SGM2220
1μA Low Quiescent Current, Low Dropout, 300mA, High Voltage Regulator

GENERAL DESCRIPTION

The SGM2220 is a low quiescent current, low dropout and high input voltage linear regulator. It is capable of supplying 300mA output current with typical dropout voltage of 330mV. The operating input voltage range is from 2.2V to 13V and fixed output voltage range is from 1.8V to 5.0V.

Other features include short-circuit current limit and thermal shutdown protection.

The SGM2220 is available in Green SOT-23-5 and SOT-89-3 packages. It operates over an operating temperature range of -40℃ to +125℃.

FEATURES

- **Operating Input Voltage Range: 2.2V to 13V**
- **Fixed Outputs of 1.8V, 2.8V, 3.0V, 3.3V, 3.9V, 4.0V, 4.1V, 4.2V and 5.0V**
- **Low Power Consumption: 1μA (TYP) at No Load**
- **Low Dropout Voltage: 330mV (TYP) at 300mA, V_{OUT} = 5.0V**
- **Current Limiting and Thermal Protection**
- **Stable with Small Case Size Ceramic Capacitors**
- **UVLO with Hysteresis**
- **Reverse Current Protection when V_{OUT} > V_{IN}**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in Green SOT-23-5 and SOT-89-3 Packages**

APPLICATIONS

Portable Electronics
Smartphone
Industrial and medical Equipment
Digital Cameras and Audio Devices

TYPICAL APPLICATION

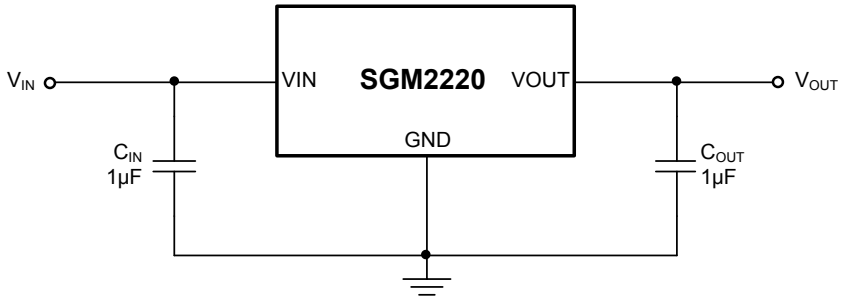


Figure 1. Typical Application Circuit

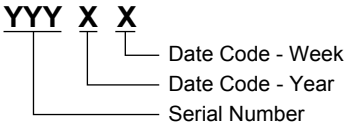
PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2220-1.8	SOT-23-5	-40℃ to +125℃	SGM2220-1.8XN5G/TR	02SXX	Tape and Reel, 3000
SGM2220-2.8	SOT-23-5	-40℃ to +125℃	SGM2220-2.8XN5G/TR	02TXX	Tape and Reel, 3000
SGM2220-3.0	SOT-23-5	-40℃ to +125℃	SGM2220-3.0XN5G/TR	02UXX	Tape and Reel, 3000
SGM2220-3.3	SOT-23-5	-40℃ to +125℃	SGM2220-3.3XN5G/TR	00LXX	Tape and Reel, 3000
SGM2220-3.9	SOT-23-5	-40℃ to +125℃	SGM2220-3.9XN5G/TR	02VXX	Tape and Reel, 3000
SGM2220-4.0	SOT-23-5	-40℃ to +125℃	SGM2220-4.0XN5G/TR	02WXX	Tape and Reel, 3000
SGM2220-4.1	SOT-23-5	-40℃ to +125℃	SGM2220-4.1XN5G/TR	02XXX	Tape and Reel, 3000
SGM2220-4.2	SOT-23-5	-40℃ to +125℃	SGM2220-4.2XN5G/TR	02YXX	Tape and Reel, 3000
SGM2220-5.0	SOT-23-5	-40℃ to +125℃	SGM2220-5.0XN5G/TR	00MXX	Tape and Reel, 3000
SGM2220-3.9	SOT-89-3	-40℃ to +125℃	SGM2220-3.9XK3G/TR	00QXX	Tape and Reel, 2500
SGM2220-4.0	SOT-89-3	-40℃ to +125℃	SGM2220-4.0XK3G/TR	02ZXX	Tape and Reel, 2500

MARKING INFORMATION

NOTE: XX = Date Code.

SOT-23-5/SOT-89-3



Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

ABSOLUTE MAXIMUM RATINGS

VIN to GND ..... -0.3V to 14V
VOUT to GND ..... -0.3V to 6V
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃

RECOMMENDED OPERATING CONDITIONS

Input Voltage Range ..... 2.7V to 13V
Input Effective Capacitance, C_{IN} ..... 0.5μF (MIN)
Output Effective Capacitance, C_{OUT} ..... 0.47μF to 10μF
Operating Junction Temperature Range ..... -40℃ to +125℃

OVERSTRESS CAUTION

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

ESD SENSITIVITY CAUTION

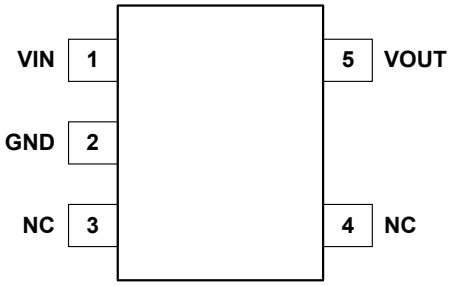
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

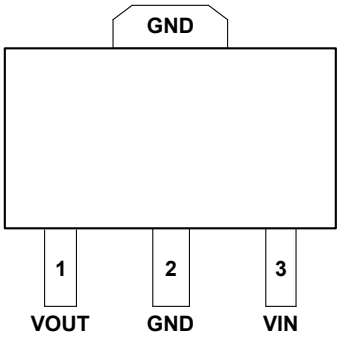
PIN CONFIGURATIONS

(TOP VIEW)



SOT-23-5

(TOP VIEW)



SOT-89-3

PIN DESCRIPTION

PIN		NAME	FUNCTION
SOT-23-5	SOT-89-3		
1	3	VIN	Input Supply Voltage Pin. It is recommended to use a 1μF or larger ceramic capacitor from VIN pin to ground to get good power supply decoupling. This ceramic capacitor should be placed as close as possible to VIN pin.
2	2	GND	Ground.
3, 4	–	NC	No Connection.
5	1	VOUT	Regulator Output Pin. It is recommended to use a ceramic capacitor with effective capacitance in the range of 0.47μF to 10μF to ensure stability. This ceramic capacitor should be placed as close as possible to VOUT pin.

FUNCTIONAL BLOCK DIAGRAM

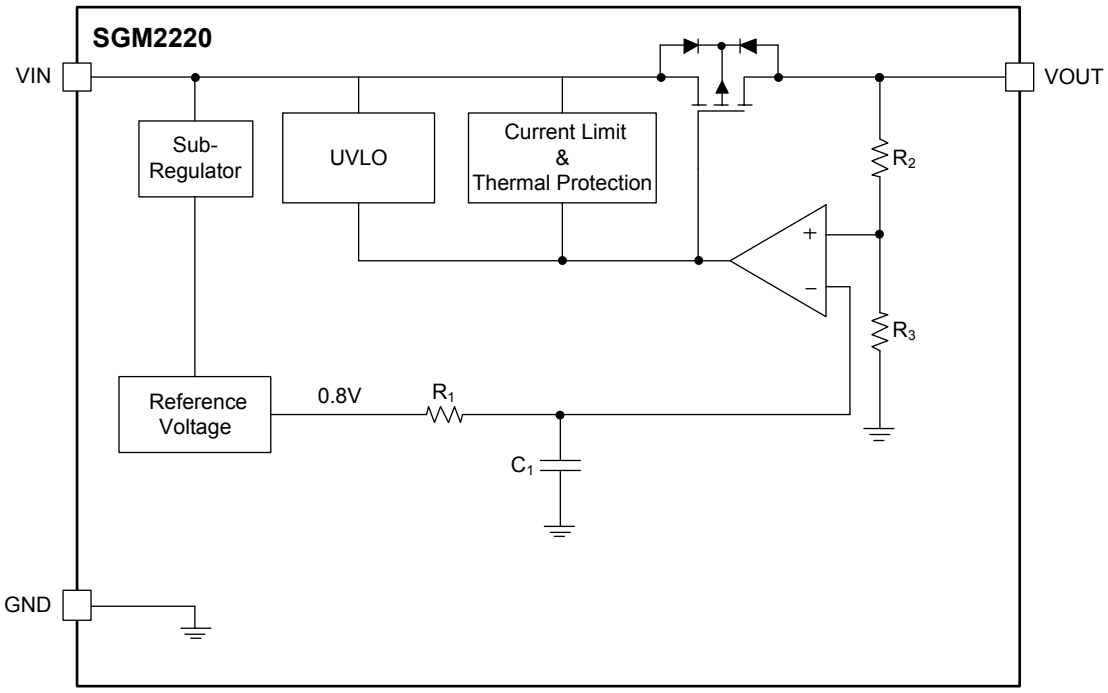


Figure 2. Internal Block Diagram

ELECTRICAL CHARACTERISTICS

(V_{IN} = (V_{OUT} + 1V) or 2.2V (whichever is greater), C_{IN} = C_{OUT} = 1μF, T_J = -40℃ to +125℃, typical values are at T_J = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Input Voltage Range	V_{IN}			2.2		13	V
Output Voltage Accuracy	V_{OUT}	I_{OUT} = 1mA			TBD		%
Maximum Output Current					300		mA
Under-Voltage Lockout Thresholds	V_{UVLO}	V_{IN} rising			1.57		V
		V_{IN} falling			1.51		V
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	V_{IN} = (V_{OUT} + 1V) to 13V, I_{OUT} = 0.1mA			0.006		%/V
Load Regulation	ΔV_{OUT}	I_{OUT} = 0.1mA to 300mA			20		mV
Dropout Voltage (1)	V_{DROP}	I_{OUT} = 300mA	V_{OUT} = 1.8V		580		mV
			V_{OUT} = 3.3V		400		
			V_{OUT} = 3.9V		379		
			V_{OUT} = 5.0V		330		
Output Current Limit	I_{LIMIT}	V_{IN} = V_{OUT} + 2V, V_{OUT} forced at 95% × $V_{OUT(NOM)}$			750		mA
Short-Circuit Current Limit	I_{SHORT}	V_{OUT} = 0V			420		mA
Ground Pin Current	I_{GND}	No load			1		μA
		I_{OUT} = 50mA			73		
		I_{OUT} = 300mA			280		
Reverse Threshold Voltage	V_{RH}	V_{OUT} rising, V_{OUT} - V_{IN}			39		mV
	V_{RL}	V_{OUT} falling, V_{OUT} - V_{IN}			12		mV
Reverse Leakage Current	I_{RL}	V_{OUT} = 5.2V, V_{IN} = 2.2V			10		μA
		V_{OUT} = 5.2V, V_{IN} = 0V			23		μA
Power Supply Rejection Ratio	PSRR	V_{OUT} = 3.3V, V_{IN} = $V_{OUT(NOM)}$ + 1, ΔV_{RIPPLE} = 0.2V_{P-P}, I_{OUT} = 10mA	f = 217Hz		61		dB
			f = 1kHz		52		
Output Voltage Noise	e_n	V_{OUT} = 3.3V, f = 10Hz to 100kHz, I_{OUT} = 10mA			74		μV_{RMS}
Thermal Shutdown Temperature	T_{SHDN}				170		℃
Thermal Shutdown Hysteresis	ΔT_{SHDN}				30		℃

NOTE:

1. The dropout voltage is defined as the difference between V_{IN} and V_{OUT} when V_{OUT} falls to 95% × $V_{OUT(NOM)}$.

APPLICATION INFORMATION

The SGM2220 is a low quiescent current, low dropout and high input voltage LDO and provides 300mA output current. These features make the device a reliable solution to solve many challenging problems in the generation of clean and accurate power supply. The high performance also makes the SGM2220 useful in a variety of applications.

Input Capacitor Selection (C_{IN})

The input decoupling capacitor should be placed as close as possible to the VIN pin for ensuring the device stability. A 1μF to 10μF X7R or X5R ceramic capacitor is selected to get good dynamic performance.

When V_{IN} is required to provide large current instantaneously, a large effective input capacitor is required. Multiple input capacitors can limit the input tracking inductance. Adding more input capacitors is available to restrict the ringing and to keep it below the device absolute maximum ratings.

Output Capacitor Selection (C_{OUT})

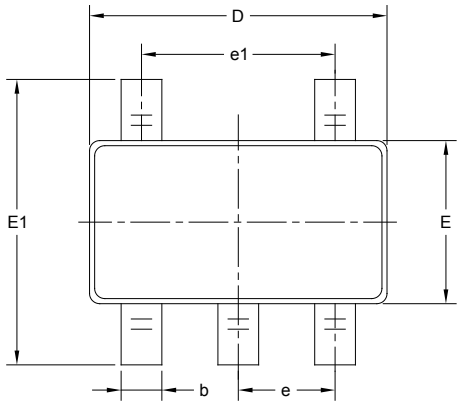
The output decoupling capacitor should be placed as close as possible to the VOUT pin. A 1μF to 10μF X7R or X5R ceramic capacitor is selected to get good dynamic performance. For ceramic capacitor, temperature, DC bias and package size will change the effective capacitance, so enough margin of C_{OUT} must be considered in design. Additionally, C_{OUT} with larger capacitance and lower ESR will help increase the high frequency PSRR and improve the load transient response.

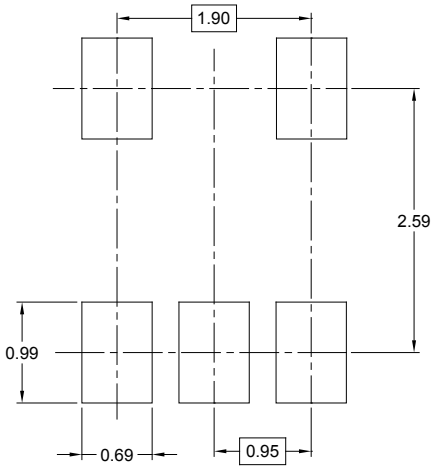
Thermal Shutdown

The SGM2220 can detect the temperature of die. When the die temperature exceeds the threshold value of thermal shutdown, the SGM2220 will be in shutdown state and it will remain in this state until the die temperature decreases to +140℃.

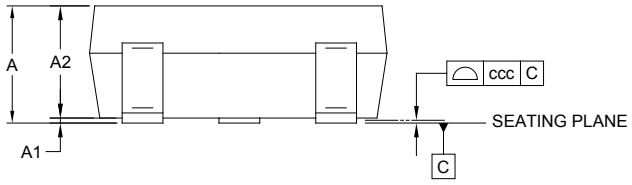
PACKAGE OUTLINE DIMENSIONS

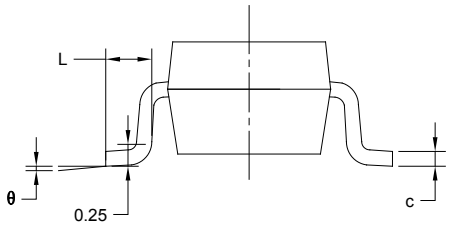
SOT-23-5





RECOMMENDED LAND PATTERN (Unit: mm)



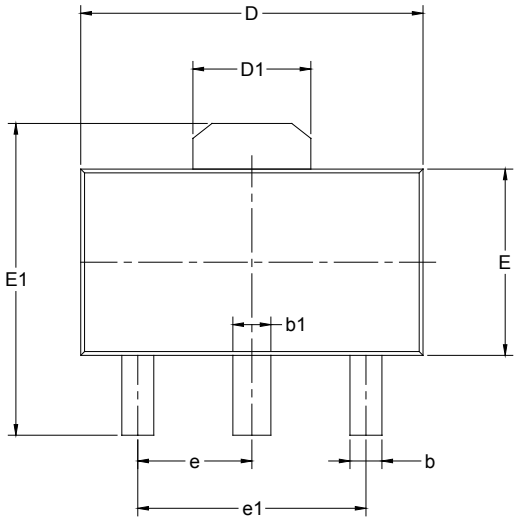


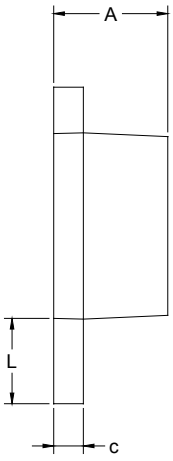
Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A	-	-	1.450
A1	0.000	-	0.150
A2	0.900	-	1.300
b	0.300	-	0.500
c	0.080	-	0.220
D	2.750	-	3.050
E	1.450	-	1.750
E1	2.600	-	3.000
e	0.950 BSC		
e1	1.900 BSC		
L	0.300	-	0.600
θ	0°	-	8°
ccc	0.100		

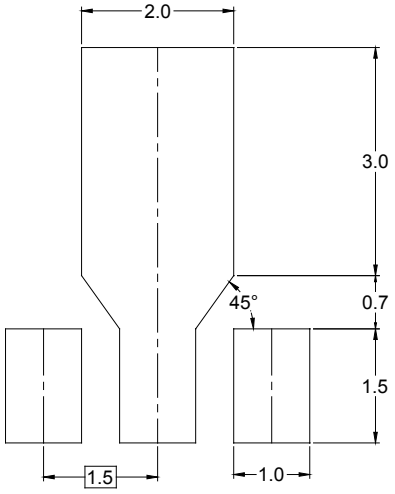
NOTES:
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MO-178.

PACKAGE OUTLINE DIMENSIONS

SOT-89-3







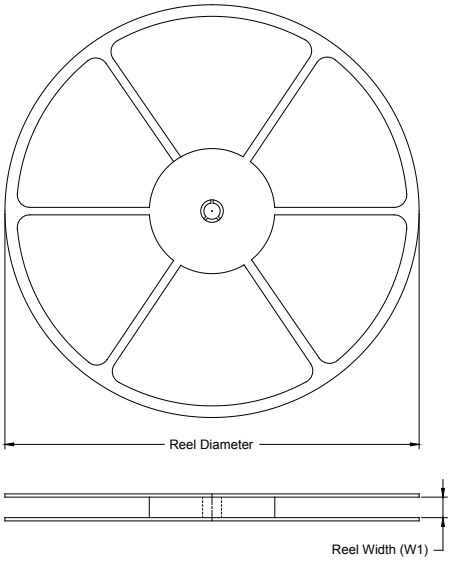
RECOMMENDED LAND PATTERN (Unit: mm)

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

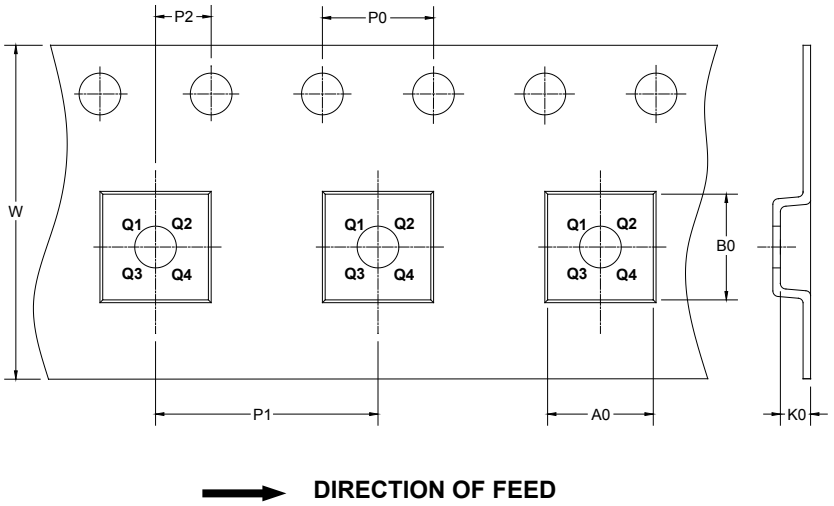
NOTES:
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



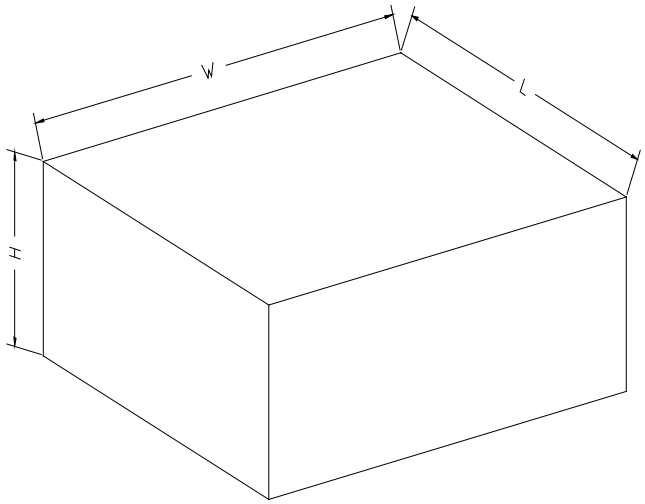
NOTE: The picture is only for reference. Please make the object as the standard.

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	3.20	3.20	1.40	4.0	4.0	2.0	8.0	Q3
SOT-89-3	7″	13.2	4.85	4.45	1.85	4.0	8.0	2.0	12.0	Q3

DD0001

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

DD0002