

1. General description

Planar passivated Silicon Controlled Rectifier (SCR) in a TO220F "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 ($T_{j(max)} = 150\text{ °C}$).

2. Features and benefits

- High junction operating temperature capability ($T_{j(max)} = 150\text{ °C}$)
- 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 ($T_{j(max)} = 150\text{ °C}$)

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; $T_h \leq 95\text{ °C}$; Fig. 1 ; Fig. 2 ; Fig. 3	12	A
I_{TSM}	non-repetitive peak on-state current	half sine wave; $T_{j(init)} = 25\text{ °C}$; $t_p = 10\text{ ms}$; Fig. 4 ; Fig. 5	120	A
		half sine wave; $T_{j(init)} = 25\text{ °C}$; $t_p = 8.3\text{ ms}$	132	A
T_j	junction temperature		150	°C

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Static characteristics						
I_{GT}	gate trigger current	$V_D = 12\text{ V}$; $I_T = 0.1\text{ A}$; $T_j = 25\text{ °C}$; Fig. 7	1.5	-	5	mA
I_H	holding current	$V_D = 12\text{ V}$; $T_j = 25\text{ °C}$; Fig. 9	-	-	20	mA
V_T	on-state voltage	$I_T = 12\text{ A}$; $T_j = 25\text{ °C}$; Fig. 10	-	1.15	1.5	V
Dynamic characteristics						
dV_D/dt	rate of rise of off-state voltage	$V_{DM} = 436\text{ V}$; $T_j = 150\text{ °C}$; $R_{GK} = 100\ \Omega$; ($V_{DM} = 67\%$ of V_{DRM}); exponential waveform;	500	1000	-	V/ μ s

5. Pinning information

Table 2. Pinning information

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

6. Ordering information

Table 3. Ordering information

Type number	Package name	Orderable part number	Packing method	Small packing quantity	Package version	Package issue date
BT151X-650LTN	TO220F	BT151X-650LTNQ	Tube	50	SOT186A	14-Nov-2013

7. Marking

Table 4. Marking codes

Type number	Marking codes
BT151X-650LTN	BT151X-650LTN

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; $T_h \leq 95\text{ }^\circ\text{C}$	7.5	A
$I_{T(RMS)}$	RMS on-state current	half sine wave; $T_h \leq 95\text{ }^\circ\text{C}$; Fig. 1 ; Fig. 2 ; Fig. 3	12	A
I_{TSM}	non-repetitive peak on-state current	half sine wave; $T_{j(\text{init})} = 25\text{ }^\circ\text{C}$; $t_p = 10\text{ ms}$; Fig. 4 ; Fig. 5	120	A
		half sine wave; $T_{j(\text{init})} = 25\text{ }^\circ\text{C}$; $t_p = 8.3\text{ ms}$	132	A
I^2t	I^2t for fusing	$t_p = 10\text{ms}$; sine wave	72	A^2s
di_T/dt	rate of rise of on-state current	$I_G = 10\text{mA}$	50	$\text{A}/\mu\text{s}$
I_{GM}	peak gate current		2	A
V_{RGM}	peak reverse gate voltage		18	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	$^\circ\text{C}$
T_j	junction temperature		150	$^\circ\text{C}$

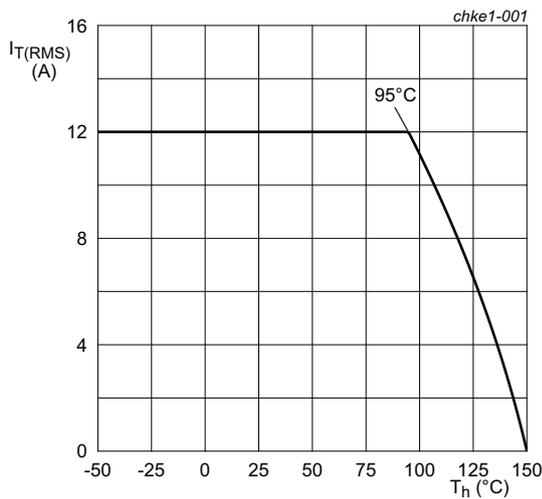


Fig. 1. RMS on-state current as a function of heatsink temperature; maximum values

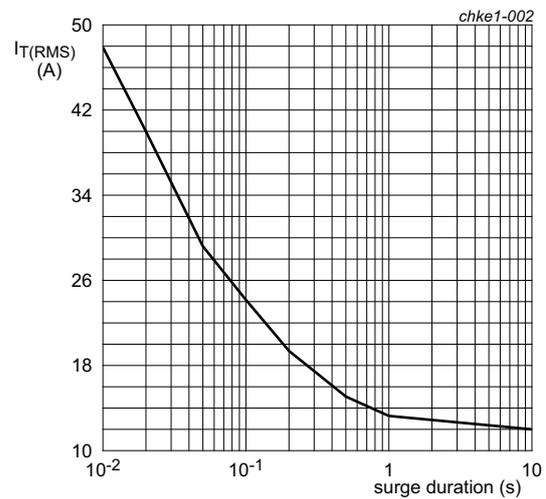


Fig. 2. RMS on-state current as a function of surge duration; maximum values
 $f = 50\text{ Hz}$; $T_h = 95\text{ }^\circ\text{C}$

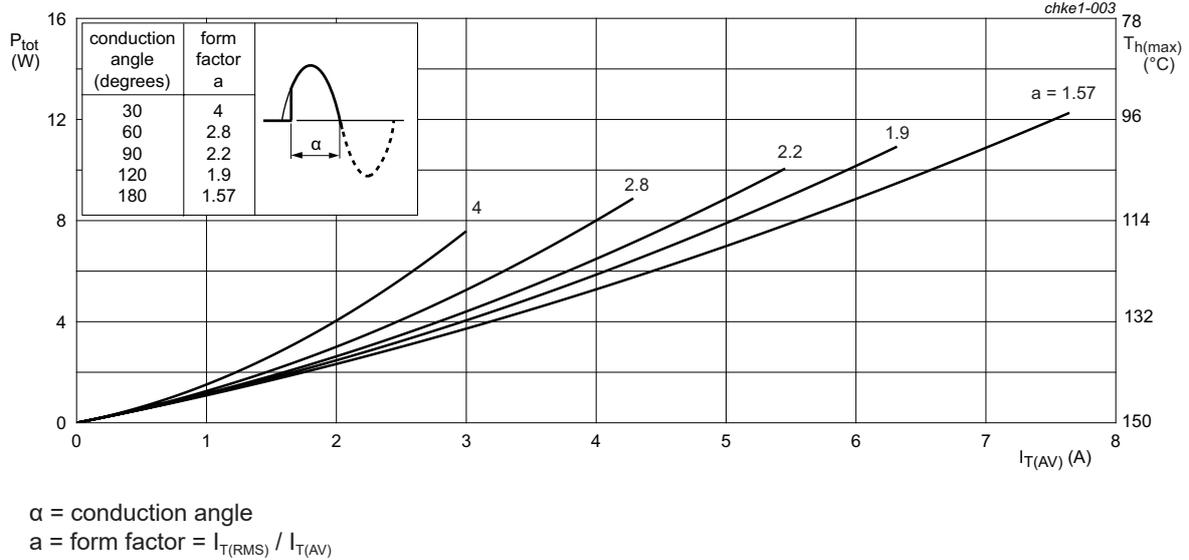


Fig. 3. Total power dissipation as a function of average on-state current; maximum values

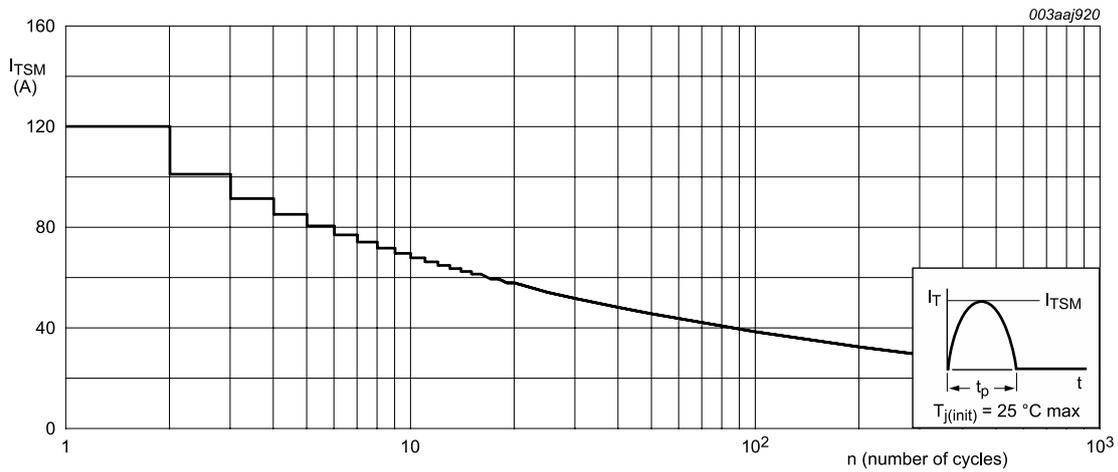
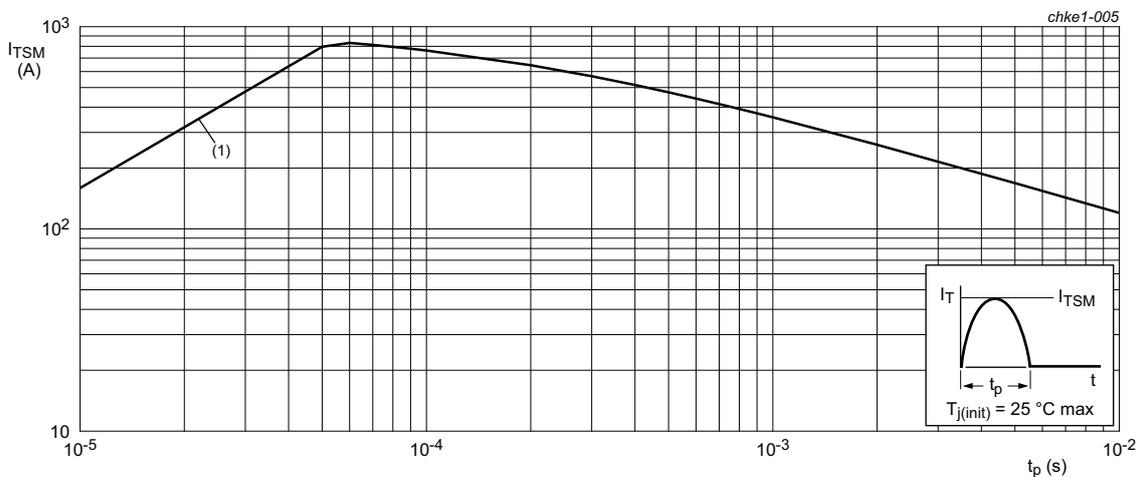


Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



$t_p \leq 10$ ms ;
 (1) di_T/dt limit

Fig. 5. 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	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

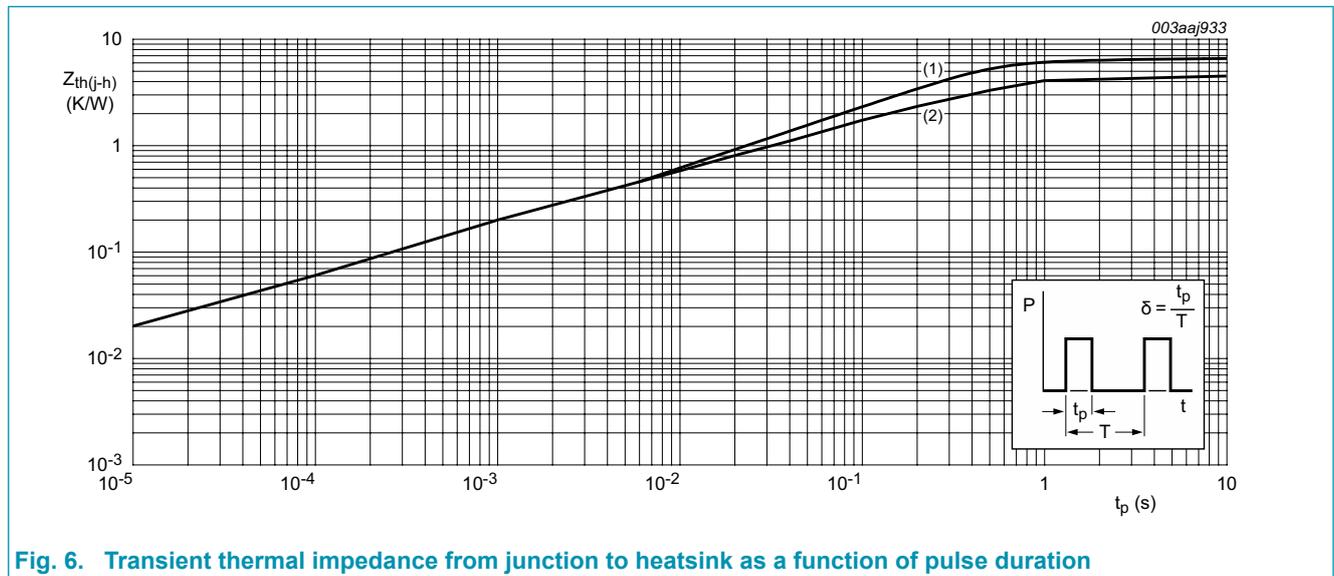


Fig. 6. Transient thermal impedance from junction to heatsink as a function of pulse duration

10. Isolation characteristics

Table 7. Isolation characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{isol(RMS)}$	RMS isolation voltage	50 Hz \leq f \leq 60 Hz; RH \leq 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	$V_D = 12\text{ V}; I_T = 0.1\text{ A}; T_j = 25\text{ }^\circ\text{C}$; Fig. 7	1.5	-	5	mA
I_L	latching current	$V_D = 12\text{ V}; I_T = 0.1\text{ A}; T_j = 25\text{ }^\circ\text{C}$; Fig. 8	-	-	40	mA
I_H	holding current	$V_D = 12\text{ V}; T_j = 25\text{ }^\circ\text{C}$; Fig. 9	-	-	20	mA
V_T	on-state voltage	$I_T = 12\text{ A}; T_j = 25\text{ }^\circ\text{C}$; Fig. 10	-	1.15	1.5	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	-	0.65	1	V
		$V_D = 400\text{ V}; I_T = 0.1\text{ A}; T_j = 150\text{ }^\circ\text{C}$	0.2	0.4	-	V
I_D	off-state current	$V_D = 650\text{ V}; T_j = 150\text{ }^\circ\text{C}$	-	-	1	mA
I_R	reverse current	$V_D = 650\text{ V}; T_j = 150\text{ }^\circ\text{C}$	-	-	1	mA
Dynamic characteristics						
dV_D/dt	rate of rise of off-state voltage	$V_{DM} = 436\text{ V}; T_j = 150\text{ }^\circ\text{C}; R_{GK} = 100\text{ }\Omega$; ($V_{DM} = 67\%$ of V_{DRM}); exponential waveform;	500	1000	-	V/ μ s
		$V_{DM} = 436\text{ V}; T_j = 150\text{ }^\circ\text{C}; (V_{DM} = 67\%$ of $V_{DRM})$; exponential waveform; gate open circuit	50	-	-	V/ μ s
t_{gt}	gate-controlled turn-on time	$I_{TM} = 12\text{ A}; V_D = 650\text{ V}; I_G = 100\text{ mA}; (dI_G/dt)_M = 5\text{ A}/\mu\text{s}; T_j = 25\text{ }^\circ\text{C}$	-	2	-	μ s
t_q	commutated turn-off time	$V_{DM} = 436\text{ V}; T_j = 125\text{ }^\circ\text{C}; I_{TM} = 12\text{ A}; V_R = 25\text{ V}; dV_D/dt = 30\text{ V}/\mu\text{s}; (dI_T/dt)_M = 30\text{ A}/\mu\text{s}; R_{GK(ext)} = 100\text{ }\Omega$; ($V_{DM} = 67\%$ of V_{DRM})	-	70	-	μ s

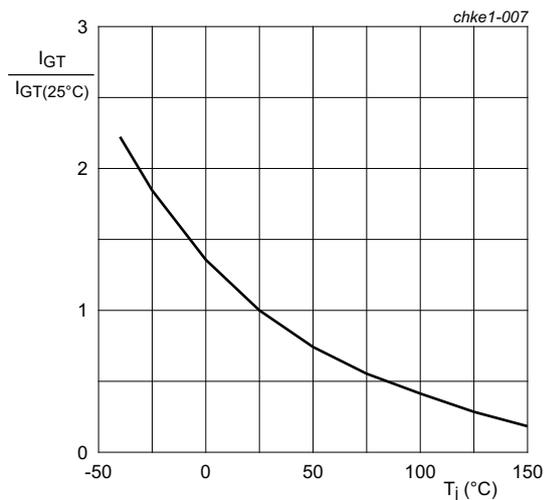


Fig. 7. Normalized gate trigger current as a function of junction temperature

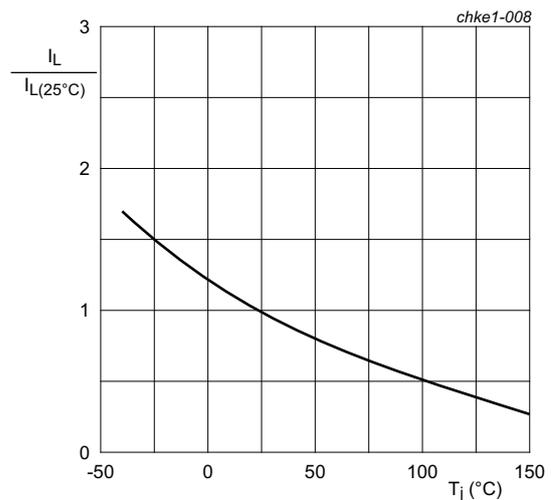


Fig. 8. Normalized latching current as a function of junction temperature

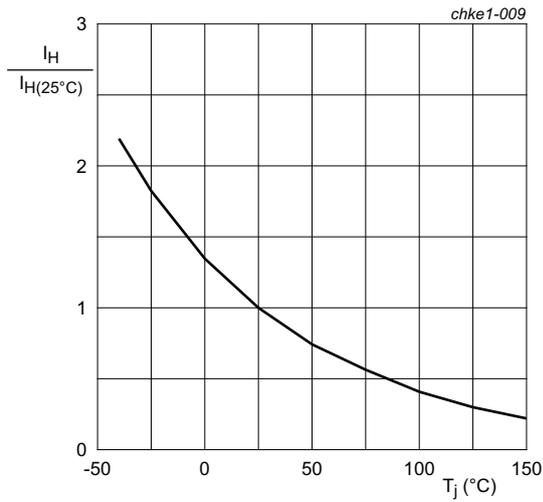
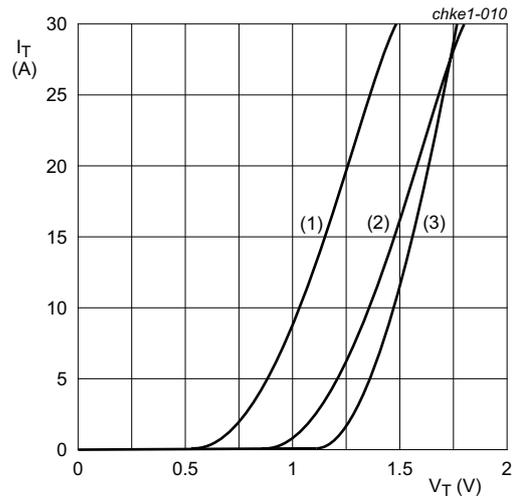


Fig. 9. Normalized holding current as a function of junction temperature



$V_o = 1.008 \text{ V}; R_s = 0.0317 \Omega$
 (1) $T_j = 150^\circ\text{C}$; typical values
 (2) $T_j = 150^\circ\text{C}$; maximum values
 (3) $T_j = 25^\circ\text{C}$; maximum values

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

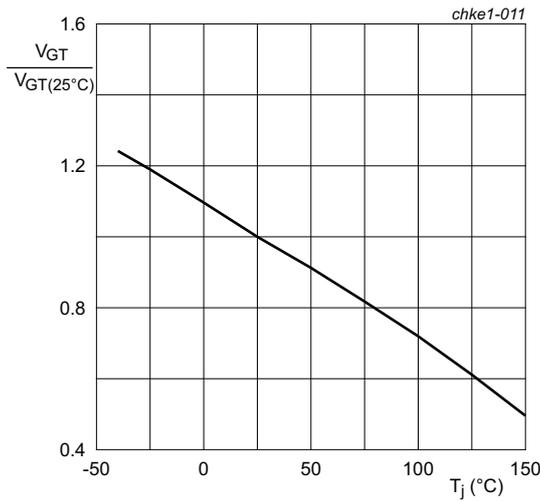
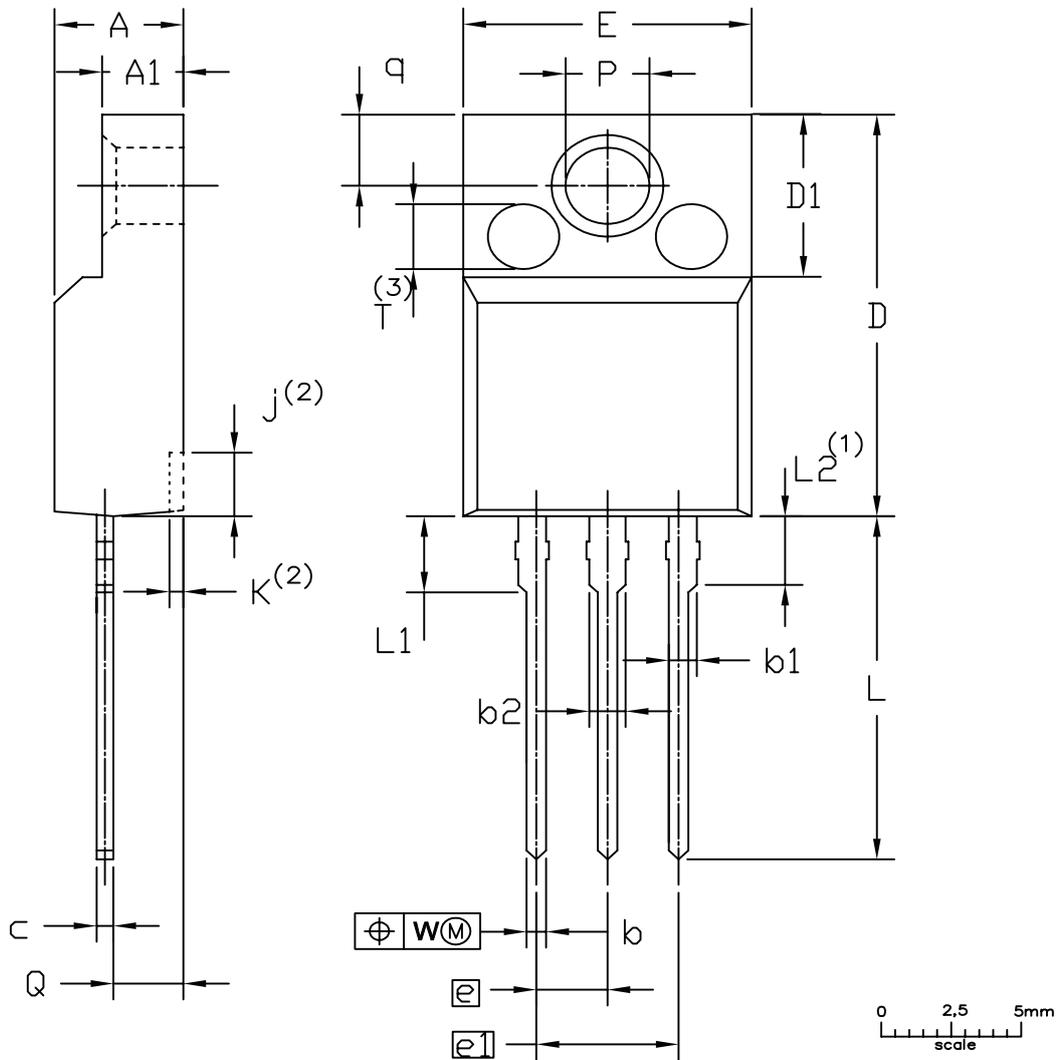


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

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	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

- Terminal dimensions within this zone are uncontrolled
- Dot lines area designs may vary
- 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

Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

- [1] Please consult the most recently issued document before initiating or completing a design.
- [2] The term 'short data sheet' is explained in section "Definitions".
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14. Contents

1. General description.....	1
2. Features and benefits	1
3. Applications	1
4. Quick reference data	1
5. Pinning information.....	2
6. Ordering information.....	2
7. Marking.....	3
8. Limiting values	3
9. Thermal characteristics	5
10. Isolation characteristics	5
11. Characteristics.....	6
12. Package outline	8
13. Legal information	9
14. Contents	11

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