

## High temperature 20 A Snubberless™ Triacs

### 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
- 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.

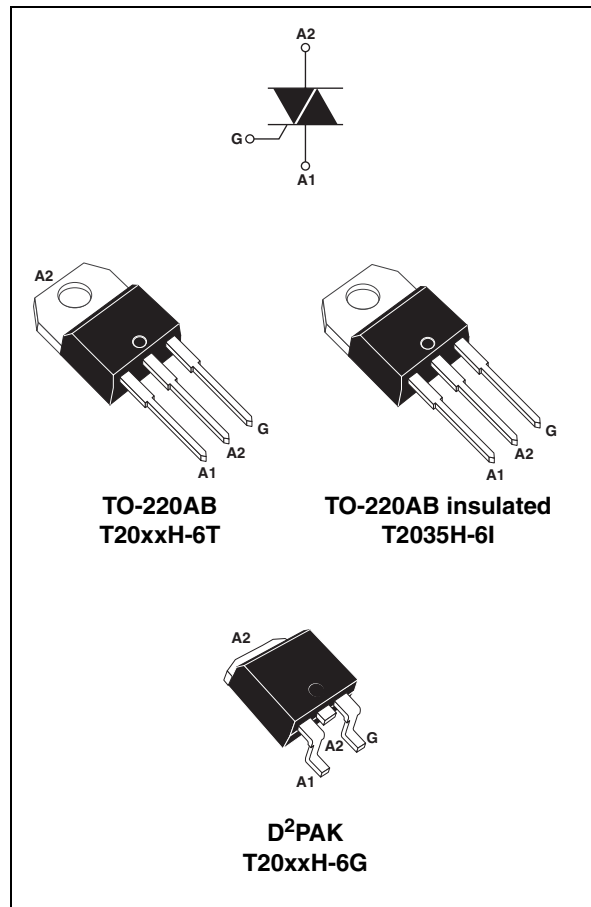
### Description

Available in through-hole and surface mount packages, the T2035H and T2050H Triac series are suitable for general purpose mains power AC switching.

These 20 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.

By using an internal ceramic pad, the T20xxH-6I provides voltage insulation (rated at 2500 V rms).



**Table 1. Device summary**

Symbol	Value	Unit
$I_{T(RMS)}$	20	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)	TO-220AB, D <sup>2</sup> PAK	$T_c = 128\text{ °C}$	20	A
		TO-220AB insulated	$T_c = 108\text{ °C}$		
$I_{TSM}$	Non repetitive surge peak on-state current (full cycle, $T_j$ initial = 25 °C)	F = 50 Hz	t = 20 ms	200	A
		F = 60 Hz	t = 16.7 ms	210	
$I^2t$	$I^2t$ Value for fusing	$t_p = 10\text{ ms}$		265	A <sup>2</sup> 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	$T_j = 150\text{ °C}$	50	A/ $\mu$ s
$V_{DSM}/V_{RSM}$	Non repetitive surge peak off-state voltage	$t_p = 10\text{ ms}$	$T_j = 25\text{ °C}$	$V_{DRM}/V_{RRM} + 100$	V
$I_{GM}$	Peak gate current	$t_p = 20\text{ }\mu\text{s}$	$T_j = 150\text{ °C}$	4	A
$P_{G(AV)}$	Average gate power dissipation		$T_j = 150\text{ °C}$	1	W
$T_{stg}$ $T_j$	Storage junction temperature range Operating junction temperature range			- 40 to + 150 - 40 to + 150	°C

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

Symbol	Test conditions	Quadrant	Value		Unit	
			T2035H	T2050H		
$I_{GT}^{(1)}$	$V_D = 12\text{ V}$ , $R_L = 33\text{ }\Omega$	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
$I_L$	$I_G = 1.2 I_{GT}$	I - III	MAX.	50	90	mA
		II		80	110	
dV/dt <sup>(2)</sup>	$V_D = 67\% V_{DRM}$ , gate open, $T_j = 150\text{ °C}$		MIN.	1000	1500	V/ $\mu$ s
(dI/dt) <sub>c</sub> <sup>(2)</sup>	Without snubber, $T_j = 150\text{ °C}$		MIN.	27	36	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
$V_T^{(1)}$	$I_{TM} = 28 \text{ A}$ , $t_p = 380 \text{ } \mu\text{s}$	$T_j = 25 \text{ }^\circ\text{C}$	MAX.	1.5	V
$V_{i0}^{(1)}$	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.	19	m $\Omega$
$I_{DRM}$ $I_{RRM}^{(2)}$	$V_{DRM} = V_{RRM}$	$T_j = 25 \text{ }^\circ\text{C}$	MAX.	5	$\mu\text{A}$
		$T_j = 150 \text{ }^\circ\text{C}$	MAX.	6.2	mA
	$V_D/V_R = 400 \text{ V}$ (at peak mains voltage)	$T_j = 150 \text{ }^\circ\text{C}$	MAX.	5.0	
	$V_D/V_R = 200 \text{ V}$ (at peak mains voltage)	$T_j = 150 \text{ }^\circ\text{C}$	MAX.	4.0	

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)	TO-220AB, D <sup>2</sup> PAK	1	$^\circ\text{C/W}$
		TO-220AB Ins	1.9	
$R_{th(j-a)}$	Junction to ambient	TO-220AB, TO-220AB insulated	60	
		$S = 1 \text{ cm}^2$ D <sup>2</sup> PAK	45	

Figure 1. Maximum power dissipation versus on-state rms current

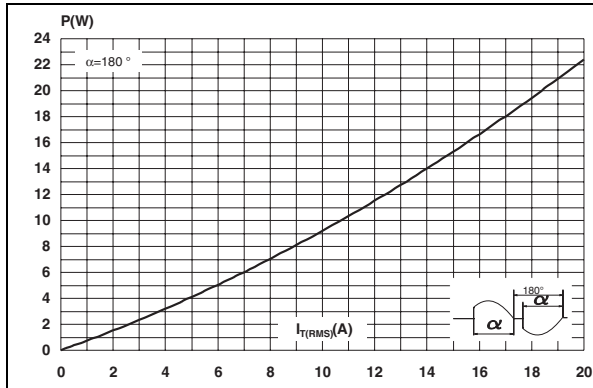


Figure 2. On-state rms current versus case temperature

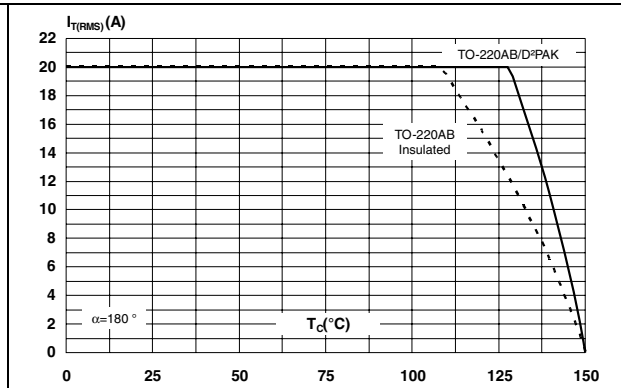


Figure 3. On-state rms current versus ambient temperature

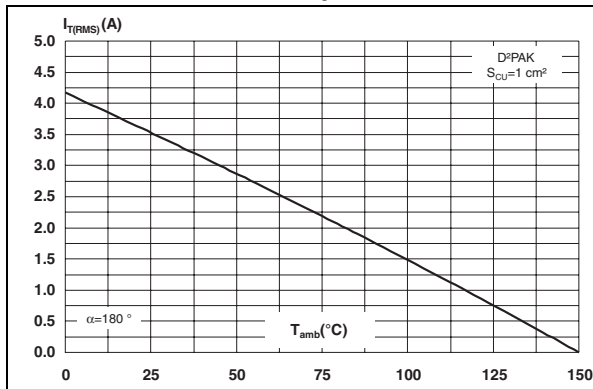


Figure 4. Variation of thermal impedance versus pulse duration

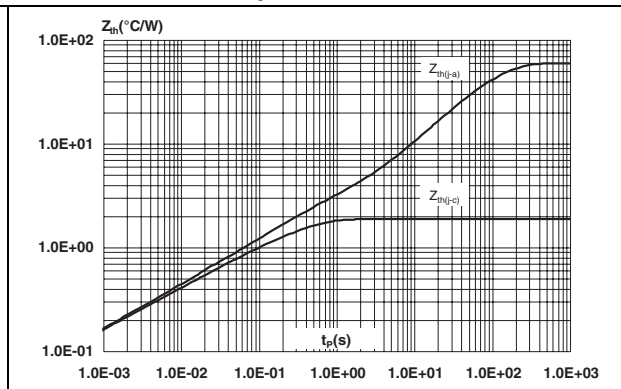


Figure 5. On-state characteristics (maximum values)

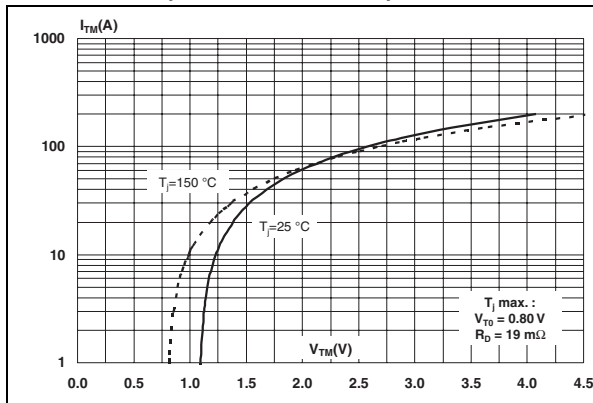
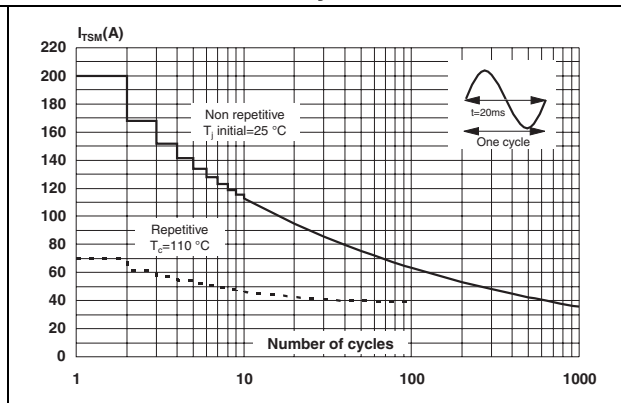
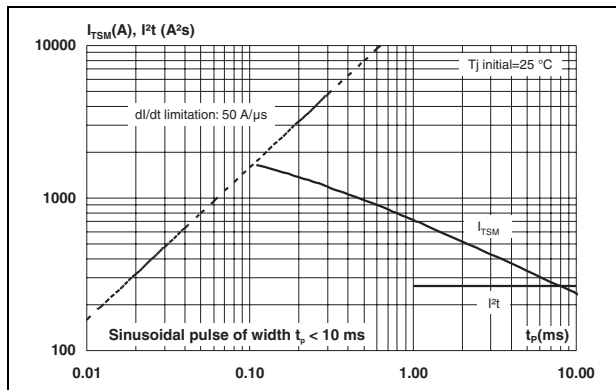


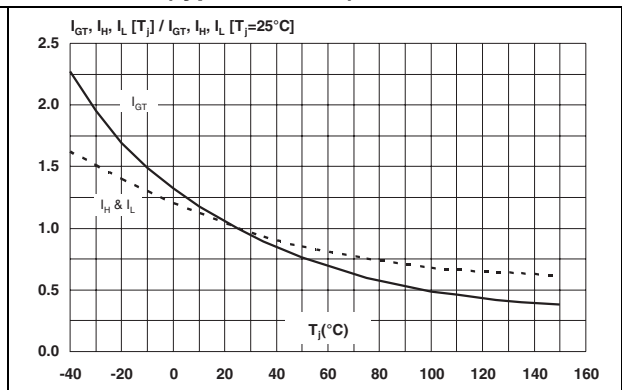
Figure 6. Surge peak on-state current versus number of cycles



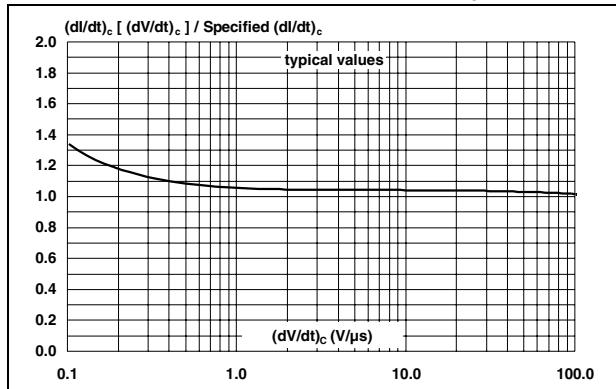
**Figure 7. Non-repetitive surge peak on-state current and corresponding values of  $I^2t$**



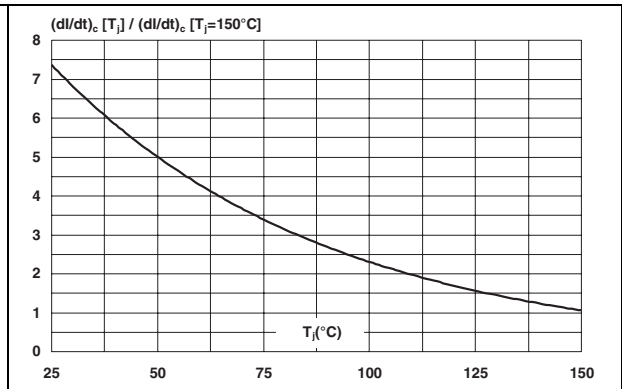
**Figure 8. Relative variation of  $I_{GT}, I_H, I_L$  versus junction temperature (typical values)**



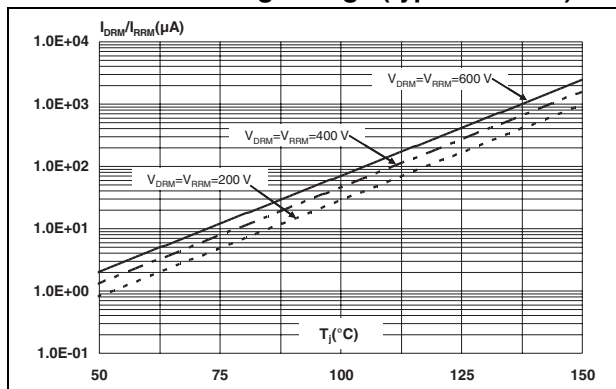
**Figure 9. Relative variation of critical rate of decrease of main current  $(di/dt)_c$  versus reapplied  $(dV/dt)_c$**



**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 to ambient thermal resistance**

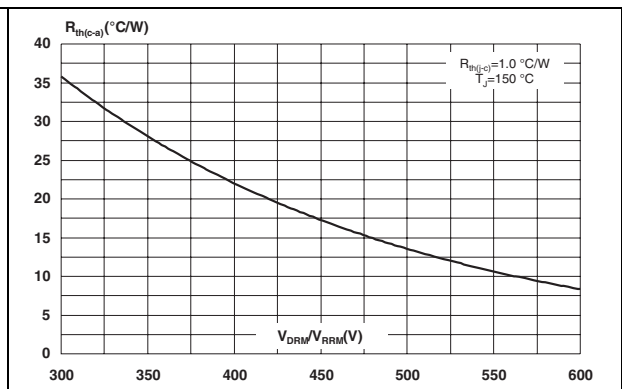
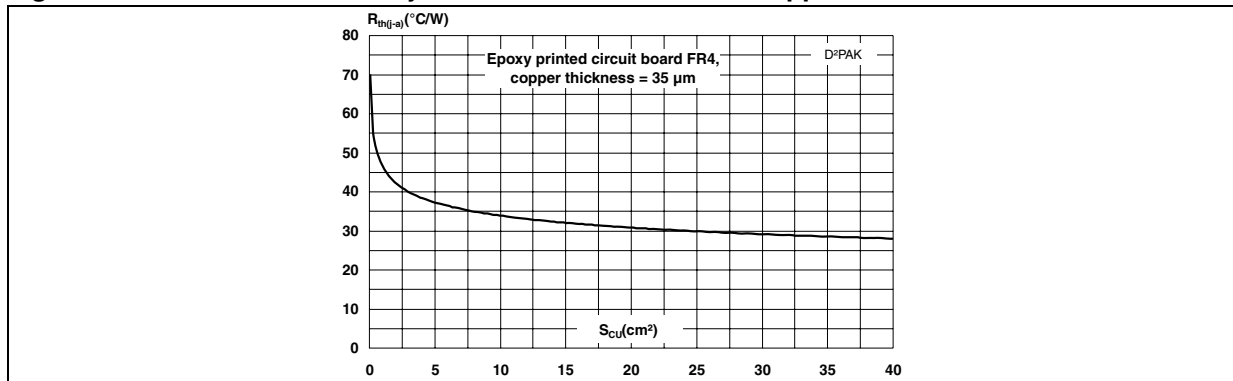
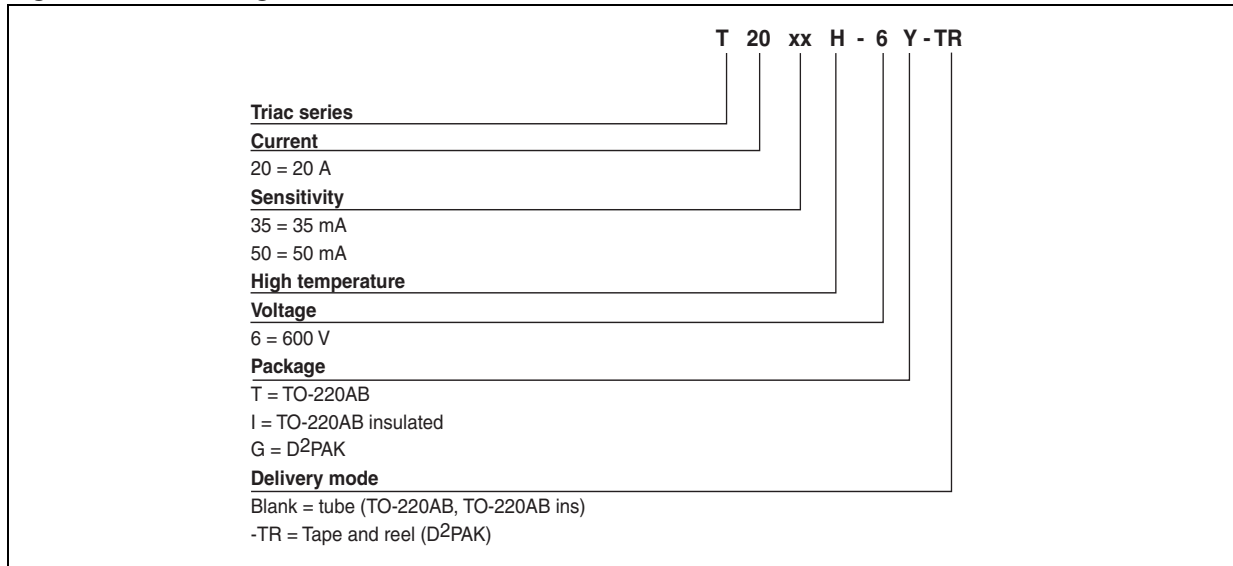


Figure 13. Thermal resistance junction to ambient versus copper surface under tab



## 2 Ordering information

Figure 14. Ordering information

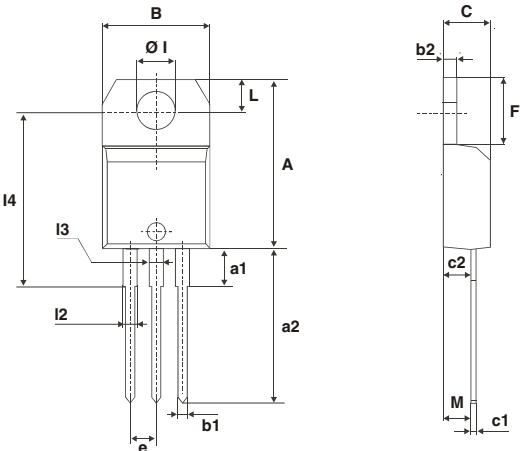


### 3 Package information

- 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. TO-220AB and TO-220AB insulated dimensions**

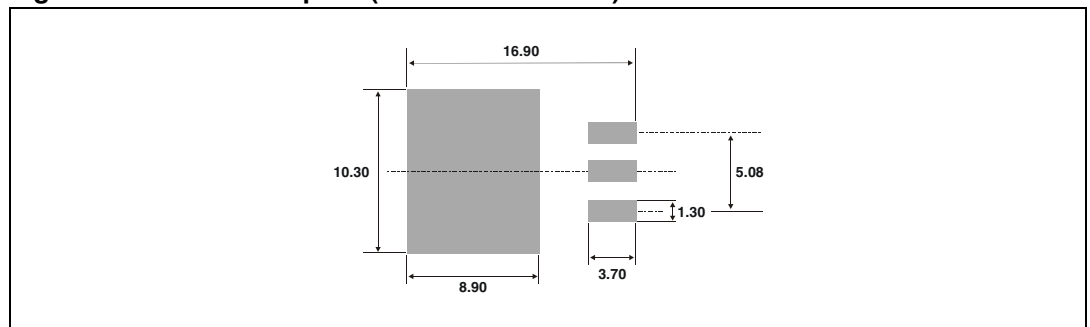


Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	15.20		15.90	0.598		0.625
a1		3.75			0.147	
a2	13.00		14.00	0.511		0.551
B	10.00		10.40	0.393		0.409
b1	0.61		0.88	0.024		0.034
b2	1.23		1.32	0.048		0.051
C	4.40		4.60	0.173		0.181
c1	0.49		0.70	0.019		0.027
c2	2.40		2.72	0.094		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 7. 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 15. D<sup>2</sup>PAK footprint (dimensions in mm)





## 4 Ordering information

**Table 8. Ordering information**

Order code	Marking	Package	Weight	Base qty	Delivery mode
T20xxH-6T	T20xxH 6T	TO-220AB	2.3 g	50	Tube
T20xxH-6I	T20xxH 6T	TO-220AB insulated	2.3 g	50	Tube
T20xxH-6G-TR	T20xxH 6G	D <sup>2</sup> PAK	1.5 g	1000	Tape and reel

## 5 Revision history

**Table 9. Document revision history**

Date	Revision	Changes
31-May-2007	1	First issue.
15-Nov-2007	2	Added TO-220AB Ins and D <sup>2</sup> PAK packages. Reformatted to current standards.
08-Aug-2011	3	Updated: <i>Features</i> and <i>Description</i> . Removed order code T20xxH-6G from <i>Figure 14</i> and <i>Table 8</i> .

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