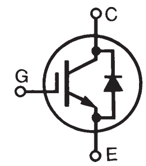
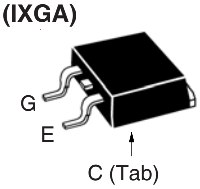
HiPerFAST™ IGBTs B2-Class High Speed w/ Diode

IXGA16N60B2D1
IXGP16N60B2D1
IXGH16N60B2D1

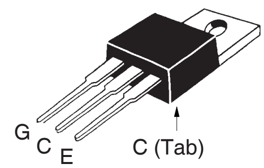
V_{CES} = 600V
I_{C110} = 16A
$V_{CE(sat)}$ ≤ 1.95V
$t_{fi(typ)}$ = 70ns



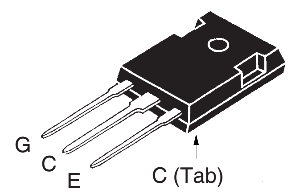
TO-263 AA (IXGA)



TO-220AB (IXGP)



TO-247 (IXGH)



G = Gate C = Collector
E = Emitter Tab = Collector

Symbol	Test Conditions	Maximum Ratings	
V_{CES}	T_J = 25°C to 150°C	600	V
V_{CGR}	T_J = 25°C to 150°C, R_{GE} = 1MΩ	600	V
V_{GES}	Continuous	±20	V
V_{GEM}	Transient	±30	V
I_{C25}	T_C = 25°C (Chip Capability)	40	A
I_{C110}	T_C = 110°C	16	A
I_{F110}	T_C = 110°C	11	A
I_{CM}	T_C = 25°C, 1ms	100	A
SSOA (RBSOA)	V_{GE} = 15V, T_J = 125°C, R_G = 22Ω Clamped Inductive load	I_{CM} = 32 $V_{CE} \leq V_{CES}$	A
P_C	T_C = 25°C	150	W
T_J		-55 ... +150	°C
T_{JM}		150	°C
T_{stg}		-55 ... +150	°C
M_d	Mounting Torque (TO-220 & TO-247)	1.13/10	Nm/lb.in.
F_C	Mounting Force (TO-263)	10..65 / 2.2..14.6	N/lb.
T_L	Maximum Lead Temperature for Soldering	300	°C
T_{SOLD}	1.6mm (0.062 in.) from Case for 10s	260	°C
Weight	TO-263	2.5	g
	TO-220	3.0	g
	TO-247	6.0	g

Symbol	Test Conditions (T_J = 25°C, Unless Otherwise Specified)	Characteristic Values Min.	Typ.	Max.	
$V_{GE(th)}$	I_C = 250µA, $V_{CE} = V_{GE}$	3.0		5.5	V
I_{CES}	$V_{CE} = V_{CES}$, V_{GE} = 0V			25	µA
	T_J = 125°C			1	mA
I_{GES}	V_{CE} = 0V, V_{GE} = ±20V			±100	nA
$V_{CE(sat)}$	I_C = 12A, V_{GE} = 15V, Note1			1.95	V
	T_J = 125°C		1.65		V

Features

- Optimized for Low Conduction and Switching Losses
- Square RBSOA
- Anti-Parallel Ultra Fast Diode
- 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

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	8			S
C_{ies}	V_{CE} = 25V, V_{GE} = 0V, f = 1MHz		675		pF
C_{oes}			70		pF
C_{res}			20		pF
$Q_{g(on)}$	I_C = 12A, V_{GE} = 15V, V_{CE} = 0.5 • V_{CES}		24		nC
Q_{ge}			5		nC
Q_{gc}			13		nC
$t_{d(on)}$	**Inductive load, T_J = 25°C**		18		ns
t_{ri}	I_C = 12A, V_{GE} = 15V		20		ns
E_{on}	V_{CE} = 400V, R_G = 22Ω		0.16		mJ
$t_{d(off)}$	Note 2		73		ns
t_{fi}			70		ns
E_{off}			0.12	0.22	mJ
$t_{d(on)}$	**Inductive load, T_J = 125°C**		17		ns
t_{ri}	I_C = 12A, V_{GE} = 15V		20		ns
E_{on}	V_{CE} = 400V, R_G = 22Ω		0.26		mJ
$t_{d(off)}$	Note 2		140		ns
t_{fi}			125		ns
E_{off}			0.38		mJ
R_{thJC}				0.83	°C/W
R_{thCK}	TO-220		0.50		°C/W
	TO-247		0.21		°C/W

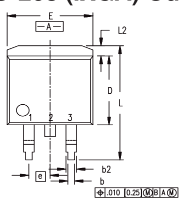
Reverse Diode (FRED)

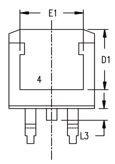
Symbol	Test Conditions (T_J = 25°C, Unless Otherwise Specified)	Characteristic Values Min.	Typ.	Max.	
V_F	I_F = 10A, V_{GE} = 0V, Note 1			3.0	V
	T_J = 125°C		1.7		V
I_{RM}	I_F = 12A, V_{GE} = 0V, -di_F/dt = 100A/μs, V_R = 100V, T_J = 125°C		2.5		A
t_{rr}			110		ns
t_{rr}	I_F = 1A, V_{GE} = 0V, -di_F/dt = 100A/μs, V_R = 30V		30		ns
R_{thJC}				2.5	°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.

TO-263 (IXGA) Outline

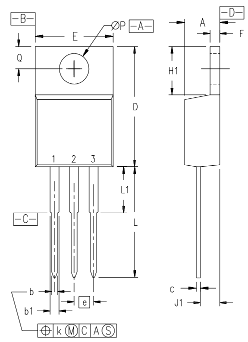




1. Gate
2. Collector
3. Emitter
4. Collector
   Bottom Side

Dim.	Millimeter		Inches	
	Min.	Max.	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

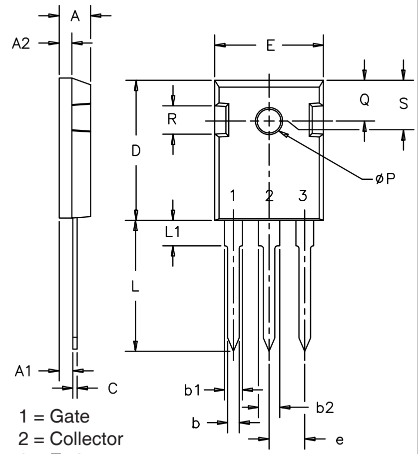
TO-220 (IXGP) Outline



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
ØP	.139	.161	3.53	4.08
Q	.100	.125	2.54	3.18

TO-247 (IXGH) AD Outline



1 = Gate
2 = Collector
3 = Emitter

SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.185	.209	4.7	5.3
A_1	.087	.102	2.2	2.54
A_2	.059	.098	2.2	2.6
b	.040	.055	1.0	1.4
b_1	.065	.084	1.65	2.13
b_2	.113	.123	2.87	3.12
C	.016	.031	.4	.8
D	.819	.845	20.80	21.46
E	.610	.640	15.75	16.26
e	.215 BSC		5.45 BSC	
L	.780	.800	19.81	20.32
L1		.177		4.50
øP	.140	.144	3.55	3.65
Q	.212	.244	5.4	6.2
R	.170	.216	4.32	5.49
S	.242 BSC		6.15 BSC	

Fig. 1. Output Characteristics @ T_J = 25ºC

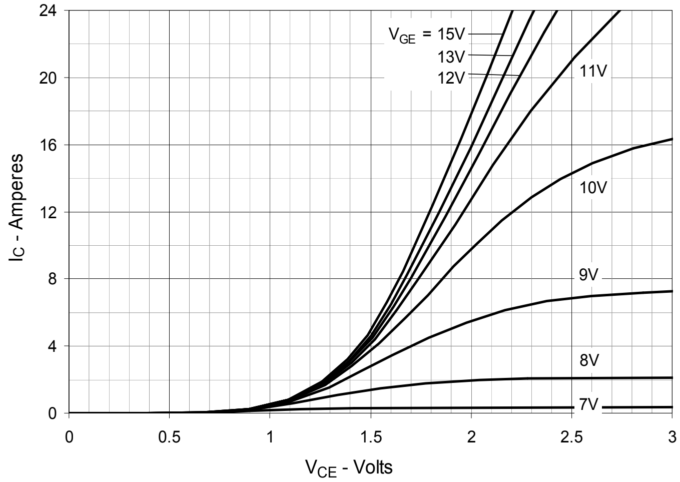


Fig. 2. Extended Output Characteristics @ T_J = 25ºC

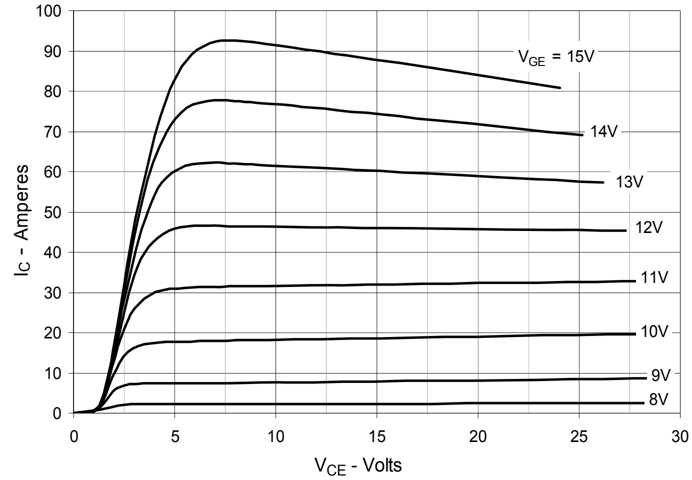


Fig. 3. Output Characteristics @ T_J = 125ºC

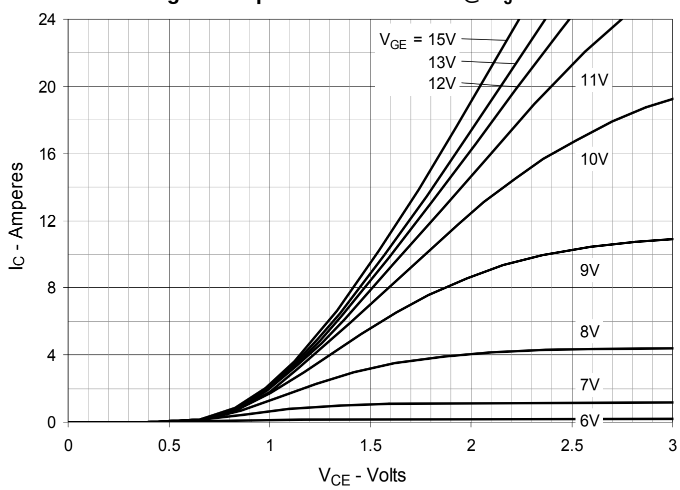


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

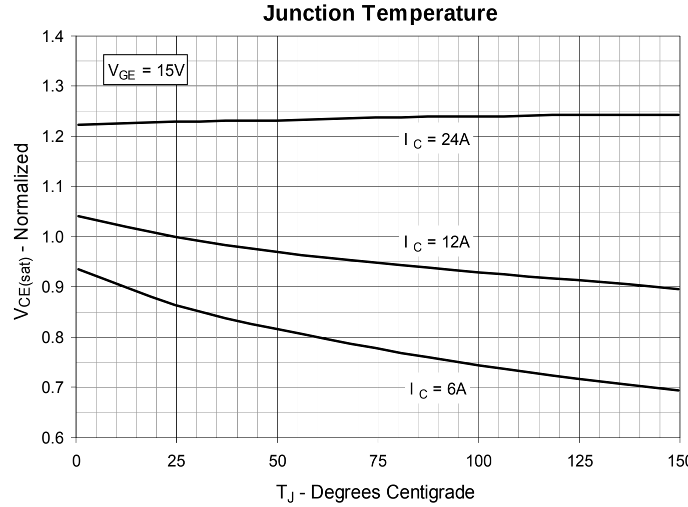


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

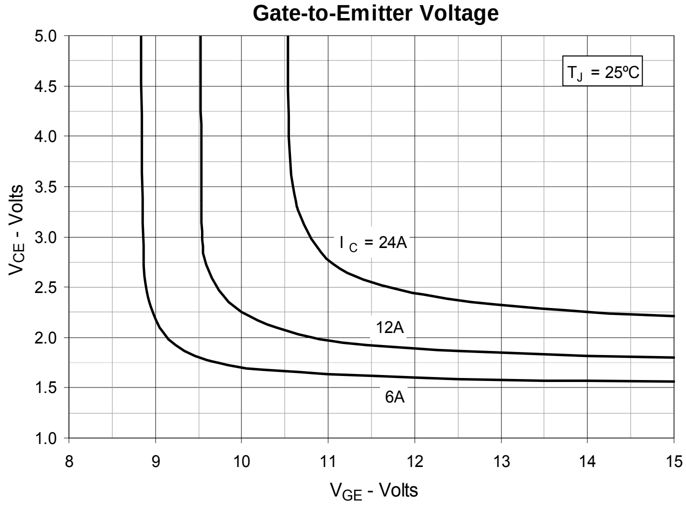


Fig. 6. Input Admittance

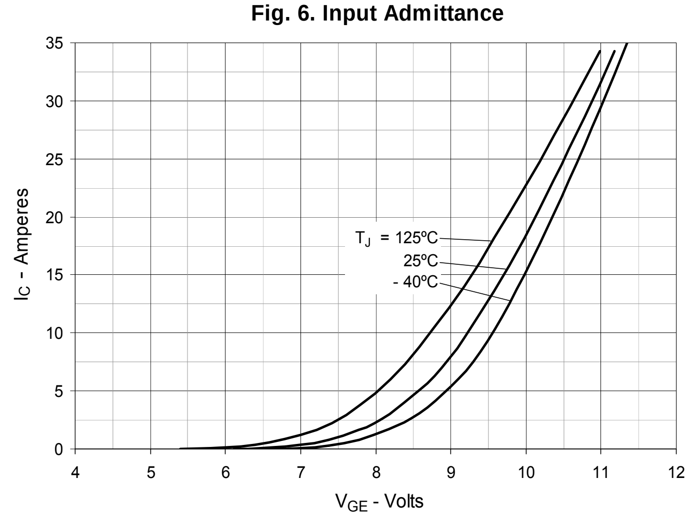


Fig. 7. Transconductance

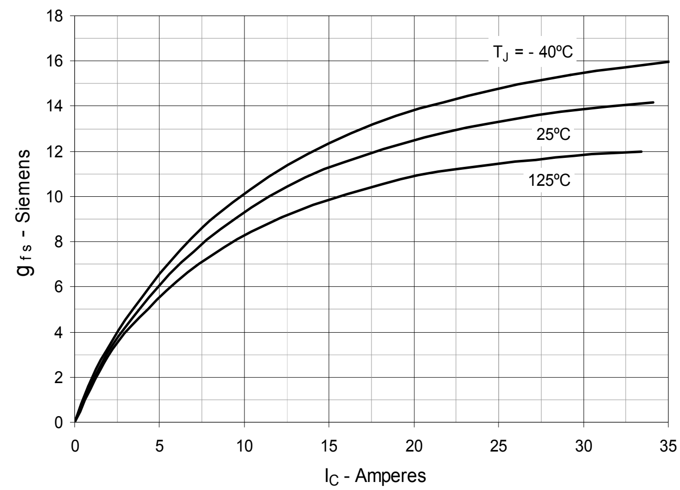


Fig. 8. Gate Charge

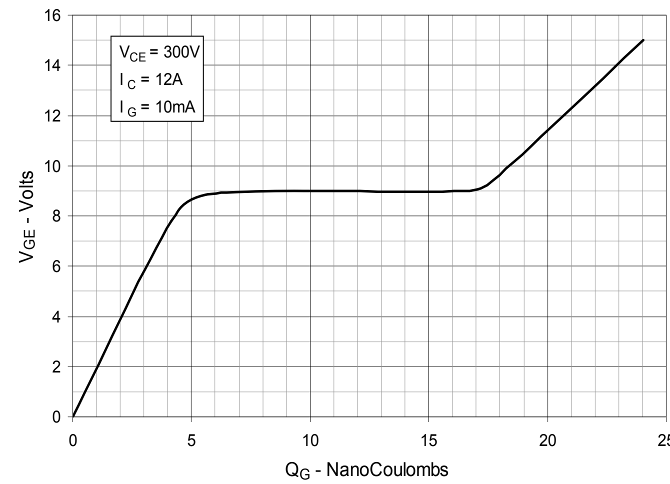


Fig. 9. Capacitance

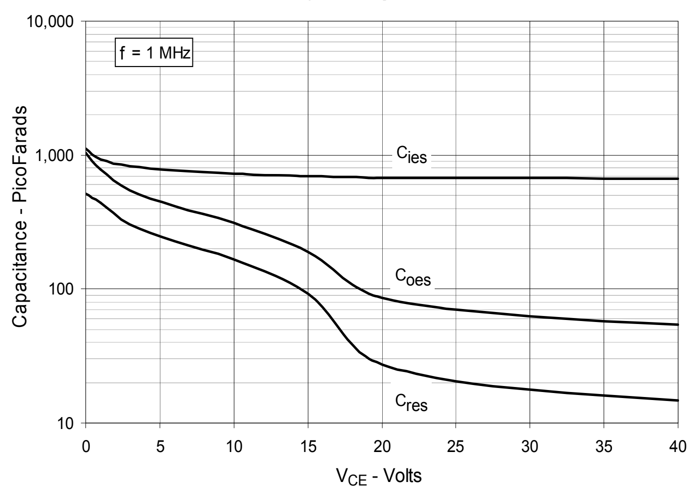


Fig. 10. Reverse-Bias Safe Operating Area

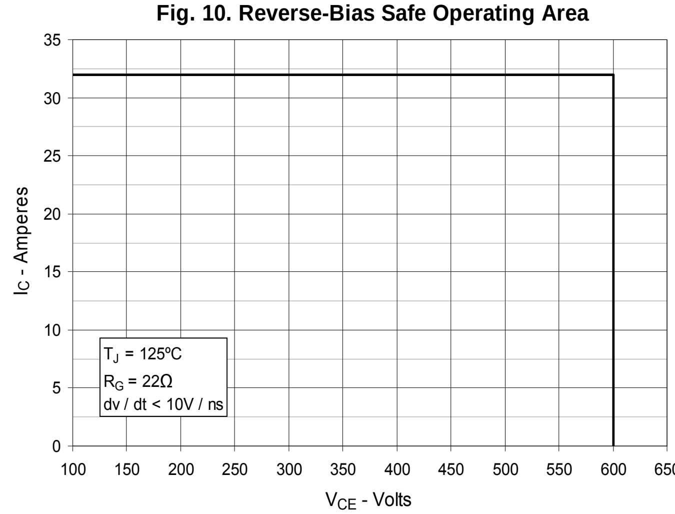


Fig. 11. Maximum Transient Thermal Impedance

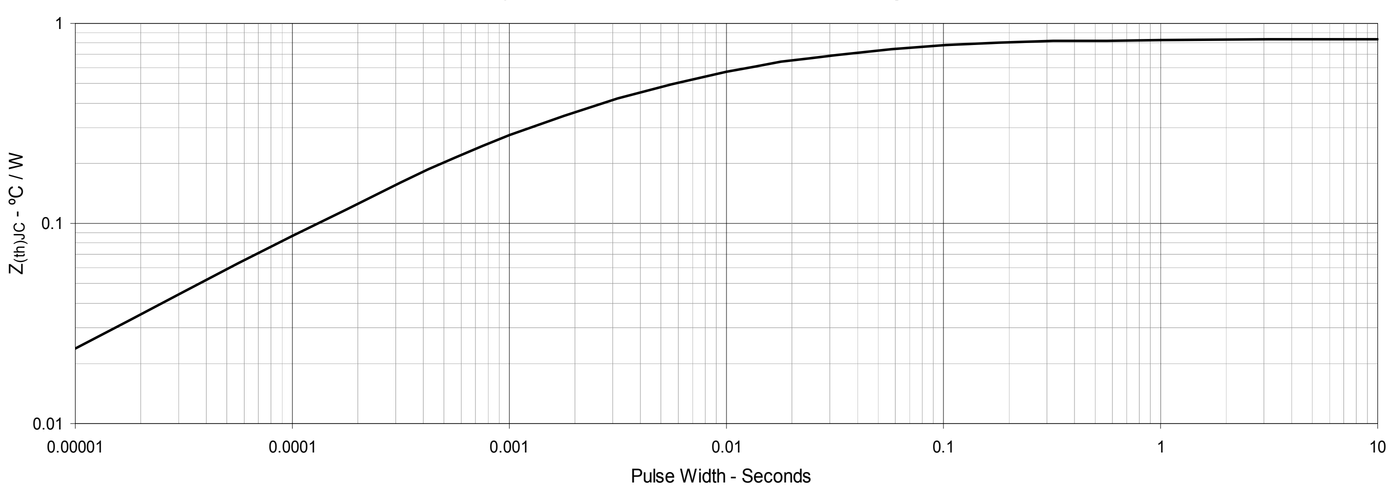


Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance

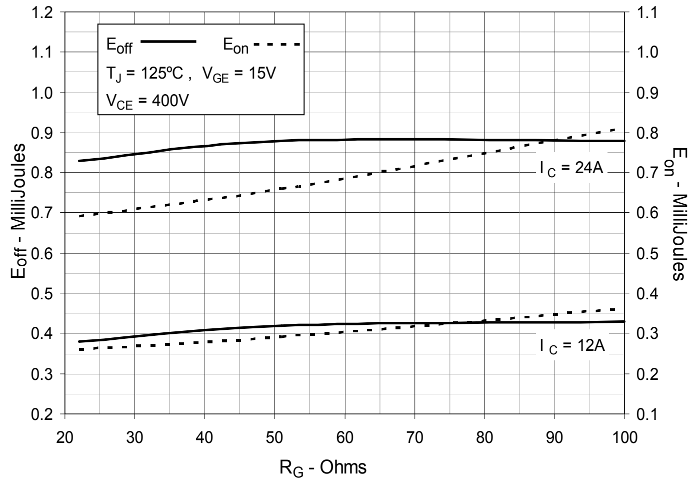


Fig. 13. Inductive Switching Energy Loss vs. Collector Current

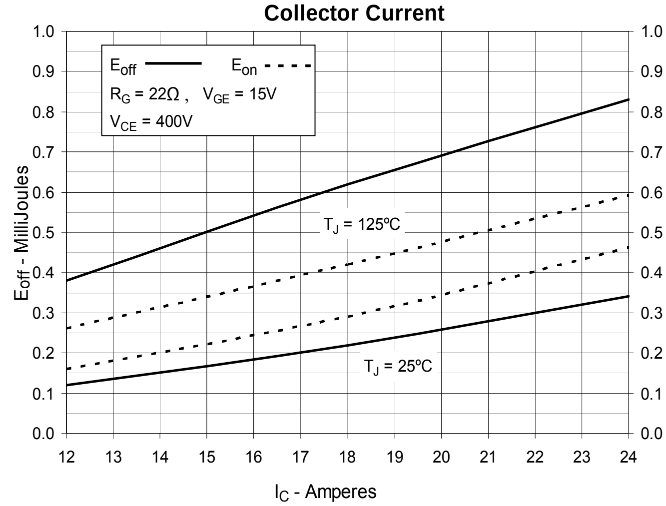


Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature

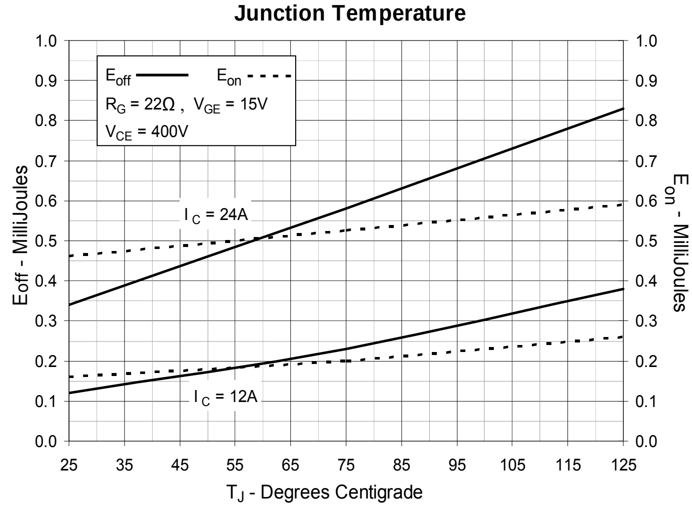


Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance

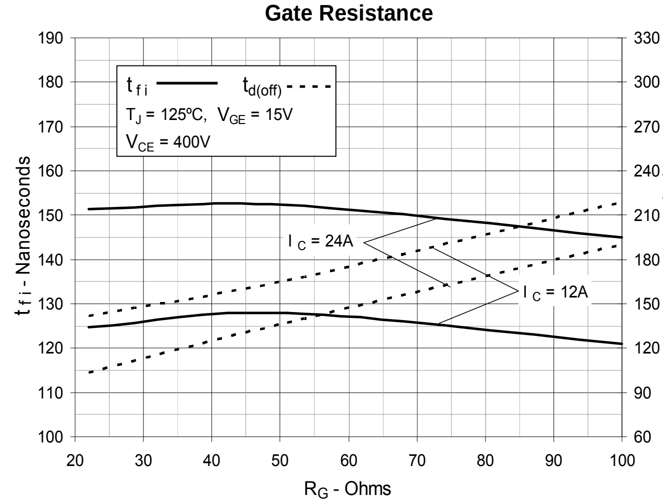


Fig. 16. Inductive Turn-off Switching Times vs. Collector Current

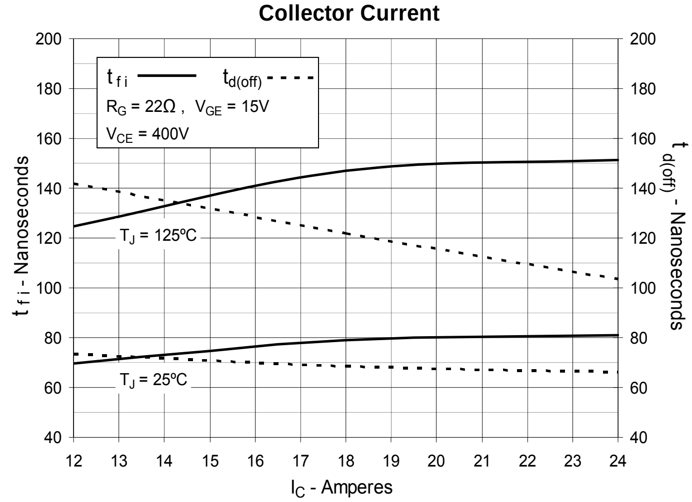


Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature

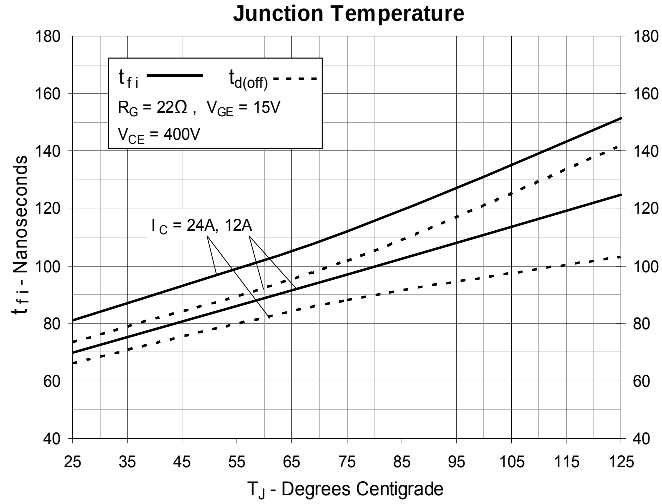


Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance

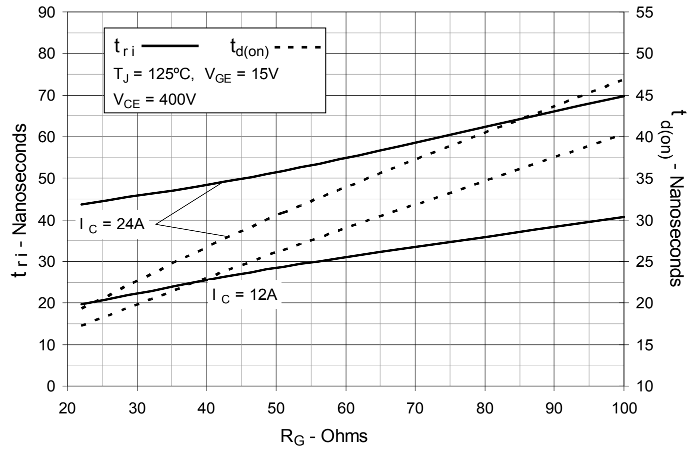


Fig. 19. Inductive Turn-on Switching Times vs. Collector Current

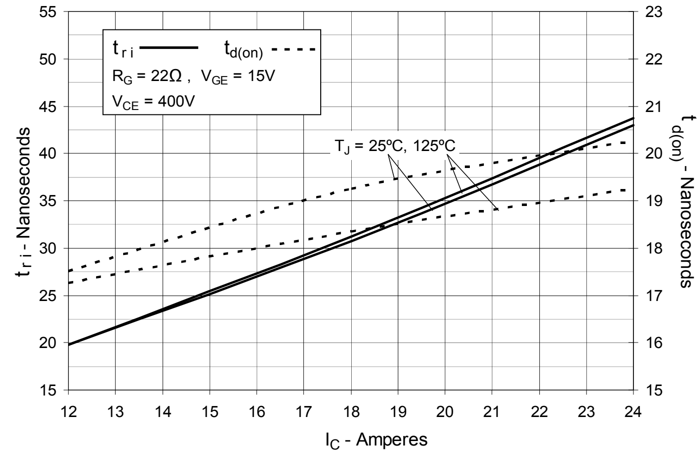


Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature