

# 1 Characteristics

**Table 2. Absolute maximum ratings (limiting values;  $T_j = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)**

| Symbol                              | Parameter                                                                                                 |                        |                          | Value                                    | Unit             |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------|------------------------|--------------------------|------------------------------------------|------------------|
| I <sub>T(RMS)</sub>                 | On-state rms current (full sine wave)                                                                     |                        | T <sub>c</sub> = 86 °C   | 16                                       | A                |
| I <sub>TSM</sub>                    | Non repetitive surge peak on-state current (full cycle, T <sub>j</sub> initial = 25 °C)                   | F = 50 Hz              | t <sub>p</sub> = 20 ms   | 120                                      | A                |
|                                     |                                                                                                           | F = 60 Hz              | t <sub>p</sub> = 16.7 ms | 126                                      |                  |
| I <sup>2</sup> t                    | I <sup>2</sup> t Value for fusing                                                                         | t <sub>p</sub> = 10 ms |                          | 105                                      | A <sup>2</sup> s |
| di/dt                               | Critical rate of rise of on-state current I <sub>G</sub> = 2 x I <sub>GT</sub><br>t <sub>r</sub> ≤ 100 ns | F = 60 Hz              | T <sub>j</sub> = 125 °C  | 50                                       | A/μs             |
| V <sub>DSM</sub> / V <sub>RSM</sub> | Non repetitive surge peak off-state voltage                                                               | t <sub>p</sub> = 10 ms | T <sub>j</sub> = 25 °C   | V <sub>DRM</sub> /V <sub>RRM</sub> + 100 | V                |
| I <sub>GM</sub>                     | Peak gate current                                                                                         | t <sub>p</sub> = 20 μs | T <sub>j</sub> = 125 °C  | 4                                        | A                |
| P <sub>G(AV)</sub>                  | Average gate power dissipation                                                                            |                        | T <sub>j</sub> = 125 °C  | 1                                        | W                |
| T <sub>stg</sub>                    | Storage junction temperature range                                                                        |                        |                          | - 40 to + 150                            | °C               |
| T <sub>j</sub>                      | Operating junction temperature range                                                                      |                        |                          | - 40 to + 125                            | °C               |

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

| Symbol            | Test conditions                                                                  | Quadrant                                  |      | T16xxT |        |        | Unit             |
|-------------------|----------------------------------------------------------------------------------|-------------------------------------------|------|--------|--------|--------|------------------|
|                   |                                                                                  |                                           |      | T1610T | T1620T | T1635T |                  |
| $I_{GT}^{(1)}$    | $V_D = 12\text{ V}$ $R_L = 30\text{ W}$                                          | I - II - III                              | MAX. | 10     | 20     | 35     | mA               |
|                   |                                                                                  | IV                                        |      |        |        |        |                  |
| $V_{GT}$          | $V_D = V_{DRM}$ , $R_L = 3.3\text{ kW}$ ,<br>$T_j = 25\text{ }^{\circ}\text{C}$  | ALL                                       | MAX. | 1.3    |        |        | V                |
| $V_{GD}$          | $V_D = V_{DRM}$ , $R_L = 3.3\text{ kW}$ ,<br>$T_j = 125\text{ }^{\circ}\text{C}$ | ALL                                       | MIN. | 0.2    |        |        | V                |
| $I_H^{(2)}$       | $I_T = 500\text{ mA}$                                                            |                                           | MAX. | 12     | 25     | 40     | mA               |
| $I_L$             | $I_G = 1.2\text{ }I_{GT}$                                                        | I - III                                   | MAX. | 20     | 35     | 50     | mA               |
|                   |                                                                                  | IV                                        |      |        |        |        |                  |
|                   |                                                                                  | II                                        |      | 30     | 40     | 80     |                  |
| $dV/dt^{(2)}$     | $V_D = 67\%\text{ }V_{DRM}$ , gate open                                          | $T_j = 125\text{ }^{\circ}\text{C}$       | MIN. | 100    | 1000   | 2000   | V/ $\mu\text{s}$ |
|                   |                                                                                  | $T_j = 150\text{ }^{\circ}\text{C}^{(3)}$ |      | 20     | 500    | 1000   |                  |
| $(di/dt)_c^{(2)}$ | $(dV/dt)_c = 0.1\text{ V}/\mu\text{s}$                                           | $T_j = 125\text{ }^{\circ}\text{C}$       | MIN. | 8      |        |        | A/ms             |
|                   | $(dV/dt)_c = 10\text{ V}/\mu\text{s}$                                            |                                           |      | 4      |        |        |                  |
|                   | Without snubber                                                                  |                                           |      |        | 6      | 16     |                  |
|                   | $(dV/dt)_c = 0.1\text{ V}/\mu\text{s}$                                           | $T_j = 150\text{ }^{\circ}\text{C}^{(3)}$ |      | 3      |        |        |                  |
|                   | $(dV/dt)_c = 10\text{ V}/\mu\text{s}$                                            |                                           |      | 1      |        |        |                  |
|                   | Without snubber                                                                  |                                           |      |        | 3      | 12     |                  |

1. minimum  $I_{GT}$  is guaranteed at 5% of  $I_{GT}$  max.
2. for both polarities of A2 referenced to A1.
3. derating information for excess temperature above  $T_j$  max.

Table 4. Static characteristics

| Symbol                 | Test conditions                                           |                                           |      | Value | Unit             |
|------------------------|-----------------------------------------------------------|-------------------------------------------|------|-------|------------------|
| $V_T^{(1)}$            | $I_{TM} = 22.6\text{ A}$ , $t_p = 380\text{ }\mu\text{s}$ | $T_j = 25\text{ }^{\circ}\text{C}$        | MAX. | 1.55  | V                |
| $V_{TO}^{(1)}$         | Threshold voltage                                         | $T_j = 125\text{ }^{\circ}\text{C}$       | MAX. | 0.85  | V                |
| $R_D^{(1)}$            | Dynamic resistance                                        | $T_j = 125\text{ }^{\circ}\text{C}$       | MAX. | 30    | $\text{m}\Omega$ |
| $I_{DRM}$<br>$I_{RRM}$ | $V_{DRM} = V_{RRM}$                                       | $T_j = 25\text{ }^{\circ}\text{C}$        | MAX. | 5     | $\mu\text{A}$    |
|                        |                                                           | $T_j = 125\text{ }^{\circ}\text{C}$       |      | 1     | mA               |
|                        | $V_D = 0.9 \times V_{DRM}$                                | $T_j = 150\text{ }^{\circ}\text{C}^{(2)}$ | TYP. | 1.9   |                  |

1. for both polarities of A2 referenced to A1.
2. derating information for excess temperature above  $T_j$  max.

Table 5. Thermal resistance

| Symbol        | Parameter                | Value | Unit                 |
|---------------|--------------------------|-------|----------------------|
| $R_{th(j-c)}$ | Junction to case (AC)    | 2.1   | $^{\circ}\text{C/W}$ |
| $R_{th(j-a)}$ | Junction to ambient (DC) | 60    | $^{\circ}\text{C/W}$ |

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

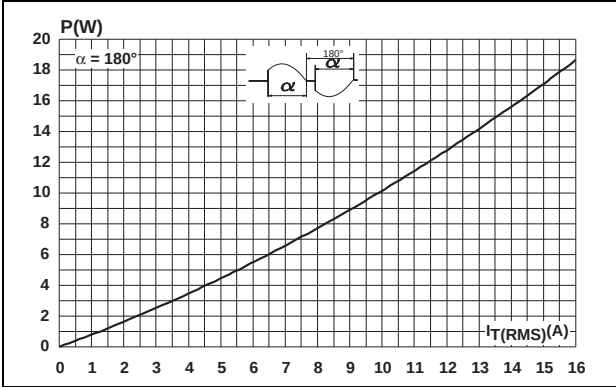


Figure 2. On-state rms current versus case temperature (full cycle)

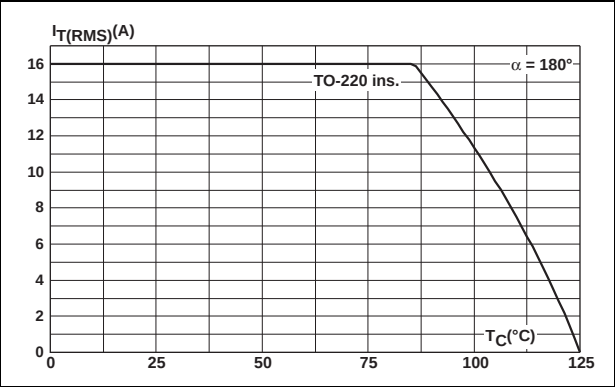


Figure 3. On-state rms current versus ambient temperature

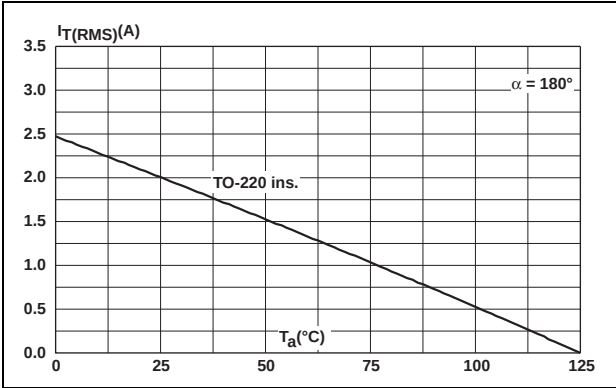


Figure 4. Relative variation of thermal impedance versus pulse duration

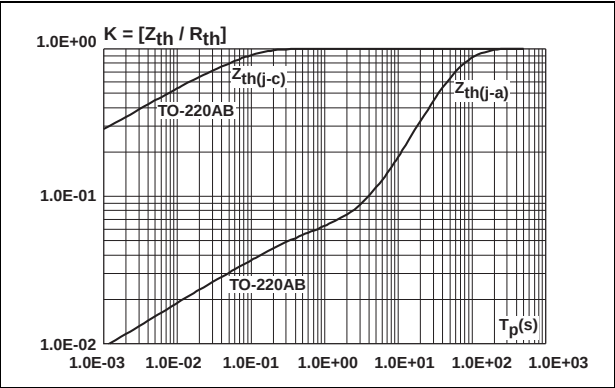


Figure 5. On state characteristics (maximum values)

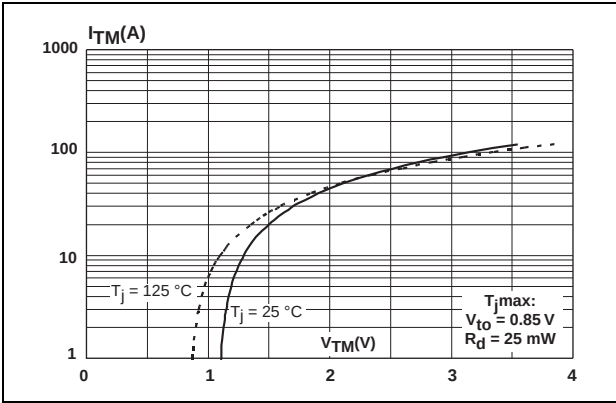


Figure 6. Surge peak on state current versus number of cycles

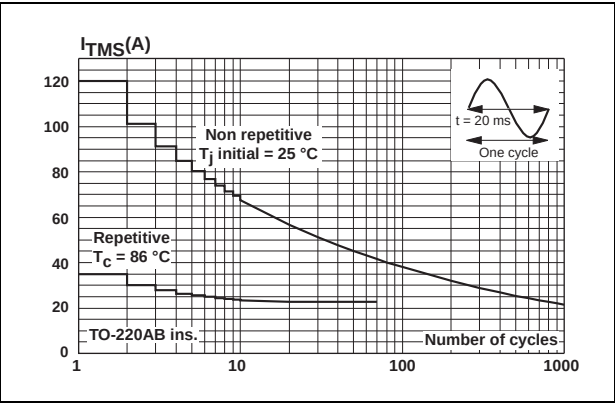


Figure 7. Non repetitive surge peak on state current for a sinusoidal

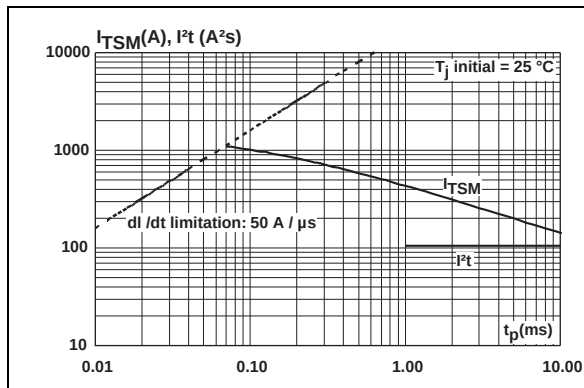


Figure 8. Relative variation of gate trigger current and gate trigger voltage versus junction temperature

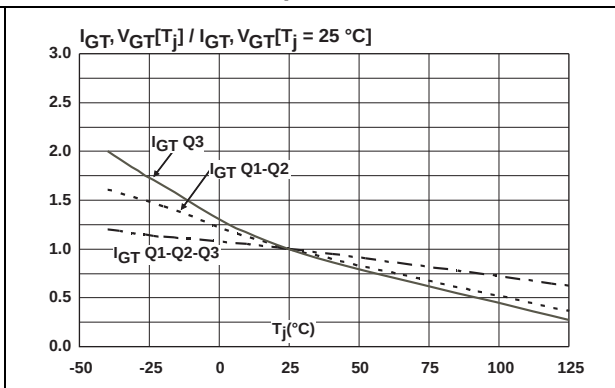


Figure 9. Relative variation of holding current and latching current versus junction temperature

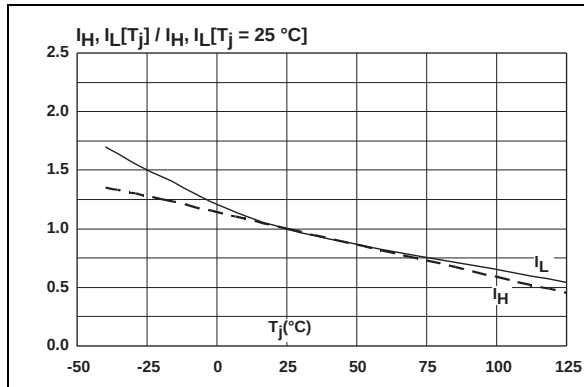


Figure 10. Relative variation of critical rate of decrease of main current versus junction temperature

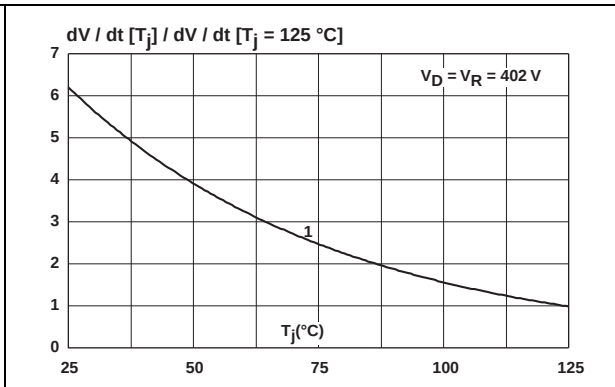


Figure 11. Relative variation of critical rate of decrease of main current versus junction temperature

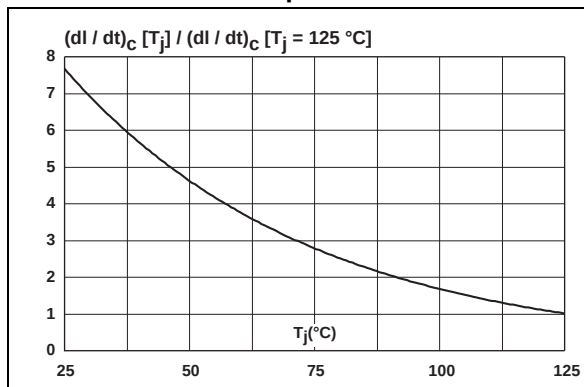
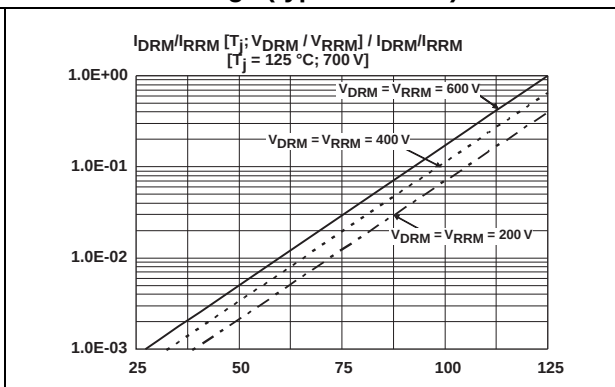
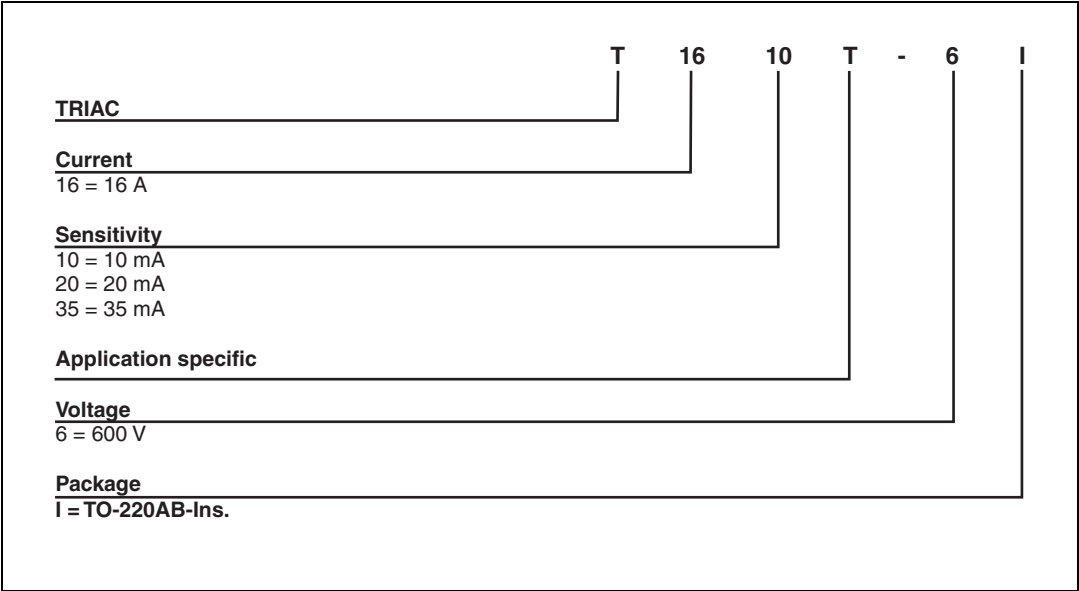


Figure 12. Leakage current versus junction temperature for different values of blocking voltage (typical values)



2      Ordering information scheme

Figure 13. Ordering information scheme



### 3 Package mechanical data

- Epoxy meets UL94, V0
- Lead-free packages

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

**Table 6. TO-220AB 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 7. Ordering information

| Order code | Marking   | Package       | Weight | Base qty | Delivery mode |
|------------|-----------|---------------|--------|----------|---------------|
| T1610T-6I  | T1610T-6I | TO-220AB ins. | 2.3 g  | 50       | Tube          |
| T1620T-6I  | T1620T-6I |               |        |          |               |
| T1635T-6I  | T1635T-6I |               |        |          |               |

## 5 Revision history

Table 8. Document revision history

| Date        | Revision | Changes                         |
|-------------|----------|---------------------------------|
| 03-Dec-2009 | 1        | Initial release.                |
| 18-Jan-2010 | 2        | Updated pag.1.                  |
| 19-Jun-2014 | 3        | Updated features in cover page. |

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