SGM2249
40V, 300mA, Low Quiescent Current and Low Dropout Voltage Linear Regulator

GENERAL DESCRIPTION

The SGM2249 is a high voltage, low quiescent current and low dropout voltage linear regulator. It is capable of supplying 300mA output current with typical dropout voltage of 740mV. The operating input voltage range is from 2.5V to 40V and output voltage range is from 0.6V to 24V.

Other features include current limit and thermal shutdown protection. The SGM2249 is suitable for various applications.

The SGM2249 is available in a Green MSOP-8 (Exposed Pad) package. It operates over an operating temperature range of -40℃ to +125℃.

FEATURES

- **Operating Input Voltage Range: 2.5V to 40V**
- **Enable Pin Accept Voltages Higher than the Supply Voltage and up to 40V**
- **Adjustable Output from 0.6V to 24V**
- **300mA Output Current**
- **Output Voltage Accuracy: ±1% at +25℃**
- **Low Quiescent Current: 3.2μA (TYP)**
- **Low Dropout Voltage:**
  740mV (TYP) at 300mA, V_{OUT} = 24V
- **Current Limiting and Thermal Protection**
- **With Output Automatic Discharge**
- **Stable with Small Case Size Ceramic Capacitors**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in a Green MSOP-8 (Exposed Pad) Package**

APPLICATIONS

Industrial Equipment
Battery-Powered Equipment
Medical Equipment

TYPICAL APPLICATION

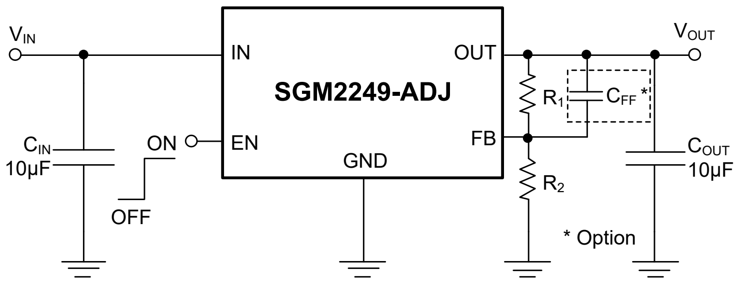


Figure 1. Typical Application Circuit

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2249-ADJ	MSOP-8 (Exposed Pad)	-40℃ to +125℃	SGM2249-ADJXPMS8G/TR	SGM25L XPMS8 XXXXX	Tape and Reel, 4000

MARKING INFORMATION

NOTE: XXXXX = Date Code, Trace Code and Vendor Code.

MSOP-8 (Exposed Pad)

XXXXX
- Vendor Code
- Trace Code
- Date Code - Year

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

IN, EN to GND .... -0.3V to 45V
OUT to GND .... -0.3V to 45V
FB to GND .... -0.3V to 45V
Package Thermal Resistance
MSOP-8 (Exposed Pad), θ_{JA} .... 47.6℃/W
MSOP-8 (Exposed Pad), θ_{JB} .... 23.1℃/W
MSOP-8 (Exposed Pad), $\theta_{JC(TOP)}$ .... 54.8℃/W
MSOP-8 (Exposed Pad), $\theta_{JC(BOT)}$ .... 8.3℃/W
Junction Temperature ....+150℃
Storage Temperature Range ....-65℃ to +150℃
Lead Temperature (Soldering, 10s) ....+260℃
ESD Susceptibility [(1) (2)]
HBM... ±6000V
CDM .... ±1000V

NOTES:

1. For human body model (HBM), all pins comply with ANSI/ESDA/JEDEC JS-001 specifications.

2. For charged device model (CDM), all pins comply with ANSI/ESDA/JEDEC JS-002 specifications.

RECOMMENDED OPERATING CONDITIONS

Supply Voltage Range, V_{IN}...................................2.5V to 40V
Enable Input Voltage Range ....0V to 40V
Input Effective Capacitance, C_{IN} .... 0.5μF (MIN)
Output Effective Capacitance, C_{OUT} .... 1μF to 100μF
Operating Ambient Temperature Range.......-40℃ to +125℃
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

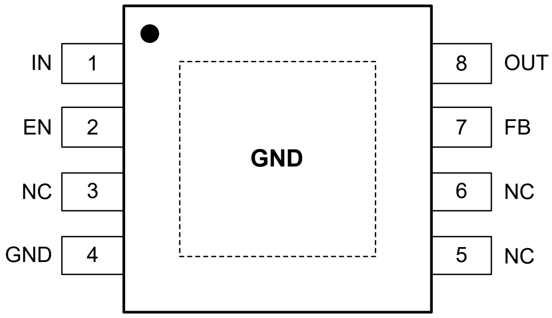
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance 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

SGM2249-ADJ (TOP VIEW)



MSOP-8 (Exposed Pad)

PIN DESCRIPTION

PIN	NAME	FUNCTION
1	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. This ceramic capacitor should be placed as close as possible to IN pin.
2	EN	Enable Pin. Drive EN high to turn on the regulator. Drive EN low to turn off the regulator.
3, 5, 6	NC	No Connection.
4	GND	Ground.
7	FB	Feedback Voltage Input Pin. Connect this pin to the midpoint of an external resistor divider to adjust the output voltage. Place the resistors as close as possible to this pin.
8	OUT	Regulator Output Pin. It is recommended to use a ceramic capacitor with effective capacitance in the range of 1μF to 100μF to ensure stability. This ceramic capacitor should be placed as close as possible to OUT pin.
Exposed Pad	GND	Exposed Pad. Connect it to GND internally. Connect it to a large ground plane to maximize thermal performance. This pad is not an electrical connection point.

FUNCTIONAL BLOCK DIAGRAM

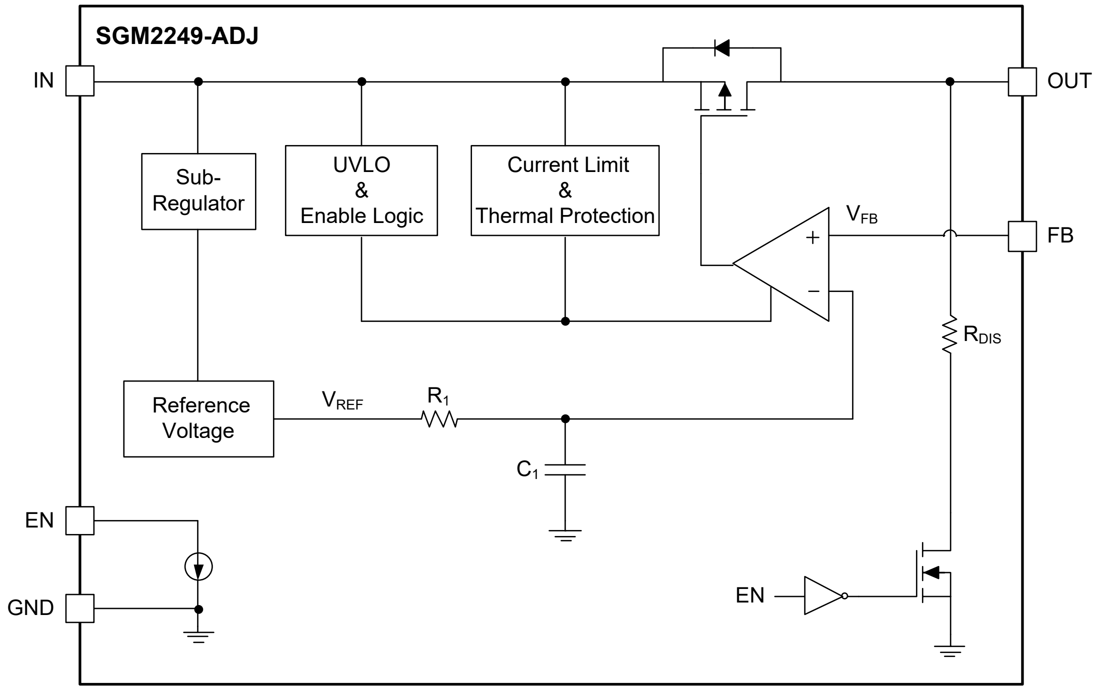


Figure 2. Block Diagram

ELECTRICAL CHARACTERISTICS

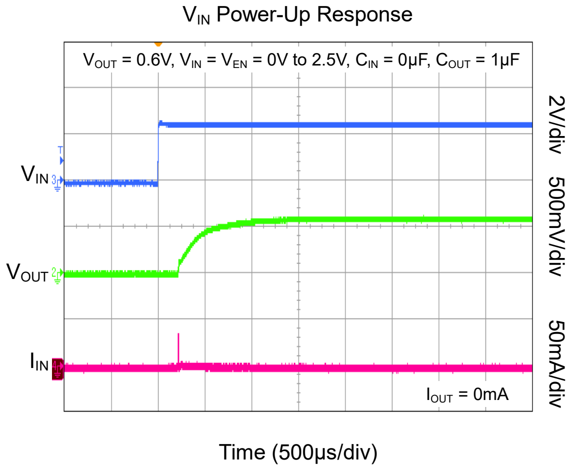
(V_{IN} = $V_{OUT(NOM)}$ + 2V, C_{IN} = 10μF, C_{OUT} = 10μF, C_{FF} = 0nF, T_J = -40℃ to +125℃ [(1)], typical values are at T_J = +25℃, unless otherwise noted.)

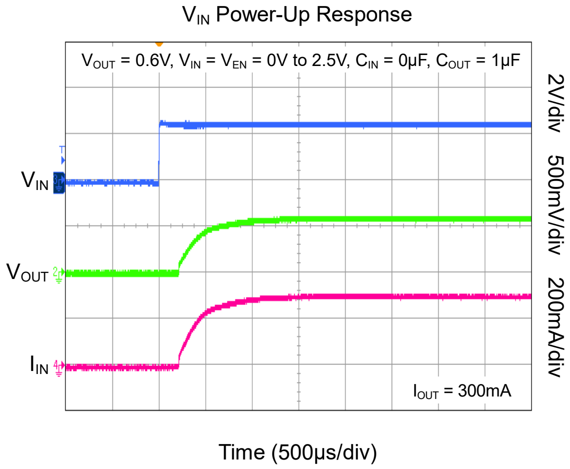
PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Input Voltage Range	V_{IN}			2.5		40	V
Output Voltage Range	V_{OUT}			0.6		24	V
Output Voltage Accuracy	V_{OUT}	V_{IN} = ($V_{OUT(NOM)}$ + 2V) to 40V, I_{OUT} = 1mA	T_J = +25℃	-1		+1	%
			T_J = -40℃ to +125℃	-2		+1.5	
Feedback Voltage	V_{FB}	V_{IN} = ($V_{OUT(NOM)}$ + 2V) to 40V, I_{OUT} = 1mA	T_J = +25℃	0.594	0.6	0.606	V
			T_J = -40℃ to +125℃	0.588	0.6	0.609	
FB Pin Input Current	I_{FB}	V_{FB} = 0.7V			0.1	100	nA
Under-Voltage Lockout	V_{UVLO}	V_{IN} rising			2.1	2.48	V
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	V_{IN} = ($V_{OUT(NOM)}$ + 2V) to 40V, I_{OUT} = 0.1mA			0.0002	0.02	%/V
Load Regulation	$\frac{\Delta V_{OUT}}{\Delta I_{OUT} \times V_{OUT}}$	I_{OUT} = 0.1mA to 300mA			0.0002	0.005	%/mA
Dropout Voltage	V_{DROP}	$V_{OUT(NOM)}$ = 24V, V_{OUT} = 95% × $V_{OUT(NOM)}$	I_{OUT} = 100mA		245	500	mV
			I_{OUT} = 300mA		740	1500	
Output Current Limit	I_{LIMIT}	$V_{OUT(NOM)}$ = 24V, V_{OUT} = 90% × $V_{OUT(NOM)}$, V_{IN} = V_{OUT} + 4V		300	650		mA
Short-Circuit Current Limit	I_{SHORT}	V_{OUT} =0V, V_{IN} = $V_{OUT(NOM)}$ + 3V			265		mA
Ground Pin Current	I_{GND}	I_{OUT} = 0mA			3.2	8	μA
		I_{OUT} = 300mA			125	260	
Shutdown Supply Current	I_{SHDN}	V_{EN} = 0V, V_{IN} = 2.5V to 40V			0.3	1.5	μA
EN Pin High-Level Input Voltage	V_{IH}	V_{IN} = 2.5V to 40V		1.8		40	V
EN Pin Low-Level Input Voltage	V_{IL}	V_{IN} = 2.5V to 40V		0		1	V
EN Pin Input Current	I_{EN}	V_{EN} = 0V, V_{IN} = 40V			5	500	nA
		V_{EN} = 40V, V_{IN} = 40V			50	1000	
Output Discharge Resistance	R_{DIS}	V_{EN} = 0V			215		Ω
Turn-On Time	t_{ON}	From assertion of V_{EN} to V_{OUT} = 90% × $V_{OUT(NOM)}$, $V_{OUT(NOM)}$ = 0.6V			0.83	1.3	ms
Power Supply Ripple Rejection	PSRR	V_{OUT} = 0.6V, V_{IN} = 2.5V I_{OUT} = 10mA, C_{OUT} = 4.7μF	f = 100Hz		69		dB
			f = 1kHz		52		
			f = 100kHz		39		
		V_{OUT} = 3.3V, V_{IN} = 5.3V, I_{OUT} = 10mA, C_{OUT} = 4.7μF	f = 100Hz		63		
			f = 1kHz		45		
			f = 100kHz		43		
Output Voltage Noise	e_n	I_{OUT} = 10mA, C_{OUT} = 4.7μF, f = 10Hz to 100kHz	V_{OUT} = 0.6V		46		$μV_{RMS}$
			V_{OUT} = 3.3V		164		
Thermal Shutdown Temperature	T_{SHDN}	T_J rising			160		℃
Thermal Shutdown Hysteresis	ΔT_{SHDN}	Hysteresis			20		℃

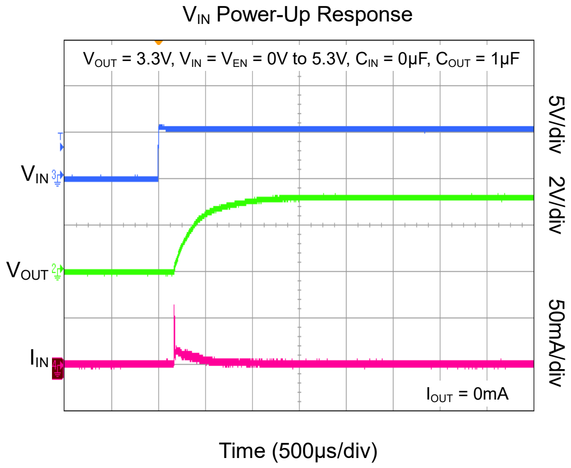
NOTE:
1. Tested under pulse load conditions, so $T_J \approx T_A$.

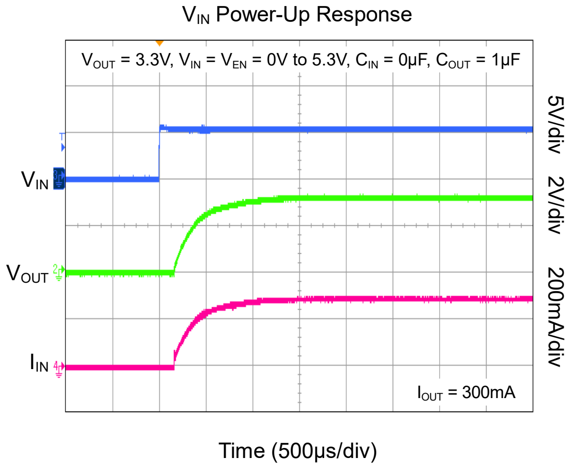
TYPICAL PERFORMANCE CHARACTERISTICS

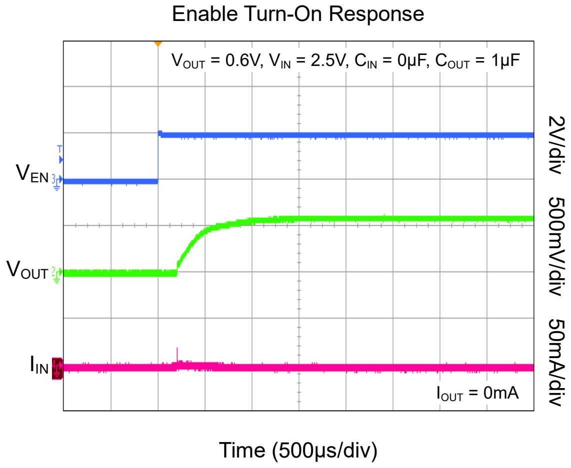
T_J = +25℃, V_{EN} = V_{IN}, C_{IN} = 10μF, C_{OUT} = 10μF, C_{FF} = 0nF, unless otherwise noted.

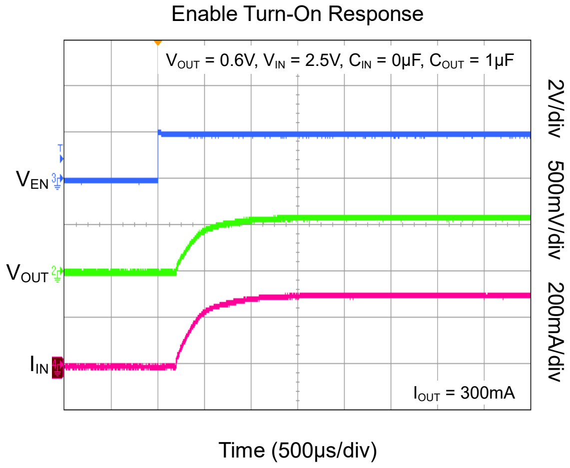








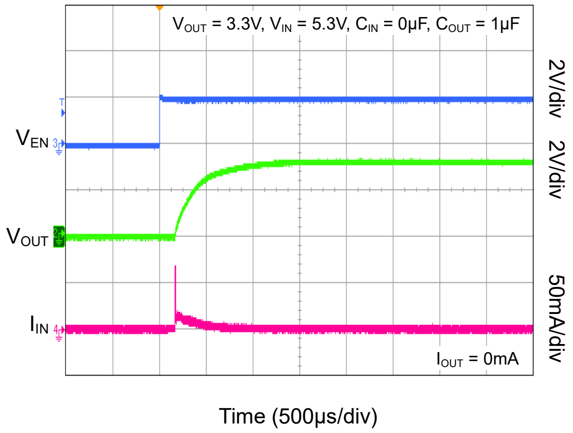




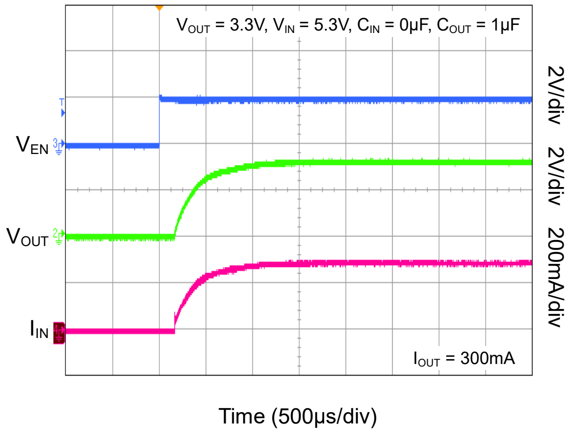
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_J = +25℃, V_{EN} = V_{IN}, C_{IN} = 10μF, C_{OUT} = 10μF, C_{FF} = 0nF, unless otherwise noted.

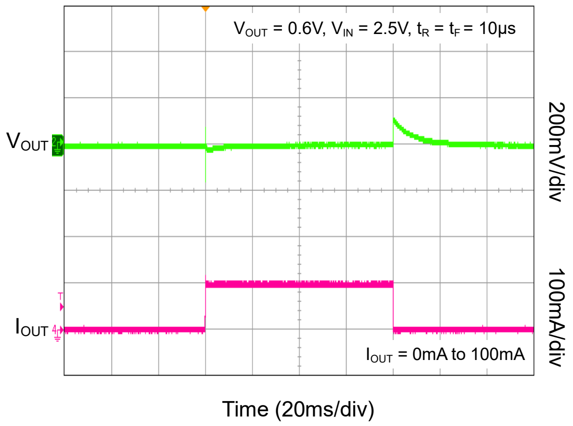
Enable Turn-On Response



Enable Turn-On Response



Load Transient Response



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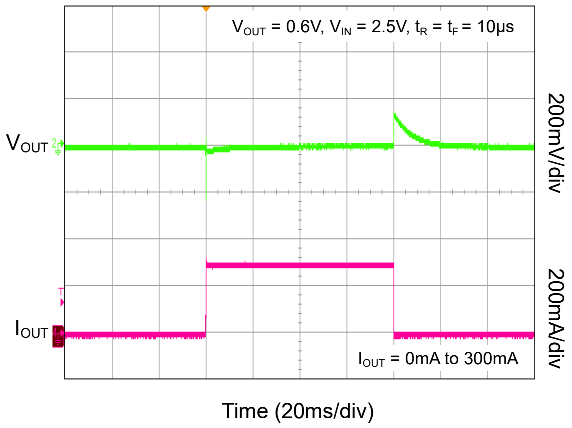
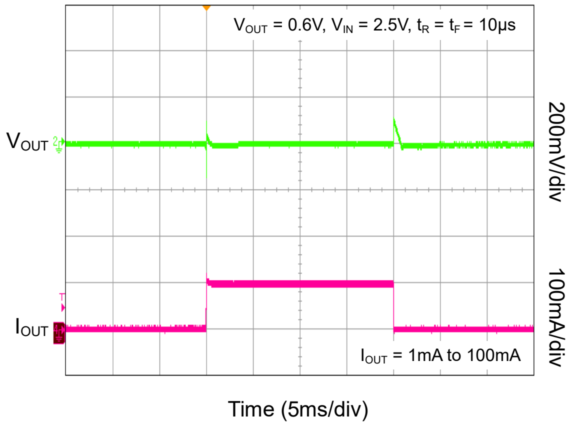
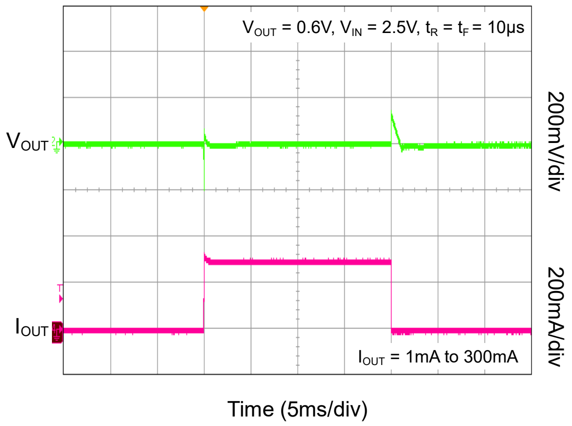


Load Transient Response



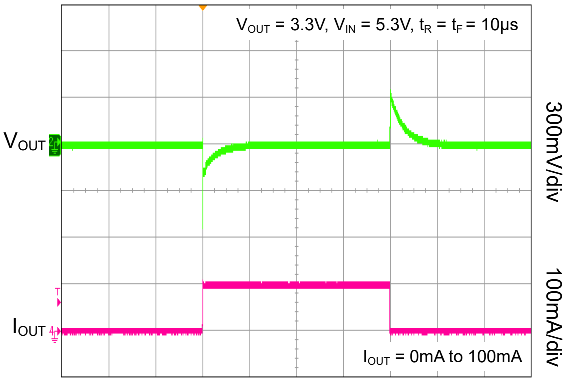
Load Transient Response



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

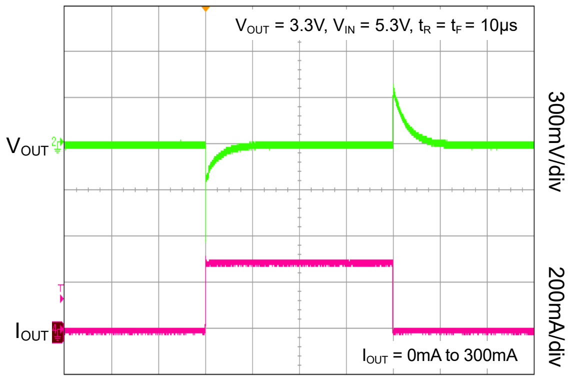
T_J = +25℃, V_{EN} = V_{IN}, C_{IN} = 10μF, C_{OUT} = 10μF, C_{FF} = 0nF, unless otherwise noted.

Load Transient Response



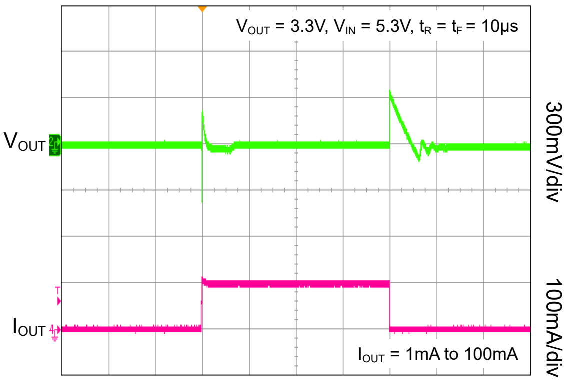
Time (50ms/div)

Load Transient Response



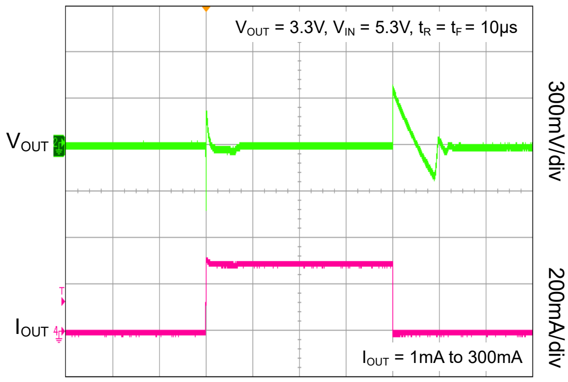
Time (50ms/div)

Load Transient Response



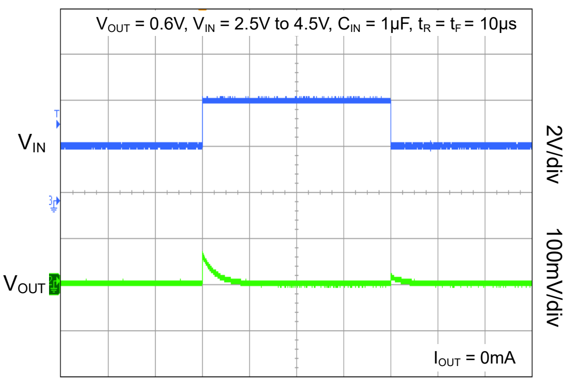
Time (5ms/div)

Load Transient Response



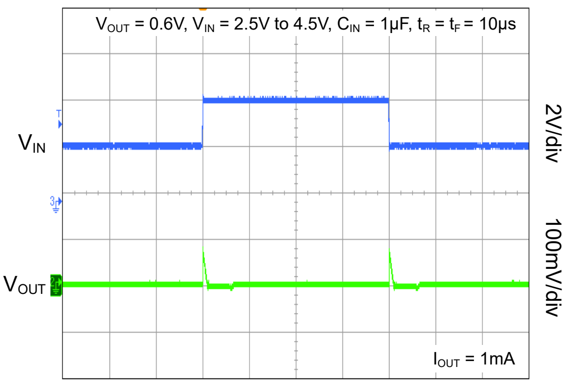
Time (5ms/div)

Line Transient Response



Time (50ms/div)

Line Transient Response

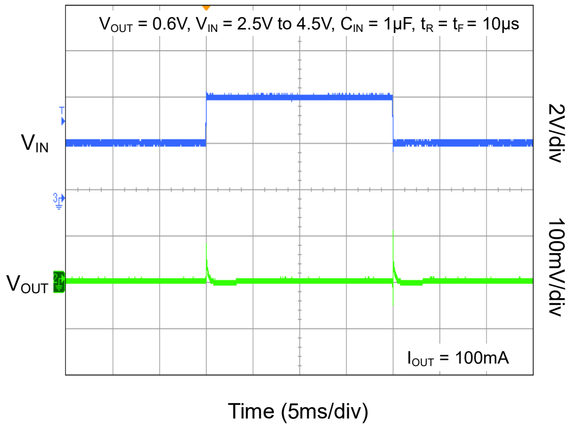


Time (5ms/div)

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_J = +25℃, V_{EN} = V_{IN}, C_{IN} = 10μF, C_{OUT} = 10μF, C_{FF} = 0nF, unless otherwise noted.

Line Transient Response



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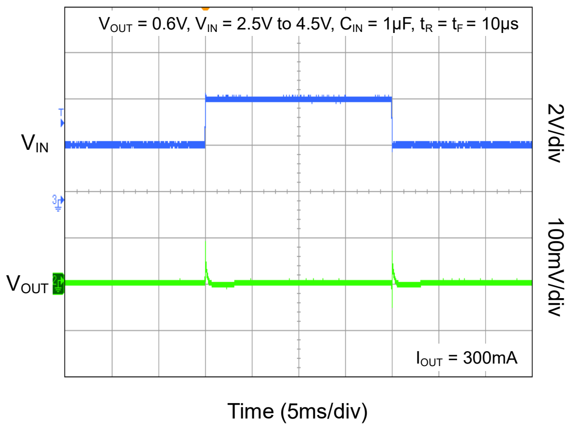

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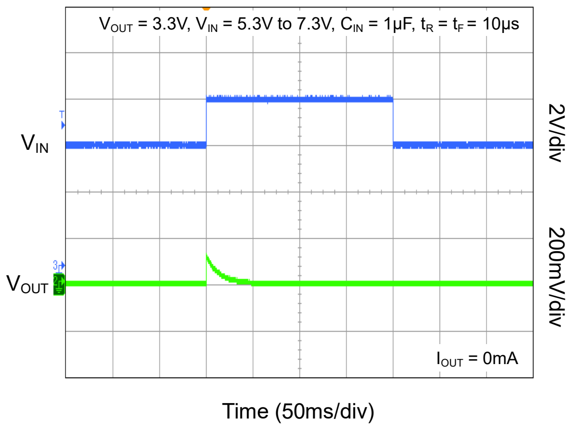

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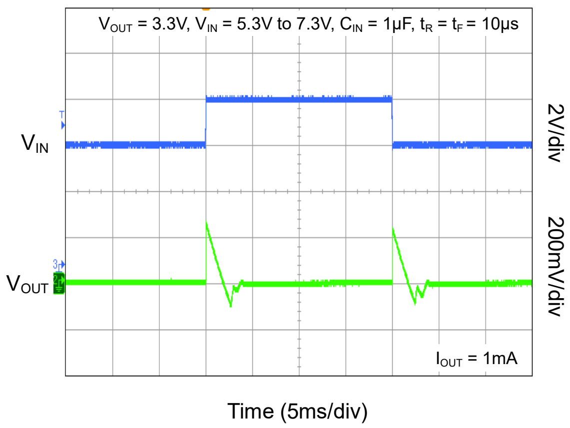

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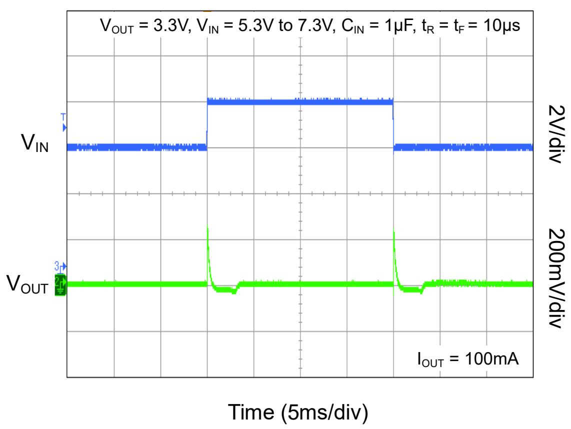
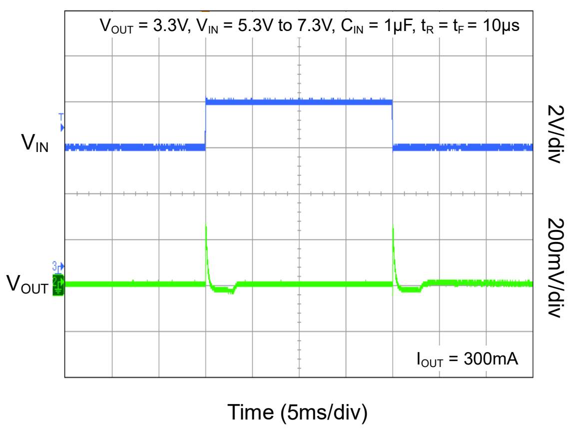
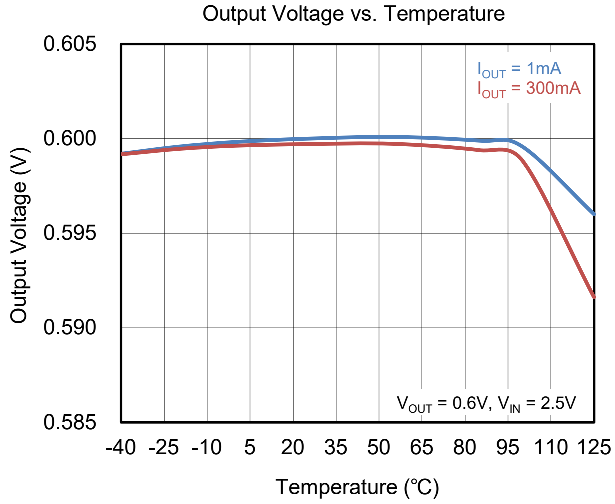


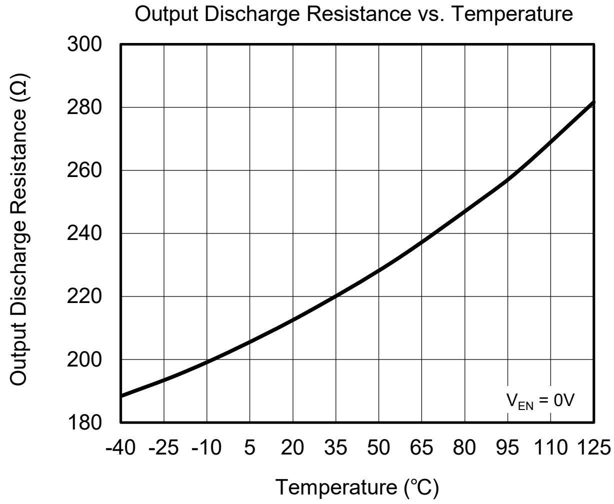
Line Transient Response

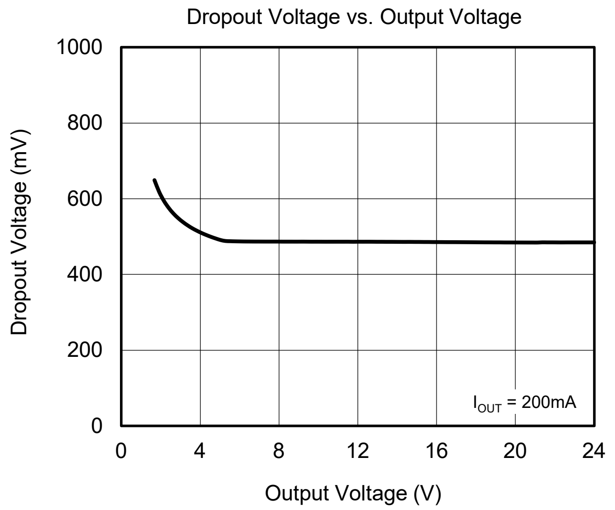


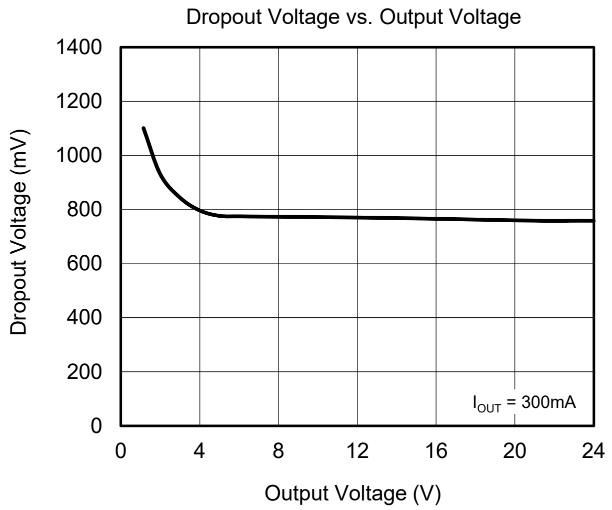
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

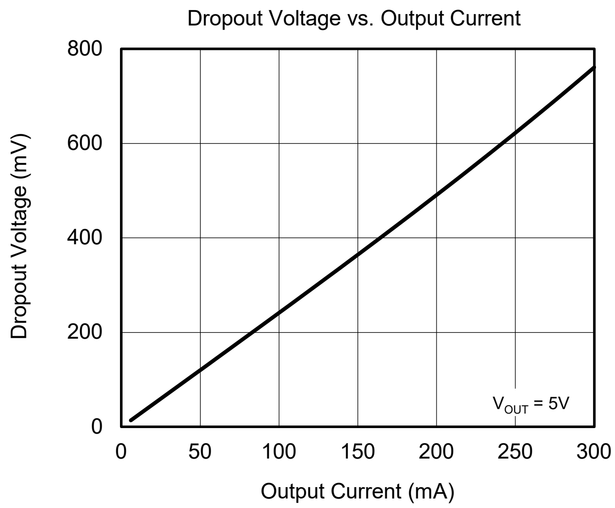
T_J = +25℃, V_{EN} = V_{IN}, C_{IN} = 10μF, C_{OUT} = 10μF, C_{FF} = 0nF, unless otherwise noted.

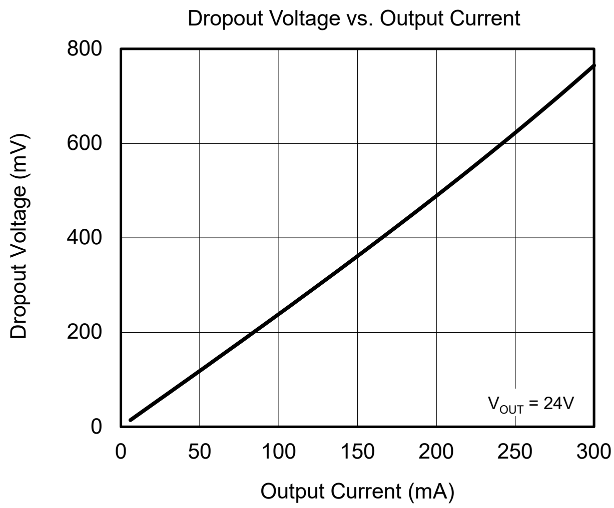












TYPICAL PERFORMANCE CHARACTERISTICS (continued)

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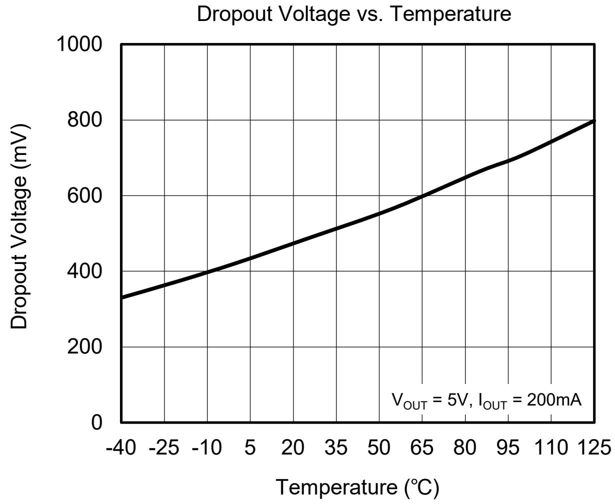

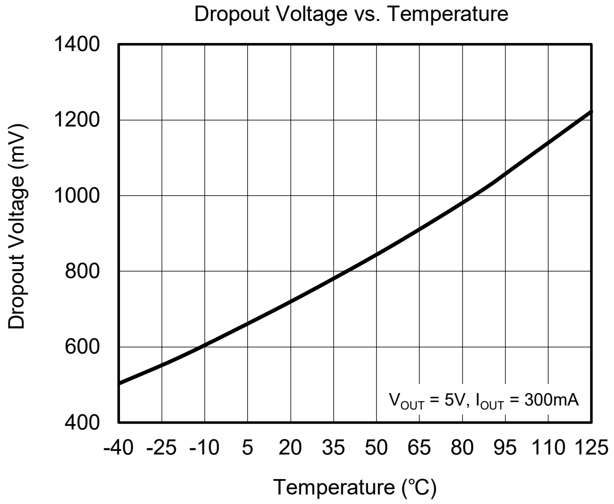

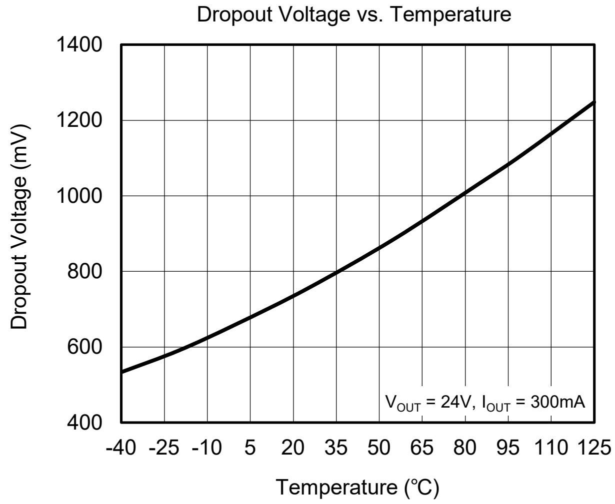

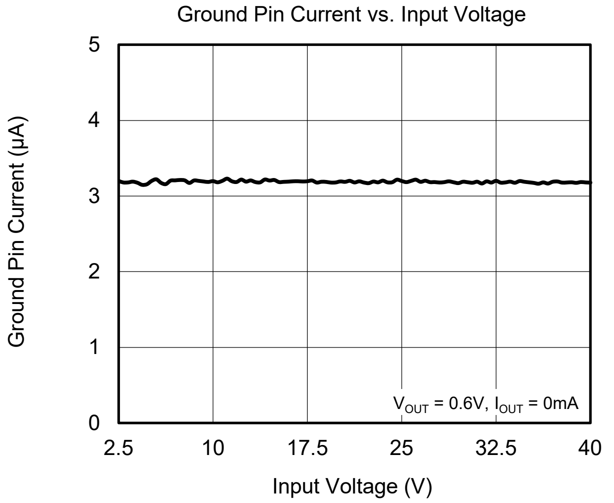

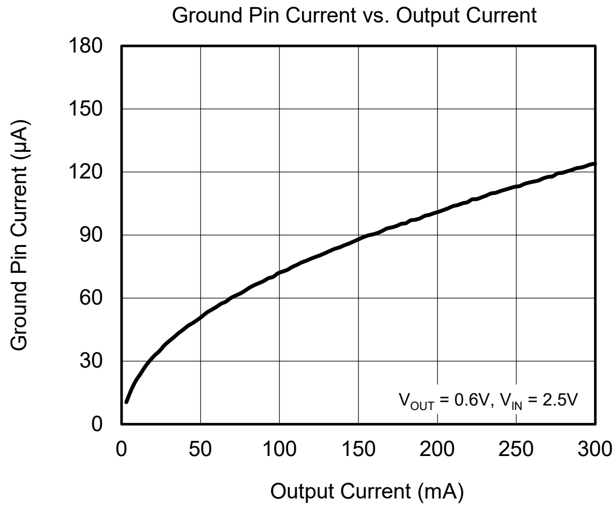

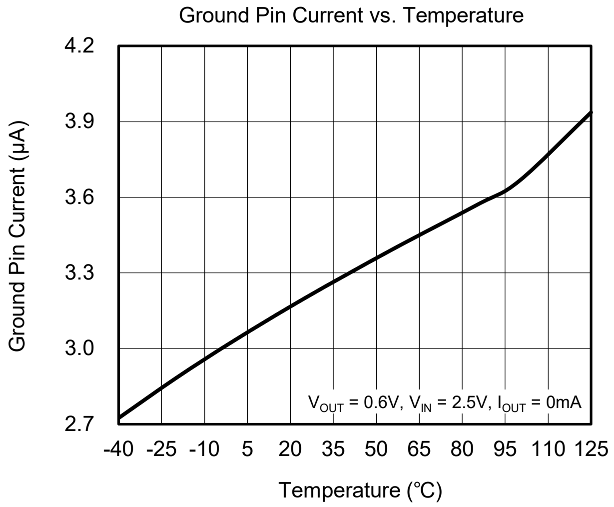

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

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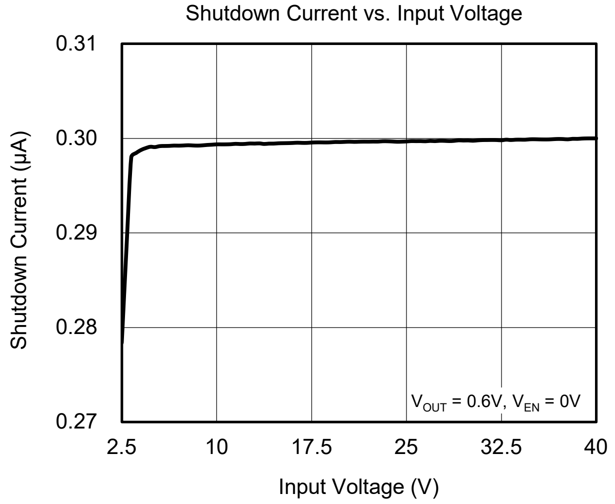
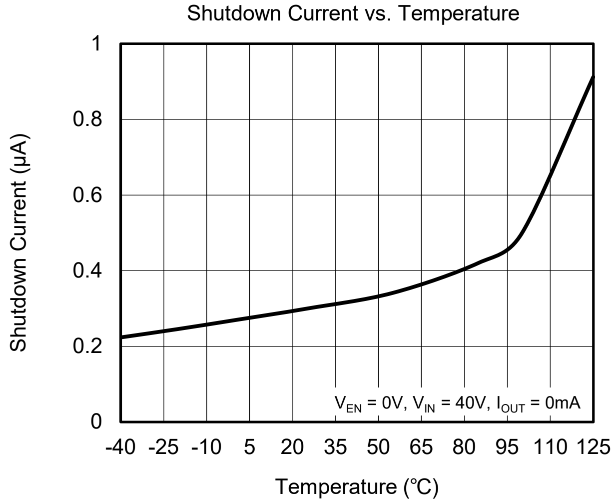
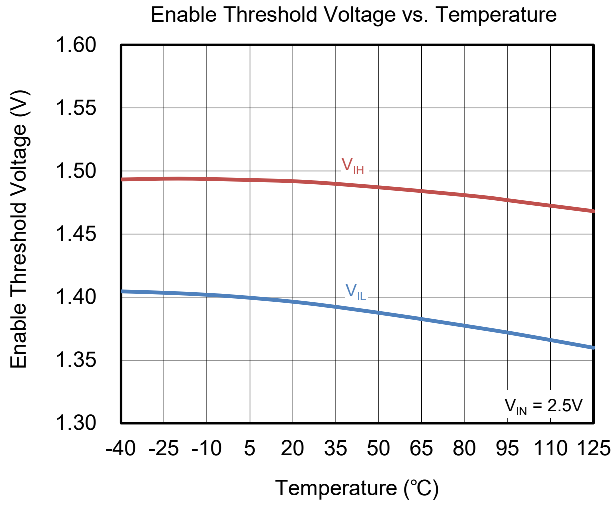
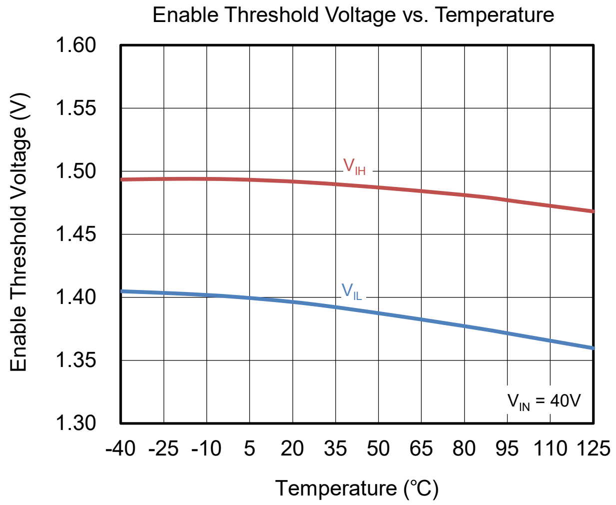
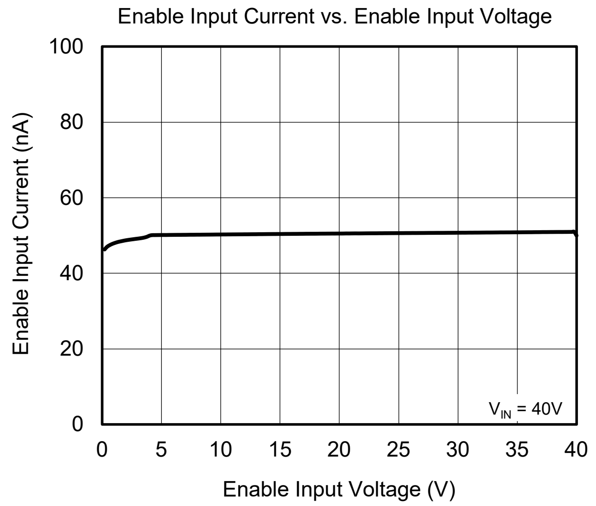
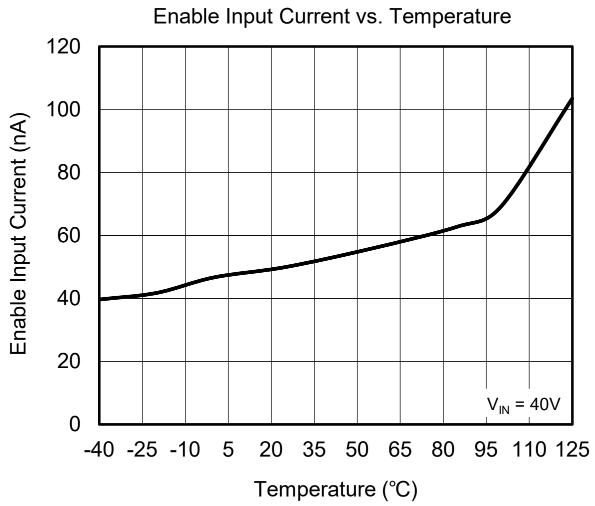






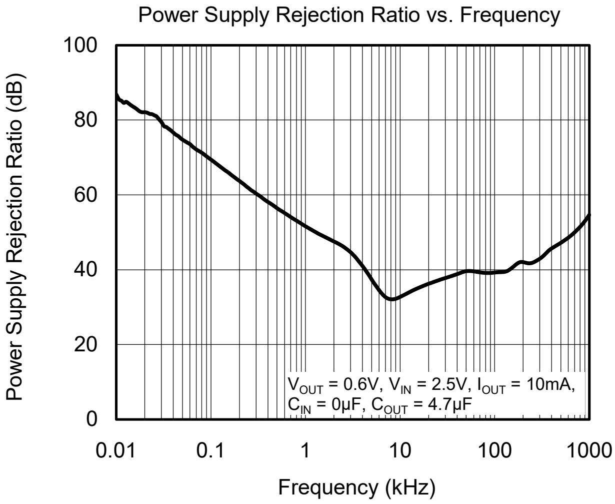


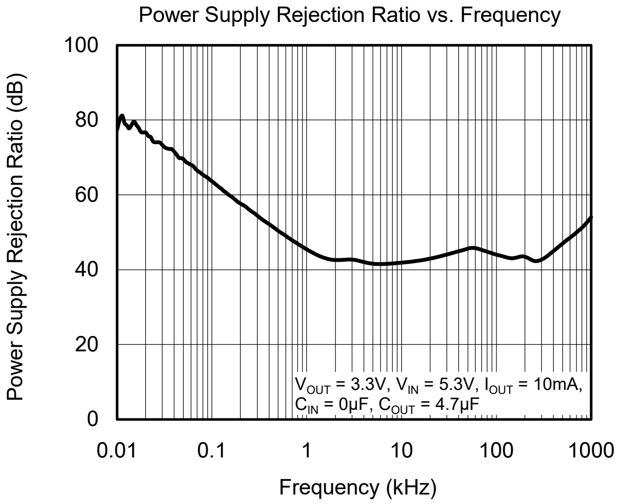


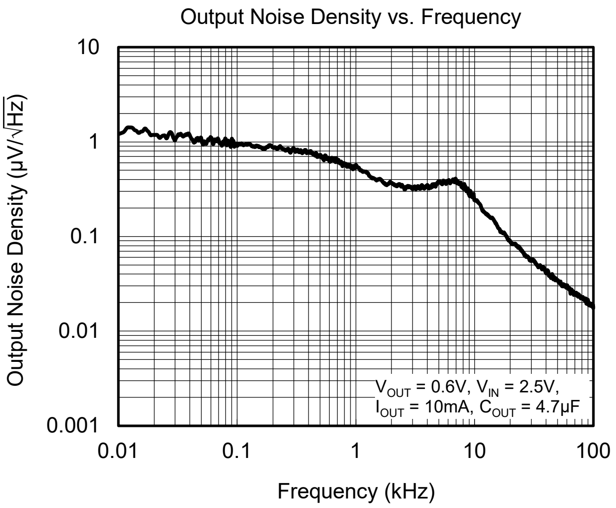


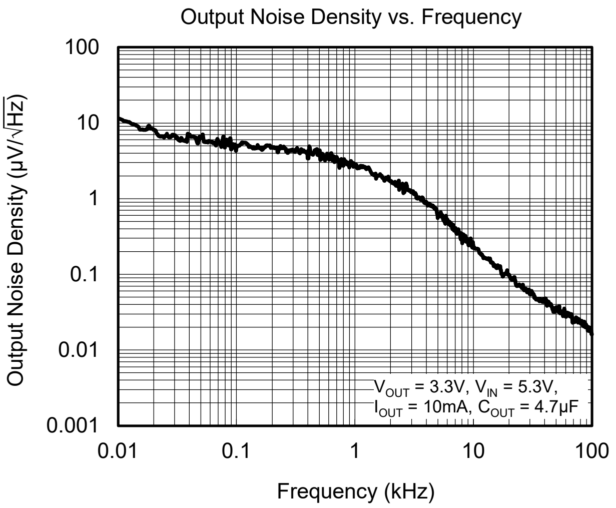
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_J = +25℃, V_{EN} = V_{IN}, C_{IN} = 10μF, C_{OUT} = 10μF, C_{FF} = 0nF, unless otherwise noted.









APPLICATION INFORMATION

The SGM2249 is a high voltage, low quiescent current and low dropout 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 SGM2249 useful in a variety of applications. The SGM2249 provides protection functions for output overload 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. For C_{OUT} with larger capacitance, it is recommended to choose the larger capacitance C_{IN}.

Output Capacitor Selection (C_{OUT})

One or more output capacitors are required to maintain the stability of the LDO, and the output capacitors should be placed as close as possible to the OUT pin. In addition, in order to obtain the best transient performance, it is recommended to use X7R and X5R ceramic capacitors as output capacitors. Ceramic capacitors have low equivalent series resistance (ESR), excellent temperature and DC bias characteristics. However, it cannot be ignored that the effective capacitance of ceramic capacitors is affected by temperature, DC bias and package size.

For example, Figure 3 shows the capacitance and DC bias and temperature characteristics of 0805, 10V, 10μF±10%, X7R capacitor. Therefore, it is necessary to evaluate whether the effective capacitance of the output capacitor can meet the stability requirements of the LDO in practical applications. In general, a capacitor in higher voltage rating and a larger package exhibits better stability, and the effective capacitance can be obtained from the manufacturer datasheet.

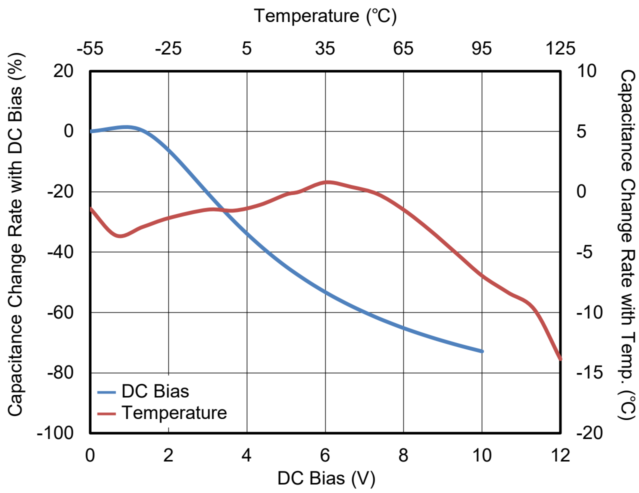


Figure 3. Capacitance vs. DC Bias and Temperature Characteristics

The SGM2249 requires a minimum effective capacitance of 1μF for C_{OUT} to ensure stability. Additionally, C_{OUT} with larger capacitance and lower ESR will help increase the high frequency PSRR and improve the load transient response.

Adjustable Regulator

The output voltage of the SGM2249-ADJ can be adjusted from 0.6V to 24V. The FB pin will be connected to two external resistors as shown in Figure 4. The output voltage is determined by the following equation:

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

where:

V_{OUT} is output voltage and V_{FB} is the internal voltage reference, V_{FB} = 0.6V. One parallel capacitor (C_{FF}) with R_1 can be used to improve the feedback loop stability and PSRR, increase the transient response and reduce the output noise. R_1 and R_2 can be calculated for any output voltage range using equation 1. Choose $R_2 \le$ 500kΩ to maintain a 1.2μA minimum load.

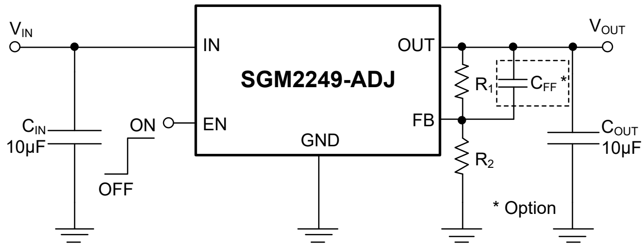


Figure 4. Adjustable Output Voltage Application

APPLICATION INFORMATION (continued)

Enable Operation

The EN pin of the SGM2249 is used to enable/disable the device and to deactivate/activate the output automatic discharge function.

When the EN pin voltage is lower than 1V, the device is in shutdown state. There is no current flowing from IN to OUT pins. In this state, the automatic discharge transistor is active to discharge the output voltage through a 215Ω (TYP) resistor.

When the EN pin voltage is higher than 1.8V, the device is in active state. The output voltage is regulated to the expected value and the automatic discharge transistor is turned off.

Reverse Current Protection

The PMOS power transistor has an inherent body diode. This body diode will be forward biased when $V_{OUT} > V_{IN}$. When $V_{OUT} > V_{IN}$, the reverse current flowing from the OUT pin to the IN pin will damage the SGM2249. If reverse current protection function is needed in application, the circuit in Figure 5 is good solution to provide reverse current protection.

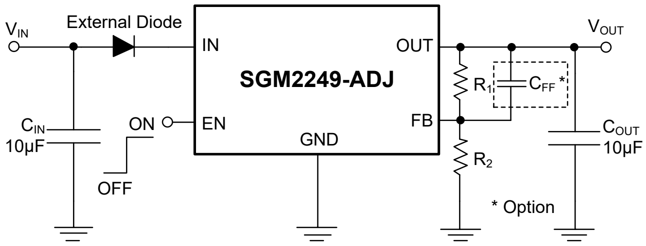


Figure 5. Reverse Protection Reference Design

Output Current Limit Protection

When overload events happen, the output current is internally limited to 650mA (TYP). When the OUT pin is shorted to ground, the output current is internally limited to 265mA (TYP).

Thermal Shutdown

When the die temperature exceeds the threshold value of thermal shutdown, the SGM2249 will be in shutdown state and it will remain in this state until the die temperature decreases to +140℃.

Power Dissipation (P_D)

Power dissipation (P_D) of the SGM2249 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 SGM2249 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.

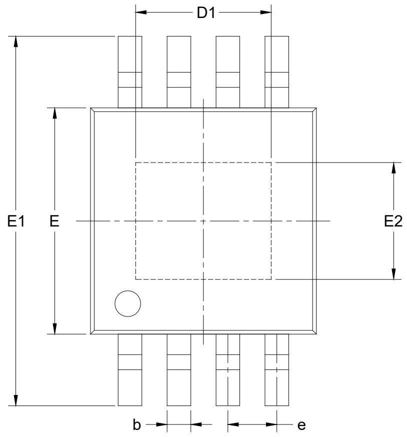
REVISION HISTORY

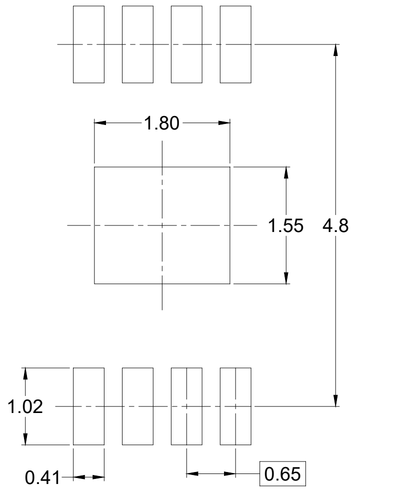
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original to REV.A (DECEMBER 2025)	Page
Changed from product preview to production data	All

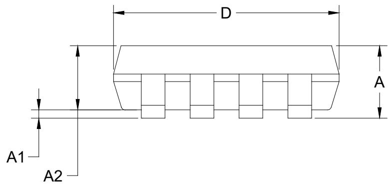
PACKAGE OUTLINE DIMENSIONS

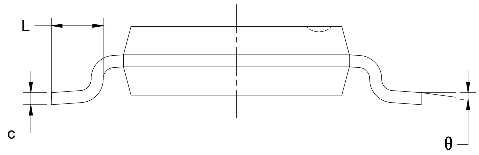
MSOP-8 (Exposed Pad)





RECOMMENDED LAND PATTERN (Unit: mm)



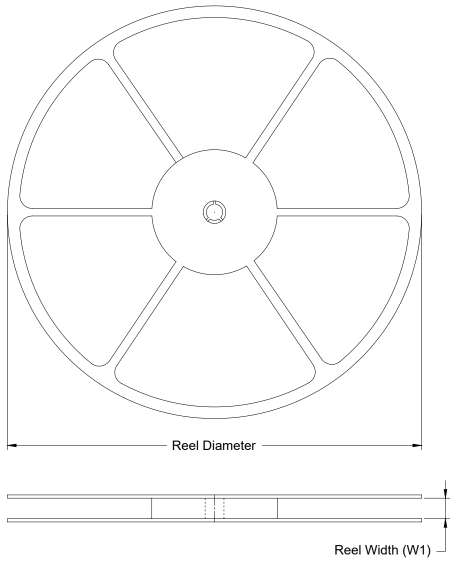


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.250	0.380	0.010	0.015
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
D1	1.700	1.900	0.067	0.075
e	0.65 BSC		0.026 BSC	
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
E2	1.450	1.650	0.057	0.065
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

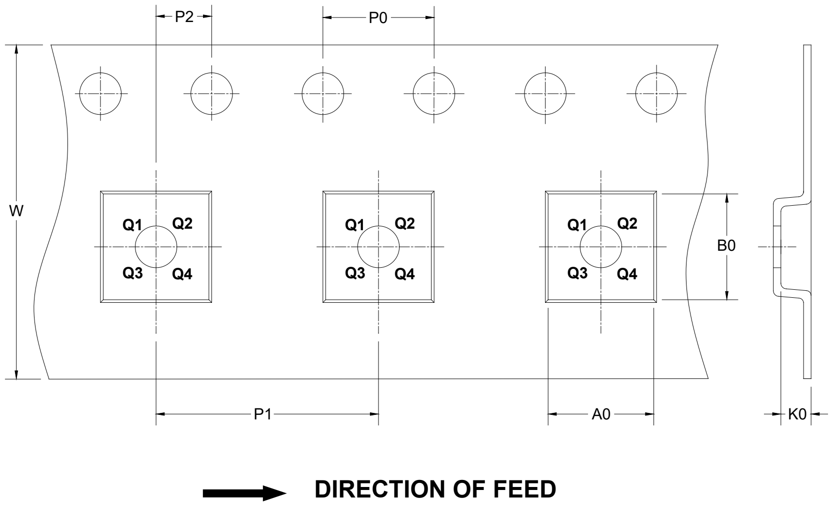
NOTES:
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



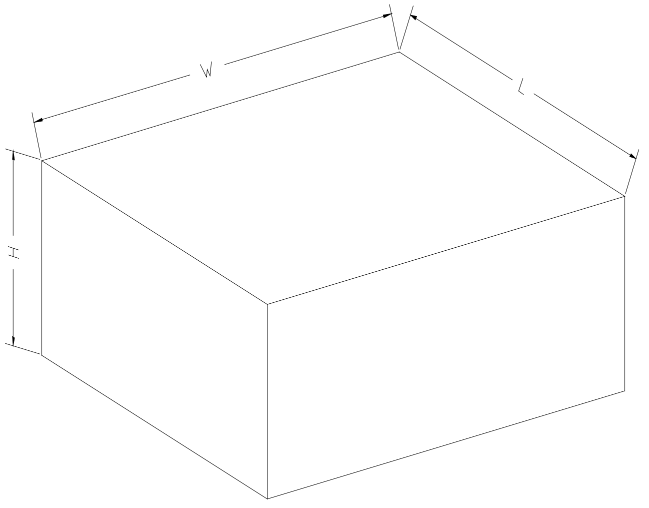
NOTE: The picture is only for reference. Please make the object as the standard.

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
MSOP-8 (Exposed Pad)	13"	12.4	5.20	3.30	1.50	4.0	8.0	2.0	12.0	Q1

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
13″	386	280	370	5

DD0002