

# 1 Characteristics

**Table 1. Absolute maximum ratings**

| Symbol            | Parameters                                                                                             |                               |                                     | Value                   | Unit                           |
|-------------------|--------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------------|-------------------------|--------------------------------|
| $I_{T(RMS)}$      | RMS on-state current (full sine wave)                                                                  | TO-220AB                      | $T_c = 105\text{ }^{\circ}\text{C}$ | 10                      | A                              |
|                   |                                                                                                        | TO-220AB Ins.                 | $T_c = 95\text{ }^{\circ}\text{C}$  |                         |                                |
| $I_{TSM}$         | Non repetitive surge peak on-state current (full cycle, $T_j$ initial = $25\text{ }^{\circ}\text{C}$ ) | F = 50 Hz                     | $t_p = 20\text{ ms}$                | 100                     | A                              |
|                   |                                                                                                        | F = 60 Hz                     | $t_p = 16.7\text{ ms}$              | 105                     |                                |
| $I^2t$            | $I^2t$ value for fusing                                                                                | $t_p = 10\text{ ms}$          |                                     | 55                      | $\text{A}^2\text{s}$           |
| $di/dt$           | Critical rate of rise of on-state current<br>$I_G = 2 \times I_{GT}$ , $t_r \leq 100\text{ ns}$        | F = 120 Hz                    | $T_j = 125\text{ }^{\circ}\text{C}$ | 50                      | $\text{A}/\mu\text{s}$         |
| $V_{DSM}/V_{RSM}$ | Non repetitive surge peak off-state voltage                                                            | $t_p = 10\text{ ms}$          | $T_j = 25\text{ }^{\circ}\text{C}$  | $V_{DRM}/V_{RRM} + 100$ | V                              |
| $I_{GM}$          | Peak gate current                                                                                      | $t_p = 20\text{ }\mu\text{s}$ | $T_j = 125\text{ }^{\circ}\text{C}$ | 4                       | A                              |
| $P_{G(AV)}$       | Average gate power dissipation                                                                         |                               | $T_j = 125\text{ }^{\circ}\text{C}$ | 1                       | W                              |
| $T_{stg}$         | Storage junction temperature range                                                                     |                               |                                     |                         | -40 to +150 $^{\circ}\text{C}$ |
| $T_j$             | Operating junction temperature range                                                                   |                               |                                     |                         | -40 to +125 $^{\circ}\text{C}$ |

**Table 2. Static electrical characteristics**

| Symbol            | Test conditions                                         | $T_j$                         |      | Value | Unit             |
|-------------------|---------------------------------------------------------|-------------------------------|------|-------|------------------|
| $V_T^{(1)}$       | $I_{TM} = 14\text{ A}$ , $t_p = 380\text{ }\mu\text{s}$ | $25\text{ }^{\circ}\text{C}$  | Max. | 1.55  | V                |
| $V_{TO}$          | threshold on-state voltage                              | $125\text{ }^{\circ}\text{C}$ | Max. | 0.85  | V                |
| $R_D$             | Dynamic resistance                                      | $125\text{ }^{\circ}\text{C}$ | Max. | 40    | $\text{m}\Omega$ |
| $I_{DRM}/I_{RRM}$ | $V_{DRM} = V_{RRM}$                                     | $25\text{ }^{\circ}\text{C}$  | Max. | 5     | $\mu\text{A}$    |
|                   |                                                         | $125\text{ }^{\circ}\text{C}$ |      | 1     | mA               |

1. For both polarities of A2 referenced to A1

**Table 3. Electrical characteristics ( $T_j = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) - Snubberless™ (3 quadrants)**

| Symbol        | Parameters                                                                         | Quadrant     |      | T1035 | BTA10-xCW<br>BTB10-xCW | T1050<br>BTA10-xBW<br>BTB10-xBW | Unit                   |
|---------------|------------------------------------------------------------------------------------|--------------|------|-------|------------------------|---------------------------------|------------------------|
| $I_{GT}$      | $V_D = 12\text{ V}$ , $R_L = 33\text{ }\Omega$                                     | I - II - III | Max. | 35    |                        | 50                              | mA                     |
| $V_{GT}$      |                                                                                    | I - II - III | Max. | 1.3   |                        |                                 | V                      |
| $V_{GD}$      | $V_D = V_{DRM}$ , $R_L = 3,3\text{ k}\Omega$ , $T_j = 125\text{ }^{\circ}\text{C}$ | I - II - III | Min. | 0.2   |                        |                                 | V                      |
| $I_H$         | $I_T = 500\text{ mA}$                                                              | I - II - III | Max. | 35    |                        | 50                              | mA                     |
| $I_L$         | $I_G = 1.2\text{ }I_{GT}$                                                          | I - III      | Max. | 50    |                        | 70                              | mA                     |
|               |                                                                                    | II           | Max. | 80    | 60                     | 80                              |                        |
| $dV/dt^{(2)}$ | $V_D = 67\text{ }\% V_{DRM}$ gate open, $T_j = 125\text{ }^{\circ}\text{C}$        |              | Min. | 500   |                        | 1000                            | $\text{V}/\mu\text{s}$ |

| Symbol            | Parameters                                 | Quadrant |      | T1035 | BTA10-xCW<br>BTB10-xCW | T1050<br>BTA10-xBW<br>BTB10-xBW | Unit |
|-------------------|--------------------------------------------|----------|------|-------|------------------------|---------------------------------|------|
| $(di/dt)_c^{(2)}$ | Without snubber, $T_j = 125^\circ\text{C}$ |          | Min. | 5.5   |                        | 9                               | 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. Electrical characteristics ( $T_j = 25^\circ\text{C}$ , unless otherwise specified) - standard Triac (4 quadrants)**

| Symbol            | Parameters                                                         | Quadrant     |      | Value |     | Unit             |
|-------------------|--------------------------------------------------------------------|--------------|------|-------|-----|------------------|
|                   |                                                                    |              |      | C     | B   |                  |
| $I_{GT}^{(1)}$    | $V_D = 12\text{ V}, R_L = 33\ \Omega$                              | I - II - III | Max. | 25    | 50  | mA               |
|                   |                                                                    | IV           | Max. | 50    | 100 |                  |
| $V_{GT}$          |                                                                    | All          | Max. | 1.3   |     | V                |
| $V_{GD}$          | $V_D = V_{DRM}, R_L = 3.3\text{ k}\Omega, T_j = 125^\circ\text{C}$ | I - II - III | Min. | 0.2   |     | V                |
| $I_H^{(2)}$       | $I_T = 500\text{ mA}$                                              | I - II - III | Max. | 25    | 50  | mA               |
| $I_L$             | $I_G = 1.2 I_{GT}$                                                 | I - III      | Max. | 40    | 50  | mA               |
|                   |                                                                    | II           | Max. | 80    | 100 |                  |
| $dV/dt^{(2)}$     | $V_D = 67\% V_{DRM}$ gate open, $T_j = 125^\circ\text{C}$          |              | Min. | 200   | 400 | V/ $\mu\text{s}$ |
| $(dV/dt)_c^{(2)}$ | $(di/dt)_c = 4.4\text{ A/ms}, T_j = 125^\circ\text{C}$             |              | Min. | 5     | 10  | V/ $\mu\text{s}$ |

1. Minimum  $I_{GT}$  is guaranteed at 5 % of  $I_{GT}$  max.
2. For both polarities of A2 referenced to A1

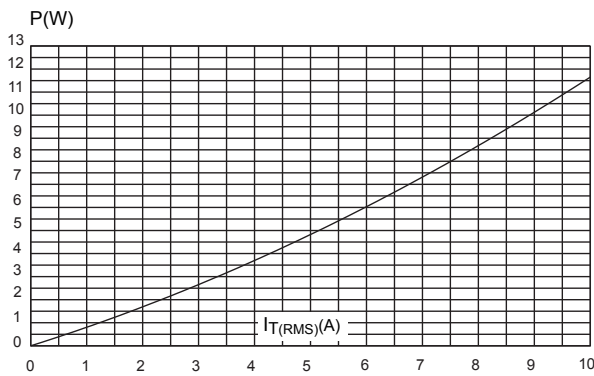
**Table 5. Thermal resistance**

| Symbol               | Parameters                                        |                               | Value | Unit               |
|----------------------|---------------------------------------------------|-------------------------------|-------|--------------------|
| $R_{th(j-c)}$ (typ.) | Junction to case (AC)                             | TO-220AB / D <sup>2</sup> PAK | 1.5   | $^\circ\text{C/W}$ |
|                      |                                                   | TO-220AB insulated            | 2.4   |                    |
| $R_{th(j-a)}$ (max.) | Junction to ambient ( $S^{(1)} = 2\text{ cm}^2$ ) | D <sup>2</sup> PAK            | 45    |                    |
|                      | Junction to ambient                               | TO-220AB / TO-220AB ins       | 60    |                    |

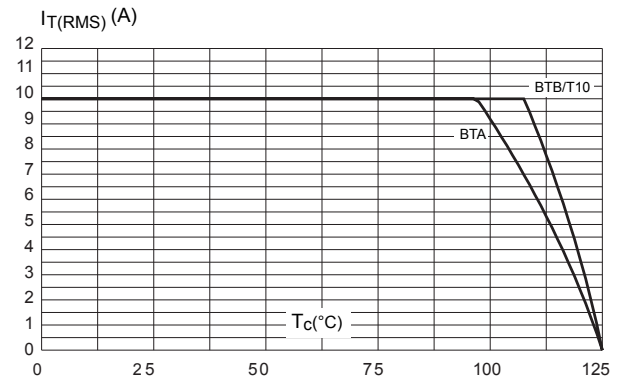
1. Copper surface under tab.

## 1.1 Characteristics (curves)

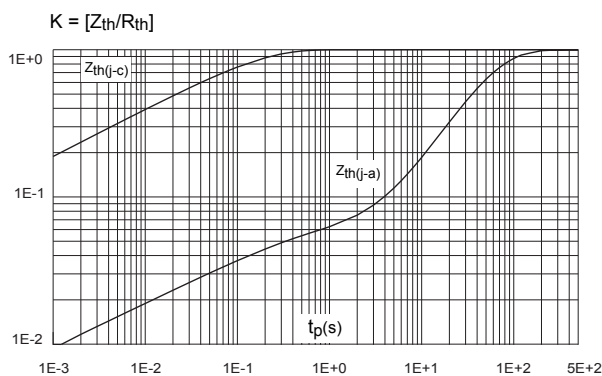
**Figure 2. Maximum power dissipation versus on-state RMS current (full cycle)**



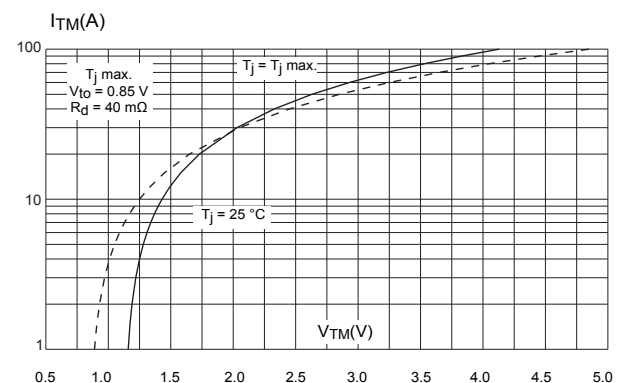
**Figure 3. RMS on-state current versus case temperature (full cycle)**



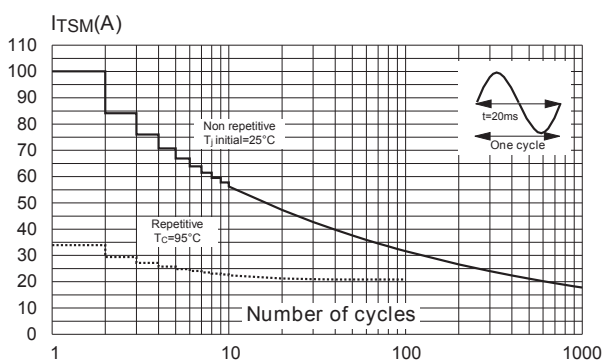
**Figure 4. Relative variation of thermal impedance versus pulse duration**



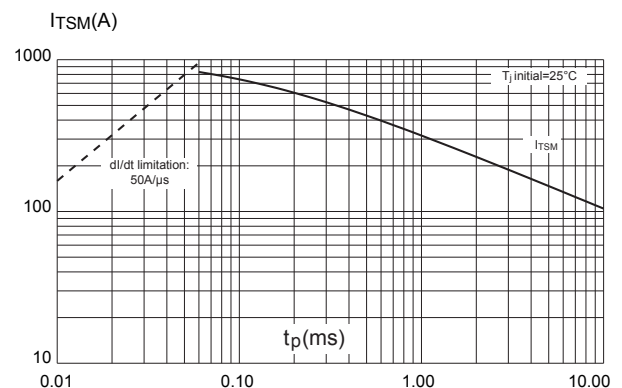
**Figure 5. On-state characteristics (maximum values)**



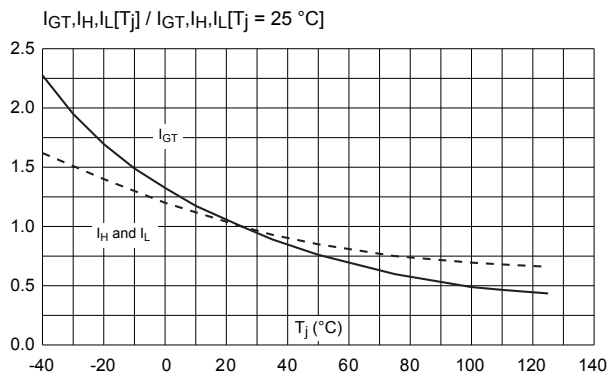
**Figure 6. Surge peak on-state current versus number of cycles**



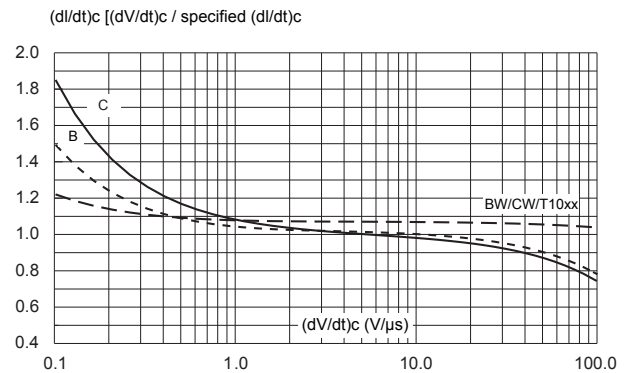
**Figure 7. Non repetitive surge peak on-state current versus sinusoidal pulse width ( $t_p < 10$  ms)**



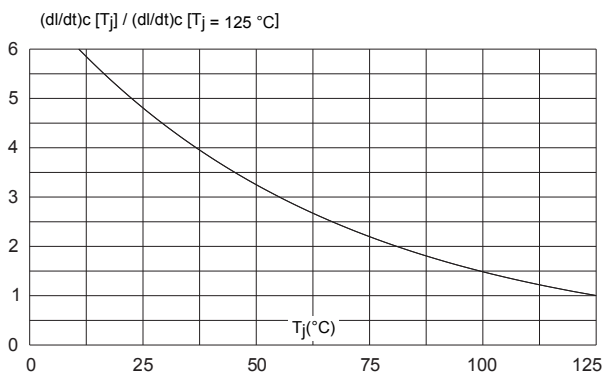
**Figure 8. Relative variation of gate trigger current, holding current and latching current versus junction temperature (typical values)**



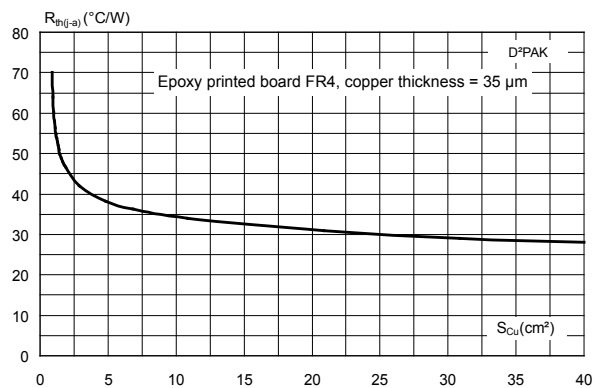
**Figure 9. Relative variation of critical rate of decrease of main current versus  $(dV/dt)_c$  (typical values)**



**Figure 10. Relative variation of critical rate of decrease of main current versus junction temperature**



**Figure 11. D<sup>2</sup>PAK thermal resistance junction to ambient versus copper surface under tab**

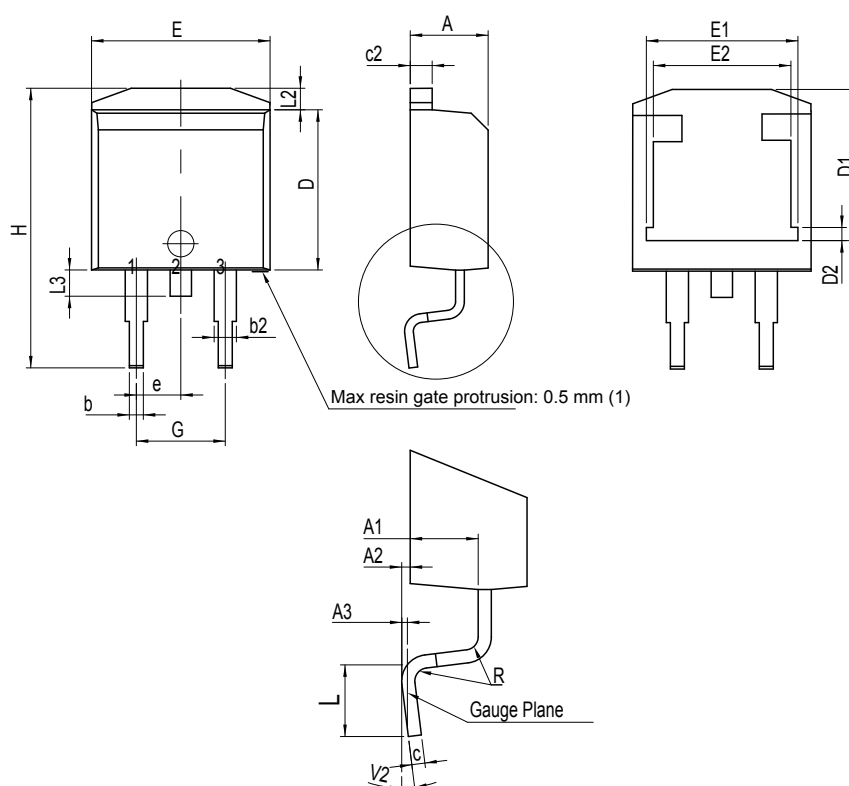


## 2 Package information

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 D<sup>2</sup>PAK package information

**Figure 12. D<sup>2</sup>PAK package outline**



(1) Resin gate is accepted in each of position shown on the drawing, or their symmetrical.

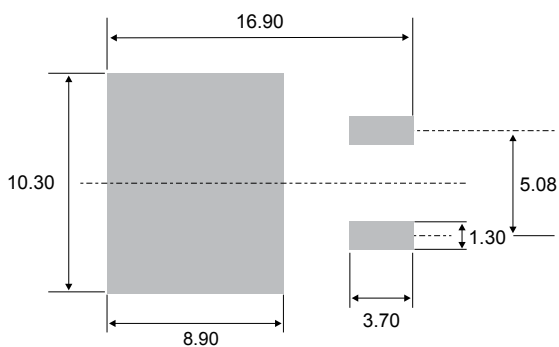
**Table 6. D<sup>2</sup>PAK package mechanical data**

| Ref. | Dimensions  |      |      |                       |        |        |
|------|-------------|------|------|-----------------------|--------|--------|
|      | Millimeters |      |      | Inches <sup>(1)</sup> |        |        |
|      | Min.        | Typ. | Max. | Min.                  | Typ.   | Max.   |
| A    | 4.30        |      | 4.60 | 0.1693                |        | 0.1811 |
| A1   | 2.49        |      | 2.69 | 0.0980                |        | 0.1059 |
| A2   | 0.03        |      | 0.23 | 0.0012                |        | 0.0091 |
| A3   |             | 0.25 |      |                       | 0.0098 |        |
| b    | 0.70        |      | 0.93 | 0.0276                |        | 0.0366 |
| b2   | 1.25        |      | 1.7  | 0.0492                |        | 0.0669 |

| Ref. | Dimensions  |      |       |                       |        |        |
|------|-------------|------|-------|-----------------------|--------|--------|
|      | Millimeters |      |       | Inches <sup>(1)</sup> |        |        |
|      | Min.        | Typ. | Max.  | Min.                  | Typ.   | Max.   |
| c    | 0.45        |      | 0.60  | 0.0177                |        | 0.0236 |
| c2   | 1.21        |      | 1.36  | 0.0476                |        | 0.0535 |
| D    | 8.95        |      | 9.35  | 0.3524                |        | 0.3681 |
| D1   | 7.50        |      | 8.00  | 0.2953                |        | 0.3150 |
| D2   | 1.30        |      | 1.70  | 0.0512                |        | 0.0669 |
| e    | 2.54        |      |       | 0.1                   |        |        |
| E    | 10.00       |      | 10.28 | 0.3937                |        | 0.4047 |
| E1   | 8.30        |      | 8.70  | 0.3268                |        | 0.3425 |
| E2   | 6.85        |      | 7.25  | 0.2697                |        | 0.2854 |
| G    | 4.88        |      | 5.28  | 0.1921                |        | 0.2079 |
| H    | 15          |      | 15.85 | 0.5906                |        | 0.6240 |
| L    | 1.78        |      | 2.28  | 0.0701                |        | 0.0898 |
| L2   | 1.27        |      | 1.40  | 0.0500                |        | 0.0551 |
| L3   | 1.40        |      | 1.75  | 0.0551                |        | 0.0689 |
| R    |             | 0.40 |       |                       | 0.0157 |        |
| V2   | 0°          |      | 8°    | 0°                    |        | 8°     |

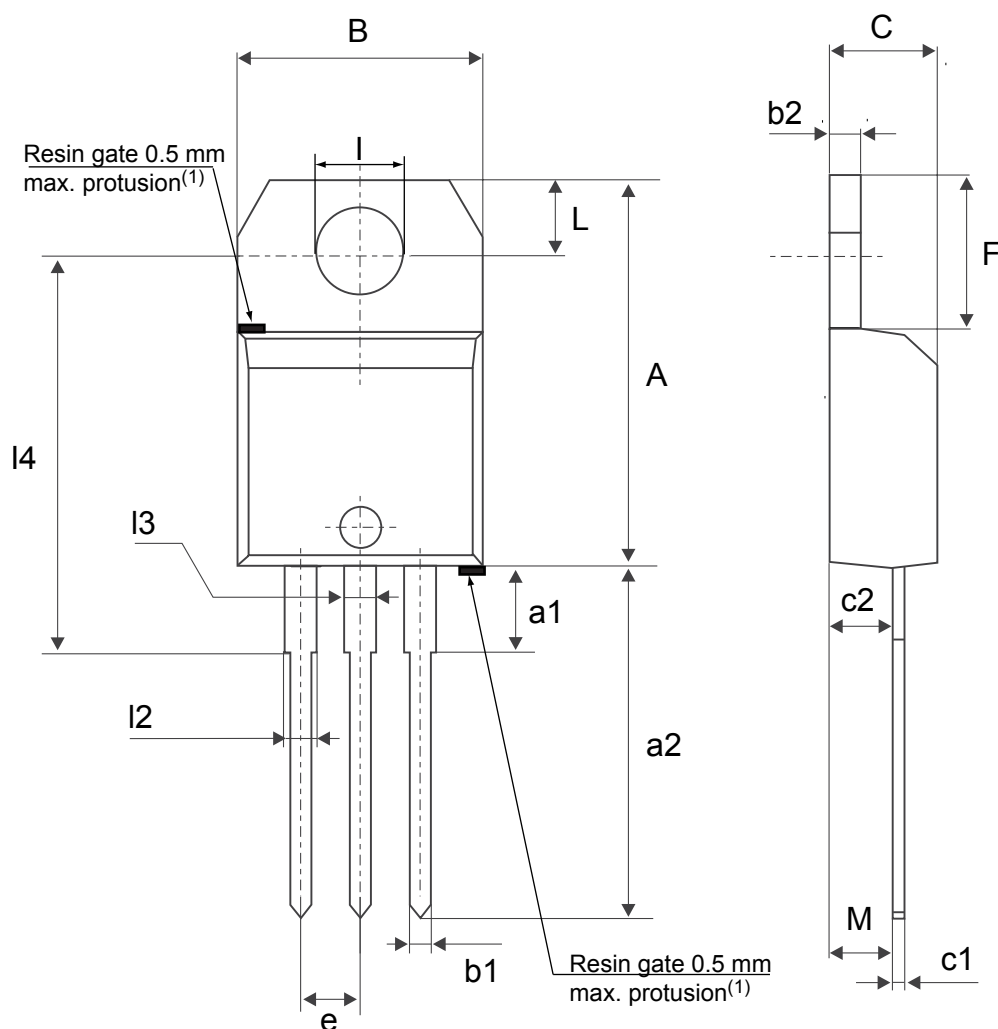
1. Dimensions in inches are given for reference only

**Figure 13. D<sup>2</sup>PAK recommended footprint (dimensions are in mm)**



## 2.2 TO-220AB non ins. and insulated package information

**Figure 14.** TO-220AB non ins. and insulated package outline



(1) Resin gate position accepted in one of the two positions or in the symmetrical opposites.

**Table 7.** TO-220AB non ins. and insulated package mechanical data

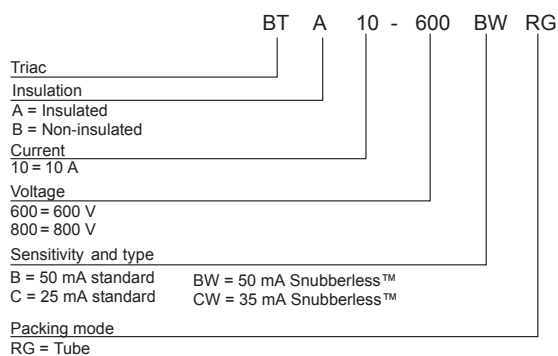
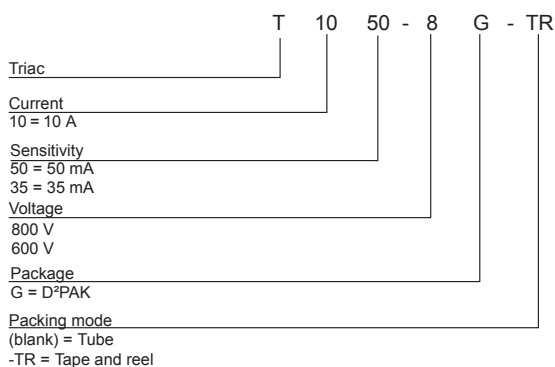
| Ref. | Dimensions  |      |       |                     |        |        |
|------|-------------|------|-------|---------------------|--------|--------|
|      | Millimeters |      |       | Inches <sup>1</sup> |        |        |
|      | Min.        | Typ. | Max.  | Min.                | Typ.   | Max.   |
| A    | 15.20       |      | 15.90 | 0.5984              |        | 0.6260 |
| a1   |             | 3.75 |       |                     | 0.1476 |        |
| a2   | 13.00       |      | 14.00 | 0.5118              |        | 0.5512 |
| B    | 10.00       |      | 10.40 | 0.3937              |        | 0.4094 |
| b1   | 0.61        |      | 0.88  | 0.0240              |        | 0.0346 |
| b2   | 1.23        |      | 1.32  | 0.0484              |        | 0.0520 |
| C    | 4.40        |      | 4.60  | 0.1732              |        | 0.1811 |

| Ref. | Dimensions  |       |       |                     |        |        |
|------|-------------|-------|-------|---------------------|--------|--------|
|      | Millimeters |       |       | Inches <sup>1</sup> |        |        |
|      | Min.        | Typ.  | Max.  | Min.                | Typ.   | Max.   |
| c1   | 0.49        |       | 0.70  | 0.0193              |        | 0.0276 |
| c2   | 2.40        |       | 2.72  | 0.0945              |        | 0.1071 |
| e    | 2.40        |       | 2.70  | 0.0945              |        | 0.1063 |
| F    | 6.20        |       | 6.60  | 0.2441              |        | 0.2598 |
| I    | 3.73        |       | 3.88  | 0.1469              |        | 0.1528 |
| L    | 2.65        |       | 2.95  | 0.1043              |        | 0.1161 |
| I2   | 1.14        |       | 1.70  | 0.0449              |        | 0.0669 |
| I3   | 1.14        |       | 1.70  | 0.0449              |        | 0.0669 |
| I4   | 15.80       | 16.40 | 16.80 | 0.6220              | 0.6457 | 0.6614 |
| M    |             | 2.6   |       |                     | 0.1024 |        |

1. Inch dimensions are for reference only.



### 3 Ordering information

**Figure 15. BTA10 and BTB10 series ordering information scheme**

**Figure 16. T10xx series ordering information scheme**

**Table 8. Ordering information**

| Order code    | Marking     | Package            | Weight | Base qty. | Delivery mode     |
|---------------|-------------|--------------------|--------|-----------|-------------------|
| BTA10-600BRG  | BTA10-600B  | TO-220AB Ins.      | 2.3 g  | 50        | Tube              |
| BTA10-600CRG  | BTA10-600C  |                    |        |           |                   |
| BTA10-600BWRG | BTA10-600BW |                    |        |           |                   |
| BTA10-600CWRG | BTA10-600CW |                    |        |           |                   |
| BTA10-800BWRG | BTA10-800BW |                    |        |           |                   |
| BTA10-800CWRG | BTA10-800CW |                    |        |           |                   |
| BTB10-600BWRG | BTB10-600BW | TO-220AB           |        |           |                   |
| BTB10-800BWRG | BTB10-800BW |                    |        |           |                   |
| T1035-6G      | T1035-6G    | D <sup>2</sup> PAK | 1.50 g | 1000      | Tape and reel 13" |
| T1050-8G      | T1050-8G    |                    |        |           |                   |
| T1035-6G-TR   | T1035-6G    |                    |        |           |                   |
| T1050-8G-TR   | T1050-8G    |                    |        |           |                   |

## Revision history

**Table 9. Document revision history**

| Date        | Revision | Changes                                                                                                                                                                                                                                              |
|-------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sep-2002    | 5A       | Last update.                                                                                                                                                                                                                                         |
| 13-Feb-2006 | 6        | TO-220AB delivery mode changed from bulk to tube. ECOPACK statement added.                                                                                                                                                                           |
| 06-Feb-2017 | 7        | Added D <sup>2</sup> PAK package information.                                                                                                                                                                                                        |
| 15-Mar-2018 | 8        | Updated Table 3. Electrical characteristics (T <sub>j</sub> = 25 °C, unless otherwise specified) - Snubberless™ (3 quadrants), Section 3 Ordering information and Section 2.1 D <sup>2</sup> PAK package information.<br>Added RPNs T1035 and T1050. |
| 01-Mar-2019 | 9        | Updated Links syntax.                                                                                                                                                                                                                                |

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