

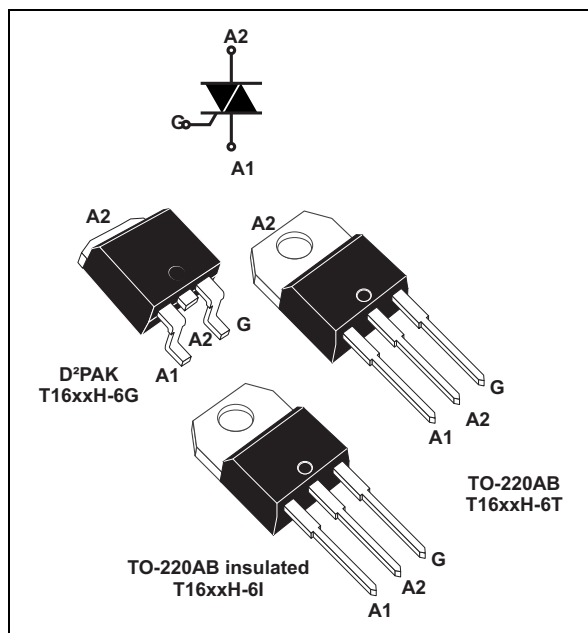


THE DATASHEET OF T1650H-6I



High temperature 16 A Snubberless™ Triacs

Datasheet - production data



Features

- Medium current Triac
- 150 °C max. T_j turn-off commutation
- Low thermal resistance with clip bonding
- Very high 3 quadrants 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 16 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 T1635H and T1650H Triac series are suitable for general purpose mains power ac switching.

By using an internal ceramic pad, the T16xxH-6I provides voltage insulation (rated at 2500 V rms).

Table 1. Device summary

Symbol	Value	Unit
$I_{T(RMS)}$	16	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 ² PAK, TO-220AB	$T_c = 130\text{ }^{\circ}\text{C}$	16	A
		TO-220AB Ins	$T_c = 113\text{ }^{\circ}\text{C}$		
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	160	A
		F = 60 Hz	t = 16.7 ms	168	
I^2t	I^2t Value for fusing	$t_p = 10\text{ ms}$		169	A ² 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	$T_j = 150\text{ }^{\circ}\text{C}$	50	A/ μ 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} T_j	Storage junction temperature range Operating junction temperature range			- 40 to + 150 - 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
				T1635H	T1650H	
$I_{GT}^{(1)}$	$V_D = 12\text{ V}$, $R_L = 33\text{ }\Omega$	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 ⁽²⁾	$V_D = 67\%\text{ }V_{DRM}$, gate open, $T_j = 150\text{ }^{\circ}\text{C}$		MIN.	1000	1500	V/ μ s
(dI/dt) _c ⁽²⁾	Without snubber, $T_j = 150\text{ }^{\circ}\text{C}$		MIN.	21	28	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
$V_T^{(1)}$	$I_{TM} = 23\text{ A}$, $t_p = 380\text{ }\mu\text{s}$	$T_j = 25\text{ }^\circ\text{C}$	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.	23	m Ω
I_{DRM} $I_{RRM}^{(2)}$	$V_{DRM} = V_{RRM}$	$T_j = 25\text{ }^\circ\text{C}$	MAX.	5	μA
		$T_j = 150\text{ }^\circ\text{C}$	MAX.	4.1	mA
	$V_D/V_R = 400\text{ V}$ (at peak mains voltage)	$T_j = 150\text{ }^\circ\text{C}$	MAX.	3.5	
	$V_D/V_R = 200\text{ V}$ (at peak mains voltage)	$T_j = 150\text{ }^\circ\text{C}$	MAX.	3.0	

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 ² PAK / TO-220AB	1.15	$^\circ\text{C/W}$
		TO-220AB Ins	2.1	
$R_{th(j-a)}$	Junction to ambient	$S = 1\text{ cm}^2$ D ² PAK	45	
		TO-220AB / TO-220AB Ins	60	

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

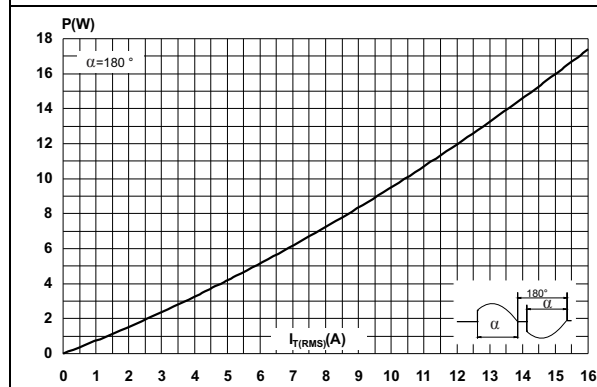


Figure 2. On-state rms current versus case temperature (full cycle)

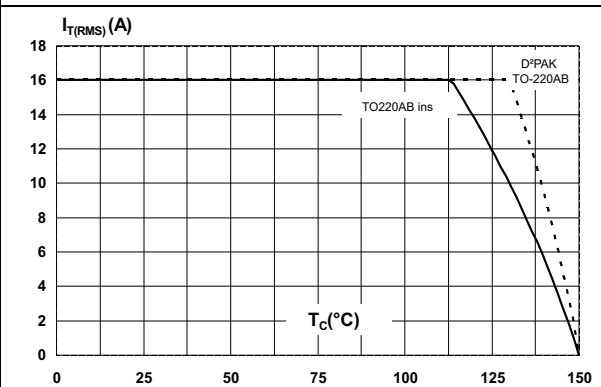


Figure 3. On-state rms current versus ambient temperature

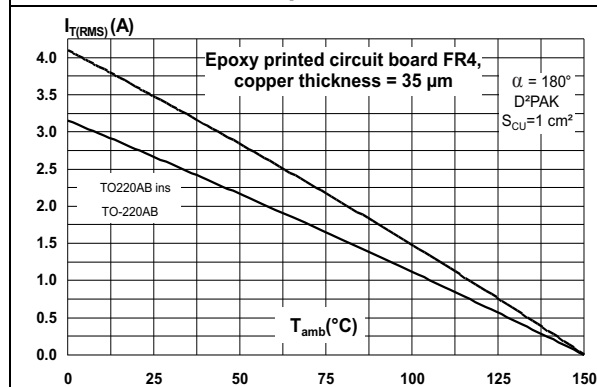


Figure 4. Relative variation of thermal impedance versus pulse duration

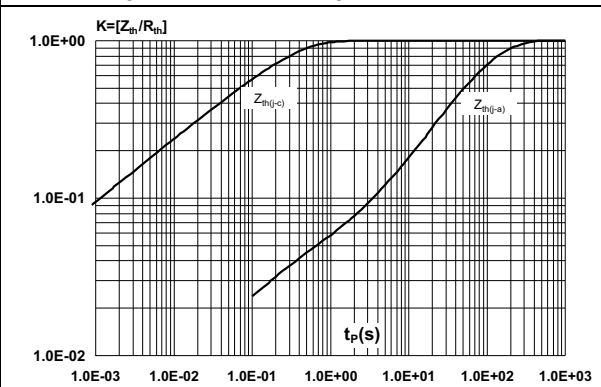


Figure 5. On-state characteristics (maximum values)

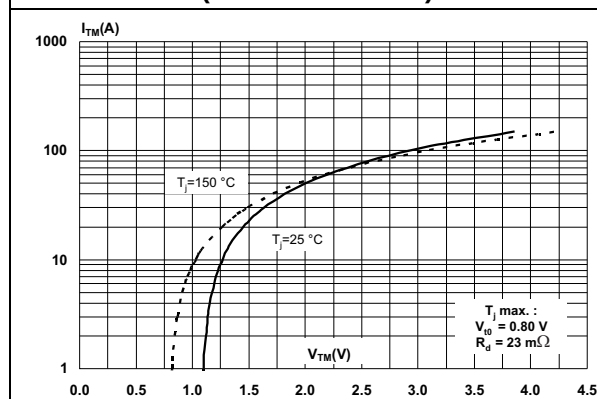


Figure 6. Surge peak on-state current versus number of cycles

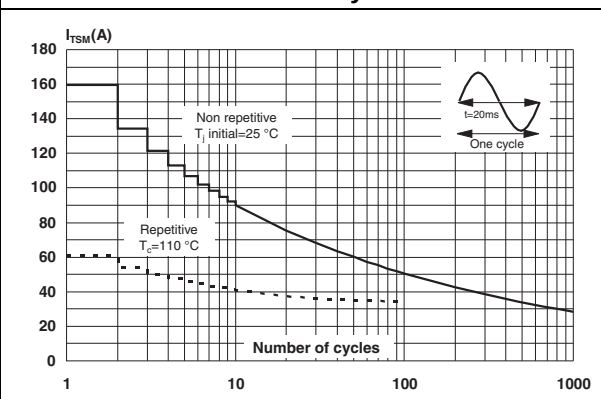
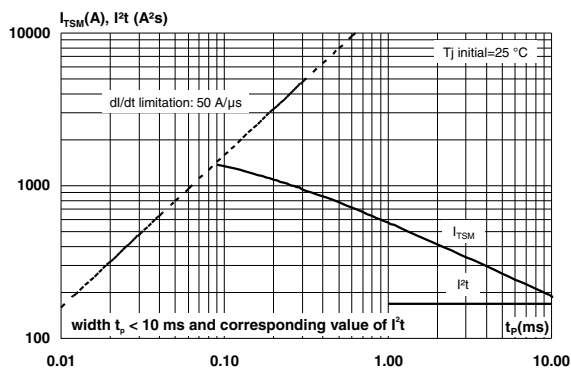
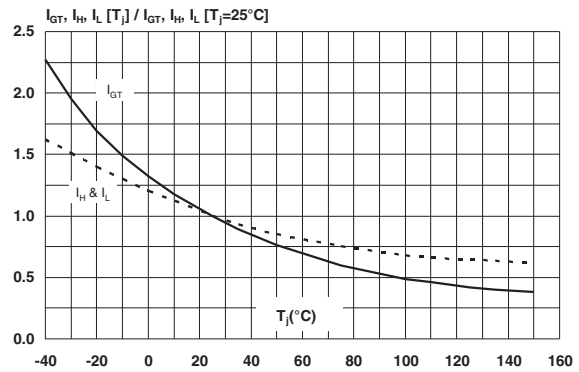
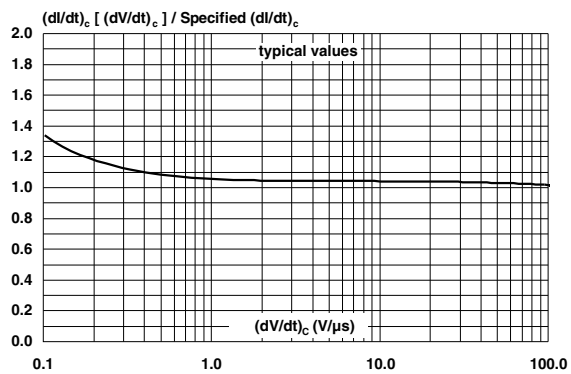
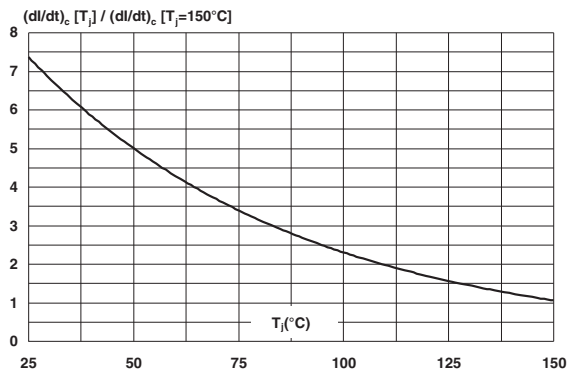
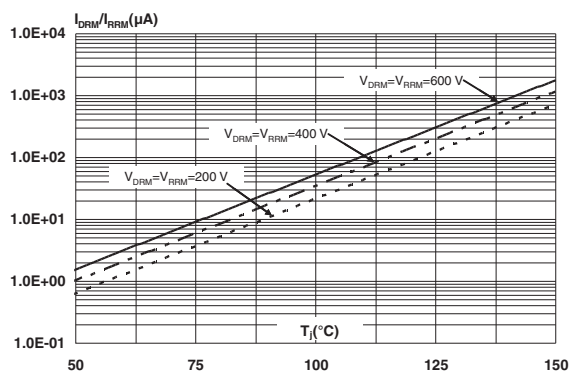
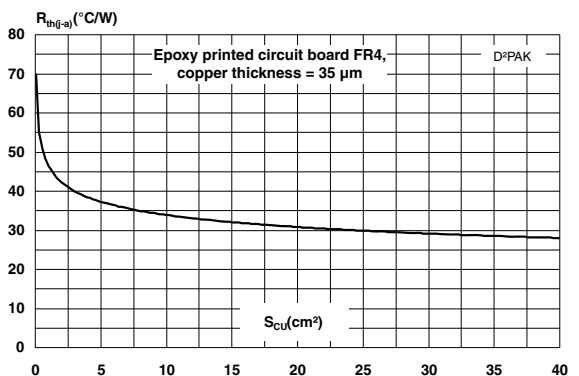


Figure 7. Non-repetitive surge peak on-state current for a sinusoidal pulse**Figure 8. Relative variation of I_{GT} , I_H , I_L vs junction temperature (typical values)****Figure 9. Relative variation of critical rate of decrease of main current $(dl/dt)_c$ versus reappied $(dV/dt)_c$** **Figure 10. 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 Package information

- Epoxy meets UL94, V0
- Lead-free package
- 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. ECOPACK[®] is an ST trademark.

Figure 13. TO-220AB dimension definitions

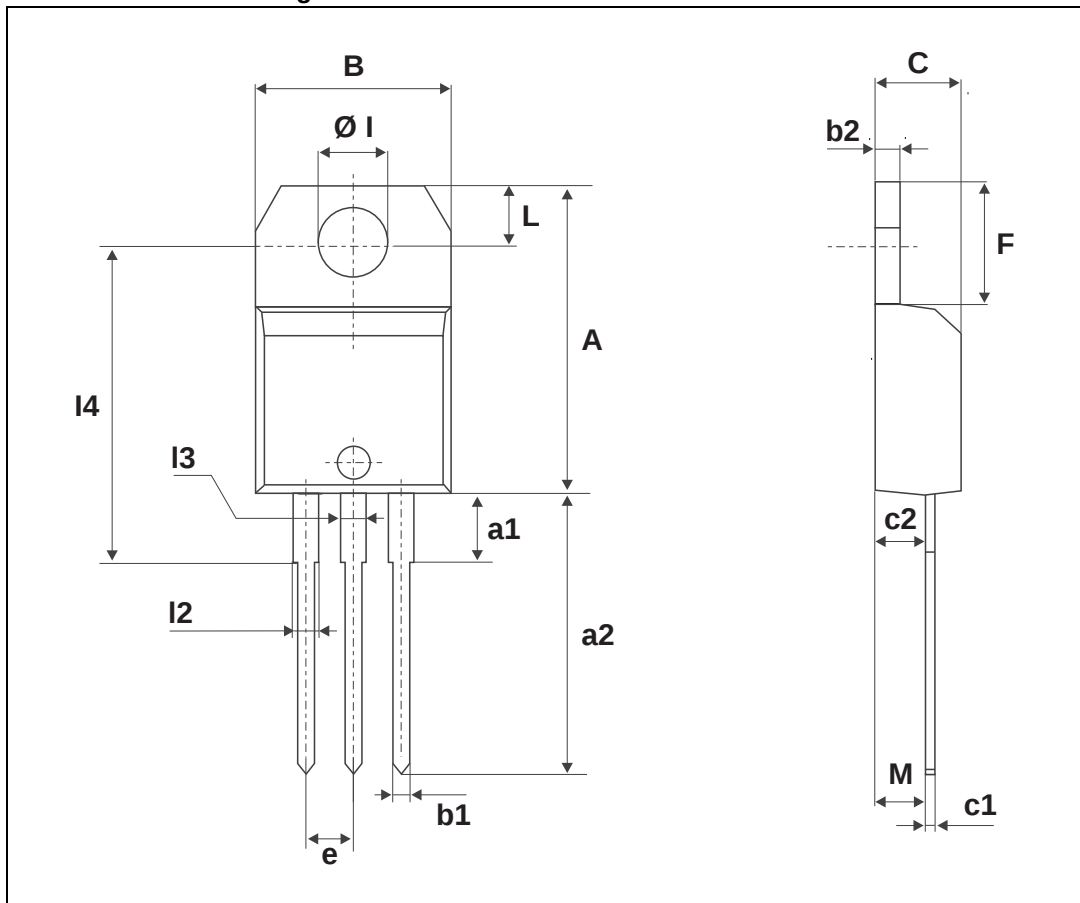


Table 6. TO-220AB dimension values

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	

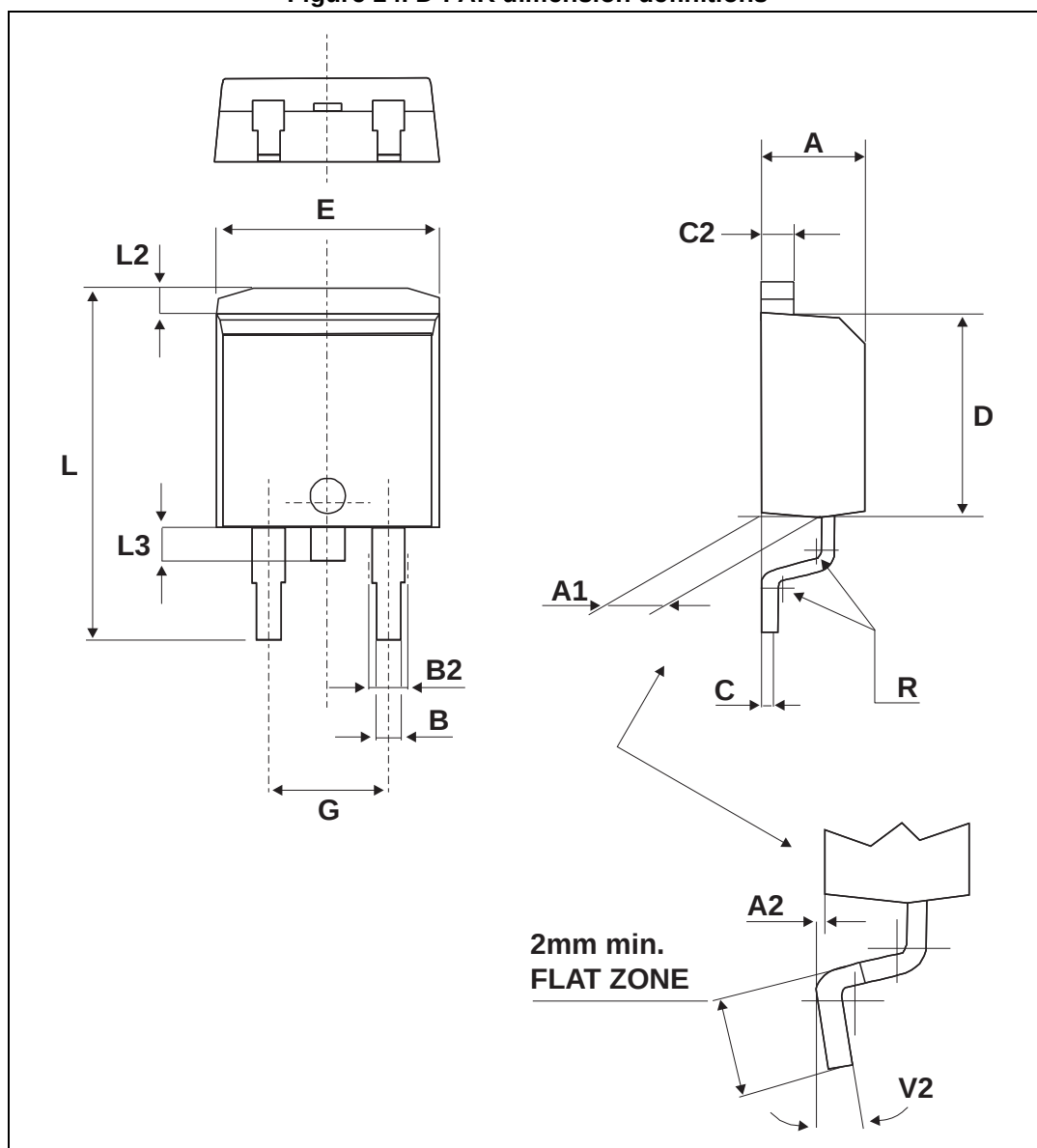
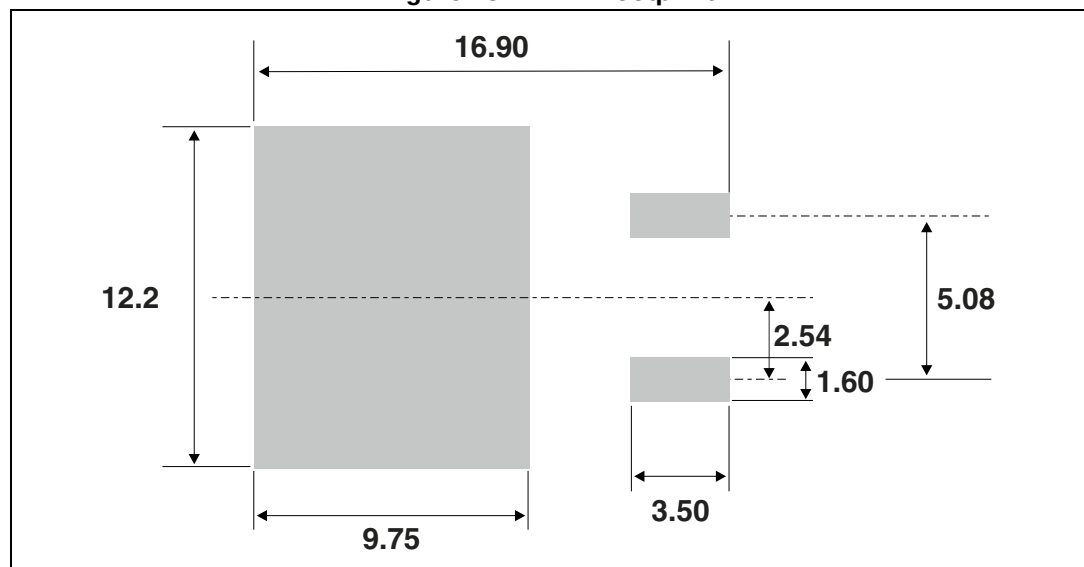
Figure 14. D²PAK dimension definitions

Table 7. D²PAK dimension values

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 15. D²PAK footprint

3 Ordering information

Figure 16. Ordering information scheme

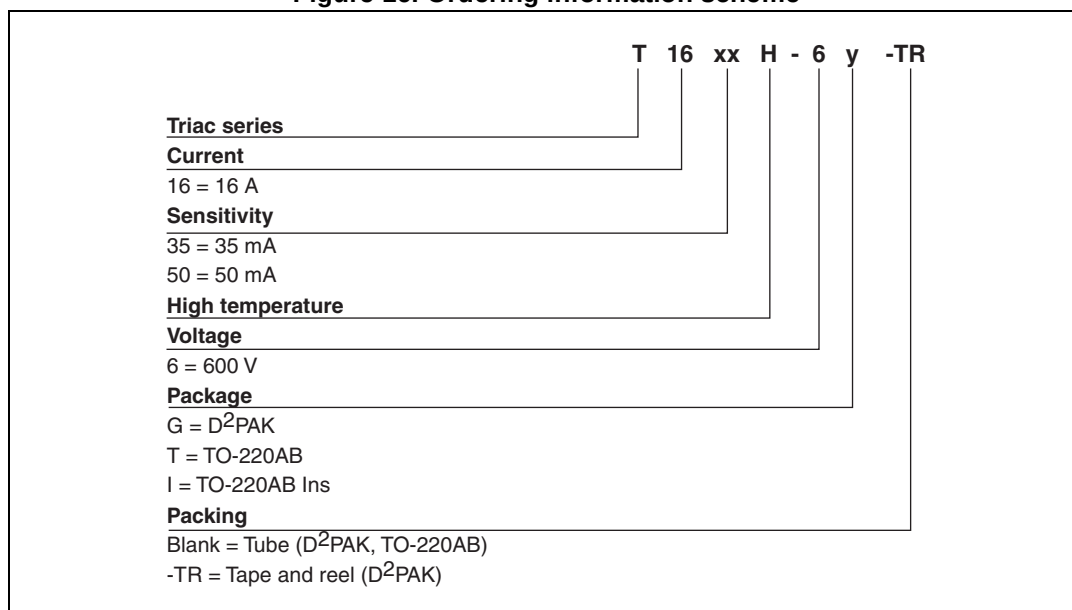


Table 8. Ordering information

Order code	Marking	Package	Weight	Base qty	Delivery mode
T16xxH-6G	T16xxH 6G	D ² PAK	1.5 g	50	Tube
T16xxH-6G-TR	T16xxH 6G	D ² PAK	1.5 g	1000	Tape and reel
T16xxH-6T	T16xxH 6T	TO-220AB	2.3 g	50	Tube
T16xxH-6I	T16xxH 6I	TO-220AB Ins	2.3 g	50	Tube

4 Revision history

Table 9. Document revision history

Date	Revision	Changes
29-May-2007	1	First issue.
20-Sep-2011	2	Updated: Features , Description and Figure 2 .
31-Jan-2014	3	Updated Figure 2 , Figure 3 , Figure 4 , Table 2 and Table 5 .

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