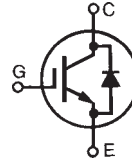


# HiPerFAST™ IGBT with Diode C2-Class High Speed IGBTs

IXGR 50N60C2  
IXGR 50N60C2D1

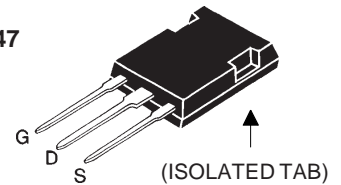
$V_{CES} = 600 \text{ V}$   
 $I_{C25} = 75 \text{ A}$   
 $V_{CE(sat)} = 2.7 \text{ V}$   
 $t_{fi(typ)} = 48 \text{ ns}$

Preliminary Data Sheet



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
$I_{C25}$	$T_C = 25^\circ\text{C}$	75	A
$I_{C110}$	$T_C = 110^\circ\text{C}$	36	A
$I_{CM}$	$T_C = 25^\circ\text{C}$ , 1 ms	300	A
<b>SSOA (RBSOA)</b>	$V_{GE} = 15 \text{ V}$ , $T_{VJ} = 125^\circ\text{C}$ , $R_G = 10 \Omega$ Clamped inductive load @ $V_{CE} \leq 600 \text{ V}$	$I_{CM} = 100$	A
$P_C$	$T_C = 25^\circ\text{C}$	200	W
$V_{ISOL}$	50/60 Hz RMS, $t = 1 \text{ m}$	2500	V
$T_J$		-55 ... +150	$^\circ\text{C}$
$T_{JM}$		150	$^\circ\text{C}$
$T_{stg}$		-55 ... +150	$^\circ\text{C}$
<b>Weight</b>		5	g
	Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s	300	$^\circ\text{C}$

ISOPLUS247  
(IXGR)



G = Gate      C = Collector  
E = Emitter

### Features

- Very high frequency IGBT and anti-parallel FRED in one package
- Square RBSOA
- High current handling capability
- MOS Gate turn-on for drive simplicity
- Fast Recovery Epitaxial Diode (FRED) with soft recovery and low  $I_{RM}$

### Applications

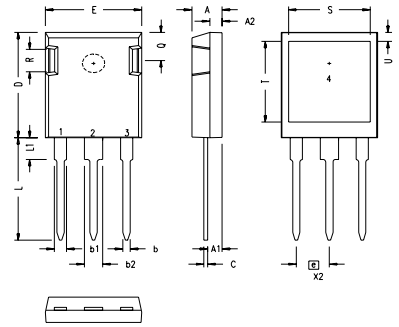
- Switch-mode and resonant-mode power supplies
- Uninterruptible power supplies (UPS)
- DC choppers
- AC motor speed control
- DC servo and robot drives

### Advantages

- Space savings (two devices in one package)
- Easy to mount with 1 screw

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
$I_{CES}$	$V_{CE} = V_{CES}$ $V_{GE} = 0 \text{ V}$		$T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$	650 $\mu\text{A}$ 5 mA
$I_{GES}$	$V_{CE} = 0 \text{ V}$ , $V_{GE} = \pm 20 \text{ V}$			$\pm 100$ nA
$V_{CE(sat)}$	$I_C = 40 \text{ A}$ , $V_{GE} = 15 \text{ V}$ Note 1		$T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$	2.7 V V

Symbol	Test Conditions	Characteristic Values ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)			
		Min.	Typ.	Max.	
$g_{fs}$	$I_C = 40\text{ A}; V_{CE} = 10\text{ V}$ , Note 1	40	51	S	
$C_{ies}$	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$		3700	pF	
$C_{oes}$			290	pF	
$C_{res}$			50	pF	
$Q_g$	$I_C = 40\text{ A}, V_{GE} = 15\text{ V}, V_{CE} = 0.5 V_{CES}$		138	nC	
$Q_{ge}$			25	nC	
$Q_{gc}$			40	nC	
$t_{d(on)}$	<b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b> $I_C = 40\text{ A}, V_{GE} = 15\text{ V}$ $V_{CE} = 480\text{ V}, R_G = R_{off} = 2.0\ \Omega$		18	ns	
$t_{ri}$			25	ns	
$t_{d(off)}$			115	150	ns
$t_{fi}$			48		ns
$E_{off}$			0.38	0.7	mJ
$t_{d(on)}$	<b>Inductive load, <math>T_J = 125^\circ\text{C}</math></b> $I_C = 40\text{ A}, V_{GE} = 15\text{ V}$ $V_{CE} = 480\text{ V}, R_G = R_{off} = 2.0\ \Omega$		18	ns	
$t_{ri}$			25	ns	
$E_{on}$			1.4		mJ
$t_{d(off)}$			170		ns
$t_{fi}$			60		ns
$E_{off}$		0.74		mJ	
$R_{thJC}$			0.62	K/W	
$R_{thCK}$		0.15		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

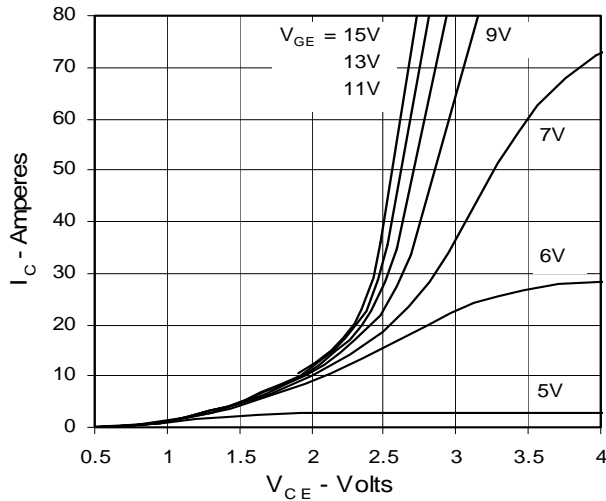
NOTE: This drawing will meet all dimensions requirement of JEDEC outline TO-247AD except screw hole.

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
$I_{RM}$	$I_F = 60\text{ A}, V_{GE} = 0\text{ V}, -di_F/dt = 100\text{ A}/\mu\text{s}$ $T_J = 100^\circ\text{C}$ $V_R = 100\text{ V}$			8.3 A
$t_{rr}$	$I_F = 1\text{ A}; -di/dt = 200\text{ A}/\text{ms}; V_R = 30\text{ V}$		35	ns
$R_{thJC}$				0.85 K/W

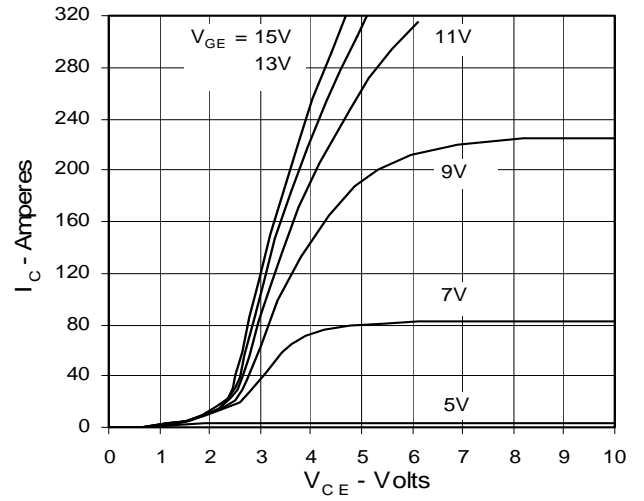
Note 1: Pulse test,  $t \leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$

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

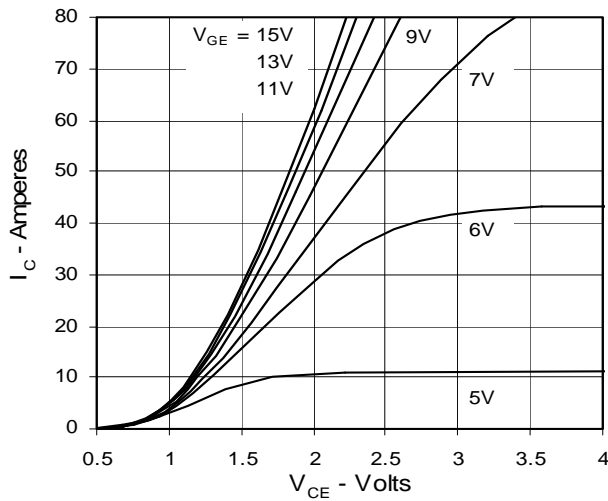
**Fig. 1. Output Characteristics  
@ 25 Deg. C**



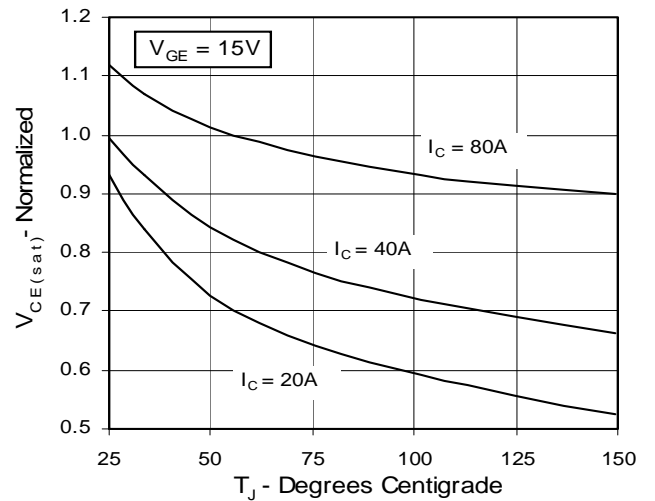
**Fig. 2. Extended Output Characteristics  
@ 25 deg. C**



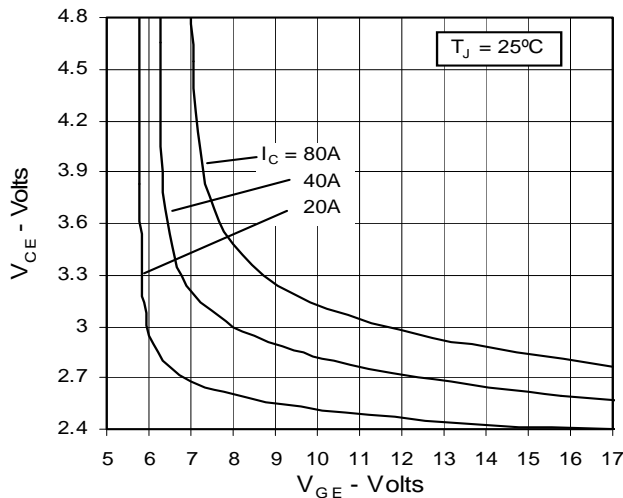
**Fig. 3. Output Characteristics  
@ 125 Deg. C**



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



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



**Fig. 6. Input Admittance**

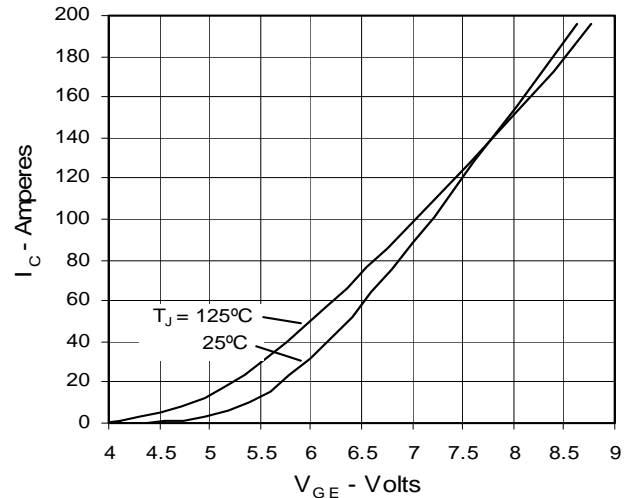


Fig. 7. Transconductance

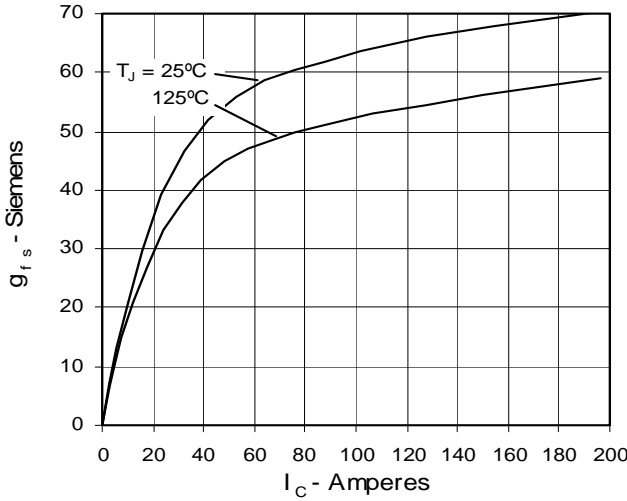


Fig. 8. Dependence of Turn-Off Energy on  $R_G$

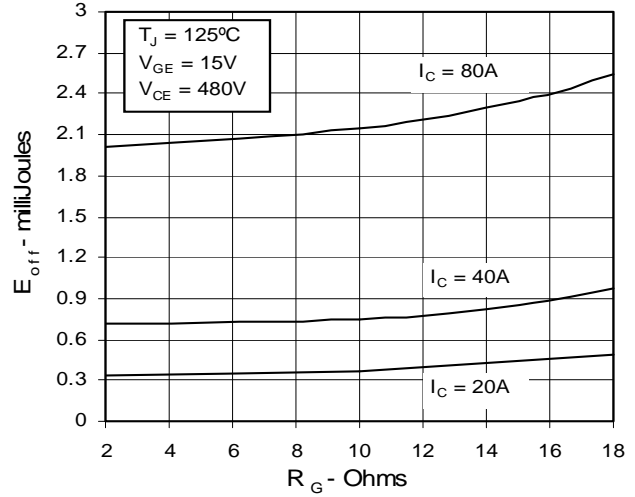


Fig. 9. Dependence of Turn-Off Energy on  $I_C$

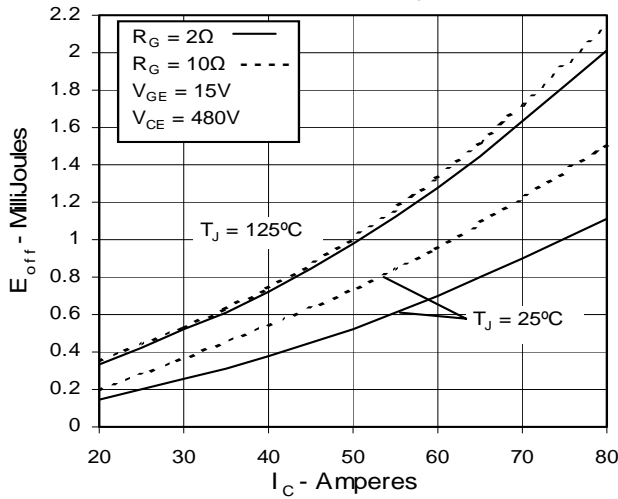


Fig. 10. Dependence of Turn-Off Energy on Temperature

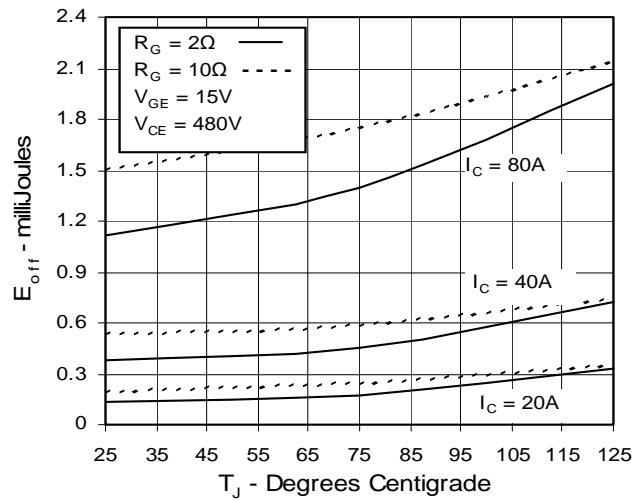


Fig. 11. Dependence of Turn-Off Switching Time on  $R_G$

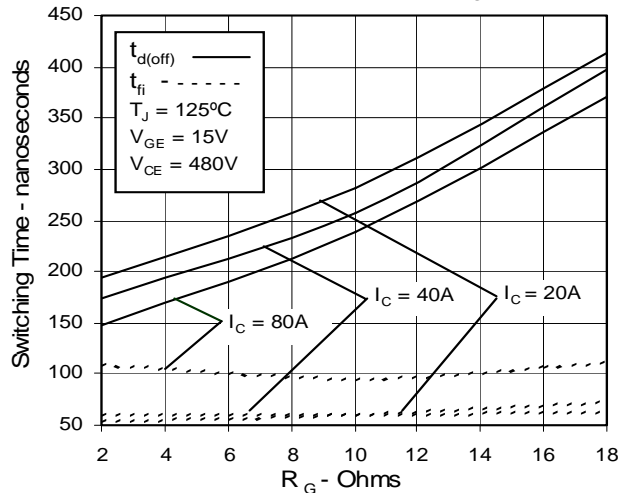
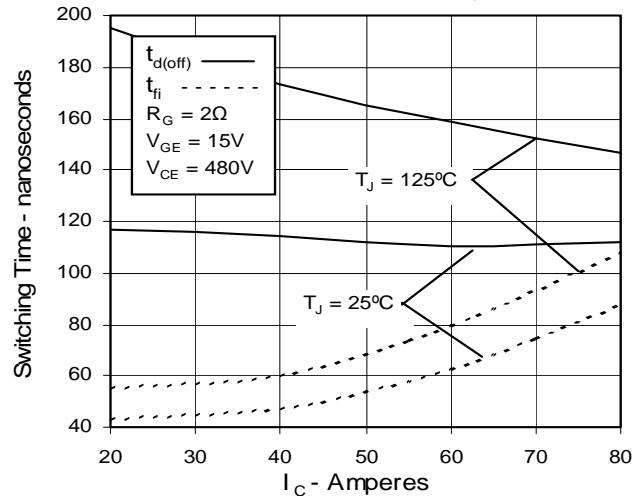
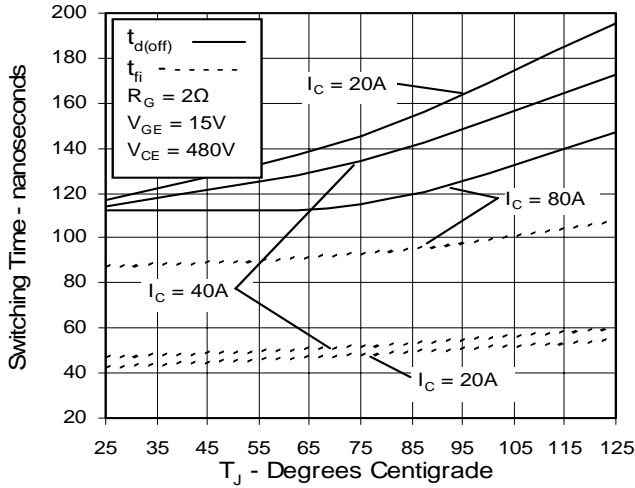


Fig. 12. Dependence of Turn-Off Switching Time on  $I_C$

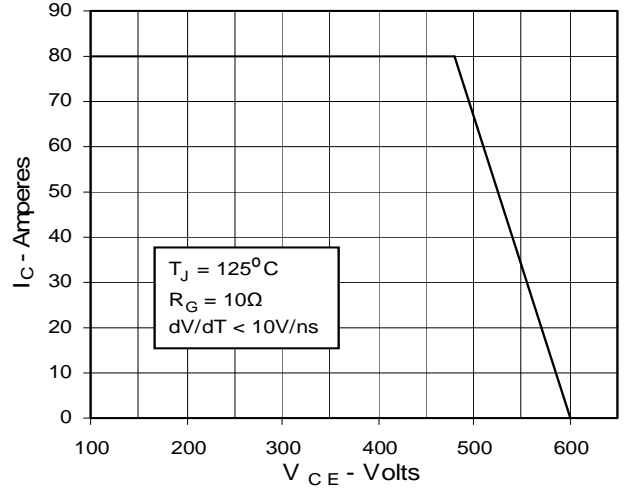


IXYS reserves the right to change limits, test conditions, and dimensions.

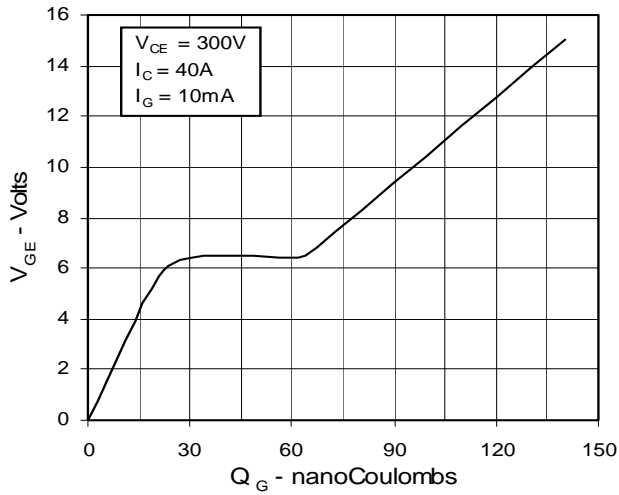
**Fig. 13. Dependence of Turn-Off Switching Time on Temperature**



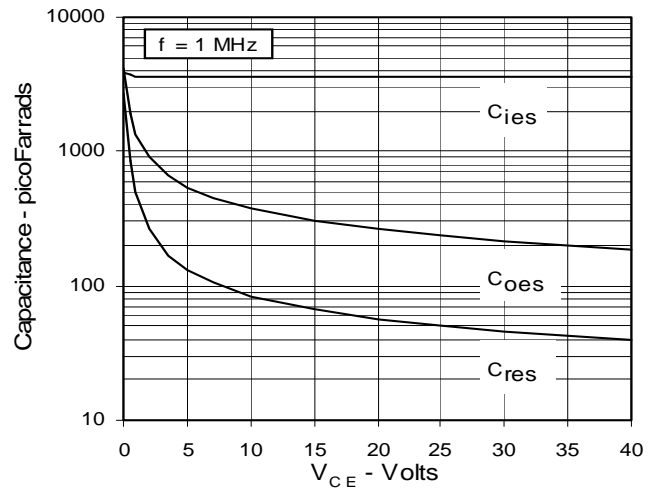
**Fig. 14. Reverse-Bias Safe Operating Area**



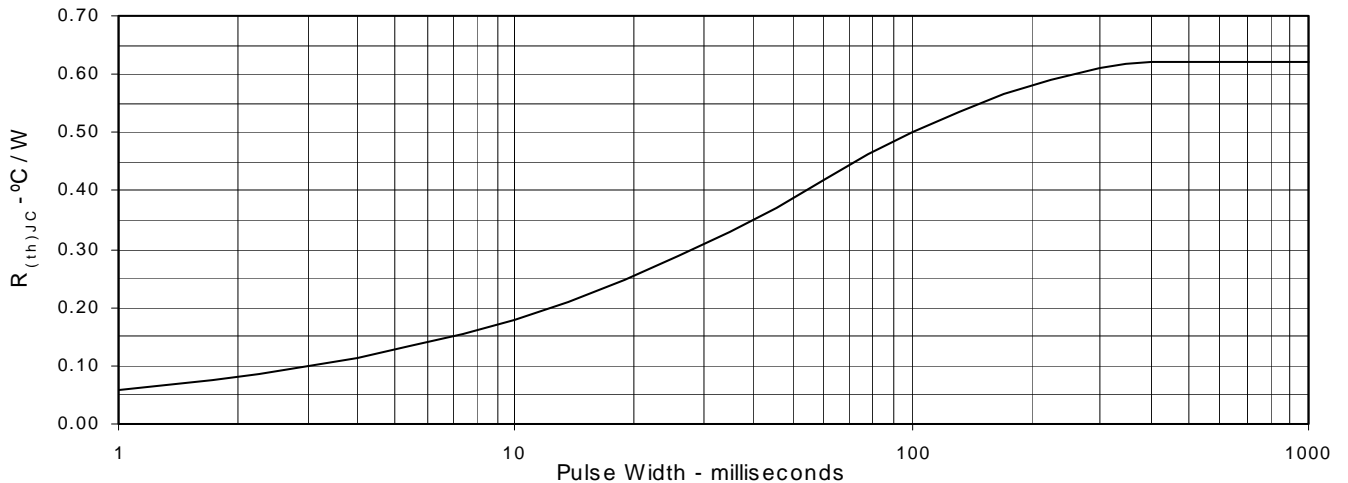
**Fig. 15. Gate Charge**



**Fig. 16. Capacitance**



**Fig. 16. Maximum Transient Thermal Resistance**



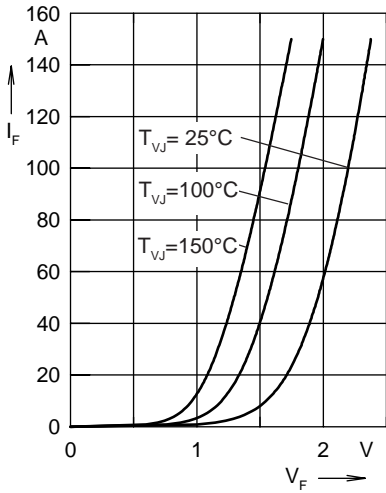


Fig. 18 Forward current  $I_F$  versus  $V_F$

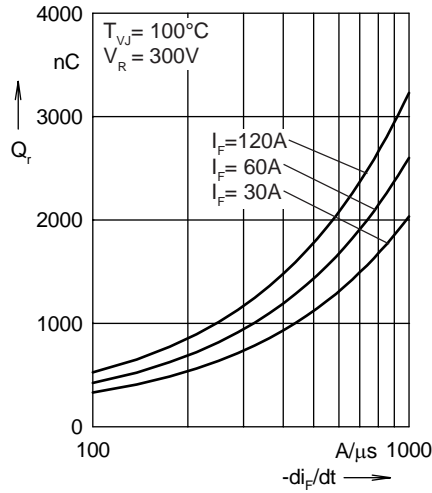


Fig. 19 Reverse recovery charge  $Q_r$  versus  $-di_F/dt$

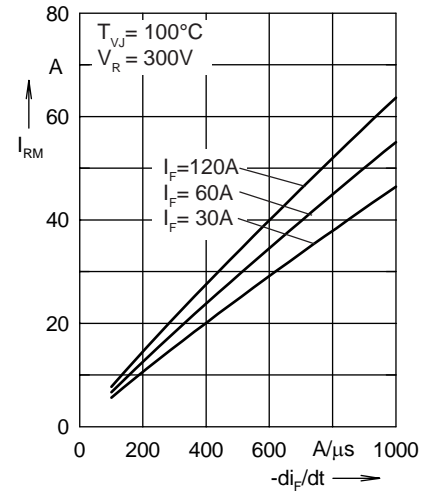


Fig. 20 Peak reverse current  $I_{RM}$  versus  $-di_F/dt$

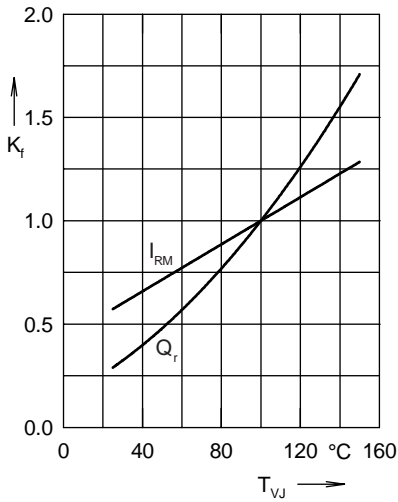


Fig. 21 Dynamic parameters  $Q_r$ ,  $I_{RM}$  versus  $T_{VJ}$

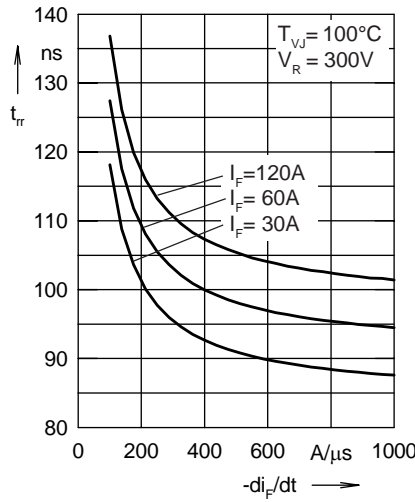


Fig. 22 Recovery time  $t_{tr}$  versus  $-di_F/dt$

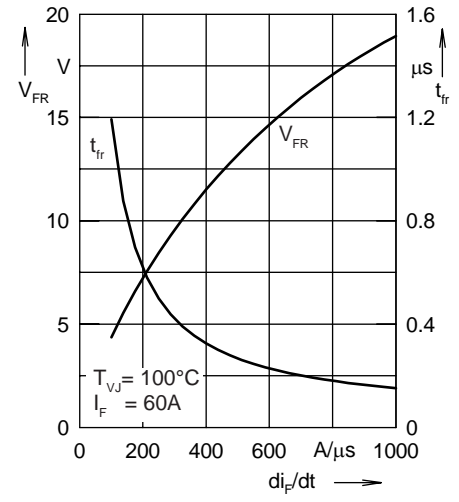


Fig. 23 Peak forward voltage  $V_{FR}$  and  $t_{tr}$  versus  $di_F/dt$

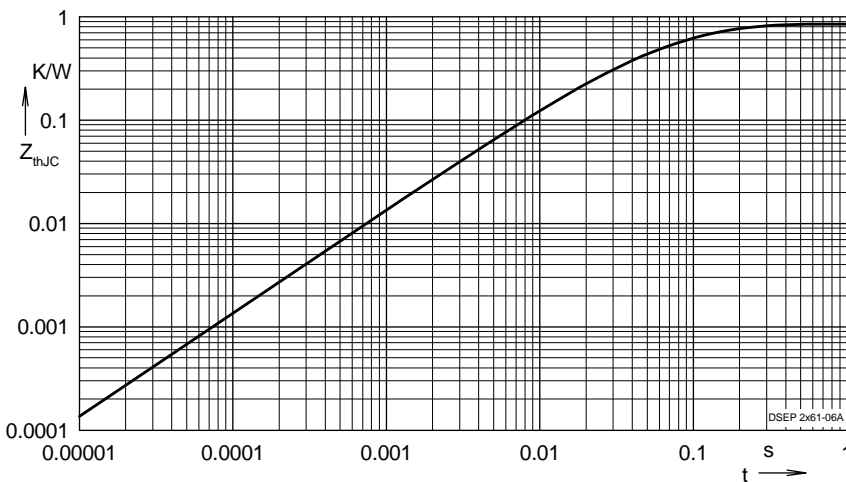


Fig. 24 Transient thermal resistance junction to case

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