

# HiPerFAST™ IGBTs w/ Diode

**IXGT40N60C2D1**  
**IXGJ40N60C2D1**  
**IXGH40N60C2D1**

**$V_{CES} = 600V$**   
 **$I_{C110} = 40A$**   
 **$V_{CE(SAT)} \leq 2.7V$**   
 **$t_{fi(typ)} = 32ns$**

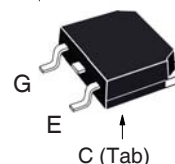
## C2-Class High Speed IGBTs



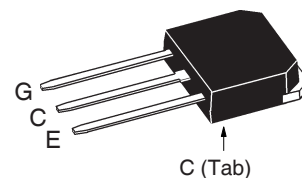
Symbol	Test Conditions	Maximum Ratings	
$V_{CES}$	$T_J = 25^\circ C$ to $150^\circ C$	600	V
$V_{CGR}$	$T_J = 25^\circ C$ to $150^\circ C$ , $R_{GE} = 1M\Omega$	600	V
$V_{GES}$	Continuous	$\pm 20$	V
$V_{GEM}$	Transient	$\pm 30$	V
$I_{C25}$	$T_C = 25^\circ C$ ( Limited by Lead)	75	A
$I_{C110}$	$T_C = 110^\circ C$	40	A
$I_{CM}$	$T_C = 25^\circ C$ , 1ms	200	A
<b>SSOA</b> <b>(RBSOA)</b>	$V_{GE} = 15V$ , $T_J = 125^\circ C$ , $R_G = 10\Omega$ Clamped Inductive Load	$I_{CM} = 80$ $V_{CE} \leq V_{CES}$	A
$P_C$	$T_C = 25^\circ C$	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	$^\circ C$
$M_d$	Mounting Torque (TO-247)	1.13/10	Nm/lb.in.
<b>Weight</b>	TO-247	6	g
	TO-268	4	g

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
$I_{CES}$	$V_{CE} = V_{CES}$ , $V_{GE} = 0V$ $T_J = 125^\circ C$			200 $\mu A$ 3 mA
$I_{GES}$	$V_{CE} = 0V$ , $V_{GE} = \pm 20V$			$\pm 100$ nA
$V_{CE(sat)}$	$I_C = 30A$ , $V_{GE} = 15V$ , Note 1 $T_J = 125^\circ C$		2.2 1.7	2.7 V V

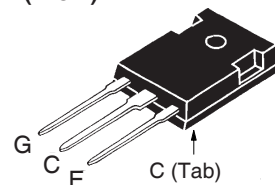
TO-268 (IXGT)



TO-268 (IXGJ)



TO-247 (IXGH)



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

### Features

- Very High Frequency IGBT
- Square RBSOA
- High Current Handling Capability

### Applications

- Uninterruptible Power Supplies (UPS)
- Switch-Mode and Resonant-Mode Power Supplies
- AC Motor Speed Control
- DC Servo and Robot Drives
- DC Choppers

### Advantages

- High Power Density
- Very Fast Switching Speeds for High Frequency Applications
- High Power Surface Mountable Packages

### Symbol Test Conditions

( $T_J = 25^\circ\text{C}$  Unless Otherwise Specified)

### Characteristic Values

		Min.	Typ.	Max.	
$g_{fs}$	$I_C = 30\text{A}, V_{CE} = 10\text{V}$ , Note 1	20	36		S
$C_{ies}$	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$		2500		pF
$C_{oes}$			220		pF
$C_{res}$			54		pF
$Q_g$	$I_C = 30\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 \cdot V_{CES}$		95		nC
$Q_{ge}$			14		nC
$Q_{gc}$			36		nC
$t_{d(on)}$	<b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b>		18		ns
$t_{ri}$		$I_C = 30\text{A}, V_{GE} = 15\text{V}$		20	
$t_{d(off)}$	$V_{CE} = 400\text{V}, R_G = 3\Omega$		90	140	ns
$t_{fi}$				32	
$E_{off}$	Note 2		0.20	0.37	mJ
$t_{d(on)}$	<b>Inductive load, <math>T_J = 125^\circ\text{C}</math></b>		18		ns
$t_{ri}$		$I_C = 30\text{A}, V_{GE} = 15\text{V}$		20	
$E_{on}$	$V_{CE} = 400\text{V}, R_G = 3\Omega$		0.60		mJ
$t_{d(off)}$				130	
$t_{fi}$	Note 2		80		ns
$E_{off}$				0.50	
$R_{thJC}$				0.42	$^\circ\text{C/W}$
$R_{thCS}$	TO-247 & TO-268		0.25		$^\circ\text{C/W}$

### Reverse Diode (FRED)

### Symbol Test Conditions

( $T_J = 25^\circ\text{C}$  Unless Otherwise Specified)

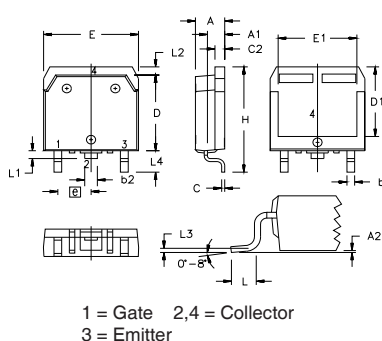
### Characteristic Values

		Min.	Typ.	Max.	
$V_F$	$I_F = 30\text{A}, V_{GE} = 0\text{V}$ , Note 1			2.5	V
$I_{RM}$	$I_F = 30\text{A}, V_{GE} = 0\text{V}, -di_F/dt = 100\text{A}/\mu\text{s}$			4	A
$t_{rr}$	$V_R = 100\text{V}$		100		ns
	$I_F = 1\text{A}, V_{GE} = 0\text{V}, -di_F/dt = 100\text{A}/\mu\text{s}, V_R = 30\text{V}$		25		ns
$R_{thJC}$				0.9	$^\circ\text{C/W}$

Notes:

1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .
2. Switching times & energy losses may increase for higher  $V_{CE}$  (clamp),  $T_J$  or  $R_G$ .

### TO-268 Outline

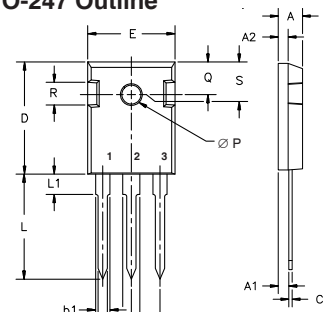


SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.193	.201	4.90	5.10
A1	.106	.114	2.70	2.90
A2	.001	.010	0.02	0.25
b	.045	.057	1.15	1.45
b2	.075	.083	1.90	2.10
C	.016	.026	0.40	0.65
C2	.057	.063	1.45	1.60
D	.543	.551	13.80	14.00
D1	.488	.500	12.40	12.70
E	.624	.632	15.85	16.05
E1	.524	.535	13.30	13.60
e	.215 BSC		5.45 BSC	
H	.736	.752	18.70	19.10
L	.094	.106	2.40	2.70
L1	.047	.055	1.20	1.40
L2	.039	.045	1.00	1.15
L3	.010 BSC		0.25 BSC	
L4	.150	.161	3.80	4.10

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

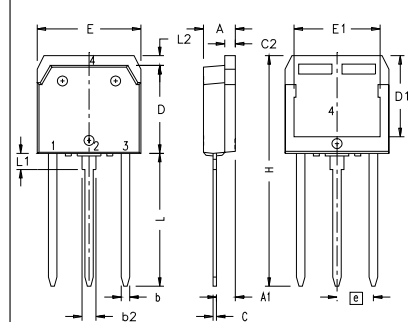
IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:	4,835,592	4,931,844	5,049,961	5,237,481	6,162,665	6,404,065 B1	6,683,344	6,727,585	7,005,734 B2	7,157,338B2
	4,850,072	5,017,508	5,063,307	5,381,025	6,259,123 B1	6,534,343	6,710,405 B2	6,759,692	7,063,975 B2	
	4,881,106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

### TO-247 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	.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

### TO-268 Ledged Outline



SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.193	.201	4.90	5.10
A1	.106	.114	2.70	2.90
b	.045	.057	1.15	1.45
b2	.075	.083	1.90	2.10
C	.016	.026	0.40	0.65
C2	.057	.063	1.45	1.60
D	.543	.551	13.80	14.00
D1	.488	.500	12.40	12.70
E	.624	.632	15.85	16.05
E1	.524	.535	13.30	13.60
e	.215 BSC		5.45 BSC	
H	1.365	1.395	34.67	35.43
L	.780	.800	19.81	20.32
L1	.079	.091	2.00	2.30
L2	.039	.045	1.00	1.15

NOTE: ALL METAL AREA ARE SOLDER PLATED.

- 1 - GATE
- 2 - DRAIN (COLLECTOR)
- 3 - SOURCE (EMITTER)
- 4 - DRAIN (COLLECTOR)

Fig. 1. Output Characteristics  
@ 25 Deg. C

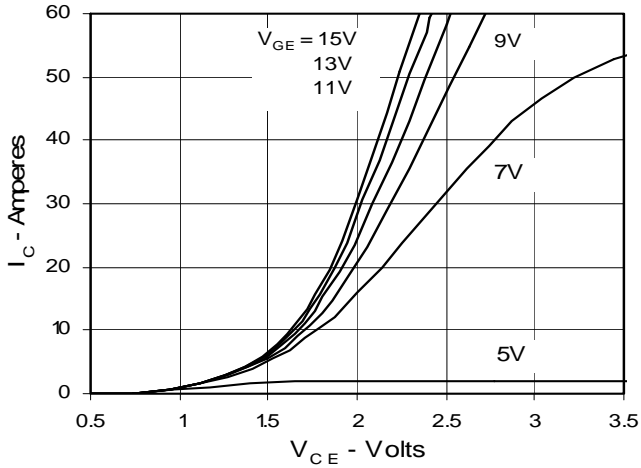


Fig. 2. Extended Output Characteristics  
@ 25 deg. C

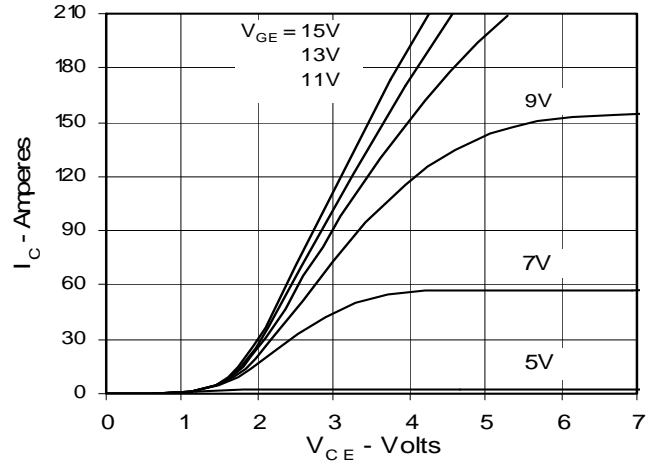


Fig. 3. Output Characteristics  
@ 125 Deg. C

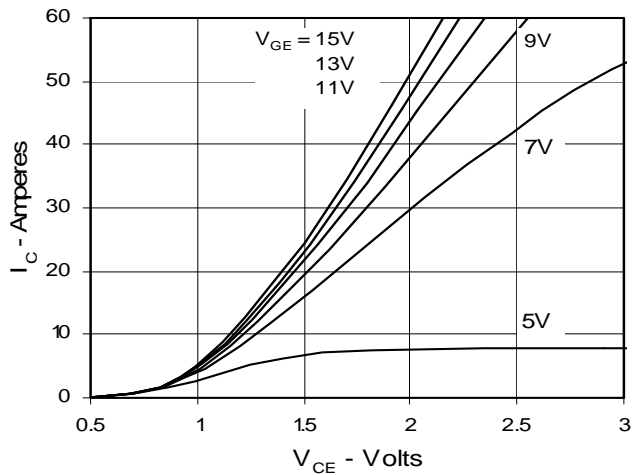


Fig. 4. Temperature Dependence of  $V_{CE(sat)}$

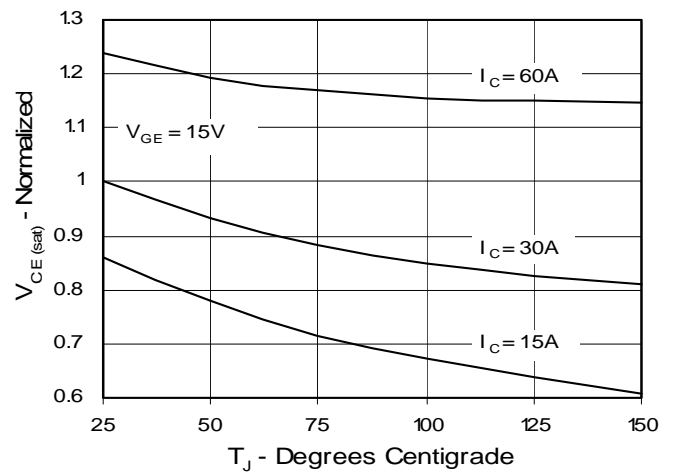


Fig. 5. Collector-to-Emitter Voltage  
vs. Gate-to-Emitter voltage

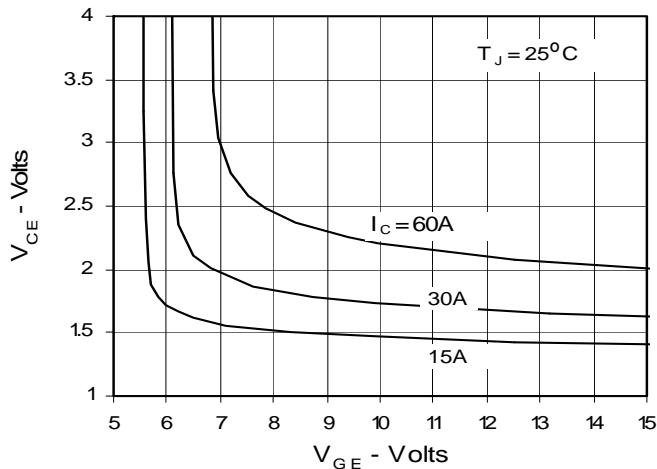


Fig. 6. Input Admittance

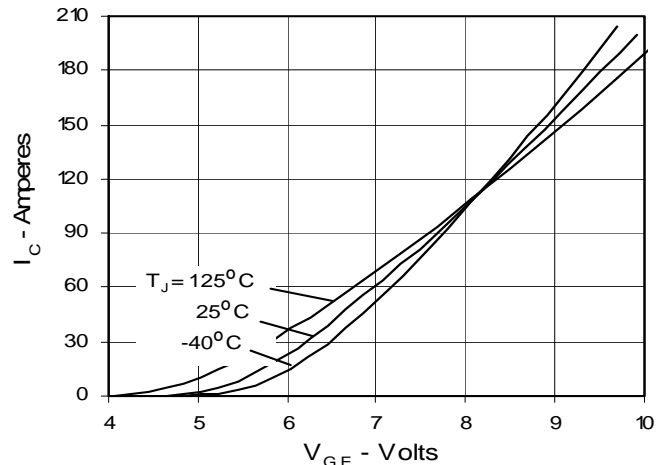


Fig. 7. Transconductance

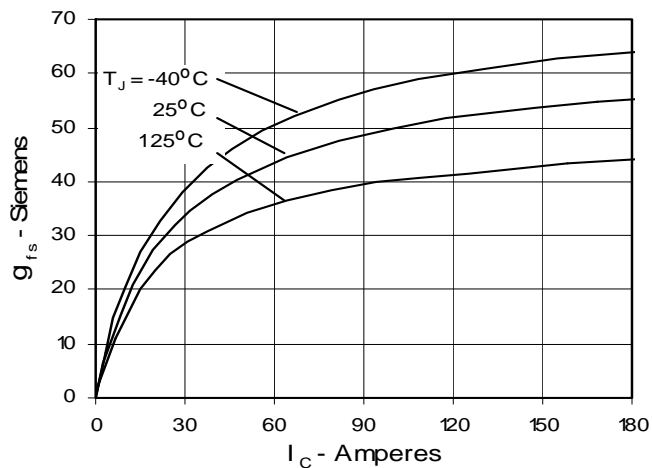


Fig. 8. Dependence of  $E_{off}$  on  $R_G$

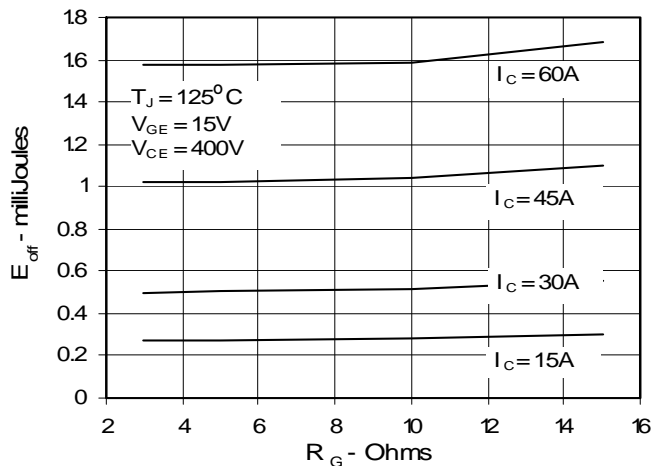


Fig. 9. Dependence of  $E_{off}$  on  $I_C$

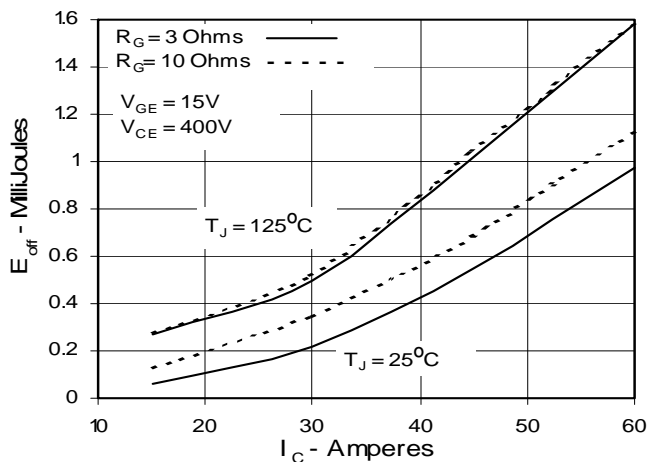


Fig. 10. Dependence of  $E_{off}$  on Temperature

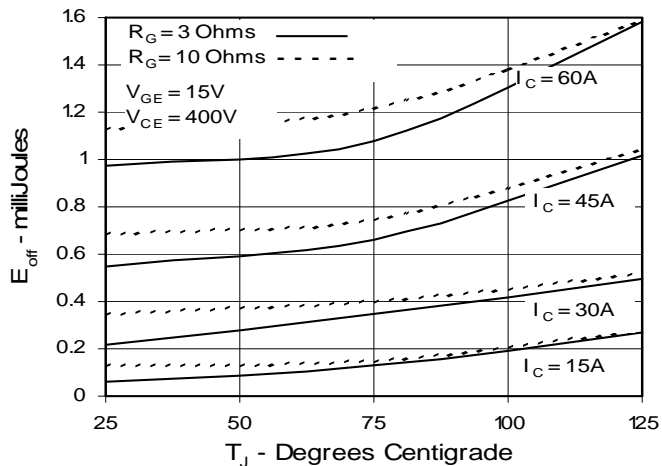


Fig. 11. Gate Charge

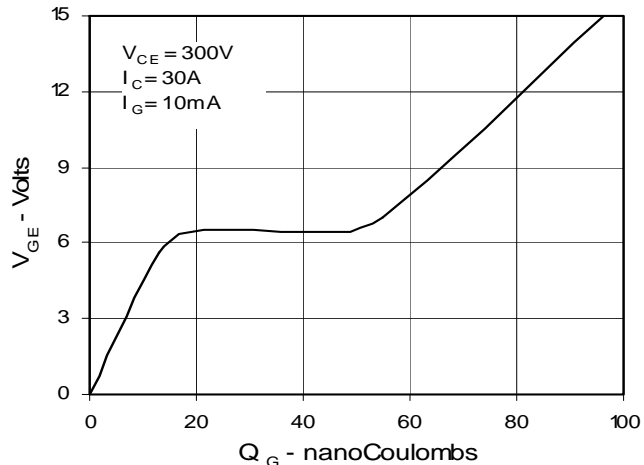


Fig. 12. Capacitance

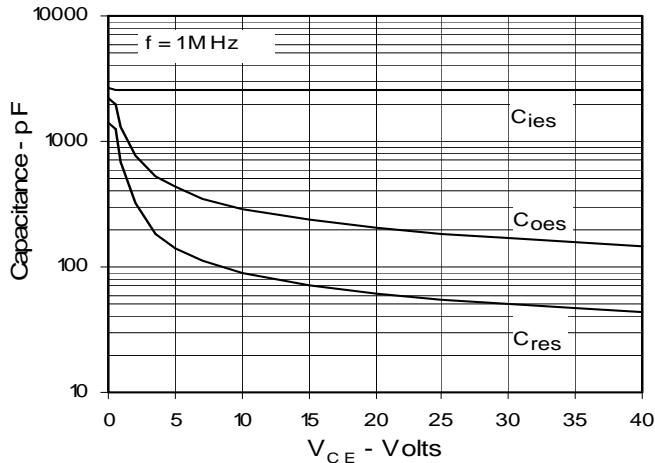
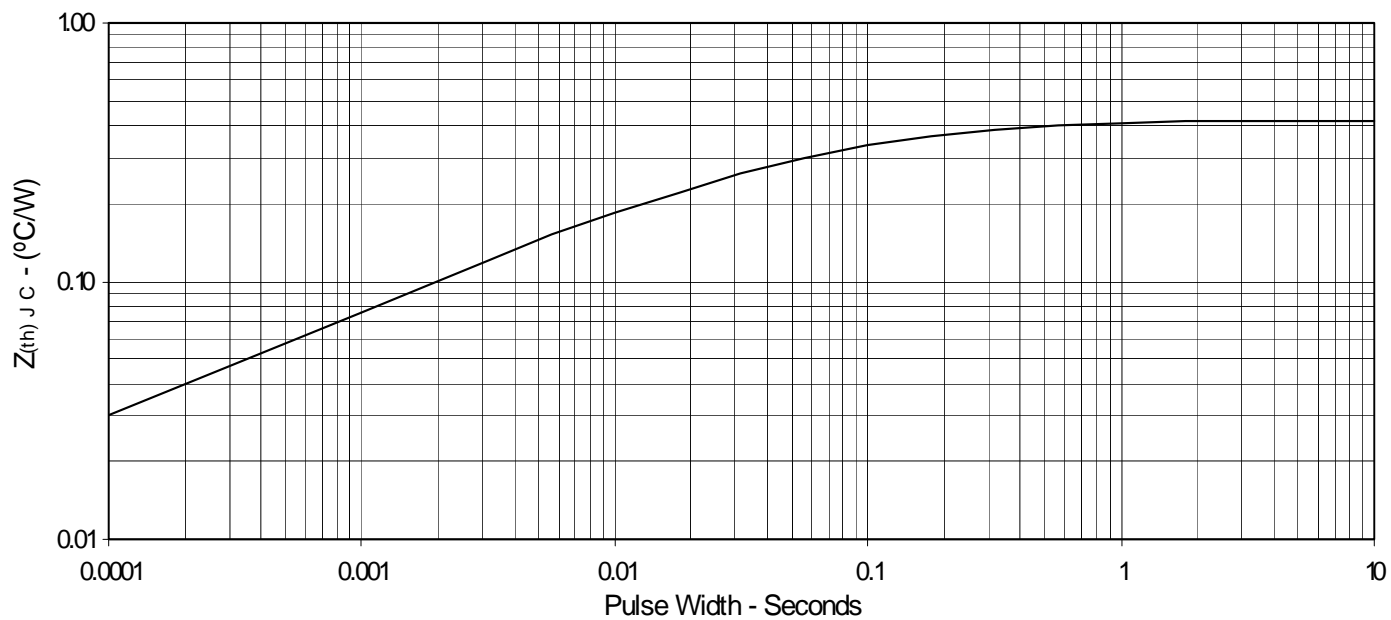


Fig. 13. Maximum Transient Thermal Impedance



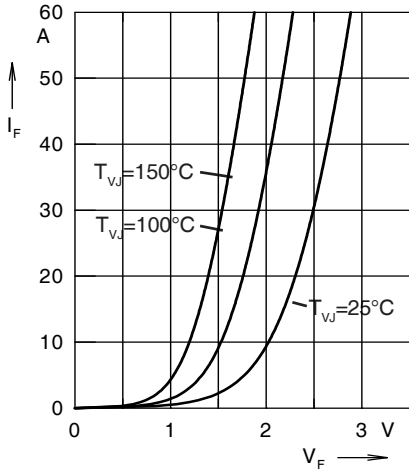


Fig. 14. Forward current  $I_F$  versus  $V_F$

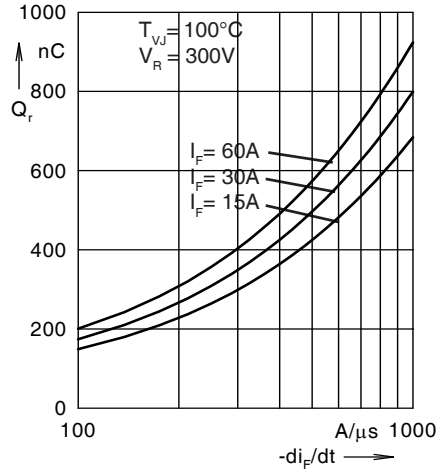


Fig. 15. Reverse recovery charge  $Q_r$  versus  $-di_F/dt$

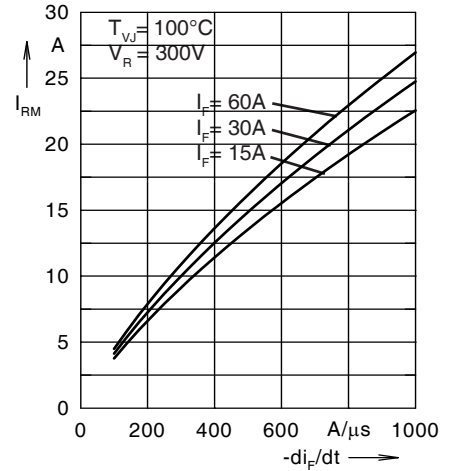


Fig. 16. Peak reverse current  $I_{RM}$  versus  $-di_F/dt$

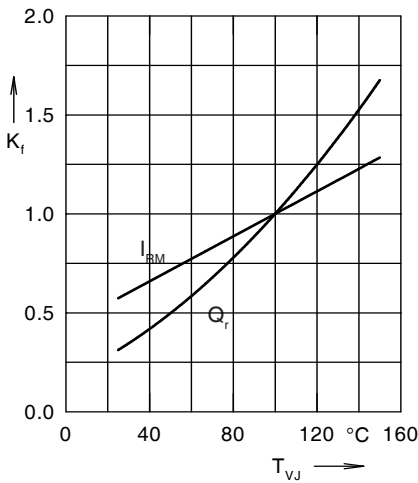


Fig. 17. Dynamic parameters  $Q_r$ ,  $I_{RM}$  versus  $T_{VJ}$

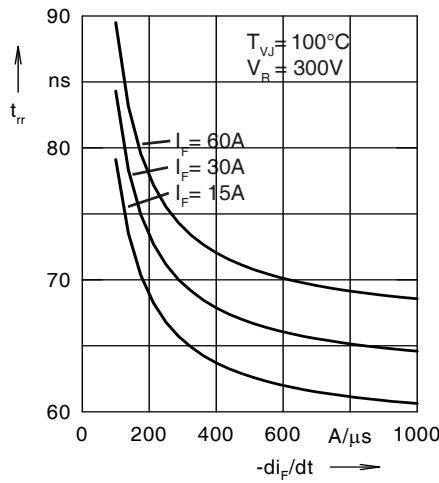


Fig. 18. Recovery time  $t_{rr}$  versus  $-di_F/dt$

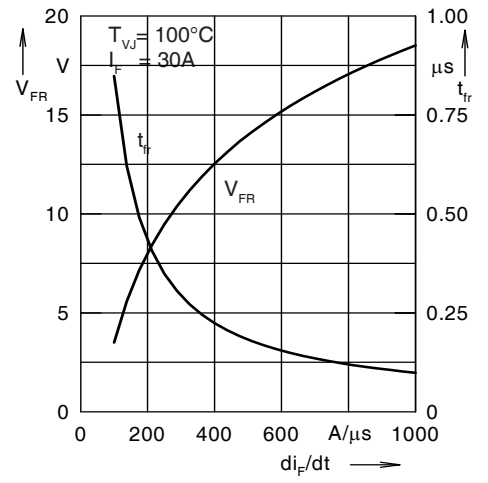


Fig. 19. Peak forward voltage  $V_{FR}$  and  $t_{rr}$  versus  $di_F/dt$

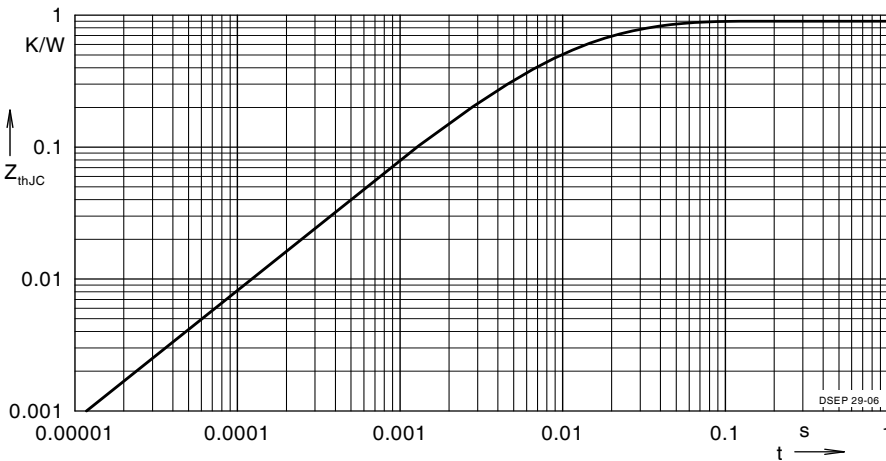


Fig. 20. Transient thermal resistance junction to case

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