



## T1635H Series

### Snubberless™ high temperature 16 A Triacs

#### Main features

| Symbol            | Value | Unit |
|-------------------|-------|------|
| $I_{T(RMS)}$      | 16    | A    |
| $V_{DRM}/V_{RRM}$ | 600   | V    |
| $I_{GT}(Q1)$      | 35    | mA   |

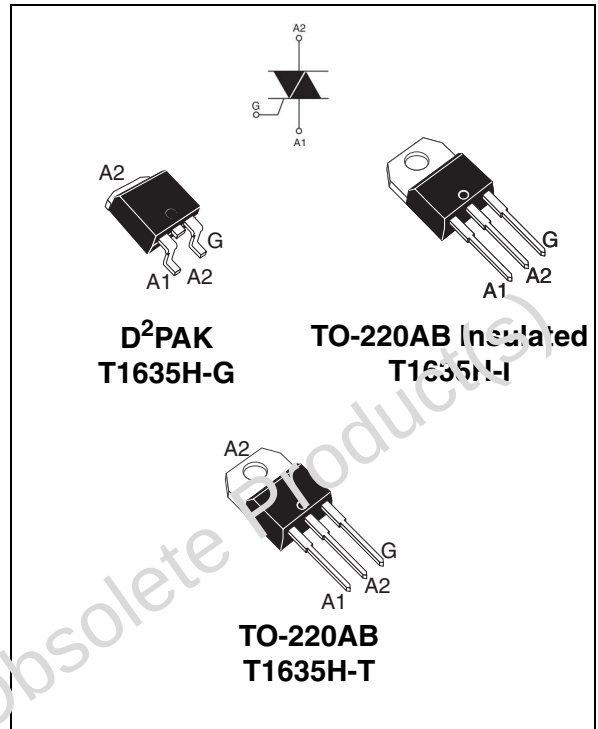
#### Description

Specifically designed to operate at 150° C, the new 16 A T1635H Triacs provide an enhanced performance in terms of power loss and thermal dissipation. This facilitates the optimization of heatsink dimensioning, leading to improved space and cost effectiveness when compared to electro-mechanical solutions.

Based on ST Snubberless™ technology, the T1635H series offers high commutation switching capabilities and high noise immunity levels on the full range of  $T_j$ .

The T1635H series facilitates the optimization of the control of universal motors and inductive loads found in appliances such as vacuum cleaners, and washing machines.

The T1635H Triacs are also suitable for use in high temperature environment found in hot appliances such as cookers, ovens, hobs, electric heaters, and coffee machines.



#### Order code

| Part number    | Marking     |
|----------------|-------------|
| T1635H-600G    | T1635H-600G |
| T1635H-600G-TR | T1635H-600G |
| T1635H-600TRG  | T1635H-600T |
| T1635H-600IRG  | T1635H-600I |

TM: Snubberless is a trademark of STMicroelectronics

# 1 Characteristics

**Table 1. Absolute maximum ratings**

| Symbol             | Parameter                                                                                                 |                                |                           | Value                      | Unit                   |
|--------------------|-----------------------------------------------------------------------------------------------------------|--------------------------------|---------------------------|----------------------------|------------------------|
| $I_{T(RMS)}$       | RMS on-state current (full sine wave)                                                                     | D <sup>2</sup> PAK<br>TO-220AB | $T_c = 130^\circ\text{C}$ | 16                         | A                      |
|                    |                                                                                                           | TO-220AB Ins                   | $T_c = 110^\circ\text{C}$ |                            |                        |
| $I_{TSM}$          | Non repetitive surge peak on-state current<br>(full cycle sine wave, $T_j$ initial = $25^\circ\text{C}$ ) | F = 60 Hz                      | $t = 16.7\text{ ms}$      | 170                        | A                      |
|                    |                                                                                                           | F = 50 Hz                      | $t = 20\text{ ms}$        | 160                        |                        |
| $I^2t$             | $I^2t$ Value for fusing                                                                                   | $tp = 10\text{ ms}$            |                           | 128                        | $\text{A}^2\text{s}$   |
| $di/dt$            | Critical rate of rise of on-state current<br>$I_G = 2 \times I_{GT}$ , $tr \leq 100\text{ ns}$            | F = 120 Hz                     | $T_j = 150^\circ\text{C}$ | 50                         | $\text{A}/\mu\text{s}$ |
| $V_{DSM}/V_{RSM}$  | Non repetitive surge peak off state voltage                                                               |                                | $T_j = 25^\circ\text{C}$  | 700                        | V                      |
| $I_{GM}$           | Peak gate current                                                                                         | $t_p = 20\text{ }\mu\text{s}$  | $T_j = 150^\circ\text{C}$ | 4                          | A                      |
| $P_{G(AV)}$        | Average gate power dissipation                                                                            |                                | $T_j = 150^\circ\text{C}$ | 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 2. Electrical characteristics ( $T_j = 25^\circ\text{C}$ , unless otherwise specified)**

| Symbol            | Test conditions                                             | Quadrant |     | Value | Unit                   |
|-------------------|-------------------------------------------------------------|----------|-----|-------|------------------------|
| $I_{GT}^{(1)}$    | $V_D = 12\text{ V}$ , $R_L = 33\text{ }\Omega$              | II - III | MAX | 35    | mA                     |
| $V_{GT}$          |                                                             | II - III | MAX | 1.3   | V                      |
| $V_{GD}$          | $V_D = V_{DRM}$ , $R_L = 3.3\text{ k}\Omega$                | II - III | MIN | 0.15  | V                      |
| $I_H^{(2)}$       | $I_T = 100\text{ mA}$                                       |          | MAX | 35    | mA                     |
| $I_L$             | $I_G = 1.2 \times I_{GT}$                                   | I - III  | MAX | 50    | mA                     |
|                   |                                                             | II       |     | 80    |                        |
| $dV/dt^{(2)}$     | $V_D = 67\% V_{DRM}$ , gate open, $T_j = 150^\circ\text{C}$ |          | MIN | 300   | $\text{V}/\mu\text{s}$ |
| $(di/dt)_c^{(2)}$ | Without snubber, $T_j = 150^\circ\text{C}$                  |          | MIN | 7.1   | $\text{A}/\text{ms}$   |

1. minimum  $I_{GT}$  is guaranteed at 5% of  $I_{GT}$  max

2. for both polarities of A2 referenced to A1

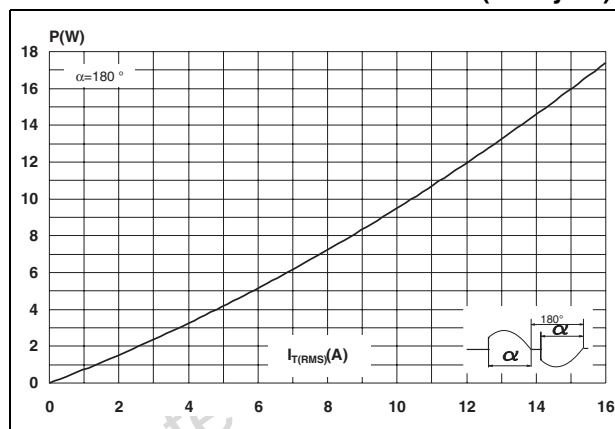
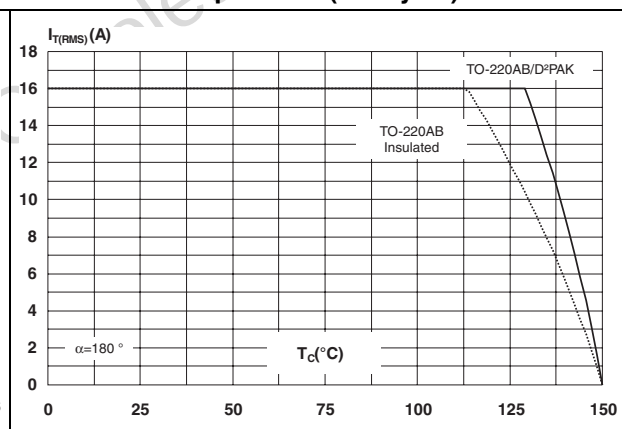
**Table 3. Static electrical characteristics**

| Symbol                 | Test conditions                                           |                            |     | Value | Unit          |
|------------------------|-----------------------------------------------------------|----------------------------|-----|-------|---------------|
| $V_{TM}^{(1)}$         | $I_{TM} = 22.5\text{ A}$ , $t_p = 380\text{ }\mu\text{s}$ | $T_J = 25^\circ\text{ C}$  | MAX | 1.5   | V             |
| $V_{TO}^{(1)}$         |                                                           | $T_J = 150^\circ\text{ C}$ | MAX | 0.80  | V             |
| $R_D^{(1)}$            |                                                           | $T_J = 150^\circ\text{ C}$ | MAX | 23    | m $\Omega$    |
| $I_{DRM}$<br>$I_{RRM}$ | $V_{DRM} = V_{RRM}$                                       | $T_J = 25^\circ\text{ C}$  | MAX | 5     | $\mu\text{A}$ |
|                        |                                                           | $T_J = 150^\circ\text{ C}$ |     | 6.4   | mA            |
|                        | $V_D/V_R = 400\text{ V}$ (at peak mains voltage)          | $T_J = 150^\circ\text{ C}$ |     | 4.2   |               |

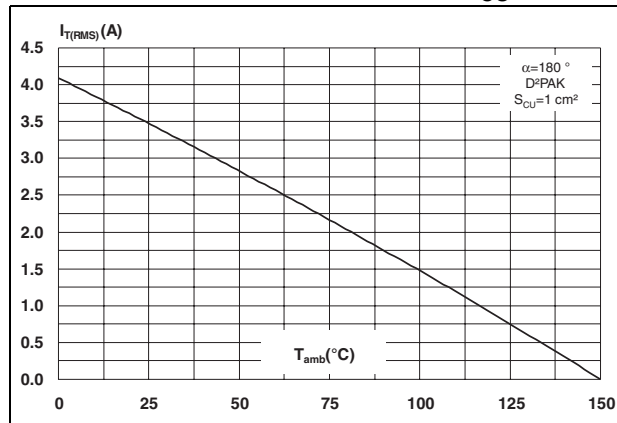
1. for both polarities of A2 referenced to A1

**Table 4. Thermal resistance**

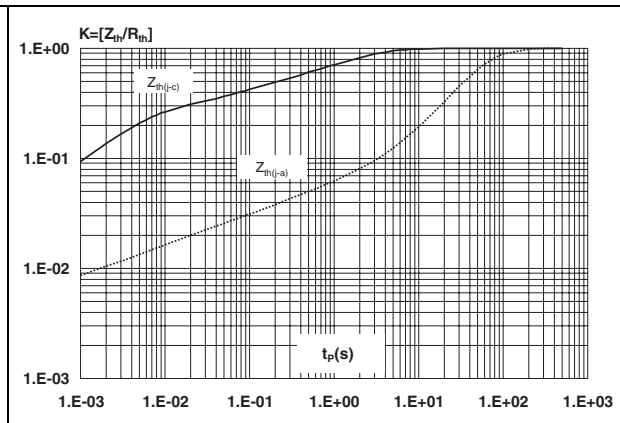
| Symbol        | Parameter             |                                             | Value | Unit               |
|---------------|-----------------------|---------------------------------------------|-------|--------------------|
| $R_{th(j-c)}$ | Junction to case (AC) | D <sup>2</sup> PAK<br>TO-220AB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

**Figure 1. Maximum power dissipation vs RMS on-state current (full cycle)****Figure 2. RMS on-state current vs case temperature (full cycle)**

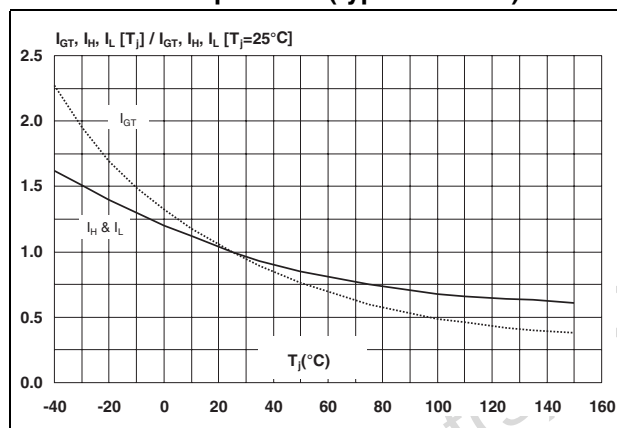
**Figure 3. RMS on-state current vs ambient temperature, PCB FR4,  $e_{CU} = 35 \mu m$**



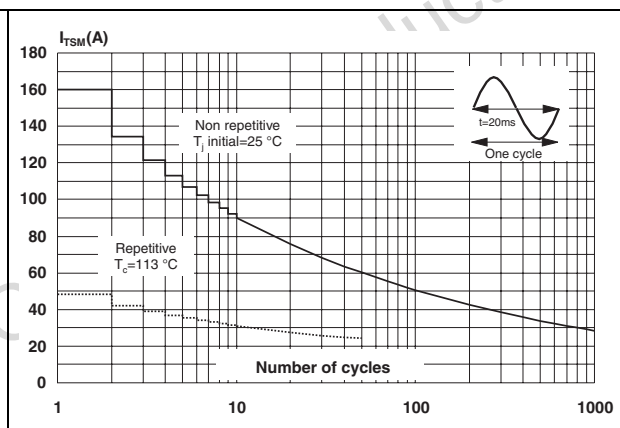
**Figure 4. Relative variation of thermal impedance vs pulse duration**



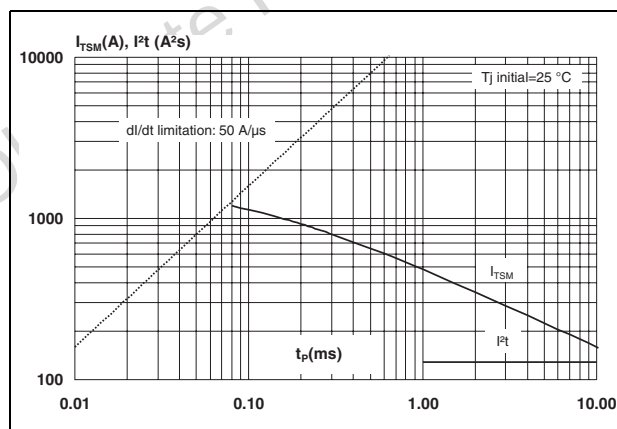
**Figure 5. Relative variation of gate trigger current, holding current and latching current vs junction temperature (typical values)**



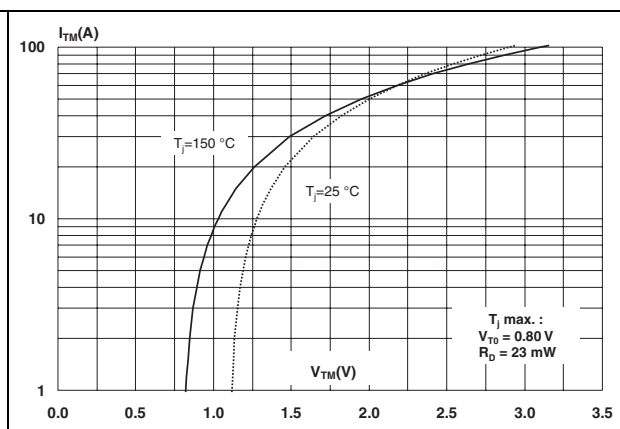
**Figure 6. Surge peak on-state current vs number of cycles**



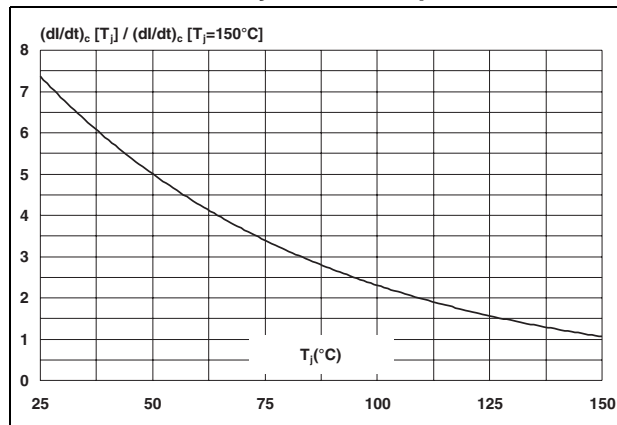
**Figure 7. Non repetitive surge peak on-state current (sinusoidal pulse width  $t_p < 10 \text{ ms}$ ) and corresponding value of  $I^2t$**



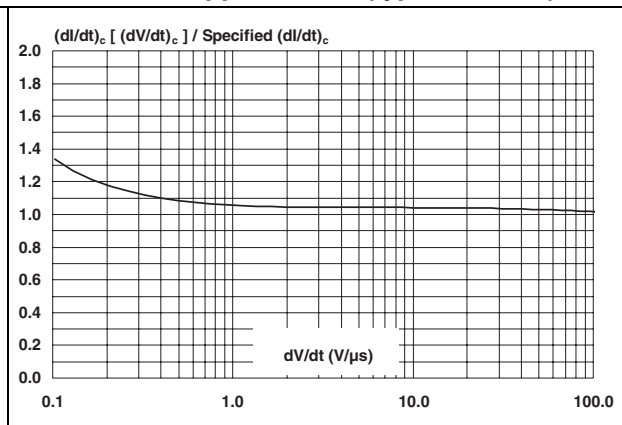
**Figure 8. On-state characteristics (maximum values)**



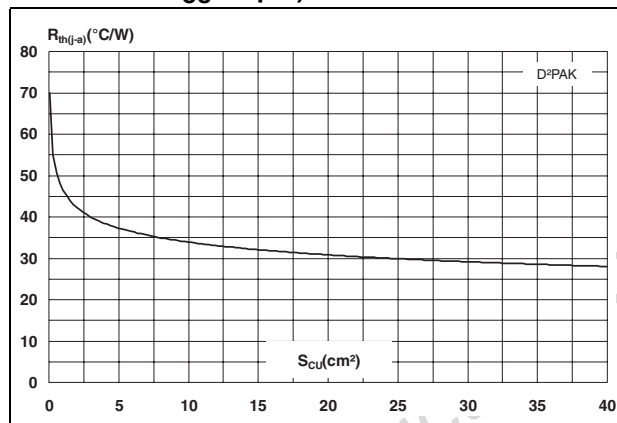
**Figure 9. Relative variation of critical rate of decrease of main current  $(di/dt)_c$  versus junction temperature**



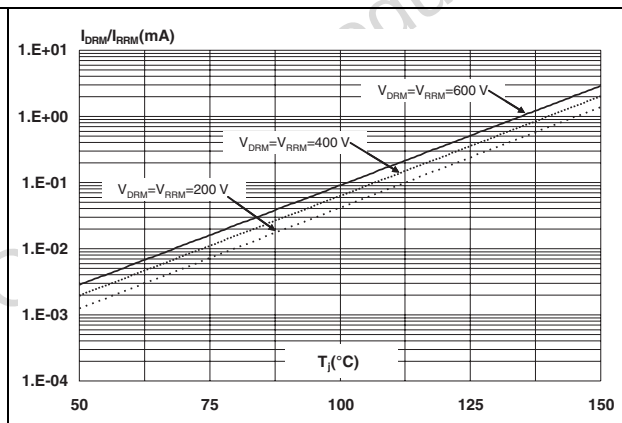
**Figure 10. Relative variation of critical rate of decrease of main current  $(di/dt)_c$  vs reappplied  $dV/dt$  (typical values)**



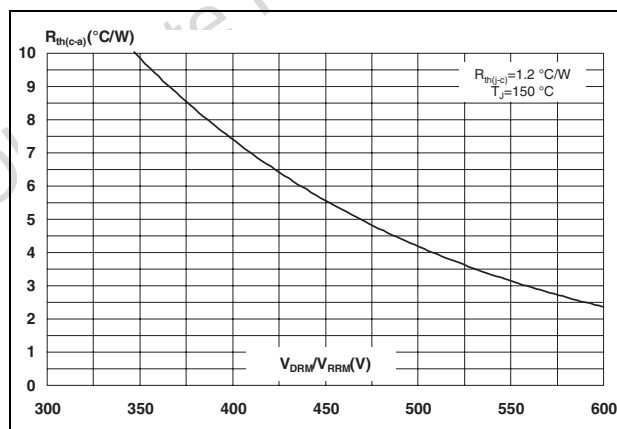
**Figure 11. Variation of thermal resistance, junction to ambient versus copper surface under tab (PCB FR4,  $e_{Cu}$  35 μm)**



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



**Figure 13. Acceptable repetitive peak off-state voltage versus case-ambient thermal resistance**



2      Ordering information scheme

|                                                                                                                              |   |    |    |   |   |     |   |       |
|------------------------------------------------------------------------------------------------------------------------------|---|----|----|---|---|-----|---|-------|
|                                                                                                                              | T | 16 | 35 | H | - | 600 | I | (-TR) |
| <b>Triac series</b>                                                                                                          |   |    |    |   |   |     |   |       |
| <b>Current</b><br>16 = 16 A                                                                                                  |   |    |    |   |   |     |   |       |
| <b>Sensitivity</b><br>35 = 35 mA                                                                                             |   |    |    |   |   |     |   |       |
| <b>High temperature</b>                                                                                                      |   |    |    |   |   |     |   |       |
| <b>Voltage</b><br>600 = 600 V                                                                                                |   |    |    |   |   |     |   |       |
| <b>Package</b><br>G = D <sup>2</sup> PAK<br>I = TO-220AB Ins<br>T = TO-220AB                                                 |   |    |    |   |   |     |   |       |
| <b>Packing mode</b><br>Blank = Tube (D <sup>2</sup> PAK)<br>-TR = Tape and reel (D <sup>2</sup> PAK)<br>RG = Tube (TO-220AB) |   |    |    |   |   |     |   |       |

### 3 Package information

Table 5. TO-220AB and 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 |       |

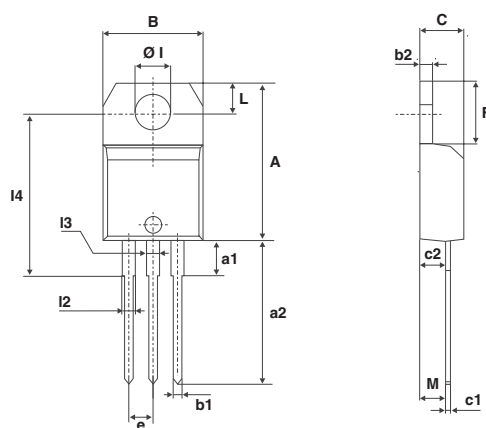
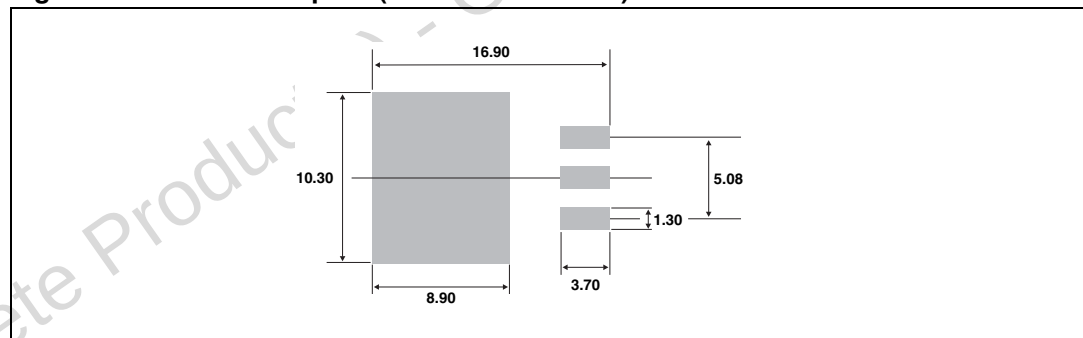


Table 6. D<sup>2</sup>PAK Mechanical data

| REF. | DIMENSIONS  |       |            |       |
|------|-------------|-------|------------|-------|
|      | Millimeters |       | Inches     |       |
|      | Min.        | Max.  | Min.       | Max.  |
| A    | 4.40        | 4.60  | 0.173      | 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   | 1.14        | 1.70  | 0.045      | 0.067 |
| C    | 0.45        | 0.60  | 0.017      | 0.024 |
| C2   | 1.23        | 1.36  | 0.048      | 0.054 |
| D    | 8.95        | 9.35  | 0.352      | 0.368 |
| E    | 10.00       | 10.40 | 0.393      | 0.409 |
| 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 |
| M    | 2.40        | 3.20  | 0.094      | 0.126 |
| R    | 0.40 typ.   |       | 0.016 typ. |       |
| V2   | 0°          | 8°    | 0°         | 8°    |

Figure 14. D<sup>2</sup>PAK Footprint (dimensions in mm)

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: [www.st.com](http://www.st.com).

## 4 Ordering information

| Part number    | Marking     | Package            | Weight | Base Qty | Packing mode  |
|----------------|-------------|--------------------|--------|----------|---------------|
| T1635H-600G    | T1635H-600G | D <sup>2</sup> PAK | 1.5 g  | 50       | Tube          |
| T1635H-600G-TR | T1635H-600G | D <sup>2</sup> PAK | 1.5 g  | 1000     | Tape and Reel |
| T1635H-600TRG  | T1635H-600T | TO-220AB           | 2.3 g  | 50       | Tube          |
| T1635H-600IRG  | T1635H-600I | TO-220AB Ins       | 2.3 g  | 50       | Tube          |

## 5 Revision history

| Date        | Revision | Changes         |
|-------------|----------|-----------------|
| 31-Aug-2006 | 1        | Initial release |

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