

# 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  | $T_c = 130\text{ }^{\circ}\text{C}$ | 12                             | A                  |
|                    |                                                                                                        | TO-220AB Ins                  | $T_c = 120\text{ }^{\circ}\text{C}$ |                                |                    |
| $I_{TSM}$          | Non repetitive surge peak on-state current (full cycle, $T_j$ initial = $25\text{ }^{\circ}\text{C}$ ) | F = 50 Hz                     | t = 20 ms                           | 120                            | A                  |
|                    |                                                                                                        | F = 60 Hz                     | t = 16.7 ms                         | 126                            |                    |
| $I^2t$             | $I^2t$ Value for fusing                                                                                | $t_p = 10\text{ ms}$          |                                     | 95                             | A <sup>2</sup> s   |
| di/dt              | Critical rate of rise of on-state current<br>$I_G = 2 \times I_{GT}$ , $t_r \leq 100\text{ ns}$        | F = 120 Hz                    | $T_j = 150\text{ }^{\circ}\text{C}$ | 50                             | A/ $\mu$ s         |
| $V_{DSM}/V_{RSM}$  | Non repetitive surge peak off-state voltage                                                            | $t_p = 10\text{ ms}$          | $T_j = 25\text{ }^{\circ}\text{C}$  | $V_{DRM}/V_{RRM} + 100$        | V                  |
| $I_{GM}$           | Peak gate current                                                                                      | $t_p = 20\text{ }\mu\text{s}$ | $T_j = 150\text{ }^{\circ}\text{C}$ | 4                              | A                  |
| $P_{G(AV)}$        | Average gate power dissipation                                                                         |                               | $T_j = 150\text{ }^{\circ}\text{C}$ | 1                              | W                  |
| $T_{stg}$<br>$T_j$ | Storage junction temperature range<br>Operating junction temperature range                             |                               |                                     | - 40 to + 150<br>- 40 to + 150 | $^{\circ}\text{C}$ |

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

| Symbol                              | Test conditions                                                              | Quadrant     |      | Value  |        | Unit       |
|-------------------------------------|------------------------------------------------------------------------------|--------------|------|--------|--------|------------|
|                                     |                                                                              |              |      | T1235H | T1250H |            |
| $I_{GT}^{(1)}$                      | $V_D = 12\text{ V}$ , $R_L = 33\text{ }\Omega$                               | 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         |
| $I_L$                               | $I_G = 1.2\text{ }I_{GT}$                                                    | I - III      | MAX. | 50     | 90     | mA         |
|                                     |                                                                              | II           |      | 80     | 110    |            |
| dV/dt <sup>(2)</sup>                | $V_D = 67\%\text{ }V_{DRM}$ , gate open, $T_j = 150\text{ }^{\circ}\text{C}$ |              | MIN. | 1000   | 1500   | V/ $\mu$ s |
| (di/dt) <sub>c</sub> <sup>(2)</sup> | Without snubber, $T_j = 150\text{ }^{\circ}\text{C}$                         |              | MIN. | 16     | 21     | 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          |
|------------------------------|---------------------------------------------------------|-----------------------------------|------|-------|---------------|
| $V_T^{(1)}$                  | $I_{TM} = 17\text{ A}$ , $t_p = 380\text{ }\mu\text{s}$ | $T_j = 25\text{ }^\circ\text{C}$  | MAX. | 1.5   | V             |
| $V_{t0}^{(1)}$               | 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. | 30    | 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. | 3.9   | mA            |
|                              | $V_D/V_R = 400\text{ V}$ (at peak mains voltage)        | $T_j = 150\text{ }^\circ\text{C}$ | MAX. | 3.2   |               |
|                              | $V_D/V_R = 200\text{ V}$ (at peak mains voltage)        | $T_j = 150\text{ }^\circ\text{C}$ | MAX. | 2.7   |               |

1. for both polarities of A2 referenced to A1

2.  $t_p = 380\text{ }\mu\text{s}$ **Table 5. Thermal resistance**

| Symbol        | Parameter             |                                        | Value | Unit               |
|---------------|-----------------------|----------------------------------------|-------|--------------------|
| $R_{th(j-c)}$ | Junction to case (AC) | D <sup>2</sup> PAK / TO-220AB          | 1.4   | $^\circ\text{C/W}$ |
|               |                       | TO-220AB Ins                           | 3.3   |                    |
| $R_{th(j-a)}$ | Junction to ambient   | $S = 1\text{ cm}^2$ D <sup>2</sup> PAK | 45    |                    |
|               |                       | TO-220AB / TO-220AB Ins                | 60    |                    |

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

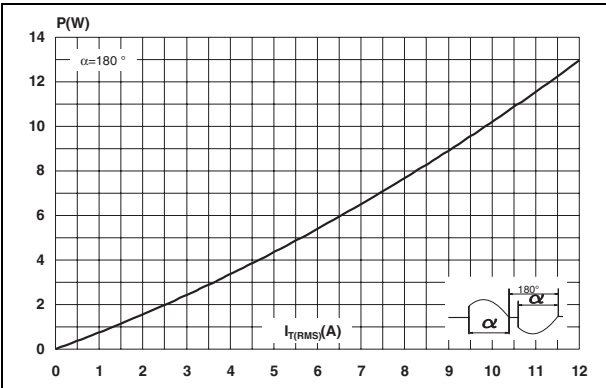


Figure 2. On-state rms current versus case temperature (full cycle)

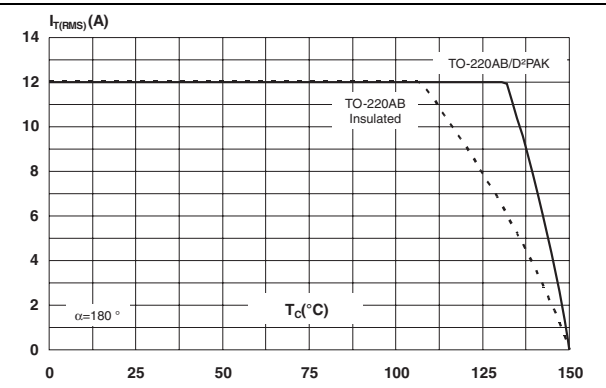


Figure 3. On-state rms current versus ambient temperature

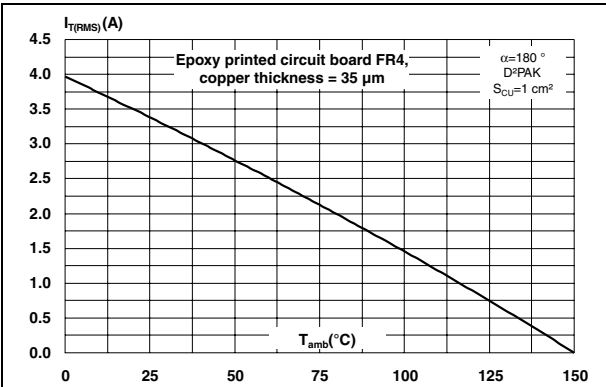


Figure 4. Variation of thermal impedance versus pulse duration

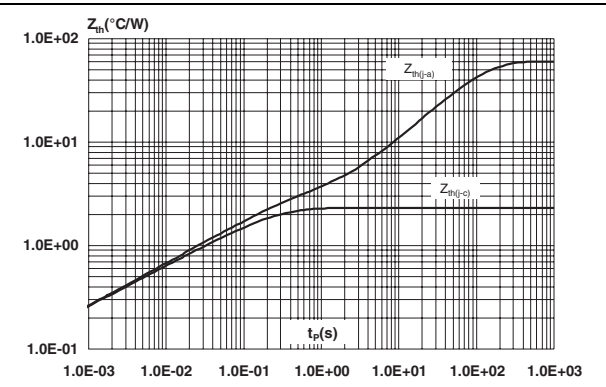


Figure 5. On-state characteristics (maximum values)

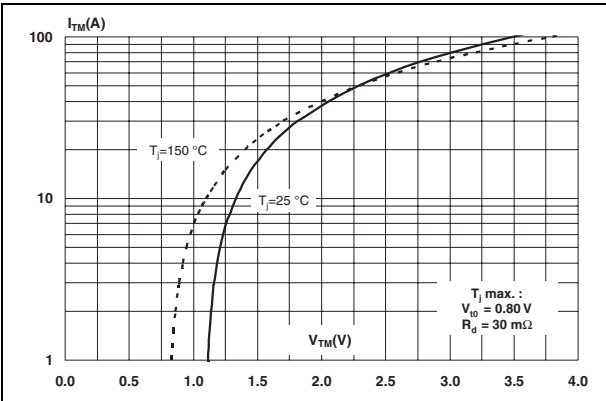
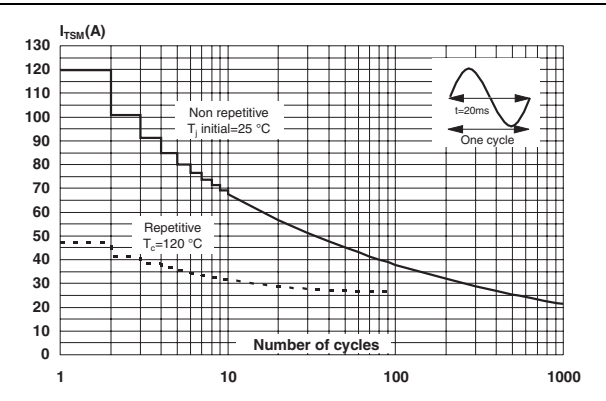
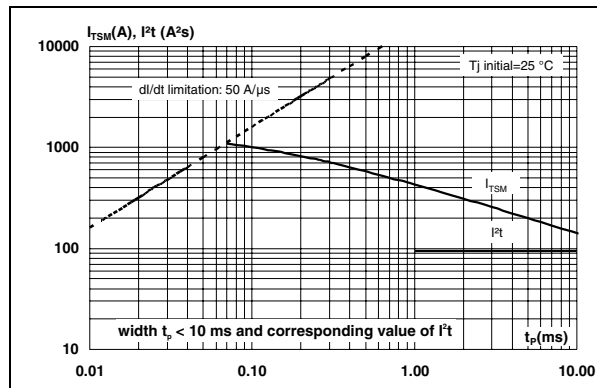


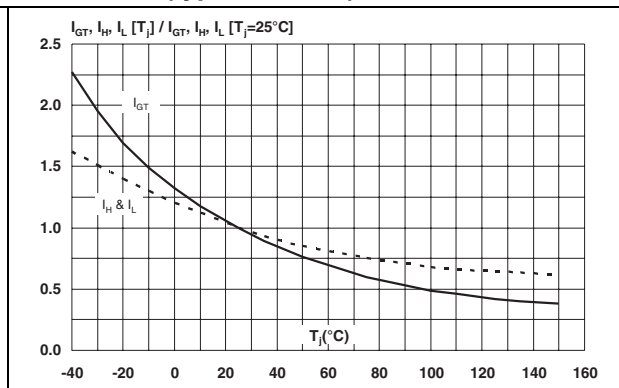
Figure 6. Surge peak on-state current versus number of cycles



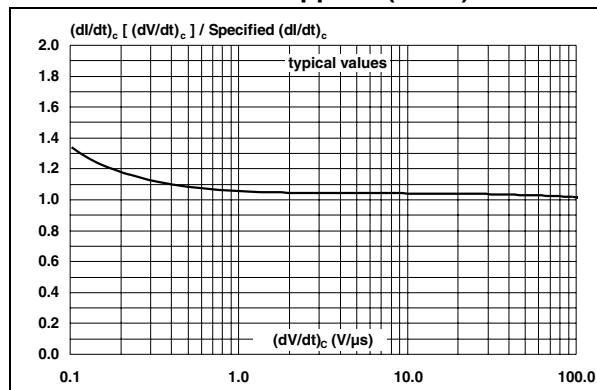
**Figure 7. Non-repetitive surge peak on-state current for a sinusoidal pulse with**



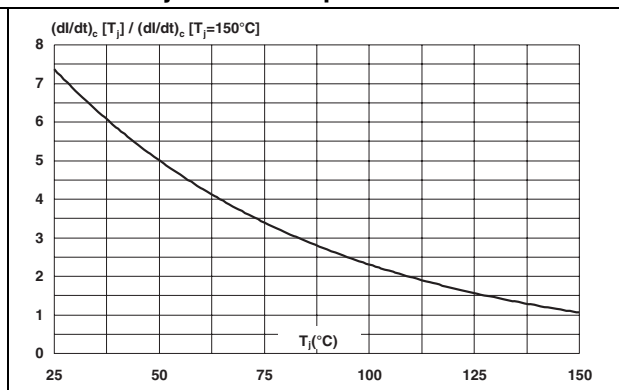
**Figure 8. Relative variation of  $I_{GT}, I_H, I_L$  vs junction temperature (typical values)**



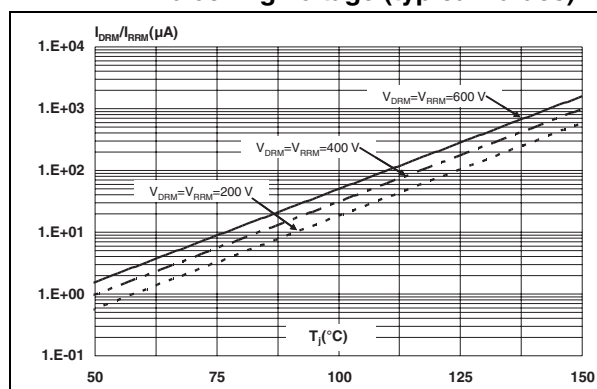
**Figure 9. Relative variation of critical rate of decrease of main current (dI/dt)\_c versus reappplied (dV/dt)\_c**



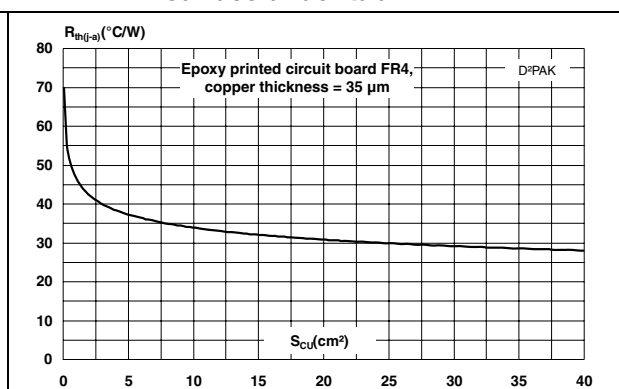
**Figure 10. Relative variation of critical rate of decrease of main current versus junction temperature**



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

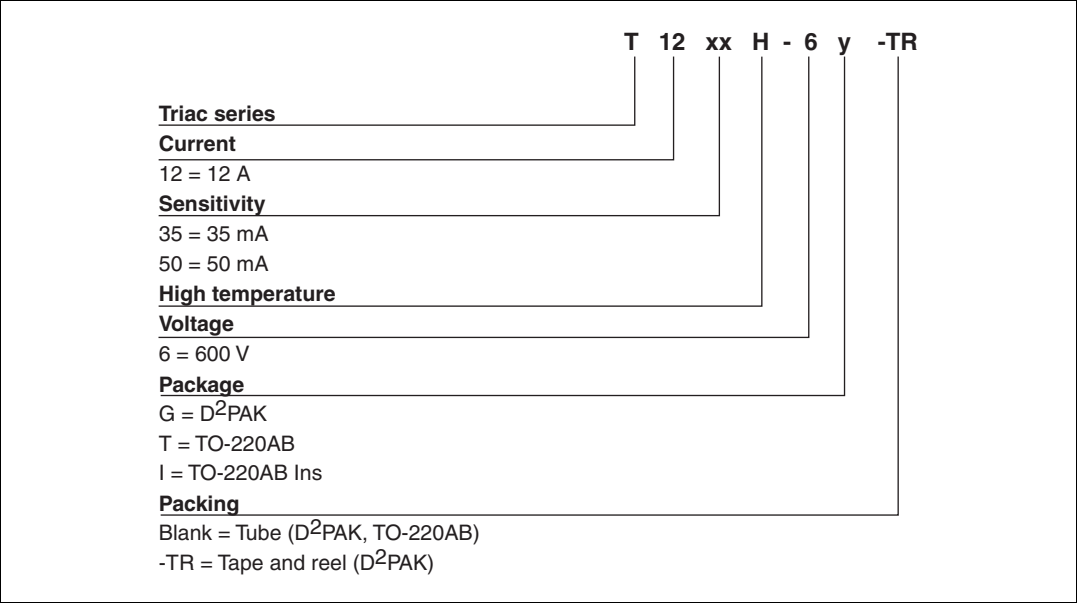


**Figure 12. Variation of thermal resistance junction to ambient versus copper surface under tab**



## 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)

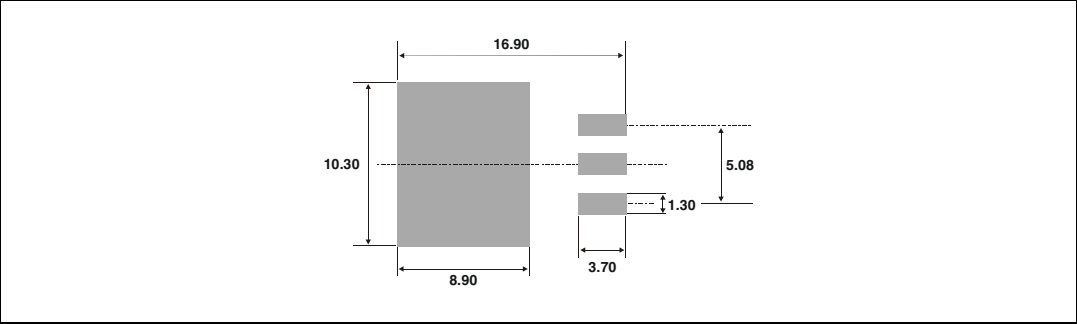


Table 7. TO-220AB and TO-220AB Ins dimensions

| 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 |
| 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 8. Ordering information**

| Order code   | Marking   | Package            | Weight | Base qty | Delivery mode |
|--------------|-----------|--------------------|--------|----------|---------------|
| T12xxH-6G    | T12xxH 6G | D <sup>2</sup> PAK | 1.5 g  | 50       | Tube          |
| T12xxH-6G-TR | T12xxH 6G | D <sup>2</sup> PAK | 1.5 g  | 1000     | Tape and reel |
| T12xxH-6T    | T12xxH 6T | TO-220AB           | 2.3 g  | 50       | Tube          |
| T12xxH-6I    | T12xxH 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: <a href="#">Features</a> , <a href="#">Description</a> and <a href="#">Figure 2</a> . |



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