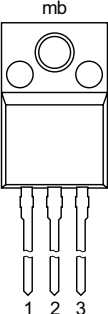


5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	T1	main terminal 1		
2	T2	main terminal 2		
3	G	gate		
mb	n.c.	mounting base; isolated		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BT139X-600	TO-220F	plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack"	SOT186A

7. Marking

Table 4. Marking codes

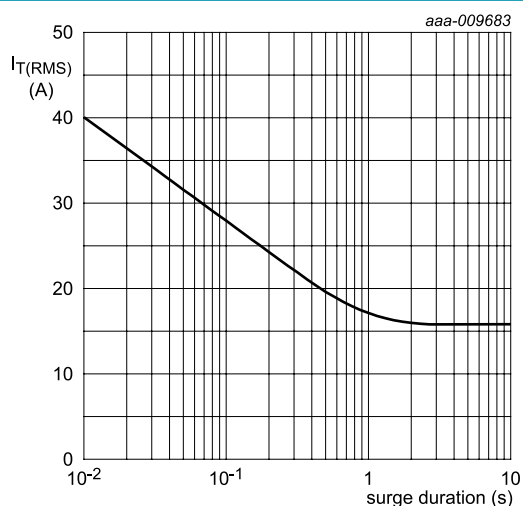
Type number	Marking codes
BT139X-600	BT139X-600

8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions	Values	Unit
V_{DRM}	repetitive peak off-state voltage		600	V
$I_{\text{T(RMS)}}$	RMS on-state current	full sine wave; $T_h \leq 38\text{ }^{\circ}\text{C}$; Fig 1 ; Fig 2 ; Fig 3	16	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$; $t_p = 20\text{ ms}$; Fig 4 ; Fig 5	155	A
		full sine wave; $T_{\text{j(init)}} = 25\text{ }^{\circ}\text{C}$; $t_p = 16.7\text{ ms}$	170	A
I^2t	I^2t for fusing	$t_p = 10\text{ ms}$; SIN	120	A^2s
dl_T/dt	rate of rise of on-state current	$I_G = 70\text{ mA}$; T2+ G+	50	$\text{A}/\mu\text{s}$
		$I_G = 70\text{ mA}$; T2+ G-	50	$\text{A}/\mu\text{s}$
		$I_G = 70\text{ mA}$; T2- G-	50	$\text{A}/\mu\text{s}$
		$I_G = 140\text{ mA}$; T2- G+	10	$\text{A}/\mu\text{s}$
I_{GM}	peak gate current		2	A
P_{GM}	peak gate power		5	W
$P_{\text{G(AV)}}$	average gate power	over any 20 ms period	0.5	W
T_{slg}	storage temperature		-40 to 150	$^{\circ}\text{C}$
T_j	junction temperature		125	$^{\circ}\text{C}$



$f = 50\text{ Hz}$; $T_h = 38\text{ }^{\circ}\text{C}$

Fig. 1. RMS on-state current as a function of surge duration; maximum values

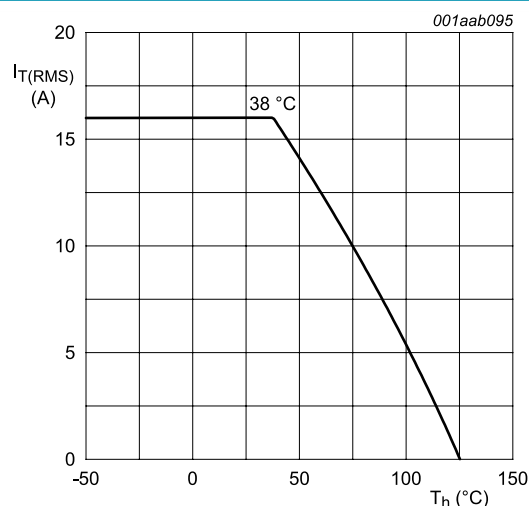


Fig. 2. RMS on-state current as a function of heatsink temperature; maximum values

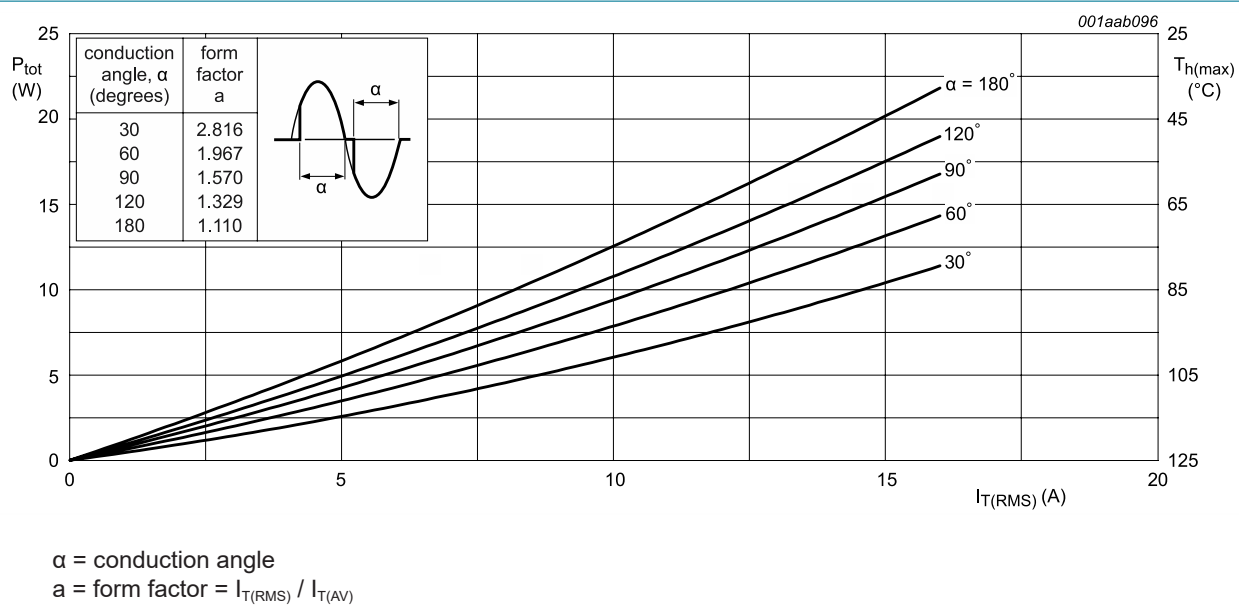


Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values

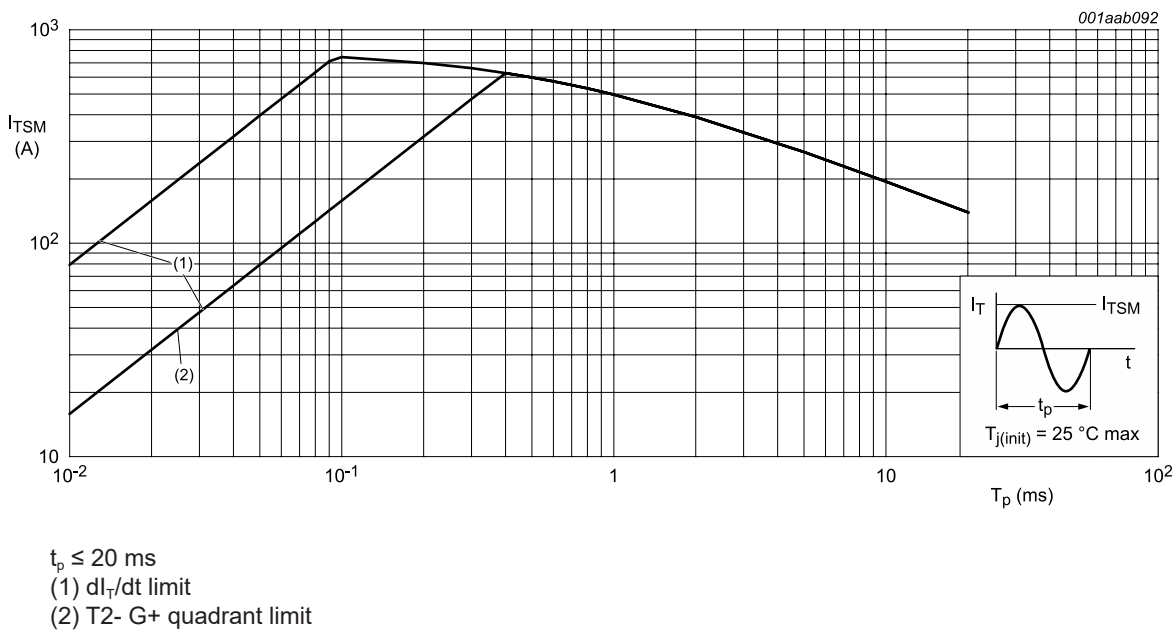
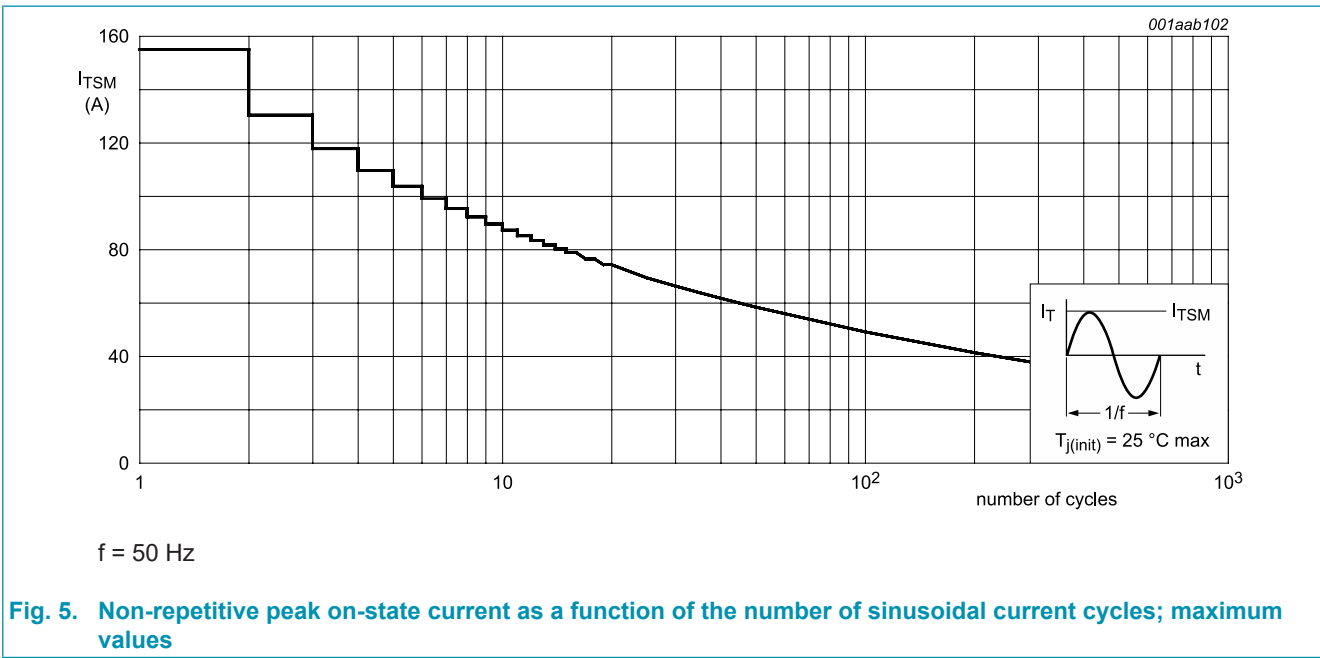


Fig. 4. Non-repetitive peak on-state current as a function of pulse width; maximum values



9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$R_{th(j-h)}$	thermal resistance from junction to heatsink	full or half cycle; with heatsink compound; Fig 6	-	-	4	K/W
		full or half cycle; without heatsink compound; Fig 6	-	-	5.5	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	-	55	-	K/W

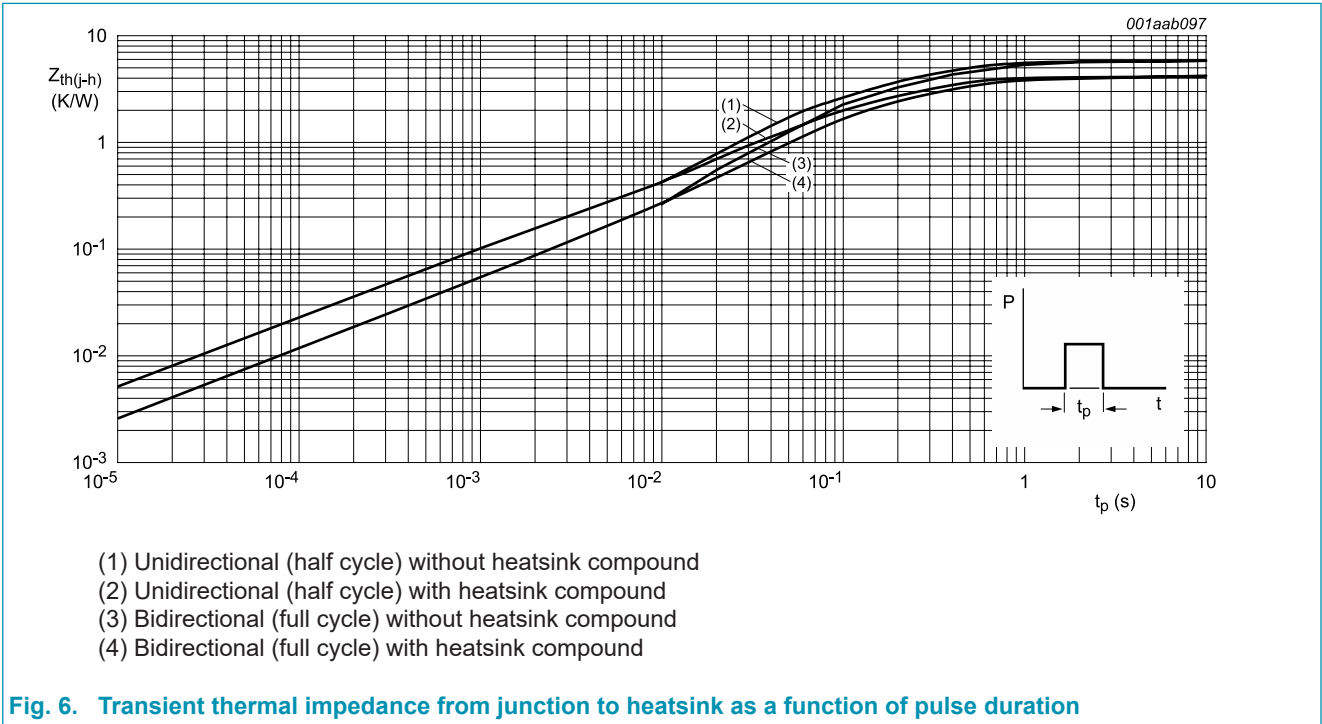


Fig. 6. Transient thermal impedance from junction to heatsink as a function of pulse duration

10. Isolation characteristics

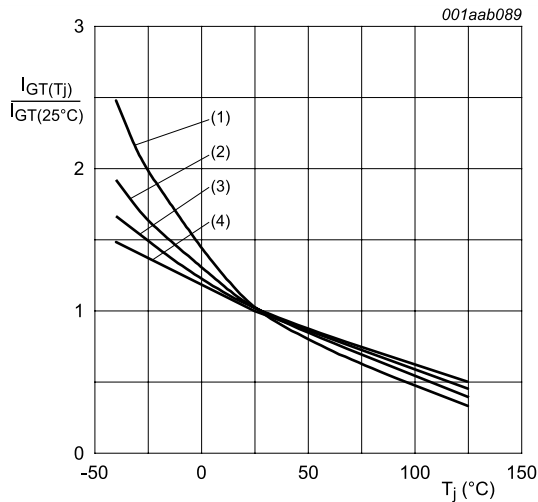
Table 7. Isolation characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{isol(RMS)}$	RMS isolation voltage	from all terminals to external heatsink; sinusoidal waveform; clean and dust free; 50 Hz ≤ f ≤ 60 Hz; RH ≤ 65 %; T _h = 25 °C	-	-	2500	V
C_{isol}	isolation capacitance	from main terminal 2 to external heatsink; f = 1 MHz; T _h = 25 °C	-	10	-	pF

11. Characteristics

Table 8. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
I_{GT}	gate trigger current	$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G+; $T_J = 25\text{ }^\circ\text{C}$; Fig. 7		-	5	35	mA
		$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2+ G-; $T_J = 25\text{ }^\circ\text{C}$; Fig. 7		-	8	35	mA
		$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G-; $T_J = 25\text{ }^\circ\text{C}$; Fig. 7		-	10	35	mA
		$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; T2- G+; $T_J = 25\text{ }^\circ\text{C}$; Fig. 7		-	22	70	mA
I_L	latching current	$V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G+; $T_J = 25\text{ }^\circ\text{C}$; Fig. 8		-	7	40	mA
		$V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2+ G-; $T_J = 25\text{ }^\circ\text{C}$; Fig. 8		-	20	60	mA
		$V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2- G-; $T_J = 25\text{ }^\circ\text{C}$; Fig. 8		-	8	40	mA
		$V_D = 12\text{ V}$; $I_G = 0.1\text{ A}$; T2- G+; $T_J = 25\text{ }^\circ\text{C}$; Fig. 8		-	10	60	mA
I_H	holding current	$V_D = 12\text{ V}$; $T_J = 25\text{ }^\circ\text{C}$; Fig. 9		-	6	45	mA
V_T	on-state voltage	$I_T = 20\text{ A}$; $T_J = 25\text{ }^\circ\text{C}$; Fig. 10		-	1.2	1.6	V
V_{GT}	gate trigger voltage	$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; $T_J = 25\text{ }^\circ\text{C}$; Fig. 11		-	0.7	1	V
		$V_D = 400\text{ V}$; $I_T = 0.1\text{ A}$; $T_J = 125\text{ }^\circ\text{C}$; Fig. 11		0.25	0.4	-	V
I_D	off-state current	$V_D = 600\text{ V}$; $T_J = 125\text{ }^\circ\text{C}$		-	0.1	0.5	mA
Dynamic characteristics							
dV_D/dt	rate of rise of off-state voltage	$V_{DM} = 402\text{ V}$; $T_J = 125\text{ }^\circ\text{C}$; ($V_{DM} = 67\%$ of V_{DRM}); exponential waveform; gate open circuit		200	250	-	V/ μs
dV_{com}/dt	rate of change of commutating voltage	$V_D = 400\text{ V}$; $T_J = 95\text{ }^\circ\text{C}$; $I_T = 16\text{ A}$; $di_{com}/dt = 7.2\text{ A/ms}$; gate open circuit		10	20	-	V/ μs
t_{gt}	gate-controlled turn-on time	$V_D = 600\text{ V}$; $I_{TM} = 20\text{ A}$; $I_G = 0.1\text{ A}$; $di_G/dt = 5\text{ A}/\mu\text{s}$		-	2	-	μs



- (1) T2- G+
- (2) T2- G-
- (3) T2+ G-
- (4) T2+ G+

Fig. 7. Normalized gate trigger current as a function of junction temperature

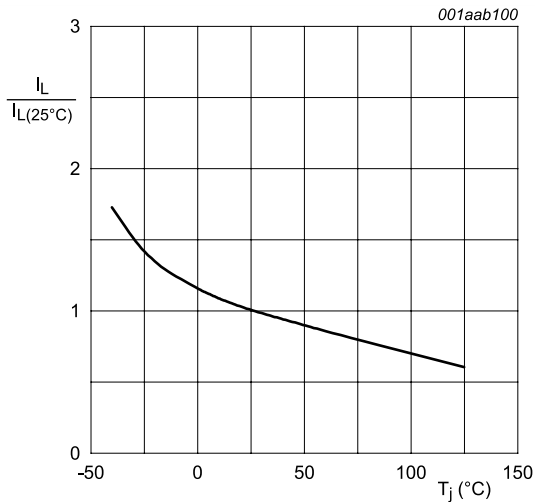


Fig. 8. Normalized latching current as a function of junction temperature

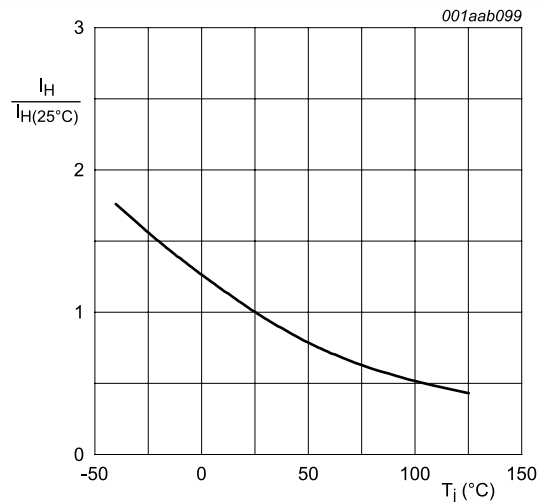
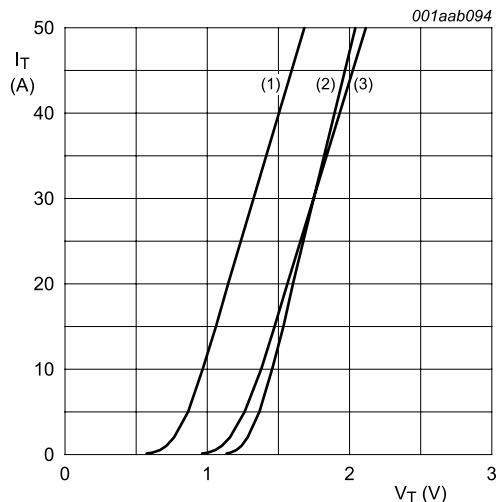


Fig. 9. Normalized holding current as a function of junction temperature



- $V_o = 1.195\text{ V}; R_s = 0.018\ \Omega$
- (1) $T_j = 125^\circ\text{C}$; typical values
 - (2) $T_j = 125^\circ\text{C}$; maximum values
 - (3) $T_j = 25^\circ\text{C}$; maximum values

Fig. 10. On-state current as a function of on-state voltage

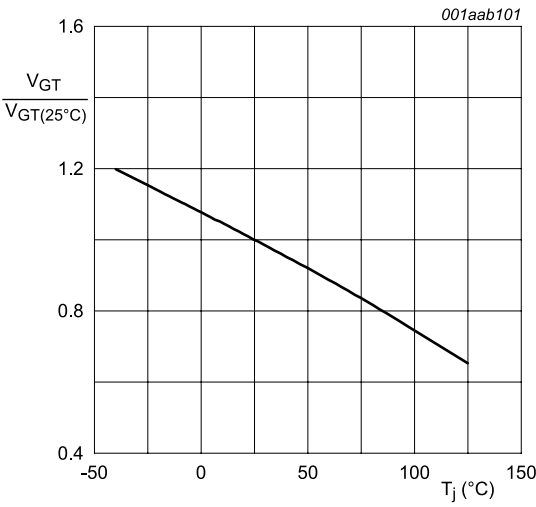
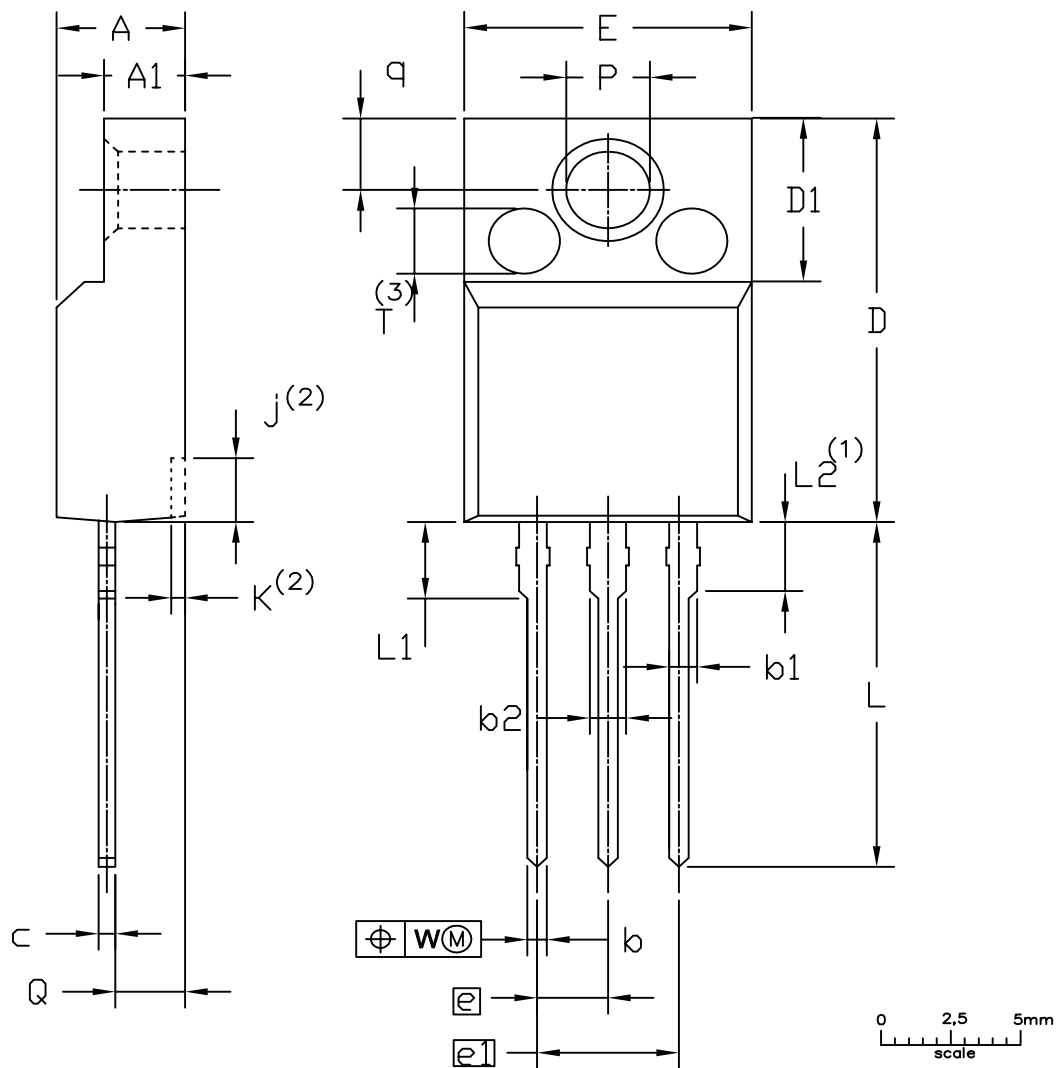


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

12. Package outline

Plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3-lead TO-220 "full pack"

SOT186A



UNIT	A	A ₁	b	b ₁	b ₂	c	D	D ₁	E	e	e ₁	j ⁽²⁾	k ⁽²⁾	L	L ₁	L ₂ ⁽¹⁾ max.	P	Q	q	W	T ⁽³⁾
mm	4.6 4.0	2.9 2.5	0.9 0.7	1.1 0.9	1.4 1.0	0.7 0.4	15.8 15.2	6.5 6.3	10.3 9.7	2.54	5.08	2.7 1.7	0.6 0.4	14.4 13.5	3.30 2.79	3	3.2 3.0	2.6 2.3	3.0 2.6	0.4	2.5

- Notes
1. Terminal dimensions within this zone are uncontrolled
 2. Dot lines area designs may vary
 3. Eject pin mark is for reference only

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT186A		3 LEADS TO220F				2013-11-14

13. Legal information

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Document status [1][2]	Product status [3]	Definition
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- [2] The term 'short data sheet' is explained in section "Definitions".
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