Date:- 04 Oct, 2019

Data Sheet Issue:- P2

Tentative data

Insulated Gate Bi-Polar Transistor

Type T1000EC33G

Absolute Maximum Ratings

	VOLTAGE RATINGS	MAXIMUM LIMITS	UNITS
V_{CES}	Collector – emitter voltage	3300	V
$V_{DC\ link}$	Permanent DC voltage for 100 FIT failure rate.	1800	V
V_{GES}	Peak gate – emitter voltage	±20	V

	RATINGS	MAXIMUM LIMITS	UNITS
$I_{C(DC)}$	DC collector current, IGBT	1000	A
I_{CRM}	Repetitive peak collector current, t_p=1ms, IGBT	2000	A
$I_{F(DC)}$	Continuous DC forward current, Diode	1000	A
I_{FRM}	Repetitive peak forward current, t_p=1ms, Diode	2000	A
I_{FSM}	Peak non-repetitive surge t_p=10ms, V_{RM}=60%V_{RRM}, Diode (Note 4)	6000	A
I_{FSM2}	Peak non-repetitive surge t_p=10ms, V_{RM}≤10V, Diode (Note 4)	6600	A
P_{MAX}	Maximum power dissipation, IGBT (Note 2)	6.4	kW
P_D	Maximum power dissipation, Diode (Note 2)	4.05	kW
$(di/dt)_{cr}$	Critical diode di/dt (note 3)	2000	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	-	2.57	2.97	I_C = 1000A, V_{GE} = 15V, T_j = 25°C	V
		-	3.40	3.80	I_C = 1000A, V_{GE} = 15V	V
V_0	Threshold voltage	-	-	1.84	Current range: 333 – 1000A	V
r_s	Slope resistance	-	-	1.97		mΩ
$V_{GE(TH)}$	Gate threshold voltage	-	5.3	-	V_{CE} = V_{GE}, I_C = 85mA	V
I_{CES}	Collector – emitter cut-off current		10	25	V_{CE} = V_{CES}, V_{GE} = 0V	mA
I_{GES}	Gate leakage current	-	-	±10	V_{GE} = ±20V	µA
C_{ies}	Input capacitance	-	135	-	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz	nF
$t_{d(on)}$	Turn-on delay time	-	1.7	-		µs
t_r(V)	Rise time	-	1.8	-	I_C =1000A, V_{CE} =1800V, di/dt=2000A/µs	µs
$Q_{g(on)}$	Turn-on gate charge	-	21	-	V_{GE} = ±15V, L_s=200nH	µC
E_{on}	Turn-on energy	-	2.6	-	$R_{G(ON)}$= 2.2Ω, $R_{G(OFF)}$=15Ω, C_{GE}=430nF	J
$t_{d(off)}$	Turn-off delay time	-	5.3	-	Integral diode used as freewheel diode	µs
t_f(I)	Fall time	-	1.5	-	(Note 3, 4 & 5)	µs
$Q_{g(off)}$	Turn-off gate charge	-	13	-		µC
E_{off}	Turn-off energy	-	2.7	-		J
I_{SC}	Short circuit current	-	3000	-	V_{GE}=+15V, V_{CC}=1800V, V_{CEmax}≤V_{CES}, t_p≤10µs	A

Diode Characteristics

	PARAMETER	MIN	TYP	MAX	TEST CONDITIONS	UNITS
V_F	Forward voltage	-	2.66	2.95	I_F = 1000A, T_j =25°C	V
		-	3.0	3.3	I_F = 1000A	V
V_0	Threshold voltage	-	-	1.71	Current range 333 - 1000A	V
r_s	Slope resistance	-	-	1.59		mΩ
I_{rm}	Peak reverse recovery current	-	470	-	I_F = 1000A, V_{GE} = ±15V, di/dt=2000A/µs	A
Q_{rr}	Recovered charge	-	1040	-		µC
t_{rr}	Reverse recovery time, 50% chord	-	1.7	-		µs
E_r	Reverse recovery energy	-	1.2	-		J

Thermal Characteristics

	PARAMETER	MIN	TYP	MAX	TEST CONDITIONS	UNITS
R_{thJK}	Thermal resistance junction to sink, IGBT	-	-	15.6	Double side cooled	K/kW
		-	-	25.4	Collector side cooled	K/kW
		-	-	40.5	Emitter side cooled	K/kW
R_{thJK}	Thermal resistance junction to sink, Diode	-	-	24.7	Double side cooled	K/kW
		-	-	37.9	Cathode side cooled	K/kW
		-	-	70.8	Anode side cooled	K/kW
F	Mounting force	25	-	35	Note 2	kN
W_t	Weight	-	1.2	-		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) E_{on} integration time 15µs from 10% rising I_G.
5) E_{off} integration time 15µs from 90% falling V_{GE} .

Curves

Figure 1 – Typical collector-emitter saturation voltage characteristics

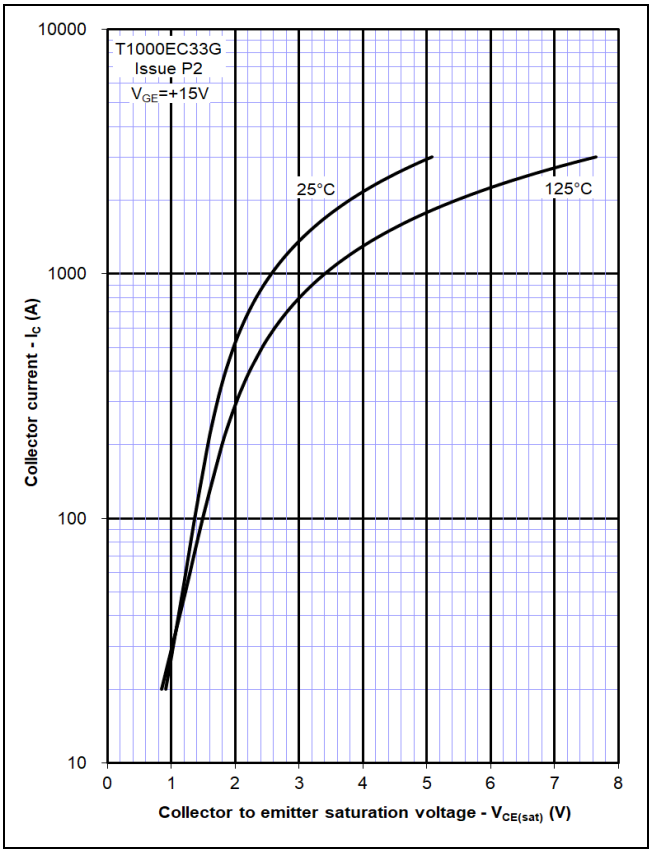


Figure 2 – Typical output characteristic

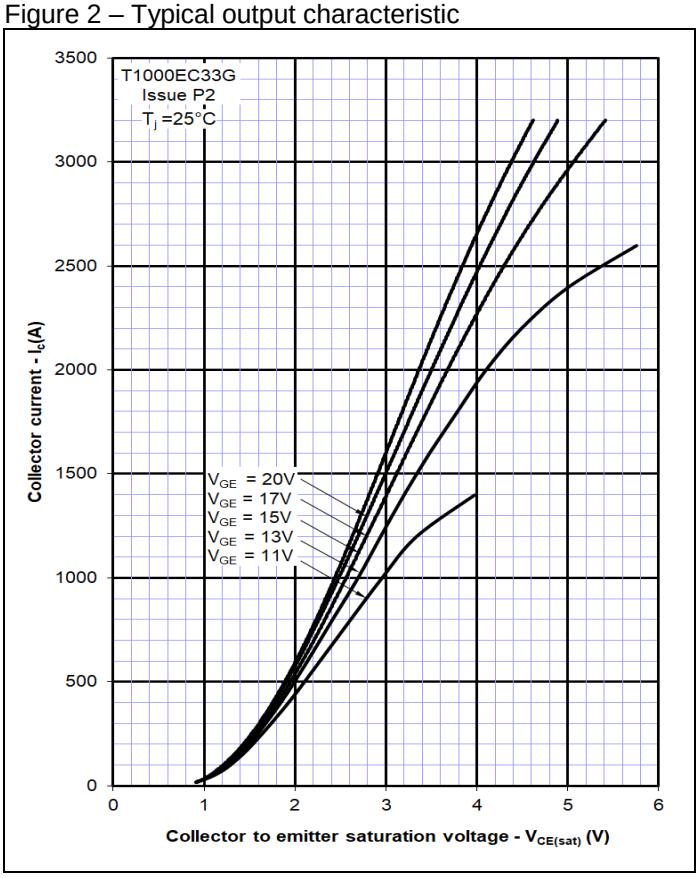


Figure 3 – Typical output characteristic

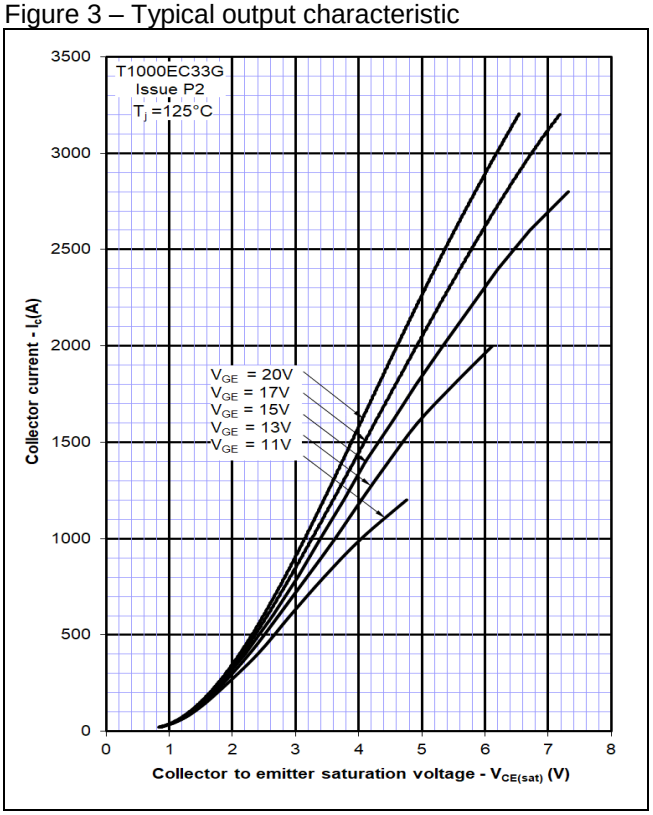


Figure 4 – Typical turn-on delay time vs gate resistance

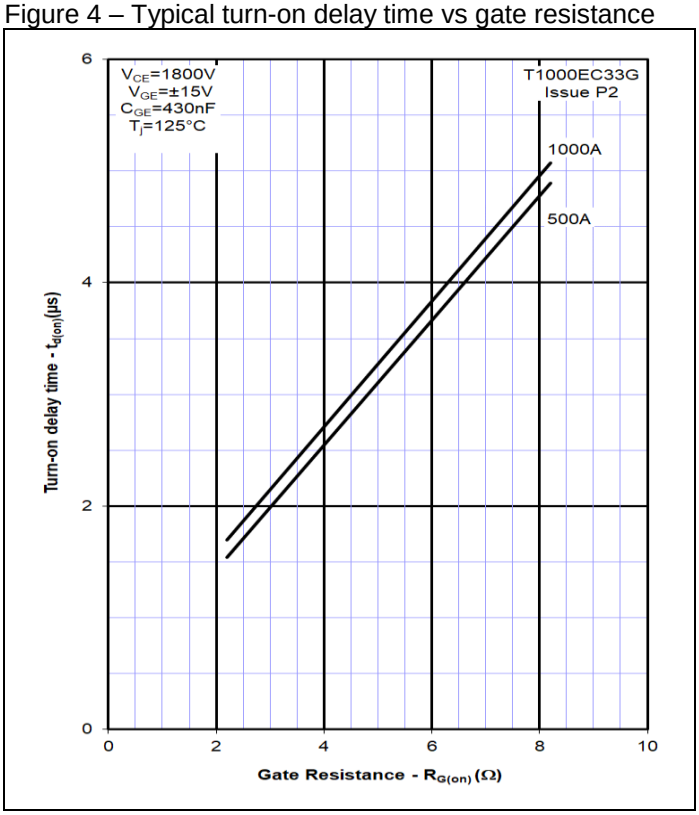


Figure 5 – Typical turn-off delay time vs. gate resistance

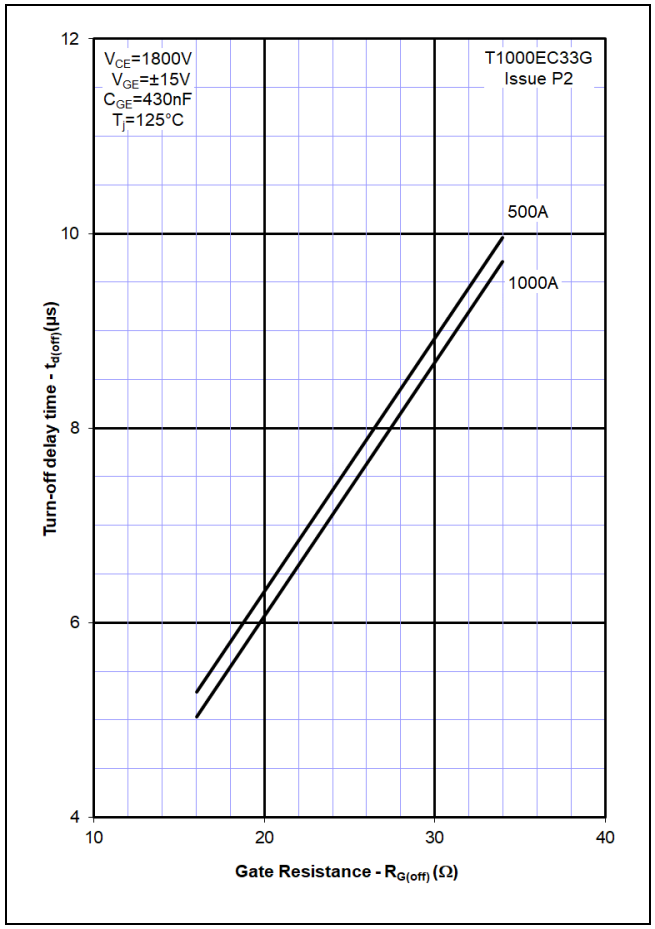


Figure 6 – Typical turn-on energy vs. collector current

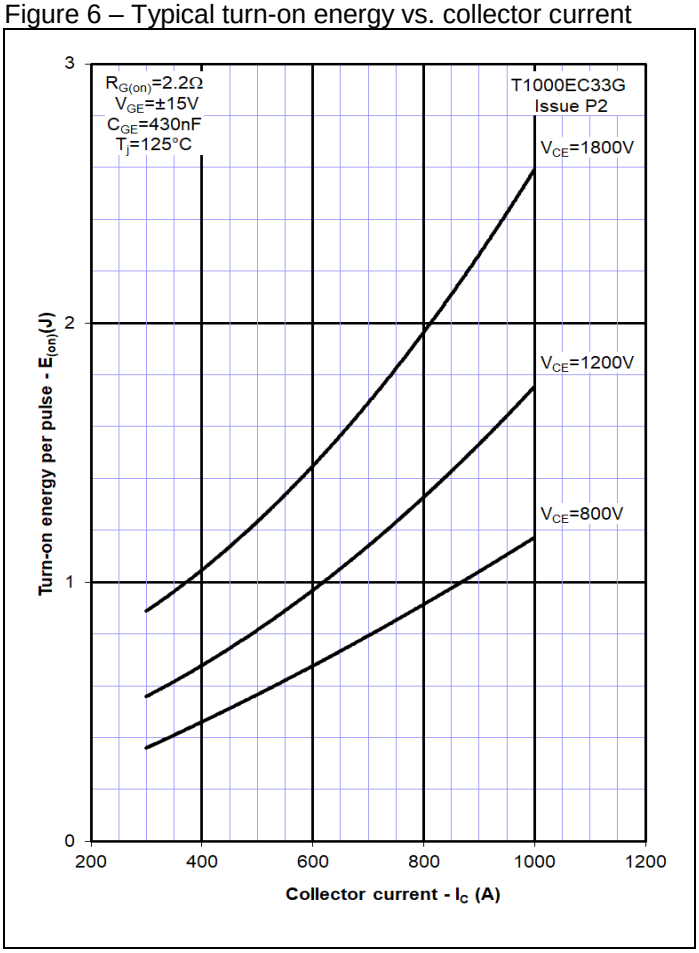


Figure 7 – Typical turn-on energy vs. di/dt

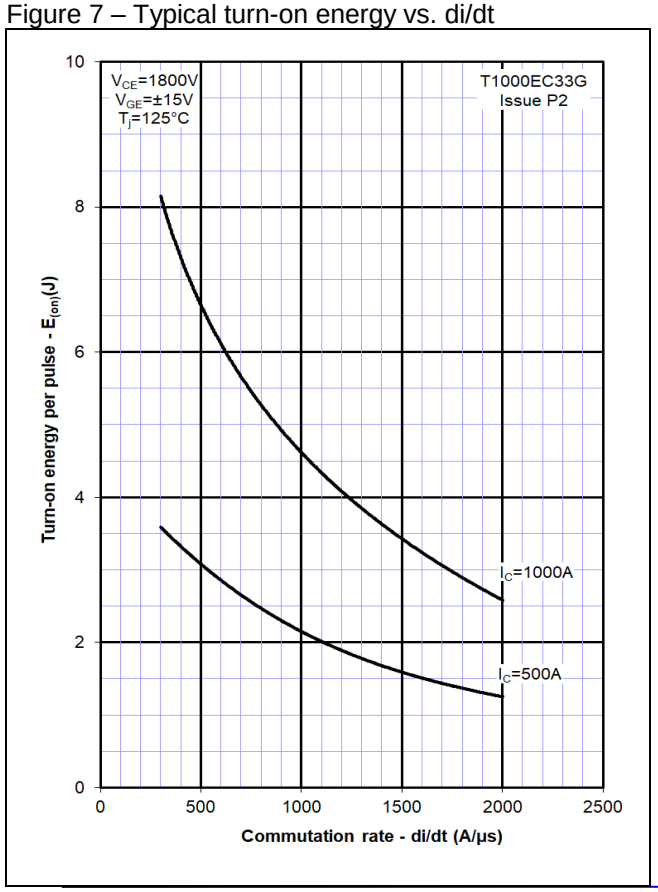


Figure 8 – Typical turn-off energy vs. collector current

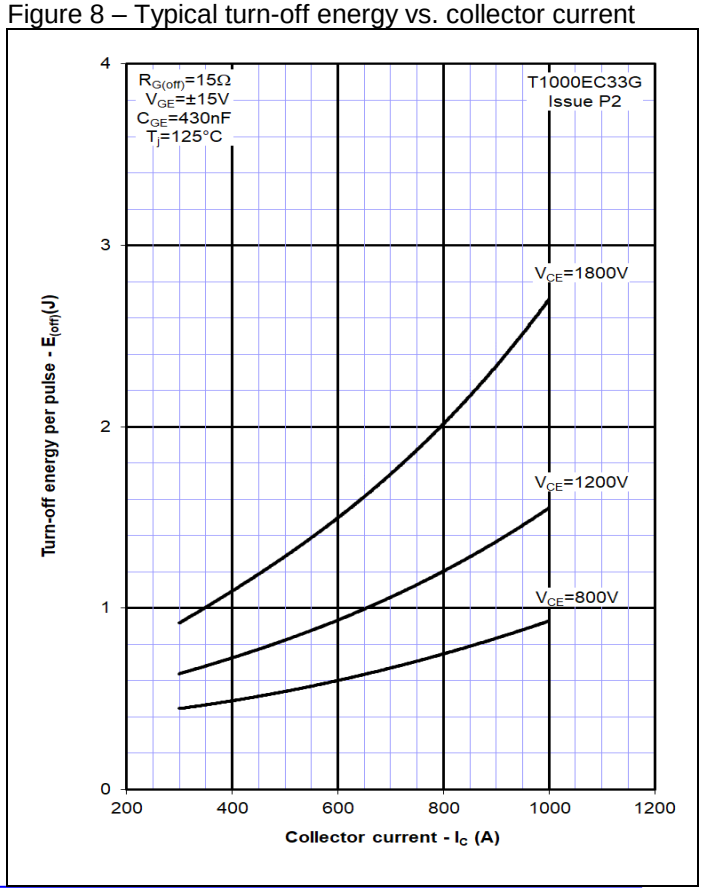


Figure 9 – Turn-off energy vs voltage

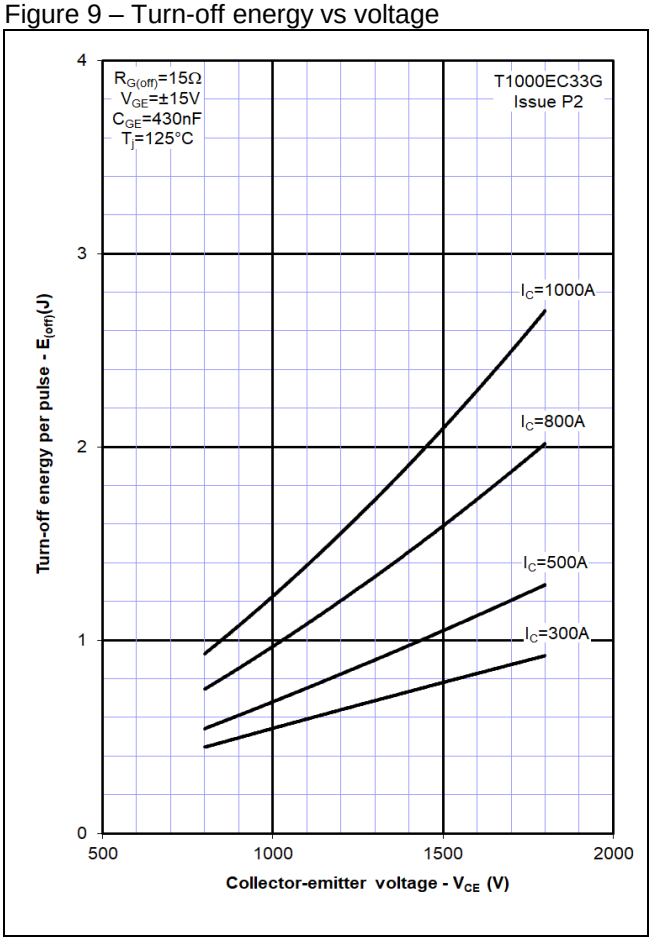


Figure 10 – Safe operating area (IGBT)

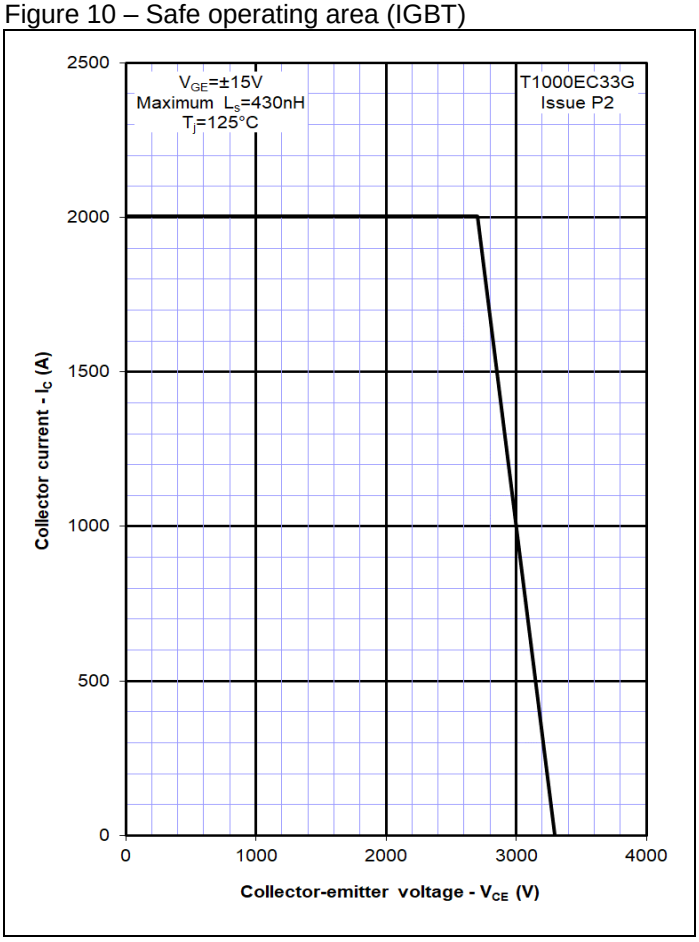


Figure 11 – Typical diode forward characteristics

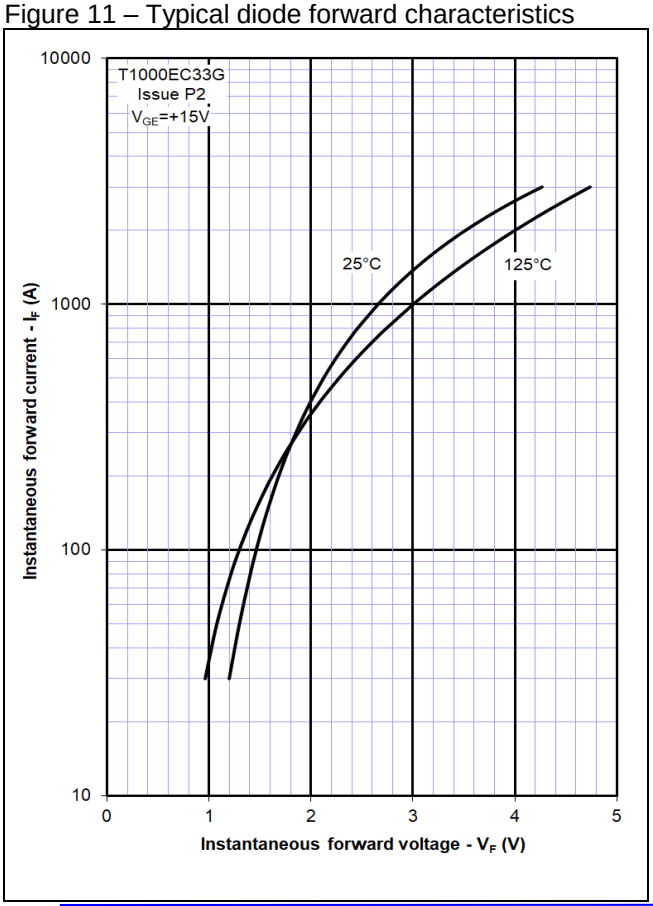


Figure 12 – Typical recovered charge

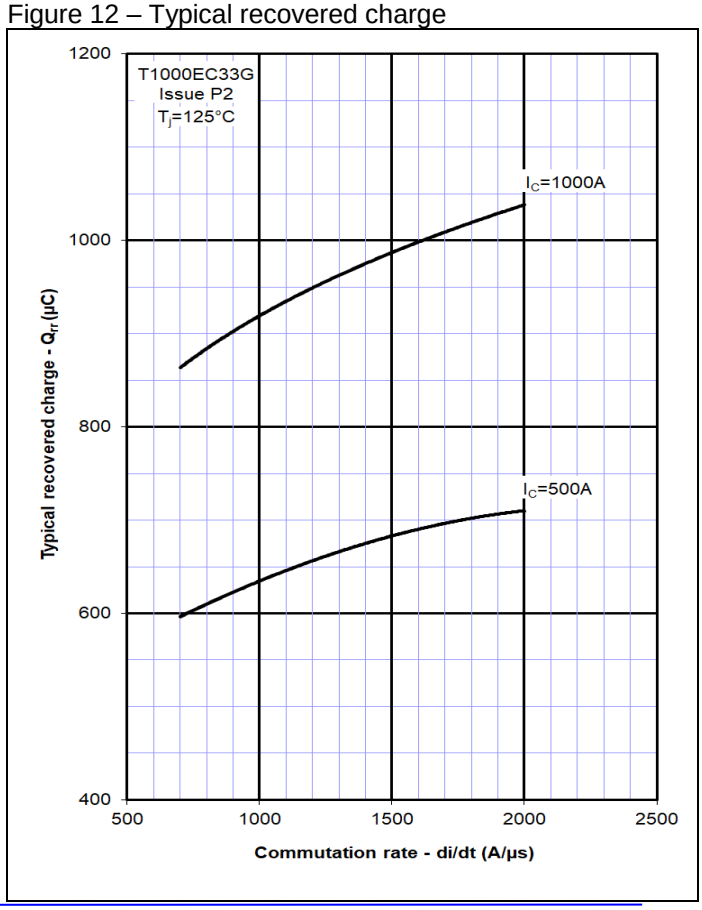


Figure 13 – Typical reverse recovery current

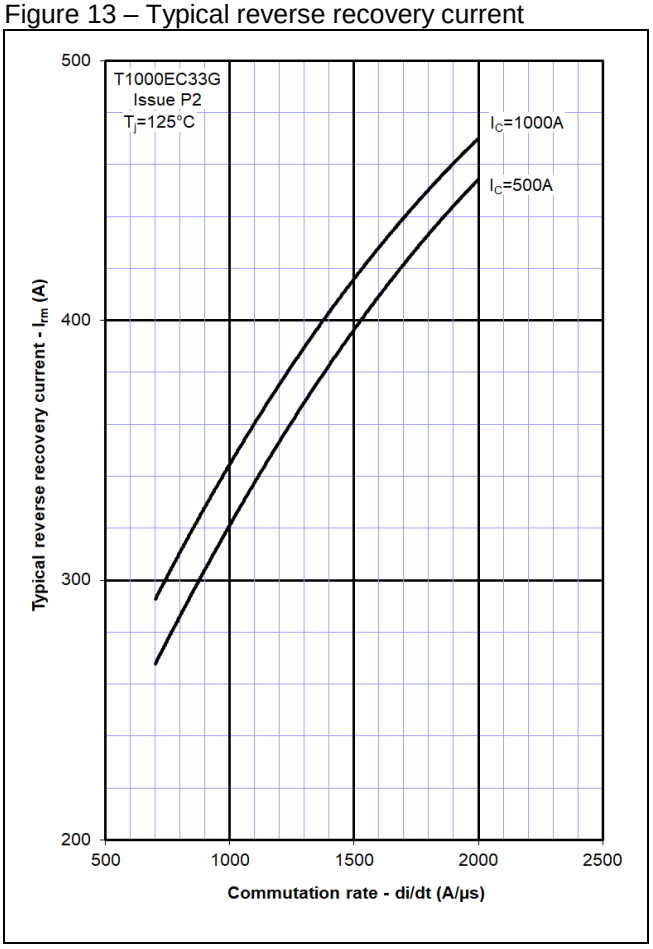


Figure 14 – Typical reverse recovery time

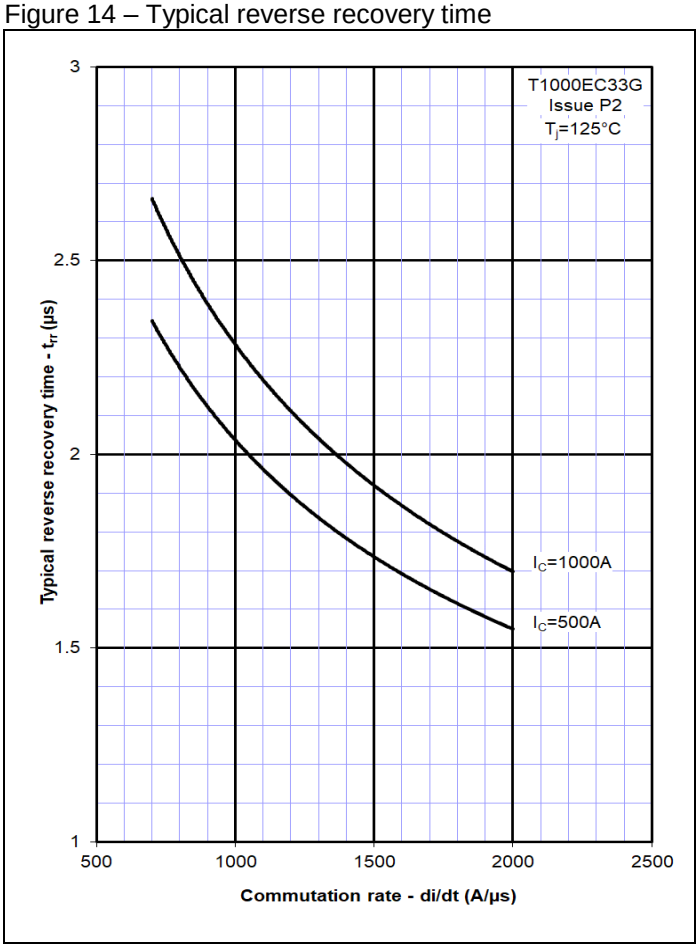


Figure 15 – Typical reverse recovery energy

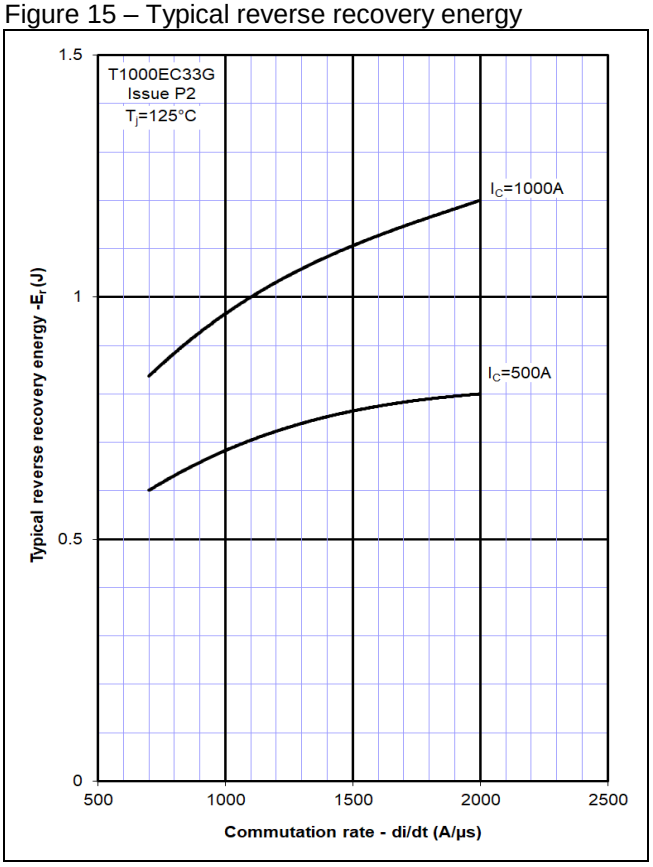


Figure 16 – Safe operating area (Diode)

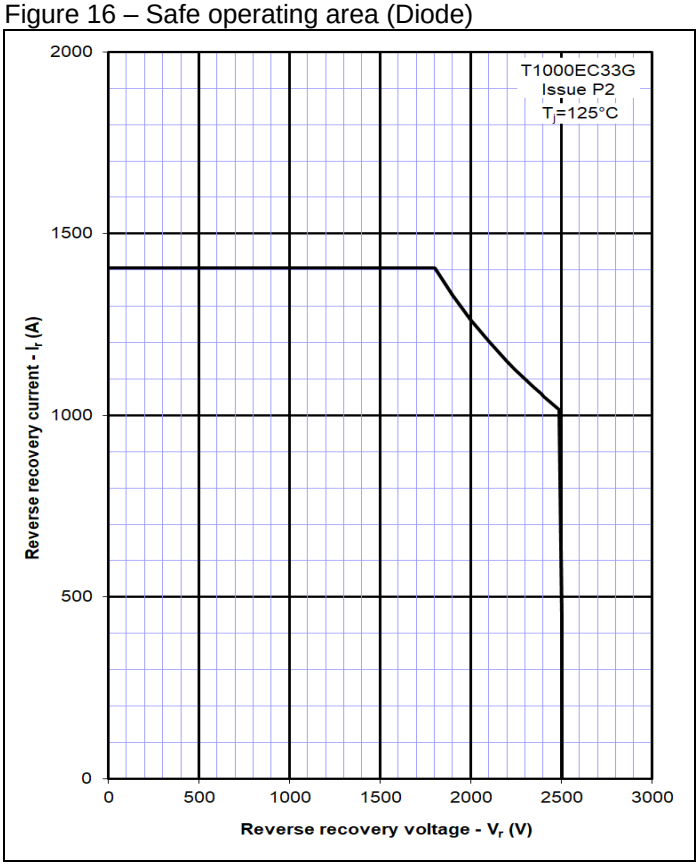


Figure 17 – Transient thermal impedance (IGBT)

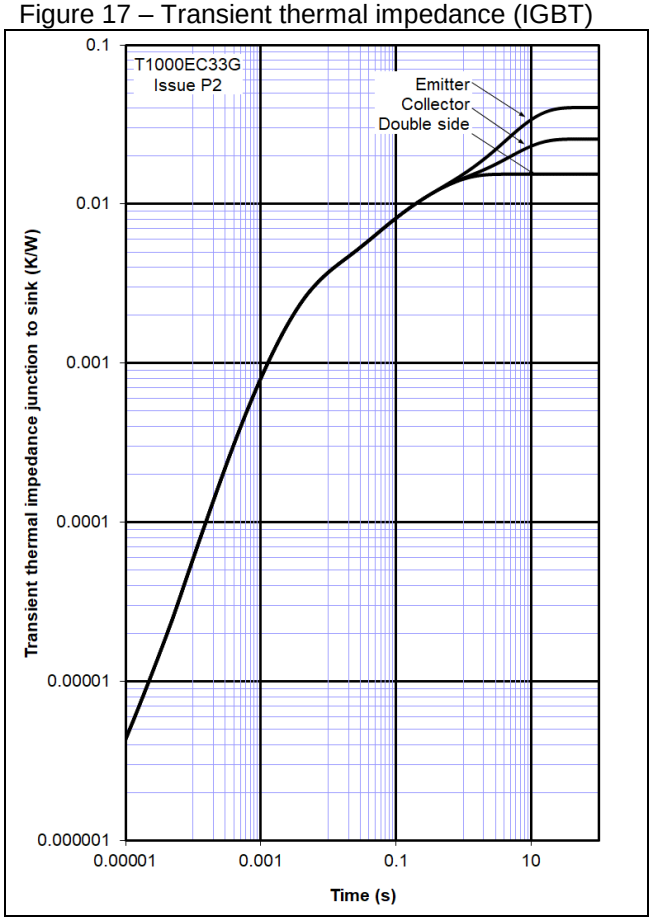
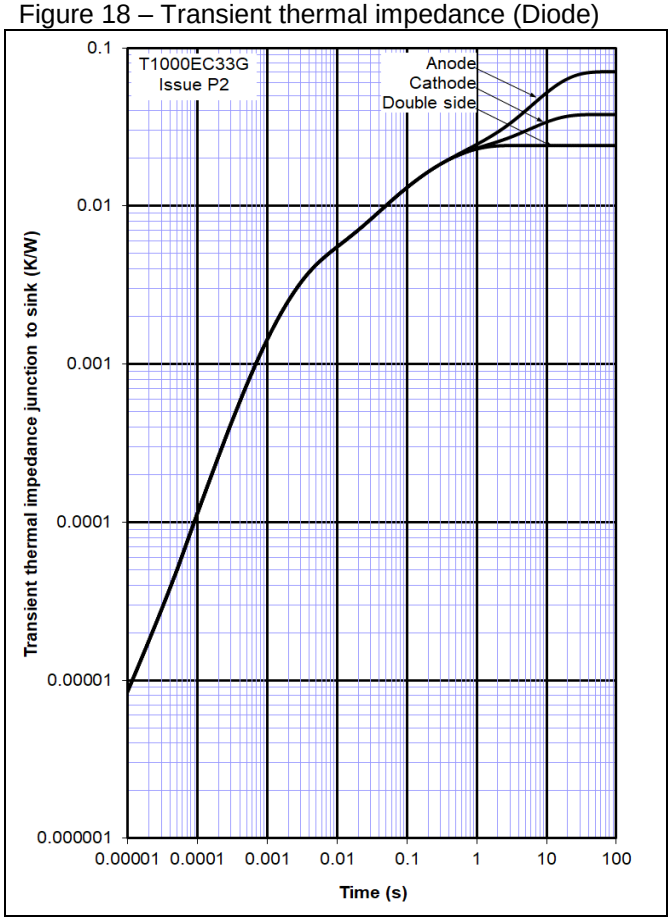
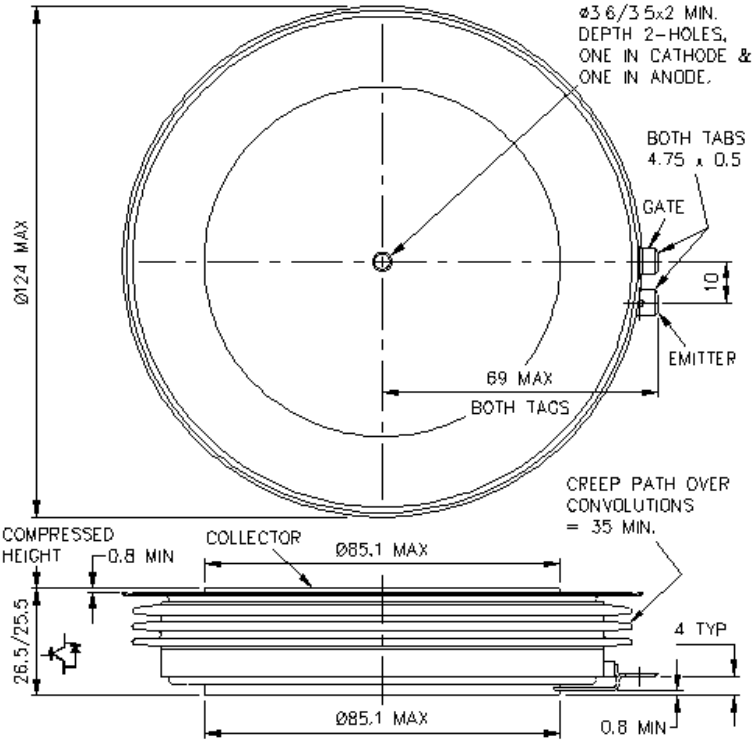


Figure 18 – Transient thermal impedance (Diode)



Outline Drawing & Ordering Information



101A340

ORDERING INFORMATION (Please quote 10 digit code as below)

T1000	EC	33	G
Fixed type Code	Fixed Outline Code	Voltage Grade V_{CES}/100 33	Fixed format code

Typical order code: T1000EC33G (V_{CES} = 3300V)

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

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

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

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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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