SGM2013
300mA, Low Power, Low Dropout 3-Terminal, Linear Regulators

GENERAL DESCRIPTION

The SGM2013 series low-power, low-noise, low-dropout, CMOS linear voltage regulators operate from a 2.5V to 5.5V input voltage. They are the perfect choice for low voltage, low power applications. A low ground current makes this part attractive for battery operated power systems. The SGM2013 series also offer ultra low dropout voltage to prolong battery life in portable electronics.

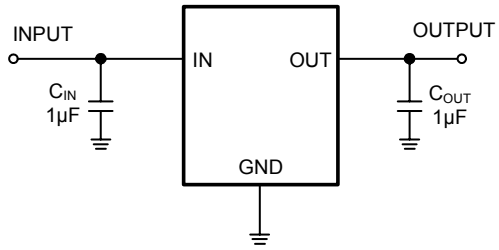
The SGM2013 features include foldback current limit and thermal shut-down protection.

SGM2013 operates over an ambient temperature range of -40°C to +125°C. It comes in Green SOT-23-3 (only 1.8V output voltage), SOT-89-3 and SOT-223-3 packages.

APPLICATIONS

Cellular Telephones
Digital Cameras
MP3, MP4
USB 2.0
Modems
PC Cameras
Hand-Held Instruments
Electronic Dictionarys
Portable/Battery-Powered Equipment

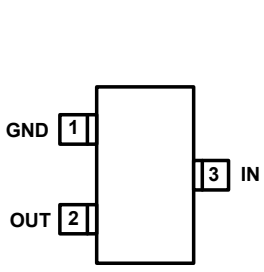
TYPICAL OPERATION CIRCUIT



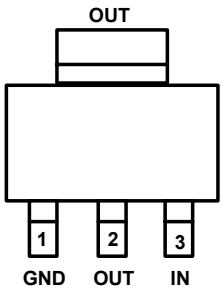
FEATURES

- **Low Output Noise**
- **Low Dropout Voltage**
- **Maximum Output Current: 300mA**
- **Thermal-Overload Protection**
- **Output Current Limit**
- **Available in Multiple Output Voltage Versions**
- **Output Voltage:**
  Available in Fixed Outputs 1.2V, 1.5V, 1.8V, 2.5V, 2.7V, 2.8V, 2.9V, 3.0V and 3.3V

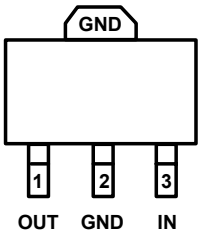
PIN CONFIGURATIONS (TOP VIEW)



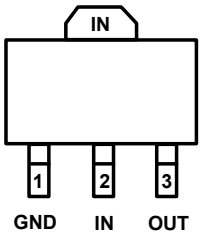
SOT-23-3



SOT-223-3(R-Type)



SOT-89-3



SOT-89-3(L-Type)

PIN DESCRIPTION

NAME	FUNCTION
IN	Regulator Input. Supply voltage can range from 2.5V to 5.5V.
GND	Ground.
OUT	Regulator Output.

PACKAGE/ORDERING INFORMATION

MODEL	V_{OUT} (V)	PIN-PACKAGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM2013-1.2	1.2V	SOT-89-3	SGM2013-1.2XK3/TR	SGM2013-1.2XK3	Tape and Reel, 1000
		SOT-89-3(L-Type)	SGM2013-1.2XK3L/TR	SGM2013-1.2XK3L	Tape and Reel, 1000
SGM2013-1.5	1.5V	SOT-89-3	SGM2013-1.5XK3/TR	SGM2013-1.8XK3	Tape and Reel, 1000
		SOT-89-3(L-Type)	SGM2013-1.5XK3L/TR	SGM2013-1.8XK3L	Tape and Reel, 1000
SGM2013-1.8	1.8V	SOT-23-3	SGM2013-1.8XN3/TR	XD18	Tape and Reel, 3000
		SOT-89-3	SGM2013-1.8XK3/TR	SGM2013-1.8XK3	Tape and Reel, 1000
		SOT-89-3(L-Type)	SGM2013-1.8XK3L/TR	SGM2013-1.8XK3L	Tape and Reel, 1000
		SOT-223-3(R-Type)	SGM2013-1.8XKC3R/TR	SGM2013-1.8XKC3R	Tape and Reel, 2500
SGM2013-2.5	2.5V	SOT-89-3	SGM2013-2.5XK3/TR	SGM2013-2.5XK3	Tape and Reel, 1000
		SOT-89-3(L-Type)	SGM2013-2.5XK3L/TR	SGM2013-2.5XK3L	Tape and Reel, 1000
SGM2013-2.7	2.7V	SOT-89-3	SGM2013-2.7XK3/TR	SGM2013-2.7XK3	Tape and Reel, 1000
		SOT-89-3(L-Type)	SGM2013-2.7XK3L/TR	SGM2013-2.7XK3L	Tape and Reel, 1000
SGM2013-2.8	2.8V	SOT-89-3	SGM2013-2.8XK3/TR	SGM2013-2.8XK3	Tape and Reel, 1000
		SOT-89-3(L-Type)	SGM2013-2.8XK3L/TR	SGM2013-2.8XK3L	Tape and Reel, 1000
SGM2013-2.9	2.9V	SOT-89-3	SGM2013-2.9XK3/TR	SGM2013-2.9XK3	Tape and Reel, 1000
		SOT-89-3(L-Type)	SGM2013-2.9XK3L/TR	SGM2013-2.9XK3L	Tape and Reel, 1000
SGM2013-3.0	3.0V	SOT-89-3	SGM2013-3.0XK3/TR	SGM2013-3.0XK3	Tape and Reel, 1000
		SOT-89-3(L-Type)	SGM2013-3.0XK3L/TR	SGM2013-3.0XK3L	Tape and Reel, 1000
SGM2013-3.3	3.3V	SOT-89-3	SGM2013-3.3XK3/TR	SGM2013-3.3XK3	Tape and Reel, 1000
		SOT-89-3(L-Type)	SGM2013-3.3XK3L/TR	SGM2013-3.3XK3L	Tape and Reel, 1000
		SOT-223-3(R-Type)	SGM2013-3.3XKC3R/TR	SGM2013-3.3XKC3R	Tape and Reel, 2500

ABSOLUTE MAXIMUM RATINGS

IN to GND.....-0.3V to 6V
Output Short-Circuit Duration.....Infinite
OUT to GND.....-0.3V to (V_{IN} + 0.3V)
Power Dissipation, P_D @ T_A = 25℃
SOT-23-3 .....0.4W
SOT-89-3 .....0.571W
Package Thermal Resistance
SOT-23-3, θ_{JA}..... 250℃/W
SOT-89-3, θ_{JA}.....175℃/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

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 last datasheet.

ELECTRICAL CHARACTERISTICS

(V_{IN} = $V_{OUT\ (NOMINAL)}$ + 0.5V or 2.5V whichever is greater , T_A =25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Input Voltage	V_{IN}			2.5		5.5	V
Output Voltage Accuracy				-2.2		+2.2	%
Maximum Output Current				300			mA
Current Limit	I_{LIM}			310	500		mA
Ground Pin Current	I_Q	No load			110	220	μA
		I_{OUT} = 300mA			200		
Dropout Voltage (1)		I_{OUT} = 1mA			1		mV
		I_{OUT} = 300mA			270	420	
Line Regulation	ΔV_{LNR}	V_{IN} = 2.5V or (V_{OUT} + 0.5V) to 5.5V, I_{OUT} = 1mA			0.03	0.06	%/V
Load Regulation	ΔV_{LDR}	I_{OUT} = 0.1mA to 300mA, C_{OUT} = 1μF, V_{OUT} ＞ 2V			0.003	0.006	%/mA
		I_{OUT} = 0.1mA to 300mA, C_{OUT} = 1μF, V_{OUT} ≤ 2V			0.005	0.012	
Power Supply Rejection Rate	PSRR	I_{LOAD} = 50mA, C_{OUT} = 1μF V_{IN} = V_{OUT} +1V	f = 100Hz		69		dB
			f = 1kHz		52		dB
THERMAL PROTECTION							
Thermal Shutdown Temperature	T_{SHDN}				150		℃
Thermal Shutdown Hysteresis	ΔT_{SHDN}				10		℃

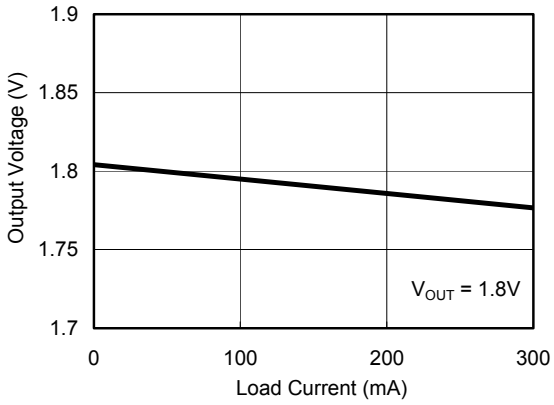
NOTE:

1. 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.)

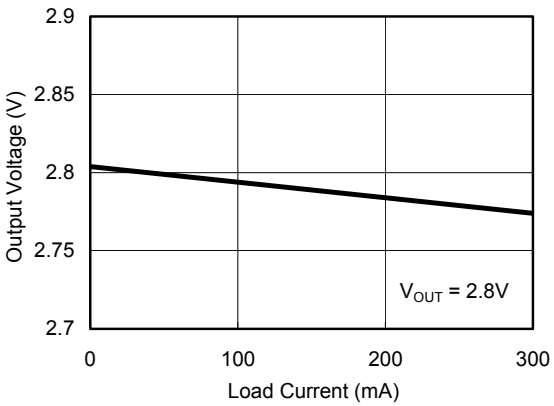
TYPICAL OPERATING CHARACTERISTICS

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

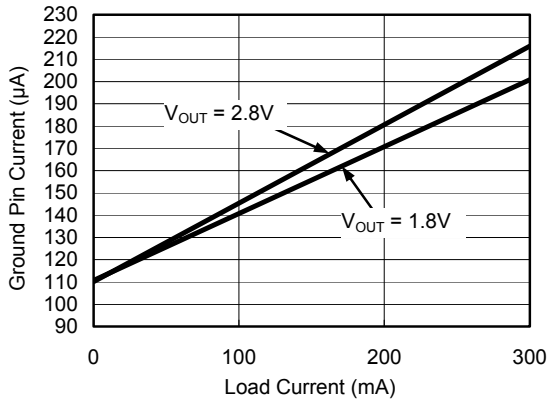
Output Voltage vs. Load Current



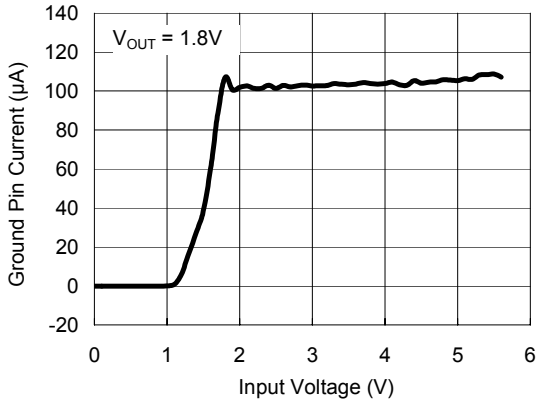
Output Voltage vs. Load Current



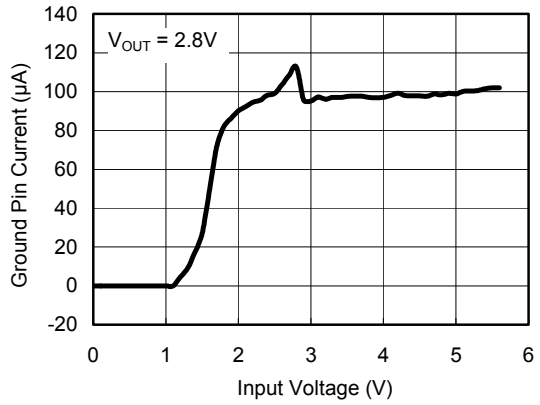
Ground Pin Current vs. Load Current



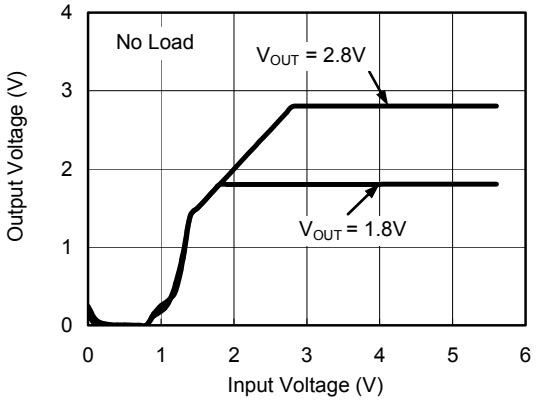
Ground Pin Current vs. Input Voltage



Ground Pin Current vs. Input Voltage



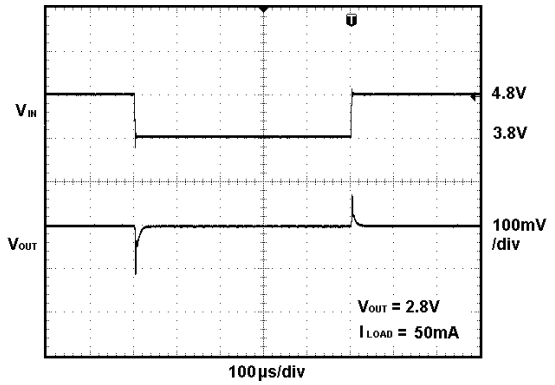
Output Voltage vs. Input Voltage



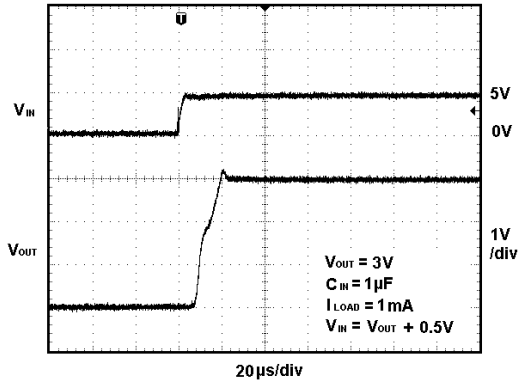
TYPICAL OPERATING CHARACTERISTICS

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

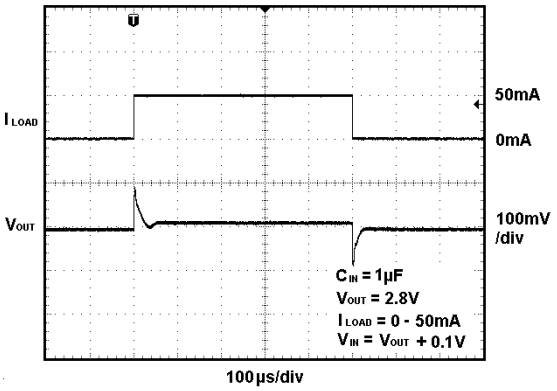
Line-Transient Response



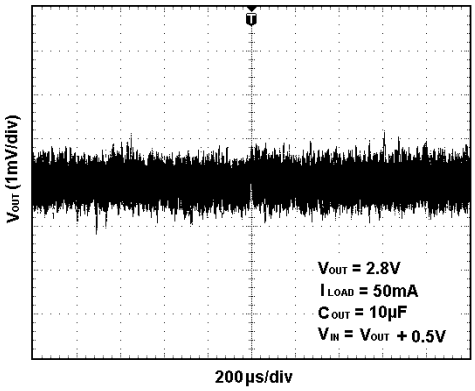
Start up



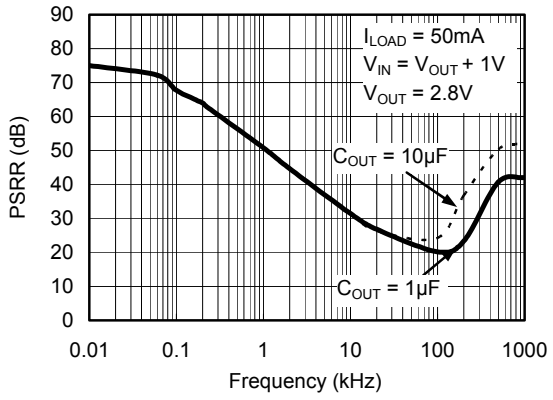
Load-Transient Response



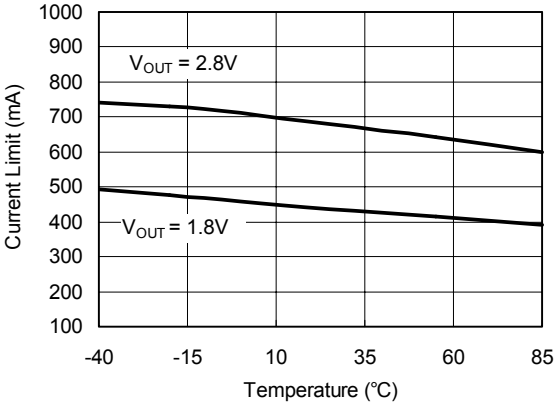
Output Noise 10Hz to 100kHz



Power-Supply Rejection Ratio vs. Frequency



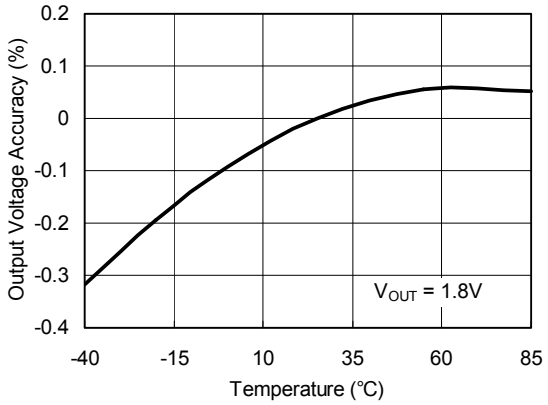
Current Limit vs. Temperature



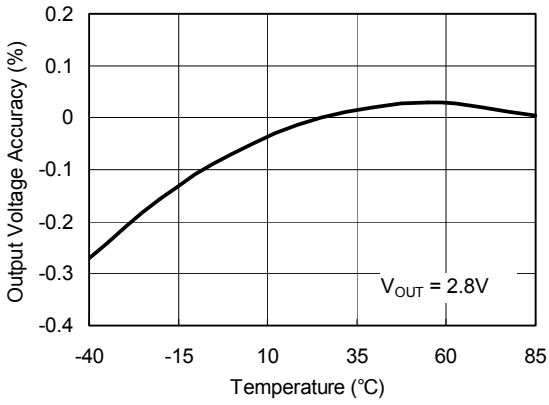
TYPICAL OPERATING CHARACTERISTICS

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

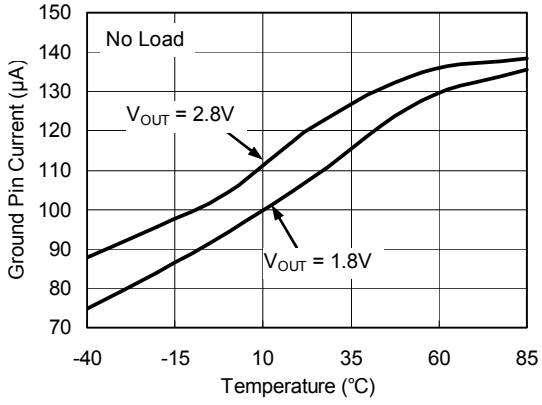
Output Voltage Accuracy vs. Temperature



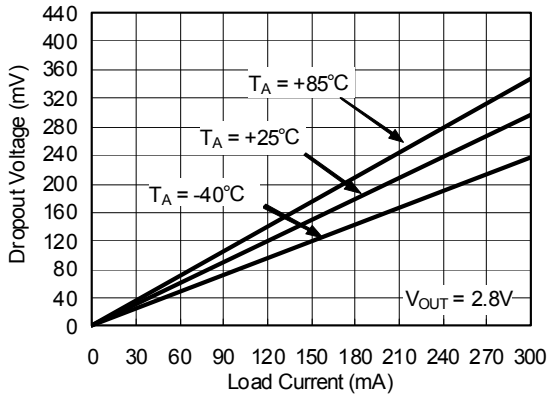
Output Voltage Accuracy vs. Temperature



Ground Pin Current vs. Temperature

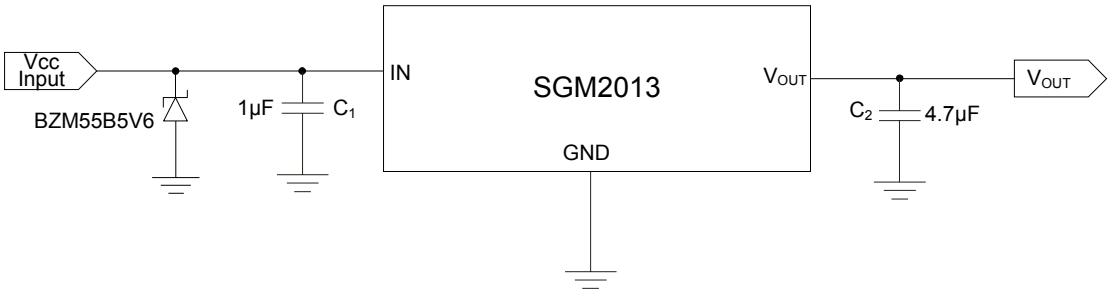


Dropout Voltage vs. Load Current



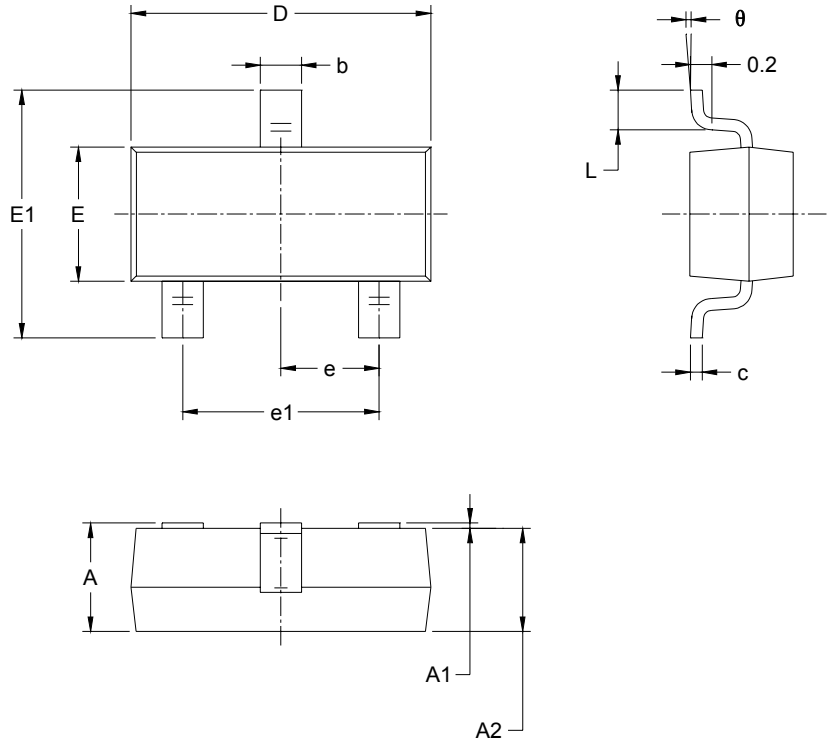
APPLICATION NOTE

When LDO is used in handheld products, attention must be paid to voltage spikes which could damage SGM2013. 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

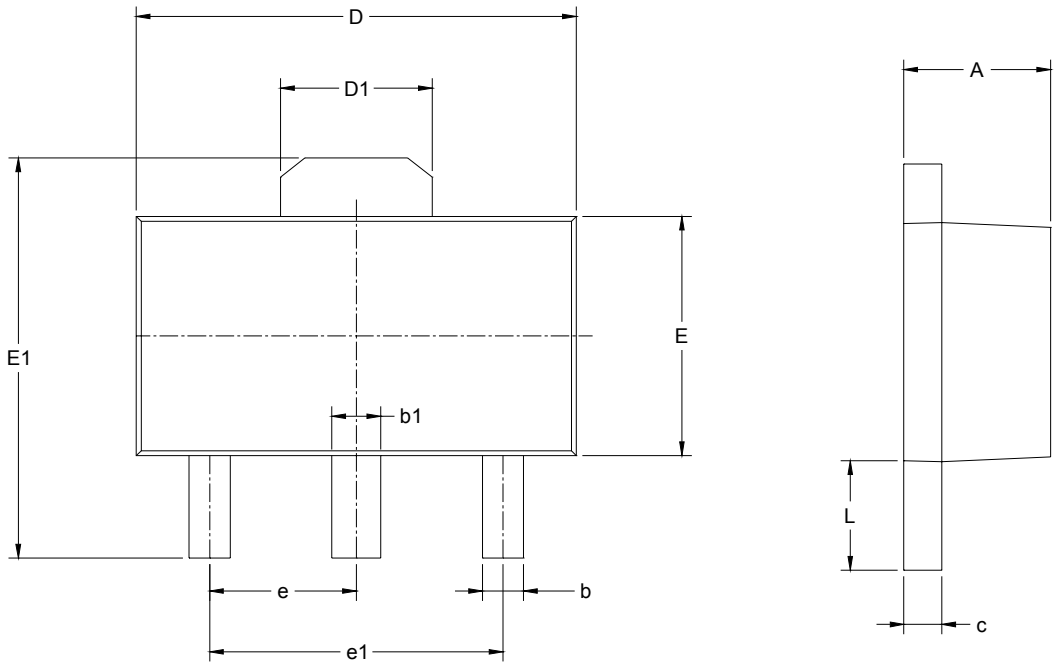
SOT-23-3



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	0.500	0.012	0.020
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	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

PACKAGE OUTLINE DIMENSIONS

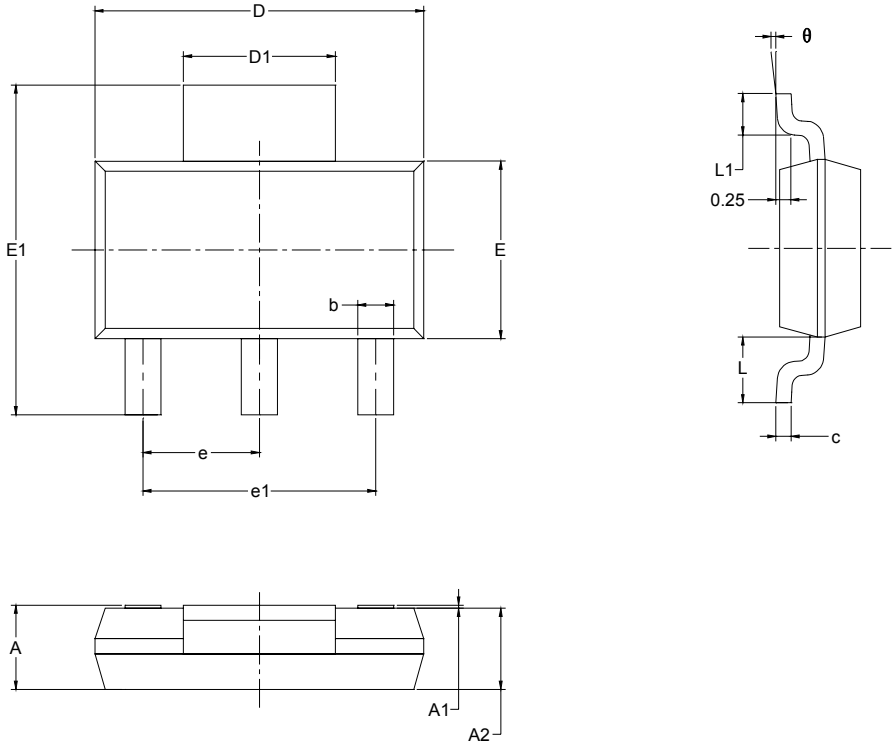
SOT-89-3/SOT-89-3(L-Type)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.400	0.580	0.016	0.023
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550 REF		0.061 REF	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 TYP		0.060 TYP	
e1	3.000 TYP		0.118 TYP	
L	0.900	1.200	0.035	0.047

PACKAGE OUTLINE DIMENSIONS

SOT-223-3(R-type)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.520	1.800	0.060	0.071
A1	0.020	0.100	0.001	0.004
A2	1.500	1.700	0.059	0.067
b	0.610	0.810	0.024	0.032
c	0.250	0.350	0.010	0.014
D	6.300	6.700	0.248	0.264
D1	2.900	3.100	0.114	0.122
E	3.300	3.700	0.130	0.146
E1	6.700	7.300	0.264	0.287
e	2.300 TYP		0.091 TYP	
e1	4.500	4.700	0.177	0.185
L	1.500 REF		0.059 REF	
L1	0.900		0.035	
θ	0°	10°	0°	10°