SGM2207
800mA, High Voltage, Low Noise and Low Dropout Voltage Regulator

GENERAL DESCRIPTION

The SGM2207 is a high voltage linear voltage regulator with very low dropout voltage, typically 400mV at full load.

Designed especially for hand-held, battery-powered devices, the SGM2207 features low ground current to help prolong battery life. An enable/shutdown pin can further improve battery life with near-zero shutdown current.

Key features include high PSRR, low ground current, fast load transient, output short circuit protection, reversed-battery protection, current limiting, over-temperature shutdown and availability in thermally-efficient packaging. The SGM2207 is available in adjustable output version.

The SGM2207 is available in a Green TDFN-2×3-8BL package. It operates over an operating temperature range of -40℃ to +125℃.

FEATURES

- **Wide Input Voltage Range: 2.5V to 20V**
- **Output Voltage Range: 1.8V to 12V**
- **Guaranteed 800mA Output Current over the Full Operating Temperature Range**
- **Low Dropout Voltage: 400mV (TYP) at Full Load**
- **Extremely Tight Load and Line Regulations**
- **Fast Load Transient**
- **Low Output Voltage Temperature Coefficient**
- **Output Short Circuit Protection**
- **Current and Thermal Limiting**
- **No-Load Stability**
- **-40℃ to +125℃ Operating Temperature Range**
- **Thermally-Efficient Surface-Mount Package**
- **Available in a Green TDFN-2×3-8BL Package**

APPLICATIONS

Laptop, Notebook and Palmtop Computers
Cellular Telephones
Consumer and Personal Electronics
SMPS Post-Regulator/DC-to-DC Modules
High-Efficiency Linear Power Supplies

TYPICAL APPLICATION

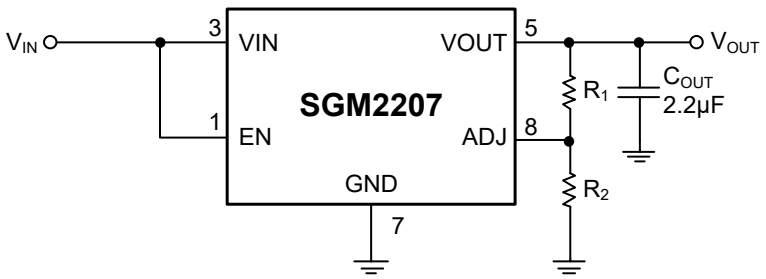


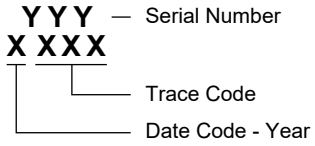
Figure 1. Typical Application Circuit

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2207-ADJ	TDFN-2×3-8BL	-40℃ to +125℃	SGM2207-ADJXTDC8G/TR	CZ2 XXXX	Tape and Reel, 3000

MARKING INFORMATION

NOTE: X = Date Code. XXX = Trace 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} ..... -24V to +24V
OUT to GND (V_{IN} ≥ 0V)
..... -0.3V to (V_{IN} +5.5V) or +24V (whichever is lower)
EN to GND (V_{IN} ≥ 0V) ..... -0.3V to +24V
ADJ to GND (V_{IN} ≥ 0V)..... -0.3V to +6V
Package Thermal Resistance
TDFN-2×3-8BL, θ_{JA}..... 91℃/W
TDFN-2×3-8BL, θ_{JB}..... 44℃/W
TDFN-2×3-8BL, θ_{JC} ..... 57℃/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} .....2.5V to 20V
Adjustable Output Voltage Range.....1.8V to 12V
Input Capacitance, C_{IN}.....0.5μF (MIN)
Output 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.

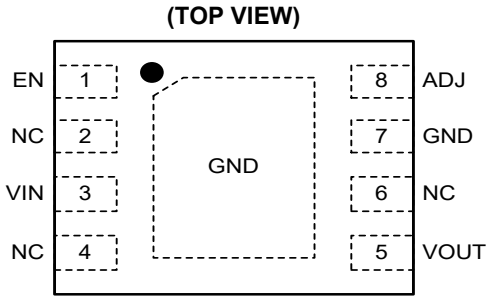
ESD SENSITIVITY CAUTION

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



TDFN-2×3-8BL

PIN DESCRIPTION

PIN	NAME	FUNCTION
1	EN	Enable Pin. CMOS-logic compatible control input. Driving this pin to logic high enables the device; driving this pin to logic low disables the device.
2, 4, 6	NC	Not Connected.
3	VIN	Supply Input Pin.
5	VOUT	Regulator Output Pin. It is recommended to use an output capacitor with effective capacitance in the range of 1μF to 10μF.
7	GND	Ground Pin.
8	ADJ	Adjustable Pin. Feedback input. Connect to resistive voltage-divider network.
Exposed Pad	GND	Exposed Thermal Pad. Connect to GND for best thermal performance.

ELECTRICAL CHARACTERISTICS

(T_J = -40℃ to +125℃, typical values are at T_J = +25℃, V_{IN} = $V_{OUT(NOM)}$ + 1V, C_{OUT} = 2.2μF, I_{OUT} = 100μA, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage Range	V_{IN}	T_J = +25℃	2.5		20	V
Ground Pin Current (1, 2)	I_Q	V_{EN} ≥ 1.2V, no load, T_J = +25℃		80	104	μA
		V_{EN} ≥ 1.2V, no load			120	
		V_{EN} ≥ 1.2V, I_{OUT} = 100μA, T_J = +25℃		80	104	
		V_{EN} ≥ 1.2V, I_{OUT} = 100μA			120	
		V_{EN} ≥ 1.2V, I_{OUT} = 50mA, T_J = +25℃		220	280	
		V_{EN} ≥ 1.2V, I_{OUT} = 50mA			290	
		V_{EN} ≥ 1.2V, I_{OUT} = 800mA, T_J = +25℃		1950	2250	
		V_{EN} ≥ 1.2V, I_{OUT} = 800mA			2350	
Ground Pin Quiescent Current (2)	$I_{Q(GND)}$	V_{EN} ≤ 0.4V (shutdown), T_J = +25℃		2.7	3.5	μA
		V_{EN} ≤ 0.4V (shutdown)			6.8	
Current Limit	I_{LIMIT}	V_{OUT} = 93% × $V_{OUT(NOM)}$, T_J = +25℃	820	1100		mA
Short Current Limit	I_{SHORT}	V_{IN} = V_{EN} = 3V, V_{OUT} = 0V		230		mA
Dropout Voltage (3)	V_{DROP}	V_{OUT} = 3.3V, I_{OUT} = 50mA, T_J = +25℃		25	40	mV
		V_{OUT} = 3.3V, I_{OUT} = 50mA			45	
		V_{OUT} = 3.3V, I_{OUT} = 200mA, T_J = +25℃		100	130	
		V_{OUT} = 3.3V, I_{OUT} = 200mA			185	
		V_{OUT} = 3.3V, I_{OUT} = 800mA, T_J = +25℃		400	510	
		V_{OUT} = 3.3V, I_{OUT} = 800mA			750	
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	V_{IN} = ($V_{OUT(NOM)}$ + 1V) to 20V, T_J = +25℃		0.0003	0.003	%/V
		V_{IN} = ($V_{OUT(NOM)}$ + 1V) to 20V			0.005	
Load Regulation	$\frac{\Delta V_{OUT}}{V_{OUT}}$	I_{OUT} = 100μA to 800mA, T_J = +25℃		0.1	0.3	%
		I_{OUT} = 100μA to 800mA			0.4	
Power Supply Rejection Ratio	PSRR	f =1kHz, V_{OUT} = 2.5V, I_{OUT} = 50mA		75		dB
Output Voltage Noise	e_n	V_{OUT} = 2.5V, I_{OUT} = 50mA, C_{OUT} = 2.2μF		400		nV / $\sqrt{Hz}$
Output Voltage Temperature Coefficient (4)	$\frac{\Delta V_{OUT}}{\Delta T_J \times V_{OUT}}$	T_J = -40℃ to +125℃		40		ppm/℃
Enable Input Logic Low Voltage	V_{EN}	V_{EN} = logic low (regulator shutdown)			0.4	V
		V_{EN} = logic high (regulator enabled)	1.2			
Enable Input Current	I_{ENL}	V_{EN} ≤ 0.4V			0.3	μA
	I_{ENH}	V_{EN} = V_{IN}			1	
Reference Voltage	V_{REF}	T_J = +25℃	1.223	1.235	1.247	V
			1.216		1.254	

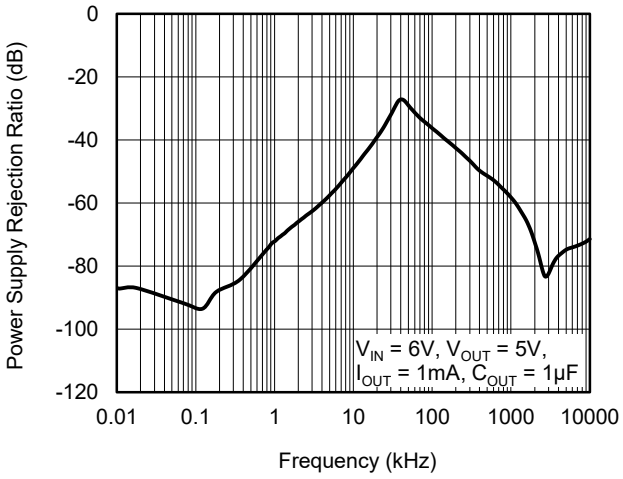
NOTES:

1. Ground pin current is the regulator quiescent current plus pass transistor base current. The total current drawn from the supply is the sum of the load current plus the ground pin current.
2. V_{EN} is the voltage externally applied to devices with the EN pin.
3. Dropout voltage is characterized when V_{OUT} falls 5% below $V_{OUT(NOM)}$.
4. Output voltage temperature coefficient is defined as the worst-case voltage change divided by the total temperature range.

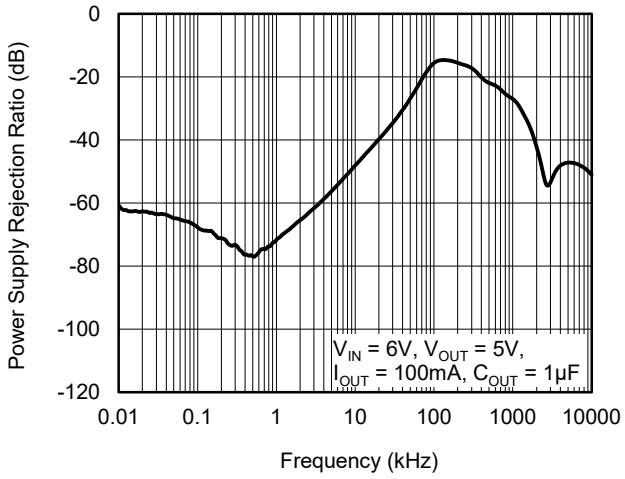
TYPICAL PERFORMANCE CHARACTERISTICS

T_J = +25℃, C_{OUT} = 2.2μF and I_{OUT} = 100μA, unless otherwise noted.

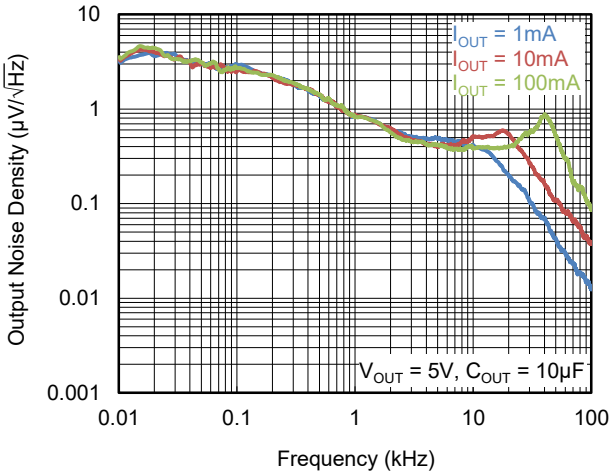
Power Supply Rejection Ratio vs. Frequency



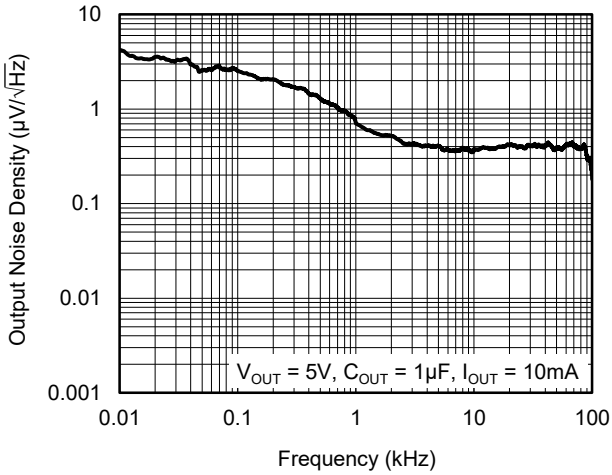
Power Supply Rejection Ratio vs. Frequency



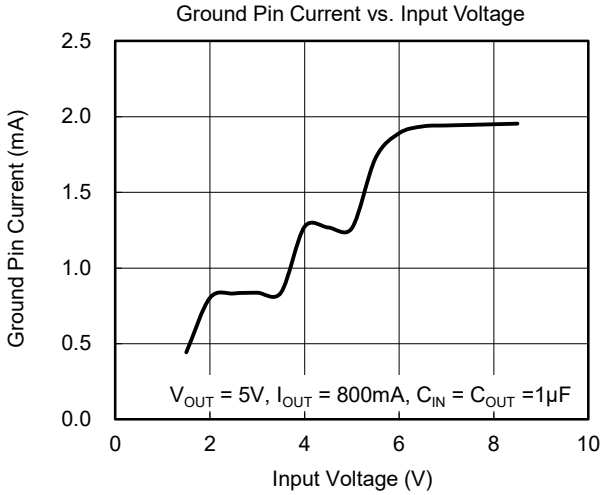
Output Noise Density vs. Frequency



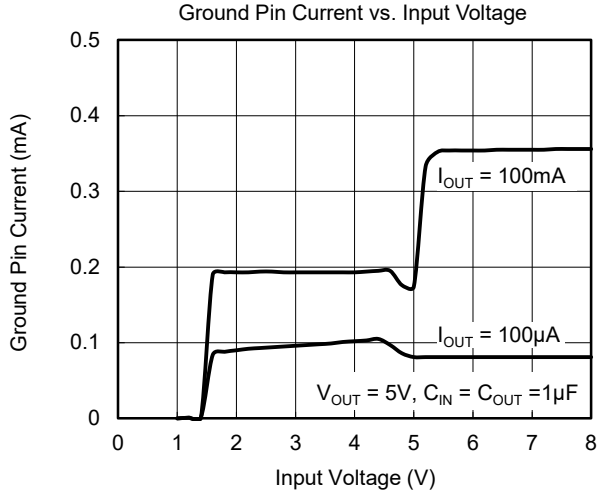
Output Noise Density vs. Frequency



Ground Pin Current vs. Input Voltage



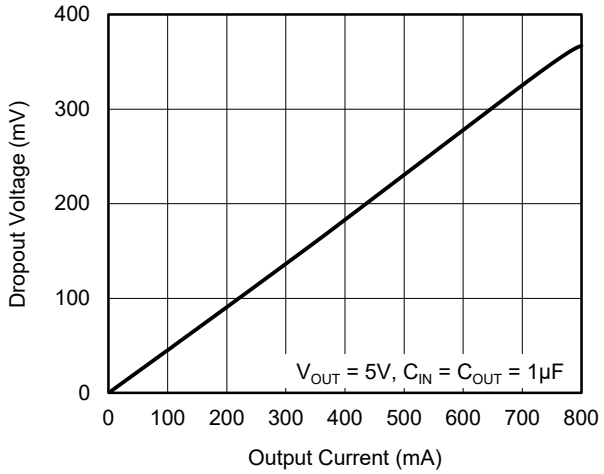
Ground Pin Current vs. Input Voltage



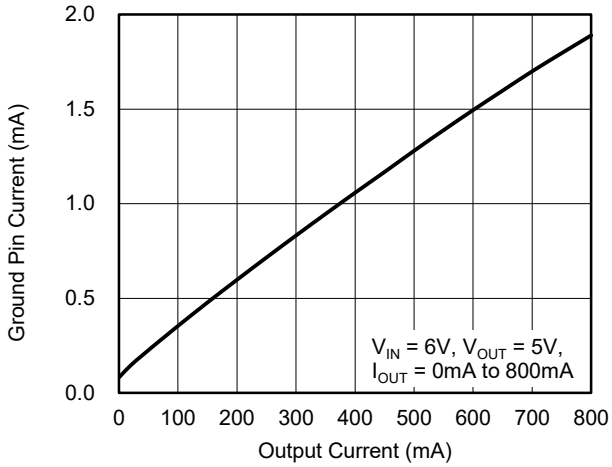
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_J = +25℃, C_{OUT} = 2.2μF and I_{OUT} = 100μA, unless otherwise noted.

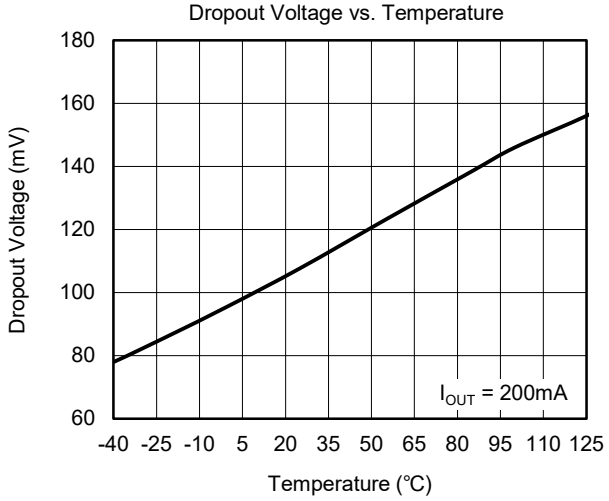
Dropout Voltage vs. Output Current



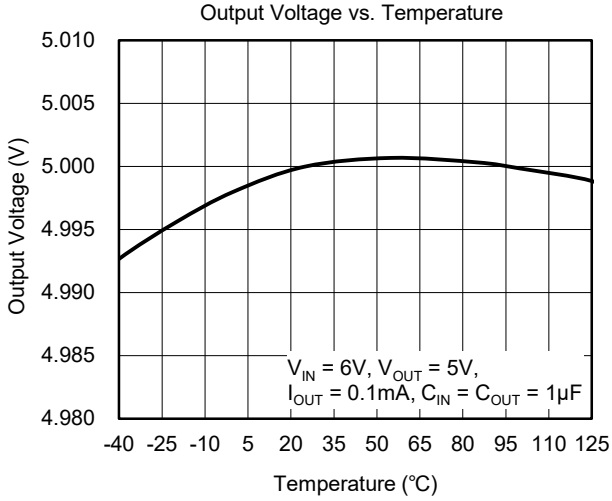
Ground Pin Current vs. Output Current



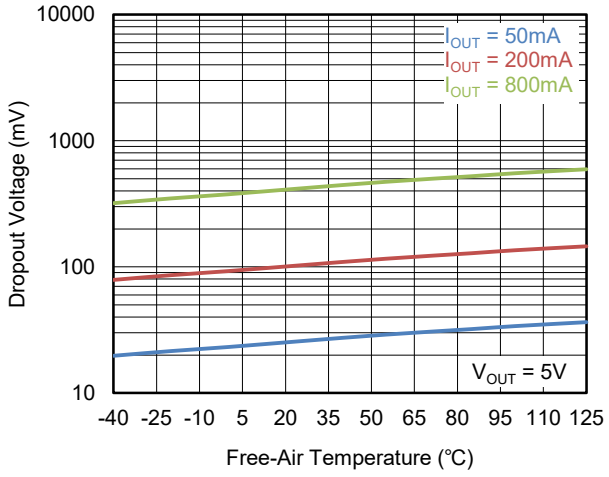
Dropout Voltage vs. Temperature



Output Voltage vs. Temperature



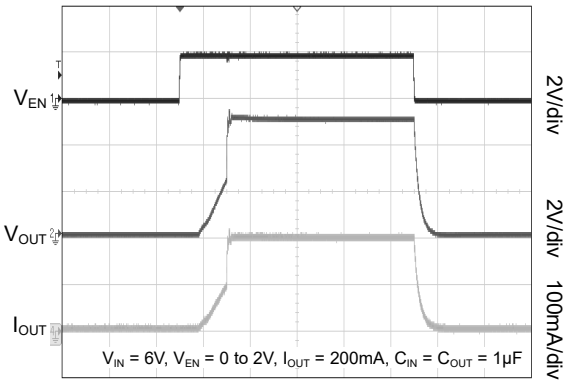
Dropout Voltage vs. Free-Air Temperature



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

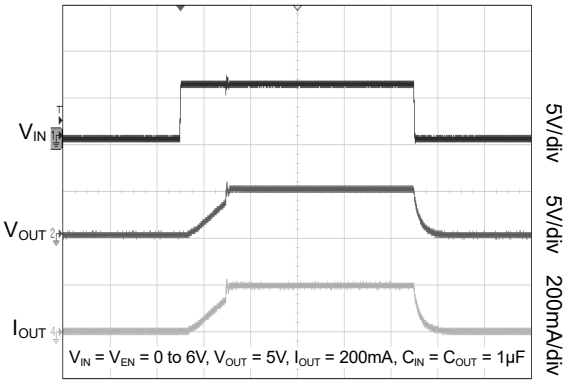
T_J = +25℃, C_{OUT} = 2.2μF and I_{OUT} = 100μA, unless otherwise noted.

Start-Up with Enable



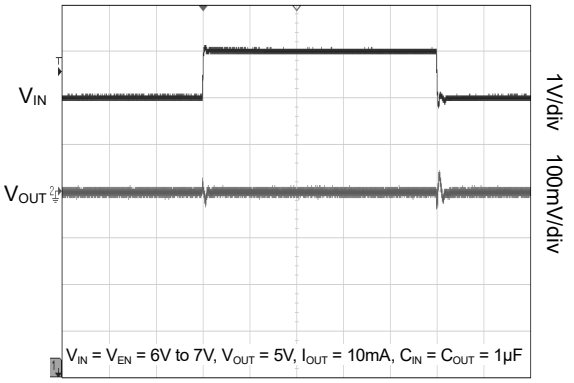
Time (200μs/div)

Turn-On Time



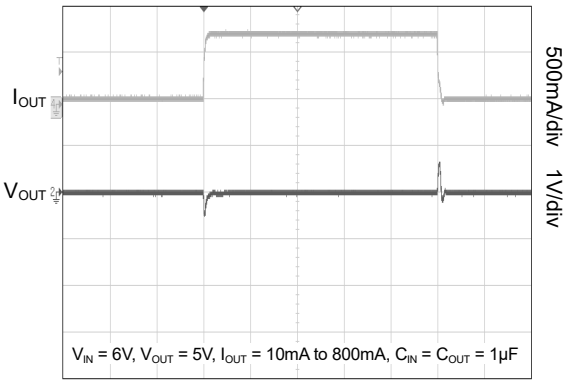
Time (200μs/div)

Line Transient Response



Time (100μs/div)

Load Transient Response



Time (100μs/div)

FUNCTIONAL BLOCK DIAGRAM

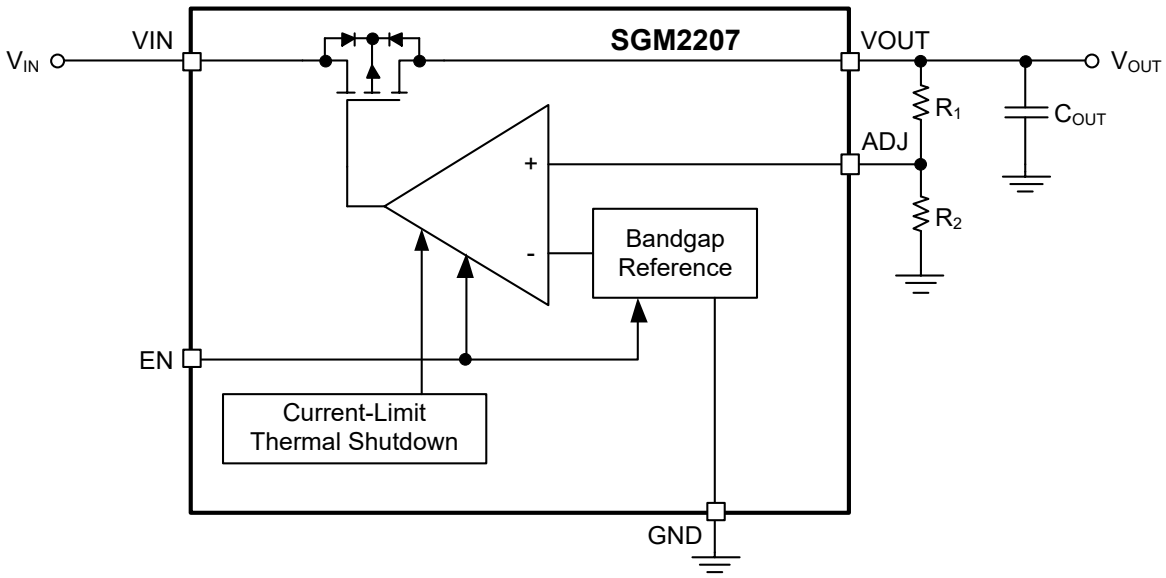


Figure 2. Block Diagram

APPLICATION INFORMATION

Enable Shutdown

Forcing V_{EN} high (> 1.2V) enables the regulator. The EN pin is CMOS-logic compatible. If the enable/shutdown feature is not required, connect the EN pin to the VIN pin (supply input) immediately.

Input Capacitor (C_{IN})

A 1μF capacitor should be placed from the VIN pin to GND if there is more than 10 inches of wire between the input and the AC filter capacitor or if a battery is used as the input.

Output Capacitor (C_{OUT})

An output capacitor is required between the VOUT pin and GND to prevent oscillation. The minimum effective capacitance of the output capacitor is 1μF. Larger values improve the regulator's transient response.

Most tantalum or aluminum electrolytic capacitors are adequate; film types will work, but are more expensive. Since many aluminum electrolytes have electrolytes that freeze at about -30℃, solid tantalums are recommended for operation below -25℃.

No-Load Stability

The SGM2207 remains stable and in regulation with no load (other than the internal voltage divider) unlike many other voltage regulators. This is especially important in CMOS RAM keep-alive applications.

Low Voltage Operation

The programmable output down to 1.8V requires special consideration when used in voltage-sensitive systems. They may momentarily overshoot their nominal output voltages unless appropriate output capacitor value is chosen.

During regulator power-up, the pass transistor is fully saturated for a short time, while the error amplifier and voltage reference are being powered up more slowly from the output (see Functional Block Diagram).

Selecting larger output capacitor allows additional time for the error amplifier and reference to turn on and prevents overshoot.

To ensure that no overshoot is present when starting up with a light load (100μA), use a 4.7μF output capacitor. This slows the turn-on enough to allow the regulator to react and keep the output voltage from exceeding its nominal value. At heavier loads, use a 10μF output capacitor. Lower values of output capacitance can be used, depending on the sensitivity of the system.

Applications that can tolerate some overshoot on the output of the regulator can reduce the output capacitor. Applications that are not sensitive to overshoot due to power-on reset delays can use normal output configuration.

Adjustable Regulator Circuit

The SGM2207 can be adjusted to a specific output voltage by using two external resistors as shown in Figure 3. The resistors set the output voltage based on the equation:

$$V_{OUT} = 1.235V \times \left(1 + \frac{R_1}{R_2}\right)$$

Although the ADJ pin is a high-impedance input, but for best performance, R_1 should not exceed 470kΩ. The capacitor C_{ADJ} = 4.7pF improves the stability.

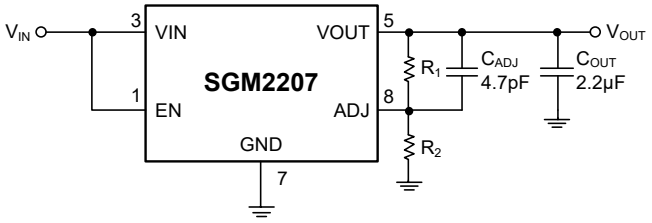


Figure 3. Low Noise Adjustable Output Voltage Application

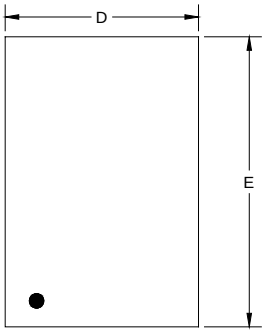
REVISION HISTORY

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

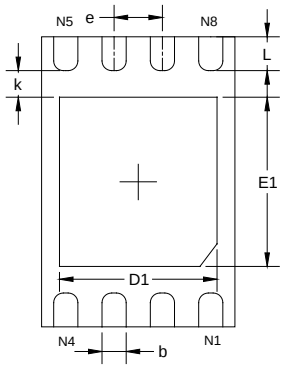
Changes from Original (DECEMBER 2020) to REV.A	Page
Changed from product preview to production data	All

PACKAGE OUTLINE DIMENSIONS

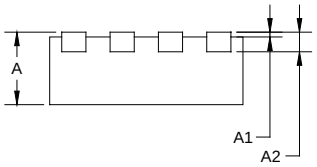
TDFN-2×3-8BL



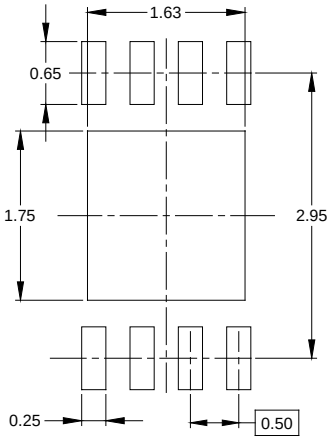
TOP VIEW



BOTTOM VIEW



SIDE VIEW

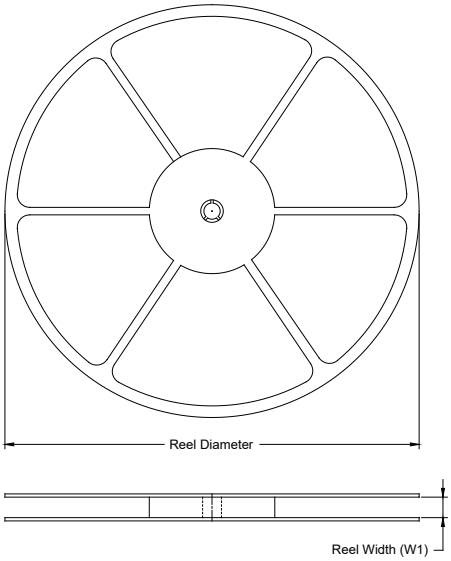


RECOMMENDED LAND PATTERN (Unit: mm)

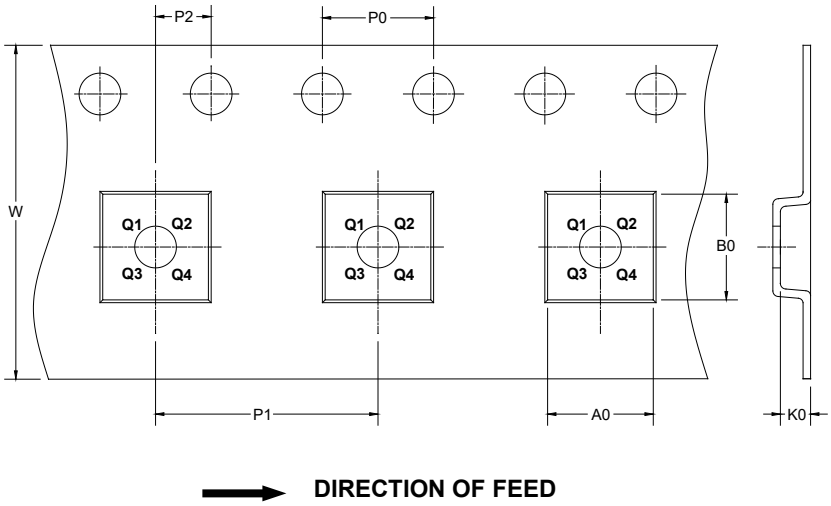
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203 REF		0.008 REF	
D	1.950	2.050	0.077	0.081
D1	1.530	1.730	0.060	0.068
E	2.950	3.050	0.116	0.120
E1	1.650	1.850	0.065	0.073
b	0.200	0.300	0.008	0.012
e	0.500 BSC		0.020 BSC	
k	0.250 REF		0.010 REF	
L	0.300	0.450	0.012	0.018

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



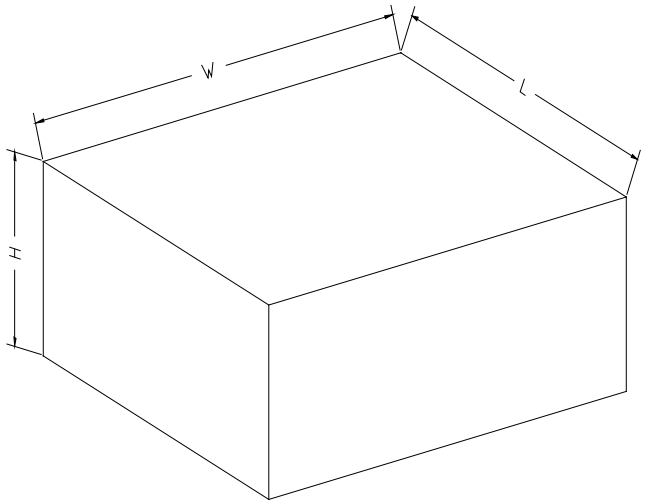
NOTE: The picture is only for reference. Please make the object as the standard.

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
TDFN-2×3-8BL	7″	9.5	2.30	3.30	1.10	4.0	4.0	2.0	8.0	Q2

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