

# High Voltage, High Gain BIMOSFET™ Monolithic Bipolar MOS Transistor

## IXBT20N360HV IXBH20N360HV



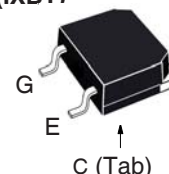
$$V_{CES} = 3600V$$

$$I_{C110} = 20A$$

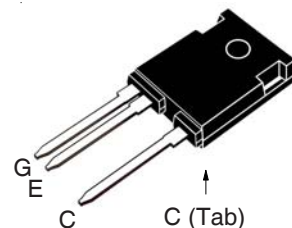
$$V_{CE(sat)} \leq 3.4V$$

Symbol	Test Conditions	Maximum Ratings	
$V_{CES}$	$T_J = 25^\circ C$ to $150^\circ C$	3600	V
$V_{CGR}$	$T_J = 25^\circ C$ to $150^\circ C$ , $R_{GE} = 1M\Omega$	3600	V
$V_{GES}$	Continuous	$\pm 20$	V
$V_{GEM}$	Transient	$\pm 30$	V
$I_{C25}$	$T_C = 25^\circ C$	70	A
$I_{C110}$	$T_C = 110^\circ C$	20	A
$I_{CM}$	$T_C = 25^\circ C$ , 1ms	220	A
<b>SSOA</b> <b>(RBSOA)</b>	$V_{GE} = 15V$ , $T_{VJ} = 125^\circ C$ , $R_G = 10\Omega$ Clamped Inductive Load	$I_{CM} = 160$ $V_{CES} \leq 1500$	A V
<b><math>T_{SC}</math></b> <b>(SCSOA)</b>	$V_{GE} = 15V$ , $T_J = 125^\circ C$ , $R_G = 52\Omega$ , $V_{CE} = 1500V$ , Non-Repetitive	10	$\mu s$
$P_C$	$T_C = 25^\circ C$	430	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	$^\circ C$
$T_{SOLD}$	Plastic Body for 10s	260	$^\circ C$
$M_d$	Mounting Torque (TO-247HV)	1.13/10	Nm/lb.in
<b>Weight</b>	TO-268HV	4	g
	TO-247HV	6	g

TO-268HV (IXBT)



TO-247HV (IXBH)



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

### Features

- High Voltage Packages
- High Blocking Voltage
- High Peak Current Capability
- Low Saturation Voltage

### Advantages

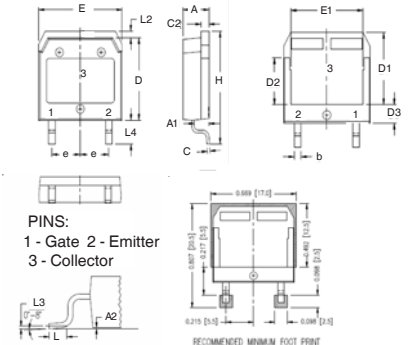
- Low Gate Drive Requirement
- High Power Density

### Applications

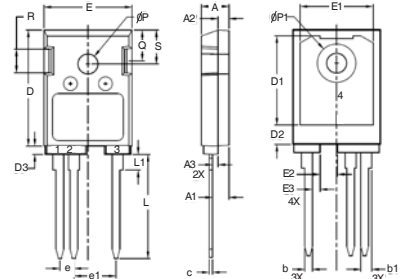
- Switch-Mode and Resonant-Mode Power Supplies
- Uninterruptible Power Supplies (UPS)
- Laser Generators
- Capacitor Discharge Circuits
- AC Switches

Symbol	Test Conditions ( $T_J = 25^\circ C$ Unless Otherwise Specified)	Characteristic Values		
		Min.	Typ.	Max.
$BV_{CES}$	$I_C = 250\mu A$ , $V_{GE} = 0V$	3600		V
$V_{GE(th)}$	$I_C = 250\mu A$ , $V_{CE} = V_{GE}$	3.0		5.0 V
$I_{CES}$	$V_{CE} = V_{CES}$ , $V_{GE} = 0V$ $T_J = 125^\circ C$			25 $\mu A$ 500 $\mu A$
$I_{GES}$	$V_{CE} = 0V$ , $V_{GE} = \pm 20V$			$\pm 100$ nA
$V_{CE(sat)}$	$I_C = 20A$ , $V_{GE} = 15V$ , Note 1 $T_J = 125^\circ C$		2.9 3.6	3.4 V V

Symbol Test Conditions		Characteristic Values		
(T <sub>J</sub> = 25°C Unless Otherwise Specified)		Min.	Typ.	Max.
<b>g<sub>fs</sub></b>	I <sub>C</sub> = 20A, V <sub>CE</sub> = 10V, Note 1	10	17	S
<b>C<sub>ies</sub></b>	V <sub>CE</sub> = 25V, V <sub>GE</sub> = 0V, f = 1MHz		2045	pF
<b>C<sub>oes</sub></b>		110	pF	
<b>C<sub>res</sub></b>		50	pF	
<b>Q<sub>g(on)</sub></b>	I <sub>C</sub> = 20A, V <sub>GE</sub> = 15V, V <sub>CE</sub> = 1000V		110	nC
<b>Q<sub>ge</sub></b>		13	nC	
<b>Q<sub>gc</sub></b>		43	nC	
<b>t<sub>d(on)</sub></b>	<b>Inductive load, T<sub>J</sub> = 25°C</b> I <sub>C</sub> = 20A, V <sub>GE</sub> = 15V V <sub>CE</sub> = 1500V, R <sub>G</sub> = 10Ω Note 2		18	ns
<b>t<sub>ri</sub></b>		14	ns	
<b>E<sub>on</sub></b>		15.50	mJ	
<b>t<sub>d(off)</sub></b>		238	ns	
<b>t<sub>fi</sub></b>		206	ns	
<b>E<sub>off</sub></b>		4.30	mJ	
<b>t<sub>d(on)</sub></b>	<b>Inductive load, T<sub>J</sub> = 125°C</b> I <sub>C</sub> = 20A, V <sub>GE</sub> = 15V V <sub>CE</sub> = 1500V, R <sub>G</sub> = 10Ω Note 2		20	ns
<b>t<sub>ri</sub></b>		22	ns	
<b>E<sub>on</sub></b>		16.10	mJ	
<b>t<sub>d(off)</sub></b>		247	ns	
<b>t<sub>fi</sub></b>		216	ns	
<b>E<sub>off</sub></b>		4.15	mJ	
<b>t<sub>d(on)</sub></b>	<b>Resistive load, T<sub>J</sub> = 25°C</b> I <sub>C</sub> = 20A, V <sub>GE</sub> = 15V V <sub>CE</sub> = 960V, R <sub>G</sub> = 10Ω		30	ns
<b>t<sub>r</sub></b>		325	ns	
<b>t<sub>d(off)</sub></b>		165	ns	
<b>t<sub>f</sub></b>		1045	ns	
<b>t<sub>d(on)</sub></b>	<b>Resistive load, T<sub>J</sub> = 125°C</b> I <sub>C</sub> = 20A, V <sub>GE</sub> = 15V V <sub>CE</sub> = 960V, R <sub>G</sub> = 10Ω		32	ns
<b>t<sub>r</sub></b>		890	ns	
<b>t<sub>d(off)</sub></b>		185	ns	
<b>t<sub>f</sub></b>		1100	ns	
<b>R<sub>thJC</sub></b>	TO-247HV			0.29°C/W
<b>R<sub>thCS</sub></b>		0.21	°C/W	

**TO-268HV Outline**

**PINS:**  
 1 - Gate 2 - Emitter  
 3 - Collector

SYM	INCHES		MILLIMETER	
	MIN	MAX	MIN	MAX
A	.193	.201	4.90	5.10
A1	.106	.114	2.70	2.90
A2	.001	.010	0.02	0.25
b	.045	.057	1.15	1.45
C	.016	.026	0.40	0.65
C2	.057	.063	1.45	1.60
D	.543	.551	13.80	14.00
D1	.465	.476	11.80	12.10
D2	.295	.307	7.50	7.80
D3	.114	.126	2.90	3.20
E	.624	.632	15.85	16.05
E1	.524	.535	13.30	13.60
E	.215	BSC	5.45	BSC
H	.736	.752	18.70	19.10
L	.067	.079	1.70	2.00
L2	.039	.045	1.00	1.15
L3	.010	BSC	0.25	BSC
L4	.150	.161	3.80	4.10

**TO-247HV Outline**

**PINS:**  
 1 - Gate 2 - Emitter  
 3, 4 - Collector

SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.193	.201	4.90	5.10
A1	.114	.122	2.90	3.10
A2	.075	.083	1.90	2.10
A3	.035	.043	0.90	1.10
b	.053	.059	1.35	1.50
b1	.075	.083	1.90	2.10
c	.022	.030	0.55	0.75
D	.819	.843	20.80	21.40
D1	.638	.646	16.20	16.40
D2	.134	.146	3.40	3.70
D3	.055	.063	1.40	1.60
E	.622	.638	15.80	16.20
E1	.520	.528	13.20	13.40
E2	.118	.126	3.00	3.20
E3	.051	.059	1.30	1.50
e	.100	BSC	2.54	BSC
e1	.300	BSC	7.62	BSC
L	.732	.748	18.60	19.00
L1	.106	.118	2.70	3.00
∅P	.138	.142	3.50	3.60
∅P1	.272	.280	6.90	7.10
Q	.216	.224	5.50	5.70
R	.165	.169	4.20	4.30
S	.240	.248	6.10	6.30

**Reverse Diode**

Symbol Test Conditions		Characteristic Values		
(T <sub>J</sub> = 25°C Unless Otherwise Specified)		Min.	Typ.	Max
<b>V<sub>F</sub></b>	I <sub>F</sub> = 20A, V <sub>GE</sub> = 0V, Note 1			3.5 V
<b>t<sub>rr</sub></b>	I <sub>F</sub> = 10A, V <sub>GE</sub> = 0V, -di <sub>F</sub> /dt = 100A/μs V <sub>R</sub> = 100V, V <sub>GE</sub> = 0V		1.7	μs
<b>I<sub>RM</sub></b>		35	A	
<b>Q<sub>RM</sub></b>		30	μC	

- Note: 1. Pulse test, t ≤ 300μs, duty cycle, d ≤ 2%.  
 2. Switching times & energy losses may increase for higher V<sub>CE</sub>(clamp), T<sub>J</sub> or R<sub>G</sub>.

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

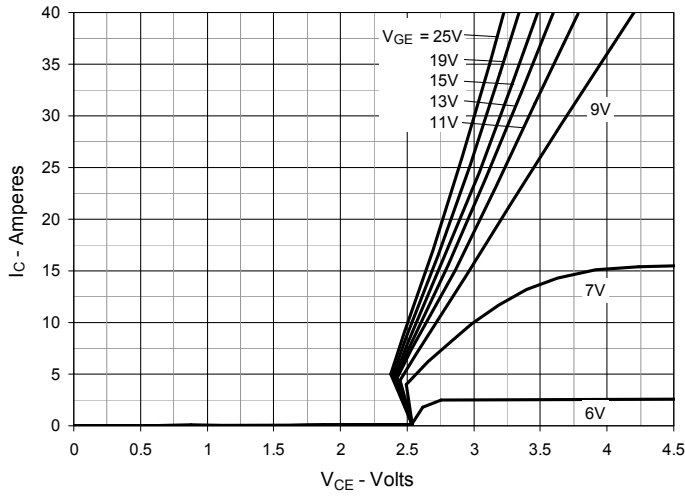


Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$

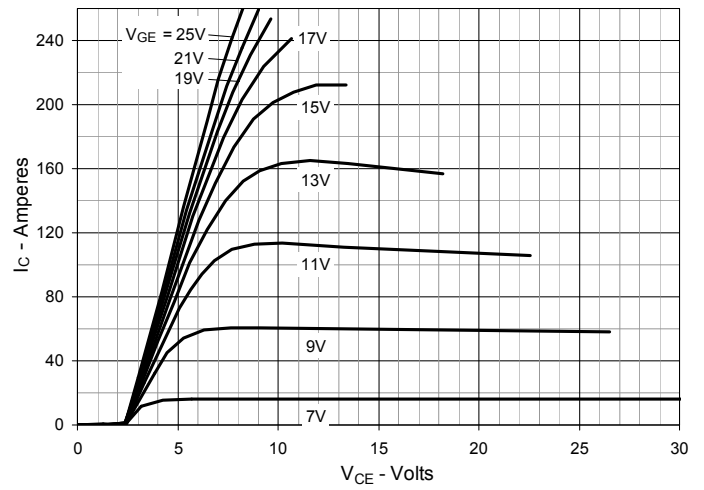


Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$

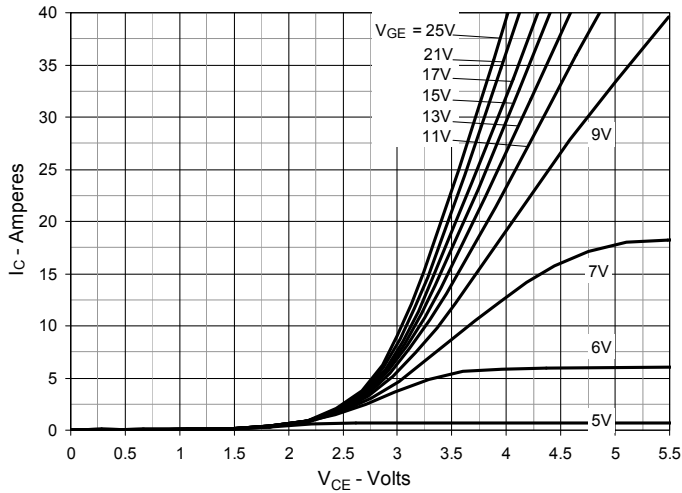


Fig. 4. Dependence of  $V_{CE(sat)}$  on Junction Temperature

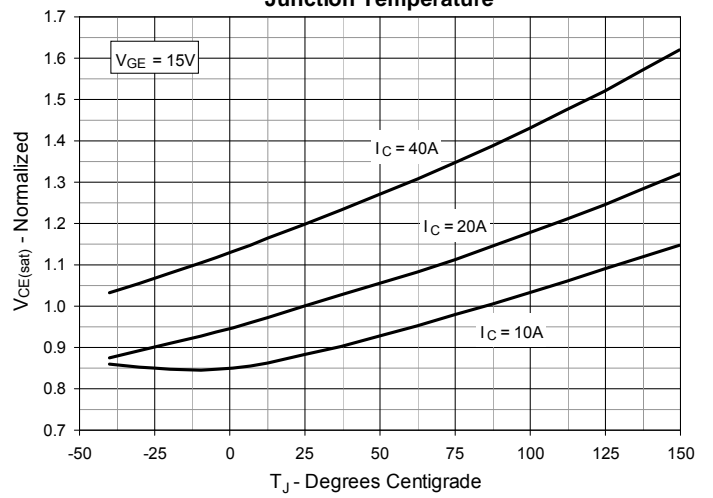


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter Voltage

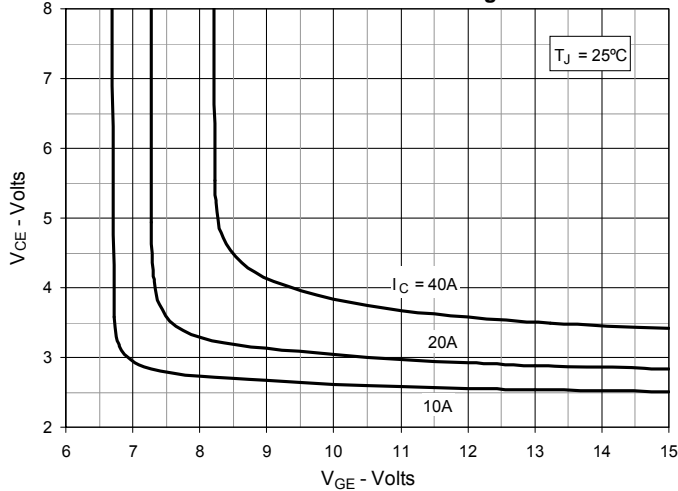
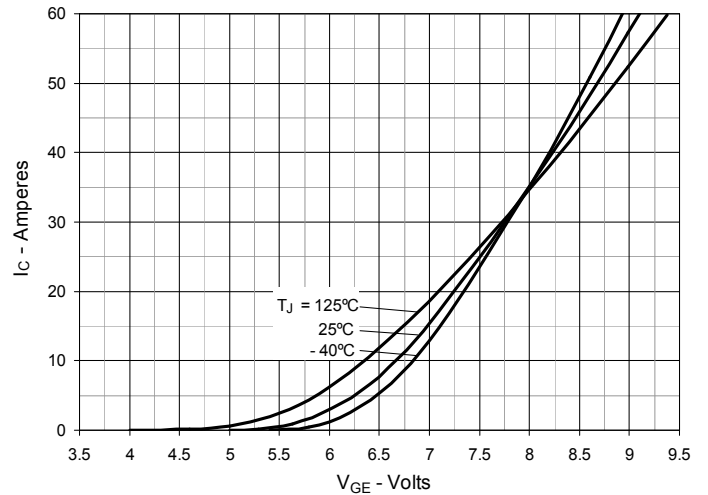
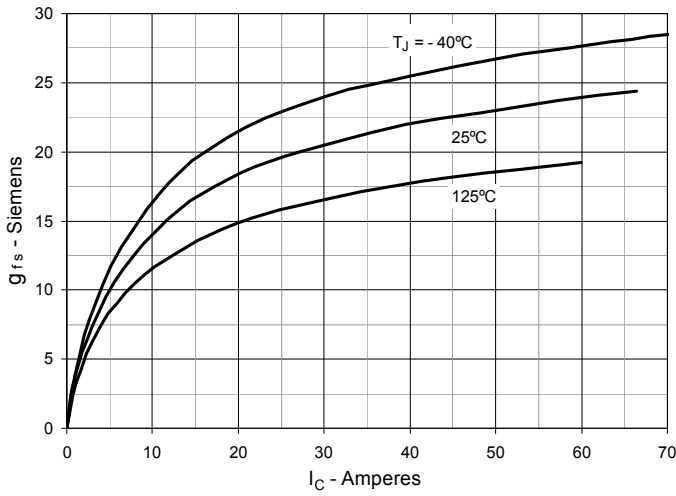


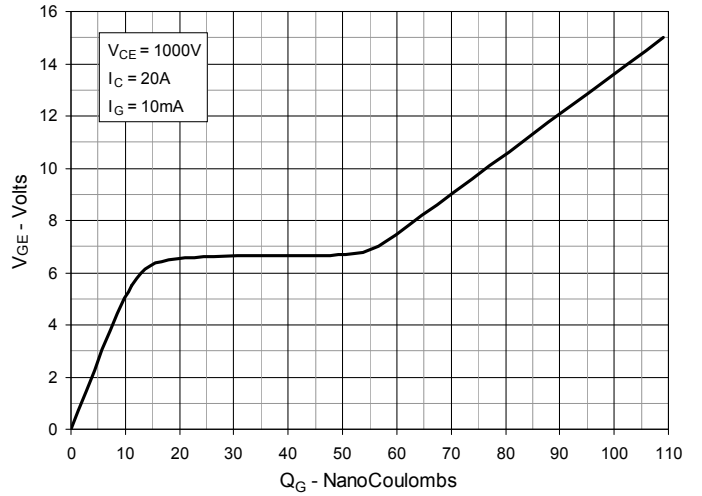
Fig. 6. Input Admittance



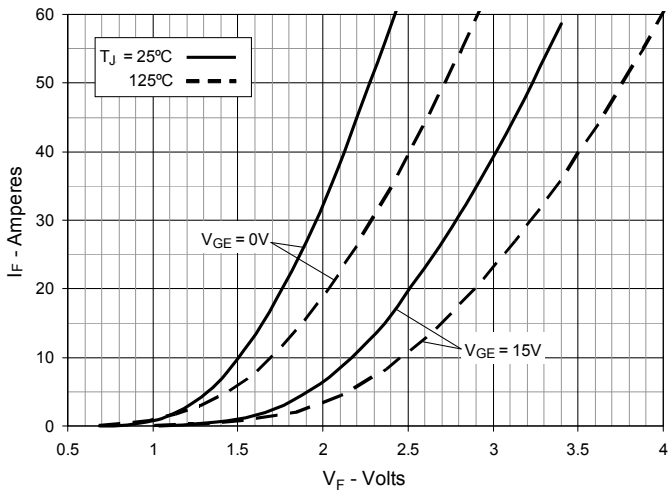
**Fig. 7. Transconductance**



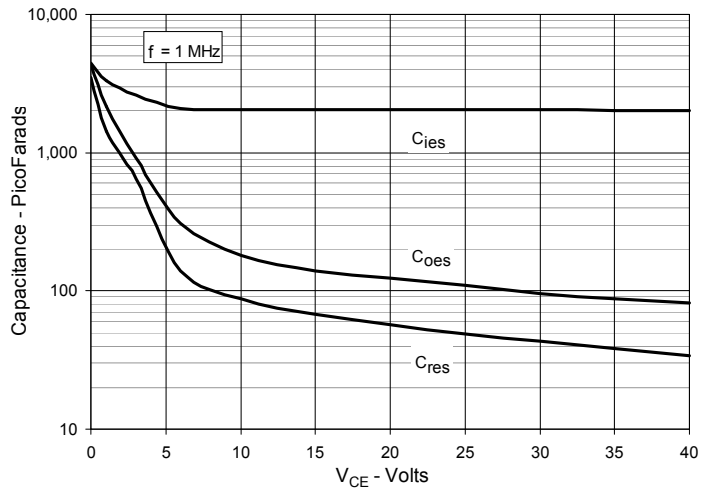
**Fig. 8. Gate Charge**



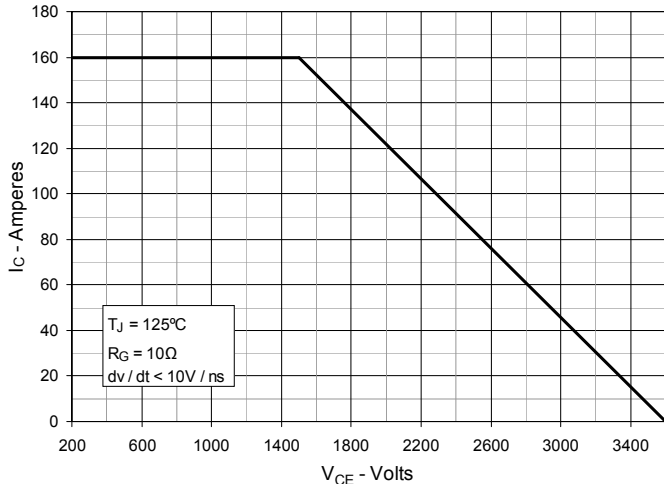
**Fig. 9. Forward Voltage Drop of Intrinsic Diode**



**Fig. 10. Capacitance**



**Fig. 11. Reverse-Bias Safe Operating Area**



**Fig. 12. Maximum Transient Thermal Impedance**

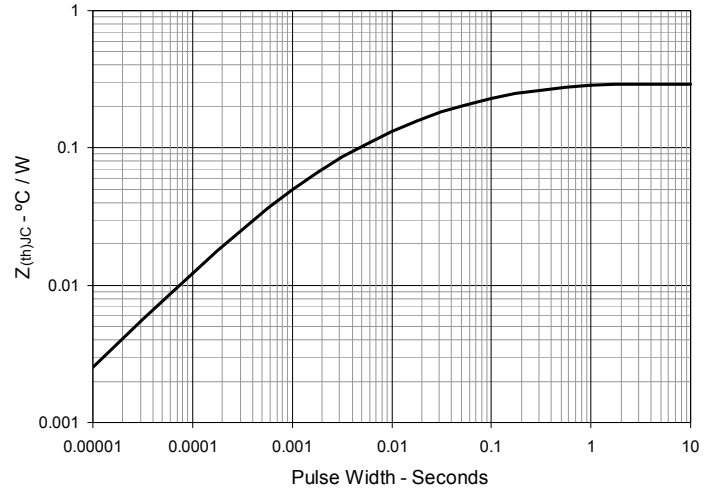


Fig. 13. Forward-Bias Safe Operating Area @  $T_C = 25^\circ\text{C}$

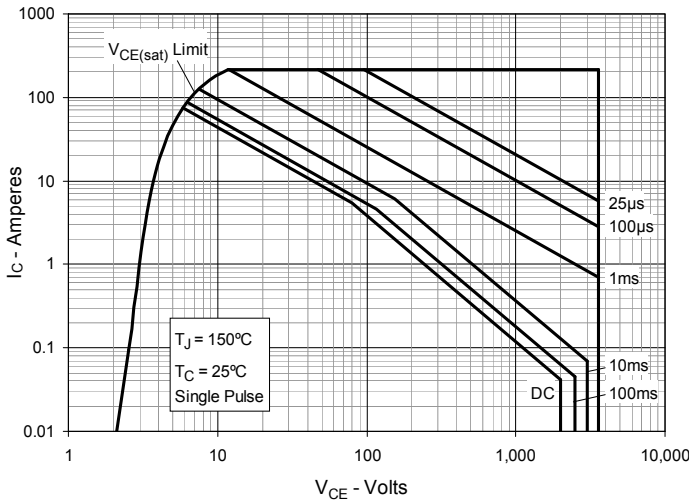


Fig. 14. Forward-Bias Safe Operating Area @  $T_C = 75^\circ\text{C}$

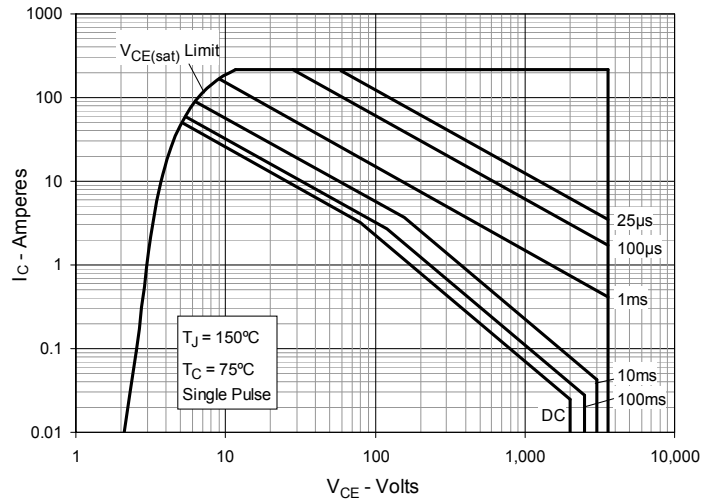


Fig. 15. Inductive Switching Energy Loss vs. Gate Resistance

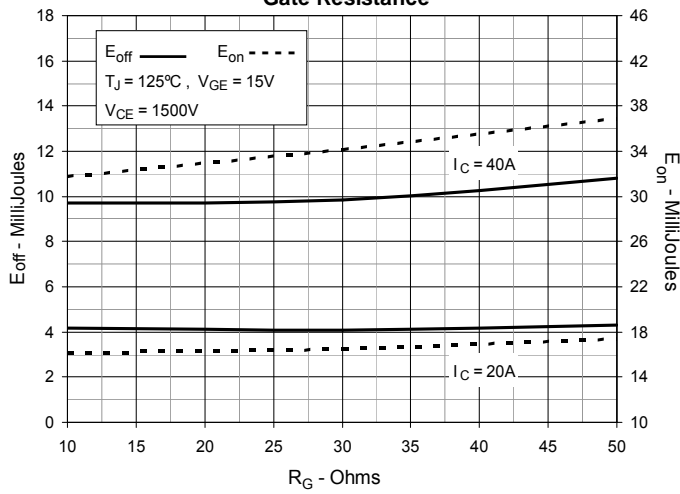


Fig. 16. Inductive Switching Energy Loss vs. Collector Current

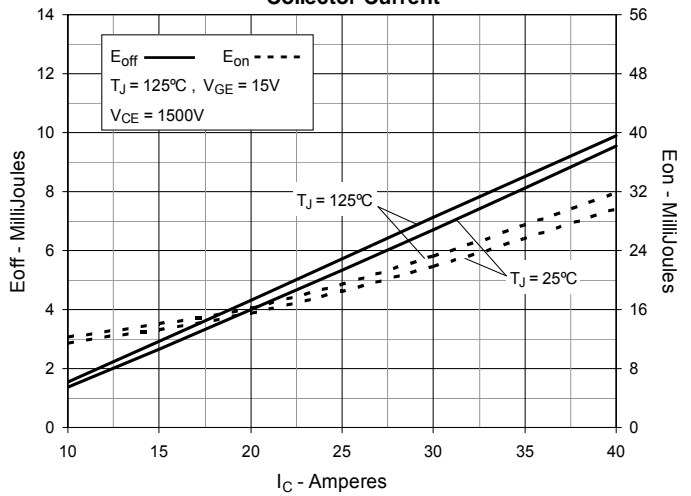


Fig. 17. Inductive Switching Energy Loss vs. Junction Temperature

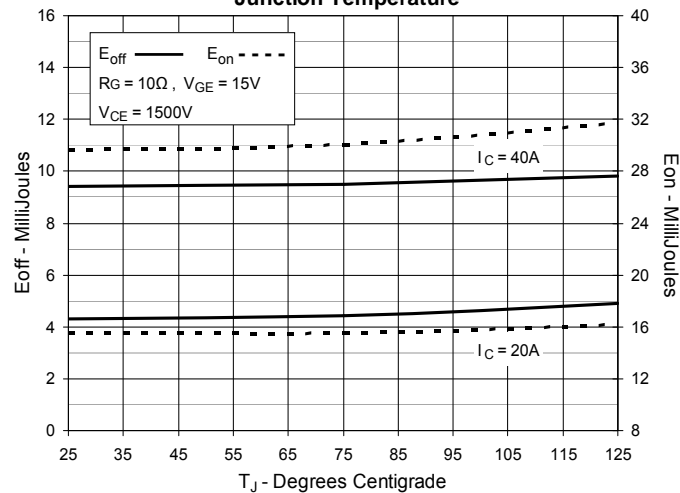
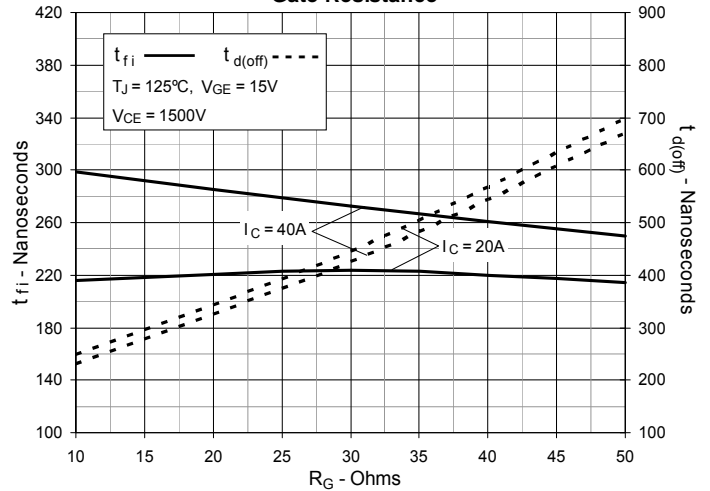
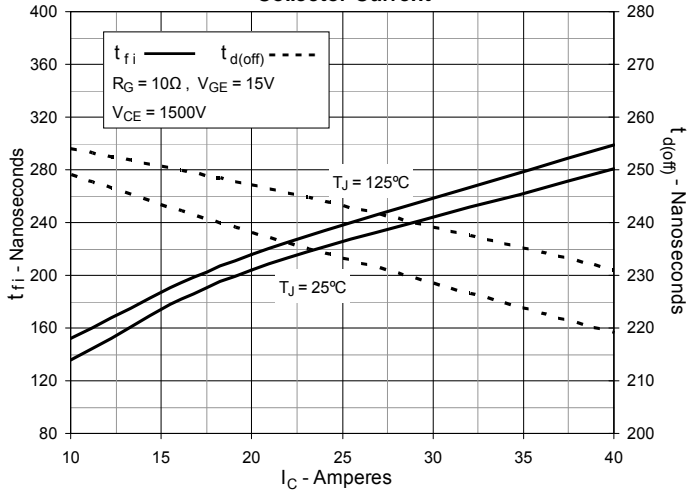


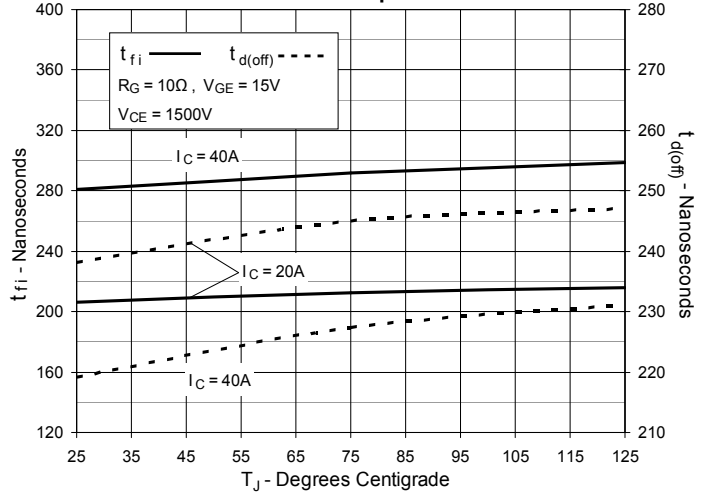
Fig. 18. Inductive Turn-off Switching Times vs. Gate Resistance



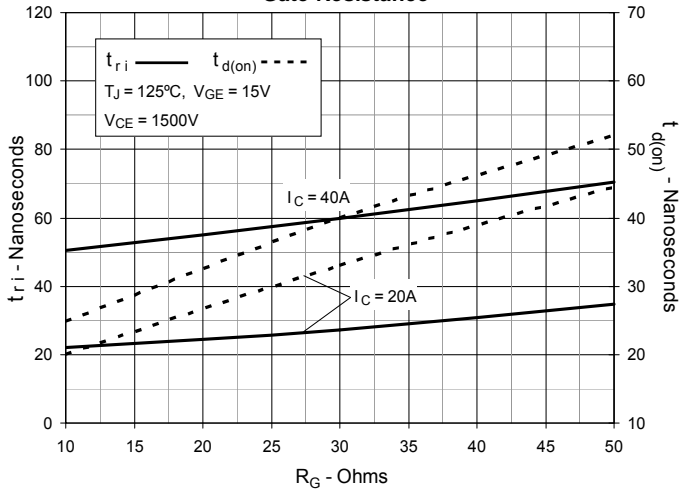
**Fig. 19. Inductive Turn-off Switching Times vs. Collector Current**



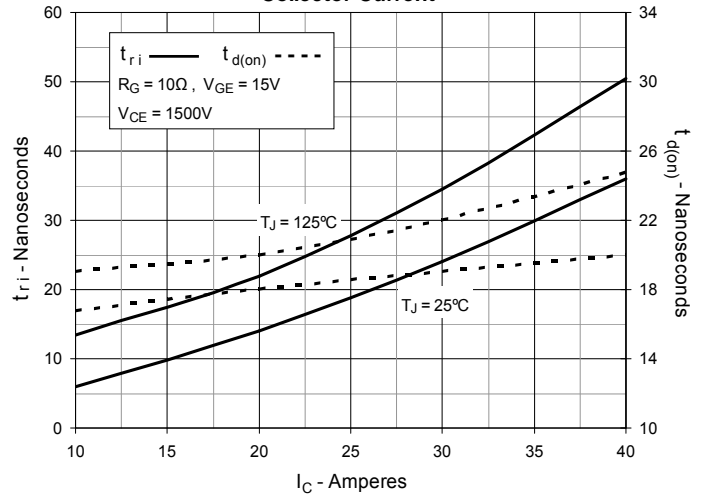
**Fig. 20. Inductive Turn-off Switching Times vs. Junction Temperature**



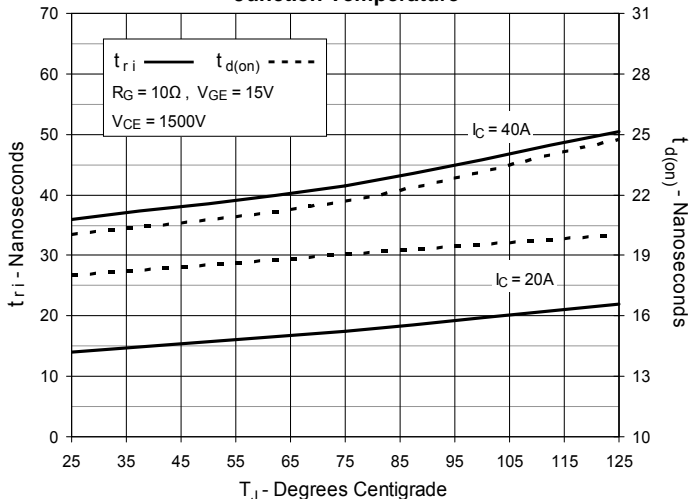
**Fig. 21. Inductive Turn-on Switching Times vs. Gate Resistance**



**Fig. 22. Inductive Turn-on Switching Times vs. Collector Current**



**Fig. 23. Inductive Turn-on Switching Times vs. Junction Temperature**





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