

# HiPerFAST™ IGBT

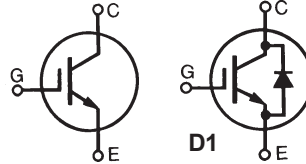
## ISOPLUS247™

### B2-Class High Speed IGBTs

(Electrically Isolated Back Surface)

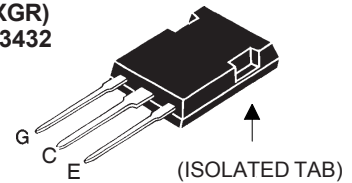
IXGR 60N60B2  
IXGR 60N60B2D1

$V_{CES}$  = 600 V  
 $I_{C25}$  = 75 A  
 $V_{CE(sat)}$  = 2.0 V  
 $t_{fi(typ)}$  = 100 ns



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 $150^\circ\text{C}$ ; $R_{GE} = 1\ \text{M}\Omega$	600	V
$V_{GES}$	Continuous	$\pm 20$	V
$V_{GEM}$	Transient	$\pm 30$	V
$I_{C25}$	$T_C = 25^\circ\text{C}$ (limited by leads)	75	A
$I_{C110}$	$T_C = 110^\circ\text{C}$	47	A
$I_{CM}$	$T_C = 25^\circ\text{C}$ , 1 ms	300	A
<b>SSOA</b> <b>(RBSOA)</b>	$V_{GE} = 15\ \text{V}$ , $T_{VJ} = 125^\circ\text{C}$ , $R_G = 10\ \Omega$ Clamped inductive load @ $V_{CE} \leq 600\ \text{V}$	$I_{CM} = 150$	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	$^\circ\text{C}$
$V_{ISOL}$	50/60 Hz, RMS, $t = 1\ \text{m}$	2500	V
<b>Weight</b>		5	g
	Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s	300	$^\circ\text{C}$

PLUS247(IXGR)  
E153432



G = Gate      C = Collector  
E = Emitter

#### Features

- DCB Isolated mounting tab
- Meets TO-247AD package Outline
- High current handling capability
- Latest generation HDMOS™ process
- MOS Gate turn-on - drive simplicity

#### Applications

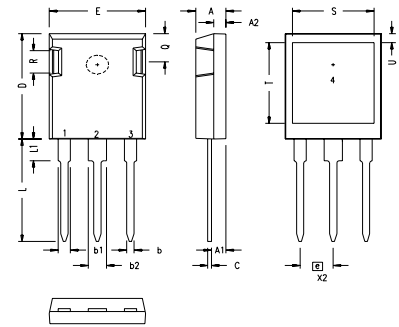
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies
- AC motor speed control
- DC servo and robot drives
- DC choppers

#### Advantages

- Easy assembly
- High power density
- Very fast switching speeds for high frequency applications

Symbol	Test Conditions	Characteristic Values ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)		
		Min.	Typ.	Max.
$V_{GE(th)}$	$I_C = 250\ \mu\text{A}$ , $V_{CE} = V_{GE}$	3.0		5.0 V
$I_{CES}$	$V_{CE} = V_{CES}$ $V_{GE} = 0\ \text{V}$ $T_J = 125^\circ\text{C}$			300 $\mu\text{A}$ 5 mA
$I_{GES}$	$V_{CE} = 0\ \text{V}$ , $V_{GE} = \pm 20\ \text{V}$			$\pm 100\ \text{nA}$
$V_{CE(sat)}$	$I_C = 50\ \text{A}$ , $V_{GE} = 15\ \text{V}$ Note 1			2.0 V

Symbol	Test Conditions	Characteristic Values ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)			
		Min.	Typ.	Max.	
$g_{fs}$	$I_C = 50\text{ A}; V_{CE} = 10\text{ V}$ , Note 1	40	58	S	
$C_{ies}$	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$		3900	pF	
$C_{oes}$			340	pF	
$C_{res}$			100	pF	
$Q_g$	$I_C = 50\text{ A}, V_{GE} = 15\text{ V}, V_{CE} = 0.5 V_{CES}$		170	nC	
$Q_{ge}$			25	nC	
$Q_{gc}$			57	nC	
$t_{d(on)}$	<b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b> $I_C = 50\text{ A}, V_{GE} = 15\text{ V}$ $V_{CE} = 400\text{ V}, R_G = R_{off} = 3.3\ \Omega$		28	ns	
$t_{ri}$			30	ns	
$t_{d(off)}$			160	270	ns
$t_{fi}$			100	170	ns
$E_{off}$			1.0	2.5	mJ
$t_{d(on)}$	<b>Inductive load, <math>T_J = 125^\circ\text{C}</math></b> $I_C = 50\text{ A}, V_{GE} = 15\text{ V}$ $V_{CE} = 400\text{ V}, R_G = R_{off} = 2.0\ \Omega$		28	ns	
$t_{ri}$			36	ns	
$E_{on}$			1.5	mJ	
$t_{d(off)}$			310	ns	
$t_{fi}$			240	ns	
$E_{off}$		2.8	mJ		
$R_{thJC}$			0.15	0.5 K/W	
$R_{thCK}$				K/W	

**ISOPLUS 247 Outline**


SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.190	.205	4.83	5.21
A1	.090	.100	2.29	2.54
A2	.075	.085	1.91	2.16
b	.045	.055	1.14	1.40
b1	.075	.084	1.91	2.13
b2	.115	.123	2.92	3.12
C	.024	.031	0.61	0.80
D	.819	.840	20.80	21.34
E	.620	.635	15.75	16.13
e	.215 BSC		5.45 BSC	
L	.780	.800	19.81	20.32
L1	.150	.170	3.81	4.32
Q	.220	.244	5.59	6.20
R	.170	.190	4.32	4.83
S	.520	.540	13.21	13.72
T	.620	.640	15.75	16.26
U	.065	.080	1.65	2.03

- 1 - GATE
- 2 - DRAIN (COLLECTOR)
- 3 - SOURCE (EMITTER)
- 4 - NO CONNECTION

NOTE: This drawing will meet all dimensions requirement of JEDEC outline TO-247AD except screw hole.

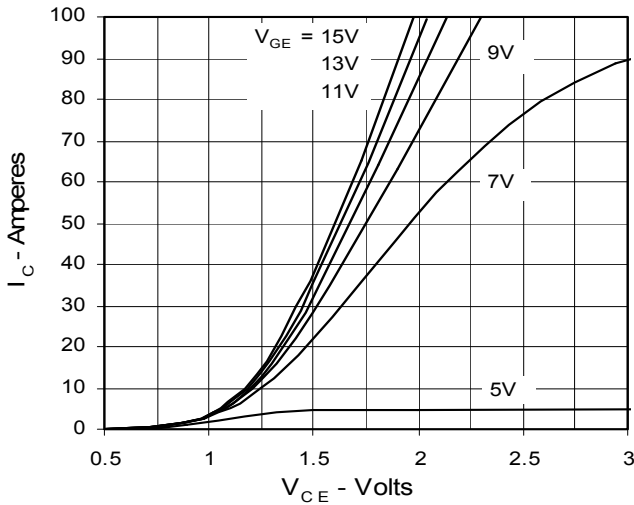
**Reverse Diode (FRED)**

Symbol	Test Conditions	Characteristic Values ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)		
		min.	typ.	max.
$V_F$	$I_F = 60\text{ A}, V_{GE} = 0\text{ V}$ , Note 1			2.1 V
		$T_J = 150^\circ\text{C}$		1.4 V
$I_{RM}$	$I_F = 60\text{ A}, V_{GE} = 0\text{ V}, -di_F/dt = 100\text{ A}/\mu\text{s}$ $V_R = 100\text{ V}$			8.3 A
$t_{rr}$	$I_F = 1\text{ A}; -di/dt = 200\text{ A/ms}; V_R = 30\text{ V}$		35	ns
$R_{thJC}$				0.85 K/W

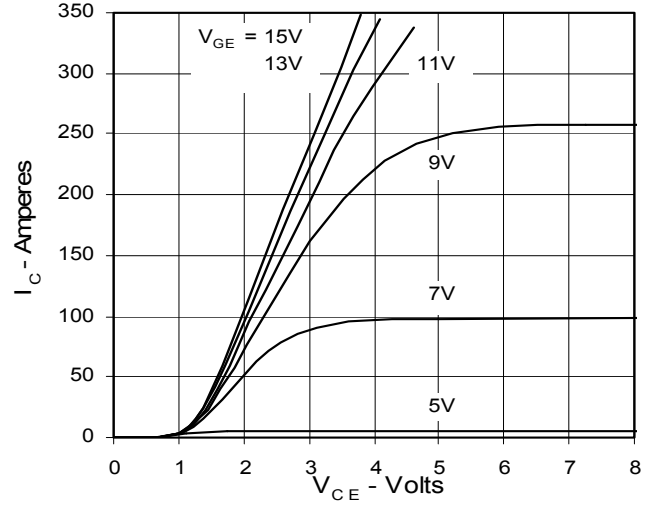
Note 1: Pulse test,  $t \leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$

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

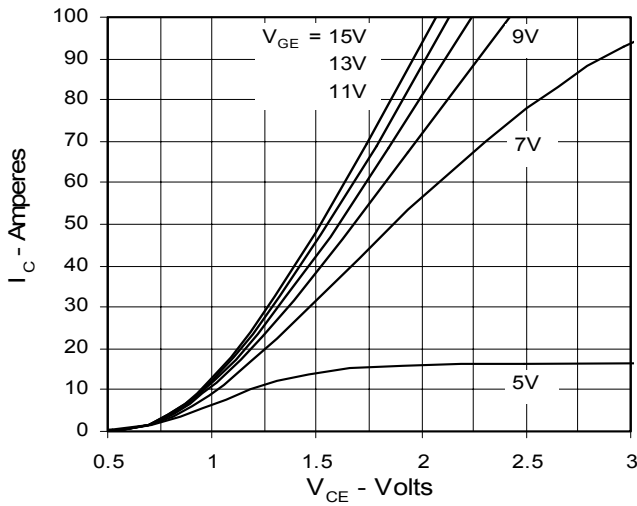
**Fig. 1. Output Characteristics**  
**@ 25 Deg. C**



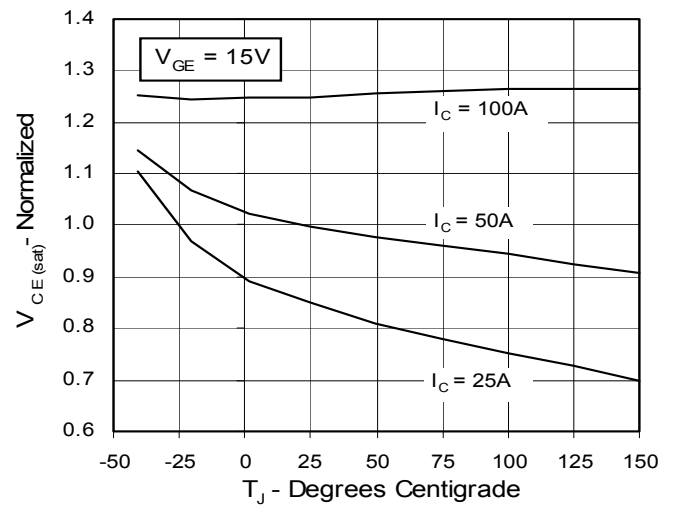
**Fig. 2. Extended Output Characteristics**  
**@ 25 deg. C**



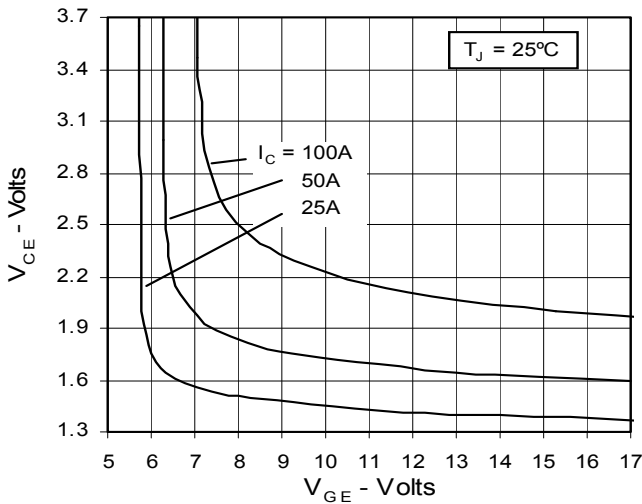
**Fig. 3. Output Characteristics**  
**@ 125 Deg. C**



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



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



**Fig. 6. Input Admittance**

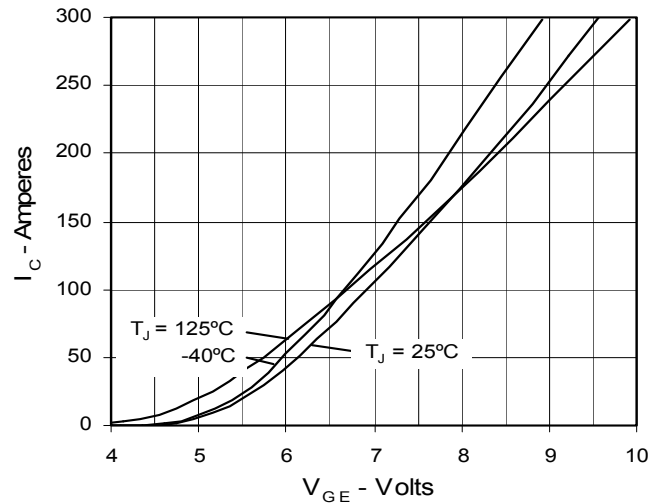


Fig. 7. Transconductance

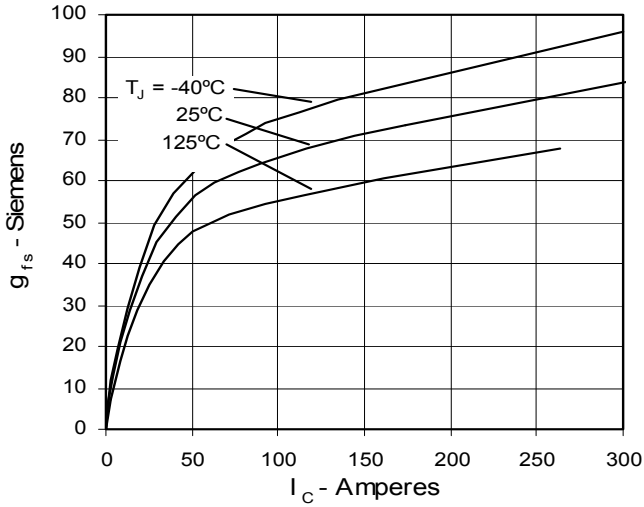


Fig. 8. Dependence of Turn-Off Energy on  $R_G$

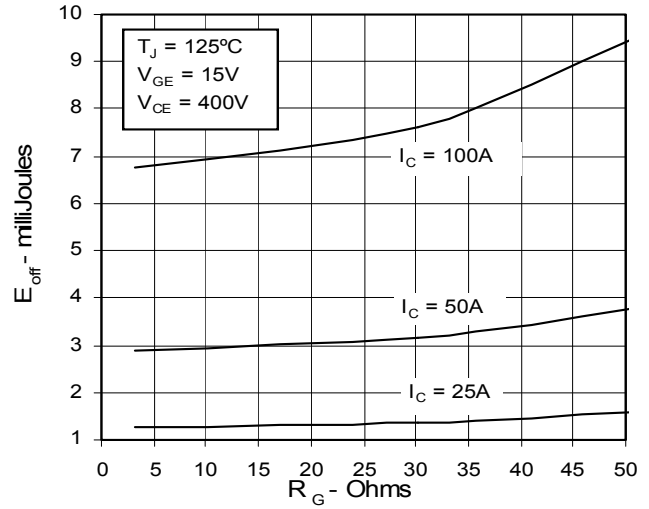


Fig. 9. Dependence of Turn-Off Energy on  $I_C$

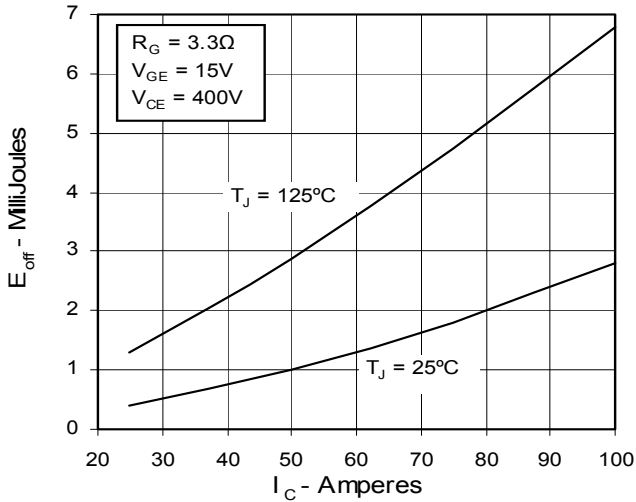


Fig. 10. Dependence of Turn-Off Energy on Temperature

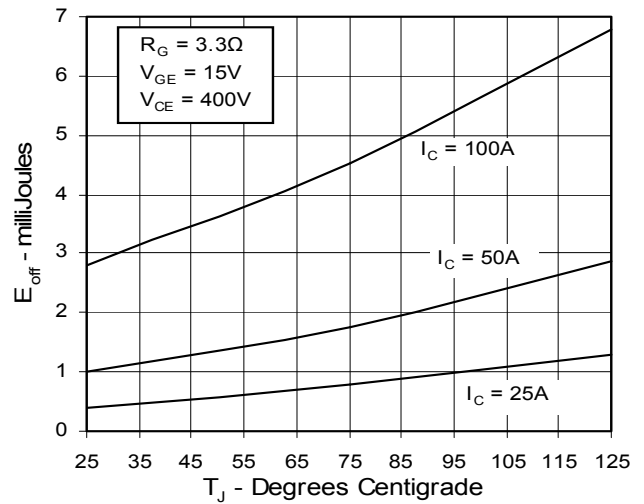


Fig. 11. Dependence of Turn-Off Switching Time on  $R_G$

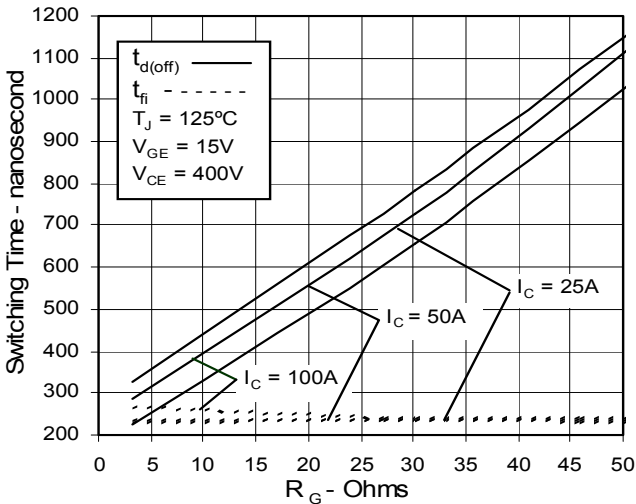
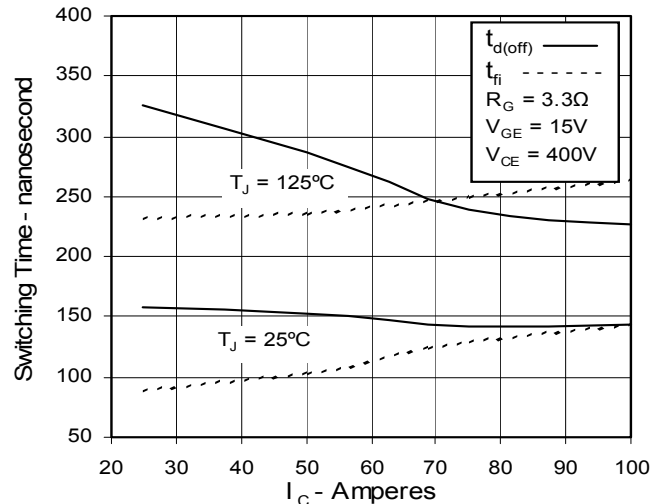
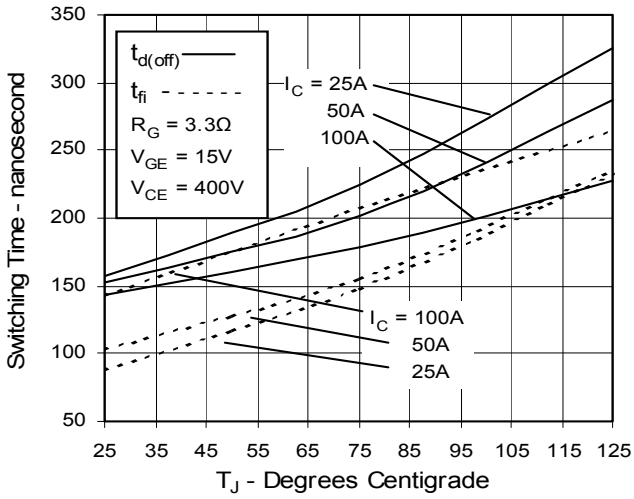


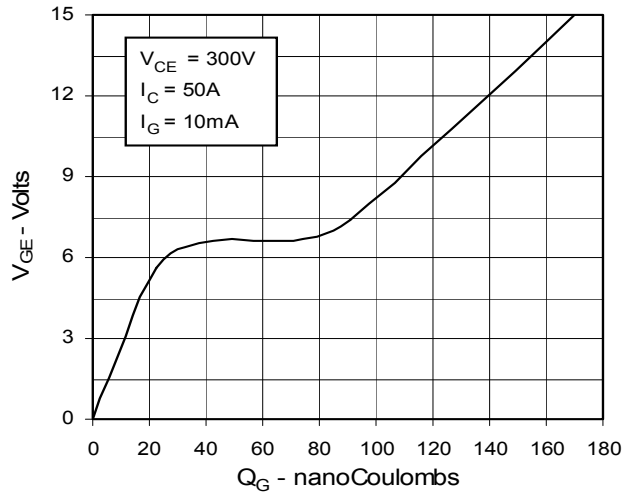
Fig. 12. Dependence of Turn-Off Switching Time on  $I_C$



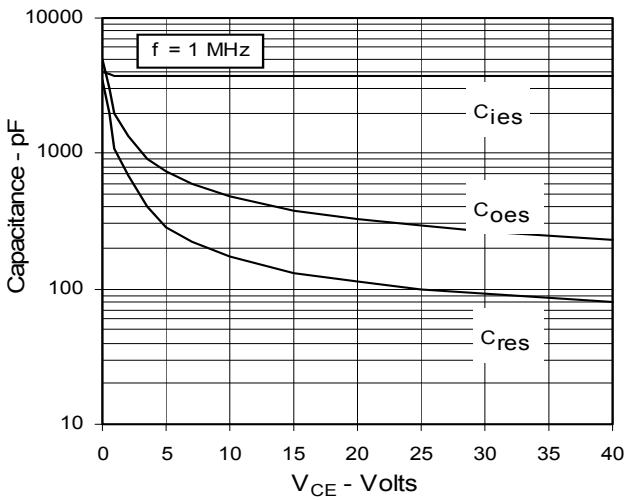
**Fig. 13. Dependence of Turn-Off Switching Time on Temperature**



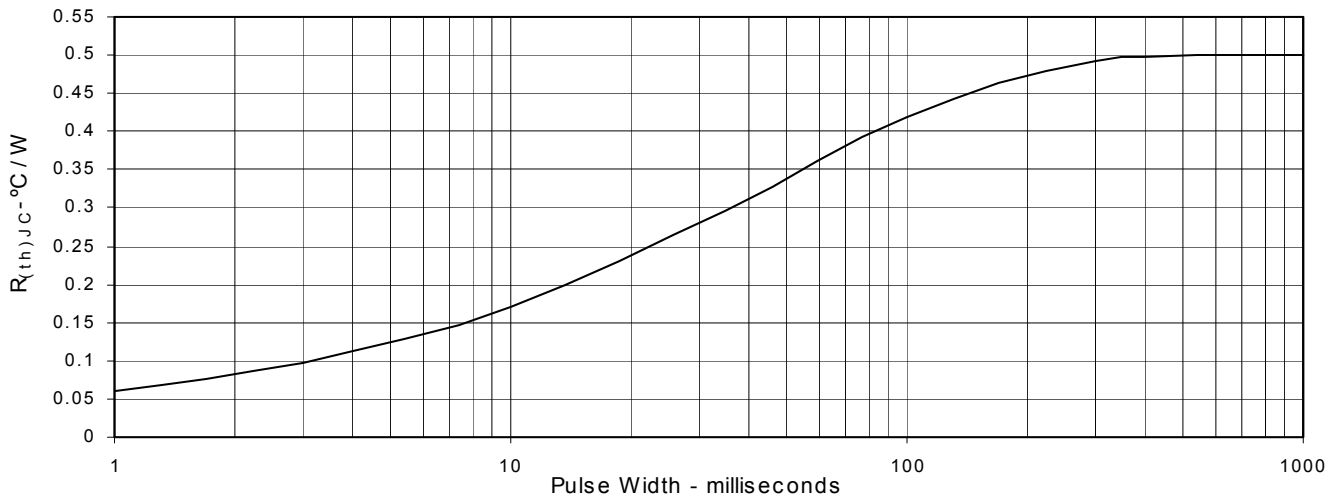
**Fig. 14. Gate Charge**



**Fig. 15. Capacitance**



**Fig. 13. Maximum Transient Thermal Resistance**



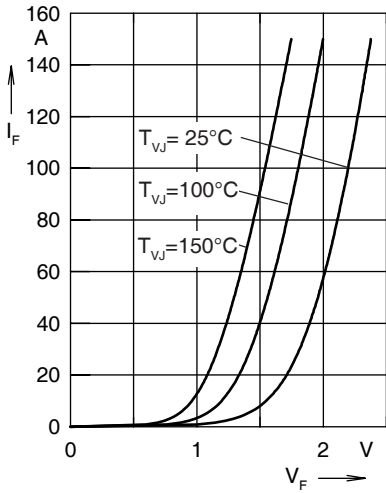


Fig. 17. Forward current  $I_F$  versus  $V_F$

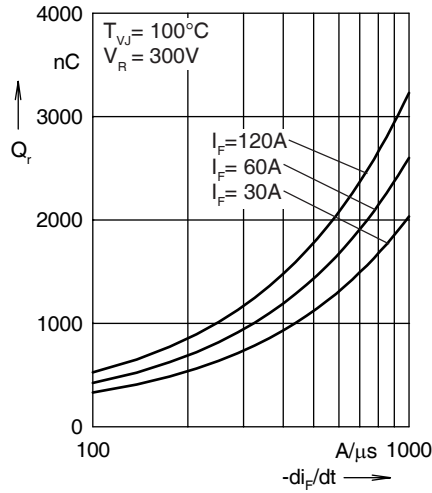


Fig. 18. Reverse recovery charge  $Q_r$  versus  $-di_F/dt$

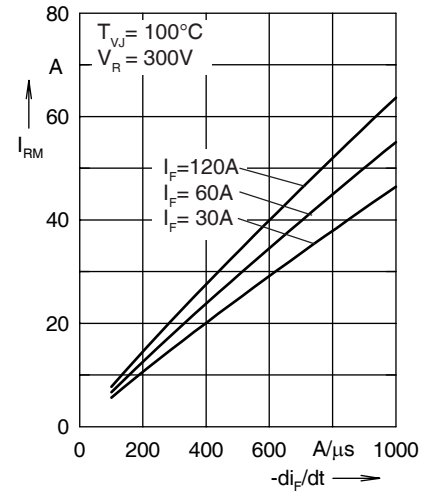


Fig. 19. Peak reverse current  $I_{RM}$  versus  $-di_F/dt$

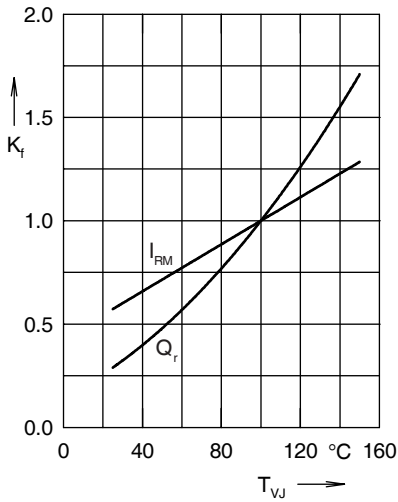


Fig. 20. Dynamic parameters  $Q_r$ ,  $I_{RM}$  versus  $T_{VJ}$

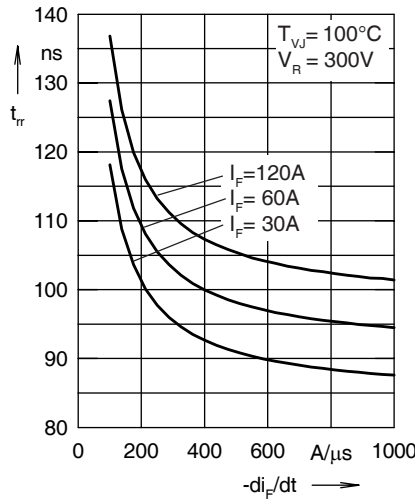


Fig. 21. Recovery time  $t_{tr}$  versus  $-di_F/dt$

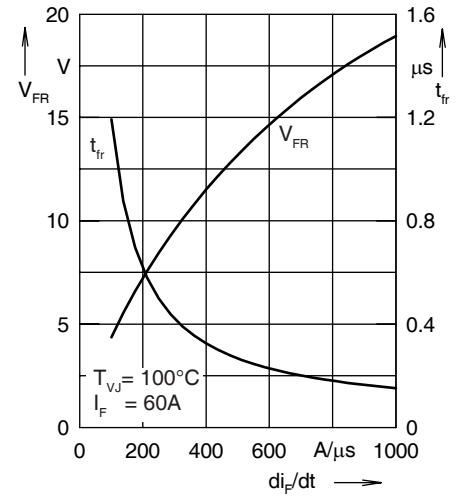


Fig. 22. Peak forward voltage  $V_{FR}$  and  $t_{tr}$  versus  $di_F/dt$

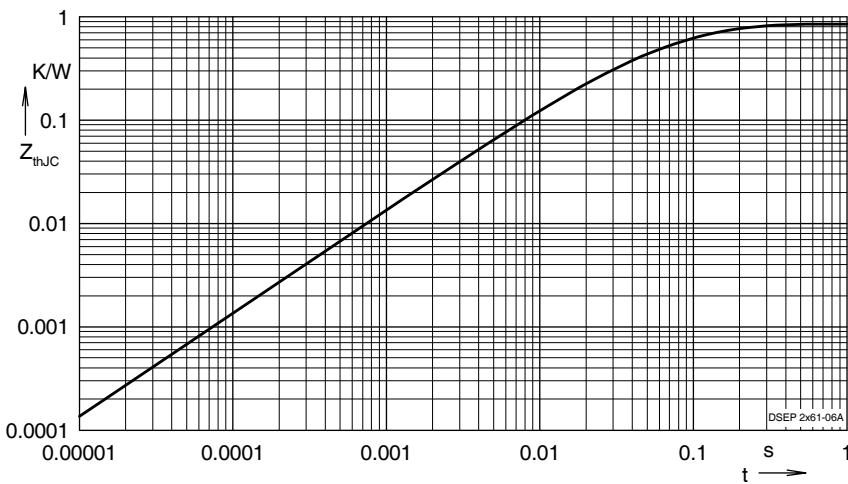


Fig. 23. Transient thermal resistance junction to case

Constants for  $Z_{thJC}$  calculation:

i	$R_{thi}$ (K/W)	$t_i$ (s)
1	0.3073	0.0055
2	0.3533	0.0092
3	0.0887	0.0007
4	0.1008	0.0399