

# High Voltage, High Frequency, BiMOSFET™ Monolithic Bipolar MOS Transistor

## IXBF20N360



$$V_{CES} = 3600V$$

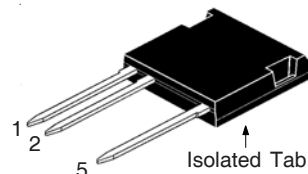
$$I_{C110} = 18A$$

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

(Electrically Isolated Tab)

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
$I_{C25}$	$T_C = 25^\circ C$	45	A
$I_{C110}$	$T_C = 110^\circ C$	18	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	$\mu s$
$P_C$	$T_C = 25^\circ C$	230	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	$^\circ C$
$F_C$	Mounting Force with Clip	20..120 / 4.5..27	N/lb
$V_{ISOL}$	50/60Hz, 5 Seconds	4000	V~
<b>Weight</b>		8	g

### ISOPLUS i4-Pak™



1 = Gate  
2 = Emitter  
5 = Collector

### Features

- Silicon Chip on Direct-Copper Bond (DCB) Substrate
- Isolated Mounting Surface
- 4000V~ Electrical Isolation
- High Blocking Voltage
- High Frequency Operation

### Advantages

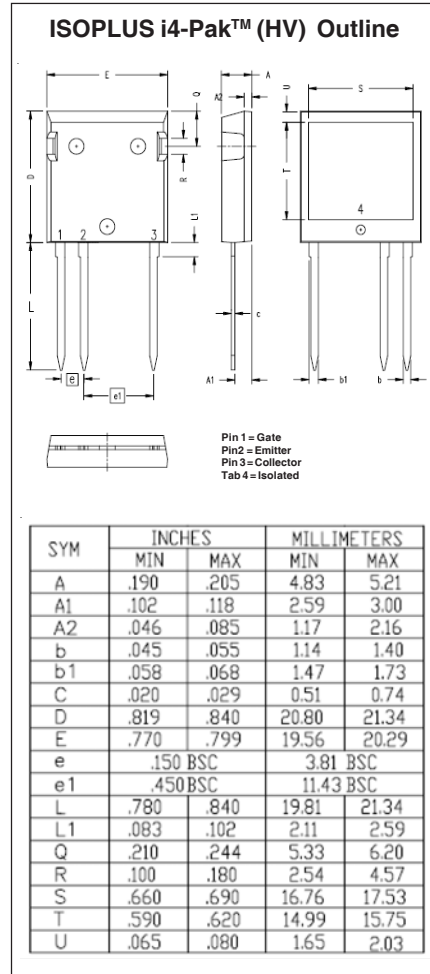
- Low Gate Drive Requirement
- High Power Density

### 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
$I_{CES}$	$V_{CE} = 3000V$ , $V_{GE} = 0V$ Note 2, $T_J = 125^\circ C$		125	25 $\mu A$ $\mu A$
$I_{GES}$	$V_{CE} = 0V$ , $V_{GE} = \pm 20V$			$\pm 200$ nA
$V_{CE(SAT)}$	$I_C = 20A$ , $V_{GE} = 15V$ , Note 1 $T_J = 125^\circ C$		2.9	3.4 V
			3.6	V

Symbol	Test Conditions ( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified)	Characteristic Values		
		Min.	Typ.	Max.
$g_{fs}$	$I_C = 20\text{A}, V_{CE} = 10\text{V}$ , Note 1	10	17	S
$C_{ies}$	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$		2045	pF
$C_{oes}$			110	pF
$C_{res}$			50	pF
$Q_{g(on)}$	$I_C = 20\text{A}, V_{GE} = 15\text{V}, V_{CE} = 1000\text{V}$		110	nC
$Q_{ge}$			13	nC
$Q_{gc}$			43	nC
$t_{d(on)}$	<b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b> $I_C = 20\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 1500\text{V}, R_G = 10\Omega$ Note 3		18	ns
$t_{ri}$			14	ns
$E_{on}$			15.50	mJ
$t_{d(off)}$			238	ns
$t_{fi}$			206	ns
$E_{off}$			4.30	mJ
$t_{d(on)}$	<b>Inductive load, <math>T_J = 125^\circ\text{C}</math></b> $I_C = 20\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 1500\text{V}, R_G = 10\Omega$ Note 3		20	ns
$t_{ri}$			22	ns
$E_{on}$			16.10	mJ
$t_{d(off)}$			247	ns
$t_{fi}$			216	ns
$E_{off}$			4.15	mJ
$t_{d(on)}$	<b>Resistive load, <math>T_J = 25^\circ\text{C}</math></b> $I_C = 20\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 960\text{V}, R_G = 10\Omega$		30	ns
$t_r$			325	ns
$t_{d(off)}$			165	ns
$t_f$			1045	ns
$t_t$				ns
$t_{d(on)}$	<b>Resistive load, <math>T_J = 125^\circ\text{C}</math></b> $I_C = 20\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 960\text{V}, R_G = 10\Omega$		32	ns
$t_r$			890	ns
$t_{d(off)}$			185	ns
$t_f$			1100	ns
$t_t$				ns
$R_{thJC}$				0.54 $^\circ\text{C/W}$
$R_{thCS}$		0.15		$^\circ\text{C/W}$



## Reverse Diode

Symbol	Test Conditions ( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified)	Characteristic Values		
		Min.	Typ.	Max
$V_F$	$I_F = 20\text{A}, V_{GE} = 0\text{V}$ , Note 1			3.5 V
$t_{rr}$	$I_F = 10\text{A}, V_{GE} = 0\text{V}, -di_F/dt = 100\text{A}/\mu\text{s}$ $V_R = 100\text{V}, V_{GE} = 0\text{V}$		1.7	$\mu\text{s}$
$I_{RM}$			35	A
$Q_{RM}$			30	$\mu\text{C}$

## Notes:

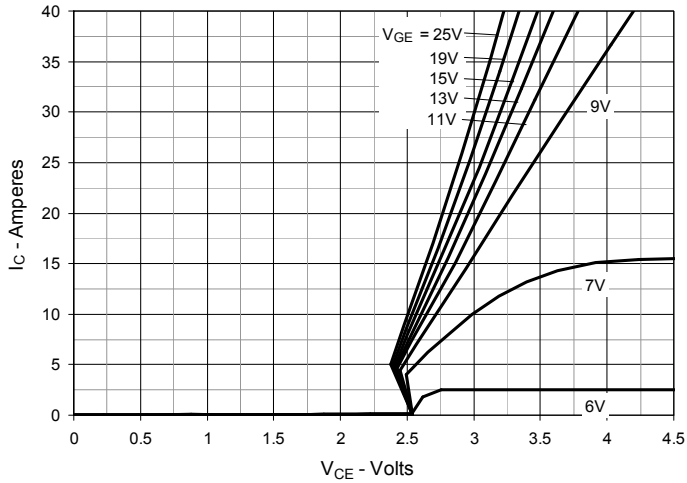
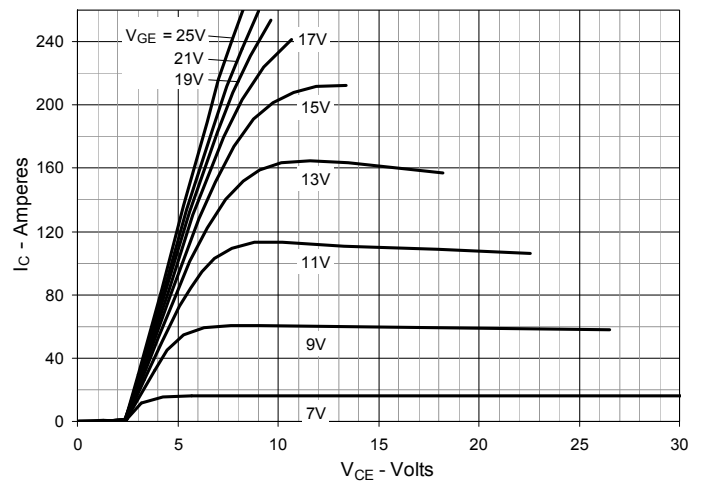
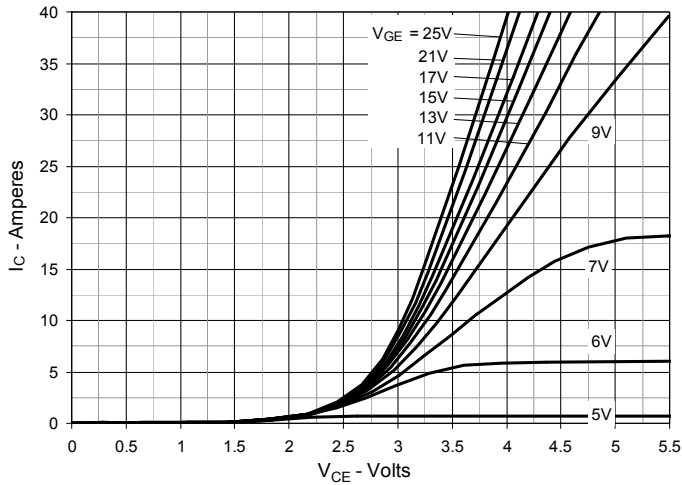
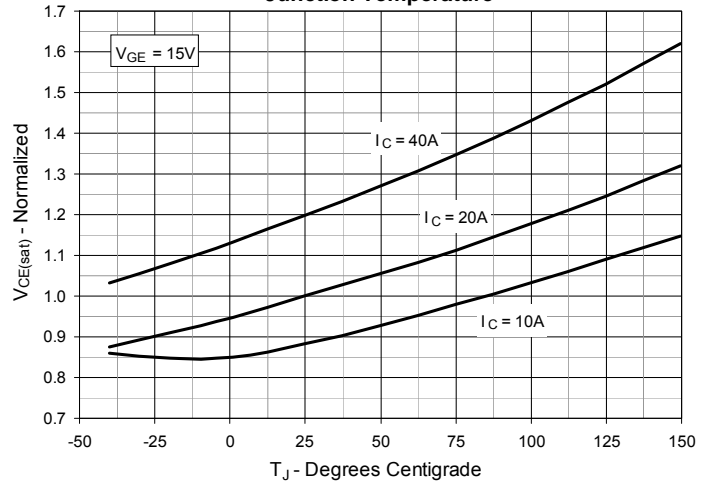
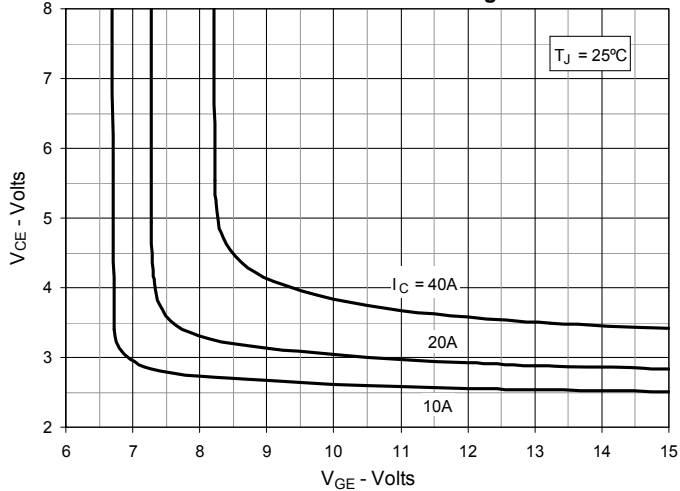
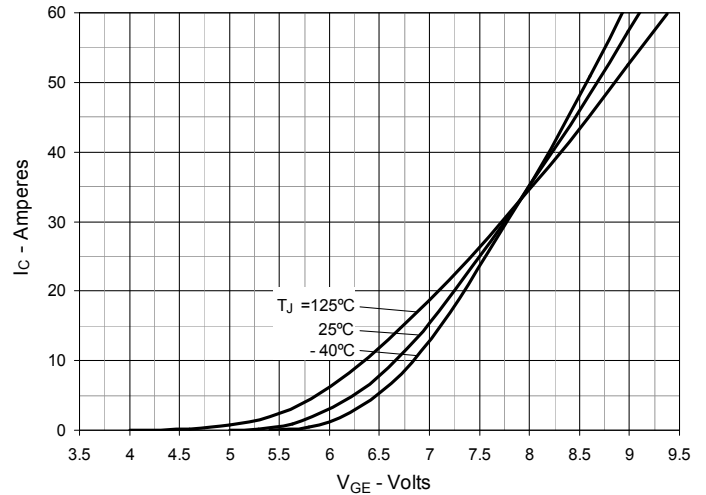
1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .
2. Device must be heatsunk for high-temperature leakage current measurements to avoid thermal runaway.
3. Switching times & energy losses may increase for higher  $V_{CE}$  (clamp),  $T_J$  or  $R_G$ .

IXYS Reserves the Right to Change Limits, Test Conditions and Dimensions.

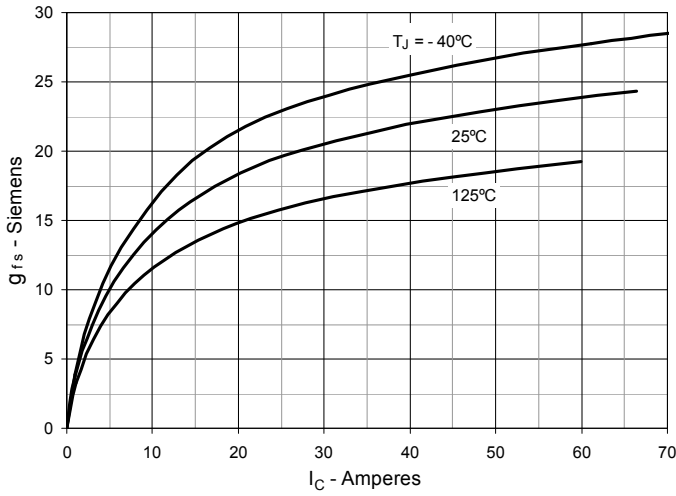
IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:	4,835,592	4,931,844	5,049,961	5,237,481	6,162,665	6,404,065 B1	6,683,344	6,727,585	7,005,734 B2	7,157,338B2
	4,860,072	5,017,508	5,063,307	5,381,025	6,259,123 B1	6,534,343	6,710,405 B2	6,759,692	7,063,975 B2	
	4,881,106	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	

## PRELIMINARY TECHNICAL INFORMATION

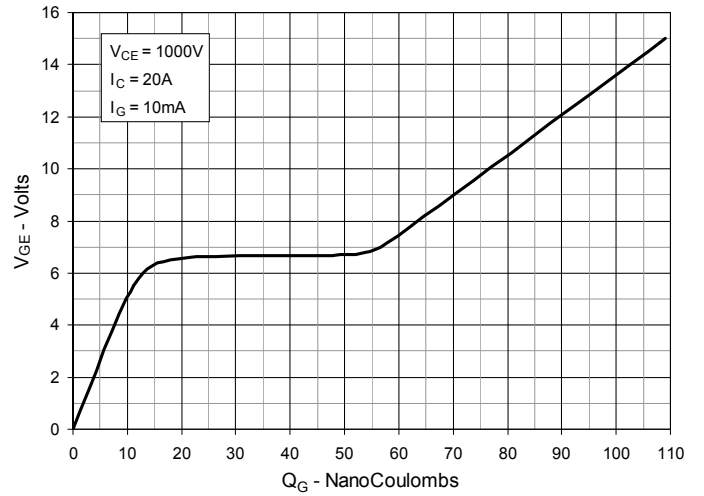
The product presented herein is under development. The Technical Specifications offered are derived from a subjective evaluation of the design, based upon prior knowledge and experience, and constitute a "considered reflection" of the anticipated result. IXYS reserves the right to change limits, test conditions, and dimensions without notice.

**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**


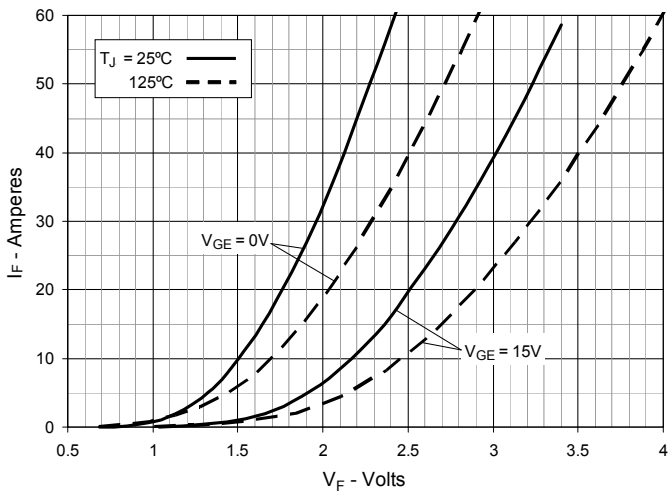
**Fig. 7. Transconductance**



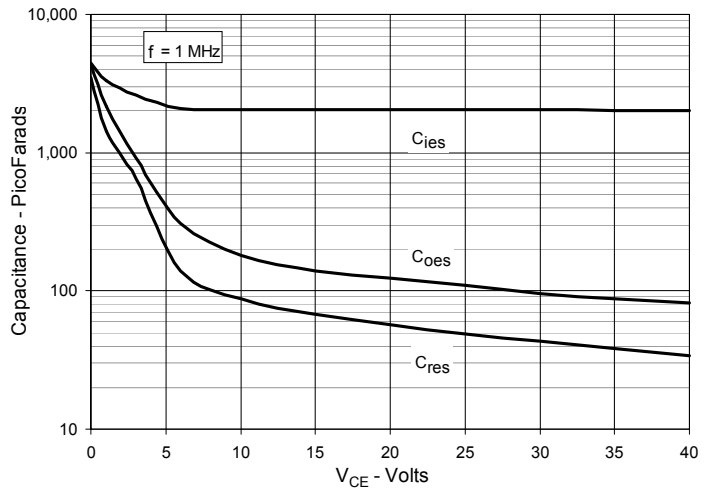
**Fig. 8. Gate Charge**



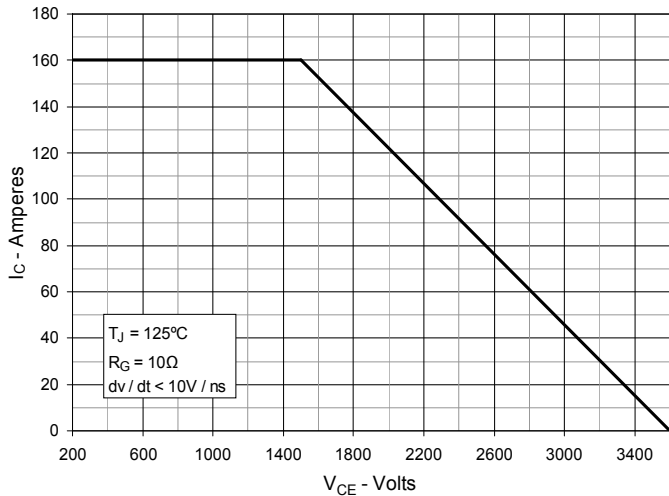
**Fig. 9. Forward Voltage Drop of Intrinsic Diode**



**Fig. 10. Capacitance**



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



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

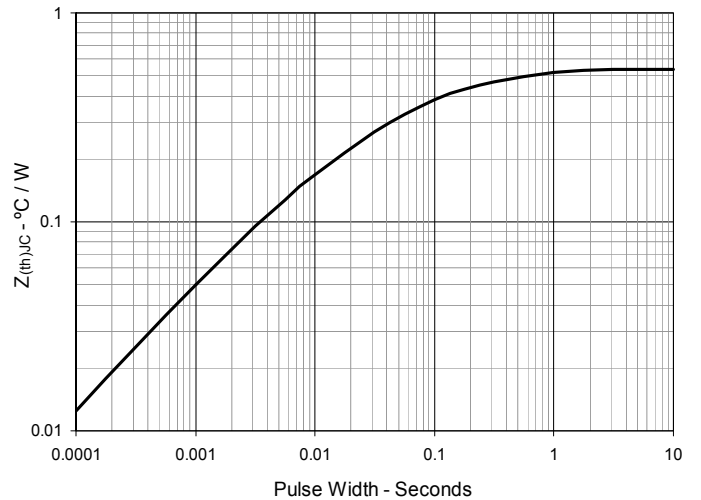


Fig. 13. Forward-Bias Safe Operating Area @  $T_C = 25^\circ\text{C}$

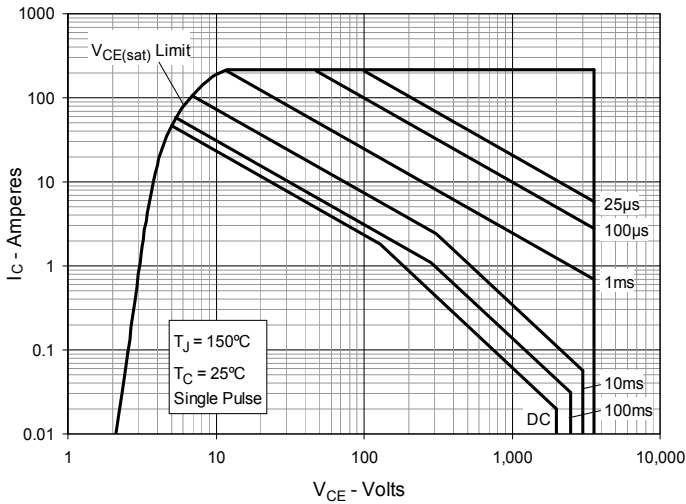


Fig. 14. Forward-Bias Safe Operating Area @  $T_C = 75^\circ\text{C}$

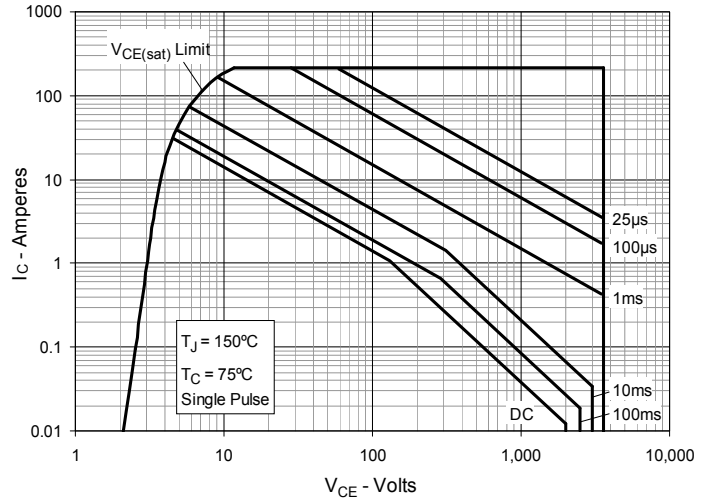


Fig. 15. Inductive Switching Energy Loss vs. Gate Resistance

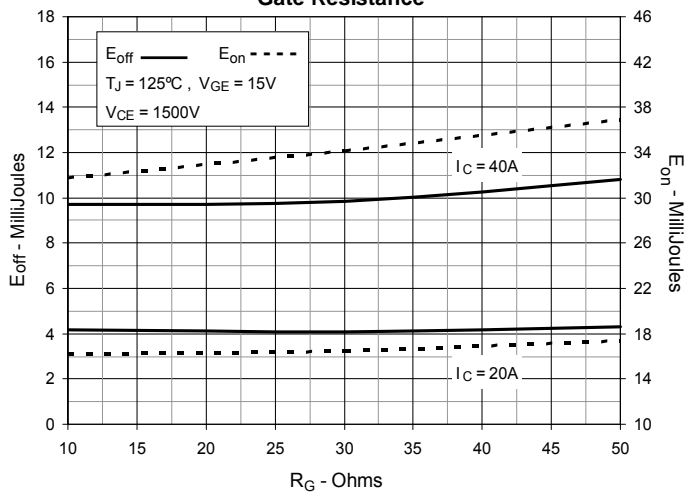


Fig. 16. Inductive Switching Energy Loss vs. Collector Current

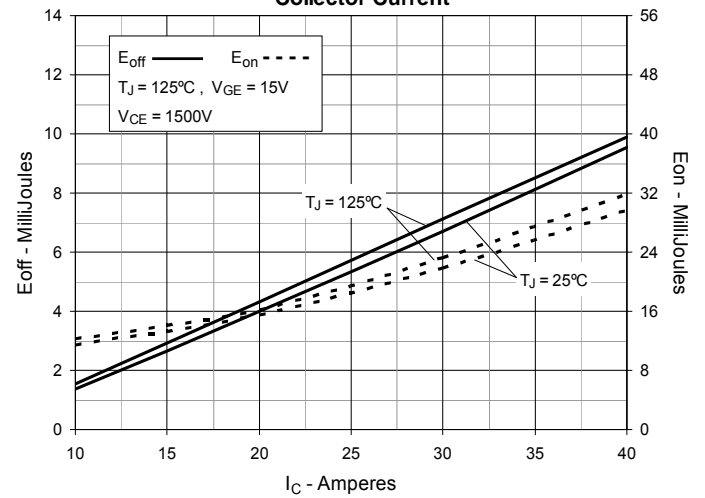


Fig. 17. Inductive Switching Energy Loss vs. Junction Temperature

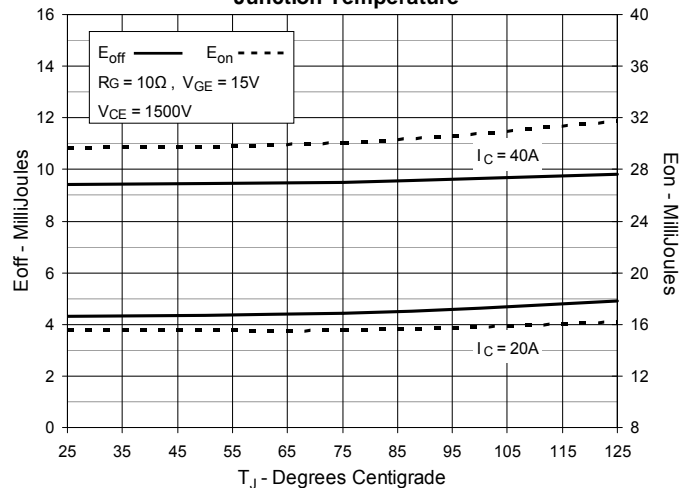
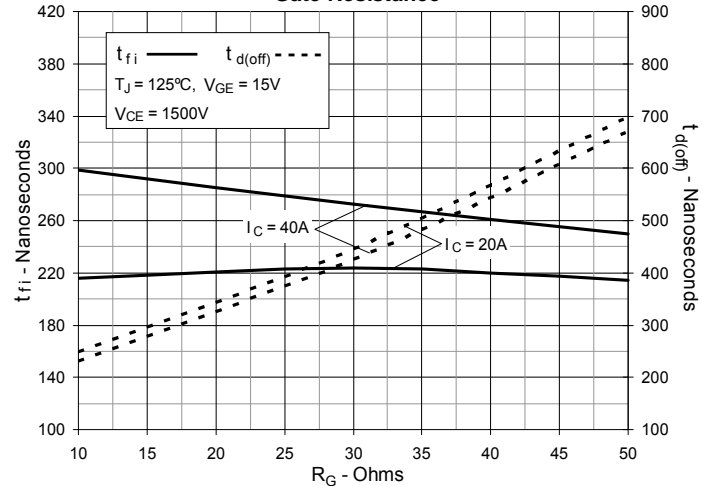
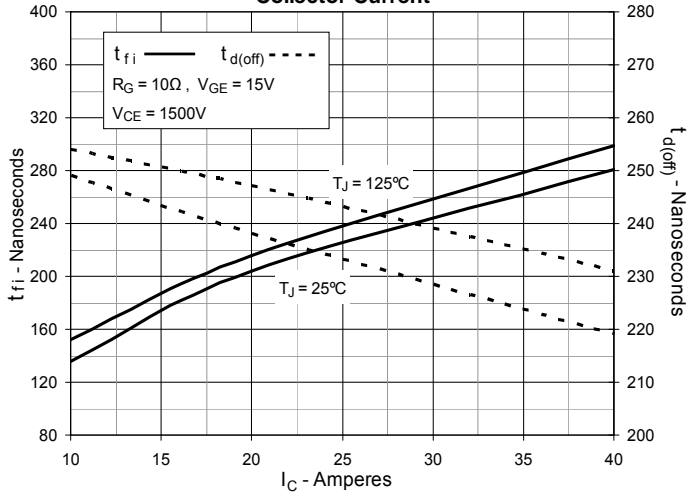
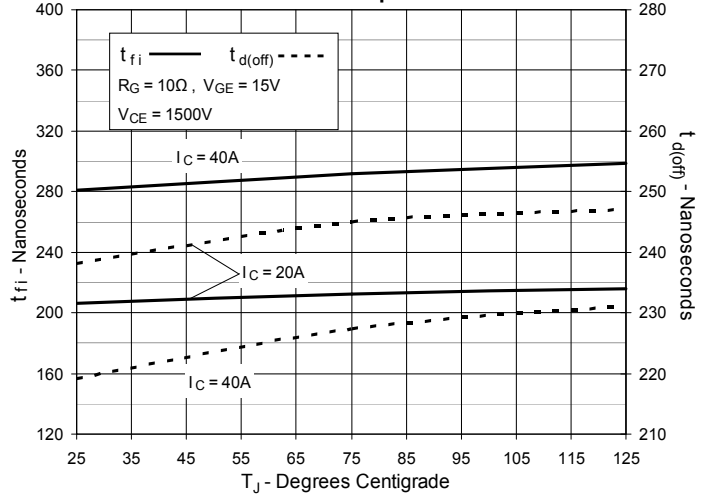
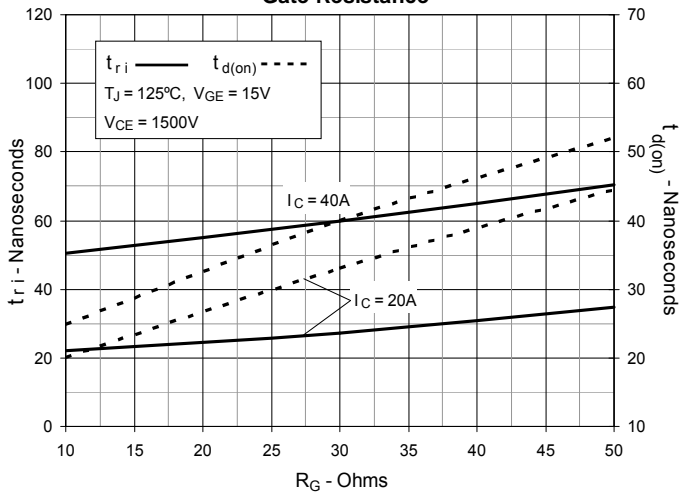
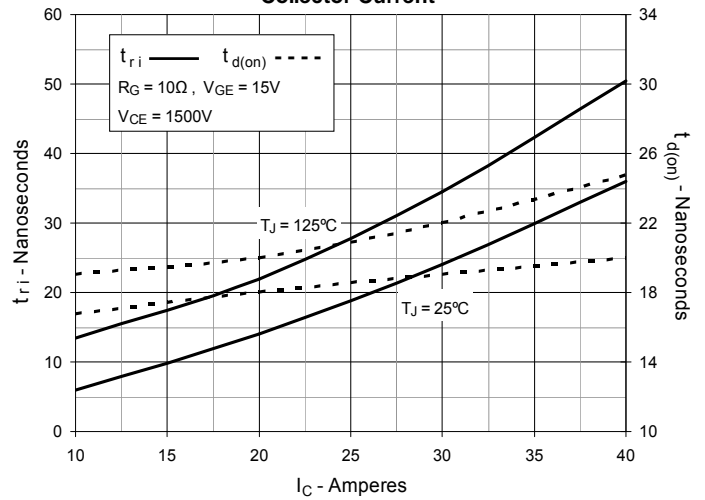
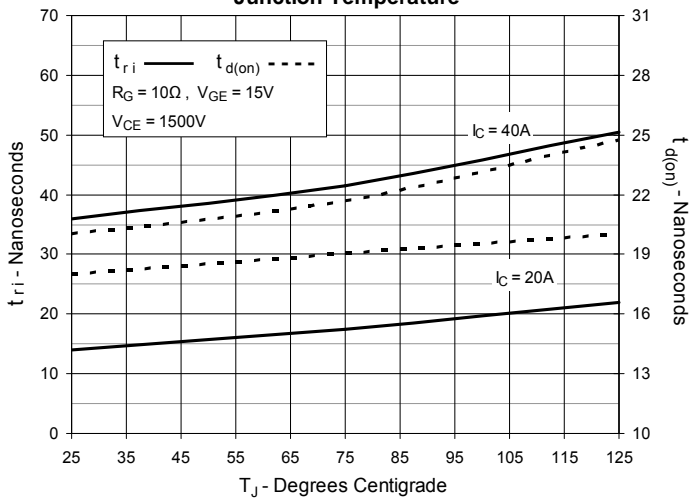


Fig. 18. Inductive Turn-off Switching Times vs. Gate Resistance



**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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