SGM2216
3A, High Voltage, Low Noise, High Current Low Dropout Regulator

GENERAL DESCRIPTION

The SGM2216 is a high voltage, low noise, high current and low dropout voltage linear regulator. It is capable of supplying 3A output current. The operating input voltage range is from 2.3V to 26V and output voltage range is from 1.24V to 25V.

Other features include under-voltage lockout, current limit, logic-controlled shutdown mode and thermal shutdown protection.

The SGM2216 is available in Green TO-263-3A, TO-263-5B and TQFN-5×5-20L packages. It operates over an operating temperature range of -40℃ to +125℃.

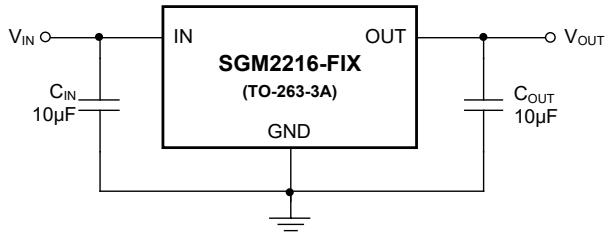
APPLICATIONS

Server Power
Industrial Power Supply
Instruments and Apparatuses
Linear Power Supply Equipment

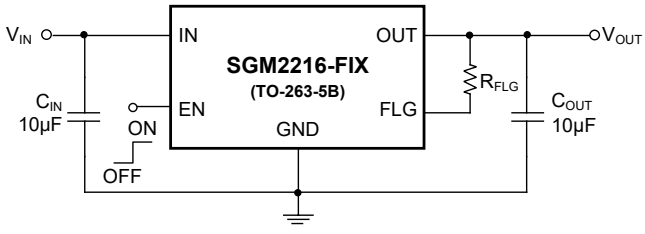
FEATURES

- **Operating Input Voltage Range: 2.3V to 26V**
- **Enable Pin Accept Voltages Higher than the Supply Voltage and up to 26V**
- **Fixed Output from 1.8V to 12V**
- **Adjustable Output from 1.24V to 25V**
- **3A Output Current**
- **Output Voltage Accuracy: ±1% at +25℃**
- **Low Dropout: 340mV (TYP) at 3A**
- **Low Noise: 37μV_{RMS} (TYP) at $V_{OUT(NOM)}$ = 1.24V**
- **Shutdown Supply Current: 1.6μA (TYP)**
- **Current Limiting and Thermal Protection**
- **UVLO with Hysteresis**
- **Reverse-Battery Protection**
- **Load Dump Protection**
- **Error Flag Signals Output Out-of-Regulation**
- **Protection Against Over-Current Faults, Reversed Input Polarity, Reversed Lead Insertion, Over-Temperature Operation, and Positive and Negative Transient Voltage Spikes**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in Green TO-263-3A, TO-263-5B and TQFN-5×5-20L Packages**

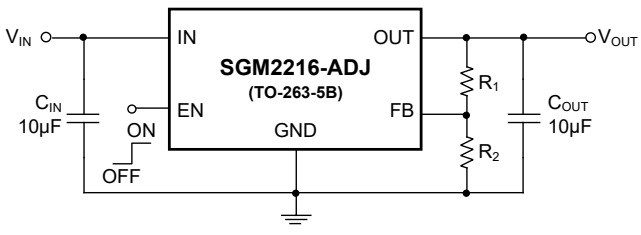
TYPICAL APPLICATION CIRCUITS



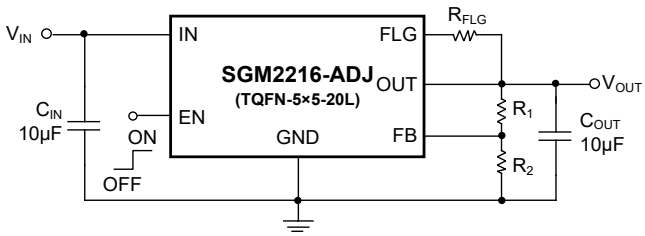
Fixed Output Voltage Version (TO-263-3A)



Fixed Output Voltage Version (TO-263-5B)



Adjustable Output Voltage Version (TO-263-5B)



Adjustable Output Voltage Version (TQFN-5×5-20L)

Figure 1. Typical Application Circuits

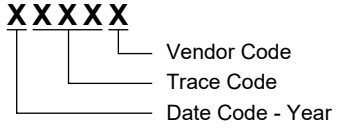
PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2216-1.8	TO-263-3A	-40℃ to +125℃	SGM2216-1.8XOA3G/TR	SGM1I2 XOA3 XXXXX	Tape and Reel, 800
	TO-263-5B	-40℃ to +125℃	SGM2216-1.8XO5G/TR	SGM1I8 XO5 XXXXX	Tape and Reel, 800
SGM2216-2.5	TO-263-3A	-40℃ to +125℃	SGM2216-2.5XOA3G/TR	SGM1I3 XOA3 XXXXX	Tape and Reel, 800
	TO-263-5B	-40℃ to +125℃	SGM2216-2.5XO5G/TR	SGM1I9 XO5 XXXXX	Tape and Reel, 800
SGM2216-3.3	TO-263-3A	-40℃ to +125℃	SGM2216-3.3XOA3G/TR	SGM1I4 XOA3 XXXXX	Tape and Reel, 800
	TO-263-5B	-40℃ to +125℃	SGM2216-3.3XO5G/TR	SGM1IA XO5 XXXXX	Tape and Reel, 800
SGM2216-4.2	TO-263-3A	-40℃ to +125℃	SGM2216-4.2XOA3G/TR	SGM1I5 XOA3 XXXXX	Tape and Reel, 800
	TO-263-5B	-40℃ to +125℃	SGM2216-4.2XO5G/TR	SGM1IB XO5 XXXXX	Tape and Reel, 800
SGM2216-5.0	TO-263-3A	-40℃ to +125℃	SGM2216-5.0XOA3G/TR	SGM1I6 XOA3 XXXXX	Tape and Reel, 800
	TO-263-5B	-40℃ to +125℃	SGM2216-5.0XO5G/TR	SGM1IC XO5 XXXXX	Tape and Reel, 800
SGM2216-12	TO-263-3A	-40℃ to +125℃	SGM2216-12XOA3G/TR	SGM1I7 XOA3 XXXXX	Tape and Reel, 800
	TO-263-5B	-40℃ to +125℃	SGM2216-12XO5G/TR	SGM1ID XO5 XXXXX	Tape and Reel, 800
SGM2216-ADJ	TO-263-5B	-40℃ to +125℃	SGM2216-ADJXO5G/TR	SGM1IE XO5 XXXXX	Tape and Reel, 800
SGM2216-ADJ	TQFN-5×5-20L	-40℃ to +125℃	SGM2216-ADJXTRM20G/TR	SGM1RZ XTRM20 XXXXX	Tape and Reel, 5000

MARKING INFORMATION

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

TO-263-3A/TO-263-5B/TQFN-5×5-20L



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 (1) ..... -26V to 60V
OUT, FB to GND ..... -26V to 30V
FLG to GND ..... -0.3V to 30V
EN, OUT, FB to IN ..... -26V to 26V
Package Thermal Resistance
TQFN-5×5-20L, θ_{JA} ..... 26.2℃/W
TQFN-5×5-20L, θ_{JB} ..... 7.7℃/W
TQFN-5×5-20L, $\theta_{JC(TOP)}$ ..... 17.7℃/W
TQFN-5×5-20L, $\theta_{JC(BOT)}$ ..... 1.1℃/W
TO-263-3A, θ_{JA} ..... 21.2℃/W
TO-263-3A, θ_{JB} ..... 5.9℃/W
TO-263-3A, $\theta_{JC(TOP)}$ ..... 30.3℃/W
TO-263-3A, $\theta_{JC(BOT)}$ ..... 1.3℃/W
TO-263-5B, θ_{JA} ..... 18.8℃/W
TO-263-5B, θ_{JB} ..... 5.1℃/W
TO-263-5B, $\theta_{JC(TOP)}$ ..... 32.1℃/W
TO-263-5B, $\theta_{JC(BOT)}$ ..... 1.7℃/W
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility (2) (3)
HBM ..... ±3000V
CDM ..... ±1000V

NOTES:

1. If the maximum positive supply voltage is 60V, the duration must be limited to less than 100ms and the duty cycle must not exceed 1%. The maximum continuous operating voltage is 30V, beyond which the device may be damaged.

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

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

RECOMMENDED OPERATING CONDITIONS

Input Voltage Range ..... 2.3V to 26V
Enable Input Voltage Range ..... 0V to 26V
Input Effective Capacitance, C_{IN} ..... 4.7μF (MIN)
Output Effective Capacitance, C_{OUT} ..... 4.7μF to 5mF
FLG Pull-Up Resistance ..... 10kΩ to 100kΩ
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

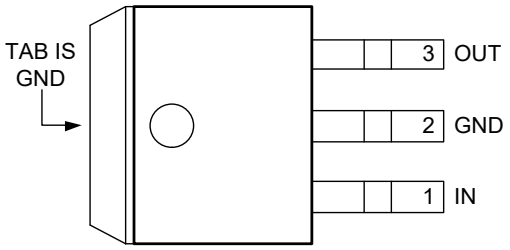
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance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

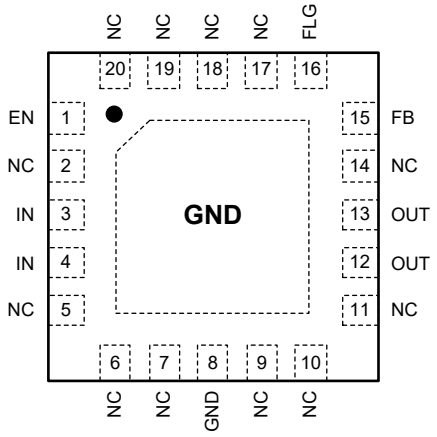
PIN CONFIGURATIONS

SGM2216-FIX (TOP VIEW)



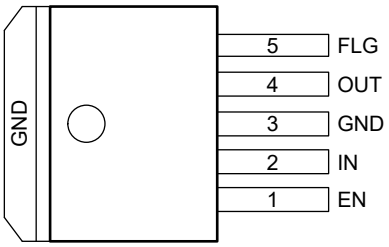
TO-263-3A

SGM2216-ADJ (TOP VIEW)



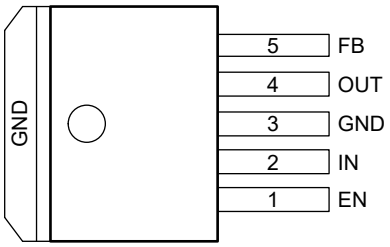
TQFN-5×5-20L

SGM2216-FIX (TOP VIEW)



TO-263-5B

SGM2216-ADJ (TOP VIEW)



TO-263-5B

PIN DESCRIPTION

PIN			NAME	FUNCTION
TO-263-3A	TO-263-5B	TQFN-5×5-20L		
—	1	1	EN	Enable Pin. Drive EN high to turn on the regulator. Drive EN low to turn off the regulator.
1	2	3, 4	IN	Input Supply Voltage Pin. It is recommended to use a 10μF 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	3, TAB	8	GND	Ground Pin.
3	4	12, 13	OUT	Regulator Output Pin.
—	5	15	FB	Feedback Voltage Input Pin (SGM2216-ADJ 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.
		16	FLG	Active Low Error Flag (SGM2216-ADJ version of TQFN-5×5-20L package and SGM2216-FIX version of TO-263-5B package). It is used to indicate the output fault status.
—	—	2, 5, 6, 7, 9, 10, 11, 14, 17, 18, 19, 20	NC	No Connection.
—	—	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 DIAGRAMS

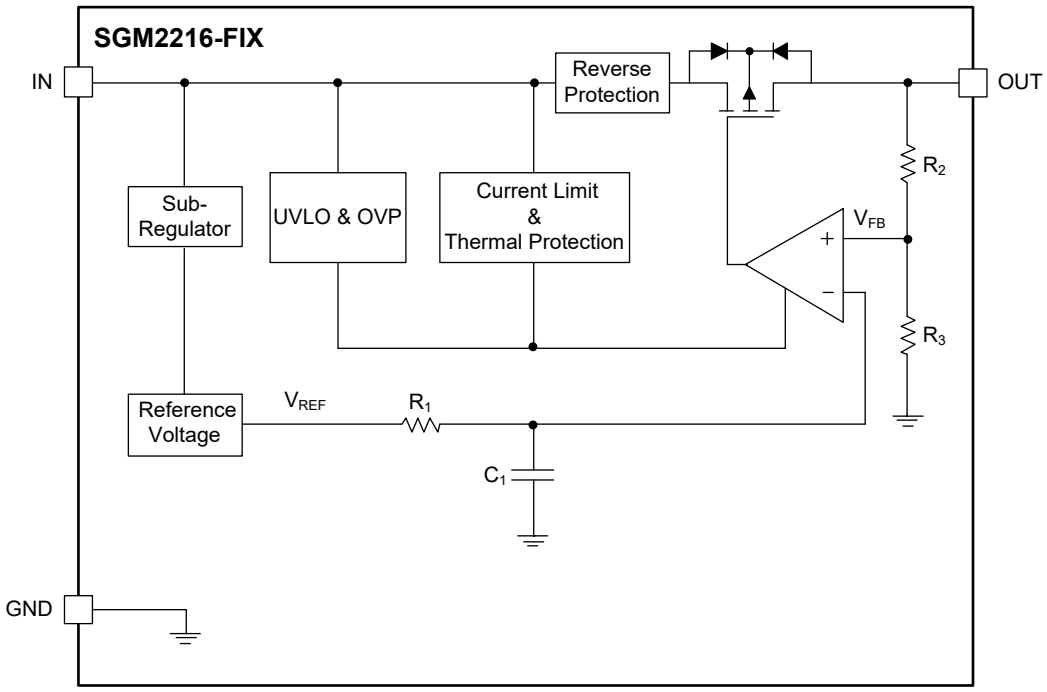


Figure 2. Internal Block Diagram of Fixed Output Voltage (TO-263-3A Version)

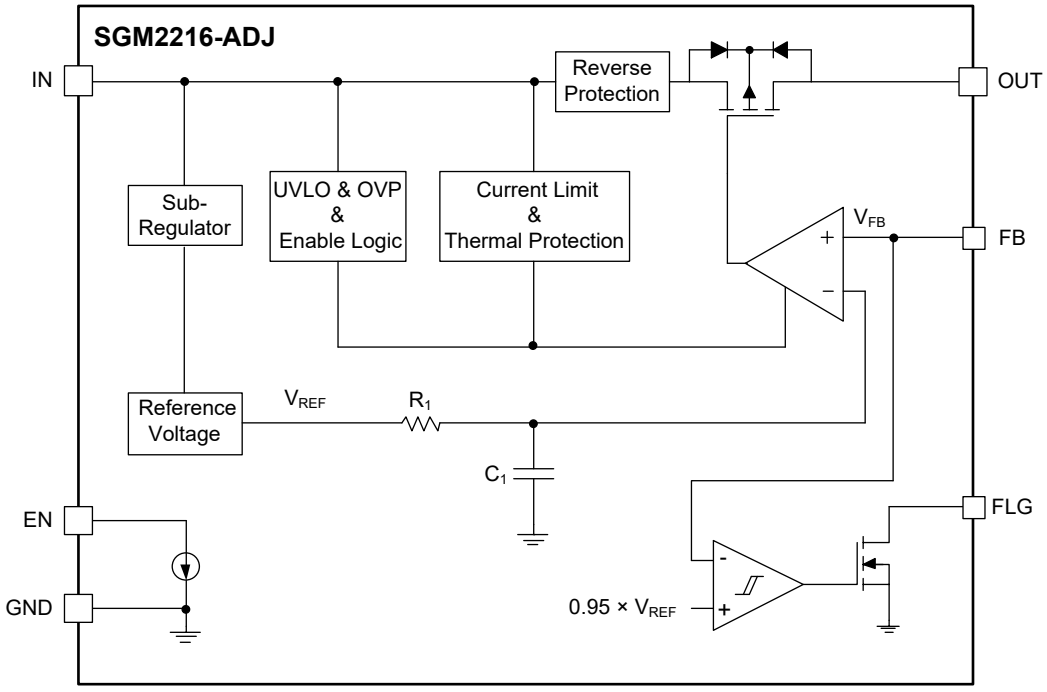


Figure 3. Internal Block Diagram of Adjustable Output Voltage (TQFN-5×5-20L Version)

FUNCTIONAL BLOCK DIAGRAMS (continued)

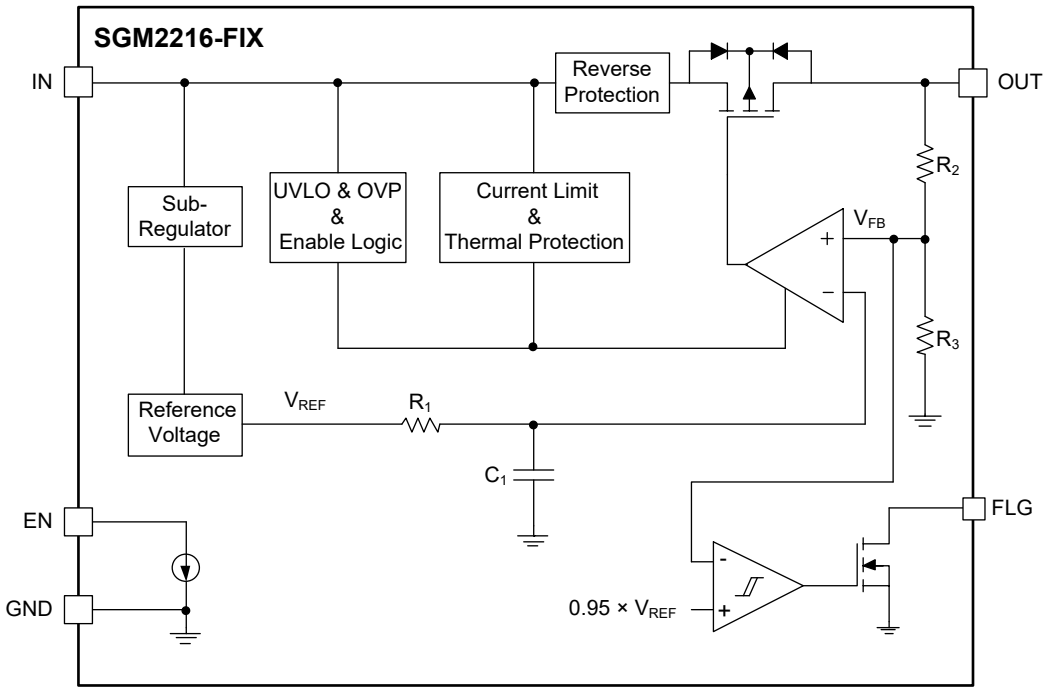


Figure 4. Internal Block Diagram of Fixed Output Voltage (TO-263-5B Version)

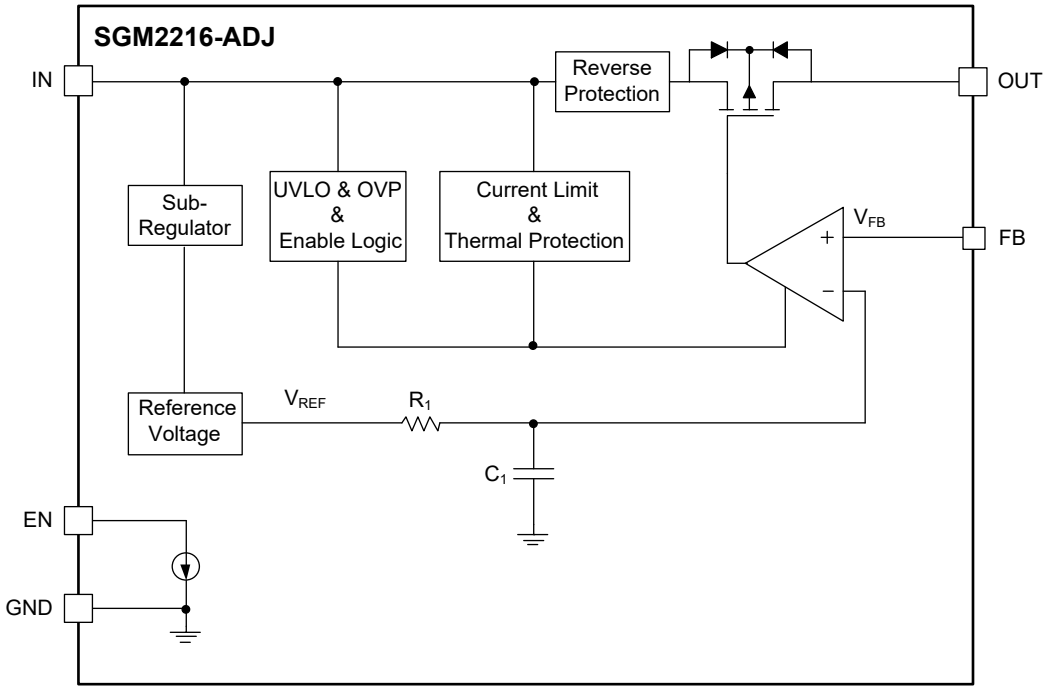


Figure 5. Internal Block Diagram of Adjustable Output Voltage (TO-263-5B Version)

ELECTRICAL CHARACTERISTICS

(V_{IN} = ($V_{OUT(NOM)}$ + 1V) or 2.3V (whichever is greater), I_{OUT} = 7mA, C_{IN} = 10μF, C_{OUT} = 10μF. For SGM2216-ADJ, tested at V_{FB} = V_{OUT}. T_J = -40℃ to +125℃ (1), typical values are at T_J = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Input Supply Voltage Range	V_{IN}			2.3		26	V
Output Voltage Range	V_{OUT}	SGM2216-FIX		1.8		12	V
		SGM2216-ADJ		1.24		25	
Output Voltage Accuracy	V_{OUT}	I_{OUT} = 7mA to 3A, V_{IN} = ($V_{OUT(NOM)}$ + 1V) to 26V	T_J = +25℃ (TO-263-3A and TQFN-5×5-20L)	-1		+1	%
			T_J = +25℃ (TO-263-5B)	-1.2		+1.2	
			T_J = -40℃ to +125℃	-2		+2	
Feedback Voltage	V_{FB}	I_{OUT} = 7mA to 3A, V_{IN} = ($V_{OUT(NOM)}$ + 1V) to 26V	T_J = +25℃ (TO-263-3A and TQFN-5×5-20L)	1.227	1.24	1.253	V
			T_J = +25℃ (TO-263-5B)	1.225		1.255	
			T_J = -40℃ to +125℃	1.215		1.265	
FB Pin Bias Current	I_{FB}	V_{FB} = 1.34V			1	50	nA
Input Supply Under-Voltage Lockout Thresholds	V_{UVLO}	V_{IN} rising			1.92	2.3	V
		Hysteresis			185		mV
Input Supply Over-Voltage Protection	V_{OVP}	V_{IN} rising		30	32.7	35.5	V
		Hysteresis			1.6		
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	I_{OUT} = 7mA, V_{IN} = ($V_{OUT(NOM)}$ + 1V) to 26V			0.001	0.006	%/V
Load Regulation	$\frac{\Delta V_{OUT}}{\Delta I_{OUT} \times V_{OUT}}$	I_{OUT} = 7mA to 3A			0.05	0.25	%/A
Dropout Voltage	V_{DROP}	V_{IN} = 2.3V, V_{FB} = 0V (TQFN-5×5-20L)	I_{OUT} = 100mA		11	22	mV
			I_{OUT} = 1.5A		165	320	
			I_{OUT} = 3A		340	640	
		V_{IN} = 2.3V, V_{FB} = 0V (TO-263-3A and TO-263-5B)	I_{OUT} = 100mA		12.5	25	
			I_{OUT} = 1.5A		195	360	
			I_{OUT} = 3A		395	720	
Output Current Limit	I_{LIMIT}	V_{OUT} = 90% × $V_{OUT(NOM)}$, V_{IN} = $V_{OUT(NOM)}$ + 3V		3	3.9		A
Short-Circuit Current Limit	I_{SHORT}	V_{OUT} = 0V	V_{IN} = $V_{OUT(NOM)}$ + 3V		1.75		A
			V_{IN} = 26V		0.9		
Ground Pin Current	I_{GND}	I_{OUT} = 7mA, V_{IN} = 26V	SGM2216-ADJ		150	230	μA
			SGM2216-FIX		170	270	
		I_{OUT} = 3A, V_{IN} = $V_{OUT(NOM)}$ + 2V	SGM2216-ADJ		190	280	
			SGM2216-FIX		225	320	
Ground Current in Shutdown	I_{GSHDN}	V_{EN} = 0V, V_{IN} = 26V			1.6	5.5	μA
Regulator Output Current in Shutdown	I_{RSHDN}	V_{EN} = 0V, V_{IN} = 26V, V_{OUT} = 0V			1.4	8.5	μA
GND Reverse Leakage Current	I_{RLGND}	V_{GND} = 26V, V_{IN} = V_{EN} = V_{OUT} = V_{FB} = 0V, FLG floating, SGM2216-ADJ			165	320	μA
OUT Reverse Leakage Current	I_{RLOUT}	V_{OUT} = 26V, V_{IN} = V_{EN} = 5V, V_{GND} = V_{FB} = 0V, FLG floating, SGM2216-ADJ			29	90	μA
EN Reverse Leakage Current	I_{RLEN}	V_{EN} = V_{IN} = 26V, V_{GND} = 5V, V_{OUT} = V_{FB} = 0V, FLG floating, SGM2216-ADJ			1.2	3	μA
FB Reverse Leakage Current	I_{RLFB}	V_{FB} = 26V, V_{EN} = V_{IN} = 5V, V_{OUT} = V_{GND} = 0V, FLG floating, SGM2216-ADJ			110	165	μA

ELECTRICAL CHARACTERISTICS (continued)

(V_{IN} = ($V_{OUT(NOM)}$ + 1V) or 2.3V (whichever is greater), I_{OUT} = 7mA, C_{IN} = 10μF, C_{OUT} = 10μF. For SGM2216-ADJ, tested at V_{FB} = V_{OUT}. T_J = -40℃ to +125℃ (1), typical values are at T_J = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Enable Threshold Voltage	V_{IH}	V_{IN} = 2.3V to 26V		1.6		26	V
	V_{IL}	V_{IN} = 2.3V to 26V		0		0.6	
EN Pin Input Current	I_{EN}	V_{EN} = 26V			1.2	3	μA
		V_{EN} = 0V			0.01	0.5	
Turn-On Time	t_{ON}	$V_{OUT(NOM)}$ = 1.24V, from assertion of V_{EN} to V_{OUT} = 90% × $V_{OUT(NOM)}$			125		μs
FLG Pin Output Low Voltage	$V_{FLG(LO)}$	I_{OL} = 250μA			22	50	mV
FLG Pin Output Leakage Current	$I_{FLG(LKG)}$	V_{OH} = 26V			0.01	1	μA
FLG Low Threshold Voltage	FLG_{LTH}	For falling V_{OUT}		88	92	96	$\%V_{FB}$
FLG Trip Hysteresis Voltage	FLG_{HYS}				3.9		$\%V_{FB}$
Power Supply Rejection Ratio	PSRR	$V_{OUT(NOM)}$ = 1.24V, V_{IN} = 3.24V, I_{OUT} = 100mA, C_{OUT} = 33μF	f = 1kHz		65		dB
			f = 1MHz		57		
Output Voltage Noise	e_n	$V_{OUT(NOM)}$ = 1.24V, V_{IN} = 3.24V, f = 10Hz to 100kHz, I_{OUT} = 100mA, C_{OUT} = 33μF			37		μV_{RMS}
Thermal Shutdown Temperature	T_{SHDN}	T_J rising			160		℃
Thermal Shutdown Hysteresis	ΔT_{SHDN}	Hysteresis			30		℃

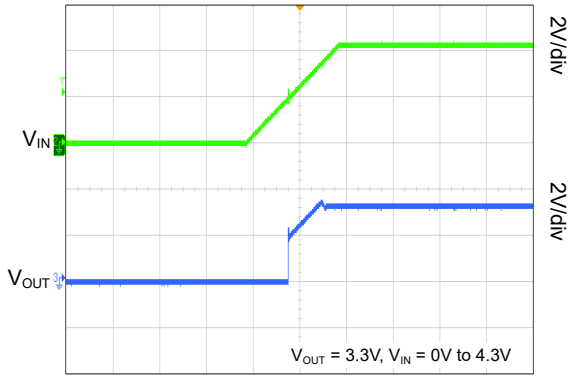
NOTE:

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

TYPICAL PERFORMANCE CHARACTERISTICS

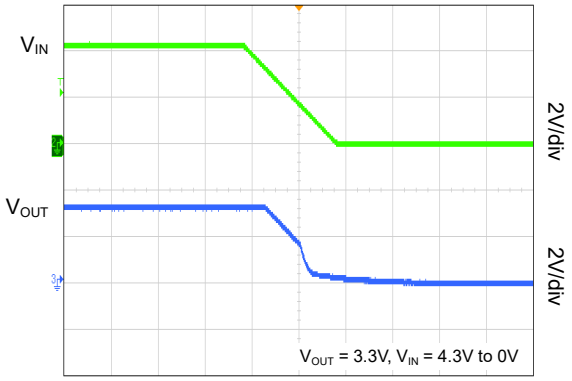
T_J = +25℃, V_{IN} = ($V_{OUT(NOM)}$ + 1V) or 2.3V (whichever is greater), I_{OUT} = 7mA, C_{IN} = 10μF, C_{OUT} = 10μF, unless otherwise noted.

Power-Up Response



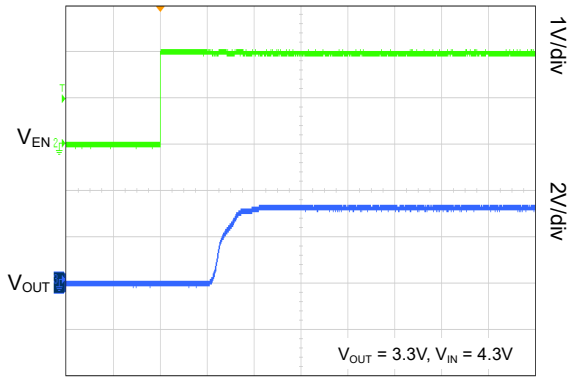
Time (5ms/div)

Power-Down Response



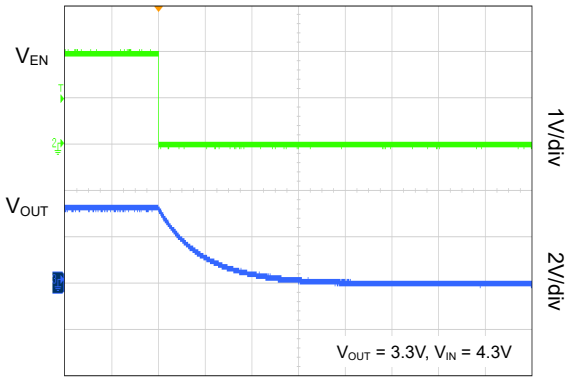
Time (5ms/div)

EN Start-Up Response



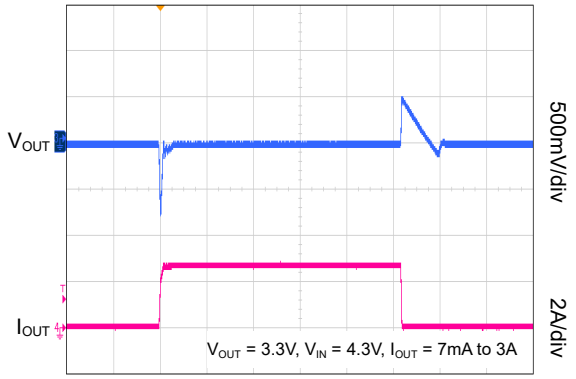
Time (100μs/div)

EN Shutdown Response



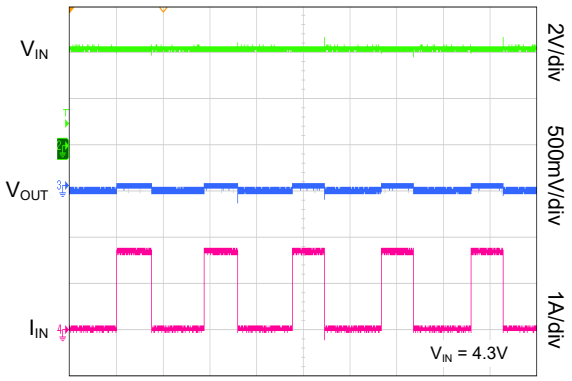
Time (5ms/div)

Load Transient Response



Time (1ms/div)

Short Output

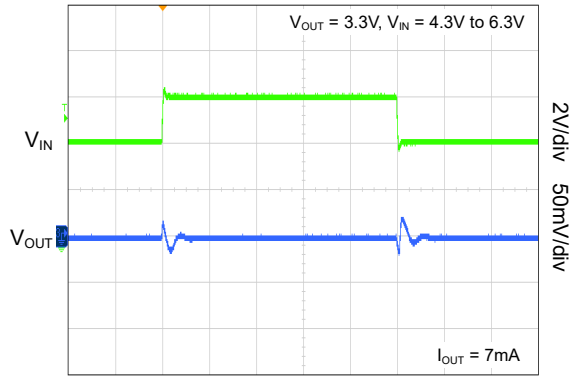


Time (2s/div)

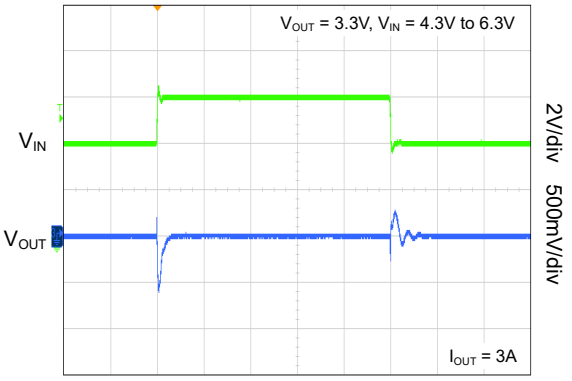
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_J = +25℃, V_{IN} = ($V_{OUT(NOM)}$ + 1V) or 2.3V (whichever is greater), I_{OUT} = 7mA, C_{IN} = 10μF, C_{OUT} = 10μF, unless otherwise noted.

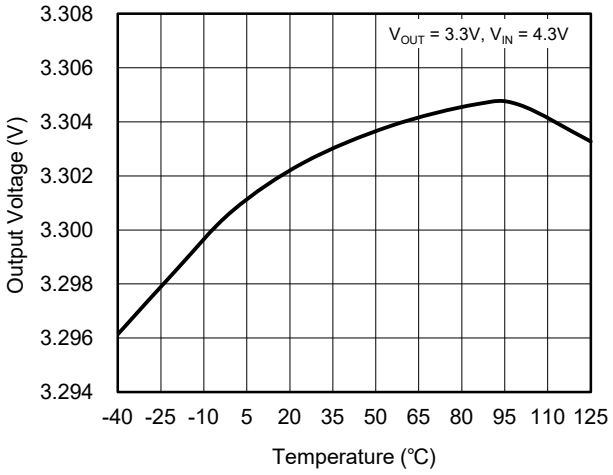
Line Transient Response



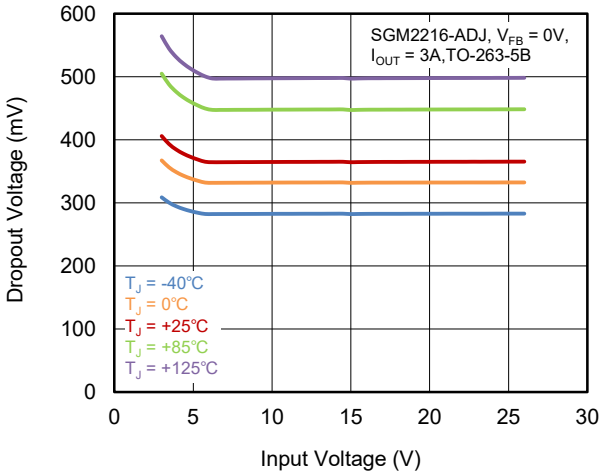
Line Transient Response



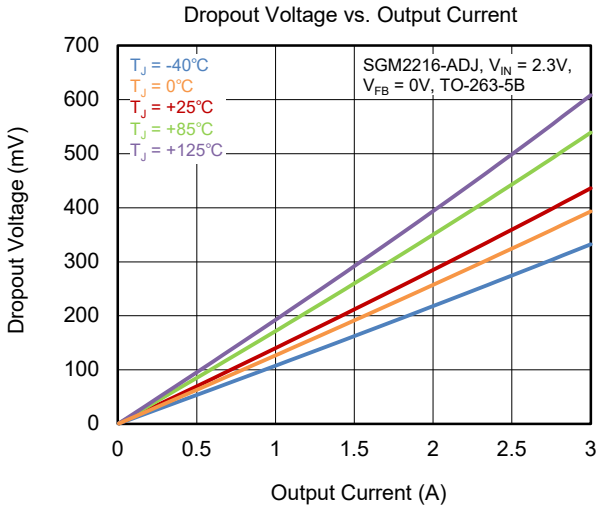
Output Voltage vs. Temperature



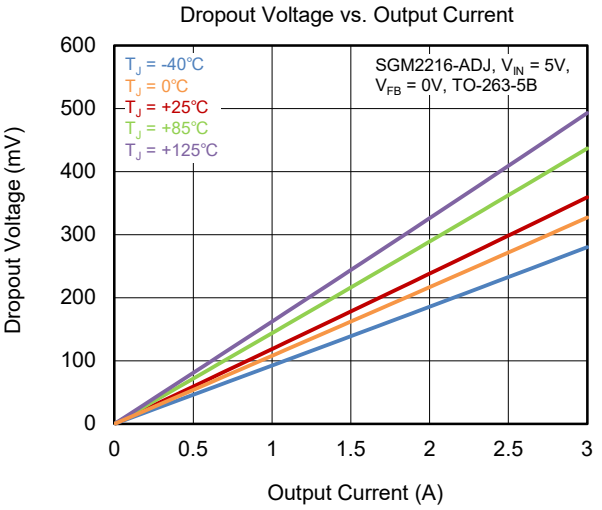
Dropout Voltage vs. Input Voltage



Dropout Voltage vs. Output Current



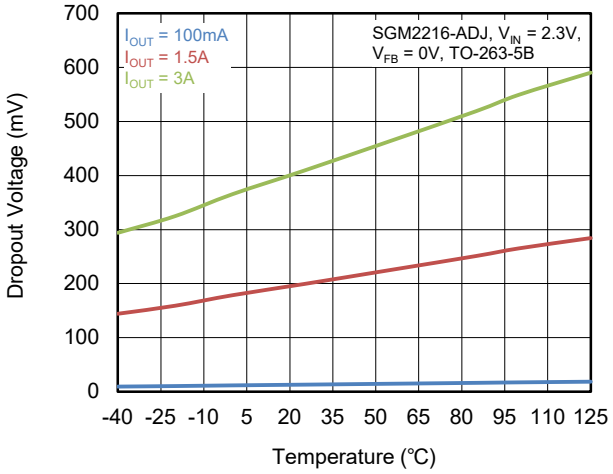
Dropout Voltage vs. Output Current



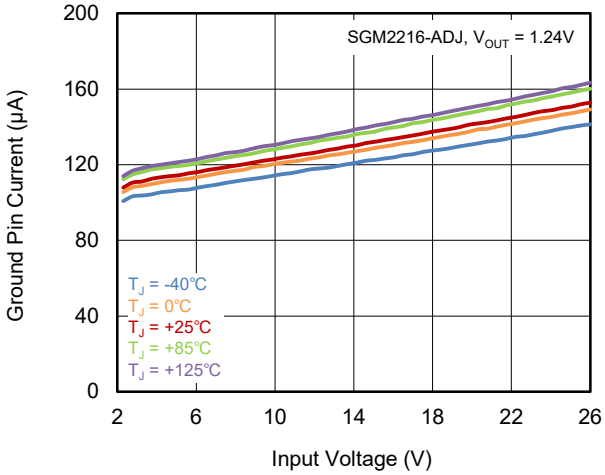
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_J = +25℃, V_{IN} = ($V_{OUT(NOM)}$ + 1V) or 2.3V (whichever is greater), I_{OUT} = 7mA, C_{IN} = 10μF, C_{OUT} = 10μF, unless otherwise noted.

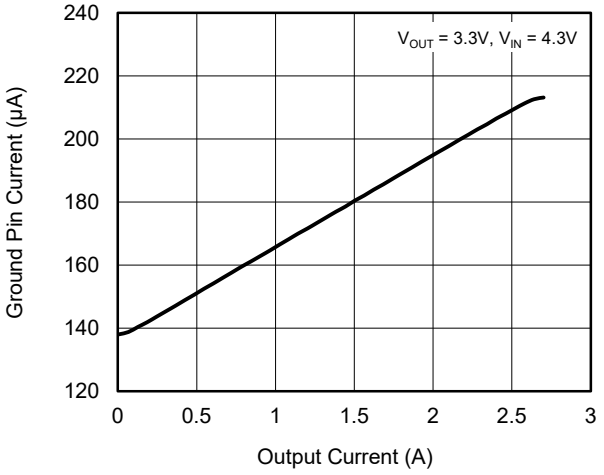
Dropout Voltage vs. Temperature



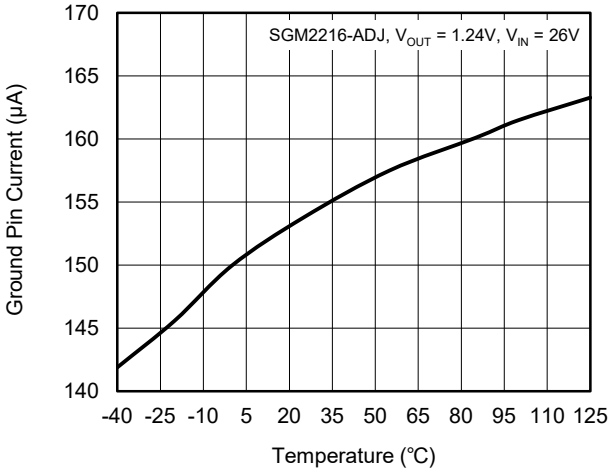
Ground Pin Current vs. Input Voltage



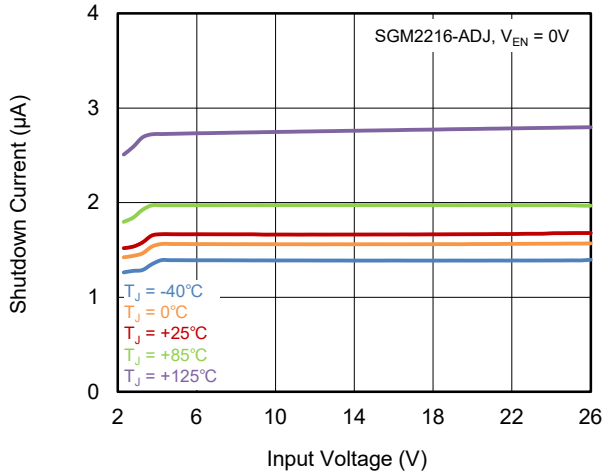
Ground Pin Current vs. Output Current



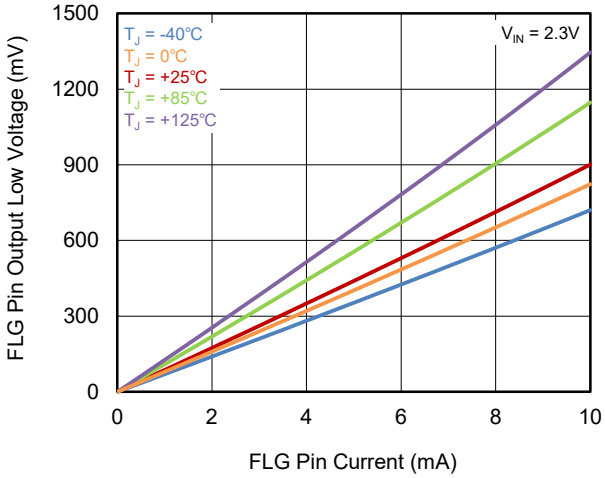
Ground Pin Current vs. Temperature



Shutdown Current vs. Input Voltage



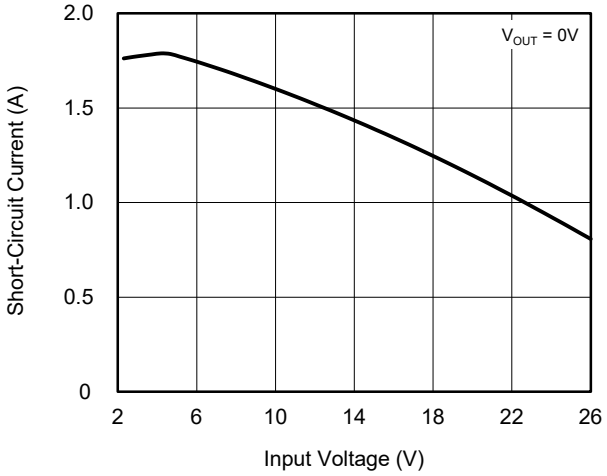
FLG Pin Output Low Voltage vs. FLG Pin Current



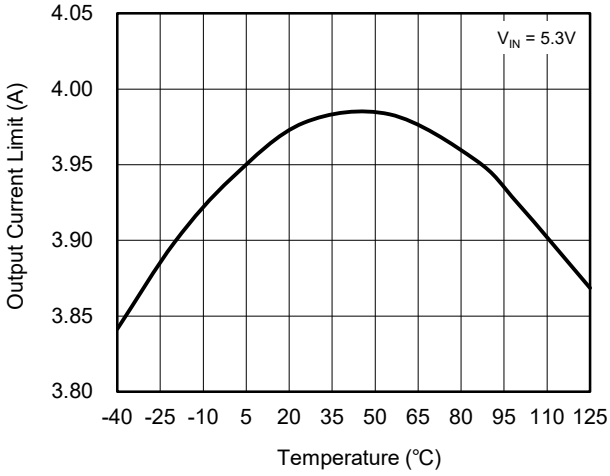
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_J = +25℃, V_{IN} = ($V_{OUT(NOM)}$ + 1V) or 2.3V (whichever is greater), I_{OUT} = 7mA, C_{IN} = 10μF, C_{OUT} = 10μF, unless otherwise noted.

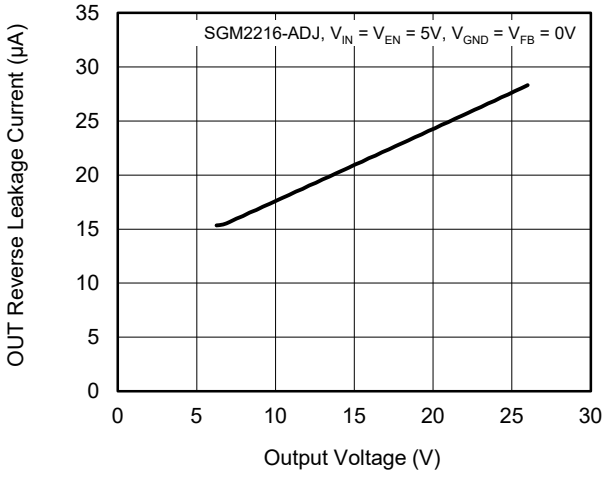
Short-Circuit Current vs. Input Voltage



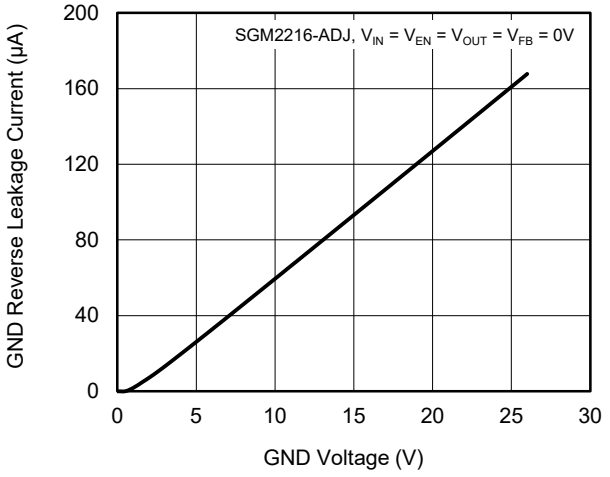
Output Current Limit vs. Temperature



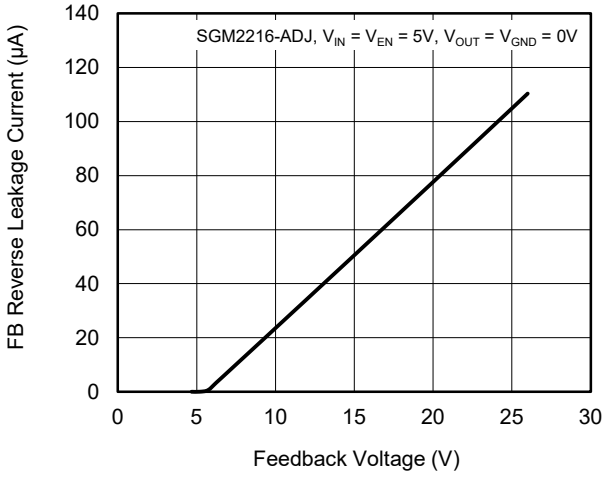
OUT Reverse Leakage Current vs. Output Voltage



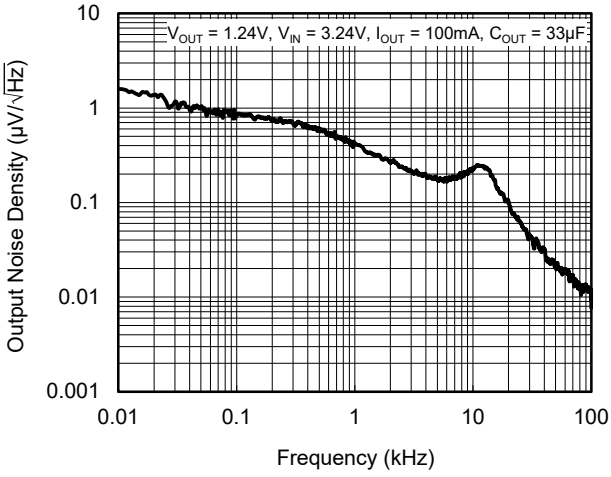
GND Reverse Leakage Current vs. GND Voltage



FB Reverse Leakage Current vs. Feedback Voltage



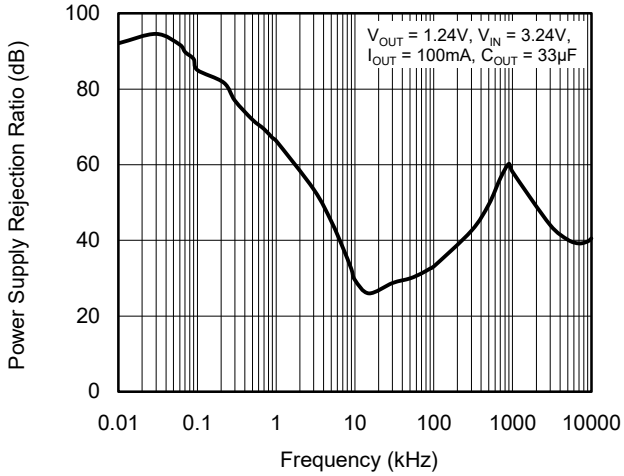
Output Noise Density vs. Frequency



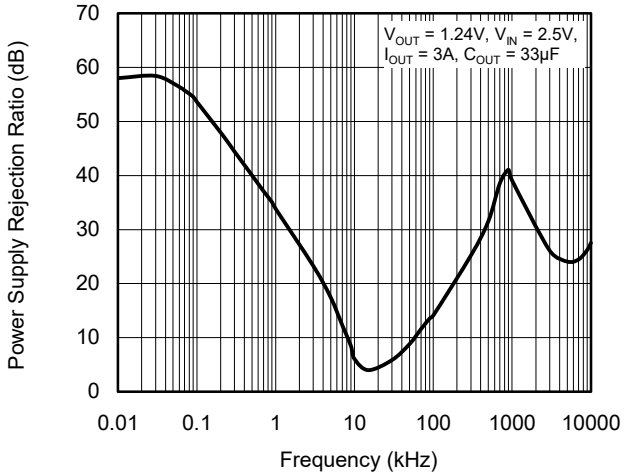
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_J = +25℃, V_{IN} = ($V_{OUT(NOM)}$ + 1V) or 2.3V (whichever is greater), I_{OUT} = 7mA, C_{IN} = 10μF, C_{OUT} = 10μF, unless otherwise noted.

Power Supply Rejection Ratio vs. Frequency



Power Supply Rejection Ratio vs. Frequency



APPLICATION INFORMATION

The SGM2216 is a high voltage, low noise, high current and low dropout voltage linear regulator and provides 3A 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 SGM2216 useful in a variety of applications. The SGM2216 provides protection functions for output overload and overheating.

The SGM2216 provides an EN pin as an external chip enable control to enable/disable the device. When the regulator is in shutdown state, the shutdown current consumes as low as 1.6μA (TYP).

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. C_{IN} = 10μF 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 6 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.

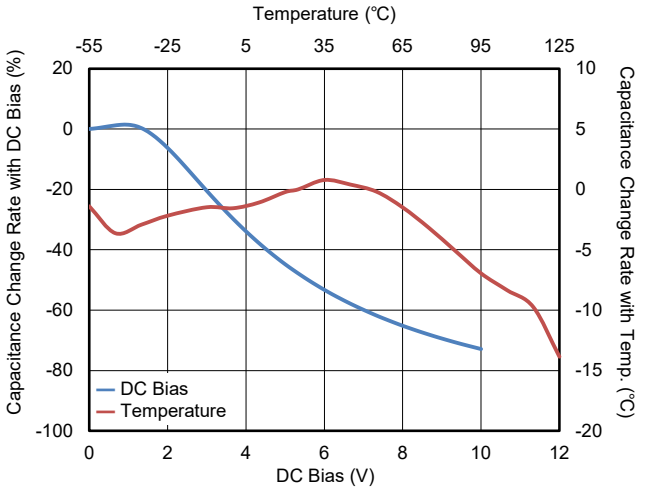


Figure 6. Capacitance vs. DC Bias and Temperature Characteristics

The SGM2216 requires a minimum effective capacitance of 4.7μF 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.

Minimum Load

The SGM2216 requires minimum load current with 7mA to maintain stability.

Adjustable Regulator

The output voltage of the SGM2216-ADJ can be adjusted from 1.24V to 25V. The FB pin will be connected to two external resistors as shown in Figure 7. 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} = 1.24V. Choose $R_2 \leq 50k\Omega$. R_1 or R_2 cannot be connected in parallel with additional capacitors.

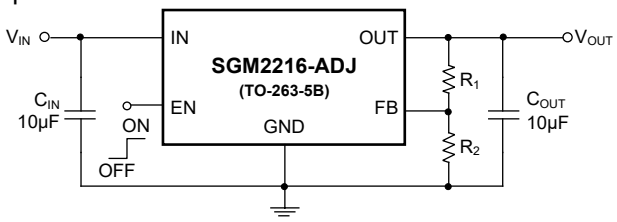


Figure 7. Adjustable Output Voltage Application

APPLICATION INFORMATION (continued)

Enable Operation

The EN pin of the SGM2216 is used to enable/disable the device.

When the EN pin voltage is lower than 0.6V, the device is in shutdown state. There is no current flowing from IN to OUT pins. When the EN pin voltage is higher than 1.6V, the device is in active state.

Under-Voltage Lockout (UVLO)

To protect the device from malfunctioning when the input voltage is insufficient, under-voltage lockout (UVLO) protection is included. The device will not operate until the input voltage exceeds UVLO rising threshold, and will lockout if the input voltage falls below the UVLO falling threshold. The local input capacitance prevents severe brownouts in most applications.

Reverse Current Protection

The SGM2216 incorporates reverse current protection circuit that prevents current flow backwards through the pass element when the output voltage is greater than the input voltage. A comparator senses the difference between the input and output voltages.

Output Current Limit Protection

When overload events happen, the output current is internally limited to 3.9A (TYP). When the OUT pin is shorted to ground, the output current is internally limited.

Thermal Shutdown

When the die temperature exceeds the threshold value of thermal shutdown, the SGM2216 will be in shutdown state and it will remain in this state until the die temperature decreases to +130℃.

Power Dissipation (P_D)

Power dissipation (P_D) of the SGM2216 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 SGM2216 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.

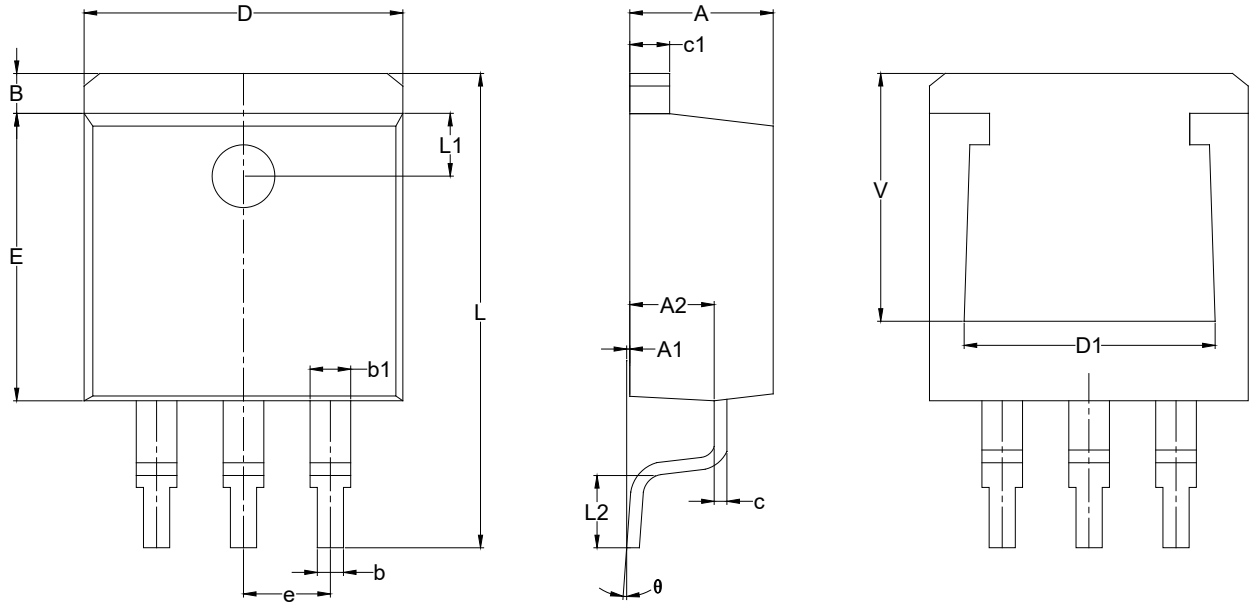
REVISION HISTORY

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

TO-263-3A

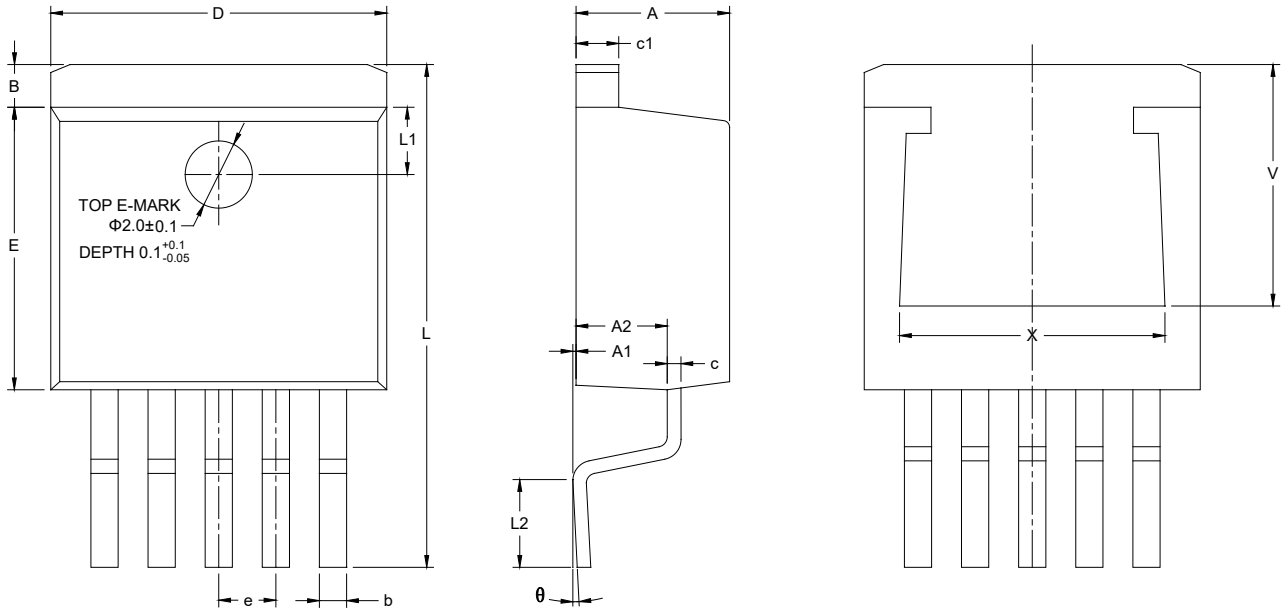


Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	4.400	4.570	4.700
A1	0.000	0.100	0.250
A2	2.590	2.690	2.790
B	1.170	1.270	1.400
b	0.770	-	0.900
b1	1.230	-	1.360
c	0.340	-	0.470
c1	1.220	-	1.320
D	10.060	10.160	10.260
D1	7.800	-	8.200
E	9.050	9.150	9.250
e	2.540 BSC		
L	14.700	15.100	15.500
L1	2.000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

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

PACKAGE OUTLINE DIMENSIONS

TO-263-5B

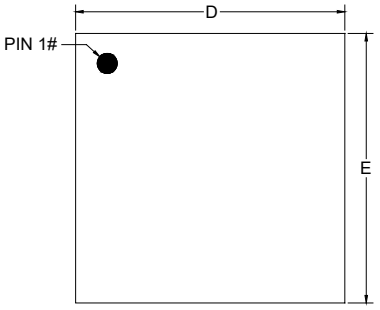


Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	4.40	4.57	4.70
A1	0	0.10	0.25
A2	2.59	2.69	2.79
b	0.77	-	0.90
c	0.34	-	0.47
c1	1.22	-	1.32
e	1.70 BSC		
D	10.06	10.16	10.26
E	9.05	9.15	9.25
B	1.17	1.27	1.40
V	6.86	-	7.50
X	7.50	-	8.30
L	14.70	15.10	15.50
L1	2.00 REF		
L2	2.00	2.30	2.60
θ	0°	-	8°

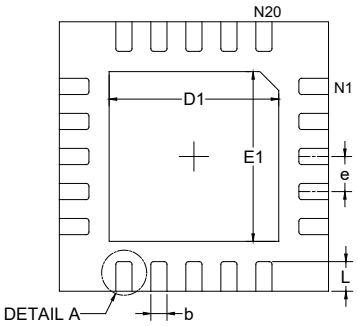
NOTES:
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

PACKAGE OUTLINE DIMENSIONS

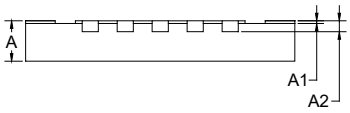
TQFN-5×5-20L



TOP VIEW

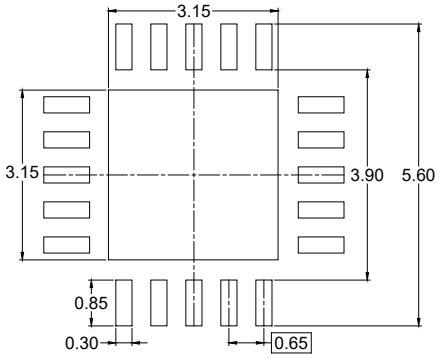


BOTTOM VIEW



SIDE VIEW

DETAIL A
ALTERNATE TERMINAL CONSTRUCTION



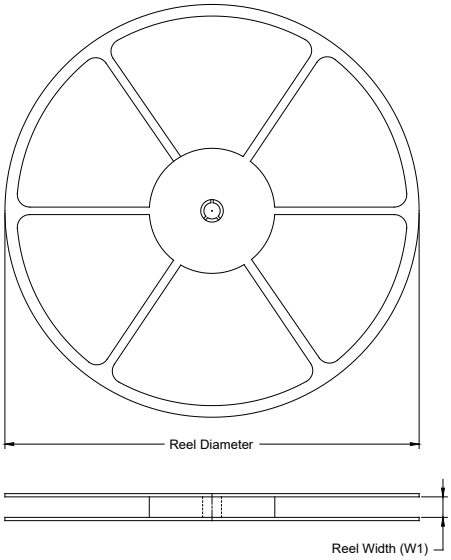
RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	0.700	0.750	0.800
A1	0.000	-	0.050
A2	0.203 REF		
D	4.950	5.000	5.050
D1	3.100	3.150	3.200
E	4.950	5.000	5.050
E1	3.100	3.150	3.200
b	0.250	0.300	0.350
e	0.650 BSC		
L	0.500	0.550	0.600

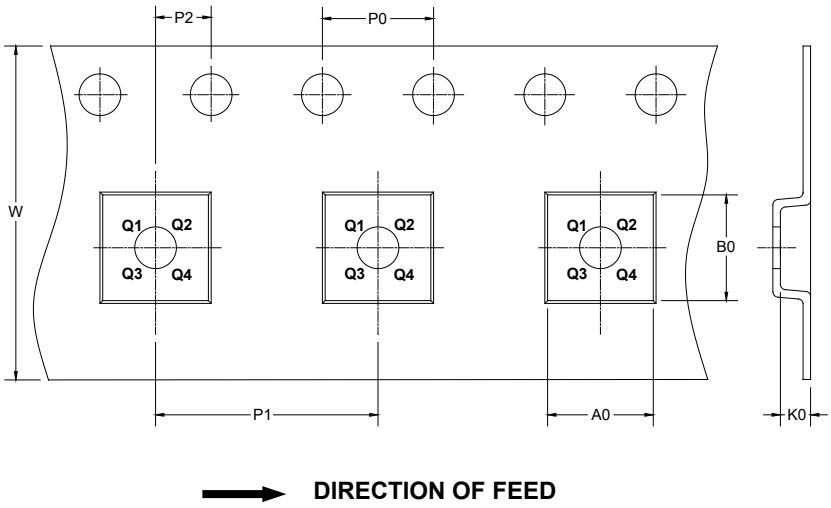
NOTE: This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



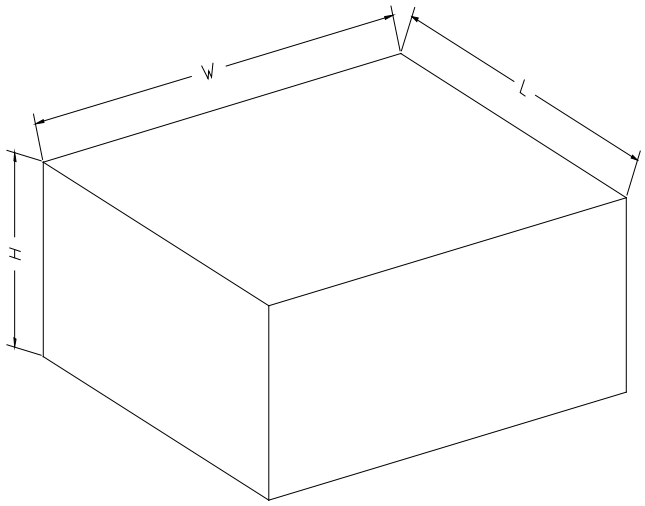
NOTE: The picture is only for reference. Please make the object as the standard.

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
TO-263-3A	13"	24.4	10.80	16.30	5.11	4.0	16.0	2.0	24.0	
TO-263-5B	13"	24.4	10.80	16.30	5.11	4.0	16.0	2.0	24.0	
TQFN-5×5-20L	13"	12.4	5.30	5.30	1.10	4.0	8.0	2.0	12.0	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
13″	386	280	370	5

DD0002