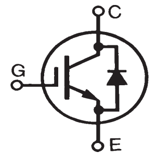
IXYS

High Speed IGBT

IXSA 20N60B2D1
IXSP 20N60B2D1

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

Short Circuit SOA Capability

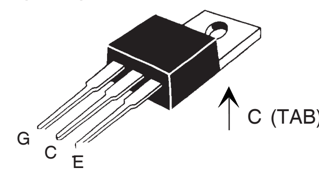


Preliminary Data Sheet

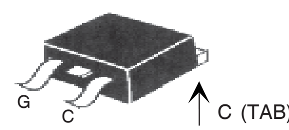
Symbol	Test Conditions	Maximum Ratings	
V_{CES}	T_J = 25°C to 150°C	600	V
V_{CGR}	T_J = 25°C to 150°C; R_{GE} = 1 MΩ	600	V
V_{GES}	Continuous	±20	V
V_{GEM}	Transient	±30	V
I_{C25}	T_C = 25°C	35	A
I_{C110}	T_C = 110°C	20	A
$I_{F(110)}$		11	A
I_{CM}	T_C = 25°C, 1 ms	60	A
SSOA (RBSOA)	V_{GE} = 15 V, T_J = 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}				85	µA
	V_{GE} = 0 V	T_J = 125 °C			0.6	mA
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-220 (IXSP)



TO-220 (IXSA)



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

DS99181B(12/05)

Characteristic Values (T_J = 25°C, unless otherwise specified)

Symbol	Test Conditions		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; Switching times may increase for V_{CE}			116		ns
t_{fi}	(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 V_{CE} (Clamp) > 0.8 • V_{CES}, higher T_J			180		ns
t_{fi}	or increased R_G			210		ns
E_{off}				970		µJ
R_{thJC}					0.66	K/W
R_{thCS}				0.3		K/W

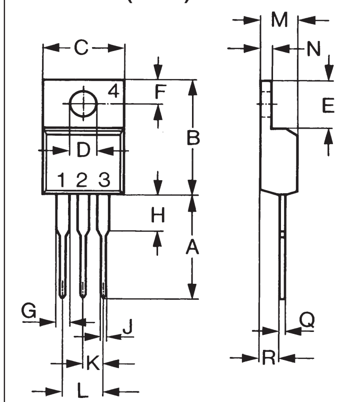
Reverse Diode (FRED)

Characteristic Values (T_J = 25°C, unless otherwise specified)

Symbol	Test Conditions		min.	typ.	max.	
V_F	I_F = 10A, V_{GE} = 0 V				1.66	V
		T_J =150°C			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

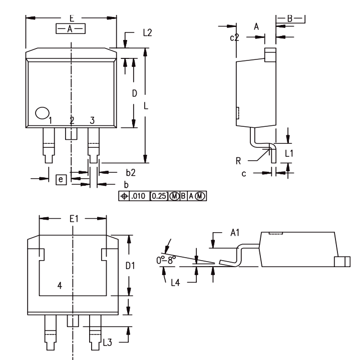
Note 1: Pulse test, t ≤ 300 µs, duty cycle d ≤ 2 %

TO-220 AB (IXSP) Outline



Dim.	Millimeter Min.	Millimeter Max.	Inches Min.	Inches 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.	Millimeter Max.	Inches Min.	Inches 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 MOSFETs and IGBTs are covered by one or more of the following U.S. patents: 4,835,592 4,931,844 5,049,961 5,237,481 6,162,665 6,404,065 B1 6,683,344 6,727,585 4,850,072 5,017,508 5,063,307 5,381,025 6,259,123 B1 6,534,343 6,710,405B2 6,759,692 4,881,106 5,034,796 5,187,117 5,486,715 6,306,728 B1 6,583,505 6,710,463 6771478 B2

Fig. 1. Output Characteristics @ 25 ºC

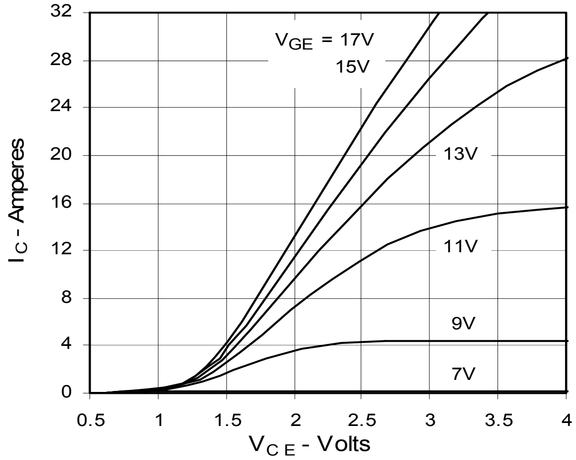


Fig. 2. Extended Output Characteristics @ 25 ºC

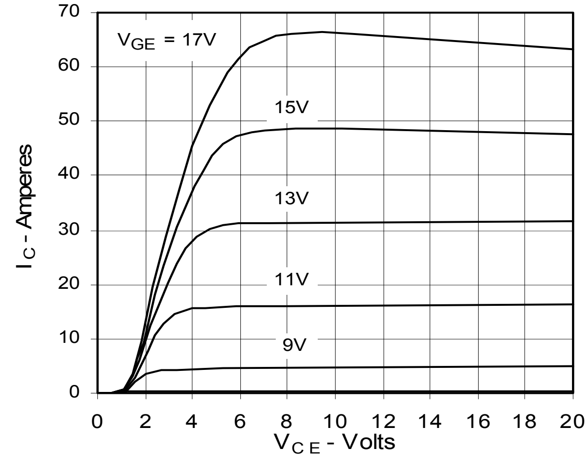


Fig. 3. Output Characteristics @ 125 ºC

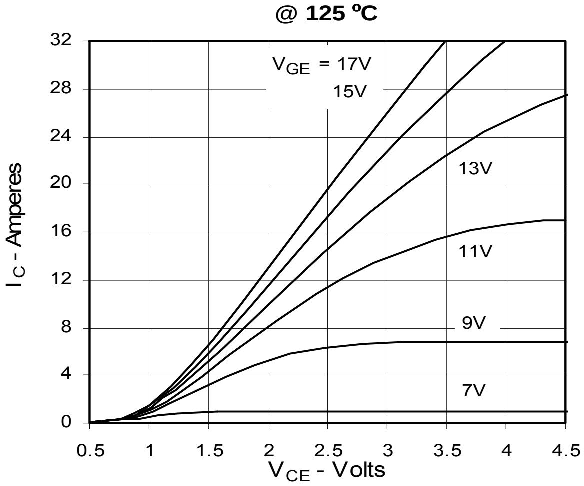


Fig. 4. Dependence of $V_{CE(sat)}$ on Temperature

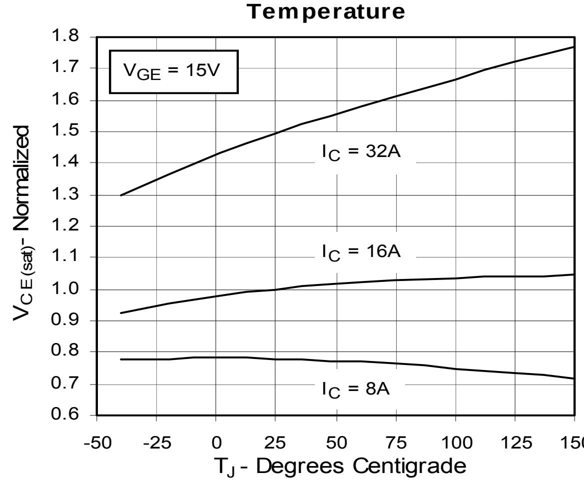


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter voltage

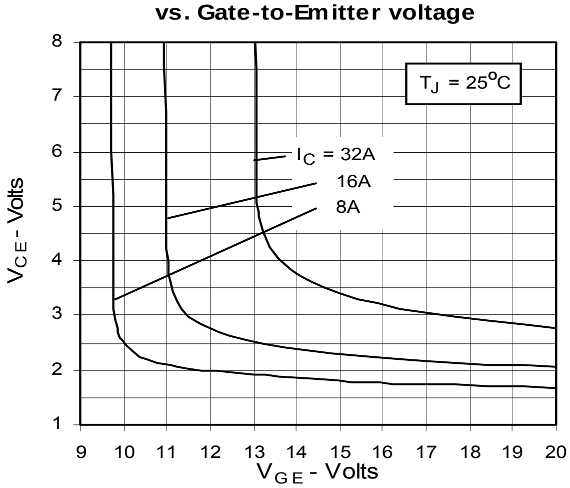


Fig. 6. Input Admittance

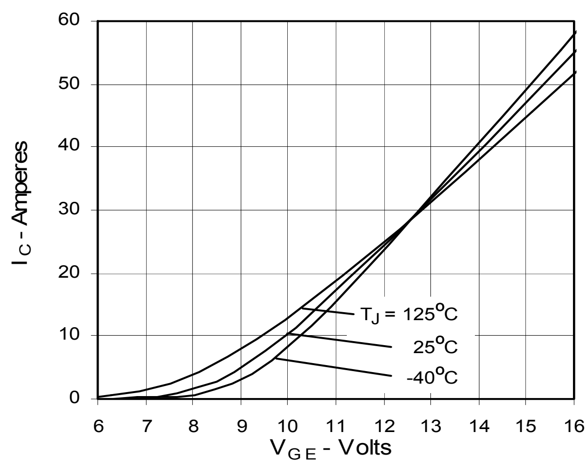


Fig. 7. Transconductance

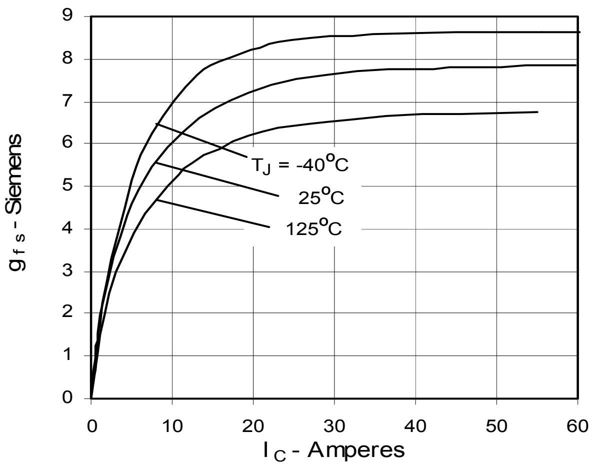


Fig. 8. Dependence of Turn-off Energy Loss on R_G

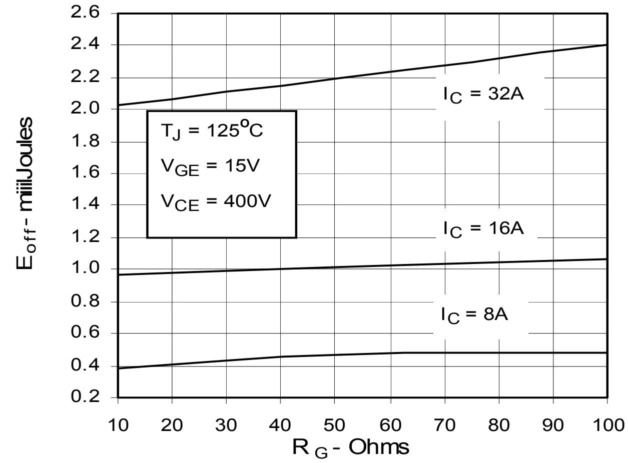


Fig. 9. Dependence of Turn-Off Energy Loss on I_C

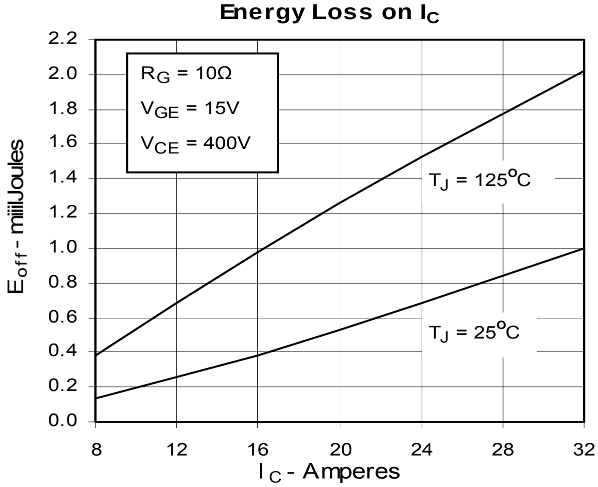


Fig. 10. Dependence of Turn-off Energy Loss on Temperature

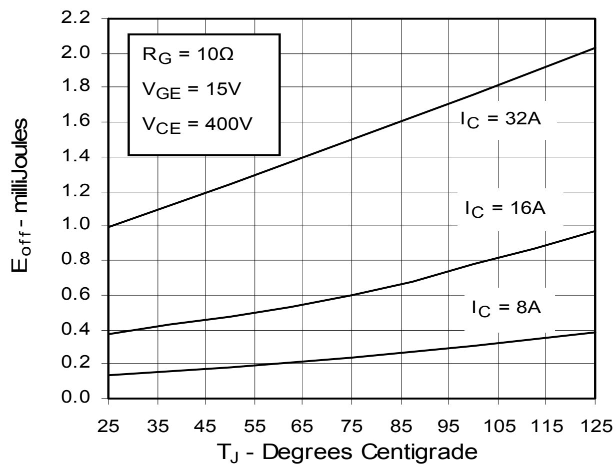


Fig. 11. Dependence of Turn-off Switching Time on R_G

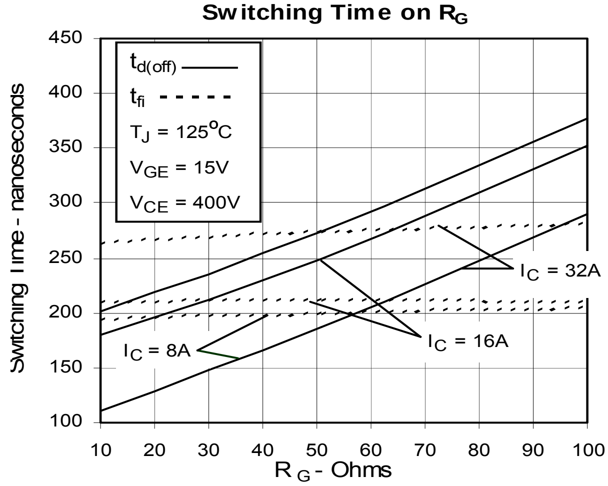


Fig. 12. Dependence of Turn-off Switching Time on I_C

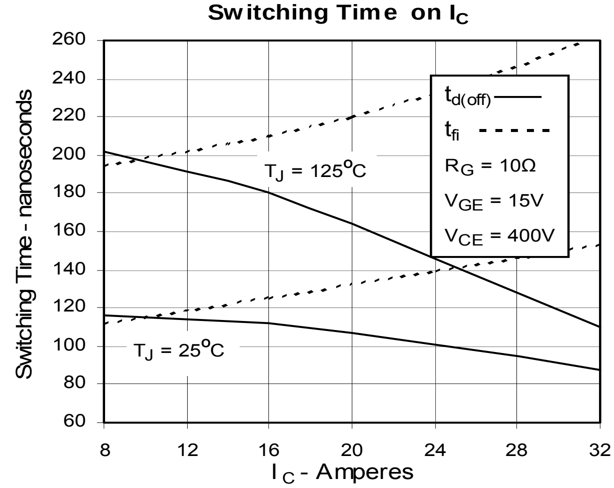


Fig. 13. Dependence of Turn-off Switching Time on Temperature

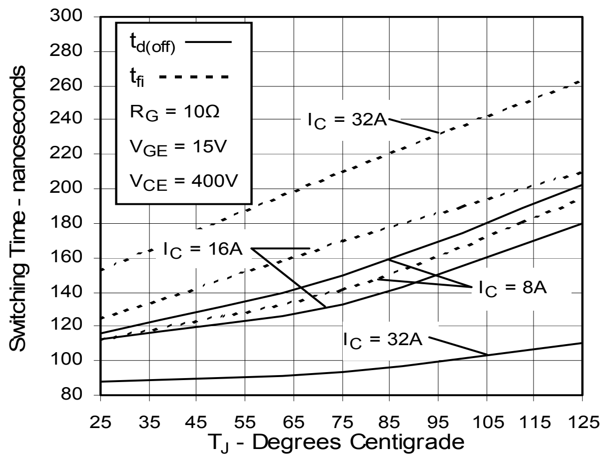


Fig. 14. Gate Charge

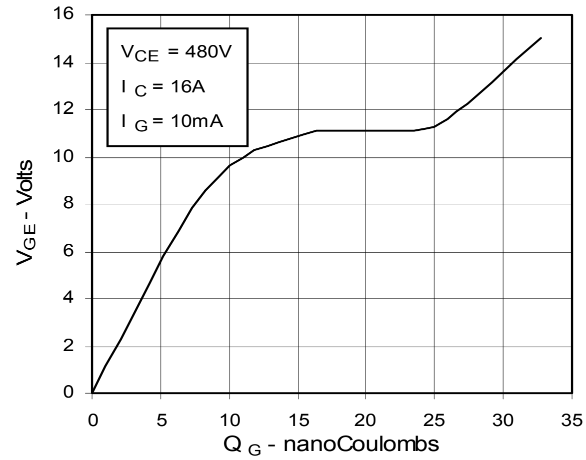


Fig. 15. Capacitance

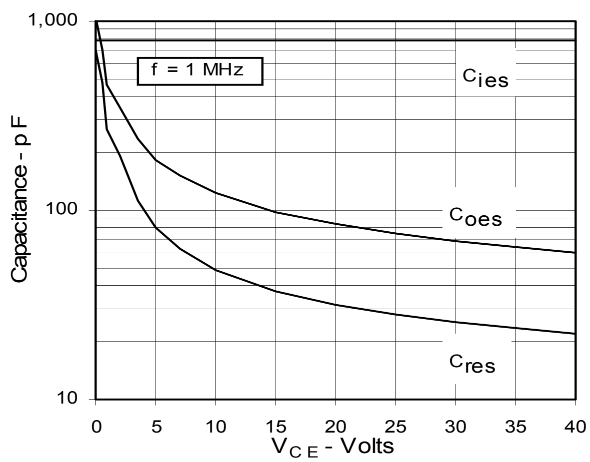


Fig. 16. Reverse-Bias Safe Operating Area

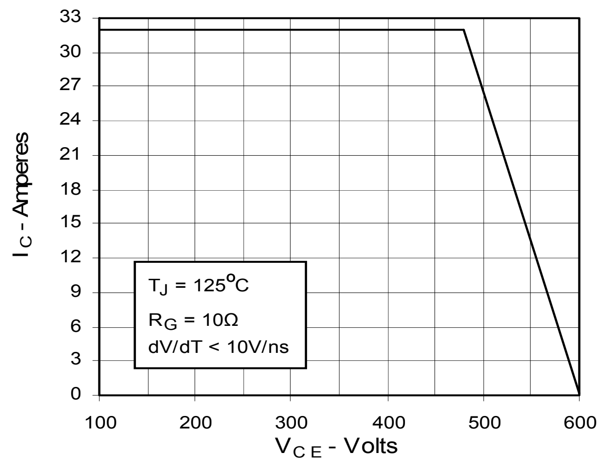
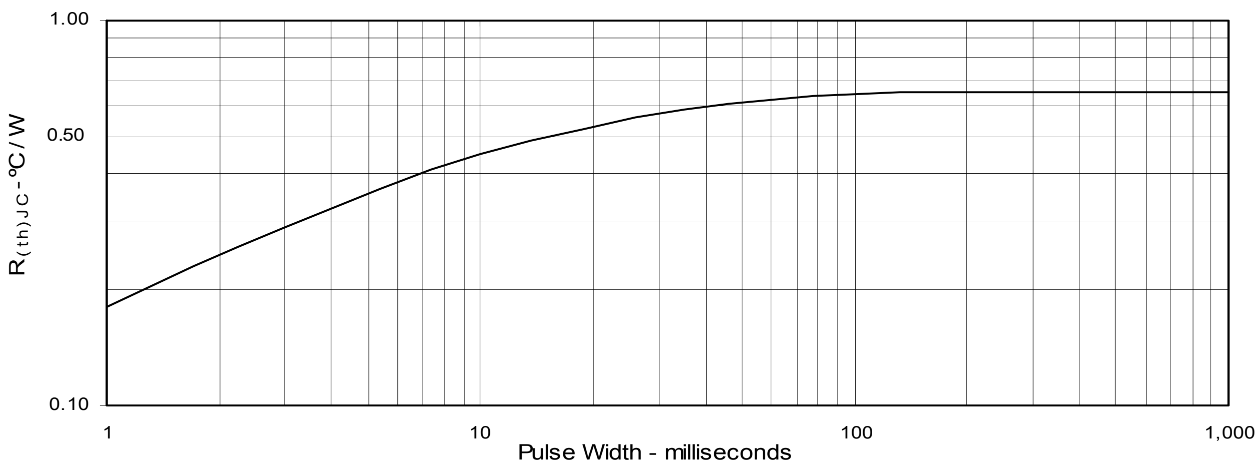


Fig. 17. Maximum Transient Thermal Resistance



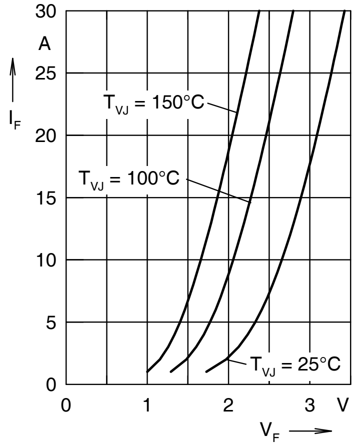


Fig. 18. Forward current I_F versus V_F

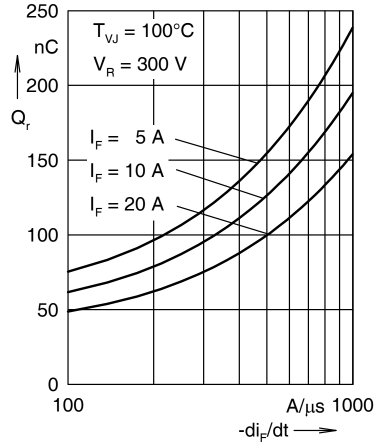


Fig. 19. Reverse recovery charge Q_r

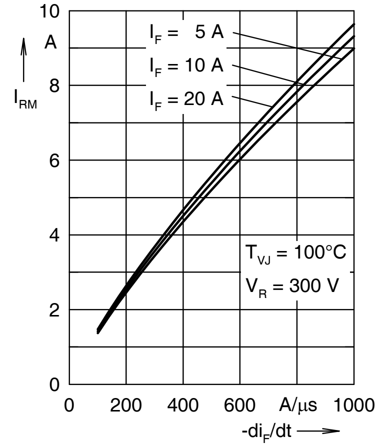


Fig. 20. Peak reverse current I_{RM}

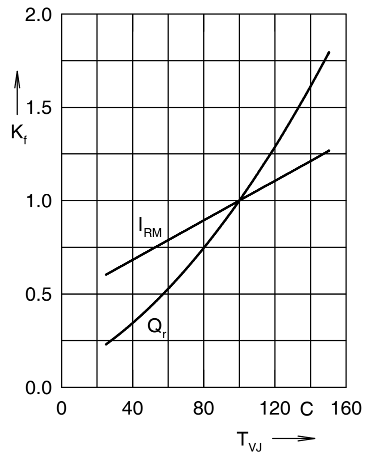


Fig. 21. Dynamic parameters Q_r, I_{RM}

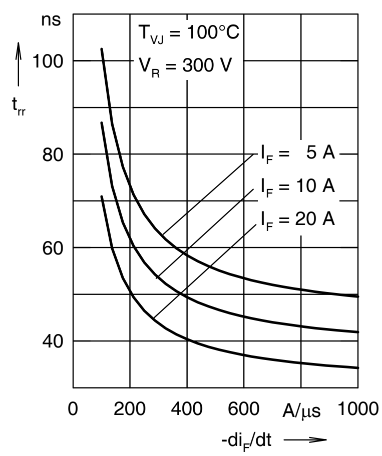


Fig. 22. Recovery time t_{rr} versus $-di_F/dt$

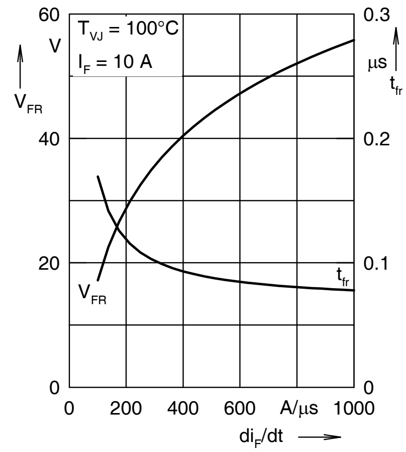


Fig. 23. Peak forward voltage V_{FR} and

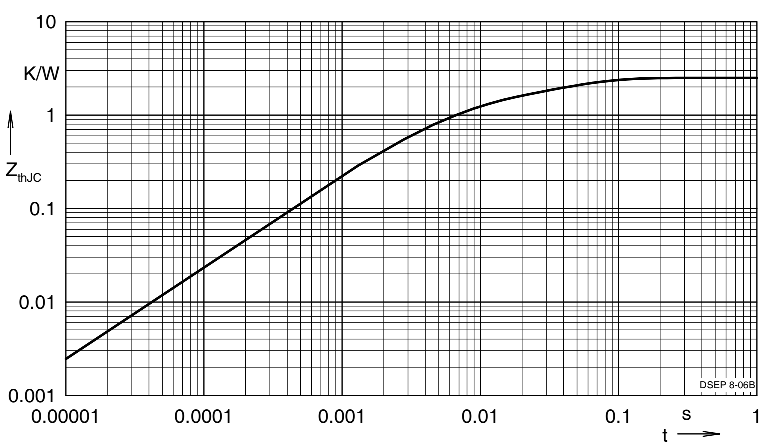


Fig. 24. Transient thermal resistance junction-to-case

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

IXYS MOSFETs and IGBTs are covered by	4,835,592	4,881,106	5,017,508	5,049,961	5,187,117	5,381,025	6,162,665	6,306,728 B1	6,534,343	6,683,344
one or more of the following U.S. patents:	4,850,072	4,931,844	5,034,796	5,063,307	5,237,481	5,486,715	6,259,123 B1	6,404,065 B1	6,583,505	6,710,405B2