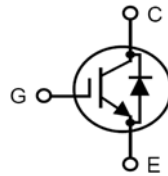


**XPT™ 650V IGBT
GenX3™ w/Diode**
IXYP10N65C3D1

 Extreme Light Punch Through
IGBT for 20-60kHz Switching


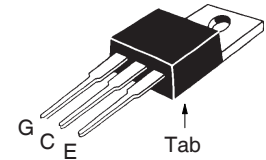
$$V_{CES} = 650V$$

$$I_{C110} = 10A$$

$$V_{CE(sat)} \leq 2.50V$$

$$t_{fi(typ)} = 23ns$$

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}	$T_C = 25^\circ C$	30	A
I_{C110}	$T_C = 110^\circ C$	10	A
I_{F110}	$T_C = 110^\circ C$	9	A
I_{CM}	$T_C = 25^\circ C$, 1ms	54	A
I_A	$T_C = 25^\circ C$	5	A
E_{AS}	$T_C = 25^\circ C$	50	mJ
SSOA	$V_{GE} = 15V$, $T_{VJ} = 150^\circ C$, $R_G = 50\Omega$	$I_{CM} = 20$	A
(RBSOA)	Clamped Inductive Load	$V_{CE} \leq V_{CES}$	
t_{sc}	$V_{GE} = 15V$, $V_{CE} = 360V$, $T_J = 150^\circ C$	8	μs
(SCSOA)	$R_G = 150\Omega$, Non Repetitive		
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		2.5	g

Features

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

Advantages

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

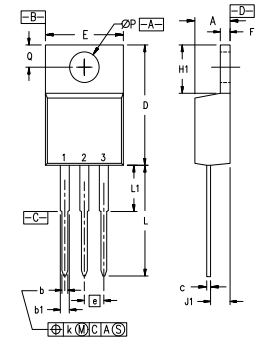
Applications

- 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
$V_{GE(th)}$	$I_C = 250\mu A$, $V_{CE} = V_{GE}$	3.5		6.0 V
I_{CES}	$V_{CE} = V_{CES}$, $V_{GE} = 0V$ $T_J = 150^\circ C$			10 μA 200 μA
I_{GES}	$V_{CE} = 0V$, $V_{GE} = \pm 20V$			± 100 nA
$V_{CE(sat)}$	$I_C = 10A$, $V_{GE} = 15V$, Note 1 $T_J = 150^\circ C$		2.27 2.54	2.50 V V

Symbol	Test Conditions ($T_J = 25^\circ\text{C}$ Unless Otherwise Specified)	Characteristic Values		
		Min.	Typ.	Max.
g_{fs}	$I_C = 10\text{A}, V_{CE} = 10\text{V}$, Note 1	3.8	6.2	S
C_{ies}	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$		423	pF
C_{oes}			42	pF
C_{res}			10	pF
$Q_{g(on)}$	$I_C = 10\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$		18	nC
Q_{ge}			4	nC
Q_{gc}			8	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = 10\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 400\text{V}, R_G = 50\Omega$ Note 2		20	ns
t_{ri}			26	ns
E_{on}			0.24	mJ
$t_{d(off)}$			77	ns
t_{fi}			23	ns
E_{off}			0.11	0.17 mJ
$t_{d(on)}$	Inductive load, $T_J = 150^\circ\text{C}$ $I_C = 10\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 400\text{V}, R_G = 50\Omega$ Note 2		17	ns
t_{ri}			27	ns
E_{on}			0.44	mJ
$t_{d(off)}$			90	ns
t_{fi}			38	ns
E_{off}			0.15	mJ
R_{thJC}			0.94	$^\circ\text{C/W}$
R_{thCS}		0.50		$^\circ\text{C/W}$

TO-220 Outline



Pins: 1 - Gate 2 - Collector
3 - Emitter

SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.170	.190	4.32	4.83
b	.025	.040	0.64	1.02
b1	.045	.065	1.15	1.65
c	.014	.022	0.35	0.56
D	.580	.630	14.73	16.00
E	.390	.420	9.91	10.66
e	.100 BSC		2.54 BSC	
F	.045	.055	1.14	1.40
H1	.230	.270	5.85	6.85
J1	.090	.110	2.29	2.79
k	0	.015	0	0.38
L	.500	.550	12.70	13.97
L1	.110	.230	2.79	5.84
$\varnothing P$.139	.161	3.53	4.08
Q	.100	.125	2.54	3.18

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 $T_J = 150^\circ\text{C}$		1.5	2.5 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}			170	ns
R_{thJC}				2.30 $^\circ\text{C/W}$

Notes:

1. Pulse test, $t \leq 300\mu\text{s}$, duty cycle, $d \leq 2\%$.
2. Switching times & energy losses may increase for higher $V_{CE}(\text{clamp})$, 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	4,931,844	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 @ $T_J = 25^\circ\text{C}$

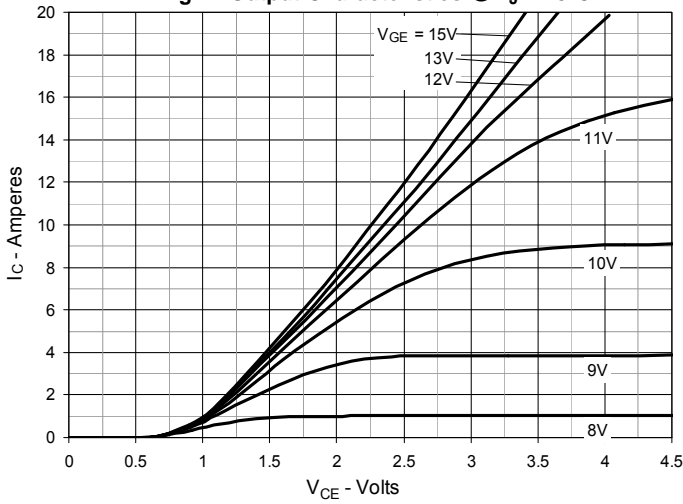


Fig. 2. Extended Output Characteristics @ $T_J = 25^\circ\text{C}$

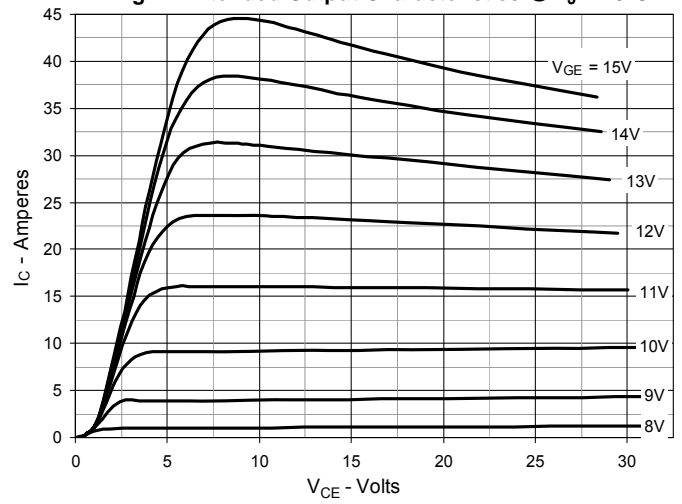


Fig. 3. Output Characteristics @ $T_J = 150^\circ\text{C}$

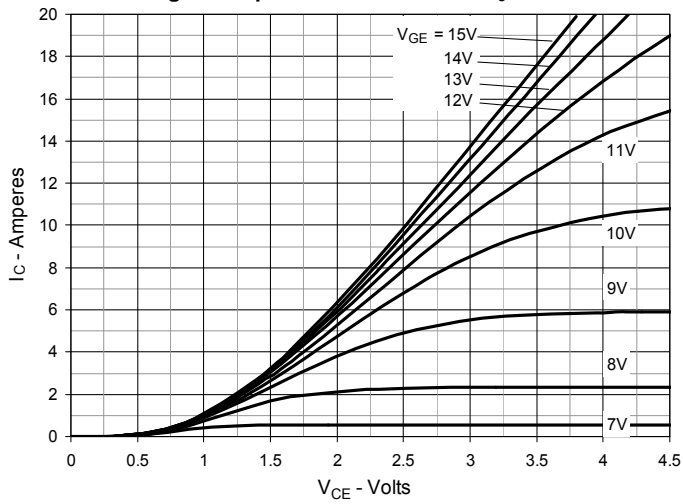


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

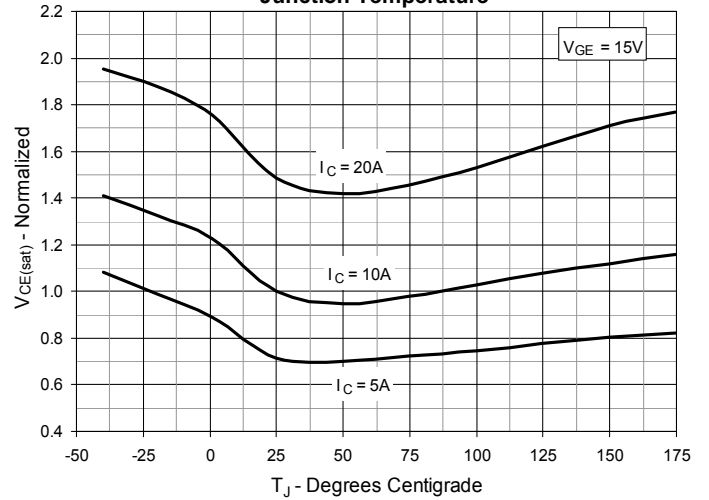


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

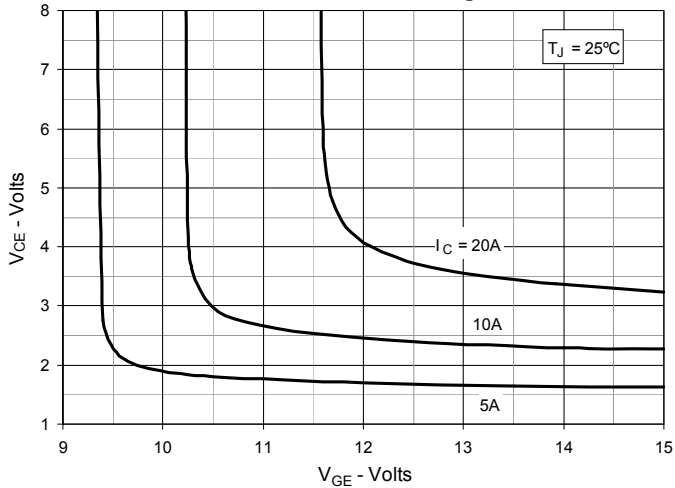


Fig. 6. Input Admittance

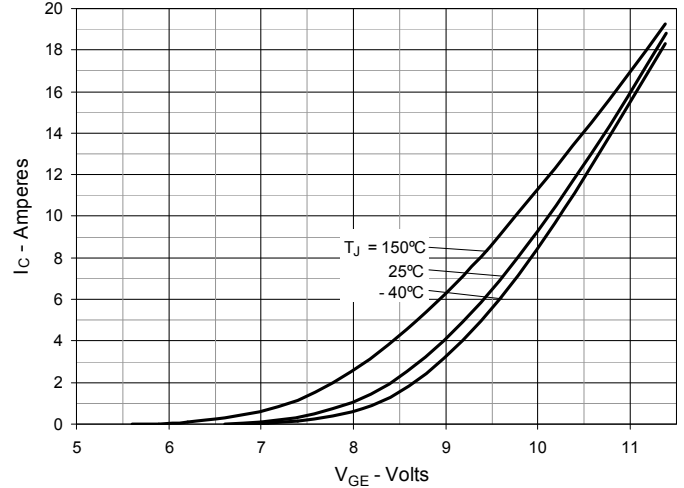


Fig. 7. Transconductance

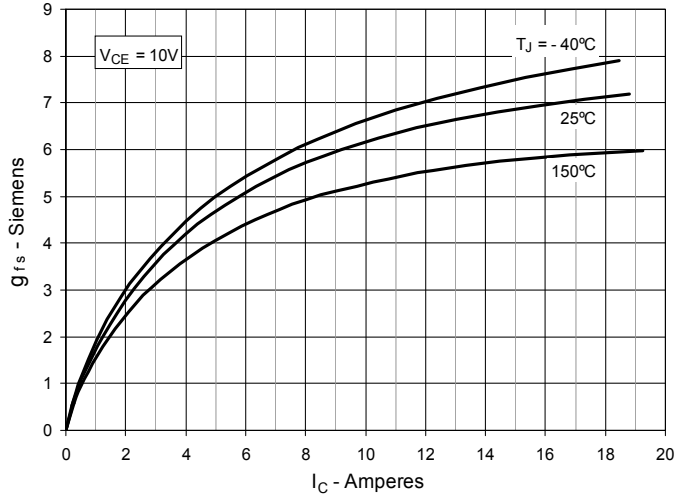


Fig. 8. Gate Charge

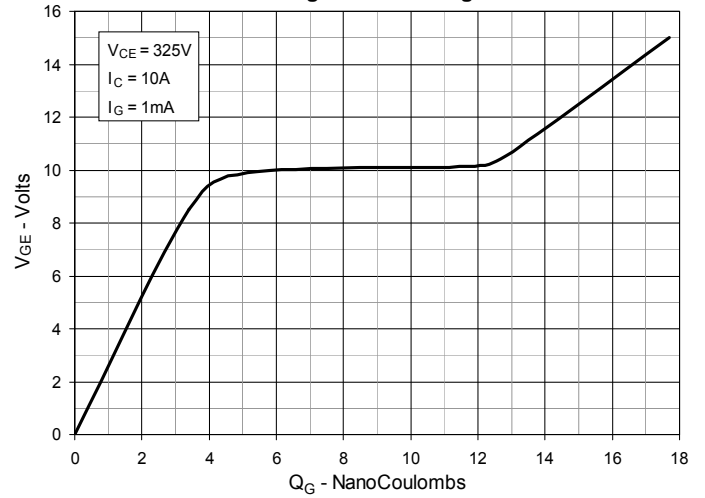


Fig. 9. Capacitance

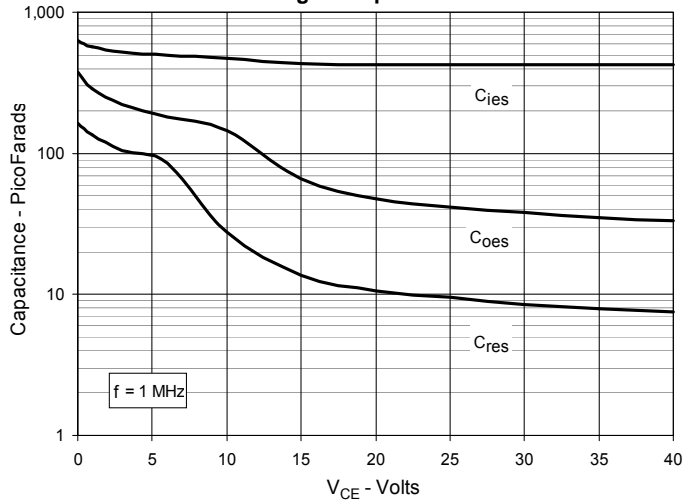


Fig. 10. Reverse-Bias Safe Operating Area

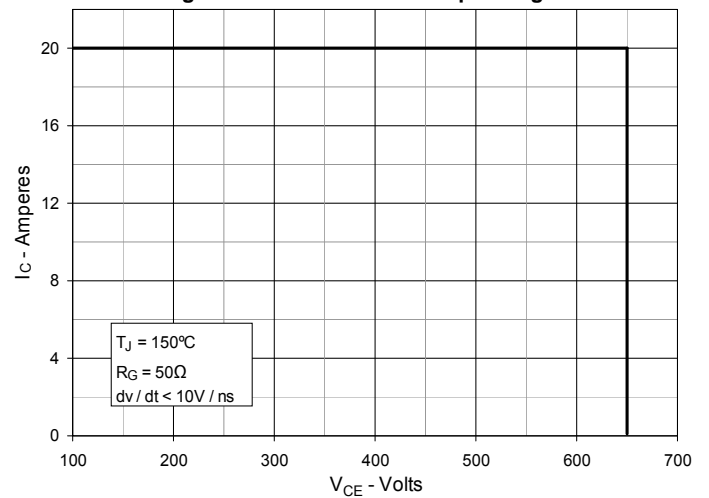


Fig. 11. Forward-Bias Safe Operating Area

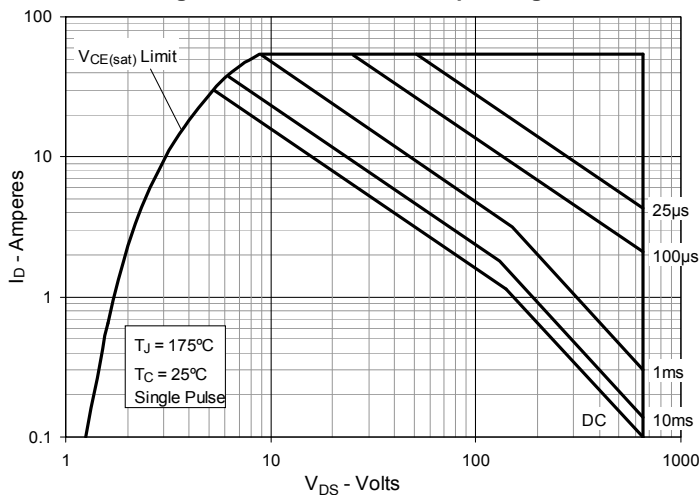


Fig. 12. Maximum Transient Thermal Impedance (IGBT)

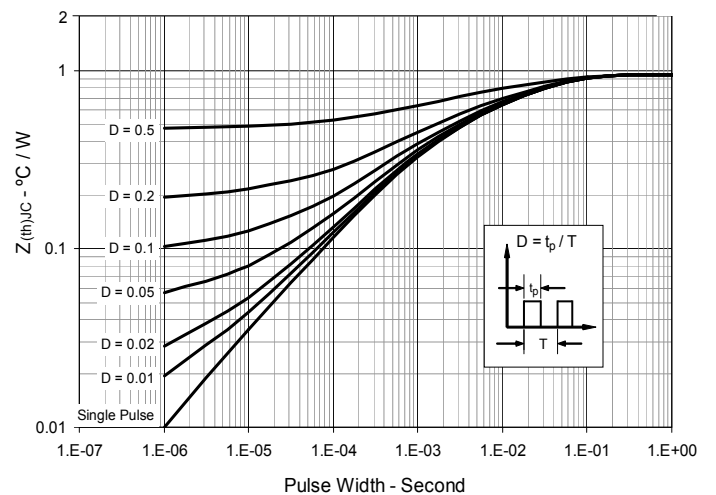


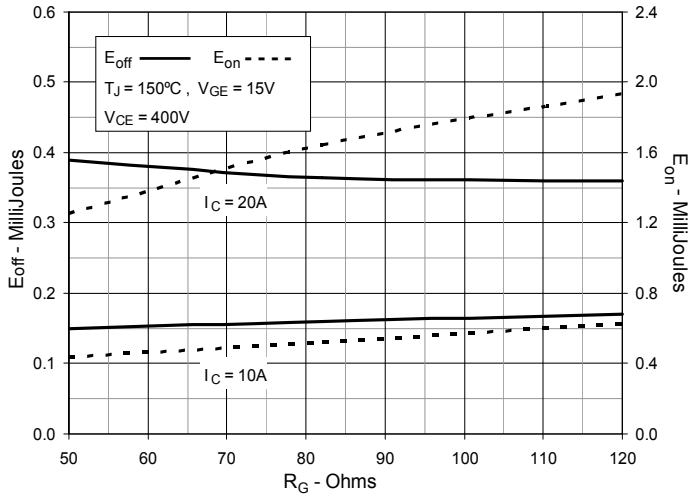
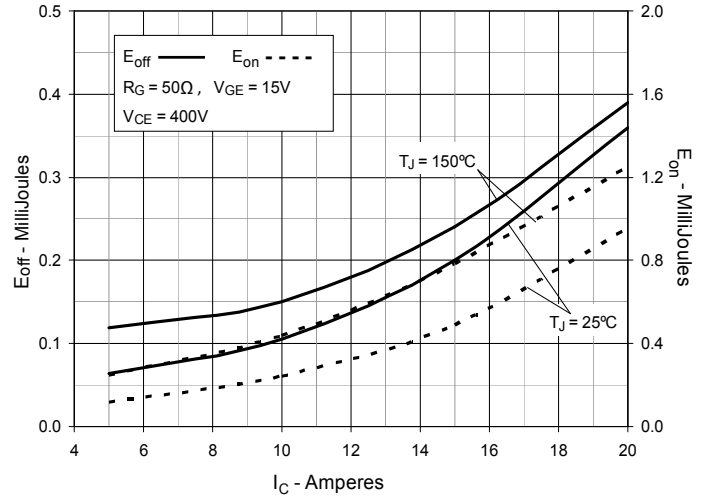
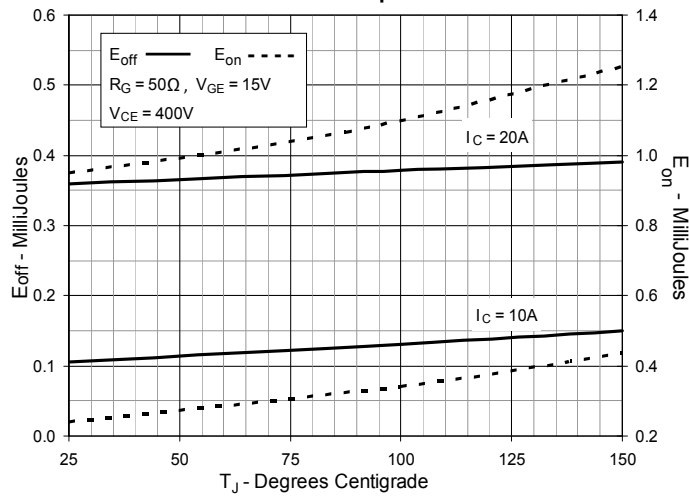
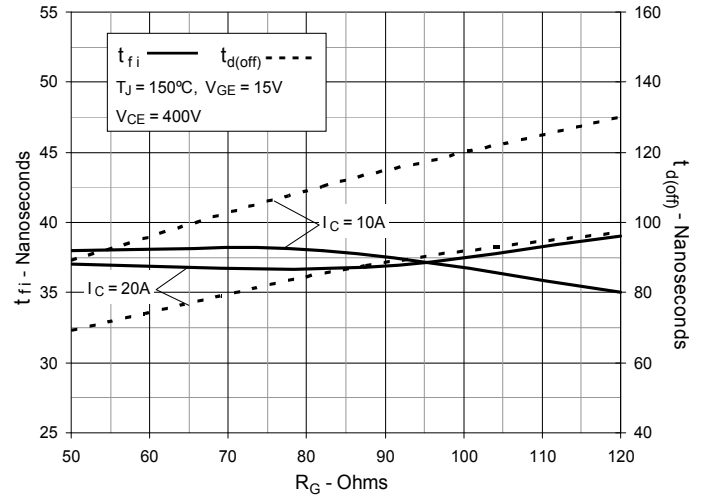
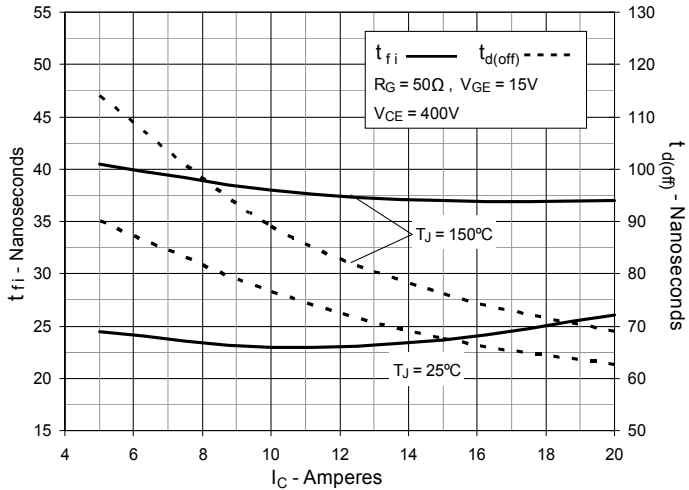
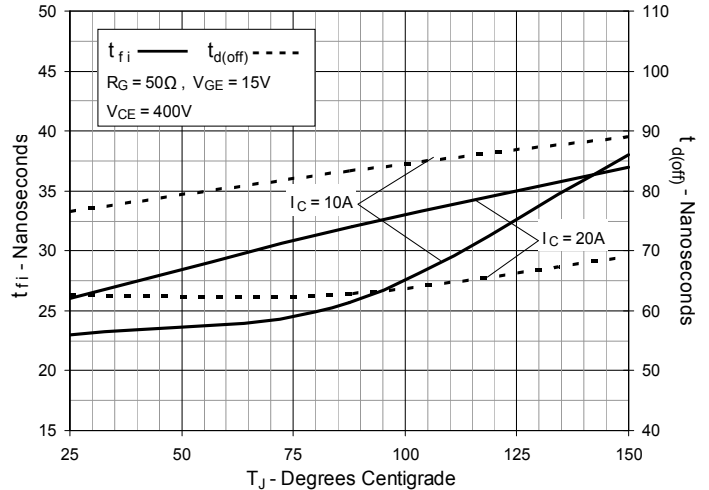
Fig. 13. Inductive Switching Energy Loss vs. Gate Resistance

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


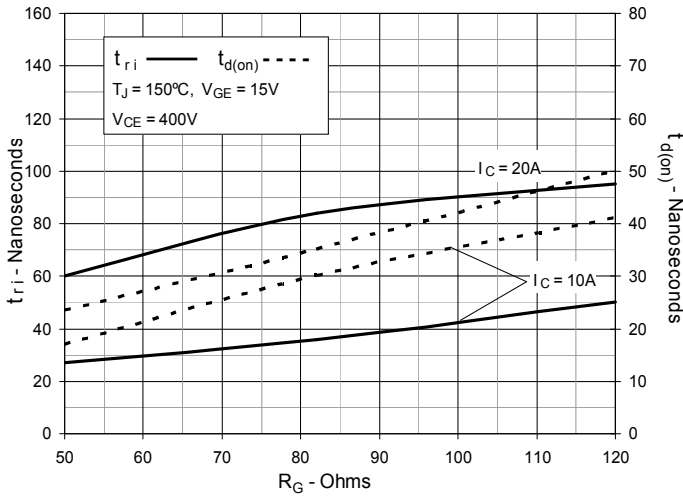
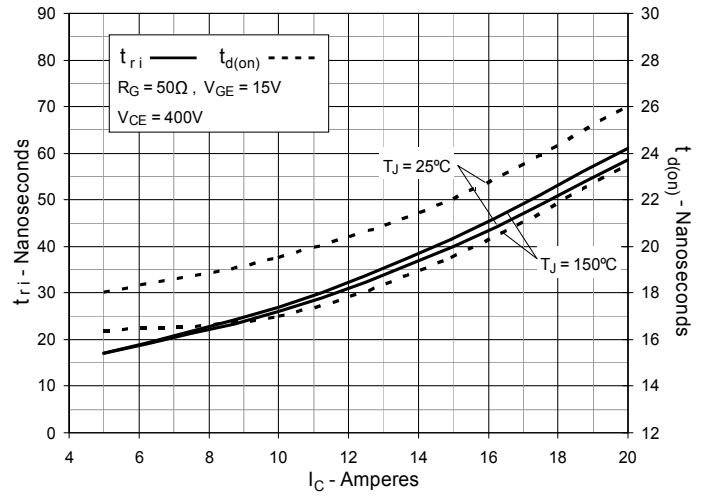
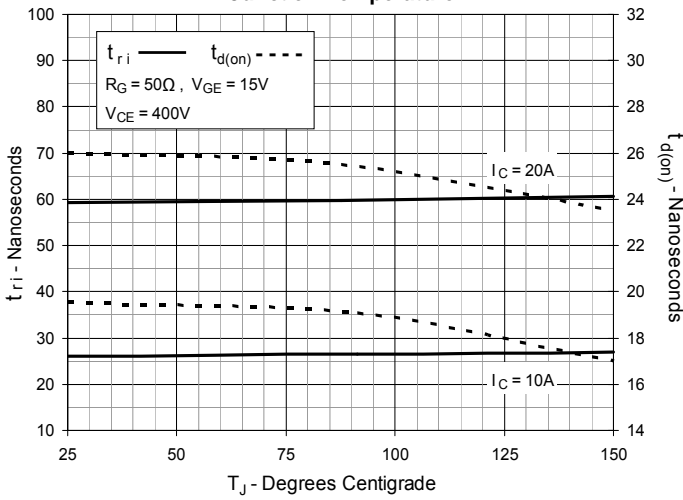
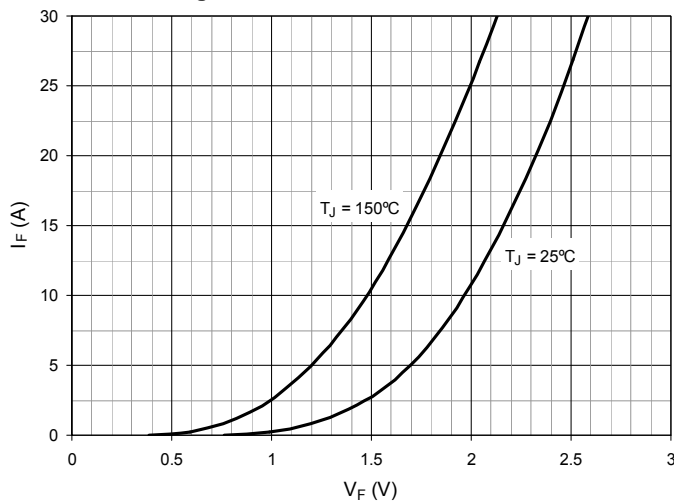
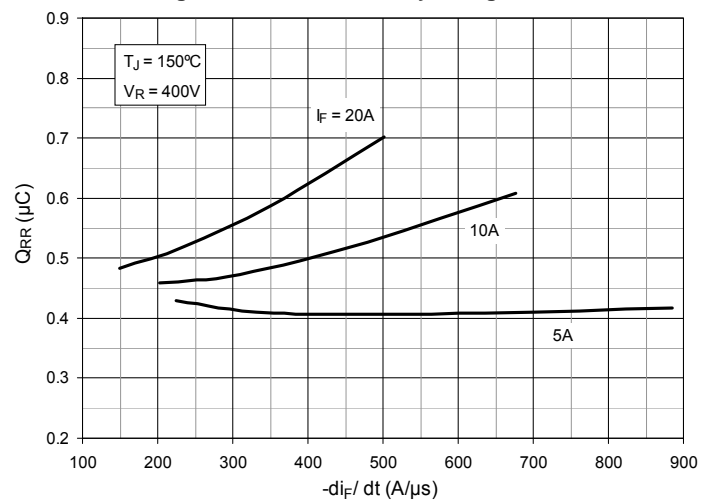
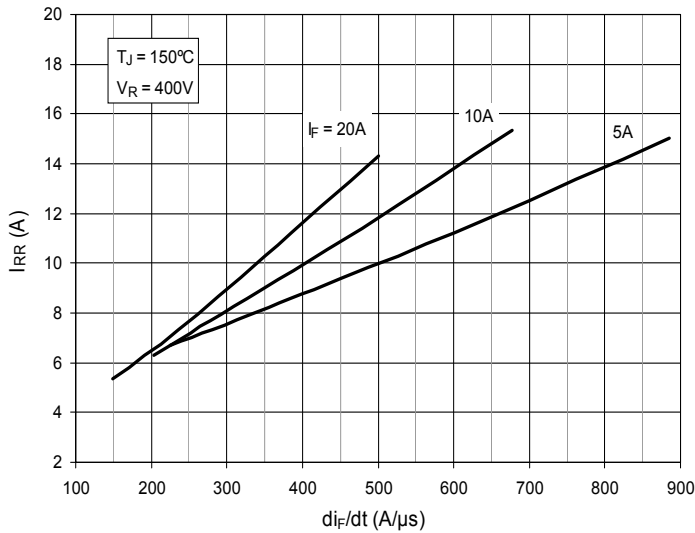
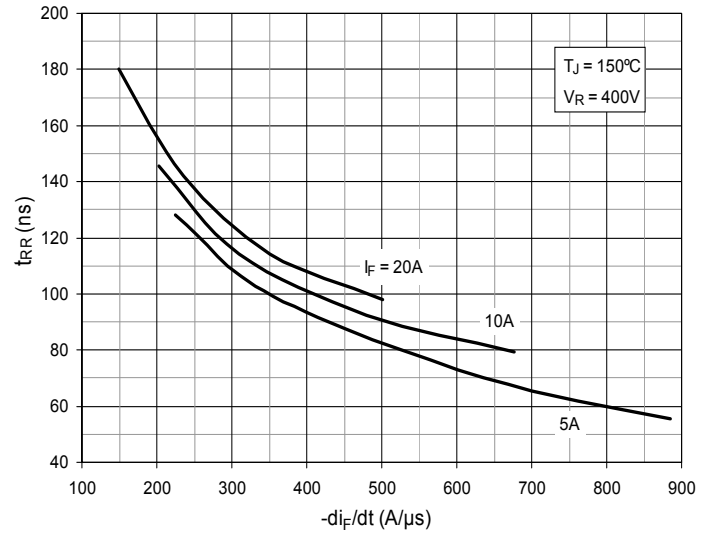
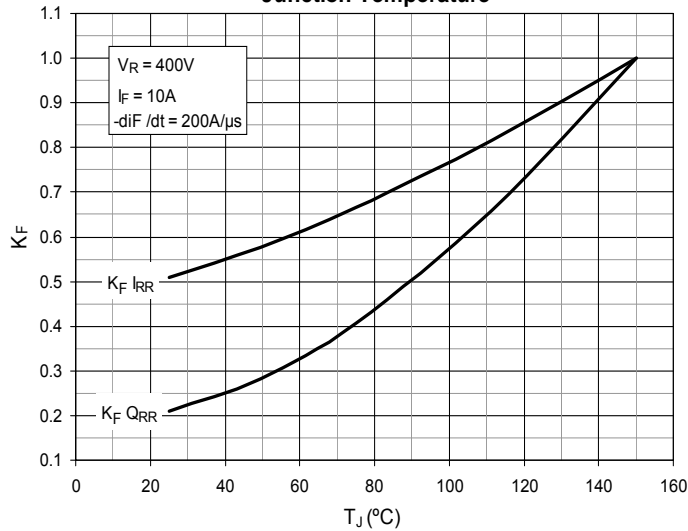
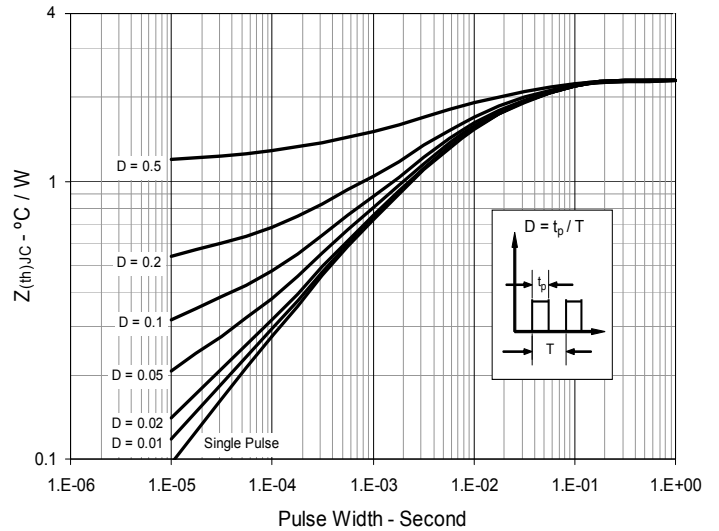
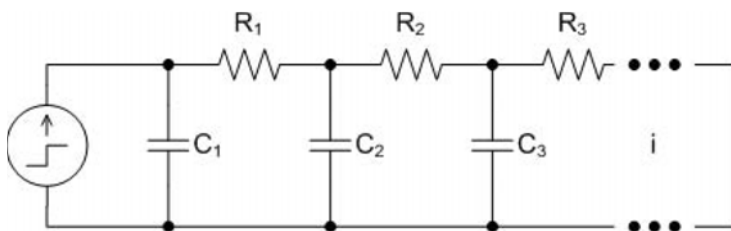
Fig. 19. Inductive Turn-on Switching Times vs. Gate Resistance

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

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

Fig. 22. 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)

Fig. 28. Cauer Thermal Network

IGBT

i	Ri (°C/W)	Ci (J/°C)
1	0.314390	0.00097276
2	0.289260	0.00981820
3	0.090928	0.07681600

DIODE

i	Ri (°C/W)	Ci (J/°C)
1	0.862020	0.00082372
2	0.650090	0.00427340
3	0.192070	0.05408700



Disclaimer Notice - Information furnished is believed to be accurate and reliable. However, users should independently evaluate the suitability of and test each product selected for their own applications. Littelfuse products are not designed for, and may not be used in, all applications. Read complete Disclaimer Notice at www.littelfuse.com/disclaimer-electronics.