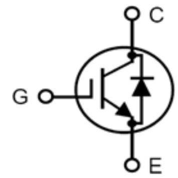
IXYS

XPT™ 650V IGBT GenX4™ w/ Sonic Diode

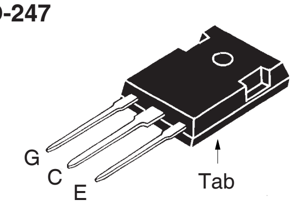
IXXH60N65B4H1

V_{CES} = 650V
I_{C110} = 60A
$V_{CE(sat)} \leq$ 2.2V
$t_{fi(typ)}$ = 43ns

Extreme Light Punch Through IGBT for 5-30 kHz Switching



TO-247



G = Gate, C = Collector
E = Emitter, Tab = Collector

Symbol	Test Conditions	Maximum Ratings	
V_{CES}	T_J = 25°C to 175°C	650	V
V_{CGR}	T_J = 25°C to 175°C, R_{GE} = 1MΩ	650	V
V_{GES}	Continuous	±20	V
V_{GEM}	Transient	±30	V
I_{C25}	T_C = 25°C (Chip Capability)	145	A
I_{C110}	T_C = 110°C	60	A
I_{F110}	T_C = 110°C	47	A
I_{CM}	T_C = 25°C, 1ms	265	A
SSOA	V_{GE} = 15V, T_{VJ} = 150°C, R_G = 5Ω	I_{CM} = 120	A
(RBSOA)	Clamped Inductive Load	@$V_{CE} \leq V_{CES}$	
t_{sc}	V_{GE} = 15V, V_{CE} = 360V, T_J = 150°C	10	µs
(SCSOA)	R_G = 82Ω, Non Repetitive		
P_C	T_C = 25°C	536	W
T_J		-55 ... +175	°C
T_{JM}		175	°C
T_{stg}		-55 ... +175	°C
T_L	Maximum Lead Temperature for Soldering	300	°C
T_{SOLD}	1.6 mm (0.062in.) from Case for 10s	260	°C
M_d	Mounting Torque	1.13/10	Nm/lb.in
Weight		6	g

Features

- Optimized for 5-30kHz Switching
- Square RBSOA
- Anti-Parallel Sonic Diode
- Short Circuit Capability
- International Standard Package

Advantages

- High Power Density
- Extremely Rugged
- Low Gate Drive Requirement

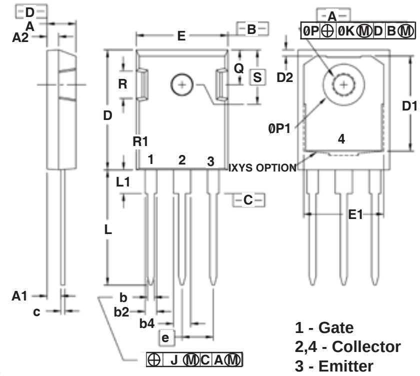
Applications

- Power Inverters
- UPS
- Motor Drives
- SMPS
- PFC Circuits
- Battery Chargers
- Welding Machines
- Lamp Ballasts

Symbol	Test Conditions (T_J = 25°C, Unless Otherwise Specified)	Characteristic Values Min.	Typ.	Max.	
BV_{CES}	I_C = 250µA, V_{GE} = 0V	650			V
$V_{GE(th)}$	I_C = 250µA, V_{CE} = V_{GE}	4.0		6.5	V
I_{CES}	V_{CE} = V_{CES}, V_{GE} = 0V			25	µA
	T_J = 150°C			3	mA
I_{GES}	V_{CE} = 0V, V_{GE} = ±20V			±100	nA
$V_{CE(sat)}$	I_C = 60A, V_{GE} = 15V, Note 1		1.8	2.2	V
	T_J = 150°C		2.1		V

Symbol	Test Conditions (T_J = 25°C Unless Otherwise Specified)	Characteristic Values Min.	Typ.	Max.	
g_{fs}	I_C = 60A, V_{CE} = 10V, Note 1	17	28		S
C_{ies}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz		2590		pF
C_{oes}			310		pF
C_{res}			40		pF
$Q_{g(on)}$	I_C = 60A, V_{GE} = 15V, V_{CE} = 0.5 • V_{CES}		86		nC
Q_{ge}			22		nC
Q_{gc}			35		nC
$t_{d(on)}$	**Inductive load, T_J = 25°C**		19		ns
t_{ri}	I_C = 60A, V_{GE} = 15V		80		ns
E_{on}	V_{CE} = 400V, R_G = 5Ω		3.2		mJ
$t_{d(off)}$	Note 2		107		ns
t_{fi}			43		ns
E_{off}			1.1		mJ
$t_{d(on)}$	**Inductive load, T_J = 150°C**		20		ns
t_{ri}	I_C = 60A, V_{GE} = 15V		74		ns
E_{on}	V_{CE} = 400V, R_G = 5Ω		4.2		mJ
$t_{d(off)}$	Note 2		120		ns
t_{fi}			88		ns
E_{off}			1.8		mJ
R_{thJC}				0.28	°C/W
R_{thCS}			0.21		°C/W

TO-247 (IXXH) Outline



1 - Gate
2,4 - Collector
3 - Emitter

SYM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	.190	.205	4.83	5.21
A1	.090	.100	2.29	2.54
A2	.075	.085	1.91	2.16
b	.045	.055	1.14	1.40
b2	.075	.087	1.91	2.20
b4	.115	.126	2.92	3.20
C	.024	.031	0.61	0.80
D	.819	.840	20.80	21.34
D1	.650	.690	16.51	17.53
D2	.035	.050	0.89	1.27
E	.620	.635	15.75	16.13
E1	.545	.565	13.84	14.35
e	.215 BSC		5.45 BSC	
J	--	.010	--	0.25
K	--	.025	--	0.64
L	.780	.810	19.81	20.57
L1	.150	.170	3.81	4.32
øP	.140	.144	3.55	3.65
øP1	.275	.290	6.99	7.37
Q	.220	.244	5.59	6.20
R	.170	.190	4.32	4.83
S	.242 BSC		6.15 BSC	

Reverse Sonic Diode (FRD)

Symbol	Test Conditions (T_J = 25°C Unless Otherwise Specified)		Characteristic Values Min.	Typ.	Max.	
V_F	I_F = 30A, V_{GE} = 0V, Note 1				2.5	V
		T_J = 150°C		1.5		V
I_{RM}	I_F = 30A, V_{GE} = 0V,	T_J = 150°C		25		A
t_{rr}	$-di_F/dt$ = 900A/μs, V_R = 300V	T_J = 150°C		78		ns
R_{thJC}					0.60	°C/W

Notes:

1. Pulse test, t ≤ 300μs, duty cycle, d ≤ 2%.
2. Switching times & energy losses may increase for higher V_{CE}(clamp), T_J or R_G.

Fig. 1. Output Characteristics @ T_J = 25ºC

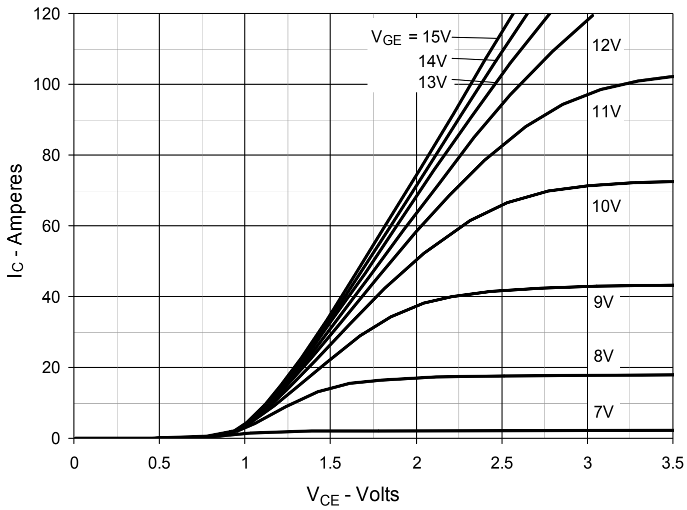


Fig. 2. Extended Output Characteristics @ T_J = 25ºC

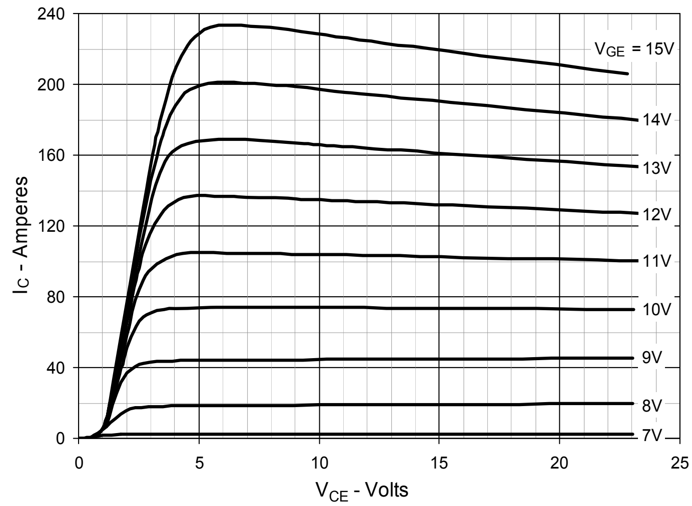


Fig. 3. Output Characteristics @ T_J = 150ºC

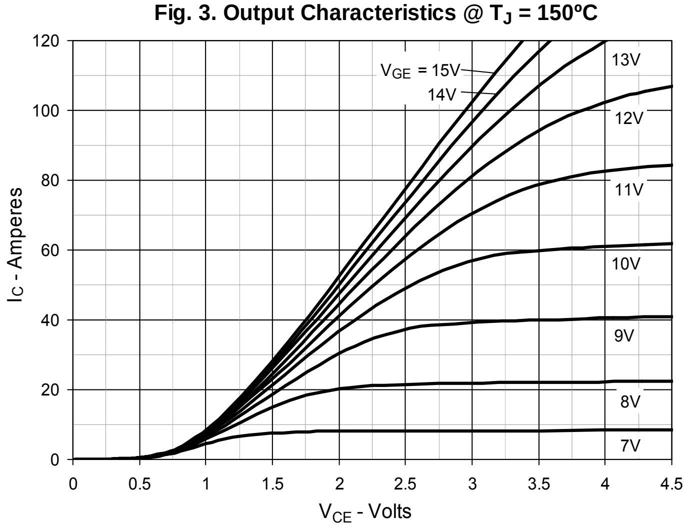


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

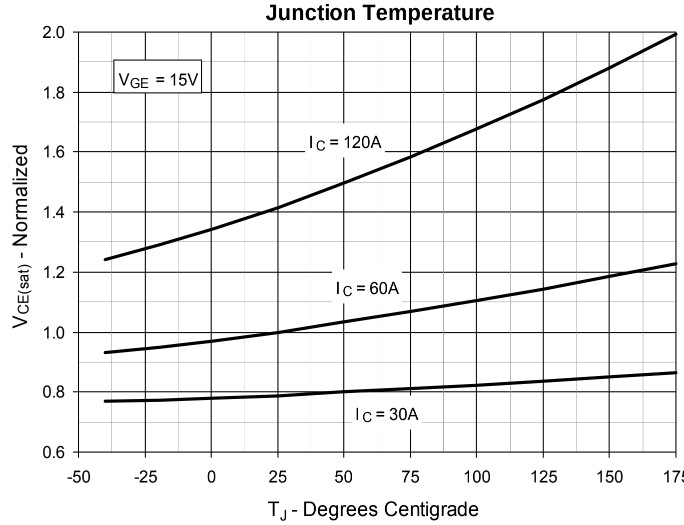


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

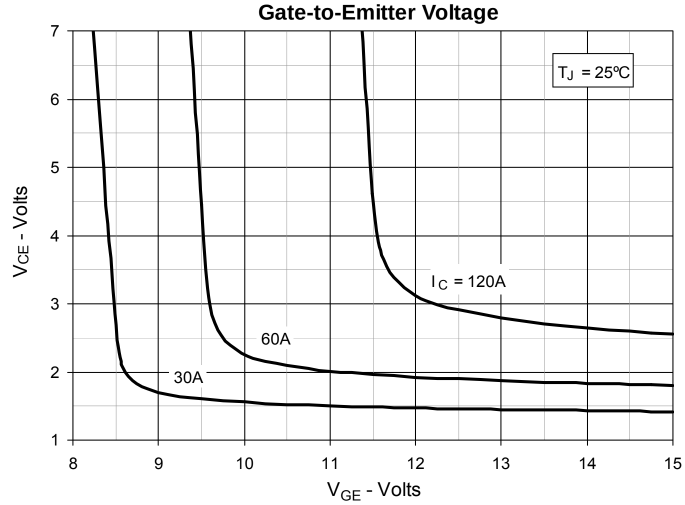


Fig. 6. Input Admittance

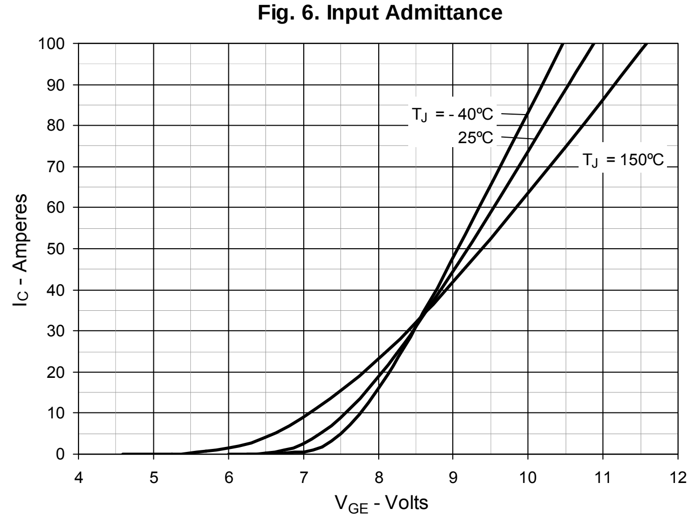


Fig. 7. Transconductance

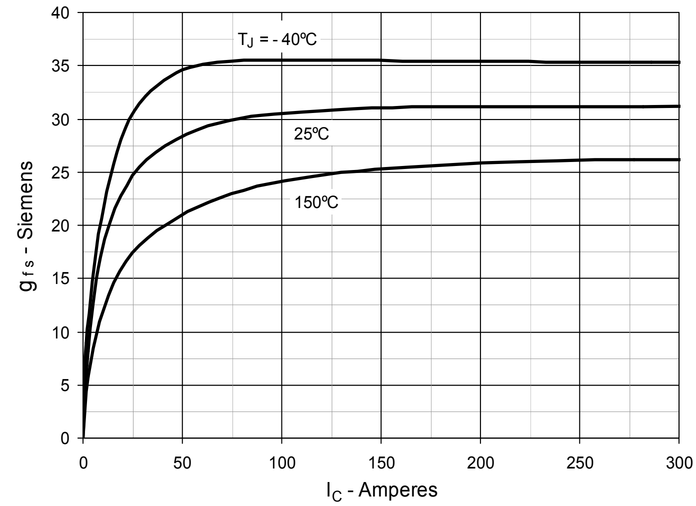


Fig. 8. Gate Charge

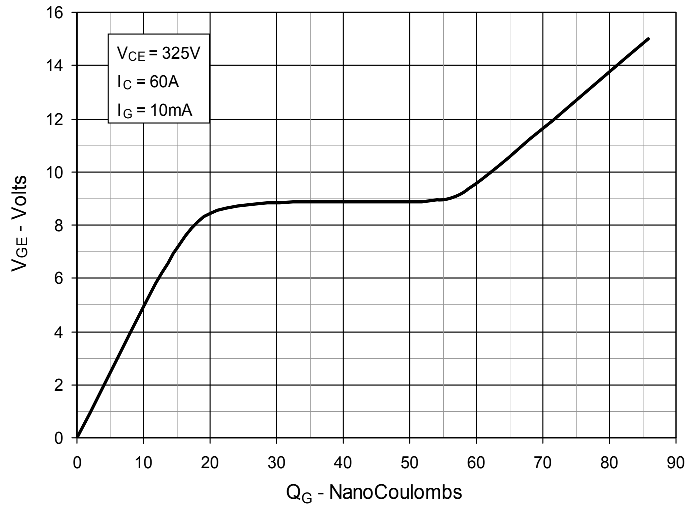


Fig. 9. Capacitance

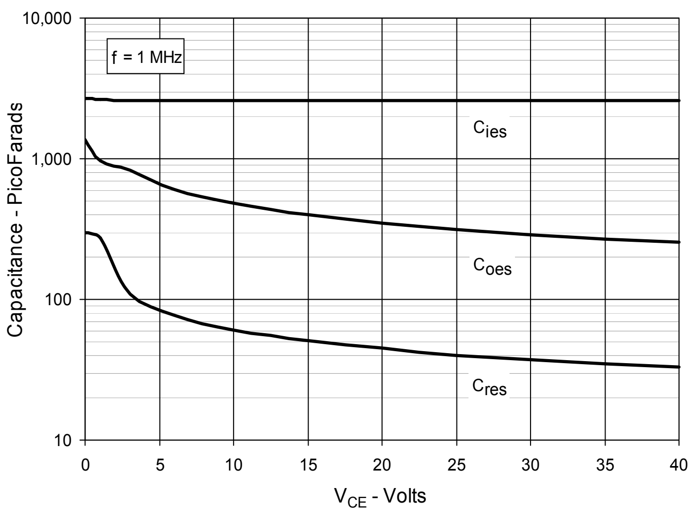


Fig. 10. Reverse-Bias Safe Operating Area

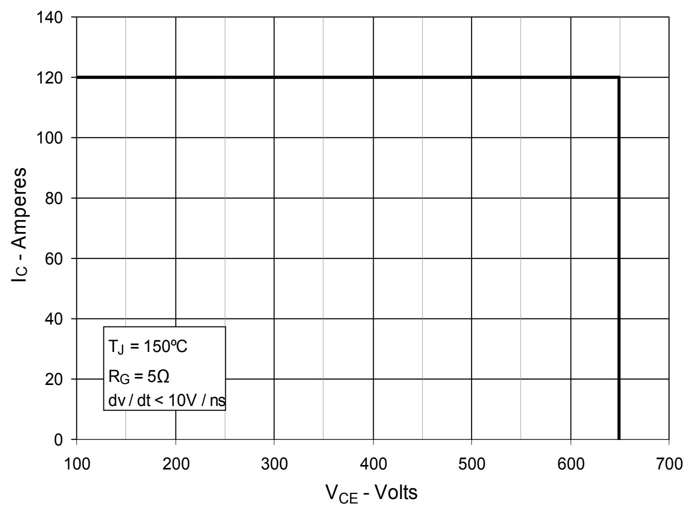


Fig. 11. Maximum Transient Thermal Impedance (IGBT)

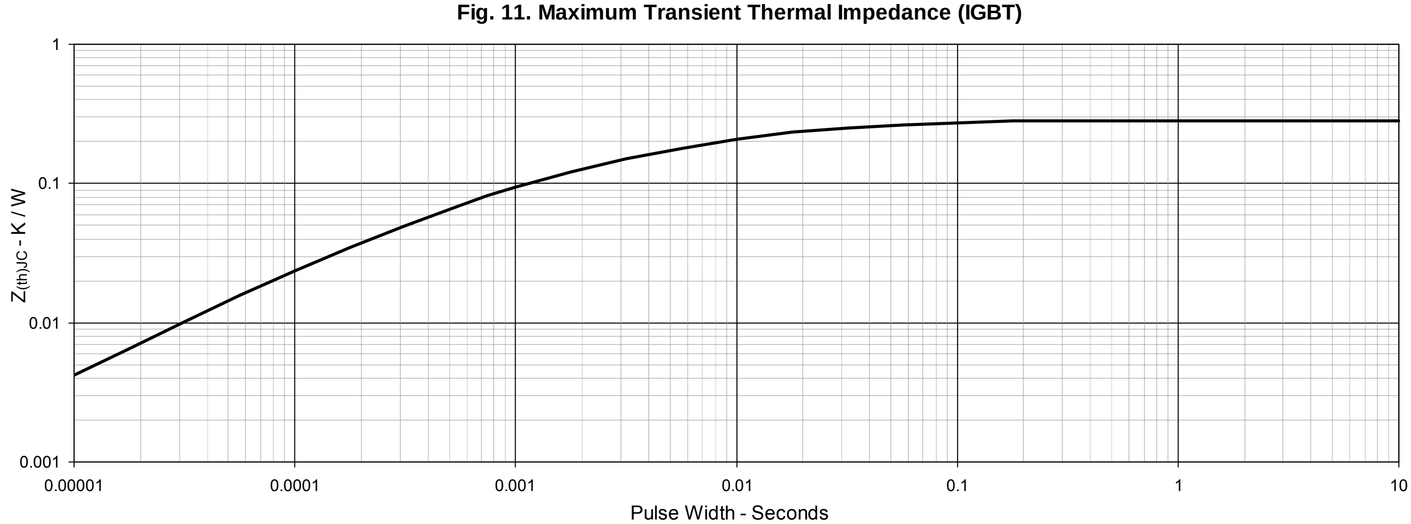


Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance

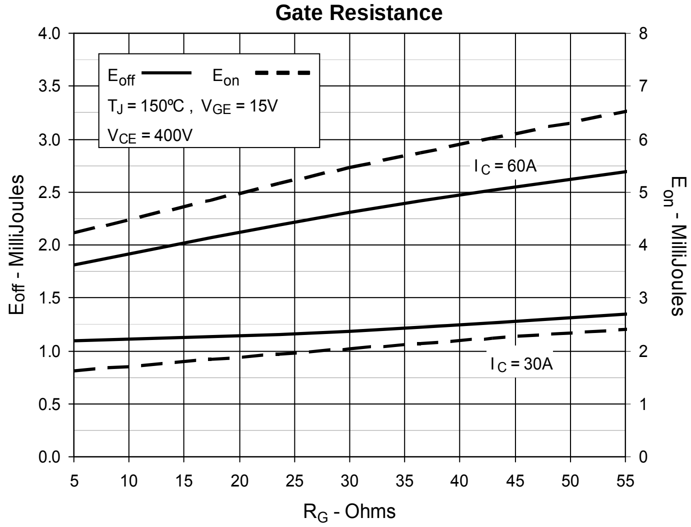


Fig. 13. Inductive Switching Energy Loss vs. Collector Current

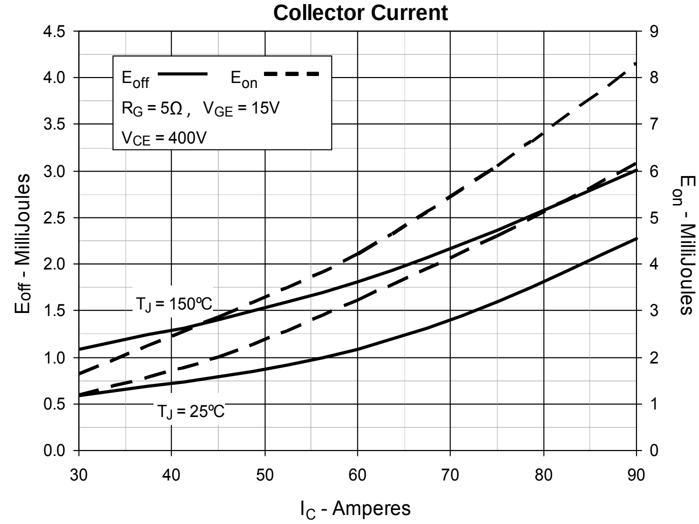


Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature

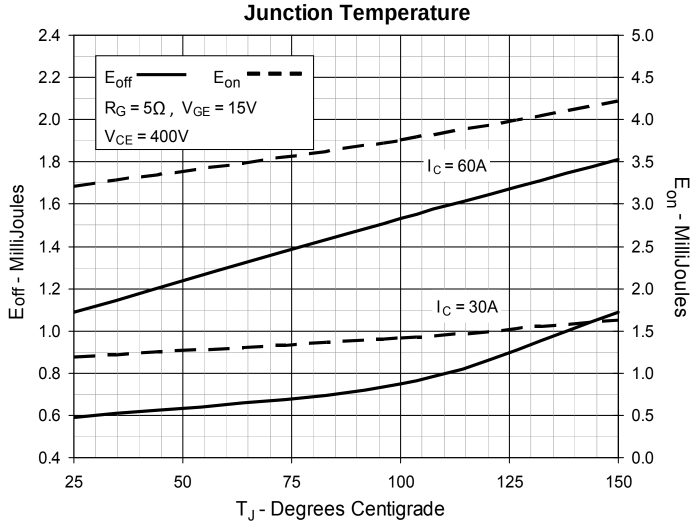


Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance

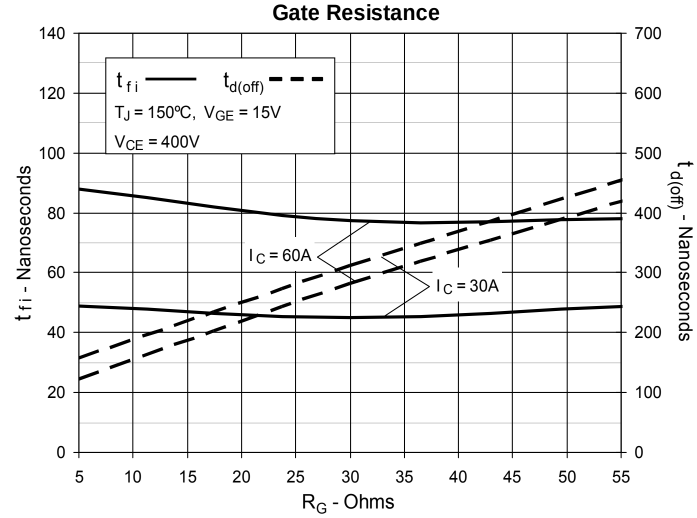


Fig. 16. Inductive Turn-off Switching Times vs. Collector Current

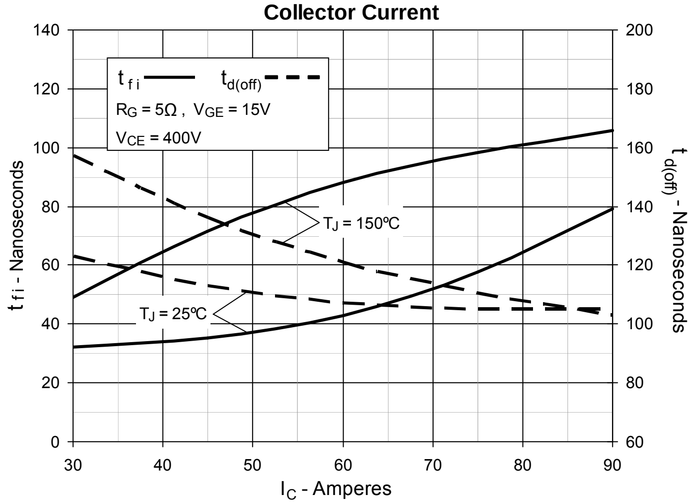


Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature

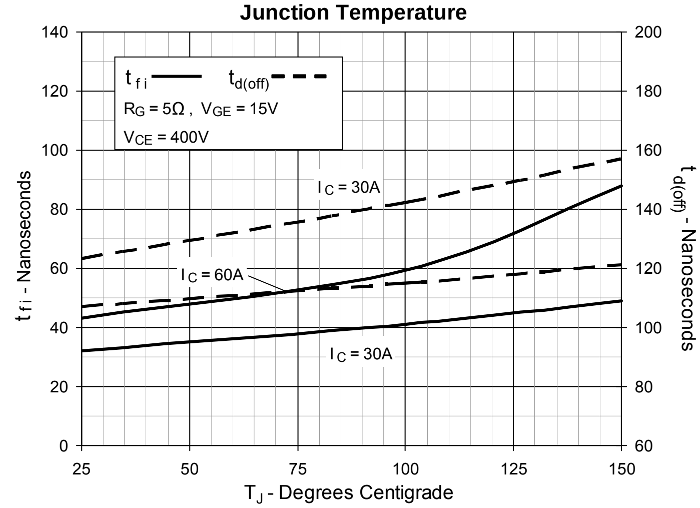


Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance

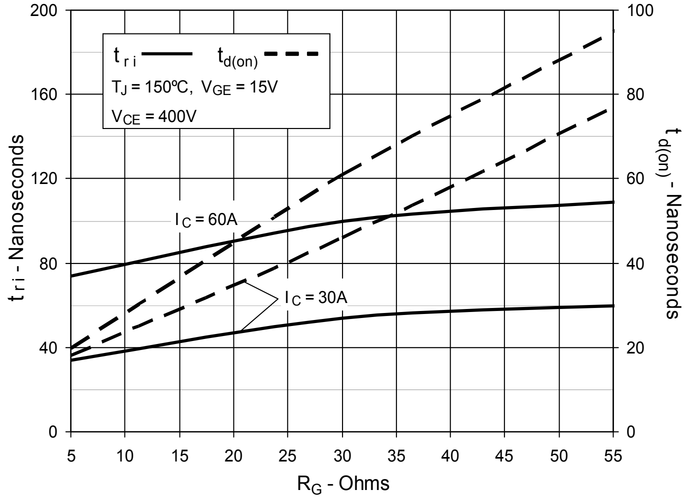


Fig. 19. Inductive Turn-on Switching Times vs. Collector Current

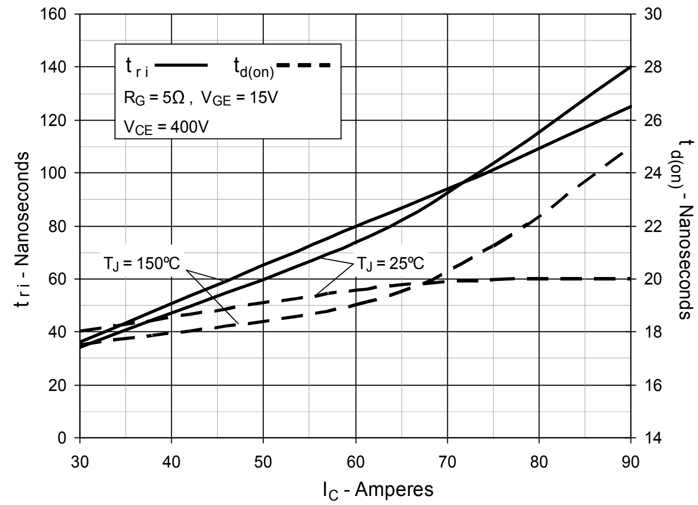


Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature

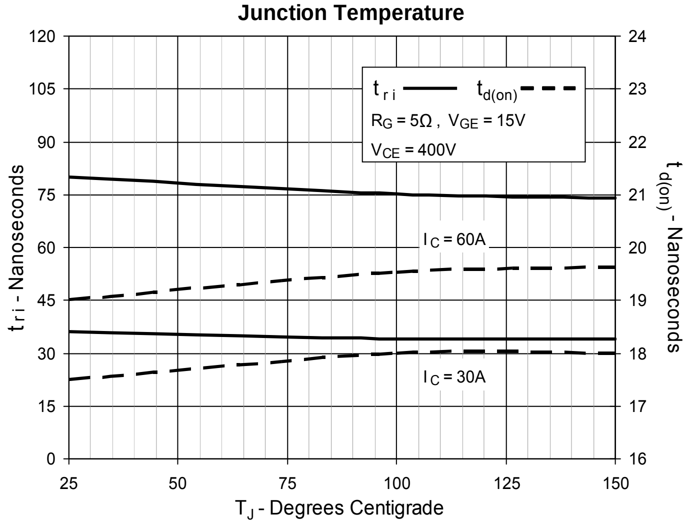


Fig. 21. Forward Current vs. Forward Voltage

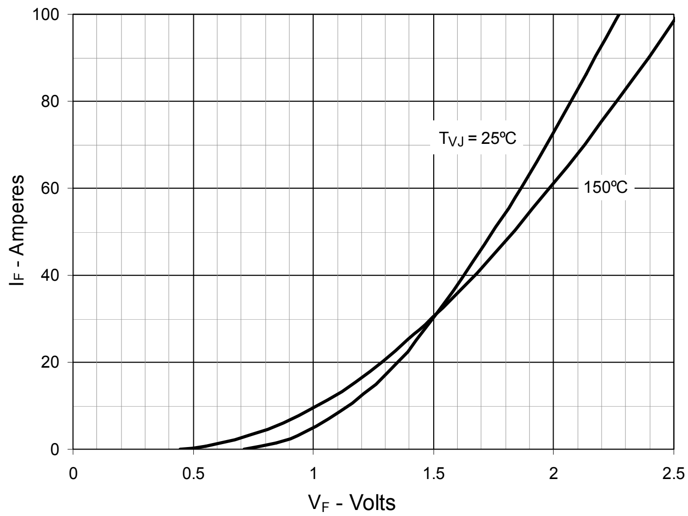


Fig. 22. Reverse Recovery Charge Q_{RR} vs. $-di_F/dt$

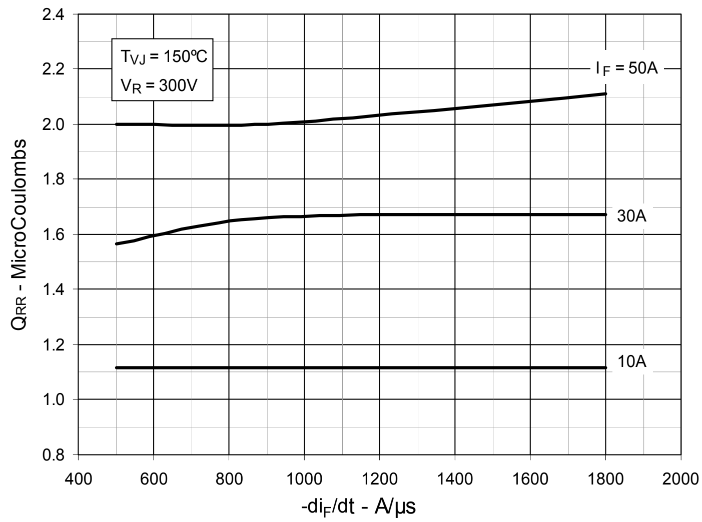


Fig. 23. Peak Reverse Current I_{RM} vs. $-di_F/dt$

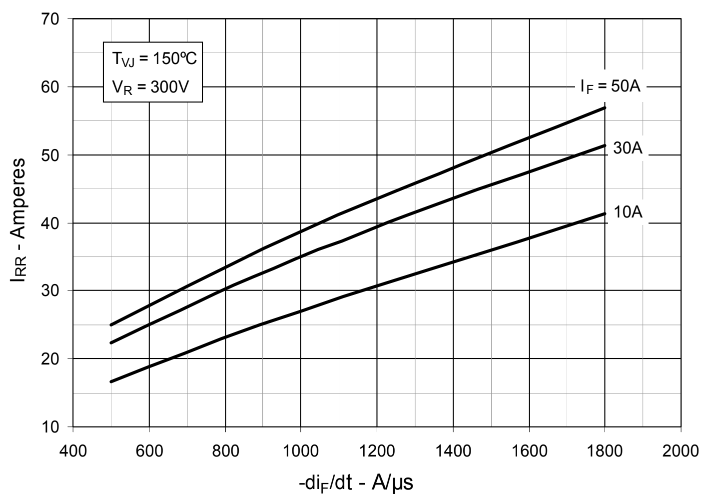


Fig. 24. Recover Time t_{RR} vs. $-di_F/dt$

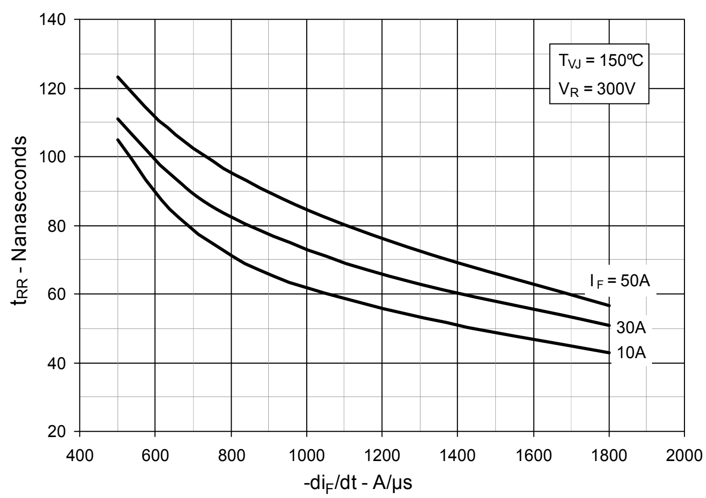


Fig. 25. Recovery Energy E_{REC} vs. $-di_F/dt$

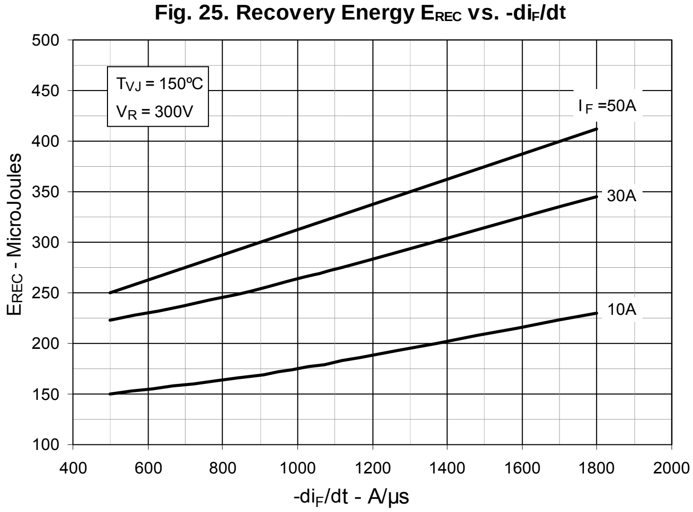


Fig. 26. Dynamic Parameters Q_{RR}, I_{RM} vs. Virtual Junction Temperature T_{VJ}

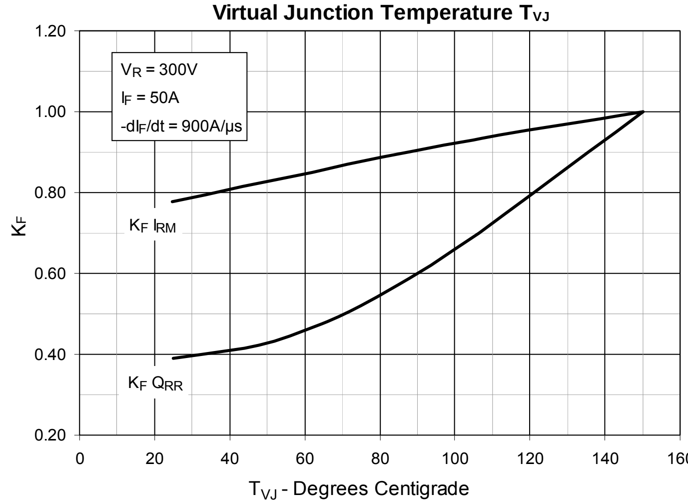


Fig. 27. Maximum Transient Thermal Impedance (Diode)