

# 1 Characteristics

**Table 3. Absolute maximum ratings ( $T_j = 25\text{ °C}$  unless otherwise stated)**

Symbol	Parameter			Value	Unit
$I_{T(rms)}$	On-state rms current (full sine wave)	IPAK, DPAK, TO-220AB	$T_c = 110\text{ °C}$	4	A
$I_{TSM}$	Non repetitive surge peak on-state current (full cycle, $T_j$ initial = $25\text{ °C}$ )	$F = 50\text{ Hz}$	$t = 20\text{ ms}$	30	A
		$F = 60\text{ Hz}$	$t = 16.7\text{ ms}$	31	
$I^2t$	$I^2t$ value for fusing		$t_p = 10\text{ ms}$	5.1	$A^2s$
$di/dt$	Critical rate of rise of on-state current $I_G = 2 \times I_{GT}$ , $t_r \leq 100\text{ ns}$	$F = 120\text{ Hz}$	$T_j = 125\text{ °C}$	50	$A/\mu s$
$I_{GM}$	Peak gate current	$t_p = 20\text{ }\mu s$	$T_j = 125\text{ °C}$	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	$^{\circ}C$
$T_j$	Operating junction temperature range			- 40 to +125	

**Table 4. Electrical characteristics ( $T_j = 25\text{ °C}$ , unless otherwise stated)**

Symbol	Test conditions	Quadrant		Value			Unit
				T405	T410	T435	
$I_{GT}^{(1)}$	$V_D = 12\text{ V}$ , $R_L = 30\text{ }\Omega$	I - II - III	Max.	5	10	35	mA
$V_{GT}$	$V_D = 12\text{ V}$ , $R_L = 30\text{ }\Omega$	I - II - III	Max.	1.3			V
$V_{GD}$	$V_D = V_{DRM}$ , $R_L = 3.3\text{ k}\Omega$ , $T_j = 125\text{ °C}$	I - II - III	Min.	0.2			V
$I_H^{(2)}$	$I_T = 100\text{ mA}$		Max.	10	15	35	mA
$I_L$	$I_G = 1.2 I_{GT}$	I - III	Max.	10	25	50	mA
		II	Max.	15	30	60	
$dV/dt^{(2)}$	$V_D = 67\% V_{DRM}$ , gate open	$T_j = 125\text{ °C}$	Min.	20	40	400	$V/\mu s$
$(di/dt)_c^{(2)}$	$(dV/dt)_c = 0.1\text{ V}/\mu s$	$T_j = 125\text{ °C}$	Min.	1.8	2.7		A/ms
	$(dV/dt)_c = 10\text{ V}/\mu s$			0.9	2.0		
	(without snubber)					2.5	

1. Minimum  $I_{GT}$  is guaranteed at 5% of  $I_{GT}$  max.

2. For both polarities of A2 referenced to A1

Table 5. Static characteristics

Symbol	Test conditions			Value	Unit
$V_{TM}^{(1)}$	$I_{TM} = 5.5 \text{ A}$ , $t_p = 380 \text{ } \mu\text{s}$	$T_j = 25 \text{ } ^\circ\text{C}$	Max.	1.56	V
$V_{t0}^{(1)}$	Threshold voltage	$T_j = 125 \text{ } ^\circ\text{C}$	Max.	0.89	V
$R_d^{(1)}$	Dynamic resistance	$T_j = 125 \text{ } ^\circ\text{C}$	Max.	120	m $\Omega$
$I_{DRM}$ $I_{RRM}$	$V_{DRM} = V_{RRM}$	$T_j = 25 \text{ } ^\circ\text{C}$	Max.	5	$\mu\text{A}$
		$T_j = 125 \text{ } ^\circ\text{C}$		1	mA

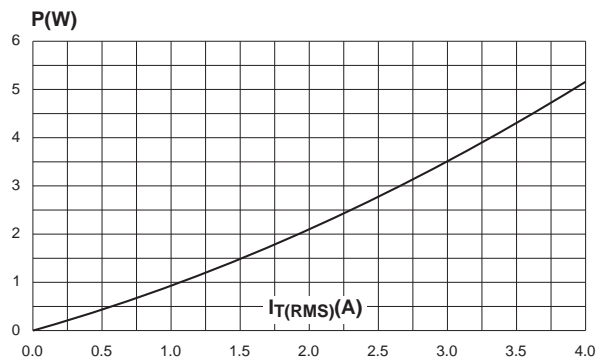
1. For both polarities of A2 referenced to A1

Table 6. Thermal resistance

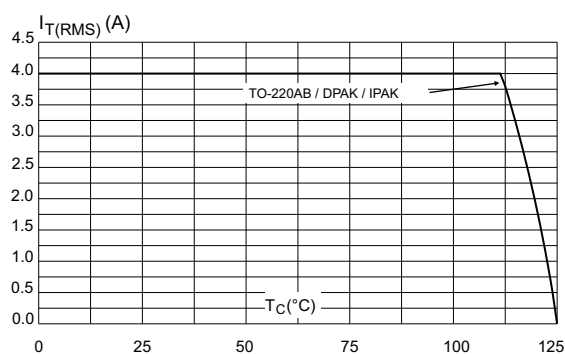
Symbol	Parameter			Value	Unit
$R_{th(j-c)}$	Junction to case (AC)		IPAK, DPAK, TO-220AB	2.6	$^\circ\text{C/W}$
$R_{th(j-a)}$	Junction to ambient	$S^{(1)} = 0.5 \text{ cm}^2$	DPAK	70	$^\circ\text{C/W}$
	Junction to ambient		TO-220AB	60	$^\circ\text{C/W}$
			IPAK	100	$^\circ\text{C/W}$

1. S = Copper surface under tab.

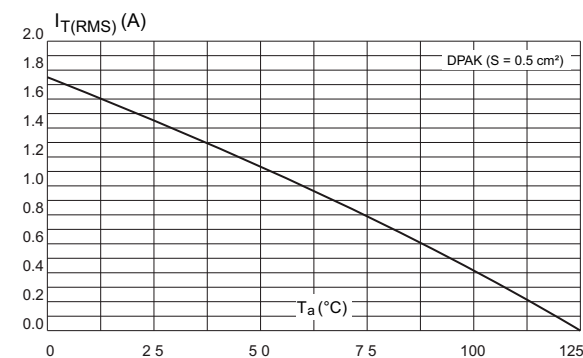
**Figure 1. Maximum power dissipation versus RMS on-state current (full cycle)**



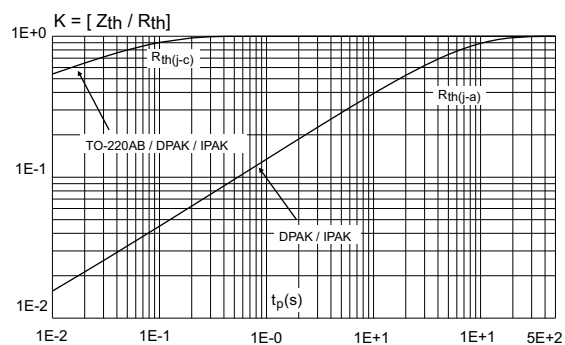
**Figure 2. RMS on-state current versus case temperature (full cycle)**



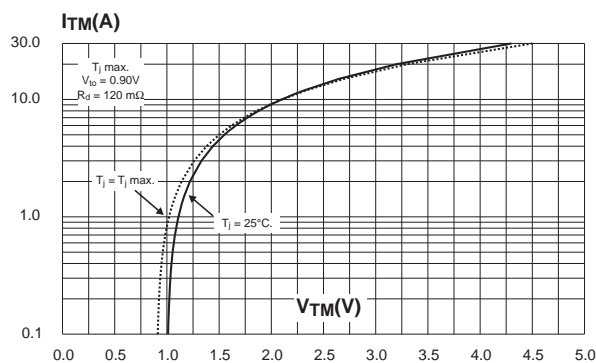
**Figure 3. RMS on-state current versus ambient temperature (printed circuit board FR4, copper thickness: 35μm) (full cycle)**



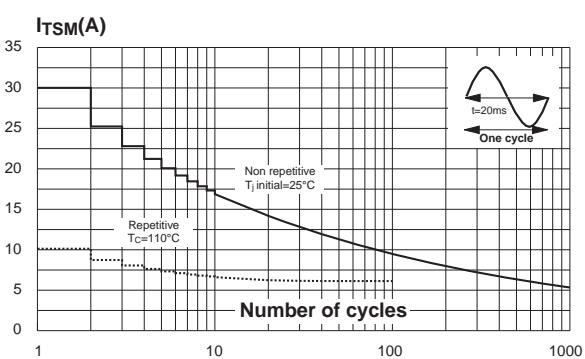
**Figure 4. Relative variation of thermal impedance versus pulse duration**



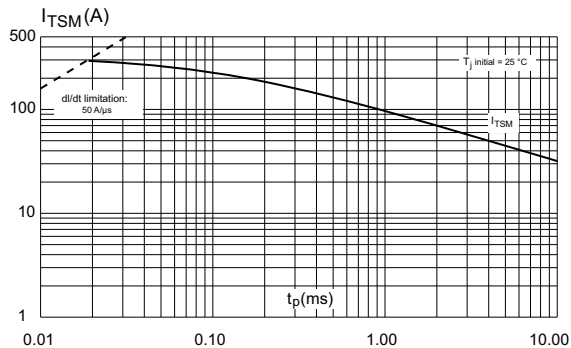
**Figure 5. On-state characteristics (maximum values)**



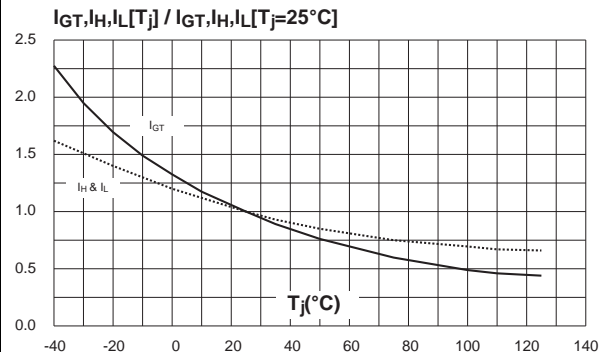
**Figure 6. Surge peak on-state current versus number of cycles**



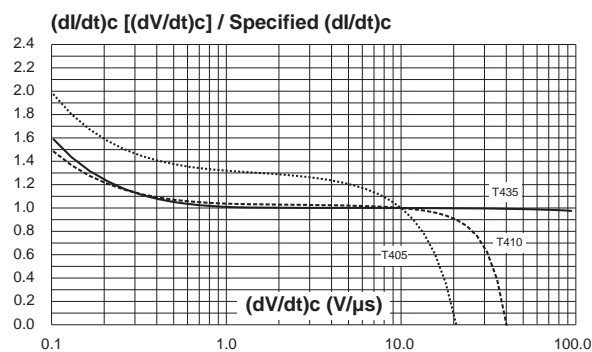
**Figure 7. Non-repetitive surge peak on-state current for a sinusoidal pulse with width  $t_p < 10$  ms**



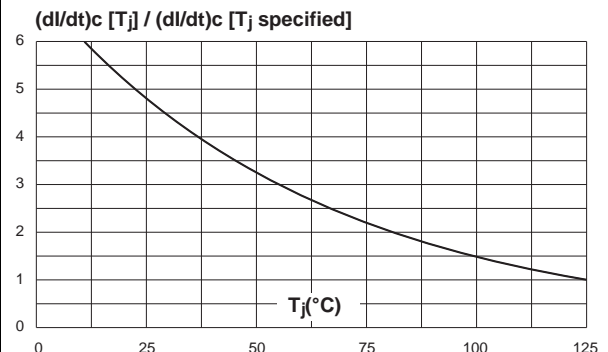
**Figure 8. Relative variation of gate trigger current, holding current and latching current versus junction temperature (typical values)**



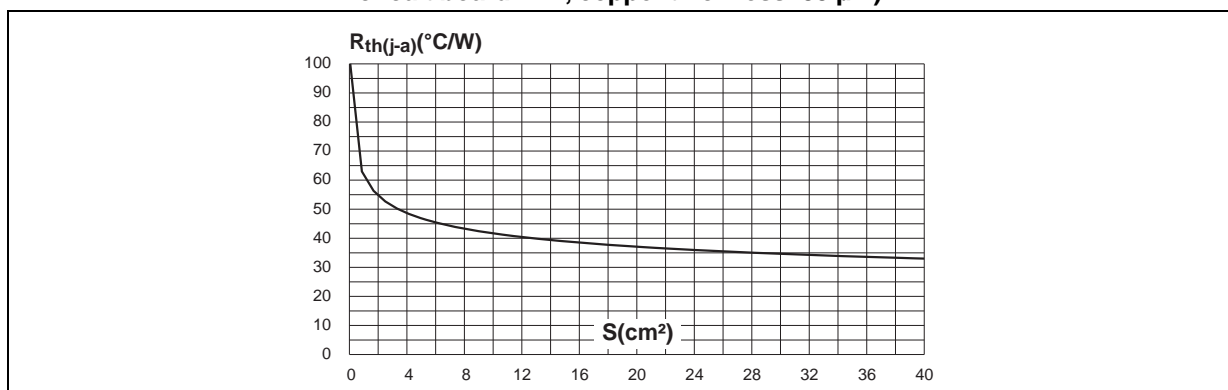
**Figure 9. Relative variation of critical rate of decrease of main current versus  $(dV/dt)_c$  (typical values)**



**Figure 10. Relative variation of critical rate of decrease of main current versus junction temperature**



**Figure 11. DPAK thermal resistance junction to ambient versus copper surface under tab (printed circuit board FR4, copper thickness: 35 μm)**



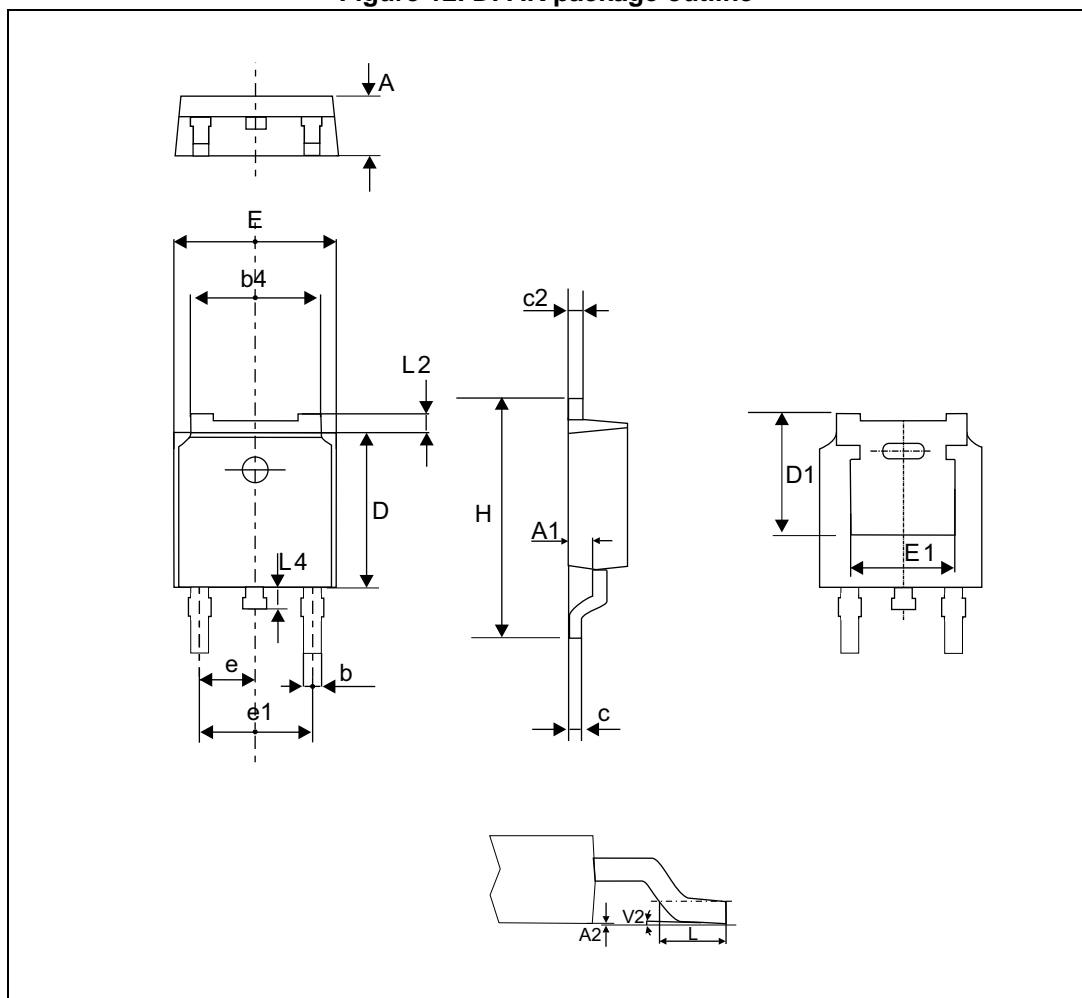
## 2 Package information

- Molding epoxy meets UL94, V0 and is halogen free
- Lead-free package
- Recommended torque: 0.4 to 0.6 N·m for TO-220AB

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### 2.1 DPAK package information

Figure 12. DPAK package outline



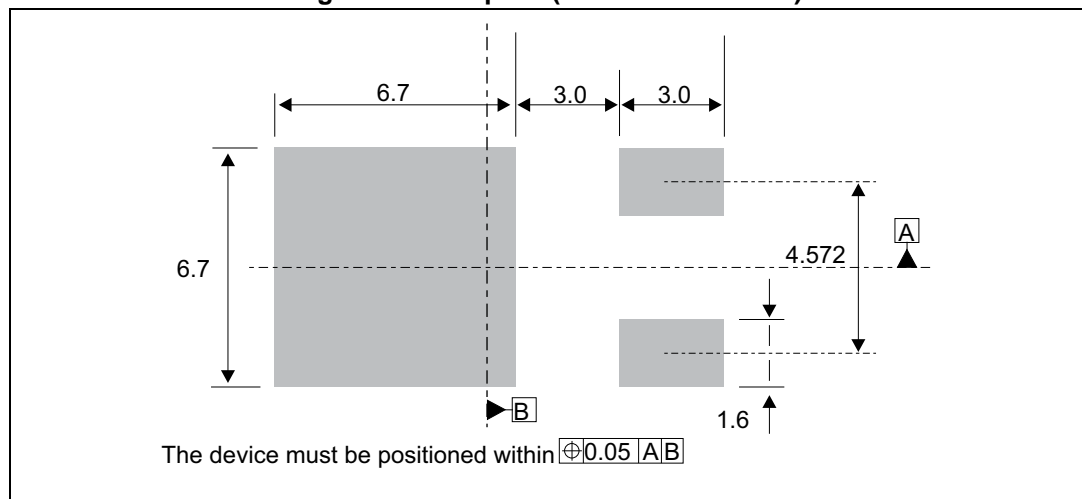
**Note:** This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.

Table 7. DPAK package mechanical data

Ref.	Dimensions					
	Millimeters			Inches <sup>(1)</sup>		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.18		2.40	0.086		0.0944
A1	0.9		1.10	0.035		0.0433
A2	0.03		0.23	0.0011		0.0090
b	0.64		0.90	0.0251		0.0354
b4	4.95		5.46	0.1948		0.2149
c	0.46		0.61	0.0181		0.0240
c2	0.46		0.60	0.0181		0.0236
D	5.97		6.22	0.2350		0.2448
D1	4.95			0.1948		
E	6.35		6.73	0.2500		0.2649
E1	4.32			0.1700		
e		2.286			0.09	
e1		4.572			0.18	
H	9.35		10.40	0.3681		0.4094
L	1.0		1.78	0.039		0.0700
L2			1.27			0.0500
L4	0.6		1.02	0.023		0.0401
V2	-8°		+8°	-8°		+8°

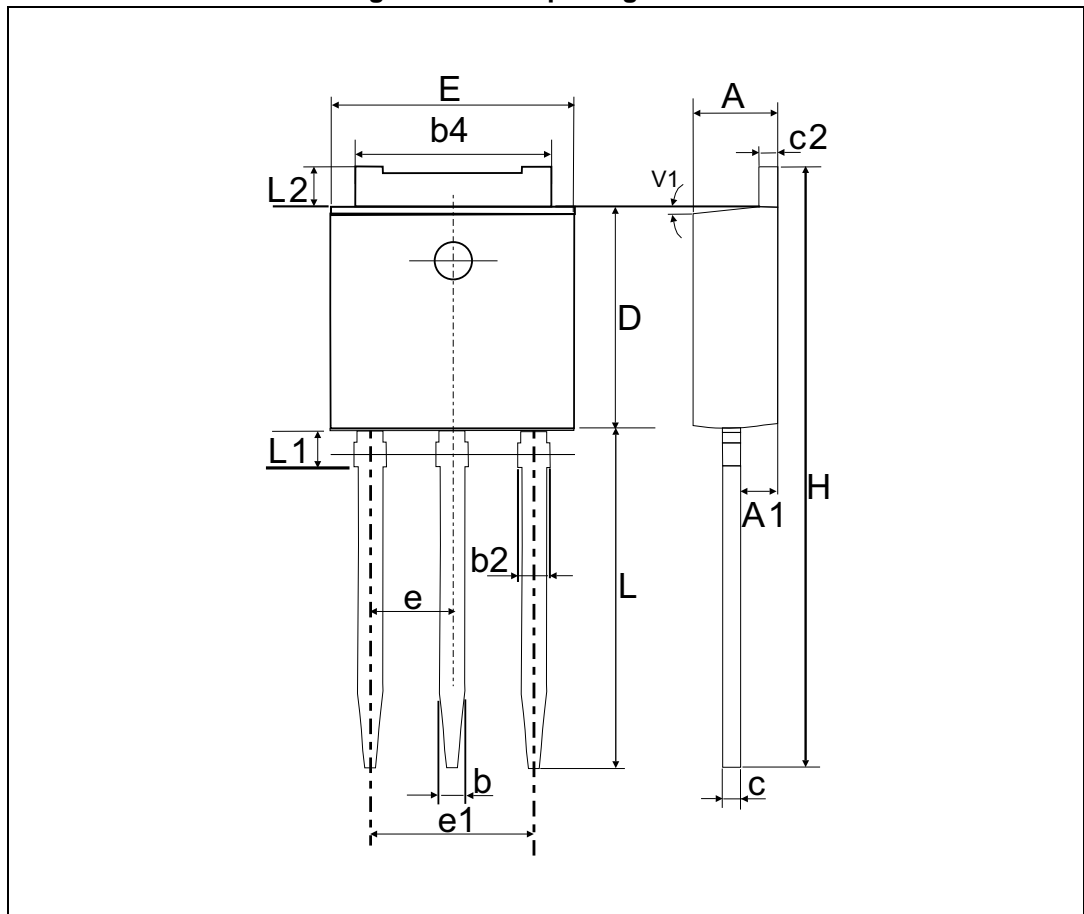
1. Inch dimensions are only for reference

Figure 13. Footprint (dimensions in mm)



## 2.2 IPAK package information

Figure 14. IPAK package outline



**Note:** This package drawing may slightly differ from the physical package. However, all the specified dimensions are guaranteed.

Table 8. IPAK package mechanical data

Ref.	Dimensions					
	Millimeters			Inches <sup>(1)</sup>		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.20		2.40	0.0866		0.0945
A1	0.90		1.10	0.0354		0.0433
b	0.64		0.90	0.0252		0.0354
b2			0.95			0.0374
b4	5.20		5.43	0.2047		0.2138
c	0.45		0.60	0.0177		0.0236
c2	0.46		0.60	0.0181		0.0236
D	6		6.20	0.2362		0.2441
E	6.40		6.65	0.2520		0.2618
e		2.28			0.0898	
e1	4.40		4.60	0.1732		0.1811
H		16.10			0.6339	
L	9		9.60	0.3543		0.3780
L1	0.8		1.20	0.0315		0.0472
L2		0.80	1.25		0.0315	0.0492
V1		10°			10°	

1. Inch dimensions are only for reference



## 2.3 TO-220AB (insulated and non-insulated) information

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

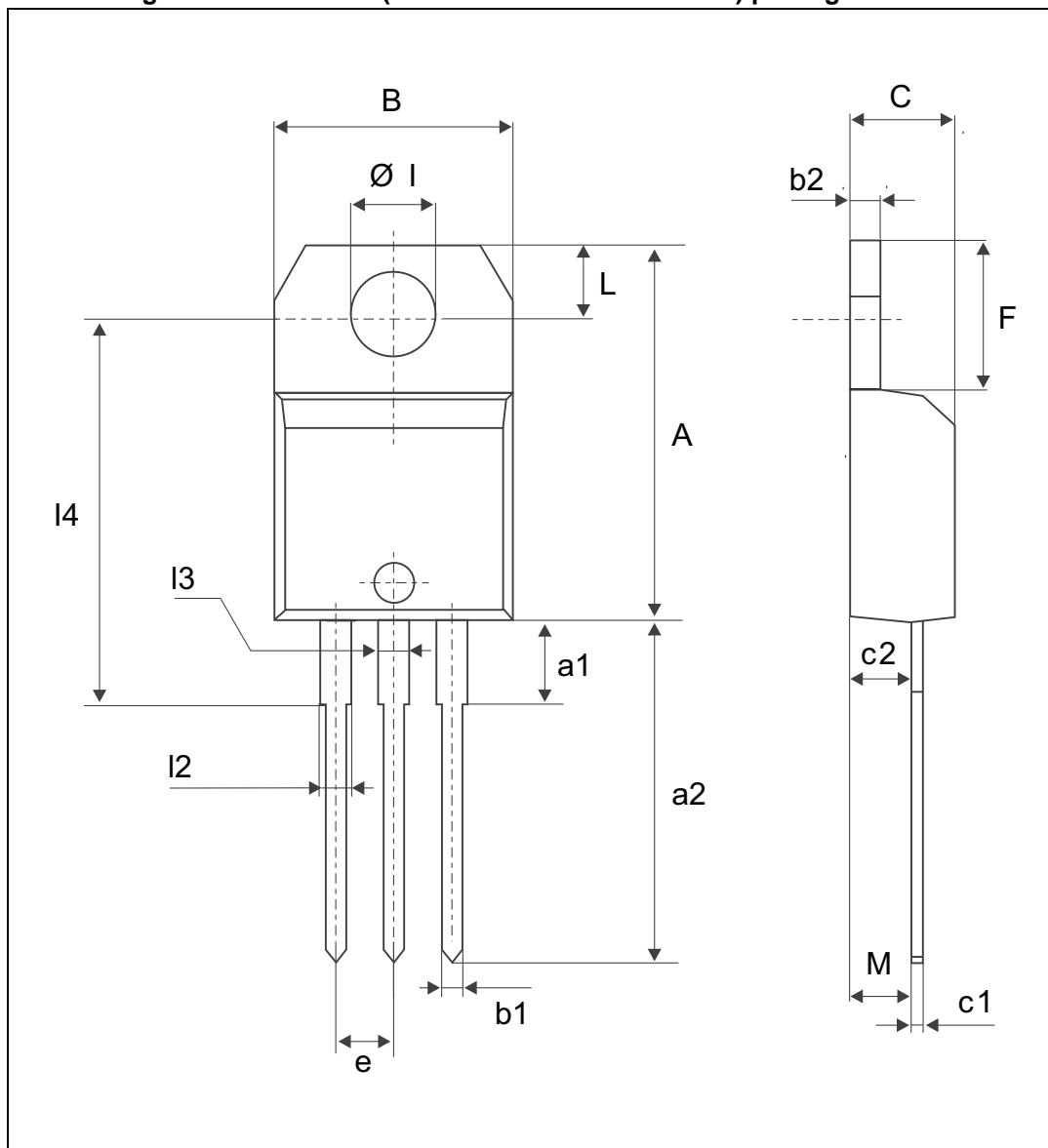


Table 9. TO-220AB (insulated and non-insulated) package mechanical data

Ref.	Dimensions					
	Millimeters			Inches <sup>(1)</sup>		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	15.20		15.90	0.5984		0.6259
a1		3.75			0.1476	
a2	13.00		14.00	0.5118		0.5511
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		0.0519
C	4.40		4.60	0.1732		0.1811
c1	0.49		0.70	0.0192		0.0275
c2	2.40		2.72	0.0944		0.1070
e	2.40		2.70	0.0944		0.1062
F	6.20		6.60	0.2440		0.2598
ØI	3.73		3.88	0.1468		0.1527
I4	15.80	16.40	16.80	0.6220	0.6456	0.6614
L	2.65		2.95	0.1043		0.1161
I2	1.14		1.70	0.0448		0.0669
I3	1.14		1.70	0.0448		0.0669
M		2.60			0.1023	

1. Inch dimensions are only for reference

### 3 Ordering information

Figure 16. Order information scheme

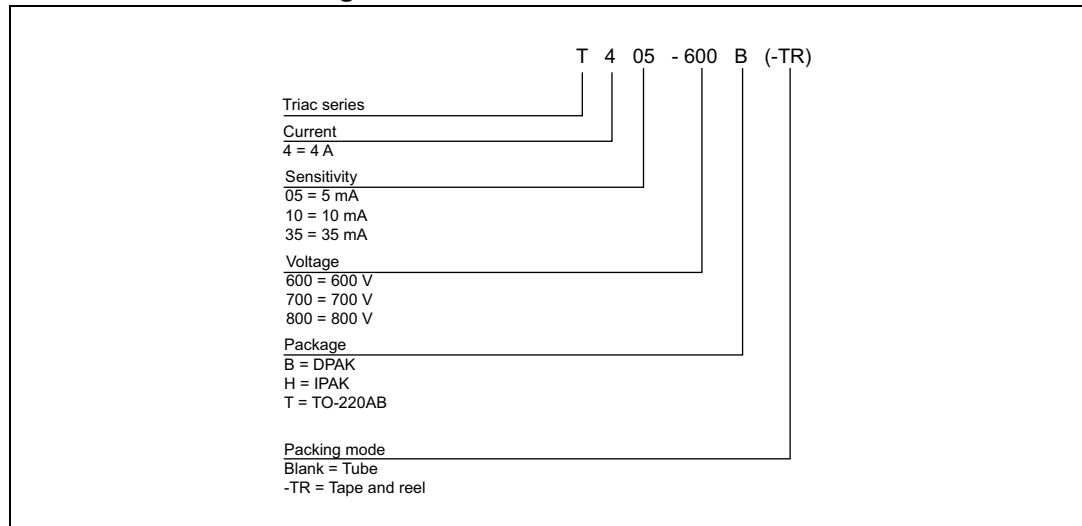


Table 10. Product selector

Part number	Voltage (xxx)			Sensitivity	Type	Package
	600 V	700 V	800 V			
T405-xxxB	X			5 mA	Logic level	DPAK
T405-xxxB-TR	X	X	X	5 mA	Logic level	DPAK
T405-xxxH	X		X	5 mA	Logic level	IPAK
T405-xxxT	X			5 mA	Logic level	TO-220AB
T410-xxxB	X			10 mA	Logic level	DPAK
T410-xxxB-TR	X		X	10 mA	Logic level	DPAK
T410-xxxH	X		X	10 mA	Logic level	IPAK
T410-xxxT	X	X	X	10 mA	Logic level	TO-220AB
T435-xxxB	X			35 mA	Snubberless	DPAK
T435-xxxB-TR	X	X	X	35 mA	Snubberless	DPAK
T435-xxxH	X		X	35 mA	Snubberless	IPAK
T435-xxxT	X		X	35 mA	Snubberless	TO-220AB

Blank = Unavailable

Table 11. Ordering information

Order code	Marking	Package	Weight	Base qty.	Delivery mode	
T405-600B	T4 0560	DPAK	0.3 g	75	Tube	
T410-600B	T4 1060					
T435-600B	T4 3560					
T405-600B-TR	T4 0560			2500	Tape and reel	
T410-600B-TR	T4 1060					
T435-600B-TR	T4 3560					
T405-700B-TR	T4 0570					
T435-700B-TR	T4 3570					
T405-800B-TR	T4 0580					
T410-800B-TR	T4 1080					
T435-800B-TR	T4 3580					
T405-600H	T4 0560	IPAK	0.4 g	75	Tube	
T410-600H	T4 1060					
T435-600H	T4 3560					
T405-800H	T4 0580					
T410-800H	T4 1080					
T435-800H	T4 3580					
T405-600T	T405-600T	TO-220AB	2.3 g	50		
T410-600T	T410-600T					
T435-600T	T435-600T					
T410-700T	T410-700T					
T410-800T	T410-800T					
T435-800T	T435-800T					

## 4 Revision history

**Table 12. Document revision history**

Date	Revision	Changes
Jun-2003	2	Last updated.
25-Mar-2005	3	Layout updated, No content change.
25-Jan-2006	4	Markings changed in <i>Table 12</i> .
14-May-2014	5	Updated DPAK and IPAK package information and reformatted to current standard.
11-Feb-2015	6	Updated package silhouettes in cover page.
1-Apr-2016	7	Removed ISOWATT-220AB package information.
05-Oct-2016	8	Updated <i>Table 3</i> and <i>Table 11</i> . Updated <i>Figure 2</i> and <i>Figure 4</i> .
14-Nov-2016	9	Updated <a href="#">Table 1</a> .

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