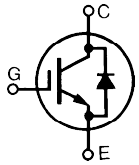
XPT™ 650V IGBT GenX4™ w/Sonic Diode

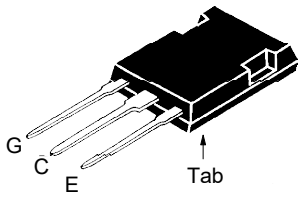
IXXX140N65B4H1

Extreme Light Punch Through
IGBT for 10-30kHz Switching



V_{CES} = 650V
I_{C110} = 140A
$V_{CE(sat)}$ ≤ 1.90V
$t_{fi(typ)}$ = 44ns

PLUS247



G = Gate E = Emitter
C = Collector 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 (Chip Capability)	340	A
I_{LRMS}	Terminal Current Limit	160	A
I_{C110}	T_C = 110°C	140	A
I_{F110}	T_C = 110°C	72	A
I_{CM}	T_C = 25°C, 1ms	840	A
SSOA (RBSOA)	V_{GE} = 15V, T_{VJ} = 150°C, R_G = 4.7Ω Clamped Inductive Load	I_{CM} = 240 $V_{CE} \le V_{CES}$	A
t_{sc} (SCSOA)	V_{GE} = 15V, V_{CE} = 400V, T_J = 150°C R_G = 10Ω, Non Repetitive	10	μs
P_C	T_C = 25°C	1200	W
T_J		-55 ... +175	°C
T_{JM}		175	°C
T_{stg}		-55 ... +175	°C
T_L	Maximum Lead Temperature for Soldering 1.6 mm (0.062 in.) from Case for 10s	300	°C
F_C	Mounting Force	20..120 /4.5..27	N/lb
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}	4.0		6.5	V
I_{CES}	V_{CE} = V_{CES}, V_{GE} = 0V			25	μA
	T_J = 150°C			5	mA
I_{GES}	V_{CE} = 0V, V_{GE} = ±20V			±100	nA
$V_{CE(sat)}$	I_C = 120A, V_{GE} = 15V, Note 1		1.55	1.90	V
	T_J = 150°C		1.76		V

Features

- Optimized for 10-30kHz Switching
- Square RBSOA
- Short Circuit Capability
- Anti-Parallel Sonic Diode
- High Current Handling Capability
- International Standard Package

Advantages

- High Power Density
- 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.	
g_{fs}	I_C = 60A, V_{CE} = 10V, Note 1	40	70		S
C_{ies}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz		8000		pF
C_{oes}			560		pF
C_{res}			107		pF
$Q_{g(on)}$	I_C = 140A, V_{GE} = 15V, V_{CE} = 0.5 • V_{CES}		250		nC
Q_{ge}			70		nC
Q_{gc}			90		nC
$t_{d(on)}$	**Inductive load, T_J = 25°C**		54		ns
t_{ri}	I_C = 100A, V_{GE} = 15V		105		ns
E_{on}	V_{CE} = 400V, R_G = 4.7Ω		5.75		mJ
$t_{d(off)}$	Note 2		270		ns
t_{fi}			44		ns
E_{off}			2.67		mJ
$t_{d(on)}$	**Inductive load, T_J = 150°C**		43		ns
t_{ri}	I_C = 100A, V_{GE} = 15V		85		ns
E_{on}	V_{CE} = 400V, R_G = 4.7Ω		6.80		mJ
$t_{d(off)}$	Note 2		240		ns
t_{fi}			100		ns
E_{off}			3.90		mJ
R_{thJC}				0.125	°C/W
R_{thCS}			0.15		°C/W

Reverse Sonic Diode (FRD)

Symbol	Test Conditions (T_J = 25°C Unless Otherwise Specified)	Characteristic Values Min.	Typ.	Max.	
V_F	I_F = 100A, V_{GE} = 0V, Note 1		2.1	2.5	V
	T_J = 150°C		2.2		V
I_{RM}	I_F = 100A, V_{GE} = 0V, T_J = 150°C		43		A
t_{rr}	$-di_F/dt$ = 600A/μs, V_R = 400V		210		ns
R_{thJC}				0.24	°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

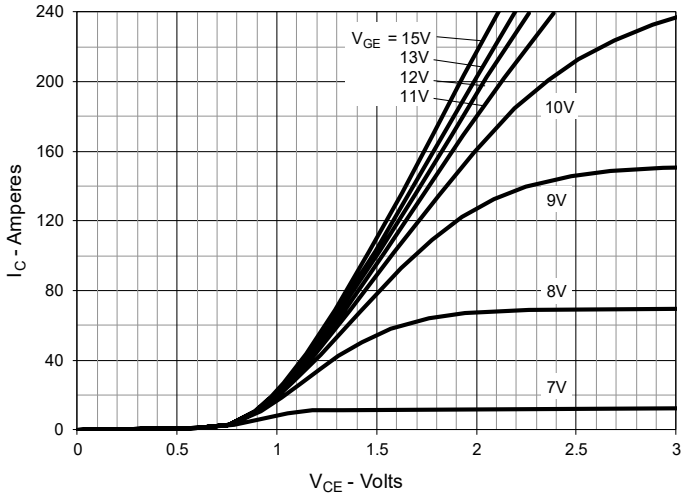


Fig. 2. Extended Output Characteristics @ T_J = 25ºC

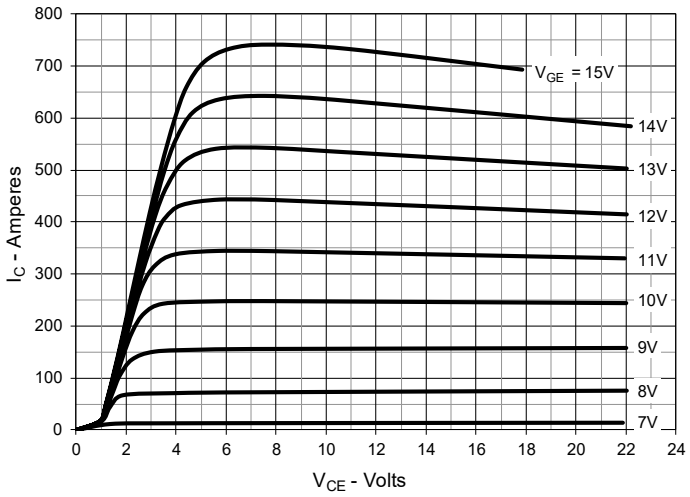


Fig. 3. Output Characteristics @ T_J = 150ºC

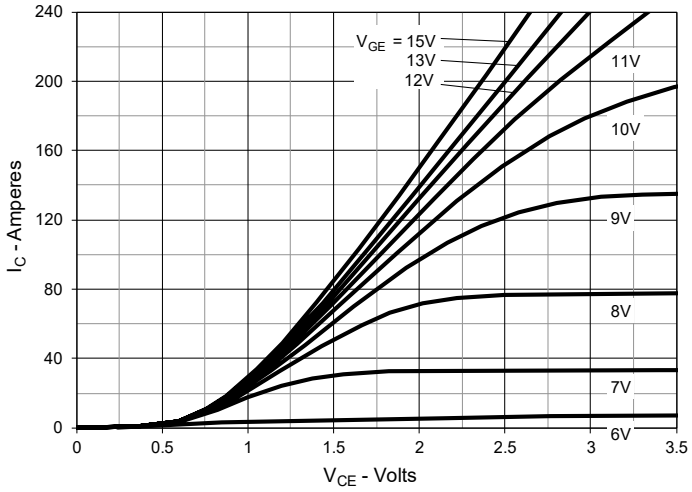


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

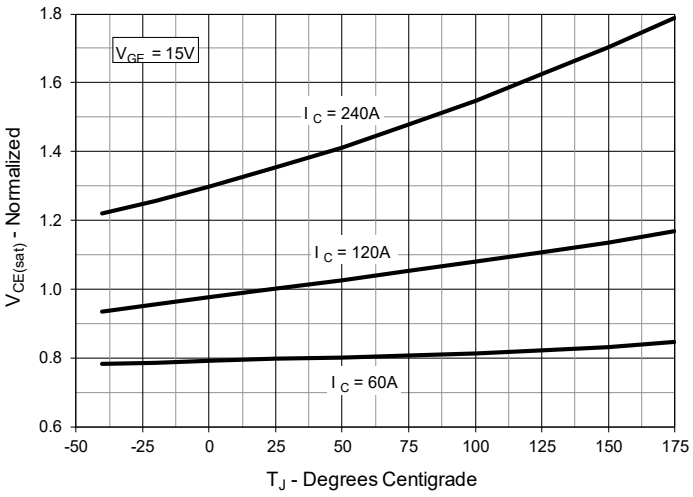


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

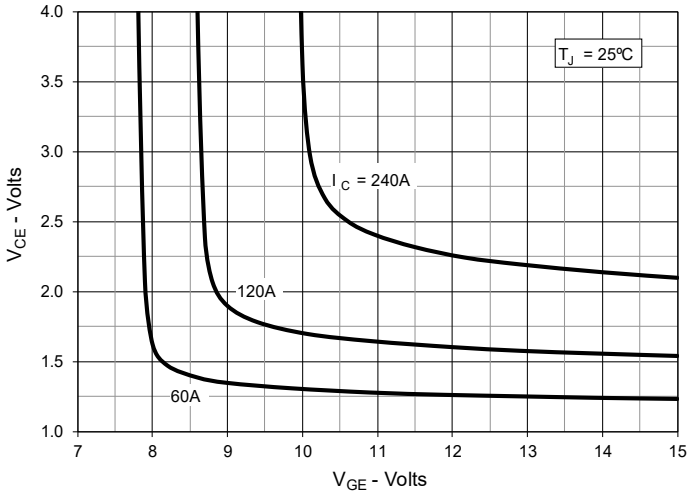


Fig. 6. Input Admittance

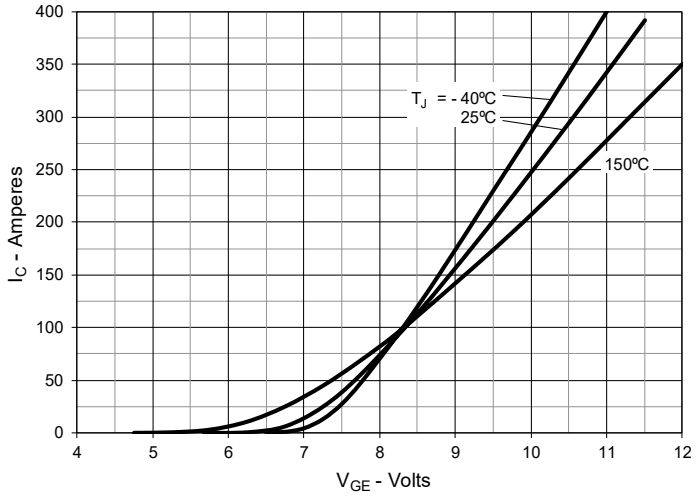


Fig. 7. Transconductance

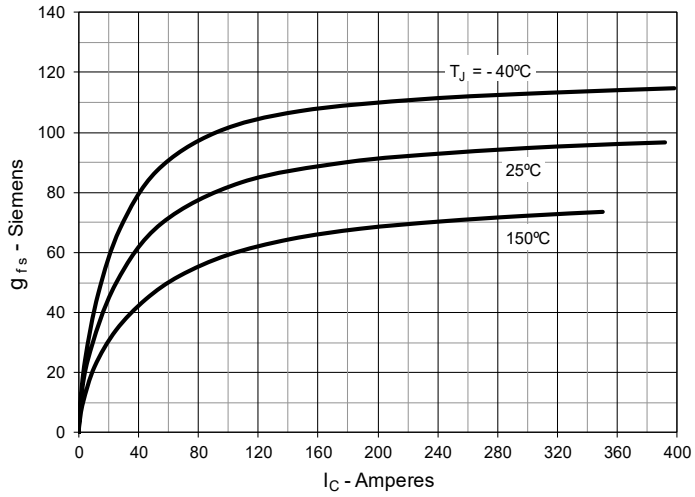


Fig. 8. Gate Charge

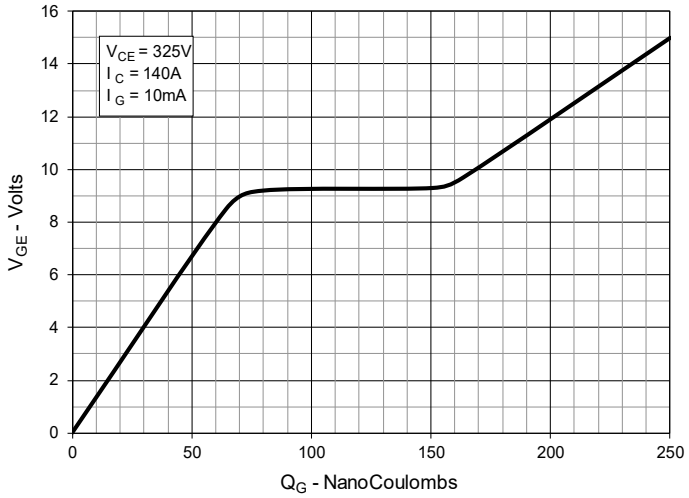


Fig. 9. Capacitance

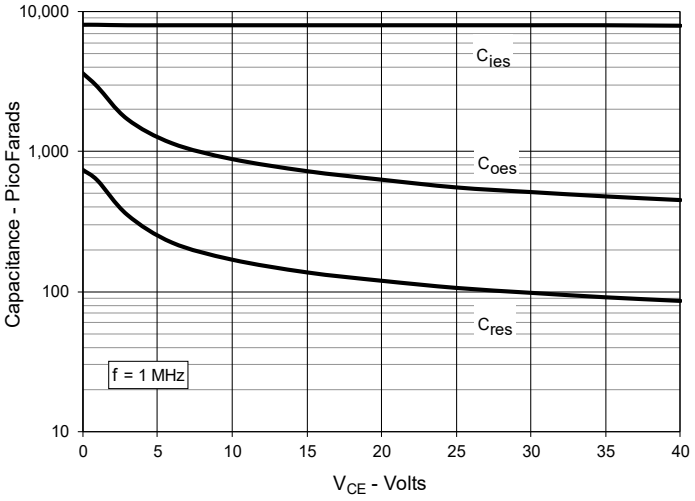


Fig. 10. Reverse-Bias Safe Operating Area

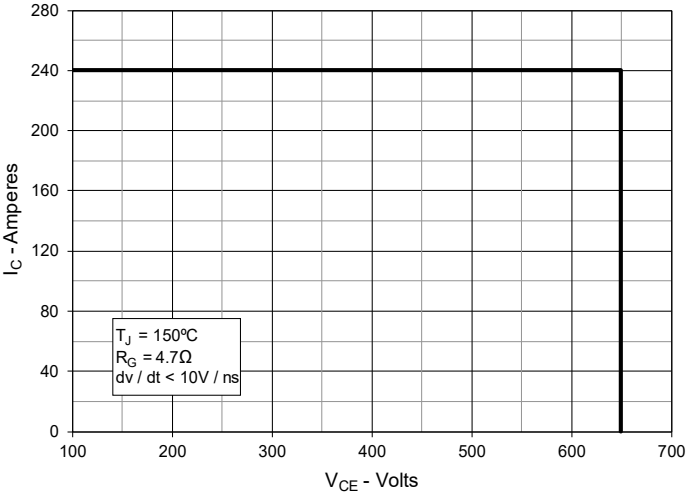


Fig. 11. Forward-Bias Safe Operating Area

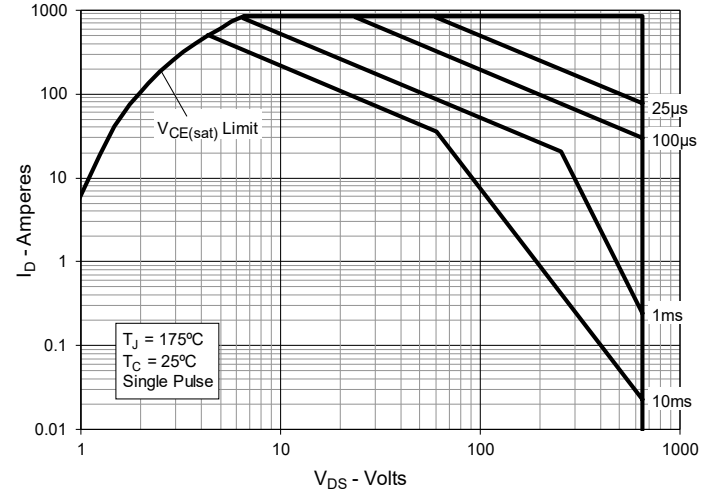


Fig. 12. Maximum Transient Thermal Impedance (IGBT)

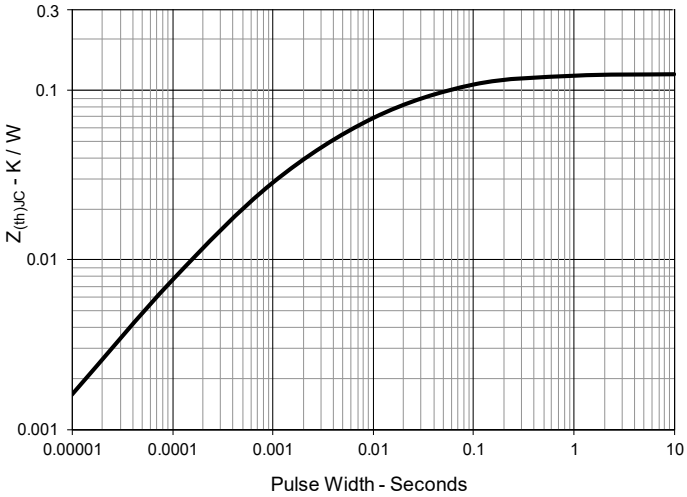


Fig. 13. Inductive Switching Energy Loss vs. Gate Resistance

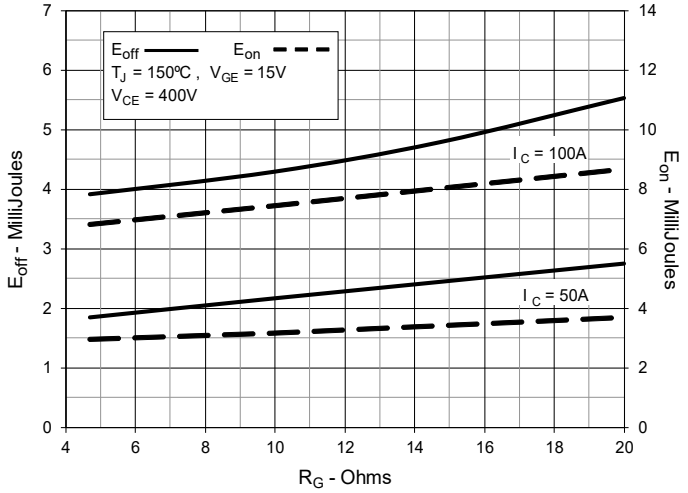


Fig. 14. Inductive Switching Energy Loss vs. Collector Current

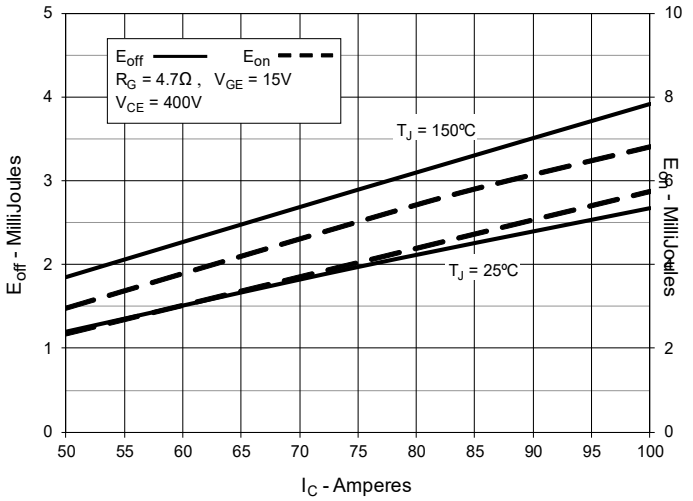


Fig. 15. Inductive Switching Energy Loss vs. Junction Temperature

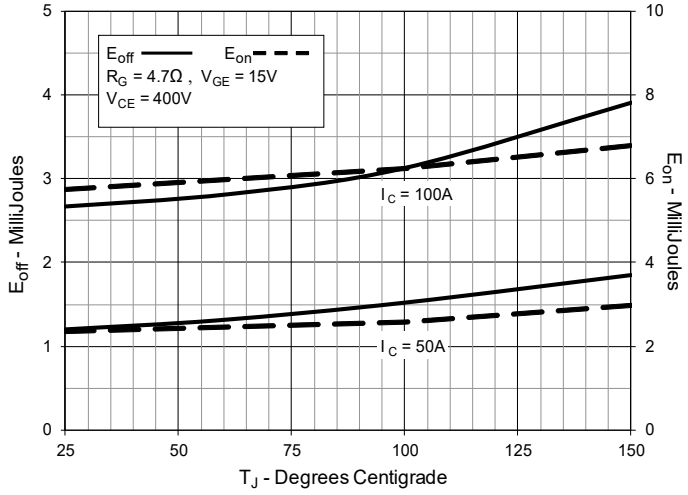


Fig. 16. Inductive Turn-off Switching Times vs. Gate Resistance

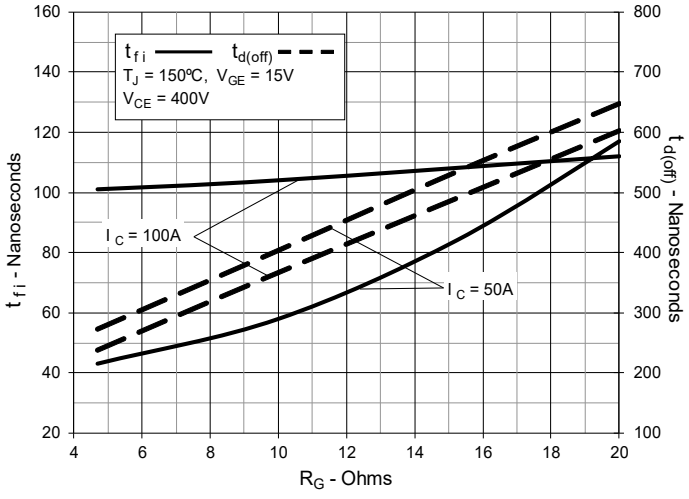


Fig. 17. Inductive Turn-off Switching Times vs. Collector Current

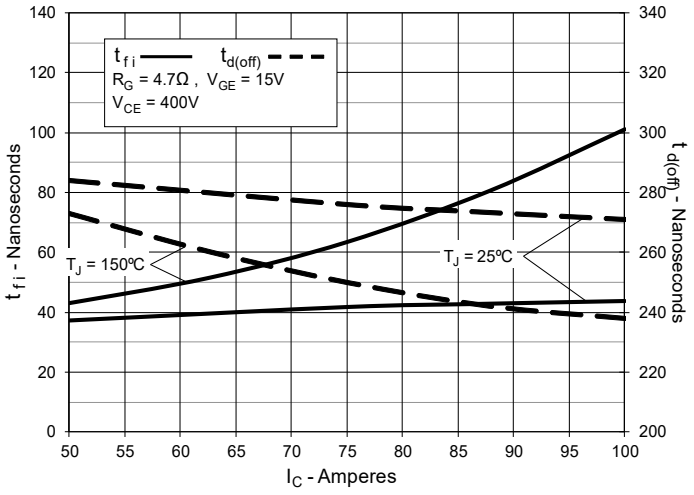


Fig. 18. Inductive Turn-off Switching Times vs. Junction Temperature

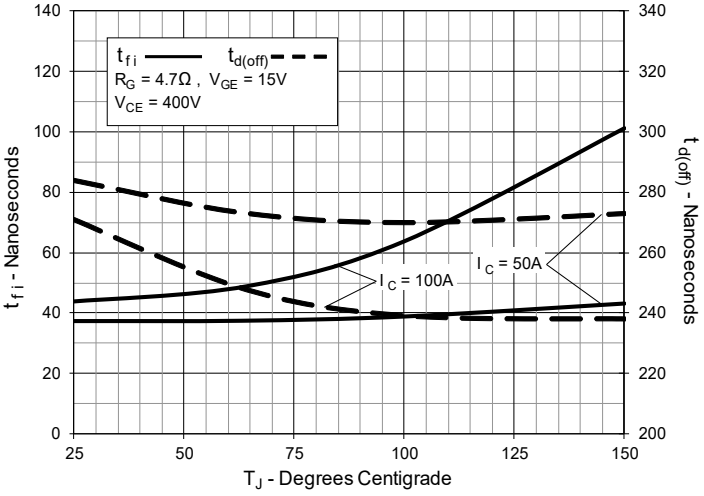


Fig. 19. Inductive Turn-on Switching Times vs. Gate Resistance

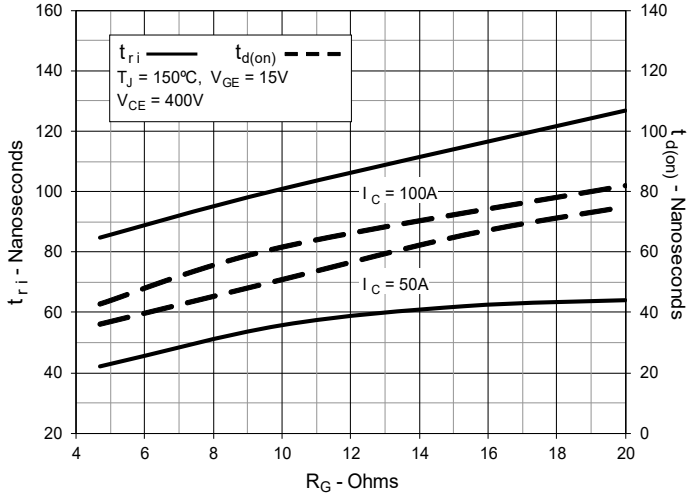


Fig. 20. Inductive Turn-on Switching Times vs. Collector Current

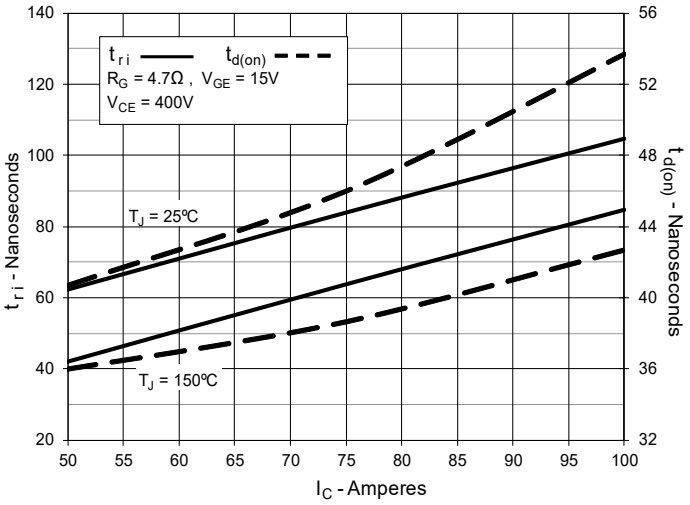


Fig. 21. Inductive Turn-on Switching Times vs. Junction Temperature

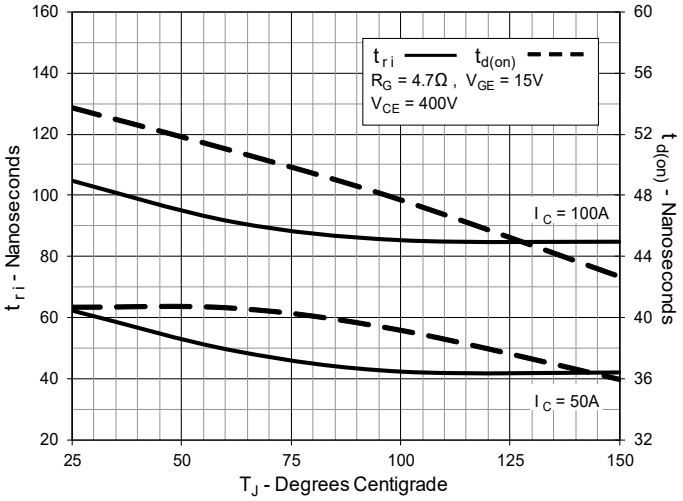


Fig. 22. Diode Forward Characteristics

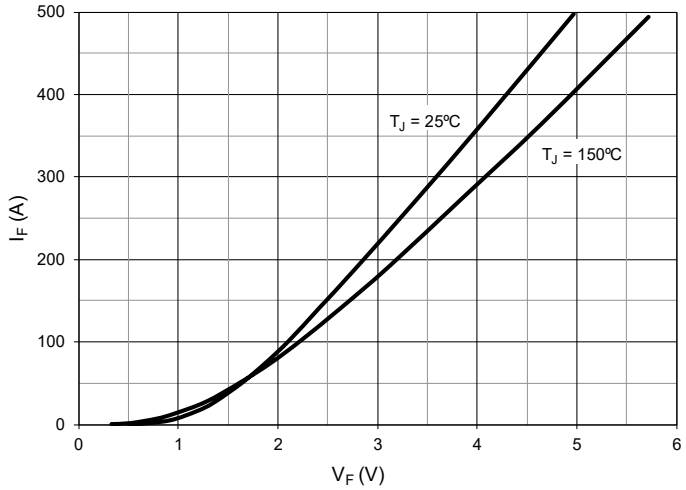


Fig. 23. Reverse Recovery Charge vs. -di_F/dt

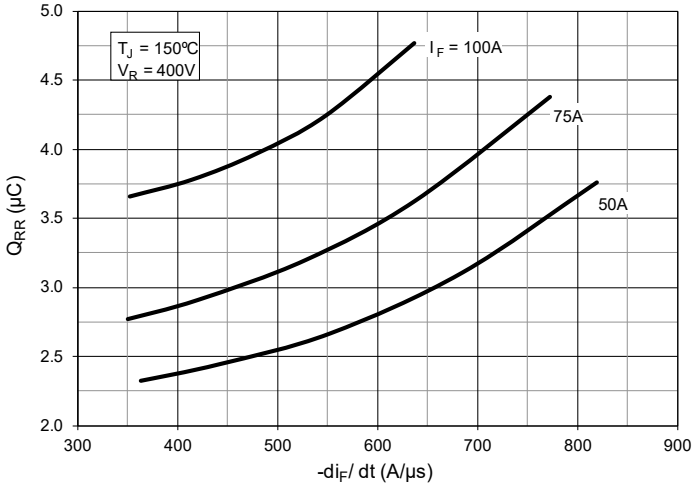


Fig. 24. Reverse Recovery Current vs. -di_F/dt

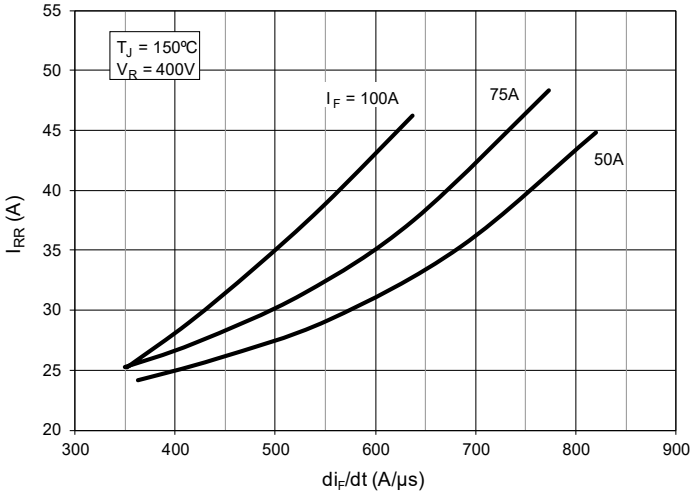


Fig. 25. Reverse Recovery Time vs. -di_F/dt

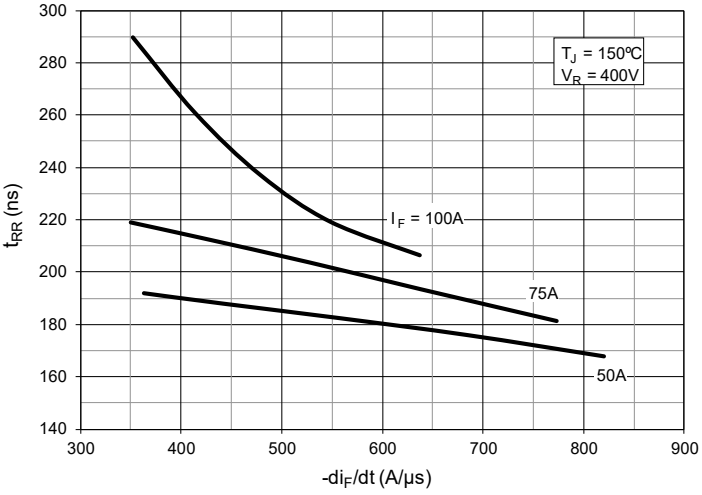


Fig. 26. Dynamic Parameters Q_{RR}, I_{RR} vs. Junction Temperature

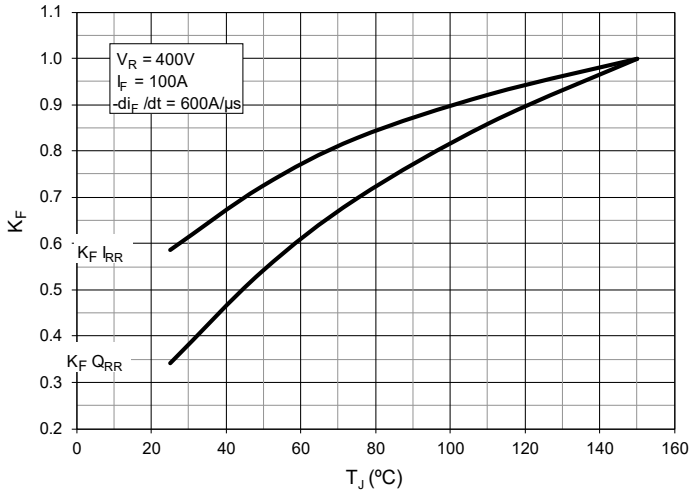
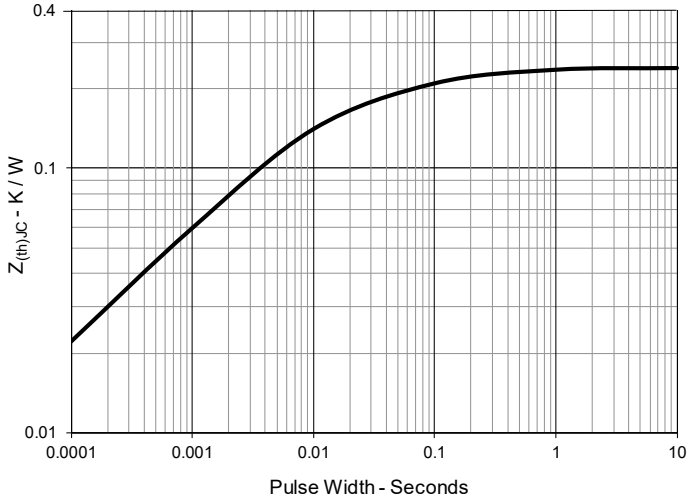
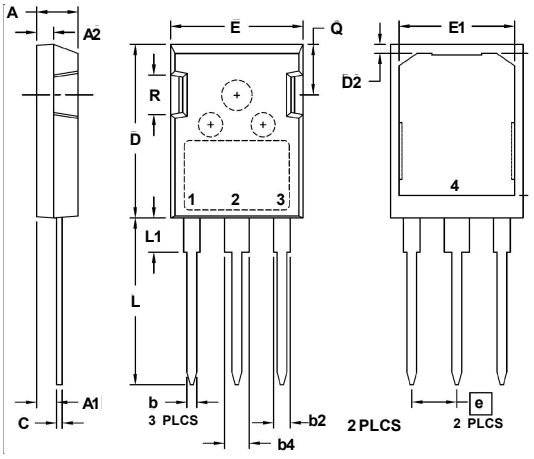


Fig. 27. Maximum Transient Thermal Impedance (Diode)



PLUS247™ Outline



1 = Gate
2,4 = Collector
3 = Emitter

SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	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	.520	.560	13.08	14.22
e	.215 BSC		5.45 BSC	
L	.780	.810	19.81	20.57
L1	.150	.170	3.81	4.32
Q	.220	.244	5.59	6.20
R	.170	.190	4.32	4.83