

### GENERAL DESCRIPTION

The SGM2527 is a compact electronic fuse (eFuse) with a complete set of protection functions. The wide operating voltage range is specifically designed for many popular DC buses. Extremely low  $R_{DS(ON)}$  of the integrated protection N-channel MOSFET helps to reduce power loss during the normal operation. The programmable soft-start time controls the slew rate of the output voltage during the power-up procedure. Independent enable control allows complex system sequencing control. Internal over-temperature protection turns off the MOSFET when  $T_J$  is more than  $+150^{\circ}\text{C}$ . The SGM2527 latches off the internal FET. During the thermal shutdown, the fault pin is pulled low to signal a fault condition.

The SGM2527 is available in a Green TDFN-3x3-10L package and operates over a temperature range of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ .

### FEATURES

- **Wide Input Voltage Range from 4.5V to 18V with Surge up to 30V**
- **Extremely Low  $R_{DS(ON)}$  for the Integrated Protection Switch: 23m $\Omega$**
- **Programmable Soft-Start Time**
- **Programmable Current Limit up to 5A**
- **Thermal Shutdown Protection & Latch-Off**
- **Selectable Input Range**
- **Enable Interface Pin**
- **$-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  Operating Temperature Range**
- **Available in a Green TDFN-3x3-10L Package**

### APPLICATIONS

- Notebook PC
- iPad mini
- Server
- Service PC

### TYPICAL APPLICATION

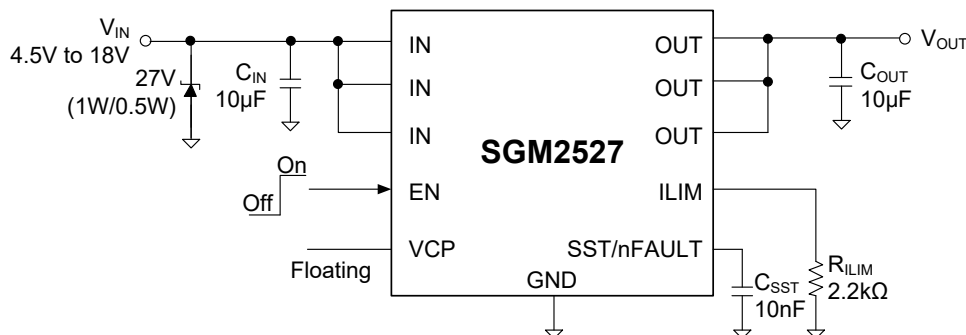


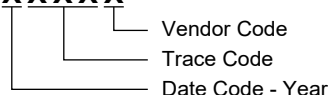
Figure 1. Typical Application Circuit

**PACKAGE/ORDERING INFORMATION**

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2527	TDFN-3×3-10L	-40°C to +85°C	SGM2527YTD10G/TR	SGM 2527D XXXXX	Tape and Reel, 4000

**MARKING INFORMATION**

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

**XXXXX**

Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

**ABSOLUTE MAXIMUM RATINGS**

IN, OUT, EN, VCP to GND .....	-0.3V to 20V
ILIM, SST/nFAULT to GND.....	-0.3V to 6V
Package Thermal Resistance	
TDFN-3×3-10L, $\theta_{JA}$ .....	62°C/W
Junction Temperature .....	+150°C
Storage Temperature Range.....	-65°C to +150°C
Lead Temperature (Soldering, 10s) .....	+260°C
ESD Susceptibility	
HBM.....	4000V
CDM .....	1000V

**RECOMMENDED OPERATING CONDITIONS**

Supply Input Voltage.....	4.5V to 18V
Operating Ambient Temperature Range.....	-40°C to +85°C
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.

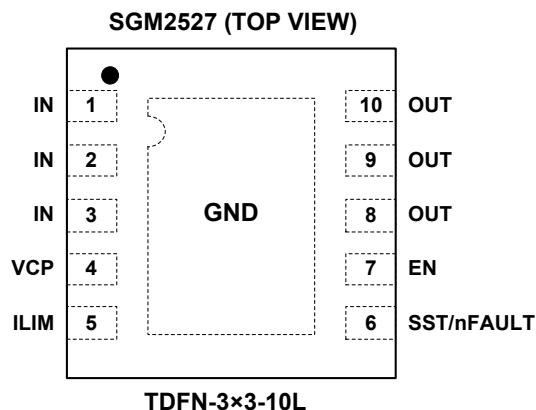
**ESD SENSITIVITY CAUTION**

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 CONFIGURATION



## PIN DESCRIPTION

PIN	NAME	FUNCTION
1, 2, 3	IN	Power Input Pin. Power input and supply voltage of the device. Decouple high frequency noise by connecting at least a 0.1 $\mu$ F ceramic capacitor to ground.
4	VCP	UVLO Thresholds Selection Based on the Input Voltage. Pull VCP pin high by connecting a resistor to IN pin, or float VCP pin to select different UVLO thresholds. Recommend to place a 0.1 $\mu$ F decoupling capacitor as close as this pin.
5	ILIM	Current Limit Program Pin. Program the current limit by connecting a resistor to ground.
6	SST/nFAULT	Soft-Start Time Program or Fault Event Indicator Pin. Connect a capacitor to ground to program the soft-start time. nFAULT event indicator, goes low to indicate fault condition due to under-voltage or thermal shutdown event.
7	EN	Enable Interface Pin. Pull it high to enable the IC.
8, 9, 10	OUT	Power Output Pin.
Exposed Pad	GND	Ground Pin.

**ELECTRICAL CHARACTERISTICS**

(T<sub>J</sub> = +25°C, V<sub>IN</sub> = 5V, R<sub>LIM</sub> = 10kΩ, C<sub>SST</sub> = 10nF, C<sub>IN</sub> = 10μF and C<sub>OUT</sub> = 10μF, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage Range	V <sub>IN</sub>		4.5		18	V
Input UVLO Threshold Voltage	V <sub>UVLO</sub>	VCP = High	3.4	3.6	3.8	V
		VCP = Floating	8.2	8.6	9.0	V
UVLO Hysteresis	V <sub>UVHYS</sub>	VCP = High		0.1		V
		VCP = Floating		0.2		
Bias Current	I <sub>BIAS</sub>			170	200	μA
Shutdown Current	I <sub>SHDN</sub>	EN = 0V		0.7	1.2	μA
FET On-Resistance	R <sub>DS(ON)</sub>			23	29	mΩ
Soft-Start Time <sup>(1)</sup>	t <sub>SST</sub>	C <sub>SST</sub> = 0F		1.4		ms
		C <sub>SST</sub> = 10nF		2.6		ms
Soft-Start Time Accuracy <sup>(1)</sup>		C <sub>SST</sub> = 10nF		±30% t <sub>SST</sub>		
Current Limit		R <sub>LIM</sub> = 11kΩ	0.92	1.0	1.09	A
Current Limit Program Range <sup>(2)</sup>	I <sub>LIM</sub>		1		5	A
EN Turn-On Threshold Voltage	V <sub>EN_ON</sub>	T <sub>J</sub> = -40°C to +85°C	1.2			V
EN Turn-Off Threshold Voltage	V <sub>EN_OFF</sub>	T <sub>J</sub> = -40°C to +85°C			0.4	V
Thermal Shutdown Temperature	T <sub>SD</sub>			150		°C
Thermal Shutdown Hysteresis	T <sub>HYS</sub>			20		°C

NOTES:

1. Refers to the Equations:

$$t_{SST} = t_{SST\_DLT} \text{ (No External } C_{SST} \text{)} \tag{1}$$

$$t_{SST} = \frac{C_{SST}}{I_{INT}} \times 1.2 \text{ (} t_{SST} > t_{SST\_DLT} \text{)} \tag{2}$$

where t<sub>SST\_DLT</sub> is the internally fixed default soft-start time, about 1.4ms, which means there's no any external C<sub>SST</sub>; I<sub>INT</sub> is the internal current source, about 4.6μA. A capacitor (C<sub>SST</sub>) of less than 10nF is recommended.

2. Recommended current limit program table.

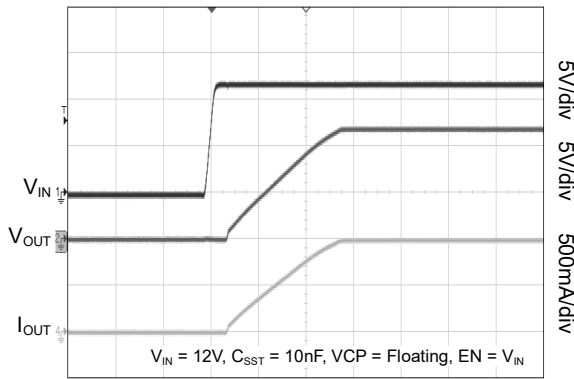
R <sub>LIM</sub> (kΩ)	11	5.5	4.4	3.7	3.1	2.8	2.4	2.2
Current Limit (A)	1.0	2.0	2.5	3.0	3.5	4.0	4.5	5.0

Calculate the R<sub>LIM</sub> and current limit as in Equation 3.

$$R_{LIM} = \frac{11}{I_{LIM}} \text{ (k}\Omega \text{)} \tag{3}$$

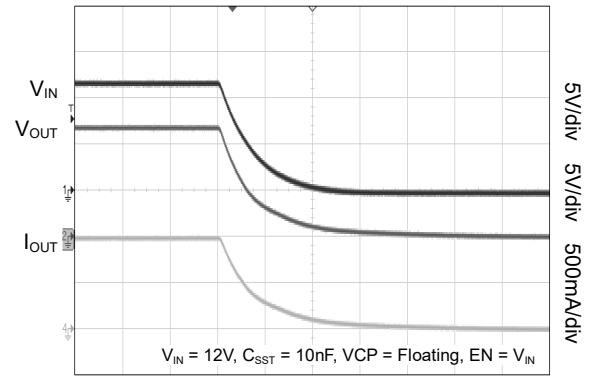
TYPICAL PERFORMANCE CHARACTERISTICS

Programmable Soft-Start Time



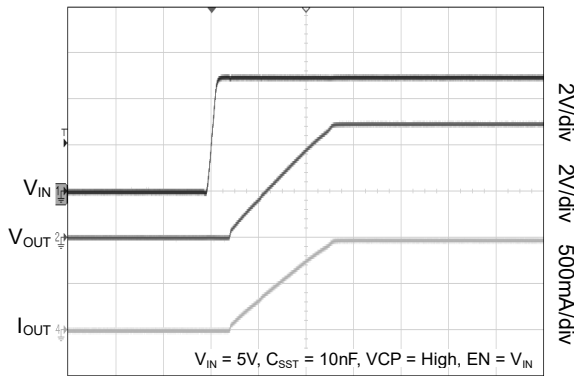
Time (1ms/div)

Power-Off



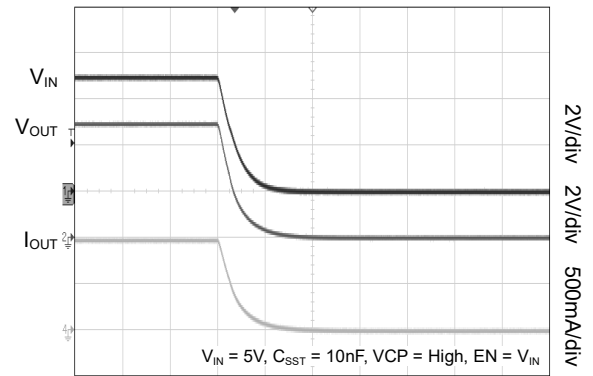
Time (50µs/div)

Programmable Soft-Start Time



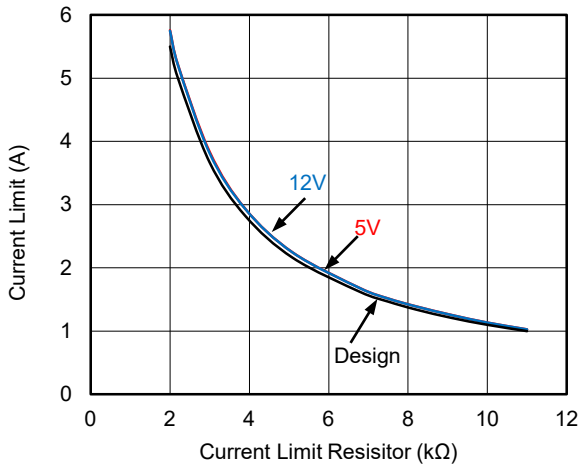
Time (1ms/div)

Power-Off



Time (100µs/div)

Programmable Current Limit



FUNCTIONAL BLOCK DIAGRAM

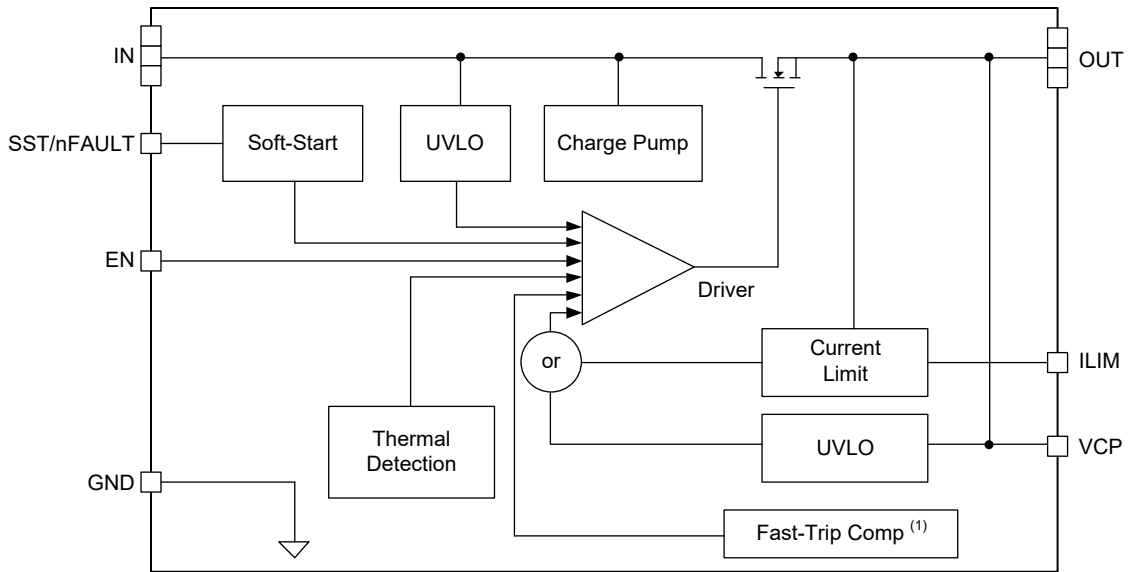


Figure 2. SGM2527 Block Diagram

NOTE:

1. During the operating of SGM2527, its output may short to ground in some abnormal conditions. As a result, the current through the device increases very rapidly. The internal current limit amplifier provides the accurate current limit control while its bandwidth is limited. So it cannot respond quickly enough to this event. Therefore, the SGM2527 offers a dedicate fast-trip comparator, which shuts down the pass device very quickly when  $I_{OUT} > I_{FAST-TRIP}$  ( $I_{FAST-TRIP} = 1.8 \times I_{LIM}$ ), and terminates the rapid short-circuit peak current. After the output short peak current has been terminated by the fast-trip comparator, the current limit amplifier smoothly regulates the output current to  $I_{LIM}$ .

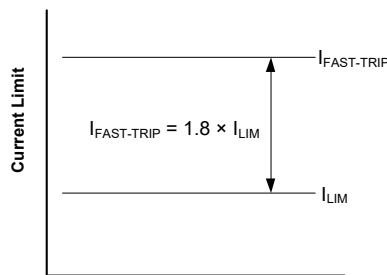


Figure 3. Over-Current Protection Levels

**APPLICATION EXAMPLES**

The SGM2527 provides simple solutions for current limit, in-rush current control and supervision of power rails for wide range of applications operating at 4.5V to 18V and delivering up to 5A.

**Protection and Current Limit for Primary-Side Regulated Power Supplies**

Primary-side regulated power supplies and adapters are dominant today in many of the applications such as LCD-TV, fast charger, set-top boxes and gaming consoles.

- No secondary-side protection for immediate termination of critical fault (such as short-circuit).
- Do not provide precision current limit for overload transients.
- Have poor output voltage regulation for sudden change in AC input voltages.

Many of the above applications require precision output current limit and secondary-side protection, driving the demand for secondary-side current detection. This requires other circuits using precision operational amplifiers. This increases the complexity of the solution and also results in sensing losses. The SGM2527 with its integrated low-ohmic N-channel MOSFET provides a simple and efficient solution.

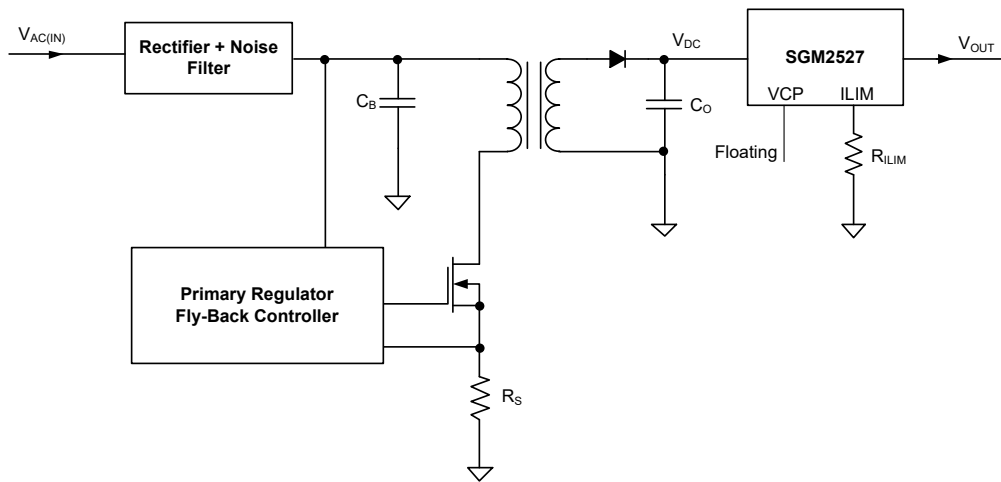


Figure 4. Current Limit and Protection for AC-DC Power Supplies

APPLICATION EXAMPLES (continued)

Precision Current Limit in Intrinsic Safety Applications

Intrinsic Safety (IS) is becoming prominent requirement for safe operation of electrical and electronic equipment in hazardous areas. IS requires that equipment is designed such that the total amount of energy available in the apparatus is simply not enough to ignite an explosive atmosphere. The energy can be electrical, in the form of a spark, or heat in the form of a hot surface.

This requires precision current limit and precision shutdown of the circuit ensuring that set voltage and current limits are not exceeded for wide operating temperature range and variable environmental conditions. Applications such as gas analyzers, medical equipment (such as electrocardiographs), portal industrial equipment, cabled power distribution systems and hand-held motor-operated tools need to meet these critical safety standards.

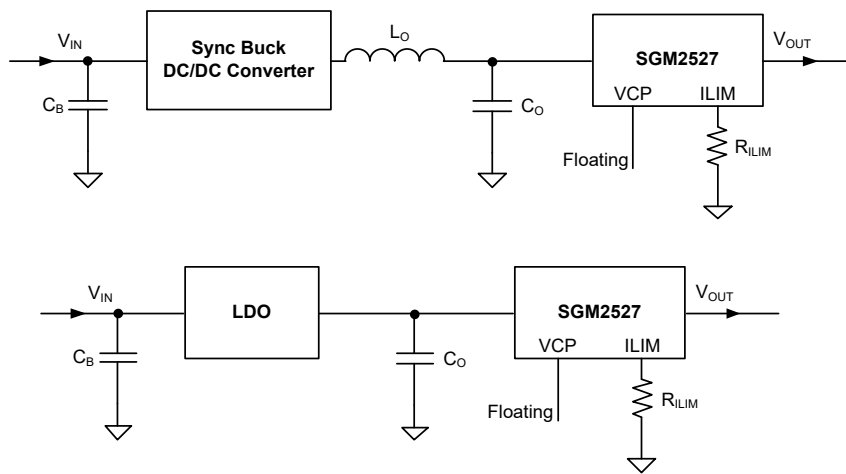


Figure 5. Precision Current Limit and Protection of Internal Rails



APPLICATION EXAMPLES (continued)

Smart Load Switch

A smart load switch is a series of MOSFETs used for switching of the load (resistive or inductive). It also provides protection during fault conditions. Typical discrete implementation is shown in Figure 6. Discrete solutions have higher component count and require complex circuitry to implement each of the protection fault needs.

SGM2527 can be used as a smart power switch for applications operating range from 4.5V to 18V. SGM2527 provides programmable soft-start, programmable current limits, over-temperature protection, a fault flag and under-voltage lockout.

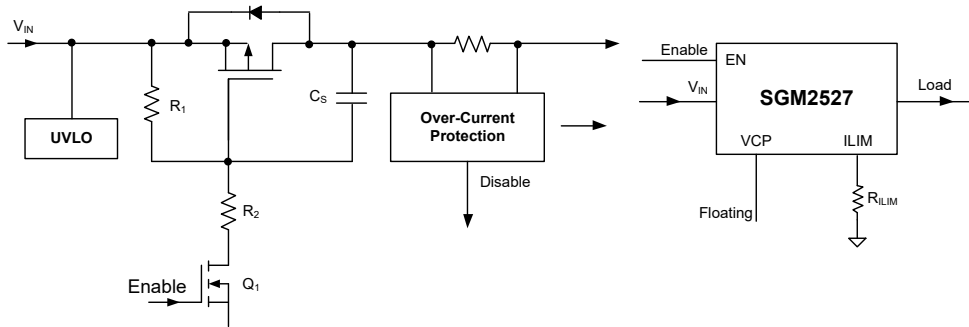


Figure 6. Smart Load Switch Implementation

Figure 6 shows typical implementation and usage of the SGM2527 as a load switch. This configuration can be used for driving a solenoid and fan control. It is recommended to use a freewheeling diode across the load when load is highly inductive.

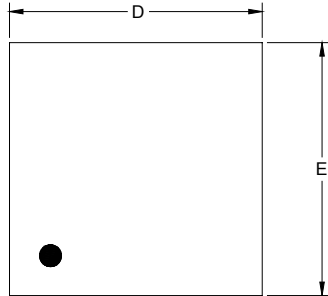
REVISION HISTORY

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

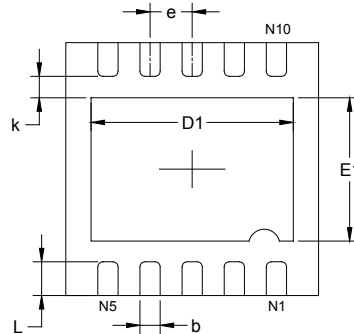
Changes from Original (NOVEMBE 2020) to REV.A	Page
Changed from product preview to production data.....	All

PACKAGE OUTLINE DIMENSIONS

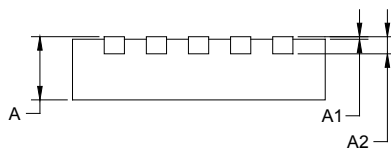
TDFN-3x3-10L



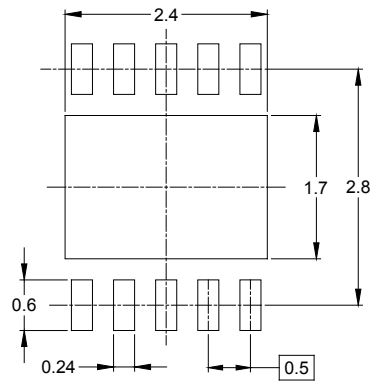
TOP VIEW



BOTTOM VIEW



SIDE VIEW



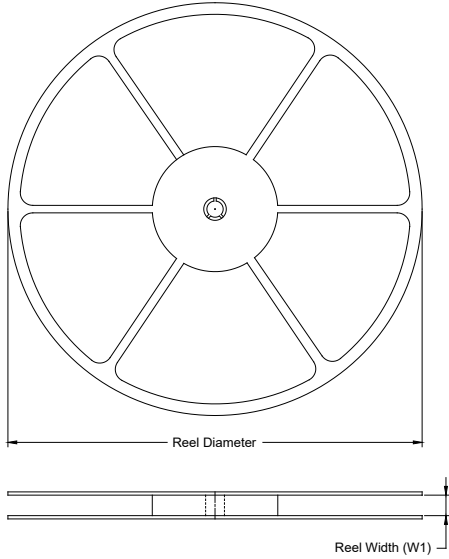
RECOMMENDED LAND PATTERN (Unit: mm)

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	2.300	2.600	0.091	0.103
E	2.900	3.100	0.114	0.122
E1	1.500	1.800	0.059	0.071
k	0.200 MIN		0.008 MIN	
b	0.180	0.300	0.007	0.012
e	0.500 TYP		0.020 TYP	
L	0.300	0.500	0.012	0.020

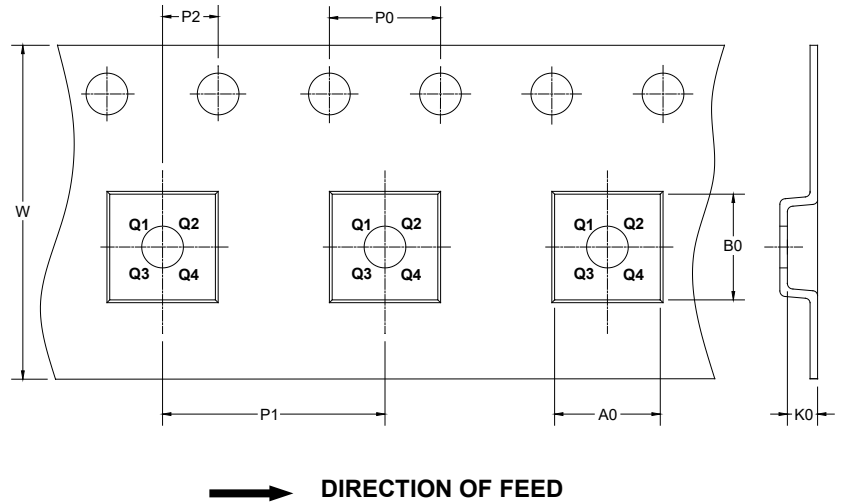
# PACKAGE INFORMATION

## TAPE AND REEL INFORMATION

### REEL DIMENSIONS



### TAPE DIMENSIONS



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

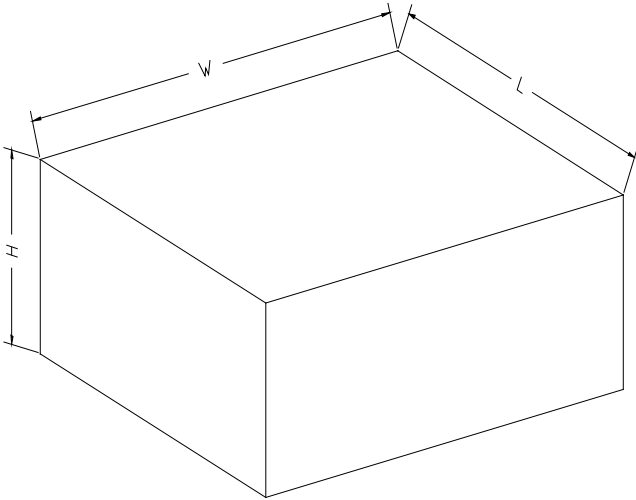
### KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
TDFN-3×3-10L	13"	12.4	3.35	3.35	1.13	4.0	8.0	2.0	12.0	Q1

DD0001

# PACKAGE INFORMATION

## CARTON BOX DIMENSIONS



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

## KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
13"	386	280	370	5

DD0002