

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	$T_c = 100\text{ }^{\circ}\text{C}$	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 = $25\text{ }^{\circ}\text{C}$)	F = 50 Hz	t = 20 ms	160	A
		F = 60 Hz	t = 16.7 ms	168	
I^2t	I^2t value for fusing	$t_p = 10\text{ ms}$		144	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	$T_j = 125\text{ }^{\circ}\text{C}$	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	$t_p = 20\text{ }\mu$ 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/ μ s
(dI/dt) _c ⁽²⁾	(dV/dt) _c = 0.1 V/ μ s	$T_j = 125\text{ }^{\circ}\text{C}$	Min.	8.5	-	8.5	-	-	A/ms
	(dV/dt) _c = 10 V/ μ 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 I_{GT} is guaranteed at 5% of I_{GT} 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	
$I_{GT}^{(1)}$	$V_D = 12\text{ V}$ $R_L = 33\text{ }\Omega$	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	$I_G = 1.2\text{ }I_{GT}$	I - III - IV	Max.	40	60	mA
		II		80	120	
$dV/dt^{(2)}$	$V_D = 67\text{ }\%V_{DRM}$ gate open	$T_j = 125\text{ }^{\circ}\text{C}$	Min.	200	400	V/ μs
$(dV/dt)_c^{(2)}$	$(dI/dt)_c = 7\text{ A/ms}$	$T_j = 125\text{ }^{\circ}\text{C}$	Min.	5	10	V/ μs

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 A t _p = 380 μs	T _j = 25 °C	Max.	1.55	V
V _{to} (2)	Threshold voltage	T _j = 125 °C	Max.	0.85	V
R _d (2)	Dynamic resistance	T _j = 125 °C	Max.	25	mΩ
I _{DRM} I _{RRM}	V _{DRM} = V _{RRM}	T _j = 25 °C	Max.	5	μA
		T _j = 125 °C		2	mA

Table 6. Thermal resistance

Symbol	Parameter		Value	Unit
$R_{th(j-c)}$	Junction to case (AC)	D ² 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 ² 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)

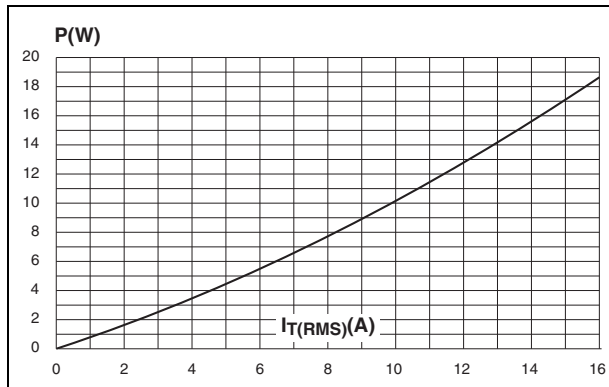


Figure 2. On-state rms current versus case temperature (full cycle)

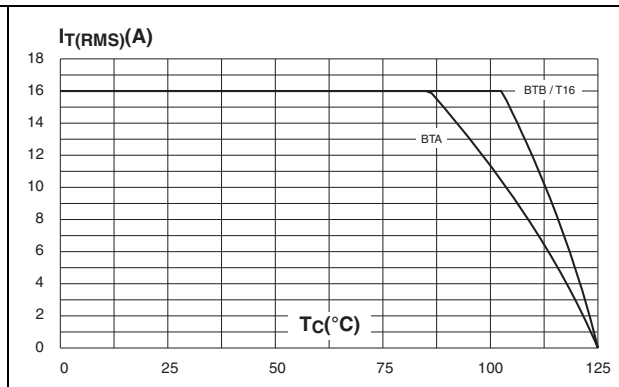


Figure 3. On-state rms current versus ambient temperature (full cycle)

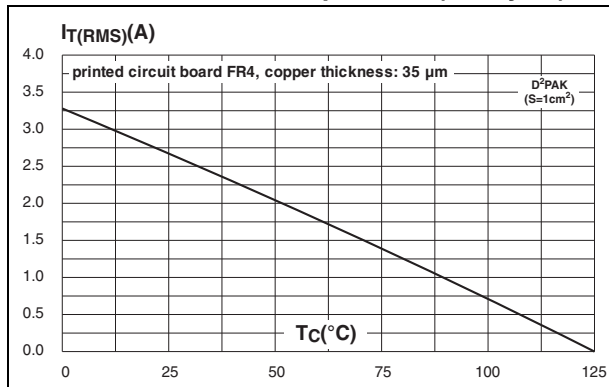


Figure 4. Relative variation of thermal impedance versus pulse duration

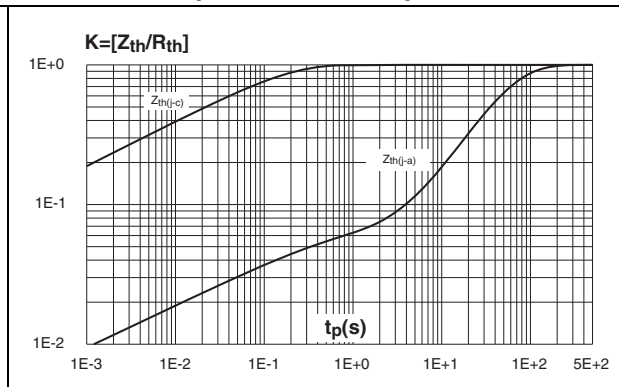


Figure 5. On-state characteristics (maximum values)

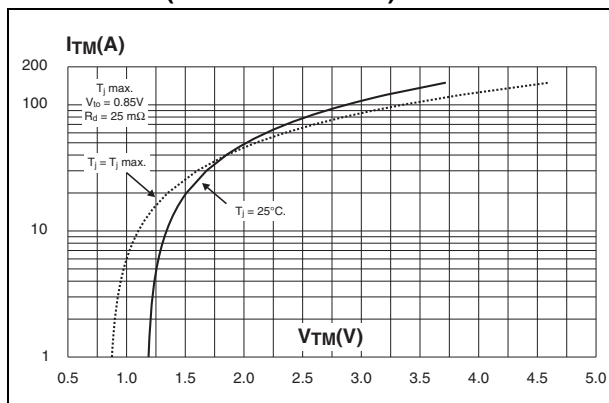


Figure 6. Surge peak on-state current versus number of cycles

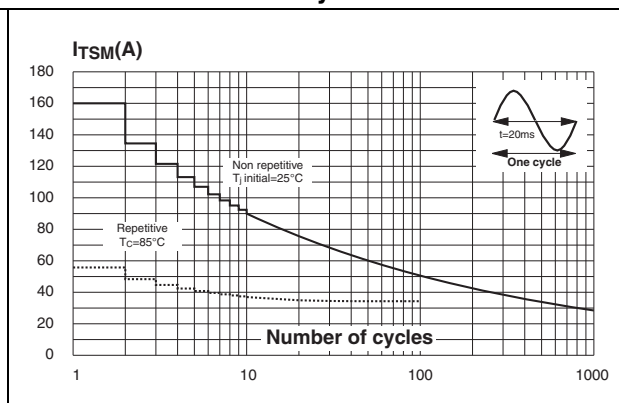
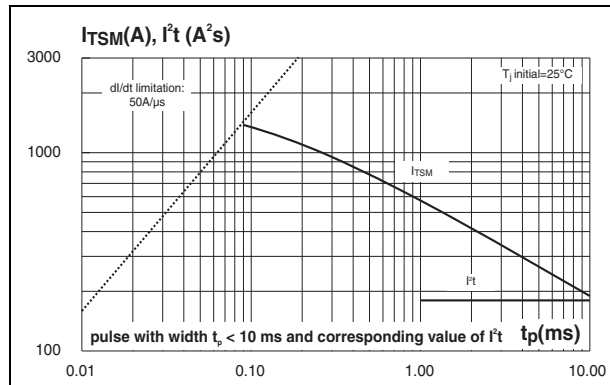
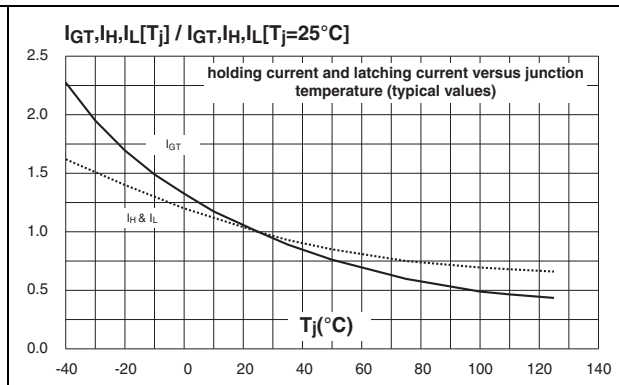
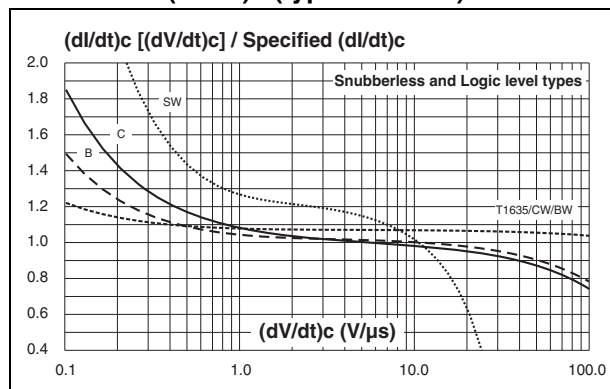
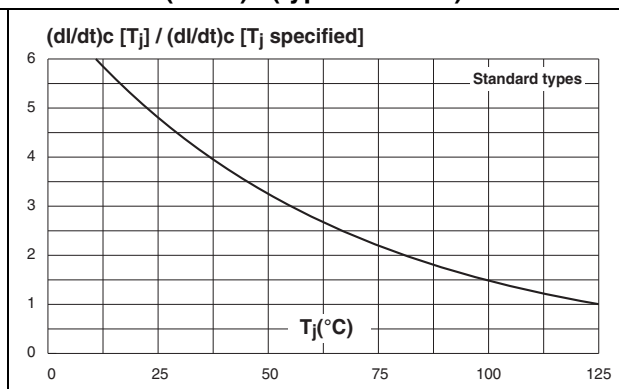
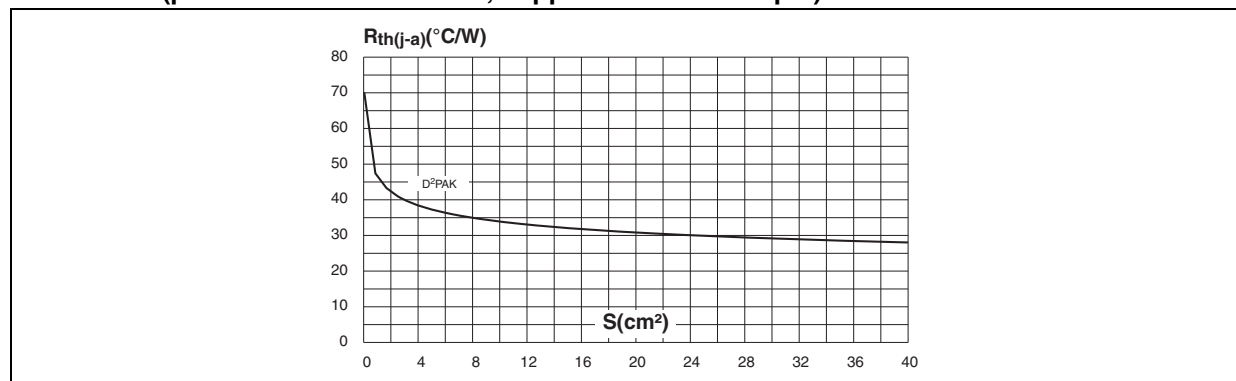


Figure 7. Non-repetitive surge peak on-state current for a sinusoidal**Figure 8. Relative variation of gate trigger current****Figure 9. Relative variation of critical rate of decrease of main current versus (dV/dt)c (typical values)****Figure 10. Relative variation of critical rate of decrease of main current versus (dV/dt)c (typical values)****Figure 11. D²PAK 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)

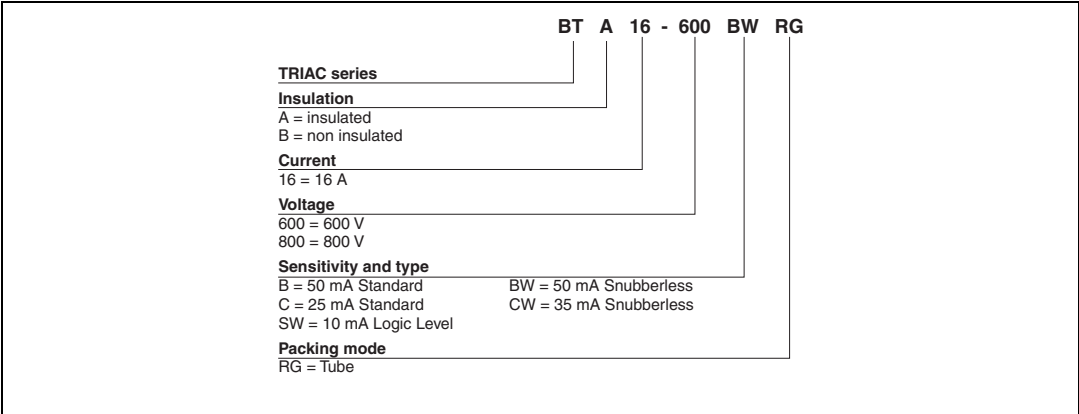


Figure 13. Ordering information scheme (T16 series)

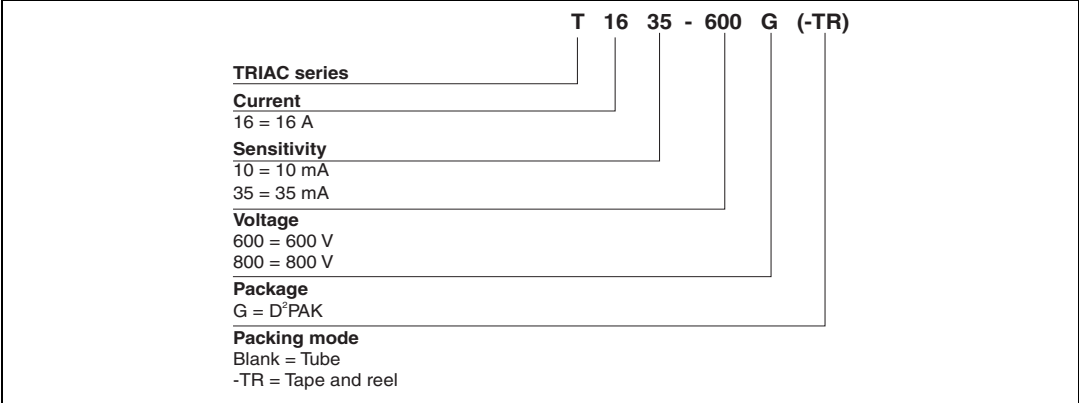


Table 7. Product selector

Device ⁽¹⁾	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 ² PAK
T1635-xxxG	X	X	35 mA	Snubberless	D ² 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. ECOPACK® is an ST trademark.

Table 8. 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 14. Footprint (dimensions in mm)

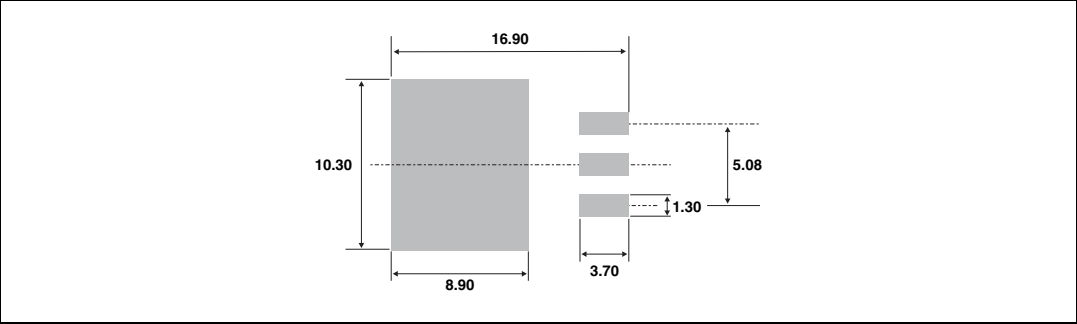


Table 9. TO-220AB (non-insulated and insulated) dimensions

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
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	

4 Ordering information

Table 10. Ordering information

Order code ⁽¹⁾	Marking ⁽¹⁾	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 ² 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 Table 2 . Updated temperature in Table 2 from 15 °C to 86 °C.

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