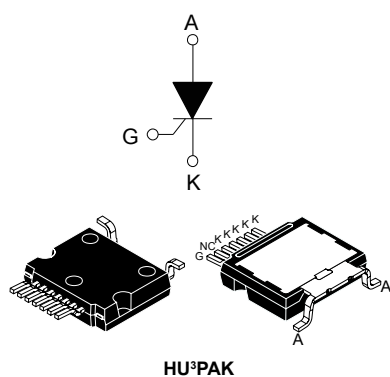


## 30 A – 1200 V automotive grade SCR Thyristor



### Features

- AEC-Q101 qualified 
- High junction temperature:  $T_j = 150\text{ }^{\circ}\text{C}$
- AC off state voltage:  $\pm 1200\text{ V}$
- Nominal on-state current:  $30\text{ A}_{\text{RMS}}$
- High noise immunity:  $1000\text{ V}/\mu\text{s}$
- Max. gate triggering current:  $50\text{ mA}$
- ECOPACK1 compliant component

### Applications

- Automotive applications: on board and off board battery charger
- Renewable energy inverters
- Solid state relay
- 3-Phase heating or motor soft start control
- UPS (uninterruptible power supply)
- Bypass SSR / hybrid relay
- Inrush current limiter in battery charger
- AC-DC voltage controlled rectifier
- Industrial welding systems

### Description

This device is an automotive grade SCR Thyristor designed for applications such as automotive and stationary battery chargers.

Rated for  $30\text{ A}_{\text{RMS}}$  power switching, this SCR Thyristor offers superior performance in terms of peak voltage robustness (up to  $1400\text{ V}$ ) and surge current handling (sine wave pulse up to  $300\text{ A}$ ). Its key features allow the design of functions such as a  $42\text{ A}_{\text{RMS}}$  AC switch (dual back-to-back SCRs) and a  $38\text{ A}$  av. AC-DC controlled rectifier bridge.

Available in HU<sup>3</sup>PAK package, it is ideal for compact SMD designs on surface mount boards or insulated metal substrate boards and and top-side cooling.

#### Product status link

TN3050HP-12L2Y

#### Product summary

|                                 |        |
|---------------------------------|--------|
| $I_{\text{T(RMS)}}$             | 30 A   |
| $V_{\text{DRM}}/V_{\text{RRM}}$ | 1200 V |
| $V_{\text{DSM}}/V_{\text{RSM}}$ | 1400 V |
| $I_{\text{GT}}$                 | 50 mA  |
| $T_j$                           | 150 °C |

# 1 Characteristics

**Table 1. Absolute ratings (limiting values)**

| Symbol                              | Parameter                                                                                       |                         |                                | Value       | Unit |
|-------------------------------------|-------------------------------------------------------------------------------------------------|-------------------------|--------------------------------|-------------|------|
| I <sub>T(RMS)</sub>                 | RMS on-state current (180 ° conduction angle)                                                   |                         | T <sub>C</sub> = 126 °C        | 30          | A    |
| I <sub>T(AV)</sub>                  | Average on-state current (180 ° conduction angle)                                               |                         |                                | 19          | A    |
| I <sub>TSM</sub> <sup>(1)</sup>     | Non repetitive surge peak on-state current, V <sub>R</sub> = 0 V                                | t <sub>p</sub> = 8.3 ms | T <sub>j</sub> initial = 25 °C | 330         | A    |
|                                     |                                                                                                 | t <sub>p</sub> = 10 ms  |                                | 300         |      |
| V <sub>DRM</sub> / V <sub>RRM</sub> | Repetitive off-state voltage (50-60 Hz)                                                         |                         | T <sub>j</sub> = 150 °C        | 1200        | V    |
| di/dt                               | Critical rate of rise of on-state current<br>I <sub>G</sub> = 2 x I <sub>GT</sub> , tr ≤ 100 ns | f = 50 Hz               | T <sub>j</sub> = 150 °C        | 200         | A/μs |
| V <sub>GM</sub>                     | Peak forward gate voltage                                                                       | t <sub>p</sub> = 20 μs  | T <sub>j</sub> = 150 °C        | 10          | V    |
| I <sub>GM</sub>                     | Peak forward gate current                                                                       |                         |                                | 8           | A    |
| P <sub>G(AV)</sub>                  | Average gate power dissipation                                                                  |                         | T <sub>j</sub> = 150 °C        | 1           | W    |
| V <sub>RGM</sub>                    | Peak reverse gate voltage                                                                       |                         | T <sub>j</sub> = 25 °C         | 5           | V    |
| T <sub>stg</sub>                    | Storage junction temperature range                                                              |                         |                                | -40 to +150 | °C   |
| T <sub>j</sub>                      | Operating junction temperature                                                                  |                         |                                | -40 to +150 | °C   |

1. ST recommend  $I^2t$  value for fusing = 450 A<sup>2</sup>s for  $T_j = 25\text{ °C}$  and  $t_p = 10\text{ ms}$

**Table 2. Electrical characteristics ( $T_j = 25\text{ °C}$  unless otherwise specified)**

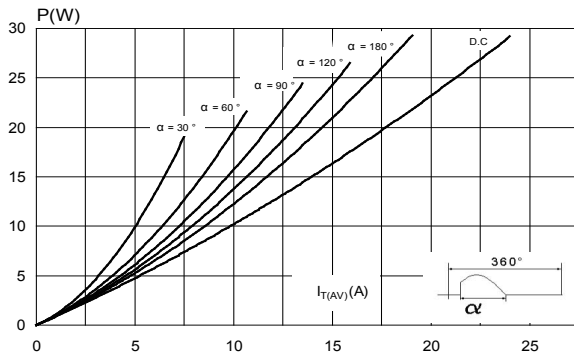
| Symbol            | Test conditions                                                                                                                                                                     |                                   | Value | Unit |                        |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-------|------|------------------------|
| $I_{GT}$          | $V_D = 12\text{ V}$ , $R_L = 33\text{ }\Omega$                                                                                                                                      |                                   | Min.  | 10   | mA                     |
|                   |                                                                                                                                                                                     |                                   | Max.  | 50   |                        |
| $V_{GT}$          | $V_D = 12\text{ V}$ , $R_L = 33\text{ }\Omega$                                                                                                                                      |                                   | Max.  | 1.3  | V                      |
| $V_{GD}$          | $V_D = 2/3 \times V_{DRM}$ , $R_L = 3.3\text{ k}\Omega$                                                                                                                             | $T_j = 150\text{ }^\circ\text{C}$ | Min.  | 0.2  | V                      |
| $I_H$             | $I_T = 500\text{ mA}$ , gate open                                                                                                                                                   |                                   | Max.  | 100  | mA                     |
| $I_L$             | $I_G = 1.2 \times I_{GT}$                                                                                                                                                           |                                   | Max.  | 125  | mA                     |
| $t_{gt}$          | $I_T = 60\text{ A}$ , $V_D = 2/3 \times V_{DRM}$ , $I_G = 100\text{ mA}$ , $dI_G/dt = 0.2\text{ A}/\mu\text{s}$                                                                     |                                   | Typ.  | 1    | $\mu\text{s}$          |
| $dV/dt$           | $V_D = 2/3 \times V_{DRM}$ , gate open                                                                                                                                              | $T_j = 150\text{ }^\circ\text{C}$ | Min.  | 1000 | $\text{V}/\mu\text{s}$ |
| $t_q$             | $I_T = 20\text{ A}$ , $dI_T/dt = 10\text{ A}/\mu\text{s}$ , $V_R = 75\text{ V}$ , $V_D = 2/3 \times V_{DRM}$ , $dV_D/dt = 20\text{ V}/\mu\text{s}$ , $t_p = 100\text{ }\mu\text{s}$ | $T_j = 150\text{ }^\circ\text{C}$ | Typ.  | 150  | $\mu\text{s}$          |
| $V_{TM}$          | $I_{TM} = 60\text{ A}$ , $t_p = 380\text{ }\mu\text{s}$                                                                                                                             |                                   | Max.  | 1.65 | V                      |
| $V_{TO}$          | Threshold voltage                                                                                                                                                                   | $T_j = 150\text{ }^\circ\text{C}$ | Max.  | 0.88 | V                      |
| $R_D$             | Dynamic resistance                                                                                                                                                                  | $T_j = 150\text{ }^\circ\text{C}$ | Max.  | 14   | $\text{m}\Omega$       |
| $I_{DRM}/I_{RRM}$ | $V_D = V_{DRM}$ , $V_R = V_{RRM}$                                                                                                                                                   | $T_j = 25\text{ }^\circ\text{C}$  | Max.  | 5    | $\mu\text{A}$          |
|                   |                                                                                                                                                                                     | $T_j = 125\text{ }^\circ\text{C}$ | Max.  | 3    | mA                     |
|                   |                                                                                                                                                                                     | $T_j = 150\text{ }^\circ\text{C}$ | Max.  | 5    | mA                     |
| $I_{DSM}/I_{RSM}$ | $V_D = V_{DSM}$ , $V_R = V_{RSM}$                                                                                                                                                   | $T_j = 25\text{ }^\circ\text{C}$  | Max.  | 10   | $\mu\text{A}$          |

**Table 3. Thermal parameters**

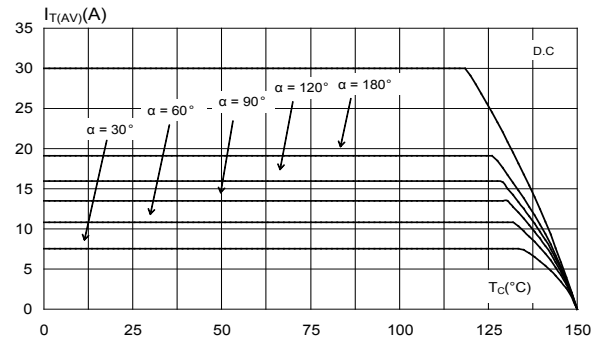
| Symbol        | Parameter                   |                     | Value | Unit |
|---------------|-----------------------------|---------------------|-------|------|
| $R_{th(j-c)}$ | Junction to case (DC, max.) | HU <sup>3</sup> PAK | 0.8   | °C/W |

## 1.1 Characteristics (curves)

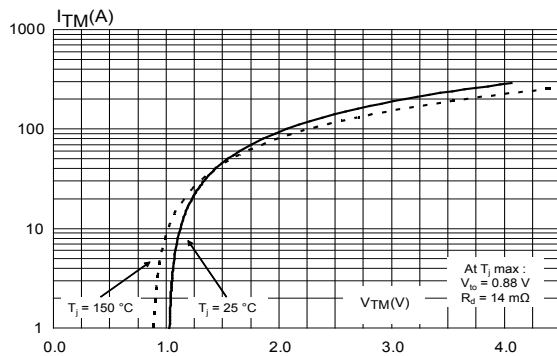
**Figure 1. Maximum average power dissipation versus average on-state current**



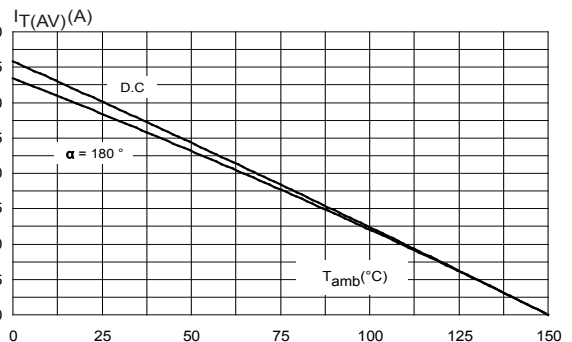
**Figure 2. Average and DC on-state current versus case temperature**



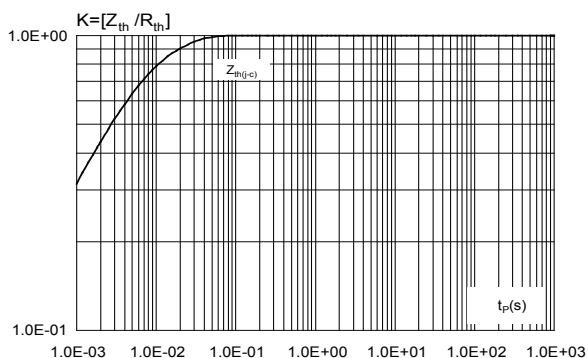
**Figure 3. On-state characteristics (maximum values)**



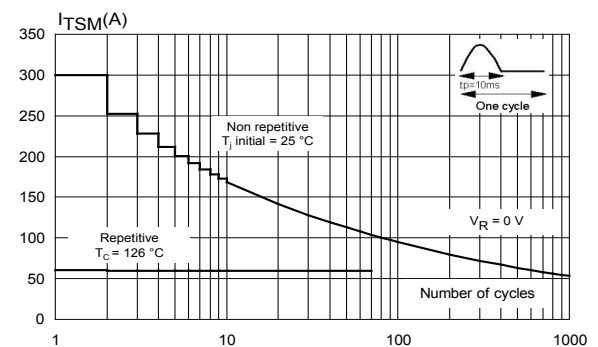
**Figure 4. Average and D.C. on-state current versus ambient temperature**

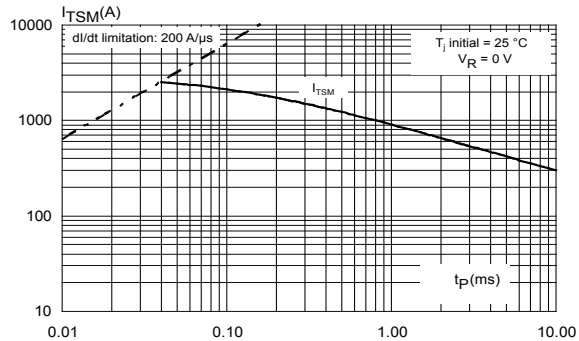
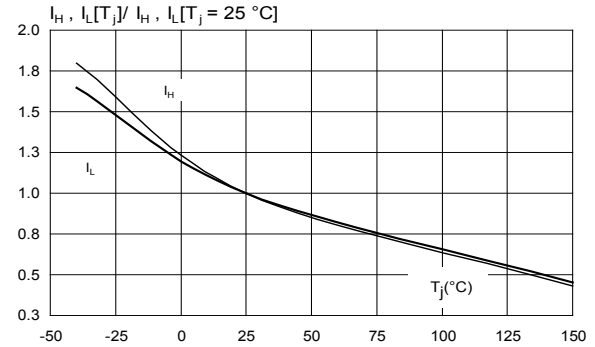
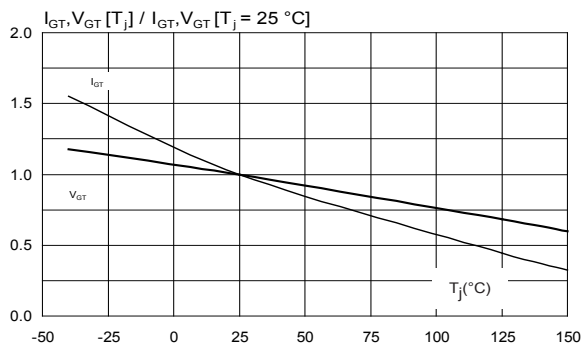
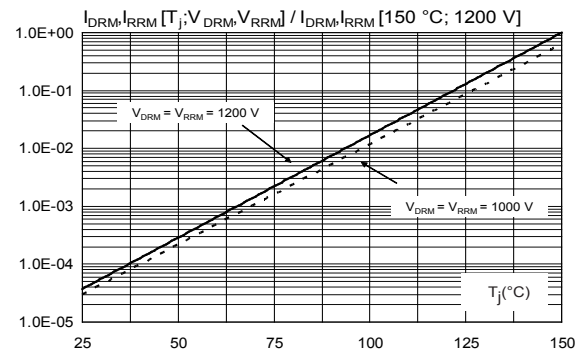
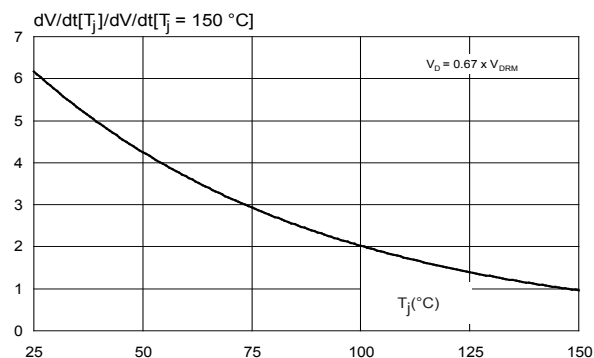


**Figure 5. Relative variation of thermal impedance junction to case versus pulse duration**



**Figure 6. Surge peak on-state current versus number of cycles**



**Figure 7. Non repetitive surge peak on-state current for a sinusoidal pulse ( $t_p < 10$  ms)**

**Figure 8. Relative variation of holding and latching current versus junction temperature (typical values)**

**Figure 9. Relative variation of gate triggering current and voltage versus junction temperature**

**Figure 10. Relative variation of leakage current versus junction temperature for different values of blocking voltage**

**Figure 11. Relative variation of the static dV/dt immunity versus junction temperature (typical values)**


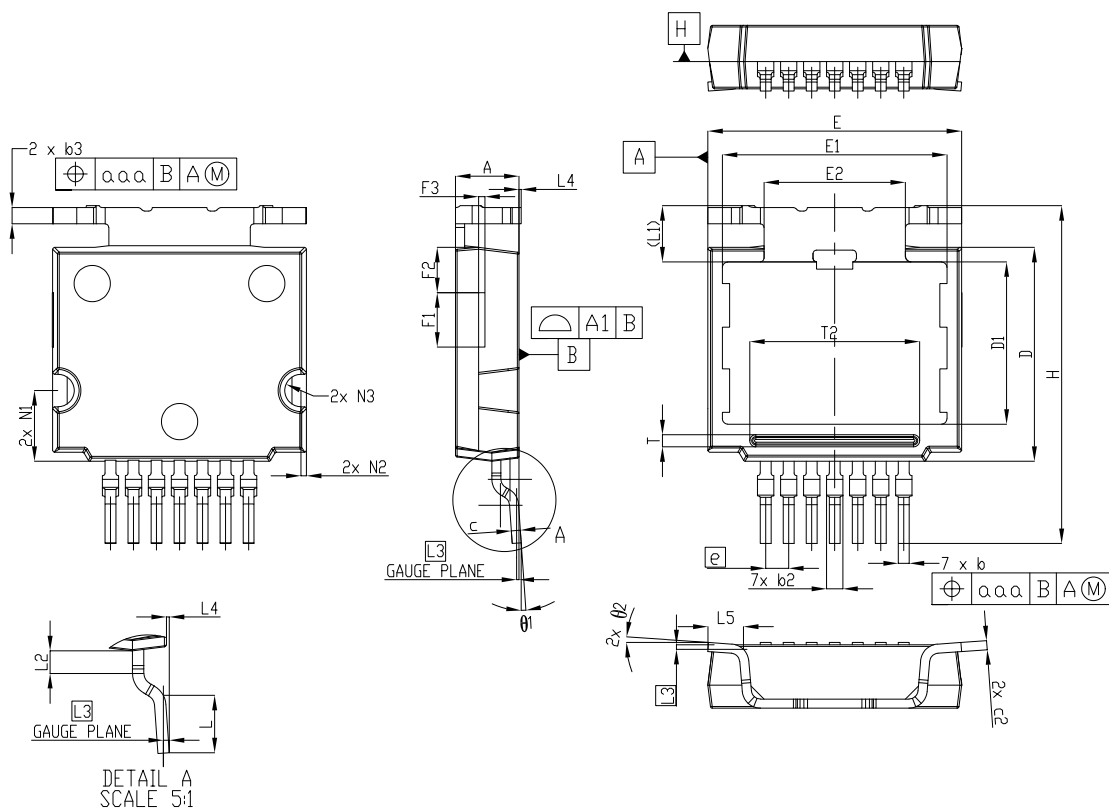
## 2 Package information

In order to meet environmental requirements, ST offers these devices in different grades of **ECOPACK** packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK is an ST trademark.

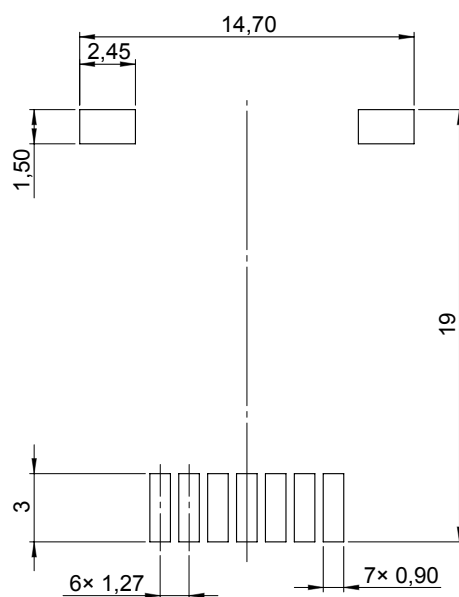
### 2.1 HU<sup>3</sup>PAK package information

- Epoxy moulding compound meets flammability standard UL94, V0
- Lead-free package leads
- Cooling method: by conduction (C)

**Figure 12. HU<sup>3</sup>PAK package outline**



**Figure 13.** HU<sup>3</sup>PAK recommended footprint (dimensions are in mm)



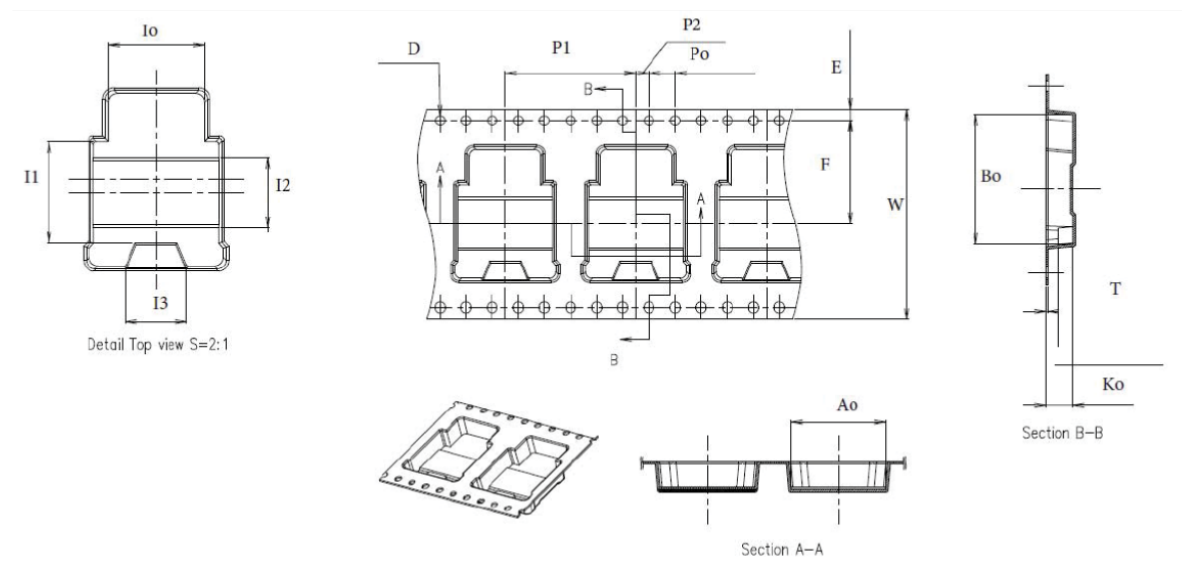
**Table 4. HU<sup>3</sup>PAK package mechanical data**

| Ref. | Dimensions  |       |       |                       |        |        |
|------|-------------|-------|-------|-----------------------|--------|--------|
|      | Millimeters |       |       | Inches <sup>(1)</sup> |        |        |
|      | Min.        | Typ.  | Max.  | Min.                  | Typ.   | Max.   |
| A    | 3.40        | 3.50  | 3.60  | 0.1339                | 0.1378 | 0.1417 |
| A1   |             |       | 0.05  |                       |        | 0.0019 |
| b    | 0.50        | 0.60  | 0.70  | 0.0197                | 0.0236 | 0.0275 |
| b2   | 0.50        | 0.70  | 1.00  | 0.0197                | 0.0276 | 0.0393 |
| b3   | 0.80        | 0.90  | 1.00  | 0.0315                | 0.0354 | 0.0393 |
| c    | 0.40        | 0.50  | 0.60  | 0.0158                | 0.0197 | 0.0236 |
| c2   | 0.40        | 0.50  | 0.60  | 0.0158                | 0.0197 | 0.0236 |
| D    | 11.70       | 11.80 | 11.90 | 0.4607                | 0.4646 | 0.4685 |
| D1   | 8.80        | 8.96  | 9.10  | 0.3465                | 0.3528 | 0.3582 |
| E    | 13.90       | 14.00 | 14.10 | 0.5473                | 0.5512 | 0.5551 |
| E1   | 12.30       | 12.40 | 12.50 | 0.4843                | 0.4882 | 0.4921 |
| E2   | 7.75        | 7.80  | 7.85  | 0.3052                | 0.3071 | 0.3090 |
| e    | BSC 1.27    |       |       | 0.0500                |        |        |
| H    | 18.00       | 18.58 | 19.00 | 0.7087                | 0.7315 | 0.7480 |
| L    | 2.40        | 2.52  | 2.60  | 0.0945                | 0.0992 | 0.1023 |
| L1   |             | 3.05  |       |                       | 0.1201 |        |
| L2   | 0.90        | 1.00  | 1.10  | 0.0355                | 0.0394 | 0.0433 |
| L3   | BSC 0.26    |       |       | 0.0103                |        |        |
| L4   | 0.075       | 0.125 | 0.175 | 0.0030                | 0.0049 | 0.0068 |
| L5   | 1.83        | 1.93  | 2.03  | 0.0721                | 0.0760 | 0.0799 |
| aaa  |             |       | 0.10  |                       |        | 0.0039 |
| θ1   | 0°          |       | 8°    |                       |        |        |
| θ2   | 0°          |       | 8°    |                       |        |        |
| F1   | 2.90        | 3.00  | 3.10  | 0.1142                | 0.1181 | 0.1220 |
| F2   | 2.40        | 2.50  | 2.60  | 0.0945                | 0.0984 | 0.1023 |
| F3   | 0.25        | 0.35  | 0.45  | 0.0099                | 0.0138 | 0.0177 |
| N1   | 3.80        | 3.90  | 4.0   | 0.1497                | 0.1535 | 0.1574 |
| N2   | 0.25        | 0.30  | 0.45  | 0.0099                | 0.0118 | 0.0177 |
| N3   | 0.80        | 0.90  | 1.00  | 0.0315                | 0.0354 | 0.0393 |
| T    | 0.50        | 0.67  | 0.70  | 0.0197                | 0.0264 | 0.0275 |
| T2   | 9.33        | 9.38  | 9.43  | 0.3674                | 0.3693 | 0.3712 |

1. Inches are given for reference only

## 2.2 HU<sup>3</sup>PAK packing information

**Figure 14. HU<sup>3</sup>PAK carrier tape outline**



**Table 5. HU<sup>3</sup>PAK tape and reel mechanical data**

| Dim. | Tape       |  |
|------|------------|--|
|      | mm         |  |
|      | Value      |  |
| A0   | 14.40 ±0.1 |  |
| B0   | 19.70      |  |
| D    | 1.50 ±0.1  |  |
| E    | 1.75 ±0.1  |  |
| F    | 15.65 ±0.1 |  |
| I0   | 11.00      |  |
| I1   | 11.60 ±0.1 |  |
| I2   | 8.0        |  |
| I3   | 7.0        |  |
| K0   | 4.20       |  |
| P0   | 4.00 ±0.1  |  |
| P1   | 20.00 ±0.1 |  |
| P2   | 2.00 ±0.1  |  |
| T    | 0.40 ±0.5  |  |
| W    | 32.00 ±0.3 |  |

### 3 Ordering information

**Table 6. Ordering information**

| Order code     | Marking     | Package             | Weight | Base qty. | Delivery mode |
|----------------|-------------|---------------------|--------|-----------|---------------|
| TN3050HP-12L2Y | TN3050HP12Y | HU <sup>3</sup> PAK | 2.32 g | 600       | Tape and reel |

## Revision history

**Table 7. Document revision history**

| Date        | Revision | Changes                                       |
|-------------|----------|-----------------------------------------------|
| 07-Apr-2020 | 1        | Initial release.                              |
| 15-Jul-2022 | 2        | Updated <a href="#">Section Description</a> . |

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