

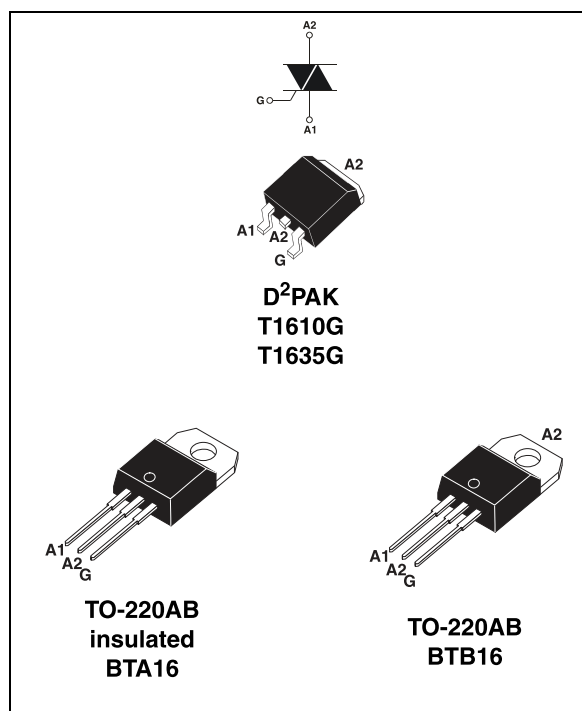
16 A Snubberless™, logic level and standard Triacs

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 I_{GT} is guaranteed at 5% of I_{GT} max

2. For both polarities of A2 referenced to A1

Table 4. Electrical characteristics ($T_j = 25\text{ °C}$, 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} | $V_D = V_{DRM}$ $R_L = 3.3\text{ k}\Omega$ $T_j = 125\text{ °C}$ | 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 | $T_j = 125\text{ °C}$ | Min. | 200 | 400 | V/ μ s |
| $(dV/dt)_c^{(2)}$ | $(dI/dt)_c = 7\text{ A/ms}$ | $T_j = 125\text{ °C}$ | Min. | 5 | 10 | V/ μ s |

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

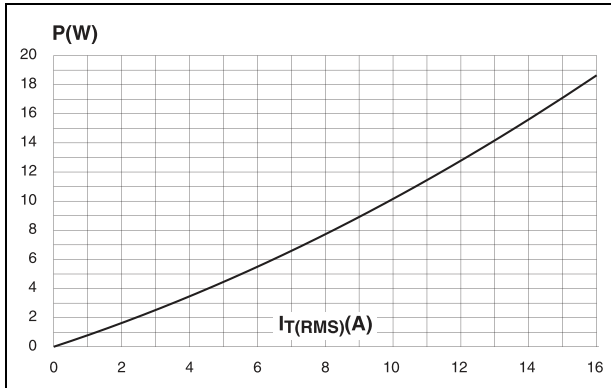


Figure 2. On-state rms current versus case temperature (full cycle)

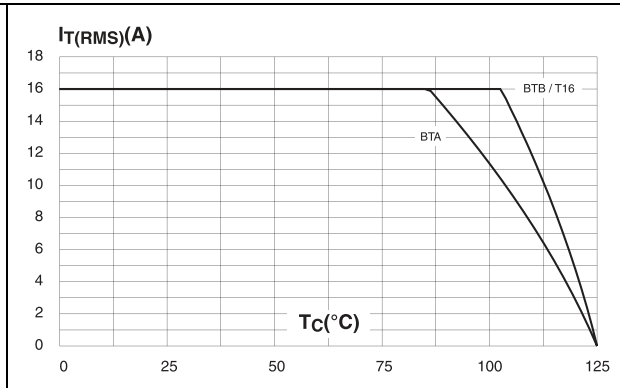


Figure 3. On-state rms current versus ambient temperature (full cycle)

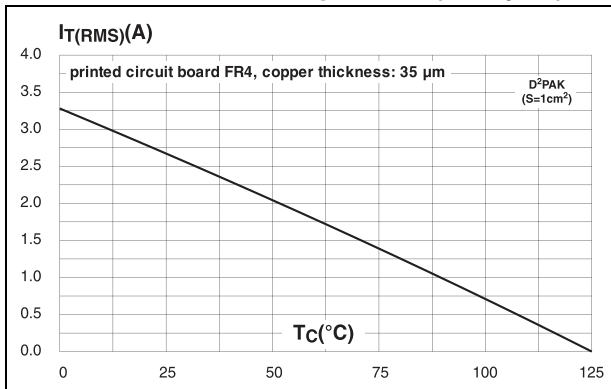


Figure 4. Relative variation of thermal impedance versus pulse duration

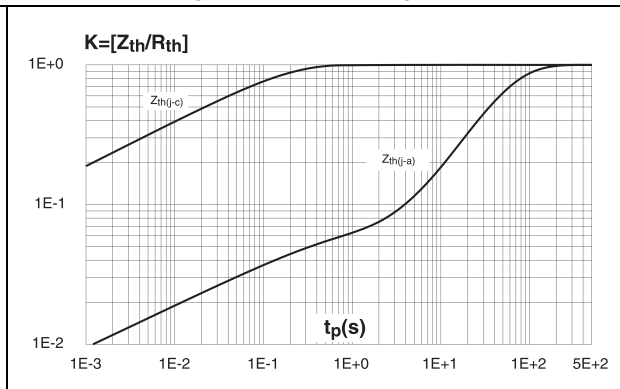


Figure 5. On-state characteristics (maximum values)

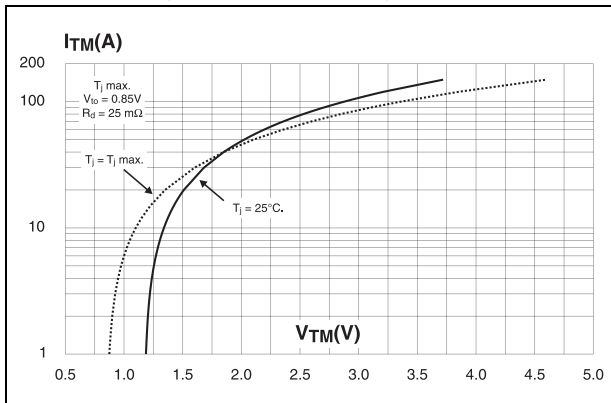


Figure 6. Surge peak on-state current versus number of cycles

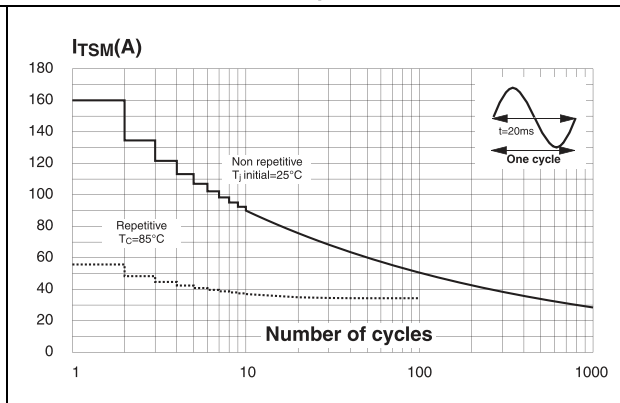


Figure 7. Non-repetitive surge peak on-state current for a sinusoidal

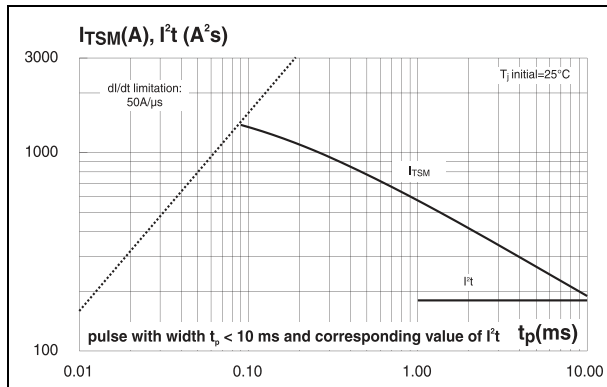


Figure 8. Relative variation of gate trigger current

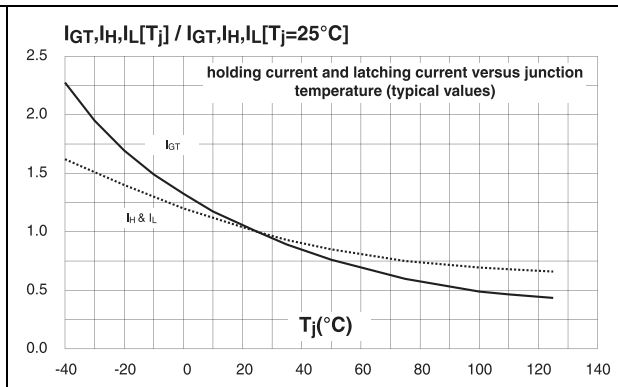


Figure 9. Relative variation of critical rate of decrease of main current versus $(dV/dt)_c$ (typical values)

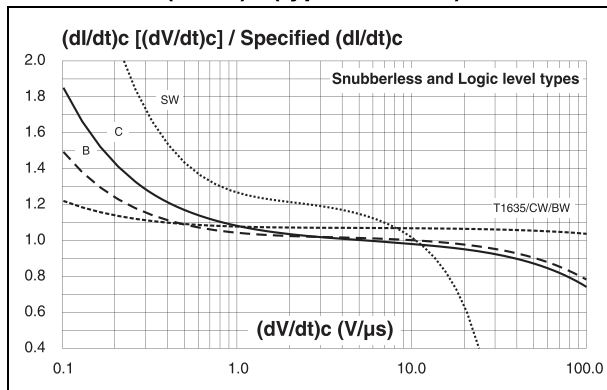


Figure 10. Relative variation of critical rate of decrease of main current versus $(dV/dt)_c$ (typical values)

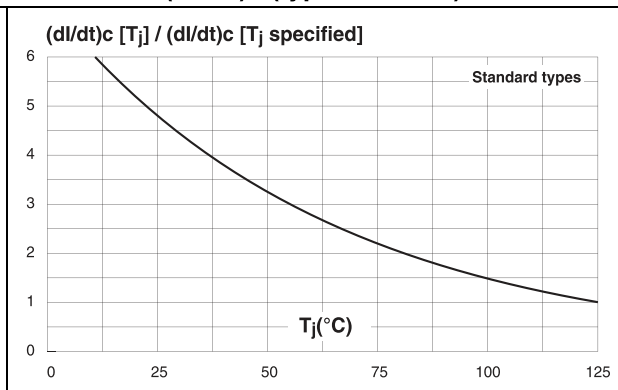
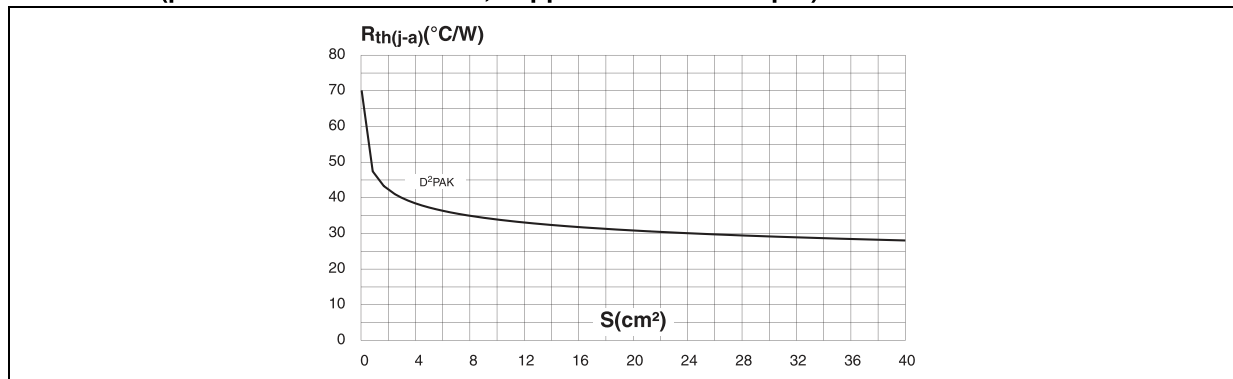


Figure 11. D²PAK thermal resistance junction to ambient versus copper surface under tab (printed circuit board FR4, copper thickness: 35 μm)



2 Ordering information

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

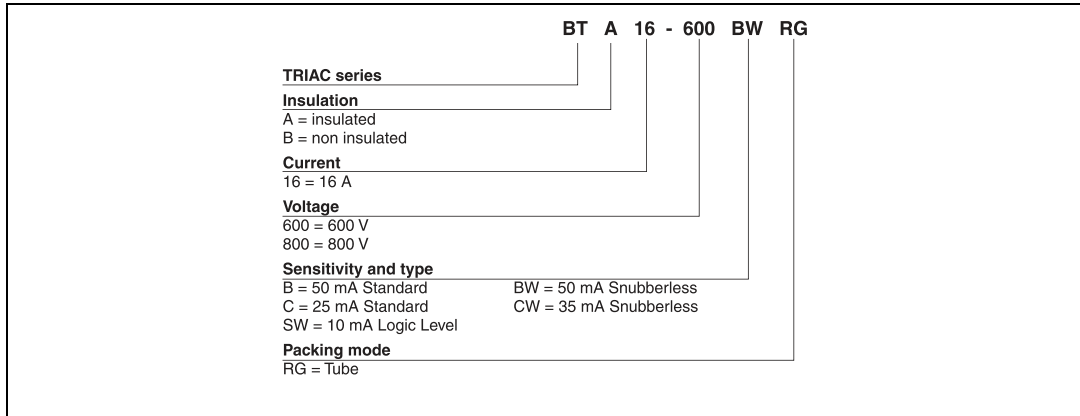


Figure 13. Ordering information scheme (T16 series)

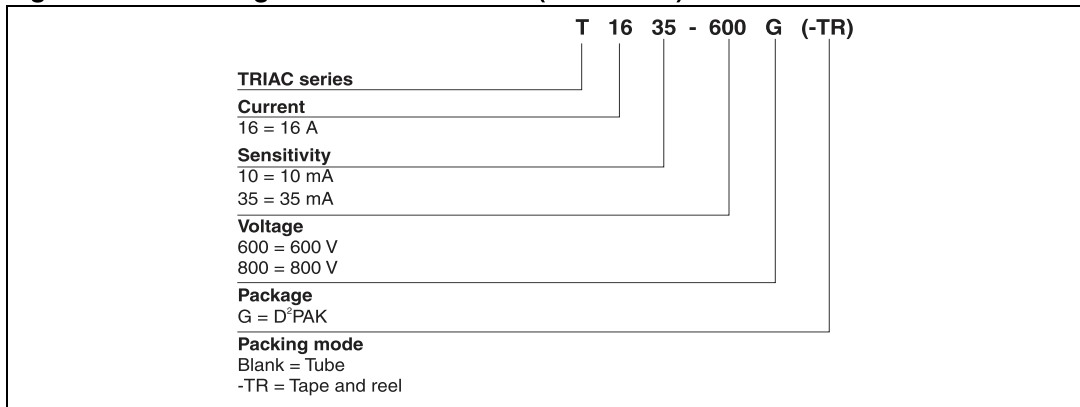


Table 7. Product selector

| 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)

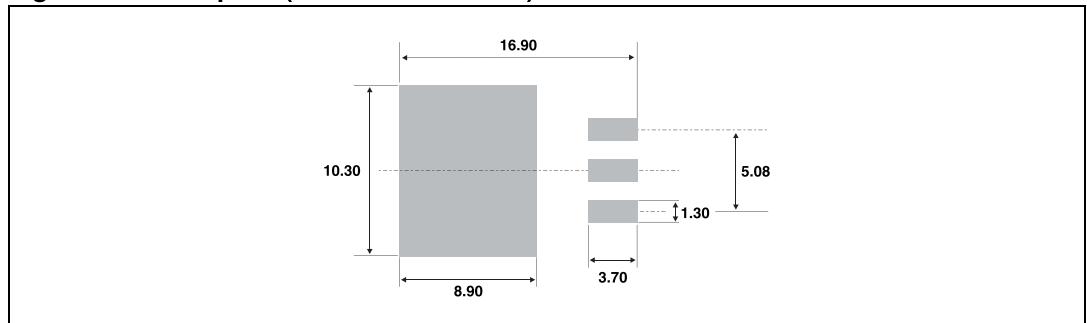


Table 9. TO-220AB (non-insulated and insulated) dimensions

| 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 |
| I4 | 15.80 | 16.40 | 16.80 | 0.622 | 0.646 | 0.661 |
| L | 2.65 | | 2.95 | 0.104 | | 0.116 |
| I2 | 1.14 | | 1.70 | 0.044 | | 0.066 |
| I3 | 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. |

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED ST REPRESENTATIVE, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2010 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com