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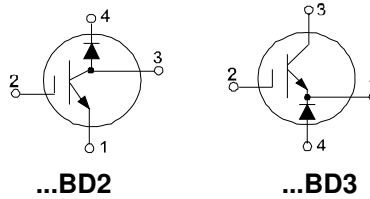


# HIGH Speed IGBT with HiPerFRED

Short Circuit SOA Capability  
Buck & boost configurations

Preliminary data

## IXSN 50N60BD2 IXSN 50N60BD3

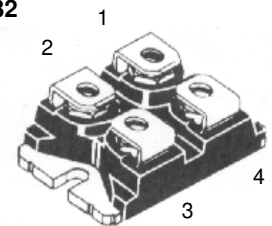


$$\begin{aligned} V_{CES} &= 600 \text{ V} \\ I_{C25} &= 75 \text{ A} \\ V_{CE(sat)} &= 2.5 \text{ V} \\ t_{fi} &= 150 \text{ ns} \end{aligned}$$

	Symbol	Test Conditions	Maximum Ratings	
IGBT	$V_{CES}$	$T_J = 25^\circ\text{C}$ 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
	$I_{C90}$	$T_C = 90^\circ\text{C}$	50	A
	$I_{CM}$	$T_C = 25^\circ\text{C}$ , 1 ms	200	A
	<b>SSOA (RBSOA)</b>	$V_{GE} = 15 \text{ V}$ , $T_{VJ} = 125^\circ\text{C}$ , $R_G = 22 \Omega$ Clamped inductive load, $L = 30 \mu\text{H}$	$I_{CM} = 100$ @ $0.8 V_{CES}$	A
	<b>t<sub>SC</sub> (SCSOA)</b>	$V_{GE} = 15 \text{ V}$ , $V_{CE} = 360 \text{ V}$ , $T_J = 125^\circ\text{C}$ $R_G = 22 \Omega$ , non repetitive	10	$\mu\text{s}$
	$P_C$	$T_C = 25^\circ\text{C}$	250	W
Diode	$V_{RRM}$		600	V
	$I_{FAVM}$	$T_C = 70^\circ\text{C}$ ; rectangular, $d = 50\%$	60	A
	$I_{FRM}$	$t_p < 10 \text{ ms}$ ; pulse width limited by $T_J$	600	A
	$P_D$	$T_C = 25^\circ\text{C}$	150	W
Case	$T_J$		-40 ... +150	$^\circ\text{C}$
	$T_{JM}$		150	$^\circ\text{C}$
	$T_{stg}$		-40 ... +150	$^\circ\text{C}$
	$M_d$	Mounting torque Terminal connection torque (M4)	1.5/13 1.5/13	Nm/lb.in. Nm/lb.in.
	<b>Weight</b>		30	g
	Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$

SOT-227B, miniBLOC

E 153432



**IXSN50N60BD2**

1 = Emitter; 2 = Gate  
3 = Collector; 4 = Diode cathode

**IXSN50N60BD3**

1 = Emitter/Diode Cathode; 2 = Gate  
3 = Collector; 4 = Diode anode

### Features

- International standard package miniBLOC
- Aluminium nitride isolation
  - high power dissipation
- Isolation voltage 3000 V~
- Very high current, fast switching IGBT & FRED diode
- MOS Gate turn-on
  - drive simplicity
- Low collector-to-case capacitance
- Low package inductance (< 10 nH)
  - easy to drive and to protect

### Applications

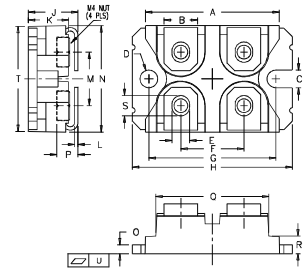
- AC motor speed control
- DC servo and robot drives
- DC choppers
- Buck converters

### Advantages

- Easy to mount with 2 screws
- Space savings
- High power density

Symbol	Test Conditions	Characteristic Values ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)		
		min.	typ.	max.
$BV_{CES}$	$I_C = 3 \text{ mA}$ , $V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 4 \text{ mA}$ , $V_{CE} = V_{GE}$	4		8 V
$I_{CES}$	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0 \text{ V}$		$T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$	350 $\mu\text{A}$ 5 mA
$I_{GES}$	$V_{CE} = 0 \text{ V}$ , $V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = I_{C90}$ , $V_{GE} = 15 \text{ V}$	2.2		2.5 V

Symbol	Test Conditions	Characteristic Values ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)		
		min.	typ.	max.
$g_{fs}$	$I_C = I_{C90}$ ; $V_{CE} = 10\text{ V}$ , Pulse test, $t \leq 300\ \mu\text{s}$ , duty cycle $\leq 2\%$	16	27	S
$C_{ies}$	$V_{CE} = 25\text{ V}$ , $V_{GE} = 0\text{ V}$ , $f = 1\text{ MHz}$		3850	pF
$C_{oes}$			440	pF
$C_{res}$			50	pF
$Q_g$	$I_C = I_{C90}$ , $V_{GE} = 15\text{ V}$ , $V_{CE} = 0.5 V_{CES}$		167	nC
$Q_{ge}$			45	nC
$Q_{gc}$			88	nC
$t_{d(on)}$	<b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b> $I_C = I_{C90}$ , $V_{GE} = 15\text{ V}$ , $L = 100\ \mu\text{H}$ , $V_{CE} = 0.8 V_{CES}$ , $R_G = R_{off} = 2.7\ \Omega$ Remarks: Switching times may increase for $V_{CE}$ (Clamp) $> 0.8 \cdot V_{CES}$ , higher $T_J$ or increased $R_G$		70	ns
$t_{ri}$			70	ns
$t_{d(off)}$			150	300 ns
$t_{fi}$			150	300 ns
$E_{off}$			3.3	6.0 mJ
$t_{d(on)}$	<b>Inductive load, <math>T_J = 125^\circ\text{C}</math></b> $I_C = I_{C90}$ , $V_{GE} = 15\text{ V}$ , $L = 100\ \mu\text{H}$ $V_{CE} = 0.8 V_{CES}$ , $R_G = R_{off} = 2.7\ \Omega$ Remarks: Switching times may increase for $V_{CE}$ (Clamp) $> 0.8 \cdot V_{CES}$ , higher $T_J$ or increased $R_G$		70	ns
$t_{ri}$			70	ns
$E_{on}$			2.5	mJ
$t_{d(off)}$			230	ns
$t_{fi}$			230	ns
$E_{off}$			4.8	mJ
$R_{thJC}$			0.50	K/W
$R_{thCK}$		0.05		K/W

**miniBLOC, SOT-227 B**


M4 screws (4x) supplied

Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	31.50	31.88	1.240	1.255
B	7.80	8.20	0.307	0.323
C	4.09	4.29	0.161	0.169
D	4.09	4.29	0.161	0.169
E	4.09	4.29	0.161	0.169
F	14.91	15.11	0.587	0.595
G	30.12	30.30	1.186	1.193
H	38.00	38.23	1.496	1.505
J	11.68	12.22	0.460	0.481
K	8.92	9.60	0.351	0.378
L	0.76	0.84	0.030	0.033
M	12.60	12.85	0.496	0.506
N	25.15	25.42	0.990	1.001
O	1.98	2.13	0.078	0.084
P	4.95	5.97	0.195	0.235
Q	26.54	26.90	1.045	1.059
R	3.94	4.42	0.155	0.174
S	4.72	4.85	0.186	0.191
T	24.59	25.07	0.968	0.987
U	-0.05	0.1	-0.002	0.004

**Reverse Diode (FRED)**
**Characteristic Values**  
( $T_J = 25^\circ\text{C}$ , unless otherwise specified)

Symbol	Test Conditions	typ.	max.
$I_R$	$T_{VJ} = 25^\circ\text{C}$ $V_R = V_{RRM}$ $T_{VJ} = 150^\circ\text{C}$		650 $\mu\text{A}$ 2.5 mA
$V_F$	$I_F = 60\text{ A}$ Pulse test, $t \leq 300\ \mu\text{s}$ , duty cycle $d \leq 2\%$		1.75 V 2.40 V
$I_{RM}$	$I_F = I_{C90}$ , $V_{GE} = 0\text{ V}$ , $-di_F/dt = 100\text{ A}/\mu\text{s}$ $V_R = 540\text{ V}$ , $T_J = 100^\circ\text{C}$		8.0 A
$t_{rr}$	$I_F = 1\text{ A}$ , $-di_F/dt = 50\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$	35	ns
$R_{thJC}$			0.85 K/W

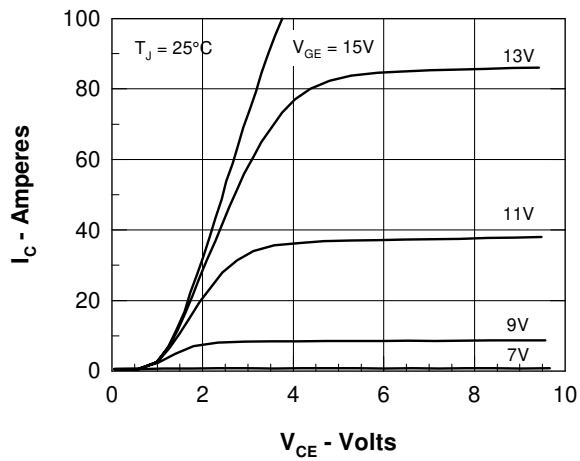


Figure 1. Saturation Voltage Characteristics

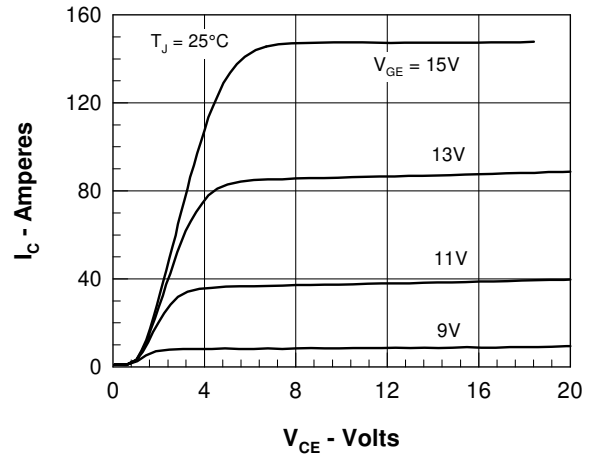


Figure 2. Extended Output Characteristics

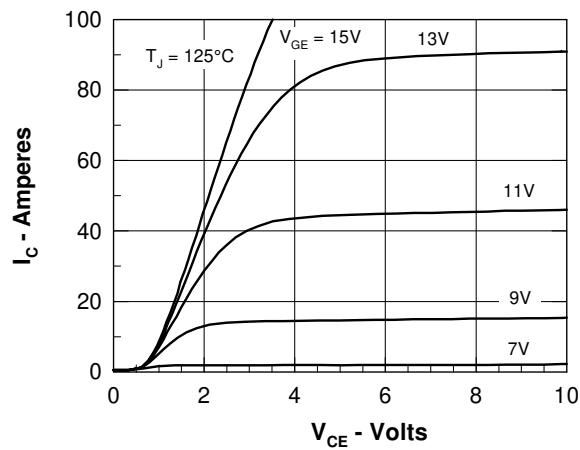


Figure 3. Saturation Voltage Characteristics

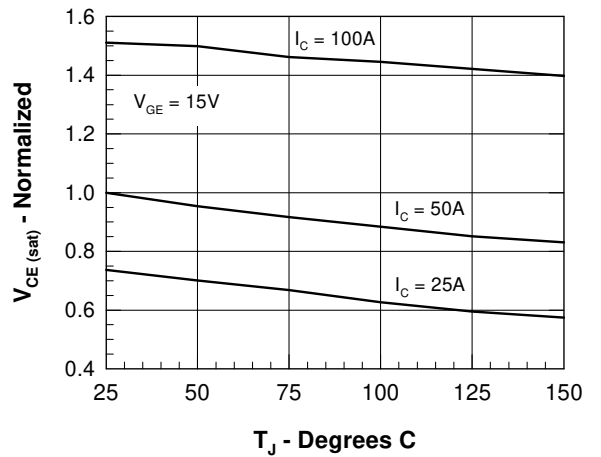


Figure 4. Temperature Dependence of  $V_{CE(sat)}$

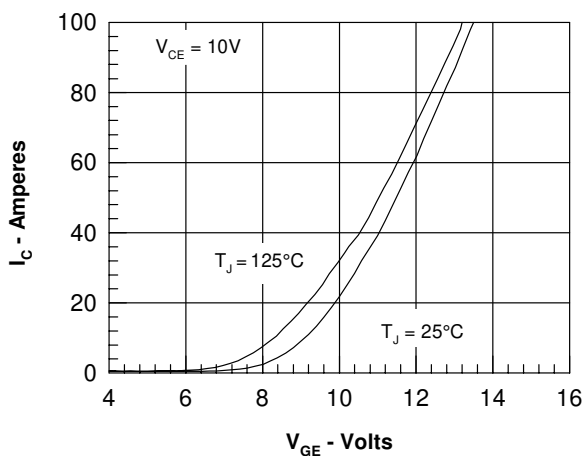


Figure 5. Admittance Curves

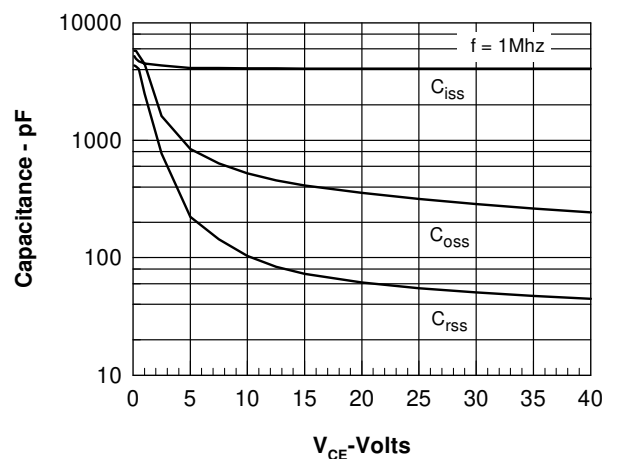


Figure 6. Capacitance Curves

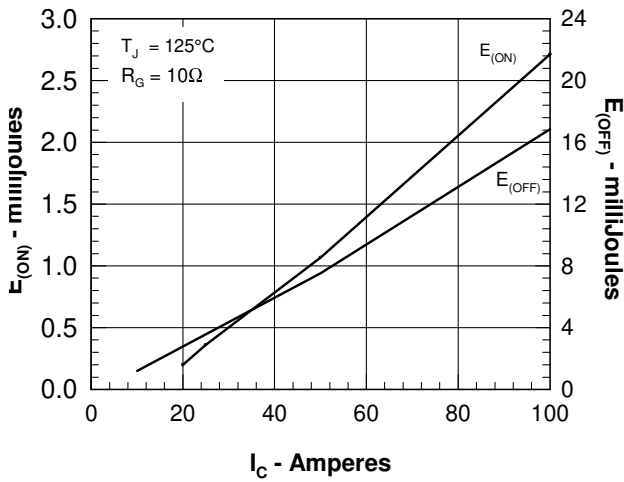


Figure 7. Dependence of  $E_{ON}$  and  $E_{OFF}$  on  $I_C$ .

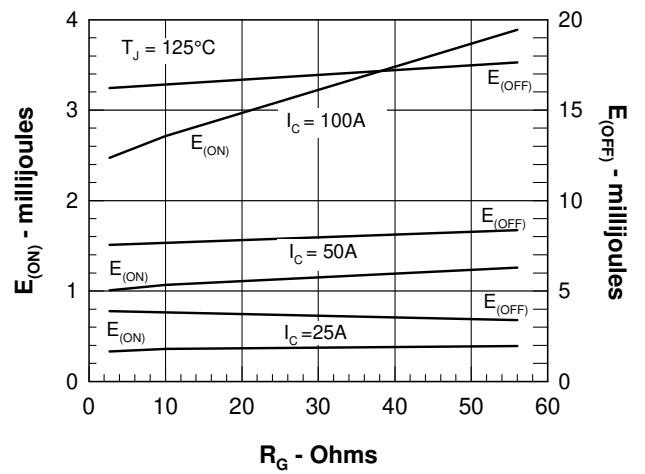


Figure 8. Dependence of  $E_{ON}$  and  $E_{OFF}$  on  $R_G$ .

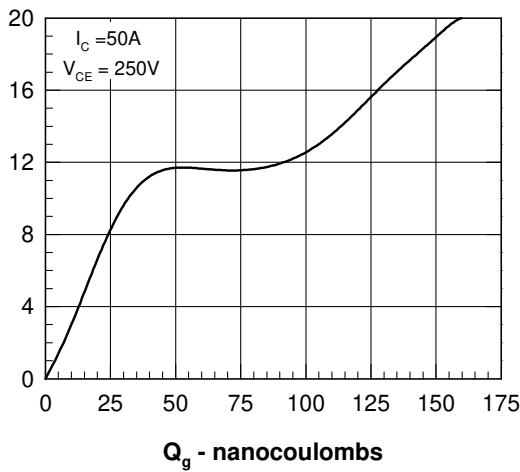


Figure 9. Gate Charge

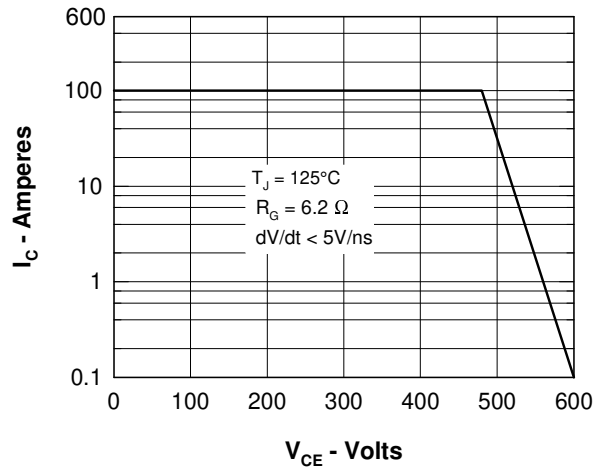


Figure 10. Turn-off Safe Operating Area

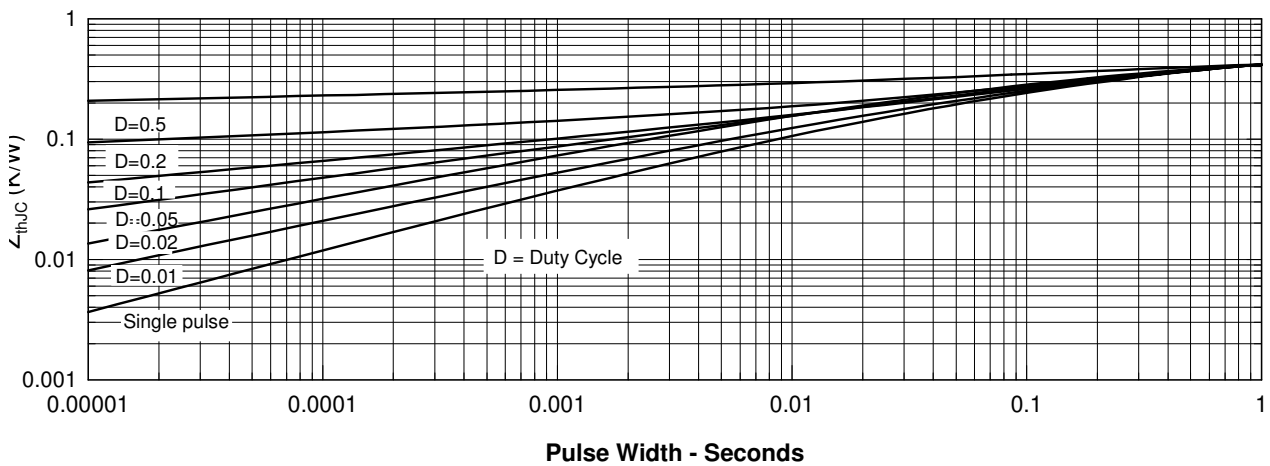


Figure 11. Transient Thermal Resistance

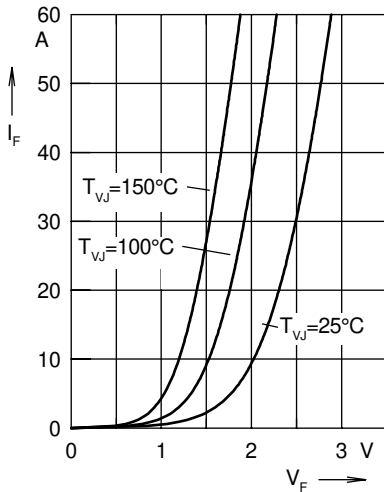


Fig. 12 Forward current  $I_F$  versus  $V_F$

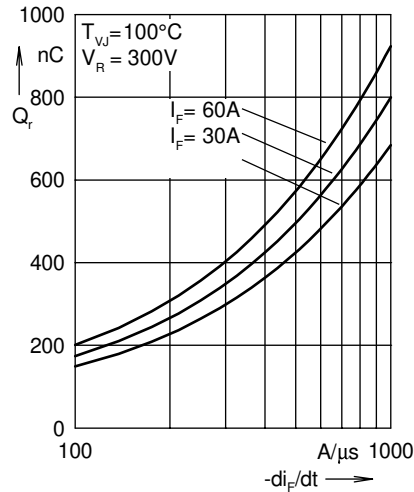


Fig. 13 Reverse recovery charge  $Q_r$  versus  $-di_F/dt$

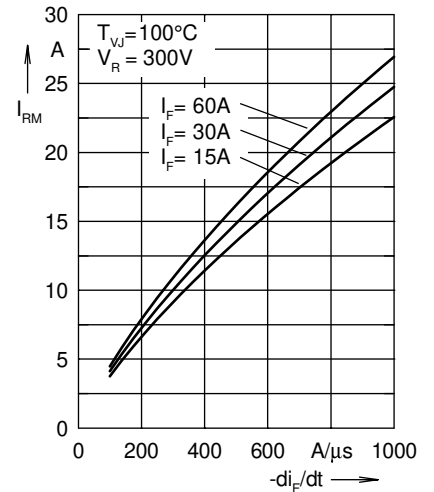


Fig. 14 Peak reverse current  $I_{RM}$  versus  $-di_F/dt$

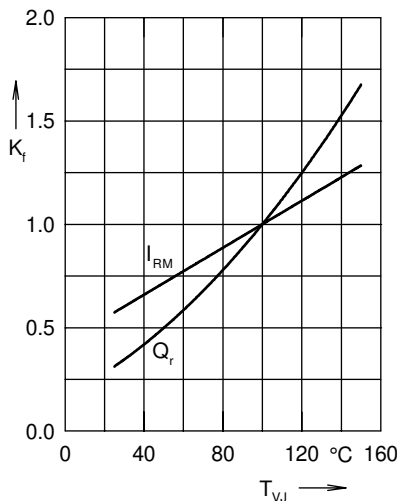


Fig. 15 Dynamic parameters  $Q_r$ ,  $I_{RM}$  versus  $T_{VJ}$

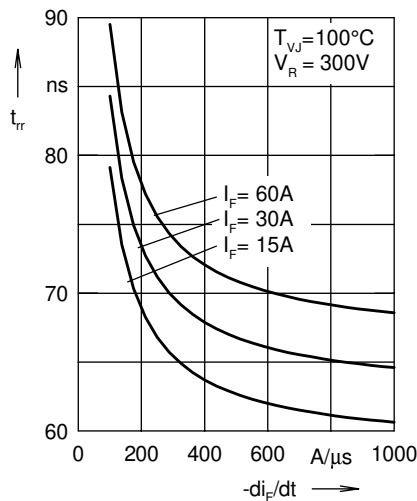


Fig. 16 Recovery time  $t_{rr}$  versus  $-di_F/dt$

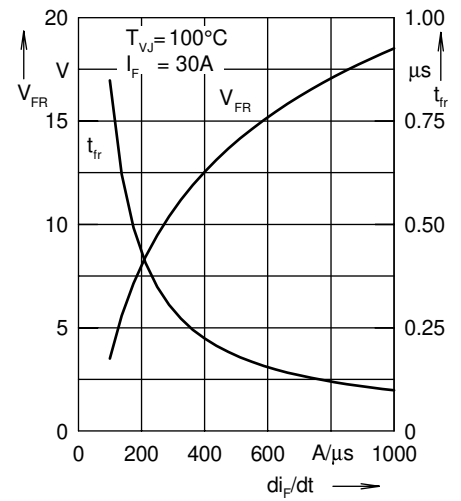
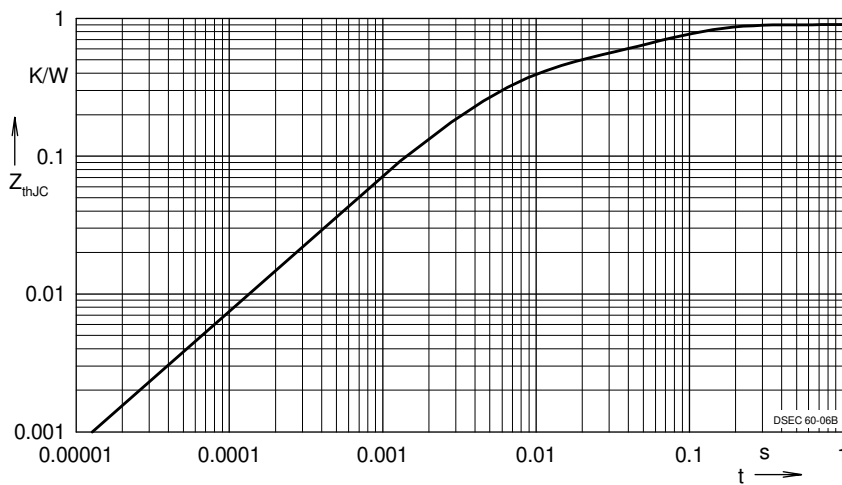


Fig. 17 Peak forward voltage  $V_{FR}$  and  $t_{fr}$  versus  $di_F/dt$



Constants for  $Z_{thJC}$  calculation:

i	$R_{thi}$ (K/W)	$t_i$ (s)
1	0.465	0.0052
2	0.179	0.0003
3	0.256	0.0396