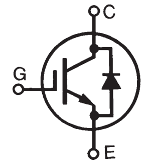
IXYS

XPT™ 650V GenX4™ w/ Sonic Diode

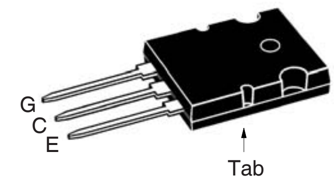
IXXK110N65B4H1
IXXX110N65B4H1

V_{CES} = 650V
I_{C110} = 110A
$V_{CE(sat)}$ ≤ 2.10V
$t_{fi(typ)}$ = 43ns

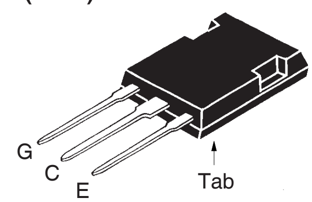
Extreme Light Punch Through
IGBT for 10-30kHz Switching



TO-264 (IXXK)



PLUS247 (IXXX)



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)	250	A
I_{LRMS}	Terminal Current Limit	160	A
I_{C110}	T_C = 110°C	110	A
I_{F110}	T_C = 110°C	78	A
I_{CM}	T_C = 25°C, 1ms	570	A
SSOA (RBSOA)	V_{GE} = 15V, T_{VJ} = 150°C, R_G = 2Ω Clamped Inductive Load	I_{CM} = 220 @$V_{CE} \le V_{CES}$	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	880	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 (TO-264)	1.13/10	Nm/lb.in.
F_C	Mounting Force (PLUS247)	20..120 /4.5..27	N/lb.
Weight	TO-264	10	g
	PLUS247	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			3	mA
I_{GES}	V_{CE} = 0V, V_{GE} = ±20V			±100	nA
$V_{CE(sat)}$	I_C = 110A, V_{GE} = 15V, Note 1		1.72	2.10	V
	T_J = 150°C		2.05		V

Features

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

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)	Min.	Typ.	Max.	
g_{fs}	I_C = 60A, V_{CE} = 10V, Note 1	30	52		S
C_{ies}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz		5500		pF
C_{oes}			470		pF
C_{res}			80		pF
$Q_{g(on)}$	I_C = 110A, V_{GE} = 15V, V_{CE} = 0.5 • V_{CES}		183		nC
Q_{ge}			32		nC
Q_{gc}			83		nC
$t_{d(on)}$	**Inductive load, T_J = 25°C** I_C = 55A, V_{GE} = 15V V_{CE} = 400V, R_G = 2Ω Note 2		26		ns
t_{ri}			40		ns
E_{on}			2.20		mJ
$t_{d(off)}$			146		ns
t_{fi}			43		ns
E_{off}			1.05	1.70	mJ
$t_{d(on)}$	**Inductive load, T_J = 150°C** I_C = 55A, V_{GE} = 15V V_{CE} = 400V, R_G = 2Ω Note 2		25		ns
t_{ri}			40		ns
E_{on}			3.00		mJ
$t_{d(off)}$			140		ns
t_{fi}			110		ns
E_{off}			2.16		mJ
R_{thJC}				0.17	°C/W
R_{thCS}			0.15		°C/W

Reverse Sonic Diode (FRD)

Symbol	Test Conditions (T_J = 25°C Unless Otherwise Specified)	Min.	Typ.	Max.	
V_F	I_F = 100A, V_{GE} = 0V, Note 1		1.7	2.3	V
	T_J = 150°C		1.8		V
I_{RM}	I_F = 100A, V_{GE} = 0V, T_J = 150°C		95		A
t_{rr}	$-di_F/dt$ = 1500A/μs, V_R = 300V		100		ns
R_{thJC}				0.38	°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 @ $T_J = 25^oC$

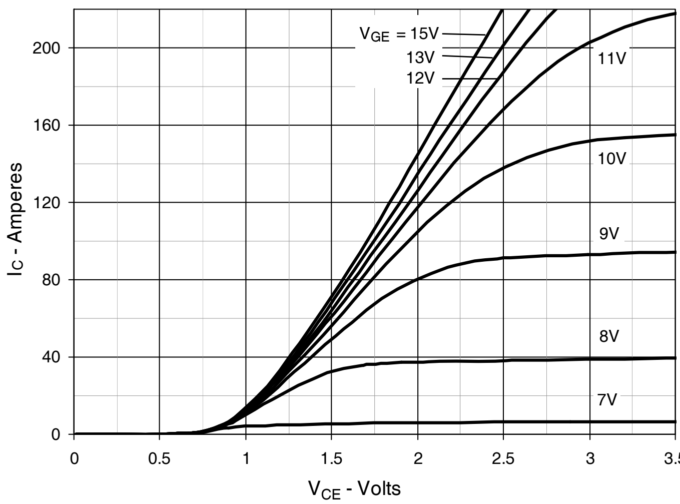


Fig. 2. Extended Output Characteristics @ $T_J = 25^oC$

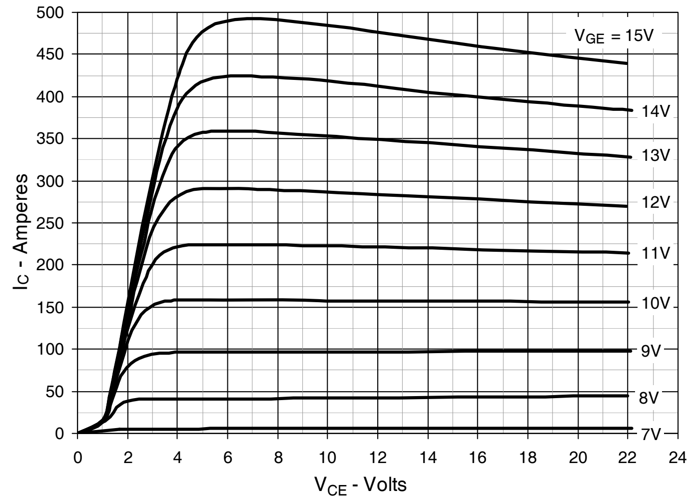


Fig. 3. Output Characteristics @ $T_J = 150^oC$

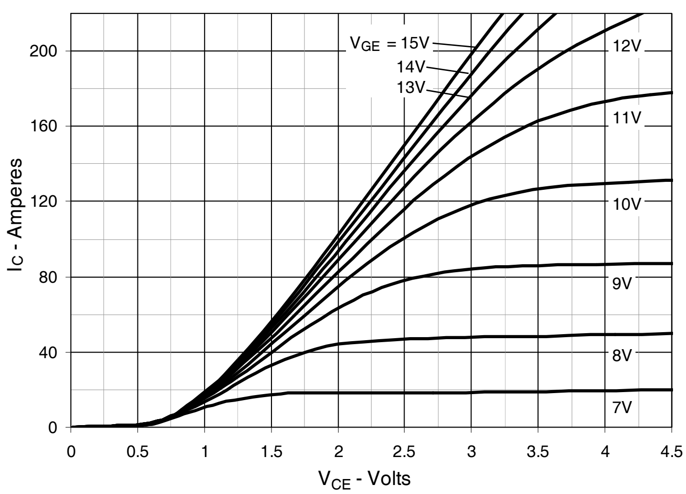


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

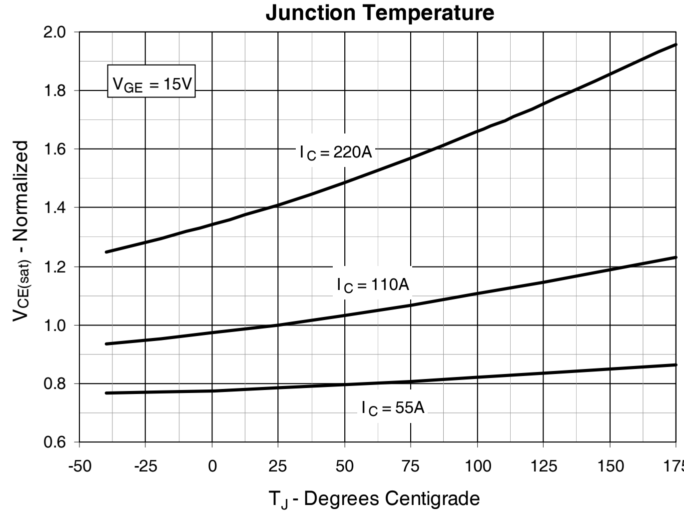


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

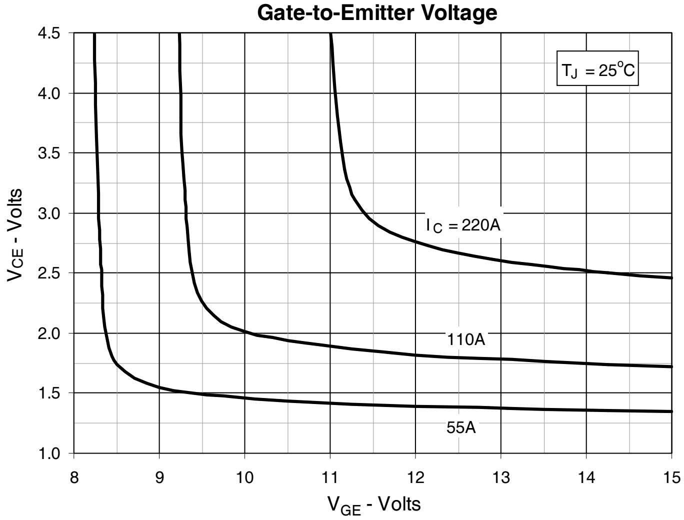
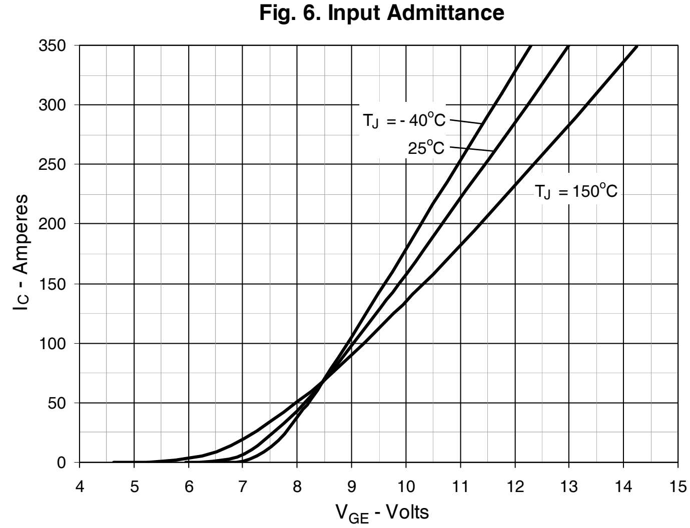


Fig. 6. Input Admittance



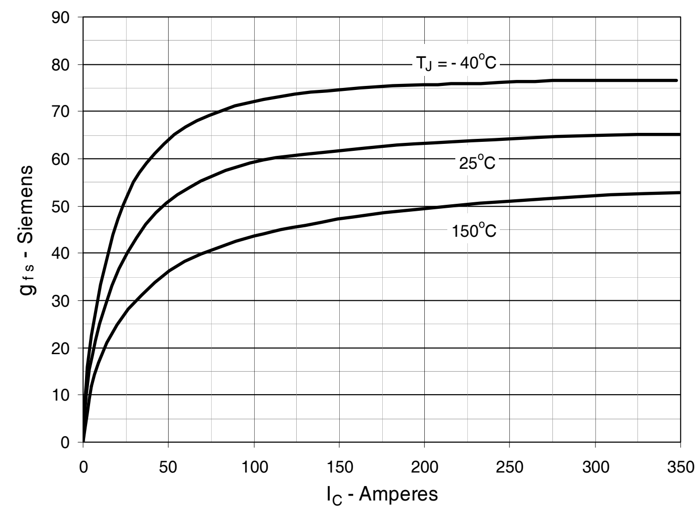


Fig. 7. Transconductance

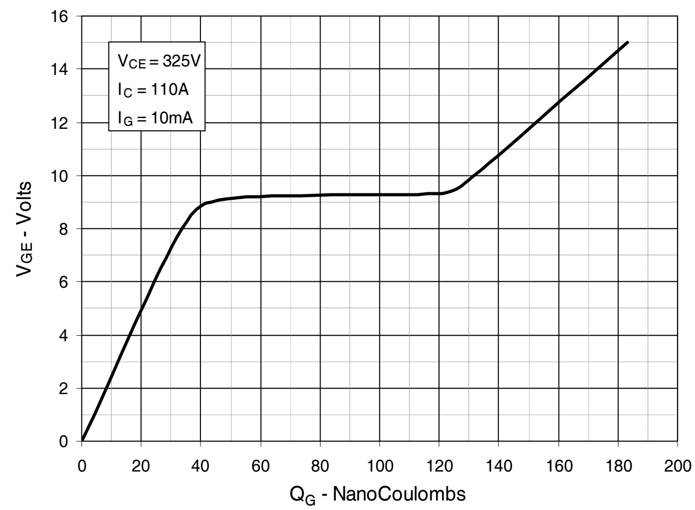


Fig. 8. Gate Charge

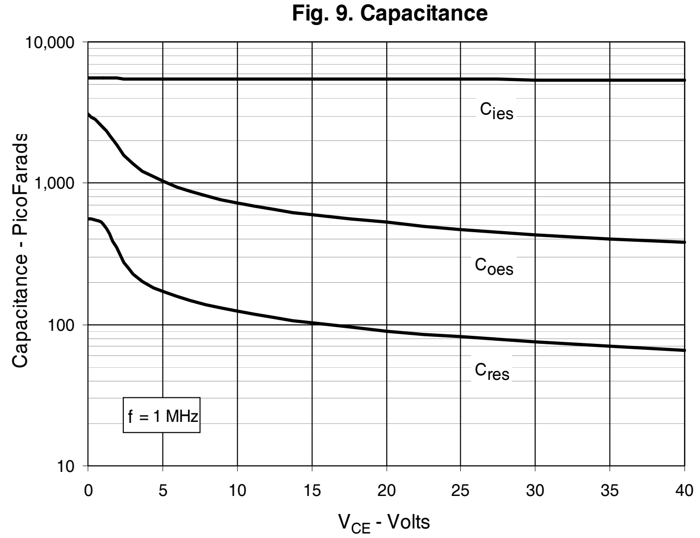


Fig. 9. Capacitance

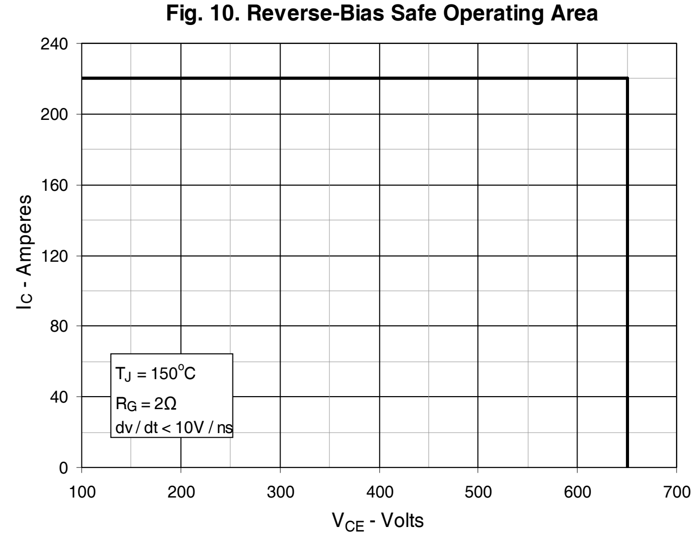
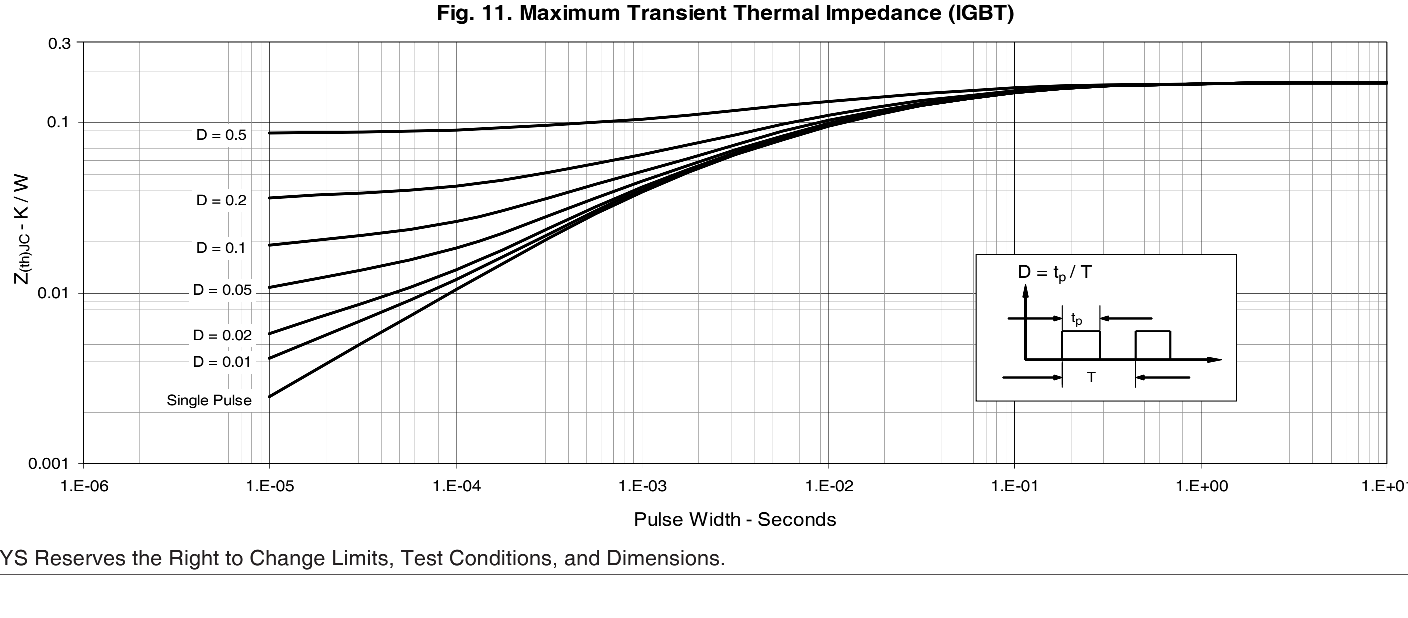


Fig. 10. Reverse-Bias Safe Operating Area

Fig. 11. Maximum Transient Thermal Impedance (IGBT)



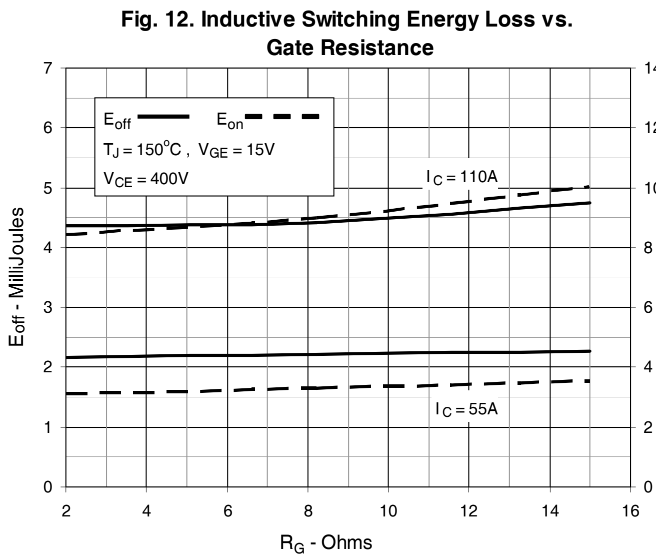


Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance
Eoff Eon
TJ = 150°C , VGE = 15V
VCE = 400V
I C = 110A
I C = 55A
Eoff - MilliJoules
Eon - MilliJoules
RG - Ohms

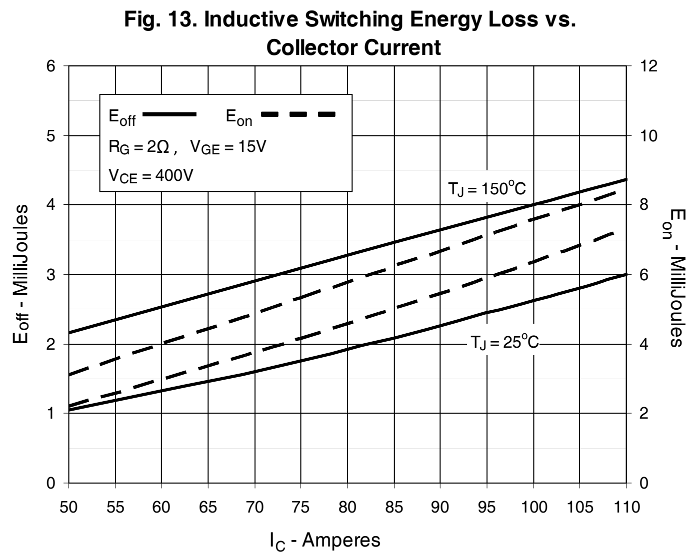


Fig. 13. Inductive Switching Energy Loss vs. Collector Current
Eoff Eon
RG = 2Ω , VGE = 15V
VCE = 400V
TJ = 150°C
TJ = 25°C
Eoff - MilliJoules
Eon - MilliJoules
IC - Amperes

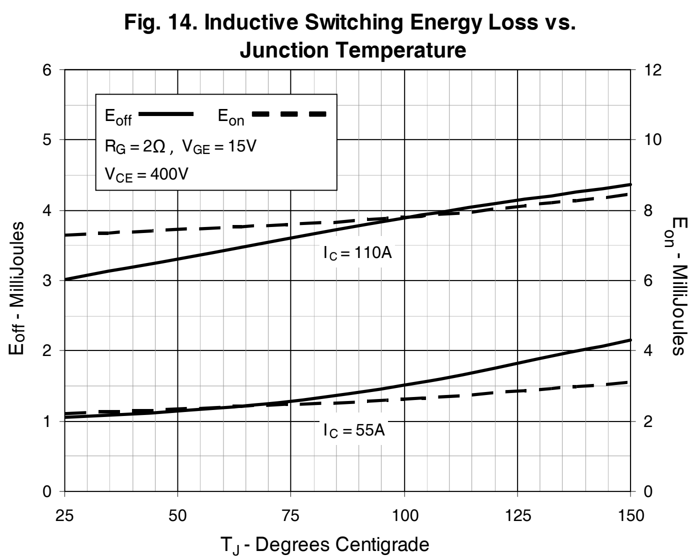


Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature
Eoff Eon
RG = 2Ω , VGE = 15V
VCE = 400V
I C = 110A
I C = 55A
Eoff - MilliJoules
Eon - MilliJoules
TJ - Degrees Centigrade

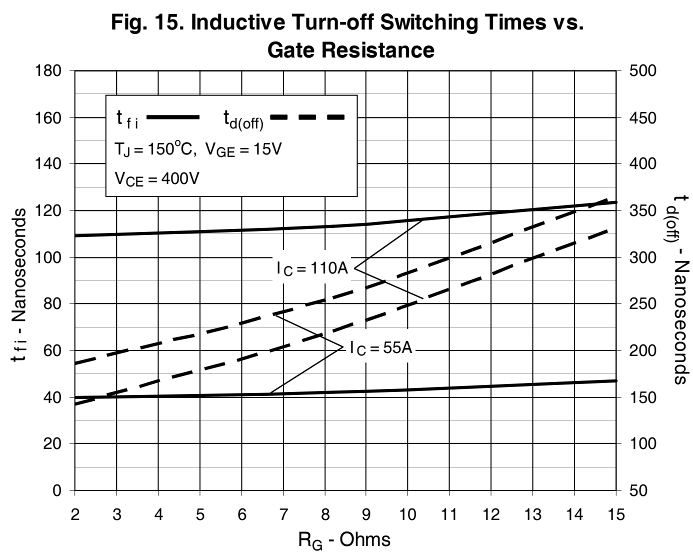


Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance
t f i td(off)
TJ = 150°C, VGE = 15V
VCE = 400V
I C = 110A
I C = 55A
t f i - Nanoseconds
t d(off) - Nanoseconds
RG - Ohms

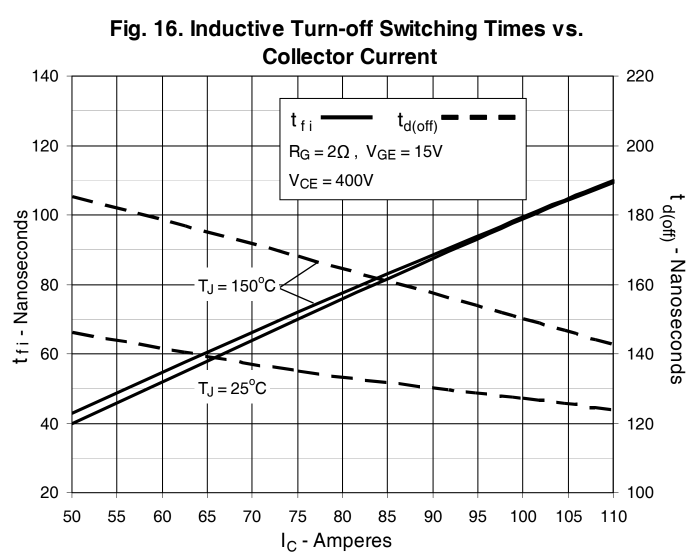


Fig. 16. Inductive Turn-off Switching Times vs. Collector Current
t f i td(off)
RG = 2Ω , VGE = 15V
VCE = 400V
TJ = 150°C
TJ = 25°C
t f i - Nanoseconds
t d(off) - Nanoseconds
IC - Amperes

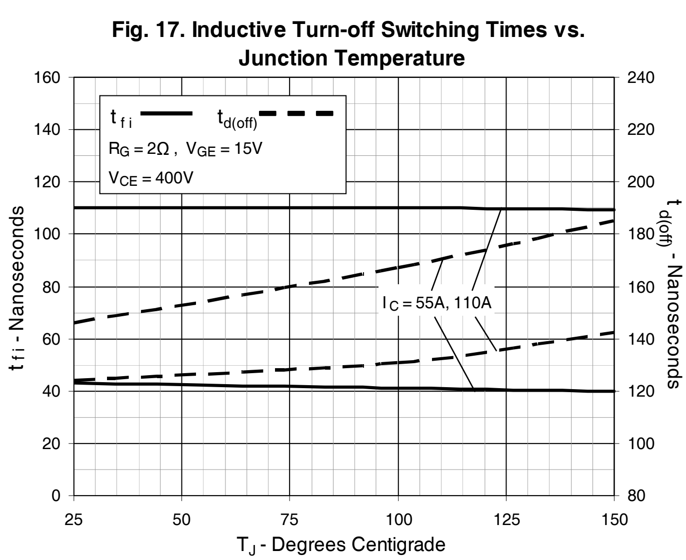


Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature
t f i td(off)
RG = 2Ω , VGE = 15V
VCE = 400V
I C = 55A, 110A
t f i - Nanoseconds
t d(off) - Nanoseconds
TJ - Degrees Centigrade

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

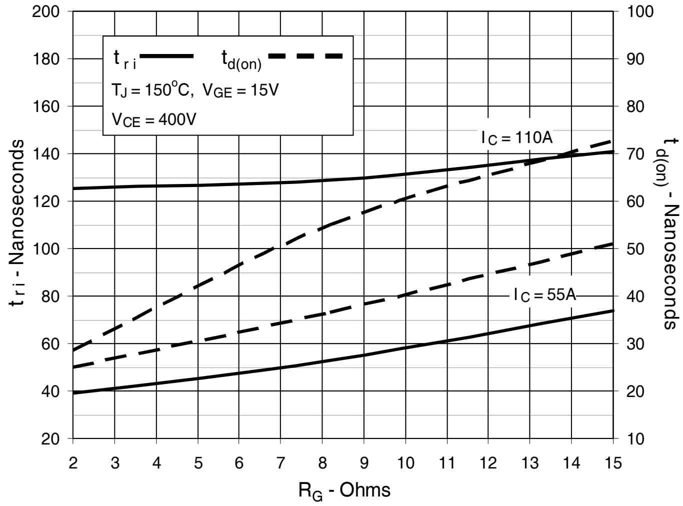


Fig. 19. Inductive Turn-on Switching Times vs. Collector Current

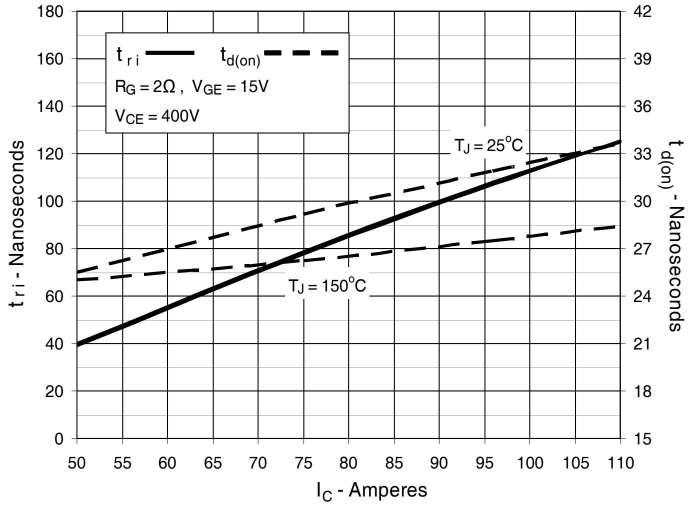


Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature

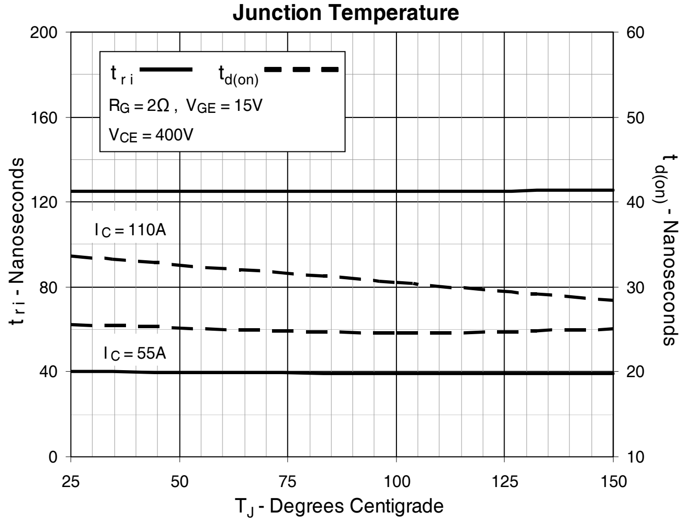


Fig. 21. Typ. Forward characteristics

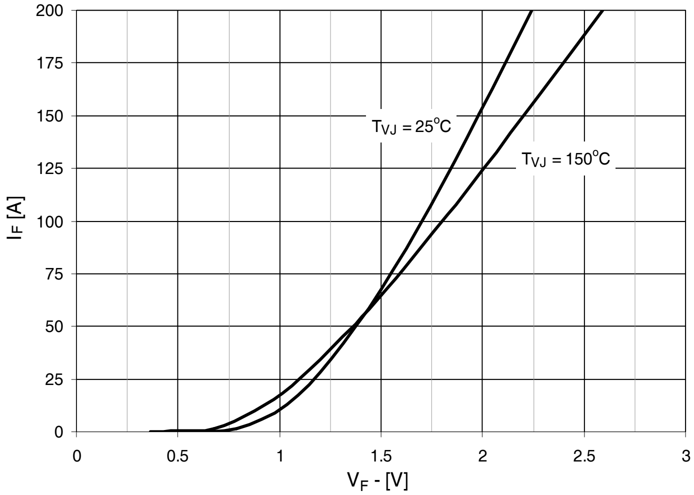


Fig. 22. Typ. Reverse Recovery Charge Q_{rr} vs. -di_F/dt

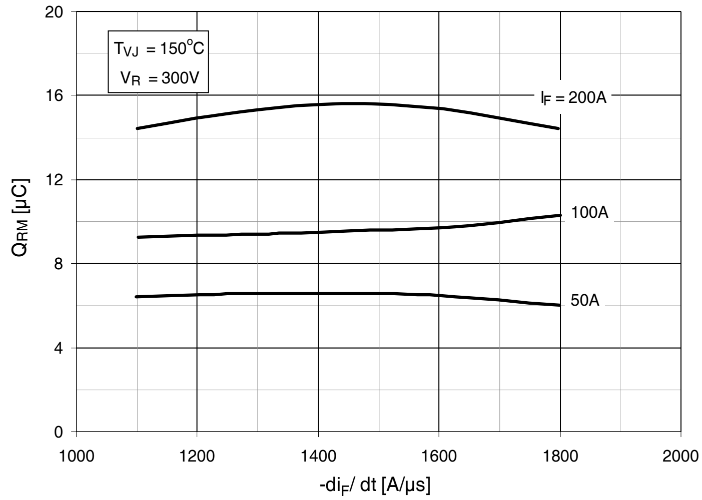


Fig. 23. Typ. Peak Reverse Current I_{RM} vs. -di_F/dt

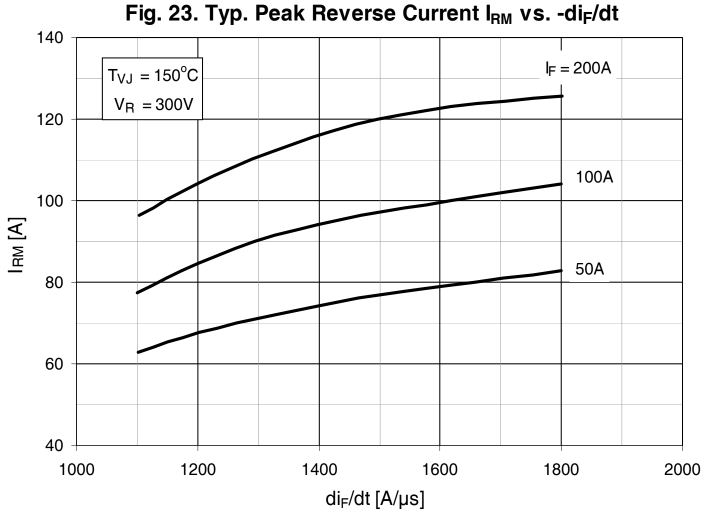


Fig. 24. Typ. Recovery Time t_{rr} vs. -di_F/dt

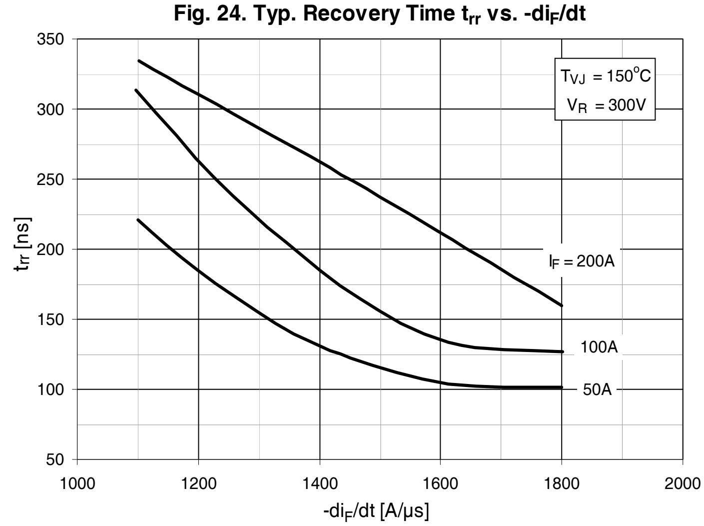


Fig. 25. Typ. Recovery Energy E_{rec} vs. -di_F/dt

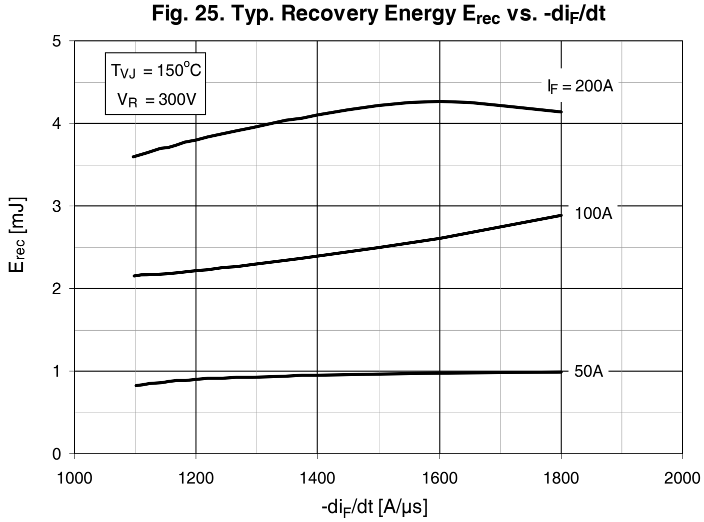
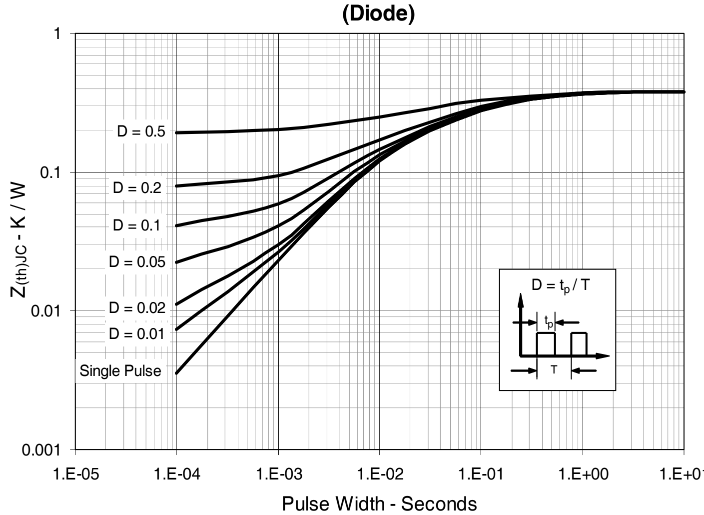
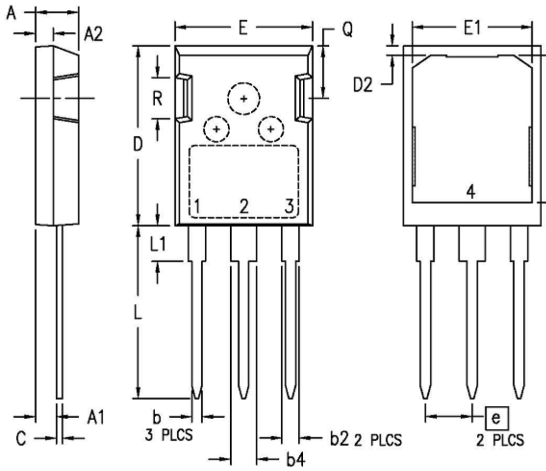


Fig. 26. Maximum Transient Thermal Impedance (Diode)



PLUS247 Outline

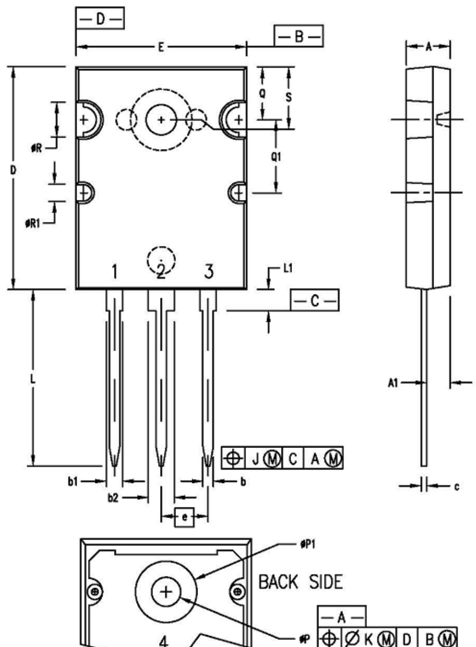


SYM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	.190	.205	4.83	5.21
A1	.090	.100	2.29	2.54
A2	.075	.085	1.91	2.16
b	.045	.055	1.14	1.40
b2	.075	.087	1.91	2.20
b4	.115	.126	2.92	3.20
C	.024	.031	0.61	0.80
D	.819	.840	20.80	21.34
D1	.650	.690	16.51	17.53
D2	.035	.050	0.89	1.27
E	.620	.635	15.75	16.13
E1	.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

PINS:
1 - Gate
2,4 - Collector
3 - Emitter

NOTE:
1. This drawing will meet all dimensions requirement of JEDEC outline TO-247 AD (R-PSIP-F3) except screw mounting hole.
2. Pin #2 is connected to the bottom heatsink (#4).
3. Lead finish – One of the following depending on the packaging plants.
   3.1 Matte pure tin plating on the leads and back heatsink.
   3.2 Pb free solder dip on the leads and pre Ni plated back heatsink.

TO-264 Outline



SYMBOL	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	.185	.209	4.70	5.31
A1	.102	.118	2.59	3.00
b	.037	.055	0.94	1.40
b1	.087	.102	2.21	2.59
b2	.110	.126	2.79	3.20
c	.017	.029	0.43	0.74
D	1.007	1.047	25.58	26.59
E	.760	.799	19.30	20.29
e	.215BSC		5.46 BSC	
J	.000	.010	0.00	0.25
K	.000	.010	0.00	0.25
L	.779	.842	19.79	21.39
L1	.087	.102	2.21	2.59
øP	.122	.138	3.10	3.51
øP1	.270	.290	6.86	7.37
Q	.240	.256	6.10	6.50
Q1	.330	.346	8.38	8.79
øR	.155	.187	3.94	4.75
øR1	.085	.093	2.16	2.36
S	.243	.253	6.17	6.43

PINS:
1 - Gate 2,4 - Collector
3 - Emitter

NOTE:
1. This drawing meets all dimensions requirement of JEDEC outlines TO-264AA.
2. Back heatsink is pre-Ni plated Cu.
3. Leads are Lead free solder dip unless specified as matte pure tin plating.

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