

1 Characteristics

Table 1. Absolute maximum ratings

| Symbol | Parameters | | Value | Unit | |
|--------------------|---|-------------------------------|------------------------|--------------------------|------------------|
| $I_{T(RMS)}$ | RMS on-state current (full sine wave) | D ² PAK / TO-220AB | $T_c = 100\text{ °C}$ | 25 | A |
| | | TO-220AB Ins. | $T_c = 75\text{ °C}$ | | |
| I_{TSM} | Non repetitive surge peak on-state current (full cycle, T_j initial = 25 °C) | f = 60 Hz | $t_p = 16,7\text{ ms}$ | 260 | A |
| | | f = 50 Hz | $t_p = 20\text{ ms}$ | 250 | |
| I^2t | I^2t value for fusing | $t_p = 10\text{ ms}$ | | 340 | A ² s |
| di/dt | Critical rate of rise of on-state current $I_G = 2 \times I_{GT}$, $t_r \leq 100\text{ ns}$ | f = 120 Hz | $T_j = 125\text{ °C}$ | 50 | A/ μ s |
| V_{DSM}, V_{RSM} | Non repetitive surge peak off-state voltage | $t_p = 10\text{ ms}$ | $T_j = 25\text{ °C}$ | $V_{DRM}, V_{RRM} + 100$ | V |
| V_{DRM}, V_{RRM} | Repetitive peak off-state voltage | | $T_j = 25\text{ °C}$ | 600 or 800 | V |
| I_{GM} | Peak gate current | $t_p = 20\text{ }\mu\text{s}$ | $T_j = 125\text{ °C}$ | 4 | A |
| $P_{G(AV)}$ | Average gate power dissipation | | $T_j = 125\text{ °C}$ | 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 ($T_j = 25\text{ °C}$, unless otherwise specified) - Snubberless (3 quadrants) T25, BTA24-XXXXW, BTB24-XXXXW

| Symbol | Parameters | Quadrant | | T25 | BTA/BTB | | Unit |
|------------------------|--|--------------|------|-------|---------|------|------------|
| | | | | T2535 | CW | BW | |
| $I_{GT}^{(1)}$ | $V_D = 12\text{ V}, R_L = 33\text{ }\Omega$ | I - II - III | Max. | 35 | 35 | 50 | mA |
| V_{GT} | | I - II - III | Max. | 1.3 | | V | |
| V_{GD} | $V_D = V_{DRM}, R_L = 3.3\text{ k}\Omega, T_j = 125\text{ °C}$ | I - II - III | Min. | 0.2 | | V | |
| $I_H^{(2)}$ | $I_T = 500\text{ mA}$ | | Max. | 50 | 50 | 75 | mA |
| I_L | $I_G = 1.2 I_{GT}$ | I - III | Max. | 70 | 70 | 80 | |
| | | II | Max. | 80 | 80 | 100 | |
| dV/dt ⁽²⁾ | $V_D = 67\% V_{DRM}$ gate open, $T_j = 125\text{ °C}$ | | Min. | 500 | 500 | 1000 | V/ μ s |
| (di/dt) ⁽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 ($T_j = 25\text{ °C}$, unless otherwise specified) - standard (4 quadrants) BTB24-800B, BTB24-600B

| Symbol | Parameters | Quadrant | | Value | Unit |
|-------------------|--|--------------|------|-------|------------|
| $I_{GT}^{(1)}$ | $V_D = 12\text{ V}, R_L = 33\ \Omega$ | I - II - III | Max. | 50 | mA |
| | | IV | | 100 | |
| V_{GT} | | All | Max. | 1.3 | V |
| V_{GD} | $V_D = V_{DRM}, R_L = 3.3\text{ k}\Omega, T_j = 125\text{ °C}$ | All | Min. | 0.2 | V |
| $I_H^{(2)}$ | $I_T = 500\text{ mA}$ | | 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, $T_j = 125\text{ °C}$ | | Min. | 500 | V/ μ s |
| $(dV/dt)_c^{(2)}$ | $(dI/dt)_c = 13.3\text{ A/ms}, T_j = 125\text{ °C}$ | | Min. | 10 | V/ μ s |

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 |
|-------------------|--|--------|------|-------|------------|
| $V_{TM}^{(1)}$ | $I_{TM} = 35\text{ A}, t_p = 380\ \mu\text{s}$ | 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 | m Ω |
| I_{DRM}/I_{RRM} | $V_T = V_{DRM}, V_T = V_{RRM}$ | 25 °C | Max. | 5 | μ A |
| | | 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 ² PAK / TO-220AB | Max. | 0.8 | °C/W |
| | | TO-220AB insulated | | 1.7 | |
| $R_{th(j-a)}$ | Junction to ambient, $S^{(1)} = 2.5\text{ cm}^2$ | D ² PAK | 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)

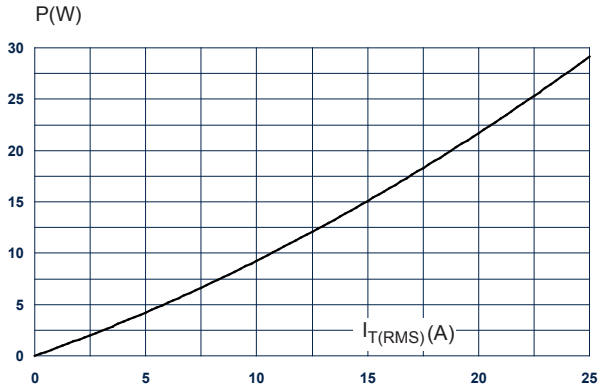


Figure 2. RMS on-state current versus case temperature (full cycle)

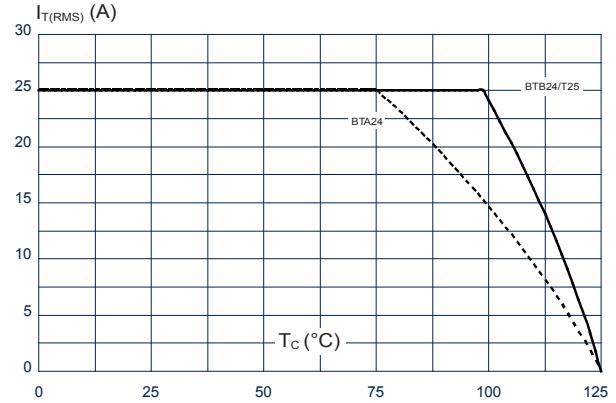


Figure 3. RMS on-state current versus ambient temperature (full cycle) D²PAK

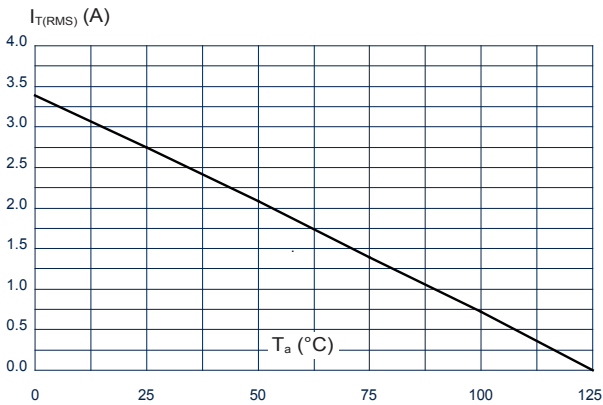


Figure 4. Relative variation of thermal impedance versus pulse duration

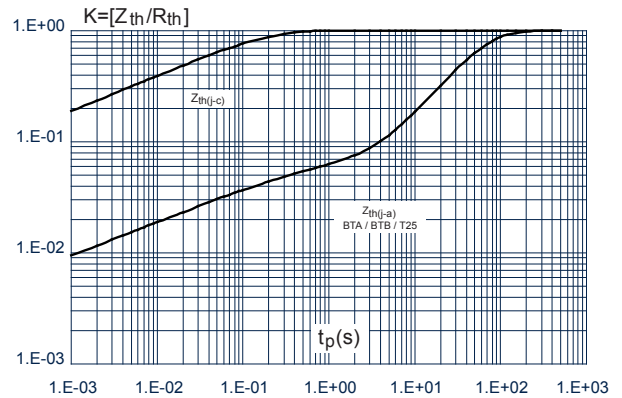


Figure 5. On-state characteristics (maximum values)

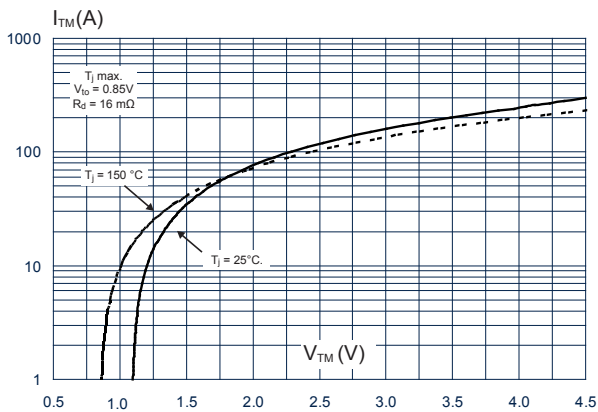


Figure 6. Surge peak on-state current versus number of cycles

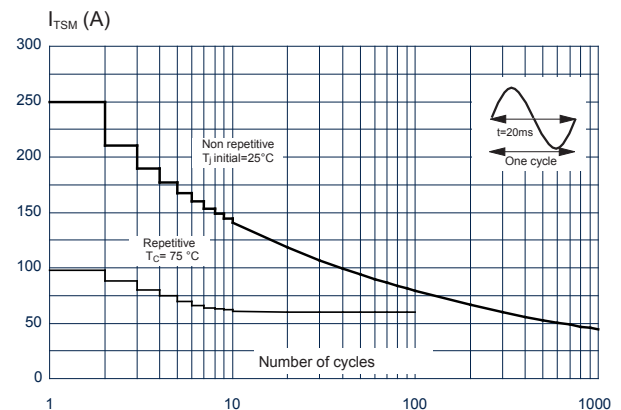


Figure 7. Non-repetitive surge peak on-state current for a sinusoidal pulse with width $t_p < 10$ ms

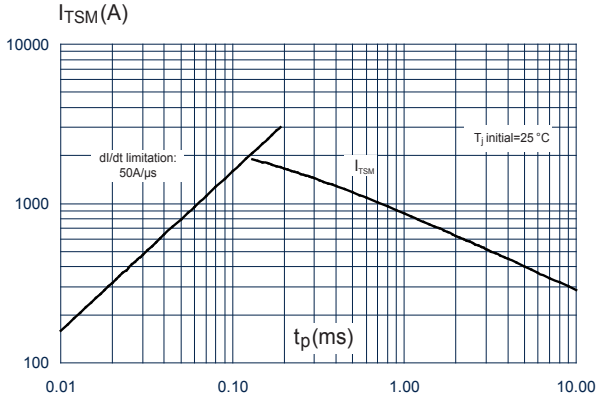


Figure 8. Relative variation of gate trigger current, holding and latching current versus junction temperature

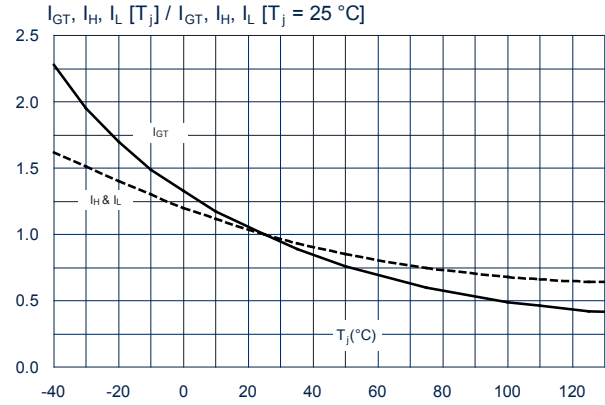


Figure 9. Relative variation of critical rate of decrease of main current versus (dV/dt)c (typical values)

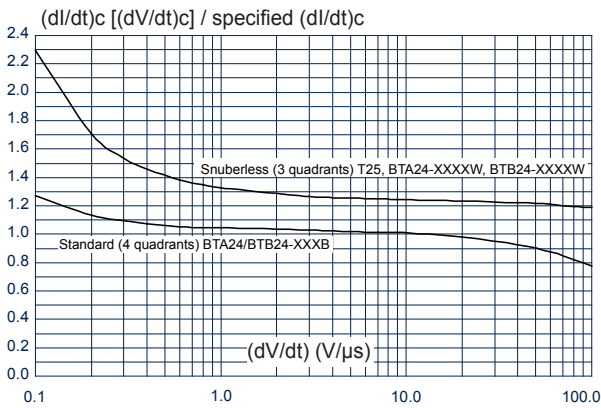


Figure 10. Relative variation of critical rate of decrease of main current versus junction temperature (typical values)

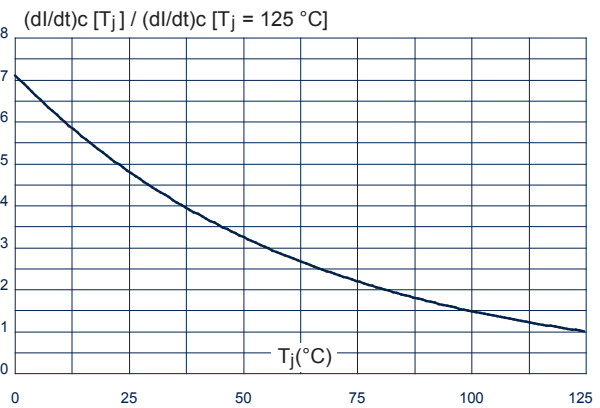
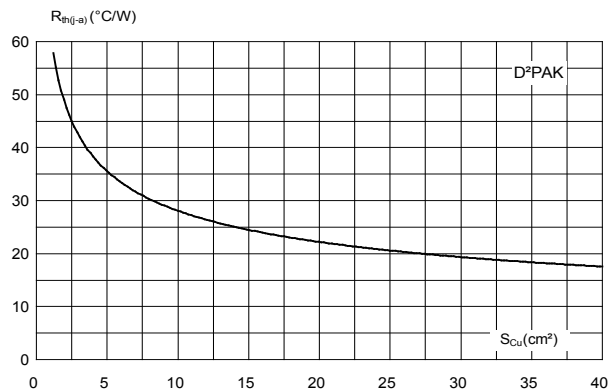


Figure 11. D²PAK thermal resistance junction to ambient versus copper surface under tab



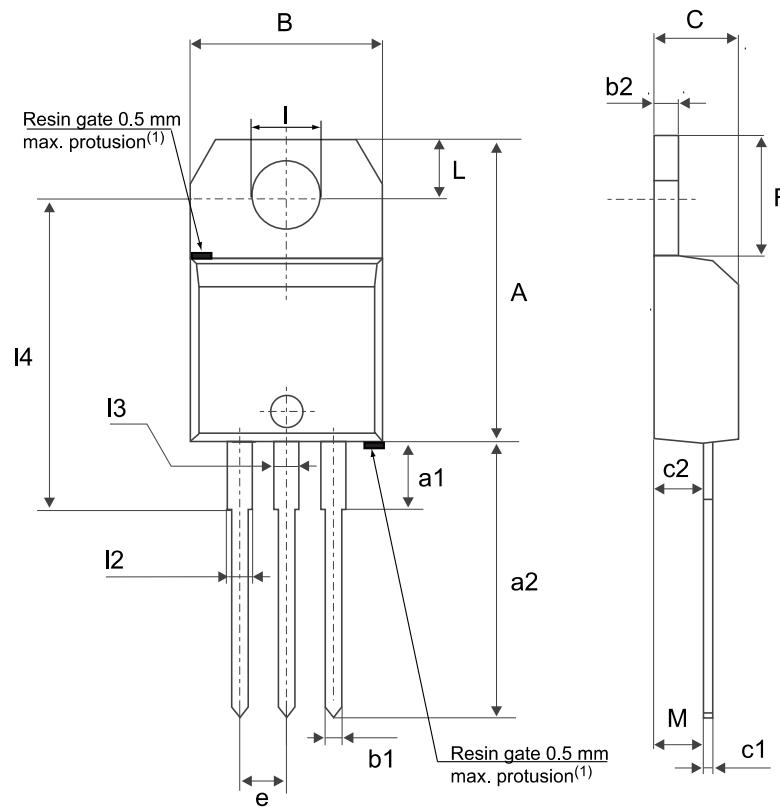
2 Package information

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: 0.4 to 0.6 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

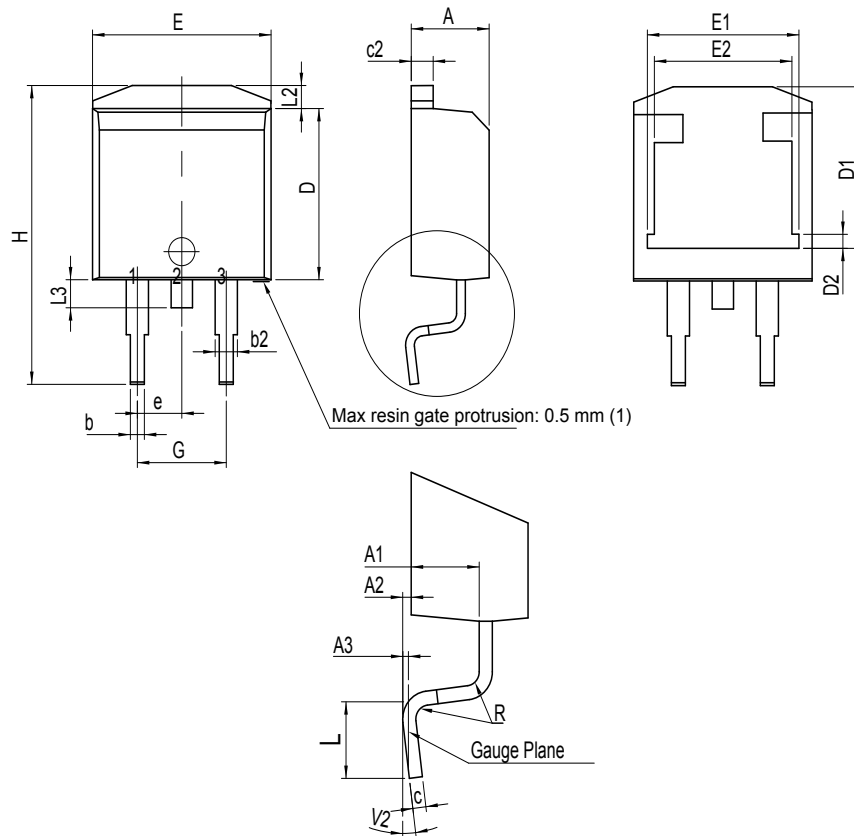
| Ref. | Dimensions | | | | | |
|------|-------------|-------|-------|-----------------------|--------|--------|
| | Millimeters | | | Inches ⁽¹⁾ | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 15.20 | | 15.90 | 0.5984 | | 0.6260 |
| a1 | | 3.75 | | | 0.1476 | |
| a2 | 13.00 | | 14.00 | 0.5118 | | 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 |
| 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.

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 | | | 0.10000 | | |
| 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)

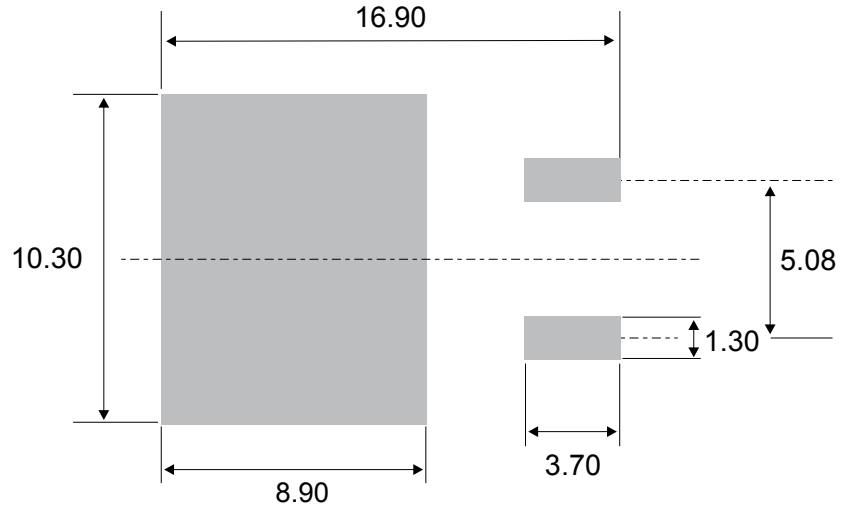
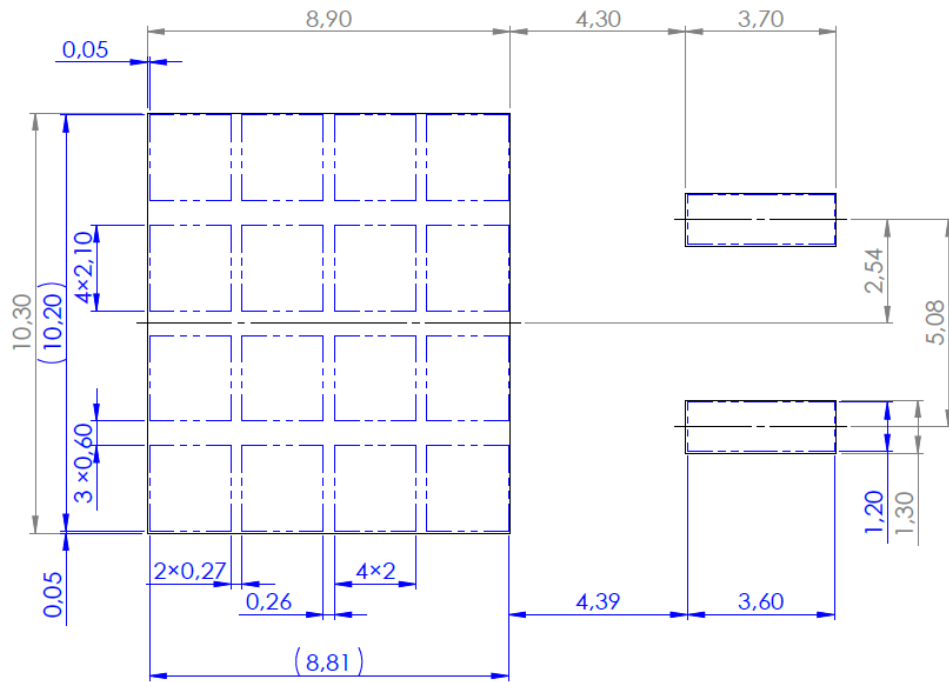


Figure 15. D²PAK stencil definitions (dimensions are in mm)



3 Ordering information

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

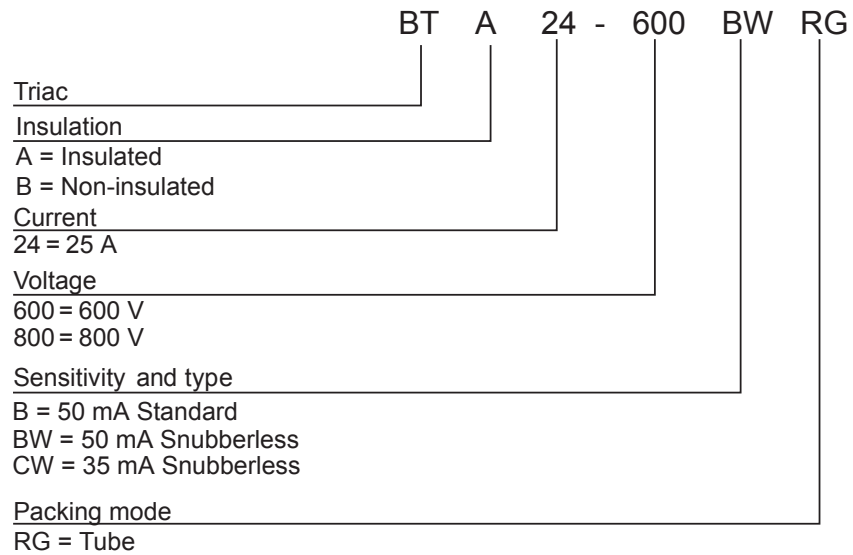


Figure 17. Ordering information scheme (T25 series)

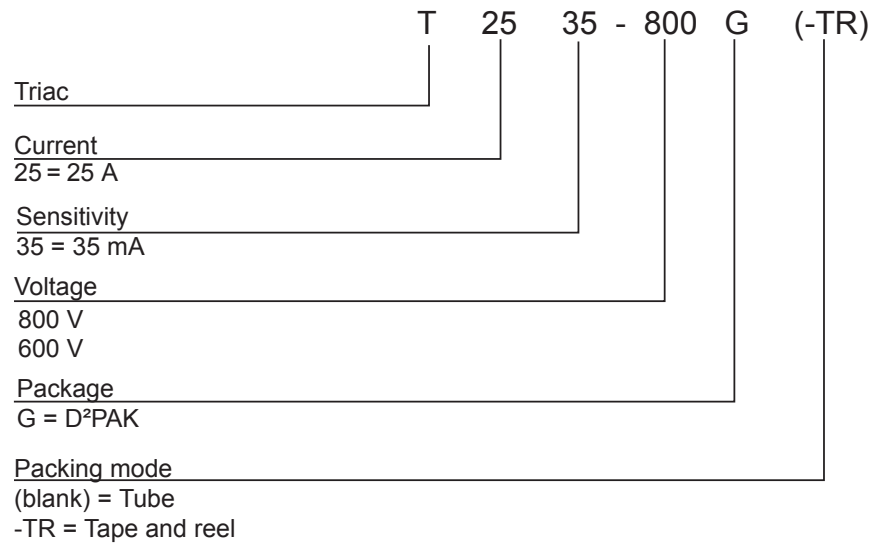


Table 8. Ordering information

| 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 | D ² PAK | 1.5 g | 50 | Tube |
| T2535-600G-TR | T2535 600G | | | 2500 | Tape and reel |
| T2535-800G | T2535 800G | | | 50 | Tube |
| T2535-800G-TR | T2535 800G | | | 2500 | 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. 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. 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. Minor text changes. |
| 29-Sep-2021 | 12 | Updated Table 2 . |

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