IXYS

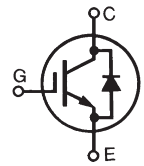
Advance Technical Information

XPT™ 600V IGBT GenX3™ w/ Diode

IXXH30N60B3D1

V_{CES} = 600V
I_{C110} = 30A
$V_{CE(sat)}$ ≤ 1.85V
$t_{fi(typ)}$ = 125ns

Extreme Light Punch Through
IGBT for 5-30 kHz Switching



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	60	A
I_{C110}	T_C = 110°C	30	A
I_{F110}	T_C = 110°C	30	A
I_{CM}	T_C = 25°C, 1ms	115	A
I_A	T_C = 25°C	20	A
E_{AS}	T_C = 25°C	250	mJ
SSOA (RBSOA)	V_{GE} = 15V, T_{VJ} = 150°C, R_G = 10Ω Clamped Inductive Load	I_{CM} = 48 @$V_{CE} \le V_{CES}$	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	270	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			100	μA
	T_J = 150°C			1	mA
I_{GES}	V_{CE} = 0V, V_{GE} = ±20V			±100	nA
$V_{CE(sat)}$	I_C = 24A, V_{GE} = 15V, Note 1		1.66	1.85	V
	T_J = 150°C		1.97		V

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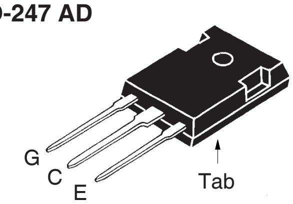


G = Gate
E = Emitter
C = Collector
Tab = Collector

Features

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

Advantages

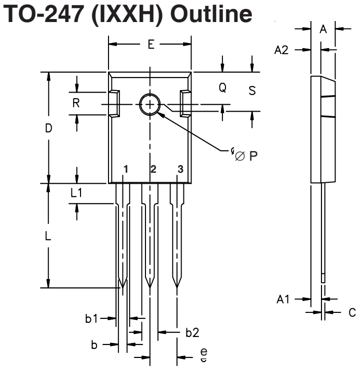
- High Power Density
- 175°C Rated
- Extremely Rugged
- Low Gate Drive Requirement

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}	$I_C = 24A$, $V_{CE} = 10V$, Note 1	8	14		S
C_{ies}	$V_{CE} = 25V$, $V_{GE} = 0V$, f = 1MHz		1185		pF
C_{oes}			137		pF
C_{res}			25		pF
$Q_{g(on)}$	$I_C = 24A$, $V_{GE} = 15V$, $V_{CE} = 0.5 \bullet V_{CES}$		39		nC
Q_{ge}			9		nC
Q_{gc}			17		nC
$t_{d(on)}$	**Inductive load, $T_J = 25°C$**		23		ns
t_{ri}	$I_C = 24A$, $V_{GE} = 15V$		36		ns
E_{on}	$V_{CE} = 400V$, $R_G = 10\Omega$		0.55		mJ
$t_{d(off)}$	Note 2		97	150	ns
t_{fi}			125		ns
E_{off}			0.50	0.80	mJ
$t_{d(on)}$	**Inductive load, $T_J = 150°C$**		23		ns
t_{ri}	$I_C = 24A$, $V_{GE} = 15V$		34		ns
E_{on}	$V_{CE} = 400V$, $R_G = 10\Omega$		1.10		mJ
$t_{d(off)}$	Note 2		112		ns
t_{fi}			180		ns
E_{off}			0.70		mJ
R_{thJC}				0.55	°C/W
R_{thCS}			0.21		°C/W

TO-247 (IXXH) Outline



Terminals: 1 - Gate 2 - Collector 3 - Emitter

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 Diode (FRED)

Symbol	Test Conditions ($T_J = 25°C$ Unless Otherwise Specified)		Characteristic Values Min.	Typ.	Max.	
V_F	$I_F = 24A$, $V_{GE} = 0V$, 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.

ADVANCE TECHNICAL INFORMATION

The product presented herein is under development. The Technical Specifications offered are derived from a subjective evaluation of the design, based upon prior knowledge and experience, and constitute a "considered reflection" of the anticipated result. IXYS reserves the right to change limits, test conditions, and dimensions without notice.

Fig. 1. Output Characteristics @ T_J = 25ºC

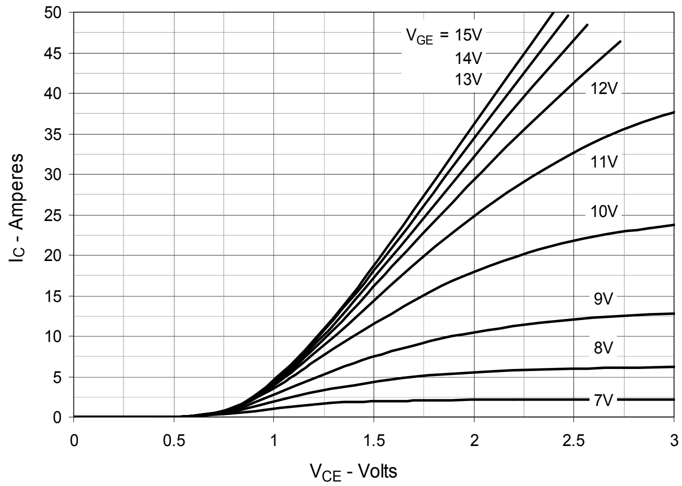


Fig. 2. Extended Output Characteristics @ T_J = 25ºC

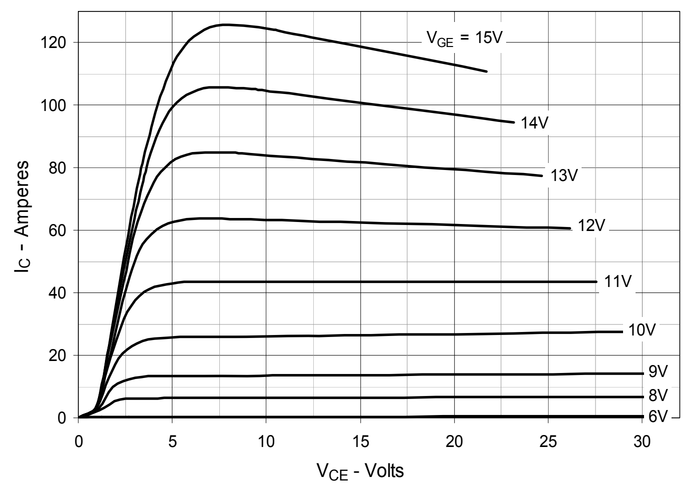


Fig. 3. Output Characteristics @ T_J = 150ºC

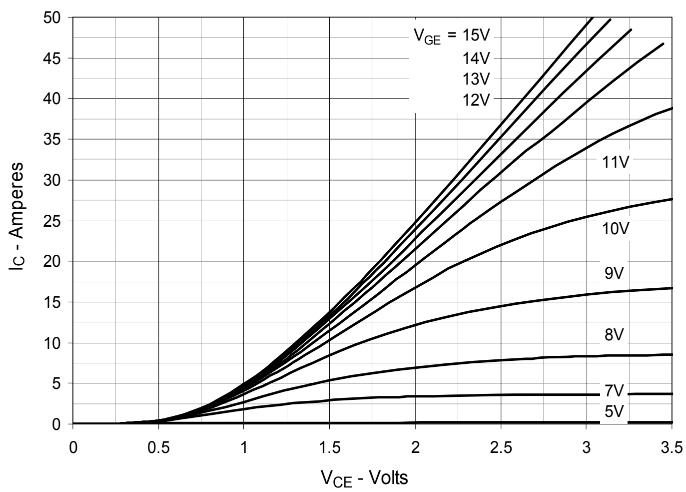


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

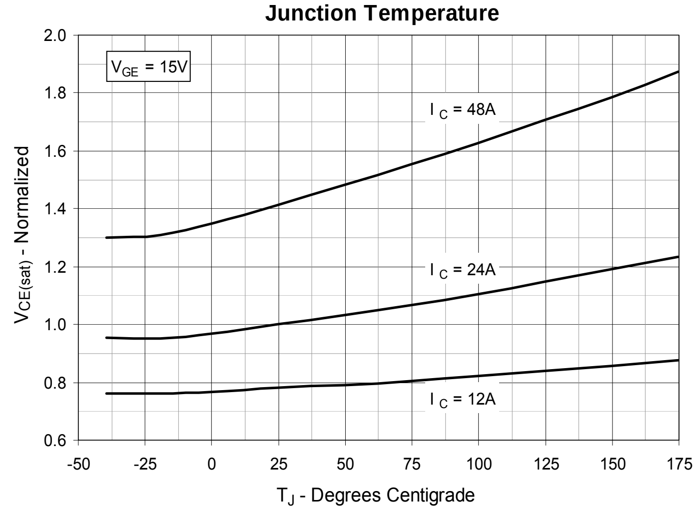


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

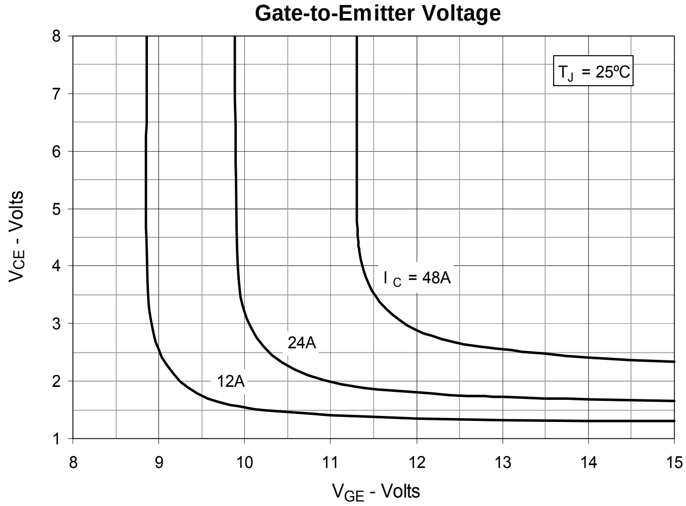
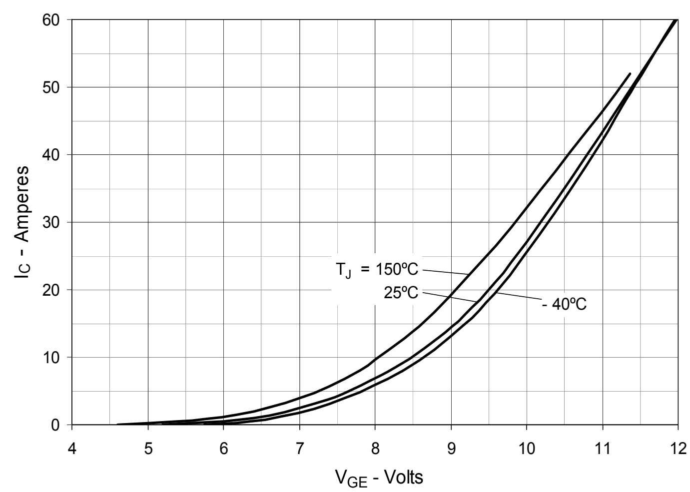


Fig. 6. Input Admittance



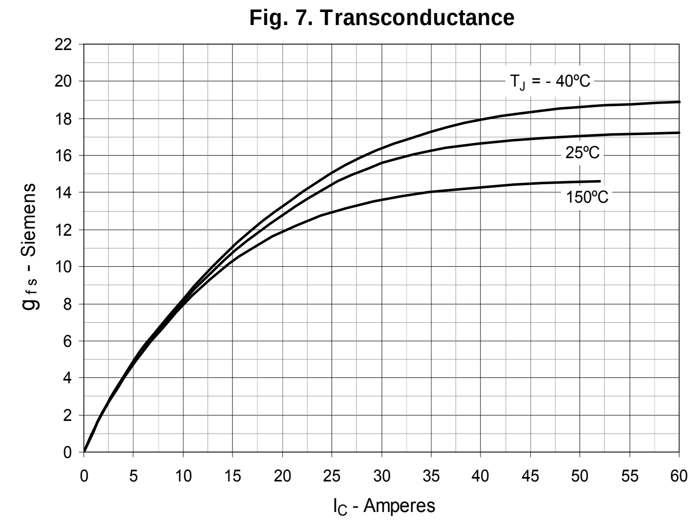


Fig. 7. Transconductance
TJ = - 40ºC
25ºC
150ºC
g f s - Siemens
IC - Amperes

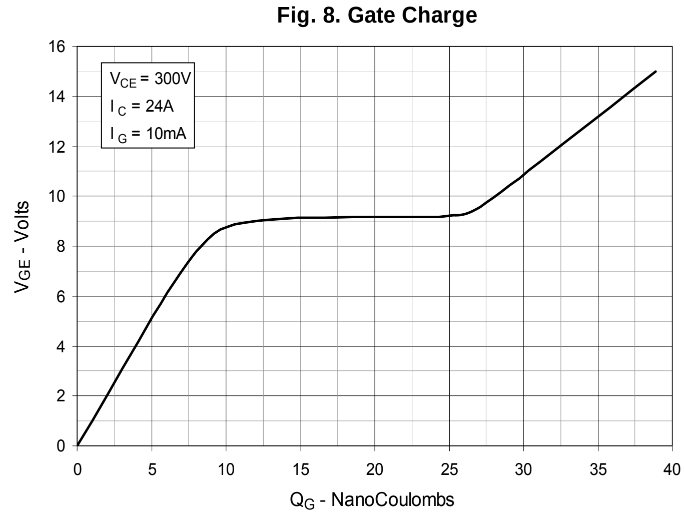


Fig. 8. Gate Charge
VCE = 300V
I C = 24A
I G = 10mA
VGE - Volts
QG - NanoCoulombs

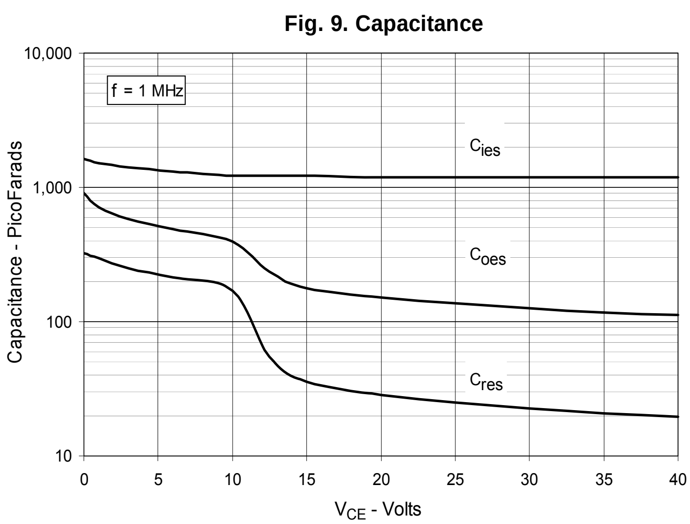


Fig. 9. Capacitance
f = 1 MHz
Cies
Coes
Cres
Capacitance - PicoFarads
VCE - Volts

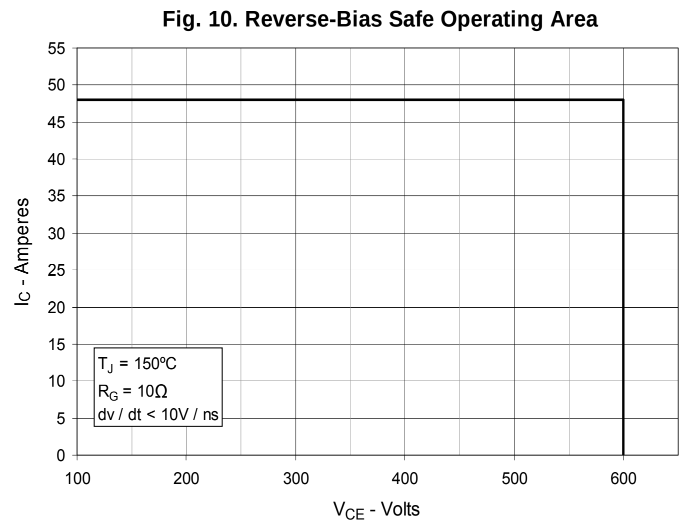


Fig. 10. Reverse-Bias Safe Operating Area
TJ = 150ºC
RG = 10Ω
dv / dt < 10V / ns
IC - Amperes
VCE - Volts

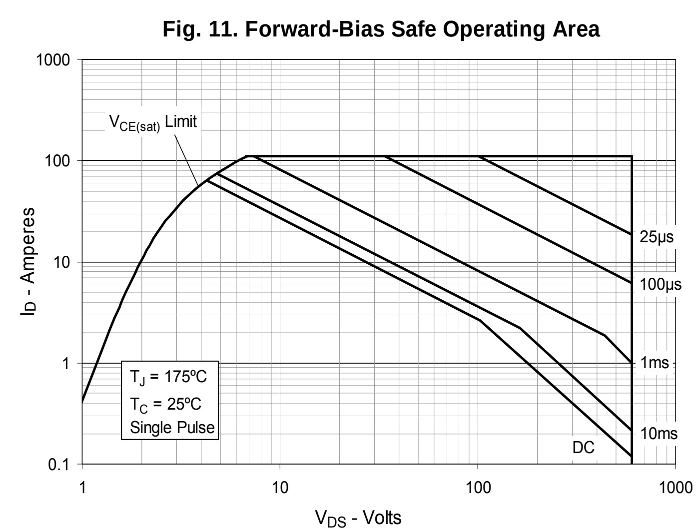


Fig. 11. Forward-Bias Safe Operating Area
VCE(sat) Limit
25µs
100µs
1ms
10ms
DC
TJ = 175ºC
TC = 25ºC
Single Pulse
ID - Amperes
VDS - Volts

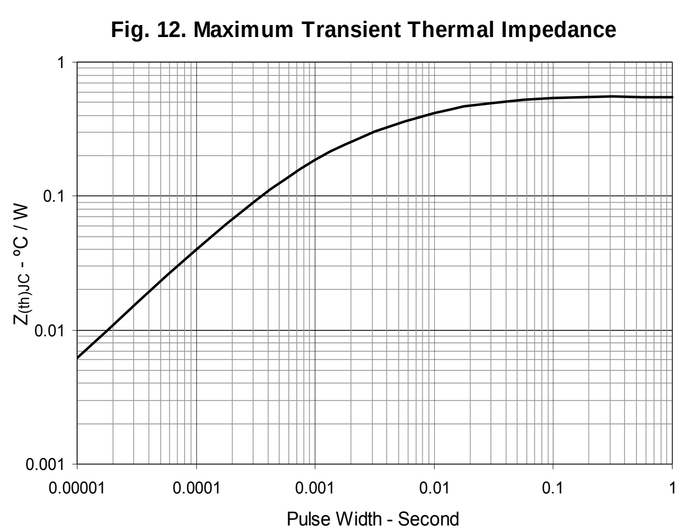


Fig. 12. Maximum Transient Thermal Impedance
Z(th)JC - ºC / W
Pulse Width - Second

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

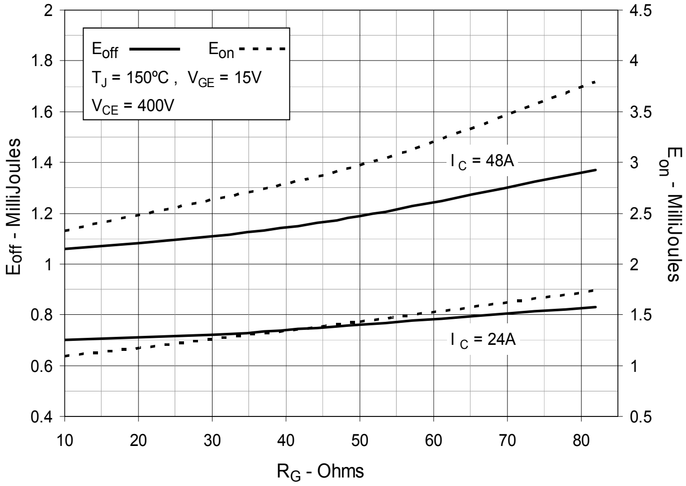


Fig. 14. Inductive Switching Energy Loss vs. Collector Current

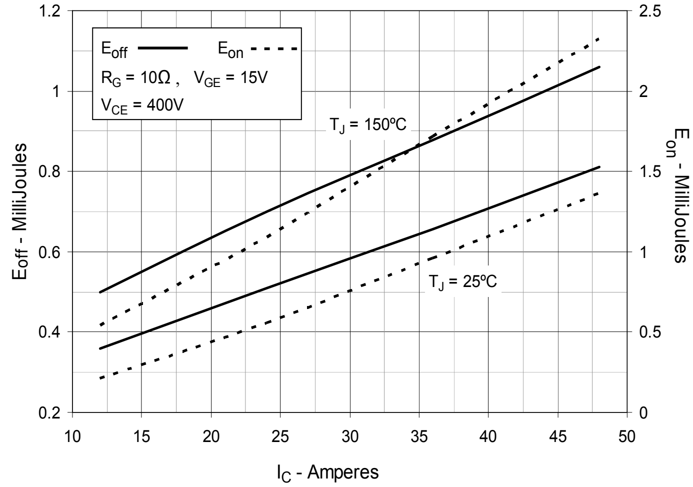


Fig. 15. Inductive Switching Energy Loss vs. Junction Temperature

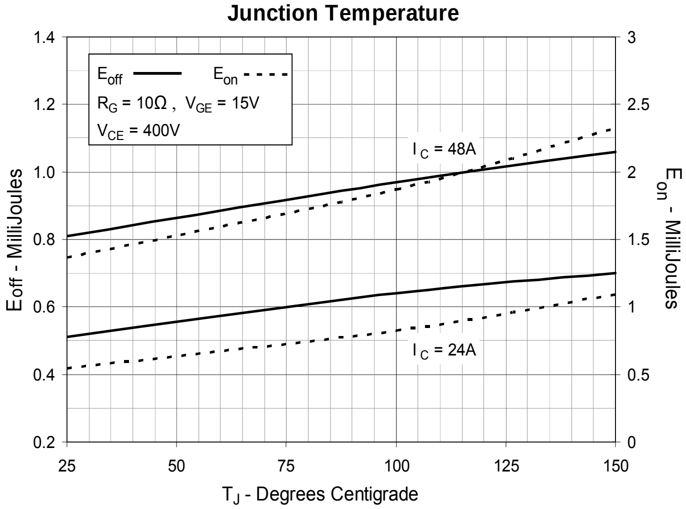


Fig. 16. Inductive Turn-off Switching Times vs. Gate Resistance

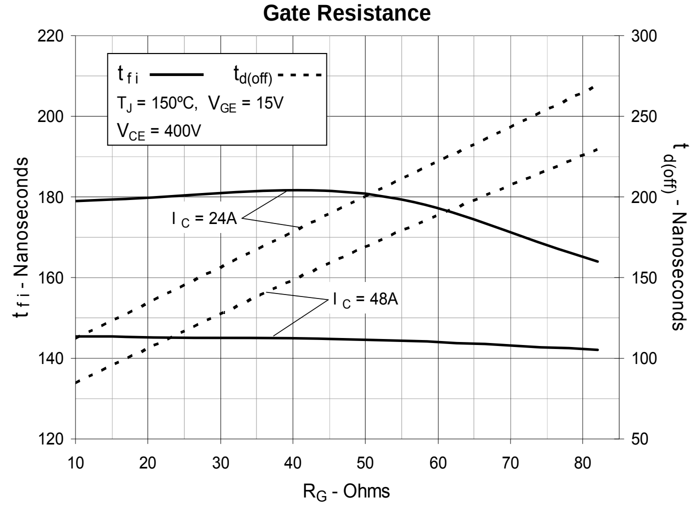


Fig. 17. Inductive Turn-off Switching Times vs. Collector Current

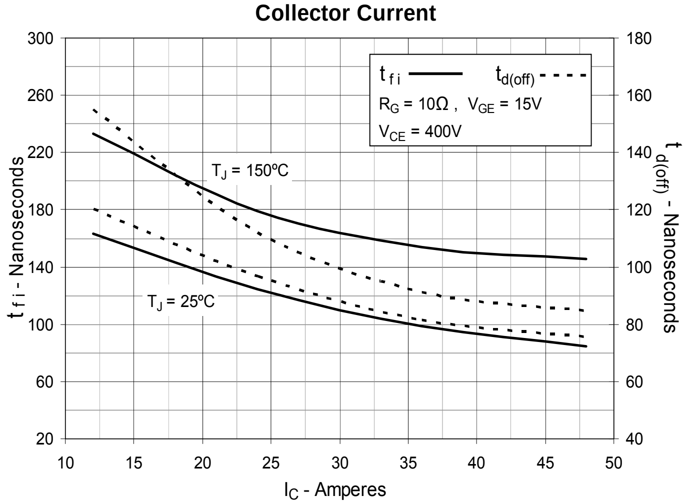


Fig. 18. Inductive Turn-off Switching Times vs. Junction Temperature

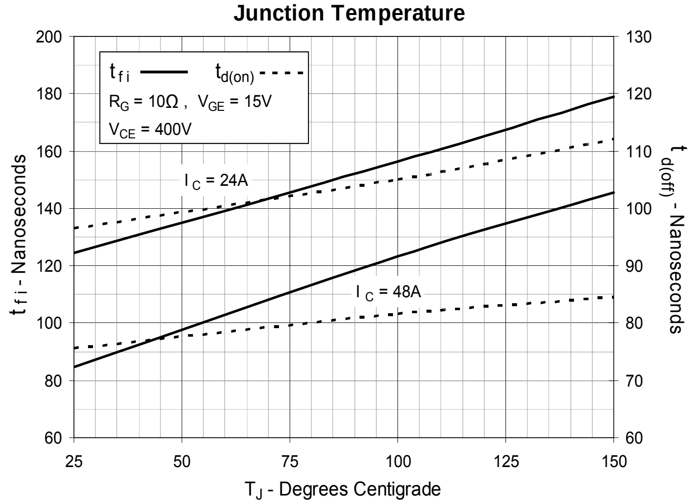


Fig. 19. Inductive Turn-on Switching Times vs. Gate Resistance

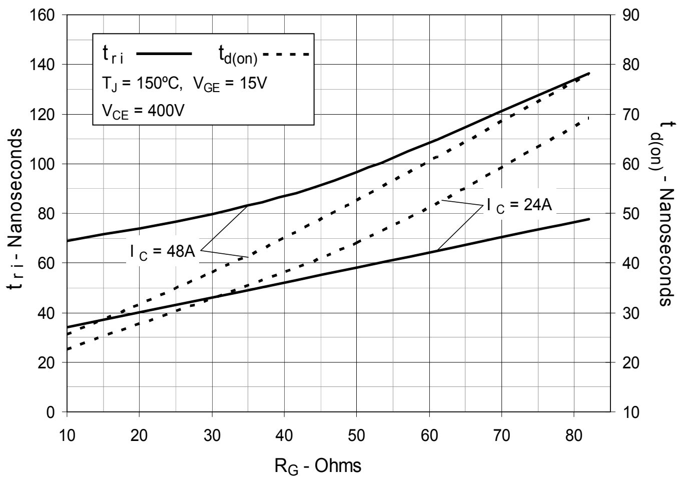


Fig. 20. Inductive Turn-on Switching Times vs. Collector Current

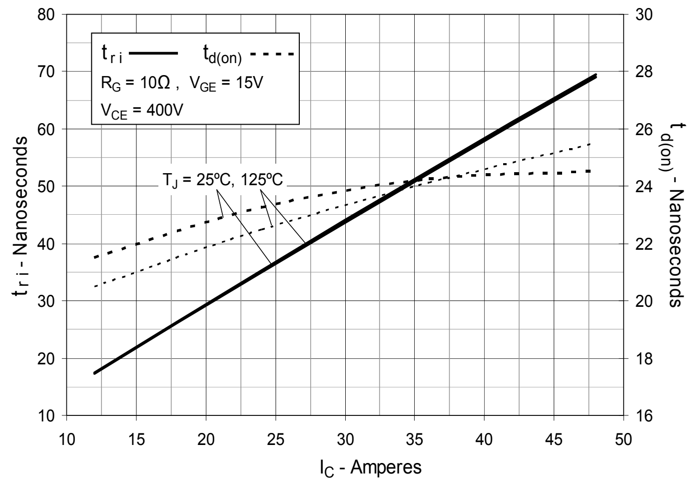
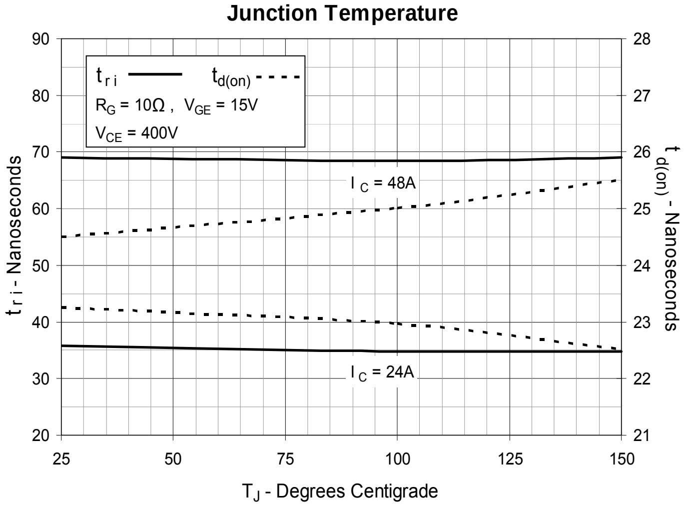


Fig. 21. Inductive Turn-on Switching Times vs. Junction Temperature



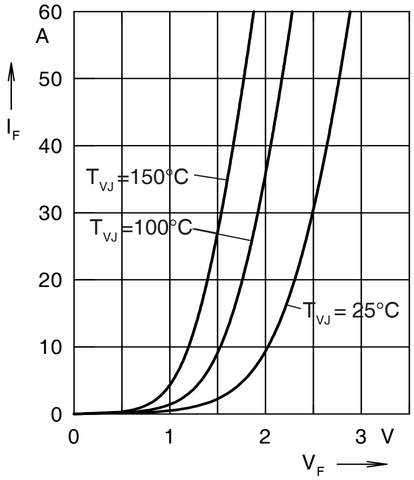


Fig. 22. Forward Current I_F Versus V_F

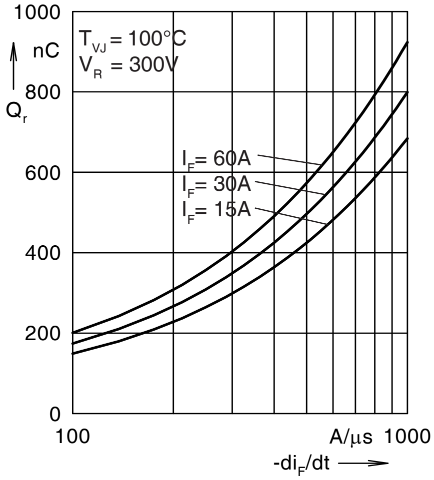


Fig. 23. Reverse Recovery Charge Q_r Versus $-di_F/dt$

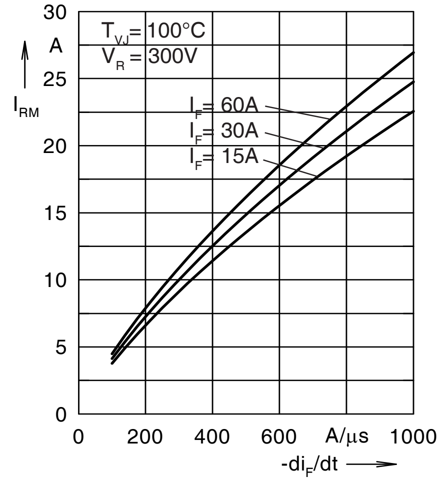


Fig. 24. Peak Reverse Current I_{RM} Versus $-di_F/dt$

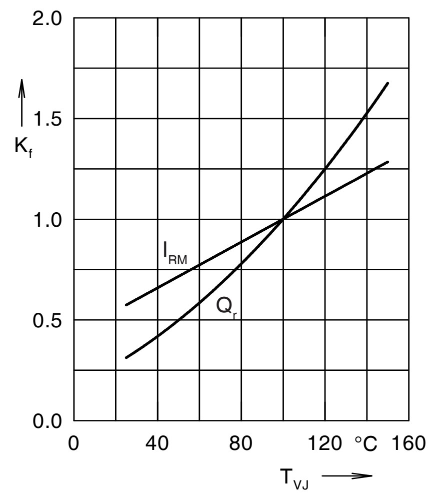


Fig. 25. Dynamic Parameters Q_r, I_{RM} Versus T_{VJ}

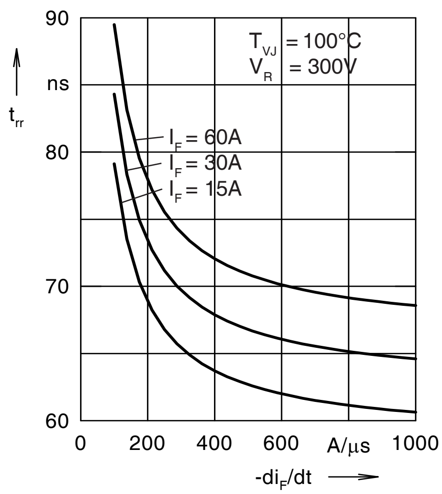


Fig. 26. Recovery Time t_{rr} Versus $-di_F/dt$

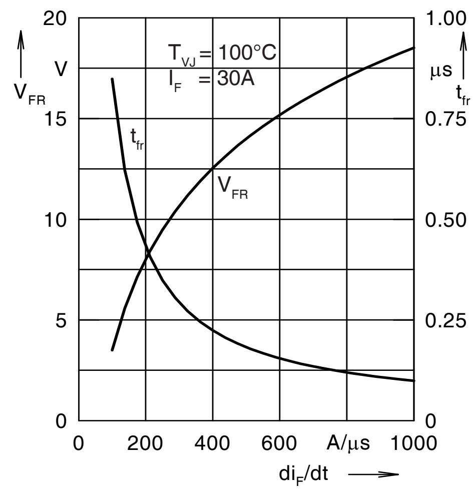


Fig. 28. Peak Forward Voltage V_{FR} and t_{fr} Versus di_F/dt

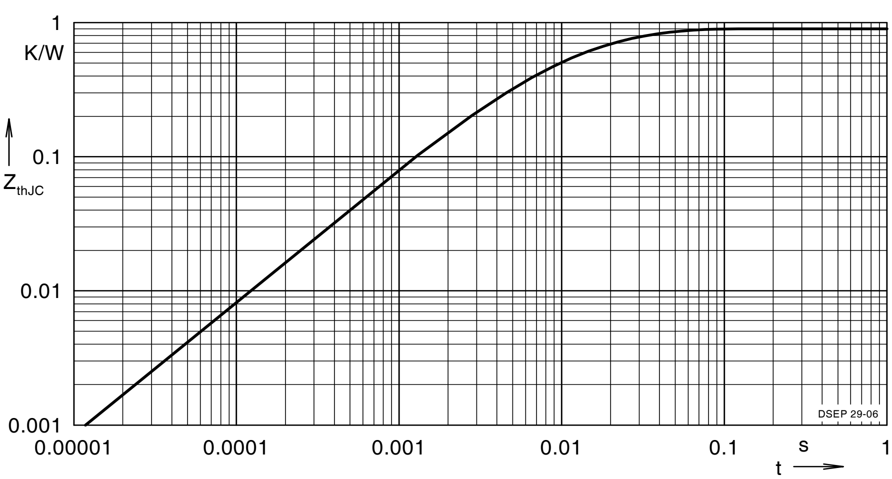


Fig. 28. Transient Thermal Resistance Junction to Case