



**THE DATASHEET OF  
IXGR50N60BD1**

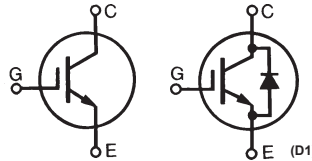


# HiPerFAST™ IGBT IXGR 50N60B

# ISOPLUS247™ IXGR 50N60BD1

(Electrically Isolated Back Surface)

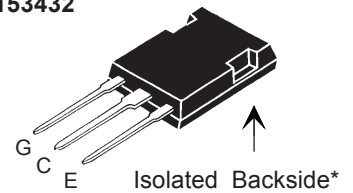
$V_{CES} = 600 \text{ V}$   
 $I_{C25} = 75 \text{ A}$   
 $V_{CE(sat)} = 2.5 \text{ V}$   
 $t_{fi(typ)} = 85 \text{ ns}$



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
$I_{C25}$	$T_C = 25^\circ\text{C}$	75	A
$I_{C110}$	$T_C = 110^\circ\text{C}$	45	A
$I_{CM}$	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	200	A
<b>SSOA (RBSOA)</b>	$V_{GE} = 15 \text{ V}, T_{VJ} = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load, $L = 100 \mu\text{H}$	$I_{CM} = 100$ @ $0.8 V_{CES}$	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	$^\circ\text{C}$
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
$V_{ISOL}$	50/60 Hz, RMS, $t = 1 \text{ minute leads-to-tab}$	2500	V
<b>Weight</b>		5	g

## ISOPLUS 247

E153432



G = Gate, C = Collector  
E = Emitter

\* Patent pending

## 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

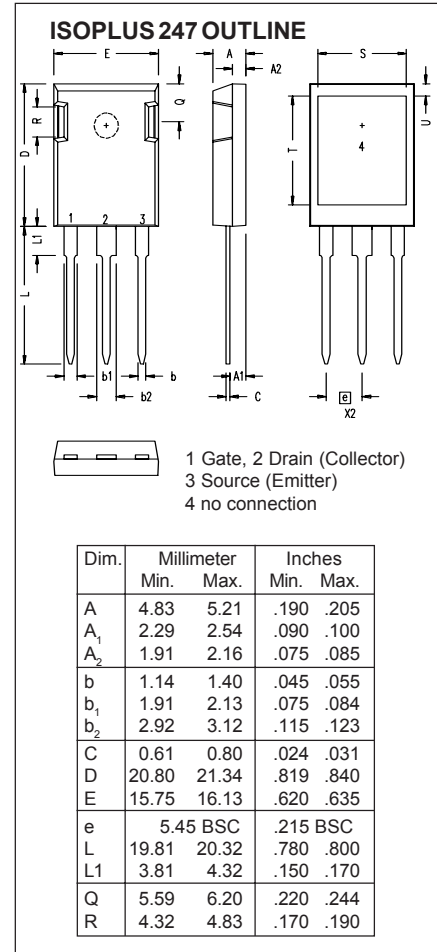
- Uninterruptible power supplies (UPS)
- Switched-mode and resonant-mode power supplies
- AC motor speed control
- DC servo and robot drives
- DC choppers

## Advantages

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

Symbol	Test Conditions	Characteristic Values			
		$(T_J = 25^\circ\text{C}, \text{ unless otherwise specified})$			
		Min.	Typ.	Max.	
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	50N60B	2.5	5.0	V
	$I_C = 500 \mu\text{A}$	50N60BD1	2.5	5.0	V
$I_{CES}$	$V_{CE} = 600\text{V}$ $V_{GE} = 0 \text{ V}$	50N60B		200	$\mu\text{A}$
		50N60BD1		650	$\mu\text{A}$
		50N60B	$T_J = 125^\circ\text{C}$	1	mA
		50N60BD1		5	mA
$I_{GES}$	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100$	nA
$V_{CE(sat)}$	$I_C = I_T, V_{GE} = 15 \text{ V}$			2.5	V

Symbol	Test Conditions	Characteristic Values ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)			
		min.	typ.	max.	
$g_{fs}$	$I_C = I_T; V_{CE} = 10\text{ V}$ , Pulse test, $t \leq 300\ \mu\text{s}$ , duty cycle $\leq 2\%$	25	35	S	
$C_{ies}$	$V_{CE} = 25\text{ V}, V_{GE} = 0\text{ V}, f = 1\text{ MHz}$		4100	pF	
$C_{oes}$			300	pF	
$C_{res}$			50	pF	
$Q_g$	$I_C = I_T, V_{GE} = 15\text{ V}, V_{CE} = 0.5 V_{CES}$		110	nC	
$Q_{ge}$			30	nC	
$Q_{gc}$			35	nC	
$t_{d(on)}$	<b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b> $I_C = I_T, V_{GE} = 15\text{ V}, L = 100\ \mu\text{H}$ $V_{CE} = 0.8 \cdot V_{CES}, R_G = R_{off} = 2.7\ \Omega$ Remarks: Switching times may increase for $V_{CE}$ (Clamp) $> 0.8 \cdot V_{CES}$ , higher $T_J$ or increased $R_G$		50	ns	
$t_{ri}$			50	ns	
$t_{d(off)}$			110	270	ns
$t_{fi}$			85	150	ns
$E_{off}$			3.0	4.0	mJ
$t_{d(on)}$	<b>Inductive load, <math>T_J = 125^\circ\text{C}</math></b> $I_C = I_T, V_{GE} = 15\text{ V}, L = 100\ \mu\text{H}$ $V_{CE} = 0.8 \cdot V_{CES}, R_G = R_{off} = 2.7\ \Omega$ Remarks: Switching times may increase for $V_{CE}$ (Clamp) $> 0.8 \cdot V_{CES}$ , higher $T_J$ or increased $R_G$		50	ns	
$t_{ri}$			60	ns	
$E_{on}$			3	mJ	
$t_{d(off)}$			200	ns	
$t_{fi}$			250	ns	
$E_{off}$		4.2	mJ		
$R_{thJC}$			0.5	K/W	
$R_{thCK}$		0.15		K/W	



Symbol	Test Conditions	Characteristic Values ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)		
		min.	typ.	max.
$V_F$	$I_F = I_T, V_{GE} = 0\text{ V}$ , Pulse test, $t \leq 300\text{ ms}$ , duty cycle $\leq 2\%$			1.6 V 2.5 V
$I_{RM}$	$I_F = I_T, V_{GE} = 0\text{ V}, -di_F/dt = 100\text{ A/ms}, T_J = 100^\circ\text{C}$ $V_R = 100\text{ V}$		3.2	A ns
$t_{rr}$	$I_F = 1\text{ A}; -di/dt = 200\text{ A/ms}; V_R = 30\text{ V}$		35	ns
$R_{thJC}$				0.85 K/W

Note:  $I_T = 50\text{ A}$

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
4,850,072	5,017,508	5,063,307	5,381,025	6,259,123 B1	6,534,343	6,710,405 B2	
4,881,106	5,034,796	5,187,117	5,486,715	6,306,728 B1	6,583,505	6,710,463	

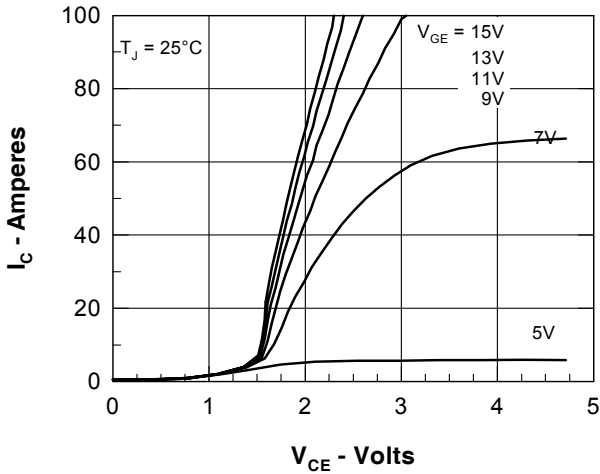


Fig. 1. Saturation Voltage Characteristics

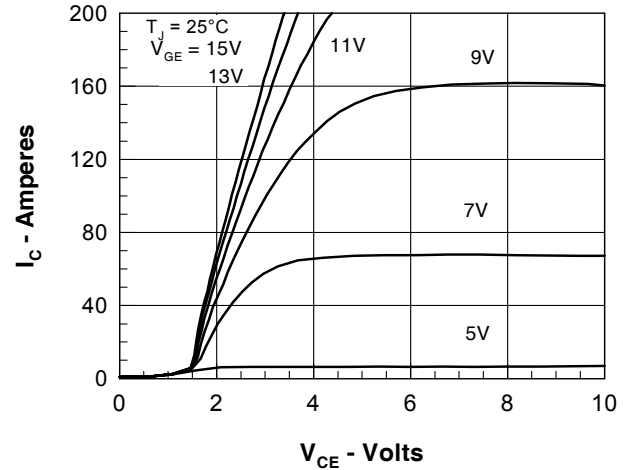


Fig. 2. Extended Output Characteristics

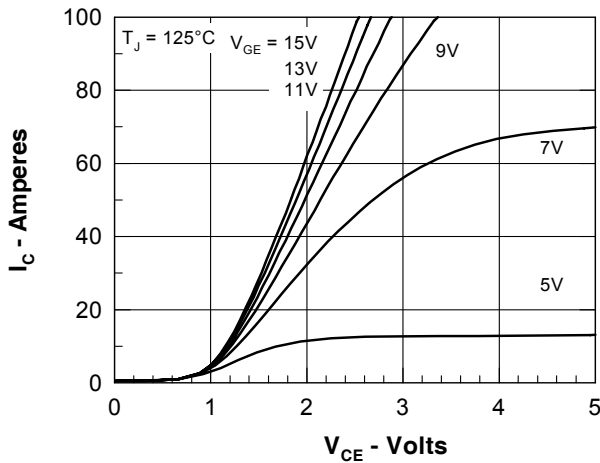


Fig. 3. Saturation Voltage Characteristics

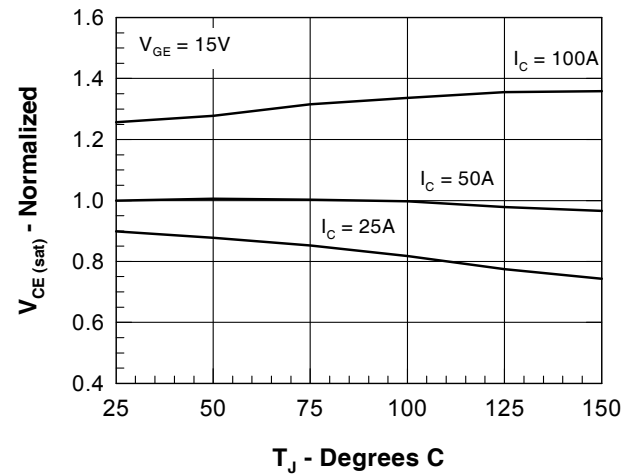


Fig. 4. Temperature Dependence of  $V_{CE(sat)}$

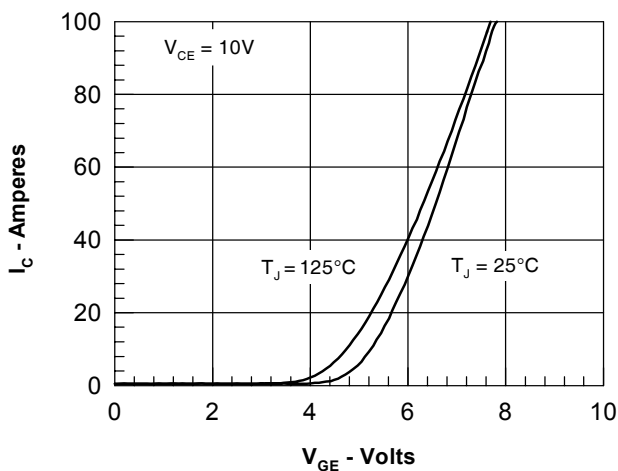


Fig. 5. Saturation Voltage Characteristics

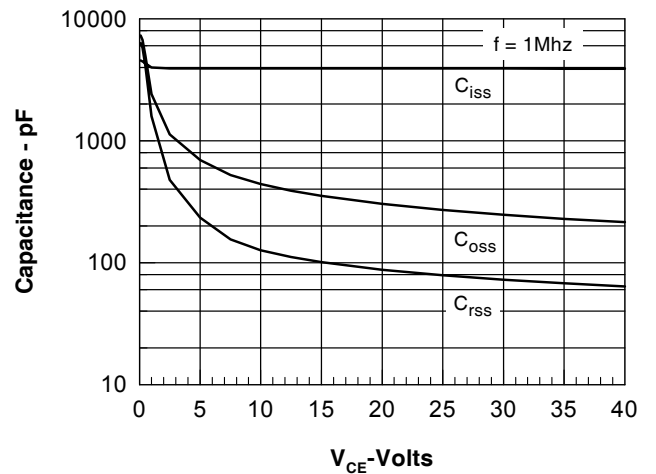


Fig. 6. Junction Capacitance Curves

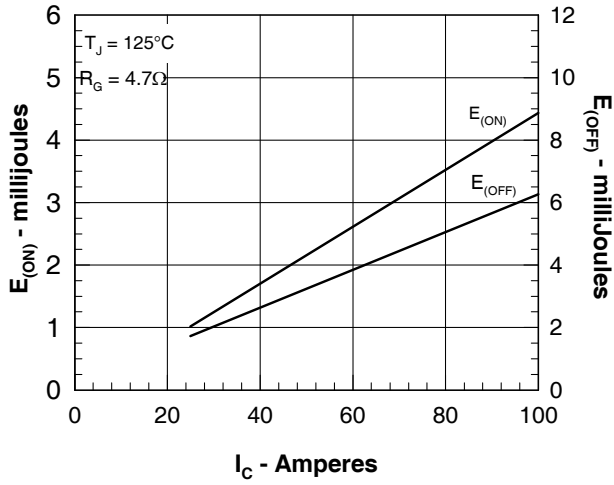


Fig. 7. Dependence of  $E_{ON}$  and  $E_{OFF}$  on  $I_C$ .

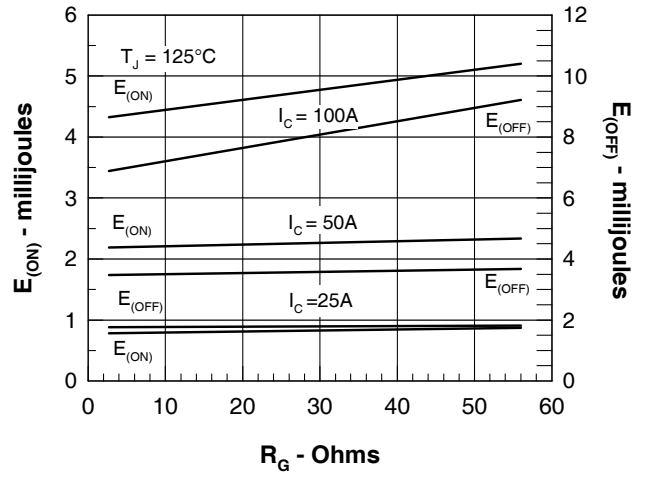


Fig. 8. Dependence of  $t_{fi}$  and  $E_{OFF}$  on  $R_G$ .

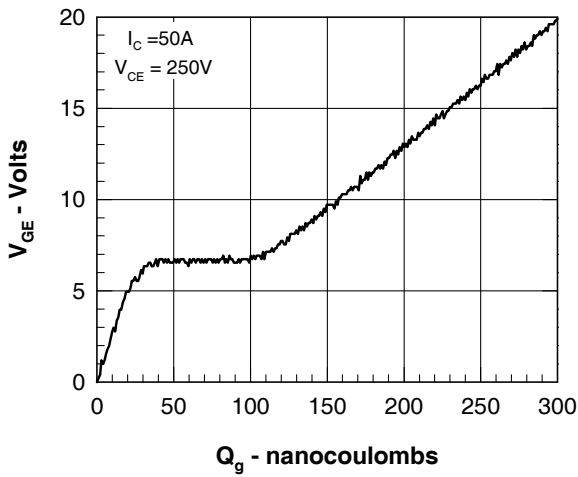


Fig. 9. Gate Charge

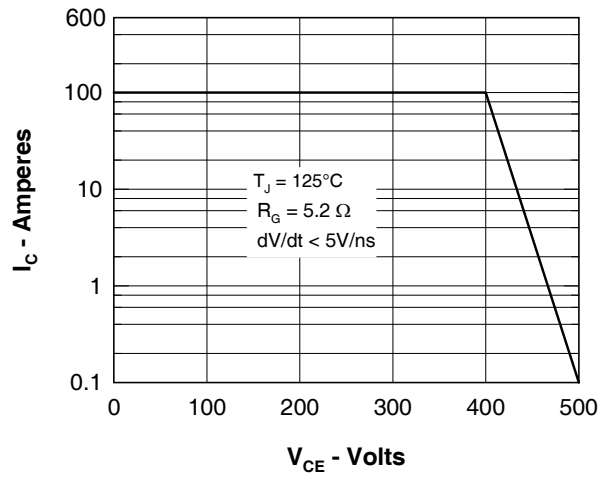


Fig. 10. Turn-off Safe Operating Area

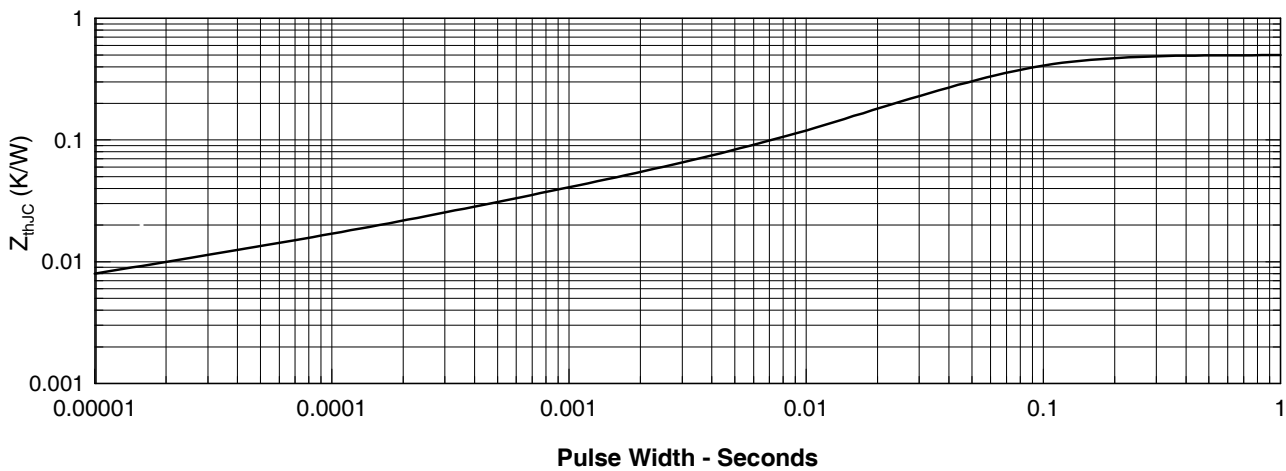


Figure 11. IGBT Transient Thermal Resistance

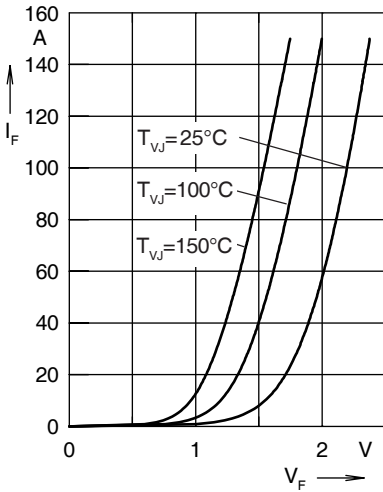


Fig. 12 Forward current  $I_F$  versus  $V_F$

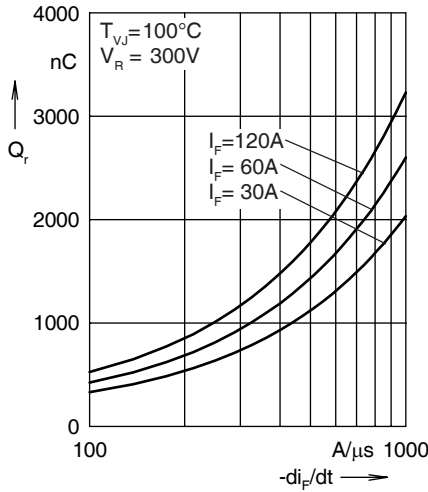


Fig. 13 Reverse recovery charge  $Q_r$  versus  $-di_F/dt$

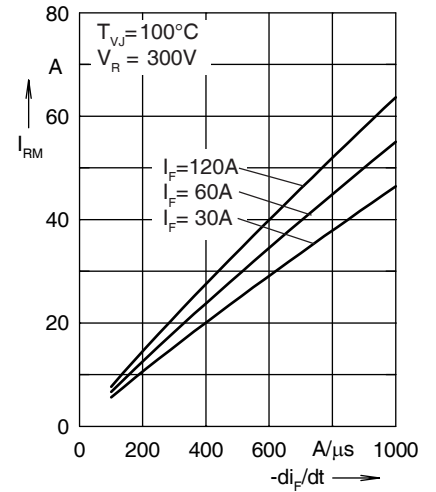


Fig. 14 Peak reverse current  $I_{RM}$  versus  $-di_F/dt$

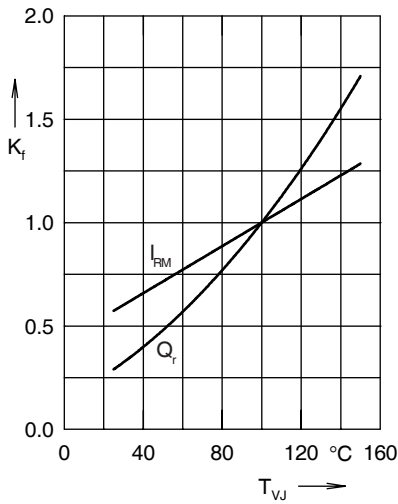


Fig. 15 Dynamic parameters  $Q_r$ ,  $I_{RM}$  versus  $T_{VJ}$

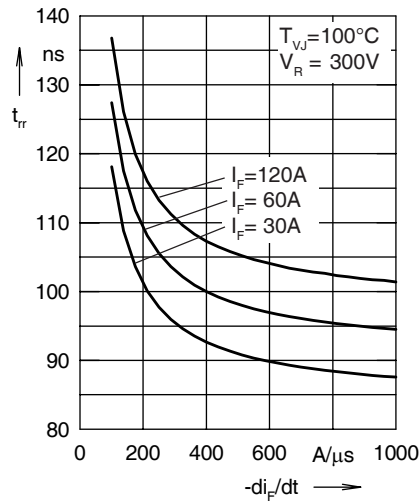


Fig. 16 Recovery time  $t_{rr}$  versus  $-di_F/dt$

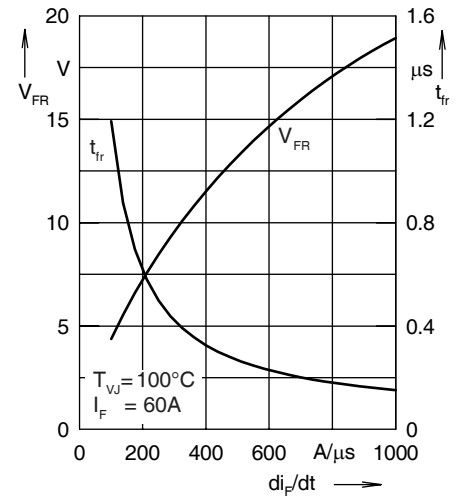


Fig. 17 Peak forward voltage  $V_{FR}$  and  $t_{rr}$  versus  $di_F/dt$

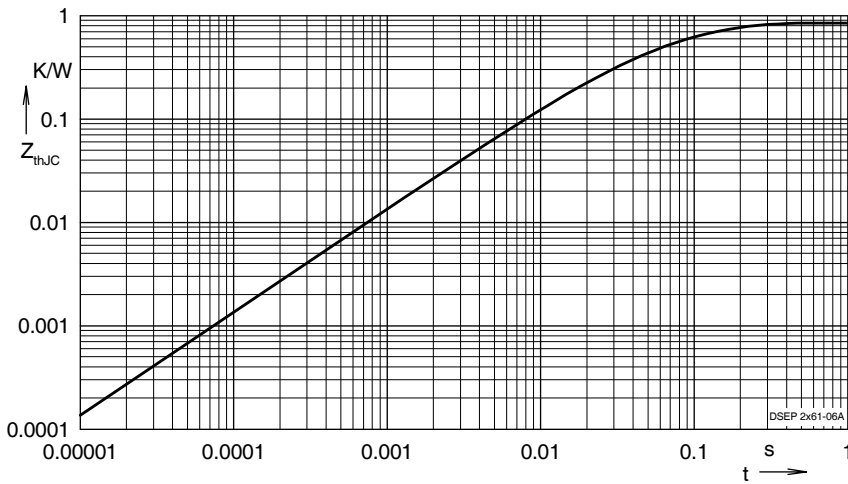


Fig. 18 Transient thermal resistance junction to case

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







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