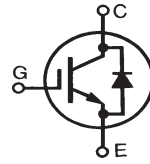


# GenX3™ 600V IGBT

# IXGH56N60B3D1

Medium speed low  $V_{sat}$  PT  
IGBTs 5-40 kHz switching



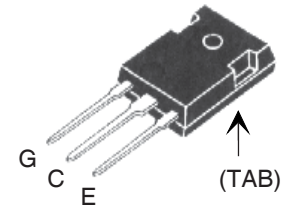
$$V_{CES} = 600V$$

$$I_{C110} = 56A$$

$$V_{CE(sat)} \leq 1.8V$$

Symbol	Test Conditions	Maximum Ratings	
$V_{CES}$	$T_C = 25^\circ C$ 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
$I_{C110}$	$T_C = 110^\circ C$	56	A
$I_{CM}$	$T_C = 25^\circ C$ , 1ms	350	A
<b>SSOA (RBSOA)</b>	$V_{GE} = 15V$ , $T_{VJ} = 125^\circ C$ , $R_G = 5\Omega$ Clamped inductive load @ $\leq 600V$	$I_{CM} = 150$	A
$P_d$	$T_C = 25^\circ C$	330	W
$T_J$		- 55 ... +150	$^\circ C$
$T_{JM}$		150	$^\circ C$
$T_{stg}$		- 40 ... +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	$^\circ C$
$M_d$	Mounting torque	1.13/10	Nm/lb.in.
<b>Weight</b>		6	g

## TO-247 (IXGH)



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

## Features

- Optimized for low conduction and switching losses
- Square RBSOA
- Anti-parallel ultra fast diode
- International standard package

## Advantages

- High power density
- Low gate drive requirement

## Applications

- 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		5.0 V
$I_{CES}$	$V_{CE} = V_{CES}$ $V_{GE} = 0V$ $T_J = 125^\circ C$			300 $\mu A$ 2 mA
$I_{GES}$	$V_{CE} = 0V$ , $V_{GE} = \pm 20V$			$\pm 100$ nA
$V_{CE(sat)}$	$I_C = 44A$ , $V_{GE} = 15V$ , Note 1 $T_J = 125^\circ C$	1.49 1.47		1.80 V

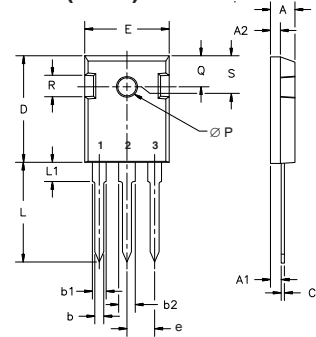
### Symbol Test Conditions

( $T_J = 25^\circ\text{C}$  unless otherwise specified)

### Characteristic Values

Symbol	Test Conditions	Characteristic Values			
		Min.	Typ.	Max.	
$g_{fs}$	$I_C = 44\text{A}, V_{CE} = 10\text{V}$ , Note 1	36	60	S	
$C_{ies}$	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$		3950	pF	
$C_{oes}$			220	pF	
$C_{res}$			56	pF	
$Q_g$	$I_C = 40\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$		138	nC	
$Q_{ge}$			25	nC	
$Q_{gc}$			47	nC	
$t_{d(on)}$	<b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b> $I_C = 44\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 480\text{V}, R_G = 5\Omega$		26	ns	
$t_{ri}$			41	ns	
$E_{on}$			1.30	mJ	
$t_{d(off)}$			155	335	ns
$t_{fi}$			95	165	ns
$E_{off}$			1.05	2.0	mJ
$t_{d(on)}$	<b>Inductive load, <math>T_J = 125^\circ\text{C}</math></b> $I_C = 44\text{A}, V_{GE} = 15\text{V}$ $V_{CE} = 480\text{V}, R_G = 5\Omega$		26	ns	
$t_{ri}$			37	ns	
$E_{on}$			2.34	mJ	
$t_{d(off)}$			220	ns	
$t_{fi}$			165	ns	
$E_{off}$			2.20	mJ	
$R_{thJC}$			0.375	$^\circ\text{C/W}$	
$R_{thCS}$		0.21		$^\circ\text{C/W}$	

### TO-247 (IXGH) Outline



Terminals: 1 - Gate 2 - Drain  
3 - Source Tab - Drain

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	.059	.098
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
ØP	3.55	3.65	.140	.144
Q	5.89	6.40	0.232	0.252
R	4.32	5.49	.170	.216
S	6.15	BSC	242	BSC

### Reverse Diode (FRED)

### Characteristic Values

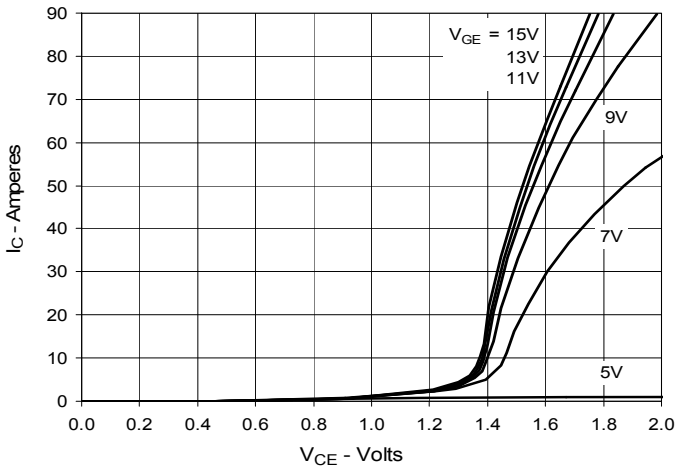
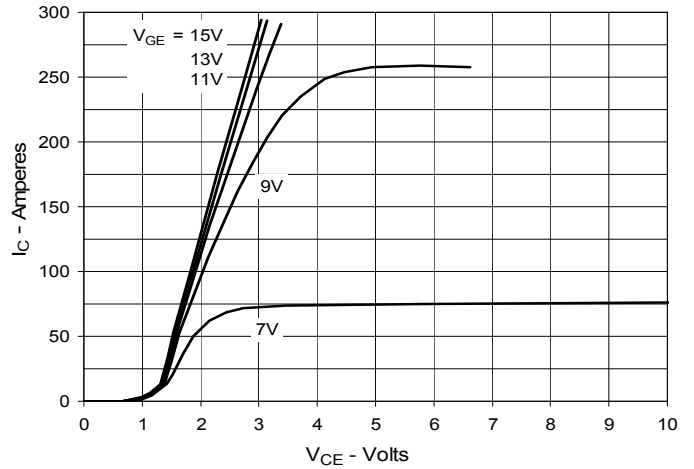
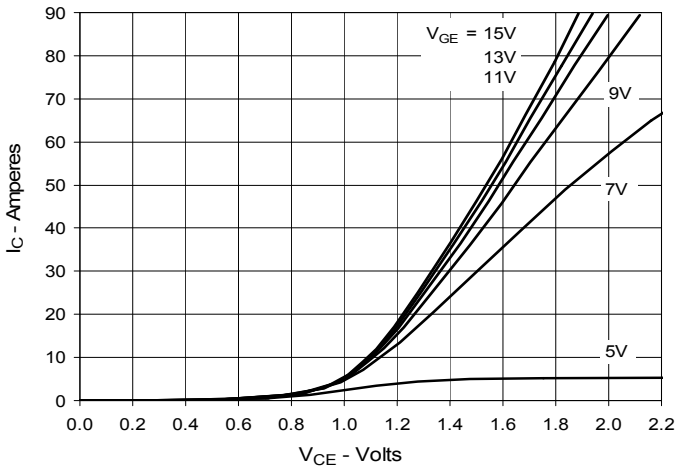
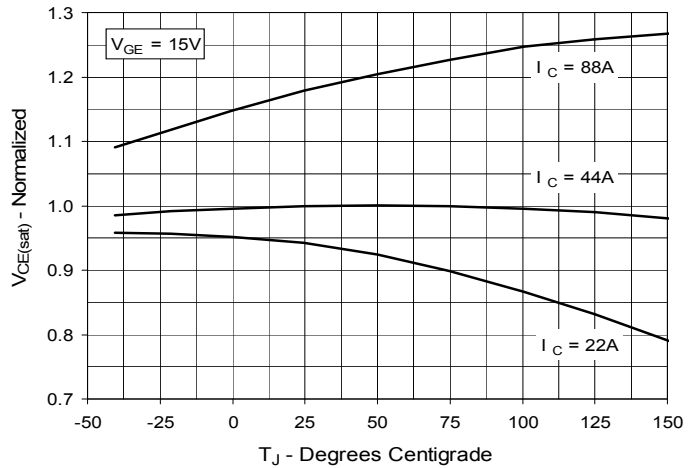
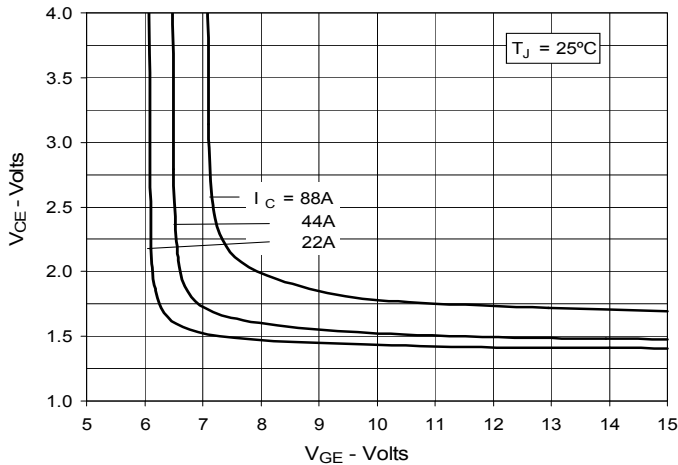
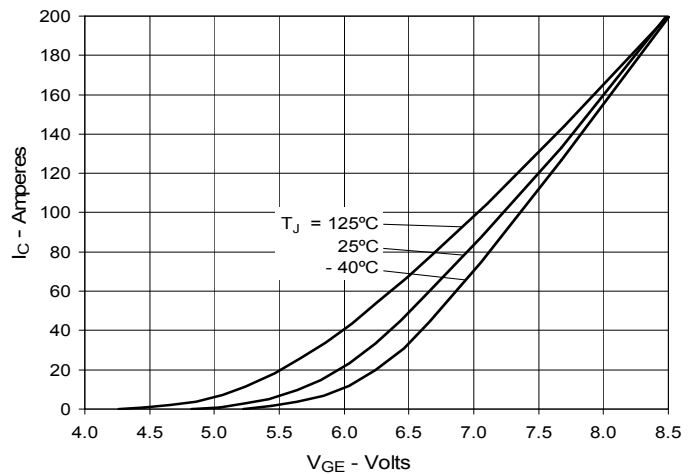
( $T_J = 25^\circ\text{C}$ , unless otherwise specified)

Symbol	Test Conditions	Characteristic Values		
		Min.	Typ.	Max.
$V_F$	$I_F = 30\text{A}, V_{GE} = 0\text{V}$ , Note 1		2.8	V
		$T_J = 150^\circ\text{C}$	1.6	V
$I_{RM}$	$I_F = 30\text{A}, V_{GE} = 0\text{V}, V_R = 100\text{V}$ $-di_F/dt = 100\text{A}/\mu\text{s}$		4	A
$t_{rr}$	$I_F = 1\text{A}; -di/dt = 100\text{A}/\mu\text{s}, V_R = 30\text{V}$	$T_J = 100^\circ\text{C}$	100	ns
$R_{thJC}$			1.5	$^\circ\text{C/W}$
$R_{thCS}$			1.5	$^\circ\text{C/W}$

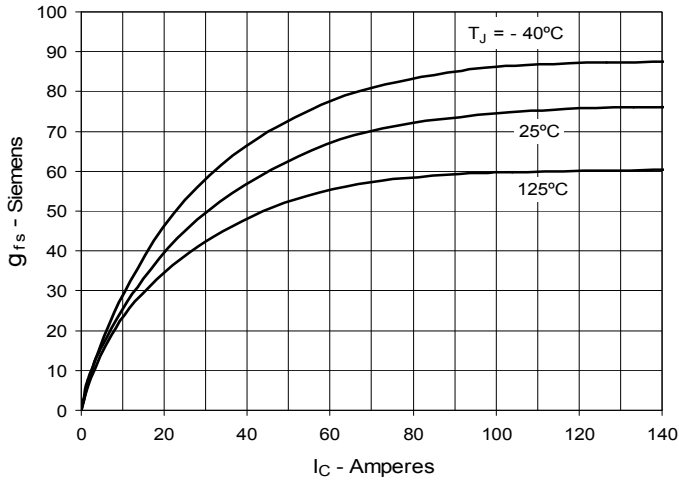
Notes 1: Pulse test,  $t \leq 300\mu\text{s}$ ; duty cycle,  $d \leq 2\%$ .

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

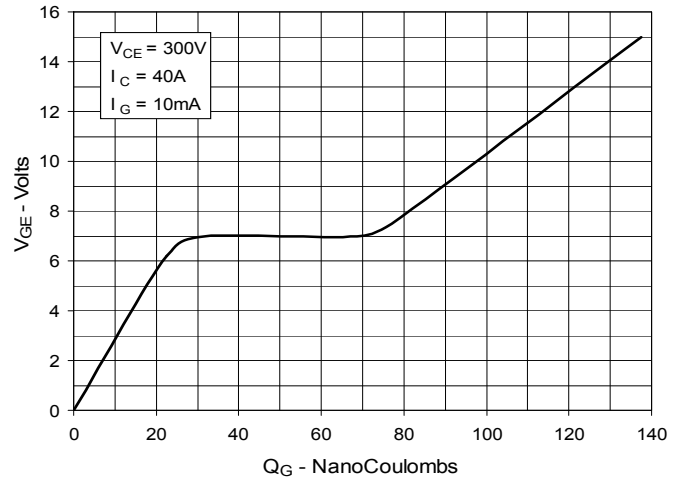
IXYS MOSFETs and IGBTs are covered 4,835,592 4,931,844 5,049,961 5,237,481 6,162,665 6,404,065 B1 6,683,344 6,727,585 7,005,734 B2 7,157,338B2  
by one or more of the following U.S. patents: 4,850,072 5,017,508 5,063,307 5,381,025 6,259,123 B1 6,534,343 6,710,405 B2 6,759,692 7,063,975 B2  
4,881,106 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**


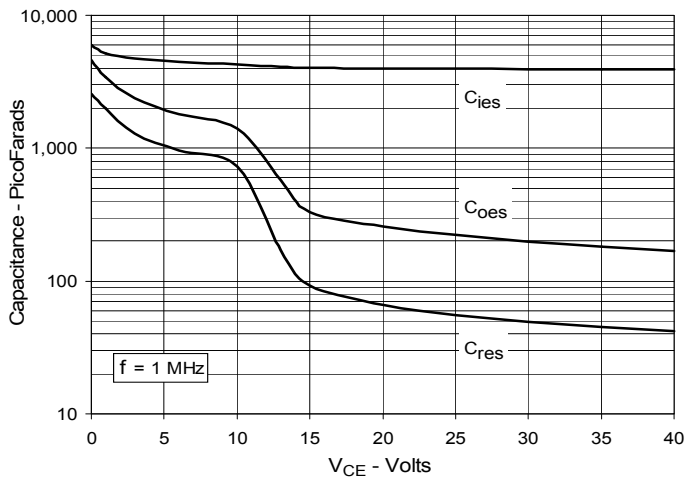
**Fig. 7. Transconductance**



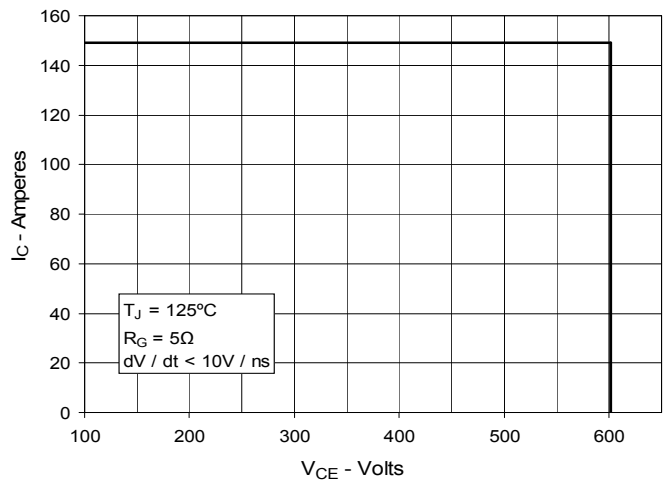
**Fig. 8. Gate Charge**



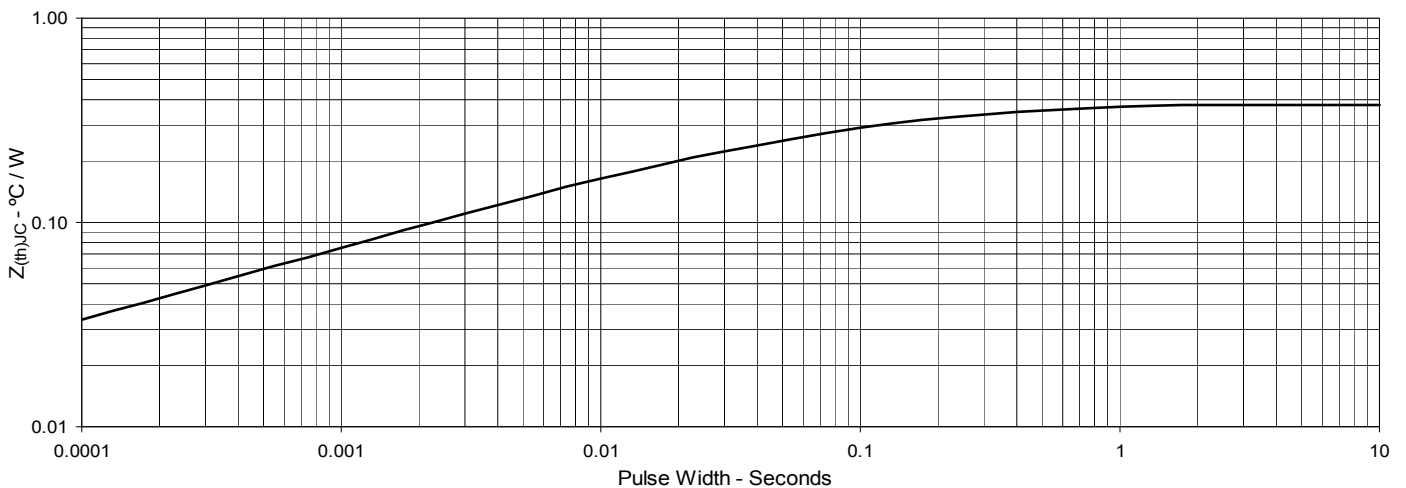
**Fig. 9. Capacitance**



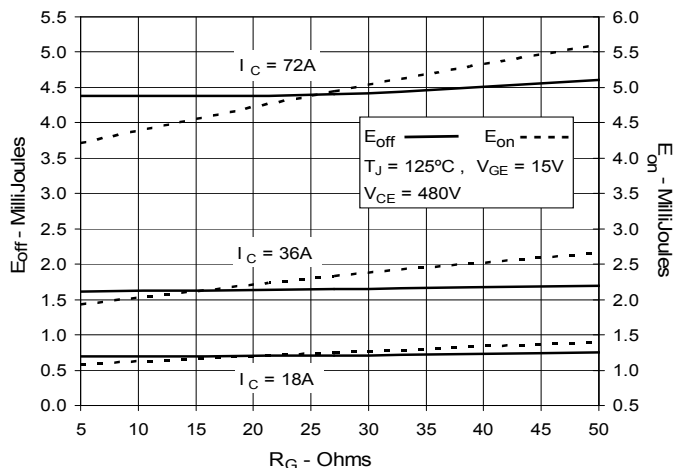
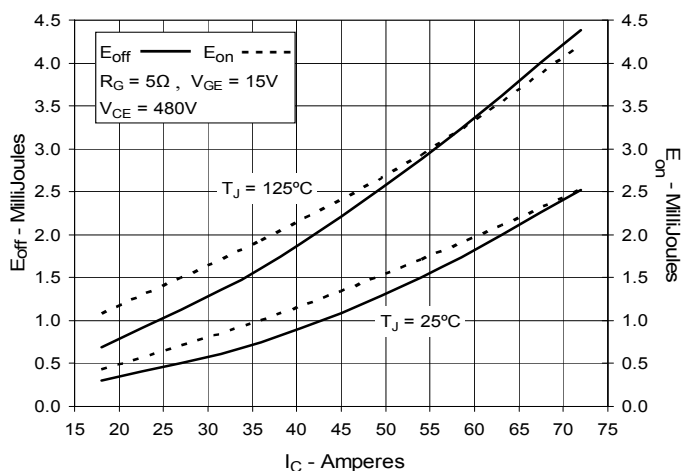
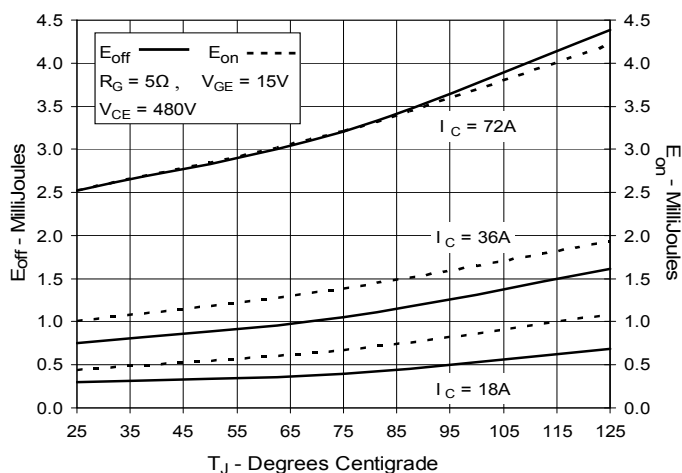
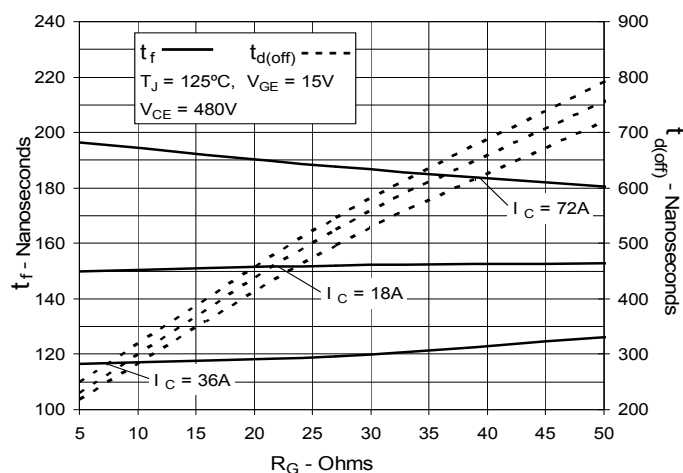
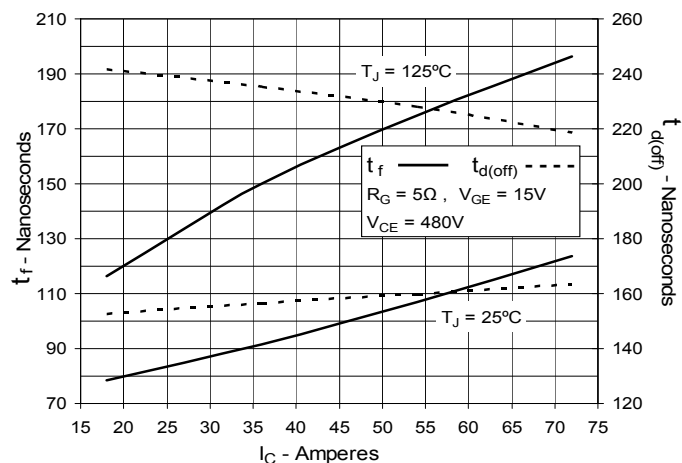
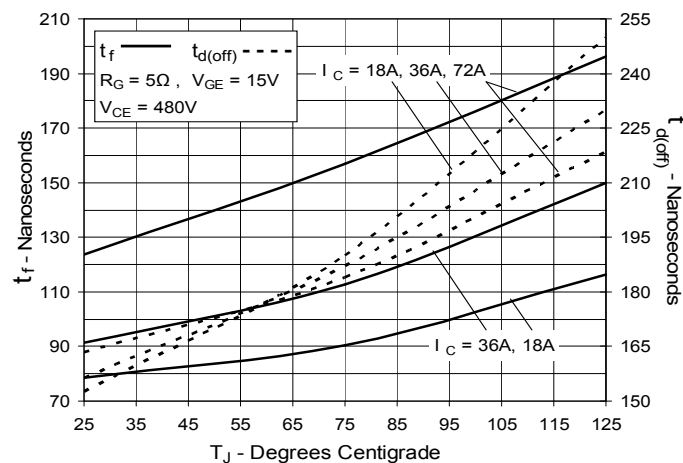
**Fig. 10. Reverse-Bias Safe Operating Area**

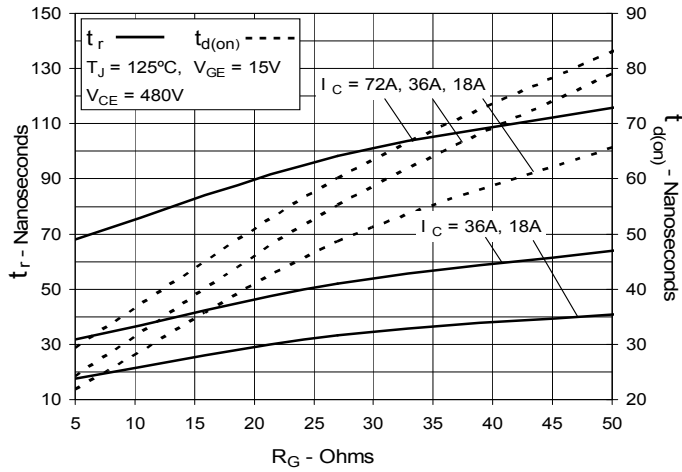
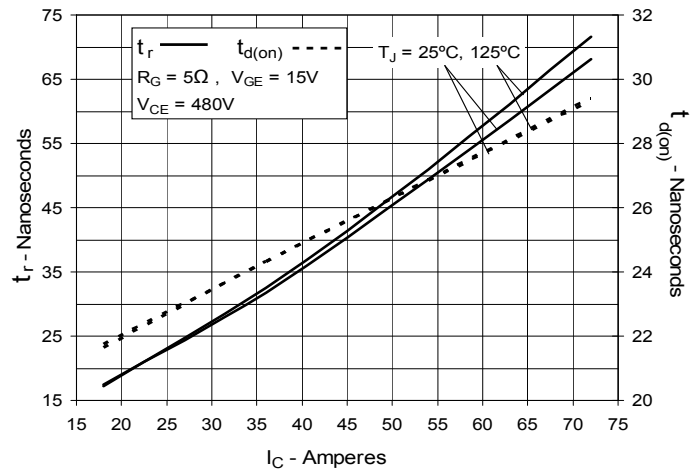
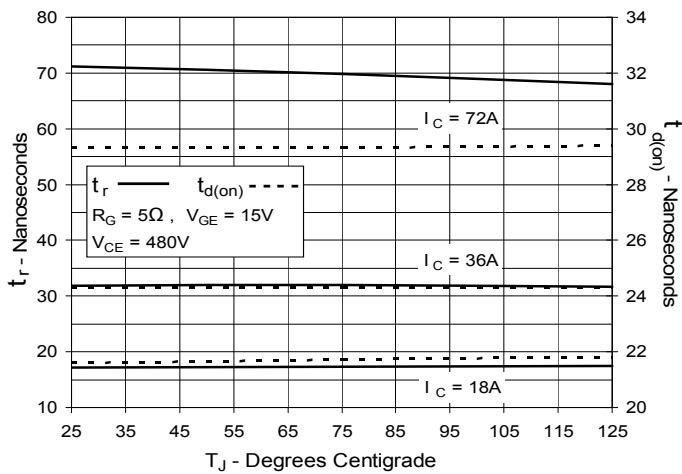


**Fig. 11. Maximum Transient Thermal Impedance**



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**


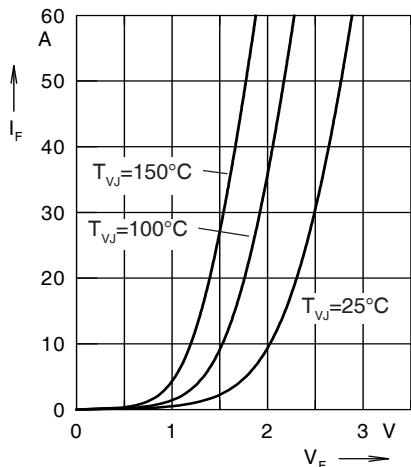


Fig. 21. Forward current  $I_F$  versus  $V_F$

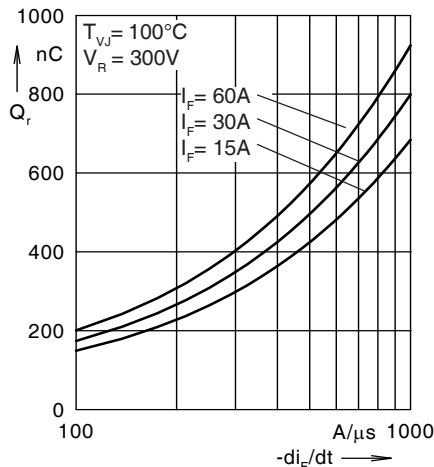


Fig. 22. Reverse recovery charge  $Q_r$  versus  $-di_F/dt$

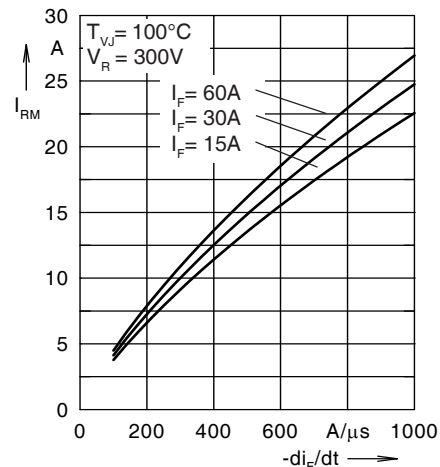


Fig. 23. Peak reverse current  $I_{RM}$  versus  $-di_F/dt$

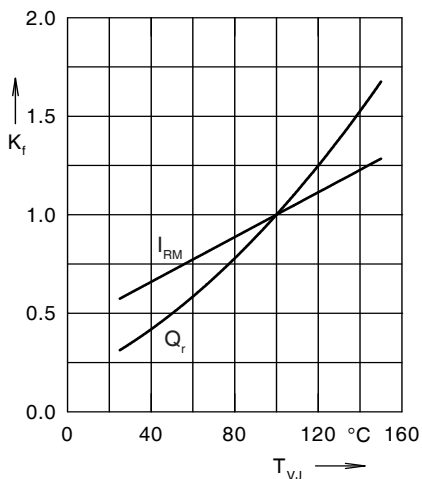


Fig. 24. Dynamic parameters  $Q_r$ ,  $I_{RM}$  versus  $T_{VJ}$

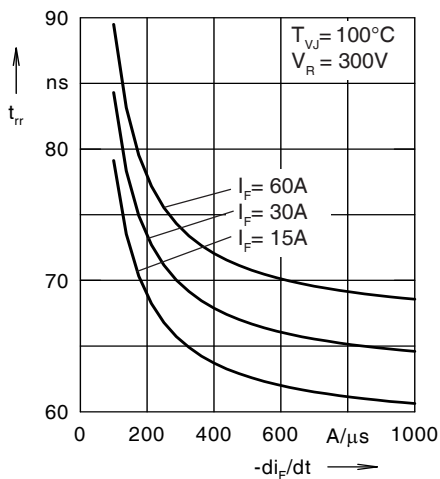


Fig. 25. Recovery time  $t_{rr}$  versus  $-di_F/dt$

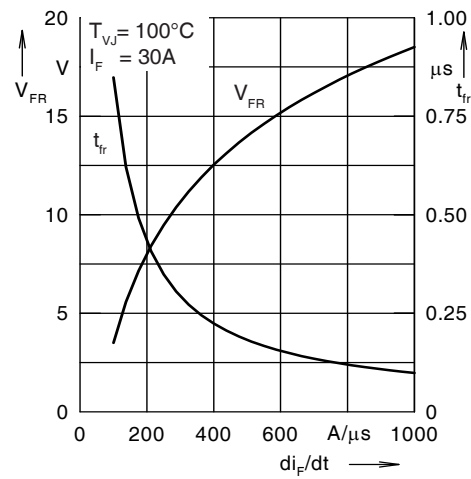


Fig. 26. Peak forward voltage  $V_{FR}$  and  $t_{fr}$  versus  $di_F/dt$

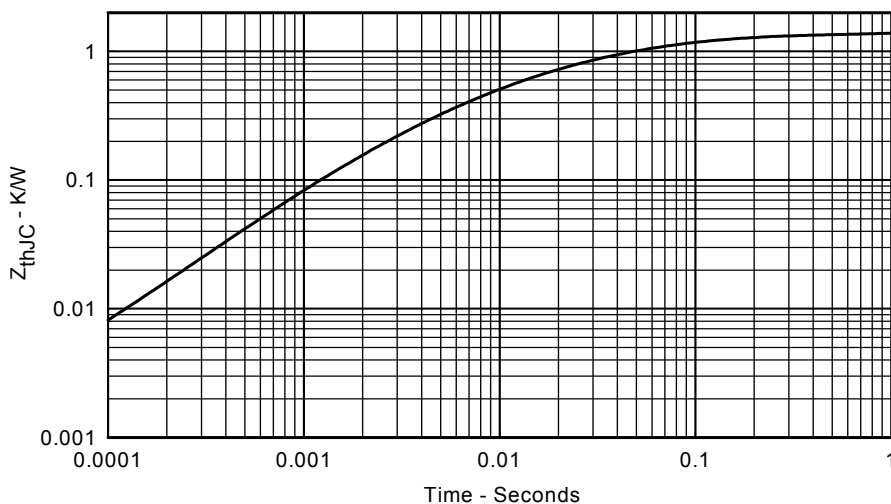


Fig. 27. Transient thermal resistance junction to case