

General Description

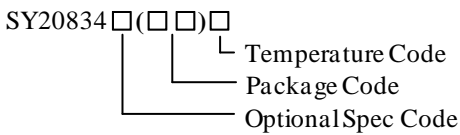
The SY20834 is a programmable current limit switch with input voltage range selection and output voltage clamping. Extremely low $R_{DS(ON)}$ of the integrated protection N-channel FET helps to reduce power loss during the normal operation. Programmable soft-start time controls the slew rate of the output voltage during the start-up time. Independent enable control allows the complicated system sequencing control. It integrates the over-temperature protection shutdown and auto-recovery with hysteresis.

This IC along with small DFN3X3-10 footprint provides small PCB area application.

Features

- Wide Input Voltage Range: 2.5V to 15V with Surge up to 30V
- Extremely Low $R_{DS(ON)}$ for the Integrated Protection Switch: 50 m Ω
- Programmable Soft-Start Time
- Programmable Current Limit up to 4A
- 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: DFN3X3-10

Ordering Information



| Ordering Number | Package type | Note |
|-----------------|---|------|
| SY20834DBC | DFN3x3-10 RoHS Compliant and Halogen Free | ---- |

Applications

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

Typical Application

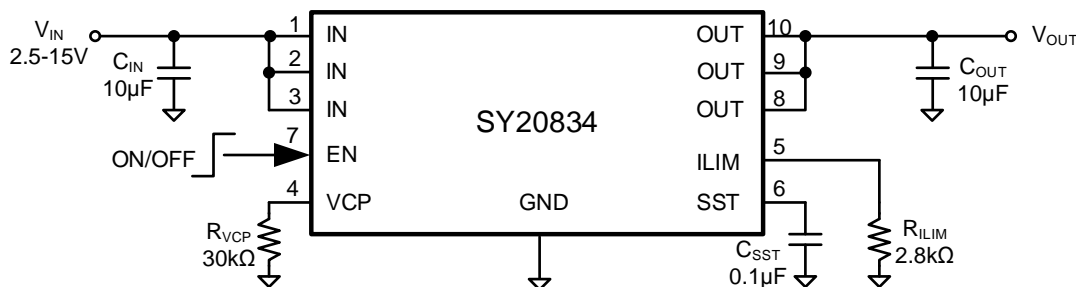
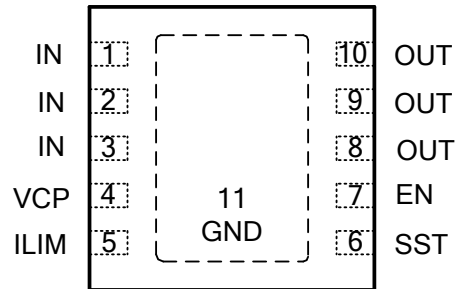


Figure 1. Schematic Diagram

Pinout (top view)

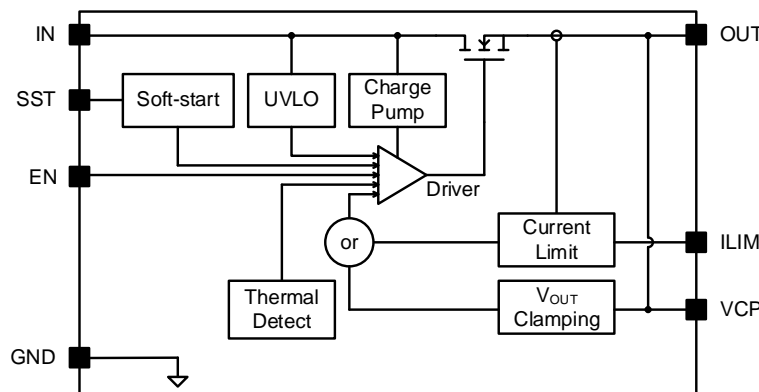


(DFN3x3-10)

Top mark: **JTxyz** (Device code: JT, **x=year code**, **y=week code**, **z=lot number code**)

| Pin Name | Pin Number | Pin Description | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------|-----------------|--|-------|-------|------|--------------------|--|--|-----|-----|-----|-----|------|---------|------|------|------|------|----|---------|------|------|------|------|-----|----------|-------|-------|-----|
| IN | 1,2,3 | Power input pin. Decouple high frequency noise by connecting at least 0.1μF MLCC to ground. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| GND | 11(exposed pad) | Ground pin. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| OUT | 8,9,10 | Power output pin. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 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. Connect a 0~1MΩ resistor to GND or IN for pulling low or high. | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| VCP | 4 | Output clamp voltage selection based on the input voltage. Pull VCP pin to High by connecting a 0~30kΩ resistor to IN, or pull VCP pin to Low by connecting a 0~30kΩ resistor to ground, or float VCP Pin to select different output clamping thresholds. Recommend to decoupling this pin with 0.1μF capacitor. <table border="1" style="margin-top: 10px;"> <thead> <tr> <th rowspan="2">VCP</th> <th colspan="2" rowspan="2">IN</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>3.3V</td> <td>Over 4V</td> <td>3.6V</td> <td>3.8V</td> <td>4.0V</td> </tr> <tr> <td>High</td> <td>5V</td> <td>Over 6V</td> <td>5.4V</td> <td>5.7V</td> <td>6.0V</td> </tr> <tr> <td>Open</td> <td>12V</td> <td>Over 14V</td> <td>12.6V</td> <td>13.3V</td> <td>14V</td> </tr> </tbody> </table> | 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 |
| 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





Absolute Maximum Ratings (Note 1)

Supply Input Voltage ----- 30V
 EN, VCP ----- 30V
 Power Dissipation, P_D @ T_A = 25°C DFN3X3-10 ----- 2.6W
 Package Thermal Resistance (Note 2)
 θ_{JA} ----- 38°C/W
 θ_{JC} ----- 8°C/W
 Junction Temperature Range ----- 125°C
 Lead Temperature (Soldering, 10 sec.) ----- 260°C
 Storage Temperature Range ----- -65°C to 150°C

Recommended Operating Conditions (Note 3)

Supply Input Voltage ----- 2.5V to 15V
 Junction Temperature Range ----- -40°C to 125°C
 Ambient Temperature Range ----- -40°C to 85°C

Electrical Characteristics

(V_{IN} = 5V, R_{LIM}=10kΩ, C_{SST}=105nF, C_{IN} = 10μF, C_{OUT} = 10μF, 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 | 2.2 | | 2.4 | V |
| | | VCP=HIGH | 3.4 | | 3.8 | V |
| | | VCP=OPEN | 8.1 | | 9.0 | V |
| UVLO Hysteresis | V _{HYS} | VCP=LOW | 0.05 | 0.085 | 0.13 | V |
| | | VCP=HIGH | 0.06 | 0.095 | 0.15 | |
| | | VCP=OPEN | 0.1 | 0.19 | 0.29 | |
| Bias Current | I _{BIAS} | | | 200 | | 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 | | 4 | 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 |
| Thermal Shutdown Temperature | T _{SD} | | | 140 | | °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 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 $T_A = 25^\circ\text{C}$ 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, about 1.4ms, which means there's no any external C_{SST} ; I_{INT} is the internal current source, about 3.6 μ A.

Note5. Recommended Current Limit Program Table

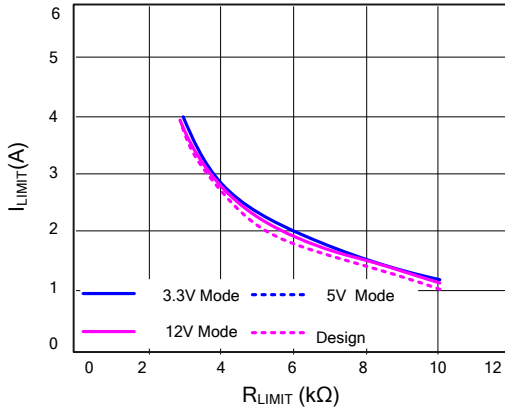
| | | | | | | |
|--|-----|-----|-----|-----|-----|-----|
| Current Limit Resistance (k Ω) | 11 | 5.5 | 4.4 | 3.7 | 3.1 | 2.8 |
| Current Limit (A) | 1.0 | 2.0 | 2.5 | 3.0 | 3.5 | 4.0 |

Recommended Formula for R_{LIM} & Current Limit Calculation

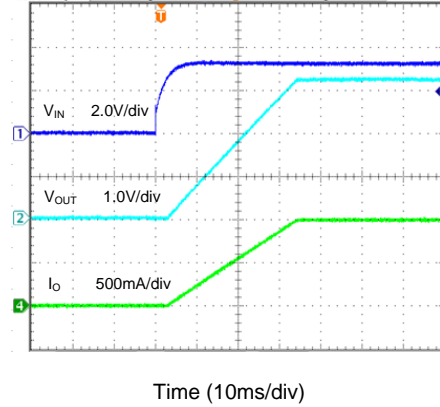
$$R_{LIM} = \frac{11k}{I_{LIM}} (\Omega).$$

Typical Performance Characteristics

Programmable Current Limit

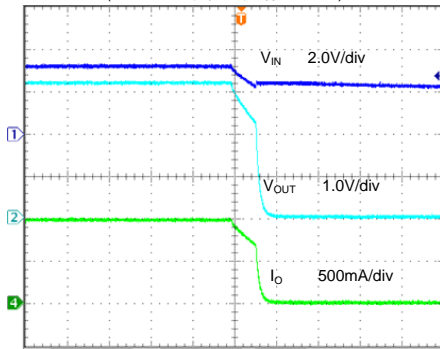


Programmable Soft-start Time
(3.3V Mode, $I_o=1A$, $C_{SS1}=100nF$)



Shutdown

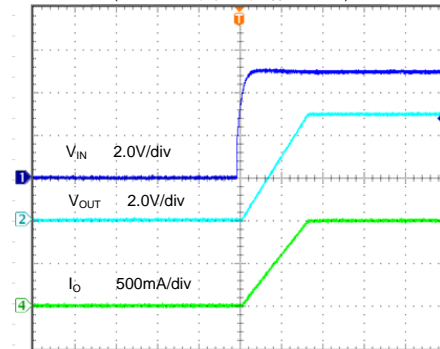
(3.3V Mode, $I_o=1A$, $C_{SS1}=100nF$)



Time (400us/div)

Programmable Soft-start Time

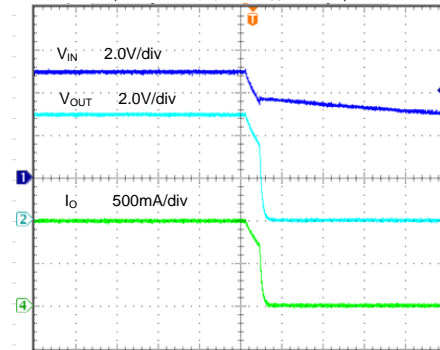
(5.0V Mode, $I_o=1A$, $C_{SS1}=100nF$)



Time (20ms/div)

Shutdown

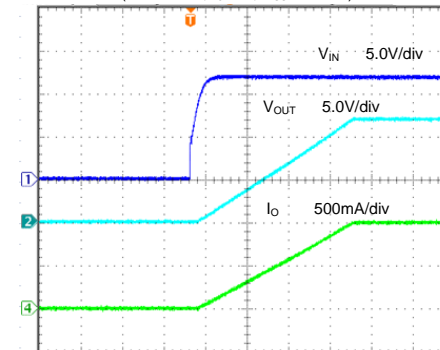
(5.0V Mode, $I_o=1A$, $C_{SS1}=100nF$)



Time (1.0ms/div)

Programmable Soft-start Time

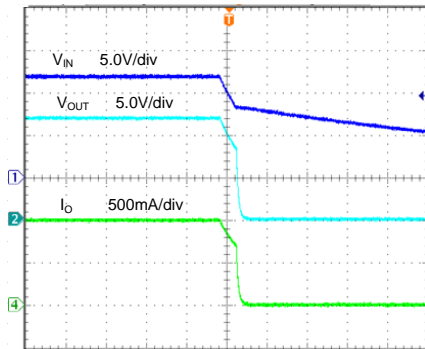
(12V Mode, $I_o=1A$, $C_{SS1}=100nF$)



Time (10ms/div)

Shutdown

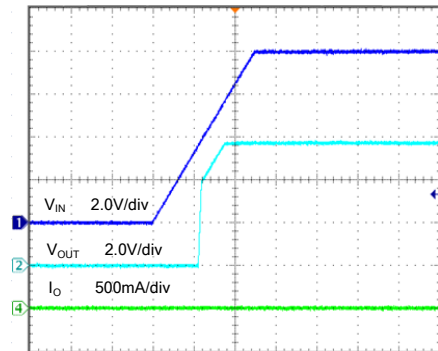
(12V Mode, $I_o=1A$, $C_{SST}=100nF$)



Time (2.0ms/div)

Over Voltage Protection

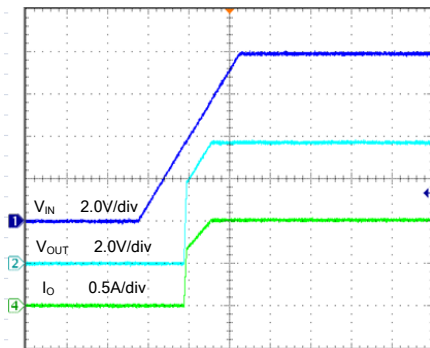
(5V Mode, $V_{IN}=8V$, $I_o=0A$)



Time (400ms/div)

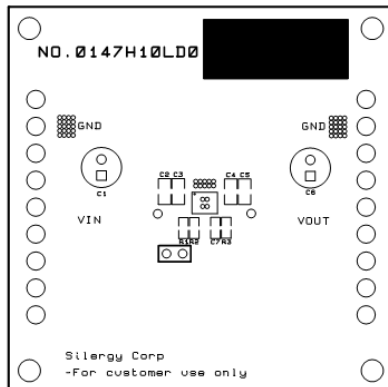
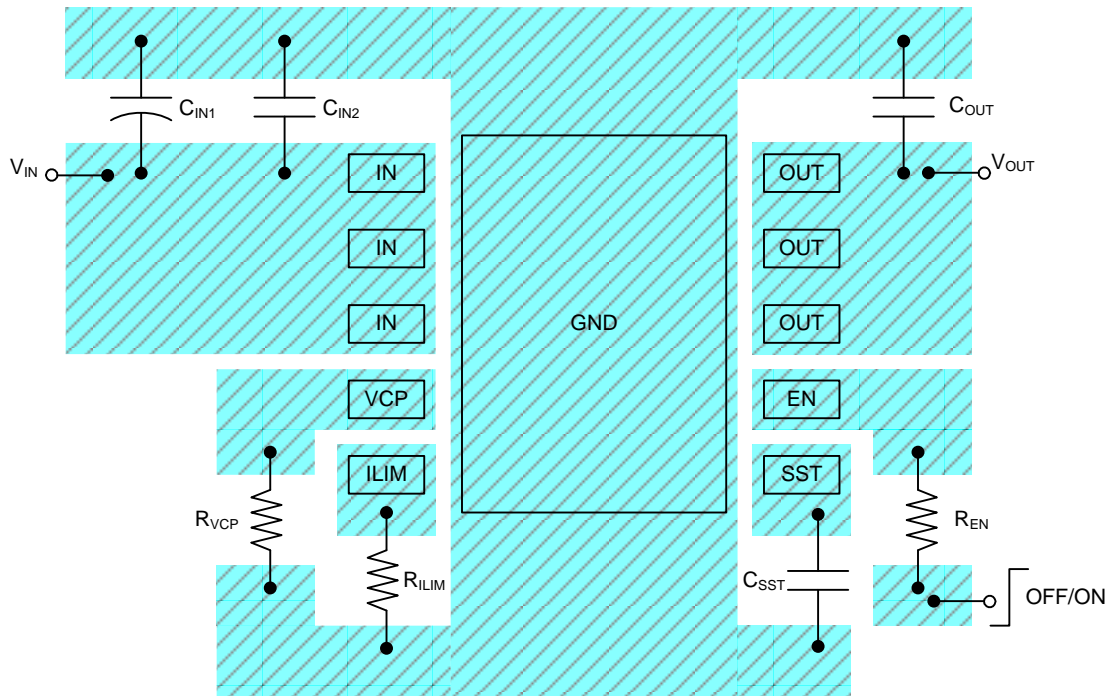
Over Voltage Protection

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

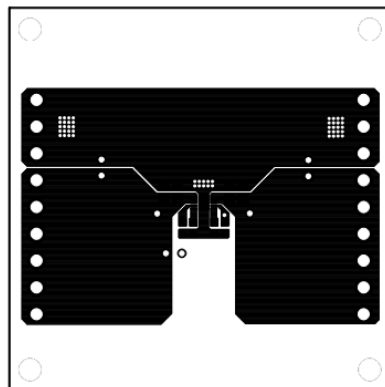


Time (400ms/div)

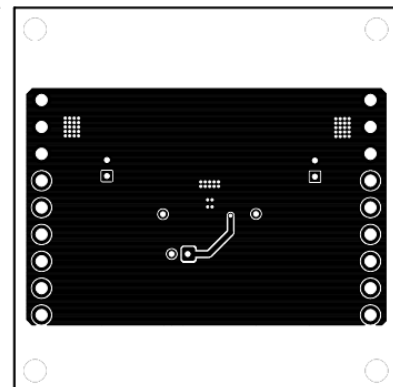
PCB Layout Guideline



Top Silkscreen

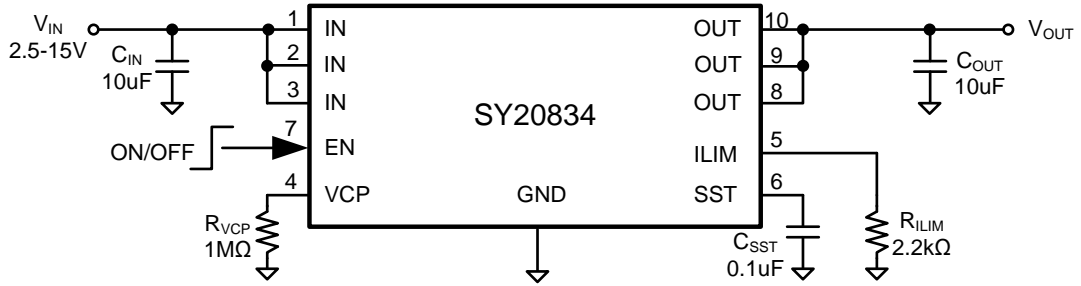


Top Layer



Bottom Layer

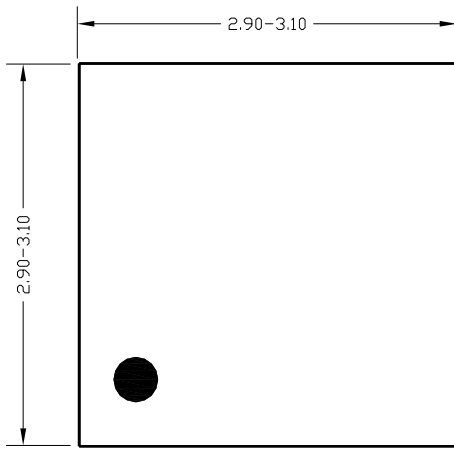
Schematic



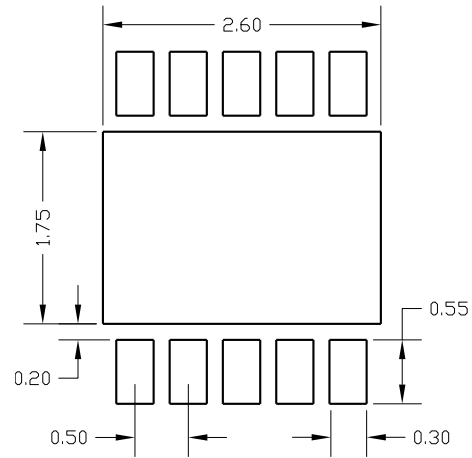
BOM List

| Reference Designator | Description | Part Number | Manufacturer |
|---------------------------------|-----------------------------------|----------------|--------------|
| U1 | Programmable Current Limit Switch | SY20834DBC | |
| C ₃ , C ₄ | 10μF/25V/X7R, 1206 | C3225X7R1E106M | TDK |
| R ₁ | 2.8kΩ, 0603, 1% | | |
| R ₂ | 1MΩ, 0603, 1% | | |
| C ₇ | 0.1μF, 0603 | | |

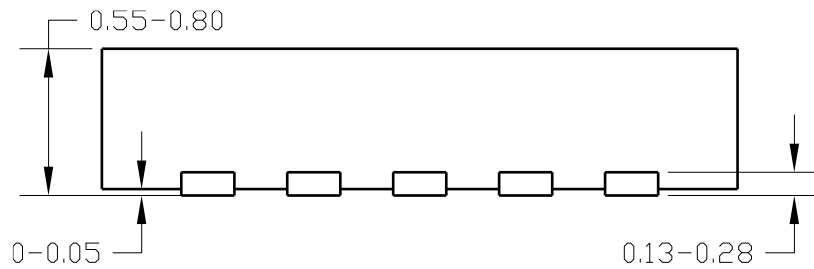
DFN3x3-10 Package outline



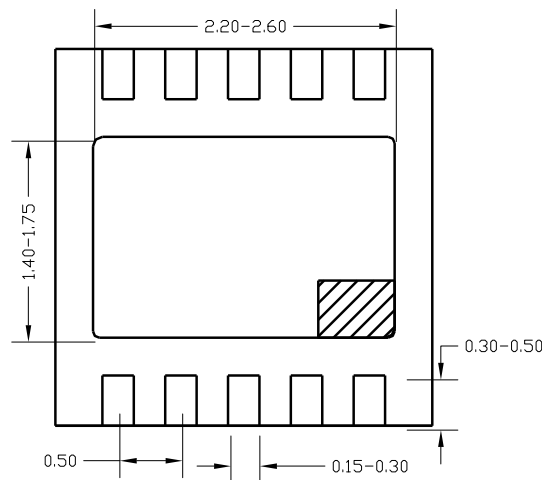
Top View



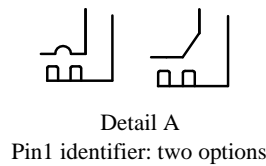
PCB layout (recommended)



Side View



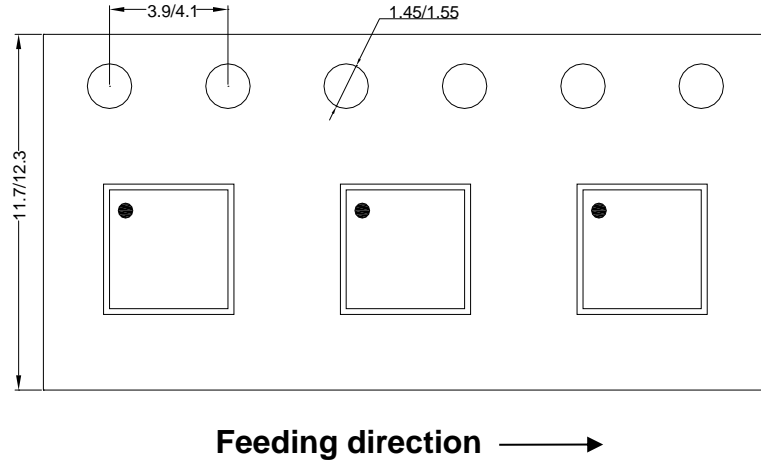
Bottom View



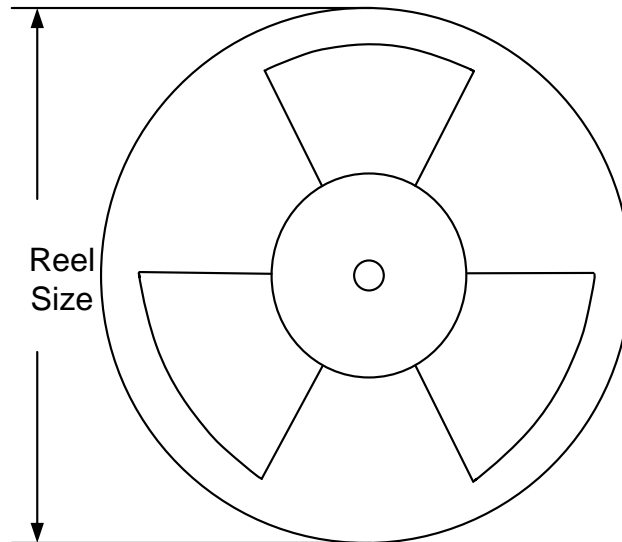
Notes: *All dimensions are in millimeters and exclude mold flash & metal burr.*

Taping & Reel Specification

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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