



Insulated Gate Bi-Polar Transistor Type T2960BB45E

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	± 20	V

	RATINGS	MAXIMUM LIMITS	UNITS
I_C	Continuous DC collector current, IGBT	3000	A
I_{CRM}	Repetitive peak collector current, $t_p=1ms$, IGBT	6000	A
I_{ECO}	Maximum reverse emitter current, $t_p=100\mu s$, (note 2 & 3)	3000	A
P_{MAX}	Maximum power dissipation, IGBT (note 2)	23.8	kW
$T_{j\ op}$	Operating temperature range	-40 to +125	$^{\circ}C$
T_{stg}	Storage temperature range	-40 to +125	$^{\circ}C$

Notes: -

- 1) Unless otherwise indicated $T_j = 125^{\circ}C$.
- 2) $T_{sink} = 25^{\circ}C$, double side cooled.
- 3) Maximum commutation loop inductance 200nH.
- 4) Half-sinewave, $125^{\circ}C$ T_j initial.

Characteristics

IGBT Characteristics

	PARAMETER	MIN	TYP	MAX	TEST CONDITIONS	UNITS
$V_{CE(sat)}$	Collector – emitter saturation voltage	-	2.75	3.15	$I_C = 3000A$, $V_{GE} = 15V$, $T_J = 25^\circ C$	V
		-	3.6	4.0	$I_C = 3000A$, $V_{GE} = 15V$	V
V_{T0}	Threshold voltage	-	-	1.84	Current range: 1000A – 3000A	V
r_T	Slope resistance	-	-	0.73		m Ω
$V_{GE(TH)}$	Gate threshold voltage	-	5.1	-	$V_{CE} = V_{GE}$, $I_C = 300mA$	V
I_{CES}	Collector – emitter cut-off current	-	55	85	$V_{CE} = V_{CES}$, $V_{GE} = 0V$	mA
I_{GES}	Gate leakage current	-	-	± 35	$V_{GE} = \pm 20V$	μA
C_{ies}	Input capacitance	-	495	-	$V_{CE} = 25V$, $V_{GE} = 0V$, $f = 1MHz$	nF
$t_{d(on)}$	Turn-on delay time	-	1.1	-	$I_C = 3000A$, $V_{CE} = 2800V$, $di/dt = 5000A/\mu s$ $V_{GE} = \pm 15V$, $L_s = 200nH$ $R_{g(ON)} = 1.3\Omega$, $R_{g(OFF)} = 6.8\Omega$, $C_{GE} = 330nF$ Freewheel diode type E2400TC45C at $T_J = 125^\circ C$. (Notes 3, 4 & 5)	μs
$t_r(V)$	Rise time	-	2.2	-		μs
$Q_{g(on)}$	Turn-on gate charge	-	21	-		μC
E_{on}	Turn-on energy	-	11.5	-		J
$t_{d(off)}$	Turn-off delay time	-	5.3	-		μs
$t_f(I)$	Fall time	-	2.5	-		μs
$Q_{g(off)}$	Turn-off gate charge	-	18	-		μC
E_{off}	Turn-off energy	-	17.5	-		J
I_{SC}	Short circuit current	-	10.9	-	$V_{GE} = +15V$, $V_{CC} = 2800V$, $V_{CEmax} \leq V_{CES}$, $t_p \leq 10\mu s$	kA

Thermal Characteristics

	PARAMETER	MIN	TYP	MAX	TEST CONDITIONS	UNITS
R_{thJK}	Thermal resistance junction to sink, IGBT	-	-	4.2	Double side cooled	K/kW
		-	-	6.87	Collector side cooled	K/kW
		-	-	10.9	Emitter side cooled	K/kW
F	Mounting force	75	-	85	Note 2	kN
W_t	Weight	-	2.8	-		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 μs from 10% rising I_C .
- 5) E_{off} integration time 15 μs from 90% falling V_{GE} .

Curves

Figure 1 – Typical collector-emitter saturation voltage characteristics

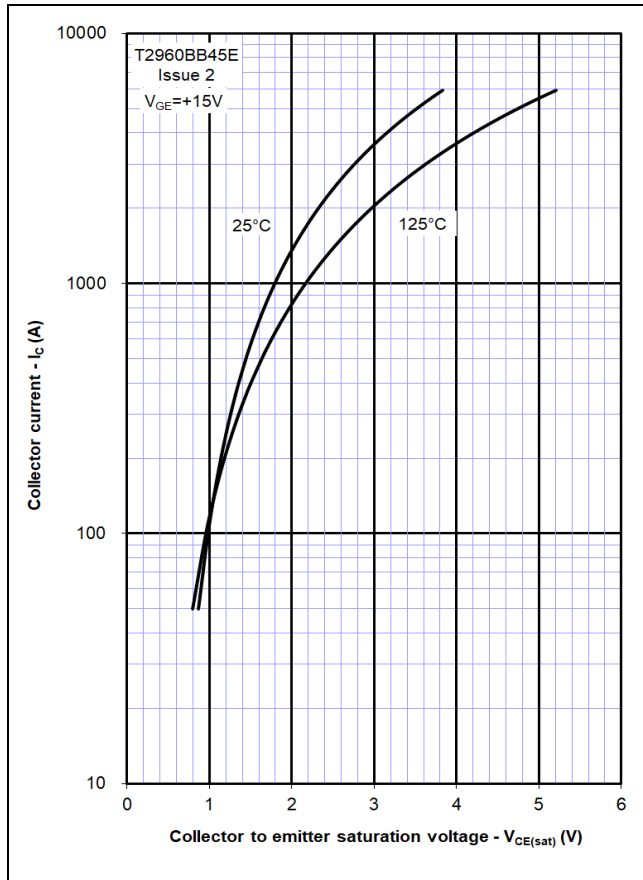


Figure 2 – Typical output characteristic

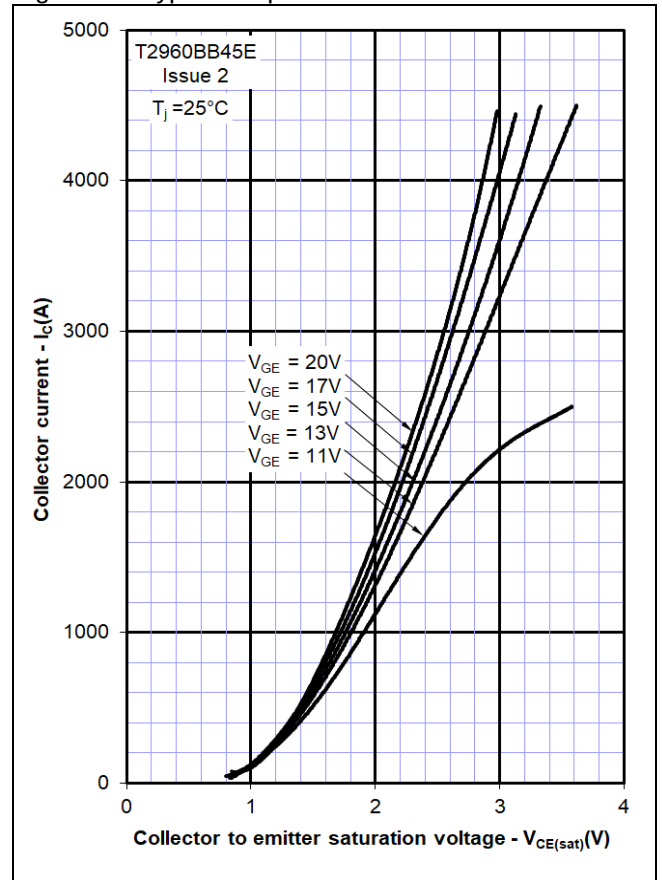


Figure 3 – Typical output characteristic

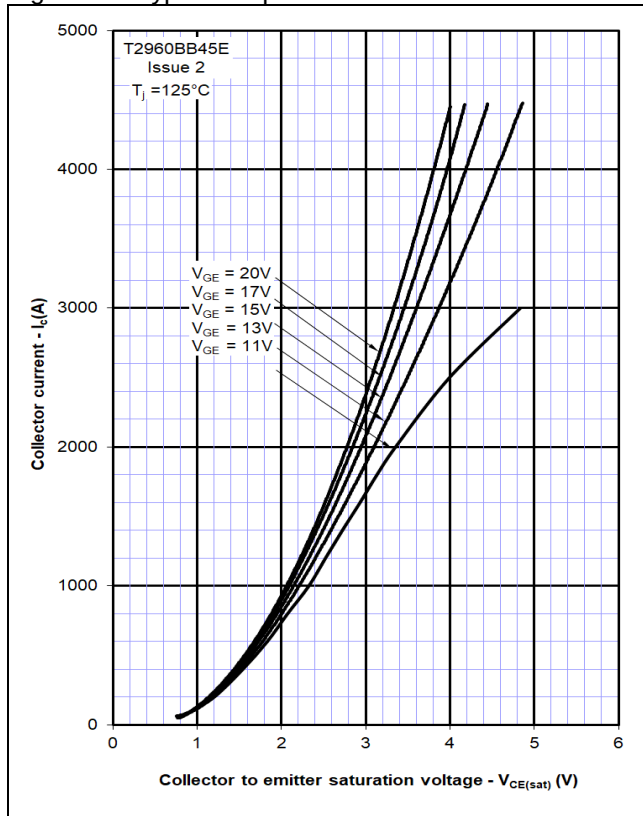


Figure 4 – Typical turn-on delay time vs gate resistance

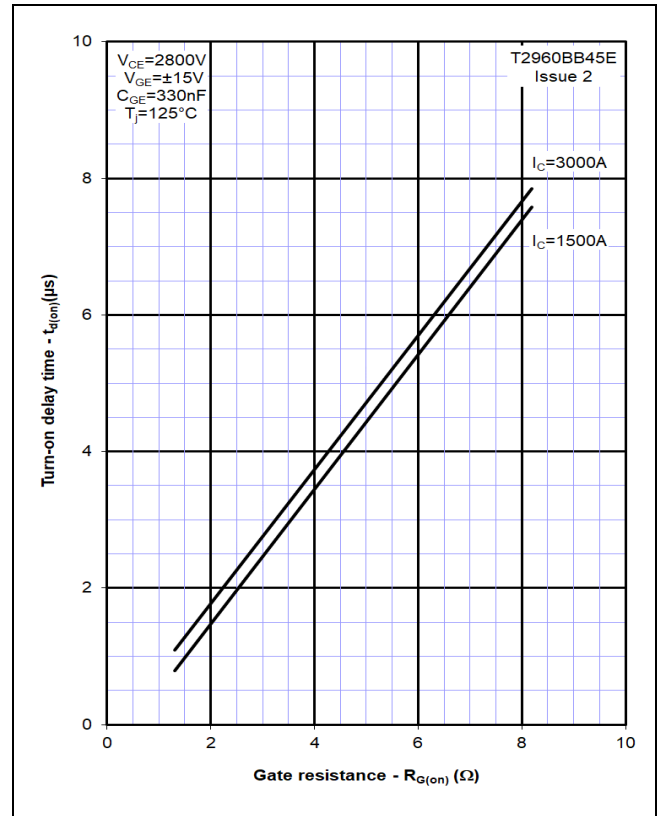


Figure 5 – Typical turn-off delay time vs. gate resistance

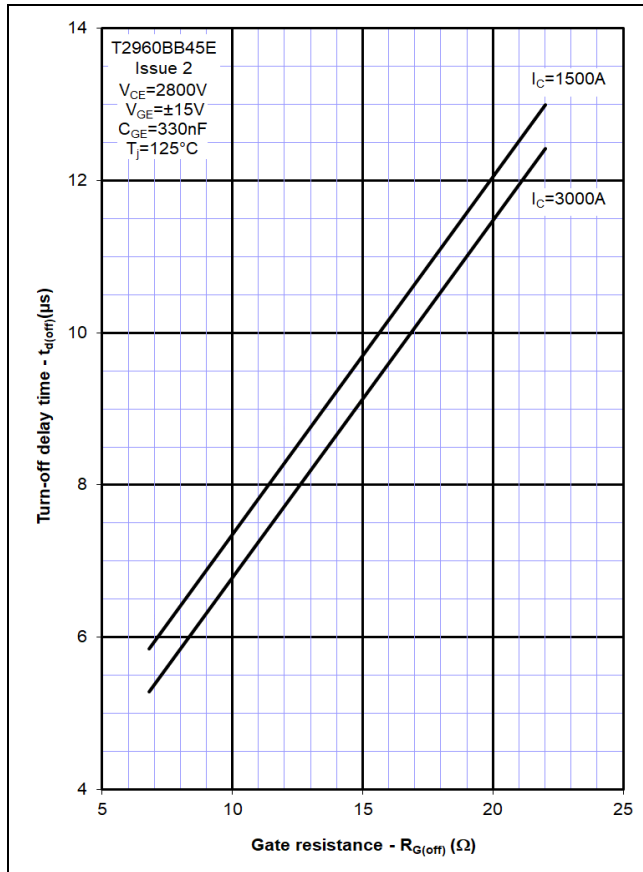


Figure 6 – Typical turn-on energy vs. collector current

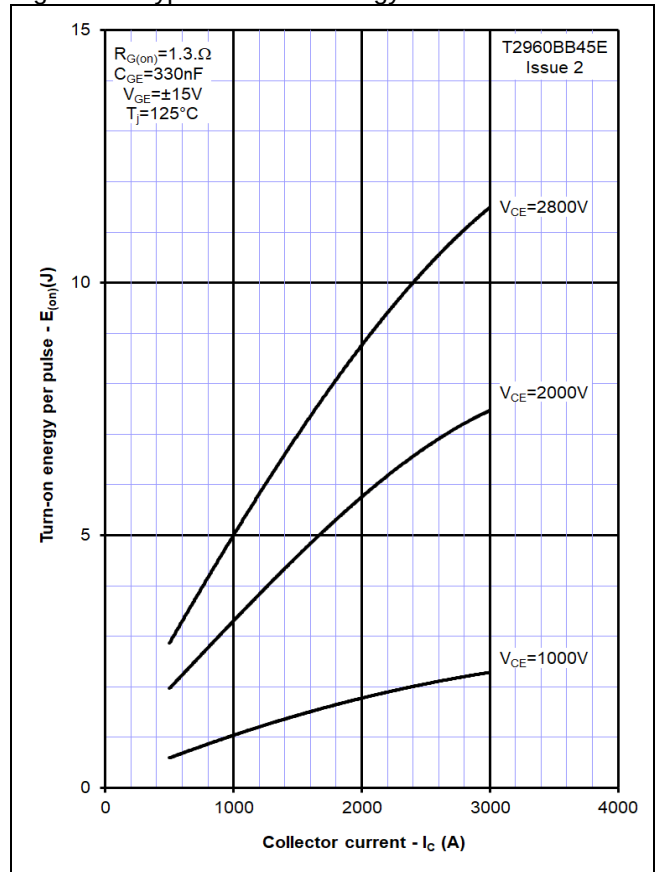


Figure 7 – Typical turn-on energy vs. di/dt

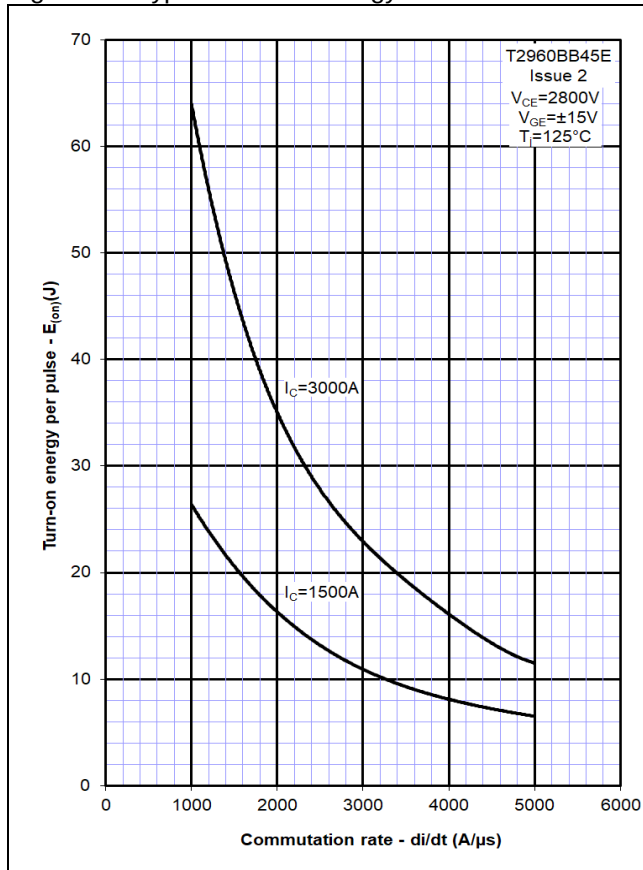


Figure 8 – Typical turn-off energy vs. collector current

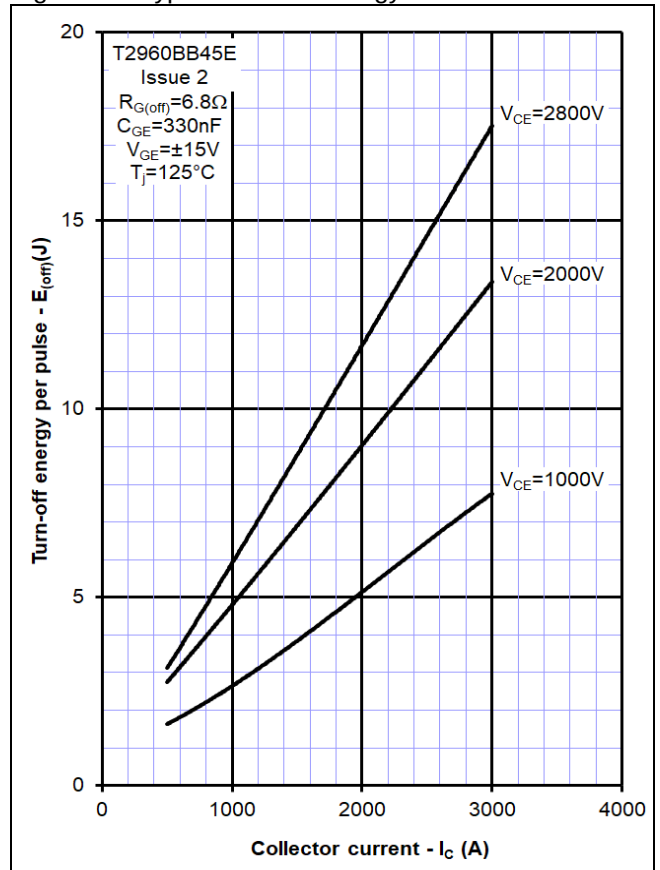


Figure 9 – Turn-off energy vs voltage

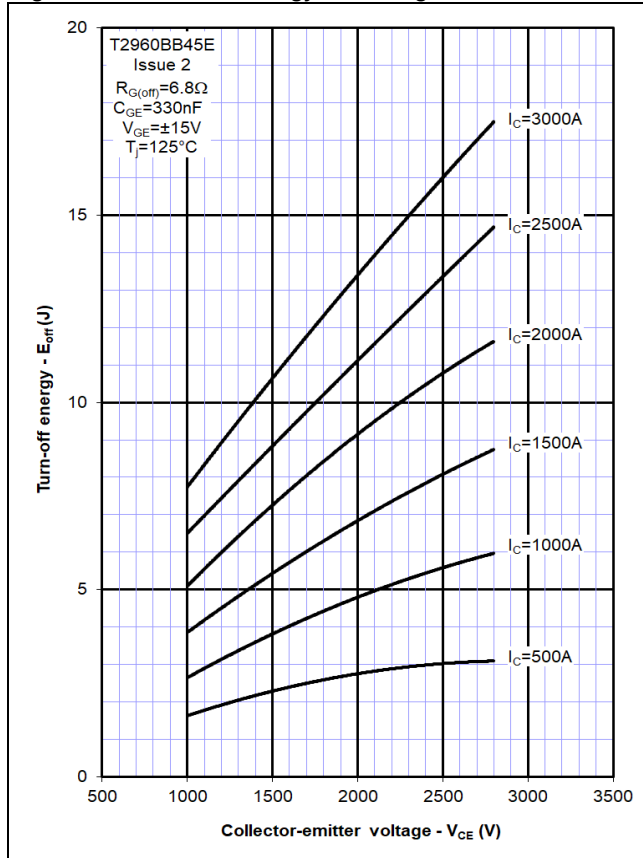


Figure 10 – Safe operating area

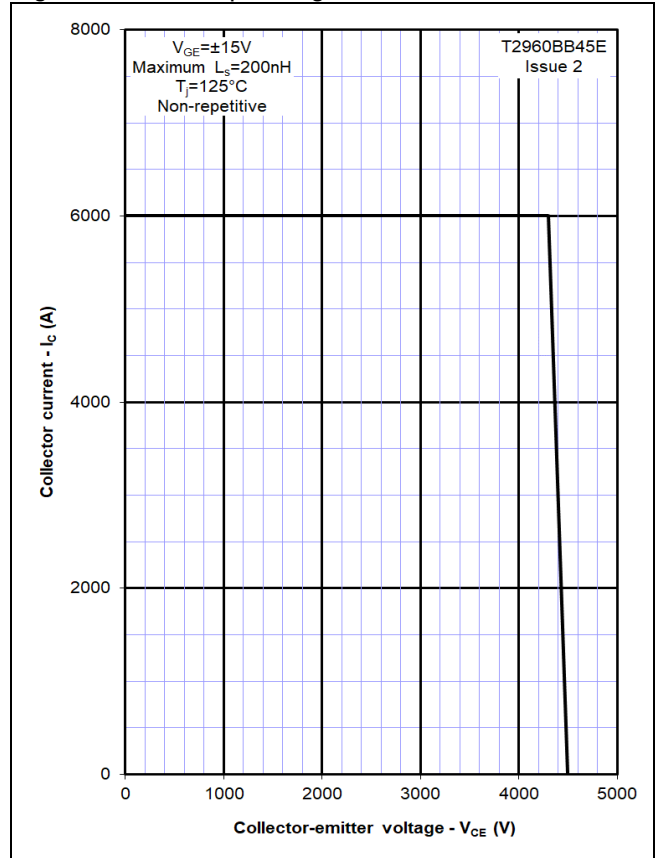
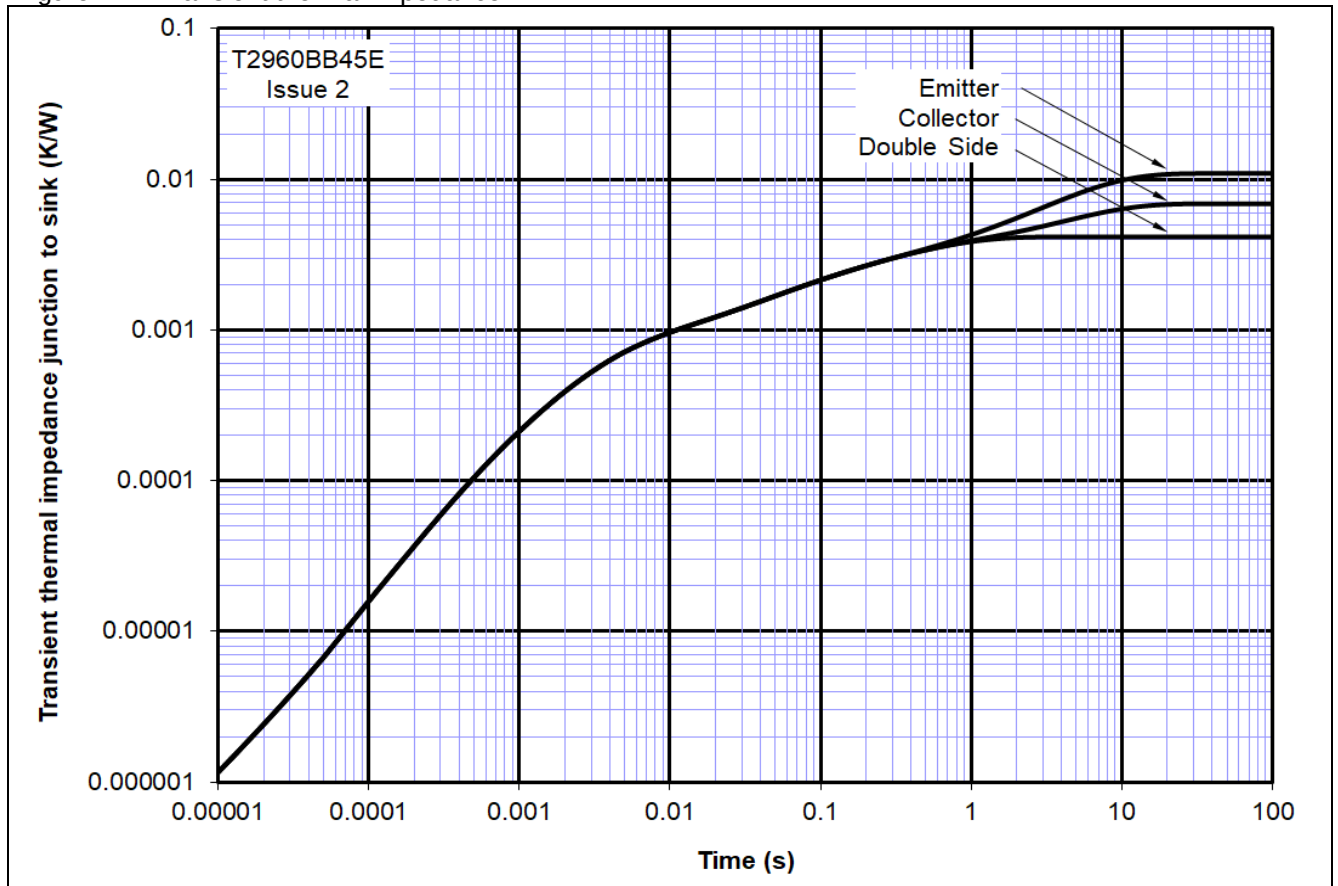
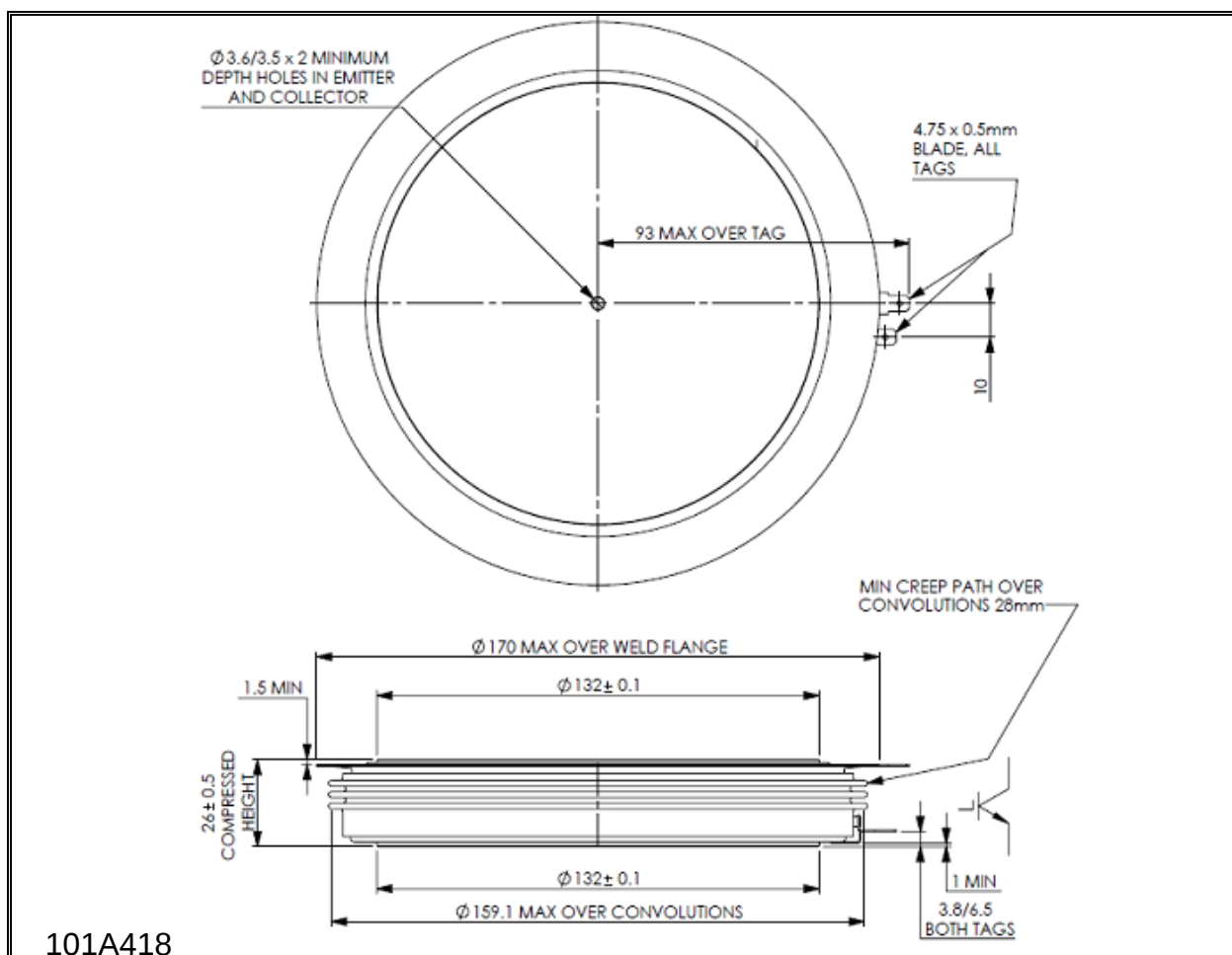


Figure 11 – Transient thermal impedance



Outline Drawing & Ordering Information



ORDERING INFORMATION

(Please quote 10 digit code as below)

T2960	BB	45	E
Fixed type Code	Fixed Outline Code	Voltage Grade $V_{CES}/100$ 45	Fixed format code

 Typical order code: T2960BB45E ($V_{CES} = 4500V$)

IXYS Semiconductor GmbH

 Edisonstraße 15
 D-68623 Lampertheim
 Tel: +49 6206 503-0
 Fax: +49 6206 503-627
 E-mail: marcom@ixys.de


IXYS

 A Littelfuse Technology

IXYS Corporation

 1590 Buckeye Drive
 Milpitas CA 95035-7418
 Tel: +1 (408) 457 9000
 Fax: +1 (408) 496 0670
 E-mail: sales@ixys.net
www.littelfuse.com
www.ixysuk.com
www.ixys.net

IXYS UK Westcode Ltd

 Langley Park Way, Langley Park,
 Chippenham, Wiltshire, SN15 1GE
 Tel: +44 (0)1249 444524
 E-mail: sales@ixysuk.com

IXYS Long Beach

 IXYS Long Beach, Inc
 2500 Mira Mar Ave, Long Beach
 CA 90815
 Tel: +1 (562) 296 6584
 Fax: +1 (562) 296 6585
 E-mail: service@ixyslongbeach.com

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