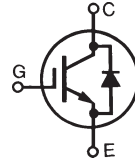


# GenX3™ 600V IGBT with Diode

## IXGH48N60C3D1

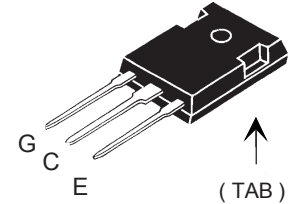
High speed PT IGBT for 40-100kHz Switching



$V_{CES} = 600V$   
 $I_{C110} = 48A$   
 $V_{CE(sat)} \leq 2.5V$   
 $t_{fi(typ)} = 38ns$

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
$I_{C25}$	$T_C = 25^\circ C$ (Limited by Leads)	75	A
$I_{C110}$	$T_C = 110^\circ C$	48	A
$I_{D110}$	$T_C = 110^\circ C$	30	A
$I_{CM}$	$T_C = 25^\circ C$ , 1ms	250	A
$I_A$	$T_C = 25^\circ C$	30	A
$E_{AS}$	$T_C = 25^\circ C$	300	mJ
<b>SSOA</b>	$V_{GE} = 15V$ , $T_{VJ} = 125^\circ C$ , $R_G = 3\Omega$	$I_{CM} = 100$	A
<b>(RBSOA)</b>	Clamped Inductive Load	@ $V_{CE} \leq 600$	V
$P_C$	$T_C = 25^\circ C$	300	W
$T_J$		-55 ... +150	$^\circ C$
$T_{JM}$		150	$^\circ C$
$T_{stg}$		-55 ... +150	$^\circ C$
$T_L$	1.6mm (0.062 in.) from Case for 10s	300	$^\circ C$
$T_{SOLD}$	Plastic Body for 10 Seconds	260	$^\circ C$
$F_C$	Mounting Torque	1.13/10	Nm/lb.in
<b>Weight</b>		6	g

TO-247



G = Gate      C = Collector  
 E = Emitter    TAB = Collector

### Features

- Optimized for Low Switching Losses
- Square RBSOA
- Anti-Parallel Ultra Fast Diode
- Fast Switching
- Avalanche Rated
- International Standard Package

### Advantages

- High Power Density
- Low Gate Drive Requirement

### Applications

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

Symbol	Test Conditions ( $T_J = 25^\circ C$ , Unless Otherwise Specified)	Characteristic Values		
		Min.	Typ.	Max.
$V_{GE(th)}$	$I_C = 250\mu A$ , $V_{CE} = V_{GE}$	3.0		5.5 V
$I_{CES}$	$V_{CE} = V_{CES}$ $V_{GE} = 0V$ $T_J = 125^\circ C$			300 $\mu A$ 1.75 mA
$I_{GES}$	$V_{CE} = 0V$ , $V_{GE} = \pm 20V$			$\pm 100$ nA
$V_{CE(sat)}$	$I_C = 30A$ , $V_{GE} = 15V$ , Note 1 $T_J = 125^\circ C$	2.3 1.8		2.5 V V

Symbol	Test Conditions	Characteristic Values		
		Min.	Typ.	Max.
$g_{fs}$	$I_C = 30A, V_{CE} = 10V, \text{Note 1}$	20	30	S
$C_{ies}$	$V_{CE} = 25V, V_{GE} = 0V, f = 1MHz$		1960	pF
$C_{oes}$			202	pF
$C_{res}$			66	pF
$Q_g$	$I_C = 30A, V_{GE} = 15V, V_{CE} = 0.5 \cdot V_{CES}$		77	nC
$Q_{ge}$			16	nC
$Q_{gc}$			32	nC
$t_{d(on)}$	<b>Inductive Load, <math>T_J = 25^\circ C</math></b> $I_C = 30A, V_{GE} = 15V$ $V_{CE} = 400V, R_G = 3\Omega$		19	ns
$t_{ri}$			26	ns
$E_{on}$			0.41	mJ
$t_{d(off)}$			60	100 ns
$t_{fi}$			38	ns
$E_{off}$			0.23	0.42 mJ
$t_{d(on)}$	<b>Inductive Load, <math>T_J = 125^\circ C</math></b> $I_C = 30A, V_{GE} = 15V$ $V_{CE} = 400V, R_G = 3\Omega$		19	ns
$t_{ri}$			26	ns
$E_{on}$			0.65	mJ
$t_{d(off)}$			92	ns
$t_{fi}$			95	ns
$E_{off}$			0.57	mJ
$R_{thJC}$			0.42	$^\circ C/W$
$R_{thCS}$		0.21		$^\circ C/W$

### TO-247 AD Outline



Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.7	5.3	.185	.209
A <sub>1</sub>	2.2	2.54	.087	.102
A <sub>2</sub>	2.2	2.6	.087	.102
b	1.0	1.4	.040	.055
b <sub>1</sub>	1.65	2.13	.065	.084
b <sub>2</sub>	2.87	3.12	.113	.123
C	.4	.8	.016	.031
D	20.80	21.46	.819	.845
E	15.75	16.26	.610	.640
e	5.20	5.72	0.205	0.225
L	19.81	20.32	.780	.800
L1		4.50		.177
∅P	3.55	3.65	.140	.144
Q	5.89	6.40	0.232	0.252
R	4.32	5.49	.170	.216

### Reverse Diode (FRED)

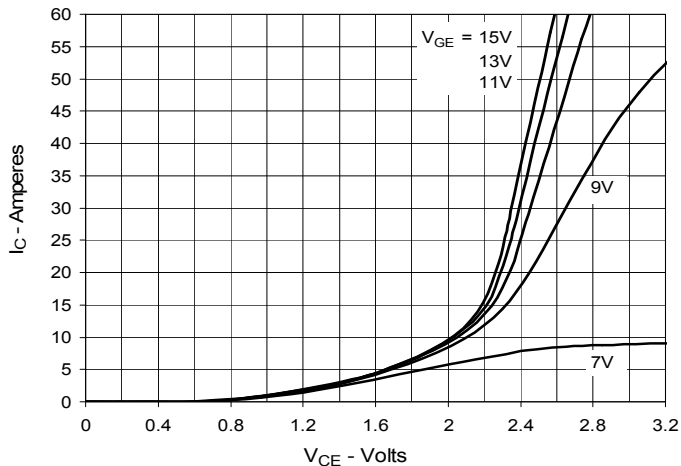
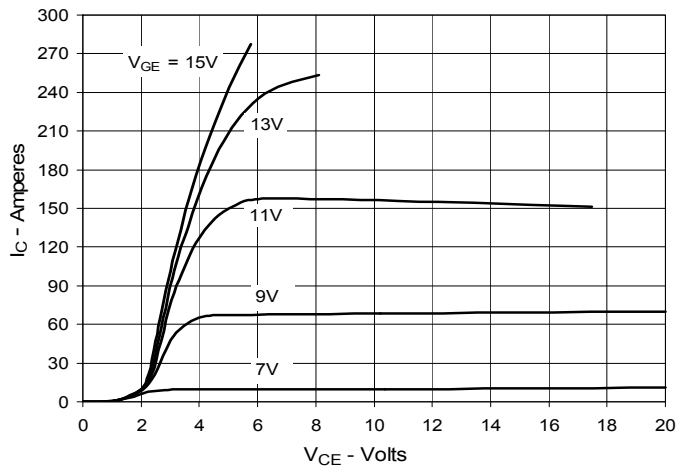
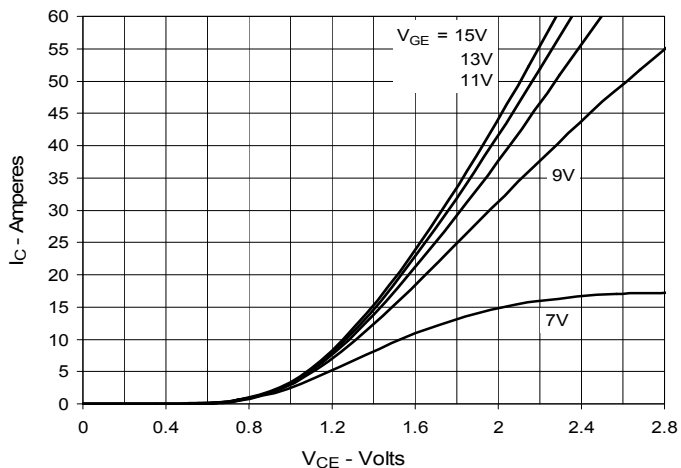
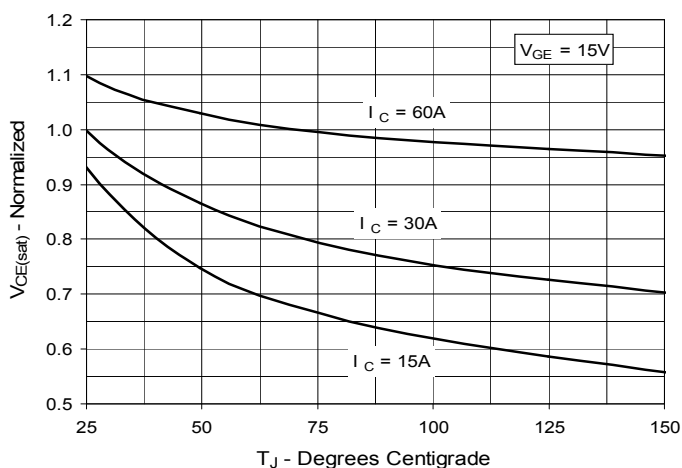
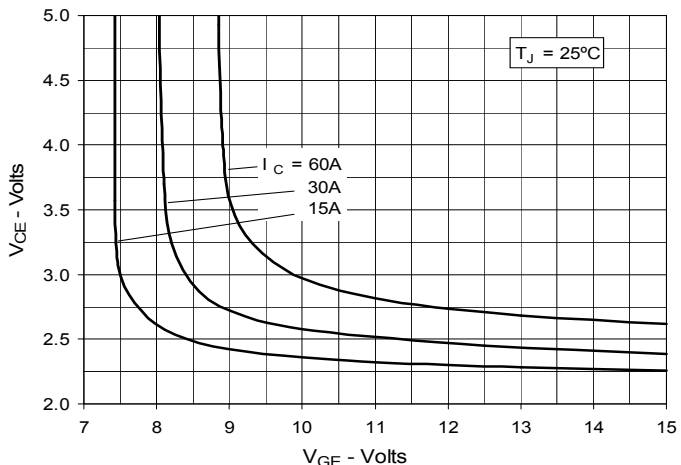
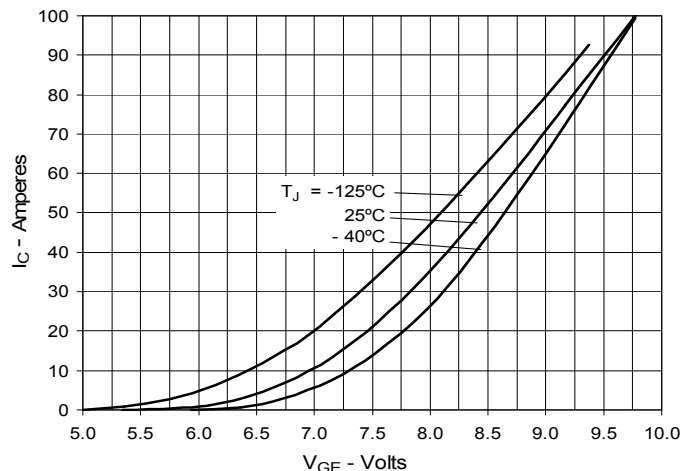
**Characteristic Values**  
( $T_J = 25^\circ C$ , Unless Otherwise Specified)

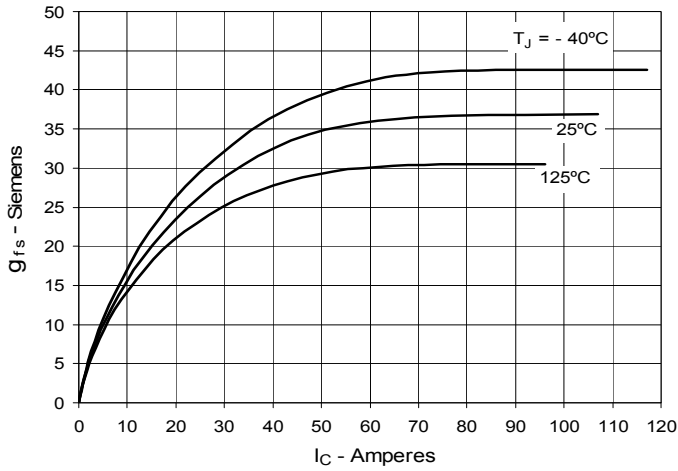
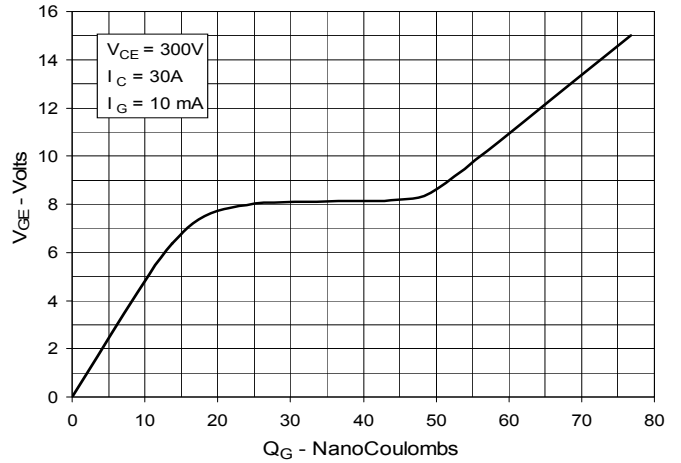
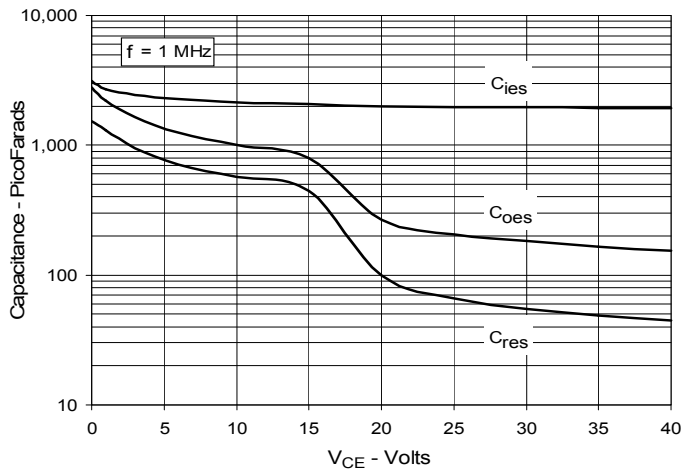
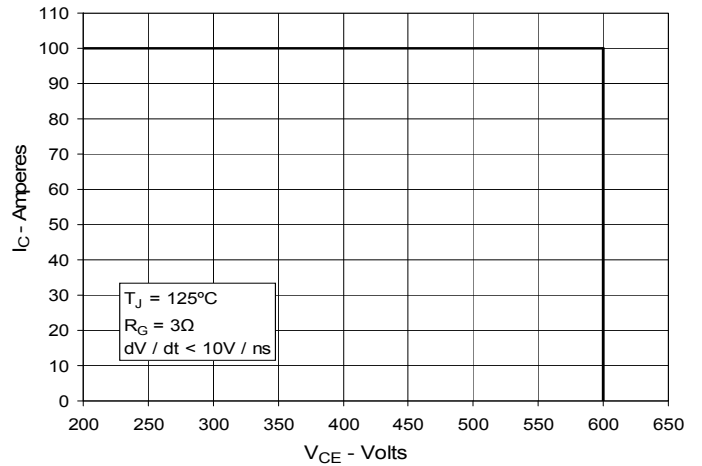
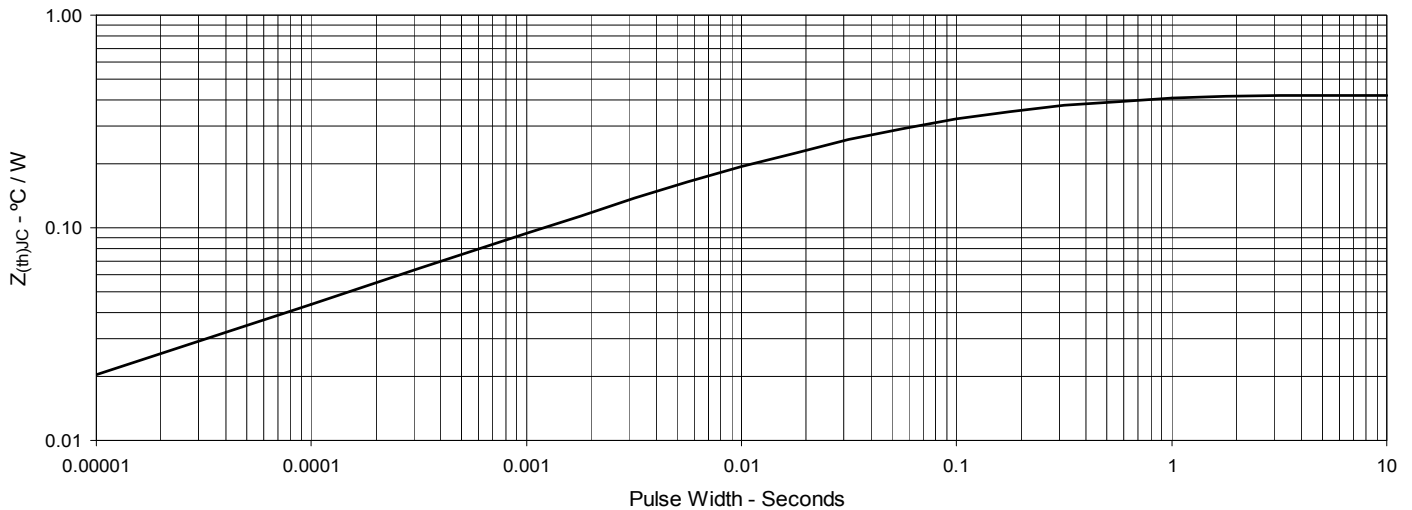
Symbol	Test Conditions	Characteristic Values		
		Min.	Typ.	Max.
$V_F$	$I_F = 30A, V_{GE} = 0V, \text{Note 1}$			2.7 V
		$T_J = 150^\circ C$	1.6	V
$I_{RM}$	$I_F = 30A, V_{GE} = 0V, -di_F/dt = 100A/\mu s,$	$T_J = 100^\circ C$		4 A
$t_{rr}$	$V_R = 100V$	$T_J = 100^\circ C$	100	ns
	$I_F = 1A, V_{GE} = 0V, -di_F/dt = 100A/\mu s, V_R = 30V$		25	ns
$R_{thJC}$				0.9 $^\circ C/W$

Note 1: Pulse Test,  $t \leq 300\mu s$ , Duty Cycle,  $d \leq 2\%$ .

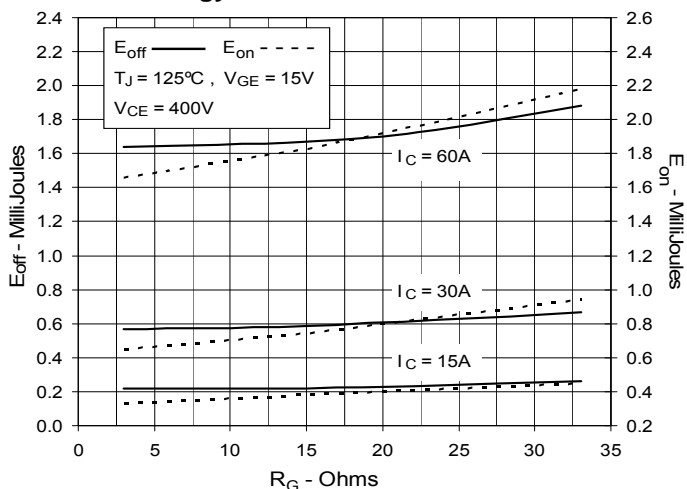
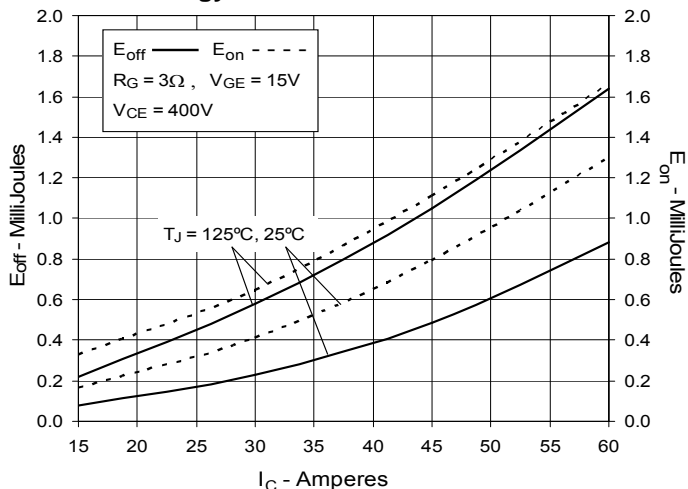
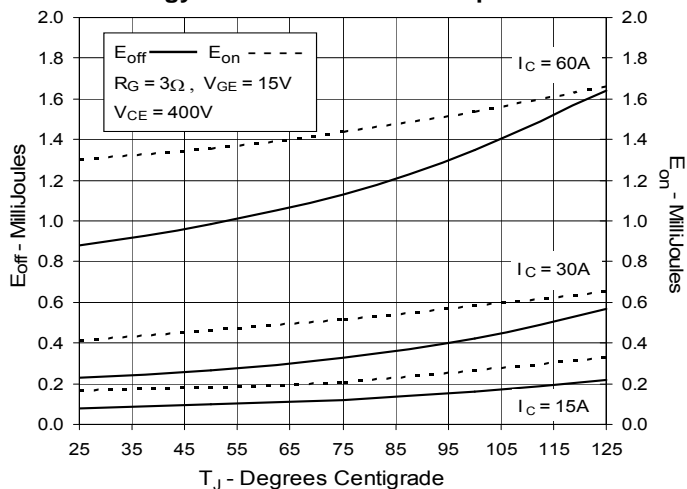
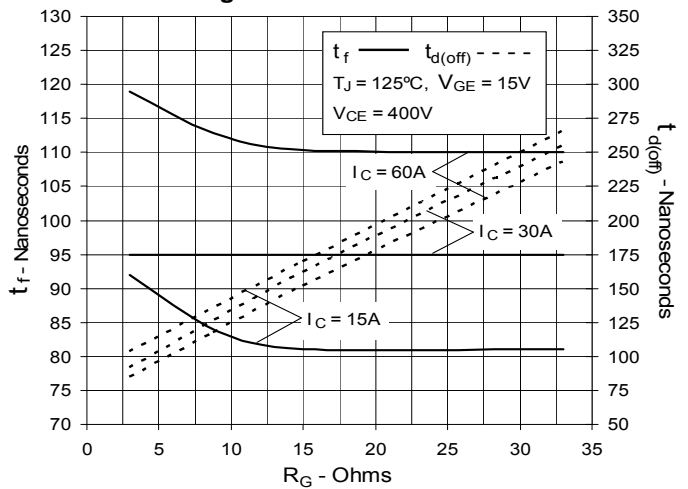
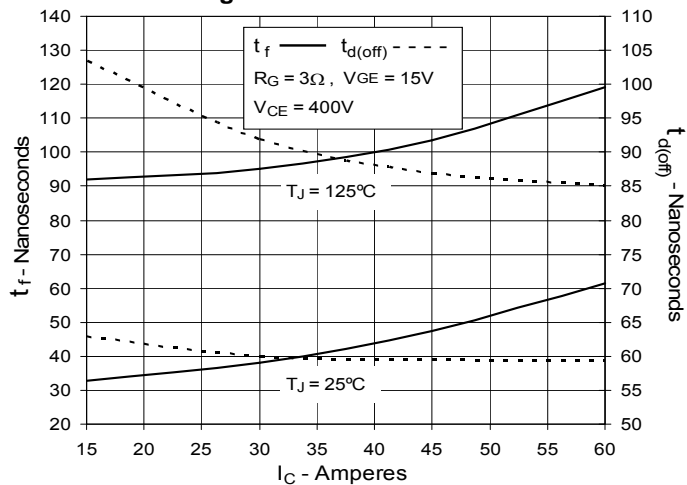
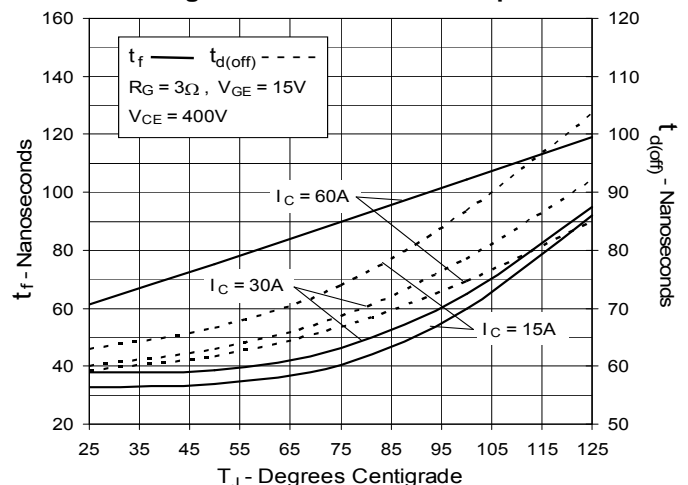
IXYS reserves the right to change limits, test conditions, and dimensions.

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
	4,850,072	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	

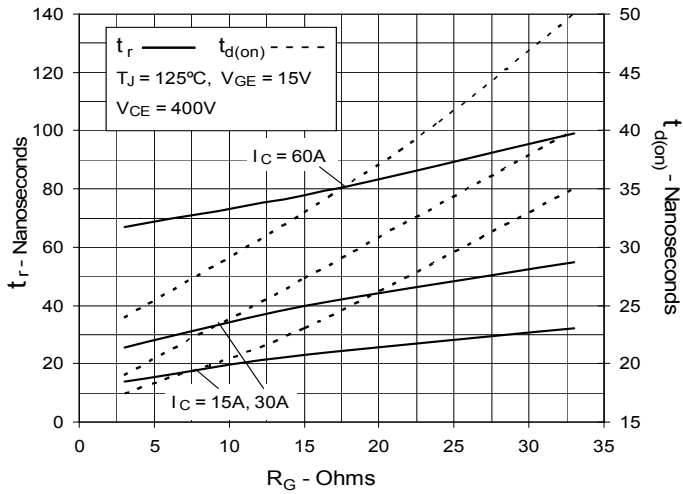
**Fig. 1. Output Characteristics  
@ 25°C**

**Fig. 2. Extended Output Characteristics  
@ 25°C**

**Fig. 3. Output Characteristics  
@ 125°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**


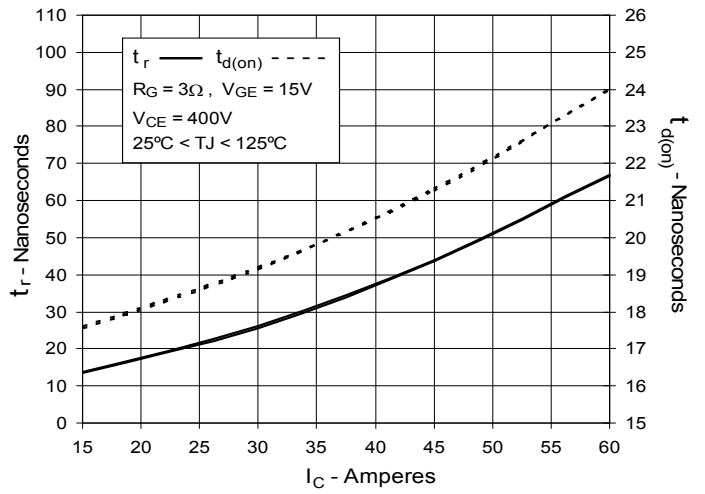
IXYS reserves the right to change limits, test conditions, and dimensions.

**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**


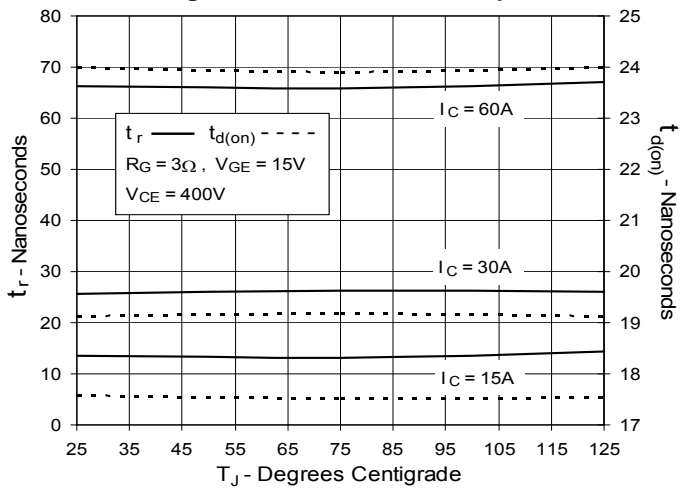
**Fig. 18. Inductive Turn-on Switching Times vs. Gate Resistance**

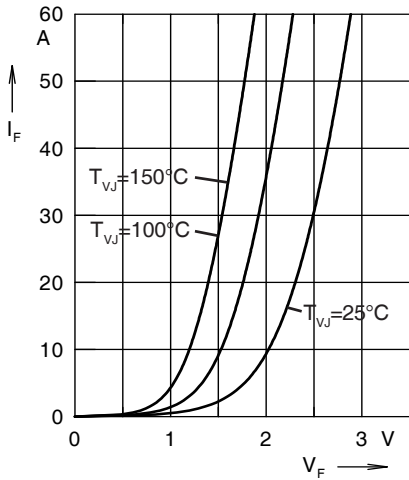


**Fig. 19. Inductive Turn-on Switching Times vs. Collector Current**

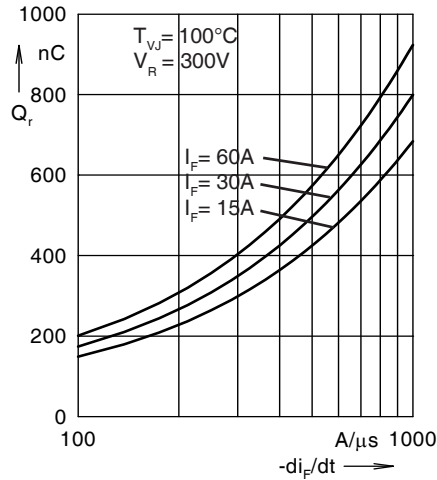


**Fig. 20. Inductive Turn-on Switching Times vs. Junction Temperature**

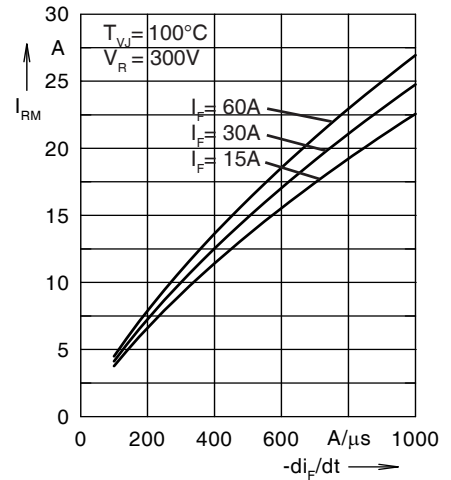




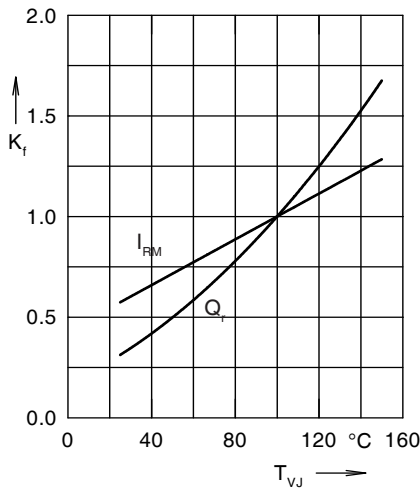
**Fig. 21. Forward current  $I_F$  versus  $V_F$**



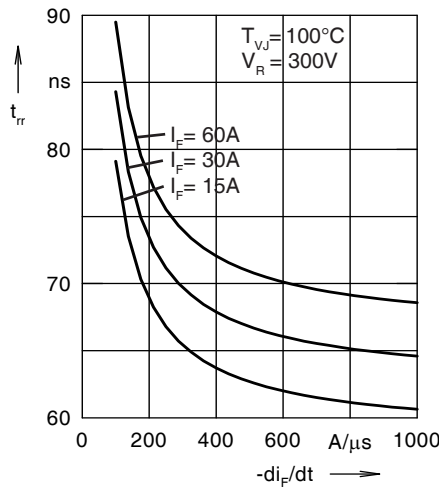
**Fig. 22. Reverse recovery charge  $Q_r$  versus  $-di_F/dt$**



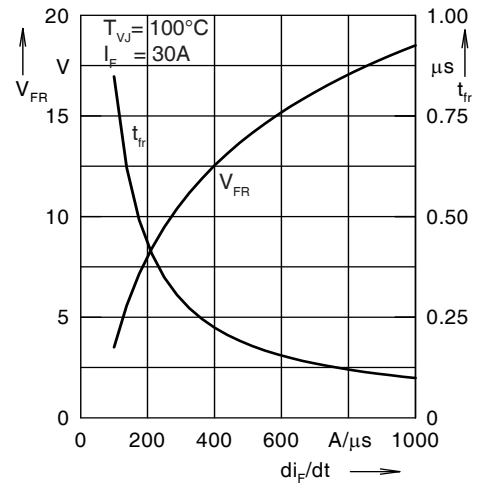
**Fig. 23. Peak reverse current  $I_{RM}$  versus  $-di_F/dt$**



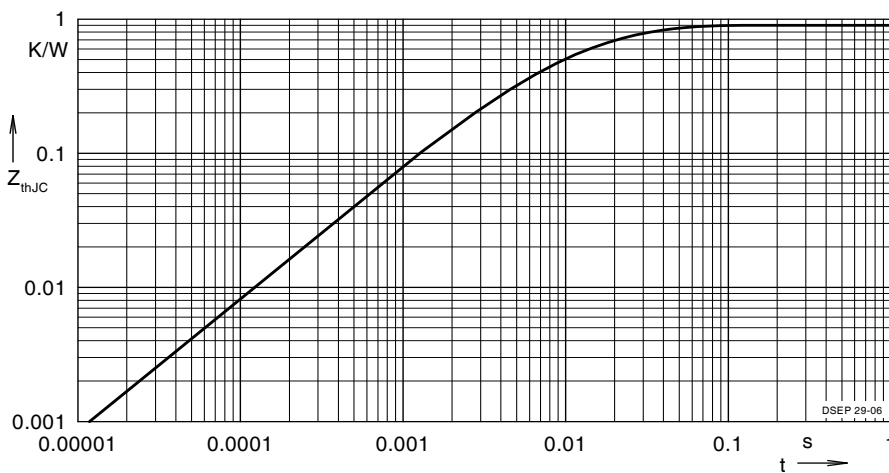
**Fig. 24. Dynamic parameters  $Q_r$ ,  $I_{RM}$  versus  $T_{VJ}$**



**Fig. 25. Recovery time  $t_{rr}$  versus  $-di_F/dt$**



**Fig. 26. Peak forward voltage  $V_{FR}$  and  $t_{rr}$  versus  $di_F/dt$**



**Fig. 27. Transient thermal resistance junction to case**

Constants for  $Z_{thJC}$  calculation:

i	$R_{thi}$ (K/W)	$t_i$ (s)
1	0.502	0.0052
2	0.193	0.0003
3	0.205	0.0162