Application Note: SY6282L

6V, 2.5A Low Loss Power Distribution Switch

General Description

SY6282L is ultra-low $R_{DS(ON)}$ switch with programmable current limit to protect the power source from over current and short circuit conditions. It incorporates over temperature protection and reverse blocking function.

Ordering Information

SY6282 □(□□)□
- Temperature Code
- Package Code
- Optional Spec Code

Ordering Number	Package type	Note
SY6282LACC	TSOT23-5	

Features

- Input Voltage: 2.4V to 6V
- 2.5A Load Current Capability
- Programmable Current limit
- Over Temperature Protection
- Reverse Blocking (No Body Diode)
- OUT Can be Forced Higher Than IN at Shutdown
- Compact TSOT23-5 Package Minimizes the Board Space
- RoHS Compliant and Halogen Free

Applications

- USB 3G Datacard
- USB Dongle
- MiniPCI Accessories
- USB Charger
- Public Place Multi-USB Charger

Typical Application

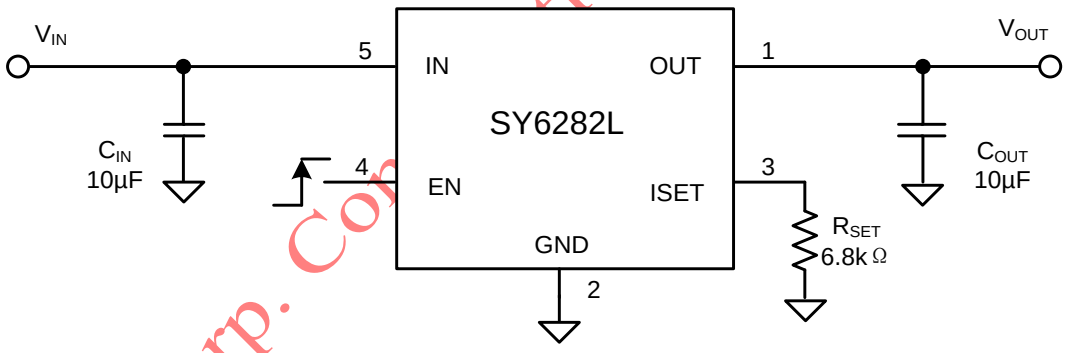
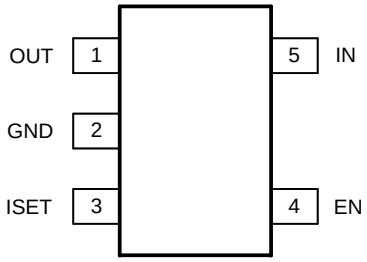


Figure1. Schematic Diagram

Pinout (top view)



(TSOT23-5)

Top mark: **Vm*xyz*** for SY6282LACC (Device code: Vm, ***x=year code, y=week code, z= lot number code*****)**

Pin Name	Pin number	Pin Description
OUT	1	Output pin, decoupled with a 10μF capacitor to GND.
GND	2	Ground pin.
ISET	3	Current limit programming pin. Connect a resistor R_{SET} from this pin to ground to program the current limit: I_{LIM} (A)=6800/R_{SET} (Ω)
EN	4	ON/OFF control. Pull high to enable IC. Do not leave it floating.
IN	5	Input pin, decoupled with a 10μF capacitor to GND.

Block Diagram

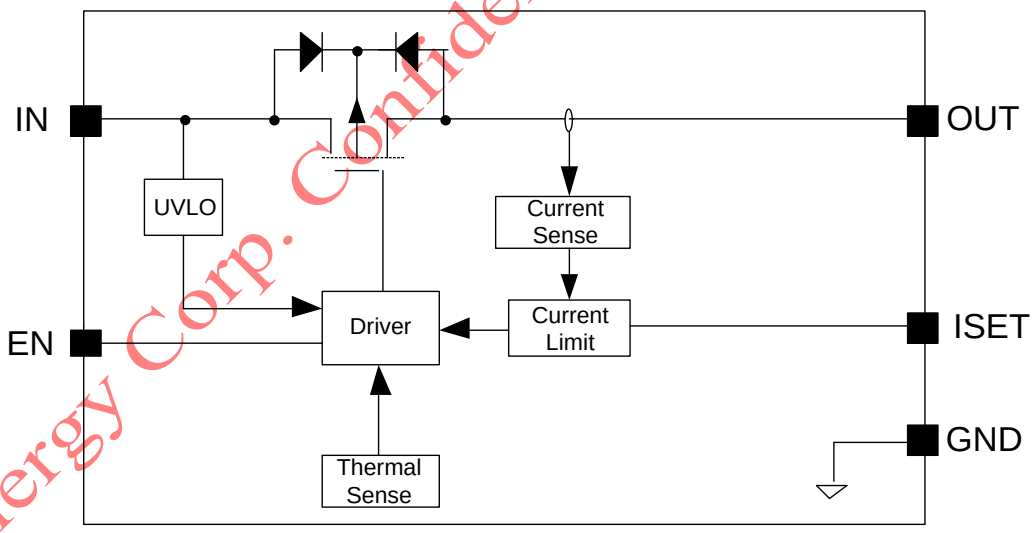


Figure2. Block Diagram

Absolute Maximum Ratings (Note 1)

IN, OUT, EN, ISET ---------- -0.3V to 7V
Power Dissipation, P_D @ T_A = 25℃ TSOT23-5 ---------- 1.46W
Package Thermal Resistance (Note 2)
θ_{JA} ---------- 68.5℃/W
θ_{JC} ---------- 10.9℃/W
Junction Temperature Range ---------- -40℃ to 150℃
Lead Temperature (Soldering, 10 sec.) ---------- 260℃
Storage Temperature Range ---------- -65℃ to 150℃

Recommended Operating Conditions (Note 3)

IN---------- 2.4V to 6V
OUT, ISET---------- 0V to 6V
EN ---------- 0V to IN
Junction Temperature Range ---------- -40℃ to 125℃
Ambient Temperature Range ---------- -40℃ to 85℃

Electrical Characteristics

(V_{IN} = 5V, C_{OUT}=10μF, T_A = 25℃, unless otherwise specified.)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage Range	V_{IN}		2.4		6	V
Shutdown Input Current	I_{SHDN}	Open load, IC disabled		0.2	1	μA
Quiescent Supply Current	I_Q	Open load, IC enabled		38		μA
FET R_{ON}	$R_{DS(ON)}$			80		mΩ
EN Rising Threshold	$V_{EN(H)}$		2			V
EN Falling Threshold	$V_{EN(L)}$				0.8	V
EN Leakage Current	I_{EN}	V_{EN}=5.0V			1	μA
IN UVLO Threshold	V_{IN_UVLO}				2.3	V
IN UVLO Hysteresis	V_{IN_HYS}			0.1		V
Over Current Limit	I_{LIM}	R_{SET}=6.8kΩ	0.75	1	1.25	A
Programmable current limit range	I_{RANGE}		0.4		2.5	A
Turn-on Time	t_{ON}	R_L=10Ω, C_{OUT}=1μF		130		μs
Turn-off Time	t_{OFF}	R_L=10Ω, C_{OUT}=1μF		20		μs
Thermal Shutdown Temperature	t_{SD}			150		℃
Thermal Shutdown Hysteresis	t_{SD_HYS}			20		℃

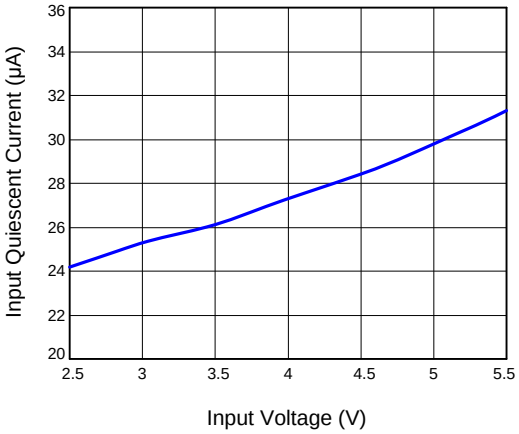
Note 1: Stresses beyond the "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Note 2: θ_{JA} is measured in the natural convection at T_A = 25℃ on a Silergy test board. Pin 2 of TSOT23-5 package is the case position for θ_{JC} measurement.

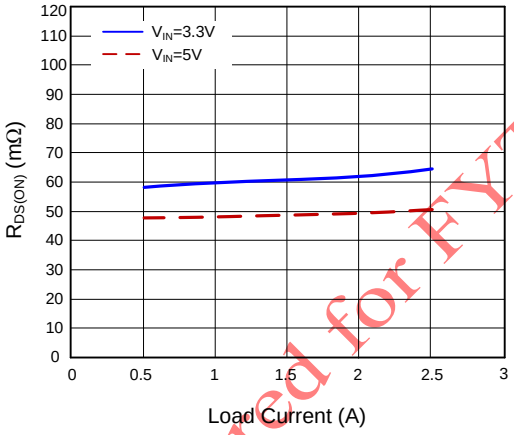
Note 3: The device is not guaranteed to function outside its operating conditions.

Typical Performance Characteristics

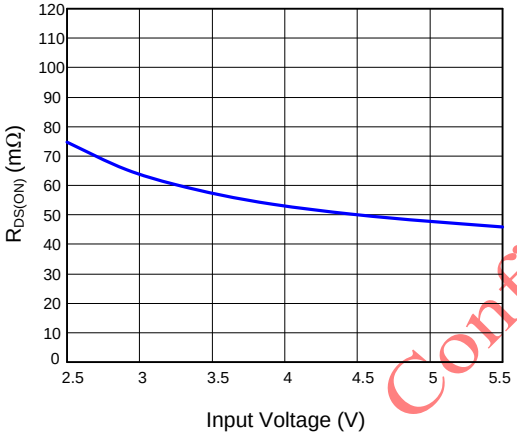
Input Quiescent Current vs. Input Voltage



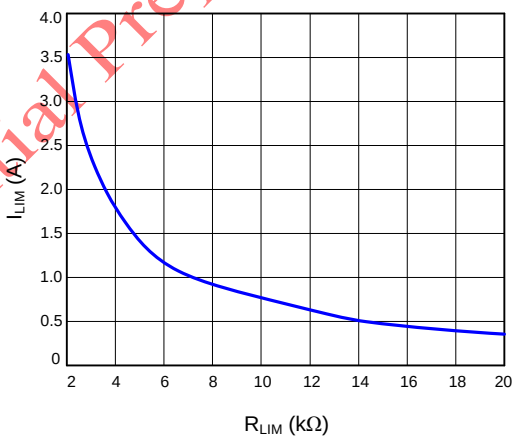
$R_{DS(ON)}$ vs. Load Current



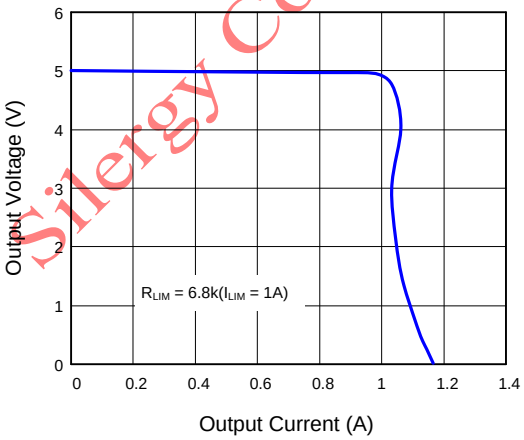
$R_{DS(ON)}$ vs. Input Voltage



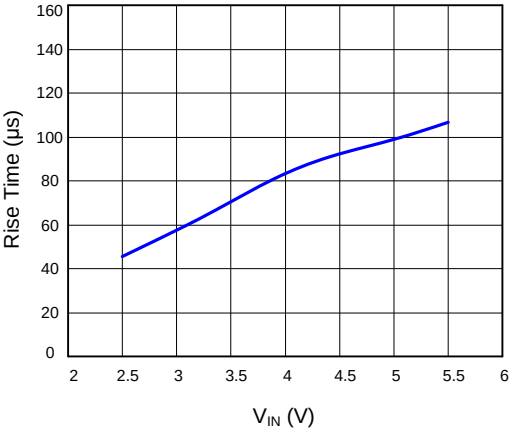
R_{LIM} vs. I_{LIM}



Output Voltage vs. Output Current

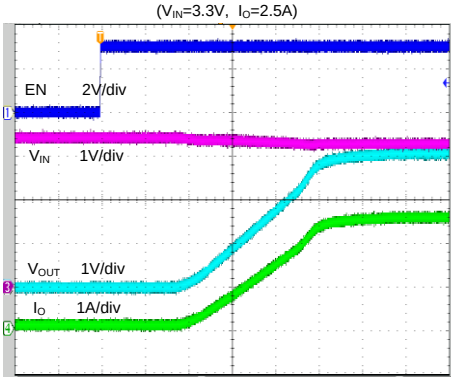


Rise Time vs. V_{IN}



Startup from Enable

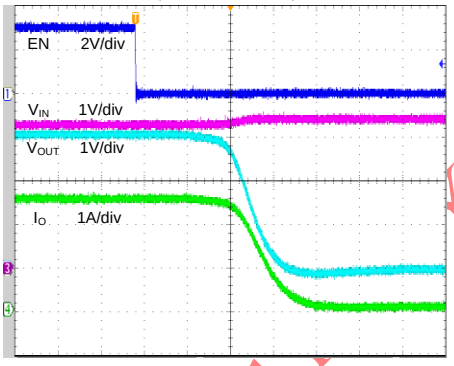
(V_{IN}=3.3V, I_O=2.5A)



Time (40μs/div)

Shutdown from Enable

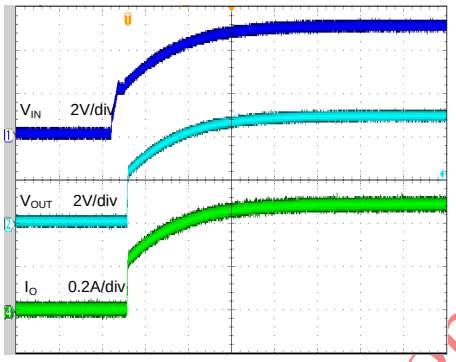
(V_{IN}=3.3V, I_O=2.5A)



Time (2μs/div)

Startup from V_{IN}

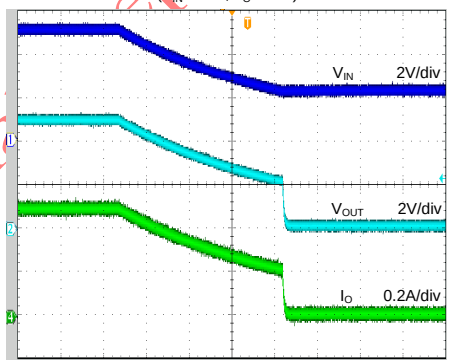
(V_{IN}=3.3V, I_O=0.5A)



Time(2ms/div)

Shutdown from V_{IN}

(V_{IN}=3.3V, I_O=0.5A)



Time (2ms/div)

Applications Information

SY6282L is a current limited P-channel MOSFET power switch with over current and over temperature protections. There is no body diode across the drain and the source of the MOSFET. It prevents the current flow from the output to the input after the chip is disabled.

Over Current Protection

When the over current condition is detected, the switch is regulated to achieve constant output current. If the over current condition lasts for a long time, and results in a junction temperature over 150℃, the switch will be shutdown. Once the junction temperature drops to 130℃, the part will restart.

Supply Filter Capacitor

In order to prevent the input voltage from dropping during hot-plug condition, a 10μF ceramic capacitor from VIN to GND is strongly recommended. However, higher capacitance could help reduce the voltage drop. Furthermore, an output short will cause ringing on the input without the input capacitor. It could destroy the internal circuitry when the input transient voltage exceeds the absolute maximum supply voltage even for a short duration.

Current Limiting Setting

Current limit is programmable to protect the power source from over current and short circuit conditions. Connect a resistor R_{SET} from ISET pin to GND to program the current limit:

$$I_{LIM}\ (A) = 6800 / R_{SET}\ (\Omega)$$

The minimum current limit is 0.4A. Current limit beyond 2.5A is not recommended.

Maximum Input Voltage Consideration:

For any application, input voltage for SY6282L should not be allowed to exceed the maximum recommended value (6V).

Below is a typical application circuit for SY6282L. The front stage is a non-synchronous Boost stage and the input power supply can be a battery or an adapter.

Some adapters may have poor output voltage tolerance, or may have large output voltage overshoot if the adapter is hot plug in directly. The voltage overshoot higher than V_{IN} (6V) will significantly reduce the reliability of SY6282L and may even lead to IC EOS failure.

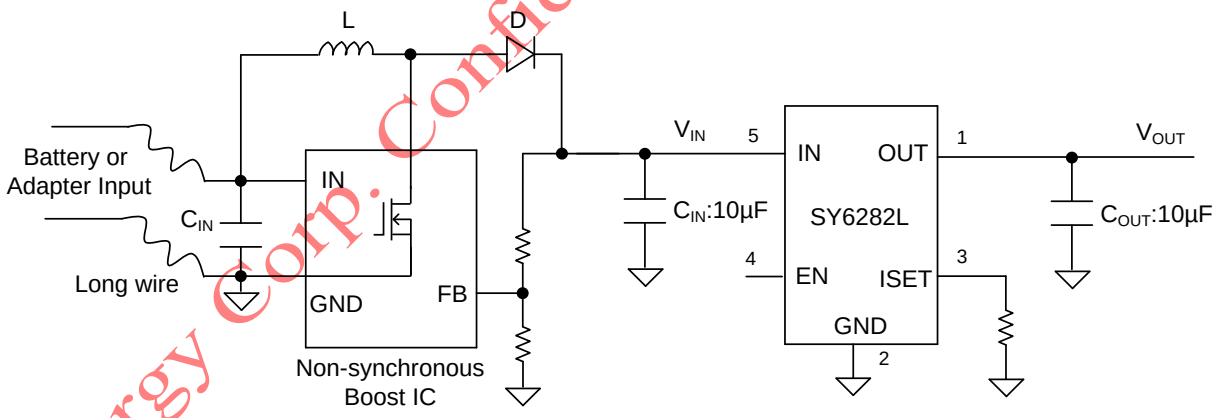


Figure3. USB Host Application

PCB Layout Guide

To achieve a better performance, the following guidelines must be strictly followed:

1) Keep all power traces as short and wide as possible and use at least 2 ounce copper for all power traces.
2) Place a ground plane under all circuitry to lower both resistance and inductance and improve DC and transient performance.
3) Locate the output capacitors as close to the connectors as possible to lower the impedance (mainly inductance) between the port and the capacitor and improve transient performance.
4) Input and output capacitors should be placed close to the IC and connected to the ground plane to reduce noise coupling.
5) Locate the ceramic bypass capacitors as close as possible to the IN pin and OUT pin of SY6282L.

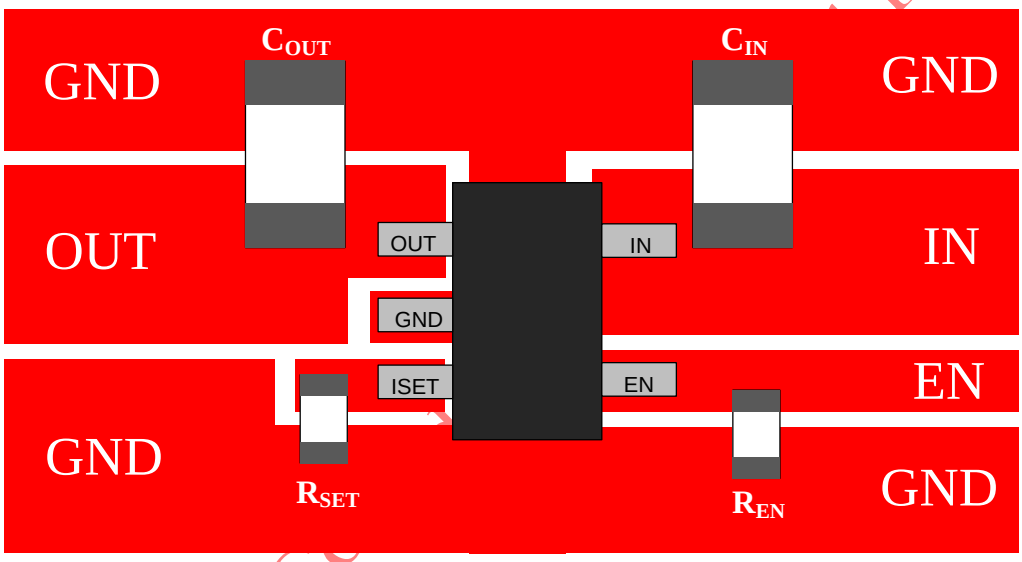
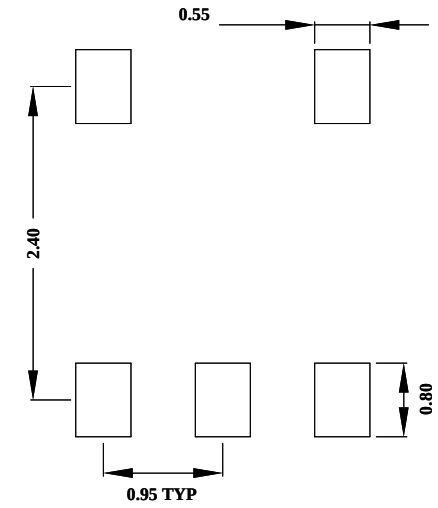
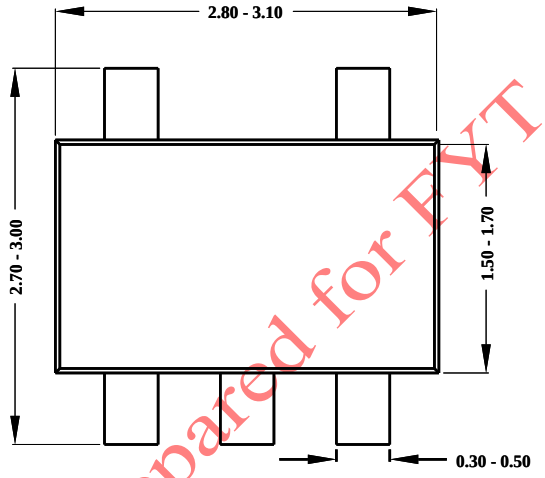


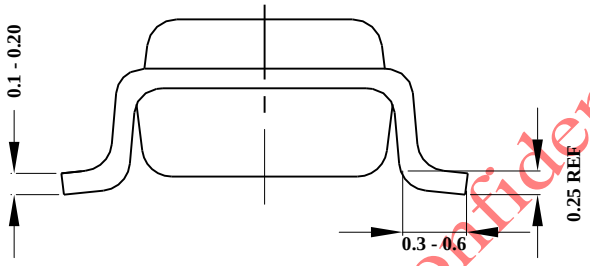
Figure4. PCB Layout Suggestion

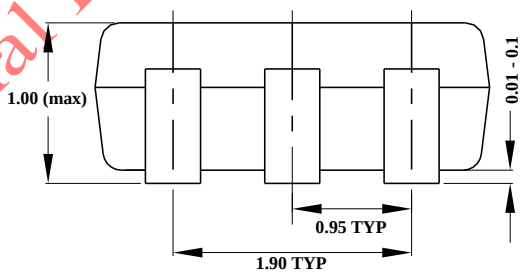
TSOT23-5 Package outline & PCB Layout Design



Recommended Pad Layout





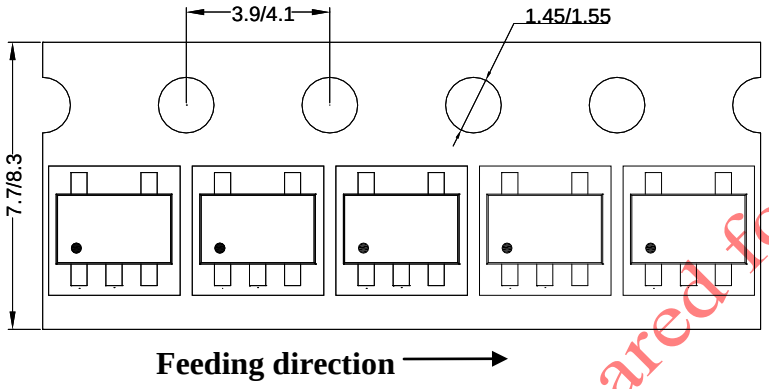


Notes: All dimensions are in millimeters.
All dimensions don't include mold flash & metal burr.

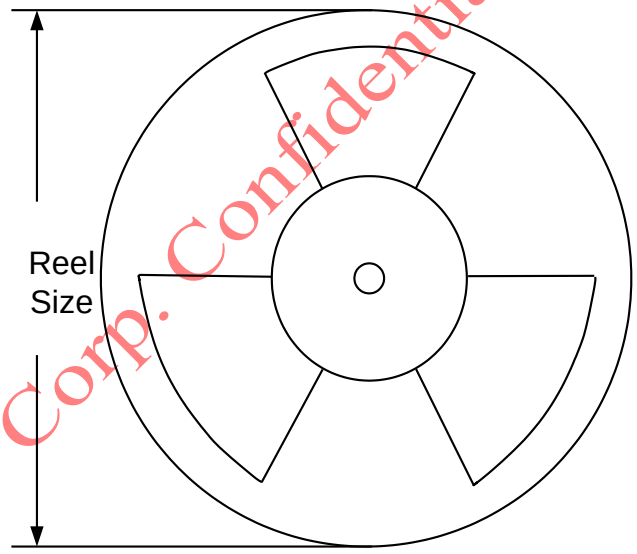
Taping & Reel Specification

1. Taping orientation

TSOT23-5



2. Carrier Tape & Reel specification for packages



Package type	Tape width (mm)	Pocket pitch(mm)	Reel size (Inch)	Trailer length(mm)	Leader length (mm)	Qty per reel
TSOT23-5	8	4	7"	280	160	3000

3. Others: NA

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