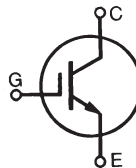


# XPT™ 600V IGBTs GenX3™

**IXXA50N60B3**  
**IXXP50N60B3**  
**IXXH50N60B3**

**V<sub>CES</sub> = 600V**  
**I<sub>C110</sub> = 50A**  
**V<sub>CE(sat)</sub> ≤ 1.80V**

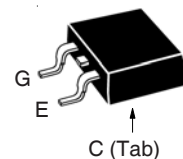
Extreme Light Punch Through  
IGBT for 5-30 kHz Switching



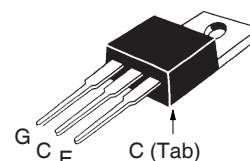
Symbol	Test Conditions	Maximum Ratings	
V <sub>CES</sub>	T <sub>J</sub> = 25°C to 175°C	600	V
V <sub>CGR</sub>	T <sub>J</sub> = 25°C to 175°C, R <sub>GE</sub> = 1MΩ	600	V
V <sub>GES</sub>	Continuous	±20	V
V <sub>GEM</sub>	Transient	±30	V
I <sub>C25</sub>	T <sub>C</sub> = 25°C	120	A
I <sub>C110</sub>	T <sub>C</sub> = 110°C	50	A
I <sub>CM</sub>	T <sub>C</sub> = 25°C, 1ms	200	A
I <sub>A</sub>	T <sub>C</sub> = 25°C	25	A
E <sub>AS</sub>	T <sub>C</sub> = 25°C	200	mJ
<b>SSOA</b> <b>(RBSOA)</b>	V <sub>GE</sub> = 15V, T <sub>VJ</sub> = 150°C, R <sub>G</sub> = 5Ω Clamped Inductive Load	I <sub>CM</sub> = 100 @V <sub>CE</sub> ≤ V <sub>CES</sub>	A
t <sub>sc</sub> <b>(SCSOA)</b>	V <sub>GE</sub> = 15V, V <sub>CE</sub> = 360V, T <sub>J</sub> = 150°C R <sub>G</sub> = 22Ω, Non Repetitive	10	μs
P <sub>C</sub>	T <sub>C</sub> = 25°C	600	W
T <sub>J</sub>		-55 ... +175	°C
T <sub>JM</sub>		175	°C
T <sub>stg</sub>		-55 ... +175	°C
T <sub>L</sub>	Maximum Lead Temperature for Soldering	300	°C
T <sub>SOLD</sub>	1.6 mm (0.062in.) from Case for 10s	260	°C
F <sub>C</sub>	Mounting Force (TO-263)	10..65 / 2.2..14.6	N/lb.
M <sub>d</sub>	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 <sub>J</sub> = 25°C, Unless Otherwise Specified)	Characteristic Values		
		Min.	Typ.	Max.
<b>BV<sub>CES</sub></b>	I <sub>C</sub> = 250μA, V <sub>GE</sub> = 0V	600		V
<b>V<sub>GE(th)</sub></b>	I <sub>C</sub> = 250μA, V <sub>CE</sub> = V <sub>GE</sub>	3.5		V
<b>I<sub>CES</sub></b>	V <sub>CE</sub> = V <sub>CES</sub> , V <sub>GE</sub> = 0V T <sub>J</sub> = 150°C			25 μA 2 mA
<b>I<sub>GES</sub></b>	V <sub>CE</sub> = 0V, V <sub>GE</sub> = ±20V			±100 nA
<b>V<sub>CE(sat)</sub></b>	I <sub>C</sub> = 36A, V <sub>GE</sub> = 15V, Note 1 T <sub>J</sub> = 150°C		1.55 1.80	V V

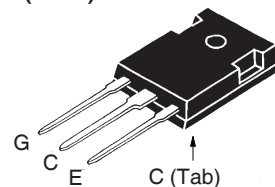
TO-263 (IXXA)



TO-220 (IXXP)



TO-247 (IXXH)



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

## Features

- Optimized for 5-30kHz Switching
- Square RBSOA
- Avalanche Capability
- Short Circuit Capability
- International Standard Packages

## Advantages

- High Power Density
- 175°C Rated
- Extremely Rugged
- Low Gate Drive Requirement
- Easy to Parallel

## Applications

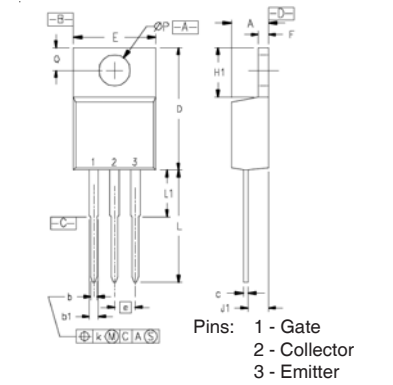
- Power Inverters
- UPS
- Motor Drives
- SMPS
- PFC Circuits
- Battery Chargers
- Welding Machines
- Lamp Ballasts

Symbol Test Conditions ( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified)		Characteristic Values			
		Min.	Typ.	Max.	
$g_{fs}$	$I_C = 36\text{A}, V_{CE} = 10\text{V}$ , Note 1	12	19	S	
$C_{ies}$	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$		2230	pF	
$C_{oes}$			195	pF	
$C_{res}$			44	pF	
$Q_{g(on)}$	$I_C = 36\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$		70	nC	
$Q_{ge}$			16	nC	
$Q_{gc}$			29	nC	
$t_{d(on)}$	<b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b> $I_C = 36\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 360\text{V}, R_G = 5\Omega$ Note 2		27	ns	
$t_{ri}$			40	ns	
$E_{on}$			0.67	mJ	
$t_{d(off)}$			100	150	ns
$t_{fi}$			135	ns	
$E_{off}$			0.74	1.20	mJ
$t_{d(on)}$	<b>Inductive load, <math>T_J = 150^\circ\text{C}</math></b> $I_C = 36\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 360\text{V}, R_G = 5\Omega$ Note 2		30	ns	
$t_{ri}$			45	ns	
$E_{on}$			1.40	mJ	
$t_{d(off)}$			130	ns	
$t_{fi}$			190	ns	
$E_{off}$			1.20	mJ	
$R_{thJC}$				0.25 $^\circ\text{C/W}$	
$R_{thCS}$	TO-247	0.21		$^\circ\text{C/W}$	
	TO-220	0.50		$^\circ\text{C/W}$	

**Notes:**

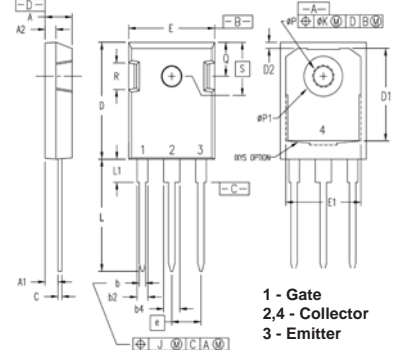
1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .
2. Switching times & energy losses may increase for higher  $V_{CE}$  (clamp),  $T_J$  or  $R_G$ .

**TO-220 Outline**



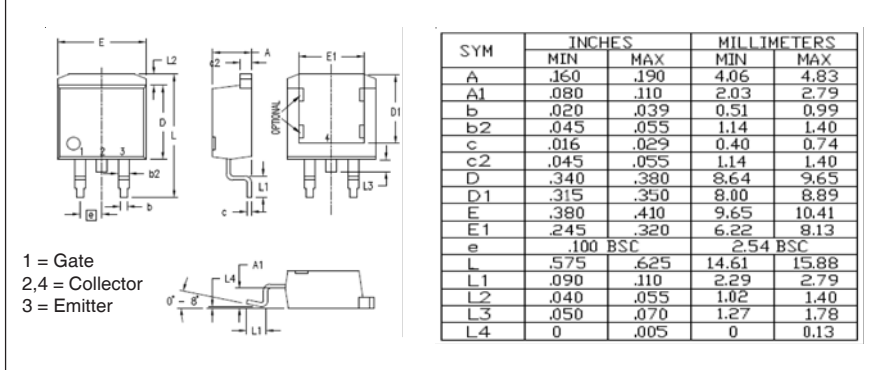
SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.170	.190	4.32	4.83
b	.025	.040	0.64	1.02
b1	.045	.065	1.15	1.65
c	.014	.022	0.35	0.56
D	.580	.630	14.73	16.00
E	.390	.420	9.91	10.66
e	.100 BSC		2.54 BSC	
F	.045	.055	1.14	1.40
H1	.230	.270	5.85	6.85
J1	.090	.110	2.29	2.79
k	0	.015	0	0.38
L	.500	.550	12.70	13.97
L1	.110	.230	2.79	5.84
$\varnothing P$	.139	.161	3.53	4.08
Q	.100	.125	2.54	3.18

**TO-247 Outline**



Dim.	Millimeter		Inches	
	min	max	min	max
A	4.70	5.30	0.185	0.209
A1	2.21	2.59	0.087	0.102
A2	1.50	2.49	0.059	0.098
b	0.99	1.40	0.039	0.055
b2	1.65	2.39	0.065	0.094
b4	2.59	3.43	0.102	0.135
c	0.38	0.89	0.015	0.035
D	20.79	21.45	0.819	0.845
D1	13.07	-	0.515	-
D2	0.51	1.35	0.020	0.053
E	15.48	16.24	0.610	0.640
E1	13.45	-	0.53	-
E2	4.31	5.48	0.170	0.216
e	5.45 BSC		0.215 BSC	
L	19.80	20.30	0.078	0.800
L1	-	4.49	-	0.177
$\varnothing P$	3.55	3.65	0.140	0.144
$\varnothing P1$	-	7.39	-	0.290
Q	5.38	6.19	0.212	0.244
S	6.14 BSC		0.242 BSC	

**TO-263 Outline**



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	7,157,338B2
	4,860,072	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 @  $T_J = 25^\circ\text{C}$

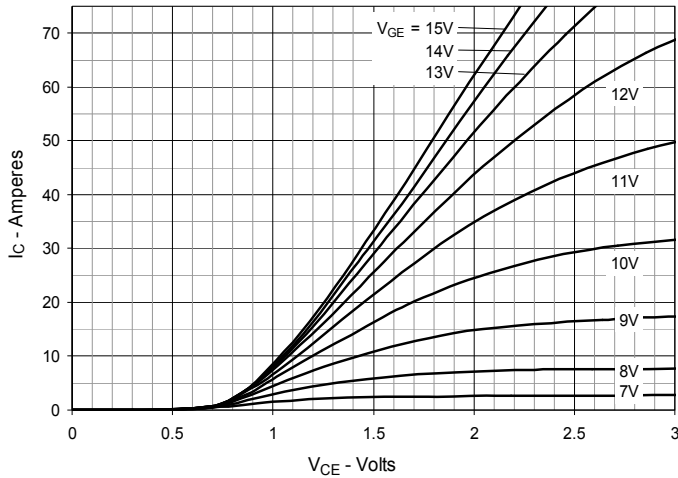


Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$

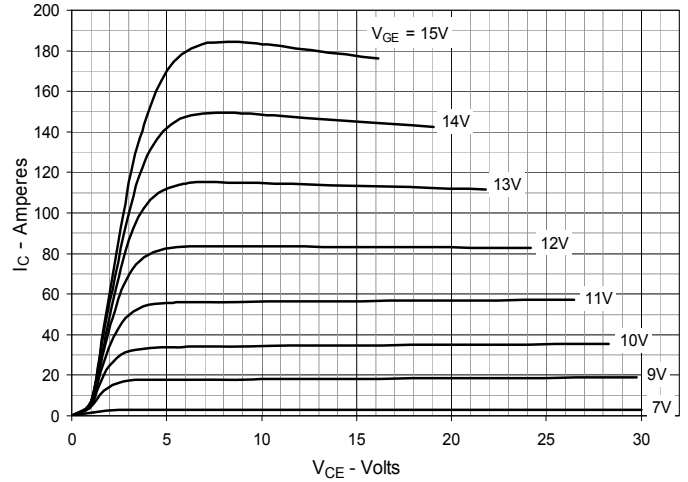


Fig. 3. Output Characteristics @  $T_J = 150^\circ\text{C}$

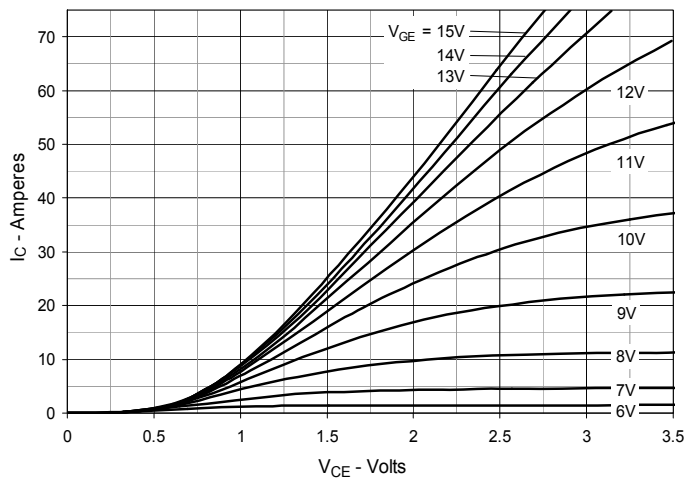


Fig. 4. Dependence of  $V_{CE(sat)}$  on Junction Temperature

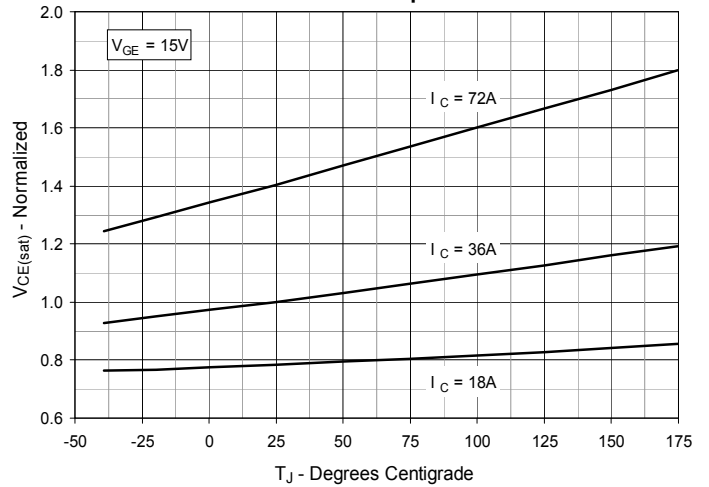


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

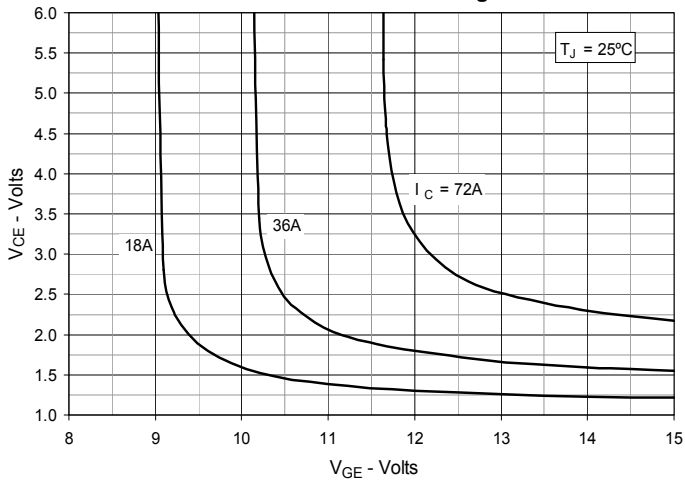


Fig. 6. Input Admittance

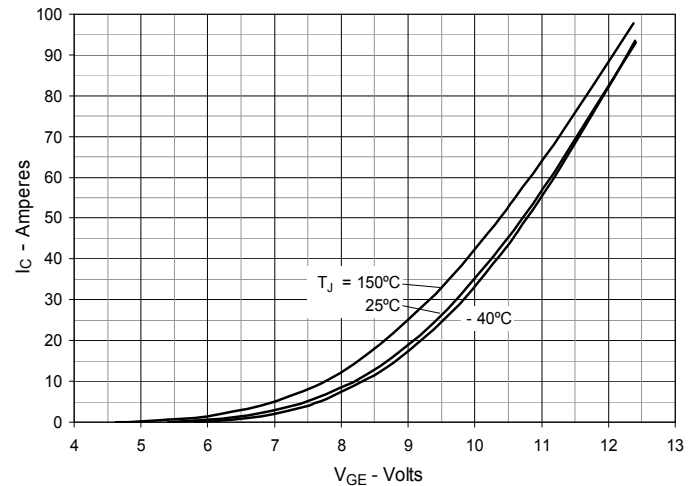


Fig. 7. Transconductance

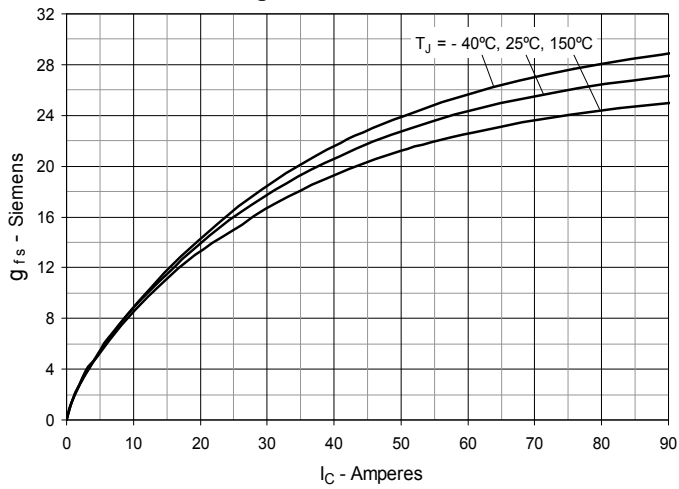


Fig. 8. Gate Charge

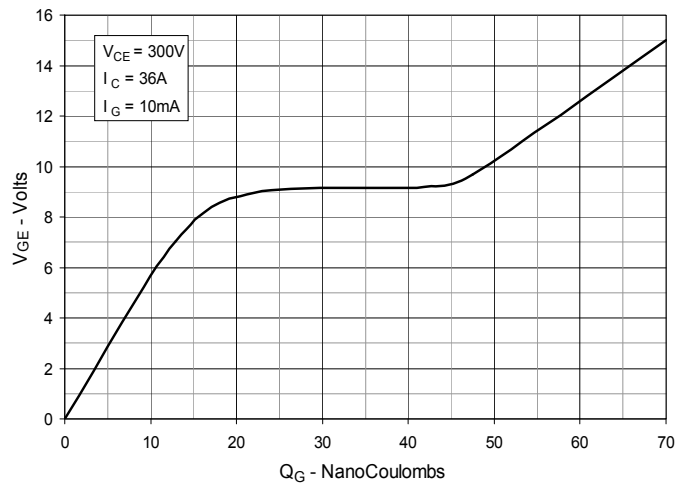


Fig. 9. Capacitance

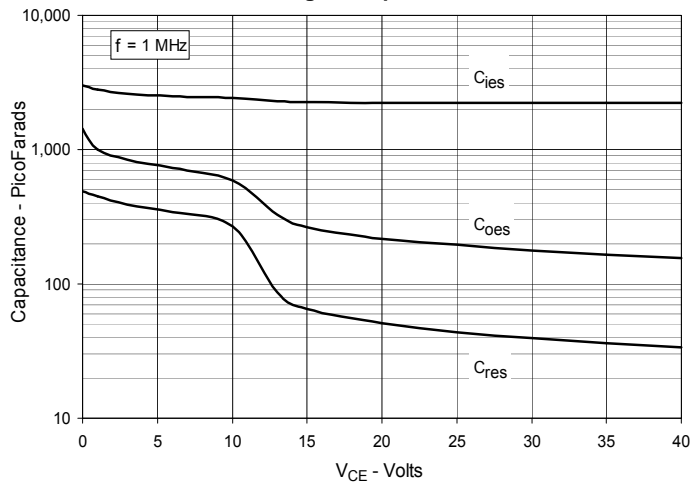


Fig. 10. Reverse-Bias Safe Operating Area

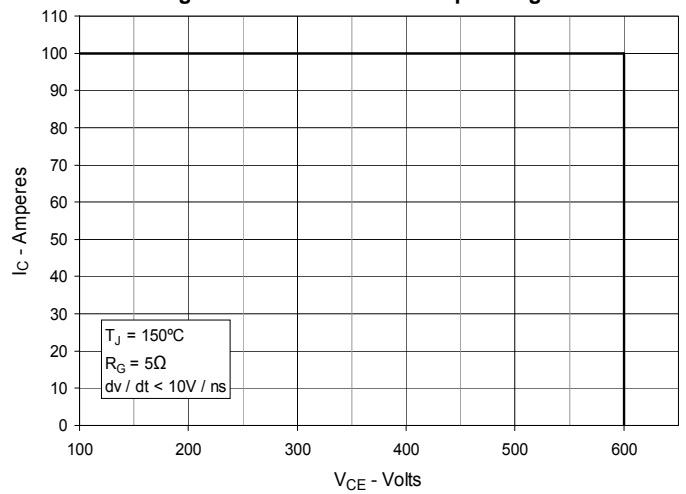


Fig. 11. Forward-Bias Safe Operating Area

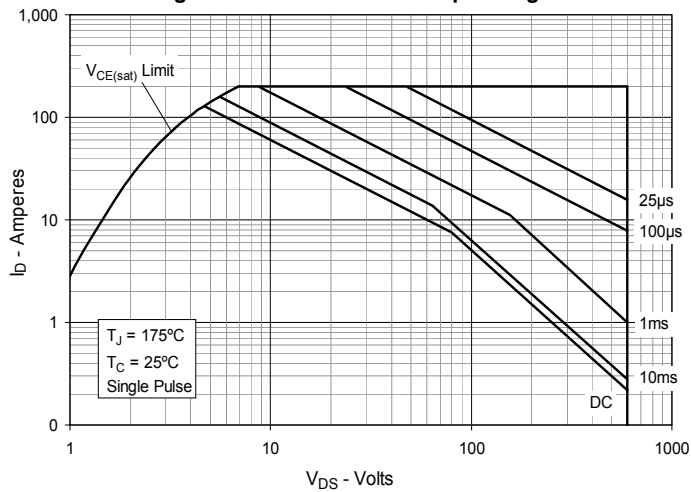
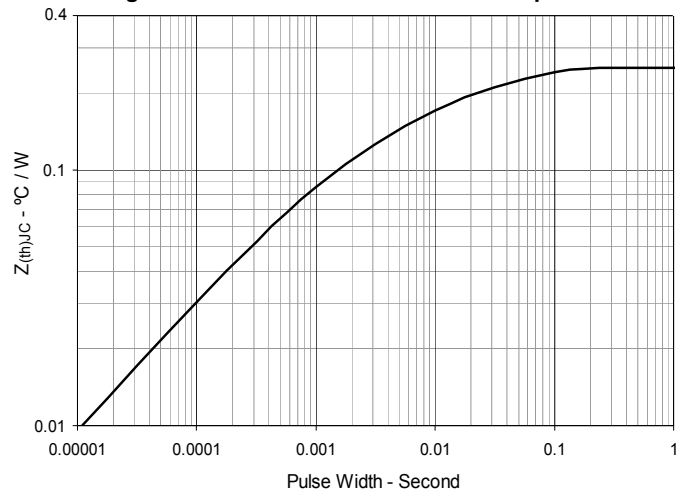
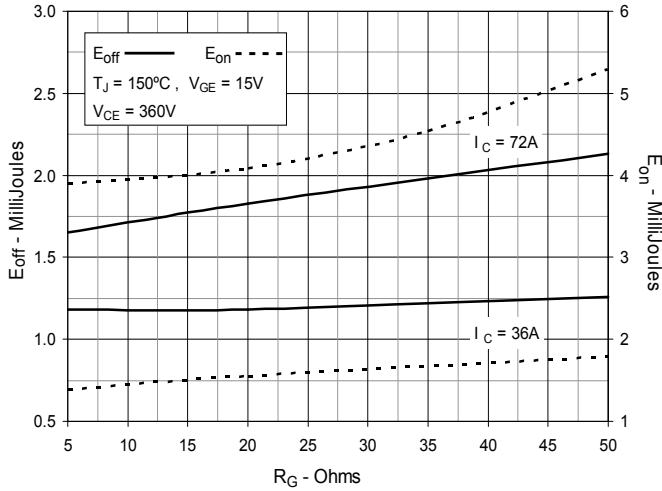


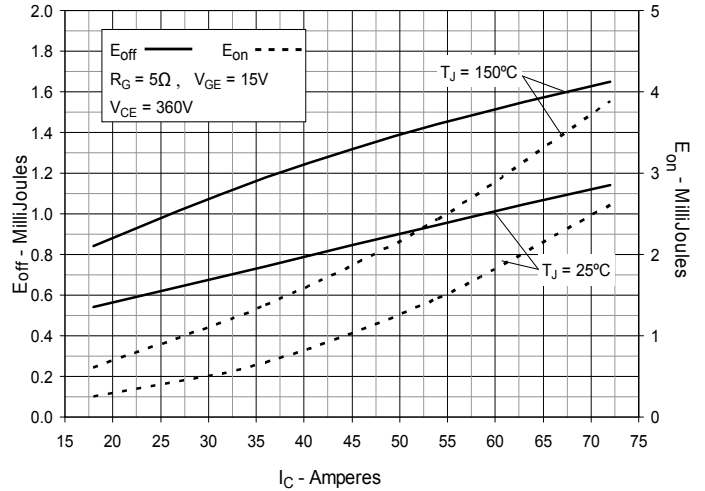
Fig. 12. Maximum Transient Thermal Impedance



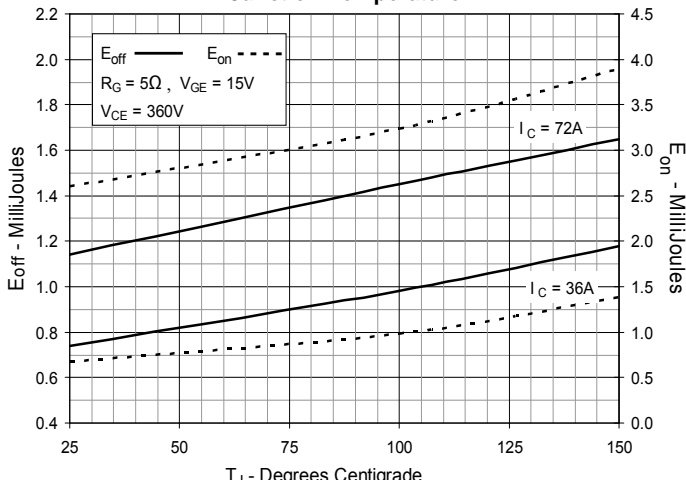
**Fig. 13. Inductive Switching Energy Loss vs. Gate Resistance**



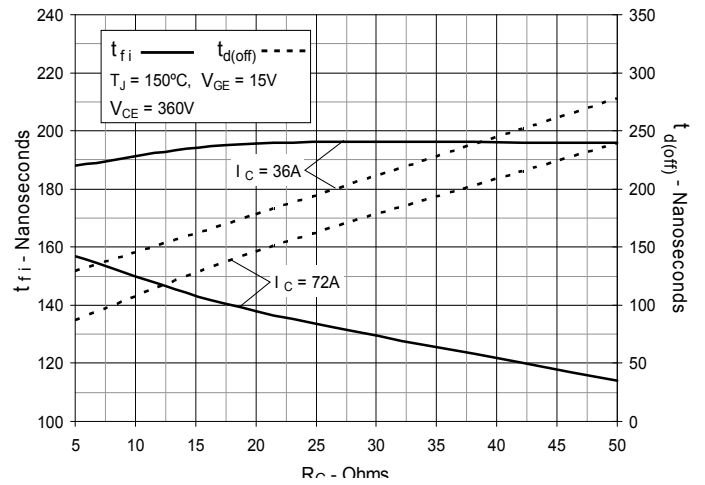
**Fig. 14. Inductive Switching Energy Loss vs. Collector Current**



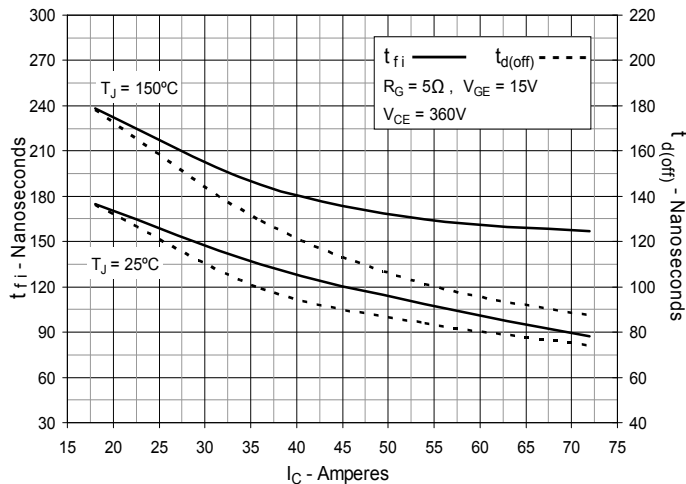
**Fig. 15. Inductive Switching Energy Loss vs. Junction Temperature**



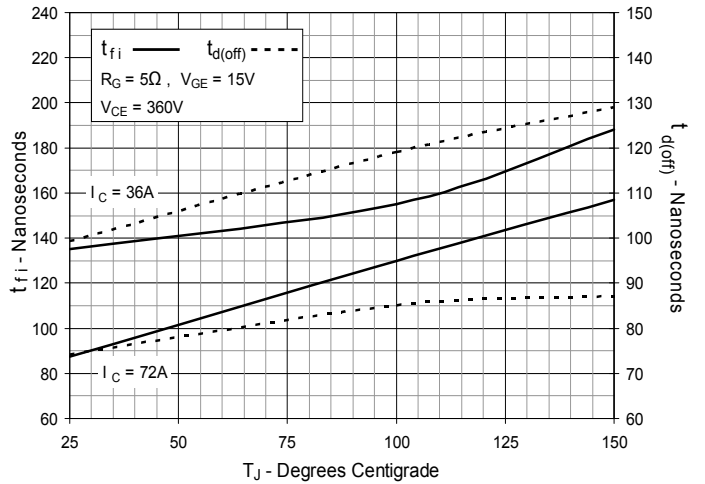
**Fig. 16. Inductive Turn-off Switching Times vs. Gate Resistance**



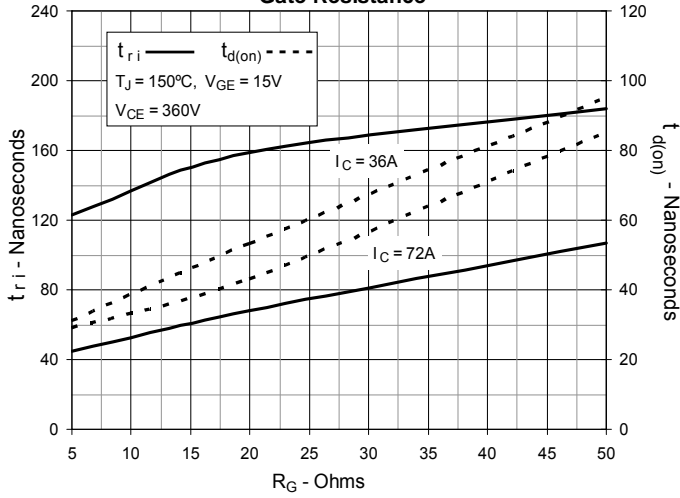
**Fig. 17. Inductive Turn-off Switching Times vs. Collector Current**



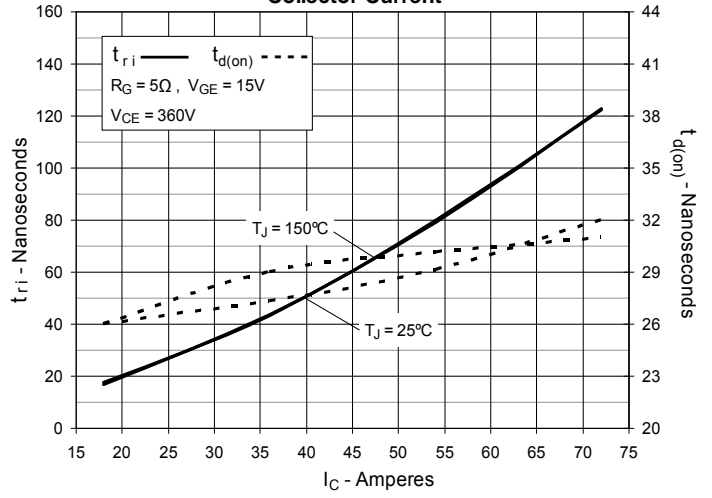
**Fig. 18. Inductive Turn-off Switching Times vs. Junction Temperature**



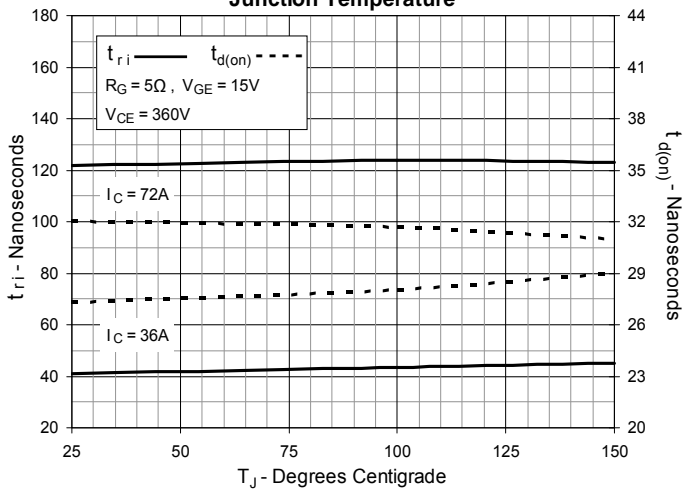
**Fig. 19. Inductive Turn-on Switching Times vs. Gate Resistance**



**Fig. 20. Inductive Turn-on Switching Times vs. Collector Current**



**Fig. 21. Inductive Turn-on Switching Times vs. Junction Temperature**



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