

Prospective Data  
**Insulated Gate Bi-Polar Transistor**  
**Type T0600AF65G**

**Absolute Maximum Ratings**

	<b>VOLTAGE RATINGS</b>	<b>MAXIMUM LIMITS</b>	<b>UNITS</b>
V <sub>CES</sub>	Collector – emitter voltage	6500	V
V <sub>CES</sub>	Collector – emitter voltage (T <sub>j</sub> 25°C)	6500	V
V <sub>CES</sub>	Collector – emitter voltage (T <sub>j</sub> -40°C)	6000	V
V <sub>DC link</sub>	Permanent DC voltage for 100 FIT failure rate.	3600	V
V <sub>GES</sub>	Peak gate – emitter voltage	±20	V

	<b>RATINGS</b>	<b>MAXIMUM LIMITS</b>	<b>UNITS</b>
I <sub>C</sub>	DC collector current, IGBT	600	A
I <sub>CRM</sub>	Repetitive peak collector current, t <sub>p</sub> =1ms, IGBT	1200	A
I <sub>F(DC)</sub>	Continuous DC forward current, Diode	600	A
I <sub>FRM</sub>	Repetitive peak forward current, t <sub>p</sub> =1ms, Diode	1200	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)	4910	A
I <sub>FSM2</sub>	Peak non-repetitive surge t <sub>p</sub> =10ms, V <sub>RM</sub> ≤10V, Diode (Note 4)	5400	A
P <sub>MAX</sub>	Maximum power dissipation, IGBT (Note 2)	7.1	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 430nH.
- 4) Half-sinewave, 125°C T<sub>j</sub> initial.

## Characteristics

### IGBT Characteristics

	PARAMETER	MIN	TYP	MAX	TEST CONDITIONS	UNITS
$V_{CE(sat)}$	Collector – emitter saturation voltage	-	3.6	-	$I_C = 600A, V_{GE} = 15V, T_j = 25^\circ C$	V
		4.4	4.8	5.2	$I_C = 600A, V_{GE} = 15V$	V
$V_{T0}$	Threshold voltage	-		2.49	Current range: 200A – 600A	V
$r_T$	Slope resistance	-		4.52		m $\Omega$
$V_{GE(TH)}$	Gate threshold voltage	-	5.2	-	$V_{CE} = V_{GE}, I_C = 600mA$	V
$I_{CES}$	Collector – emitter cut-off current	-	6	25	$V_{CE} = V_{CES}, V_{GE} = 0V$	mA
$I_{GES}$	Gate leakage current	-	-	30	$V_{GE} = \pm 20V$	$\mu A$
$C_{ies}$	Input capacitance	-	105	-	$V_{CE} = 10V, V_{GE} = 0V, f = 100kHz, T_j = 25^\circ C$	nF
$t_{d(on)}$	Turn-on delay time	-	1.6	-	$I_C = 600A, V_{CE} = 3600V, di/dt = 1500A/\mu s$	$\mu s$
$t_r(V)$	Rise time	-	3.4	-		$\mu s$
$Q_{g(on)}$	Turn-on gate charge	-	3.5	-	$V_{GE} = \pm 15V, L_g = 430nH$	$\mu C$
$E_{on}$	Turn-on energy	-	4.2	-	$R_{g(ON)} = 5.1\Omega, R_{g(OFF)} = 16\Omega, C_{GE} = 56nF$	J
$t_{d(off)}$	Turn-off delay time	-	4.8	-	Integral diode used as freewheel diode (Note 3 & 4)	$\mu s$
$t_f(l)$	Fall time	-	2.1	-		$\mu s$
$Q_{g(off)}$	Turn-off gate charge	-	5.8	-		$\mu C$
$E_{off}$	Turn-off energy	-	3.4	-		J
$I_{SC}$	Short circuit current	-	3250	-	$V_{GE} = +15V, V_{CC} = 3600V, V_{CEmax} \leq V_{CES}, t_p \leq 10\mu s$	A

### Diode Characteristics

	PARAMETER	MIN	TYP	MAX	TEST CONDITIONS	UNITS
$V_F$	Forward voltage	-	3.1	-	$I_F = 600A, T_j = 25^\circ C$	V
		-	3.45	3.85	$I_F = 600A$	V
$V_{T0}$	Threshold voltage	-	-	1.89	Current range 200A – 600A	V
$r_T$	Slope resistance	-	-	3.27		m $\Omega$
$I_{rm}$	Peak reverse recovery current	-	700	-	$V_i = 3600V, I_F = 600A, V_{GE} = -15V, di/dt = 1500A/\mu s$	A
$Q_{rr}$	Recovered charge	-	960	-		$\mu C$
$t_{rr}$	Reverse recovery time, 50% chord	-	1.1	-		$\mu s$
$E_r$	Reverse recovery energy	-	1.4	-		J

### Thermal Characteristics

	PARAMETER	MIN	TYP	MAX	TEST CONDITIONS	UNITS
$R_{thJK}$	Thermal resistance junction to sink, IGBT	-	-	14.1	Double side cooled	K/kW
		-	-	21.4	Collector side cooled	K/kW
		-	-	41.3	Emitter side cooled	K/kW
$R_{thJK}$	Thermal resistance junction to sink, Diode	-	-	24.3	Double side cooled	K/kW
		-	-	35.1	Cathode side cooled	K/kW
		-	-	78.4	Anode side cooled	K/kW
F	Mounting force	25	-	35	Note 2	kN
$W_t$	Weight	-	1.7	-		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

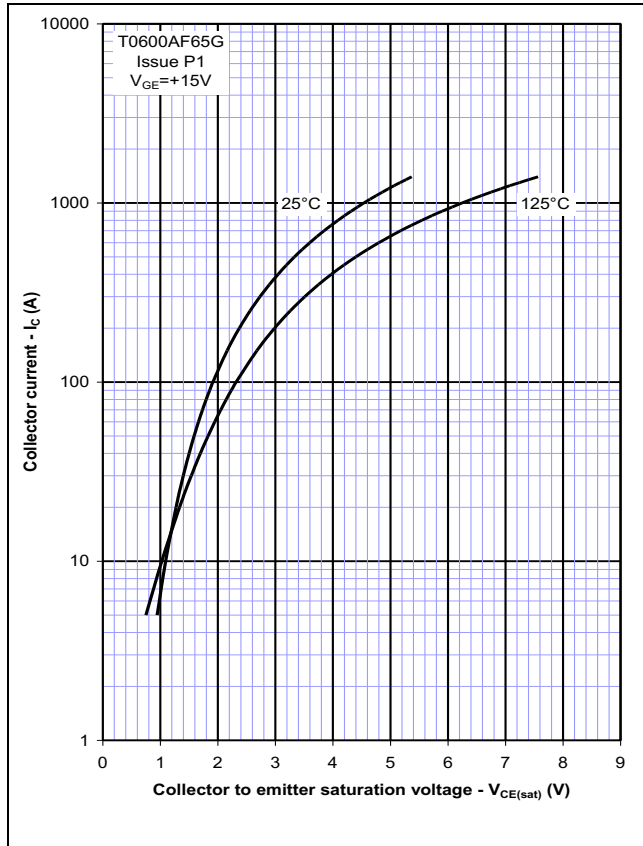


Figure 2 – Typical output characteristic

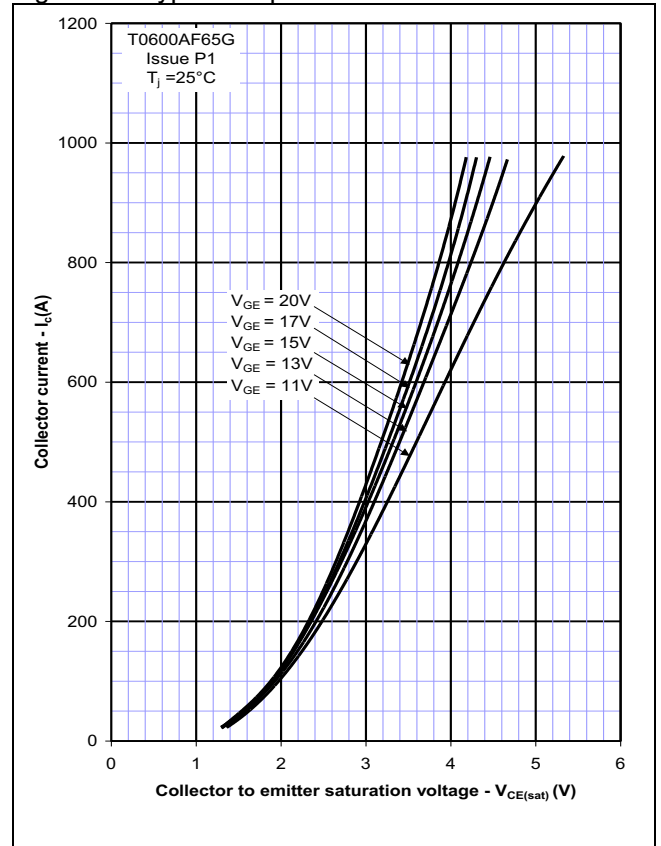


Figure 3 – Typical output characteristic

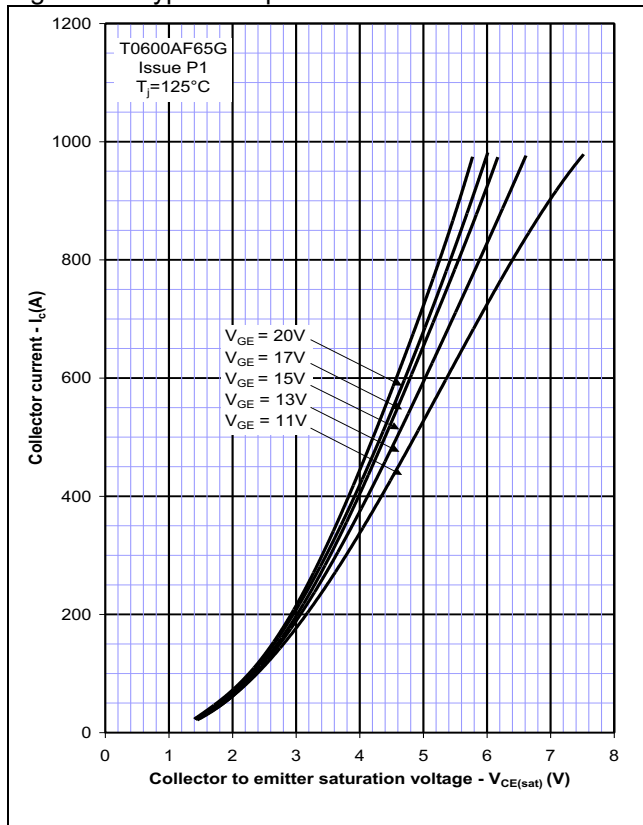


Figure 4 – Typical turn-on delay time vs gate resistance

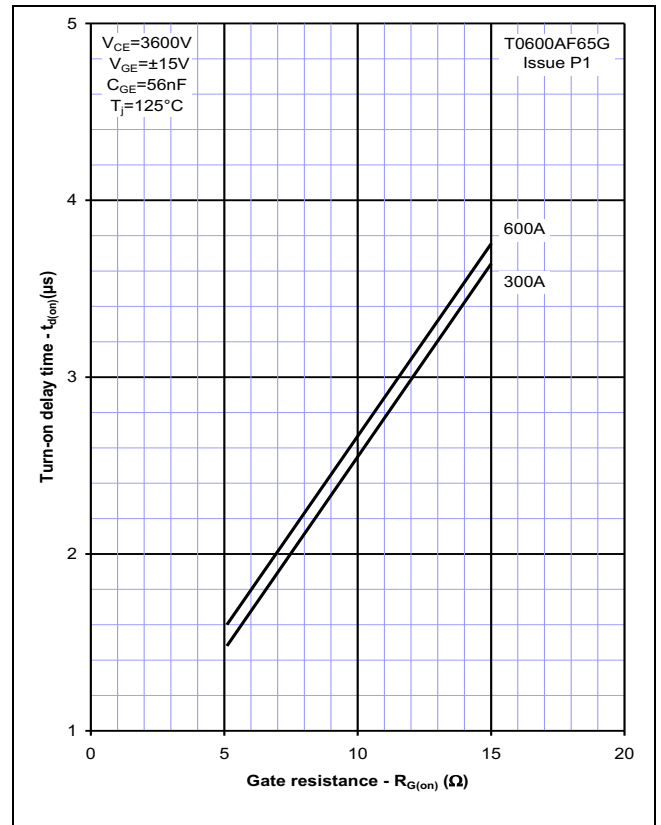


Figure 5 – Typical turn-off delay time vs. gate resistance

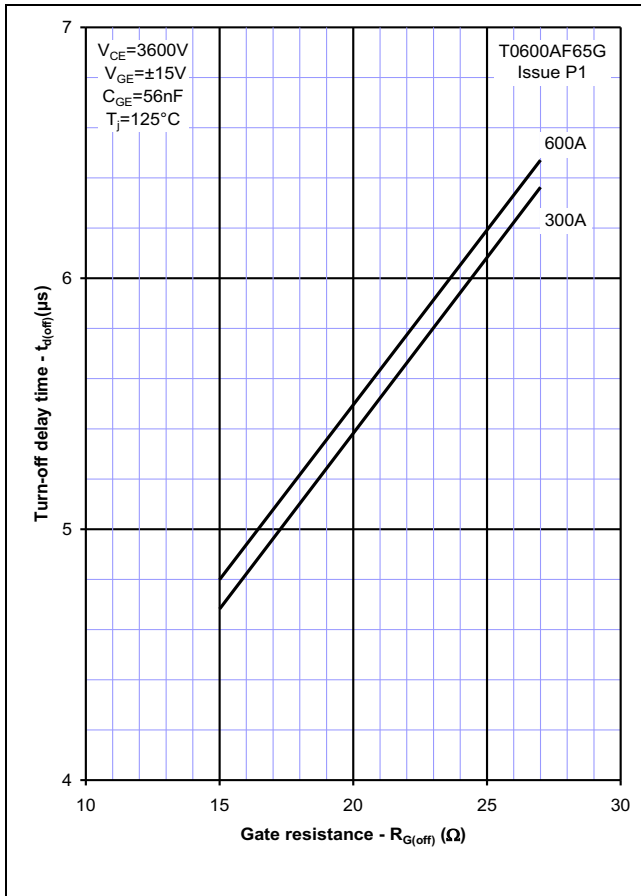


Figure 6 – Typical turn-on energy vs. collector current

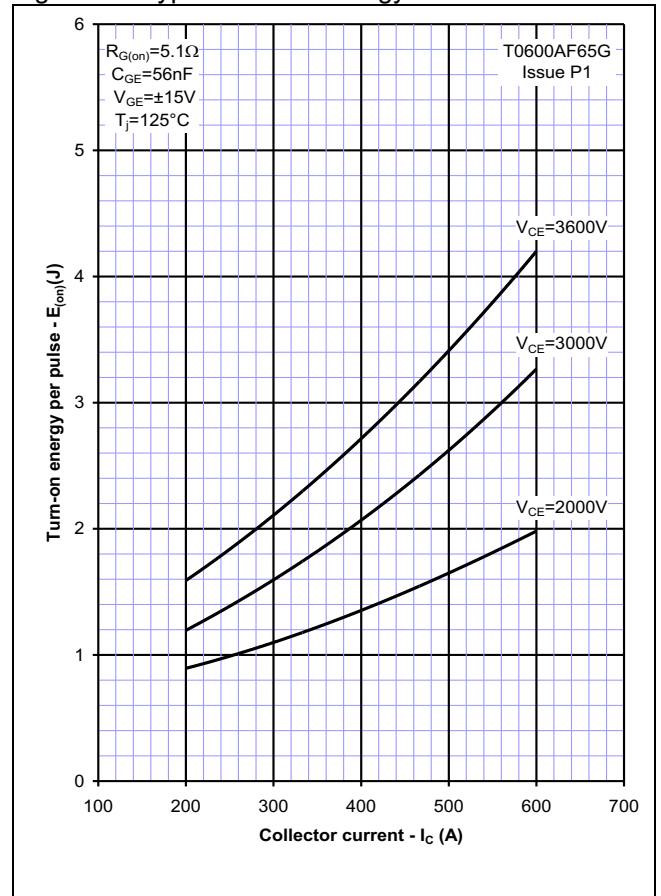


Figure 7 – Typical turn-on energy vs. di/dt

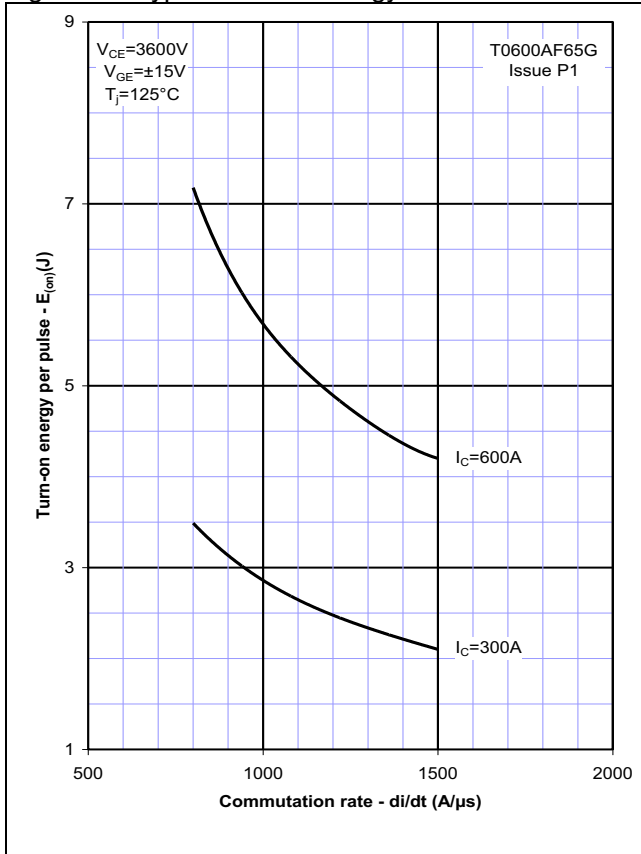


Figure 8 – Typical turn-off energy vs. collector current

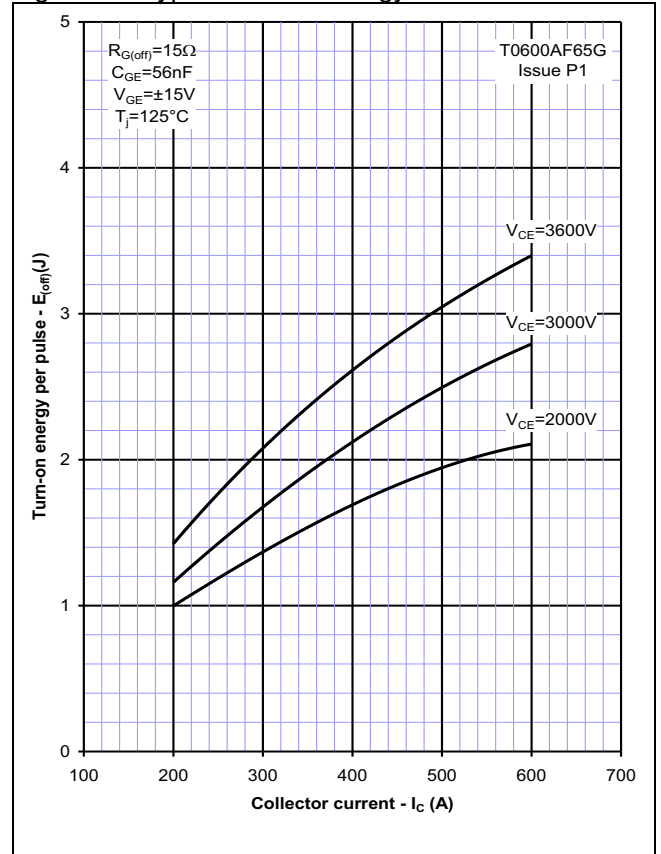


Figure 9 – Turn-off energy vs voltage

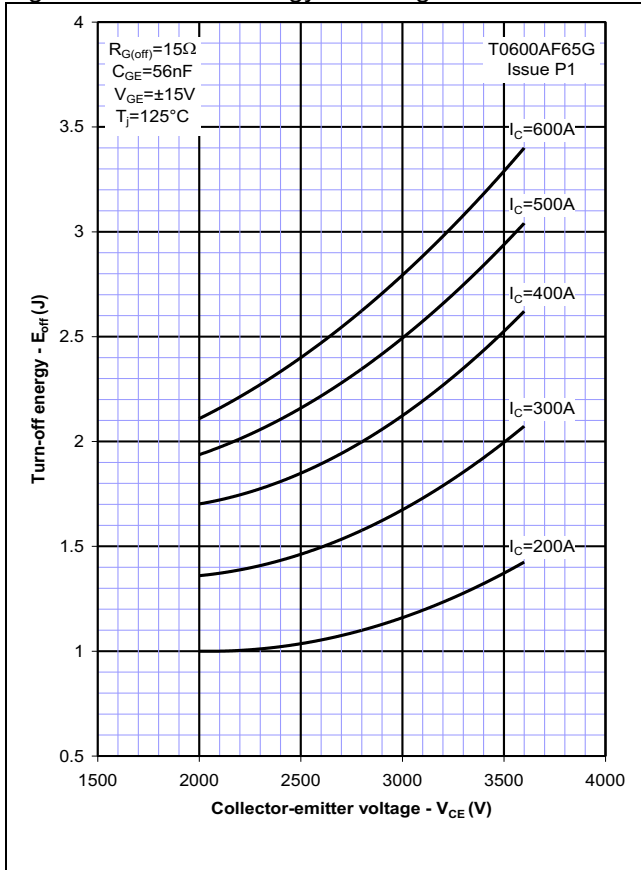


Figure 10 – Safe operating area (IGBT)

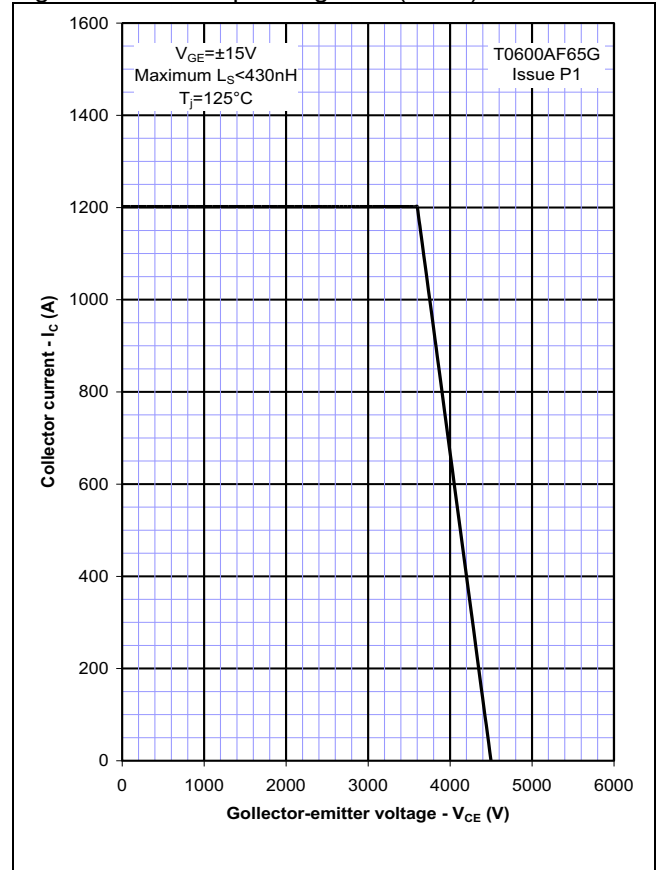


Figure 11 – Typical diode forward characteristics

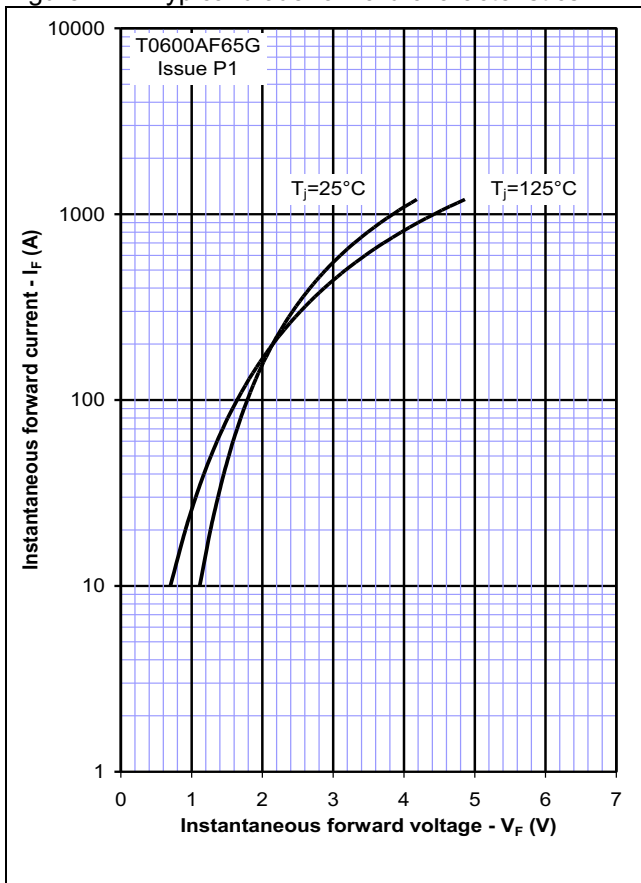


Figure 12 – Typical recovered charge

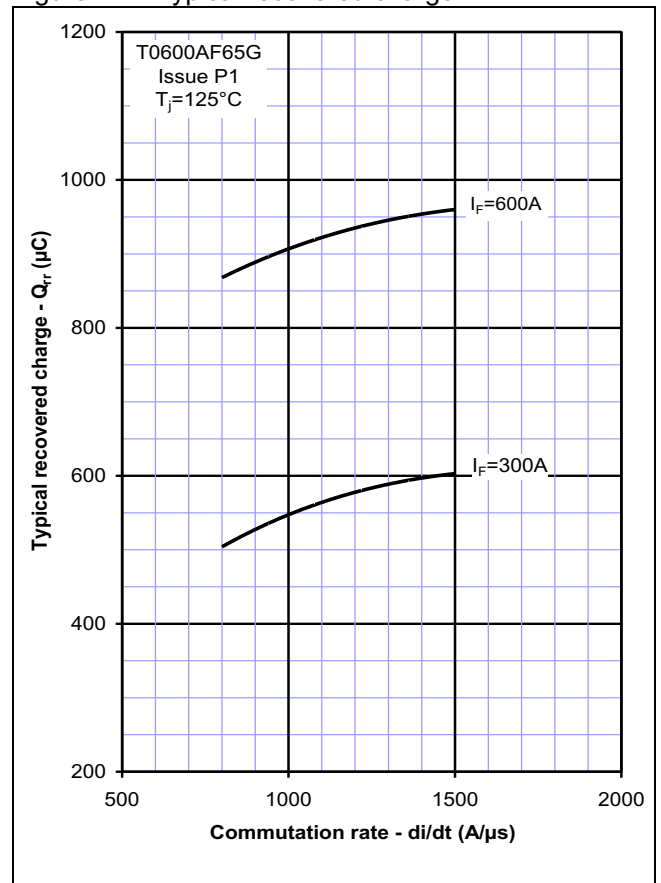


Figure 13 – Typical reverse recovery current

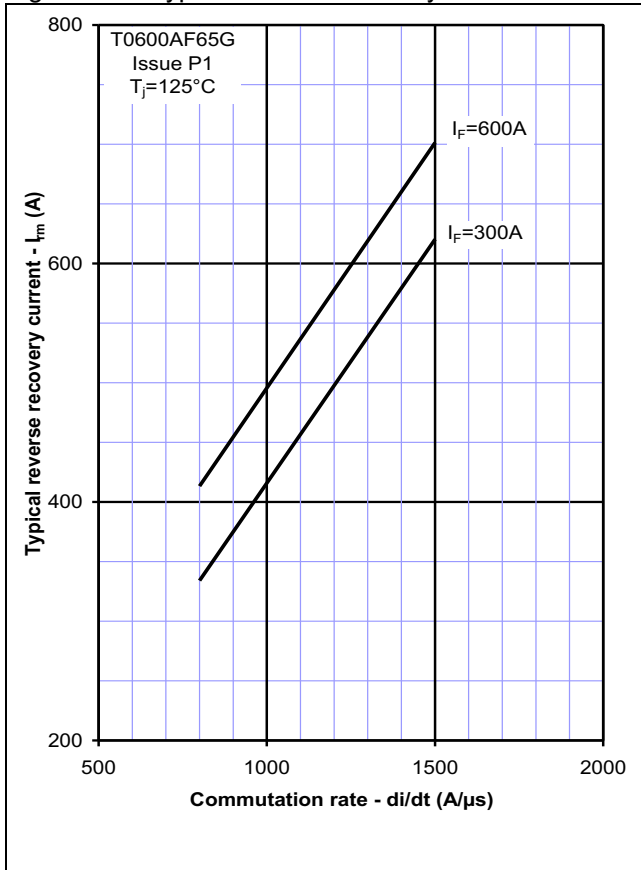


Figure 14 – Typical reverse recovery time

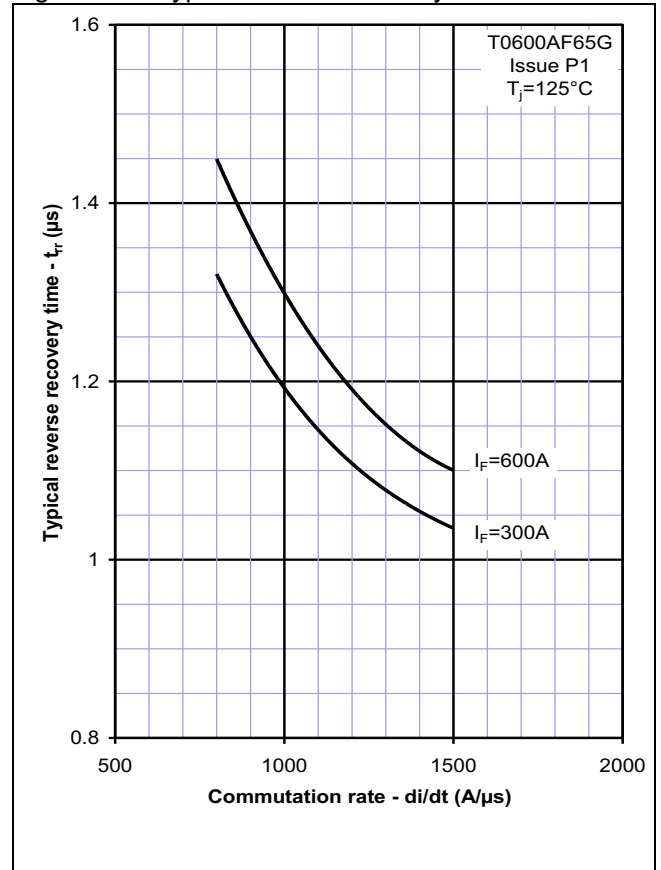


Figure 15 – Typical reverse recovery energy

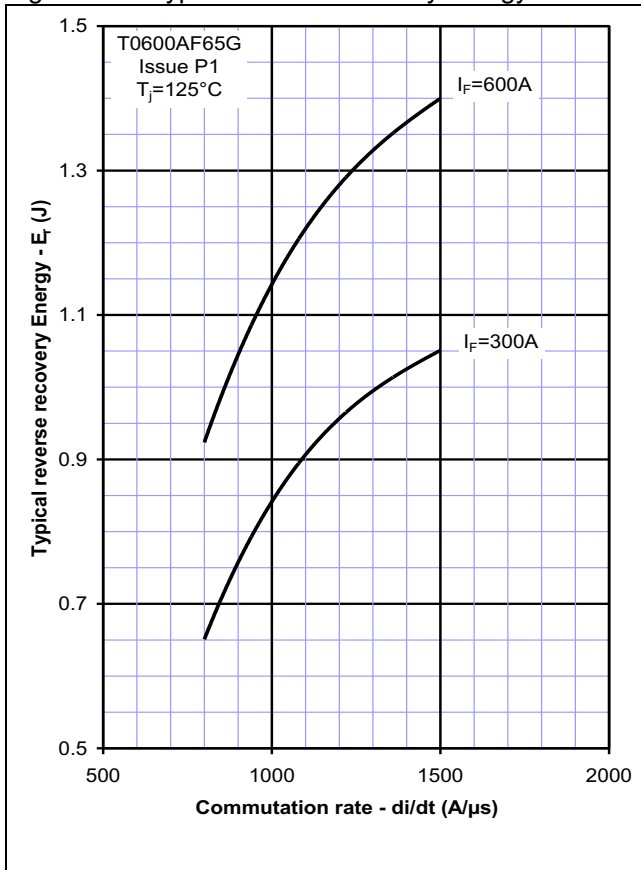


Figure 16 – Safe operating area (Diode)

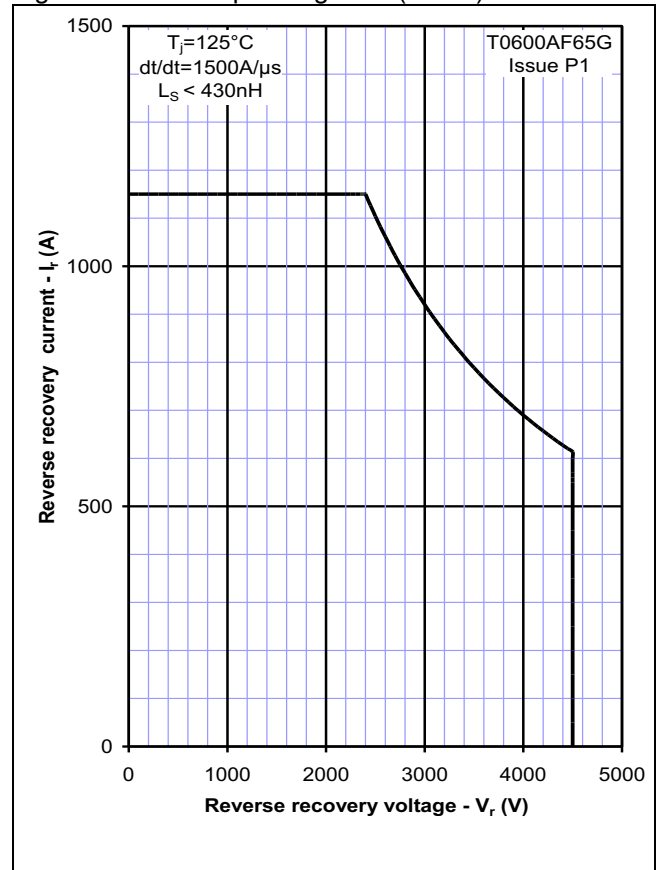


Figure 17 – Transient thermal impedance (IGBT)

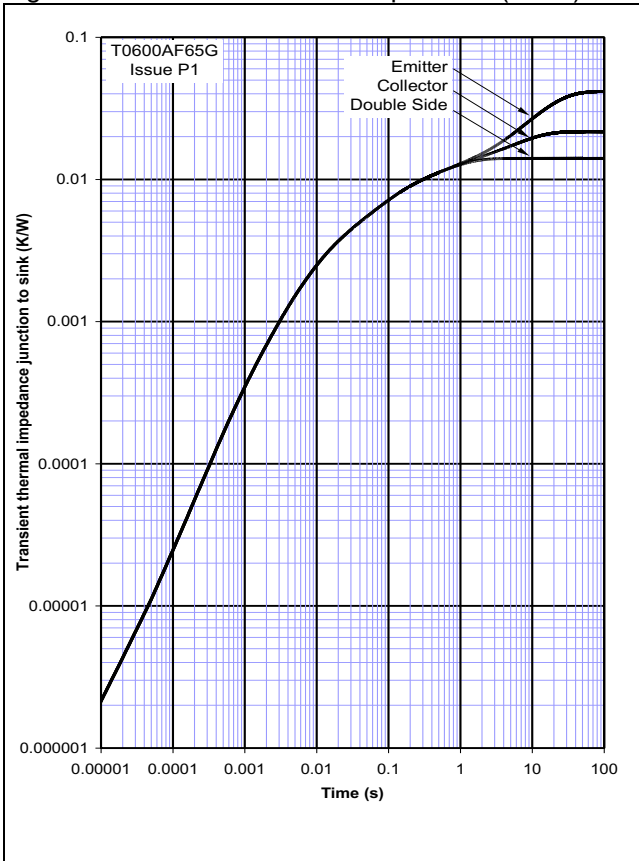
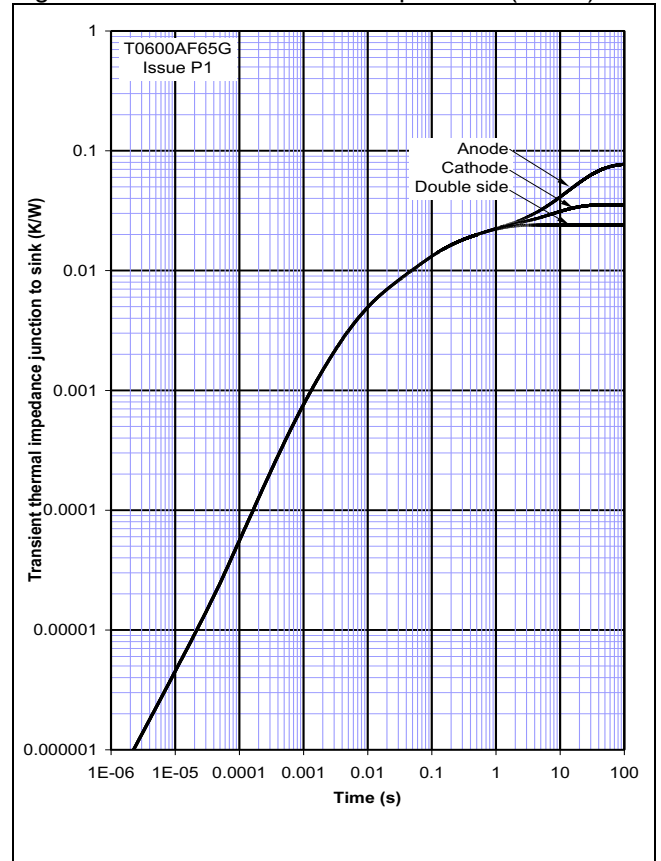
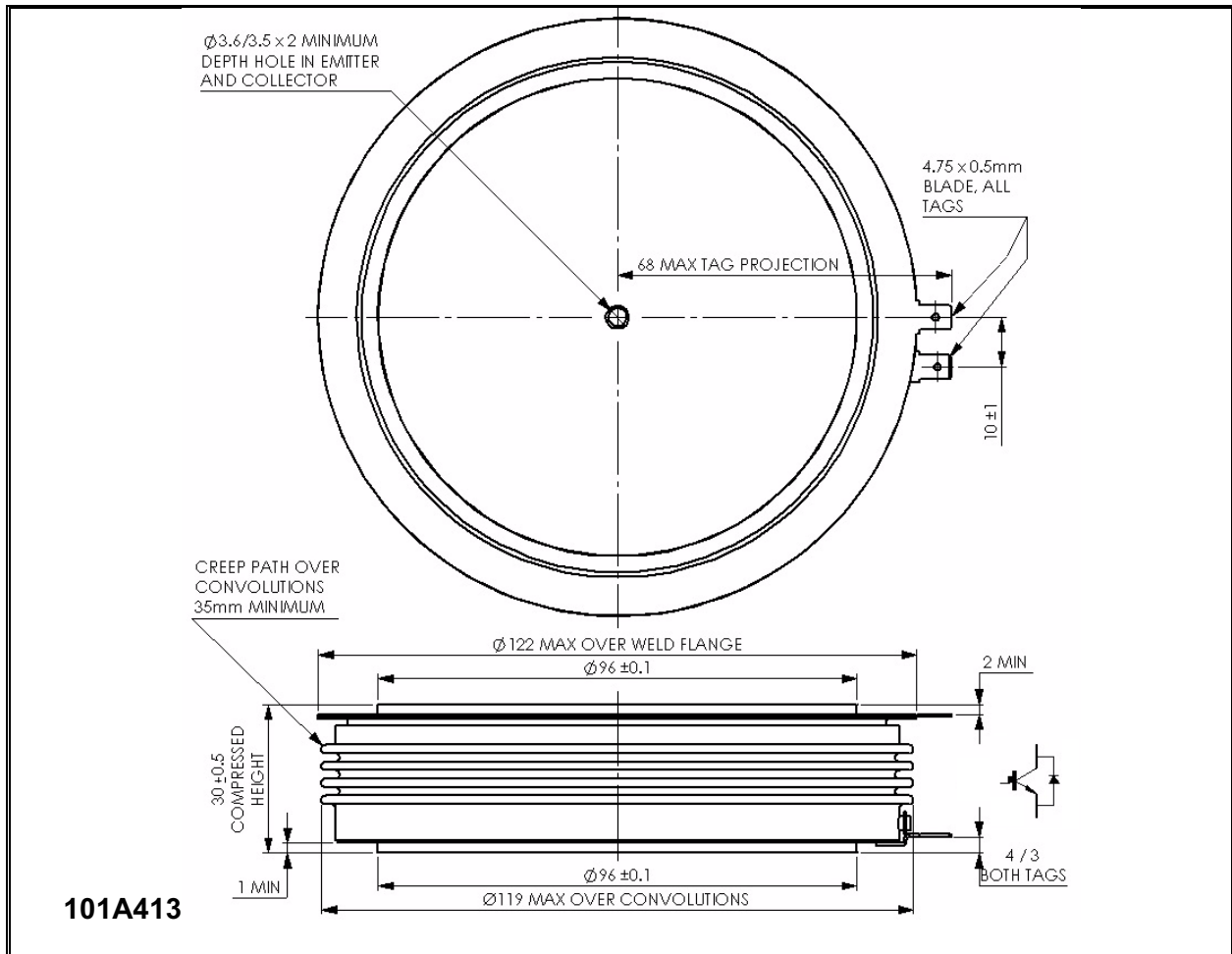


Figure 18 – Transient thermal impedance (Diode)



**Outline Drawing & Ordering Information**



**ORDERING INFORMATION**

(Please quote 10 digit code as below)

<b>T0600</b>	<b>AF</b>	<b>65</b>	<b>G</b>
Fixed type Code	Fixed Outline Code	Voltage Grade $V_{CES}/100$ 65	Fixed format code

Typical order code: T0600AF65G ( $V_{CES} = 6500V$ )

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