

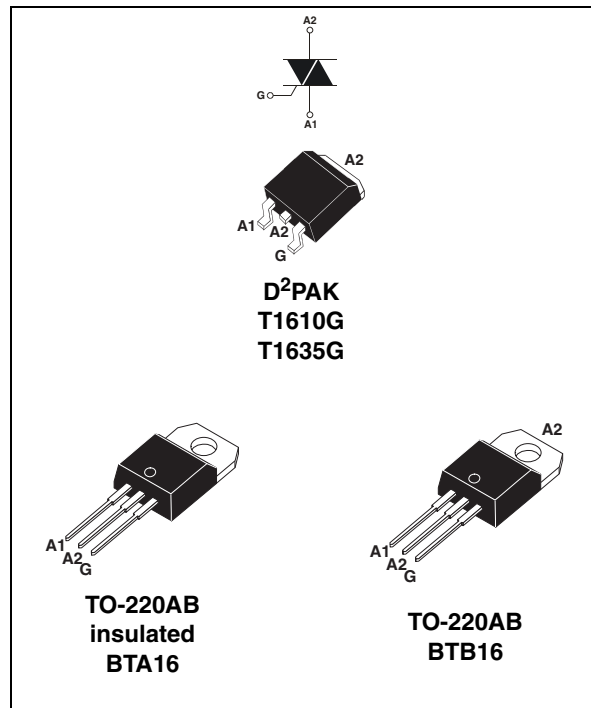
16 A Snubberless™, logic level and standard Triacs

Features

- Medium current Triac
- Low thermal resistance with clip bonding
- Low thermal resistance insulation ceramic for insulated BTA
- High commutation (4Q) or very high commutation (3Q) capability
- BTA series UL1557 certified (File ref: 81734)
- RoHS (2002/95/EC) compliant
- Insulated tab (BTA series, rated at 2500 V_{RMS})

Applications

- Snubberless versions (BTA/BTB...W and T1635) especially recommended for use on inductive loads, because of their high commutation performances
- On/off or phase angle function in applications such as static relays, light dimmers and appliance motor speed controllers



Description

Available either in through-hole or surface-mount packages, the BTA16, BTB16, T1610 and T1635 Triacs series are suitable for general purpose mains power AC switching.

Table 1. Device summary

| Symbol | Parameter | BTA16 ⁽¹⁾ | BTB16 | T1610 | T1635 |
|------------------------|-----------------------------------|----------------------|---------|---------|---------|
| $I_{T(RMS)}$ | On-state rms current | 16 | 16 | 16 | 16 |
| V_{DRM}/V_{RRM} | Repetitive peak off-state voltage | 600/800 | 600/800 | 600/800 | 600/800 |
| I_{GT} (Snubberless) | Triggering gate current | 35/50 | 35/50 | - | 35 |
| I_{GT} (logic level) | Triggering gate current | 10 | 10 | 10 | - |
| I_{GT} (standard) | Triggering gate current | 25/50 | 25/50 | - | - |

1. Insulated

TM: Snubberless is a trademark of STMicroelectronics

1 Characteristics

Table 2. Absolute maximum ratings

| Symbol | Parameter | | Value | Unit |
|-------------------|-------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|-------------------------|------------------|
| $I_{T(RMS)}$ | On-state rms current (full sine wave) | D ² PAK / TO-220AB $T_c = 100\text{ }^\circ\text{C}$ | 16 | A |
| | | TO-220AB insulated $T_c = 86\text{ }^\circ\text{C}$ | | |
| I_{TSM} | Non repetitive surge peak on-state current (full cycle, T_j initial = 25 °C) | F = 50 Hz t = 20 ms | 160 | A |
| | | F = 60 Hz t = 16.7 ms | 168 | |
| I^2t | I^2t value for fusing | $t_p = 10\text{ ms}$ | 144 | 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 $T_j = 125\text{ }^\circ\text{C}$ | 50 | A/ μ s |
| V_{DSM}/V_{RSM} | Non repetitive surge peak off-state voltage | $t_p = 10\text{ ms}$ $T_j = 25\text{ }^\circ\text{C}$ | $V_{DRM}/V_{RRM} + 100$ | 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 temperature range | | | -40 to + 150 |
| T_j | Maximum operating junction temperature | | | -40 to + 125 |

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

| Symbol | Test conditions | Quadrant | | T1610 | T1635 | BTA16 / BTB16 | | | Unit |
|--------------------------|------------------------------------------------------------------------------------|-----------------------------------|------|-------|-------|---------------|-----|------|------------|
| | | | | | | SW | CW | BW | |
| $I_{GT}^{(1)}$ | $V_D = 12\text{ V}$ $R_L = 33\text{ }\Omega$ | I - II - III | Max. | 10 | 35 | 10 | 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 |
| $I_H^{(2)}$ | $I_T = 500\text{ mA}$ | | Max. | 15 | 35 | 15 | 35 | 50 | mA |
| I_L | $I_G = 1.2 I_{GT}$ | I - III | Max. | 25 | 50 | 25 | 50 | 70 | mA |
| | | II | | 30 | 60 | 30 | 60 | 80 | |
| dV/dt (2) | $V_D = 67\% V_{DRM}$ gate open | $T_j = 125\text{ }^\circ\text{C}$ | Min. | 40 | 500 | 40 | 500 | 1000 | V/ μ s |
| (dI/dt) _c (2) | (dV/dt) _c = 0.1 V/ μ s | $T_j = 125\text{ }^\circ\text{C}$ | Min. | 8.5 | - | 8.5 | - | - | A/ms |
| | (dV/dt) _c = 10 V/ μ s | $T_j = 125\text{ }^\circ\text{C}$ | | 3.0 | - | 3.0 | - | - | |
| | Without snubber | $T_j = 125\text{ }^\circ\text{C}$ | | - | 8.5 | - | 8.5 | 14 | |

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

2. For both polarities of A2 referenced to A1

Table 4. Electrical characteristics ($T_j = 25\text{ }^\circ\text{C}$, unless otherwise specified) standard (4 quadrants)

| Symbol | Test conditions | Quadrant | | BTA16 / BTB16 | | Unit |
|-------------------|------------------------------------------------------------------------------|-----------------------------------|------|---------------|-----------|------------------|
| | | | | C | B | |
| $I_{GT}^{(1)}$ | $V_D = 12\text{ V}$ $R_L = 33\ \Omega$ | I - II - III IV | Max. | 25 50 | 50 100 | mA |
| V_{GT} | | ALL | Max. | 1.3 | | V |
| V_{GD} | $V_D = V_{DRM}$ $R_L = 3.3\text{ k}\Omega$ $T_j = 125\text{ }^\circ\text{C}$ | ALL | Min. | 0.2 | | V |
| $I_H^{(2)}$ | $I_T = 500\text{ mA}$ | | Max. | 25 | 50 | mA |
| I_L | $I_G = 1.2\ I_{GT}$ | I - III - IV | Max. | 40 | 60 | mA |
| | | II | | 80 | 120 | |
| $dV/dt^{(2)}$ | $V_D = 67\ \%V_{DRM}$ gate open | $T_j = 125\text{ }^\circ\text{C}$ | Min. | 200 | 400 | V/ μs |
| $(dV/dt)_c^{(2)}$ | $(dI/dt)_c = 7\text{ A/ms}$ | $T_j = 125\text{ }^\circ\text{C}$ | Min. | 5 | 10 | V/ μs |

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

Table 5. Static characteristics

| Symbol | Test conditions | | Value | Unit | |
|------------------------|---------------------------------------------------|-----------------------------------|-------|------|---------------|
| $V_T^{(2)}$ | $I_{TM} = 22.5\text{ A}$ $t_p = 380\ \mu\text{s}$ | $T_j = 25\text{ }^\circ\text{C}$ | Max. | 1.55 | V |
| $V_{to}^{(2)}$ | Threshold voltage | $T_j = 125\text{ }^\circ\text{C}$ | Max. | 0.85 | V |
| $R_d^{(2)}$ | Dynamic resistance | $T_j = 125\text{ }^\circ\text{C}$ | Max. | 25 | m Ω |
| I_{DRM} I_{RRM} | $V_{DRM} = V_{RRM}$ | $T_j = 25\text{ }^\circ\text{C}$ | Max. | 5 | μA |
| | | $T_j = 125\text{ }^\circ\text{C}$ | | 2 | mA |

Table 6. Thermal resistance

| Symbol | Parameter | Value | Unit | |
|---------------|-----------------------|----------------------------------------------|------|--------------------|
| $R_{th(j-c)}$ | Junction to case (AC) | D ² PAK / TO-220AB | 1.2 | $^\circ\text{C/W}$ |
| | | TO-220AB insulated | 2.1 | |
| $R_{th(j-a)}$ | Junction to ambient | $S^{(1)} = 1\text{ cm}^2$ D ² PAK | 45 | $^\circ\text{C/W}$ |
| | | TO-220AB / TO-220AB insulated | 60 | |

1. S = Copper surface under tab

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

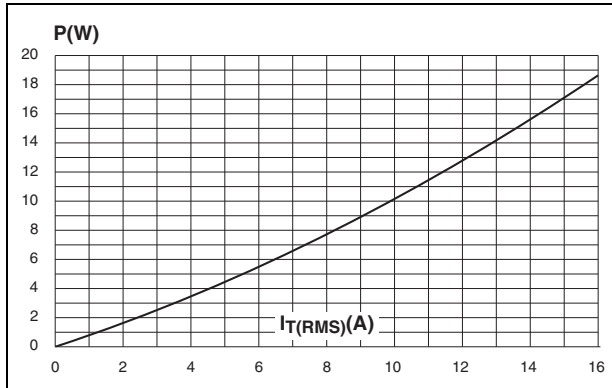


Figure 2. On-state rms current versus case temperature (full cycle)

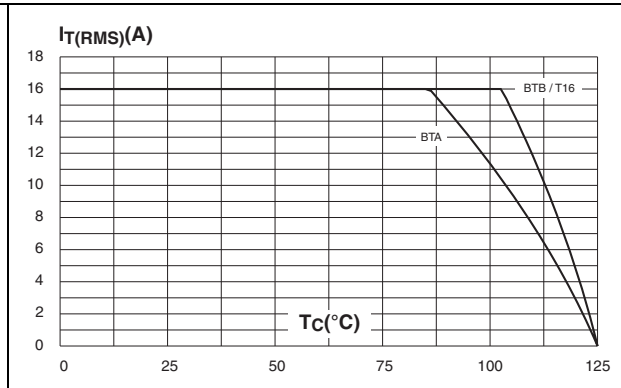


Figure 3. On-state rms current versus ambient temperature (full cycle)

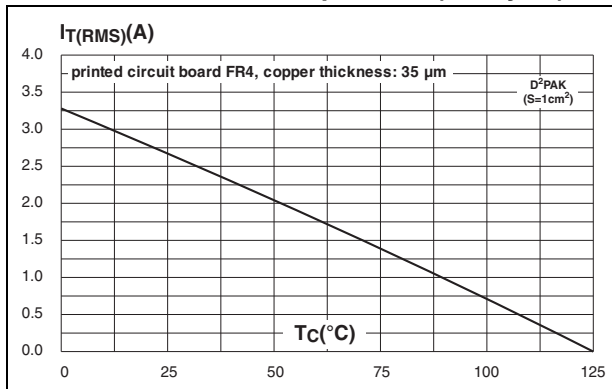


Figure 4. Relative variation of thermal impedance versus pulse duration

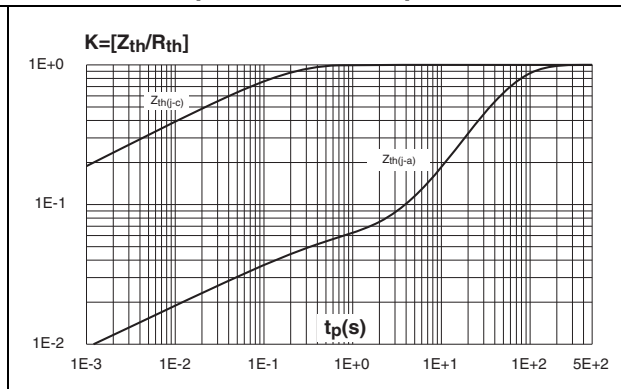


Figure 5. On-state characteristics (maximum values)

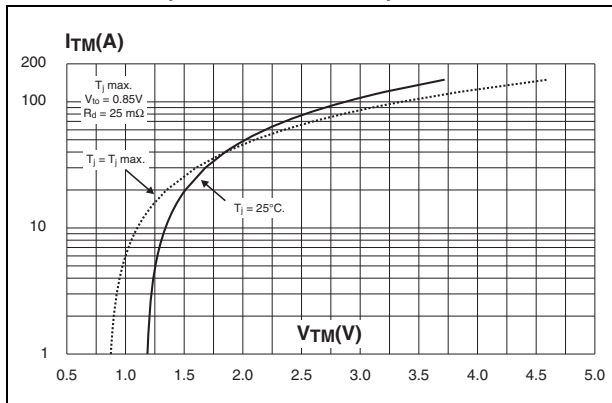


Figure 6. Surge peak on-state current versus number of cycles

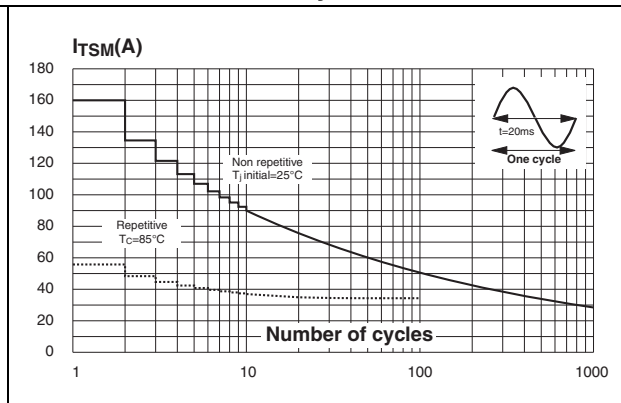


Figure 7. Non-repetitive surge peak on-state current for a sinusoidal

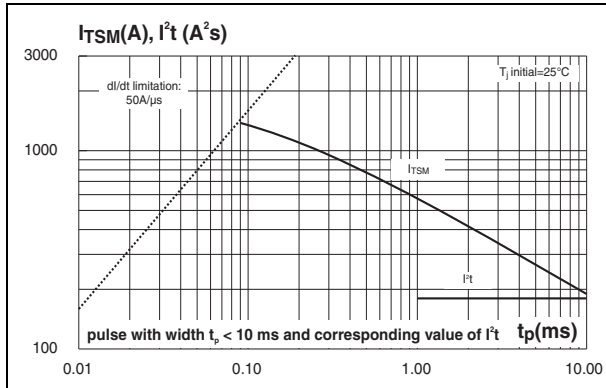


Figure 8. Relative variation of gate trigger current

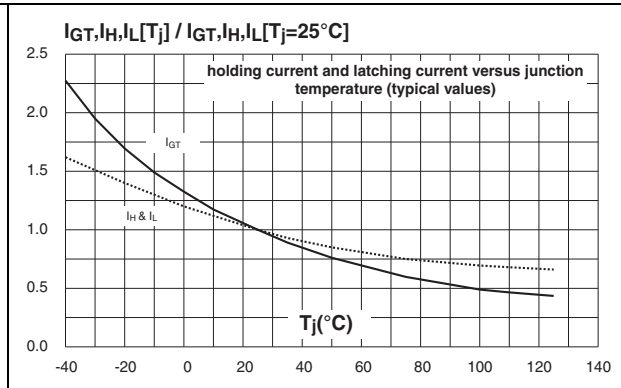


Figure 9. Relative variation of critical rate of decrease of main current versus $(dV/dt)_c$ (typical values)

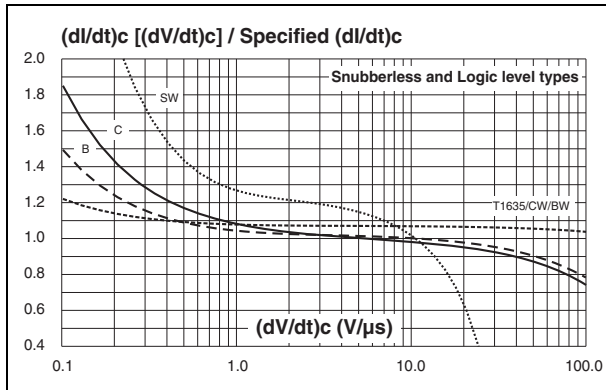


Figure 10. Relative variation of critical rate of decrease of main current versus $(dV/dt)_c$ (typical values)

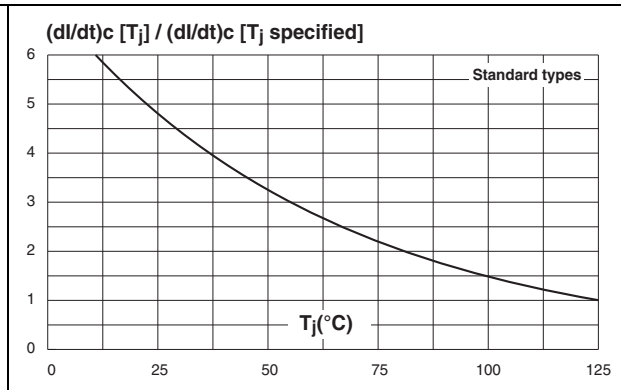
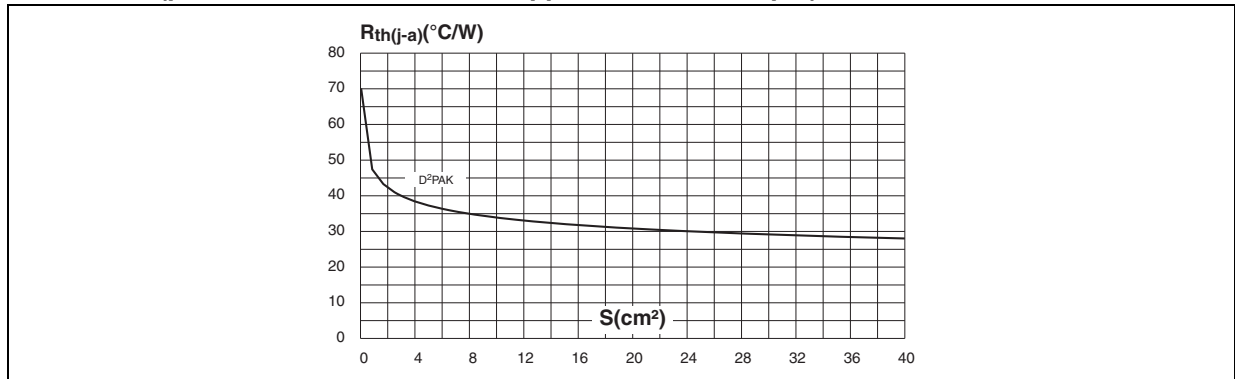


Figure 11. D²PAK thermal resistance junction to ambient versus copper surface under tab (printed circuit board FR4, copper thickness: 35 μm)



2 Ordering information

Figure 12. Ordering information scheme (BTA16 and BTB16 series)

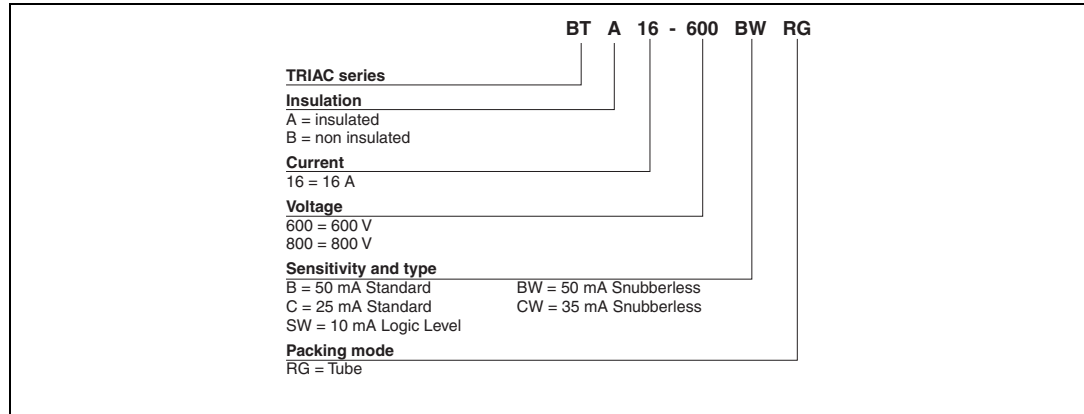


Figure 13. Ordering information scheme (T16 series)

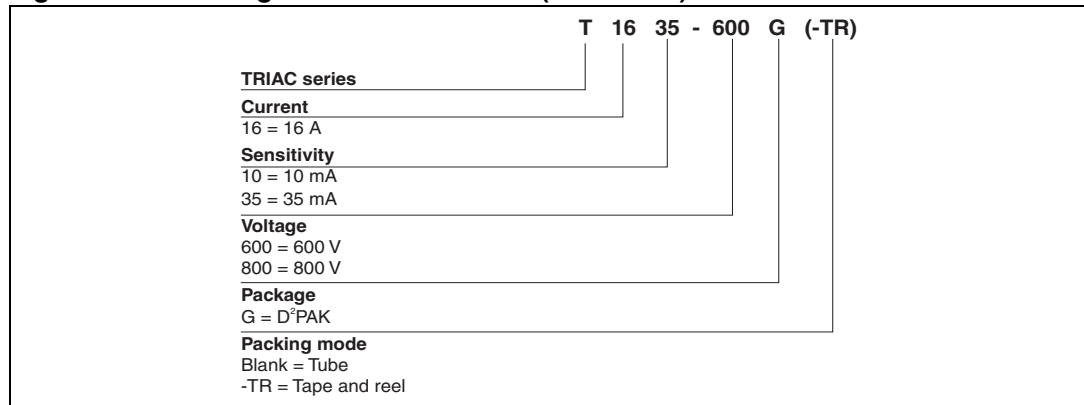


Table 7. Product selector

| Device ⁽¹⁾ | Voltage (xxx) | | Sensitivity | Type | Package |
|-----------------------|---------------|-------|-------------|-------------|--------------------|
| | 600 V | 800 V | | | |
| BTA/BTB16-xxxB | X | X | 50 mA | Standard | TO-220AB |
| BTA/BTB16-xxxBW | X | X | 50 mA | Snubberless | TO-220AB |
| BTA/BTB16-xxxC | X | | 25 mA | Standard | TO-220AB |
| BTA/BTB16-xxxCW | X | X | 35 mA | Snubberless | TO-220AB |
| BTA/BTB16-xxxSW | X | X | 10 mA | Logic level | TO-220AB |
| T1610-xxxG | X | X | 10 mA | Logic level | D ² PAK |
| T1635-xxxG | X | X | 35 mA | Snubberless | D ² PAK |

1. **BTB**: non insulated TO-220AB package

3 Package information

- Epoxy meets UL94, V0
- Recommended torque value: 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. ECOPACK® is an ST trademark.

Table 8. D²PAK dimensions

| Ref. | Dimensions | | | | | |
|------|-------------|------|-------|--------|-------|-------|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 4.30 | | 4.60 | 0.169 | | 0.181 |
| A1 | 2.49 | | 2.69 | 0.098 | | 0.106 |
| A2 | 0.03 | | 0.23 | 0.001 | | 0.009 |
| B | 0.70 | | 0.93 | 0.027 | | 0.037 |
| B2 | 1.25 | 1.40 | | 0.048 | 0.055 | |
| C | 0.45 | | 0.60 | 0.017 | | 0.024 |
| C2 | 1.21 | | 1.36 | 0.047 | | 0.054 |
| D | 8.95 | | 9.35 | 0.352 | | 0.368 |
| E | 10.00 | | 10.28 | 0.393 | | 0.405 |
| G | 4.88 | | 5.28 | 0.192 | | 0.208 |
| L | 15.00 | | 15.85 | 0.590 | | 0.624 |
| L2 | 1.27 | | 1.40 | 0.050 | | 0.055 |
| L3 | 1.40 | | 1.75 | 0.055 | | 0.069 |
| R | 0.40 | | | 0.016 | | |
| V2 | 0° | | 8° | 0° | | 8° |

Figure 14. Footprint (dimensions in mm)

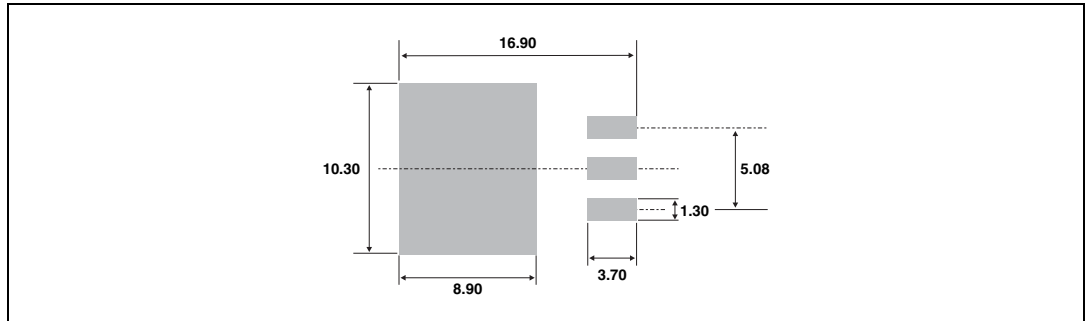
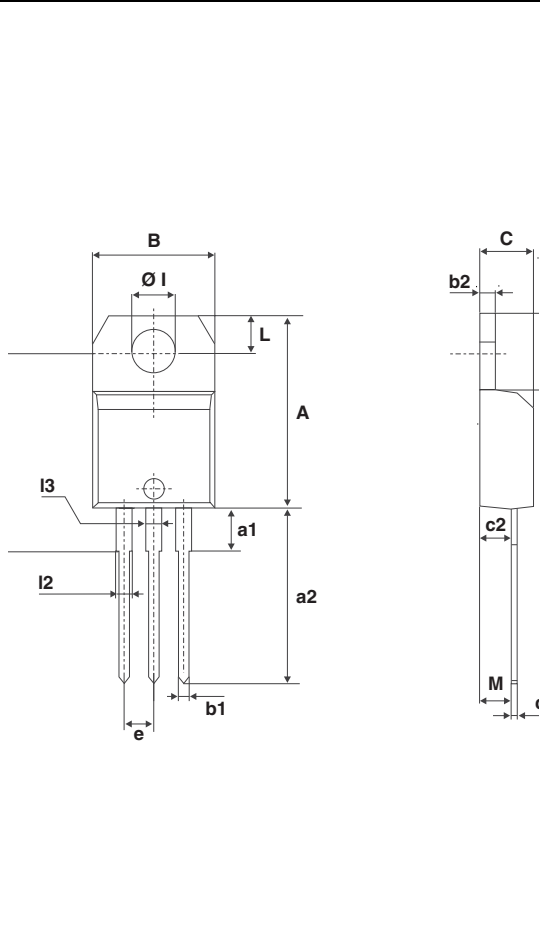


Table 9. TO-220AB (non-insulated and insulated) dimensions



| Ref. | Dimensions | | | | | |
|------|-------------|-------|-------|--------|-------|-------|
| | Millimeters | | | Inches | | |
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | 15.20 | | 15.90 | 0.598 | | 0.625 |
| a1 | | 3.75 | | | 0.147 | |
| a2 | 13.00 | | 14.00 | 0.511 | | 0.551 |
| B | 10.00 | | 10.40 | 0.393 | | 0.409 |
| b1 | 0.61 | | 0.88 | 0.024 | | 0.034 |
| b2 | 1.23 | | 1.32 | 0.048 | | 0.051 |
| C | 4.40 | | 4.60 | 0.173 | | 0.181 |
| c1 | 0.49 | | 0.70 | 0.019 | | 0.027 |
| c2 | 2.40 | | 2.72 | 0.094 | | 0.107 |
| e | 2.40 | | 2.70 | 0.094 | | 0.106 |
| F | 6.20 | | 6.60 | 0.244 | | 0.259 |
| ØI | 3.75 | | 3.85 | 0.147 | | 0.151 |
| l4 | 15.80 | 16.40 | 16.80 | 0.622 | 0.646 | 0.661 |
| L | 2.65 | | 2.95 | 0.104 | | 0.116 |
| l2 | 1.14 | | 1.70 | 0.044 | | 0.066 |
| l3 | 1.14 | | 1.70 | 0.044 | | 0.066 |
| M | | 2.60 | | | 0.102 | |

4 Ordering information

Table 10. Ordering information

| Order code ⁽¹⁾ | Marking ⁽¹⁾ | Package | Weight | Base qty | Delivery mode |
|---------------------------|------------------------|--------------------|--------|----------|---------------|
| BTA16-xxxzyRG | BTA16xxxzy | TO-220AB | 2.3 g | 50 | Tube |
| BTB16-xxxzyRG | BTB16xxxzy | TO-220AB | 2.3 g | 50 | Tube |
| T1610-xxxG-TR | T1610xxxG | D ² PAK | 1.5 g | 1000 | Tape and reel |
| T1635-xxxG | T1635xxxG | | | 50 | Tube |
| T1635-xxxG-TR | T1635xxxG | | | 1000 | Tape and reel |

1. xxx = voltage, y = sensitivity, z = type

5 Revision history

Table 11. Document revision history

| Date | Revision | Changes |
|-------------|----------|--------------------------------------------------------------------------------------------------------------------------------------|
| Oct-2002 | 6A | Last update. |
| 13-Feb-2006 | 7 | TO-220AB delivery mode changed from bulk to tube. ECOPACK statement added. |
| 03-Jul-2009 | 8 | Added part number T1610. |
| 11-Mar-2010 | 9 | Updated value for V_{DSM}/V_{RSM} in Table 2 . Updated temperature in Table 2 from 15 °C to 86 °C. |

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