SGM2020
Low Power, Low Dropout, RF - Linear Regulators

GENERAL DESCRIPTION

The SGM2020 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 SGM2020 series also offer 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 SGM2020 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.

Other features include a 10nA logic- controlled shutdown mode, foldback current limit and thermal shut-down protection.

The SGM2020 is available in Green SOT-23-5 and SC70-5 packages. It operates over an ambient temperature range of -40°C to +85°C.

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)
- **Low Dropout Voltage**
- **Low 110μA No-Load Supply Current**
- **Quick Auto-Discharge in Shutdown Status**
- **High PSRR (67dB at 1kHz)**
- **Thermal-Overload Protection**
- **Output Current Limit**
- **10nA Logic-Controlled Shutdown**
- **Available in Multiple Output Voltage Versions**
  Fixed Outputs of 1.2V, 1.5V, 1.8V, 2.5V, 2.8V, 2.85V, 3.0V and 3.3V
- **-40℃ to +85℃ Operating Temperature Range**
- **Green SOT-23-5 and SC70-5 Packages**

PRODUCT NAME STRUCTURE

SGM2020-XXX X XX G / TR

Tape and Reel

Green Product

Package Type

N5	SOT-23-5
C5	SC70-5

Operating Temperature Range

Y	-40℃ to +85℃

Output Voltage

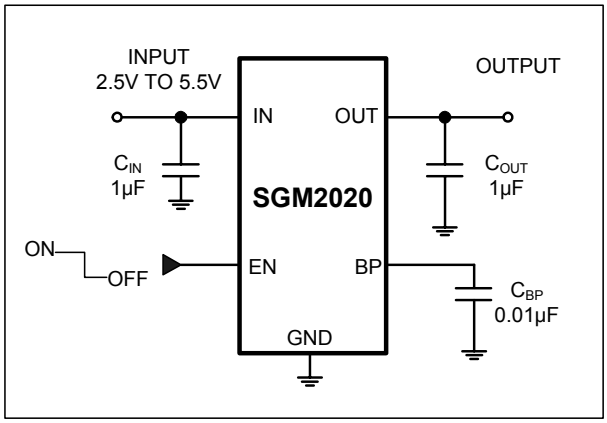
1.2	1.2V
1.5	1.5V
1.8	1.8V
2.5	2.5V
2.8	2.8V
2.85	2.85V
3.0	3.0V
3.3	3.3V

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 to GND..... -0.3V to (V_{IN} + 0.3V)
Operating Temperature Range..... -40℃ to +85℃
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.

TYPICAL APPLICATION CIRCUIT

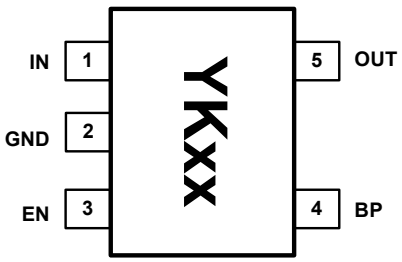


CAUTION

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.

PIN CONFIGURATIONS (TOP VIEW)



SOT-23-5 / SC70-5

NOTE1: The location of pin 1 on the YKxx is determined by orienting the package marking as shown.

NOTE2: "xx" is the output voltage code. (For Example: when the output voltage is 2.8V, it is expressed as 28.)

PIN DESCRIPTION

SOT-23-5/SC70-5	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.
5	OUT	Regulator Output.

ELECTRICAL CHARACTERISTICS

(V_{IN} = $V_{OUT\ (NOMINAL)}$ + 0.5V [1], Full = -40°C to +85°C, unless otherwise noted.)

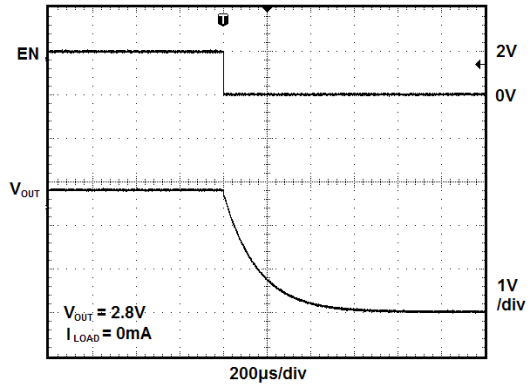
PARAMETER	SYMBOL	CONDITIONS		TEMP	MIN	TYP	MAX	UNITS
Input Voltage	V_{IN}			+25℃	2.5		5.5	V
Output Voltage Accuracy [1]		I_{OUT} = 0.1mA		+25℃	-2		+2	%
Maximum Output Current		SOT-23-5		+25℃	300			mA
		V_{OUT} = 1.8V, SC70-5 [1]			150			
		V_{OUT} > 2V, SC70-5 [1]			250			
Current Limit	I_{LIM}			+25℃	310	500		mA
Ground Pin Current	I_Q	No load, EN = 2V		+25℃		110	220	μA
Dropout Voltage [2]		I_{OUT} = 1mA		+25℃		1		mV
		I_{OUT} = 300mA				270	400	
On Resistance of Nch for Auto-Discharge	R_{LOW}	EN = 0V		+25℃		48		Ω
Line Regulation [1]		V_{IN} = 2.5V or (V_{OUT} + 0.5V) to 5.5V, I_{OUT} = 1mA		+25℃		0.02	0.06	%/V
Load Regulation		I_{OUT} =0.1mA to 300mA, C_{OUT} = 1μF, V_{OUT} > 2V		+25℃		0.002	0.006	%/mA
		I_{OUT} =0.1mA to 300mA, C_{OUT} = 1μF, V_{OUT} ≤ 2V				0.004	0.01	
Output Voltage Noise	e_n	f = 10Hz to 100kHz, C_{BP} = 0.01μF, C_{OUT} = 10μF		+25℃		30		μV_{RMS}
Power Supply Rejection Rate	PSRR	C_{BP} = 0.1μF, I_{LOAD} = 50mA, C_{OUT} = 1μF, V_{IN} = Vout+1V	f = 217Hz	+25℃		73		dB
			f = 1kHz	+25℃		67		dB
SHUTDOWN [3]								
EN Input Threshold	V_{IH}	V_{IN} = 2.5V to 5.5V		Full	1.5			V
	V_{IL}			Full			0.3	
EN Input Bias Current	$I_{B(SHDN)}$	EN = 0V and EN = 5.5V		+25℃		0.01	1	μA
				Full		0.01		
Shutdown Supply Current	$I_{Q(SHDN)}$	EN = 0.4V		+25℃		0.01	1	μA
				Full		0.01		
Shutdown Exit Delay [4]		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		℃

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: V_{EN} = -0.3V to V_{IN}
NOTE 4: Time needed for V_{OUT} to reach 90% of final value.

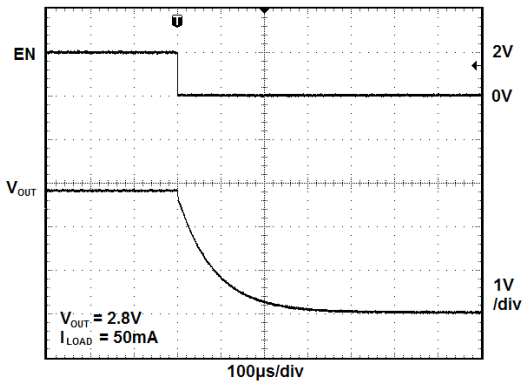
TYPICAL OPERATING CHARACTERISTICS

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°C, unless otherwise noted.

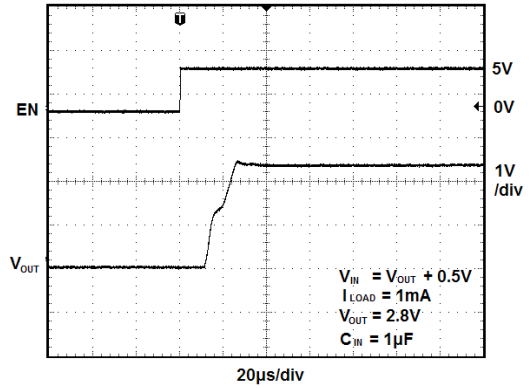
Entering Shutdown



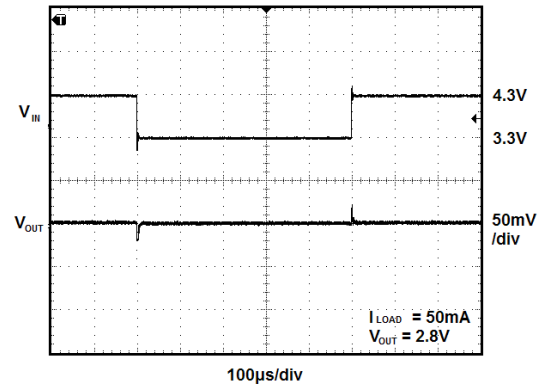
Entering Shutdown



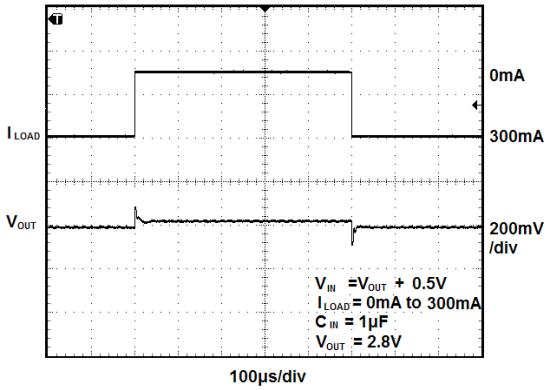
Start Up



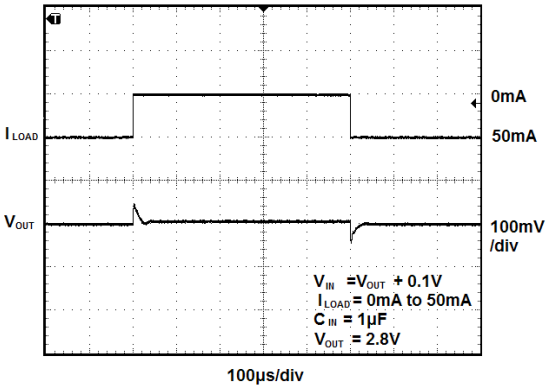
Line-Transient Response



Load-Transient Response



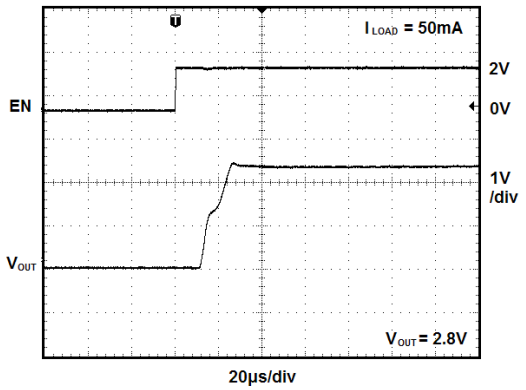
Load-Transient Response Near Dropout



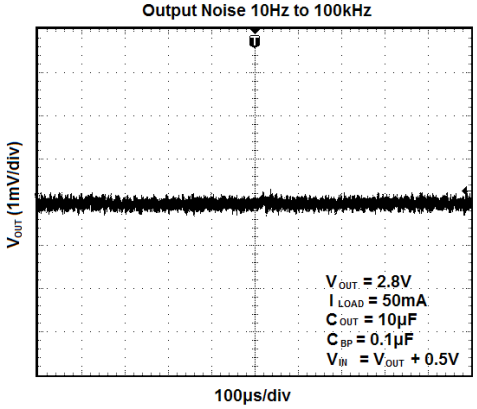
TYPICAL OPERATING CHARACTERISTICS

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.

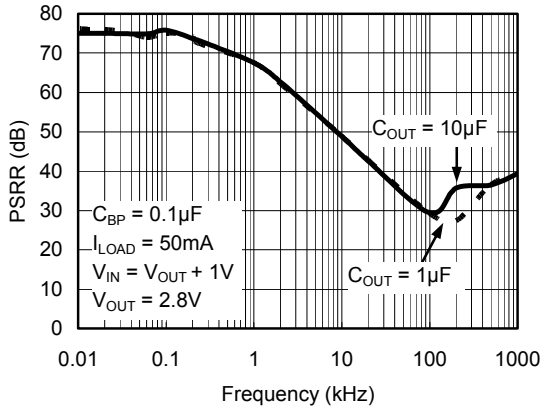
Shutdown Exit Delay



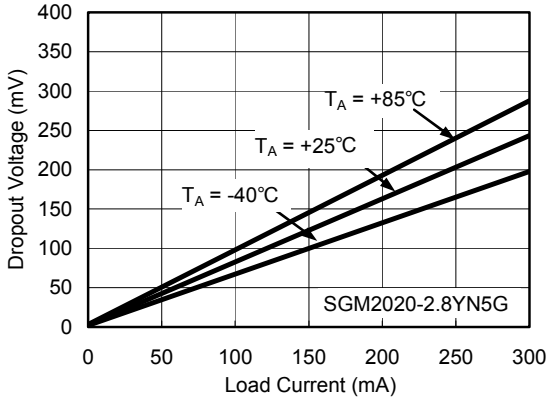
Output Noise 10Hz to 100kHz



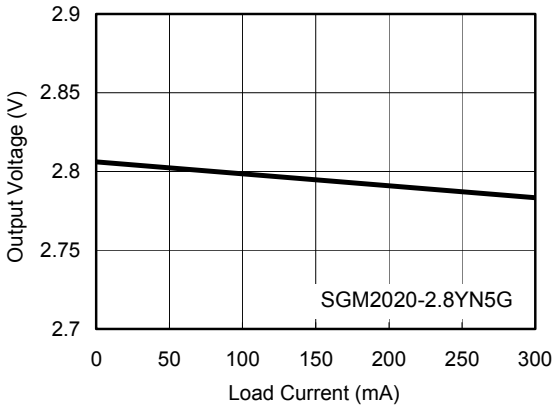
Power-Supply Rejection Ratio vs. Frequency



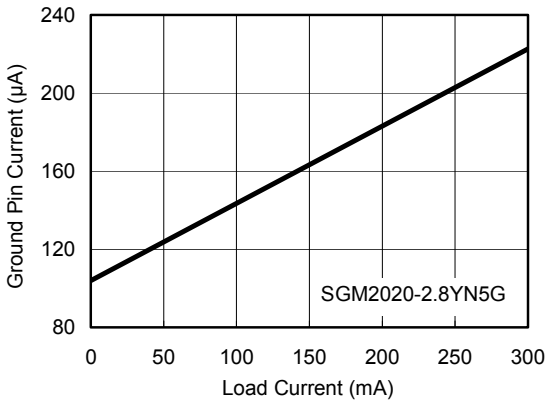
Dropout Voltage vs. Load Current



Output Voltage vs. Load Current



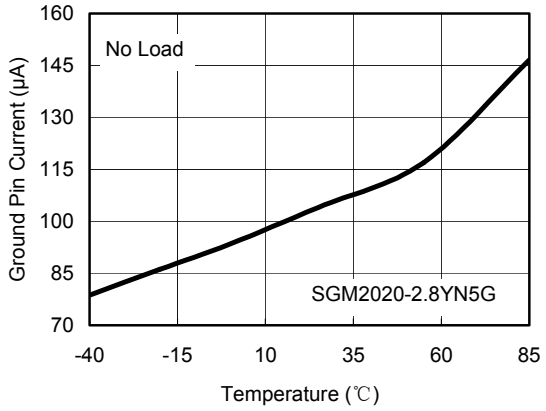
Ground Pin Current vs. Load Current



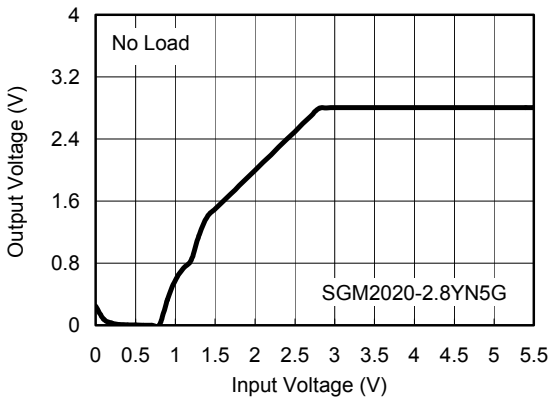
TYPICAL OPERATING CHARACTERISTICS

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

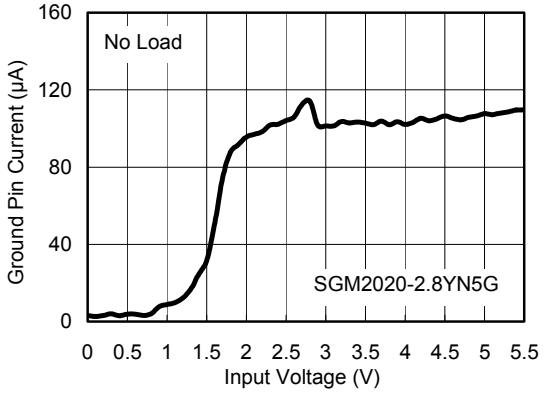
Ground Pin Current vs.Temperature



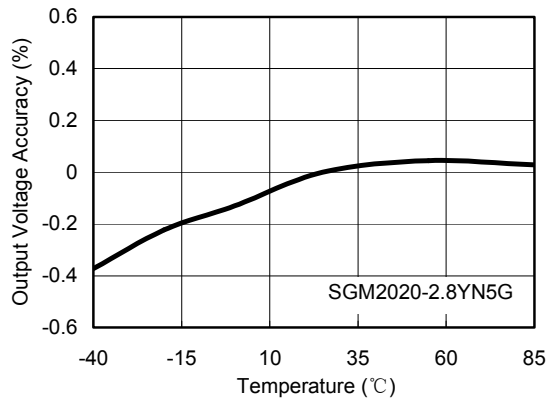
Output Voltage vs. Input Voltage



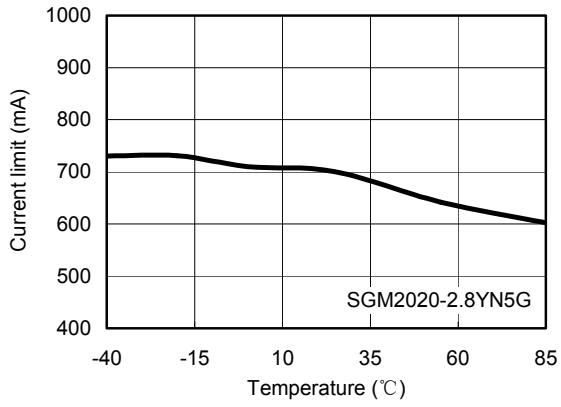
Ground Pin Current vs.Input Voltage



Output Voltage Accuracy vs. Temperature

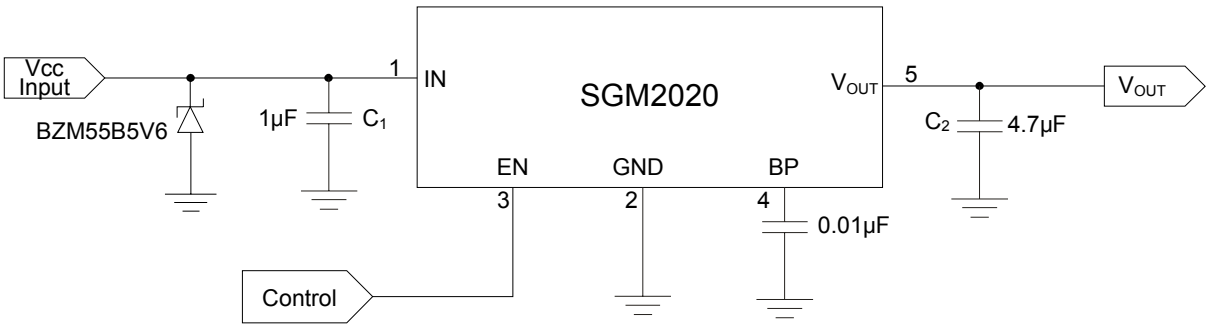


Current limit vs. Temperature



APPLICATION NOTE

When LDO is used in handheld products, attention must be paid to voltage spikes which could damage SGM2020. 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.

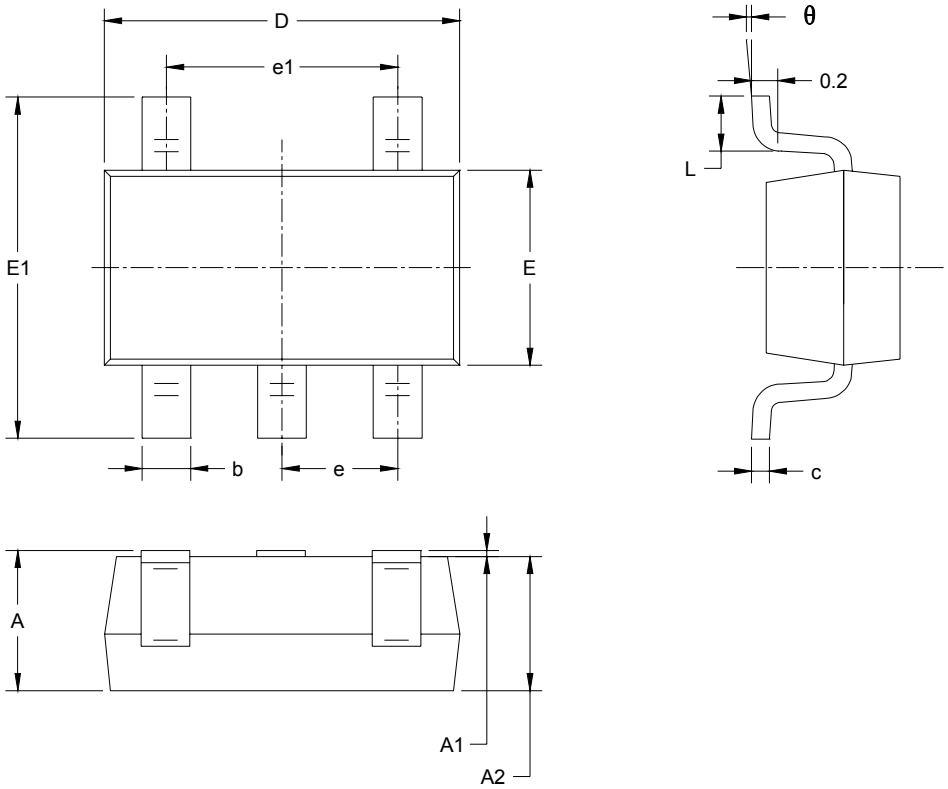


EXPANDED ORDERING INFORMATION

MODEL	V_{OUT}(V)	PIN-PACKAGE	ORDERING NUMBER	PACKAGE MARKING	PACKAGE OPTION
SGM2020-1.2	1.2V	SOT-23-5	SGM2020-1.2YN5G/TR	YK12	Tape and Reel, 3000
SGM2020-1.5	1.5V	SOT-23-5	SGM2020-1.5YN5G/TR	YK15	Tape and Reel, 3000
SGM2020-1.8	1.8V	SOT-23-5	SGM2020-1.8YN5G/TR	YK18	Tape and Reel, 3000
SGM2020-1.8	1.8V	SC70-5	SGM2020-1.8YC5G/TR	YK18	Tape and Reel, 3000
SGM2020-2.5	2.5V	SOT-23-5	SGM2020-2.5YN5G/TR	YK25	Tape and Reel, 3000
SGM2020-2.8	2.8V	SOT-23-5	SGM2020-2.8YN5G/TR	YK28	Tape and Reel, 3000
SGM2020-2.8	2.8V	SC70-5	SGM2020-2.8YC5G/TR	YK28	Tape and Reel, 3000
SGM2020-2.85	2.85V	SOT-23-5	SGM2020-2.85YN5G/TR	YK2J	Tape and Reel, 3000
SGM2020-3.0	3.0V	SOT-23-5	SGM2020-3.0YN5G/TR	YK30	Tape and Reel, 3000
SGM2020-3.3	3.3V	SOT-23-5	SGM2020-3.3YN5G/TR	YK33	Tape and Reel, 3000

PACKAGE OUTLINE DIMENSIONS

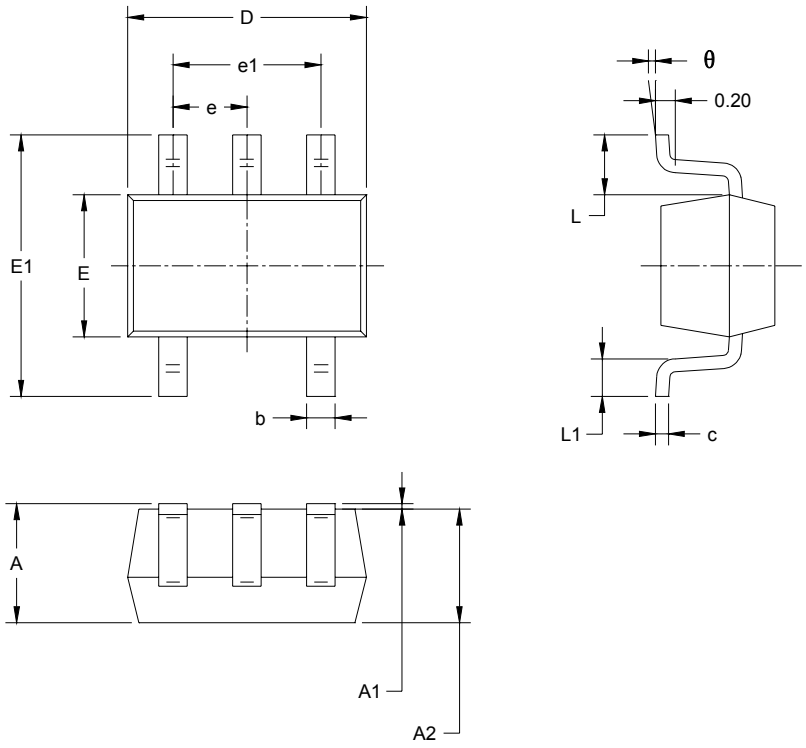
SOT-23-5



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	0.500	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

SC70-5



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.65 TYP		0.026 TYP	
e1	1.300 BSC		0.051 BSC	
L	0.525 REF		0.021 REF	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°