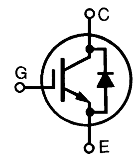
High Speed IGBT with Diode

Short Circuit SOA Capability

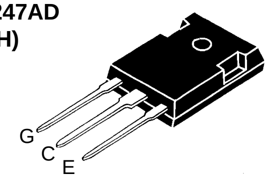
IXSH 30N60BD1
IXSK 30N60BD1
IXST 30N60BD1

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

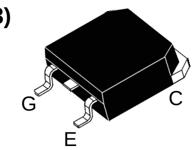


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	T_J = 25°C to 150°C	600	V
V_{CGR}	T_J = 25°C to 150°C; R_{GE} = 1 MΩ	600	V
V_{GES}	Continuous	±20	V
V_{GEM}	Transient	±30	V
I_{C25}	T_C = 25°C	55	A
I_{C90}	T_C = 90°C	30	A
I_{CM}	T_C = 25°C, 1 ms	110	A
SSOA (RBSOA)	V_{GE} = 15 V, T_J = 125°C, R_G = 10 Ω 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 TO-264	6/4 10	g g

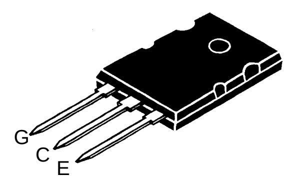
TO-247AD (IXSH)



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} V_{GE} = 0 V	T_J = 25°C T_J = 125°C			200 3	µA mA
I_{GES}	V_{CE} = 0 V, V_{GE} = ±20 V				±100	nA
$V_{CE(sat)}$	V_{GE} = 15 V	I_C = I_{C90} I_C = I_{C25}			2.0 2.7	V V

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

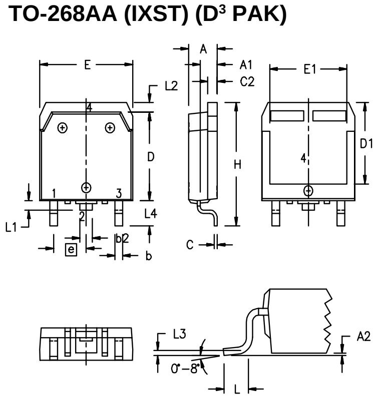
Symbol	Test Conditions	Characteristic Values (T_J = 25°C, unless otherwise specified) min.	typ.	max.	
g_{fs}	$I_C = I_{C90}$; V_{CE} = 10 V, Pulse test, t ≤ 300 µs, duty cycle ≤ 2 %	10			S
C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz		3100		pF
C_{oes}			240		pF
C_{res}			30		pF
Q_g	$I_C = I_{C90}$, 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

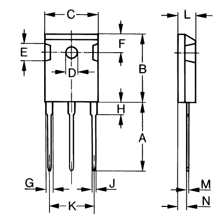
Notes: 1. Switching times may increase for V_{CE} (Clamp) > 0.8 • V_{CES}, higher T_J or increased R_G.
2. Pulse test, t ≤ 300 µs, duty cycle d ≤ 2 %

TO-268AA (IXST) (D³ PAK)



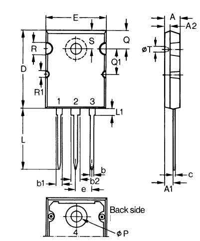
Dim.	Millimeter Min.	Max.	Inches Min.	Max.
A	4.9	5.1	.193	.201
A_1	2.7	2.9	.106	.114
A_2	.02	.25	.001	.010
b	1.15	1.45	.045	.057
b_2	1.9	2.1	.75	.83
C	.4	.65	.016	.026
D	13.80	14.00	.543	.551
E	15.85	16.05	.624	.632
E_1	13.3	13.6	.524	.535
e	5.45 BSC		.215 BSC	
H	18.70	19.10	.736	.752
L	2.40	2.70	.094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

TO-247 AD (IXSH) Outline



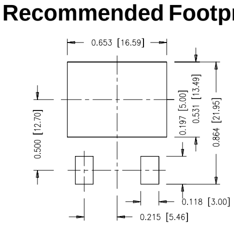
Dim.	Millimeter Min.	Max.	Inches Min.	Max.
A	19.81	20.32	0.780	0.800
B	20.80	21.46	0.819	0.845
C	15.75	16.26	0.610	0.640
D	3.55	3.65	0.140	0.144
E	4.32	5.49	0.170	0.216
F	5.4	6.2	0.212	0.244
G	1.65	2.13	0.065	0.084
H	-	4.5	-	0.177
J	1.0	1.4	0.040	0.055
K	10.8	11.0	0.426	0.433
L	4.7	5.3	0.185	0.209
M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

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

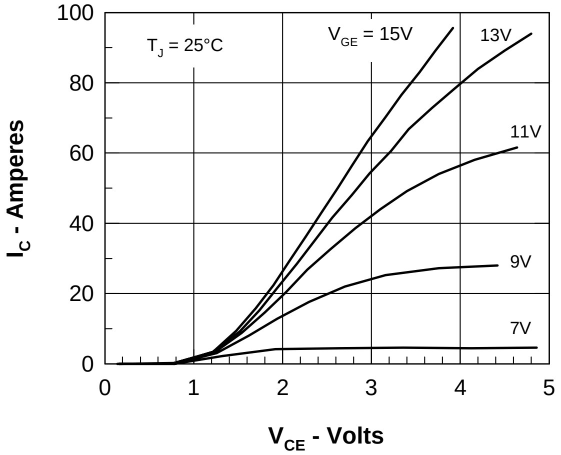


Fig.2 Output Characterstics

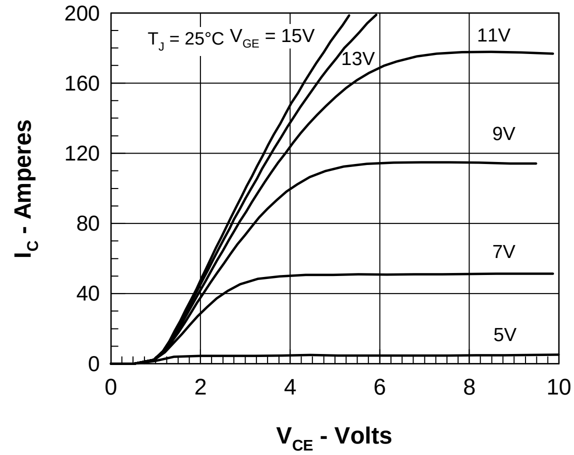


Fig.3 Collector-Emitter Voltage vs. Gate-Emitter Voltage

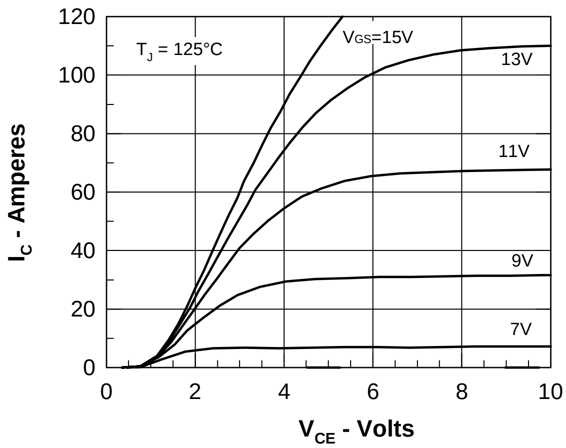


Fig.4 Temperature Dependence of Output Saturation Voltage

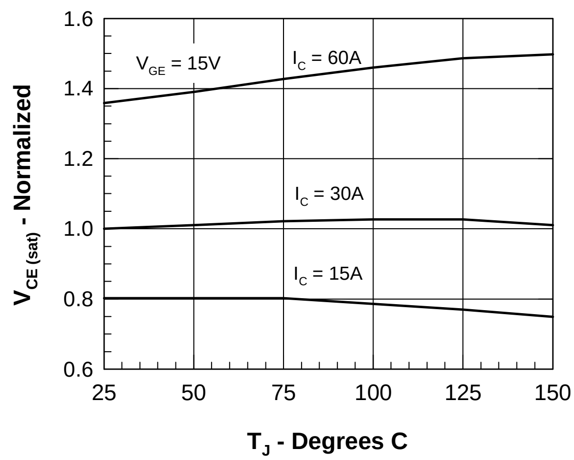


Fig.5 Input Admittance

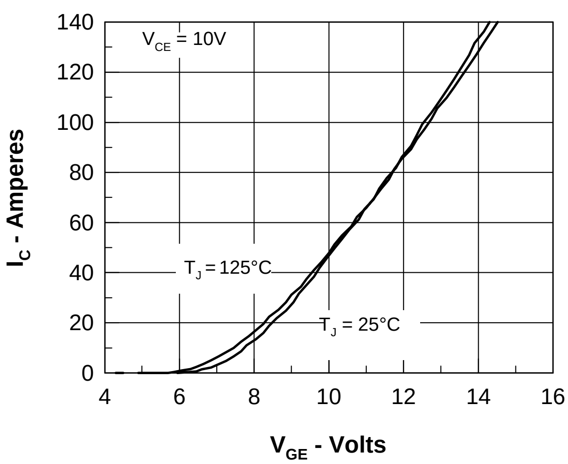


Fig.6 Temperature Dependence of Breakdown and Threshold Voltage

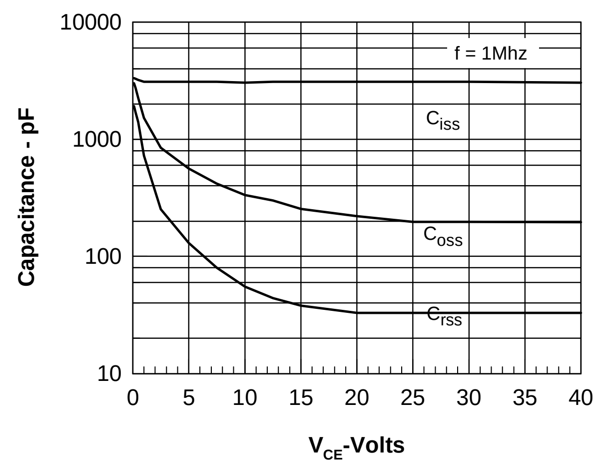


Fig.7 Turn-Off Energy per Pulse and Fall Time on Collector Current

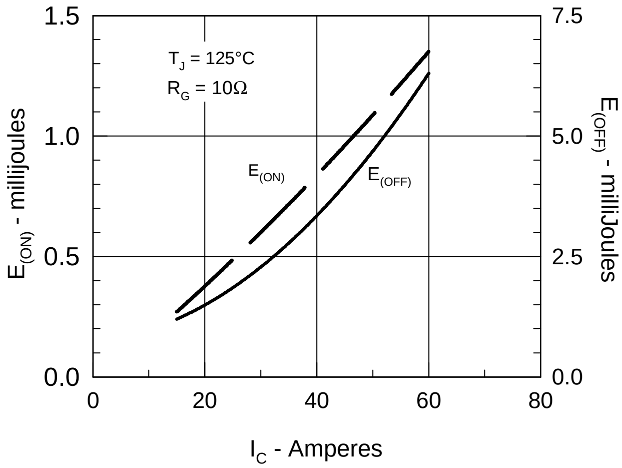


Fig.8 Dependence of Turn-Off Energy Per Pulse and Fall Time on R$_G$

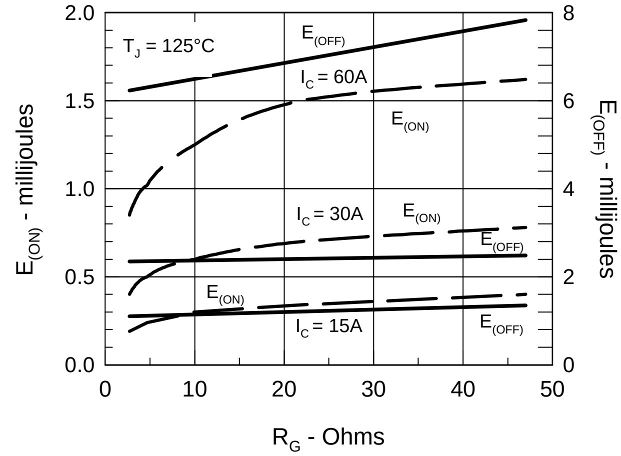


Fig.9 Gate Charge Characteristic Curve

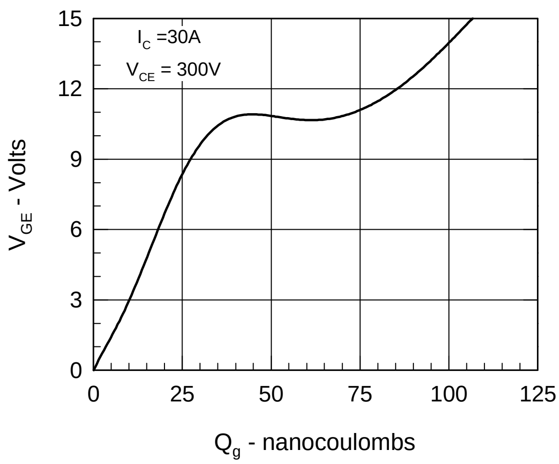


Fig.10 Turn-Off Safe Operating Area

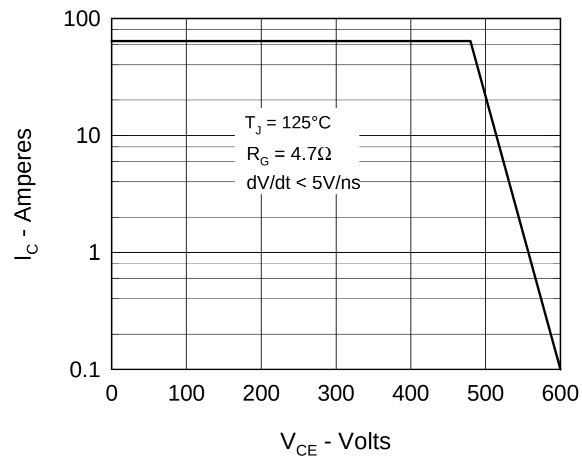
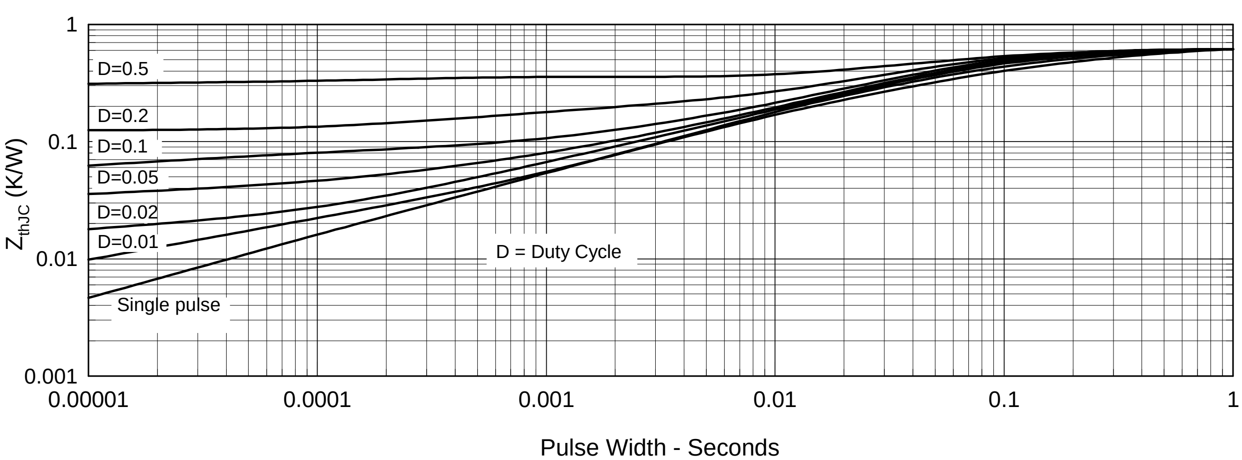


Fig.11 Transient Thermal Resistance



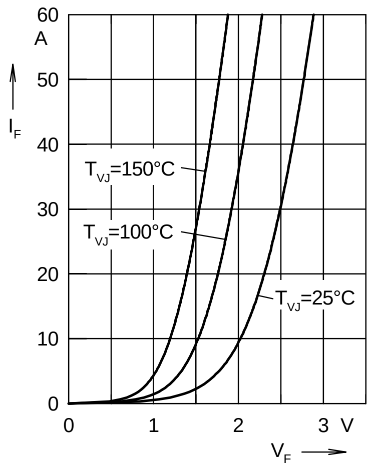


Fig. 12 Forward current I_F versus V_F

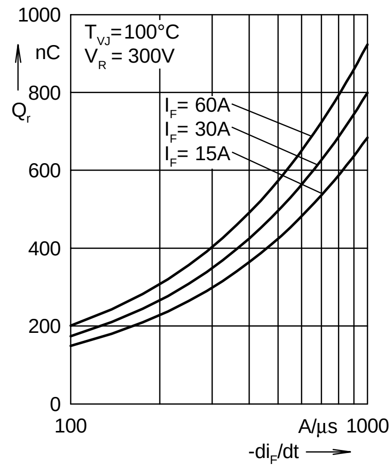


Fig. 13 Reverse recovery charge Q_r versus $-di_F/dt$

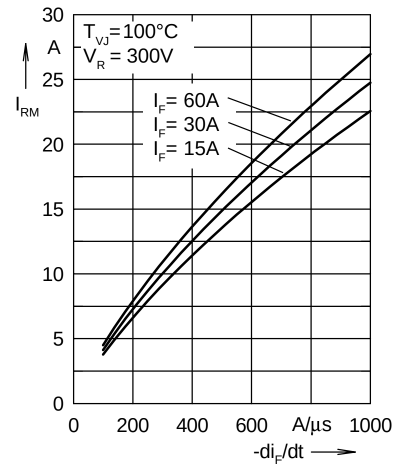


Fig. 14 Peak reverse current I_{RM} versus $-di_F/dt$

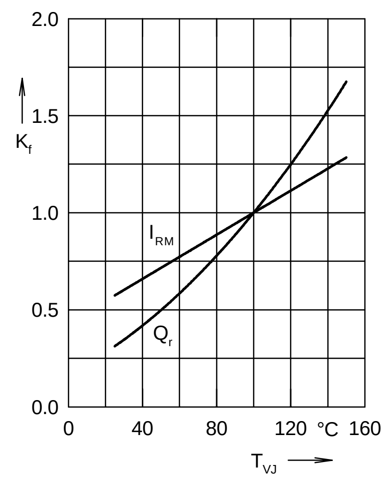


Fig. 15 Dynamic parameters Q_r, I_{RM} versus T_{VJ}

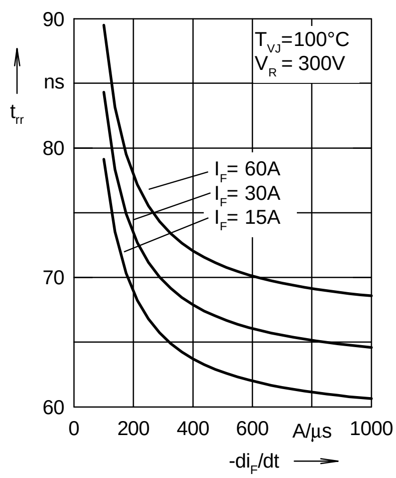


Fig. 16 Recovery time t_{rr} versus $-di_F/dt$

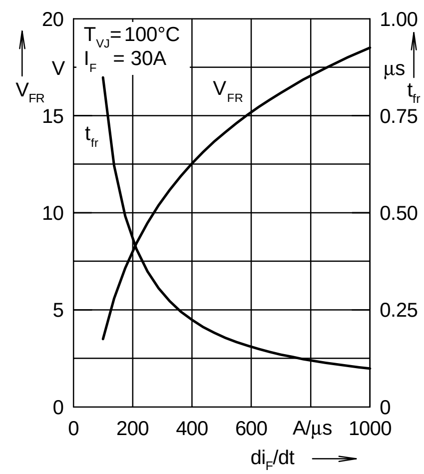


Fig. 17 Peak forward voltage V_{FR} and t_{fr} versus di_F/dt

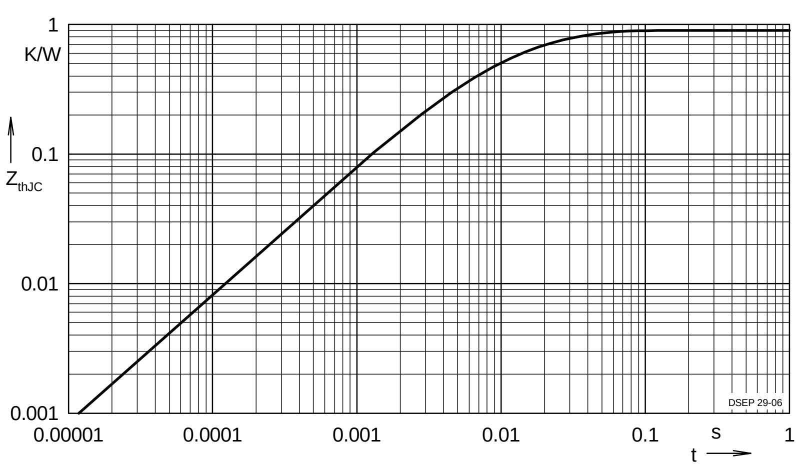


Fig. 18 Transient thermal resistance junction to case

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