1 Characteristics

Table 1. Absolute maximum ratings

Symbol	Parameters			Value	Unit
$I_{T(RMS)}$	RMS on-state current (full sine wave)	TO-220AB, D^2PAK	T_c = 100 °C	16	A
		TO-220AB Ins.	T_c = 86 °C		
I_{TSM}	Non repetitive surge peak on-state current (full cycle, T_j initial = 25 °C)	F = 50 Hz	t_p = 20 ms	160	A
		F = 60 Hz	t_p = 16.7 ms	168	
I^2t	I^2t value for fusing	t_p = 10 ms		144	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}	Storage junction temperature range			-40 to +150	°C
T_j	Operating junction temperature range			-40 to +125	°C

Table 2. Static electrical characteristics

Symbol	Test conditions	T_j		Value	Unit
V_T(1)	I_{TM} = 22.5 A, t_p = 380 µs	25 °C	Max.	1.55	V
V_{TO}(1)	threshold on-state voltage	125 °C	Max.	0.85	V
R_D(1)	Dynamic resistance	125 °C	Max.	25	mΩ
I_{DRM}/I_{RRM}	V_{DRM} = V_{RRM}	25 °C	Max.	5	µA
		125 °C		2	mA

1. *For both polarities of A2 referenced to A1*

Table 3. Electrical characteristics (T_j = 25 °C, unless otherwise specified) - standard (4 quadrants)

Symbol	Parameters	Quadrant		BTA16 BTB16		Unit
				C	B	
I_{GT}(1)	V_D = 12 V, R_L = 33 Ω	I - II - III	Max.	25	50	mA
		IV		50	100	
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	60	mA
		II	Max.	80	120	

Symbol	Parameters	Quadrant		BTA16 BTB16		Unit
				C	B	
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 = 7 A/ms, T_j = 125 °C		Min.	5	10	V/µs

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 °C, unless otherwise specified) - Snubberless and logic level (3 quadrants)

Symbol	Parameters	Quadrant		T1610 / BTA16-SW / BTB16-SW	T1635 / BTA16-CW / BTB16-CW	T1650 / BTA16-BW / BTB16-BW	Unit
I_{GT}(1)	V_D = 12 V, R_L = 30 Ω	I - II - III	Max.	10	35	50	mA
V_{GT}			Max.	1.3			V
V_{GD}	V_D = V_{DRM}, R_L = 3,3 kΩ, T_j = 125 °C		Min.	0.2			V
I_H(2)	I_T = 500 mA		Max.	15	35	50	mA
I_L	I_G = 1.2 I_{GT}	I - III	Max.	25	50	70	mA
		II	Max.	30	60	80	
(dV/dt)(2)	VD = 67 % V_{DRM} gate open, T_j = 125 °C		Min.	40	500	1000	V/µs
(dI/dt)c(2)	(dV/dt)c = 0.1 V/µs, T_j = 125 °C		Min.	8.5			A/ms
	(dV/dt)c = 10 V/µs, T_j = 125 °C			3.0			
	Without snubber, T_j = 125 °C				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 5. Thermal resistance

Symbol	Parameters		Value	Unit
$R_{th(j-c)}$	Max. junction to case (AC)	TO-220AB / D²PAK	1.2	°C/W
		TO-220AB insulated	2.1	
$R_{th(j-a)}$	Junction to ambient (S = 2 cm²)	D²PAK	45	
	Junction to ambient	TO-220AB / TO-220AB ins	60	

1. *Copper surface under tab.*

1.1 Characteristics (curves)

Figure 2. Maximum power dissipation versus on-state RMS current (full cycle)

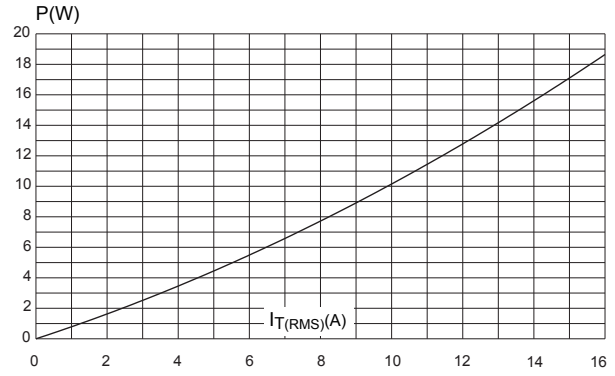


Figure 3. RMS on-state current versus case temperature (full cycle)

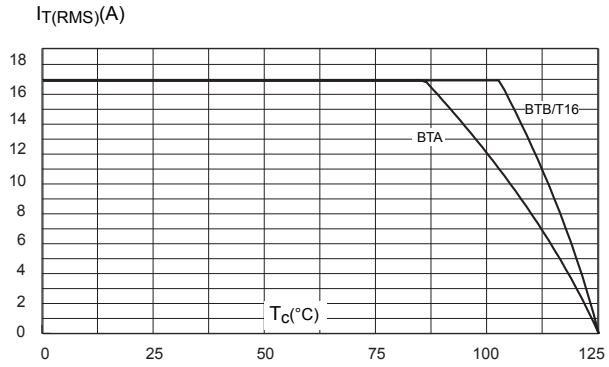


Figure 4. On-state rms current versus ambient temperature (full cycle)

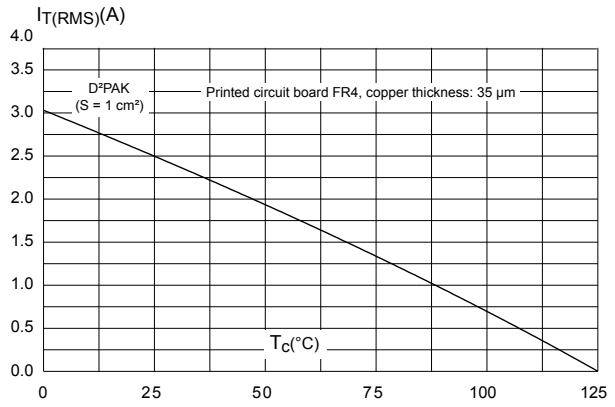


Figure 5. Relative variation of thermal impedance versus pulse duration

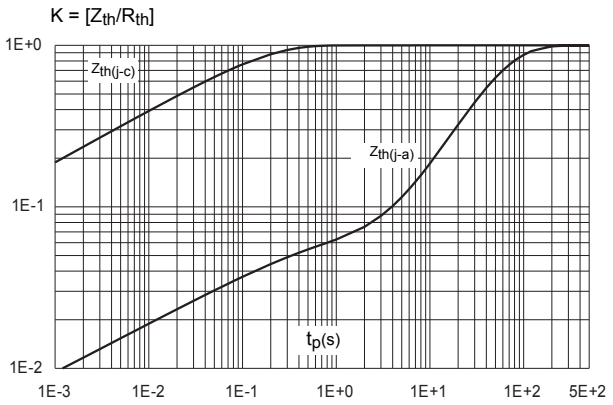


Figure 6. On-state characteristics (maximum values)

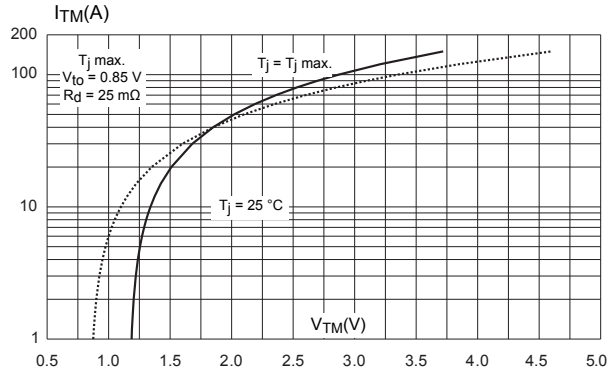


Figure 7. Surge peak on-state current versus number of cycles

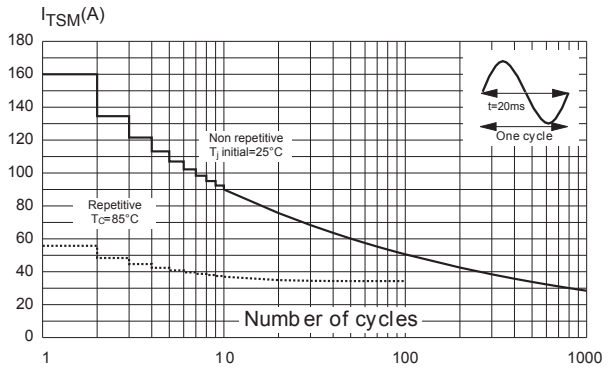


Figure 8. Non-repetitive surge peak on-state current for a sinusoidal

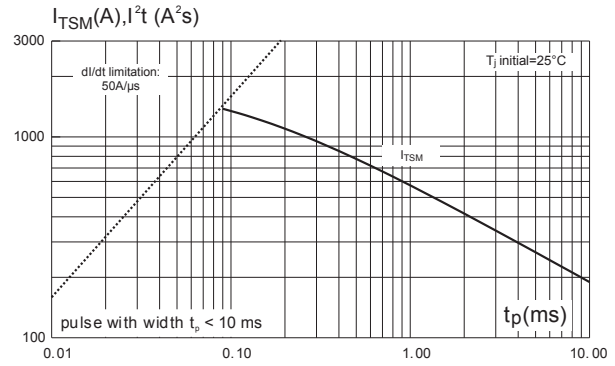


Figure 9. Relative variation of gate trigger current

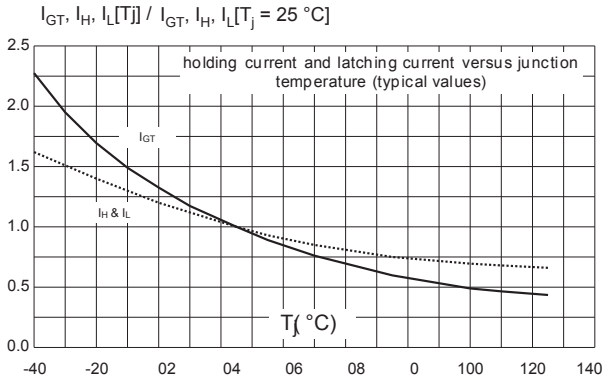


Figure 10. Relative variation of critical rate of decrease of main current versus (dV/dt)c (typical values)

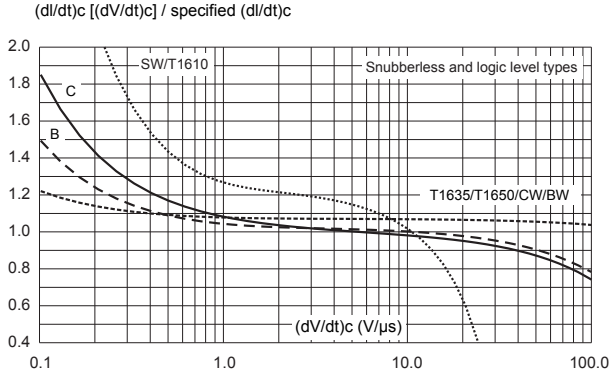


Figure 11. Relative variation of critical rate of decrease of main current versus (junction temperature (typical values)

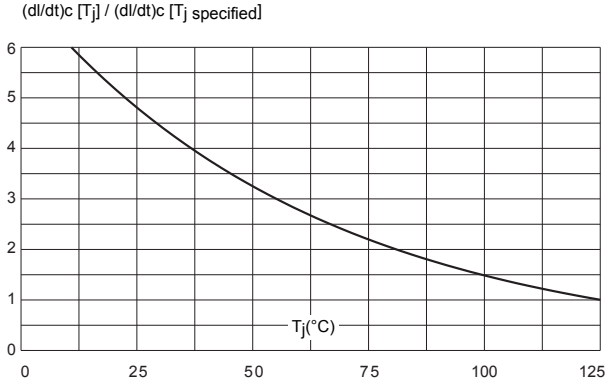
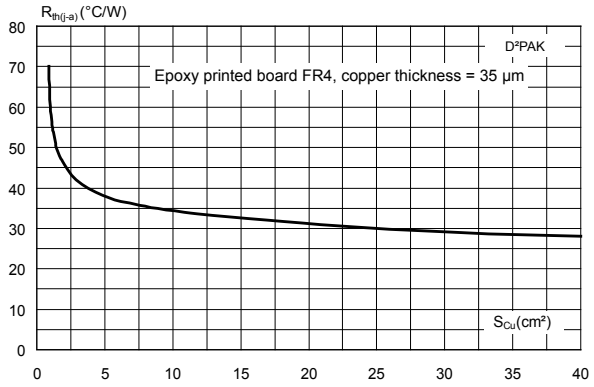


Figure 12. D²PAK thermal resistance junction to ambient versus copper surface under tab



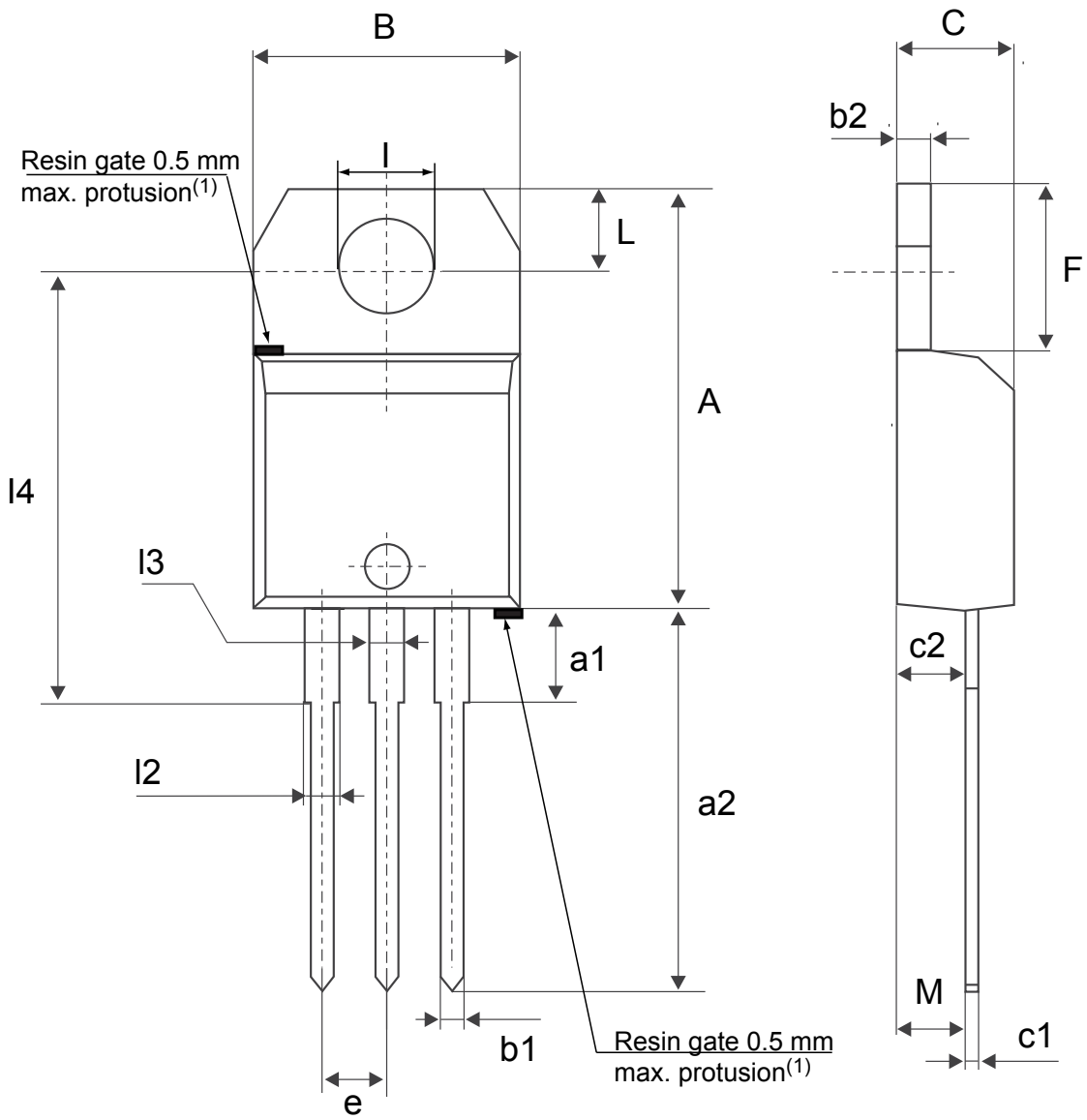
2 Package information

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.

2.1 TO-220AB Insulated and non Insulated package information

- Epoxy meets UL 94,V0
- Cooling method: by conduction (C)
- Recommended torque value: 0.55 N·m
- Maximum torque value: 0.70 N·m

Figure 13. TO-220AB Insulated and non Insulated package outline



(1)Resin gate position accepted in one of the two positions or in the symmetrical opposites.

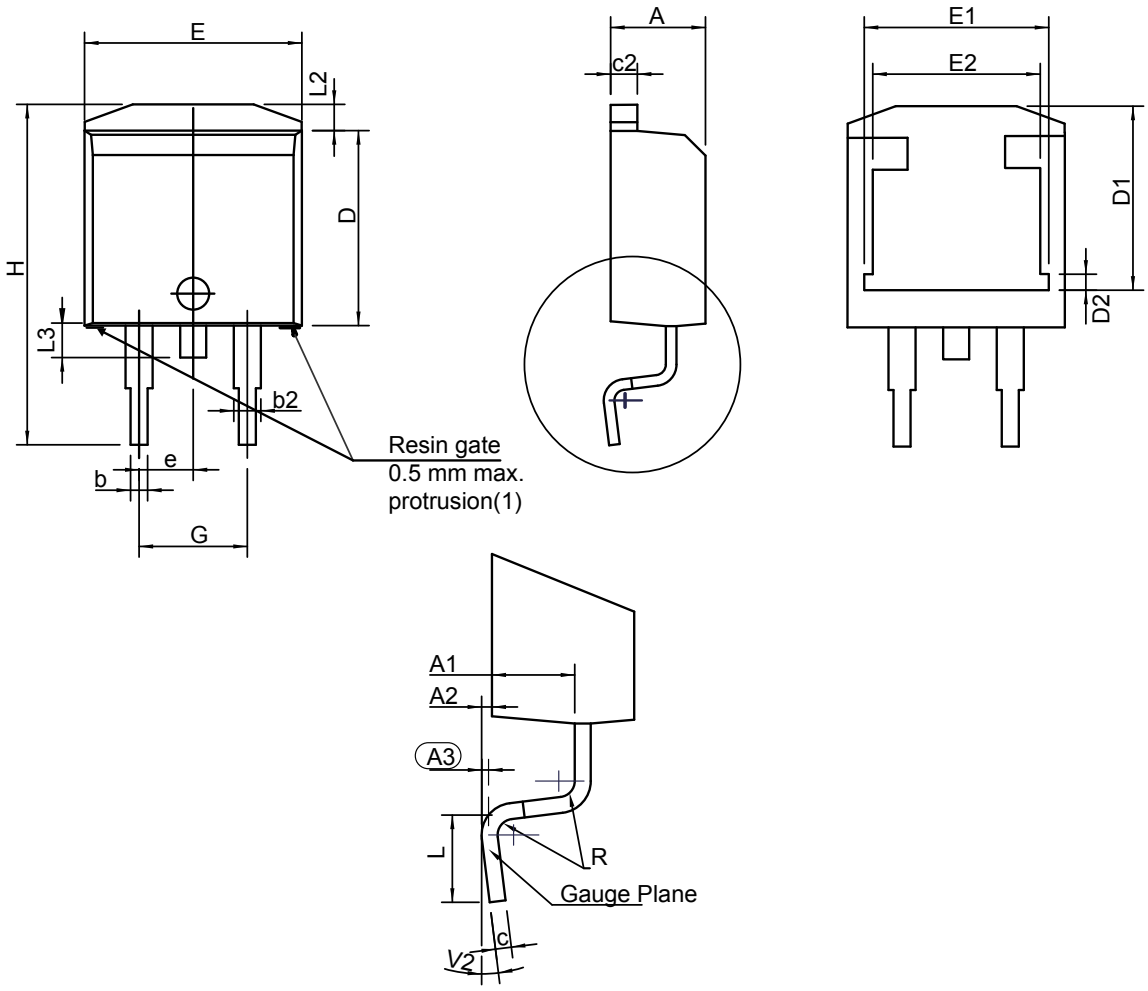
Table 6. TO-220ABInsulated and non Insulated package mechanical data

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	15.20		15.90	0.5984		0.6260
a1		3.75			0.1476	
a2	13.00		14.00	0.5118		0.5512
B	10.00		10.40	0.3937		0.4094
b1	0.61		0.88	0.0240		0.0346
b2	1.23		1.32	0.0484		0.0520
C	4.40		4.60	0.1732		0.1811
c1	0.49		0.70	0.0193		0.0276
c2	2.40		2.72	0.0945		0.1071
e	2.40		2.70	0.0945		0.1063
F	6.20		6.60	0.2441		0.2598
I	3.73		3.88	0.1469		0.1528
L	2.65		2.95	0.1043		0.1161
l2	1.14		1.70	0.0449		0.0669
l3	1.14		1.70	0.0449		0.0669
l4	15.80	16.40	16.80	0.6220	0.6457	0.6614
M		2.6			0.1024	

1. *Inch dimensions are for reference only.*

2.2 D²PAK package information

Figure 14. **D²PAK package outline**



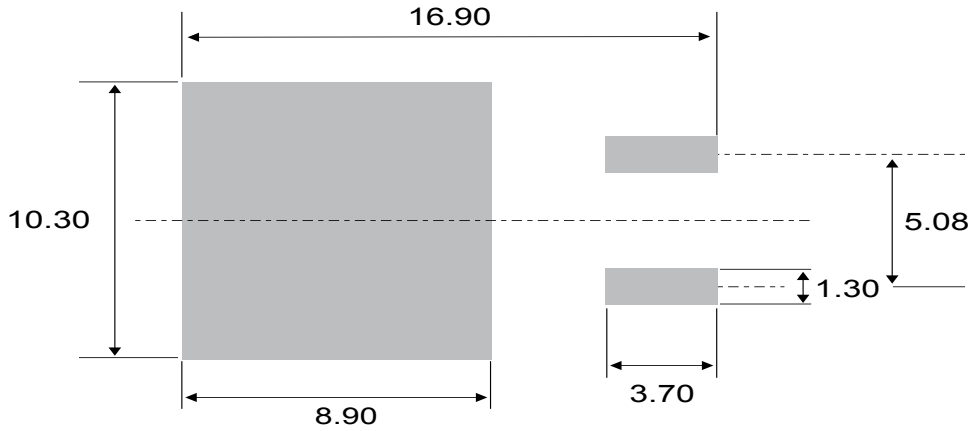
(1) Resin gate position accepted in one of the two positions or in the symmetrical opposites

Table 7. **D²PAK package mechanical data**

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.30		4.60	0.1693		0.1811
A1	2.49		2.69	0.0980		0.1059
A2	0.03		0.23	0.0012		0.0091
A3		0.25			0.0098	
b	0.70		0.93	0.0276		0.0366
b2	1.25		1.7	0.0492		0.0669
c	0.45		0.60	0.0177		0.0236
c2	1.21		1.36	0.0476		0.0535
D	8.95		9.35	0.3524		0.3681
D1	7.50		8.00	0.2953		0.3150
D2	1.30		1.70	0.0512		0.0669
e	2.54			0.1		
E	10.00		10.28	0.3937		0.4047
E1	8.30		8.70	0.3268		0.3425
E2	6.85		7.25	0.2697		0.2854
G	4.88		5.28	0.1921		0.2079
H	15		15.85	0.5906		0.6240
L	1.78		2.28	0.0701		0.0898
L2	1.27		1.40	0.0500		0.0551
L3	1.40		1.75	0.0551		0.0689
R		0.40			0.0157	
V2	0°		8°	0°		8°

1. *Dimensions in inches are given for reference only*

Figure 15. D²PAK recommended footprint (dimensions are in mm)



3 Ordering information

Figure 16. **Ordering information scheme (BTA16 and BTB16 series)**

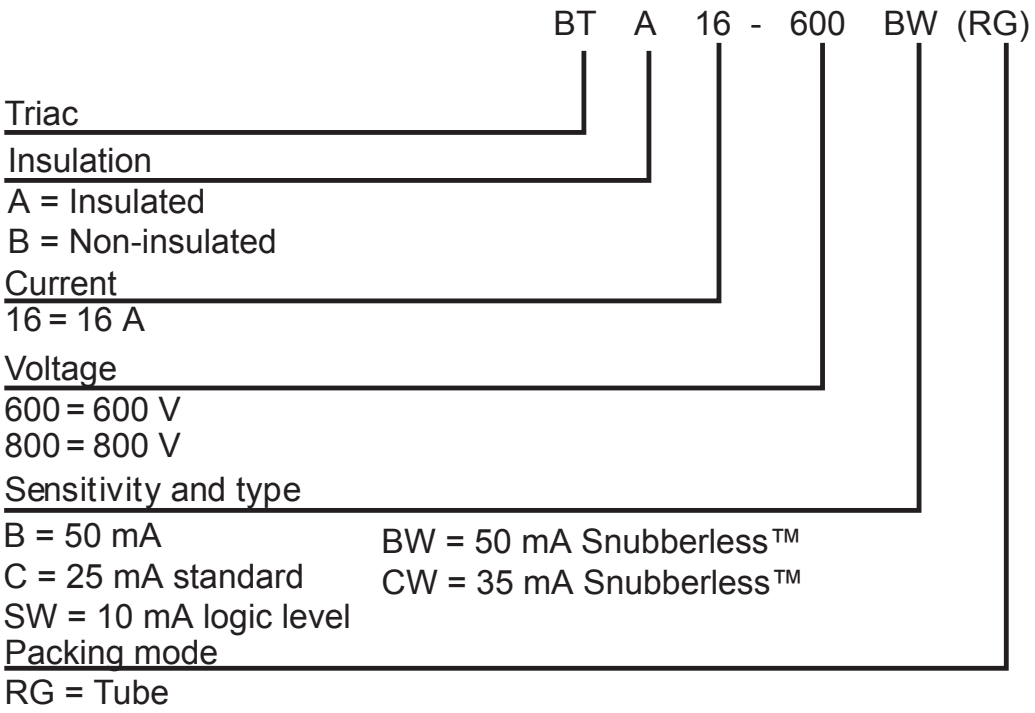
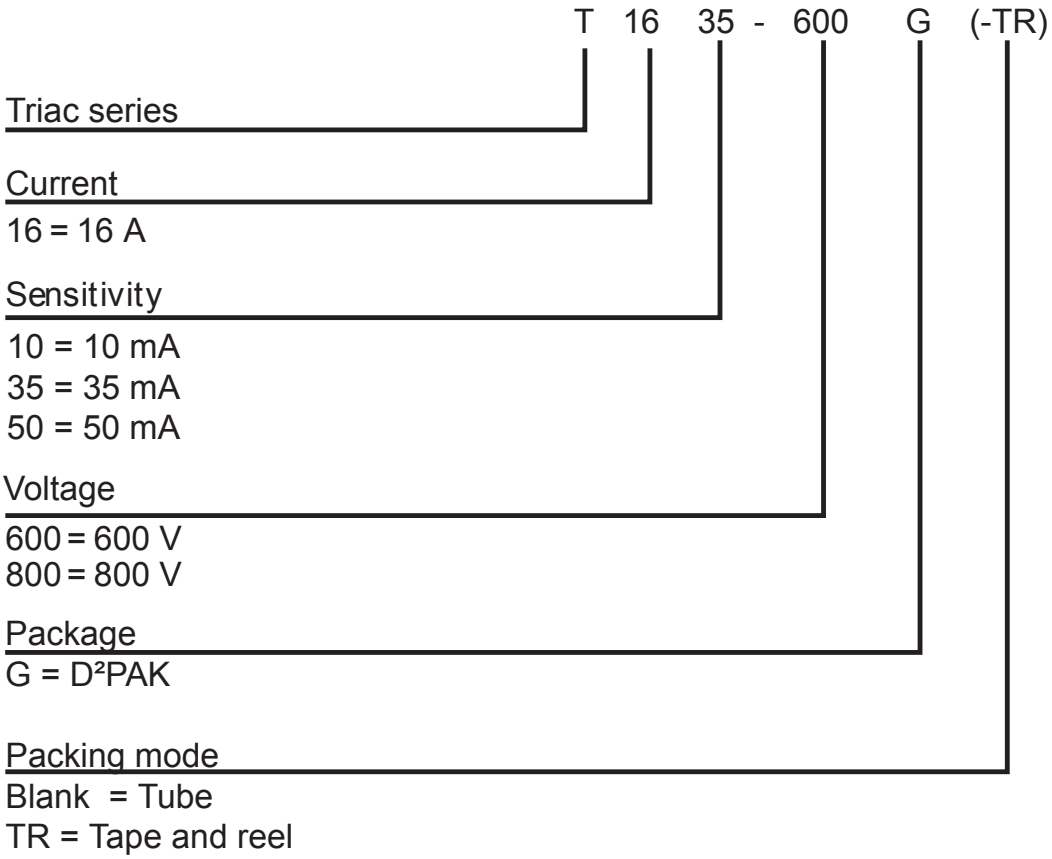


Figure 17. **Ordering information scheme (T8 series)**



3.1 Product selector

Table 8. **Product selector**

Part Number		Sensitivity	Type	Package
600	800			
BTB16-600C		35 mA	Standard	TO-220AB
BTB16-600B	BTB16-800B	50 mA	Standard	TO-220AB
BTB16-600SW	BTB16-800SW	10 mA	Snubberless™	TO-220AB
BTB16-600CW	BTB16-800CW	35 mA	Snubberless™	TO-220AB
BTB16-600BW	BTB16-800BW	50 mA	Snubberless™	TO-220AB
BTA16-600C		35 mA	Standard	TO-220AB Ins.
BTA16-600B	BTA16-800B	50 mA	Standard	TO-220AB Ins.
BTA16-600SW	BTA16-800SW	10 mA	Snubberless™	TO-220AB Ins.
BTA16-600CW	BTA16-800CW	35 mA	Snubberless™	TO-220AB Ins.
BTA16-600BW	BTA16-800BW	50 mA	Snubberless™	TO-220AB Ins.
T1610-600G	T1610-800G	10 mA	Snubberless™	D^2PAK
T1635-600G	T1635-800G	35 mA	Snubberless™	D^2PAK
T1650-600G		50 mA	Snubberless™	D^2PAK

3.2 Ordering information

Table 9. **Ordering information**

Order code	Marking	Package	Weight	Base qty.	Delivery mode
BTA16-600BRG	BTA16-600B	TO-220AB Ins.	2.30	50	Tube
BTA16-600BWRG	BTA16-600BW				
BTA16-600CRG	BTA16-600C				
BTA16-600CWRG	BTA16-600CW				
BTA16-600SWRG	BTA16-600SW				
BTA16-800BRG	BTA16-800B				
BTA16-800BWRG	BTA16-800BW				
BTA16-800CWRG	BTA16-800CW				
BTA16-800SWRG	BTA16-800SW				
BTB16-600BRG	BTB16-600B	TO-220AB			Tube
BTB16-600BWRG	BTB16-600BW				
BTB16-600CRG	BTB16-600C				
BTB16-600CWRG	BTB16-600CW				
BTB16-600SWRG	BTB16-600SW				
BTB16-800BRG	BTB16-800B				
BTB16-800BWRG	BTB16-800BW				
BTB16-800CWRG	BTB16-800CW				
BTB16-800SWRG	BTB16-800SW				
T1610-600G-TR	T1610-600G	D²PAK	1.50	1000	Tape and reel
T1610-800G-TR	T1610-800G				
T1635-600G-TR	T1635-600G				
T1635-800G-TR	T1635-800G				
T1650-600G-TR	T1650-600G				
T1635-600G	T1635-600G			50	Tube

Revision history

Table 10. **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.
04-Dec-2009	9	Updated value for V_{DSM} / V_{RSM} in Table 2. Updated temperature in Table 2 from 15 °C to 86 °C.
11-Mar-2010	10	Updated value for V_{DSM} / V_{RSM} in Table 2. Updated temperature in Table 2 from 15 °C to 86 °C.
30-May-2018	11	Updated Section ● Product status / summary. Added T1650 package information.