BT151X-650LT

SCR

Rev - 01 28 November 2018

Product data sheet

1. General description

Planar passivated Silicon Controlled Rectifier (SCR) in a SOT186A (TO-220F) "full pack" plastic package intended for use in applications requiring good bidirectional blocking voltage and high current surge capability with high thermal cycling performance and high junction temperature capability ($T_{j(max)}$ = 150 °C).

2. Features and benefits

- High junction operating temperature capability ($T_{j(max)}$ = 150 °C)
- Good bidirectional blocking voltage capability
- High current surge capability
- High thermal cycling performance
- Isolated mounting base package
- Planar passivated for voltage ruggedness and reliability

3. Applications

- Capacitive Discharge Ignition (CDI)
- Crowbar protection
- Inrush protection
- Motor control
- Voltage regulation
- High junction operating temperature capability ($T_{j(max)}$ = 150 °C)

4. Quick reference data

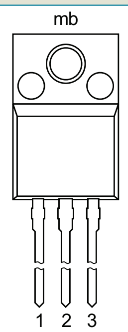
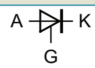
Table 1. Quick reference data

Symbol	Parameter	Conditions	Values	Unit
Absolute maximum rating				
V_{RRM}	repetitive peak reverse voltage		650	V
$I_{T(RMS)}$	RMS on-state current	half sine wave; T_h ≤ 94 °C; Fig. 1; Fig. 2; Fig. 3	12	A
I_{TSM}	non-repetitive peak on-state current	half sine wave; $T_{j(init)}$ = 25 °C; t_p = 10 ms; Fig. 4; Fig. 5	120	A
		half sine wave; $T_{j(init)}$ = 25 °C; t_p = 8.3 ms	132	A
T_j	junction temperature		150	°C

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
I_{GT}	gate trigger current	V_D = 12 V; I_T = 0.1 A; T_j = 25 °C; Fig. 7		-	-	5	mA
I_H	holding current	V_D = 12 V; T_j = 25 °C; Fig. 9		-	7	20	mA
V_T	on-state voltage	I_T = 12 A; T_j = 25 °C; Fig. 10		-	1.18	1.54	V
Dynamic characteristics							
dV_D/dt	rate of rise of off-state voltage	V_{DM} = 436 V; T_j = 150 °C; R_{GK}= 100 Ω; (V_{DM} = 67% of V_{DRM}); exponential waveform;		200	1000	-	V/µs

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	K	cathode		 sym037
2	A	anode		
3	G	gate		
mb	n.c.	mounting base; isolated		

6. Ordering information

Table 3. Ordering information

Type number	Package		
	Name	Description	Version
BT151X-650LT	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
BT151X-650LT	BT151X-650LT

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		650	V
V_{RRM}	repetitive peak reverse voltage		650	V
$I_{T(AV)}$	average on-state current	half sine wave; $T_h \leq 94$ °C;	7.5	A
$I_{T(RMS)}$	RMS on-state current	half sine wave; $T_h \leq 94$ °C; Fig. 1; Fig. 2; Fig. 3	12	A
I_{TSM}	non-repetitive peak on-state current	half sine wave; $T_{j(init)} = 25$ °C; $t_p = 10$ ms; Fig. 4; Fig. 5	120	A
		half sine wave; $T_{j(init)} = 25$ °C; $t_p = 8.3$ ms	132	A
I^2t	I^2t for fusing	$t_p = 10$ ms; sine wave	72	A^2s
dI_T/dt	rate of rise of on-state current	$I_G = 10$ mA	50	A/µs
I_{GM}	peak gate current		2	A
V_{GM}	peak gate voltage		5	V
P_{GM}	peak gate power		5	W
$P_{G(AV)}$	average gate power	over any 20 ms period	0.5	W
T_{stg}	storage temperature		-40 to 150	°C
T_j	junction temperature		150	°C

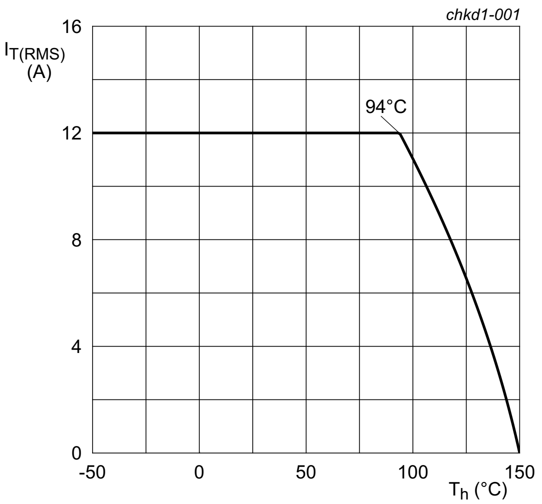
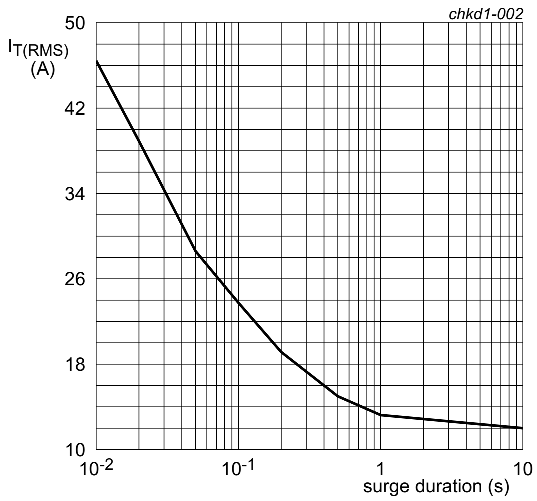
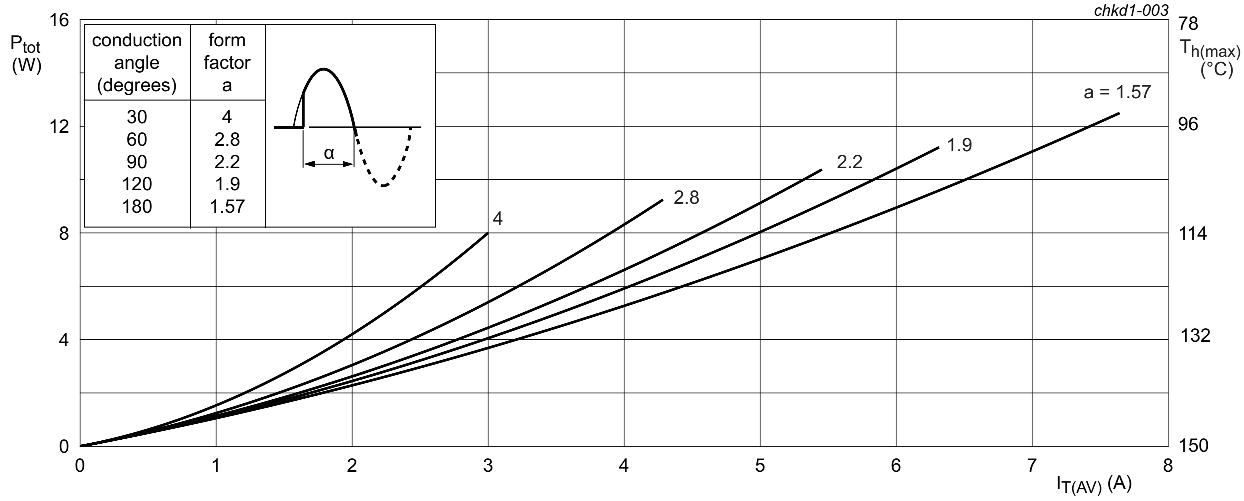


Fig. 1. RMS on-state current as a function of heatsink temperature; maximum values



f = 50Hz; T_h = 94 °C

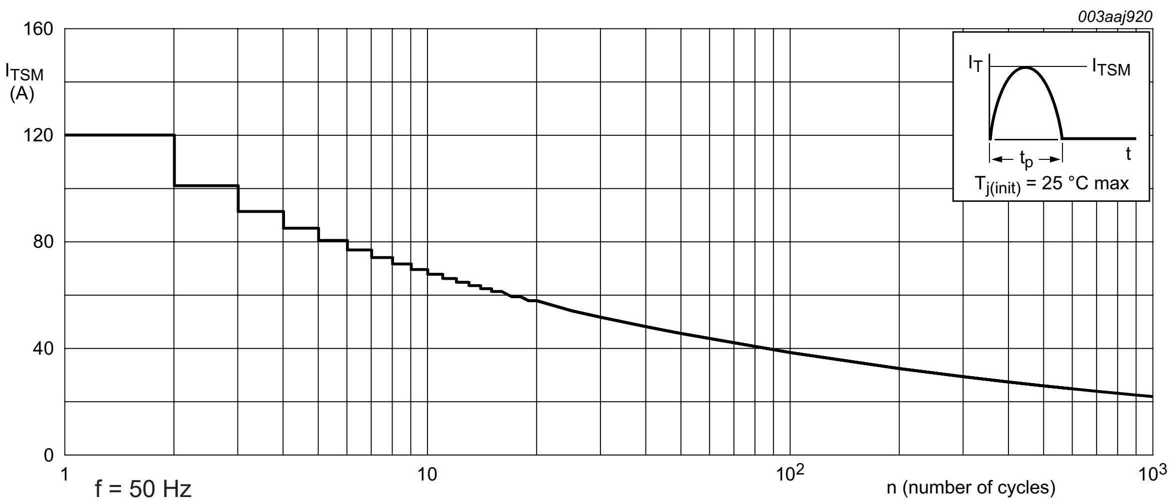
Fig. 2. RMS on-state current as a function of surge duration; maximum values



α = conduction angle

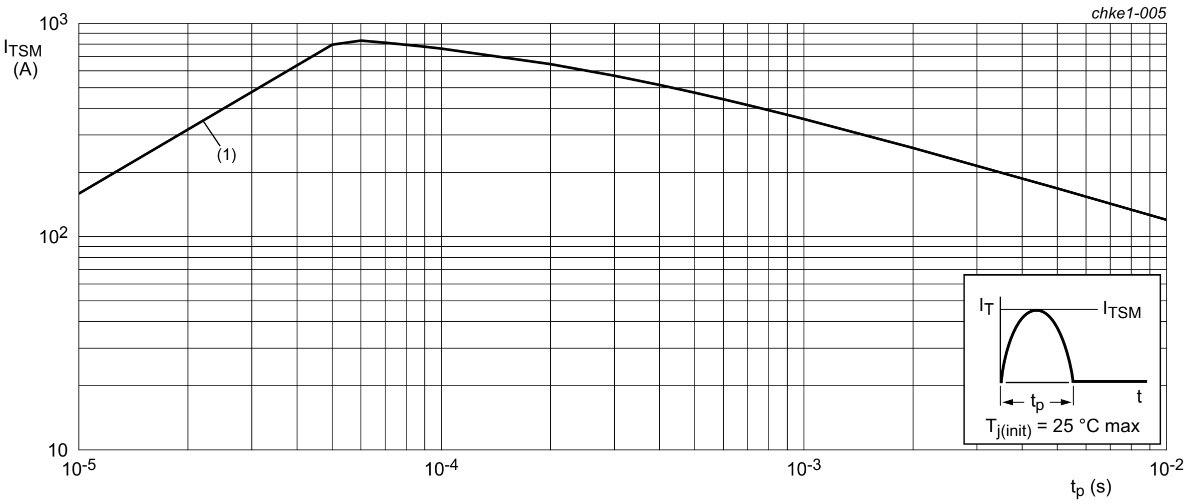
a = form factor = $I_{T(RMS)}$ / $I_{T(AV)}$

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



f = 50 Hz

Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



t_p ≤ 10 ms ;

(1) dI_T/dt limit

Fig. 5. Total power dissipation as a function of RMS on-state current; 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	with heatsink compound; Fig. 6		-	-	4.5	K/W
		without heatsink compound; Fig. 6		-	-	6.5	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air	in free air		-	55	-	K/W

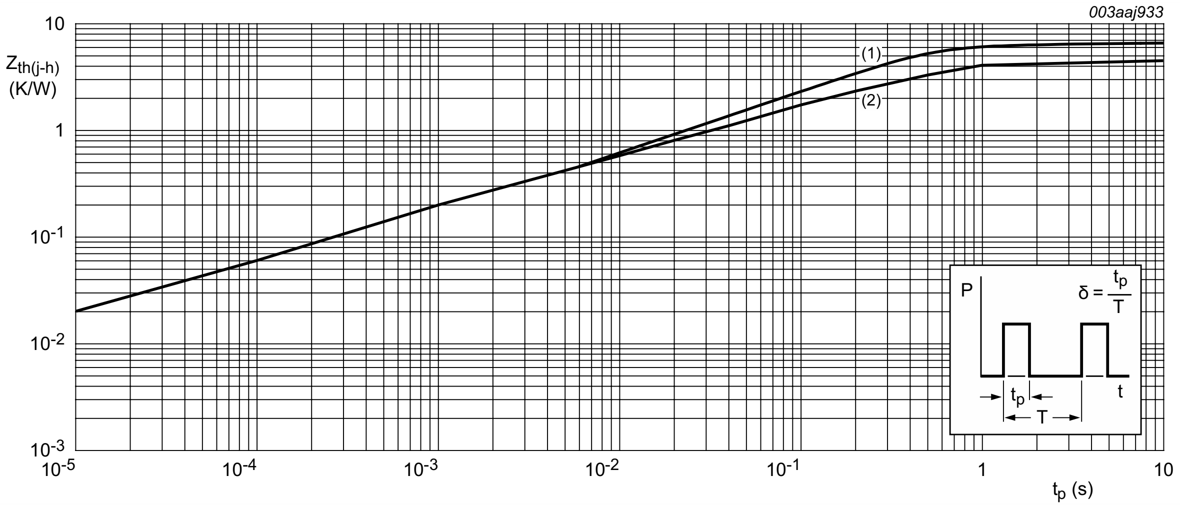


Fig. 6. Transient thermal impedance from junction to heatsink as a function of pulse duration

10. Isolation characteristics

Table 7. Isolation characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$V_{isol(RMS)}$	RMS isolation voltage	50 Hz ≤ f ≤ 60 Hz; RH ≤ 65 %; from all pins to external heatsink; sinusoidal waveform; clean and dust free		-	-	2500	V
C_{isol}	isolation capacitance	from cathode to external heatsink		-	10	-	PF

11. Characteristics

Table 8. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
I_{GT}	gate trigger current	V_D = 12 V; I_T = 0.1 A; T_j = 25 °C; Fig. 7		-	-	5	mA
I_L	latching current	V_D = 12 V; I_T = 0.1 A; T_j = 25 °C; Fig. 8		-	10	40	mA
I_H	holding current	V_D = 12 V; T_j = 25 °C; Fig. 9		-	7	20	mA
V_T	on-state voltage	I_T = 12 A; T_j = 25 °C; Fig. 10		-	1.18	1.54	V
V_{GT}	gate trigger voltage	V_D = 12 V; I_T = 0.1 A; T_j = 25 °C; Fig. 11		-	0.6	1	V
		V_D = 400 V; I_T = 0.1 A; T_j = 150 °C; Fig. 11		0.2	0.4	-	V
I_D	off-state current	V_D = 650 V; T_j = 150 °C		-	-	1	mA
I_R	reverse current	V_D = 650 V; T_j = 150 °C		-	-	1	mA
Dynamic characteristics							
dV_D/dt	rate of rise of off-state voltage	V_{DM} = 436 V; T_j = 150 °C; R_{GK}= 100 Ω; (V_{DM} = 67% of V_{DRM}); exponential waveform;		200	1000	-	V/μs
		V_{DM} = 436 V; T_j = 150 °C; (V_{DM} = 67% of V_{DRM}); exponential waveform; gate open circuit		50	-	-	V/μs
t_{gt}	gate-controlled turn-on time	I_{TM} = 12 A; V_D = 650 V; I_G = 10 mA; $(dI_G/dt)_M$ = 5 A/μs; T_j = 25 °C			2	-	μs
t_q	commutated turn-off time	V_{DM} = 436 V; T_j = 150 °C; I_{TM} = 12 A; V_R = 25 V; dV_D/dt = 30 V/μs; $(dI_T/dt)_M$ = 30 A/μs; $R_{GK(ext)}$ = 100 Ω ; (V_{DM} = 67% of V_{DRM})			70	-	μs

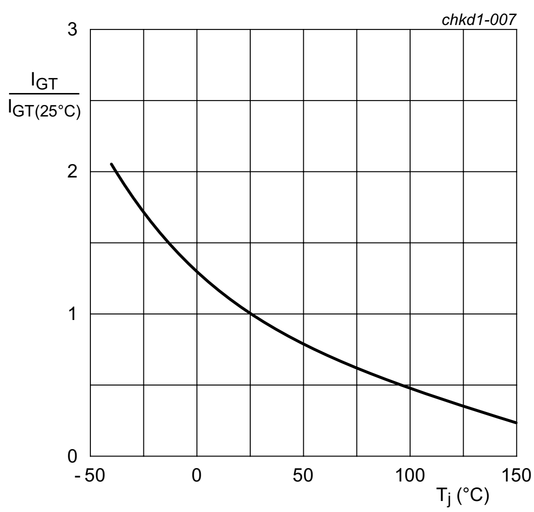


Fig. 7. Normalized gate trigger current as a function of junction temperature

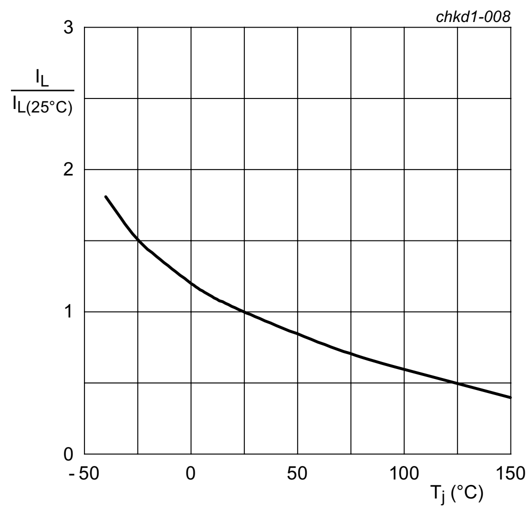


Fig. 8. Normalized latching current as a function of junction temperature

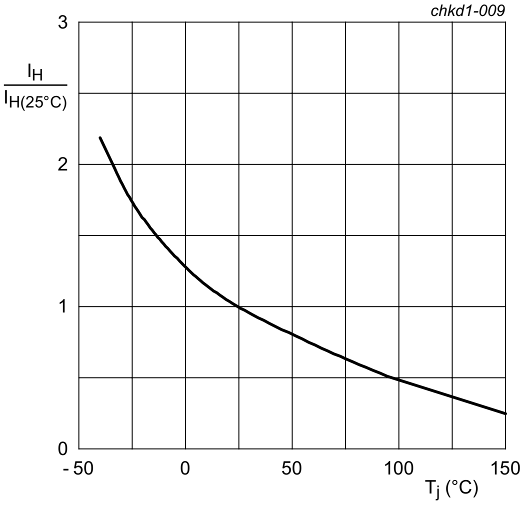
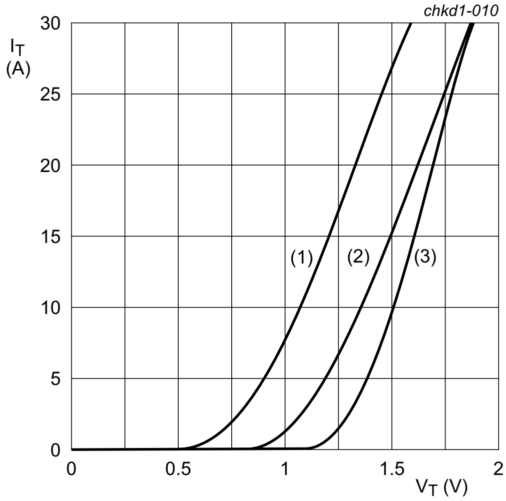


Fig. 9. Normalized holding current as a function of junction temperature



V_o = 0.967 V; R_s = 0.0354 Ω
(1) T_j = 150 °C; typical values
(2) T_j = 150 °C; maximum values
(3) T_j = 25 °C; maximum values

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

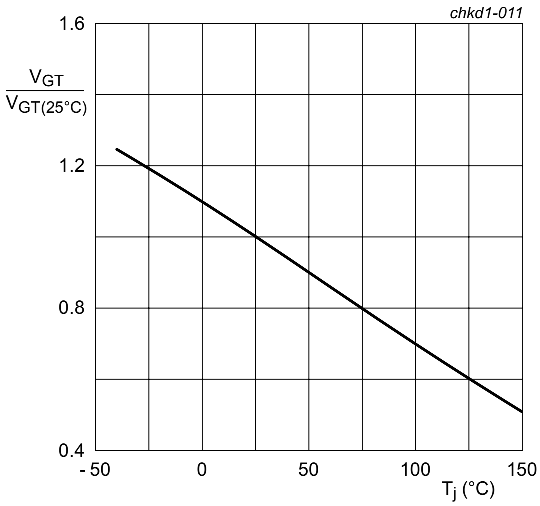
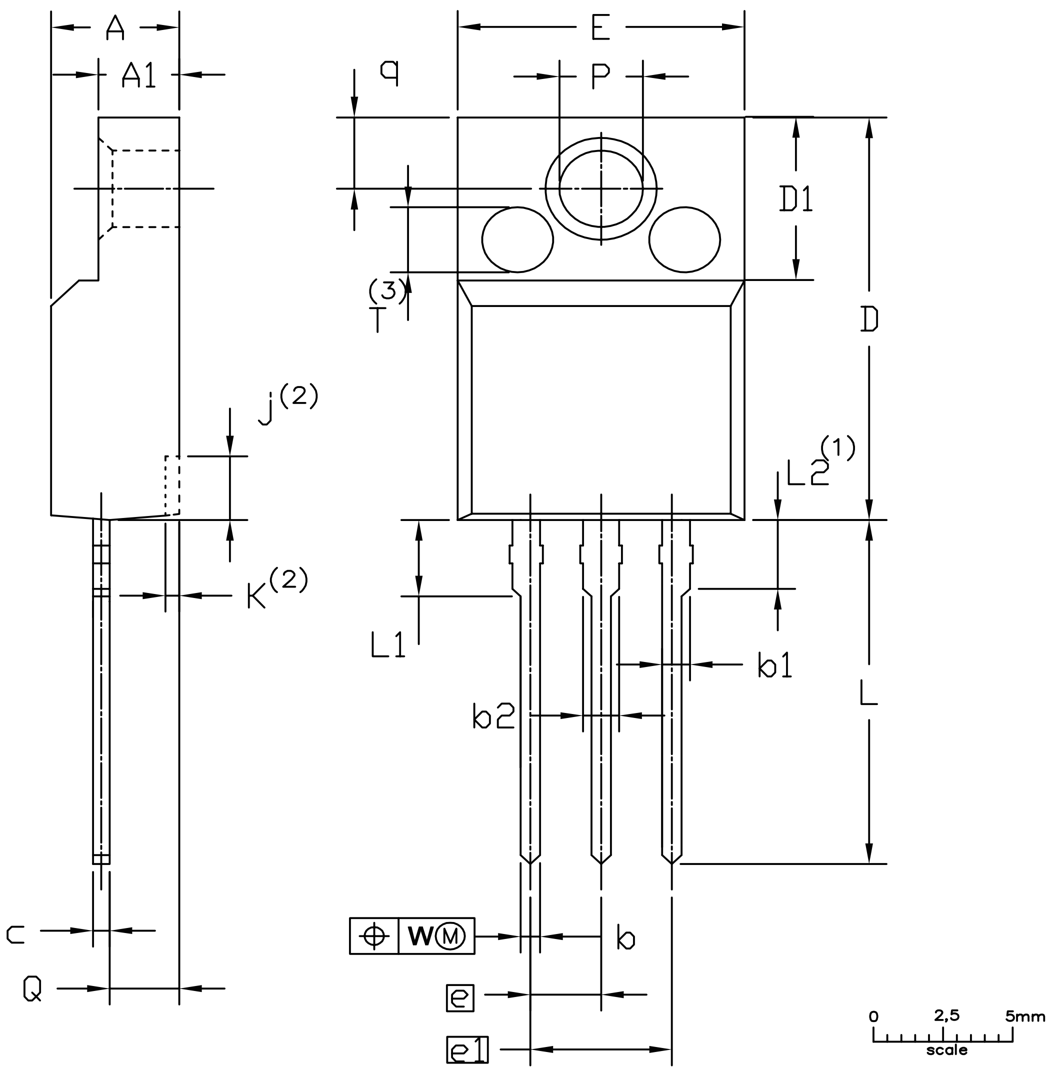


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

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	2.9	0.9	1.1	1.4	0.7	15.8	6.5	10.3	2.54	5.08	2.7	0.6	14.4	3.30	3	3.2	2.6	3.0	0.4	2.5
	4.0	2.5	0.7	0.9	1.0	0.4	15.2	6.3	9.7			1.7	0.4	13.5	2.79		3.0	2.3	2.6		

Notes
1. Terminal dimensions within this zone are uncotrolled
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
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
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Product [short] data sheet	Production	This document contains the product specification.

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14. Contents

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