ULTRA FAST-RECOVERY DOUBLE RECTIFIER DIODES FEATURING LOW REVERSE LEAKAGE

Glass-passivated, high-efficiency epitaxial rectifier diodes in plastic envelopes, featuring low reverse leakage current, low forward voltage drop, ultra fast reverse recovery times with very low stored charge and soft recovery characteristics. They are intended for use in switched-mode power supplies and high frequency circuits in general, where both low conduction and low switching losses are essential. Their single chip construction ensures excellent matching of the forward and switching characteristics of the two halves, allowing parallel operation without the need for derating. The series consists of common-cathode types.

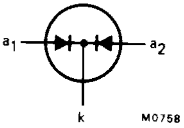
QUICK REFERENCE DATA

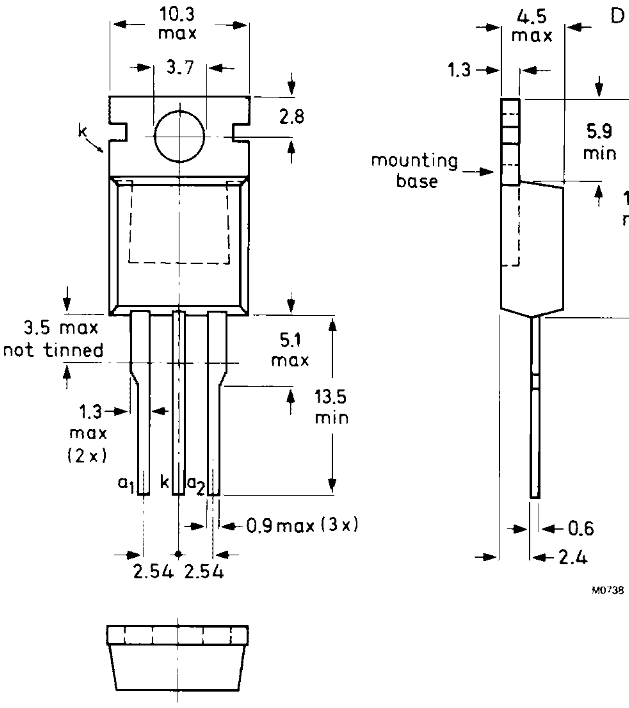
Per diode, unless otherwise stated			BYP22-50	100	150	200	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	200	V
Output current (both diodes conducting)	I_O	max.	20				A
Forward voltage	V_F	<	0.895				V
Reverse recovery time	t_{rr}	<	25				ns
Reverse leakage current	I_R	<	5				µA

MECHANICAL DATA

Fig.1 TO-220AB

Dimensions in mm





Net mass: 2 g

Accessories supplied on request: see data sheets Mounting instructions and accessories for TO-220 envelopes.

RATINGS

Limiting values in accordance with the Absulute Maximum System (IEC 134).

Voltages			BYP22-50	100	150	200	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	200	V
Crest working reverse voltage	V_{RWM}	max.	50	100	150	200	V
Continuous reverse voltage	V_R	max.	50	100	150	200	V

Currents (both diodes conducting; note 1)

Output current; switching losses negligible up to 500 kHz; square wave; $\delta = 0.5$; up to $T_{mb} = 150\ ^{o}C$	I_O	max.	16	A
square wave; $\delta = 0.5$; up to $T_{mb} = 143\ ^{o}C$	I_O	max.	20	A
sinusoidal; up to $T_{mb} = 150\ ^{o}C$	I_O	max.	16	A
R.M.S. forward current	$I_{F(RMS)}$	max.	20	A
Repetitive peak forward current $t_p = 20\ \mu s$; $\delta = 0.02$ (note 2)	I_{FRM}	max.	230	A
Non-repetitive peak forward current half sine-wave; $T_j = 175\ ^{o}C$ prior to surge; with reapplied V_{RWM}max. (note 2)				
$t = 10$ ms	I_{FSM}	max.	140	A
$t = 8.3$ ms	I_{FSM}	max.	150	A
I^2t for fusing ($t = 10$ ms; note 2)	I^2t	max.	98	A^2s

Temperatures

Storage temperature	T_{stg}		−65 to +175	^{o}C
Junction temperature	T_j	max.	175	^{o}C

Notes

1. The limits for both diodes apply whether both diodes conduct simultaneously or on alternate half cycles.
2. Figures apply to each diode.

THERMAL RESISTANCE

From junction to mounting base; total package	$R_{th\ j\text{-}mb}$	=	1.6	K/W
per diode	$R_{th\ j\text{-}mb}$	=	2.4	K/W

Influence of mounting method

1. Heatsink mounted with clip (see mounting instructions)

Thermal resistance from mounting base to heatsink

a. with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.3	K/W
b. with heatsink compound and 0.06 mm maximum mica insulator	$R_{th\ mb\text{-}h}$	=	1.4	K/W
c. with heatsink compound and 0.1 mm maximum mica washer (56369)	$R_{th\ mb\text{-}h}$	=	2.2	K/W
d. with heatsink compound and 0.25 mm maximum alumina insulator (56367)	$R_{th\ mb\text{-}h}$	=	0.8	K/W
e. without heatsink compound	$R_{th\ mb\text{-}h}$	=	1.4	K/W

2. Free air operation

The quoted values of $R_{th\ j\text{-}a}$ should be used only when no leads of other dissipating components run to the same tie point.

Thermal resistance from junction to ambient in free air:

mounted on a printed circuit board at any lead length	$R_{th\ j\text{-}a}$		60	K/W

CHARACTERISTICS

Forward voltage				
$I_F = 8$ A; $T_j = 100$ °C	V_F	<	0.895	V*
$I_F = 8$ A; $T_j = 25$ °C	V_F	<	0.975	V*
$I_F = 20$ A; $T_j = 25$ °C	V_F	<	1.15	V*
Reverse current				
$V_R = V_{RWMmax}$; $T_j = 175$ °C	I_R	<	500	μA
$T_j = 125$ °C	I_R	<	250	μA
$T_j = 100$ °C	I_R	<	50	μA
$T_j = 25$ °C	I_R	<	5	μA
Reverse recovery when switched from $I_F = 1$ A to $V_R \geqslant 30$ V with $-dI_F/dt = 100$ A/μs; $T_j = 25$ °C; recovery time	t_{rr}	<	25	ns
Step reverse recovery when switched from $I_F = 0.5$ A to $I_R = 1$ A, measured at $I_{RR} = 0.25$ A; recovery time	t_{rr}	<	25	ns
$I_F = 2$ A to $V_R \geqslant 30$ V with $-dI_F/dt = 20$ A/μs; $T_j = 25$ °C; recovered charge	Q_s	<	15	nC
$I_F = 10$ A to $V_R \geqslant 30$ V with $-dI_F/dt = 50$ A/μs; $T_j = 100$ °C; peak recovery current	I_{RRM}	<	2	A
Forward recovery when switched to $I_F = 1$ A with $dI_F/dt = 10$ A/μs; $T_j = 25$ °C	V_{fr}	typ.	0.9	V

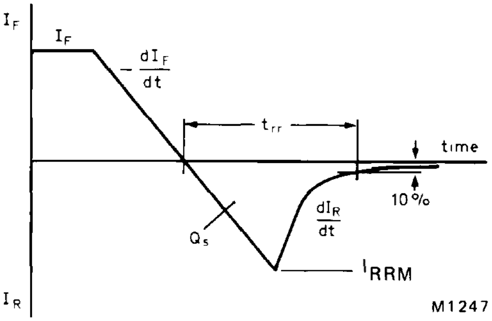


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

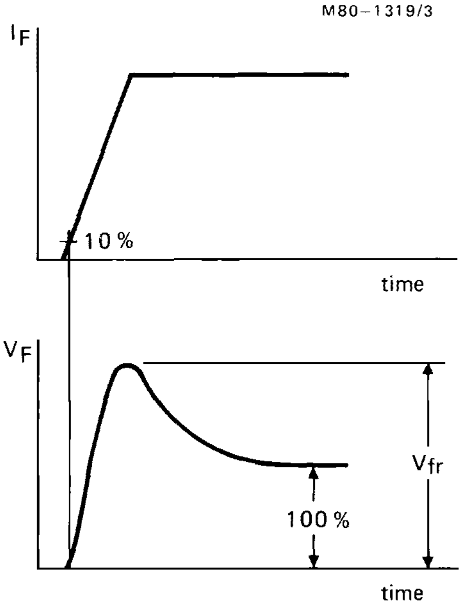


Fig.3 Definition of V_{fr}.

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*Measured under pulse conditions to avoid excessive dissipation.

MOUNTING INSTRUCTIONS

1. The device may be soldered directly into the circuit, but the maximum permissible temperature of the soldering iron or bath is 275 °C; the heat source must not be in contact with the joint for more than 5 seconds. Soldered joints must be at least 4.7 mm from the seal.
2. The leads should not be bent less than 2.4 mm from the seal, and should be supported during bending. The bend radius must be no less than 1.0 mm.
3. Mounting by means of a spring clip is the best mounting method because it offers:
   a. a good thermal contact under the crystal area and slightly lower $R_{th\ mb\text{-}h}$ values than does screw mounting.
   b. safe isolation for mains operation.
   However, if a screw is used, it should be M3 cross-recess pan head. Care should be taken to avoid damage to the plastic body.
4. For good thermal contact heatsink compound should be used between mounting base and heatsink. Values of $R_{th\ mb\text{-}h}$ given for mounting with heatsink compound refer to the use of a metallic-oxide loaded compound. Ordinary silicone grease is not recommended.
5. Rivet mounting (only possible for non-insulated mounting).
   Devices may be rivetted to flat heatsinks; such a process **must neither** deform the mounting tab, **nor** enlarge the mounting hole.

OPERATING NOTES

Dissipation and heatsink considerations:

The various components of junction temperature rise above ambient are illustrated below:

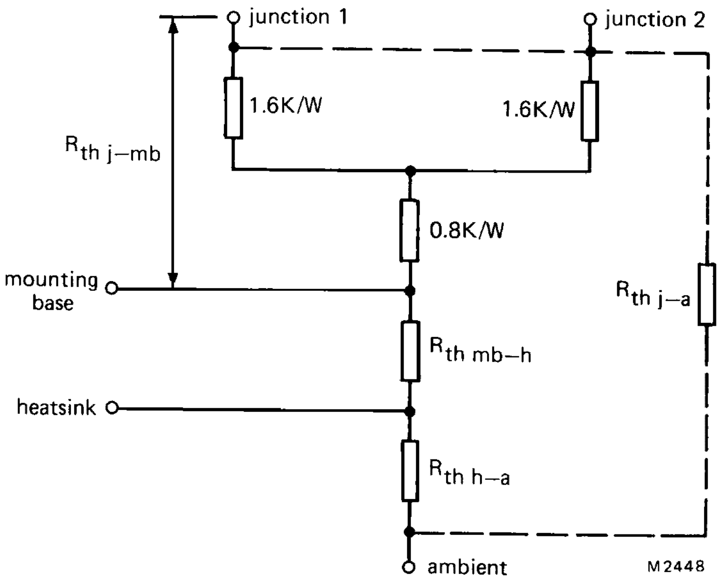


Fig.4

Any measurement of heatsink temperature should be made immediately adjacent to the device.

SQUARE-WAVE OPERATION (PER DIODE)

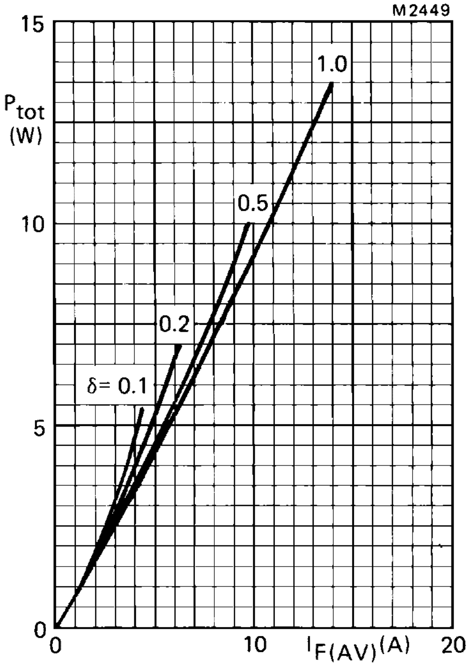
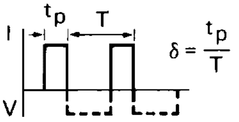


Fig.5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.



$\delta = \frac{t_p}{T}$

$I_{F(AV)} = I_{F(RMS)} \times \sqrt{\delta}$

Power includes reverse current losses and switching losses up to f = 500 kHz

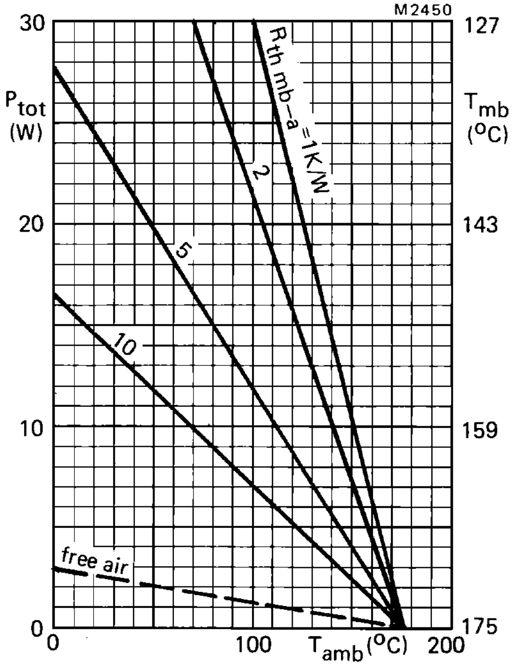


Fig.6

SINUSOIDAL OPERATION (PER DIODE)

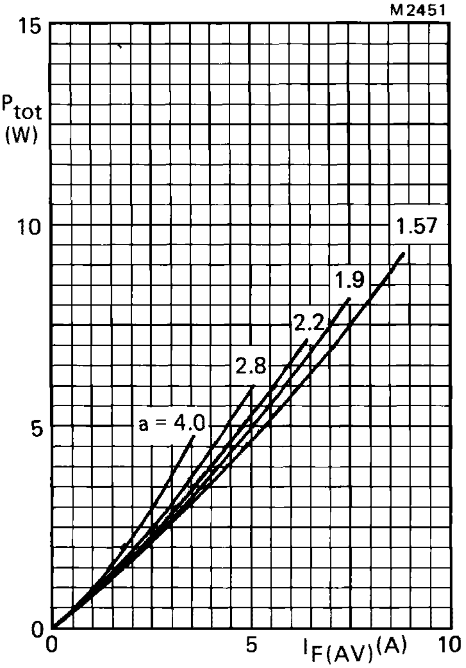


Fig.7 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temepratures.

a = form factor = $I_{F(RMS)}/I_{F(AV)}$

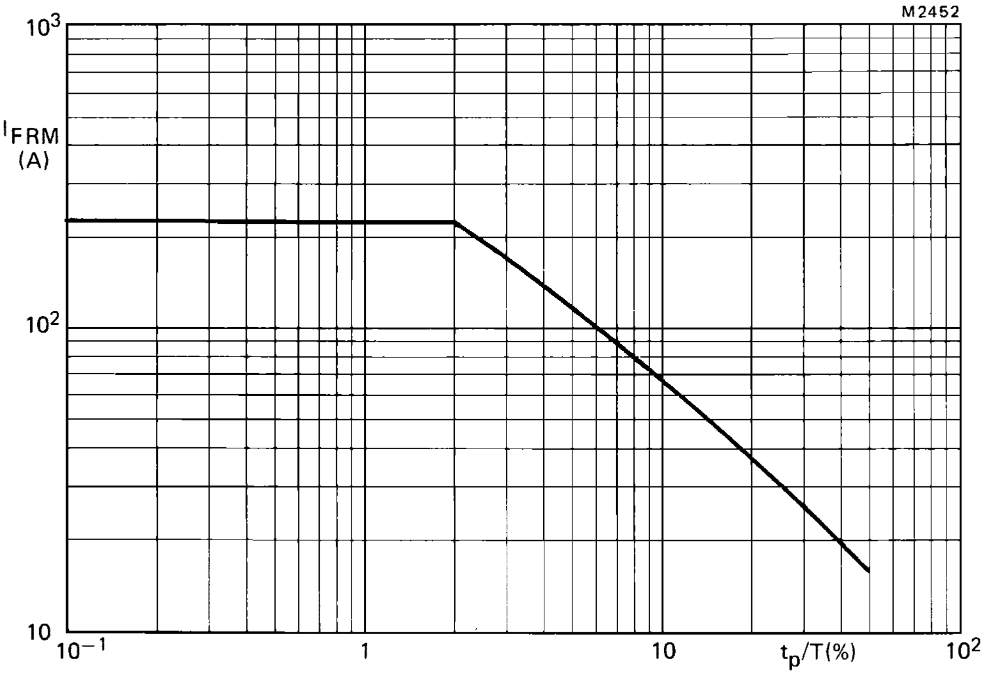
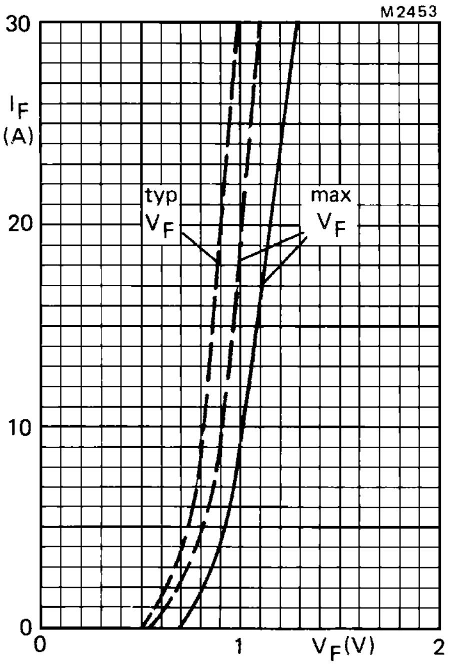
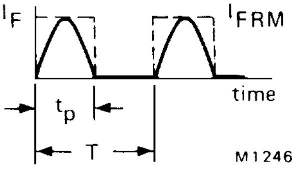


Fig.8 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 $\mu s < t_p < 1$ ms.





Definition of I_{FRM} and t_p/T.

Fig.9 —— $T_j = 25$ °C; – – – $T_j = 100$ °C. per diode.

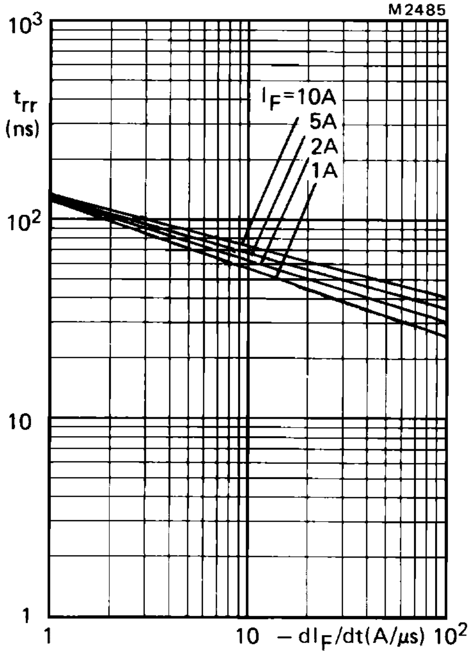


Fig.10 Maximum t_{rr} at T_j = 25 °C.

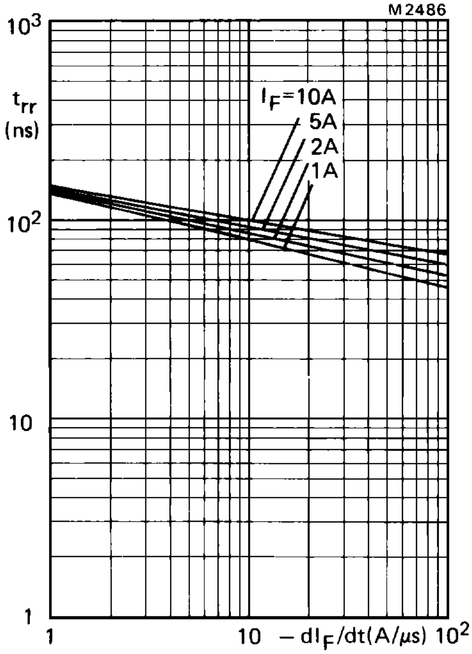


Fig.11 Maximum t_{rr} at T_j = 100 °C.

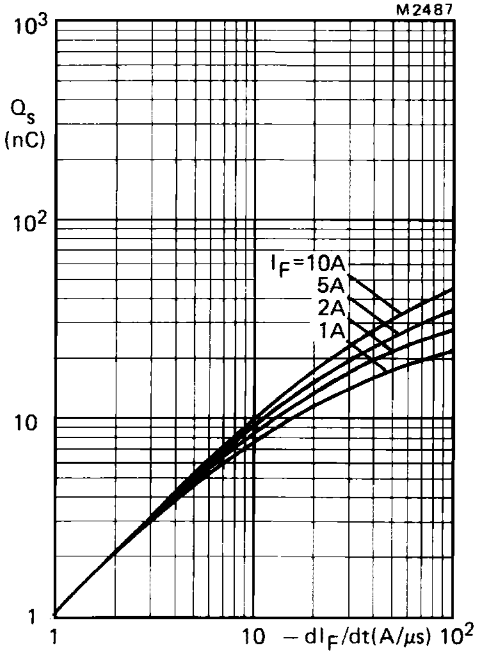


Fig.12 Maximum Q_s at T_j = 25 °C.

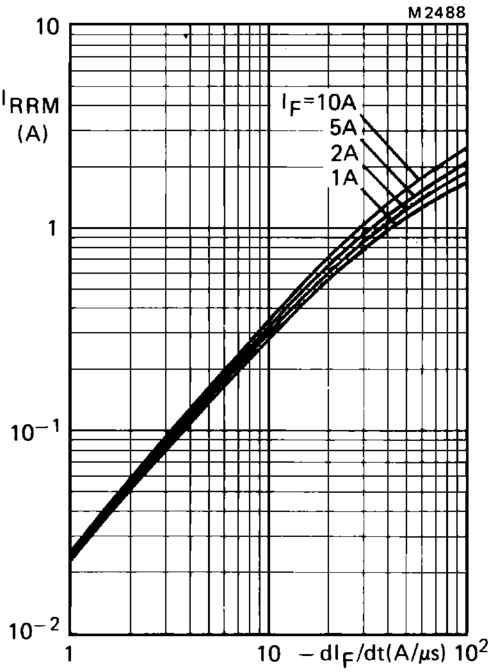


Fig.13 Maximum I_{RRM} at T_j = 25 °C.

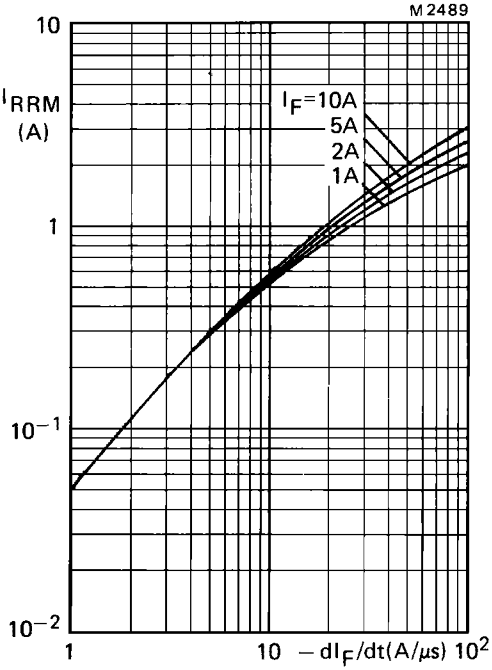


Fig.14 Maximum I_{RRM} at T_j = 100 °C.

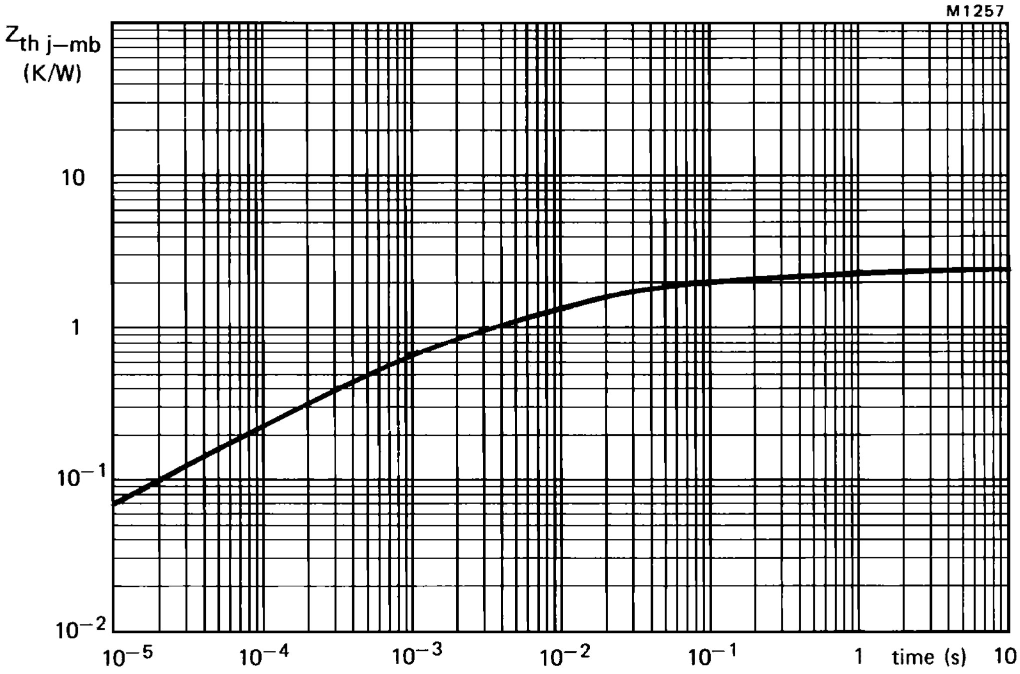


Fig.15 Transient thermal impedance; one diode conducting.