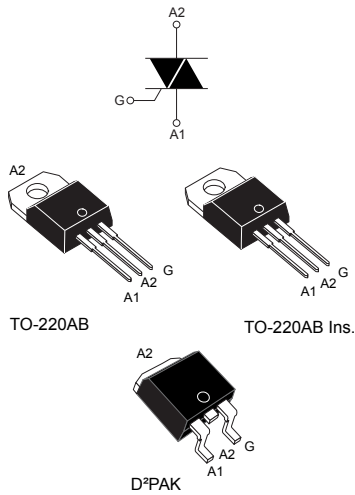


## 12 A Snubberless, logic level and standard Triacs



### 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
- Packages are RoHS (2011/65/EU) compliant

### Description

Available either in through-hole or surface mount packages, the **BTA12**, **BTB12** and **T12xx** Triac series are suitable for general purpose mains power AC switching. They can be used as ON/OFF function in applications such as static relays, heating regulation or induction motor starting circuit. They are also recommended for phase control operations in light dimmers and appliance motors speed controllers.

The Snubberless versions (W suffix and T12xx) are especially recommended for use on inductive loads, because of their high commutation performance. By using an internal ceramic pad, the Snubberless™ series provide an insulated tab (rated at 2500 V<sub>RMS</sub>).

Logic Level BTA12-600TW and BTA12-600SW offer low holding current, ideal to design light dimmers for LED lamps.

Figure 1. Ordering information scheme (BTA12 and BTB12 series)

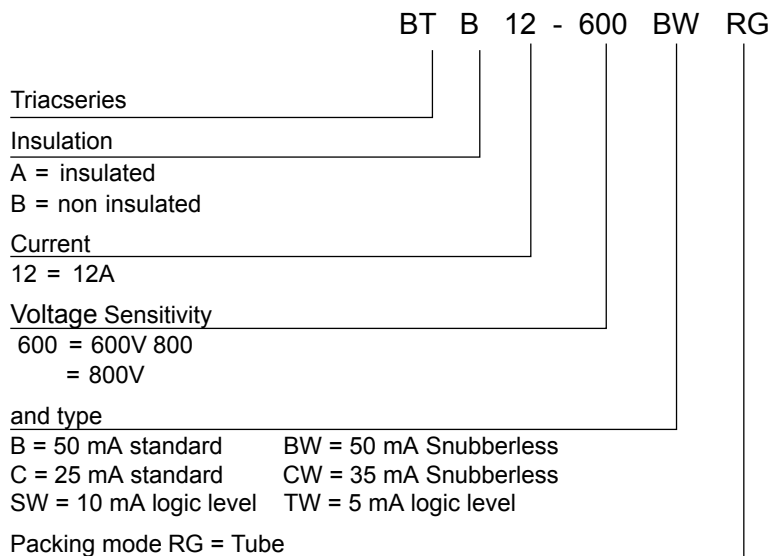
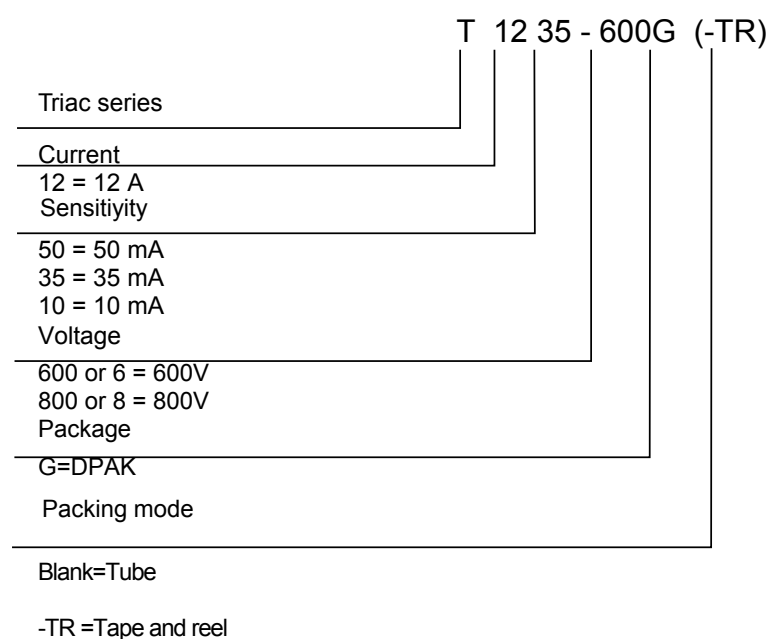


Figure 2. Ordering information scheme (T12 series)



## 1 Characteristics

**Table 1. Absolute maximum ratings ( $T_j = 25\text{ °C}$  unless otherwise stated)**

Symbol	Parameter			Value	Unit
$I_{T(RMS)}$	RMS on-state current (full sine wave)	TO-220AB, D <sup>2</sup> PAK	$T_c = 105\text{ °C}$	12	A
		TO-220AB Ins.	$T_c = 90\text{ °C}$		
$I_{TSM}$	Non repetitive surge peak on-state current (full cycle, $T_j$ initial = $25\text{ °C}$ )	f = 50 Hz	t = 20 ms	120	A
		f = 60 Hz	$t_p = 16.7\text{ ms}$	126	
$I^2t$	$I^2t$ value for fusing		$t_p = 10\text{ ms}$	78	A <sup>2</sup> s
dI/dt	Critical rate of rise of on-state current $I_G = 2 \times I_{GT}$ , tr ≤ 100 ns	f = 120 Hz	$T_j = 125\text{ °C}$	50	A/μs
$V_{DSM}/V_{RSM}$	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	$t_p = 20\text{ μs}$	$T_j = 125\text{ °C}$	4	A
$P_{G(AV)}$	Average gate power dissipation		$T_j = 125\text{ °C}$	1	W
$T_{stg}$	Storage junction temperature range			-40 to +150	°C
$T_j$	Operating junction temperature range			-40 to +125	°C

**Table 2. Electrical characteristics ( $T_j = 25\text{ °C}$ , unless otherwise specified) - Snubberless™ and logic level (3 quadrants)**

Symbol	Parameter	Quadrant		T1205 BTB12-TW BTB12-TW	T1210 BTB12-SW BTA12-SW	T1235 BTB12- CW BTA12-	T1250 BTB12- BW BTA12-	Unit
$I_{GT}^{(1)}$	$V_D = 12\text{ V}$ , $R_L = 30\text{ Ω}$	I - II - III	Max.	5	10	35	50	mA
$V_{GT}$		I - II - III	Max.	1.3				V
$V_{GD}$	$V_D = V_{DRM}$ , $R_L = 3.3\text{ kΩ}$ , $T_j = 125\text{ °C}$	I - II - III	Min.	0.2				V
$I_H^{(2)}$	$I_T = 100\text{ mA}$	I - II - III	Max.	10	15	35	50	mA
$I_L^{(2)}$	$I_G = 1.2 \times I_{GT}$	I - III	Max.	10	25	50	70	mA
		II	Max.	15	30	60	80	
$dV/dt^{(2)}$	$V_D = 67\% V_{DRM}$ , gate open, $T_j = 125\text{ °C}$		Max.	20	40	500	1000	V/μs
$(dI/dt)_c^{(2)}$	$(dV/dt)_c = 0.1\text{ V/μs}$ , $T_j = 125\text{ °C}$		Min.	3.5	6.5			A/ms
	$(dV/dt)_c = 10\text{ V/μs}$ , $T_j = 125\text{ °C}$		Min.	1.0	2.9			
	Without snubber, $T_j = 125\text{ °C}$		Min.			6.5	12	

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

**Table 3. Electrical characteristics ( $T_j = 25\text{ }^\circ\text{C}$ , unless otherwise specified) - Standard Triac (4 quadrants)**

Symbol	Parameter	Quadrant		Value		Unit
				C	B	
$I_{GT}^{(1)}$	$V_D = 12\text{ V}$ , $R_L = 30\ \Omega$	I - II - III	Max.	25	50	mA
		IV		50	100	
$V_{GT}$		All	Max.	1.3		V
$V_{GD}$	$V_D = V_{DRM}$ , $R_L = 33\text{ k}\Omega$ , $T_j = 125\text{ }^\circ\text{C}$	All	Min.	0.2		V
$I_H^{(2)}$	$I_T = 500\text{ mA}$	I - II - III	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, $T_j = 125\text{ }^\circ\text{C}$		Min.	200	400	V/ $\mu\text{s}$
$(dV/dt)_c^{(2)}$	$(dI/dt)_c = 5.3\text{ A/ms}$ , $T_j = 125\text{ }^\circ\text{C}$		Min.	5	10	V/ $\mu\text{s}$

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

**Table 4. Static electrical characteristics**

Symbol	Test conditions			Value	Unit
$V_{TM}^{(1)}$	$I_{TM} = 17\text{ A}$ , $t_p = 380\ \mu\text{s}$	$T_j = 25\text{ }^\circ\text{C}$	Max.	1.55	V
$V_{TO}^{(1)}$	threshold on-state voltage	$T_j = 125\text{ }^\circ\text{C}$	Max.	0.85	V
$R_D^{(1)}$	Dynamic resistance	$T_j = 125\text{ }^\circ\text{C}$	Max.	35	m $\Omega$
$I_{DRM}$ $I_{RRM}$	$V_{DRM} = V_{RRM}$	$T_j = 25\text{ }^\circ\text{C}$	Max.	5	$\mu\text{A}$
		$T_j = 125\text{ }^\circ\text{C}$	Max.	1	mA

1. For both polarities of A2 referenced to A1

**Table 5. Thermal resistance**

Symbol	Parameter			Value	Unit	
$R_{th(j-c)}$	Max. junction to case thermal resistance (AC)		D <sup>2</sup> PAK / TO-220AB	Max.	1.4	$^\circ\text{C/W}$
			TO-220AB insulated	Max.	2.3	
$R_{th(j-a)}$	Junction to ambient	$S = 2\text{ cm}^2$ <sup>(1)</sup>	D <sup>2</sup> PAK	Typ.	45	$^\circ\text{C/W}$
	Junction to ambient		TO-220AB / TO-220AB insulated	Typ.	60	

1.  $S$  = Copper surface under tab.

1.1 Characteristics (curves)

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

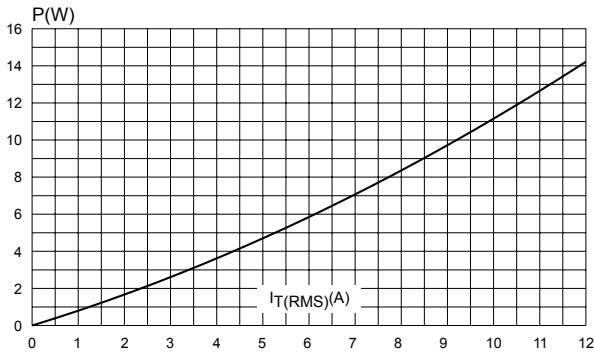


Figure 2. RMS on-state current cycle versus case temperature (full cycle)

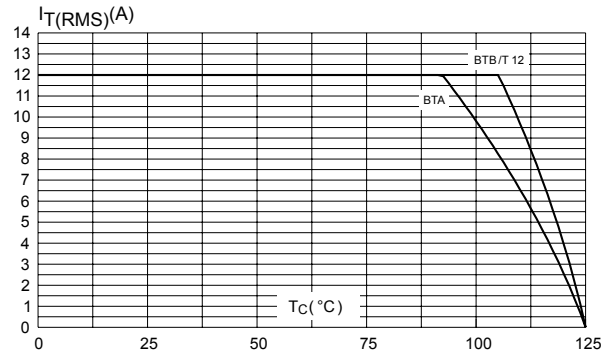


Figure 3. RMS on-state current versus ambient temperature (printed circuit board FR4, copper thickness: 35 μm) (full cycle)

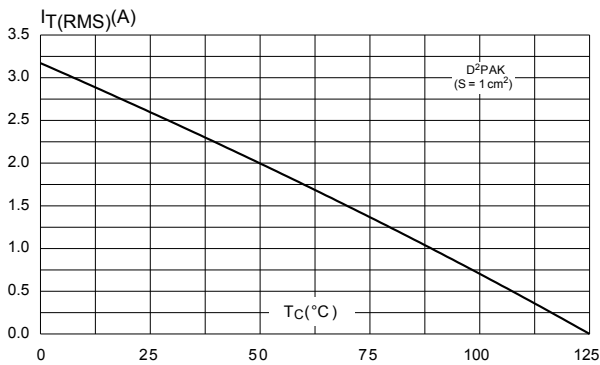


Figure 4. Relative variation of thermal impedance versus pulse duration

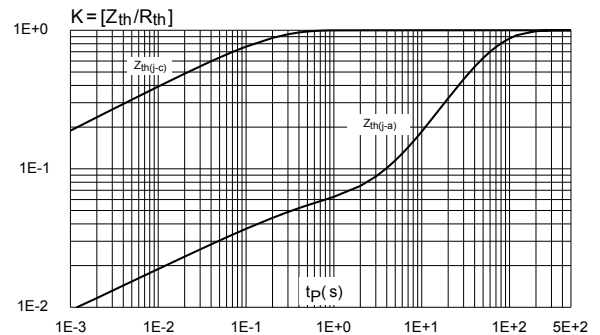


Figure 5. On-state characteristics (maximum values)

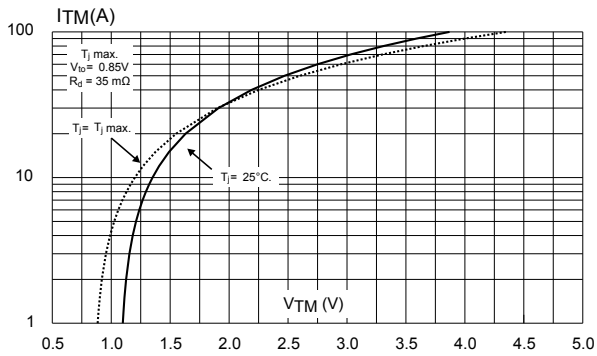


Figure 6. Surge peak on-state current versus number of cycles

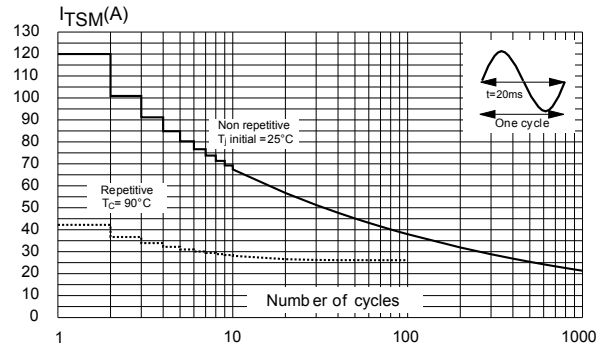


Figure 7. Non repetitive surge peak on-state current for a sinusoidal pulse

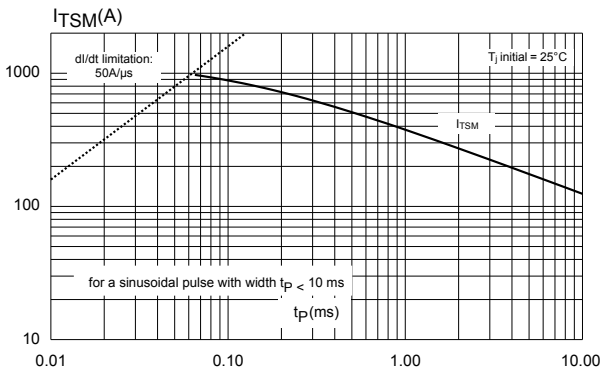
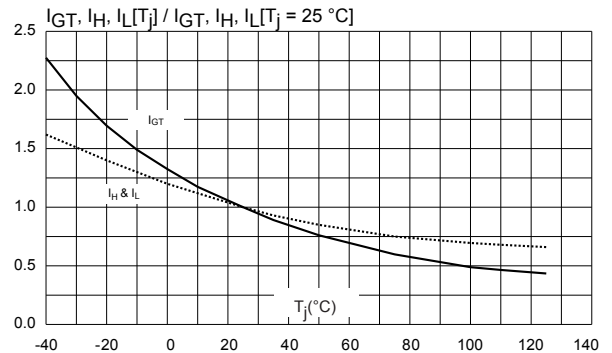
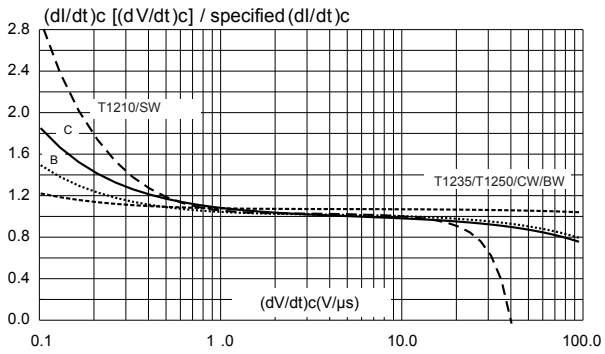


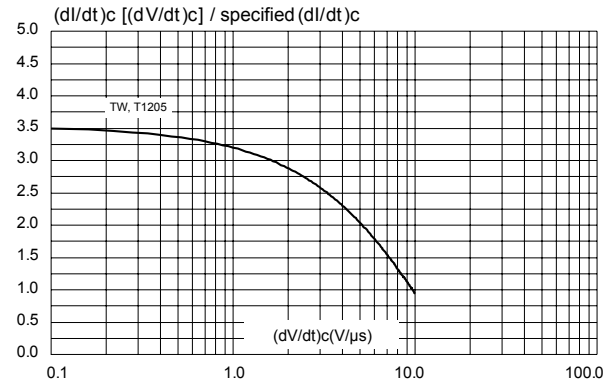
Figure 8. Relative variation of gate trigger current holding current and latching current versus junction temperature (typical values)



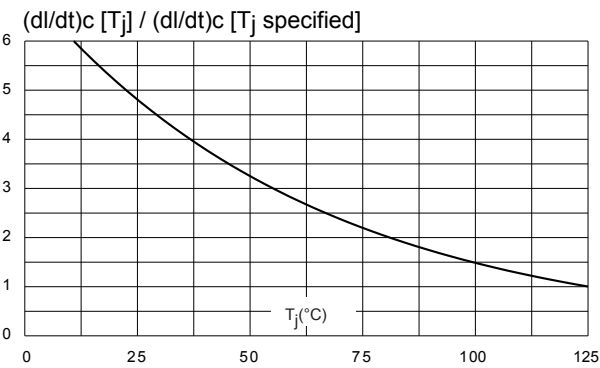
**Figure 9. Relative variation of critical rate of decrease of main current versus (dV/dt)<sub>c</sub> (typical values)**



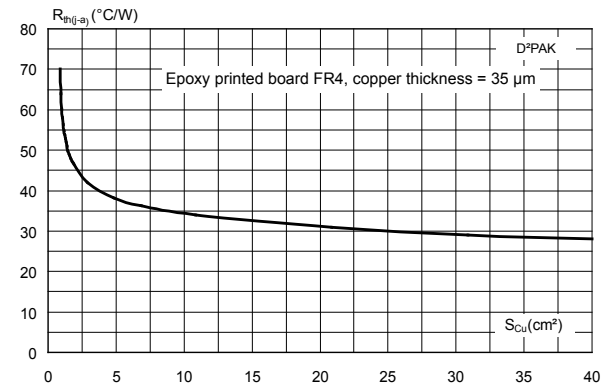
**Figure 10. Relative variation of critical rate of decrease of main current versus (dV/dt)<sub>c</sub> (typical values)(TW)**



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



**Figure 12. D<sup>2</sup>PAK thermal resistance junction to ambient versus copper surface under tab**

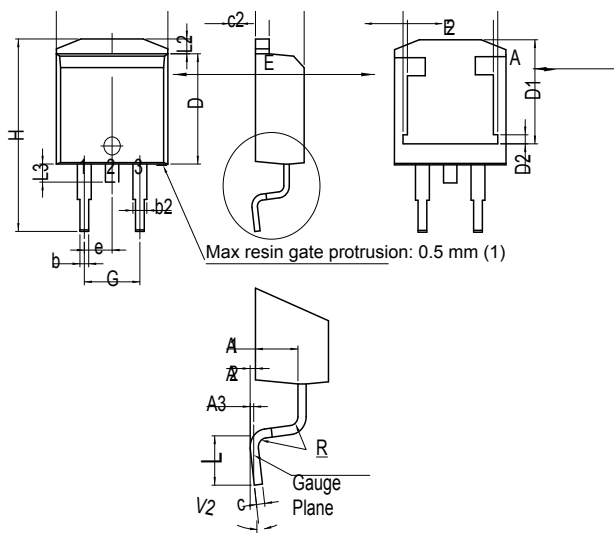


## 2 Package information

### 2.1 D<sup>2</sup>PAK package information

- ECOPACK2® compliant
- Lead-free package leads finishing
- Molding compound resin is halogen-free and meets UL standard level V0

Figure 13. D<sup>2</sup>PAK package outline



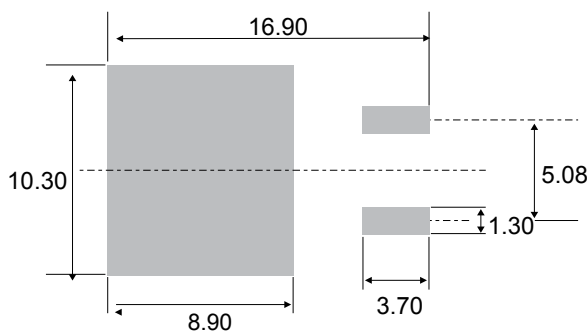
(1) Resin gate is accepted in each of position shown on the drawing, or their symmetrical.

Table 6. D<sup>2</sup>PAK package mechanical data

Ref.	Dimensions					
	Millimeters			Inches <sup>(1)</sup>		
	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

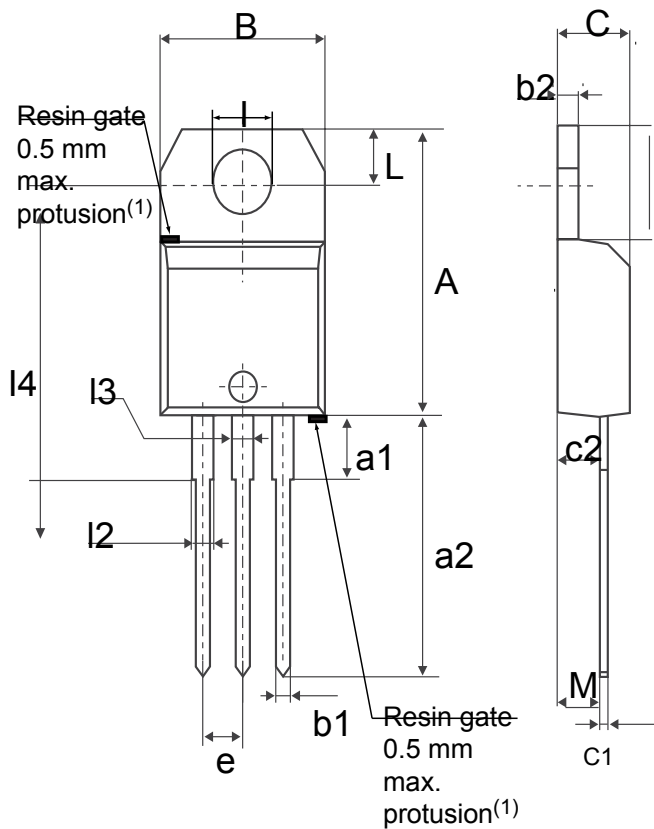
Figure 14. D<sup>2</sup>PAK recommended footprint (dimensions are in mm)



**2.2 TO-220AB insulated package information**

- Cooling method: by conduction (C)
- Recommended torque value: 0.55 N·m
- Maximum torque value: 0.70 N·m

Figure 15. TO-220AB insulated and non insulated package outline



Ref.	Dimensions					
	Millimeters			Inches <sup>(1)</sup>		
	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
I2	1.14		1.70	0.0449		0.0669
I3	1.14		1.70	0.0449		0.0669
I4	15.80	16.40	16.80	0.6220	0.6457	0.6614
M		2.6			0.1024	

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

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