SY20771
Linear Charger

General Description

SY20771 is a linear charger, which includes pre-charge/constant current/constant voltage mode. During constant current mode, its output current could be adjusted by external PWM signal. Its max output current capacity is up to 500mA. It is an ideal linear charger solution for single cell Li-Ion application.

Ordering Information

SY20771 □(□,□)□
- Temperature Code
- Package Code
- Optional Spec Code

Ordering Number	Package Type	Note
SY20771ADC	TSOT23-6	----

Features

- Input Voltage Range: 3.8V to 5.5V
- Up to 500mA Constant Current, the Current Could be Adjusted by External PWM Signal
- PWM Signal Frequency Range: 20kHz~200kHz
- Charge Status Report
- Thermal Regulation Control
- Thermal Shutdown Protection
- Pb-free Package: TSOT23-6

Applications

- Battery Powered Applications
- Consumer and Portable Products

Typical Application

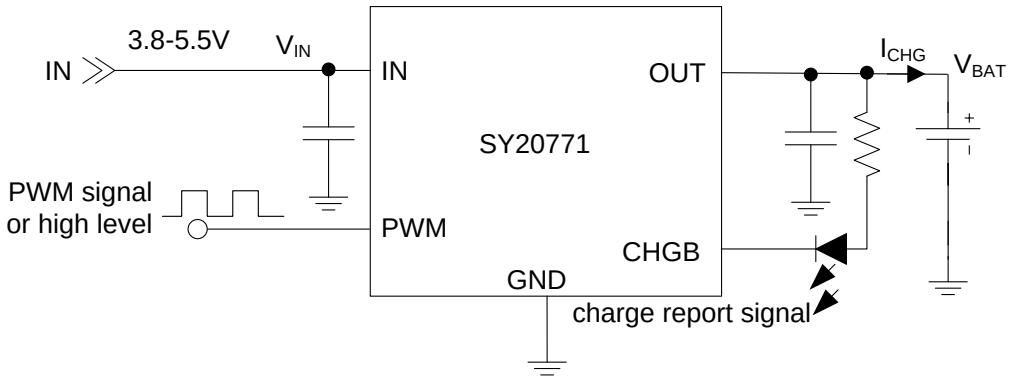
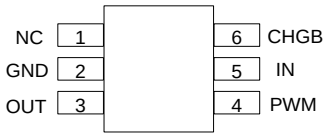


Figure1. Schematic Diagram

Pinout (Top View)



(TSOT23-6)

Top Mark: Zf*xyz* (device code: Zf, ***x=year code, y=week code, z= lot number code)***

Pin Name	Pin Number	Pin Description
NC	1	Not connect.
GND	2	Ground.
OUT	3	Battery charge current output.
PWM	4	IC enable and output current adjust pin. Connect external PWM signal to adjust output current. This pin has an internal 300kΩ pull down to GND.
IN	5	Power supply input pin. Decouple this pin to GND pin with 1μF or greater ceramic capacitor. It receives the input from 3.8V to 5.5V.
CHGB	6	Charge status report pin, which is open drain output. Indicate low when battery is charging, indicate high when battery charging finished.

Absolute Maximum Ratings (Note 1)

IN ---------- 6.5V
OUT, PWM, CHGB ---------- 6V
Power Dissipation, P_D@ T_A=25°C ---------- 0.98W
Package Thermal Resistance (Note 2)
θ_{JA} ---------- 128℃/W
θ_{JC} ---------- 59℃/W
Junction Temperature Range ---------- -40°C to 150°C
Lead Temperature (Soldering, 10 sec.) ---------- 260°C
Storage Temperature Range ---------- -65°C to 150°C

Recommended Operating Conditions (Note 3)

IN ---------- 3.8V to 5.5V
Ambient Temperature Range ---------- -40°C to 85°C

Electrical Characteristics

(V_{IN} =5V, T_A = 25°C, unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage Range	V_{IN}		3.8		5.5	V
V_{IN} UVLO Rising Threshold	V_{INUVLO}				3.7	V
V_{IN} UVLO Hysteresis	$UVLO_{HYS}$			0.2		V
OUT Current (Battery Current into OUT Terminal)	$I_{OUTDOWM}$	V_{IN} =5V,PWM=high level, charging terminate		40		μA
Battery Leakage Current (Battery Current into OUT Terminal)	I_{LK}	PWM =low level		1		μA
Minimum Dropout Voltage	V_{DPMIN}	$V_{DPMIN}=V_{IN}-V_{BAT}$, I_{CHG}=500mA		500		mV
Charge Current Accuracy	I_{CHGA}	PWM=high level, V_{BAT}=4V	-5%	500	+5%	mA
		PWM=20kHz， PWM Duty=20%, V_{BAT}=4V	-7.5%	100	+7.5%	mA
Battery Regulation Voltage (CV)	V_{REG}		-0.5%	4.2	+0.5%	V
Constant Voltage to Constant Current Transition Hysteresis (Battery Recharge)	V_{RCHYS}	V_{REG} Hysteresis		100		mV
Pre-charge to Constant Charge Transition Rising Threshold	V_{PCHG}		2.4	2.5	2.6	V
Battery Pre-charge Threshold Hysteresis	V_{PCHGH}			0.1		V
Pre-charge Current	I_{PCHG}	PWM=high level, percentage of charge setting current	12	15	18	%
Termination Threshold Current	I_{TERM}	PWM=high level, percentage of charge setting current	7	9	11	%
PWM Input Logic High	V_{IH}		1.4			V
PWM Input Logic Low	V_{IL}				0.5	V
CHGB Pull Down Voltage		I_{sink}=1mA			0.54	V
Thermal Regulation Control Temperature Threshold	T_{REG}			115		°C
Thermal Shutdown Temperature	T_{SD}			150		°C
Thermal Shutdown Hysteresis	T_{HYS}			20		°C

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.

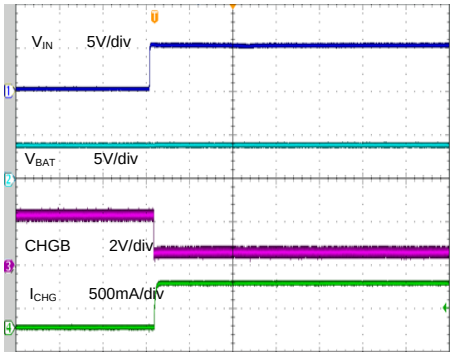
Note 2: θ_{JA} is measured in the natural convection at T_A = 25°C on a low effective single layer thermal conductivity test board of JEDEC 51-3 thermal measurement standard.

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

Typical Performance Characteristic

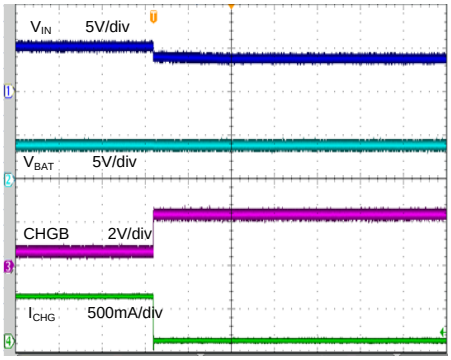
(V_{IN} = 5V, V_{BAT}=3.7V， PWM=5V)

Startup from V_{IN}



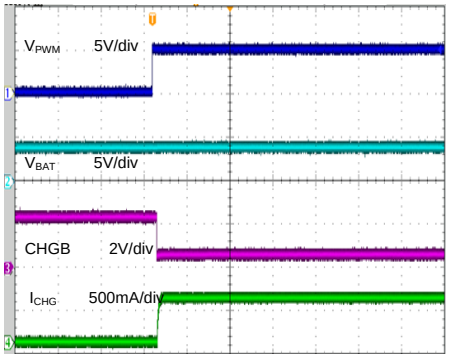
Time (2ms/div)

Shutdown from V_{IN}



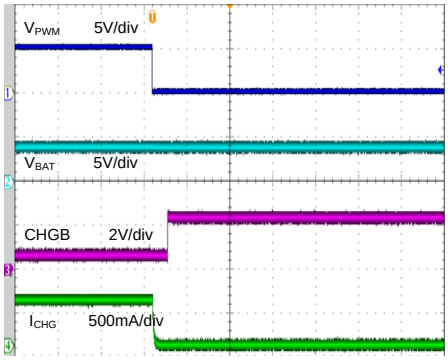
Time (2ms/div)

Startup from PWM



Time (2ms/div)

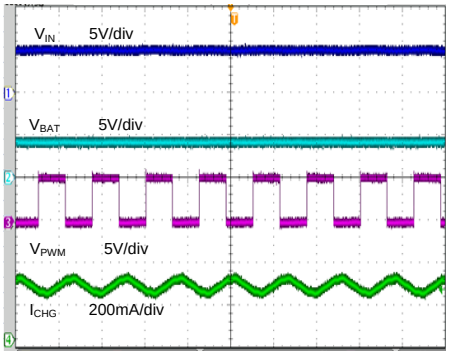
Shutdown from PWM



Time (2ms/div)

Adjustable Charge Current Waveform

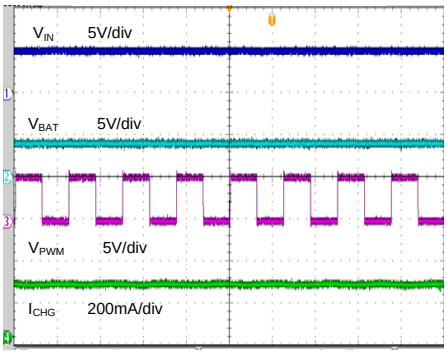
(F_{PWM}=20kHz, Duty=50%)



Time (40us/div)

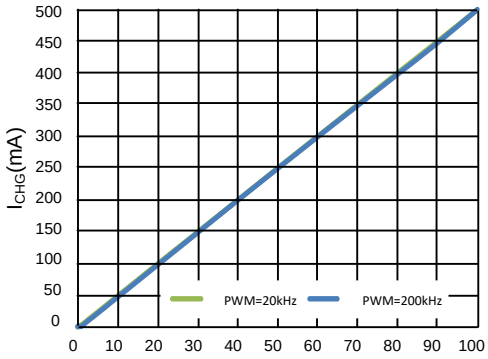
Adjustable Charge Current Waveform

(F_{PWM}=200kHz, Duty=50%)

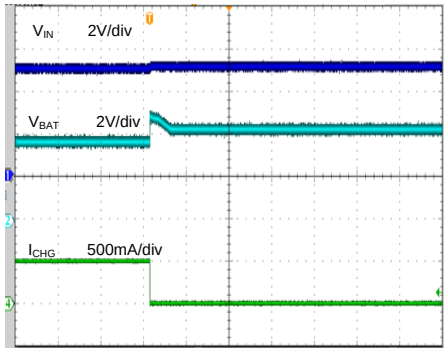


Time (4us/div)

Charge Current vs PWM Duty Cycle



Battery Open Protection



Function Description

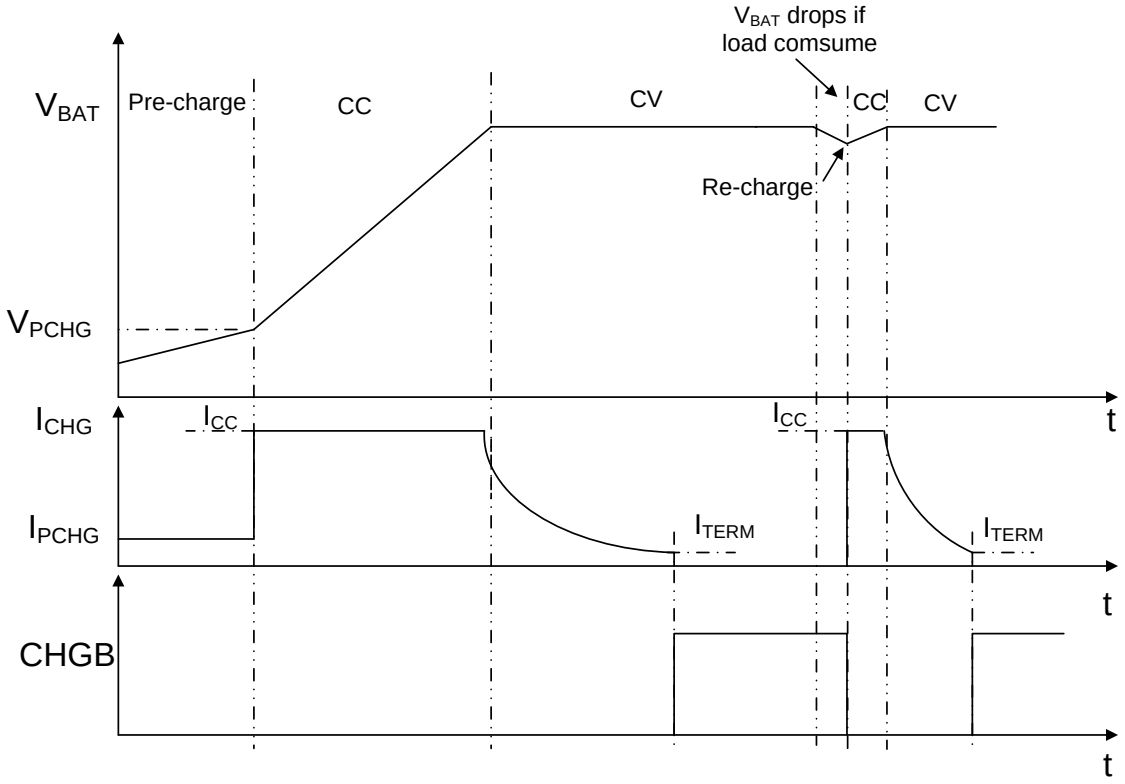


Figure2. Typical Charge Profile (if not Trigger Thermal Regulation)

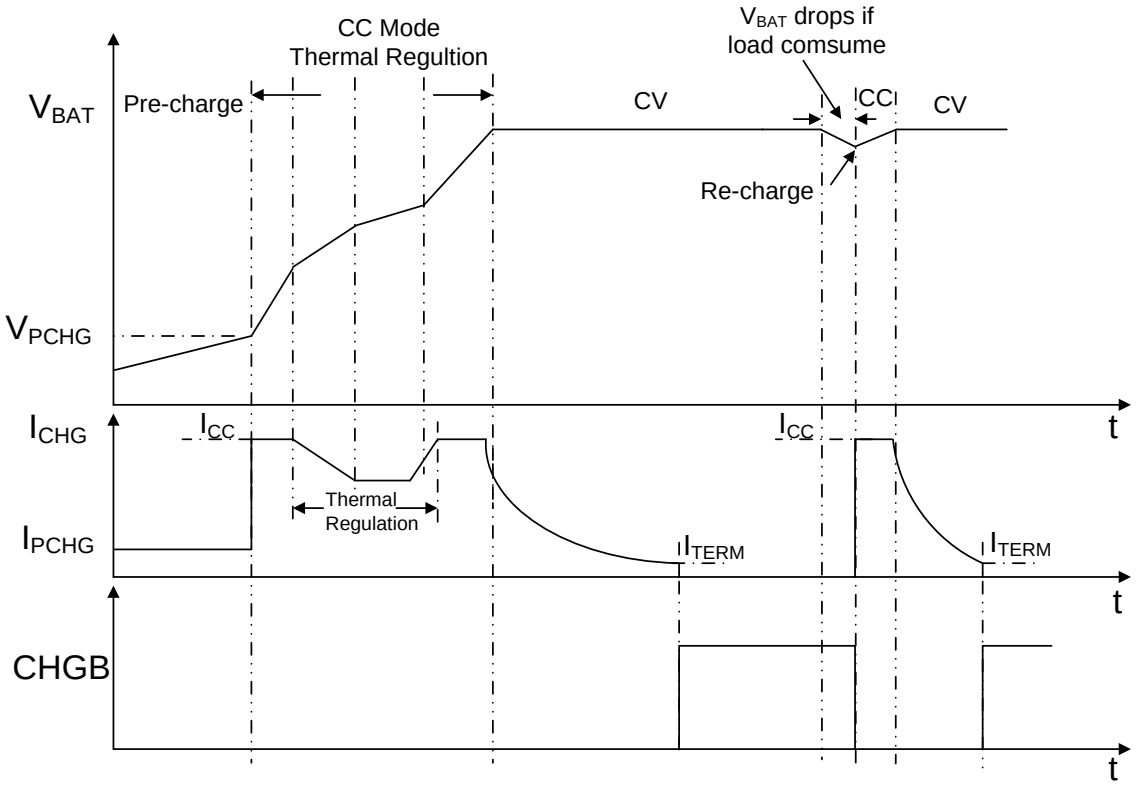


Figure3. Typical Charge Profile (if Trigger Thermal Regulation)

Battery Charge Profile

SY20771 charges a Li-Ion battery under pre-charge, constant current (CC) mode or constant voltage (CV) mode.

Battery Pre-charge Current (Pre-charge Mode)

When the battery voltage is less than V_{PCHG} (Pre-charge to Constant Charge Transition Rising Threshold), SY20771 applies a pre-charge mode to the battery. This feature revives deeply discharged cells and protects battery life. The internally determined pre-charge rate is 15% (typical) of the constant charge current.

Battery Charge Current (CC Mode)

CC Mode charge current is determined by PWM signal duty cycle. The CC current can be calculated by the following equation:

I_{CC}=500 × PWM signal duty cycle (mA).

It is recommended to apply the PWM signal frequency in the 20kHz to 200kHz range. The PWM signal frequency is higher; the output current ripple is less.

Battery Voltage Regulation (CV Mode)

The battery voltage regulation feedback is through the OUT pin. SY20771 monitors the battery voltage between the OUT and GND pin. When battery voltage is close to battery regulation voltage threshold, the voltage regulation phase begins and the charging current begins to taper down. When battery voltage is over battery regulation voltage threshold and charge mode stops, SY20771 still monitors the battery voltage. Charge current is resumed when the battery voltage falls under battery regulation voltage threshold by hysteresis

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Enable and Disable the Device

The IC will be shut down if PWM is always low level or floating.

To enable the IC, a high level or PWM signal is added between the PWM pin and GND pin.

Thermal Shutdown Protection

When the IC junction temperature reaches 150℃, the IC will shut down. The IC will not start up again until the junction temperature falls below 130℃ or the power input is recycled.

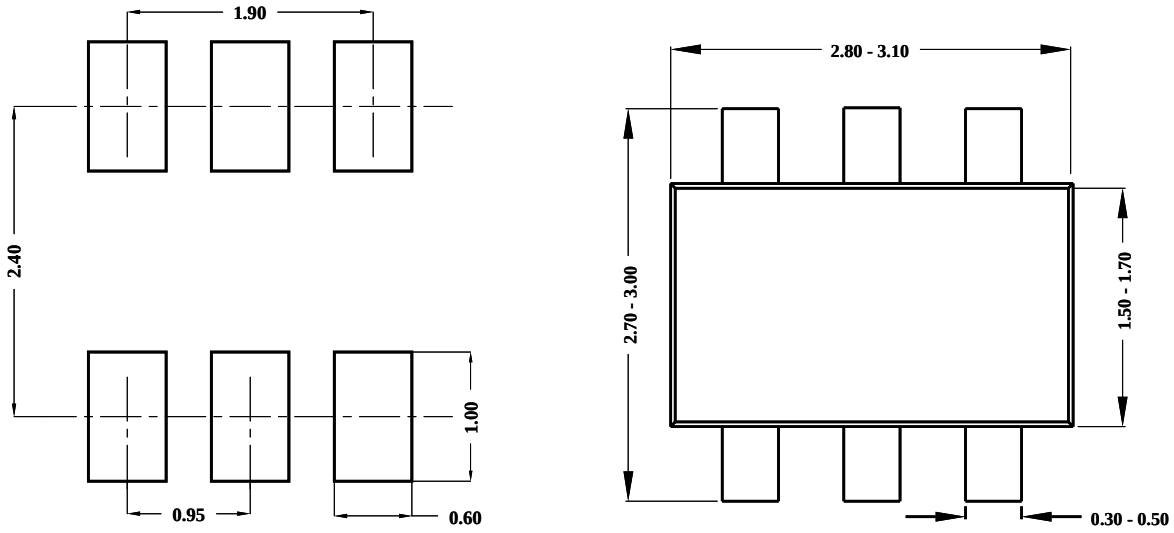
Thermal Regulation Control

Automatic thermal regulation control is active when SY20771's junction temperature is higher than 115℃. The charge current will be automatically decreased according to the thermal regulation control. It can prevent the IC from triggering thermal shutdown.

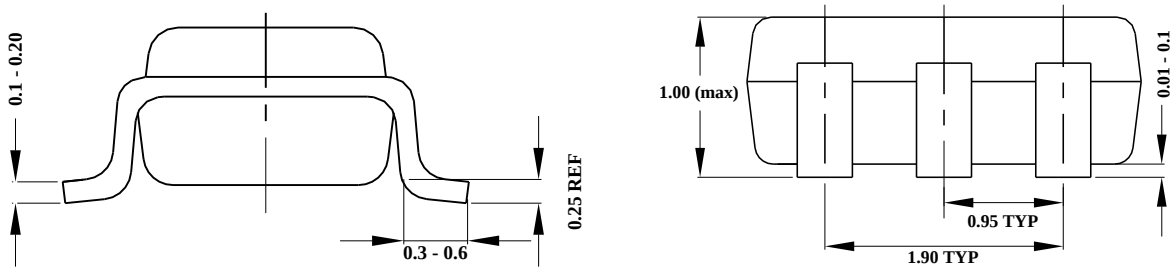
Input and Output Reverse Protection

When the IC has been enabled, if V_{IN}-V_{BAT}≤100mV, internal switcher will be shutdown, then if V_{IN}-V_{BAT}>300mV, internal switcher will be recovery.

TSOT23-6 Package Outline & PCB Layout



Recommended Pad Layout

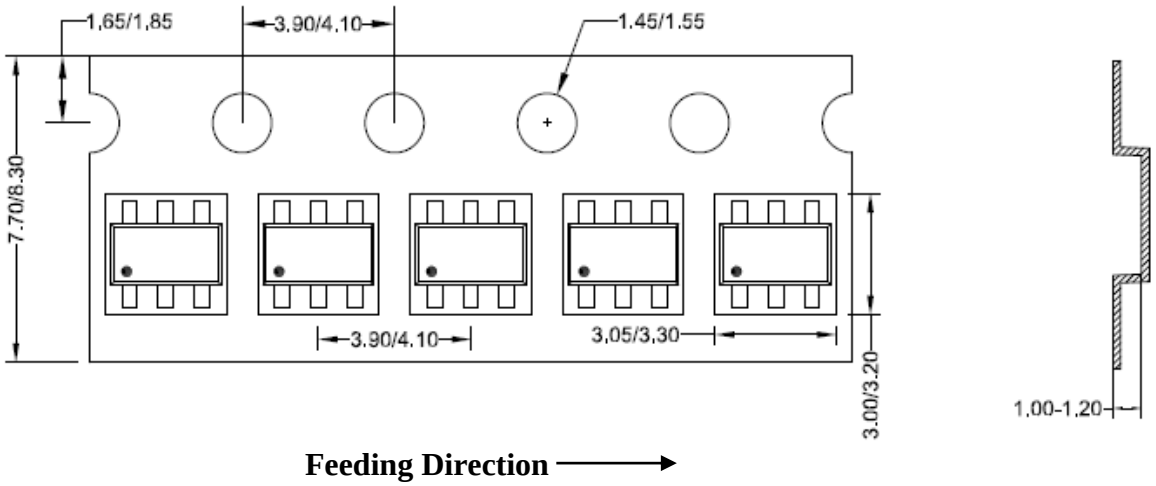


Notes: All dimensions are in millimeters.
All dimensions don't include mold flash & metal burr.

Taping & Reel Specification

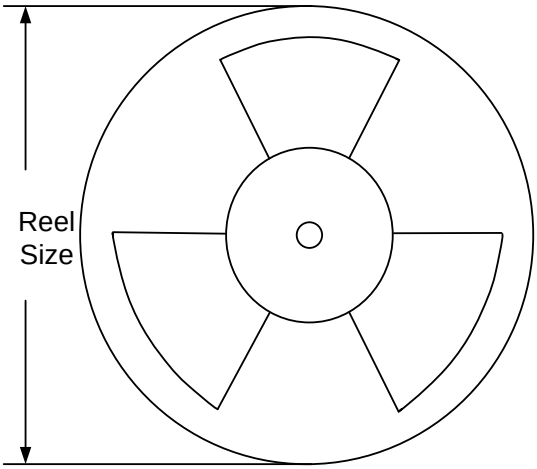
1. Taping orientation

TSOT23-6



Feeding Direction ⟶

2. Carrier Tape & Reel specification for packages



Package types	Tape width (mm)	Pocket pitch(mm)	Reel size (Inch)	Trailer length(mm)	Leader length (mm)	Qty per reel (pcs)
TSOT23-6	8	4	7"	400	160	3000

3. Others: NA

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