IXYS

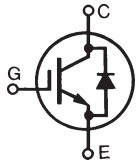
Preliminary Technical Information

XPT™ 650V IGBT GenX3™ w/ Diode

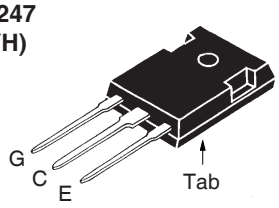
IXYH40N65C3D1
IXYQ40N65C3D1

V_{CES} = 650V
I_{C110} = 40A
$V_{CE(sat)}$ ≤ 2.35V
$t_{fi(typ)}$ = 20ns

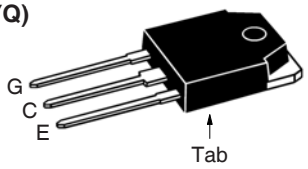
Extreme Light Punch Through
IGBT for 20-60 kHz Switching



TO-247 (IXYH)



TO-3P (IXYQ)



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	80	A
I_{C110}	T_C = 110°C	40	A
I_{F110}	T_C = 110°C	50	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 @$V_{CE} \leq V_{CES}$	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	TO-247	6.0	g
	TO-3P	5.5	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			10	μA
	T_J = 150°C			1.5	mA
I_{GES}	V_{CE} = 0V, V_{GE} = ±20V			±100	nA
$V_{CE(sat)}$	I_C = 40A, V_{GE} = 15V, Note 1		2.0	2.35	V
	T_J = 150°C		2.4		V

Features

- Optimized for 20-60kHz Switching
- Square RBSOA
- Anti-Parallel Fast Diode
- Avalanche Rated
- Short Circuit Capability

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

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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	16	26		S
C_{ies}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz		1950		pF
C_{oes}			205		pF
C_{res}			40		pF
$Q_{g(on)}$	I_C = 40A, V_{GE} = 15V, V_{CE} = 0.5 • V_{CES}		66		nC
Q_{ge}			13		nC
Q_{gc}			32		nC
$t_{d(on)}$	**Inductive load, T_J = 25°C**		23		ns
t_{ri}	I_C = 30A, V_{GE} = 15V		40		ns
E_{on}	V_{CE} = 400V, R_G = 10Ω		0.83		mJ
$t_{d(off)}$	Note 2		110		ns
t_{fi}			20		ns
E_{off}			0.36	0.65	mJ
$t_{d(on)}$	**Inductive load, T_J = 150°C**		24		ns
t_{ri}	I_C = 30A, V_{GE} = 15V		40		ns
E_{on}	V_{CE} = 400V, R_G = 10Ω		1.60		mJ
$t_{d(off)}$	Note 2		130		ns
t_{fi}			30		ns
E_{off}			0.53		mJ
R_{thJC}				0.50	°C/W
R_{thCS}			0.25		°C/W

Reverse Fast Recovery 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				2.5	V
		T_J = 150°C		1.2		V
I_{rr}	I_F = 30A, V_{GE} = 0V,	T_J = 150°C		23		A
t_{rr}	$-di_F/dt$ = 500A/µs, V_R = 400V	T_J = 150°C		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.

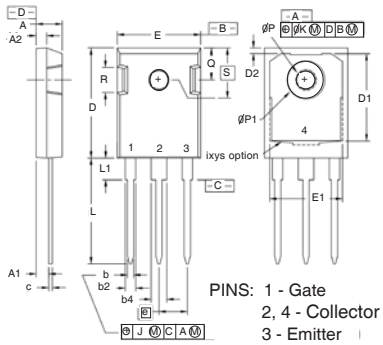
PRELIMINARY TECHNICAL INFORMATION

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.

IXYS Reserves the Right to Change Limits, Test Conditions, and Dimensions.

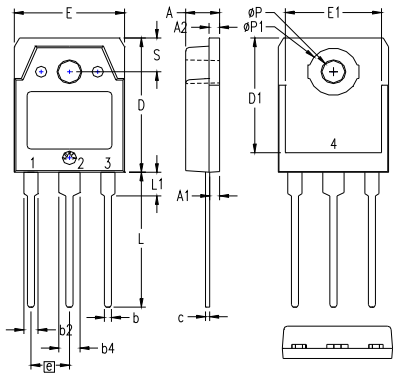
IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents: 4,835,592 4,860,072 4,881,106 4,931,844 5,017,508 5,034,796 5,049,961 5,063,307 5,187,117 5,237,481 5,381,025 5,486,715 6,162,665 6,259,123 B1 6,306,728 B1 6,404,065 B1 6,534,343 6,583,505 6,683,344 6,710,405 B2 6,710,463 6,727,585 6,759,692 6,771,478 B2 7,005,734 B2 7,063,975 B2 7,071,537 7,157,338B2

TO-247 Outline



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	

TO-3P Outline



Pins: 1 - Gate 2 - Collector
3 - Emitter 4 - Collector

SYM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	.185	.193	4.70	4.90
A1	.051	.059	1.30	1.50
A2	.057	.065	1.45	1.65
b	.035	.045	0.90	1.15
b2	.075	.087	1.90	2.20
b4	.114	.126	2.90	3.20
c	.022	.031	0.55	0.80
D	.780	.791	19.80	20.10
D1	.665	.677	16.90	17.20
E	.610	.622	15.50	15.80
E1	.531	.539	13.50	13.70
e	.215 BSC		5.45 BSC	
L	.779	.795	19.80	20.20
L1	.134	.142	3.40	3.60
øP	.126	.134	3.20	3.40
øP1	.272	.280	6.90	7.10
S	.193	.201	4.90	5.10

Fig. 1. Output Characteristics @ T_J = 25°C

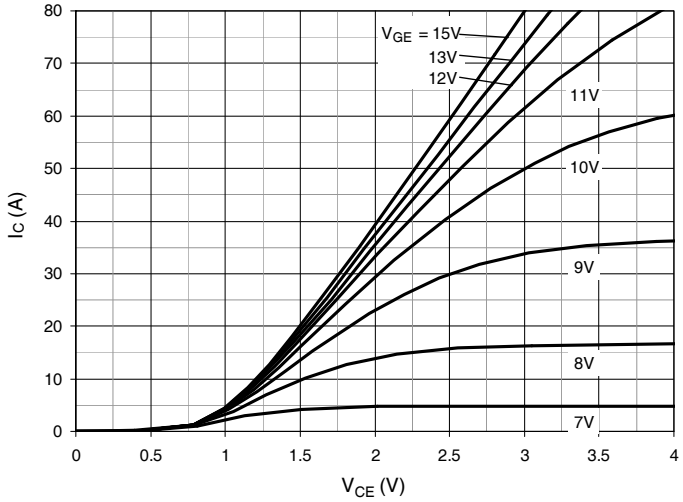


Fig. 2. Extended Output Characteristics @ T_J = 25°C

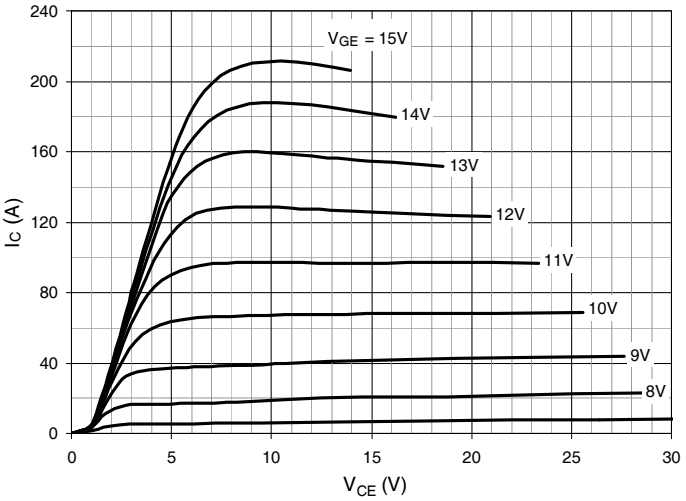


Fig. 3. Output Characteristics @ T_J = 150°C

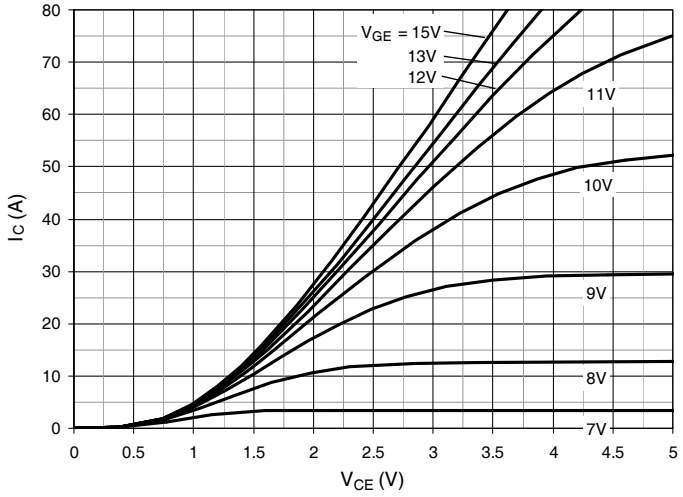


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

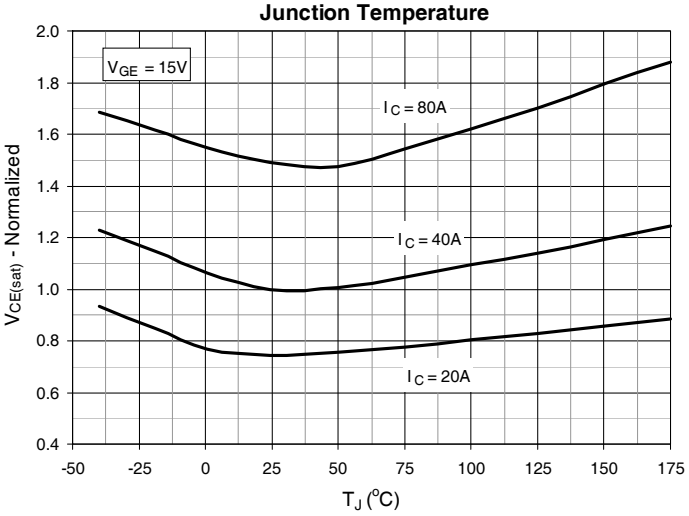


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

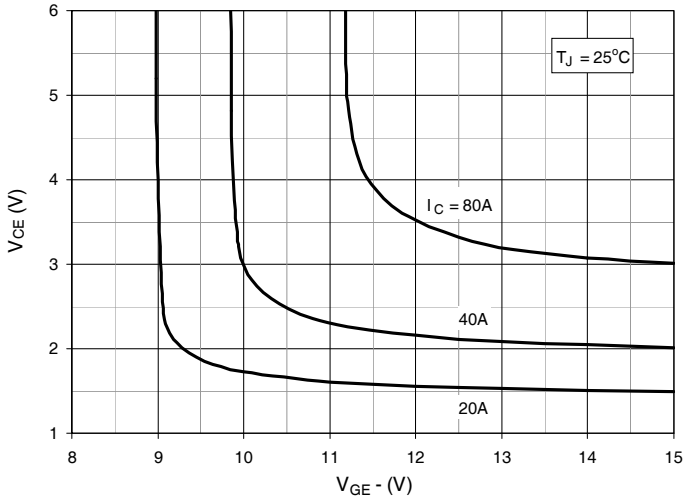
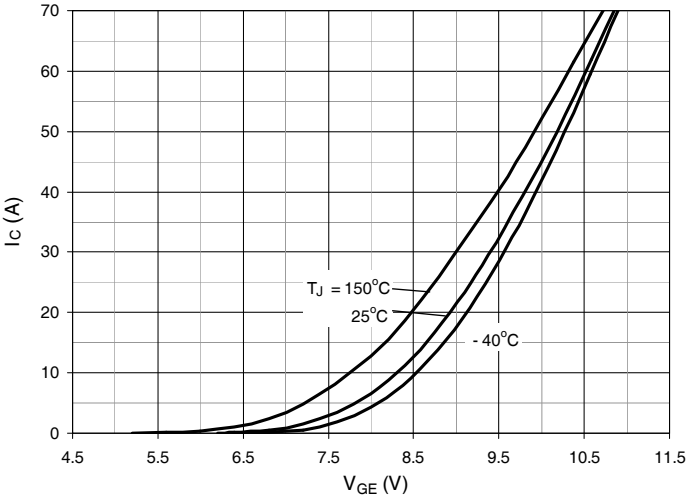


Fig. 6. Input Admittance



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Fig. 7. Transconductance

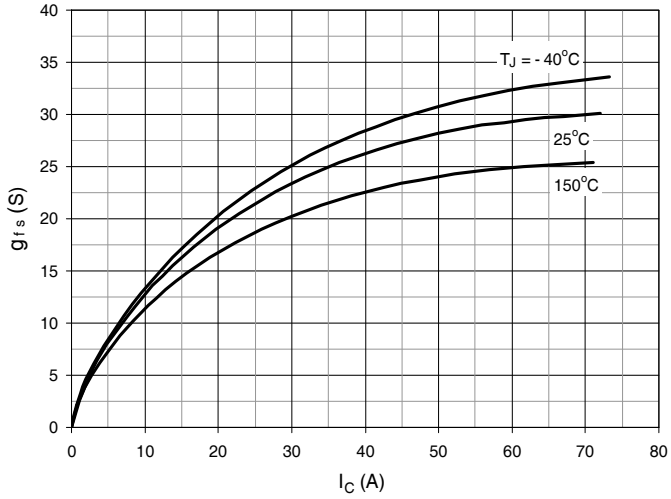


Fig. 8. Gate Charge

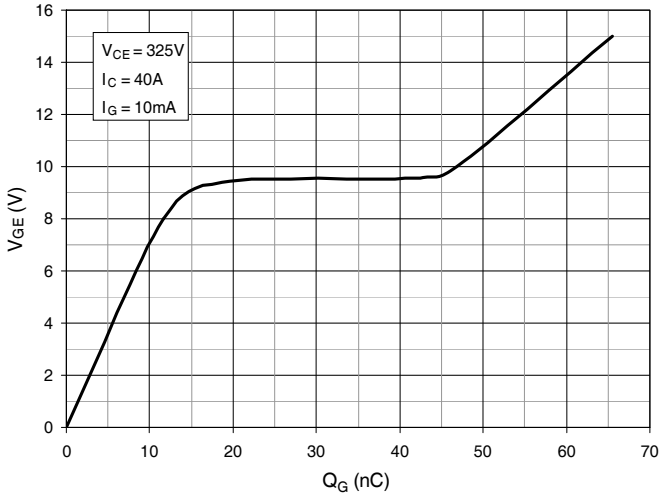


Fig. 9. Capacitance

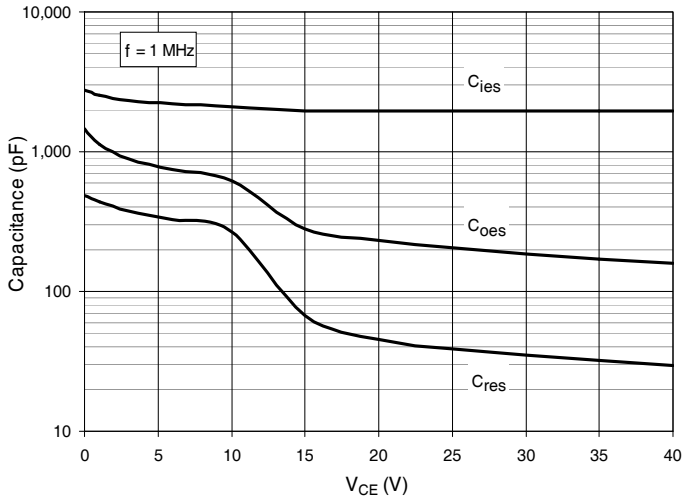


Fig. 10. Reverse-Bias Safe Operating Area

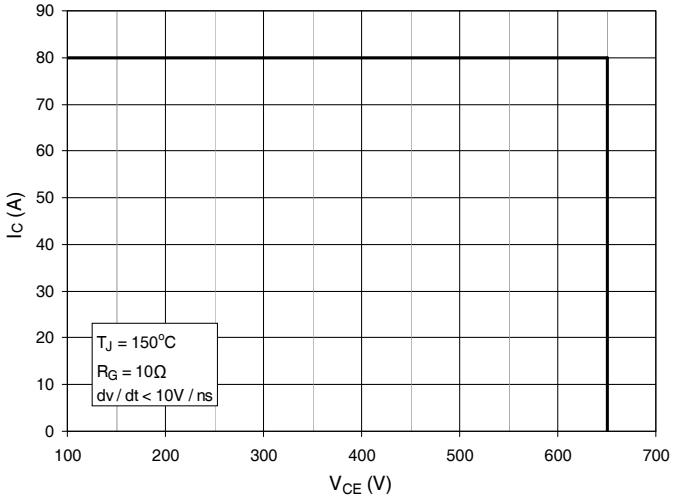


Fig. 11. Forward-Bias Safe Operating Area

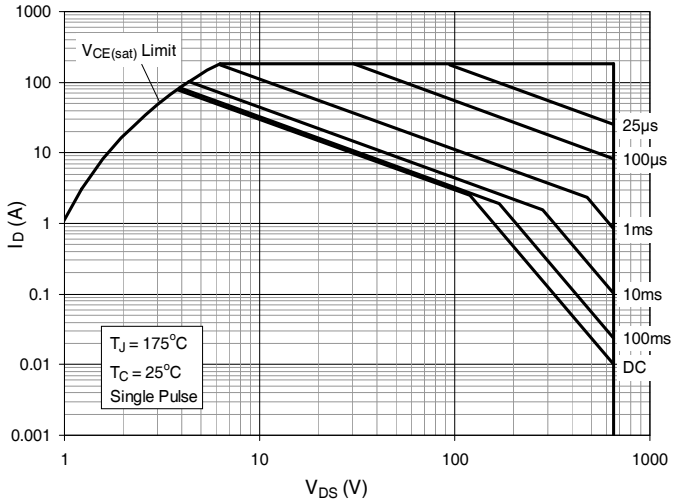
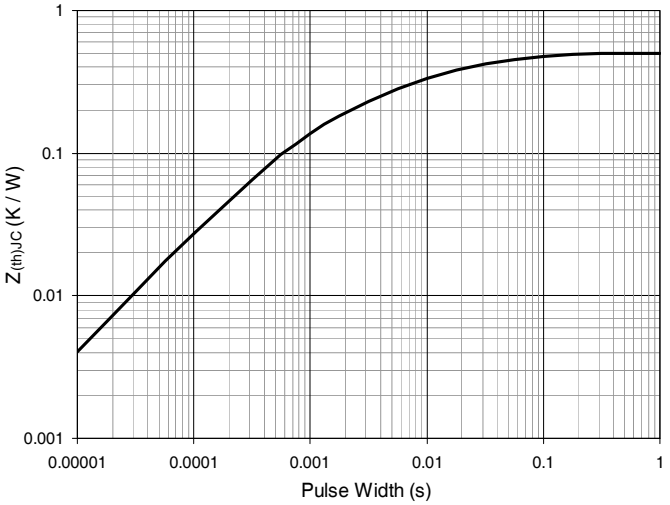


Fig. 12. Maximum Transient Thermal Impedance (IGBT)



IXYS Reserves the Right to Change Limits, Test Conditions, and Dimensions.

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

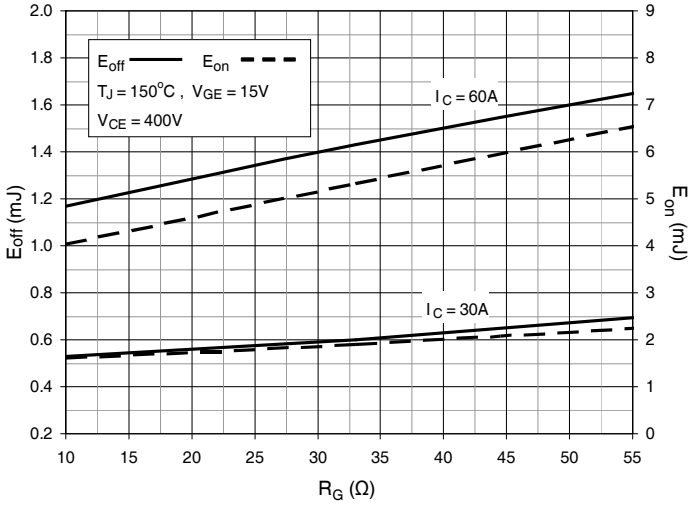


Fig. 14. Inductive Switching Energy Loss vs. Collector Current

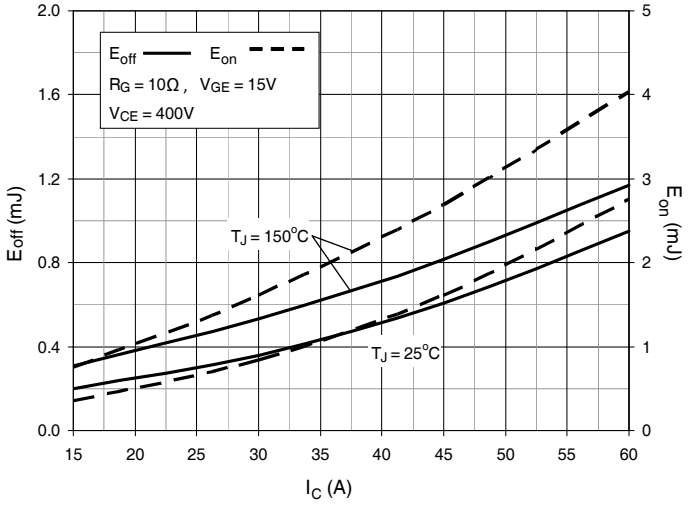


Fig. 15. Inductive Switching Energy Loss vs. Junction Temperature

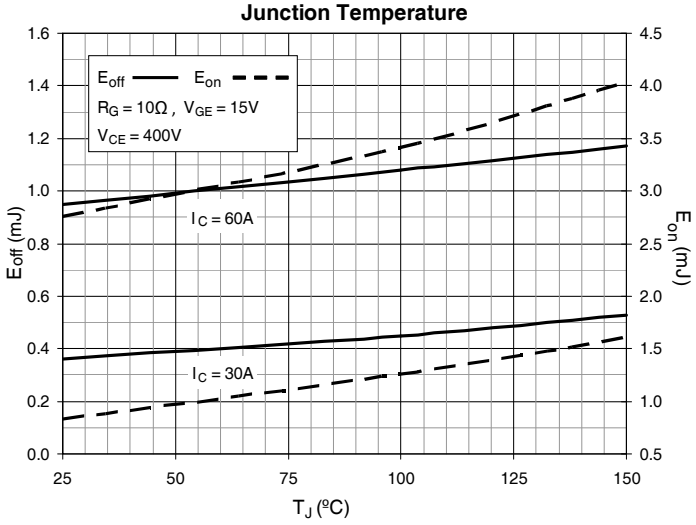


Fig. 16. Inductive Turn-off Switching Times vs. Gate Resistance

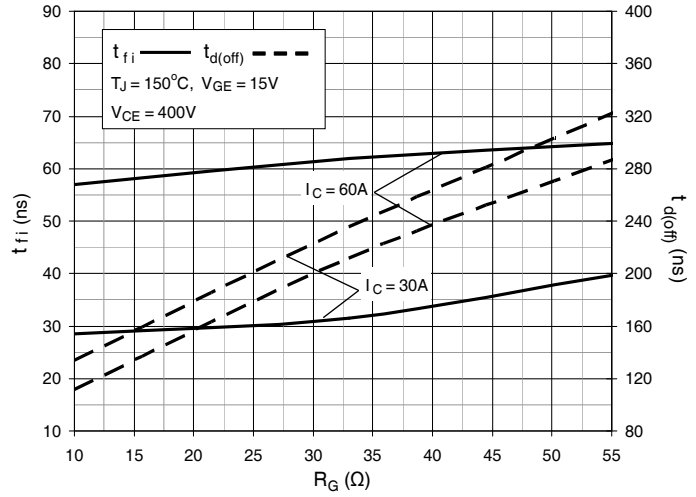


Fig. 17. Inductive Turn-off Switching Times vs. Collector Current

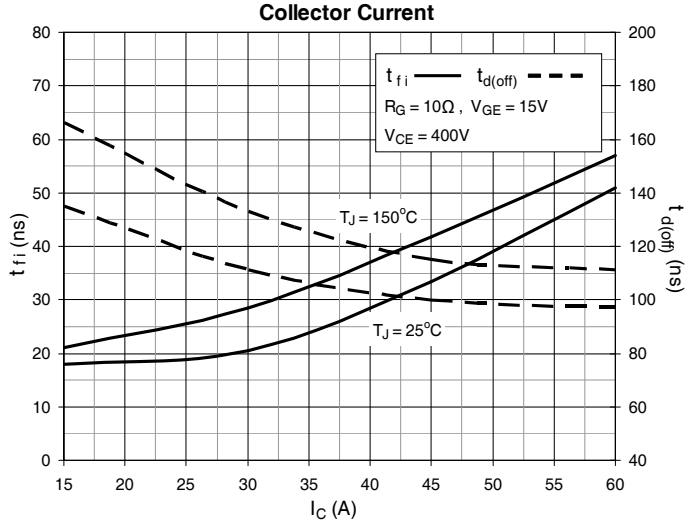
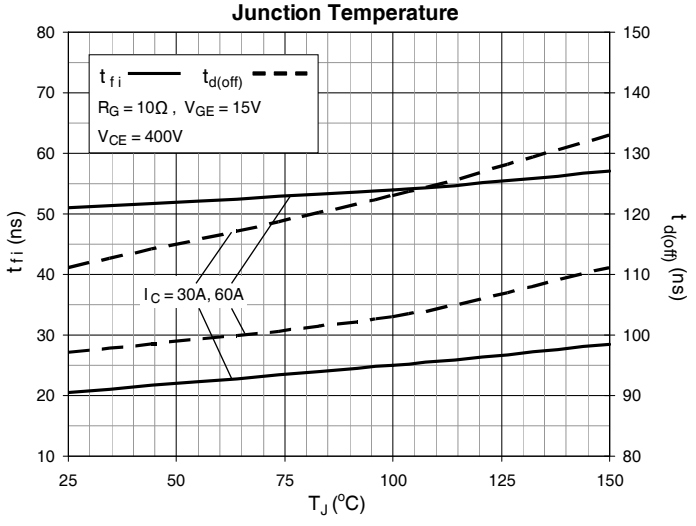


Fig. 18. Inductive Turn-off Switching Times vs. Junction Temperature



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

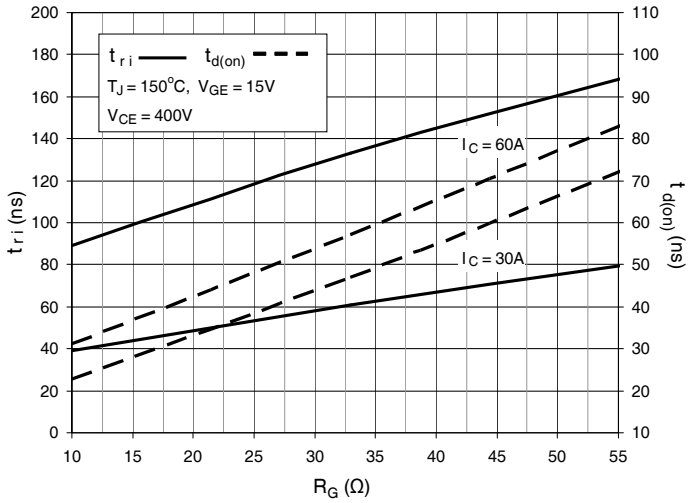


Fig. 20. Inductive Turn-on Switching Times vs. Collector Current

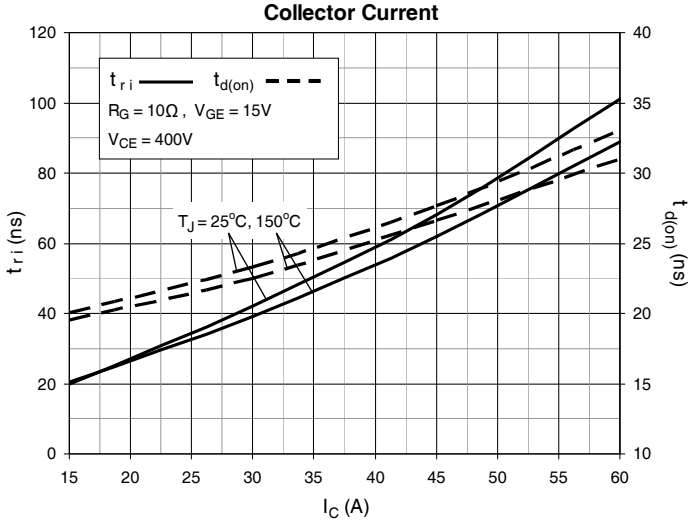


Fig. 21. Inductive Turn-on Switching Times vs. Junction Temperature

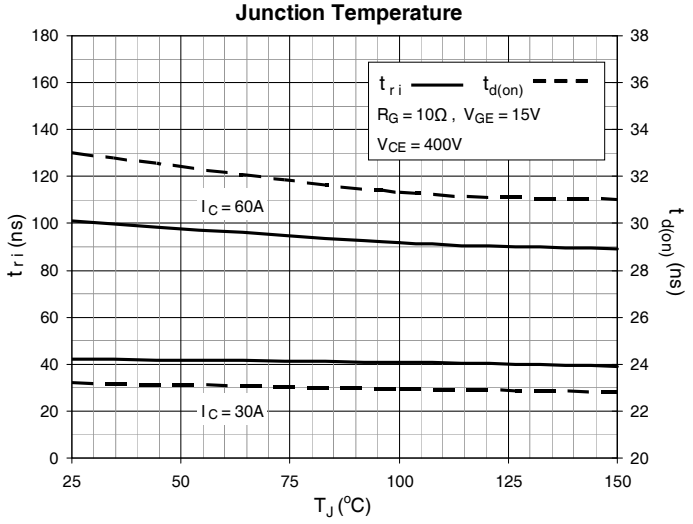


Fig. 22. Diode Forward Characteristics

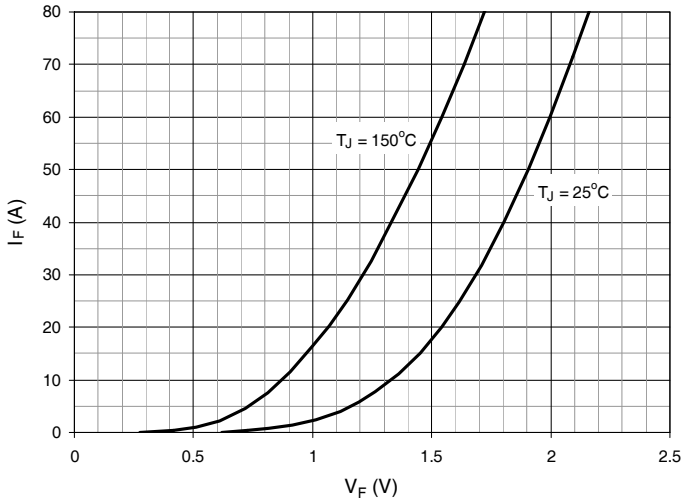


Fig. 23. Reverse Recovery Charge vs. -di$_F$/dt

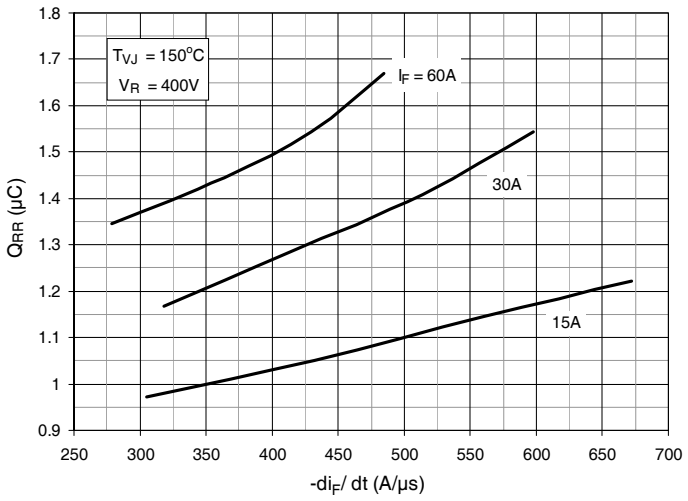


Fig. 24. Reverse Recovery Current vs. -di$_F$/dt

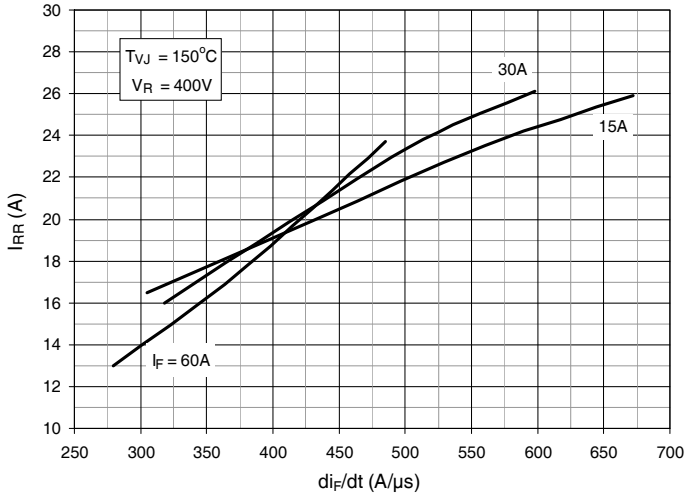


Fig. 25. Reverse Recovery Time vs. -di$_F$/dt

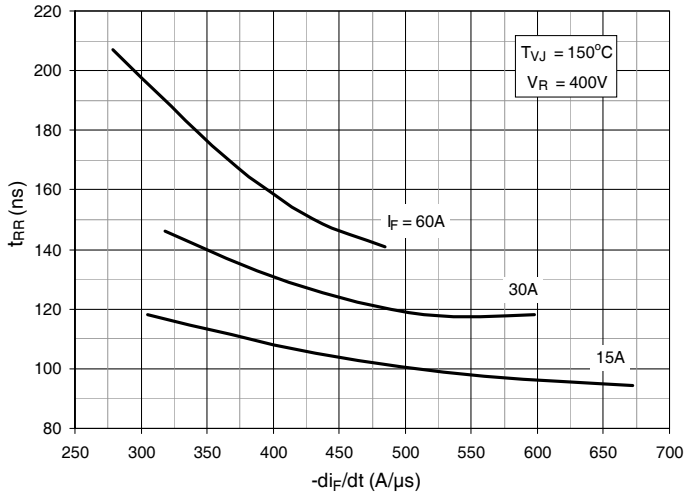


Fig. 26. Dynamic Parameters Q_{RR}, I_{RR} vs. Junction Temperature

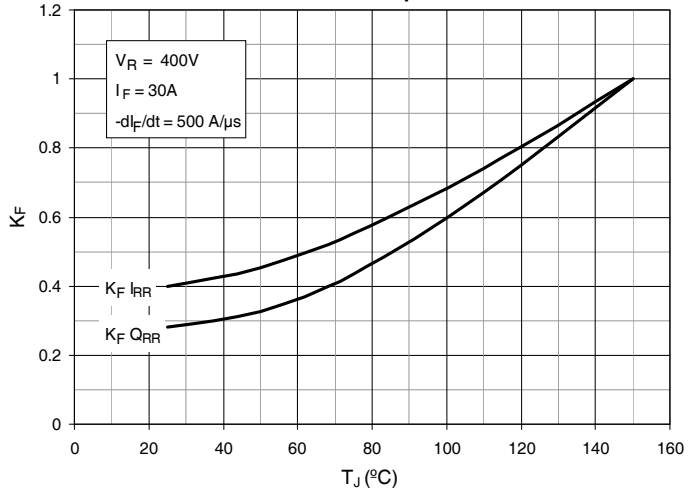
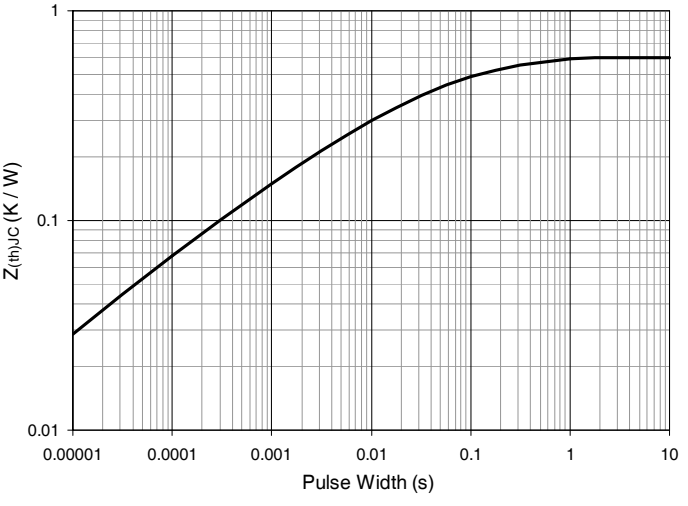


Fig. 27. Maximum Transient Thermal Impedance (Diode)



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