

# SGM2217

## 1.5A, Low Dropout Positive Regulator

### GENERAL DESCRIPTION

The SGM2217 is a low noise, high current and low dropout voltage linear regulator. It is capable of supplying 1.5A output current with typical dropout voltage of 1.3V. The operating input voltage range is from 2.8V to 30V. The fixed output voltages are 1.8V, 2.5V, 2.8V, 3.0V, 3.3V, 5.0V and 12V. The adjustable output voltage range is from 1.25V to 26V.

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

The SGM2217 is available in Green TO-263-3A and TDFN-4×4-8L packages. It operates over an operating temperature range of -40°C to +125°C.

### FEATURES

- **Wide Input Voltage Range: 2.8V to 30V**
- **Adjustable Output from 1.25V to 26V**
- **Fixed Outputs of 1.8V, 2.5V, 2.8V, 3.0V, 3.3V, 5.0V and 12V**
- **1.5A Maximum Output Current**
- **Low Dropout Voltage: 1.3V (TYP) at 1.5A**
- **Line Regulation: 0.04% (TYP)**
- **Load Regulation: 0.04% (TYP)**
- **Current Limiting and Thermal Protection**
- **Excellent Load and Line Transient Responses**
- **Stable with Small Case Size Ceramic Capacitors**
- **-40°C to +125°C Operating Temperature Range**
- **Available in Green TO-263-3A and TDFN-4×4-8L Packages**

### APPLICATIONS

Battery Chargers  
Microprocessor Supplies  
Switching Power Supplies  
Constant Current Monitoring System

### TYPICAL APPLICATION

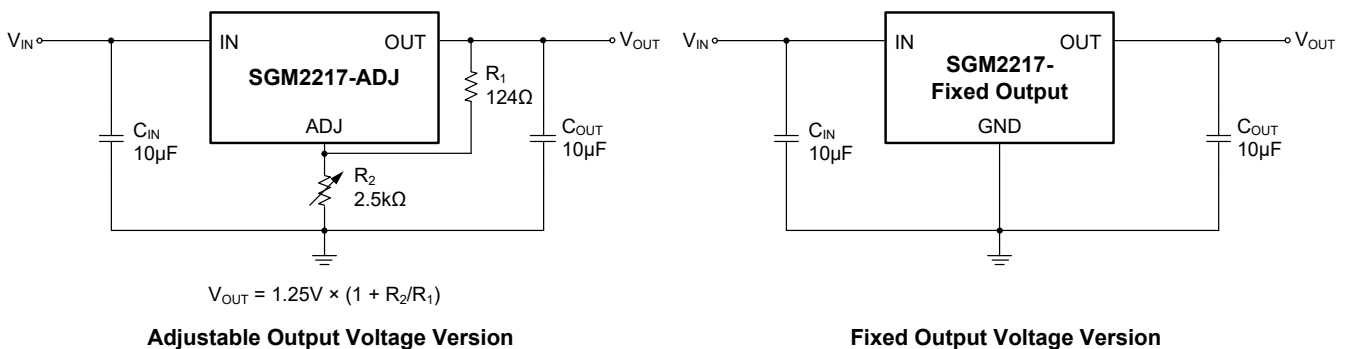


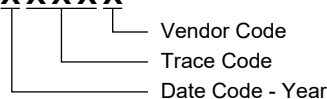
Figure 1. Typical Application Circuits

## PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2217-1.8	TO-263-3A	-40°C to +125°C	SGM2217-1.8XOA3G/TR	SGMR9B XOA3 XXXXXX	Tape and Reel, 800
	TDFN-4x4-8L	-40°C to +125°C	SGM2217-1.8XTEL8G/TR	SGMR9D XTEL8 XXXXXX	Tape and Reel, 3000
SGM2217-2.5	TO-263-3A	-40°C to +125°C	SGM2217-2.5XOA3G/TR	SGMRBA XOA3 XXXXXX	Tape and Reel, 800
	TDFN-4x4-8L	-40°C to +125°C	SGM2217-2.5XTEL8G/TR	SGMRBB XTEL8 XXXXXX	Tape and Reel, 3000
SGM2217-2.8	TO-263-3A	-40°C to +125°C	SGM2217-2.8XOA3G/TR	SGMRBC XOA3 XXXXXX	Tape and Reel, 800
	TDFN-4x4-8L	-40°C to +125°C	SGM2217-2.8XTEL8G/TR	SGMRBD XTEL8 XXXXXX	Tape and Reel, 3000
SGM2217-3.0	TO-263-3A	-40°C to +125°C	SGM2217-3.0XOA3G/TR	SGMRBE XOA3 XXXXXX	Tape and Reel, 800
	TDFN-4x4-8L	-40°C to +125°C	SGM2217-3.0XTEL8G/TR	SGMRBF XTEL8 XXXXXX	Tape and Reel, 3000
SGM2217-3.3	TO-263-3A	-40°C to +125°C	SGM2217-3.3XOA3G/TR	SGMRC0 XOA3 XXXXXX	Tape and Reel, 800
	TDFN-4x4-8L	-40°C to +125°C	SGM2217-3.3XTEL8G/TR	SGMRC1 XTEL8 XXXXXX	Tape and Reel, 3000
SGM2217-5.0	TO-263-3A	-40°C to +125°C	SGM2217-5.0XOA3G/TR	SGMRC2 XOA3 XXXXXX	Tape and Reel, 800
	TDFN-4x4-8L	-40°C to +125°C	SGM2217-5.0XTEL8G/TR	SGMRC3 XTEL8 XXXXXX	Tape and Reel, 3000
SGM2217-12	TO-263-3A	-40°C to +125°C	SGM2217-12XOA3G/TR	SGMR9C XOA3 XXXXXX	Tape and Reel, 800
	TDFN-4x4-8L	-40°C to +125°C	SGM2217-12XTEL8G/TR	SGMRA3 XTEL8 XXXXXX	Tape and Reel, 3000
SGM2217-ADJ	TO-263-3A	-40°C to +125°C	SGM2217-ADJXOA3G/TR	SGM2217 XOA3 XXXXXX	Tape and Reel, 800
	TDFN-4x4-8L	-40°C to +125°C	SGM2217-ADJXTEL8G/TR	SGM2217 XTEL8 XXXXXX	Tape and Reel, 3000

## MARKING INFORMATION

NOTE: 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 to Output Voltage .....	31V
Package Thermal Resistance	
TO-263-3A, $\theta_{JA}$ .....	30°C/W
TO-263-3A, $\theta_{JB}$ .....	32°C/W
TO-263-3A, $\theta_{JC(TOP)}$ .....	5°C/W
TO-263-3A, $\theta_{JC(BOT)}$ .....	2°C/W
TDFN-4×4-8L, $\theta_{JA}$ .....	42°C/W
TDFN-4×4-8L, $\theta_{JB}$ .....	16°C/W
TDFN-4×4-8L, $\theta_{JC(TOP)}$ .....	27°C/W
TDFN-4×4-8L, $\theta_{JC(BOT)}$ .....	2°C/W
Junction Temperature .....	+150°C
Storage Temperature Range .....	-65°C to +150°C
Lead Temperature (Soldering, 10s) .....	+260°C
ESD Susceptibility	
HBM .....	3000V
CDM .....	1000V

**RECOMMENDED OPERATING CONDITIONS**

Input Voltage Range .....	2.8V to 30V
Input Effective Capacitance, $C_{IN}$ .....	2.3 $\mu$ F (MIN)
Output Effective Capacitance, $C_{OUT}$ .....	2.3 $\mu$ F to 100 $\mu$ F
Capacitor Effective Series Resistance, ESR .....	1m $\Omega$ to 8 $\Omega$
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.

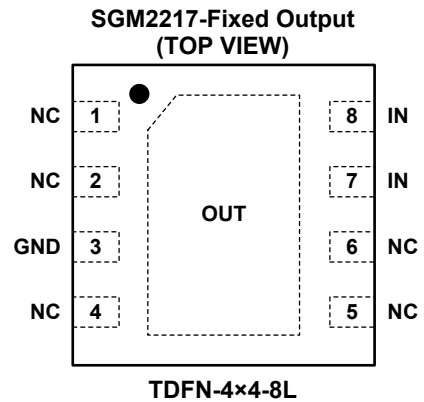
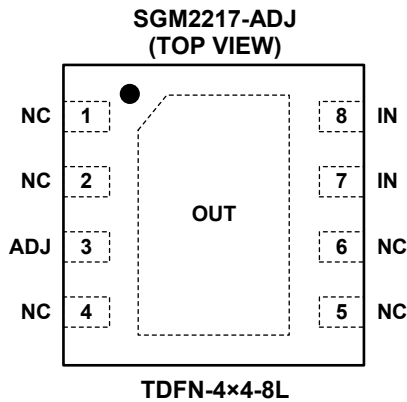
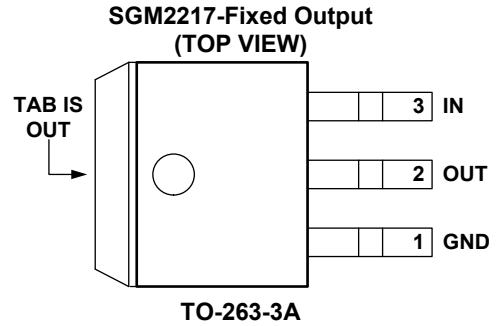
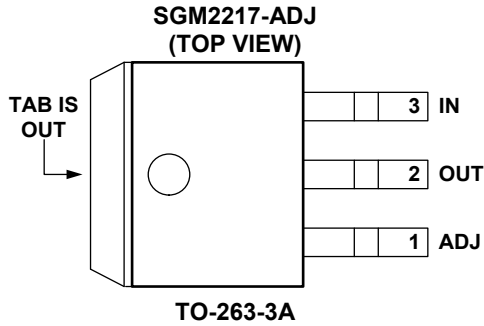
**ESD SENSITIVITY CAUTION**

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	FUNCTION
TO-263-3A	TDFN-4x4-8L		
1	3	ADJ	Feedback Voltage Input Pin (adjustable voltage version only). 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.
		GND	Ground (fixed output voltage version only).
2, TAB	Exposed Pad	OUT	Regulator Output Pin. It is recommended to use a ceramic capacitor with effective capacitance in the range of 2.3μF to 100μF to get good power supply decoupling. This ceramic capacitor should be placed as close as possible to OUT pin.
3	7, 8	IN	Input Supply Voltage Pin. It is recommended to use a 4.7μF or larger ceramic capacitor from IN pin to ground. This ceramic capacitor should be placed as close as possible to IN pin.
—	1, 2, 4, 5, 6	NC	No Connection.

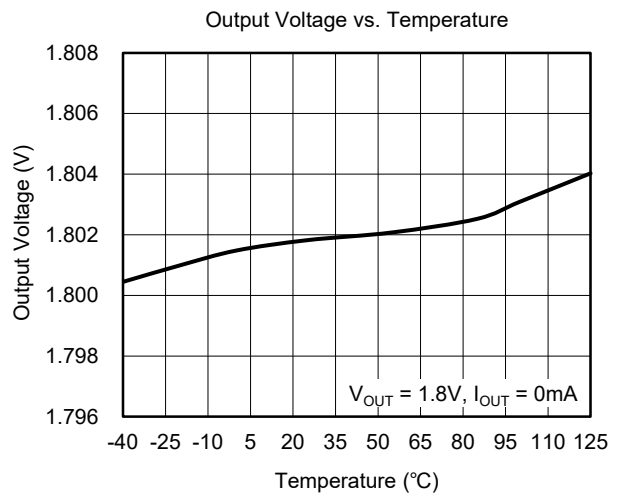
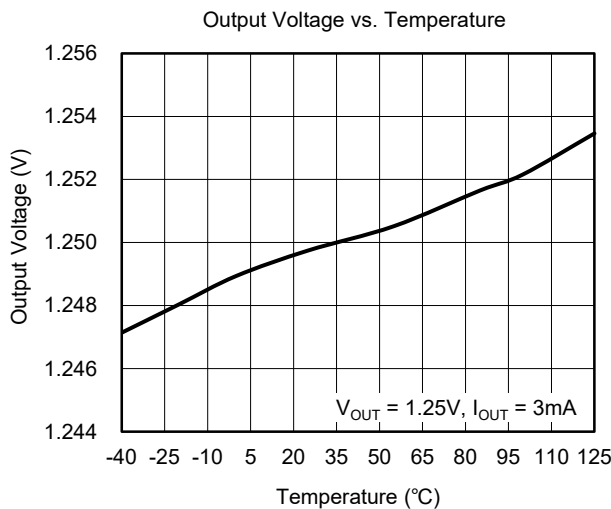
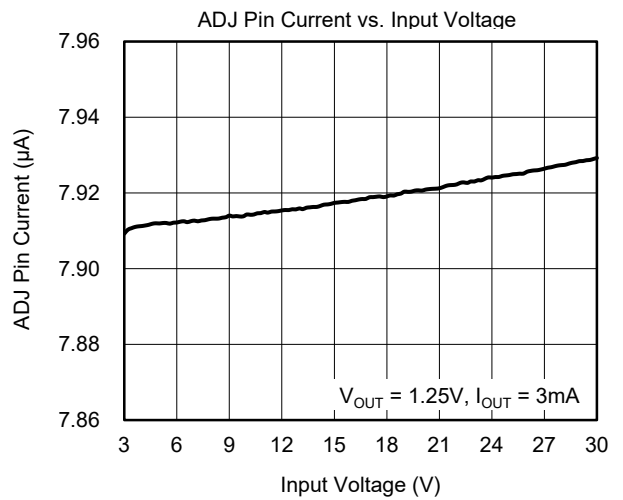
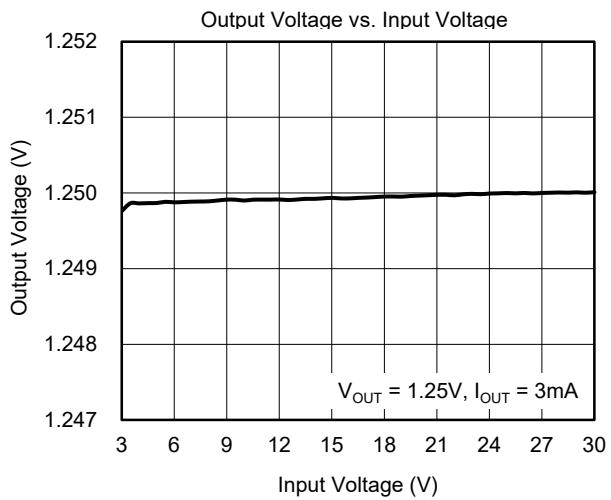
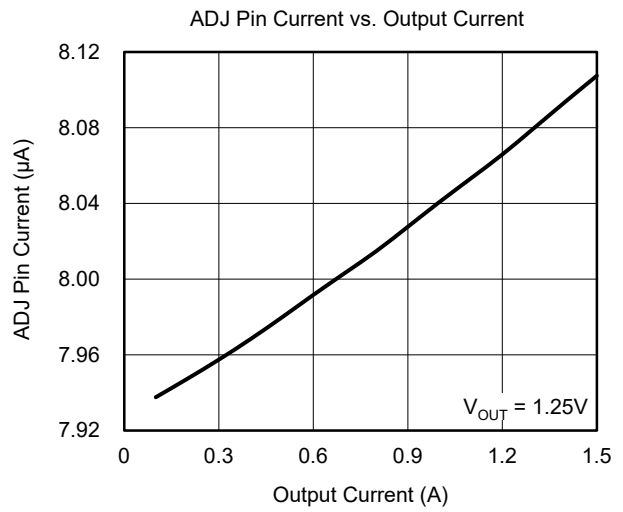
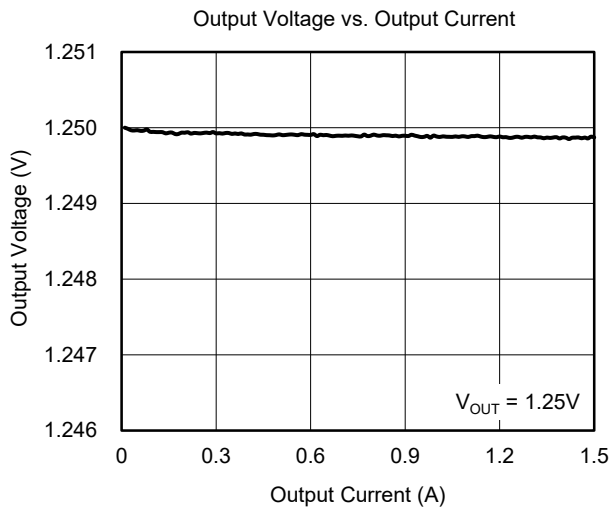
## ELECTRICAL CHARACTERISTICS

(T<sub>J</sub> = -40°C to +125°C, typical values are at T<sub>J</sub> = +25°C, C<sub>IN</sub> = C<sub>OUT</sub> = 10μF (ceramic capacitor), unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Reference Voltage (SGM2217-ADJ)	V <sub>REF</sub>	I <sub>OUT</sub> = 5mA, (V <sub>IN</sub> - V <sub>OUT</sub> ) = 3V, T <sub>J</sub> = +25°C	1.238	1.25	1.262	V
		I <sub>OUT</sub> = 5mA to 1.5A <sup>(1)</sup> , V <sub>IN</sub> = (1.55V + V <sub>OUT</sub> ) to 30V	1.225		1.275	
Output Voltage Accuracy (SGM2217-Fixed Output)	V <sub>OUT</sub>	I <sub>OUT</sub> = 0mA, (V <sub>IN</sub> - V <sub>OUT</sub> ) = 3V, T <sub>J</sub> = +25°C	-1		+1	%
		I <sub>OUT</sub> = 0mA to 1.5A <sup>(1)</sup> , V <sub>IN</sub> = (1.55V + V <sub>OUT</sub> ) to 30V	-2		+2	
Line Regulation	$\frac{\Delta V_{OUT}}{V_{OUT}}$	I <sub>OUT</sub> = 5mA, V <sub>IN</sub> = (1.55V + V <sub>OUT</sub> ) to 30V, SGM2217-ADJ, T <sub>J</sub> = +25°C		0.04	0.16	%
		I <sub>OUT</sub> = 5mA, V <sub>IN</sub> = (1.55V + V <sub>OUT</sub> ) to 30V, SGM2217-ADJ			0.20	
		I <sub>OUT</sub> = 0mA, V <sub>IN</sub> = (1.55V + V <sub>OUT</sub> ) to 30V, SGM2217-Fixed Output, T <sub>J</sub> = +25°C		0.04	0.16	
		I <sub>OUT</sub> = 0mA, V <sub>IN</sub> = (1.55V + V <sub>OUT</sub> ) to 30V, SGM2217-Fixed Output			0.20	
Load Regulation	$\frac{\Delta V_{OUT}}{V_{OUT}}$	I <sub>OUT</sub> = 5mA to 1.5A, (V <sub>IN</sub> - V <sub>OUT</sub> ) = 3V, T <sub>J</sub> = +25°C		0.04	0.3	%
		I <sub>OUT</sub> = 5mA to 1.5A, (V <sub>IN</sub> - V <sub>OUT</sub> ) = 3V			0.4	
		I <sub>OUT</sub> = 0mA to 1.5A, (V <sub>IN</sub> - V <sub>OUT</sub> ) = 3V, T <sub>J</sub> = +25°C		0.04	0.3	
		I <sub>OUT</sub> = 0mA to 1.5A, (V <sub>IN</sub> - V <sub>OUT</sub> ) = 3V			0.4	
Dropout Voltage	V <sub>DROP</sub>	I <sub>OUT</sub> = 1.5A, ΔV <sub>OUT</sub> = 1%		1.3	1.55	V
Output Current Limit	I <sub>LIMIT</sub>	(V <sub>IN</sub> - V <sub>OUT</sub> ) = 5V, ΔV <sub>OUT</sub> = 5%	1.55	3		A
		(V <sub>IN</sub> - V <sub>OUT</sub> ) = 25V, V <sub>OUT</sub> = 0V	0.05	0.3		
Thermal Regulation		30ms Pulse, T <sub>J</sub> = +25°C		0.01	0.07	%/W
Supply Pin Current	I <sub>Q</sub>	V <sub>IN</sub> = 30V, I <sub>OUT</sub> = 0mA, SGM2217-Fixed Output		2	5	mA
Minimum Load Current	I <sub>OUT_MIN</sub>	V <sub>IN</sub> = 30V, SGM2217-ADJ		2	5	mA
ADJ Pin Current	I <sub>ADJ</sub>	I <sub>OUT</sub> = 5mA, (V <sub>IN</sub> - V <sub>OUT</sub> ) = 3V, SGM2217-ADJ		8	20	μA
ADJ Pin Current Change	ΔI <sub>ADJ</sub>	I <sub>OUT</sub> = 5mA to 1.5A, (V <sub>IN</sub> - V <sub>OUT</sub> ) = 1.55V to 15V, SGM2217-ADJ		0.2	2	μA
Turn-On Time	t <sub>ON</sub>	From assertion of V <sub>IN</sub> to V <sub>OUT</sub> = 95% × V <sub>OUT(NOM)</sub>		0.2	1	ms
Temperature Stability				0.5		%
Long Term Stability		1000 hours, T <sub>J</sub> = +125°C		0.3		%
Power Supply Ripple Rejection	PSRR	ΔV <sub>RIPPLE</sub> = 3V <sub>P-P</sub> , (V <sub>IN</sub> - V <sub>OUT</sub> ) = 3V, I <sub>OUT</sub> = 1.5A, f <sub>RIPPLE</sub> = 120Hz, C <sub>OUT</sub> = 20μF	C <sub>ADJ</sub> = 25μF, SGM2217-ADJ		72	dB
			V <sub>OUT</sub> = 1.8V		68	
			V <sub>OUT</sub> = 3.3V		64	
			V <sub>OUT</sub> = 5.0V		60	
			V <sub>OUT</sub> = 12V		53	
Output Voltage Noise	e <sub>n</sub>	f = 10Hz to 10kHz, I <sub>OUT</sub> = 1.5A		0.004		%
Thermal Shutdown Temperature	T <sub>SHDN</sub>			160		°C
Thermal Shutdown Hysteresis	ΔT <sub>SHDN</sub>			20		°C

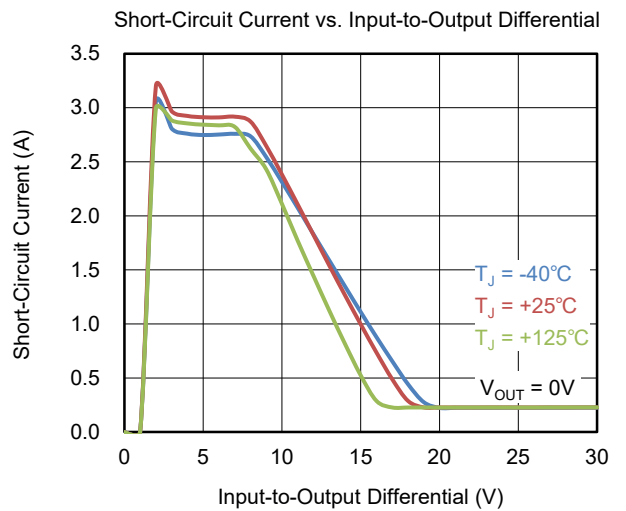
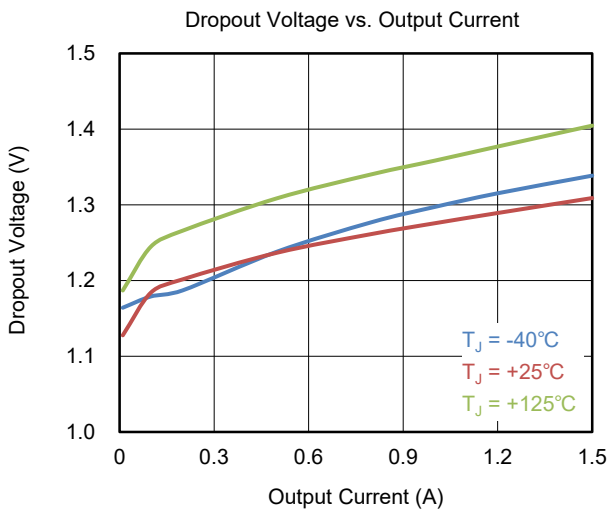
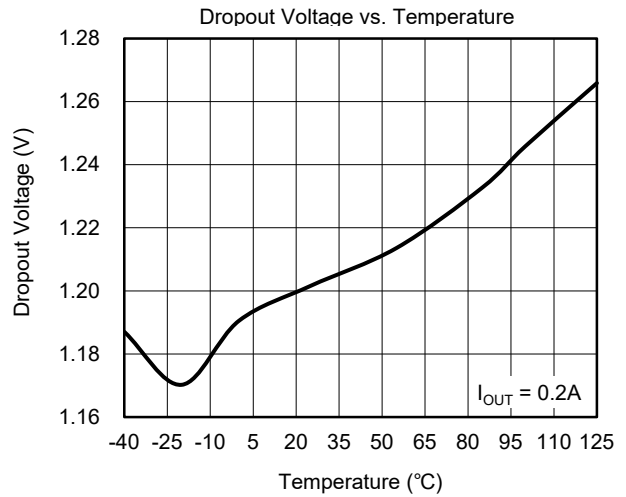
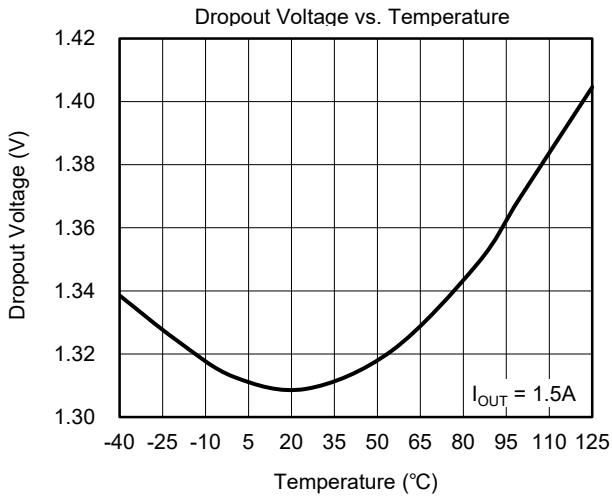
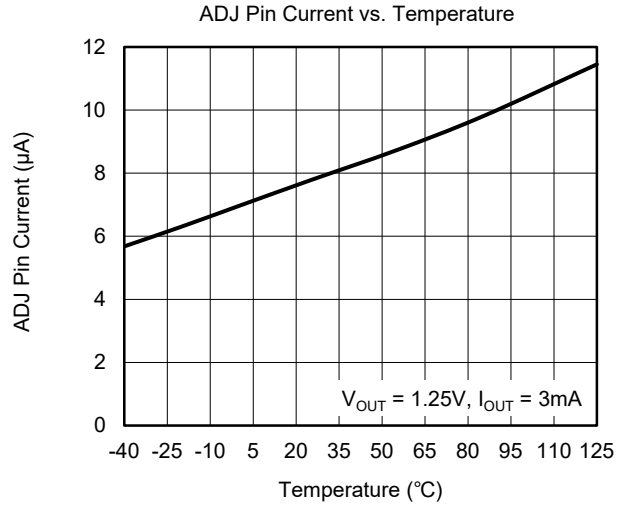
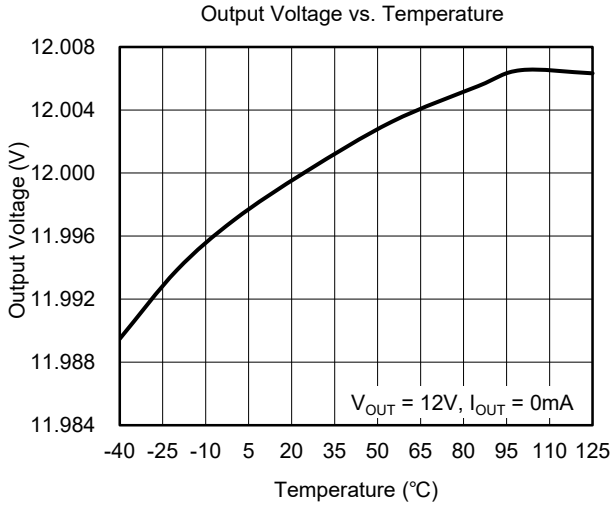
TYPICAL PERFORMANCE CHARACTERISTICS

$T_J = +25^\circ\text{C}$ ,  $(V_{IN} - V_{OUT}) = 3\text{V}$ ,  $C_{IN} = C_{OUT} = 10\mu\text{F}$  (ceramic capacitor), unless otherwise noted.



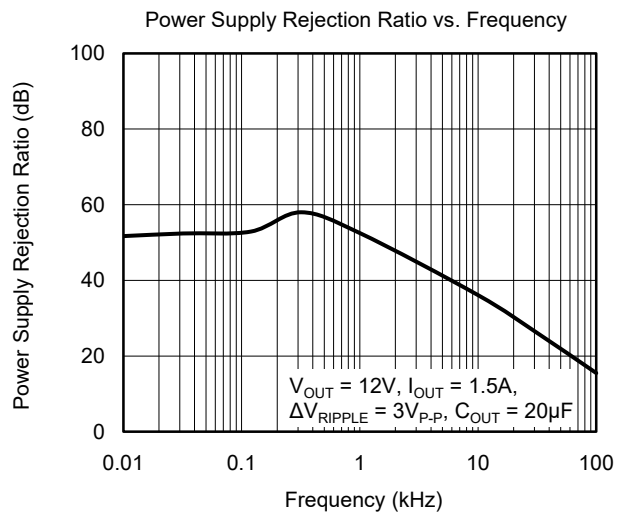
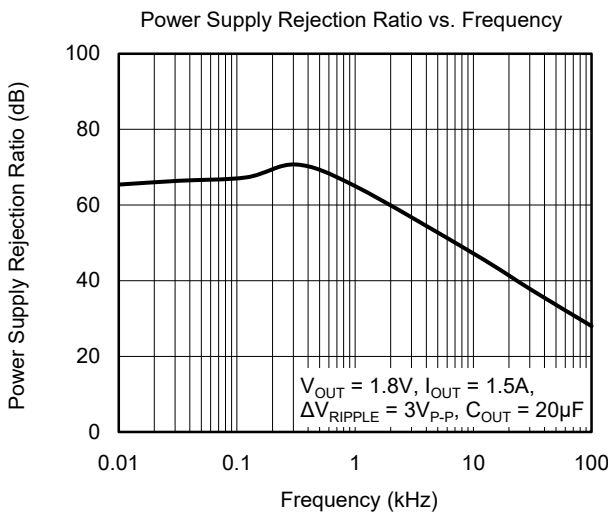
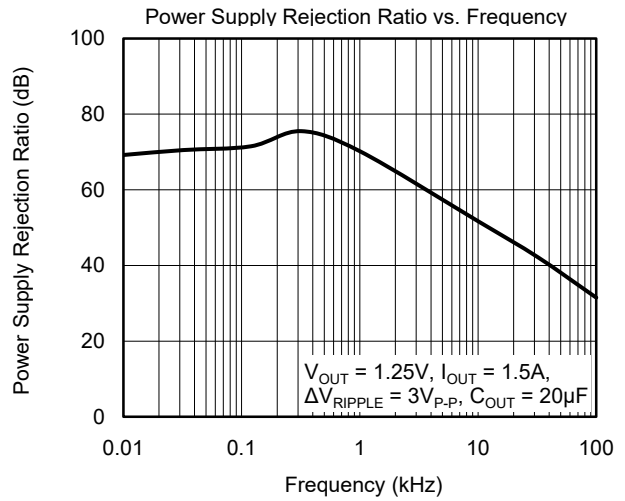
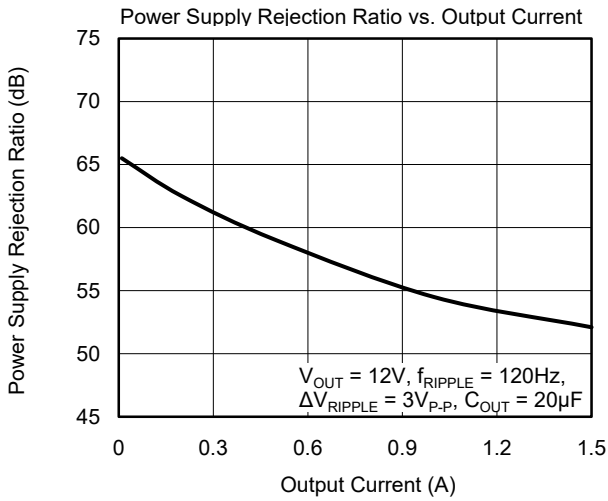
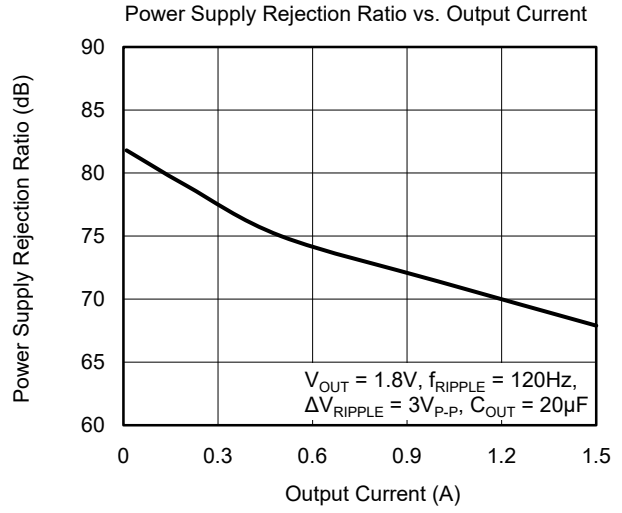
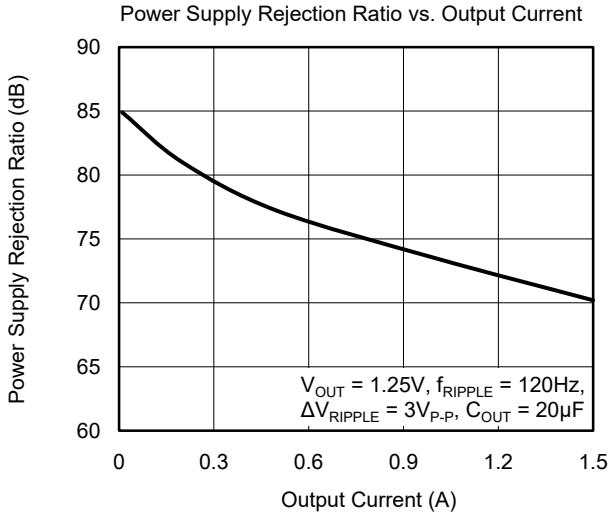
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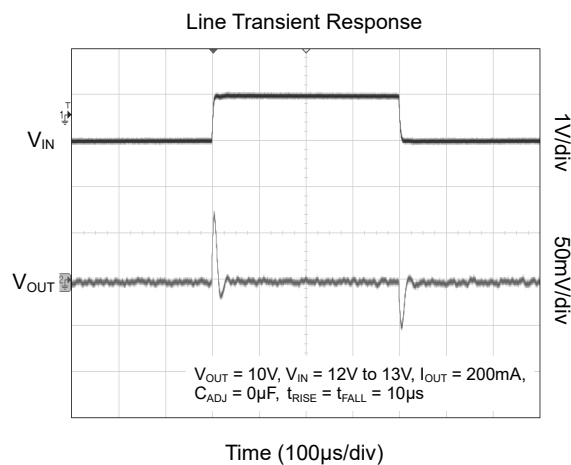
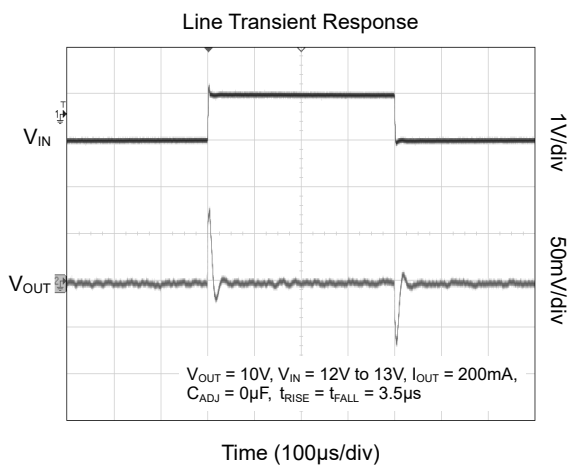
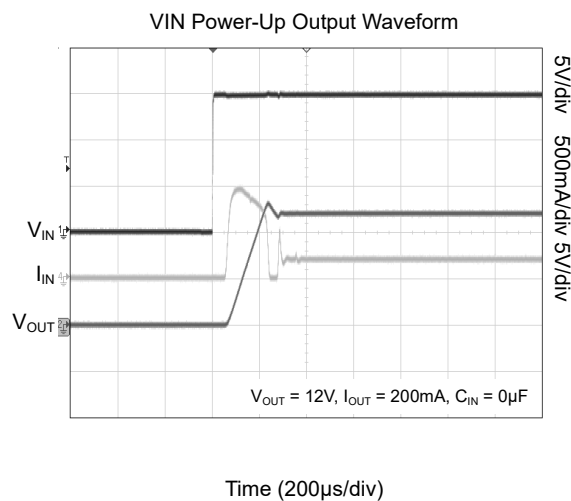
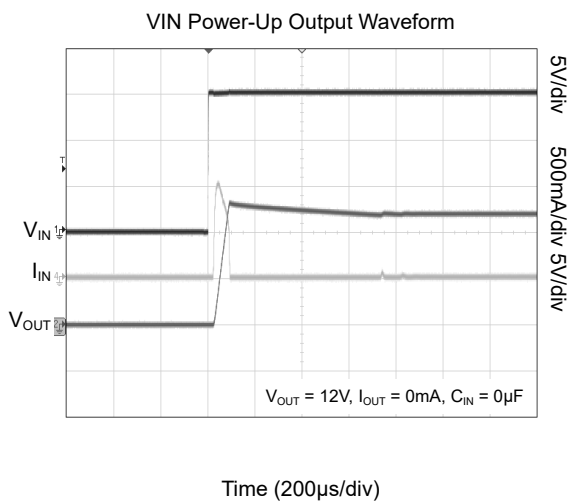
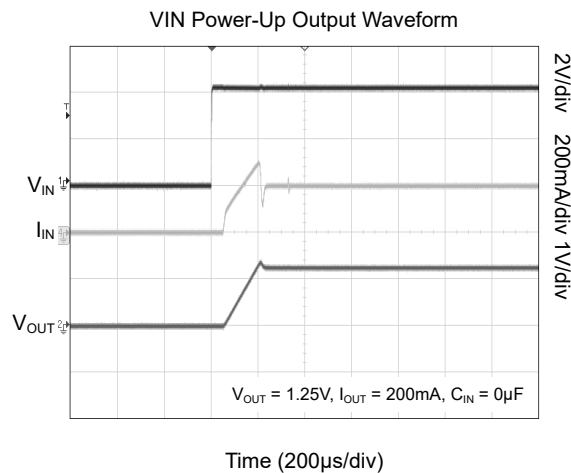
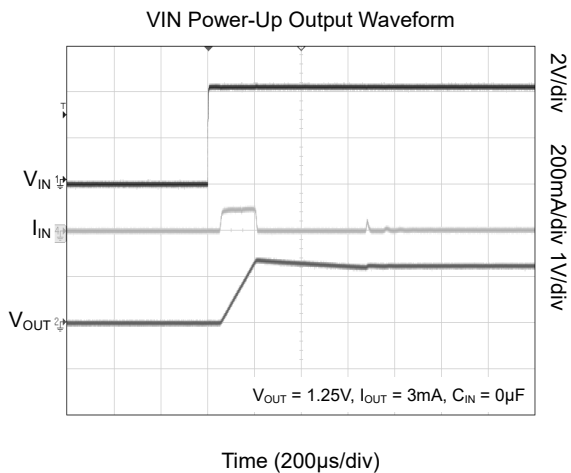
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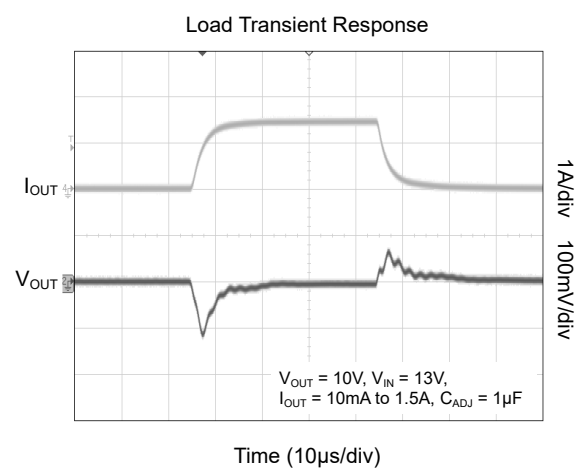
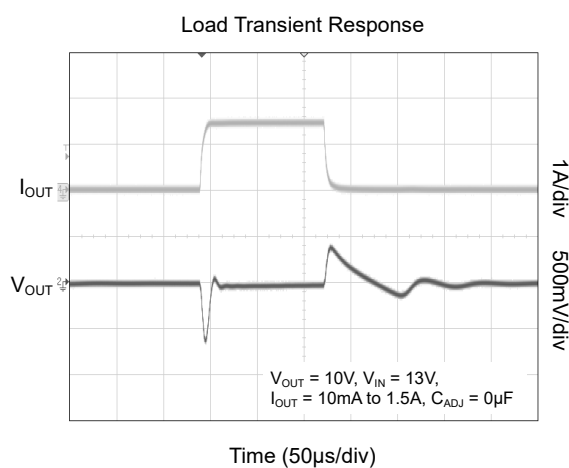
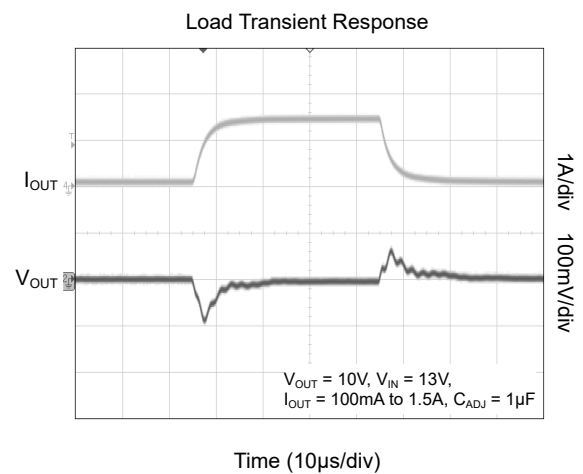
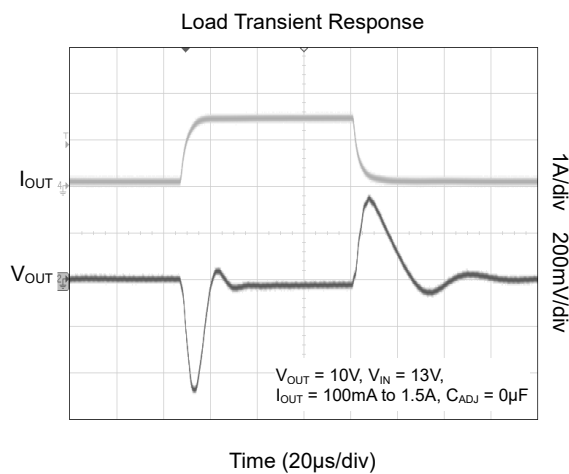
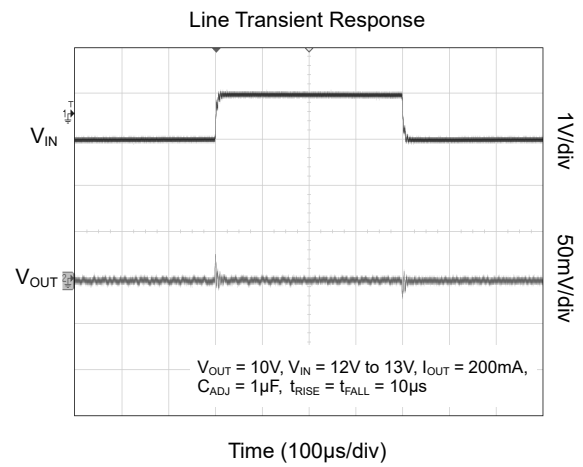
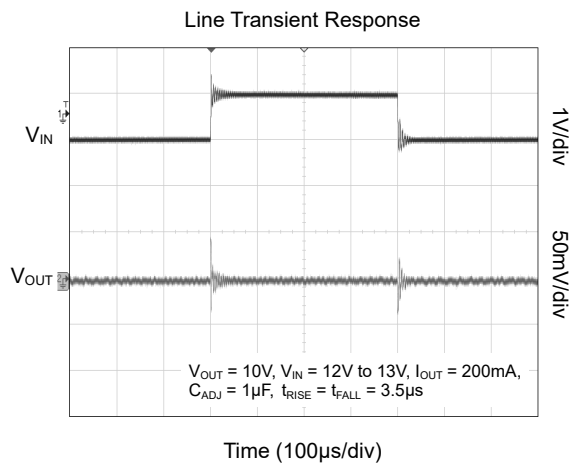
**TYPICAL PERFORMANCE CHARACTERISTICS (continued)**

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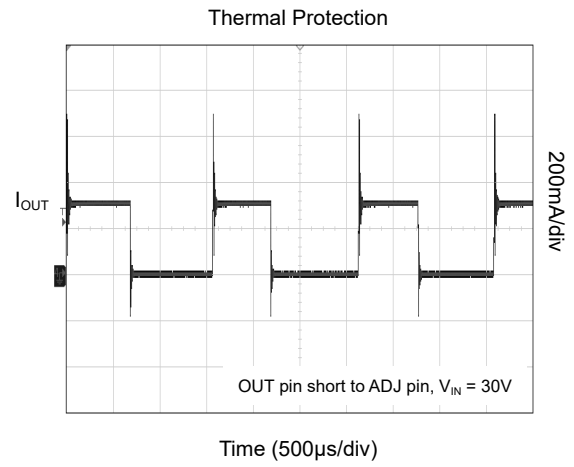
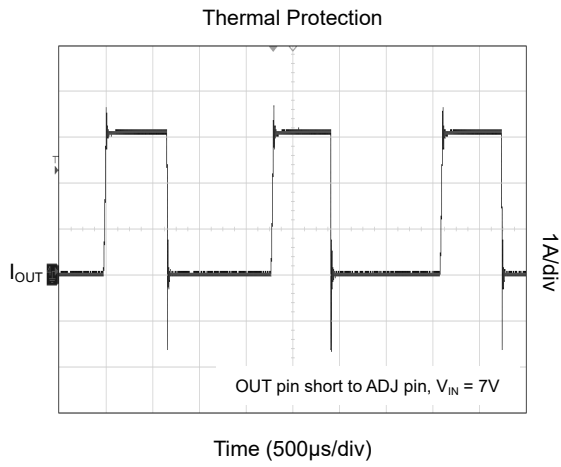
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FUNCTIONAL BLOCK DIAGRAMS

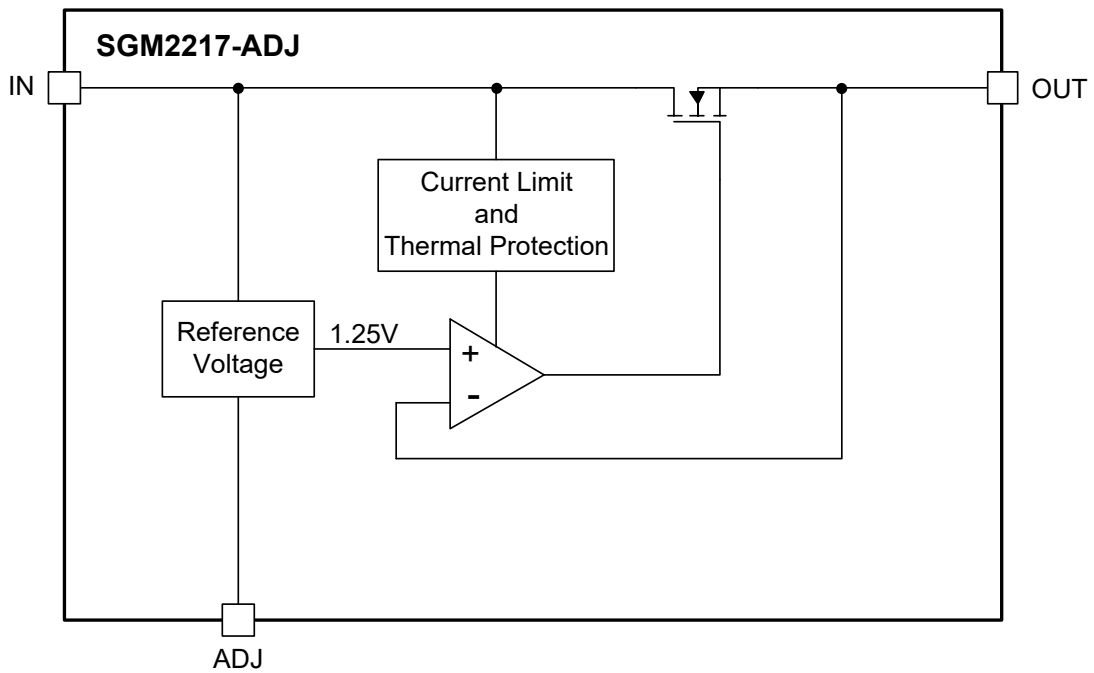


Figure 2. Adjustable Output Voltage Internal Block Diagram

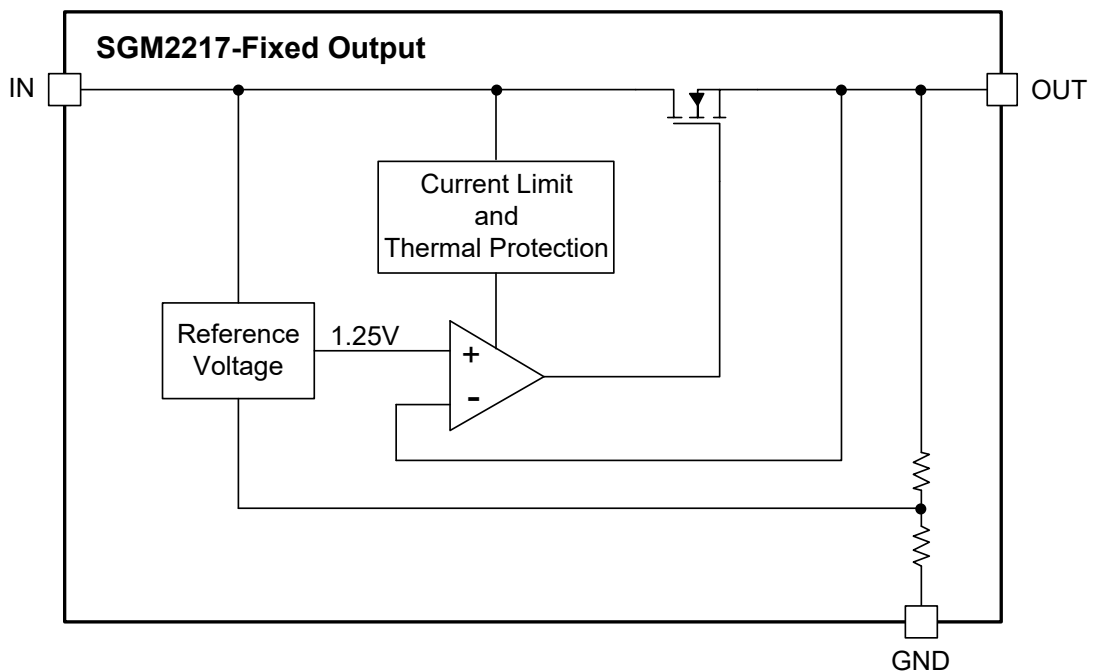


Figure 3. Fixed Output Voltage Internal Block Diagram

## APPLICATION INFORMATION

The SGM2217 is a low noise, high current and low dropout LDO and provides 1.5A 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 SGM2217 useful in a variety of applications. The SGM2217 provides protection functions for output overload, output short-circuit condition and overheating.

### Input Capacitor Selection ( $C_{IN}$ )

The input decoupling capacitor is necessary to be connected as close as possible to the IN pin for ensuring the device stability. 10 $\mu$ 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 decoupling capacitor should be located as close as possible to the OUT pin. 10 $\mu$ F or larger X7R or X5R ceramic capacitor is selected to get good dynamic performance. The minimum effective capacitance of  $C_{OUT}$  that SGM2217 can remain stable is 2.3 $\mu$ 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. Larger capacitance and lower ESR  $C_{OUT}$  will help improve the load transient response and increase the high frequency PSRR.

### Adjustable Regulator

The output voltage of the SGM2217-ADJ can be adjusted from 1.25V to 26V. The ADJ pin will be connected to two external resistors as shown in Figure 4. The output voltage is determined by the following equation:

$$V_{OUT} = 1.25V \times \left( 1 + \frac{R_2}{R_1} \right) \quad (1)$$

One parallel capacitor ( $C_{FF}$ ) with  $R_2$  can be used to improve the feedback loop stability and PSRR, increase the transient response and reduce the output noise.

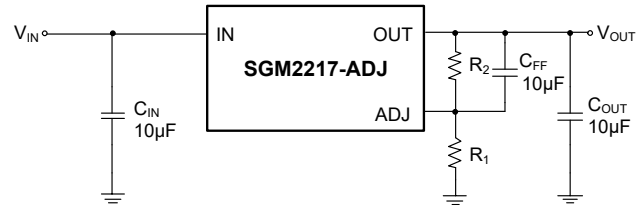


Figure 4. Adjustable Output Voltage Application

### Output Current Limit and Short-Circuit Protection

When overload events happen, the output current is internally limited to 3A (TYP). When the OUT pin is shorted to ground, the short-circuit protection will limit the output current.

### Thermal Shutdown

The SGM2217 can detect the temperature of die. When the die temperature exceeds the threshold value of thermal shutdown, the SGM2217 will be in shutdown state and it will remain in this state until the die temperature decreases to +140°C.

### Power Dissipation ( $P_D$ )

Thermal protection limits power dissipation in the SGM2217. When power dissipation on pass element ( $P_D = (V_{IN} - V_{OUT}) \times I_{OUT}$ ) is too much and the operating junction temperature exceeds +160°C, 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 SGM2217 must not exceed +125°C.

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:

$$P_{D(MAX)} = (T_{J(MAX)} - T_A) / \theta_{JA} \quad (3)$$

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

**REVISION HISTORY**

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

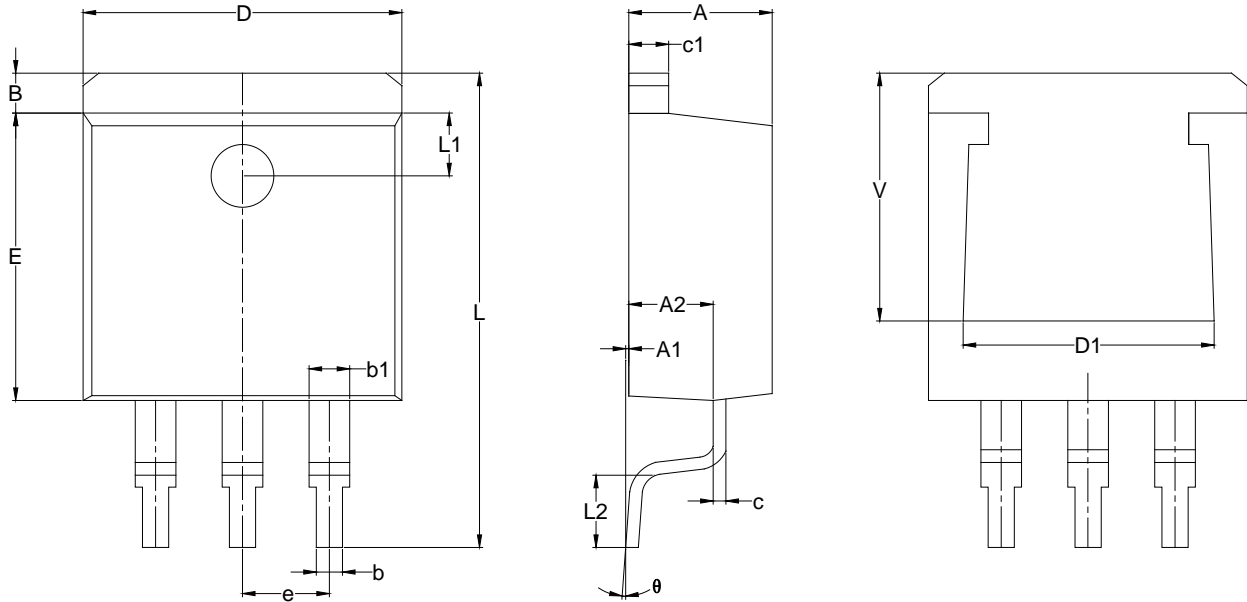
<b>Changes from Original (JUNE 2021) to REV.A</b>	<b>Page</b>
Changed from product preview to production data .....	All

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# PACKAGE INFORMATION

## PACKAGE OUTLINE DIMENSIONS

### TO-263-3A



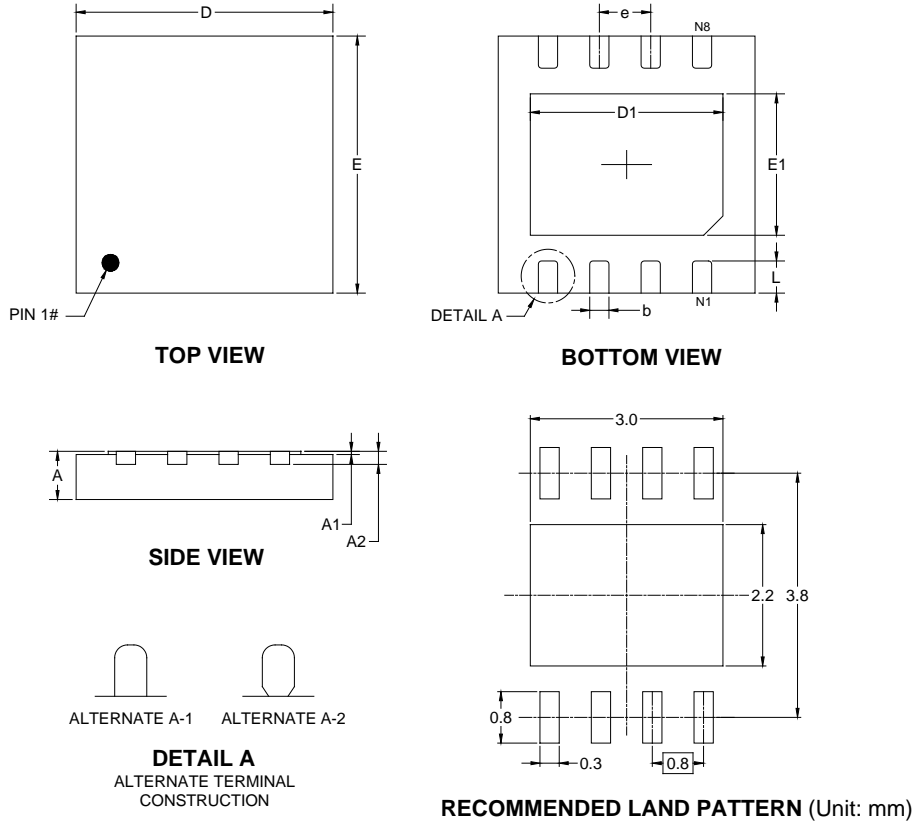
Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A	4.400	4.570	4.700
A1	0.000	0.100	0.250
A2	2.590	2.690	2.790
B	1.170	1.270	1.400
b	0.770	-	0.900
b1	1.230	-	1.360
c	0.340	-	0.470
c1	1.220	-	1.320
D	10.060	10.160	10.260
D1	7.800	-	8.200
E	9.050	9.150	9.250
e	2.540 BSC		
L	14.700	15.100	15.500
L1	2.000 REF		
L2	2.000	2.300	2.600
V	6.600	-	-
$\theta$	0°		8°

NOTE: This drawing is subject to change without notice.

# PACKAGE INFORMATION

## PACKAGE OUTLINE DIMENSIONS

### TDFN-4x4-8L



Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A	0.700	0.750	0.800
A1	-	-	0.050
A2	0.203 REF		
D	3.950	4.000	4.050
D1	2.950	3.000	3.050
E	3.950	4.000	4.050
E1	2.150	2.200	2.250
b	0.250	0.300	0.350
e	0.800 BSC		
L	0.450	0.500	0.550

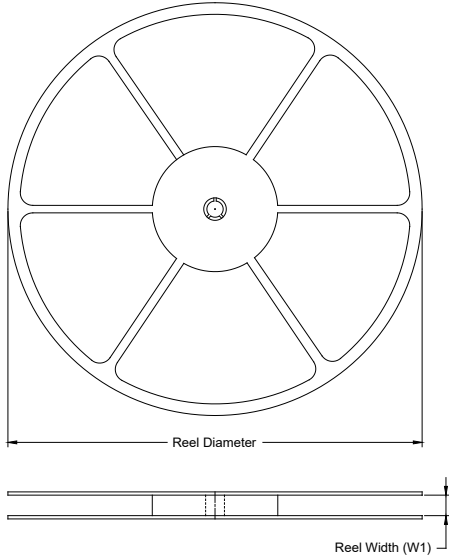
NOTE: This drawing is subject to change without notice.



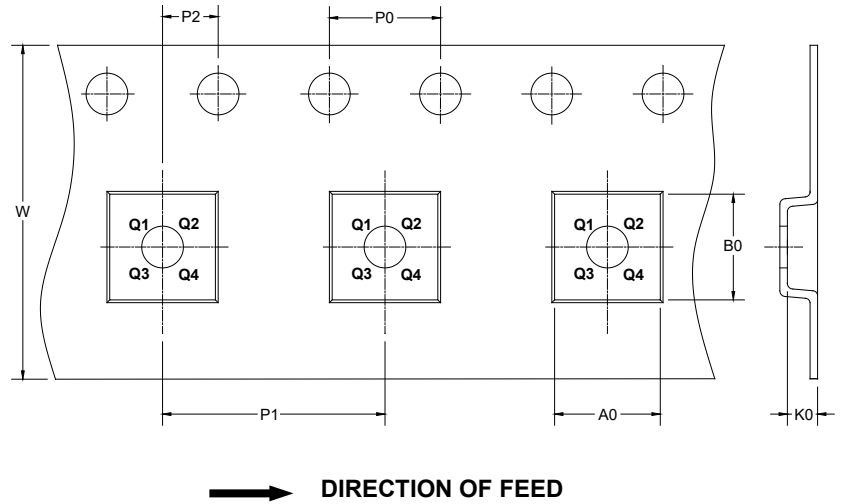
# PACKAGE INFORMATION

## TAPE AND REEL INFORMATION

### REEL DIMENSIONS

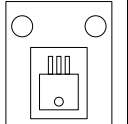


### TAPE DIMENSIONS



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
TO-263-3A	13"	24.4	10.80	16.30	5.11	4.0	16.0	2.0	24.0	
TDFN-4x4-8L	13"	12.4	4.30	4.30	1.10	4.0	8.0	2.0	12.0	Q2

DD0001

# 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