THE DATASHEET OF

IXSH30N60BD1

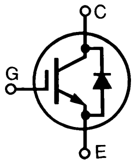
IXYS

High Speed IGBT with Diode

Short Circuit SOA Capability

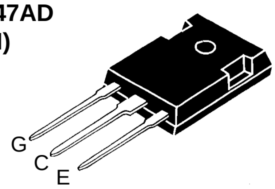
IXSH 30N60BD1
IXSK 30N60BD1
IXST 30N60BD1

V_{CES}	=	600 V
I_{C25}	=	55 A
$V_{CE(sat)}$	=	2.0 V
t_{fi}	=	140 ns

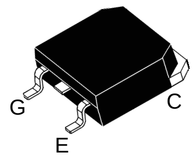


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	T_J = 25°C to 150°C	600	V
V_{CGR}	T_J = 25°C to 150°C; R_{GE} = 1 MΩ	600	V
V_{GES}	Continuous	±20	V
V_{GEM}	Transient	±30	V
I_{C25}	T_C = 25°C	55	A
I_{C90}	T_C = 90°C	30	A
I_{CM}	T_C = 25°C, 1 ms	110	A
SSOA (RBSOA)	V_{GE}= 15 V, T_J = 125°C, R_G = 10 Ω Clamped inductive load, V_{CL} = 0.8 V_{CES}	I_{CM} = 60	A
t_{SC} **(SCSOA)**	V_{GE}= 15 V, V_{CE} = 360 V, T_J = 125°C R_G = 33 Ω, non repetitive	10	µs
P_C	T_C = 25°C	200	W
T_J		-55 ... +150	°C
T_{JM}		150	°C
T_{stg}		-55 ... +150	°C
M_d	Mounting torque	1.13/10	Nm/lb.in.
Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s		300	°C
Weight	TO-247/TO-268	6/4	g
	TO-264	10	g

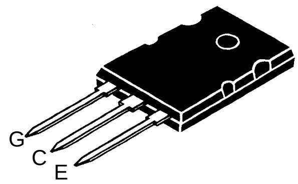
TO-247AD (IXSH)



TO-268 (D3) (IXST)



TO-264 (IXSK)



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

Features

- International standard packages: JEDEC TO-247, TO-264& TO-268
- Short Circuit SOA capability
- Medium freqeuncy IGBT and anti-parallel FRED in one package
- New generation HDMOS™ process

Applications

- AC motor speed control
- DC servo and robot drives
- DC choppers
- Uninterruptible power supplies (UPS)
- Switch-mode and resonant-mode power supplies

Advantages

- Space savings (two devices in one package)
- Easy to mount with 1 screw (isolated mounting screw hole)
- Surface mountable, high power case style
- Reduces assembly time and cost
- High power density

Symbol	Test Conditions		Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
BV_{CES}	I_C = 750 µA, V_{GE} = 0 V		600			V
$V_{GE(th)}$	I_C = 2.5 mA, V_{CE} = V_{GE}		4		7	V
I_{CES}	V_{CE} = 0.8 • V_{CES}	T_J = 25°C			200	µA
	V_{GE} = 0 V	T_J = 125°C			3	mA
I_{GES}	V_{CE} = 0 V, V_{GE} = ±20 V				±100	nA
$V_{CE(sat)}$	V_{GE} = 15 V	I_C = I_{C90}			2.0	V
		I_C = I_{C25}			2.7	V

IXYS reserves the right to change limits, test conditions, and dimensions. 98517A (7/00)

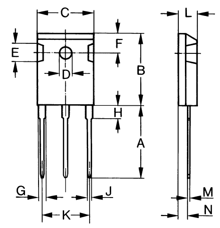
Symbol	Test Conditions	Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
g_{fs}	$I_C = I_{C90}$; V_{CE} = 10 V, Pulse test, t ≤ 300 µs, duty cycle ≤ 2 %	10			S
C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz		3100		pF
C_{oes}			240		pF
C_{res}			30		pF
Q_g	$I_C = I_{C90}$, V_{GE} = 15 V, V_{CE} = 0.5 V_{CES}		100		nC
Q_{ge}			30		nC
Q_{gc}			38		nC
$t_{d(on)}$	**Inductive load, T_J = 25°C**		30		ns
t_{ri}	$I_C = I_{C90}$; V_{GE} = 15 V		30		ns
$t_{d(off)}$	V_{CE} = 0.8 V_{CES}; R_G = 4.7 Ω		150	270	ns
t_{fi}	Note 1.		140	270	ns
E_{off}			1.5	2.5	mJ
$t_{d(on)}$	**Inductive load, T_J = 125°C**		30		ns
t_{ri}	$I_C = I_{C90}$; V_{GE} = 15 V		35		ns
E_{on}	V_{CE} = 0.8 V_{CES}; R_G = 4.7 Ω		0.5		mJ
$t_{d(off)}$	Note 1		270		ns
t_{fi}			250		ns
E_{off}			2.5		mJ
R_{thJC}				0.62	K/W
R_{thCK}	TO-247		0.25		K/W
R_{thCK}	TO-264		0.15		K/W

Reverse Diode (FRED)

Symbol	Test Conditions	Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
V_F	$I_F = I_{C90}$, V_{GE} = 0 V, T_J = 150 °C			1.7	V
	Note 2, T_J = 25 °C			2.5	V
I_{RM}	I_F = 50A; V_{GE} = 0 V; T_J = 100 °C; V_R = 100 V; $-di_F/dt$ = 100 A/µs		2	2.5	A
t_{rr}	I_F = 1 A; -di/dt = 100 A/µs; V_R = 30 V T_J = 25°C		35	50	ns
R_{thJC}				.09	K/W

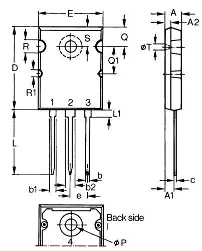
Notes: 1. Switching times may increase for V_{CE} (Clamp) > 0.8 • V_{CES}, higher T_J or increased R_G.
2. Pulse test, t ≤ 300 µs, duty cycle d ≤ 2 %

TO-247 AD (IXSH) Outline



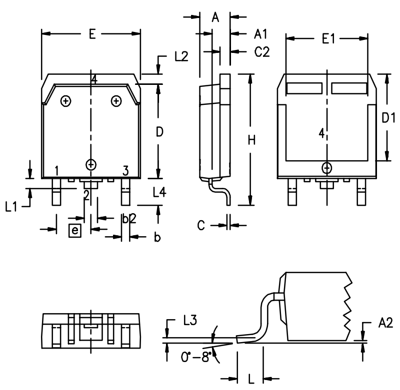
Dim.	Millimeter Min.	Max.	Inches Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M	0.4	0.8	0.016	0.031
N	1.5	2.49	0.087	0.102

TO-264 AA (IXSK) Outline



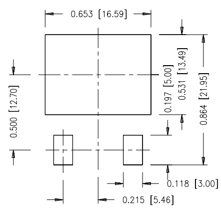
Dim.	Millimeter Min.	Max.	Inches Min.	Max.
A	4.82	5.13	.190	.202
A1	2.54	2.89	.100	.114
A2	2.00	2.10	.079	.083
b	1.12	1.42	.044	.056
b1	2.39	2.69	.094	.106
b2	2.90	3.09	.114	.122
c	0.53	0.83	.021	.033
D	25.91	26.16	1.020	1.030
E	19.81	19.96	.780	.786
e	5.46 BSC		.215 BSC	
J	0.00	0.25	.000	.010
K	0.00	0.25	.000	.010
L	20.32	20.83	.800	.820
L1	2.29	2.59	.090	.102
P	3.17	3.66	.125	.144
Q	6.07	6.27	.239	.247
Q1	8.38	8.69	.330	.342
R	3.81	4.32	.150	.170
R1	1.78	2.29	.070	.090
S	6.04	6.30	.238	.248
T	1.57	1.83	.062	.072

TO-268AA (IXST) (D³ PAK)



Dim.	Millimeter Min.	Max.	Inches Min.	Max.
A	4.9	5.1	.193	.201
A_1	2.7	2.9	.106	.114
A_2	.02	.25	.001	.010
b	1.15	1.45	.045	.057
b_2	1.9	2.1	.75	.83
C	.4	.65	.016	.026
D	13.80	14.00	.543	.551
E	15.85	16.05	.624	.632
E_1	13.3	13.6	.524	.535
e	5.45 BSC		.215 BSC	
H	18.70	19.10	.736	.752
L	2.40	2.70	.094	.106
L1	1.20	1.40	.047	.055
L2	1.00	1.15	.039	.045
L3	0.25 BSC		.010 BSC	
L4	3.80	4.10	.150	.161

Min. Recommended Footprint



IXYS MOSFETS and IGBTs are covered by one or more of the following U.S. patents:
4,835,592 4,881,106 5,017,508 5,049,961 5,187,117 5,486,715
4,850,072 4,931,844 5,034,796 5,063,307 5,237,481 5,381,025

Fig.1 Saturation Characteristics

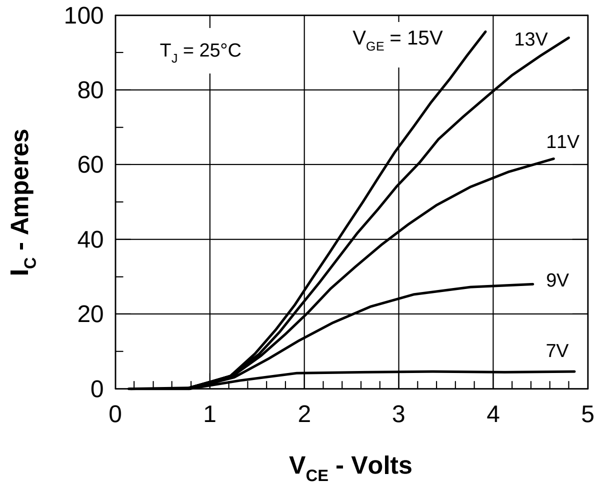


Fig.2 Output Characterstics

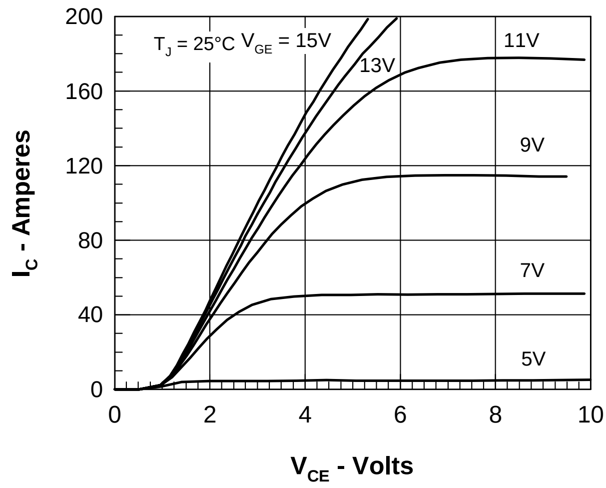


Fig.3 Collector-Emitter Voltage vs. Gate-Emitter Voltage

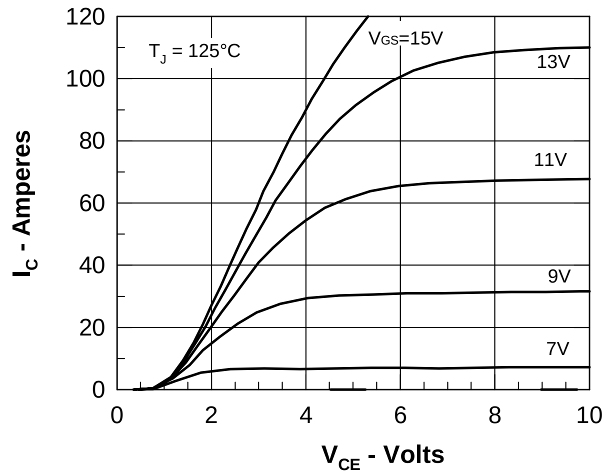


Fig.4 Temperature Dependence of Output Saturation Voltage

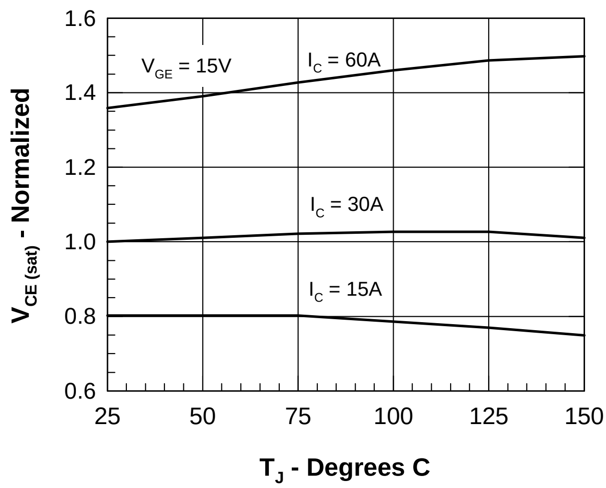


Fig.5 Input Admittance

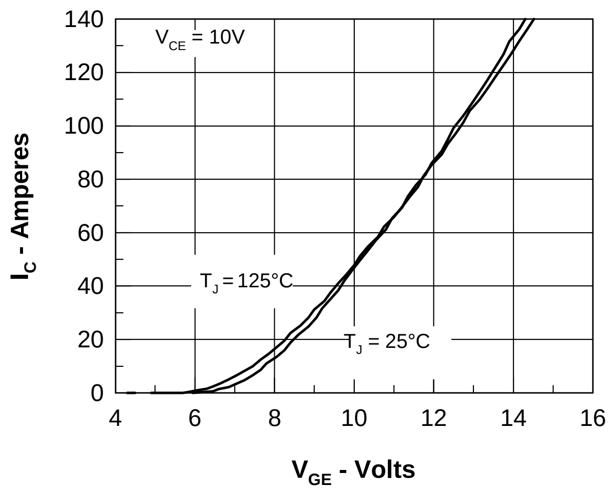


Fig.6 Temperature Dependence of Breakdown and Threshold Voltage

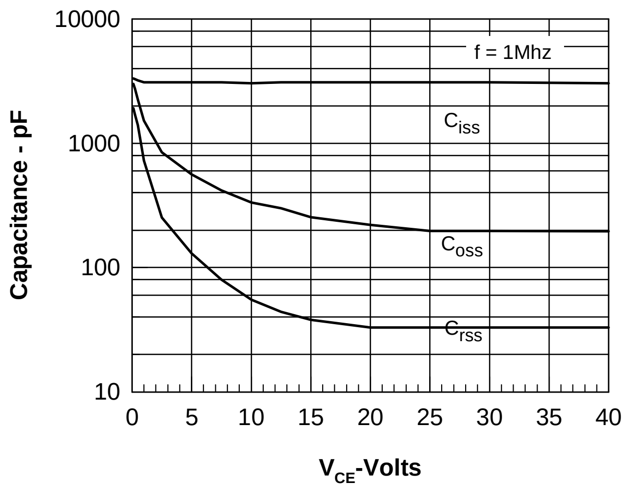


Fig.7 Turn-Off Energy per Pulse and Fall Time on Collector Current

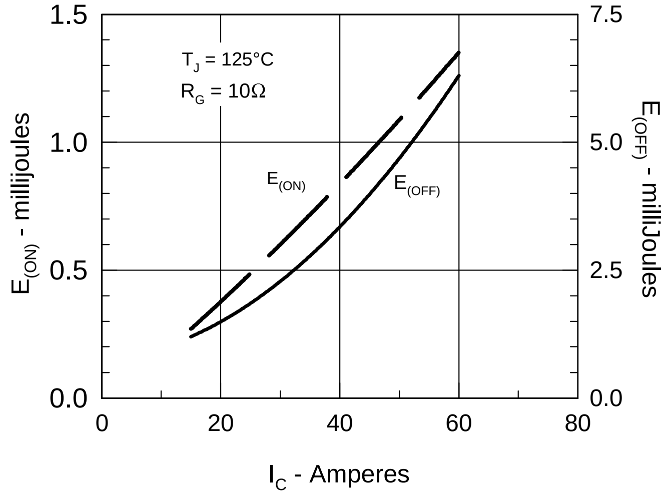


Fig.8 Dependence of Turn-Off Energy Per Pulse and Fall Time on R_G

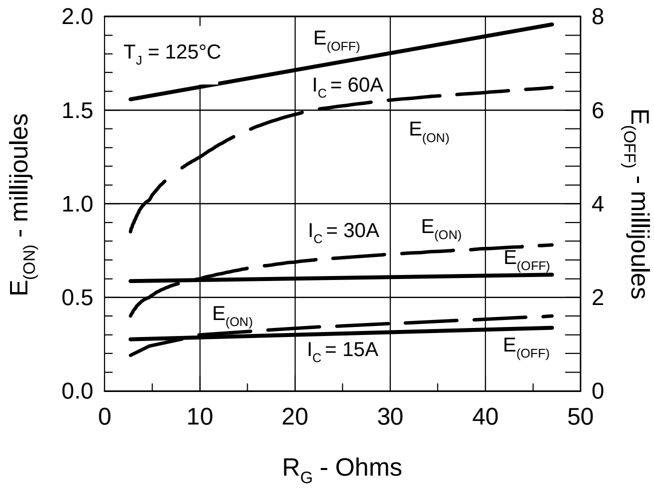


Fig.9 Gate Charge Characteristic Curve

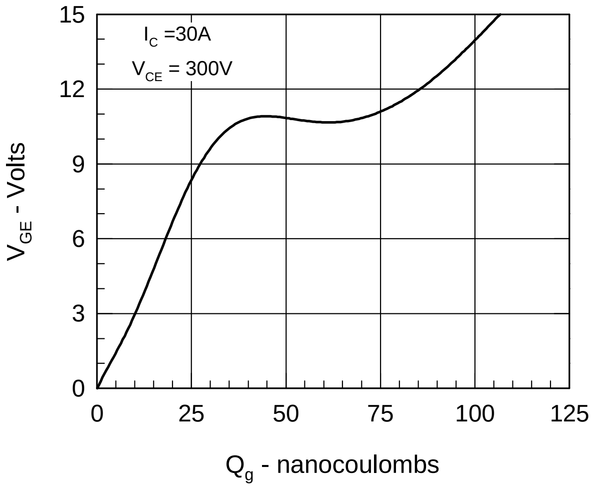


Fig.10 Turn-Off Safe Operating Area

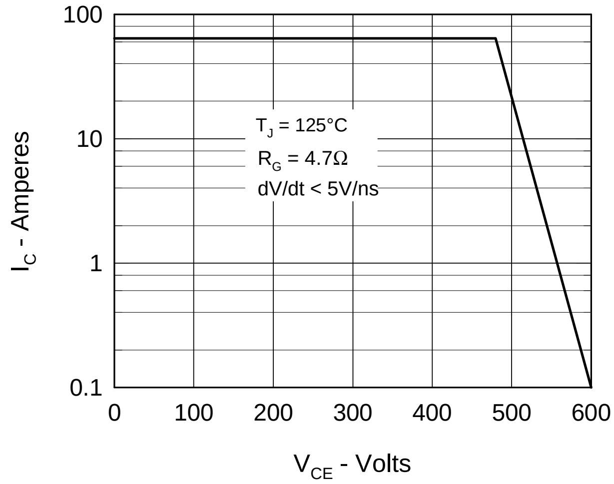
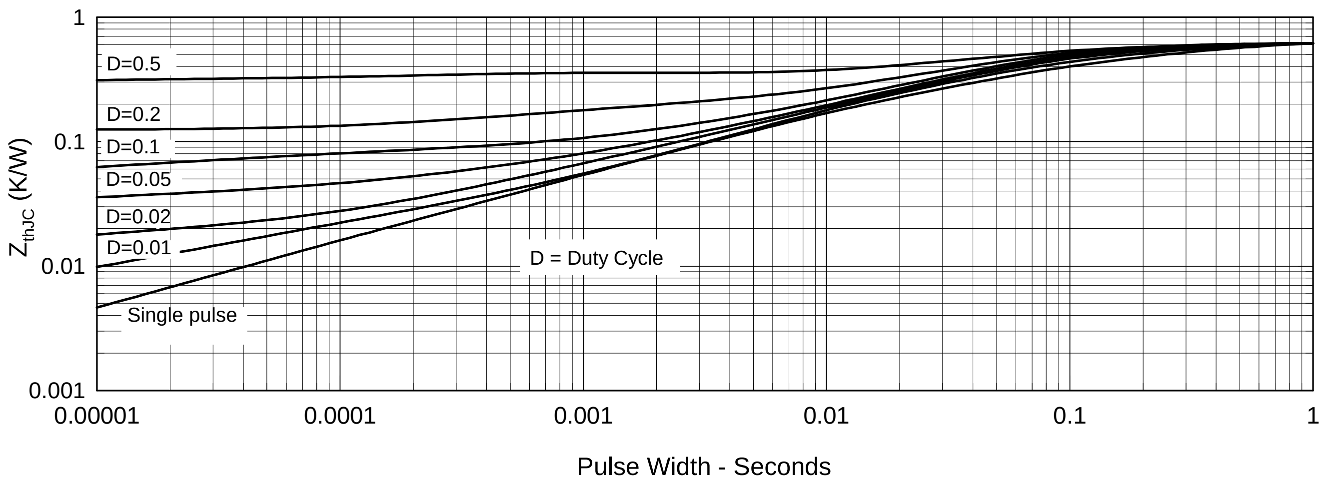


Fig.11 Transient Thermal Resistance



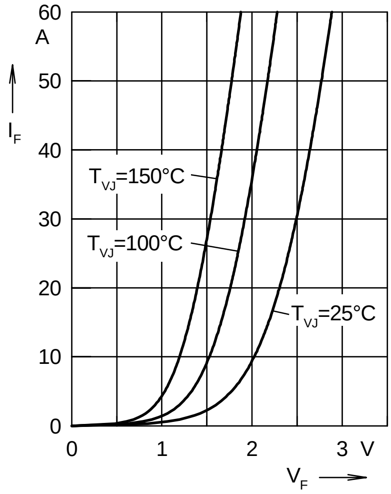


Fig. 12 Forward current I_F versus V_F

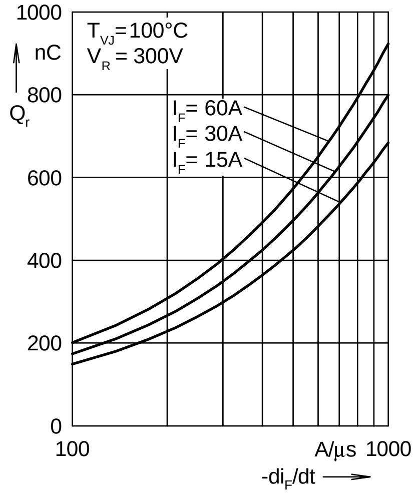


Fig. 13 Reverse recovery charge Q_r versus $-di_F/dt$

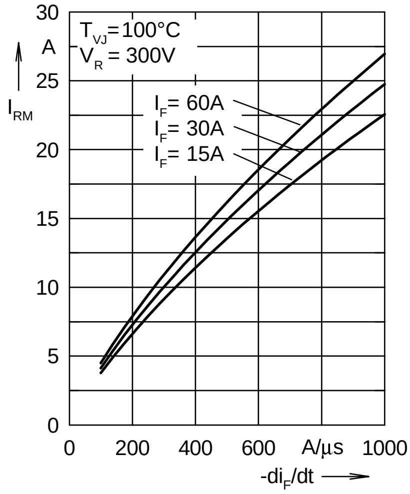


Fig. 14 Peak reverse current I_{RM} versus $-di_F/dt$

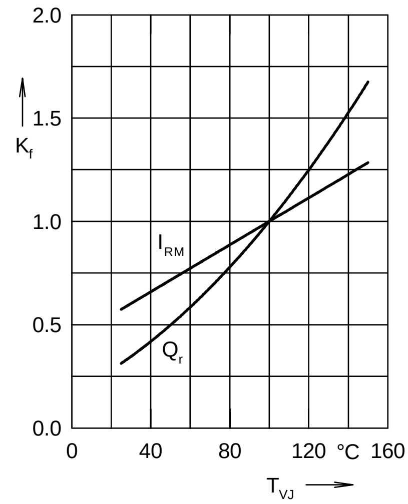


Fig. 15 Dynamic parameters Q_r, I_{RM} versus T_{VJ}

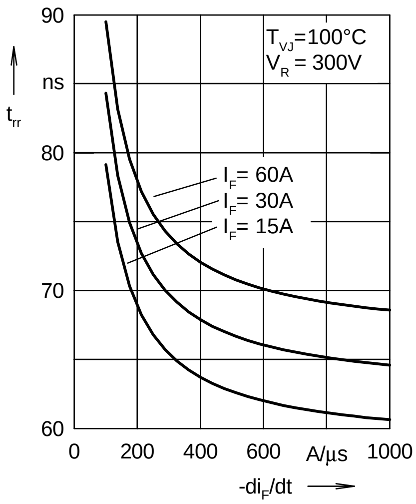


Fig. 16 Recovery time t_{rr} versus $-di_F/dt$

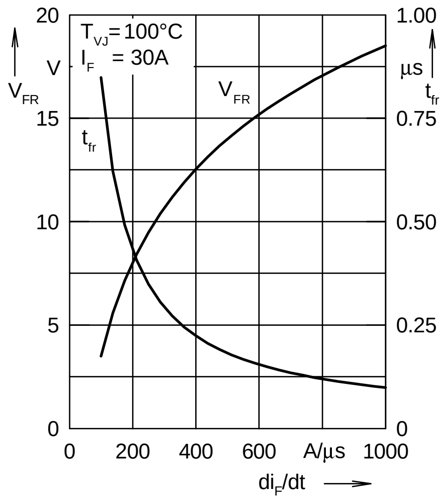


Fig. 17 Peak forward voltage V_{FR} and t_{fr} versus di_F/dt

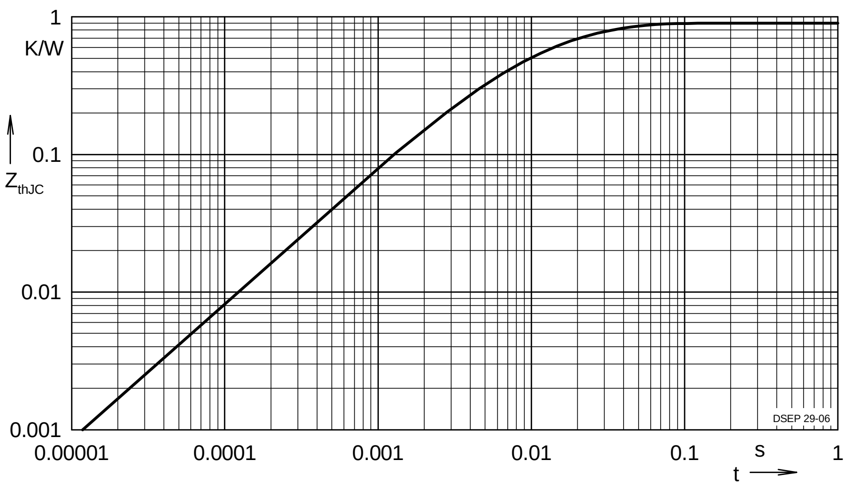


Fig. 18 Transient thermal resistance junction to case

Constants for Z_{thJC} calculation:

i	R_{thi} (K/W)	t_i (s)
1	0.502	0.0052
2	0.193	0.0003
3	0.205	0.0162