

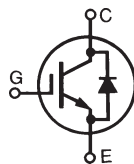
# HiPerFAST™ IGBTs

## B2-Class High Speed

### w/ Diode

**IXGA16N60B2D1**  
**IXGP16N60B2D1**  
**IXGH16N60B2D1**

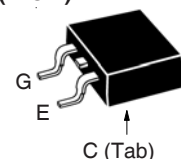
$V_{CES} = 600V$   
 $I_{C110} = 16A$   
 $V_{CE(sat)} \leq 2.3V$   
 $t_{fi(typ)} = 70ns$



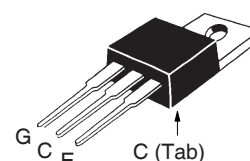
Symbol	Test Conditions	Maximum Ratings	
$V_{CES}$	$T_J = 25^\circ C$ to $150^\circ C$	600	V
$V_{CGR}$	$T_J = 25^\circ C$ to $150^\circ C$ , $R_{GE} = 1M\Omega$	600	V
$V_{GES}$	Continuous	$\pm 20$	V
$V_{GEM}$	Transient	$\pm 30$	V
$I_{C25}$	$T_C = 25^\circ C$	40	A
$I_{C110}$	$T_C = 110^\circ C$	16	A
$I_{F110}$	$T_C = 110^\circ C$	11	A
$I_{CM}$	$T_C = 25^\circ C$ , 1ms	100	A
<b>SSOA</b> <b>(RBSOA)</b>	$V_{GE} = 15V$ , $T_J = 125^\circ C$ , $R_G = 22\Omega$ Clamped Inductive load	$I_{CM} = 32$ $V_{CE} \leq V_{CES}$	A
$P_C$	$T_C = 25^\circ C$	150	W
$T_J$		-55 ... +150	$^\circ C$
$T_{JM}$		150	$^\circ C$
$T_{stg}$		-55 ... +150	$^\circ C$
$M_d$	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	$^\circ C$
$T_{SOLD}$	1.6mm (0.062 in.) from Case for 10s	260	$^\circ C$
<b>Weight</b>	TO-263	2.5	g
	TO-220	3.0	g
	TO-247	6.0	g

Symbol	Test Conditions ( $T_J = 25^\circ C$ , Unless Otherwise Specified)	Characteristic Values		
		Min.	Typ.	Max.
$V_{GE(th)}$	$I_C = 250\mu A$ , $V_{CE} = V_{GE}$	3.0		5.5 V
$I_{CES}$	$V_{CE} = V_{CES}$ , $V_{GE} = 0V$ $T_J = 125^\circ C$			25 $\mu A$ 1 mA
$I_{GES}$	$V_{CE} = 0V$ , $V_{GE} = \pm 20V$			$\pm 100$ nA
$V_{CE(sat)}$	$I_C = 12A$ , $V_{GE} = 15V$ , Note1 $T_J = 125^\circ C$		1.65	2.30 V V

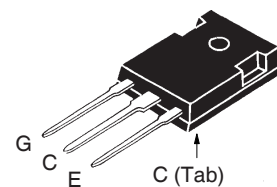
TO-263 AA (IXGA)



TO-220AB (IXGP)



TO-247 (IXGH)



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

### 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 ( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)	Characteristic Values		
		Min.	Typ.	Max.
$g_{fs}$	$I_C = 12\text{A}, V_{CE} = 10\text{V}$ , Note 1	8		S
$C_{ies}$ $C_{oes}$ $C_{res}$	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$		675	pF
			70	pF
			20	pF
$Q_{g(on)}$ $Q_{ge}$ $Q_{gc}$	$I_C = 12\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$		24	nC
			5	nC
			13	nC
$t_{d(on)}$ $t_{ri}$ $E_{on}$ $t_{d(off)}$ $t_{fi}$ $E_{off}$	<b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b> $I_C = 12\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 400\text{V}, R_G = 22\Omega$ Note 2		18	ns
			20	ns
			0.16	mJ
			73	ns
			70	ns
			0.12	0.22 mJ
$t_{d(on)}$ $t_{ri}$ $E_{on}$ $t_{d(off)}$ $t_{fi}$ $E_{off}$	<b>Inductive load, <math>T_J = 125^\circ\text{C}</math></b> $I_C = 12\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 400\text{V}, R_G = 22\Omega$ Note 2		17	ns
			20	ns
			0.26	mJ
			140	ns
			125	ns
			0.38	mJ
$R_{thJC}$ $R_{thCK}$	TO-220 TO-247		0.83 $^\circ\text{C/W}$ 0.50 $^\circ\text{C/W}$ 0.21 $^\circ\text{C/W}$	

**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 $T_J = 125^\circ\text{C}$		1.7	3.0 V V
$I_{RM}$ $t_{rr}$ $t_{rr}$	$I_F = 12\text{A}, V_{GE} = 0\text{V}$ , $-di_F/dt = 100\text{A}/\mu\text{s}, V_R = 100\text{V}, T_J = 125^\circ\text{C}$ $I_F = 1\text{A}, V_{GE} = 0\text{V}, -di_F/dt = 100\text{A}/\mu\text{s}, V_R = 30\text{V}$		2.5	A
			110	ns
			30	ns
$R_{thJC}$				2.5 $^\circ\text{C/W}$

**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  $R_G$ .

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
	4,850,072	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 @  $T_J = 25^\circ\text{C}$

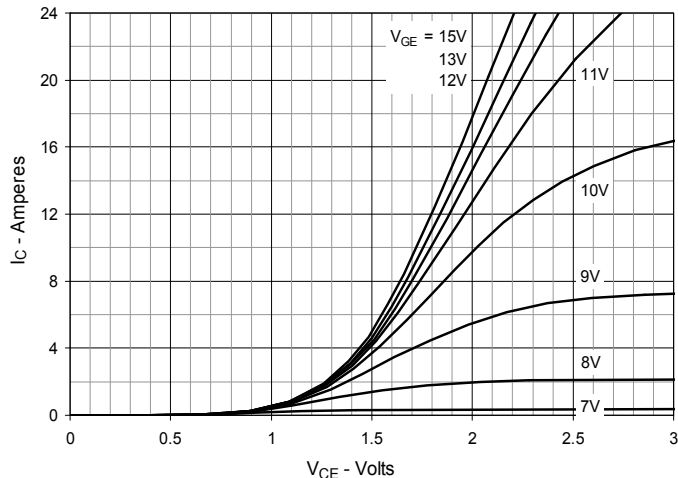


Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$

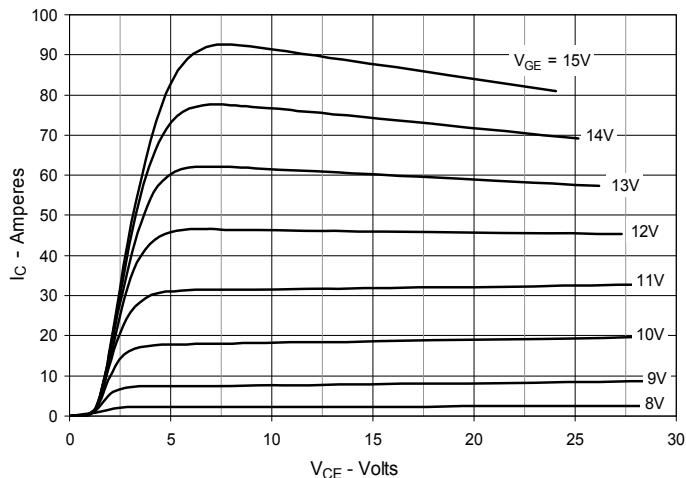


Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$

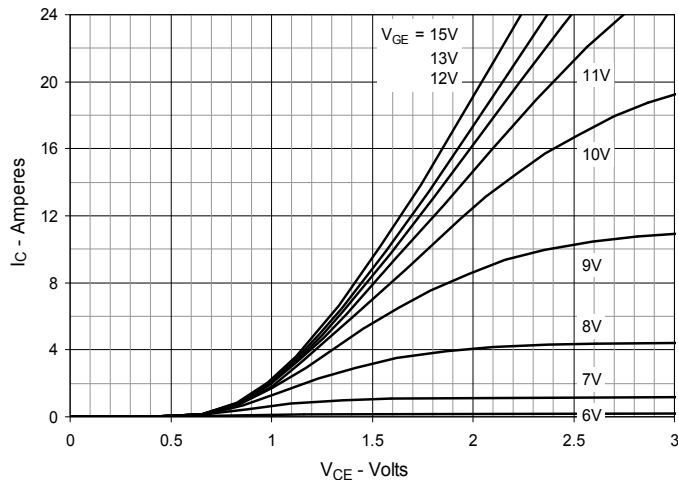


Fig. 4. Dependence of  $V_{CE(sat)}$  on Junction Temperature

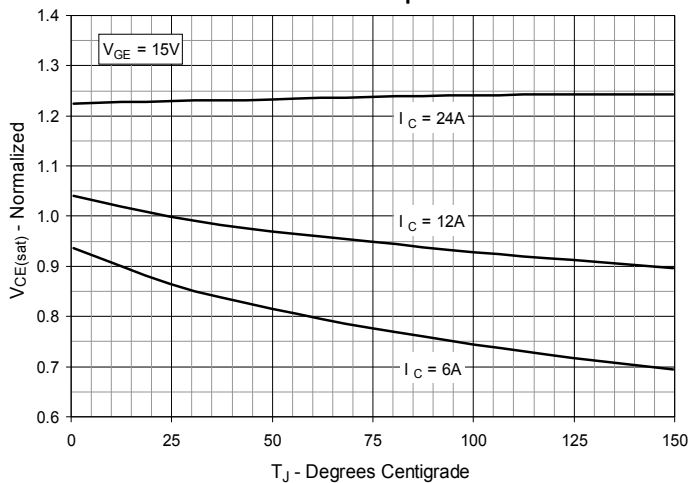


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

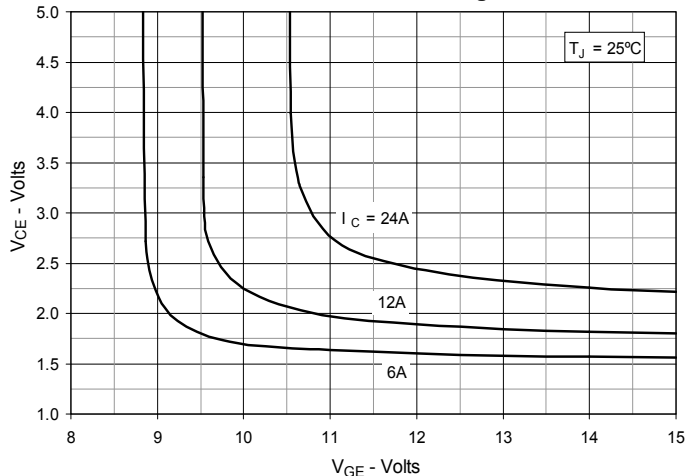


Fig. 6. Input Admittance

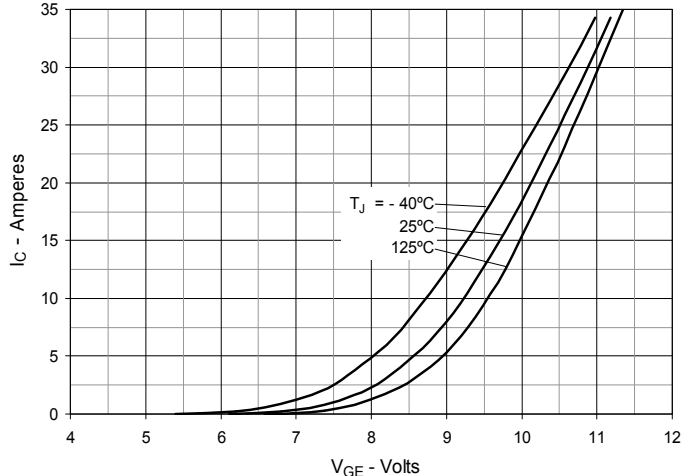


Fig. 7. Transconductance

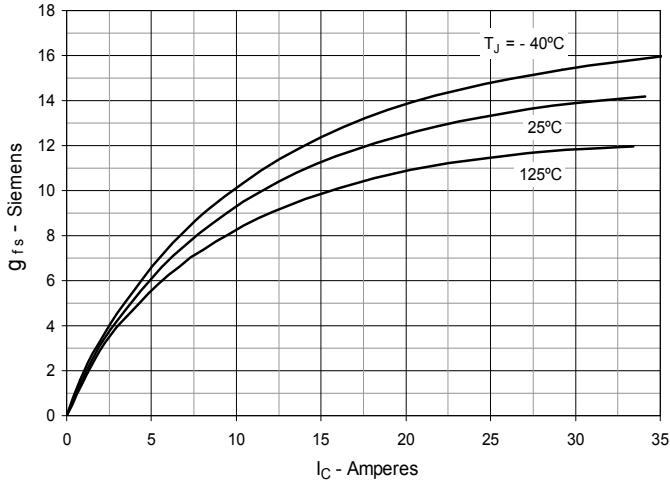


Fig. 8. Gate Charge

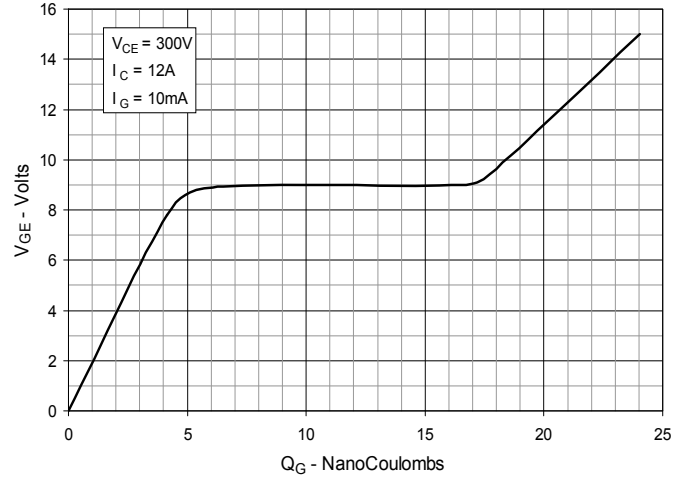


Fig. 9. Capacitance

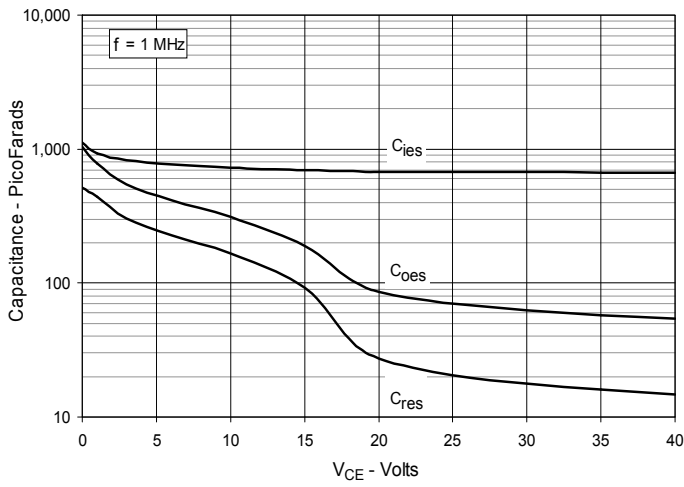


Fig. 10. Reverse-Bias Safe Operating Area

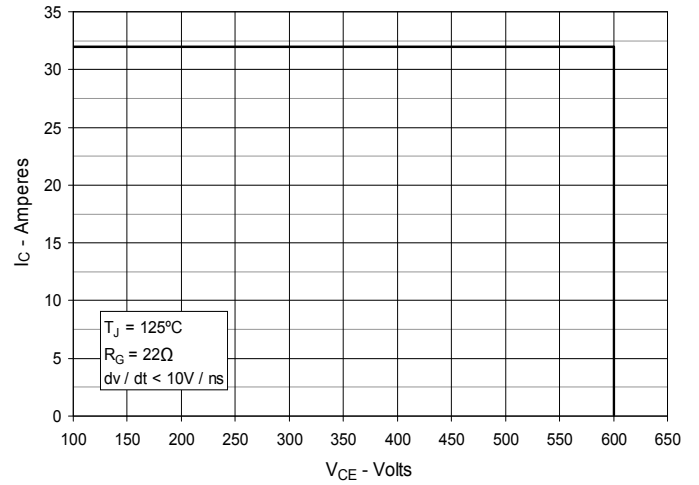
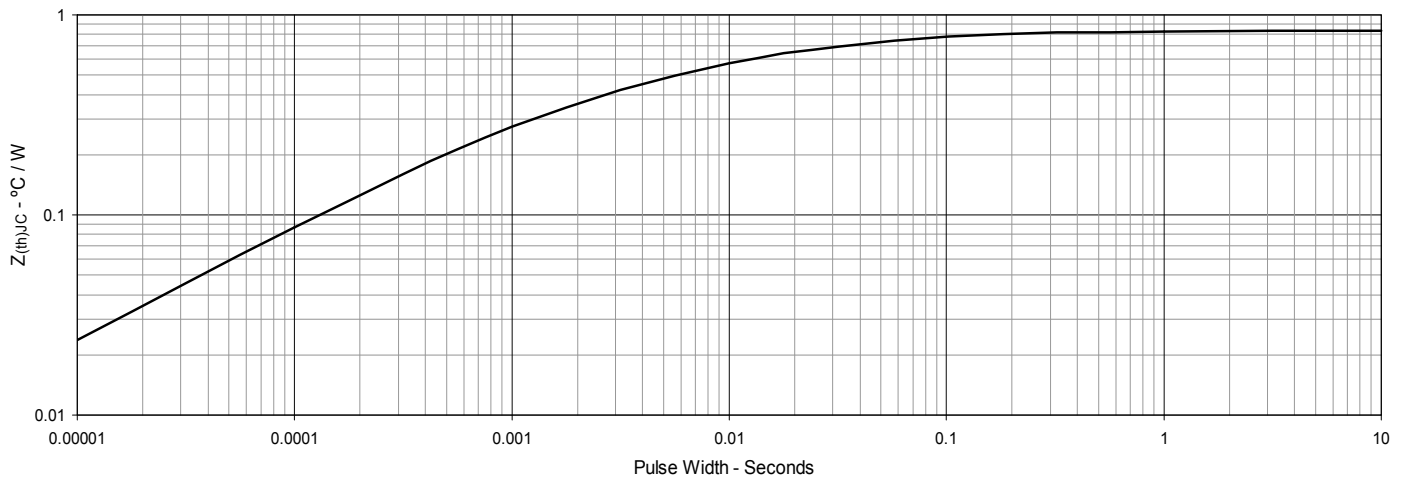
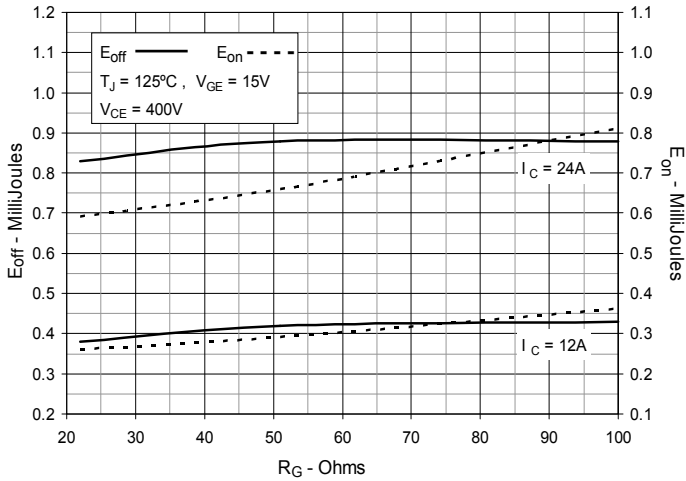


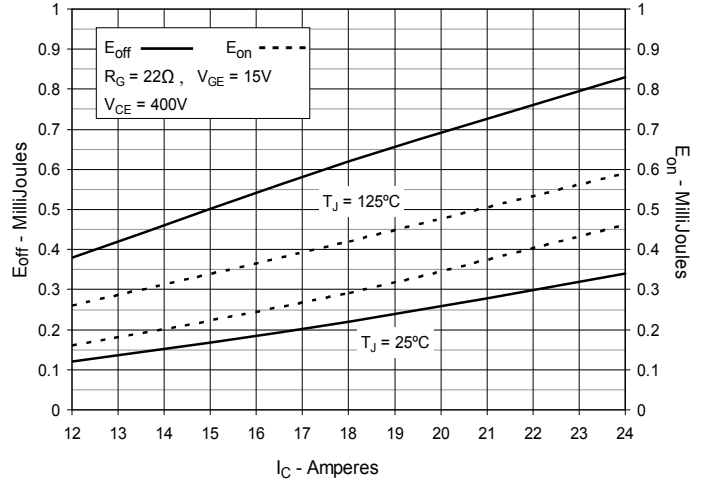
Fig. 11. Maximum Transient Thermal Impedance



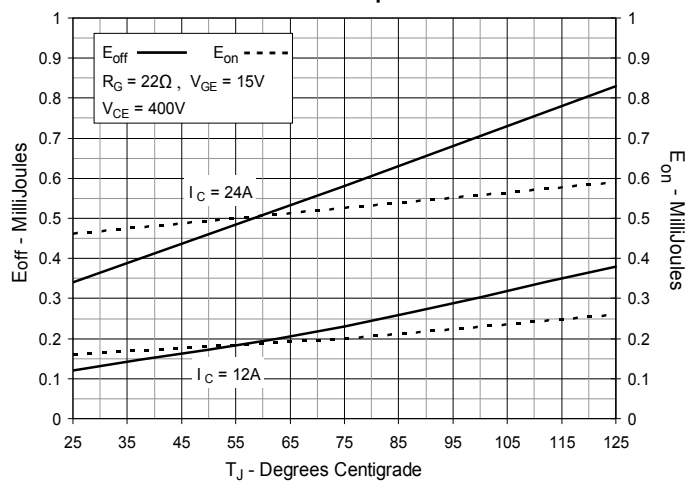
**Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance**



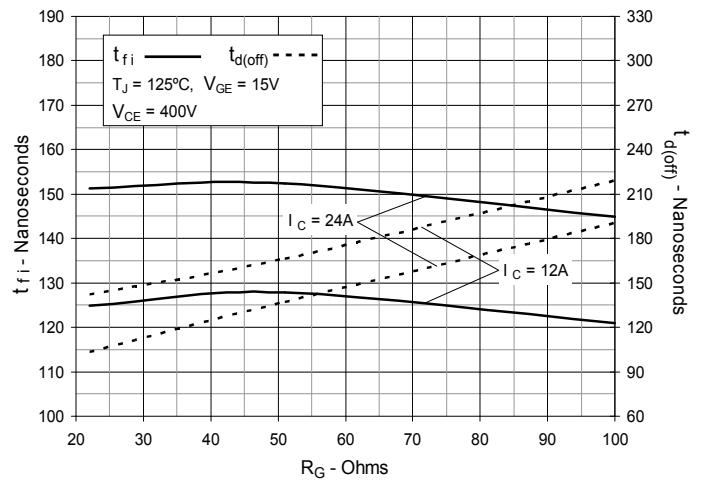
**Fig. 13. Inductive Switching Energy Loss vs. Collector Current**



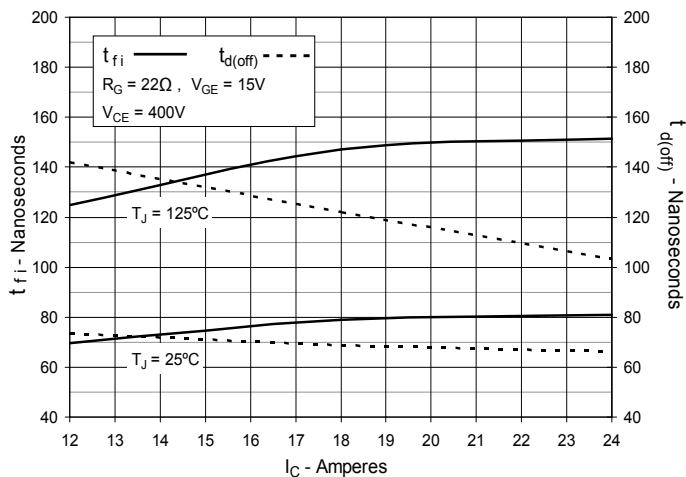
**Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature**



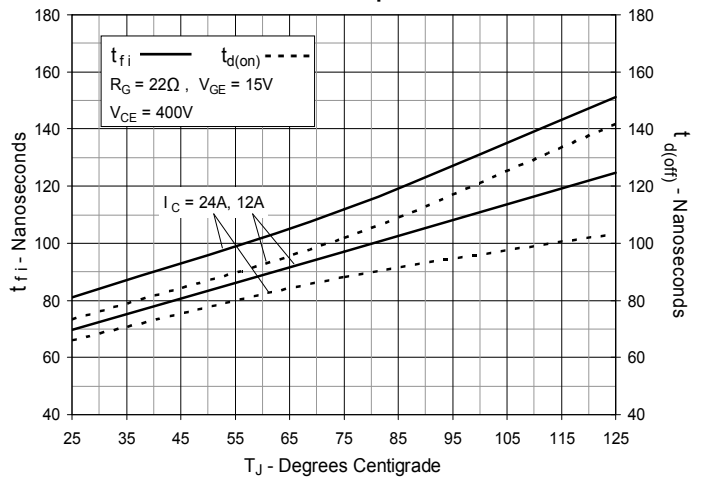
**Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance**



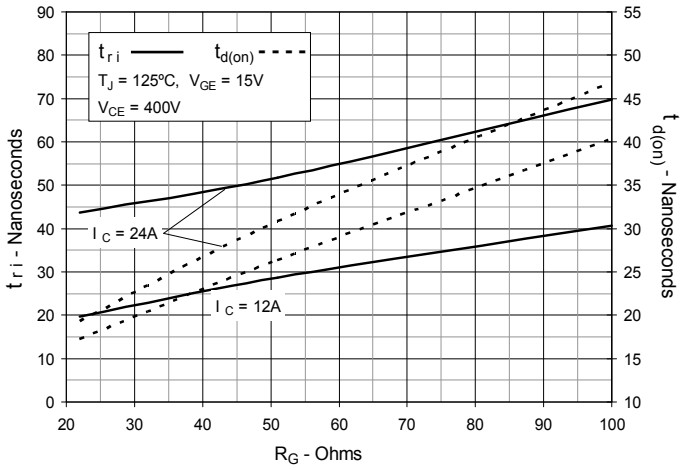
**Fig. 16. Inductive Turn-off Switching Times vs. Collector Current**



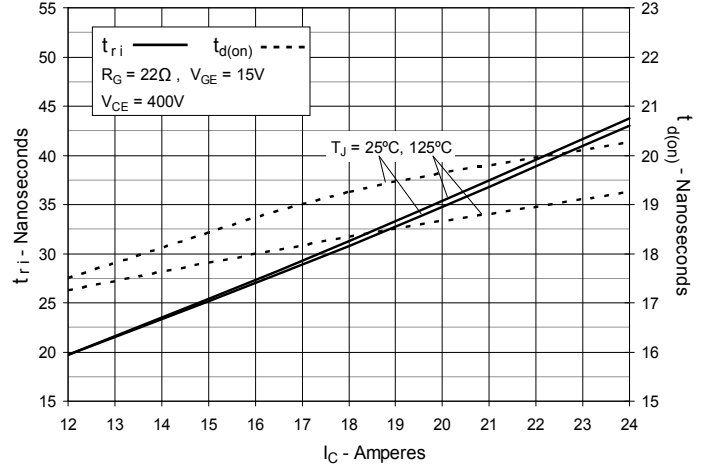
**Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature**



**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**

