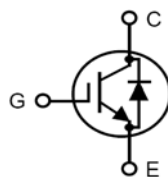


XPT™ 650V IGBT GenX4™ w/Diode

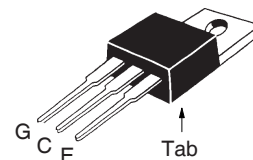
IXXP12N65B4D1

$V_{CES} = 650V$
 $I_{C110} = 12A$
 $V_{CE(sat)} \leq 1.95V$
 $t_{fi(typ)} = 57ns$

Extreme Light Punch Through
IGBT for 5-30kHz Switching



TO-220



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

Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ C$ to $175^\circ C$	650	V
V_{CGR}	$T_J = 25^\circ C$ to $175^\circ C$, $R_{GE} = 1M\Omega$	650	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ C$	38	A
I_{C110}	$T_C = 110^\circ C$	12	A
I_{F110}	$T_C = 110^\circ C$	11	A
I_{CM}	$T_C = 25^\circ C$, 1ms	70	A
SSOA (RBSOA)	$V_{GE} = 15V$, $T_{VJ} = 150^\circ C$, $R_G = 20\Omega$ Clamped Inductive Load	$I_{CM} = 24$ @ $V_{CE} \leq V_{CES}$	A
t_{sc} (SCSOA)	$V_{GE} = 15V$, $V_{CE} = 360V$, $T_J = 150^\circ C$ $R_G = 82\Omega$, Non Repetitive	10	μs
P_C	$T_C = 25^\circ C$	160	W
T_J		-55 ... +175	$^\circ C$
T_{JM}		175	$^\circ C$
T_{stg}		-55 ... +175	$^\circ C$
T_L	Maximum Lead Temperature for Soldering	300	$^\circ C$
T_{SOLD}	1.6 mm (0.062in.) from Case for 10s	260	$^\circ C$
M_d	Mounting Torque	1.13/10	Nm/lb.in.
Weight		3	g

Features

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

Advantages

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

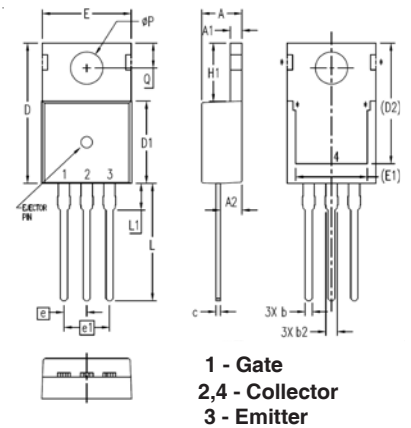
Applications

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

Symbol	Test Conditions ($T_J = 25^\circ C$, Unless Otherwise Specified)	Characteristic Values		
		Min.	Typ.	Max.
BV_{CES}	$I_C = 250\mu A$, $V_{GE} = 0V$	650		V
$V_{GE(th)}$	$I_C = 250\mu A$, $V_{CE} = V_{GE}$	4.0		6.5 V
I_{CES}	$V_{CE} = V_{CES}$, $V_{GE} = 0V$ $T_J = 150^\circ C$			10 μA 350 μA
I_{GES}	$V_{CE} = 0V$, $V_{GE} = \pm 20V$			± 100 nA
$V_{CE(sat)}$	$I_C = 12A$, $V_{GE} = 15V$, Note 1 $T_J = 150^\circ C$		1.74 2.00	1.95 V V

Symbol Test Conditions ($T_J = 25^\circ\text{C}$ Unless Otherwise Specified)		Characteristic Values		
		Min.	Typ.	Max.
g_{fs}	$I_C = 12\text{A}, V_{CE} = 10\text{V}$, Note 1	3.6	6.0	S
C_{ies}	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$		442	pF
C_{oes}			58	pF
C_{res}			18	pF
$Q_{g(on)}$	$I_C = 12\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$		34	nC
Q_{ge}			5	nC
Q_{gc}			17	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = 12\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 400\text{V}, R_G = 20\Omega$ Note 2		13	ns
t_{ri}			43	ns
E_{on}			0.44	mJ
$t_{d(off)}$			158	ns
t_{fi}			57	ns
E_{off}			0.22	mJ
$t_{d(on)}$	Inductive load, $T_J = 150^\circ\text{C}$ $I_C = 12\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 400\text{V}, R_G = 20\Omega$ Note 2		11	ns
t_{ri}			33	ns
E_{on}			0.83	mJ
$t_{d(off)}$			135	ns
t_{fi}			110	ns
E_{off}			0.38	mJ
R_{thJC}			0.94	$^\circ\text{C}/\text{W}$
R_{thCS}		0.50		$^\circ\text{C}/\text{W}$

TO-220 (IXXP) OUTLINE



SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.169	.185	4.30	4.70
A1	.047	.055	1.20	1.40
A2	.079	.106	2.00	2.70
b	.024	.039	0.60	1.00
b2	.045	.057	1.15	1.45
c	.014	.026	0.35	0.65
D	.587	.626	14.90	15.90
D1	.335	.370	8.50	9.40
(D2)	.500	.531	12.70	13.50
E	.382	.406	9.70	10.30
(E1)	.283	.323	7.20	8.20
e	.100 BSC		2.54 BSC	
e1	.200 BSC		5.08 BSC	
H1	.244	.268	6.20	6.80
L	.492	.547	12.50	13.90
L1	.110	.154	2.80	3.90
ØP	.134	.150	3.40	3.80
Q	.106	.126	2.70	3.20

Reverse Diode (FRED)

Symbol Test Conditions ($T_J = 25^\circ\text{C}$, Unless Otherwise Specified)		Characteristic Values		
		Min.	Typ.	Max.
V_F	$I_F = 10\text{A}, V_{GE} = 0\text{V}$, Note 1 $T_J = 150^\circ\text{C}$		1.6	1.9 V
I_{RM}	$I_F = 10\text{A}, V_{GE} = 0\text{V}$, $-di_F/dt = 200\text{A}/\mu\text{s}, V_R = 400\text{V}, T_J = 150^\circ\text{C}$		6.3	A
t_{rr}			146	ns
R_{thJC}			2.30	$^\circ\text{C}/\text{W}$

Notes:

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

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	4,931,844	5,049,961	5,237,481	6,162,665	6,404,065 B1	6,683,344	6,727,585	7,005,734 B2	7,157,338B2
	4,860,072	5,017,508	5,063,307	5,381,025	6,259,123 B1	6,534,343	6,710,405 B2	6,759,692	7,063,975 B2	
	4,881,106	5,034,796	5,187,117	5,486,715	6,306,728 B1	6,583,505	6,710,463	6,771,478 B2	7,071,537	

Fig. 1. Output Characteristics @ $T_J = 25^\circ\text{C}$

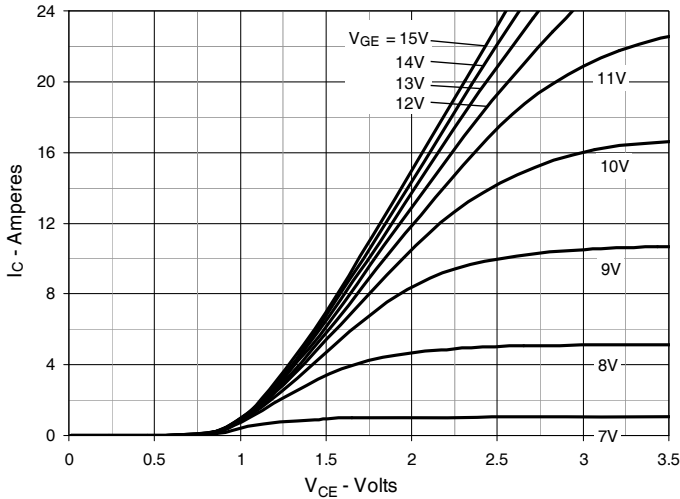


Fig. 2. Extended Output Characteristics @ $T_J = 25^\circ\text{C}$

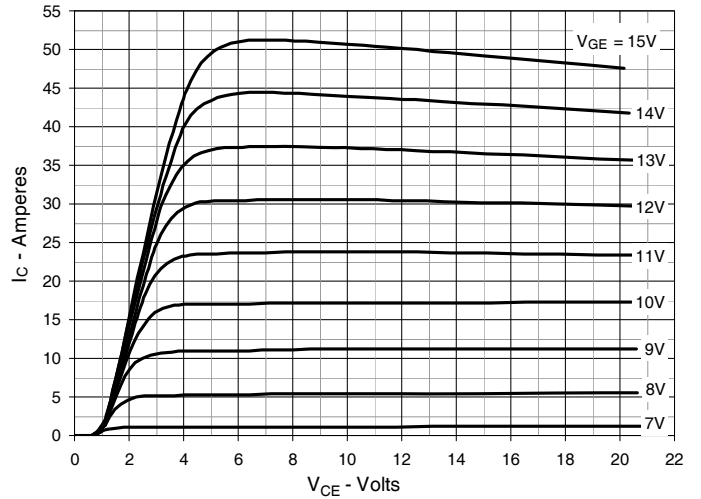


Fig. 3. Output Characteristics @ $T_J = 150^\circ\text{C}$

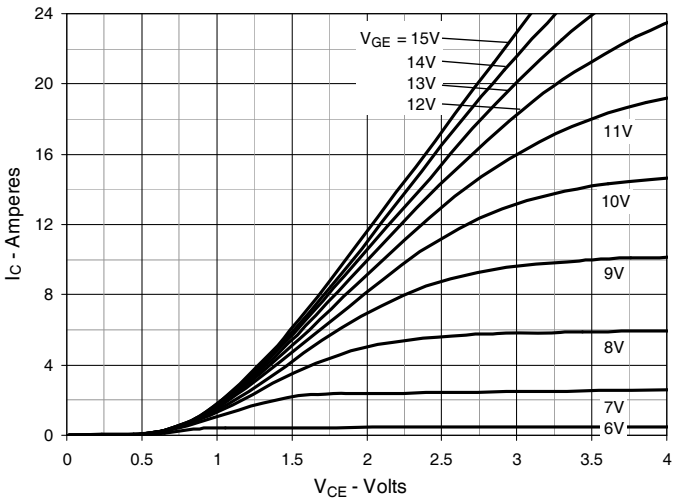


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

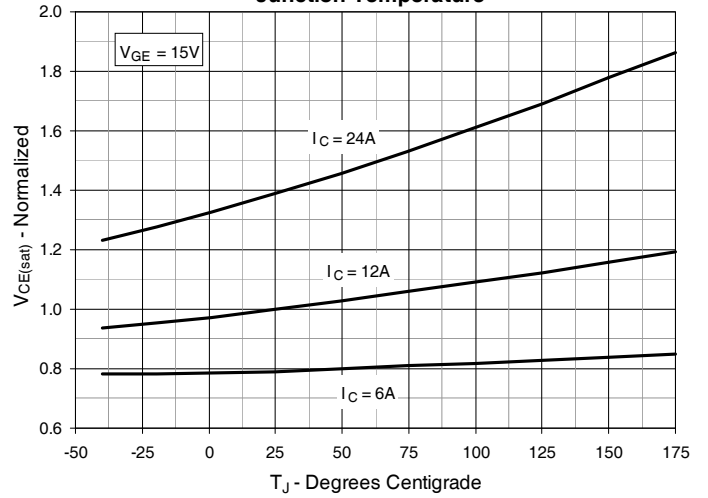


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

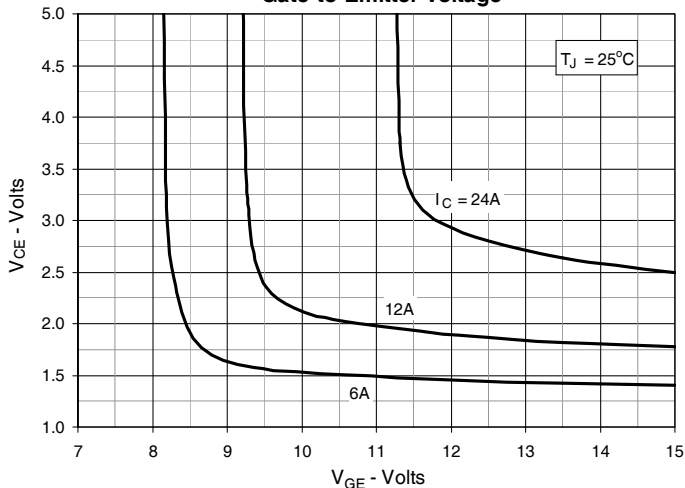


Fig. 6. Input Admittance

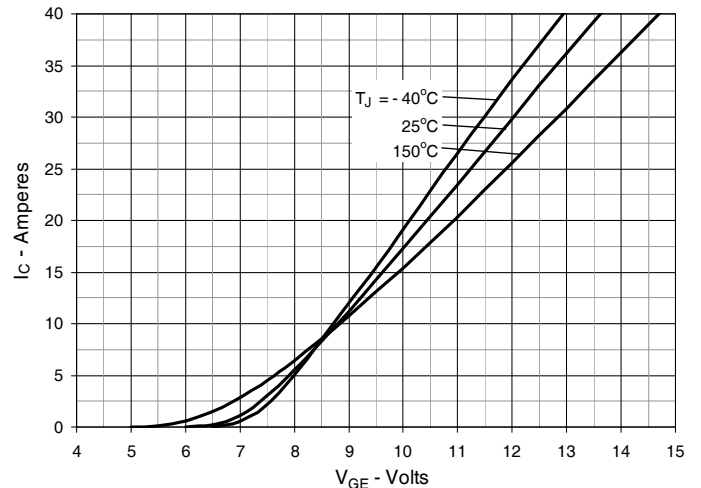


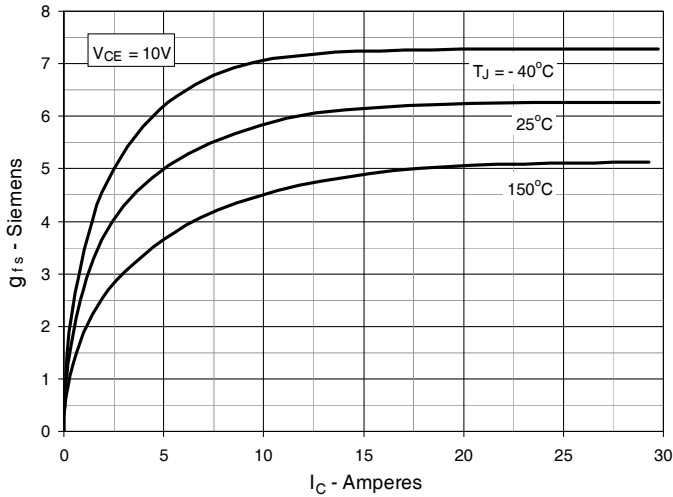
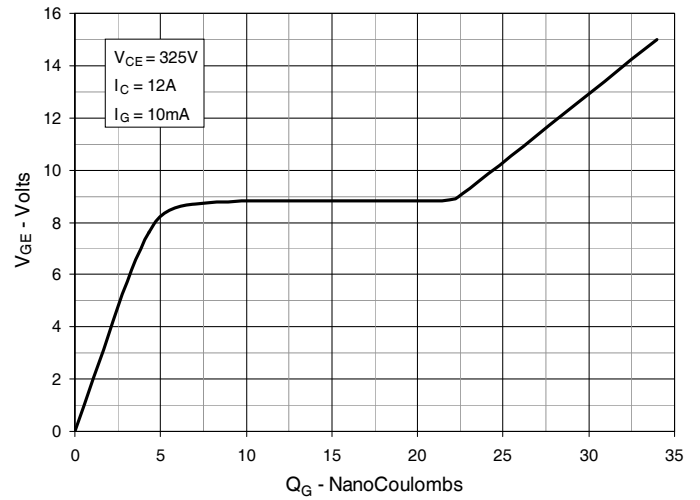
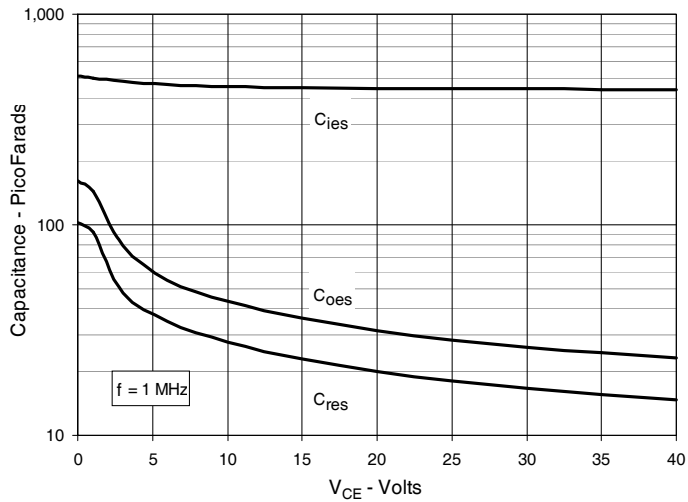
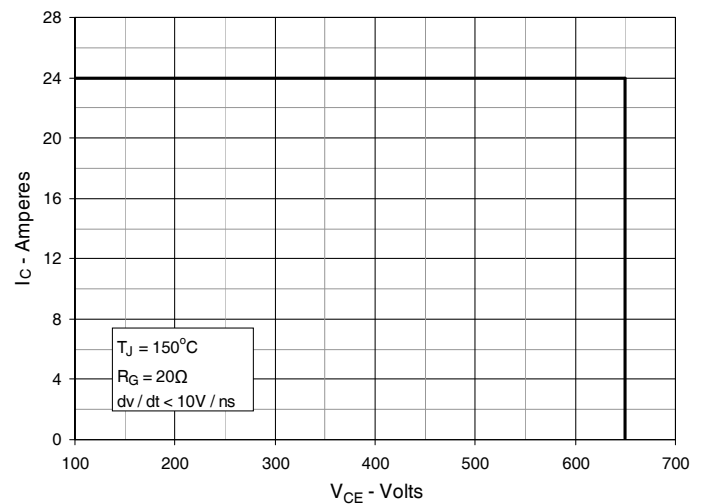
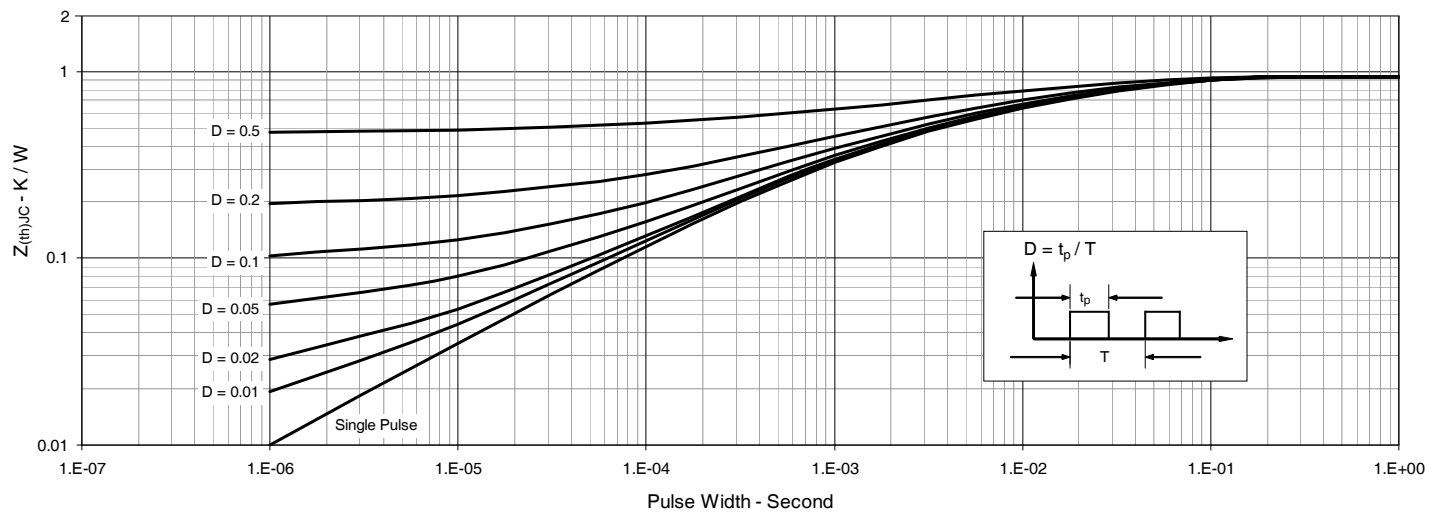
Fig. 7. Transconductance

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

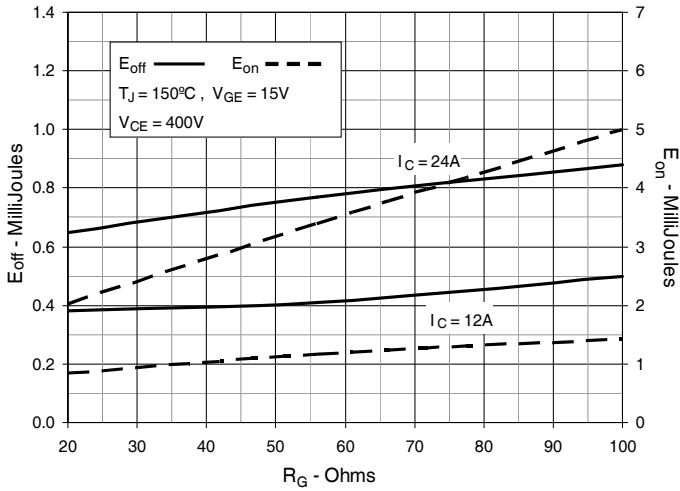


Fig. 13. Inductive Switching Energy Loss vs. Collector Current

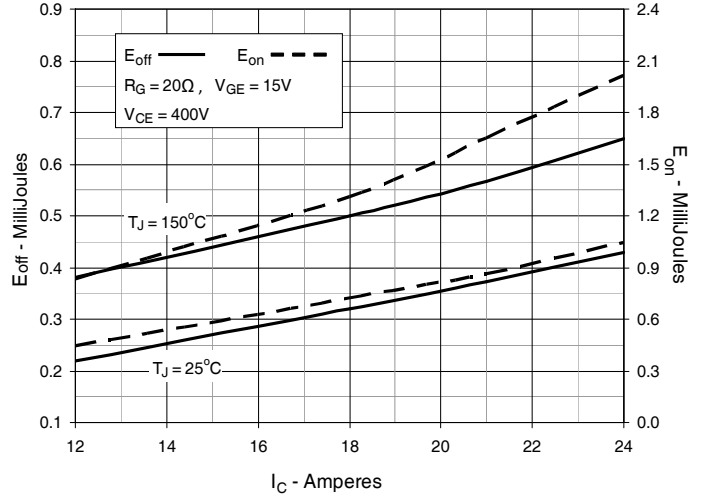


Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature

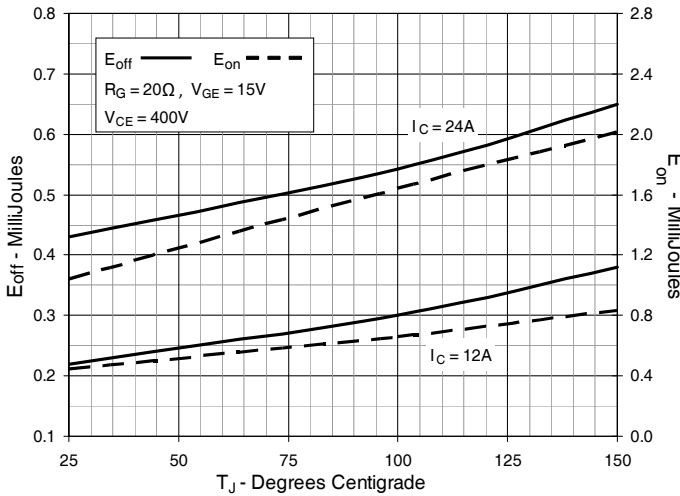


Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance

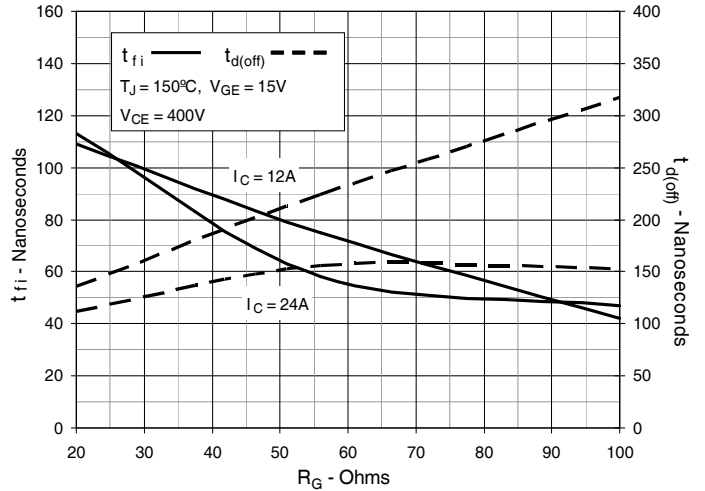


Fig. 16. Inductive Turn-off Switching Times vs. Collector Current

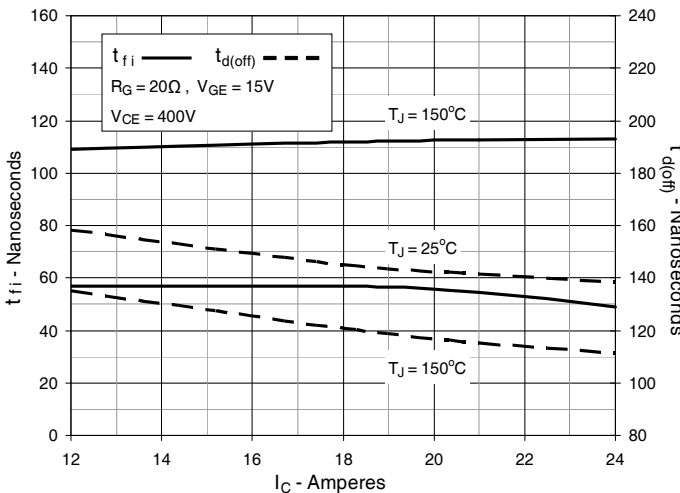


Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature

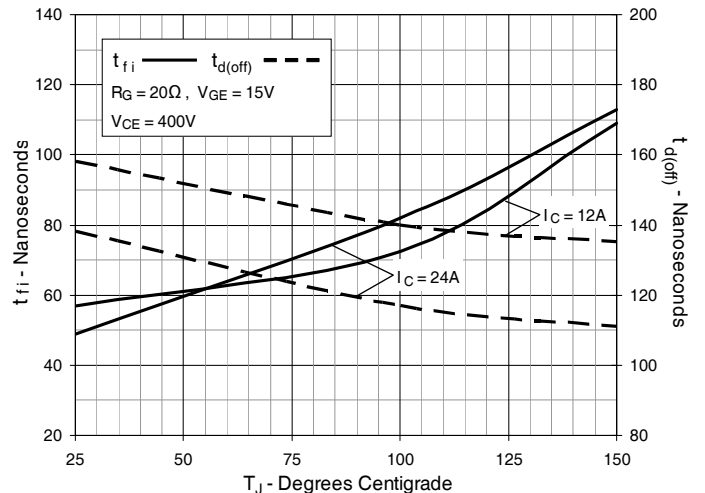


Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance

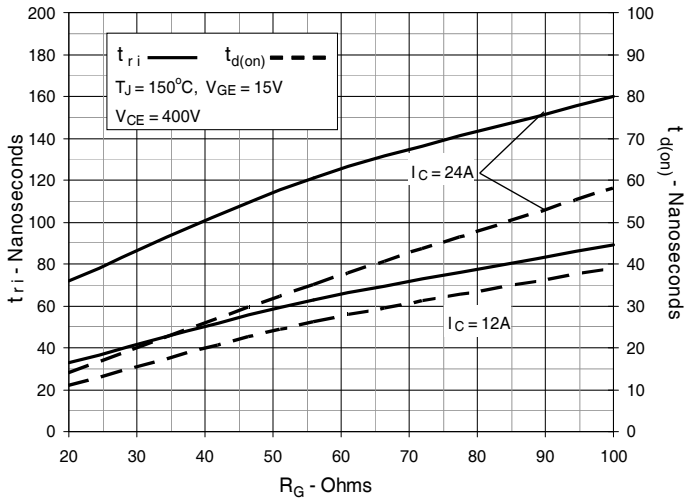


Fig. 19. Inductive Turn-on Switching Times vs. Collector Current

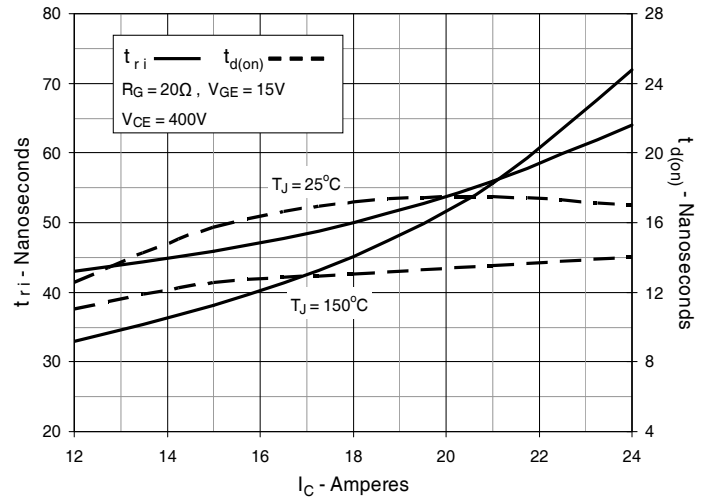


Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature

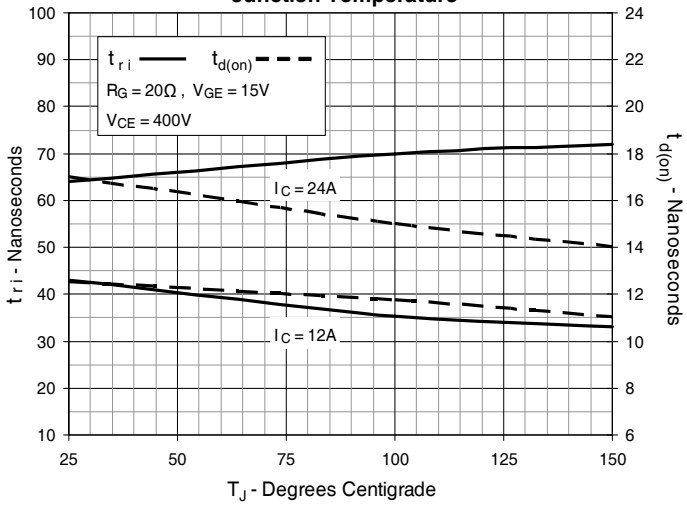


Fig. 21. Diode Forward Characteristics

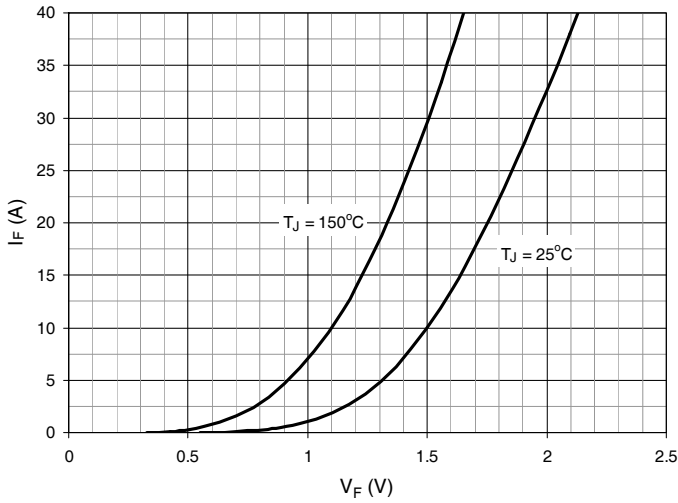


Fig. 22. Reverse Recovery Charge vs. $-di_F/dt$

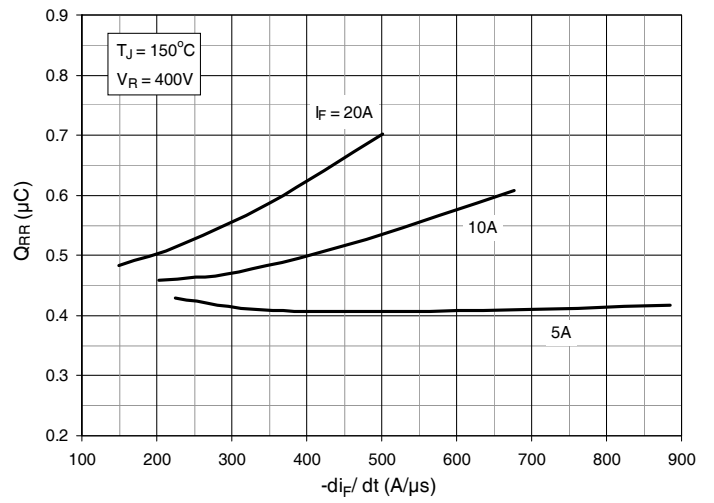


Fig. 23. Reverse Recovery Current vs. $-di_F/dt$

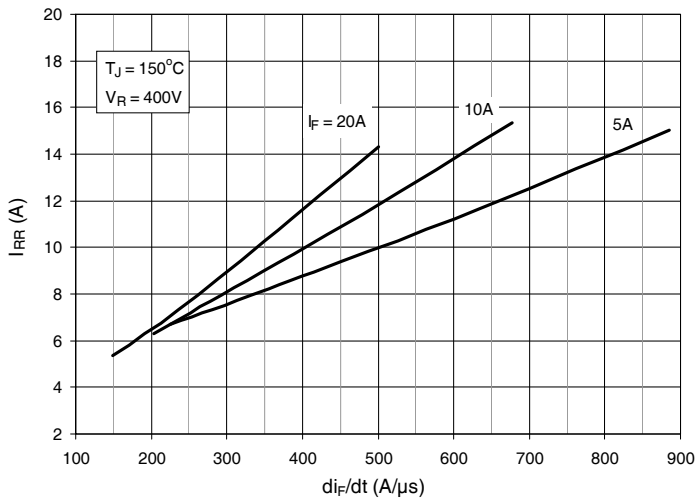


Fig. 24. Reverse Recovery Time vs. $-di_F/dt$

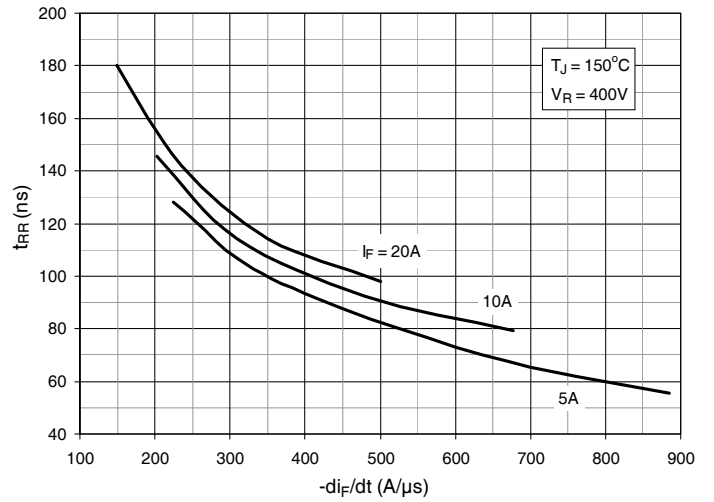


Fig. 25. Dynamic Parameters Q_{RR} , I_{RR} vs. Junction Temperature

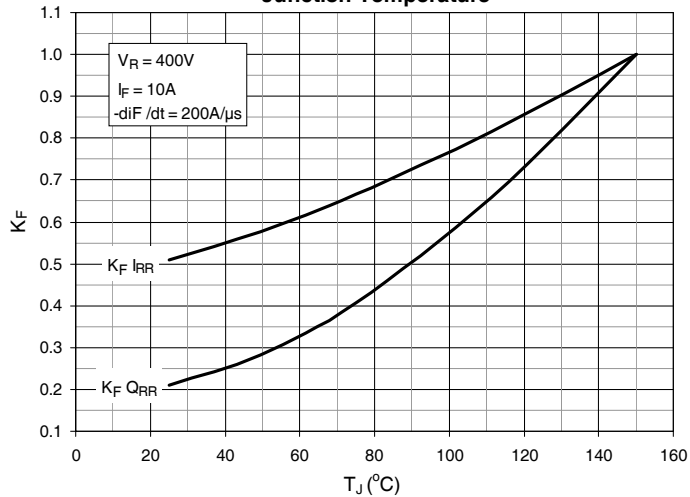
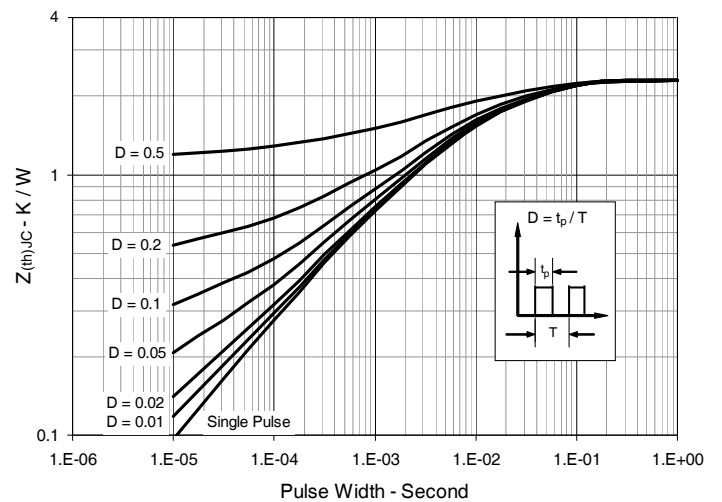


Fig. 26. Maximum Transient Thermal Impedance (Diode)





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