



# SGM2047

## 200mA, Ultra-Low Quiescent Current CMOS Low Dropout Regulators

### GENERAL DESCRIPTION

The SGM2047 is an ultra-low quiescent current, fast transient response, high accuracy and low dropout voltage linear regulator. It is capable of supplying 200mA output current with typical dropout voltage of only 200mV. The operating input voltage range is from 1.7V to 5.5V and output voltage range is from 0.6V to 3.6V.

Other features include logic-controlled shutdown mode, short-circuit current limit and thermal shutdown protection. The SGM2047A has automatic discharge function to quickly discharge  $V_{OUT}$  in the disabled status.

The SGM2047 is suitable for application which needs ultra-low quiescent current and fast transient response power supply, such as power supply of low power wireless in wearable equipment.

The SGM2047 is available in Green XTDFN-1×1-4L and SOT-23-5 packages. It operates over an operating temperature range of -40°C to +125°C.

### FEATURES

- **Input Voltage Range: 1.7V to 5.5V**
- **Output Voltage Range: 0.6V to 3.6V**
- **Output Voltage Accuracy:  $\pm 1\%$  (TYP) at +25°C**
- **Low Dropout: 200mV (TYP) at 200mA**
- **Ultra-Low Quiescent Current: 0.6 $\mu$ A (TYP)**
- **Stable with Small Case Size Ceramic Capacitors**
- **Over-Current Protection**
- **Thermal Shutdown Protection**
- **SGM2047A: With Output Active Discharge**
- **SGM2047B: Without Output Active Discharge**
- **-40°C to +125°C Operating Temperature Range**
- **Available in Green XTDFN-1×1-4L and SOT-23-5 Packages**

### APPLICATIONS

Battery-Powered System  
 Portable Computing Equipment  
 Wearable Equipment  
 Low Power Wireless

### TYPICAL APPLICATION

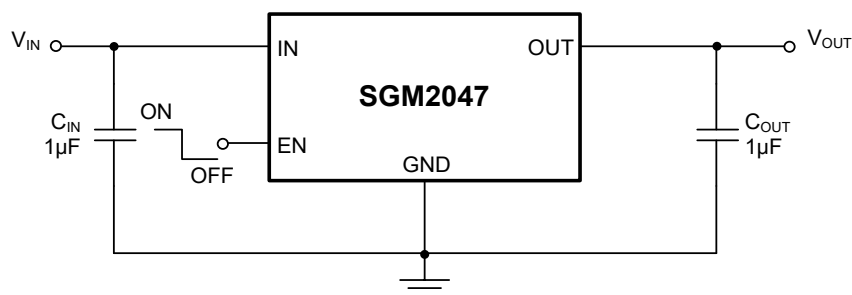


Figure 1. Typical Application Circuit

## PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2047A-0.6	XTDFN-1×1-4L	-40°C to +125°C	SGM2047A-0.6XXDH4G/TR	XJ	Tape and Reel, 10000
SGM2047A-0.7	XTDFN-1×1-4L	-40°C to +125°C	SGM2047A-0.7XXDH4G/TR	0I	Tape and Reel, 10000
SGM2047A-0.8	XTDFN-1×1-4L	-40°C to +125°C	SGM2047A-0.8XXDH4G/TR	0J	Tape and Reel, 10000
SGM2047A-0.9	XTDFN-1×1-4L	-40°C to +125°C	SGM2047A-0.9XXDH4G/TR	0K	Tape and Reel, 10000
SGM2047A-1.0	XTDFN-1×1-4L	-40°C to +125°C	SGM2047A-1.0XXDH4G/TR	0L	Tape and Reel, 10000
SGM2047A-1.1	XTDFN-1×1-4L	-40°C to +125°C	SGM2047A-1.1XXDH4G/TR	0M	Tape and Reel, 10000
SGM2047A-1.2	XTDFN-1×1-4L	-40°C to +125°C	SGM2047A-1.2XXDH4G/TR	XK	Tape and Reel, 10000
SGM2047A-1.5	XTDFN-1×1-4L	-40°C to +125°C	SGM2047A-1.5XXDH4G/TR	0N	Tape and Reel, 10000
SGM2047A-1.8	XTDFN-1×1-4L	-40°C to +125°C	SGM2047A-1.8XXDH4G/TR	0P	Tape and Reel, 10000
SGM2047A-2.5	XTDFN-1×1-4L	-40°C to +125°C	SGM2047A-2.5XXDH4G/TR	0Q	Tape and Reel, 10000
SGM2047A-2.8	XTDFN-1×1-4L	-40°C to +125°C	SGM2047A-2.8XXDH4G/TR	0R	Tape and Reel, 10000
SGM2047A-3.0	XTDFN-1×1-4L	-40°C to +125°C	SGM2047A-3.0XXDH4G/TR	0S	Tape and Reel, 10000
SGM2047A-3.3	XTDFN-1×1-4L	-40°C to +125°C	SGM2047A-3.3XXDH4G/TR	XL	Tape and Reel, 10000
SGM2047A-3.6	XTDFN-1×1-4L	-40°C to +125°C	SGM2047A-3.6XXDH4G/TR	XM	Tape and Reel, 10000
SGM2047B-0.6	XTDFN-1×1-4L	-40°C to +125°C	SGM2047B-0.6XXDH4G/TR	0T	Tape and Reel, 10000
SGM2047B-0.7	XTDFN-1×1-4L	-40°C to +125°C	SGM2047B-0.7XXDH4G/TR	0U	Tape and Reel, 10000
SGM2047B-0.8	XTDFN-1×1-4L	-40°C to +125°C	SGM2047B-0.8XXDH4G/TR	0V	Tape and Reel, 10000
SGM2047B-0.9	XTDFN-1×1-4L	-40°C to +125°C	SGM2047B-0.9XXDH4G/TR	0W	Tape and Reel, 10000
SGM2047B-1.0	XTDFN-1×1-4L	-40°C to +125°C	SGM2047B-1.0XXDH4G/TR	0X	Tape and Reel, 10000
SGM2047B-1.1	XTDFN-1×1-4L	-40°C to +125°C	SGM2047B-1.1XXDH4G/TR	0Y	Tape and Reel, 10000
SGM2047B-1.2	XTDFN-1×1-4L	-40°C to +125°C	SGM2047B-1.2XXDH4G/TR	0Z	Tape and Reel, 10000
SGM2047B-1.5	XTDFN-1×1-4L	-40°C to +125°C	SGM2047B-1.5XXDH4G/TR	1G	Tape and Reel, 10000
SGM2047B-1.8	XTDFN-1×1-4L	-40°C to +125°C	SGM2047B-1.8XXDH4G/TR	1H	Tape and Reel, 10000
SGM2047B-2.5	XTDFN-1×1-4L	-40°C to +125°C	SGM2047B-2.5XXDH4G/TR	1J	Tape and Reel, 10000
SGM2047B-2.8	XTDFN-1×1-4L	-40°C to +125°C	SGM2047B-2.8XXDH4G/TR	1K	Tape and Reel, 10000
SGM2047B-3.0	XTDFN-1×1-4L	-40°C to +125°C	SGM2047B-3.0XXDH4G/TR	1L	Tape and Reel, 10000
SGM2047B-3.3	XTDFN-1×1-4L	-40°C to +125°C	SGM2047B-3.3XXDH4G/TR	1M	Tape and Reel, 10000
SGM2047B-3.6	XTDFN-1×1-4L	-40°C to +125°C	SGM2047B-3.6XXDH4G/TR	1N	Tape and Reel, 10000

## 200mA, Ultra-Low Quiescent Current CMOS Low Dropout Regulators

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2047A-0.6	SOT-23-5	-40°C to +125°C	SGM2047A-0.6XN5G/TR	SVWXX	Tape and Reel, 3000
SGM2047A-0.7	SOT-23-5	-40°C to +125°C	SGM2047A-0.7XN5G/TR	G3YXX	Tape and Reel, 3000
SGM2047A-0.8	SOT-23-5	-40°C to +125°C	SGM2047A-0.8XN5G/TR	G3ZXX	Tape and Reel, 3000
SGM2047A-0.9	SOT-23-5	-40°C to +125°C	SGM2047A-0.9XN5G/TR	G4BXX	Tape and Reel, 3000
SGM2047A-1.0	SOT-23-5	-40°C to +125°C	SGM2047A-1.0XN5G/TR	G4GXX	Tape and Reel, 3000
SGM2047A-1.1	SOT-23-5	-40°C to +125°C	SGM2047A-1.1XN5G/TR	G4HXX	Tape and Reel, 3000
SGM2047A-1.2	SOT-23-5	-40°C to +125°C	SGM2047A-1.2XN5G/TR	SVXXX	Tape and Reel, 3000
SGM2047A-1.5	SOT-23-5	-40°C to +125°C	SGM2047A-1.5XN5G/TR	G4IXX	Tape and Reel, 3000
SGM2047A-1.8	SOT-23-5	-40°C to +125°C	SGM2047A-1.8XN5G/TR	G4JXX	Tape and Reel, 3000
SGM2047A-2.5	SOT-23-5	-40°C to +125°C	SGM2047A-2.5XN5G/TR	G4KXX	Tape and Reel, 3000
SGM2047A-2.8	SOT-23-5	-40°C to +125°C	SGM2047A-2.8XN5G/TR	G4LXX	Tape and Reel, 3000
SGM2047A-3.0	SOT-23-5	-40°C to +125°C	SGM2047A-3.0XN5G/TR	G4MXX	Tape and Reel, 3000
SGM2047A-3.3	SOT-23-5	-40°C to +125°C	SGM2047A-3.3XN5G/TR	SVYXX	Tape and Reel, 3000
SGM2047A-3.6	SOT-23-5	-40°C to +125°C	SGM2047A-3.6XN5G/TR	SVZXX	Tape and Reel, 3000
SGM2047B-0.6	SOT-23-5	-40°C to +125°C	SGM2047B-0.6XN5G/TR	G4NXX	Tape and Reel, 3000
SGM2047B-0.7	SOT-23-5	-40°C to +125°C	SGM2047B-0.7XN5G/TR	G4PXX	Tape and Reel, 3000
SGM2047B-0.8	SOT-23-5	-40°C to +125°C	SGM2047B-0.8XN5G/TR	G4QXX	Tape and Reel, 3000
SGM2047B-0.9	SOT-23-5	-40°C to +125°C	SGM2047B-0.9XN5G/TR	G4RXX	Tape and Reel, 3000
SGM2047B-1.0	SOT-23-5	-40°C to +125°C	SGM2047B-1.0XN5G/TR	G4SXX	Tape and Reel, 3000
SGM2047B-1.1	SOT-23-5	-40°C to +125°C	SGM2047B-1.1XN5G/TR	G4TXX	Tape and Reel, 3000
SGM2047B-1.2	SOT-23-5	-40°C to +125°C	SGM2047B-1.2XN5G/TR	G4UXX	Tape and Reel, 3000
SGM2047B-1.5	SOT-23-5	-40°C to +125°C	SGM2047B-1.5XN5G/TR	G4VXX	Tape and Reel, 3000
SGM2047B-1.8	SOT-23-5	-40°C to +125°C	SGM2047B-1.8XN5G/TR	G4WXX	Tape and Reel, 3000
SGM2047B-2.5	SOT-23-5	-40°C to +125°C	SGM2047B-2.5XN5G/TR	G4XXX	Tape and Reel, 3000
SGM2047B-2.8	SOT-23-5	-40°C to +125°C	SGM2047B-2.8XN5G/TR	G4YXX	Tape and Reel, 3000
SGM2047B-3.0	SOT-23-5	-40°C to +125°C	SGM2047B-3.0XN5G/TR	G4ZXX	Tape and Reel, 3000
SGM2047B-3.3	SOT-23-5	-40°C to +125°C	SGM2047B-3.3XN5G/TR	G5GXX	Tape and Reel, 3000
SGM2047B-3.6	SOT-23-5	-40°C to +125°C	SGM2047B-3.6XN5G/TR	G5HXX	Tape and Reel, 3000

## 3

**ABSOLUTE MAXIMUM RATINGS**

Input Voltage Range ..... -0.3V to 6V  
Output Voltage Range ..... -0.3V to  $V_{IN} + 0.3V$   
Chip Enable Input ..... -0.3V to 6V  
Junction Temperature ..... +150°C  
Storage Temperature Range ..... -65°C to +150°C  
Lead Temperature (Soldering, 10s) ..... +260°C

**RECOMMENDED OPERATING CONDITIONS**

Input Voltage Range ..... 1.7V to 5.5V  
Input Effective Capacitance,  $C_{IN}$  ..... 1μF (MIN)  
Output Effective Capacitance,  $C_{OUT}$  ..... 1μF to 10μF  
Operating Junction Temperature Range ..... -40°C to +125°C

**OVERSTRESS CAUTION**

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

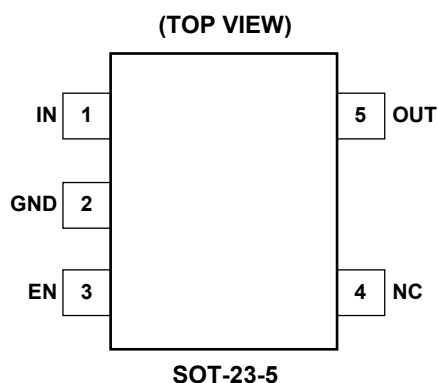
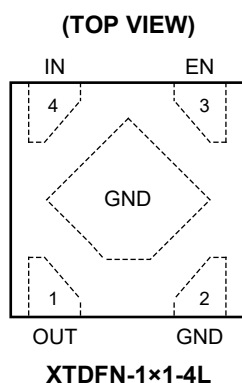
**ESD SENSITIVITY CAUTION**

This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

**DISCLAIMER**

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

## PIN CONFIGURATIONS



## PIN DESCRIPTION

PIN		NAME	FUNCTION
XTDFN-1x1-4L	SOT-23-5		
1	5	OUT	Regulator Output Pin. It is recommended to use a ceramic capacitor with effective capacitance in the range of 1 $\mu$ F to 10 $\mu$ F to get good power supply decoupling. This ceramic capacitor should be placed as close as possible to OUT pin.
2	2	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	IN	Input Voltage Supply Pin. It is recommended to use a 1 $\mu$ F or larger ceramic capacitor from IN pin to ground. This ceramic capacitor should be placed as close as possible to IN pin.
–	4	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.

## ELECTRICAL CHARACTERISTICS

( $V_{IN} = (V_{OUT} + 1V)$  or 2.5V (whichever is greater),  $I_{OUT} = 1mA$ ,  $C_{IN} = C_{OUT} = 1\mu F$ , typical values are at  $T_J = +25^\circ C$ , unless otherwise noted.)

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNITS
Input Voltage Range	V <sub>IN</sub>			1.7		5.5	V
Output Voltage Accuracy	V <sub>OUT</sub>	T <sub>J</sub> = +25°C		-1		1	%
Output Current Limit	I <sub>OUT</sub>			200			mA
Short-Circuit Current Limit	I <sub>SHORT</sub>	V <sub>OUT</sub> = 0V			300		mA
Quiescent Current	I <sub>Q</sub>	I <sub>OUT</sub> = 0			0.6		μA
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN} \times V_{OUT}}$	V <sub>IN</sub> = (V <sub>OUT</sub> + 1V) or 2.5V to 5.5V, I <sub>OUT</sub> = 1mA			0.01		%/V
Load Regulation	ΔV <sub>OUT</sub>	I <sub>OUT</sub> = 0mA to 200mA			3		mV
Dropout Voltage <sup>(1)</sup>	V <sub>DROP</sub>	I <sub>OUT</sub> = 200mA, V <sub>OUT</sub> = 3.3V			200		mV
Output Voltage Noise	e <sub>n</sub>	V <sub>IN</sub> = 5.5V, V <sub>OUT</sub> = 3.3V, I <sub>OUT</sub> = 1mA, C <sub>OUT</sub> = 1μF, f = 100Hz to 1MHz			90		μV <sub>RMS</sub>
Power Supply Rejection Ratio	PSRR	f = 1kHz, V <sub>IN</sub> = V <sub>OUT</sub> + 1V, V <sub>OUT</sub> = 3.3V, ΔV <sub>RIPPLE</sub> = 0.2V <sub>P-P</sub>	I <sub>OUT</sub> = 150mA		42		dB
			I <sub>OUT</sub> = 10mA		42		
Enable							
EN Pin Threshold Voltage	V <sub>IH</sub>	EN Input Voltage “H”		1.2			V
	V <sub>IL</sub>	EN Input Voltage “L”				0.4	
EN Leakage Current	I <sub>EN</sub>	V <sub>IN</sub> = 0V to 5.5V			1		nA
Shutdown Supply Current	I <sub>SHDN</sub>	V <sub>EN</sub> = 0V			0.1		μA
Output Active Discharge Resistance (SGM2047A Only)	R <sub>DIS</sub>	V <sub>IN</sub> = 5.5V, V <sub>EN</sub> = 0V			80		Ω
Thermal Protection							
Thermal Shutdown Temperature	T <sub>SHDN</sub>				150		°C
Thermal Shutdown Hysteresis	ΔT <sub>SHDN</sub>				20		°C

## NOTE:

1. Dropout voltage is characterized when  $V_{OUT}$  falls 5% below  $V_{OUT(NOM)}$ .

## FUNCTIONAL BLOCK DIAGRAMS

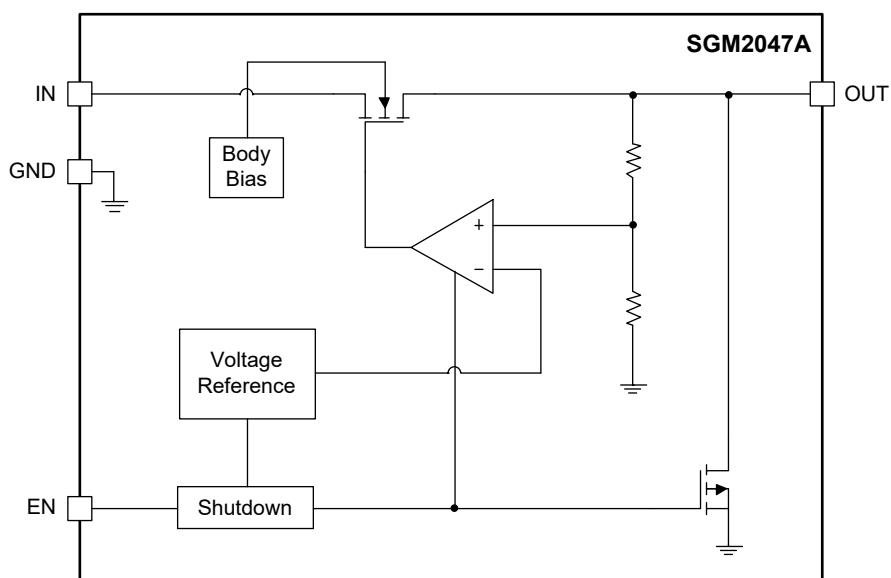


Figure 2. Block Diagram (SGM2047A)

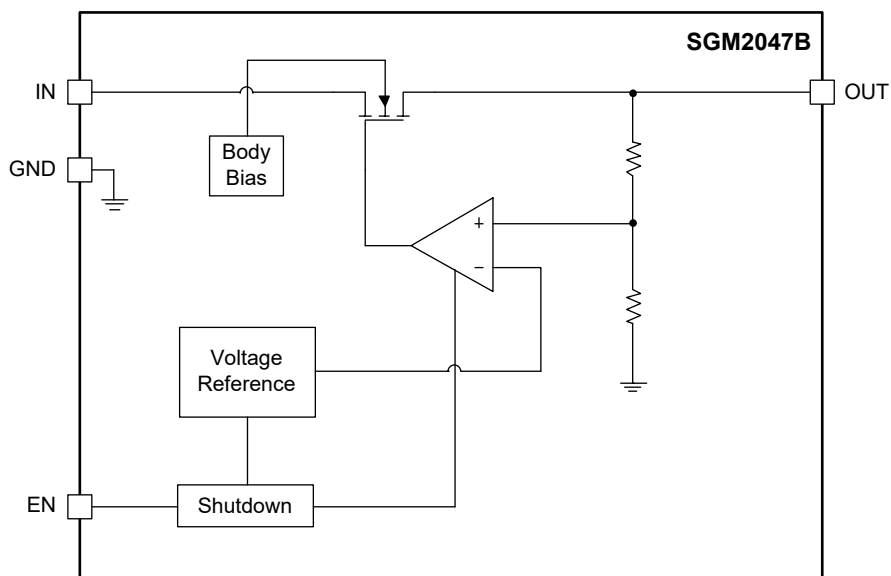


Figure 3. Block Diagram (SGM2047B)

## APPLICATION INFORMATION

The SGM2047 is an ultra-low quiescent current, fast transient response high performance LDO and provides 200mA output current. These special features make the device a good choice for dealing with many challenging power supply designs in wearable equipment. The SGM2047 also provides the protection function for output overload, output short-circuit condition and overheating.

The SGM2047 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 0.1 $\mu$ A (TYP).

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

The input decoupling capacitor is necessary to be connected as close as possible to the IN pin for ensuring the device stability. 1 $\mu$ F or greater 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.

### Output Capacitor ( $C_{OUT}$ )

The output decoupling capacitor is necessary to be connected as close as possible to the OUT pin. 1 $\mu$ F or greater X7R or X5R ceramic capacitor is selected to get good dynamic performance. For ceramic capacitor,

temperature, DC bias and package size will change the effective capacitance, so enough margin of  $C_{OUT}$  must be considered in design. Larger capacitance and lower ESR  $C_{OUT}$  will help improve the load transient response and increase the high frequency PSRR.

### Enable Operation

The SGM2047 uses the EN pin to enable/disable the device and to deactivate/activate the output automatic discharge function.

When the EN pin voltage is lower than 0.4V, 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 an 80 $\Omega$  (TYP) resistor.

When the EN pin voltage is higher than 1.2V, the device is in active state, the input voltage is regulated to the output voltage and the automatic discharge transistor is turned off.

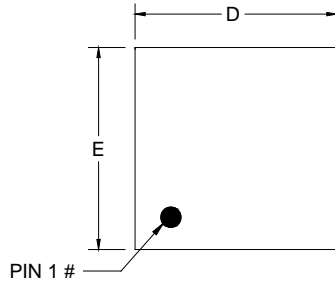
### Thermal Shutdown

The SGM2047 can detect the temperature of die. When the die temperature exceeds the threshold value of thermal shutdown, the SGM2047 will be in shutdown state and it will remain in this state until the die temperature decreases to +150°C.

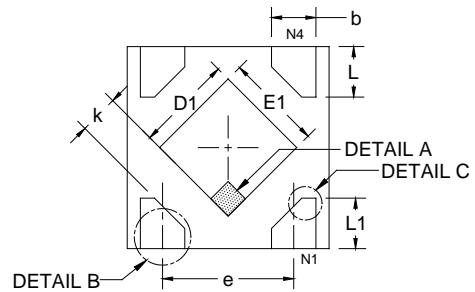


## PACKAGE OUTLINE DIMENSIONS

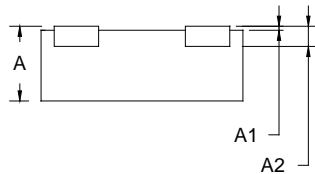
### XTDFN-1x1-4L



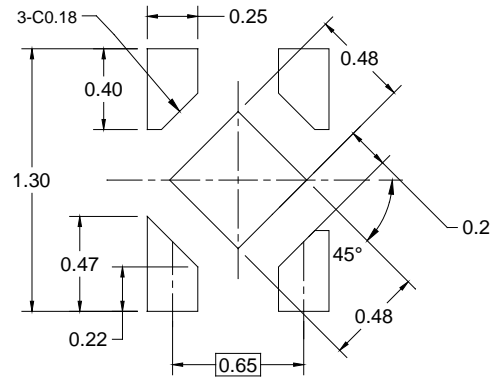
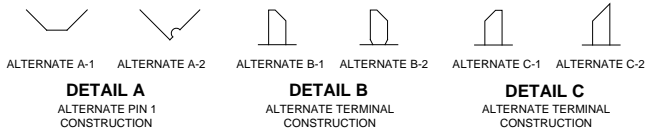
**TOP VIEW**



**BOTTOM VIEW**



**SIDE VIEW**



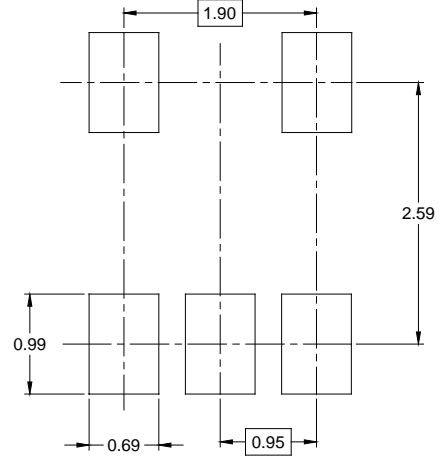
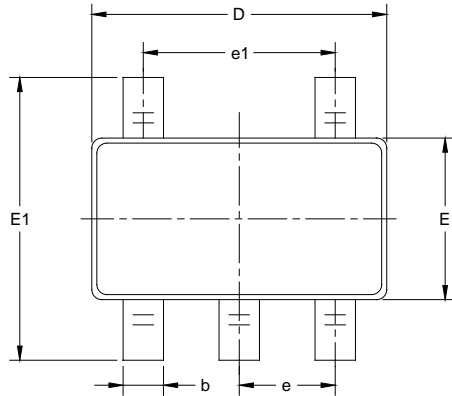
**RECOMMENDED LAND PATTERN (Unit: mm)**

Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A	0.340	0.370	0.400
A1	0.000	0.020	0.050
A2	0.100 REF		
b	0.170	-	0.300
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	0.200	-	0.370
e	0.650 BSC		
k	0.150	-	-

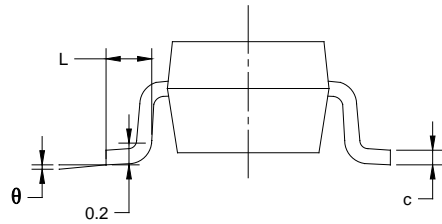
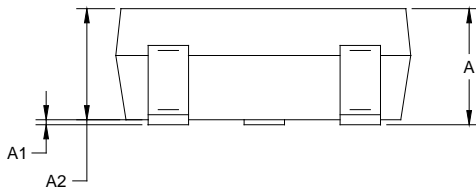
NOTE: This drawing is subject to change without notice.

## PACKAGE OUTLINE DIMENSIONS

### SOT-23-5



RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

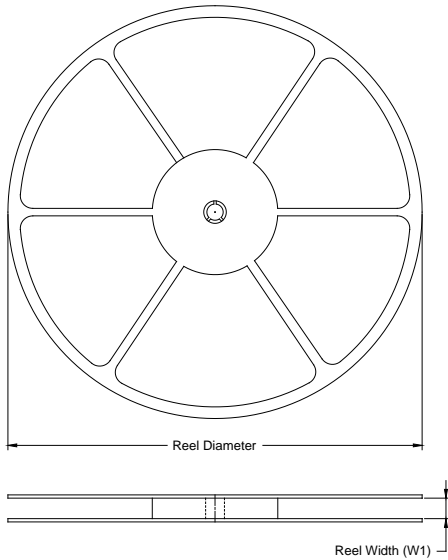
#### NOTES:

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

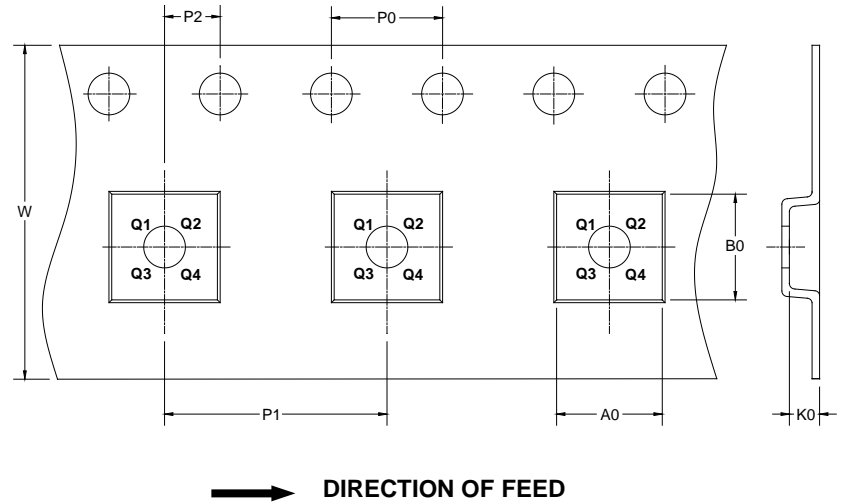
# PACKAGE INFORMATION

## 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
XTDFN-1x1-4L	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

DD00001

## PACKAGE INFORMATION

### CARTON BOX DIMENSIONS



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

### KEY PARAMETER LIST OF CARTON BOX

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

DD0002