

## 1. General description

Planar passivated Silicon Controlled Rectifier (SCR) in ITO220 internally insulated 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
- Planar passivated for voltage ruggedness and reliability
- Internally insulated package
- Isolated mounting base with 2500 V (RMS) isolation

## 3. Applications

- Protection circuit in Power Supplies for Consumer / Industrial / Medical Equipment
- Capacitive Discharge Ignition (CDI)
- Crowbar protection
- Inrush protection
- Motor control
- Voltage regulation

## 4. Quick reference data

Table 1. Quick reference data

Symbol	Parameter	Conditions	Values	Unit
<b>Absolute maximum rating</b>				
$V_{DRM}$	repetitive peak off-state voltage		650	V
$I_{T(RMS)}$	RMS on-state current	half sine wave; $T_{mb} \leq 123\text{ °C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>	12	A
$I_{TSM}$	non-repetitive peak on-state current	half sine wave; $T_{j(init)} = 25\text{ °C}$ ; $t_p = 10\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>	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
<b>Static characteristics</b>						
$I_{GT}$	gate trigger current	$V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>	1.5	-	5	mA
$I_H$	holding current	$V_D = 12\text{ V}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 9</a>	-	-	20	mA
$V_T$	on-state voltage	$I_T = 12\text{ A}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 10</a>	-	1.15	1.5	V
<b>Dynamic characteristics</b>						
$dV_D/dt$	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	-	-	V/ $\mu$ 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	IITO220	BT151Y-650LTNQ	Tube	50	IITO220E (E)	15-Dec-2017
					IITO220P (P)	31-Mar-2023

## 7. Marking

Table 4. Marking codes

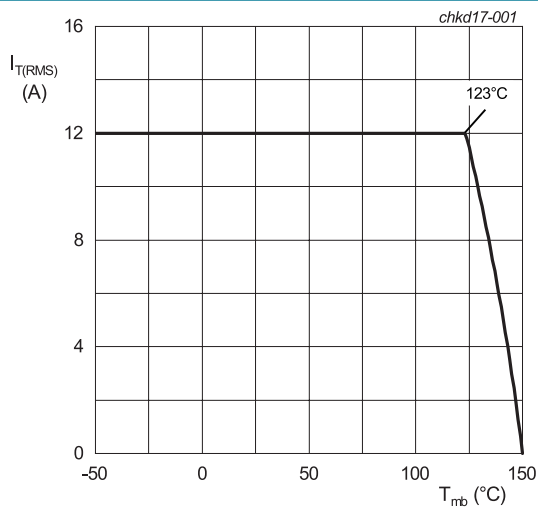
Type number	Marking codes	
	Assembly factory: E	Assembly factory: P
BT151Y-650LTN	BT151Y 650LTN PJExxxx xx	BT151Y 650LTN PJPxxxx xx

## 8. Limiting values

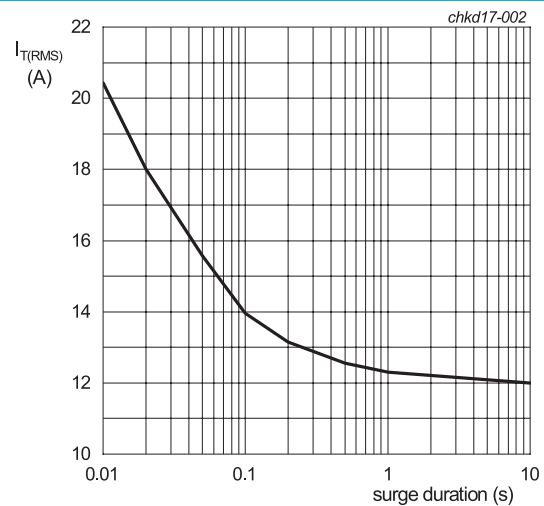
**Table 5. Limiting values**

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

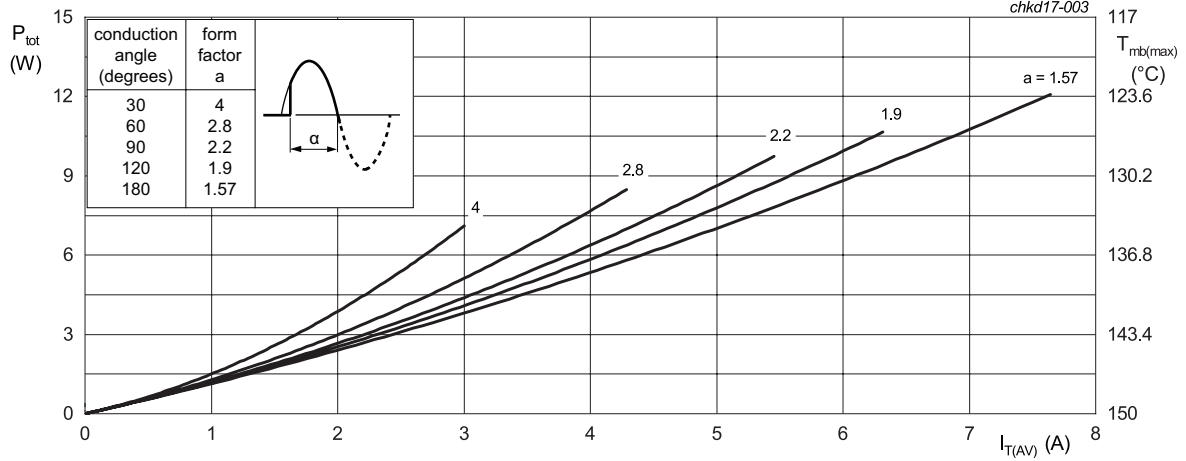
Symbol	Parameter	Conditions	Values	Unit
$V_{DRM}$	repetitive peak off-state voltage		650	V
$V_{RRM}$	repetitive peak reverse voltage		650	V
$I_{T(AV)}$	average on-state current	half sine wave; $T_{mb} \leq 123\text{ °C}$	7.5	A
$I_{T(RMS)}$	RMS on-state current	half sine wave; $T_{mb} \leq 123\text{ °C}$ ; <a href="#">Fig. 1</a> ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>	12	A
$I_{TSM}$	non-repetitive peak on-state current	half sine wave; $T_{j(\text{init})} = 25\text{ °C}$ ; $t_p = 10\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a>	120	A
		half sine wave; $T_{j(\text{init})} = 25\text{ °C}$ ; $t_p = 8.3\text{ ms}$	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	$A/\mu s$
$I_{GM}$	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	$^{\circ}C$
$T_j$	junction temperature		150	$^{\circ}C$



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

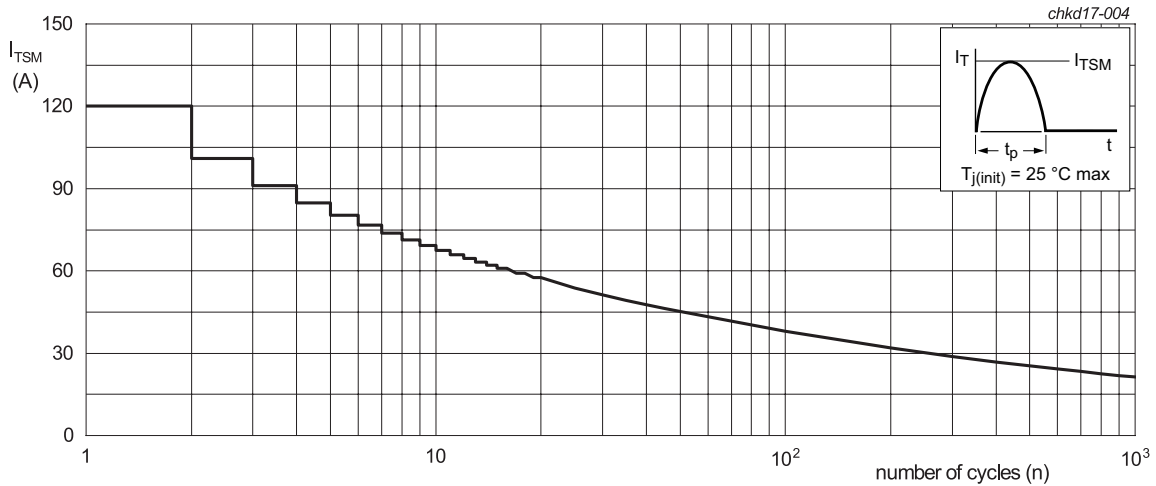


**Fig. 2. RMS on-state current as a function of surge duration; maximum values**  
 $f = 50\text{ Hz}$ ;  $T_{mb} = 123\text{ }^{\circ}C$



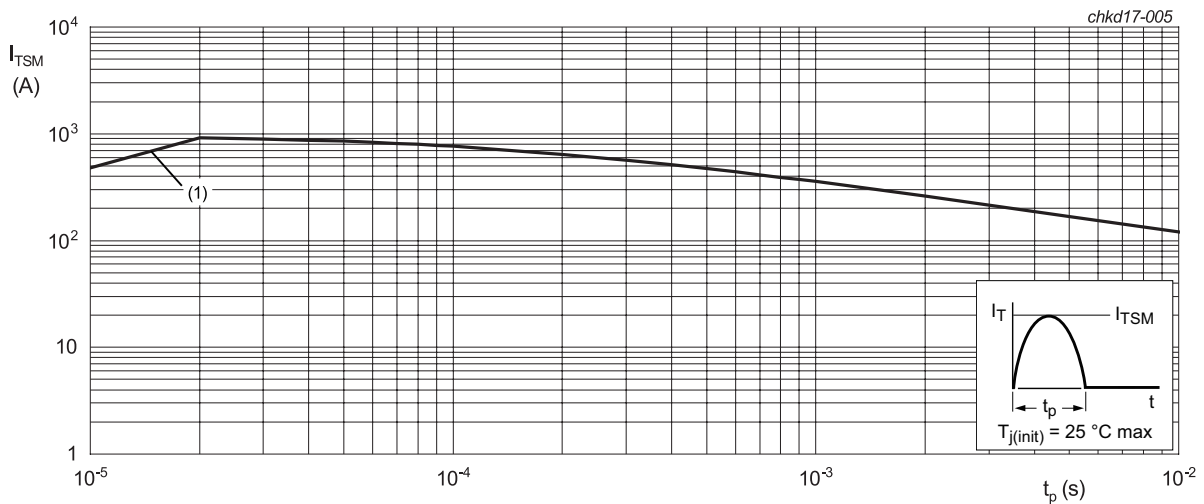
$\alpha$  = conduction angle  
 $a$  = form factor =  $I_{T(RMS)} / I_{T(AV)}$

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	<a href="#">Fig. 6</a>	-	-	2.2	K/W
$R_{th(j-a)}$	thermal resistance from junction to ambient free air	in free air	-	60	-	K/W

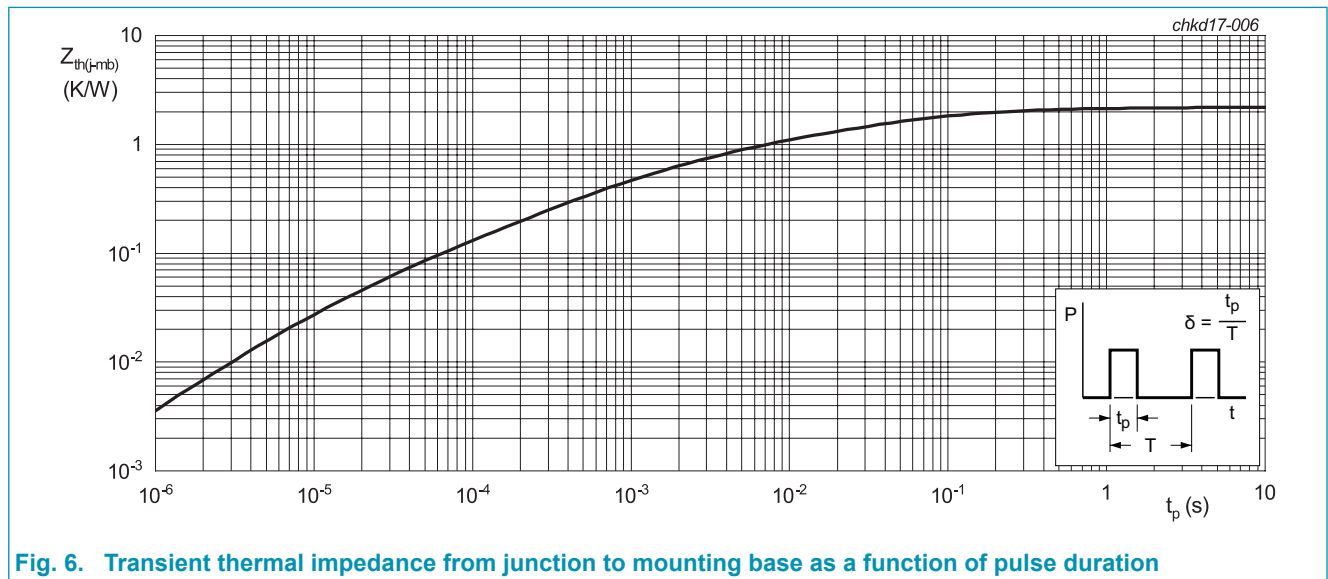


Fig. 6. Transient thermal impedance from junction to mounting base as a function of pulse duration

## 10. Isolation characteristics

Table 7. Isolation characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{isol(RMS)}$	RMS isolation voltage	50 Hz ≤ 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
<b>Static characteristics</b>						
$I_{GT}$	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
<b>Dynamic characteristics</b>						
$dV_D/dt$	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	-	-	V/ $\mu\text{s}$
		$V_{DM} = 436\text{ V}; T_j = 150\text{ }^\circ\text{C}; (V_{DM} = 67\%$ of $V_{DRM})$ ; exponential waveform; gate open circuit	50	-	-	V/ $\mu\text{s}$
$t_{gt}$	gate-controlled turn-on time	$I_{TM} = 12\text{ A}; V_D = 650\text{ V}; I_G = 10\text{ mA}$ ; $(dI_G/dt)_M = 5\text{ A}/\mu\text{s}; T_j = 25\text{ }^\circ\text{C}$		2	-	$\mu\text{s}$
$t_q$	commutated turn-off time	$V_{DM} = 436\text{ V}; T_j = 125\text{ }^\circ\text{C}; I_{TM} = 12\text{ A}$ ; $V_R = 25\text{ V}; dV_D/dt = 50\text{ V}/\mu\text{s}; (dI_T/dt)_M = 30\text{ A}/\mu\text{s}; R_{GK(ext)} = 100\text{ }\Omega$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ )		70	-	$\mu\text{s}$

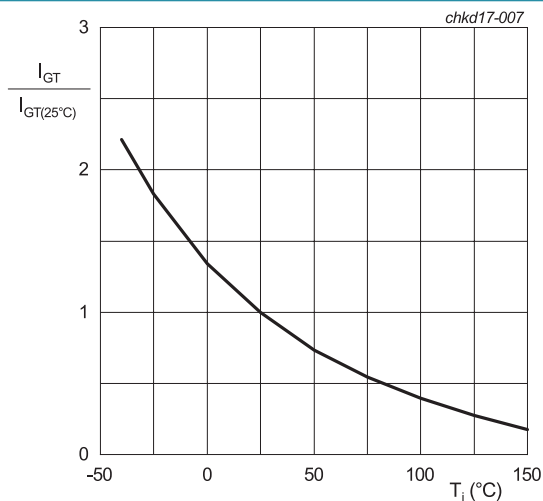


Fig. 7. Normalized gate trigger current as a function of junction temperature

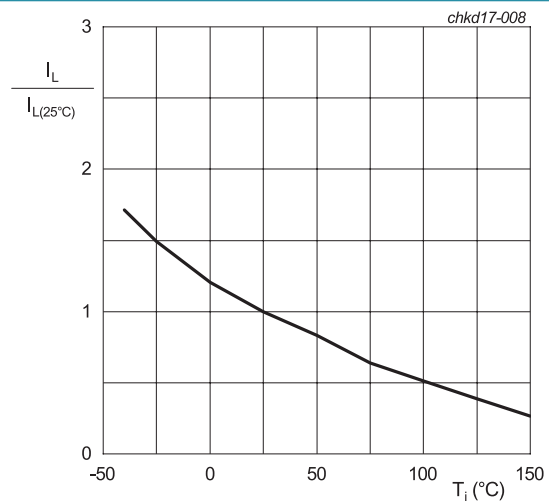


Fig. 8. Normalized latching current as a function of junction temperature

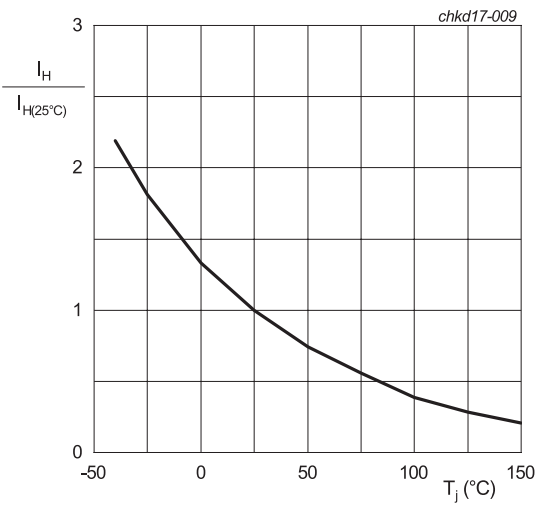
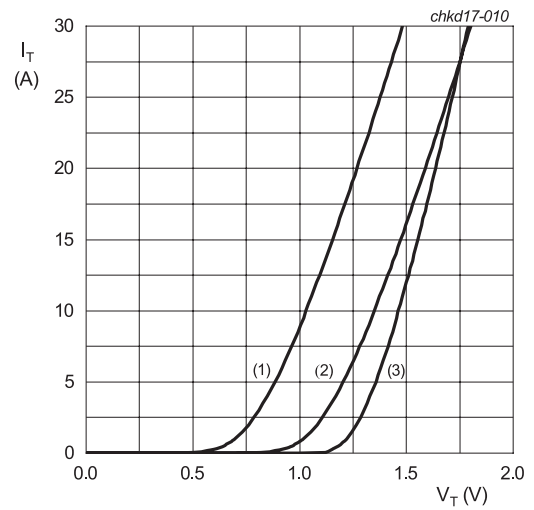


Fig. 9. Normalized holding current as a function of junction temperature



$V_o = 1.069 \text{ V}; R_s = 0.0271 \ \Omega$   
 (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

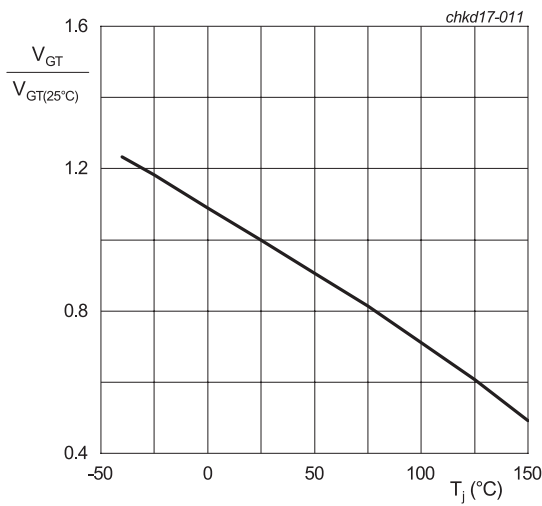


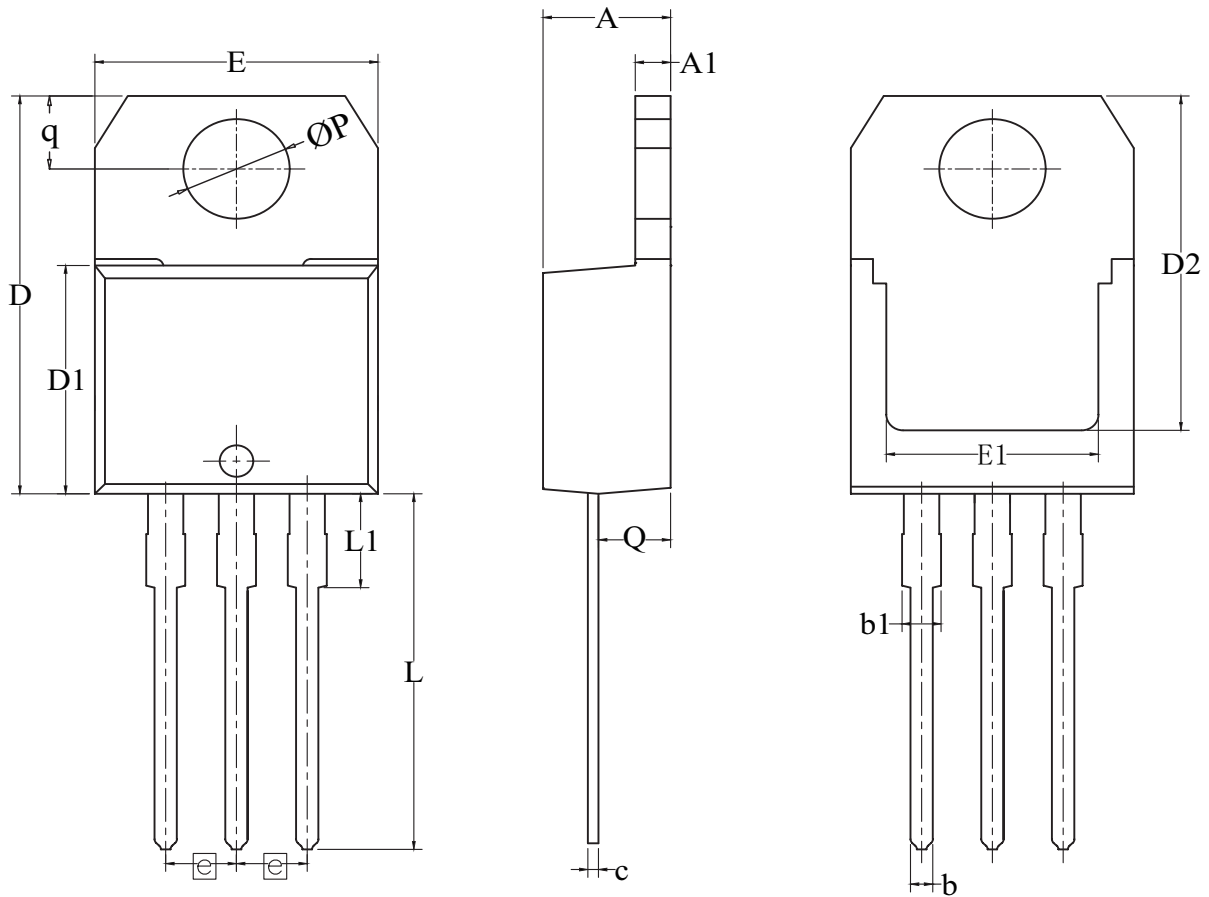
Fig. 11. Normalized gate trigger voltage as a function of junction temperature

## 12. Package outline

Assembly factory: E

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

IITO220



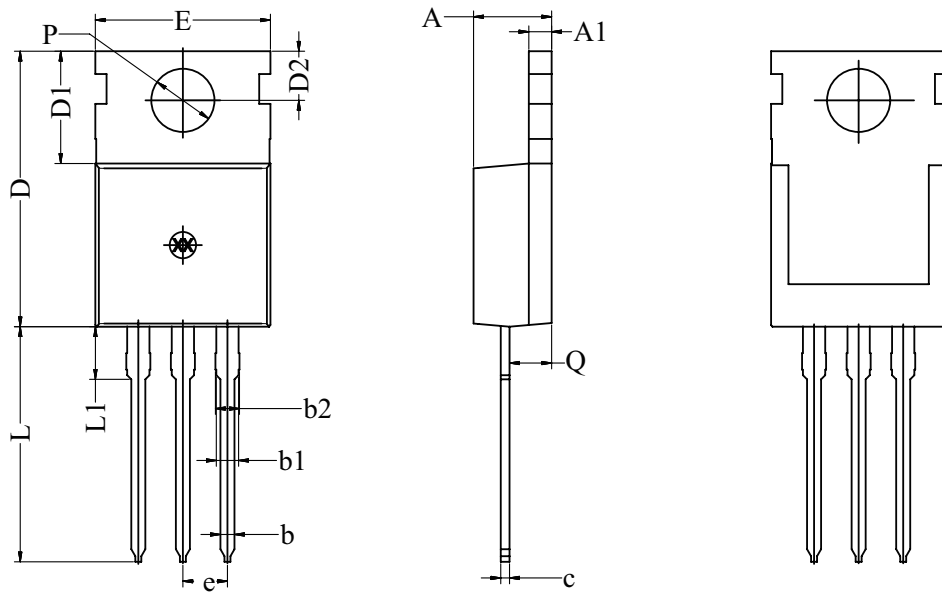
Unit	A	A1	b	b1	c	D	D1	D2	E	E1	e	L	L1	P	Q	q
MM	min	4.30	1.25	0.69	1.20	0.40	15.20	8.50	12.20	10.00	6.86	12.80	2.70	3.70	2.40	2.70
	max	4.70	1.40	0.90	1.72	0.60	16.00	9.02	12.88	10.40	2.54 (BSC)	14.00	3.30	3.95	2.80	3.00



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.
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