

## DESCRIPTION

JW7728H6D is a synchronous rectifier for Flyback converters. It integrates a 60V power MOSFET that can replace Schottky diode for high efficiency. It turns on the internal MOSFET if the  $V_{SW} < -140\text{mV}$  and turns it off before the current from GND to SW is lower than zero.

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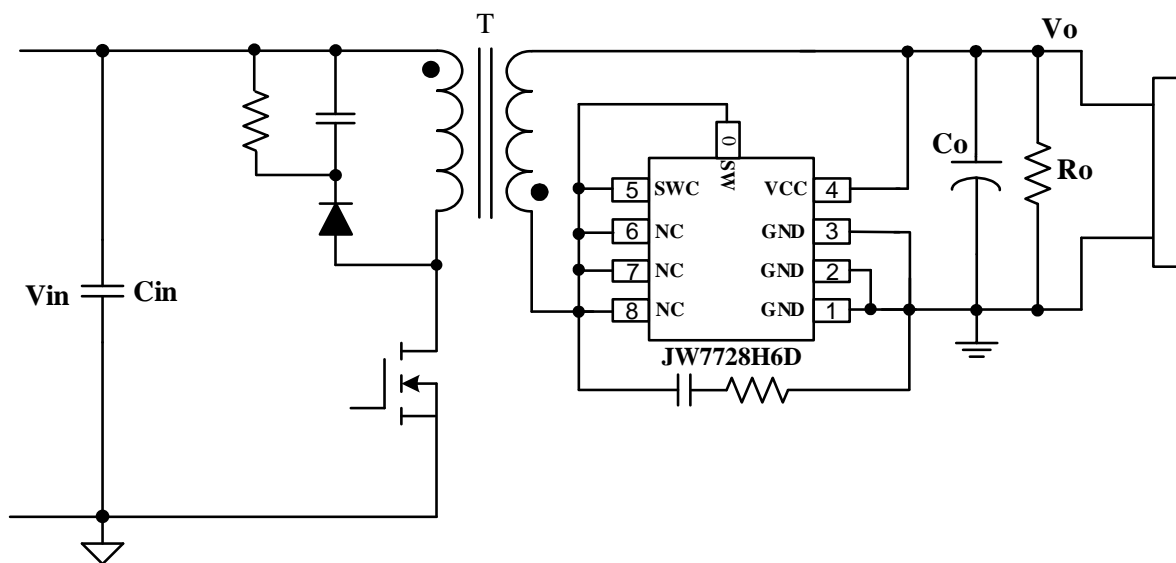
## FEATURES

- Supports DCM and Quasi-Resonant Flyback Converter
- Integrated 8mΩ 60V Power MOSFET
- Supports Low-side Rectification
- No Need External Power Supply

## APPLICATIONS

- Flyback Converters
- Adaptors

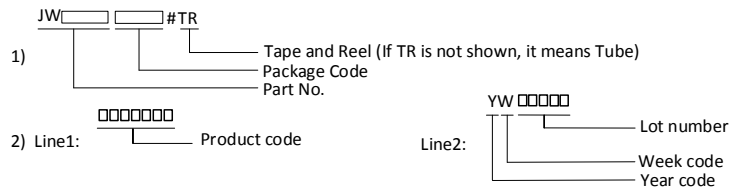
## TYPICAL APPLICATION



## ORDER INFORMATION

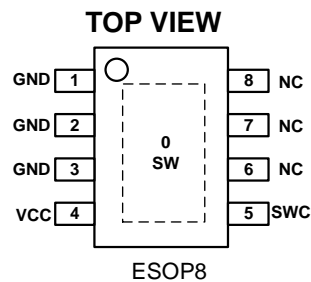
| DEVICE <sup>1)</sup> | PACKAGE | TOP MARKING <sup>2)</sup> | ENVIRONMENTAL <sup>3)</sup> |
|----------------------|---------|---------------------------|-----------------------------|
| JW7728H6DESOP#TR     | ESOP-8  | 7728H6D<br>YW□□□□□        | Green                       |

## Notes:



3) All JoulWatt products are packaged with Pb-free and Halogen-free materials and compliant to RoHS standards.

## PIN CONFIGURATION

ABSOLUTE MAXIMUM RATING<sup>1)</sup>

|  |                |
|--|----------------|
| SW PIN .....   | 60V            |
| SWC PIN .....  | -1 to 60V      |
| VCC PIN .....  | 20V            |
| Junction Temperature <sup>2) 3)</sup> .....  | 150°C          |
| Lead Temperature .....   | 260°C          |
| Storage Temperature .....  | -65°C to 150°C |
| Continuous Power Dissipation( $T_A=+25^\circ\text{C}$ ) <sup>4)</sup> ESOP-8 ..... | 2.5W           |

## RECOMMENDED OPERATING CONDITIONS

|                                      |                |
|--------------------------------------|----------------|
| VCC PIN .....                        | 3.3V to 15V    |
| SWC PIN .....                        | -1V to 54V     |
| Operation Junction Temperature ..... | -40°C to 125°C |

THERMAL PERFORMANCE<sup>5)</sup>

|             |               |               |
|-------------|---------------|---------------|
|             | $\theta_{JA}$ | $\theta_{JC}$ |
| ESOP8 ..... | 50            | 10°C/W        |

**Note:**

- 1) Exceeding these ratings may damage the device. These stress rating do not imply function operation of the device at any other conditions beyond those indicated under RECOMMENDED OPERATING CONDITIONS.
- 2) Continuous operation over the specified absolute maximum operating junction temperature may damage the device.
- 3) The device is not guaranteed to function outside of its operating conditions.
- 4) The maximum allowable continuous power dissipation at any ambient temperature is calculated by  $P_D(MAX) = (T_J(MAX) - T_A) / \theta_{JA}$ .
- 5) Measured on JESD51-7, 4-layer PCB.

## ELECTRICAL CHARACTERISTICS

$T_A = 25^\circ\text{C}$ , unless otherwise stated

*Advance Information, not production data, subject to change without notice.*

| Item  | Symbol            | Condition                    | Min. | Typ. | Max. | Units |
|---|-------------------|------------------------------|------|------|------|-------|
| <b>VCC Section</b>                          |                   |                              |      |      |      |       |
| VCC Startup Voltage                         | $V_{CC\_Startup}$ | VCC Rising                   |      | 3.0  |      | V     |
| VCC UVLO                                    | $V_{CC\_UVLO}$    | VCC Falling                  |      | 2.7  |      | V     |
| Quiescent Current                           | $I_q$             | VCC=4.5V                     |      | 30   |      | uA    |
| <b>SWC Section</b>                          |                   |                              |      |      |      |       |
| SW Regulation Voltage                       | $V_{MOS\_REG}$    |                              |      | -45  |      | mV    |
| Gate Turn On Threshold                      | $V_{MOS\_ON}$     |                              |      | -140 |      | mV    |
| Gate Turn Off Threshold                     | $V_{MOS\_OFF}$    |                              |      | -3   |      | mV    |
| GT Turn On Propagation Delay <sup>6)</sup>  | $T_{DON\_PRO}$    |                              |      | 20   | 30   | ns    |
| GT turn Off Propagation Delay <sup>6)</sup> | $T_{DOFF\_PRO}$   |                              |      | 15   | 20   | ns    |
| GT Minimum On Time                          | $T_{MIN-ON}$      |                              |      | 0.55 |      | us    |
| GT Minimum Off Time                         | $T_{MIN-OFF}$     |                              |      | 2.5  |      | us    |
| <b>SW Section</b>                           |                   |                              |      |      |      |       |
| Internal MOSFET Breakdown Voltage           | $V_{(BR)DSS}$     | $I_{SW}=250\mu\text{A}$      | 60   |      |      | V     |
| Internal MOSFET $R_{dson}$                  | $R_{dson}$        | VGS=10V, $I_{sw}=1\text{A}$  |      | 8    | 10.5 | mΩ    |
|   |                   | VGS=4.5V, $I_{sw}=1\text{A}$ |      | 10.5 | 14   | mΩ    |
| Maximum Peak Current <sup>6)</sup>          | $I_{peak}$        |                              |      | 35   |      | A     |
| Drain Current-continuous <sup>6)</sup>      | $I_D$             |                              |      | 20   |      | A     |



## FUNCTIONAL DESCRIPTION

### Operation

JW7728H6D is a synchronous rectifier controller which combined with external MOSFET can replace the Schottky Barrier Diode. It supports all operations, such as DCM, CrCM, (Quasi-Resonant) and CCM when adopted in Flyback converter.

### Startup

During the startup period, when the VCC is directly charged by the output voltage ( $V_o$ ) of the Flyback converter.

Once the VCC voltage exceeds  $V_{CC\_Startup}$ , the JW7728H6D exits the UVLO. If VCC is lower than  $V_{CC\_UVLO}$ , the internal MOSFET is turned off. The current flows through body diode before the VCC reaches to the startup voltage  $V_{cc\_startup}$ .

### Under-Voltage Lockout (UVLO)

When the VCC is below UVLO threshold, the internal MOSFET is turned off and pulled low internally. Once the VCC exceeds the startup voltage  $V_{cc\_startup}$ , the parts is activated again.

### Turn On Phase

When the synchronous MOSFET is conducting, current flows through the body diode of MOSFET, which generates a negative voltage  $V_{SW}$  across it. When  $V_{SW}$  is lower than  $V_{MOS\_ON}$ , the part will pull the internal gate high to turn on the synchronous MOSFET after turn on delay time  $T_{DON\_PRO}$ .

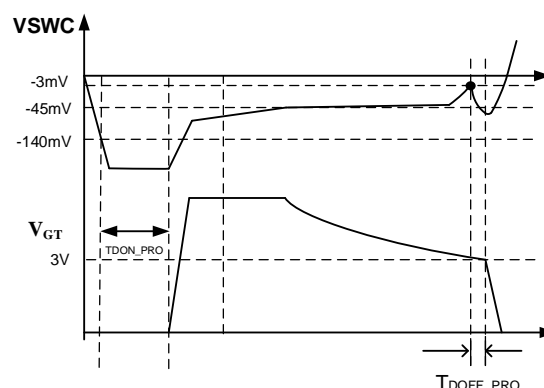


Figure-1 Turn on delay and turn off delay

### Minimum On Time (MOT)

When the synchronous MOSFET is turn on, there is a minimum on time for the SR. The VSWC voltage may have a parasitic ring when the synchronous MOSFET turns on. So, a minimum on time ( $T_{MIN-ON}$ ) is very important to avoid the MOSFET turn off threshold is false triggered.

### Conducting Phase

When the synchronous MOSFET is turned on, the drain source voltage VSWC it is determined by its on resistance and the current through it. The part adjusts the gate voltage and regulates the VSWC to the internal threshold ( $V_{MOS\_REG}$ ) after the synchronous MOSFET turn on. When the VSWC is lower than  $V_{MOS\_REG}$ , the gate keeps its maximum voltage. And the synchronous MOSFET is fully on.

The VSWC rises when the current follow through the MOSFET decreases. The gate voltage will be decreased to increase its on resistance and regulate the Vsw around  $V_{MOS\_REG}$ .

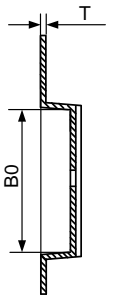
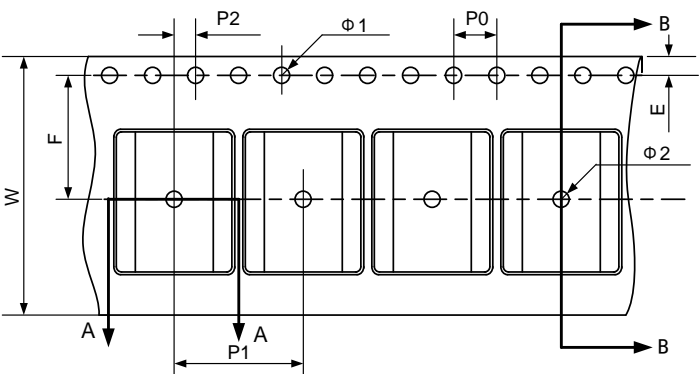
## Turn Off Phase

After synchronous MOSFET conducting, once the voltage VSWC touches the MOSFET turn off threshold ( $V_{MOS\_OFF}$ ), the gate is pulled to low after a turn off delay time  $T_{DOFF\_PRO}$ . A blanking time ( $T_{MIN-OFF}$ ) is necessary to avoid error trigger.

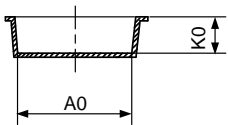
TAPE AND REEL INFORMATION

Carrier Tape

UNIT: mm



SECTION B-B

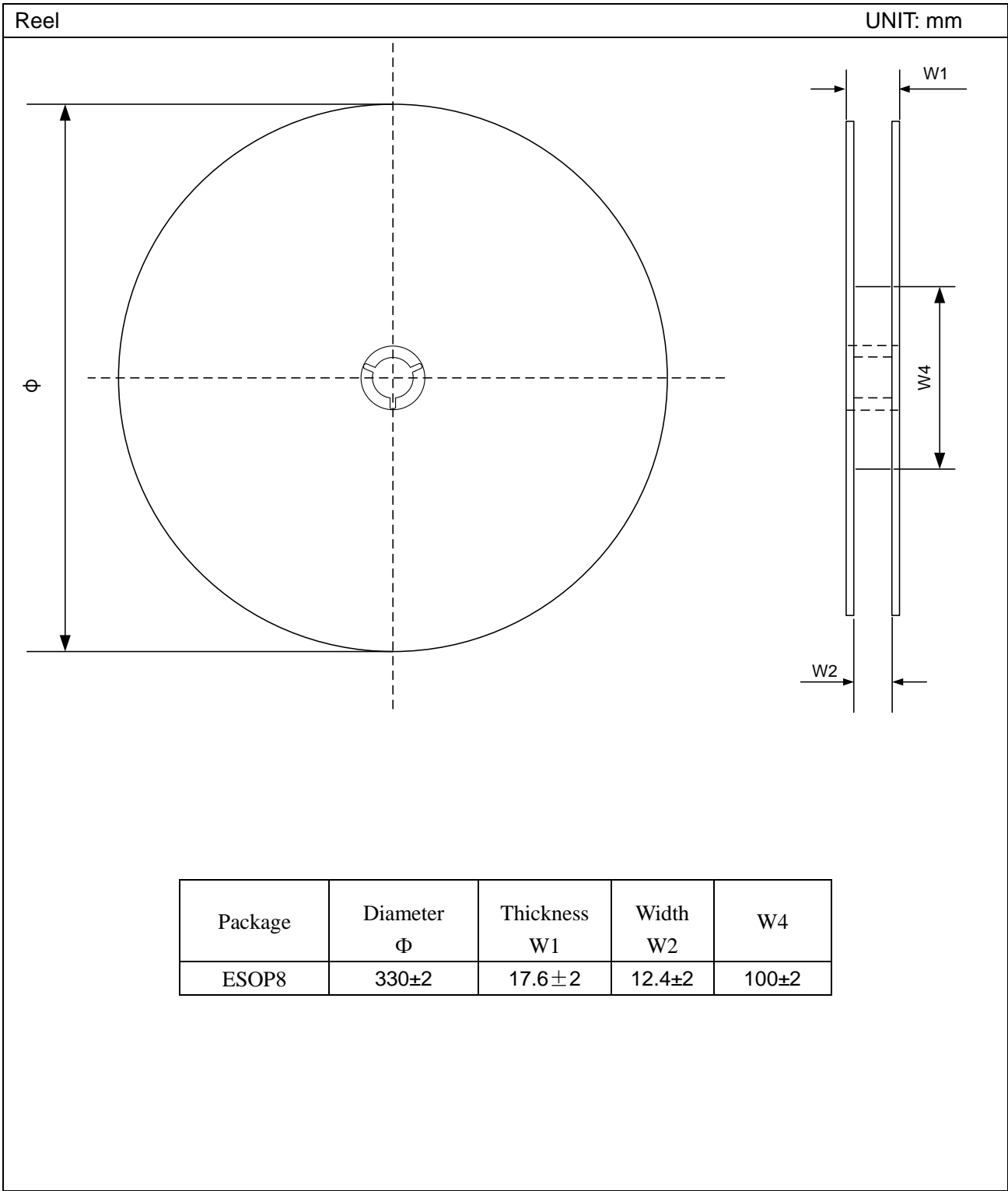


SECTION A-A

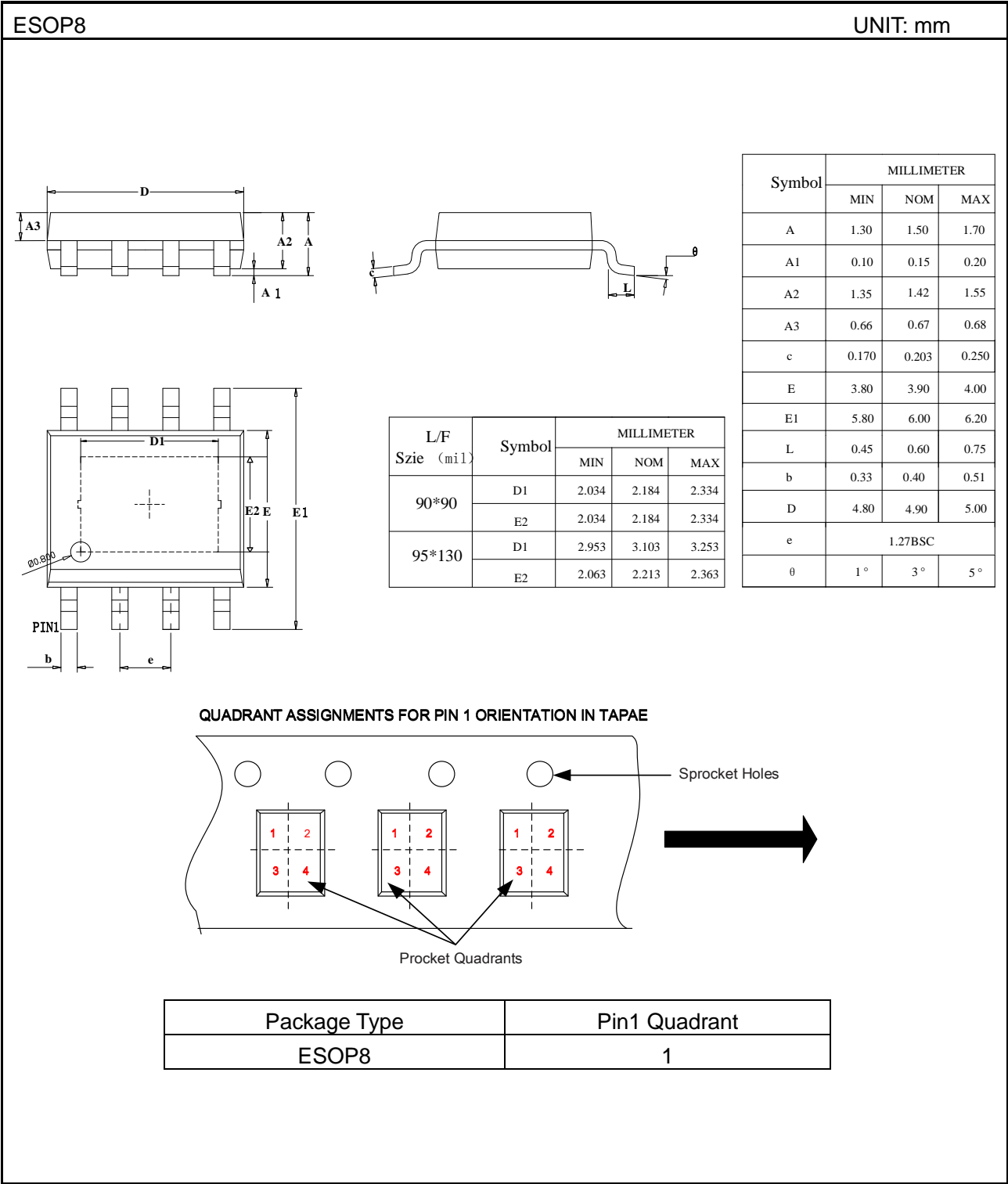
- Note :
- 1) The carrier type is black, and colorless transparent.
  - 2) Carrier camber is within 1mm in 100mm.
  - 3) 10 pocket hole pitch cumulative tolerance:  $\pm 0.20$ .
  - 4) All dimensions are in mm.

| Package | Tape dimensions (mm) |         |         |          |          |          |          |          |          |          |          |           |
|---------|----------------------|---------|---------|----------|----------|----------|----------|----------|----------|----------|----------|-----------|
|         | P0                   | P2      | P1      | A0       | B0       | W        | T        | K0       | $\Phi 1$ | $\Phi 2$ | E        | F         |
| ESOP8   | 4.0±0.1              | 2.0±0.1 | 8.0±0.1 | 6.40±0.3 | 5.35±0.3 | 12.0±0.3 | 0.25±0.2 | 2.00±0.2 | 1.50min  | 1.50min  | 1.75±0.1 | 5.50±0.10 |





PACKAGE OUTLINE



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