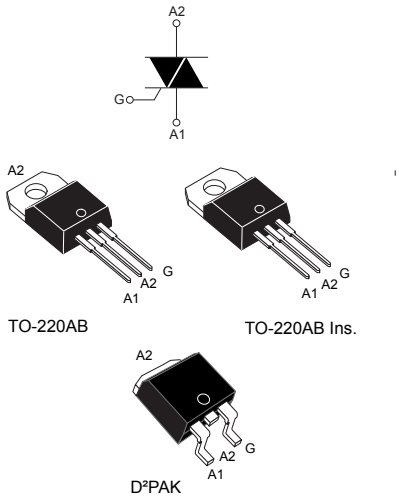
# BTA24, BTB24, T25

Datasheet

## 800 V and 600 V, 25 A standard and Snubberless Triacs




### Features

- High current 25 A RMS current Triac
- Low thermal resistance
- High commutation (4 quadrants) or very high commutation (3 quadrants) capability
- BTA series UL1557 recognized components (file ref: 81734)
- RoHS (2002/95/EC) compliant packages
- UL-94, V0 flammability package resin compliance

### Application

- On/off function in static relays, heating regulation, induction motor starting circuits
- Phase control operations in light dimmers and motor speed controllers

### Description

Available either in through-hole or surface-mount packages, the BTA24, BTB24 and T25 are suitable for general purpose AC switching.

| Product status link | |
|---|---|
| BTA24 | TO-220AB insulated package |
| BTB24 | TO-220AB uninsulated package |
| T25 | D²PAK package |

| Product summary | | | |
|---|---|---|---|
| | BTA24 | BTB24 | T25 |
| $I_{T(RMS)}$ | 25 A | | |
| $V_{DRM}/V_{RRM}$ | 600 V and 800 V | | |
| $I_{GT}$ Snubberless | 35 / 50 mA | | 35 mA |
| $I_{GT}$ standard | | 50 mA | |

# 1 Characteristics

**Table 1. Absolute maximum ratings**

| Symbol | Parameters | | | Value | Unit |
|---|---|---|---|---|---|
| $I_{T(RMS)}$ | RMS on-state current (full sine wave) | $D^2PAK$ / TO-220AB | $T_c$ = 100 °C | 25 | A |
| | | TO-220AB Ins. | $T_c$ = 75 °C | | |
| $I_{TSM}$ | Non repetitive surge peak on-state current (full cycle, $T_j$ initial = 25 °C) | f = 60 Hz | $t_p$ = 16,7 ms | 260 | A |
| | | f = 50 Hz | $t_p$ = 20 ms | 250 | |
| $I^2t$ | $I^2t$ value for fusing | $t_p$ = 10 ms | | 340 | $A^2s$ |
| dI/dt | Critical rate of rise of on-state current<br>$I_G$ = 2 x $I_{GT}$ , $t_r \leq$ 100 ns | f = 120 Hz | $T_j$ = 125 °C | 50 | A/µs |
| $V_{DSM}$, $V_{RSM}$ | Non repetitive surge peak off-state voltage | $t_p$ = 10 ms | $T_j$ = 25 °C | $V_{DRM}$, $V_{RRM}$ + 100 | V |
| $V_{DRM}$, $V_{RRM}$ | Repetitive peak off-state voltage | | $T_j$ = 25 °C | 600 or 800 | V |
| $I_{GM}$ | Peak gate current | $t_p$ = 20 µs | $T_j$ = 125 °C | 4 | A |
| $P_{G(AV)}$ | Average gate power dissipation | | $T_j$ = 125 °C | 1 | W |
| $T_{stg}$ | Storage junction temperature range | | | -40 to +150 | °C |
| $T_j$ | Operating junction temperature range | | | -40 to +125 | °C |
| $T_L$ | Maximum lead temperature for soldering during 10 s | | | 260 | °C |
| $V_{INS}$ | Insulation RMS voltage, 1 minute | | | 2.5 | kV |

**Table 2. Electrical characteristics ($T_j$ = 25 °C, unless otherwise specified) - Snubberless (3 quadrants) T25, BTA24-XXXXW, BTB24-XXXXW**

| Symbol | Parameters | Quadrant | | T25 | BTA/BTB | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | T2535 | CW | BW | |
| $I_{GT}$(1) | $V_D$ = 12 V, $R_L$ = 33 Ω | I - II - III | Max. | 35 | 35 | 50 | mA |
| $V_{GT}$ | | I - II - III | Max. | 1.3 | | | V |
| $V_{GD}$ | $V_D$ = $V_{DRM}$, $R_L$ = 3.3 kΩ, $T_j$ = 125 °C | I - II - III | Min. | 0.2 | | | V |
| $I_H$(2) | $I_T$ = 500 mA | | Max. | 50 | 50 | 75 | mA |
| $I_L$ | $I_G$ = 1.2 $I_{GT}$ | I - III | Max. | 70 | 70 | 80 | mA |
| | | II | Max. | 80 | 80 | 100 | |
| dV/dt(2) | $V_D$ = 67 % $V_{DRM}$ gate open, $T_j$ = 125 °C | | Min. | 500 | 500 | 1000 | V/µs |
| (dI/dt)c(2) | Without snubber | | Min. | 13 | 13 | 22 | A/ms |

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

**Table 3. Electrical characteristics ($T_j$ = 25 °C, unless otherwise specified) - standard (4 quadrants) BTB24-800B, BTB24-600B**

| Symbol | Parameters | Quadrant | | Value | Unit |
|---|---|---|---|---|---|
| $I_{GT}$(1) | $V_D$ = 12 V, $R_L$ = 33 Ω | I - II - III | Max. | 50 | mA |
| | | IV | | 100 | |
| $V_{GT}$ | | All | Max. | 1.3 | V |
| $V_{GD}$ | $V_D$ = $V_{DRM}$, $R_L$ = 3.3 kΩ, $T_j$ = 125 °C | All | Min. | 0.2 | V |
| $I_H$(2) | $I_T$ = 500 mA | | Max. | 80 | mA |
| $I_L$ | $I_G$ = 1.2 $I_{GT}$ | I - III - IV | Max. | 70 | mA |
| | | II | Max. | 160 | |
| dV/dt(2) | $V_D$ = 67 % $V_{DRM}$ gate open, $T_j$ = 125 °C | | Min. | 500 | V/µs |
| (dV/dt)c(2) | (dI/dt)c = 13.3 A/ms, $T_j$ = 125 °C | | Min. | 10 | V/µs |

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

**Table 4. Static electrical characteristics**

| Symbol | Test conditions | $T_j$ | | Value | Unit |
|---|---|---|---|---|---|
| $V_{TM}$(1) | $I_{TM}$ = 35 A, $t_p$ = 380 µs | 25 °C | Max. | 1.55 | V |
| $V_{TO}$(1) | threshold on-state voltage | 125 °C | Max. | 0.85 | V |
| $R_D$(1) | Dynamic resistance | 125 °C | Max. | 16 | mΩ |
| $I_{DRM}/I_{RRM}$ | $V_T$ = $V_{DRM}$, $V_T$ = $V_{RRM}$ | 25 °C | Max. | 5 | µA |
| | | 125 °C | | 3 | mA |

1. *For both polarities of A2 referenced to A1*

**Table 5. Thermal resistance**

| Symbol | Parameters | | | Value | Unit |
|---|---|---|---|---|---|
| $R_{th(j-c)}$ | Junction to case (AC) | $D^2PAK$ / TO-220AB | Max. | 0.8 | °C/W |
| | | TO-220AB insulated | | 1.7 | |
| $R_{th(j-a)}$ | Junction to ambient, S(1) = 2.5 cm² | $D^2PAK$ | Typ. | 45 | |
| | Junction to ambient | TO-220AB / TO-220AB insulated | | 60 | |

1. *S = Copper surface under tab.*

## 1.1 Characteristics (curves)

**Figure 1. Maximum power dissipation versus on-state RMS current (full cycle)**

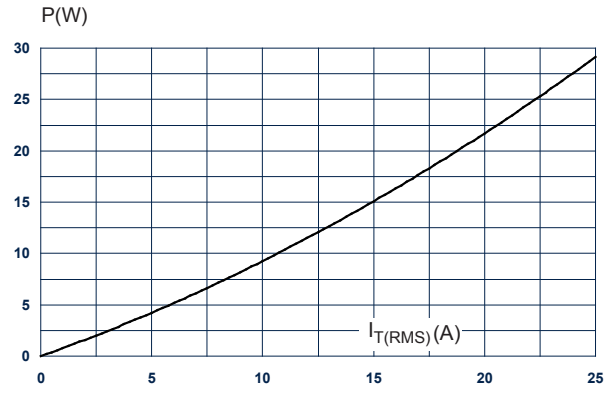



**Figure 2. RMS on-state current versus case temperature (full cycle)**

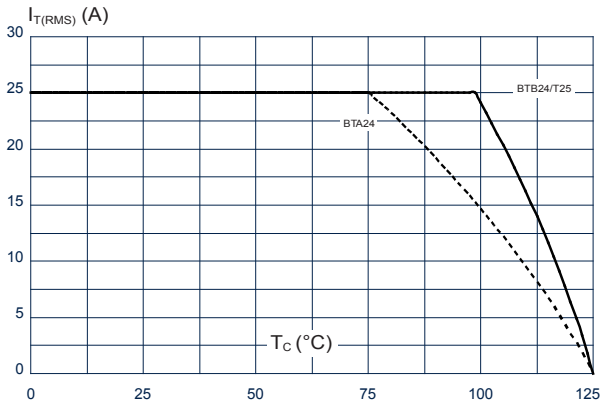



**Figure 3. RMS on-state current versus ambient temperature (full cycle) D²PAK**

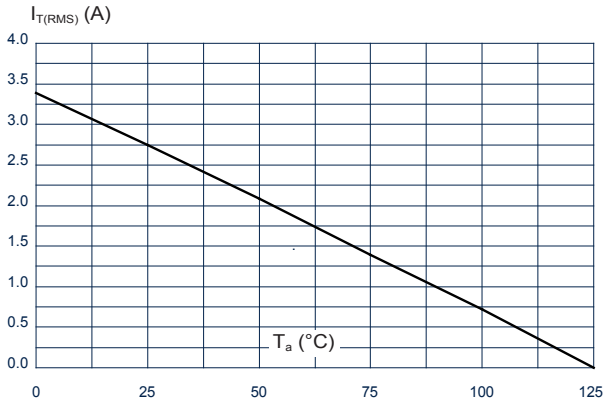



**Figure 4. Relative variation of thermal impedance versus pulse duration**

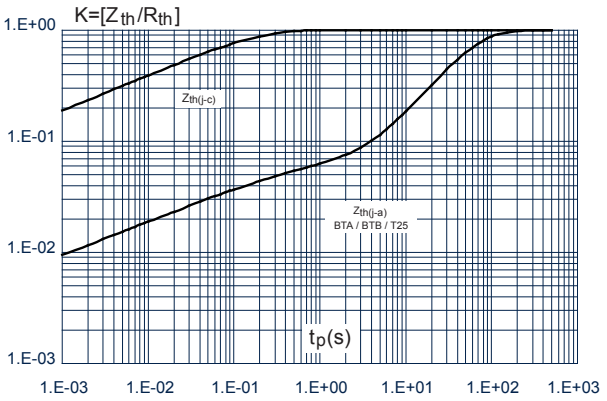



**Figure 5. On-state characteristics (maximum values)**

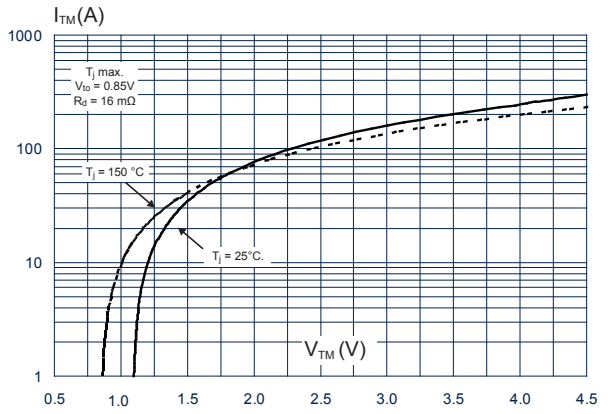



**Figure 6. Surge peak on-state current versus number of cycles**

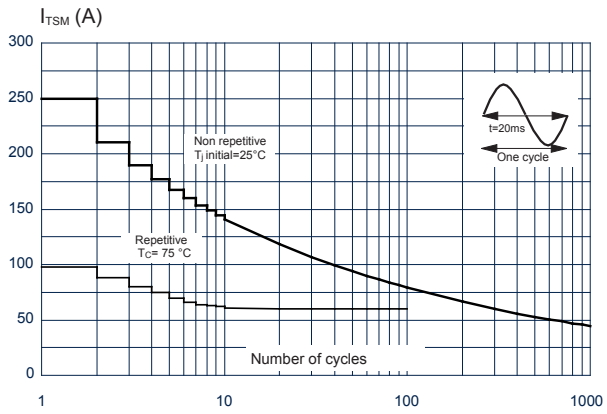


**Figure 7. Non-repetitive surge peak on-state current for a sinusoidal pulse with width $t_P$ < 10 ms**

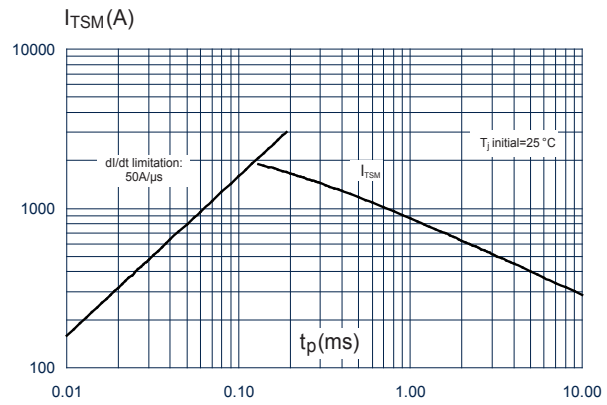



**Figure 8. Relative variation of gate trigger current, holding and latching current versus junction temperature**

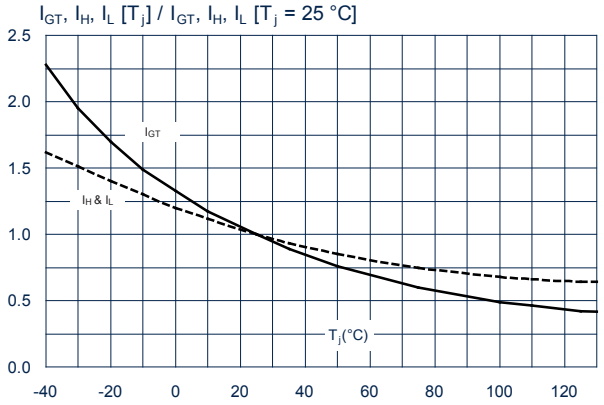



**Figure 9. Relative variation of critical rate of decrease of main current versus (dV/dt)c (typical values)**

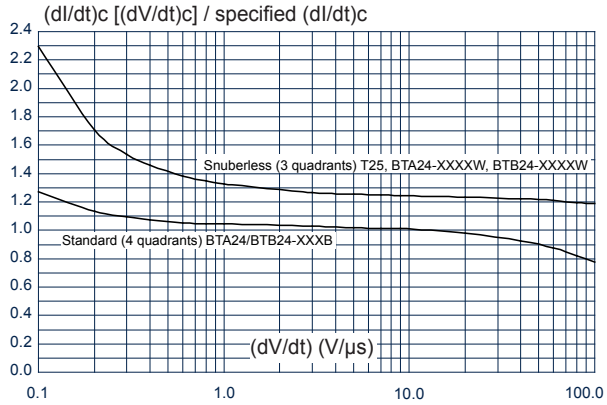



**Figure 10. Relative variation of critical rate of decrease of main current versus junction temperature (typical values)**

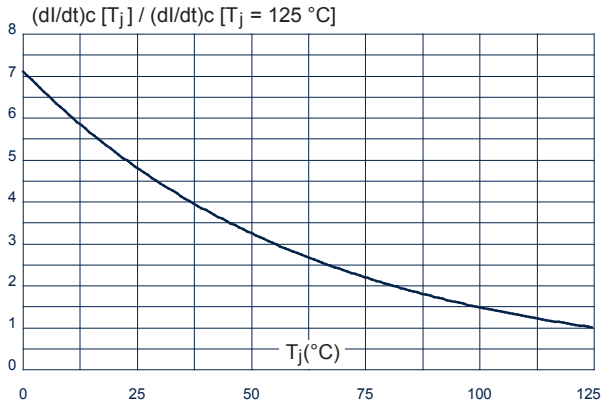
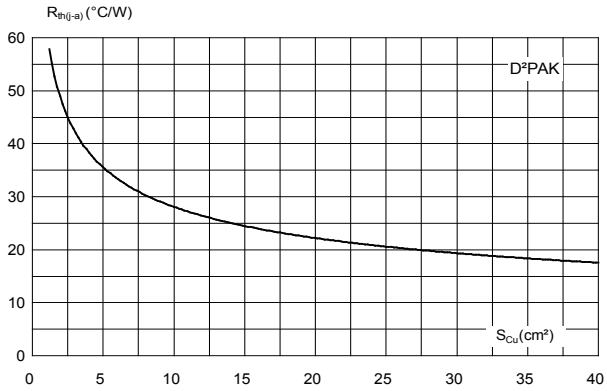



**Figure 11. D²PAK thermal resistance junction to ambient versus copper surface under tab**



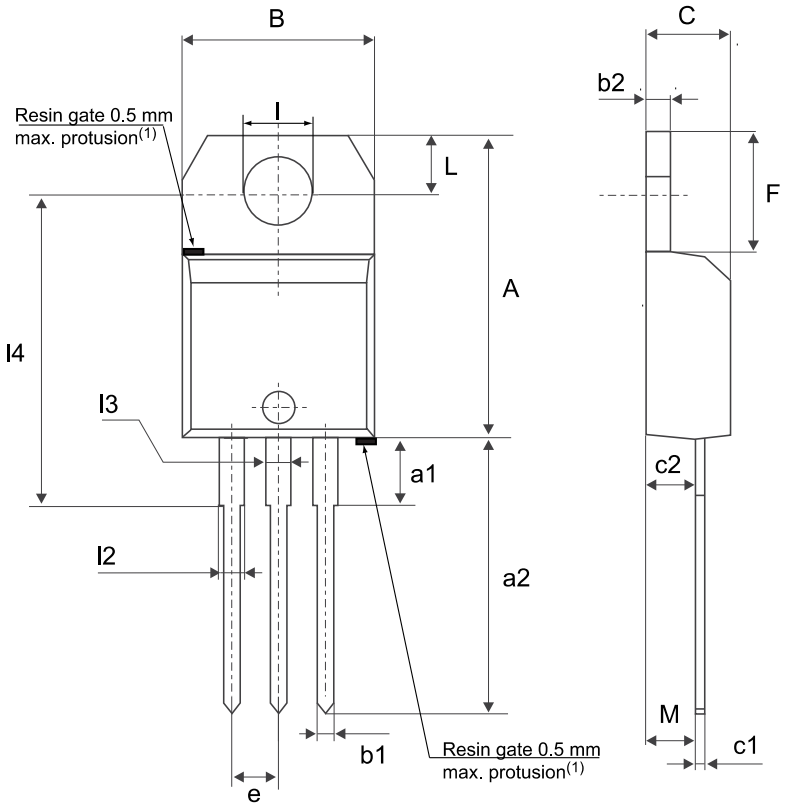
# 2 Package information

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. ECOPACK is an ST trademark.

## 2.1 TO-220AB package information

- Molding compound resin is halogen free and meets UL94 flammability standard, level V0
- Lead-free plating package leads
- Recommended torque value: 0.55 N·m
- Maximum torque value: 0.70 N·m

**Figure 12. TO-220AB package outline**




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

**Table 6. TO-220AB package mechanical data**

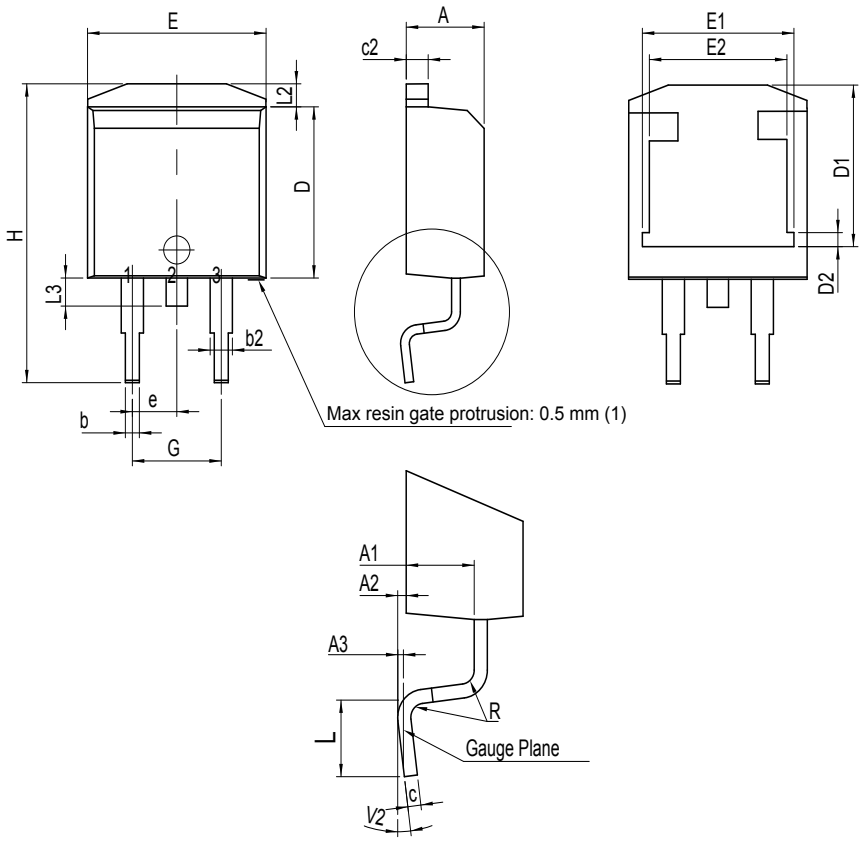
| Ref. | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches[1] | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 15.20 | | 15.90 | 0.5984 | | 0.6260 |
| a1 | | 3.75 | | | 0.1476 | |
| a2 | 13.00 | | 14.00 | 0.5118 | | 0.5512 |
| B | 10.00 | | 10.40 | 0.3937 | | 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 |
| 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 |
| l2 | 1.14 | | 1.70 | 0.0449 | | 0.0669 |
| l3 | 1.14 | | 1.70 | 0.0449 | | 0.0669 |
| l4 | 15.80 | 16.40 | 16.80 | 0.6220 | 0.6457 | 0.6614 |
| M | | 2.6 | | | 0.1024 | |

1. *Inch dimensions are for reference only.*

## 2.2 D²PAK package information

- ECOPACK2 compliant
- Lead-free package leads finishing
- Molding compound resin is halogen-free and meets UL94 flammability standard level V0

**Figure 13. D²PAK package outline**




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

Table 7. D²PAK package mechanical data

| Ref. | Dimensions | | | | | |
|---|---|---|---|---|---|---|
| | Millimeters | | | Inches[1] | | |
| | 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 |
| 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 | | | 0.1000 | |
| 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 | 1.19 | | 1.40 | 0.0468 | | 0.0551 |
| L3 | 1.40 | | 1.75 | 0.0551 | | 0.0689 |
| R | | 0.40 | | | 0.0157 | |
| V2[2] | 0° | | 8° | 0° | | 8° |

1. *Dimensions in inches are given for reference only*
2. *Degrees*

Figure 14. D²PAK recommended footprint (dimensions are in mm)

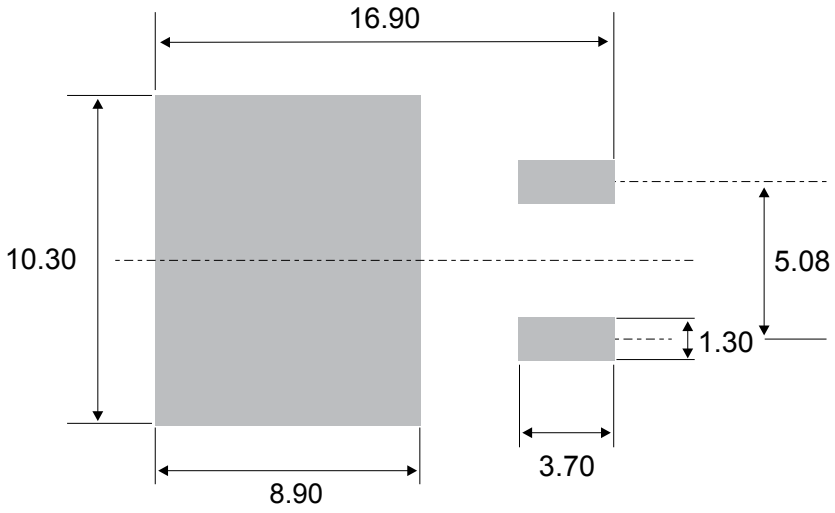
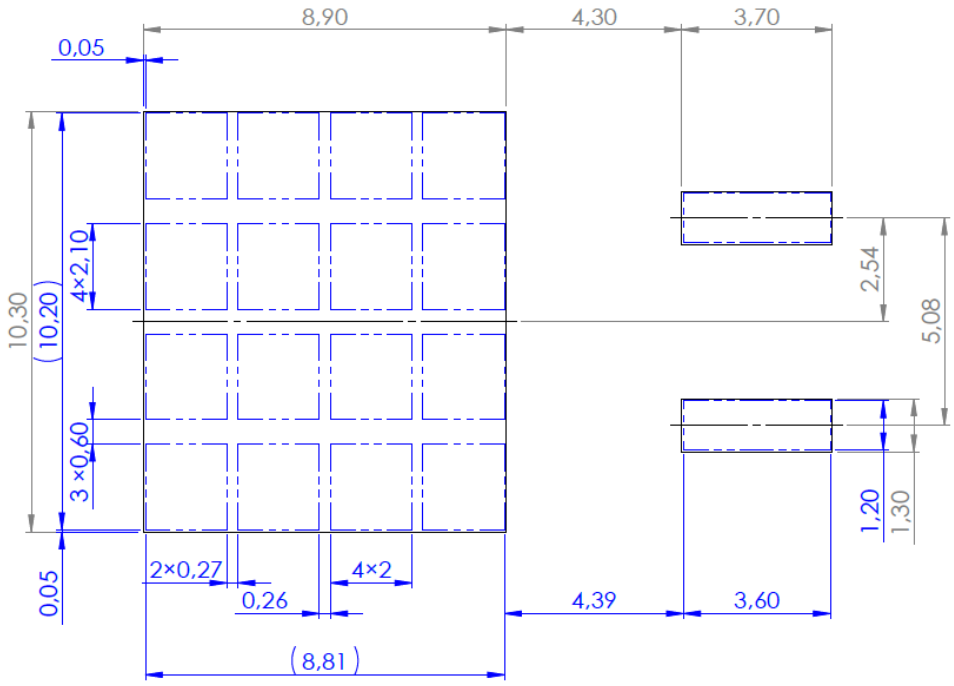



Figure 15. D²PAK stencil definitions (dimensions are in mm)



# 3 Ordering information

**Figure 16. Ordering information scheme (BTA24 and BTB24 series)**

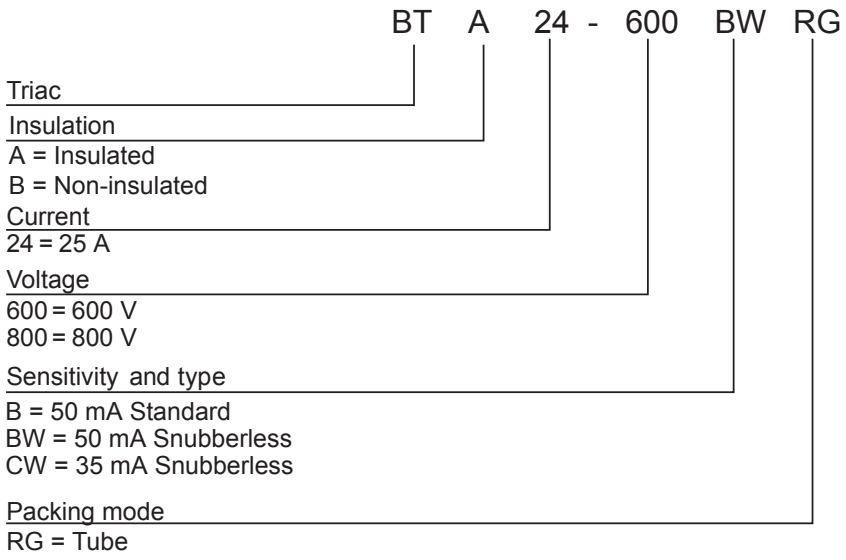



**Figure 17. Ordering information scheme (T25 series)**

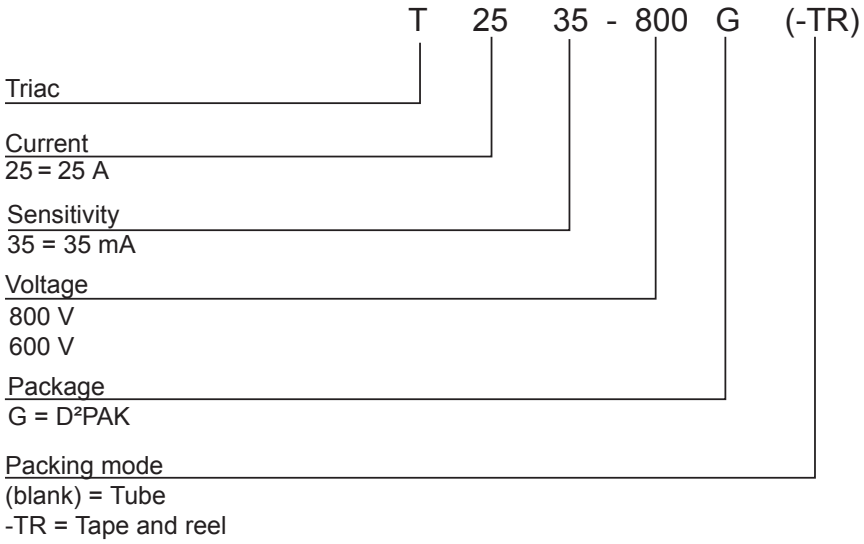


**Table 8. Ordering information**

| Order code | Marking | Package | Weight | Base qty. | Delivery mode |
|---|---|---|---|---|---|
| BTA24-600BWRG | BTA24 600BW | TO-220AB insulated | 2.3 g | 50 | Tube |
| BTA24-600CWRG | BTA24 600CW | | | | |
| BTA24-800BWRG | BTA24 800BW | | | | |
| BTA24-800CWRG | BTA24 800CW | | | | |
| BTB24-600BRG | BTB24 600B | TO-220AB | | | |
| BTB24-600BWRG | BTB24 600BW | | | | |
| BTB24-600CWRG | BTB24 600CW | | | | |
| BTB24-800BRG | BTB24 800B | | | | |
| BTB24-800BWRG | BTB24 800BW | | | | |
| BTB24-800CWRG | BTB24 800CW | | | | |
| T2535-600G | T2535 600G | D²PAK | 1.5 g | 50 | Tube |
| T2535-600G-TR | T2535 600G | | | 1000 | Tape and reel |
| T2535-800G | T2535 800G | | | 50 | Tube |
| T2535-800G-TR | T2535 800G | | | 1000 | Tape and reel |

## Revision history

**Table 9. Document revision history**

| Date | Revision | Changes |
|---|---|---|
| Oct-2002 | 6A | Previous update. |
| 13-Feb-2006 | 7 | TO-220AB delivery mode changed from bulk to tube.<br>ECOPACK statement added. |
| 31-May-2006 | 8 | Reformatted to current standard. Tc in *figure 3* changed to Tamb |
| 31-Jul-2006 | 9 | Typing error corrected on page 1 (BTB124 instead of BTB24) |
| 05-Jul-2007 | 10 | Added BTB26-600BRG. Restructured cover page and *section 2: Ordering information scheme* on page 6 to simplify product selection.<br>Thermal resistance values updated in *Table 6* and *Figure 2*. Graphic for I2t updated in *Figure 7*. |
| 28-Jul-2021 | 11 | Removed RD91, TOP3 insulated and TOP3 package information. Put in separate specification.<br>Minor text changes. |
| 29-Sep-2021 | 12 | Updated *Table 2*. |
| 18-Jul-2024 | 13 | Updated Table 8. |

**IMPORTANT NOTICE – READ CAREFULLY**

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgment.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. For additional information about ST trademarks, refer to www.st.com/trademarks. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2024 STMicroelectronics – All rights reserved