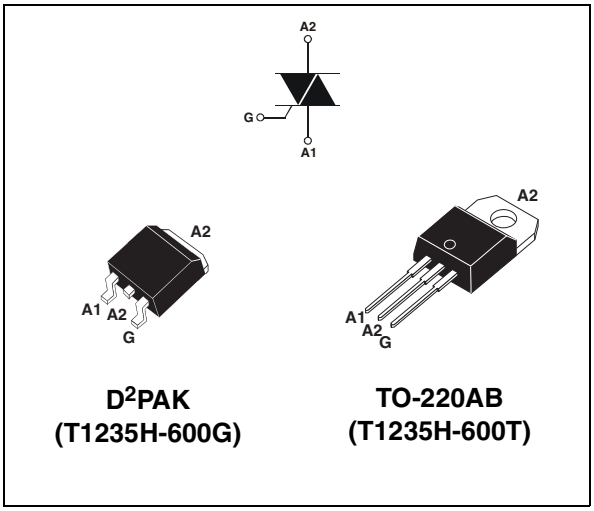
# T1235H

## 12A TRIACs

**SNUBBERLESS™ HIGH TEMPERATURE**

**Table 1: Main Features**

| Symbol | Value | Unit |
|---|---|---|
| $I_{T(RMS)}$ | 12 | A |
| $V_{DRM}/V_{RRM}$ | 600 | V |
| $I_{GT\ (Q_1)}$ | 35 | mA |




**D²PAK (T1235H-600G)** **TO-220AB (T1235H-600T)**

### DESCRIPTION

Specifically designed for use in high temperature environment (found in hot appliances such as cookers, ovens, hobs, electric heaters, coffee machines...), the new 12 Amps **T1235H** triacs provide an enhanced performance in terms of power loss and thermal dissipation. This allows for optimization of the heatsinking dimensioning, leading to space and cost effectivness when compared to electro-mechnical solutions.

Based on ST snubberless technology, they offer high commutation switching capabilities and high noise immunity levels. And, thanks to their clip assembly technique, they provide a superior performance in surge current handling.

**Table 2: Order Codes**

| Part Number | Marking |
|---|---|
| T1235H-600G | T1235H600G |
| T1235H-600G-TR | T1235H600G |
| T1235H-600TRG | T1235H600T |

**Table 3: Absolute Maximum Ratings**

| Symbol | Parameter | | | Value | Unit |
|---|---|---|---|---|---|
| $I_{T(RMS)}$ | RMS on-state current (full sine wave) | | $T_c$ = 135°C | 12 | A |
| $I_{TSM}$ | Non repetitive surge peak on-state current (full cycle, $T_j$ initial = 25°C) | F = 50 Hz | t = 20 ms | 140 | A |
| | | F = 60 Hz | t = 16.7 ms | 145 | |
| $I^2t$ | $I^2t$ Value for fusing | $t_p$ = 10 ms | | 112 | $A^2s$ |
| dI/dt | Critical rate of rise of on-state current $I_G$ = 2 x $I_{GT}$ , $t_r \leq$ 100 ns | F = 120 Hz | $T_j$ = 150°C | 50 | A/µs |
| $V_{DSM}/V_{RSM}$ | Non repetitive surge peak off-state voltage | $t_p$ = 10 ms | $T_j$ = 25°C | 700 | V |
| $I_{GM}$ | Peak gate current | $t_p$ = 20 µs | $T_j$ = 150°C | 4 | A |
| $P_{G(AV)}$ | Average gate power dissipation | | $T_j$ = 150°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 |

**Tables 4: Electrical Characteristics** ($T_j$ = 25°C, unless otherwise specified)

| Symbol | Test Conditions | Quadrant | | Value | Unit |
|---|---|---|---|---|---|
| $I_{GT}$ (1) | $V_D$ = 12 V $R_L$ = 33 Ω | I - II - III | MAX. | 35 | mA |
| $V_{GT}$ | | I - II - III | MAX. | 1.3 | V |
| $V_{GD}$ | $V_D = V_{DRM}$ $R_L$ = 3.3 kΩ $T_j$ = 150°C | I - II - III | MIN. | 0.15 | V |
| $I_H$ (2) | $I_T$ = 100 mA | | MAX. | 35 | mA |
| $I_L$ | $I_G = 1.2\ I_{GT}$ | I - III | MAX. | 50 | mA |
| | | II | | 80 | |
| dV/dt (2) | $V_D$ = 67 %$V_{DRM}$ gate open $T_j$ = 150°C | | MIN. | 300 | V/µs |
| (dI/dt)c (2) | Without snubber $T_j$ = 150°C | | MIN. | 5.3 | A/ms |

**Table 5: Static Characteristics**

| Symbol | Test Conditions | | | Value | Unit |
|---|---|---|---|---|---|
| $V_T$ (2) | $I_{TM}$ = 17 A $t_p$ = 380 µs | $T_j$ = 25°C | MAX. | 1.55 | V |
| $V_{to}$ (2) | Threshold voltage | $T_j$ = 150°C | MAX. | 0.80 | V |
| $R_d$ (2) | Dynamic resistance | $T_j$ = 150°C | MAX. | 25 | mΩ |
| $I_{DRM}$ $I_{RRM}$ | $V_{DRM} = V_{RRM}$ | $T_j$ = 25°C | MAX. | 5 | µA |
| | | $T_j$ = 150°C | | 5.5 | mA |
| | $V_{DRM}/V_{RRM}$ = 400V (at mains peak voltage) | $T_j$ = 150°C | | 3.5 | |

**Note 1:** minimum $I_{GT}$ is guaranted at 10% of $I_{GT}$ max.

**Note 2:** for both polarities of A2 referenced to A1.

**Table 6: Thermal resistance**

| Symbol | Parameter | | | Value | Unit |
|---|---|---|---|---|---|
| $R_{th(j-c)}$ | Junction to case (AC) | | $D^2PAK$ | 1.2 | °C/W |
| | | | TO-220AB | | |
| $R_{th(j-a)}$ | Junction to ambient | S = 1 $cm^2$ | $D^2PAK$ | 45 | °C/W |
| | | | TO-220AB | 60 | |

S = Copper surface under tab.

**Figure 1: Maximum power dissipation versus RMS on-state current (full cycle)**

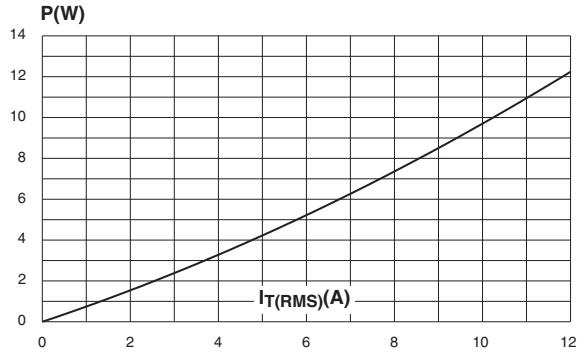



**Figure 2: RMS on-state current versus case temperature (full cycle)**

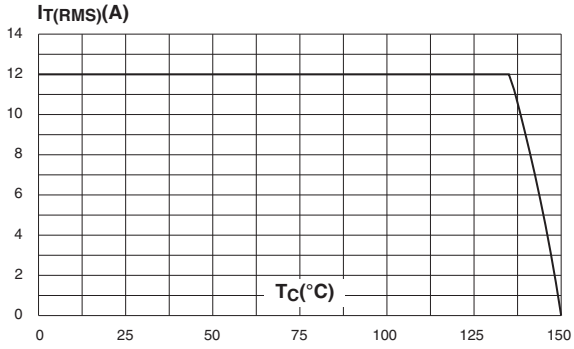



**Figure 3: RMS on-state current versus ambient temperature (printed circuit board FR4, copper thickness: 35µm) (full cycle)**

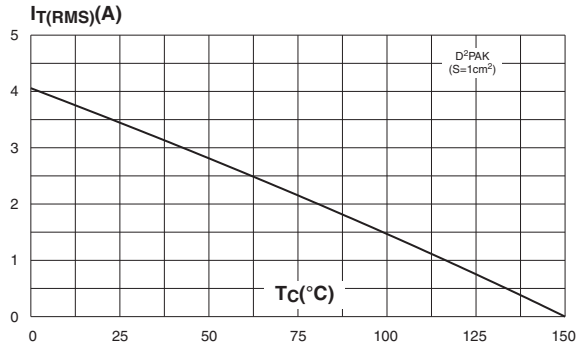



**Figure 4: Relative variation of thermal impedance versus pulse duration**

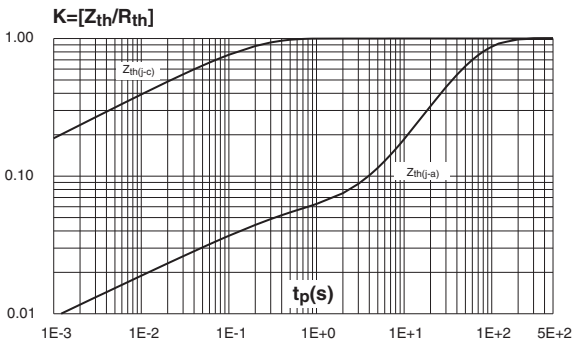



**Figure 5: On-state characteristics (maximum values)**

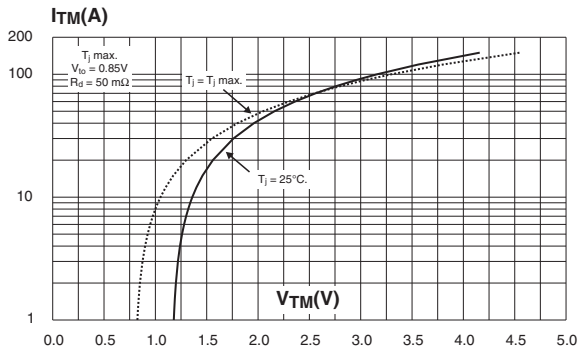



**Figure 6: Surge peak on-state current versus number of cycles**

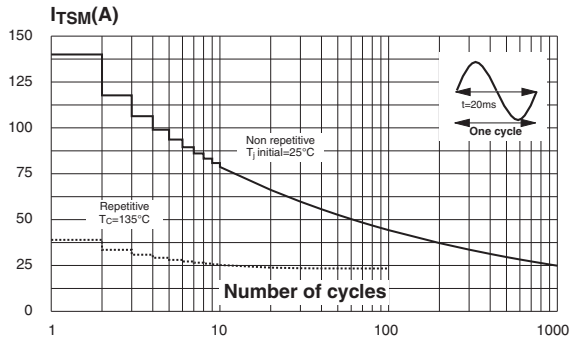


**Figure 7: Non-repetitive surge peak on-state current for a sinusoidal pulse with width $t_p < 10$ ms and corresponding value of $I^2t$**

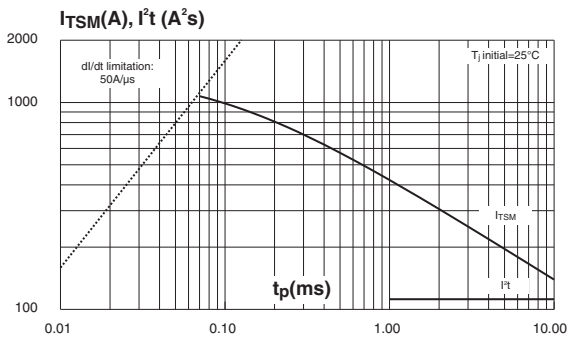



**Figure 8: Relative variation of gate trigger current, holding current and latching current versus junction temperature (typical values)**

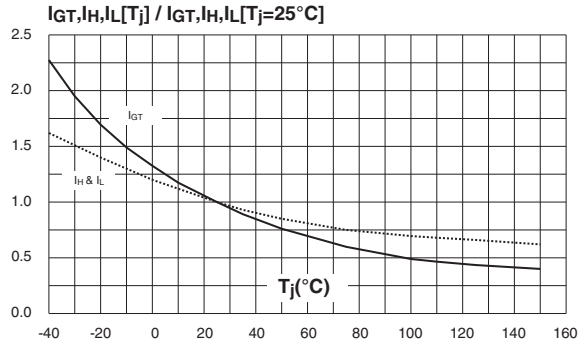



**Figure 9: Relative variation of critical rate of decrease of main current versus (dV/dt)c (typical values)**

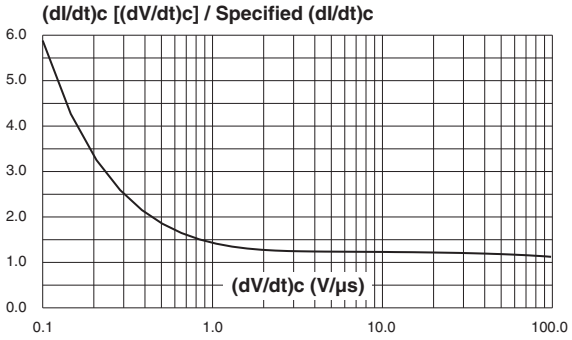



**Figure 10: Relative variation of critical rate of decrease of main current versus junction temperature**

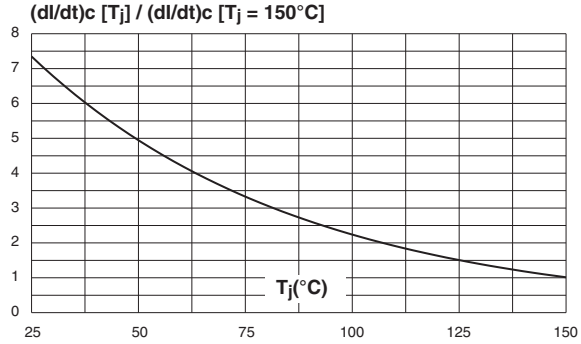



**Figure 11: Leakage current versus junction temperature for different values of blocking voltage (typical values)**

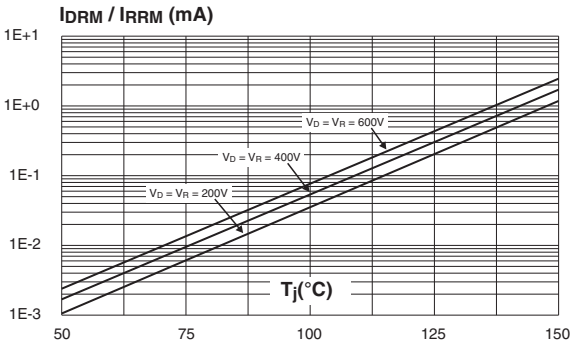



**Figure 12: Acceptable repetitive peak off-state voltage versus case-ambient thermal resistance**

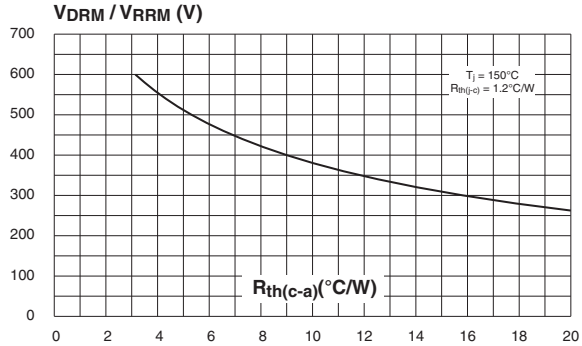


**Figure 13: D²PAK Thermal resistance junction to ambient versus copper surface under tab (printed circuit board FR4, copper thickness: 35 µm)**

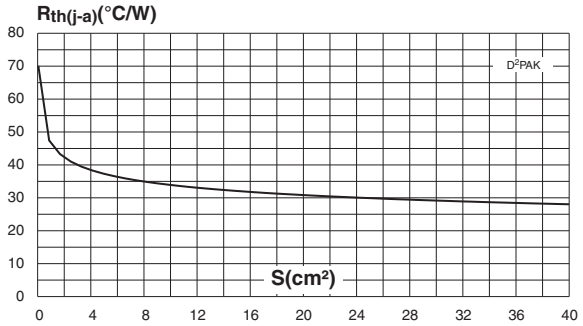



**Figure 14: Ordering Information Scheme**

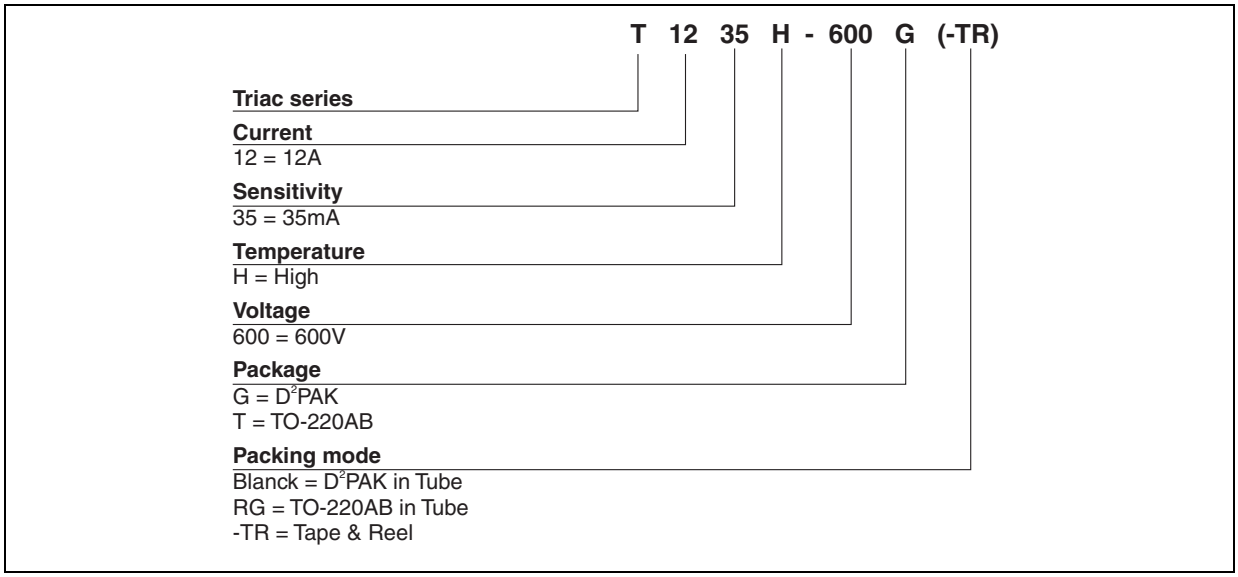
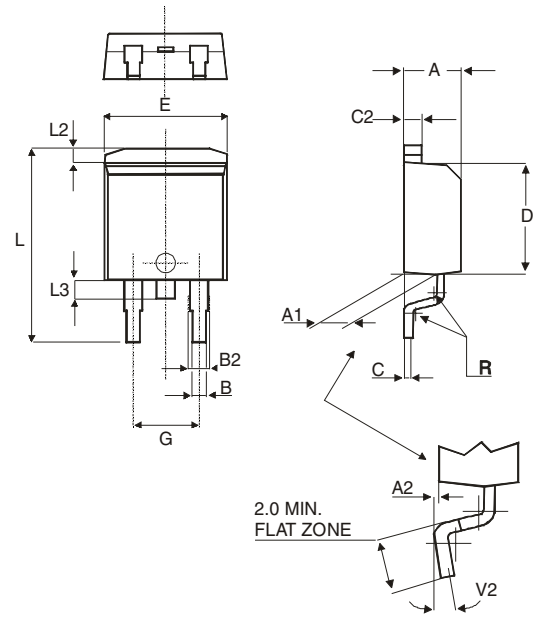



**Table 7: Product Selector**

| Part Numbers | Voltage | Sensitivity | Type | Package |
|---|---|---|---|---|
| T1235H-600G | 600 V | 35 mA | Snubberless | D²PAK |
| T1235H-600T | 600 V | 35 mA | Snubberless | TO-220AB |

**Figure 15: D²PAK Package Mechanical Data**




| 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 16: D²PAK Foot Print Dimensions**
(in millimeters)

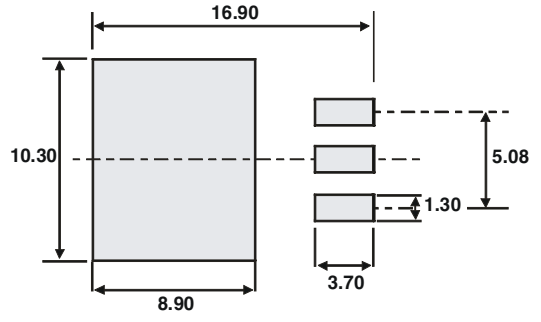
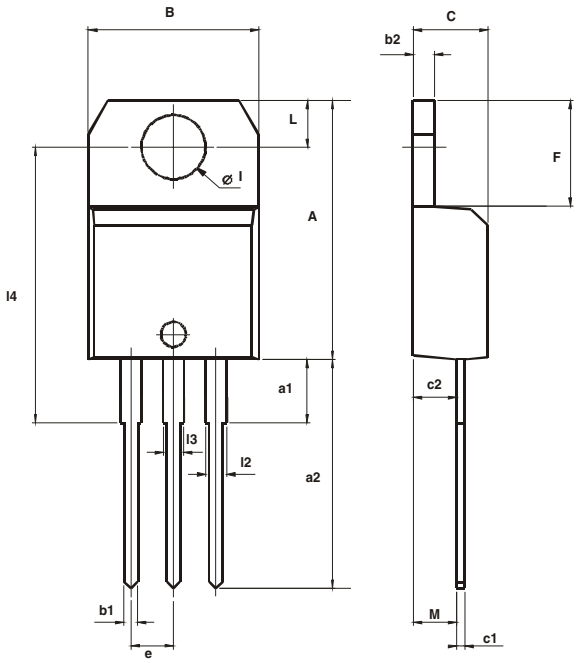


**Figure 17: TO-220AB and TO-220AB Insulated Package Mechanical Data**




| 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 |
| I | 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 | |

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.

**Table 8: Ordering Information**

| Ordering type | Marking | Package | Weight | Base qty | Delivery mode |
|---|---|---|---|---|---|
| T1235H-600TRG | T1235H600T | TO-220AB | 2.3 g | 50 | Tube |
| T1235H-600G | T1235H600G | $D^2PAK$ | 1.5 g | 50 | Tube |
| T1235H-600G-TR | T1235H600G | | | 1000 | Tape & reel |

**Table 9: Revision History**

| Date | Revision | Description of Changes |
|---|---|---|
| Apr-2002 | 5A | Last update. |
| 13-Feb-2006 | 6 | TO-220AB delivery mode changed from bulk to tube.<br>ECOPACK statement added. |