BT151X-650LTF

SCR

Rev.02 - 07 April 2022 Product data sheet

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 surge current capability 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 surge current 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)

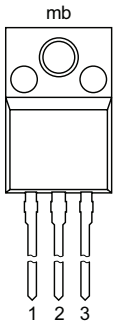
4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{DRM}	repetitive peak off-state voltage			-	-	650	V
$I_{T(RMS)}$	RMS on-state current	half sine wave; $T_h \leq 93$ °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			-40	-	150	°C
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		-	-	20	mA
V_T	on-state voltage	I_T = 12 A; T_j = 25 °C; Fig. 10		-	-	1.6	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		500	1000	-	V/µs

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-650LTF	TO220F	BT151X-650LTFQ	Tube	50	SOT186A	14-Nov-2013

7. Marking

Table 4. Marking codes

Type number	Marking codes
BT151X-650LTF	BT151X 650LTF

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8. Limiting values

Table 5. Limiting values

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

Symbol	Parameter	Conditions		Min	Max	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; $T_h \leq 93$ °C;		-	7.5	A
$I_{T(RMS)}$	RMS on-state current	half sine wave; $T_h \leq 93$ °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 pulse		-	72	A^2s
dI_T/dt	rate of rise of on-state current	$I_G = 10$ mA		-	150	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		-	1	W
T_{stg}	storage temperature			-40	150	°C
T_j	junction temperature			-	150	°C

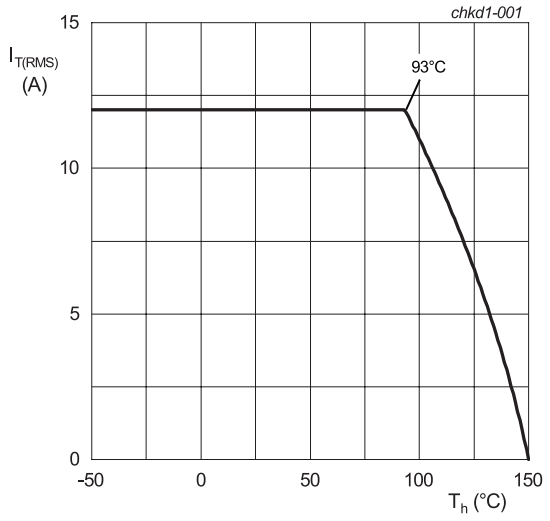
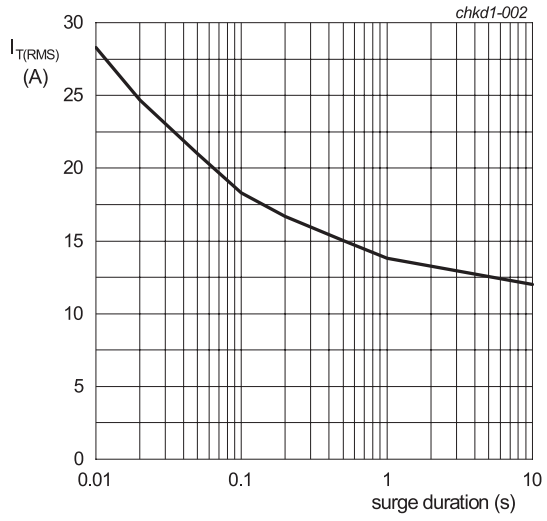


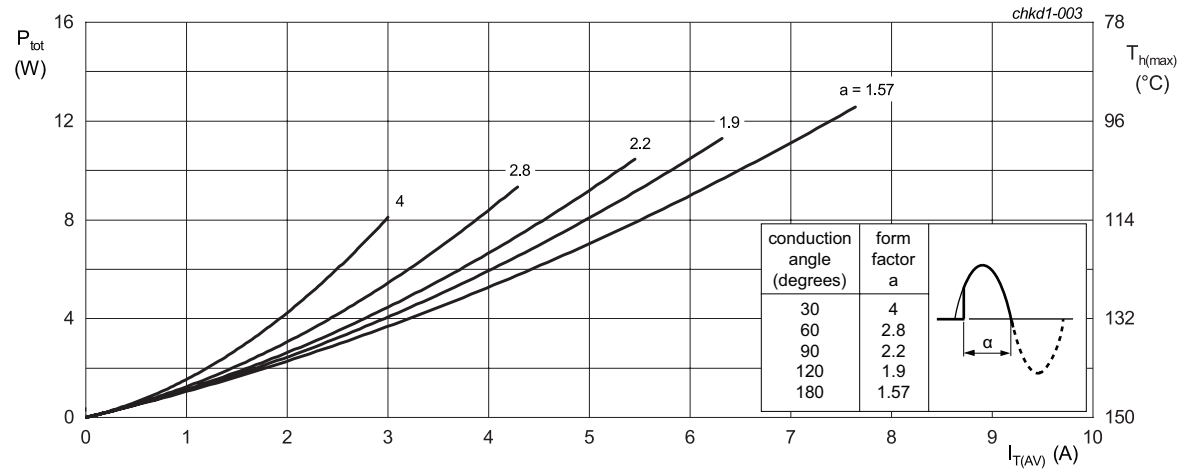
Fig. 1. RMS on-state current as a function of heatsink temperature; maximum values



f = 50 Hz; T_h = 93 °C

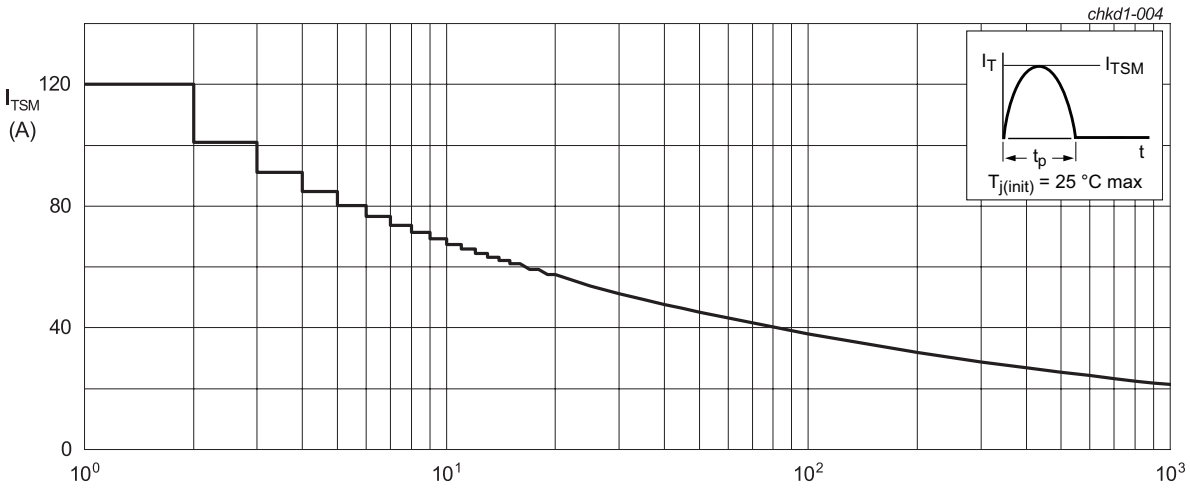
Fig. 2. RMS on-state current as a function of surge duration; maximum values

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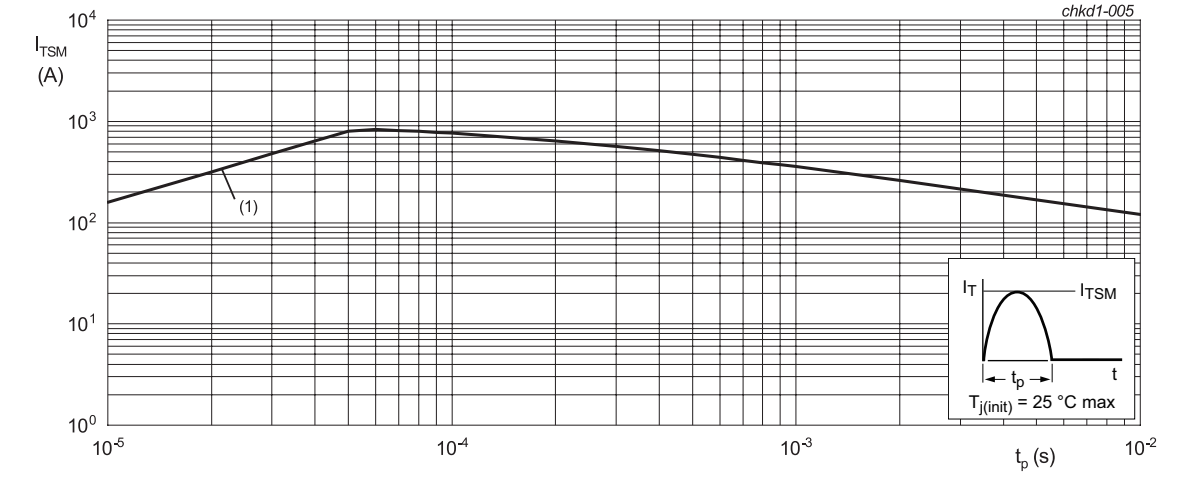
α = conduction angle
a = form factor = $I_{T(RMS)} / I_{T(AV)}$

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



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

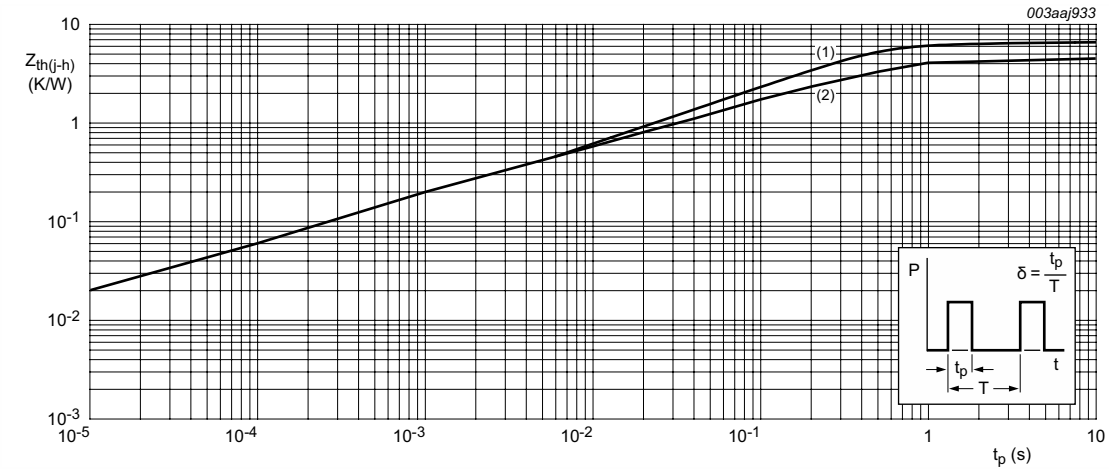
Fig. 5. Non-repetitive peak on-state current as a function of pulse duration; maximum values

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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		-	-	6.5	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air		-	55	-	K/W



(1) Without heatsink compound
(2) With heatsink compound

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	f = 1 MHz; T_h = 25 °C; from cathode to external heatsink		-	10	-	pF

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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_G = 0.1 A; T_j = 25 °C; Fig. 8		-	-	40	mA
I_H	holding current	V_D = 12 V; T_j = 25 °C; Fig. 9		-	-	20	mA
V_T	on-state voltage	I_T = 12 A; T_j = 25 °C; Fig. 10		-	-	1.6	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		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		500	1000	-	V/µs
		V_{DM} = 436 V; T_j = 150 °C; (V_{DM} = 67% of V_{DRM}); exponential waveform; gate open circuit		200	-	-	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	I_{TM} = 2 A; t_p = 50 µs; dV_D/dt = 5 V/µs; dI/dt = 30 A/µs		-	-	12	µs

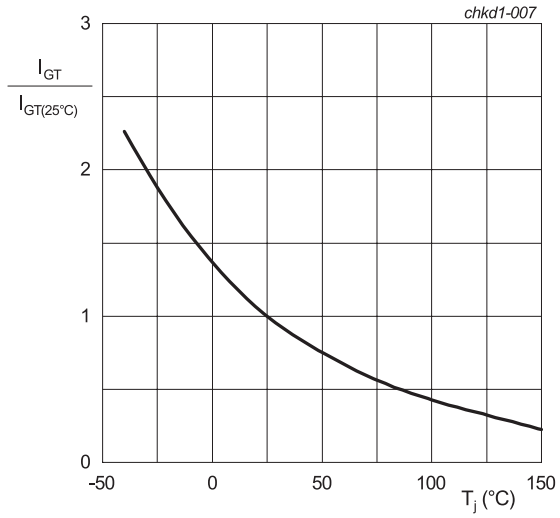


Fig. 7. Normalized gate trigger current as a function of junction temperature

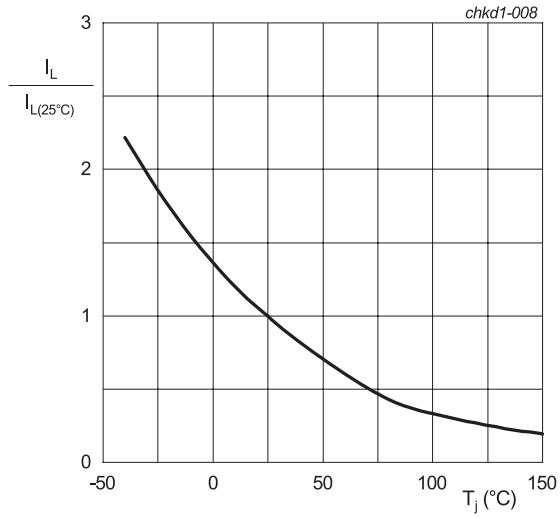


Fig. 8. Normalized latching current as a function of junction temperature

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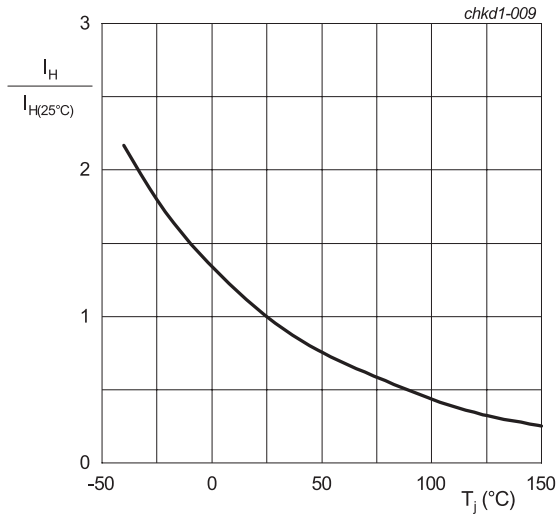
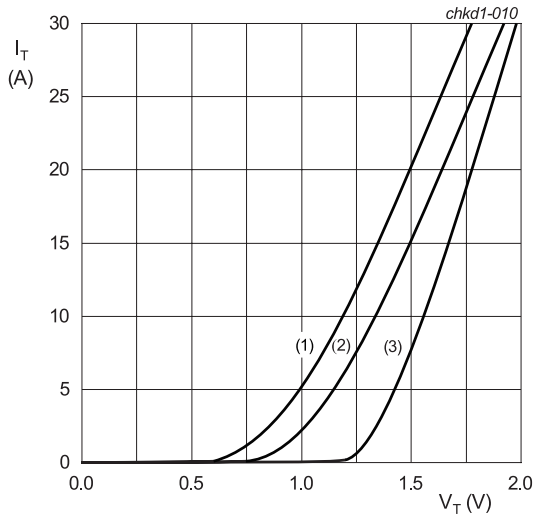


Fig. 9. Normalized holding current as a function of junction temperature



V_o = 0.962 V; R_s = 0.0362 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

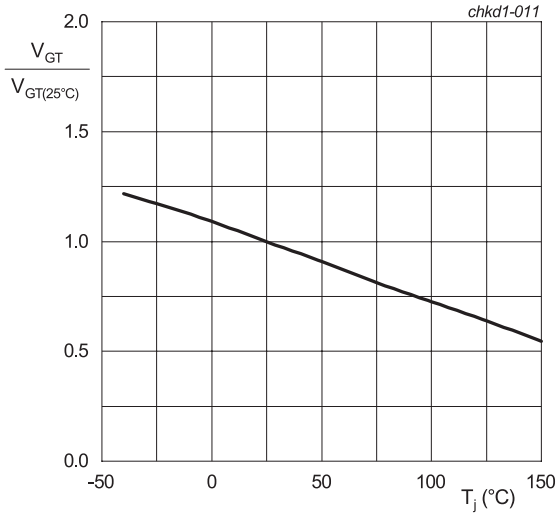


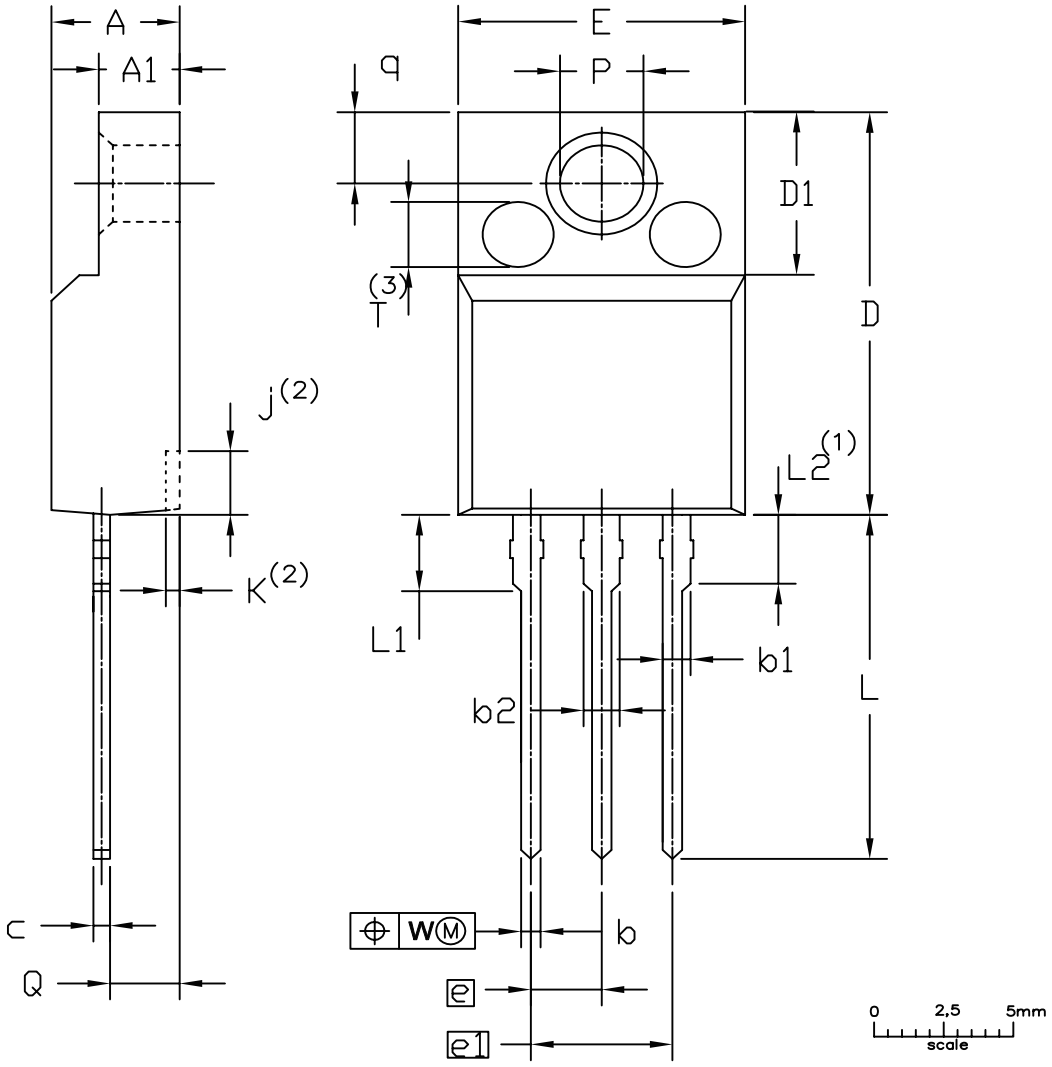
Fig. 11. Normalized gate trigger voltage as a function of junction temperature

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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

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Date of release: 07 April 2022