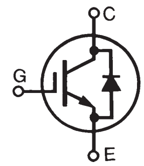
Preliminary Technical Information

XPT™ 600V IGBT GenX3™ w/ Diode

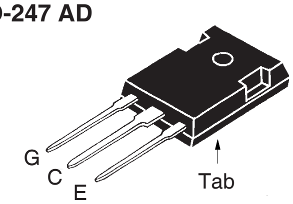
IXXH50N60C3D1

V_{CES} = 600V
I_{C110} = 50A
$V_{CE(sat)}$ ≤ 2.30V
$t_{fi(typ)}$ = 42ns

Extreme Light Punch Through IGBT for 20-60 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	600	V
V_{CGR}	T_J = 25°C to 175°C, R_{GE} = 1MΩ	600	V
V_{GES}	Continuous	±20	V
V_{GEM}	Transient	±30	V
I_{C25}	T_C = 25°C (Chip Capability)	100	A
I_{C110}	T_C = 110°C	50	A
I_{F110}	T_C = 110°C	30	A
I_{CM}	T_C = 25°C, 1ms	200	A
I_A	T_C = 25°C	25	A
E_{AS}	T_C = 25°C	200	mJ
SSOA (RBSOA)	V_{GE} = 15V, T_{VJ} = 150°C, R_G = 5Ω Clamped Inductive Load	I_{CM} = 100 @ ≤ V_{CES}	A
t_{sc} **(SCSOA)**	V_{GE}= 15V, V_{CE} = 360V, T_J = 150°C R_G = 22Ω, Non Repetitive	10	µs
P_C	T_C = 25°C	600	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	600			V
$V_{GE(th)}$	I_C = 250µA, V_{CE} = V_{GE}	3.0		5.5	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 = 36A, V_{GE} = 15V, Note 1		1.95	2.30	V
	T_J = 150°C		2.45		V

Features

- Optimized for 20-60kHz Switching
- Square RBSOA
- Anti-Parallel Ultra Fast Diode
- Avalanche Capability
- Short Circuit Capability
- International Standard Package

Advantages

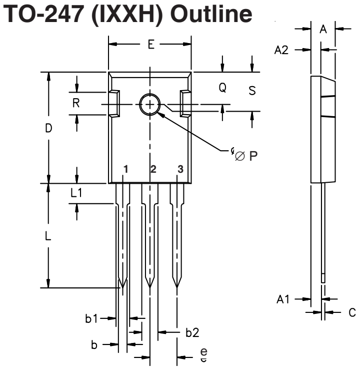
- High Power Density
- 175°C Rated
- Extremely Rugged
- Low Gate Drive Requirement

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}	$I_C = 36A$, $V_{CE} = 10V$, Note 1	11	18		S
C_{ies}	$V_{CE} = 25V$, $V_{GE} = 0V$, f = 1MHz		2320		pF
C_{oes}			138		pF
C_{res}			42		pF
Q_g	$I_C = 36A$, $V_{GE} = 15V$, $V_{CE} = 0.5 \bullet V_{CES}$		64		nC
Q_{ge}			18		nC
Q_{gc}			25		nC
$t_{d(on)}$	**Inductive load, $T_J = 25°C$**		24		ns
t_{ri}	$I_C = 36A$, $V_{GE} = 15V$		40		ns
E_{on}	$V_{CE} = 360V$, $R_G = 5\Omega$		0.72		mJ
$t_{d(off)}$	Note 2		62	100	ns
t_{fi}			42		ns
E_{off}			0.33	0.55	mJ
$t_{d(on)}$	**Inductive load, $T_J = 150°C$**		25		ns
t_{ri}	$I_C = 36A$, $V_{GE} = 15V$		44		ns
E_{on}	$V_{CE} = 360V$, $R_G = 5\Omega$		1.46		mJ
$t_{d(off)}$	Note 2		80		ns
t_{fi}			90		ns
E_{off}			0.48		mJ
R_{thJC}				0.25	°C/W
R_{thCS}			0.21		°C/W

TO-247 (IXXH) Outline



Terminals: 1 - Gate 2 - Collector 3 - Emitted

Dim.	Millimeter Min.	Millimeter Max.	Inches Min.	Inches 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 Diode (FRED)

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				2.7	V
		$T_J = 150°C$		1.6		V
I_{RM}	$I_F = 30A$, $V_{GE} = 0V$, $-di_F/dt = 100A/\mu s$,	$T_J = 100°C$			4	A
t_{rr}	$V_R = 100V$	$T_J = 100°C$		100		ns
	$I_F = 1A$, $V_{GE} = 0V$, $-di_F/dt = 100A/\mu s$, $V_R = 30V$			25		ns
R_{thJC}					0.9	°C/W

Notes:

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

PRELIMINARY TECHNICAL INFORMATION

The product presented herein is under development. The Technical Specifications offered are derived from data gathered during objective characterizations of preliminary engineering lots; but also may yet contain some information supplied during a pre-production design evaluation. IXYS reserves the right to change limits, test conditions, and dimensions without notice.

Fig. 1. Output Characteristics @ T_J = 25ºC

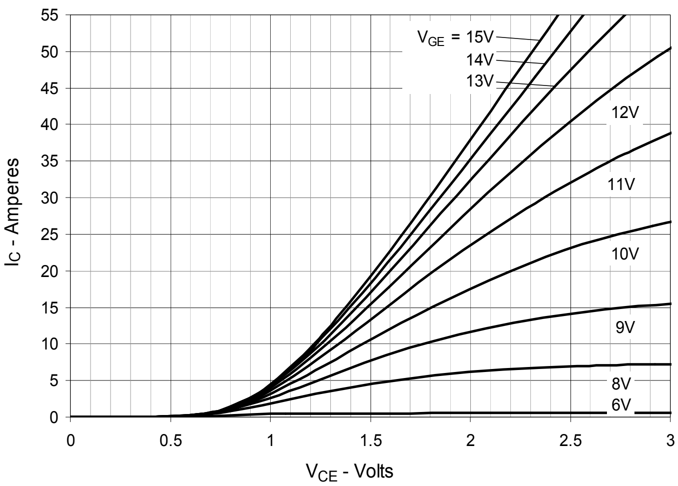


Fig. 2. Extended Output Characteristics @ T_J = 25ºC

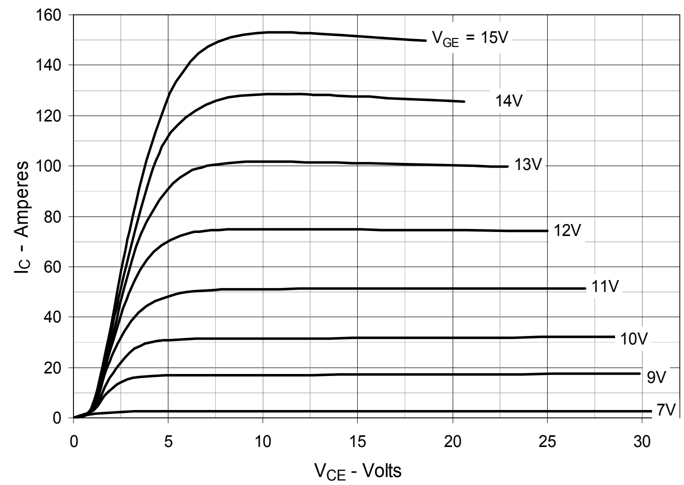


Fig. 3. Output Characteristics @ T_J = 150ºC

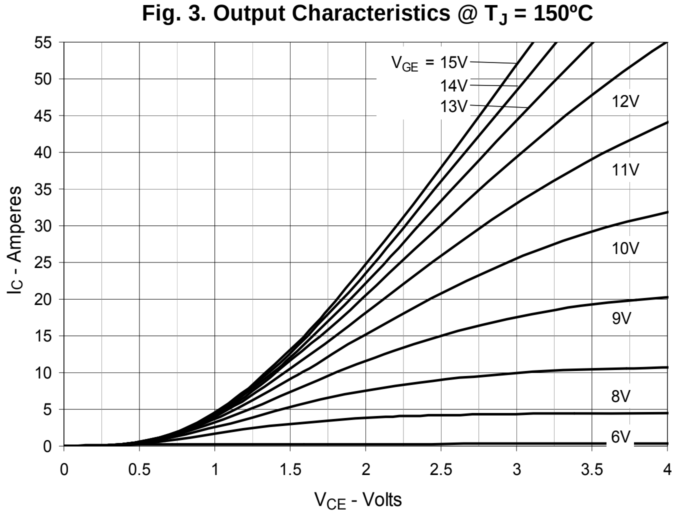


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

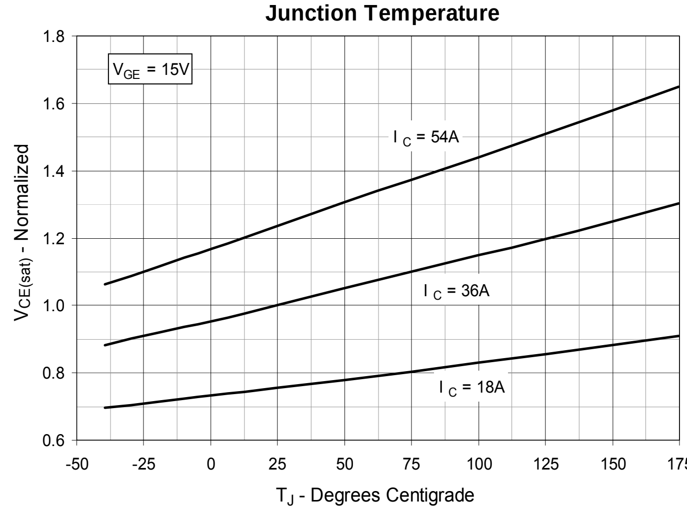


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

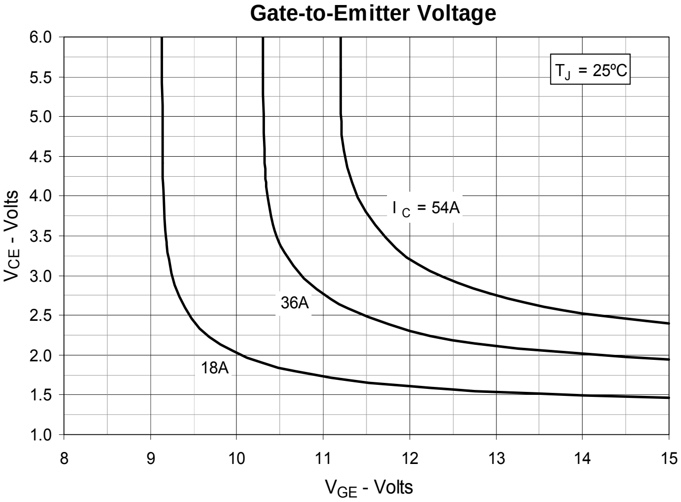


Fig. 6. Input Admittance

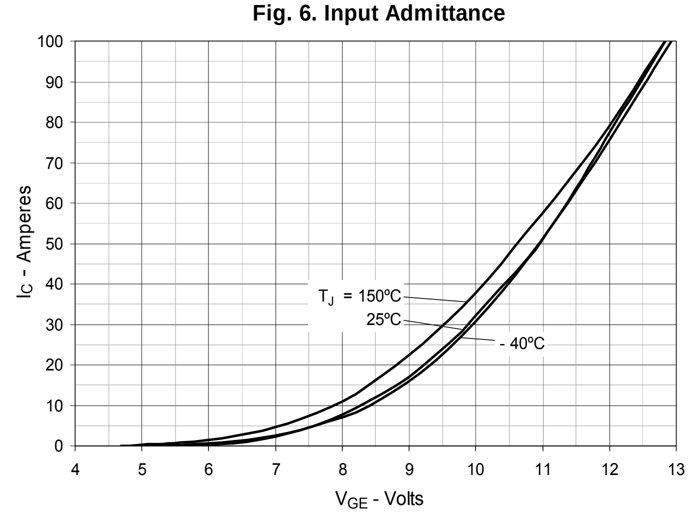


Fig. 7. Transconductance

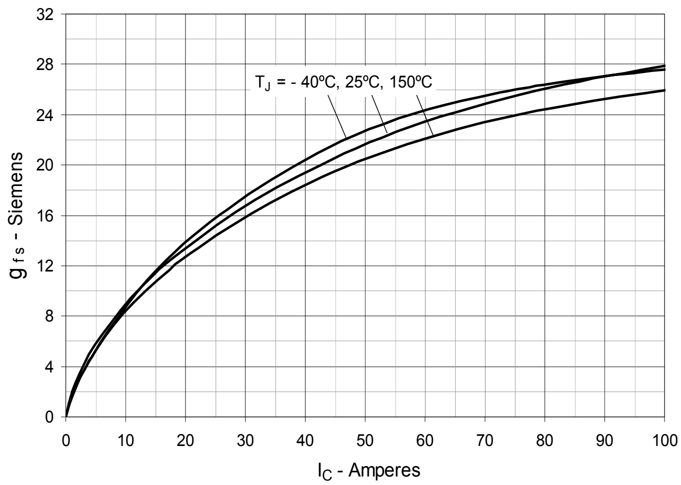


Fig. 8. Gate Charge

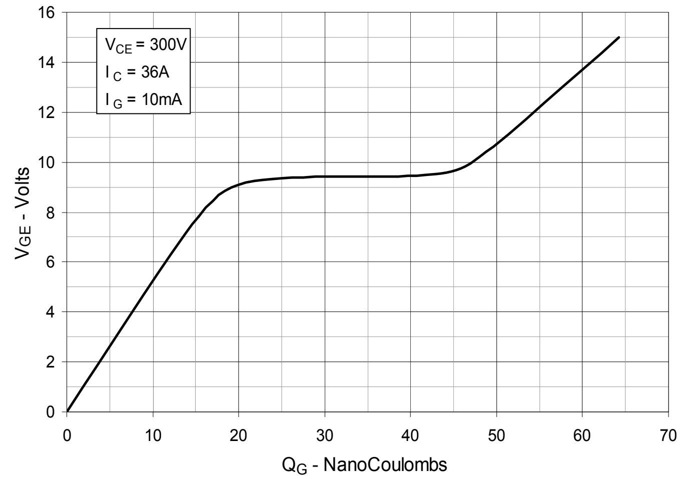


Fig. 9. Capacitance

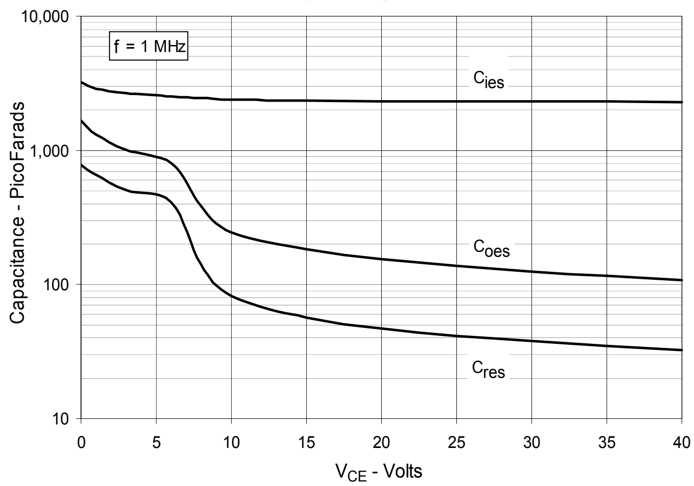


Fig. 10. Reverse-Bias Safe Operating Area

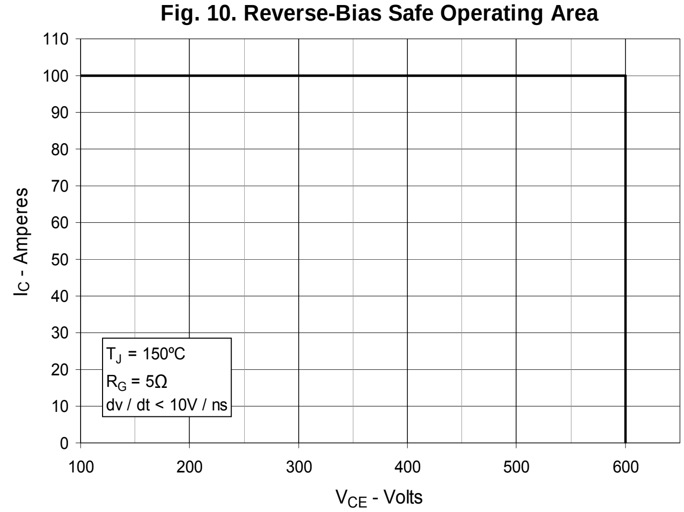


Fig. 11. Forward-Bias Safe Operating Area

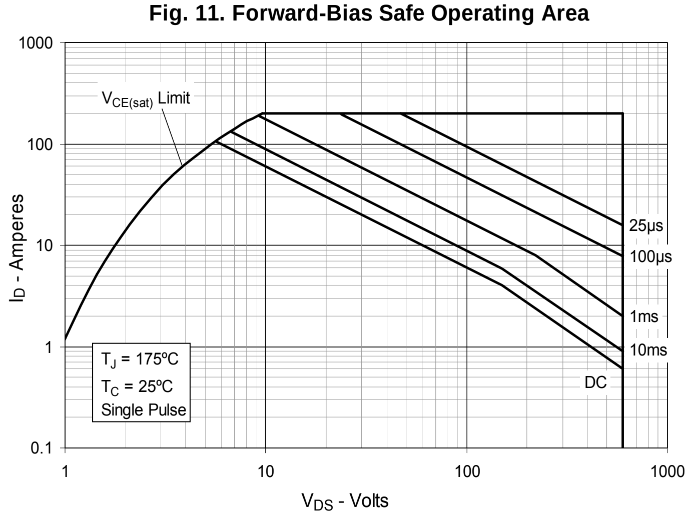


Fig. 12. Maximum Transient Thermal Impedance

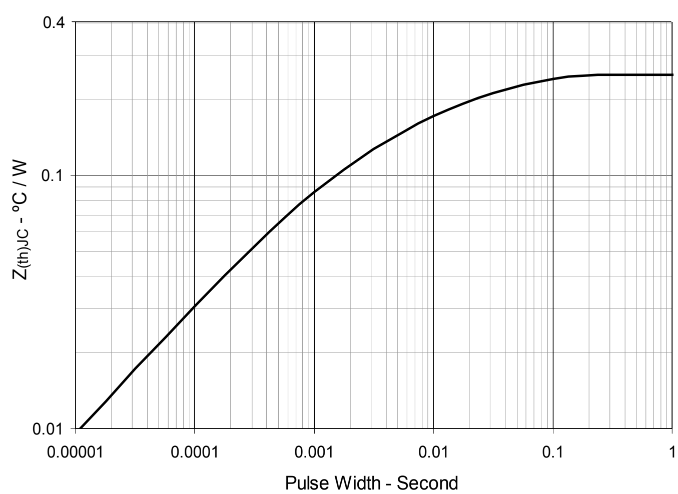


Fig. 13. Inductive Switching Energy Loss vs. Gate Resistance

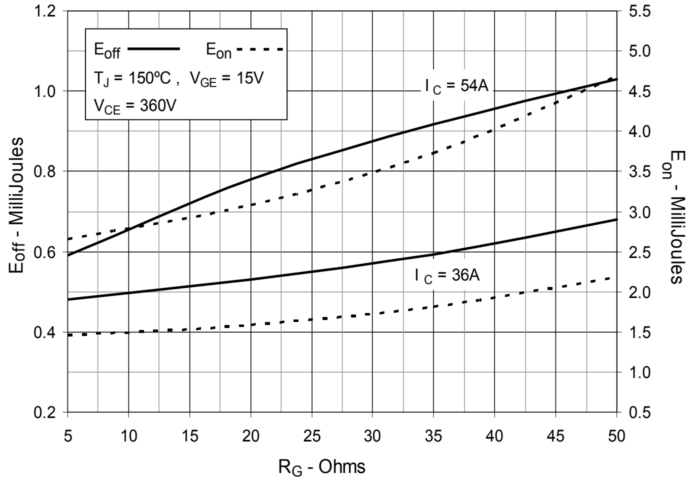


Fig. 14. Inductive Switching Energy Loss vs. Collector Current

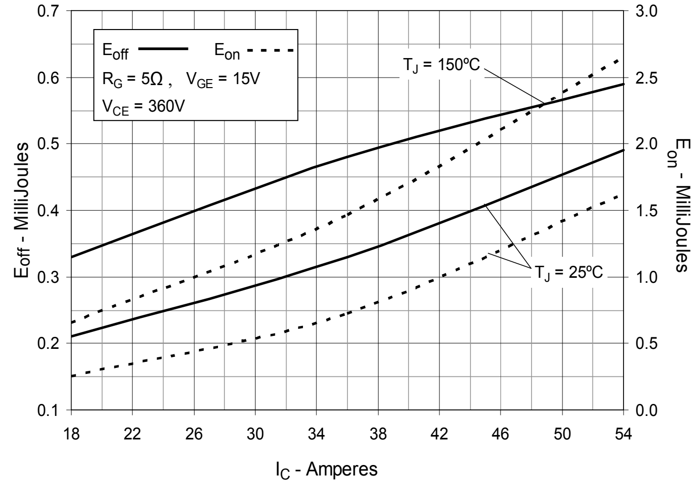


Fig. 15. Inductive Switching Energy Loss vs. Junction Temperature

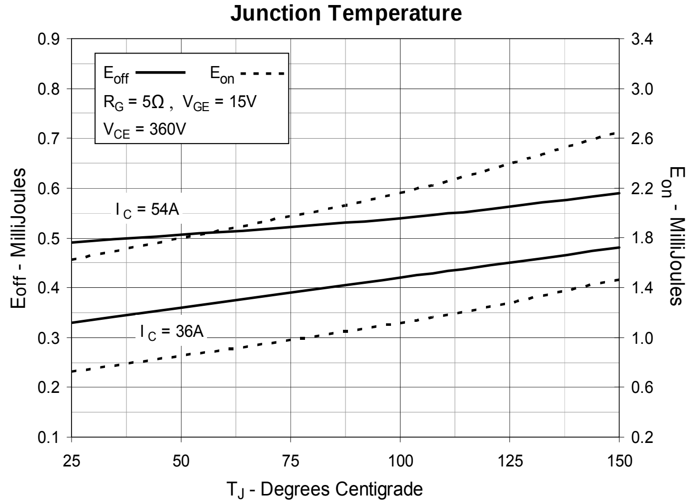


Fig. 16. Inductive Turn-off Switching Times vs. Gate Resistance

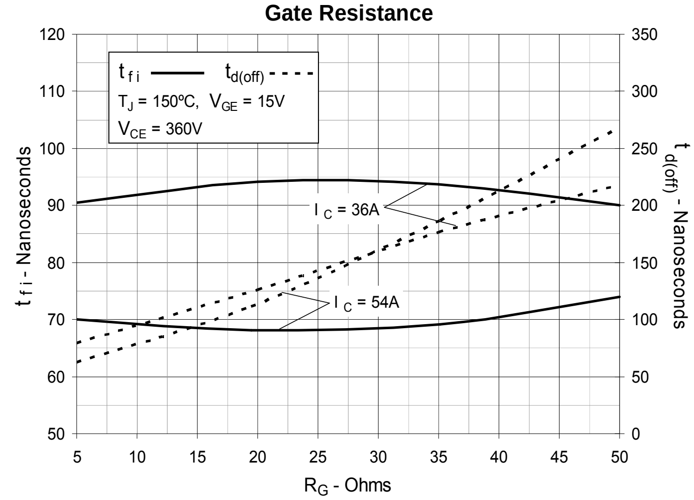


Fig. 17. Inductive Turn-off Switching Times vs. Collector Current

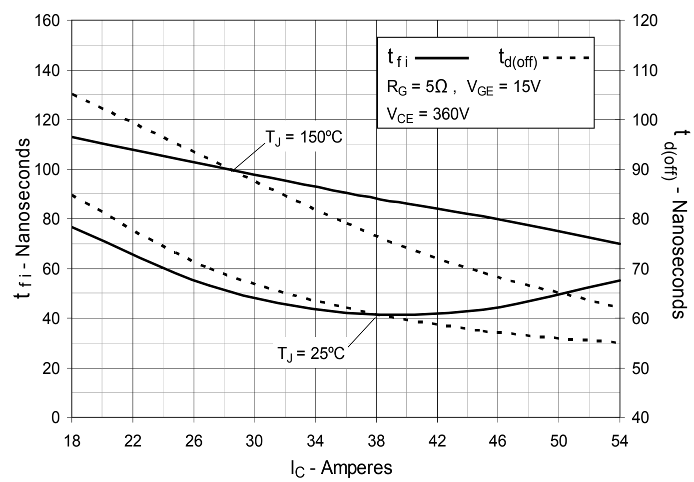


Fig. 18. Inductive Turn-off Switching Times vs. Junction Temperature

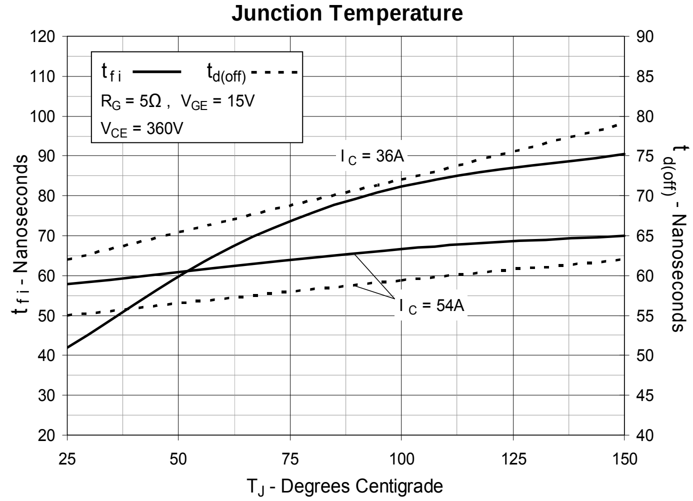


Fig. 19. Inductive Turn-on Switching Times vs. Gate Resistance

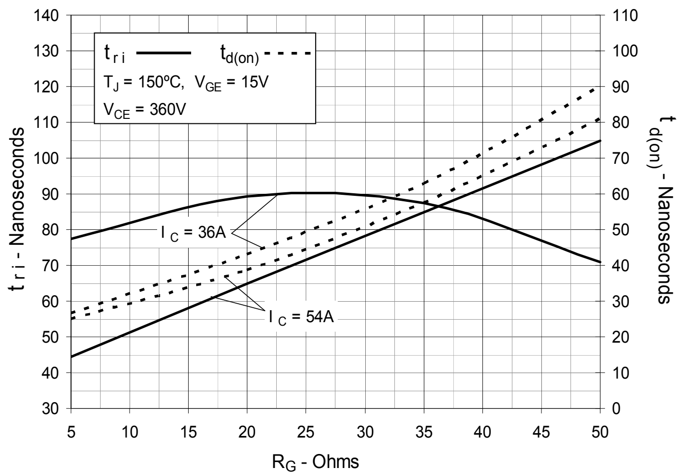


Fig. 20. Inductive Turn-on Switching Times vs. Collector Current

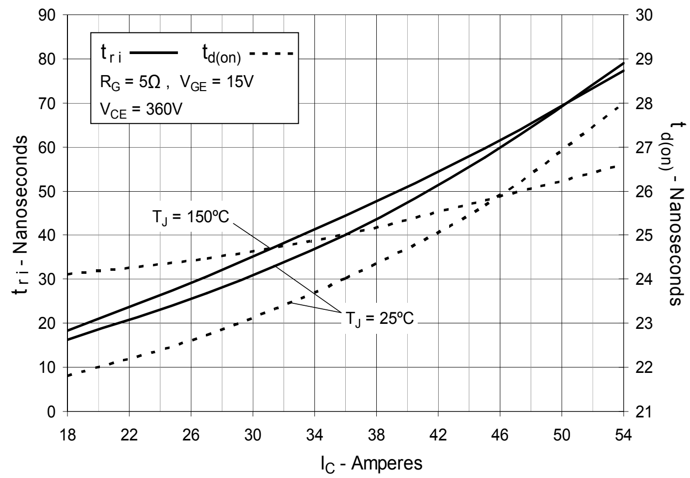
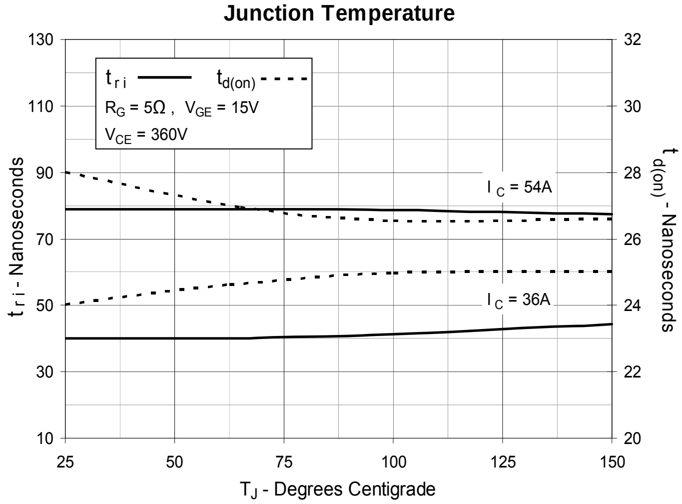


Fig. 21. Inductive Turn-on Switching Times vs. Junction Temperature



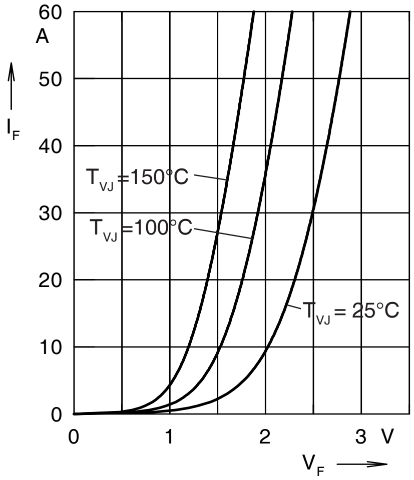


Fig. 22. Forward Current I_F Versus V_F

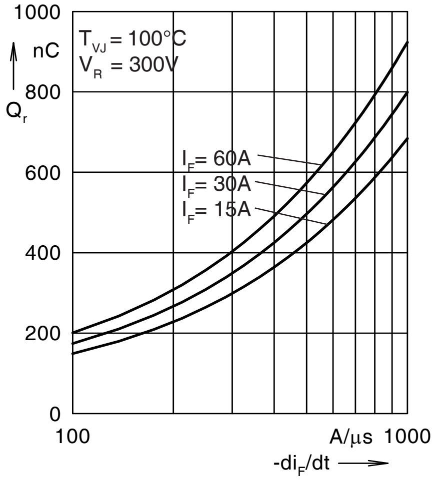


Fig. 23. Reverse Recovery Charge Q_r Versus $-di_F/dt$

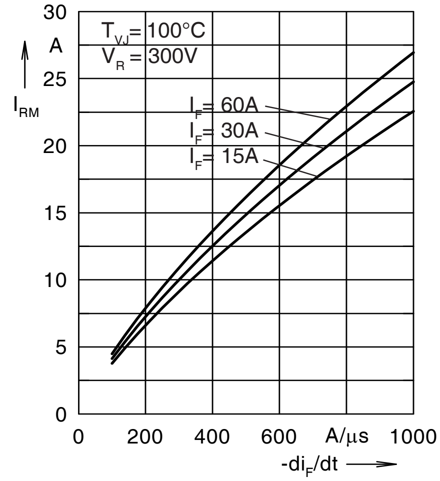


Fig. 24. Peak Reverse Current I_{RM} Versus $-di_F/dt$

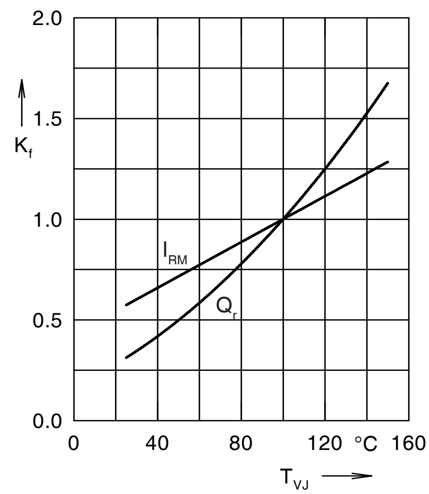


Fig. 25. Dynamic Parameters Q_r, I_{RM} Versus T_{VJ}

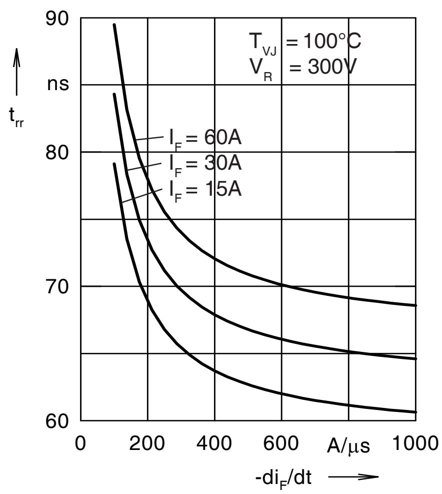


Fig. 26. Recovery Time t_{rr} Versus $-di_F/dt$

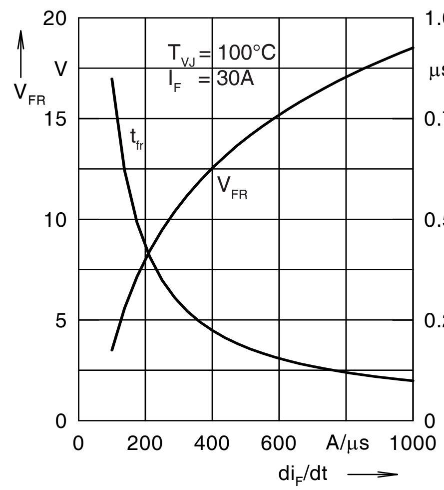


Fig. 27. Peak Forward Voltage V_{FR} and t_{fr} Versus di_F/dt

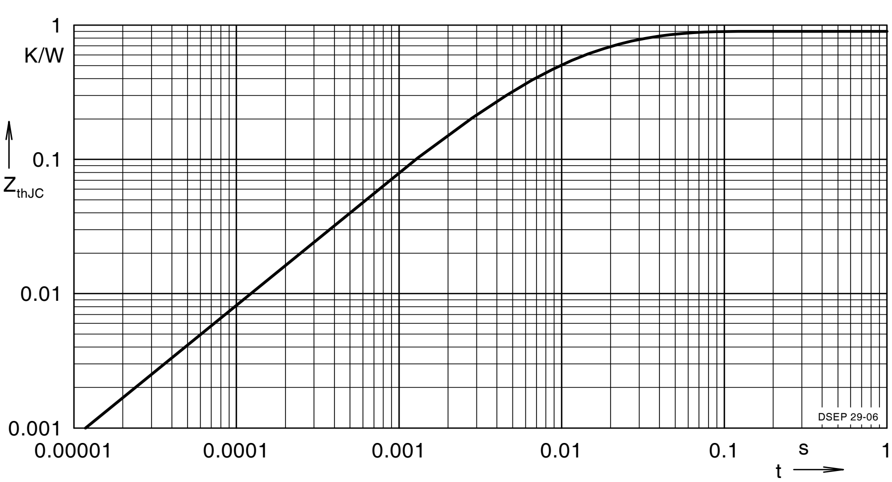


Fig. 28. Transient Thermal Resistance Junction to Case

Constants for Z_{thJC} calculation:

i	R_{thi} (K/W)	t_i (s)
1	0.502	0.0052
2	0.193	0.0003
3	0.205	0.0162