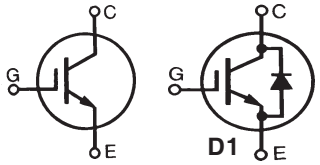
High Speed IGBT

IXSP 20N60B2
IXSP 20N60B2D1

V_{CES} = 600 V
I_{C25} = 35 A
$V_{CE(sat)}$ = 2.5 V

Short Circuit SOA Capability

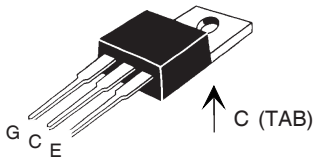
Preliminary Data Sheet



Symbol	Test Conditions	Maximum Ratings	
V_{CES}	T_J = 25°C to 150°C	600	V
V_{CGR}	T_J = 25°C to 150°C; R_{GE} = 1 MΩ	600	V
V_{GES}	Continuous	±20	V
V_{GEM}	Transient	±30	V
I_{C25}	T_C = 25°C	35	A
I_{C110}	T_C = 110°C	20	A
$I_{F(110)}$		11	A
I_{CM}	T_C = 25°C, 1 ms	60	A
SSOA (RBSOA)	V_{GE} = 15 V, T_J = 125°C, R_G = 82Ω Clamped inductive load	I_{CM} = 32 @ 0.8 V_{CES}	A
t_{SC} **(SCSOA)**	V_{GE} = 15 V, V_{CE} = 360 V, T_J = 125°C R_G = 82 Ω, non repetitive	10	µs
P_C	T_C = 25°C	190	W
T_J		-55 ... +150	°C
T_{JM}		150	°C
T_{stg}		-55 ... +150	°C
Weight		2	g
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	°C
Maximum tab temperature for soldering for 10s		260	°C

Symbol	Test Conditions		Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
BV_{CES}	I_C = 250 µA, V_{GE} = 0 V		600			V
$V_{GE(th)}$	I_C = 750 µA, V_{CE} = V_{GE}		3.5		6.5	V
I_{CES}	V_{CE} = V_{CES} V_{GE} = 0 V	SP20N60B2 SP20N60B2D1			25 85	µA µA
I_{GES}	V_{CE} = 0 V, V_{GE} = ±20 V				±100	nA
$V_{CE(sat)}$	I_C = 16A, V_{GE} = 15 V				2.5	V

TO-220AB (IXSP)



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

Features

- International standard package
- Guaranteed Short Circuit SOA capability
- Low $V_{CE(sat)}$
  - for low on-state conduction losses
- High current handling capability
- MOS Gate turn-on
  - drive simplicity
- Fast fall time for switching speeds up to 20 kHz

Applications

- AC motor speed control
- Uninterruptible power supplies (UPS)
- Welding

Advantages

- High power density

DS99181A(07/04)

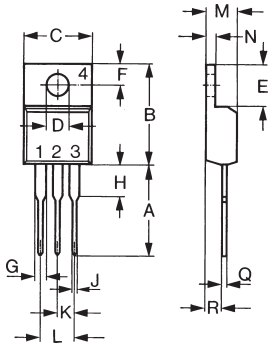
Symbol	Test Conditions		Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
g_{fs}	I_C = 16A; V_{CE} = 10 V, Note 1		3.5	7.0		S
C_{ies}				800		pF
C_{oes}	V_{CE} = 25 V, V_{GE} = 0 V			76		pF
	f = 1 MHz	20N60B2D1		90		pF
C_{res}				28		pF
Q_g				33		nC
Q_{ge}	I_C = 16A, V_{GE} = 15 V, V_{CE} = 0.5 V_{CES}			12		nC
Q_{gc}				12		nC
$t_{d(on)}$	**Inductive load, T_J = 25°C**			30		ns
t_{ri}	I_C = 16A, V_{GE} = 15 V			30		ns
$t_{d(off)}$	V_{CE} = 0.8 V_{CES}, R_G = 10 Ω			116		ns
t_{fi}	Switching times may increase for V_{CE} (Clamp) > 0.8 • V_{CES}, higher T_J or			126		ns
E_{off}	increased R_G			380	600	µJ
$t_{d(on)}$				30		ns
t_{ri}	**Inductive load, T_J = 125°C**			30		ns
E_{on}	I_C = 16 A, V_{GE} = 15 V	20N60B2		0.12		mJ
	V_{CE} = 0.8 V_{CES}, R_G = 10 Ω	20N60B2D1		0.42		mJ
$t_{d(off)}$	Switching times may increase for			180		ns
t_{fi}	V_{CE} (Clamp) > 0.8 • V_{CES}, higher T_J or increased R_G			210		ns
E_{off}				970		µJ
R_{thJC}					0.66	K/W
R_{thCS}				0.3		K/W

Reverse Diode (FRED)

Symbol	Test Conditions		Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 10A, V_{GE} = 0 V	T_J =150°C		1.66		V
				2.66		V
I_{RM}	I_F = 12A, V_{GE} = 0 V, -di_F/dt = 100 A/µs	T_J = 100°C		1.5		A
t_{rr}	V_R = 100 V	T_J = 100°C		90		ns
t_{rr}	I_F = 1 A; -di/dt = 100 A/µs; V_R = 30 V			30		ns
R_{thJC}					2.5	K/W

Note 1: Pulse test, t ≤ 300 µs, duty cycle d ≤ 2 %

TO-220 AB (IXSP) Outline



Dim.	Millimeter Min.	Max.	Inches Min.	Max.
A	12.70	13.97	0.500	0.550
B	14.73	16.00	0.580	0.630
C	9.91	10.66	0.390	0.420
D	3.54	4.08	0.139	0.161
E	5.85	6.85	0.230	0.270
F	2.54	3.18	0.100	0.125
G	1.15	1.65	0.045	0.065
H	2.79	5.84	0.110	0.230
J	0.64	1.01	0.025	0.040
K	2.54	BSC	0.100	BSC
M	4.32	4.82	0.170	0.190
N	1.14	1.39	0.045	0.055
Q	0.35	0.56	0.014	0.022
R	2.29	2.79	0.090	0.110

Fig. 1. Output Characteristics @ 25 ºC

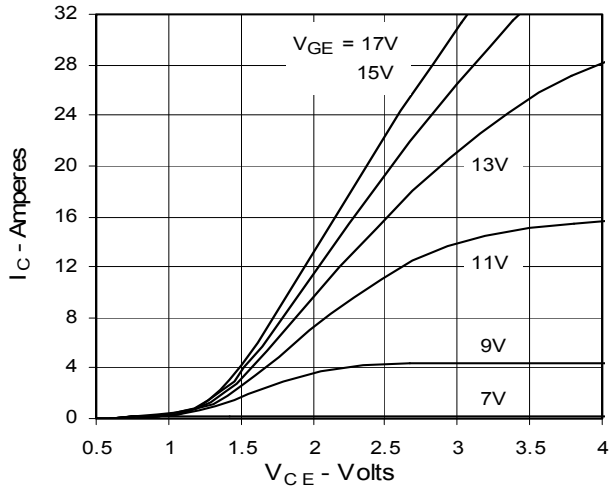


Fig. 2. Extended Output Characteristics @ 25 ºC

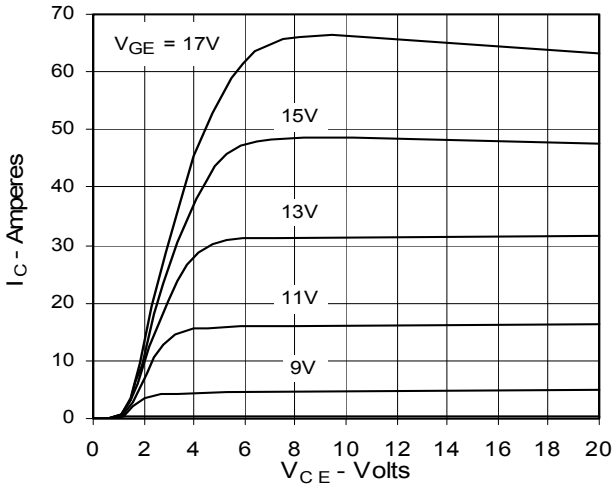


Fig. 3. Output Characteristics @ 125 ºC

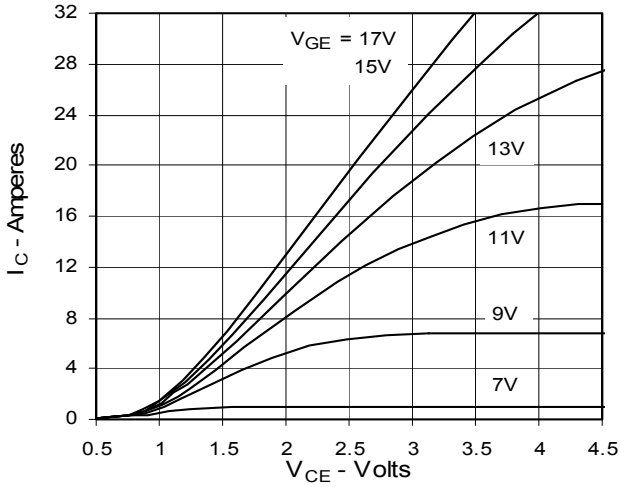


Fig. 4. Dependence of $V_{CE(sat)}$ on Temperature

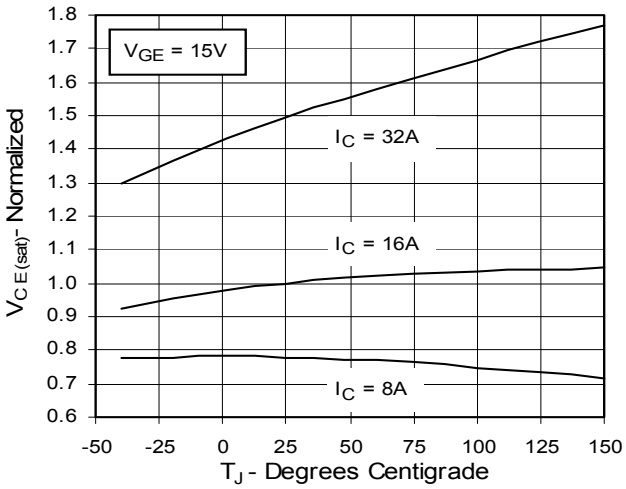


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter voltage

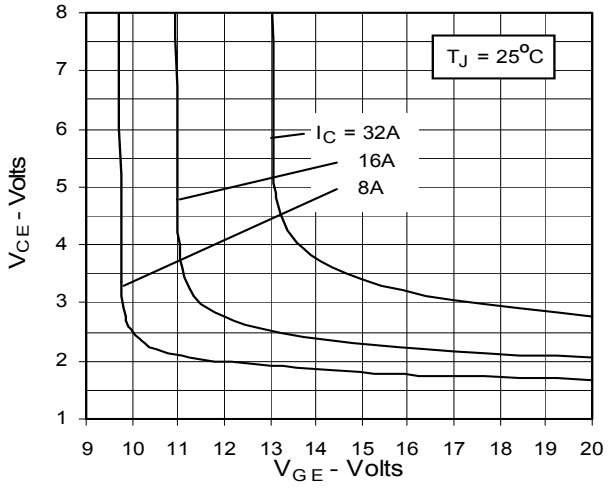


Fig. 6. Input Admittance

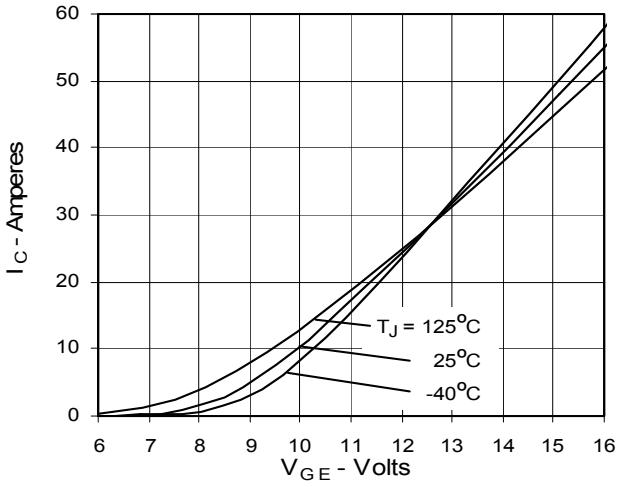


Fig. 7. Transconductance

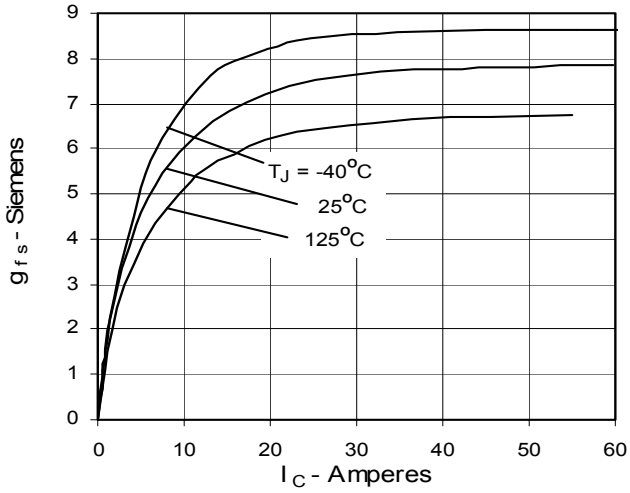


Fig. 8. Dependence of Turn-off Energy Loss on R_G

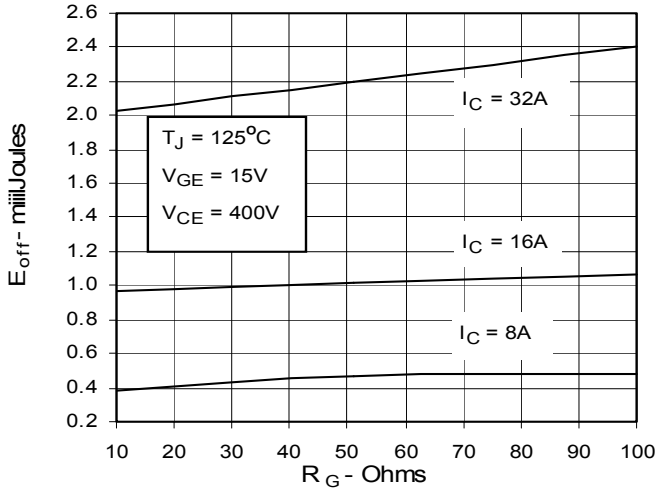


Fig. 9. Dependence of Turn-Off Energy Loss on I_C

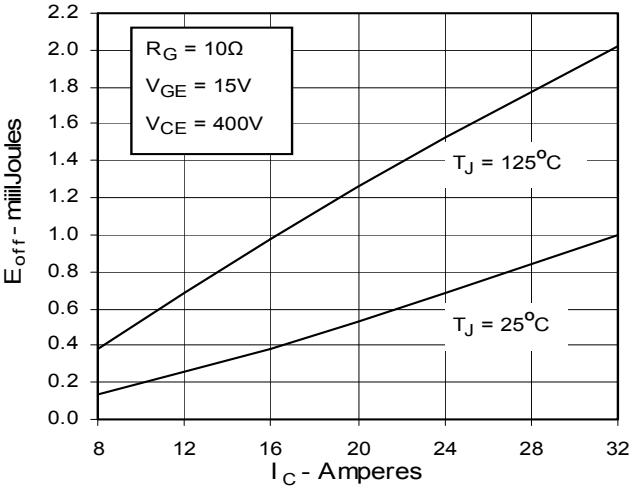


Fig. 10. Dependence of Turn-off Energy Loss on Temperature

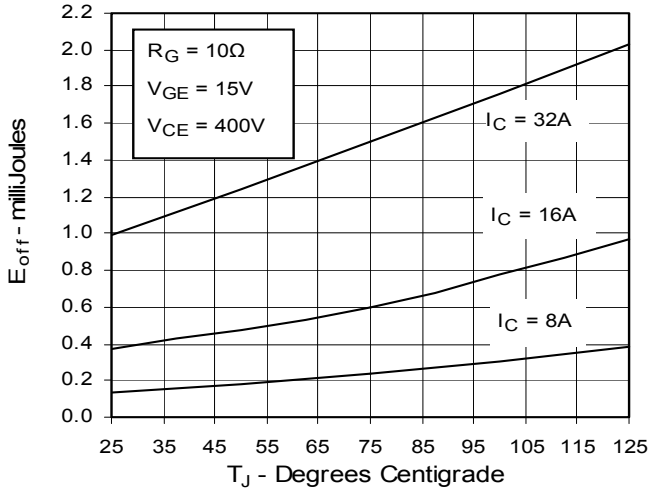


Fig. 11. Dependence of Turn-off Switching Time on R_G

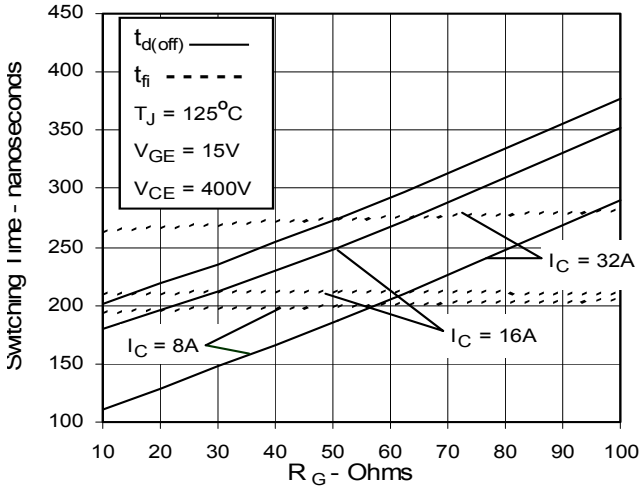


Fig. 12. Dependence of Turn-off Switching Time on I_C

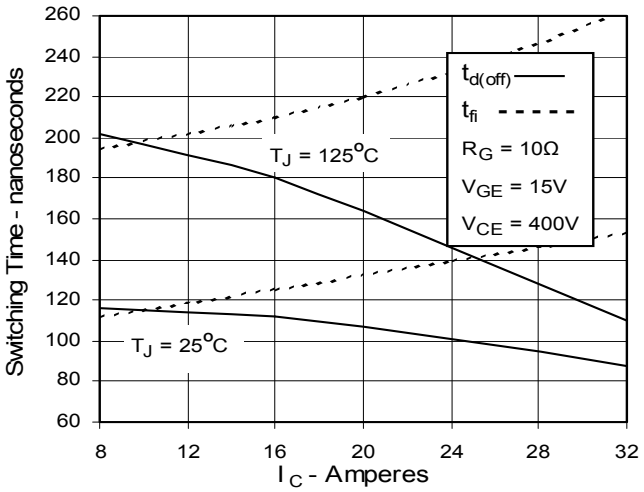


Fig. 13. Dependence of Turn-off Switching Time on Temperature

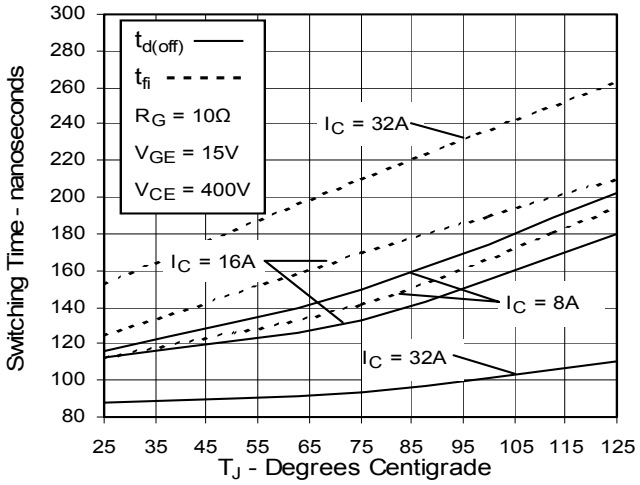


Fig. 14. Gate Charge

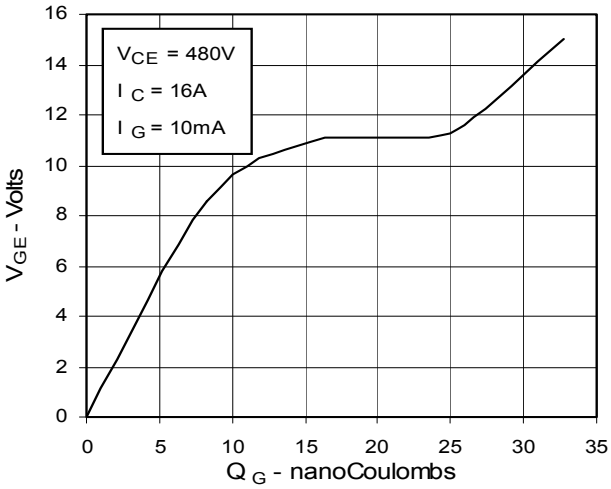


Fig. 15. Capacitance

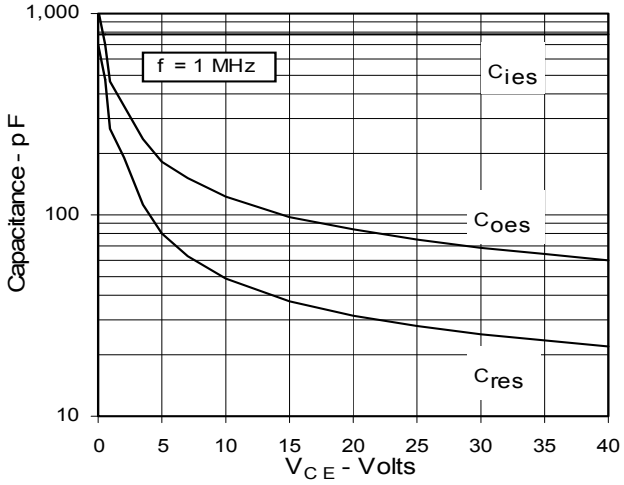


Fig. 16. Reverse-Bias Safe Operating Area

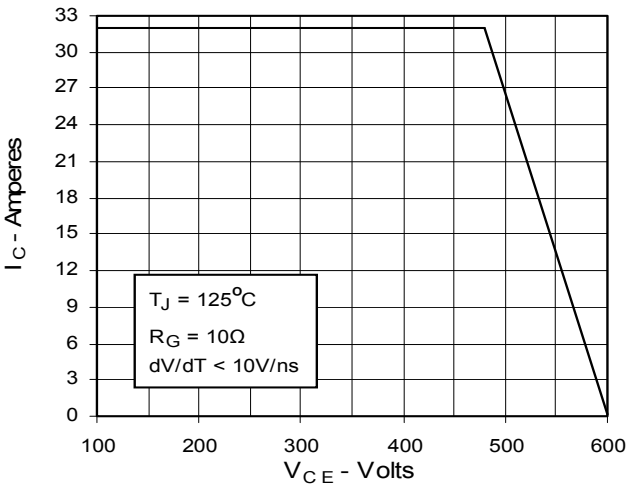
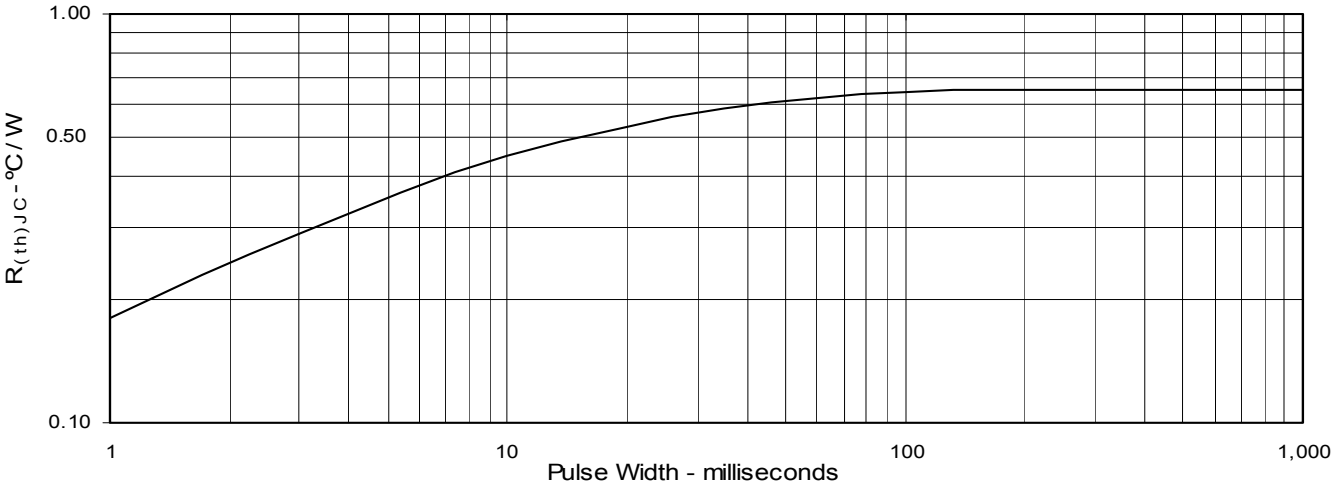


Fig. 17. Maximum Transient Thermal Resistance



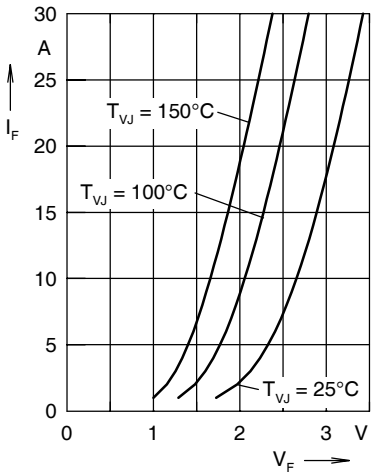


Fig. 18. Forward current I_F versus V_F

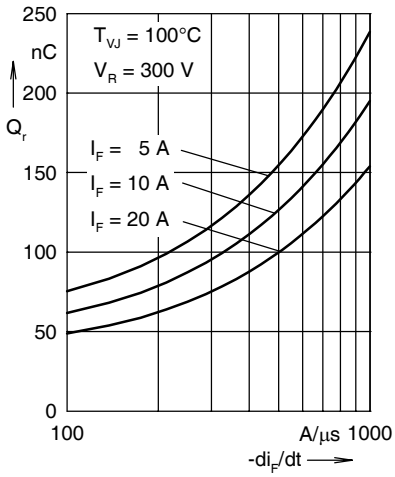


Fig. 19. Reverse recovery charge Q_r

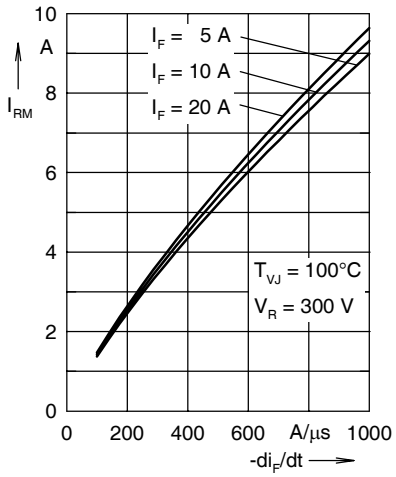


Fig. 20. Peak reverse current I_{RM}

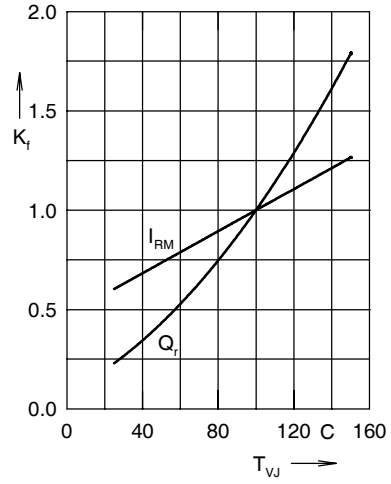


Fig. 21. Dynamic parameters Q_r, I_{RM}

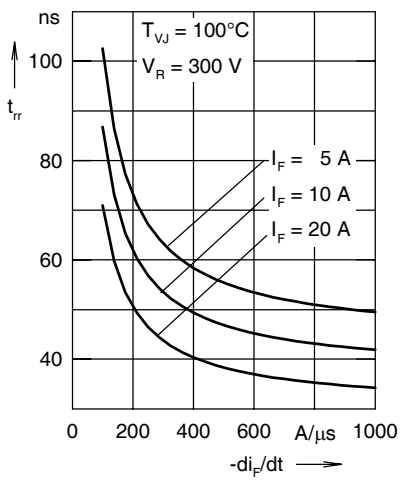


Fig. 22. Recovery time t_{rr} versus $-di_F/dt$

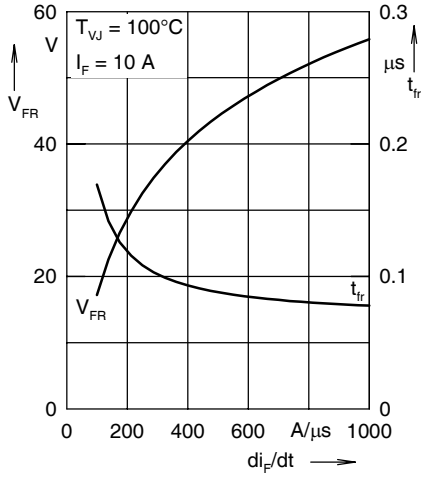


Fig. 23. Peak forward voltage V_{FR} and

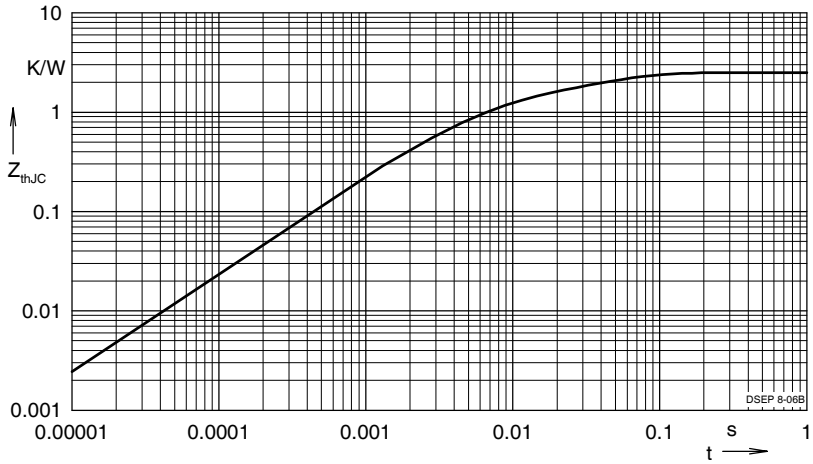


Fig. 24. Transient thermal resistance junction-to-case

Constants for Z_{thJC} calculation:

i	R_{thi} (K/W)	t_i (s)
1	1.449	0.0052
2	0.5578	0.0003

NOTE: Fig. 18 to Fig. 23 shows typical values