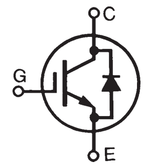
IXYS

XPT™ 650V IGBT GenX3™ w/ Sonic Diode

IXYH40N65C3H1

V_{CES} = 650V
I_{C110} = 40A
$V_{CE(sat)}$ ≤ 2.35V
$t_{fi(typ)}$ = 52ns

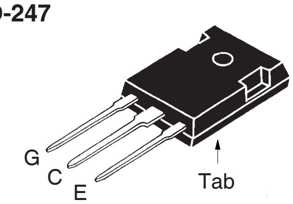
Extreme Light Punch Through IGBT for 20-60 kHz Switching



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	80	A
I_{C110}	T_C = 110°C	40	A
I_{F110}	T_C = 110°C	40	A
I_{CM}	T_C = 25°C, 1ms	180	A
I_A	T_C = 25°C	20	A
E_{AS}	T_C = 25°C	300	mJ
SSOA (RBSOA)	V_{GE} = 15V, T_{VJ} = 150°C, R_G = 10Ω Clamped Inductive Load	I_{CM} = 80 $V_{CE} \le V_{CES}$	A
t_{sc} (SCSOA)	V_{GE}= 15V, V_{CE} = 360V, T_J = 150°C R_G = 82Ω, Non Repetitive	5	µs
P_C	T_C = 25°C	300	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}	3.5		6.0	V
I_{CES}	V_{CE} = V_{CES}, V_{GE} = 0V			50	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		2.00	2.35	V
	T_J = 150°C		2.40		V

TO-247



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

Features

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

Advantages

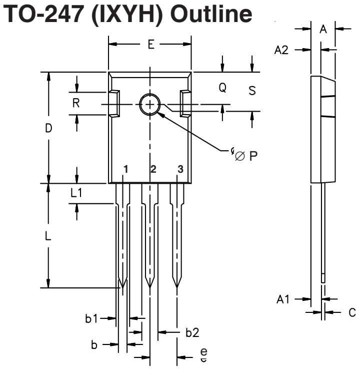
- High Power Density
- Extremely Rugged
- Low Gate Drive Requirement

Applications

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

Symbol	Test Conditions (T_J = 25°C Unless Otherwise Specified)	Min.	Typ.	Max.	Unit
g_{fs}	I_C = 40A, V_{CE} = 10V, Note 1	16	27		S
C_{ies}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz		1980		pF
C_{oes}			215		pF
C_{res}			40		pF
$Q_{g(on)}$	I_C = 40A, V_{GE} = 15V, V_{CE} = 0.5 • V_{CES}		70		nC
Q_{ge}			14		nC
Q_{gc}			34		nC
$t_{d(on)}$	**Inductive load, T_J = 25°C**		26		ns
t_{ri}	I_C = 30A, V_{GE} = 15V		40		ns
E_{on}	V_{CE} = 400V, R_G = 10Ω		0.86		mJ
$t_{d(off)}$	Note 2		106		ns
t_{fi}			52		ns
E_{off}			0.40	0.75	mJ
$t_{d(on)}$	**Inductive load, T_J = 150°C**		25		ns
t_{ri}	I_C = 30A, V_{GE} = 15V		40		ns
E_{on}	V_{CE} = 400V, R_G = 10Ω		1.33		mJ
$t_{d(off)}$	Note 2		126		ns
t_{fi}			80		ns
E_{off}			0.46		mJ
R_{thJC}				0.50	°C/W
R_{thCS}			0.21		°C/W

TO-247 (IXYH) 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 Sonic Diode (FRD)

Symbol	Test Conditions (T_J = 25°C Unless Otherwise Specified)		Min.	Typ.	Max.	Unit
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		32		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

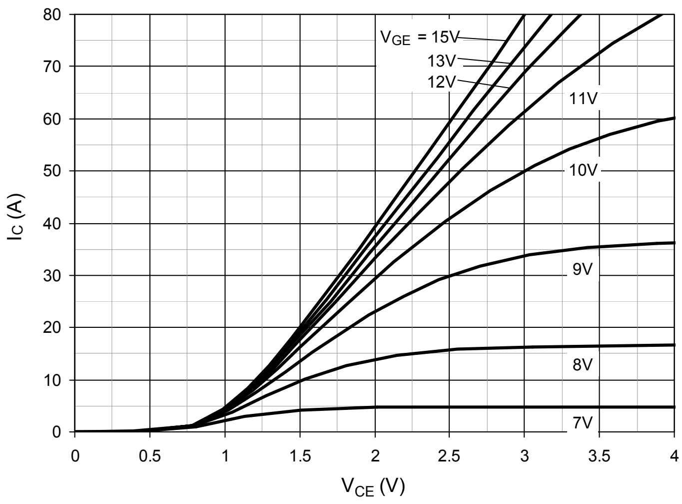


Fig. 2. Extended Output Characteristics @ T_J = 25ºC

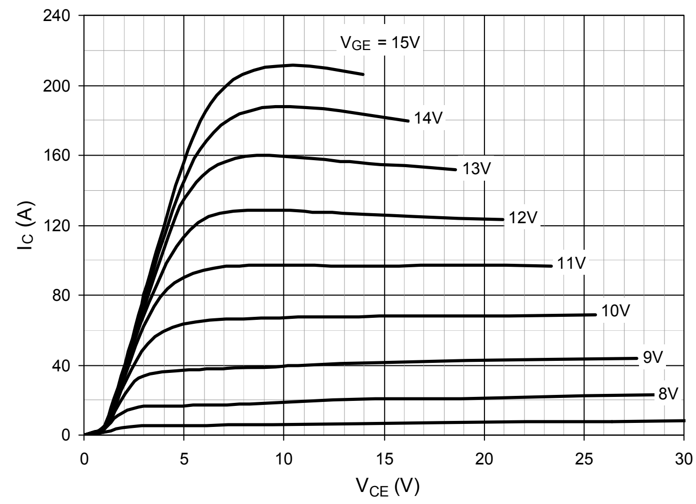


Fig. 3. Output Characteristics @ T_J = 150ºC

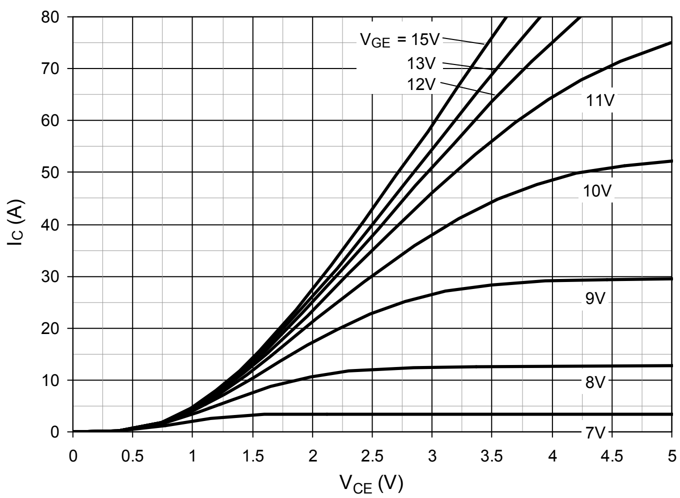


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

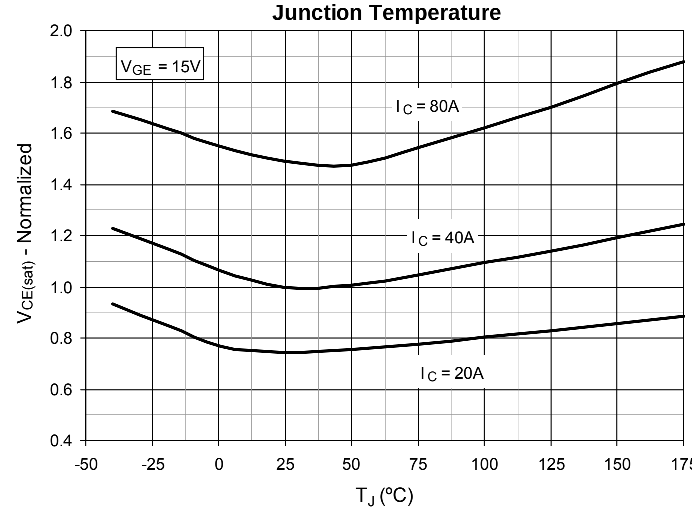


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

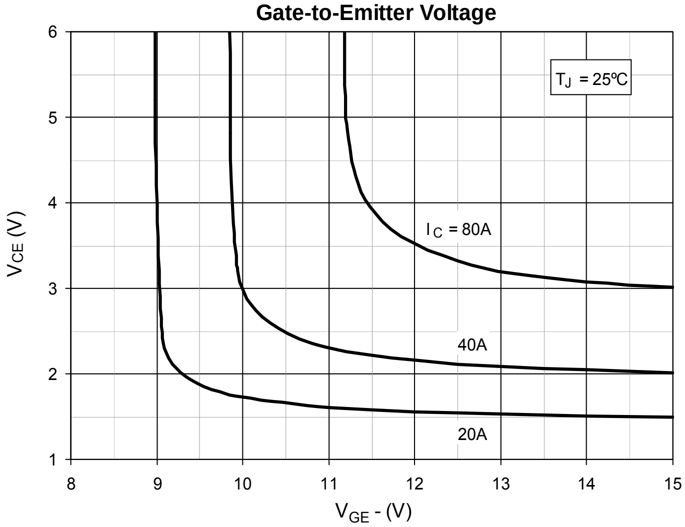
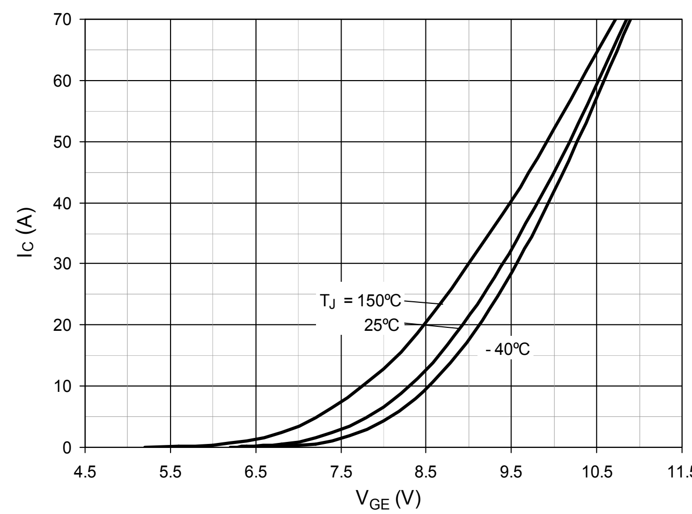


Fig. 6. Input Admittance



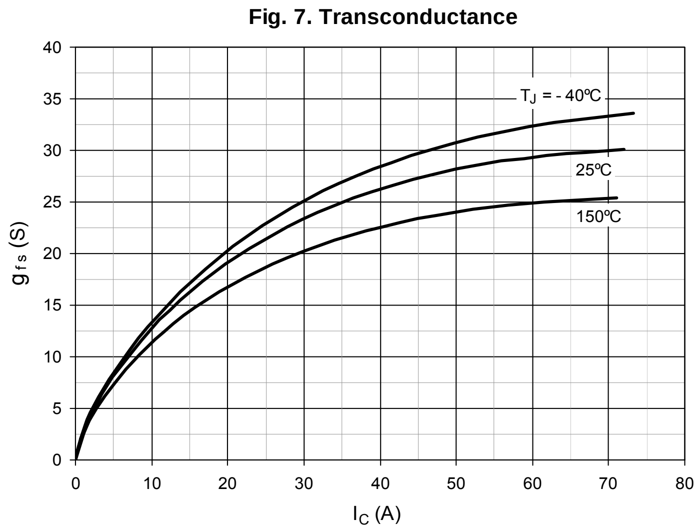


Fig. 7. Transconductance
T_J = - 40ºC
25ºC
150ºC
g_{fs} (S)
I_C (A)

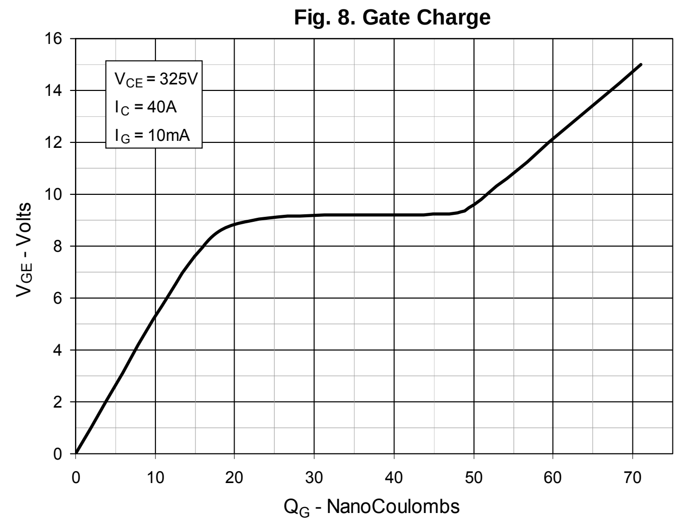


Fig. 8. Gate Charge
V_{CE} = 325V
I_C = 40A
I_G = 10mA
V_{GE} - Volts
Q_G - NanoCoulombs

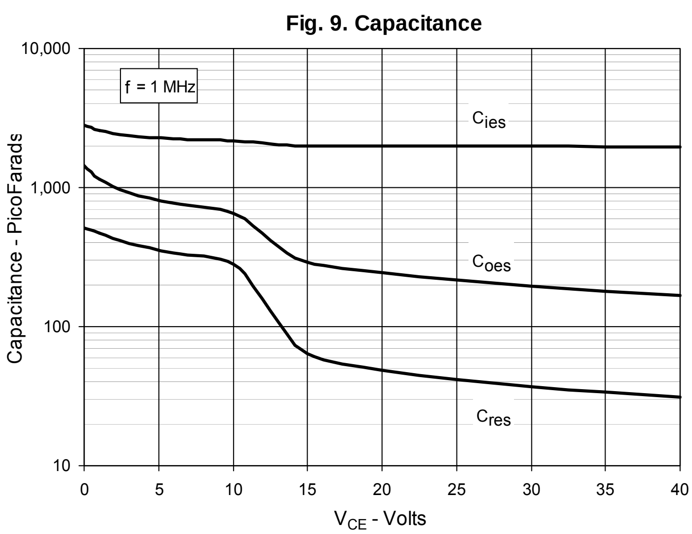


Fig. 9. Capacitance
f = 1 MHz
C_{ies}
C_{oes}
C_{res}
Capacitance - PicoFarads
V_{CE} - Volts

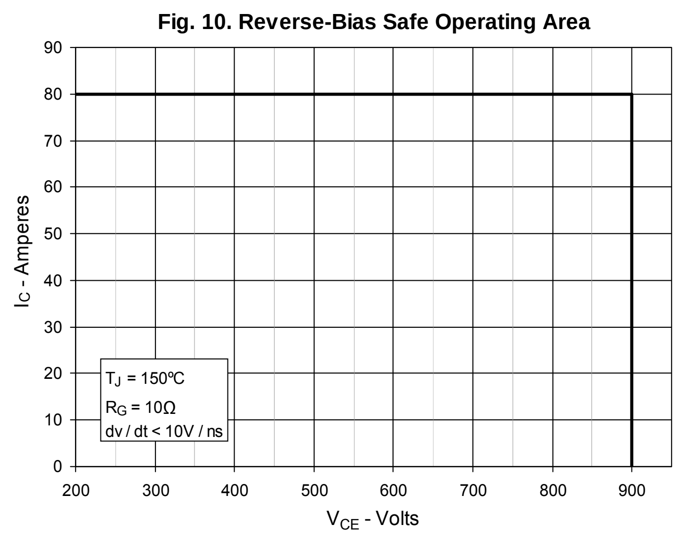


Fig. 10. Reverse-Bias Safe Operating Area
T_J = 150ºC
R_G = 10Ω
dv / dt < 10V / ns
I_C - Amperes
V_{CE} - Volts

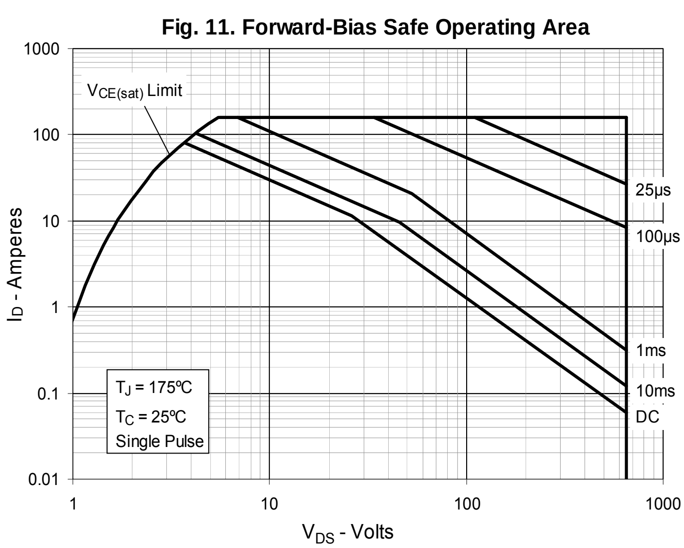


Fig. 11. Forward-Bias Safe Operating Area
$V_{CE(sat)}$ Limit
25µs
100µs
1ms
10ms
DC
T_J = 175ºC
T_C = 25ºC
Single Pulse
I_D - Amperes
V_{DS} - Volts

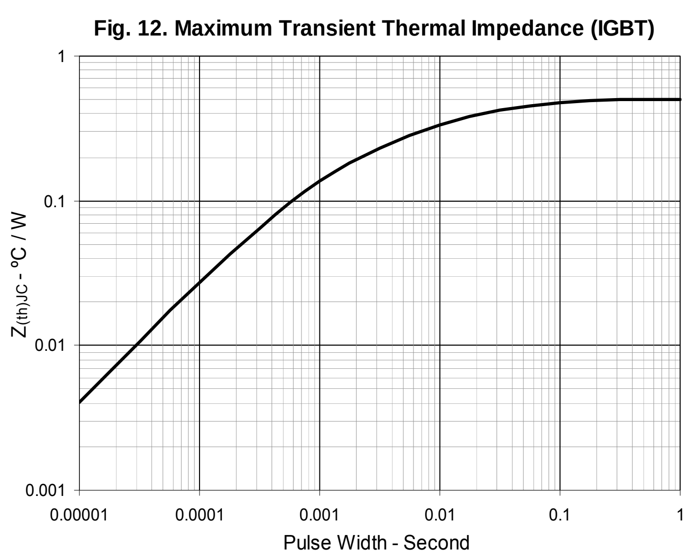


Fig. 12. Maximum Transient Thermal Impedance (IGBT)
$Z_{(th)JC}$ - ºC / W
Pulse Width - Second

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

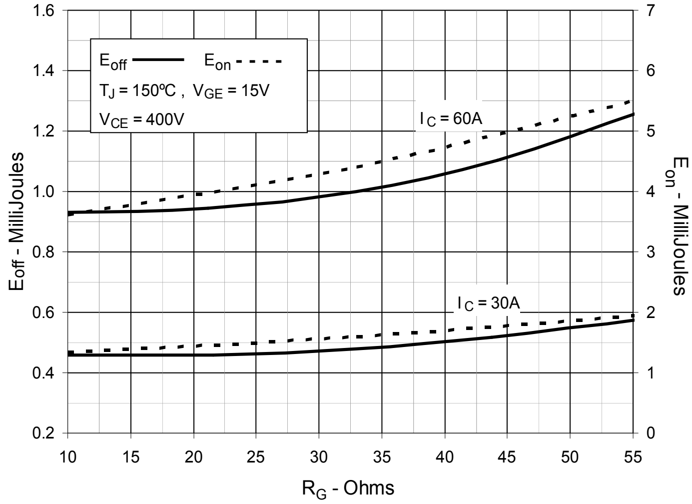


Fig. 14. Inductive Switching Energy Loss vs. Collector Current

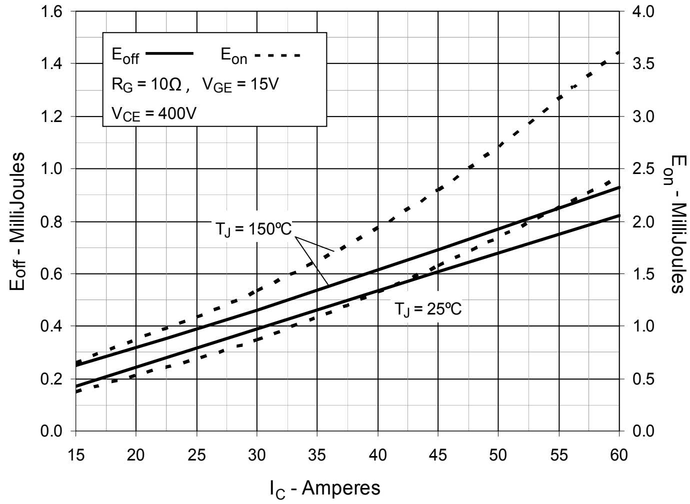


Fig. 15. Inductive Switching Energy Loss vs. Junction Temperature

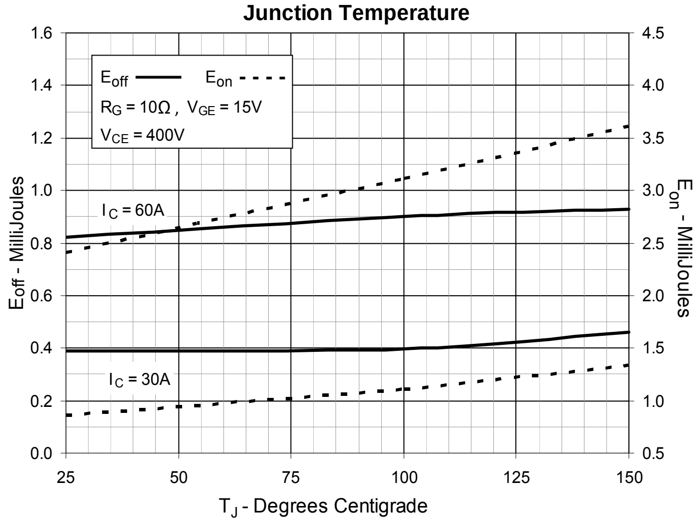


Fig. 16. Inductive Turn-off Switching Times vs. Gate Resistance

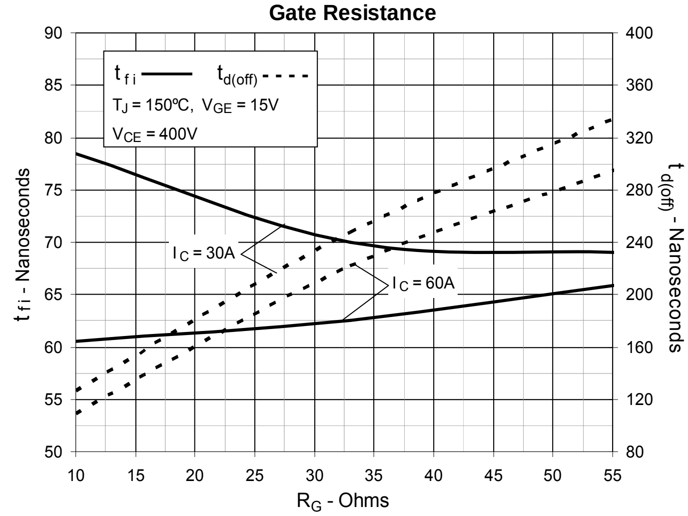


Fig. 17. Inductive Turn-off Switching Times vs. Collector Current

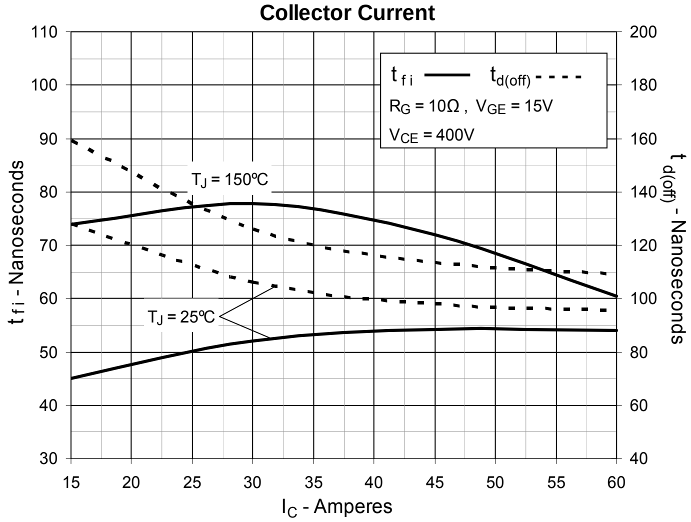
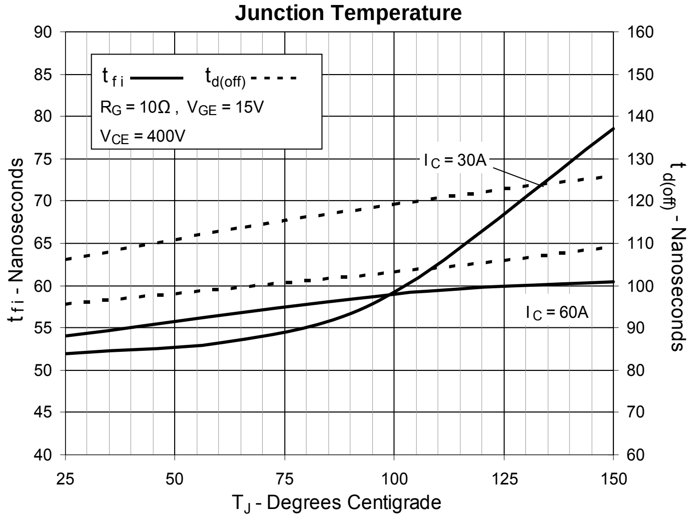


Fig. 18. Inductive Turn-off Switching Times vs. Junction Temperature



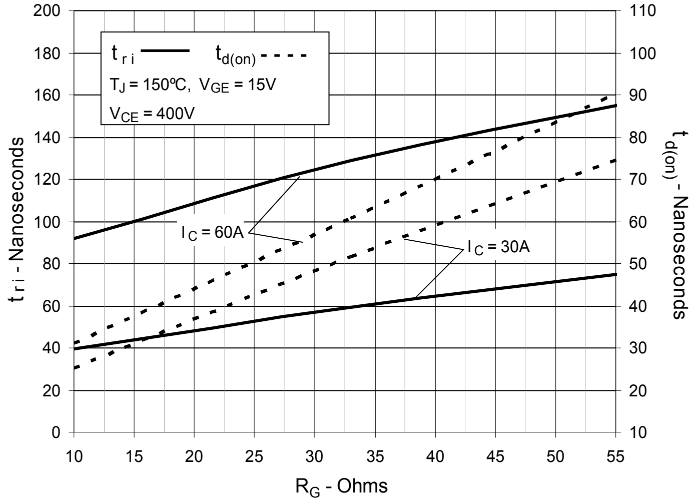


Fig. 19. Inductive Turn-on Switching Times vs. Gate Resistance

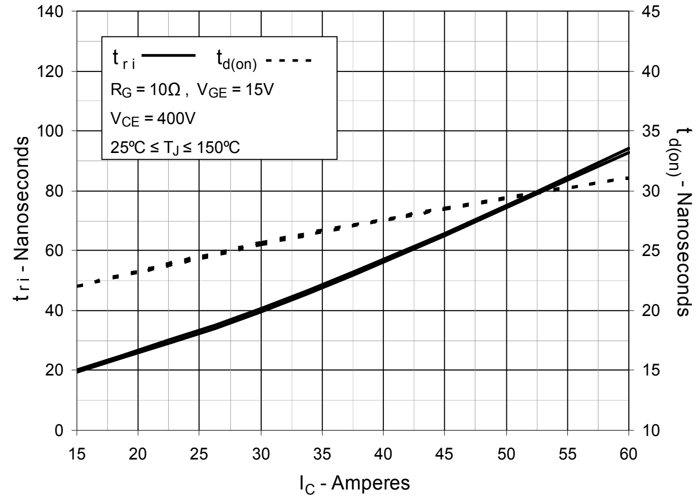


Fig. 20. Inductive Turn-on Switching Times vs. Collector Current

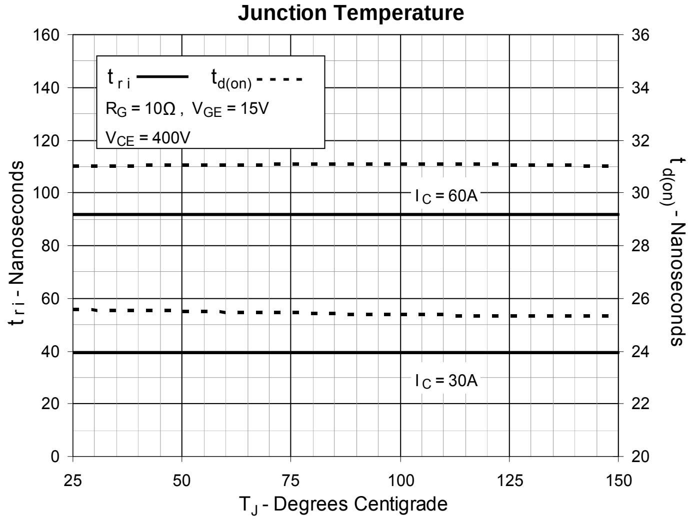


Fig. 21. Inductive Turn-on Switching Times vs. Junction Temperature

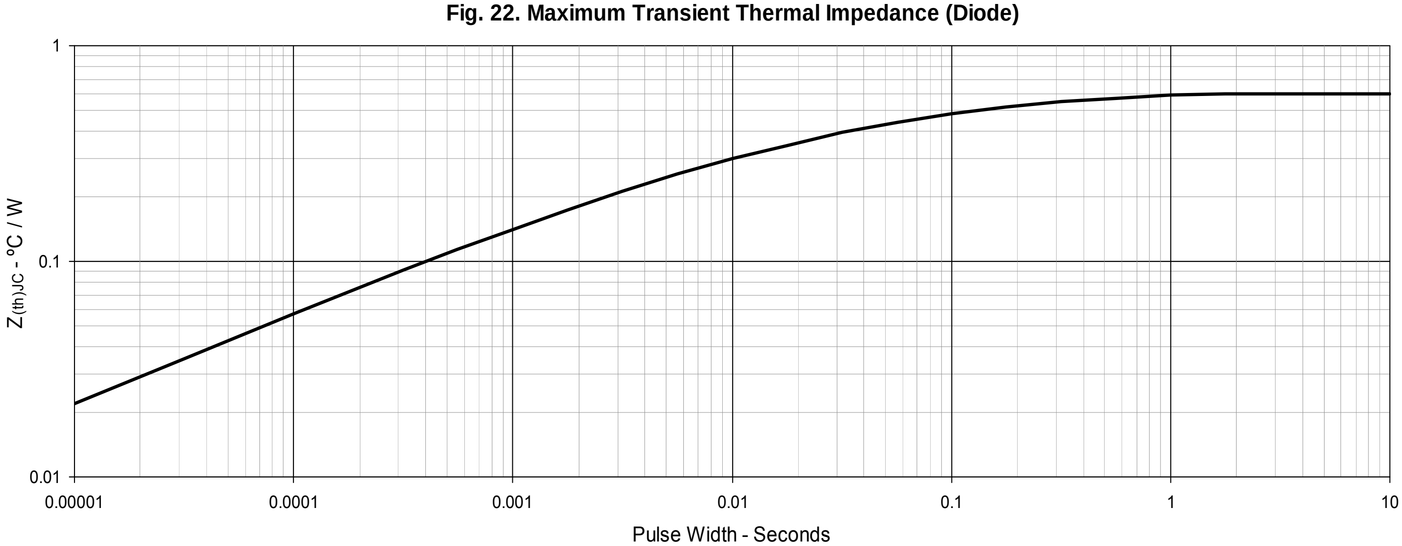


Fig. 22. Maximum Transient Thermal Impedance (Diode)

Fig. 23. Forward Current vs. Forward Voltage

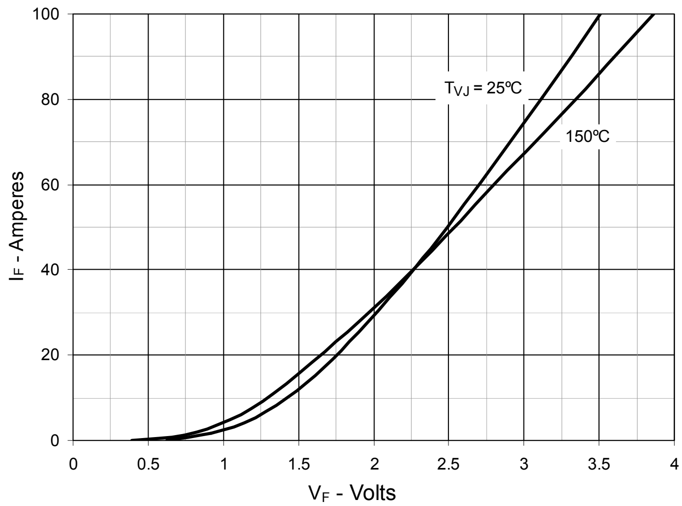


Fig. 24. Reverse Recovery Charge Q_{RR} vs. $-di_F/dt$

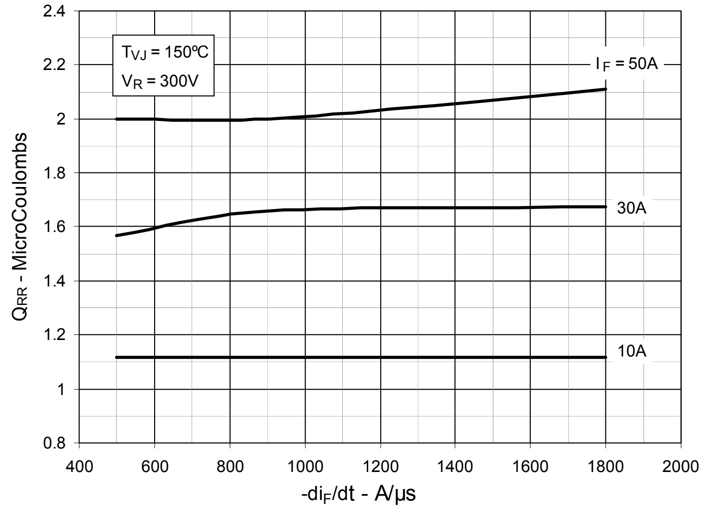


Fig. 25. Peak Reverse Current I_{RM} vs. $-di_F/dt$

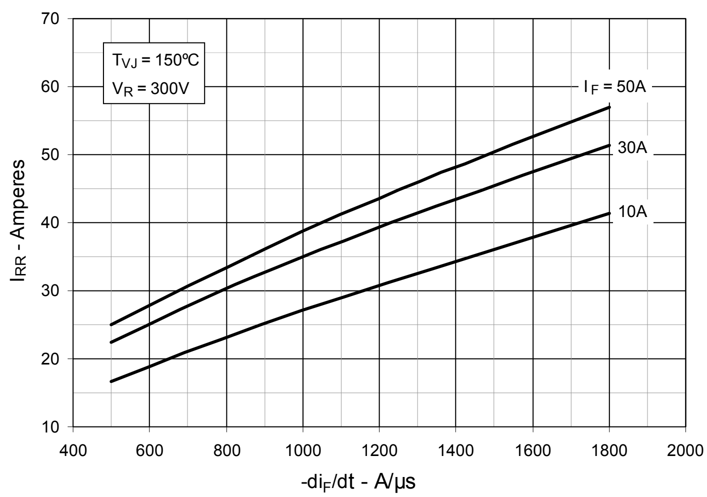


Fig. 26. Recover Time t_{RR} vs. $-di_F/dt$

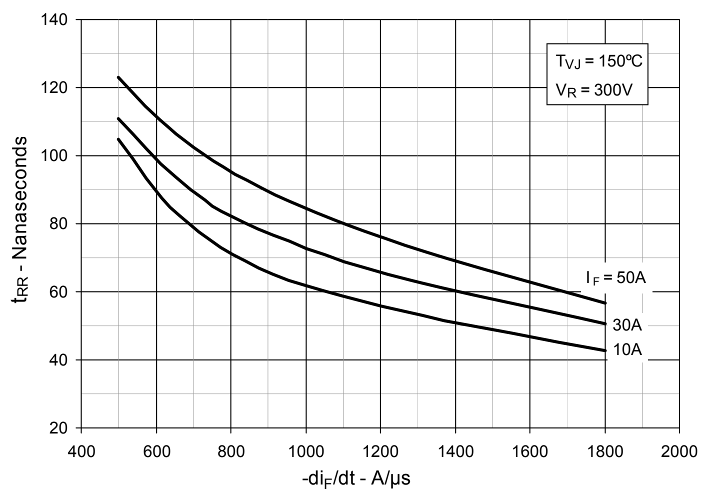


Fig. 27. Recovery Energy E_{REC} vs. $-di_F/dt$

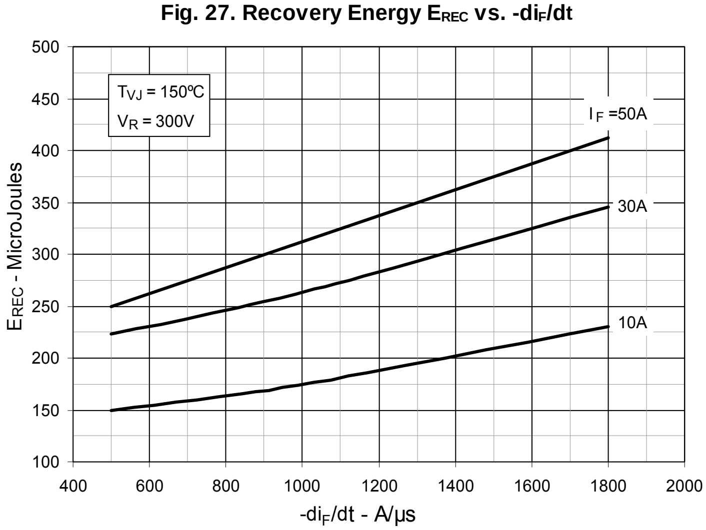


Fig. 28. Dynamic Parameters Q_{RR}, I_{RM} vs. Virtual Junction Temperature T_{VJ}