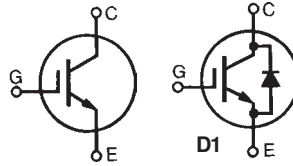


# High Voltage IGBT with Diode

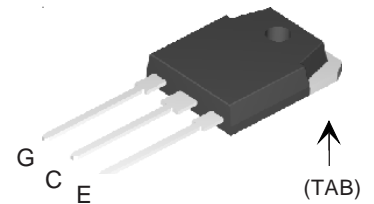
## IXGQ 28N120B IXGQ 28N120BD1



$V_{CES} = 1200 \text{ V}$   
 $I_{C25} = 50 \text{ A}$   
 $V_{CE(sat)} = 3.5 \text{ V}$   
 $t_{fi(typ)} = 160 \text{ ns}$

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
$I_{C25}$	$T_C = 25^\circ\text{C}$	50	A
$I_{C110}$	$T_C = 110^\circ\text{C}$	28	A
$I_{CM}$	$T_C = 25^\circ\text{C}, 1 \text{ ms}$	150	A
<b>SSOA (RBSOA)</b>	$V_{GE} = 15 \text{ V}, T_J = 125^\circ\text{C}, R_G = 10 \Omega$ Clamped inductive load	$I_{CM} = 60$ @ $0.8 V_{CES}$	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	$^\circ\text{C}$
$M_d$	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      C = Collector  
 E = Emitter    TAB = Collector

### Features

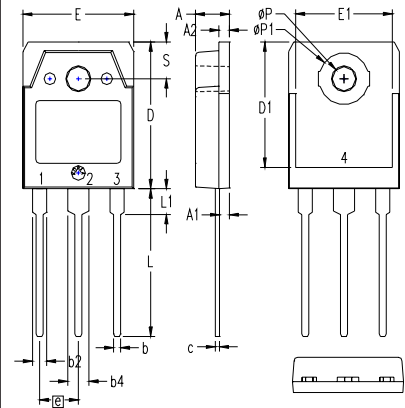
- International standard package
- IGBT and anti-parallel FRED for resonant power supplies
  - Induction heating
  - Rice cookers
- MOS Gate turn-on
  - drive simplicity
- Fast Recovery Expitaxial Diode (FRED)
  - soft recovery with low  $I_{RM}$

### 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
$I_{CES}$	$V_{CE} = V_{CES}, T_J = 25^\circ\text{C}$ $V_{GE} = 0 \text{ V}$		28N120B 28N120BD1	25 $\mu\text{A}$ 50 $\mu\text{A}$
$I_{GES}$	$V_{CE} = 0 \text{ V}, V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$I_C = 28 \text{ A}, V_{GE} = 15 \text{ V}$ Note 2			2.9 2.8 V

Symbol	Test Conditions	Characteristic Values ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)		
		min.	typ.	max.
$g_{fs}$	$I_C = 28\text{A}; V_{CE} = 10\text{V}$ , Note 2	20	30	S
$C_{ies}$			2700	pF
			170	pF
$C_{oes}$	$V_{CE} = 25\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$	28N120B		
$C_{res}$		28N120BD1	180	pF
$Q_g$			60	pF
$Q_{ge}$	$I_C = 28\text{A}, V_{GE} = 15\text{V}, V_{CE} = 0.5 V_{CES}$		92	nC
$Q_{gc}$			17	nC
$t_{d(on)}$	<b>Inductive load, <math>T_J = 25^\circ\text{C}</math></b>		30	ns
$t_{ri}$	$I_C = 28\text{A}; V_{GE} = 15\text{V}$		20	ns
$t_{d(off)}$	$V_{CE} = 0.8 V_{CES}; R_G = R_{off} = 5\ \Omega$		180	280
$t_{fi}$	Note 1.		160	320
$E_{off}$			2.0	5.0
$t_{d(on)}$	<b>Inductive load, <math>T_J = 125^\circ\text{C}</math></b>		35	ns
$t_{ri}$			28	ns
$E_{on}$	$I_C = 28\text{A}; V_{GE} = 15\text{V}$		2.5	mJ
$t_{d(off)}$	$V_{CE} = 0.8 V_{CES}; R_G = R_{off} = 5\ \Omega$		250	ns
$t_{fi}$	Note 1		300	ns
$E_{off}$			8.0	mJ
$R_{thJC}$			0.25	0.5 K/W
$R_{thCK}$				K/W

**TO-3P (IXTQ) 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
$\phi P$	.126	.134	3.20	3.40
$\phi P1$	.272	.280	6.90	7.10
S	.193	.201	4.90	5.10

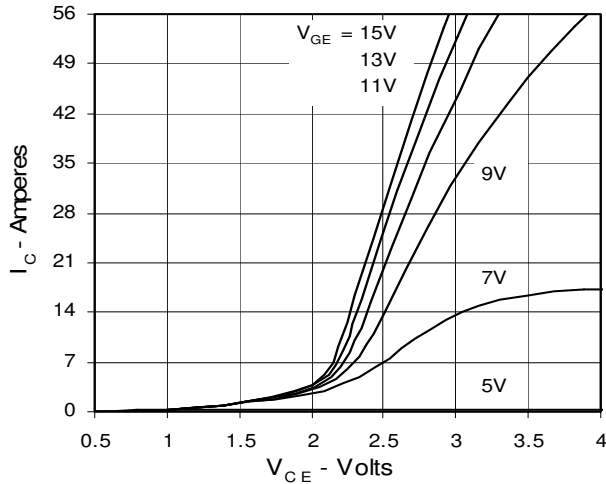
All metal area are tin plated.

Symbol	Test Conditions	Characteristic Values ( $T_J = 25^\circ\text{C}$ , unless otherwise specified)		
		min.	typ.	max.
$I_F$	$T_C = 90^\circ\text{C}$			10 A
$V_F$	$I_F = 10\text{A}, V_{GE} = 0\text{V}$			2.95 V
	$I_F = 10\text{A}, V_{GE} = 0\text{V}, T_J = 125^\circ\text{C}$			2.0 V
$I_{RM}$	$I_F = 10\text{A}; -di_F/dt = 400\text{A}/\mu\text{s}, V_R = 600\text{V}$		14	A
$t_{rr}$	$V_{GE} = 0\text{V}; T_J = 125^\circ\text{C}$		120	ns
$t_{rr}$	$I_F = 1\text{A}; -di_F/dt = 100\text{A}/\mu\text{s}; V_R = 30\text{V}, V_{GE} = 0\text{V}$		40	ns
$R_{thJC}$				2.5 K/W

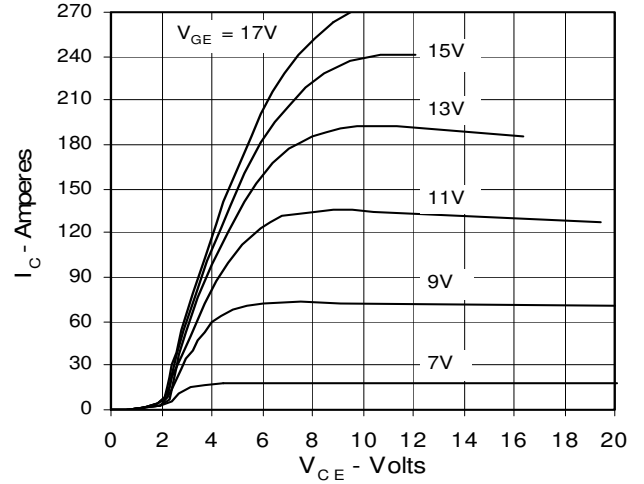
- Notes:
- Switching times may increase for  $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$ , higher  $T_J$  or increased  $R_G$ .
  - Pulse test,  $t \leq 300\ \mu\text{s}$ , duty cycle  $d \leq 2\%$

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

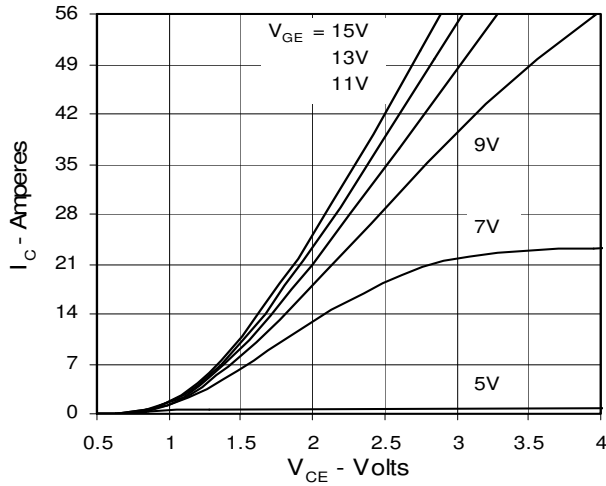
**Fig. 1. Output Characteristics  
@ 25 Deg. C**



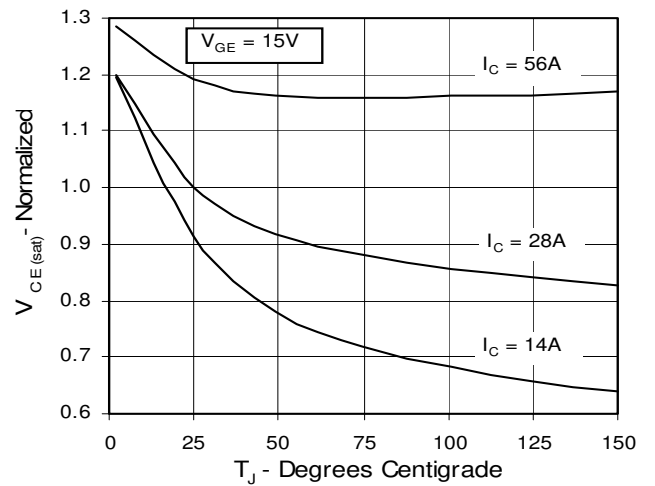
**Fig. 2. Extended Output Characteristics  
@ 25 deg. C**



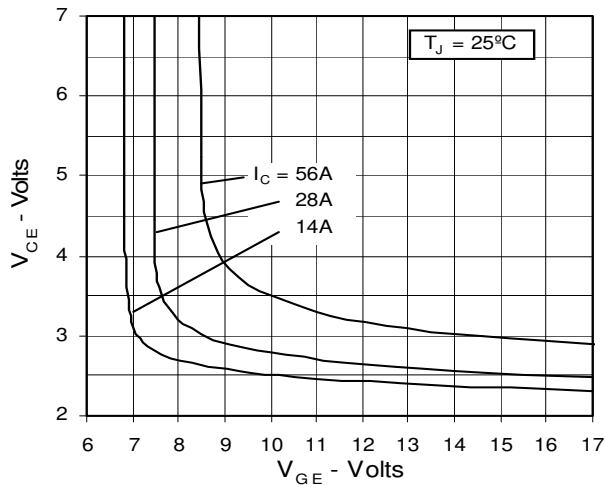
**Fig. 3. Output Characteristics  
@ 125 Deg. C**



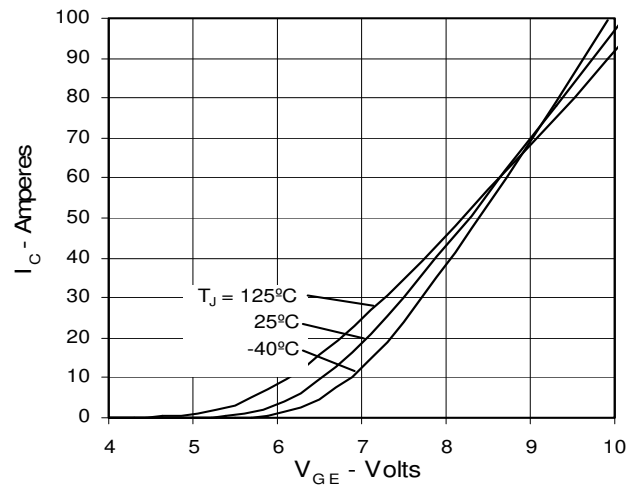
**Fig. 4. Dependence of  $V_{CE(sat)}$  on  
Temperature**



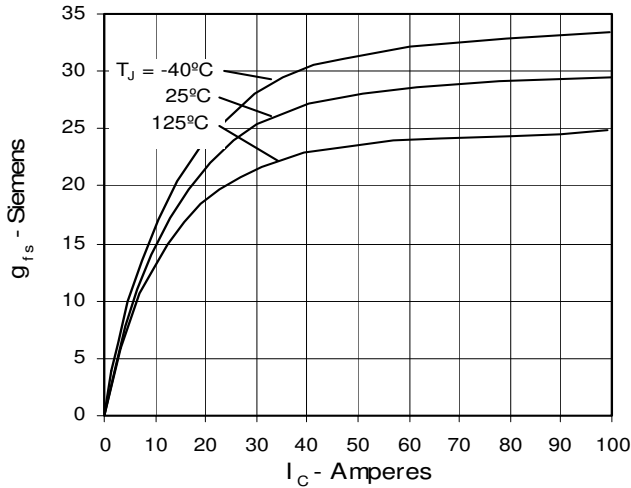
**Fig. 5. Collector-to-Emitter Voltage  
vs. Gate-to-Emitter voltage**



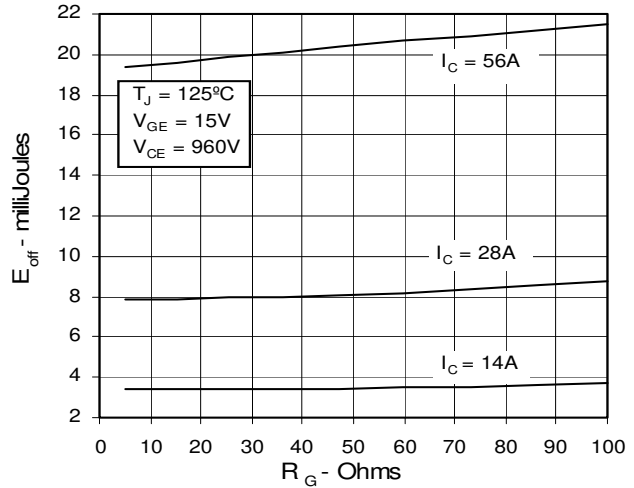
**Fig. 6. Input Admittance**



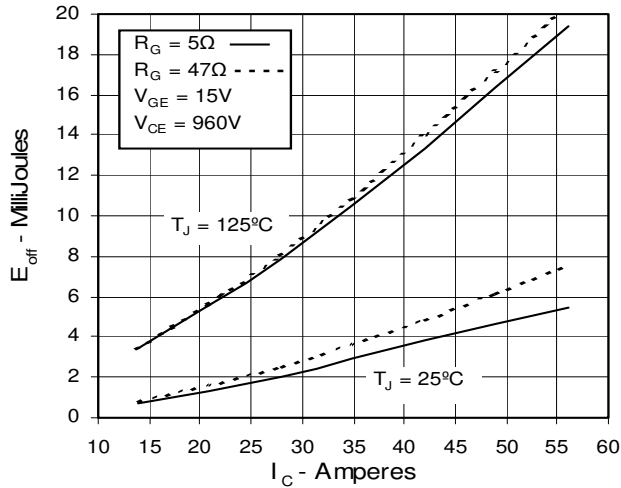
**Fig. 7. Transconductance**



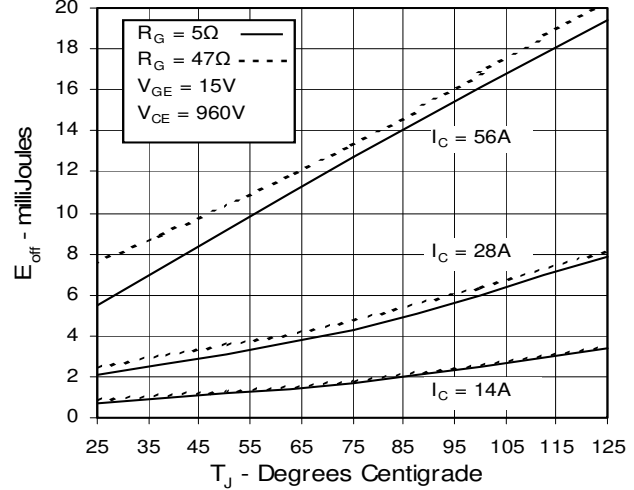
**Fig. 8. Dependence of Turn-off Energy Loss on  $R_G$**



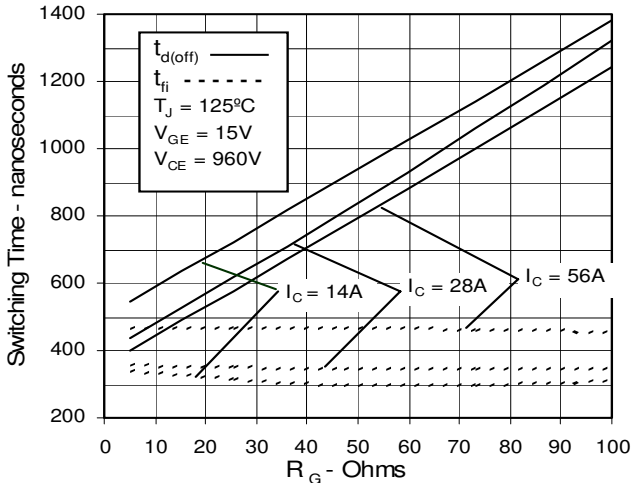
**Fig. 9. Dependence of Turn-Off Energy Loss on  $I_C$**



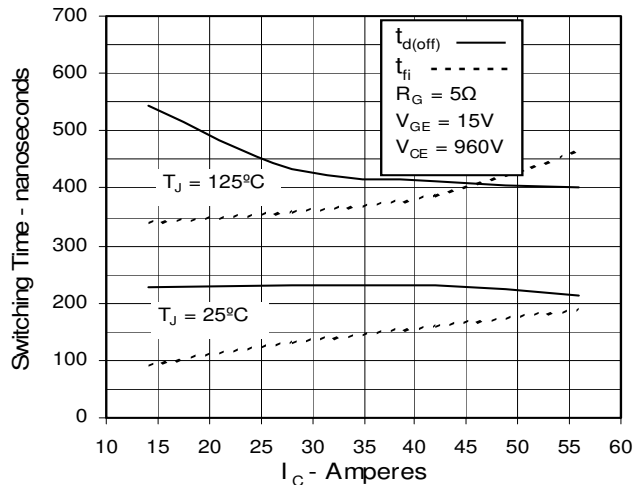
**Fig. 10. Dependence of Turn-off Energy Loss on Temperature**



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



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

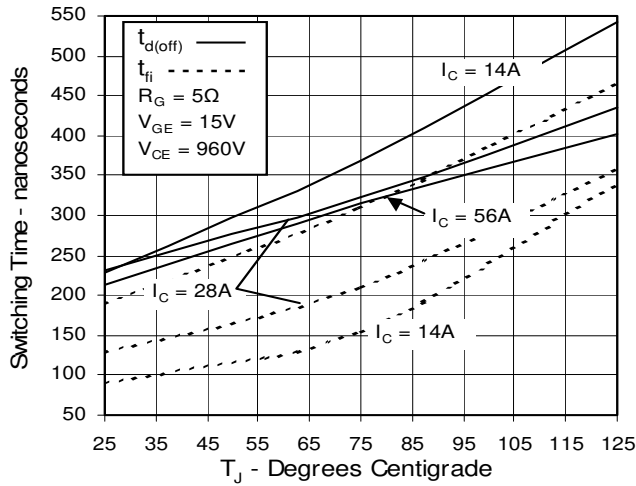


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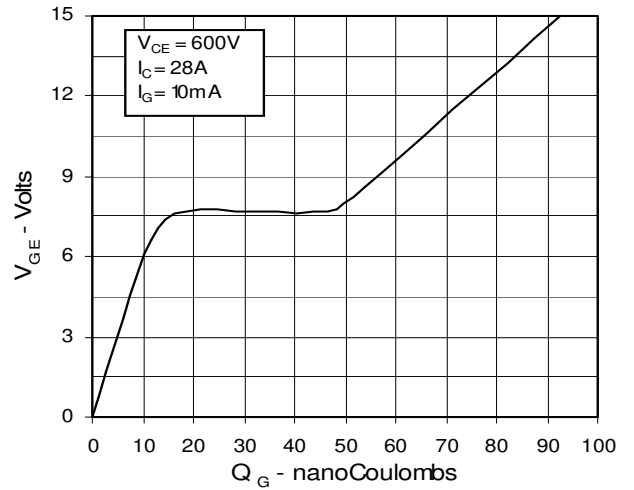
IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:

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	6,583,505
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	6,683,344

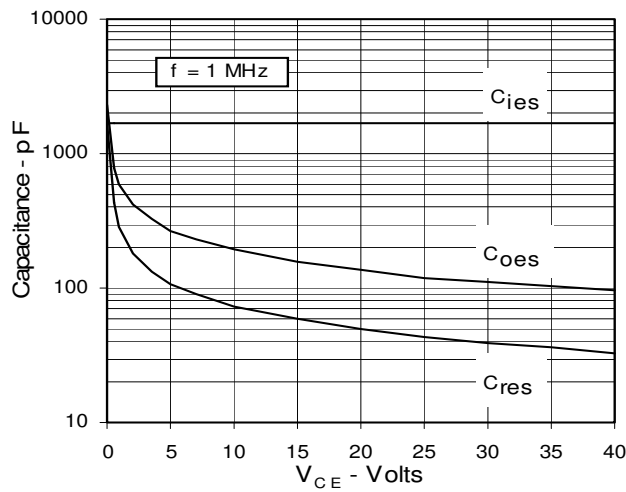
**Fig. 13. Dependence of Turn-off Switching Time on Temperature**



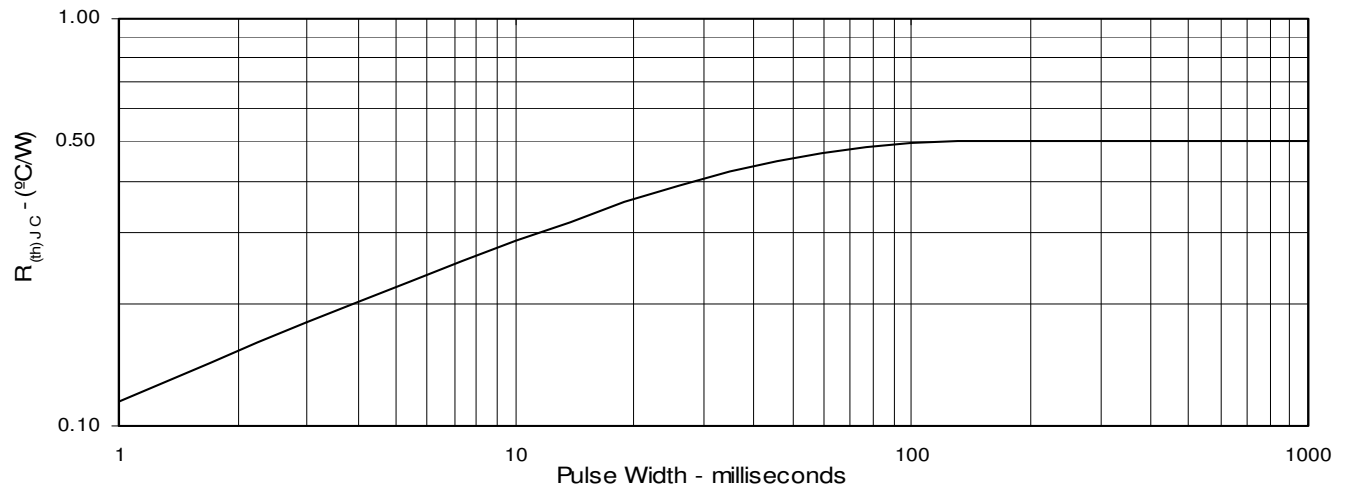
**Fig. 14. Gate Charge**



**Fig. 15. Capacitance**



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



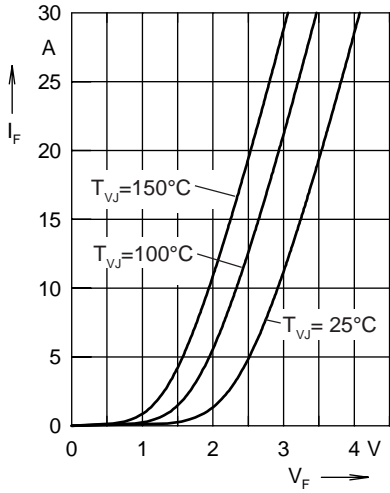


Fig. 17 Forward current  $I_F$  versus  $V_F$

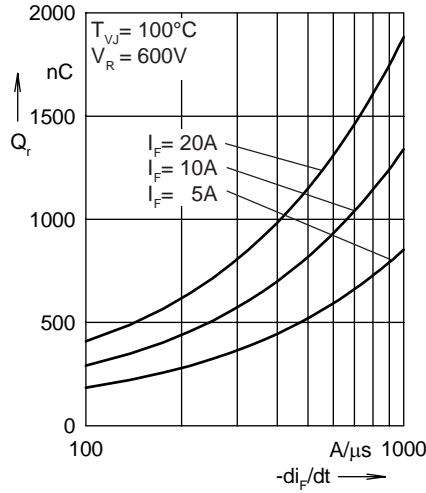


Fig. 18 Reverse recovery charge  $Q_r$  versus  $-di_F/dt$

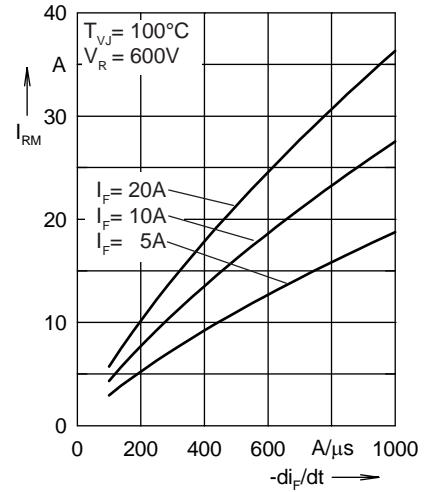


Fig. 19 Peak reverse current  $I_{RM}$  versus  $-di_F/dt$

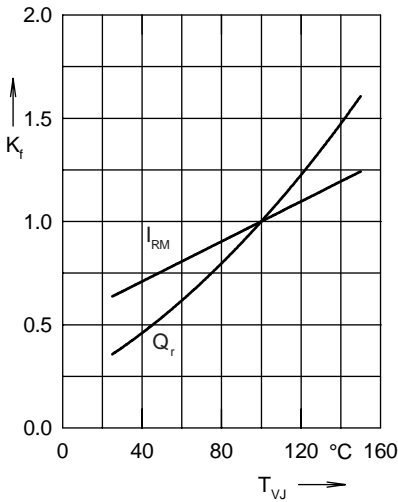


Fig. 20 Dynamic parameters  $Q_r$ ,  $I_{RM}$  versus  $T_{VJ}$

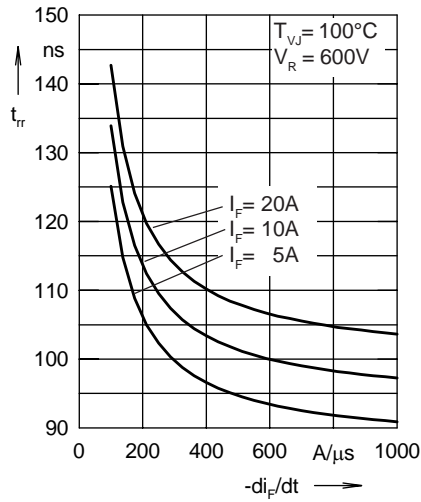


Fig. 21 Recovery time  $t_{tr}$  versus  $-di_F/dt$

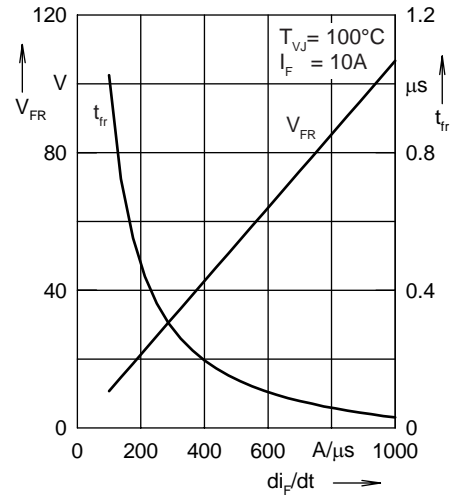


Fig. 22 Peak forward voltage  $V_{FR}$  and  $t_{tr}$  versus  $di_F/dt$

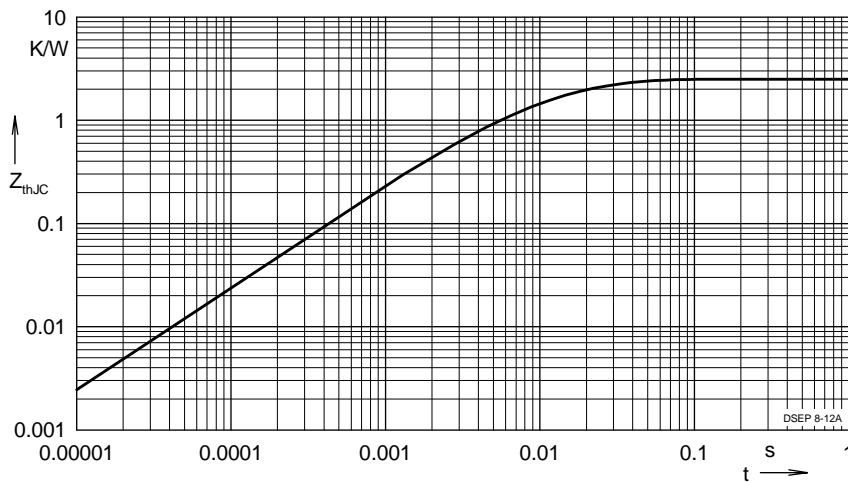


Fig. 23 Transient thermal resistance junction to case

Constants for  $Z_{thJC}$  calculation:

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

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