

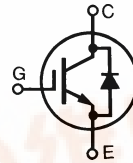


High Speed IGBT with Diode

IXSH 30N60BD1
IXSK 30N60BD1
IXST 30N60BD1

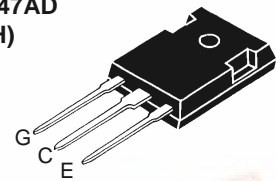
Short Circuit SOA Capability

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

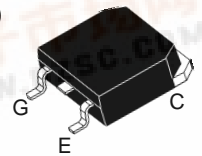


Symbol	Test Conditions	Maximum Ratings	
V_{CES}	$T_J = 25^\circ\text{C}$ to 150°C	600	V
V_{CGR}	$T_J = 25^\circ\text{C}$ to 150°C ; $R_{GE} = 1\text{ M}\Omega$	600	V
V_{GES}	Continuous	± 20	V
V_{GEM}	Transient	± 30	V
I_{C25}	$T_C = 25^\circ\text{C}$	55	A
I_{C90}	$T_C = 90^\circ\text{C}$	30	A
I_{CM}	$T_C = 25^\circ\text{C}$, 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

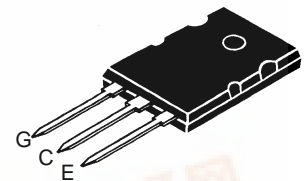
TO-247AD (IXSH)



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		V
I_{CES}	$V_{CE} = 0.8 \cdot V_{CES}$ $V_{GE} = 0\text{ V}$	$T_J = 25^\circ\text{C}$		200 μA
		$T_J = 125^\circ\text{C}$		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



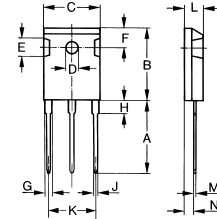
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)			
		min.	typ.	max.	
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\ \mu\text{s}$, duty cycle $\leq 2\%$	10		S	
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		3100	pF	
C_{oes}			240	pF	
C_{res}			30	pF	
Q_g	$I_C = I_{C90}$; $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		100	nC	
Q_{ge}			30	nC	
Q_{gc}			38	nC	
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$ $I_C = I_{C90}$; $V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 V_{CES}$; $R_G = 4.7\ \Omega$ 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, $T_J = 125^\circ\text{C}$ $I_C = I_{C90}$; $V_{GE} = 15\text{ V}$ $V_{CE} = 0.8 V_{CES}$; $R_G = 4.7\ \Omega$ 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	$I_F = I_{C90}$; $V_{GE} = 0\text{ V}$ Note 2			1.7 V 2.5 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 $V_{CE}(\text{Clamp}) > 0.8 \cdot V_{CES}$, higher T_J or increased R_G .
2. Pulse test, $t \leq 300\ \mu\text{s}$, duty cycle $d \leq 2\%$

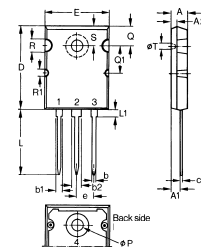
TO-268AA (IXST) (D ³ PAK)		Dim.	Millimeter Min. Max.	Inches Min. Max.	
	A	4.9	5.1	.193	.201
	A ₁	2.7	2.9	.106	.114
	A ₂	.02	.25	.001	.010
	b	1.15	1.45	.045	.057
	b ₂	1.9	2.1	.75	.83
	C	.4	.65	.016	.026
	D	13.80	14.00	.543	.551
	E	15.85	16.05	.624	.632
	E ₁	13.3	13.6	.524	.535
	e	5.45 BSC		.215 BSC	
	H	18.70	19.10	.736	.752
	L	2.40	2.70	.094	.106
	L ₁	1.20	1.40	.047	.055
	L ₂	1.00	1.15	.039	.045
L ₃	0.25 BSC		.010 BSC		
L ₄	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
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

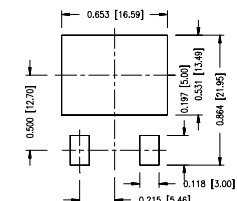


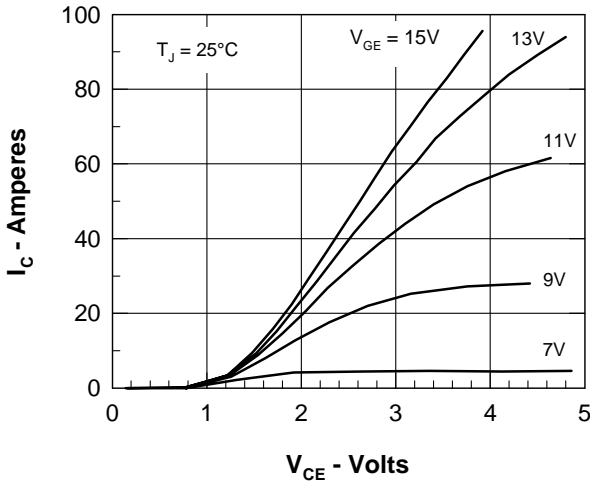
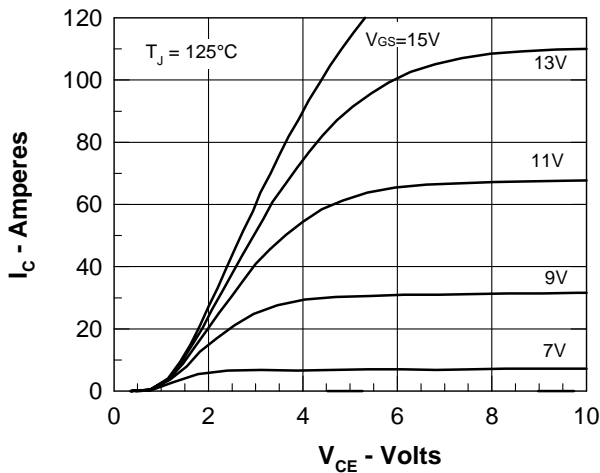
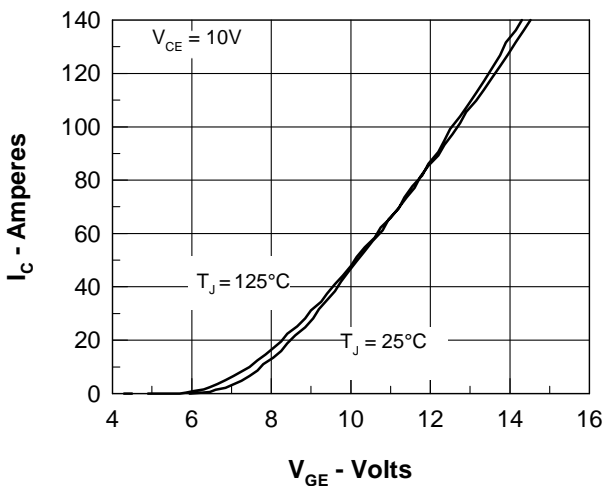
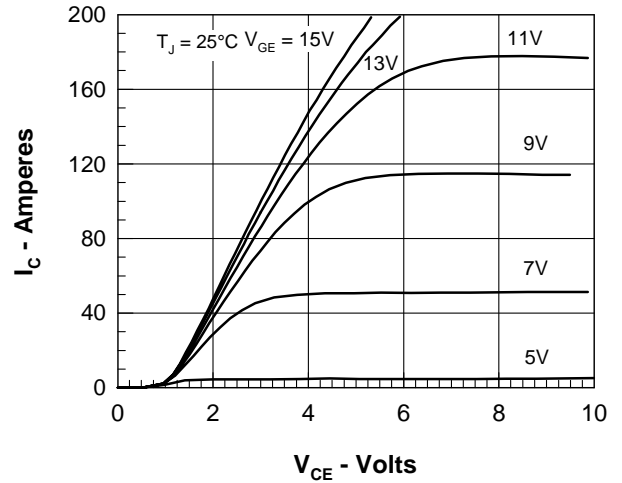
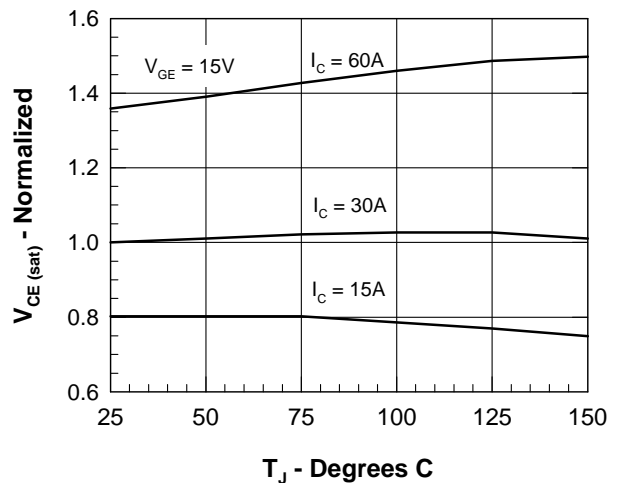
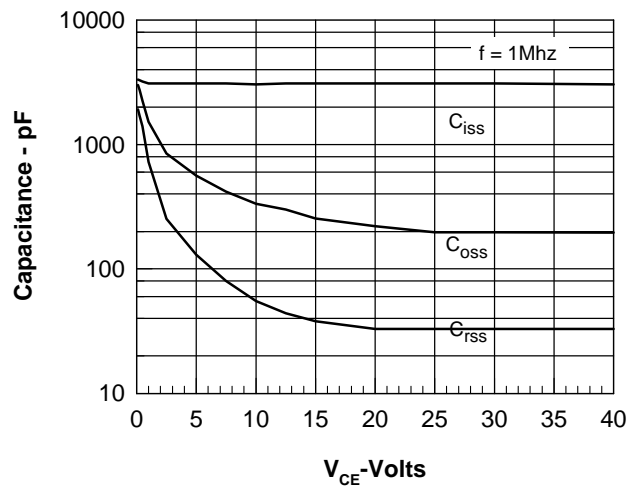
Fig.1 Saturation Characteristics

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

Fig.5 Input Admittance

Fig.2 Output Characteristics

Fig.4 Temperature Dependence of Output Saturation Voltage

Fig.6 Temperature Dependence of Breakdown and Threshold Voltage


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

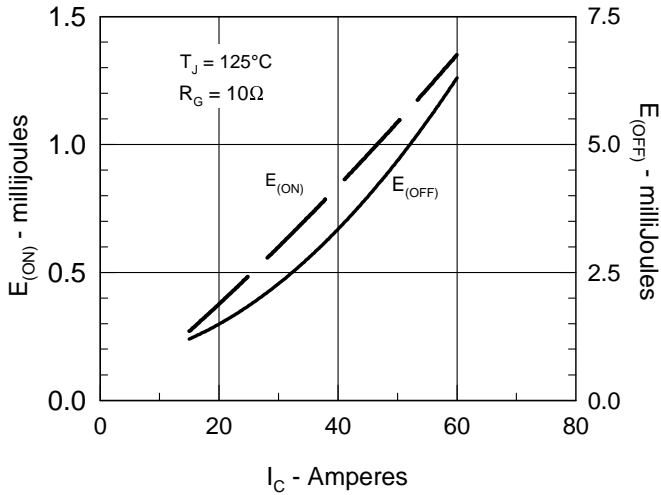


Fig.8 Dependence of Turn-Off Energy Per Pulse and Fall Time on R_G

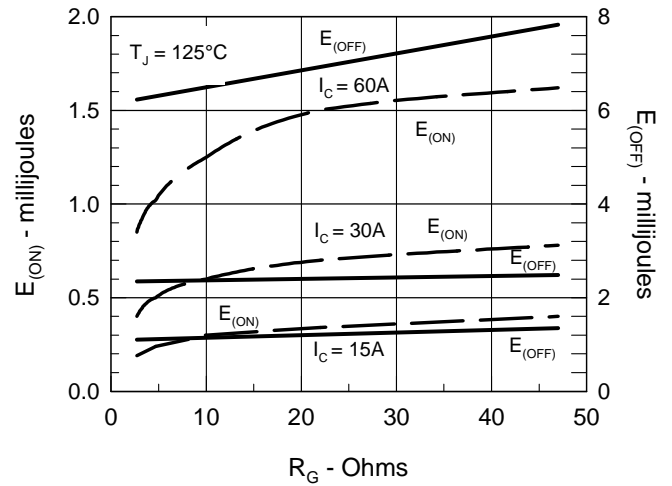


Fig.9 Gate Charge Characteristic Curve

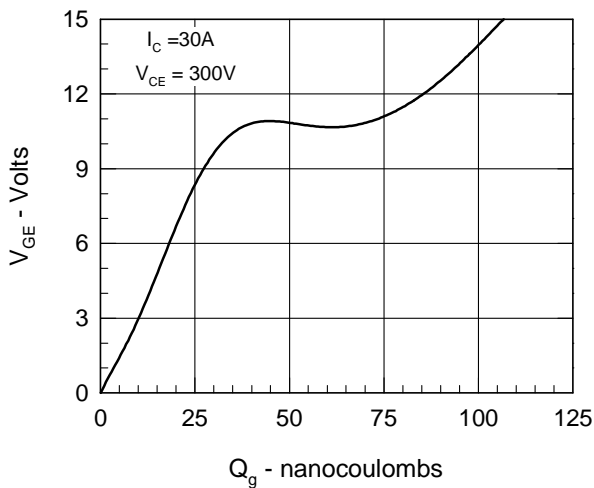


Fig.10 Turn-Off Safe Operating Area

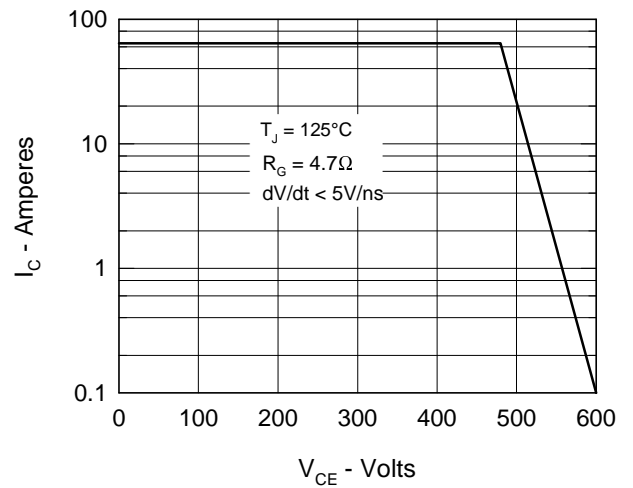
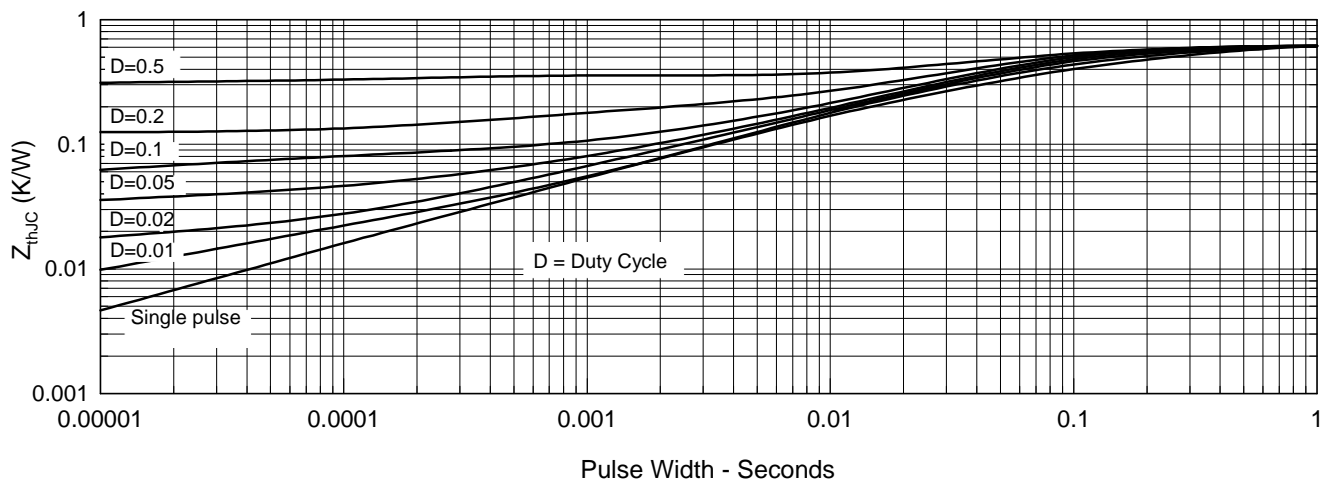


Fig.11 Transient Thermal Resistance



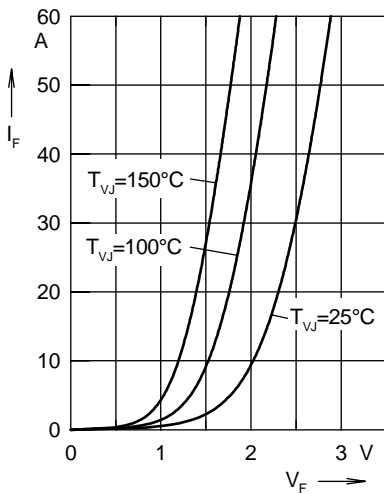


Fig. 12 Forward current I_F versus V_F

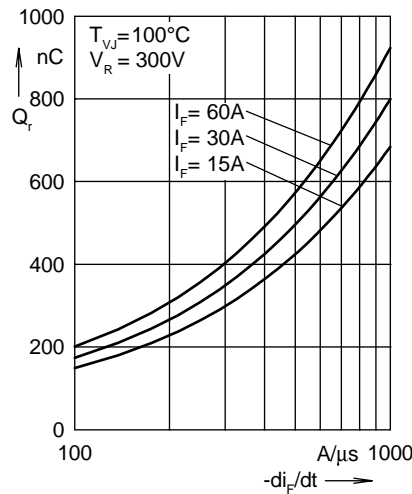


Fig. 13 Reverse recovery charge Q_r versus $-di_F/dt$

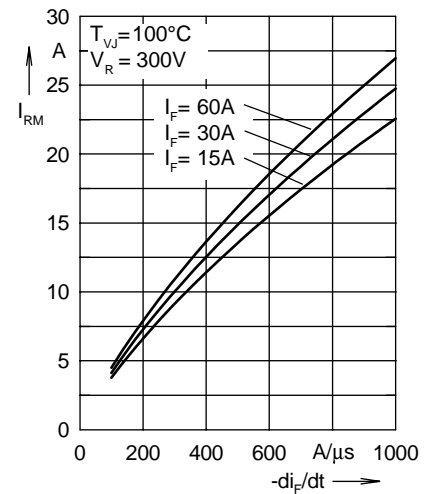


Fig. 14 Peak reverse current I_{RM} versus $-di_F/dt$

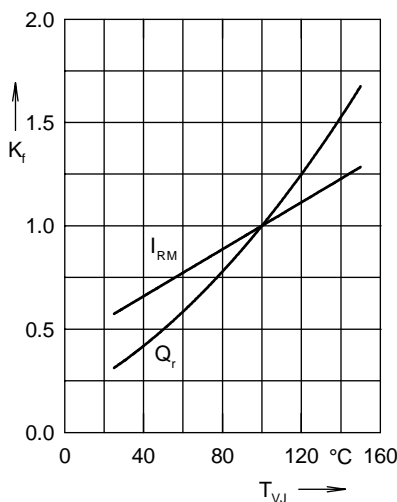


Fig. 15 Dynamic parameters Q_r , I_{RM} versus T_{VJ}

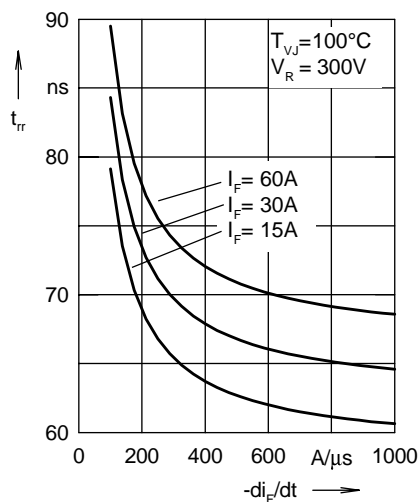


Fig. 16 Recovery time t_{tr} versus $-di_F/dt$

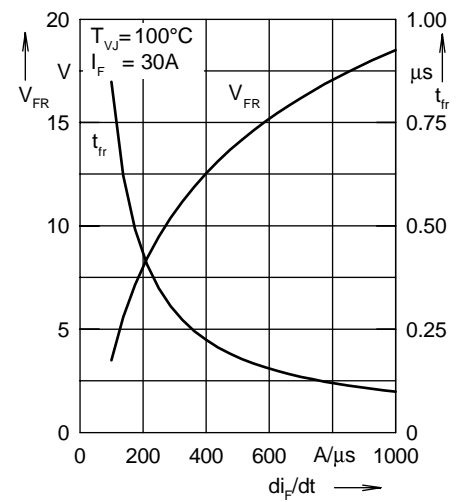


Fig. 17 Peak forward voltage V_{FR} and t_{tr} versus di_F/dt

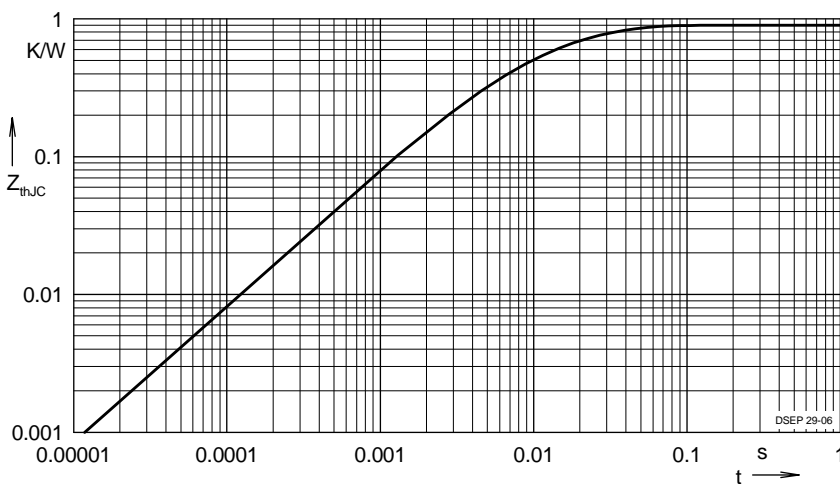


Fig. 18 Transient thermal resistance junction to case

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