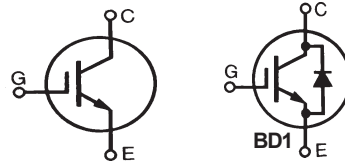


# High Voltage IGBT with Diode

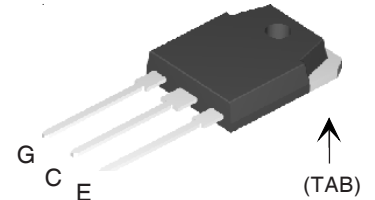
**IXGQ 20N120B**  
**IXGQ 20N120BD1**



$V_{CES} = 1200 \text{ V}$   
 $I_{C25} = 40 \text{ A}$   
 $V_{CE(sat)} = 3.4 \text{ V}$   
 $t_{fi(typ)} = 160 \text{ ns}$

Symbol	Test Conditions	Maximum Ratings	
$V_{CES}$	$T_J = 25^\circ\text{C to } 150^\circ\text{C}$	1200	V
$V_{CGR}$	$T_J = 25^\circ\text{C to } 150^\circ\text{C}; R_{GE} = 1 \text{ M}\Omega$	1200	V
$V_{GES}$	Continuous	$\pm 20$	V
$V_{GEM}$	Transient	$\pm 30$	V
$I_{C25}$	$T_C = 25^\circ\text{C}$	40	A
$I_{C110}$	$T_C = 110^\circ\text{C}$	20	A
$I_{CM}$	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	100	A
<b>SSOA (RBSOA)</b>	$V_{GE} = 15 \text{ V}, T_J = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load	$I_{CM} = 40$ @ $0.8 V_{CES}$	A
$P_C$	$T_C = 25^\circ\text{C}$	190	W
$T_J$		-55 ... +150	$^\circ\text{C}$
$T_{JM}$		150	$^\circ\text{C}$
$T_{stg}$		-55 ... +150	$^\circ\text{C}$
$M_d$	Mounting torque	1.13/10 Nm/lb.in.	
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	$^\circ\text{C}$
<b>Weight</b>		6	g

## TO-3P (IXGQ)



G = Gate  
E = Emitter  
C = Collector  
TAB = Collector

## Features

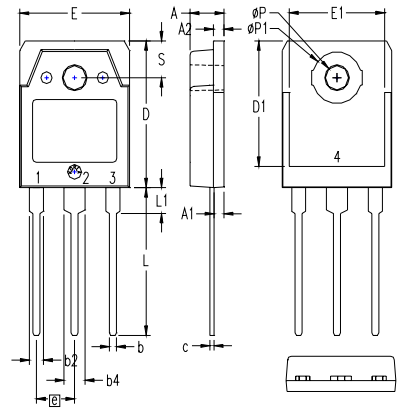
- International standard package
- IGBT and anti-parallel FRED for resonant power supplies
  - Induction heating
  - Rice cookers
- MOS Gate turn-on
  - drive simplicity
- Fast Recovery Exipitaxial Diode (FRED)
  - soft recovery with low  $I_{RM}$

## Advantages

- Saves space (two devices in one package)
- Easy to mount with 1 screw (isolated mounting screw hole)
- Reduces assembly time and cost

Symbol	Test Conditions	Characteristic Values ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)		
		min.	typ.	max.
$V_{GE(th)}$	$I_C = 250 \mu\text{A}, V_{CE} = V_{GE}$	2.5		5.0 V
$I_{CES}$	$V_{CE} = V_{CES}$ $V_{GE} = 0 \text{ V}$			20N120B: 25 $\mu\text{A}$ 20N120BD1: 50 $\mu\text{A}$
$I_{GES}$	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = 20 \text{ A}, V_{GE} = 15 \text{ V}$ Note 2		$T_J = 125^\circ\text{C}$	2.9 V 3.4 V 2.8 V

Symbol	Test Conditions	Characteristic Values		
		(T <sub>J</sub> = 25°C, unless otherwise specified)		
		min.	typ.	max.
<b>g<sub>fs</sub></b>	I <sub>C</sub> = 20A; V <sub>CE</sub> = 10 V, Note 2.	12	16	S
<b>C<sub>ies</sub></b>			1700	pF
			70	pF
<b>C<sub>oes</sub></b>	V <sub>CE</sub> = 25 V, V <sub>GE</sub> = 0 V, f = 1 MHz		80	pF
<b>C<sub>res</sub></b>			23	pF
<b>Q<sub>g</sub></b>			62	nC
<b>Q<sub>ge</sub></b>	I <sub>C</sub> = 20A, V <sub>GE</sub> = 15 V, V <sub>CE</sub> = 0.5 V <sub>CES</sub>		9	nC
<b>Q<sub>gc</sub></b>			24	nC
<b>t<sub>d(on)</sub></b>	<b>Inductive load, T<sub>J</sub> = 25°C</b>		20	ns
<b>t<sub>ri</sub></b>	I <sub>C</sub> = 20 A; V <sub>GE</sub> = 15 V		14	ns
<b>t<sub>d(off)</sub></b>	V <sub>CE</sub> = 0.8 V <sub>CES</sub> ; R <sub>G</sub> = R <sub>off</sub> = 10 Ω		270	380 ns
<b>t<sub>fi</sub></b>	Note 1.		160	320 ns
<b>E<sub>off</sub></b>			2.1	3.5 mJ
<b>t<sub>d(on)</sub></b>	<b>Inductive load, T<sub>J</sub> = 125°C</b>		25	ns
<b>t<sub>ri</sub></b>	I <sub>C</sub> = 20A; V <sub>GE</sub> = 15 V		18	ns
<b>E<sub>on</sub></b>	V <sub>CE</sub> = 0.8 V <sub>CES</sub> ; R <sub>G</sub> = R <sub>off</sub> = 10 Ω		1.4	mJ
<b>t<sub>d(off)</sub></b>	Note 1		270	ns
<b>t<sub>fi</sub></b>			360	ns
<b>E<sub>off</sub></b>			4.5	mJ
<b>R<sub>thJC</sub></b>				0.65 K/W
<b>R<sub>thCK</sub></b>	(TO-247)		0.25	K/W

**TO-3P (IXGQ) Outline**


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

SYM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.185	.193	4.70	4.90
A1	.051	.059	1.30	1.50
A2	.057	.065	1.45	1.65
b	.035	.045	0.90	1.15
b2	.075	.087	1.90	2.20
b4	.114	.126	2.90	3.20
c	.022	.031	0.55	0.80
D	.780	.791	19.80	20.10
D1	.665	.677	16.90	17.20
E	.610	.622	15.50	15.80
E1	.531	.539	13.50	13.70
e	.215 BSC		5.45 BSC	
L	.779	.795	19.80	20.20
L1	.134	.142	3.40	3.60
øP	.126	.134	3.20	3.40
øP1	.272	.280	6.90	7.10
S	.193	.201	4.90	5.10

All metal area are tin plated.

**Reverse Diode (FRED)**

Symbol	Test Conditions	Characteristic Values		
		(T <sub>J</sub> = 25°C, unless otherwise specified)		
		min.	typ.	max.
<b>I<sub>F</sub></b>	T <sub>C</sub> = 90°C			10 A
<b>V<sub>F</sub></b>	I <sub>F</sub> = 10 A, V <sub>GE</sub> = 0 V			3.3 V
<b>I<sub>RM</sub></b>	I <sub>F</sub> = 10 A; -di <sub>F</sub> /dt = 400 A/μs; V <sub>R</sub> = 600 V		14	A
<b>t<sub>rr</sub></b>	V <sub>GE</sub> = 0 V; T <sub>J</sub> = 125°C		120	ns
<b>t<sub>rr</sub></b>	I <sub>F</sub> = 1 A; -di <sub>F</sub> /dt = 100 A/μs; V <sub>R</sub> = 30 V, V <sub>GE</sub> = 0 V		40	ns
<b>R<sub>thJC</sub></b>				2.5 K/W

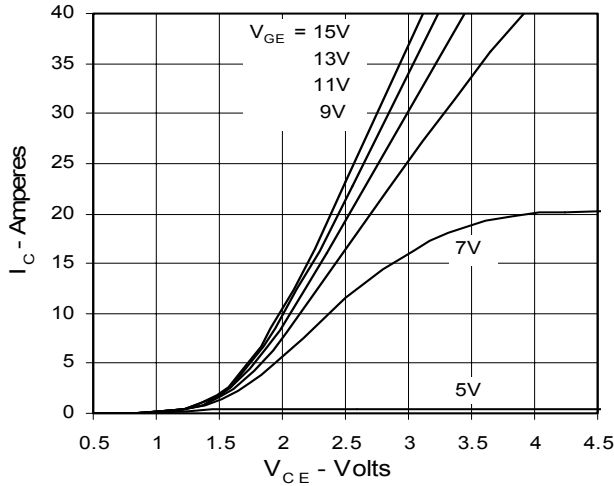
- Notes:
- Switching times may increase for V<sub>CE</sub> (Clamp) > 0.8 • V<sub>CES</sub>, higher T<sub>J</sub> or increased R<sub>G</sub>.
  - Pulse test, t ≤ 300 μs, duty cycle d ≤ 2 %

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

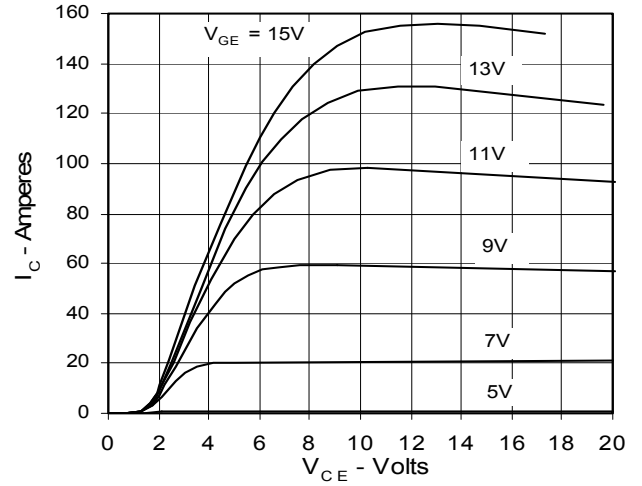
IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:

4,835,592 4,881,106 5,017,508 5,049,961 5,187,117 5,486,715 6,306,728B1 6,259,123B1 6,306,728B1  
 4,850,072 4,931,844 5,034,796 5,063,307 5,237,481 5,381,025 6,404,065B1 6,162,665 6,534,343

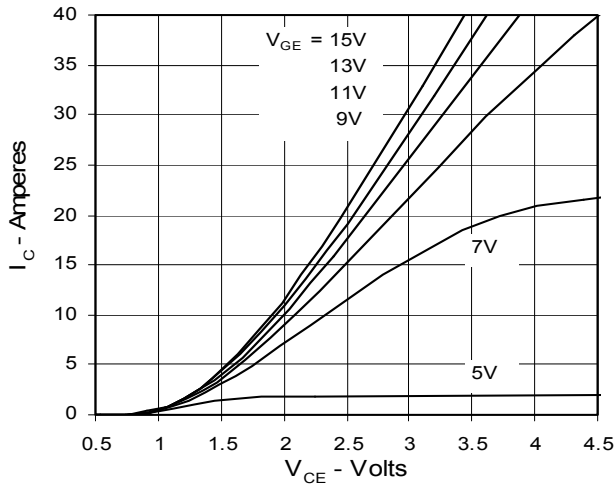
**Fig. 1. Output Characteristics  
@ 25 Deg. C**



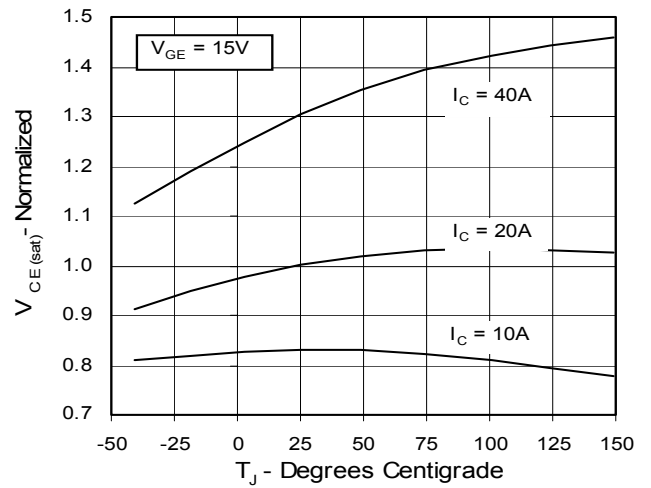
**Fig. 2. Extended Output Characteristics  
@ 25 deg. C**



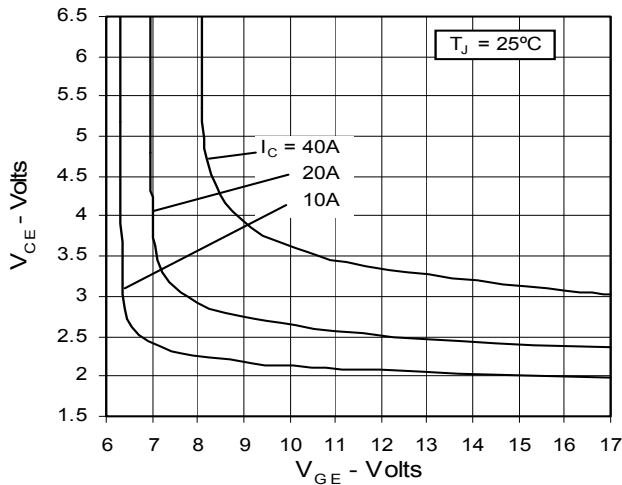
**Fig. 3. Output Characteristics  
@ 125 Deg. C**



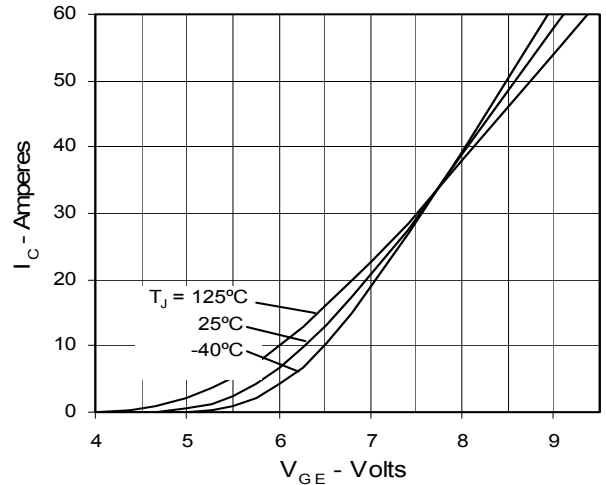
**Fig. 4. Dependence of  $V_{CE(sat)}$  on  
Temperature**



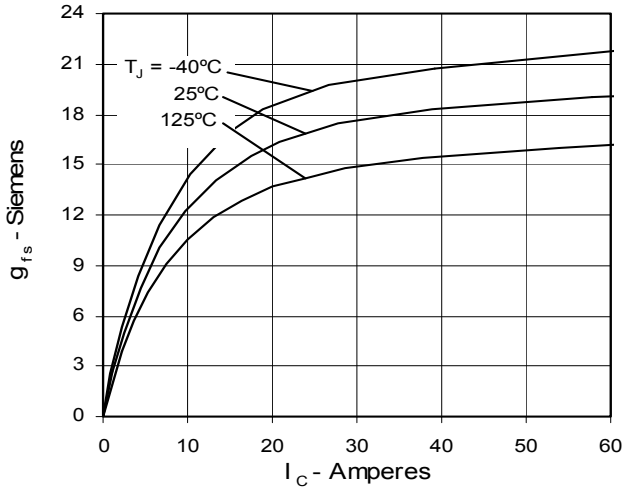
**Fig. 5. Collector-to-Emitter Voltage  
vs. Gate-to-Emitter voltage**



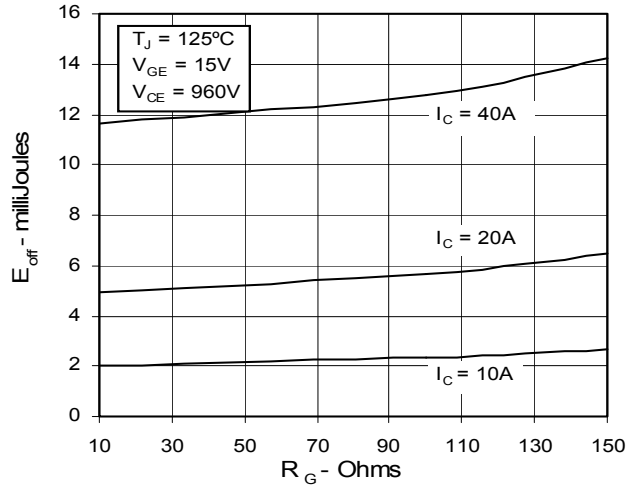
**Fig. 6. Input Admittance**



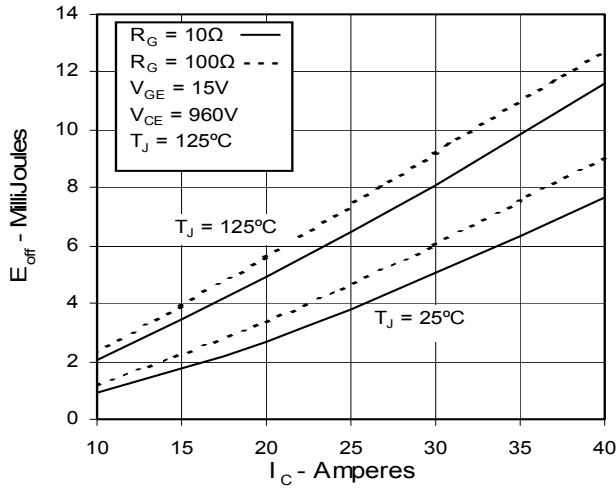
**Fig. 7. Transconductance**



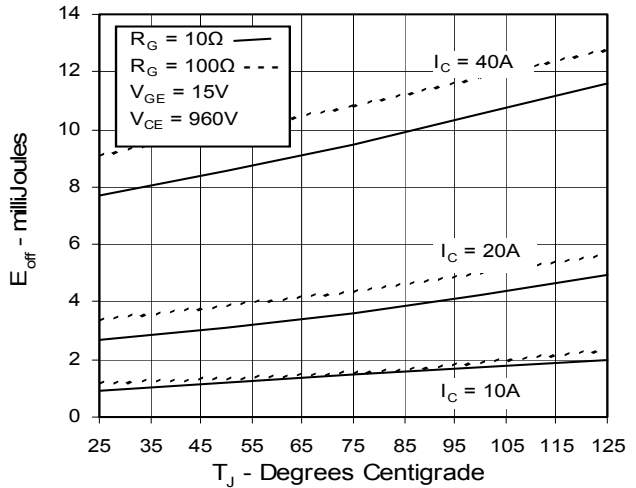
**Fig. 8. Dependence of Turn-off Energy Loss on  $R_G$**



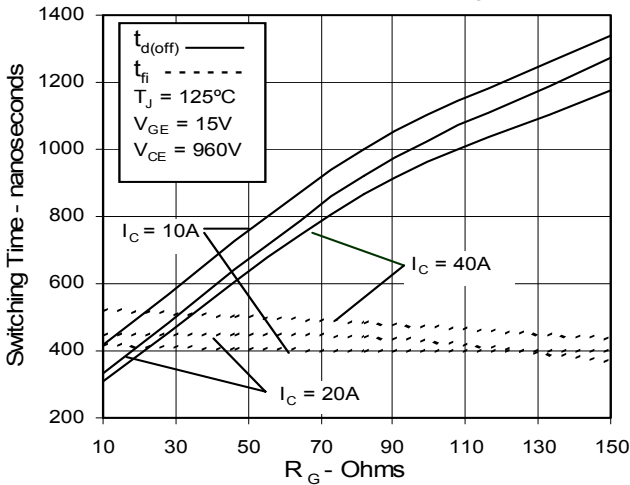
**Fig. 9. Dependence of Turn-Off Energy Loss on  $I_C$**



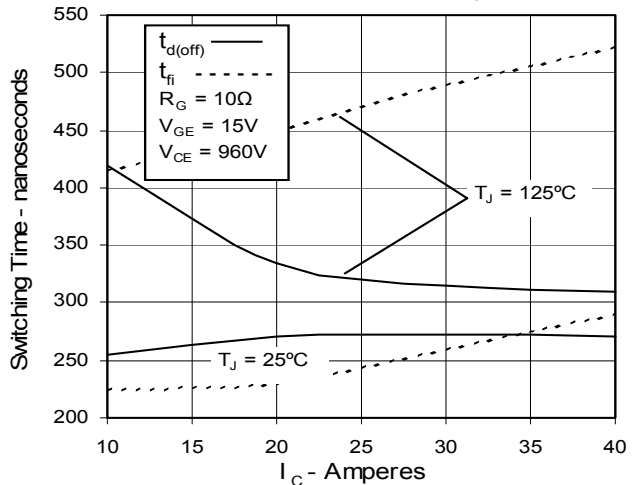
**Fig. 10. Dependence of Turn-off Energy Loss on Temperature**



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



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

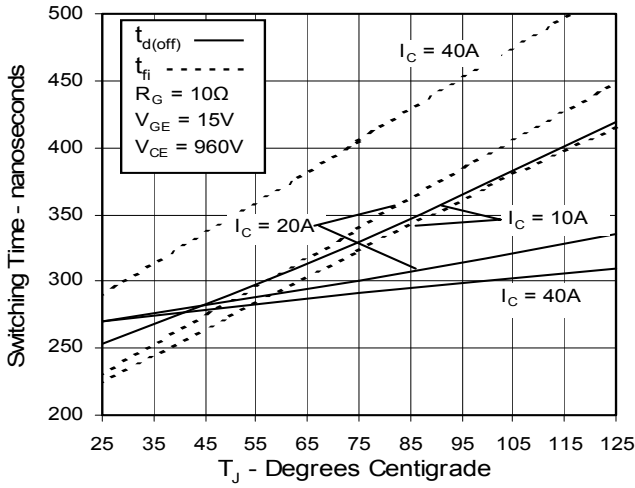


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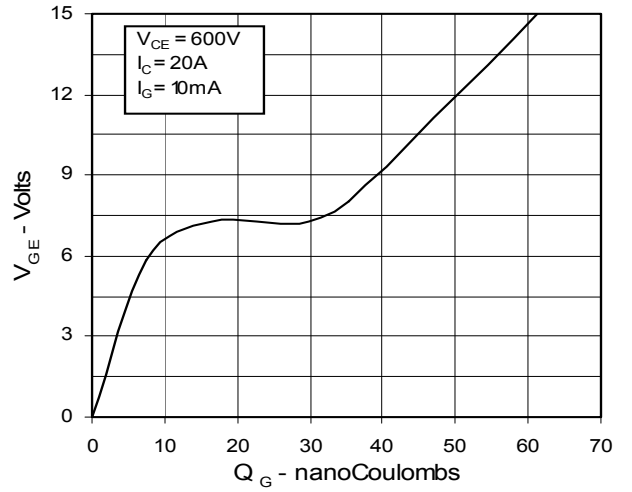
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4,850,072 4,931,844 5,034,796 5,063,307 5,237,481 5,381,025 6,404,065B1 6,162,665 6,534,343

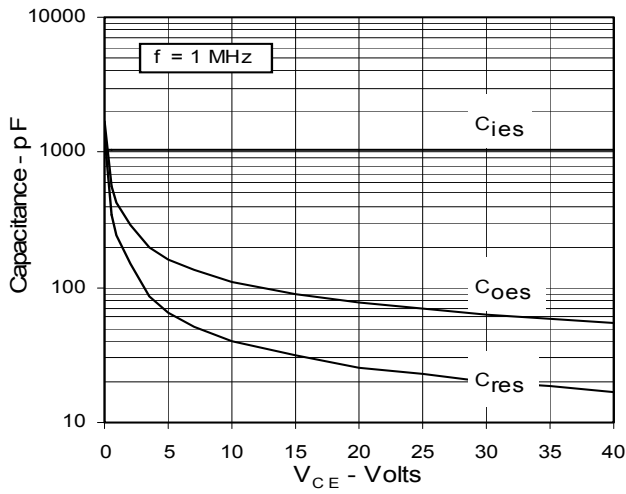
**Fig. 13. Dependence of Turn-off Switching Time on Temperature**



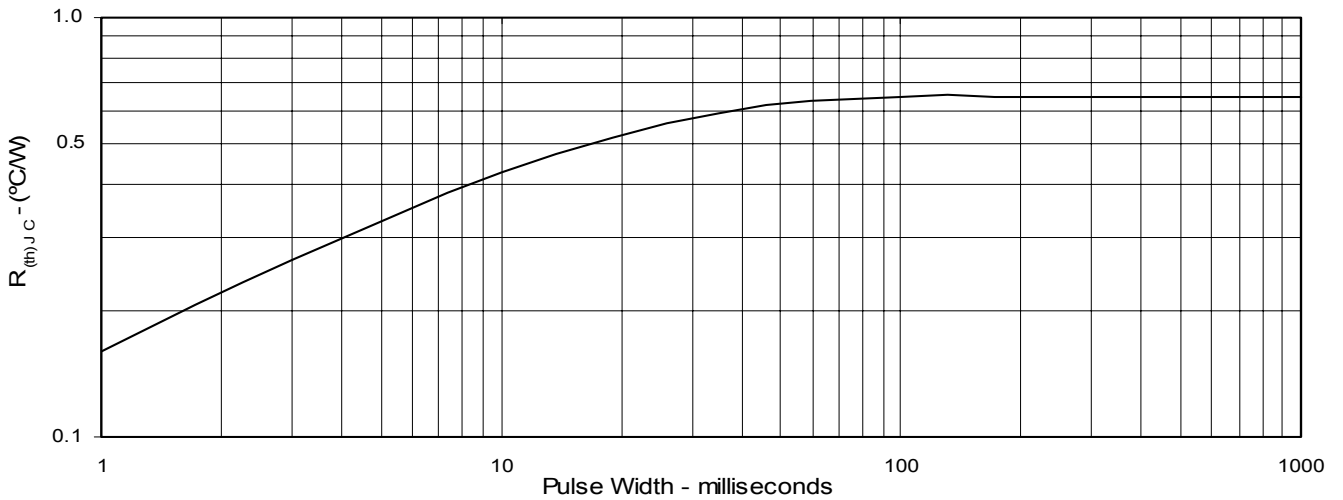
**Fig. 14. Gate Charge**



**Fig. 15. Capacitance**



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



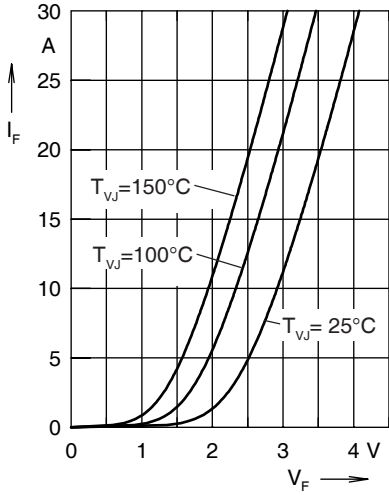


Fig. 17 Forward current  $I_F$  versus  $V_F$

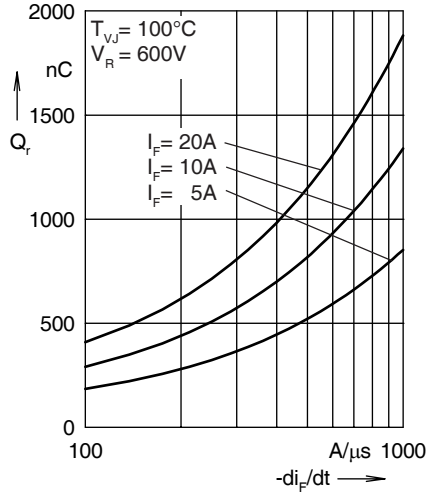


Fig. 18 Reverse recovery charge  $Q_r$  versus  $-di_F/dt$

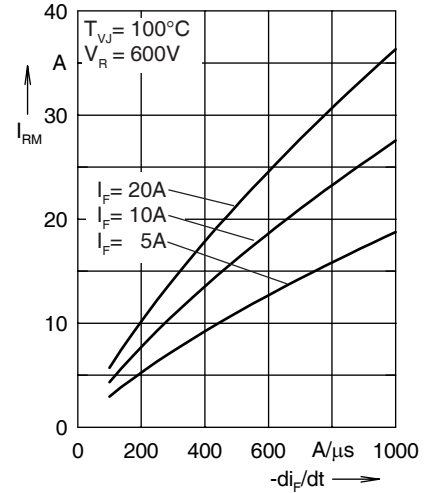


Fig. 19 Peak reverse current  $I_{RM}$  versus  $-di_F/dt$

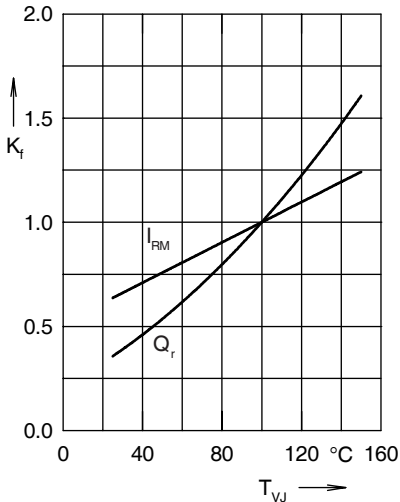


Fig. 20 Dynamic parameters  $Q_r$ ,  $I_{RM}$  versus  $T_{VJ}$

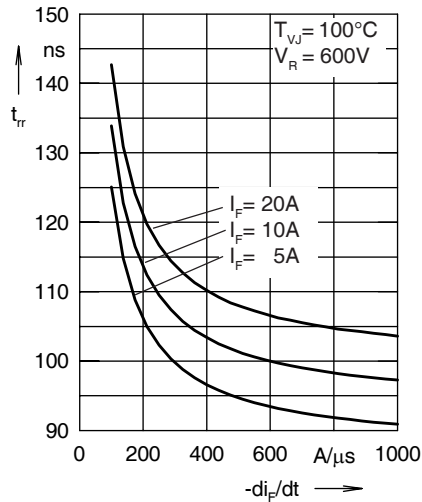


Fig. 21 Recovery time  $t_{rr}$  versus  $-di_F/dt$

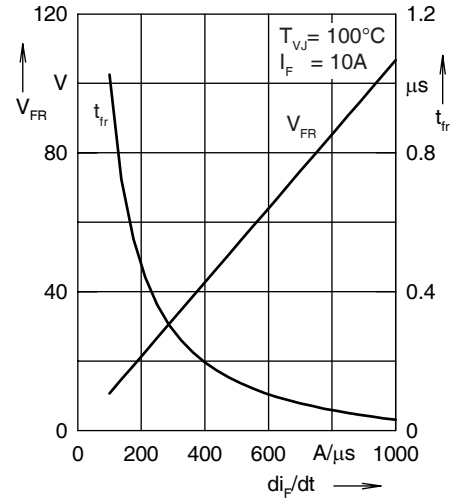


Fig. 22 Peak forward voltage  $V_{FR}$  and  $t_{rr}$  versus  $di_F/dt$

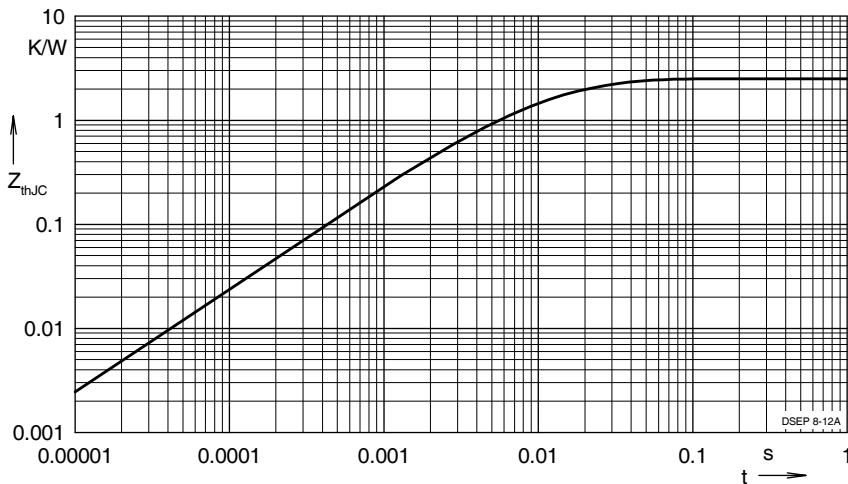


Fig. 23 Transient thermal resistance junction to case

Constants for  $Z_{thJC}$  calculation:

i	$R_{thi}$ (K/W)	$t_i$ (s)
1	1.449	0.0052
2	0.558	0.0003
3	0.493	0.017

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