T1635H, T1650H

Snubberless™

High temperature 16 A Triacs

Main characteristics

Symbol	Value	Unit
$I_{T(RMS)}$	16	A
V_{DRM}/V_{RRM}	600	V
I_{GT}	35 or 50	mA

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

Applications

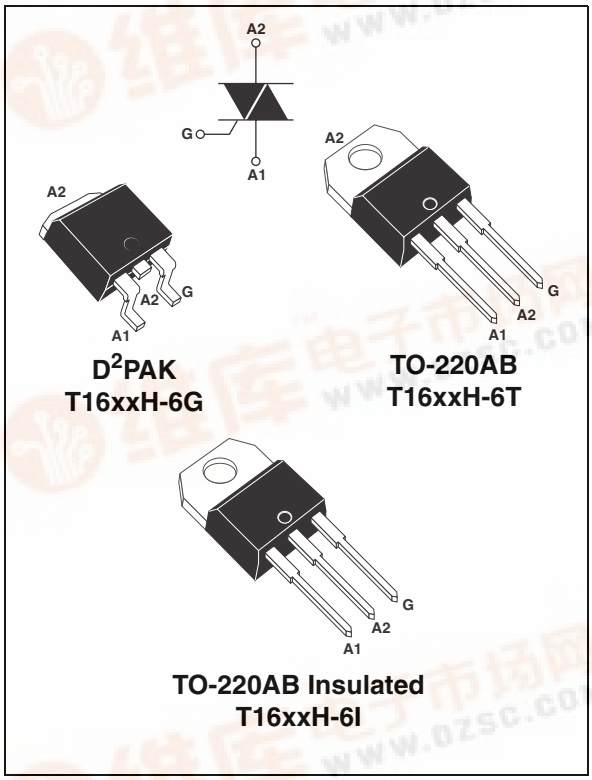
Especially designed to operate in high power density or universal motor applications such as vacuum cleaner and washing machine drum motor, these 16 A triacs provide a very high switching capability up to junction temperatures of 150° C.

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.

TM: Snubberless is a trademark of STMicroelectronics



D²PAK
T16xxH-6G

TO-220AB
T16xxH-6T

TO-220AB Insulated
T16xxH-6I

Order codes

Part Numbers	Marking
T1635H-6G	T1635H 6G
T1650H-6G	T1650H 6G
T1635H-6G-TR	T1635H 6G
T1650H-6G-TR	T1650H 6G
T1635H-6T	T1635H 6T
T1650H-6T	T1650H 6T
T1635H-6I	T1635H 6I
T1650H-6I	T1650H 6I

1 Characteristics

Table 1. Absolute Maximum Ratings

Symbol	Parameter			Value	Unit
$I_{T(RMS)}$	RMS on-state current (full sine wave)	D^2PAK, TO-220AB	T_c = 130° C	16	A
		TO-220AB Ins	T_c = 110° C		
I_{TSM}	Non repetitive surge peak on-state current (full cycle, T_j initial = 25° 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 ms		169	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	V_{DRM}/V_{RRM} + 100	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} T_j	Storage junction temperature range Operating junction temperature range			- 40 to + 150 - 40 to + 150	° C

Table 2. Electrical Characteristics (T_j = 25° C, unless otherwise specified)

Symbol	Test Conditions	Quadrant		Value		Unit
				T1635H	T1650H	
I_{GT} (1)	V_D = 12 V R_L = 33 Ω	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 kΩ	I - II - III	MIN.	0.15		V
I_H (2)	I_T = 500 mA		MAX.	35	75	mA
I_L	I_G = 1.2 I_{GT}	I - III	MAX.	50	90	mA
		II		80	110	
dV/dt (2)	V_D = 67% V_{DRM}, gate open, T_j = 150° C		MIN.	1000	1500	V/µs
(dI/dt)c (2)	Without snubber, T_j = 150° C		MIN.	21	28	A/ms

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

Table 3. Static Characteristics

Symbol	Test Conditions			Value	Unit
V_T (1)	I_{TM} = 23 A, t_p = 380 µs	T_j = 25° C	MAX.	1.5	V
V_{t0} (1)	Threshold voltage	T_j = 150° C	MAX.	0.80	V
R_d (1)	Dynamic resistance	T_j = 150° C	MAX.	23	mΩ
I_{DRM} I_{RRM}(2)	V_{DRM} = V_{RRM}	T_j = 25° C	MAX.	5	µA
		T_j = 150° C	MAX.	4.1	mA
	V_D/V_R = 400 V (at peak mains voltage)	T_j = 150° C	MAX.	3.5	
	V_D/V_R = 200 V (at peak mains voltage)	T_j = 150° C	MAX.	3.0	

1. for both polarities of A2 referenced to A1
2. t_p = 380 µs.

Table 4. Thermal resistance

Symbol	Parameter			Value	Unit
$R_{th(j-c)}$	Junction to case (AC)		D^2PAK / TO-220AB	1.15	° C/W
			TO-220AB Ins	3.1	
$R_{th(j-a)}$	Junction to ambient	S = 1 cm^2	D^2PAK	45	
			TO-220AB / TO-220AB Ins	60	

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

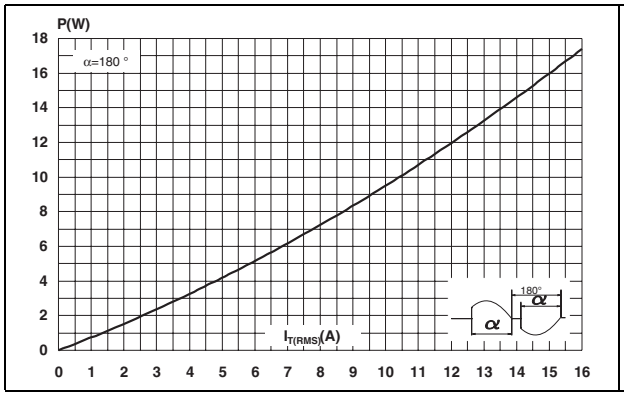


Figure 2. RMS on-state current versus case temperature (full cycle)

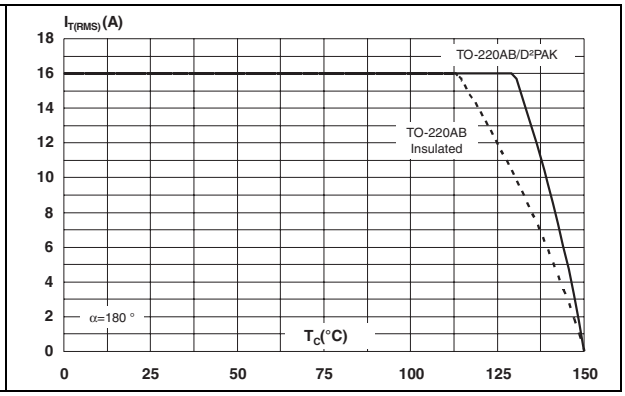


Figure 3. RMS on-state current versus ambient temperature (Epoxy printed circuit board FR4, copper thickness = 35 µm)

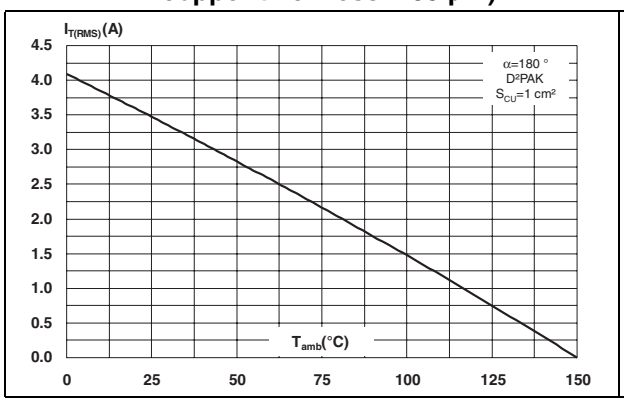


Figure 4. Variation of thermal impedance versus pulse duration

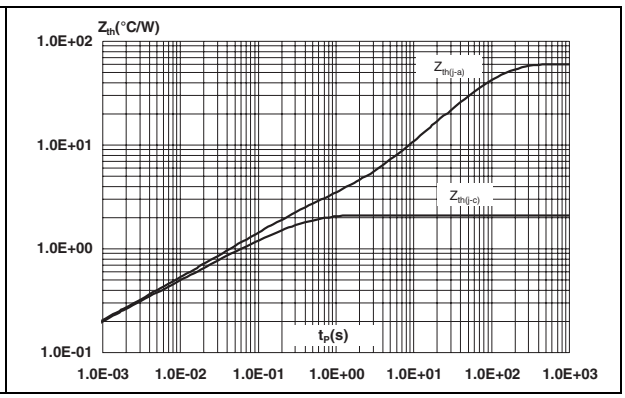


Figure 5. On-state characteristics (maximum values)

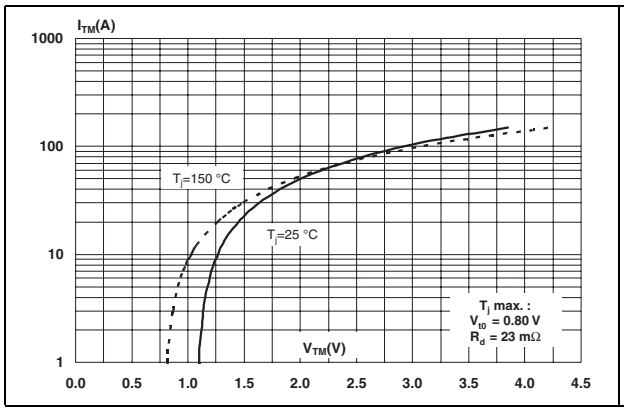


Figure 6. Surge peak on-state current versus number of cycles

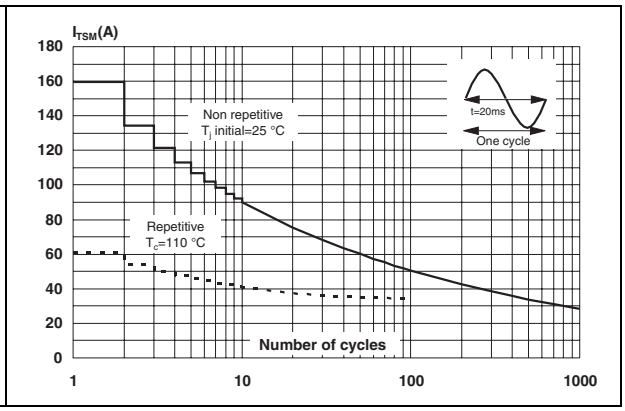


Figure 7. Non-repetitive surge peak on-state current for a sinusoidal pulse with width t_p < 10 ms and corresponding value of I^2t

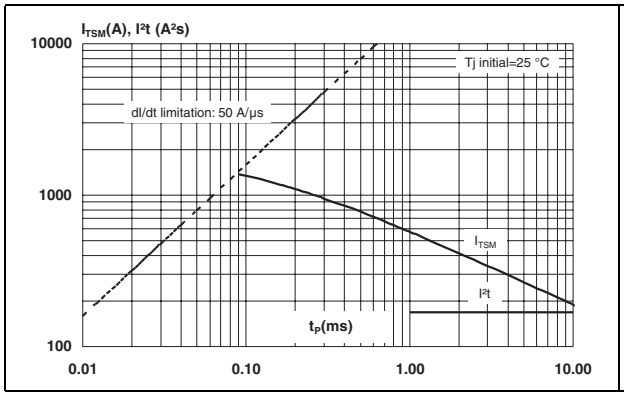


Figure 8. Relative variation of gate trigger current, holding current and latching current versus junction temperature (typical values)

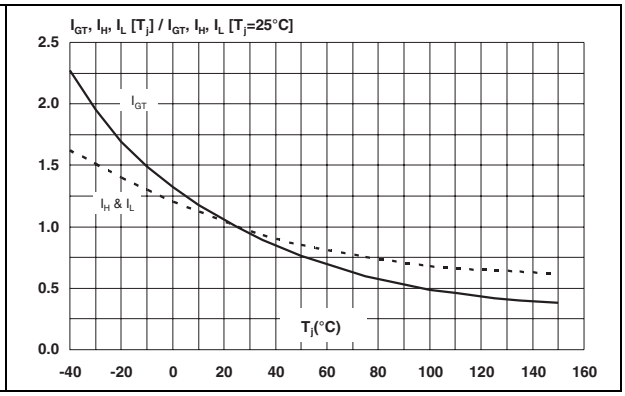


Figure 9. Relative variation of critical rate of decrease of main current (dI/dt)c versus reapplied (dV/dt)c (typical values)

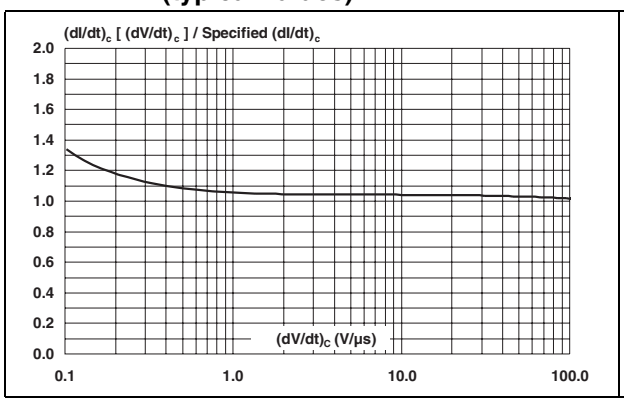


Figure 10. Relative variation of critical rate of decrease of main current versus junction temperature

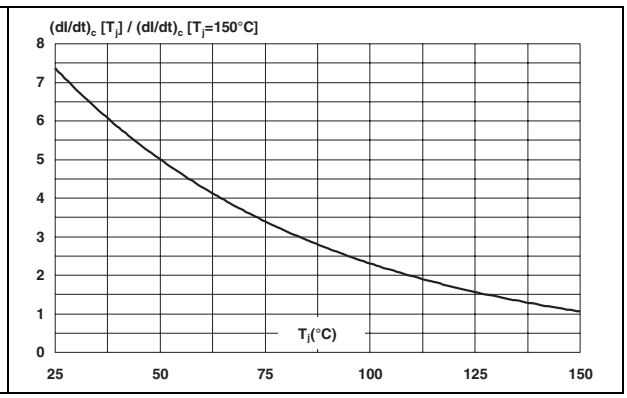


Figure 11. Leakage current versus junction temperature for different values of blocking voltage (typical values)

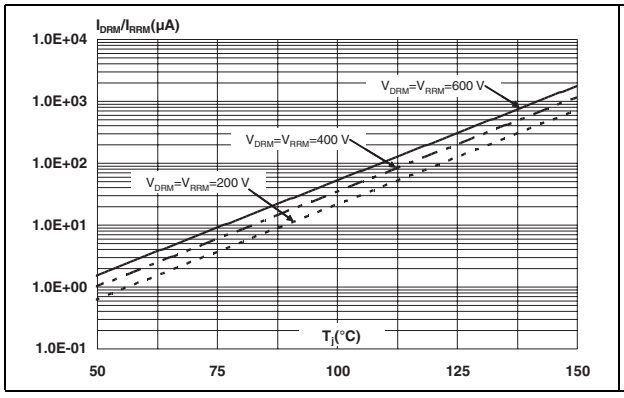
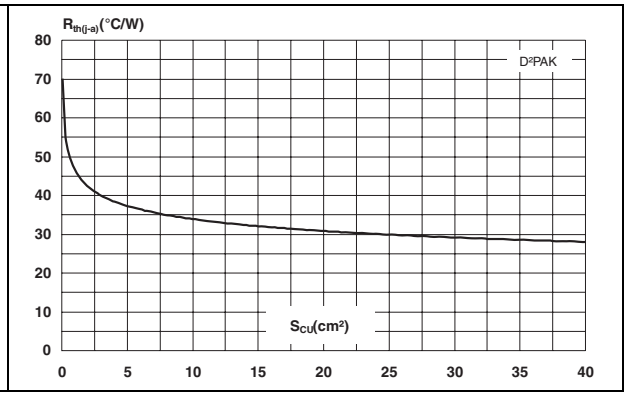
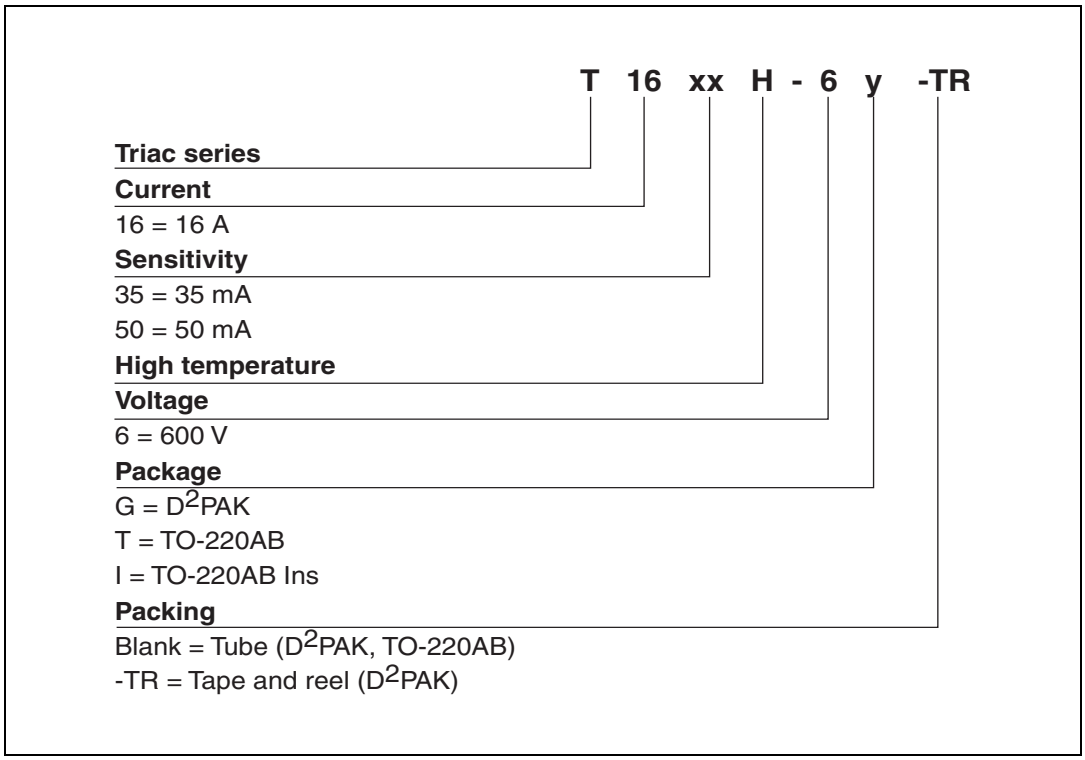


Figure 12. Variation of thermal resistance junction to ambient versus copper surface under tab (Epoxy printed circuit board FR4, copper thickness = 35 µm)



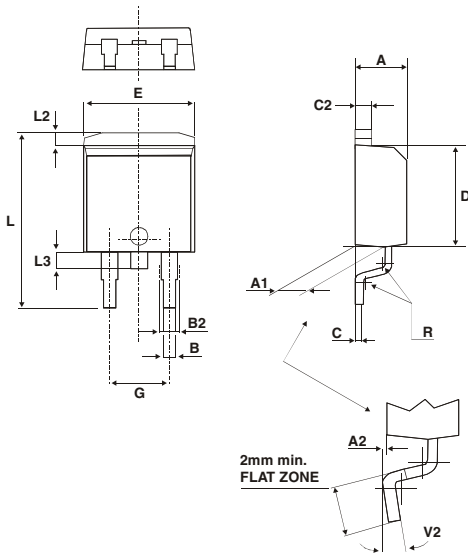
2 Ordering information



3 Package mechanical data

- Epoxy meets UL94, V0
- Recommended torque 0.4 to 0.6 Nm

Table 5. D²PAK 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 13. Footprint (dimensions in mm)

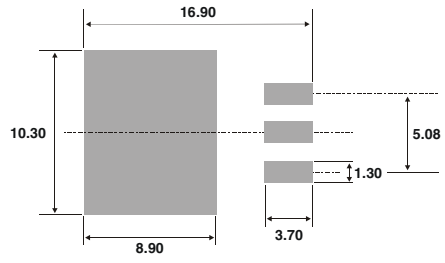
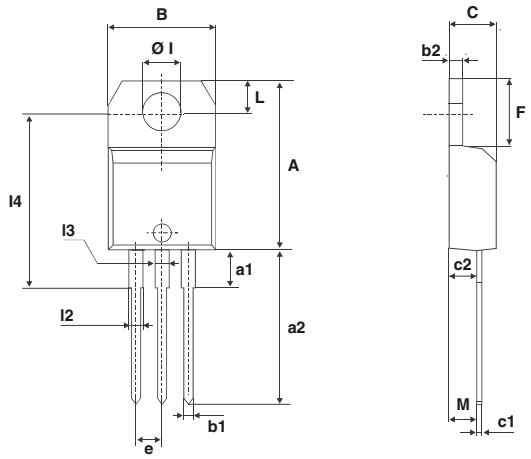


Table 6. TO-220AB and TO-220AB Ins dimensions



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	

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.

4 Ordering Information

Ordering type	Marking	Package	Weight	Base qty	Delivery mode
T16xxH-6G	T16xxH 6G	D^2PAK	1.5 g	50	Tube
T16xxH-6G-TR	T16xxH 6G	D^2PAK	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

5 Revision history

Date	Revision	Description of Changes
29-May-2007	1	First issue

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST’s terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST’S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED ST REPRESENTATIVE, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER’S OWN RISK.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com