

SGM2205

800mA, High Voltage, Low Noise LDO Regulator

GENERAL DESCRIPTION

The SGM2205 is a high voltage efficient linear voltage regulator with very low dropout voltage, typically 480mV at full load.

Designed especially for hand-held, battery-powered devices, the SGM2205 features low ground current to help prolong battery life. An enable/shutdown pin on SOIC-8, TDFN-3×3-8L and TO-263-5B versions can further improve battery life with near-zero shutdown current.

Key features include high PSRR, low ground current, fast load transient, output shorted to GND protection, reversed-battery protection, current limiting, over-temperature shutdown, ultra low noise capability and availability in thermally-efficient packaging. The SGM2205 is available in adjustable or fixed output voltages.

The SGM2205 is available in Green SOT-89-3, SOT-223-3, SOIC-8, TDFN-3×3-8L and TO-263-5B packages. It operates over an ambient temperature range of -40°C to +125°C.

FEATURES

- 2.5V to 20V Wide Input Voltage Range
- Output Voltage Range: 1.8V to 15V
- Guaranteed 800mA Output over the Full Operating Temperature Range
- Low 480mV (TYP) Dropout Voltage at Full Load
- Extremely Tight Load and Line Regulation
- Fast Load Transient
- Low Temperature Coefficient
- Output Shorted to GND Protection
- Current and Thermal Limiting
- No-Load Stability
- Ultra Low Noise Capability
- -40°C to +125°C Operating Temperature Range
- Thermally-Efficient Surface-Mount Package
- Available in Green SOT-89-3, SOT-223-3, SOIC-8, TDFN-3×3-8L and TO-263-5B Packages

APPLICATIONS

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

TYPICAL APPLICATIONS

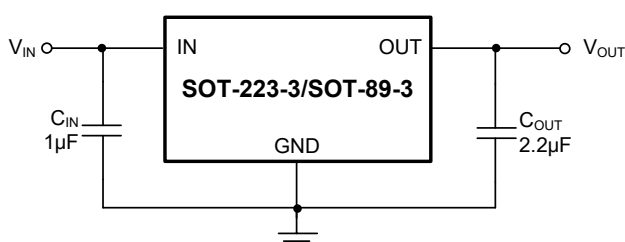


Figure 1. Fixed Voltage Typical Application Circuit

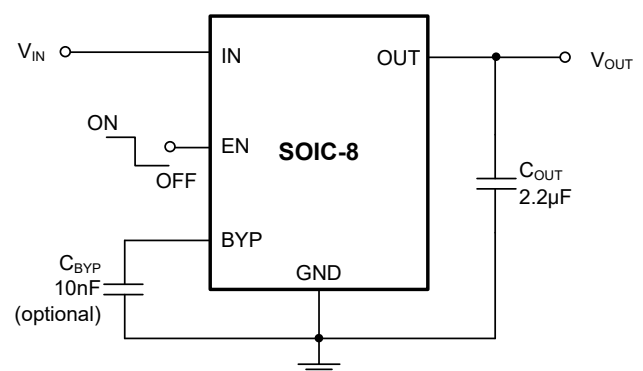


Figure 2. Ultra Low Noise Regulator

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2205-1.8	SOT-89-3	-40°C to +125°C	SGM2205-1.8XK3G/TR	MJFXX	Tape and Reel, 1000
SGM2205-12	SOT-89-3	-40°C to +125°C	SGM2205-12XK3G/TR	GRBXX	Tape and Reel, 1000
SGM2205-1.8	SOT-223-3	-40°C to +125°C	SGM2205-1.8XKC3G/TR	M86 XXXXX	Tape and Reel, 2500
SGM2205-2.5	SOT-223-3	-40°C to +125°C	SGM2205-2.5XKC3G/TR	M87 XXXXX	Tape and Reel, 2500
SGM2205-3.0	SOT-223-3	-40°C to +125°C	SGM2205-3.0XKC3G/TR	M89 XXXXX	Tape and Reel, 2500
SGM2205-3.3	SOT-223-3	-40°C to +125°C	SGM2205-3.3XKC3G/TR	M8A XXXXX	Tape and Reel, 2500
SGM2205-3.6	SOT-223-3	-40°C to +125°C	SGM2205-3.6XKC3G/TR	M8B XXXXX	Tape and Reel, 2500
SGM2205-4.2	SOT-223-3	-40°C to +125°C	SGM2205-4.2XKC3G/TR	GP4 XXXXX	Tape and Reel, 2500
SGM2205-5.0	SOT-223-3	-40°C to +125°C	SGM2205-5.0XKC3G/TR	M8C XXXXX	Tape and Reel, 2500
SGM2205-12	SOT-223-3	-40°C to +125°C	SGM2205-12XKC3G/TR	M8D XXXXX	Tape and Reel, 2500
SGM2205-15	SOT-223-3	-40°C to +125°C	SGM2205-15XKC3G/TR	M8E XXXXX	Tape and Reel, 2500
SGM2205-1.8	SOIC-8	-40°C to +125°C	SGM2205-1.8XS8G/TR	SGM MM2XS8 XXXXX	Tape and Reel, 4000
SGM2205-2.5	SOIC-8	-40°C to +125°C	SGM2205-2.5XS8G/TR	SGM MM3XS8 XXXXX	Tape and Reel, 4000
SGM2205-3.0	SOIC-8	-40°C to +125°C	SGM2205-3.0XS8G/TR	SGM MM4XS8 XXXXX	Tape and Reel, 4000
SGM2205-3.3	SOIC-8	-40°C to +125°C	SGM2205-3.3XS8G/TR	SGM MM5XS8 XXXXX	Tape and Reel, 4000
SGM2205-3.6	SOIC-8	-40°C to +125°C	SGM2205-3.6XS8G/TR	SGM MM6XS8 XXXXX	Tape and Reel, 4000
SGM2205-4.2	SOIC-8	-40°C to +125°C	SGM2205-4.2XS8G/TR	SGM M33XS8 XXXXX	Tape and Reel, 4000
SGM2205-5.0	SOIC-8	-40°C to +125°C	SGM2205-5.0XS8G/TR	SGM MM7XS8 XXXXX	Tape and Reel, 4000
SGM2205-12	SOIC-8	-40°C to +125°C	SGM2205-12XS8G/TR	SGM MM8XS8 XXXXX	Tape and Reel, 4000
SGM2205-15	SOIC-8	-40°C to +125°C	SGM2205-15XS8G/TR	SGM MM9XS8 XXXXX	Tape and Reel, 4000
SGM2205-ADJ	SOIC-8	-40°C to +125°C	SGM2205-ADJXS8G/TR	SGM 2205ADJXS8 XXXXX	Tape and Reel, 4000

PACKAGE/ORDERING INFORMATION (continued)

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2205-1.8	TDFN-3×3-8L	-40°C to +125°C	SGM2205-1.8XTDB8G/TR	SGM MP6DB XXXXX	Tape and Reel, 4000
SGM2205-3.3	TDFN-3×3-8L	-40°C to +125°C	SGM2205-3.3XTDB8G/TR	SGM CABDB XXXXX	Tape and Reel, 4000
SGM2205-5.0	TDFN-3×3-8L	-40°C to +125°C	SGM2205-5.0XTDB8G/TR	SGM CACDB XXXXX	Tape and Reel, 4000
SGM2205-ADJ	TDFN-3×3-8L	-40°C to +125°C	SGM2205-ADJXTDB8G/TR	SGM R1DB XXXXX	Tape and Reel, 4000
SGM2205-1.8	TO-263-5B	-40°C to +125°C	SGM2205-1.8XO5G/TR	SGMMMA XO5 XXXXX	Tape and Reel, 800
SGM2205-2.5	TO-263-5B	-40°C to +125°C	SGM2205-2.5XO5G/TR	SGMMMB XO5 XXXXX	Tape and Reel, 800
SGM2205-3.0	TO-263-5B	-40°C to +125°C	SGM2205-3.0XO5G/TR	SGMMMC XO5 XXXXX	Tape and Reel, 800
SGM2205-3.3	TO-263-5B	-40°C to +125°C	SGM2205-3.3XO5G/TR	SGMMMD XO5 XXXXX	Tape and Reel, 800
SGM2205-3.6	TO-263-5B	-40°C to +125°C	SGM2205-3.6XO5G/TR	SGMMME XO5 XXXXX	Tape and Reel, 800
SGM2205-4.2	TO-263-5B	-40°C to +125°C	SGM2205-4.2XO5G/TR	SGMMN2 XO5 XXXXX	Tape and Reel, 800
SGM2205-5.0	TO-263-5B	-40°C to +125°C	SGM2205-5.0XO5G/TR	SGMMMF XO5 XXXXX	Tape and Reel, 800
SGM2205-12	TO-263-5B	-40°C to +125°C	SGM2205-12XO5G/TR	SGMMN0 XO5 XXXXX	Tape and Reel, 800
SGM2205-15	TO-263-5B	-40°C to +125°C	SGM2205-15XO5G/TR	SGMMN1 XO5 XXXXX	Tape and Reel, 800
SGM2205-ADJ	TO-263-5B	-40°C to +125°C	SGM2205-ADJXO5G/TR	SGM2205ADJ XO5 XXXXX	Tape and Reel, 800

MARKING INFORMATION

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

SOT-89-3

YYY X X

Date Code - Week
 Date Code - Year
 Serial Number

SOT-223-3/SOIC-8/TDFN-3×3-8L/TO-263-5B

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

Supply Voltage Range (V_{IN})	-28V to +28V
Power Dissipation, P_D @ $T_A = +25^\circ\text{C}$	
SOT-89-3	1.66W
SOT-223-3	1.32W
SOIC-8	1.32W
TDFN-3x3-8L	1.36W
TO-263-5B	2.78W
Package Thermal Resistance	
SOT-89-3, θ_{JA}	75°C/W
SOT-223-3, θ_{JA}	95°C/W
SOIC-8, θ_{JA}	95°C/W
TDFN-3x3-8L, θ_{JA}	92°C/W
TO-263-5B, θ_{JA}	45°C/W
Junction Temperature	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10s)	+260°C

RECOMMENDED OPERATING CONDITIONS

Supply Voltage Range (V_{IN})	2.5V to 20V
Adjustable Output Voltage Range	1.8V to 15V
Operating Temperature Range	-40°C to +125°C

OVERSTRESS CAUTION

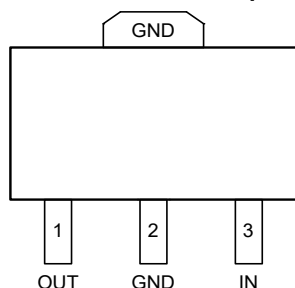
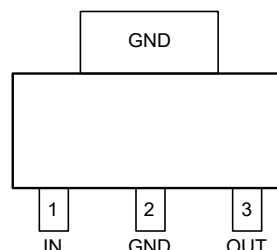
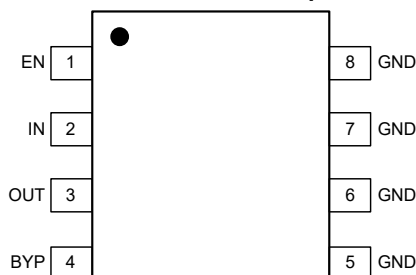
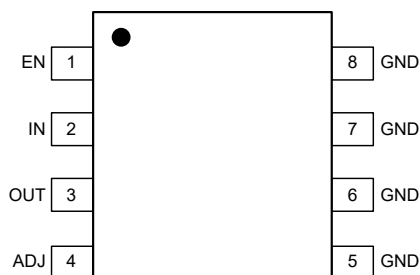
Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

ESD SENSITIVITY CAUTION

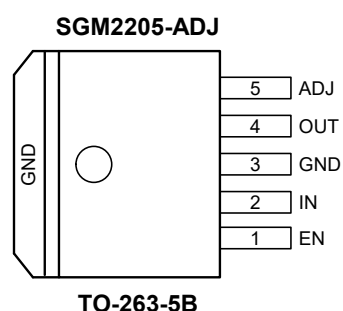
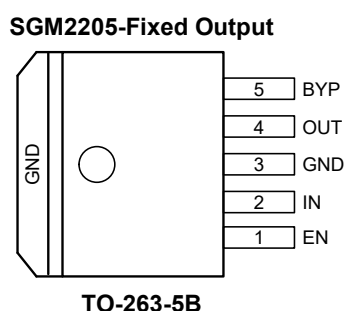
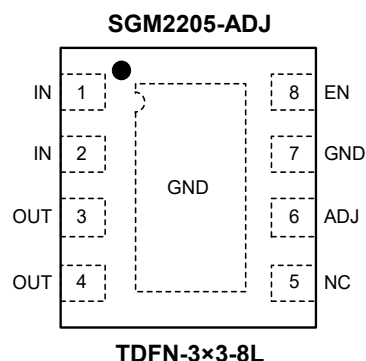
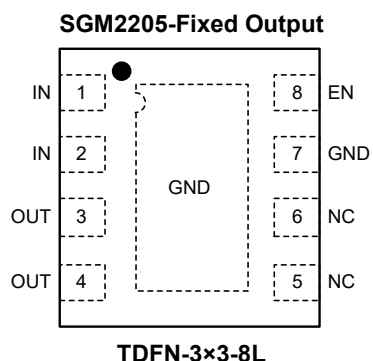
This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

PIN CONFIGURATIONS**SGM2205-Fixed Output****SOT-89-3****SGM2205-Fixed Output****SOT-223-3****SGM2205-Fixed Output****SOIC-8****SGM2205-ADJ****SOIC-8**

PIN CONFIGURATIONS (continued)



PIN DESCRIPTION

PIN					NAME	FUNCTION
SOT-89-3	SOT-223-3	SOIC-8	TDFN-3x3-8L	TO-263-5B		
1	3	3	3, 4	4	OUT	Regulator Output Pin. It is recommended to use output capacitor with effective capacitance in the range of 1 μ F to 10 μ F. TDFN-3x3-8L pins 3 and 4 must be tied together.
2	2	5-8	7	3	GND	Ground Pin. SOIC-8 pins 5 through 8 are internally connected.
3	1	2	1, 2	2	IN	Supply Input Pin.
–	–	1	8	1	EN	Enable Pin: CMOS-Compatible Control Input. Logic High = Enable; Logic Low = Shutdown.
–	–	4	–	5	BYP	Reference Bypass (fixed voltage version only). Connect external 10nF capacitor to GND to reduce output noise.
			6		ADJ	Adjustable Pin: Feedback Input (adjustable voltage version only). Connect to resistive voltage-divider network.
–	–	–	6	–	NC	Not Connected (fixed voltage version only).
–	–	–	5	–	NC	Not Connected.
–	–	–	Exposed Pad	–	GND	Exposed Thermal Pad. Connect to GND for best thermal performance.

ELECTRICAL CHARACTERISTICS

($V_{IN} = V_{OUT(NOM)} + 1.0V$, $C_{OUT} = 2.2\mu F$, $I_{OUT} = 100\mu A$, Full = $-40^{\circ}C$ to $+125^{\circ}C$, typical values are at $T_A = +25^{\circ}C$, unless otherwise noted.)

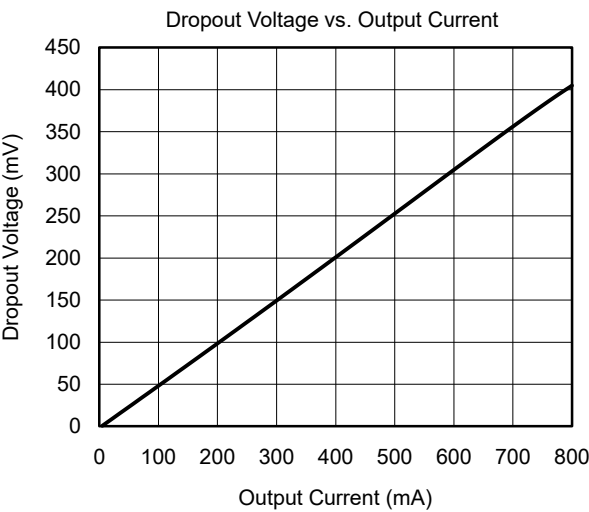
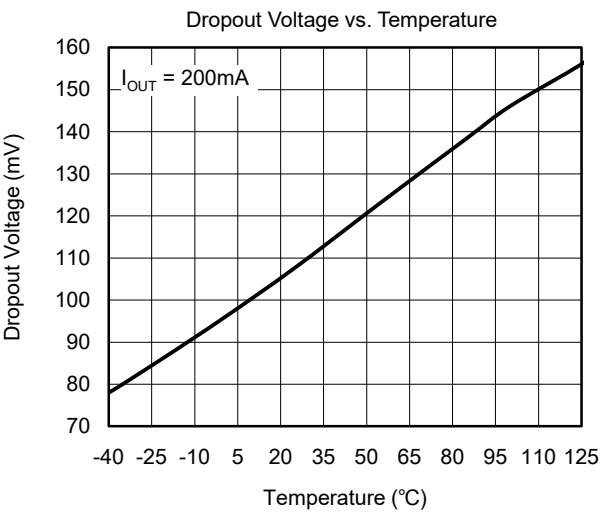
PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Input Voltage Range	V_{IN}		$+25^{\circ}C$	2.5		20	V
Ground Pin Current ^(1, 2)	I_Q	$V_{EN} \geq 1.6V$, no load	$+25^{\circ}C$		75		μA
		$V_{EN} \geq 1.6V$, $I_{OUT} = 100\mu A$	$+25^{\circ}C$		75		
		$V_{EN} \geq 1.6V$, $I_{OUT} = 50mA$	$+25^{\circ}C$		220		
		$V_{EN} \geq 1.6V$, $I_{OUT} = 500mA$	$+25^{\circ}C$		1320		
		$V_{EN} \geq 1.6V$, $I_{OUT} = 800mA$	$+25^{\circ}C$		1950		
Ground Pin Quiescent Current ⁽²⁾	$I_{Q(GND)}$	$V_{EN} \leq 0.4V$ (Shutdown)	$+25^{\circ}C$		1.2		μA
Current Limit	I_{LIM}	$V_{OUT} = 90\%V_{OUT(NOM)}$	$+25^{\circ}C$		1100		mA
Dropout Voltage ⁽³⁾	V_{DROP}	$I_{OUT} = 50mA$	$+25^{\circ}C$		30		mV
		$I_{OUT} = 200mA$	$+25^{\circ}C$		120		
		$I_{OUT} = 500mA$	$+25^{\circ}C$		300		
		$I_{OUT} = 800mA$	$+25^{\circ}C$		480		
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	$V_{IN} = V_{OUT(NOM)} + 1.0V$ to $20V$	$+25^{\circ}C$		0.009		%/V
Load Regulation	ΔV_{OUT}	$I_{OUT} = 100\mu A$ to $800mA$	$+25^{\circ}C$		0.08		%
Power Supply Rejection Ratio	PSRR	$f = 1kHz$, $V_{OUT} = 2.5V$, $I_{OUT} = 50mA$	$+25^{\circ}C$		75		dB
Output Voltage Noise ⁽⁴⁾	e_n	$V_{OUT} = 2.5V$, $I_{OUT} = 50mA$, $C_{OUT} = 2.2\mu F$, $C_{BYP} = 0\mu F$	$+25^{\circ}C$		500		nV/ $\sqrt{Hz}$
Output Voltage Temperature Coefficient ⁽⁵⁾	$\frac{\Delta V_{OUT}}{\Delta T_A \times V_{OUT}}$		Full		40		ppm/ $^{\circ}C$
Enable Input Logic-Low Voltage	V_{ENL}	$V_{EN} = \text{Logic Low (Regulator Shutdown)}$	$+25^{\circ}C$			0.4	V
		$V_{EN} = \text{Logic High (Regulator Enabled)}$	$+25^{\circ}C$	1.6			
Enable Input Current	I_{ENL}	$V_{ENL} \leq 0.4V$	$+25^{\circ}C$		1		μA
	I_{ENH}	$V_{ENH} \geq 1.6V$	$+25^{\circ}C$		1		
Voltage Reference	V_{REF}		$+25^{\circ}C$		1.2		V

NOTES:

1. Ground pin current is the regulator quiescent current plus pass transistor base current. The total current drawn from the supply is the sum of the load current plus the ground pin current.
2. V_{EN} is the voltage externally applied to devices with the EN (enable) input pin (SOIC-8, TDFN-3×3-8L and TO-263-5B packages only).
3. Dropout voltage is characterized when V_{OUT} falls 5% below $V_{OUT(NOM)}$.
4. C_{BYP} is an optional, external bypass capacitor connected to devices with a BYP (bypass) pin (SOIC-8, TDFN-3×3-8L and TO-263-5B packages only).
5. Output voltage temperature coefficient is defined as the worst-case voltage change divided by the total temperature range.

TYPICAL PERFORMANCE CHARACTERISTICS

T_A = +25°C, C_{OUT} = 2.2μF, I_{OUT} = 100μA, unless otherwise noted.



FUNCTIONAL BLOCK DIAGRAMS

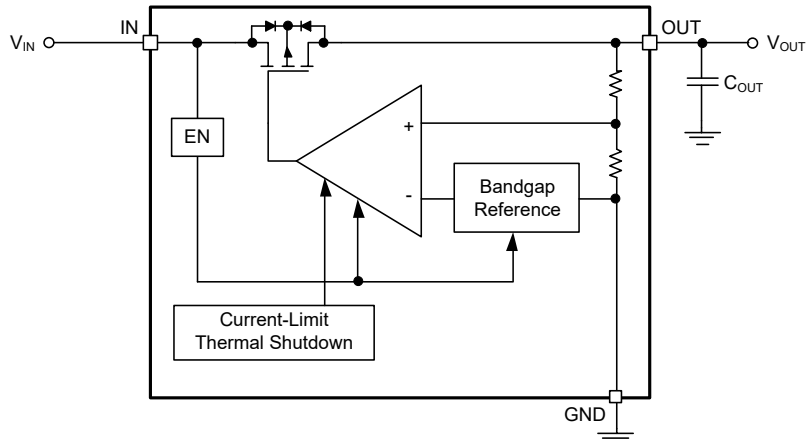


Figure 3. Low Noise Fixed Regulator (SOT-89-3 and SOT-223-3 Versions)

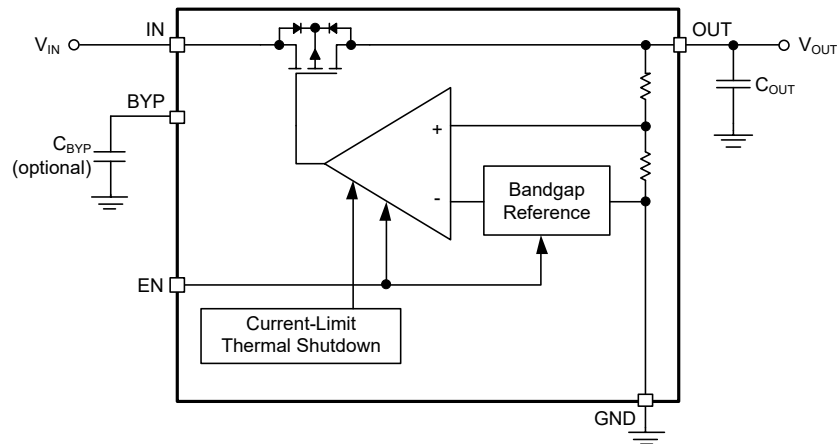


Figure 4. Ultra Low Noise Fixed Regulator (SOIC-8 and TO-263-5B Versions)

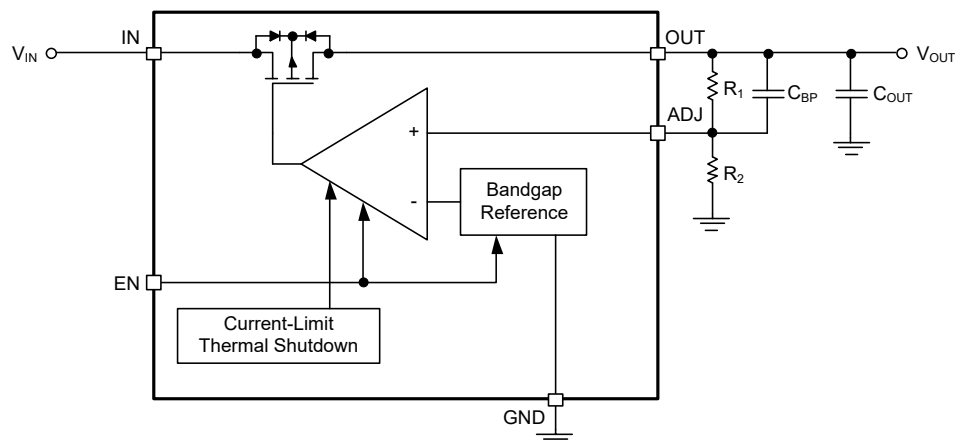


Figure 5. Ultra Low Noise Adjustable Regulator (SOIC-8, TDFN-3x3-8L and TO-263-5B Versions)

APPLICATION INFORMATION

Enable Shutdown

Enable is not available on devices in the SOT-89-3 and SOT-223-3 packages.

Forcing EN (enable/shutdown) high ($> 1.6\text{V}$) enables the regulator. EN is compatible with CMOS logic. If the enable/shutdown feature is not required, connect EN to IN (supply input).

Input Capacitor (C_{IN})

A $1\mu\text{F}$ capacitor should be placed from IN to GND if there is more than 10 inches of wire between the input and the AC filter capacitor or if a battery is used as the input.

Output Capacitor (C_{OUT})

An output capacitor is required between OUT and GND to prevent oscillation. The minimum size of the output capacitor is $1\mu\text{F}$. Larger values improve the regulator's transient response.

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

No-Load Stability

The SGM2205 will remain stable and in regulation with no load (other than the internal voltage divider) unlike many other voltage regulators. This is especially important in CMOS RAM keep-alive applications.

Reference Bypass Capacitor (C_{BYP})

BYP (reference bypass) is available only on devices in SOIC-8 and TO-263-5B packages.

BYP is connected to the internal voltage reference. A 10nF capacitor connected from BYP to GND quiets this reference, providing a significant reduction in output noise (ultra low noise performance).

The start-up speed of the SGM2205 is inversely proportional to the size of the reference bypass capacitor.

Applications requiring a slow ramp-up of output voltage should consider larger values of C_{BYP} . Likewise, if rapid turn-on is necessary, consider omitting C_{BYP} .

If output noise is not critical, omit C_{BYP} and leave BYP open.

Low Voltage Operation

The SGM2205-1.8 requires special consideration when used in voltage-sensitive systems. They may momentarily overshoot their nominal output voltages unless appropriate output and bypass capacitor values are chosen.

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

Selecting larger output and bypass capacitors allows additional time for the error amplifier and reference to turn-on and prevent overshoot.

To ensure that no overshoot is present when starting up into a light load ($100\mu\text{A}$), use a $4.7\mu\text{F}$ output capacitance and 10nF bypass capacitance. This slows the turn-on enough to allow the regulator to react and keep the output voltage from exceeding its nominal value. At heavier loads, use a $10\mu\text{F}$ output capacitance and 10nF bypass capacitance. Lower values of output and bypass capacitance can be used, depending on the sensitivity of the system.

Applications that can withstand some overshoot on the output of the regulator can reduce the output capacitor and/or reduce or eliminate the bypass capacitor. Applications those are not sensitive to overshoot due to power-on reset delays can use normal output and bypass capacitor configurations.

Fixed Regulator Circuits

Figure 6 shows a basic SOIC-8 fixed output voltage regulator circuit. A $1\mu\text{F}$ minimum output capacitor is required for basic fixed output voltage applications.

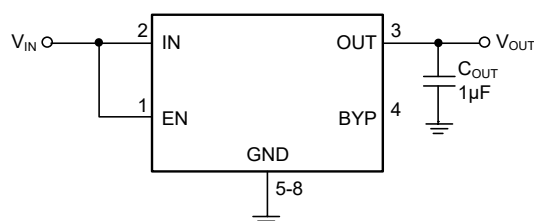


Figure 6. Low Noise Fixed Voltage Regulator

APPLICATION INFORMATION (continued)

Figure 7 includes the optional 10nF noise bypass capacitor between BYP and GND to reduce output noise.

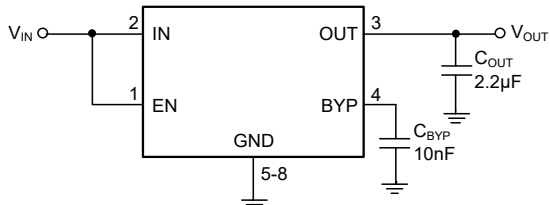


Figure 7. Ultra Low Noise Fixed Voltage Regulator

Adjustable Regulator Circuits

The SGM2205-ADJ can be adjusted to a specific output voltage by using two external resistors as shown in Figure 8. The resistors set the output voltage based on the equation:

$$V_{OUT} = 1.2V \left(1 + \frac{R_1}{R_2} \right) \quad (1)$$

Although ADJ pin is a high-impedance input and for best performance, R_2 should not exceed 470kΩ.

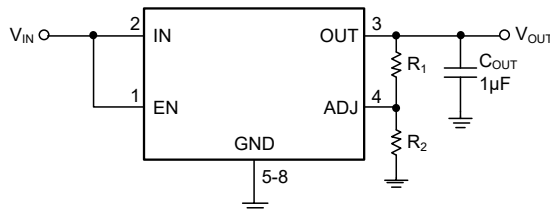


Figure 8. Low Noise Adjustable Voltage Regulator

Figure 9 includes the optional 470pF bypass capacitor from ADJ to OUT to reduce output noise.

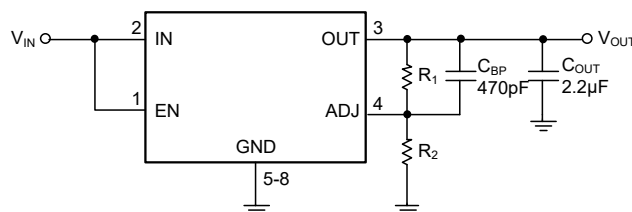
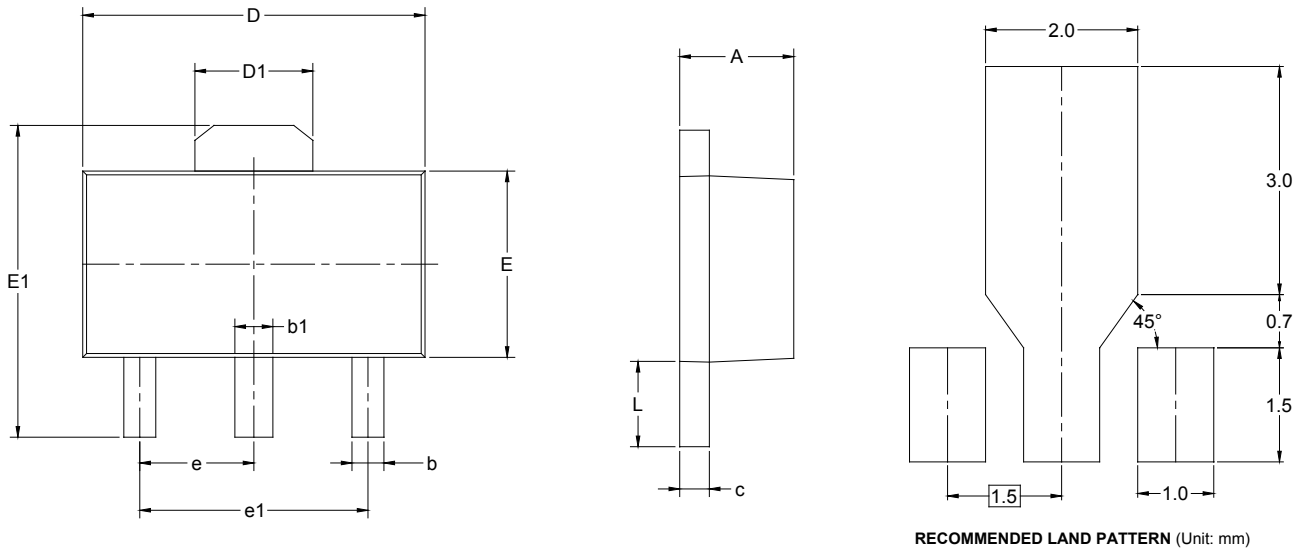


Figure 9. Ultra Low Noise Adjustable Application

PACKAGE OUTLINE DIMENSIONS

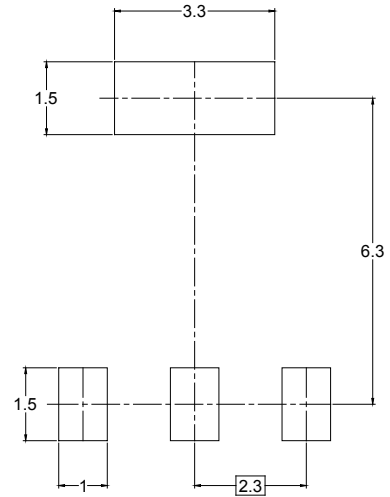
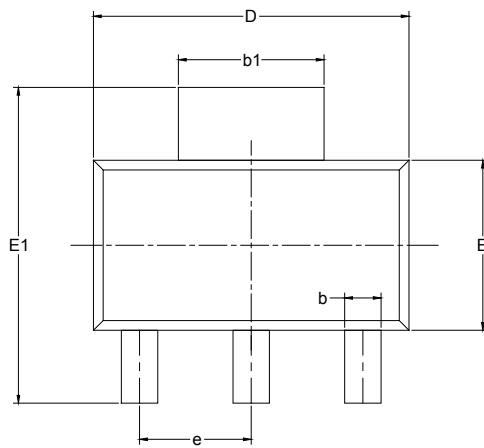
SOT-89-3



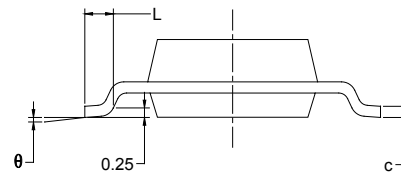
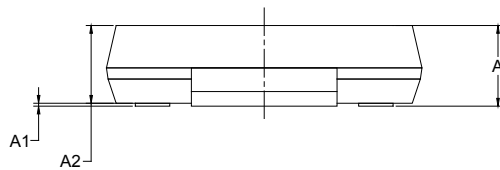
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.400	0.580	0.016	0.023
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550 REF		0.061 REF	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 TYP		0.060 TYP	
e1	3.000 TYP		0.118 TYP	
L	0.900	1.200	0.035	0.047

PACKAGE OUTLINE DIMENSIONS

SOT-223-3



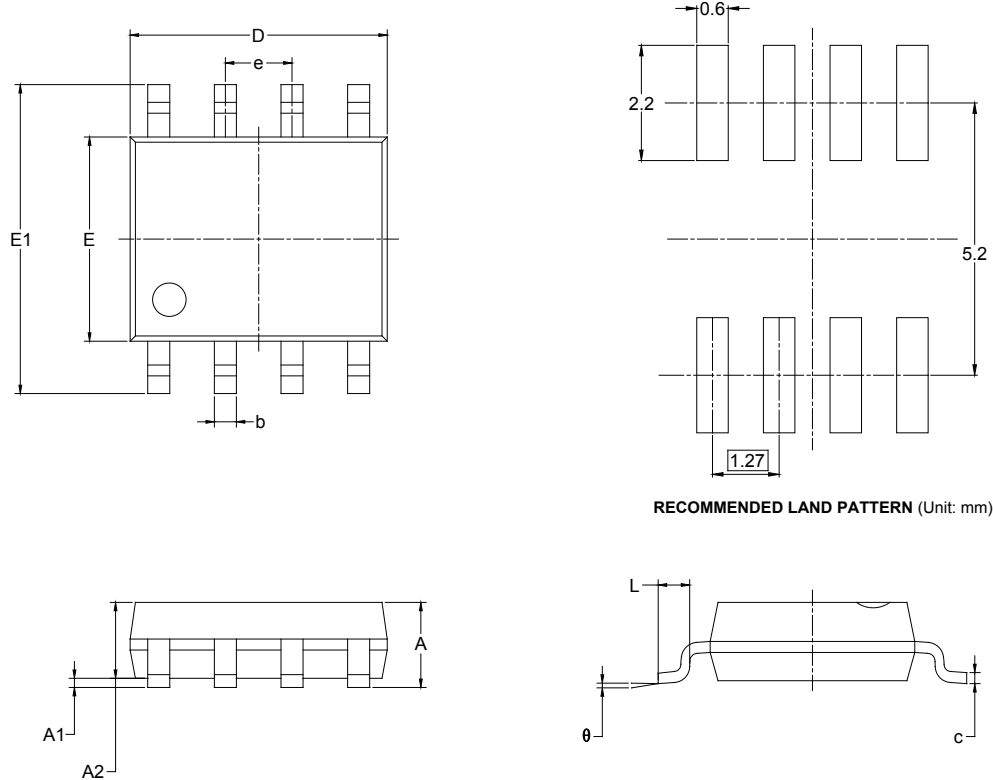
RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A		1.800		0.071
A1	0.020	0.100	0.001	0.004
A2	1.500	1.700	0.059	0.067
b	0.660	0.840	0.026	0.033
b1	2.900	3.100	0.114	0.122
c	0.230	0.350	0.009	0.014
D	6.300	6.700	0.248	0.264
E	3.300	3.700	0.130	0.146
E1	6.700	7.300	0.264	0.287
e	2.300 BSC		0.091 BSC	
L	0.750		0.030	
θ	0°	10°	0°	10°

PACKAGE OUTLINE DIMENSIONS

SOIC-8

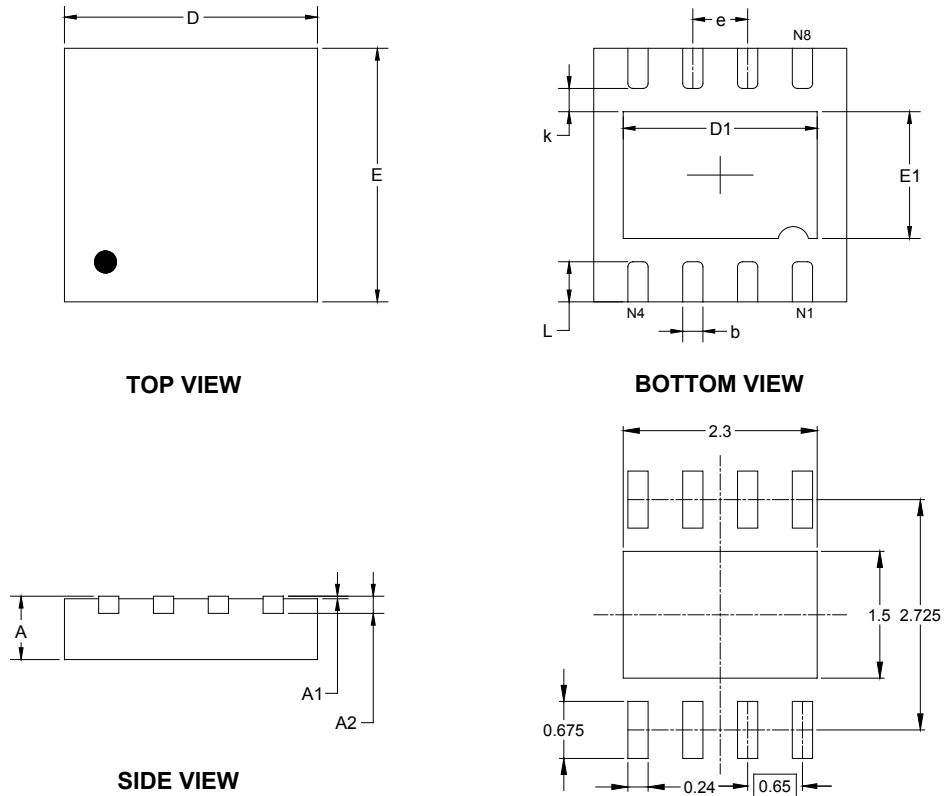


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050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

PACKAGE INFORMATION

PACKAGE OUTLINE DIMENSIONS

TDFN-3×3-8L

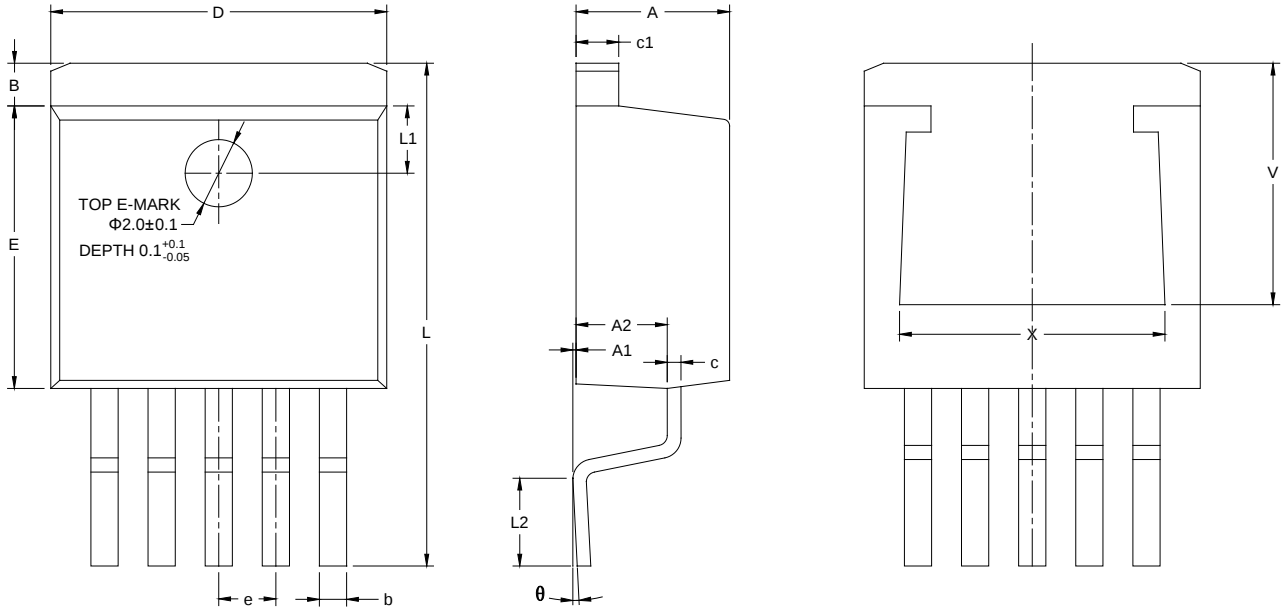


RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203 REF		0.008 REF	
D	2.900	3.100	0.114	0.122
D1	2.200	2.400	0.087	0.094
E	2.900	3.100	0.114	0.122
E1	1.400	1.600	0.055	0.063
k	0.200 MIN		0.008 MIN	
b	0.180	0.300	0.007	0.012
e	0.650 TYP		0.026 TYP	
L	0.375	0.575	0.015	0.023

PACKAGE OUTLINE DIMENSIONS

TO-263-5B

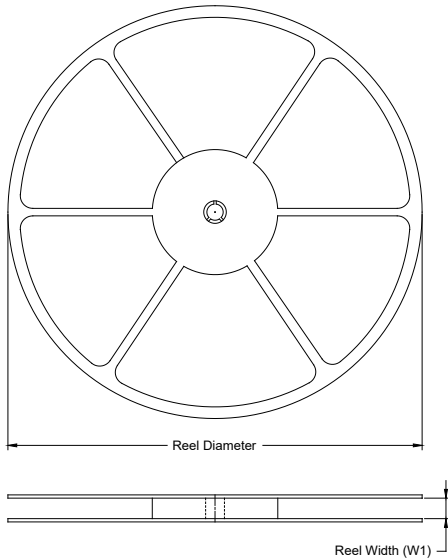


Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A	4.40	4.57	4.70
A1	0	0.10	0.25
A2	2.59	2.69	2.79
b	0.77	-	0.90
c	0.34	-	0.47
c1	1.22	-	1.32
e	1.70 BSC		
D	10.06	10.16	10.26
E	9.05	9.15	9.25
B	1.17	1.27	1.40
V	6.86	-	7.50
X	7.50	-	8.30
L	14.70	15.10	15.50
L1	2.00 REF		
L2	2.00	2.30	2.60
θ	0°	-	8°

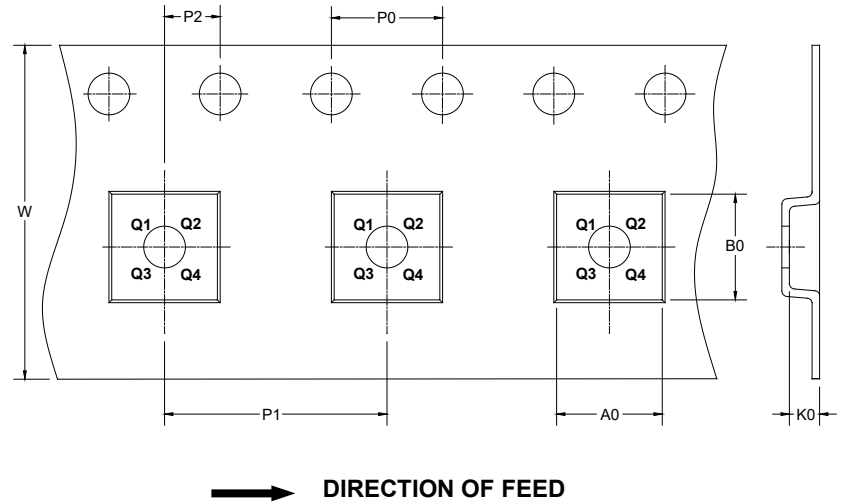
PACKAGE INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS

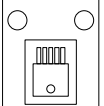


TAPE DIMENSIONS



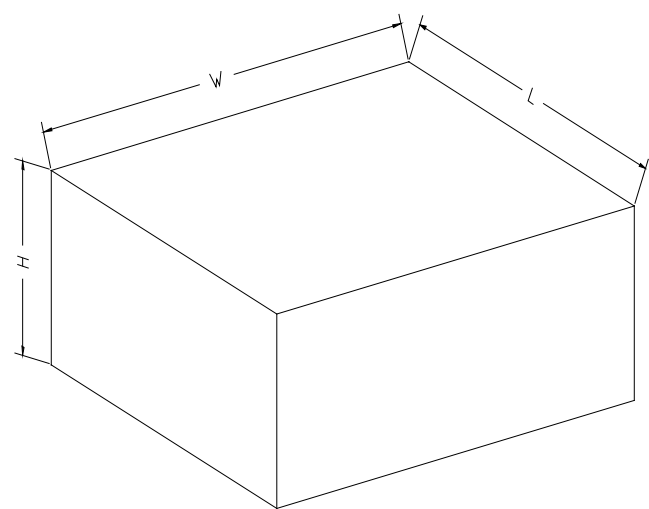
NOTE: The picture is only for reference. Please make the object as the standard.

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
SOT-89-3	7"	13.2	4.85	4.45	1.85	4.0	8.0	2.0	12.0	Q3
SOT-223-3	13"	12.4	6.55	7.25	1.90	4.0	8.0	2.0	12.0	Q3
SOIC-8	13"	12.4	6.40	5.40	2.10	4.0	8.0	2.0	12.0	Q1
TDFN-3×3-8L	13"	12.4	3.35	3.35	1.13	4.0	8.0	2.0	12.0	Q1
TO-263-5B	13"	24.4	10.80	16.30	5.11	4.0	16.0	2.0	24.0	

DD0001

CARTON BOX DIMENSIONS



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

KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
7" (Option)	368	227	224	8
7"	442	410	224	18
13"	386	280	370	5

DD00002