1 Characteristics

Table 2. Absolute maximum ratings

Symbol	Parameter			Value	Unit
$I_{T(RMS)}$	RMS on-state current (full sine wave)	I^2PAK / D^2PAK / TO-220AB	T_c = 105° C	12	A
		TO-220AB Ins.	T_c = 90° C		
I_{TSM}	Non repetitive surge peak on-state current (full cycle, T_j initial = 25° C)	F = 50 Hz	t = 20 ms	120	A
		F = 60 Hz	t = 16.7 ms	126	
I^2t	I^2t Value for fusing	t_p = 10 ms		78	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 = 125° 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 = 125° C	4	A
$P_{G(AV)}$	Average gate power dissipation		T_j = 125° C	1	W
T_{stg} T_j	Storage junction temperature range Operating junction temperature range			- 40 to + 150 - 40 to + 125	°C

Table 3. Electrical characteristics (T_j = 25°C, unless otherwise specified)

Snubberless and logic level (3 quadrants)

Symbol	Test conditions	Quadrant		T12xx			BTA12 / BTB12				Unit
				T1210	T1235	T1250	TW	SW	CW	BW	
I_{GT} (1)	V_D = 12 V R_L = 30 Ω	I - II - III	MAX.	10	35	50	5	10	35	50	mA
V_{GT}		I - II - III	MAX.	1.3							V
V_{GD}	V_D = V_{DRM} R_L = 3.3 kΩ T_j = 125° C	I - II - III	MIN.	0.2							V
I_H (2)	I_T = 100 mA		MAX.	15	35	50	10	15	35	50	mA
I_L	I_G = 1.2 I_{GT}	I - III	MAX.	25	50	70	10	25	50	70	mA
		II		30	60	80	15	30	60	80	
dV/dt (2)	V_D = 67 %V_{DRM} gate open T_j = 125° C		MIN.	40	500	1000	20	40	500	1000	V/µs
(dI/dt)c (2)	(dV/dt)c = 0.1 V/µs T_j = 125° C		MIN.	6.5			3.5	6.5			A/ms
	(dV/dt)c = 10 V/µs T_j = 125° C			2.9			1	2.9			
	Without snubber T_j= 125° C				6.5	12			6.5	12	

1. Minimum I_{GT} is guaranted at 5% of I_{GT} max
2. for both polarities of A2 referenced to A1

Table 4. Electrical characteristics (T_j = 25°C, unless otherwise specified)
standard (4 quadrants)

Symbol	Test Conditions	Quadrant		BTA12 / BTB12		Unit
				C	B	
I_{GT} (1)	V_D = 12 V R_L = 30 Ω	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 kΩ T_j = 125° C	ALL	MIN.	0.2		V
I_H (2)	I_T = 500 mA		MAX.	25	50	mA
I_L	$I_G = 1.2\ I_{GT}$	I - III - IV	MAX.	40	50	mA
		II		80	100	
dV/dt (2)	V_D = 67% V_{DRM} gate open T_j = 125° C		MIN.	200	400	V/µs
(dV/dt)c (2)	(dI/dt)c = 5.3 A/ms T_j = 125° C		MIN.	5	10	V/µs

1. Minimum I_{GT} is guaranted at 5% of I_{GT} max.
2. for both polarities of A2 referenced to A1.

Table 5. Static characteristics

Symbol	Test conditions			Value	Unit
V_T (1)	I_{TM} = 17 A t_p = 380 µs	T_j = 25° C	MAX.	1.55	V
V_{t0} (1)	Threshold voltage	T_j = 125° C	MAX.	0.85	V
R_d (1)	Dynamic resistance	T_j = 125° C	MAX.	35	mΩ
I_{DRM} I_{RRM}	$V_{DRM} = V_{RRM}$	T_j = 25° C	MAX.	5	µA
		T_j= 125° C		1	mA

1. for both polarities of A2 referenced to A1

Table 6. Thermal resistance

Symbol	Parameter			Value	Unit
$R_{th(j-c)}$	Junction to case (AC)		I^2PAK / D^2PAK / TO-220AB	1.4	°C/W
			TO-220AB insulated	2.3	
$R_{th(j-a)}$	Junction to ambient	$S^{(1)}$ = 1 cm^2	D^2PAK	45	°C/W
			TO-220AB / I^2PAK TO-220AB insulated	60	

1. Copper surface under tab.

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

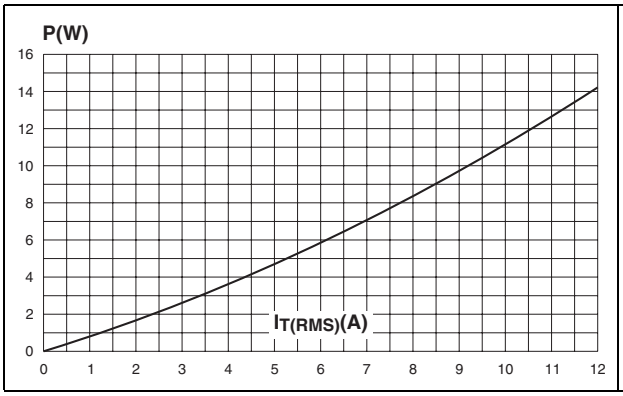


Figure 2. RMS on-state current versus case temperature (full cycle)

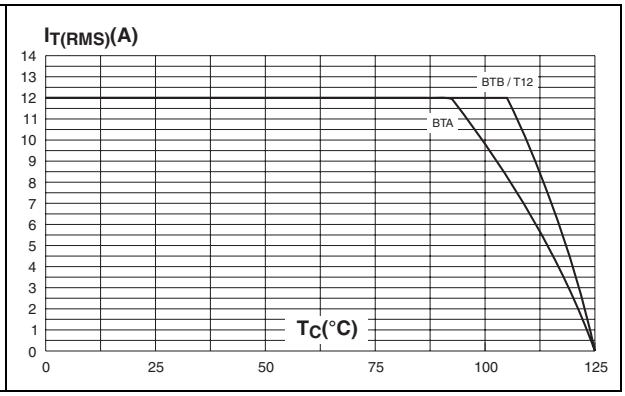


Figure 3. RMS on-state current versus ambient temperature (printed circuit board FR4, copper thickness: 35µm) (full cycle)

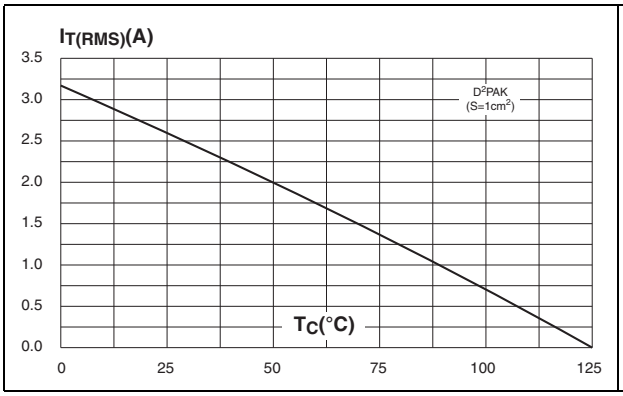


Figure 4. Relative variation of thermal impedance versus pulse duration

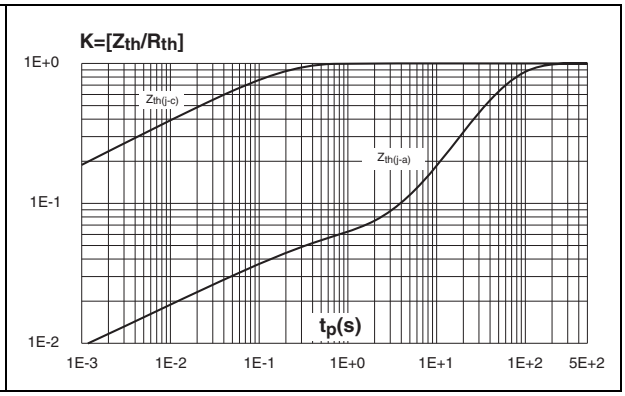


Figure 5. On-state characteristics (maximum values)

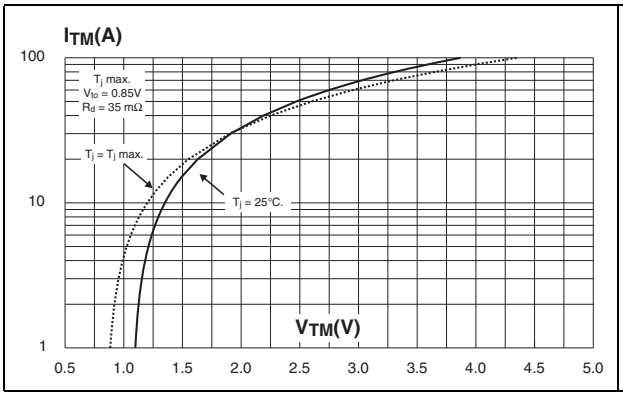


Figure 6. Surge peak on-state current versus number of cycles

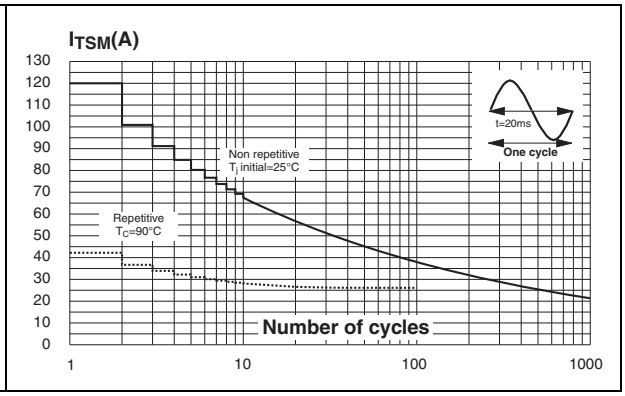


Figure 7. Non-repetitive surge peak on-state current for a sinusoidal pulse with width t_p < 10 ms and corresponding value of I^2t

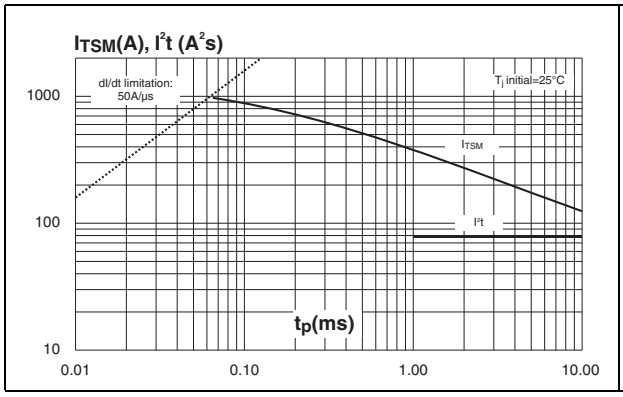


Figure 8. Figure 8: Relative variation of gate trigger current, holding current and latching current versus junction temperature (typical values)

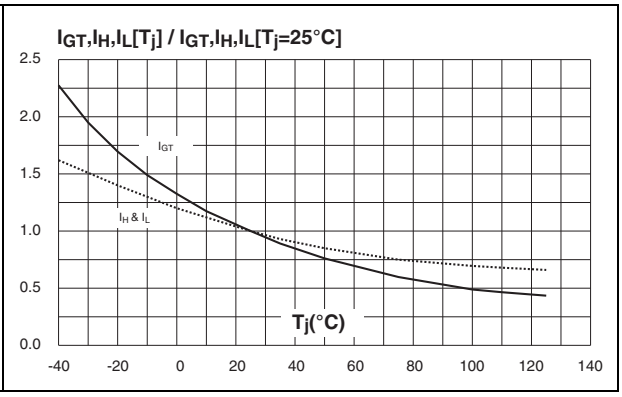


Figure 9. Relative variation of critical rate of decrease of main current versus (dV/dt)c (typical values) (BW/CW/T1210/T1235)

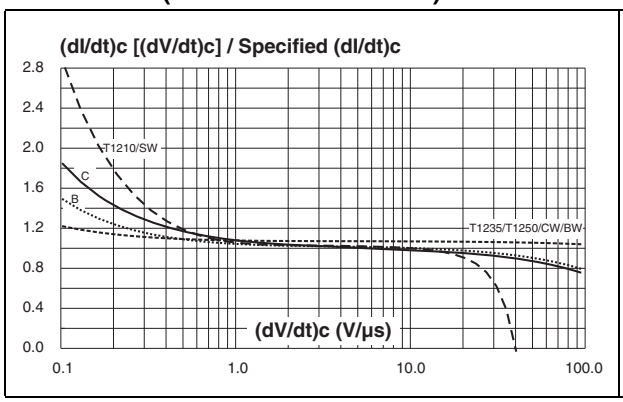


Figure 10. Relative variation of critical rate of decrease of main current versus (dV/dt)c (typical values) (TW)

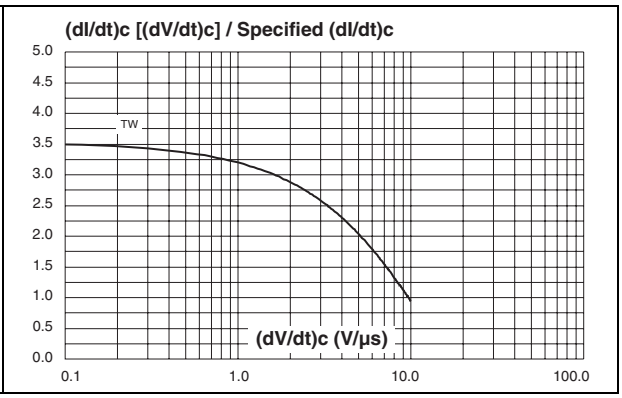


Figure 11. Relative variation of critical rate of decrease of main current versus junction temperature

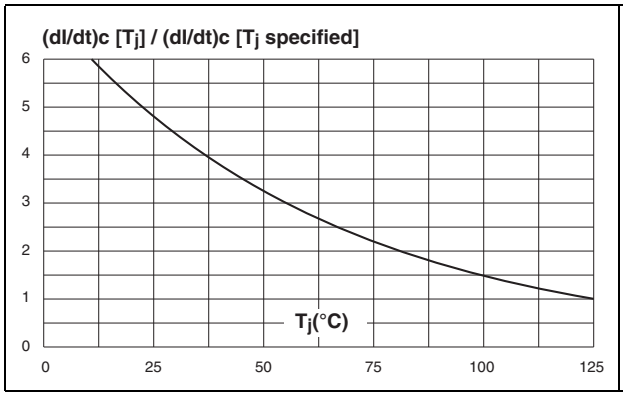
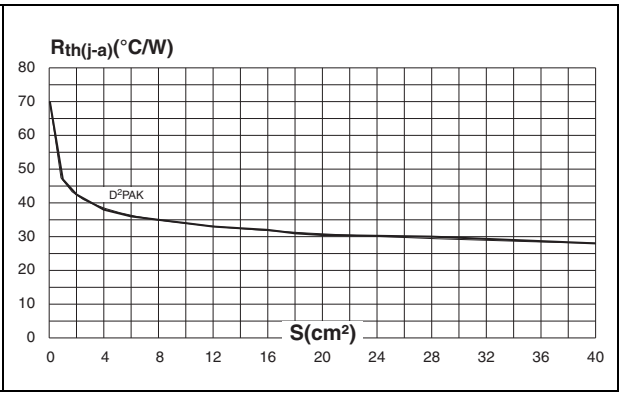


Figure 12. D^2PAK thermal resistance junction to ambient versus copper surface under tab (printed circuit board FR4, copper thickness: 35 µm)



2 Ordering information scheme

Figure 13. BTA12 and BTB12 series

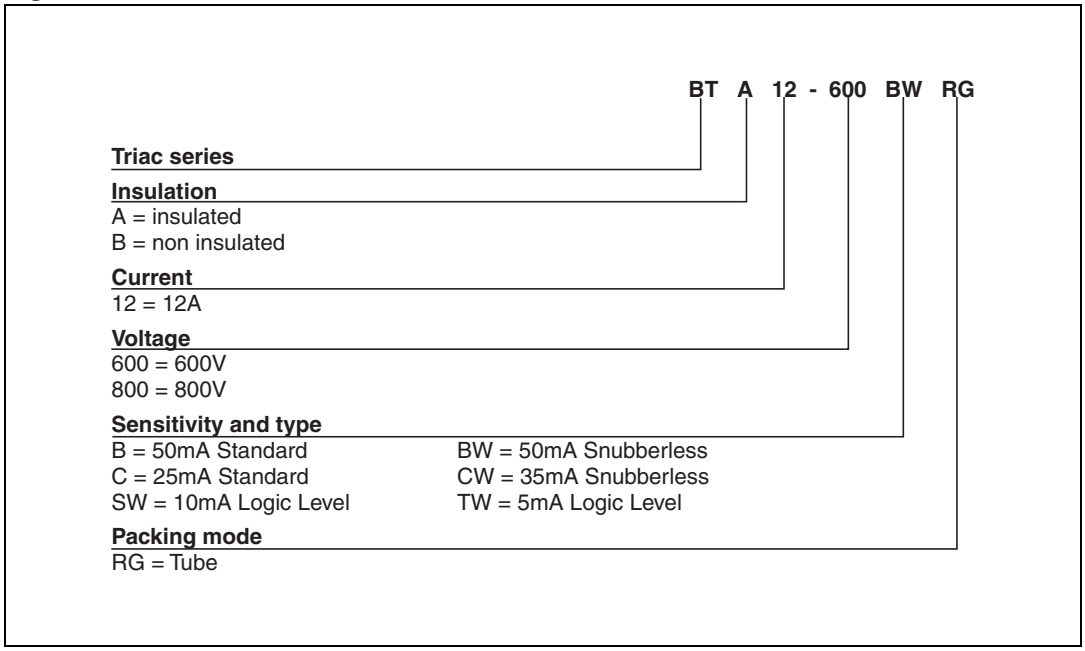


Figure 14. T12xx series

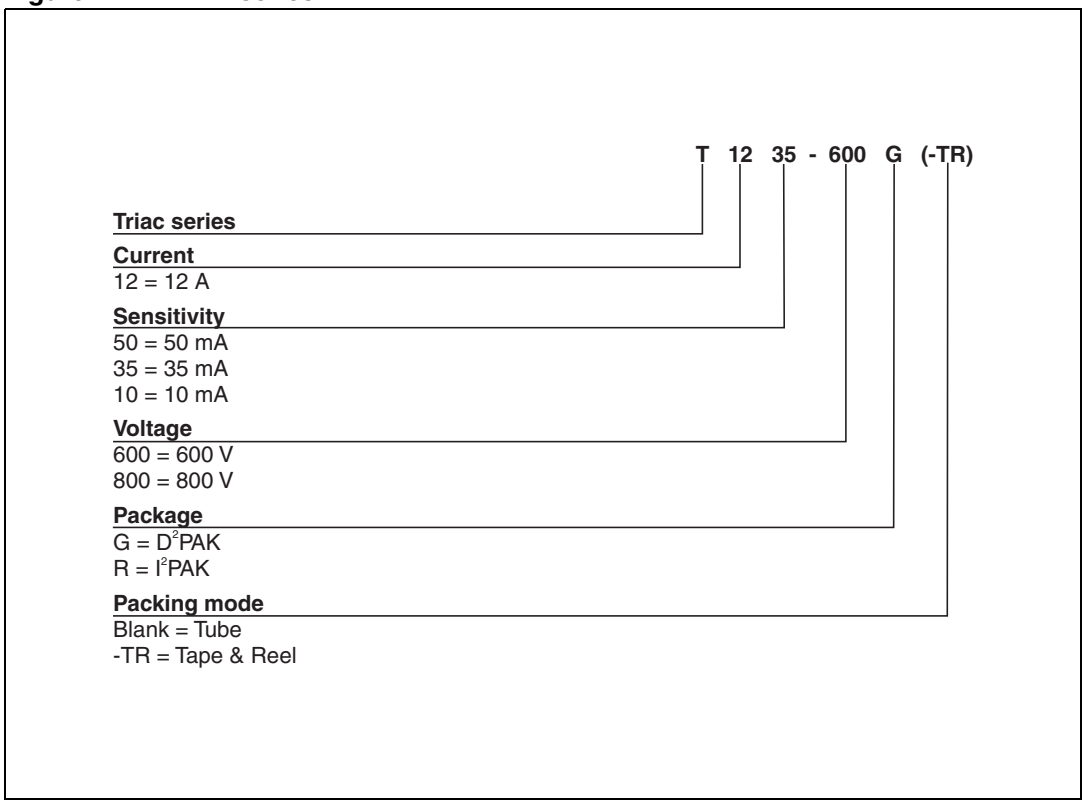


Table 7. Product selector

Order code[1]	Voltage (xxx)		Sensitivity	Type	Package
	600 V	800 V			
BTA/BTB12-xxxBRG	X	X	50 mA	Standard	TO-220AB
BTA/BTB12-xxxBWRG	X	X	50 mA	Snubberless	TO-220AB
BTA/BTB12-xxxCRG	X	X	25 mA	Standard	TO-220AB
BTA/BTB12-xxxCWRG	X	X	35 mA	Snubberless	TO-220AB
BTA/BTB12-xxxSWRG	X	X	10 mA	Logic Level	TO-220AB
BTA/BTB12-xxxTWRG	X	X	5 mA	Logic Level	TO-220AB
T1210-800G	-	X	10 mA	Logic Level	D^2PAK
T1235-xxxG	X	X	35 mA	Snubberless	D^2PAK
T1235-xxxR	X	X	35 mA	Snubberless	I^2PAK
T1250-600G	X	-	50 mA	Snubberless	D^2PAK

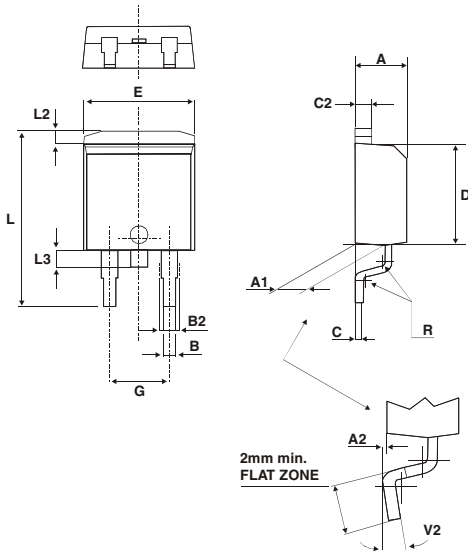
1. **BTB:** non insulated TO-220AB package

3 Packaging information

- Epoxy meets UL94, V0

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.

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 15. Footprint (dimensions in mm)

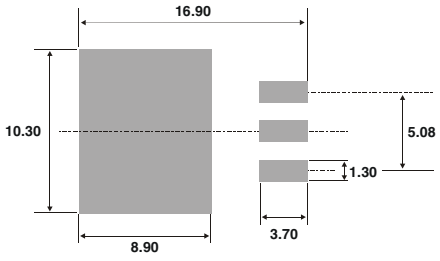
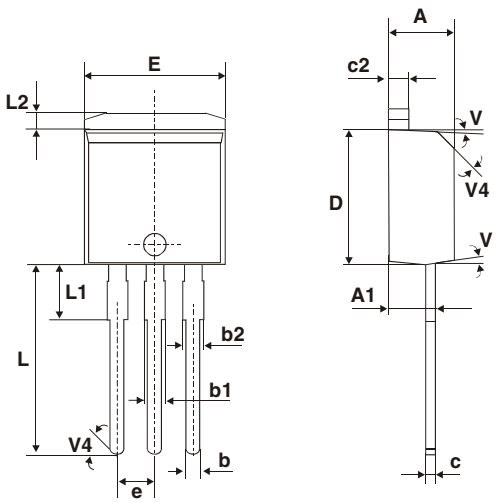
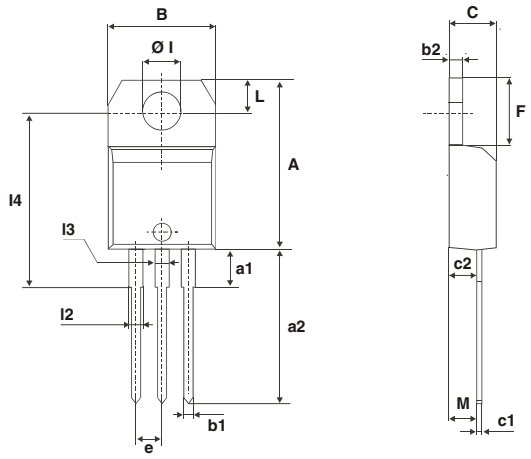


Table 9. I^2PAK dimensions



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
b	0.70		0.93	0.028		0.037
b1	1.20		1.38	0.047		0.054
b2	1.25	1.40		0.049	0.055	
c	0.45		0.60	0.018		0.024
c2	1.21		1.36	0.048		0.054
D	8.95		9.35	0.352		0.368
e	2.44		2.64	0.096		0.104
E	10.00		10.28	0.394		0.405
L	13.10		13.60	0.516		0.535
L1		3.75			0.148	
L2	1.27		1.40	0.050		0.055
V		5°			5°	
V4		45°			45°	

Table 10. TO-220AB dimensions (insulated and non-insulated)



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 11. Ordering information

Order code	Marking	Package	Weight	Base qty	Delivery mode
BTA/BTB12-xxxyzRG	BTA/BTB12-xxxyz	TO-220AB	2.3 g	50	Tube
T1210-xxxG-TR	T1210-xxxG	D^2PAK	1.5 g	1000	Tape and reel
T1235-xxxG	T1235xxxG	D^2PAK	1.5 g	50	Tube
T1235-xxxG-TR	T1235xxxG			1000	Tape and reel
T1235-xxxR	T1235-xxxR	I^2PAK	1.5 g	50	Tube
T1250-xxxG-TR	T1250xxxG	D^2PAK	1.5 g	1000	Tape and reel

Note: xxx = voltage, y = sensitivity, z = type

5 Revision history

Table 12. Revision history

Date	Revision	Changes
Sep-2002	6A	Last update.
25-Mar-2005	7	1. I^2PAK package added. 2. TO-220AB delivery mode changed from bulk to tube.
27-May-2005	8	T1210 added
28-Sep-2007	9	Reformatted to current standards. T1250 added

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