

GENERAL DESCRIPTION

The SGM2214 is a low quiescent current, low dropout voltage regulator that stable with a 2.2 μ F output capacitor. With the integrated low $R_{DS(ON)}$ PMOS, the dropout voltage is very low (typically 235mV at an output current of 300mA) and is directly proportional to the output current. A sleep mode is also provided to save internal dissipation. Additionally, logic high level at nEN pin will disable the regulator and reduce the quiescent current to less than 1 μ A. These key features make the SGM2214 suitable for battery-powered systems. The Power-Good (PG) function is an active high output that can be used in system, such as a power-on reset, a low-battery indicator or an interrupt signal. The output voltage accuracy is specified as $\pm 1.5\%$ over line, load and temperature range.

The SGM2214 is available in a Green SOIC-8 package. It operates over an operating temperature range of -40°C to +125°C.

FEATURES

- Input Voltage Range: 2.7V to 16V
- Output Voltage Accuracy: $\pm 1\%$ at +25°C
- Low Dropout Voltage: 235mV (TYP) at 300mA
- Low Quiescent Current: 40 μ A (TYP)
- Available in Multiple Output Voltage Versions
- Fixed Outputs of 1.5V, 1.8V, 2.5V, 2.7V, 2.8V, 3.0V, 3.3V and 5.0V
- Adjustable Output Voltage Range: 1.2V to 12V
- Power Supply Rejection Ratio: 85dB (TYP) at 1kHz
- Open-Drain Power-Good Function
- Thermal Shutdown Protection
- -40°C to +125°C Operating Temperature Range
- Available in a Green SOIC-8 Package

APPLICATIONS

Post Regulator for Switching DC/DC Converters
 High Efficiency Linear Regulators
 Portable Instrumentation

TYPICAL APPLICATION

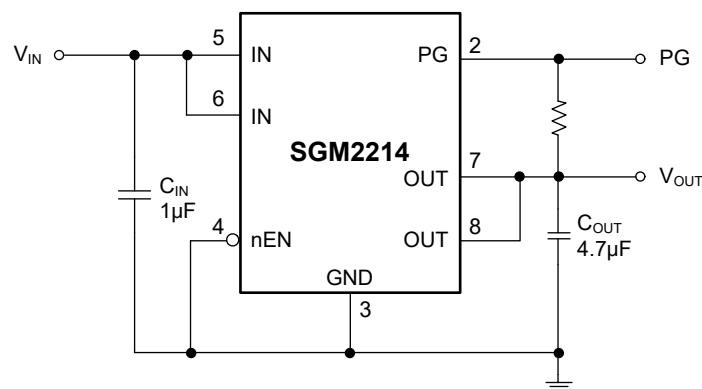


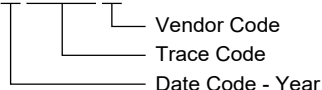
Figure 1. Typical Application Circuit

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2214-1.5	SOIC-8	-40°C to +125°C	SGM2214-1.5XS8G/TR	SGM CHEXS8 XXXXX	Tape and Reel, 4000
SGM2214-1.8	SOIC-8	-40°C to +125°C	SGM2214-1.8XS8G/TR	SGM OP2XS8 XXXXX	Tape and Reel, 4000
SGM2214-2.5	SOIC-8	-40°C to +125°C	SGM2214-2.5XS8G/TR	SGM CHFXS8 XXXXX	Tape and Reel, 4000
SGM2214-2.7	SOIC-8	-40°C to +125°C	SGM2214-2.7XS8G/TR	SGM OP3XS8 XXXXX	Tape and Reel, 4000
SGM2214-2.8	SOIC-8	-40°C to +125°C	SGM2214-2.8XS8G/TR	SGM OP4XS8 XXXXX	Tape and Reel, 4000
SGM2214-3.0	SOIC-8	-40°C to +125°C	SGM2214-3.0XS8G/TR	SGM OP5XS8 XXXXX	Tape and Reel, 4000
SGM2214-3.3	SOIC-8	-40°C to +125°C	SGM2214-3.3XS8G/TR	SGM CJXS8 XXXXX	Tape and Reel, 4000
SGM2214-5.0	SOIC-8	-40°C to +125°C	SGM2214-5.0XS8G/TR	SGM CJBXS8 XXXXX	Tape and Reel, 4000
SGM2214-ADJ	SOIC-8	-40°C to +125°C	SGM2214-ADJXS8G/TR	SGM CHBXS8 XXXXX	Tape and Reel, 4000

MARKING INFORMATION

XXXXX = Date Code, Trace Code and Vendor Code.

XXXXX

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

Input Voltage Range	-0.3V to 22V
Maximum PG Voltage	22V
Output Voltage, V_{OUT}	7V
Enable Voltage Range	-0.3V to 22V
Peak Output Current	Internally Limited
Package Thermal Resistance	
SOIC-8, θ_{JA}	111°C/W
Junction Temperature	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10s)	+260°C
ESD Susceptibility	
HBM	8000V
CDM	1000V

RECOMMENDED OPERATING CONDITIONS

Input Voltage Range	2.7V to 16V
Output Current Range	0mA to 300mA
Input Capacitance, C_{IN}	0.5 μ F (MIN)
Output Capacitance, C_{OUT}	2.2 μ F to 10 μ F
Operating Junction Temperature Range	-40°C to +125°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.

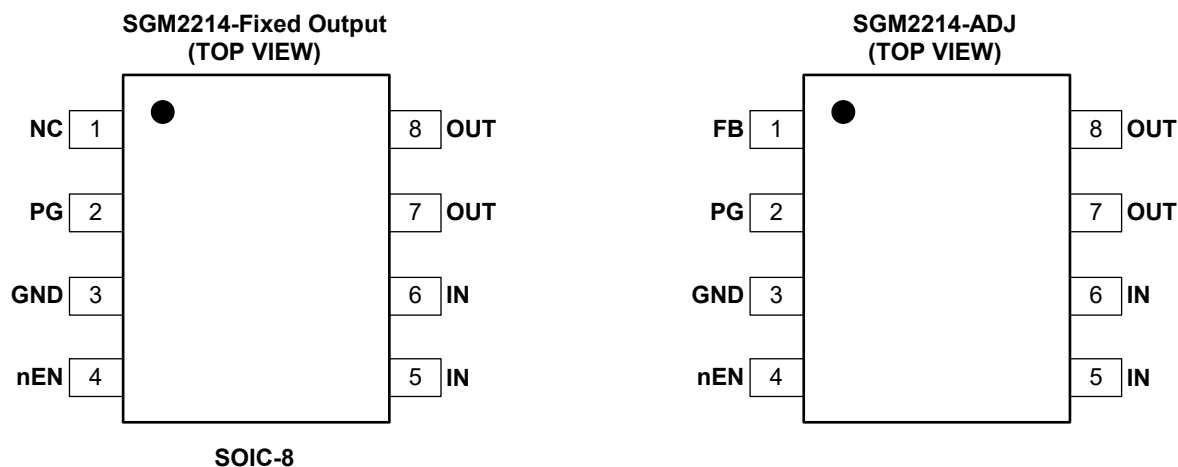
ESD SENSITIVITY CAUTION

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 CONFIGURATIONS



PIN DESCRIPTION

PIN	NAME	
1	NC	Not Connected (fixed voltage version only).
	FB	Feedback Input (adjustable voltage version only). An external resistor divider sets the output voltage.
2	PG	Power-Good Output Pin.
3	GND	Ground Pin.
4	nEN	Enable Input Pin. Driving this pin to logic low enables the device; driving this pin to logic high disables the device.
5,6	IN	Input Voltage Supply Pin.
7,8	OUT	Regulated Output Voltage Pin. It is recommended to use an output capacitor with effective capacitance in the range of 2.2µF to 10µF.

ELECTRICAL CHARACTERISTICS

($V_{IN} = V_{OUT(NOM)} + 1V$, $V_{rEN} = 0V$, $I_{OUT} = 1mA$, $C_{IN} = 1\mu F$ and $C_{OUT} = 4.7\mu F$, $T_J = -40^\circ C$ to $+125^\circ C$, typical values are at $T_J = +25^\circ C$, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Output Voltage	V_{OUT}	$V_{OUT} = \text{ADJ}$, $V_{IN} = 2.7V$ to $16V$, $T_J = +25^\circ C$	1.188	1.2	1.212	V
		$V_{OUT} = \text{ADJ}$, $V_{IN} = 2.7V$ to $16V$	1.182		1.218	
		$V_{OUT} = 1.5V$, $V_{IN} = 2.7V$ to $16V$, $T_J = +25^\circ C$	1.485	1.5	1.515	
		$V_{OUT} = 1.5V$, $V_{IN} = 2.7V$ to $16V$	1.478		1.522	
		$V_{OUT} = 2.5V$, $V_{IN} = 3.5V$ to $16V$, $T_J = +25^\circ C$	2.475	2.5	2.525	
		$V_{OUT} = 2.5V$, $V_{IN} = 3.5V$ to $16V$	2.463		2.537	
		$V_{OUT} = 3.3V$, $V_{IN} = 4.3V$ to $16V$, $T_J = +25^\circ C$	3.267	3.3	3.333	
		$V_{OUT} = 3.3V$, $V_{IN} = 4.3V$ to $16V$	3.251		3.349	
		$V_{OUT} = 5V$, $V_{IN} = 6V$ to $16V$, $T_J = +25^\circ C$	4.95	5	5.05	
		$V_{OUT} = 5V$, $V_{IN} = 6V$ to $16V$	4.925		5.075	
Quiescent Current	I_Q	$V_{rEN} = 0V$, $I_{OUT} = 0\mu A$		40		μA
		$V_{rEN} = 0V$, $I_{OUT} = 0\mu A$, $T_J = -40^\circ C$ to $+125^\circ C$			65	
		$V_{rEN} = 0V$, $I_{OUT} = 50mA$		225		
		$V_{rEN} = 0V$, $I_{OUT} = 50mA$, $T_J = -40^\circ C$ to $+125^\circ C$			320	
		$V_{rEN} = 0V$, $I_{OUT} = 300mA$		640		
		$V_{rEN} = 0V$, $I_{OUT} = 300mA$, $T_J = -40^\circ C$ to $+125^\circ C$			775	
Output Voltage Line Regulation ⁽¹⁾	$\frac{\Delta V_{OUT}}{\Delta V_{OUT} \times V_{OUT}}$	$V_{IN} = (V_{OUT(NOM)} + 1V)$ to $16V$, $I_{OUT} = 1mA$		0.001		%V
		$V_{IN} = (V_{OUT(NOM)} + 1V)$ to $16V$, $I_{OUT} = 1mA$, $T_J = -40^\circ C$ to $+125^\circ C$			0.006	
Load Regulation	ΔV_{OUT}	$I_{OUT} = 10\mu A$ to $300mA$		0.02		%mA
		$I_{OUT} = 10\mu A$ to $300mA$, $T_J = -40^\circ C$ to $+125^\circ C$			0.5	
Output Voltage Noise	e_n	$V_{OUT} = 3.3V$, $I_{OUT} = 10mA$, $BW = 10Hz$ to $100kHz$		50		μV_{RMS}
Output Current Limit	I_{LIMIT}	$V_{OUT} = 90\%V_{OUT(NOM)}$, $T_J = +25^\circ C$	500	960		mA
Enable Input High Voltage	V_{IH}	$V_{IN} = 2.7V$ to $16V$, $T_J = +25^\circ C$	1.5			V
Enable Input Low Voltage	V_{IL}	$V_{IN} = 2.7V$ to $16V$, $T_J = +25^\circ C$			0.4	
Standby Current		$V_{rEN} = V_{IN}$, $T_J = +25^\circ C$			2.5	μA
		$V_{rEN} = V_{IN}$			3	
Power Supply Rejection Ratio	PSRR	$I_{OUT} = 10mA$, $f = 1kHz$		85		dB
Dropout Voltage ⁽²⁾	V_{DROP}	$V_{OUT} = 2.5V$, $V_{IN} = 3.5V$, $I_{OUT} = 300mA$		275		mV
		$V_{OUT} = 2.5V$, $V_{IN} = 3.5V$, $I_{OUT} = 300mA$, $T_J = -40^\circ C$ to $+125^\circ C$			460	
		$V_{OUT} = 3.3V$, $V_{IN} = 4.3V$, $I_{OUT} = 300mA$		235		
		$V_{OUT} = 3.3V$, $V_{IN} = 4.3V$, $I_{OUT} = 300mA$, $T_J = -40^\circ C$ to $+125^\circ C$			410	
		$V_{OUT} = 5V$, $V_{IN} = 6V$, $I_{OUT} = 300mA$		195		
		$V_{OUT} = 5V$, $V_{IN} = 6V$, $I_{OUT} = 300mA$, $T_J = -40^\circ C$ to $+125^\circ C$			340	

NOTES:

- Minimum IN operating voltage is 2.7V or $V_{OUT(NOM)} + 1V$, whichever is greater. Maximum IN operating voltage is 16V.
- Dropout voltage is characterized when V_{OUT} falls 5% below $V_{OUT(NOM)}$.

ELECTRICAL CHARACTERISTICS (continued)

($V_{IN} = V_{OUT(NOM)} + 1V$, $V_{nEN} = 0V$, $I_{OUT} = 1mA$, $C_{IN} = 1\mu F$ and $C_{OUT} = 4.7\mu F$, $T_J = -40^\circ C$ to $+125^\circ C$, typical values are at $T_J = +25^\circ C$, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
nEN Pin Input Current	I_{nENL}	$V_{nEN} = 0V$, $T_J = -40^\circ C$ to $+125^\circ C$	-1	0	1	μA
	I_{nENH}	$V_{nEN} = V_{IN}$	-1		1	
Thermal Shutdown Temperature	T_{SHDN}			150		$^\circ C$
Thermal Shutdown Hysteresis	ΔT_{SHDN}			20		$^\circ C$
Power-Good						
Minimum Input Voltage for Valid PG		$I_{OUT} = 300\mu A$		1.2		V
Trip Threshold Voltage		V_{OUT} decreasing, $T_J = +25^\circ C$	92		98	$\%V_{OUT}$
Hysteresis Voltage		Measured at V_{OUT}		0.75		$\%V_{OUT}$
Output Low Voltage		$V_{IN} = 2.7V$, $I_{OUT(PG)} = 1mA$		0.12		V
Leakage Current		$V_{(PG)} = 5V$, $T_J = +25^\circ C$			1	μA

TEST CIRCUIT

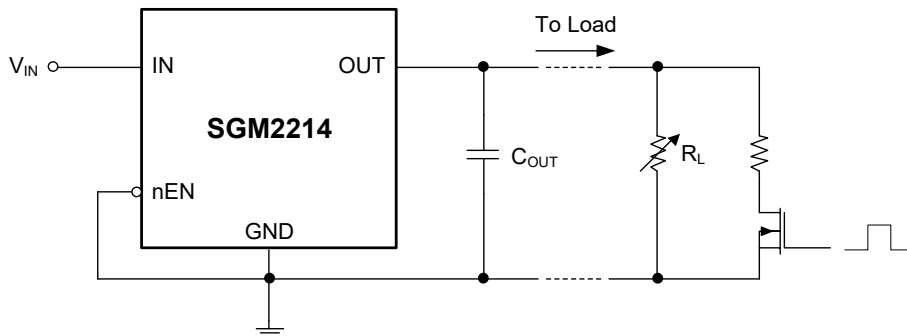
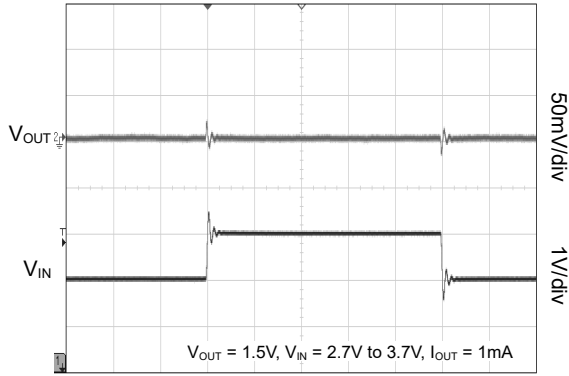


Figure 2. Test Circuit

TYPICAL PERFORMANCE CHARACTERISTICS

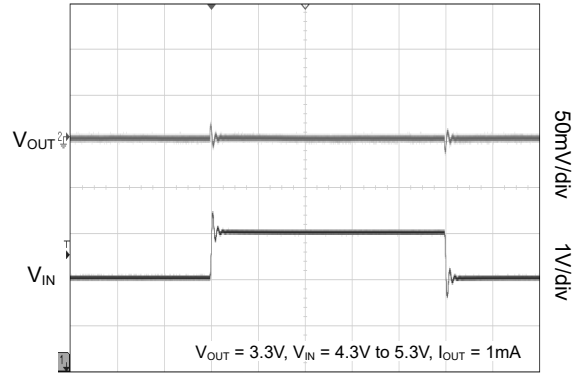
$T_J = +25^\circ\text{C}$, $V_{IN} = 4.3\text{V}$, $V_{OUT} = 3.3\text{V}$, $I_{OUT} = 300\text{mA}$, $C_{IN} = 1\mu\text{F}$ and $C_{OUT} = 4.7\mu\text{F}$, unless otherwise noted.

Line Transient Response



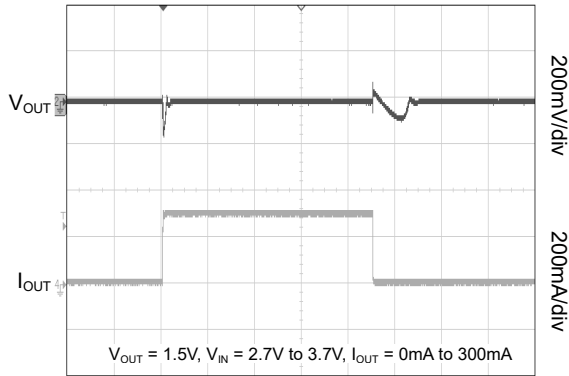
Time (100 $\mu\text{s/div}$)

Line Transient Response



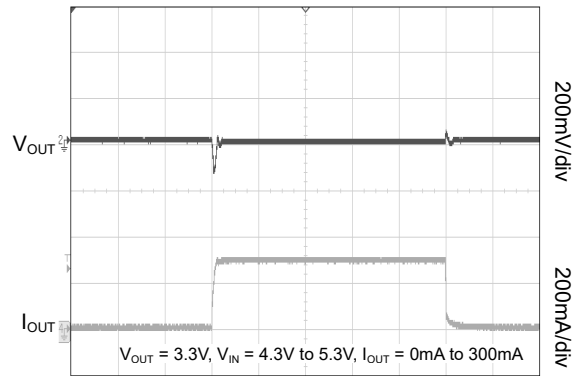
Time (100 $\mu\text{s/div}$)

Load Transient Response



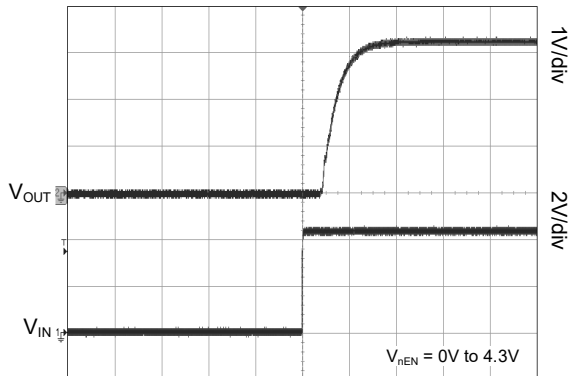
Time (100 $\mu\text{s/div}$)

Load Transient Response



Time (100 $\mu\text{s/div}$)

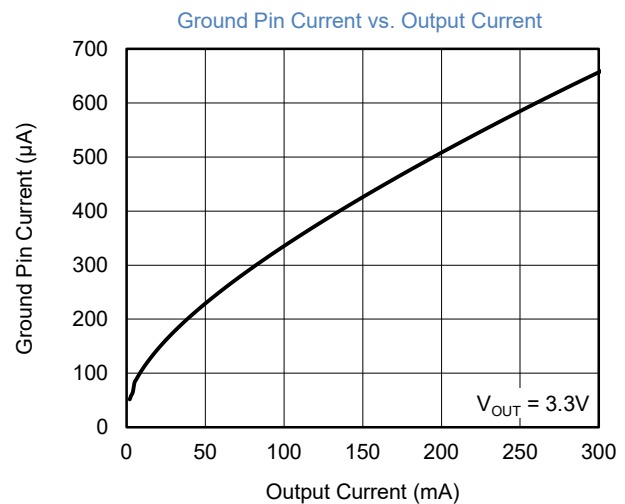
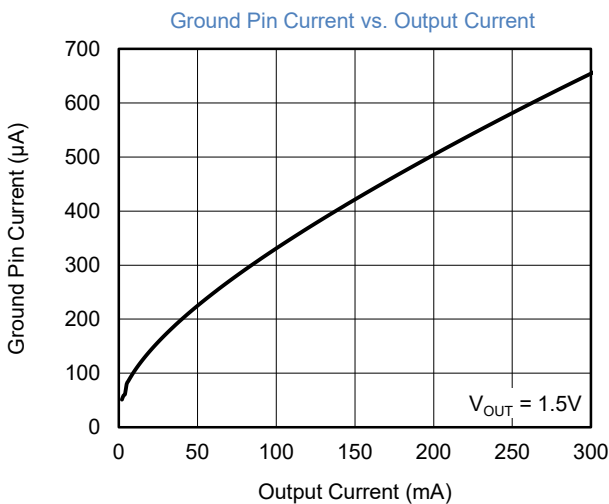
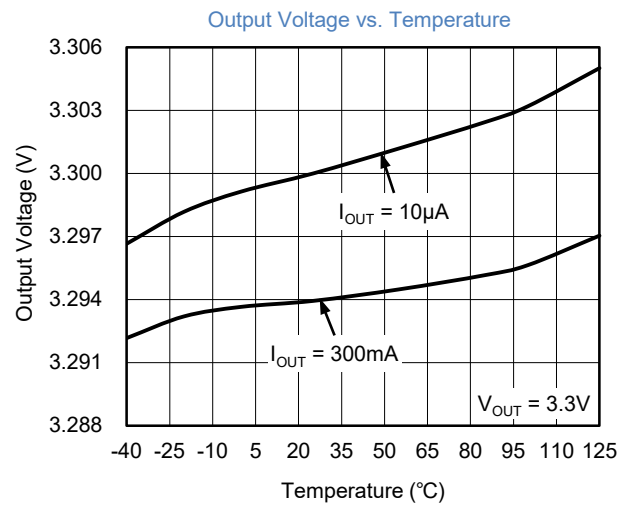
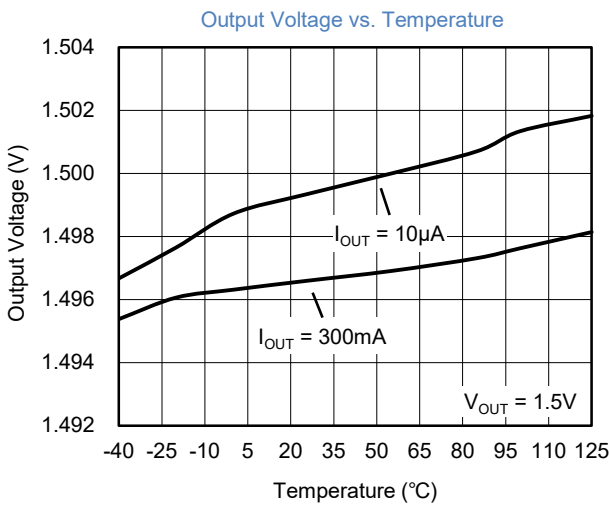
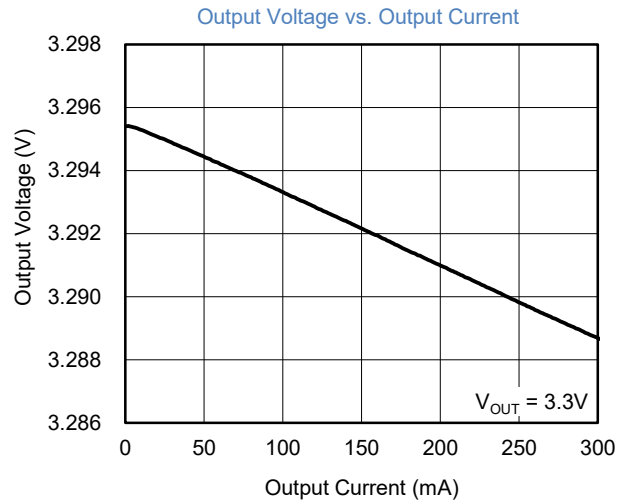
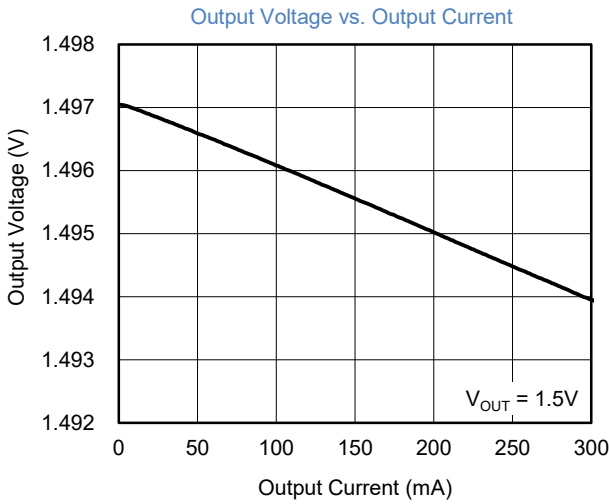
Enable Turn-On Time



Time (200 $\mu\text{s/div}$)

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

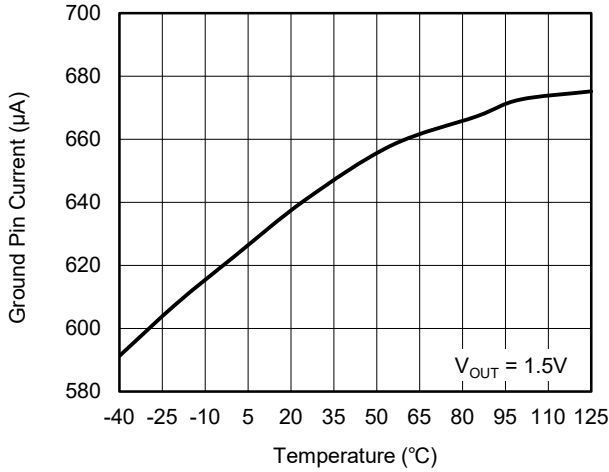
$T_J = +25^\circ\text{C}$, $V_{IN} = 4.3\text{V}$, $V_{OUT} = 3.3\text{V}$, $I_{OUT} = 300\text{mA}$, $C_{IN} = 1\mu\text{F}$ and $C_{OUT} = 4.7\mu\text{F}$, unless otherwise noted.



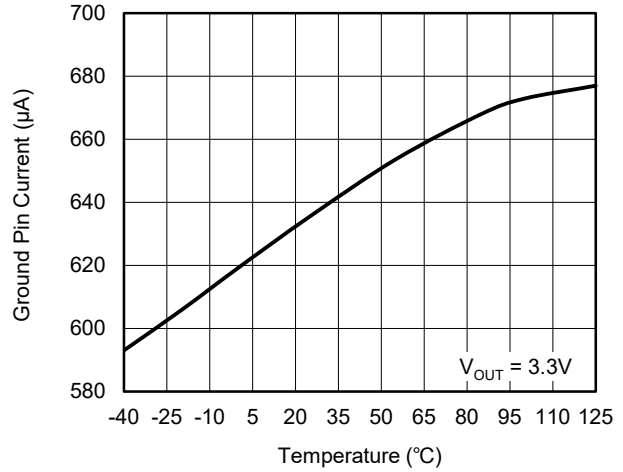
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

$T_J = +25^\circ\text{C}$, $V_{IN} = 4.3\text{V}$, $V_{OUT} = 3.3\text{V}$, $I_{OUT} = 300\text{mA}$, $C_{IN} = 1\mu\text{F}$ and $C_{OUT} = 4.7\mu\text{F}$, unless otherwise noted.

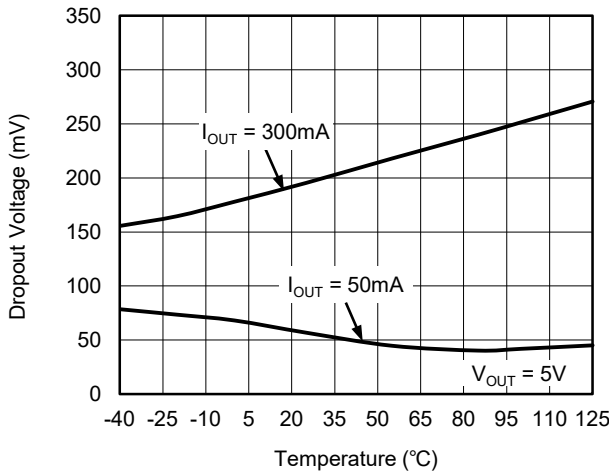
Ground Pin Current vs. Temperature



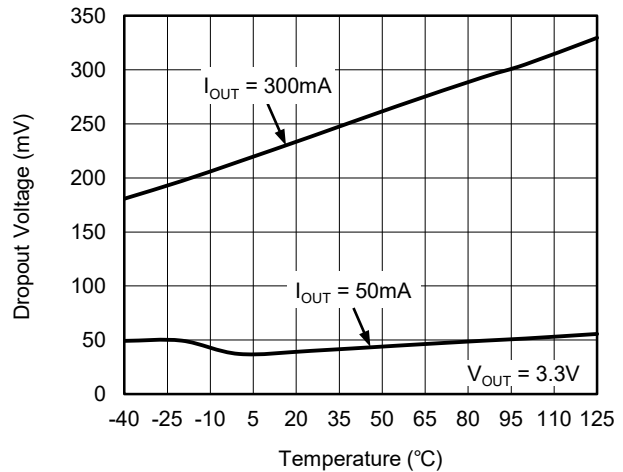
Ground Pin Current vs. Temperature



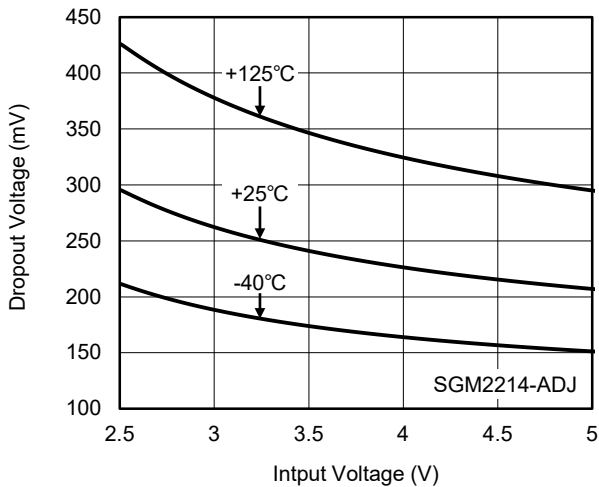
Dropout Voltage vs. Temperature



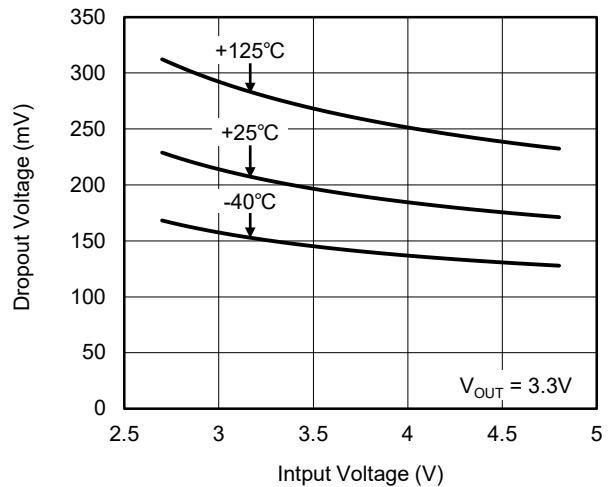
Dropout Voltage vs. Temperature



Dropout Voltage vs. Input Voltage

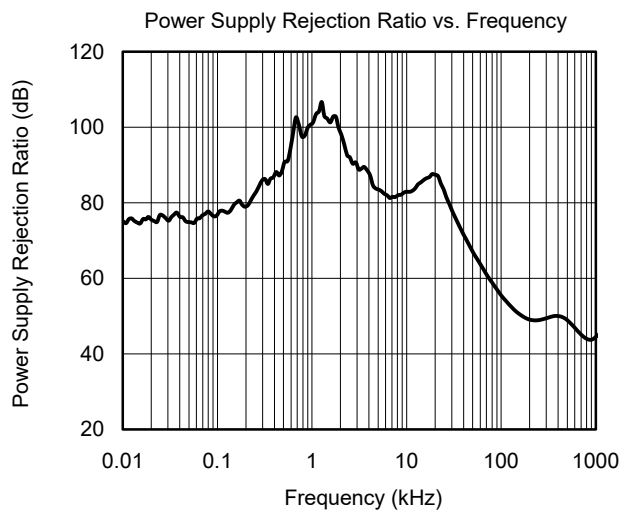
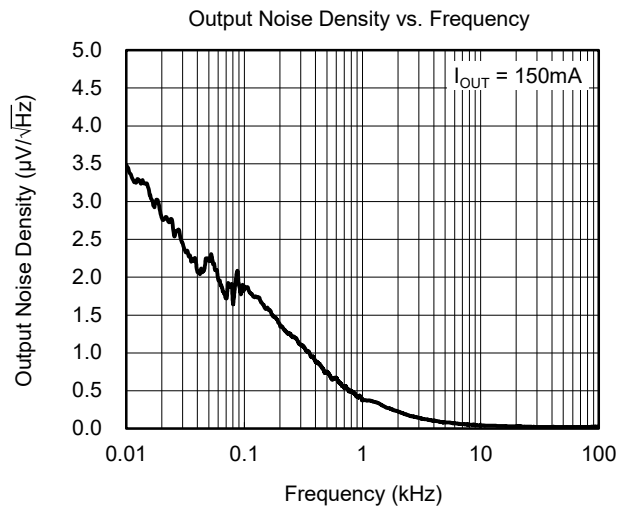
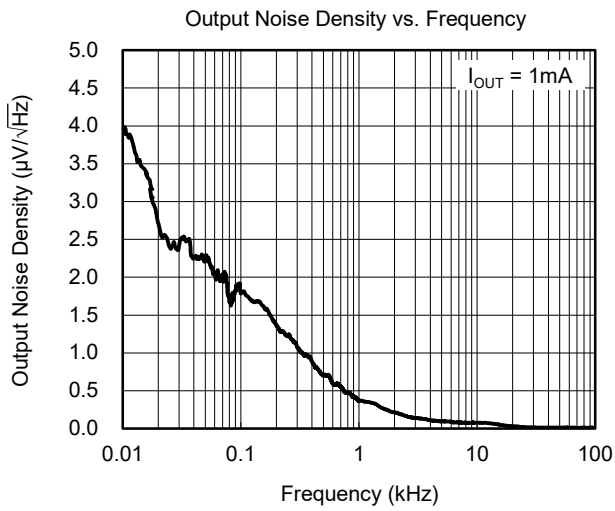


Dropout Voltage vs. Input Voltage



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

$T_J = +25^\circ\text{C}$, $V_{IN} = 4.3\text{V}$, $V_{OUT} = 3.3\text{V}$, $I_{OUT} = 300\text{mA}$, $C_{IN} = 1\mu\text{F}$ and $C_{OUT} = 4.7\mu\text{F}$, unless otherwise noted.



FUNCTIONAL BLOCK DIAGRAMS

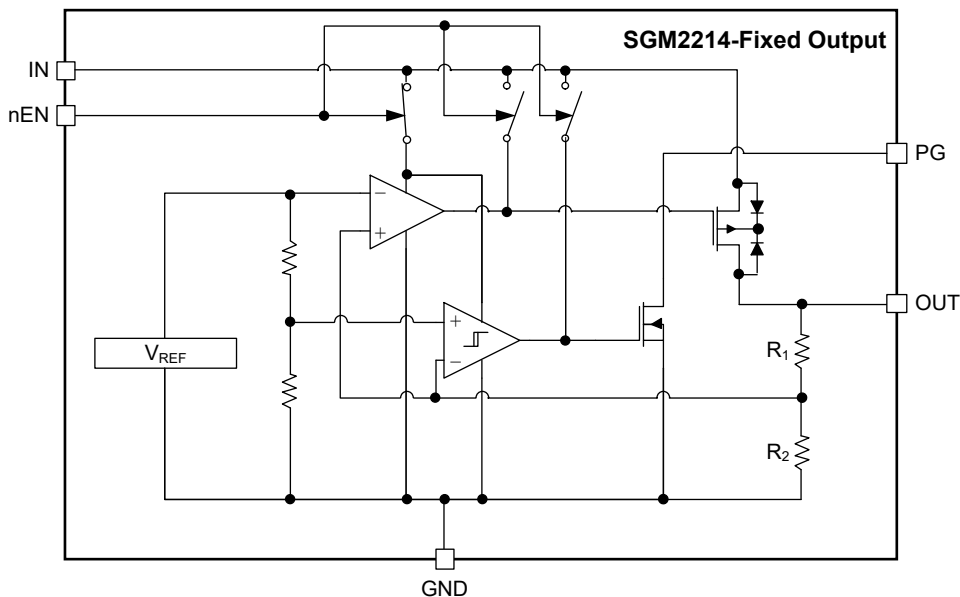


Figure 3. Fixed Version Block Diagram

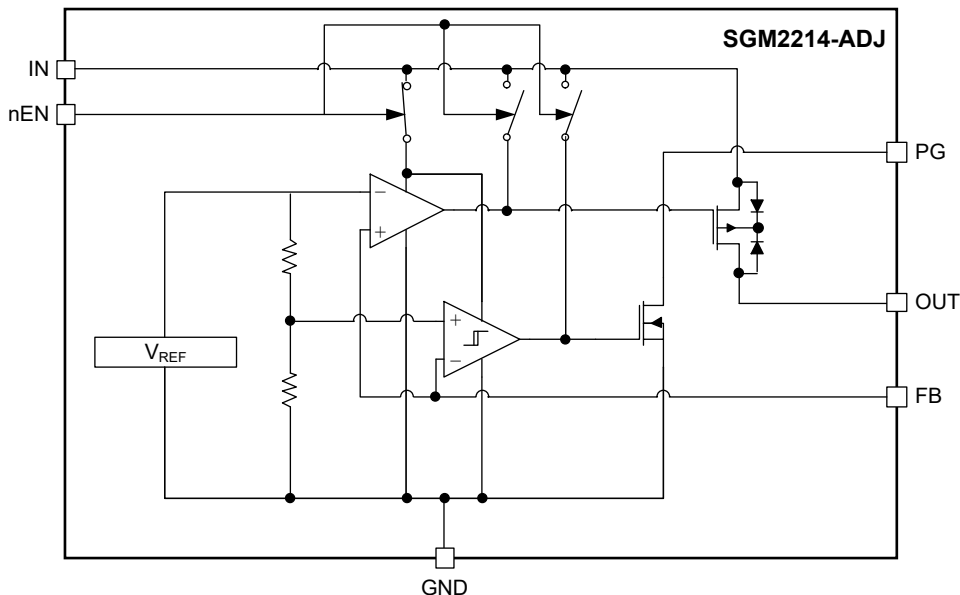


Figure 4. Adjustable Version Block Diagram

APPLICATION INFORMATION

Device Operation

The SGM2214 is a low quiescent current, low dropout voltage regulator that stable with a PMOS pass transistor. This device uses the PMOS to pass current; because the gate of the PMOS is voltage driven, operating current is low and invariable over the full load range. The SGM2214 operates with a very low current consumption and is accompanied with PMOS pass element and low drop voltage to prolong the battery-powered system run-time.

The SGM2214 also features a shutdown mode that places the output in the high-impedance state and reduces quiescent current to 3µA. If the shutdown feature is not used, the nEN pin should be tied to ground. Response to an enable transition is quick.

Minimum Load Requirements

The SGM2214 is stable even at no load and there is no minimum load required for operation.

Input Capacitor (C_{IN})

An input capacitor (C_{IN}) is always required. A 1µF or larger ceramic bypass capacitor improves load transient response and noise rejection if the SGM2214 is located more than a few inches from the power supply. A higher capacitance electrolytic capacitor may be necessary if large (hundreds of milliamps) load transients with fast rise times are anticipated.

Output Capacitor (C_{OUT})

The SGM2214 requires an output capacitor (C_{OUT}) connected between the OUT and GND pins to stabilize the internal control loop. The minimum recommended capacitance value is 2.2µF.

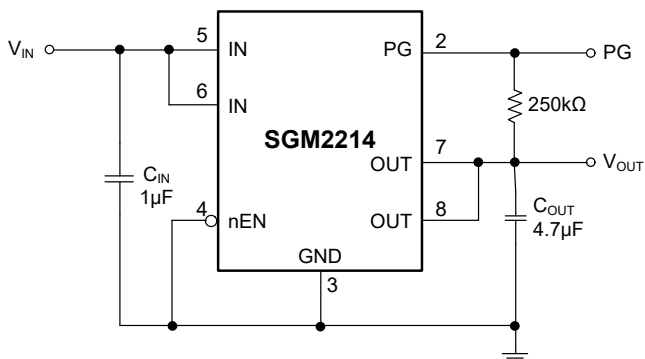


Figure 5. Typical Application Circuit for Fixed Version

Feedback Input (Adjustable Version Only)

The FB pin is an input pin to sense the output voltage and close the loop for the adjustable option. The output voltage is sensed through a resistor divider network to close the loop as it is shown in Figure 6. Normally, this connection should be as short as possible; however, the connection can be made near a critical circuit to improve performance at that point. Internally, the FB pin connects to a high-impedance wide-bandwidth amplifier and noise pickup feeds through to the regulator output. Routing the FB connection to minimize noise pickup is essential.

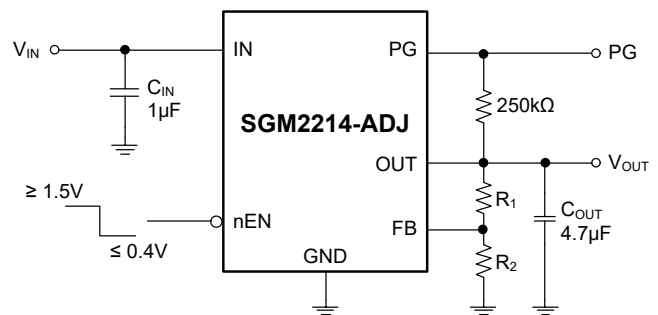


Figure 6. Typical Application Circuit for Adjustable Version

Programming the Adjustable Output Voltage

The output voltage of the SGM2214-ADJ is programmed using an external resistor divider as shown in Figure 6. The output voltage is calculated using:

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

where:

V_{REF} is 1.2V (TYP) internal reference voltage.

Resistors R₁ and R₂ should be chosen for approximately 7mA divider current. Lower value resistors can be used but offer no inherent advantage and waste more power. Higher values should be avoided as leakage currents at FB increase the output voltage error. The recommended design procedure is to choose R₂ = 169kΩ to set the divider current at 7mA and then calculate R₁ using:

$$R_1 = R_2 \times \left(\frac{V_{OUT}}{V_{REF}} - 1 \right) \tag{2}$$

APPLICATION INFORMATION (continued)

Thermal Protection

The SGM2214 also features internal current limiting and thermal protection. During normal operation, the device limits output current to approximately 960mA (TYP). When current limiting engages, the output voltage scales back linearly until the overcurrent condition ends. While current limiting is designed to prevent gross device failure, care should be taken not to exceed the power dissipation ratings of the package. If the temperature of the device exceeds +150°C (TYP), thermal-protection circuitry shuts it down. Once the device has cooled below +130°C (TYP), regulator operation resumes.

Power-Good Indicator

The SGM2214 features a power-good (PG) output that can be used to monitor the status of the regulator. The internal comparator monitors the output voltage: when the output voltage drops to 95.4% of its nominal regulated value, the PG output transistor turns on, taking the signal low. The open-drain output requires a pull-up resistor. If not used, it can be left floating. PG can be used to drive power-on reset circuitry or used as a low-battery indicator.

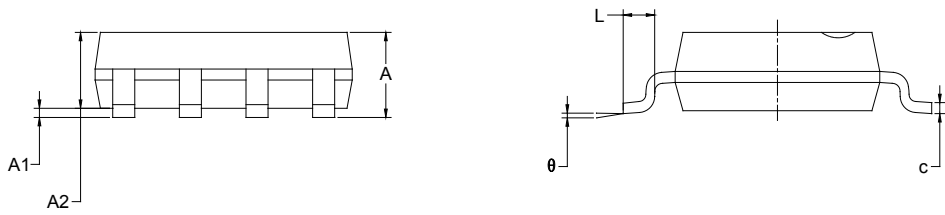
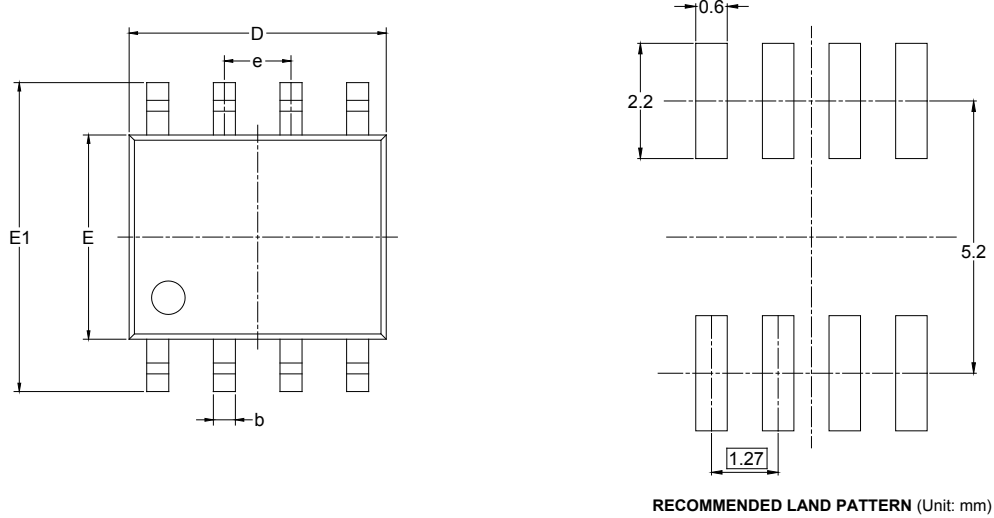
REVISION HISTORY

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

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

PACKAGE OUTLINE DIMENSIONS

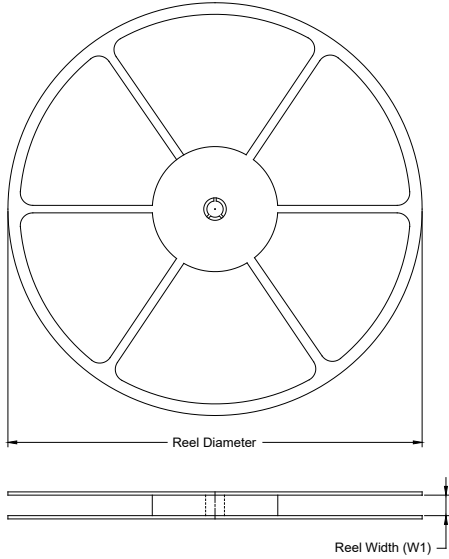
SOIC-8



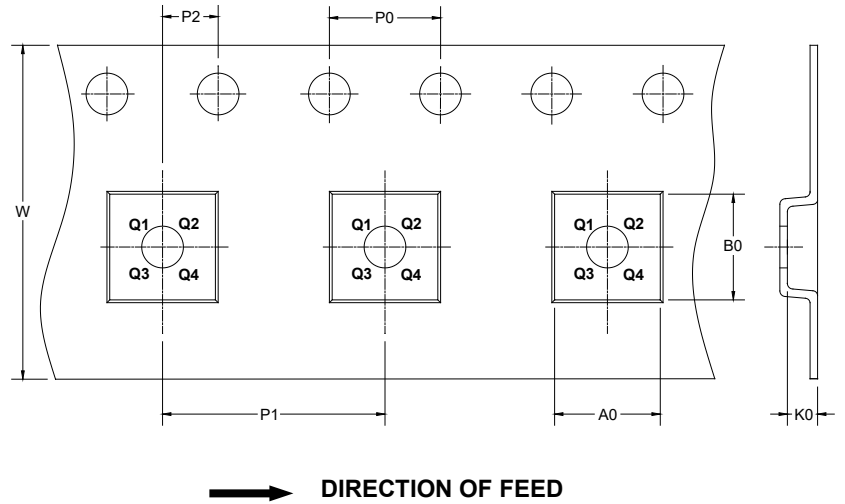
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050 BSC	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

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
SOIC-8	13"	12.4	6.40	5.40	2.10	4.0	8.0	2.0	12.0	Q1

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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
13"	386	280	370	5

DD0002