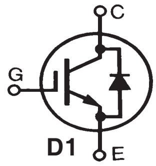
High Speed IGBT with Diode

IXSA 10N60B2D1
IXSP 10N60B2D1

V_{CES} = 600 V
I_{C25} = 20 A
$V_{CE(sat)}$ = 2.5 V

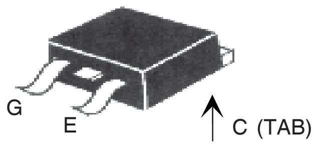
Short Circuit SOA Capability

Preliminary Data Sheet

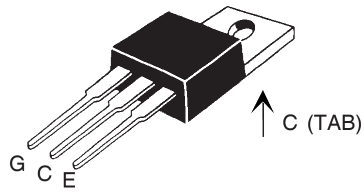


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	T_J = 25°C to 150°C	600	V
V_{CGR}	T_J = 25°C to 150°C; R_{GE} = 1 MΩ	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	T_C = 25°C	20	A
I_{C110}	T_C = 110°C	10	A
$I_{F(110)}$		11	A
I_{CM}	T_C = 25°C, 1 ms	30	A
SSOA (RBSOA)	V_{GE} = 15 V, T_J = 125°C, R_G = 82Ω Clamped inductive load, V_{GE} = 20 V	I_{CM} = 20 @ 0.8 V_{CES}	A
t_{SC} (SCSOA)	V_{GE} = 15 V, V_{CE} = 360 V, T_J = 125°C R_G = 150 Ω, non repetitive	10	µs
P_C	T_C = 25°C	100	W
T_J		-55 ... +150	°C
T_{JM}		150	°C
T_{stg}		-55 ... +150	°C
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	°C
Plastic Body	t = 10s	250	°C
M_d	Mounting torque (TO-220)	1.3/10	Nm/lb. in
Weight		2	g

TO-263 (IXSA)



TO-220AB (IXSP)



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

Features
- International standard packages
- 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

Symbol	Test Conditions	Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
$V_{GE(th)}$	I_C = 750 µA, V_{CE} = V_{GE}	4.0		7.0	V
I_{CES}	V_{CE} = V_{CES} V_{GE} = 0 V			75 200	µA µA
I_{GES}	V_{CE} = 0 V, V_{GE} = ± 20 V			± 100	nA
$V_{CE(sat)}$	I_C = 10A, V_{GE} = 15 V			2.5	V

DS99193A(10/04)

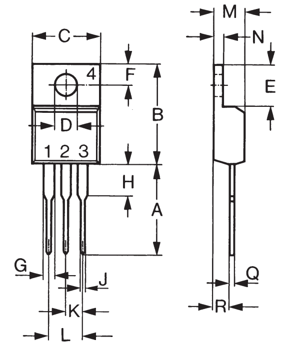
Symbol	Test Conditions	Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
g_{fs}	I_C = 10A; V_{CE} = 10 V, Note 1	2.0	3.6		S
C_{ies}			400		pF
C_{oes}	V_{CE} = 25 V, V_{GE} = 0 V		50		pF
C_{res}	f = 1 MHz		11		pF
Q_g			17		nC
Q_{ge}	I_C = 10A, V_{GE} = 15 V, V_{CE} = 0.5 V_{CES}		6		nC
Q_{gc}			7.5		nC
$t_{d(on)}$	**Inductive load, T_J = 25°C**		30		ns
t_{ri}	I_C = 10A, V_{GE} = 15 V		30		ns
$t_{d(off)}$	V_{CE} = 0.8 V_{CES}, R_G = 30 Ω		180		ns
t_{fi}	Switching times may increase for V_{CE} (Clamp) > 0.8 • V_{CES}, higher T_J or		165		ns
E_{off}	increased R_G		430	750	µJ
$t_{d(on)}$			30		ns
t_{ri}			30		ns
E_{on}	**Inductive load, T_J = 125°C**		0.32		mJ
$t_{d(off)}$	I_C = 10 A, V_{GE} = 15 V; V_{CE} = 0.8 V_{CES}, R_G = 30 Ω		260		ns
t_{fi}	Switching times may increase for		270		ns
E_{off}	V_{CE} (Clamp) > 0.8 • V_{CES}, higher T_J or increased R_G		790		µJ
R_{thJC}				1.25	K/W
R_{thCS}	TO-220		0.25		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			25		ns
R_{thJC}					2.5	K/W

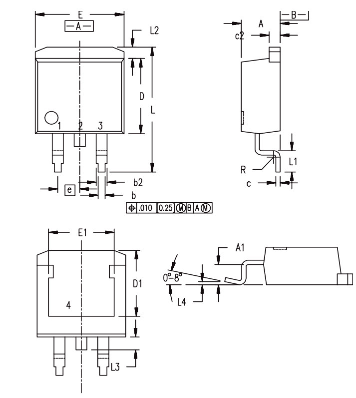
Note 1: Pulse test, t ≤ 300 µs, duty cycle d ≤ 2 %

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

TO-263 (IXSA) Outline



Dim.	Millimeter Min.	Max.	Inches Min.	Max.
A	4.06	4.83	.160	.190
A1	2.03	2.79	.080	.110
b	0.51	0.99	.020	.039
b2	1.14	1.40	.045	.055
c	0.46	0.74	.018	.029
c2	1.14	1.40	.045	.055
D	8.64	9.65	.340	.380
D1	7.11	8.13	.280	.320
E	9.65	10.29	.380	.405
E1	6.86	8.13	.270	.320
e	2.54	BSC	.100	BSC
L	14.61	15.88	.575	.625
L1	2.29	2.79	.090	.110
L2	1.02	1.40	.040	.055
L3	1.27	1.78	.050	.070
L4	0	0.38	0	.015
R	0.46	0.74	.018	.029

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

Fig. 1. Output Characteristics @ 25 ºC

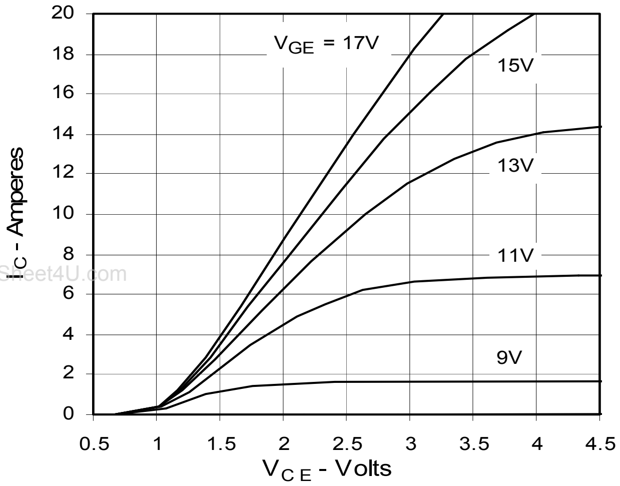


Fig. 2. Extended Output Characteristics @ 25 ºC

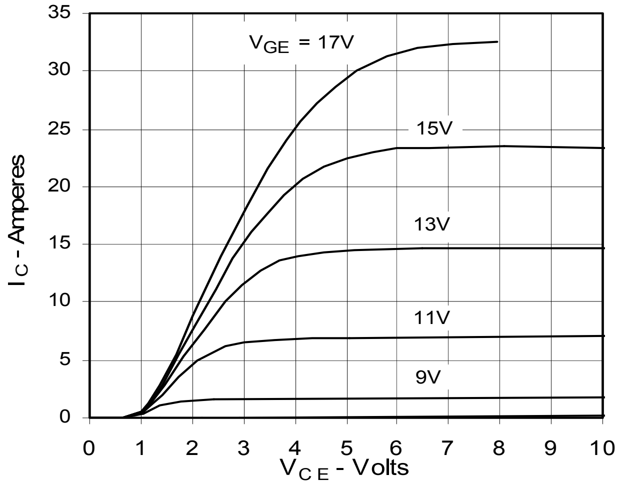


Fig. 3. Output Characteristics @ 125 ºC

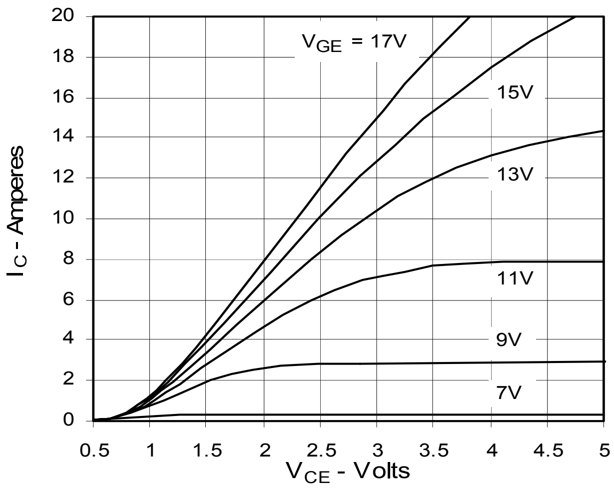


Fig. 4. Dependence of $V_{CE(sat)}$ on Temperature

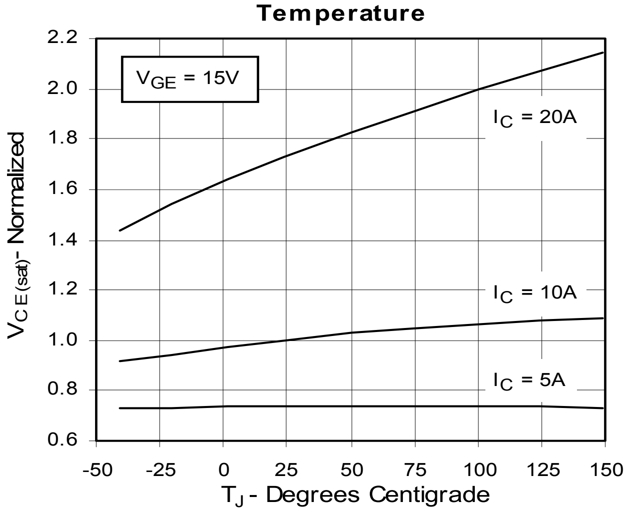


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter voltage

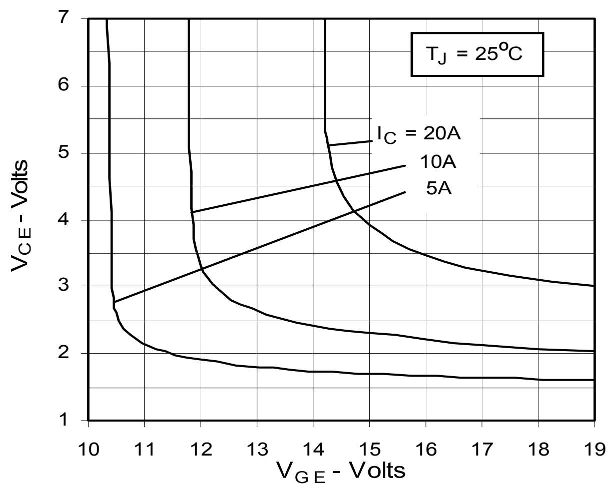


Fig. 6. Input Admittance

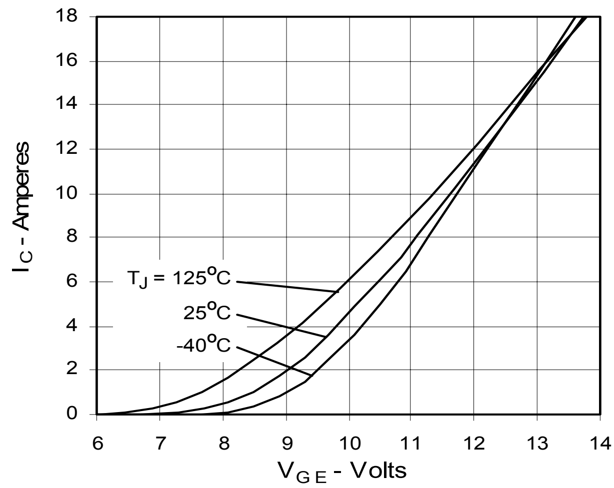


Fig. 7. Transconductance

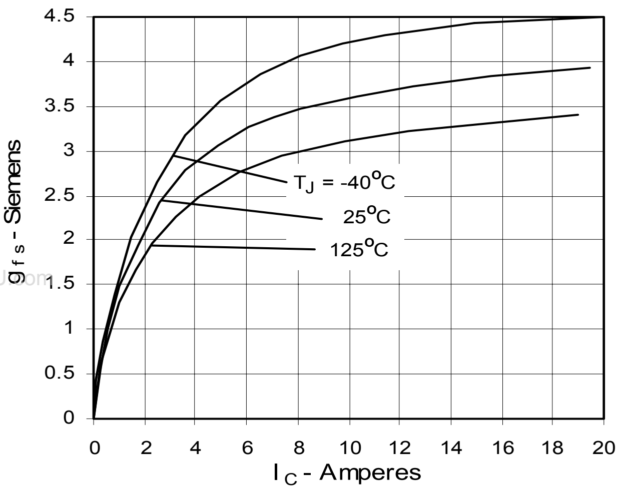


Fig. 8. Dependence of Turn-off Energy Loss on R_G

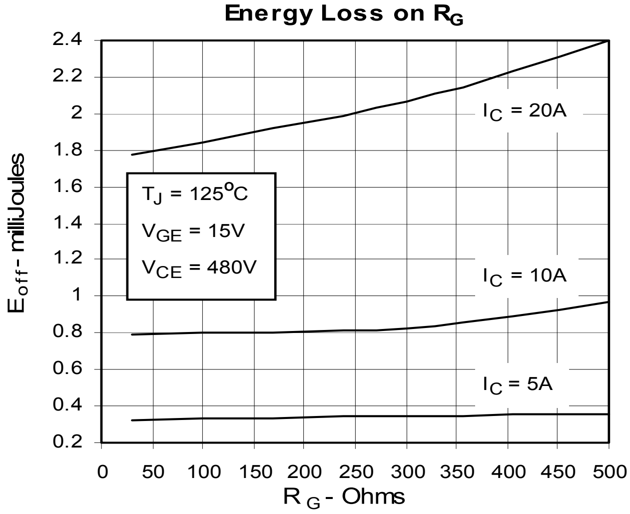


Fig. 9. Dependence of Turn-Off Energy Loss on I_C

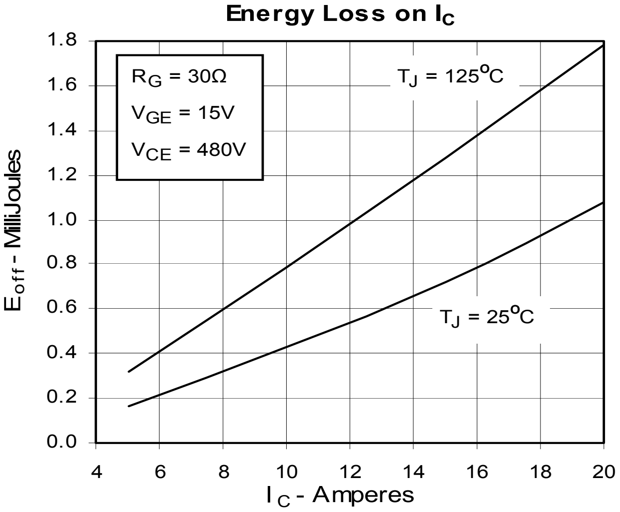


Fig. 10. Dependence of Turn-off Energy Loss on Temperature

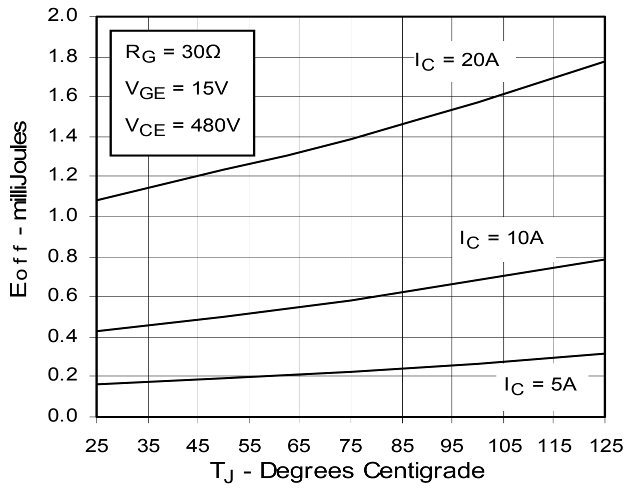


Fig. 11. Dependence of Turn-off Switching Time on R_G

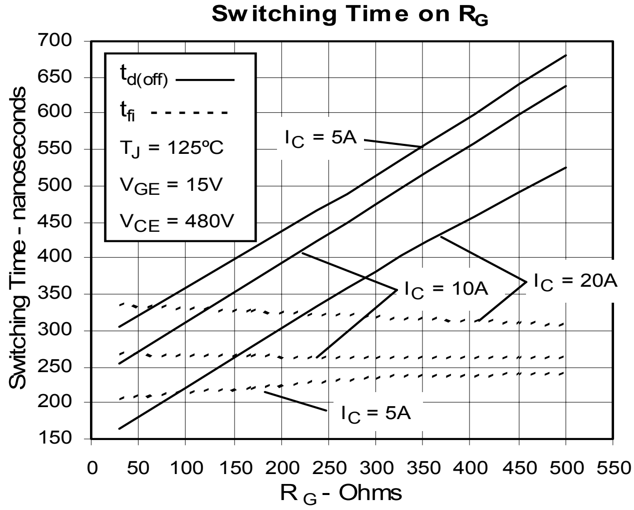


Fig. 12. Dependence of Turn-off Switching Time on I_C

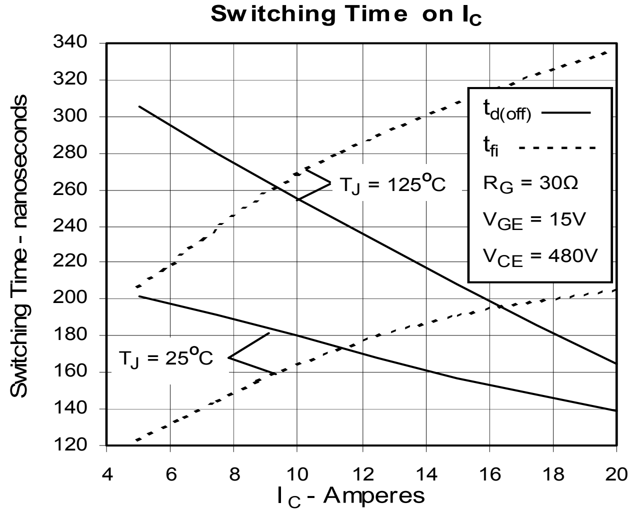


Fig. 13. Dependence of Turn-off Switching Time on Temperature

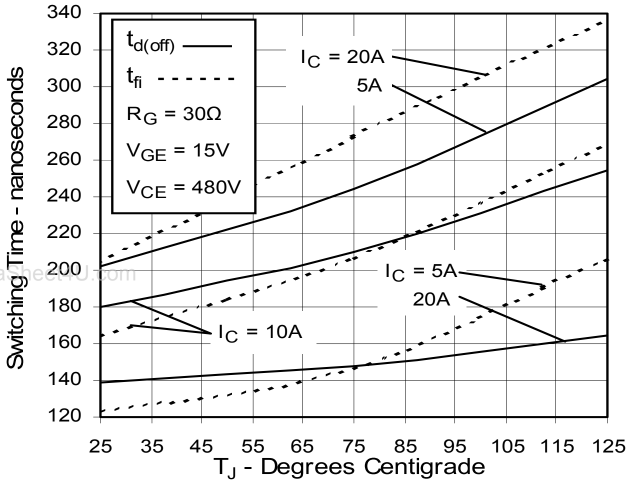


Fig. 14. Gate Charge

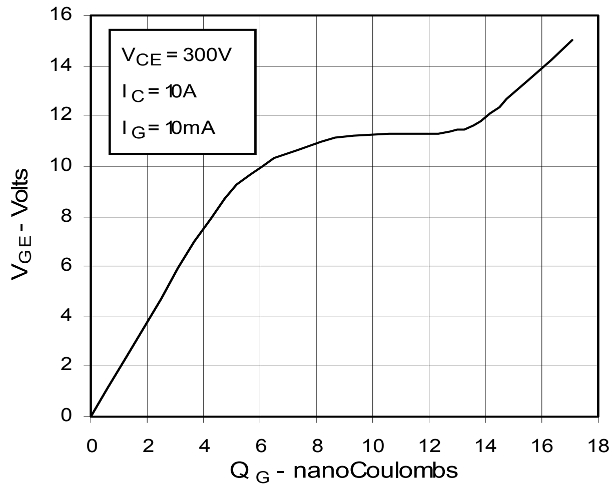


Fig. 15. Capacitance

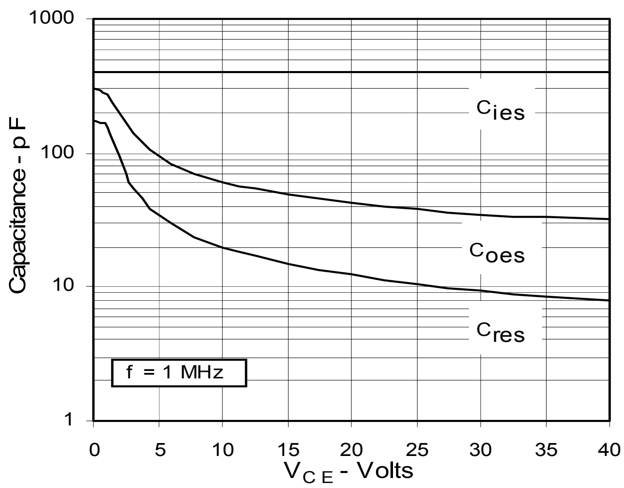


Fig. 16. Reverse-Bias Safe Operating Area

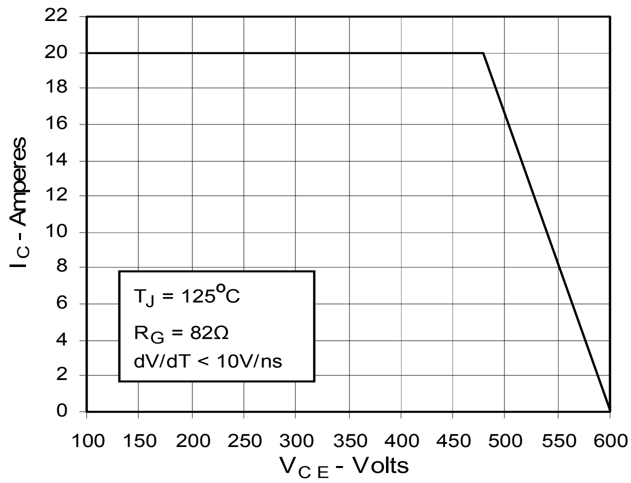
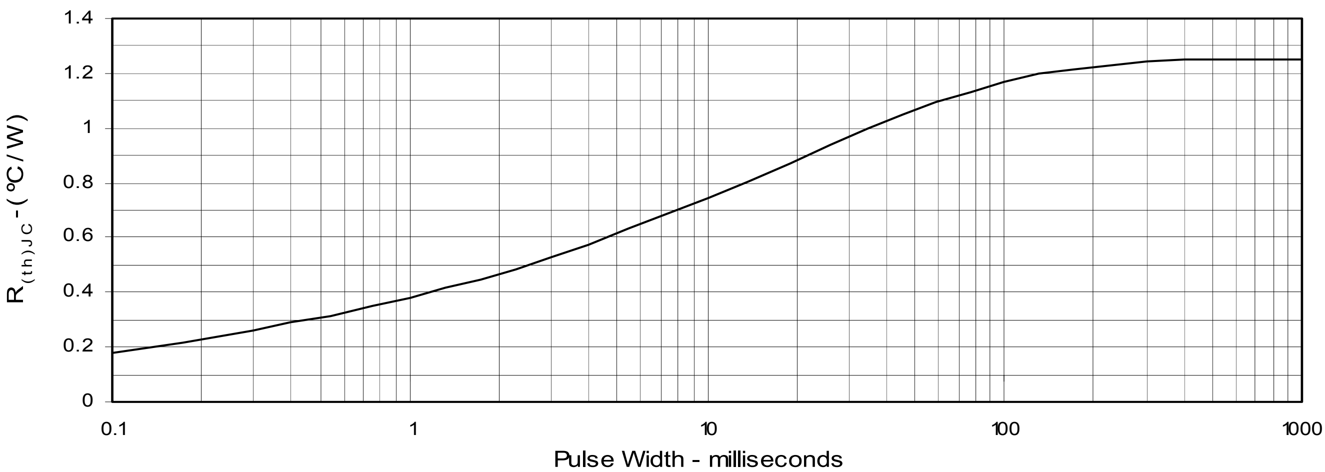


Fig. 17. Maximum Transient Thermal Resistance



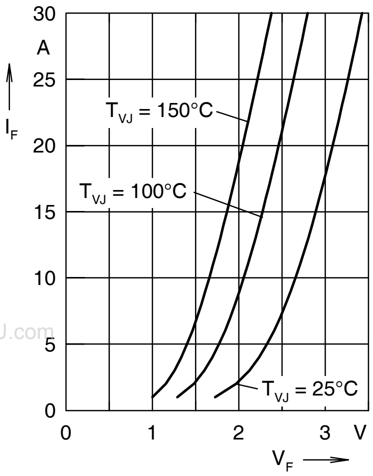


Fig. 18. Forward current I_F versus V_F

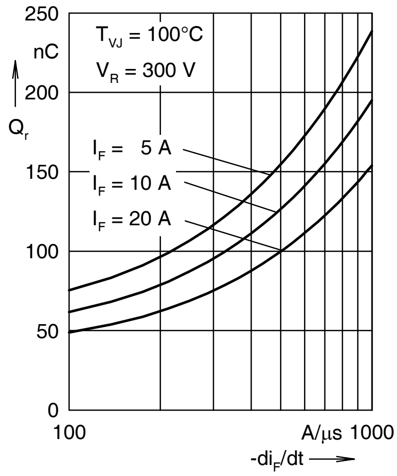


Fig. 19. Reverse recovery charge Q_r versus $-di_F/dt$

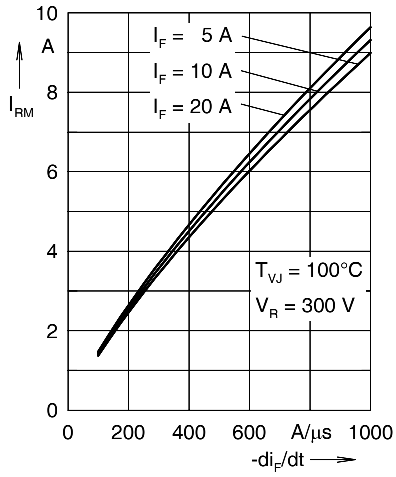


Fig. 20. Peak reverse current I_{RM} versus $-di_F/dt$

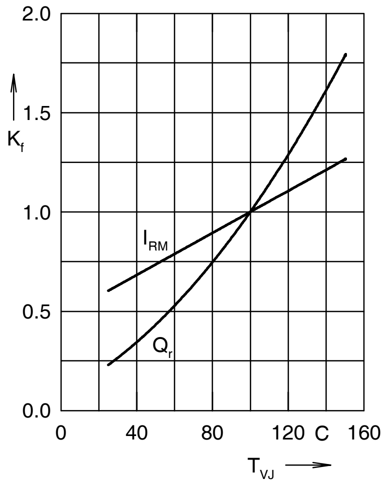


Fig. 21. Dynamic parameters Q_r, I_{RM} versus T_{VJ}

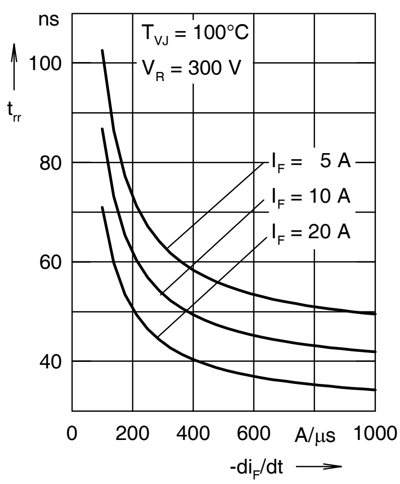


Fig. 22. Recovery time t_{rr} versus $-di_F/dt$

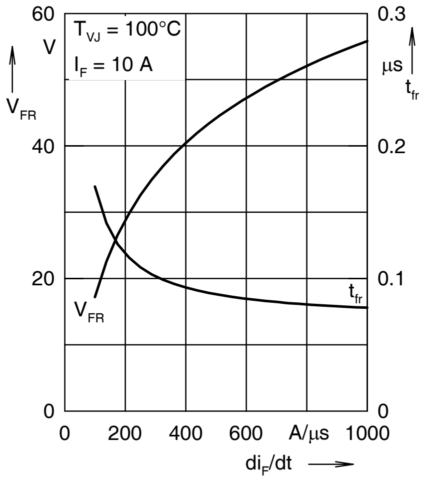


Fig. 23. Peak forward voltage V_{FR} and t_{fr} versus di_F/dt

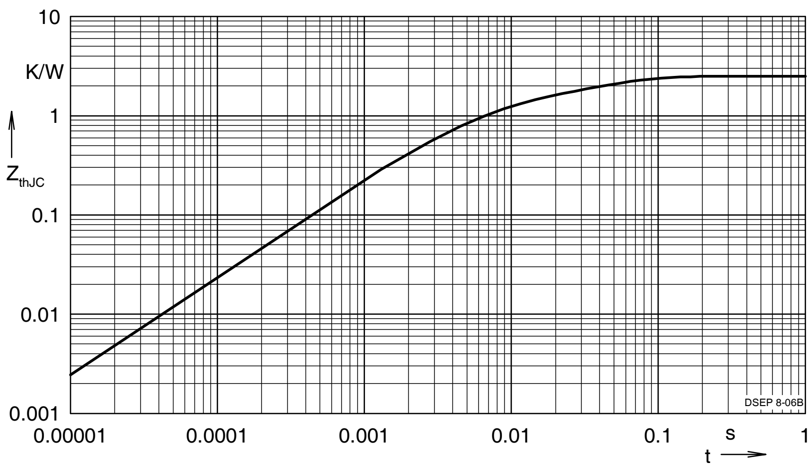


Fig. 24. Transient thermal resistance junction-to-case

Constants for Z_{thJC} calculation:

i	R_{thi} (K/W)	t_i (s)
1	1.449	0.0052
2	0.5578	0.0003
3	0.4931	0.0169

NOTE: Fig. 19 to Fig. 23 shows typical values