



# IXYS

A Littelfuse Technology

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 <sub>CES</sub>	Collector – emitter voltage	3300	V
V <sub>DC link</sub>	Permanent DC voltage for 100 FIT failure rate.	1800	V
V <sub>GES</sub>	Peak gate – emitter voltage	±20	V

	RATINGS	MAXIMUM LIMITS	UNITS
I <sub>C(DC)</sub>	DC collector current, IGBT	1000	A
I <sub>CRM</sub>	Repetitive peak collector current, t <sub>p</sub> =1ms, IGBT	2000	A
I <sub>F(DC)</sub>	Continuous DC forward current, Diode	1000	A
I <sub>FRM</sub>	Repetitive peak forward current, t <sub>p</sub> =1ms, Diode	2000	A
I <sub>FSM</sub>	Peak non-repetitive surge t <sub>p</sub> =10ms, V <sub>RM</sub> =60%V <sub>RRM</sub> , Diode (Note 4)	6000	A
I <sub>FSM2</sub>	Peak non-repetitive surge t <sub>p</sub> =10ms, V <sub>RM</sub> ≤10V, Diode (Note 4)	6600	A
P <sub>MAX</sub>	Maximum power dissipation, IGBT (Note 2)	6.4	kW
P <sub>D</sub>	Maximum power dissipation, Diode (Note 2)	4.05	kW
(di/dt) <sub>cr</sub>	Critical diode di/dt (note 3)	2000	A/μs
T <sub>j</sub>	Operating temperature range.	-40 to +125	°C
T <sub>stg</sub>	Storage temperature range.	-40 to +125	°C

Notes: -

- 1) Unless otherwise indicated T<sub>j</sub> = 125°C.
- 2) T<sub>sink</sub> = 25°C, double side cooled.
- 3) Maximum commutation loop inductance 200nH.
- 4) Half-sinewave, 125°C T<sub>j</sub> initial.

## Characteristics

### IGBT Characteristics

	PARAMETER	MIN	TYP	MAX	TEST CONDITIONS	UNITS	
V <sub>CE(sat)</sub>	Collector – emitter saturation voltage	-	2.57	2.97	I <sub>C</sub> = 1000A, V <sub>GE</sub> = 15V, T <sub>j</sub> = 25°C	V	
		-	3.40	3.80	I <sub>C</sub> = 1000A, V <sub>GE</sub> = 15V	V	
V <sub>0</sub>	Threshold voltage	-	-	1.84	Current range: 333 – 1000A	V	
r <sub>s</sub>	Slope resistance	-	-	1.97		mΩ	
V <sub>GE(TH)</sub>	Gate threshold voltage	-	5.3	-	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 85mA	V	
I <sub>CES</sub>	Collector – emitter cut-off current	-	10	25	V <sub>CE</sub> = V <sub>CES</sub> , V <sub>GE</sub> = 0V	mA	
I <sub>GES</sub>	Gate leakage current	-	-	±10	V <sub>GE</sub> = ±20V	μA	
C <sub>ies</sub>	Input capacitance	-	135	-	V <sub>CE</sub> = 25V, V <sub>GE</sub> = 0V, f = 1MHz	nF	
t <sub>d(on)</sub>	Turn-on delay time	-	1.7	-	I <sub>C</sub> = 1000A, V <sub>CE</sub> = 1800V, di/dt = 2000A/μs V <sub>GE</sub> = ±15V, L <sub>S</sub> = 200nH R <sub>G(ON)</sub> = 2.2Ω, R <sub>G(OFF)</sub> = 15Ω, C <sub>GE</sub> = 430nF Integral diode used as freewheel diode (Note 3, 4 & 5)	μs	
t <sub>r(V)</sub>	Rise time	-	1.8	-		μs	
Q <sub>g(on)</sub>	Turn-on gate charge	-	21	-		μC	
E <sub>on</sub>	Turn-on energy	-	2.6	-		J	
t <sub>d(off)</sub>	Turn-off delay time	-	5.3	-		μs	
t <sub>f(I)</sub>	Fall time	-	1.5	-		μs	
Q <sub>g(off)</sub>	Turn-off gate charge	-	13	-		μC	
E <sub>off</sub>	Turn-off energy	-	2.7	-		J	
I <sub>SC</sub>	Short circuit current	-	3000	-		V <sub>GE</sub> = +15V, V <sub>CC</sub> = 1800V, V <sub>CEmax</sub> ≤ V <sub>CES</sub> , t <sub>p</sub> ≤ 10μs	A

### Diode Characteristics

	PARAMETER	MIN	TYP	MAX	TEST CONDITIONS	UNITS
V <sub>F</sub>	Forward voltage	-	2.66	2.95	I <sub>F</sub> = 1000A, T <sub>j</sub> = 25°C	V
		-	3.0	3.3	I <sub>F</sub> = 1000A	V
V <sub>0</sub>	Threshold voltage	-	-	1.71	Current range 333 - 1000A	V
r <sub>s</sub>	Slope resistance	-	-	1.59		mΩ
I <sub>rm</sub>	Peak reverse recovery current	-	470	-	I <sub>F</sub> = 1000A, V <sub>GE</sub> = ±15V, di/dt = 2000A/μs	A
Q <sub>rr</sub>	Recovered charge	-	1040	-		μC
t <sub>rr</sub>	Reverse recovery time, 50% chord	-	1.7	-		μs
E <sub>r</sub>	Reverse recovery energy	-	1.2	-		J

### Thermal Characteristics

	PARAMETER	MIN	TYP	MAX	TEST CONDITIONS	UNITS
R <sub>thJK</sub>	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 <sub>thJK</sub>	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 <sub>t</sub>	Weight	-	1.2	-		kg

#### Notes:-

- 1) Unless otherwise indicated T<sub>j</sub> = 125°C.
- 2) Consult application note 2008AN01 for detailed mounting requirements
- 3) C<sub>GE</sub> is additional gate – emitter capacitance added to output of gate drive
- 4) E<sub>on</sub> integration time 15μs from 10% rising I<sub>C</sub>.
- 5) E<sub>off</sub> integration time 15μs from 90% falling V<sub>GE</sub>.

**Curves**

Figure 1 – Typical collector-emitter saturation voltage characteristics

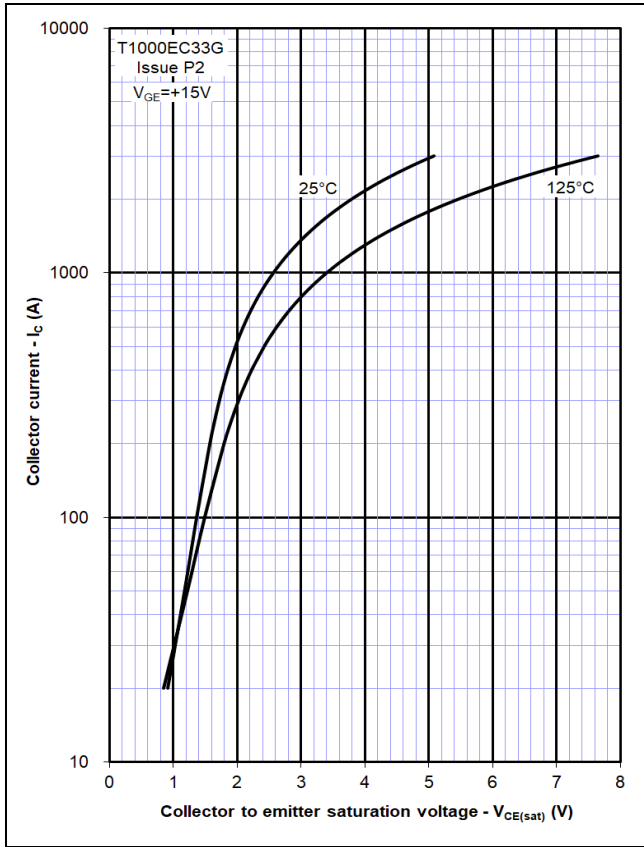


Figure 2 – Typical output characteristic

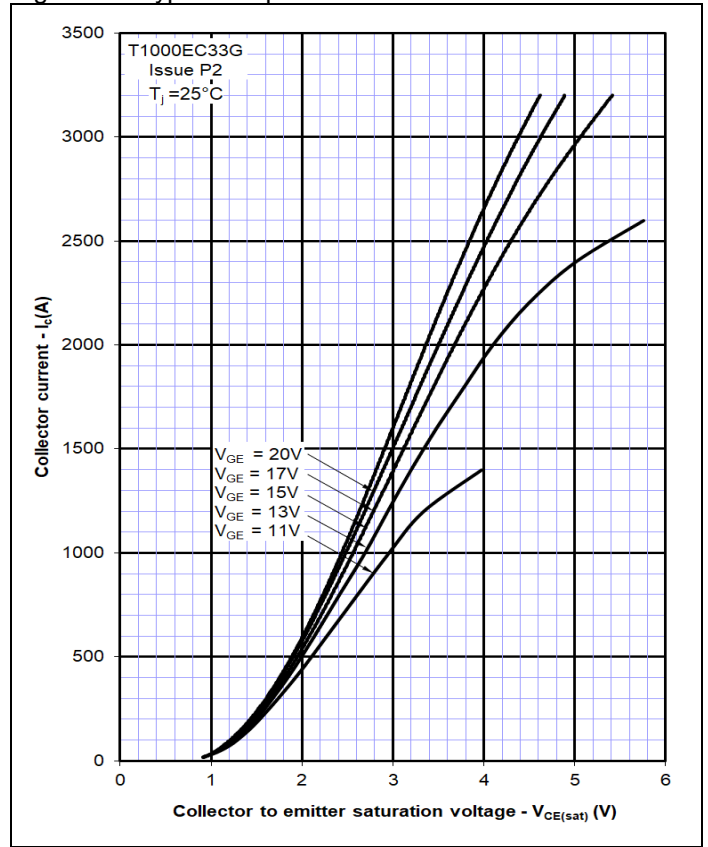


Figure 3 – Typical output characteristic

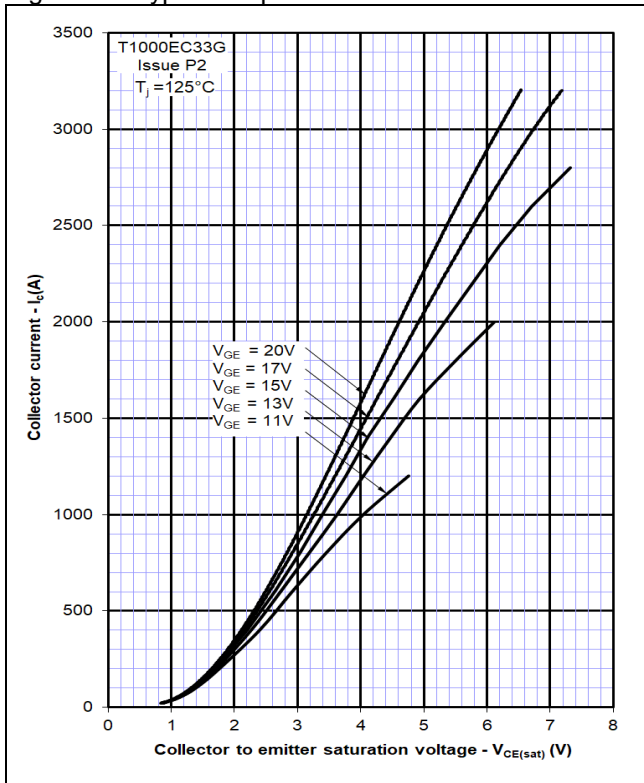


Figure 4 – Typical turn-on delay time vs gate resistance

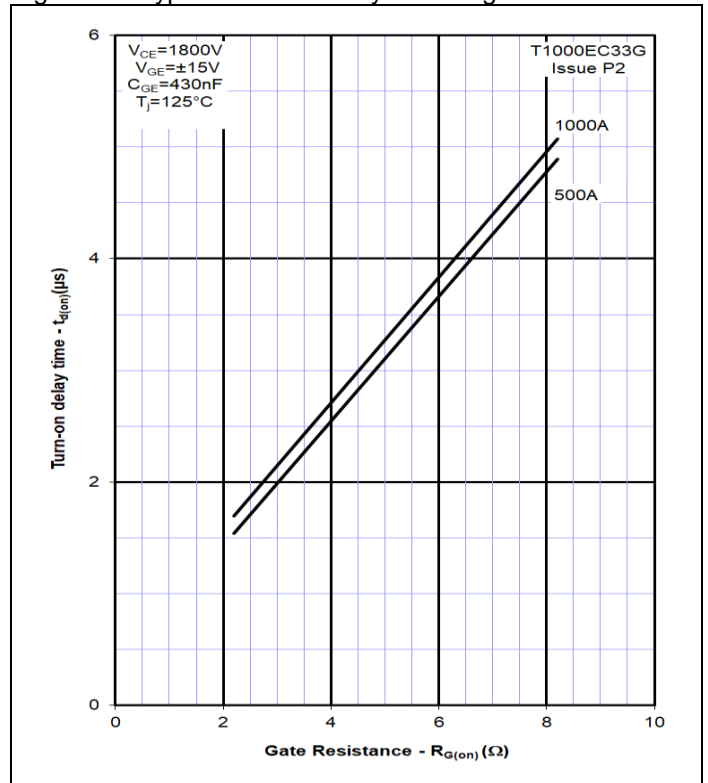


Figure 5 – Typical turn-off delay time vs. gate resistance

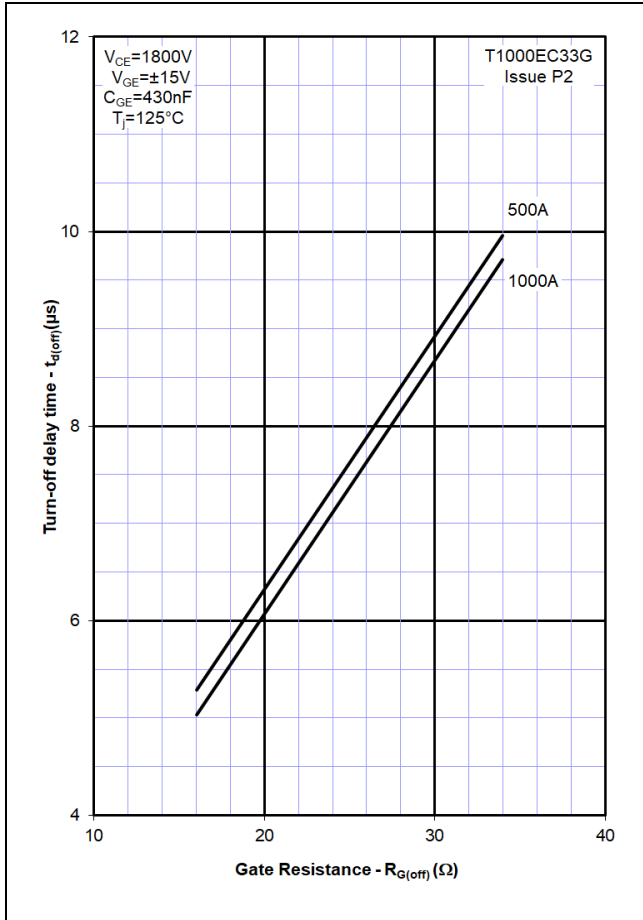


Figure 6 – Typical turn-on energy vs. collector current

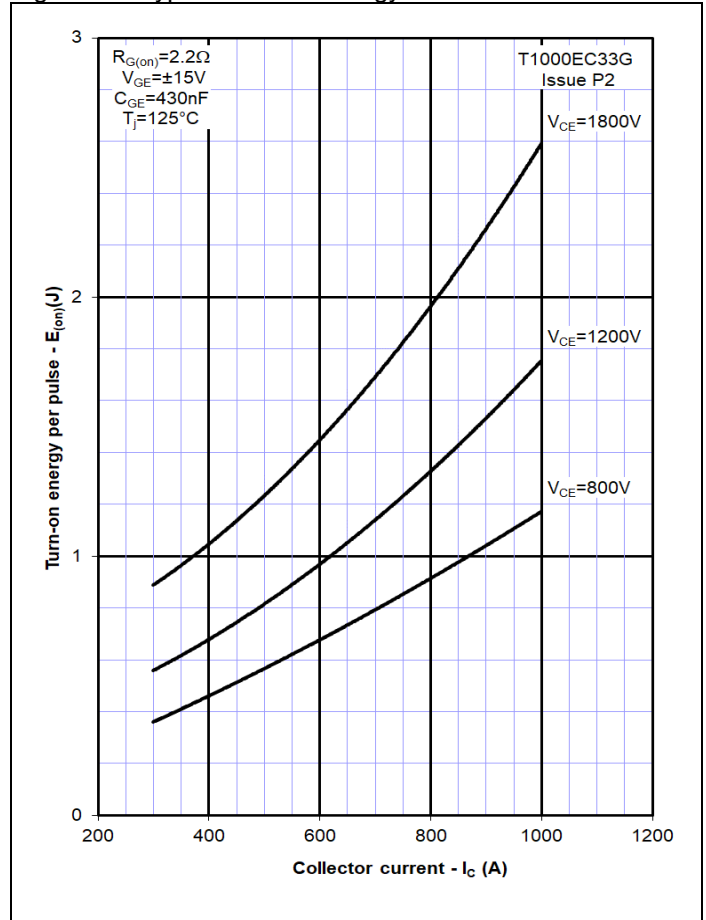


Figure 7 – Typical turn-on energy vs. di/dt

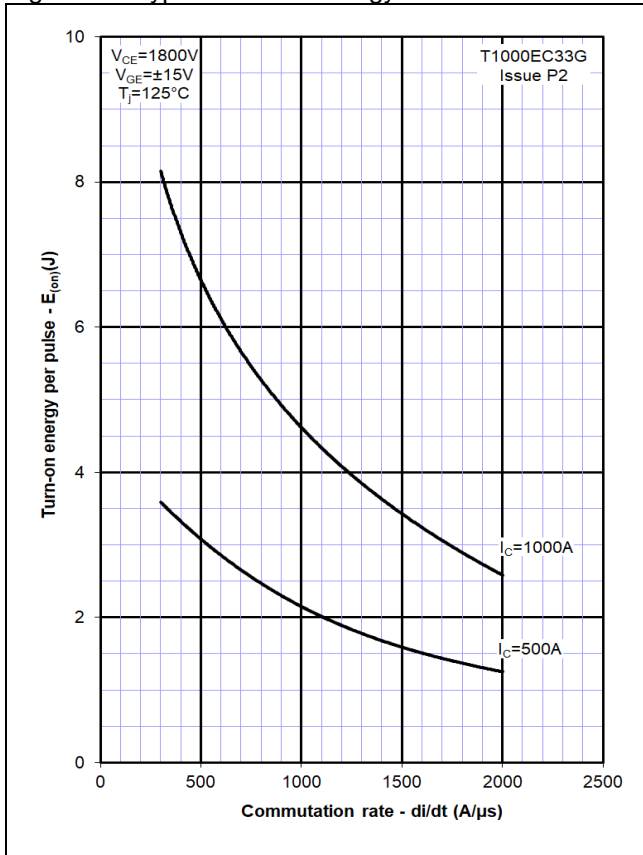


Figure 8 – Typical turn-off energy vs. collector current

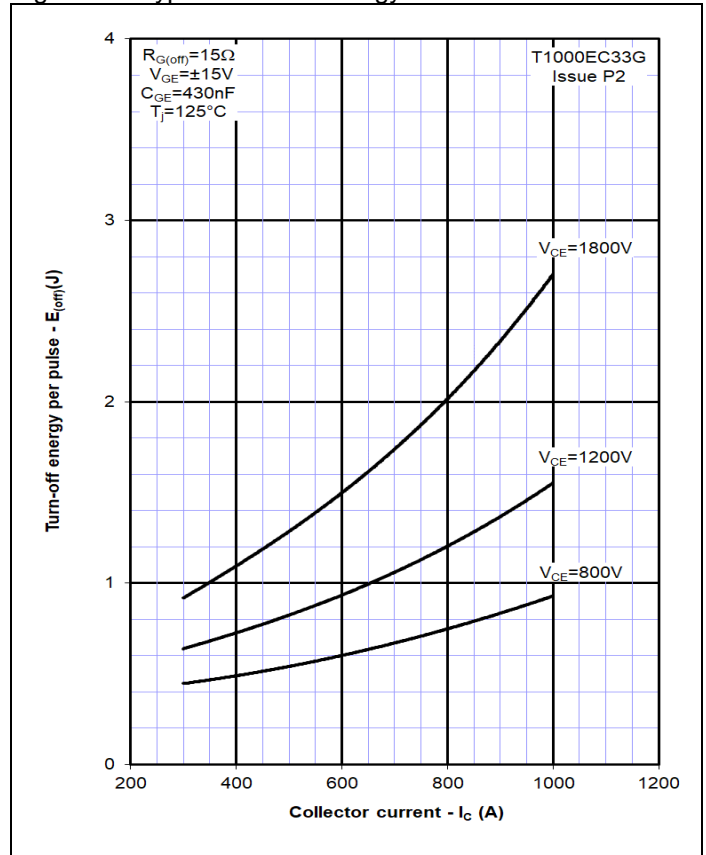


Figure 9 – Turn-off energy vs voltage

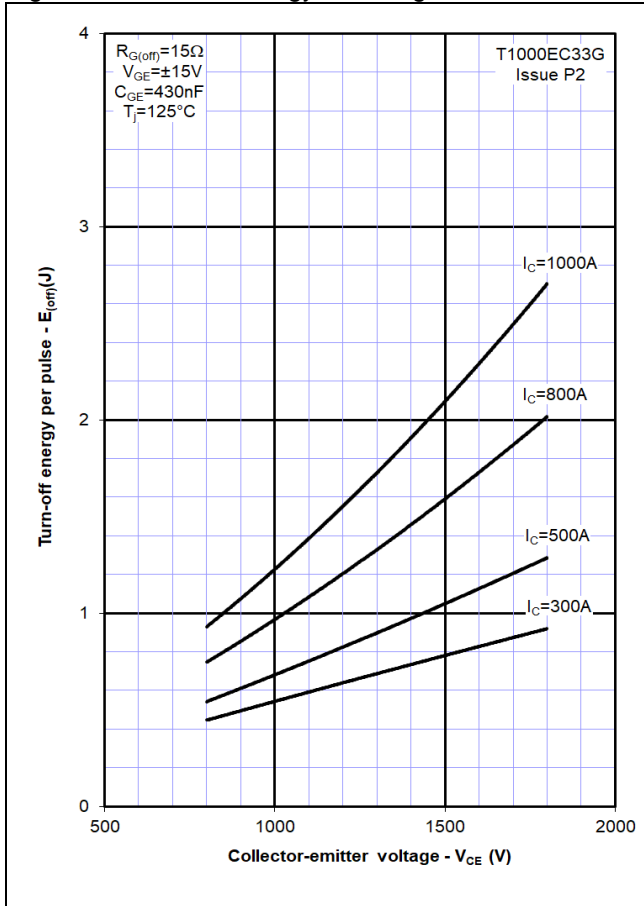


Figure 10 – Safe operating area (IGBT)

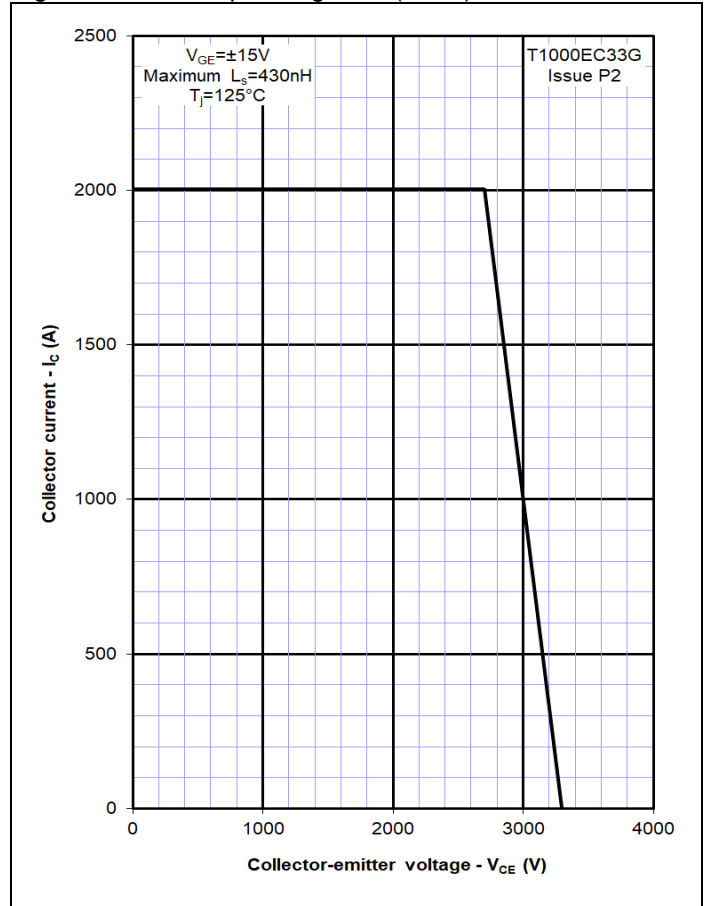


Figure 11 – Typical diode forward characteristics

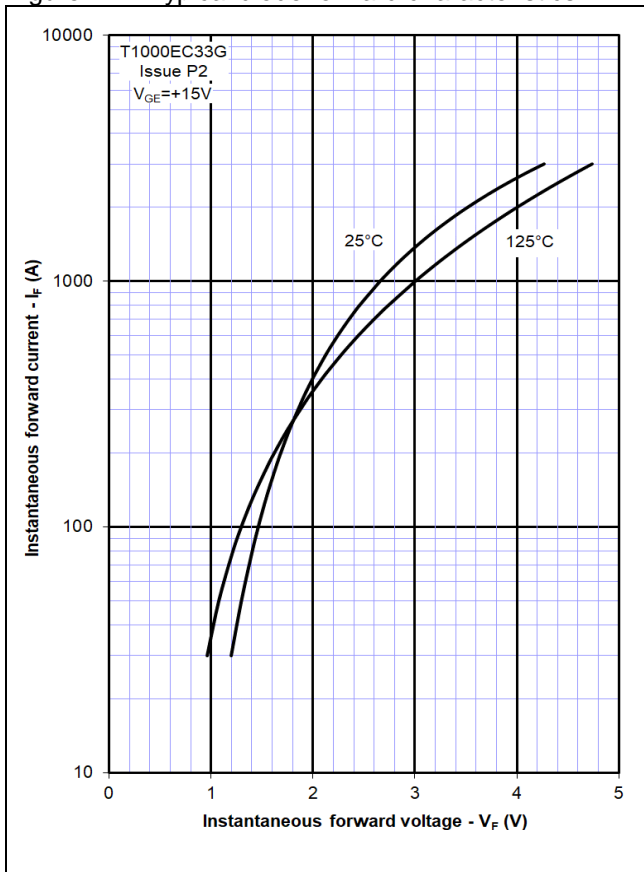


Figure 12 – Typical recovered charge

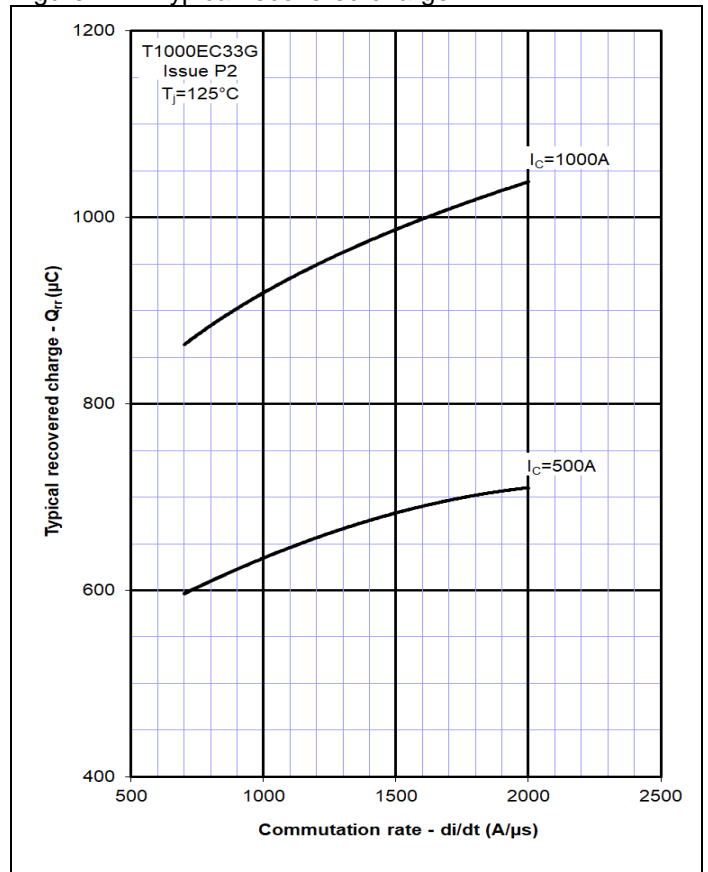


Figure 13 – Typical reverse recovery current

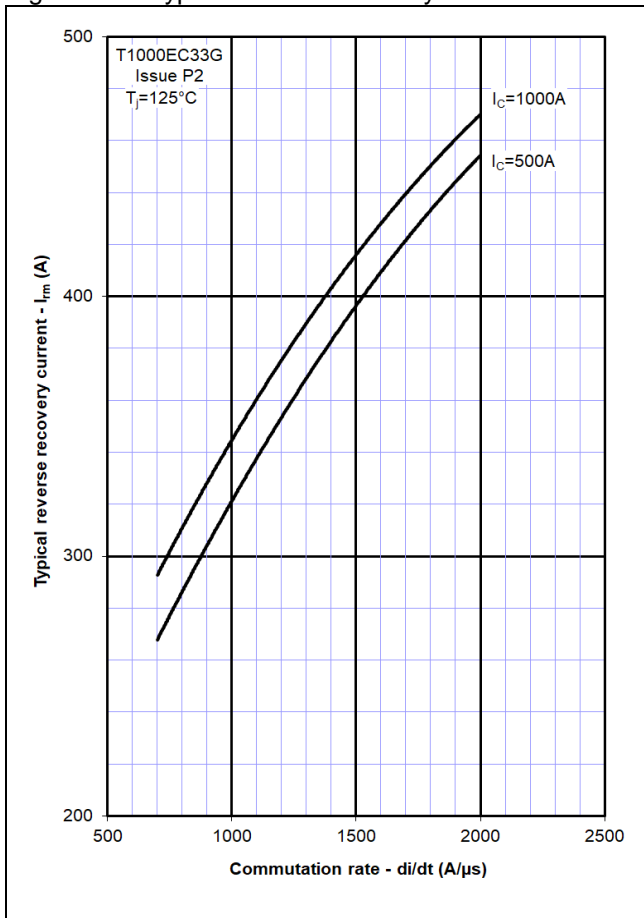


Figure 14 – Typical reverse recovery time

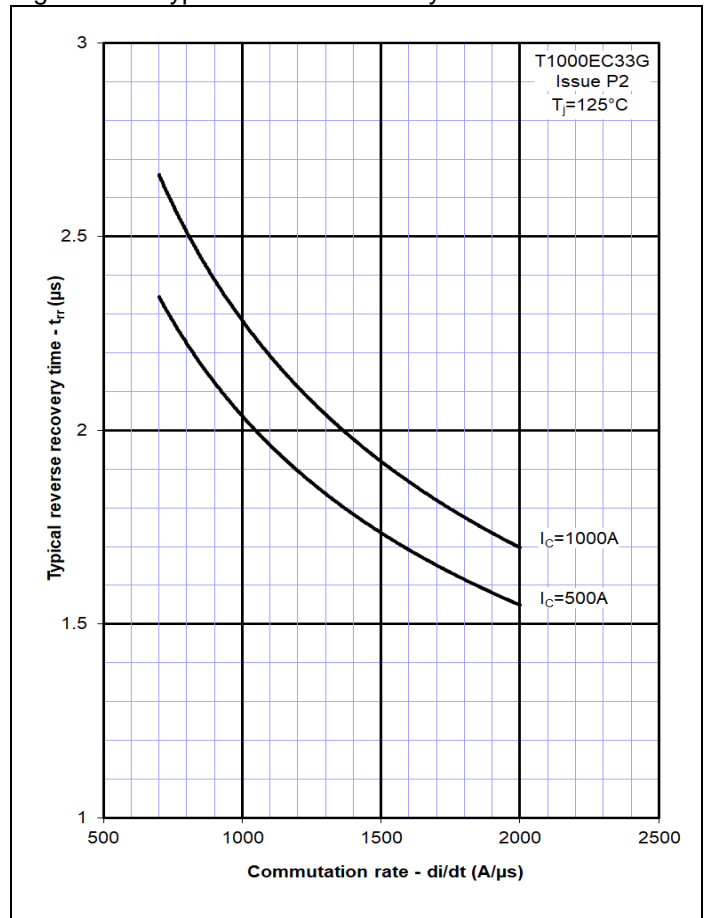


Figure 15 – Typical reverse recovery energy

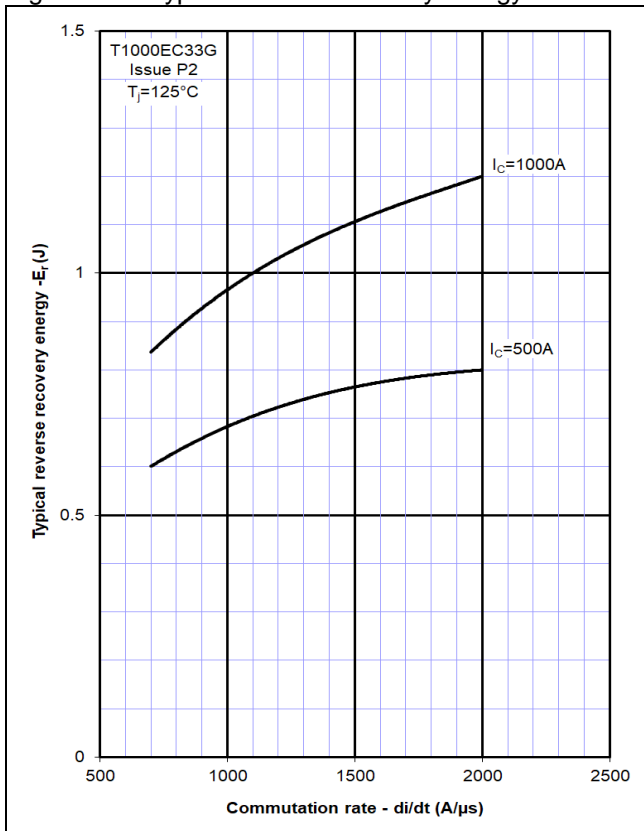


Figure 16 – Safe operating area (Diode)

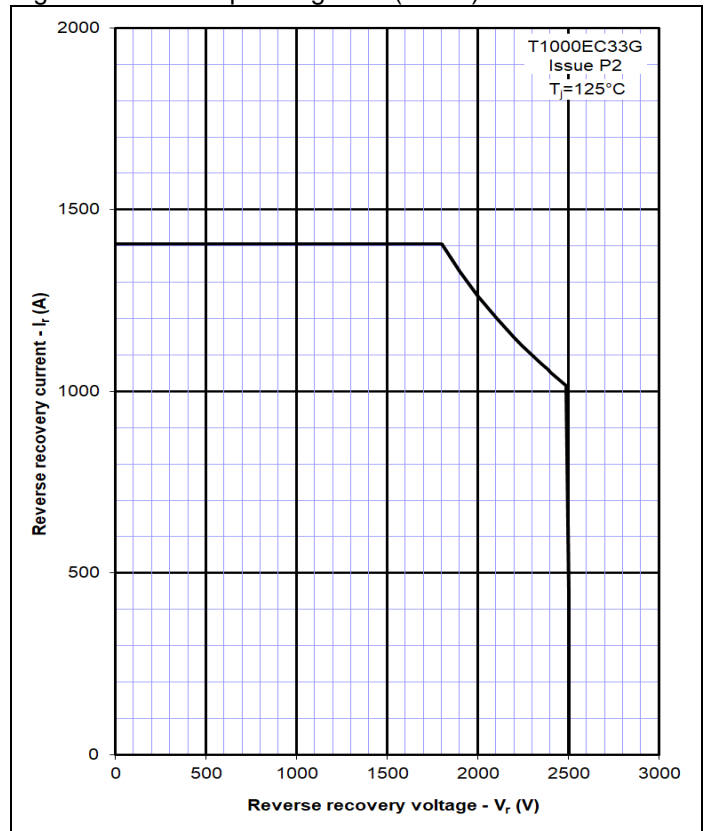


Figure 17 – Transient thermal impedance (IGBT)

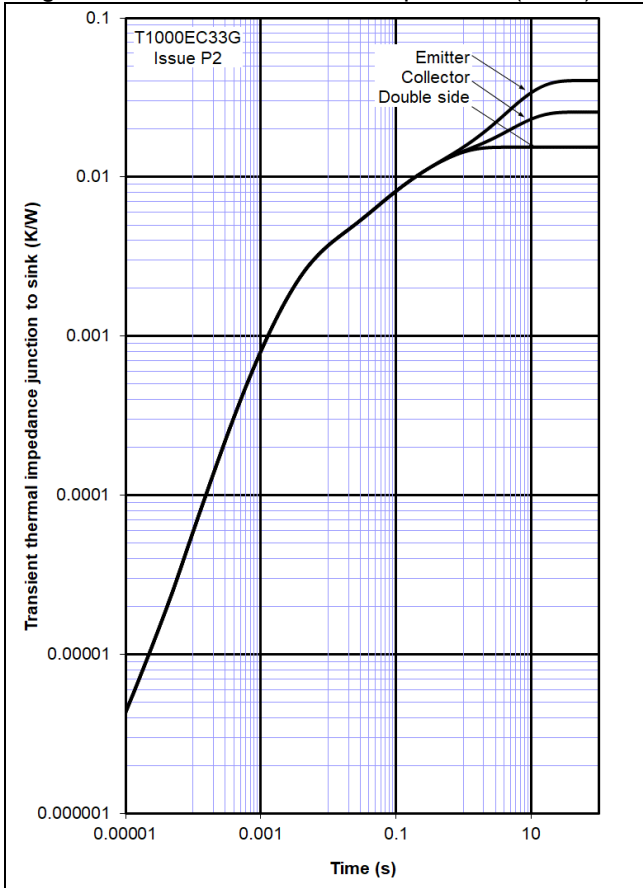
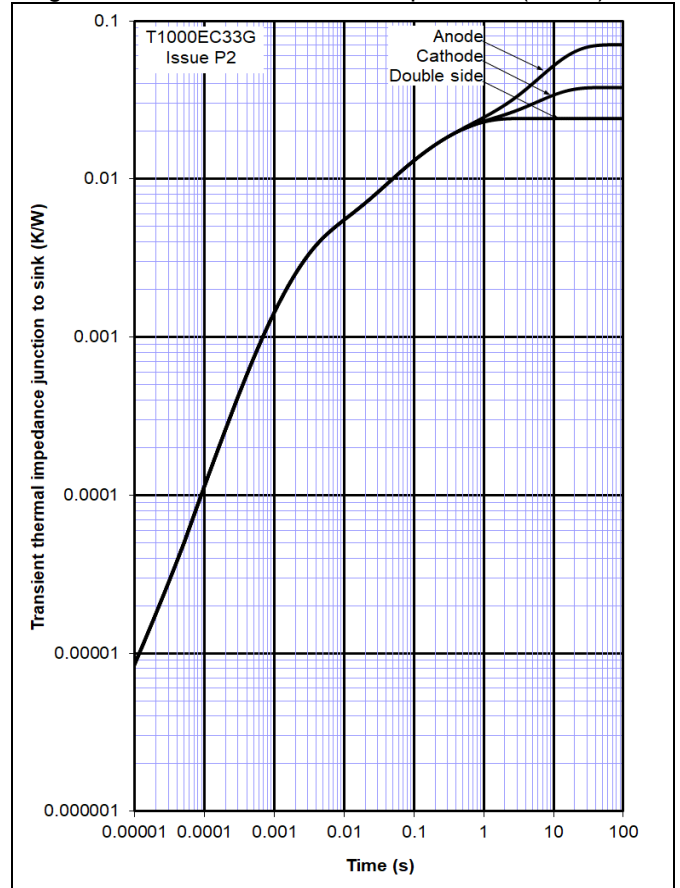
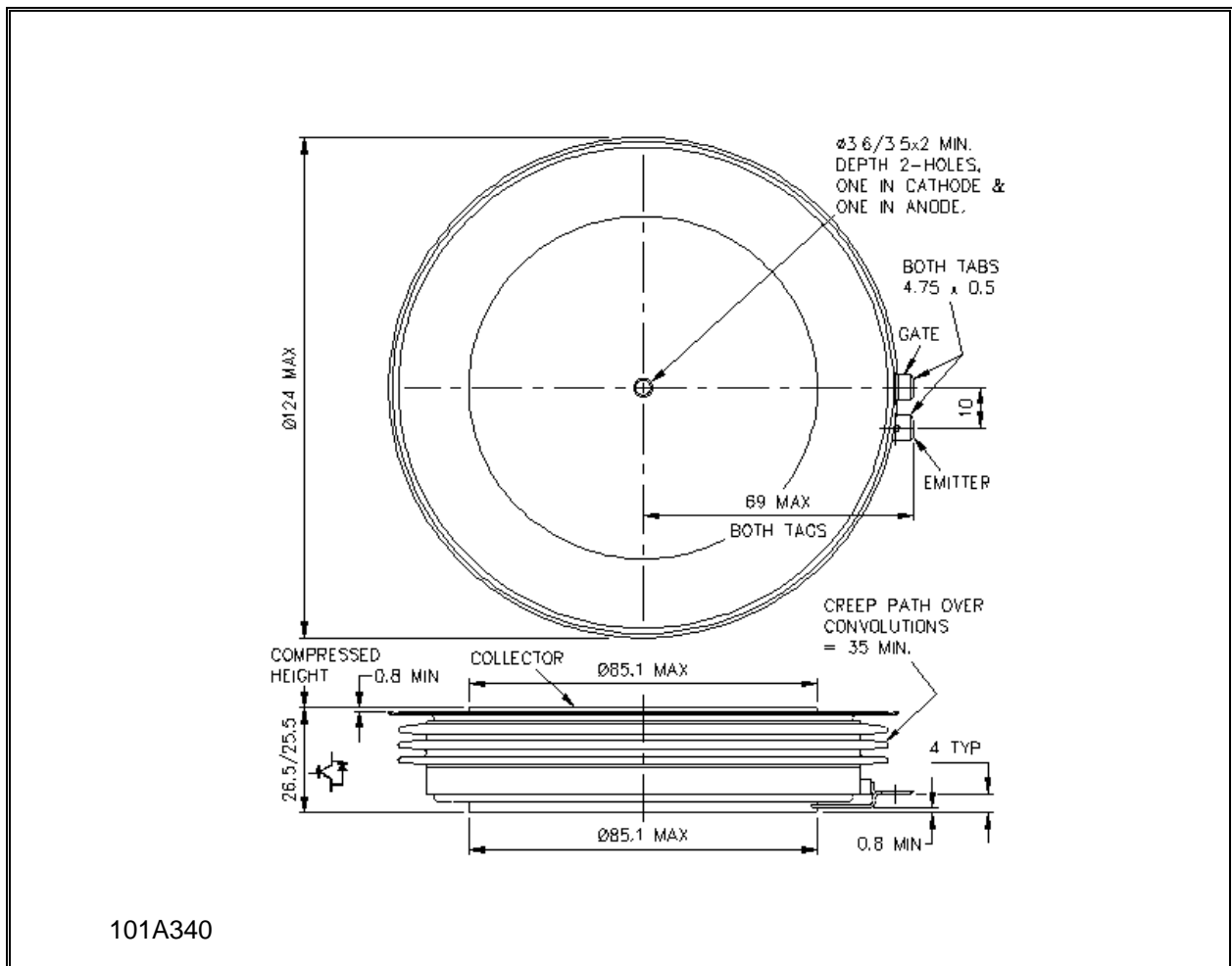


Figure 18 – Transient thermal impedance (Diode)



## Outline Drawing & Ordering Information



### 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 ( $V_{CES} = 3300V$ )

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