SGM2022
Dual, Low Dropout, 250mA LDO Regulators

GENERAL DESCRIPTION

The SGM2022 is a dual, low-power, low-dropout, CMOS linear voltage regulators. It operates from a 2.5V to 5.5V input and delivers up to 250mA at each channel.

The SGM2022 is the perfect choice for low voltage, low power. The ground current is 190μA (both LDO's enabled and active) that makes this part attractive for battery operated power systems. The SGM2022 also offers low dropout voltage (250mV at 250mA output) to prolong battery life in portable electronics.

Separate enable pins control each individual LDO output. The EN function allows the output of each regulator to be turned off independently, resulting in greatly reduced power consumption. Other features include a 10nA logic-controlled shutdown mode, foldback current limit and thermal shut- down protection.

Devices come in 6-pin SOT23 package.

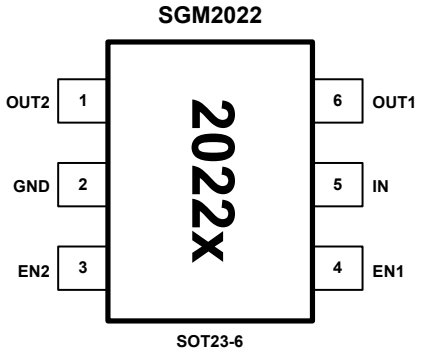
APPLICATIONS

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

FEATURES

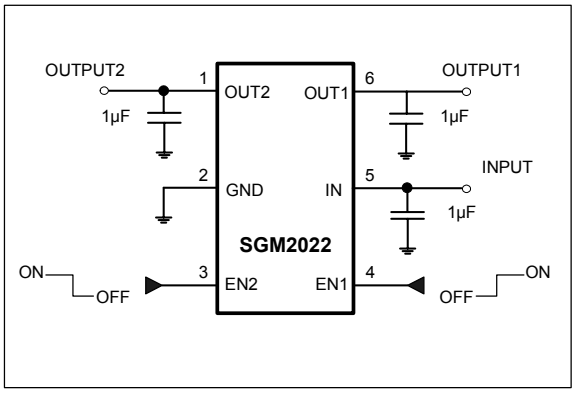
- **Highly Accurate: ±2%**
- **Ultra-Low Dropout Voltage:**
  250mV at 250mA Output
- **190μA No-Load Supply Current**
- **Thermal-Overload Protection**
- **Output Current Limit**
- **10nA Logic-Controlled Shutdown**
- **Operating Temperature Range: -40℃ to +85℃**
- **Small Package**

PIN CONFIGURATION (TOP VIEW)



Note: The location of pin 1 on the 2022x is determined by orienting the package marking as shown.

TYPICAL OPERATION CIRCUIT



PACKAGE/ORDERING INFORMATION

ORDERING NUMBER	V_{OUT1}	V_{OUT2}	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	PACKAGE MARKING	PACKAGE OPTION
SGM2022-AYN6/TR	2.8V	2.8V	SOT23-6	-40°C to +85°C	2022A	Tape and Reel, 3000
SGM2022-CYN6/TR	2.8V	3.0V	SOT23-6	-40°C to +85°C	2022C	Tape and Reel, 3000
SGM2022-DYN6/TR	2.8V	2.5V	SOT23-6	-40°C to +85°C	2022D	Tape and Reel, 3000
SGM2022-EYN6/TR	2.8V	1.8V	SOT23-6	-40°C to +85°C	2022E	Tape and Reel, 3000
SGM2022-GYN6/TR	2.5V	1.8V	SOT23-6	-40°C to +85°C	2022G	Tape and Reel, 3000
SGM2022-HYN6/TR	3.3V	2.5V	SOT23-6	-40°C to +85°C	2022H	Tape and Reel, 3000
SGM2022-IYN6/TR	3.3V	1.8V	SOT23-6	-40°C to +85°C	2022I	Tape and Reel, 3000
SGM2022-KYN6/TR	3.0V	1.8V	SOT23-6	-40°C to +85°C	2022K	Tape and Reel, 3000
SGM2022-MYN6/TR	2.8V	1.2V	SOT23-6	-40°C to +85°C	2022M	Tape and Reel, 3000
SGM2022-NYN6/TR	2.8V	1.3V	SOT23-6	-40°C to +85°C	2022N	Tape and Reel, 3000
SGM2022-OYN6/TR	2.8V	1.5V	SOT23-6	-40°C to +85°C	2022O	Tape and Reel, 3000
SGM2022-PYN6/TR	1.5V	2.8V	SOT23-6	-40°C to +85°C	2022P	Tape and Reel, 3000
SGM2022-QYN6/TR	2.5V	1.5V	SOT23-6	-40°C to +85°C	2022Q	Tape and Reel, 3000
SGM2022-RYN6/TR	2.5V	2.8V	SOT23-6	-40°C to +85°C	2022R	Tape and Reel, 3000
SGM2022-SYN6/TR	1.3V	2.8V	SOT23-6	-40°C to +85°C	2022S	Tape and Reel, 3000
SGM2022-TYN6/TR	1.5V	3.3V	SOT23-6	-40°C to +85°C	2022T	Tape and Reel, 3000
SGM2022-UYN6/TR	3.3V	3.0V	SOT23-6	-40°C to +85°C	2022U	Tape and Reel, 3000
SGM2022-VYN6/TR	1.8V	3.3V	SOT23-6	-40°C to +85°C	2022V	Tape and Reel, 3000
SGM2022-WYN6/TR	1.2V	2.8V	SOT23-6	-40°C to +85°C	2022W	Tape and Reel, 3000
SGM2022-XYN6/TR	3.3V	2.8V	SOT23-6	-40°C to +85°C	2022X	Tape and Reel, 3000
SGM2022-YYN6/TR	1.8V	2.8V	SOT23-6	-40°C to +85°C	2022Y	Tape and Reel, 3000
SGM2022-ZYN6/TR	1.8V	1.8V	SOT23-6	-40°C to +85°C	2022Z	Tape and Reel, 3000
SGM2022-AAYN6/TR	1.2V	1.8V	SOT23-6	-40°C to +85°C	2022AA	Tape and Reel, 3000

NOTE: Order number is defined as the follow:

ORDER NUMBER

SGM2022-XYX/TR

Tape and Reel

Package Type

N6 SOT23-6

Operating Temperature Range

Y -40℃ to +85℃

Output Voltage

A : 2.8V (output1), 2.8V (output2)
C : 2.8V (output1), 3.0V (output2)
D : 2.8V (output1), 2.5V (output2)
⋮ ⋮
AA : 1.2V (output1), 1.8V (output2)

ABSOLUTE MAXIMUM RATINGS

IN to GND.....-0.3V to 6V
Output Short-Circuit Duration .....Infinite
EN to GND.....-0.3V to V_{IN}
OUT to GND.....-0.3V to (V_{IN} + 0.3V)
Power Dissipation, P_D @ T_A = 25℃
SOT23-6 .....0.24W
Package Thermal Resistance
SOT23-6, θ_{JA}..... 250℃/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 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	OUT2	Channel 2 Output Voltage
2	GND	Common Ground
3	EN2 (Note1)	On/Off Control 2. A logic low reduces the supply current to 10nA.
4	EN1 (Note1)	On/Off Control 1. A logic low reduces the supply current to 10nA.
5	IN	Supply Input
6	OUT1	Channel 1 Output Voltage

Note 1: If EN1 and EN2 are both low, both regulators and the reference turn off.

ELECTRICAL CHARACTERISTICS

(V_{IN} = $V_{OUT\ (NOMINAL)}$ + 0.5V or 2.5V (whichever is greater), T_A = -40°C to +85°C, typical values are at T_A = + 25°C, for each LDO unless otherwise specified.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Input Voltage	V_{IN}			2.5		5.5	V
Output Voltage Accuracy		I_{OUT} = 0.1mA, T_A = +25°C		-2		+2	%
Maximum Output Current (Note3)				250			mA
Current Limit	I_{LIM}			310	500		mA
Ground Pin Current	I_Q	EN = 2V, both LDOs No Load			190	295	μA
Dropout Voltage (Note1)		I_{OUT} = 1mA			1		mV
		I_{OUT} = 250mA			250	350	
Line Regulation	ΔV_{LNR}	V_{IN} = 2.5V or (V_{OUT} + 0.5V) to 5.5V, I_{OUT} = 1mA			0.02	0.15	%/V
Load Regulation	ΔV_{LDR}	I_{OUT} = 0.1mA to 250mA, C_{OUT} = 1μF			0.004	0.01	%/mA
Power Supply Rejection Rate	PSRR	I_{LOAD} = 50mA, C_{OUT} = 1μF	f = 100Hz		71		dB
SHUTDOWN							
EN Input Threshold	V_{IH}	V_{IN} = 2.5V to 5.5V		1.5			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	$I_{Q(SHDN)}$	EN1 = EN2 = 0.4V	T_A = +25°C		0.01	1	μA
			T_A = +85°C		0.01		
Shutdown Exit Delay (Note2)		C_{OUT} = 1μF, No load	T_A = +25°C		20		μs
THERMAL PROTECTION							
Thermal Shutdown Temperature	T_{SHDN}				160		℃
Thermal Shutdown Hysteresis	ΔT_{SHDN}				15		℃

Specifications subject to changes without notice.

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 +3.3V)

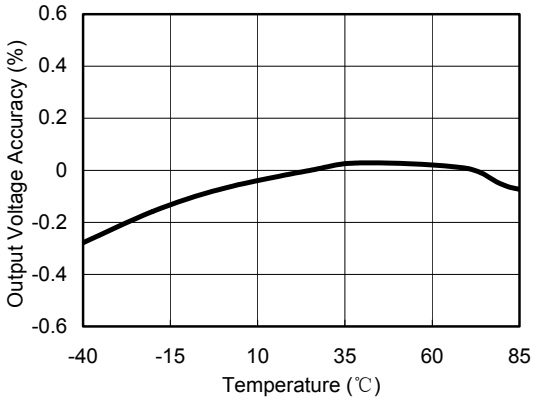
Note 2: Time needed for V_{OUT} to reach 95% of final value.

Note 3: Each channel provides 300mA of maximum output current when the condition of dissipating heat is good.

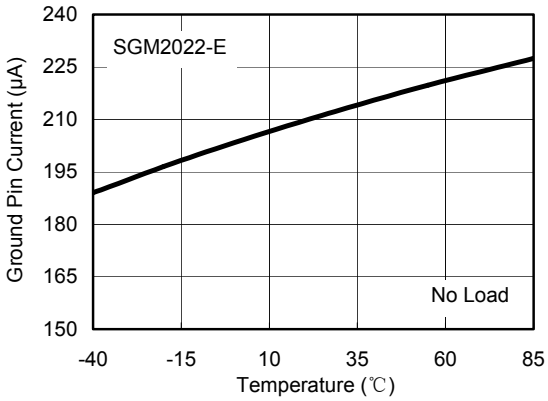
TYPICAL OPERATING CHARACTERISTICS

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.

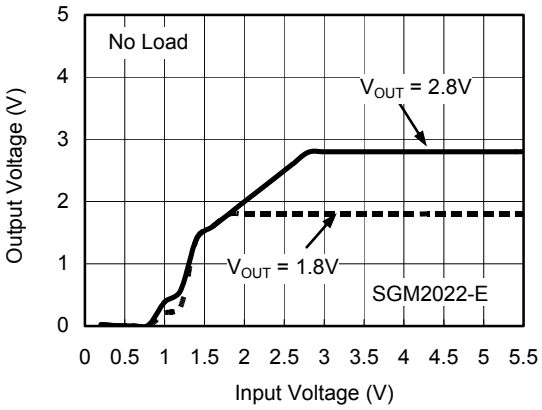
Output Voltage Accuracy vs. Temperature



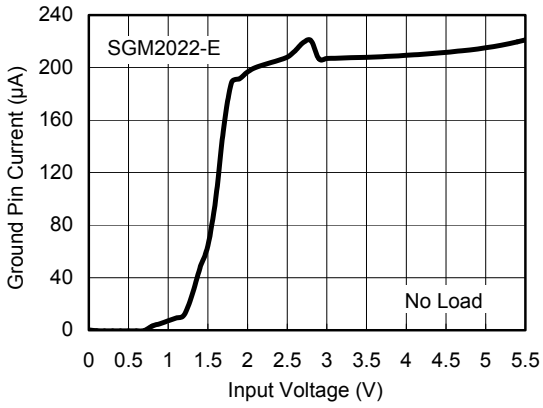
Ground Pin Current vs. Temperature



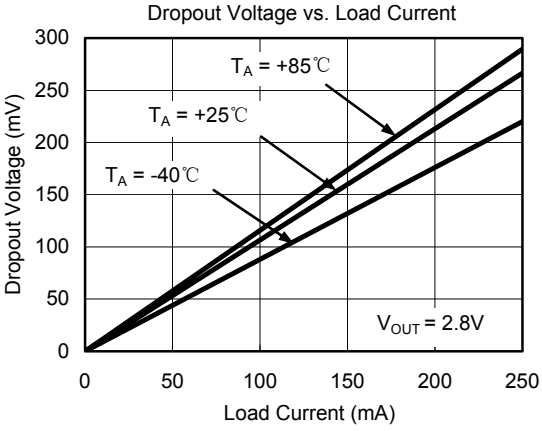
Output Voltage vs. Input Voltage



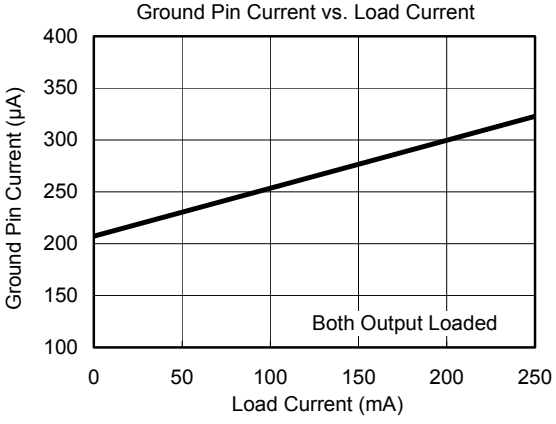
Ground Pin Current vs. Input Voltage



Dropout Voltage vs. Load Current



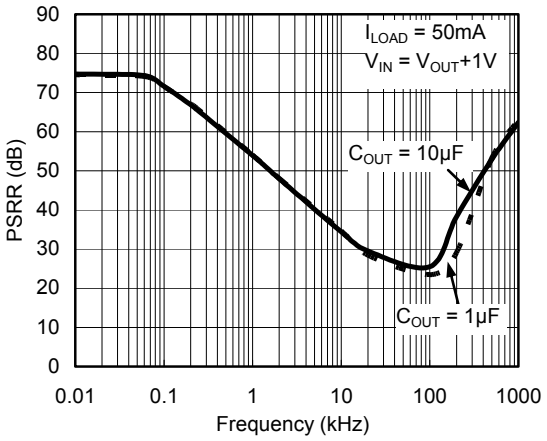
Ground Pin Current vs. Load Current



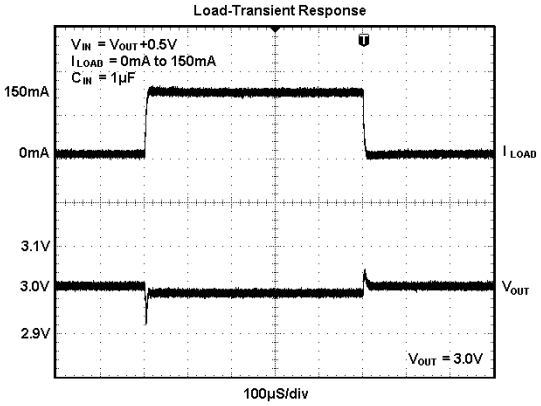
TYPICAL OPERATING CHARACTERISTICS

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.

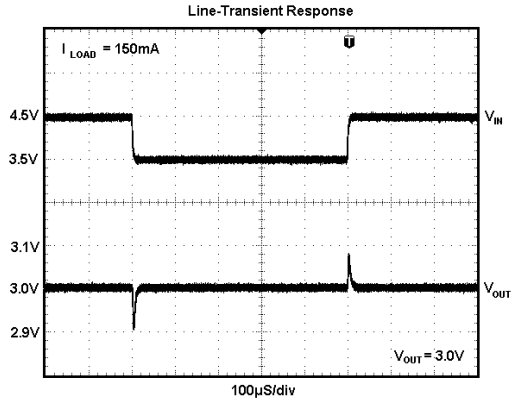
Power-Supply Rejection Ratio vs. Frequency



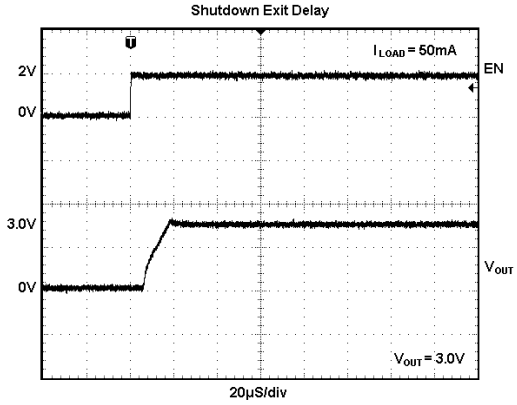
Load-Transient Response



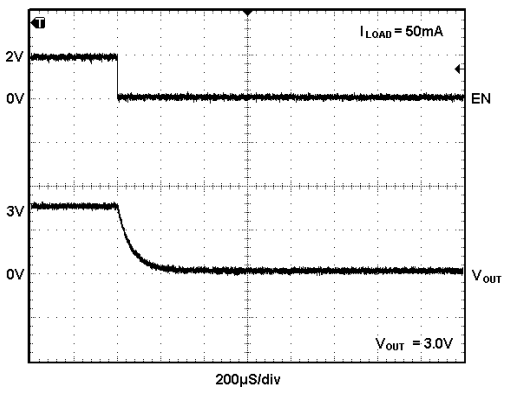
Line-Transient Response



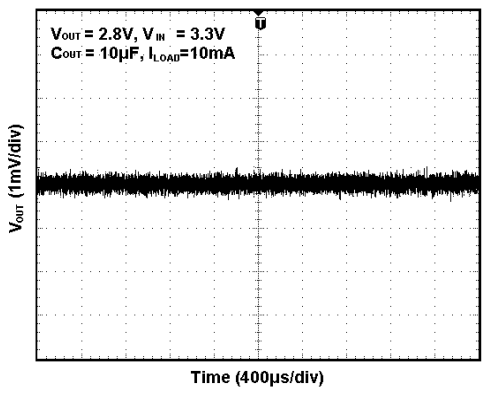
Shutdown Exit Delay



Entering Shutdown

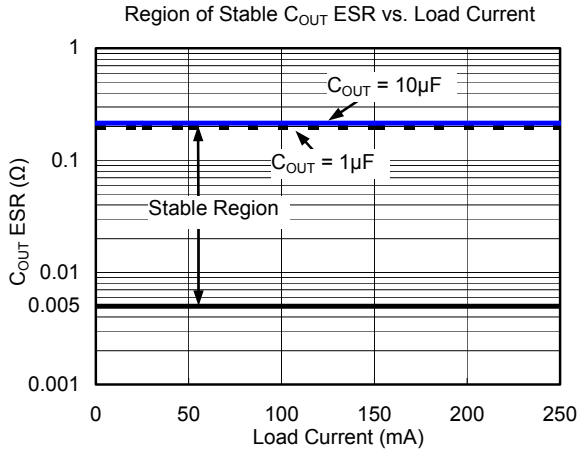


Output Noise 10Hz to 100kHz

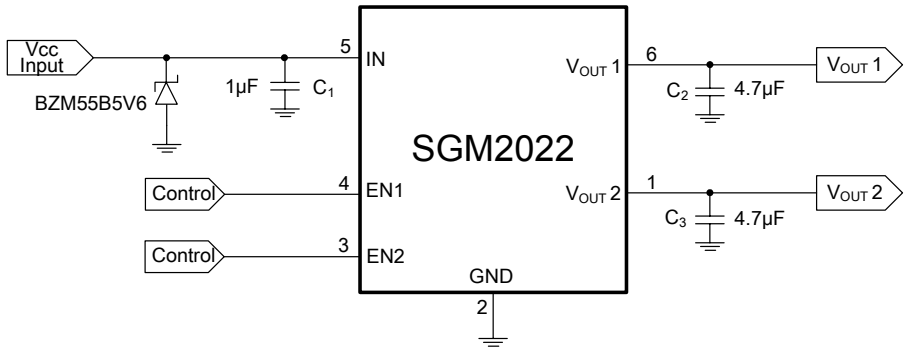


APPLICATION NOTE

The SGM2022 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 SGM2022 output ensures stability. The SGM2022 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.

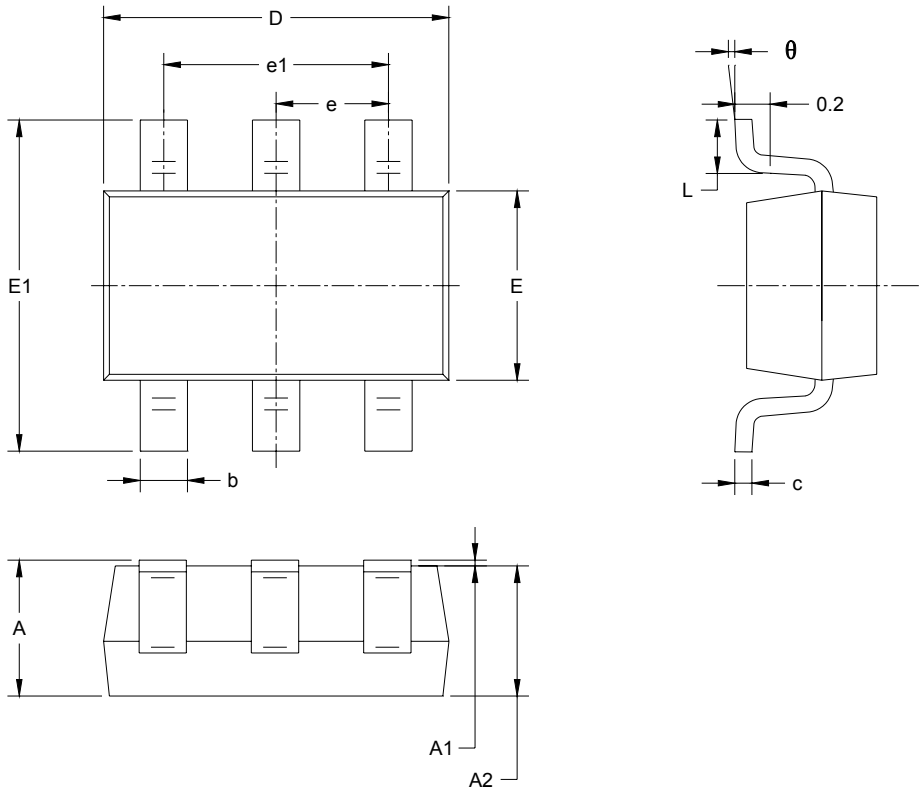


When LDO is used in handheld products, attention must be paid to voltage spikes which could damage SGM2022. In such applications, voltage spikes will be generated at charger interface and V_{BUS} pin of USB interface when charger adapters and USB equipments are hot-plugged. Besides this, handheld products 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

SOT23-6



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°

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