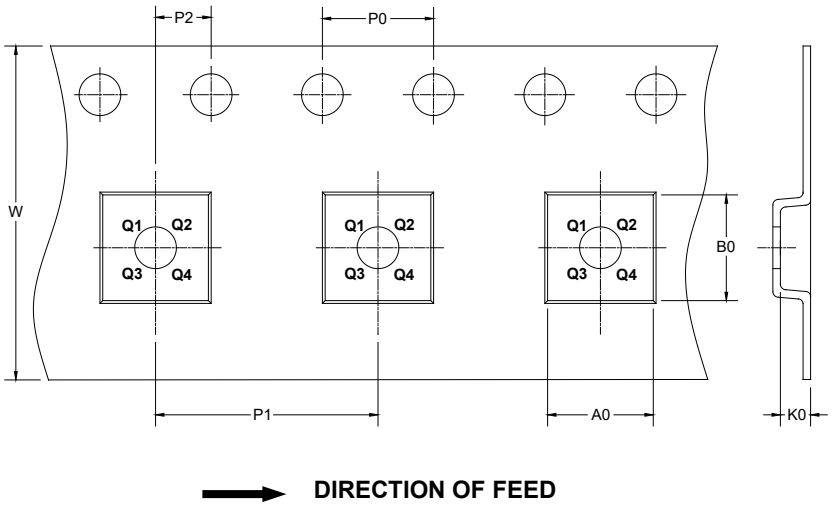
NOTE: This drawing is subject to change without notice.

# TAPE AND REEL INFORMATION

### REEL DIMENSIONS




### TAPE DIMENSIONS




DIRECTION OF FEED

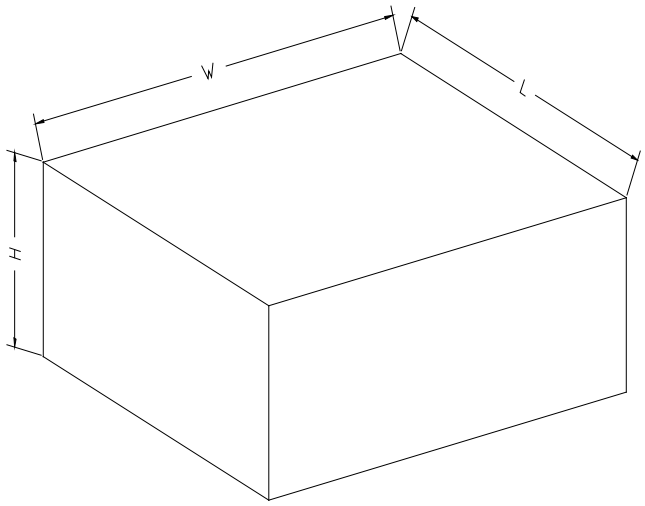
NOTE: The picture is only for reference. Please make the object as the standard.

### 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| TDFN-2×2-6AL | 7" | 9.5 | 2.30 | 2.30 | 1.10 | 4.0 | 4.0 | 2.0 | 8.0 | Q1 |
| TDFN-3×3-8JL | 13" | 12.4 | 3.35 | 3.35 | 1.13 | 4.0 | 8.0 | 2.0 | 12.0 | Q1 |

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