



# SGM2035C

## 500mA, Ultra Low Dropout, Low Power, RF Linear Regulators

### GENERAL DESCRIPTION

The SGM2035C is a low-power, low-noise, low-dropout, CMOS linear voltage regulator that operates from a 2.5V to 5.5V input voltage.

The SGM2035C is the perfect choice for low voltage, low power applications. A low ground current makes this part attractive for battery operated power systems. The SGM2035C also offers ultra low dropout voltage to prolong battery life in portable electronics. Systems requiring a quiet voltage source, such as RF applications, will benefit from the SGM2035C's ultra low output noise ( $30\mu V_{RMS}$ ) and high PSRR. An external noise bypass capacitor connected to the device's BP pin can further reduce the noise level.

Other features include a 110k $\Omega$  pull down resistor at EN pin, current limit and thermal shutdown protection.

The SGM2035C is available in Green UTDFN-1.6 $\times$ 1.6-6L and TDFN-2 $\times$ 2-6L packages. It operates over an ambient temperature range of -40°C to +85°C.

### FEATURES

- 500mA Guaranteed Output Current
- Ultra Low Dropout Voltage
- Low Output Noise
- Thermal-Overload Protection
- Output Current Limit
- High PSRR (73dB at 1kHz)
- 1.8V Logic-Controlled Shutdown
- 110k $\Omega$  Pull Down Resistor at EN Pin
- Fixed Output Voltages: 2.8V, 3.0V and 3.3V
- Adjustable Output from 1.2V to 5.0V
- -40°C to +85°C Operating Temperature Range
- Available in Green UTDFN-1.6 $\times$ 1.6-6L and TDFN-2 $\times$ 2-6L Packages

### APPLICATIONS

Cellular Telephones  
Cordless Telephones  
PCMCIA Cards  
Modems  
MP3 Player  
Hand-Held Instruments  
Palmtop Computers  
Electronic Planners  
Portable/Battery-Powered Equipment

## PACKAGE/ORDERING INFORMATION

| MODEL        | V <sub>OUT</sub> (V) | PIN-PACKAGE      | ORDERING NUMBER       | PACKAGE MARKING | PACKAGE OPTION      |
|--------------|----------------------|------------------|-----------------------|-----------------|---------------------|
| SGM2035C-3.3 | 3.3V                 | UTDFN-1.6×1.6-6L | SGM2035C-3.3YUDN6G/TR | HBX             | Tape and Reel, 3000 |
| SGM2035C-3.3 | 3.3V                 | TDFN-2×2-6L      | SGM2035C-3.3YTDI6G/TR | SHA<br>XXXX     | Tape and Reel, 3000 |
| SGM2035C-3.0 | 3.0V                 | UTDFN-1.6×1.6-6L | SGM2035C-3.0YUDN6G/TR | TEX             | Tape and Reel, 3000 |
| SGM2035C-2.8 | 2.8V                 | UTDFN-1.6×1.6-6L | SGM2035C-2.8YUDN6G/TR | S0X             | Tape and Reel, 3000 |
| SGM2035C-ADJ | ADJ                  | UTDFN-1.6×1.6-6L | SGM2035C-ADJYUDN6G/TR | M7X             | Tape and Reel, 3000 |

NOTE: X = Date Code, XXXX = Date Code.

## ABSOLUTE MAXIMUM RATINGS

IN to GND..... -0.3V to 6V  
 Output Short-Circuit Duration ..... Infinite  
 EN to GND..... -0.3V to (V<sub>IN</sub> + 0.3V)  
 OUT, BP/FB to GND..... -0.3V to (V<sub>IN</sub> + 0.3V)  
 Power Dissipation, P<sub>D</sub> @ T<sub>A</sub> = 25°C  
 TDFN-2×2-6L..... 0.91W  
 UTDFN-1.6×1.6-6L..... 0.88W  
 Package Thermal Resistance  
 TDFN-2×2-6L, θ<sub>JA</sub>..... 138°C/W  
 UTDFN-1.6×1.6-6L, θ<sub>JA</sub>..... 142°C/W  
 Operating Temperature Range..... -40°C to +85°C  
 Junction Temperature..... 150°C  
 Storage Temperature Range..... -65°C to +150°C  
 Lead Temperature (soldering, 10s)..... 260°C  
 ESD Susceptibility  
 HBM..... 4000V  
 MM..... 400V

## NOTE:

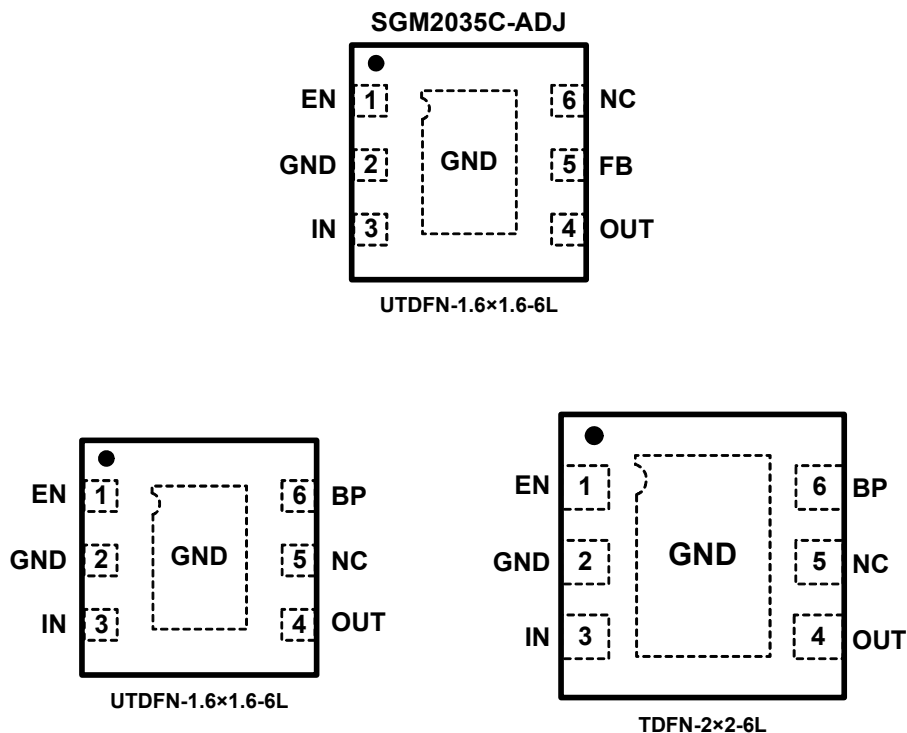
Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## CAUTION

This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. 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 very small parametric changes could cause the device not to meet its published specifications.

SGMICRO reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact SGMICRO sales office to get the latest datasheet.

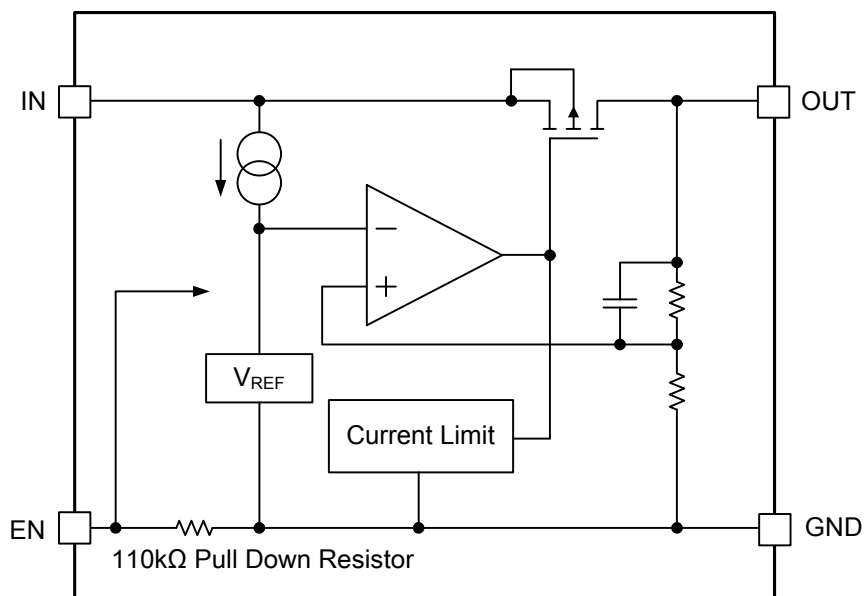
## PIN CONFIGURATIONS (TOP VIEW)



## PIN DESCRIPTION

| PIN         | NAME | FUNCTION                                                                                                                                 |
|-------------|------|------------------------------------------------------------------------------------------------------------------------------------------|
| 1           | EN   | Shutdown Input. A logic low reduces the supply current to 10nA. 110kΩ pull down resistor at EN pin.                                      |
| 2           | GND  | Ground.                                                                                                                                  |
| 3           | IN   | Regulator Input. Supply voltage can range from 2.5V to 5.5V. Bypass with a 1μF capacitor to GND.                                         |
| 4           | OUT  | Regulator Output.                                                                                                                        |
| 5           | NC   | No Connection (fixed voltage version only).                                                                                              |
|             | FB   | Feedback Pin (adjustable voltage version only). This is used to set the output voltage of the device.                                    |
| 6           | BP   | Reference-Noise Bypass (fixed voltage version only). Bypass with a low-leakage 0.01μF ceramic capacitor for reduced noise at the output. |
|             | NC   | No Connection (adjustable voltage version only).                                                                                         |
| Exposed Pad | GND  | Exposed pad should be soldered to PCB board and connected to GND.                                                                        |

## FUNCTION BLOCK DIAGRAM



## ELECTRICAL CHARACTERISTICS

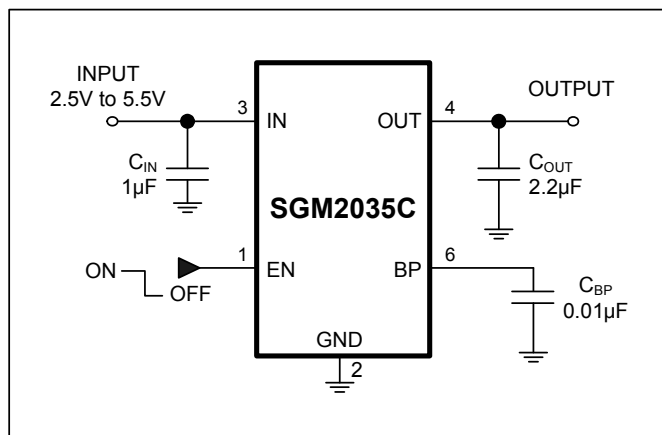
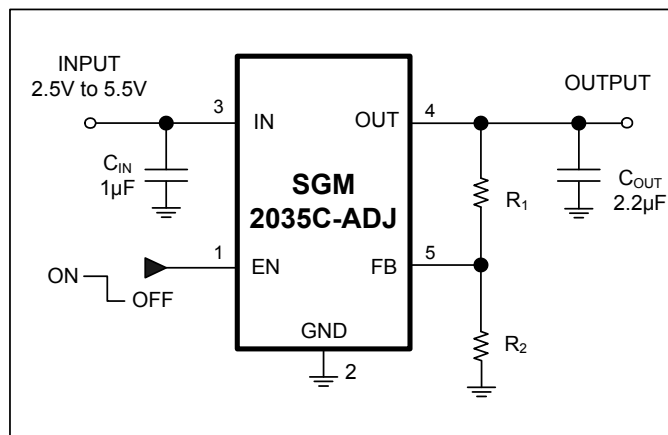
( $V_{IN} = V_{OUT(NOMINAL)} + 0.5V$  or  $2.5V$ , whichever is greater, Full =  $-40^{\circ}C$  to  $+85^{\circ}C$ , unless otherwise noted. For SGM2035C-ADJ,  $V_{OUT} = 3.3V$ .)

| PARAMETER                             | SYMBOL                                                  | CONDITIONS                                                                                                         |           | TEMP  | MIN | TYP    | MAX    | UNITS             |
|---------------------------------------|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-----------|-------|-----|--------|--------|-------------------|
| Input Voltage                         | V <sub>IN</sub>                                         |                                                                                                                    |           | +25°C | 2.5 |        | 5.5    | V                 |
| Output Voltage Accuracy               |                                                         | I <sub>OUT</sub> = 0.1mA                                                                                           |           | +25°C | -3  |        | +3     | %                 |
| Maximum Output Current <sup>(1)</sup> |                                                         |                                                                                                                    |           | +25°C | 500 |        |        | mA                |
| Current Limit                         | I <sub>LIM</sub>                                        |                                                                                                                    |           | +25°C | 510 |        |        | mA                |
| Ground Pin Current                    | I <sub>Q</sub>                                          | No Load, V <sub>EN</sub> = 2V                                                                                      |           | +25°C |     | 115    | 220    | µA                |
| Dropout Voltage <sup>(2)</sup>        |                                                         | I <sub>OUT</sub> = 100mA                                                                                           |           | +25°C |     | 50     | 90     | mV                |
|                                       |                                                         | I <sub>OUT</sub> = 300mA                                                                                           |           |       |     | 150    | 250    |                   |
|                                       |                                                         | I <sub>OUT</sub> = 500mA                                                                                           |           |       |     | 250    | 400    |                   |
| Line Regulation                       | $\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$   | V <sub>IN</sub> = 2.5V to 5.5V, I <sub>OUT</sub> = 1mA                                                             |           | +25°C |     | 0.02   | 0.095  | %/V               |
| Load Regulation                       | $\frac{\Delta V_{OUT}}{\Delta I_{LOAD} \times V_{OUT}}$ | I <sub>OUT</sub> = 0.1mA to 500mA, C <sub>OUT</sub> = 1µF                                                          |           | +25°C |     | 0.0025 | 0.0075 | %/mA              |
| Output Voltage Noise                  | e <sub>n</sub>                                          | f = 10Hz to 100kHz, C <sub>BP</sub> = 0.01µF, C <sub>OUT</sub> = 10µF                                              |           | +25°C |     | 30     |        | µV <sub>RMS</sub> |
| Power Supply Rejection Ratio          | PSRR                                                    | C <sub>BP</sub> = 0.1µF, I <sub>LOAD</sub> = 50mA, C <sub>OUT</sub> = 1µF, V <sub>IN</sub> = V <sub>OUT</sub> + 1V | f = 217Hz | +25°C |     | 77     |        | dB                |
|                                       |                                                         |                                                                                                                    | f = 1kHz  | +25°C |     | 73     |        | dB                |
| SHUTDOWN                              |                                                         |                                                                                                                    |           |       |     |        |        |                   |
| EN Input Threshold                    | V <sub>IH</sub>                                         | V <sub>IN</sub> = 2.5V to 5.5V                                                                                     |           | Full  | 1.5 |        |        | V                 |
|                                       | V <sub>IL</sub>                                         |                                                                                                                    |           | Full  |     |        | 0.3    |                   |
| Pull Down Resistor                    | R <sub>PULL DOWN</sub>                                  |                                                                                                                    |           | +25°C |     | 110    |        | kΩ                |
| Shutdown Supply Current               | I <sub>Q(SHDN)</sub>                                    | V <sub>EN</sub> = 0.3V                                                                                             |           | Full  |     | 0.01   |        | µA                |
| Shutdown Exit Delay <sup>(3)</sup>    |                                                         | C <sub>BP</sub> = 0.01µF, C <sub>OUT</sub> =1µF, No Load                                                           |           | +25°C |     | 30     |        | µs                |
| THERMAL PROTECTION                    |                                                         |                                                                                                                    |           |       |     |        |        |                   |
| Thermal Shutdown Temperature          | T <sub>SHDN</sub>                                       |                                                                                                                    |           |       |     | 150    |        | °C                |
| Thermal Shutdown Hysteresis           | ΔT <sub>SHDN</sub>                                      |                                                                                                                    |           |       |     | 15     |        | °C                |

## NOTES:

- Maximum output current is affected by PCB layout, size of metal trace, the thermal conduction path between metal layers and the environment of the system.
- The dropout voltage is defined as  $V_{IN} - V_{OUT}$ , when  $V_{OUT}$  is 100mV below the value of  $V_{OUT}$  for  $V_{IN} = V_{OUT} + 0.5V$ . (Only applicable for  $V_{OUT} = +2.5V$  to  $+5.0V$ .)
- Time needed for  $V_{OUT}$  to reach 90% of final value.

## TYPICAL APPLICATION CIRCUITS

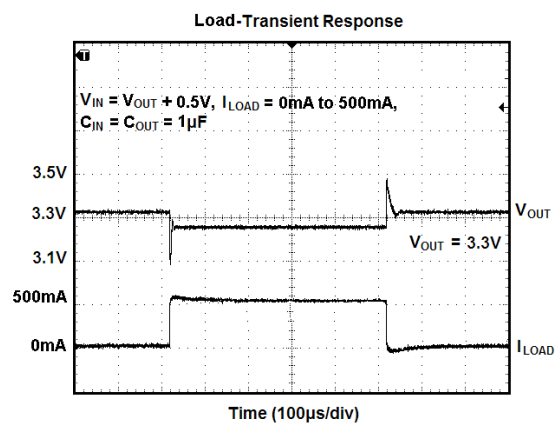
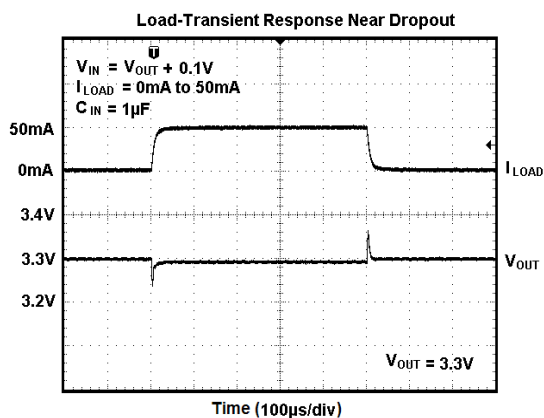
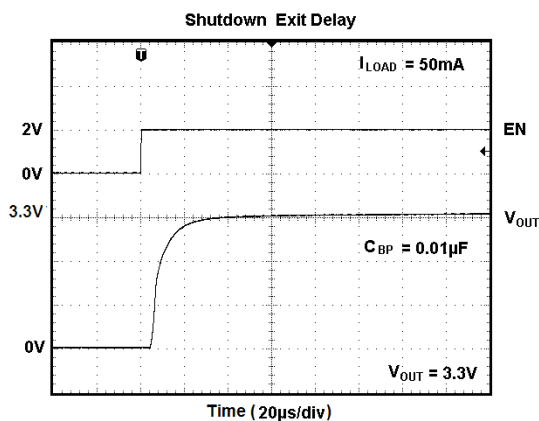
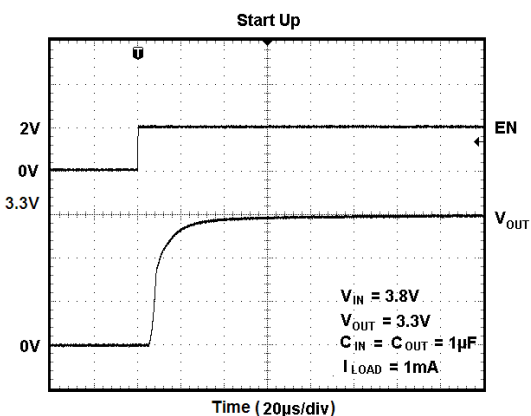
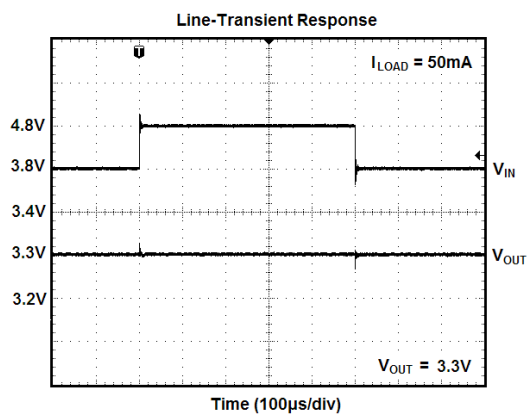
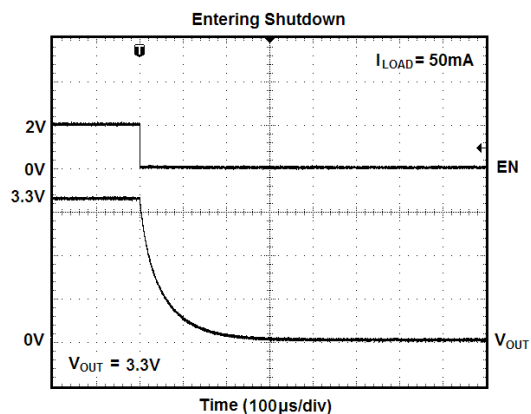


NOTE: Choose  $R_2 = 47\text{k}\Omega$  to maintain a  $26\mu\text{A}$  minimum load.  
Calculate the value for  $R_1$  using the following equation:

$$R_1 = R_2 \times \left( \frac{V_{\text{OUT}}}{1.206\text{V}} - 1 \right)$$

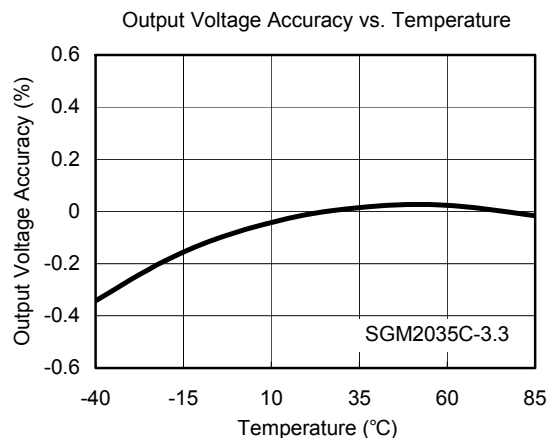
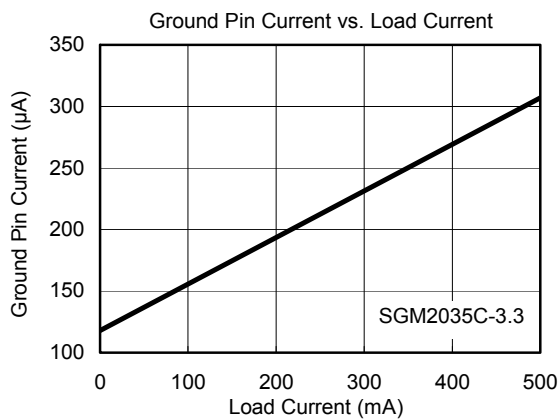
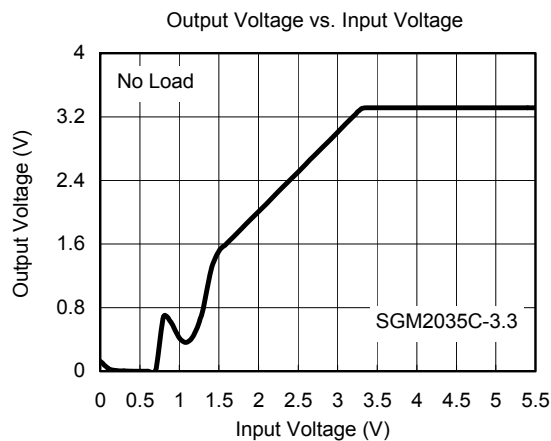
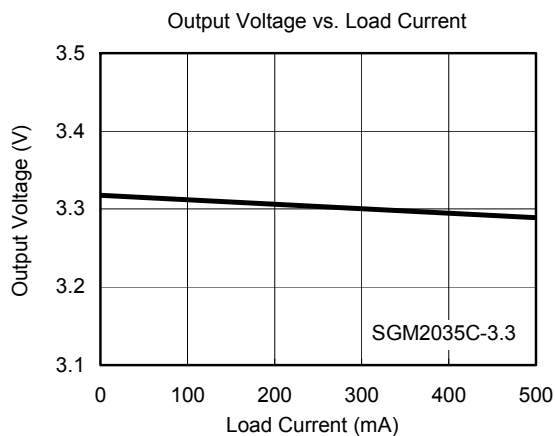
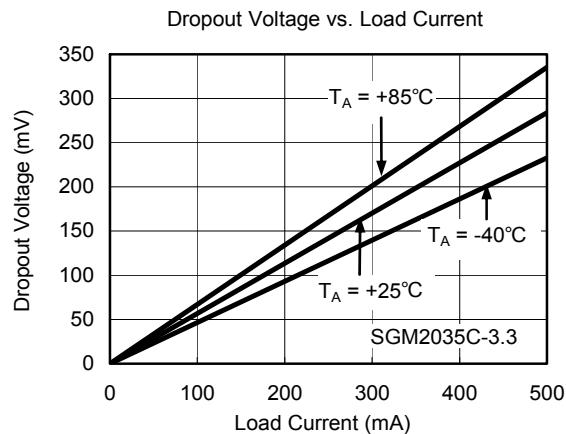
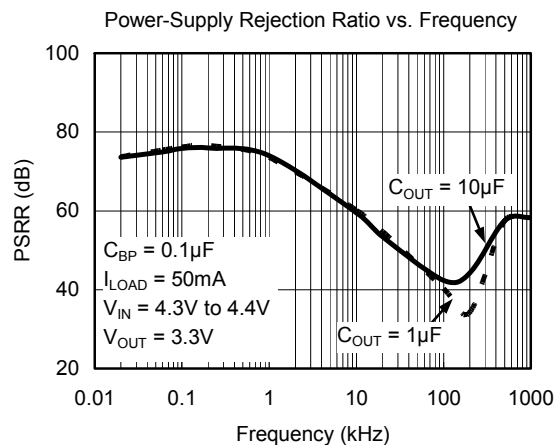
## TYPICAL PERFORMANCE CHARACTERISTICS

$V_{IN} = V_{OUT(NOMINAL)} + 0.5V$  or  $2.5V$  (whichever is greater),  $C_{IN} = 1\mu F$ ,  $C_{OUT} = 1\mu F$ ,  $C_{BP} = 0.01\mu F$ ,  $T_A = +25^\circ C$ , unless otherwise noted.



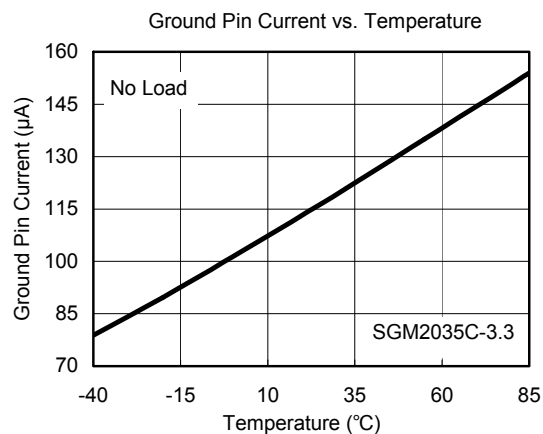
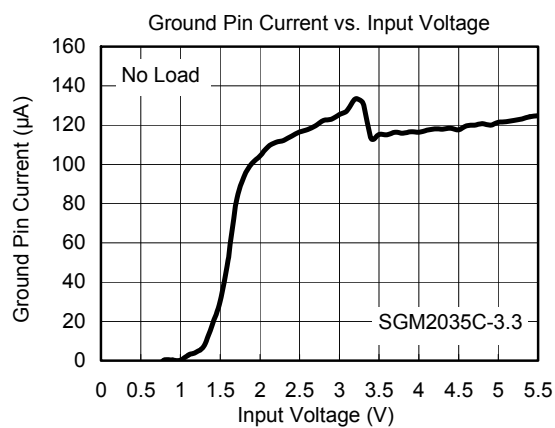
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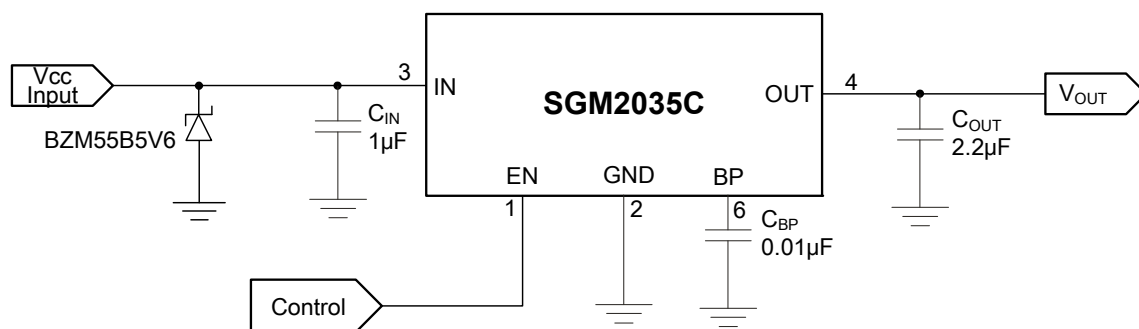
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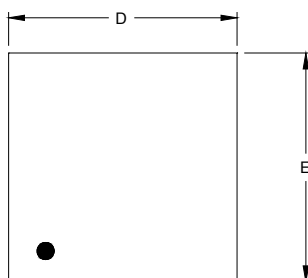
## APPLICATION NOTE

When LDO is used in handheld products, attention must be paid to voltage spikes which could damage SGM2035C. In such applications, voltage spikes will be generated at charger interface and  $V_{BUS}$  pin of USB interface when charger adapters and USB equipments are hot-plugged. Besides this, handheld products will be tested on the production line without battery. Test engineer will apply power from the connector pin which connects with positive pole of the battery. When external power supply is turned on suddenly, the voltage spikes will be generated at the battery connector. The voltage spikes will be very high, and it always exceeds the absolute maximum input voltage (6.0V) of LDO. In order to get robust design, design engineer needs to clear up this voltage spike. Zener diode is a cheap and effective solution to eliminate such voltage spike. For example, BZM55B5V6 is a 5.6V small package Zener diode which can be used to remove voltage spikes in cell phone designs. The schematic is shown below.

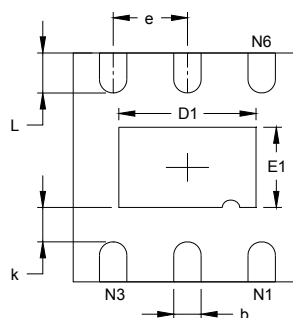


## PACKAGE OUTLINE DIMENSIONS

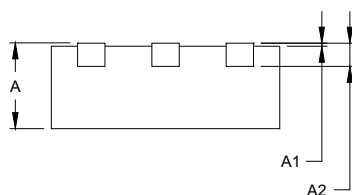
## TDFN-2×2-6L



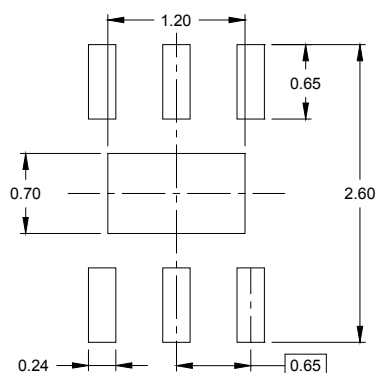
TOP VIEW



BOTTOM VIEW



SIDE VIEW



RECOMMENDED LAND PATTERN (Unit: mm)

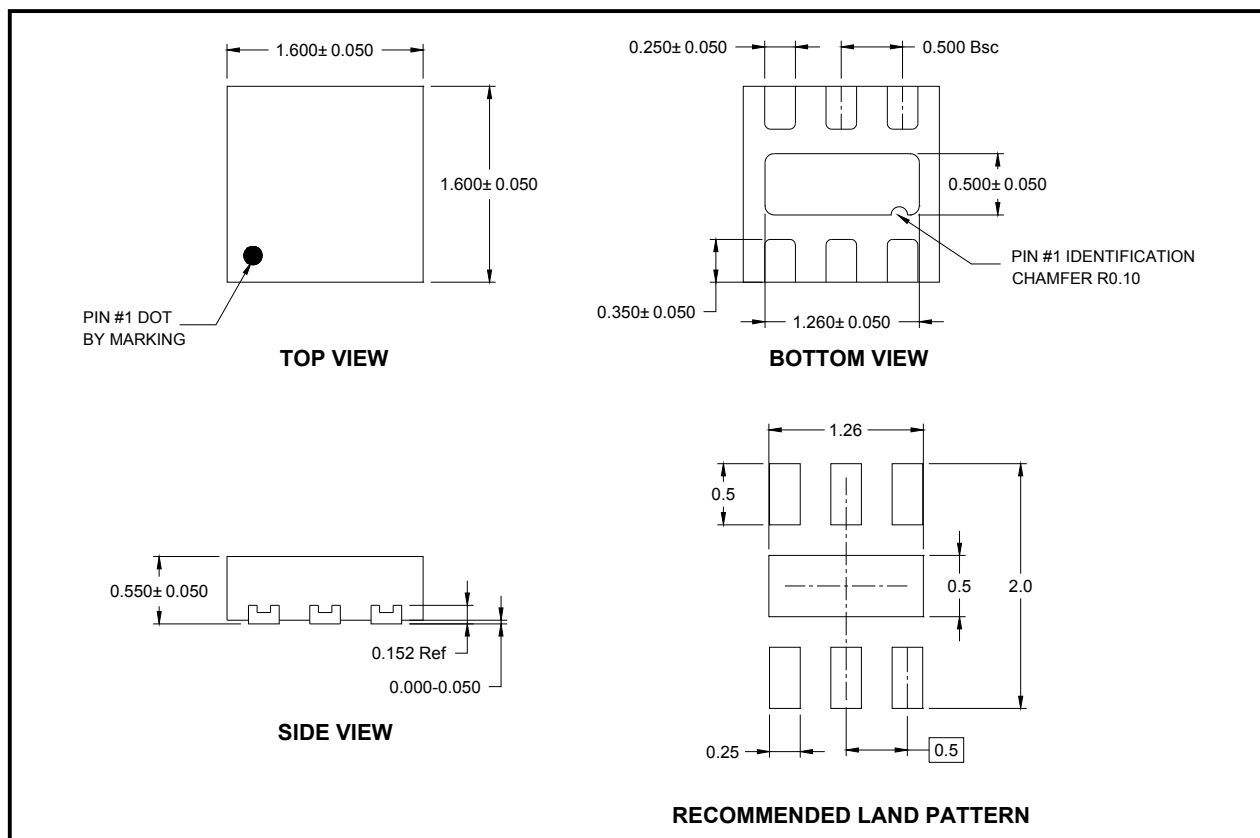
| Symbol | Dimensions<br>In Millimeters |       | Dimensions<br>In Inches |       |
|--------|------------------------------|-------|-------------------------|-------|
|        | MIN                          | MAX   | MIN                     | MAX   |
| A      | 0.700                        | 0.800 | 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     | 1.100                        | 1.300 | 0.043                   | 0.051 |
| E      | 1.900                        | 2.100 | 0.075                   | 0.083 |
| E1     | 0.600                        | 0.800 | 0.024                   | 0.031 |
| k      | 0.200 MIN                    |       | 0.008 MIN               |       |
| b      | 0.180                        | 0.300 | 0.007                   | 0.012 |
| e      | 0.650 TYP                    |       | 0.026 TYP               |       |
| L      | 0.250                        | 0.450 | 0.010                   | 0.018 |

SGM2035C

500mA, Ultra Low Dropout,  
Low Power, RF Linear Regulators

## PACKAGE OUTLINE DIMENSIONS

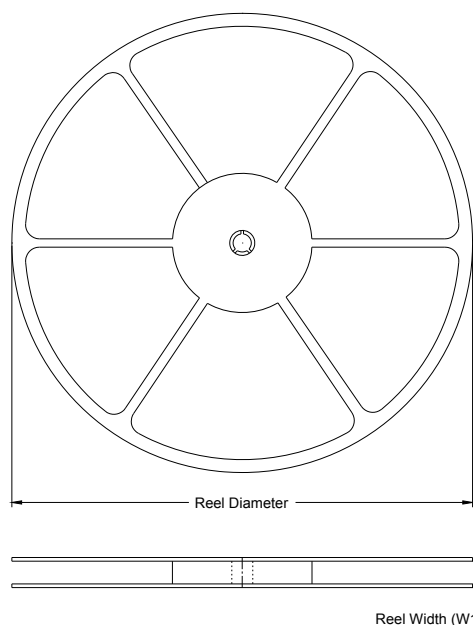
UTDFN-1.6×1.6-6L



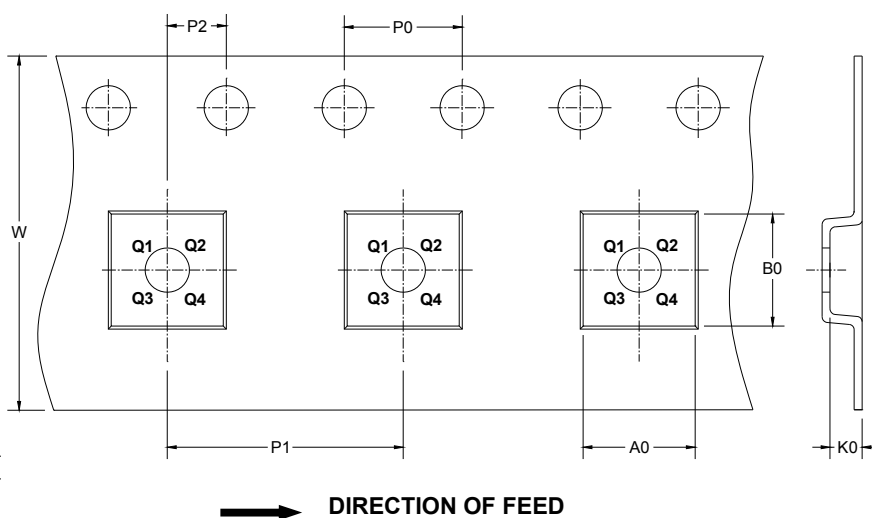
NOTE: All linear dimensions are in millimeters.

## TAPE AND REEL INFORMATION

## REEL DIMENSIONS



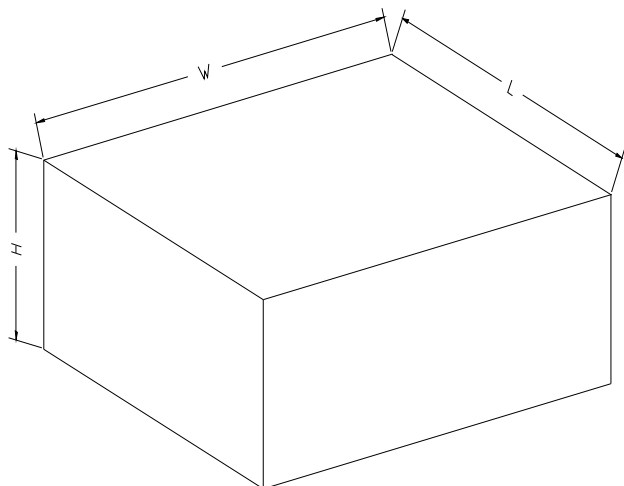
## TAPE DIMENSIONS



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 |
|------------------|---------------|--------------------|---------|---------|---------|---------|---------|---------|--------|---------------|
| UTDFN-1.6×1.6-6L | 7"            | 9.0                | 1.78    | 1.78    | 0.69    | 4.00    | 4.00    | 2.00    | 8.00   | Q1            |
| TDFN-2×2-6L      | 7"            | 9.5                | 2.30    | 2.30    | 1.10    | 4.00    | 4.00    | 2.00    | 8.00   | Q1            |

**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<br>(mm) | Width<br>(mm) | Height<br>(mm) | Pizza/Carton |
|-------------|----------------|---------------|----------------|--------------|
| 7" (Option) | 368            | 227           | 224            | 8            |
| 7"          | 442            | 410           | 224            | 18           |