

# GenX3™ 600V IGBTs

**IXGA48N60A3**  
**IXGP48N60A3**  
**IXGH48N60A3**

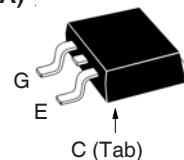
**$V_{CES} = 600V$**   
 **$I_{C110} = 48A$**   
 **$V_{CE(sat)} \leq 1.35V$**

Ultra Low  $V_{sat}$  PT IGBTs for up to 5kHz switching

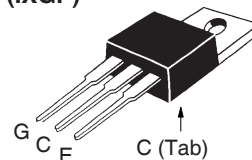
Symbol	Test Conditions	Maximum Ratings	
$V_{CES}$	$T_J = 25^\circ C$ to $150^\circ C$	600	V
$V_{CGR}$	$T_J = 25^\circ C$ to $150^\circ C$ , $R_{GE} = 1M\Omega$	600	V
$V_{GES}$	Continuous	$\pm 20$	V
$V_{GEM}$	Transient	$\pm 30$	V
$I_{C25}$	$T_C = 25^\circ C$	120	A
$I_{C110}$	$T_C = 110^\circ C$	48	A
$I_{CM}$	$T_C = 25^\circ C$ , 1ms	300	A
<b>SSOA (RBSOA)</b>	$V_{GE} = 15V$ , $T_{VJ} = 125^\circ C$ , $R_G = 5\Omega$ Clamped Inductive Load	$I_{CM} = 96$ $V_{CE} \leq V_{CES}$	A
$P_C$	$T_C = 25^\circ C$	300	W
$T_J$		-55 ... +150	$^\circ C$
$T_{JM}$		150	$^\circ C$
$T_{stg}$		-55 ... +150	$^\circ C$
$T_L$	Maximum Lead Temperature for Soldering	300	$^\circ C$
$T_{SOLD}$	1.6 mm (0.062in.) from Case for 10s	260	$^\circ C$
$F_C$	Mounting Force (TO-263)	10..65 / 2.2..14.6	N/lb.
$M_d$	Mounting Torque (TO-220 & TO-247)	1.13 / 10	Nm/lb.in.
<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.
$BV_{CES}$	$I_C = 250\mu A$ , $V_{GE} = 0V$	600		V
$V_{GE(th)}$	$I_C = 250\mu A$ , $V_{CE} = V_{GE}$	3.0		5.5 V
$I_{CES}$	$V_{CE} = V_{CES}$ , $V_{GE} = 0V$ $T_J = 125^\circ C$			25 $\mu A$
				250 $\mu A$
$I_{GES}$	$V_{CE} = 0V$ , $V_{GE} = \pm 20V$			$\pm 100$ nA
$V_{CE(sat)}$	$I_C = 32A$ , $V_{GE} = 15V$ , Note 1	1.18	1.35	V

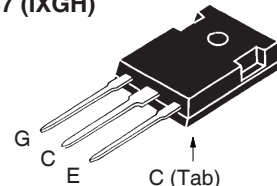
TO-263 (IXGA)



TO-220 (IXGP)



TO-247 (IXGH)



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

## Features

- Optimized for Low Conduction Losses
- Square RBSOA
- 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
- Inrush Current Protection Circuits

### Symbol Test Conditions

( $T_J = 25^\circ\text{C}$  unless otherwise specified)

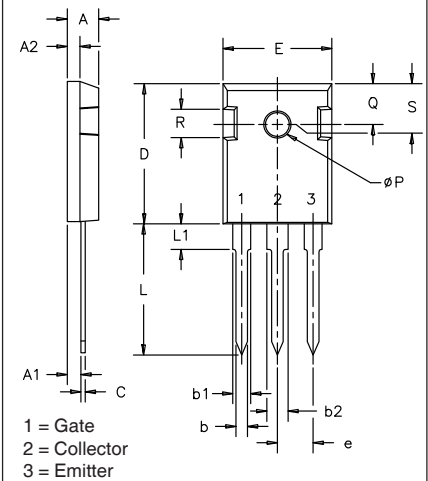
### Characteristic Values

		Min.	Typ.	Max.	
$g_{fs}$	$I_C = 32\text{A}, V_{CE} = 10\text{V}, \text{Note 1}$	30	48		S
$C_{ies}$	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$		3190		pF
$C_{oes}$			175		pF
$C_{res}$			43		pF
$Q_g$	$I_C = 32\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$		110		nC
$Q_{ge}$			21		nC
$Q_{gc}$			42		nC
$t_{d(on)}$	<b>Inductive Load, <math>T_J = 25^\circ\text{C}</math></b> $I_C = 32\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 480\text{V}, R_G = 5\Omega$ Note 2		25		ns
$t_{ri}$			30		ns
$E_{on}$			0.95		mJ
$t_{d(off)}$			334		ns
$t_{fi}$			224		ns
$E_{off}$			2.9		mJ
$t_{d(on)}$	<b>Inductive Load, <math>T_J = 125^\circ\text{C}</math></b> $I_C = 32\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 480\text{V}, R_G = 5\Omega$ Note 2		24		ns
$t_{ri}$			30		ns
$E_{on}$			1.97		mJ
$t_{d(off)}$			545		ns
$t_{fi}$			380		ns
$E_{off}$			5.6		mJ
$R_{thJC}$				0.42	$^\circ\text{C/W}$
$R_{thCK}$	TO-220		0.50		$^\circ\text{C/W}$
	TO-247		0.21		$^\circ\text{C/W}$

### Notes:

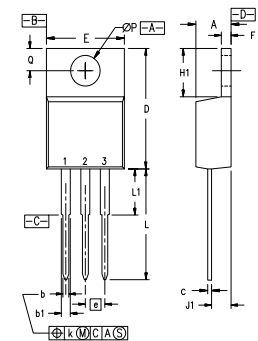
1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .
2. Switching times & energy losses may increase for higher  $V_{CE}$  (clamp),  $T_J$  or  $R_G$ .

### TO-247 Outline



SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.185	.209	4.7	5.3
A1	.087	.102	2.2	2.54
A2	.059	.098	2.2	2.6
b	.040	.055	1.0	1.4
b1	.065	.084	1.65	2.13
b2	.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
$\phi P$	.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	

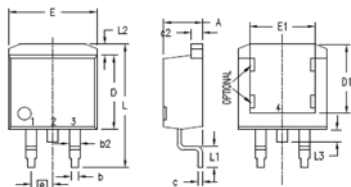
### TO-220 Outline



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
$\phi P$	.139	.161	3.53	4.08
Q	.100	.125	2.54	3.18

### TO-263 Outline



1 = Gate  
2 = Collector  
3 = Emitter  
4 = Collector

SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.160	.190	4.06	4.83
A1	.080	.110	2.03	2.79
b	.020	.039	0.51	0.99
b2	.045	.055	1.14	1.40
c	.016	.029	0.40	0.74
c2	.045	.055	1.14	1.40
D	.340	.380	8.64	9.65
D1	.315	.350	8.00	8.89
E	.380	.410	9.65	10.41
E1	.245	.320	6.22	8.13
e	.100 BSC		2.54 BSC	
L	.575	.625	14.61	15.88
L1	.090	.110	2.29	2.79
L2	.040	.055	1.02	1.40
L3	.050	.070	1.27	1.78
L4	0	.005	0	0.13

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	7,157,338 B2
	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 @  $T_J = 25^\circ\text{C}$

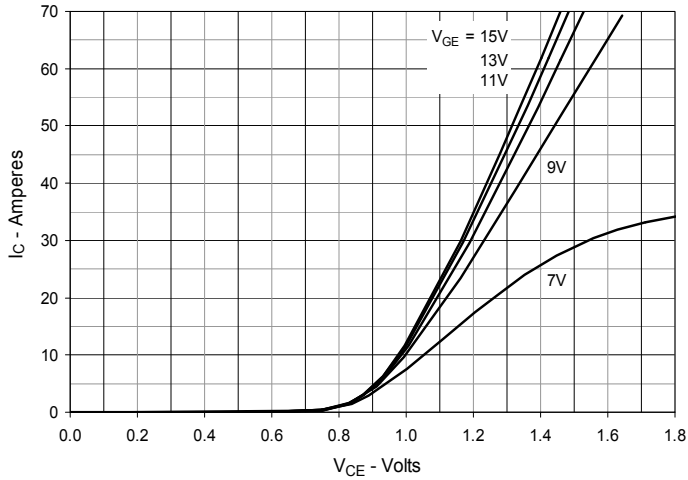


Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$

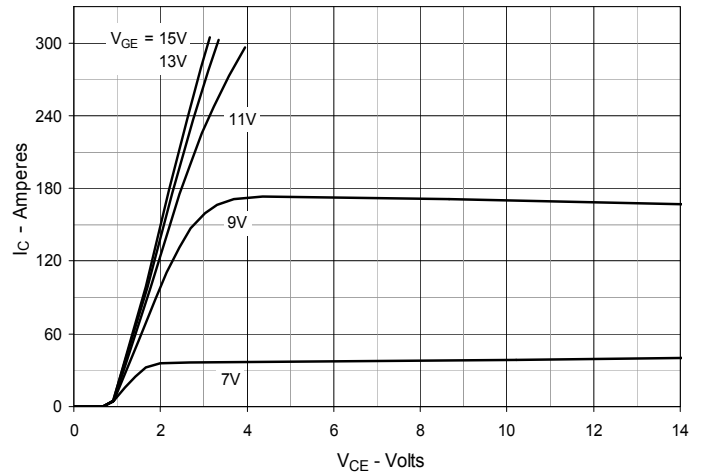


Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$

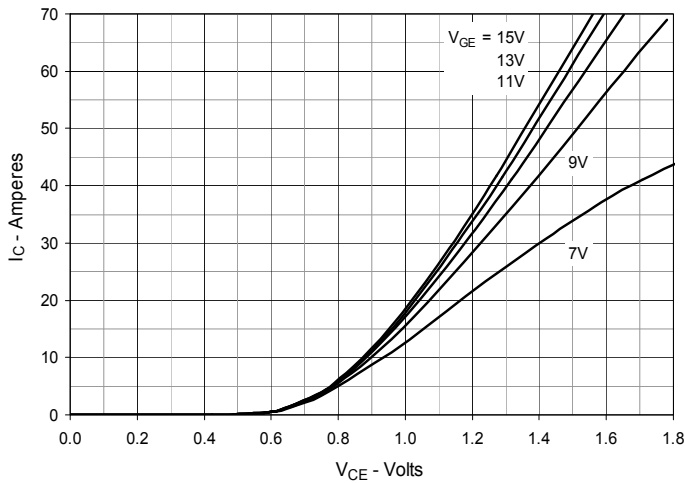


Fig. 4. Dependence of  $V_{CE(sat)}$  on Junction Temperature

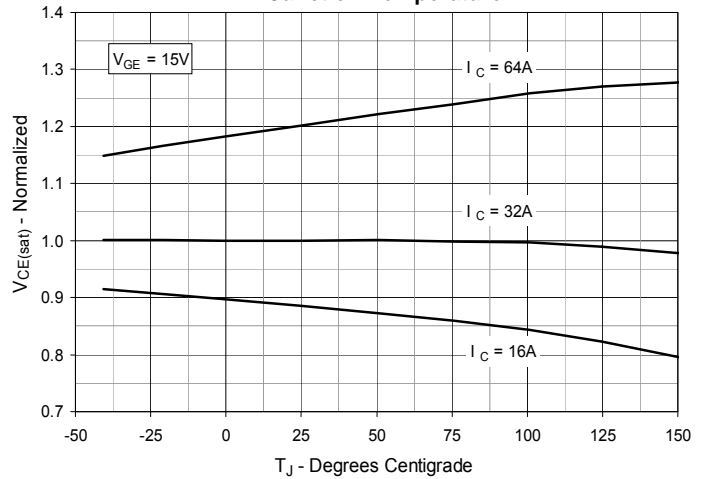


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

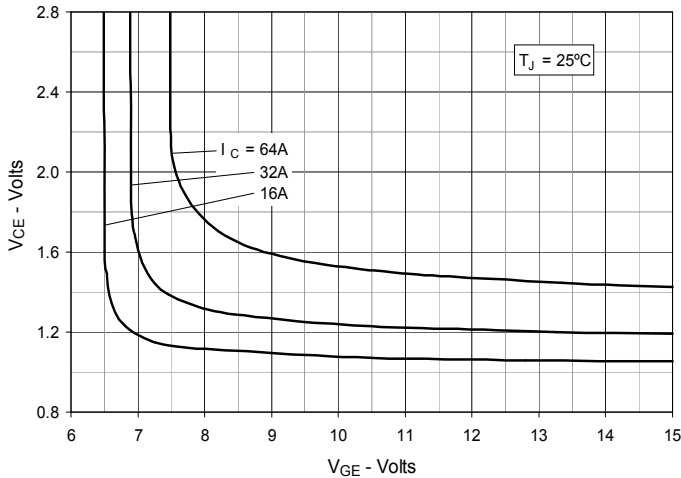


Fig. 6. Input Admittance

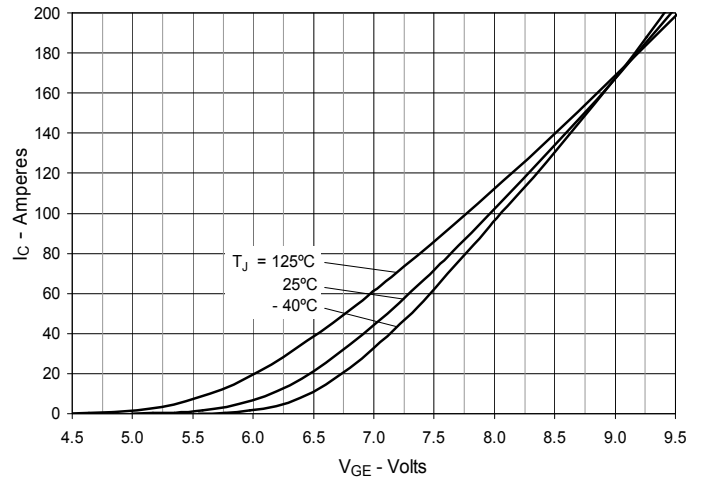


Fig. 7. Transconductance

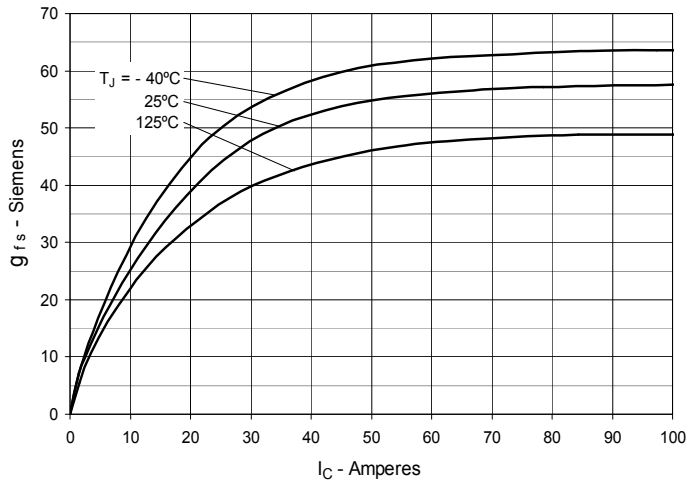


Fig. 8. Gate Charge

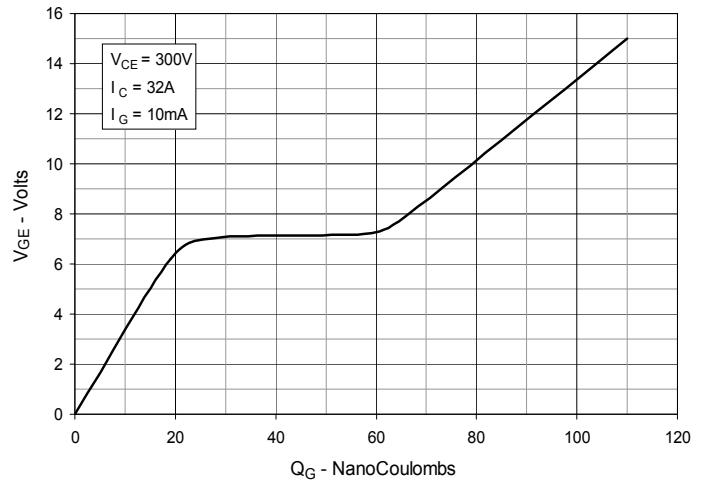


Fig. 9. Capacitance

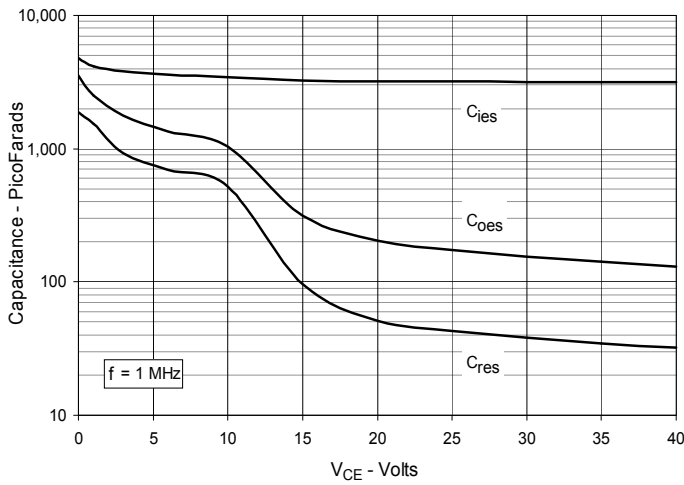


Fig. 10. Reverse-Bias Safe Operating Area

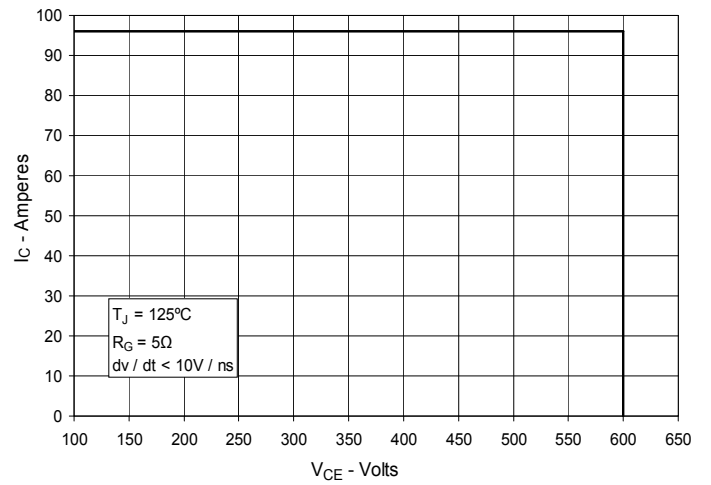
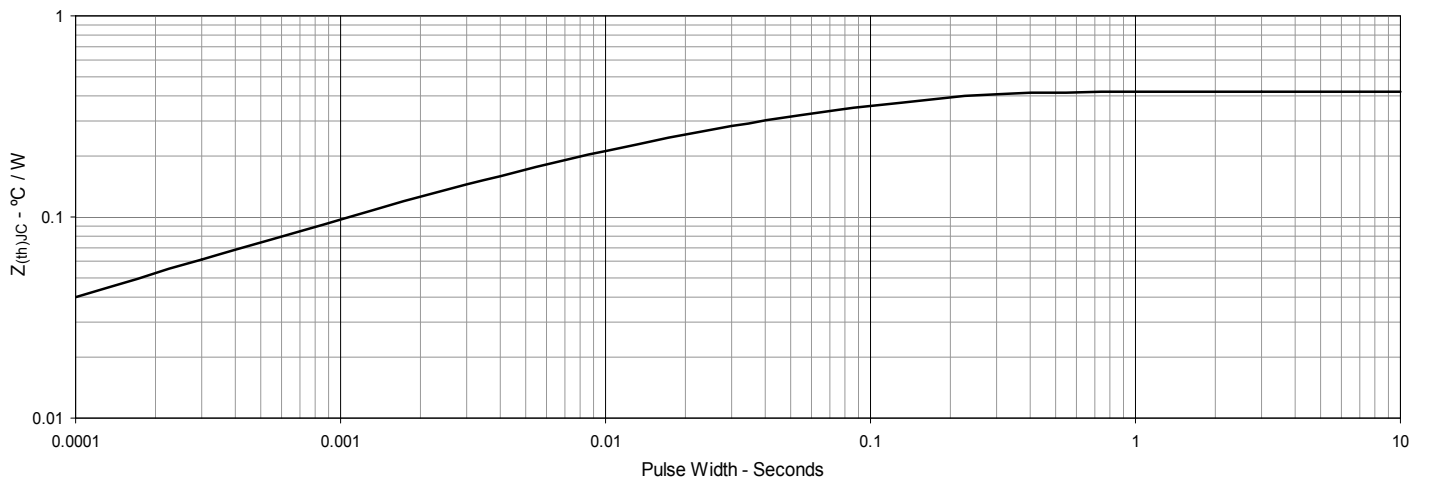
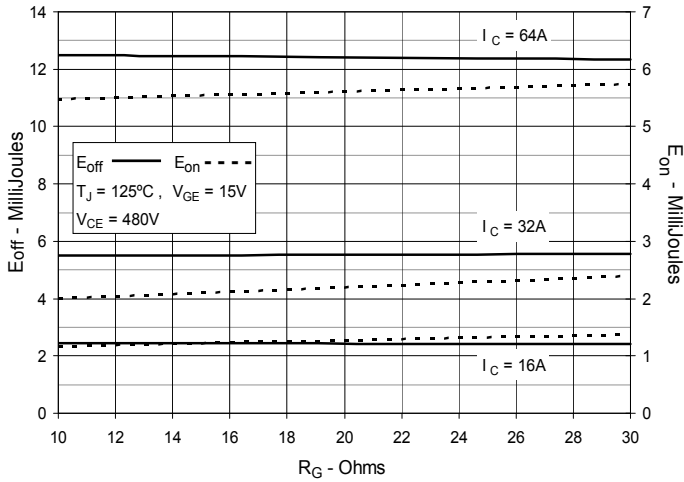


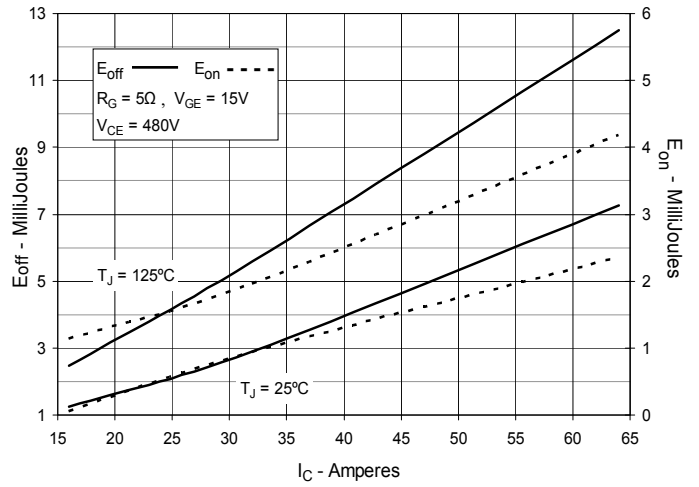
Fig. 11. Maximum Transient Thermal Impedance



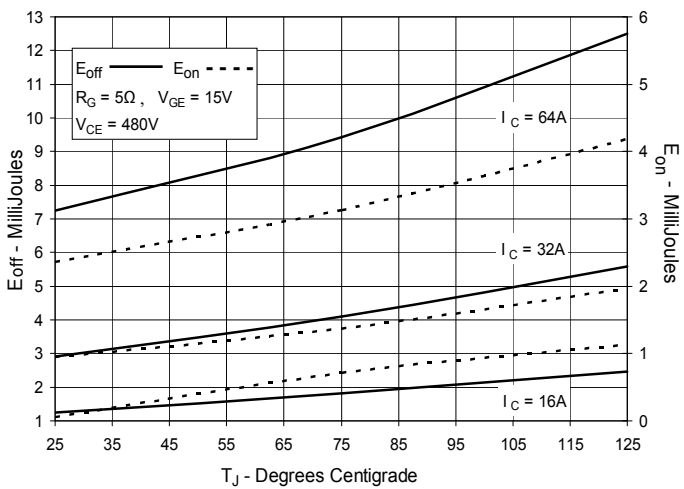
**Fig. 12. Inductive Switching Energy Loss vs. Gate Resistance**



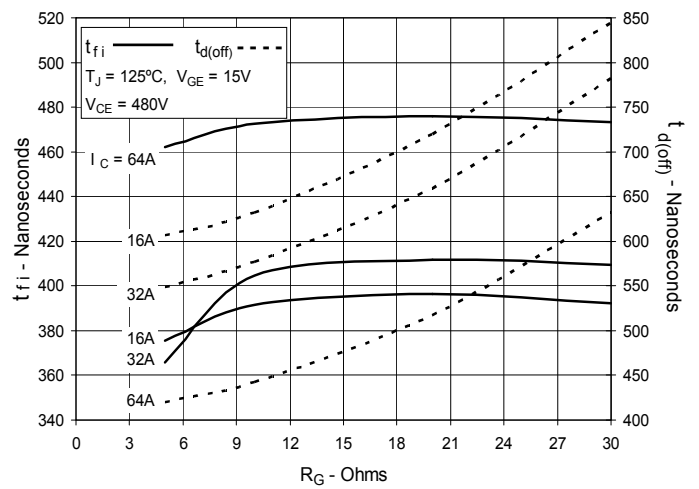
**Fig. 13. Inductive Switching Energy Loss vs. Collector Current**



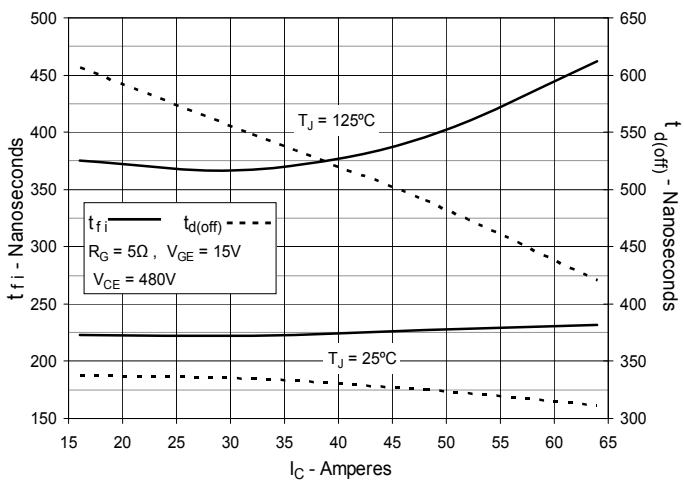
**Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature**



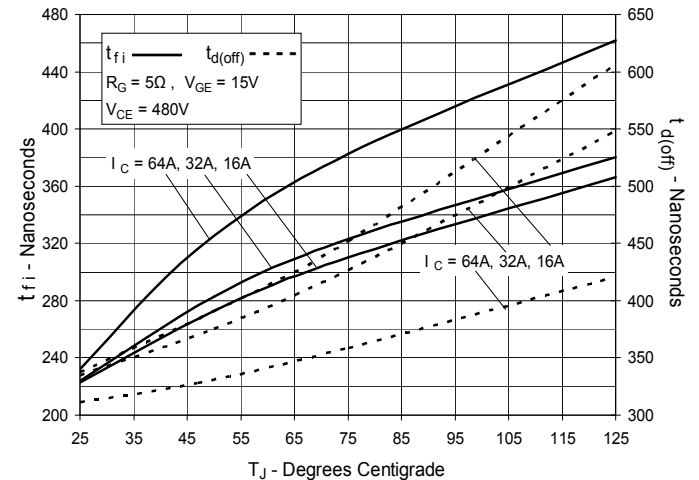
**Fig. 15. Inductive Turn-off Switching Times vs. Gate Resistance**



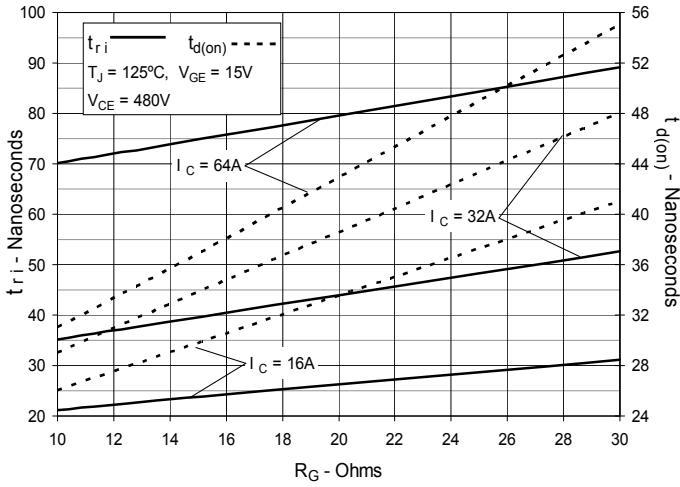
**Fig. 16. Inductive Turn-off Switching Times vs. Collector Current**



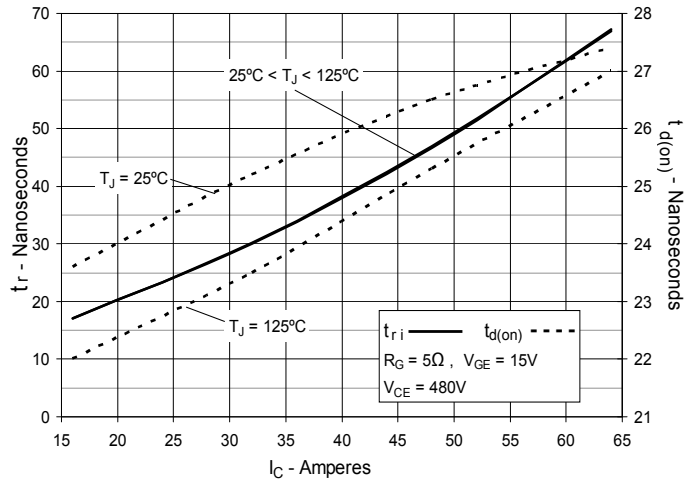
**Fig. 17. Inductive Turn-off Switching Times vs. Junction Temperature**



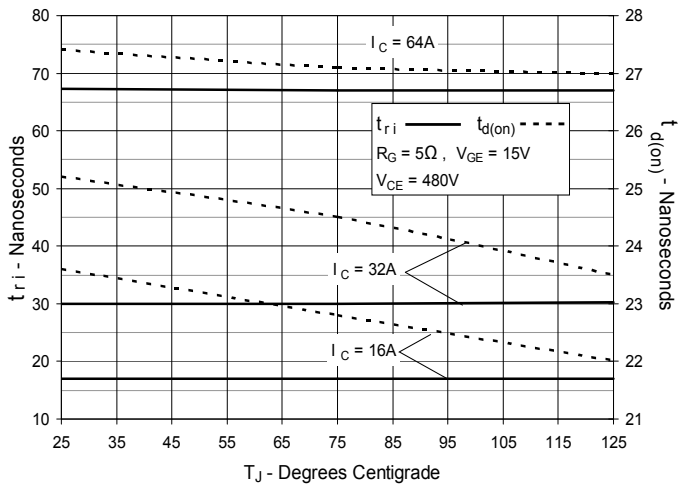
**Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance**



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



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





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