

## High temperature 10 A Snubberless™ Triacs

### Features

- Medium current Triac
- 150 °C max.  $T_j$  turn-off commutation
- Low thermal resistance with clip bonding
- Very high 3 quadrant commutation capability
- Packages are RoHS (2002/95/EC) compliant
- UL certified (ref. file E81734)

### Applications

Especially designed to operate in high power density or universal motor applications such as vacuum cleaner and washing machine drum motor, these 10 A Triacs provide a very high switching capability up to junction temperatures of 150 °C.

The heatsink can be reduced, compared to traditional Triacs, according to the high performance at given junction temperatures.

### Description

Available in through-hole or surface mount packages, the T1035H and T1050H Triacs series are suitable for general purpose mains power ac switching.

By using an internal ceramic pad, the T10xxH-6I provides voltage insulation (rated at 2500 V rms).



**Table 1. Device summary**

| Symbol            | Value    | Unit |
|-------------------|----------|------|
| $I_{T(RMS)}$      | 10       | A    |
| $V_{DRM}/V_{RRM}$ | 600      | V    |
| $I_{GT}$          | 35 or 50 | mA   |

**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 <sup>2</sup> PAK, TO-220AB | $T_c = 135\text{ °C}$ | 10                             | A                |
|                    |  | TO-220AB Ins                 | $T_c = 125\text{ °C}$ |                                |                  |
| $I_{TSM}$          | Non repetitive surge peak on-state current (full cycle, $T_j$ initial = 25 °C)               | F = 50 Hz                    | t = 20 ms             | 100                            | A                |
|                    |  | F = 60 Hz                    | t = 16.7 ms           | 105                            |                  |
| $I^2t$             | $I^2t$ Value for fusing  | $t_p = 10\text{ ms}$         |                       | 66                             | A <sup>2</sup> 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                   | $T_j = 150\text{ °C}$ | 50                             | A/ $\mu$ 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                |
| $I_{GM}$           | Peak gate current  | $t_p = 20\text{ }\mu$ s      | $T_j = 150\text{ °C}$ | 4                              | A                |
| $P_{G(AV)}$        | Average gate power dissipation   | $T_j = 150\text{ °C}$        |                       | 1                              | W                |
| $T_{stg}$<br>$T_j$ | Storage junction temperature range<br>Operating junction temperature range                   |                              |                       | - 40 to + 150<br>- 40 to + 150 | °C               |

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

| Symbol                              | Test Conditions   | Quadrant     |      | Value  |        | Unit       |
|-------------------------------------|---|--------------|------|--------|--------|------------|
|                                     |   |              |      | T1035H | T1050H |            |
| $I_{GT}^{(1)}$                      | $V_D = 12\text{ V}$ , $R_L = 33\text{ }\Omega$          | I - II - III | MAX. | 35     | 50     | mA         |
| $V_{GT}$                            |   | I - II - III | MAX. | 1.0    |        | V          |
| $V_{GD}$                            | $V_D = V_{DRM}$ , $R_L = 3.3\text{ k}\Omega$            | I - II - III | MIN. | 0.15   |        | V          |
| $I_H^{(2)}$                         | $I_T = 500\text{ mA}$                                   |              | MAX. | 35     | 75     | mA         |
| $I_L$                               | $I_G = 1.2 I_{GT}$                                      | I - III      | MAX. | 50     | 90     | mA         |
|                                     |   | II           |      | 80     | 110    |            |
| dV/dt <sup>(2)</sup>                | $V_D = 67\% V_{DRM}$ , gate open, $T_j = 150\text{ °C}$ |              | MIN. | 1000   | 1500   | V/ $\mu$ s |
| (dI/dt) <sub>c</sub> <sup>(2)</sup> | Without snubber, $T_j = 150\text{ °C}$                  |              | MIN. | 13     | 18     | A/ms       |

1. minimum  $I_{GT}$  is guaranteed at 20% of  $I_{GT}$  max.
2. for both polarities of A2 referenced to A1.

Table 4. Static characteristics

| Symbol                       | Test Conditions                                   |                                    |      | Value | Unit             |
|------------------------------|---|------------------------------------|------|-------|------------------|
| $V_T^{(1)}$                  | $I_{TM} = 14 \text{ A}$ , $t_p = 380 \mu\text{s}$ | $T_j = 25 \text{ }^\circ\text{C}$  | MAX. | 1.5   | V                |
| $V_{i0}^{(1)}$               | Threshold voltage                                 | $T_j = 150 \text{ }^\circ\text{C}$ | MAX. | 0.80  | V                |
| $R_d^{(1)}$                  | Dynamic resistance                                | $T_j = 150 \text{ }^\circ\text{C}$ | MAX. | 34    | $\text{m}\Omega$ |
| $I_{DRM}$<br>$I_{RRM}^{(2)}$ | $V_{DRM} = V_{RRM}$                               | $T_j = 25 \text{ }^\circ\text{C}$  | MAX. | 5     | $\mu\text{A}$    |
|                              |   | $T_j = 150 \text{ }^\circ\text{C}$ | MAX. | 3.6   | mA               |
|                              | $V_D/V_R = 400 \text{ V}$ (at peak mains voltage) | $T_j = 150 \text{ }^\circ\text{C}$ | MAX. | 3.0   |                  |
|                              | $V_D/V_R = 200 \text{ V}$ (at peak mains voltage) | $T_j = 150 \text{ }^\circ\text{C}$ | MAX. | 2.5   |                  |

1. for both polarities of A2 referenced to A1.

2.  $t_p = 380 \mu\text{s}$

Table 5. Thermal resistance

| Symbol        | Parameter             |  | Value | Unit               |
|---------------|-----------------------|--|-------|--------------------|
| $R_{th(j-c)}$ | Junction to case (AC) | D <sup>2</sup> PAK / TO-220AB              | 1.45  | $^\circ\text{C/W}$ |
|               |                       | TO-220AB Ins                               | 3.4   |                    |
| $R_{th(j-a)}$ | Junction to ambient   | $S = 1 \text{ cm}^2$<br>D <sup>2</sup> PAK | 45    |                    |
|               |                       | TO-220AB / TO-220AB Ins                    | 60    |                    |

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



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

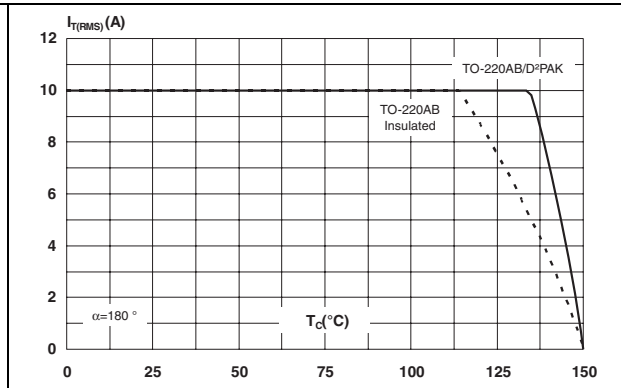


Figure 3. On-state rms current versus ambient temperature



Figure 4. Variation of thermal impedance versus pulse duration

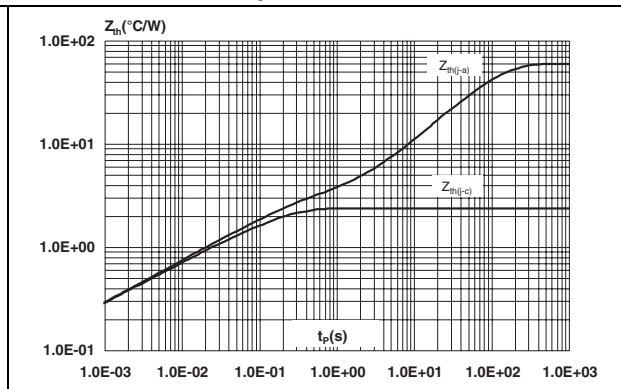


Figure 5. On-state characteristics (maximum values)



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

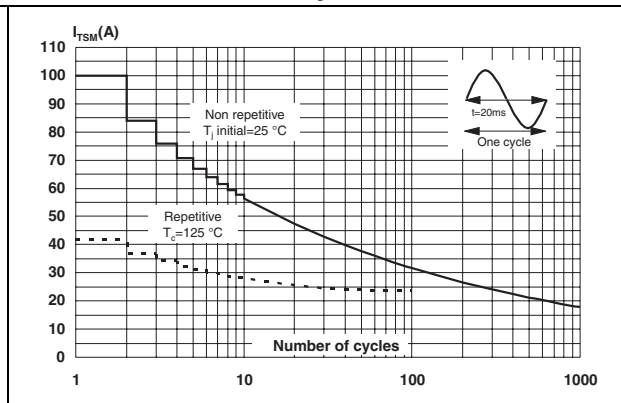


Figure 7. Non-repetitive surge peak on-state current for a sinusoidal pulse with

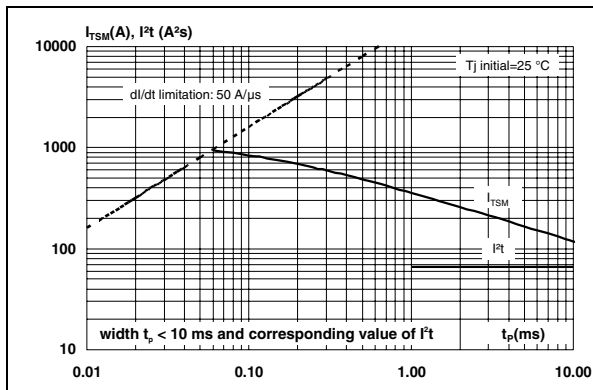


Figure 8. Relative variation of  $I_{GT}, I_H, I_L$  vs junction temperature (typical values)



Figure 9. Relative variation of critical rate of decrease of main current (dI/dt)<sub>c</sub> versus reapplied (dV/dt)<sub>c</sub>



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



Figure 11. Leakage current versus junction temperature for different values of blocking voltage (typical values)



Figure 12. Variation of thermal resistance junction to ambient versus copper surface under tab



## 2 Ordering information scheme

Figure 13. Ordering information scheme



### 3 Package information

- Epoxy meets UL94, V0
- Recommended torque 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](http://www.st.com). ECOPACK® is an ST trademark.

Table 6. D<sup>2</sup>PAK 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)

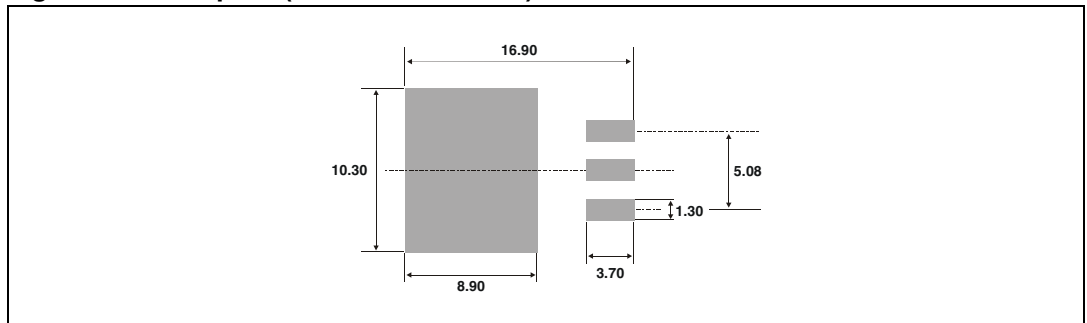
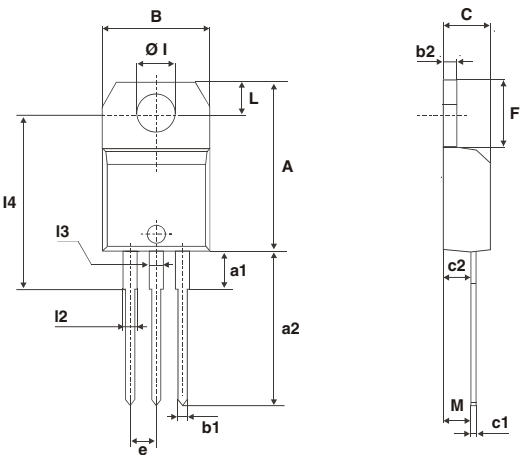


Table 7. TO-220AB and TO-220AB Ins dimensions



| 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 8. Ordering information

| Order code   | Marking   | Package            | Weight | Base qty | Delivery mode |
|--------------|-----------|--------------------|--------|----------|---------------|
| T10xxH-6G    | T10xxH 6G | D <sup>2</sup> PAK | 1.5 g  | 50       | Tube          |
| T10xxH-6G-TR | T10xxH 6G | D <sup>2</sup> PAK | 1.5 g  | 1000     | Tape and reel |
| T10xxH-6T    | T10xxH 6T | TO-220AB           | 2.3 g  | 50       | Tube          |
| T10xxH-6I    | T10xxH 6I | TO-220AB Ins       | 2.3 g  | 50       | Tube          |

## 5 Revision history

Table 9. Document revision history

| Date        | Revision | Changes   |
|-------------|----------|---|
| 17-Apr-2007 | 1        | First issue   |
| 20-Sep-2011 | 2        | Updated: <i>Features</i> , <i>Description</i> and <i>Figure 2</i> . |

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