

General Description

The SY20809L is an ultra-low $R_{DS(ON)}$ power distribution switch. It has a resistor programmable current limit to protect the power source from overcurrent and short-circuit conditions.

The device incorporates overtemperature protection and a reverse blocking function to ensure reliable operation.

Its low quiescent and very low shutdown currents make this part attractive for battery powered applications.

The SY20809L is available in a TSOT23-5 package.

Features

- Input Voltage: 2.4V to 6V
- 2.5A Load Current Capability
- Quiescent Current I_Q 38 μ A (typ.)
- Shutdown Current I_{SHDN} 0.2 μ A (typ.)
- Programmable Current Limit
- Overtemperature Protection
- Reverse Blocking (No Body Diode)
- OUT Can be Forced Higher than IN at Shutdown
- Compact Package: TSOT23-5
- RoHS Compliant and Halogen Free

Applications

- Battery Operated Products
- USB Dongles
- MiniPCI Accessories
- USB Chargers
- Public Place Multi-USB Chargers

Typical Application Circuit

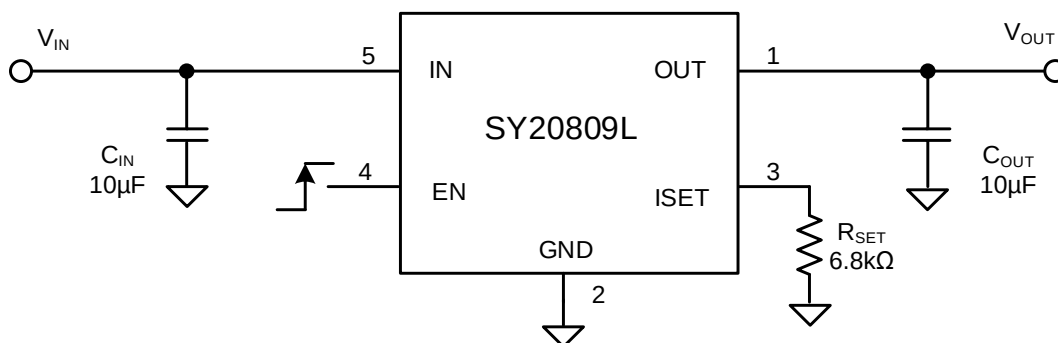


Figure 1. Schematic Diagram

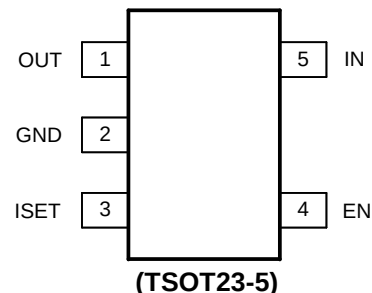
Ordering Information

Ordering Number	Package Type	Top Mark
SY20809LACC	TSOT23-5 RoHS Compliant and Halogen Free	Vmxyz

Device code: Vm

x=year code, y=week code, z= lot number code

Pinout (Top View)



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: $I_{LIM} (A) = 6800 / R_{SET} (\Omega)$
EN	4	ON/OFF control. Pull high to enable operation. Do not leave it floating.
IN	5	Input pin, decouple with a 10μF capacitor to GND.

Block Diagram

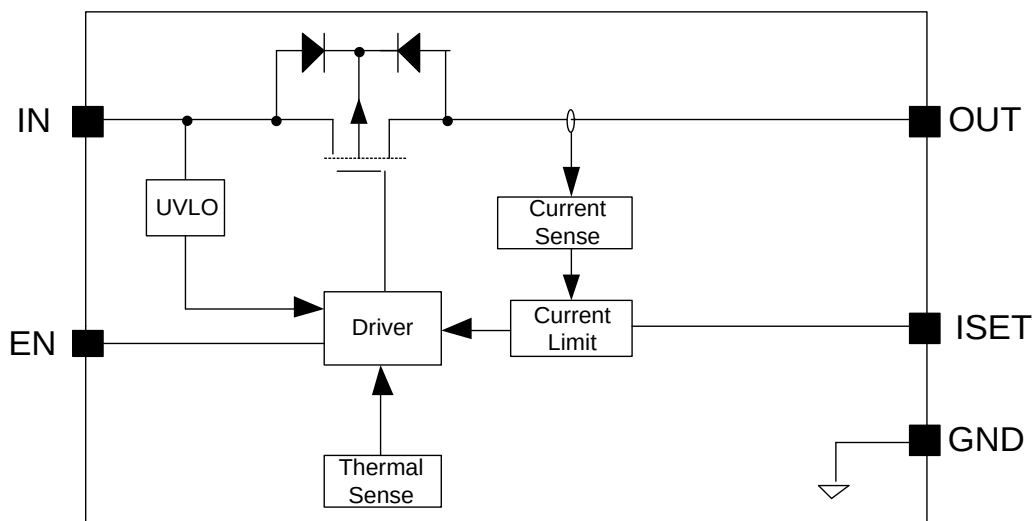


Figure 2. Block Diagram

Absolute Maximum Ratings

Parameter (Note 1)	Min	Max	Unit
IN, OUT, EN, ISET	-0.3	7	V
Lead Temperature (Soldering, 10s)		260	°C
Junction Temperature, Operating	-40	150	
Storage Temperature	-65	150	

Thermal Information

Parameter (Note 2)	Typ	Unit
θ_{JA} Junction-to-Ambient Thermal Resistance	68.5	°C/W
θ_{JC} Junction-to-Case Thermal Resistance	10.9	
P_D Power Dissipation $T_A = 25^\circ\text{C}$	1.46	W

Recommended Operating Conditions

Parameter (Note 3)	Min	Max	Unit
IN	2.4	6	V
OUT, ISET	0	6	
EN	0	V_{IN}	
Junction Temperature, Operating	-40	125	°C
Ambient Temperature	-40	85	

Electrical Characteristics

($V_{IN} = 5V$, $C_{OUT} = 10\mu F$, $T_A = 25^\circ\text{C}$, 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		m Ω
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}	$R_{SET} = 6.8k\Omega$	0.75	1	1.25	A
Programmable Current Limit Range	I_{RANGE}		0.4		2.5	A
Turn-On Time	t_{ON}	$R_L = 10\Omega$, $C_{OUT} = 1\mu F$		130		μs
Turn-Off Time	t_{OFF}	$R_L = 10\Omega$, $C_{OUT} = 1\mu F$		20		μs
Thermal Shutdown Temperature	t_{SD}			150		°C
Thermal Shutdown Hysteresis	t_{SD_HYS}			20		°C

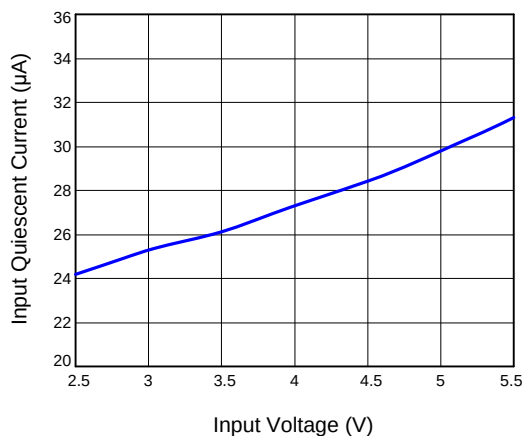
Note 1: Stresses beyond the “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specification is not implied. Exposure to absolute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

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

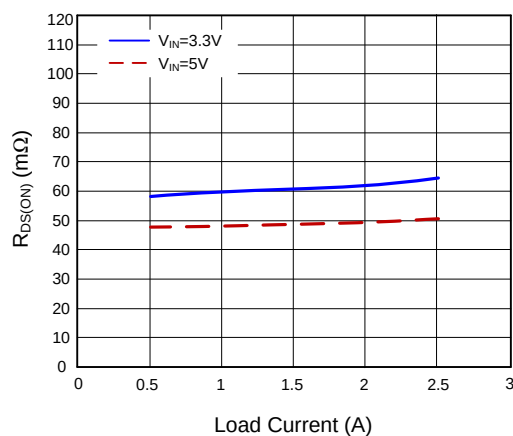
Note 3: The device is not guaranteed to function outside its operating conditions.

Typical Performance Characteristics

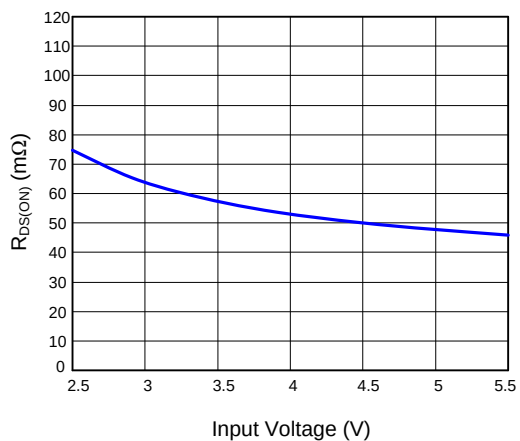
Input Quiescent Current vs. Input Voltage



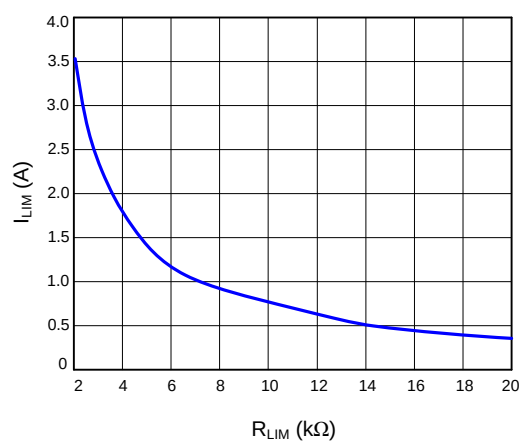
$R_{DS(ON)}$ vs. Load Current



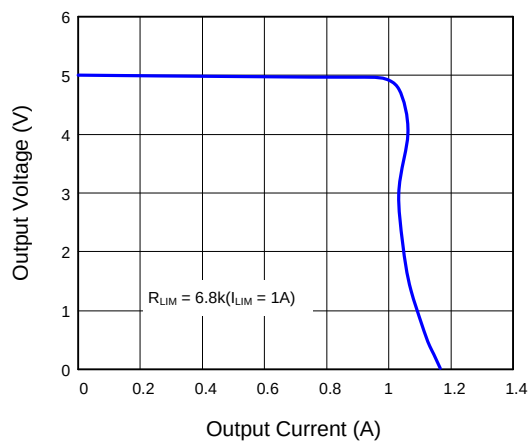
$R_{DS(ON)}$ vs. Input Voltage



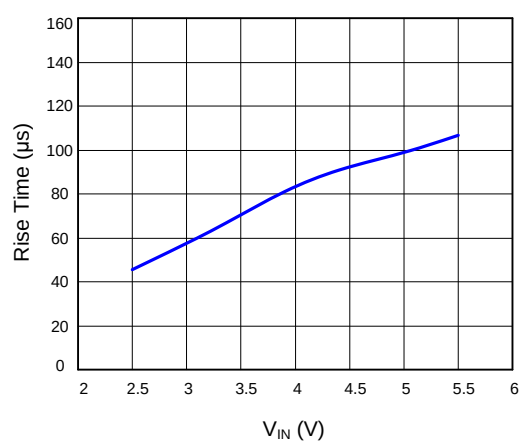
R_{LIM} vs. I_{LIM}



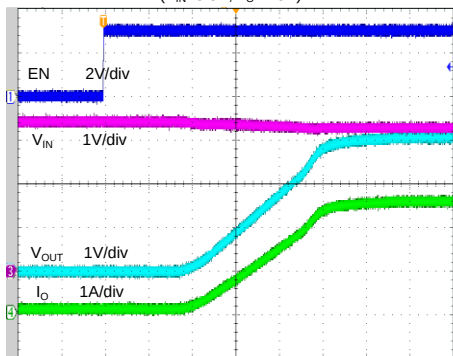
Output Voltage vs. Output Current



Rise Time vs. V_{IN}

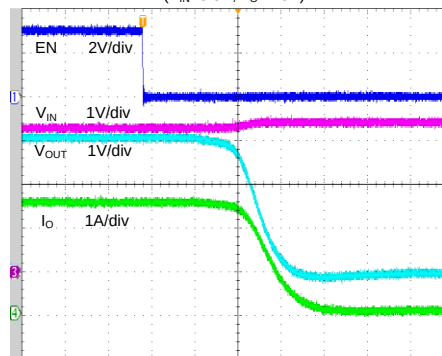


Startup from Enable
($V_{IN}=3.3V$, $I_O=2.5A$)



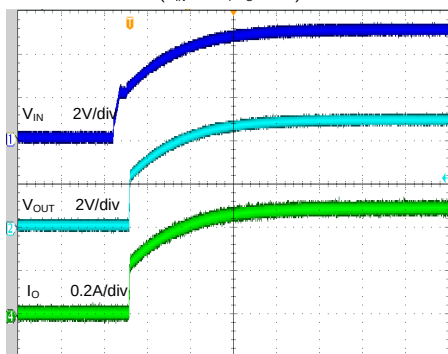
Time (40µs/div)

Shutdown from Enable
($V_{IN}=3.3V$, $I_O=2.5A$)



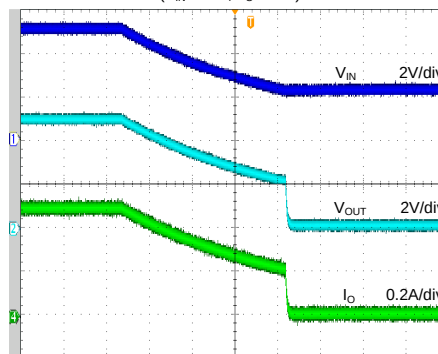
Time (2µs/div)

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)

Application Information

The SY20809L is a current limited P-channel MOSFET power switch with overcurrent and overtemperature protections. There is no body diode between the drain and the source of the MOSFET. The SY20808F3 prevents the current flow from the output to the input when the chip is disabled.

Overcurrent Protection:

When the overcurrent condition is detected, the gate of the pass MOSFET is regulated to achieve a constant output current. If the overcurrent condition persists and result in a junction temperature over 150°C, the device shuts down. When the junction temperature drops below 130°C, the part will restart.

Supply Filter Capacitor:

To prevent an input voltage drop during hot-plug events, a 10μF ceramic capacitor from VIN to GND is strongly recommended. Higher capacitor values can further reduce input voltage drop.

Without an input capacitor, an output short can cause ringing on the input, which could destroy the internal circuitry when the input transient exceeds the absolute maximum supply voltage, even for a short duration.

Current Limiting Setting:

The current limit can be programmed to protect the power source from overcurrent and short-circuit conditions. Connect a resistor R_{SET} from the ISET pin to GND to program the current limit:

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

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

Maximum Input Voltage Consideration:

For any application, the input voltage for SY20809L should not be allowed to exceed the maximum recommended value (6V).

Below is a typical application circuit for the SY20809L. 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 significant output voltage overshoot if the adapter is hot-plugged directly. A voltage overshoot higher than the maximum operating value (6V) will significantly reduce the reliability of the SY20809L and may lead to electrical overstress and failure of the device.

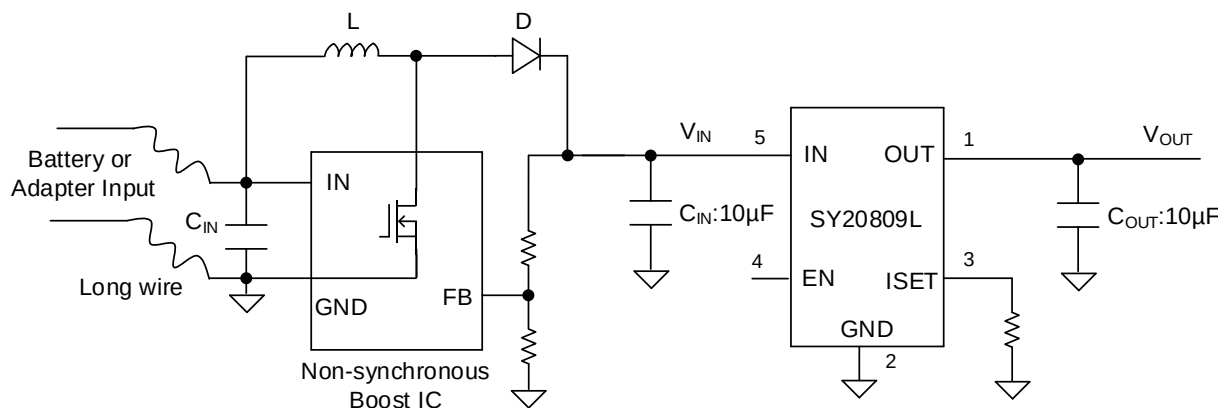


Figure 3. USB Host Application

PCB Layout Guide:

For the best performance of the SY20809, the following guidelines must be 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 resistance and inductance and improve DC and transient performance.
3. Place 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 device and connected to the ground plane to reduce noise coupling.
5. Place the ceramic bypass capacitors as close as possible to the IN and OUT pins.

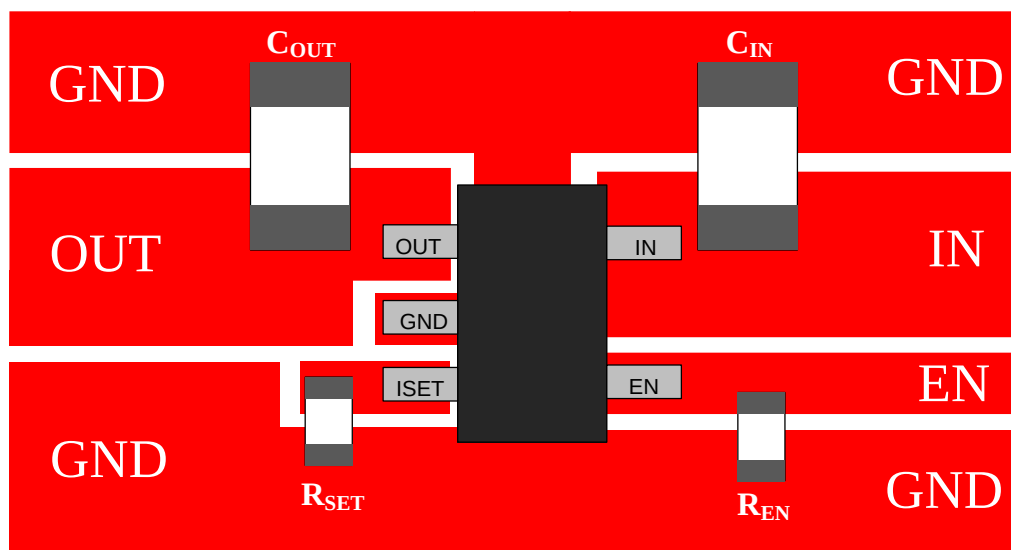
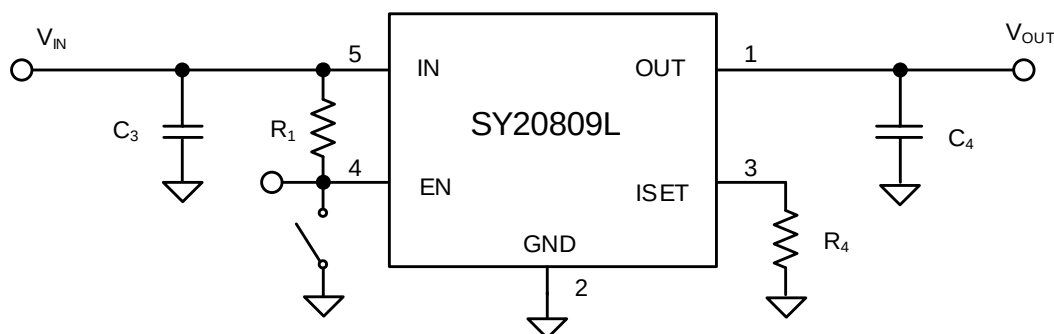


Figure 4. PCB Layout Suggestion

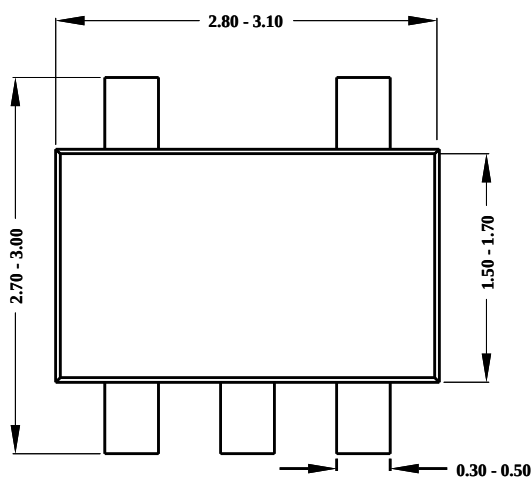
Schematic



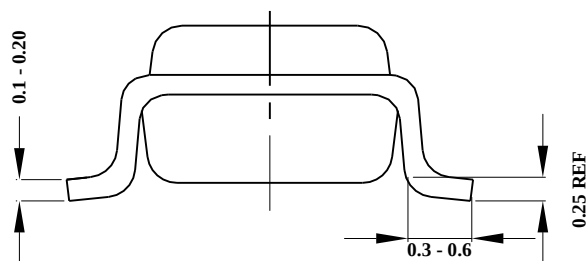
BOM List

Reference Designator	Description	Part Number	Manufacturer
C ₃	10μF/25V, 0805, X5R	C2012X5R1E106K	TDK
C ₄	10μF/25V, 0805, X5R	C2012X5R1E106K	TDK
R ₁	1MΩ, 0603		
R ₄	6.8kΩ, 0603		

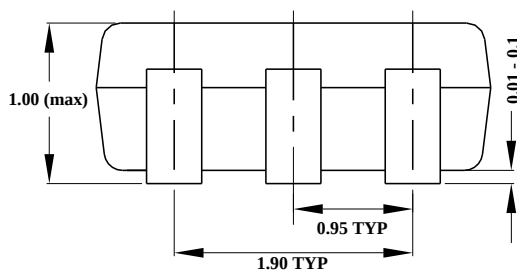
TSOT23-5 Package Outline & PCB Layout Design



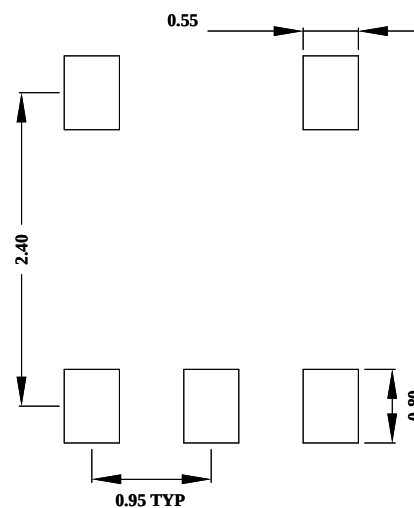
Top View



Side View



Front View

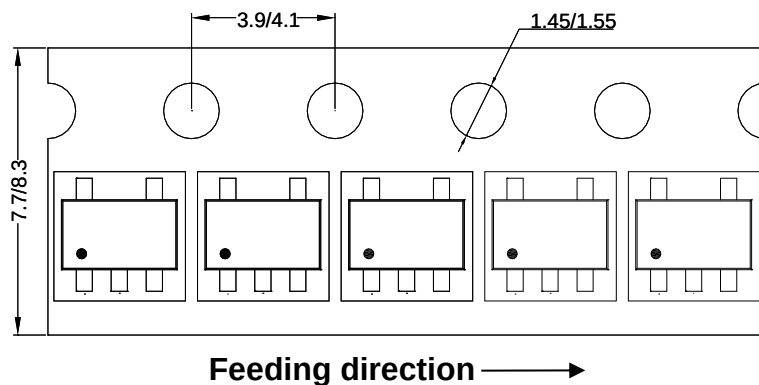


**Recommended PAD Layout
(Reference Only)**

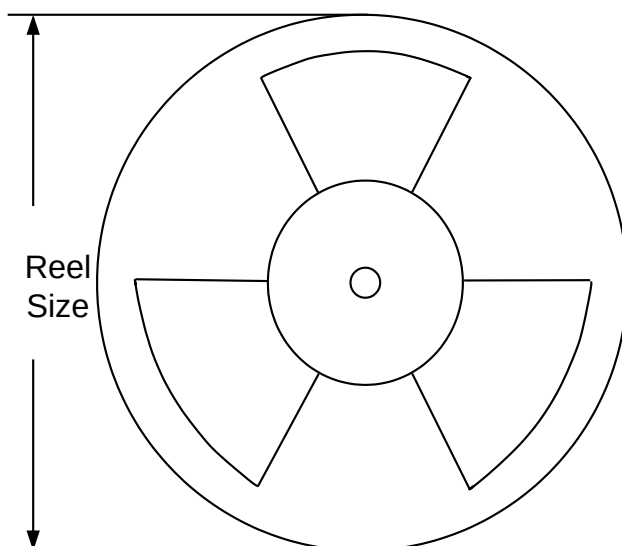
Note: All dimensions are in millimeters and exclude mold flash and metal burr.

Taping & Reel Specification

1. TSOT23-5 Taping Orientation



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



Revision History

The revision history provided is for informational purpose only and is believed to be accurate, however, not warranted. Please make sure that you have the latest revision.

Date	Revision	Change
Jan.05, 2024	Revision 1.0	Language improvements for clarity.



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