FAST SOFT-RECOVERY ELECTRICALLY ISOLATED RECTIFIER DIODES

Glass-passivated, double-diffused rectifier diodes in full-pack plastic envelopes, featuring fast reverse recovery times and non-snap-off characteristics. Their electrical isolation makes them ideal for mounting on a common heatsink alongside other components without the need for additional insulators. They are intended for use in chopper applications as well as in switched-mode power supplies and as efficiency diodes and scan rectifiers in television receivers.

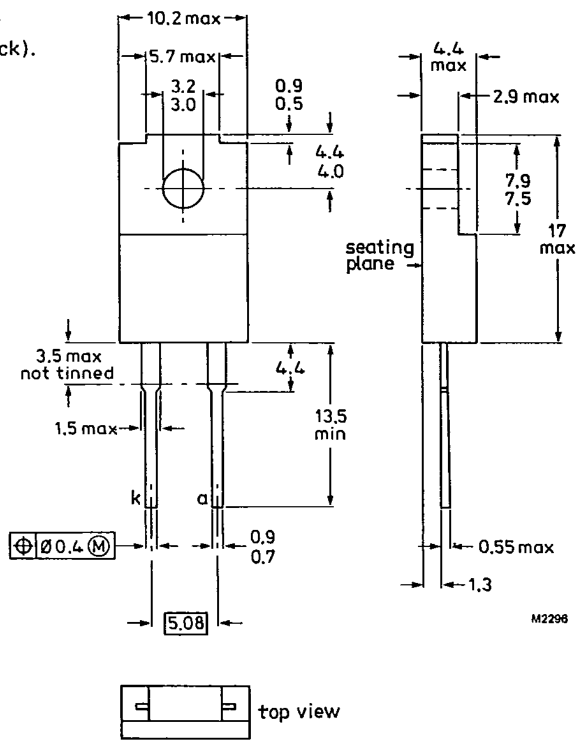
QUICK REFERENCE DATA

			BY229F–200	400	600	800	
Repetitive peak reverse voltage	V_{RRM}	max.	200	400	600	800	V
Average forward current	$I_{F(AV)}$	max.	7				A
Non-repetitive peak forward current	I_{FSM}	<	60				A
Reverse recovery time	t_{rr}	<	150				ns

MECHANICAL DATA

Dimensions in mm

Fig.1 SOT-186 (full-pack).



Net mass: 2 g.

The seating plane is electrically isolated from all terminals.

Accessories supplied on request (see data sheets Mounting instructions for F-pack devices and Accessories for SOT-186 envelopes).

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC134).

Voltages (Note 1)

			BY229F–200	400	600	800	
Non-repetitive peak reverse voltage	V_{RSM}	max.	200	400	600	800	V
Repetitive peak reverse voltage	V_{RRM}	max.	200	400	600	800	V
Crest working reverse voltage	V_{RWM}	max.	150	300	500	600	V
Continuous reverse voltage	V_R	max.	150	300	500	600	V

Currents

Average forward current assuming zero switching losses (Note 2)				
square wave; $\delta = 0.5$; up to $T_{hs} = 90\ ^oC$	$I_{F(AV)}$	max.	7	A
sinusoidal; up to $T_{hs} = 93\ ^oC$	$I_{F(AV)}$	max.	6.25	A
R.M.S. forward current	$I_{F(RMS)}$	max.	10	A
Repetitive peak forward current $t_p = 20\ \mu s$; $\delta = 0.02$	I_{FRM}	max.	135	A
Non-repetitive peak forward current half sine-wave; $T_j = 150\ ^oC$ prior to surge; with reapplied $V_{RWM\ max}$				
t = 10 ms	I_{FSM}	max.	60	A
t = 8.3 ms	I_{FSM}	max.	65	A
I^2t for fusing (t = 10 ms)	I^2t	max.	18	A^2s

Temperatures

Storage temperature	T_{stg}		−40 to +150	^oC
Junction temperature	T_j	max.	150	^oC

ISOLATION

Peak isolation voltage from all terminals to external heatsink	V_{isol}	max.	1000	V
Isolation capacitance from cathode to external heatsink (Note 3)	C_p	typ.	12	pF

Notes

1. To ensure thermal stability: $R_{th\ j\text{-}a} < 15$ K/W for continuous reverse voltage.
2. The quoted temperatures assume heatsink compound is used.
3. Mounted without heatsink compound and 20 Newtons pressure on the centre of the envelope.

THERMAL RESISTANCE

From junction to external heatsink with minimum of 2 kgf (20 Newtons) pressure on the centre of the envelope,

without heatsink compound	$R_{th\ j\text{-}h}$	=	7.2	K/W
with heatsink compound	$R_{th\ j\text{-}h}$	=	5.5	K/W

Free-air operation

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

Thermal resistance from junction to ambient in free air, mounted on a printed circuit board	$R_{th\ j\text{-}a}$	=	55	K/W

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage I_F = 20 A	V_F	<	1.85	V*
Reverse current $V_R = V_{RWM\ max}$; T_j = 125 °C	I_R	<	0.4	mA
Reverse recovery when switched from I_F = 1 A to $V_R \geq 30$ V with $-dI_F/dt$ = 50 A/μs, recovery time	t_{rr}	<	150	ns
I_F = 2 A to $V_R \geq 30$ V with $-dI_F/dt$ = 20 A/μs recovered charge	Q_s	<	0.7	μC
Maximum slope of the reverse recovery current I_F = 2 A, $-dI_F/dt$ = 20 A/μs	$\lvert dI_R/dt \rvert$	<	60	A/μs

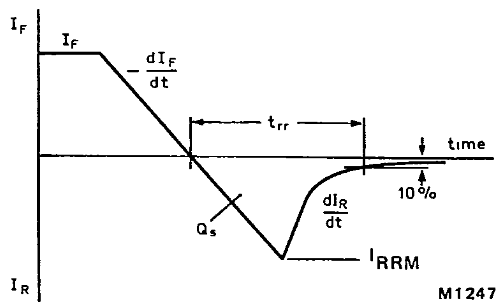


Fig.2 Definition of t_{rr} and Q_s.

*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 mm.
3. Mounting by means of a spring clip is the best mounting method because it offers a good thermal contact under the crystal area and slightly lower $R_{th\ j\text{-}h}$ values than screw mounting. The force exerted on the top of the device by the clip should be at least 2 kgf (20 Newtons) to ensure good thermal contact and must not exceed 3.5 kgf (35 Newtons) to avoid damage to the device.
4. If screw mounting is used, it should be M3 cross-recess pan head.
   Minimum torque to ensure good thermal contact: 5.5 kgf (0.55 Nm)
   Maximum torque to avoid damage to the device: 8.0 kgf (0.80 Nm)
5. For good thermal contact, heatsink compound should be used between baseplate and heatsink. Values of $R_{th\ j\text{-}h}$ given for mounting with heatsink compound refer to the use of a metallic-oxide loaded compound. Ordinary silicone grease is not recommended.
6. Rivet mounting.
   It is not recommended to use rivets, since extensive damage could result to the plastic, which could destroy the insulating properties of the device.
7. The heatsink must have a flatness in the mounting area of 0.02 mm maximum per 10 mm. Mounting holes must be deburred.

OPERATING NOTES

The various components of junction temperature rise above ambient are illustrated in Fig.3.

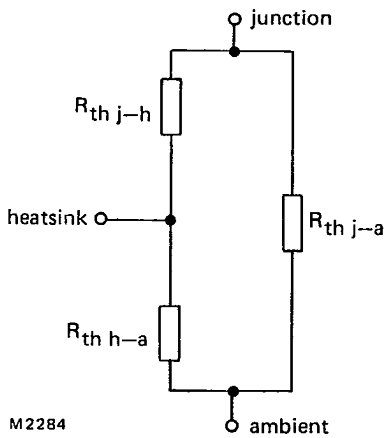


Fig.3.

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

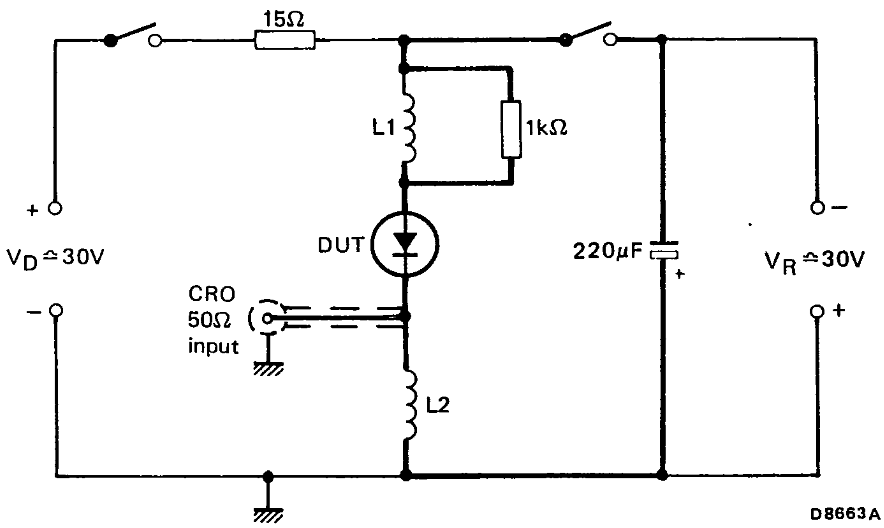


Fig.4 Simplified circuit diagram of practical apparatus to test softness of recovery.

NOTES

1. Duty factor of forward current should be low, < 2%.
2. dI_F/dt is set by L1, 1.5 μH gives 20 A/μs.
3. dI_R/dt is measured across L2, 200 nH gives 5 A/μs/V.
4. Wiring shown in heavy should be kept as short as possible.

SQUARE-WAVE OPERATION

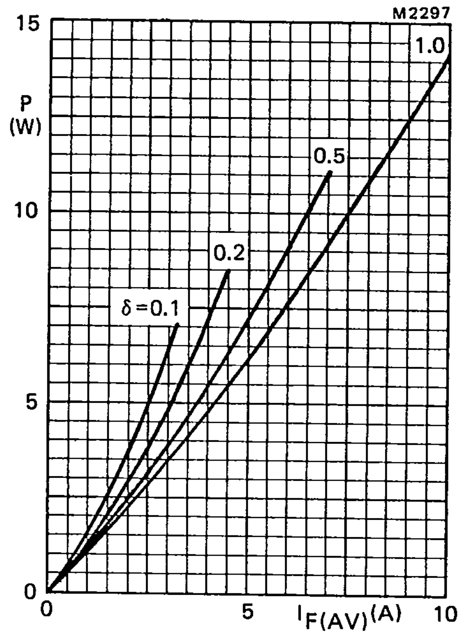
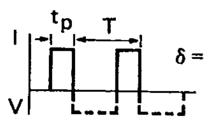


Fig.5 Power rating.

The power loss in the diode should first be determined from the required forward current on the $I_{F(AV)}$ axis and the appropriate duty cycle.
Having determined the power (P), use Fig.7 (if heatsink compound is not being used) or Fig.8 (if heatsink compound is being used) to determine the heatsink size and corresponding maximum ambient and heatsink temperatures.

Note: P = power including reverse current losses but excluding switching losses.



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

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

SINUSOIDAL OPERATION

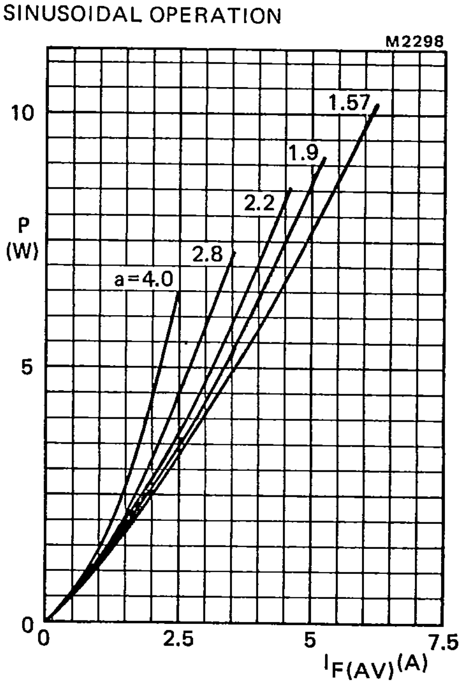


Fig.6 Power rating.

The power loss in the diode should first be determined from the required forward current on the $I_{F(AV)}$ axis and the appropriate form factor.
Having determined the power (P), use Fig.7 (if heatsink compound is not being used) or Fig.8 (if heatsink compound is being used) to determine the heatsink size and corresponding maximum ambient and heatsink temperatures.

Note: P = power including reverse current losses but excluding switching losses.

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

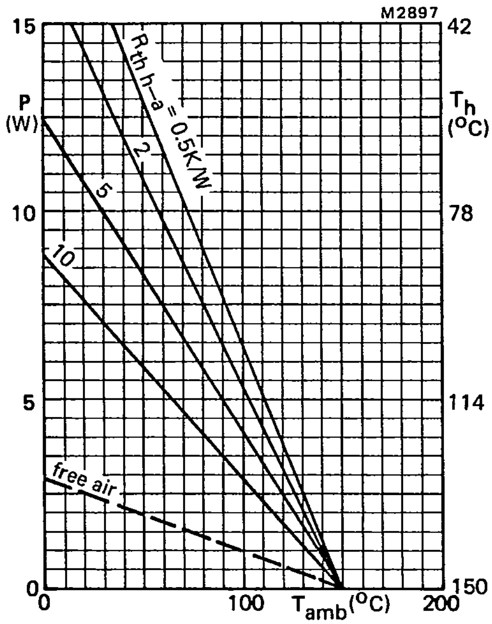


Fig.7 Heatsink rating; without heatsink compound.

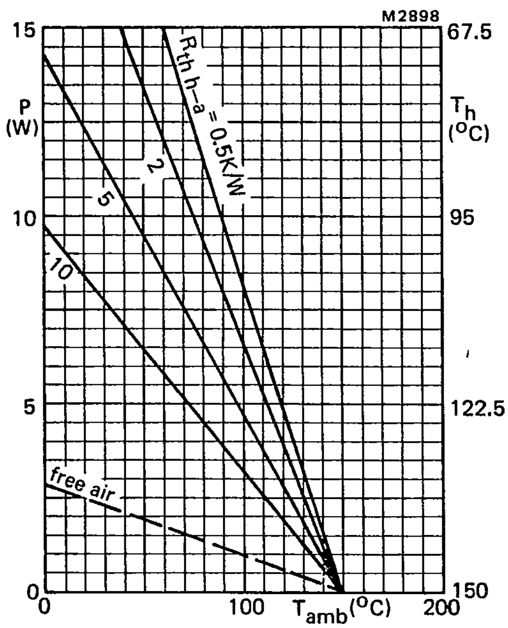


Fig.8 Heatsink rating; with heatsink compound.

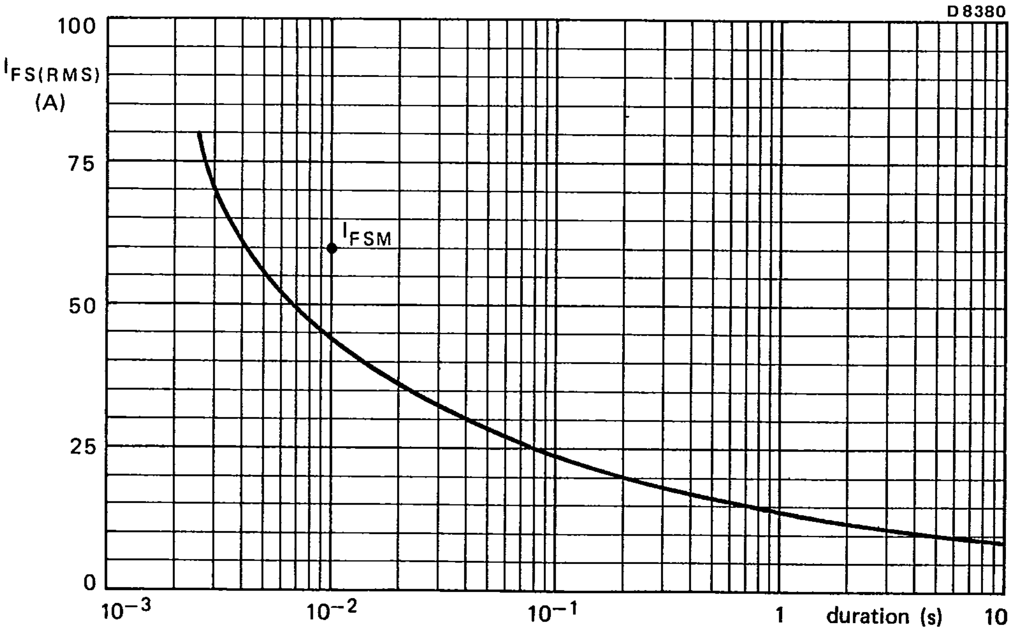


Fig.9 Maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz); T_j = 150 °C prior to surge; with reapplied V_{RWMmax}.

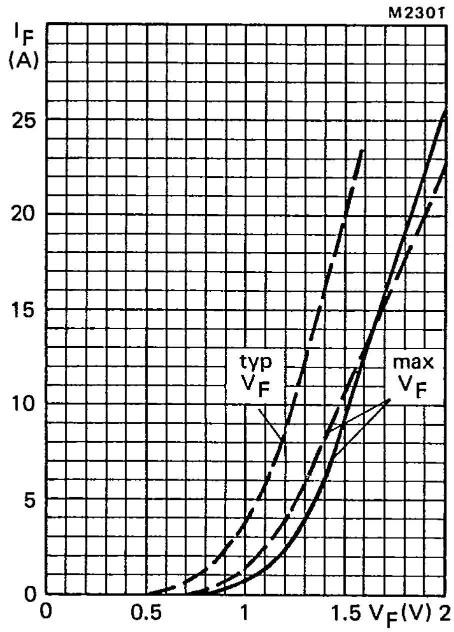


Fig.10 ——— T_j = 25 °C; – – – – T_j = 125 °C.

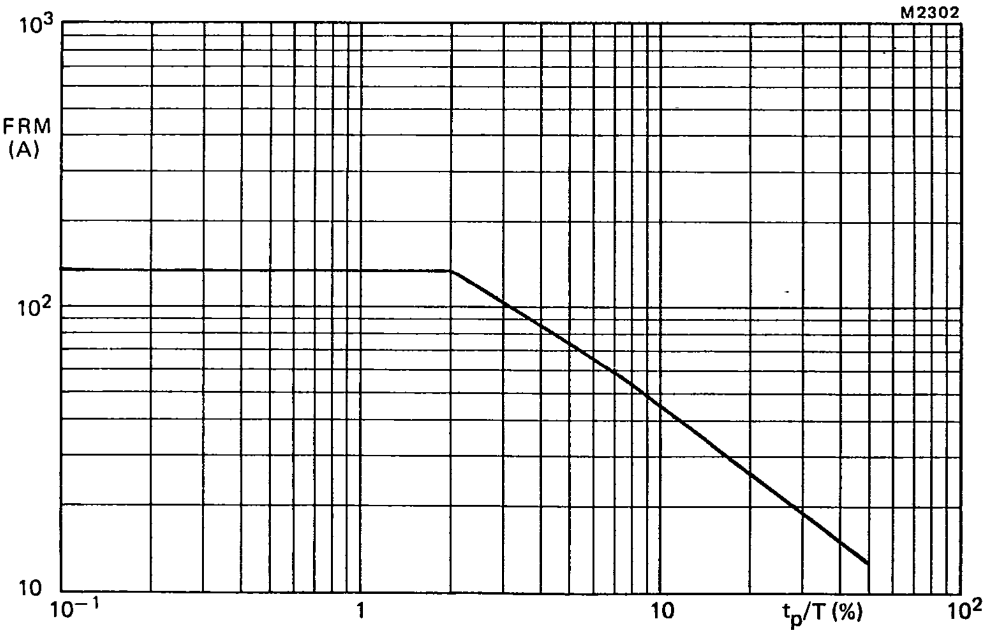
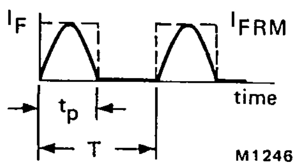


Fig.11 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 $\mu s < t_p < 1$ ms.



Definition of I_{FRM} and t_p/T.

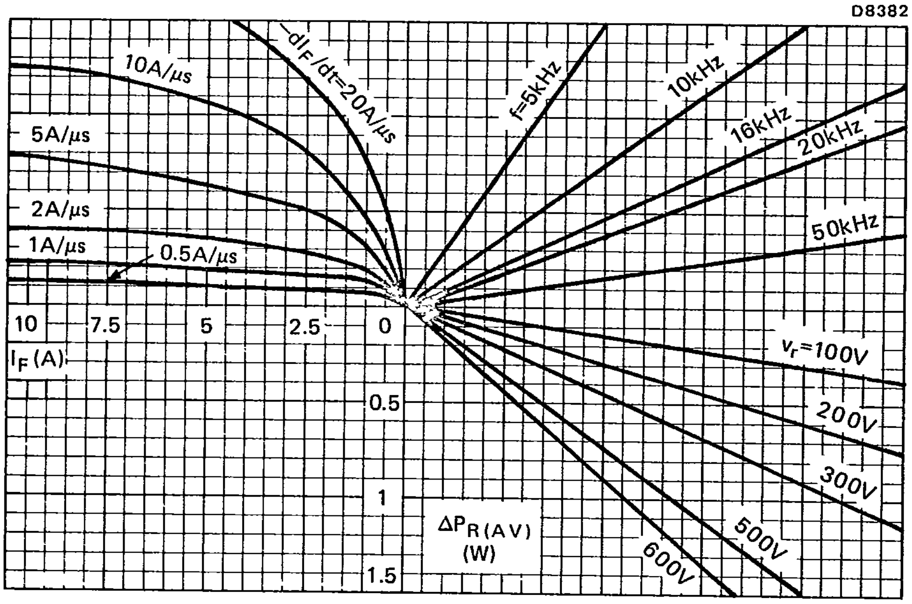
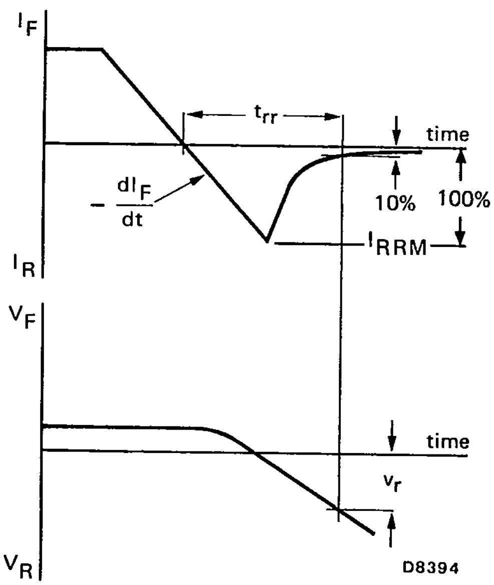


Fig.12 NOMOGRAM

Power loss $\Delta P_{R(AV)}$ due to switching only (to be added to steady state power losses).
I_F = forward current just before switching off; T_j = 150 °C.



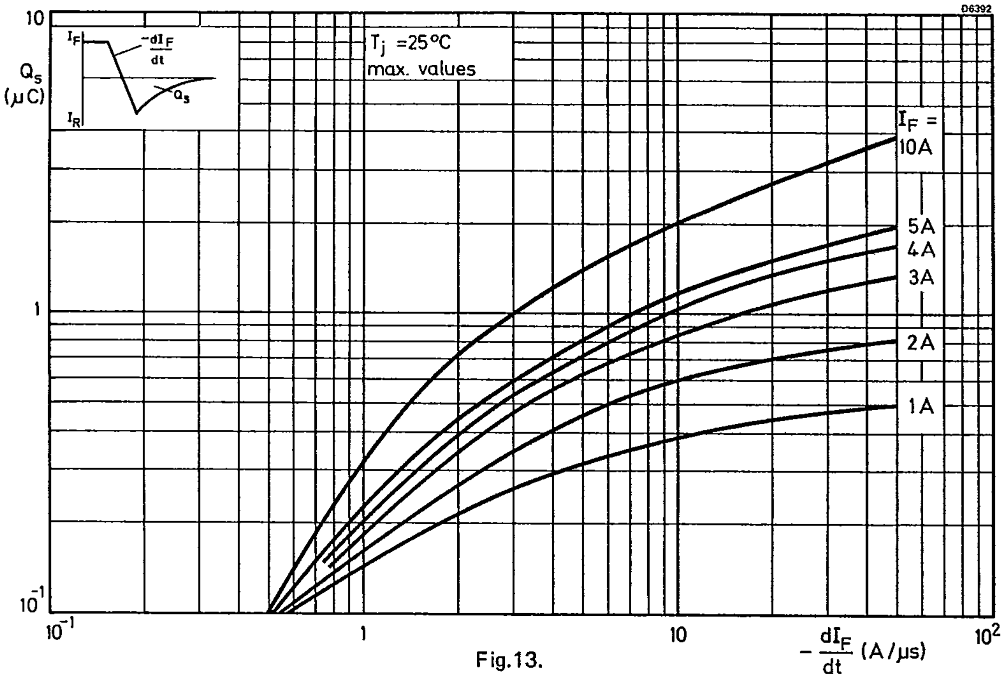

M6392
10
1
10^{-1}
Q_s (μC)
I_F
$-\frac{dI_F}{dt}$
Q_s
I_R
T_j =25°C
max. values
I_F =
10A
5A
4A
3A
2A
1A
10^{-1}
1
10
10^2
$-\frac{dI_F}{dt}$ (A/μs)

Fig.13.

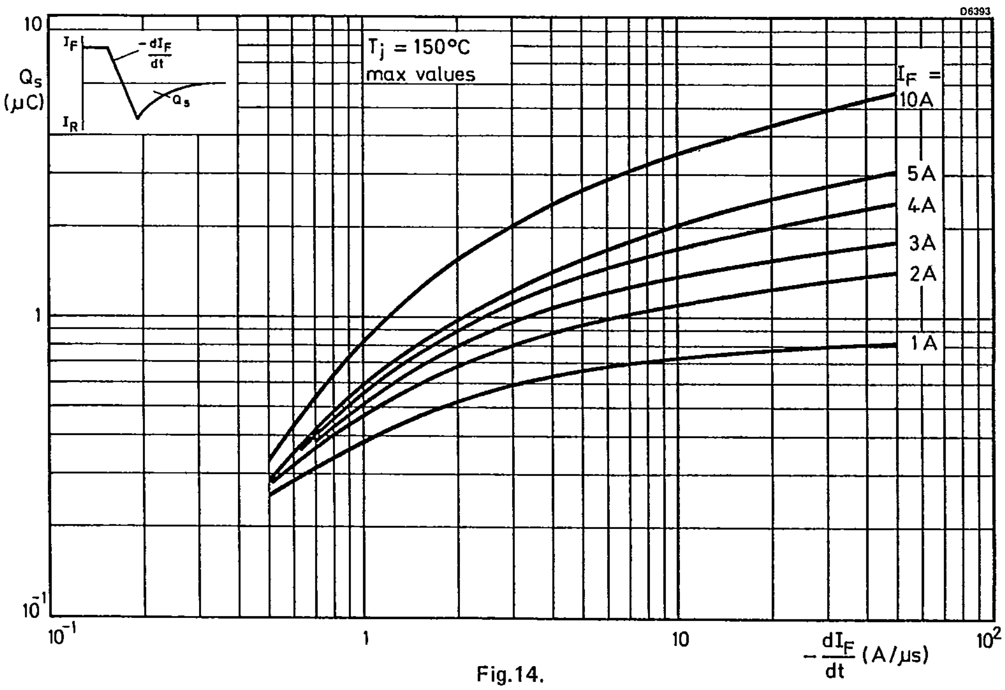

M6393
10
1
10^{-1}
Q_s (μC)
I_F
$-\frac{dI_F}{dt}$
Q_s
I_R
T_j = 150°C
max values
I_F =
10A
5A
4A
3A
2A
1A
10^{-1}
1
10
10^2
$-\frac{dI_F}{dt}$ (A/μs)

Fig.14.

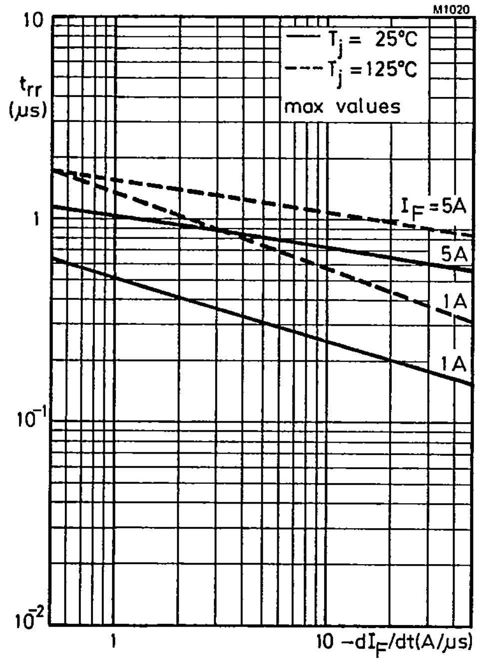


Fig.15.

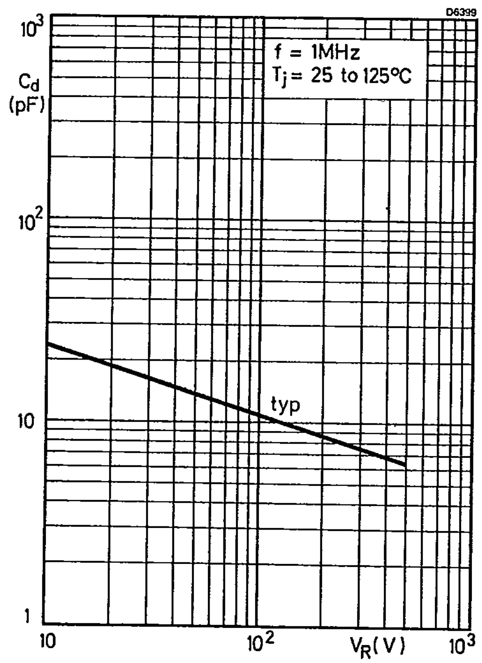


Fig.16.

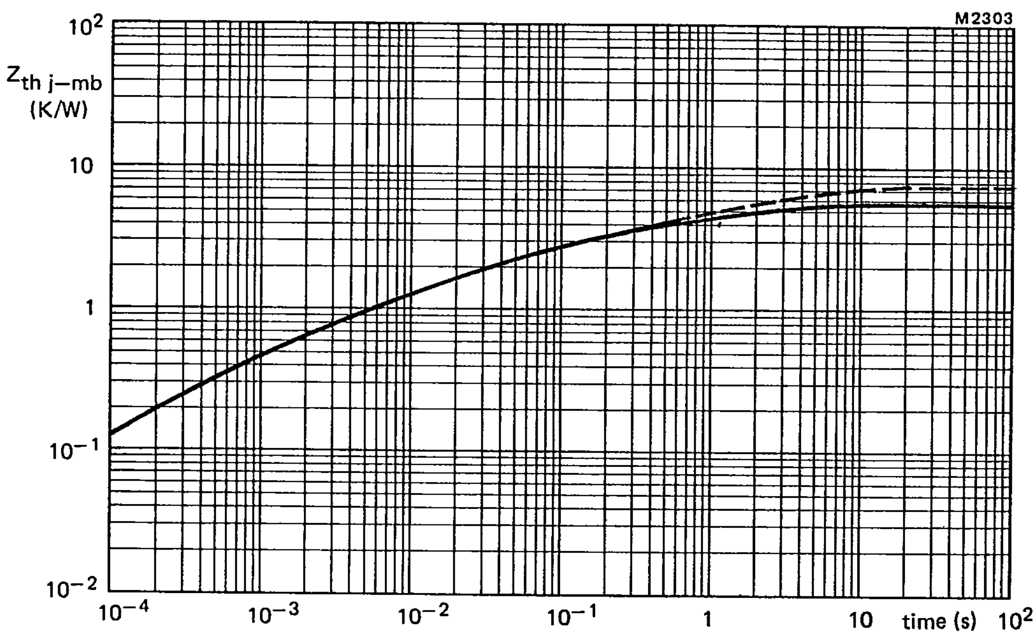


Fig.17 ——— with heatsink compound; — — — — without heatsink compound.