IXYS
A Littelfuse Technology

Date:- 29th Nov, 2018

Data Sheet Issue:- 2

Insulated Gate Bi-Polar Transistor

Type T1600GB45G

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	DC collector current, IGBT	1600	A
I_{CRM}	Repetitive peak collector current, t_p=1ms, IGBT	3200	A
$I_{F(DC)}$	Continuous DC forward current, Diode	1600	A
I_{FRM}	Repetitive peak forward current, t_p=1ms, Diode	3200	A
I_{FSM}	Peak non-repetitive surge t_p=10ms, V_{RM}=60%V_{RRM}, Diode (Note 4)	30	kA
I_{FSM2}	Peak non-repetitive surge t_p=10ms, V_{RM}≤10V, Diode (Note 4)	33	kA
P_{MAX}	Maximum power dissipation, IGBT (Note 2)	12.8	kW
P_D	Maximum power dissipation, Diode (Note 2)	8.13	kW
$(di/dt)_{cr}$	Critical diode di/dt (note 3)	3000	A/µs
T_j	Operating temperature range.	-40 to +125	°C
T_{stg}	Storage temperature range.	-40 to +125	°C

Notes: -
1) Unless otherwise indicated T_j = 125ºC.
2) T_{sink} = 25°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	-	2.75	3.2	I_C = 1600A, V_{GE} = 15V, T_j = 25°C	V
		-	3.50	3.9	I_C = 1600A, V_{GE} = 15V	V
V_{T0}	Threshold voltage	-	-	1.79	Current range: 530A – 1600A	V
r_T	Slope resistance	-	-	1.32		mΩ
$V_{GE(TH)}$	Gate threshold voltage	-	5.1	-	V_{CE} = V_{GE}, I_C = 170mA	V
I_{CES}	Collector – emitter cut-off current		45	70	V_{CE} = V_{CES}, V_{GE} = 0V	mA
I_{GES}	Gate leakage current	-	-	±20	V_{GE} = ±20V	µA
C_{ies}	Input capacitance	-	270	-	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz	nF
$t_{d(on)}$	Turn-on delay time	-	2.2	-		µs
$t_r(V)$	Rise time	-	4.4	-	I_C =1600A, V_{CE} =2800V, di/dt=2700A/µs	µs
$Q_{g(on)}$	Turn-on gate charge	-	9	-	V_{GE} = ±15V, L_s=200nH	µC
E_{on}	Turn-on energy	-	12	-	$R_{G(ON)}$= 4.3Ω, $R_{G(OFF)}$=12Ω, C_{GE}=133nF	J
$t_{d(off)}$	Turn-off delay time	-	4.8	-	Integral diode used as freewheel diode	µs
$t_f(I)$	Fall time	-	2.6	-	(Note 3 & 4)	µs
$Q_{g(off)}$	Turn-off gate charge	-	10	-		µC
E_{off}	Turn-off energy	-	8.7	-		J
I_{SC}	Short circuit current	-	5000	-	V_{GE}=+15V, V_{CC}=2800V, V_{CEmax}≤V_{CES}, t_p≤10µs	A

Diode Characteristics

	PARAMETER	MIN	TYP	MAX	TEST CONDITIONS	UNITS
V_F	Forward voltage	-	3.3	3.6	I_F = 1600A, T_j =25°C	V
		-	3.45	3.8	I_F = 1600A	V
V_{To}	Threshold voltage	-	-	2.14	Current range 530A - 1600A	V
r_T	Slope resistance	-	-	1.04		mΩ
I_{rm}	Peak reverse recovery current	-	1270	-		A
Q_{rr}	Recovered charge	-	1960	-	I_F = 1600A, V_r = 2800V, V_{GE} = -15V,	µC
t_{rr}	Reverse recovery time, 50% chord	-	1.75	-	di/dt=2700A/µs	µs
E_r	Reverse recovery energy	-	2.03	-		J

Thermal Characteristics

	PARAMETER	MIN	TYP	MAX	TEST CONDITIONS	UNITS
R_{thJK}	Thermal resistance junction to sink, IGBT	-	-	7.8	Double side cooled	K/kW
		-	-	12.8	Collector side cooled	K/kW
		-	-	20.3	Emitter side cooled	K/kW
R_{thJK}	Thermal resistance junction to sink, Diode	-	-	12.3	Double side cooled	K/kW
		-	-	19.5	Cathode side cooled	K/kW
		-	-	35.7	Anode side cooled	K/kW
F	Mounting force	50	-	70	Note 2	kN
W_t	Weight	-	2	-		kg

Notes:-

1) Unless otherwise indicated T_j=125°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 4 to 10 are obtained using integral diode as freewheeling diode

Curves

Figure 1 – Typical collector-emitter saturation voltage characteristics

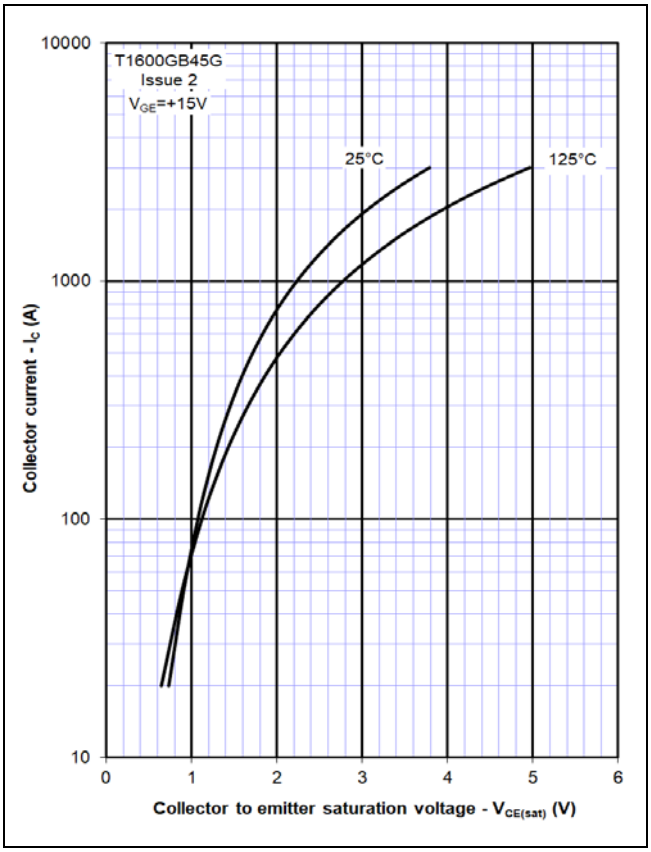


Figure 2 – Typical output characteristic

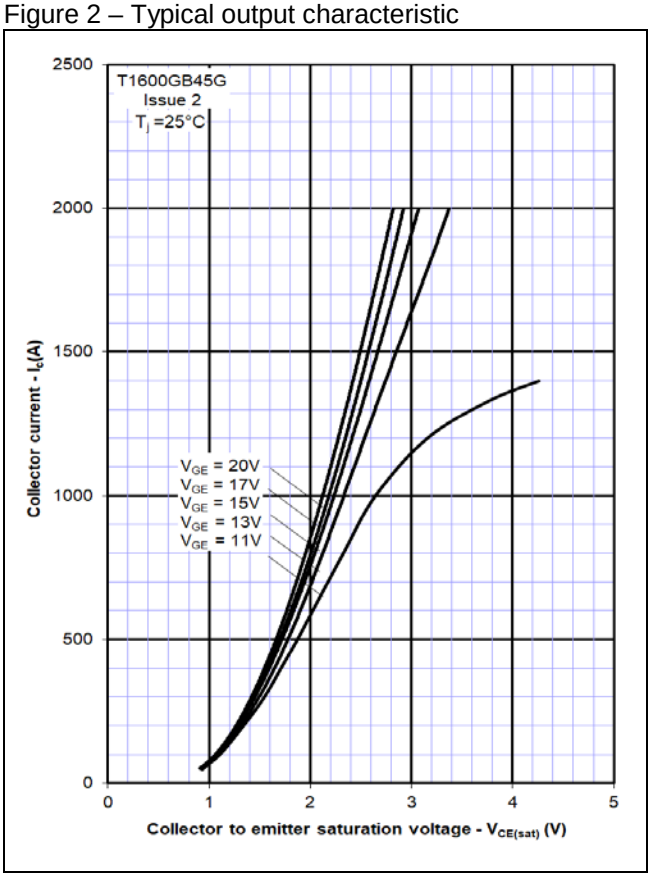


Figure 3 – Typical output characteristic

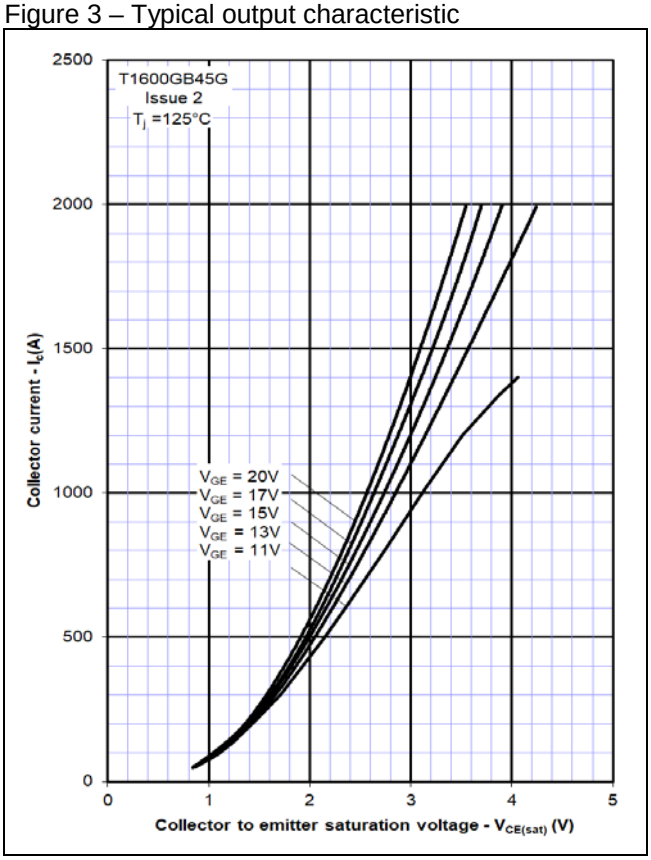


Figure 4 – Typical turn-on delay time vs gate resistance

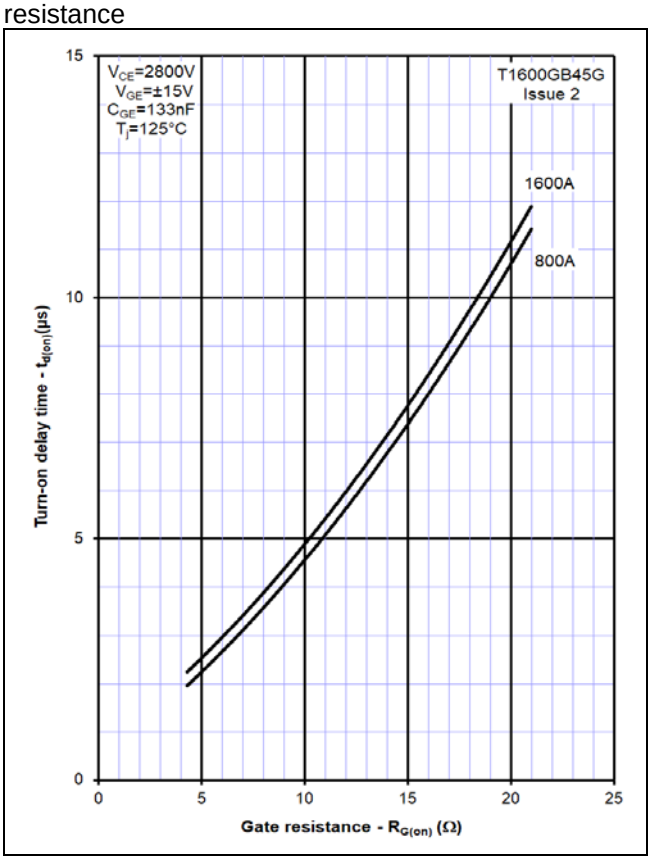


Figure 5 – Typical turn-off delay time vs. gate resistance

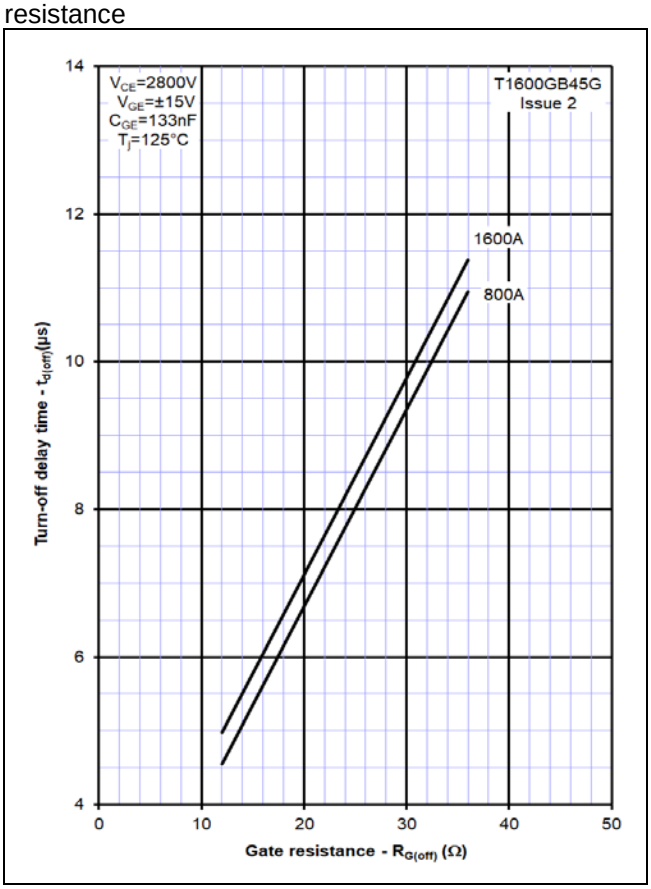


Figure 6 – Typical turn-on energy vs. collector current

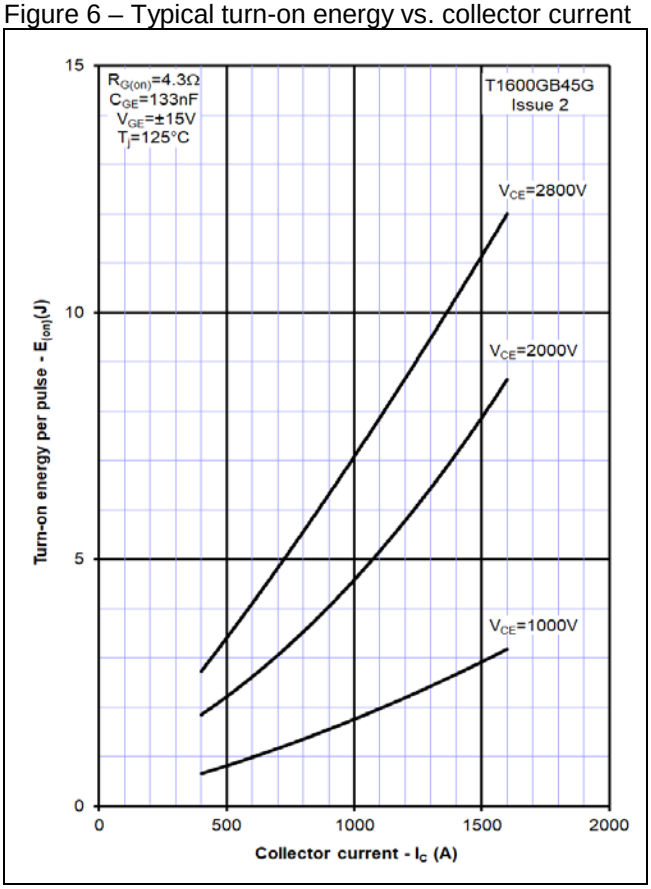


Figure 7 – Typical turn-on energy vs. di/dt

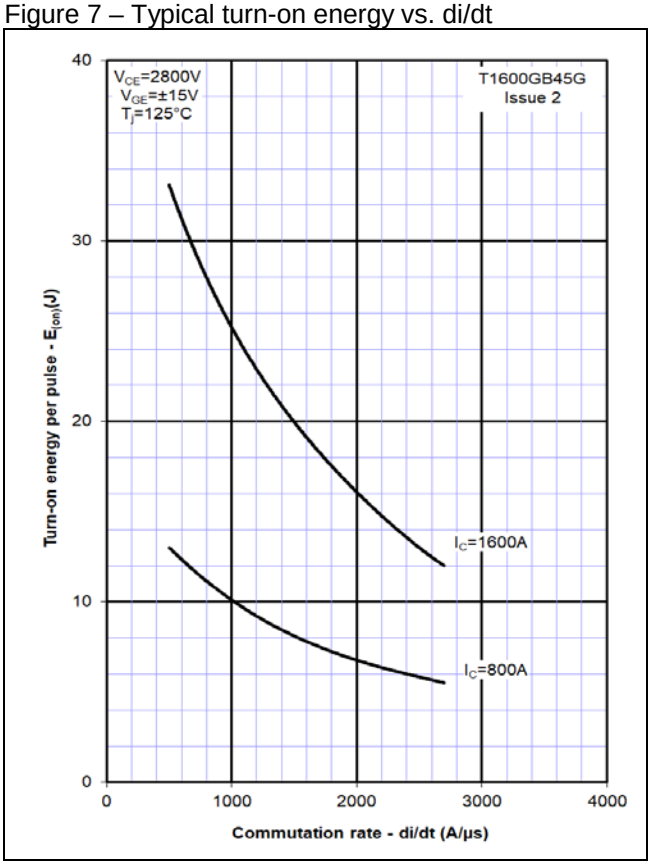


Figure 8 – Typical turn-off energy vs. collector current

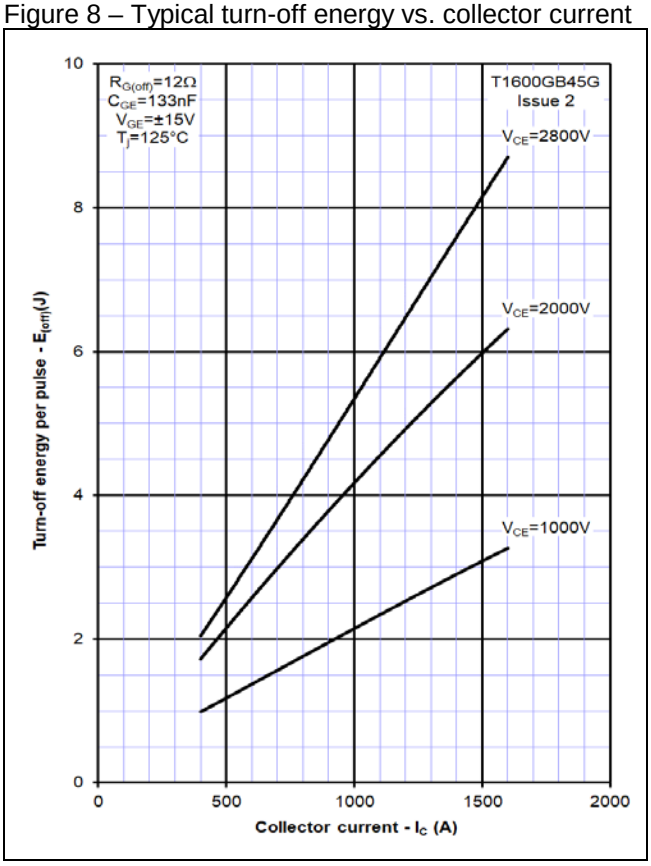


Figure 9 – Turn-off energy vs voltage

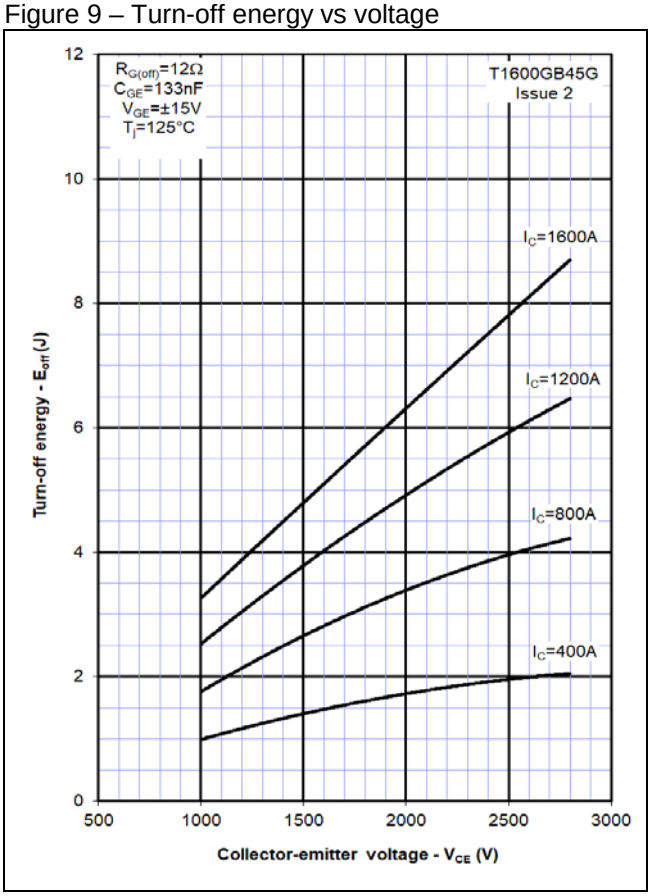


Figure 10 – Safe operating area (IGBT)

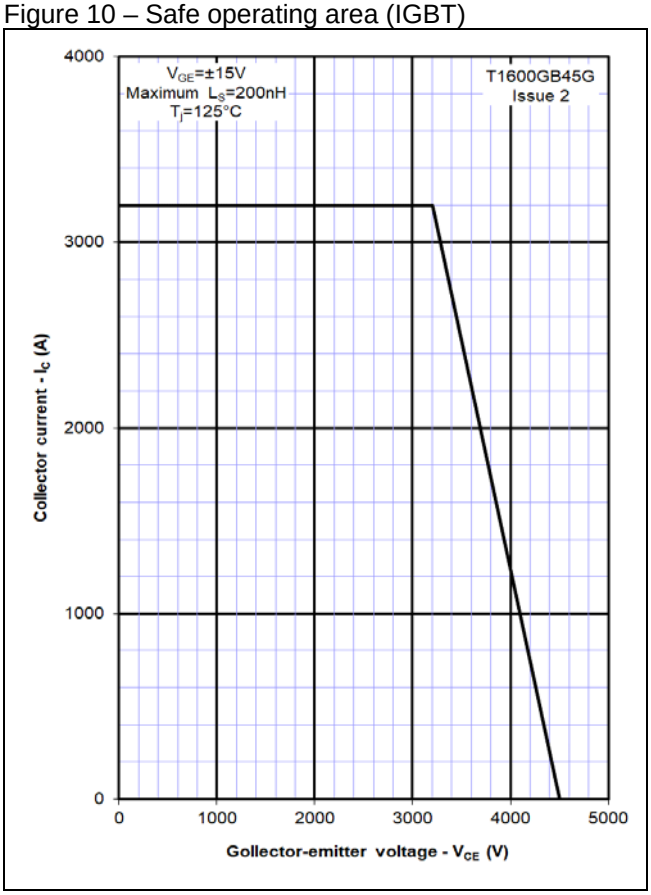


Figure 11 – Typical diode forward characteristics

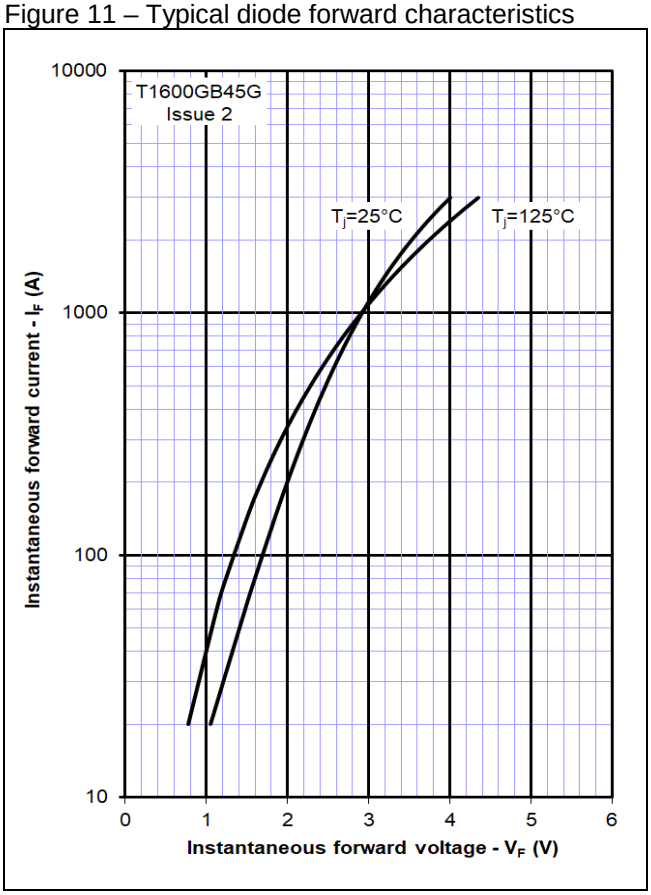


Figure 12 – Typical recovered charge

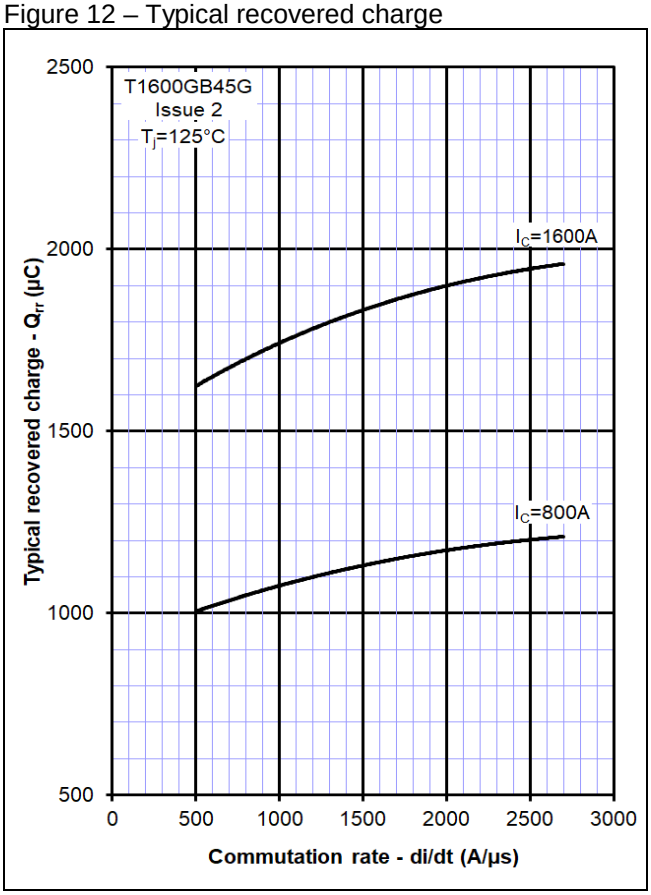


Figure 13 – Typical reverse recovery current

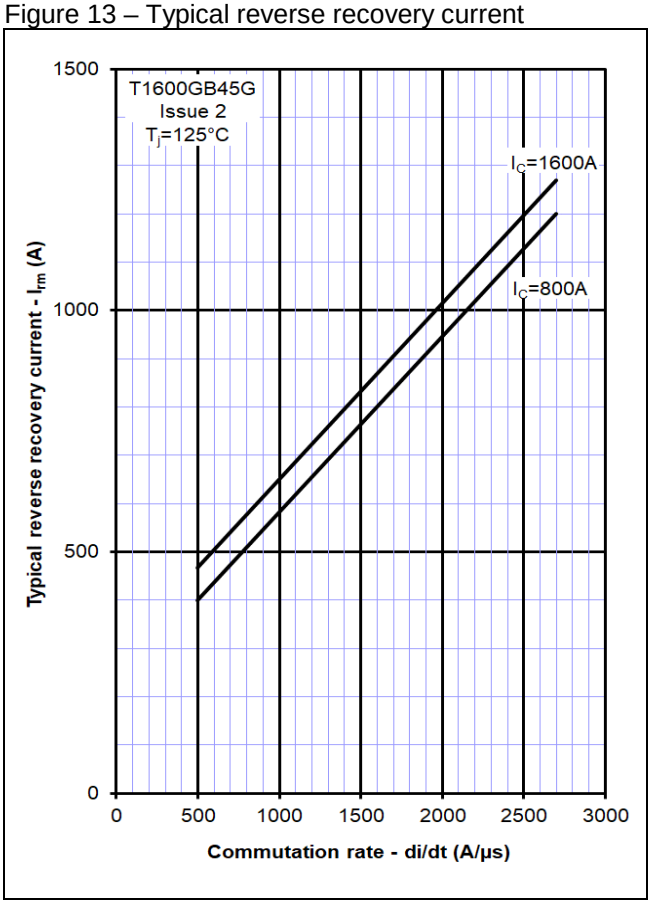


Figure 14 – Typical reverse recovery time

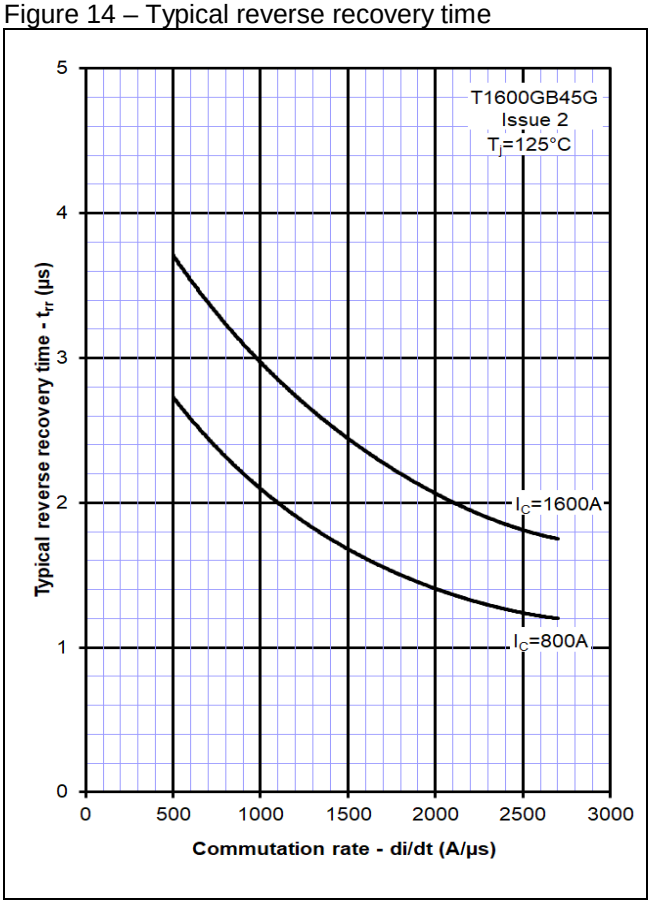


Figure 15 – Typical reverse recovery energy

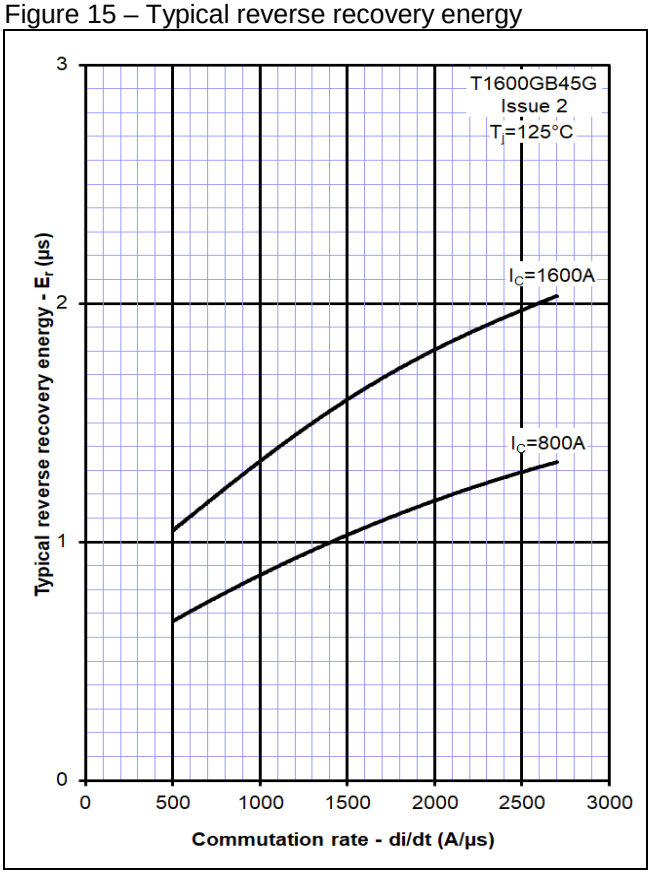


Figure 16 – Safe operating area (Diode)

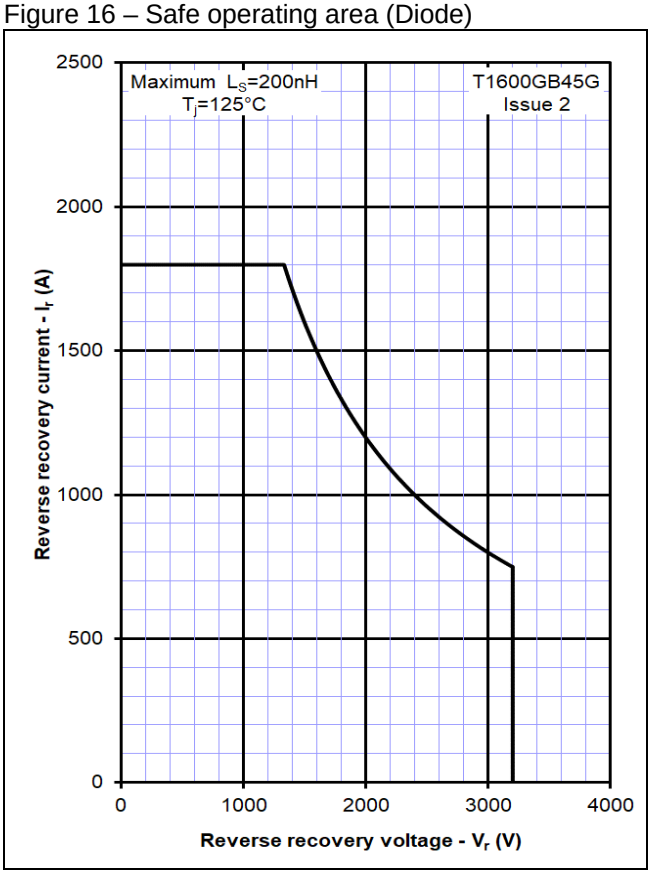


Figure 17 – Transient thermal impedance (IGBT)

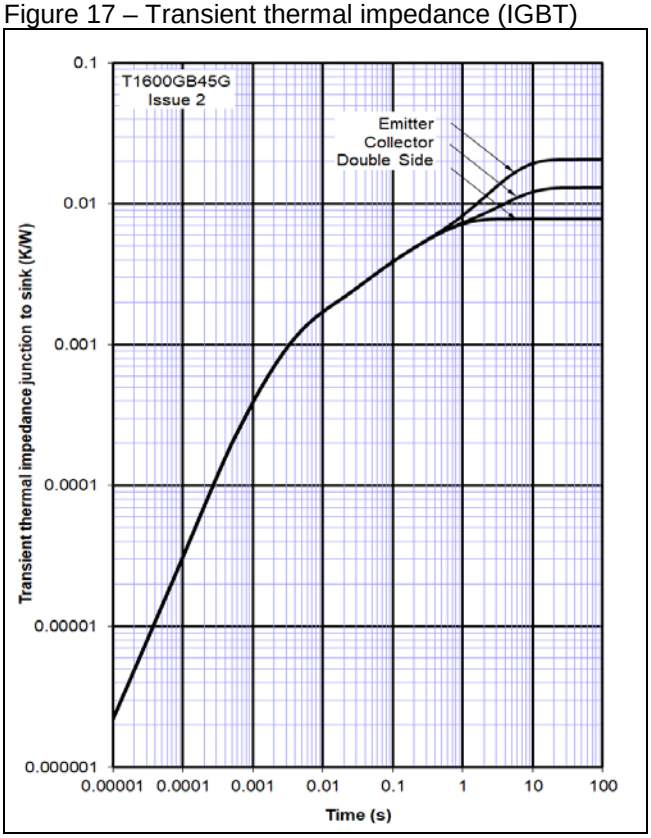
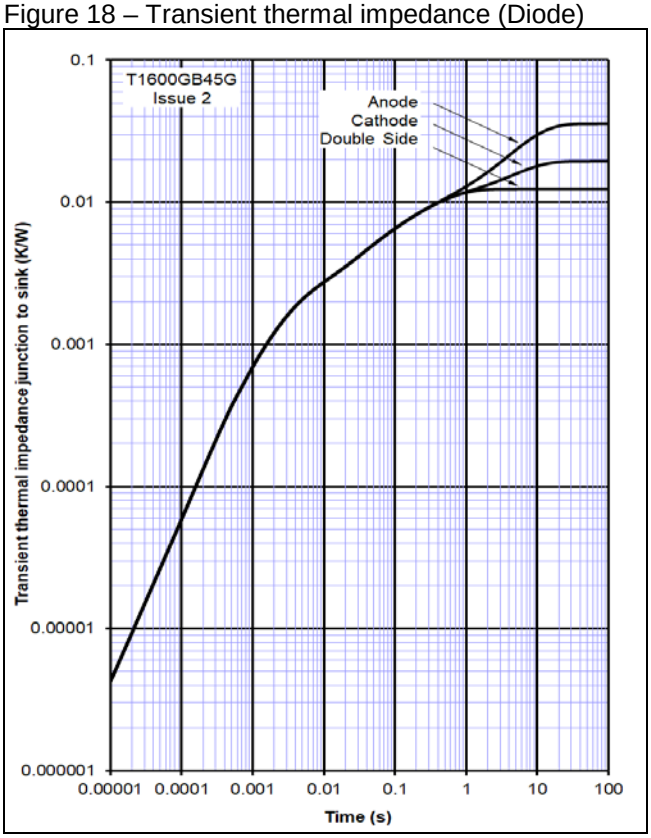
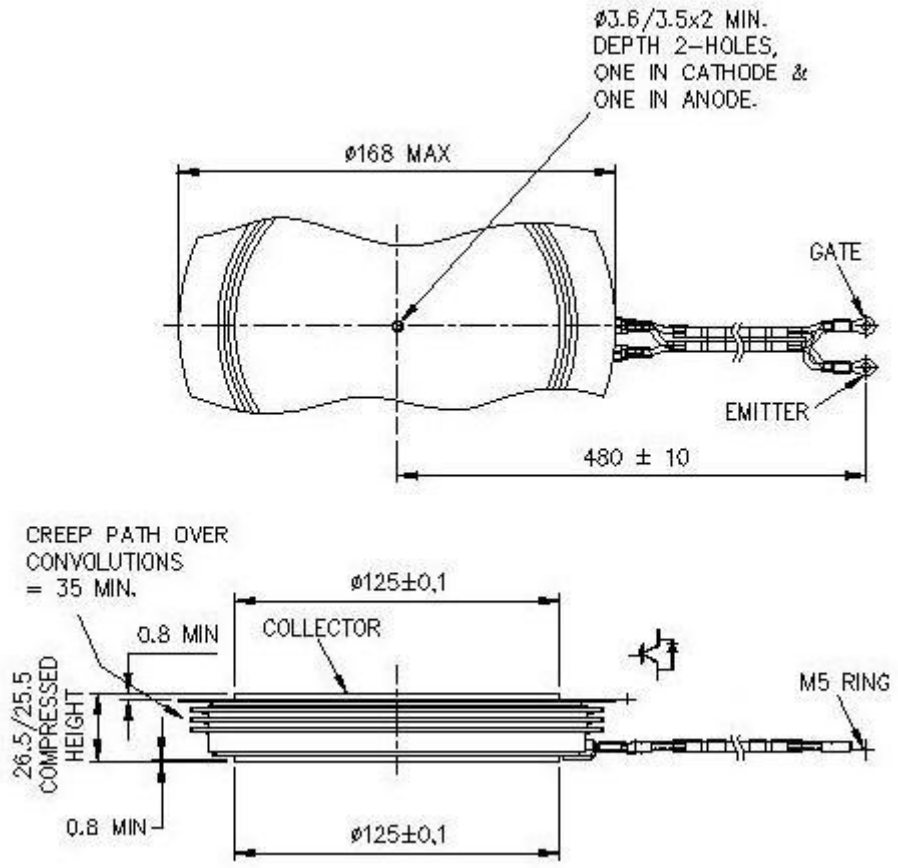


Figure 18 – Transient thermal impedance (Diode)



Outline Drawing & Ordering Information



101A426

ORDERING INFORMATION (Please quote 10 digit code as below)

T1600	GB	45	G
Fixed type Code	Fixed Outline Code	Voltage Grade V_{CES}/100 45	Fixed format code

Typical order code: T1600GB45G (V_{CES} = 4500V)

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