

# GenX3™ 600V IGBT w/ Diode

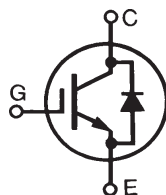
## IXGH36N60B3D1

$$V_{CES} = 600V$$

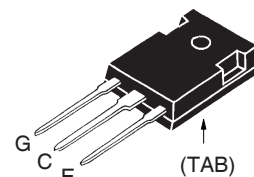
$$I_{C110} = 36A$$

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

Medium-Speed Low-V<sub>sat</sub> PT IGBT  
for 5 - 40kHz Switching



TO-247



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

Symbol	Test Conditions	Maximum Ratings	
$V_{CES}$	$T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$	600	V
$V_{CGR}$	$T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ , $R_{GE} = 1M\Omega$	600	V
$V_{GES}$	Continuous	$\pm 20$	V
$V_{GEM}$	Transient	$\pm 30$	V
$I_{C110}$	$T_C = 110^\circ\text{C}$	36	A
$I_{F110}$	$T_C = 110^\circ\text{C}$	30	A
$I_{CM}$	$T_C = 25^\circ\text{C}$ , 1ms	200	A
<b>SSOA</b> <b>(RBSOA)</b>	$V_{GE} = 15V$ , $T_{VJ} = 125^\circ\text{C}$ , $R_G = 5\Omega$ Clamped Inductive Load	$I_{CM} = 80$ $V_{CE} \leq V_{CES}$	A
$P_C$	$T_C = 25^\circ\text{C}$	250	W
$T_J$		-55 ... +150	$^\circ\text{C}$
$T_{JM}$		150	$^\circ\text{C}$
$T_{stg}$		-55 ... +150	$^\circ\text{C}$
$T_L$	1.6mm (0.062 in.) from Case for 10s	300	$^\circ\text{C}$
$T_{SOLD}$	Plastic Body for 10s	260	$^\circ\text{C}$
$M_d$	Mounting Torque	1.13/10	Nm/lb.in.
<b>Weight</b>		6	g

### 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

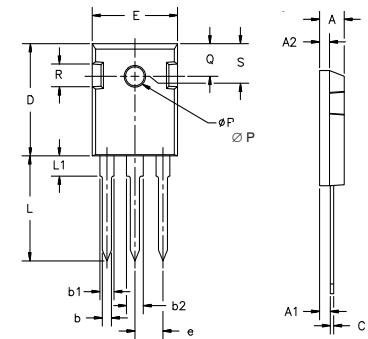
### Applications

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

Symbol	Test Conditions ( $T_J = 25^\circ\text{C}$ Unless Otherwise Specified)	Characteristic Values		
		Min.	Typ.	Max.
$BV_{CES}$	$I_C = 250\mu\text{A}$ , $V_{GE} = 0V$	600		V
$V_{GE(th)}$	$I_C = 250\mu\text{A}$ , $V_{CE} = V_{GE}$	3.0		5.0 V
$I_{CES}$	$V_{CE} = V_{CES}$ , $V_{GE} = 0V$  $T_J = 125^\circ\text{C}$			300 $\mu\text{A}$ 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	1.5	1.8	V

Symbol	Test Conditions	Characteristic Values		
		Min.	Typ.	Max.
$g_{fs}$	$I_C = 30A, V_{CE} = 10V, \text{Note 1}$	28	42	S
$C_{ies}$	$V_{CE} = 25V, V_{GE} = 0V, f = 1MHz$		2280	pF
$C_{oes}$			120	pF
$C_{res}$			32	pF
$Q_g$	$I_C = 30A, V_{GE} = 15V, V_{CE} = 0.5 \cdot V_{CES}$		80	nC
$Q_{ge}$			12	nC
$Q_{gc}$			36	nC
$t_{d(on)}$	<b>Inductive Load, <math>T_J = 25^\circ C</math></b> $I_C = 30A, V_{GE} = 15V$ $V_{CE} = 400V, R_G = 5\Omega$		19	ns
$t_{ri}$			24	ns
$E_{on}$			0.54	mJ
$t_{d(off)}$			125	200 ns
$t_{fi}$			100	160 ns
$E_{off}$			0.8	1.5 mJ
$t_{d(on)}$	<b>Inductive Load, <math>T_J = 125^\circ C</math></b> $I_C = 30A, V_{GE} = 15V$ $V_{CE} = 400V, R_G = 5\Omega$		19	ns
$t_{ri}$			26	ns
$E_{on}$			0.9	mJ
$t_{d(off)}$			180	ns
$t_{fi}$			170	ns
$E_{off}$			1.5	mJ
$R_{thJC}$			0.50	$^\circ C/W$
$R_{thCS}$		0.21		$^\circ C/W$

### TO-247 Outline (IXGH)



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
∅P	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)

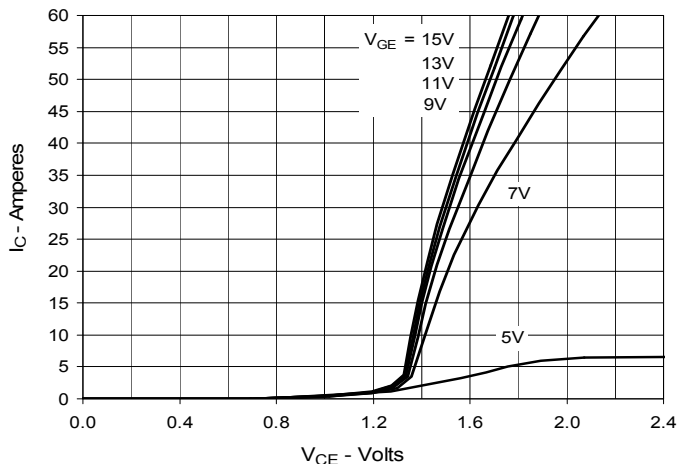
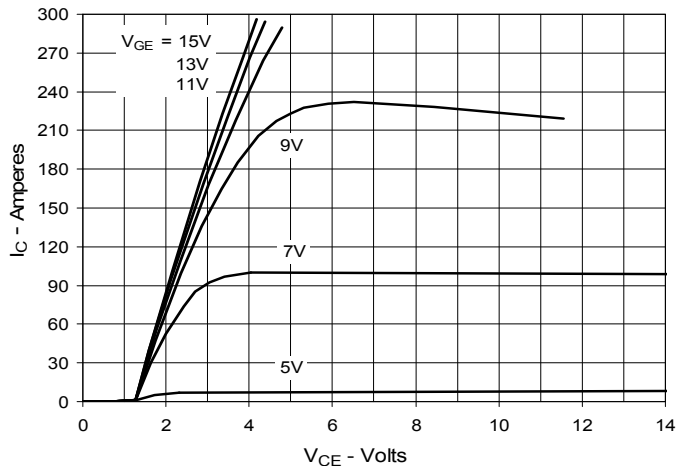
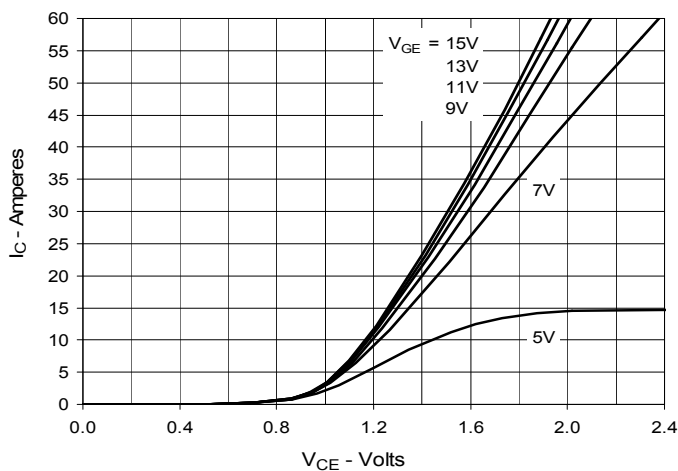
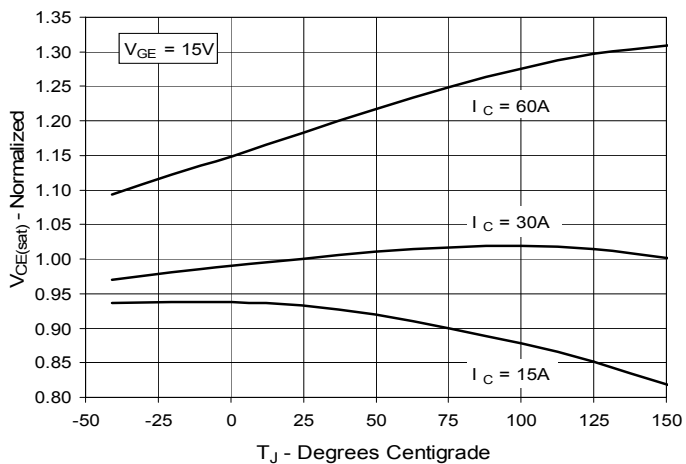
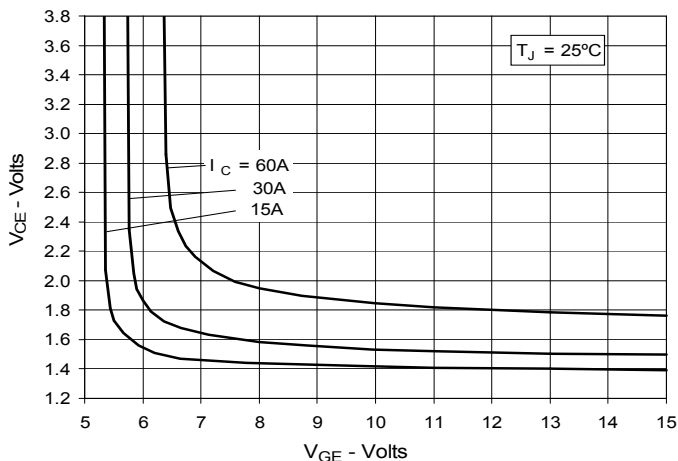
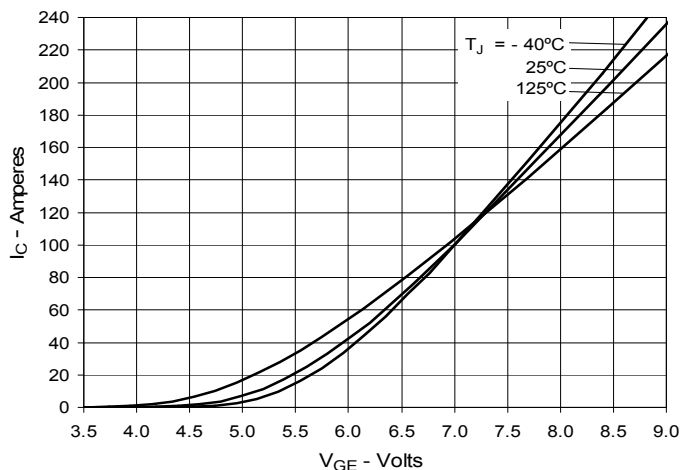
Symbol	Test Conditions	Characteristic Values		
		Min.	Typ.	Max.
$V_F$	$I_F = 30A, V_{GE} = 0V, \text{Note 1}$ $T_J = 150^\circ C$			2.8 V 1.7 V
$I_{RM}$	$I_F = 30A, V_{GE} = 0V, -di_F/dt = 100A/\mu s, T_J = 100^\circ C$ $V_R = 100V$		6	A
$t_{rr}$	$I_F = 1A, -di_F/dt = 100A/\mu s, V_R = 30V$ $T_J = 100^\circ C$		25 100	ns ns
$R_{thJC}$				0.9 $^\circ C/W$

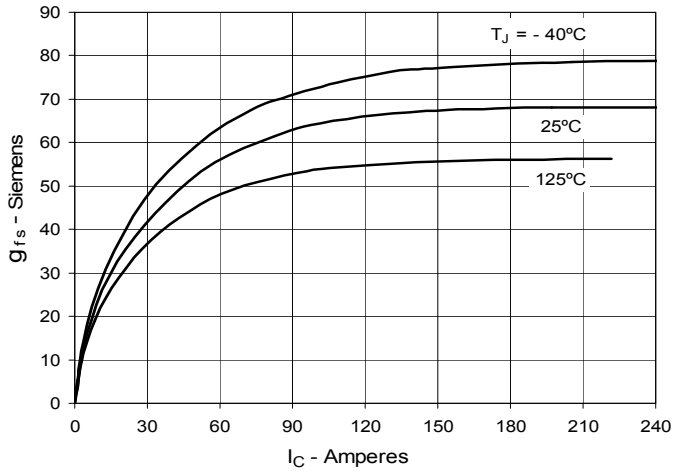
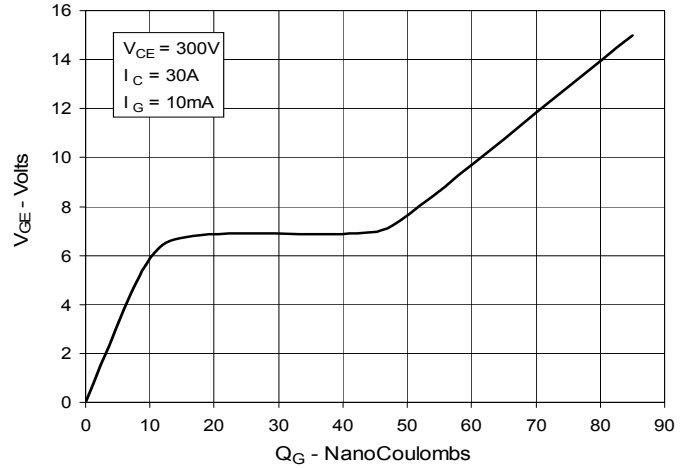
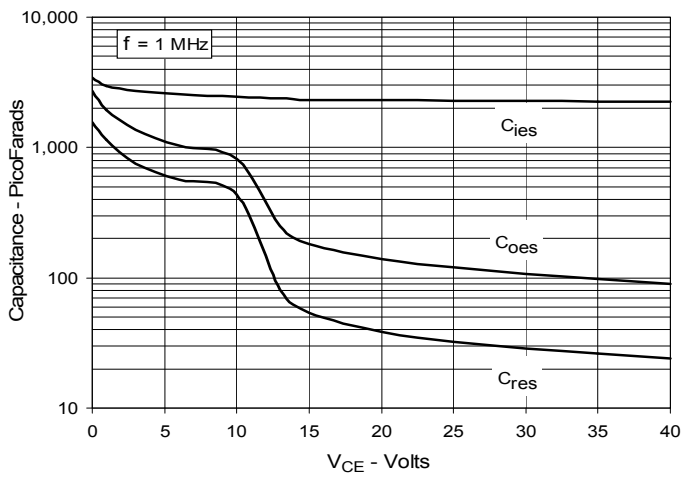
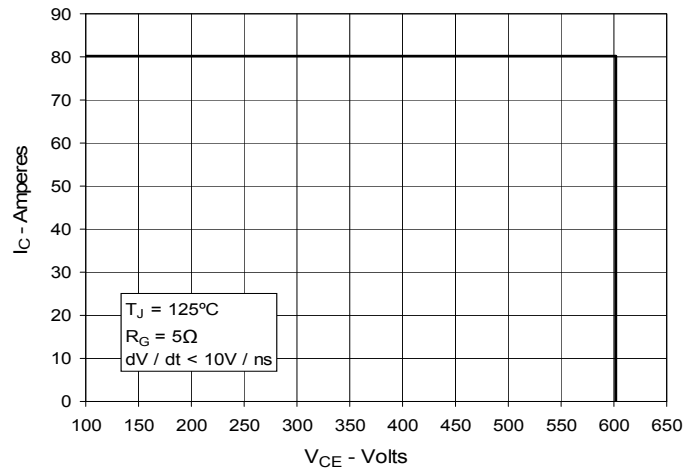
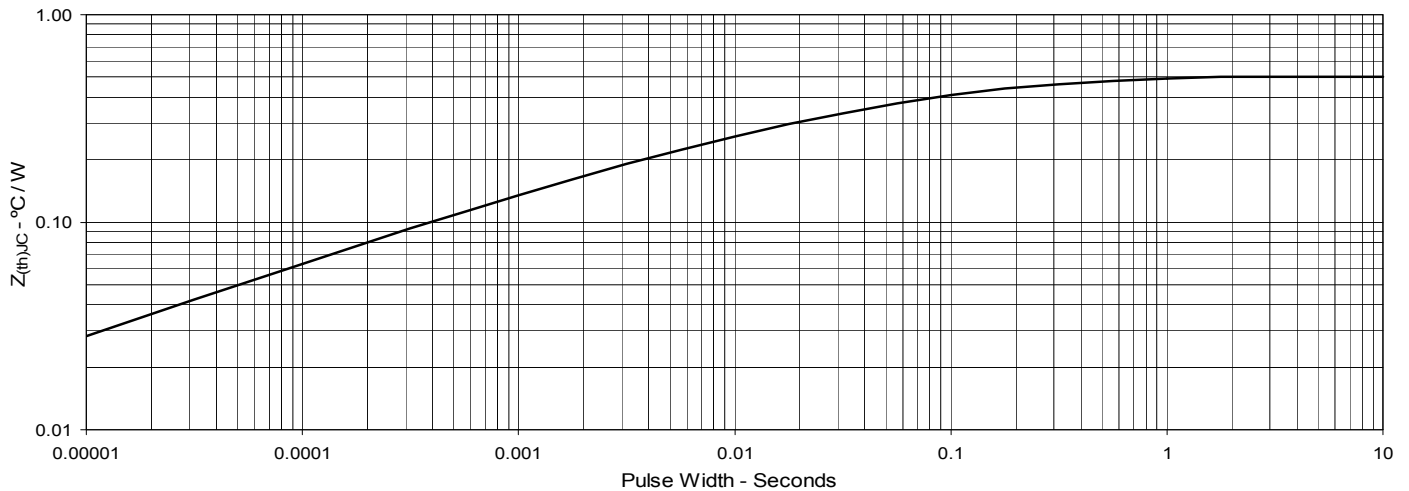
Note 1. Pulse test,  $t \leq 300\mu s$ ; duty cycle,  $d \leq 2\%$ .

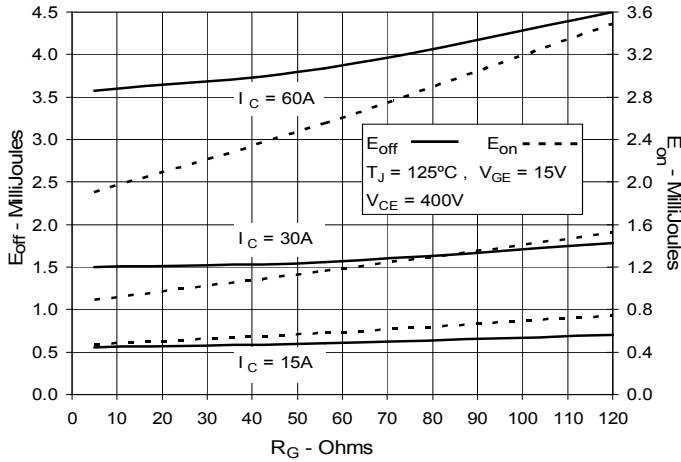
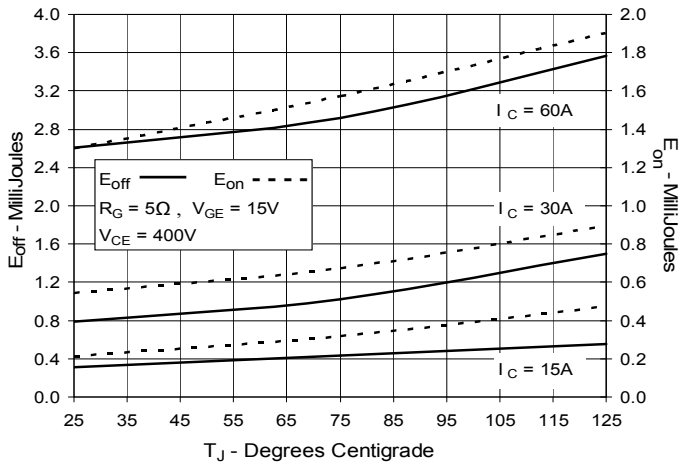
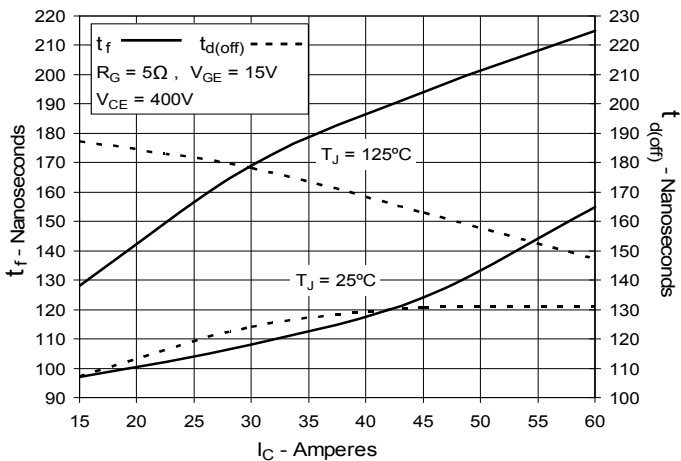
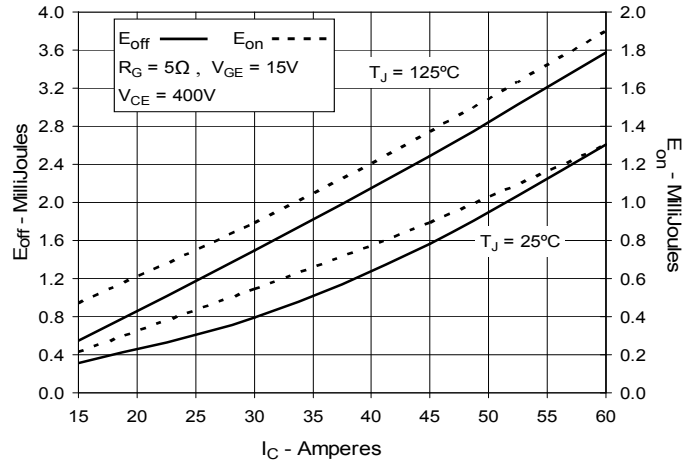
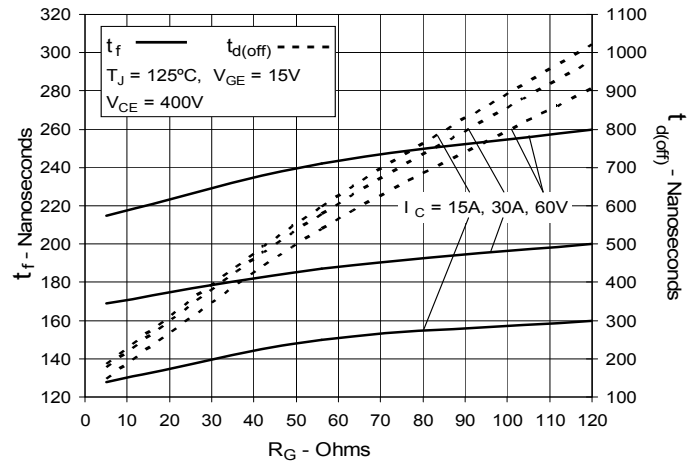
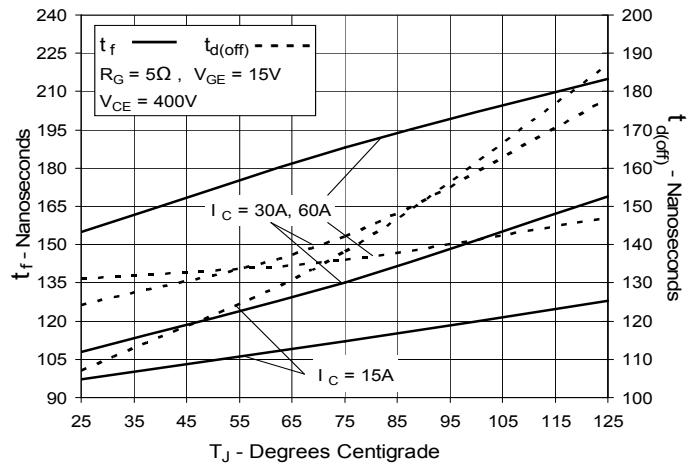
IXYS Reserves the Right to Change Limits, Test Conditions, and Dimensions.

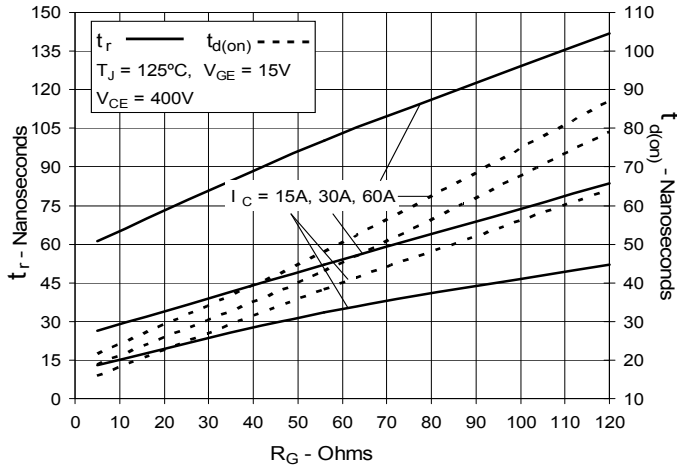
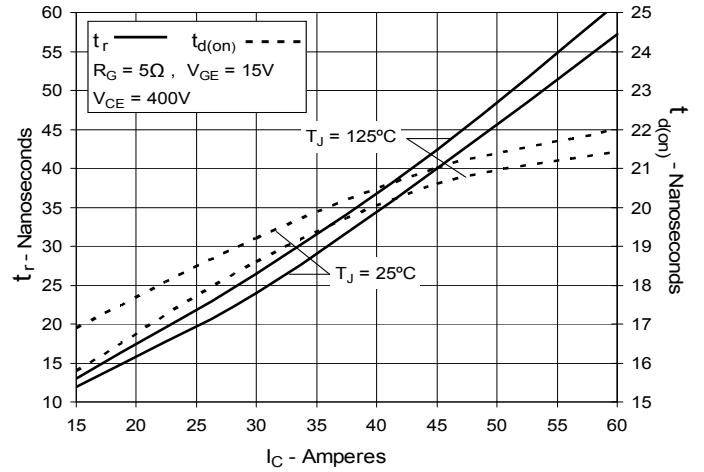
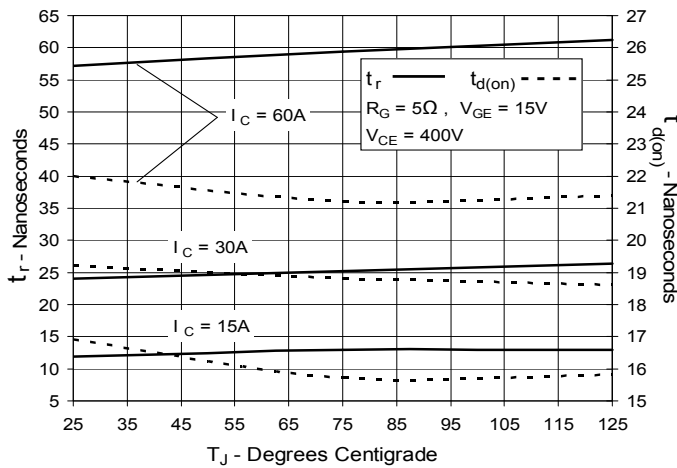
IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:

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**


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

**Fig. 14. Inductive Switching Energy Loss vs. Junction Temperature**

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

**Fig. 13. Inductive Switching Energy Loss vs. Collector Current**

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

**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**


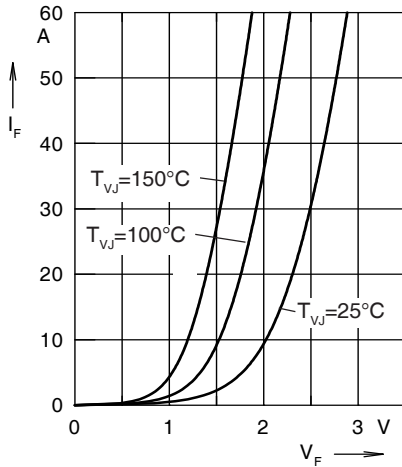


Fig. 21. Forward current  $I_F$  versus  $V_F$

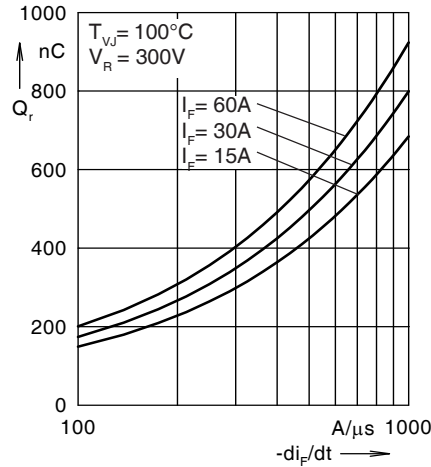


Fig. 22. Reverse recovery charge  $Q_r$  versus  $-di_F/dt$

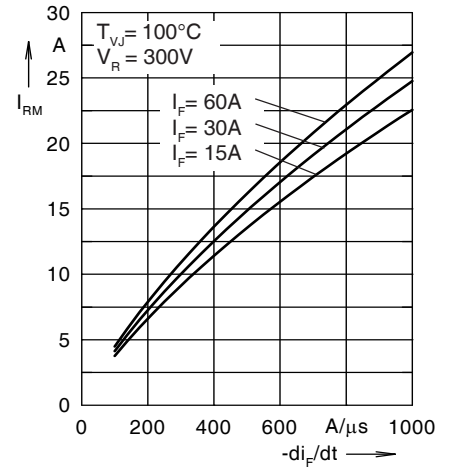


Fig. 23. Peak reverse current  $I_{RM}$  versus  $-di_F/dt$

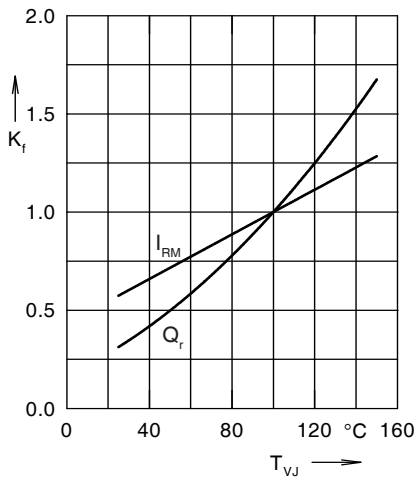


Fig. 24. Dynamic parameters  $Q_r$ ,  $I_{RM}$  versus  $T_{VJ}$

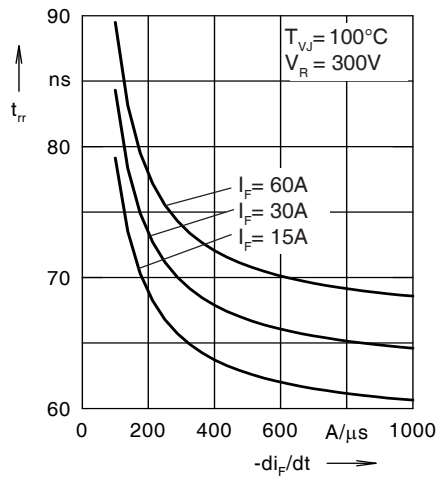


Fig. 25. Recovery time  $t_{tr}$  versus  $-di_F/dt$

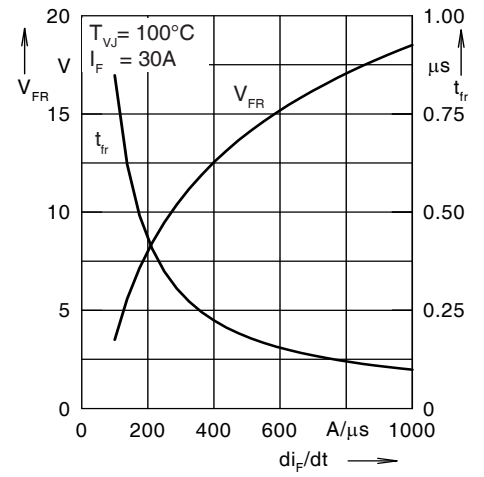


Fig. 26. Peak forward voltage  $V_{FR}$  and  $t_{tr}$  versus  $di_F/dt$

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

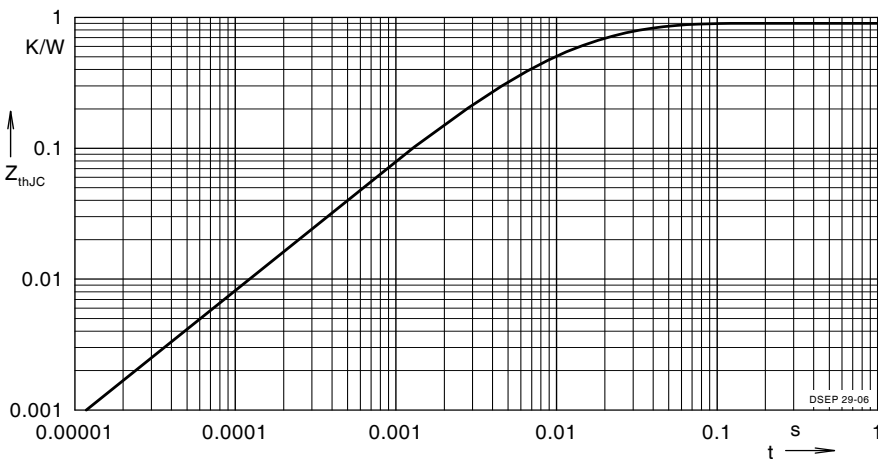


Fig. 27. Transient thermal resistance junction to case



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