

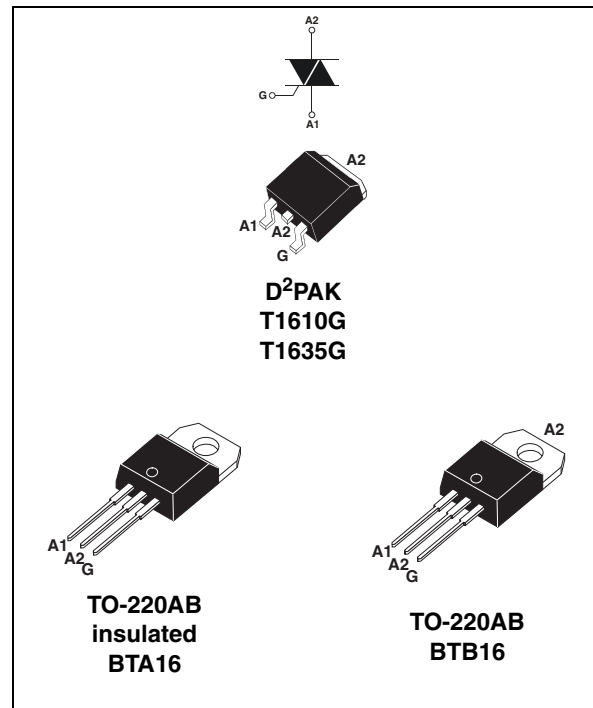
## 16 A Snubberless™, logic level and standard Triacs

### Features

- Medium current Triac
- Low thermal resistance with clip bonding
- Low thermal resistance insulation ceramic for insulated BTA
- High commutation (4Q) or very high commutation (3Q) capability
- BTA series UL1557 certified (File ref: 81734)
- RoHS ( 2002/95/EC) compliant
- Insulated tab (BTA series, rated at 2500 V<sub>RMS</sub>)

### Applications

- Snubberless versions (BTA/BTB...W and T1635) especially recommended for use on inductive loads, because of their high commutation performances
- On/off or phase angle function in applications such as static relays, light dimmers and appliance motor speed controllers



### Description

Available either in through-hole or surface-mount packages, the BTA16, BTB16, T1610 and T1635 Triacs series are suitable for general purpose mains power AC switching.

**Table 1. Device summary**

Symbol	Parameter	BTA16 <sup>(1)</sup>	BTB16	T1610	T1635
$I_{T(RMS)}$	On-state rms current	16	16	16	16
$V_{DRM}/V_{RRM}$	Repetitive peak off-state voltage	600/800	600/800	600/800	600/800
$I_{GT}$ (Snubberless)	Triggering gate current	35/50	35/50	-	35
$I_{GT}$ (logic level)	Triggering gate current	10	10	10	-
$I_{GT}$ (standard)	Triggering gate current	25/50	25/50	-	-

1. Insulated

**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 <sup>2</sup> PAK / TO-220AB $T_c = 100\text{ }^\circ\text{C}$	16	A
		TO-220AB insulated $T_c = 86\text{ }^\circ\text{C}$		
$I_{TSM}$	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	$t_p = 10\text{ ms}$	144	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 $T_j = 125\text{ }^\circ\text{C}$	50	A/ $\mu$ s
$V_{DSM}/V_{RSM}$	Non repetitive surge peak off-state voltage	$t_p = 10\text{ ms}$ $T_j = 25\text{ }^\circ\text{C}$	$V_{DRM}/V_{RRM} + 100$	V
$I_{GM}$	Peak gate current	$t_p = 20\text{ }\mu\text{s}$ $T_j = 125\text{ }^\circ\text{C}$	4	A
$P_{G(AV)}$	Average gate power dissipation	$T_j = 125\text{ }^\circ\text{C}$	1	W
$T_{stg}$	Storage temperature range			-40 to + 150
$T_j$	Maximum operating junction temperature			-40 to + 125

**Table 3. Electrical characteristics ( $T_j = 25\text{ }^\circ\text{C}$ , unless otherwise specified) Snubberless and logic level (3 quadrants)**

Symbol	Test conditions	Quadrant		T1610	T1635	BTA16 / BTB16			Unit
						SW	CW	BW	
$I_{GT}^{(1)}$	$V_D = 12\text{ V}$ $R_L = 33\text{ }\Omega$	I - II - III	Max.	10	35	10	35	50	mA
$V_{GT}$		I - II - III	Max.	1.3					V
$V_{GD}$	$V_D = V_{DRM}$ $R_L = 3.3\text{ k}\Omega$ $T_j = 125\text{ }^\circ\text{C}$	I - II - III	Min.	0.2					V
$I_H^{(2)}$	$I_T = 500\text{ mA}$		Max.	15	35	15	35	50	mA
$I_L$	$I_G = 1.2 I_{GT}$	I - III	Max.	25	50	25	50	70	mA
		II		30	60	30	60	80	
dV/dt (2)	$V_D = 67\% V_{DRM}$ gate open	$T_j = 125\text{ }^\circ\text{C}$	Min.	40	500	40	500	1000	V/ $\mu$ s
(dI/dt) <sub>c</sub> (2)	(dV/dt) <sub>c</sub> = 0.1 V/ $\mu$ s	$T_j = 125\text{ }^\circ\text{C}$	Min.	8.5	-	8.5	-	-	A/ms
	(dV/dt) <sub>c</sub> = 10 V/ $\mu$ s	$T_j = 125\text{ }^\circ\text{C}$		3.0	-	3.0	-	-	
	Without snubber	$T_j = 125\text{ }^\circ\text{C}$		-	8.5	-	8.5	14	

1. Minimum IGT is guaranteed at 5% of I<sub>GT</sub> max

2. For both polarities of A2 referenced to A1

**Table 4. Electrical characteristics ( $T_j = 25\text{ }^\circ\text{C}$ , unless otherwise specified) standard (4 quadrants)**

Symbol	Test conditions	Quadrant		BTA16 / BTB16		Unit
				C	B	
$I_{GT}^{(1)}$	$V_D = 12\text{ V}$ $R_L = 33\ \Omega$	I - II - III IV	Max.	25 50	50 100	mA
$V_{GT}$		ALL	Max.	1.3		V
$V_{GD}$	$V_D = V_{DRM}$ $R_L = 3.3\text{ k}\Omega$ $T_j = 125\text{ }^\circ\text{C}$	ALL	Min.	0.2		V
$I_H^{(2)}$	$I_T = 500\text{ mA}$		Max.	25	50	mA
$I_L$	$I_G = 1.2\ I_{GT}$	I - III - IV	Max.	40	60	mA
		II		80	120	
$dV/dt^{(2)}$	$V_D = 67\ \%V_{DRM}$ gate open	$T_j = 125\text{ }^\circ\text{C}$	Min.	200	400	V/ $\mu\text{s}$
$(dV/dt)_c^{(2)}$	$(dI/dt)_c = 7\text{ A/ms}$	$T_j = 125\text{ }^\circ\text{C}$	Min.	5	10	V/ $\mu\text{s}$

1. Minimum  $I_{GT}$  is guaranteed at 5% of  $I_{GT\text{ max}}$
2. For both polarities of A2 referenced to A1

**Table 5. Static characteristics**

Symbol	Test conditions		Value	Unit	
$V_T^{(2)}$	$I_{TM} = 22.5\text{ A}$ $t_p = 380\ \mu\text{s}$	$T_j = 25\text{ }^\circ\text{C}$	Max.	1.55	V
$V_{to}^{(2)}$	Threshold voltage	$T_j = 125\text{ }^\circ\text{C}$	Max.	0.85	V
$R_d^{(2)}$	Dynamic resistance	$T_j = 125\text{ }^\circ\text{C}$	Max.	25	m $\Omega$
$I_{DRM}$ $I_{RRM}$	$V_{DRM} = V_{RRM}$	$T_j = 25\text{ }^\circ\text{C}$	Max.	5	$\mu\text{A}$
		$T_j = 125\text{ }^\circ\text{C}$		2	mA

**Table 6. Thermal resistance**

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

1. S = Copper surface under tab

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

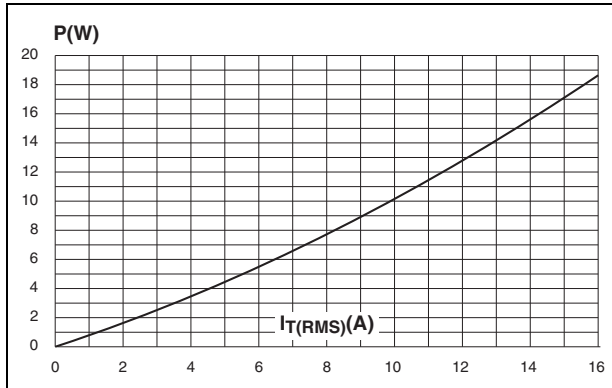


Figure 2. On-state rms current versus case temperature (full cycle)

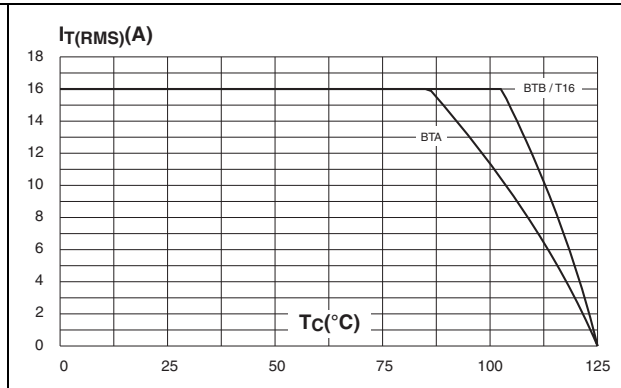


Figure 3. On-state rms current versus ambient temperature (full cycle)

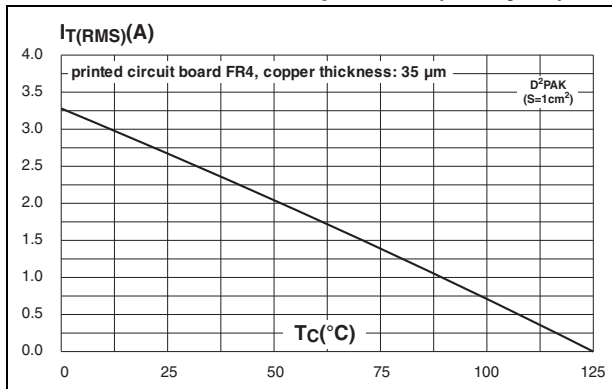


Figure 4. Relative variation of thermal impedance versus pulse duration

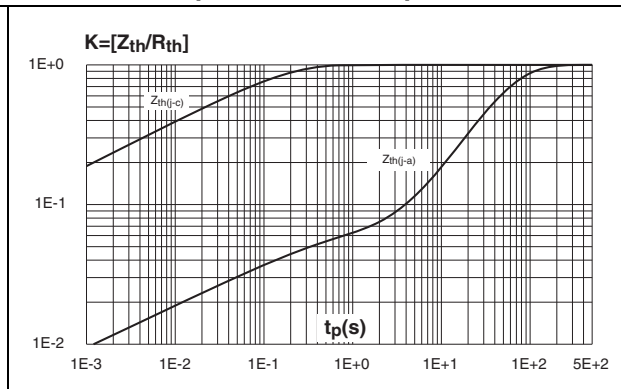


Figure 5. On-state characteristics (maximum values)

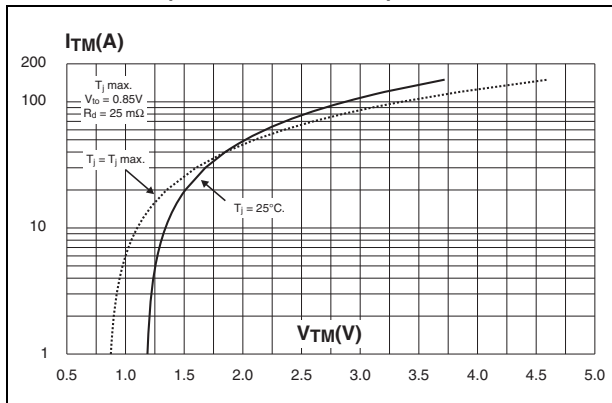


Figure 6. Surge peak on-state current versus number of cycles

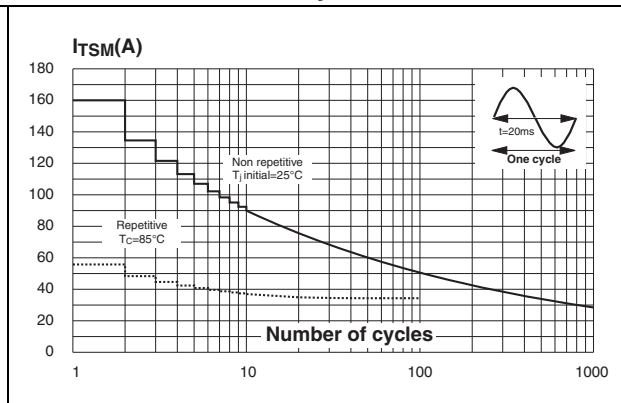


Figure 7. Non-repetitive surge peak on-state current for a sinusoidal

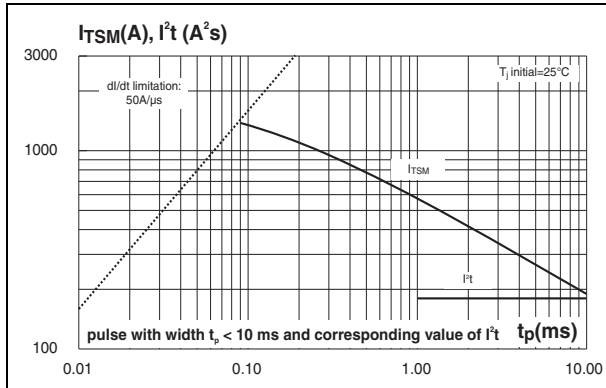


Figure 8. Relative variation of gate trigger current

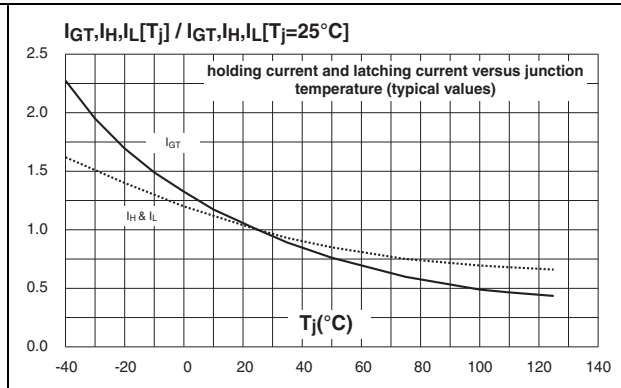


Figure 9. Relative variation of critical rate of decrease of main current versus  $(dV/dt)_c$  (typical values)

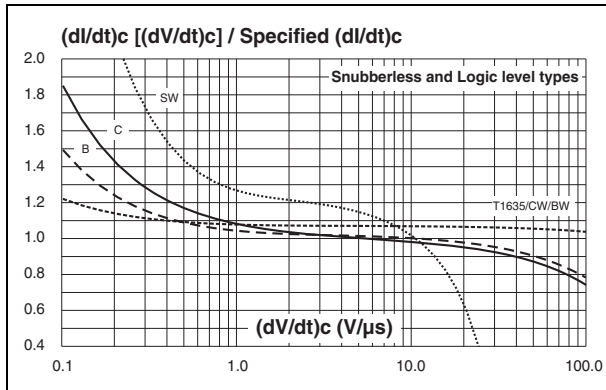


Figure 10. Relative variation of critical rate of decrease of main current versus  $(dV/dt)_c$  (typical values)

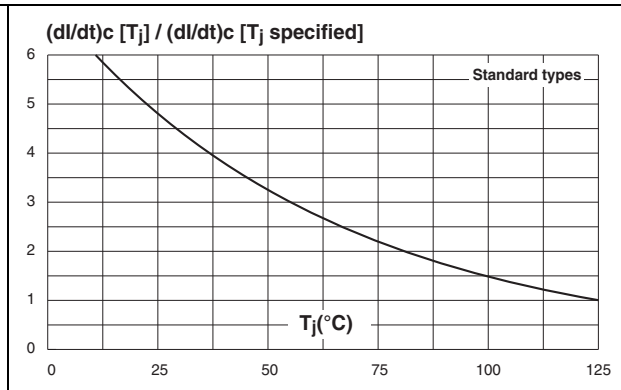
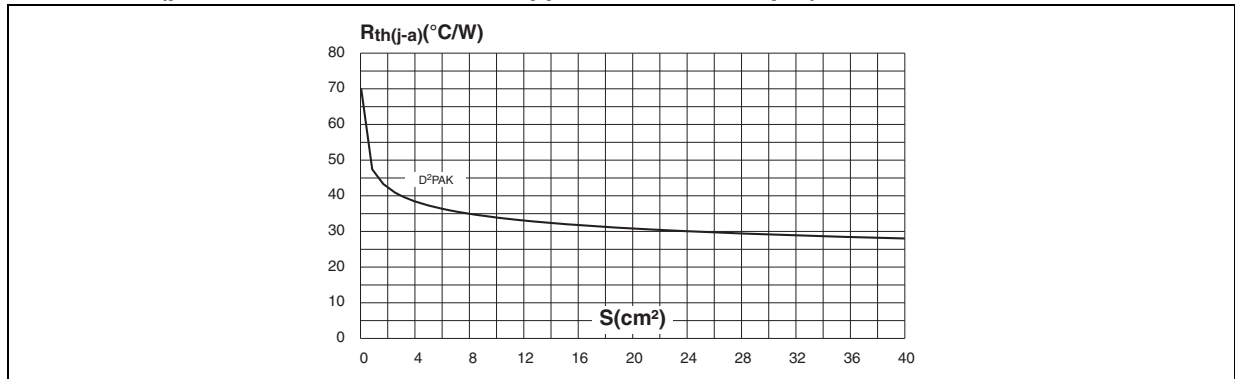


Figure 11. D<sup>2</sup>PAK thermal resistance junction to ambient versus copper surface under tab (printed circuit board FR4, copper thickness: 35 μm)



## 2 Ordering information

Figure 12. Ordering information scheme (BTA16 and BTB16 series)

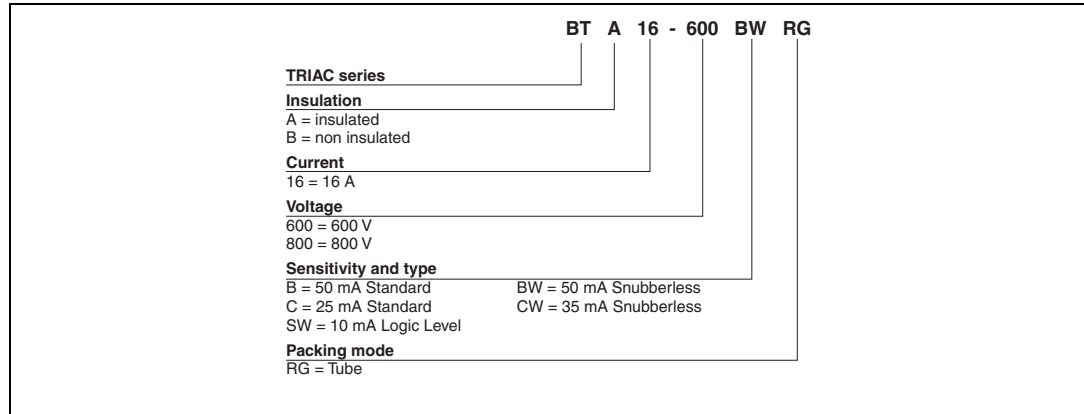


Figure 13. Ordering information scheme (T16 series)

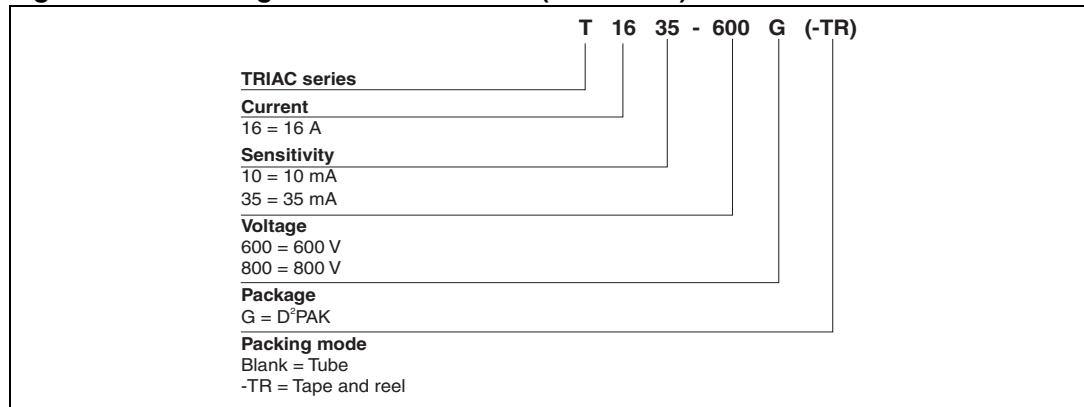


Table 7. Product selector

Device <sup>(1)</sup>	Voltage (xxx)		Sensitivity	Type	Package
	600 V	800 V			
BTA/BTB16-xxxB	X	X	50 mA	Standard	TO-220AB
BTA/BTB16-xxxBW	X	X	50 mA	Snubberless	TO-220AB
BTA/BTB16-xxxC	X		25 mA	Standard	TO-220AB
BTA/BTB16-xxxCW	X	X	35 mA	Snubberless	TO-220AB
BTA/BTB16-xxxSW	X	X	10 mA	Logic level	TO-220AB
T1610-xxxG	X	X	10 mA	Logic level	D <sup>2</sup> PAK
T1635-xxxG	X	X	35 mA	Snubberless	D <sup>2</sup> PAK

1. **BTB**: non insulated TO-220AB package

### 3 Package information

- Epoxy meets UL94, V0
- Recommended torque value: 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.

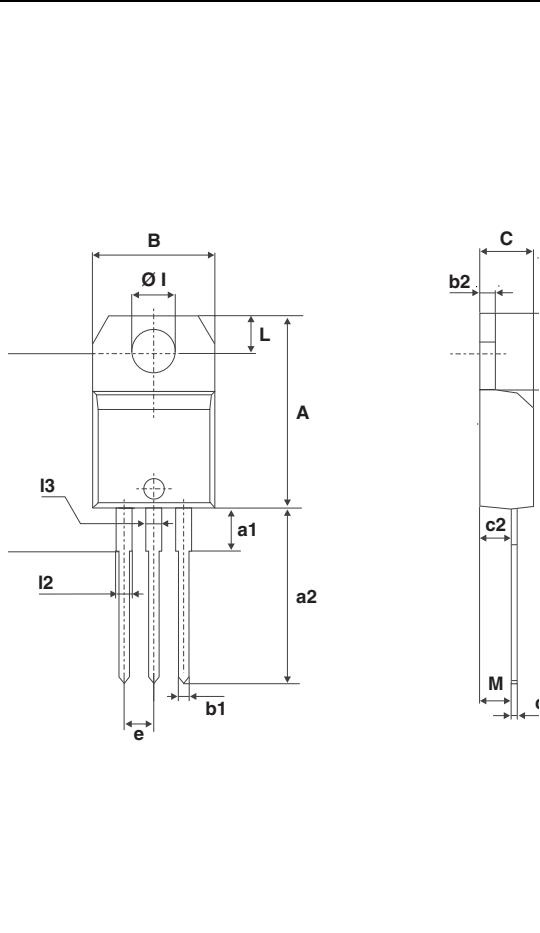
**Table 8. D<sup>2</sup>PAK dimensions**

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 14. Footprint (dimensions in mm)**



Table 9. TO-220AB (non-insulated and 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
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	



## 4 Ordering information

**Table 10. Ordering information**

Order code <sup>(1)</sup>	Marking <sup>(1)</sup>	Package	Weight	Base qty	Delivery mode
BTA16-xxxzyRG	BTA16xxxzy	TO-220AB	2.3 g	50	Tube
BTB16-xxxzyRG	BTB16xxxzy	TO-220AB	2.3 g	50	Tube
T1610-xxxG-TR	T1610xxxG	D <sup>2</sup> PAK	1.5 g	1000	Tape and reel
T1635-xxxG	T1635xxxG			50	Tube
T1635-xxxG-TR	T1635xxxG			1000	Tape and reel

1. xxx = voltage, y = sensitivity, z = type

## 5 Revision history

**Table 11. Document revision history**

Date	Revision	Changes
Oct-2002	6A	Last update.
13-Feb-2006	7	TO-220AB delivery mode changed from bulk to tube. ECOPACK statement added.
03-Jul-2009	8	Added part number T1610.
11-Mar-2010	9	Updated value for $V_{DSM}/V_{RSM}$ in <a href="#">Table 2</a> . Updated temperature in <a href="#">Table 2</a> from 15 °C to 86 °C.

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