

### General Description

The SY20845D 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. Programmable soft-start time controls the slew rate of the output voltage during the start-up time.

The SY20845D 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 SY20845D 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: 40 mΩ
- Programmable Soft-Start Time
- Programmable Current Limit
- 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

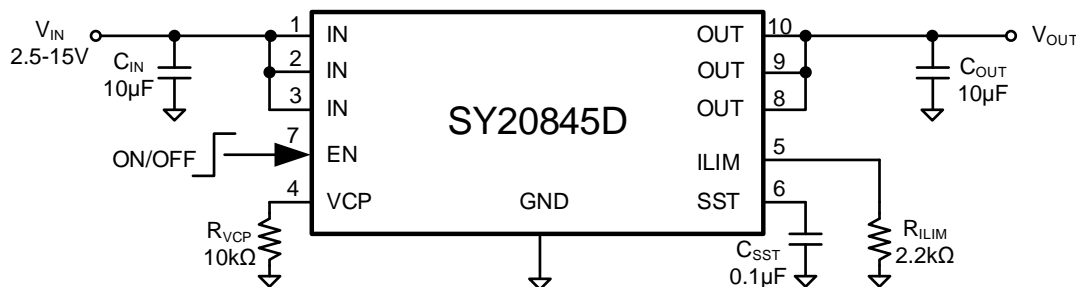


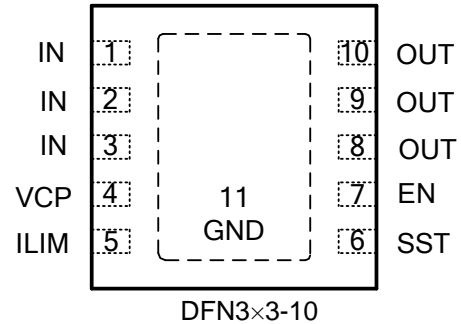
Figure 1. Schematic Diagram

## Ordering Information

Ordering Number	Package Type	Top Mark
SY20845DDBC	DFN3×3-10 RoHS Compliant and Halogen Free	KDxyz

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

## Pinout (Top View)



## 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 resistor 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 ≤ 10kΩ to IN, or pull VCP pin to Low by connecting a resistor ≤ 10kΩ to ground, or float VCP Pin to select different output clamping thresholds. It's recommended to decouple this pin with a 0.1μF capacitor. <table border="1" data-bbox="820 1239 1266 1407"> <thead> <tr> <th rowspan="2">VCP</th> <th colspan="3">Clamping Threshold</th> </tr> <tr> <th>Min</th> <th>Typ</th> <th>Max</th> </tr> </thead> <tbody> <tr> <td>Low</td> <td>3.6V</td> <td>3.8V</td> <td>4.0V</td> </tr> <tr> <td>High</td> <td>5.4V</td> <td>5.7V</td> <td>6.0V</td> </tr> <tr> <td>Open</td> <td>9.1V</td> <td>9.6V</td> <td>10.1V</td> </tr> </tbody> </table>	VCP	Clamping Threshold			Min	Typ	Max	Low	3.6V	3.8V	4.0V	High	5.4V	5.7V	6.0V	Open	9.1V	9.6V	10.1V
VCP	Clamping Threshold																				
	Min	Typ	Max																		
Low	3.6V	3.8V	4.0V																		
High	5.4V	5.7V	6.0V																		
Open	9.1V	9.6V	10.1V																		

## Block Diagram

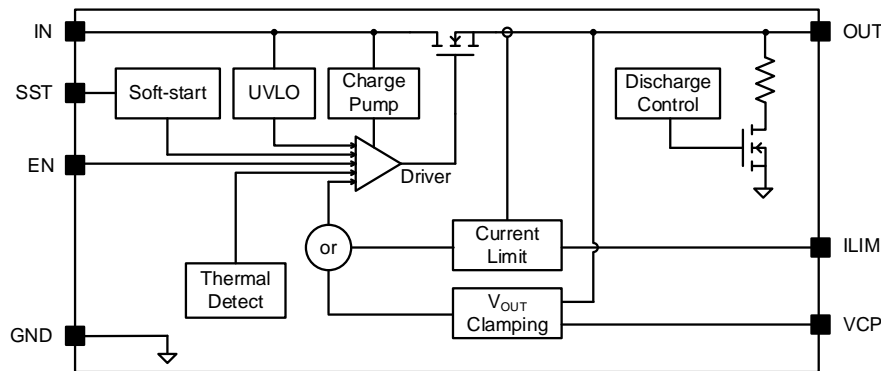


Figure 2. Block Diagram

## 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
$\theta_{JA}$ Junction-to-Ambient Thermal Resistance	38	°C/W
$\theta_{JC}$ Junction-to-Case Thermal Resistance	8	
$P_D$ Power Dissipation $T_A = 25^\circ\text{C}$	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

( $V_{IN} = 5\text{V}$ ,  $R_{LIM} = 10\text{k}\Omega$ ,  $C_{SST} = 105\text{nF}$ ,  $C_{IN} = 10\mu\text{F}$ ,  $C_{OUT} = 10\mu\text{F}$ ,  $T_A = 25^\circ\text{C}$ , unless otherwise specified )

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage Range	$V_{IN}$		2.5		30	V
Input UVLO Threshold	$V_{UVLO}$		2.2		2.4	V
UVLO hysteresis	$V_{HYS}$		0.05	0.085	0.13	V
Bias Current	$I_{BIAS}$			200		$\mu\text{A}$
Shutdown Current	$I_{SHDN}$	EN=0		10		$\mu\text{A}$
Protection FET RON	$R_{DS(ON)}$			40	70	m $\Omega$
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	9.1	9.6	10.1	V
Soft-start Time	$T_{SST}$	$C_{SST} = 105\text{nF}$ (Note 4)		29.4		ms
Soft-start Time Accuracy				$\pm 30\% T_{SST}$		
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		$\Omega$
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:**  $\theta_{JA}$  is measured in the natural convection at  $T_A = 25^\circ\text{C}$  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

$$t_{SST} = \begin{cases} t_{SS\_DLT}, & \text{No external } C_{SST} \\ \frac{C_{SST}}{I_{INT}}, & t_{SST} > t_{SS\_DLT} \end{cases}$$

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 3.6 $\mu\text{A}$  (typ.).

**Note5. Recommended Current Limit Program Table**

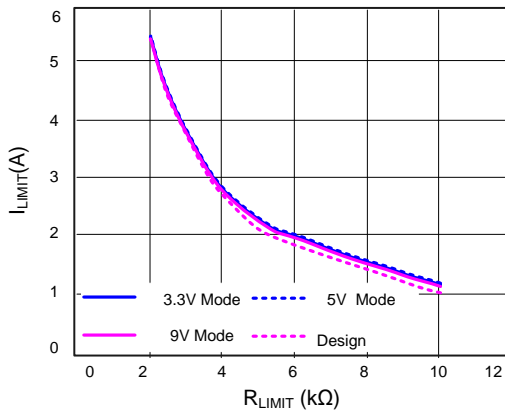
Current Limit Resistance (k $\Omega$ )	11	5.5	4.4	3.7	3.1	2.8	2.4	2.2
Current Limit (A)	1.0	2.0	2.5	3.0	3.5	4.0	4.5	5.0

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

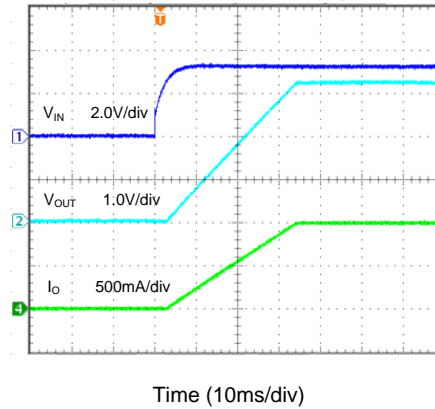
$$R_{LIM} = \frac{11k}{I_{LIM}} (\Omega).$$

## Typical Performance Characteristics

Programmable Current Limit

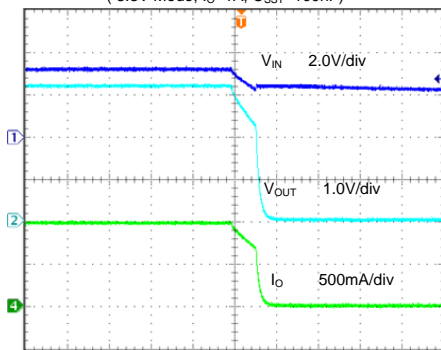


Programmable Soft-start Time  
(3.3V Mode,  $I_o=1A$ ,  $C_{SS1}=100nF$ )



Shutdown

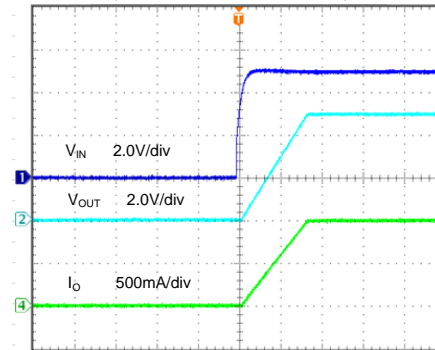
(3.3V Mode,  $I_o=1A$ ,  $C_{SS1}=100nF$ )



Time (400us/div)

Programmable Soft-start Time

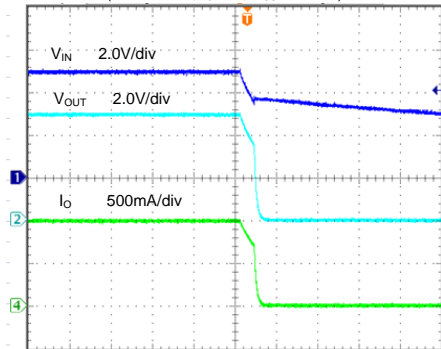
(5.0V Mode,  $I_o=1A$ ,  $C_{SS1}=100nF$ )



Time (20ms/div)

Shutdown

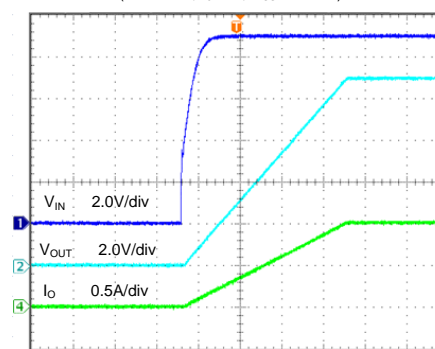
(5.0V Mode,  $I_o=1A$ ,  $C_{SS1}=100nF$ )



Time (1.0ms/div)

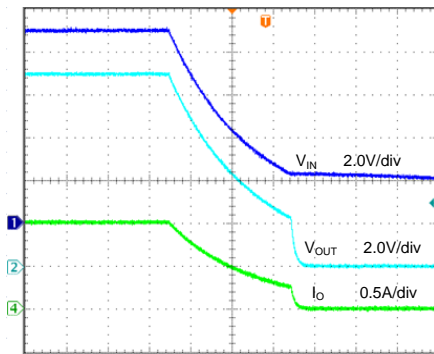
Programmable Soft-start Time

(9V Mode,  $I_o=1A$ ,  $C_{SS1}=100nF$ )



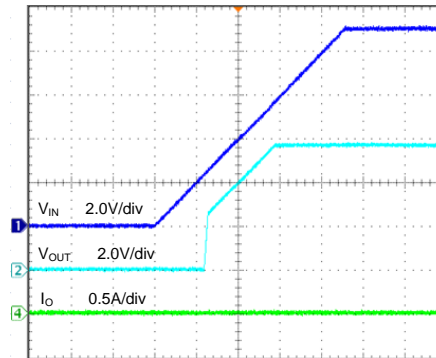
Time (10ms/div)

**Shutdown**  
(9V Mode,  $I_o=1A$ ,  $C_{SS1}=100nF$ )



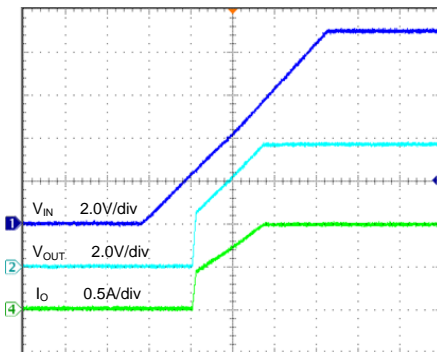
Time (1.0ms/div)

**Over Voltage Protection**  
(5V Mode,  $V_{IN}=9V$ ,  $I_o=0A$ )



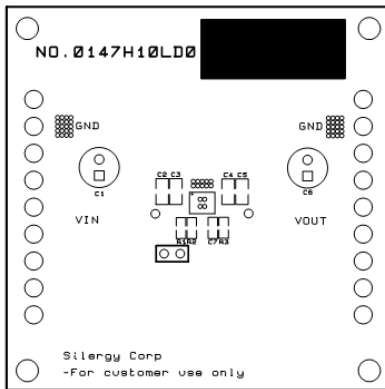
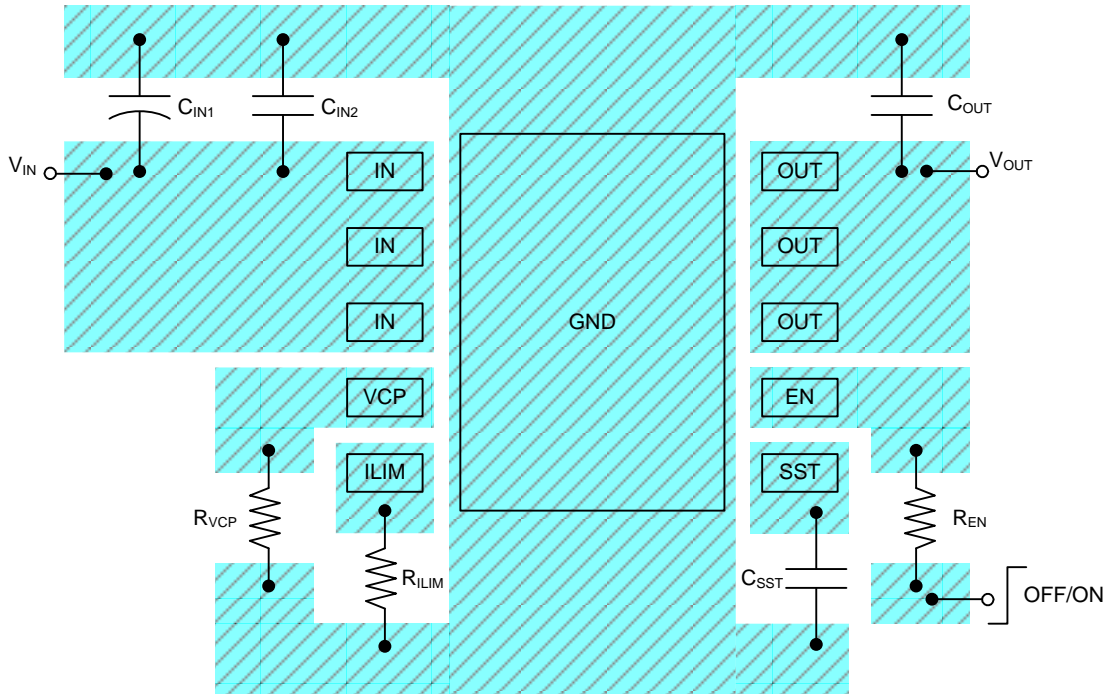
Time (200ms/div)

**Over Voltage Protection**  
(5V Mode,  $V_{IN}=9V$ ,  $I_o=1A$ )

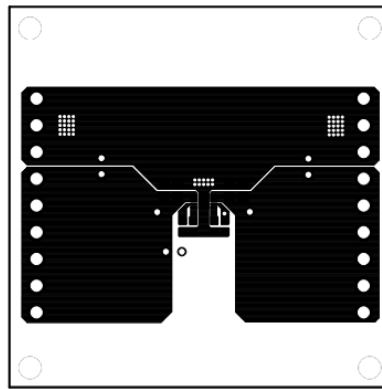


Time (200ms/div)

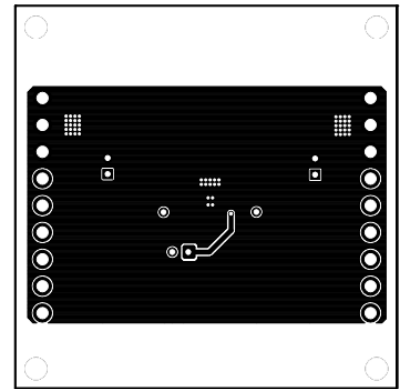
## PCB Layout Guideline



**Top Silkscreen**

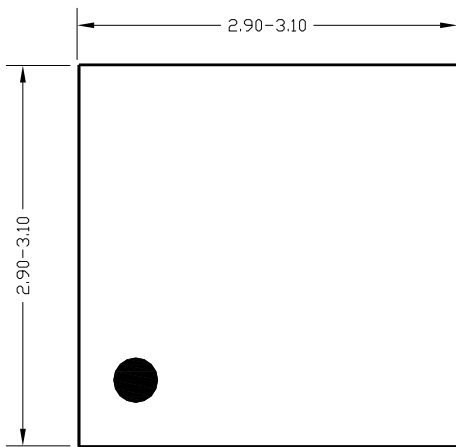


**Top Layer**

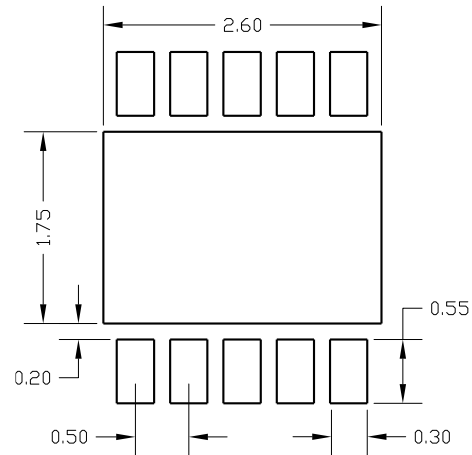


**Bottom Layer**

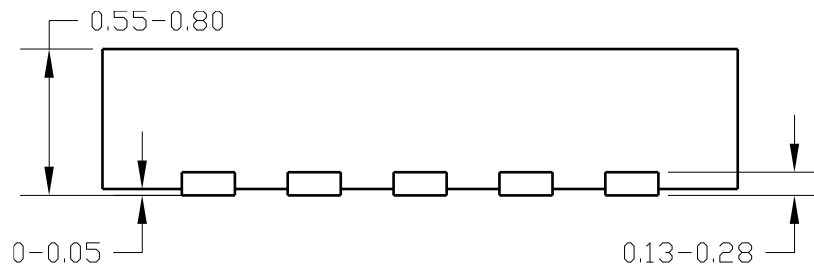
**DFN3x3-10 Package outline**



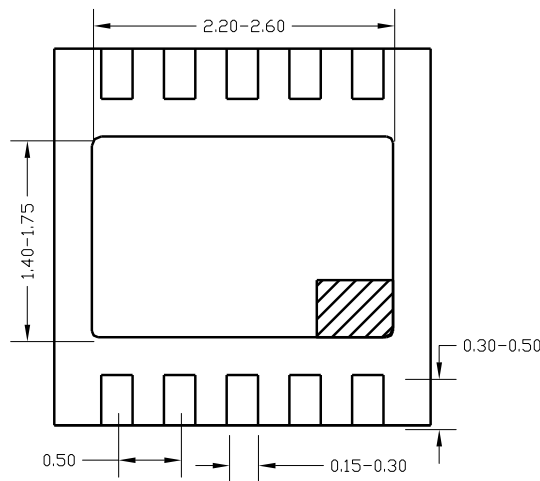
**Top View**



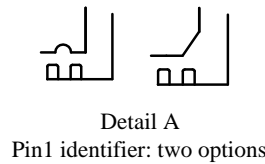
**PCB layout (recommended)**



**Side View**



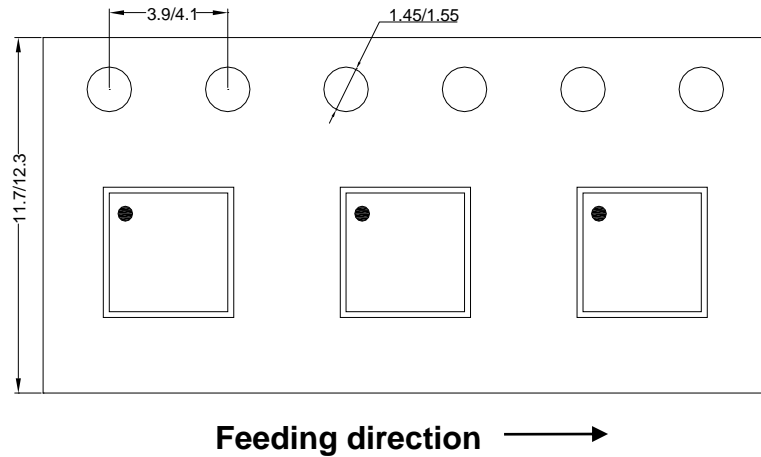
**Bottom View**



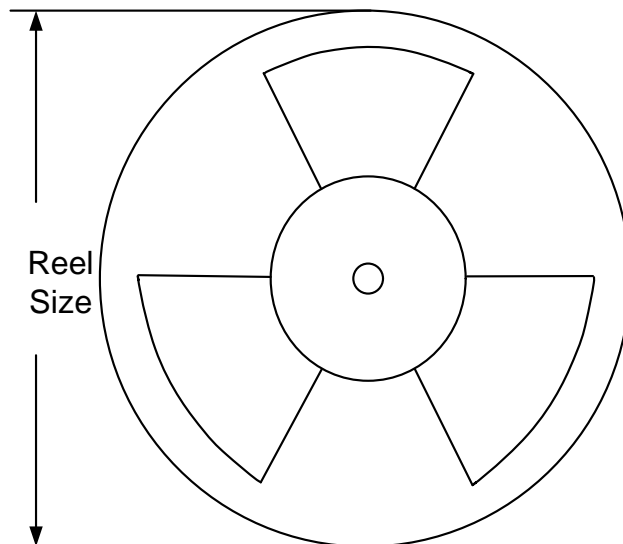
**Notes: All dimensions are in millimeters and exclude mold flash & metal burr.**

## Tape and Reel Information

### 1. DFN3x3-10 taping orientation



### 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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