IXYS

High Speed IGBT with Diode

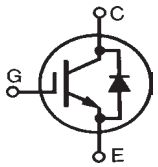
IXSH 30N60B2D1*
IXST 30N60B2D1

*Obsolete Part Number

V_{CES} = 600 V
I_{C25} = 48 A
$V_{CE(sat)}$ = 2.5 V

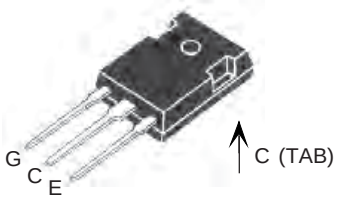
Short Circuit SOA Capability

Preliminary Data Sheet

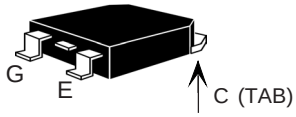


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	T_J = 25°C to 150°C	600	V
V_{CGR}	T_J = 25°C to 150°C; R_{GE} = 1 MΩ	600	V
V_{GES}	Continuous	±20	V
V_{GEM}	Transient	±30	V
I_{C25}	T_C = 25°C	48	A
I_{C110}	T_C = 110°C	30	A
$I_{F(110)}$		28	A
I_{CM}	T_C = 25°C, 1 ms	90	A
SSOA (RBSOA)	V_{GE} = 15 V, T_J = 125°C, R_G = 10Ω Clamped inductive load	I_{CM} = 48 @ 0.8 V_{CES}	A
t_{SC} **(SCSOA)**	V_{GE} = 15 V, V_{CE} = 360 V, T_J = 125°C R_G = 10 Ω, non repetitive	10	µs
P_C	T_C = 25°C	250	W
T_J		-55 ... +150	°C
T_{JM}		150	°C
T_{stg}		-55 ... +150	°C
Weight	TO-247 TO-268	6 5	g 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

TO-247 (IXSH)



TO-268 (IXST)



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

Symbol	Test Conditions (T_J = 25°C, unless otherwise specified)	Characteristic Values 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			150 1	µA mA
I_{GES}	V_{CE} = 0 V, V_{GE} = ± 20 V			±100	nA
$V_{CE(sat)}$	I_C = 24A, V_{GE} = 15 V			2.5	V

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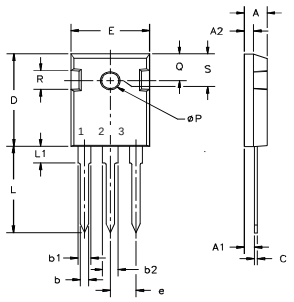
Symbol	Test Conditions		Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
g_{fs}	I_C = 24A; V_{CE} = 10 V, Note 1		7.0	12.0		S
C_{ies}				1220		pF
C_{oes}	V_{CE} = 25 V, V_{GE} = 0 V			110		pF
	f = 1 MHz	20N60B2D1		140		pF
C_{res}				42		pF
Q_g				50		nC
Q_{ge}	I_C = 24A, V_{GE} = 15 V, V_{CE} = 0.5 V_{CES}			23		nC
Q_{gc}				15		nC
$t_{d(on)}$	**Inductive load, T_J = 25°C**			30		ns
t_{ri}	I_C = 24A, V_{GE} = 15 V			30		ns
$t_{d(off)}$	V_{CE} = 400 V, R_G = 5 Ω			130	280	ns
t_{fi}	Switching times may increase for V_{CE} (Clamp) > 0.8 • V_{CES}, higher T_J or increased R_G			140	300	ns
E_{off}				0.55	1.0	mJ
$t_{d(on)}$				30		ns
t_{ri}	**Inductive load, T_J = 125°C**			50		ns
E_{on}	I_C = 24 A, V_{GE} = 15 V	20N60B2		0.32		mJ
	V_{CE} = 400 V, R_G = 5 Ω	20N60B2D1		0.82		mJ
$t_{d(off)}$	Switching times may increase for			202		ns
t_{fi}	V_{CE} (Clamp) > 0.8 • V_{CES}, higher T_J or increased R_G			234		ns
E_{off}				1.18		mJ
R_{thJC}					0.50	K/W
R_{thCS}				0.21		K/W

Reverse Diode (FRED)

Symbol	Test Conditions		Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 30A, V_{GE} = 0 V	T_J =150°C			1.6	V
					2.5	V
I_{RM}	I_F = 50A, V_{GE} = 0 V, -di_F/dt = 100 A/µs	T_J = 100°C		2.0	2.5	A
t_{rr}	V_R = 100 V	T_J = 100°C		150		ns
t_{rr}	I_F = 1 A; -di/dt = 100 A/µs; V_R = 30 V			30		ns
R_{thJC}					0.9	K/W

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

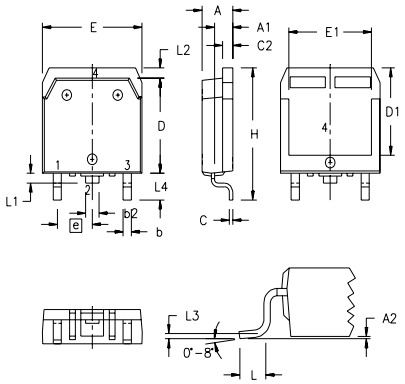
TO-247 (IXSH) Outline



Terminals: 1 - Gate 2 - Drain

Dim.	Millimeter Min.	Max.	Inches Min.	Max.
A	4.7	5.3	.185	.209
A_1	2.2	2.54	.087	.102
A_2	2.2	2.6	.059	.098
b	1.0	1.4	.040	.055
b_1	1.65	2.13	.065	.084
b_2	2.87	3.12	.113	.123
C	.4	.8	.016	.031
D	20.80	21.46	.819	.845
E	15.75	16.26	.610	.640
e	5.20	5.72	0.205	0.225
L	19.81	20.32	.780	.800
L1		4.50		.177
ØP	3.55	3.65	.140	.144
Q	5.89	6.40	0.232	0.252

TO-268 (IXST) Outline



SYM	INCHES MIN	MAX	MILLIMETERS MIN	MAX
A	.193	.201	4.90	5.10
A1	.106	.114	2.70	2.90
A2	.001	.010	0.02	0.25
b	.045	.057	1.15	1.45
b2	.075	.083	1.90	2.10
C	.016	.026	0.40	0.65
C2	.057	.063	1.45	1.60
D	.543	.551	13.80	14.00
D1	.488	.500	12.40	12.70
E	.624	.632	15.85	16.05
E1	.524	.535	13.30	13.60
e	.215 BSC		5.45 BSC	
H	.736	.752	18.70	19.10
L	.094	.106	2.40	2.70
L1	.047	.055	1.20	1.40
L2	.039	.045	1.00	1.15
L3	.010 BSC		0.25 BSC	
L4	.150	.161	3.80	4.10

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

Fig. 1. Output Characteristics @ 25 ºC

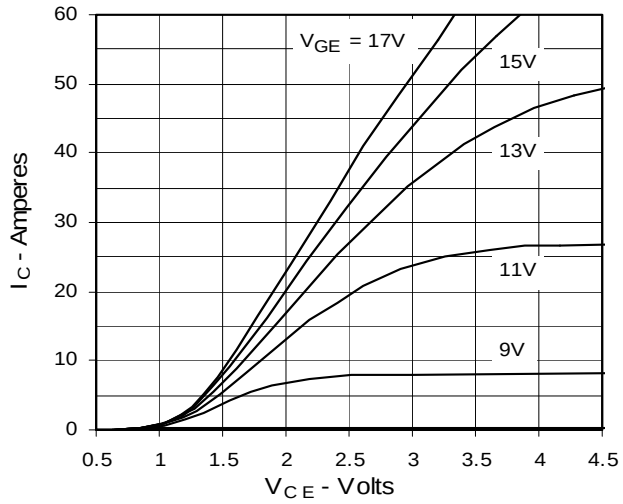


Fig. 2. Extended Output Characteristics @ 25 ºC

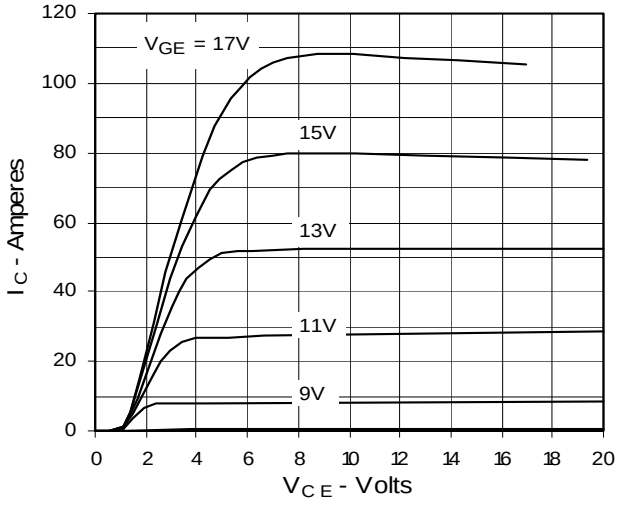


Fig. 3. Output Characteristics @ 125 ºC

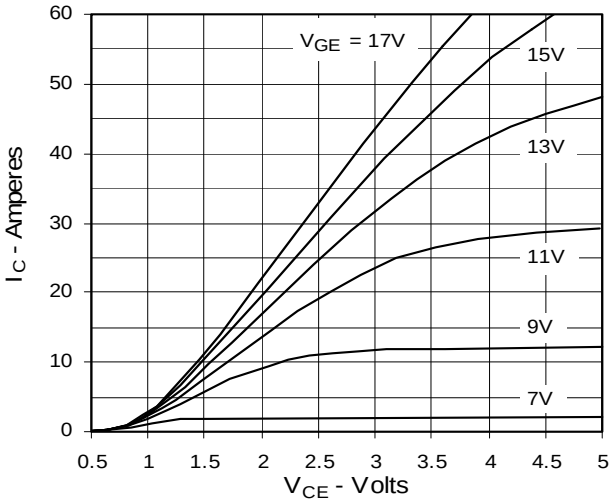


Fig. 4. Dependence of $V_{CE(sat)}$ on Temperature

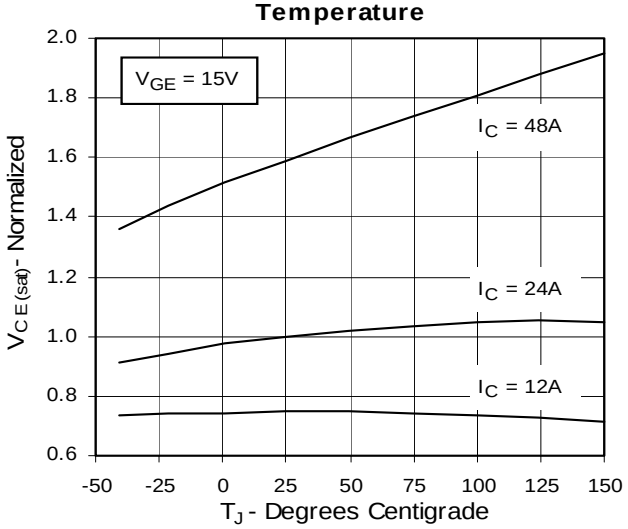


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter voltage

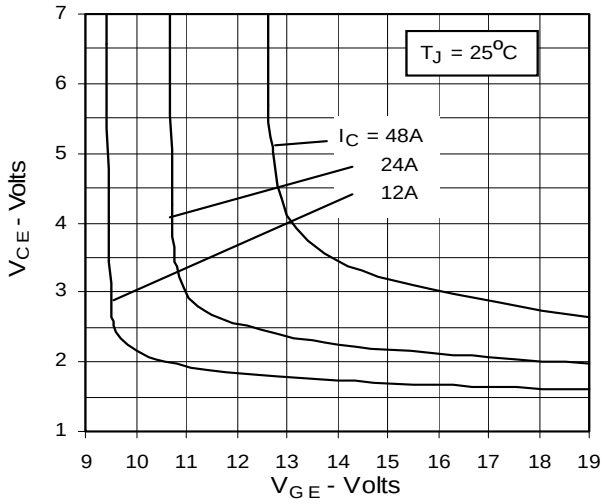


Fig. 6. Input Admittance

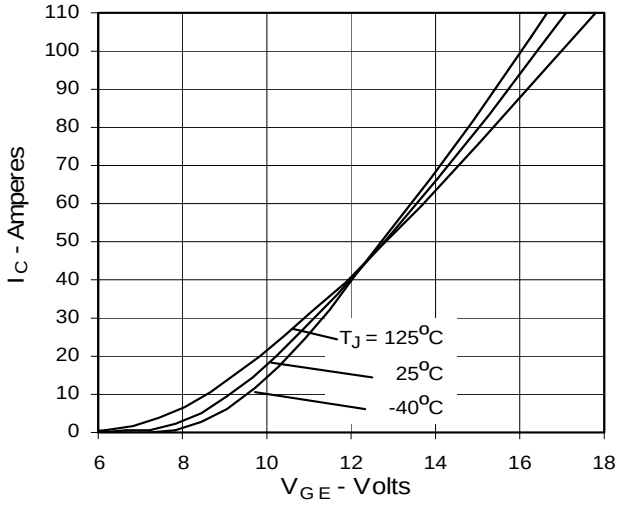


Fig. 7. Transconductance

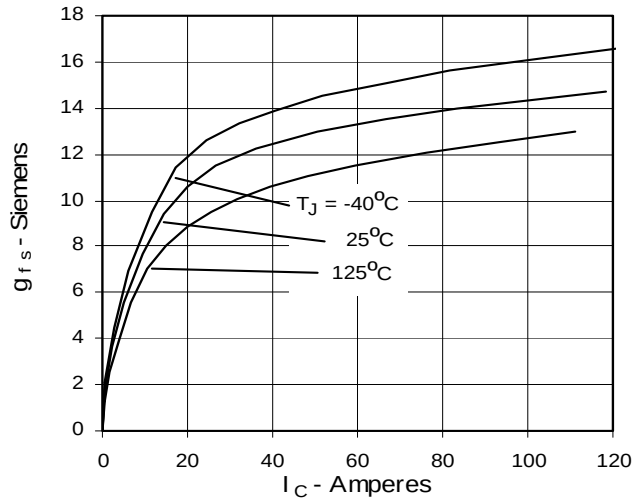


Fig. 8. Dependence of Turn-off Energy Loss on R_G

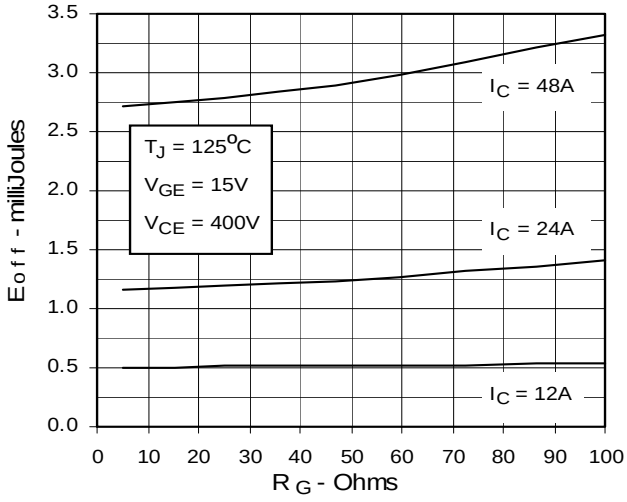


Fig. 9. Dependence of Turn-Off Energy Loss on I_C

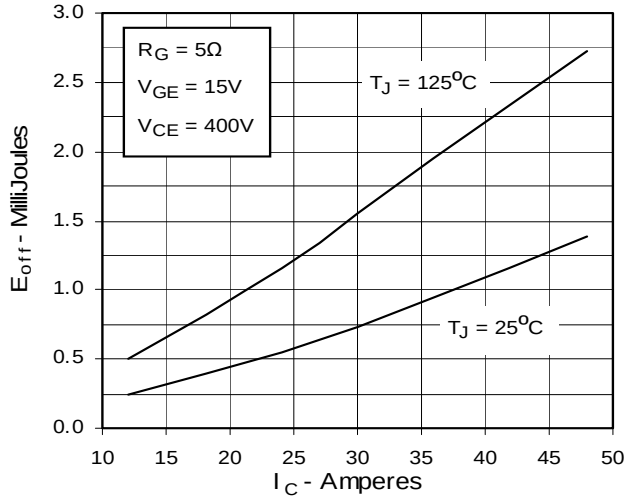


Fig. 10. Dependence of Turn-off Energy Loss on Temperature

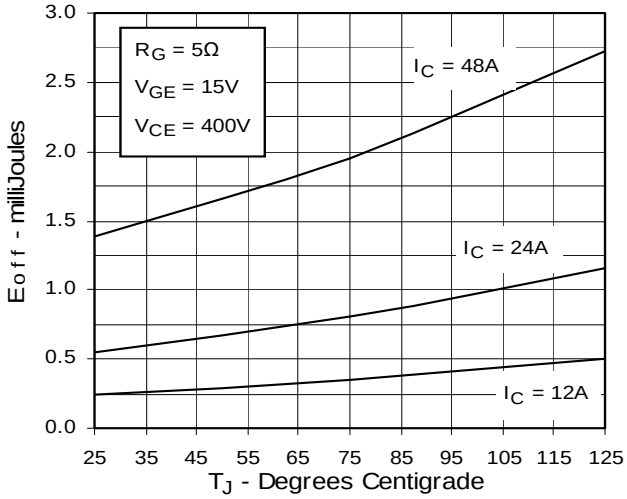


Fig. 11. Dependence of Turn-off Switching Time on R_G

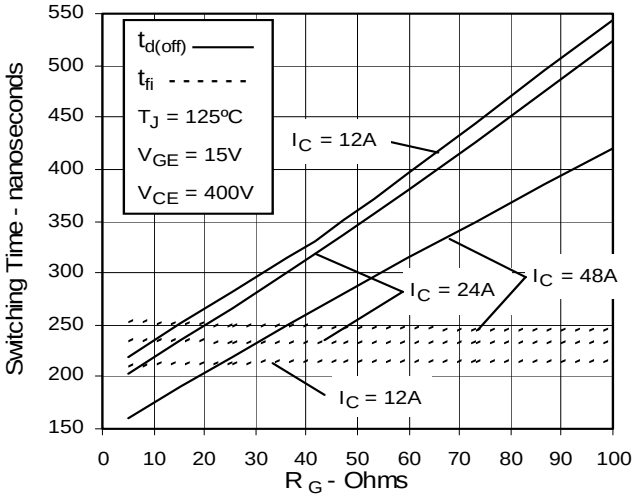


Fig. 12. Dependence of Turn-off Switching Time on I_C

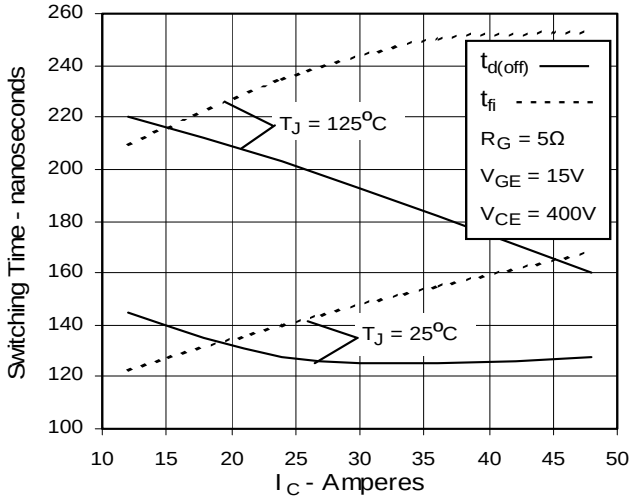


Fig. 13. Dependence of Turn-off Switching Time on Temperature

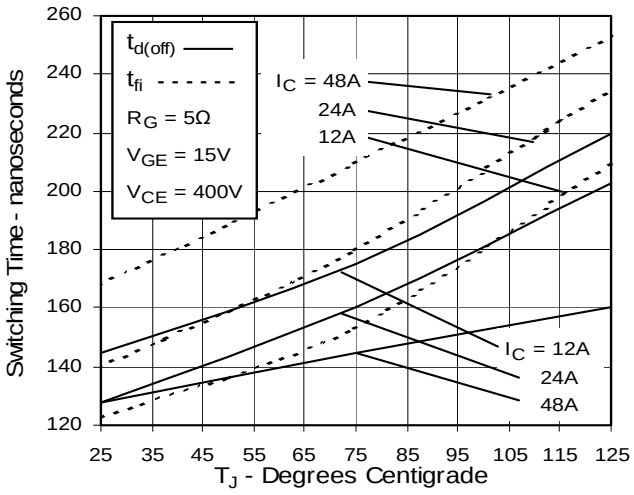


Fig. 14. Gate Charge

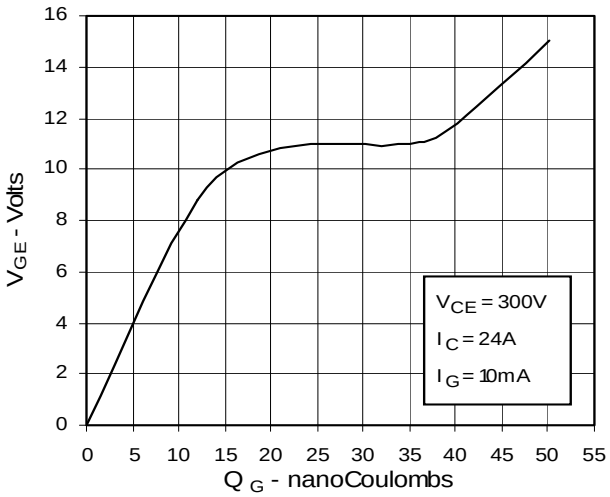


Fig. 15. Capacitance

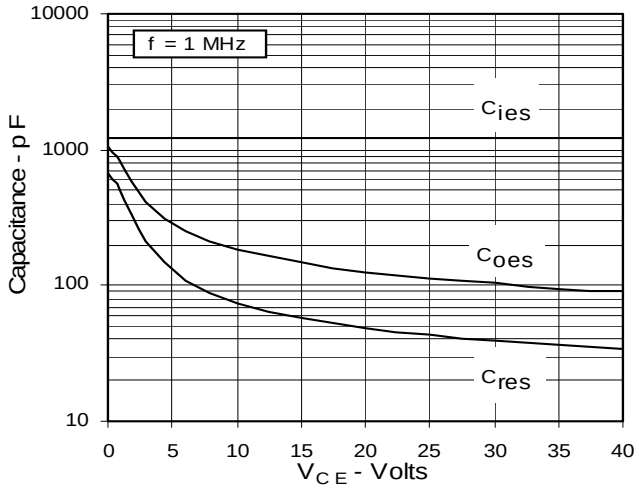


Fig. 16. Reverse-Bias Safe Operating Area

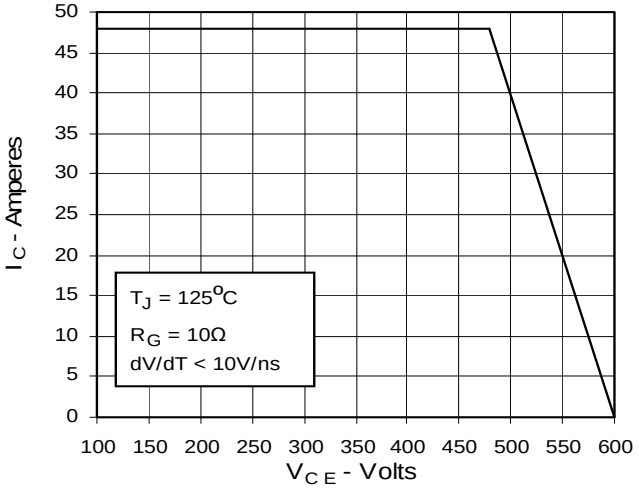
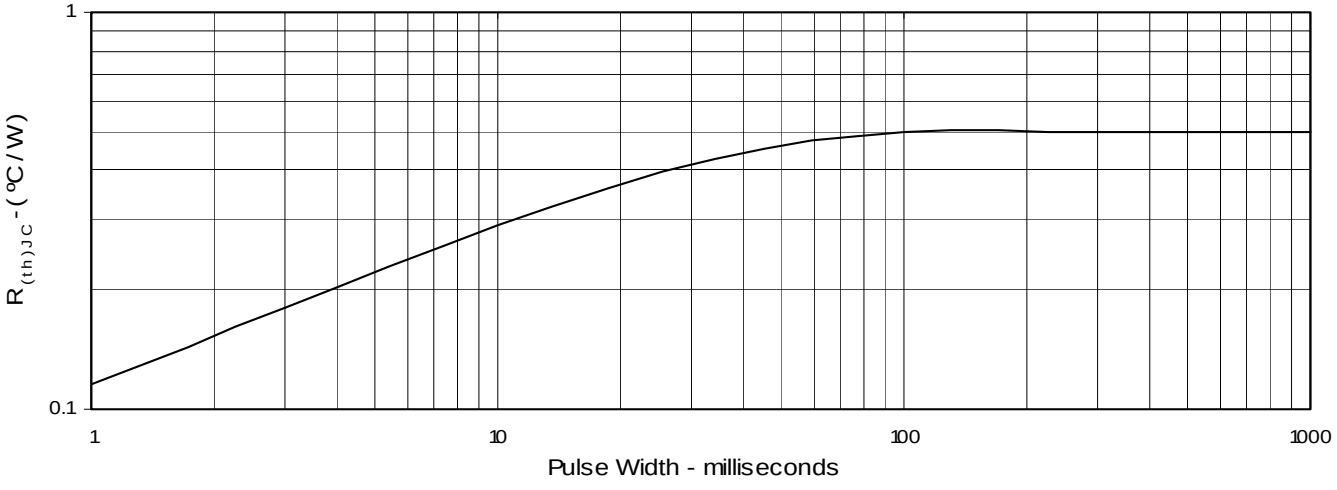


Fig. 17. Maximum Transient Thermal Resistance



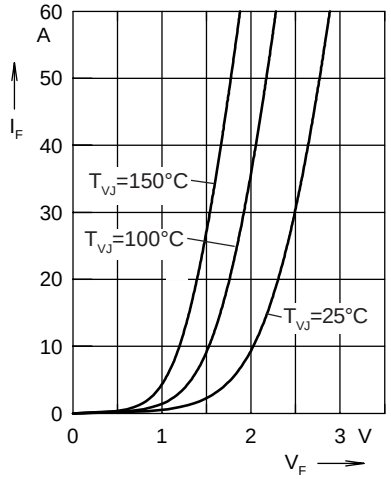


Fig. 18. Forward current I_F versus V_F

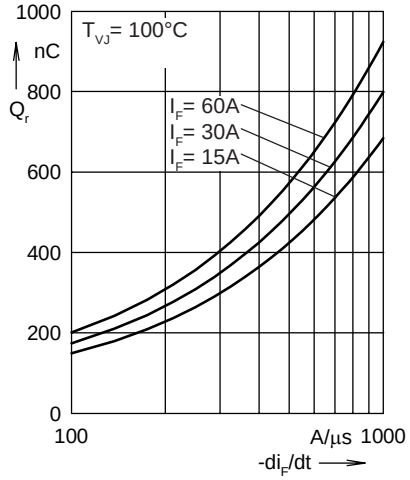


Fig. 19. Reverse recovery charge

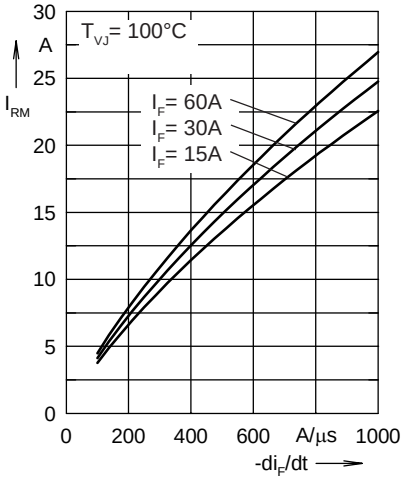


Fig. 20. Peak reverse current I_{RM}

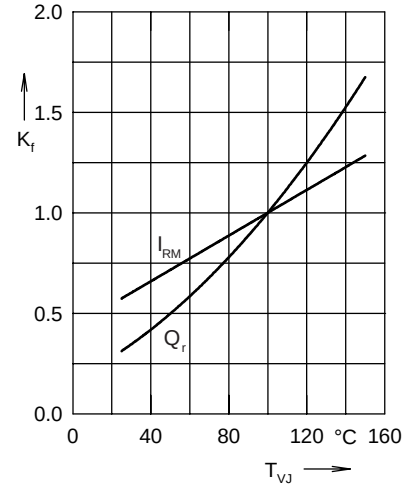


Fig. 21. Dynamic parameters Q_r, I_{RM}

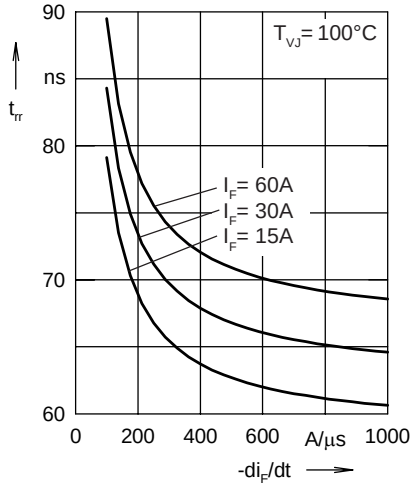


Fig. 22. Recovery time t_{rr} versus

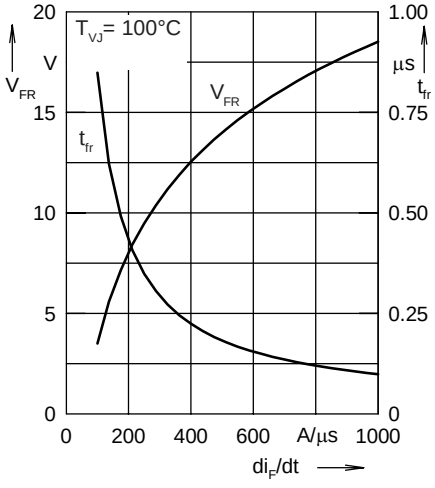


Fig. 23. Peak forward voltage V_{FR}

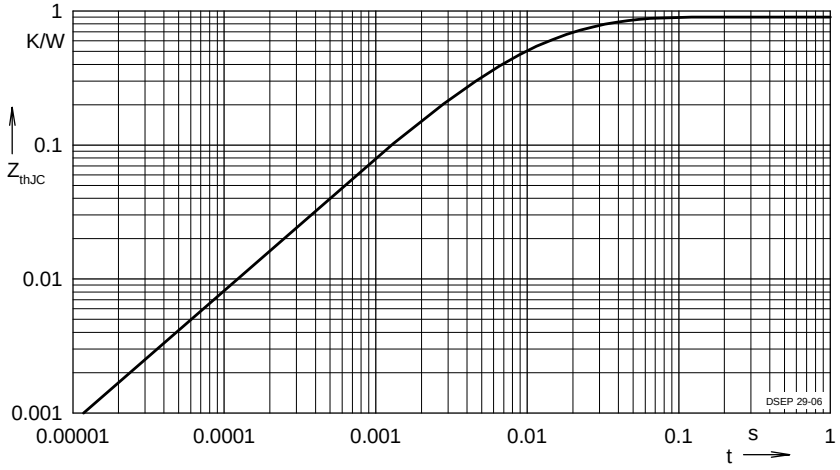


Fig. 24. Transient thermal resistance junction to case

Constants for Z_{thJC} calculation:

i	R_{thi} (K/W)	t_i (s)
1	0.502	0.0052
2	0.193	0.0003



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