SGM2028
500mA, Ultra Low Dropout, Low Power, RF Linear Regulators

GENERAL DESCRIPTION

The SGM2028 is a low-power, low-noise, low-dropout, CMOS linear voltage regulator that operates from a 2.5V to 5.5V input voltage. It is the perfect choice for low voltage, low power applications. A low ground current makes this part attractive for battery operated power systems. The SGM2028 also offers ultra low dropout voltage to prolong battery life in portable electronics. Systems requiring a quiet voltage source, such as RF applications, will benefit from the SGM2028's ultra low output noise (30μV_{RMS}) and high PSRR. An external noise bypass capacitor connected to the device's BP pin can further reduce the noise level.

Other features include output current limit and thermal shutdown protection.

The SGM2028 is available in Green SOT-23-5 package. It operates over an ambient temperature range of -40°C to +85°C.

FEATURES

- **500mA Guaranteed Output Current**
- **Ultra Low Dropout Voltage**
- **Low Output Noise**
- **Thermal-Overload Protection**
- **Output Current Limit**
- **High PSRR (73dB at 1kHz)**
- **SGM2028-2.8 and SGM2028-ADJ: 110kΩ Pull Down Resistor at EN Pin**
- **SGM2028-3.3: No Pull Down Resistor at EN Pin**
- **Available Fixed Output Voltages: 2.8V and 3.3V**
- **Adjustable Output from 1.2V to 5.0V**
- **-40℃ to +85℃ Operating Temperature Range**
- **Available in Green SOT-23-5 Package**

APPLICATIONS

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

PACKAGE/ORDERING INFORMATION

MODEL	V_{OUT} (V)	PIN-PACKAGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM2028-3.3	3.3V	SOT-23-5	SGM2028-3.3YN5G/TR	S55XX	Tape and Reel, 3000
SGM2028-2.8	2.8V	SOT-23-5	SGM2028-2.8YN5G/TR	S58XX	Tape and Reel, 3000
SGM2028-ADJ	ADJ	SOT-23-5	SGM2028-ADJYN5G/TR	S4BXX	Tape and Reel, 3000

NOTE: **XX** = Date Code.

MARKING INFORMATION

SYY X X

- Date code - Month ("A" = Jan. "B" = Feb. … "L" = Dec.)
- Date code - Year ("9" = 2009, "A" = 2010 …)
- Chip I.D.

For example: S55AJ (2010, October)

ABSOLUTE MAXIMUM RATINGS

IN to GND.. -0.3V to 6V
Output Short-Circuit Duration ....Infinite
EN to GND.. -0.3V to (V_{IN} +0.3V)
OUT, BP/FB to GND.................................. -0.3V to (V_{IN} + 0.3V)
Power Dissipation, P_D @ T_A = 25℃
SOT-23-5.. 0.34W
Package Thermal Resistance
SOT-23-5, θ_{JA}..367℃/W
Operating Temperature Range............................-40℃ to +85℃
Junction Temperature.. 150℃
Storage Temperature Range............................. -65℃ to +150℃
Lead Temperature (Soldering, 10s).................................. 260℃
ESD Susceptibility
HBM..4000V
MM..400V

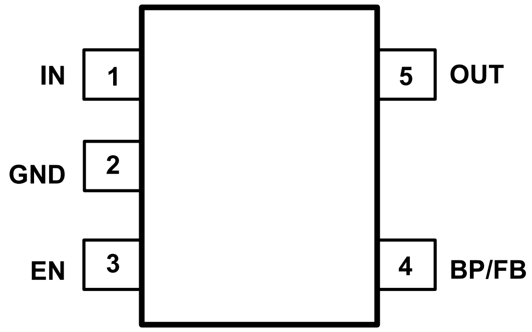
NOTE:
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. 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 latest datasheet.

PIN CONFIGURATION (TOP VIEW)



SOT-23-5

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.
	FB	Feedback Pin (adjustable voltage version only). This is used to set the output voltage of the device.
5	OUT	Regulator Output.

ELECTRICAL CHARACTERISTICS

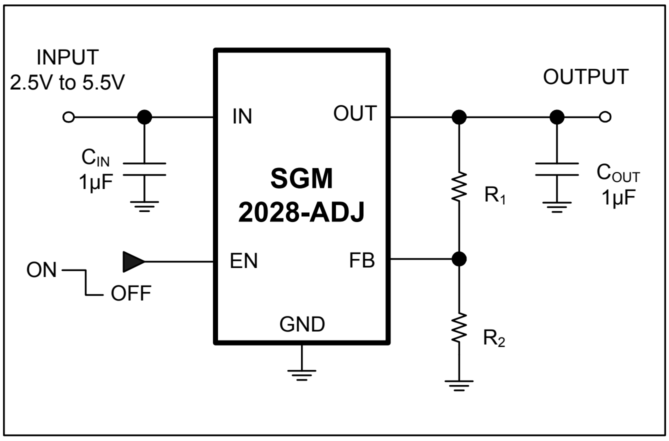
(V_{IN} = $V_{OUT\ (NOMINAL)}$ + 0.5V or 2.5V, whichever is greater, Full = -40℃ to +85℃, unless otherwise noted. For SGM2028-ADJ, V_{OUT} = 3.3V.)

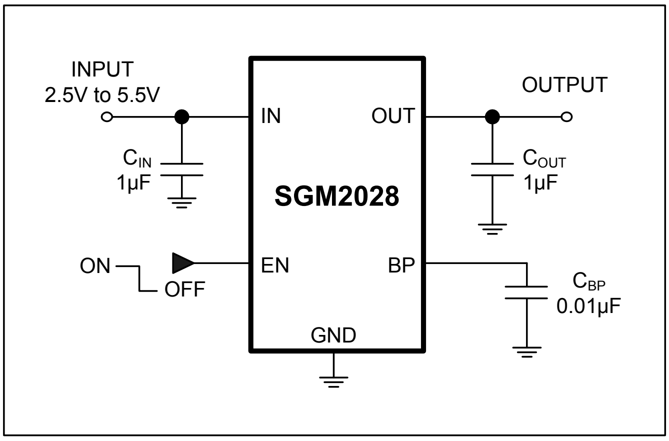
PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
Input Voltage	V_{IN}			+25℃	2.5		5.5	V
Output Voltage Accuracy		I_{OUT} = 0.1mA		+25℃	-3		+3	%
Maximum Output Current [1]				+25℃	500			mA
Current Limit	I_{LIM}			+25℃	510			mA
Ground Pin Current	I_Q	No Load, V_{EN} = 2V		+25℃		115	220	μA
Dropout Voltage [2]		I_{OUT} = 100mA		+25℃		54	90	mV
		I_{OUT} = 300mA				162	270	
		I_{OUT} = 500mA				270	420	
Line Regulation	ΔV_{LNR}	V_{IN} = 2.5V to 5.5V, I_{OUT} = 1mA		+25℃		0.02	0.095	%/V
Load Regulation	ΔV_{LDR}	I_{OUT} = 0.1mA to 500mA, C_{OUT} = 1μF		+25℃		0.0025	0.0075	%/mA
Output Voltage Noise	e_n	f = 10Hz to 100kHz, C_{BP} = 0.01μF, C_{OUT} = 10μF		+25℃		30		$μV_{RMS}$
Power Supply Rejection Ratio	PSRR	C_{BP} = 0.1μF, I_{OUT} = 50mA, C_{OUT} = 1μF, V_{IN} = V_{OUT} + 1V	f = 217Hz	+25℃		77		dB
			f = 1kHz	+25℃		73		dB
SHUTDOWN								
EN Input Threshold	V_{IH}	V_{IN} = 2.5V to 5.5V		Full	1.5			V
	V_{IL}			Full			0.3	
Shutdown Supply Current	$I_{Q(SHDN)}$	V_{EN} = 0.3V		+25℃		0.01		μA
Shutdown Exit Delay [3]		C_{BP} = 0.01μF, C_{OUT}=1μF, No Load		+25℃		30		μs
THERMAL PROTECTION								
Thermal Shutdown Temperature	T_{SHDN}					150		℃
Thermal Shutdown Hysteresis	ΔT_{SHDN}					15		℃

NOTES:

1. Maximum output current is affected by PCB layout, size of metal trace, the thermal conduction path between metal layers and the environment of the system.
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.)
3. Time needed for V_{OUT} to reach 90% of final value.

TYPICAL APPLICATION CIRCUITS





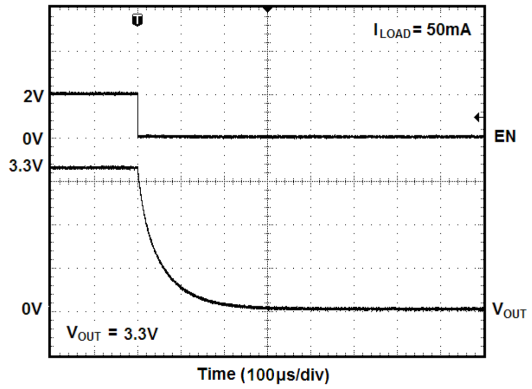
NOTE: Choose R_2 = 47kΩ to maintain a 26μA minimum load. Calculate the value for R_1 using the following equation:

$$R_1 = R_2 \times \left(\frac{V_{OUT}}{1.206V} - 1 \right)$$

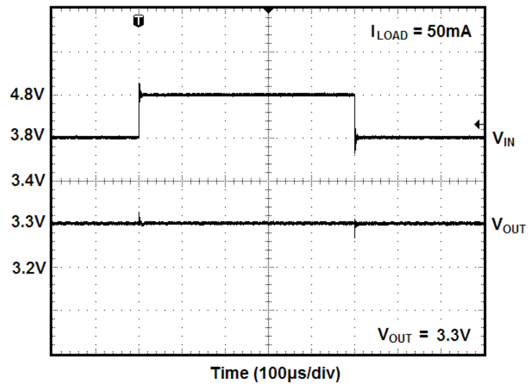
TYPICAL PERFORMANCE CHARACTERISTICS

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

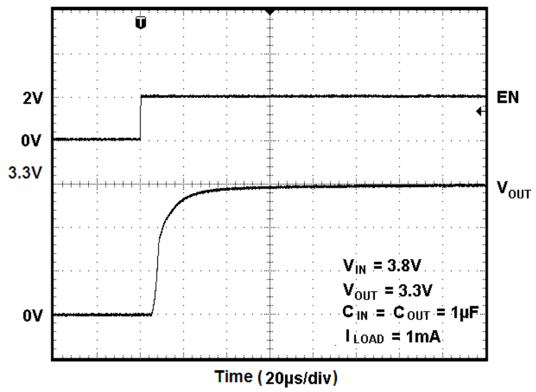
Entering Shutdown



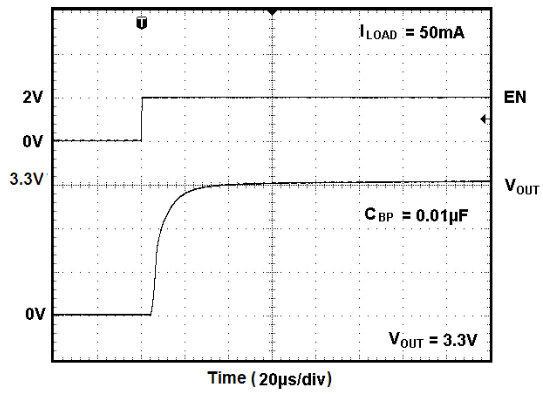
Line-Transient Response



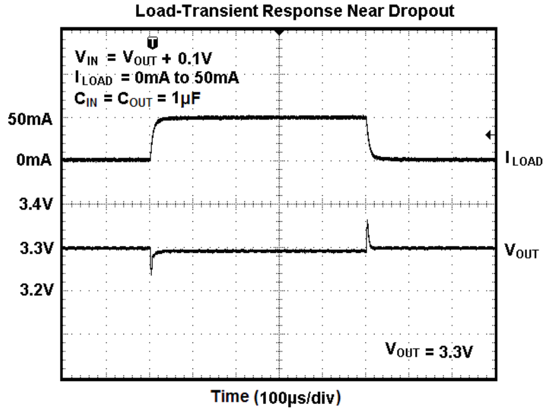
Start Up



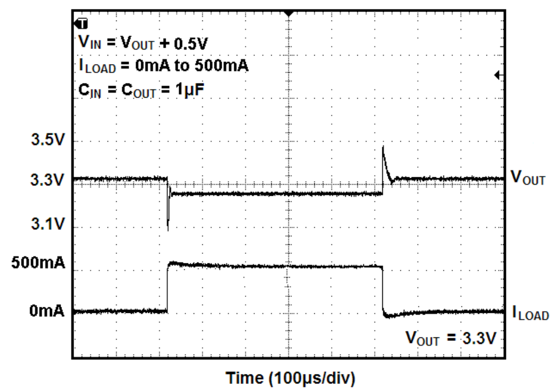
Shutdown Exit Delay



Load-Transient Response Near Dropout

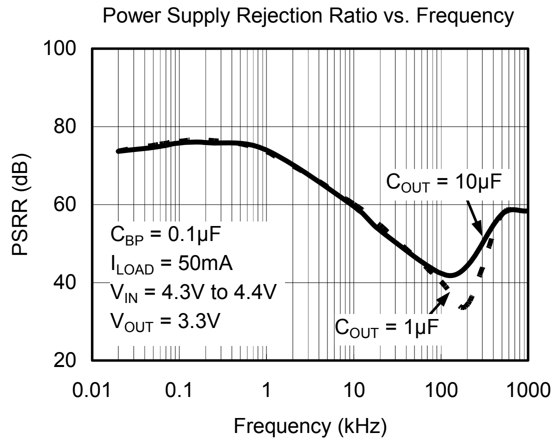


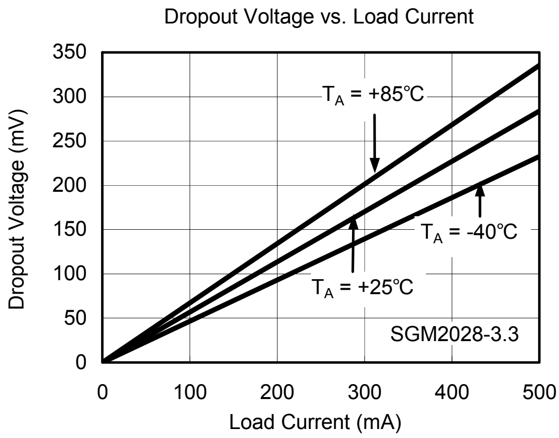
Load-Transient Response

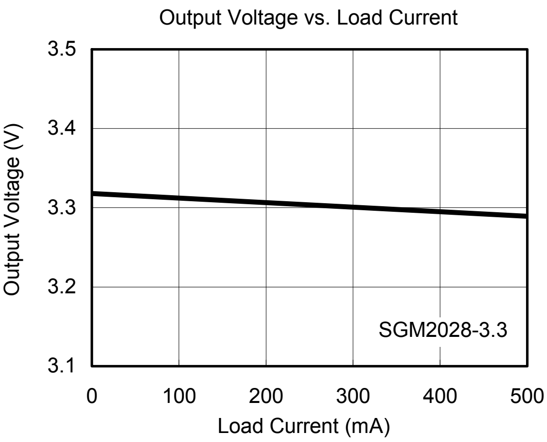


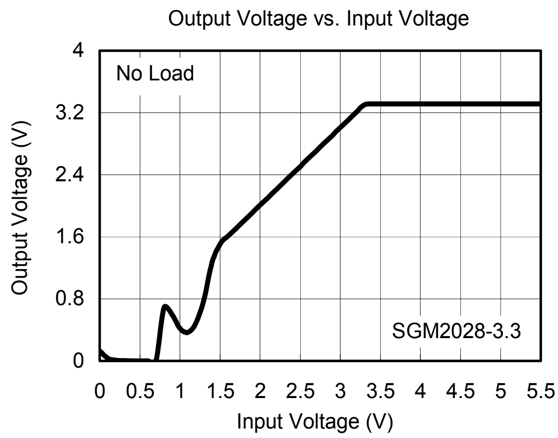
TYPICAL PERFORMANCE CHARACTERISTICS

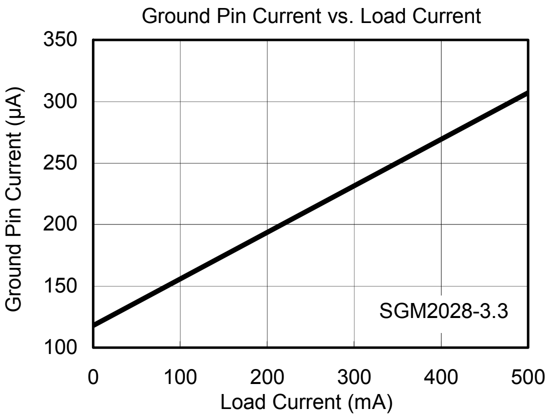
$V_{IN} = V_{OUT\ (NOMINAL)}$ + 0.5V or 2.5V, whichever is greater, C_{IN} = 1μF, C_{OUT} = 1μF, C_{BP} = 0.01μF, T_A = +25℃, unless otherwise noted.

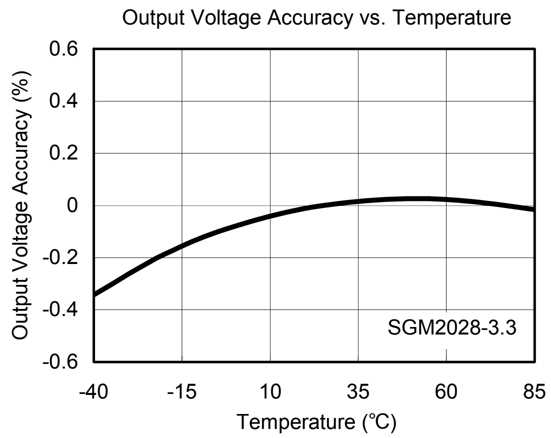












TYPICAL PERFORMANCE CHARACTERISTICS

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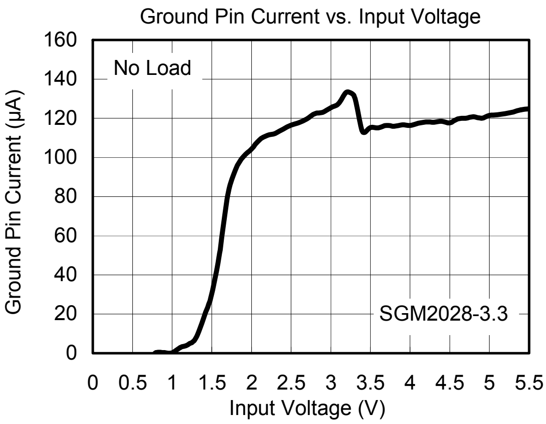
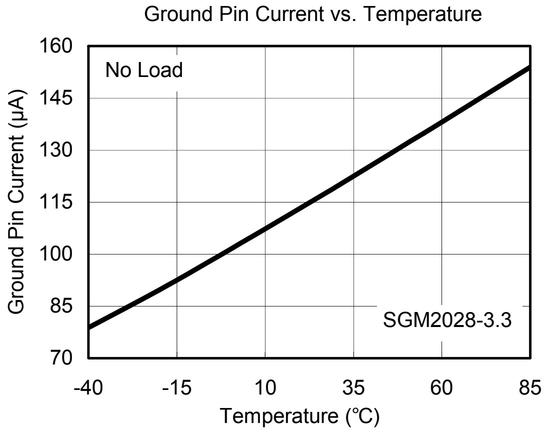
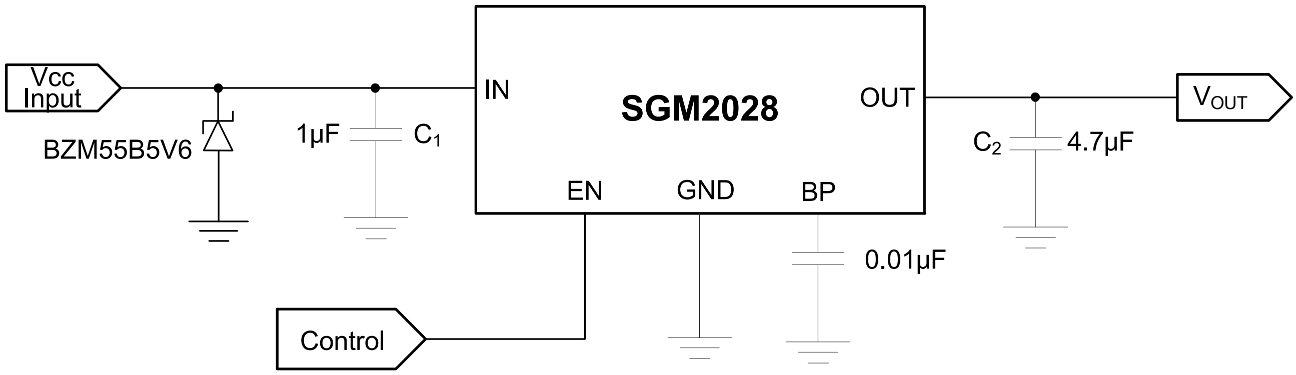




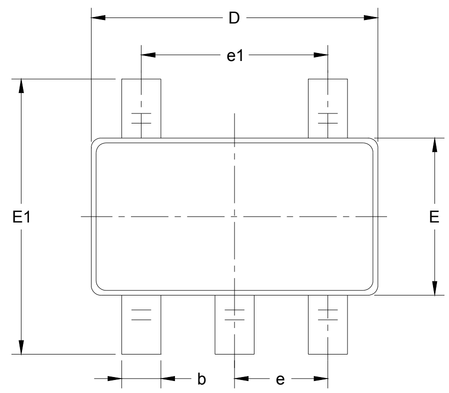
APPLICATION NOTE

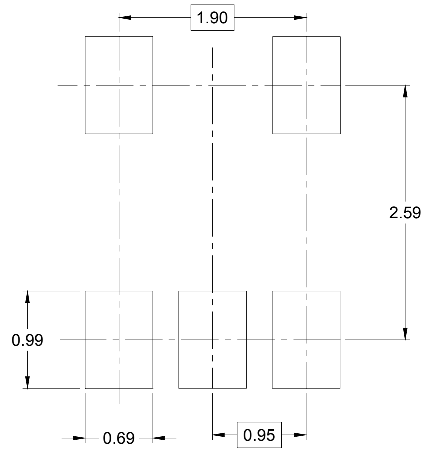
When LDO is used in handheld products, attention must be paid to voltage spikes which could damage SGM2028. In such applications, voltage spikes will be generated at charger interface and V_{BUS} pin of USB interface when charger adapters and USB equipments are hot-plugged. Besides this, handheld products 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.



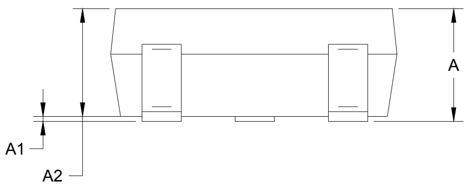
PACKAGE OUTLINE DIMENSIONS

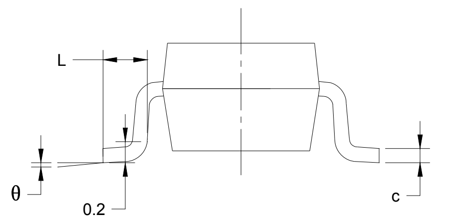
SOT-23-5





RECOMMENDED LAND PATTERN (Unit: mm)

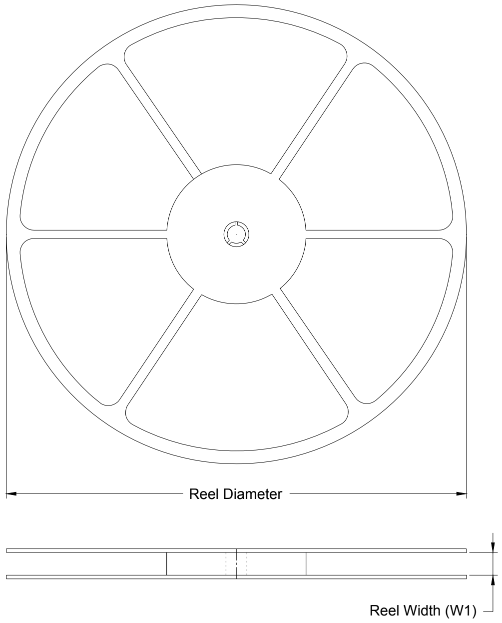




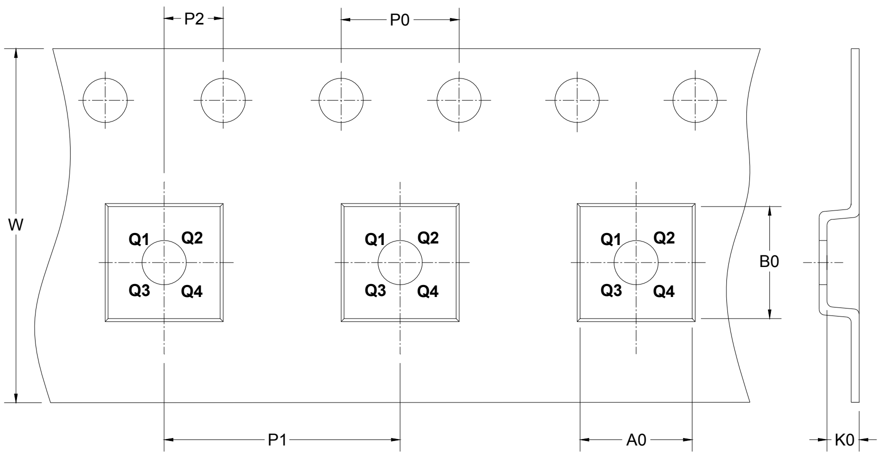
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



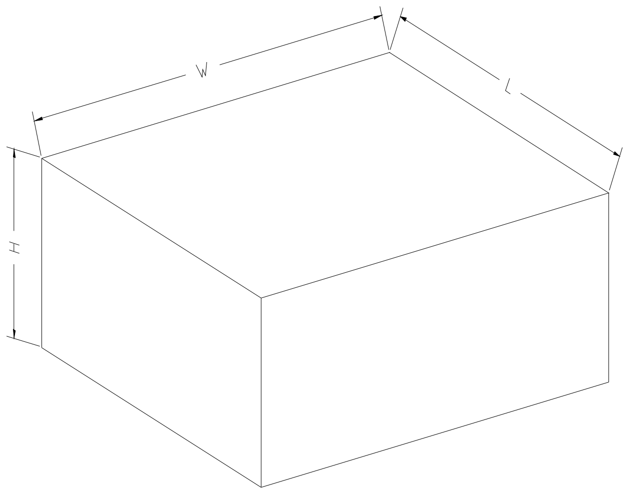
DIRECTION OF FEED

NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOT-23-5	7″	9.5	3.2	3.2	1.4	4.0	4.0	2.0	8.0	Q3

CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
7″ (Option)	368	227	224	8
7″	442	410	224	18