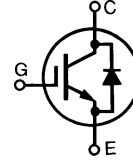


High Speed IGBT with Diode

Short Circuit SOA Capability

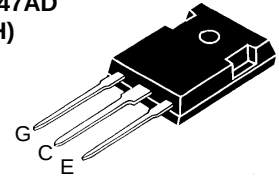
IXSH 30N60BD1
IXSK 30N60BD1
IXST 30N60BD1

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

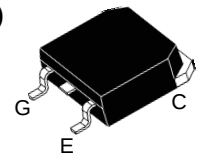


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	600	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1 \text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	55	A
I_{C90}	$T_C = 90^\circ\text{C}$	30	A
I_{CM}	$T_C = 25^\circ\text{C}$, 1 ms	110	A
SSOA (RBSOA)	$V_{GE} = 15 \text{ V}$, $T_J = 125^\circ\text{C}$, $R_G = 10 \Omega$ Clamped inductive load, $V_{CL} = 0.8 V_{CES}$	$I_{CM} = 60$	A
t_{SC} (SCSOA)	$V_{GE} = 15 \text{ V}$, $V_{CE} = 360 \text{ V}$, $T_J = 125^\circ\text{C}$ $R_G = 33 \Omega$, non repetitive	10	μs
P_C	$T_C = 25^\circ\text{C}$	200	W
T_J		-55 ... +150	$^\circ\text{C}$
T_{JM}		150	$^\circ\text{C}$
T_{stg}		-55 ... +150	$^\circ\text{C}$
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	$^\circ\text{C}$
Weight	TO-247/TO-268	6/4	g
	TO-264	10	g

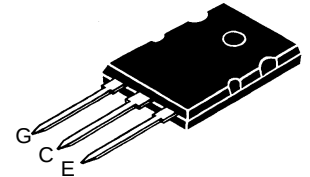
TO-247AD (IXSH)



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 frequency 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 ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
BV_{CES}	$I_C = 750 \mu\text{A}$, $V_{GE} = 0 \text{ V}$	600		V
$V_{GE(th)}$	$I_C = 2.5 \text{ mA}$, $V_{CE} = V_{GE}$	4		7 V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$			200 μA
	$V_{GE} = 0 \text{ V}$			3 mA
I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$			$\pm 100 \text{ nA}$
$V_{CE(sat)}$	$V_{GE} = 15 \text{ V}$	$I_C = I_{C90}$		2.0 V
		$I_C = I_{C25}$		2.7 V

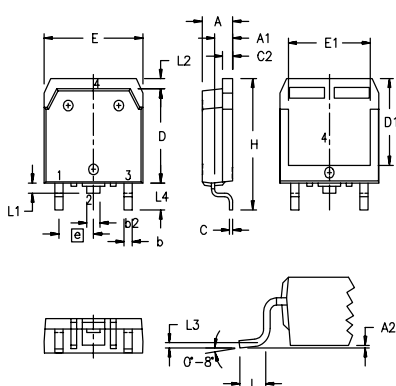
Symbol	Test Conditions	Characteristic Values (T _j = 25°C, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	I _C = I _{C90} ; V _{CE} = 10 V, Pulse test, t ≤ 300 μs, duty cycle ≤ 2 %	10		S
C_{ies}	V _{CE} = 25 V, V _{GE} = 0 V, f = 1 MHz		3100	pF
C_{oes}			240	pF
C_{res}			30	pF
Q_g	I _C = I _{C90} ; 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 V _{CE} = 0.8 V _{CES} ; R _G = 4.7 Ω Note 1.		30	ns
t_{d(off)}			150	270 ns
t_{fi}			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 V _{CE} = 0.8 V _{CES} ; R _G = 4.7 Ω Note 1		35	ns
E_{on}			0.5	mJ
t_{d(off)}			270	ns
t_{fi}			250	ns
E_{off}			2.5	mJ
R_{thJC}	TO-247 TO-264			0.62 K/W
R_{thCK}			0.25	K/W
R_{thCK}			0.15	K/W

Reverse Diode (FRED)

Reverse Diode (FRED)		Characteristic Values (T _J = 25°C, unless otherwise specified)		
Symbol	Test Conditions	min.	typ.	max.
V _F	I _F = I _{C90°} , V _{GE} = 0 V Note 2	T _J = 150 °C T _J = 25 °C		1.7 V 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

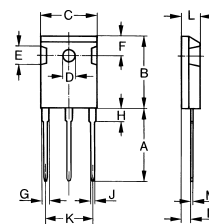
Notes: 1. Switching times may increase for $V_{CE} \text{ (Clamp)} > 0.8 \cdot V_{CES}$, higher T_J or increased $R_{\theta JA}$.
2. Pulse test. $t \leq 300 \mu s$, duty cycle $d \leq 2\%$

TO-268AA (IXST) (D³ PAK)



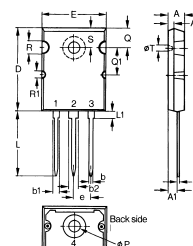
Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.9	5.1	.193	.201
A ₁	2.7	2.9	.106	.114
A ₂	.02	.25	.001	.010
b	1.15	1.45	.045	.057
b ₂	1.9	2.1	.75	.83
C	.4	.65	.016	.026
D	13.80	14.00	.543	.551
E	15.85	16.05	.624	.632
E ₁	13.3	13.6	.524	.535
e	5.45 BSC		.215 BSC	
H	18.70	19.10	.736	.752
L	2.40	2.70	.094	.106
L1	1.20	1.40	.047	.055
L2	1.00	1.15	.039	.045
L3	.025 BSC		.010 BSC	
L4	3.80	4.10	.150	.161

TO-247 AD (IXSH) Outline



Dim.	Millimeter		Inches	
	Min.	Max.	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		Inches	
	Min.	Max.	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

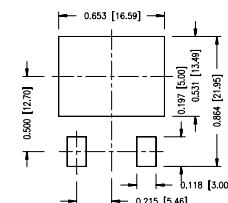


Fig.1 Saturation Characteristics

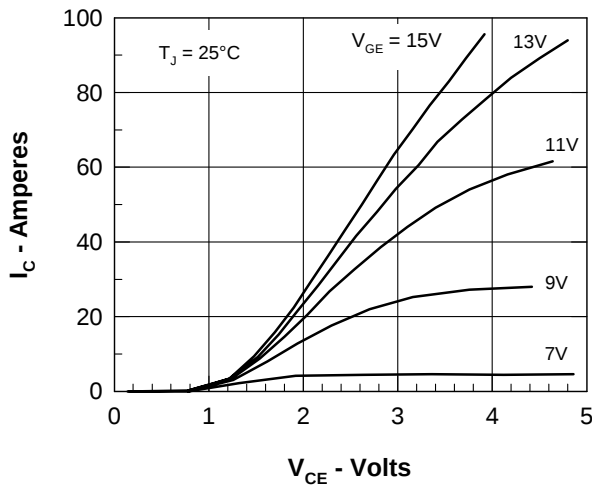


Fig.2 Output Characteristics

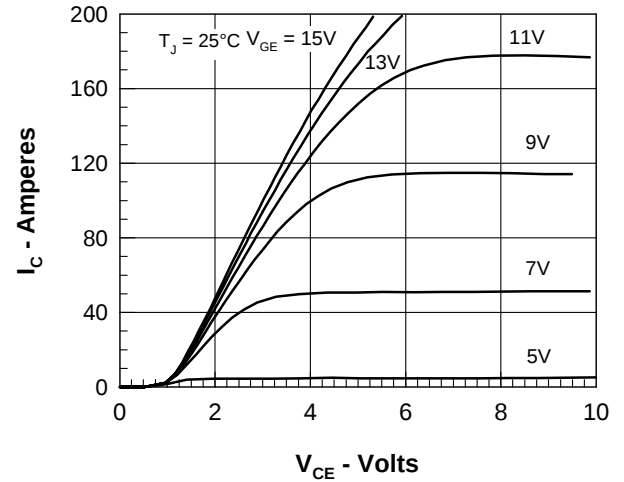


Fig.3 Collector-Emitter Voltage vs. Gate-Emitter Voltage

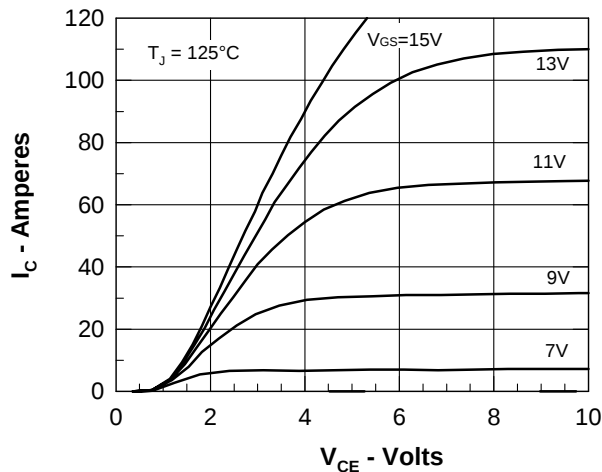


Fig.4 Temperature Dependence of Output Saturation Voltage

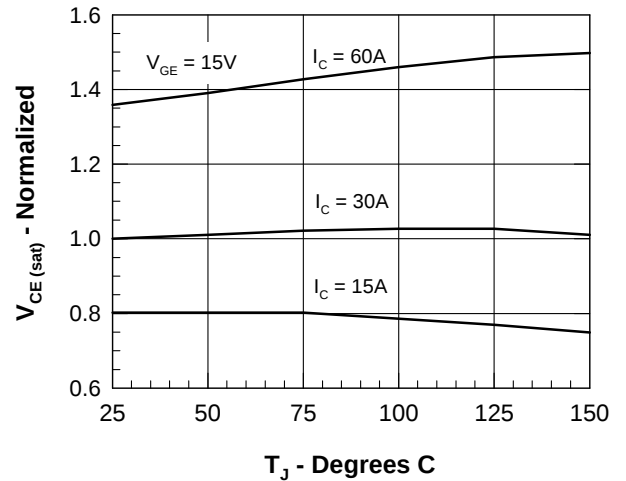


Fig.5 Input Admittance

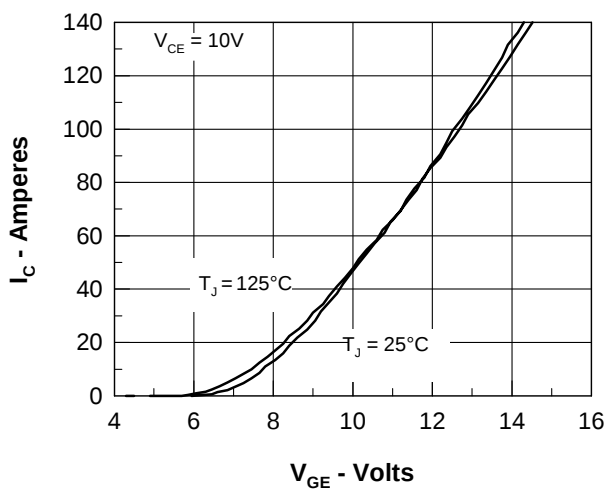


Fig.6 Temperature Dependence of Breakdown and Threshold Voltage

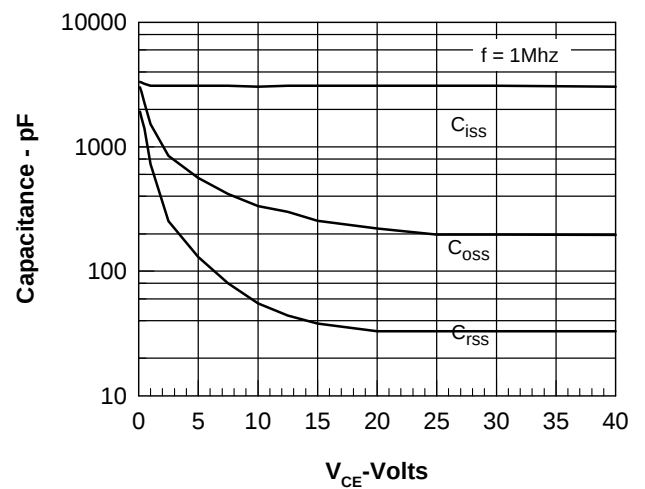


Fig.7 Turn-Off Energy per Pulse and Fall Time on Collector Current

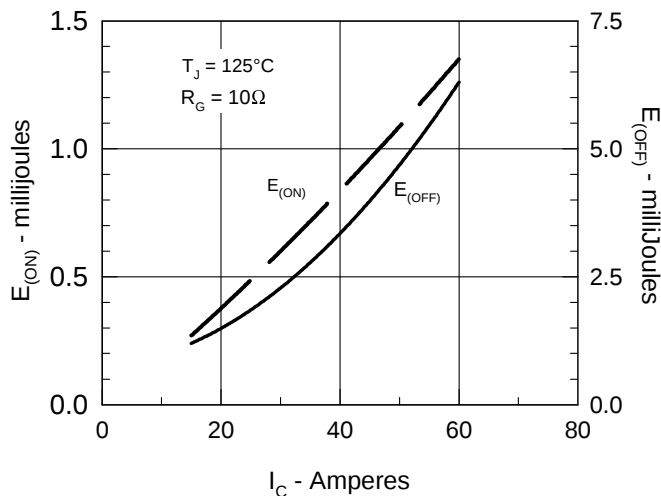


Fig.8 Dependence of Turn-Off Energy Per Pulse and Fall Time on R_G

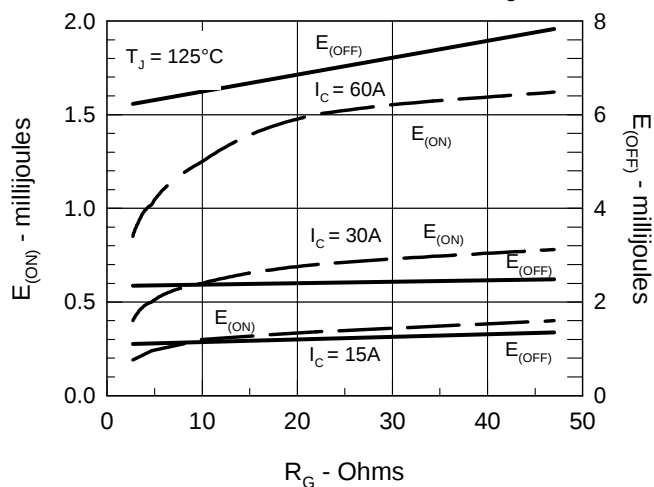


Fig.9 Gate Charge Characteristic Curve

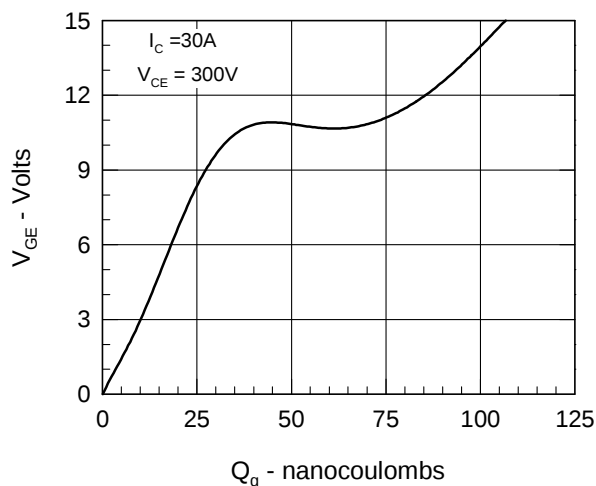


Fig.10 Turn-Off Safe Operating Area

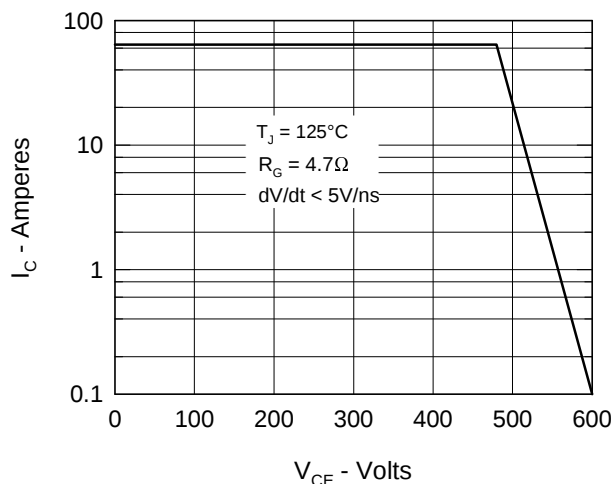
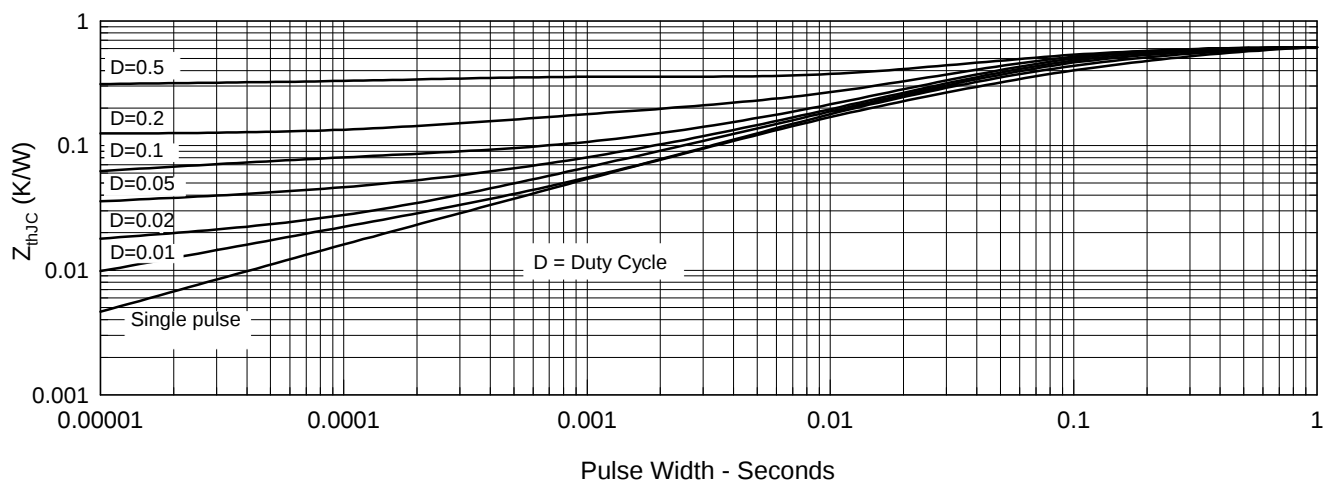


Fig.11 Transient Thermal Resistance



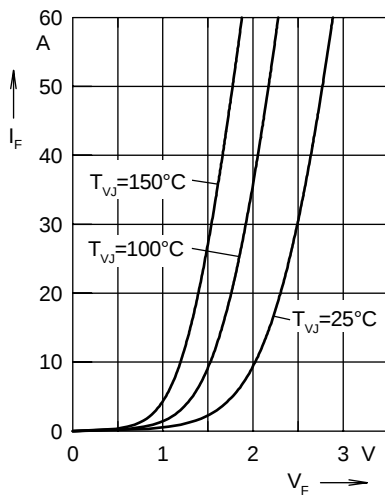


Fig. 12 Forward current I_F versus V_F

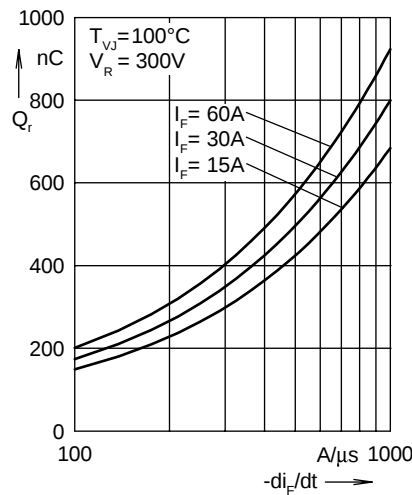


Fig. 13 Reverse recovery charge Q_r versus $-di_F/dt$

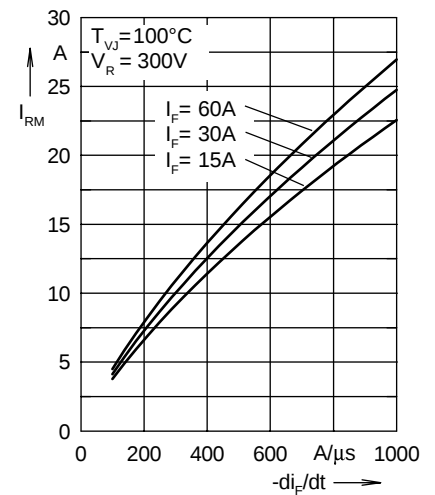


Fig. 14 Peak reverse current I_{RM} versus $-di_F/dt$

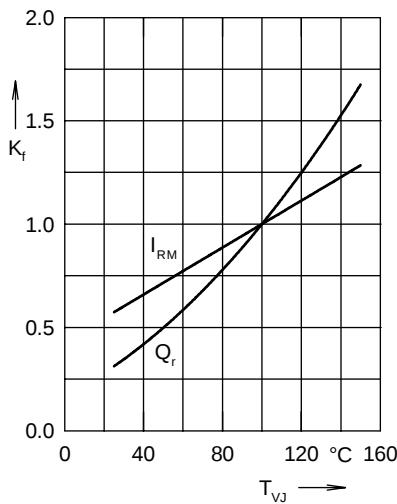


Fig. 15 Dynamic parameters Q_r , I_{RM} versus T_{VJ}

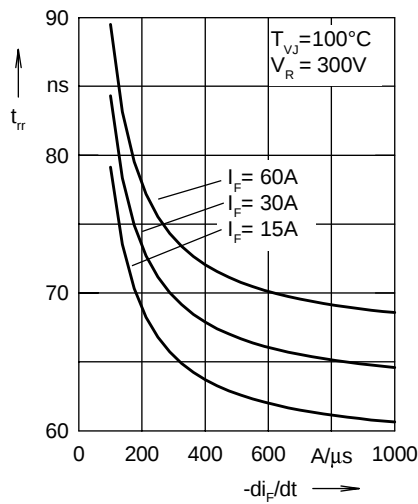


Fig. 16 Recovery time t_{rr} versus $-di_F/dt$

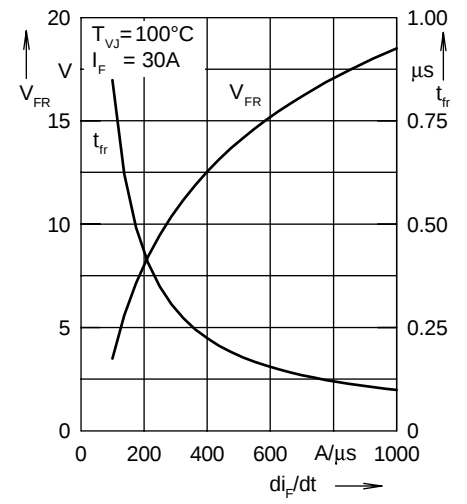


Fig. 17 Peak forward voltage V_{FR} and t_{fr} versus di_F/dt

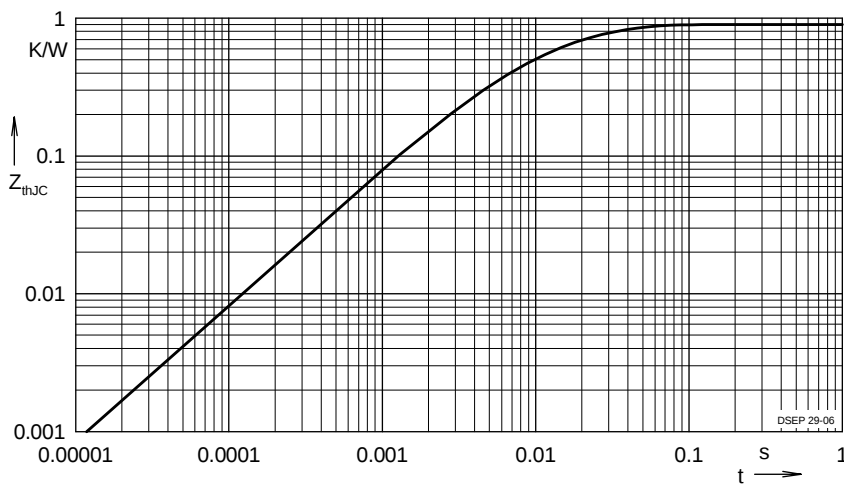


Fig. 18 Transient thermal resistance junction to case

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