SG2010

150mA, Low Power, Low Dropout, Linear Regulators

GENERAL DESCRIPTION

The SG2010 low-power, low-dropout, CMOS linear voltage regulator operates from 2.5V to 5.5V input and delivers up to 150mA. It is the perfect choice for low voltage, low power applications. An ultra low ground current (100μA at 150mA output) makes this part attractive for battery operated power systems. The SG2010 series also offers ultra low dropout voltage (105mV at 150mA output) to prolong battery life in portable electronics.

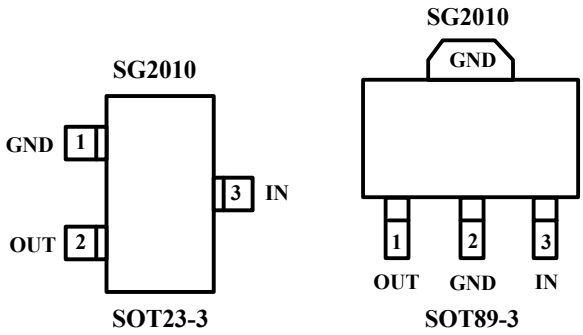
The output voltage is preset to voltages in the range of 1.5V to 5.0V. Other features include foldback current limit and thermal shut-down protection.

SG2010 comes in 3-pin SOT23 package and 3-pin SOT89 package.

FEATURES

- **Ultra-Low Dropout Voltage:**
  105mV at 150mA output
- **Low 80μA No-Load Supply Current**
- **Low 100μA Operating Supply Current**
  at 150mA Output
- **Thermal-Overload Protection**
- **Output Current Limit**
- **Preset Output Voltages（±1. 8% Accuracy)**
- **Output Voltage:**
  Available in Fixed Outputs of 1.5V, 1.8V, 2.5V, 2.8V, 3.0V, and 3.3V

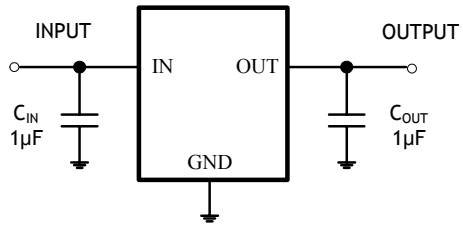
PIN CONFIGURATIONS（TOP VIEW）



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



ORDERING INFORMATION

MODEL	V_{OUT}(V)	PIN-PACKAGE	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SG2010-1.5	1.5V	SOT23-3	- 40°C to +125°C	SG2010-1.5XN3/TR	XA15	Tape and Reel, 3000
		SOT89-3		SG2010-1.5XK3/TR	SG2010-1.5XK3	Tape and Reel, 1000
SG2010-1.8	1.8V	SOT23-3	- 40°C to +125°C	SG2010-1.8XN3/TR	XA18	Tape and Reel, 3000
		SOT89-3		SG2010-1.8XK3/TR	SG2010-1.8XK3	Tape and Reel, 1000
SG2010-2.5	2.5V	SOT23-3	- 40°C to +125°C	SG2010-2.5XN3/TR	XA25	Tape and Reel, 3000
		SOT89-3		SG2010-2.5XK3/TR	SG2010-2.5XK3	Tape and Reel, 1000
SG2010-2.8	2.8V	SOT23-3	- 40°C to +125°C	SG2010-2.8XN3/TR	XA28	Tape and Reel, 3000
		SOT89-3		SG2010-2.8XK3/TR	SG2010-2.8XK3	Tape and Reel, 1000
SG2010-3.0	3.0V	SOT23-3	- 40°C to +125°C	SG2010-3.0XN3/TR	XA30	Tape and Reel, 3000
		SOT89-3		SG2010-3.0XK3/TR	SG2010-3.0XK3	Tape and Reel, 1000
SG2010-3.3	3.3V	SOT23-3	- 40°C to +125°C	SG2010-3.3XN3/TR	XA33	Tape and Reel, 3000
		SOT89-3		SG2010-3.3XK3/TR	SG2011-3.3XK3	Tape and Reel, 1000

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℃
SOT23-3 .....0.4W
SOT89-3 .....0.571W
Package Thermal Resistance
SOT23-3, θ_{JA}..... 250℃/W
SOT89-3, θ_{JA}.....175°C/W
Operating Temperature Range.....- 40°C to +125°C
Junction Temperature.....+150°C
Storage Temperature.....- 65°C to +150°C
Lead Temperature (soldering, 10s).....260°C
ESD Susceptibility
HBM.....7000V
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.

PIN DESCRIPTION

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

ELECTRICAL CHARACTERISTICS

(V_{IN} = $V_{OUT\ (NOMINAL)}$ + 0.5V or 2.5V (whichever is greater), T_A = - 40°C to +125°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		I_{OUT} = 0.1mA, T_A = +25°C		-1.8		1.8	%
		I_{OUT} = 0.1mA to 150mA, T_A = 0°C to +70°C				2.2	
		I_{OUT} = 0.1mA to 150mA, T_A = - 40°C to +125°C				2.6	
Output Current				150			mA
Current Limit	I_{LIM}			160	600		mA
Ground Pin Current	I_Q	No load			80	130	μA
		I_{OUT} = 150mA			100		
Dropout Voltage(Note1)		I_{OUT} = 1mA			0.8		mV
		I_{OUT} = 150mA			105	170	
Line Regulation	ΔV_{LNR}	V_{IN} = 2.5V or (V_{OUT} + 0.1V) to 5.5V, I_{OUT} = 1mA			0.004	0.15	%/V
Load Regulation	ΔV_{LDR}	I_{OUT} = 0.1mA to 500mA, C_{OUT} = 1μF			0.0005	0.002	%/mA
Output Voltage Noise	e_n	f = 10Hz to 100KHz, C_{OUT} = 10μF			120		μV_{RMS}
Power Supply Rejection Rate	PSRR	I_{LOAD} = 50mA, C_{OUT} = 1μF	f = 100Hz,		74		dB
			f = 1KHz,		54		dB
THERMAL PROTECTION							
Thermal Shutdown Temperature	T_{SHDN}				160		℃
Thermal Shutdown Hysteresis	ΔT_{SHDN}				15		℃

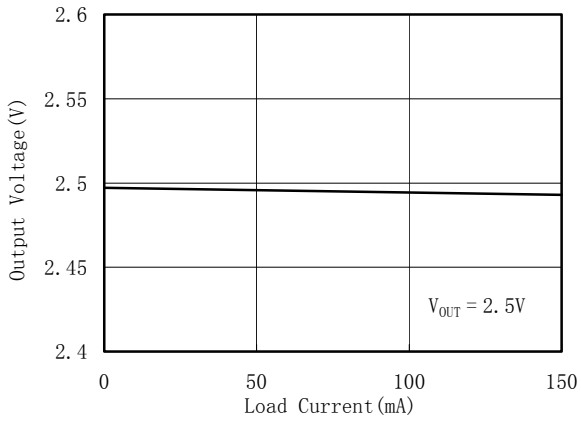
Specifications subject to change without notice.

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 +5.0V)

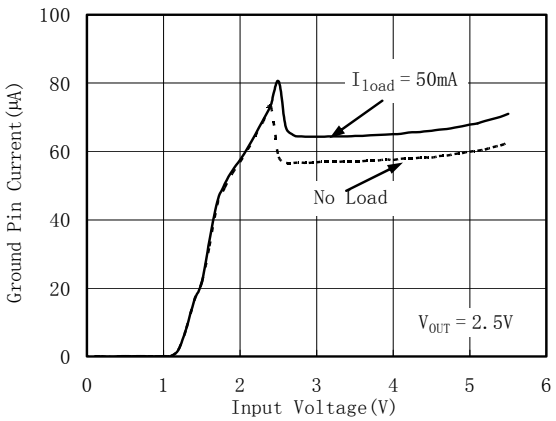
TYPICAL OPERATING CHARACTERISTICS

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

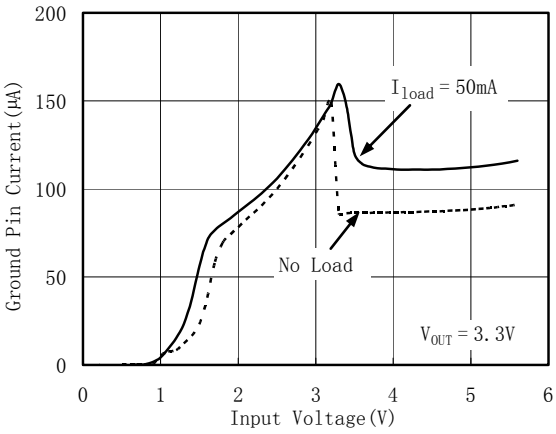
Output Voltage vs. Load Current



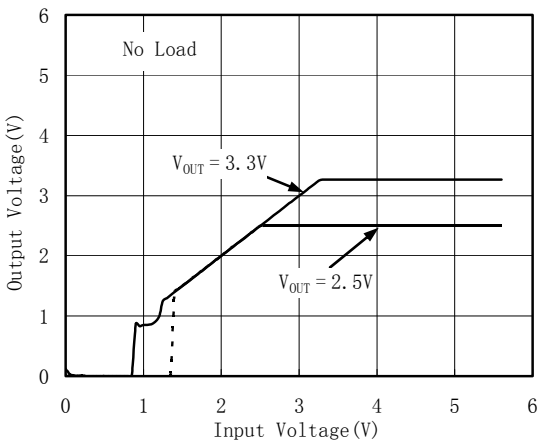
Ground Pin Current vs. Input Voltage



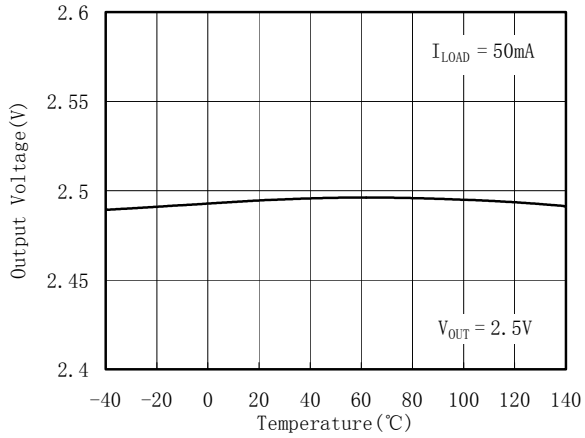
Ground Pin Current vs. Input Voltage



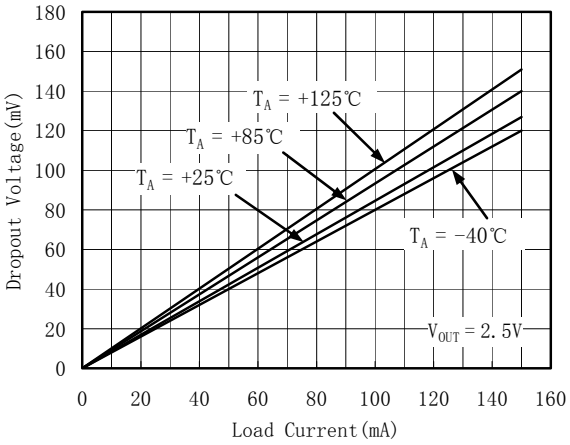
Output Voltage vs. Input Voltage



Output Voltage vs. Temperature



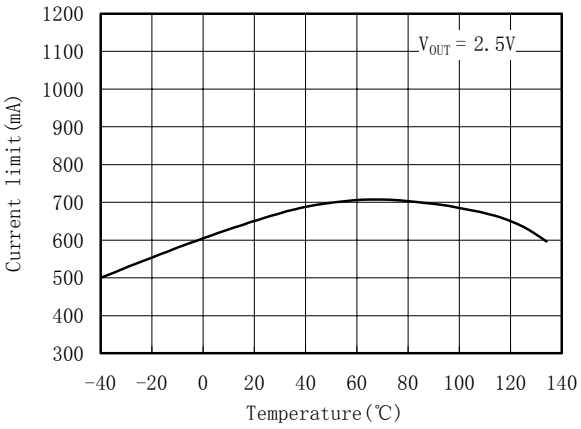
Dropout Voltage vs. Load Current



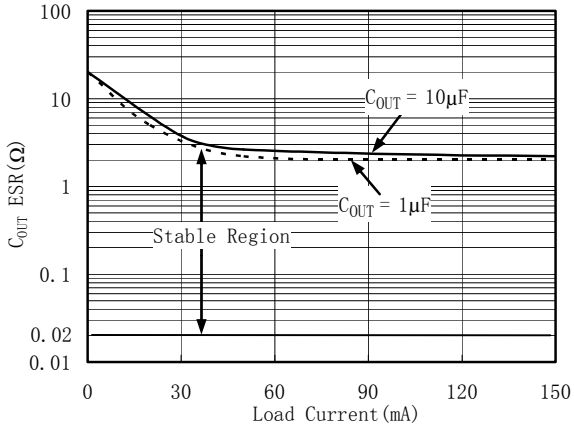
TYPICAL OPERATING CHARACTERISTICS

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

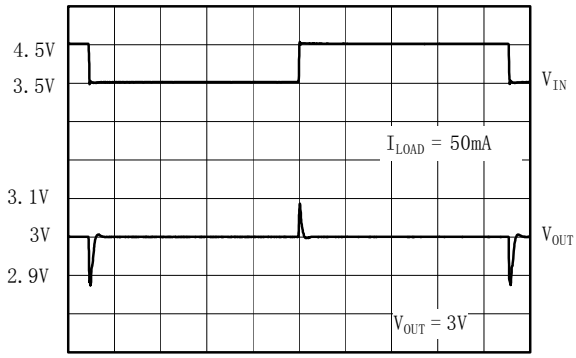
Current limit vs. Temperature



Region of Stable C_{OUT} ESR vs. Load Current

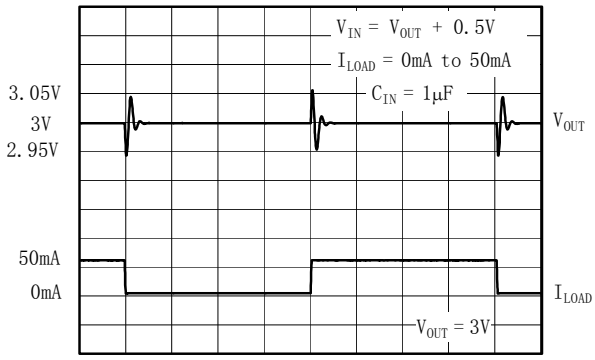


Line-Transient Response



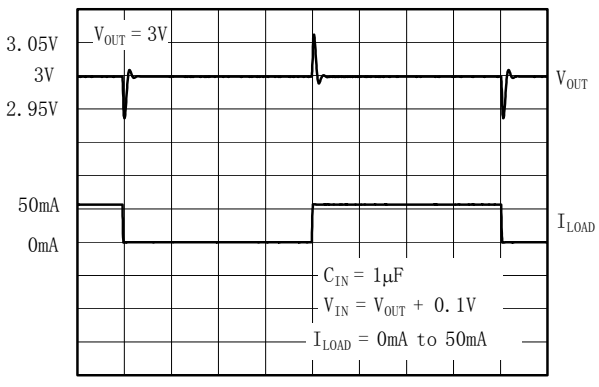
100μS/div

Load-Transient Response



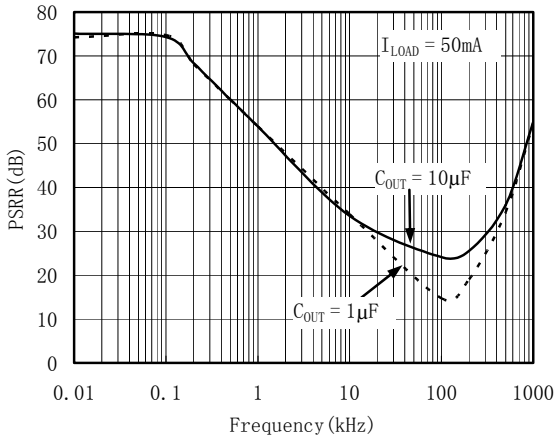
40μS/div

Load-Transient Response Near Dropout



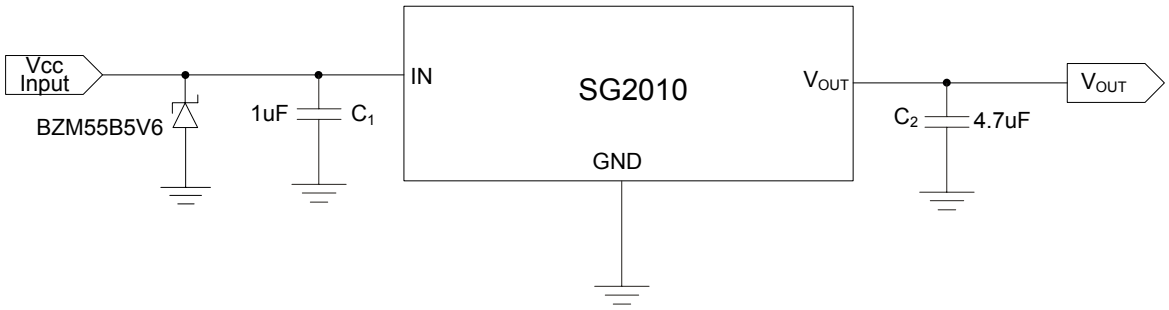
40μS/div

Power-Supply Rejection Ratio
vs. Frequency



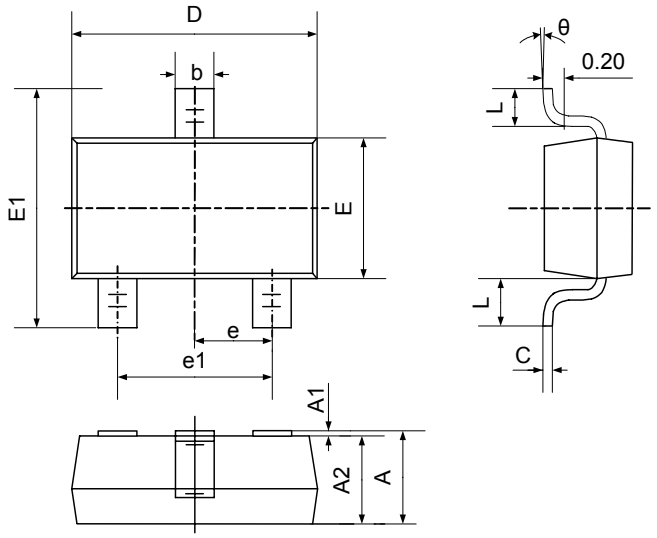
Application Notes

When LDO is used in handheld products, Attention must be paid to voltage spike which would damage SG2010. 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:



PACKAGE OUTLINE DIMENSIONS

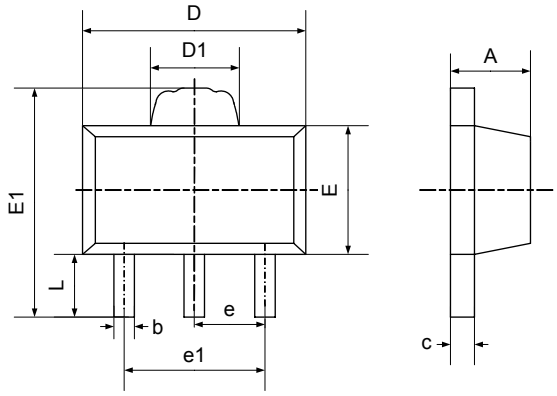
SOT23-3



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	0.400	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°

PACKAGE OUTLINE DIMENSIONS

SOT89-3



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	0.360	0.560	0.014	0.022
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.400	1.800	0.055	0.071
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500TYP		0.060TYP	
e1	2.900	3.100	0.114	0.122
L	0.900	1.100	0.035	0.043

REVISION HISTORY

Location **Page**

9/05— Data Sheet changed from preliminary to REV. A

12/06— Data Sheet changed from REV. A to REV. B

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