

# Insulated Gate Bi-Polar Transistor

## Type T0510VB45E

### Absolute Maximum Ratings

	VOLTAGE RATINGS	MAXIMUM LIMITS	UNITS
$V_{CES}$	Collector – emitter voltage	4500	V
$V_{DC\ link}$	Permanent DC voltage for 100 FIT failure rate.	2800	V
$V_{GES}$	Peak gate – emitter voltage	$\pm 20$	V

	RATINGS	MAXIMUM LIMITS	UNITS
$I_{C(DC)}$	DC collector current, IGBT	510	A
$I_{CRM}$	Repetitive peak collector current, $t_p=1\text{ms}$ , IGBT	1020	A
$I_{ECO}$	Maximum reverse emitter current, $t_p=100\mu\text{s}$ , (note 2 & 3)	510	A
$P_{MAX}$	Maximum power dissipation, IGBT (Note 2)	4.1	kW
$T_j$	Operating temperature range.	-40 to +125	$^{\circ}\text{C}$
$T_{stg}$	Storage temperature range.	-40 to +125	$^{\circ}\text{C}$

Notes: -

- 1) Unless otherwise indicated  $T_j = 125^{\circ}\text{C}$ .
- 2)  $T_{sink} = 25^{\circ}\text{C}$ , double side cooled.
- 3) The use of an-anti-parallel diode is recommended.

## Characteristics

### IGBT Characteristics

	PARAMETER	MIN	TYP	MAX	TEST CONDITIONS	UNITS	
$V_{CE(sat)}$	Collector – emitter saturation voltage	-	2.75	3.2	$I_C = 510A, V_{GE} = 15V, T_j = 25^\circ C$	V	
		-	3.60	4.0	$I_C = 510A, V_{GE} = 15V$	V	
$V_{T0}$	Threshold voltage	-	-	1.81	Current range: 170 – 510A	V	
$r_T$	Slope resistance	-	-	4.28		m $\Omega$	
$V_{GE(TH)}$	Gate threshold voltage	-	5.2	-	$V_{CE} = V_{GE}, I_C = 55mA$	V	
$I_{CES}$	Collector – emitter cut-off current	-	15	35	$V_{CE} = V_{CES}, V_{GE} = 0V$	mA	
$I_{GES}$	Gate leakage current	-	-	$\pm 10$	$V_{GE} = \pm 20V$	$\mu A$	
$C_{ies}$	Input capacitance	-	90	-	$V_{CE} = 25V, V_{GE} = 0V, f = 1MHz$	nF	
$t_{d(on)}$	Turn-on delay time	-	3.8	-	$I_C = 510A, V_{CE} = 2800V, di/dt = 750A/\mu s$ $V_{GE} = \pm 15V, L_s = 200nH$ $R_{g(ON)} = 12\Omega, R_{g(OFF)} = 15\Omega, C_{GE} = 68nF$ Freewheel diode type E0660NC45C at 125°C (Notes 3, 4 & 5)	$\mu s$	
$t_r(V)$	Rise time	-	3.3	-		$\mu s$	
$Q_{g(on)}$	Turn-on gate charge	-	10	-		$\mu C$	
$E_{on}$	Turn-on energy	-	4.2	-		J	
$t_{d(off)}$	Turn-off delay time	-	2.3	-		$\mu s$	
$t_f(I)$	Fall time	-	2.7	-		$\mu s$	
$Q_{g(off)}$	Turn-off gate charge	-	14	-		$\mu C$	
$E_{off}$	Turn-off energy	-	2.1	-		J	
$I_{SC}$	Short circuit current	-	1650	-		$V_{GE} = +15V, V_{CC} = 2800V, V_{CEmax} \leq V_{CES}, t_p \leq 10\mu s$	A

### Thermal Characteristics

	PARAMETER	MIN	TYP	MAX	TEST CONDITIONS	UNITS
$R_{thJK}$	Thermal resistance junction to sink, IGBT	-	-	24.3	Double side cooled	K/kW
		-	-	40.1	Collector side cooled	K/kW
		-	-	62.3	Emitter side cooled	K/kW
F	Mounting force	12	-	16	Note 2	kN
$W_t$	Weight	-	0.65	-		kg

#### Notes:-

- 1) Unless otherwise indicated  $T_j = 125^\circ C$ .
- 2) Consult application note 2008AN01 for detailed mounting requirements
- 3)  $C_{GE}$  is additional gate – emitter capacitance added to output of gate drive circuit
- 4)  $E_{on}$  integration time 15 $\mu s$  from 10% rising  $I_G$ .
- 5)  $E_{off}$  integration time 15 $\mu s$  from 90% falling  $V_{GE}$ .

**Curves**

Figure 1 – Typical collector-emitter saturation voltage characteristics

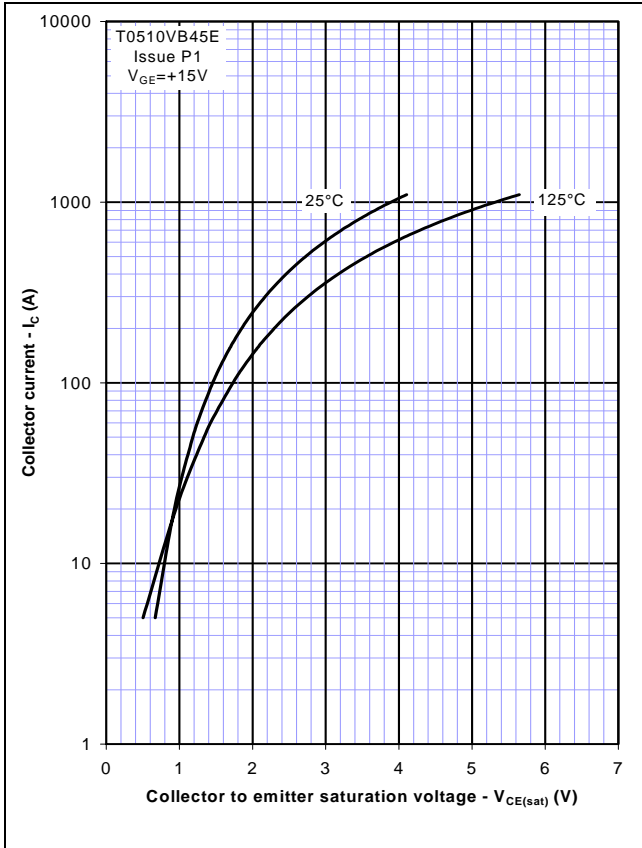


Figure 2 – Typical output characteristic

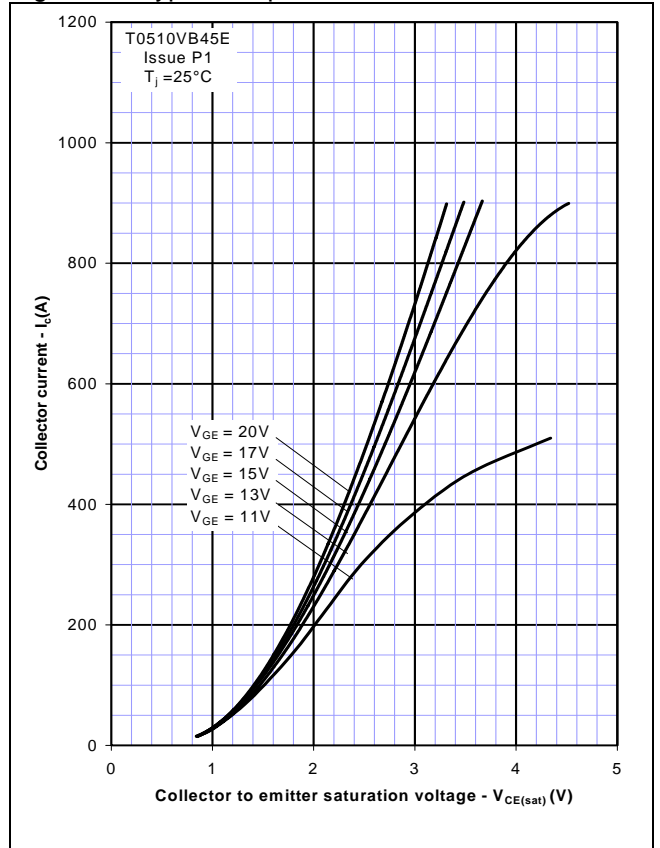


Figure 3 – Typical output characteristic

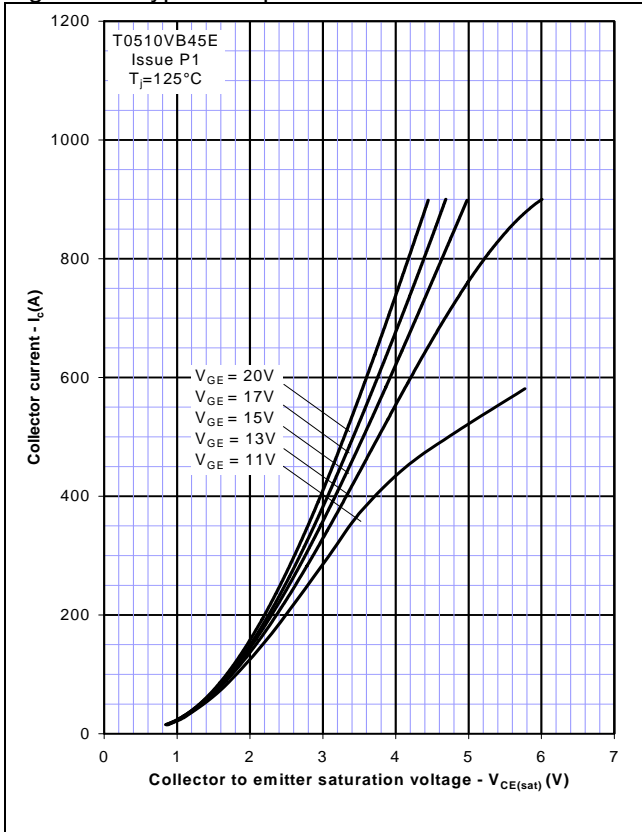


Figure 4 – Typical turn-on delay time vs gate resistance

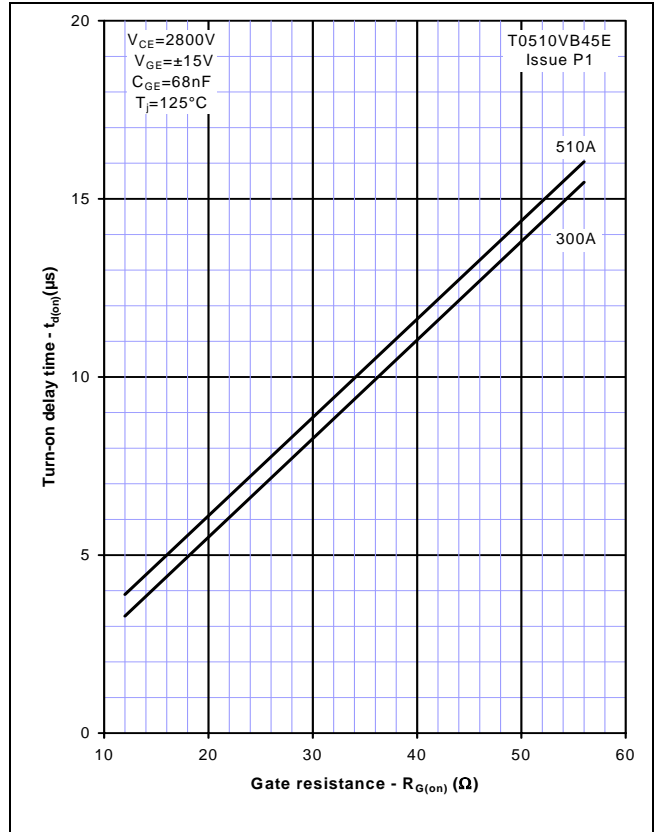


Figure 5 – Typical turn-off delay time vs. gate resistance

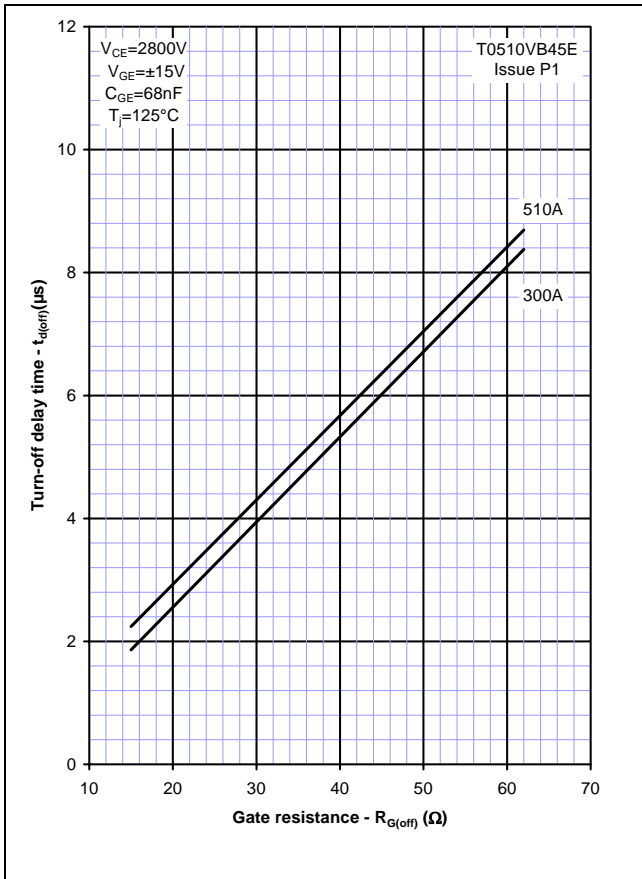


Figure 6 – Typical turn-on energy vs. collector current

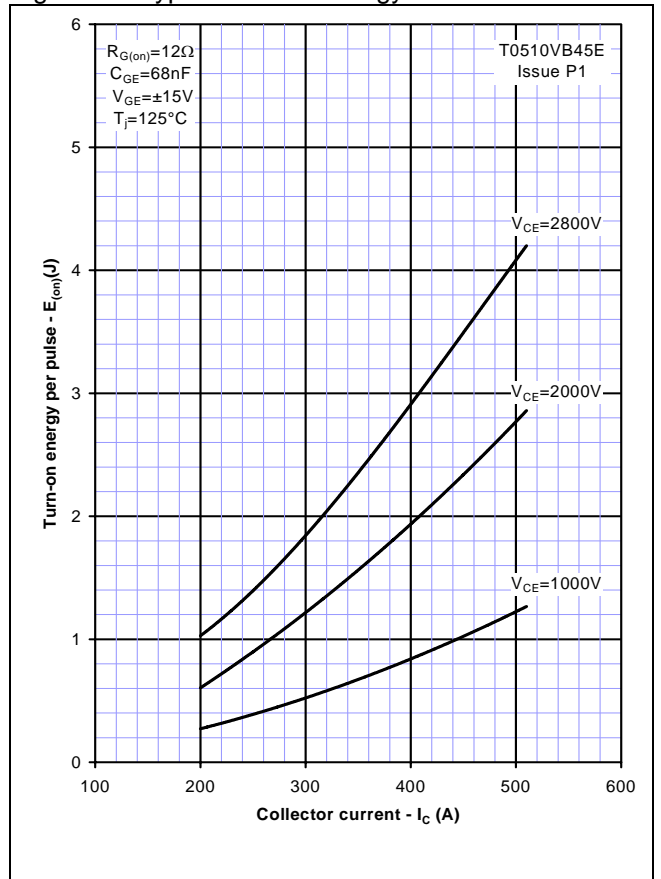


Figure 7 – Typical turn-on energy vs. di/dt

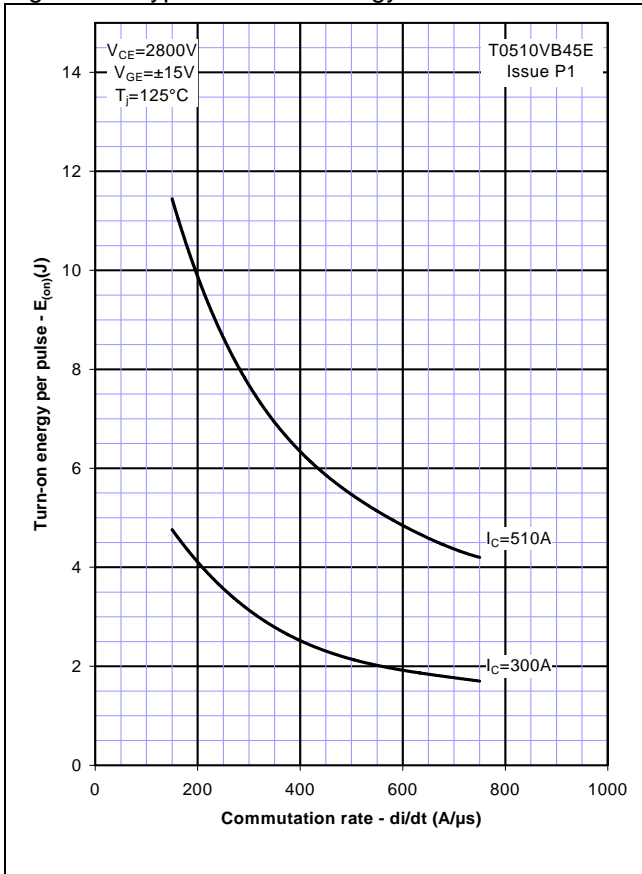


Figure 8 – Typical turn-off energy vs. collector current

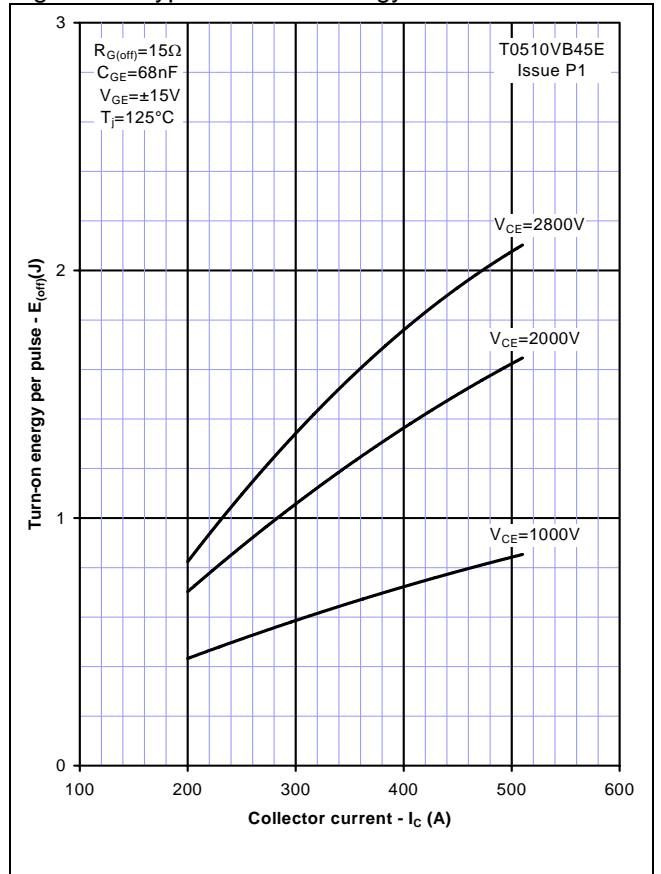


Figure 9 – Turn-off energy vs voltage

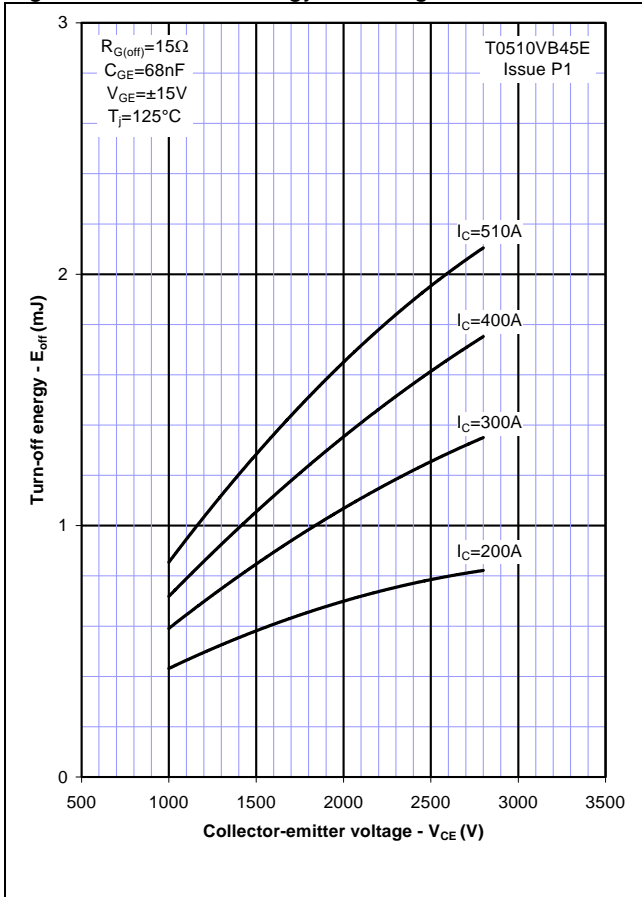


Figure 10 – Safe operating area

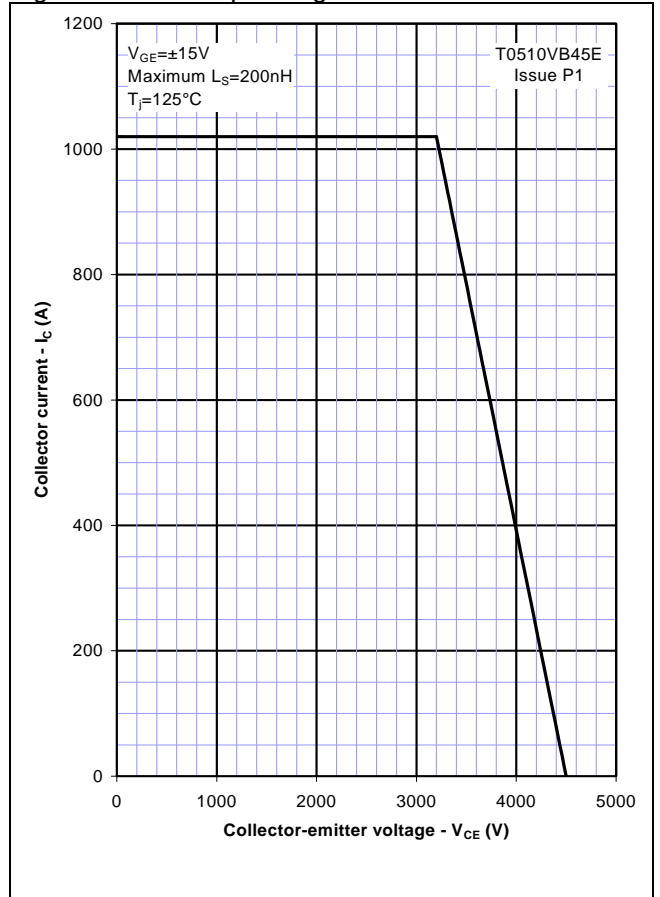
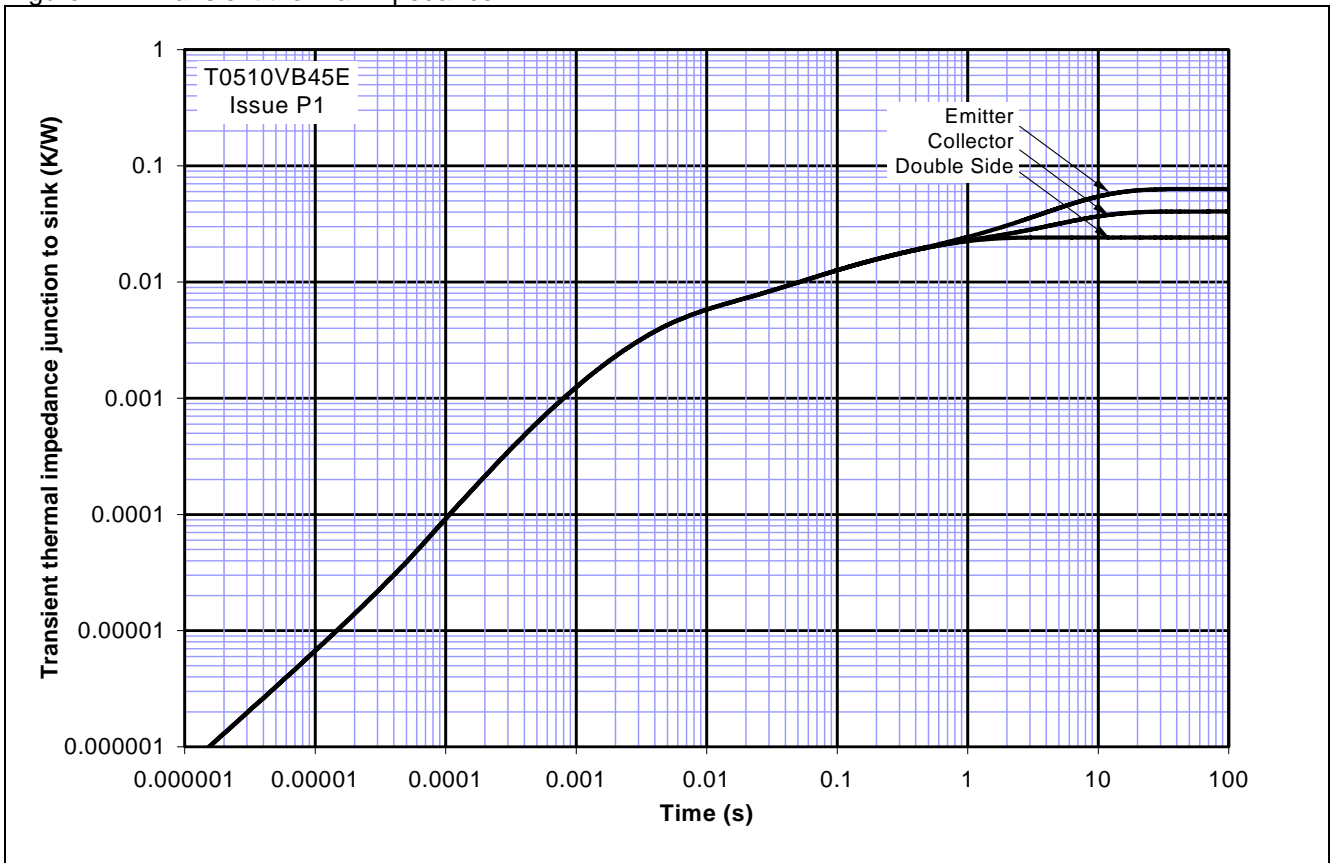
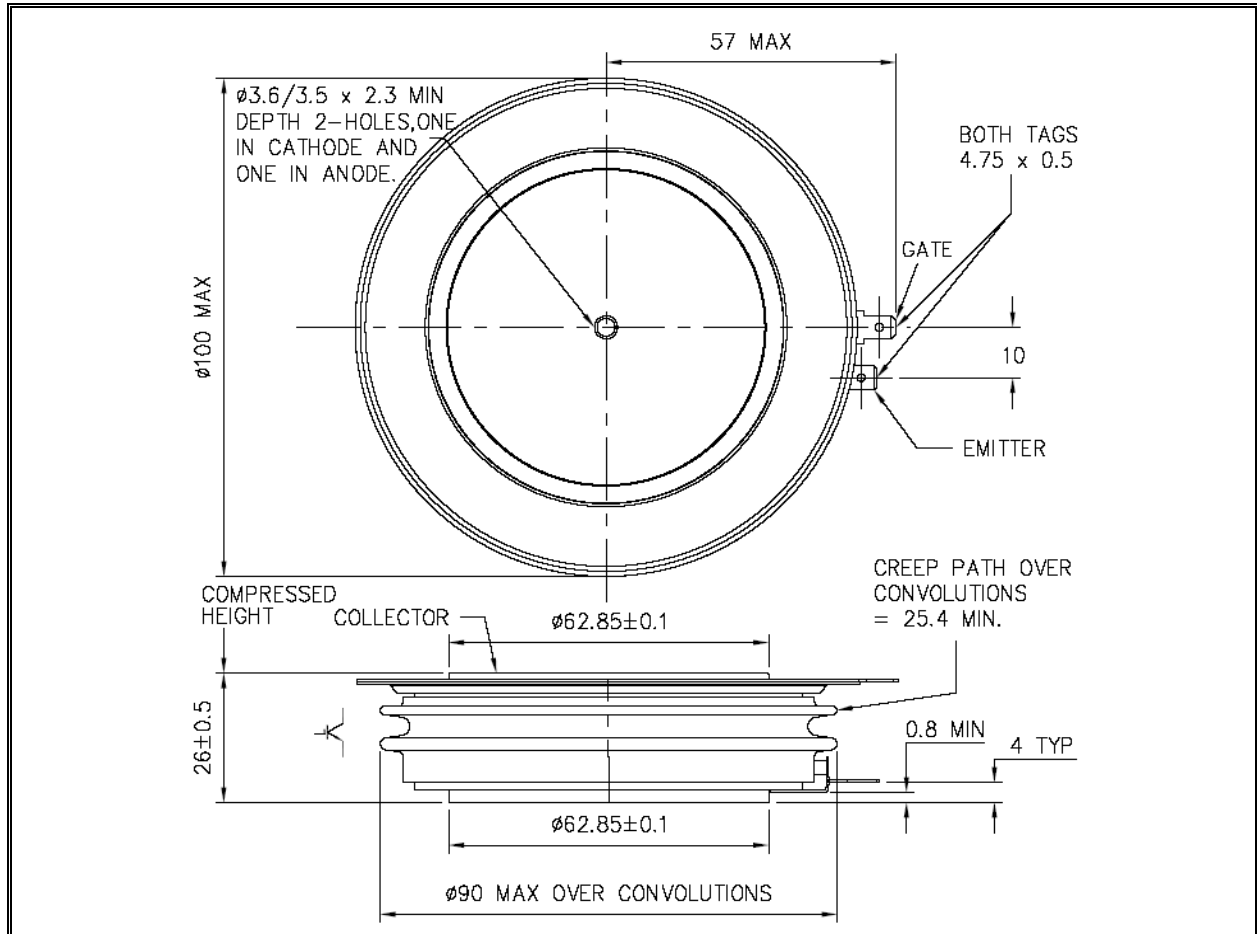


Figure 11 – Transient thermal impedance



**Outline Drawing & Ordering Information**



101A366

**ORDERING INFORMATION**

(Please quote 10 digit code as below)

<b>T0510</b> Fixed type Code	<b>VB</b> Fixed Outline Code	<b>45</b> Voltage Grade $V_{CES}/100$ 45	<b>E</b> Fixed format code
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Typical order code: T0510VB45E ( $V_{CES} = 4500V$ )

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