

**GenX3™ 600V
IGBT**
**IXGA28N60A3
IXGP28N60A3
IXGH28N60A3**

$$V_{CES} = 600V$$

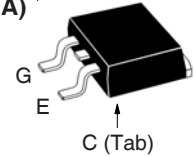
$$I_{C110} = 28A$$

$$V_{CE(sat)} \leq 1.4V$$

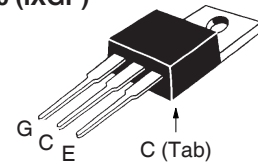
 Ultra Low Vsat PT IGBT for up
to 5kHz Switching


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	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ C$	75	A
I_{C110}	$T_C = 110^\circ C$	28	A
I_{CM}	$T_C = 25^\circ C$, 1ms	170	A
SSOA (RBSOA)	$V_{GE} = 15V$, $T_{VJ} = 125^\circ C$, $R_G = 10\Omega$ Clamped Inductive Load	$I_{CM} = 48$ @ $V_{CE} \leq V_{CES}$	A
P_C	$T_C = 25^\circ C$	190	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-247 & TO-220)	1.13 / 10	Nm/lb.in
Weight	TO-263	2.5	g
	TO-220	3.0	g
	TO-247	6.0	g

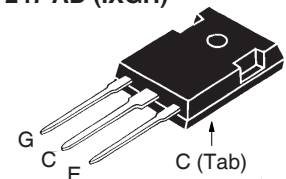
TO-263 (IXGA)



TO-220 (IXGP)



TO-247 AD (IXGH)



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

Features

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

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		V
I_{CES}	$V_{CE} = V_{CES}$, $V_{GE} = 0V$ $T_J = 125^\circ C$			25 μA 250 μA
I_{GES}	$V_{CE} = 0V$, $V_{GE} = \pm 20V$			± 100 nA
$V_{CE(sat)}$	$I_C = 24A$, $V_{GE} = 15V$, Note 1 $T_J = 125^\circ C$		1.3	1.4 V V

Symbol Test Conditions

($T_J = 25^\circ\text{C}$ Unless Otherwise Specified)

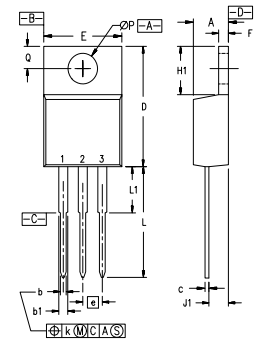
Characteristic Values

		Min.	Typ.	Max.	
g_{fs}	$I_C = 24\text{A}, V_{CE} = 10\text{V}$, Note 1	17	30		S
C_{ies}	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$		1790		pF
C_{oes}			100		pF
C_{res}			26		pF
$Q_{g(on)}$	$I_C = 24\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$		66		nC
Q_{ge}			13		nC
Q_{gc}			24		nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = 24\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 480\text{V}, R_G = 10\Omega$ Note 2		18		ns
t_{ri}			26		ns
E_{on}			0.7		mJ
$t_{d(off)}$			300		ns
t_{fi}			260		ns
E_{off}		2.4		mJ	
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$ $I_C = 24\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 480\text{V}, R_G = 10\Omega$ Note 2		20		ns
t_{ri}			26		ns
E_{on}			1.4		mJ
$t_{d(off)}$			470		ns
t_{fi}			400		ns
E_{off}		4.2		mJ	
R_{thJC}				0.66	$^\circ\text{C/W}$
R_{thCS}	TO-220		0.50		$^\circ\text{C/W}$
R_{thCS}	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 .

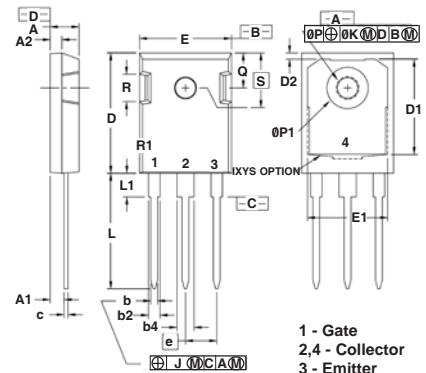
TO-220 Outline



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

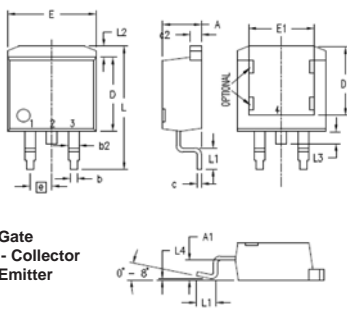
TO-247 Outline



1 - Gate
2,4 - Collector
3 - Emitter

SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.190	.205	4.83	5.21
A1	.090	.100	2.29	2.54
A2	.075	.085	1.91	2.16
b	.045	.055	1.14	1.40
b2	.075	.087	1.91	2.20
b4	.115	.126	2.92	3.20
C	.024	.031	0.61	0.80
D	.819	.840	20.80	21.34
D1	.650	.690	16.51	17.53
D2	.035	.050	0.89	1.27
E	.620	.635	15.75	16.13
E1	.545	.565	13.84	14.35
e	.215 BSC		5.45 BSC	
J	--	.010	--	0.25
K	--	.025	--	0.64
L	.780	.810	19.81	20.57
L1	.150	.170	3.81	4.32
ϕP	.140	.144	3.55	3.65
$\phi P1$.275	.290	6.99	7.37
Q	.220	.244	5.59	6.20
R	.170	.190	4.32	4.83
S	.242 BSC		6.15 BSC	

TO-263 Outline



1 - Gate
2,4 - Collector
3 - Emitter

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

ADVANCE 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.

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 @ $T_J = 25^\circ\text{C}$

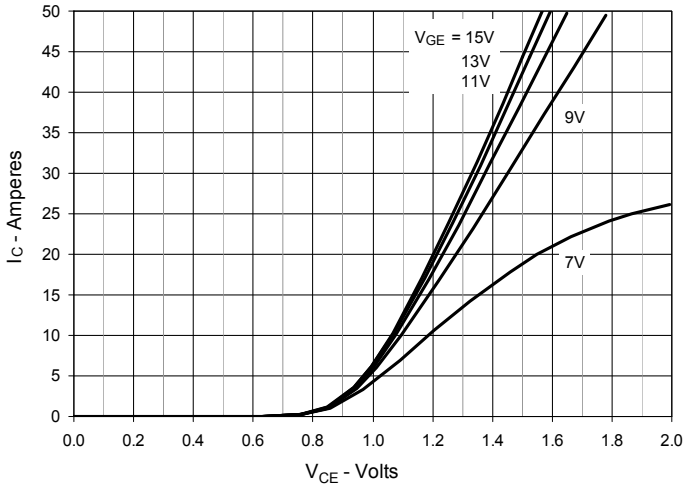


Fig. 2. Extended Output Characteristics @ $T_J = 25^\circ\text{C}$

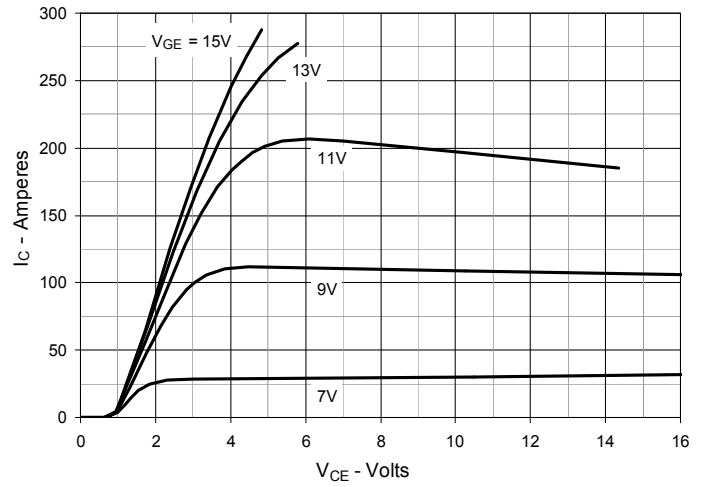


Fig. 3. Output Characteristics @ $T_J = 125^\circ\text{C}$

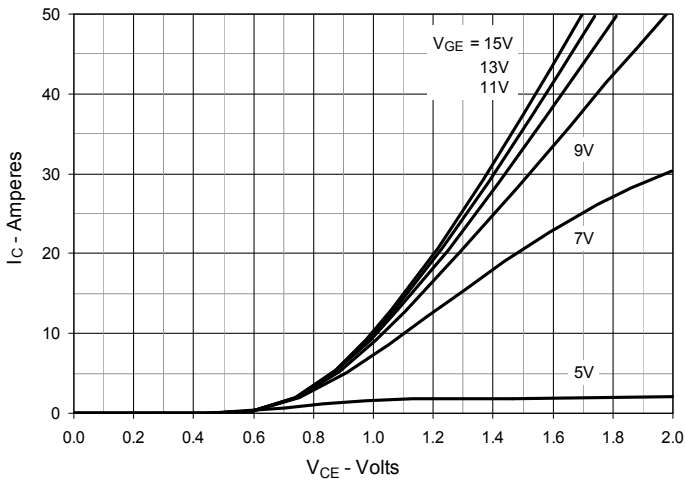


Fig. 4. Dependence of $V_{CE(sat)}$ on Junction Temperature

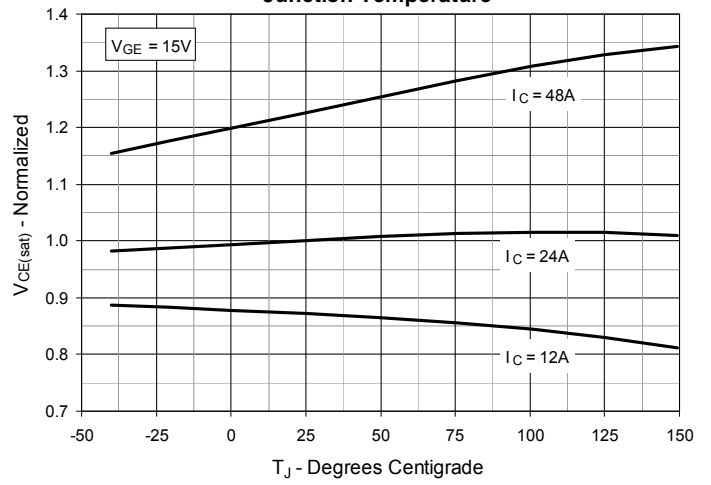


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

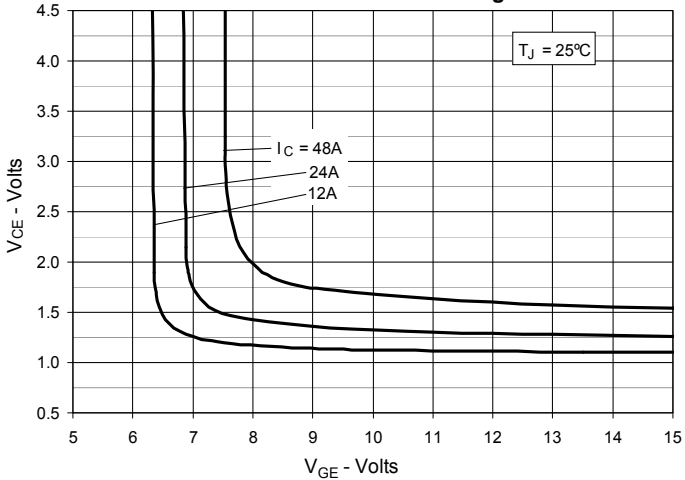


Fig. 6. Input Admittance

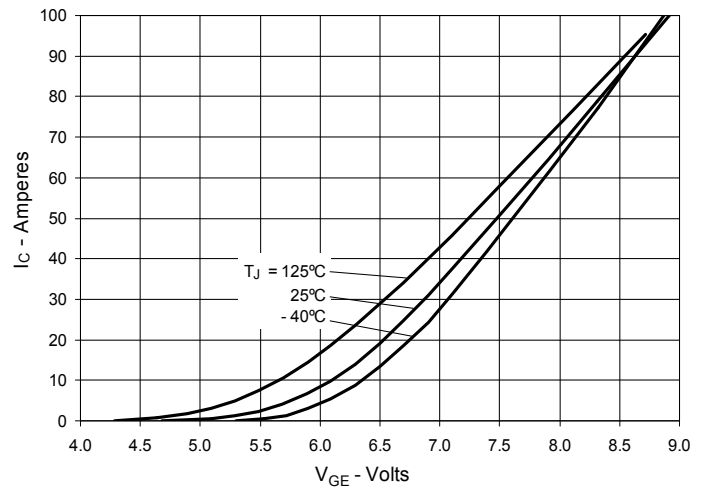


Fig. 7. Transconductance

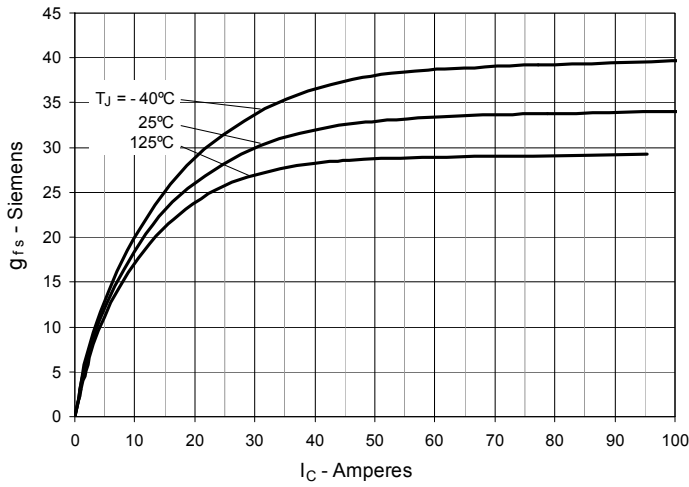


Fig. 8. Gate Charge

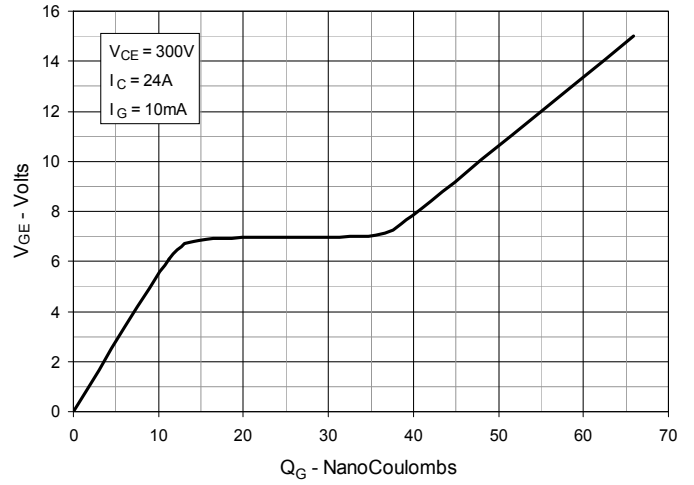


Fig. 9. Reverse-Bias Safe Operating Area

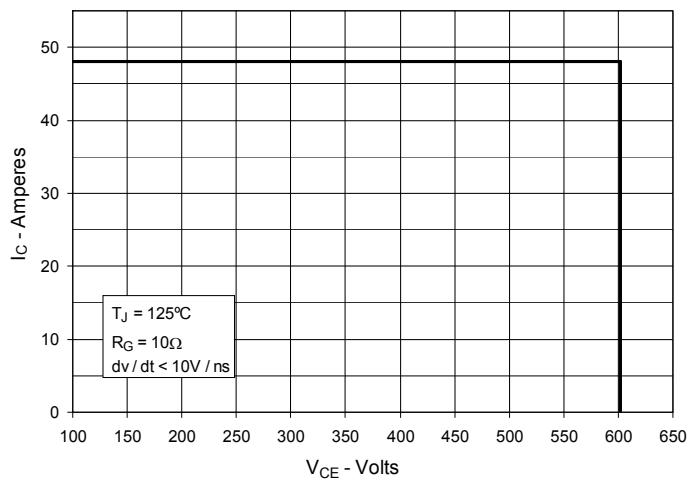


Fig. 10. Capacitance

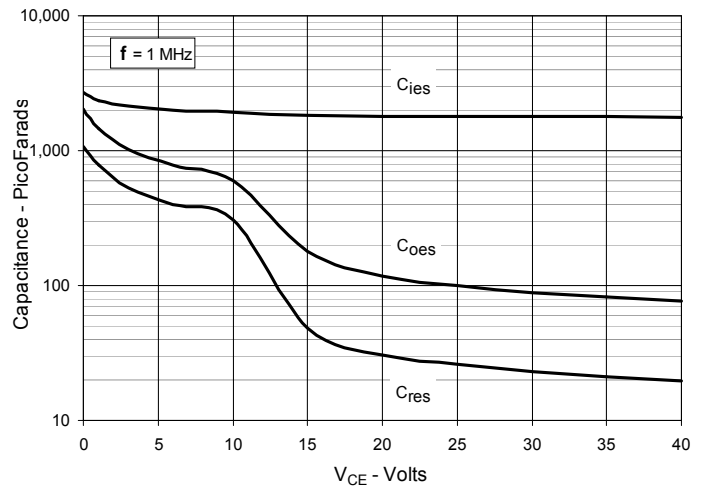
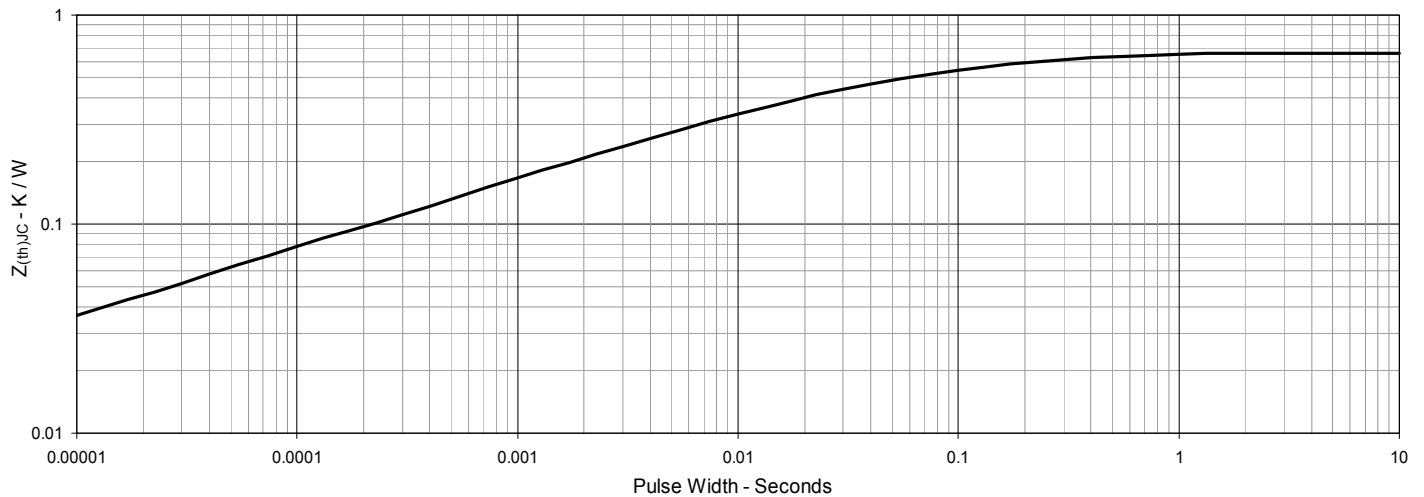
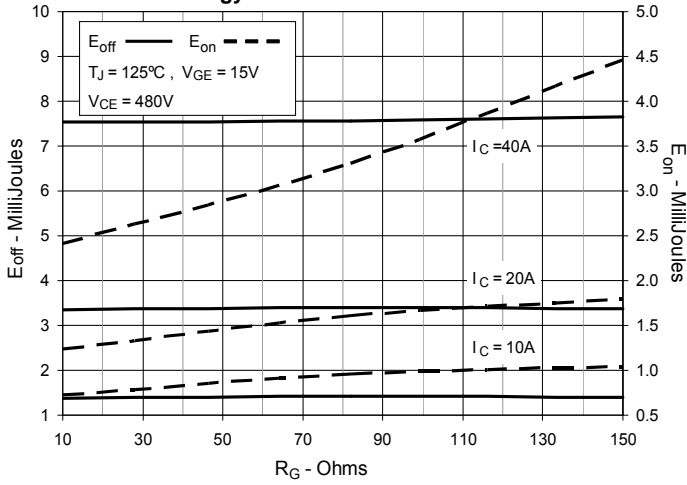


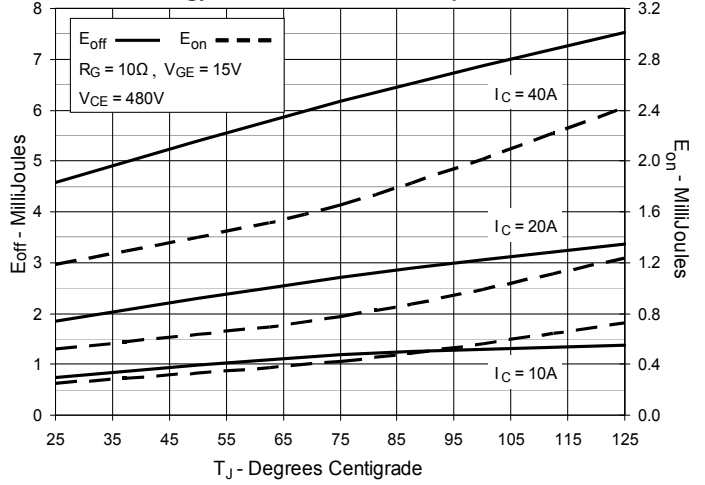
Fig. 11. Maximum Transient Thermal Impedance



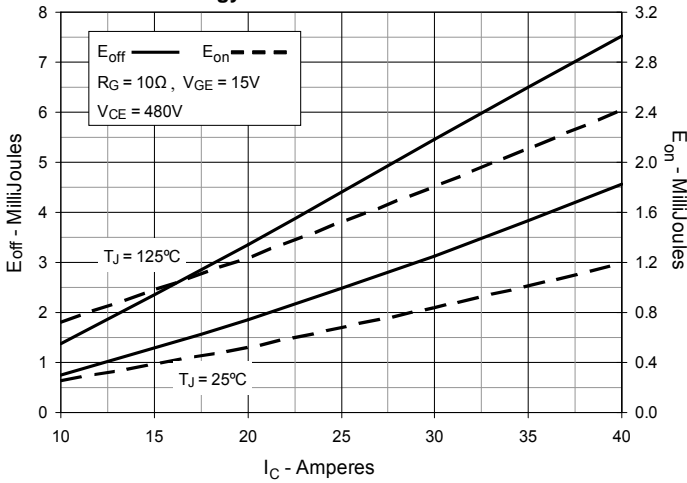
**Fig. 12. Inductive Switching
Energy Loss vs. Gate Resistance**



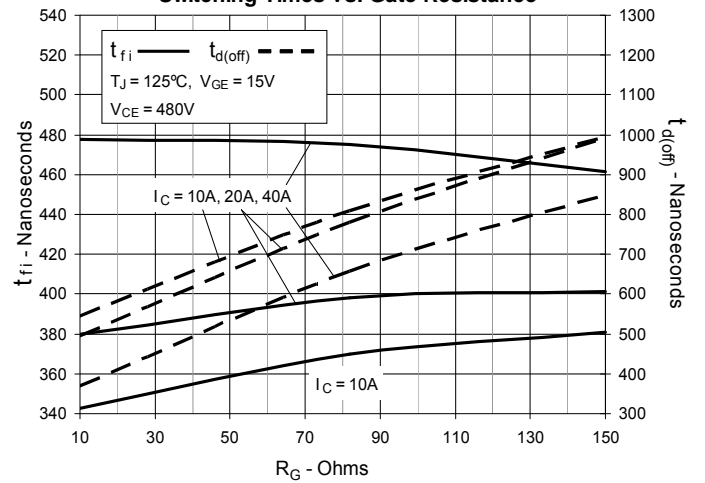
**Fig. 13. Inductive Switching
Energy Loss vs. Junction Temperature**



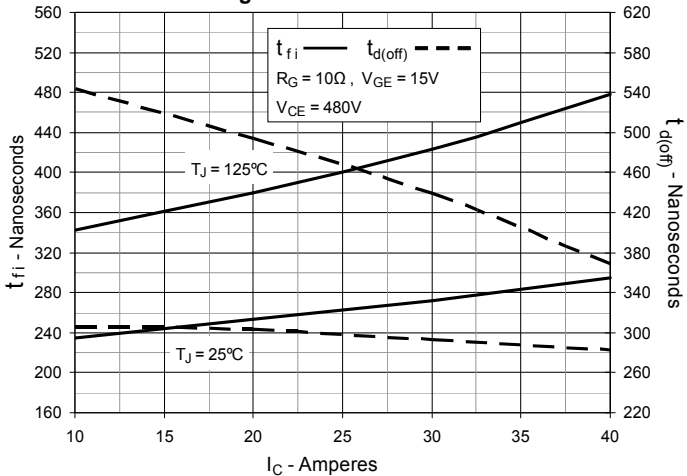
**Fig. 14. Inductive Switching
Energy Loss vs. Collector Current**



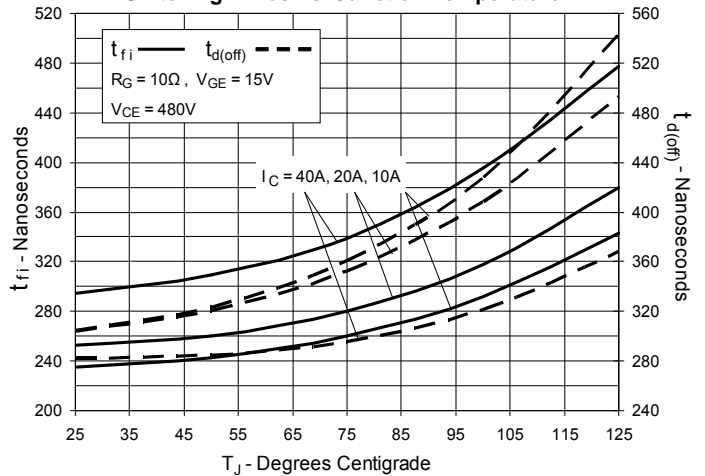
**Fig. 15. Inductive Turn-off
Switching Times vs. Gate Resistance**



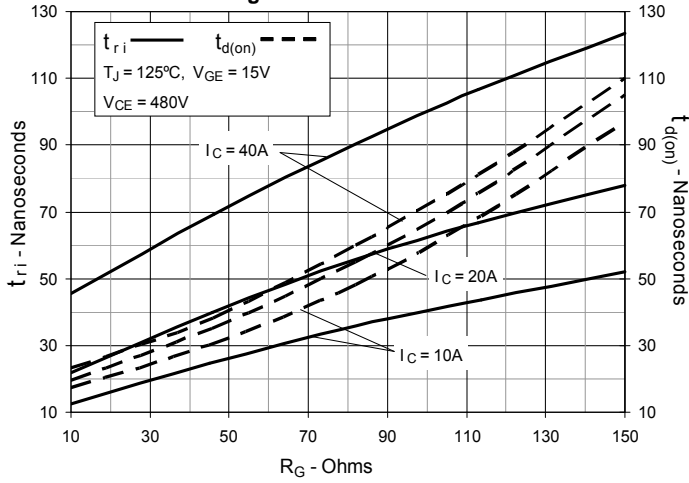
**Fig. 16. Inductive Turn-off
Switching Times vs. Collector Current**



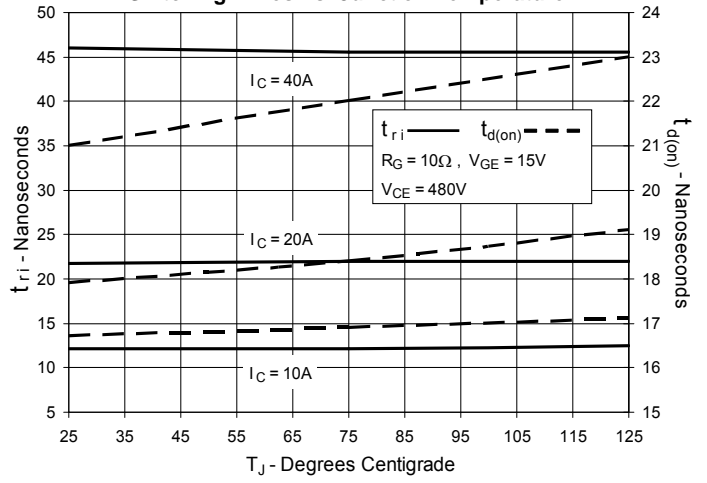
**Fig. 17. Inductive Turn-off
Switching Times vs. Junction Temperature**



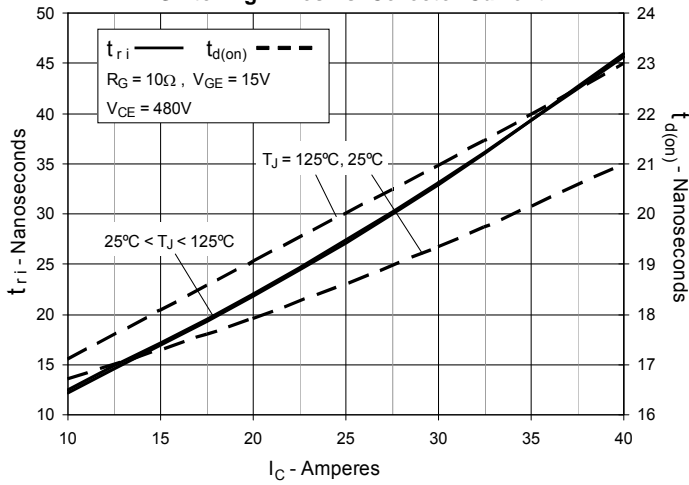
**Fig. 18. Inductive Turn-on
Switching Times vs. Gate Resistance**



**Fig. 19. Inductive Turn-on
Switching Times vs. Junction Temperature**



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





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