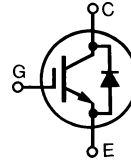


High Speed IGBT with Diode

IXSH 30N60BD1
IXSK 30N60BD1
IXST 30N60BD1

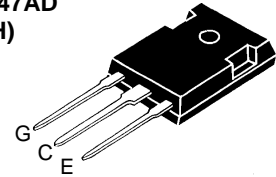
V_{CES} = 600 V
I_{C25} = 55 A
V_{CE(sat)} = 2.0 V
t_{fi} = 140 ns

Short Circuit SOA Capability

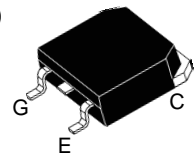


Symbol	Test Conditions	Maximum Ratings	
V _{CES}	T _J = 25°C to 150°C	600	V
V _{CGR}	T _J = 25°C to 150°C; R _{GE} = 1 MΩ	600	V
V _{GES}	Continuous	±20	V
V _{GEM}	Transient	±30	V
I _{C25}	T _C = 25°C	55	A
I _{C90}	T _C = 90°C	30	A
I _{CM}	T _C = 25°C, 1 ms	110	A
SSOA (RBSOA)	V _{GE} = 15 V, T _J = 125°C, 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

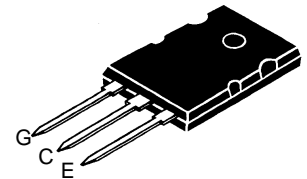
TO-247AD (IXSH)



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 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°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		200 μA
		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

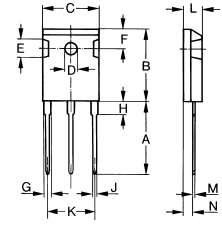
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)			
		min.	typ.	max.	
g_{fs}	$I_C = I_{C90^\circ}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\ \mu\text{s}$, duty cycle $\leq 2\%$	10		S	
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		3100	pF	
C_{oes}			240	pF	
C_{res}			30	pF	
Q_g	$I_C = I_{C90^\circ}$, $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		100	nC	
Q_{ge}			30	nC	
Q_{gc}			38	nC	
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90^\circ}$; $V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 V_{CES}$; $R_G = 4.7\ \Omega$ Note 1.		30	ns	
t_{ri}			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, $T_J = 125^\circ\text{C}$ $I_C = I_{C90^\circ}$; $V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 V_{CES}$; $R_G = 4.7\ \Omega$ Note 1		30	ns	
t_{ri}			35	ns	
E_{on}			0.5	mJ	
$t_{d(off)}$			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		

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

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

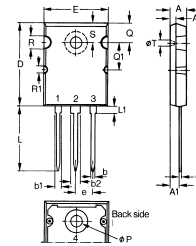
TO-268AA (IXST) (D ³ PAK)			
Dim.	Millimeter Min. Max.	Inches Min. Max.	
A	4.9 5.1	.193 .201	
A ₁	2.7 2.9	.106 .114	
A ₂	.02 .25	.001 .010	
b	1.15 1.45	.045 .057	
b ₂	1.9 2.1	.75 .83	
C	.4 .65	.016 .026	
D	13.80 14.00	.543 .551	
E	15.85 16.05	.624 .632	
E ₁	13.3 13.6	.524 .535	
e	5.45 BSC	.215 BSC	
H	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		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
A ₁	2.54	2.89	.100	.114
A ₂	2.00	2.10	.079	.083
b	1.12	1.42	.044	.056
b ₁	2.39	2.69	.094	.106
b ₂	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
L ₁	2.29	2.59	.090	.102
P	3.17	3.66	.125	.144
Q	6.07	6.27	.239	.247
Q ₁	8.38	8.69	.330	.342
R	3.81	4.32	.150	.170
R ₁	1.78	2.29	.070	.090
S	6.04	6.30	.238	.248
T	1.57	1.83	.062	.072

Min. Recommended Footprint

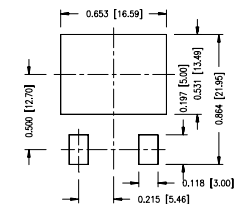


Fig.1 Saturation Characteristics

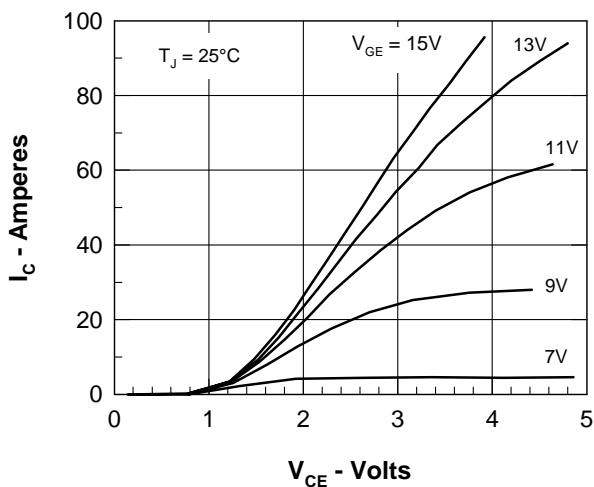


Fig.2 Output Characteristics

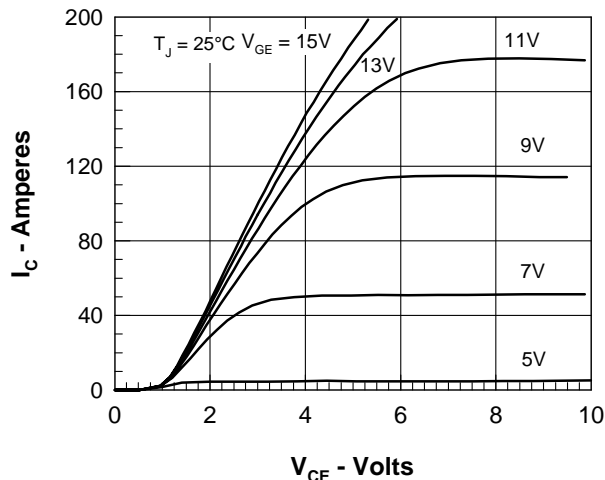


Fig.3 Collector-Emitter Voltage vs. Gate-Emitter Voltage

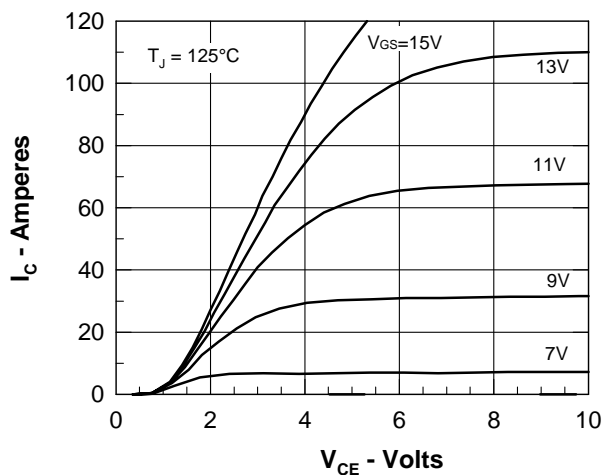


Fig.4 Temperature Dependence of Output Saturation Voltage

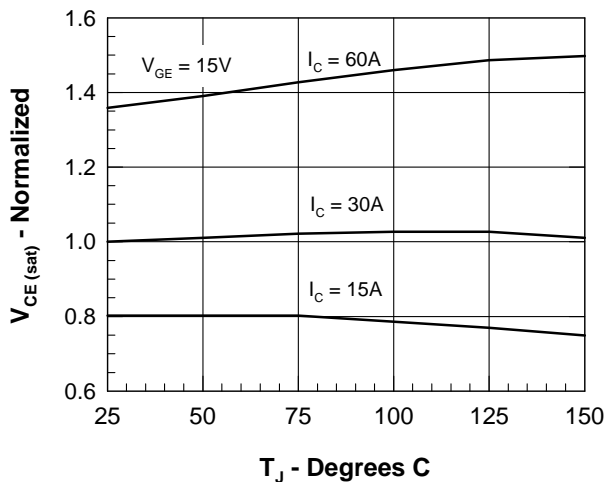


Fig.5 Input Admittance

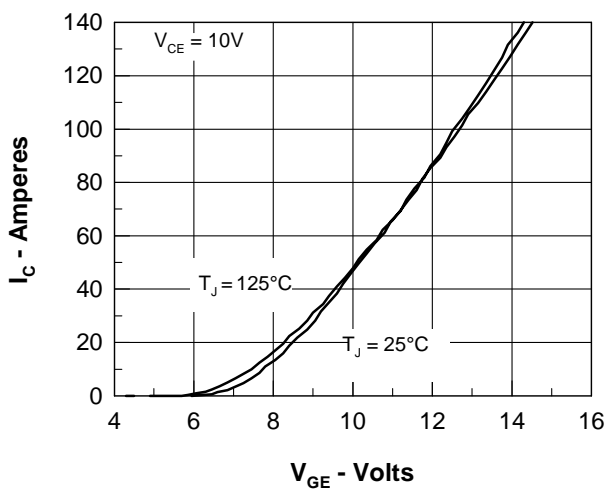


Fig.6 Temperature Dependence of Breakdown and Threshold Voltage

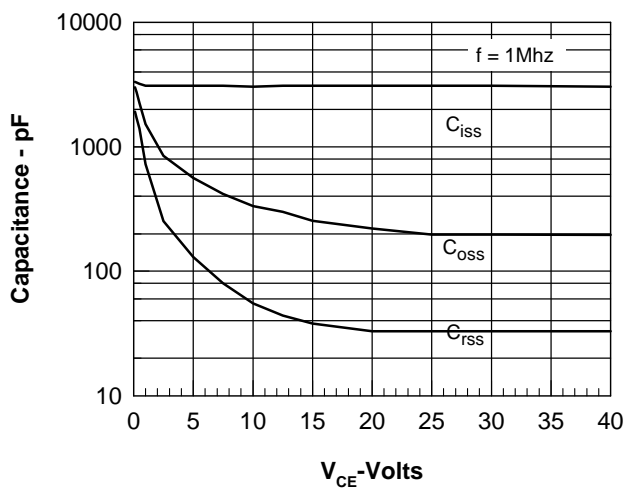


Fig.7 Turn-Off Energy per Pulse and Fall Time on Collector Current

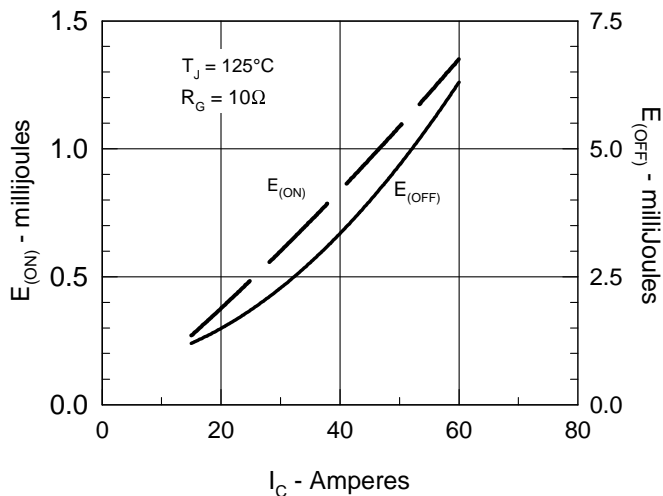
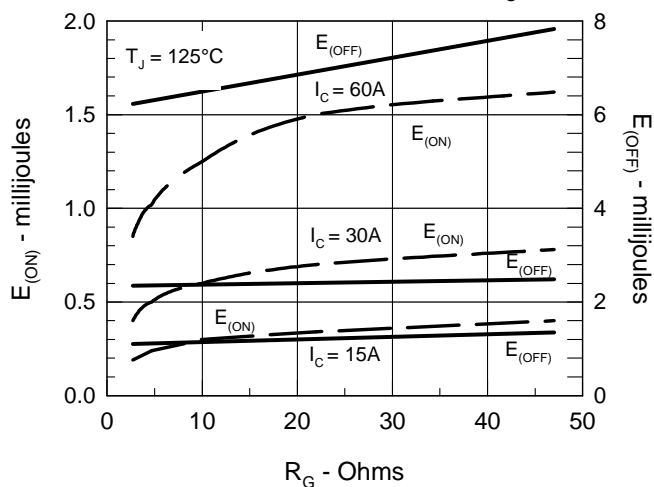

 Fig.8 Dependence of Turn-Off Energy Per Pulse and Fall Time on R_G


Fig.9 Gate Charge Characteristic Curve

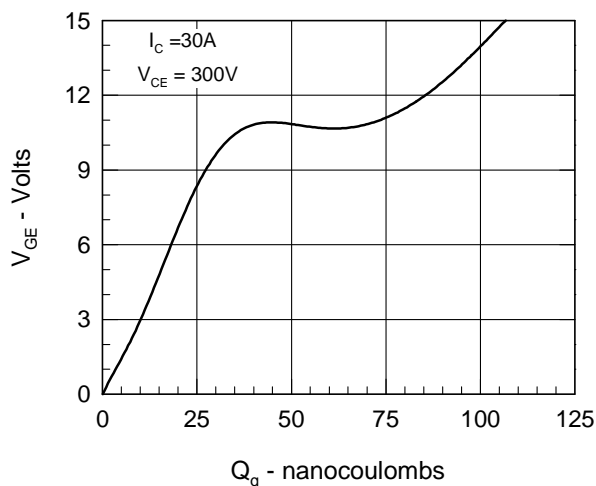


Fig.10 Turn-Off Safe Operating Area

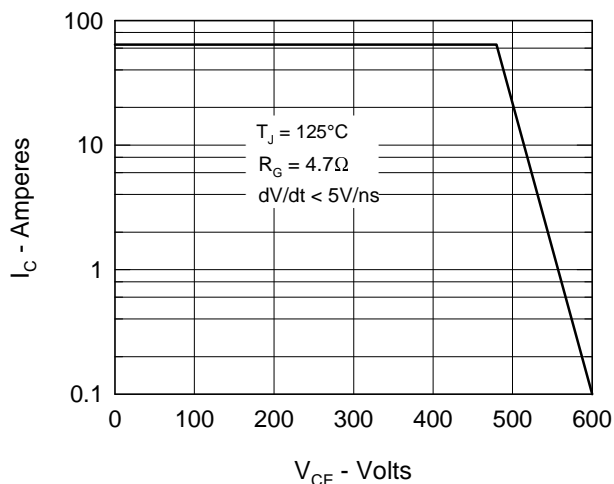
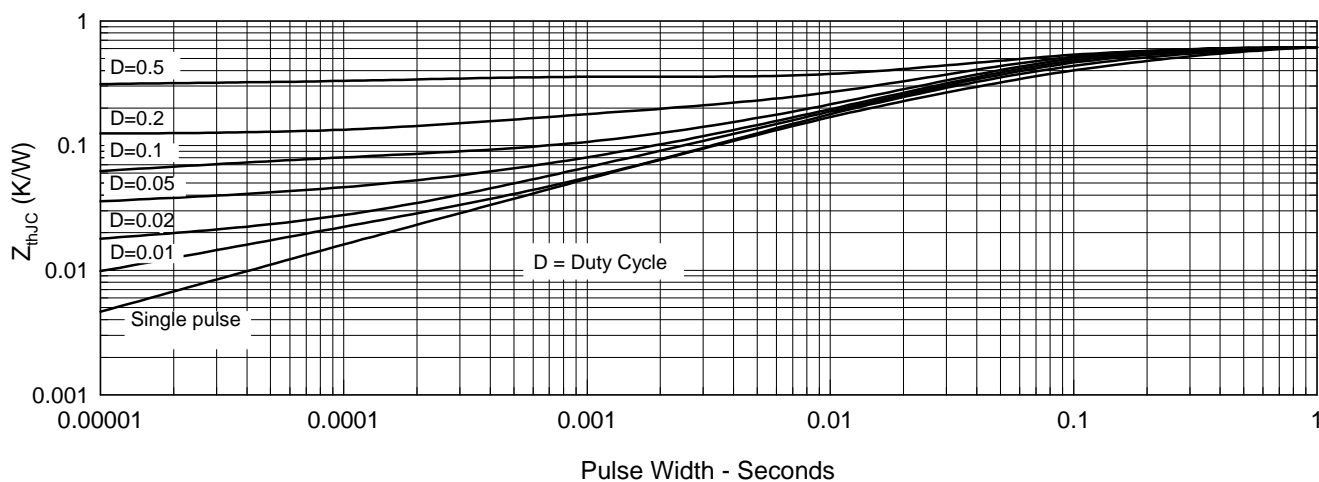


Fig.11 Transient Thermal Resistance



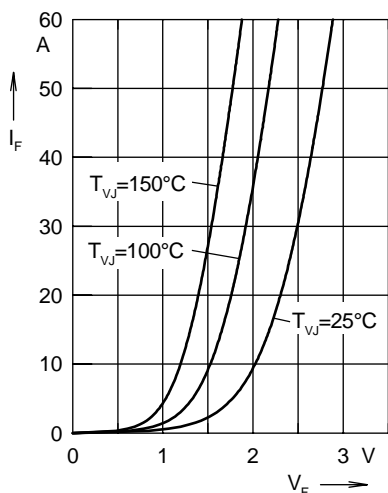


Fig. 12 Forward current I_F versus V_F

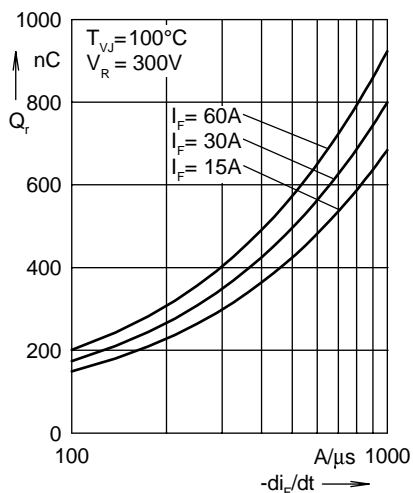


Fig. 13 Reverse recovery charge Q_r versus $-di_F/dt$

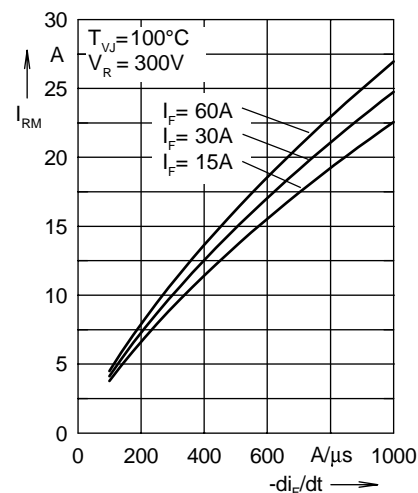


Fig. 14 Peak reverse current I_{RM} versus $-di_F/dt$

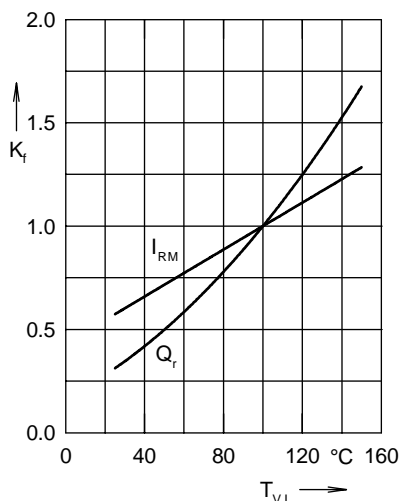


Fig. 15 Dynamic parameters Q_r , I_{RM} versus T_{VJ}

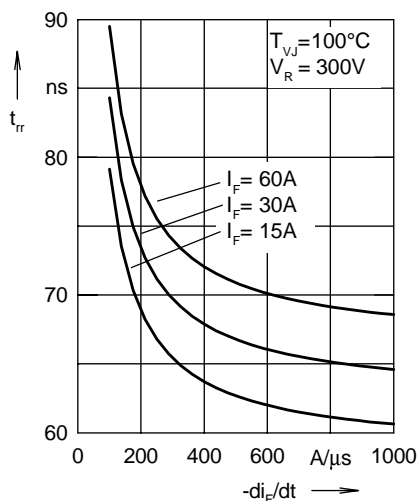


Fig. 16 Recovery time t_{rr} versus $-di_F/dt$

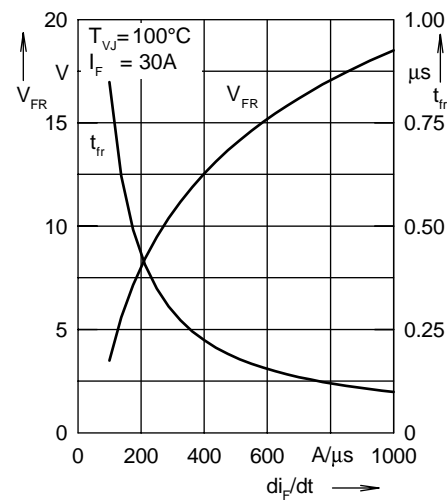


Fig. 17 Peak forward voltage V_{FR} and t_{fr} versus di_F/dt

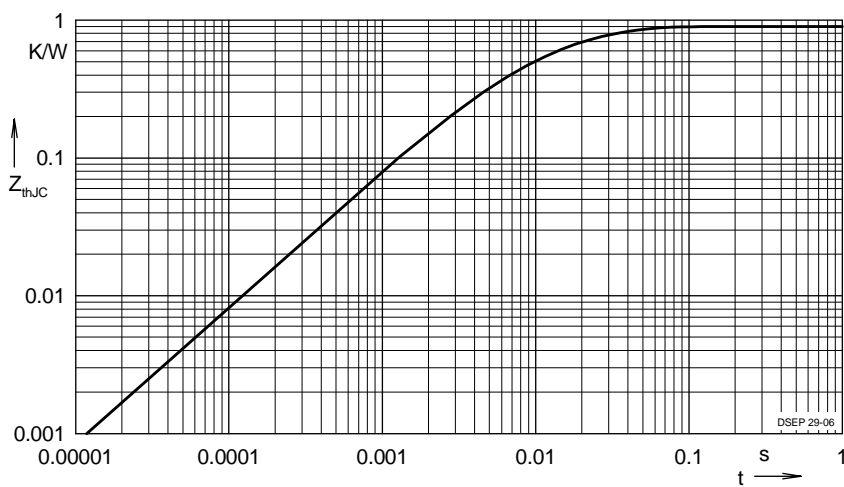


Fig. 18 Transient thermal resistance junction to case

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