SY20845C

Programmable Current Limit Switch

General Description

The SY20845C is a programmable current limit switch with input voltage range selection and output voltage clamping. 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 start-up time.

The SY20845C uses an enable control for system sequencing. The programmable current limit can be configured using an external resistor. The device integrates the over-temperature protection shutdown and auto-recovery with hysteresis.

The SY20845C is available in a compact DFN3×3-10 package.

Features

- Wide Input Voltage Range: 2.5V to 15V with Surge up to 30V
- Extremely Low $R_{DS(ON)}$ for the Integrated Protection Switch: 50mΩ
- Programmable Current Limit
- Programmable Soft-Start Time
- Short-circuit Protection
- Selectable Input Range and Clamping Output Voltage Threshold.
- Enable Interface Pin
- Thermal Shutdown Protection & Auto Recovery
- RoHS Compliant and Halogen Free
- Compact package: DFN3×3-10

Applications

- Notebook PCs
- I-pad Mini
- Servers
- Service PCs

Typical Application

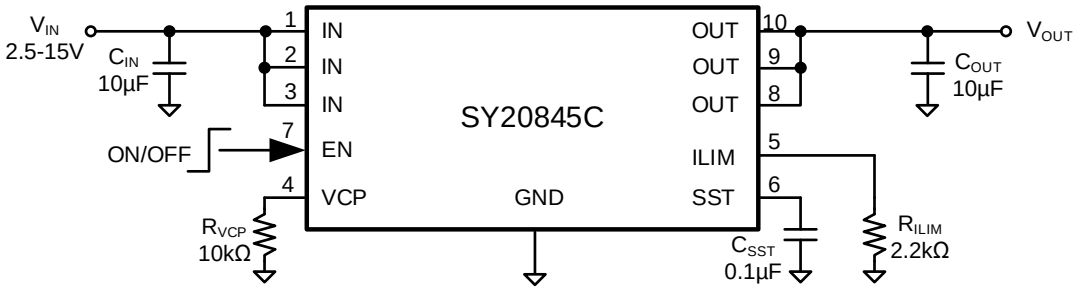


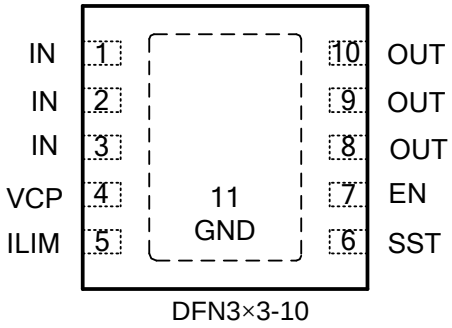
Figure 1. Schematic Diagram

Ordering Information

Ordering Number	Package Type	Top Mark
SY20845CDBC	DFN3×3-10 RoHS Compliant and Halogen Free	**KC*xyz***

Device code: KC
x=year code, y=week code, z= lot number code

Pinout (Top View)



DFN3×3-10

Pin Description

Pin Name	Pin Number	Pin Description
IN	1,2,3	Power input pin. Decouple high frequency noise by connecting at least a 0.1μF MLCC to ground.
GND	11(exposed paddle)	Ground pin.
OUT	8,9,10	Power output pins.
ILIM	5	Current limit program pin. Program the current limit by connecting a resister to ground.
SST	6	Soft-start time program pin. Connect a capacitor to ground to program the soft start time.
EN	7	Enable interface pin. Pull it High to enable the IC.
VCP	4	Output clamp voltage selection based on the input voltage. Pull VCP pin to High by connecting a resistor to IN, or pull VCP pin to Low by connecting a resistor to ground, or float VCP Pin to select different output clamping thresholds. It's recommended to decouple this pin with a 0.1μF capacitor.

VCP	IN		Clamping Threshold		
			Min	Typ	Max
Low	3.3V	Over 4V	3.6V	3.8V	4.0V
High	5V	Over 6V	5.4V	5.7V	6.0V
Open	12V	Over 14V	12.6V	13.3V	14V

Block Diagram

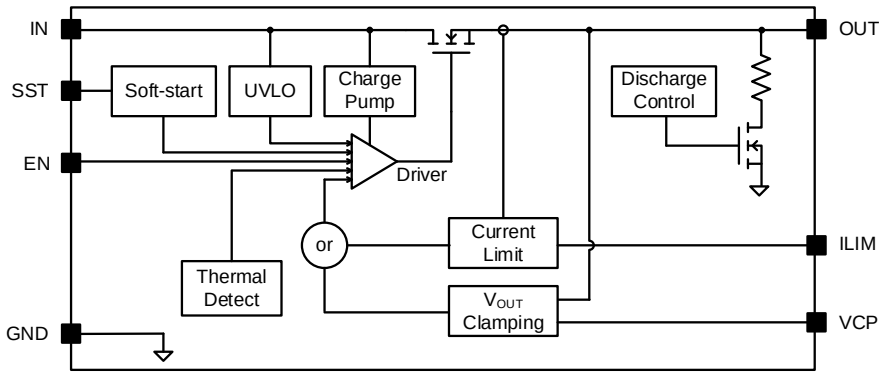


Figure 2. Block Diagram

Absolute Maximum Ratings

Parameter (Note 1)	Min	Max	Unit
IN, EN, VCP		30	V
Lead Temperature (Soldering, 10s)		260	°C
Junction Temperature, Operating	-40	125	
Storage Temperature	-65	150	

Thermal Information

Parameter (Note 2)	Typ	Unit
θ_{JA} Junction-to-Ambient Thermal Resistance	38	°C/W
θ_{JC} Junction-to-Case Thermal Resistance	8	
P_D Power Dissipation T_A = 25°C	2.6	W

Recommended Operating Conditions

Parameter (Note 3)	Min	Max	Unit
Supply Input Voltage	2.5	15	V
Junction Temperature, Operating	-40	125	°C
Ambient Temperature	-40	85	

Electrical Characteristics

(V_{IN} = 5V, R_{LIM}=10kΩ, C_{SST}=105nF, C_{IN} = 10uF, C_{OUT} = 10uF, T_A = 25°C, unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage Range	V_{IN}		2.5		30	V
Input UVLO Threshold	V_{UVLO}	VCP=LOW/HIGH	2.2		2.4	V
		VCP=OPEN	8.1		9.0	V
UVLO hysteresis	V_{HYS}	VCP=LOW/HIGH	0.05	0.085	0.13	V
		VCP=OPEN	0.1	0.19	0.29	
Bias Current	I_{BIAS}			200	320	μA
Shutdown Current	I_{SHDN}	EN=0		10		μA
Protection FET RON	$R_{DS(ON)}$			50	80	mΩ
Current Limit Accuracy				30%I_{LIM}		
Current Limit Program Range	I_{LIM}	(Note 5)	1		5	A
Clamping Output Voltage	V_{CLP}	VCP=LOW	3.6	3.8	4.0	V
		VCP=HIGH	5.4	5.7	6.0	V
		VCP=OPEN	12.6	13.3	14.0	V
Soft-start Time	T_{SST}	C_{SST}=105nF(Note 4)		29.4		ms
Soft-start Time Accuracy				±30%T_{SST}		
EN Turn-on Threshold	V_{EN_ON}		2			V
EN Turn-off Threshold	V_{EN_OFF}				0.4	V
Output Discharge Resistor	R_{DIS}	EN='0'		30		Ω
Thermal Shutdown Temperature	T_{SD}			140		°C
Thermal Shutdown Hysteresis	T_{HYS}			20		°C

Note 1: Stresses beyond "Absolute Maximum Ratings" may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions 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. Test condition: Device mounted on 2" x 2" FR-4 substrate PCB, 2oz copper, with minimum recommended pad on top layer and thermal vias to bottom layer ground plane.

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

Note4. Recommended Soft-start Time Program Table

SST cap (nF)	None	10	55	105
Rise time (ms)	1.4	2.8	15.4	29.4

Recommended Formula for C_{SST} & Soft-start Time Calculation

$$t_{SST} = \begin{cases} t_{SS\_DLT}, No\ external\ C_{SST} \\ \dfrac{C_{SST}}{I_{INT}}, \quad t_{SST} > t_{SS\_DLT} \end{cases},$$

Where, t_{SS_DLT} is the internally fixed default soft-start time of 1.4ms (typ.), which means there's no any external C_{SST}; I_{INT} is the internal current source with a value of 3.6μA (typ.).

Note5. Recommended Current Limit Program Table

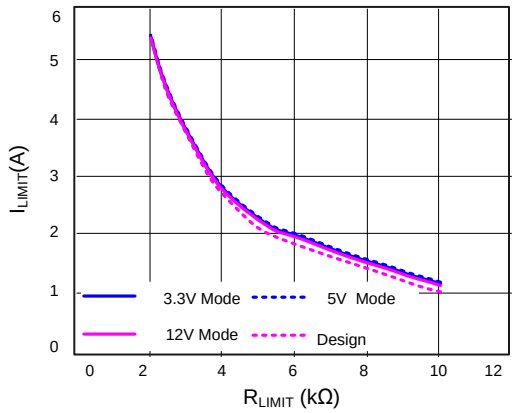
Current Limit Resistance (kΩ)	11	5.5	4.4	3.7	3.1	2.8	2.4	2.2
Current Limit (A)	1.0	2.0	2.5	3.0	3.5	4.0	4.5	5.0

Equation for R_{LIM} calculation based on the current limit required:

$$R_{LIM} = \frac{11k}{I_{LIM}}(\Omega).$$

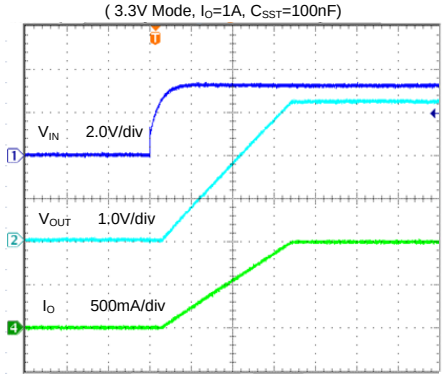
Typical Performance Characteristics

Programmable Current Limit



Programmable Soft-start Time

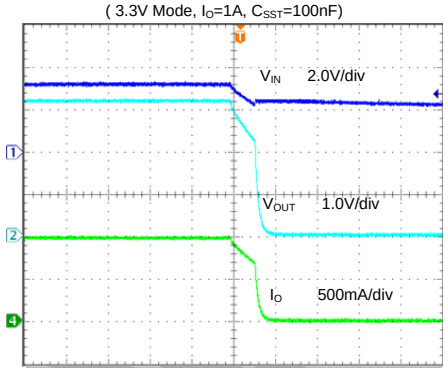
(3.3V Mode, I_O=1A, C_{SST}=100nF)



Time (10ms/div)

Shutdown

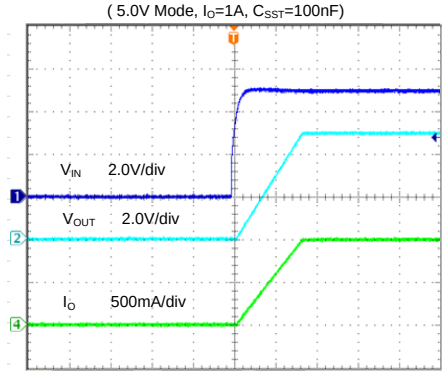
(3.3V Mode, I_O=1A, C_{SST}=100nF)



Time (400us/div)

Programmable Soft-start Time

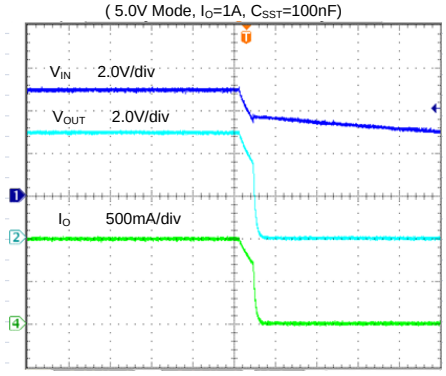
(5.0V Mode, I_O=1A, C_{SST}=100nF)



Time (20ms/div)

Shutdown

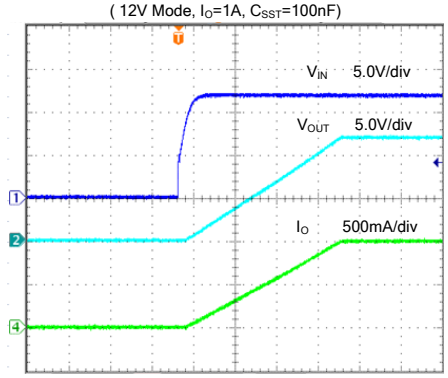
(5.0V Mode, I_O=1A, C_{SST}=100nF)



Time (1.0ms/div)

Programmable Soft-start Time

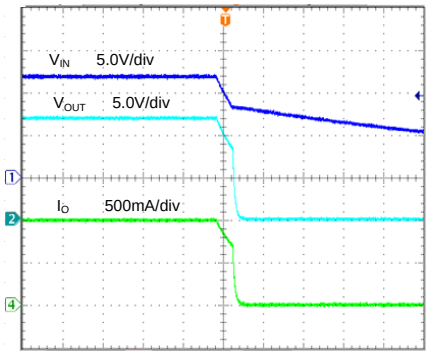
(12V Mode, I_O=1A, C_{SST}=100nF)



Time (10ms/div)

Shutdown

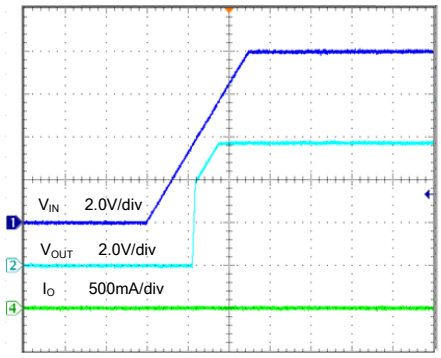
(12V Mode, I_O=1A, C_{SST}=100nF)



Time (2.0ms/div)

Over Voltage Protection

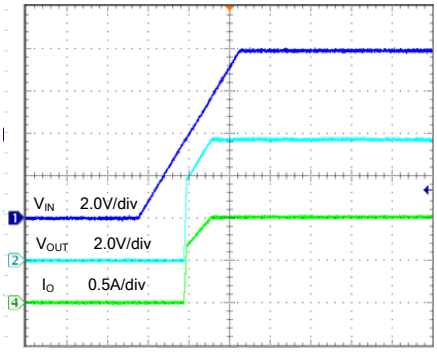
(5V Mode, V_{IN}=8V, I_O=0A)



Time (400ms/div)

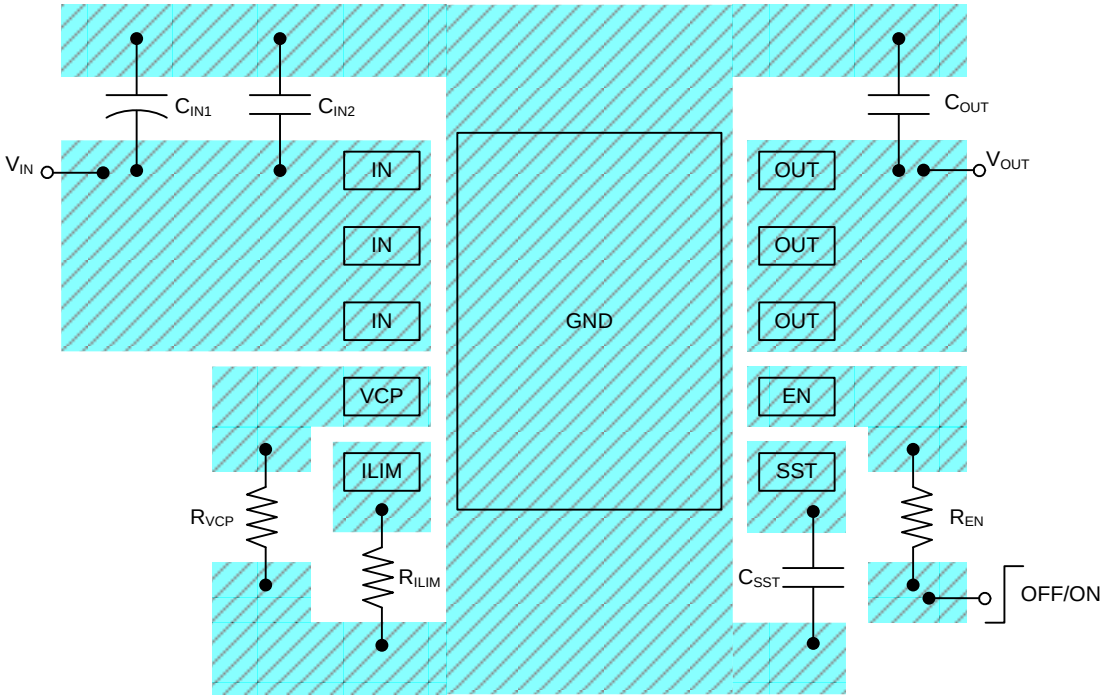
Over Voltage Protection

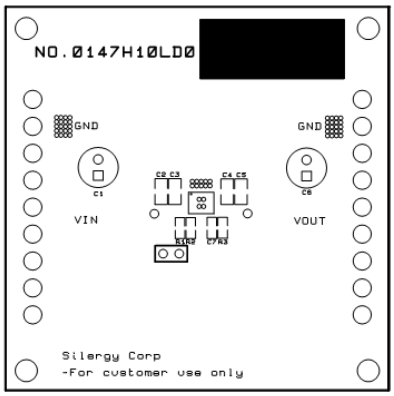
(5V Mode, V_{IN}=8V, I_O=1A)



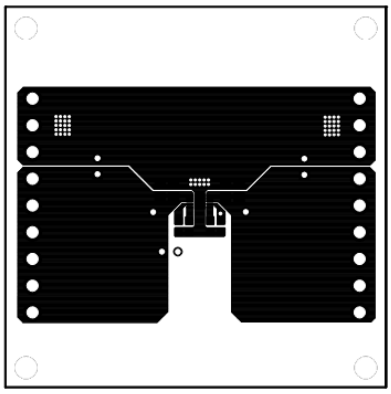
Time (400ms/div)

PCB Layout Guideline

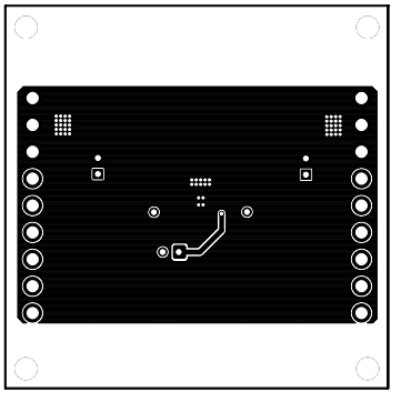




Top Silkscreen

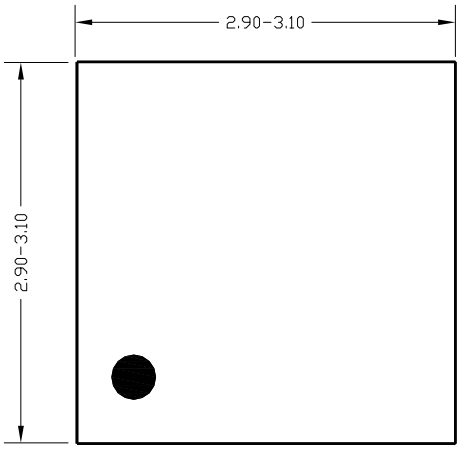


Top Layer

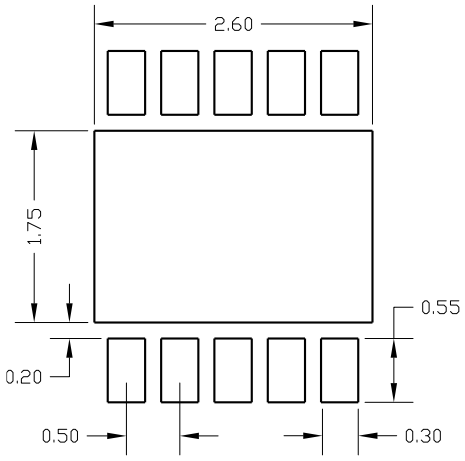


Bottom Layer

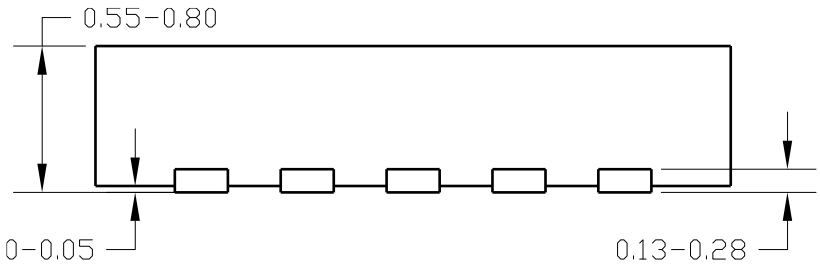
DFN3x3-10 Package outline



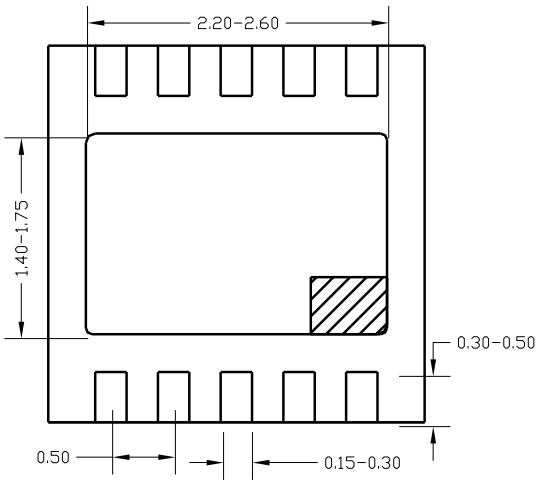
Top View

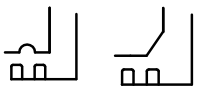


PCB layout (recommended)



Side View





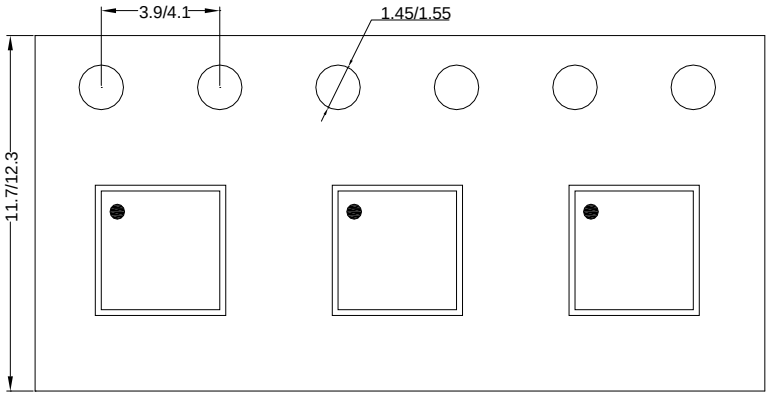
Detail A
Pin1 identifier: two options

Bottom View

Notes: **All dimensions are in millimeters and exclude mold flash & metal burr.**

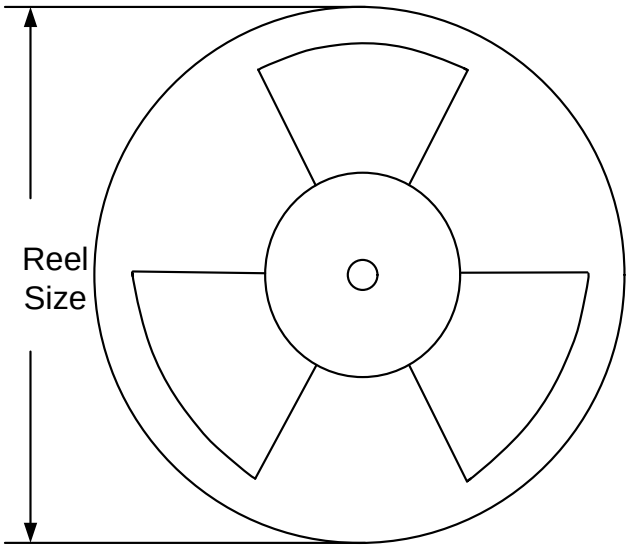
Tape and Reel Information

1. DFN3x3-10 taping orientation



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
DFN3x3	10	8	13"	400	400	5000

3. Others: NA

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