

1. General description

Planar passivated Silicon Controlled Rectifier (SCR) in a ITO220 plastic package intended for use in applications requiring good bidirectional blocking voltage and high surge current capability and high junction temperature capability ($T_{j(max)} = 150\text{ °C}$).

2. Features and benefits

- High junction operating temperature capability ($T_{j(max)} = 150\text{ °C}$)
- High bidirectional blocking voltage capability
- Very high current surge capability
- High thermal cycling performance
- Planar passivated for voltage ruggedness and reliability
- Internally insulated package
- Isolated mounting base with 2500 $V_{(RMS)}$ isolation

3. Applications

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

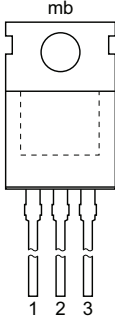

4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{DRM}	repetitive peak off-state voltage		-	-	650	V
$I_{T(RMS)}$	RMS on-state current	half sine wave; $T_{mb} \leq 122\text{ °C}$; 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
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	-	-	1.5	V
Dynamic characteristics						
dV_D/dt	rate of rise of off-state voltage	$V_{DM} = 436\text{ V}$; $T_j = 150\text{ °C}$; $R_{GK} = 100\text{ }\Omega$; ($V_{DM} = 67\%$ of V_{DRM}); exponential waveform	500	-	-	V/ μ s
		$V_{DM} = 436\text{ V}$; $T_j = 150\text{ °C}$; ($V_{DM} = 67\%$ of V_{DRM}); exponential waveform; gate open circuit	200	-	-	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
BT151Y-650LTF	IITO220	BT151Y-650LTFQ	Tube	50	SOT78D (A)	10-July-2007
					IITO220P (P)	31-Mar-2023

7. Marking

Table 4. Marking codes

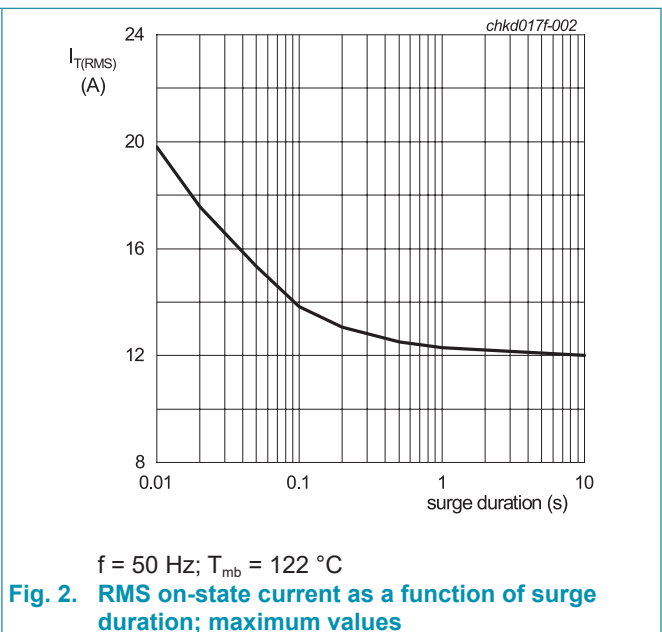
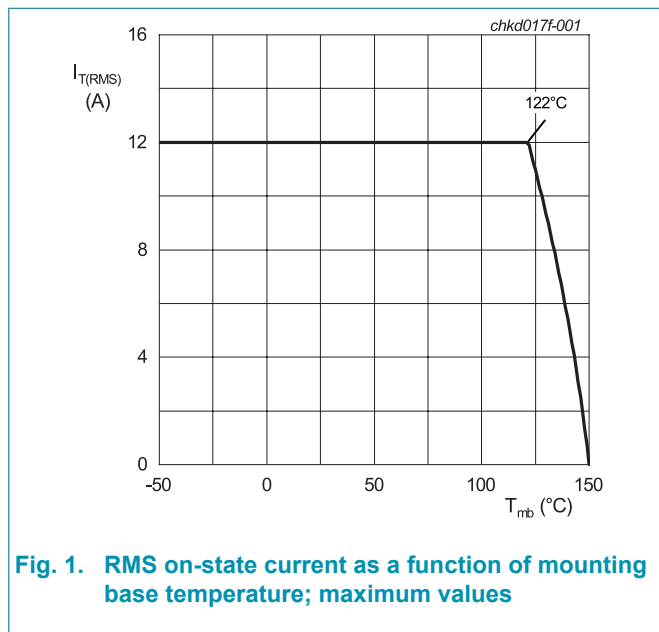
Type number	Marking codes	
	Assembly factory: A	Assembly factory: P
BT151Y-650LTF	BT151Y 650LTF PJAxxxx xx	BT151Y 650LTF PJPxxxx xx

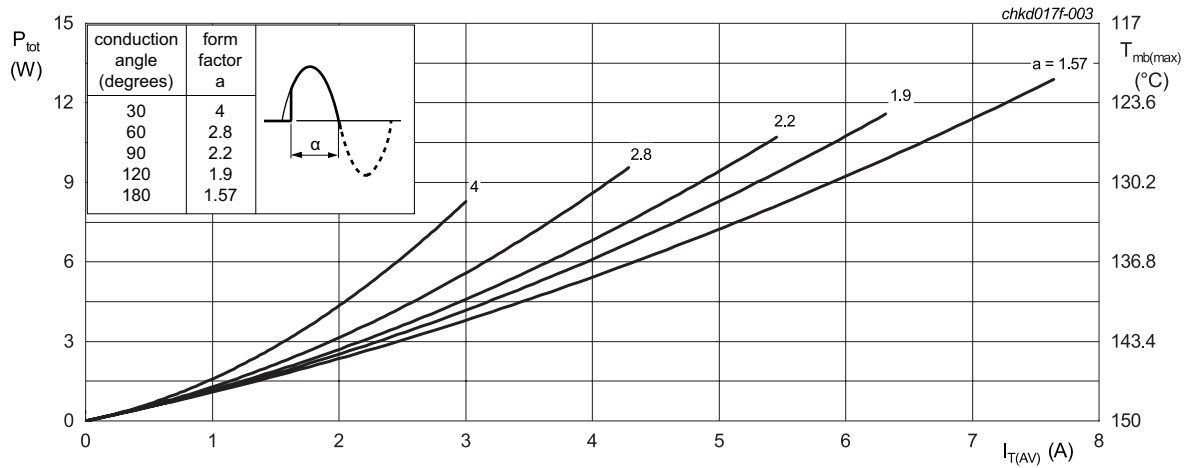
8. Limiting values

Table 5. Limiting values

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

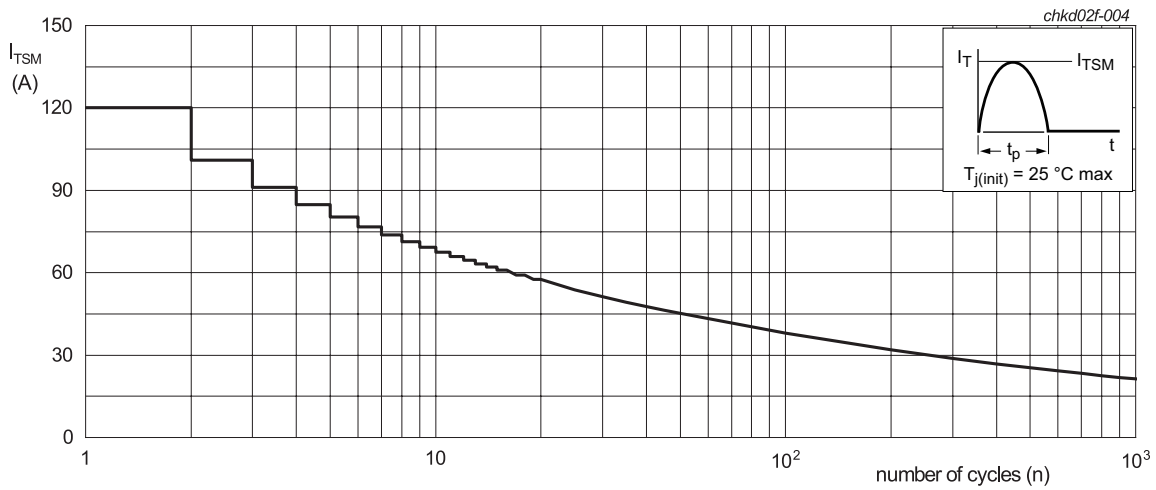
Symbol	Parameter	Conditions	Min	Max	Unit
V_{DRM}	repetitive peak off-state voltage		-	650	V
V_{RRM}	repetitive peak reverse voltage		-	650	V
$I_{T(AV)}$	average on-state current	half sine wave; $T_{mb} \leq 122\text{ }^{\circ}\text{C}$;	-	7.5	A
$I_{T(RMS)}$	RMS on-state current	half sine wave; $T_{mb} \leq 122\text{ }^{\circ}\text{C}$; 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	$I_G = 10\text{ mA}$	-	150	$\text{A}/\mu\text{s}$
I_{GM}	peak gate current		-	2	A
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	$^{\circ}\text{C}$
T_j	junction temperature		-	150	$^{\circ}\text{C}$





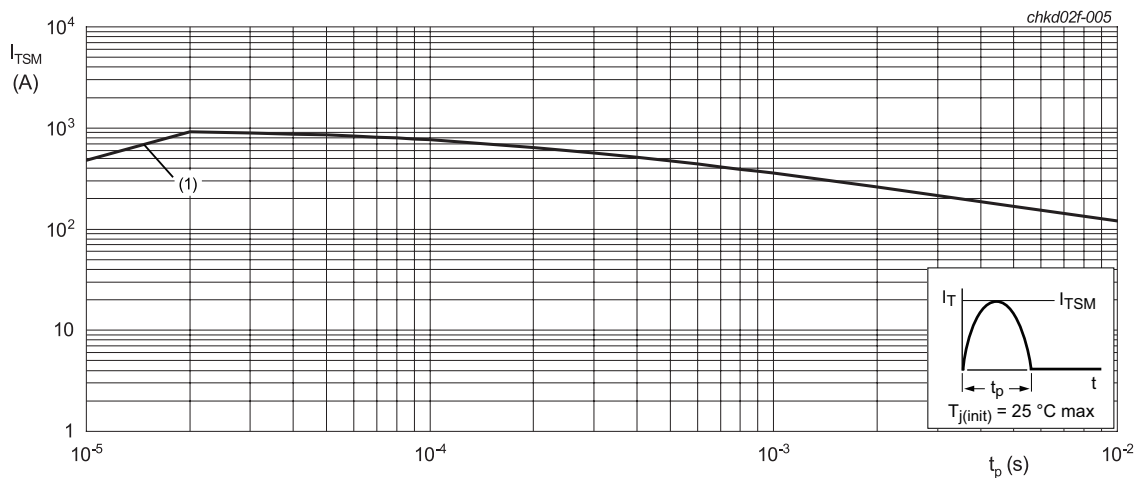
α = conduction angle
 a = form factor = $I_{T(RMS)} / I_{T(AV)}$

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
$R_{th(j-mb)}$	thermal resistance from junction to mounting base	Fig. 6	-	-	2.2	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air	in free air	-	60	-	K/W

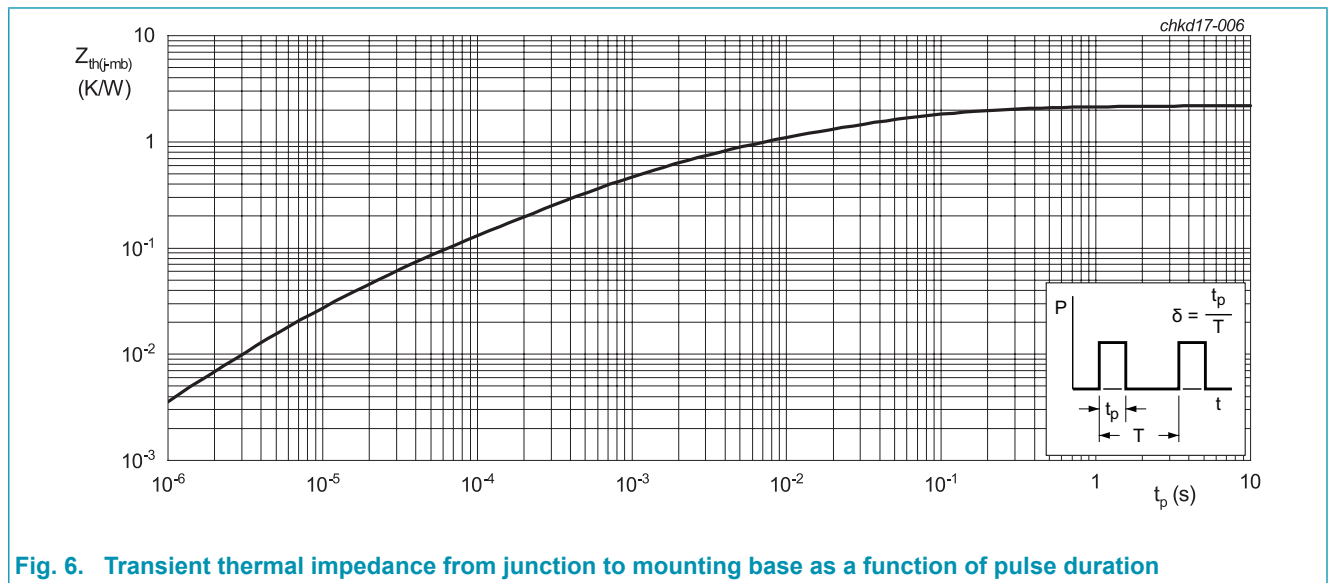


Fig. 6. Transient thermal impedance from junction to mounting base as a function of pulse duration

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	$V_D = 12\text{ V}; I_G = 0.1\text{ A}; T_j = 25\text{ }^\circ\text{C};$ 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	-	-	1.5	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	-	0.8	1	V
		$V_D = 400\text{ V}; I_T = 0.1\text{ A}; T_j = 150\text{ }^\circ\text{C}$	0.25	0.45	-	V
V_{GR}	gate reverse voltage	$I_{RG} = 100\text{ mA}$	10	-	-	V
I_D	off-state current	$V_D = 650\text{ V}; T_j = 25\text{ }^\circ\text{C}$	-	-	10	μA
		$V_D = 650\text{ V}; T_j = 150\text{ }^\circ\text{C}$	-	-	2	mA
I_R	reverse current	$V_D = 650\text{ V}; T_j = 25\text{ }^\circ\text{C}$	-	-	10	μA
		$V_D = 650\text{ V}; T_j = 150\text{ }^\circ\text{C}$	-	-	2	mA
Dynamic characteristics						
dV_D/dt	rate of rise of off-state voltage	$V_{DM} = 436\text{ V}; T_j = 150\text{ }^\circ\text{C}; R_{GK} = 100\text{ }\Omega;$ $(V_{DM} = 67\% \text{ of } V_{DRM});$ exponential waveform	500	-	-	$\text{V}/\mu\text{s}$
		$V_{DM} = 436\text{ V}; T_j = 150\text{ }^\circ\text{C}; (V_{DM} = 67\% \text{ of } V_{DRM});$ exponential waveform; gate open circuit	200	-	-	$\text{V}/\mu\text{s}$
t_{gt}	gate-controlled turn-on time	$I_{TM} = 12\text{ A}; V_D = 600\text{ V}; I_G = 20\text{ mA};$ $(di_G/dt)_M = 5\text{ A}/\mu\text{s}; T_j = 25\text{ }^\circ\text{C}$	-	2	-	μs
t_q	commutated turn-off time	$I_{TM} = 2\text{ A}; t_p = 50\text{ }\mu\text{s}; dV_D/dt = 5\text{ V}/\mu\text{s}; di/dt = 30\text{ A}/\mu\text{s}$	-	-	12	μs

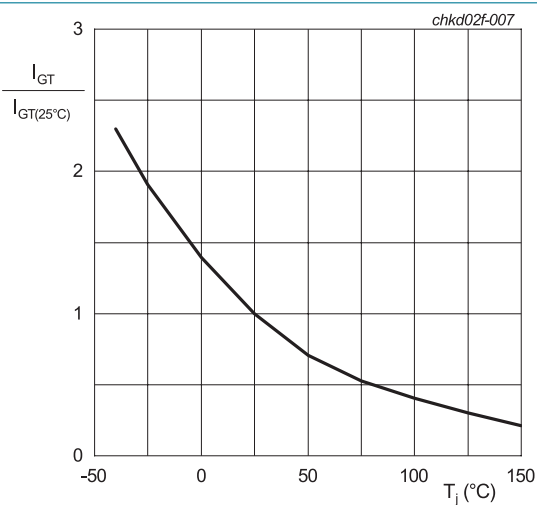


Fig. 7. Normalized gate trigger current as a function of junction temperature

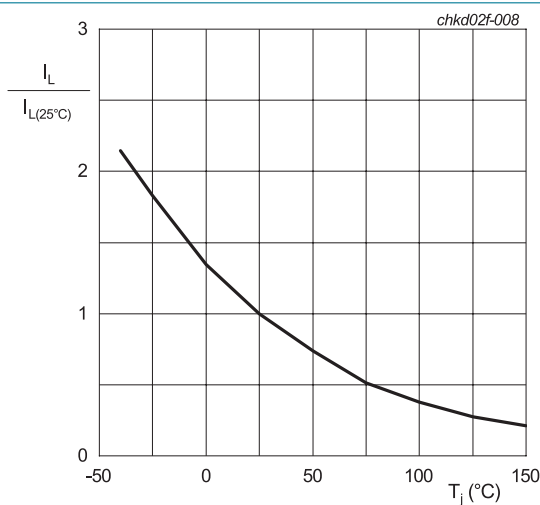


Fig. 8. Normalized latching current as a function of junction temperature

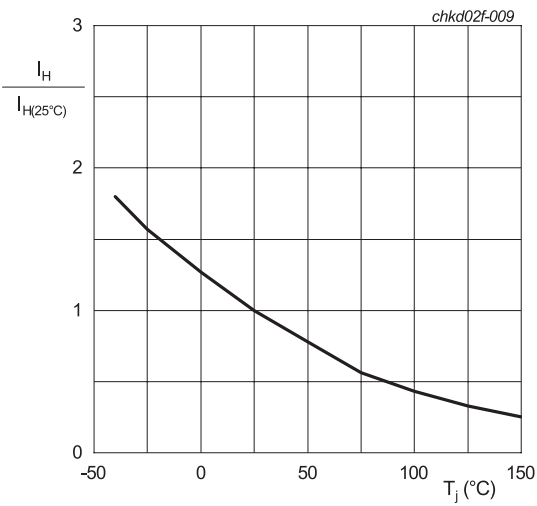
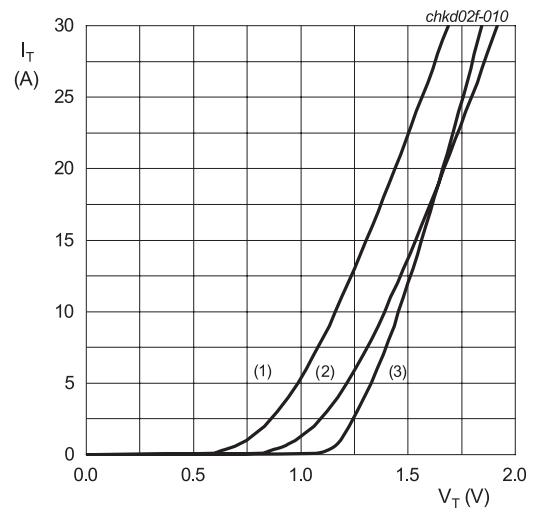


Fig. 9. Normalized holding current as a function of junction temperature



$V_o = 0.993 \text{ V}; R_s = 0.0368 \Omega$
 (1) $T_j = 150 \text{ }^\circ\text{C}$; typical values
 (2) $T_j = 150 \text{ }^\circ\text{C}$; maximum values
 (3) $T_j = 25 \text{ }^\circ\text{C}$; maximum values

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

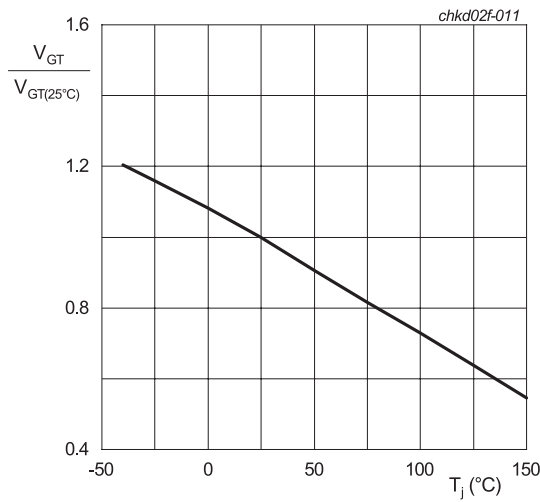


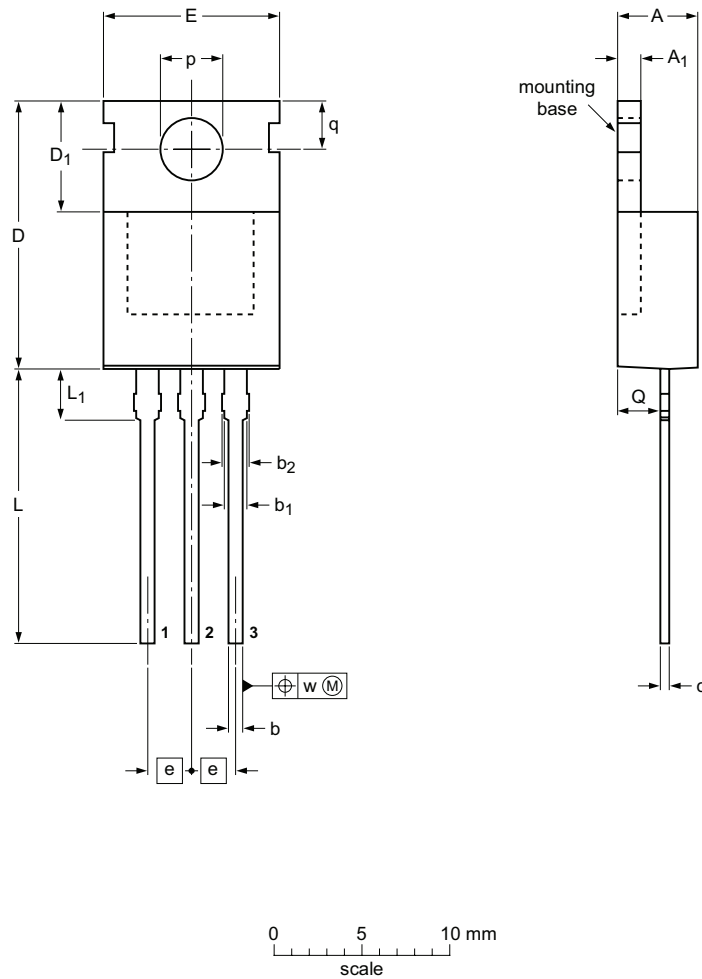
Fig. 11. Normalized gate trigger voltage as a function of junction temperature

12. Package outline

Assembly factory: A

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

SOT78D



DIMENSIONS (mm are the original dimensions)

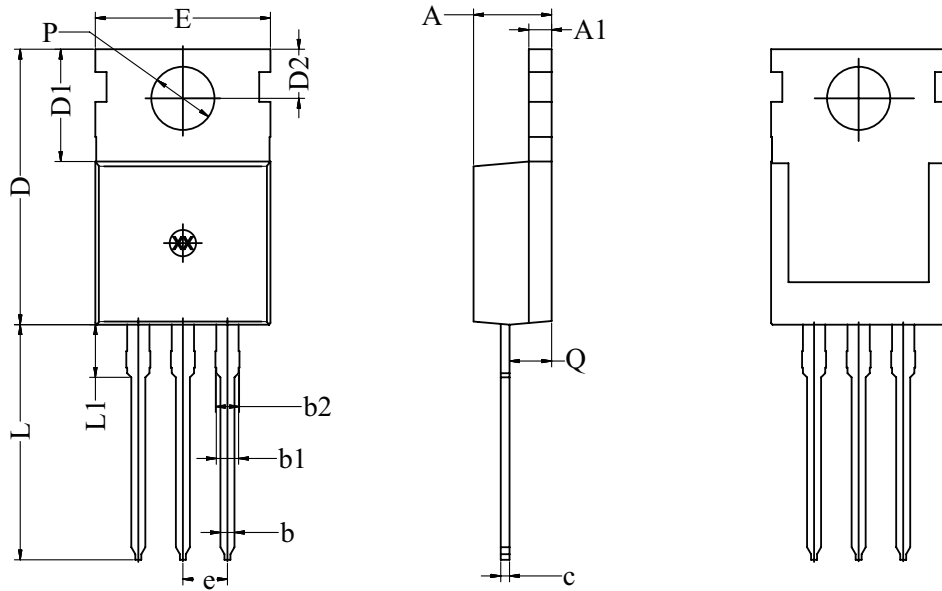
UNIT	A	A ₁	b	b ₁	b ₂	c	D	D ₁ ref	E	e	L	L ₁ ref	p	Q	q	w
mm	4.7 4.3	1.40 1.25	0.9 0.6	1.4 1.1	1.72 1.32	0.6 0.4	16.0 15.2	6.5	10.3 9.7	2.54	14.0 12.8	3.0	3.7 3.5	2.6 2.2	3.0 2.7	0.2

OUTLINE VERSION	REFERENCES			EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA		
SOT78D		TO-220			07-04-04 07-07-10

Assembly factory: P

Plastic single-ended package; isolated heatsink mounted; 1 mounting hole; 3 leads TO-220

IITO220



Dim	All Dimensions in Millimeters		
	Min	Typ	Max
A	4.30	4.45	4.70
A1	1.25	1.30	1.40
b	0.60	0.80	0.90
b1	1.10	1.27	1.40
b2	1.32	1.37	1.72
c	0.40	0.50	0.60
D	15.20	15.70	16.00
D1	6.20	6.40	6.60
D2	2.70	2.80	3.00
E	9.70	10.00	10.30
e	2.54 BSC		
L	12.80	13.40	14.00
L1	2.80	3.00	3.20
P	3.50	3.60	3.70
Q	2.20	2.40	2.60

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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- [2] The term 'short data sheet' is explained in section "Definitions".
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