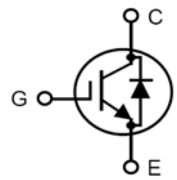
IXYS

Advance Technical Information

XPT™ 650V IGBT GenX4™ w/Diode

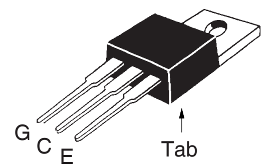
IXXP12N65B4D1

V_{CES} = 650V
I_{C110} = 12A
$V_{CE(sat)}$ ≤ 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°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	38	A
I_{C110}	T_C = 110°C	12	A
I_{F110}	T_C = 110°C	11	A
I_{CM}	T_C = 25°C, 1ms	70	A
SSOA (RBSOA)	V_{GE} = 15V, T_{VJ} = 150°C, R_G = 20Ω Clamped Inductive Load	I_{CM} = 24 @$V_{CE} \le V_{CES}$	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	160	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		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

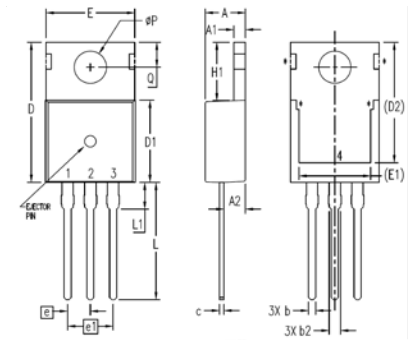
Applications

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

Symbol	Test Conditions (T_J = 25°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}	4.0		6.5	V
I_{CES}	V_{CE} = V_{CES}, V_{GE} = 0V			10	µA
	T_J = 150°C			350	µA
I_{GES}	V_{CE} = 0V, V_{GE} = ±20V			±100	nA
$V_{CE(sat)}$	I_C = 12A, V_{GE} = 15V, Note 1		1.74	1.95	V
	T_J = 150°C		2.00		V

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

TO-220 (IXXP) OUTLINE



1 - Gate
2,4 - Collector
3 - Emitter

SYM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS 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°C, Unless Otherwise Specified)	Characteristic Values Min.	Typ.	Max.	
V_F	I_F = 10A, V_{GE} = 0V, Note 1			1.8	V
	T_J = 150°C		1.6		V
I_{RM}	I_F = 10A, V_{GE} = 0V,		6.3		A
t_{rr}	$-di_F/dt$ = 200A/μs, V_R = 400V, T_J = 150°C		146		ns
R_{thJC}				2.30	°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.

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

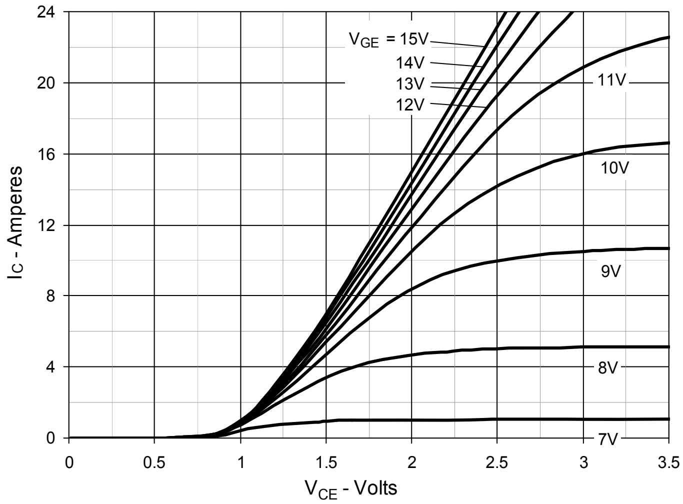


Fig. 2. Extended Output Characteristics @ T_J = 25ºC

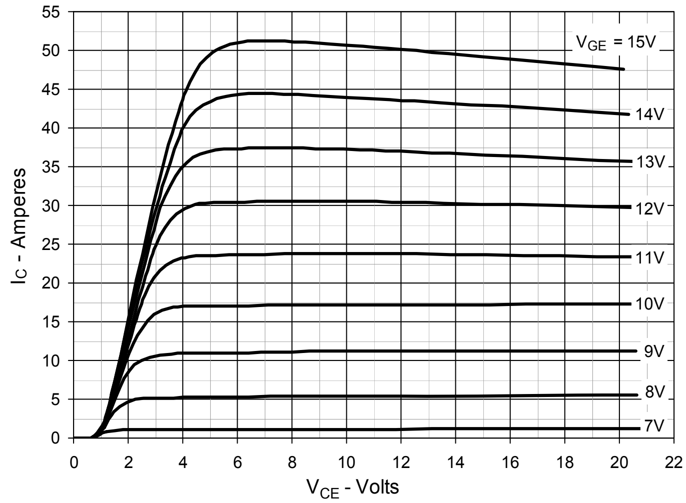


Fig. 3. Output Characteristics @ T_J = 150ºC

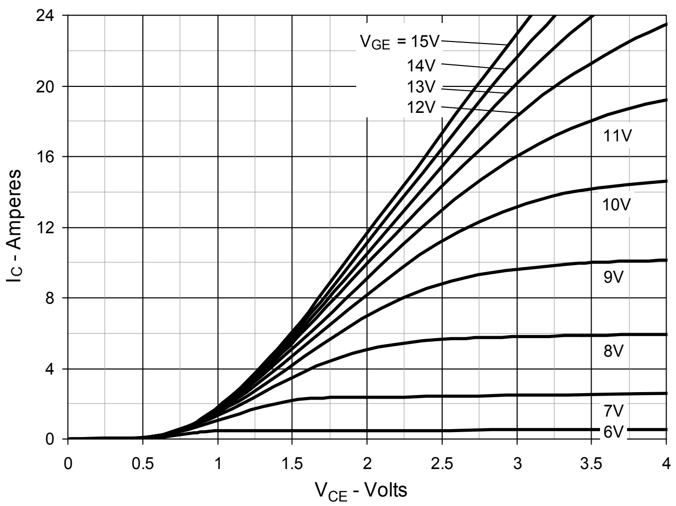


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

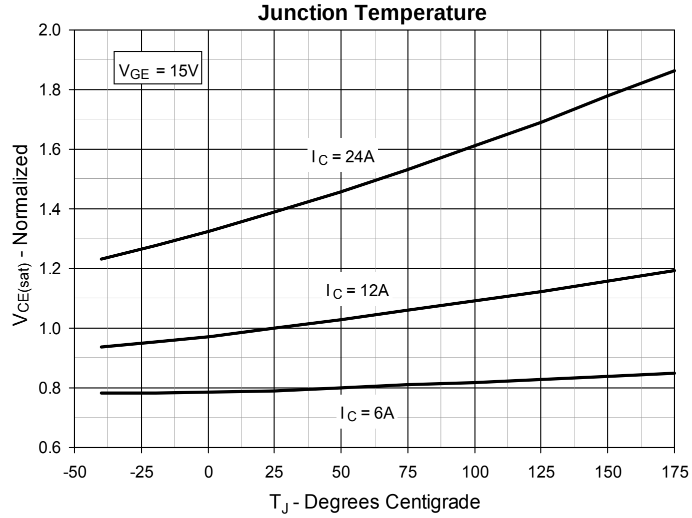


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

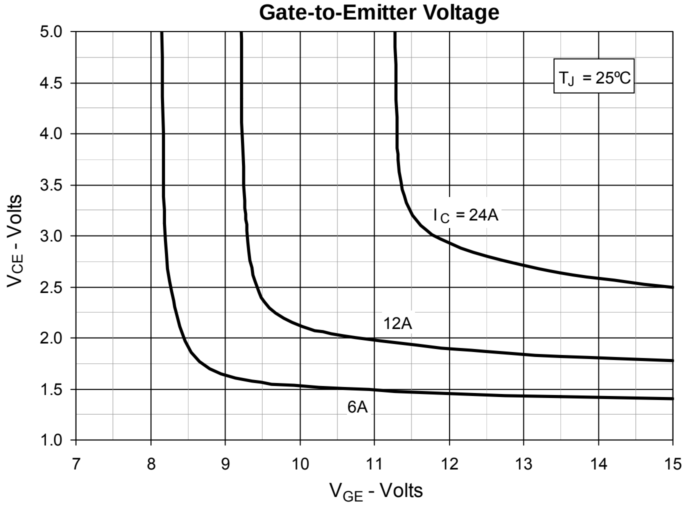


Fig. 6. Input Admittance

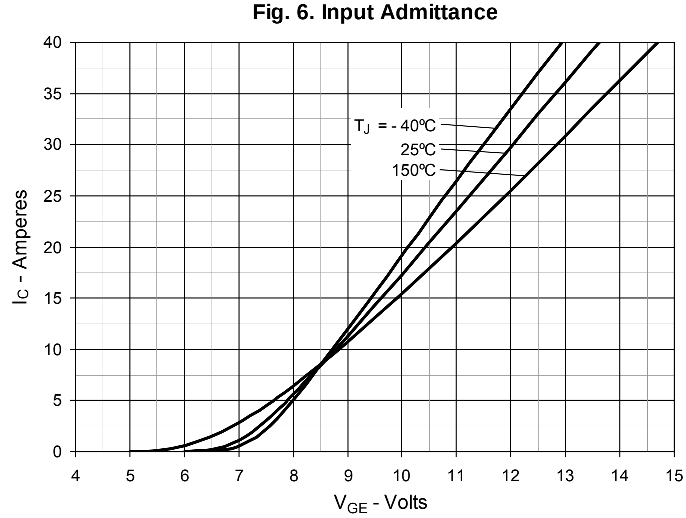


Fig. 7. Transconductance

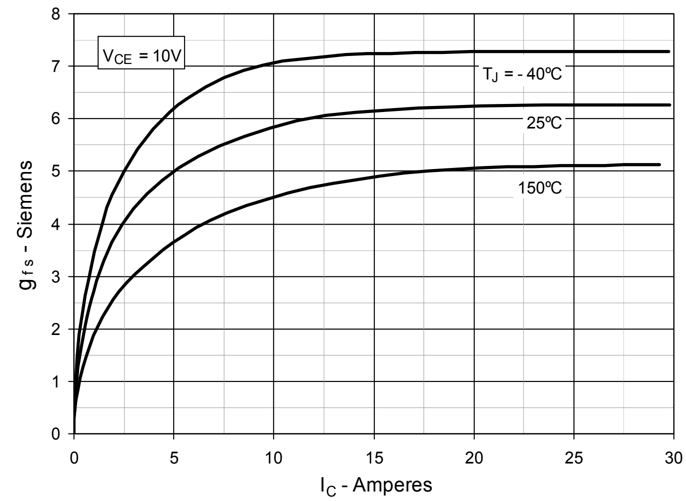


Fig. 8. Gate Charge

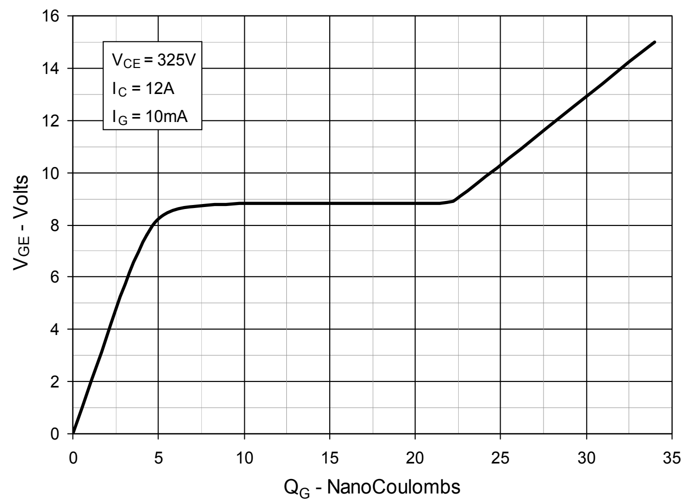


Fig. 9. Capacitance

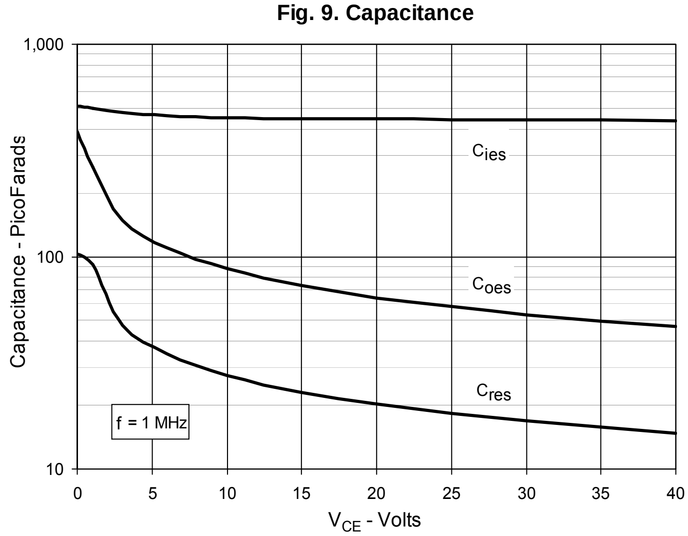


Fig. 10. Reverse-Bias Safe Operating Area

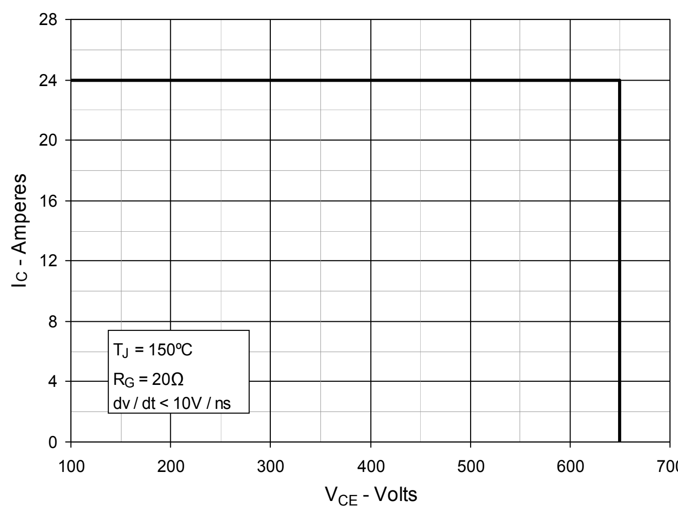
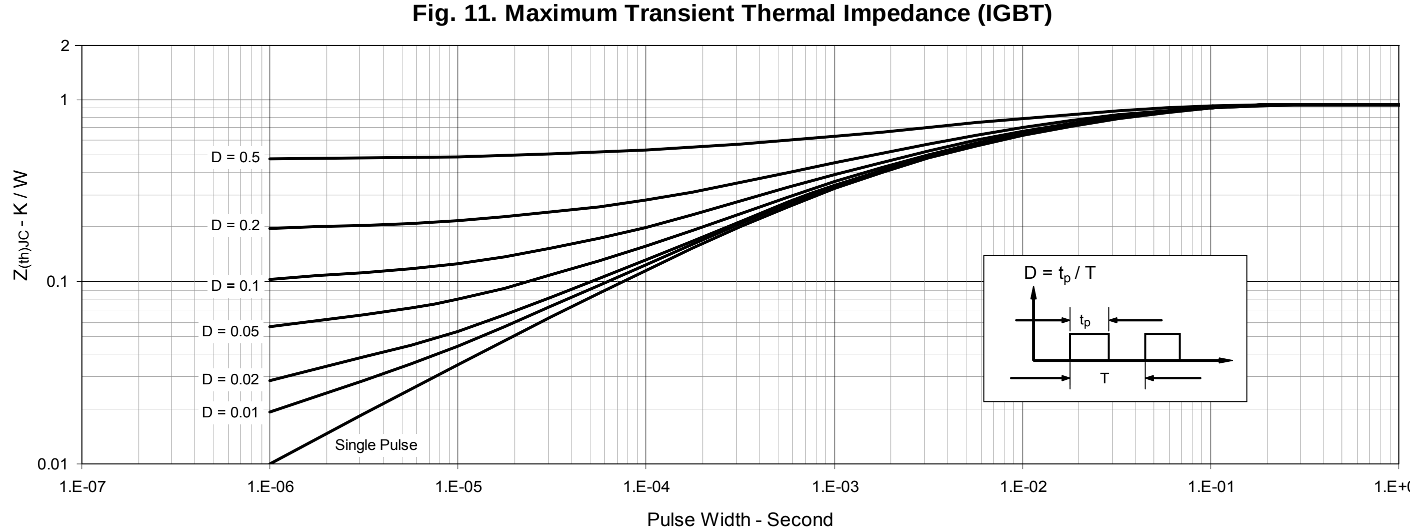


Fig. 11. Maximum Transient Thermal Impedance (IGBT)



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

Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance

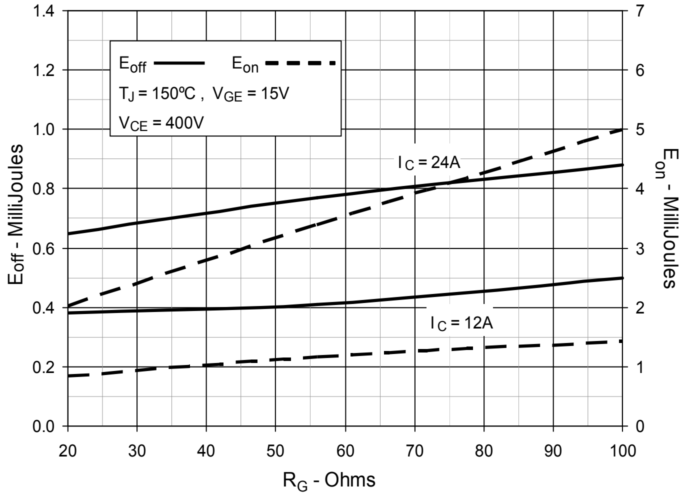


Fig. 13. Inductive Switching Energy Loss vs. Collector Current

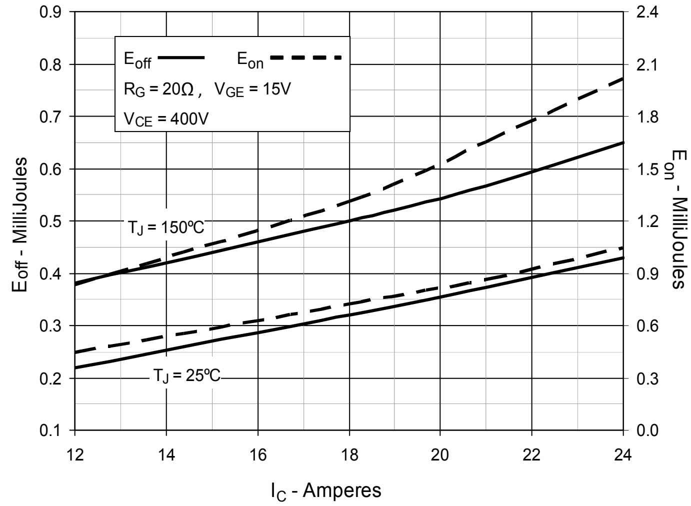


Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature

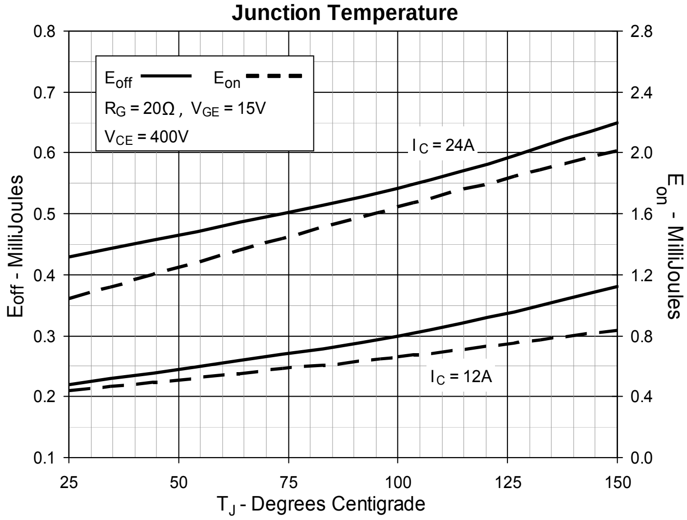


Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance

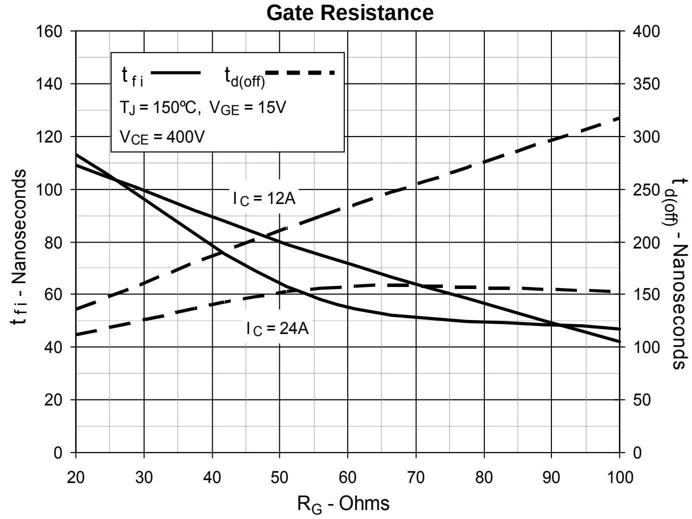


Fig. 16. Inductive Turn-off Switching Times vs. Collector Current

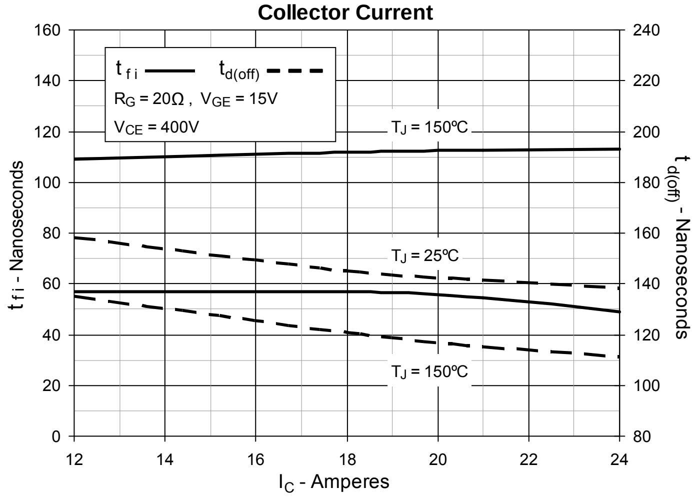


Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature

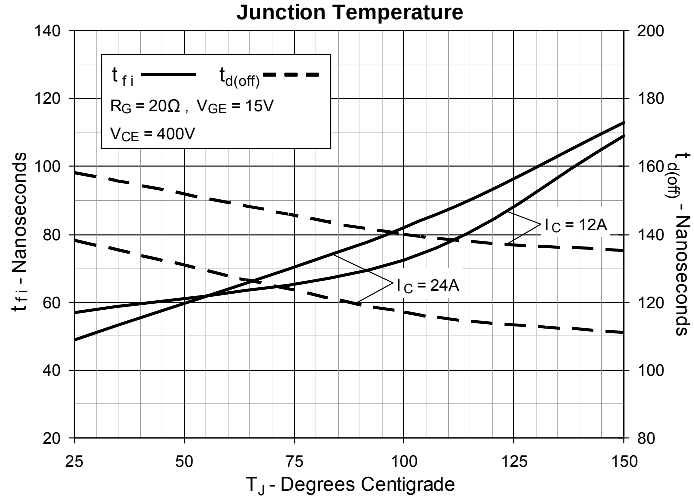


Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance

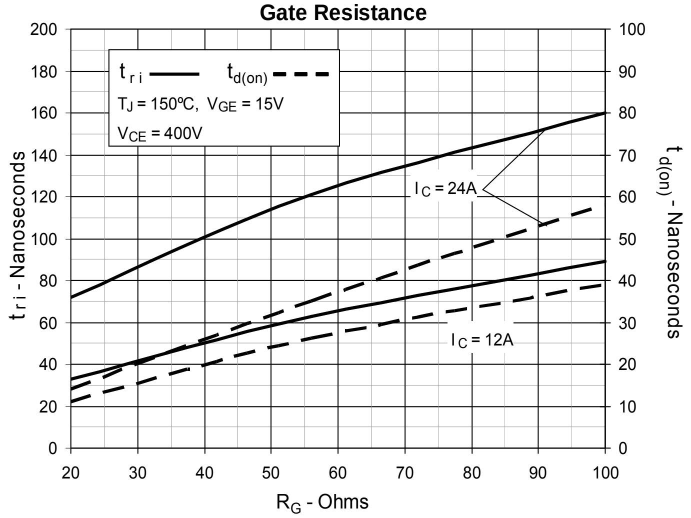


Fig. 19. Inductive Turn-on Switching Times vs. Collector Current

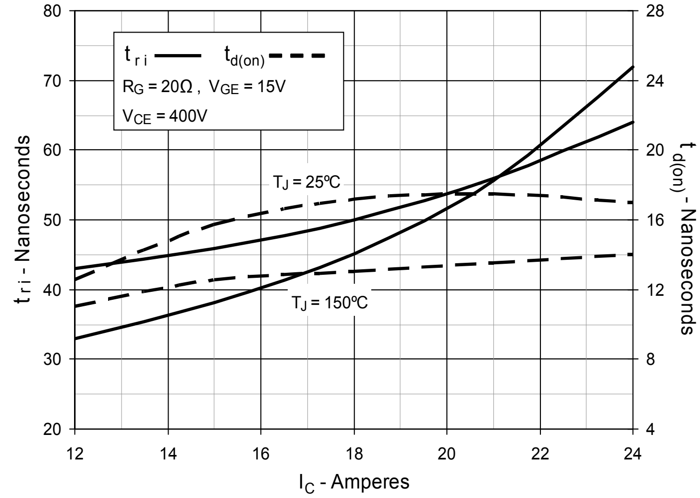


Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature

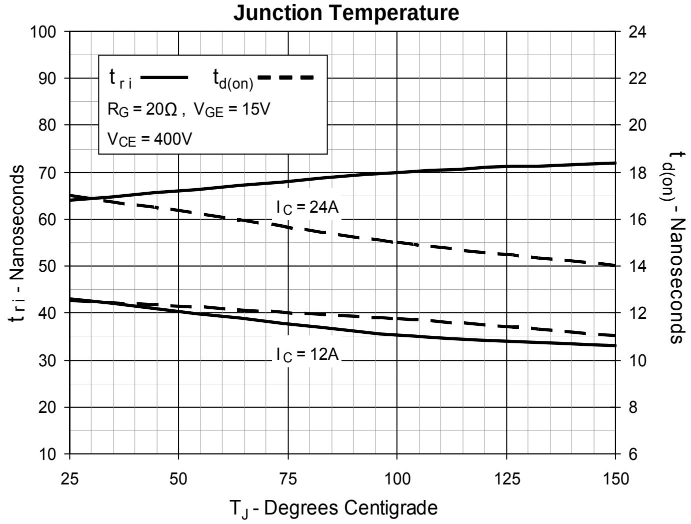


Fig. 21. Diode Forward Characteristics

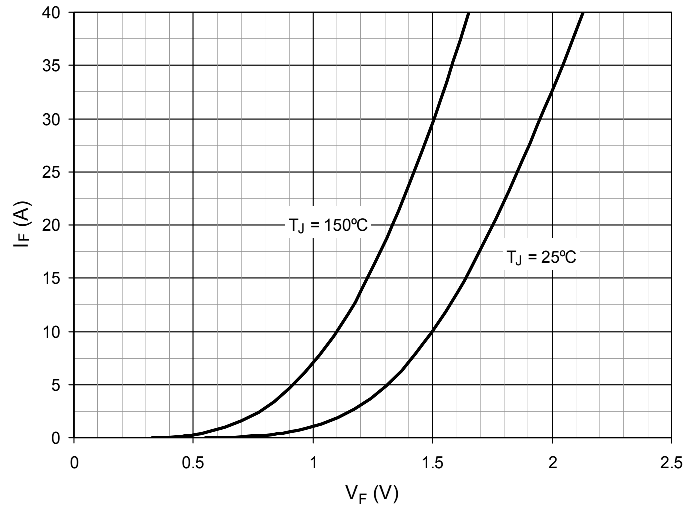


Fig. 22. Reverse Recovery Charge vs. -diF/dt

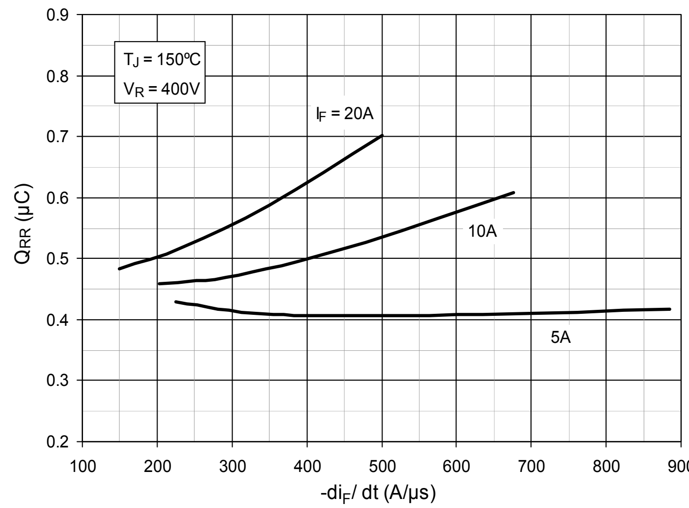


Fig. 23. Reverse Recovery Current vs. -diF/dt

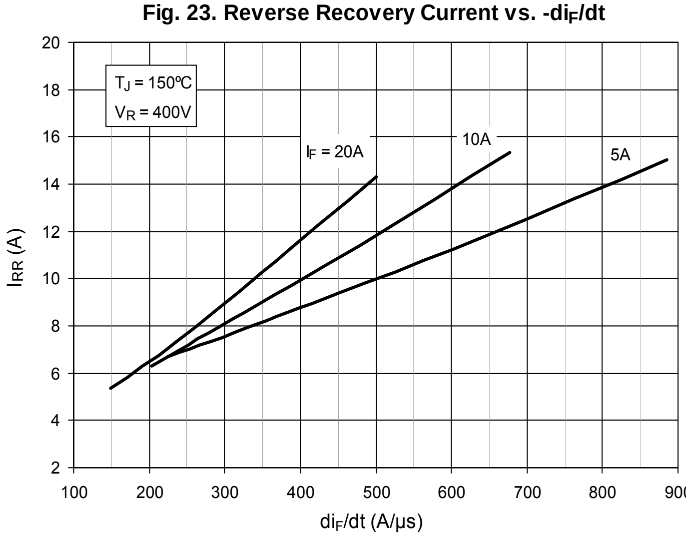


Fig. 24. Reverse Recovery Time vs. -diF/dt

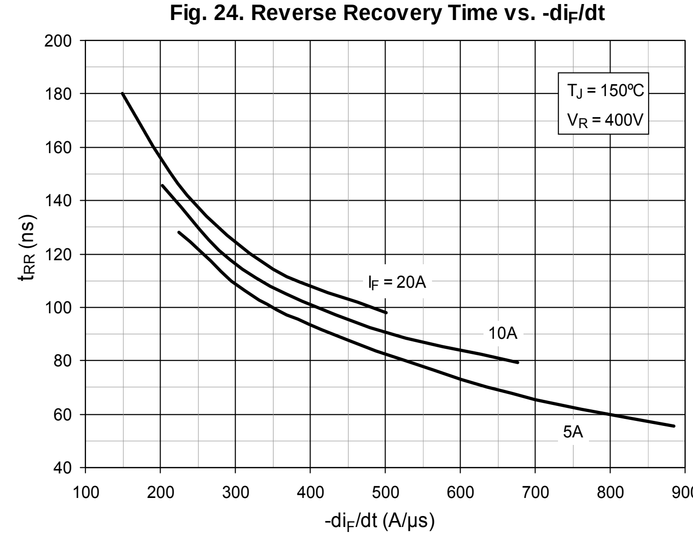


Fig. 25. Dynamic Parameters Q_{RR}, I_{RR} vs. Junction Temperature

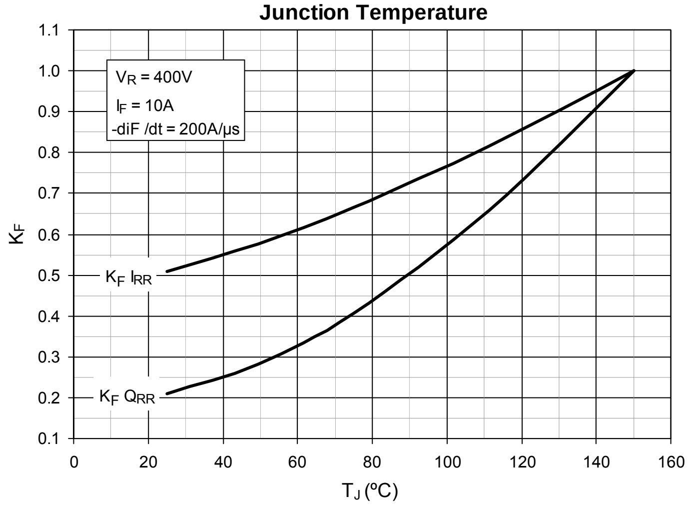
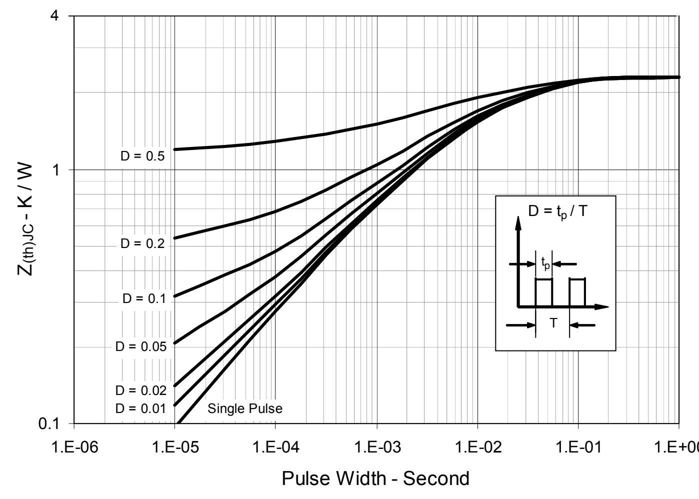


Fig. 26. Maximum Transient Thermal Impedance (Diode)



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A Littelfuse Technology