SGM2007/A
Low Power, Low Dropout, 300mA, RF - Linear Regulators

GENERAL DESCRIPTION

The SGM2007/A series low-power, low-noise, low-dropout, CMOS linear voltage regulators operate from a 2.5V to 5.5V input and deliver up to 300mA. They are the perfect choice for low voltage, low power applications. An ultra low ground current (200μA at 300mA output) makes these part attractive for battery operated power systems. The SGM2007/A series also offer ultra low dropout voltage (300mV at 300mA output) to prolong battery life in portable electronics. Systems requiring a quiet voltage source, such as RF applications, will benefit from the SGM2007/A series' 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. The SGM2007 also works with low-ESR ceramic capacitors, reducing the amount of board space necessary for power applications, critical in hand-held wireless devices.

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 5-pin SOT23 package.

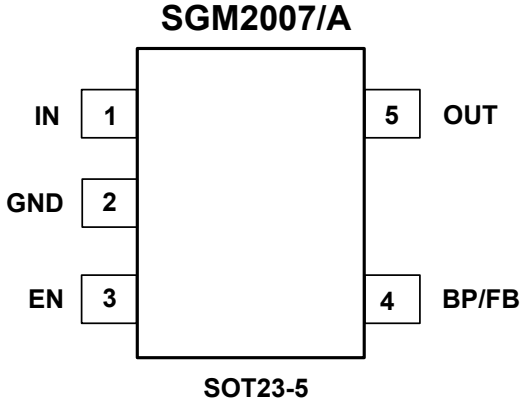
APPLICATIONS

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

FEATURES

- **Low Output Noise: $30\mu V_{RMS}$TYP (10Hz to 100kHz)**
- **Ultra-Low Dropout Voltage:**
  300mV at 300mA Output
- **Low 77μA No-Load Supply Current**
- **Low 200μA Operating Supply Current**
  at 300mA Output
- **High PSRR (73dB at 1kHz)**
- **Thermal-Overload Protection**
- **Output Current Limit**
- **10nA Logic-Controlled Shutdown**
- **Available in Multiple Output Voltage Versions**
  Fixed Outputs of 1.8V, 2.5V, 2.7V, 2.8V, 2.85V, 2.9V, 3.0V, 3.3V and 3.6V
  Adjustable Output from 1.233V to 5.0V

PIN CONFIGURATION (TOP VIEW)



PACKAGE/ORDERING INFORMATION

MODEL	V_{OUT}(V)	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM2007-1.8	1.8V	SOT23-5	- 40℃ to +125℃	SGM2007-1.8XN5/TR	X718	Tape and Reel, 3000
SGM2007-2.5	2.5V	SOT23-5	- 40℃ to +125℃	SGM2007-2.5XN5/TR	X725	Tape and Reel, 3000
SGM2007-2.7	2. 7V	SOT23-5	- 40℃ to +125℃	SGM2007-2. 7XN5/TR	X727	Tape and Reel, 3000
SGM2007-2.8	2.8V	SOT23-5	- 40℃ to +125℃	SGM2007-2.8XN5/TR	X728	Tape and Reel, 3000
SGM2007-2.85	2.85V	SOT23-5	- 40℃ to +125℃	SGM2007-2.85XN5/TR	X72J	Tape and Reel, 3000
SGM2007-2.9	2.9V	SOT23-5	- 40℃ to +125℃	SGM2007-2.9XN5/TR	X729	Tape and Reel, 3000
SGM2007-3.0	3.0V	SOT23-5	- 40℃ to +125℃	SGM2007-3.0XN5/TR	X730	Tape and Reel, 3000
SGM2007-3.3	3.3V	SOT23-5	- 40℃ to +125℃	SGM2007-3.3XN5/TR	X733	Tape and Reel, 3000
SGM2007-3.6	3.6V	SOT23-5	- 40℃ to +125℃	SGM2007-3.6XN5/TR	X736	Tape and Reel, 3000
SGM2007A	adjustable	SOT23-5	- 40℃ to +125℃	SGM2007-XN5/TR	X7AA	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 V_{IN}

OUT, BP/FB to GND.....- 0.3V to (V_{IN} + 0.3V)

Power Dissipation, P_D @ T_A = 25℃

SOT23-5 .....0.4W

Package Thermal Resistance

SOT23-5, θ_{JA}..... 250℃/W

Operating Temperature Range.....- 40℃ to +125℃

Junction Temperature.....150℃

Storage Temperature.....- 65℃ to +150℃

Lead Temperature (soldering, 10s).....260℃

ESD Susceptibility

HBM.....4000V

MM.....400V

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.

PIN DESCRIPTION

PIN	NAME	FUNCTION
1	IN	Regulator Input. Supply voltage can range from 2.5V to 5.5V. Bypass with a 1μF capacitor to GND.
2	GND	Ground.
3	EN	Shutdown Input. A logic low reduces the supply current to 10nA. Connect to IN for normal operation.
4	BP	Reference-Noise Bypass (fixed voltage version only). Bypass with a low-leakage 0.01μF ceramic capacitor for reduced noise at the output.
4	FB	Adjustable voltage version only—this is used to set the output voltage of the device.
5	OUT	Regulator Output.

ELECTRICAL CHARACTERISTICS

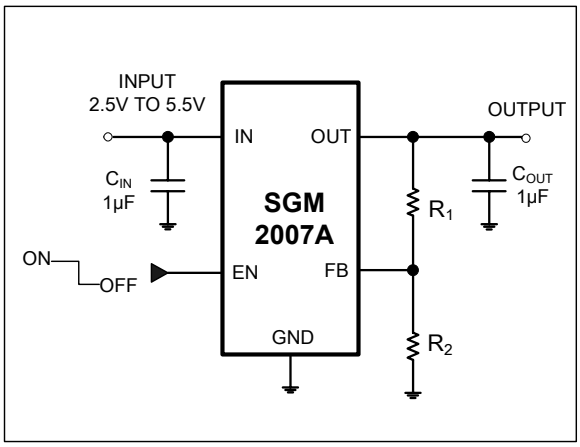
(V_{IN} = $V_{OUT\ (NOMINAL)}$ + 0.5V [1], T_A = - 40℃ to +125℃. Typical values are at T_A = + 25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Input Voltage	V_{IN}			2.5		5.5	V
Output Voltage Accuracy [1]		I_{OUT} =1mA to 300mA, T_A = +25℃ V_{OUT} + 0.5V ≤ V_{IN} ≤ 5.5V		-3		+3	%
Maximum Output Current				300			mA
Current Limit	I_{LIM}			310	750		mA
Ground Pin Current	I_Q	No load, EN = 2V			77	145	μA
		I_{OUT} = 300mA, EN = 2V			200		
Dropout Voltage [2]		I_{OUT} = 1mA			0.8		mV
		I_{OUT} = 300mA			300	380	
Line Regulation [1]	ΔV_{LNR}	V_{IN} = 2.5V or (V_{OUT} + 0.5V) to 5.5V, I_{OUT} = 1mA			0.03	0.15	%/V
Load Regulation	ΔV_{LDR}	I_{OUT} = 0.1mA to 300mA, C_{OUT} = 1μF			0.0008	0.002	%/mA
Output Voltage Noise	e_n	f = 10Hz to 100kHz, C_{BP} = 0.01μF, C_{OUT} = 10μF			30		μV_{RMS}
Power Supply Rejection Rate	PSRR	C_{BP} = 0.1μF, I_{LOAD} = 50mA, C_{OUT} = 1μF	f = 100Hz		78		dB
			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℃		0.01	1	μA
			T_A = +125℃		0.01		
Shutdown Supply Current	$I_{Q(SHDN)}$	EN = 0.4V	T_A = +25℃		0.01	1	μA
			T_A = +125℃		0.01		
Shutdown Exit Delay [3]		C_{BP} = 0.01μF C_{OUT} = 1μF, No load	T_A = +25℃		30		μs
THERMAL PROTECTION							
Thermal Shutdown Temperature	T_{SHDN}				160		℃
Thermal Shutdown Hysteresis	ΔT_{SHDN}				15		℃

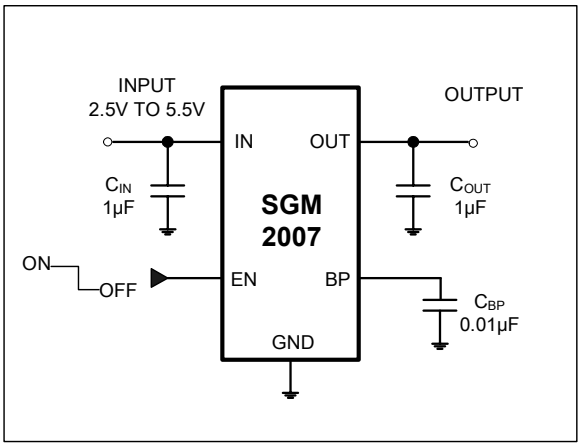
Specifications subject to change without notice.

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 +5.0V.)
Note 3: Time needed for V_{OUT} to reach 95% of final value.

TYPICAL OPERATION CIRCUIT



Adjustable Voltage Version



Fixed Voltage Version

Standard 1% Resistor Values for Common Output Voltages of Adjustable Voltage Version

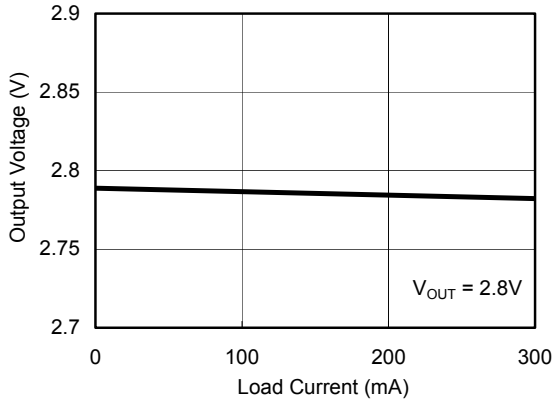
V_{OUT} (V)	R_1 (kΩ)	R_2 (kΩ)
1.5	13	61.9
1.8	28	61.9
2.5	63.4	61.9
2.7	56	47
2.8	78.7	61.9
2.85	80.6	61.9
2.9	75	56
3.0	88.7	61.9
3.3	95.3	57.6
3.6	130	68

Note: $V_{OUT} = (R_1 + R_2)/ R_2 \times 1.233$

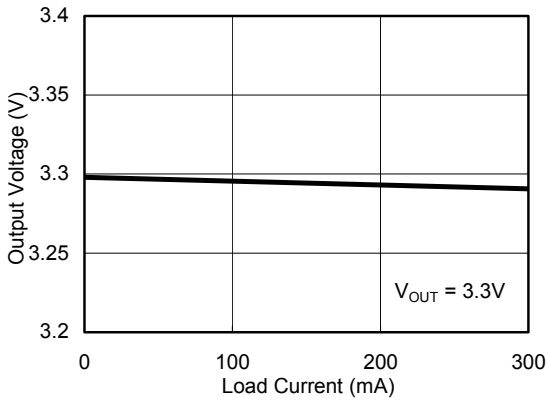
TYPICAL OPERATING CHARACTERISTICS

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.

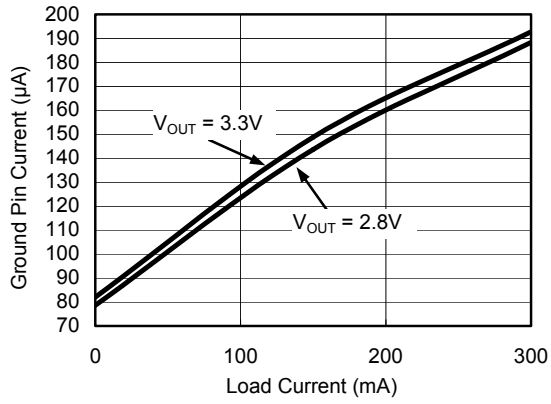
Output Voltage vs. Load Current



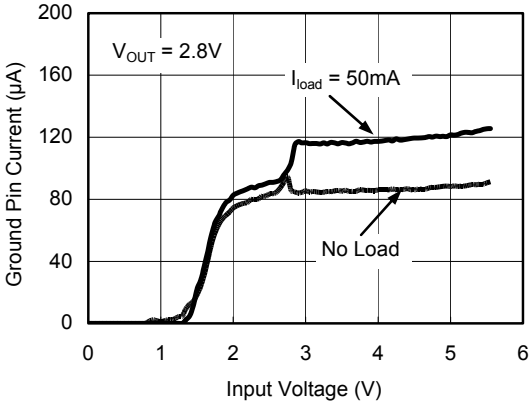
Output Voltage vs. Load Current



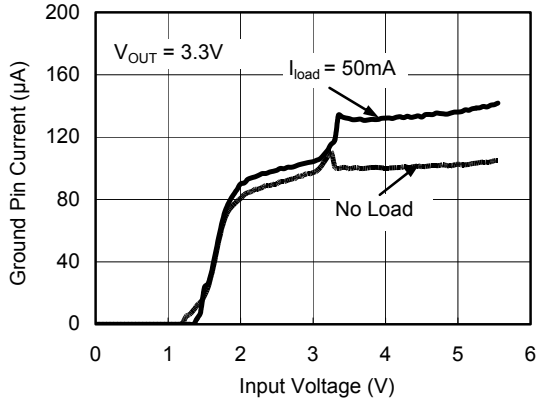
Ground Pin Current vs. Load Current



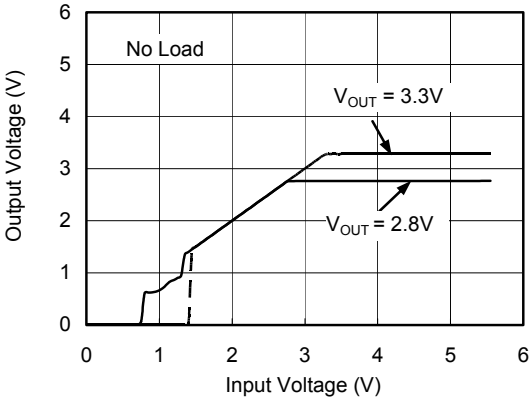
Ground Pin Current vs. Input Voltage



Ground Pin Current vs. Input Voltage



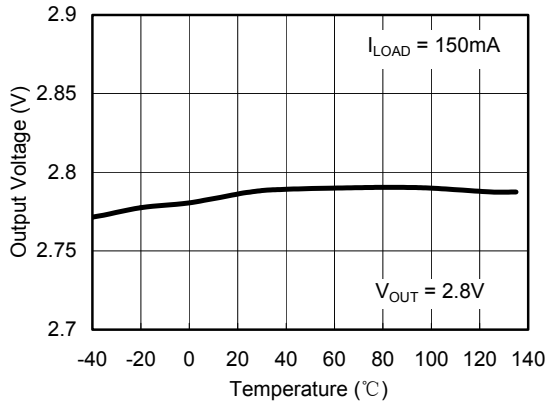
Output Voltage vs. Input Voltage



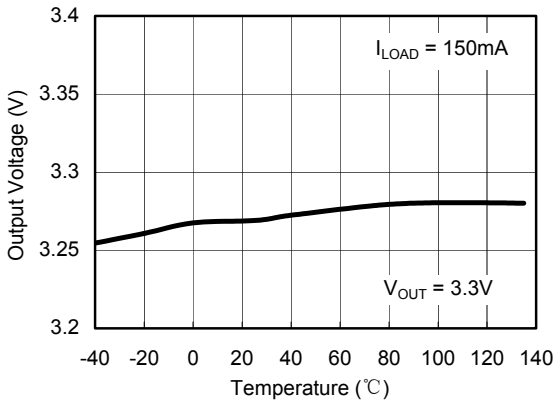
TYPICAL OPERATING CHARACTERISTICS

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.

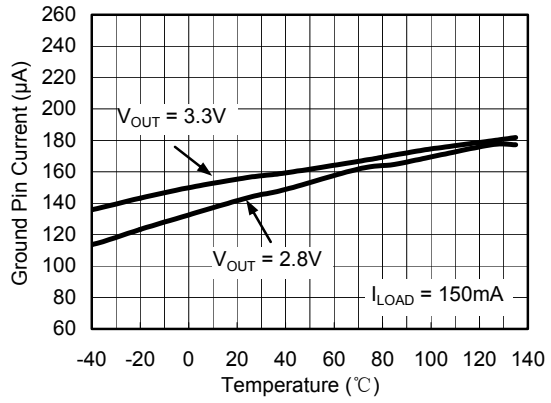
Output Voltage vs. Temperature



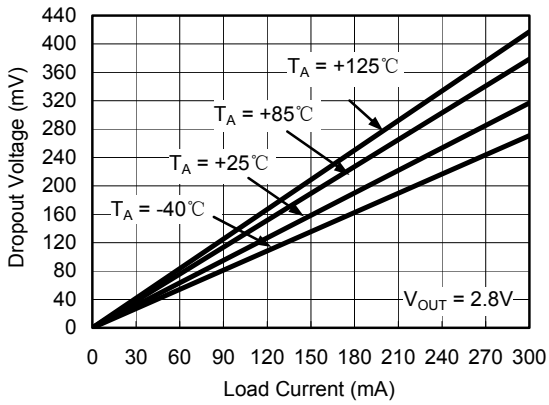
Output Voltage vs. Temperature



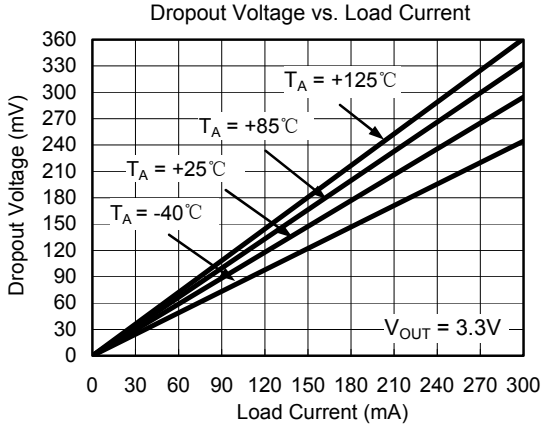
Ground Pin Current vs. Temperature



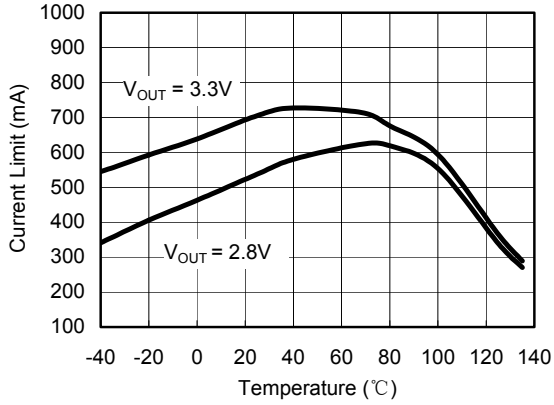
Dropout Voltage vs. Load Current



Dropout Voltage vs. Load Current



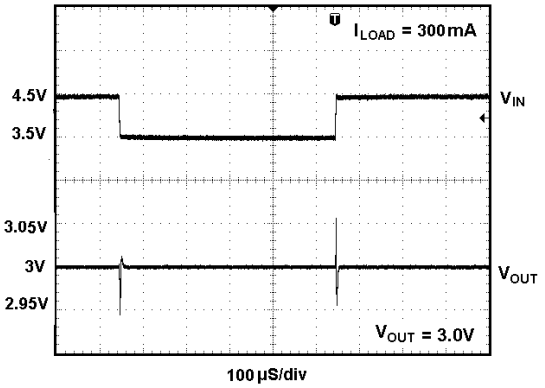
Current Limit vs. Temperature



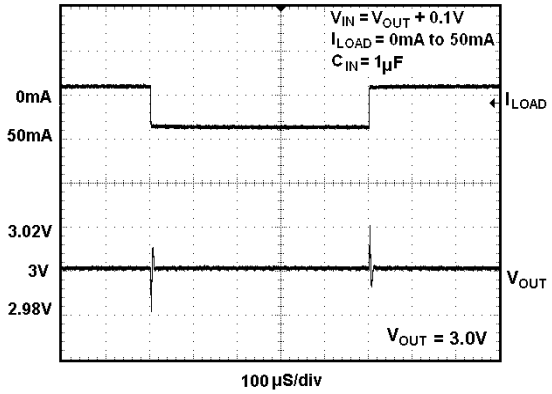
TYPICAL OPERATING CHARACTERISTICS

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.

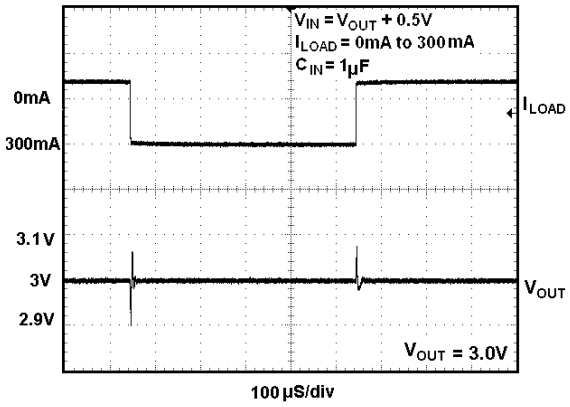
line-Transient Response



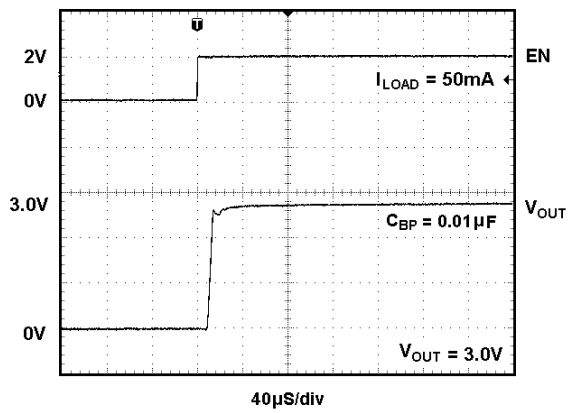
load-Transient Response Near Dropout



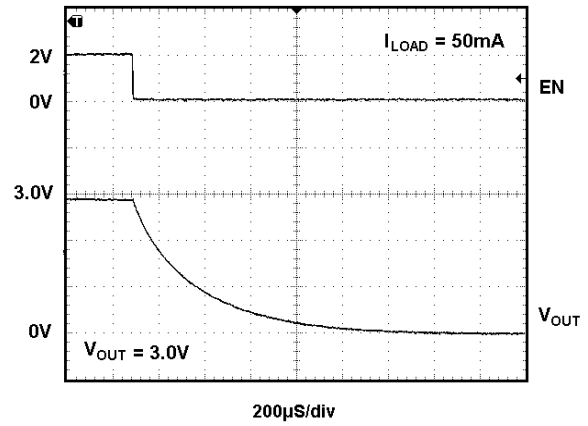
load-Transient Response



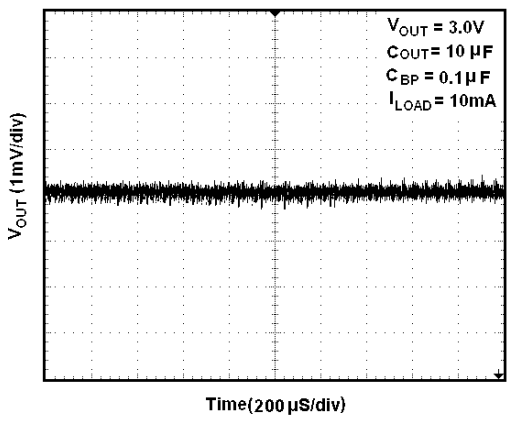
Shutdown Exit Delay



Entering Shutdown



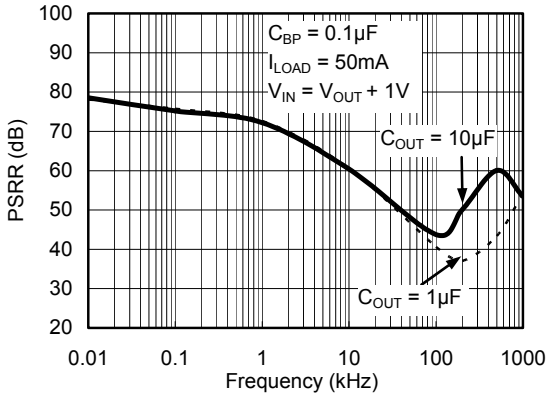
Output Noise 10Hz to 100KHz



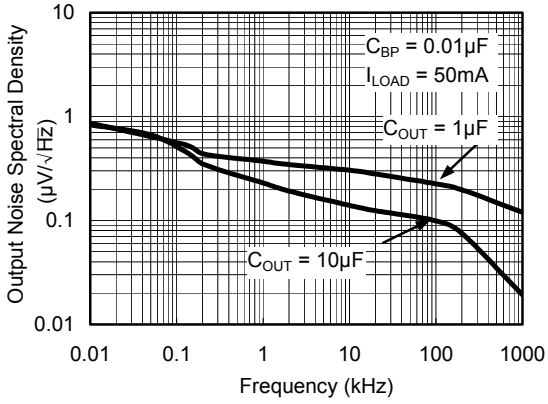
TYPICAL OPERATING CHARACTERISTICS

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 note

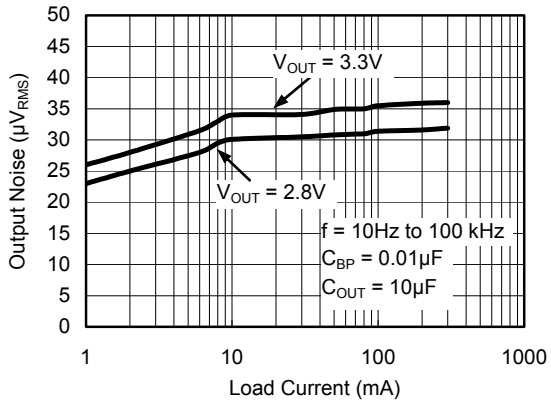
Power-Supply Rejection Ratio
vs. Frequency



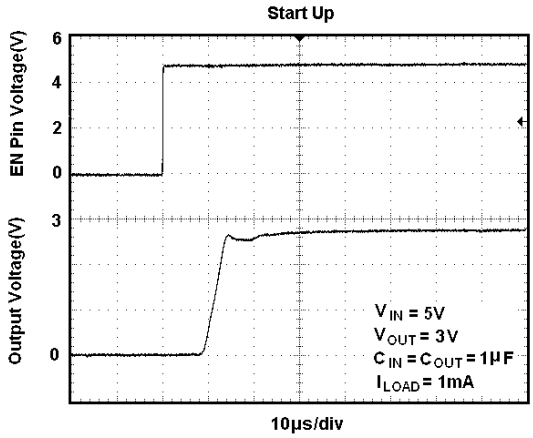
Output Noise Spectral Density
vs. Frequency



Output Noise vs. Load Current

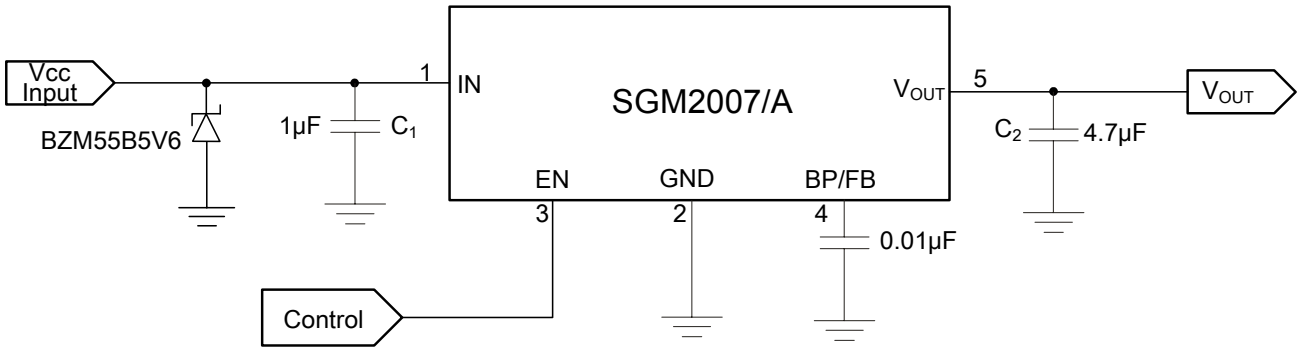


Start Up

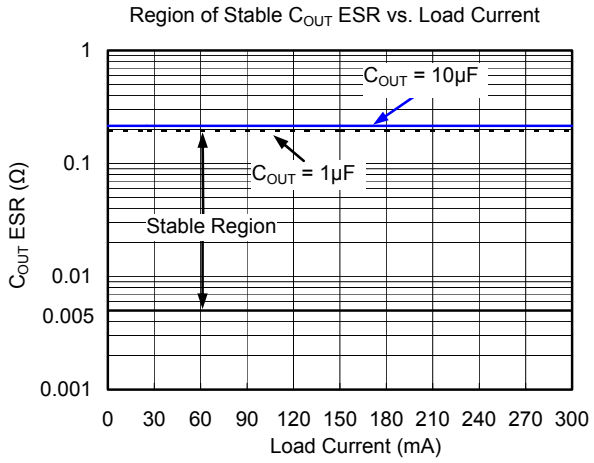


APPLICATION NOTES

When LDO is used in handheld products, attention must be paid to voltage spikes which could damage SGM2007/A. 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.

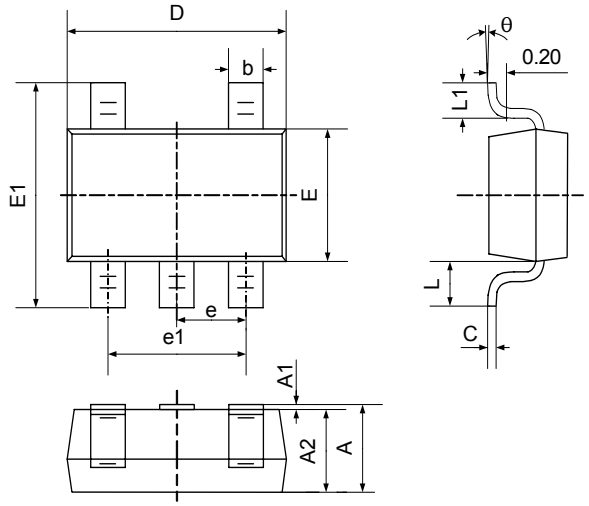


The SGM2007/A is designed specifically to work with low ESR ceramic output capacitor with space-saving and performance in consideration. Using a ceramic capacitor which is at least 1μF with ESR > 5mΩ on the SGM2007/A output ensures stability. The SGM2007/A still works well with output capacitor of other types due to the wide stable ESR range. The following figure shows the curves of allowable ESR range (5mΩ to 200mΩ) as a function of load current for various output capacitor values.



PACKAGE OUTLINE DIMENSIONS

SOT23-5



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.400	0.012	0.016
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950TYP		0.037TYP	
e1	1.800	2.000	0.071	0.079
L	0.700REF		0.028REF	
L1	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

01/2009 REV. B. 2

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