IXYS

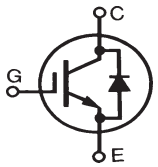
High Speed IGBT with Diode

IXSH 30N60B2D1
IXST 30N60B2D1

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

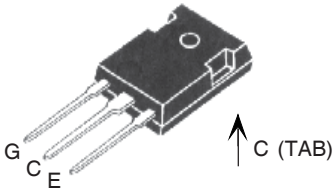
Short Circuit SOA Capability

Preliminary Data Sheet

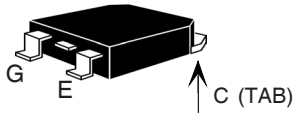


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	T_J = 25°C to 150°C	600	V
V_{CGR}	T_J = 25°C to 150°C; R_{GE} = 1 MΩ	600	V
V_{GES}	Continuous	±20	V
V_{GEM}	Transient	±30	V
I_{C25}	T_C = 25°C	48	A
I_{C110}	T_C = 110°C	30	A
$I_{F(110)}$		28	A
I_{CM}	T_C = 25°C, 1 ms	90	A
SSOA (RBSOA)	V_{GE} = 15 V, T_J = 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

DS99249(10/04)

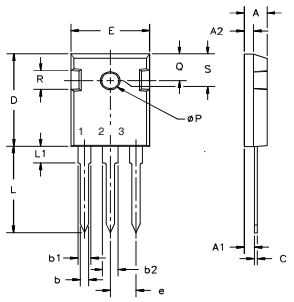
Symbol	Test Conditions		Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
g_{fs}	I_C = 24A; V_{CE} = 10 V, Note 1		7.0	12.0		S
C_{ies}				1220		pF
C_{oes}	V_{CE} = 25 V, V_{GE} = 0 V			110		pF
	f = 1 MHz	20N60B2D1		140		pF
C_{res}				42		pF
Q_g				50		nC
Q_{ge}	I_C = 24A, 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			140	300	ns
E_{off}	increased R_G			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 %

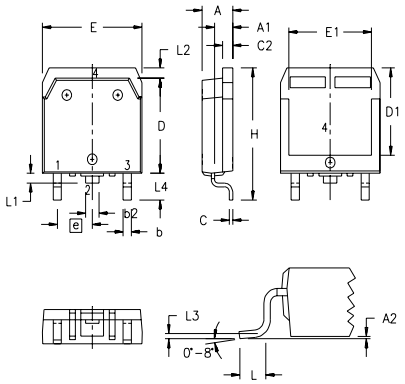
TO-247 (IXSH) Outline



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

Fig. 1. Output Characteristics @ 25 ºC

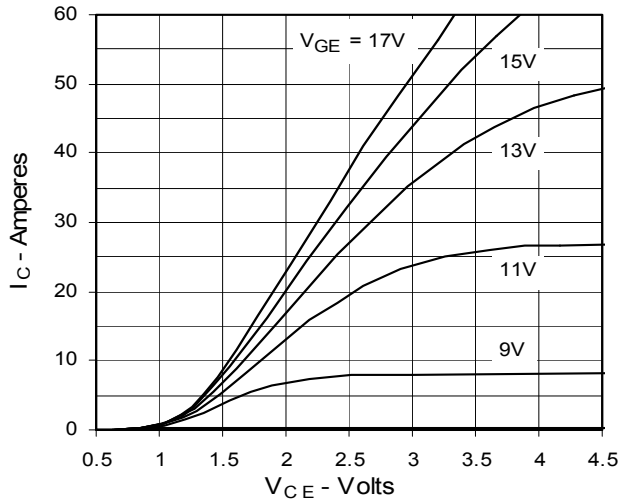


Fig. 2. Extended Output Characteristics @ 25 ºC

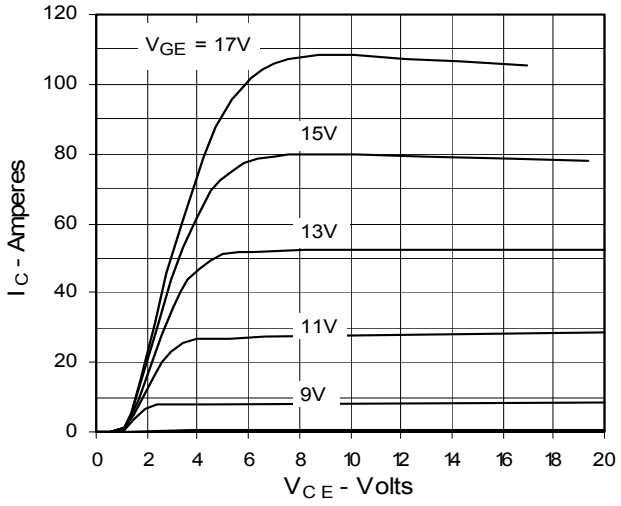


Fig. 3. Output Characteristics @ 125 ºC

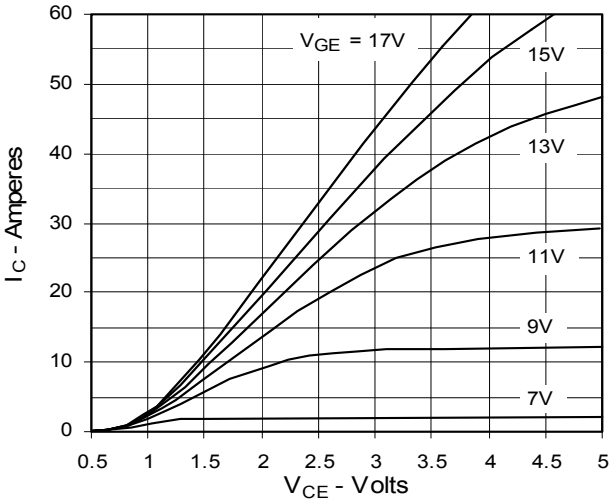


Fig. 4. Dependence of $V_{CE(sat)}$ on Temperature

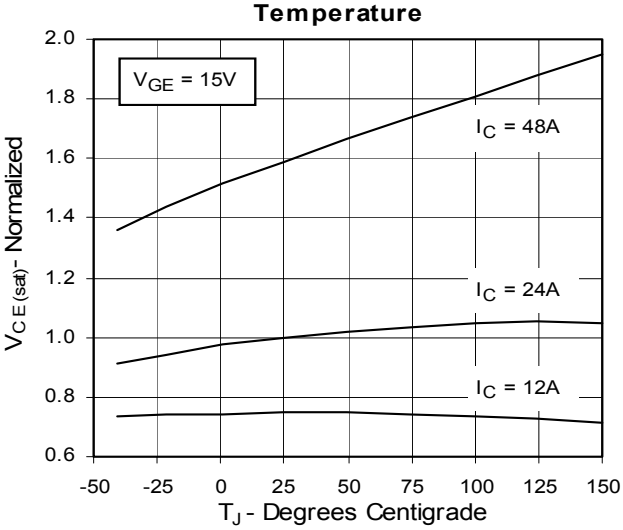


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter voltage

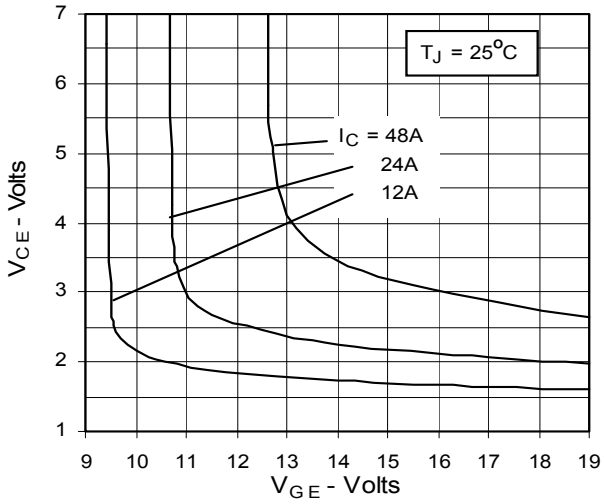


Fig. 6. Input Admittance

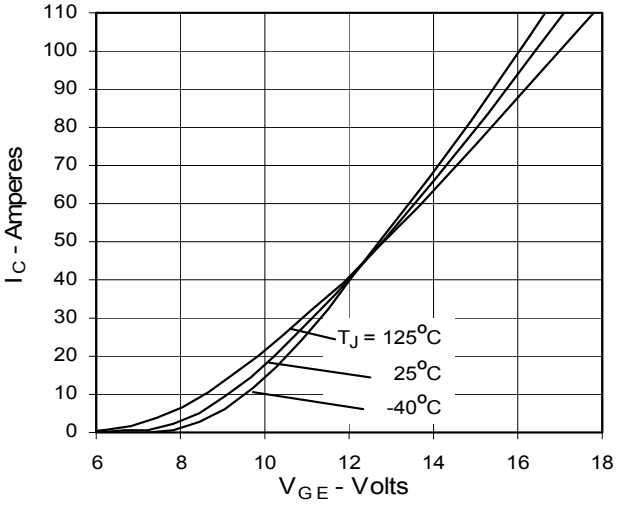


Fig. 7. Transconductance

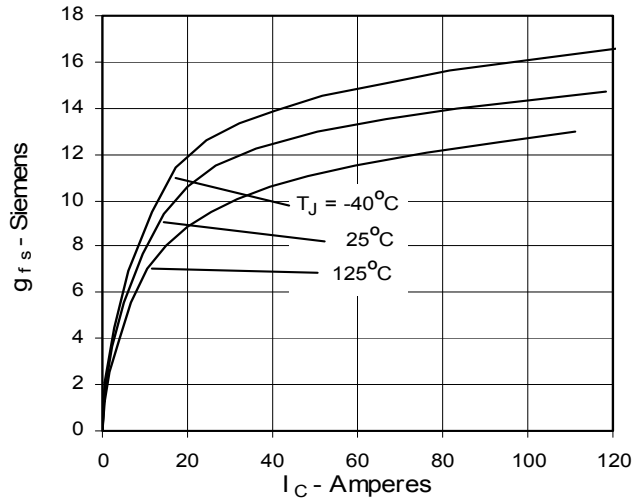


Fig. 8. Dependence of Turn-off Energy Loss on R_G

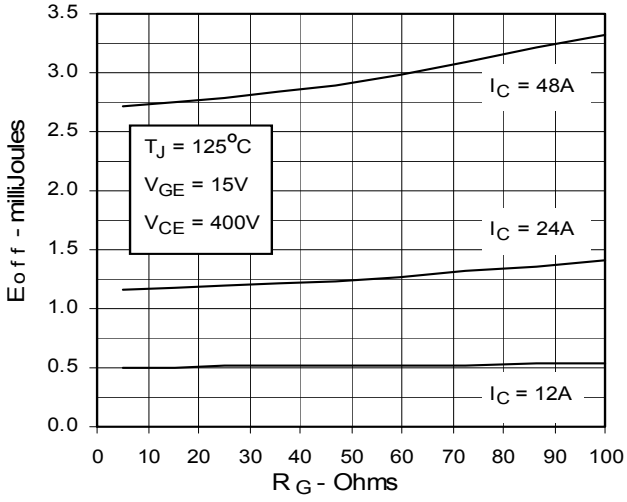


Fig. 9. Dependence of Turn-Off Energy Loss on I_C

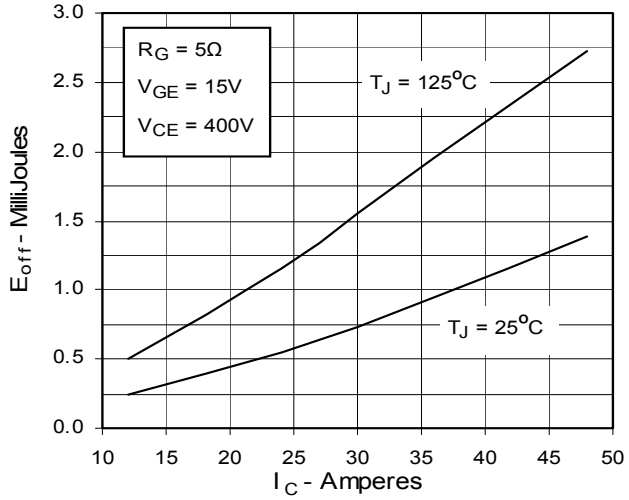


Fig. 10. Dependence of Turn-off Energy Loss on Temperature

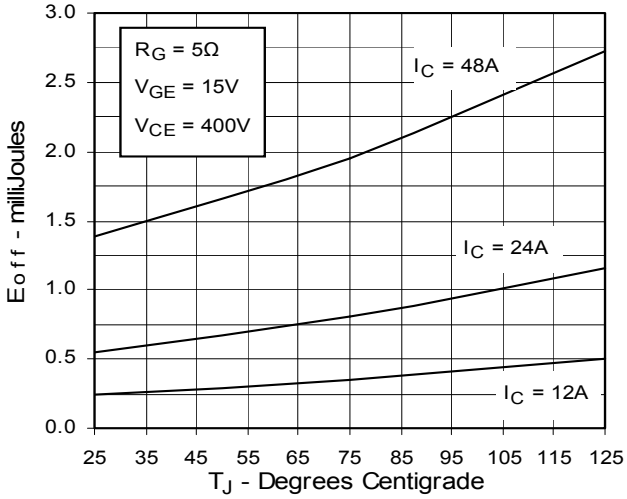


Fig. 11. Dependence of Turn-off Switching Time on R_G

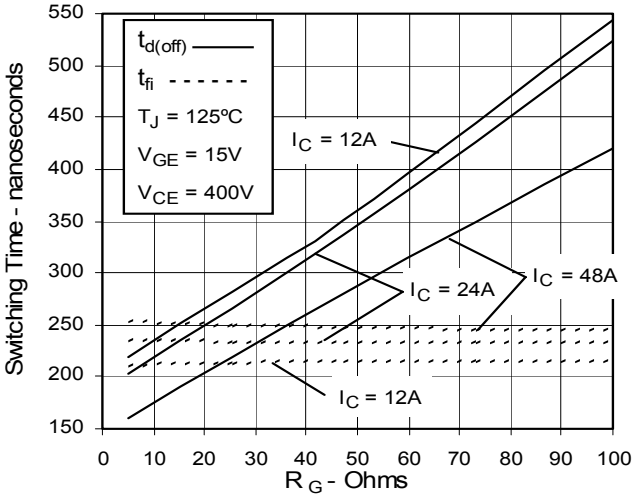


Fig. 12. Dependence of Turn-off Switching Time on I_C

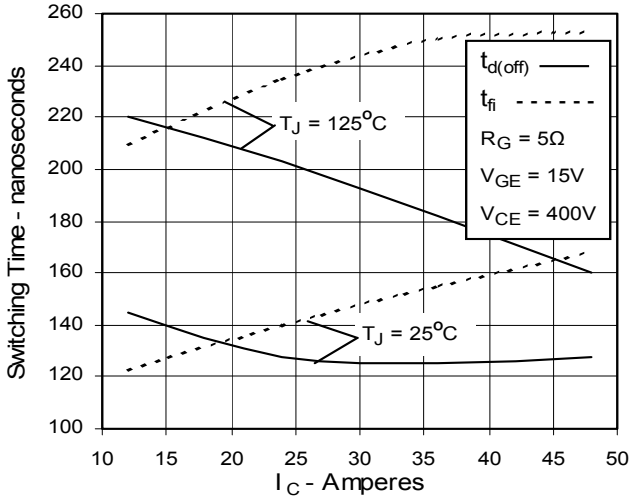


Fig. 13. Dependence of Turn-off Switching Time on Temperature

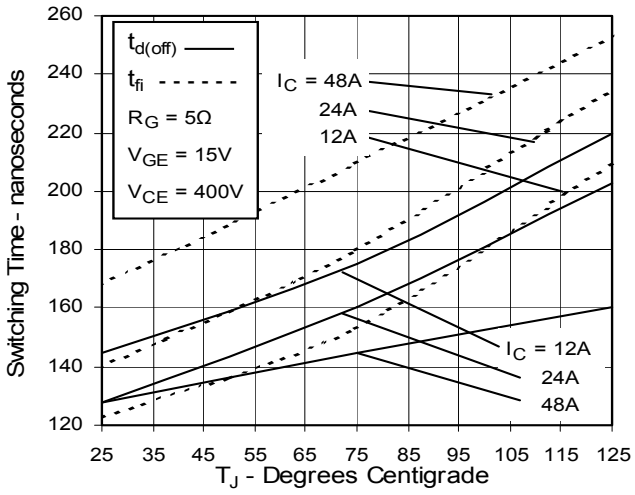


Fig. 14. Gate Charge

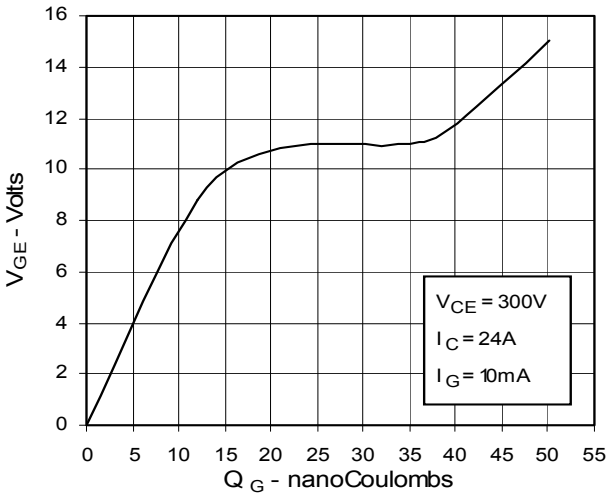


Fig. 15. Capacitance

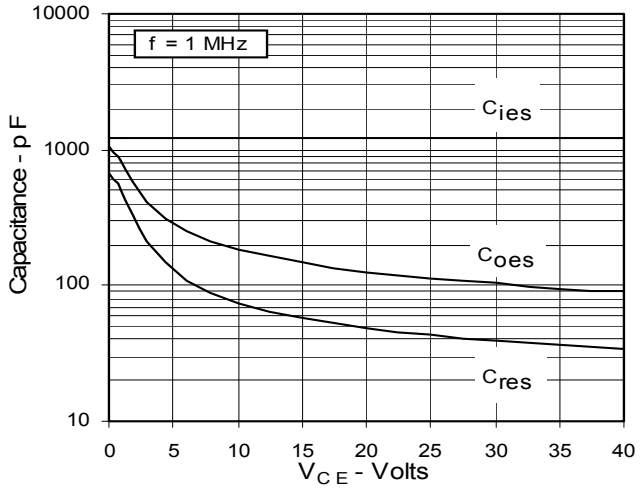


Fig. 16. Reverse-Bias Safe Operating Area

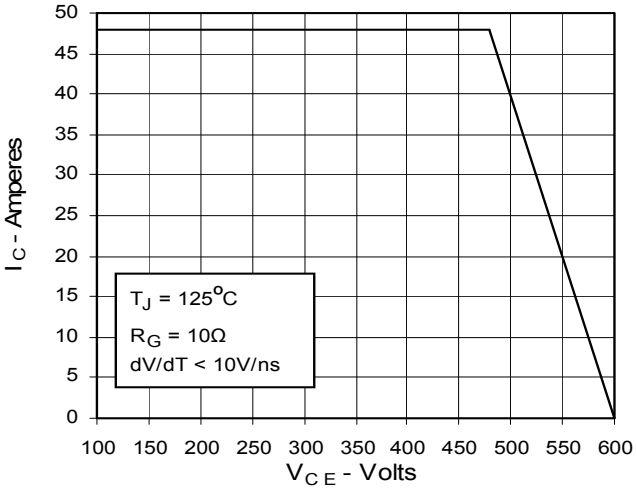
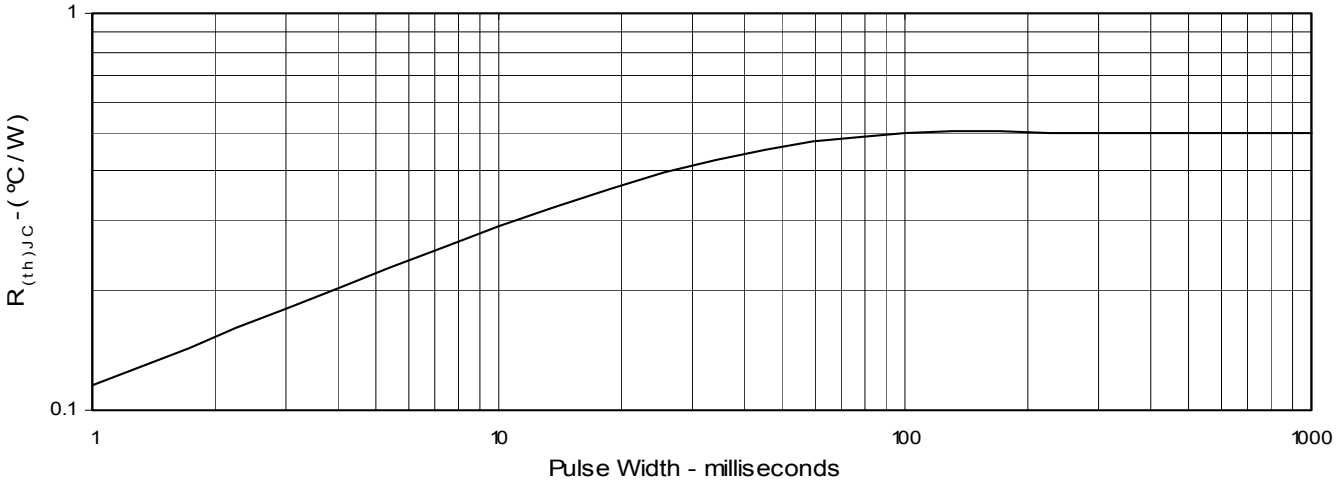


Fig. 17. Maximum Transient Thermal Resistance



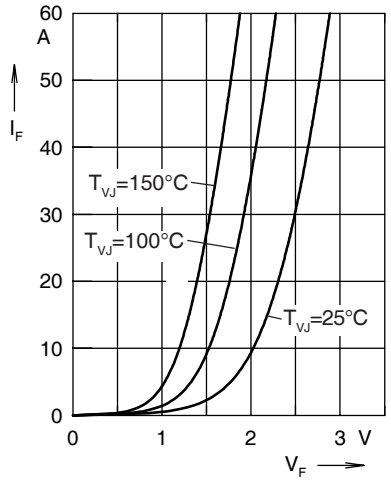


Fig. 18. Forward current I_F versus V_F

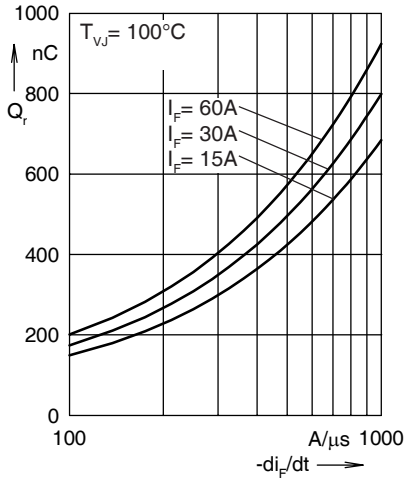


Fig. 19. Reverse recovery charge

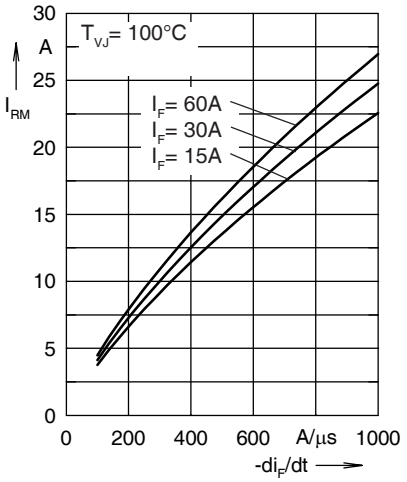


Fig. 20. Peak reverse current I_{RM}

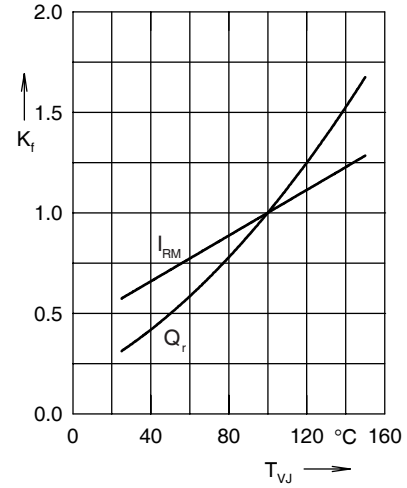


Fig. 21. Dynamic parameters Q_r, I_{RM}

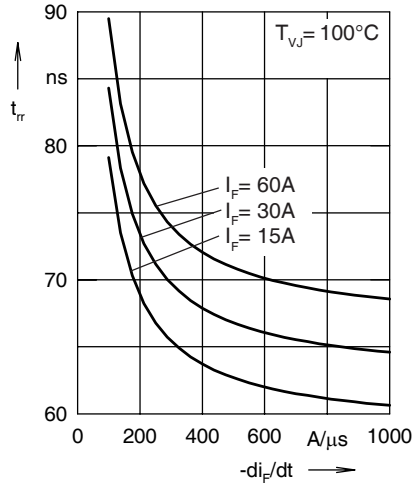


Fig. 22. Recovery time t_{rr} versus

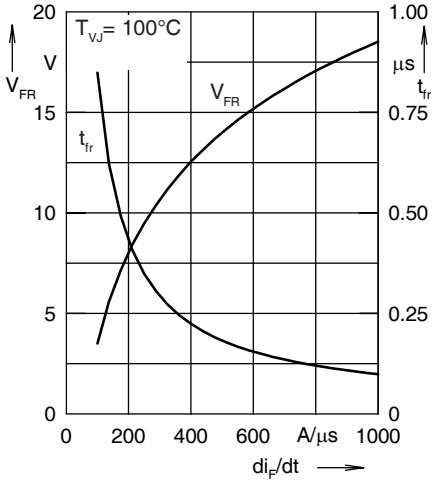


Fig. 23. Peak forward voltage V_{FR}

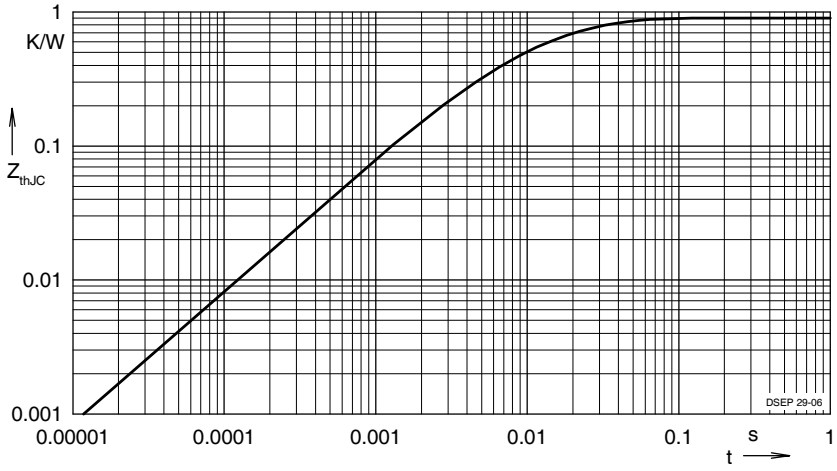


Fig. 24. Transient thermal resistance junction to case

Constants for Z_{thJC} calculation:

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