IXYS

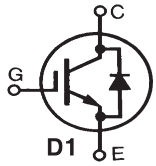
High Speed IGBT

IXSH 20N60B2D1

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

Short Circuit SOA Capability

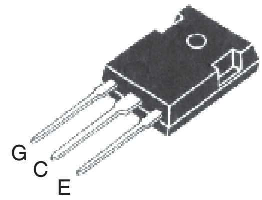
Preliminary Data Sheet



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
$I_{F(110)}$		21	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 T_J = 125°C			85 0.6	µA 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-247 (IXSH)



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

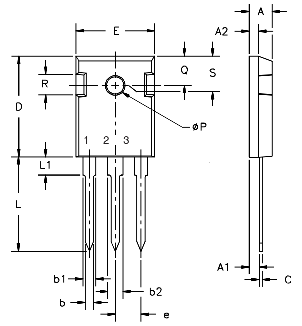
Advantages

- High power density

DS99174(10/04)

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		110		pF
C_{res}	f = 1 MHz		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
$t_{d(on)}$	**Inductive load, T_J = 125°C**		30		ns
t_{ri}	I_C = 16 A, V_{GE} = 15 V		30		ns
E_{on}	V_{CE} = 0.8 V_{CES}, R_G = 10 Ω		0.52		mJ
$t_{d(off)}$	Switching times may increase for		180		ns
t_{fi}	V_{CE} (Clamp) > 0.8 • V_{CES}, higher T_J		210		ns
E_{off}	or increased R_G		970		µJ
R_{thJC}				0.66	K/W
R_{thCS}			0.25		K/W

TO-247 Outline



Terminals: 1 - Gate 2 - Drain
3 - Source Tab - 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
∅P	3.55	3.65	.140	.144
Q	5.89	6.40	0.232	0.252
R	4.32	5.49	.170	.216
S	6.15	BSC	242	BSC

Reverse Diode (FRED)

Symbol	Test Conditions		Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	I_F = 15A, V_{GE} = 0 V	T_J =150°C			1.35 2.10	V V
I_{RM}	I_F = 25A, V_{GE} = 0 V, -di_F/dt = 100 A/µs	T_J = 100°C	4.5			A
t_{rr}	V_R = 100 V	T_J = 100°C	110			ns
t_{rr}	I_F = 1 A; -di/dt = 100 A/µs; V_R = 30 V			30		ns
R_{thJC}					1.6	K/W

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

Fig. 1. Output Characteristics @ 25 ºC

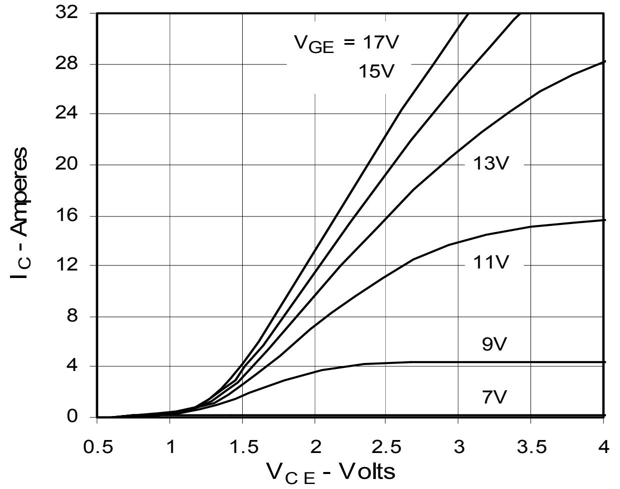


Fig. 2. Extended Output Characteristics @ 25 ºC

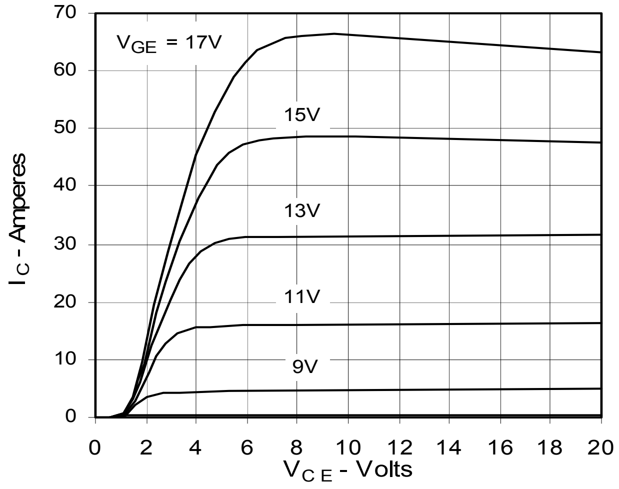


Fig. 3. Output Characteristics @ 125 ºC

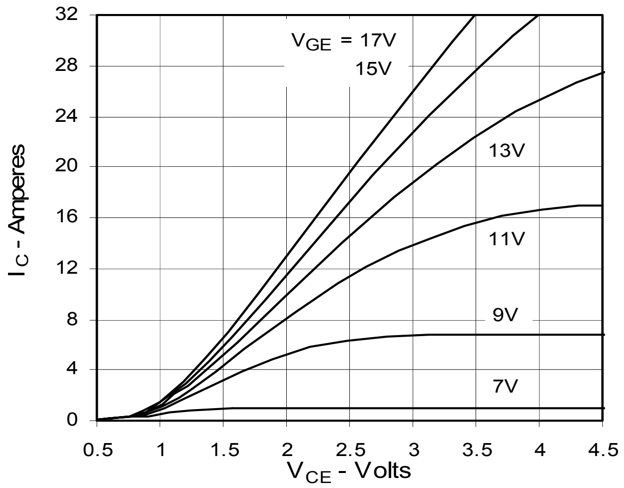


Fig. 4. Dependence of $V_{CE(sat)}$ on Temperature

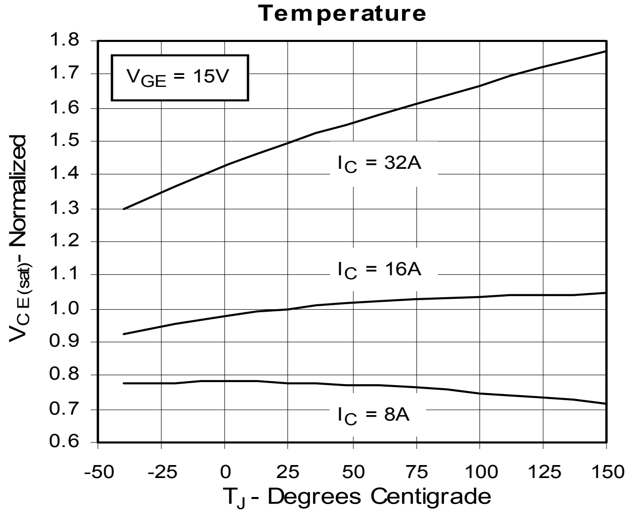


Fig. 5. Collector-to-Emitter Voltage vs. Gate-to-Emitter voltage

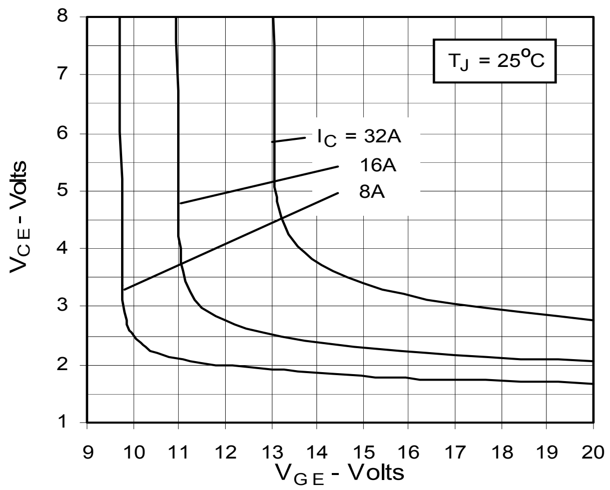
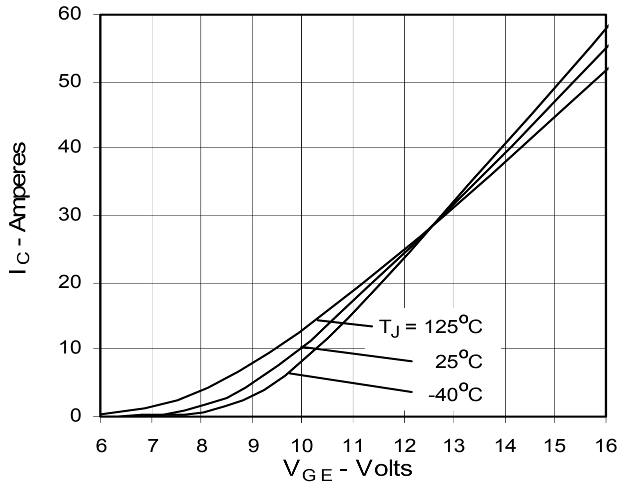


Fig. 6. Input Admittance



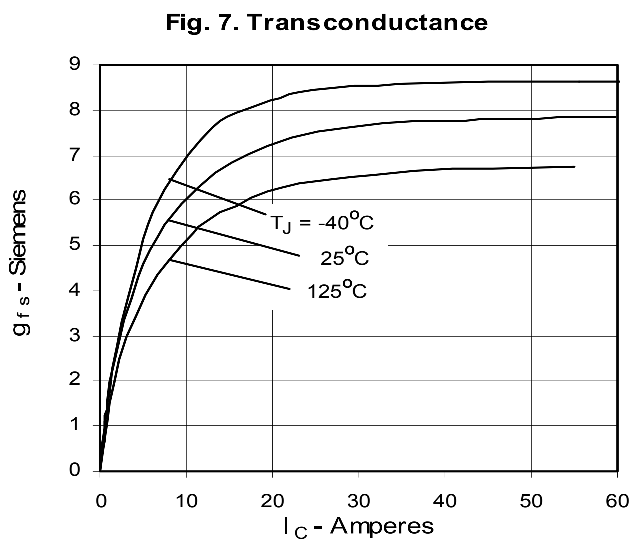


Fig. 7. Transconductance
g f s - Siemens
I C - Amperes
TJ = -40°C
25°C
125°C

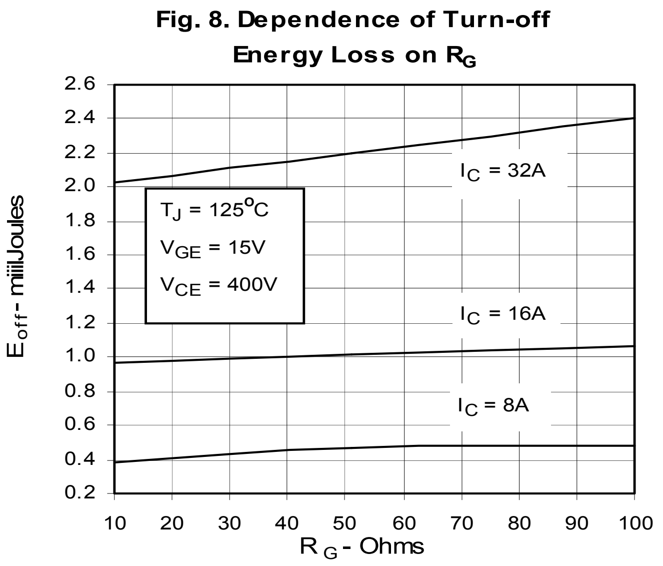


Fig. 8. Dependence of Turn-off Energy Loss on RG
E off - milliJoules
R G - Ohms
TJ = 125°C
VGE = 15V
VCE = 400V
IC = 32A
IC = 16A
IC = 8A

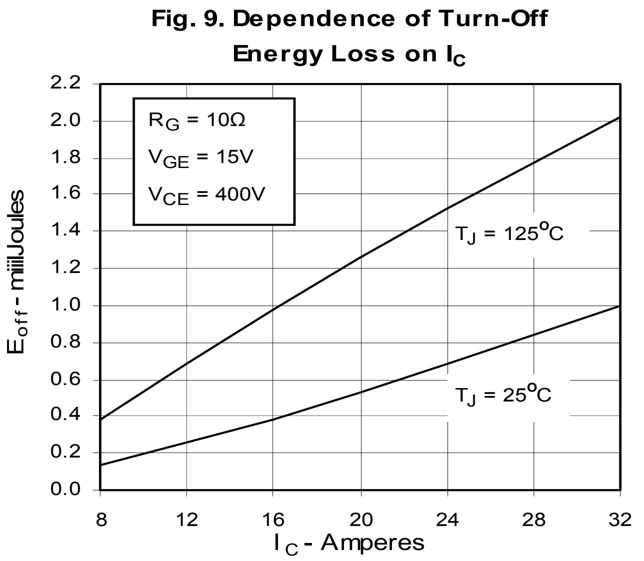


Fig. 9. Dependence of Turn-Off Energy Loss on IC
E off - milliJoules
I C - Amperes
RG = 10Ω
VGE = 15V
VCE = 400V
TJ = 125°C
TJ = 25°C

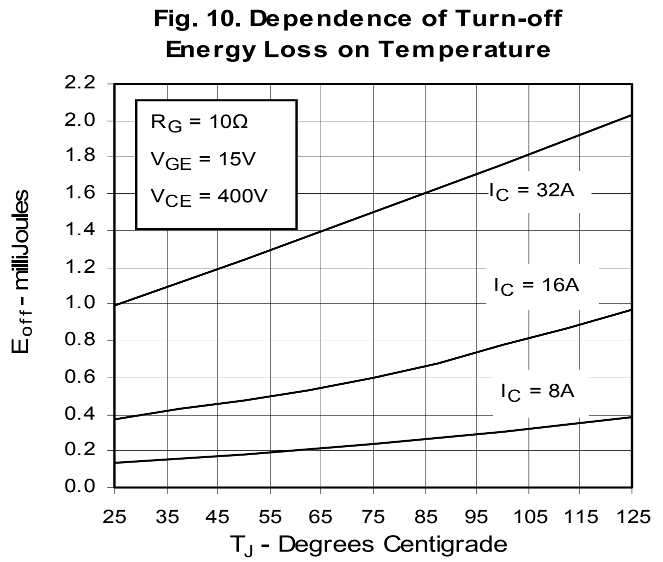


Fig. 10. Dependence of Turn-off Energy Loss on Temperature
E off - milliJoules
TJ - Degrees Centigrade
RG = 10Ω
VGE = 15V
VCE = 400V
IC = 32A
IC = 16A
IC = 8A

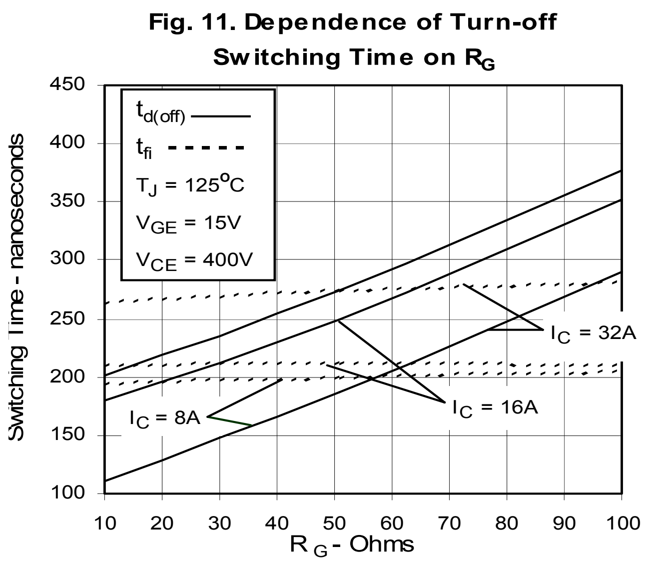


Fig. 11. Dependence of Turn-off Switching Time on RG
Switching Time - nanoseconds
R G - Ohms
td(off)
tfi
TJ = 125°C
VGE = 15V
VCE = 400V
IC = 32A
IC = 16A
IC = 8A

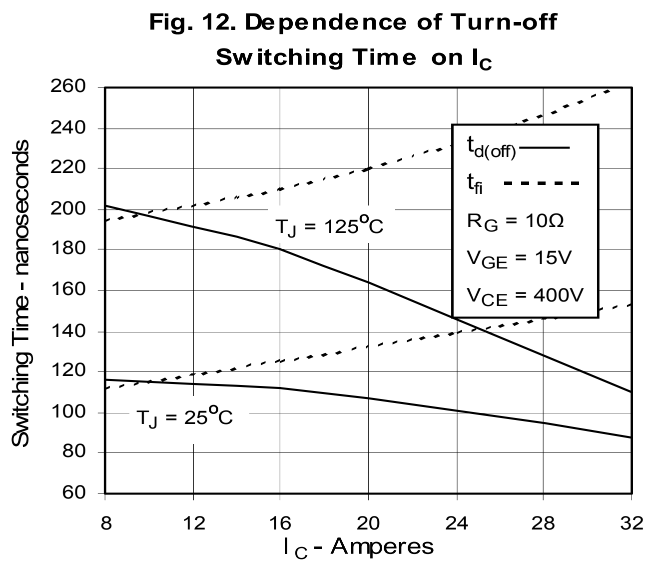


Fig. 12. Dependence of Turn-off Switching Time on IC
Switching Time - nanoseconds
I C - Amperes
td(off)
tfi
RG = 10Ω
VGE = 15V
VCE = 400V
TJ = 125°C
TJ = 25°C

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

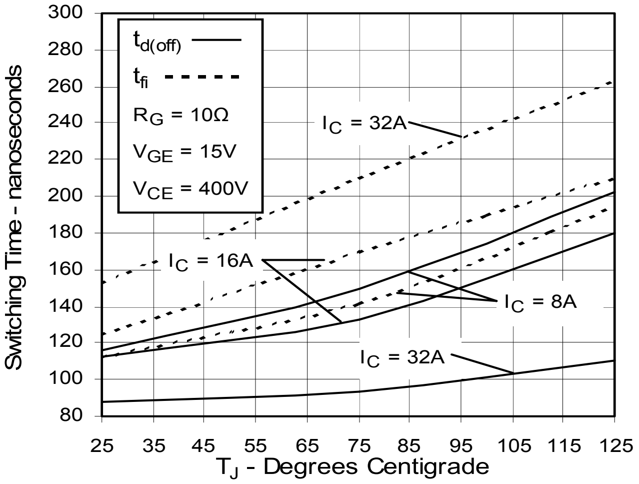


Fig. 14. Gate Charge

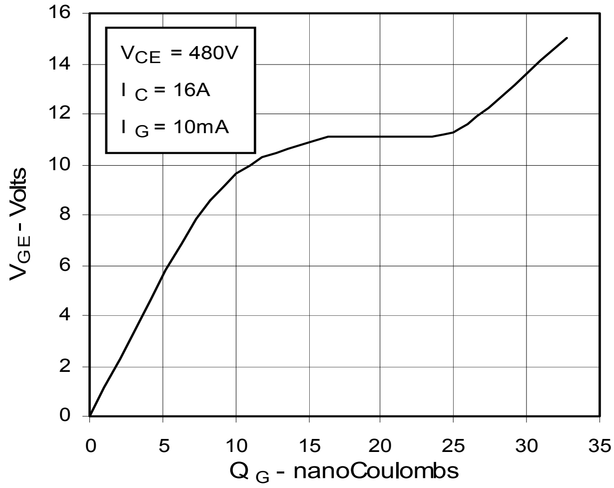


Fig. 15. Capacitance

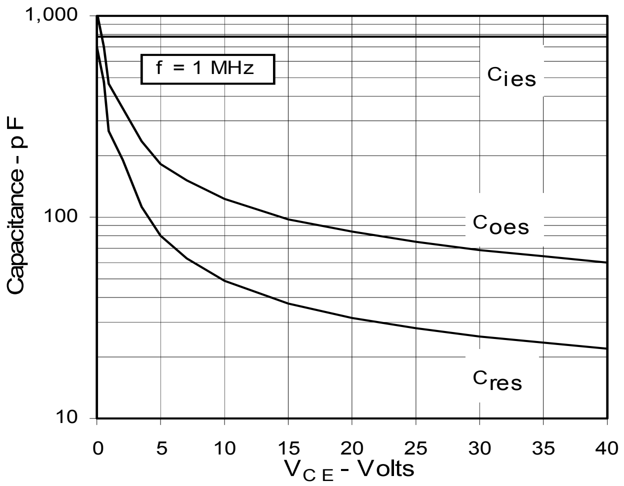


Fig. 16. Reverse-Bias Safe Operating Area

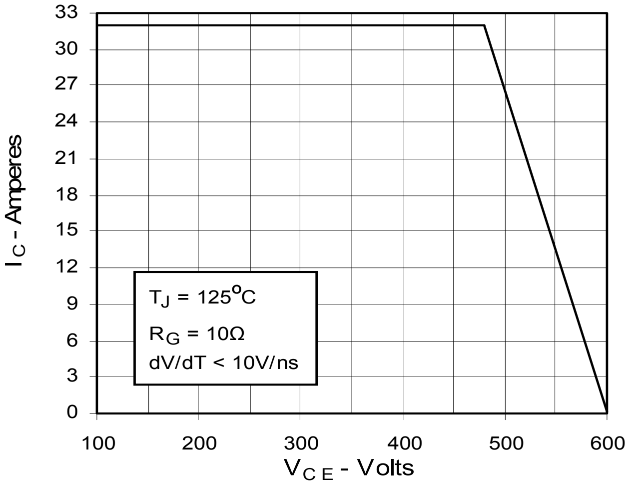
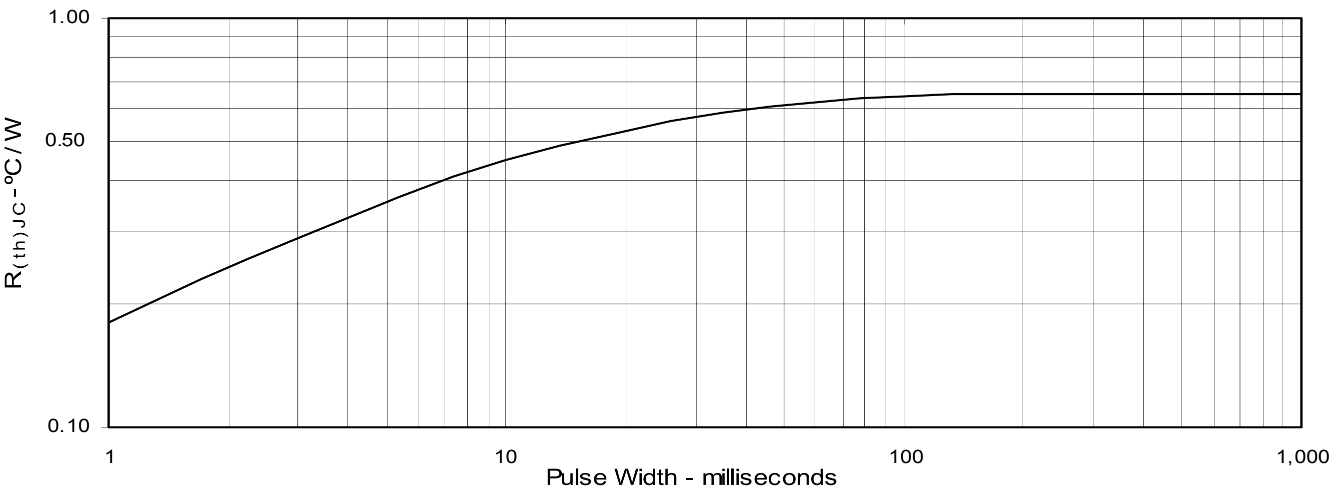


Fig. 17. Maximum Transient Thermal Resistance



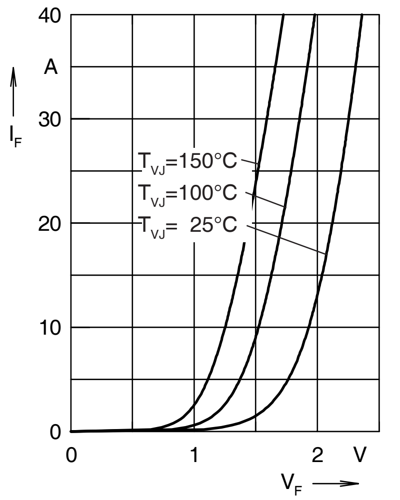


Fig. 1. Forward current I_F versus V_F

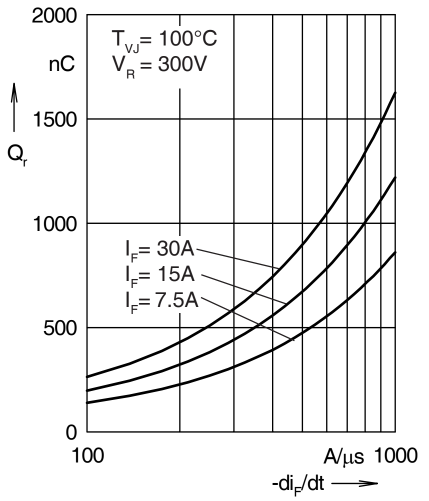


Fig. 2. Reverse recovery charge Q_r versus $-di_F/dt$

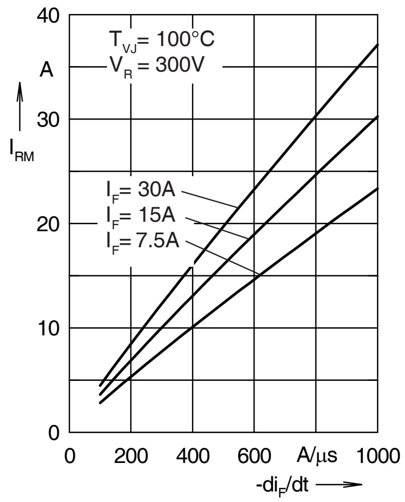


Fig. 3. Peak reverse current I_{RM} versus $-di_F/dt$

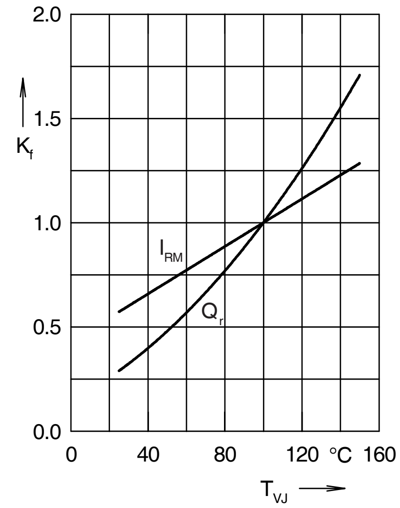


Fig. 4. Dynamic parameters Q_r, I_{RM} versus T_{VJ}

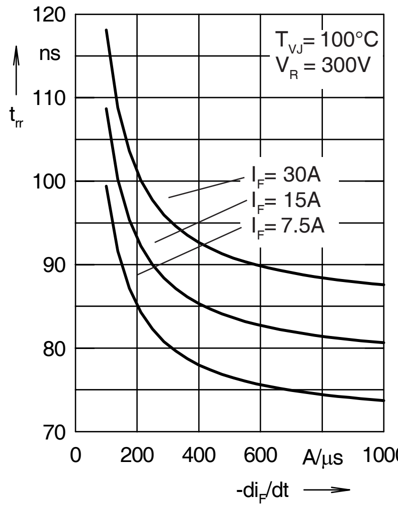


Fig. 5. Recovery time t_{rr} versus $-di_F/dt$

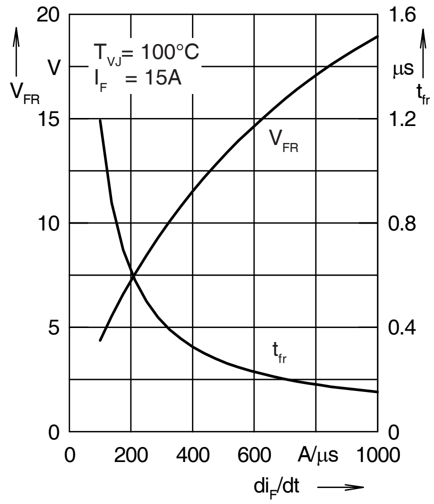


Fig. 6. Peak forward voltage V_{FR} and t_{fr} versus di_F/dt

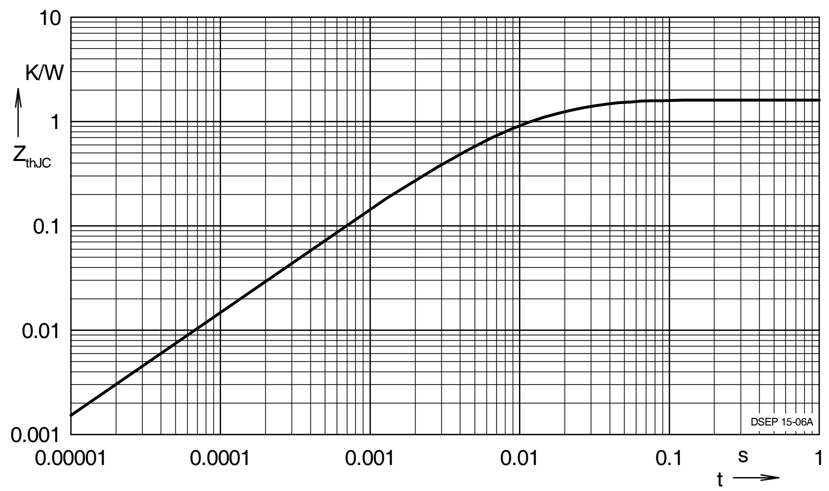


Fig. 7 Transient thermal resistance junction-to-case

Constants for Z_{thJC} calculation:

i	R_{thi} (K/W)	t_i (s)
1	0.908	0.0052
2	0.35	0.0003
3	0.342	0.017