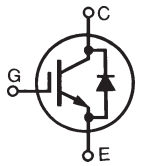
XPT™ 650V IGBT GenX4™ w/ Sonic Diode

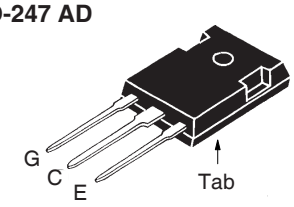
IXXH40N65B4H1

V_{CES} = 650V
I_{C110} = 40A
$V_{CE(sat)}$ ≤ 2.0V
$t_{fi(typ)}$ = 40ns

Extreme Light Punch Through
IGBT for 5-30 kHz Switching



TO-247 AD



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	123	A
I_{C110}	T_C = 110°C	40	A
I_{F110}	T_C = 110°C	40	A
I_{CM}	T_C = 25°C, 1ms	225	A
SSOA (RBSOA)	V_{GE} = 15V, T_{VJ} = 150°C, R_G = 10Ω Clamped Inductive Load	I_{CM} = 80 @$V_{CE} \leq V_{CES}$	A
t_{sc} (SCSOA)	V_{GE} = 15V, V_{CE} = 360V, T_J = 150°C R_G = 82Ω, Non Repetitive	10	μs
P_C	T_C = 25°C	455	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

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 = 40A, V_{GE} = 15V, Note 1		1.60	2.00	V
	T_J = 150°C		1.87		V

Features

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

Advantages

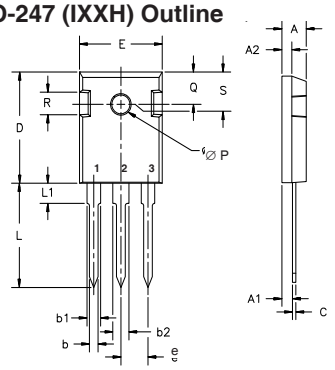
- High Power Density
- Extremely Rugged
- Low Gate Drive Requirement

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.	
g_{fs}	I_C = 40A, V_{CE} = 10V, Note 1	14	23		S
C_{ies}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz		2110		pF
C_{oes}			200		pF
C_{res}			33		pF
$Q_{g(on)}$	I_C = 40A, V_{GE} = 15V, V_{CE} = 0.5 • V_{CES}		66		nC
Q_{ge}			16		nC
Q_{gc}			27		nC
$t_{d(on)}$	**Inductive load, T_J = 25°C**		19		ns
t_{ri}	I_C = 40A, V_{GE} = 15V		48		ns
E_{on}	V_{CE} = 400V, R_G = 5Ω		1.40		mJ
$t_{d(off)}$	Note 2		112		ns
t_{fi}			40		ns
E_{off}			0.75		mJ
$t_{d(on)}$	**Inductive load, T_J = 150°C**		17		ns
t_{ri}	I_C = 40A, V_{GE} = 15V		44		ns
E_{on}	V_{CE} = 400V, R_G = 5Ω		2.20		mJ
$t_{d(off)}$	Note 2		134		ns
t_{fi}			73		ns
E_{off}			1.40		mJ
R_{thJC}				0.33	°C/W
R_{thCS}			0.21		°C/W

TO-247 (IXXH) Outline



Terminals: 1 - Gate 2 - Collector
3 - Emitted

Dim.	Millimeter Min.	Max.	Inches Min.	Max.
A	4.7	5.3	.185	.209
A_1	2.2	2.54	.087	.102
A_2	2.2	2.6	.059	.098
b	1.0	1.4	.040	.055
b_1	1.65	2.13	.065	.084
b_2	2.87	3.12	.113	.123
C	.4	.8	.016	.031
D	20.80	21.46	.819	.845
E	15.75	16.26	.610	.640
e	5.20	5.72	0.205	0.225
L	19.81	20.32	.780	.800
L1		4.50		.177
∅P	3.55	3.65	.140	.144
Q	5.89	6.40	0.232	0.252
R	4.32	5.49	.170	.216
S	6.15 BSC		242 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		2.15		V
I_{RM}	I_F = 30A, V_{GE} = 0V, T_J = 150°C		25		A
t_{rr}	$-di_F/dt$ = 500A/μs, V_R = 300V		120		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

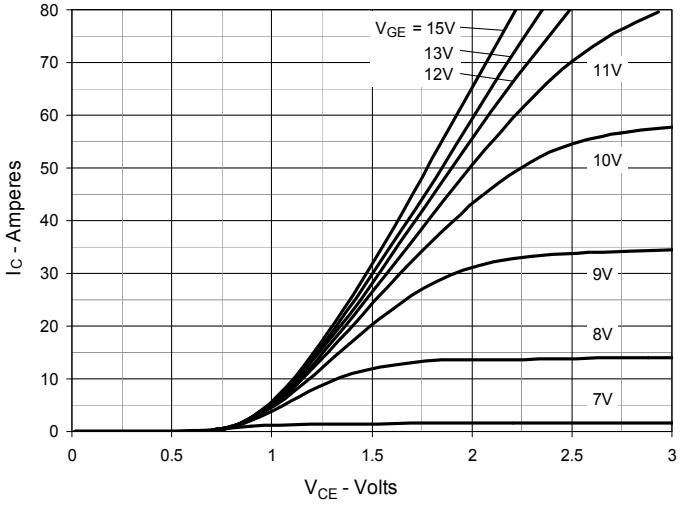


Fig. 2. Extended Output Characteristics @ T_J = 25ºC

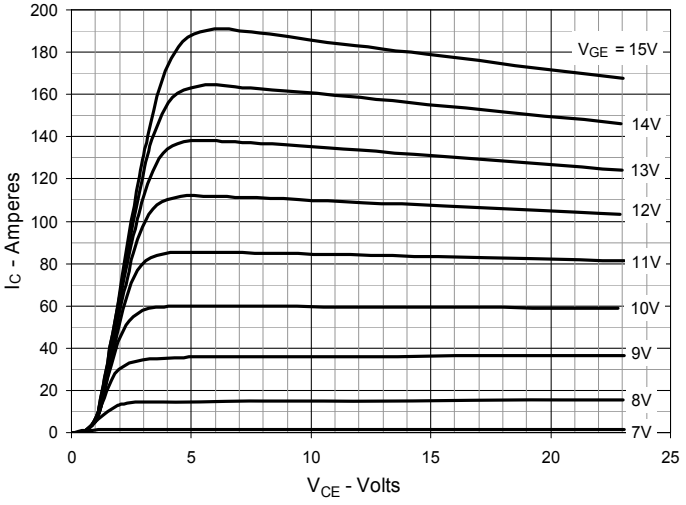


Fig. 3. Output Characteristics @ T_J = 150ºC

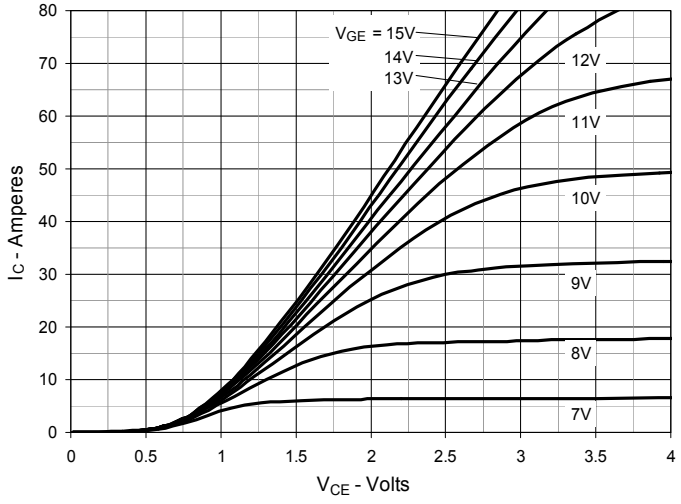


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

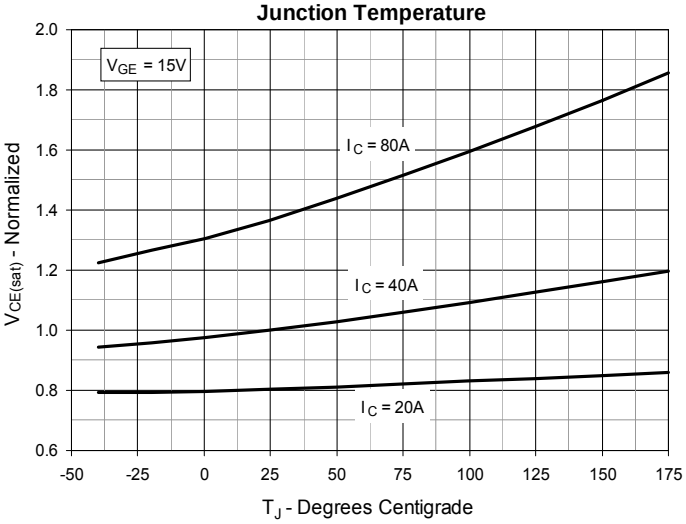


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

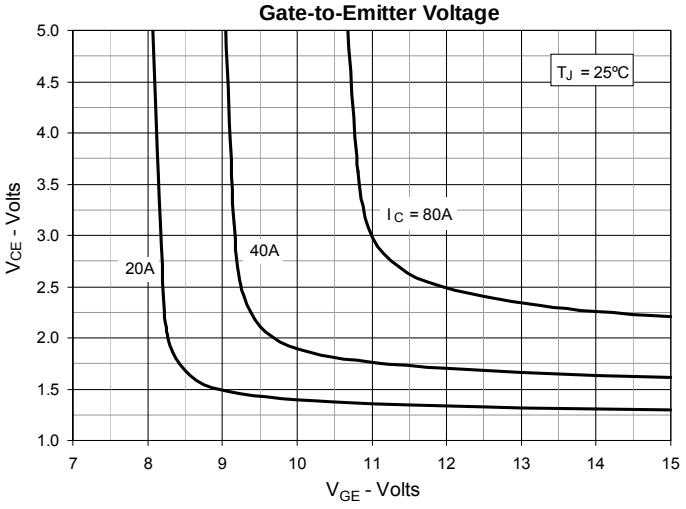


Fig. 6. Input Admittance

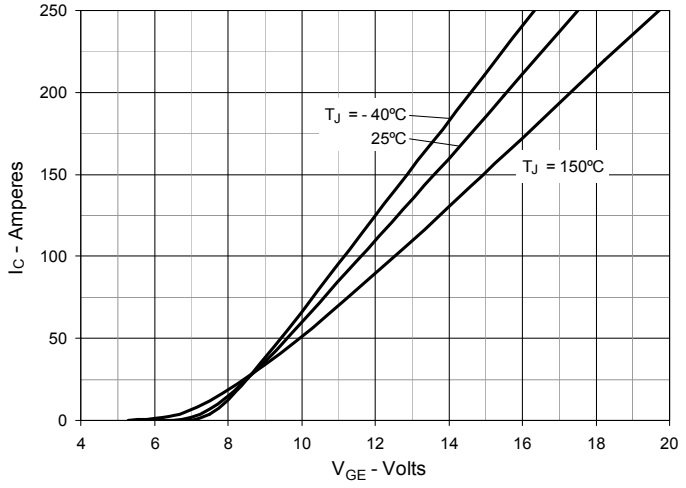


Fig. 7. Transconductance

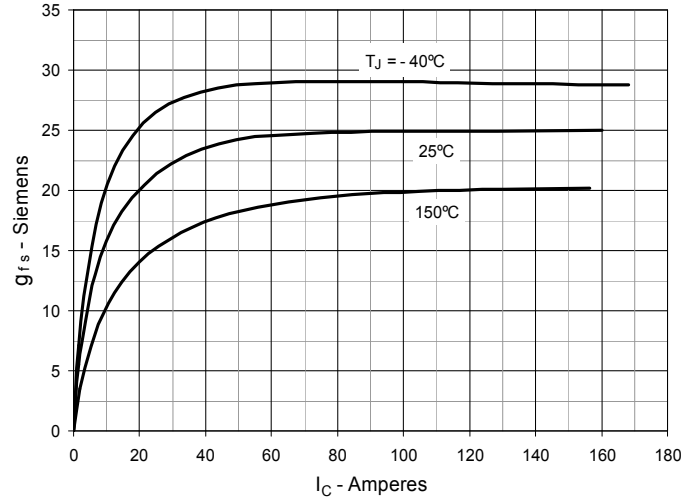


Fig. 8. Gate Charge

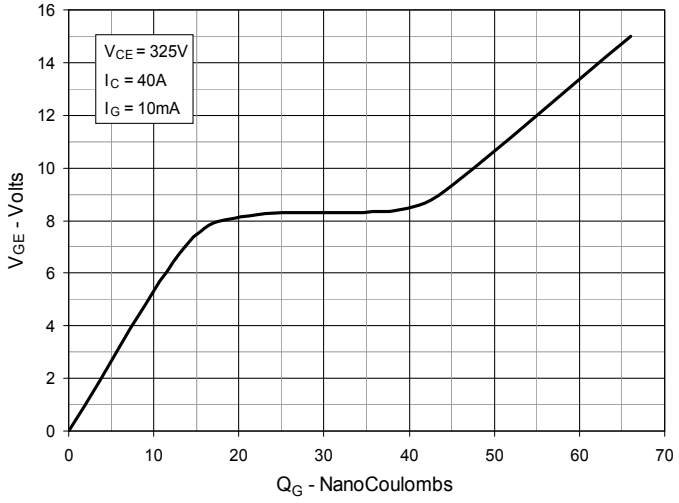


Fig. 9. Capacitance

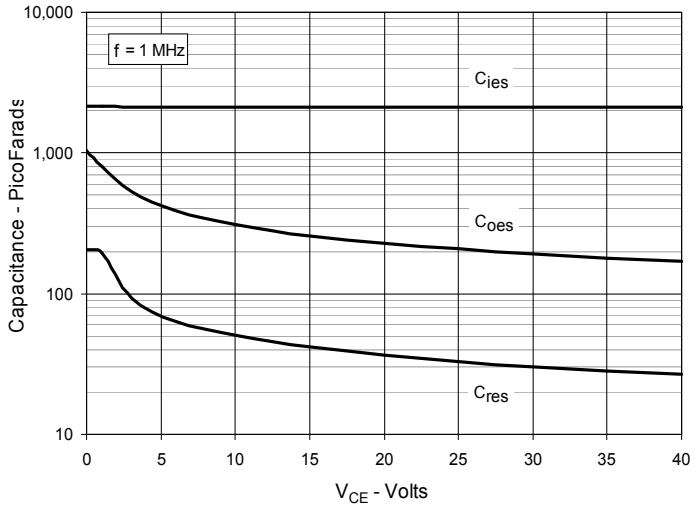


Fig. 10. Reverse-Bias Safe Operating Area

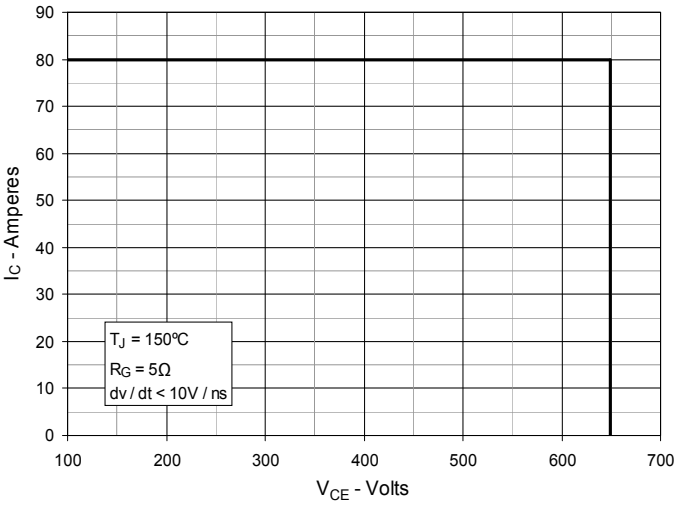


Fig. 11. Maximum Transient Thermal Impedance (IGBT)

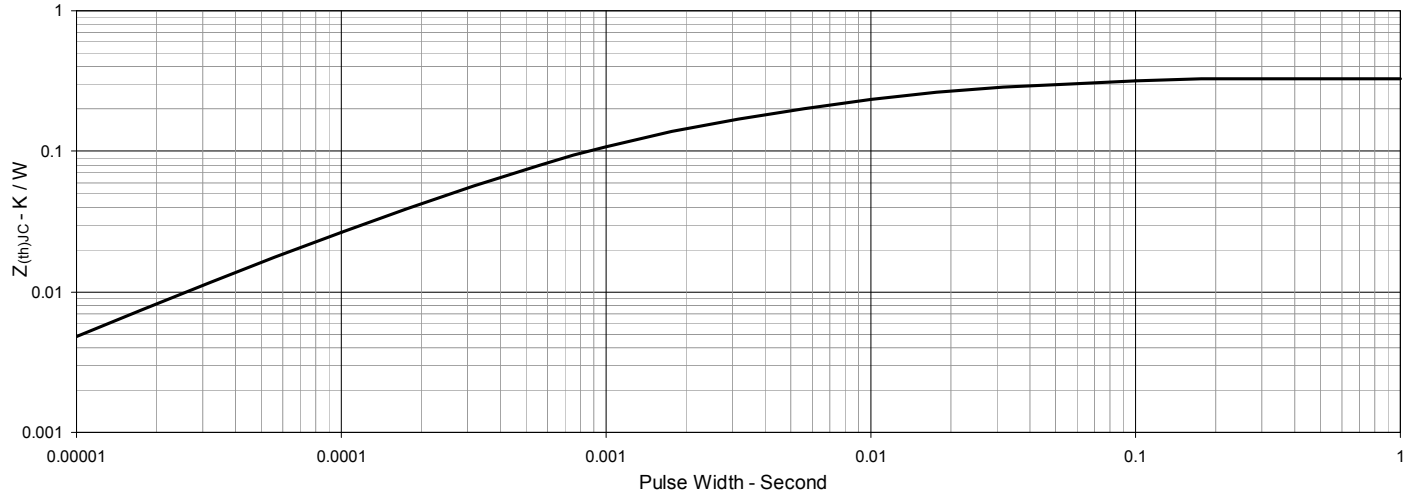


Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance

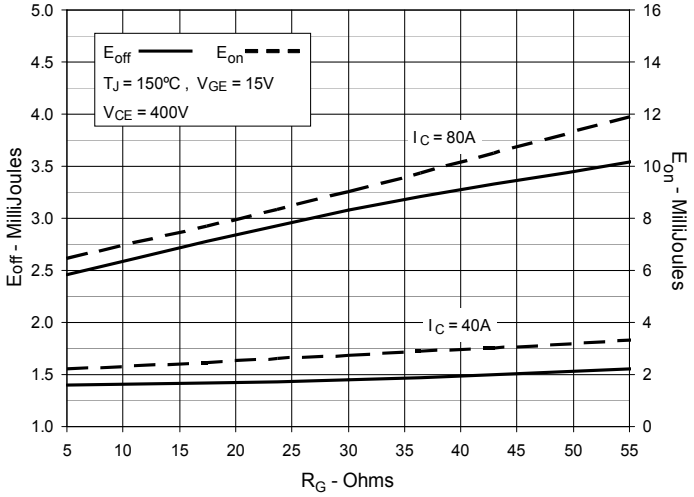


Fig. 13. Inductive Switching Energy Loss vs. Collector Current

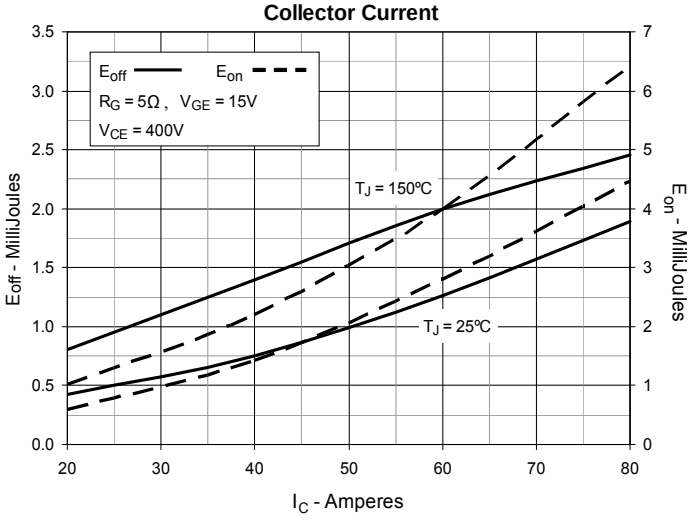


Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature

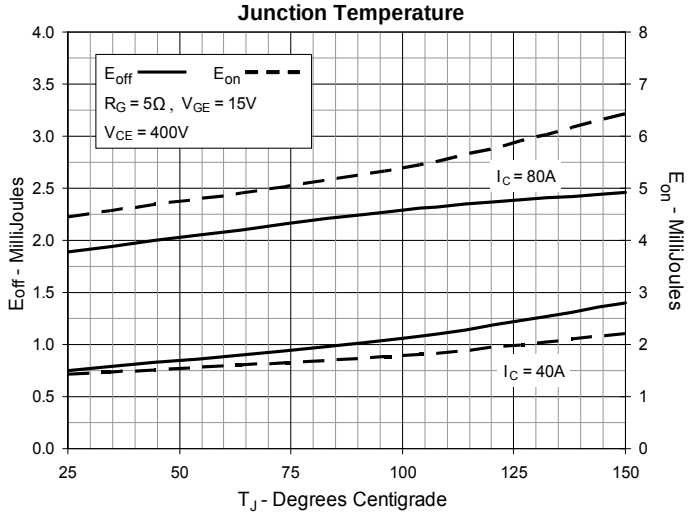


Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance

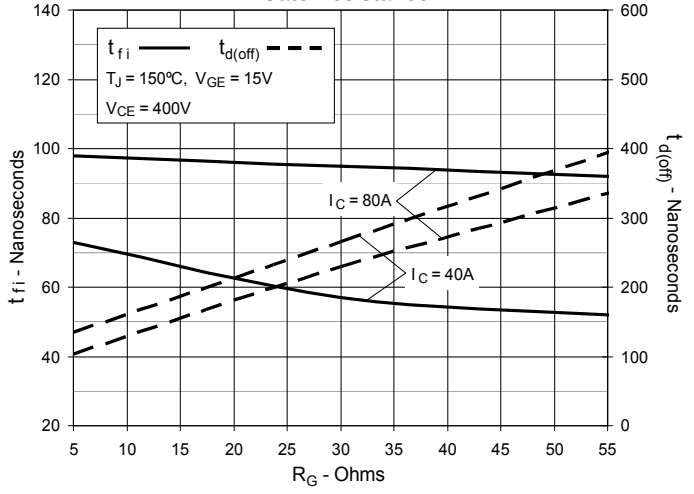


Fig. 16. Inductive Turn-off Switching Times vs. Collector Current

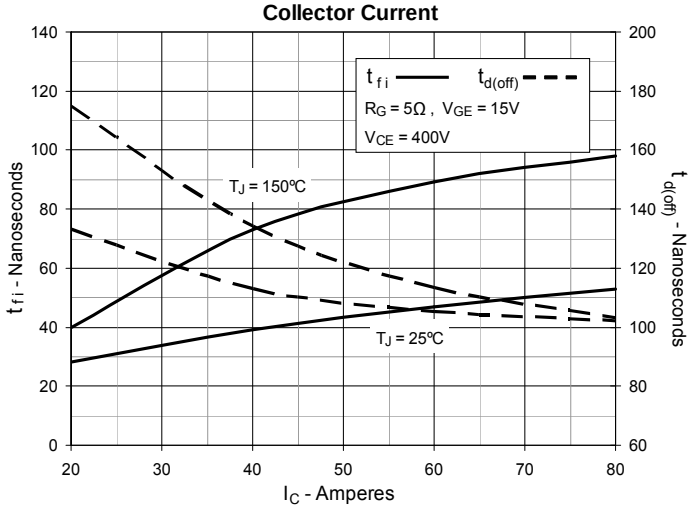


Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature

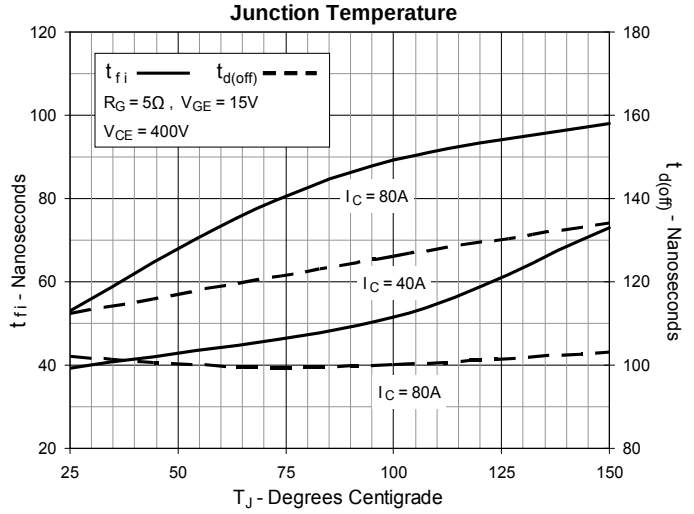


Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance

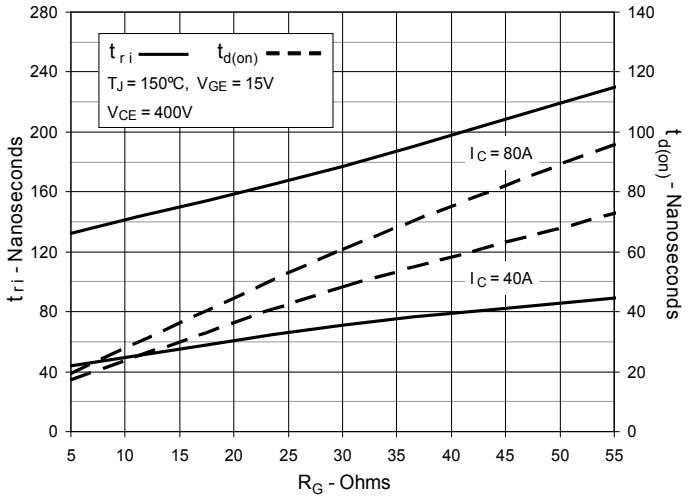


Fig. 19. Inductive Turn-on Switching Times vs. Collector Current

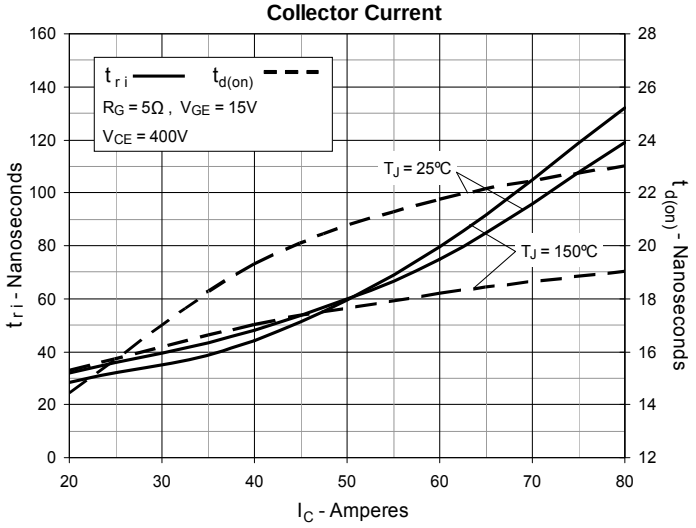


Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature

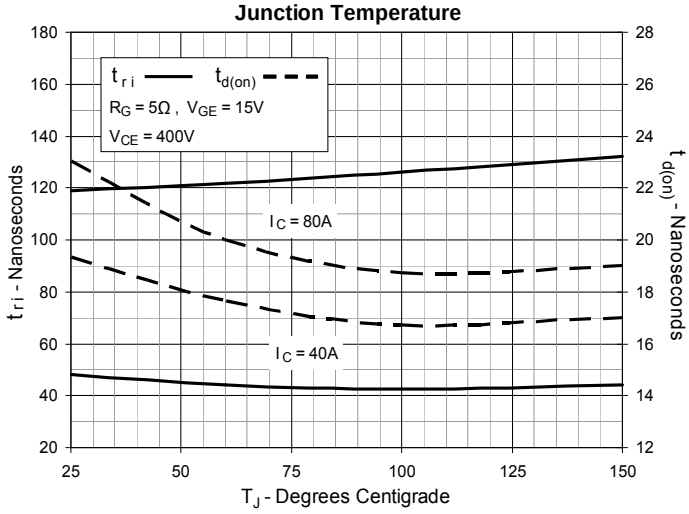


Fig. 21. Forward Current vs. Forward Voltage

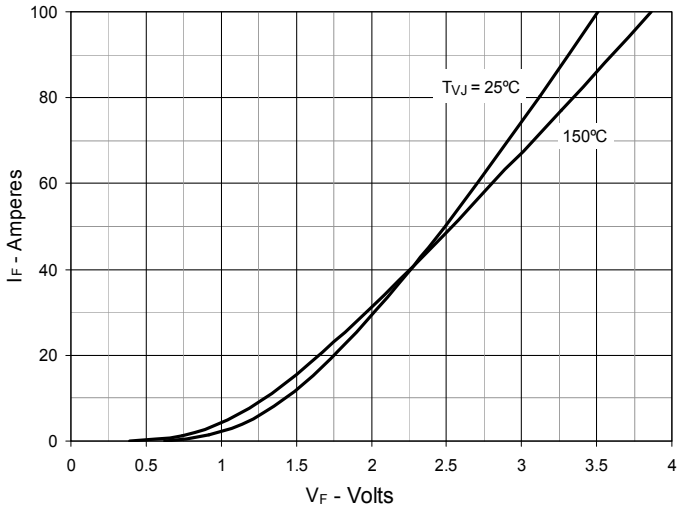


Fig. 22. Reverse Recovery Charge Q_{RR} vs. $-di_F/dt$

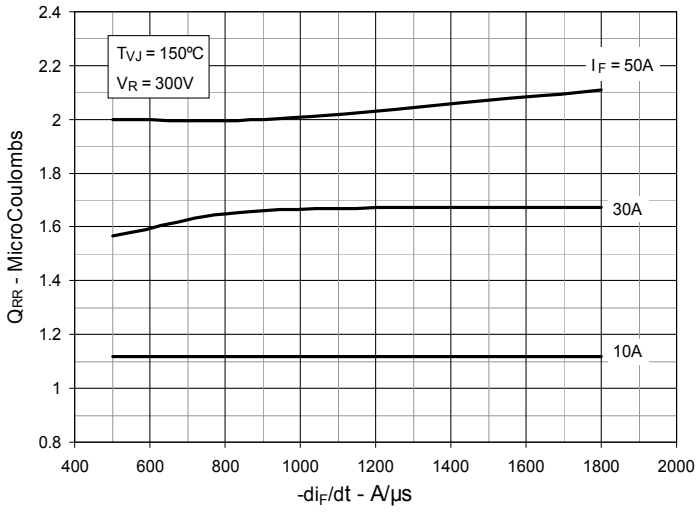


Fig. 23. Peak Reverse Current I_{RM} vs. $-di_F/dt$

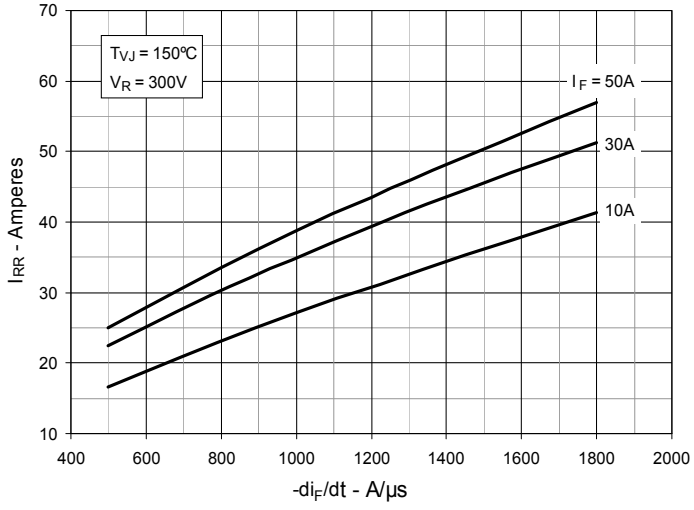


Fig. 24. Recover Time t_{RR} vs. $-di_F/dt$

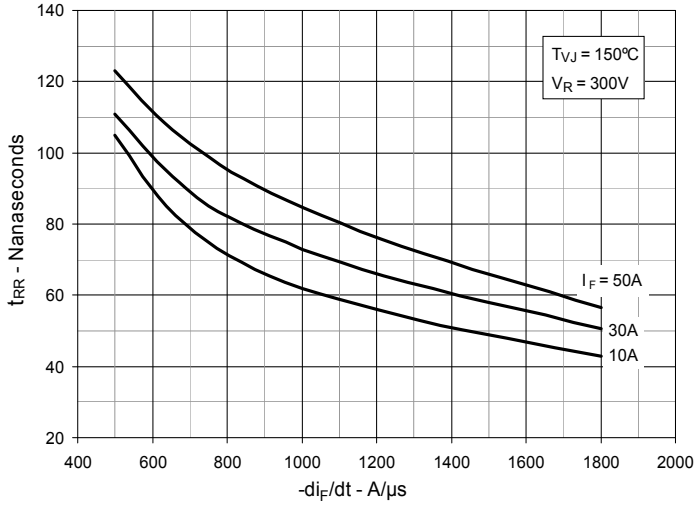


Fig. 25. Recovery Energy E_{REC} vs. $-di_F/dt$

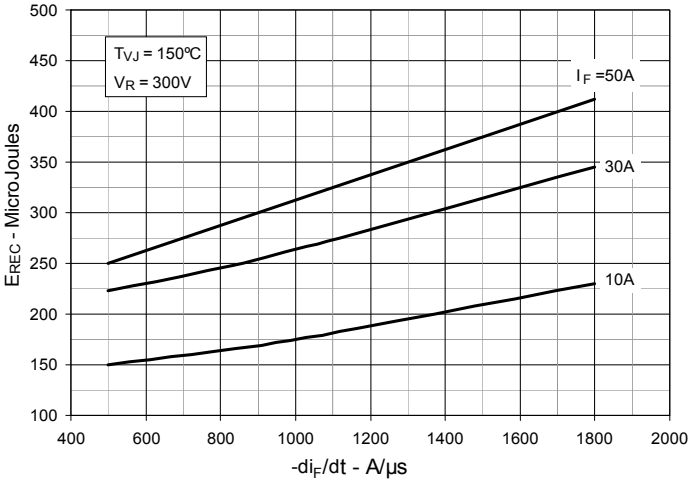


Fig. 26. Dynamic Parameters Q_{RR}, I_{RM} vs. Virtual Junction Temperature T_{VJ}

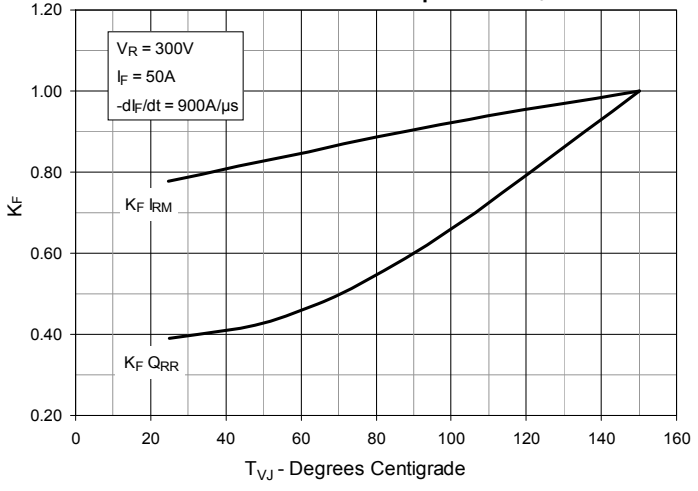


Fig. 27. Maximum Transient Thermal Impedance (Diode)