SGM2205-12XK3G
800mA, High Voltage, Low Noise LDO Regulator

GENERAL DESCRIPTION

The SGM2205-12XK3G is a high voltage, low noise and low dropout voltage linear regulator. It is capable of supplying 800mA output current with typical dropout voltage of only 450mV. The operating input voltage range is from 3.6V to 36V.

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

The SGM2205-12XK3G is available in a Green SOT-89-3 package. It operates over an operating temperature range of -40℃ to +125℃.

FEATURES

- **Wide Operating Input Voltage Range: 3.6V to 36V**
- **Fixed Output Voltage: 12V**
- **Output Voltage Accuracy: ±1.5% at +25℃**
- **Low Dropout Voltage: 450mV (TYP) at 800mA**
- **Current Limiting and Thermal Protection**
- **Excellent Load and Line Transient Responses**
- **No-Load Stability**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in a Green SOT-89-3 Package**

APPLICATIONS

Cellular Telephones
Palmtop Computers
High-Efficiency Linear Power Supplies
Portable Equipment

TYPICAL APPLICATION

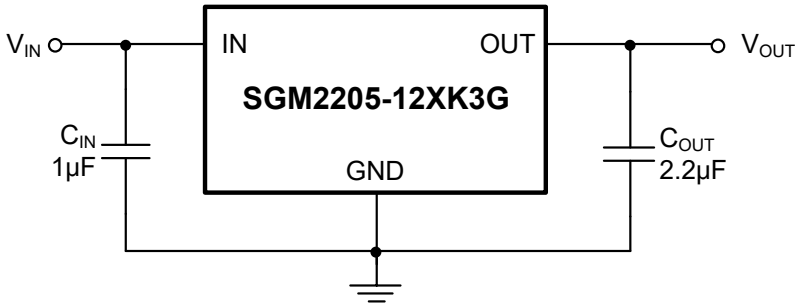


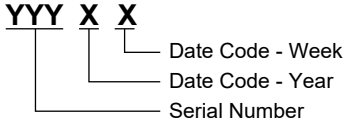
Figure 1. Typical Application Circuit

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2205-12XK3G	SOT-89-3	-40℃ to +125℃	SGM2205-12XK3G/TR	GRBXX	Tape and Reel, 1000

MARKING INFORMATION

NOTE: XX = Date Code.



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

Supply Voltage Range, V_{IN} ..... -40V to +40V
Power Dissipation, P_D @ T_J = +25℃
SOT-89-3 ..... 1.66W
Package Thermal Resistance
SOT-89-3, θ_{JA} ..... 75℃/W
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM 6000V
CDM 1000V

RECOMMENDED OPERATING CONDITIONS

Supply Voltage Range, V_{IN} ..... 3.6V to 36V
Input Effective Capacitance, C_{IN} ..... 0.5μF (MIN)
Output Effective Capacitance, C_{OUT} ..... 1μF 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.

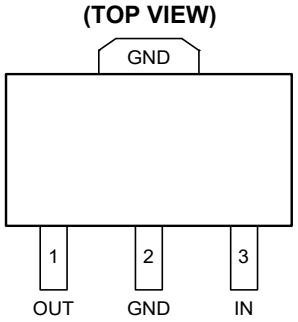
ESD SENSITIVITY CAUTION

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 CONFIGURATION



SOT-89-3

PIN DESCRIPTION

PIN	NAME	FUNCTION
1	OUT	Regulator Output Pin. It is recommended to use an output capacitor with effective capacitance in the range of 1μF to 10μF to ensure stability.
2	GND	Ground.
3	IN	Input Supply Voltage Pin. It is recommended to use a 1μF or larger ceramic capacitor from IN pin to ground to get good power supply decoupling.

ELECTRICAL CHARACTERISTICS

(V_{IN} = $V_{OUT(NOM)}$ + 1V, I_{OUT} = 0.1mA and C_{OUT} = 2.2μF, 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}	T_J = +25℃	3.6		36	V
Output Voltage Accuracy	V_{OUT}	Variation from nominal V_{OUT}, T_J = +25℃	-1.5		1.5	%
		Variation from nominal V_{OUT}	-2		2	
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	V_{IN} = ($V_{OUT(NOM)}$ + 1V) to 36V, T_J = +25℃		0.0003	0.003	%/V
		V_{IN} = ($V_{OUT(NOM)}$ + 1V) to 36V			0.005	
Load Regulation	$\frac{\Delta V_{OUT}}{V_{OUT}}$	I_{OUT} = 0.1mA to 800mA, T_J = +25℃		0.1	0.3	%
		I_{OUT} = 0.1mA to 800mA			0.4	
Dropout Voltage (1)	V_{DROP}	I_{OUT} = 50mA, T_J = +25℃		30	38	mV
		I_{OUT} = 50mA			55	
		I_{OUT} = 200mA, T_J = +25℃		115	150	
		I_{OUT} = 200mA			210	
		I_{OUT} = 800mA, T_J = +25℃		450	610	
		I_{OUT} = 800mA			850	
Output Current Limit	I_{LIMIT}	V_{OUT} = 90% × $V_{OUT(NOM)}$, T_J = +25℃	820	1100		mA
Short-Circuit Current	I_{SHORT}	V_{OUT} = 0V		230		mA
Ground Pin Current	I_Q	No load, T_J = +25℃		80	104	μA
		No load			112	
		I_{OUT} = 0.1mA, T_J = +25℃		80	104	
		I_{OUT} = 0.1mA			112	
		I_{OUT} = 50mA, T_J = +25℃		220	280	
		I_{OUT} = 50mA			290	
		I_{OUT} = 800mA, T_J = +25℃		1950	2250	
		I_{OUT} = 800mA			2350	
Power Supply Rejection Ratio	PSRR	f =1kHz, V_{OUT} = 12V, I_{OUT} = 50mA		62		dB
Output Voltage Noise	e_n	V_{OUT} = 12V, I_{OUT} = 50mA, C_{OUT} = 2.2μF		1900		nV/$\sqrt{Hz}$
Output Voltage Temperature Coefficient	$\frac{\Delta V_{OUT}}{\Delta T_J \times V_{OUT}}$			40		ppm/℃
Thermal Shutdown Temperature	T_{SHDN}			155		℃
Thermal Shutdown Hysteresis	ΔT_{SHDN}			25		℃

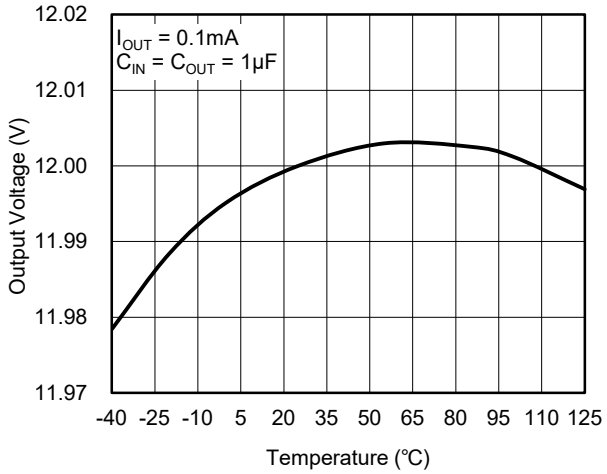
NOTE:

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

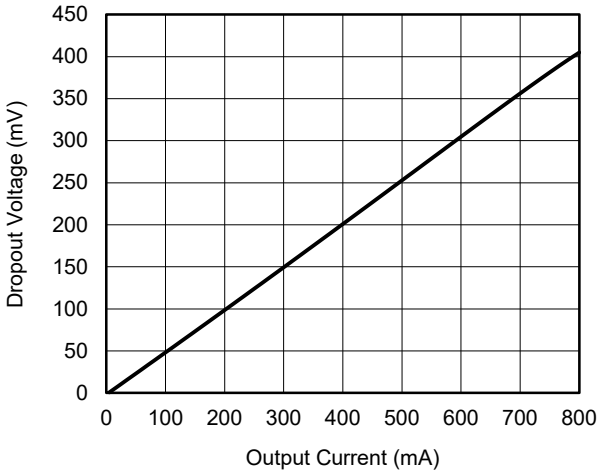
TYPICAL PERFORMANCE CHARACTERISTICS

T_J = +25℃, C_{OUT} = 2.2μF and I_{OUT} = 0.1mA, unless otherwise noted.

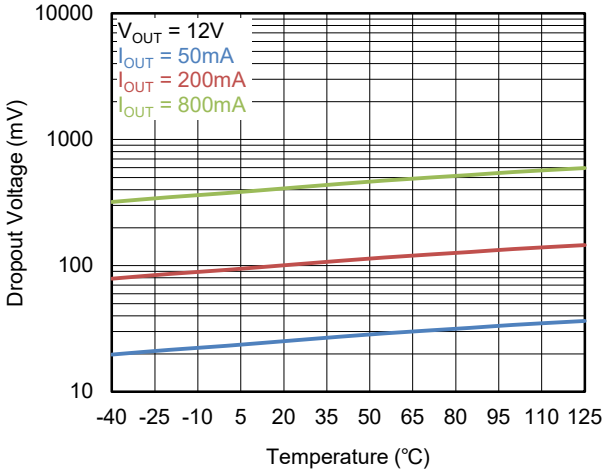
Output Voltage vs. Temperature



Dropout Voltage vs. Output Current



Dropout Voltage vs. Temperature



FUNCTIONAL BLOCK DIAGRAM

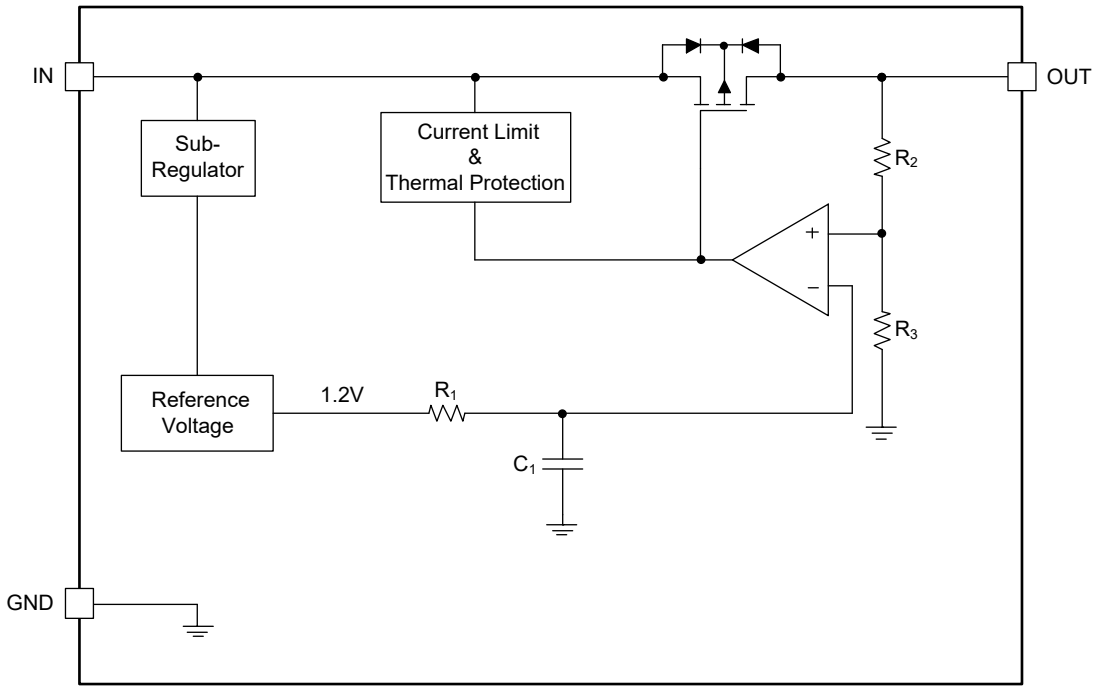


Figure 2. Block Diagram

APPLICATION INFORMATION

The SGM2205-12XK3G is a high voltage, low noise and low dropout LDO and provides 800mA 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 SGM2205-12XK3G useful in a variety of applications. The SGM2205-12XK3G provides protection functions for output overload, output short-circuit condition and overheating.

Input Capacitor Selection (C_{IN})

The input decoupling capacitor should be placed as close as possible to the IN pin to ensure the device stability. 1μF or larger 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 capacitor should be placed as close as possible to the OUT pin. 2.2μF or larger X7R or X5R ceramic capacitor is selected to get good dynamic performance. The minimum effective capacitance of C_{OUT} that SGM2205-12XK3G can remain stable is 1μF. 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.

No-Load Stability

The SGM2205-12XK3G can maintain stability without output load (except internal voltage divider).

Input Power Supply

The input power supply range is from 3.6V to 36V. V_{IN} must be larger than (V_{OUT} + V_{DROP}) in application. The input ceramic capacitor must be placed as close as possible to the IN pin, this C_{IN} can help improve the output noise performance of LDO.

Output Current Limit and Short-Circuit Protection

When overload events happen, the output current is internally limited to 1100mA (TYP). When the OUT pin is shorted to ground, the short-circuit protection will limit the output current to 230mA (TYP).

Thermal Shutdown

The SGM2205-12XK3G can detect the temperature of die. When the die temperature exceeds the threshold value of thermal shutdown, the SGM2205-12XK3G will be in shutdown state and remain in this state until the die temperature decreases to +130℃.

Power Dissipation (P_D)

Thermal protection limits power dissipation in the SGM2205-12XK3G. When power dissipation on pass element (P_D = (V_{IN} - V_{OUT}) × I_{OUT}) is too much and the operating junction temperature exceeds +155℃, the OTP circuit starts the thermal shutdown function and turns the pass element off.

Therefore, thermal analysis for the chosen application is important to guarantee reliable performance over all conditions. To guarantee reliable operation, the junction temperature of the SGM2205-12XK3G must not exceed +125℃.

The maximum allowable power dissipation depends on the thermal resistance of the IC package, the PCB layout, the rate of surrounding airflow, and the difference between the junction temperature and ambient temperature. The maximum power dissipation can be approximated using the following equation:

$$P_{D(MAX)} = (T_{J(MAX)} - T_A)/\theta_{JA} \quad (1)$$

where $T_{J(MAX)}$ is the maximum junction temperature, T_A is the ambient temperature, and θ_{JA} is the junction-to-ambient thermal resistance.

Layout Guidelines

To get good PSRR, low output noise and high transient response performance, the input and output bypass capacitors must be placed as close as possible to the IN pin and OUT pin separately. V_{IN} and V_{OUT} had better use separate ground planes and these ground planes are single point connected to the GND pin.

REVISION HISTORY

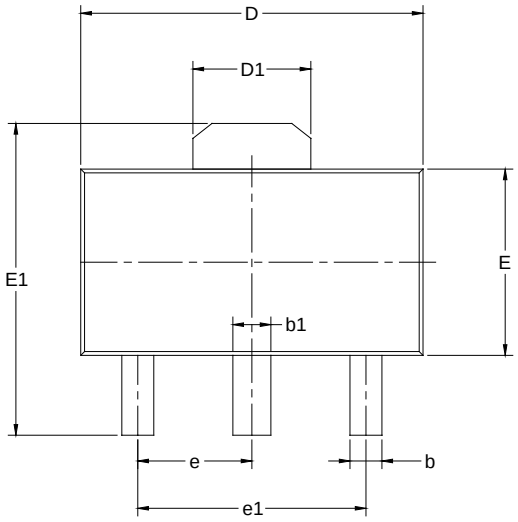
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

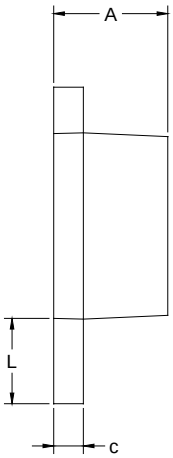
AUGUST 2022 – REV.A to REV.A.1	Page
Updated Electrical Characteristics section	4

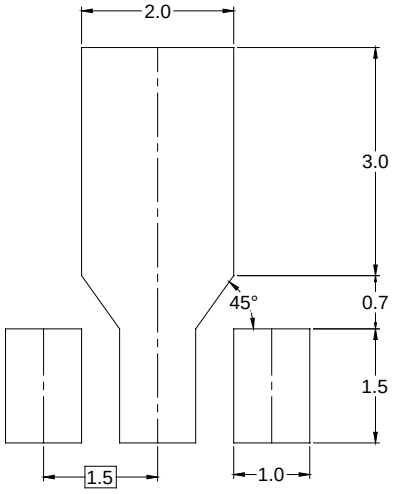
Changes from Original (MARCH 2021) to REV.A	Page
Changed from product preview to production data	All

PACKAGE OUTLINE DIMENSIONS

SOT-89-3







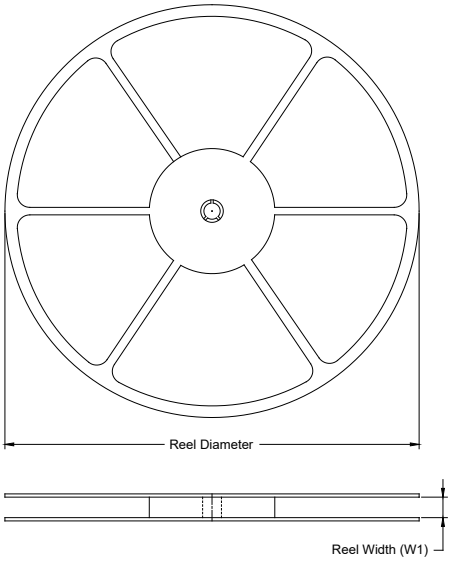
RECOMMENDED LAND PATTERN (Unit: mm)

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

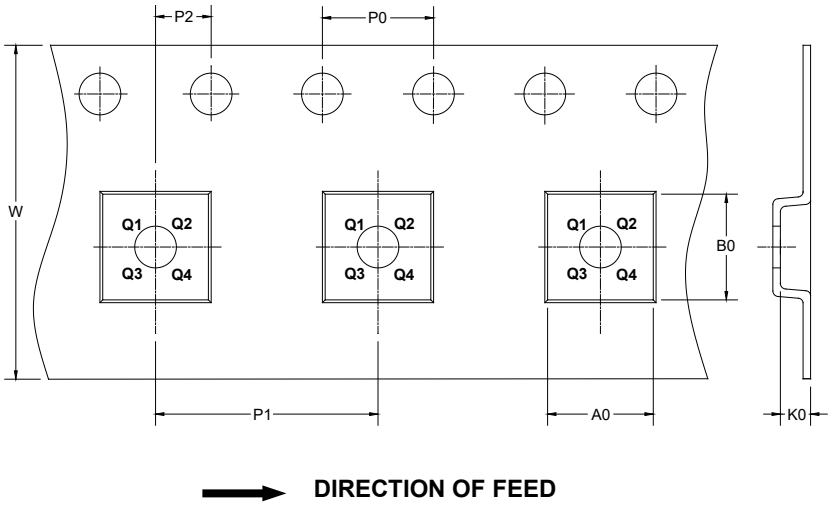
NOTES:
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



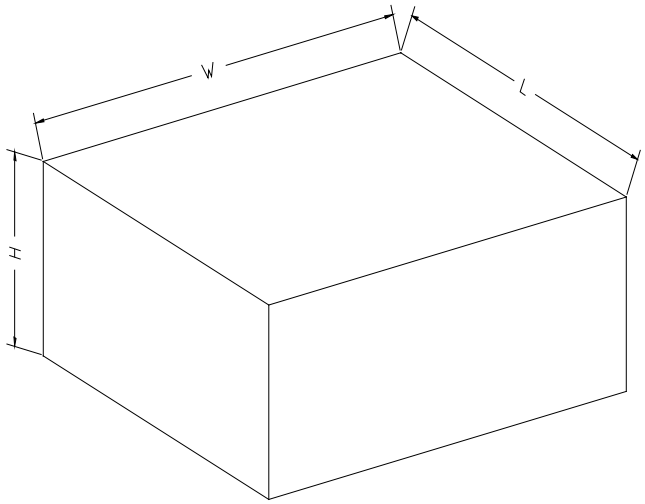
NOTE: The picture is only for reference. Please make the object as the standard.

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-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