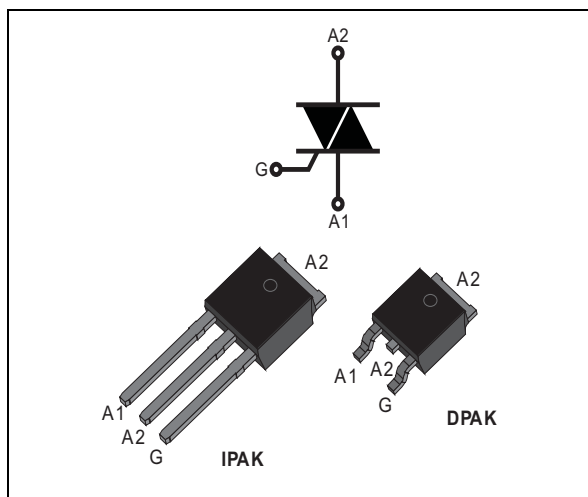




### Description

Sensitive Triacs are intended in general purpose applications where high surge current capability is required. These Triacs feature a gate current capability sensitivities of 5 mA or 10 mA depending on the quadrant.

**Table 1. Device summary**

| Symbol             | Value                 | Unit |
|--------------------|-----------------------|------|
| $I_{T(rms)}$       | 4                     | A    |
| $V_{DRM}, V_{RRM}$ | 600                   | V    |
| $V_{DSM}, V_{RSM}$ | 700                   | V    |
| $I_{GT}$           | 5 / 10 <sup>(1)</sup> | mA   |

1. Quadrant I,II,III = 5 mA, quadrant IV = 10 mA.

### Features

- MCU direct gate drive
- 4 quadrants Triac
- ECOPACK<sup>®</sup>2 compliant component

### Applications

- Motor control circuits
- Small home appliances
- Fan speed controller
- Pump and valve drive
- Mahjong machines
- Lighting dimmers

# 1 Characteristics

**Table 2. Absolute maximum ratings ( $T_j = 25\text{ °C}$  unless otherwise stated)**

| Symbol                   | Parameter                                                                                       |                         |                        | Value                          | Unit        |
|--------------------------|-------------------------------------------------------------------------------------------------|-------------------------|------------------------|--------------------------------|-------------|
| $I_{T(rms)}$             | On-state rms current (full sine wave)                                                           | IPAK, DPAK              | $T_c = 110\text{ °C}$  | 4                              | A           |
| $I_{TSM}$                | Non repetitive surge peak on-state current (full cycle, $T_j$ initial = $25\text{ °C}$ )        |                         | $t_p = 20\text{ ms}$   | 35                             | A           |
|                          |                                                                                                 |                         | $t_p = 16.7\text{ ms}$ | 38                             |             |
| $I^2t$                   | $I^2t$ value for fusing                                                                         |                         | $t_p = 10\text{ ms}$   | 6                              | $A^2s$      |
| $di/dt$                  | Critical rate of rise of on-state current<br>$I_G = 2 \times I_{GT}$ , $t_r \leq 100\text{ ns}$ |                         | $F = 100\text{ Hz}$    | 50                             | $A/\mu s$   |
| $I_{GM}$                 | Peak gate current                                                                               | $t_p = 20\text{ }\mu s$ | $T_j = 125\text{ °C}$  | 4                              | A           |
| $P_{G(AV)}$              | Average gate power dissipation                                                                  |                         | $T_j = 125\text{ °C}$  | 0.5                            | W           |
| $T_{stg}$<br>$T_j$       | Storage junction temperature range<br>Operating junction temperature range                      |                         |                        | - 40 to + 150<br>- 40 to + 125 | $^{\circ}C$ |
| $V_{DSM}$ ,<br>$V_{RSM}$ | Non repetitive surge peak off-state voltage                                                     |                         | $t_p = 10\text{ ms}$   | 700                            | V           |

**Table 3. Electrical characteristics ( $T_j = 25\text{ °C}$ , unless otherwise stated)**

| Symbol            | Test conditions                                                      | Quadrant              |      | Value   | Unit      |
|-------------------|----------------------------------------------------------------------|-----------------------|------|---------|-----------|
|                   |                                                                      |                       |      | T405Q   |           |
| $I_{GT}^{(1)}$    | $V_D = 12\text{ V}$ , $R_L = 30\text{ }\Omega$                       | I - II - III<br>IV    | Max. | 5<br>10 | mA        |
| $V_{GT}$          | $V_D = 12\text{ V}$ , $R_L = 30\text{ }\Omega$                       | All                   | Max. | 1.3     | V         |
| $V_{GD}$          | $V_D = V_{DRM}$ , $R_L = 3.3\text{ k}\Omega$ , $T_j = 125\text{ °C}$ | All                   | Min. | 0.2     | V         |
| $I_H^{(2)}$       | $I_T = 100\text{ mA}$                                                |                       | Max. | 10      | mA        |
| $I_L$             | $I_G = 1.2 I_{GT}$                                                   | I - III - IV          | Max. | 10      | mA        |
|                   |                                                                      | II                    | Max. | 15      |           |
| $dV/dt^{(2)}$     | $V_D = 67\% V_{DRM}$ , gate open                                     | $T_j = 125\text{ °C}$ | Min. | 10      | $V/\mu s$ |
| $(di/dt)_c^{(2)}$ | $(dV/dt)_c = 2\text{ V}/\mu s$                                       | $T_j = 125\text{ °C}$ | Min. | 1.8     | $A/ms$    |

1. Minimum  $I_{GT}$  is guaranteed at 5% of  $I_{GT}$  max.

2. For both polarities of A2 referenced to A1

Table 4. Static characteristics

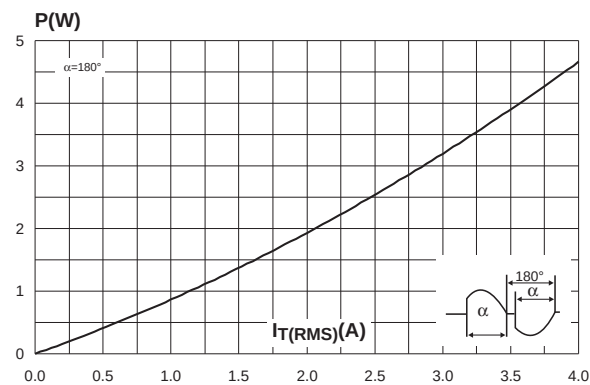
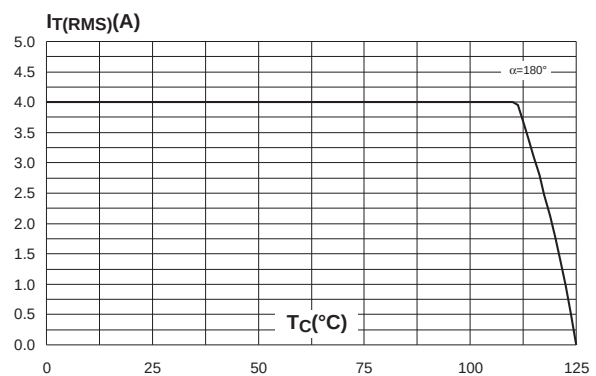
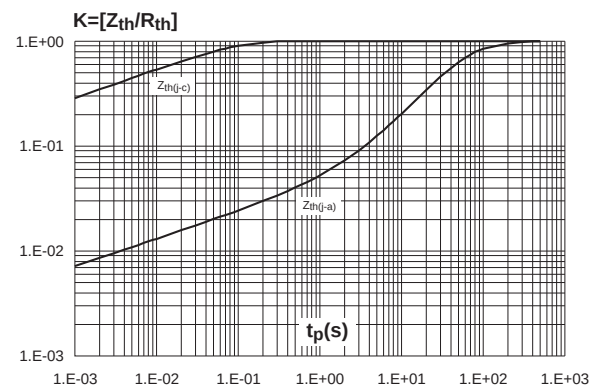
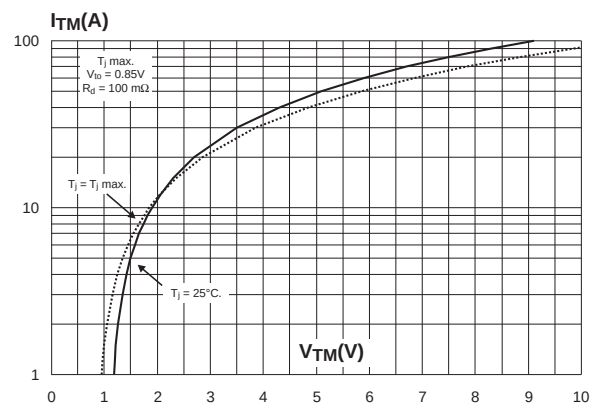
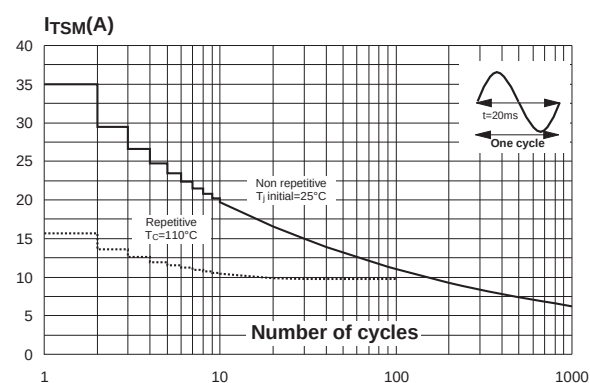
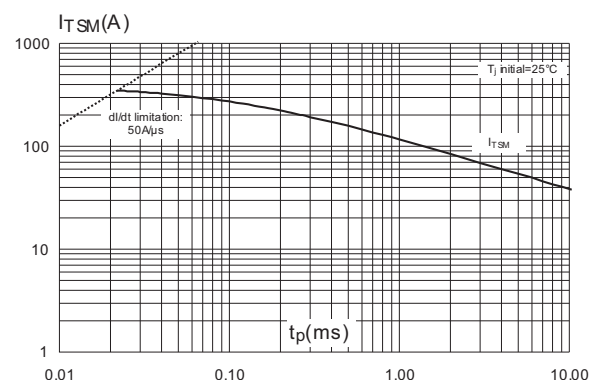
| Symbol                 | Test conditions                                        |                                   |      | Value | Unit          |
|------------------------|--------------------------------------------------------|-----------------------------------|------|-------|---------------|
| $V_{TM}^{(1)}$         | $I_{TM} = 5\text{ A}$ , $t_p = 380\text{ }\mu\text{s}$ | $T_j = 25\text{ }^\circ\text{C}$  | Max. | 1.5   | V             |
| $V_{t0}^{(1)}$         | Threshold voltage                                      | $T_j = 125\text{ }^\circ\text{C}$ | Max. | 0.85  | V             |
| $R_d^{(1)}$            | Dynamic resistance                                     | $T_j = 125\text{ }^\circ\text{C}$ | Max. | 100   | m $\Omega$    |
| $I_{DRM}$<br>$I_{RRM}$ | $V_{DRM} = V_{RRM}$                                    | $T_j = 25\text{ }^\circ\text{C}$  | Max. | 5     | $\mu\text{A}$ |
|                        |                                                        | $T_j = 125\text{ }^\circ\text{C}$ |      | 1     | mA            |

1. For both polarities of A2 referenced to A1

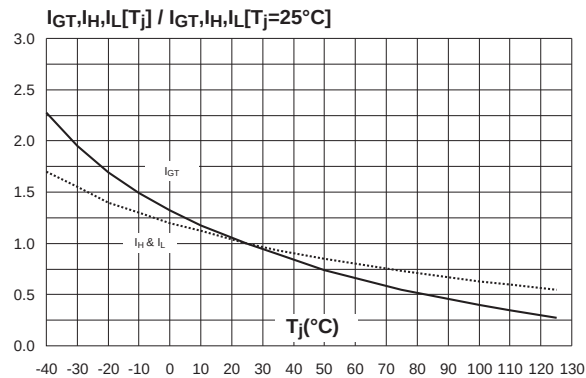
Table 5. Thermal resistance

| Symbol        | Parameter             |                             |      | Value | Unit               |
|---------------|-----------------------|-----------------------------|------|-------|--------------------|
| $R_{th(j-c)}$ | Junction to case (AC) |                             |      | 3     | $^\circ\text{C/W}$ |
| $R_{th(j-a)}$ | Junction to ambient   | $S^{(1)} = 0.5\text{ cm}^2$ | DPAK | 70    | $^\circ\text{C/W}$ |
|               |                       |                             | IPAK | 100   | $^\circ\text{C/W}$ |

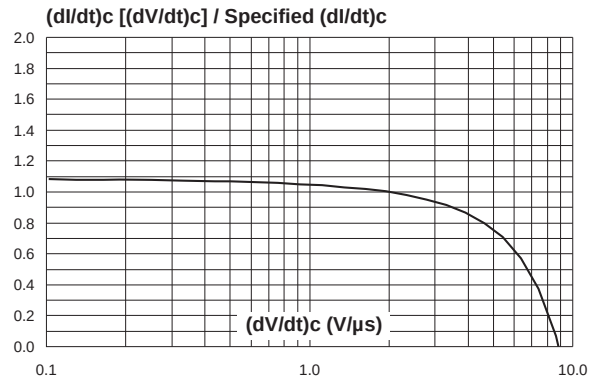
1. S = Copper surface under tab.

**Figure 1. Maximum power dissipation versus RMS on-state current****Figure 2. RMS on-state current versus case temperature****Figure 3. Relative variation of thermal impedance versus pulse duration****Figure 4. On-state characteristics (maximum values)****Figure 5. Surge peak on-state current versus number of cycles****Figure 6. Non-repetitive surge peak on-state current for a sinusoidal pulse with width  $t_p < 10 \text{ ms}$** 

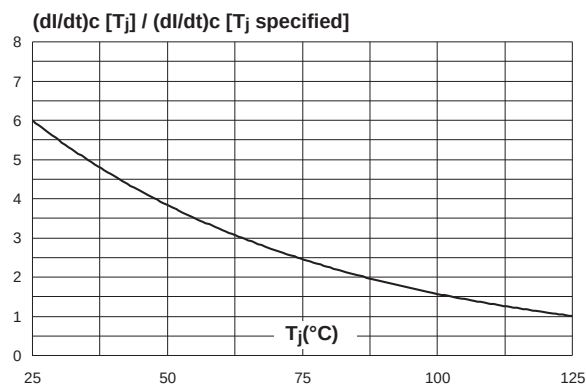
**Figure 7. Relative variation of gate trigger current, holding current and latching current versus junction temperature (typical values)**



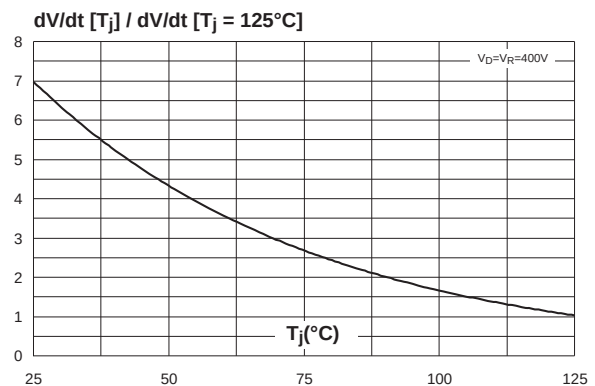
**Figure 8. Relative variation of critical rate of decrease of main current versus  $(dV/dt)_c$  (typical values)**



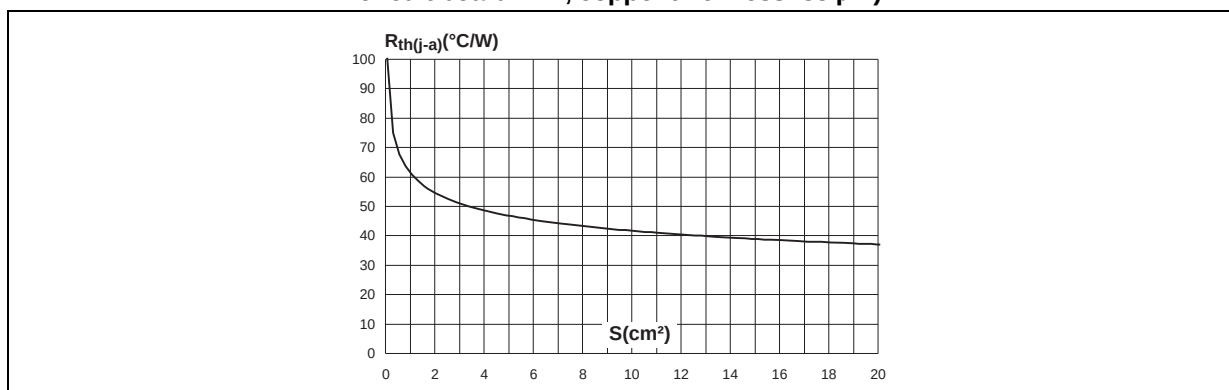
**Figure 9. Relative variation of critical rate of decrease of main current versus junction temperature**



**Figure 10. Relative variation of static  $dV/dt$  immunity versus junction temperature**



**Figure 11. DPAK thermal resistance junction to ambient versus copper surface under tab (printed circuit board FR4, copper thickness: 35  $\mu\text{m}$ )**



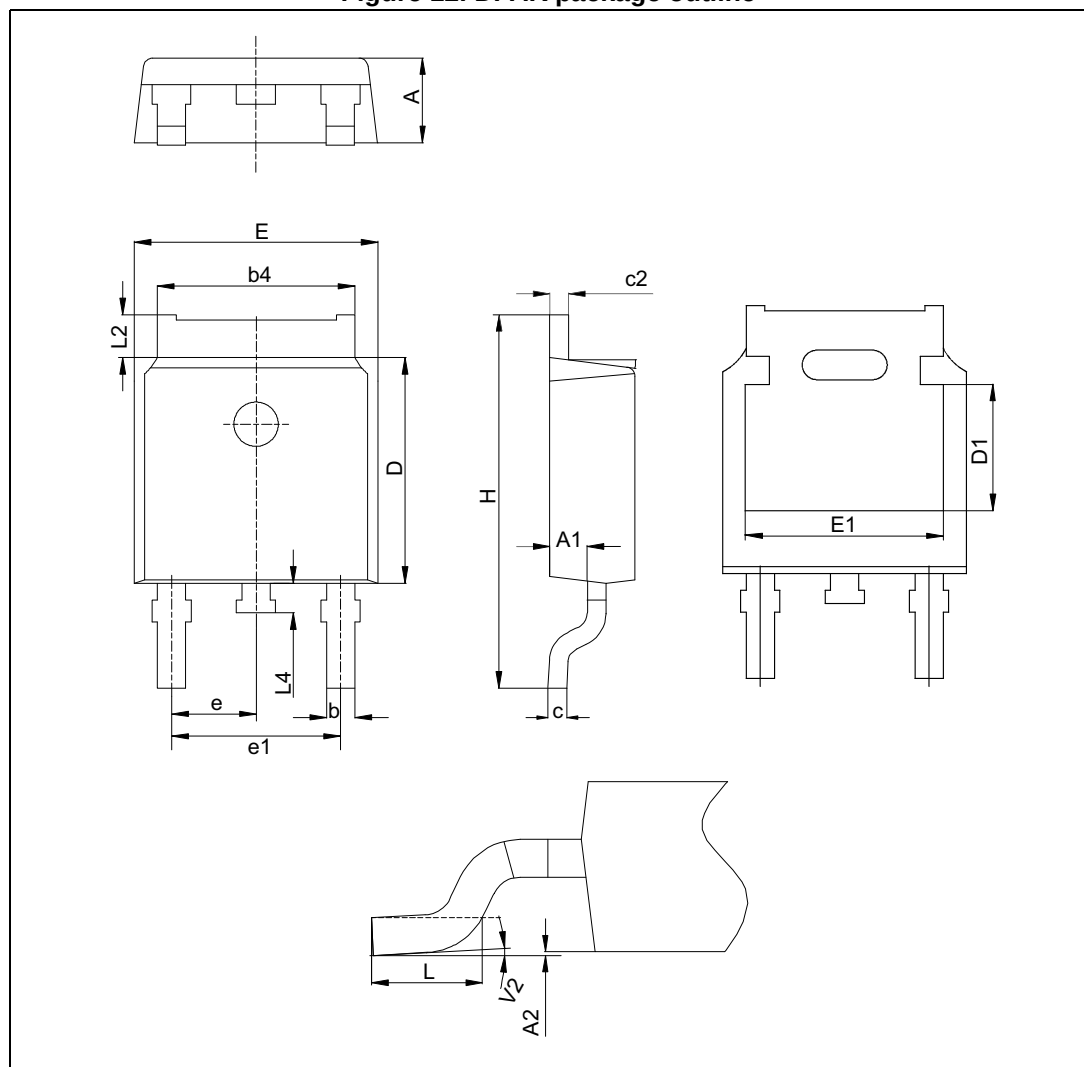
## 2 Package information

- Epoxy meets UL94, V0
- Lead-free package
- Recommended torque: 0.4 to 0.6 N·m

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 DPAK package information

Figure 12. DPAK package outline



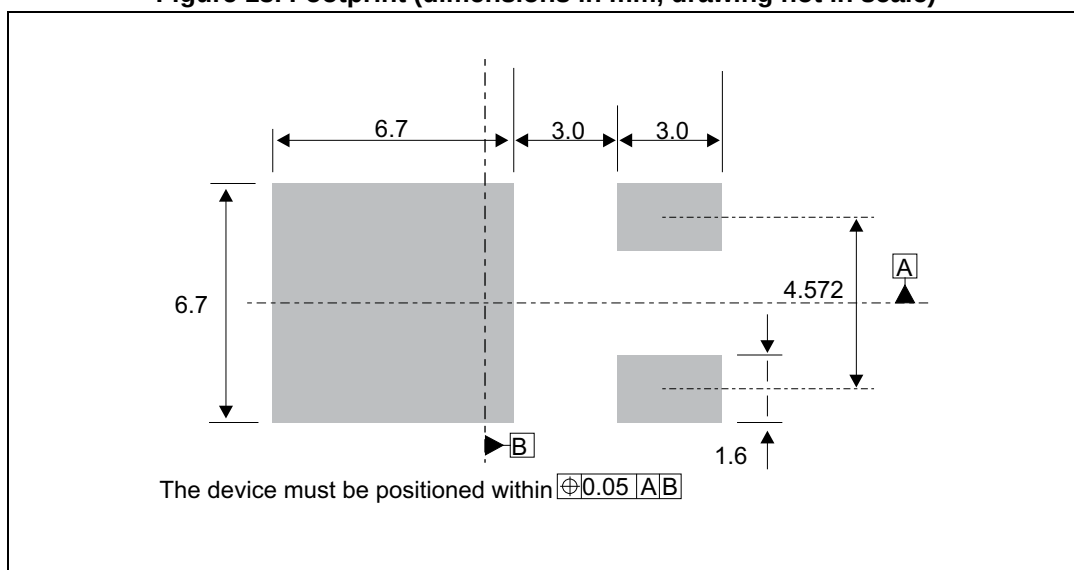
**Note:** This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.

Table 6. DPAK package mechanical data

| Ref. | Dimensions  |       |       |                       |        |        |
|------|-------------|-------|-------|-----------------------|--------|--------|
|      | Millimeters |       |       | Inches <sup>(1)</sup> |        |        |
|      | Min.        | Typ.  | Max.  | Min.                  | Typ.   | Max.   |
| A    | 2.18        |       | 2.40  | 0.0858                |        | 0.0945 |
| A1   | 0.90        |       | 1.10  | 0.0354                |        | 0.0433 |
| A2   | 0.03        |       | 0.23  | 0.0012                |        | 0.0091 |
| b    | 0.64        |       | 0.90  | 0.0252                |        | 0.0354 |
| b4   | 4.95        |       | 5.46  | 0.1949                |        | 0.2150 |
| c    | 0.46        |       | 0.61  | 0.0181                |        | 0.0240 |
| c2   | 0.46        |       | 0.60  | 0.0181                |        | 0.0236 |
| D    | 5.97        |       | 6.22  | 0.2350                |        | 0.2449 |
| D1   | 4.95        |       | 5.60  | 0.1949                |        | 0.2204 |
| E    | 6.35        |       | 6.73  | 0.2500                |        | 0.2650 |
| E1   | 4.32        |       | 5.50  | 0.1701                |        | 0.2165 |
| e    |             | 2.286 |       |                       | 0.0900 |        |
| e1   | 4.40        |       | 4.70  | 0.1732                |        | 0.1850 |
| H    | 9.35        |       | 10.40 | 0.3681                |        | 0.4094 |
| L    | 1.00        |       | 1.78  | 0.0394                |        | 0.0701 |
| L2   |             | 1.27  |       |                       | 0.0500 |        |
| L4   | 0.60        |       | 1.02  | 0.0236                |        | 0.0402 |
| V2   | -8°         |       | 8°    | -8°                   |        | 8°     |

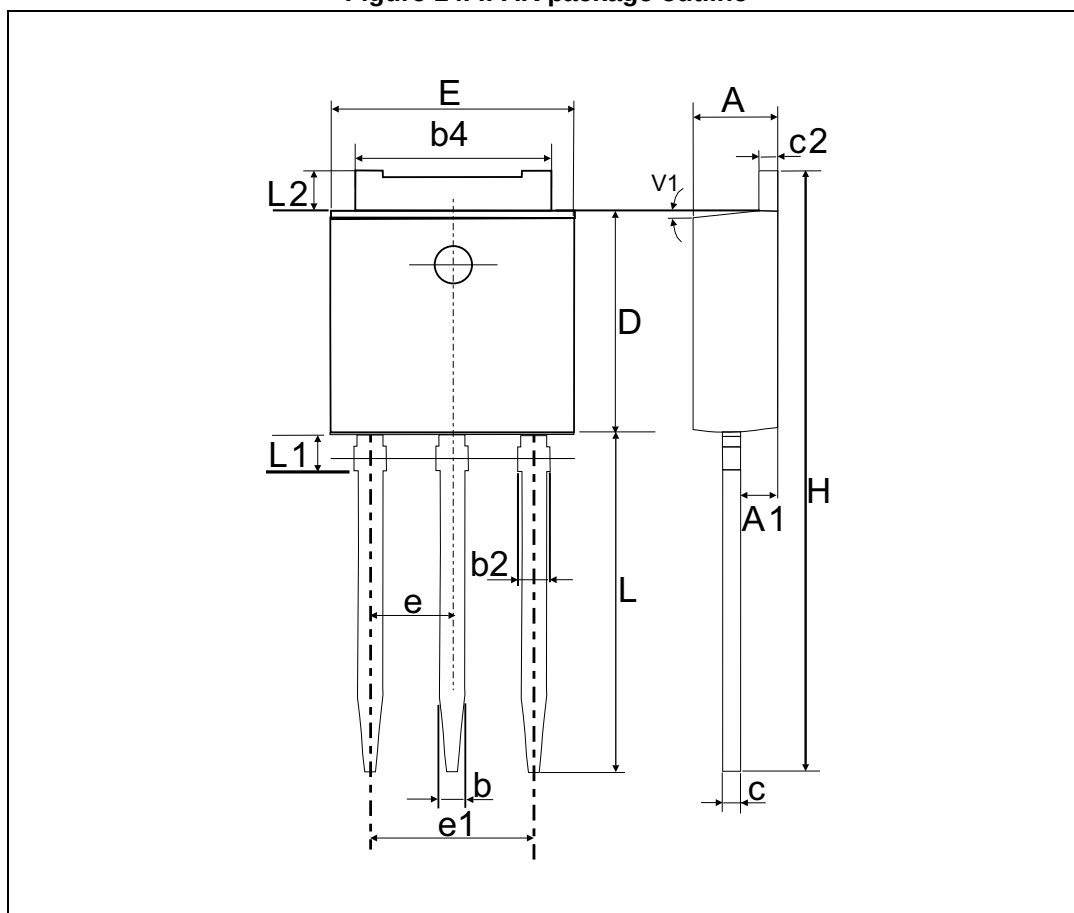
1. Inch dimensions are only for reference

Figure 13. Footprint (dimensions in mm, drawing not in scale)



## 2.2 IPAK package information

Figure 14. IPAK package outline



**Note:** This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.



Table 7. IPAK package mechanical data

| Ref. | Dimensions  |       |      |                       |        |        |
|------|-------------|-------|------|-----------------------|--------|--------|
|      | Millimeters |       |      | Inches <sup>(1)</sup> |        |        |
|      | Min.        | Typ.  | Max. | Min.                  | Typ.   | Max.   |
| A    | 2.20        |       | 2.40 | 0.0866                |        | 0.0945 |
| A1   | 0.90        |       | 1.10 | 0.0354                |        | 0.0433 |
| b    | 0.64        |       | 0.90 | 0.0252                |        | 0.0354 |
| b2   |             |       | 0.95 |                       |        | 0.0374 |
| b4   | 5.20        |       | 5.43 | 0.2047                |        | 0.2138 |
| c    | 0.45        |       | 0.60 | 0.0177                |        | 0.0236 |
| c2   | 0.46        |       | 0.60 | 0.0181                |        | 0.0236 |
| D    | 6           |       | 6.20 | 0.2362                |        | 0.2441 |
| E    | 6.40        |       | 6.65 | 0.2520                |        | 0.2618 |
| e    |             | 2.28  |      |                       | 0.0898 |        |
| e1   | 4.40        |       | 4.60 | 0.1732                |        | 0.1811 |
| H    |             | 16.10 |      |                       | 0.6339 |        |
| L    | 9           |       | 9.60 | 0.3543                |        | 0.3780 |
| L1   | 0.8         |       | 1.20 | 0.0315                |        | 0.0472 |
| L2   |             | 0.80  | 1.25 |                       | 0.0315 | 0.0492 |
| V1   |             | 10°   |      |                       | 10°    |        |

1. Inch dimensions are only for reference

### 3 Ordering information

Figure 15. Order information scheme

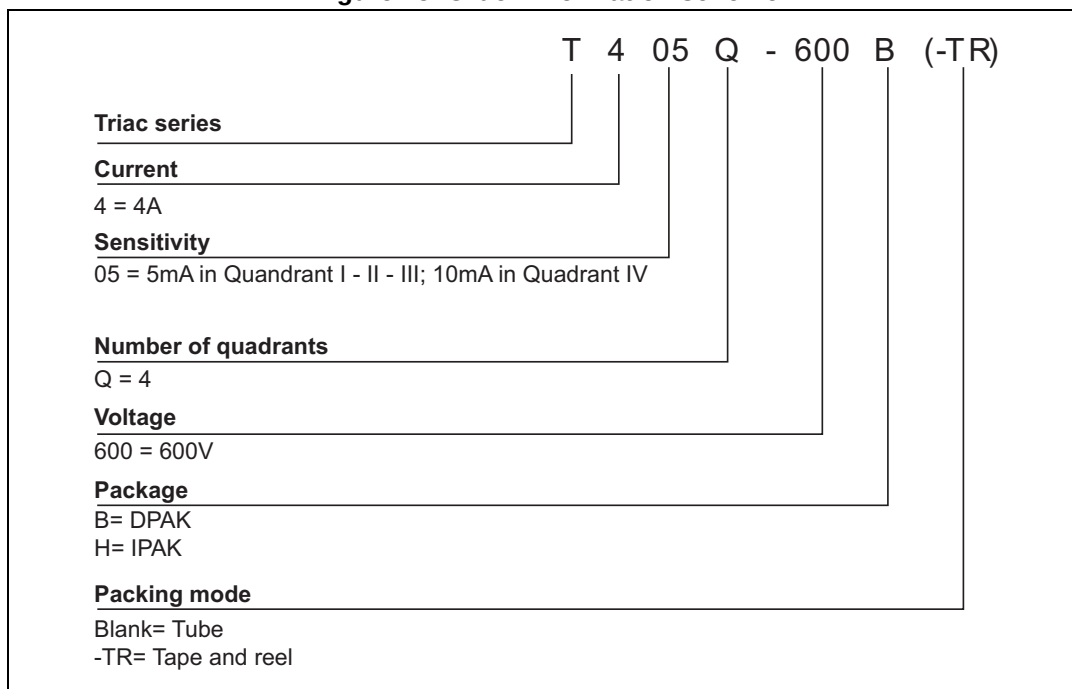


Table 8. Product selector

| Part Number   | Voltage | Sensitivity | Type      | Package |
|---------------|---------|-------------|-----------|---------|
| T405Q-600B-TR | 600 V   | 5 / 10 mA   | Sensitive | DPAK    |
| T405Q-600H    | 600 V   | 5 / 10 mA   | Sensitive | IPAK    |

Table 9. Ordering information

| Order code    | Marking   | Package | Weight | Base qty | Delivery mode |
|---------------|-----------|---------|--------|----------|---------------|
| T405Q-600B-TR | T405Q 600 | DPAK    | 0.3 g  | 2500     | Tape and reel |
| T405Q-600H    | T405Q 600 | IPAK    | 0.4 g  | 75       | Tube          |

## 4 Revision history

**Table 10. Document revision history**

| Date        | Revision | Changes                                                                                          |
|-------------|----------|--------------------------------------------------------------------------------------------------|
| July-2002   | 1        | First issue.                                                                                     |
| 29-May-2014 | 2        | Updated DPAK and IPAK package information and reformatted to current standard.                   |
| 25-Sep-2015 | 3        | Updated Features in cover page.<br>Updated Table 3 and Section 2: Package information.           |
| 11-Feb-2016 | 4        | Updated DPAK package information and reformatted to current standard. Added $V_{DSM}$ parameter. |

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