

Insulated Gate Bi-Polar Transistor

Type T0160NB45A

Absolute Maximum Ratings

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

	RATINGS	MAXIMUM LIMITS	UNITS
$I_{C(DC)}$	DC collector current, IGBT	160	A
I_{CRM}	Repetitive peak collector current, $t_p=1\text{ms}$, IGBT	320	A
$I_{F(DC)}$	Continuous DC forward current, Diode	160	A
I_{FRM}	Repetitive peak forward current, $t_p=1\text{ms}$, Diode	320	A
I_{FSM}	Peak non-repetitive surge $t_p=10\text{ms}$, $V_{RM}=60\%V_{RRM}$, Diode (Note 4)	690	A
I_{FSM2}	Peak non-repetitive surge $t_p=10\text{ms}$, $V_{RM}\leq 10\text{V}$, Diode (Note 4)	760	A
P_{MAX}	Maximum power dissipation, IGBT (Note 2)	1.47	kW
$(di/dt)_{cr}$	Critical diode di/dt (note 3)	300	A/ μs
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) $T_{\text{sink}} = 25^{\circ}\text{C}$, double side cooled.
- 3) Maximum commutation loop inductance 200nH.
- 4) Half-sinewave, 125°C T_j initial.

Characteristics

IGBT Characteristics

	PARAMETER	MIN	TYP	MAX	TEST CONDITIONS	UNITS
$V_{CE(sat)}$	Collector – emitter saturation voltage	-	2.70	3.15	$I_C = 160A, V_{GE} = 15V, T_j = 25^\circ C$	V
		-	3.40	3.80	$I_C = 160A, V_{GE} = 15V$	V
V_{T0}	Threshold voltage	-	-	1.71	Current range: 53.3 – 160A	V
r_T	Slope resistance	-	-	13.1		m Ω
$V_{GE(TH)}$	Gate threshold voltage	-	5.2	-	$V_{CE} = V_{GE}, I_C = 18mA$	V
I_{CES}	Collector – emitter cut-off current	-	5	15	$V_{CE} = V_{CES}, V_{GE} = 0V$	mA
I_{GES}	Gate leakage current	-	-	± 4	$V_{GE} = \pm 20V$	μA
C_{ies}	Input capacitance	-	30	-	$V_{CE} = 25V, V_{GE} = 0V, f = 1MHz$	nF
$t_{d(on)}$	Turn-on delay time	-	3.0	-	$I_C = 160A, V_{CE} = 2800V, di/dt = 300A/\mu s$ $V_{GE} = \pm 15V, L_s = 200nH$ $R_{g(ON)} = 33\Omega, R_{g(OFF)} = 38\Omega, C_{GE} = 22nF$ Integral diode used as freewheel diode (Note 3 & 4)	μs
$t_r(V)$	Rise time	-	2.5	-		μs
$Q_{g(on)}$	Turn-on gate charge	-	4	-		μC
E_{on}	Turn-on energy	-	1.4	-		J
$t_{d(off)}$	Turn-off delay time	-	1.8	-		μs
$t_f(I)$	Fall time	-	1.6	-		μs
$Q_{g(off)}$	Turn-off gate charge	-	5	-		μC
E_{off}	Turn-off energy	-	0.7	-		J
I_{SC}	Short circuit current	-	550	-	$V_{GE} = +15V, V_{CC} = 2800V, V_{CEmax} \leq V_{CES}, t_p \leq 10\mu s$	A

Diode Characteristics

	PARAMETER	MIN	TYP	MAX	TEST CONDITIONS	UNITS
V_F	Forward voltage	-	3.25	3.60	$I_F = 160A, T_j = 25^\circ C$	V
		-	3.40	3.75	$I_F = 160A$	V
V_{T0}	Threshold voltage	-	-	2.04	Current range 53.3 - 160A	V
r_T	Slope resistance	-	-	10.7		m Ω
I_{rm}	Peak reverse recovery current	-	120	-	$I_F = 160A, V_{GE} = -15V, di/dt = 300A/\mu s$	A
Q_{rr}	Recovered charge	-	300	-		μC
t_{rr}	Reverse recovery time, 50% chord	-	2.7	-		μs
E_r	Reverse recovery energy	-	0.24	-		J

Thermal Characteristics

	PARAMETER	MIN	TYP	MAX	TEST CONDITIONS	UNITS
R_{thJK}	Thermal resistance junction to sink, IGBT	-	-	72	Double side cooled	K/kW
		-	-	118	Collector side cooled	K/kW
		-	-	186	Emitter side cooled	K/kW
R_{thJK}	Thermal resistance junction to sink, Diode	-	-	172	Double side cooled	K/kW
		-	-	268	Cathode side cooled	K/kW
		-	-	478	Anode side cooled	K/kW
F	Mounting force	8	-	12	Note 2	kN
W_t	Weight	-	0.5	-		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
- 4) Figures 6 to 9 are obtained using integral diode as freewheeling diode

Curves

Figure 1 – Typical collector-emitter saturation voltage characteristics

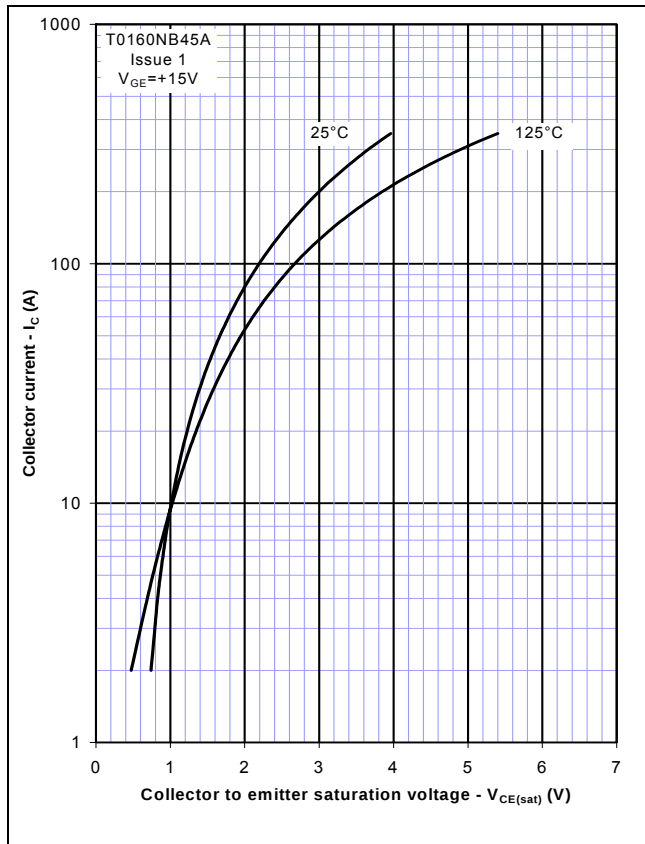


Figure 2 – Typical output characteristic

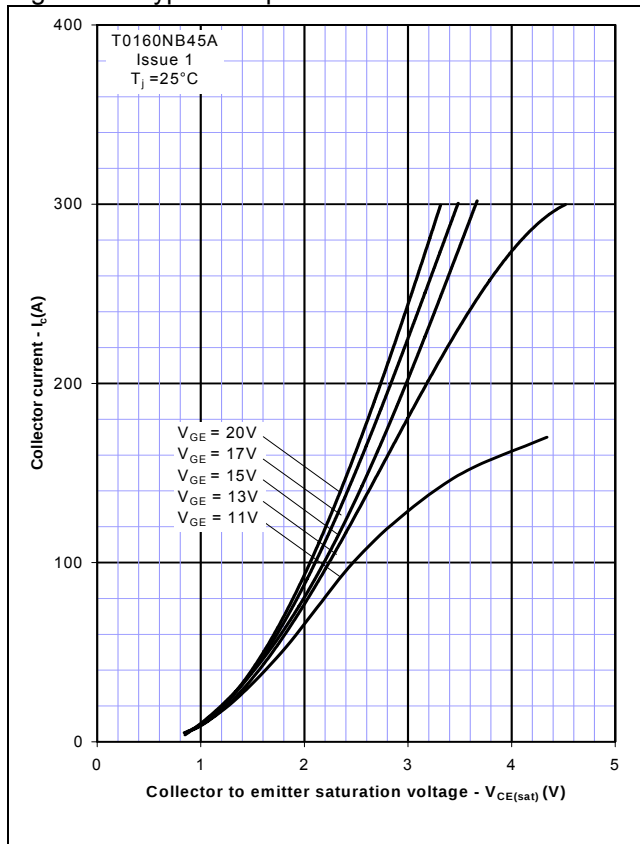


Figure 3 – Typical output characteristic

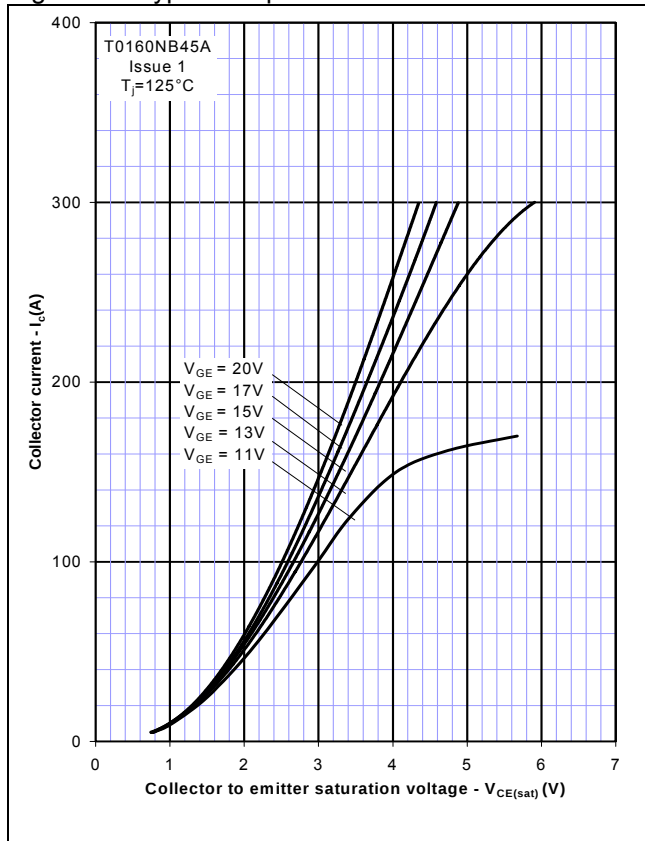


Figure 4 – Typical turn-on delay time vs gate resistance

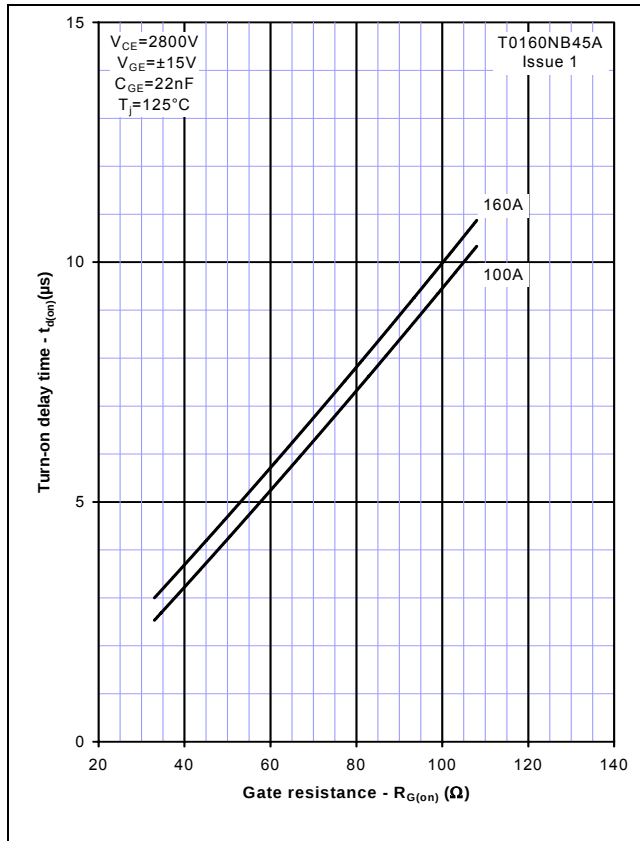


Figure 5 – Typical turn-off delay time vs. gate resistance

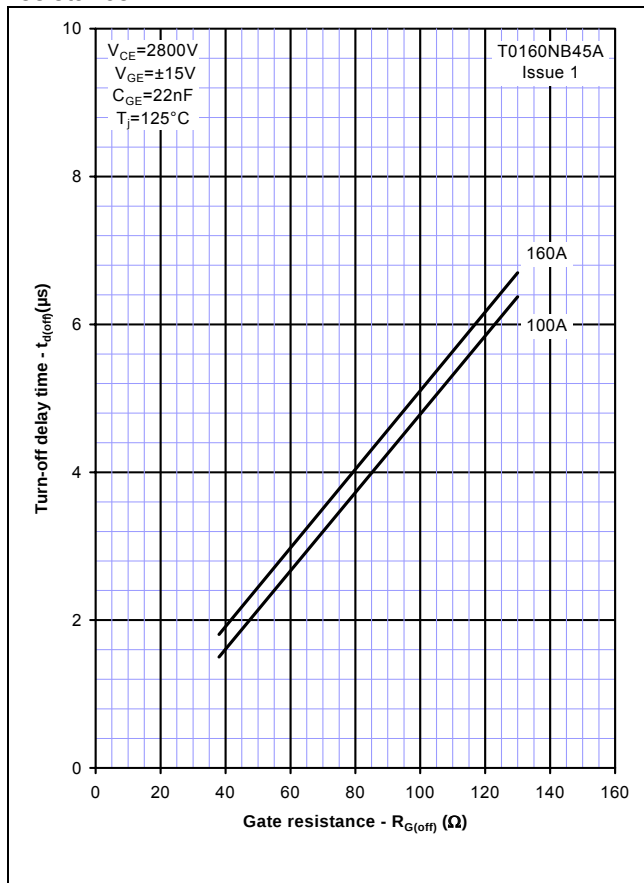


Figure 6 – Typical turn-on energy vs. collector current

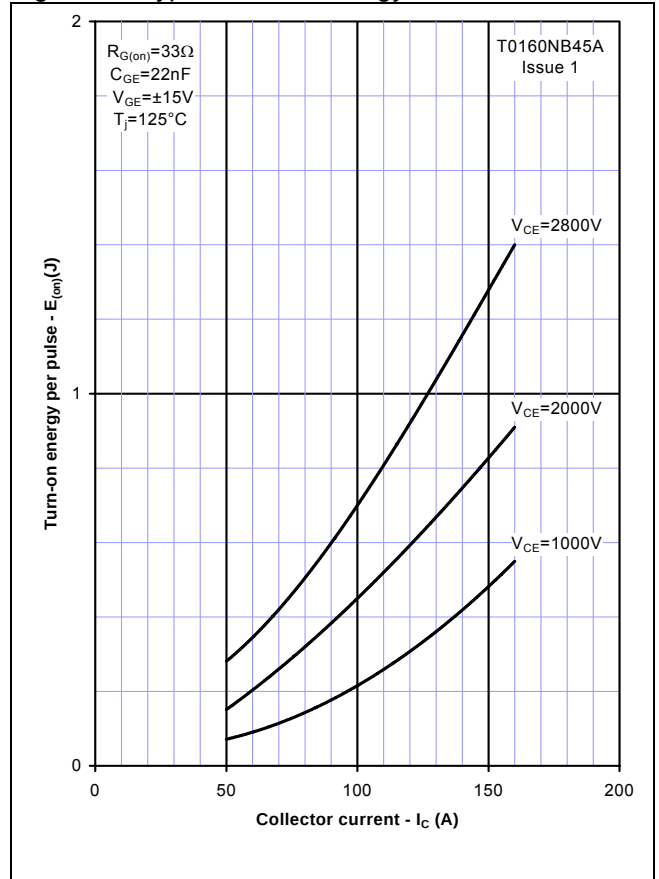


Figure 7 – Typical turn-on energy vs. di/dt

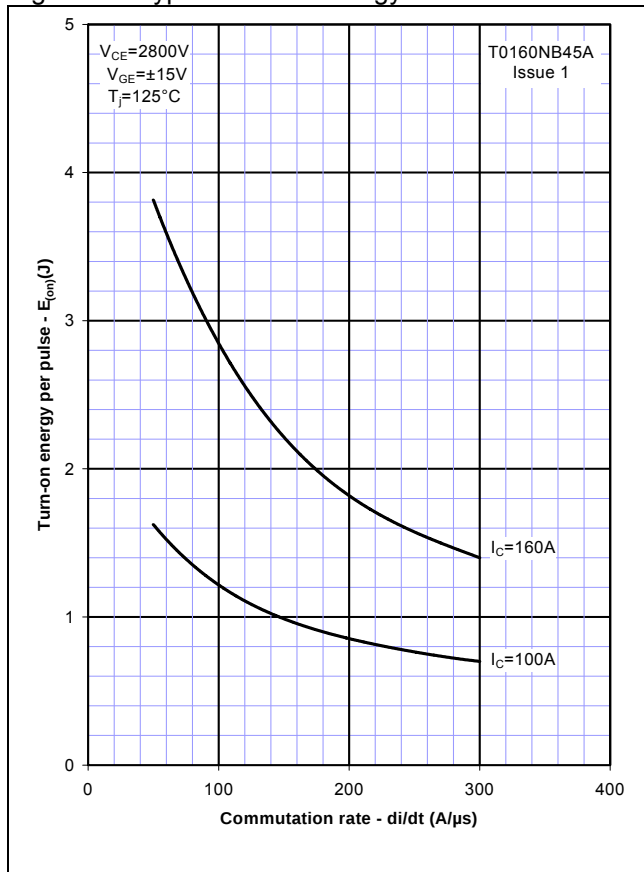


Figure 8 – Typical turn-off energy vs. collector current

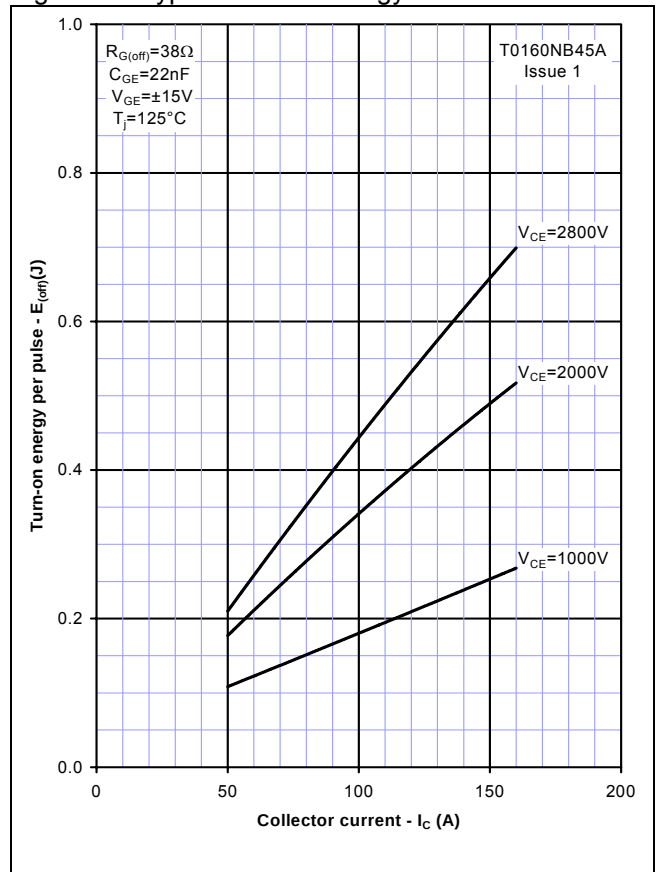


Figure 9 – Turn-off energy vs voltage

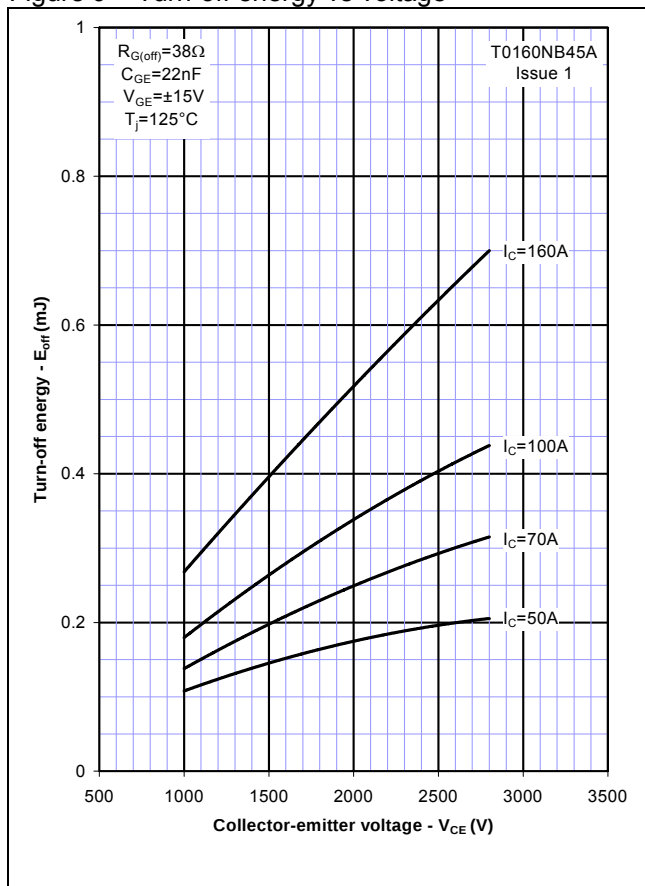


Figure 10 – Safe operating area

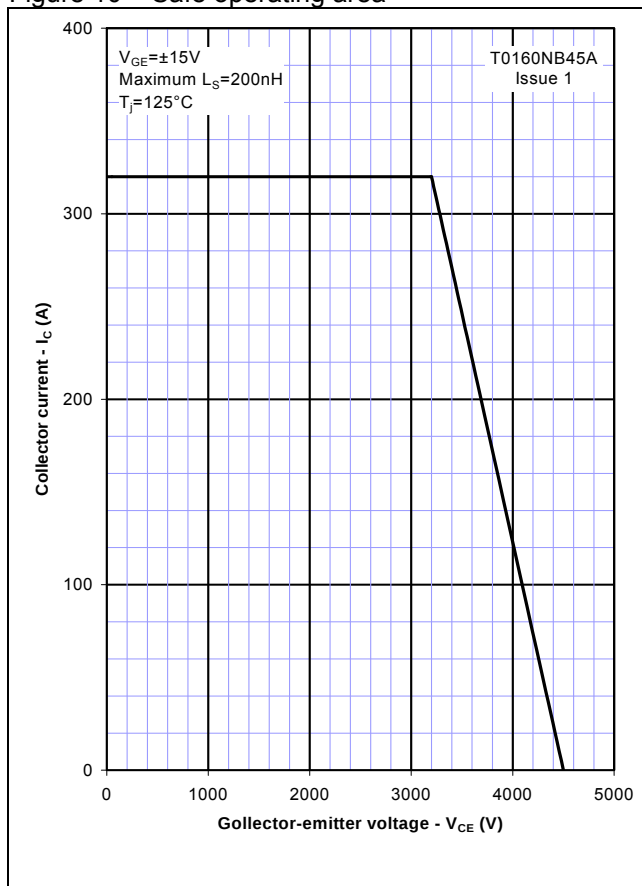


Figure 11 – Typical diode forward characteristics

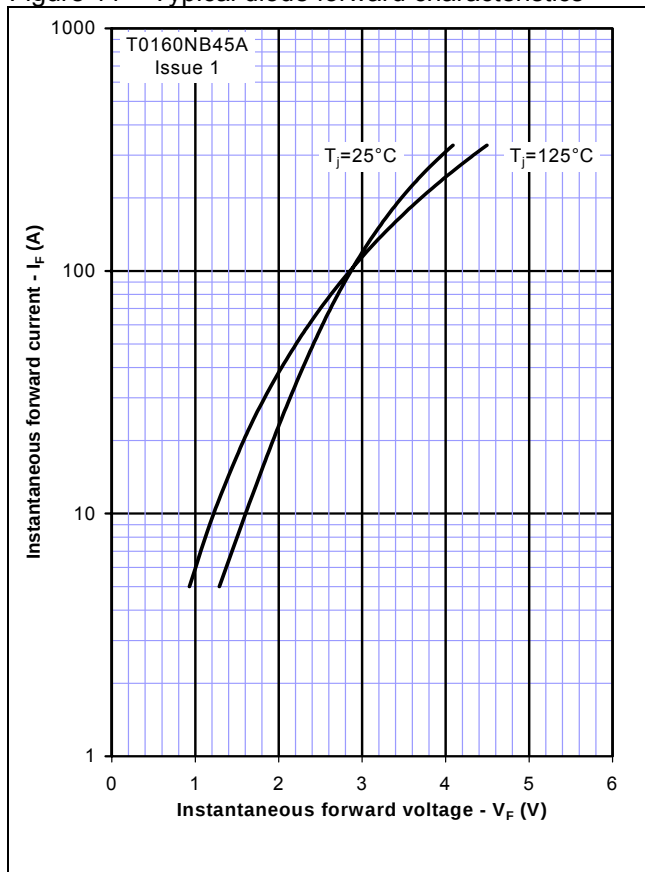


Figure 12 – Typical recovered charge

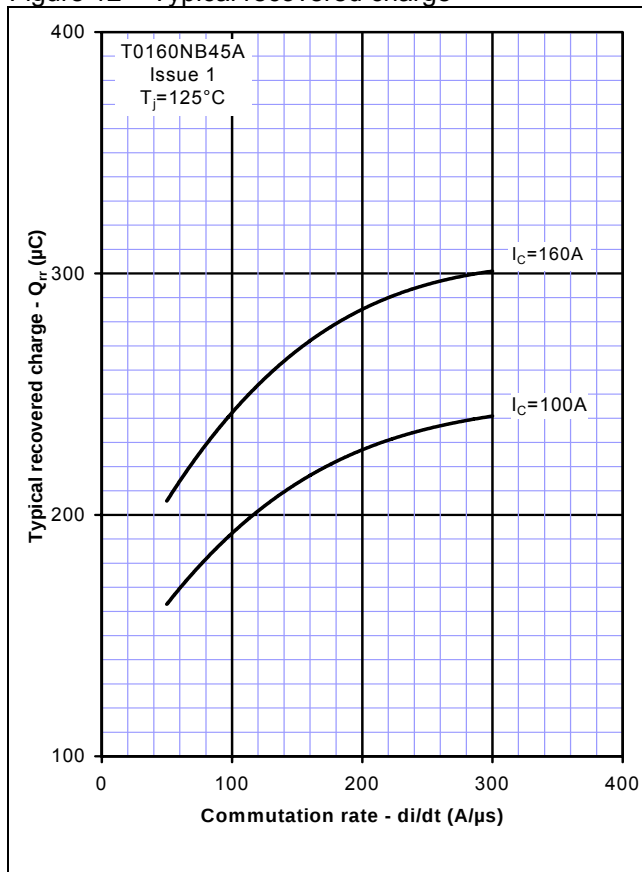


Figure 13 – Typical reverse recovery current

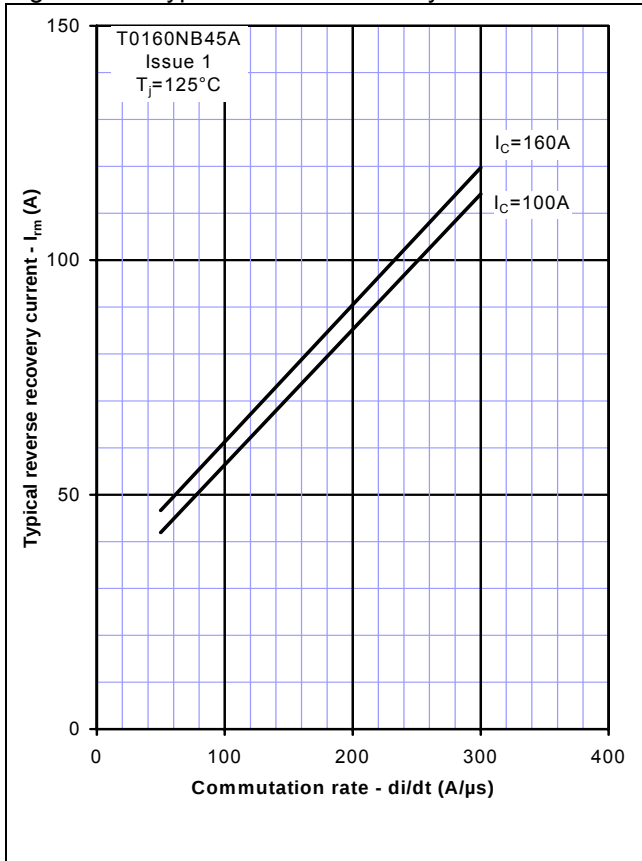


Figure 14 – Typical reverse recovery time

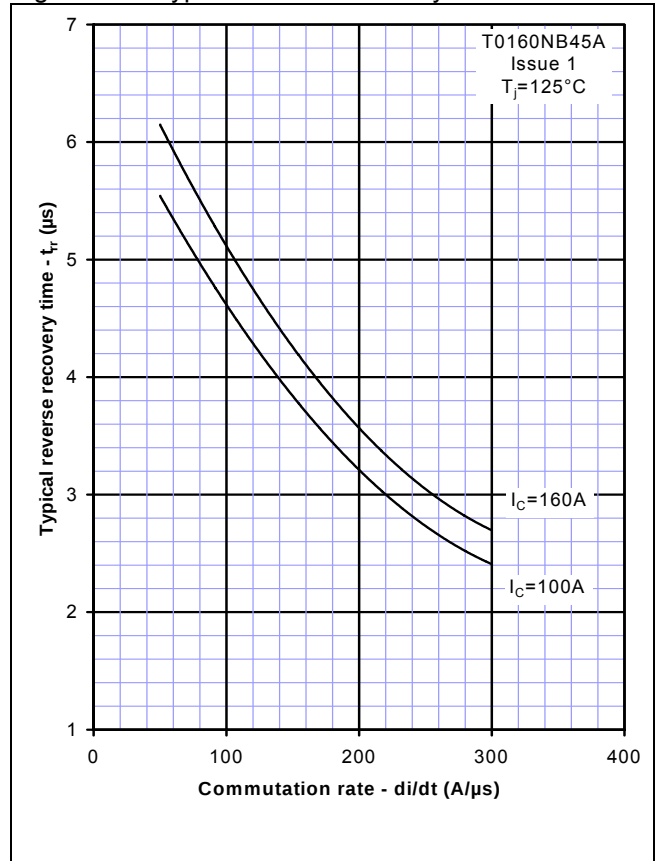


Figure 15 – Transient thermal impedance (IGBT)

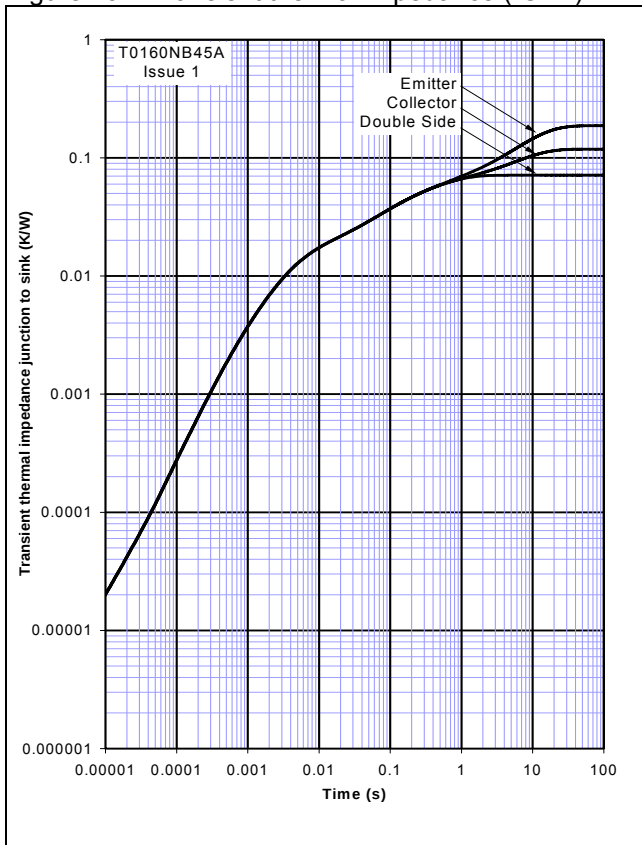
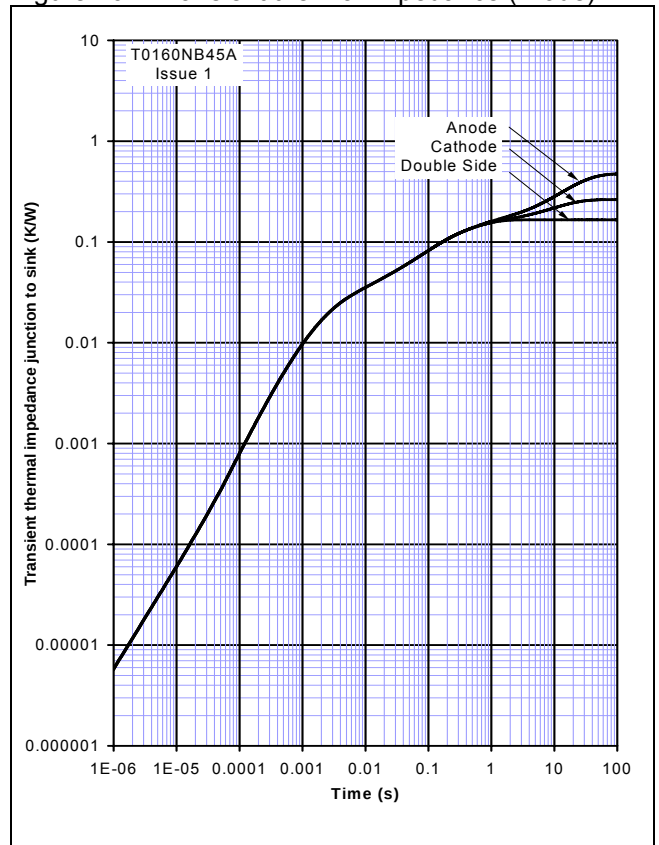
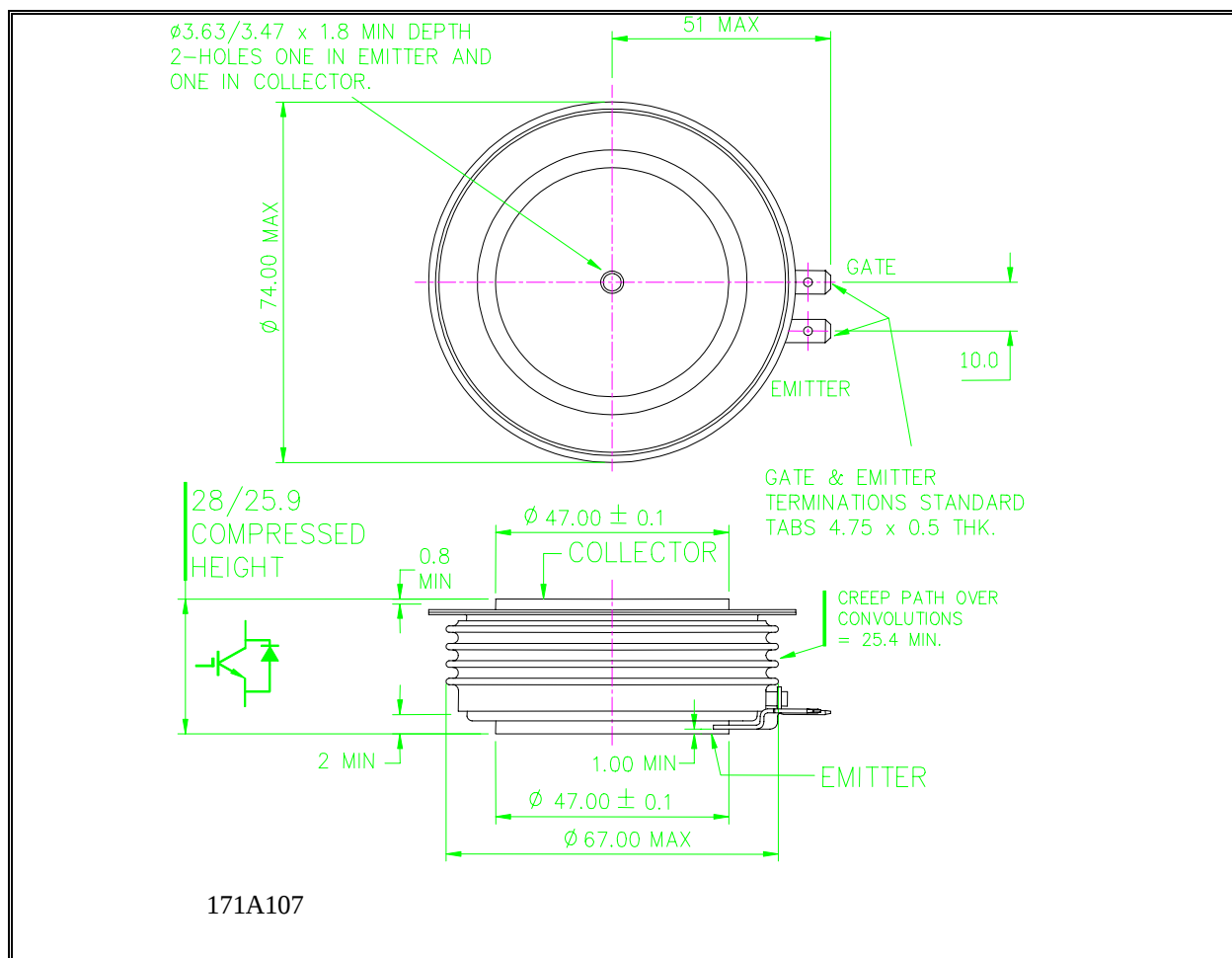


Figure 16 – Transient thermal impedance (Diode)



Outline Drawing & Ordering Information



ORDERING INFORMATION

(Please quote 10 digit code as below)

T0160	NB	45	A
Fixed type Code	Fixed Outline Code	Voltage Grade $V_{CES}/100$ 45	Fixed format code

Typical order code: T0160NB45A ($V_{CES} = 4500V$)

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