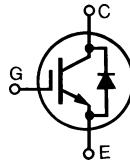


IGBT with Diode

IXSK 50N60BU1
IXSX 50N60BU1

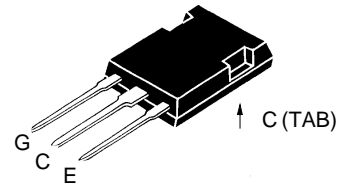
V_{CES} = 600 V
I_{C25} = 75 A
V_{CE(sat)} = 2.5 V

Short Circuit SOA Capability

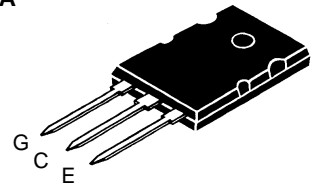


Symbol	Test Conditions	Maximum Ratings	
V _{CES}	T _J = 25°C to 150°C	600	V
V _{CGR}	T _J = 25°C to 150°C; R _{GE} = 1 MΩ	600	V
V _{GES}	Continuous	±20	V
V _{GEM}	Transient	±30	V
I _{C25}	T _C = 25°C, limited by leads	75	A
I _{C90}	T _C = 90°C	50	A
I _{CM}	T _C = 25°C, 1 ms	200	A
SSOA (RBSOA)	V _{GE} = 15 V, T _{VJ} = 125°C, R _G = 22 Ω Clamped inductive load, L = 30 μH	I _{CM} = 100 @ 0.8 V _{CES}	A
t_{SC} (SCSOA)	V _{GE} = 15 V, V _{CE} = 360 V, T _J = 125°C R _G = 22 Ω, non repetitive	10	μs
P _C	T _C = 25°C	300	W
T _J		-55 ... +150	°C
T _{JM}		150	°C
T _{stg}		-55 ... +150	°C
M _d	Mounting torque	0.9/6	Nm/lb.in.
Weight		10	g
	Maximum lead temperature for soldering 1.6 mm (0.062 in.) from case for 10 s	300	°C

PLUS247 (IXSX)



TO-264 AA (IXSK)



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

Features

- International standard package JEDEC TO-264 AA, and hole-less TO-247 package for clip mounting
- Guaranteed Short Circuit SOA capability
- High frequency IGBT and anti-parallel FRED in one package
- Latest generation HDMOS™ process
- Low V_{CE(sat)}
 - for minimum on-state conduction losses
- MOS Gate turn-on
 - drive simplicity
- Fast Recovery Epitaxial Diode (FRED)
 - soft recovery with low I_{RM}

Applications

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

Advantages

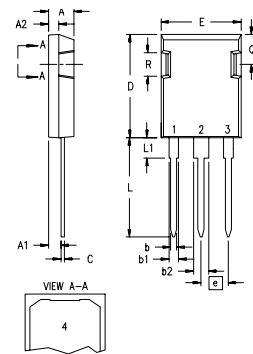
- Space savings (two devices in one package)
- Easy to mount with 1 screw (isolated mounting screw hole)
- Reduces assembly time and cost

Symbol	Test Conditions	Characteristic Values (T _J = 25°C, unless otherwise specified)		
		min.	typ.	max.
BV _{CES}	I _C = 3 mA, V _{GE} = 0 V	600		V
V _{GE(th)}	I _C = 4 mA, V _{CE} = V _{GE}	4		V
I _{CES}	V _{CE} = 0.8 • V _{CES} V _{GE} = 0 V			325 μA 17 mA
I _{GES}	V _{CE} = 0 V, V _{GE} = ±20 V			±100 nA
V _{CE(sat)}	I _C = I _{C90} ; V _{GE} = 15 V,	2.2	2.5	V

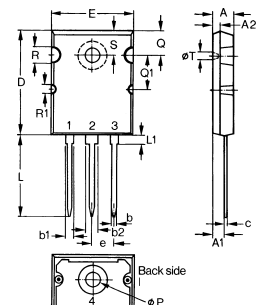
Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
g_{fs}	$I_C = I_{C90}$; $V_{CE} = 10\text{ V}$, Pulse test, $t \leq 300\ \mu\text{s}$, duty cycle $\leq 2\%$	20	23	S
$I_{C(on)}$	$V_{GE} = 15\text{ V}$, $V_{CE} = 10\text{ V}$		160	A
C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 1\text{ MHz}$		3850	pF
C_{oes}			440	pF
C_{res}			50	pF
Q_g	$I_C = I_{C90}$; $V_{GE} = 15\text{ V}$, $V_{CE} = 0.5 V_{CES}$		167	nC
Q_{ge}			45	nC
Q_{gc}			88	nC
$t_{d(on)}$	Inductive load, $T_J = 25^\circ\text{C}$		70	ns
t_{ri}	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\ \mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = 2.7\ \Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_J or increased R_G		70	ns
$t_{d(off)}$			150	300 ns
t_{fi}			150	300 ns
E_{off}			3.3	6.0 mJ
$t_{d(on)}$	Inductive load, $T_J = 125^\circ\text{C}$		70	ns
t_{ri}	$I_C = I_{C90}$, $V_{GE} = 15\text{ V}$, $L = 100\ \mu\text{H}$, $V_{CE} = 0.8 V_{CES}$, $R_G = 2.7\ \Omega$ Remarks: Switching times may increase for V_{CE} (Clamp) $> 0.8 \cdot V_{CES}$, higher T_J or increased R_G		70	ns
E_{on}			2.5	mJ
$t_{d(off)}$			230	ns
t_{fi}			230	ns
E_{off}			4.8	mJ
R_{thJC}				0.42 K/W
R_{thCK}			0.15	K/W

Reverse Diode (FRED)

Symbol	Test Conditions	Characteristic Values ($T_J = 25^\circ\text{C}$, unless otherwise specified)		
		min.	typ.	max.
V_F	$I_F = I_{C90}$; $V_{GE} = 0\text{ V}$, Pulse test, $t \leq 300\ \mu\text{s}$, duty cycle $d \leq 2\%$		1.8	V
I_{RM}	$I_F = I_{C90}$; $V_{GE} = 0\text{ V}$, $-di_F/dt = 480\text{ A}/\mu\text{s}$ $V_R = 360\text{ V}$ $T_J = 125^\circ\text{C}$ $I_F = 1\text{ A}$; $-di/dt = 200\text{ A}/\mu\text{s}$; $V_R = 30\text{ V}$ $T_J = 25^\circ\text{C}$		19	33 A
t_{rr}			175	ns
			35	50 ns
R_{thJC}				0.75 K/W

PLUS247™ (IXSX)


Dim.	Millimeter		Inches	
	Min.	Max.	Min.	Max.
A	4.83	5.21	.190	.205
A ₁	2.29	2.54	.090	.100
A ₂	1.91	2.16	.075	.085
b	1.14	1.40	.045	.055
b ₁	1.91	2.13	.075	.084
b ₂	2.92	3.12	.115	.123
C	0.61	0.80	.024	.031
D	20.80	21.34	.819	.840
E	15.75	16.13	.620	.635
e	5.45 BSC		.215 BSC	
L	19.81	20.32	.780	.800
L1	3.81	4.32	.150	.170
Q	5.59	6.20	.220	.244
R	4.32	4.83	.170	.190

TO-264 AA 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
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

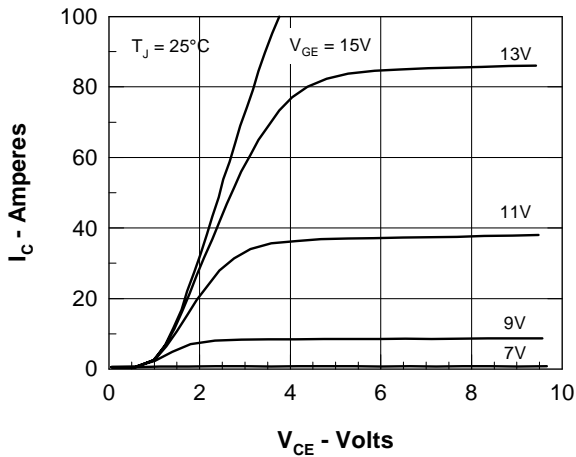


Figure 1. Saturation Voltage Characteristics

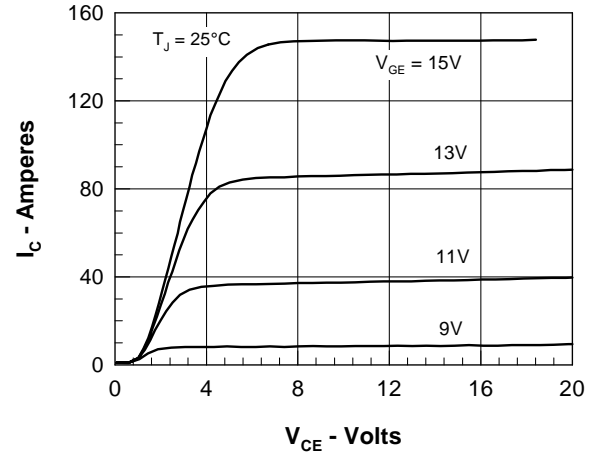


Figure 2. Extended Output Characteristics

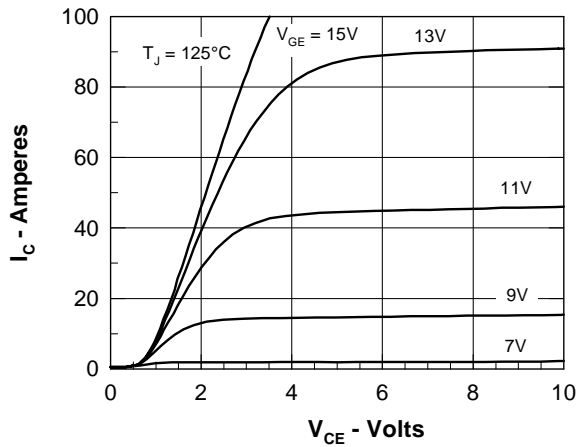


Figure 3. Saturation Voltage Characteristics

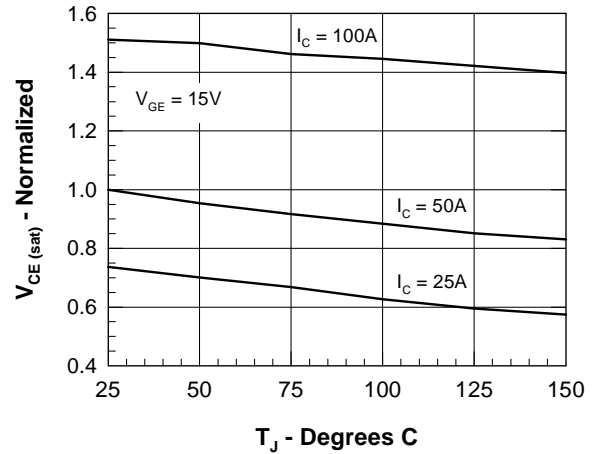
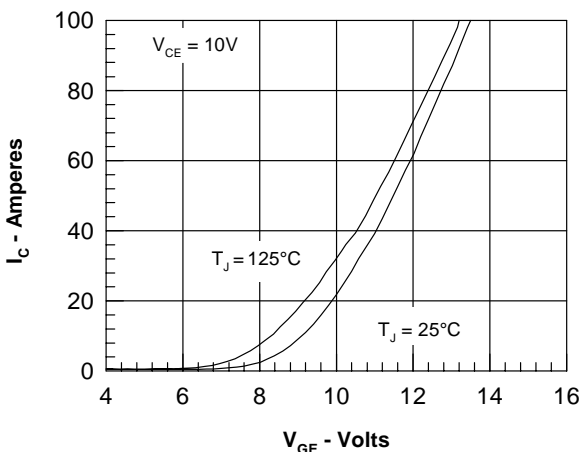

 Figure 4. Temperature Dependence of $V_{CE(sat)}$


Figure 5. Admittance Curves

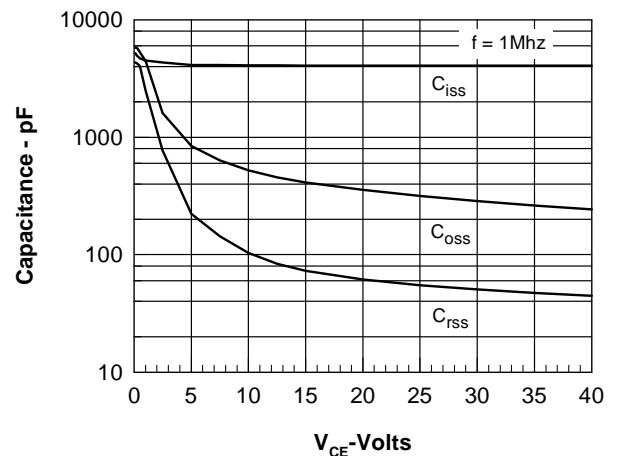


Figure 6. Capacitance Curves

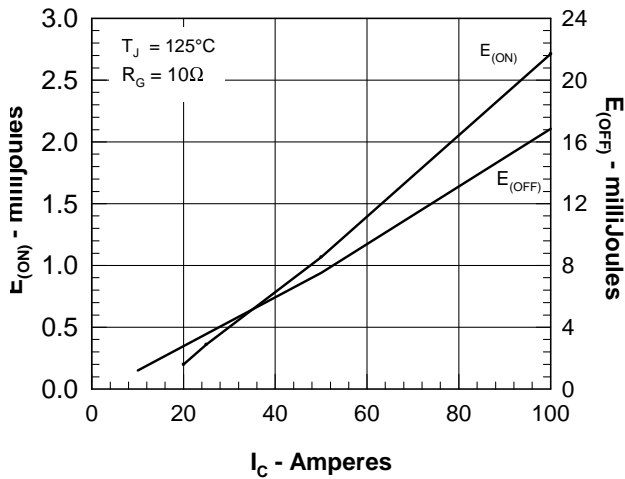


Figure 7. Dependence of E_{ON} and E_{OFF} on I_C .

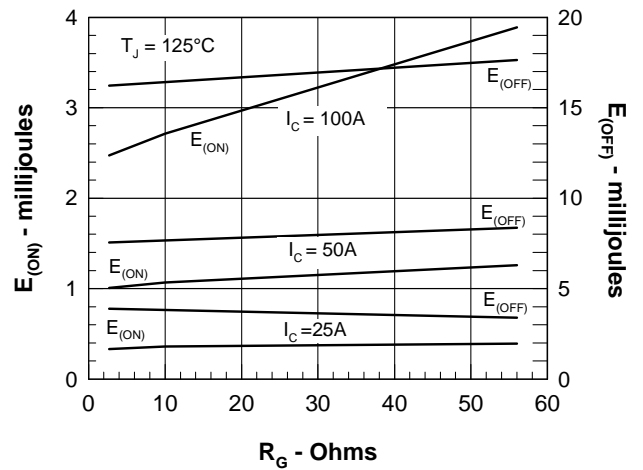


Figure 8. Dependence of E_{ON} and E_{OFF} on R_G .

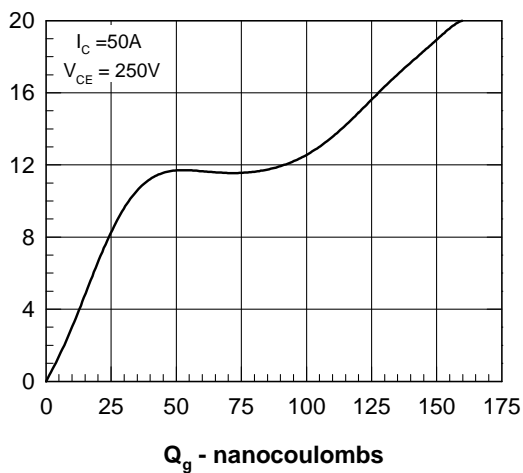


Figure 9. Gate Charge

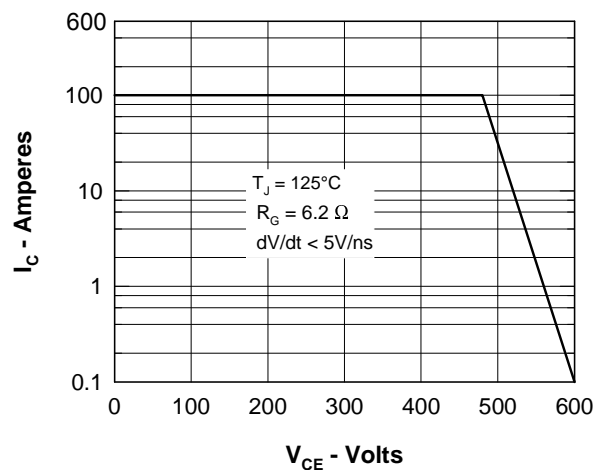


Figure 10. Turn-off Safe Operating Area

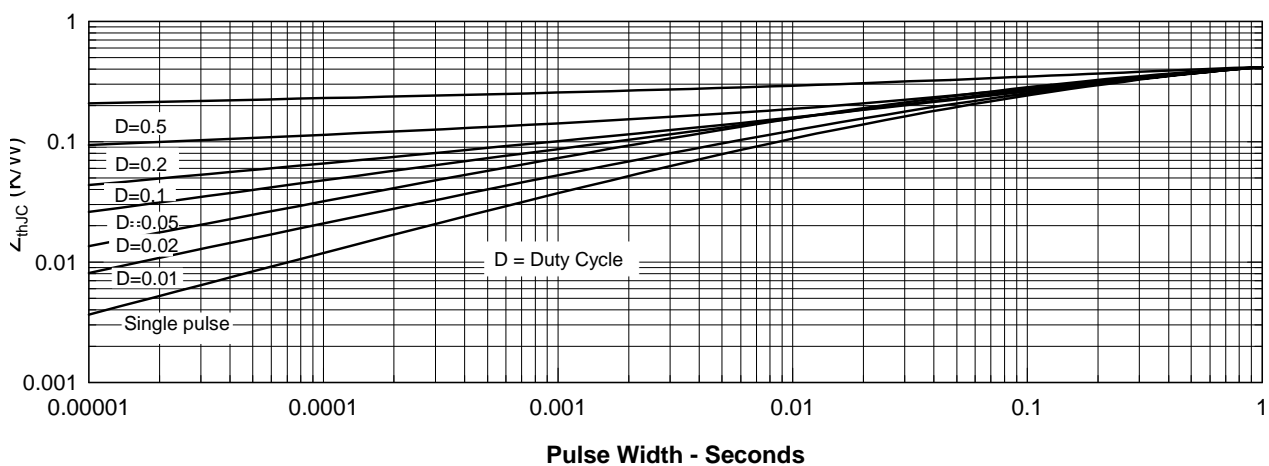


Figure 11. Transient Thermal Resistance

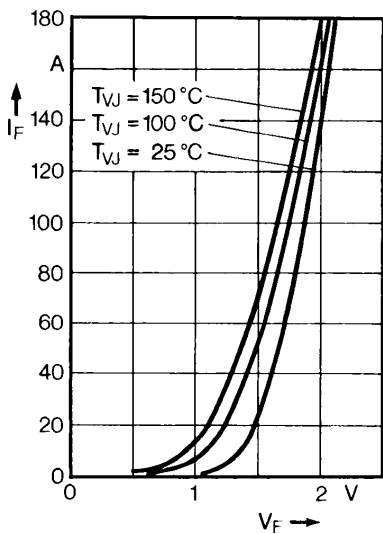


Fig. 12 Forward current versus voltage drop.

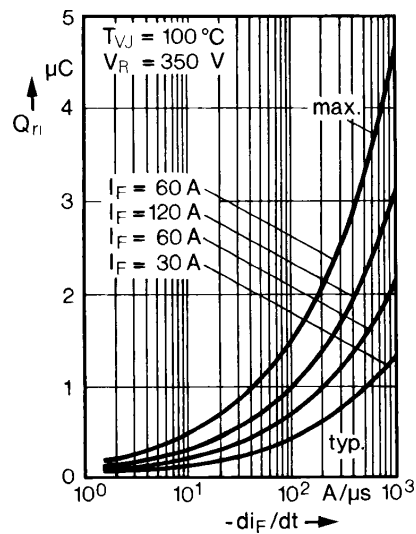


Fig. 13 Recovery charge versus $-di_F/dt$.

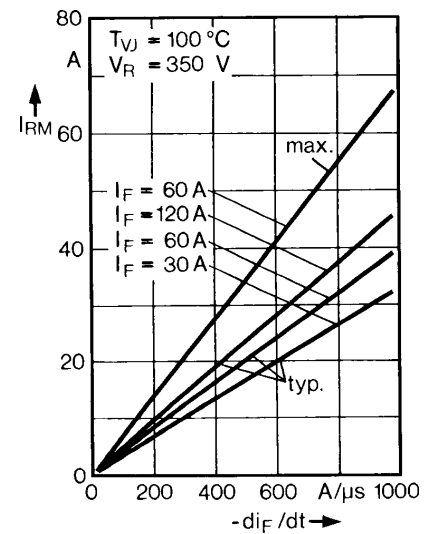


Fig. 14 Peak reverse current versus $-di_F/dt$.

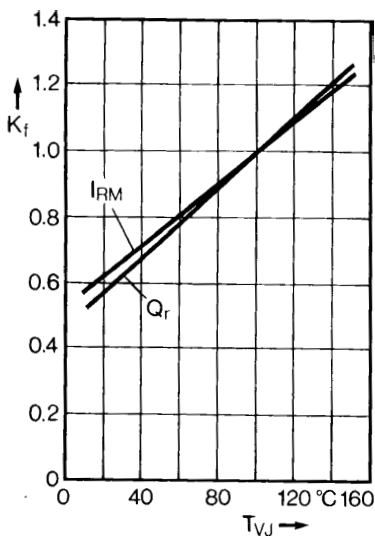


Fig. 15. Dynamic parameters versus junction temperature.

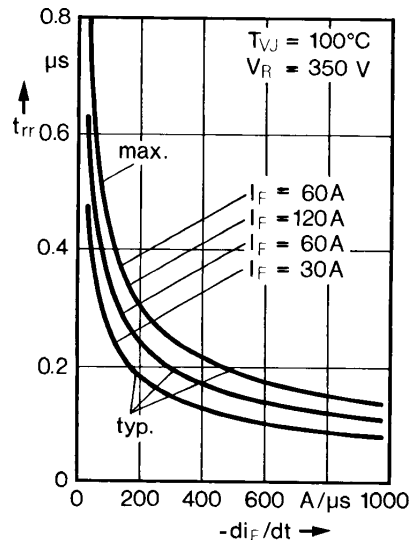


Fig. 16 Recovery time versus $-di_F/dt$.

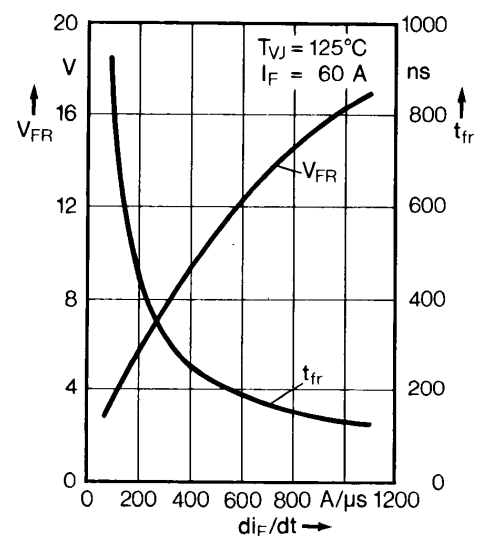


Fig. 17 Peak forward voltage vs. di_F/dt .

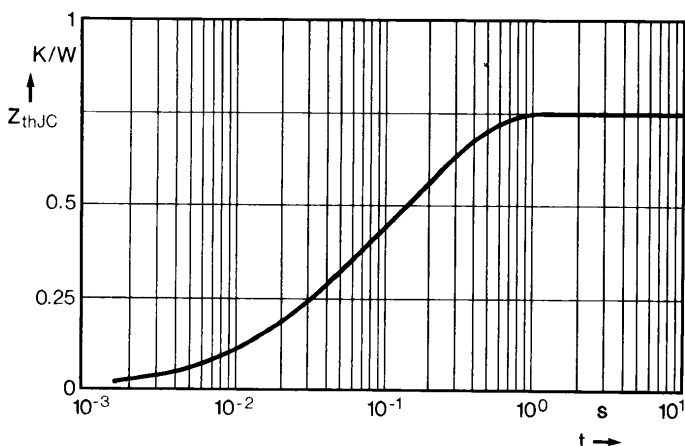


Fig. 18 Transient thermal impedance junction to case.

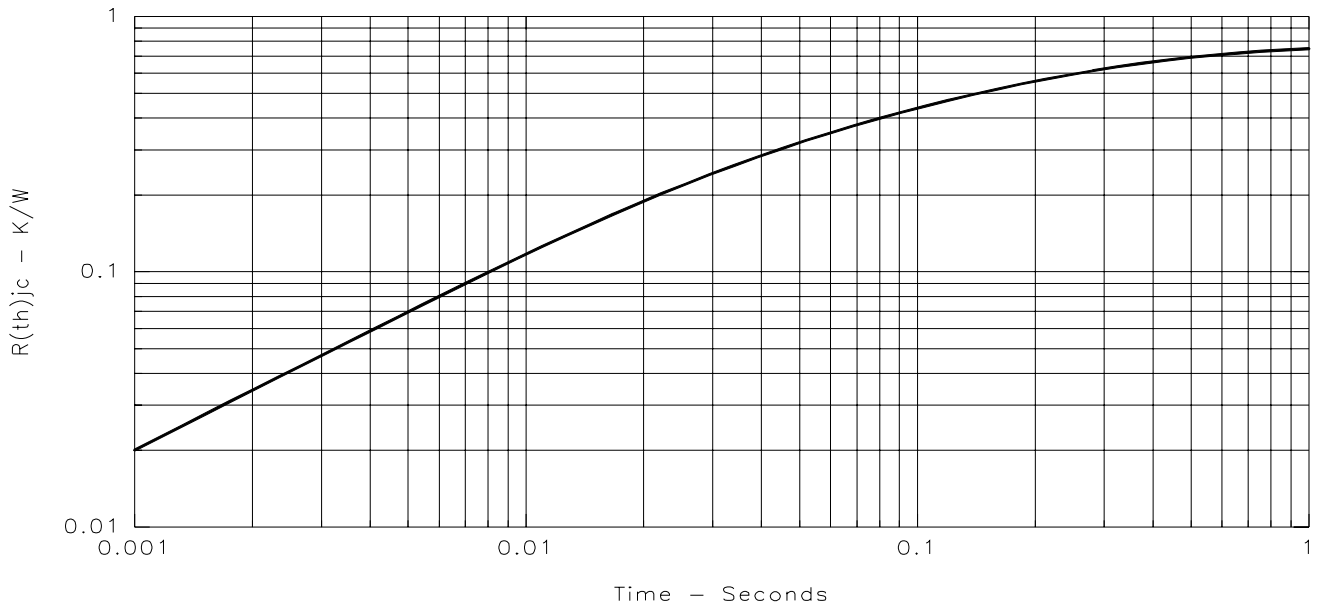


Fig. 18. Diode transient thermal resistance junction-to-case.