

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°C to +125°C.

FEATURES

- **Wide Operating Input Voltage Range: 3.6V to 36V**
- **Fixed Output Voltage: 12V**
- **Output Voltage Accuracy: $\pm 1.5\%$ at +25°C**
- **Low Dropout Voltage: 450mV (TYP) at 800mA**
- **Current Limiting and Thermal Protection**
- **Excellent Load and Line Transient Responses**
- **No-Load Stability**
- **-40°C to +125°C 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

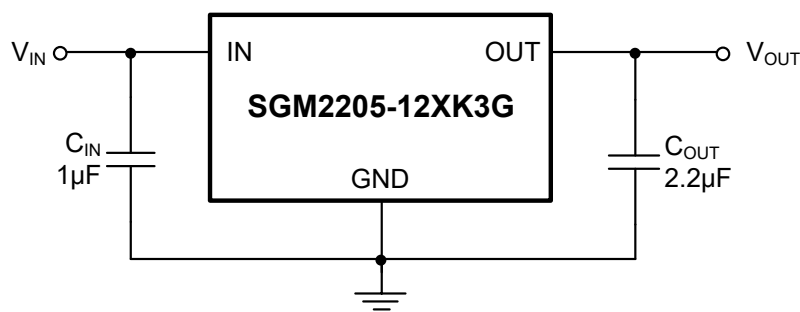


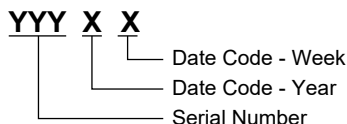
Figure 1. Typical Application Circuit

PACKAGE/ORDERING INFORMATION

| MODEL | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKING OPTION |
|----------------|---------------------|-----------------------------|-------------------|-----------------|---------------------|
| SGM2205-12XK3G | SOT-89-3 | -40°C to +125°C | 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
- OUT to GND ($V_{IN} \geq 0V$) -0.3V to MIN($V_{IN} + 5.5V, 40V$)
- Power Dissipation, P_D @ $T_J = +25^\circ C$
- SOT-89-3 1.66W
- Package Thermal Resistance
- SOT-89-3, θ_{JA} $75^\circ C/W$
- Junction Temperature $+150^\circ C$
- Storage Temperature Range $-65^\circ C$ to $+150^\circ C$
- Lead Temperature (Soldering, 10s) $+260^\circ C$
- ESD Susceptibility
- HBM 6000V
- CDM 1000V

RECOMMENDED OPERATING CONDITIONS

- Supply Voltage Range, V_{IN} 3.6V to 36V
- Input Effective Capacitance, C_{IN} $0.5\mu F$ (MIN)
- Output Effective Capacitance, C_{OUT} $1\mu F$ to $10\mu F$
- Operating Junction Temperature Range $-40^\circ C$ to $+125^\circ C$

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.

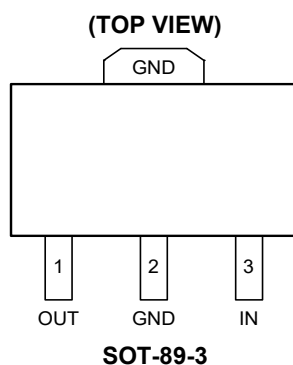
ESD SENSITIVITY CAUTION

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



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 1 μ F to 10 μ F to ensure stability. |
| 2 | GND | Ground. |
| 3 | IN | Input Supply Voltage Pin. It is recommended to use a 1 μ F 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 $C_{OUT} = 2.2\mu F$, $T_J = -40^{\circ}C$ to $+125^{\circ}C$, typical values are at $T_J = +25^{\circ}C$, unless otherwise noted.)

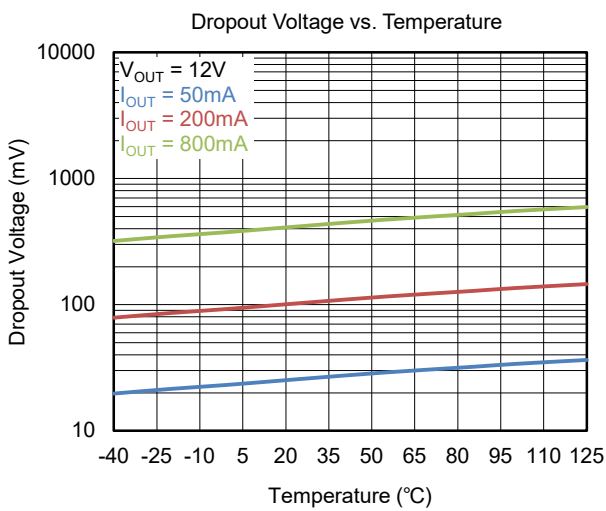
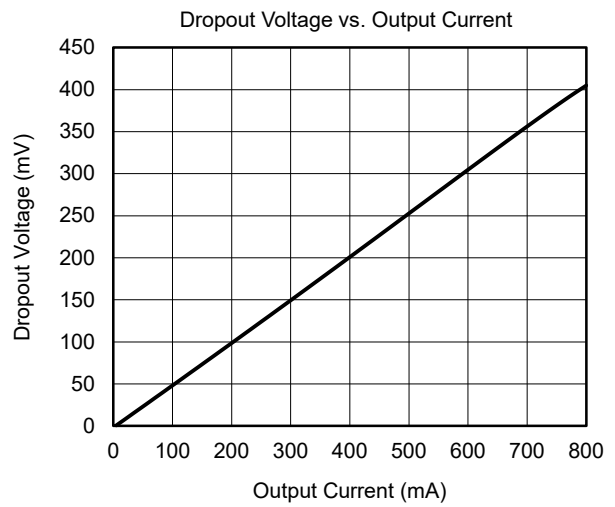
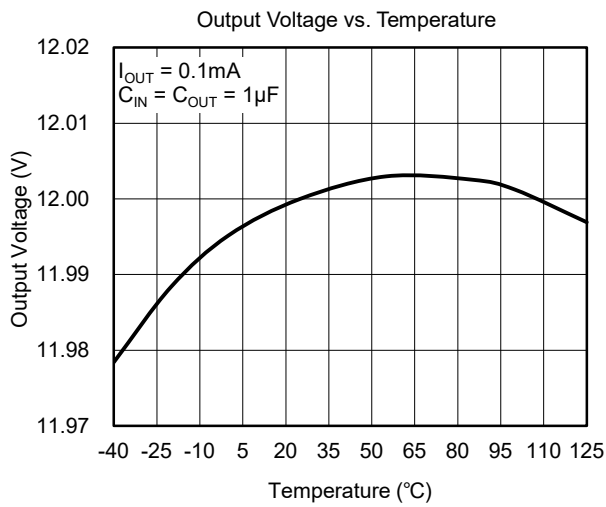
| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNITS |
|--|---|---|------|--------|-------|------------------|
| Input Voltage Range | V_{IN} | $T_J = +25^{\circ}C$ | 3.6 | | 36 | V |
| Output Voltage Accuracy | V_{OUT} | Variation from nominal V_{OUT} , $T_J = +25^{\circ}C$ | -1.5 | | 1.5 | % |
| | | 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, $T_J = +25^{\circ}C$ | | 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, $T_J = +25^{\circ}C$ | | 0.1 | 0.3 | % |
| | | $I_{OUT} = 0.1mA$ to 800mA | | | 0.4 | |
| Dropout Voltage ⁽¹⁾ | V_{DROP} | $I_{OUT} = 50mA$, $T_J = +25^{\circ}C$ | | 30 | 38 | mV |
| | | $I_{OUT} = 50mA$ | | | 55 | |
| | | $I_{OUT} = 200mA$, $T_J = +25^{\circ}C$ | | 115 | 150 | |
| | | $I_{OUT} = 200mA$ | | | 210 | |
| | | $I_{OUT} = 800mA$, $T_J = +25^{\circ}C$ | | 450 | 610 | |
| | | $I_{OUT} = 800mA$ | | | 850 | |
| Output Current Limit | I_{LIMIT} | $V_{OUT} = 90\% \times V_{OUT(NOM)}$, $T_J = +25^{\circ}C$ | 820 | 1100 | | mA |
| Short-Circuit Current | I_{SHORT} | $V_{OUT} = 0V$ | | 230 | | mA |
| Ground Pin Current | I_Q | No load, $T_J = +25^{\circ}C$ | | 80 | 104 | μA |
| | | No load | | | 112 | |
| | | $I_{OUT} = 0.1mA$, $T_J = +25^{\circ}C$ | | 80 | 104 | |
| | | $I_{OUT} = 0.1mA$ | | | 112 | |
| | | $I_{OUT} = 50mA$, $T_J = +25^{\circ}C$ | | 220 | 280 | |
| | | $I_{OUT} = 50mA$ | | | 290 | |
| | | $I_{OUT} = 800mA$, $T_J = +25^{\circ}C$ | | 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 | $V_{OUT} = 12V$, $I_{OUT} = 50mA$, $C_{OUT} = 2.2\mu F$ | | 1900 | | nV/ \sqrt{Hz} |
| Output Voltage Temperature Coefficient | $\frac{\Delta V_{OUT}}{\Delta T_J \times V_{OUT}}$ | | | 40 | | ppm/ $^{\circ}C$ |
| Thermal Shutdown Temperature | T_{SHDN} | | | 155 | | $^{\circ}C$ |
| Thermal Shutdown Hysteresis | ΔT_{SHDN} | | | 25 | | $^{\circ}C$ |

NOTE:

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

TYPICAL PERFORMANCE CHARACTERISTICS

$T_J = +25^\circ\text{C}$, $C_{OUT} = 2.2\mu\text{F}$ and $I_{OUT} = 0.1\text{mA}$, unless otherwise noted.



FUNCTIONAL BLOCK DIAGRAM

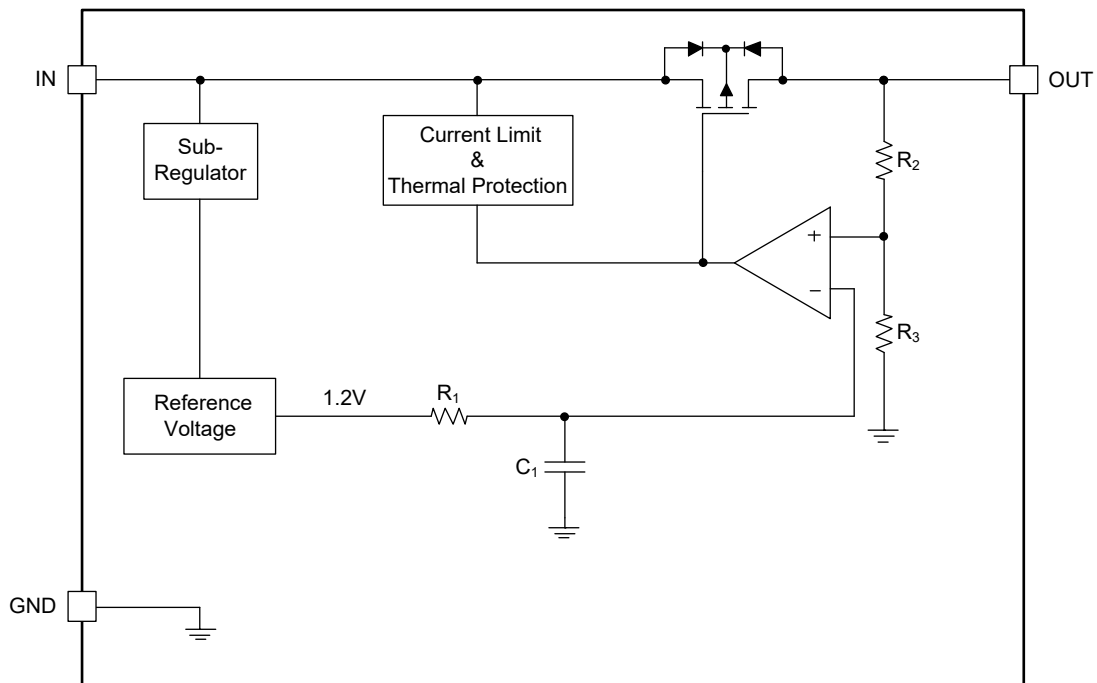


Figure 2. Block Diagram

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. 1 μ F 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. 2.2 μ F 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 1 μ F. 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

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°C.

Power Dissipation (P_D)

Power dissipation (P_D) of the SGM2205-12XK3G can be calculated by the equation $P_D = (V_{IN} - V_{OUT}) \times I_{OUT}$. The maximum allowable power dissipation ($P_{D(MAX)}$) of the SGM2205-12XK3G is affected by many factors, including the difference between junction temperature and ambient temperature ($T_{J(MAX)} - T_A$), package thermal resistance from the junction to the ambient environment (θ_{JA}), the rate of ambient airflow and PCB layout. $P_{D(MAX)}$ can be approximated by the following equation:

$$P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA} \quad (2)$$

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.

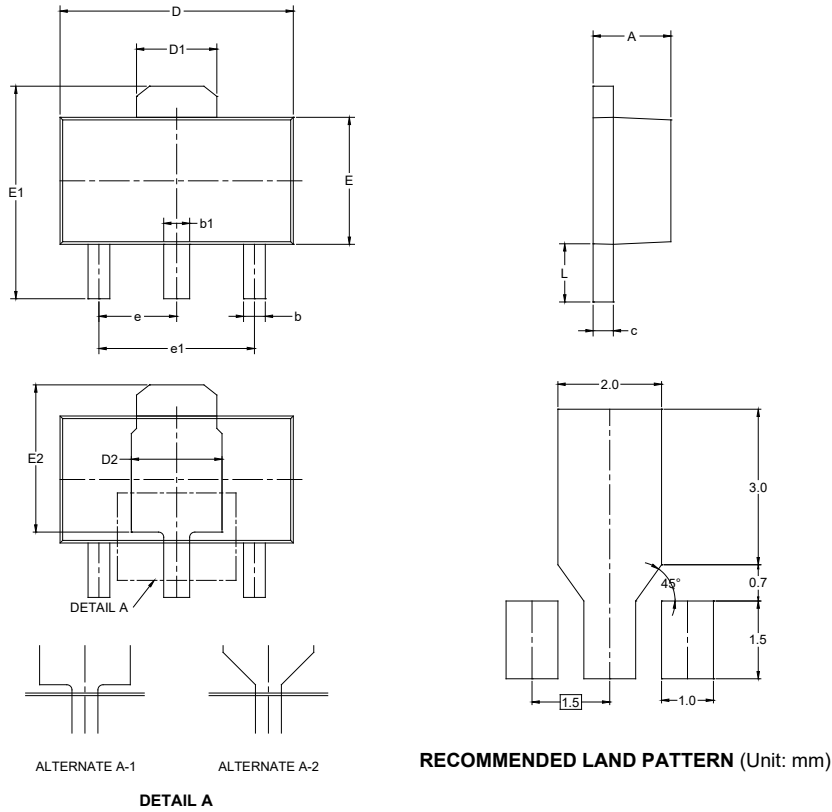
REVISION HISTORY

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

| | |
|--|-------------|
| DECEMBER 2023 – REV.A.2 to REV.A.3 | Page |
| Updated Package Outline Dimensions..... | 9 |
| DECEMBER 2023 – REV.A.1 to REV.A.2 | Page |
| Updated Absolute Maximum Ratings section..... | 2 |
| 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



| Symbol | Dimensions In Millimeters | | |
|--------|---------------------------|-----|-------|
| | MIN | MOD | MAX |
| A | 1.400 | - | 1.600 |
| b | 0.320 | - | 0.520 |
| b1 | 0.400 | - | 0.580 |
| c | 0.350 | - | 0.440 |
| D | 4.400 | - | 4.600 |
| D1 | 1.550 REF | | |
| D2 | 1.750 REF | | |
| E | 2.300 | - | 2.600 |
| E1 | 3.940 | - | 4.250 |
| E2 | 2.840 REF | | |
| e | 1.500 BSC | | |
| e1 | 3.000 BSC | | |
| L | 0.900 | - | 1.200 |

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 TO-243.

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 |

000001

PACKAGE INFORMATION

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