

### General Description

The SY6702 is an H-bridge motor driver solution for cameras, consumer products, toys, and other low-voltage or battery-powered motion-control applications. The device can drive one winding of a stepper motor or one brush DC motor. The highly integrated H-bridge driver block consists of two half-bridges with internal logic control, gate drive, over current protection and charge pump circuit.

The SY6702 operates with a power-supply voltage range from 2.5V to 16V, and 1.8A maximum output current.

To be compatible with industry-standard devices, the SY6702 use the PWM (IN/IN) input interface.

The SY6702 provides over current protection, short circuit protection, under voltage lockout and thermal shutdown.

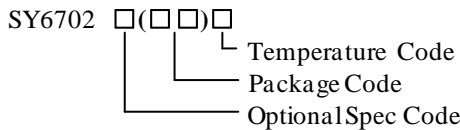
### Features

- H-bridge motor driver
  - ♦ Drives a brush DC motor or one winding of a stepper motor or other loads
  - ♦ Low MOSFET on-resistance: HS + LS < 380mΩ
- 1.8A maximum drive current
- Power supply voltage range from 2.5V to 16V
- PWM (IN/IN) interface
- Low power sleep mode with 120nA maximum Combined supply current
- Low power with less than 120µA supply current
- Internal over current protection, short circuit protection, under voltage lockout and thermal shutdown
- Compact package: DFN2x2-8

### Applications

- Cameras
- DSLR Lenses
- Consumer Products
- Toys
- Robotics
- Medical Devices

### Ordering Information



| Ordering Number | Package type | Note |
|-----------------|--------------|------|
| SY6702DFC       | DFN2x2-8     |      |

### Typical Applications

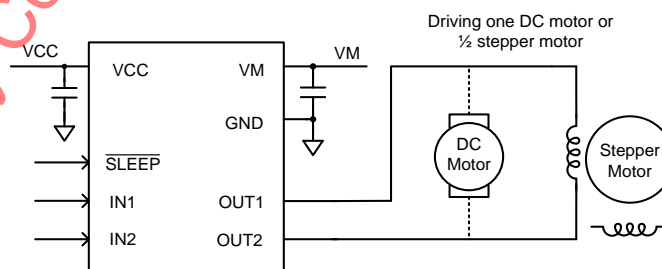
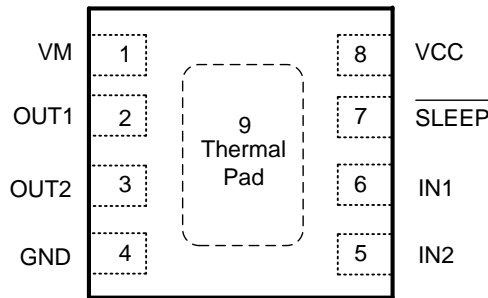


Figure 1. Schematic Diagram

## Pinout (top view)



|             |              |                       |
|-------------|--------------|-----------------------|
| Part Number | Package type | Top Mark <sup>①</sup> |
| SY6702DFC   | DFN2x2-8     | Eexyz                 |

Note ①: x=year code, y=week code, z=lot number code.

| Name        | DFN2x2-8 | Description   |
|-------------|----------|---|
| VM          | 1        | Motor power supply pin. Decouple this pin to GND pin with 10uF ceramic cap.                                 |
| OUT1        | 2        | Output 1 pin. Connect this pin to motor winding.  |
| OUT2        | 3        | Output 2 pin. Connect this pin to motor winding.  |
| GND         | 4        | Ground pin.   |
| IN2         | 5        | Input 2 pin. Logic high set OUT2 high; this pin has a internal pull-down resistor.                          |
| IN1         | 6        | Input 1 pin. Logic high set OUT1 high; this pin has a internal pull-down resistor.                          |
| SLEEP       | 7        | Sleep mode pin. Logic low puts device in low-power sleep mode, this pin has an internal pull-down resistor. |
| VCC         | 8        | Device power supply pin. Decouple this pin to GND pin with 0.1uF ceramic cap.                               |
| Thermal Pad | 9        | Thermal Pad.  |

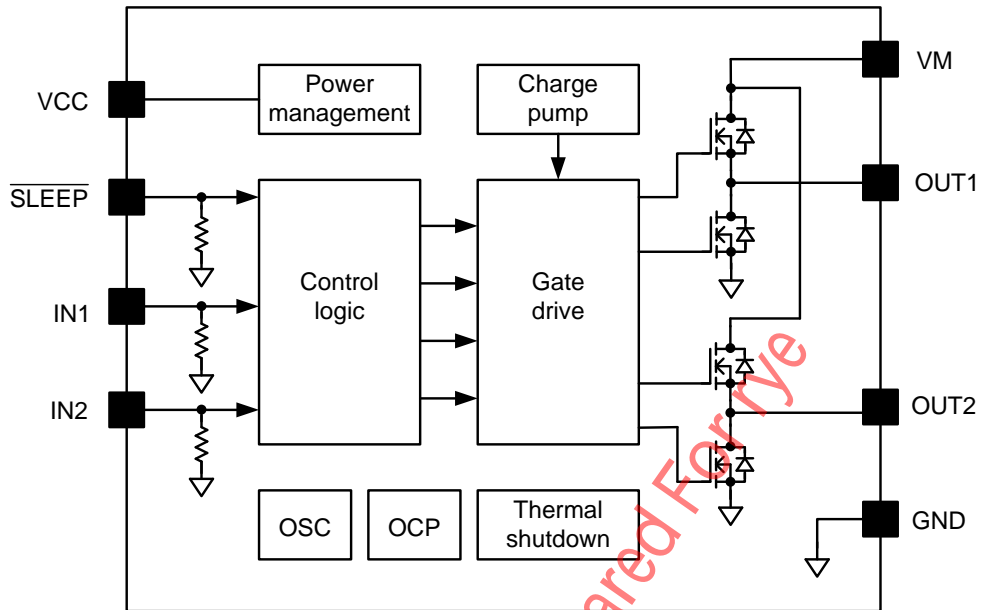
## Absolute Maximum Ratings (Note 1)

|  |       |                   |
|--|-------|-------------------|
| VCC, OUT1, OUT2  | ----- | 16V               |
| VM   | ----- | 16V               |
| SLEEP  | ----- | 6V                |
| IN1, IN2   | ----- | 6V                |
| Junction Temperature (T <sub>J</sub> )                     | ----- | -40 °C to +150 °C |
| Storage Temperature  | ----- | -65 °C to +150 °C |
| Power Dissipation, P <sub>D</sub> @ T <sub>A</sub> = 25 °C | ----- | 2.5W              |
| Package Thermal Resistance (Note2)                         |       |                   |
| θ <sub>JA</sub> ,  | ----- | 50 °C/W           |
| θ <sub>JC</sub> ,  | ----- | 62 °C/W           |

## Recommended Operating Conditions

|                                 |       |                  |
|---------------------------------|-------|------------------|
| VCC                             | ----- | 2.5V to 16V      |
| VM                              | ----- | 2.5V to 16V      |
| SLEEP                           | ----- | 0V to 5.5V       |
| IN1, IN2                        | ----- | 0V to 5.5V       |
| Logic Input PWM Frequency       | ----- | 0Hz to 250kHz    |
| H-Bridge Output Current (Note3) | ----- | 0A to 1.8A       |
| Junction Temperature Range      | ----- | -40 °C to 125 °C |
| Ambient Temperature Range       | ----- | -40 °C to 85 °C  |

Block Diagram



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**Electrical Characteristics**

(T<sub>A</sub> = 25 °C, V<sub>M</sub>=V<sub>CC</sub>=5V, unless otherwise specified)

| Parameter                         | Symbol                 | Test Conditions                             | Min | Typ | Max  | Unit |
|-----------------------------------|------------------------|---|-----|-----|------|------|
| <b>Power Supplies</b>             |                        |   |     |     |      |      |
| VM Operating Supply Current       | I <sub>VM</sub>        | No PWM                                      |     | 40  |      | μA   |
|                                   |                        | 50KHz PWM, OUTx Float                       |     | 0.8 |      | mA   |
| VM Sleep Mode Current             | I <sub>VMS</sub>       | SLEEP=0V                                    |     | 30  |      | nA   |
| VCC Sleep Mode Current            | I <sub>CCS</sub>       | SLEEP=0V                                    |     | 5   |      | nA   |
| VCC Operating Supply Current      | I <sub>CC</sub>        | No PWM                                      |     | 120 |      | μA   |
|                                   |                        | 50KHz PWM, OUTx Float                       |     | 0.7 |      | mA   |
| VCC Under voltage Lockout Voltage | V <sub>UVLO_RISE</sub> | VCC Rising                                  |     |     | 2.2  | V    |
|                                   | V <sub>UVLO_FALL</sub> | VCC Falling                                 |     |     | 2.1  | V    |
| <b>Logic Level Input</b>          |                        |   |     |     |      |      |
| Input Low Voltage                 | V <sub>IL</sub>        |   |     |     | 0.8  | V    |
| Input High Voltage                | V <sub>IH</sub>        |   | 2   |     |      | V    |
| Input Hysteresis                  | V <sub>IHYS</sub>      |   |     | 0.2 |      | V    |
| Input Low Current                 | I <sub>IL</sub>        | V <sub>IN</sub> =0V                         | -5  |     | 5    | μA   |
| Input High Current                | I <sub>IH</sub>        | V <sub>IN</sub> =3.3V                       |     |     | 50   | μA   |
| Pulldown Resistance               | R <sub>PD</sub>        |   |     | 100 |      | kΩ   |
| <b>H-Bridge MOSFETs</b>           |                        |   |     |     |      |      |
| HS + LS MOSFETs On Resistance     | R <sub>dson</sub>      | I <sub>O</sub> =800mA, T <sub>J</sub> =25°C |     | 380 | 430  | mΩ   |
| Off-State Leakage Current         | I <sub>OFF</sub>       | V <sub>OUT</sub> =0V                        |     |     | ±200 | nA   |
| <b>Protection</b>                 |                        |   |     |     |      |      |
| Output Over Current Limit         | I <sub>OCP</sub>       |   | 1.9 |     | 3.5  | A    |
| Over Current Retry Time           | t <sub>OCPR</sub>      |   |     | 1   |      | ms   |
| Thermal Shutdown Temperature      | T <sub>SD</sub>        |   | 140 | 150 |      | °C   |
| Thermal Shutdown hysteresis       | T <sub>HYS</sub>       |   |     | 20  |      | °C   |

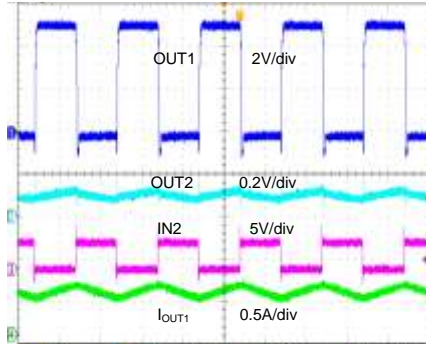
**Note 1:** Stresses beyond the “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specification is not implied. Exposure to absolute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

**Note 2:** θ<sub>JA</sub> and θ<sub>JC</sub> are measured in the natural convection at T<sub>A</sub> = 25 °C on a high effective four-layer thermal conductivity test board of JEDEC 51-5 and 51-7 thermal measurement standard.

**Note 3:** Power dissipation and thermal limits must be observed.

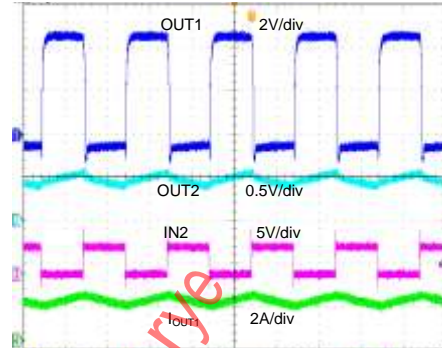
## Typical performance characteristics

Operation Waveform  
(VCC=VM=5V, I<sub>o</sub>=0.5A, IN1=High)



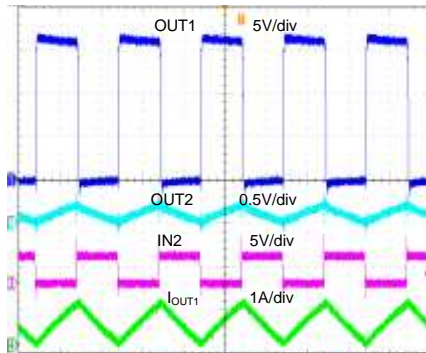
Time (2µs/div)

Operation Waveform  
(VCC=VM=5V, I<sub>o</sub>=1.8A, IN1=High)



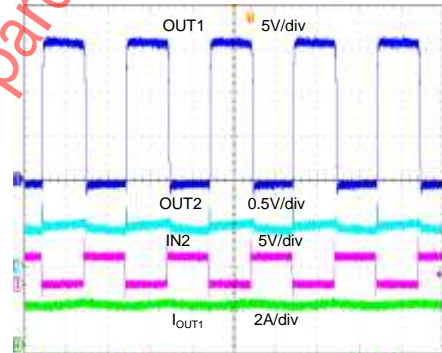
Time (2µs/div)

Operation Waveform  
(VCC=VM=16V, I<sub>o</sub>=0.5A, IN1=High)



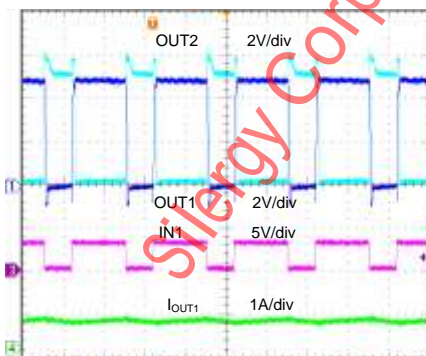
Time (2µs/div)

Operation Waveform  
(VCC=VM=16V, I<sub>o</sub>=1.8A, IN1=High)



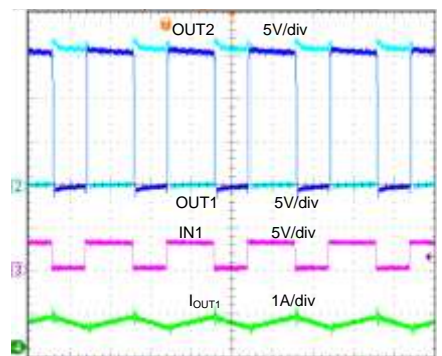
Time (2µs/div)

Operation Waveform  
(VCC=VM=5V, I<sub>o</sub>=0.5A, IN2=IN1)



Time (2µs/div)

Operation Waveform  
(VCC=VM=16V, I<sub>o</sub>=0.5A, IN2=IN1)



Time (2µs/div)

## Operation

### Timing Requirements

( $T_A = 25\text{ }^\circ\text{C}$ ,  $V_{CC}=3\text{V}$ ,  $V_M=5\text{V}$ ,  $R_L=20\Omega$ , unless otherwise specified)

|   |       |                                  | Min | Max | Unit |
|---|-------|----------------------------------|-----|-----|------|
| 1 | $t_1$ | Output Enable Time               |     | 120 | ns   |
| 2 | $t_2$ | Output Disable Time              |     | 120 | ns   |
| 3 | $t_3$ | Delay Time, INx High to OUTy Low |     | 120 | ns   |
| 4 | $t_4$ | Delay Time, INy Low to OUTx High |     | 120 | ns   |
| 5 | $t_5$ | Output Rise Time                 | 50  | 150 | ns   |
| 6 | $t_6$ | Output Fall Time                 | 50  | 150 | ns   |

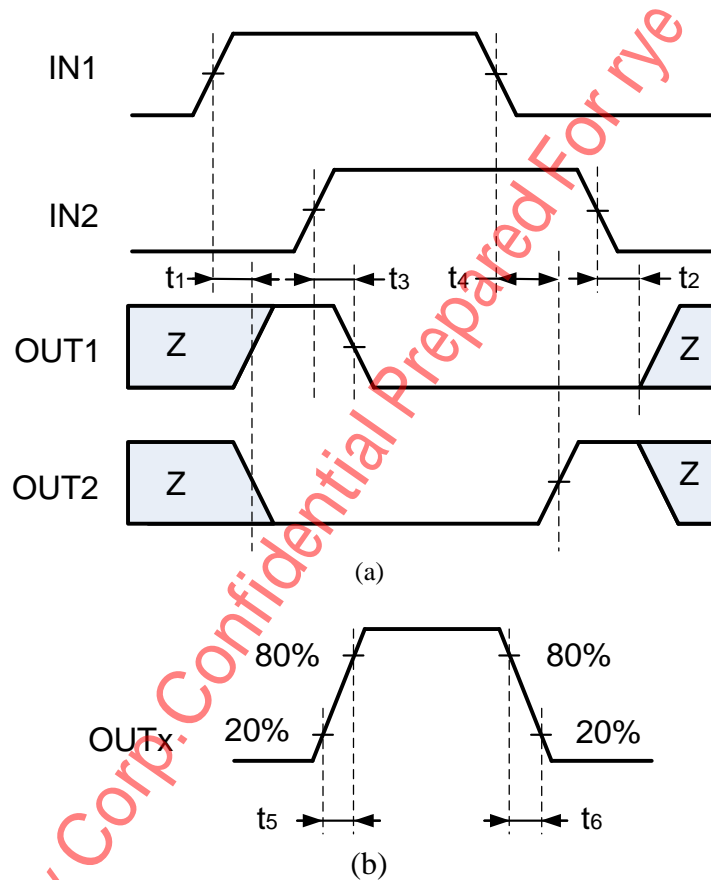


Figure 3. Input/Output Timing

### H-Bridge Driving Control

The Bridge is controlled by a PWM input interface, also called IN/IN interface. The following table shows the control logic of the device:

| IN1 | IN2 | OUT1 | OUT2 | Function (DC Motor) |
|-----|-----|------|------|---------------------|
| 0   | 0   | Z    | Z    | Coast               |
| 0   | 1   | L    | H    | Reverse             |
| 1   | 0   | H    | L    | Forward             |
| 1   | 1   | L    | L    | Brake               |



## **Sleep Mode**

If the SLEEP pin is brought to a logic-low state, the device enters a low-power sleep mode. In this state, all unnecessary internal circuitry is powered down.

## **Over Current Protection (OCP)**

A current limit circuit on each MOSFET limits the current through the MOSFET by removing the gate drive. If this current limit persists for longer than the OCP time, all MOSFETs in the H-bridge are disabled. After approximately 1 ms, the bridge is re-enabled automatically.

Over current conditions on both high and low side devices, that is, a short to ground, supply, or across the motor winding all result in an over current shutdown.

## **Thermal Shutdown (TSD)**

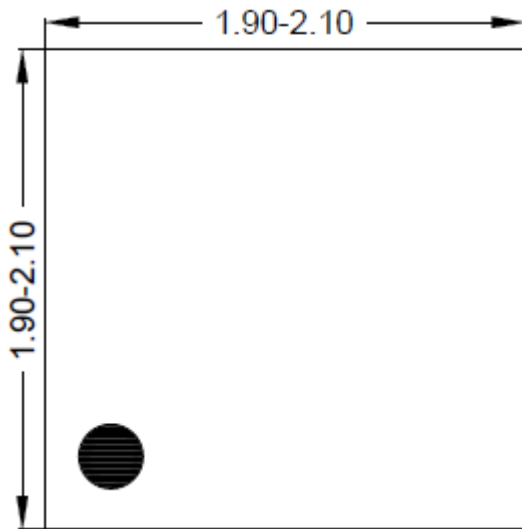
If the die temperature exceeds safe limits, all MOSFETs in the H-bridge are disabled. Once the die temperature has fallen to a safe level, operation automatically resumes.

## **Under Voltage Lockout (UVLO)**

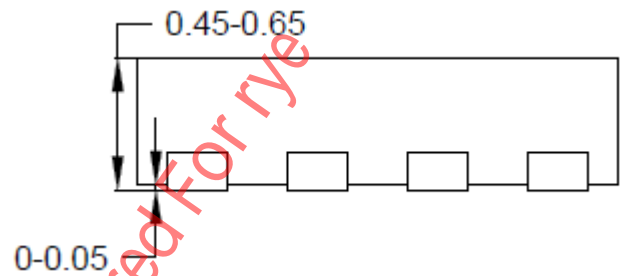
If at any time the voltage on the VCC pin falls below the undervoltage lockout threshold voltage, all circuitry in the device is disabled and internal logic is reset. Operation resumes when VCC rises above the UVLO threshold.

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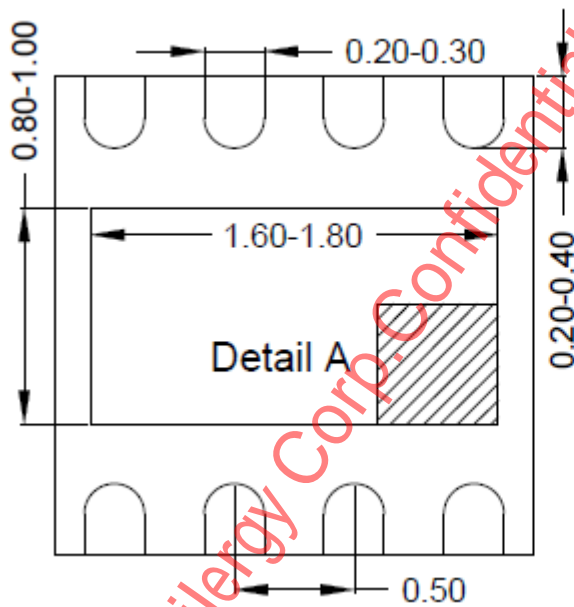
## DFN2x2-8 Package Outline (Type C)



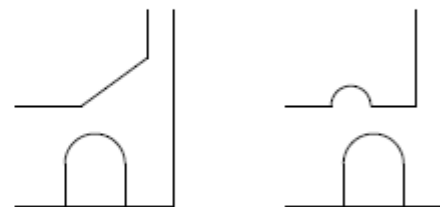
Top View



Side View



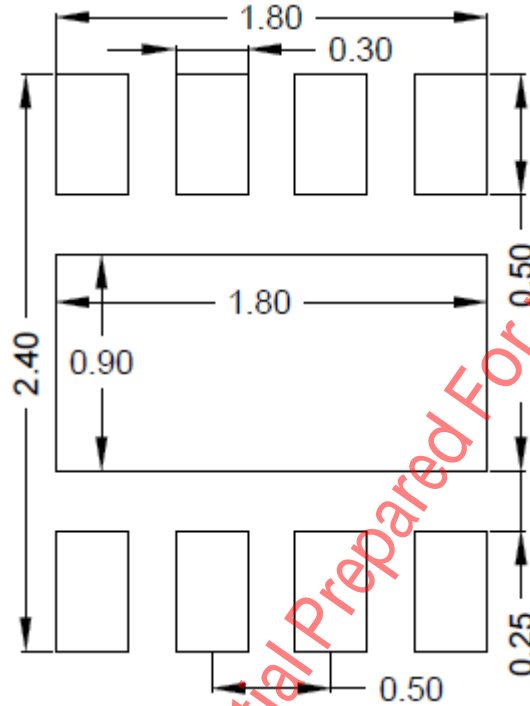
Bottom View



Detail A

Pin1 Identifier(Two options)





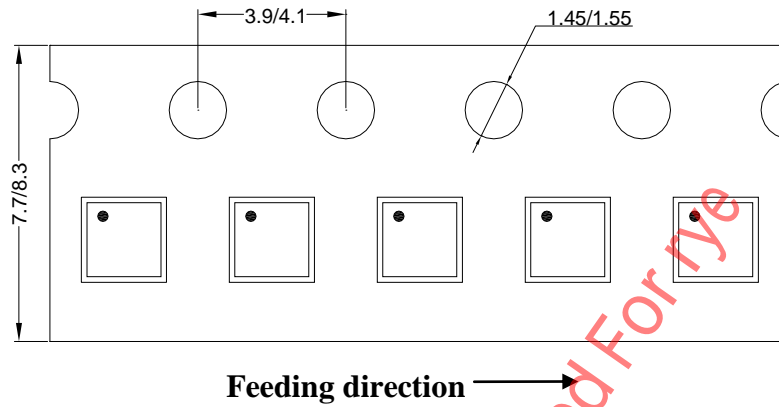
**Recommended PCB layout  
(Reference only)**

**Notes:** All dimension in millimeter and exclude mold flash & metal burr.

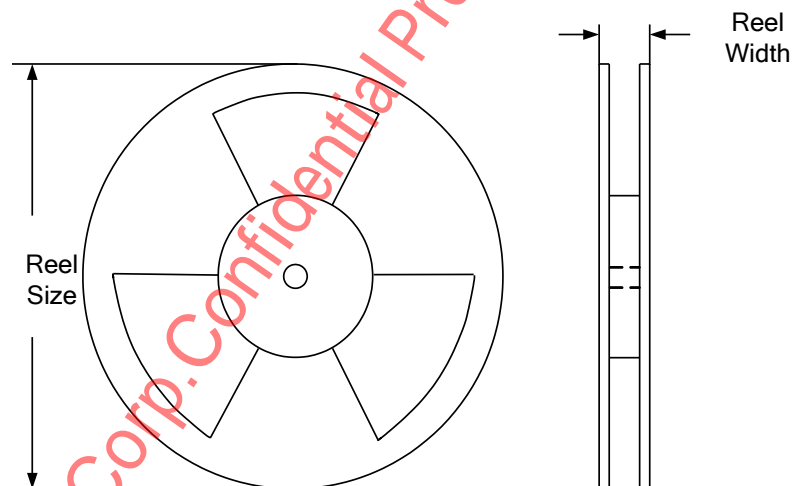
## Taping & Reel Specification

### 1. Taping orientation

DFN2x2-8



### 2. Carrier Tape & Reel specification for packages



| Package types | Tape width (mm) | Pocket pitch(mm) | Reel size (Inch) | Reel width(mm) | Trailer length(mm) | Leader length (mm) | Qty per reel |
|---------------|-----------------|------------------|------------------|----------------|--------------------|--------------------|--------------|
| DFN2x2        | 8               | 4                | 7"               | 8.4            | 400                | 160                | 3000         |

### 3. Others: NA



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