BT152X-400R

SCR

Rev.02 - 23 December 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 very high inrush current capability and high thermal cycling performance.

2. Features and benefits

- Good blocking voltage capability
- High thermal cycling performance
- Isolated mounting base package
- Planar passivated for voltage ruggedness and reliability
- Very high current surge capability

3. Applications

- Capacitive Discharge Ignition (CDI)
- Crowbar protection
- Inrush protection
- Motor control
- Voltage regulation

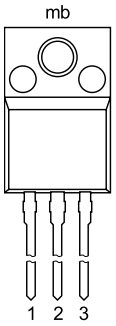
4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{RRM}	repetitive peak reverse voltage			-	-	400	V
$I_{T(AV)}$	average on-state current	half sine wave; $T_h \leq 43$ °C		-	-	13	A
$I_{T(RMS)}$	RMS on-state current	half sine wave; $T_h \leq 43$ °C; Fig. 1; Fig. 2; Fig. 3		-	-	20	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		-	-	200	A
		half sine wave; $T_{j(init)} = 25$ °C; $t_p = 8.3$ ms		-	-	220	A
T_j	junction temperature			-	-	125	°C
Static characteristics							
I_{GT}	gate trigger current	$V_D = 12$ V; $I_T = 0.1$ A; $T_j = 25$ °C; Fig. 7		-	3	32	mA
Dynamic characteristics							
dV_D/dt	rate of rise of off-state voltage	$V_{DM} = 268$ V; $T_j = 125$ °C; (V_{DM} = 67% of V_{DRM}); exponential waveform; gate open circuit; Fig. 12		200	300	-	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
BT152X-400R	TO220F	BT152X-400R,127	Tube	50	SOT186A	14-Nov-2013

7. Marking

Table 4. Marking codes

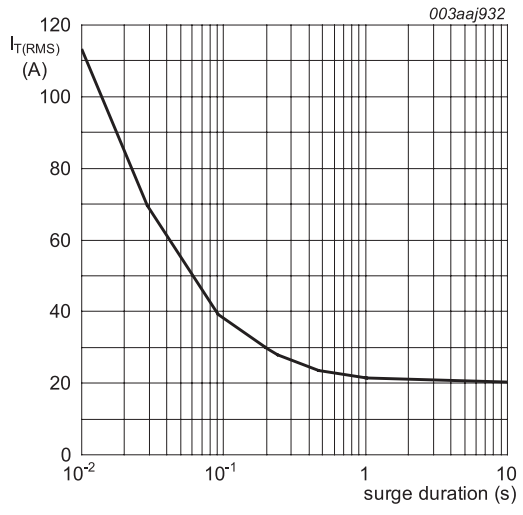
Type number	Marking codes	
	Assembly factory: d	Assembly factory: A
BT152X-400R	BT152X 400R PJdxxxx xx	BT152X 400R PJAxxxx xx

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			-	400	V
V_{RRM}	repetitive peak reverse voltage			-	400	V
$I_{T(AV)}$	average on-state current	half sine wave; $T_h \leq 43$ °C		-	13	A
$I_{T(RMS)}$	RMS on-state current	half sine wave; $T_h \leq 43$ °C; Fig. 1; Fig. 2; Fig. 3		-	20	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		-	200	A
		half sine wave; $T_{j(init)} = 25$ °C; $t_p = 8.3$ ms		-	220	A
I^2t	I^2t for fusing	$t_p = 10$ ms; SIN		-	200	A^2s
dI_T/dt	rate of rise of on-state current	$I_T = 50$ A; $I_G = 0.2$ A; $dI_G/dt = 0.2$ A/µs		-	200	A/µs
I_{GM}	peak gate current			-	5	A
V_{RGM}	peak reverse gate voltage			-	5	V
P_{GM}	peak gate power			-	20	W
$P_{G(AV)}$	average gate power	over any 20 ms period		-	0.5	W
T_{stg}	storage temperature			-40	150	°C
T_j	junction temperature			-	125	°C



f = 50 Hz; T_h = 43 °C

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

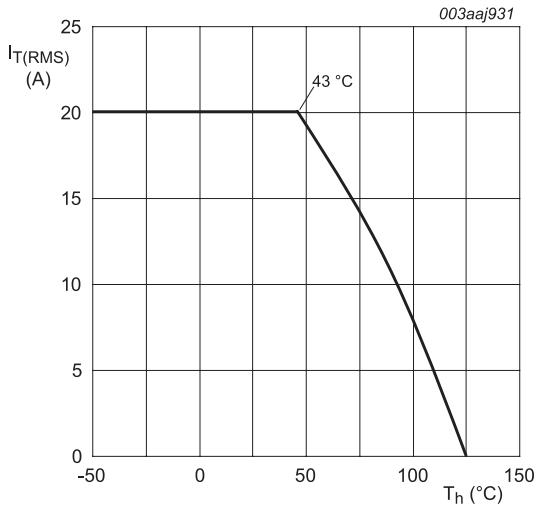
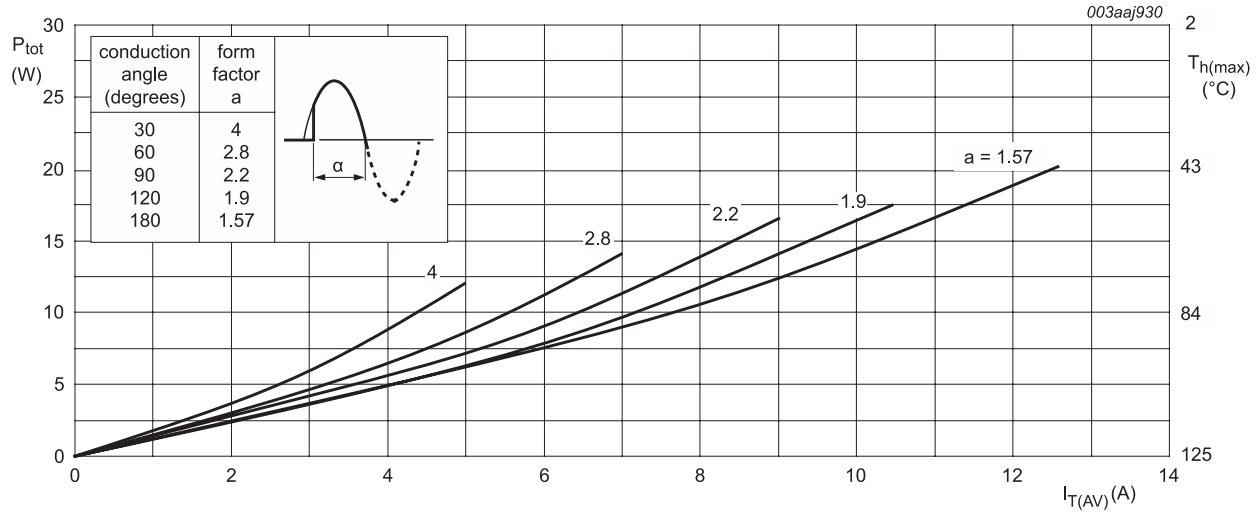


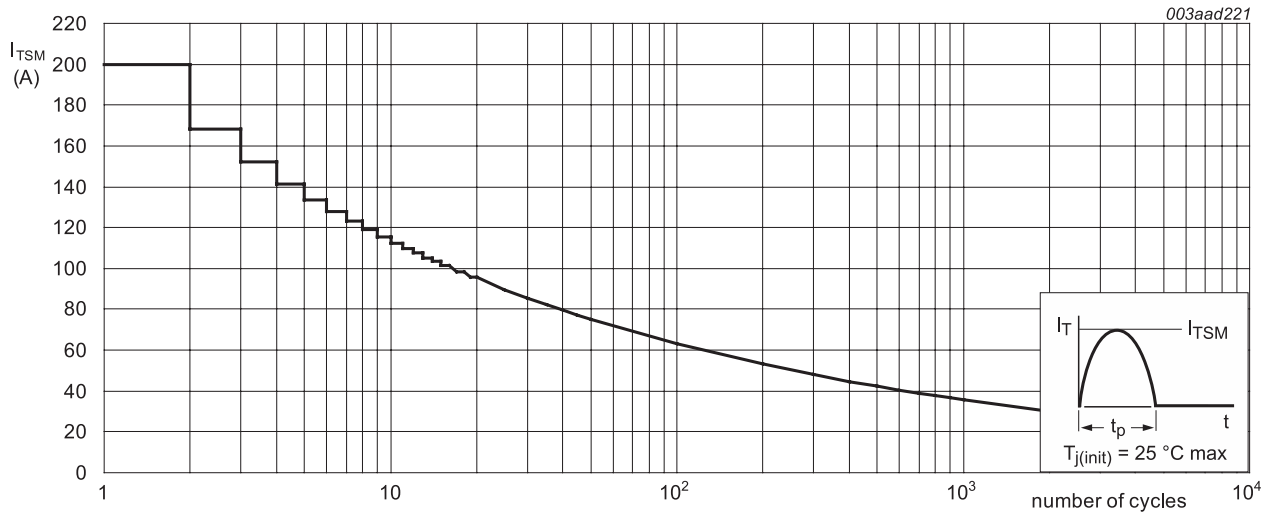
Fig. 2. RMS on-state current as a function of heatsink temperature; maximum values



α = conduction angle

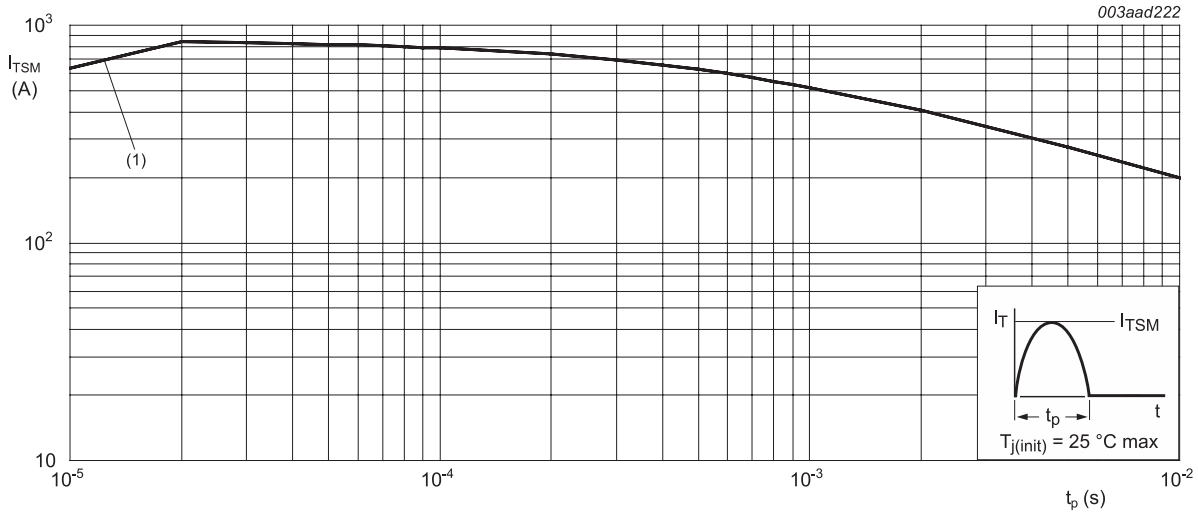
a = form factor = $I_{T(RMS)}$ / $I_{T(AV)}$

Fig. 3. Total power dissipation as a function of average 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



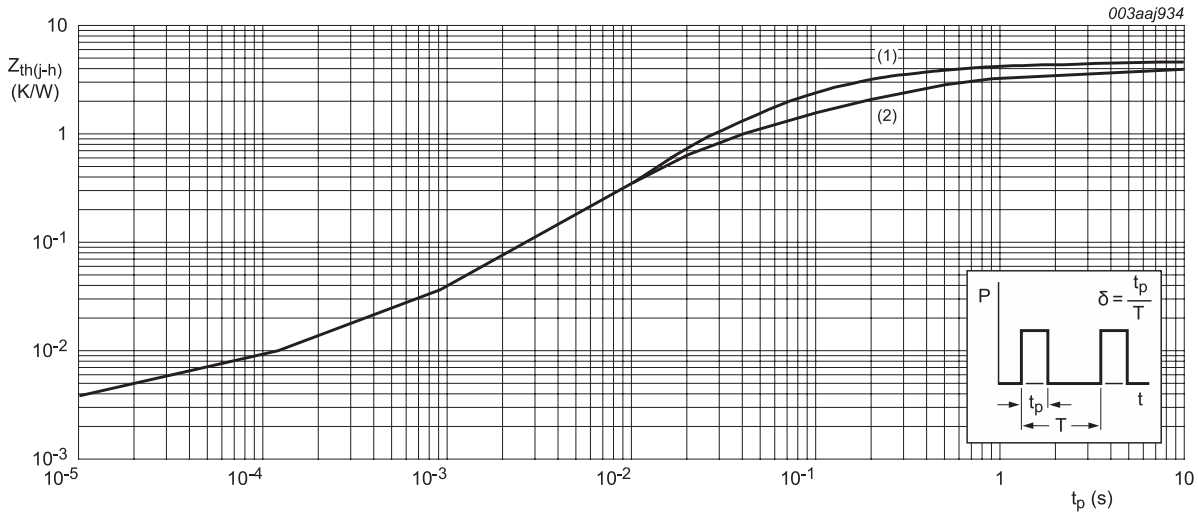
$t_p \leq 10$ ms
(1) dI_T/dt limit

Fig. 5. Non-repetitive peak on-state current as a function of pulse 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	K/W
		without heatsink compound; Fig. 6		-	-	4.5	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air	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 width

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 anode 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 V; I_T = 0.1 A; T_j = 25 °C; Fig. 7		-	3	32	mA
I_L	latching current	V_D = 12 V; I_G = 0.1 A; T_j = 25 °C; Fig. 8		-	25	80	mA
I_H	holding current	V_D = 12 V; T_j = 25 °C; Fig. 9		-	15	60	mA
V_T	on-state voltage	I_T = 40 A; T_j = 25 °C; Fig. 10		-	1.4	1.75	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 = 125 °C		0.25	0.4	-	V
I_D	off-state current	V_D = 400 V; T_j = 125 °C		-	0.2	1	mA
I_R	reverse current	V_R = 400 V; T_j = 125 °C		-	0.2	1	mA
Dynamic characteristics							
dV_D/dt	rate of rise of off-state voltage	V_{DM} = 268 V; T_j = 125 °C; (V_{DM} = 67% of V_{DRM}); exponential waveform; gate open circuit; Fig. 12		200	300	-	V/µs
t_{gt}	gate-controlled turn-on time	I_{TM} = 40 A; V_D = 400 V; I_G = 100 mA; d_{IG}/dt = 5 A/µs; T_j = 25 °C		-	2	-	µs
t_q	commutated turn-off time	V_{DM} = 268 V; T_j = 125 °C; I_{TM} = 50 A; V_R = 25 V; $(dI_T/dt)_M$ = 50 A/µs; dV_D/dt = 30 V/µs; $R_{GK(ext)}$ = 100 Ω; (V_{DM} = 67% of V_{DRM})		-	70	-	µs

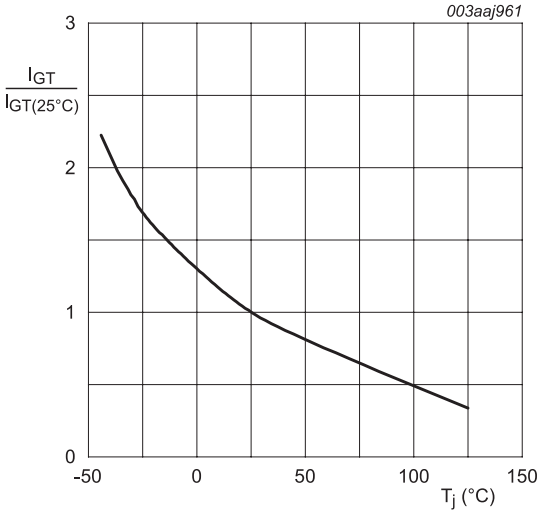


Fig. 7. Normalized gate trigger current as a function of junction temperature

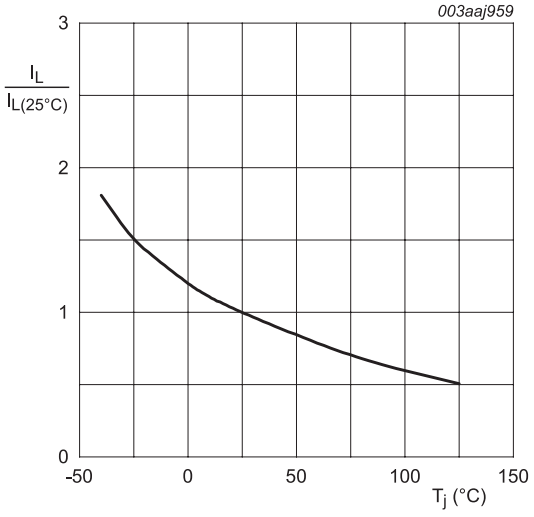


Fig. 8. Normalized latching current as a function of junction temperature

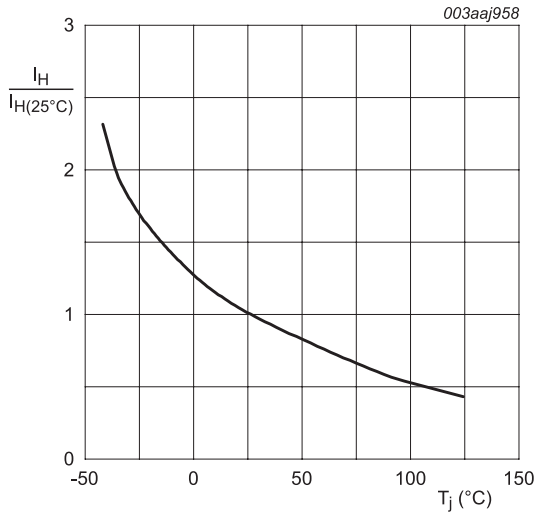
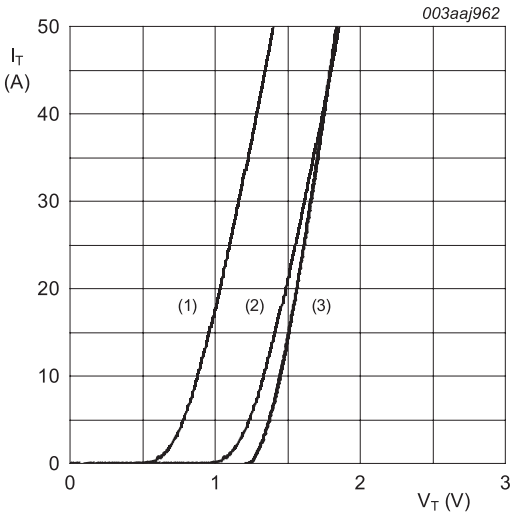


Fig. 9. Normalized holding current as a function of junction temperature



V_o = 1.12 V; R_s = 0.015 Ω
(1) T_j = 125 °C; typical values
(2) T_j = 125 °C; maximum values
(3) T_j = 25 °C; maximum values

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

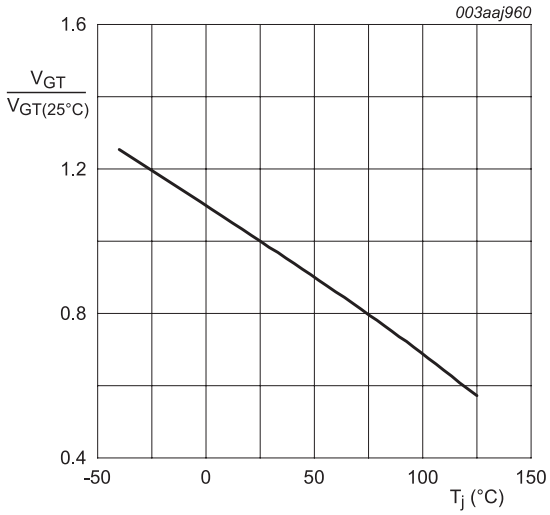
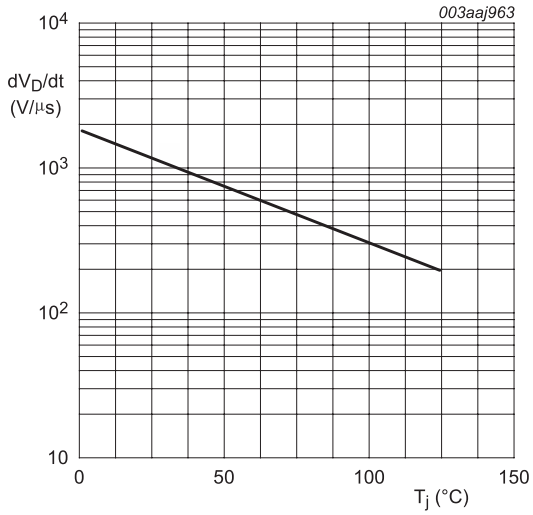


Fig. 11. Normalized gate trigger voltage as a function of junction temperature



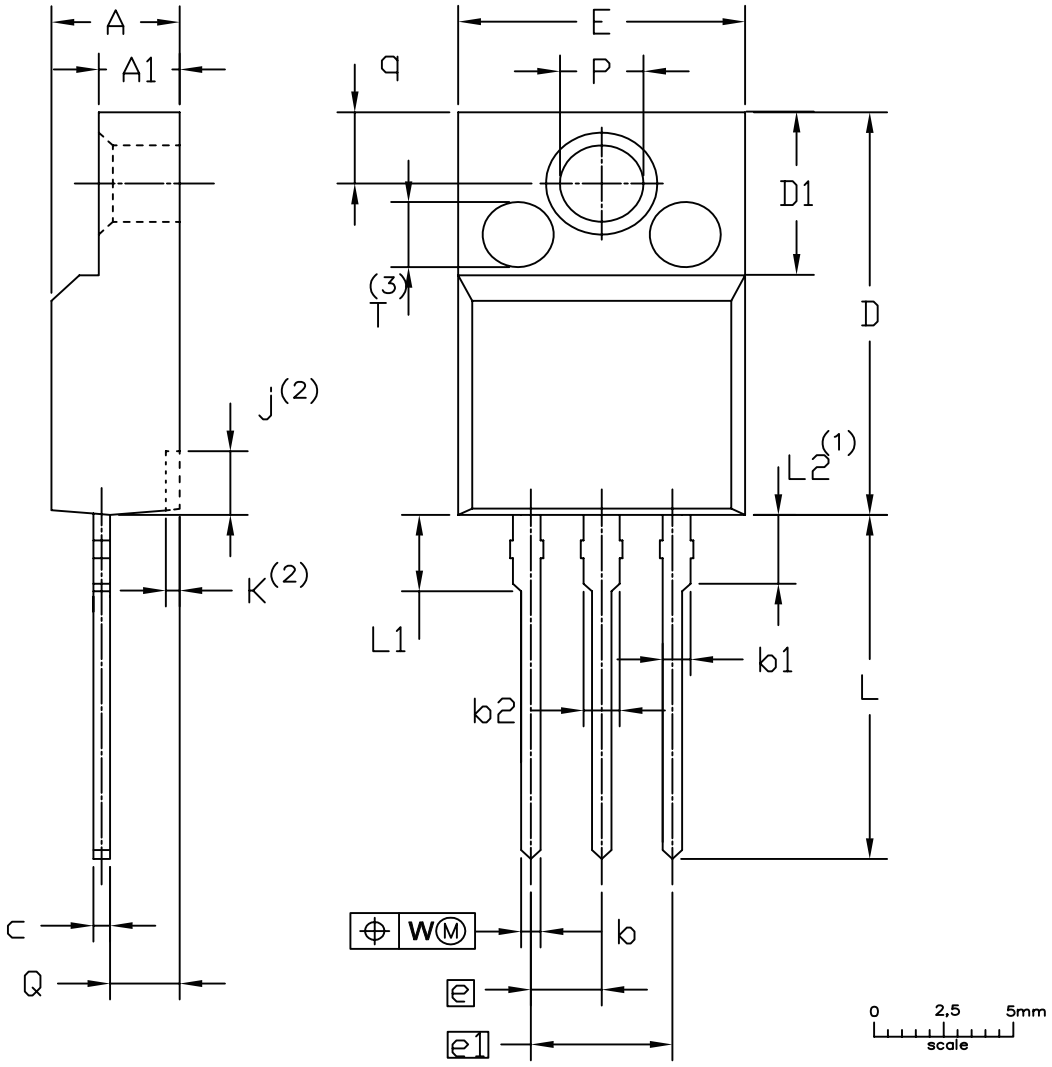
gate open circuit

Fig. 12. Critical rate of rise of off-state voltage as a function of junction temperature; minimum values

12. Package outline

Assembly factory: d & A

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

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.

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