SGM2078
300mA, 1.2V Logic, Low Power and Low Dropout RF Linear Regulator

GENERAL DESCRIPTION

The SGM2078 is a low input voltage, low noise, 1.2V logic supporting and low dropout voltage linear regulator. It is capable of supplying 300mA output current with typical dropout voltage of only 190mV. The operating input voltage range is from 1.6V to 5.5V. The output voltage range is from 0.8V to 3.3V in fixed output versions. For adjustable output version, the output voltage can be adjusted from 0.8V to 5.0V by using external resistors.

Other features include 1.2V logic-controlled shutdown mode, short-circuit current limit and thermal shutdown protection. The SGM2078 has automatic discharge function to quickly discharge V_{OUT} in the disabled status.

The SGM2078 is available in Green XTDFN-1×1-4L, SOT-23-5, SC70-5 and SOT-23-3 packages. It operates over an operating temperature range of -40℃ to +125℃.

FEATURES

- **Operating Input Voltage Range: 1.6V to 5.5V**
- **Enable Pin Accept Voltages Higher than the Supply Voltage and up to 5.5V**
- **Fixed Output from 0.8V to 3.3V**
- **Adjustable Output from 0.8V to 5.0V**
- **300mA Output Current**
- **Low Supply Pin Current: 37μA (TYP)**
- **Low Dropout Voltage:**
  190mV (TYP) at 300mA, V_{OUT} = 3.0V
- **Shutdown Supply Current: 0.75μA (TYP)**
- **Current Limiting and Thermal Protection**
- **Excellent Load and Line Transient Responses**
- **Short Start-Up Time**
- **1.2V Logic Level Enable Control**
- **With Output Automatic Discharge**
- **Stable with Small Case Size Ceramic Capacitors**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in Green XTDFN-1×1-4L, SOT-23-5, SC70-5 and SOT-23-3 Packages**

APPLICATIONS

Modems
Cellular Telephones
PCMCIA Cards
Palmtop Computers
Portable Electronics

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2078-0.8	SOT-23-5	-40℃ to +125℃	SGM2078-0.8XN5G/TR	0OFXX	Tape and Reel, 3000
SGM2078-0.9	SOT-23-5	-40℃ to +125℃	SGM2078-0.9XN5G/TR	17MXX	Tape and Reel, 3000
SGM2078-1.1	SOT-23-5	-40℃ to +125℃	SGM2078-1.1XN5G/TR	0OGXX	Tape and Reel, 3000
SGM2078-1.2	SOT-23-5	-40℃ to +125℃	SGM2078-1.2XN5G/TR	0LOXX	Tape and Reel, 3000
SGM2078-1.5	SOT-23-5	-40℃ to +125℃	SGM2078-1.5XN5G/TR	0LUXX	Tape and Reel, 3000
SGM2078-1.8	SOT-23-5	-40℃ to +125℃	SGM2078-1.8XN5G/TR	0LPXX	Tape and Reel, 3000
SGM2078-2.5	SOT-23-5	-40℃ to +125℃	SGM2078-2.5XN5G/TR	0OHXX	Tape and Reel, 3000
SGM2078-2.8	SOT-23-5	-40℃ to +125℃	SGM2078-2.8XN5G/TR	0J7XX	Tape and Reel, 3000
SGM2078-2.9	SOT-23-5	-40℃ to +125℃	SGM2078-2.9XN5G/TR	0OIXX	Tape and Reel, 3000
SGM2078-3.0	SOT-23-5	-40℃ to +125℃	SGM2078-3.0XN5G/TR	0LTXX	Tape and Reel, 3000
SGM2078-3.3	SOT-23-5	-40℃ to +125℃	SGM2078-3.3XN5G/TR	0E0XX	Tape and Reel, 3000
SGM2078-ADJ	SOT-23-5	-40℃ to +125℃	SGM2078-ADJXN5G/TR	0OJXX	Tape and Reel, 3000
SGM2078-0.8	SC70-5	-40℃ to +125℃	SGM2078-0.8XC5G/TR	0OKXX	Tape and Reel, 3000
SGM2078-0.9	SC70-5	-40℃ to +125℃	SGM2078-0.9XC5G/TR	17LXX	Tape and Reel, 3000
SGM2078-1.1	SC70-5	-40℃ to +125℃	SGM2078-1.1XC5G/TR	0OLXX	Tape and Reel, 3000
SGM2078-1.2	SC70-5	-40℃ to +125℃	SGM2078-1.2XC5G/TR	0LQXX	Tape and Reel, 3000
SGM2078-1.5	SC70-5	-40℃ to +125℃	SGM2078-1.5XC5G/TR	0LVXX	Tape and Reel, 3000
SGM2078-1.8	SC70-5	-40℃ to +125℃	SGM2078-1.8XC5G/TR	0LRXX	Tape and Reel, 3000
SGM2078-2.5	SC70-5	-40℃ to +125℃	SGM2078-2.5XC5G/TR	0OMXX	Tape and Reel, 3000
SGM2078-2.8	SC70-5	-40℃ to +125℃	SGM2078-2.8XC5G/TR	0J6XX	Tape and Reel, 3000
SGM2078-2.9	SC70-5	-40℃ to +125℃	SGM2078-2.9XC5G/TR	0ONXX	Tape and Reel, 3000
SGM2078-3.0	SC70-5	-40℃ to +125℃	SGM2078-3.0XC5G/TR	0LSXX	Tape and Reel, 3000
SGM2078-3.3	SC70-5	-40℃ to +125℃	SGM2078-3.3XC5G/TR	0DZXX	Tape and Reel, 3000
SGM2078-ADJ	SC70-5	-40℃ to +125℃	SGM2078-ADJXC5G/TR	0OPXX	Tape and Reel, 3000
SGM2078-0.8	XTDFN-1×1-4L	-40℃ to +125℃	SGM2078-0.8XXDH4G/TR	2R	Tape and Reel, 10000
SGM2078-0.9	XTDFN-1×1-4L	-40℃ to +125℃	SGM2078-0.9XXDH4G/TR	35	Tape and Reel, 10000
SGM2078-1.1	XTDFN-1×1-4L	-40℃ to +125℃	SGM2078-1.1XXDH4G/TR	2S	Tape and Reel, 10000
SGM2078-1.2	XTDFN-1×1-4L	-40℃ to +125℃	SGM2078-1.2XXDH4G/TR	1W	Tape and Reel, 10000
SGM2078-1.5	XTDFN-1×1-4L	-40℃ to +125℃	SGM2078-1.5XXDH4G/TR	2F	Tape and Reel, 10000
SGM2078-1.8	XTDFN-1×1-4L	-40℃ to +125℃	SGM2078-1.8XXDH4G/TR	1S	Tape and Reel, 10000

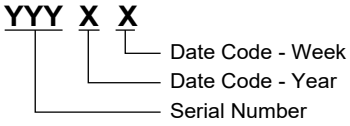
PACKAGE/ORDERING INFORMATION (continued)

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2078-2.5	XTDFN-1×1-4L	-40℃ to +125℃	SGM2078-2.5XXDH4G/TR	2T	Tape and Reel, 10000
SGM2078-2.8	XTDFN-1×1-4L	-40℃ to +125℃	SGM2078-2.8XXDH4G/TR	1T	Tape and Reel, 10000
SGM2078-2.9	XTDFN-1×1-4L	-40℃ to +125℃	SGM2078-2.9XXDH4G/TR	2U	Tape and Reel, 10000
SGM2078-3.0	XTDFN-1×1-4L	-40℃ to +125℃	SGM2078-3.0XXDH4G/TR	1U	Tape and Reel, 10000
SGM2078-3.3	XTDFN-1×1-4L	-40℃ to +125℃	SGM2078-3.3XXDH4G/TR	1V	Tape and Reel, 10000
SGM2078-1.2	SOT-23-3	-40℃ to +125℃	SGM2078-1.2XN3G/TR	3DUXX	Tape and Reel, 3000
SGM2078-1.5	SOT-23-3	-40℃ to +125℃	SGM2078-1.5XN3G/TR	2QKXX	Tape and Reel, 3000
SGM2078-1.8	SOT-23-3	-40℃ to +125℃	SGM2078-1.8XN3G/TR	2QLXX	Tape and Reel, 3000
SGM2078-2.5	SOT-23-3	-40℃ to +125℃	SGM2078-2.5XN3G/TR	3DVXX	Tape and Reel, 3000
SGM2078-2.8	SOT-23-3	-40℃ to +125℃	SGM2078-2.8XN3G/TR	2QNXX	Tape and Reel, 3000
SGM2078-3.3	SOT-23-3	-40℃ to +125℃	SGM2078-3.3XN3G/TR	2QOXX	Tape and Reel, 3000

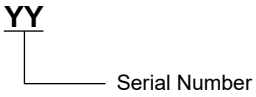
MARKING INFORMATION

NOTE: XX = Date Code.

SOT-23-5/SC70-5/SOT-23-3



XTDFN-1×1-4L



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 6V
OUT, BP/FB to GND .....-0.3V to Min((V_{IN} + 0.3V), 6V)
Package Thermal Resistance
XTDFN-1×1-4L, θ_{JA}..... 187.3℃/W
XTDFN-1×1-4L, θ_{JB}..... 133.2℃/W
XTDFN-1×1-4L, $\theta_{JC\ (TOP)}$..... 150.7℃/W
XTDFN-1×1-4L, $\theta_{JC\ (BOT)}$ ..... 120.1℃/W
SOT-23-5, θ_{JA} ..... 178.2℃/W
SOT-23-5, θ_{JB} ..... 92.6℃/W
SOT-23-5, θ_{JC} ..... 125℃/W
SC70-5, θ_{JA}..... 188℃/W
SC70-5, θ_{JB}..... 55.4℃/W
SC70-5, θ_{JC}..... 103.2℃/W
SOT-23-3, θ_{JA} ..... 210.9℃/W
SOT-23-3, θ_{JB} ..... 73.6℃/W
SOT-23-3, θ_{JC} ..... 89.6℃/W
Junction Temperature .....+150℃
Storage Temperature Range.....-65℃ to +150℃
Lead Temperature (Soldering, 10s) .....+260℃
ESD Susceptibility
HBM.....±5000V
CDM .....±1000V

RECOMMENDED OPERATING CONDITIONS

Operating Input Voltage Range .....1.6V to 5.5V
Enable Input Voltage Range .....0V to 5.5V
Input Effective Capacitance, C_{IN} ..... 0.5μF (MIN)
Output Effective Capacitance, C_{OUT}.....0.5μF to 10μF
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

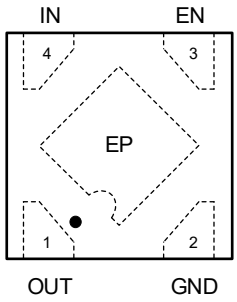
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance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

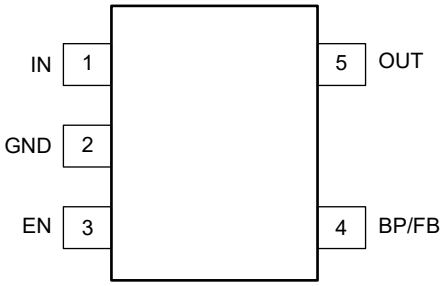
PIN CONFIGURATIONS

(TOP VIEW)



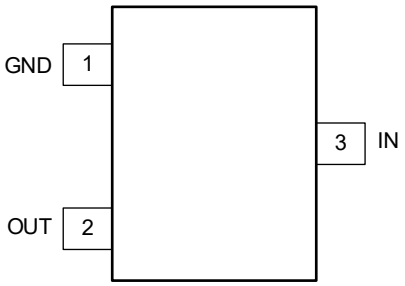
XTDFN-1×1-4L

(TOP VIEW)



SOT-23-5/SC70-5

(TOP VIEW)



SOT-23-3

PIN DESCRIPTION

PIN			NAME	FUNCTION
XTDFN-1×1-4L	SOT-23-5/ SC70-5	SOT-23-3		
1	5	2	OUT	Regulator Output Pin. It is recommended to use a ceramic capacitor with effective capacitance in the range of 0.5μF to 10μF to ensure stability. This ceramic capacitor should be placed as close as possible to OUT pin.
2	2	1	GND	Ground.
3	3	–	EN	Enable Pin. Drive EN high to turn on the regulator. Drive EN low to turn off the regulator. This pin must be pulled high by an external resistor connected to IN pin if EN pin is not used.
4	1	3	IN	Input Voltage Supply 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.
–	4	–	BP	Reference-Noise Bypass Pin (fixed voltage version only). Bypass with an external capacitor C_{BP} can reduce output noise. The capacitor is recommended to be placed very close to the pin for high PSRR.
			FB	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.
Exposed Pad	–	–	–	Exposed Pad. Connect it to a large ground plane to maximize thermal performance. This pad is not an electrical connection point.

FUNCTIONAL BLOCK DIAGRAMS

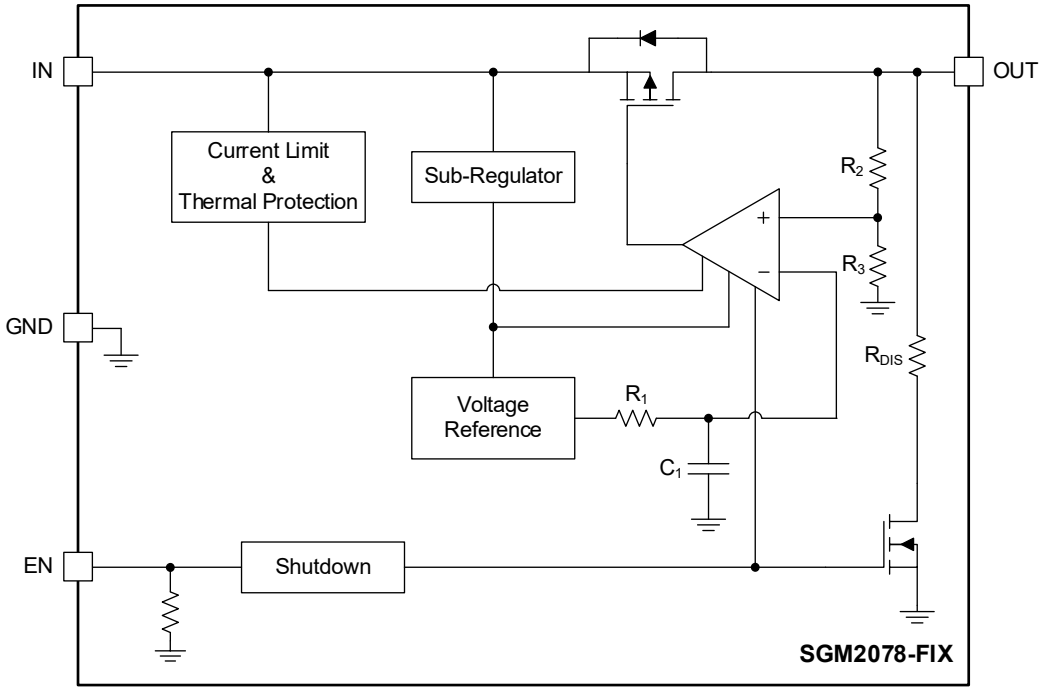


Figure 1. Internal Block Diagram of Fixed Output Voltage (XTDFN-1×1-4L Version)

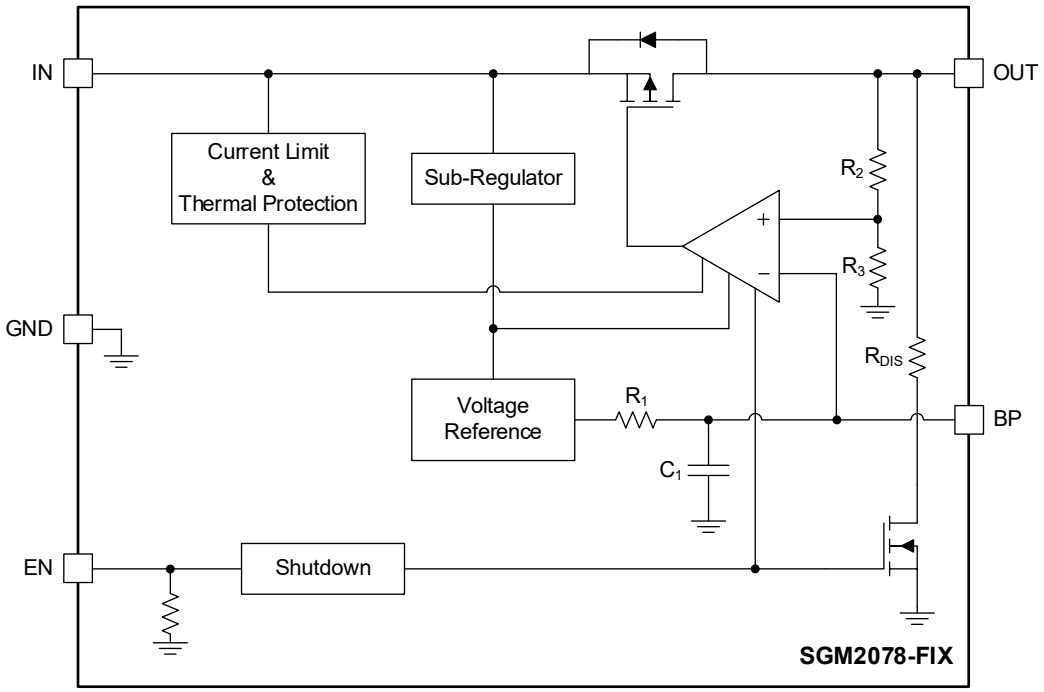


Figure 2. Internal Block Diagram of Fixed Output Voltage (SOT-23-5 and SC70-5 Versions)

FUNCTIONAL BLOCK DIAGRAMS (continued)

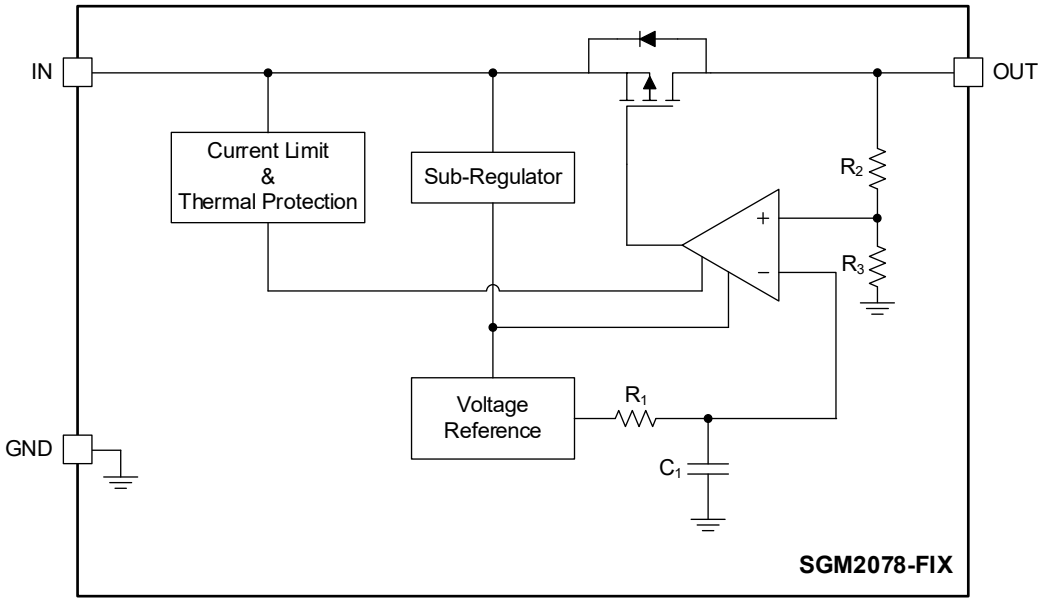


Figure 3. Internal Block Diagram of Fixed Output Voltage (SOT-23-3 Version)

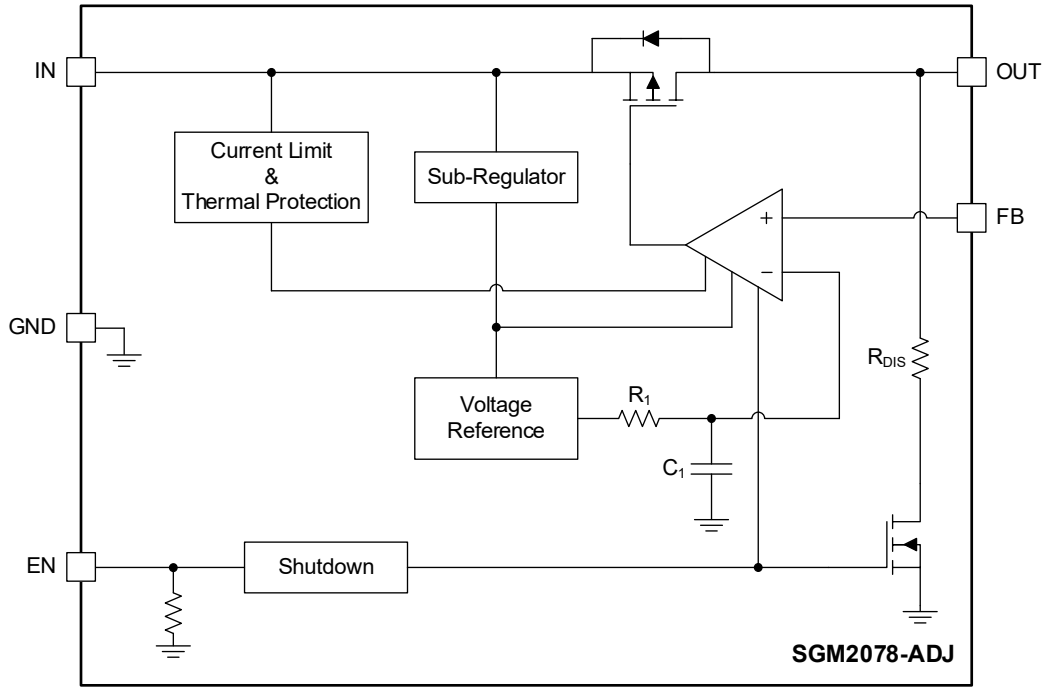


Figure 4. Internal Block Diagram of Adjustable Output Voltage (SOT-23-5, SC70-5 Versions)

ELECTRICAL CHARACTERISTICS

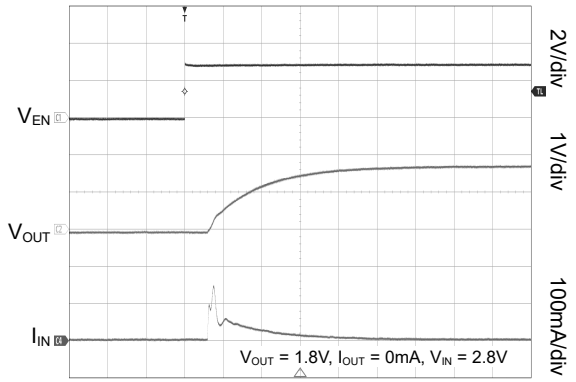
(V_{IN} = ($V_{OUT(NOM)}$ + 0.5V) or 2.5V (whichever is greater), V_{EN} = V_{IN}, T_J = -40℃ to +125℃, typical values are at T_J = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Input Voltage Range	V_{IN}			1.6		5.5	V
Output Voltage Accuracy	V_{OUT}	I_{OUT} = 1mA	T_J = +25℃	-2.5		2.5	%
			T_J = -40℃ to +125℃	-3		3	
Feedback Voltage	V_{ADJ}	I_{OUT} = 1mA, SGM2078-ADJ	T_J = +25℃	0.78	0.8	0.82	V
			T_J = -40℃ to +125℃	0.776		0.824	
FB Pin Leakage Current	I_{ADJ}	V_{FB} = 0.9V			1	100	nA
Under-Voltage Lockout Thresholds	V_{UVLO}	V_{IN} rising			1.5	1.6	V
		V_{IN} falling			1.3		
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	V_{IN} = 1.6V or ($V_{OUT(NOM)}$ + 0.5V) to 5.5V, I_{OUT} = 1mA, T_J = +25℃			0.04	0.1	%/V
Load Regulation	ΔV_{OUT}	I_{OUT} = 1mA to 300mA, T_J = +25℃			30	45	mV
		I_{OUT} = 1mA to 300mA, SGM2078-ADJ, T_J = +25℃			3	10	
Dropout Voltage	V_{DROP}	V_{OUT} = $V_{OUT(NOM)}$ - 100mV, I_{OUT} = 300mA, T_J = +25℃	$V_{OUT(NOM)}$ = 0.8V		880	1200	mV
			$V_{OUT(NOM)}$ = 0.9V		780	1100	
			1.0V ≤ $V_{OUT(NOM)}$ < 1.1V		690	1000	
			1.1V ≤ $V_{OUT(NOM)}$ < 1.2V		640	900	
			1.2V ≤ $V_{OUT(NOM)}$ < 1.5V		560	800	
			1.5V ≤ $V_{OUT(NOM)}$ < 1.8V		390	550	
			1.8V ≤ $V_{OUT(NOM)}$ < 2.1V		320	420	
			2.1V ≤ $V_{OUT(NOM)}$ < 2.5V		260	340	
			2.5V ≤ $V_{OUT(NOM)}$ < 3.0V		215	280	
			3.0V ≤ $V_{OUT(NOM)}$ ≤ 5.0V		190	250	
Output Current Limit	I_{LIMIT}			350	800		mA
Short-Circuit Current	I_{SHORT}	V_{OUT} = 0V			380		mA
Supply Pin Current	I_Q	No load, T_J = +25℃			37	55	μA
Shutdown Supply Current	I_{SHDN}	V_{EN} = 0V			0.75	2.5	μA
EN Pin High-Level Input Voltage	V_{IH}	V_{IN} = 1.6V to 5.5V		0.71		5.5	V
EN Pin Low-Level Input Voltage	V_{IL}	V_{IN} = 1.6V to 5.5V		0		0.46	
EN Input Bias Current	I_{BH}	V_{EN} = 5.5V			0.8	1.5	μA
	I_{BL}	V_{EN} = 0V			0.01	1	
Output Discharge Resistance	R_{DIS}	V_{EN} = 0V, V_{IN} = 4V, V_{OUT} = 0.3V			75		Ω
Start-Up Time	t_{STR}	C_{OUT} = 1μF, I_{OUT} = 1mA, $V_{OUT(NOM)}$ = 1.8V, from assertion of V_{EN} to V_{OUT} = 90% × $V_{OUT(NOM)}$			100		μs
Power Supply Rejection Ratio	PSRR	C_{BP} = 0nF, C_{OUT} = 1μF, I_{OUT} = 30mA, V_{IN} = 2.8V, $V_{OUT(NOM)}$ = 1.8V, ΔV_{RIPPLE} = 0.2V_{P-P}	f = 217Hz		82		dB
			f = 1kHz		76		
		C_{BP} = 10nF, C_{OUT} = 1μF, I_{OUT} = 30mA, V_{IN} = 2.8V, $V_{OUT(NOM)}$ = 1.8V, ΔV_{RIPPLE} = 0.2V_{P-P}	f = 217Hz		92		
			f = 1kHz		86		
Output Voltage Noise	e_n	$V_{OUT(NOM)}$ = 1.8V, f = 10Hz to 100kHz, I_{OUT} = 30mA, C_{OUT} = 1μF	C_{BP} = 0nF		100		μV_{RMS}
			C_{BP} = 10nF		60		
Thermal Shutdown Temperature	T_{SHDN}	T_J rising			160		℃
Thermal Shutdown Hysteresis	ΔT_{SHDN}	Hysteresis			20		℃

TYPICAL PERFORMANCE CHARACTERISTICS

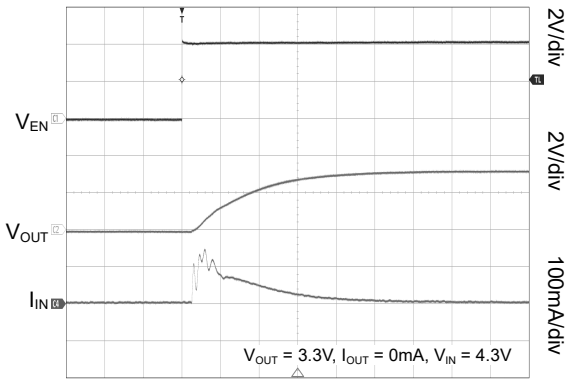
T_J = +25℃, V_{IN} = ($V_{OUT(NOM)}$ + 0.5V) or 2.5V (whichever is greater), V_{EN} = V_{IN}, C_{IN} = C_{OUT} = 1μF, C_{BP} = 0nF, unless otherwise noted.

Turn On Speed with EN Pin



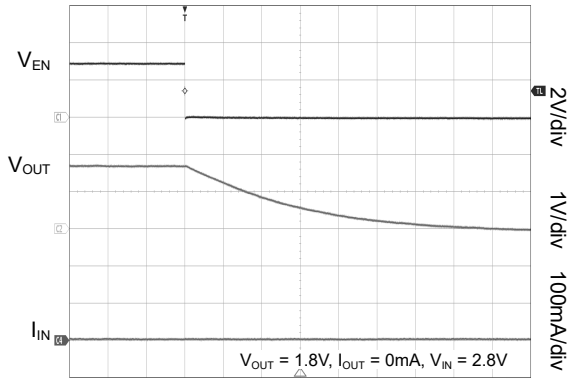
Time (20μs/div)

Turn On Speed with EN Pin



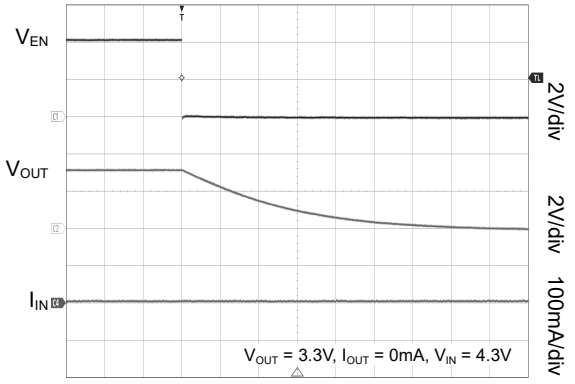
Time (20μs/div)

Turn Off Speed with EN Pin



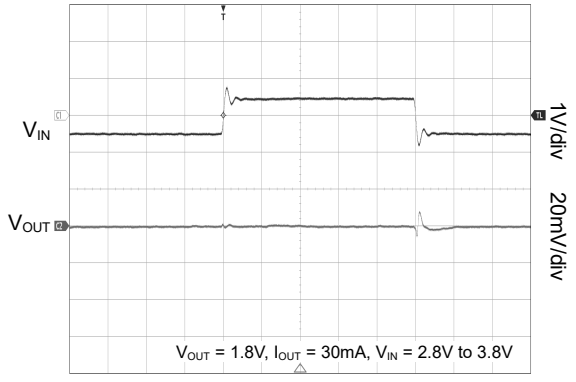
Time (40μs/div)

Turn Off Speed with EN Pin



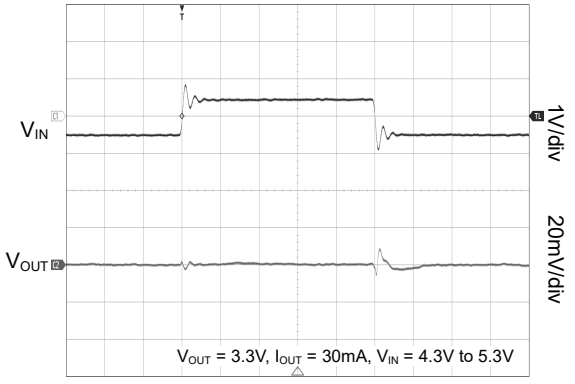
Time (40μs/div)

Line Transient Response



Time (40μs/div)

Line Transient Response

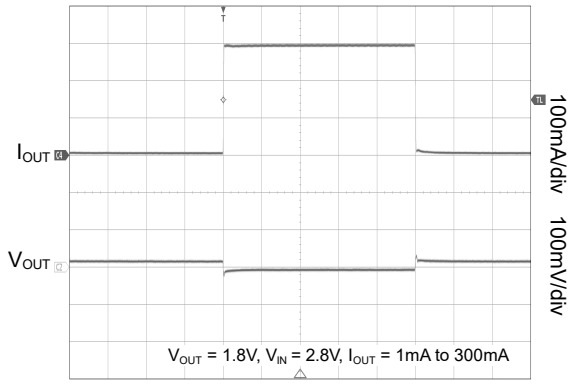


Time (40μs/div)

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

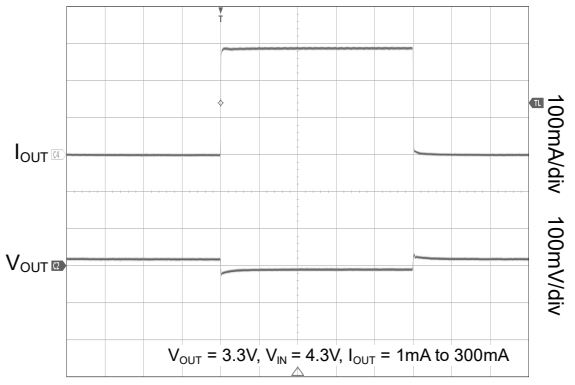
T_J = +25℃, V_{IN} = ($V_{OUT(NOM)}$ + 0.5V) or 2.5V (whichever is greater), V_{EN} = V_{IN}, C_{IN} = C_{OUT} = 1μF, C_{BP} = 0nF, unless otherwise noted.

Load Transient Response



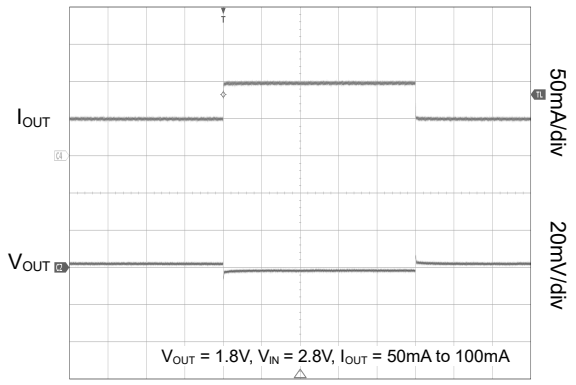
Time (100μs/div)

Load Transient Response



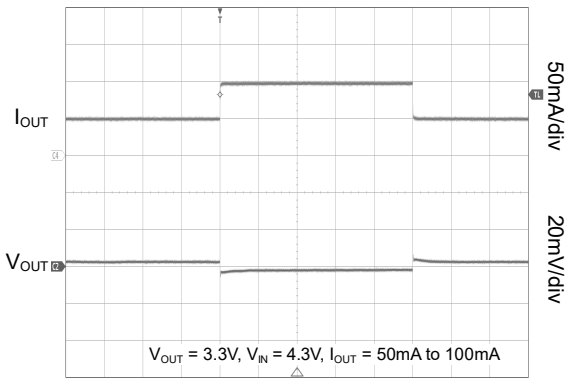
Time (100μs/div)

Load Transient Response



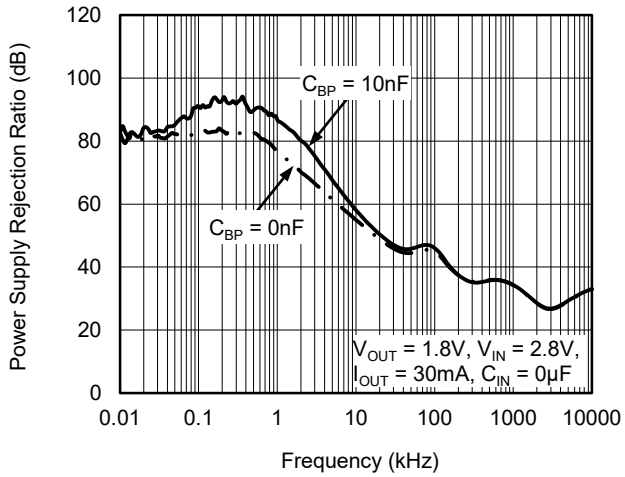
Time (100μs/div)

Load Transient Response

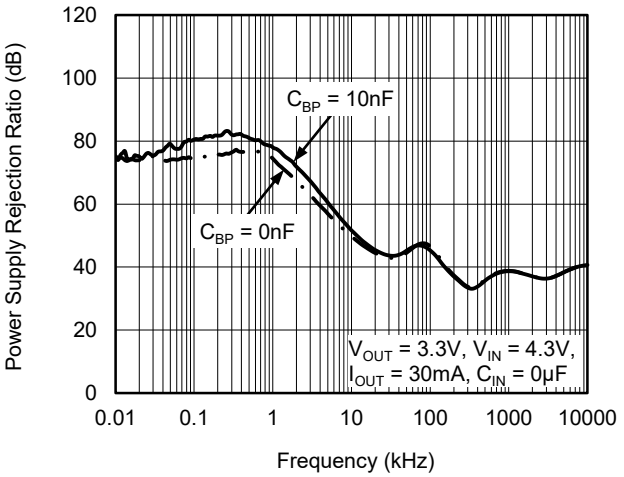


Time (100μs/div)

Power Supply Rejection Ratio vs. Frequency



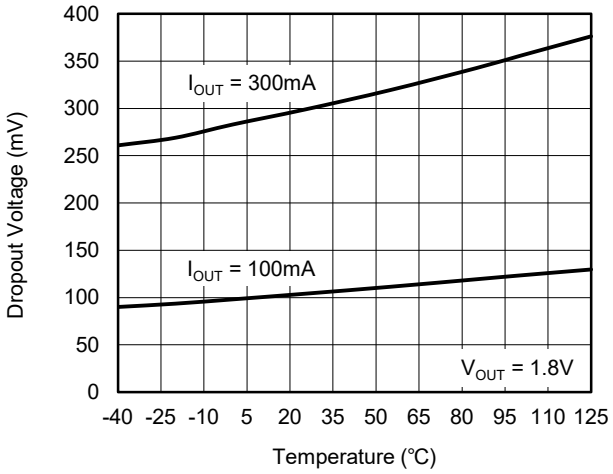
Power Supply Rejection Ratio vs. Frequency



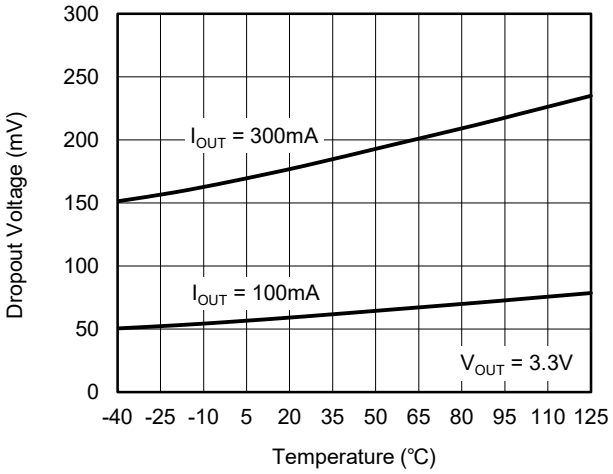
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_J = +25℃, V_{IN} = ($V_{OUT(NOM)}$ + 0.5V) or 2.5V (whichever is greater), V_{EN} = V_{IN}, C_{IN} = C_{OUT} = 1μF, C_{BP} = 0nF, unless otherwise noted.

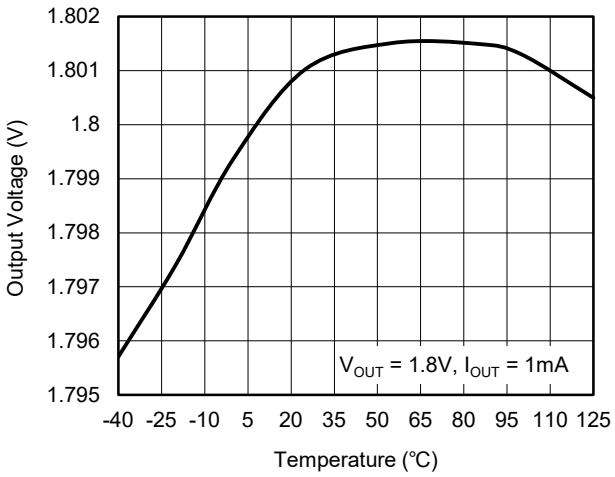
Dropout Voltage vs. Temperature



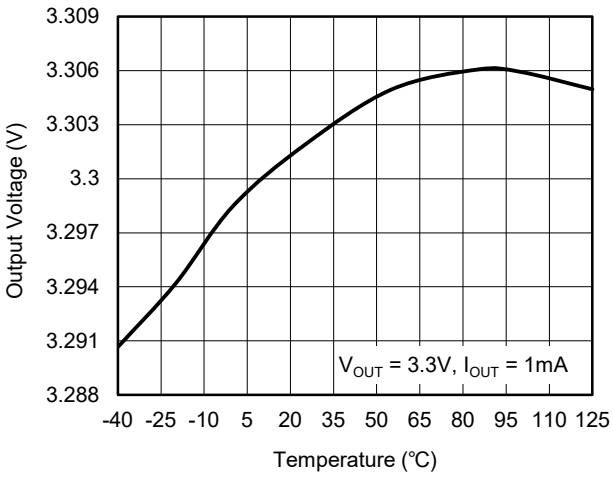
Dropout Voltage vs. Temperature



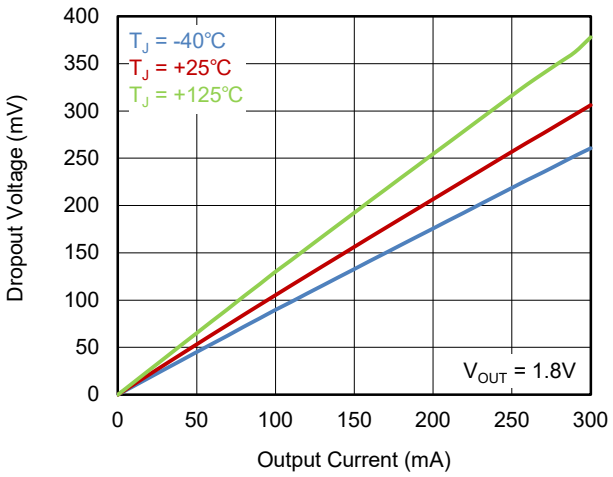
Output Voltage vs. Temperature



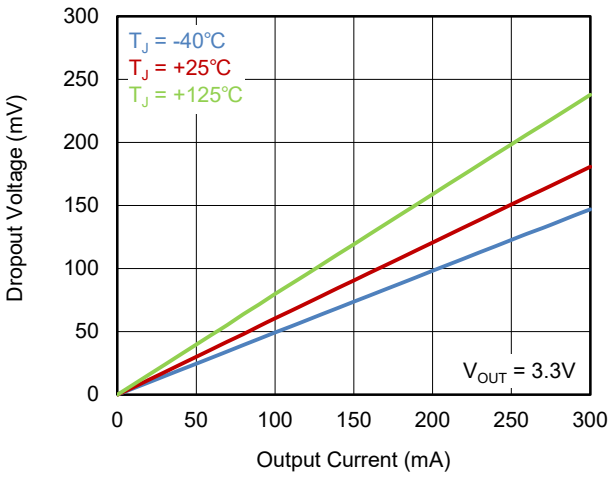
Output Voltage vs. Temperature



Dropout Voltage vs. Output Current



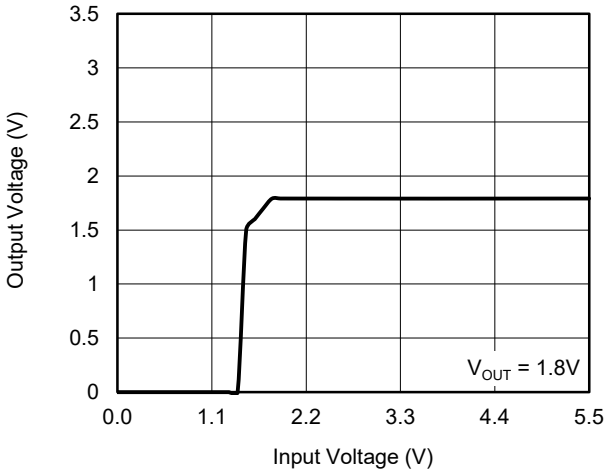
Dropout Voltage vs. Output Current



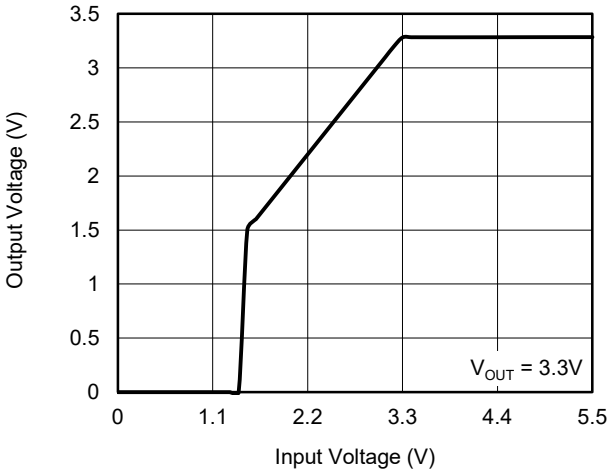
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_J = +25℃, V_{IN} = ($V_{OUT(NOM)}$ + 0.5V) or 2.5V (whichever is greater), V_{EN} = V_{IN}, C_{IN} = C_{OUT} = 1μF, C_{BP} = 0nF, unless otherwise noted.

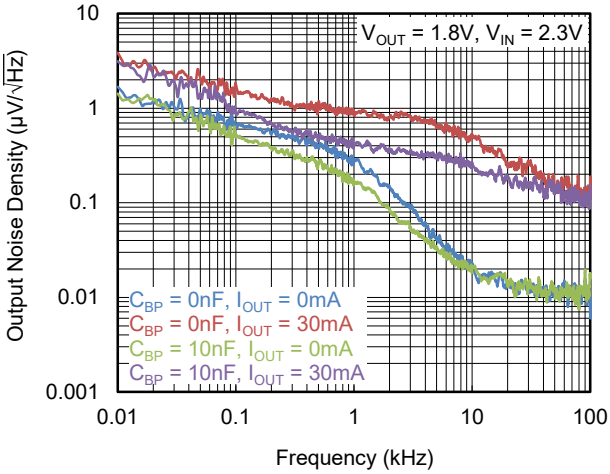
Output Voltage vs. Input Voltage



Output Voltage vs. Input Voltage



Output Noise Density vs. Frequency



TYPICAL APPLICATION CIRCUITS

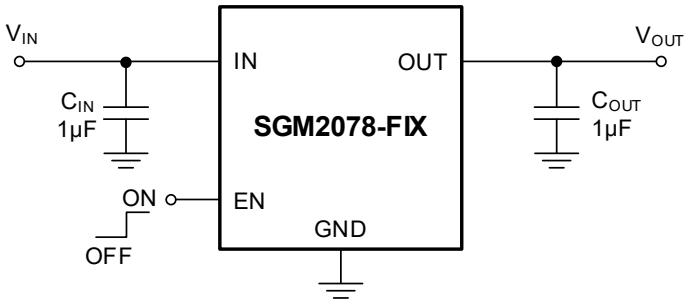


Figure 5. Fixed Output Version (XTDFN-1×1-4L)

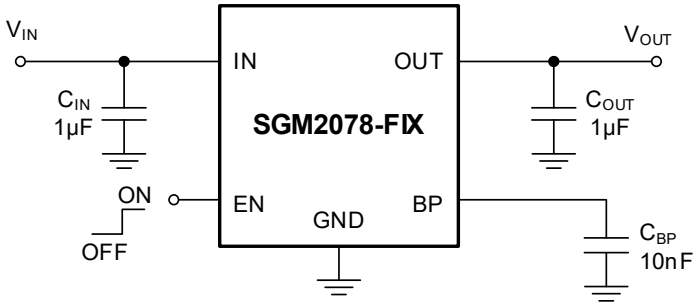


Figure 6. Fixed Output Version (SOT-23-5/SC70-5)

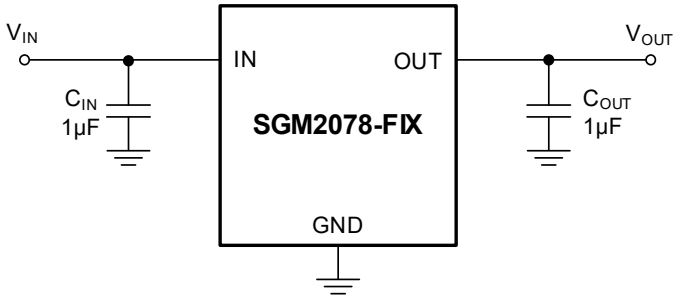
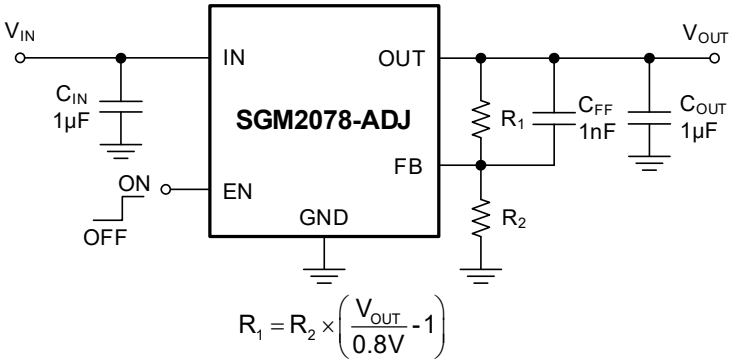


Figure 7. Fixed Output Version (SOT-23-3)



$$R_1 = R_2 \times \left(\frac{V_{OUT}}{0.8V} - 1 \right)$$

Figure 8. Adjustable Output Version (SOT-23-5/SC70-5)

APPLICATION INFORMATION

The SGM2078 is a low input voltage, low noise 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 SGM2078 useful in a variety of applications. The SGM2078 provides the protection functions for output overload, output short-circuit condition and overheating.

The SGM2078 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 0.75μA (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. 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})

The output capacitor should be placed as close as possible to the OUT pin. 1μF or larger X7R or X5R ceramic capacitor is selected to get good dynamic performance. The minimum effective capacitance of C_{OUT} that SGM2078 can remain stable is 0.5μF. 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. 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 SGM2078-ADJ can be adjusted from 0.8V to 5.0V. The FB pin will be connected with two external resistors as shown in Figure 9. The output voltage is determined by the following equation:

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

where:

V_{OUT} is output voltage and V_{ADJ} is the internal voltage reference, V_{ADJ} = 0.8V.

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. Use R_2 = 160kΩ to maintain a 5μA minimum load.

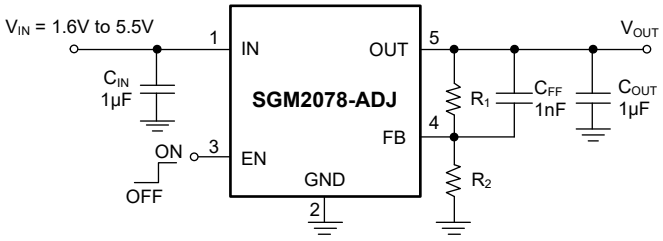


Figure 9. Adjustable Output Voltage Application

Enable Operation

The EN pin of the SGM2078 is used to enable/disable its device and to deactivate/activate the output automatic discharge function.

When the EN pin voltage is lower than 0.46V, 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 75Ω (TYP) resistor.

When the EN pin voltage is higher than 0.71V, the device is in active state. The output voltage is regulated to the expected value and the automatic discharge transistor is turned off.

The EN pin is pulled down by an internal pull-down resistor when the EN pin is floated. This current source will ensure the SGM2078 in shutdown state and reduce the power dissipation in system.

APPLICATION INFORMATION (continued)

Reverse Current Protection

The power transistor has an inherent body diode. This body diode will be forward biased when V_{OUT} > (V_{IN} + 0.3V). When V_{OUT} > (V_{IN} + 0.3V), the reverse current flowing from the OUT pin to the IN pin will damage the SGM2078. If V_{OUT} > (V_{IN} + 0.3V) event would happen in system, one external Schottky diode will be added between OUT pin and IN pin in circuit design to protect the SGM2078.

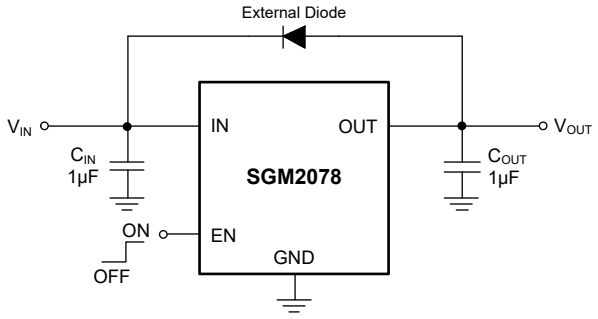


Figure 10. Reverse Protection Reference Design

Negatively Biased Output

When the output voltage is negative, the chip may not start up due to parasitic effects. Ensure that the output is greater than -0.3V under all conditions. If negatively biased output is excessive and expected in the application, a Schottky diode can be added between the OUT pin and GND pin.

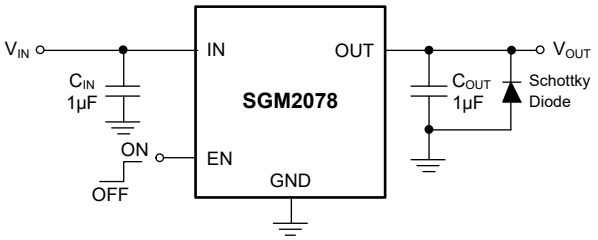


Figure 11. Negatively Biased Output Application

Output Current Limit Protection

When overload events happen, the output current is internally limited to 800mA (TYP). When the OUT pin is shorted to ground, the output current is internally limited to 380mA (TYP).

Thermal Shutdown

When the die temperature exceeds the threshold value of thermal shutdown, the SGM2078 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 SGM2078 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 SGM2078 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:

$$P_{D(MAX)} = (T_{J(MAX)} - T_A)/\theta_{JA} \quad (2)$$

REVISION HISTORY

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

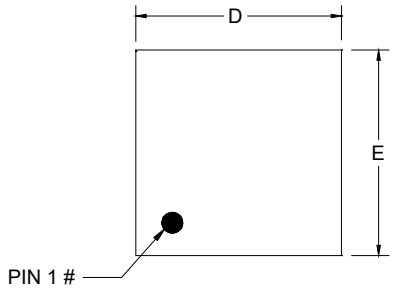
JUNE 2026 – REV.A.1 to REV.A.2	Page
Added SOT-23-3 Package	All

JULY 2024 – REV.A to REV.A.1	Page
Updated Package/Ordering Information section	2, 3

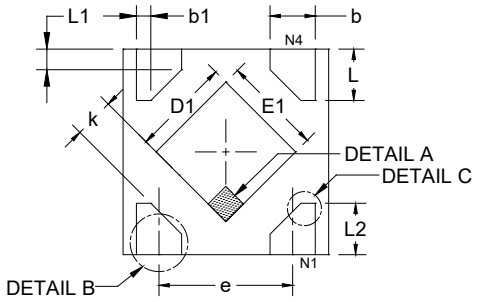
Changes from Original (OCTOBER 2023) to REV.A	Page
Changed from product preview to production data	All

PACKAGE OUTLINE DIMENSIONS

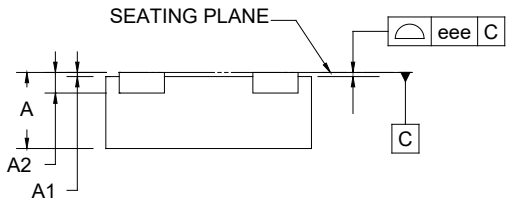
XTDFN-1×1-4L



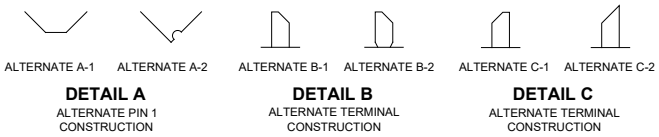
TOP VIEW



BOTTOM VIEW



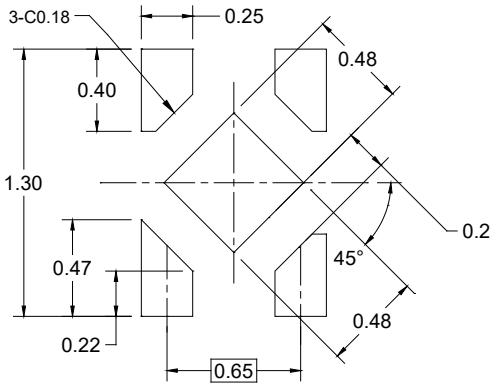
SIDE VIEW



DETAIL A
ALTERNATE PIN 1 CONSTRUCTION

DETAIL B
ALTERNATE TERMINAL CONSTRUCTION

DETAIL C
ALTERNATE TERMINAL CONSTRUCTION



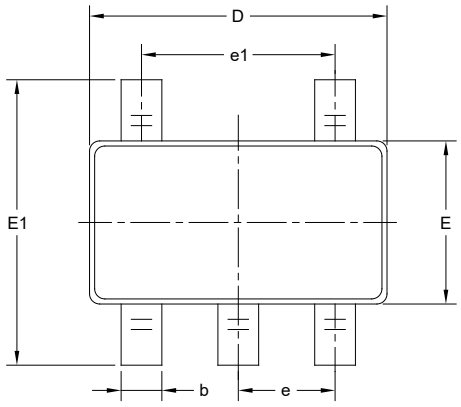
RECOMMENDED LAND PATTERN (Unit: mm)

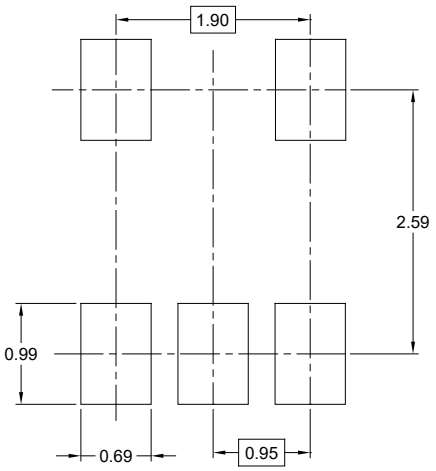
Symbol	Dimensions In Millimeters		
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A	0.340	0.370	0.400
A1	0.000	0.020	0.050
A2		0.100 REF	
b	0.170	-	0.300
b1		0.068 REF	
D	0.950	1.000	1.050
E	0.950	1.000	1.050
D1	0.430	0.480	0.530
E1	0.430	0.480	0.530
L	0.200	0.250	0.300
L1		0.093 REF	
L2	0.200	-	0.370
e		0.650 BSC	
k	0.150	-	-
eee	-	0.050	-

NOTE: This drawing is subject to change without notice.

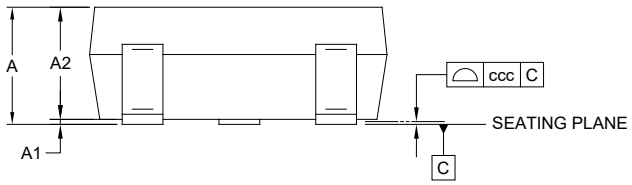
PACKAGE OUTLINE DIMENSIONS

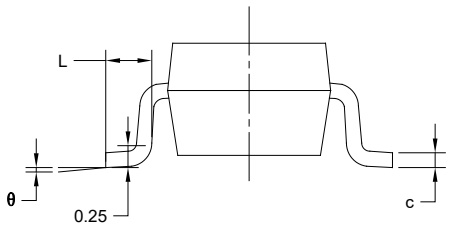
SOT-23-5





RECOMMENDED LAND PATTERN (Unit: mm)



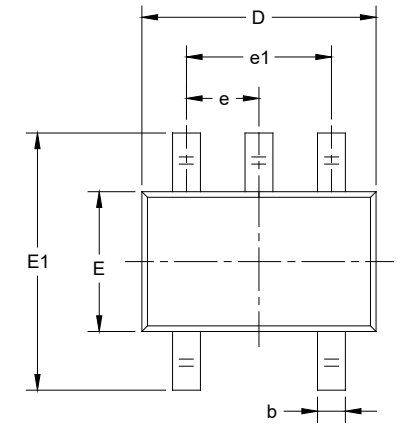


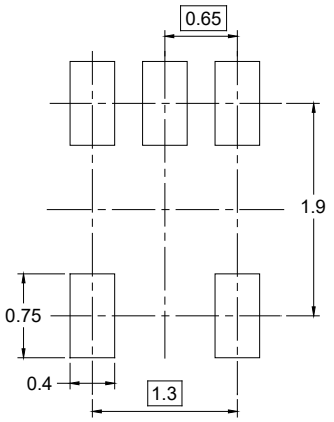
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A1	0.000	-	0.150
A2	0.900	-	1.300
b	0.300	-	0.500
c	0.080	-	0.220
D	2.750	-	3.050
E	1.450	-	1.750
E1	2.600	-	3.000
e	0.950 BSC		
e1	1.900 BSC		
L	0.300	-	0.600
θ	0°	-	8°
ccc	0.100		

NOTES:
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MO-178.

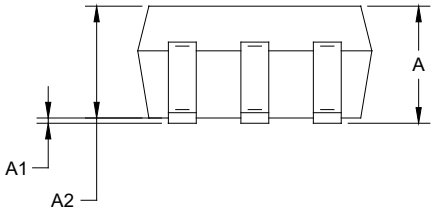
PACKAGE OUTLINE DIMENSIONS

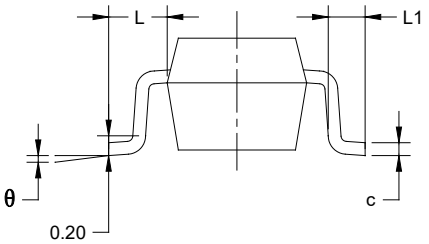
SC70-5





RECOMMENDED LAND PATTERN (Unit: mm)



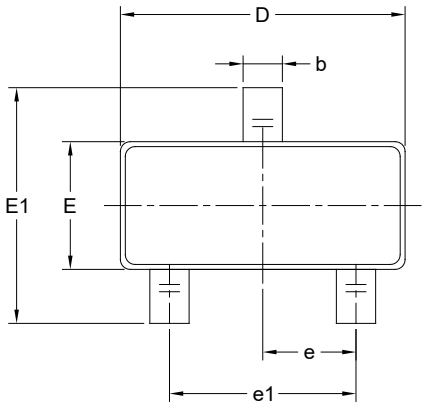


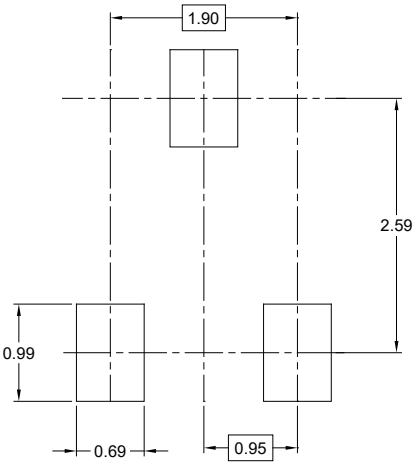
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
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A1	0.000	0.100	0.000	0.004
A2	0.800	1.000	0.031	0.039
b	0.150	0.350	0.006	0.014
c	0.080	0.220	0.003	0.009
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.65 TYP		0.026 TYP	
e1	1.300 BSC		0.051 BSC	
L	0.525 REF		0.021 REF	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°

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

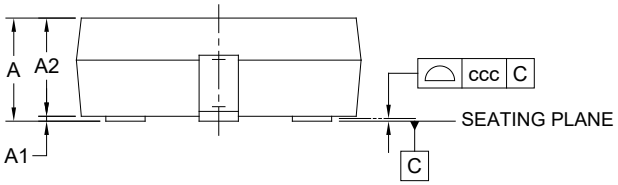
PACKAGE OUTLINE DIMENSIONS

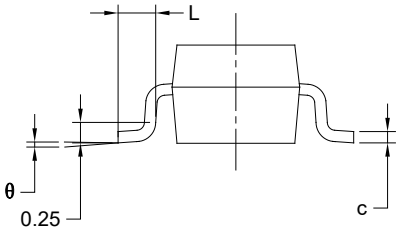
SOT-23-3





RECOMMENDED LAND PATTERN (Unit: mm)



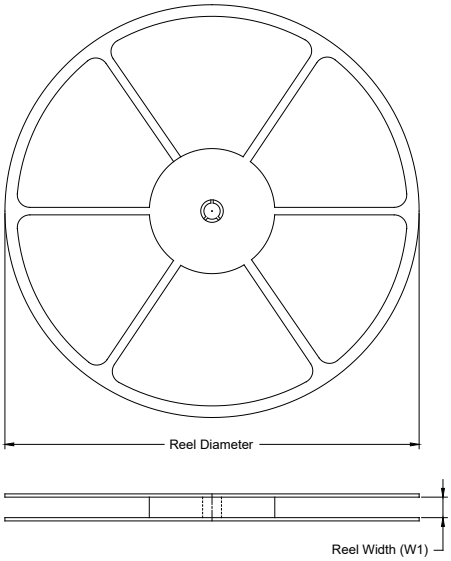


Symbol	Dimensions In Millimeters		
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A	-	-	1.450
A1	0.000	-	0.150
A2	0.900	-	1.300
b	0.300	-	0.500
c	0.080	-	0.220
D	2.750	-	3.050
E	1.450	-	1.750
E1	2.600	-	3.000
e	0.950 BSC		
e1	1.900 BSC		
L	0.300	-	0.600
θ	0°	-	8°
ccc	0.100		

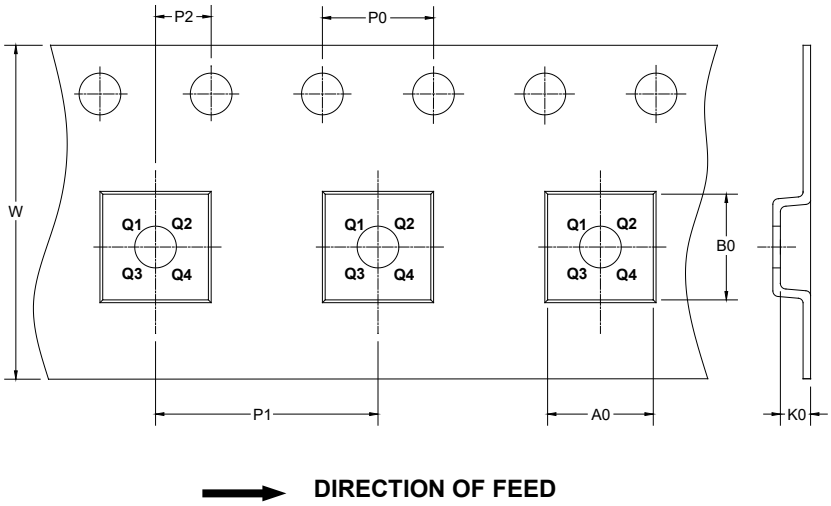
NOTES:
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MO-178.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



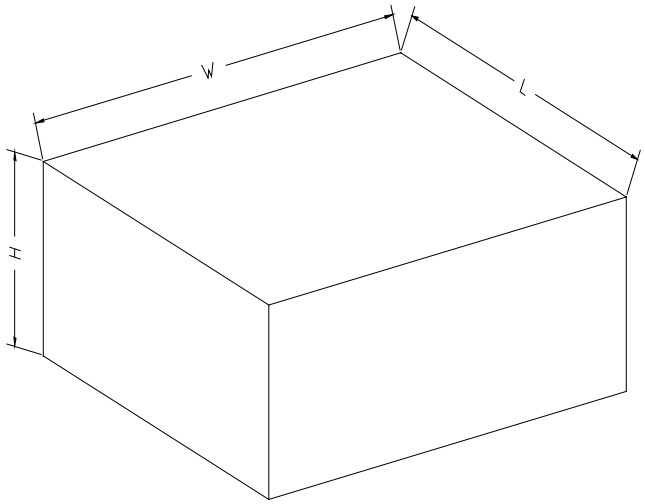
NOTE: The picture is only for reference. Please make the object as the standard.

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
XTDFN-1×1-4L	7″	9.5	1.16	1.16	0.50	4.0	2.0	2.0	8.0	Q1
SOT-23-5	7″	9.5	3.20	3.20	1.40	4.0	4.0	2.0	8.0	Q3
SC70-5	7″	9.5	2.40	2.50	1.20	4.0	4.0	2.0	8.0	Q3
SOT-23-3	7"	9.5	3.18	3.28	1.32	4.0	4.0	2.0	8.0	Q3

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

DD0002