# SGM2005

# Low Power, Low Dropout, 150mA, RF - Linear Regulators

## GENERAL DESCRIPTION

The SGM2005 series low-power, low-noise, low-dropout, CMOS linear voltage regulators operate from a 2.5V to 5.5V input and deliver up to 150mA. They are the perfect choice for low voltage, low power applications. An ultra low ground current ( 150μA at 150mA output ) makes these parts attractive for battery operated power systems. The SGM2005 series also offer ultra low dropout voltage (150mV at 150mA output) to prolong battery life in portable electronics. Systems requiring a quiet voltage source, such as RF applications, will benefit from the SGM2005 series' ultra low output noise (30μVRMS) and high PSRR. An external noise bypass capacitor connected to the device's BP pin can further reduce the noise level.

The output voltage is preset to voltages in the range of 1.5V to 5.0V. Other features include a 10nA logic-controlled shutdown mode, foldback current limit and thermal shut-down protection.

Devices come in 6-pin DFN-6 package.

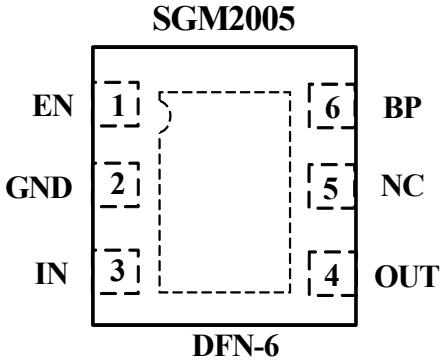
## APPLICATIONS

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

## FEATURES

- **Low Output Noise: 30μVRMS typ(10Hz to 100KHz)**
- **Ultra-Low Dropout Voltage:**
  **150mV at 150mA output**
- **Low 77μA No-Load Supply Current**
- **Low 150μA Operating Supply Current**
  **at 150mA Output**
- **High PSRR: 73dB at 1KHz**
- **Thermal-Overload Protection**
- **Output Current Limit**
- **Preset Output Voltages (±2.7% Accuracy)**
- **10nA Logic-Controlled Shutdown**
- **Available in Multiple Output Voltage Versions**
  **Fixed Outputs of 1.8V, 2.5V, 2.8V, 3.0V and 3.3V**

## PIN CONFIGURATIONS (TOP VIEW)




NC = NO CONNECT



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## ORDERING INFORMATION

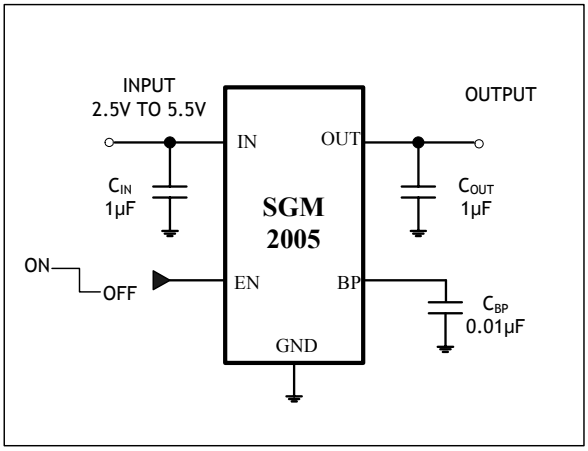
| MODEL | $V_{OUT}$(V) | PIN-PACKAGE | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKAGE OPTION |
|---|---|---|---|---|---|---|
| SGM2005-1.8 | 1.8V | DFN-6 | - 40°C to +85°C | SGM2005-1.8YD6/TR | Y518 | Tape and Reel, 3000 |
| SGM2005-2.5 | 2.5V | DFN-6 | - 40°C to +85°C | SGM2005-2.5YD6/TR | Y525 | Tape and Reel, 3000 |
| SGM2005-2.8 | 2.8V | DFN-6 | - 40°C to +85°C | SGM2005-2.8YD6/TR | Y528 | Tape and Reel, 3000 |
| SGM2005-3.0 | 3.0V | DFN-6 | - 40°C to +85°C | SGM2005-3.0YD6/TR | Y530 | Tape and Reel, 3000 |
| SGM2005-3.3 | 3.3V | DFN-6 | - 40°C to +85°C | SGM2005-3.3YD6/TR | Y533 | Tape and Reel, 3000 |

## ABSOLUTE MAXIMUM RATINGS

IN to GND.....- 0.3V to +6V
Output Short-Circuit Duration .....Infinite
EN to GND.....- 0.3V to +6V
OUT, BP to GND.....- 0.3V to ($V_{IN}$ + 0.3V)
Power Dissipation, PD @ $T_A$ = 25° C
DFN-6 ..... 300mW
Package Thermal Resistance
DFN-6, $\theta_{JA}$ .....200℃/W
Operating Temperature Range.....- 40°C to +85°C
Junction Temperature.....+150°C
Storage Temperature.....- 65°C to +150°C
Lead Temperature (soldering, 10s).....+260°C
ESD Rating.....4 kV

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.

## TYPICAL OPERATION CIRCUIT



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# ELECTRICAL CHARACTERISTICS

($V_{IN}$ = $V_{OUT\ (NOMINAL)}$ + 0.5V [1], $T_A$ = - 40°C to +85°C, unless otherwise noted. Typical values are at $T_A$ = + 25°C.)

| PARAMETER | SYMBOL | CONDITIONS | | MIN | TYP | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| Input Voltage | $V_{IN}$ | | | 2.5 | | 5.5 | V |
| Output Voltage Accuracy(1) | | $I_{OUT}$ =1mA to150mA, $T_A$ = +25°C<br>$V_{OUT}$ + 0.5V≤$V_{IN}$≤ 5.5V | | -2.7 | | +2.7 | % |
| Maximum Output Current | | | | 150 | | | mA |
| Current Limit | $I_{LIM}$ | | | 160 | 600 | | mA |
| Ground Pin Current | $I_Q$ | No load, EN = 2V | | | 77 | 145 | μA |
| | | $I_{OUT}$ = 150mA, EN = 2V | | | 150 | | |
| Dropout Voltage (2) | | $I_{OUT}$ = 1mA | | | 1 | | mV |
| | | $I_{OUT}$ = 150mA | | | 150 | 190 | |
| Line Regulation(1) | $\Delta V_{LNR}$ | $V_{IN}$ = 2.5V or ($V_{OUT}$ + 0.5V) to 5.5V,<br>$I_{OUT}$ = 1mA | | | 0.03 | 0.15 | %/V |
| Load Regulation | $\Delta V_{LDR}$ | $I_{OUT}$ = 0.1mA to 150mA, $C_{OUT}$ = 1μF | | | 0.0008 | 0.002 | %/mA |
| Output Voltage Noise | $e_n$ | f = 10Hz to 100KHz, $C_{BP}$ = 0.01μF,<br>$C_{OUT}$ = 10μF | | | 30 | | μVRMS |
| Power Supply Rejection Rate | PSRR | $C_{BP}$ = 0.1μF, $I_{LOAD}$ = 50mA, | f = 100Hz, | | 78 | | dB |
| | | $C_{OUT}$ = 1μF | f = 1KHz, | | 73 | | dB |
| **SHUTDOWN** | | | | | | | |
| EN Input Threshold | $V_{IH}$ | $V_{IN}$ = 2.5V to 5.5V | | 2.0 | | | V |
| | $V_{IL}$ | | | | | 0.4 | |
| EN Input Bias Current | $I_{B(SHDN)}$ | EN = 0V and EN = 5.5V | $T_A$ = +25°C | | 0.01 | 1 | μA |
| | | | $T_A$ = +85°C | | 0.01 | | |
| Shutdown Supply Current | $I_{Q(SHDN)}$ | EN = 0.4V | $T_A$ = +25°C | | 0.01 | 1 | μA |
| | | | $T_A$ = +85°C | | 0.01 | | |
| Shutdown Exit Delay(3) | | $C_{BP}$ = 0.01μF<br>$C_{OUT}$ = 1μF, No load | $T_A$ = +25°C | | 30 | | μs |
| **THERMAL PROTECTION** | | | | | | | |
| Thermal Shutdown Temperature | $T_{SHDN}$ | | | | 160 | | ℃ |
| Thermal Shutdown Hysteresis | $\Delta T_{SHDN}$ | | | | 15 | | ℃ |

Specifications subject to change without notice.

**Note 1:** $V_{IN}$ = $V_{OUT(NOMINAL)}$ + 0.5V or 2.5V, whichever is greater.
**Note 2:** 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 +3.3V.)
**Note 3:** Time needed for VOUT to reach 95% of final value.



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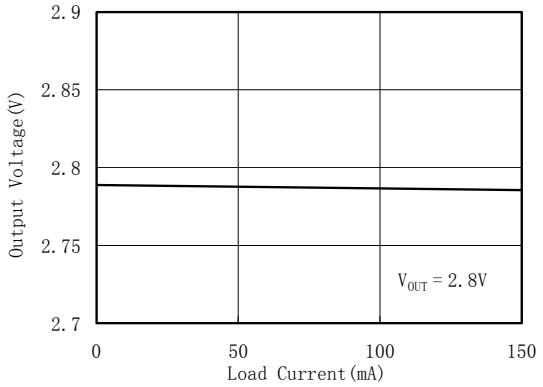
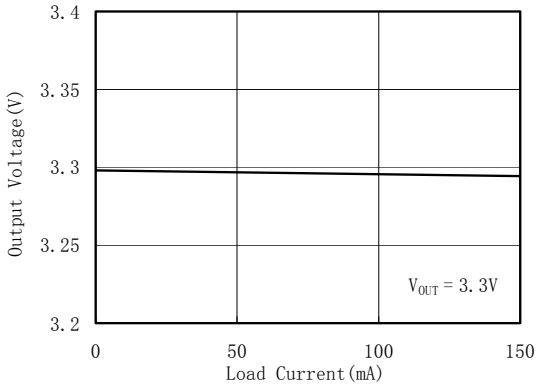
# TYPICAL OPERATING CHARACTERISTICS

$V_{IN}$ = $V_{OUT(NOMINAL)}$ + 0.5V or 2.5V (whichever is greater), $C_{IN}$ = 1μF, $C_{OUT}$ = 1μF, $C_{BP}$ = 0.01μF, $T_A$ = +25℃, unless otherwise noted.

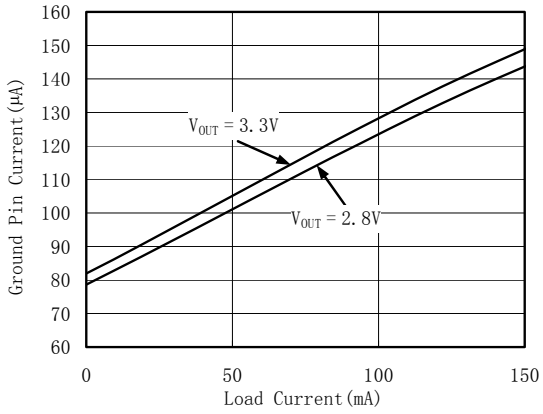
Output Voltage vs. Load Current



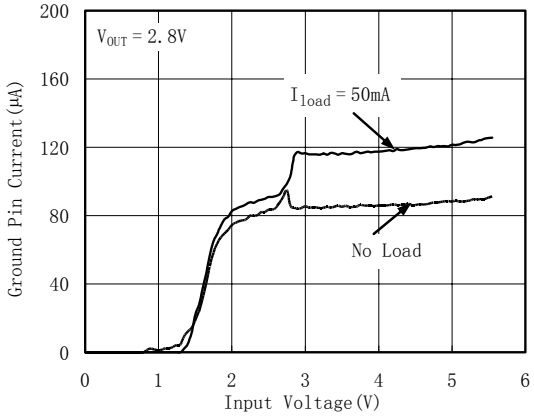

Output Voltage vs. Load Current



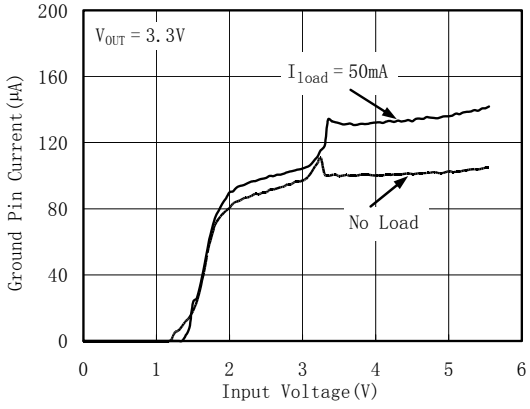

Ground Pin Current vs. Load Current



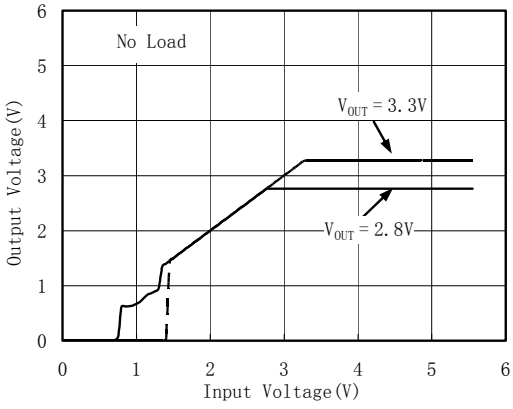

Ground Pin Current vs. Input Voltage




Ground Pin Current vs. Input Voltage




Output Voltage vs. Input Voltage



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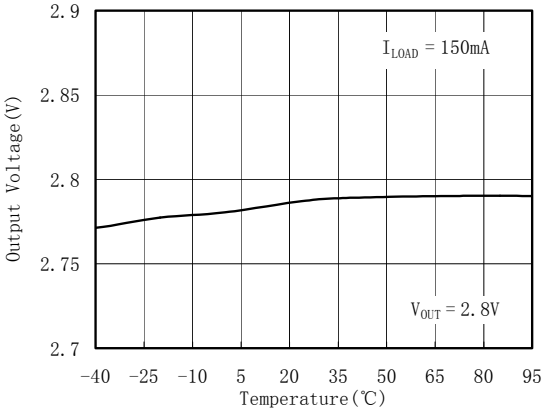
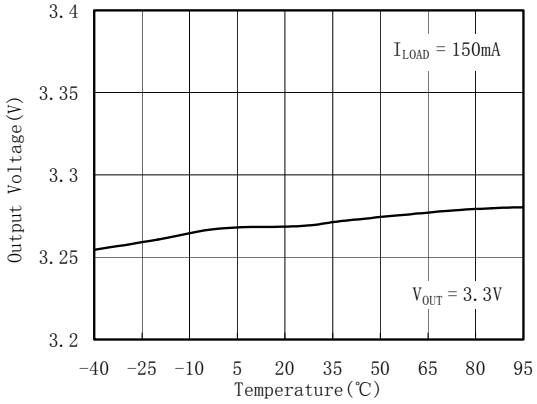
# TYPICAL OPERATING CHARACTERISTICS

$V_{IN}$ = $V_{OUT(NOMINAL)}$ + 0.5V or 2.5V (whichever is greater), $C_{IN}$ = 1μF, $C_{OUT}$ = 1μF, $C_{BP}$ = 0.01μF, $T_A$ = +25℃, unless otherwise noted.

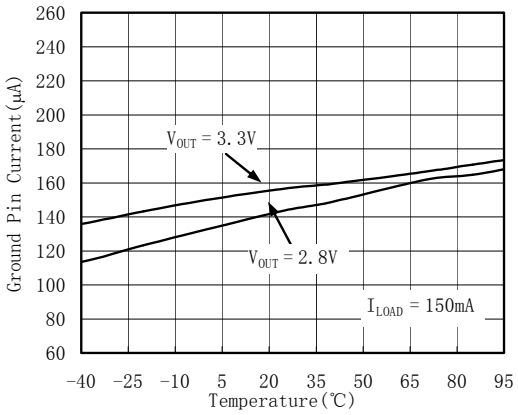
Output Voltage vs. Temperature



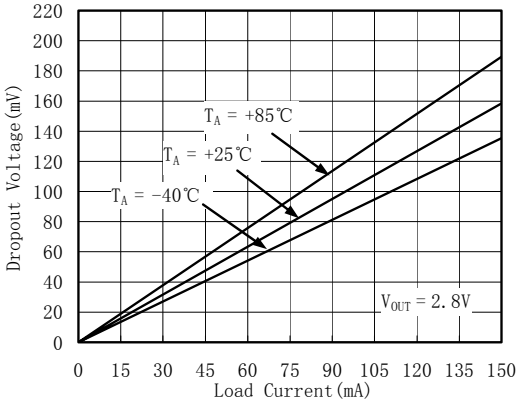

Output Voltage vs. Temperature



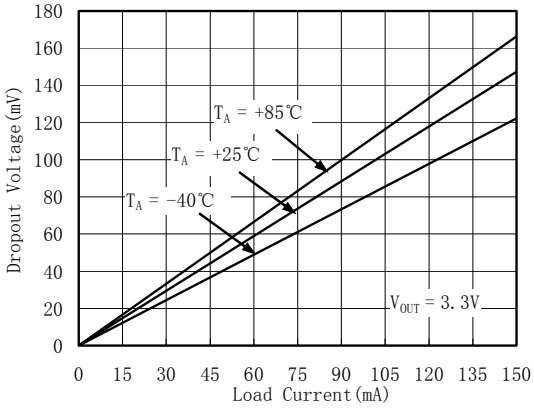

Ground Pin Current vs. Temperature



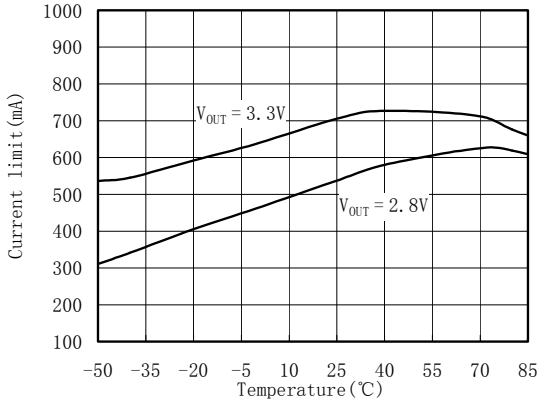

Dropout Voltage vs. Load Current




Dropout Voltage vs. Load Current




Current limit vs. Temperature



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# TYPICAL OPERATING CHARACTERISTICS

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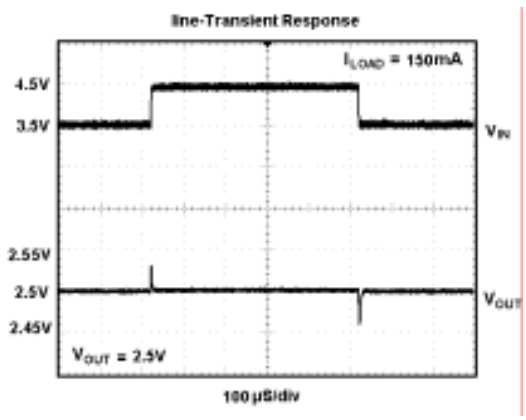


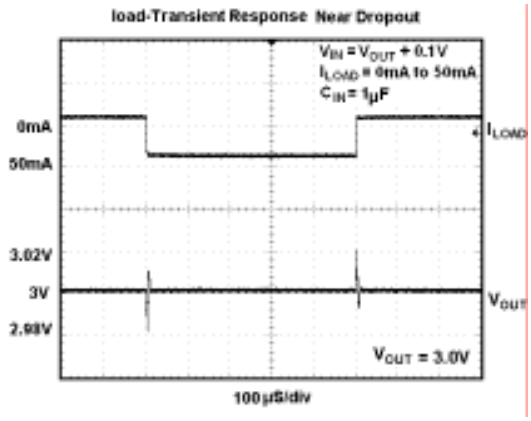


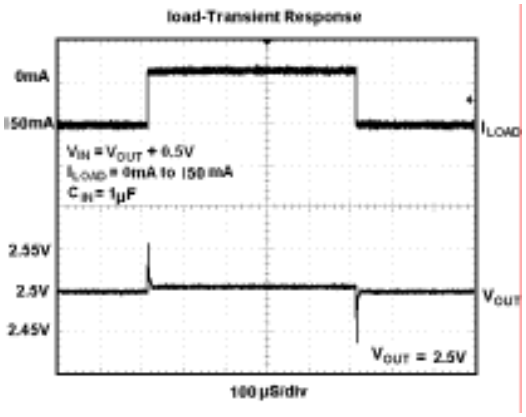


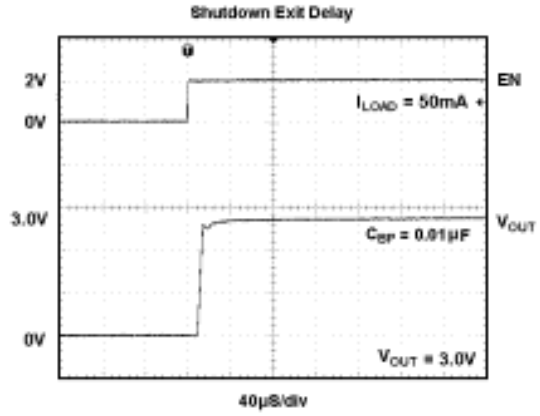


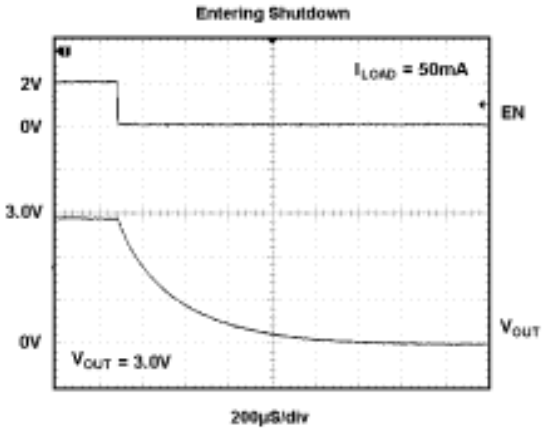


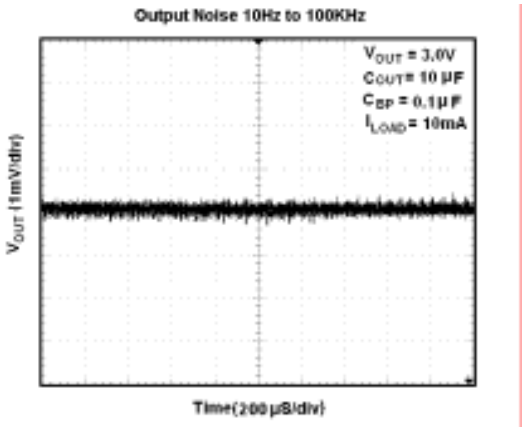




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# TYPICAL OPERATING CHARACTERISTICS

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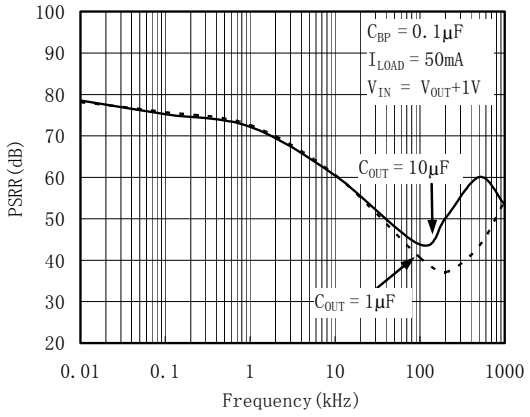
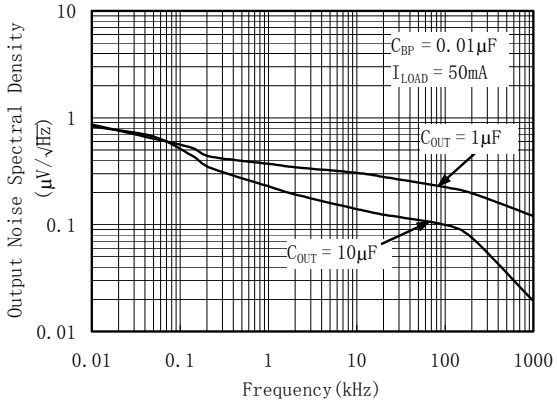
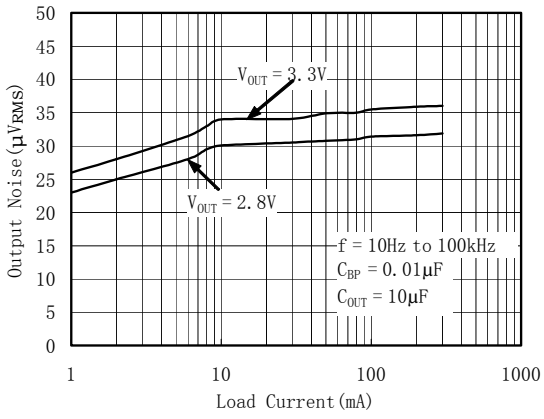
Power-Supply Rejection Ratio
vs. Frequency

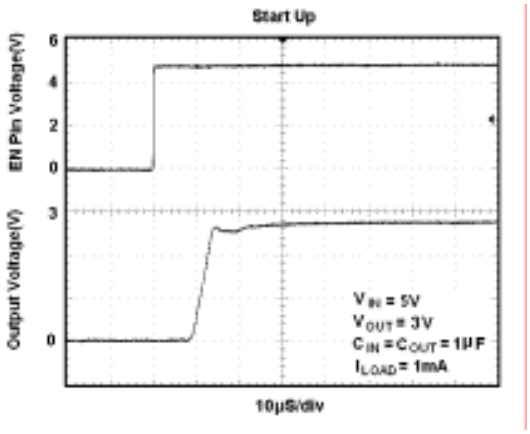



Output Noise Spectral Density
vs. Frequency




Output Noise vs. Load Current



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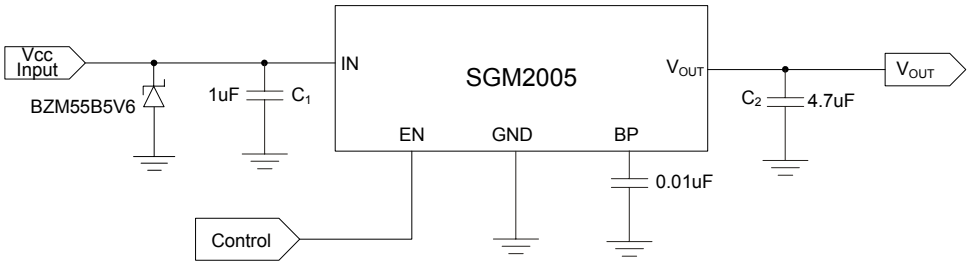
# Application Notes

When LDO is used in handheld products, Attention must be paid to voltage spike which would damage SGM2005. In such applications, voltage spike will be generated at changer interface and $V_{BUS}$ pin of USB interface when changer adapters and USB equipments are hot-inserted. Besides this, handheld products will be tested on the production line on the condition of no 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 spike will be generated at the battery connector. The voltage spike will be very high, 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 spike in cell phone design. The schematic is shown in below:



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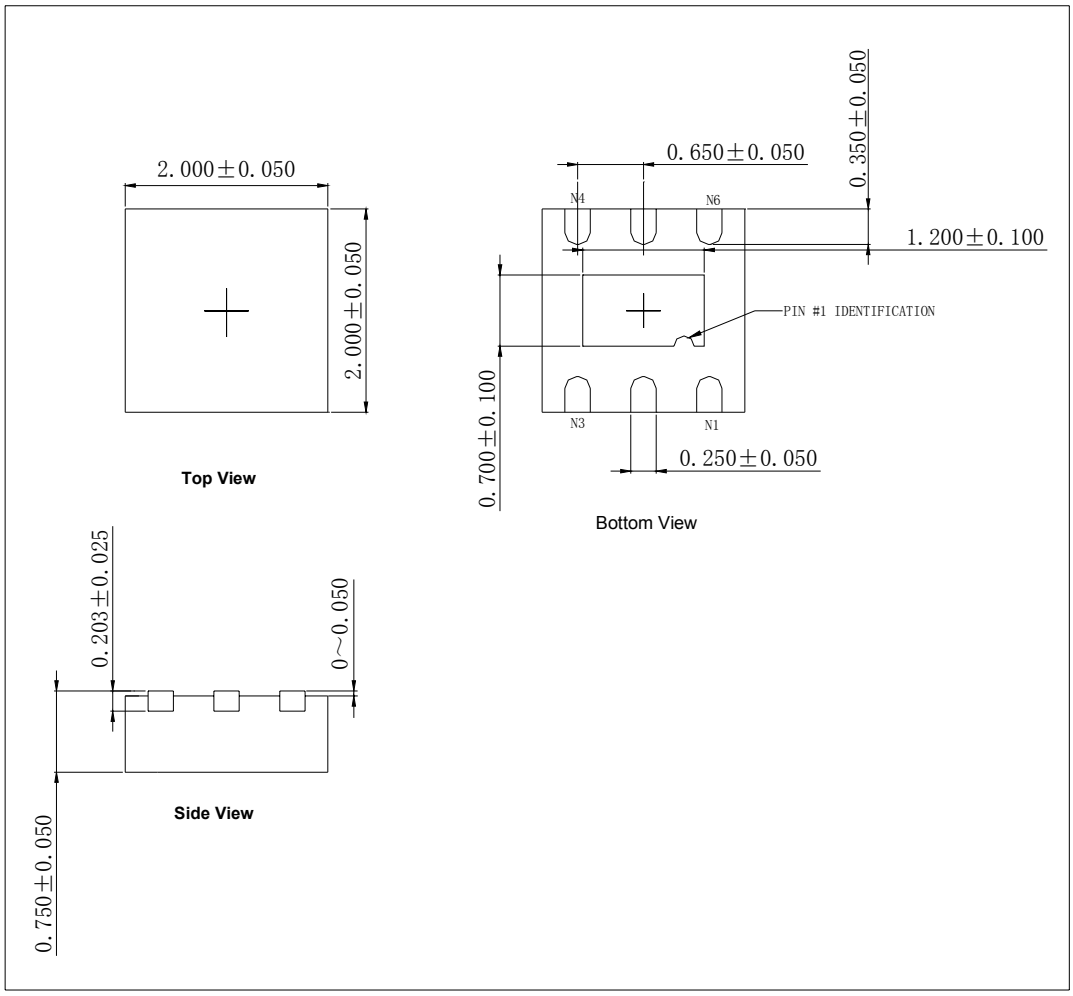
# PACKAGE OUTLINE DIMENSIONS

## DFN-6




**NOTES:**

1. All dimensions are in millimeters.



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## REVISION HISTORY

| Location | Page |
|---|---|

**03/07— Data Sheet changed from REV. A to REV. B**

Changed to TYPICAL OPERATING CHARACTERISTICS . . . . . 6


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