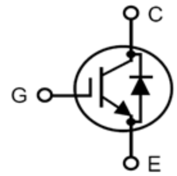
IXYS Preliminary Technical Information

XPT™ 650V IGBT GenX3™ w/Diode

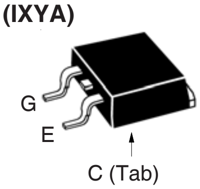
IXYA15N65C3D1
IXYP15N65C3D1

V_{CES} = 650V
I_{C110} = 15A
$V_{CE(sat)}$ ≤ 2.5V
$t_{fi(typ)}$ = 28ns

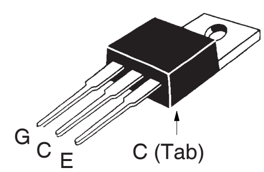
Extreme Light Punch Through
IGBT for 20-60kHz Switching



TO-263 AA (IXYA)



TO-220AB (IXYP)



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	15	A
I_{F110}	T_C = 110°C	23	A
I_{CM}	T_C = 25°C, 1ms	80	A
I_A	T_C = 25°C	5	A
E_{AS}	T_C = 25°C	100	mJ
SSOA (RBSOA)	V_{GE} = 15V, T_{VJ} = 150°C, R_G = 20Ω Clamped Inductive Load	I_{CM} = 30 @$V_{CE} \le V_{CES}$	A
t_{sc} (SCSOA)	V_{GE} = 15V, V_{CE} = 360V, T_J = 150°C R_G = 82Ω, Non Repetitive	8	μs
P_C	T_C = 25°C	200	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-220)	1.13/10	Nm/lb.in
F_C	Mounting Force (TO-263)	10..65 / 2.2..14.6	N/lb
Weight	TO-263	2.5	g
	TO-220	3.0	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}	3.5		6.0	V
I_{CES}	V_{CE} = V_{CES}, V_{GE} = 0V			10	μA
	T_J = 150°C			400	μA
I_{GES}	V_{CE} = 0V, V_{GE} = ±20V			±100	nA
$V_{CE(sat)}$	I_C = 15A, V_{GE} = 15V, Note 1		1.96	2.50	V
	T_J = 150°C		2.45		V

Features

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

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.	
g_{fs}	I_C = 15A, V_{CE} = 10V, Note 1	5.0	8.5		S
C_{ies}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz		583		pF
C_{oes}			52		pF
C_{res}			13		pF
$Q_{g(on)}$	I_C = 15A, V_{GE} = 15V, V_{CE} = 0.5 • V_{CES}		19		nC
Q_{ge}			4		nC
Q_{gc}			10		nC
$t_{d(on)}$	**Inductive load, T_J = 25°C**		15		ns
t_{ri}	I_C = 15A, V_{GE} = 15V		20		ns
E_{on}	V_{CE} = 400V, R_G = 20Ω		0.27		mJ
$t_{d(off)}$	Note 2		68		ns
t_{fi}			28		ns
E_{off}			0.23	0.40	mJ
$t_{d(on)}$	**Inductive load, T_J = 150°C**		15		ns
t_{ri}	I_C = 15A, V_{GE} = 15V		21		ns
E_{on}	V_{CE} = 400V, R_G = 20Ω		0.53		mJ
$t_{d(off)}$	Note 2		80		ns
t_{fi}			42		ns
E_{off}			0.24		mJ
R_{thJC}				0.75	°C/W
R_{thCS}	TO-220		0.50		°C/W

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			3.0	V
	T_J = 125°C		1.7		V
I_{RM}	I_F = 12A, V_{GE} = 0V,		2.5		A
t_{rr}	$-di_F/dt$ = 100A/μs, V_R = 100V, T_J = 125°C		110		ns
t_{rr}	I_F = 1A, V_{GE} = 0V, $-di_F/dt$ = 100A/μs, V_R = 30V		30		ns
R_{thJC}				1.85	°C/W

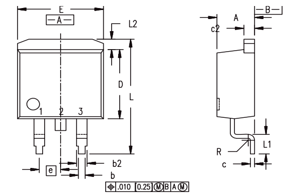
Notes:

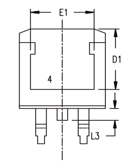
1. Pulse test, t ≤ 300μs, duty cycle, d ≤ 2%.
2. Switching times & energy losses may increase for higher V_{CE}(clamp), T_J or R_G.

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.

TO-263 Outline

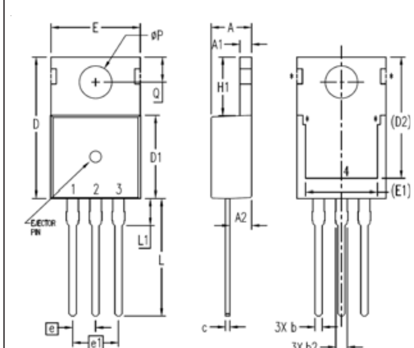




1. Gate
2. Collector
3. Emitter
4. Collector
   Bottom Side

Dim.	Millimeter Min.	Max.	Inches Min.	Max.
A	4.06	4.83	.160	.190
b	0.51	0.99	.020	.039
b2	1.14	1.40	.045	.055
c	0.40	0.74	.016	.029
c2	1.14	1.40	.045	.055
D	8.64	9.65	.340	.380
D1	8.00	8.89	.280	.320
E	9.65	10.41	.380	.405
E1	6.22	8.13	.270	.320
e	2.54	BSC	.100	BSC
L	14.61	15.88	.575	.625
L1	2.29	2.79	.090	.110
L2	1.02	1.40	.040	.055
L3	1.27	1.78	.050	.070
L4	0	0.13	0	.005

TO-220 Outline



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

SYM	INCHES MIN	MAX	MILLIMETERS 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

Fig. 1. Output Characteristics @ T_J = 25ºC

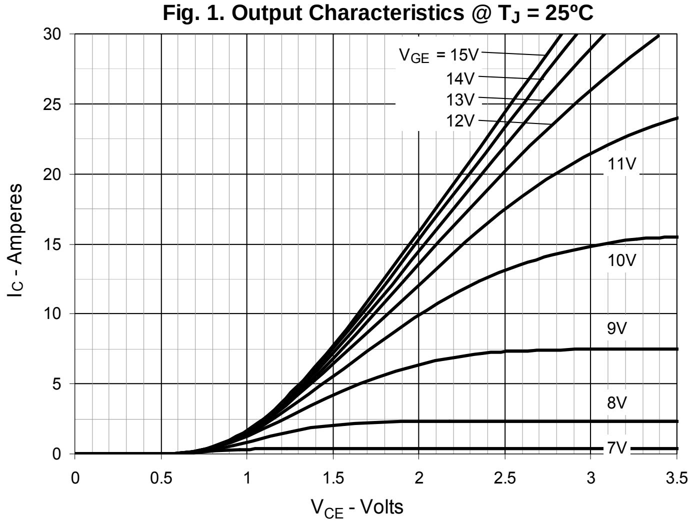


Fig. 2. Extended Output Characteristics @ T_J = 25ºC

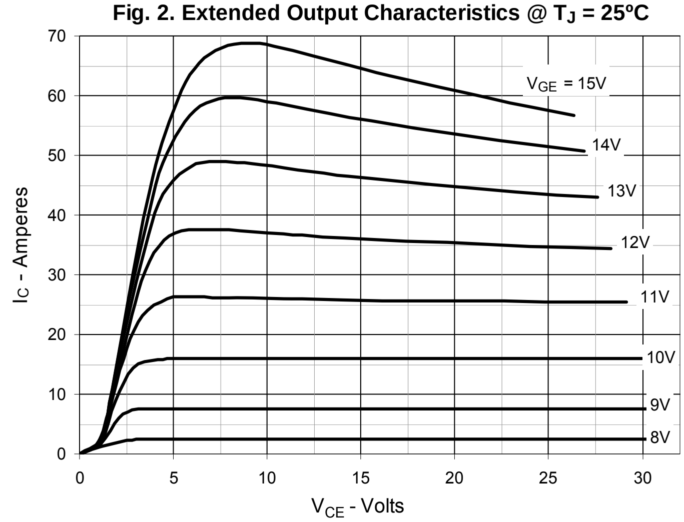


Fig. 3. Output Characteristics @ T_J = 150ºC

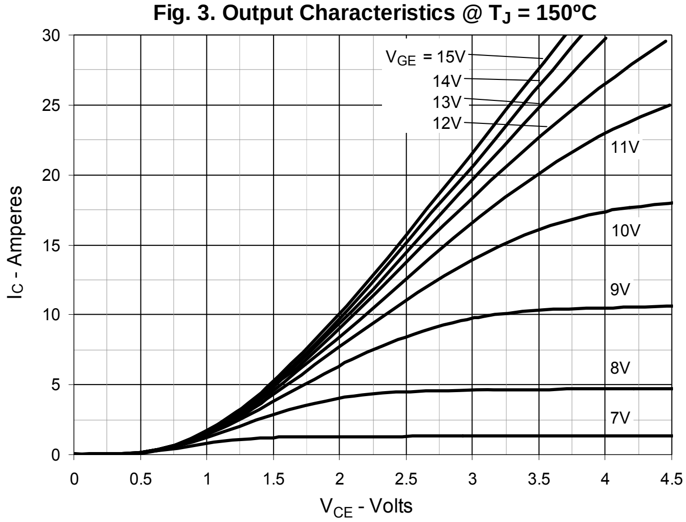


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

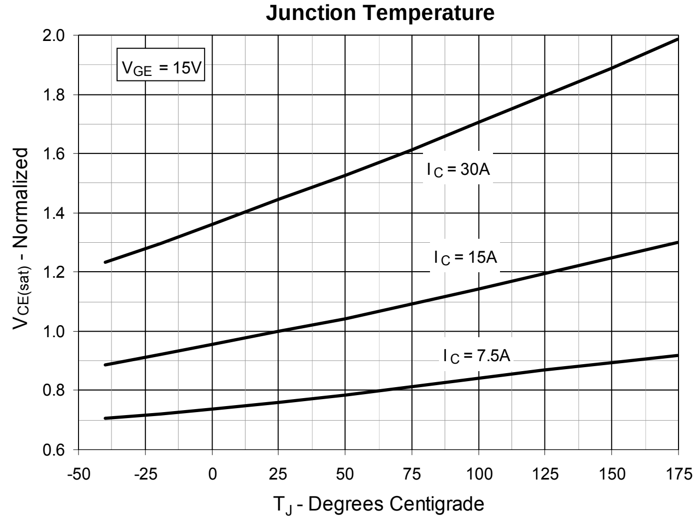


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

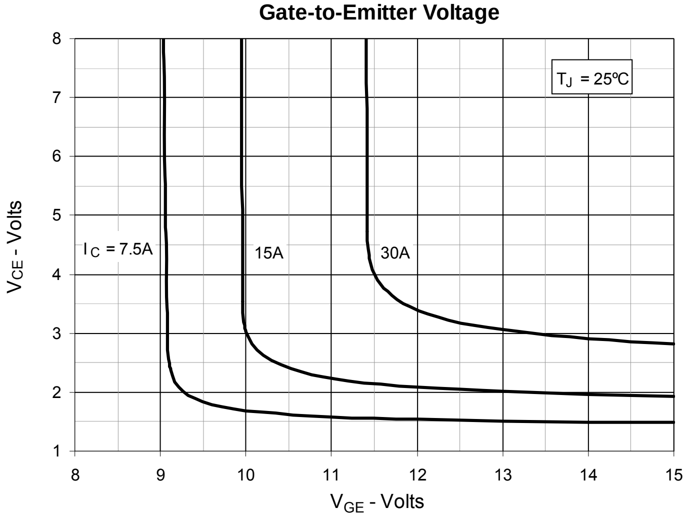
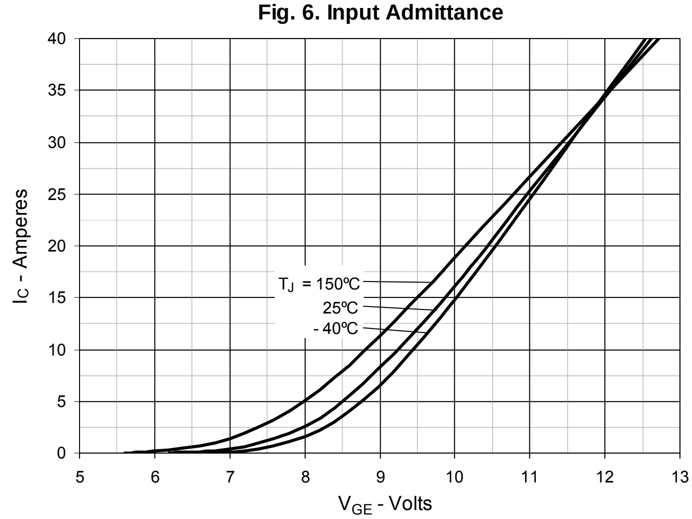


Fig. 6. Input Admittance



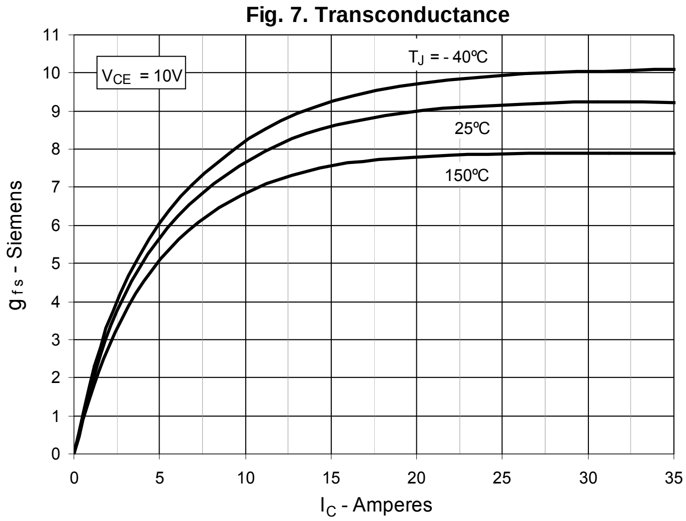


Fig. 7. Transconductance
VCE = 10V
TJ = - 40ºC
25ºC
150ºC
g f s - Siemens
IC - Amperes

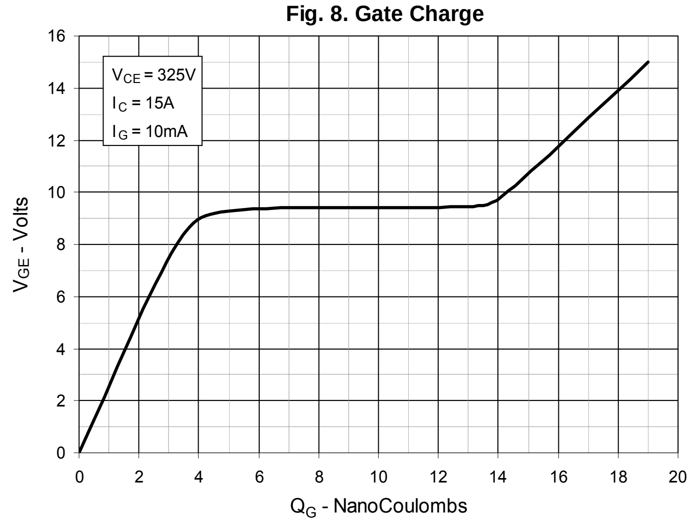


Fig. 8. Gate Charge
VCE = 325V
IC = 15A
IG = 10mA
VGE - Volts
QG - NanoCoulombs

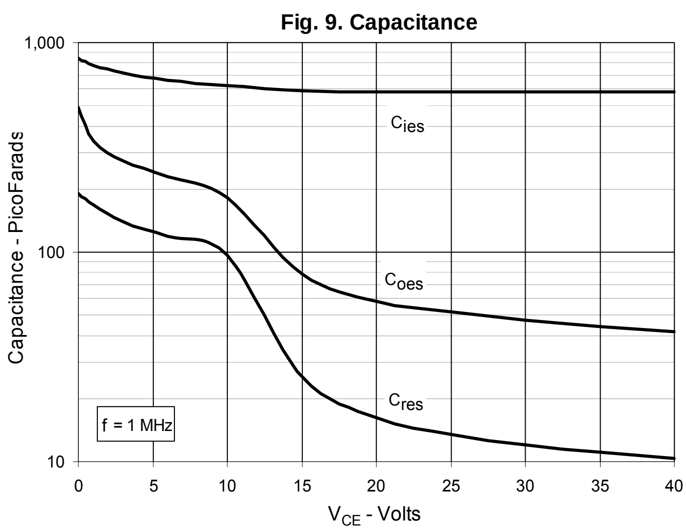


Fig. 9. Capacitance
Cies
Coes
Cres
f = 1 MHz
Capacitance - PicoFarads
VCE - Volts

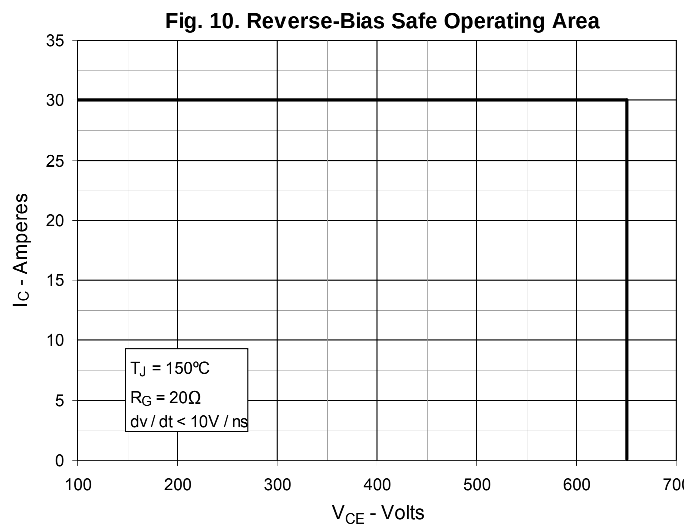


Fig. 10. Reverse-Bias Safe Operating Area
TJ = 150ºC
RG = 20Ω
dv / dt < 10V / ns
IC - Amperes
VCE - Volts

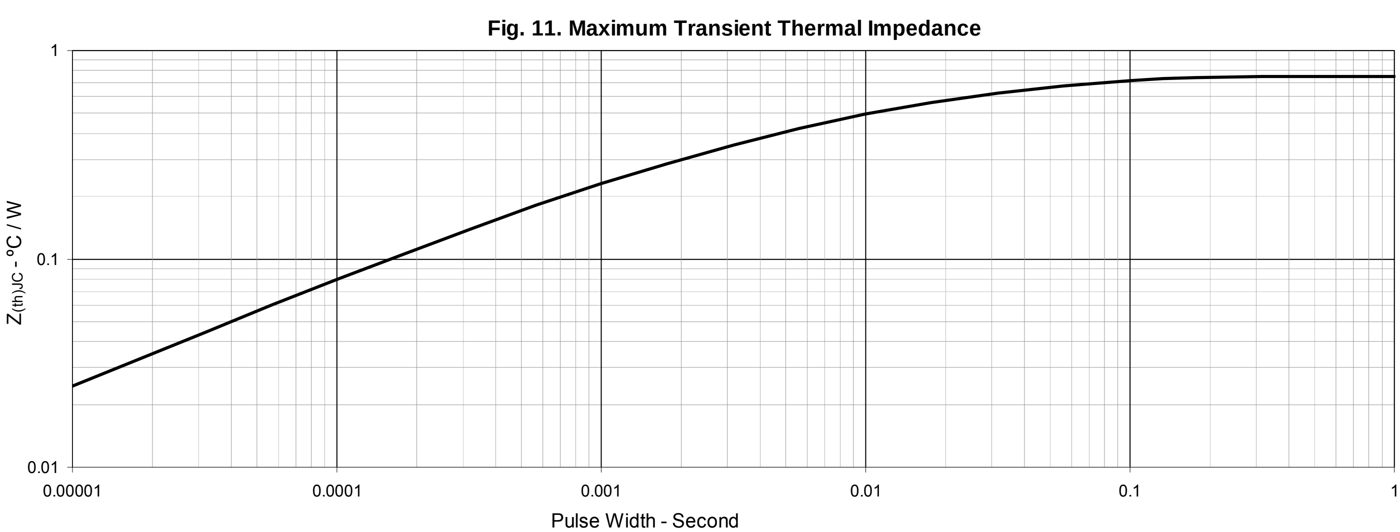


Fig. 11. Maximum Transient Thermal Impedance
Z(th)JC - ºC / W
Pulse Width - Second

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

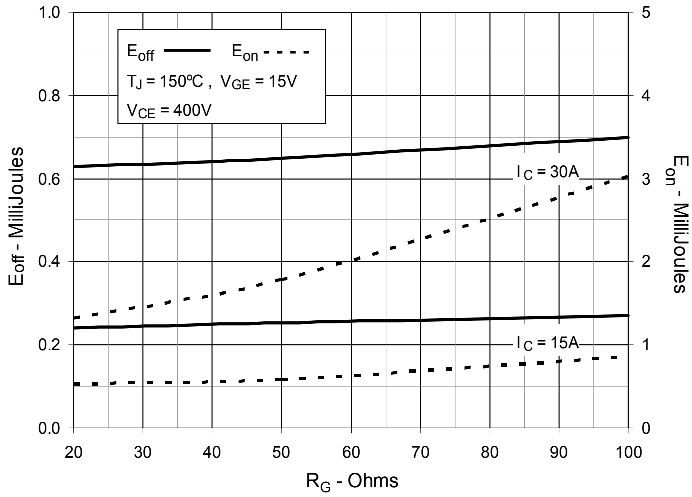


Fig. 13. Inductive Switching Energy Loss vs. Collector Current

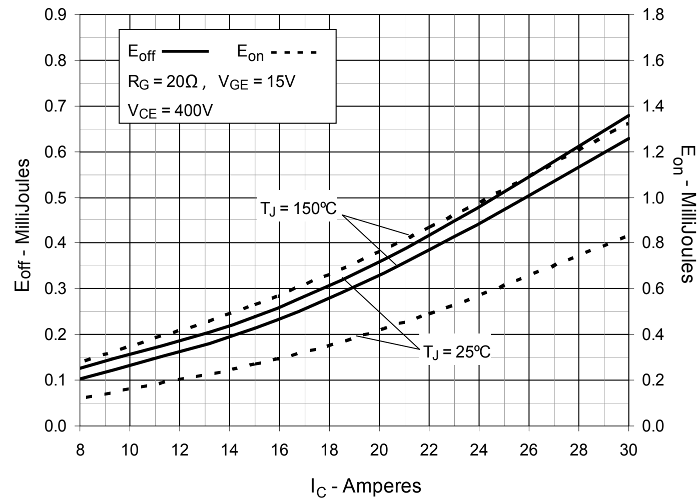


Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature

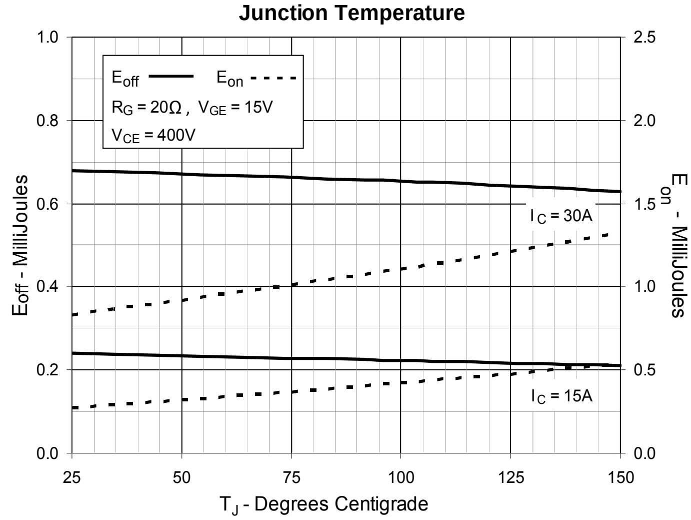


Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance

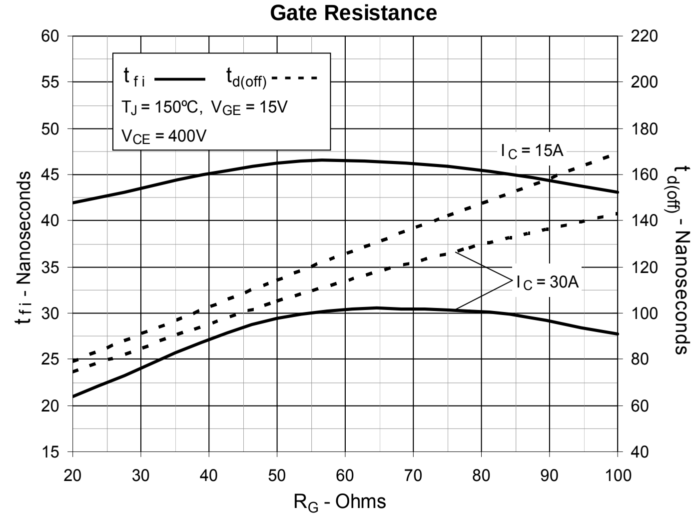


Fig. 16. Inductive Turn-off Switching Times vs. Collector Current

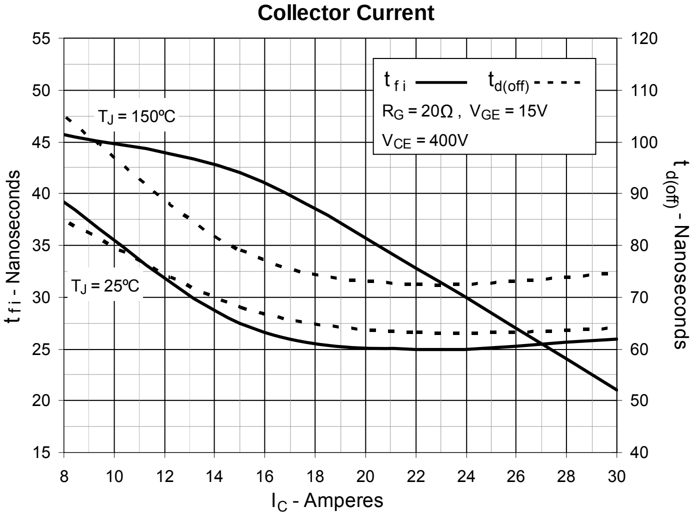


Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature

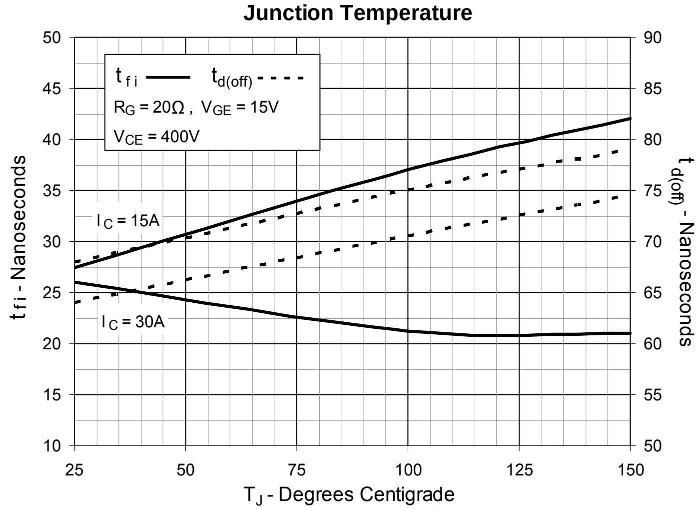


Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance

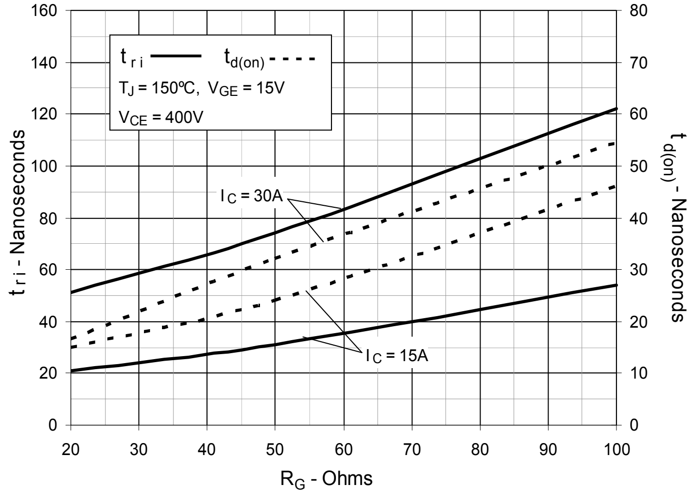


Fig. 19. Inductive Turn-on Switching Times vs. Collector Current

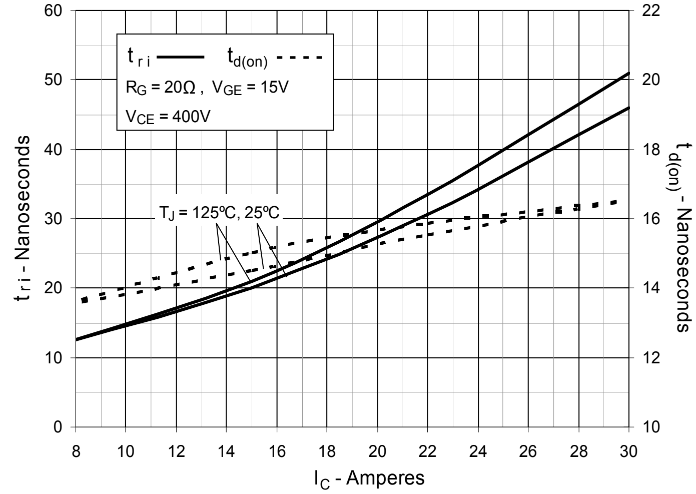


Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature

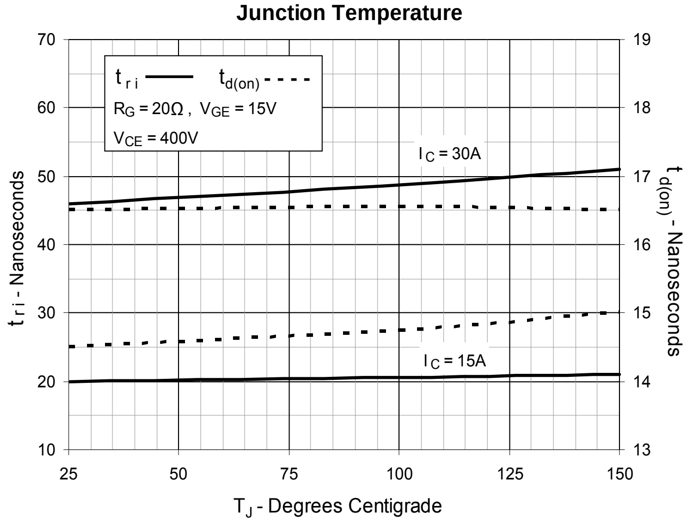


Fig. 21. Maximum Transient Impedance for Diode