DISCRETE SEMICONDUCTORS

Power Diodes

BOOK SC02 1990

Philips Components

PHILIPS

POWER DIODES

Contents

SELECTION GUIDE

FAST RECTIFIER DIODES

Ultra fast (epitaxial) types
(25 to 100 ns)

$I_{F(AV)max}$ (A)		Outline	V_{RRMmax} (V) 50	100	150	200	300	400	500	600	700	800	1000	Page
8	BYP21	TO-220AC	●	●	●	●								165
8	BYW29	TO-220AC	●	●	●	●								539
8	BYW29F	SOT-186	●	●	●	●								549
9	BYV29	TO-220AC					●	●	●					317
9	BYV29F	SOT-186					●	●	●					327
8	BYR29	TO-220AC							●	●	●	●		225
8	BYR29F	SOT-186								●	●	●		235
10	BYP20*	TO-220AB	●	●	●									157
10	BYQ27*	SOT-82	●	●	●	●								185
10	BYQ28*	TO-220AB	●	●	●	●								195
10	BYQ28F*	SOT-186	●	●	●	●								205
10	BYT28*	TO-220AB					●	●	●					273
10	BYR28*	TO-220AB							●	●	●	●		215
12	BYV32F*	SOT-186	●	●	●	●								363
14	BYV79	TO-220AC	●	●	●	●								451
14	BYW30	DO-4	●	●	●	●								559
14	BYT79	TO-220AC					●	●	●					283
14	BYV30	DO-4					●	●	●					337
14	BYR79	TO-220AC							●	●	●	●		263
14	BYR30	DO-4							●	●	●			245
20	BYP22*	TO-220AB	●	●	●	●								175
20	BYV32*	TO-220AB	●	●	●	●								353
20	BYV72F*	SOT-199	●	●	●	●								421
20	BYV74F	SOT-199					●	●	●					441
20	BYV34*	TO-220AB					●	●	●					373
20	BYR34*	TO-220AB							●	●	●	●		253
28	BYW31	DO-4	●	●	●	●								567
28	BYV31	DO-4					●	●	●					345
30	BYV42*	TO-220AB	●	●	●	●								383
30	BYV72*	SOT-93	●	●	●	●								411
30	BYV44*	TO-220AB					●	●	●					393
30	BYV74*	SOT-93					●	●	●					431
60	BYT230PI*	SOT-227A				●	●	●		●	●	●	●	293
60	BYT230PIV*	SOT-227B				●	●	●		●	●	●	●	293
100	BYV54*	SOT-227A	●	●	●	●								403
100	BYV54V*	SOT-227B	●	●	●	●								403

*Dual rectifier diodes.

FAST RECTIFIER DIODES (Cont.)

Very fast types
(100 to 450 ns)

$I_{F(AV)max}$ (A)		Outline	V_{RRMmax} (V) 200	300	400	500	600	800	1000	1200	Page
7	BY229	TO-220AC	●		●		●	●			93
7	BY229F	SOT-186	●		●		●	●			105
8	BY329	TO-220AC						●	●	●	131
12	BYV24	DO-4						●	●		309
14	BYX30**	DO-4	●	●	●	●	●				599
22	BYX46**	DO-4	●	●	●	●	●				625

**With avalanche characteristics

RECTIFIER DIODES

General purpose types

$I_{F(AV)max}$ (A)		Outline	V_{RRMmax} (V) 300	600	1200	1600	Page
6	BYX38	DO-4	●	●	●		609
6.5	BY249	TO-220AC	●	●			117
6.5	BY249F	SOT-186	●	●			123
10	BYX98	DO-4	●	●	●		659
12	BYX42	DO-4	●	●	●		621
15	BYX99	DO-4	●	●	●		665
30	BYX96	DO-4	●	●	●	●	647

Avalanche types

$I_{F(AV)max}$ (A)			V_{RWMmax} (V) 600	800	1000	1200	1400	Page
9.5	BYX39	DO-4	●	●	●	●	●	615
20	BYX25	DO-4	●	●	●	●	●	591

SCHOTTKY RECTIFIER DIODES

$I_{F(AV)max}$ (A)	Type	Outline	V_{RRMmax} (V) 35	40	45	Page
7.5	PBYR735-745	TO-220AC	●	●	●	727
7.5	PBYR735F-745F	SOT-186	●	●	●	733
10	BYV118*	TO-220AB	●	●	●	469
10	BYV118F*	SOT-186	●	●	●	479
10	PBYR635CT-645CT*	SOT-82	●	●	●	717
10	PBYR1035-45	TO-220AC	●	●	●	737
10	PBYR1035F-45F	SOT-186	●	●	●	743
15	BYV120	DO-4	●	●	●	483
15	PBYR1535CT-45CT*	TO-220AB	●	●	●	747
15	PBYR1535CTF-45CTF*	SOT-186	●	●	●	753
16	PBYR1635-45	TO-220AC	●	●	●	757
16	PBYR1635F-45F	SOT-186	●	●	●	763
20	BYV133*	TO-220AB	●	●	●	499
20	BYV133F*	SOT-186	●	●	●	509
20	BYV143F*	SOT-186	●	●	●	529
20	PBYR2035CT-45CT*	TO-220AB	●	●	●	767
20	PBYR2035CTF-45CTF*	SOT-186	●	●	●	773
20	PBYR2535CTF-45CTF*	SOT-186	●	●	●	783
30	BYV121	DO-4	●	●	●	491
30	BYV143*	TO-220AB	●	●	●	519
30	PBYR2535CT-45CT*	TO-220AB	●	●	●	777
30	PBYR3035PT-45PT*	SOT-93	●	●	●	787
120	PBYR12035T-45T*	SOT-227A	●	●	●	793
120	PBYR12035TV-45TV*	SOT-227B	●	●	●	793
160	PBYR16035T-45T*	SOT-227A	●	●	●	801
160	PBYR16035TV-45TV*	SOT-227B	●	●	●	801
300	PBYR30035CT-45CT*	TO-244	●	●	●	809
400	PBYR40035CT-45CT*	TO-244	●	●	●	815

*Dual rectifier diodes.

BREAKOVER DIODES

$I_{TSM\ max}$ (A)	Type	Outline	$V_{(BO)nom}$ (V) 65	100	120	140	160	180	200	220	240	260	280	Page
40	BR210	TO-220AC		●	●	●	●				●	●	●	43
40	BR211	SOD-84		●	●	●	●	●	●	●	●	●	●	55
40	BR213*	TO-220AB		●	●	●	●				●	●	●	65
40	BR216*†	TO-220AB	●											69
40	BR220*	TO-220AB		●	●	●	●				●	●	●	81

*Monolithic dual breakover diodes.
*†Asymmetrical breakover diode.

REGULATOR DIODES (page 683)

Type	Regulated voltage	Suppression stand-off voltage	P_{tot} max (regulator service)	P_{RSM} max (suppressor service)
BZY93–C7V5(R)	7.5 V	5.6 V	20 W	700 W
C8V2(R)	8.2 V	6.2 V		
C9V1(R)	9.1 V	6.8 V		
C10(R)	10 V	7.5 V		
C11(R)	11 V	8.2 V		
C12(R)	12 V	9.1 V		
C13(R)	13 V	10 V		
C15(R)	15 V	11 V		
C16(R)	16 V	12 V		
C18(R)	18 V	13 V		
C20(R)	20 V	15 V		
C22(R)	22 V	16 V		
C24(R)	24 V	18 V		
C27(R)	27 V	20 V		
C30(R)	30 V	22 V		
C33(R)	33 V	24 V		
C36(R)	36 V	27 V		
C39(R)	39 V	30 V		
C43(R)	43 V	33 V		
C47(R)	47 V	36 V		
C51(R)	51 V	39 V		
C56(R)	56 V	43 V		
C62(R)	62 V	47 V		
C68(R)	68 V	51 V		
C75(R)	75 V	56 V		

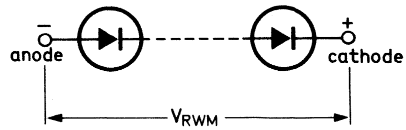
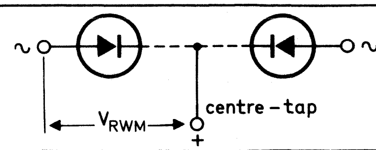
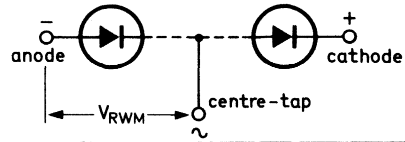
Outline: DO-4

Polarity: Both

Normal polarity (cathode to stud): no end-letter

Reverse polarity (anode to stud): R

HIGH-VOLTAGE RECTIFIER STACKS

Type No.	$I_{F(AV)}$ max.	V_{RWM} max.	Page	Configuration
OSS9115–3A to–36A	3.5 A (6 A in oil)	4.5 kV to 54 kV	689	
OSS9215–3A to–36A	5 A (20 A in oil)		697	
OSB9115–4A to–36A	7 A (12 A in oil)	3 kV to 27 kV	689	
OSB9215–4A to–36A	10 A (40 A in oil)		697	
OSM9115–4A to–36A	3.5 A (6 A in oil)	3 kV to 27 kV	689	
OSM9215–4A to–36A	5 A (20 A in oil)		697	

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GENERAL

Type designation
Rating systems
Letter symbols
Quality conformance
and reliability
General explanatory notes
Flat heatsink

PRO ELECTRON TYPE DESIGNATION CODE FOR SEMICONDUCTOR DEVICES

This type designation code applies to discrete semiconductor devices – as opposed to integrated circuits –, multiples of such devices and semiconductor chips.

"Although not all type numbers accord with the Pro Electron system, the following explanation is given for the ones that do."

A basic type number consists of:

TWO LETTERS FOLLOWED BY A SERIAL NUMBER

FIRST LETTER

The first letter gives information about the material used for the active part of the devices.

A. GERMANIUM or other material with band gap of 0,6 to 1,0 eV.
B. SILICON or other material with band gap of 1,0 to 1,3 eV.
C. GALLIUM-ARSENIDE or other material with band gap of 1,3 eV or more.
R. COMPOUND MATERIALS (e.g. Cadmium-Sulphide).

SECOND LETTER

The second letter indicates the function for which the device is primarily designed.

A. DIODE; signal, low power
B. DIODE; variable capacitance
C. TRANSISTOR; low power, audio frequency ($R_{th\ j\text{-}mb} > 15$ K/W)
D. TRANSISTOR; power, audio frequency ($R_{th\ j\text{-}mb} \leqslant 15$ K/W)
E. DIODE; tunnel
F. TRANSISTOR; low power, high frequency ($R_{th\ j\text{-}mb} > 15$ K/W)
G. MULTIPLE OF DISSIMILAR DEVICES – MISCELLANEOUS; e.g. oscillator
H. DIODE; magnetic sensitive
L. TRANSISTOR; power, high frequency ($R_{th\ j\text{-}mb} \leqslant 15$ K/W)
N. PHOTO-COUPLER
P. RADIATION DETECTOR; e.g. high sensitivity phototransistor
Q. RADIATION GENERATOR; e.g. light-emitting diode (LED)
R. CONTROL AND SWITCHING DEVICE; e.g. thyristor, low power ($R_{th\ j\text{-}mb} > 15$ K/W)
S. TRANSISTOR; low power, switching ($R_{th\ j\text{-}mb} > 15$ K/W)
T. CONTROL AND SWITCHING DEVICE; e.g. thyristor, power ($R_{th\ j\text{-}mb} \leqslant 15$ K/W)
U. TRANSISTOR; power, switching ($R_{th\ j\text{-}mb} \leqslant 15$ K/W)
X. DIODE: multiplier, e.g. varactor, step recovery
Y. DIODE; rectifying, booster
Z. DIODE; voltage reference or regulator (transient suppressor diode, with third letter **W**)

The remainder of the type number is a **serial number** indicating a particular design or development and is in one of the following two groups:

(a) **A serial number** consisting of three figures from 100 to 999.

(b) **A serial number** consisting of one letter (Z, Y, X, W, etc.) followed by two figures.

RANGE NUMBERS

Where there is a range of variants of a basic type of rectifier diode, thyristor or voltage regulator diode the type number as defined above is often used to identify the range; further letters and figures are added after a hyphen to identify associated types within the range. These additions are as follows:

RECTIFIER DIODES, THYRISTORS AND TRIACS

A group of figures indicating the rated repetitive peak reverse voltage, V_{RRM}, or the rated repetitive peak off-state voltage, V_{DRM}, whichever value is lower, in volts for each type.

The final letter R is used to denote a reverse polarity version (stud-anode) where applicable. The normal polarity version (stud cathode) has no special final letter.

REGULATOR DIODES

A first letter indicating the nominal percentage tolerance in the operating voltage V_Z.

A. 1% (according to IEC 63: series E96)
B. 2% (according to IEC 63: series E48)
C. 5% (according to IEC 63: series E24)
D. 10% (according to IEC 63: series E12)
E. 20% (according to IEC 63: series E6)

A group of figures indicating the typical operating voltage V_Z for each type at the nominal operating current I_Z rating of the range.

The letter V is used to denote a decimal sign.

The final letter R is used to denote a reverse polarity version (stud anode) where applicable. The normal polarity version (stud cathode) has no special final letter.

Examples:

BYX38-600	Silicon rectifier in the BYX38 range with 600 V maximum repetitive peak voltage, normal polarity, stud connected to cathode.
BZY93-C7V5	Silicon voltage regulator diode in the BZY93 range with 7.5 V operating ± 5% tolerance, normal polarity, stud connected to cathode.

RATING SYSTEMS

The rating systems described are those recommended by the International Electrotechnical Commission (IEC) in its Publication 134.

DEFINITIONS OF TERMS USED

Electronic device. An electronic tube or valve, transistor or other semiconductor device.

Note
This definition excludes inductors, capacitors, resistors and similar components.

Characteristic. A characteristic is an inherent and measurable property of a device. Such a property may be electrical, mechanical, thermal, hydraulic, electro-magnetic, or nuclear, and can be expressed as a value for stated or recognized conditions. A characteristic may also be a set of related values, usually shown in graphical form.

Bogey electronic device. An electronic device whose characteristics have the published nominal values for the type. A bogey electronic device for any particular application can be obtained by considering only those characteristics which are directly related to the application.

Rating. A value which establishes either a limiting capability or a limiting condition for an electronic device. It is determined for specified values of environment and operation, and may be stated in any suitable terms.

Note
Limiting conditions may be either maxima or minima.

Rating system. The set of principles upon which ratings are established and which determine their interpretation.

Note
The rating system indicates the division of responsibility between the device manufacturer and the circuit designer, with the object of ensuring that the working conditions do not exceed the ratings.

ABSOLUTE MAXIMUM RATING SYSTEM (As used throughout this book)

Absolute maximum ratings are limiting values of operating and environmental conditions applicable to any electronic device of a specified type as defined by its published data, which should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking no responsibility for equipment variations, environmental variations, and the effects of changes in operating conditions due to variations in the characteristics of the device under consideration and of all other electronic devices in the equipment.

The equipment manufacturer should design so that, initially and throughout life, no absolute maximum value for the intended service is exceeded with any device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, equipment control adjustment, load variations, signal variation, environmental conditions, and variations in characteristics of the device under consideration and of all other electronic devices in the equipment.

DESIGN MAXIMUM RATING SYSTEM

Design maximum ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under the worst probable conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device, taking responsibility for the effects of changes in operating conditions due to variations in the characteristics of the electronic device under consideration.

The equipment manufacturer should design so that, initially and throughout life, no design maximum value for the intended service is exceeded with a bogey device under the worst probable operating conditions with respect to supply voltage variation, equipment component variation, variation in characteristics of all other devices in the equipment, equipment control adjustment, load variation, signal variation and environmental conditions.

DESIGN CENTRE RATING SYSTEM

Design centre ratings are limiting values of operating and environmental conditions applicable to a bogey electronic device of a specified type as defined by its published data, and should not be exceeded under normal conditions.

These values are chosen by the device manufacturer to provide acceptable serviceability of the device in average applications, taking responsibility for normal changes in operating conditions due to rated supply voltage variation, equipment component variation, equipment control adjustment, load variation, signal variation, environmental conditions, and variations in the characteristics of all electronic devices.

The equipment manufacturer should design so that, initially, no design centre value for the intended service is exceeded with a bogey electronic device in equipment operating at the stated normal supply voltage.

LETTER SYMBOLS FOR RECTIFIER DIODES, THYRISTORS, TRIACS AND BREAKOVER DIODES

LETTER SYMBOLS FOR CURRENTS, VOLTAGES AND POWERS

Basic letters: – The basic letters to be used are:

I, i = current V, v = voltage P, p = power

Lower-case basic letters shall be used for the representation of instantaneous values which vary with time. In all other instances upper-case letters shall be used.

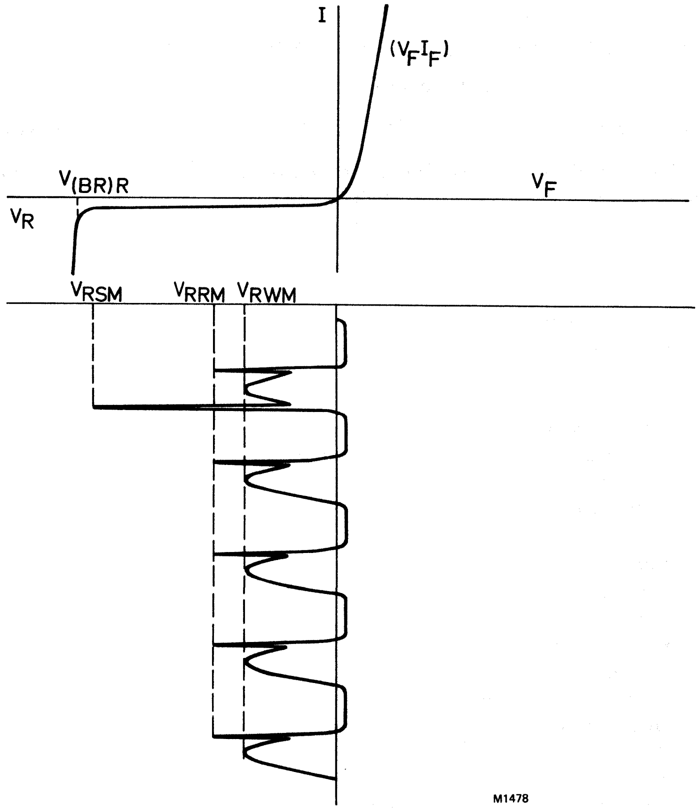
Subscripts

amb	Ambient
(AV), (av)	Average value
(BO)	Breakover
(BR)	Breakdown
case	Case
C	Controllable
D,d	Forward off-state [1]), non-triggered (gate voltage or current)
F,f	Forward [1]), fall
G,g	Gate terminal
H	Holding
I,i	Input
J,j	Junction
L	Latching
M,m	Peak or crest value
min	Minimum
O,o	Output, open circuit
(OV)	Overload
P,p	Pulse
Q,q	Turn-off
R,r	As first subscript: reverse, rise As second subscript: repetitive, recovery
(RMS), (rms)	R.M.S. value
S,s	As first subscript: storage, stray, series, source, switching As second subscript: non-repetitive
stg	Storage
T,t	Forward on-state [1]), triggered (gate voltage or current)
th	Thermal
(TO)	Threshold
tot	Total
W	Working
Z	Reference or regulator (i.e. zener)

For power rectifier diodes, thyristors and triacs, the terminals are **not** indicated in the subscript, except for the gate-terminal of thyristors and triacs.

[1]) For the anode-cathode voltage of thyristors and triacs, F is replaced either by D or T, to distinguish between 'off-state' (non-triggered) and 'on-state' (triggered).

Example of the use of letter symbols



Simplified rectifier characteristic together with an anode-cathode voltage as a function of time.

QUALITY CONFORMANCE AND RELIABILITY

In addition to 100% testing of all major device parameters in the production department, independently controlled statistical sampling for conformance and reliability takes place using BS6001 'Sampling Procedures and Tables'. BS6001 is consistent with MIL–STD–105D. DEF131A, IS02859, CA–C–115.

The market demand for a continuously improving product quality is being met by the annual updating of formal quality improvement plans.

The 'Defect free' and 'Right first time' concepts are applied regularly as part of an overall quality programme covering all aspects of device quality from initital design to final production. These concepts, together with the quality assurance requirements, embrace all the principles outlined in DEF STAN 05–21, AQAP–1, and BS5750 Pt1.

CONFORMANCE

The Company actively promote a policy of customer cooperation to determine their quality problems and future requirements. This cooperation is often in the form of a 'ppm' activity. The 'ppm' is a measure of conformance of the outgoing product, and is expressed as the number of reject devices found per million of products delivered (e.g. a process average of 0.01% = 100 ppm). Mutually agreed ppm targets are set, and a programme of quality improvement work initiated.

In addition to the above, special inspection and/or test procedures are available, following consultation with the customer and the agreement of a special specification.

RELIABILITY

'Screening', or 'Burn-in' procedures are also available, based on the requirements of CECC 50 000.

CECC 50 000 offers a choice of four screening sequences: 'A', 'B', 'C', 'D'. The Company's standard 'Hi-rel' procedure offers a combination of 'C' and 'D' sequences.

Sequence 'C'

1. High temperature storage – 24 hours minimum.
2. Rapid change of temperature – as detailed in agreed specification.
3. Sealing – fine leak test.
   – gross leak test.
4. Functional electrical characteristics – within group 'A' limits.

Sequence 'D'

1. 'Burn-in' – high-voltage reverse bias, 48 hours duration. Conditions as specified in CECC 50 000.
2. Post 'Burn-in' measurements – functional electrical characteristics, within group 'A' limits.

Other 'Hi-rel', 'Burn-in', or 'Screening' procedures may be available on request.

RECTIFIER DIODES

REVERSE RECOVERY

When a semiconductor rectifier diode has been conducting in the forward direction sufficiently long to establish the steady state, there will be a charge due to minority carriers present. Before the device can block in the reverse direction this charge must be extracted. This extraction takes the form of a transient reverse current and this, together with the reverse bias voltage results in additional power dissipation which reduces the rectification efficiency. At sine-wave frequencies up to about 400 Hz these effects can often be ignored, but at higher frequencies and for square waves the switching losses must be considered.

Stored charge

The area under the I_R- time curve is known as the stored charge (Q_s) and is normally quoted in micro- or nanocoulombs. Low stored charge devices are preferred for fast switching applications.

Reverse recovery time

Another parameter which can be used to determine the speed of the rectifier is the reverse recovery time (t_{rr}). This is measured from the instant the current passes through zero (from forward to reverse) to the instant the current recovers to 10% of its peak reverse value. Low reverse recovery times are associated with low stored charge devices.

The conditions which need to be specified are:

a. Steady-state forward current (I_F); high currents increase recovery time.
b. Reverse bias voltage (V_R); low reverse voltage increases recovery time.
c. Rate of fall of anode current (dI_F/dt); high rates of fall reduce recovery time, but increase stored charge.
d. Junction temperature (T_j); high temperatures increase both recovery time and stored charge.

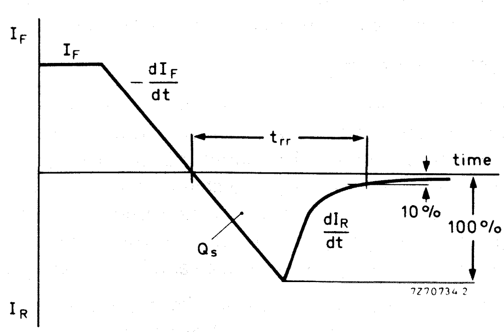


Fig. 1 Waveform showing the reverse recovery aspects.

REVERSE RECOVERY (continued)

Softness of recovery

In many switching circuits it is not just the magnitude but the shape of the reverse recovery characteristic that is important. If the positive-going edge of the characteristic has a fast rise time (as in a so-called 'snap-off' device) this edge may cause conducted or radiated r.f.i., or it may generate high voltages across inductors which may be in series with the rectifier. The maximum slope of the reverse recovery current (dI_R/dt) is quoted as a measure of the 'softness' of the characteristic. Low values are less liable to give r.f.i. problems. The measurement conditions which need to be specified are as above. When stored charges are very low, e.g. for epitaxial and Schottky-barrier rectifier diodes,this softness characteristic can be ignored.

DOUBLE-DIFFUSED RECTIFIER DIODES

A single-diffused diode with a two layer p-n structure cannot combine a high forward current density with a high reverse blocking voltage.

A way out of this dilemma is provided by the three layer double-diffused structure. A lightly doped silicon layer, called the base, is sandwiched between highly doped diffused p^+ and n^+ outer layers giving a p^+ $-pn^+$ or p^+ $-nn^+$ layer. Generally, the base gives the diode its high reverse voltage, and the two diffused regions give the high forward current rating.

Although double-diffused diodes are highly efficient, a slight compromise is still necessary. Generally, for a given silicon chip area, the thicker the base layer the higher the V_R and the lower the I_F. Reverse switching characteristics also determine the base design. Fast recovery diodes usually have n-type base regions to give 'soft' recovery. Other diodes have the base type, n or p, chosen to meet their specific requirements.

ULTRA FAST RECTIFIER DIODES

Ultra fast rectifier diodes, made by epitaxial technology, are intended for use in applications where low conduction and switching losses are of paramount importance and relatively low reverse blocking voltage (V_{RWM} = 150 V) is required: e.g., switched-mode power supplies operating at frequencies of about 50 kHz.

The use of epitaxial technology means that there is very close control over the almost ideal diffusion profile and base width giving very high carrier injection efficiencies leading to lower conduction losses than conventional technology permits. The well defined diffusion profile also allows a tight control of stored minority carriers in the base region, so that very fast turn-off times (35 ns) can be achieved. The range of devices also has a soft reverse recovery and a low forward recovery voltage.

SCHOTTKY-BARRIER RECTIFIER DIODES

Schottky-barrier rectifiers find application in low-voltage switched-mode power supplies (e.g. 5 V output) where they give an increase in efficiency due to the very low forward drop, and low switching losses. Power Schottky diodes are made by a metal-semiconductor barrier process to minimise forward voltage losses, and being majority carrier devices have no stored charge. They are therefore capable of operating at extremely high speeds. Electrical performance in forward and reverse conduction is uniquely defined by the device's metal-semiconductor 'barrier height'. We have a process to minimise forward voltage, whilst maintaining reverse leakage current at full rated working voltage and $T_{j\ max}$ at an acceptable level.

To obtain the maximum benefit from the use of Schottky devices it is recommended that particular attention be paid to the adequate suppression of voltage transients in practical circuit designs.

SWITCHING LOSSES (see also Fig.3)

The product of transient reverse current and reverse bias voltage is a power dissipation, most of which occurs during the fall time. In repetitive operation an average power can be calculated. This is then added to the forward dissipation to give the total power. The peak value of transient reverse current is known as I_{RRM}.

The conditions which need to be specified are:

a. Forward current (I_F); high currents increase switching losses.
b. Rate of fall of anode current (dI_F/dt); high rates of fall increase switching losses. This is particularly important in square-wave operation. Power losses in sine-wave operation for a given frequency are considerably less due to the much lower dI_F/dt.
c. Frequency (f); high frequency means high losses.
d. Reverse bias voltage (V_R); high reverse bias means high losses.
e. Junction temperature (T_j); high temperature means high losses.

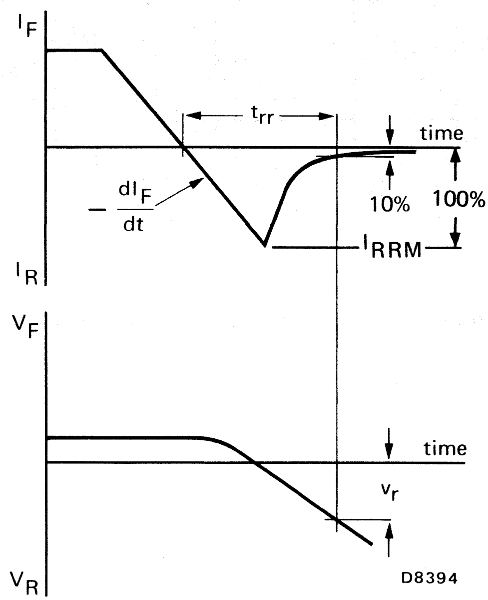


Fig.2 Waveforms showing the reverse switching losses aspects.

SWITCHING LOSSES (continued)

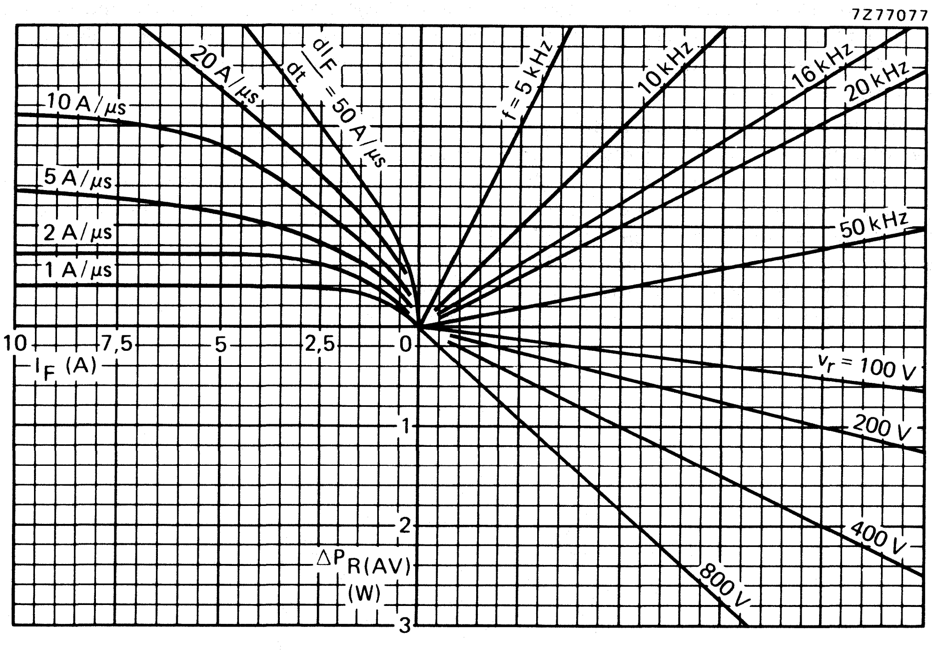


Fig. 3 **Nomogram** (example of reverse switching losses). Power loss $\Delta P_{R(AV)}$ due to switching only (to be added to steady-state power losses). I_F = forward current just before switching off; T_j = 150 °C.

FORWARD RECOVERY

At the instant a semiconductor rectifier diode is switched into forward conduction there are no carriers present at the junction, hence the forward voltage drop may be instantaneously of a high value. As the stored charge builds-up, conductivity modulation takes place and the forward voltage drop rapidly falls to the steady-state value. The peak value of forward voltage drop is known as the forward recovery voltage (V_{fr}). The time from the instant the current reaches 10% of its steady-state value to the time the forward voltage drop falls to within 10% of its final steady-state value is known as the forward recovery time (t_{fr}).

The conditions which need to be specified are:

a. Forward current (I_F); high currents give high recovery voltages.
b. Current pulse rise time (t_r); short rise times give high recovery voltages.
c. Junction temperature (T_j); the influence of temperature is slight.

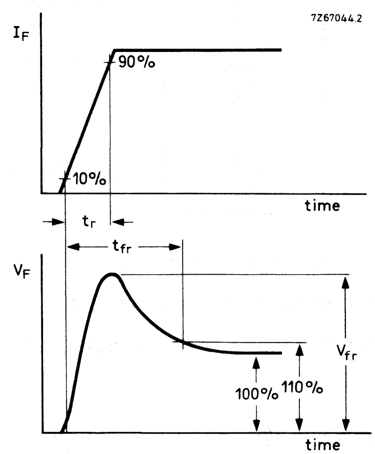


Fig. 4 Waveforms showing the forward recovery aspects.

OPERATING NOTES

When there is a possibility that transients, due to the energy stored in the transformer, will exceed the maximum permissible non-repetitive peak reverse voltage [1]), a damping circuit should be connected across the transformer.
Either a series RC circuit or a voltage dependent resistor may be used. Suitable component values for an RC circuit across the transformer primary or secondary may be calculated as follows:

$\frac{V_{RSM}}{V_{RWM}}$	RC across primary of transformer		RC across secondary of transformer	
	C (µF)	R (Ω)	C (µF)	R (Ω)
2.0	$200\frac{I_{mag}}{V_1}$	$\frac{150}{C}$	$225\frac{I_{mag}T^2}{V_1}$	$\frac{200}{C}$
1.5	$400\frac{I_{mag}}{V_1}$	$\frac{225}{C}$	$450\frac{I_{mag}T^2}{V_1}$	$\frac{275}{C}$
1.25	$550\frac{I_{mag}}{V_1}$	$\frac{260}{C}$	$620\frac{I_{mag}T^2}{V_1}$	$\frac{310}{C}$
1.0	$800\frac{I_{mag}}{V_1}$	$\frac{300}{C}$	$900\frac{I_{mag}T^2}{V_1}$	$\frac{350}{C}$

where I_{mag} = magnetising primary r.m.s. current (A)

V_1 = transformer primary r.m.s. voltage (V)

V_2 = transformer secondary r.m.s. voltage (V)

T = V_1/V_2

V_{RSM} = the transient voltage peak produced by the transformer

V_{RWM} = the actually applied crest working reverse voltage

The capacitance values calculated from the above table are minimum values; to allow for circuit variations and component tolerances, larger values should be used.

[1]) For controlled avalanche types read: non-repetitive peak reverse power.

BREAKOVER DIODES

GENERAL

Breakover diodes (BODs) are two-terminal devices that operate in either an off (non-conducting) state or an on (conducting) state. A BOD will remain in the off-state until the maximum breakover voltage is applied across its terminals. A BOD will then conduct with a low on-state voltage until the current is reduced below the minimum holding current.

BODs are available as single or dual symmetric (operation in 1st and 3rd quadrants) and dual reverse conducting types in a TO-220 outline. BODs are graded according to breakover voltage.

BREAKOVER DIODE CHARACTERISTICS

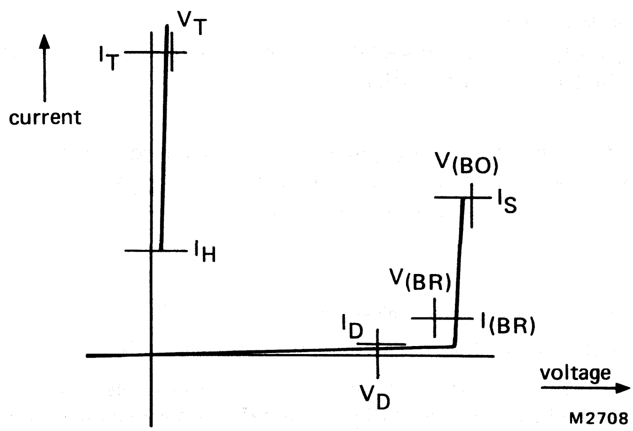


Fig.1 Breakover diode characteristics (1st quadrant).

The main characteristics are illustrated in Fig.1. These characteristics are:-

$V_{(BO)}$ breakover voltage, the maximum voltage appearing across the BOD before switching to the on-state.

V_D stand-off voltage, maximum normal operating voltage.

I_D off-state current, normally quoted at V_D.

$V_{(BR)}$ breakdown voltage, at which the BOD will commence avalanche breakdown.

$I_{(BR)}$ breakdown current, with $V_{(BR)}$ applied.

I_S switching current, the avalanche current required to switch the BOD to the on-state.

I_T on-state current.

V_T on-state voltage, specified at a given I_T.

I_H holding current, the minimum current at which the BOD will remain in the on-state.

USE OF BREAKOVER DIODES

BODs are primarily designed to protect electronic equipment connected to transmission lines against transient overvoltages. However, there are many uses for BODs as breakover switches.

In designing BOD circuits the following must be considered:-

Off-state conditions

V_D Must not be exceeded in normal off-state operation. In the off-state the BOD will not pass more current than I_D.

dV_D/dt The rate of rise of voltage must not exceed that quoted for the device. If this is exceeded, the BOD may switch to on-state.

$V_{(BR)}$ Low voltage transients may be required not to switch the BOD to the on-state. To ensure the BOD remains in the off-state the voltage must remain below the minimum $V_{(BR)}$. If this is exceeded then clipping of the voltage or switching of the BOD may occur.

I_S If V_{BR} is exceeded but the current limited to below I_S minimum, the BOD is prevented from switching to the on-state.

C_j The off-state capacitance across the BOD. In transmission line protection applications this will be across the termination of the line.

Switching conditions

$V_{(BO)}$ A transient voltage greater than $V_{(BO)}$ maximum is required to switch the BOD. $V_{(BO)}$ may be greater than the voltage across the BOD passing current I_S maximum.

I_S To enable the BOD to switch to the on-state a current greater than I_S maximum is required.

On-state conditions

V_T The on-state voltage is quoted for a given I_T.

I_H To enable the BOD to switch to the off-state the current must fall below I_H minimum.

→ I_{TSM} I_{TSM} specifies the rate of increase and duration of a transient peak on-state current. The waveshape is defined according to IEC60-2, this definition is illustrated in Fig.2. The waveform is referred to as T_1/T_2 µs waveform.

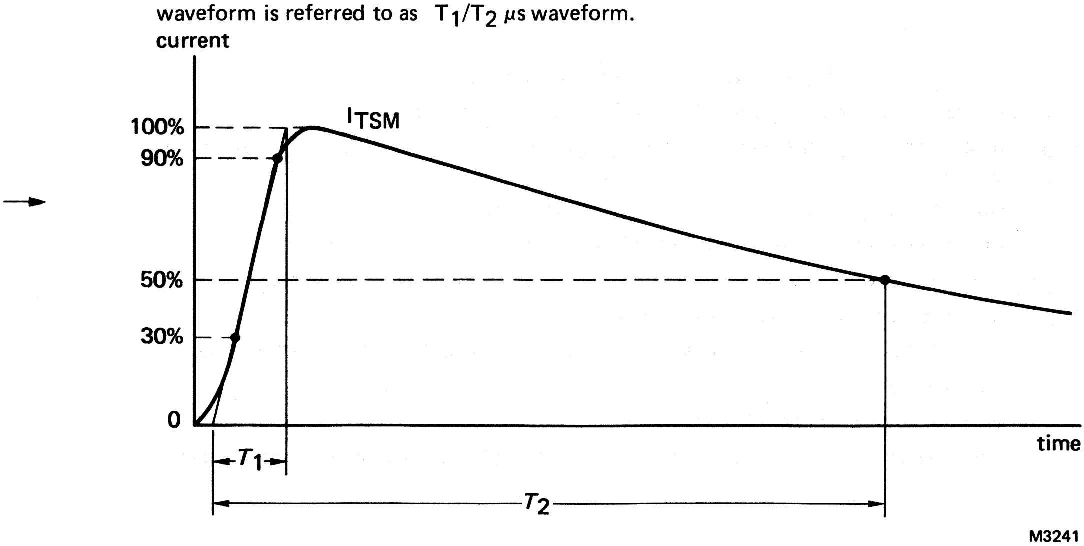


Fig.2 Definition of I_{TSM} waveform.

Thermal conditions

R_{th} For extended on-state operation (> 0.1ms) the steady-state thermal resistance should be considered. The total thermal resistance to ambient sould be sufficiently low to dissipate the heat generated by the device. For this type of application it is recommended that the BOD is mounted on a heatsink.

Z_{th} If the BOD is used only during transient overvoltages then the transient thermal impedance to ambient should be considered. It may be sufficient to mount the BOD in free-air.

Mains contact

Fig.3 illustrates the operation of a BOD during one cycle of a mains contact fault. The BOD will generate heat in avalache breakdown until the instantaneous current is greater than I_S maximum. When this current is reached the BOD will switch and generate heat in the on-state.

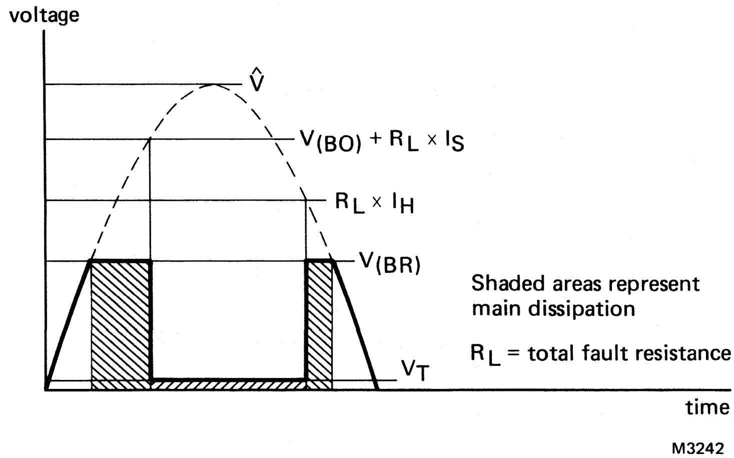


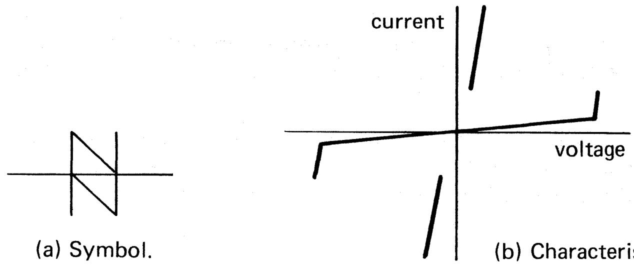
Fig.3 Voltage across BOD during mains contact fault,

During avalanche a large amount of heat is generated. If the mains fault impedance is sufficiently high the BOD will remain in avalanche breakdown until the mains voltage falls below $V_{(BR)}$ minimum. Under this condition the junction temperature may be raised considerably.

Power dissipation curves are not published for BODs during avalanche breakdown. This is because individual cases will vary greatly. However, in general if the fault impedance is about 500Ω-5kΩ then there will be excessive dissipation due to the avalanche breakdown.

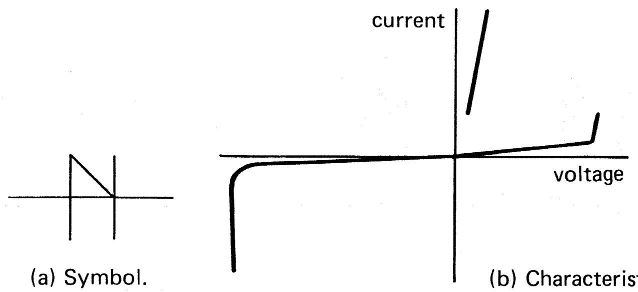
If mains contact faults are likely with impedances in the range quoted, the dissipation of the BOD should be considered carefully.

BREAKOVER DIODE SYMBOLS AND CHARACTERISTICS



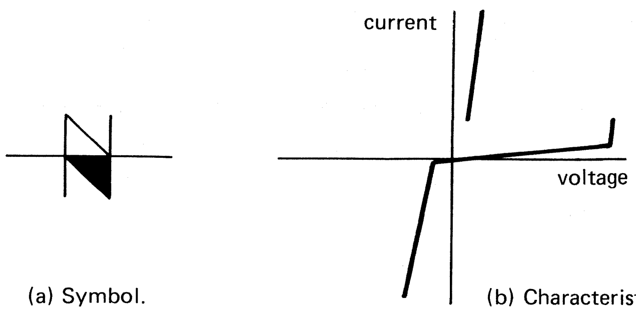
(a) Symbol. (b) Characteristic.

Fig.4 Symmetric BOD.



(a) Symbol. (b) Characteristic.

Fig.5 Reverse-blocking BOD.



(a) Symbol. (b) Characteristic.

Fig.6 Reverse-conducting BOD.

LOW-PROFILE TO-220 OUTLINES (SOT-226/SOD-94)

Low-profile versions of most devices assembled in either TO-220AB or TO-220AC are available. These outlines are designated SOT-226 (low-profile TO-220AB) or SOD-94 (low-profile TO-220AB). Devices assembled in these outlines have the same electrical ratings and characteristics as the TO-220 versions and are suitable for free-air mounting on circuit boards with limited clearance.

MECHANICAL DATA Dimensions in mm

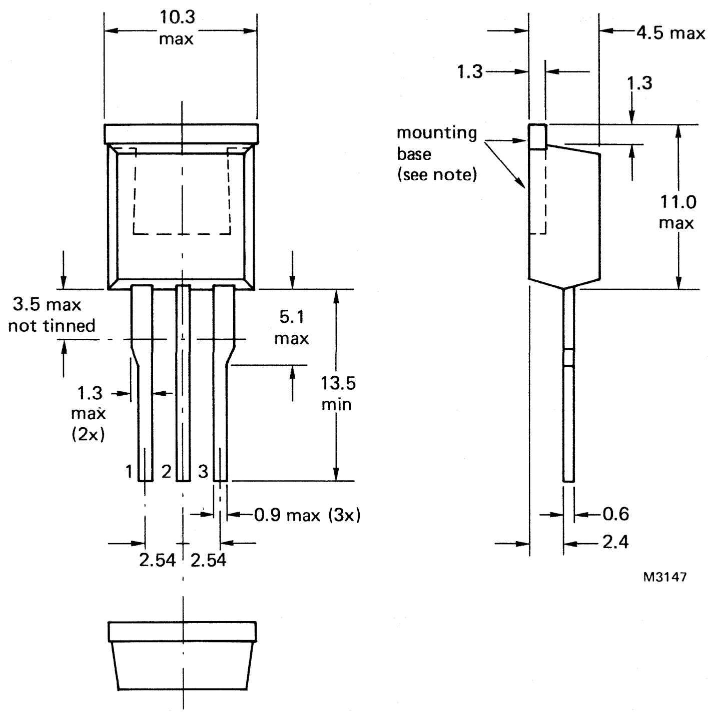


Fig.1 SOT-226, low-profile version of TO-220AB.

Net mass: 1.5 gram
Note: The exposed metal mounting base is directly connected to terminal 2.

MECHANICAL DATA (Cont)

Dimensions in mm

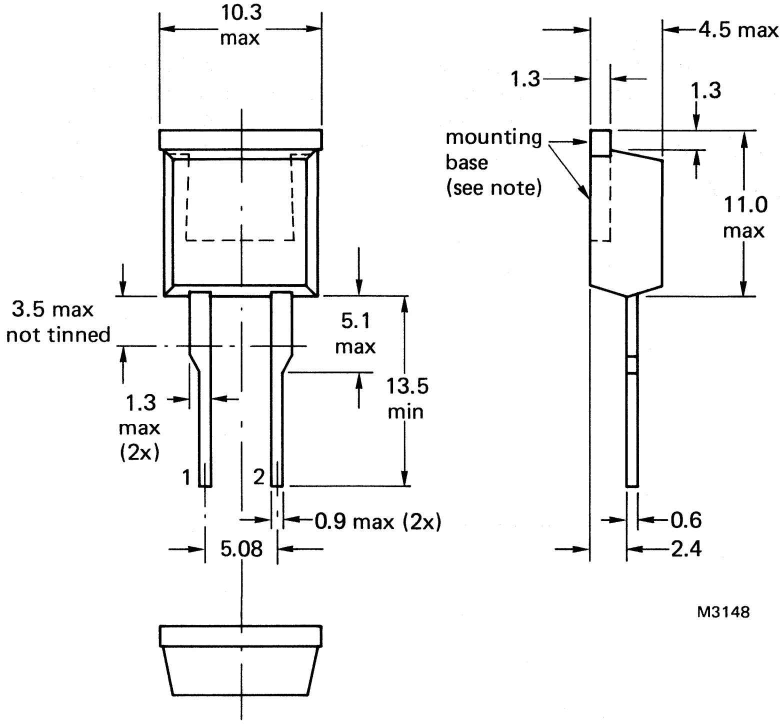


Fig.2 SOD-94, low-profile version of TO-220AC.

Net mass: 1.5 gram

Note: The exposed metal mounting base is directly connected to terminal 1.

DESIGNATION OF LOW-PROFILE DEVICES

Low-profile versions of devices types are identified by a /CR suffix added to the normal TO-220 device type code.

Example: To identify a BT151-650R in a low-profile outline.

This becomes the BT151-650R/CR in SOT-226.

The low-profile device type will have the same electrical ratings and characteristics as the TO-220 type.

MOUNTING INSTRUCTIONS

1. The lead soldering instructions for low-profile devices are the same as TO-220 devices, for details see data-sheet Mounting Instructions for TO-220 Envelopes.
2. Low-profile TO-220 outlines may be clip-mounted onto a heatsink using clips, part number 56363 (for direct mounting) or 56366 (for insulated mounting). Clip mounting is the same as TO-220 envelopes, for details see data-sheet Mounting Instructions for TO-220 Envelopes.

THERMAL RESISTANCE DATA

From junction to mounting base:
see TO-220 device type data.

Influence of mounting method:

1. Heatsink-mounted with clip

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 max. mica insulator	$R_{th\ mb\text{-}h}$	=	2.2	K/W
d. with heatsink compound and 0.25 mm max. alumina insulator	$R_{th\ mb\text{-}h}$	=	0.8	K/W
e. without heatsink compound	$R_{th\ mb\text{-}h}$	=	1.4	K/W

2. Free-air operation

The quoted value 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 $R_{th\ j\text{-}a}$ = 75 K/W

BANDOLIER AND REEL SPECIFICATION FOR SOD-84 OUTLINE

This specification concerns all axial-leaded diodes in this handbook.

The taped and reeled products fulfil the requirements of IEC 286-1: Tape packaging of components with axial leads on continuous tapes.

Dimensions in mm

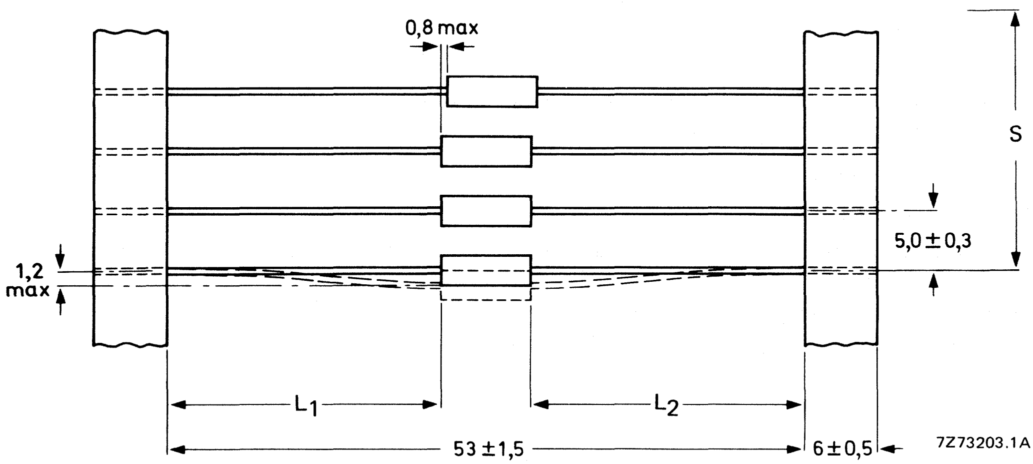


Fig. 1 Configuration of bandolier.

The cumulative space (S) measured over ten spacings = 50 ± 2; for 26 mm: 20 spacings (= 100 ± 2).

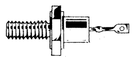
The diodes are centred so that $| L_1 - L_2 | \leqslant 1,2$ mm.

A black marker is printed on the white tape of the bandolier every 50 diodes.

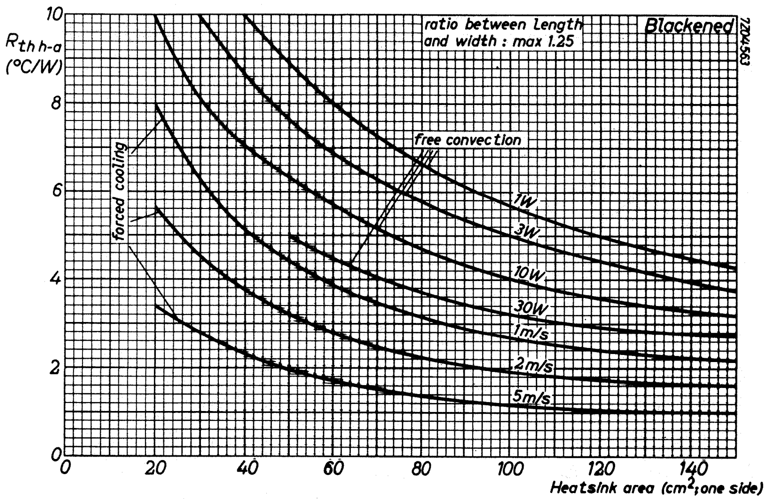
The axial taping specification described above is compatible with automatic insertion equipment as manufactured by Universal, U.S.M. (Dynapert) and M.E.I. (Panasert).

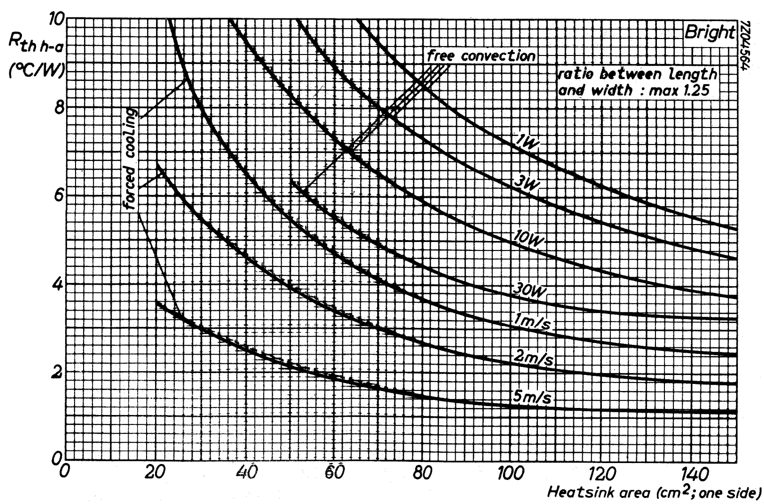
Quantity per reel: 5000.

Thermal resistance of flat heatsinks of 2 mm copper or 3 mm aluminium.
The graphs are valid for the combination of device and heatsink.

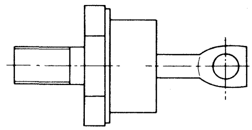


Studs: 10-32UNF
Mounting bases, across the flats: max. 11,0 mm

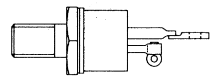




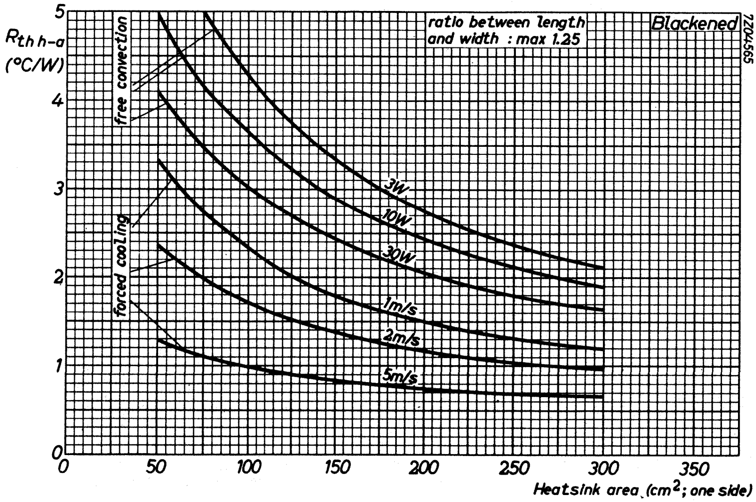
Thermal resistance of flat heatsinks of 2 mm copper or 3 mm aluminium.
The graphs are valid for the combination of device and heatsink.

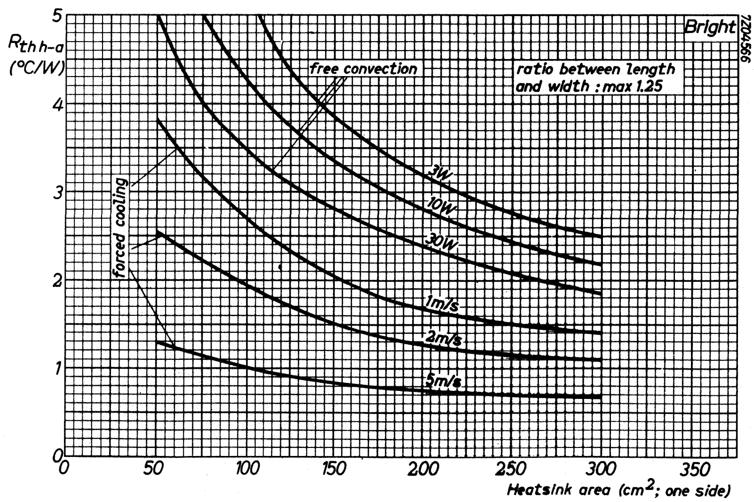


Stud: M6 ; ¼" x 28 UNF
Mounting base across the flats: max. 17 mm



Stud: M6 ; ¼" x 28 UNF
Mounting base across the flats: max. 14.0 mm





DEVICE DATA

BREAKOVER DIODES

A range of glass-passivated bidirectional breakover diodes in the TO-220AC outline, available in a +/– 12% tolerance series of nominal breakover voltage. Their controlled breakover voltage and peak current handling capability together with the high holding current make them suitable for transient overvoltage protection in applications such as telephony equipment or other data transmission lines, and remote instrumentation lines.

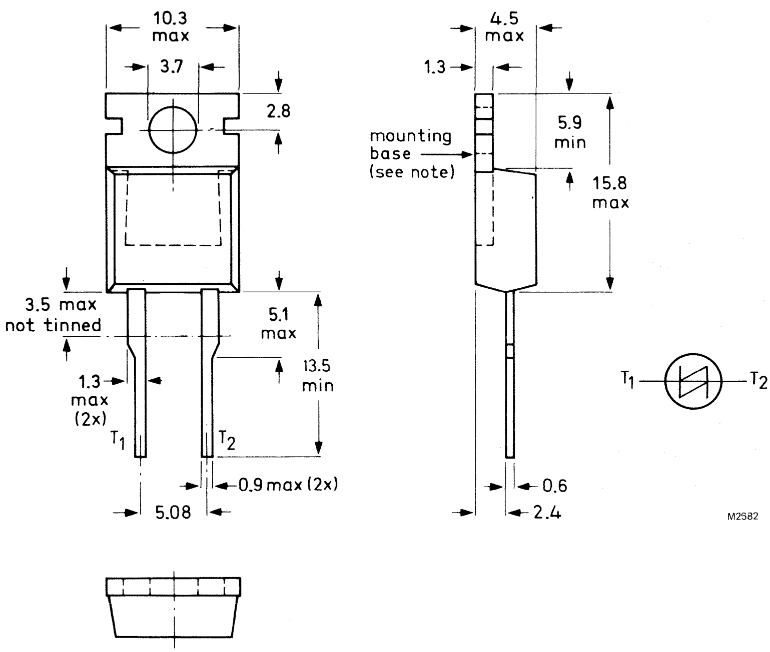
QUICK REFERENCE DATA

			BR210–100 to 280	
Breakover voltage	$V_{(BO)}$	nom.	100 to 280	V
Holding current	I_H	>	150	mA
Transient peak current (10/320 μs impulse)	I_{TSM}	max.	40	A ←

MECHANICAL DATA

Dimensions in mm

Fig.1 TO-220AC



Net mass: 2 g

Note: The exposed metal mounting base is directly connected to terminal T_1.
Accessories supplied on request: see data sheet Mounting instructions and accessories for TO-220 envelopes.

RATINGS

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

Voltages (either direction)

			BR210-100 to 280	
→ Continuous voltages	V_D	max.	75% of nom. voltage	

→ **Currents**

(in either direction)

Transient peak current (8/20 μs impulse)	I_{TSM1}	max.	150	A
Transient peak current (10/320 μs impulse) equivalent to 10/700 μs 1.6 kV voltage impulse (CCITT K17); (see Fig.4)	I_{TSM2}	max.	40	A
Average on-state current (averaged over any 20 ms period); up to T_{mb} = 75 °C	$I_{T(AV)}$	max.	5	A
RMS AC on-state current	$I_{T(RMS)}$	max.	8	A
Non-repetitive peak on-state current, T_j = 100 °C prior to surge; t = 10 ms; half sinewave	I_{TSM3}	max.	30	A
I^2t for fusing (t = 10 ms)	I^2t	max.	4.5	A^2s
Rate of rise of on-state current after $V_{(BO)}$ turn-on (t_p = 10 μs)	dI/dt	max.	50	A/μs

Power dissipation

Continuous dissipation; unidirectional operation, device mounted on infinite heatsink	P_{tot}	max.	40	W
Peak dissipation; t = 1 ms, free-air mounting	P_{TM}	max.	400	W

Temperatures

Storage temperature	T_{stg}		−40 to +150	°C
Operating temperature (off-state)	T_j	max.	125	°C
Overload temperature (on-state)	T_{vj}	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a printed circuit board at any lead length	$R_{th\ j\text{-}amb}$	=	60	K/W
From junction to mounting base				
bidirectional operation	$R_{th\ j\text{-}mb}$	=	2.5	K/W
unidirectional operation	$R_{th\ j\text{-}mb}$	=	3.1	K/W
Transient thermal impedance (t = 1 ms)	$Z_{th\ j\text{-}mb}$	=	0.3	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 max. mica insulator (56369)	$R_{th\ mb\text{-}h}$	=	2.2	K/W
d. with heatsink compound and 0.25 mm max. 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

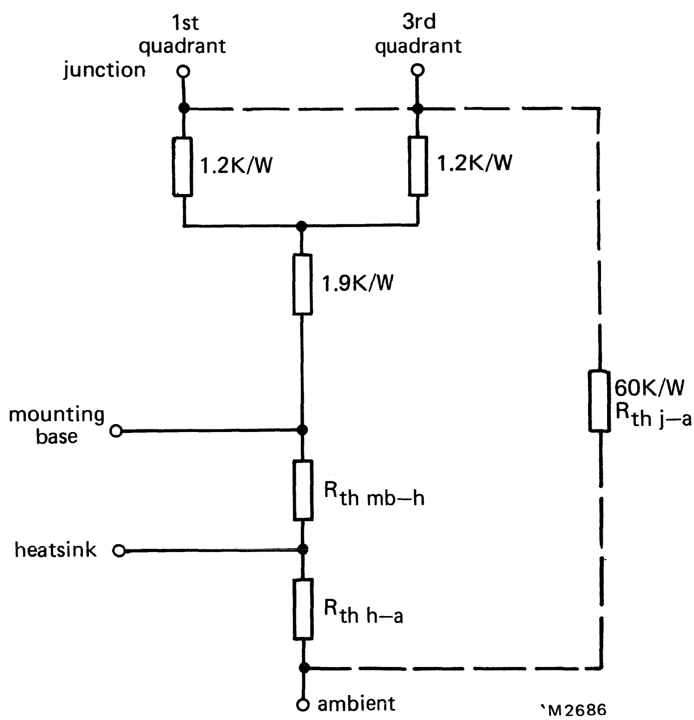


Fig.2 Components of thermal resistance (junction to ambient).

CHARACTERISTICS

T_j = 25 °C unless otherwise stated

Voltages and currents (in either direction)

On-state voltage (note 1)				
I_{TM} = 5 A	V_{TM}	<	2.5	V
Avalanche voltage $V_{(BR)}$; ($I_{(BR)}$ = 10 mA), and Breakover voltage $V_{(BO)}$; ($I \leqslant I_S$): (100 μs pulsed)		$V_{(BR)}$ min.	$V_{(BO)}$ max.	
	BR210–100	88	112	V
	–120	105	135	V
	–140	123	157	V
	–160	140	180	V
	–240	211	269	V
	–260	228	292	V
	–280	246	314	V
Temperature coefficient of $V_{(BR)}$	$S_{(br)}$	typ.	+0.1	%/K
Holding current (note 2)				
T_j = 25 °C	I_H	>	150	mA
T_j = 70 °C	I_H	>	100	mA
Switching current (note 3)	I_S	>	10	mA
(100 μs pulsed)	I_S	typ.	200	mA
	I_S	<	1000	mA
Off-state current; V_D = 85% $V_{(BR)min}$ (note 4)				
T_j = 70 °C	I_D	<	50	μA
T_j = 125 °C	I_D	<	250	μA
Linear rate of rise of off-state voltage that will not trigger any device;				
T_j = 70 °C; V_{DM} = 85% $V_{(BR)min}$	dV_D/dt	<	2000	V/μs
Off-state capacitance				
V_D = 0; f = 1 kHz to 1 MHz	C_j	<	300	pF

Notes:

1. Measured under pulsed conditions to avoid excessive dissipation.
2. The minimum current at which the BOD will remain in the on-state.
3. The avalanche current required to switch the BOD to the on-state.
4. I.e., at maximum recommended continuous voltage.

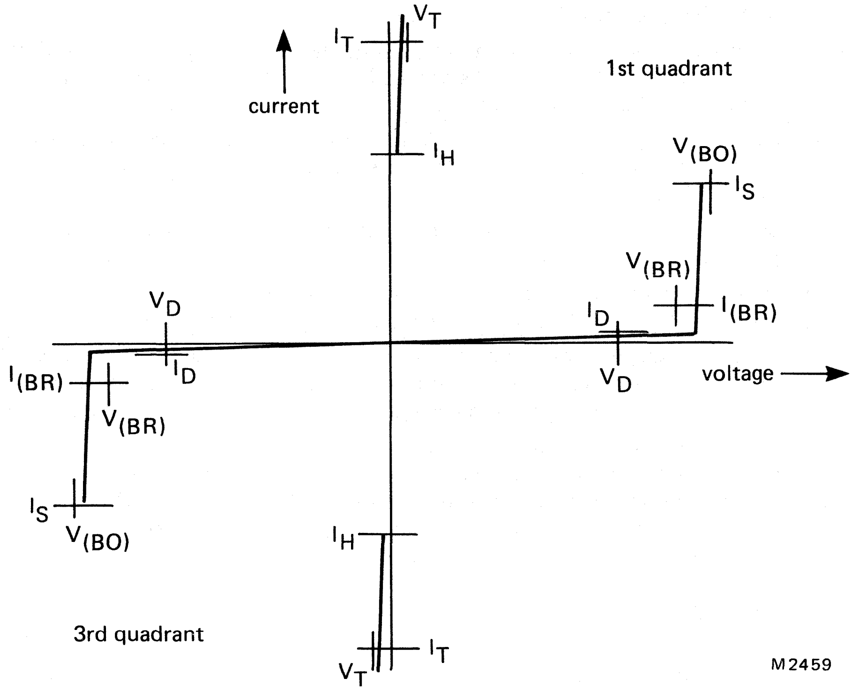


Fig.3 Breakover diode characteristics.

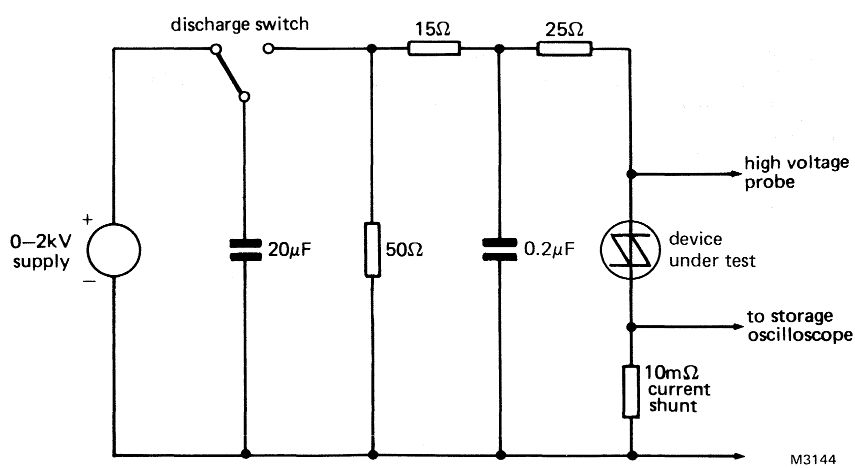


Fig.4 Test circuit for high voltage impulse (I_{TSM2})
(according to CCITT vol IX-Rec. K17)

Notes:
The 10/700 μs Impulse Waveform is defined for the voltage across the test fixture when the device under test is replaced with an open circuit. Clearly, once a breakover device has switched on to a low voltage, the current waveform will have a shorter fall-time, since the 15 Ω + 25 Ω output impedance becomes effectively in parallel with the 50 Ω.

MOUNTING INSTRUCTIONS

1. The device may be soldered directly into the circuit. The maximum permissible soldering temperature is 275 ^{o}C. Heat must not be applied for more than 5 seconds. Soldered joints must be at least 4.7 mm from the body of the device.
2. The leads must not be bent less than 2.4 mm from the body of the device and should be supported during bending. The leads can be bent twisted or straightened by 90^{o} maximum. The minimum bending radius is 1 mm.
3. Any heatsink used must have a flatness in the mounting area of 0.02 mm maximum per 10 mm. Mounting holes must be deburred.
4. For good thermal contact a metallic-oxide loaded heatsink compound must be used between the mounting base and heatsink. Ordinary silicone grease is not recommended.
5. The preferred mounting method is with the use of a spring clip. This ensures good thermal contact under the crystal area and safe isolation. However, if a screw is used, it should be M3 cross-recess pan-head. Care should be taken to avoid damage to plastic body of the device during mounting.
6. → 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. The maximum recommended hole size for rivet mounting is 3.5 mm. The pre-formed head of the rivet should be on the device side and any rivet tool used should not damage the plastic body of the device.

OPERATING NOTES

1. For most applications involving transient overvoltage protection only, the device is not normally mounted on a heatsink. The free-air rating of the device is normally adequate for non-repetitive transients.
2. Circuit connections to the T1 terminal should be made to the left-hand lead not the mounting tab.
3. During a mains contact fault, excessive dissipation can occur with the device held in its avalanche state. The following figures illustrate how power dissipation can be calculated during a mains contact fault. In general, if the fault resistance is about 500 – 5 kΩ, there may be excessive dissipation.

MAINS CONTACT

Calculation of power dissipation during mains contact fault.

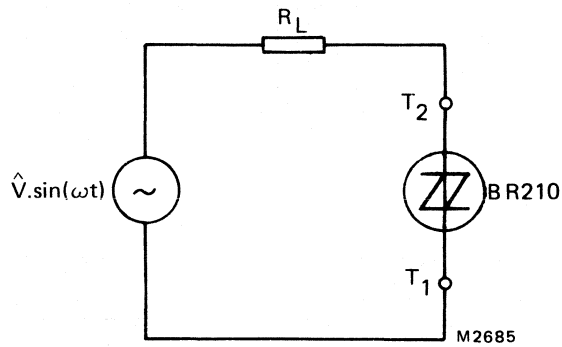


Fig.5 Equivalent circuit of BOD during mains contact fault;
R_L = total fault resistance.

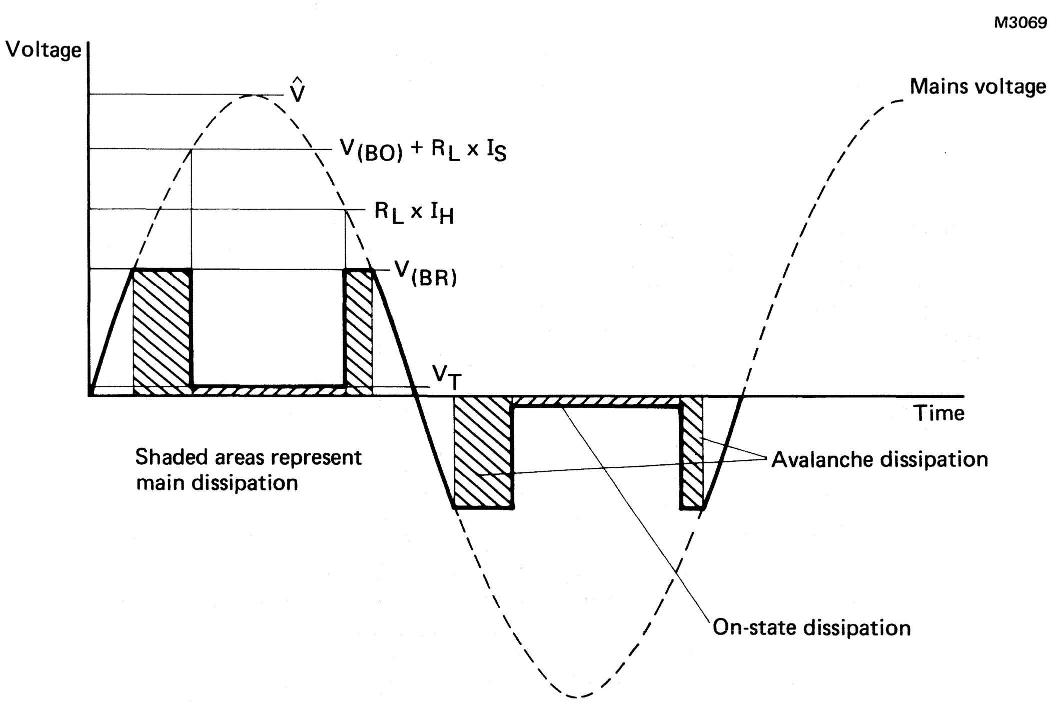
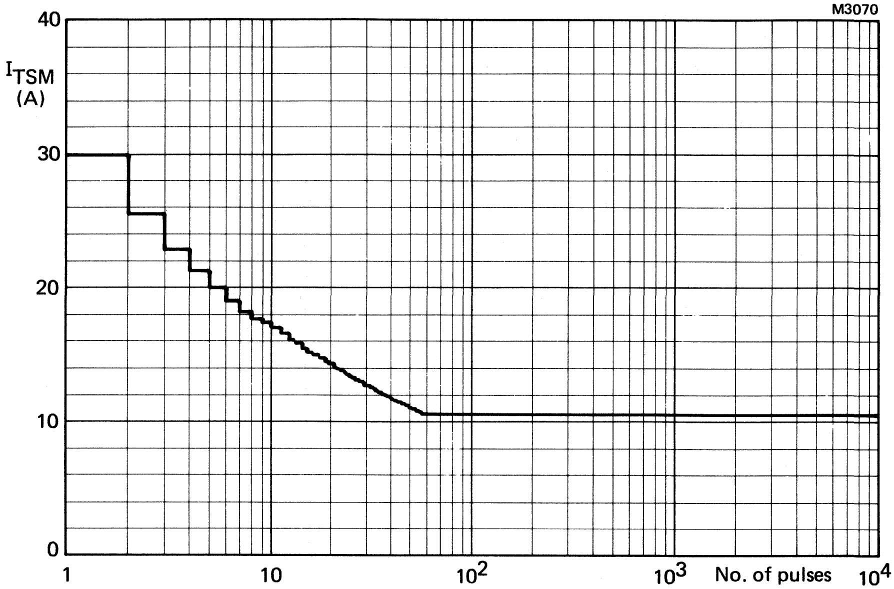


Fig.6 Dissipation during mains contact fault.
Solid line shows voltage across BOD.
Total power generated (per half-cycle) = avalanche dissipation prior to switching
+ on-state dissipation
+ avalanche dissipation after on-state.



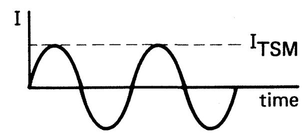


Fig.7 Maximum permissible non-repetitive on-state current based on sinusoidal currents (f = 50 Hz; device triggered at the start of each pulse). T_j = 125 °C prior to surge.

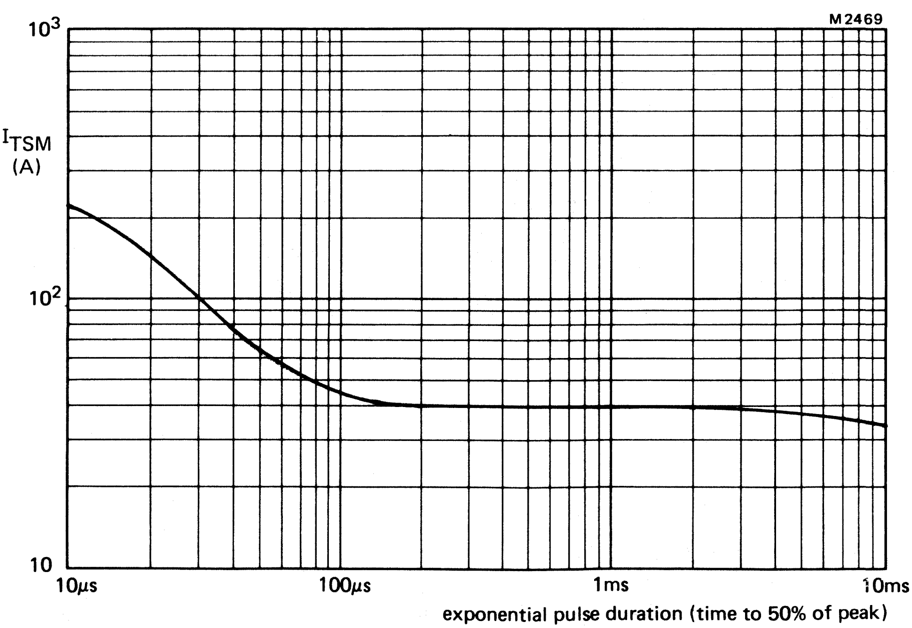


Fig.8 Maximum non-repetitive exponential waveform Impulse Current rating as a function of pulse duration (virtual front-time 10 μs).

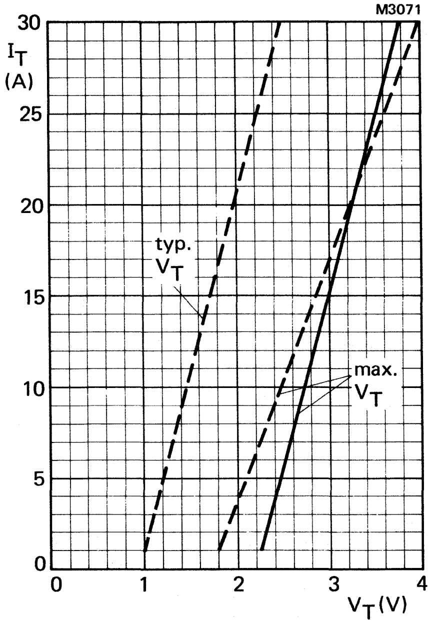


Fig.9 On-state voltage as a function of on-state current. (200 μs pulsed condition to avoid excessive dissipation) —— T_j = 25, – – – T_j = 125 °C.

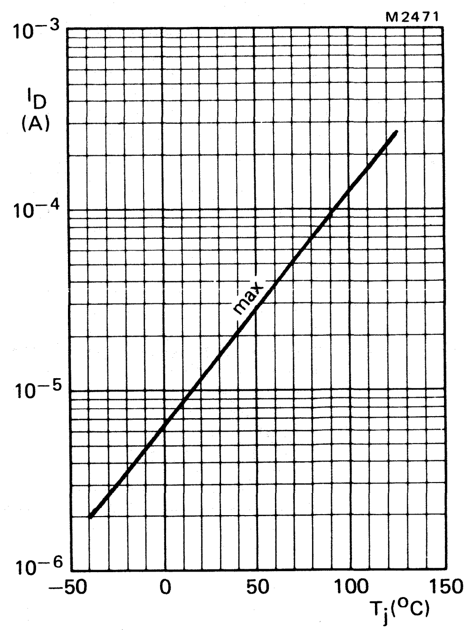


Fig.10 Maximum off-state current as a function of temperature.

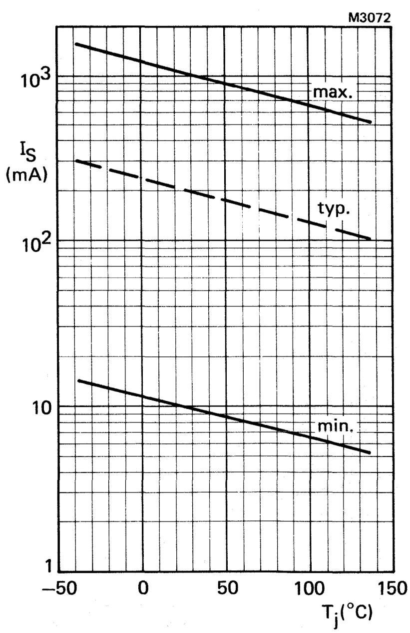


Fig.11 Switching current as a function of junction temperature.

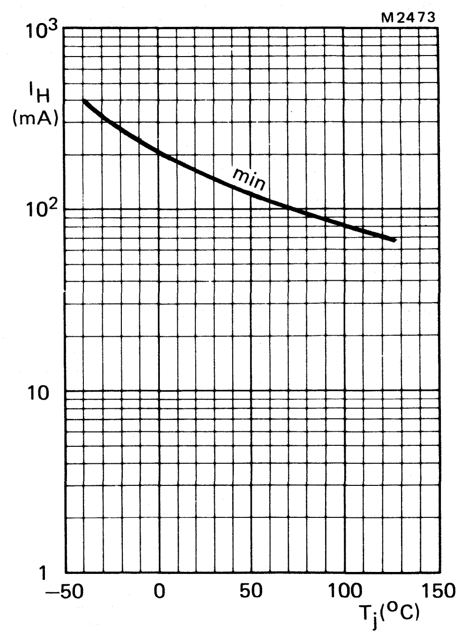


Fig.12 Minimum holding current as a function of temperature.

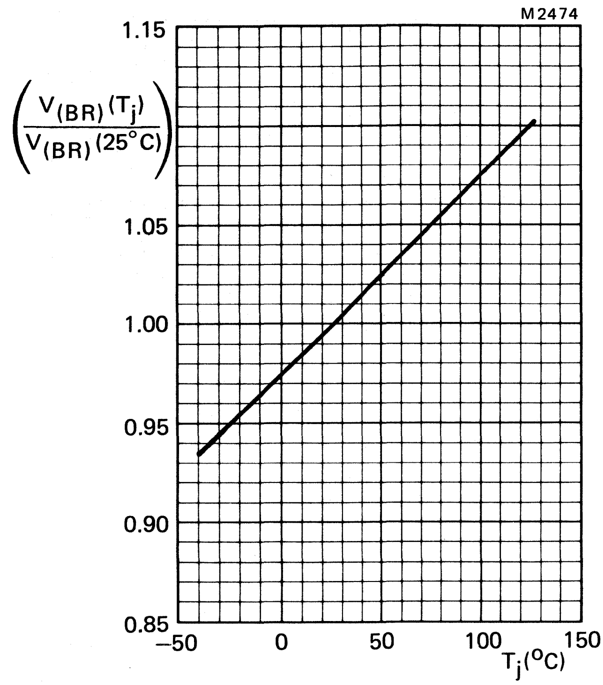


Fig.13 Normalised avalanche breakdown voltage as a function of temperature.
Note: this figure may also be used to derive normalised $V_{(BO)}$.

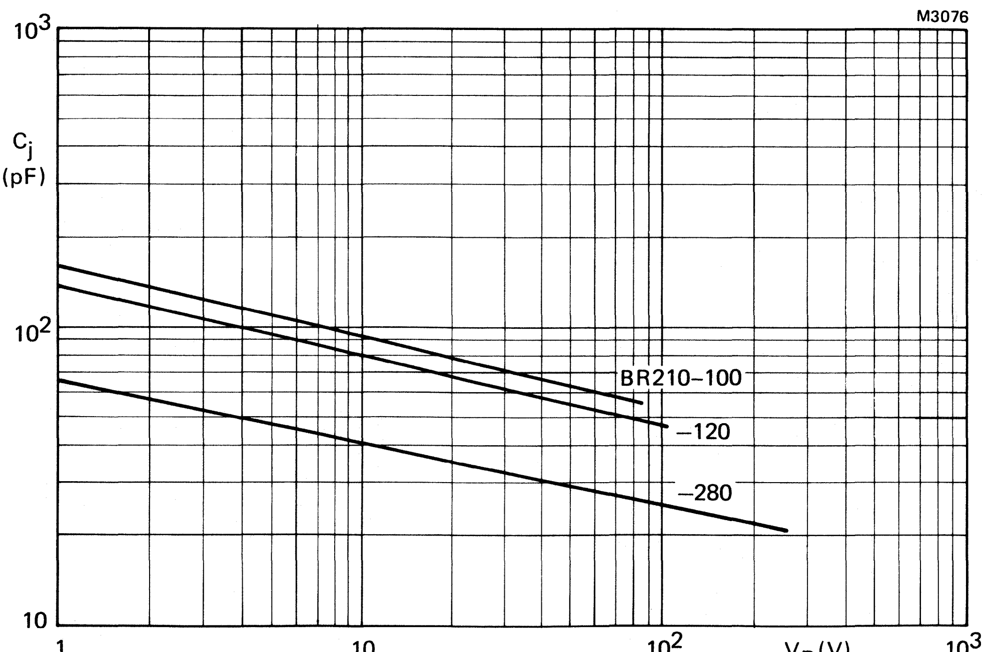


Fig.14 Typical junction capacitance as a function of off-state voltage; T_j = 25 °C; f = 1 MHz.

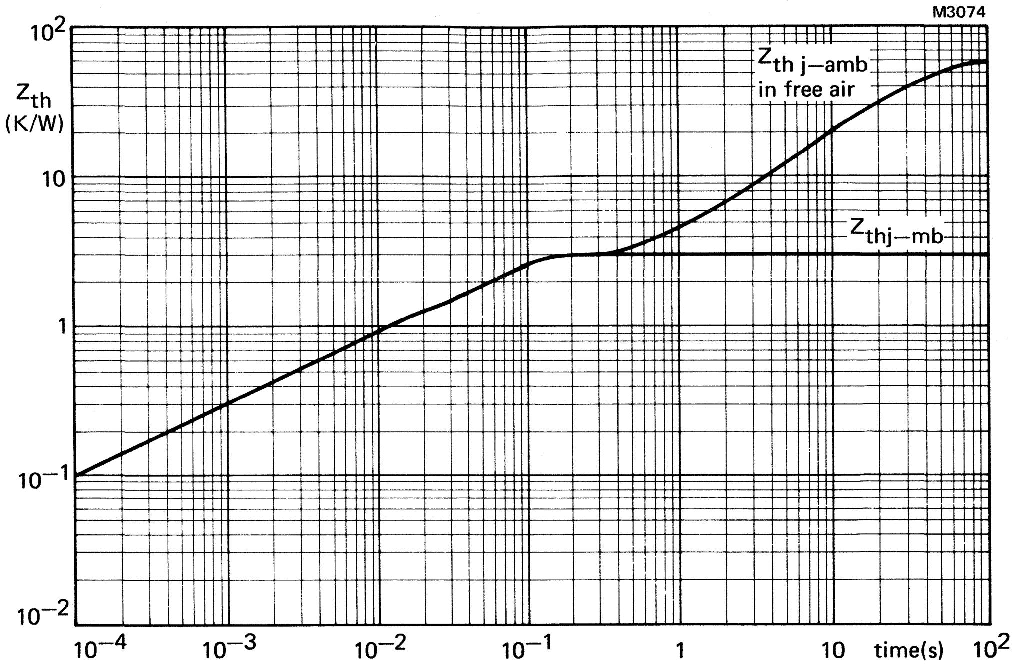


Fig.15 Transient thermal impedance as a function of time (rectangular pulse duration).

BREAKOVER DIODES

A range of bidirectional diodes in hermetically sealed axial-leaded implosion-diode glass outlines with a +/– 12% tolerance of breakover voltage. These devices feature controlled breakover voltage and high holding current together with a good peak current handling capability. Typical applications include transient overvoltage in telephony equipment, data transmission and remote instrumentation lines.

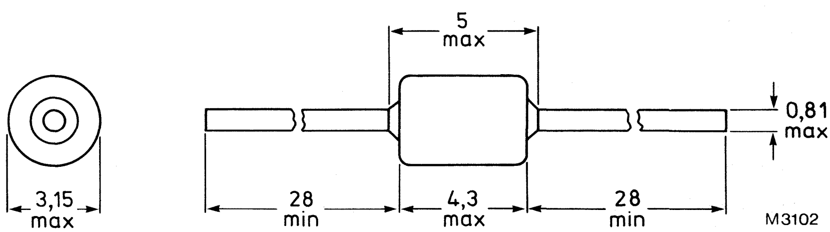
QUICK REFERENCE DATA

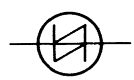
			BR211–100 to 280	
Breakover voltage	$V_{(BO)}$	nom.	100 to 280	V
Holding current	I_H	>	150	mA
Transient peak current (10/320 μs impulse)	I_{TSM}	max.	40	A

MECHANICAL DATA

Dimensions in mm

Fig.1 SOD-84.



Circuit symbol: 

Net mass: 0.35 g.

For packing details see data sheet Bandolier and reel specification for axial-leaded devices.

RATINGS

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

Voltages				
(in either direction)			BR211–100 to 280	
Continuous voltages	V_D	max.	75% of nom. voltage	
Currents				
(in either direction)				
Transient peak current (10/320 μs impulse) equivalent to 10/700 μs 1.6 kV voltage impulse (CCITT K17); (see Fig.5)	I_{TSM1}	max.	40	A
Non-repetitive peak on-state current, T_j = 70 °C prior to surge; t = 10 ms; half sinewave	I_{TSM2}	max.	15	A
I^2t for fusing (t = 10 ms)	I^2t	max.	1.1	A^2s
Rate of rise of on-state current after $V_{(BO)}$ turn-on (t_p = 10 μs)	dI_T/dt	max.	50	A/μs
Power dissipation				
Continuous dissipation; unidirectional operation, device mounted as Fig.3, T_{amb} = 25 °C	P_{tot}	max.	1.2	W
Peak dissipation; t = 1 ms, free-air mounting, T_{amb} = 25 °C	P_{TM}	max.	50	W
Temperatures				
Storage temperature	T_{stg}		–65 to +150	°C
Operating temperature (off-state)	T_{amb}	max.	70	°C
Overload temperature (on-state)	T_{vj}	max.	150	°C

DEVELOPMENT DATA

THERMAL RESISTANCE

From junction to envelope	$R_{th\ j\text{-}e}$	=	22	K/W
From envelope to tie point				
lead length = 5 mm	$R_{th\ e\text{-}tp}$	=	15	K/W
lead length = 10 mm	$R_{th\ e\text{-}tp}$	=	30	K/W
From envelope to ambient				
lead length = 5 mm	$R_{th\ e\text{-}a}$	=	440	K/W
lead length = 10 mm	$R_{th\ e\text{-}a}$	=	350	K/W
Transient thermal impedance				
t = 1 ms;	$Z_{th\ j\text{-}a}$	=	2.62	K/W

Influence of mounting method

Device mounted on a 1.5 mm thick epoxy-glass pcb with a copper thickness $\geqslant 40\ \mu m$

1. Tie point to ambient thermal resistance				
a. mounted as Fig.3	$R_{th\ tp\text{-}a}$	=	70	K/W
b. mounted with 1 cm^2 copper laminate per lead	$R_{th\ tp\text{-}a}$	=	55	K/W
c. mounted with 2.25 cm^2 copper laminate per lead	$R_{th\ tp\text{-}a}$	=	45	K/W
2. Junction to ambient thermal resistance, mounted as Fig.3	$R_{th\ j\text{-}a}$	=	105	K/W

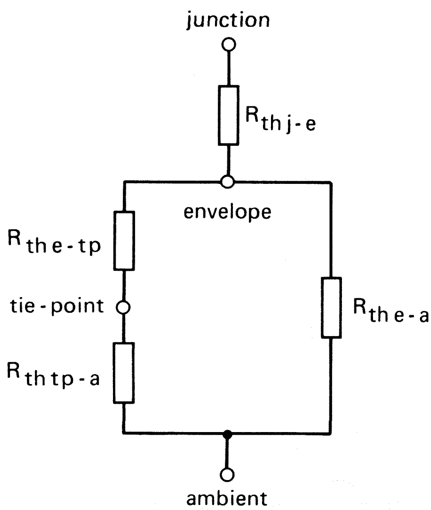


Fig.2 Components of thermal resistance.

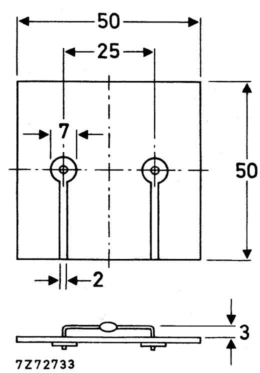


Fig.3 Mounting on pcb used for R_{th} measurement.

$$R_{th\ j\text{-}a} = R_{th\ j\text{-}e} + \frac{R_{th\ e\text{-}a}\,(R_{th\ e\text{-}tp} + R_{th\ tp\text{-}a})}{R_{th\ e\text{-}a} + R_{th\ e\text{-}tp} + R_{th\ tp\text{-}a}}$$

Notes: All figures quoted assume symmetrical lead lengths.
For further information see data sheet Thermal Model of Axial Leaded Devices.

CHARACTERISTICS

T_j = 25 °C unless otherwise stated

Voltages and currents (in either direction)

On-state voltage (note 1)				
I_{TM} = 2 A	V_{TM}	<	2.5	V
Avalanche voltage $V_{(BR)}$; ($I_{(BR)}$ = 10 mA), and Breakover voltage $V_{(BO)}$; ($I \leqslant I_S$): (100 μs pulsed)		$V_{(BR)}$ min.	$V_{(BO)}$ max.	
	BR211–100	88	112	V
	–120	105	135	V
	–140	123	157	V
	–160	140	180	V
	–180	158	202	V
	–200	176	224	V
	–220	193	247	V
	–240	211	269	V
	–260	228	292	V
	–280	246	314	V
Temperature coefficient of $V_{(BR)}$	$S_{(br)}$	typ.	+0.1	%/K
Holding current (note 2)				
T_j = 25 °C	I_H	>	150	mA
T_j = 70 °C	I_H	>	100	mA
Switching current (note 3)	I_S	>	10	mA
(100 μs pulsed)	I_S	typ.	200	mA
	I_S	<	1000	mA
Off-state current; V_D = 85% $V_{(BR)min}$ (note 4)				
T_j = 70 °C	I_D	<	10	μA
Linear rate of rise of off-state voltage that will not trigger any device; T_j = 70 °C; V_{DM} = 85% $V_{(BR)min}$	dV_D/dt	<	2000	V/μs
Off-state capacitance				
V_D = 0; f = 1 kHz to 1 MHz	C_j	<	100	pF

Notes:

1. Measured under pulsed conditions to avoid excessive dissipation.
2. The minimum current at which the BOD will remain in the on-state.
3. The avalanche current required to switch the BOD to the on-state.
4. I.e., at maximum recommended continuous voltage. Illuminance ⩽ 500 lux (daylight); relative humidity < 65%.

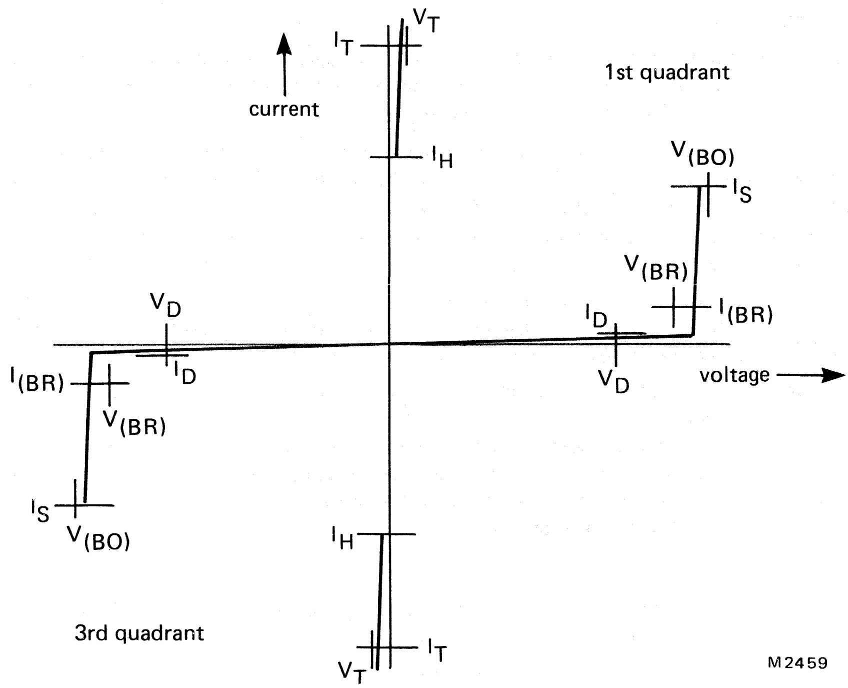


Fig.4 Breakover diode characteristics.

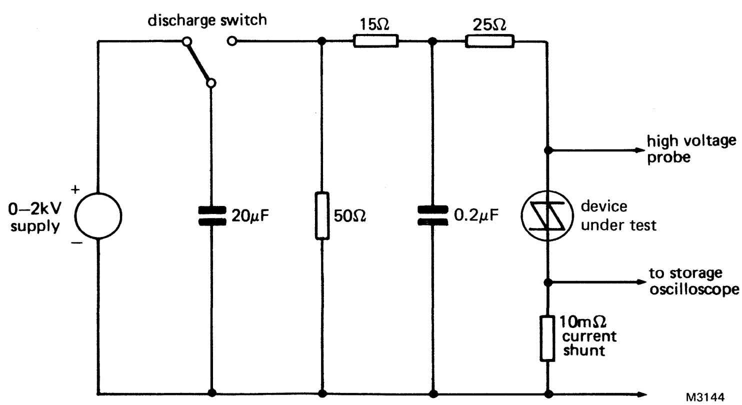


Fig.5 Test circuit for high voltage impulse (I_{TSM1})
(according to CCITT vol IX-Rec. K17)

Notes:
The 10/700 μs Impulse Waveform is defined for the voltage across the test fixture when the device under test is replaced with an open circuit. Clearly, once a breakover device has switched on to a low voltage, the current waveform will have a shorter fall-time, since the 15 Ω + 25 Ω output impedance becomes effectively in parallel with the 50 Ω.

DEVELOPMENT DATA

MOUNTING INSTRUCTIONS

1. The device may be soldered directly onto a circuit board. The maximum permissible soldering temperature is 300 °C. Heat must not be applied for more than 5 seconds. Soldered joints must be at least 0.5 mm from the body of the device.
2. If the device is soldered in any way other than directly on a printed circuit board then heat must not be applied for more than 3 seconds at a point at least 0.5 mm from the body. The maximum permissible soldering temperature is 300 °C.
3. Avoid any force on the body or leads during or just after soldering. The position of an already soldered device must not be corrected by pushing, pulling or twisting the body.
4. The leads may only be bent without supporting the leads if the bending radius is greater than 0.5 mm. The leads may be bent by 90° maximum. Axial forces on the body during bending, twisting or straightening of the leads must not exceed 20 N.
5. For complete mounting instructions see data sheet Rules for Mounting and Soldering of Axial-Leaded Devices.
   Provided that the device is soldered and mounted correctly it can be flat-mounted with the body in direct contact with hot spots or hot tracks during soldering. The device can also be mounted upright with the body in direct contact with the printed circuit board provided that it is not in contact with metal tracks or plated through holes.

OPERATING NOTES

1. For most applications involving transient overvoltage protection only the device will be adequately rated. The rating of the device may be considerably reduced for repetitive transients.
2. During mains contact fault, excessive dissipation can occur with the device in its avalanche state. The following figures illustrate how power dissipation can be calculated during a mains contact fault. In general, if the fault resistance is about 500 Ω – 5 kΩ, there may be excessive dissipation.

MAINS CONTACT

Calculation of power dissipation during mains contact fault.

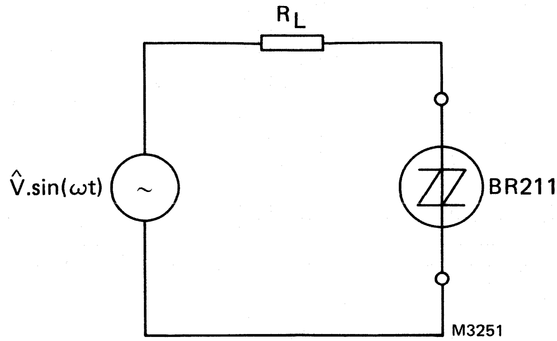


Fig.6 Equivalent circuit of BOD during mains contact fault;
R_L = total fault resistance.

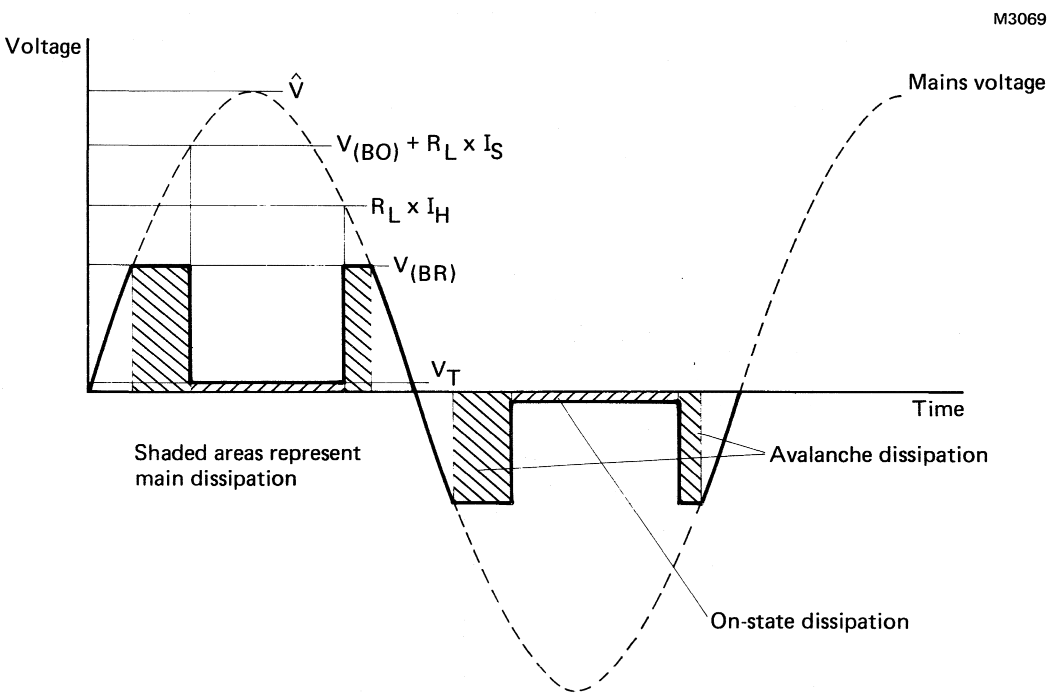


Fig.7 Dissipation during mains contact fault.

Solid line shows voltage across BOD.

Total power generated = avalanche dissipation prior to switching
(per half-cycle) + on-state dissipation
\+ avalanche dissipation after on-state.

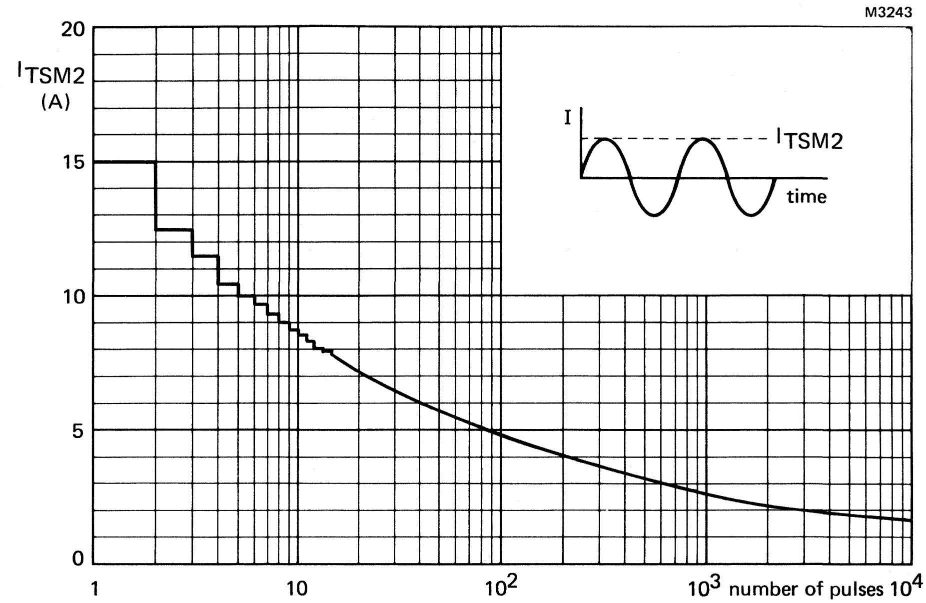


Fig.8 Maximum permissible non-repetitive on-state current based on sinusoidal currents (f = 50 Hz; device triggered at the start of each pulse). T_j = 70 °C prior to surge.

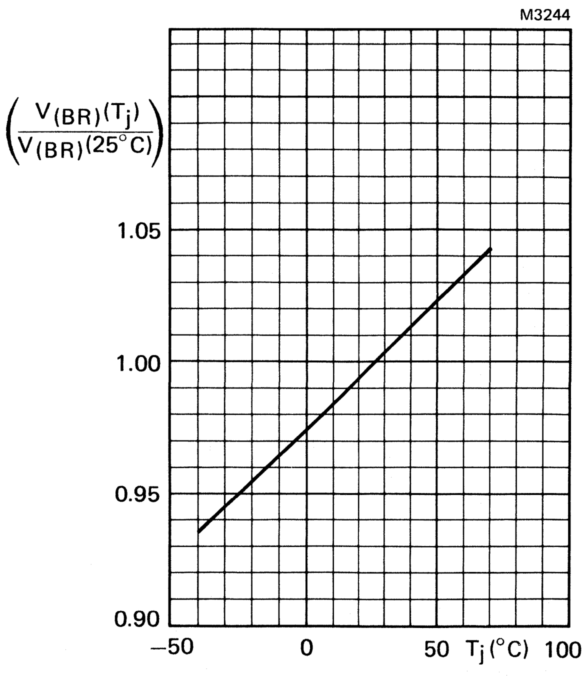


Fig.9 Normalized avalanche breakdown voltage as a function of temperature. Note: this figure may also be used to derive normalized $V_{(BO)}$.

DEVELOPMENT DATA

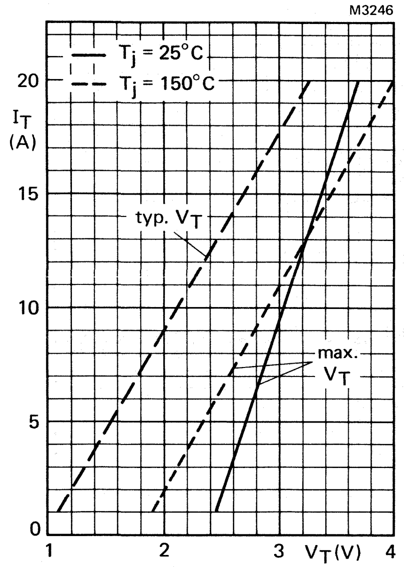


Fig.10 On-state voltage as a function of on-state current. (200 μs pulsed condition to avoid excessive dissipation)

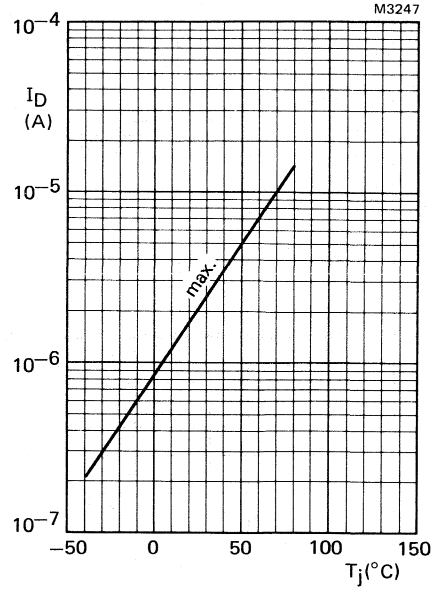


Fig.11 Maximum off-state current as a function of temperature.

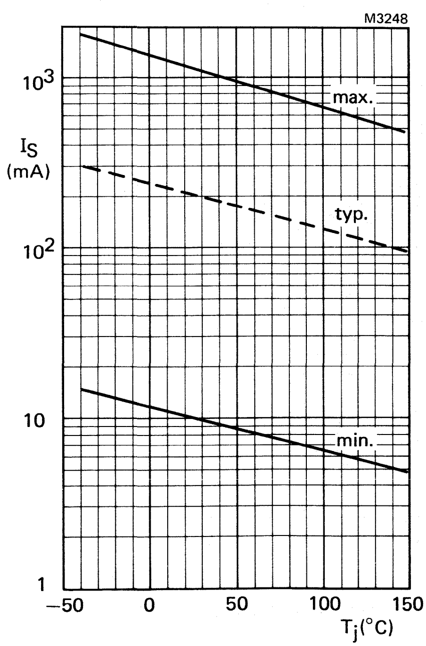


Fig.12 Switching current as a function of junction temperature.

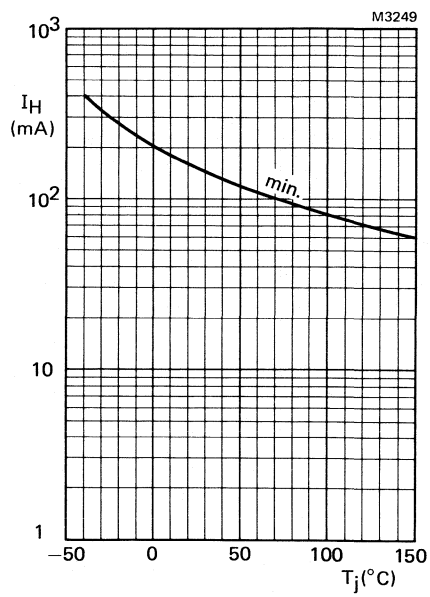


Fig.13 Minimum holding current as a function of temperature.

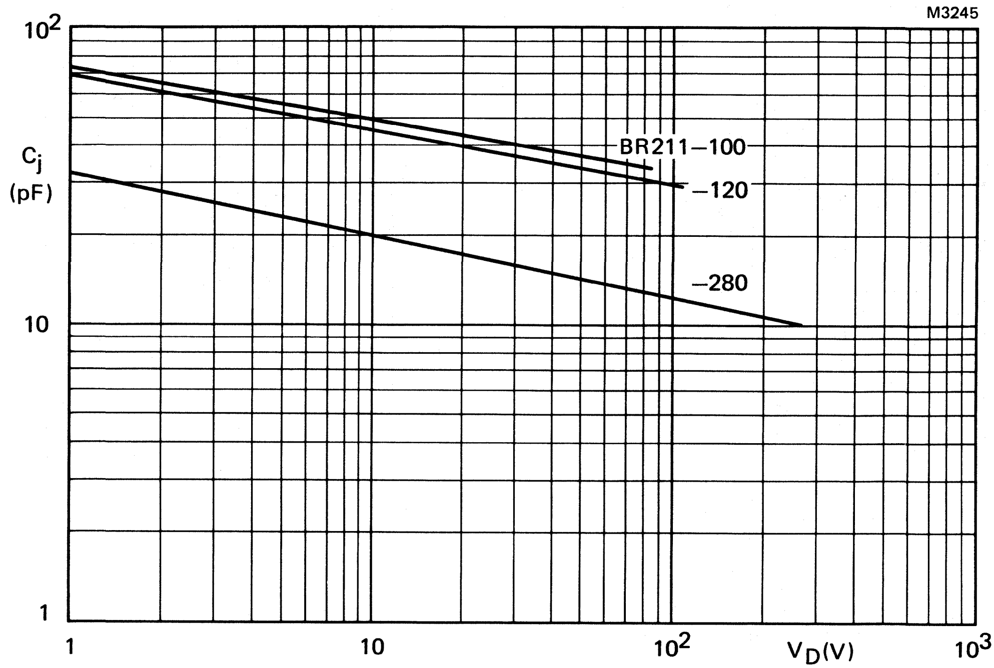


Fig.14 Typical junction capacitance as a function of off-state voltage; T_j = 25 °C; f = 1 MHz.

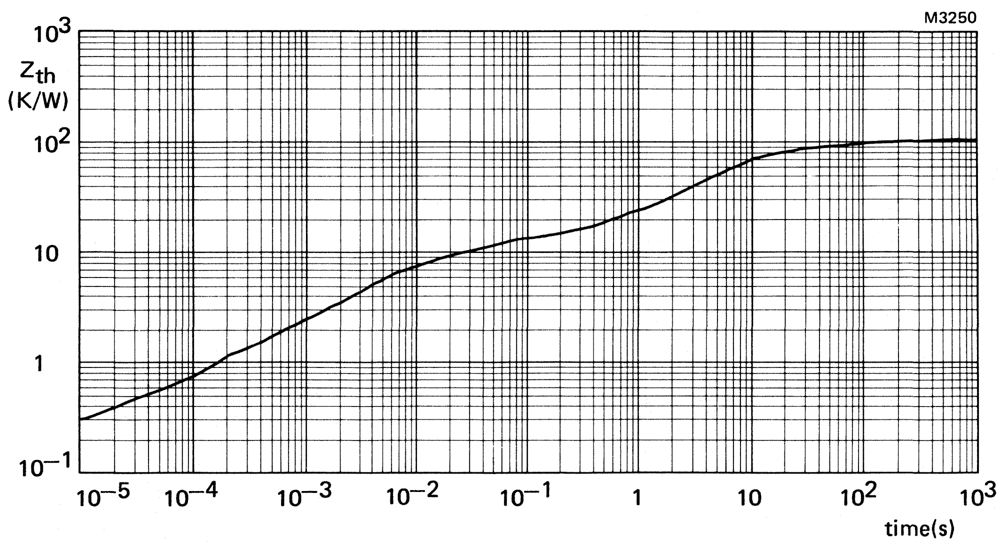


Fig.15 Transient thermal impedance as a function of time (rectangular pulse duration). Mounted as Fig.3.

DUAL BREAKOVER DIODES

A range of monolithic dual bidirectional breakover diodes with ±12% tolerance of breakover voltage. These diodes feature controlled voltage breakover across and between diodes with good peak current handling capability. Typical applications include transient overvoltage protection across lines and line to earth in telephony equipment, data transmission and remote instrumentation lines.

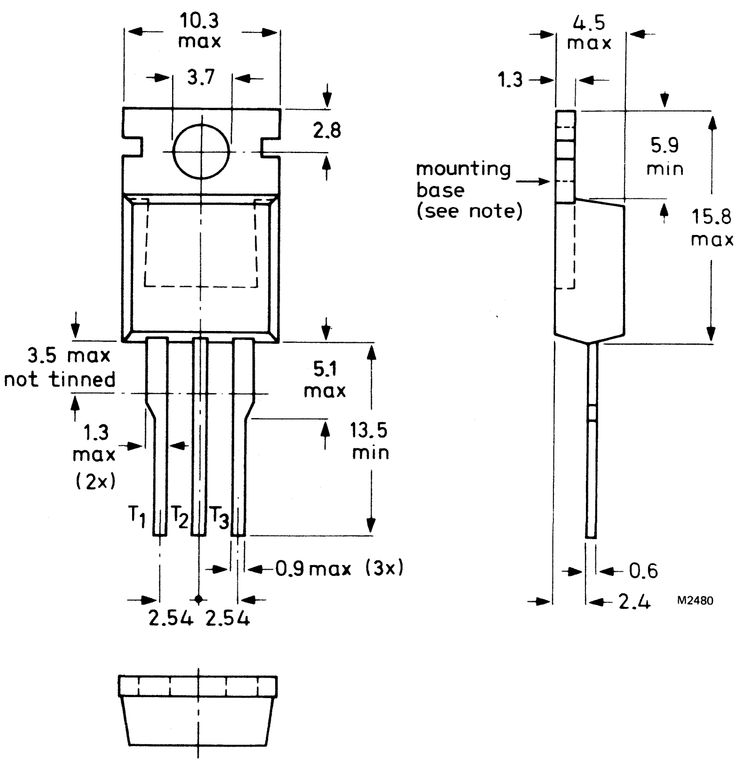
QUICK REFERENCE DATA

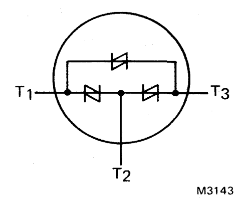
			BR213 – 100 to 280	
Breakover voltage per line	$V_{(BO)}$	nom.	100 to 280	V
Holding current	I_H	>	150	mA
Transient peak current (10/320 μs impulse)	I_{TSM}	max.	40	A

MECHANICAL DATA

Dimensions in mm

Fig.1 TO-220AB





Net mass: 2 g

Note: The exposed metal mounting base is directly connected to terminal T_2.

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

RATINGS

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

Voltages (either direction, between any two leads)

			BR213 – 100 to 280	
Continuous voltages	V_D		max. 75% of nom. voltage	

Currents

(Individually for each line to centre lead in either direction)

Transient peak current (8/20 μs impulse)	I_{TSM1}	max.	150	A
Transient peak current (10/320 μs impulse) equivalent to 10/700 μs 1.6 kV voltage impulse (CCITT K17); (see Fig.3)	I_{TSM2}	max.	40	A
Average on-state current (averaged over any 20 ms period); up to T_{mb} = 75 °C	$I_{T(AV)}$	max.	5	A
RMS AC on-state current	$I_{T(RMS)}$	max.	8	A
Non-repetitive peak on-state current; T_j = 100 °C prior to surge; t = 10 ms; half sinewave	I_{TSM3}	max.	30	A
I^2t for fusing (t = 10 ms)	I^2t	max.	4.5	A^2s
Rate of rise of on-state current after $V_{(BO)}$ turn-on (t_p = 10 μs)	dI/dt	max.	50	A/μs

Power dissipation

Continuous dissipation; one line dissipating, unidirectional operation, device mounted on infinite heatsink	P_{tot}	max.	40	W
Peak dissipation; t = 1 ms, free-air mounting	P_{TM}	max.	400	W

Temperatures

Storage temperature	T_{stg}		−40 to +150	°C
Operating temperature (off-state)	T_j	max.	125	°C
Overload temperature (on-state)	T_{vj}	max.	150	°C

CHARACTERISTICS

T_j = 25 °C unless otherwise stated

Each line to centre lead and between lines

Avalanche voltage $V_{(BR)}$; ($I_{(BR)}$ = 10mA), and
Breakover voltage $V_{(BO)}$; ($I \leqslant I_S$):
(100 μs pulsed)

	$V_{(BR)}$ min.	$V_{(BO)}$ max.	$V_{(BO)}$ max. (line-line)	
BR213 –100	88	112	125	V
–120	105	135	150	V
–140	123	157	175	V
–160	140	180	200	V
–240	211	269	300	V
–260	228	292	325	V
–280	246	314	350	V

Temperature coefficient of $V_{(BR)}$	$S_{(br)}$	typ.	+0.1	%/K
Off-state current; V_D = 85% $V_{(BR)min}$ (note 4)				
T_j = 70 °C	I_D	<	50	μA
T_j = 125 °C	I_D	<	250	μA
Linear rate of rise of off-state voltage that will not trigger any device; T_j = 70 °C; V_{DM} = 85% $V_{(BR)min}$	dV_D/dt	<	2000	V/μs
Off-state capacitance V_D = 0; f = 1 kHz to 1 MHz	C_j	<	300	pF

Each line to centre lead only

Voltages and currents (in either direction)				
On-state voltage (note 1) I_{TM} = 5 A	V_{TM}	<	2.5	V
Holding current (note 2)				
T_j = 25 °C	I_H	>	150	mA
T_j = 70 °C	I_H	>	100	mA
Switching current (note 3)	I_S	>	10	mA
(100 μs pulsed)	I_S	typ.	200	mA
	I_S	<	1000	mA

Notes:

1. Measured under pulsed conditions to avoid excessive dissipation.
2. The minimum current at which the BOD will remain in the on-state.
3. The avalanche current required to switch the BOD to the on-state.
4. I.e., at maximum recommended continuous voltage.

DEVELOPMENT DATA

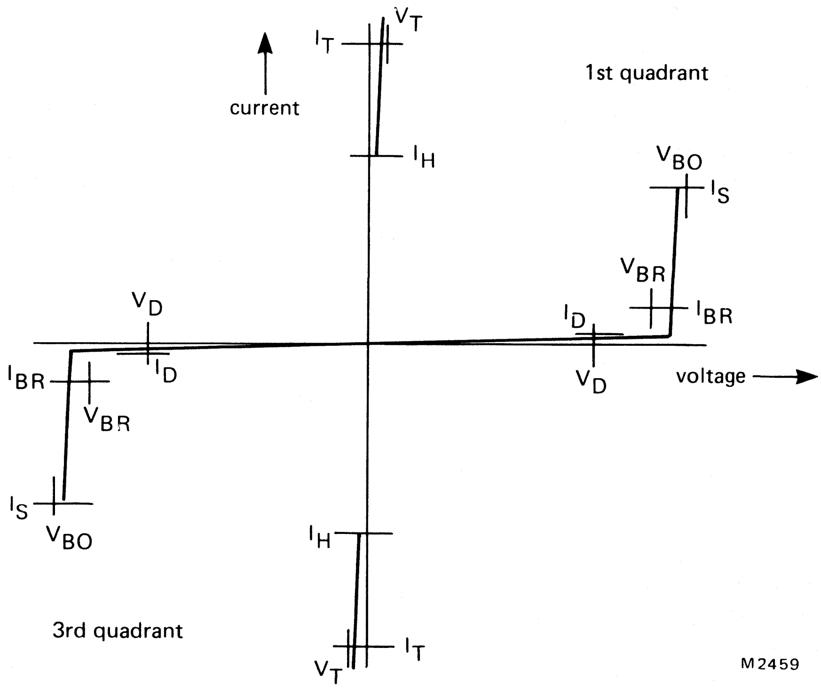


Fig.2 Breakover diode characteristics.

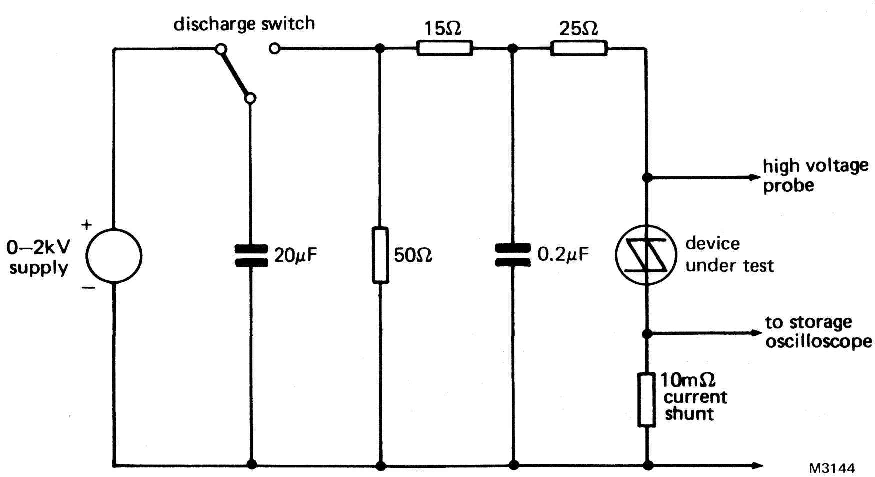


Fig.3 Test circuit for high voltage impulse (I_{TSM2})
(according to CCITT vol IX-Rec. K17).

Notes:
The 10/700 µs Impulse Waveform is defined for the voltage across the test fixture when the device under test is replaced with an open circuit. Clearly, once a breakover device has switched on to a low voltage, the current waveform will have a shorter fall-time, since the 15 Ω + 25 Ω output impedance becomes effectively in parallel with the 50 Ω.

DUAL ASYMMETRICAL BREAKOVER DIODE

The BR216 is a monolithic dual asymmetrical 65 V breakover diode in the TO-220AB outline.
Each half of the device conducts normally in one direction, but in the other direction it acts as a breakover diode.
The controlled breakover voltage and peak current handling capability together with high holding current make it suitable for two-line to earth transient overvoltage protection in applications such as telephony equipment and remote instrumentation lines.

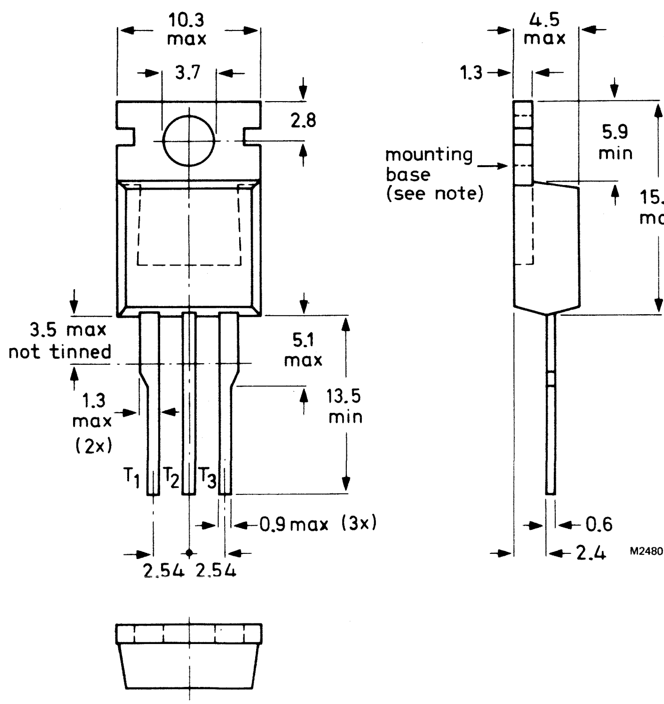
QUICK REFERENCE DATA

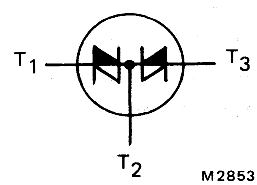
Breakover voltage per line	$V_{(BO)}$	<	78	V
Breakdown voltage per line	$V_{(BR)}$	>	58	V
Holding current	I_H	>	150	mA
Transient peak current (10/320 μs impulse)	I_{TSM}	max.	40	A

MECHANICAL DATA

Dimensions in mm

Fig.1 TO-220AB; centre lead connected to tab.





Net mass: 2 g
Note: The exposed metal mounting base is directly connected to terminal T_2.
Accessories supplied on request: see data sheet Mounting instructions and accessories for TO-220 envelopes.

RATINGS

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

Voltages				
Continuous off-state voltage	V_D	max.	50	V
Currents				
Transient peak current (8/20 µs impulse)	I_{TSM1}/I_{FSM1}	max.	150	A
Transient peak current (10/320 µs impulse) equivalent to 10/700 µs 1.6 kV voltage impulse (CCITT K17)	I_{TSM2}/I_{FSM2}	max.	40	A
Average on-state current	$I_{T(AV)}$	max.	5	A
Average forward current (averaged over any 20 ms period); up to T_{mb}= 75 °C	$I_{F(AV)}$	max.	5	A
RMS AC on-state current	$I_{T(RMS)}$	max.	8	A
Non-repetitive peak current; T_j = 100 °C prior to surge; t = 10 ms; half sinewave	I_{TSM3}/I_{FSM3}	max.	40	A
I^2t for fusing (t = 10 ms)	I^2t	max.	8	A^2s
Rate of rise of on-state current after $V_{(BO)}$ turn-on (t_p = 10 µs)	dI_T/dt	max.	50	A/µs
Power dissipation				
Continuous dissipation; one line dissipating, unidirectional operation, device mounted on infinite heatsink	P_{tot}	max.	35	W
Peak dissipation; t = 1 ms, free-air mounting	P_{TM}	max.	110	W
Temperatures				
Storage temperature	T_{stg}		−40 to +150	°C
Operating temperature (off-state)	T_j	max.	125	°C
Overload temperature (on-state)	T_{vj}	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a printed circuit board at any lead length	$R_{th\ j\text{-}amb}$	=	60	K/W
From junction to mounting base				
One line conducting				
bidirectional operation	$R_{th\ j\text{-}mb}$	=	2.7	K/W
unidirectional operation	$R_{th\ j\text{-}mb}$	=	3.5	K/W
Both lines conducting				
bidirectional operation	$R_{th\ j\text{-}mb}$	=	1.85	K/W
Transient thermal impedance (t = 1 ms)	$Z_{th\ j\text{-}mb}$	=	0.9	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 max. mica insulator (56369)	$R_{th\ mb\text{-}h}$	=	2.2	K/W
d. with heatsink compound and 0.25 mm max. 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

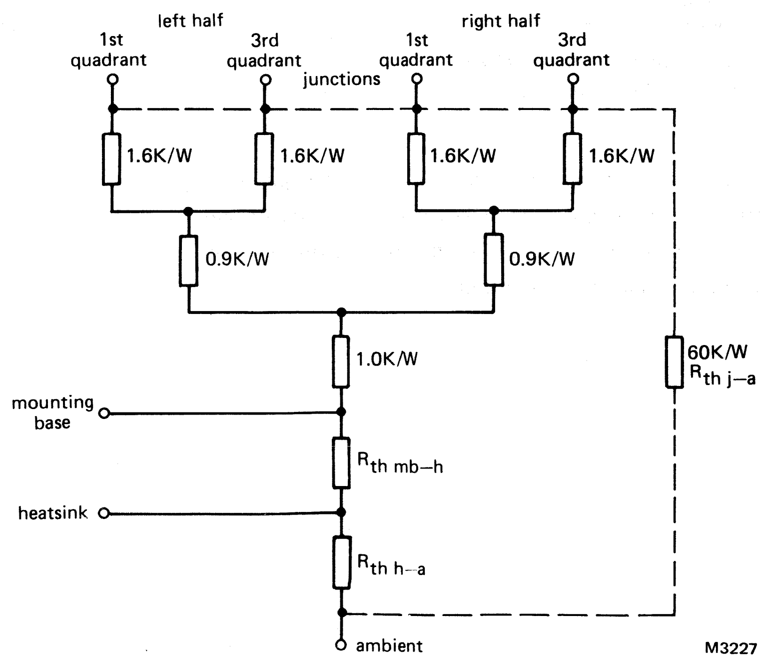


Fig.2 Components of thermal resistance (junction to ambient).

CHARACTERISTICS

T_j = 25 °C unless otherwise stated; each line to centre lead.

On-state voltage (note 1)				
I_{TM} = 5 A	V_{TM}	<	3.0	V
Forward voltage (note 1)				
I_{FM} = 5 A	V_{FM}	<	3.0	V
Avalanche voltage				
$I_{(BR)}$ = 10 mA	$V_{(BR)}$	>	58	V
Breakover voltage				
100 μs pulsed; I = I_S	$V_{(BO)}$	<	78	V
Temperature coefficient of $V_{(BR)}$	$S_{(br)}$	typ.	+0.1	%/K
Holding current (note 2)				
T_j = 25 °C	I_H	>	150	mA
T_j = 70 °C	I_H	>	100	mA
Switching current (note 3)	I_S	>	10	mA
	I_S	typ.	400	mA
	I_S	<	1000	mA
Off-state current; V_D = 50 V (note 4)				
T_j = 70 °C	I_D	<	50	μA
T_j = 125 °C	I_D	<	250	μA
Linear rate of rise of off-state voltage that will not trigger any device; T_j = 70 °C; V_{DM} = 50 V	dV_D/dt	<	2000	V/μs
Off-state capacitance				
V_D = 0; f = 1 kHz to 1 MHz	C_j	<	500	pF
Forward recovery of diode when switched to I_F = 1 A with dI_F/dt = 10 A/μs	V_{fr}	typ.	2.2	V

Notes:

1. Measured under pulsed conditions to avoid excessive dissipation.
2. The minimum current at which the BOD will remain in the on-state.
3. The avalanche current required to switch the BOD to the on-state.
4. i.e., at maximum recommended continuous voltage.

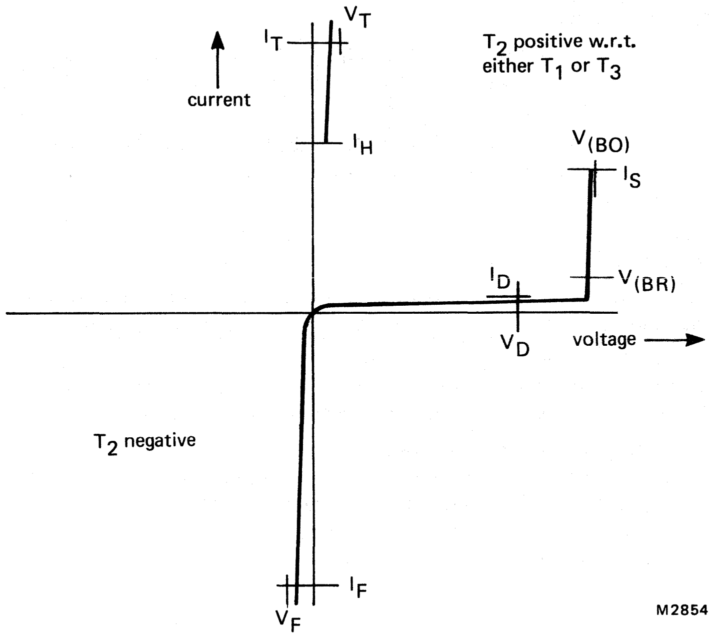


Fig.3 Breakover diode characteristics.

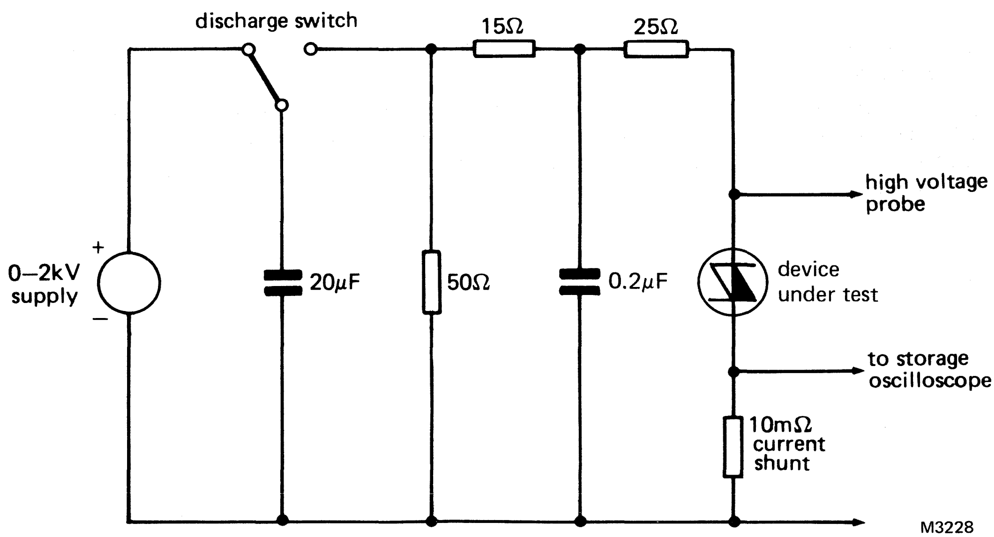


Fig.4 Test circuit for high-voltage impulse (I_{TSM2}/I_{FSM2}).
(according to CCITT vol IX-Rec. K17).

Notes:
The 10/700 μs Impulse Waveform is defined for the voltage across the test fixture when the device under test is replaced with an open circuit. Clearly, once a breakover device has switched on to a low voltage, the current waveform will have a shorter fall-time, since the 15 Ω + 25 Ω output impedance becomes effectively in parallel with the 50 Ω.

MOUNTING INSTRUCTIONS

1. The device may be soldered directly into the circuit. The maximum permissible soldering temperature is 275 ^{o}C. Heat must not be applied for more than 5 seconds. Soldered joints must be at least 4.7 mm from the body of the device.
2. The leads must not be bent less than 2.4 mm from the body of the device and should be supported during bending. The leads can be bent twisted or straightened by 90^{o} maximum. The minimum bending radius is 1 mm.
3. Any heatsink used must have a flatness in the mounting area of 0.02 mm maximum per 10 mm. Mounting holes must be deburred.
4. For good thermal contact a metallic-oxide loaded heatsink compound must be used between the mounting base and heatsink. Ordinary silicone grease is not recommended.
5. The preferred mounting method is with the use of a spring clip. This ensures good thermal contact under the crystal area and safe isolation. However, if a screw is used, it should be M3 cross-recess pan-head. Care should be taken to avoid damage to plastic body of the device during mounting.
6. 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. The maximum recommended hole size for rivet mounting is 3.5 mm. The pre-formed head of the rivet should be on the device side and any rivet tool used should not damage the plastic body of the device.

OPERATING NOTES

1. For most applications involving transient overvoltage protection only, the device is not normally mounted on a heatsink. The free-air rating of the device is normally adequate for non-repetitive transients.
2. Circuit connections to the common (T_2) terminal should be made to the centre lead not the mounting tab.
3. During a mains contact fault, excessive dissipation can occur with the device held in its avalanche state. The following figures illustrate how power dissipation can be calculated during a mains contact fault. In general, if the fault resistance is about 500 – 5 kΩ, there may be excessive dissipation.

MAINS CONTACT

Calculation of power dissipation during mains contact fault.

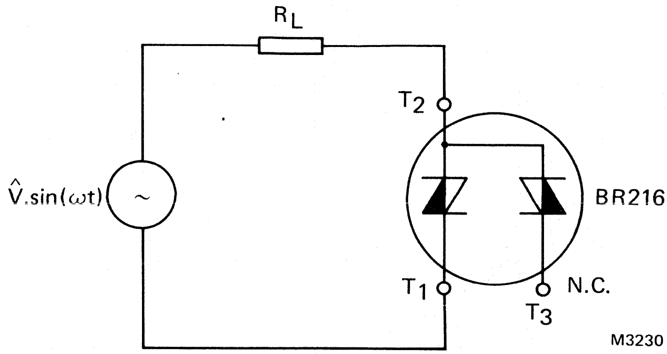


Fig.5 Equivalent circuit of BOD during mains contact fault;
R_L = total fault resistance.

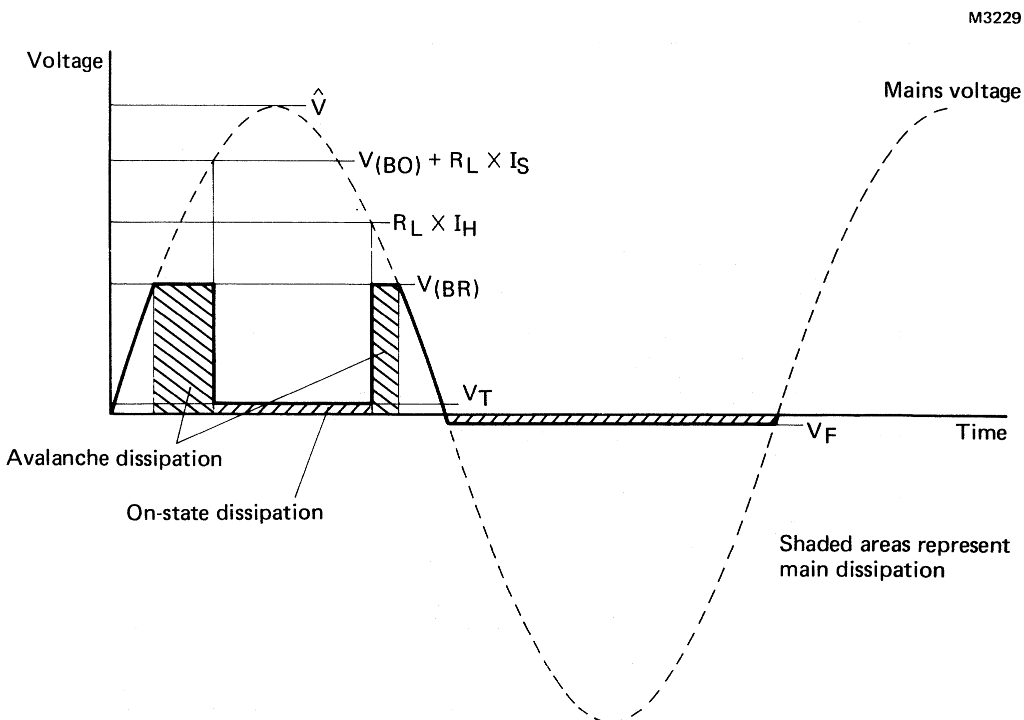


Fig.6 Dissipation during mains contact fault.

Solid line shows voltage across BOD.

Total power generated (per half-cycle) = avalanche dissipation prior to switching
+ on-state dissipation
+ avalanche dissipation after on-state.

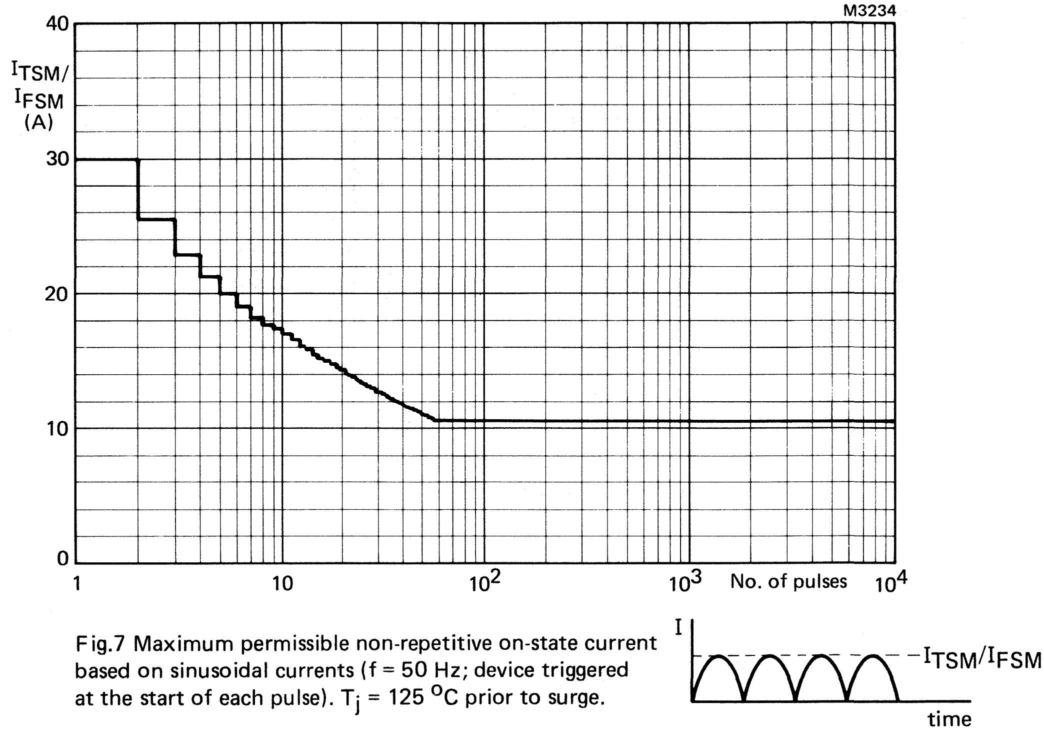


Fig.7 Maximum permissible non-repetitive on-state current based on sinusoidal currents (f = 50 Hz; device triggered at the start of each pulse). T_j = 125 °C prior to surge.

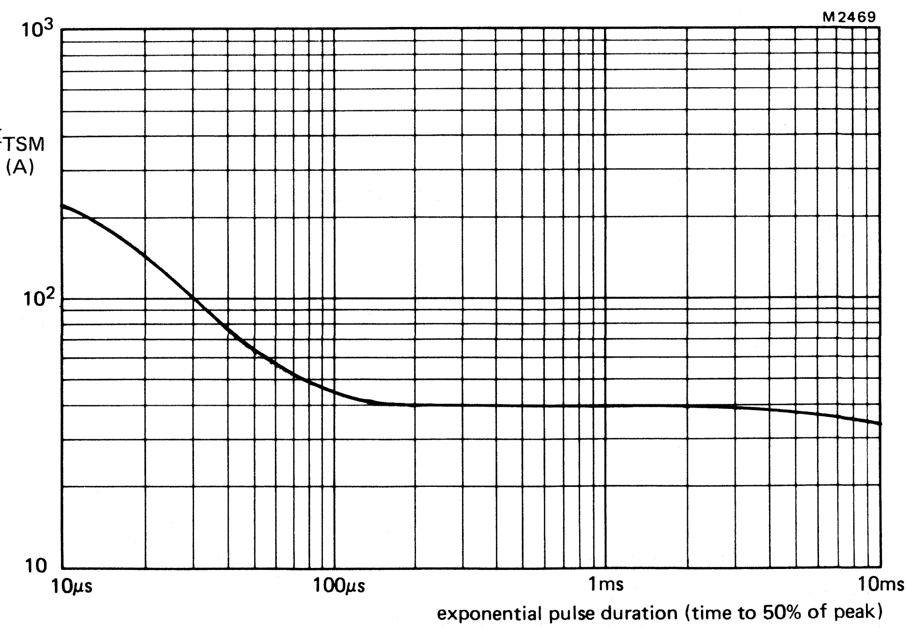


Fig.8 Maximum non-repetitive exponential waveform Impulse Current rating as a function of pulse duration (virtual front-time 10 μs).

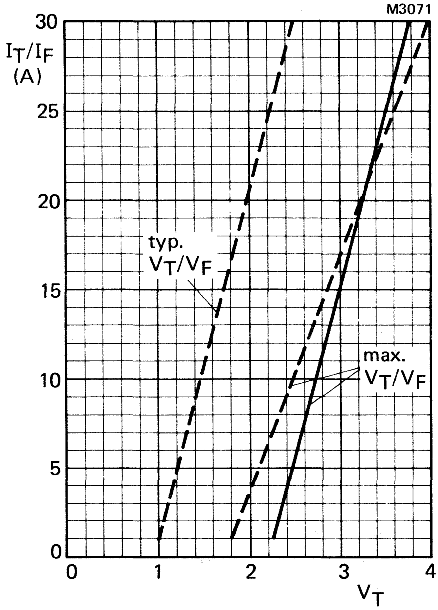


Fig.9 On-state voltage (V_T) and forward voltage (V_F) versus current. (200 μs pulsed condition to avoid excessive dissipation) —— T_j = 25, – – – T_j = 125 °C.

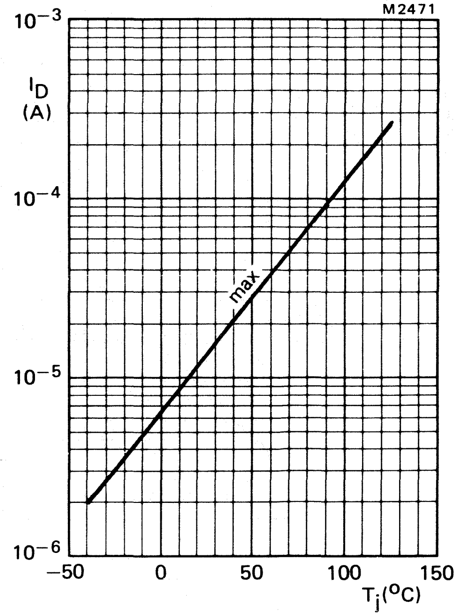


Fig.10 Maximum off-state current as a function of temperature.

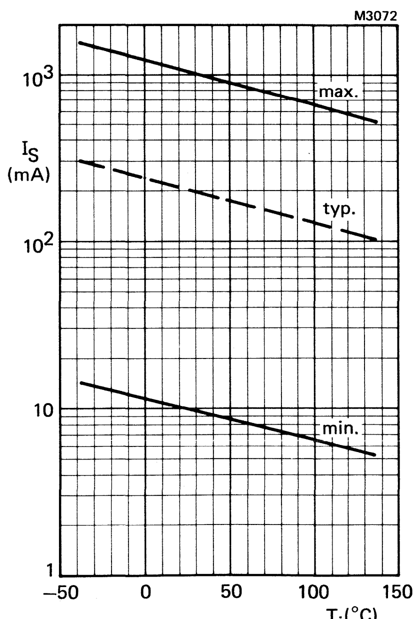


Fig.11 Switching current as a function of junction temperature

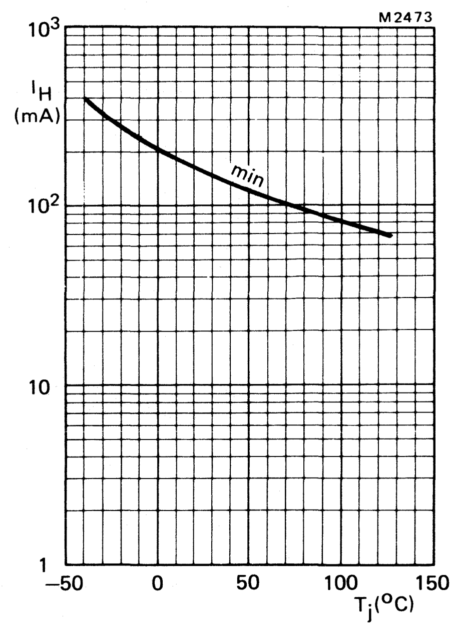


Fig.12 Minimum holding current as a function of temperature.

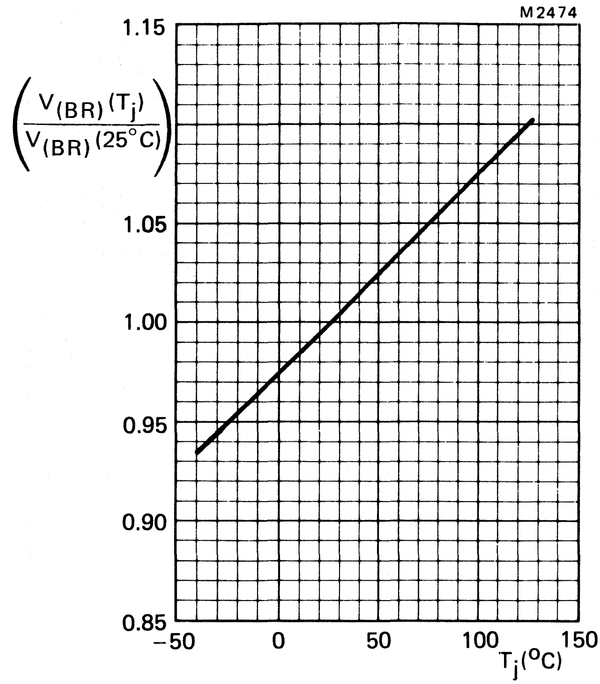


Fig. 13 Normalised avalanche breakdown voltage as a function of temperature.
Note: this figure may also be used to derive normalised $V_{(BO)}$.

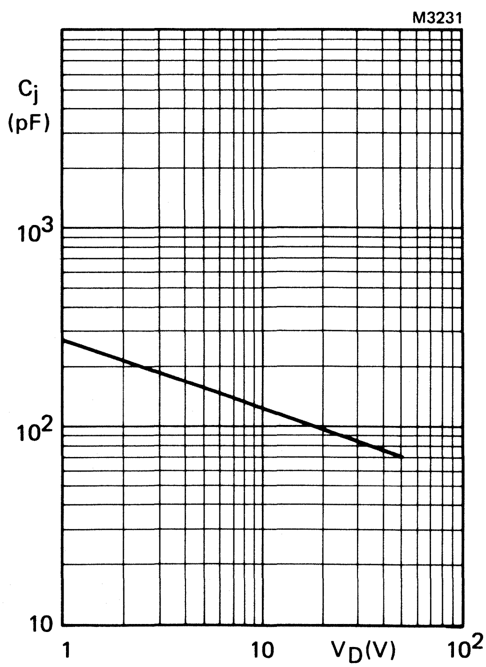


Fig. 14 Typical junction capacitance as a function of off-state voltage; T_j = 25 °C; f = 1 MHz.

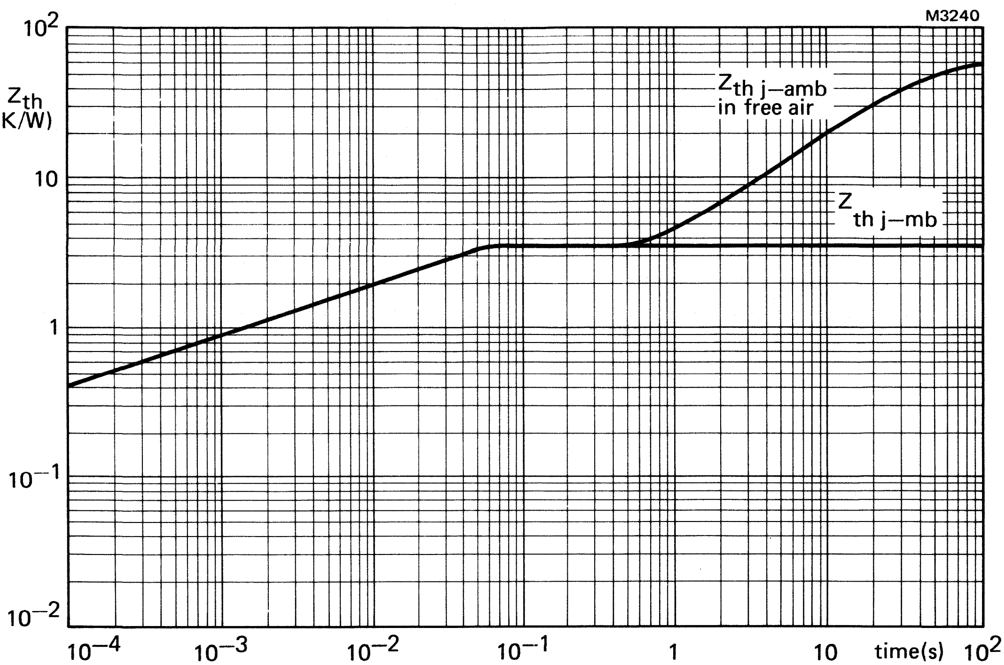


Fig.15 Transient thermal impedance as a function of time (rectangular pulse duration).

DUAL BREAKOVER DIODES

The BR220 is a range of monolithic diffusion-isolated glass-passivated dual bidirectional breakover diodes in the TO-220AB outline, available in a +/– 12% tolerance series of nominal breakover voltage. Their controlled breakover voltage and peak current handling capability together with high holding current make them suitable for transient two-line to earth overvoltage protection in applications such as telephony equipment or other data transmission lines, and remote instrumentation lines.

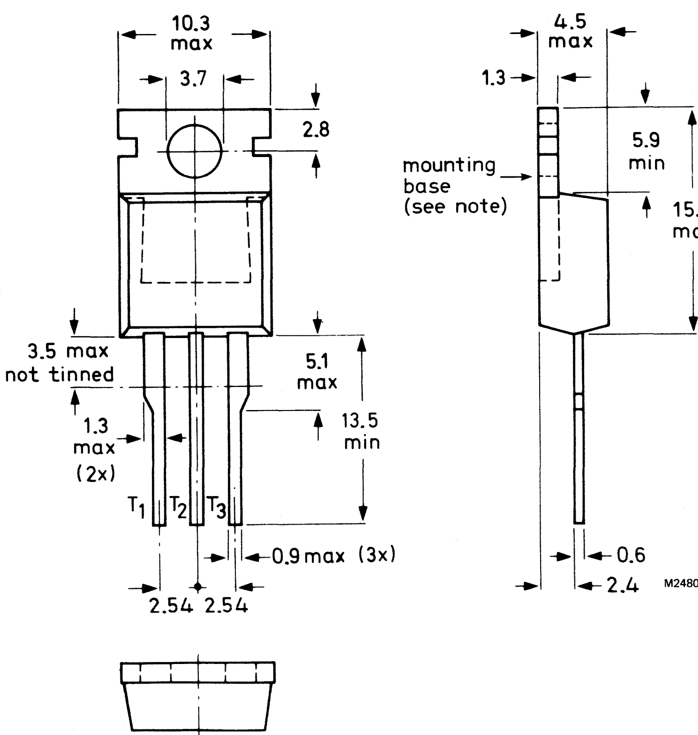
QUICK REFERENCE DATA

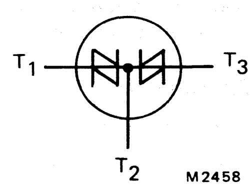
			BR220– 100 to 280	
Breakover voltage per line	$V_{(BO)}$	nom.	100 to 280	V
Holding current	I_H	>	150	mA
Transient peak current (10/320 μs impulse)	I_{TSM}	max.	40	A ←

MECHANICAL DATA

Dimensions in mm

Fig.1 TO-220AB; centre lead connected to tab.





Net mass: 2 g

Note: The exposed metal mounting base is directly connected to terminal T_2.

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

RATINGS

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

Voltages (Individually for each line in either direction)

			BR220-100 to 280	
→ Continuous voltages	V_D	max.	75% of nom. voltage	

→ Currents

(Individually for each line in either direction)

Transient peak current (8/20 μs impulse)	I_{TSM1}	max.	150	A
Transient peak current (10/320 μs impulse) equivalent to 10/700 μs 1.6 kV voltage impulse (CCITT K17); (see Fig.4)	I_{TSM2}	max.	40	A
Average on-state current (averaged over any 20 ms period); up to T_{mb} = 75 °C	$I_{T(AV)}$	max.	5	A
RMS AC on-state current	$I_{T(RMS)}$	max.	8	A
Non-repetitive peak on-state current; T_j = 100 °C prior to surge; t = 10 ms; half sinewave	I_{TSM3}	max.	30	A
I^2t for fusing (t = 10 ms)	I^2t	max.	4.5	A^2s
Rate of rise of on-state current after $V_{(BO)}$ turn-on (t_p = 10 μs)	dI/dt	max.	50	A/μs

Power dissipation

Continuous dissipation; one line dissipating, unidirectional operation, device mounted on infinite heatsink	P_{tot}	max.	40	W
Peak dissipation; t = 1 ms, free-air mounting	P_{TM}	max.	400	W

Temperatures

Storage temperature	T_{stg}		−40 to +150	°C
Operating temperature (off-state)	T_j	max.	125	°C
Overload temperature (on-state)	T_{vj}	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air mounted on a printed circuit board at any lead length	$R_{th\ j\text{-}amb}$	=	60	K/W
From junction to mounting base				
One line conducting				
bidirectional operation	$R_{th\ j\text{-}mb}$	=	2.5	K/W
unidirectional operation	$R_{th\ j\text{-}mb}$	=	3.1	K/W
Both lines conducting				
bidirectional operation	$R_{th\ j\text{-}mb}$	=	1.75	K/W
Transient thermal impedance (t = 1 ms)	$Z_{th\ j\text{-}mb}$	=	0.3	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 max. mica insulator (56369)	$R_{th\ mb\text{-}h}$	=	2.2	K/W
d. with heatsink compound and 0.25 mm max. 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

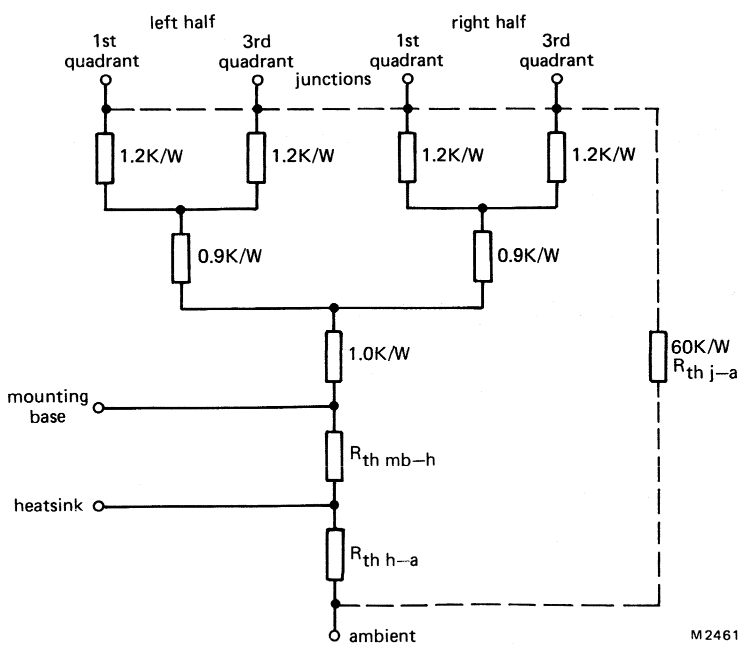


Fig.2 Components of thermal resistance (junction to ambient).

CHARACTERISTICS

T_j = 25 °C unless otherwise stated; each line to centre lead.

Voltages and currents (in either direction)

On-state voltage (note 1)				
I_{TM} = 5 A	V_{TM}	<	2.5	V
Avalanche voltage $V_{(BR)}$; ($I_{(BR)}$ = 10 mA), and Breakover voltage $V_{(BO)}$; ($I \leqslant I_S$): (100 µs pulsed)		$V_{(BR)}$ min.	$V_{(BO)}$ max.	
	BR220–100	88	112	V
	–120	105	135	V
	–140	123	157	V
	–160	140	180	V
	–240	211	269	V
	–260	228	292	V
	–280	246	314	V
Temperature coefficient of $V_{(BR)}$	$S_{(br)}$	typ.	+0.1	%/K
Holding current (note 2)				
T_j = 25 °C	I_H	>	150	mA
T_j = 70 °C	I_H	>	100	mA
Switching current (note 3)	I_S	>	10	mA
(100 µs pulsed)	I_S	typ.	200	mA
	I_S	<	1000	mA
Off-state current; V_D = 85% $V_{(BR)min}$ (note 4)				
T_j = 70 °C	I_D	<	50	µA
T_j = 125 °C	I_D	<	250	µA
Linear rate of rise of off-state voltage that will not trigger any device;				
T_j = 70 °C; V_{DM} = 85% $V_{(BR)min}$	dV_D/dt	<	2000	V/µs
Off-state capacitance				
V_D = 0; f = 1 kHz to 1 MHz	C_j	<	300	pF

Notes:

1. Measured under pulsed conditions to avoid excessive dissipation.
2. The minimum current at which the BOD will remain in the on-state.
3. The avalanche current required to switch the BOD to the on-state.
4. i.e., at maximum recommended continuous voltage.

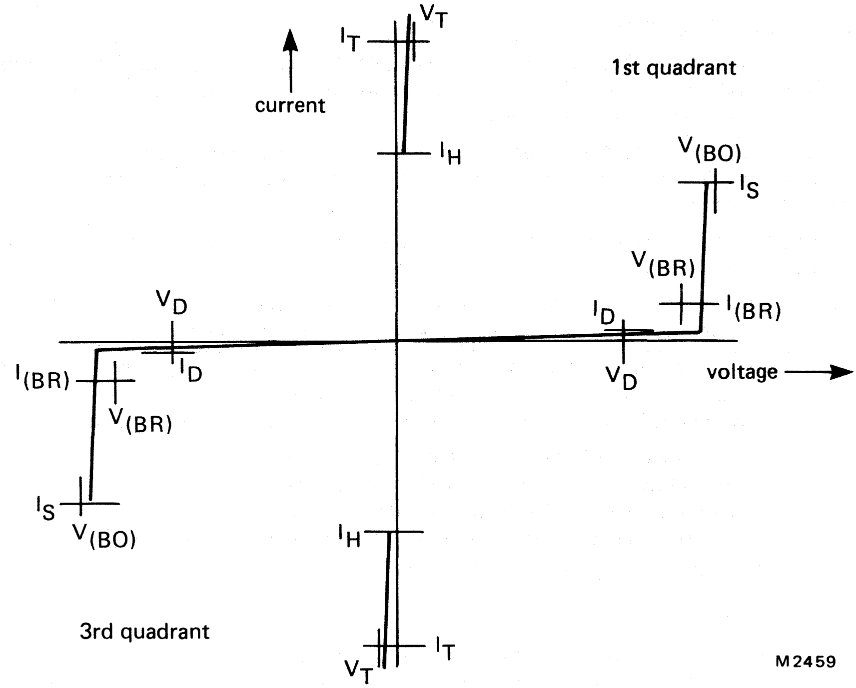


Fig.3 Breakover diode characteristics.

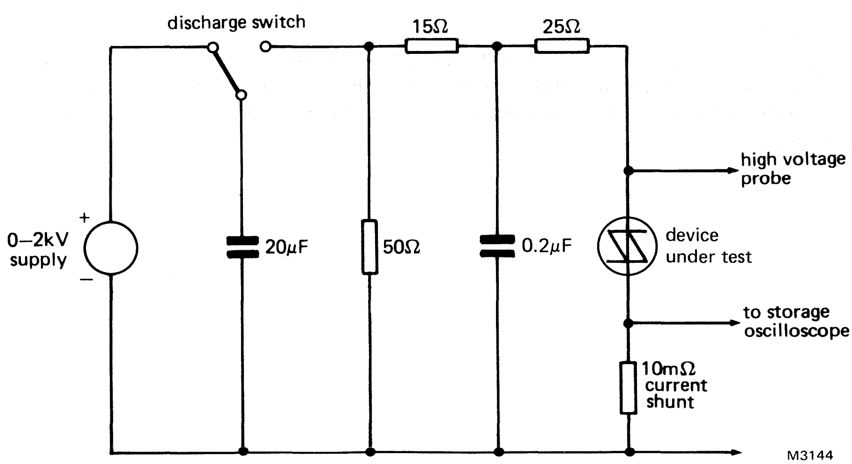


Fig.4 Test circuit for high voltage impulse (I_{TSM2})
(according to CCITT vol IX-Rec. K17)

Notes:
The 10/700 μs Impulse Waveform is defined for the voltage across the test fixture when the device under test is replaced with an open circuit. Clearly, once a breakover device has switched on to a low voltage, the current waveform will have a shorter fall-time, since the 15 Ω + 25 Ω output impedance becomes effectively in parallel with the 50 Ω.

MOUNTING INSTRUCTIONS

1. The device may be soldered directly into the circuit. The maximum permissible soldering temperature is 275 ^{o}C. Heat must not be applied for more than 5 seconds. Soldered joints must be at least 4.7 mm from the body of the device.
2. The leads must not be bent less than 2.4 mm from the body of the device and should be supported during bending. The leads can be bent twisted or straightened by 90^{o} maximum. The minimum bending radius is 1 mm.
3. Any heatsink used must have a flatness in the mounting area of 0.02 mm maximum per 10 mm. Mounting holes must be deburred.
4. For good thermal contact a metallic-oxide loaded heatsink compound must be used between the mounting base and heatsink. Ordinary silicone grease is not recommended.
5. The preferred mounting method is with the use of a spring clip. This ensures good thermal contact under the crystal area and safe isolation. However, if a screw is used, it should be M3 cross-recess pan-head. Care should be taken to avoid damage to plastic body of the device during mounting.
6. 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. The maximum recommended hole size for rivet mounting is 3.5 mm. The pre-formed head of the rivet should be on the device side and any rivet tool used should not damage the plastic body of the device.

OPERATING NOTES

1. For most applications involving transient overvoltage protection only, the device is not normally mounted on a heatsink. The free-air rating of the device is normally adequate for non-repetitive transients.
2. Circuit connections to the common (T_2) terminal should be made to the centre lead not the mounting tab.
3. During a mains contact fault, excessive dissipation can occur with the device held in its avalanche state. The following figures illustrate how power dissipation can be calculated during a mains contact fault. In general, if the fault resistance is about 500 – 5 kΩ, there may be excessive dissipation.

MAINS CONTACT

Calculation of power dissipation during mains contact fault.

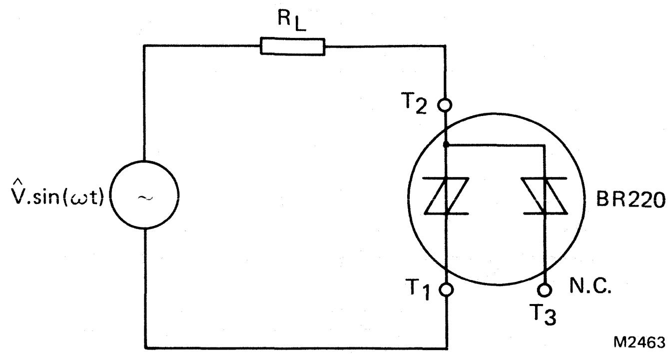


Fig.5 Equivalent circuit of BOD during mains contact fault;
R_L = total fault resistance.

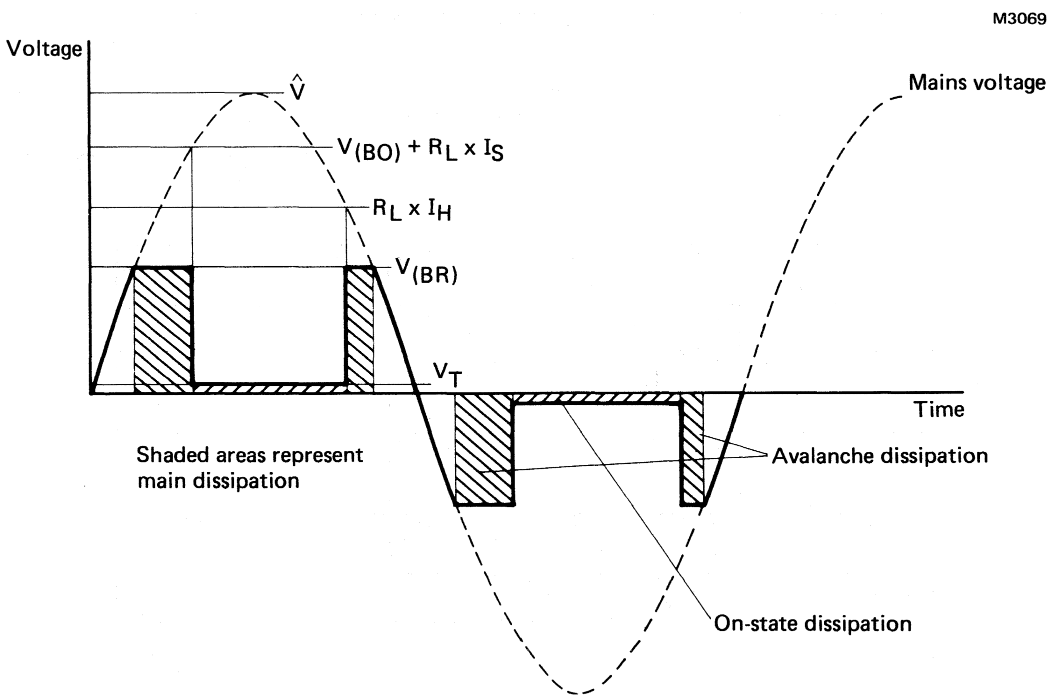


Fig.6 Dissipation during mains contact fault.

Solid line shows voltage across BOD.

Total power generated (per half-cycle) = avalanche dissipation prior to switching
+ on-state dissipation
+ avalanche dissipation after on-state.

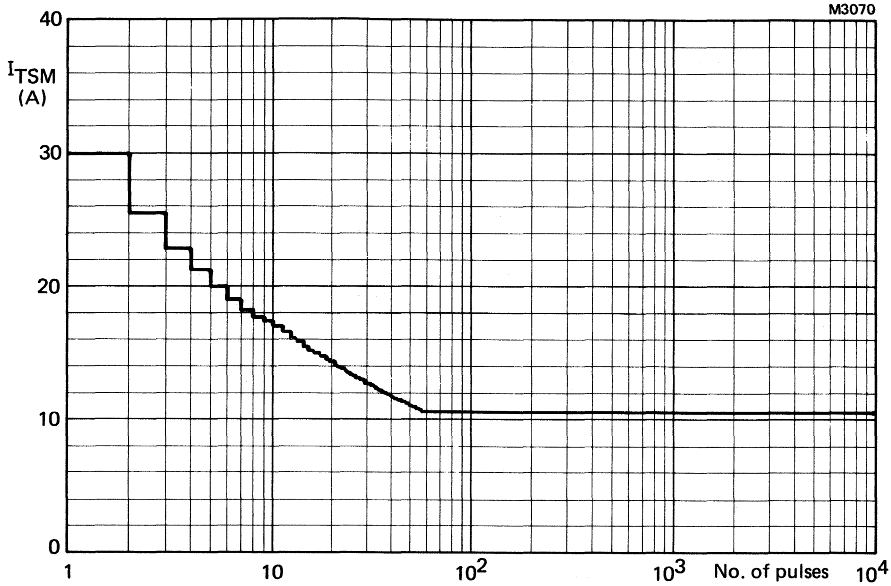
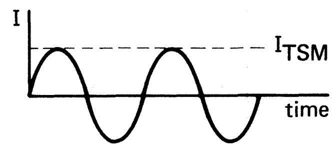


Fig.7 Maximum permissible non-repetitive on-state current based on sinusoidal currents (f = 50 Hz; device triggered at the start of each pulse). T_j = 125 °C prior to surge.



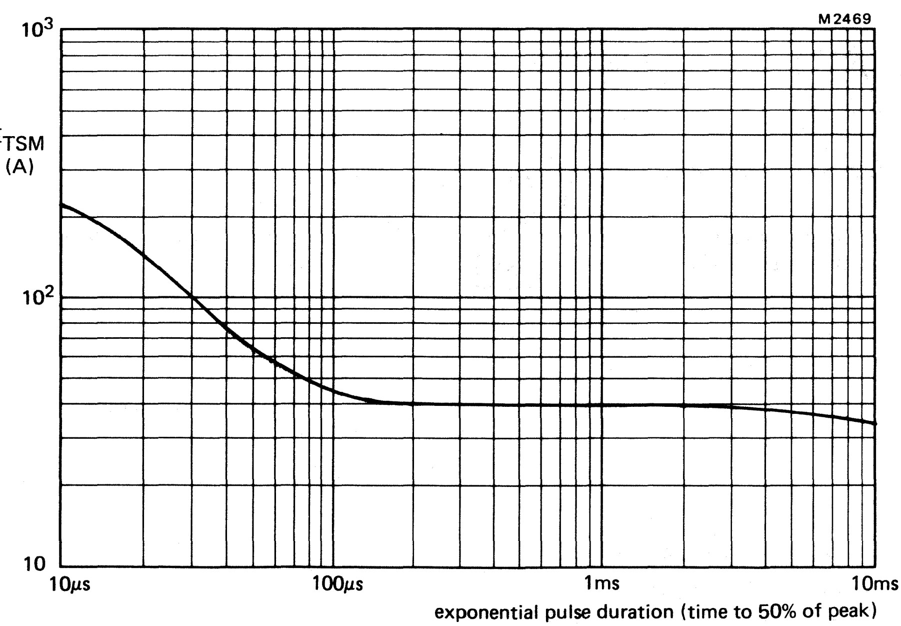


Fig.8 Maximum non-repetitive exponential waveform Impulse Current rating as a function of pulse duration (virtual front-time 10 μs).

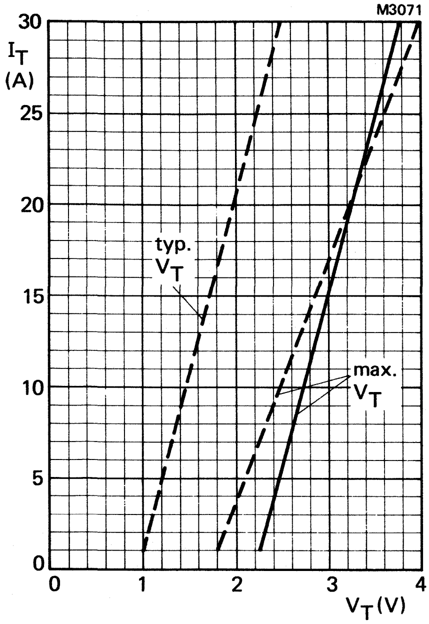


Fig.9 On-state voltage as a function of on-state current. (200 μs pulsed condition to avoid excessive dissipation) —— T_j = 25, – – – T_j = 125 °C.

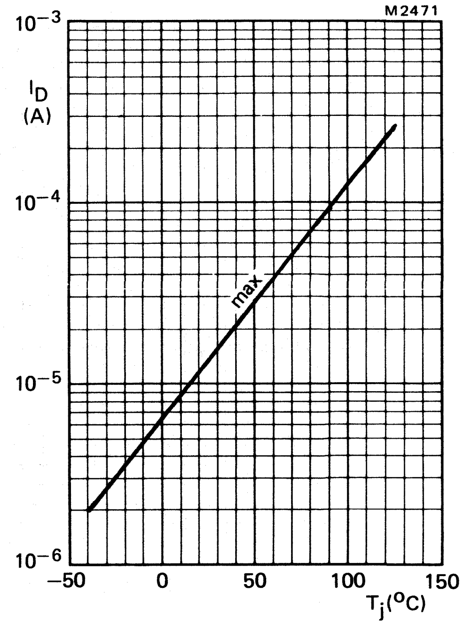


Fig.10 Maximum off-state current as a function of temperature.

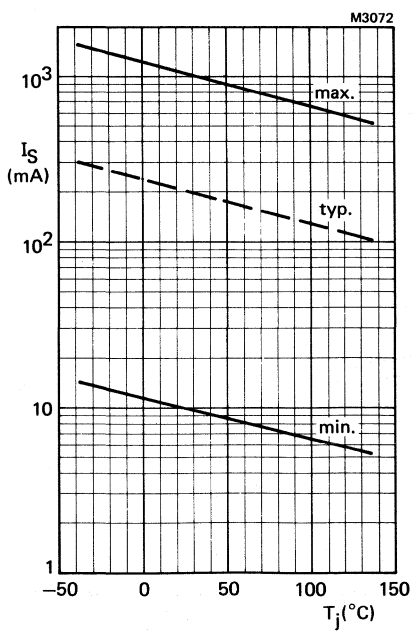


Fig.11 Switching current as a function of junction temperature.

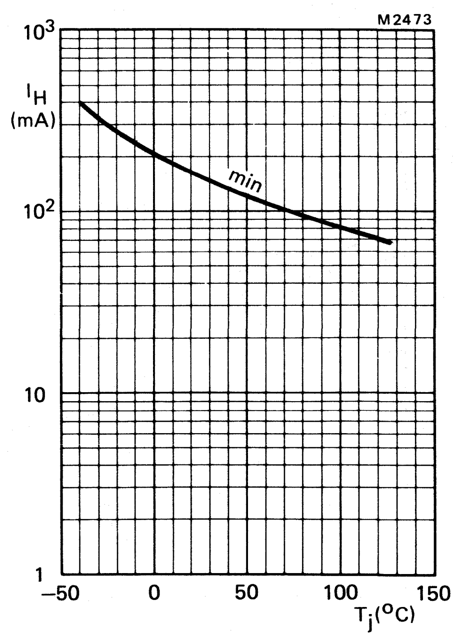


Fig.12 Minimum holding current as a function of temperature.

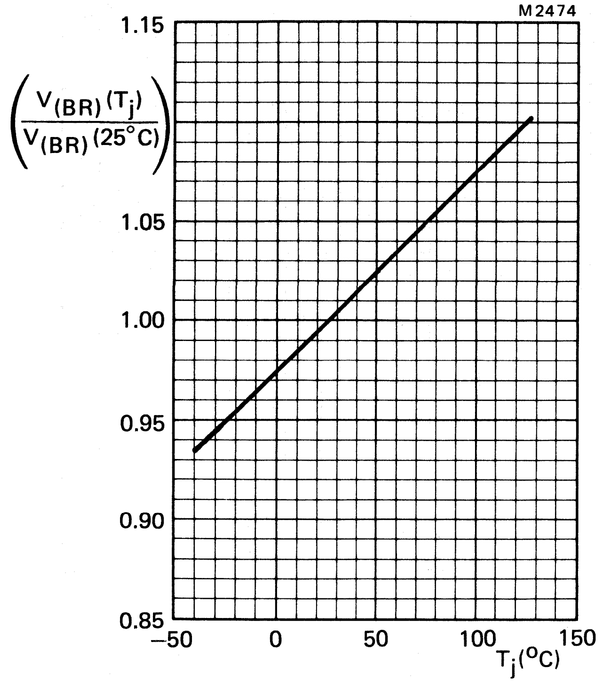


Fig.13 Normalised avalanche breakdown voltage as a function of temperature. Note: this figure may also be used to derive normalised $V_{(BO)}$.

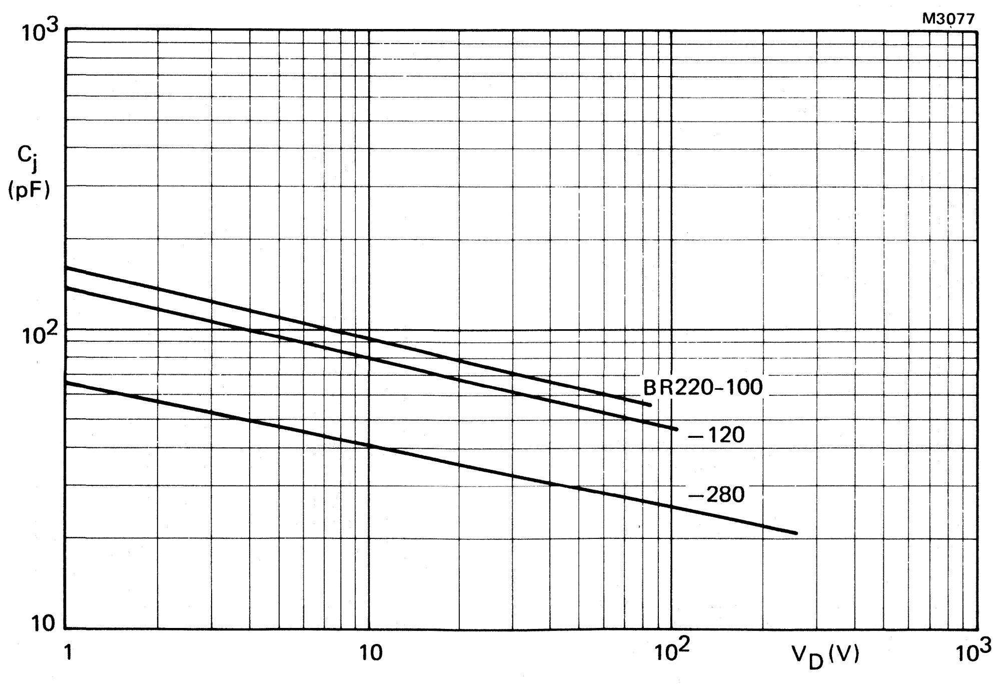


Fig.14 Typical junction capacitance as a function of off-state voltage; T_j = 25 °C; f = 1 MHz.

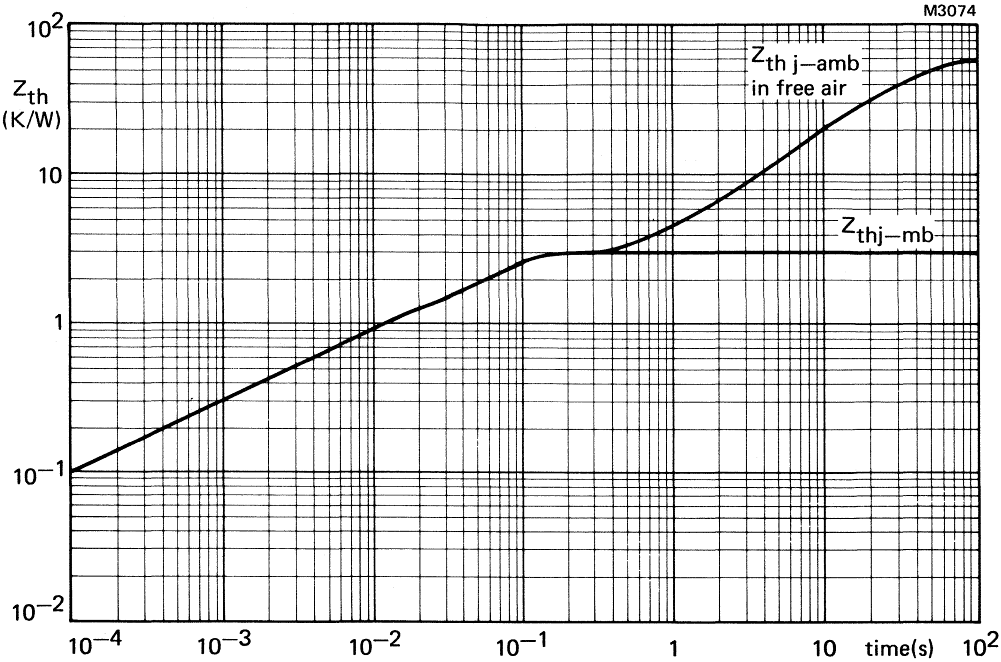


Fig.15 Transient thermal impedance as a function of time (rectangular pulse duration).

FAST SOFT-RECOVERY RECTIFIER DIODES

Glass-passivated double-diffused rectifier diodes in plastic envelopes, featuring fast reverse recovery times and non-snap-off characteristics. They are intended for use in chopper applications as well as in switched-mode power supplies, as efficiency diodes and scan rectifiers in television receivers.

The series consists of the following types:
Normal polarity: BY229–200 to 800.
Reverse polarity: BY229–200R to 800R.

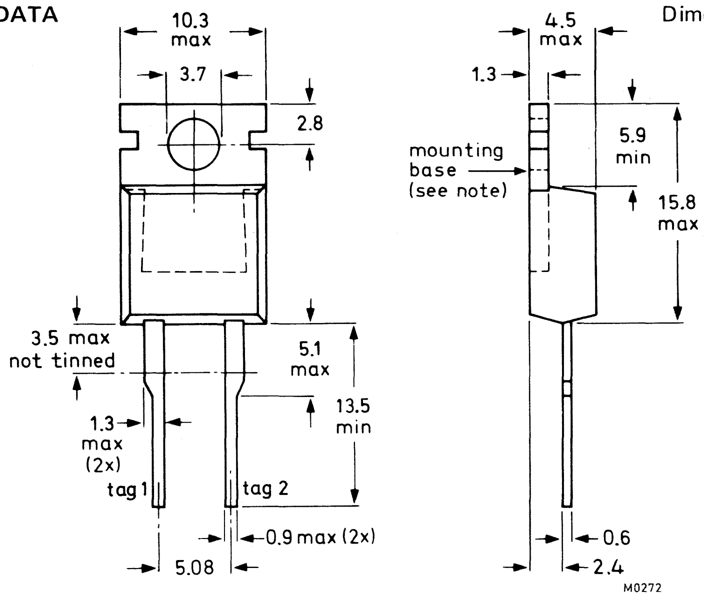
QUICK REFERENCE DATA

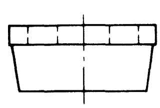
			BY229–200(R)	400(R)	600(R)	800(R)	
Repetitive peak reverse voltage	V_{RRM}	max.	200	400	600	800	V
Average forward current	$I_{F(AV)}$	max.		7			A
Non-repetitive peak forward current	I_{FSM}	max.		60			A
Reverse recovery time	t_{rr}	<		150			ns

MECHANICAL DATA

Dimensions in mm

Fig.1 TO-220AC





	tag 1	tag 2
normal	k	a
reverse	a	k

Note: The exposed metal mounting base is directly connected to tag 1. Accessories supplied on request: see data sheets Mounting instructions and accessories for TO–220 envelopes.

Products approved to CECC 50 009-021 available on request.

RATINGS

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

Voltages*			BY229-200(R)	400(R)	600(R)	800(R)	
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				
square-wave; δ = 0.5; up to T_{mb} = 100 °C	$I_{F(AV)}$	max.	7	A
square-wave; δ = 0.5; at T_{mb} = 125 °C	$I_{F(AV)}$	max.	4.1	A
sinusoidal; up to T_{mb} = 100 °C	$I_{F(AV)}$	max.	6.5	A
sinusoidal; at T_{mb} = 125 °C	$I_{F(AV)}$	max.	4	A
R.M.S. forward current	$I_{F(RMS)}$	max.	10	A
Repetitive peak forward current t_p = 20 μs; $\delta \leq 0.02$	I_{FRM}	max.	135	A
Non-repetitive peak forward current t = 10 ms;half sine-wave; T_j = 150 °C prior to surge; with reapplied $V_{RWM\ max}$	I_{FSM}	max.	60	A
I^2t for fusing (t = 10 ms)	I^2t	max.	18	A^2s

Temperatues

Storage temperature	T_{stg}		−40 to +150	°C
Junction temperature	T_j	max.	150	°C

*To ensure thermal stability: $R_{th\ j\text{-}a} \leq 15$ K/W for continuous reverse voltage.

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	4.5	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 insulator (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 value 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 device lead length and with copper laminate on the board	$R_{th\ j\text{-}a}$	=	60	K/W

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; it 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. It is recommended that the circuit connection be made to tag 1, rather than direct to the heatsink.
4. Mounting by means of a spring clip is the best mounting methode because it offers:
   a. a good thermal contact under the crystal area and slightly lower $R_{th\ mb\text{-}h}$ values than 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.
5. For good thermal contact heatsink compound should be used between base-plate 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.
6. 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.

CHARACTERISTICS

T_j = 25 °C unless otherwise specified

Forward voltage					
I_F = 20 A		V_F	<	1.85	V*
Reverse current					
$V_R = V_{RWMmax}$; T_j = 125 °C	normal polarity	I_R	<	0.4	mA
	reverse polarity	I_R	<	0.6	mA
Reverse recovery when switched from					
I_F = 1 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 50 A/µs					
recovery time		t_{rr}	<	150	ns
I_F = 2 A to $V_R \geqslant$ 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	normal polarity	$\|dI_R/dt\|$	<	60	A/µs
	reverse polarity	$\|dI_R/dt\|$	<	75	A/µs

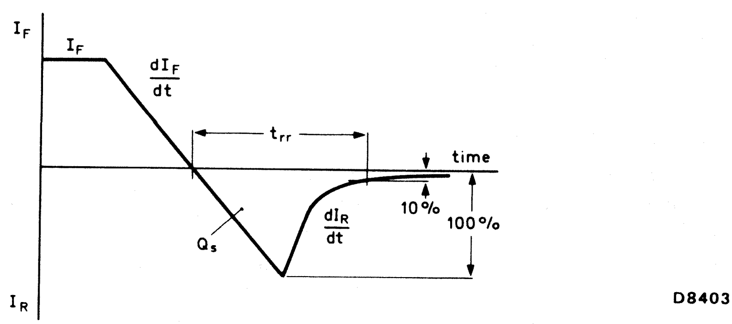


Fig.3 Definition of t_{rr} and Q_s.

*Measured under pulse conditions to avoid excessive dissipation.

SQUARE-WAVE OPERATION

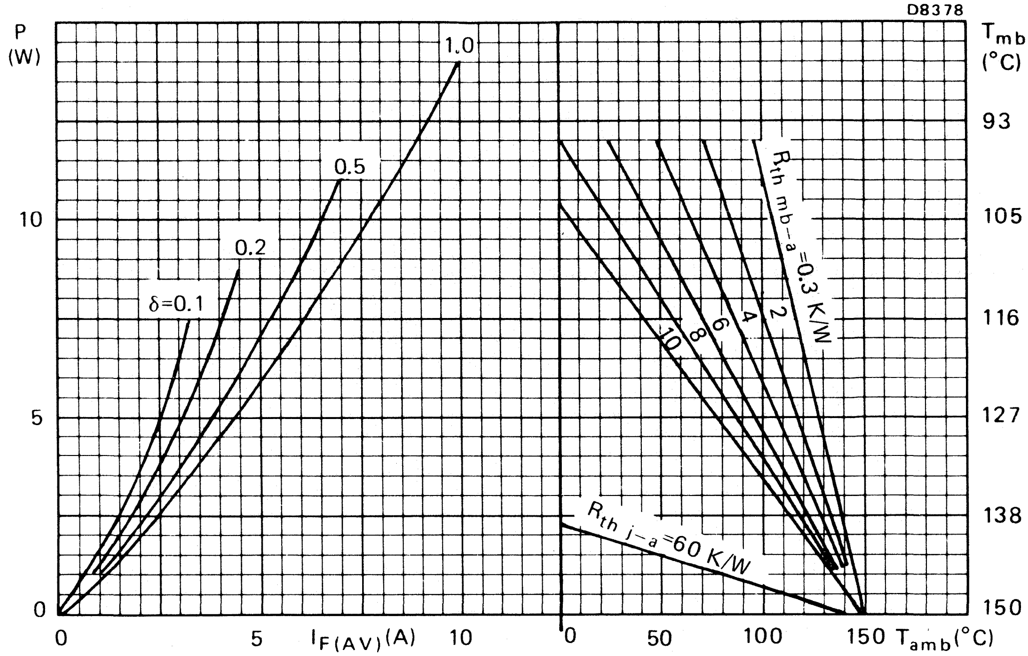
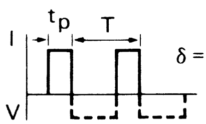


Fig. 4 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
P = power including reverse current losses but excluding switching losses.



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

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

SINUSOIDAL OPERATION

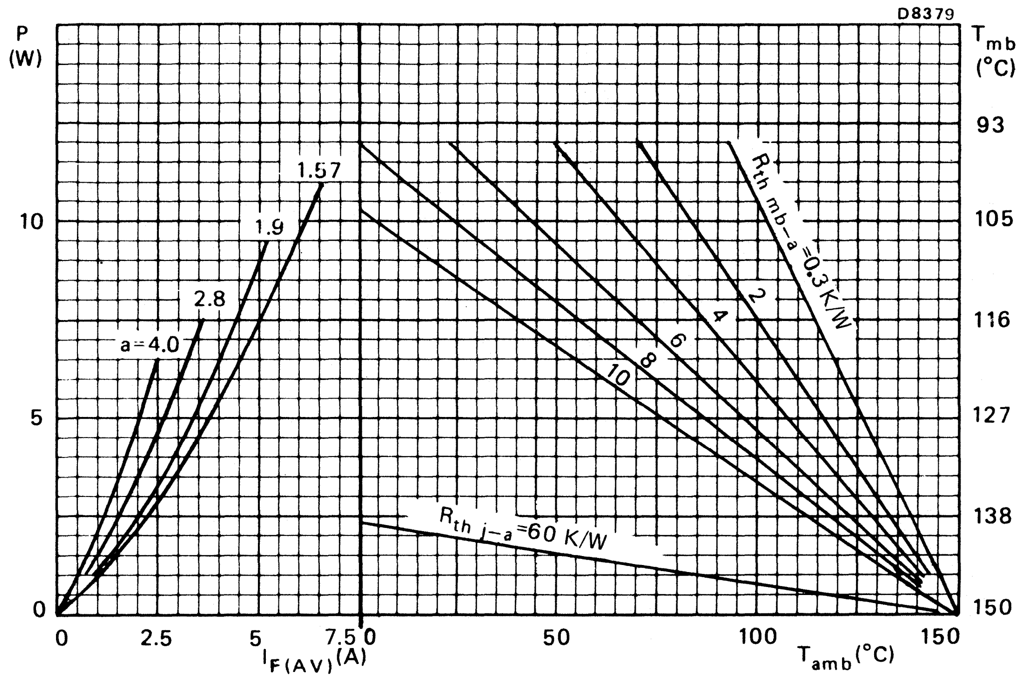


Fig. 5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
P = power including reverse current losses but excluding switching losses.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

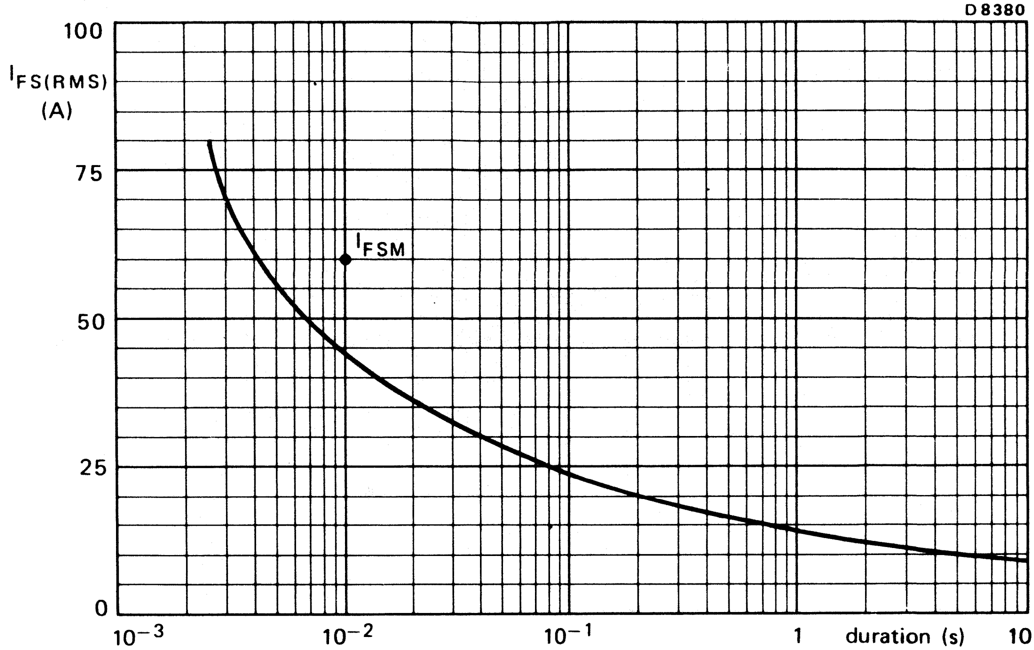
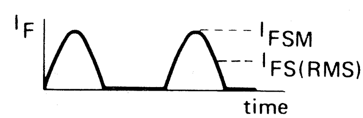


Fig. 6 Maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz); T_j = 150 °C prior to surge; with reapplied V_{RWMmax}.



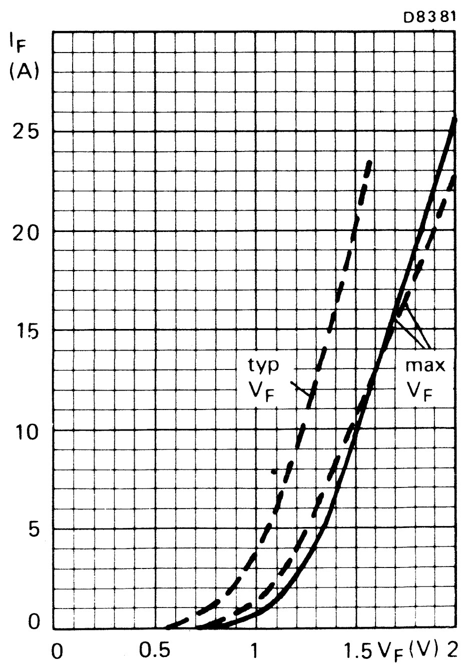


Fig. 7 ——— T_j = 25 °C; — — — —T_j = 125 °C

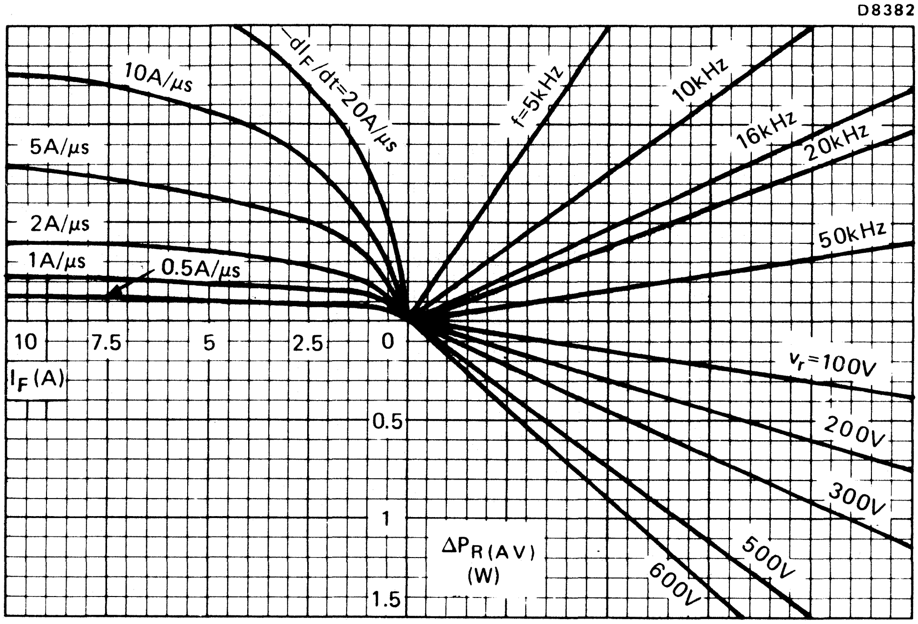
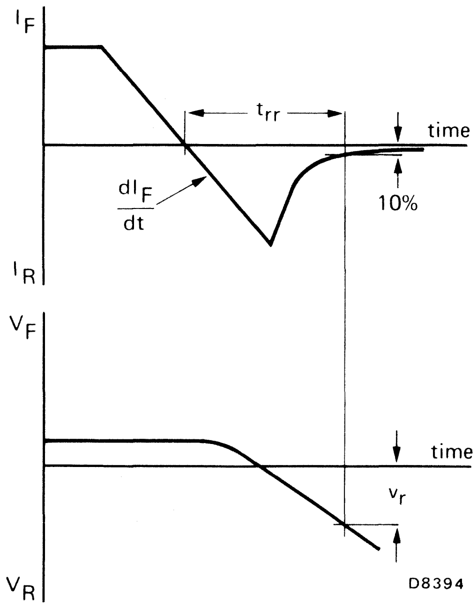


Fig. 8 NOMOGRAM

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



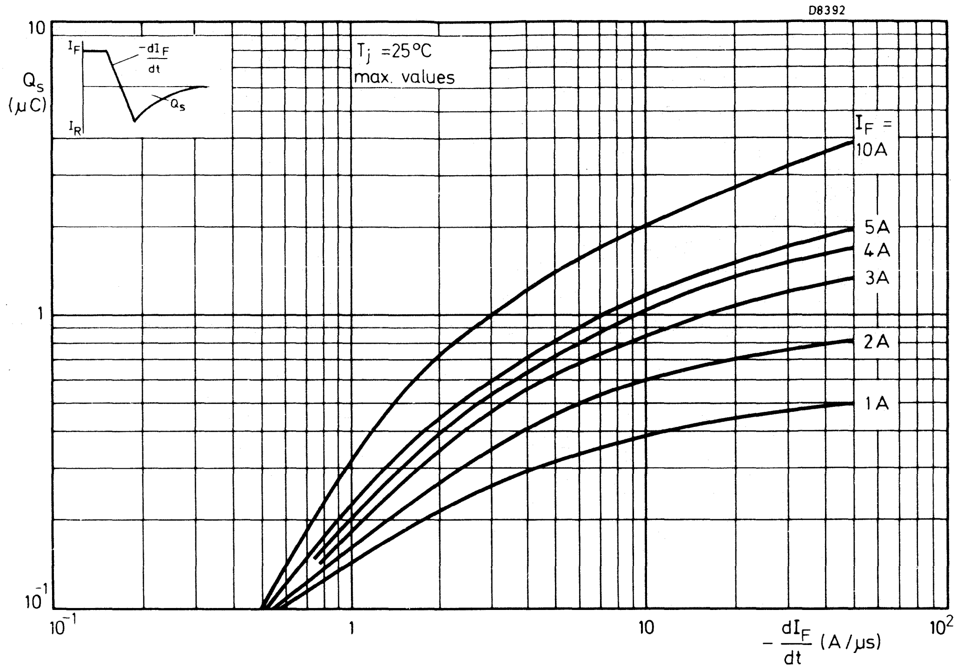

D8392
10
1
10^{-1}
Q_s (μC)
I_F
$-\frac{dI_F}{dt}$
Q_s
I_R
T_j =25°C
max. values
I_F =
10A
5A
4A
3A
2A
1A
10^{-1}
1
10
10^2
$-\frac{dI_F}{dt}$ (A/μs)

Fig.9

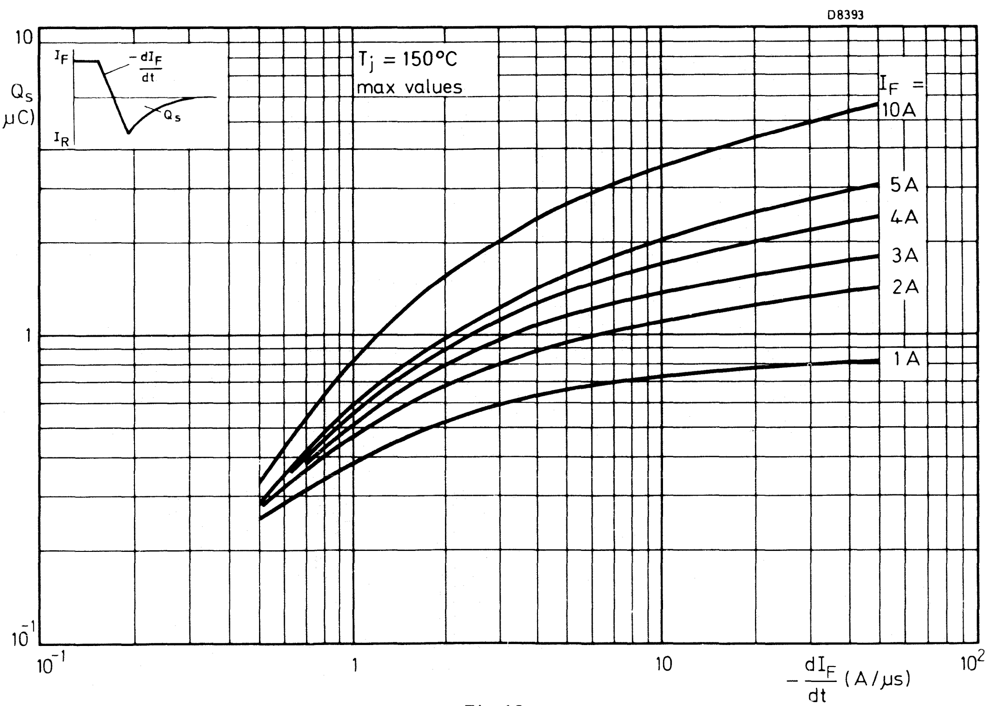

D8393
10
1
10^{-1}
Q_s (μC)
I_F
$-\frac{dI_F}{dt}$
Q_s
I_R
T_j = 150°C
max values
I_F =
10A
5A
4A
3A
2A
1A
10^{-1}
1
10
10^2
$-\frac{dI_F}{dt}$ (A/μs)

Fig.10

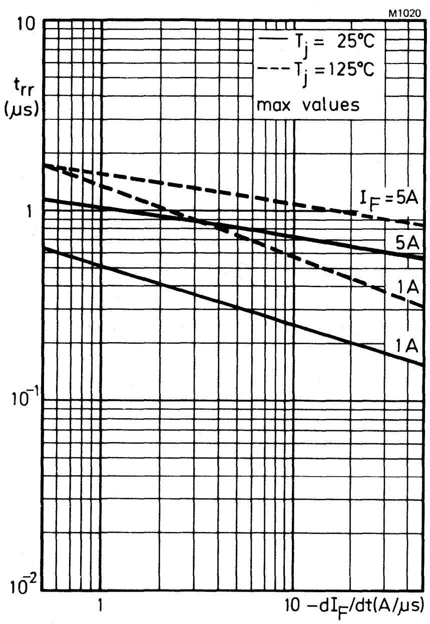


Fig. 11

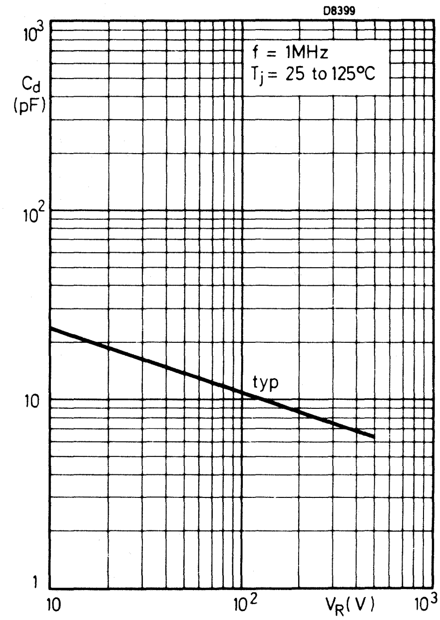


Fig. 12

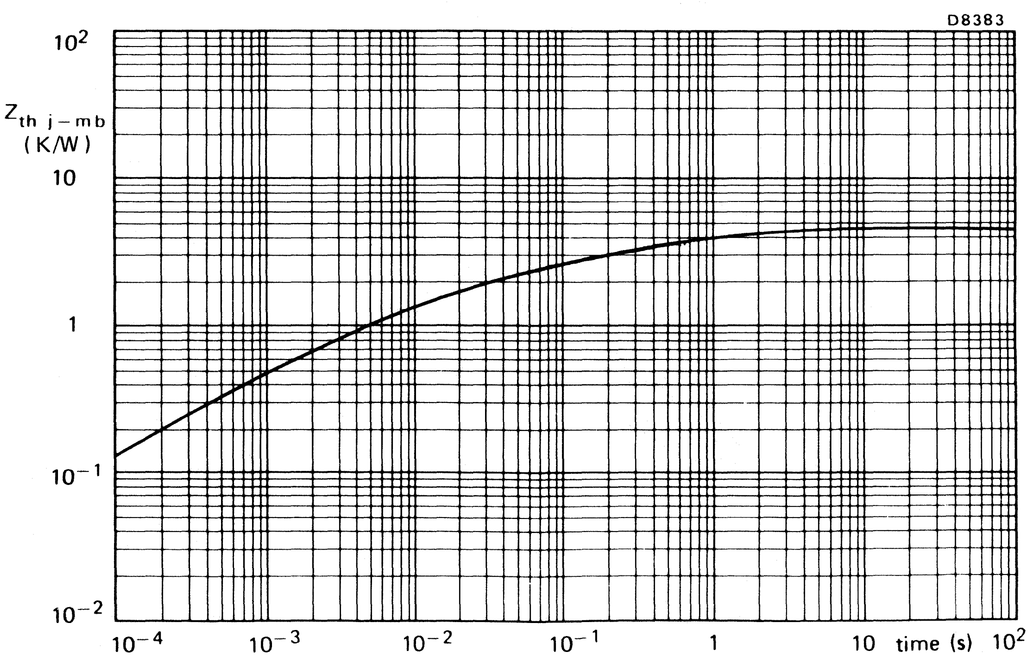


Fig. 13

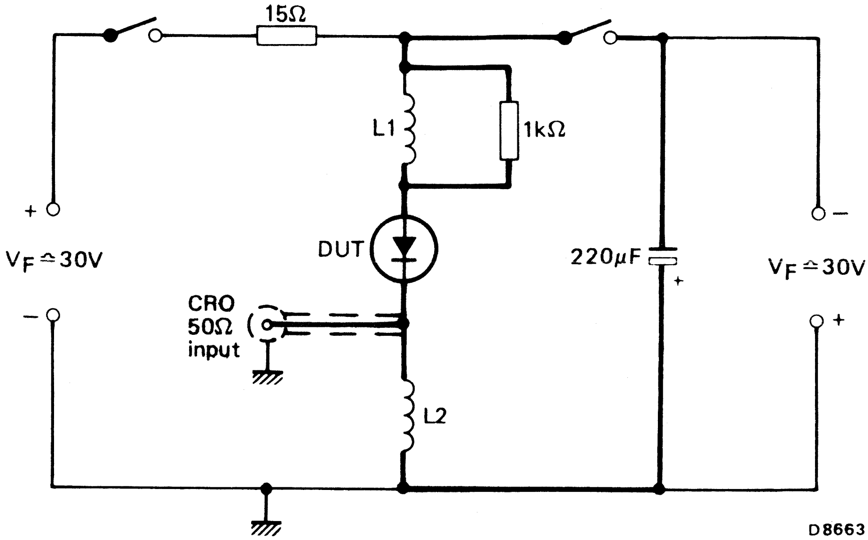


Fig.14 Simplified circuit diagram of practical apparatus to test softness of recovery.

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 5A/μs/V.
4. Wiring shown in heavy should be kept as short as possible.

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.

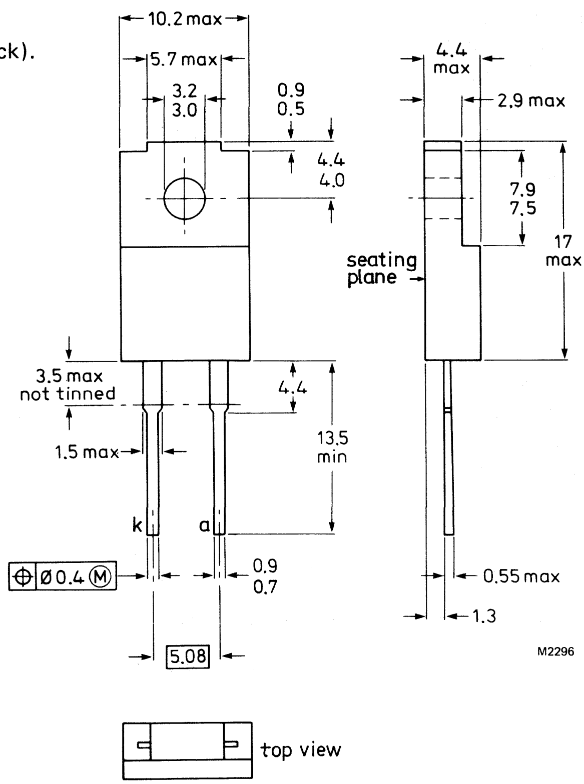
QUICK REFERENCE DATA

			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; δ = 0.5; up to T_{hs} = 90 °C	$I_{F(AV)}$	max.	7	A
sinusoidal; up to T_{hs} = 93 °C	$I_{F(AV)}$	max.	6.25	A
R.M.S. forward current	$I_{F(RMS)}$	max.	10	A
Repetitive peak forward current t_p = 20 µs; δ = 0.02	I_{FRM}	max.	135	A
Non-repetitive peak forward current half sine-wave; T_j = 150 °C 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	°C
Junction temperature	T_j	max.	150	°C

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 $V_R \geqslant 30$ V with $-dI_F/dt = 50$ A/μs, recovery time	t_{rr}	<	150	ns
$I_F = 2$ A to $V_R \geqslant 30$ 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

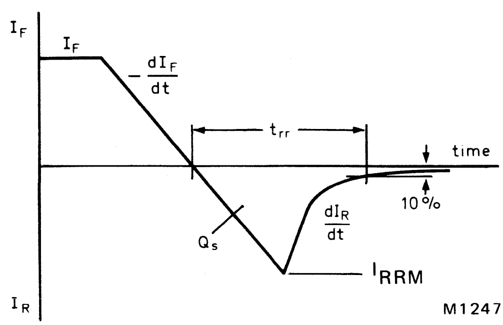


Fig.2 Definition of t_{rr} and Q_s.

*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 ^{o}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.

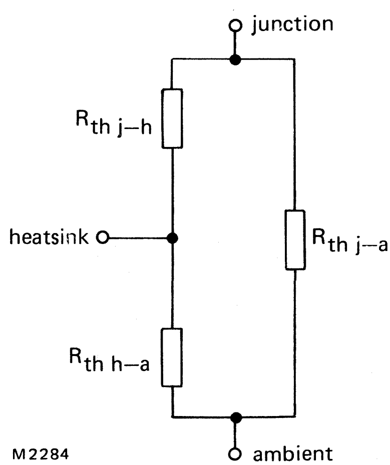


Fig.3.

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

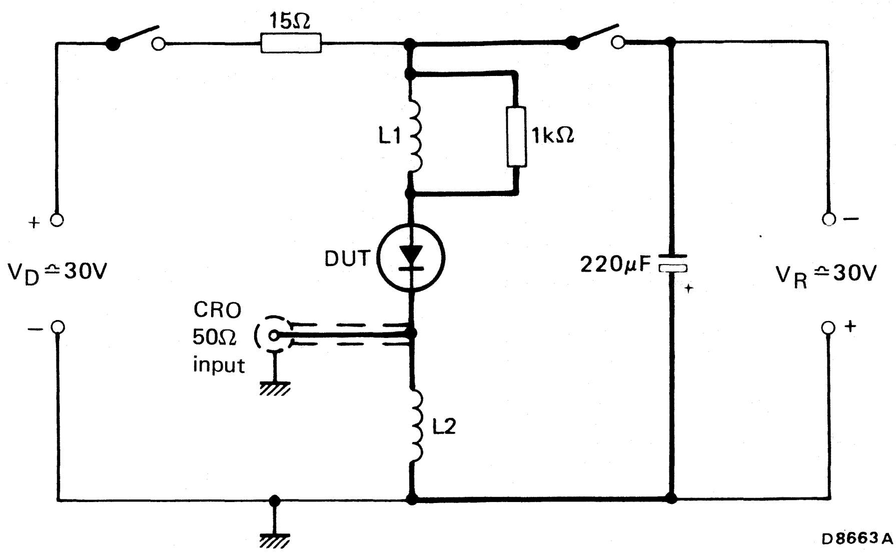


Fig.4 Simplified circuit diagram of practical apparatus to test softness of recovery.

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

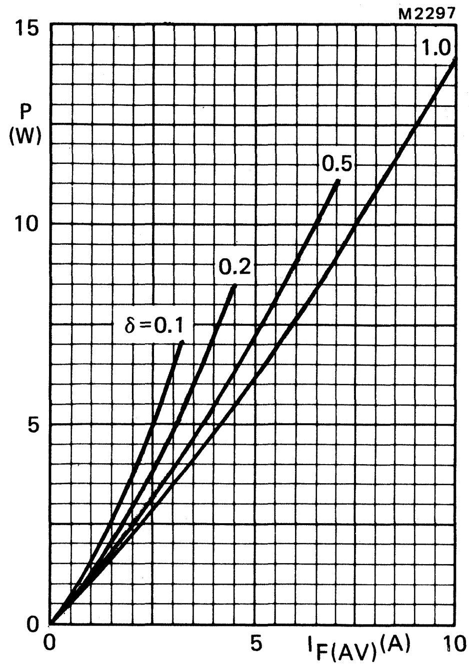
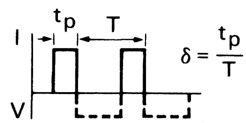


Fig.5 Power rating.

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.



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

SINUSOIDAL OPERATION

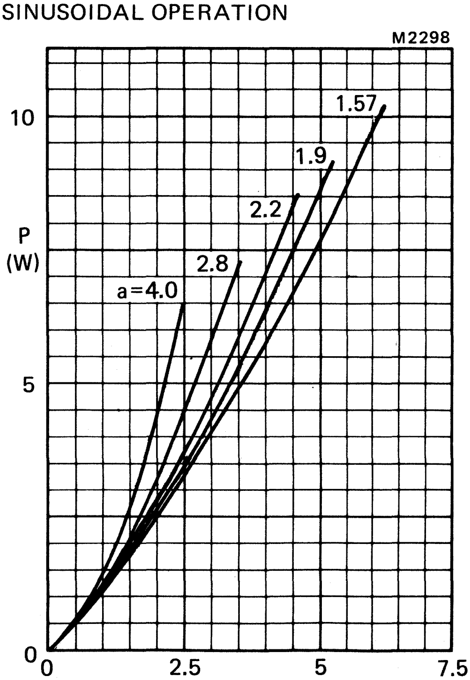


Fig.6 Power rating.

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 = $I_{F(RMS)}/I_{F(AV)}$

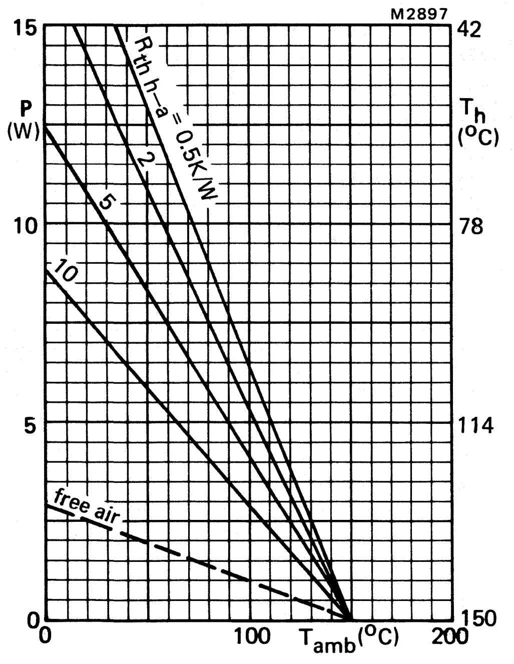


Fig.7 Heatsink rating;
without heatsink compound.

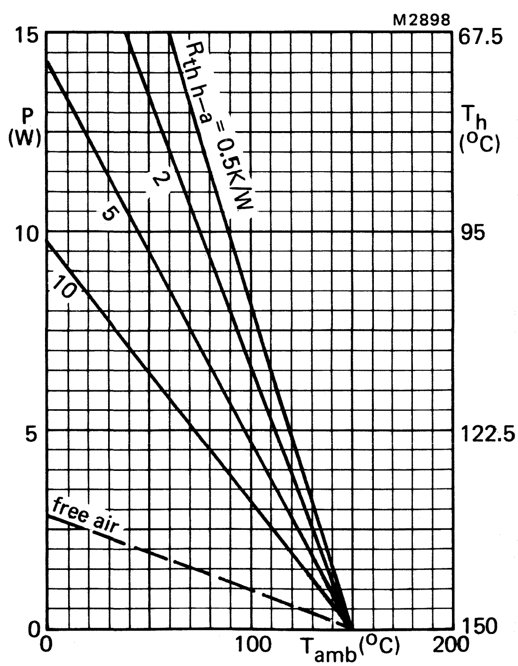


Fig.8 Heatsink rating;
with heatsink compound.

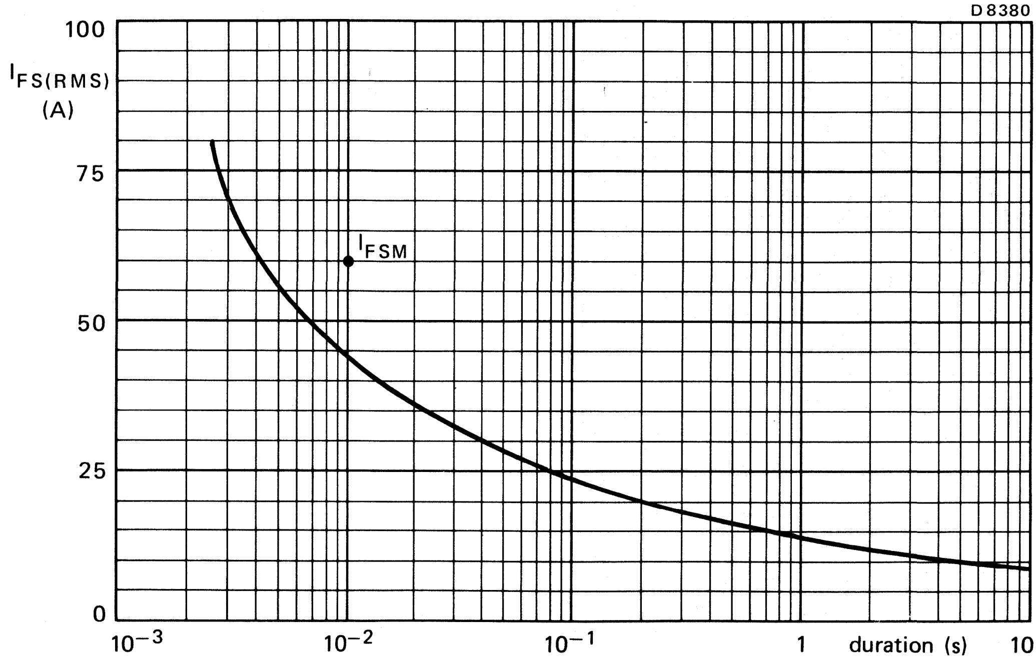
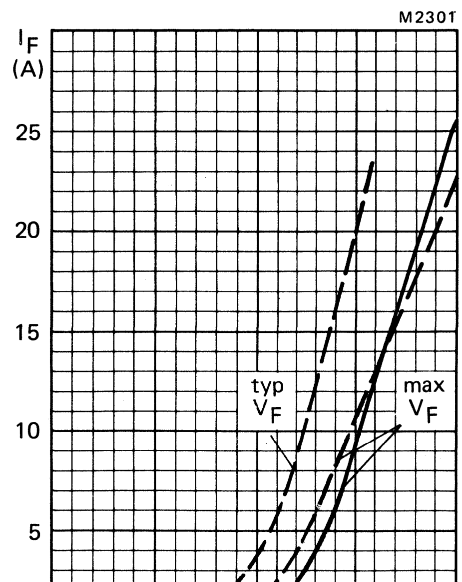


Fig.9 Maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz); T_j = 150 °C prior to surge; with reapplied V_{RWMmax}.



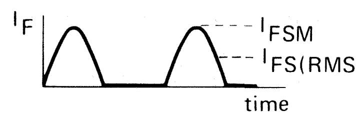


Fig.10 ——— T_j = 25 °C; – – – – T_j = 125 °C.

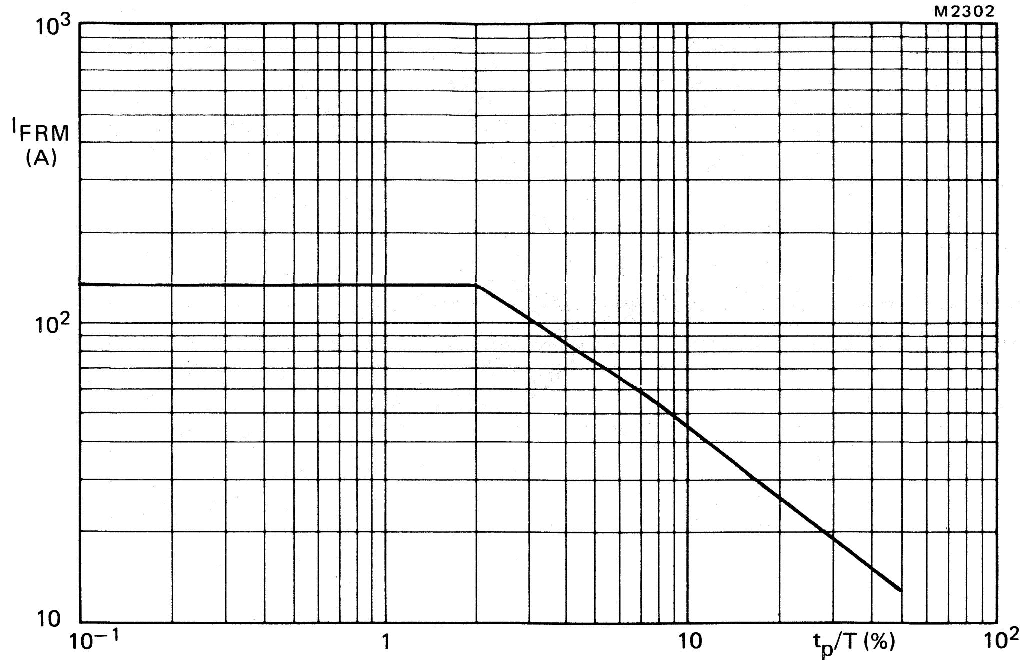
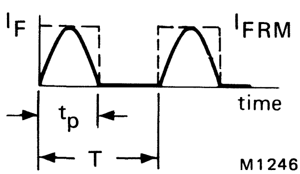


Fig.11 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 μs $< t_p <$ 1 ms.



Definition of I_{FRM} and t_p/T.

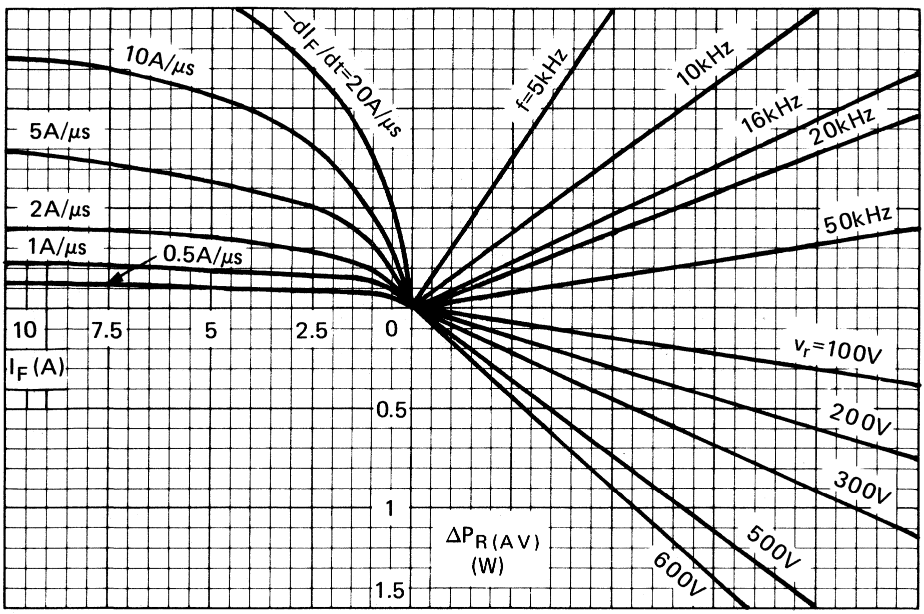
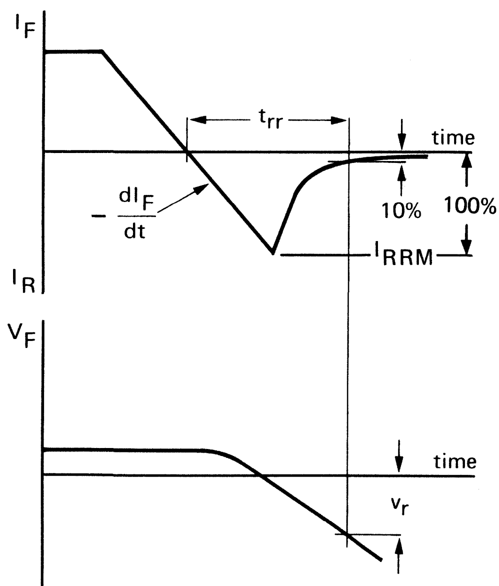


Fig.12 NOMOGRAM

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.



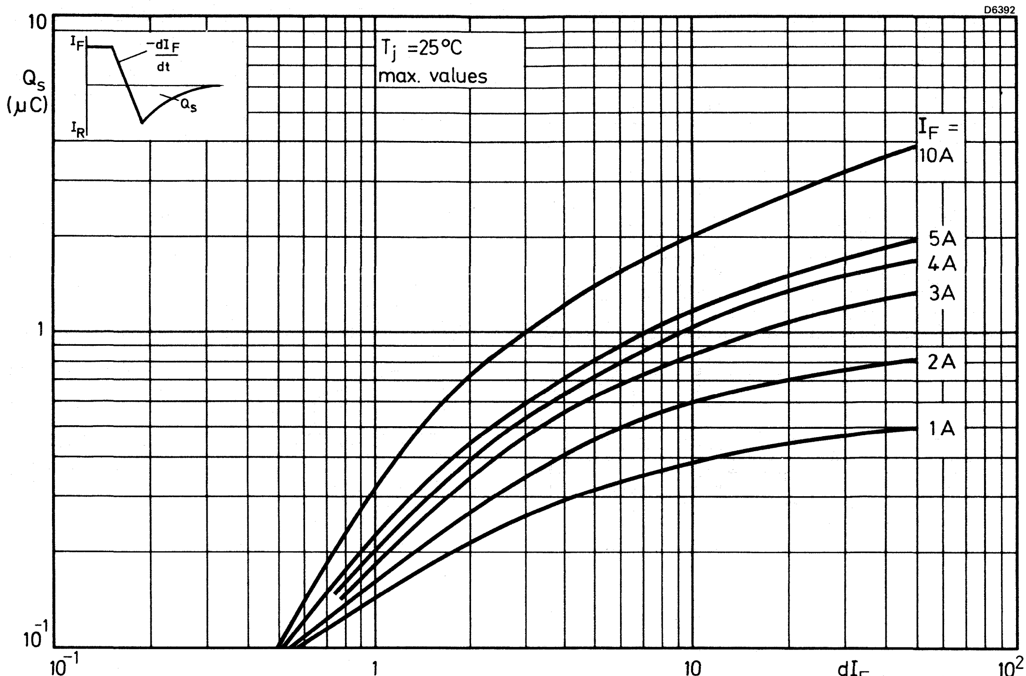

D6392
10
Q_s
(μC)
1
10^{-1}
10^{-1}
1
10
10^2
$-\frac{dI_F}{dt}$ (A/μs)
T_j =25°C
max. values
I_F
$-\frac{dI_F}{dt}$
Q_s
I_R
I_F =
10A
5A
4A
3A
2A
1A

Fig.13.

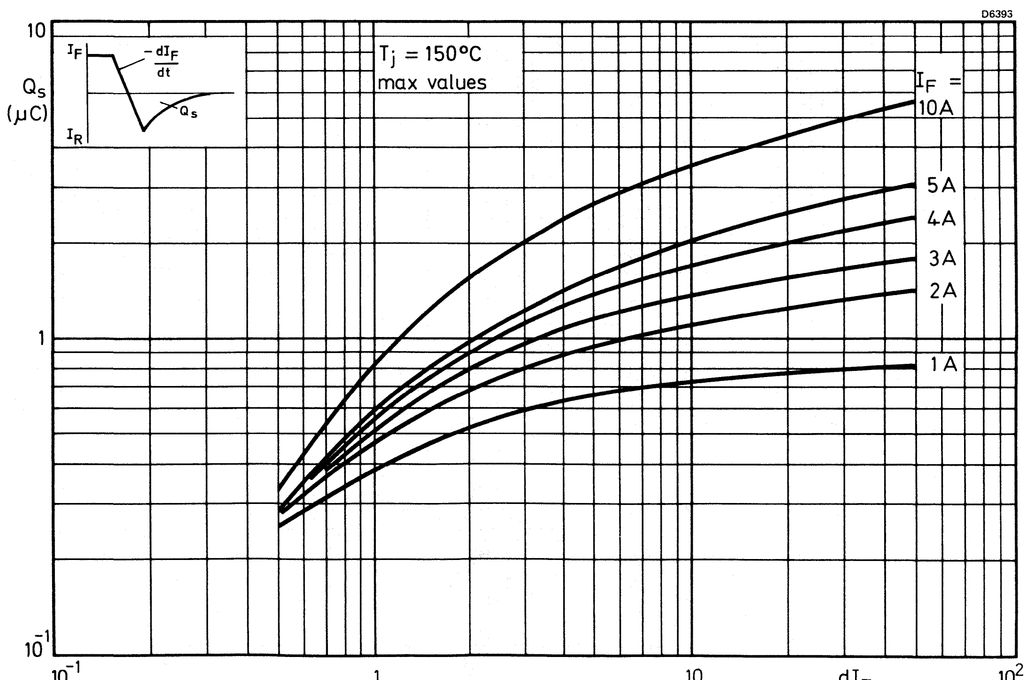

D6393
10
Q_s
(μC)
1
10^{-1}
10^{-1}
1
10
10^2
$-\frac{dI_F}{dt}$ (A/μs)
T_j = 150°C
max values
I_F
$-\frac{dI_F}{dt}$
Q_s
I_R
I_F =
10A
5A
4A
3A
2A
1A

Fig.14.

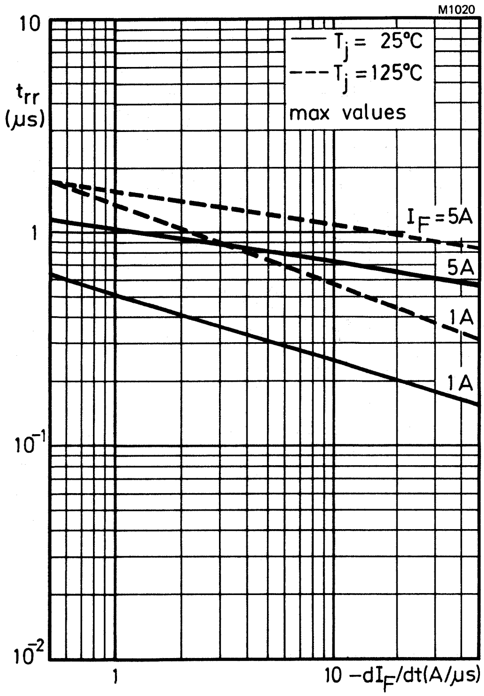


Fig.15.

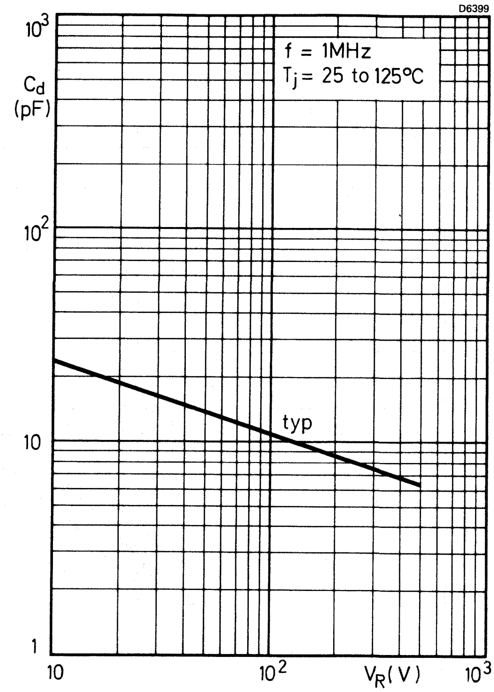


Fig.16.

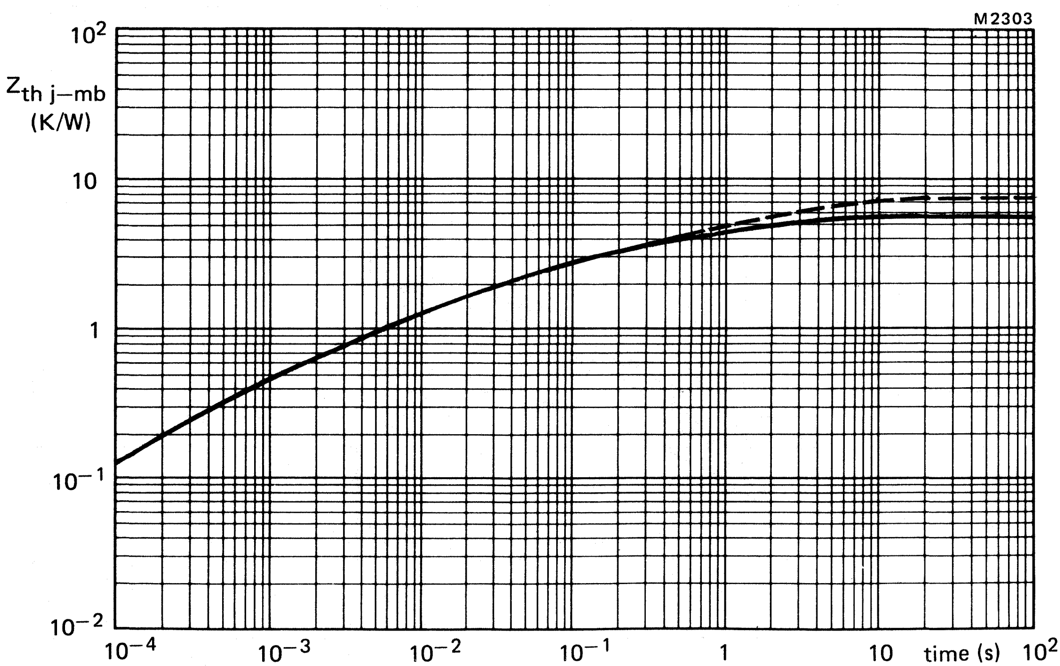


Fig.17 ——— with heatsink compound; – – – – without heatsink compound.

SILICON RECTIFIER DIODES

Glass-passivated double-diffused rectifier diodes in TO-220 plastic envelopes, intended for power rectifier applications.
The series consists of the following types:
Normal polarity (cathode to base plate): BY249–300 and BY249–600.
Reverse polarity (anode to base plate): BY249–300R and BY249–600R.

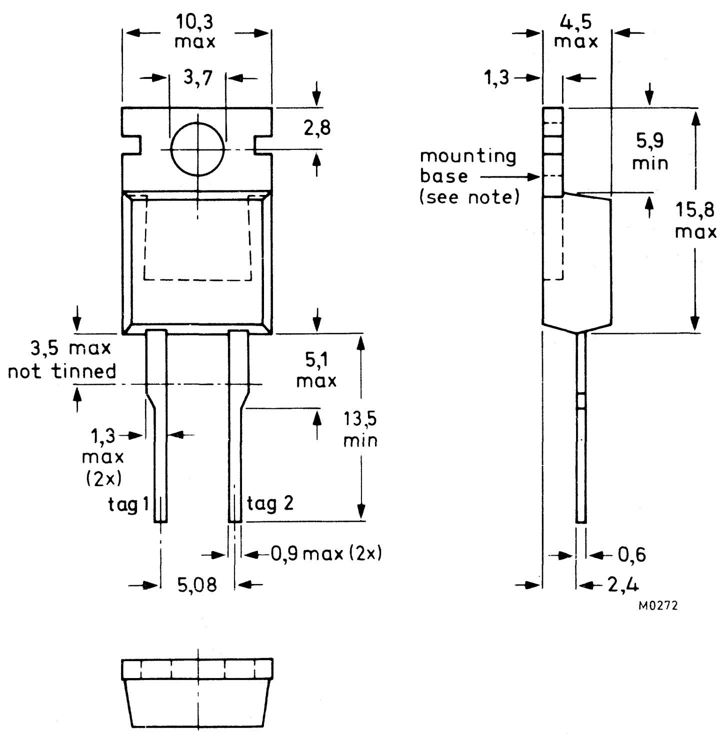
QUICK REFERENCE DATA

			BY249–300(R)	600(R)	
Repetitive peak reverse voltage	V_{RRM}	max.	300	600	V
Average forward current	$I_{F(AV)}$	max.	6.5		A
Non-repetitive peak forward current	I_{FSM}	max.	60		A

MECHANICAL DATA (see next page for polarity of connections)

Dimensions in mm

Fig. 1 TO-220AC



Note: The exposed metal mounting base is directly connected to tag 1.

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

MECHANICAL DATA (continued)

Polarity of connections:

	BY249–300 BY249–600	BY249–300R BY249–600R
base plate	cathode	anode
tag 1	cathode	anode
tag 2	anode	cathode

RATINGS

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

Voltages*			BY249–300(R)	600(R)	
Non-repetitive peak reverse voltage	V_{RSM}	max.	300	600	V
Repetitive peak reverse voltage	V_{RRM}	max.	300	600	V
Crest working reverse voltage	V_{RWM}	max.	200	400	V
Continuous reverse voltage	V_R	max.	200	400	V

Currents				
Average forward current;				
sinusoidal; up to T_{mb} = 110 °C	$I_{F(AV)}$	max.	6.5	A
sinusoidal; at T_{mb} = 125 °C	$I_{F(AV)}$	max.	4.0	A
R.M.S. forward current	$I_{F(RMS)}$	max.	9.5	A
Repetitive peak forward current; t = 10 ms; half sine-wave	I_{FRM}	max.	60	A
Non-repetitive peak forward current; t = 10 ms; half sine-wave; T_j = 150 °C prior to surge; with re-applied V_{RWMmax}	I_{FSM}	max.	60	A
I^2t for fusing; t = 10 ms	I^2t	max.	18	A^2s
Temperatures				
Storage temperature	T_{stg}		−40 to +150	°C
Junction temperature	T_j	max.	150	°C

CHARACTERISTICS

Forward voltage				
I_F = 20 A; T_j = 25 °C	V_F	<	1.6	V**
I_F = 5 A; T_j = 100 °C	V_F	<	1.05	V**
Reverse current				
$V_R = V_{RWMmax}$; T_j = 125 °C	I_R	<	0.4	mA

*To ensure thermal stability, $R_{th\ j\text{-}a} < 15$ °C/W for continuous reverse voltage.
**Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

From junction to mounting base $R_{th\ j\text{-}mb} = 4.2\ ^oC/W$

Transient thermal impedance; t = 1 ms $Z_{th\ j\text{-}mb} = 0.46\ ^oC/W$

Influence of mounting method

1. Heatsink mounted with clip (see mounting instructions)

Thermal resistance from mounting base to heatsink

a. with heatsink compound $R_{th\ mb\text{-}h} = 0.3\ ^oC/W$

b. with heatsink compound and 0.06 mm maximum mica insulator $R_{th\ mb\text{-}h} = 1.4\ ^oC/W$

c. with heatsink compound and 0.1 mm maximum mica insulator (56369) $R_{th\ mb\text{-}h} = 2.2\ ^oC/W$

d. with heatsink compound and 0.25 mm maximum alumina insulator (56367) $R_{th\ mb\text{-}h} = 0.8\ ^oC/W$

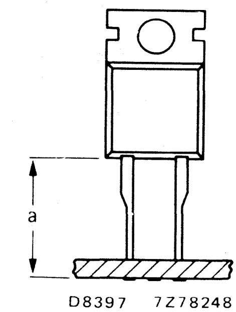
e. without heatsink compound $R_{th\ mb\text{-}h} = 1.4\ ^oC/W$

2. 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 tie-point. Thermal resistance from junction to ambient in free air: mounted on a printed-circuit board at a = any lead length.

$R_{th\ j\text{-}a} = 60\ ^oC/W$

Fig. 2



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 ^oC; it 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. It is recommended that the circuit connection be made to tag 1, rather than direct to the heatsink.
4. 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 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.
5. 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.
6. 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.

SINUSOIDAL OPERATION

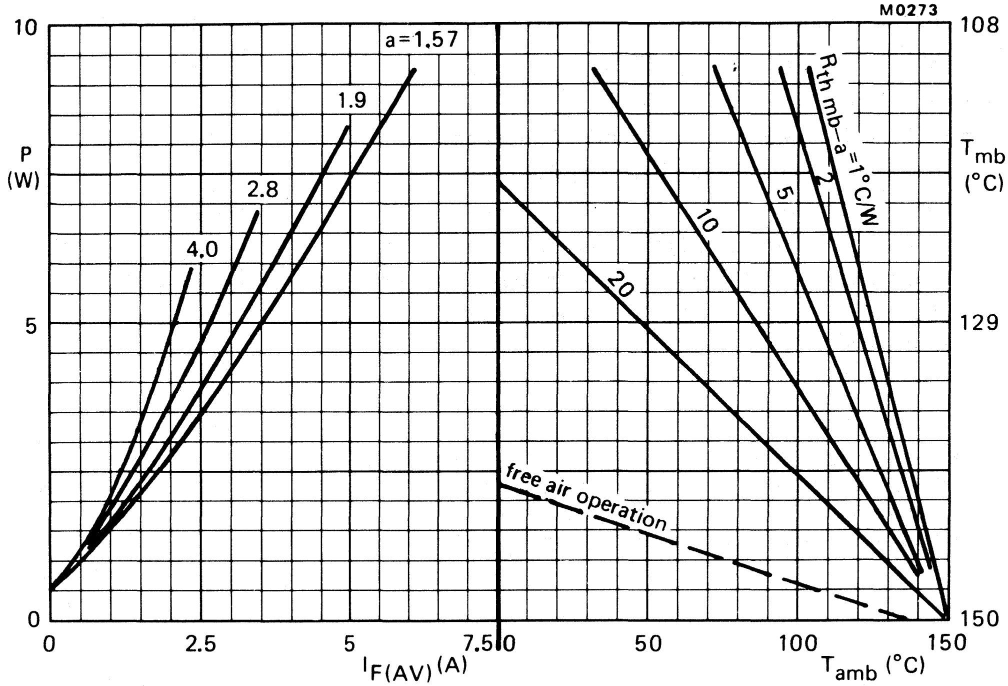


Fig. 3 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

*T_{mb} scale is for comparison purposes and is correct only for $R_{th\ mb\text{-}a} < 19.3\ ^oC/W$.

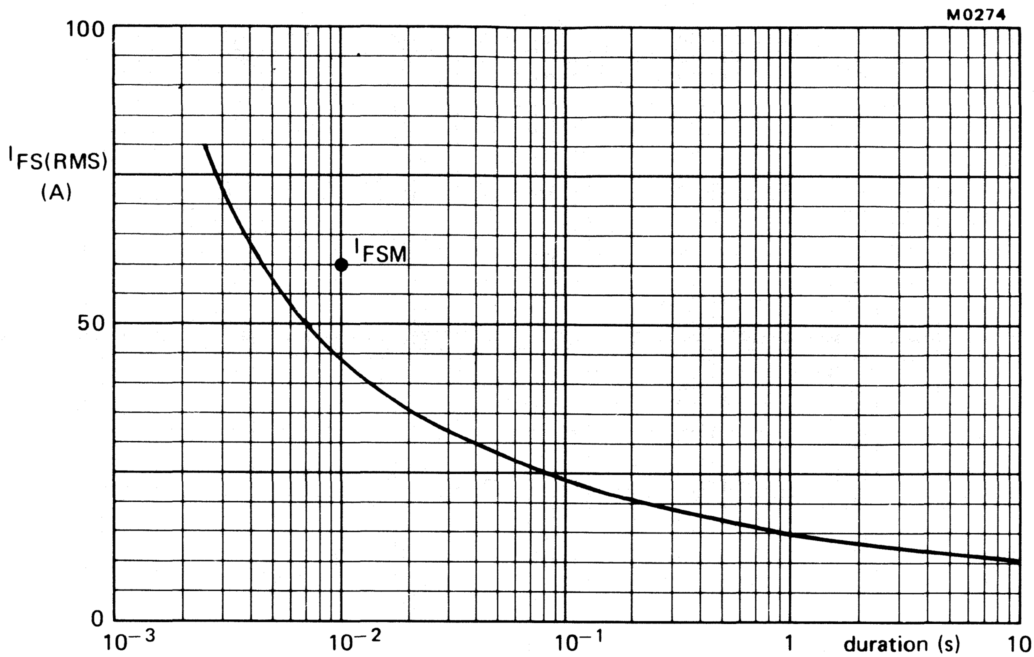
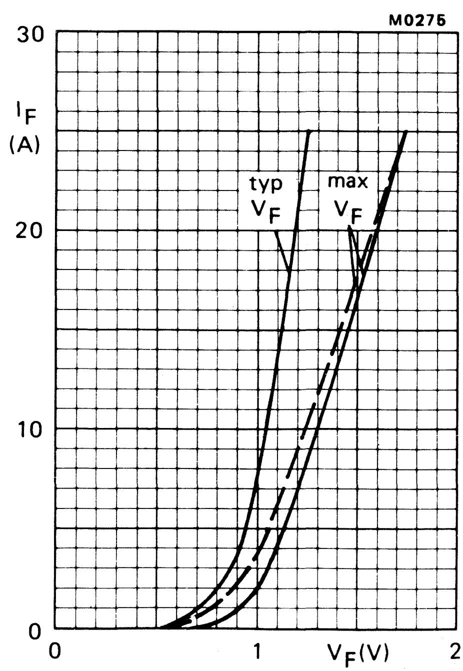


Fig. 4 Maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz); T_j = 150 °C prior to surge.



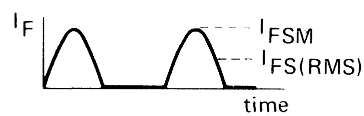


Fig. 5 ——— T_j = 25 °C; – – – T_j = 100 °C

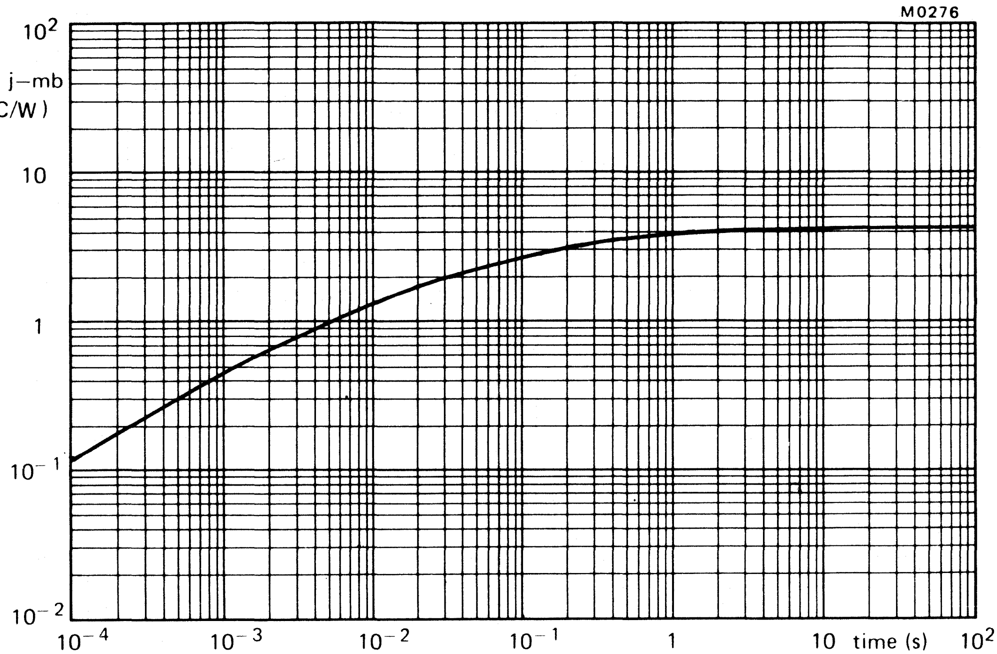


Fig. 6

ELECTRICALLY ISOLATED RECTIFIER DIODES

Glass-passivated, double-diffused rectifier diodes in full-pack plastic envelopes, intended for power rectifier applications. Their electrical isolation makes them ideal for mounting on a common heatsink alongside other components without the need for additional insulators.

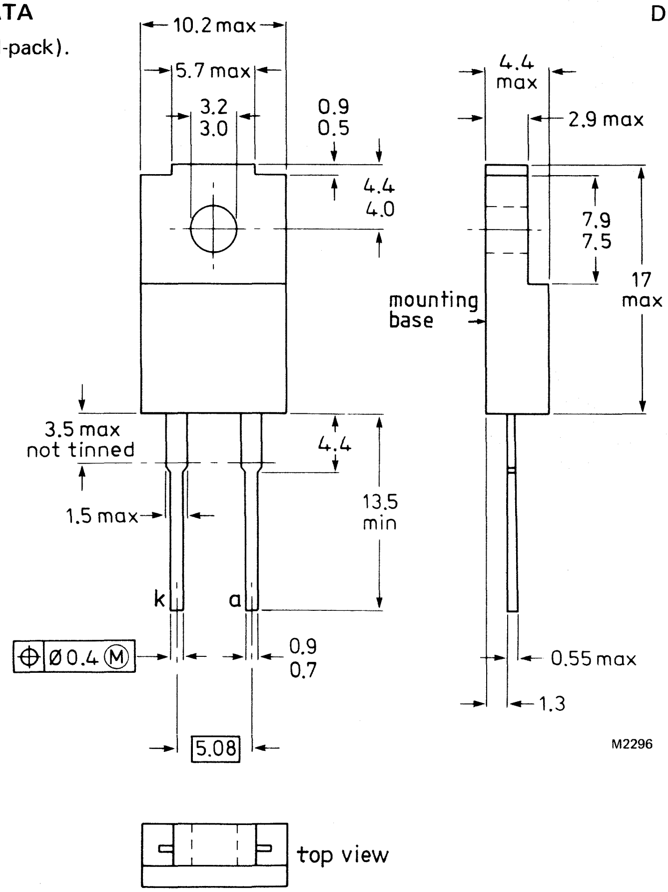
QUICK REFERENCE DATA

			BY249F–300	600	
Repetitive peak reverse voltage	V_{RRM}	max.	300	600	V
Average forward current	$I_{F(AV)}$	max.	6.5		A
Non-repetitive peak forward current	I_{FSM}	max.	60		A

MECHANICAL DATA

Dimensions in mm

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



Net mass: 2 g.

The mounting base 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 (IEC 134).

Voltages (note 1)

			BY249F–300	600	
Non-repetitive peak reverse voltage	V_{RSM}	max.	300	600	V
Repetitive peak reverse voltage	V_{RRM}	max.	300	600	V
Crest working reverse voltage	V_{RWM}	max.	200	400	V
Continuous reverse voltage	V_R	max.	200	400	V

Currents

Average forward current; (note 2)				
sinusoidal; up to T_h = 95 °C	$I_{F(AV)}$	max.	6.5	A
sinusoidal; at T_h = 125 °C	$I_{F(AV)}$	max.	3.2	A
RMS forward current	$I_{F(RMS)}$	max.	9.5	A
Repetitive peak forward current; t = 10 ms; half sinewave	I_{FRM}	max.	60	A
Non-repetitive peak forward current; t = 10 ms; half sinewave; T_j = 150 °C prior to surge; with re-applied V_{RWMmax}	I_{FSM}	max.	60	A
I^2t for fusing; t = 10 ms	I^2t	max.	18	A^2s

Temperatures

Storage temperature	T_{stg}		−40 to +150	°C
Junction temperature	T_j	max.	150	°C

ISOLATION

Peak isolation voltage from all terminals to external heatsink	$V_{(isol)M}$	max.	1000	V
Isolation capacitance between all terminals and external heatsink (note 3)	$C_{(isol)}$	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

Forward voltage				
$I_F = 20$ A; $T_j = 25\ ^oC$	V_F	<	1.6	V*
$I_F = 5$ A; $T_j = 100\ ^oC$	V_F	<	1.05	V*
Reverse current				
$V_R = V_{RWMmax}$; $T_j = 125\ ^oC$	I_R	<	0.4	mA

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 mounting base 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.2.

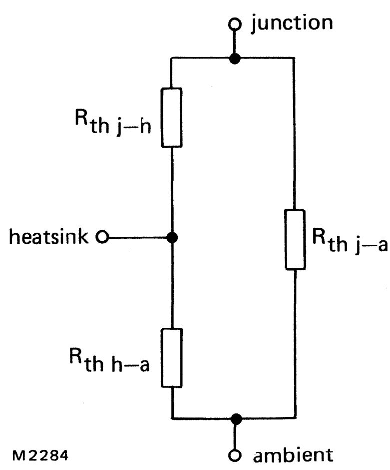


Fig.2.

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

SINUSOIDAL OPERATION

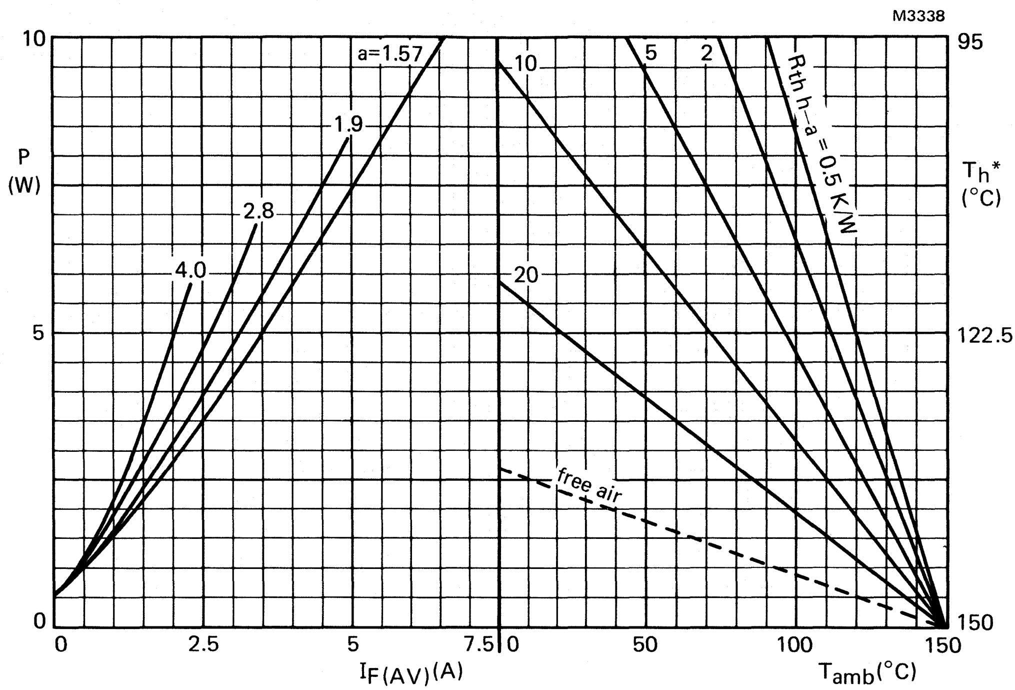


Fig.3 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

*T_h scale is for comparison purposes and is correct only for $R_{th\ h\text{-}a} < 19.3$ K/W.

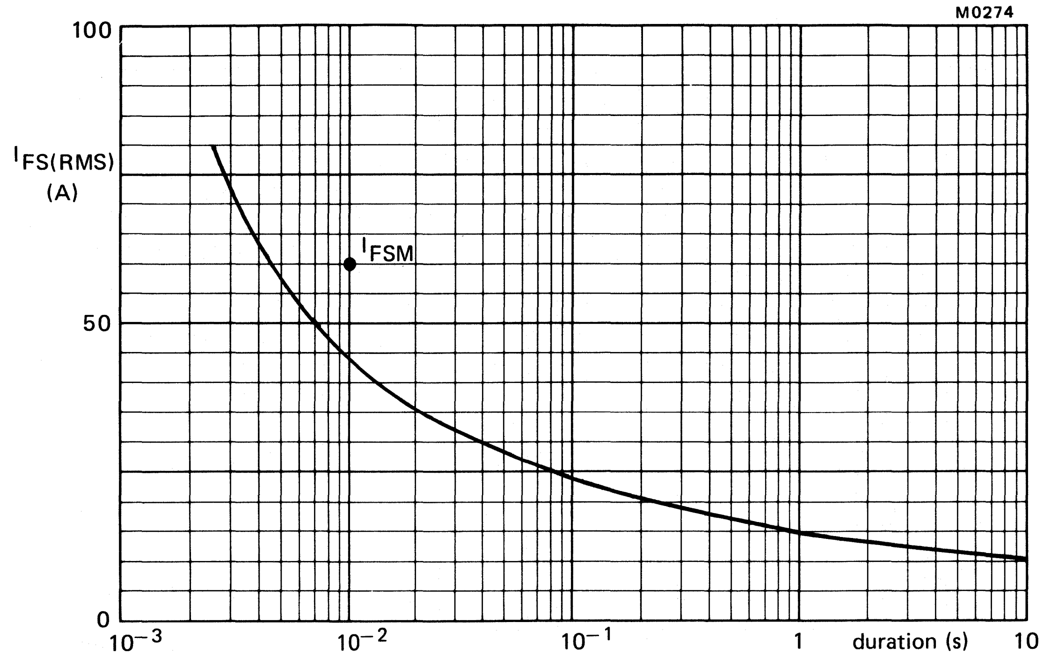
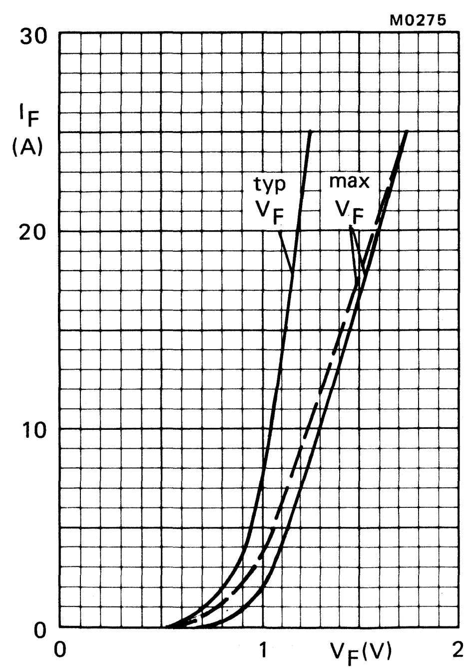


Fig.4 Maximum permissible non-repetitive RMS forward current based on sinusoidal currents (f = 50 Hz); T_j = 150 °C prior to surge.



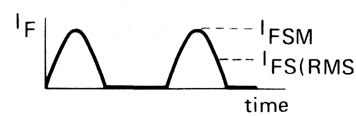


Fig.5 —— T_j = 25 °C; – – – T_j = 100 °C.

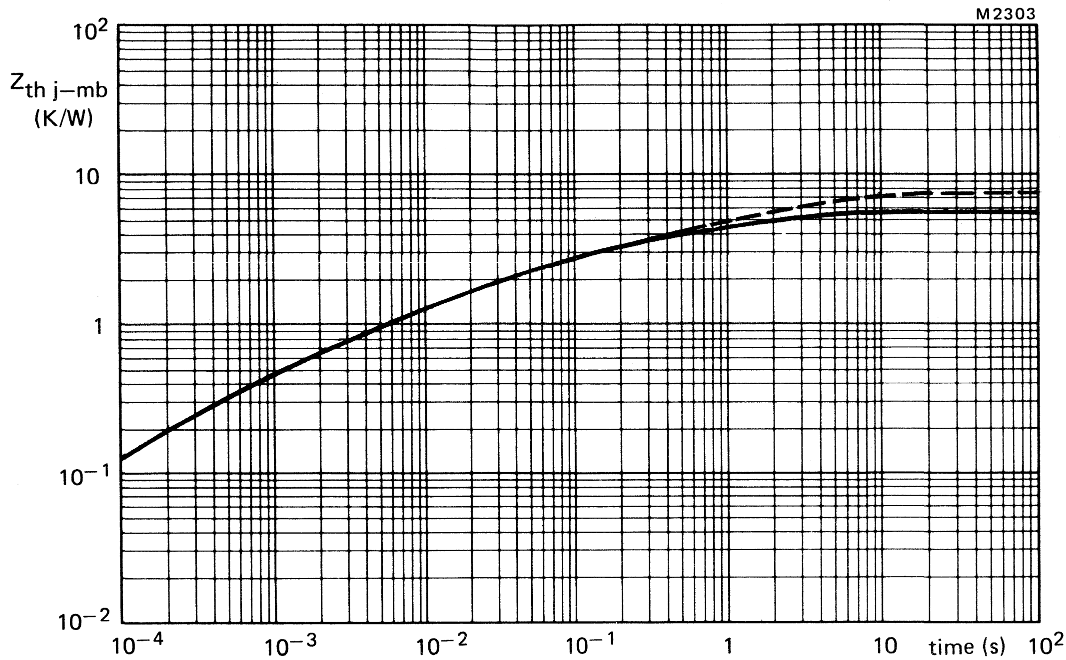


Fig.6 ——— with heatsink compound; – – – – without heatsink compound.

FAST SOFT-RECOVERY RECTIFIER DIODES

Glass-passivated double-diffused rectifier diodes in plastic envelopes, featuring fast reverse recovery times and non-snap-off characteristics. They are intended for use in chopper applications as well as in switched-mode power supplies, as efficiency diodes and scan rectifiers in television receivers. The series consists of normal polarity types (cathode to mounting base).

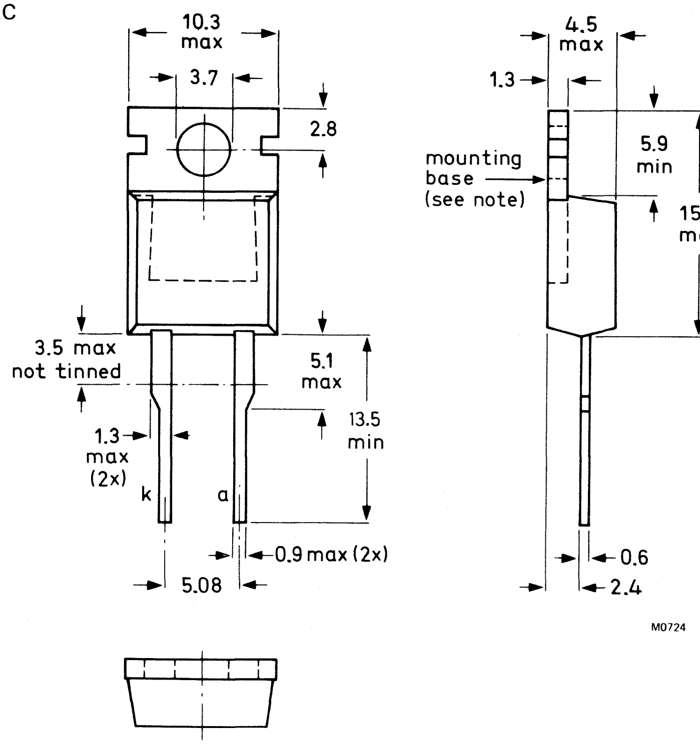
QUICK REFERENCE DATA

			BY329–800	1000	1200	
Repetitive peak reverse voltage	V_{RRM}	max.	800	1000	1200	V
Average forward current	$I_{F(AV)}$	max.		8		A
Non-repetitive peak forward current	I_{FSM}	max.		80		A
Reverse recovery time	t_{rr}	$<$		150		ns

MECHANICAL DATA

Dimensions in mm

Fig.1 TO-220AC



Note: The exposed metal mounting base is directly connected to the cathode. Accessories supplied on request: see data sheets Mounting instructions and accessories for TO–220 envelopes.

RATINGS

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

Voltages

			BY329-800	1000	1200	
Non-repetitive peak reverse voltage	V_{RSM}	max.	800	1000	1200	V
Repetitive peak reverse voltage	V_{RRM}	max.	800	1000	1200	V
Crest working reverse voltage	V_{RWM}	max.	600	800	1000	V

Currents

Average forward current assuming zero switching losses				
square-wave; $\delta = 0.5$; up to $T_{mb} = 108\ ^oC$	$I_{F(AV)}$	max.	8	A
square-wave; $\delta = 0.5$; at $T_{mb} = 125\ ^oC$	$I_{F(AV)}$	max.	5.3	A
sinusoidal; up to $T_{mb} = 113\ ^oC$	$I_{F(AV)}$	max.	7	A
sinusoidal; at $T_{mb} = 125\ ^oC$	$I_{F(AV)}$	max.	5.2	A
R.M.S. forward current	$I_{F(RMS)}$	max.	11	A
Repetitive peak forward current	I_{FRM}	max.	80	A
Non-repetitive peak forward current: t = 10 ms half sine-wave; $T_j = 150\ ^oC$ prior to surge; with reapplied $V_{RWM\ max}$	I_{FSM}	max.	80	A
I^2t for fusing (t = 10 ms)	I^2t	max.	32	A^2s

Temperatues

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

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	3.0	K/W

Influence of mounting method

1. Heatsink mounted with clip (see mounting instructions)

Thermal resistance from mounting base to heatsink

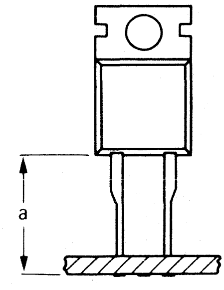
a. with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.3	K/W
b. with heatsink compound and 0.06 mm maximum mica insulator	$R_{th\ mb\text{-}h}$	=	1.4	K/W
c. with heatsink compound and 0.1 mm maximum mica insulator (56369)	$R_{th\ mb\text{-}h}$	=	2.2	K/W
d. with heatsink compound and 0.25 mm maximum alumina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

THERMAL RESISTANCE (continued)

2. Free-air operation	$R_{th\ j\text{-}a}$	=	60	$^oC/W$

The quoted value 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 a = any lead length.

Fig.2



CHARACTERISTICS

Forward voltage				
I_F = 20 A; T_j = 25 ^oC	V_F	<	1.85	V*
Reverse current				
$V_R = V_{RWMmax}$; T_j = 125 ^oC	I_R	<	1.0	mA
Reverse recovery when switched from				
I_F = 2 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 20 A/μs; T_j = 25 ^oC				
Recovered charge	Q_s	<	0.7	μC
I_F = 1 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 50 A/μs; T_j = 25 ^oC				
Recovery time	t_{rr}	<	150	ns
Maximum slope of the reverse recovery current				
I_F = 2 A; $-dI_F/dt$ = 20 A/μs; T_j = 25 ^oC	$\lvert dI_R/dt \rvert$	<	60	A/μs

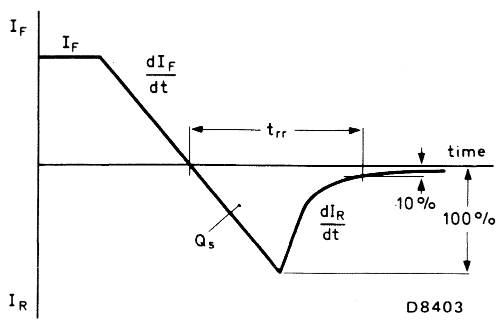


Fig.3 Definition of t_{rr} and Q_s

*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 ^{o}C; it 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. It is recommended that the circuit connection be made to the cathode tag, rather than direct to the heatsink.
4. 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 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.
5. For good thermal contact heatsink compound should be used between base-plate 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.
6. 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.

SQUARE-WAVE OPERATION

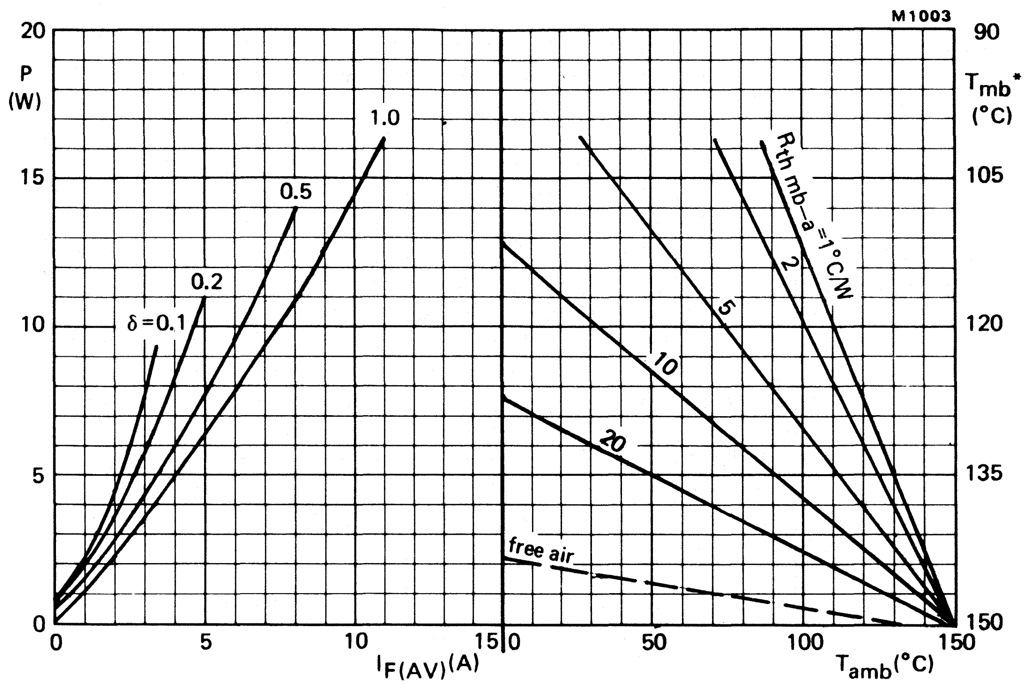
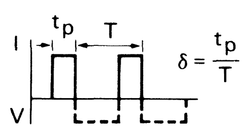


Fig.4 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
P = power including reverse current losses but excluding switching losses.



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

*T_{mb} scale is for comparison purposes and is correct only for $R_{th\ mb\text{-}a} < 10^{o}C/W$.

SINUSOIDAL OPERATION

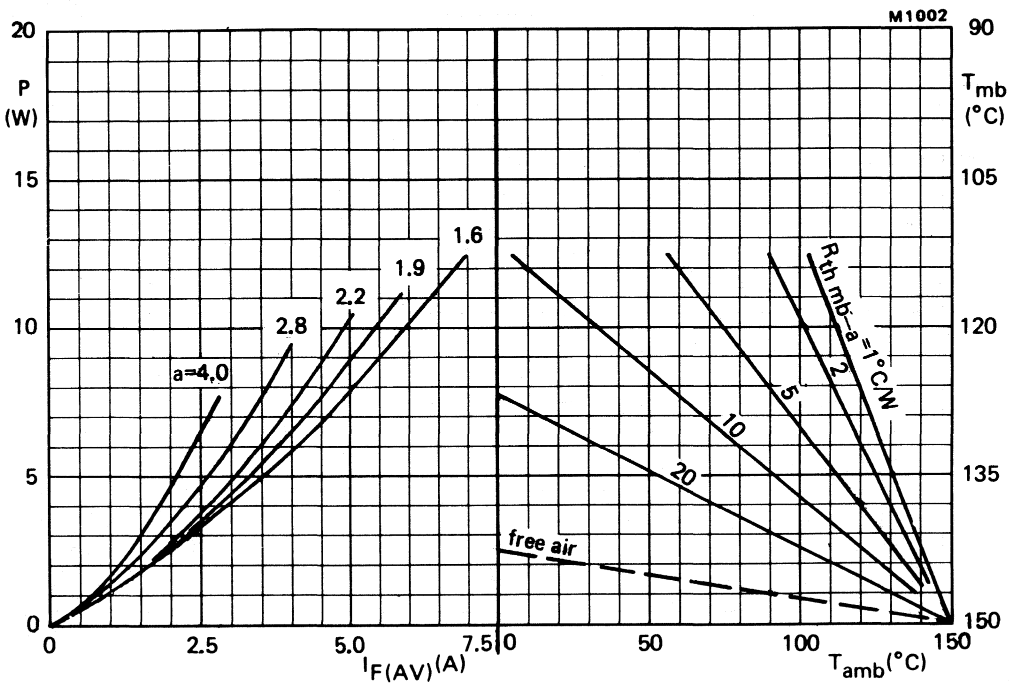


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
P = power including reverse current losses but excluding switching losses.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

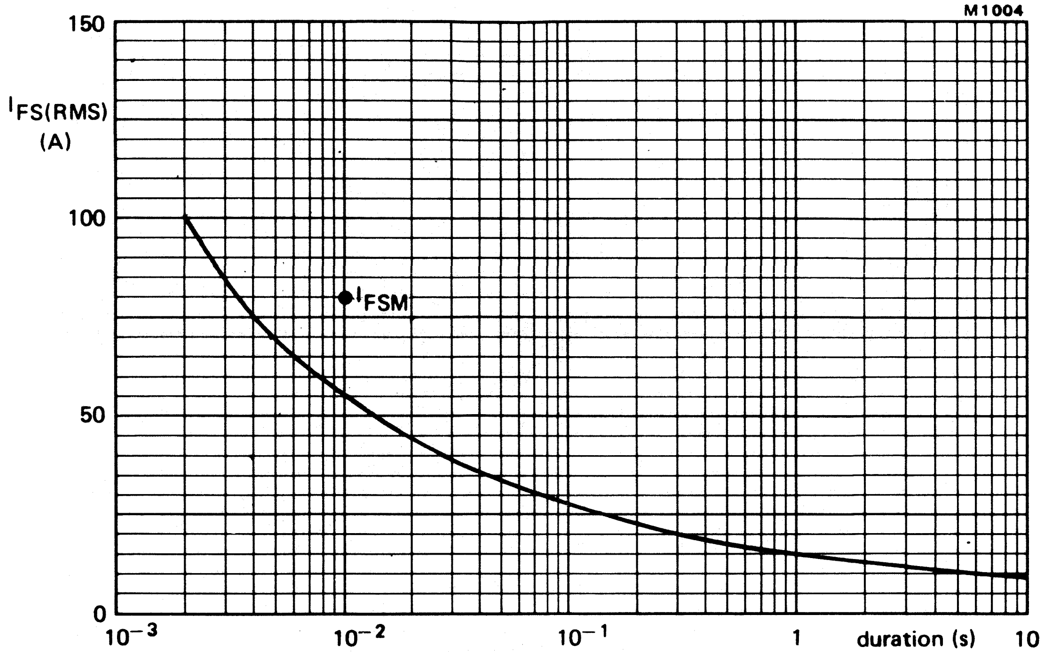
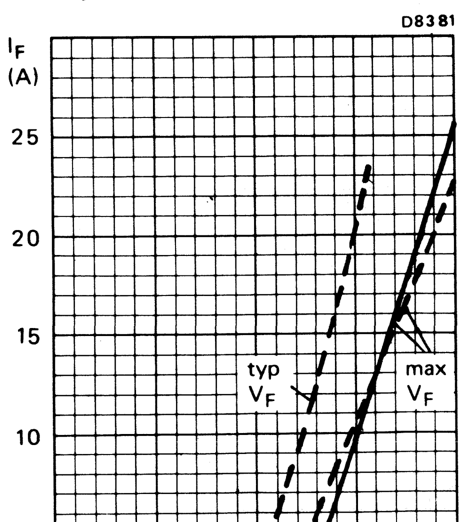


Fig.6 Maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz); T_j = 150 °C prior to surge; with reapplied V_{RWMmax}.



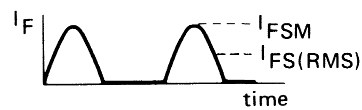


Fig.7 ——— T_j = 25 °C; – – – – T_j = 125 °C

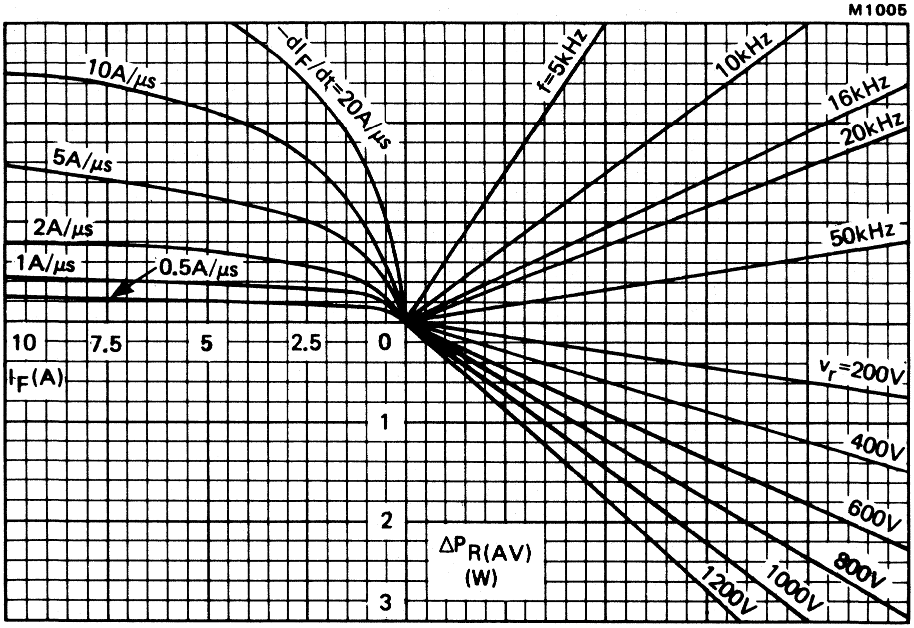
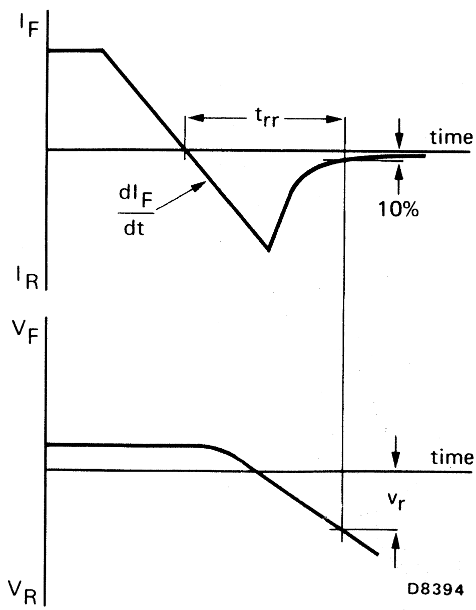


Fig.8 NOMOGRAM

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



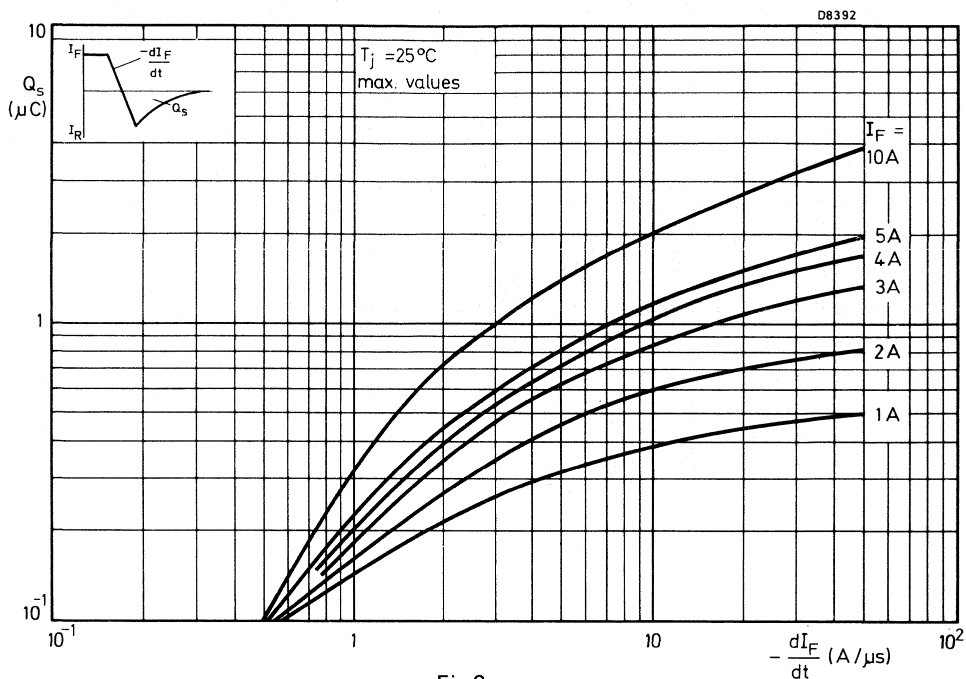

D8392
T_j = 25 °C
max. values
Q_s (µC)
I_F
I_R
$-\frac{dI_F}{dt}$
Q_s
I_F =
10A
5A
4A
3A
2A
1A
10
1
10^{-1}
1
10
10^2
$-\frac{dI_F}{dt}$ (A/µs)

Fig.9

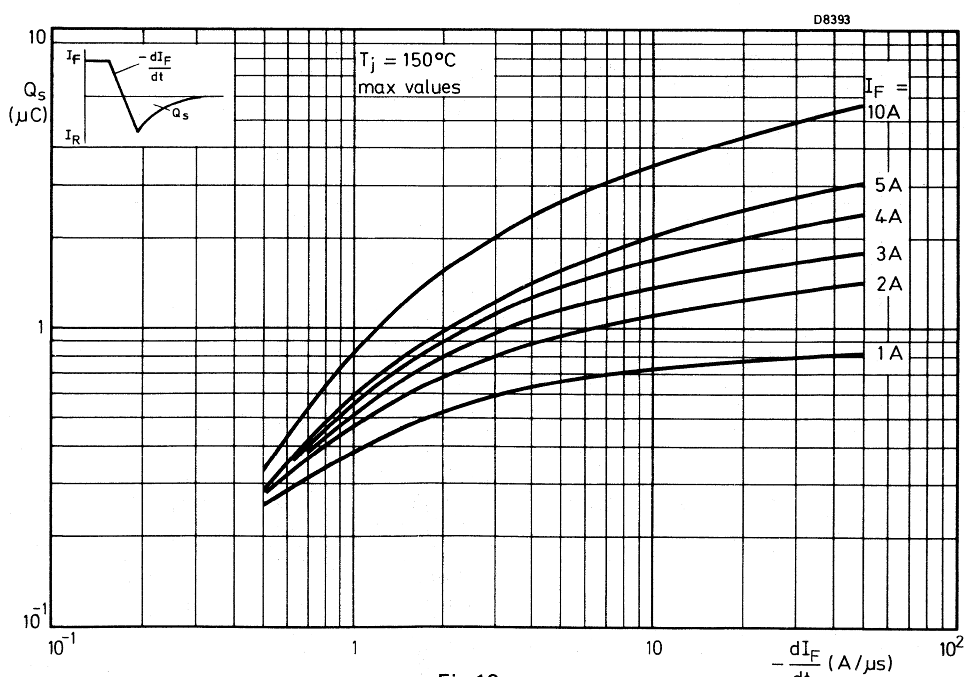

D8393
T_j = 150 °C
max values
Q_s (µC)
I_F
I_R
$-\frac{dI_F}{dt}$
Q_s
I_F =
10A
5A
4A
3A
2A
1A
10
1
10^{-1}
1
10
10^2
$-\frac{dI_F}{dt}$ (A/µs)

Fig.10

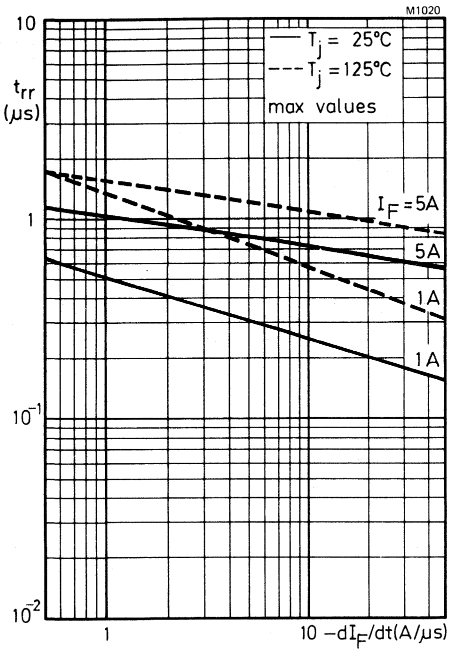


Fig.11

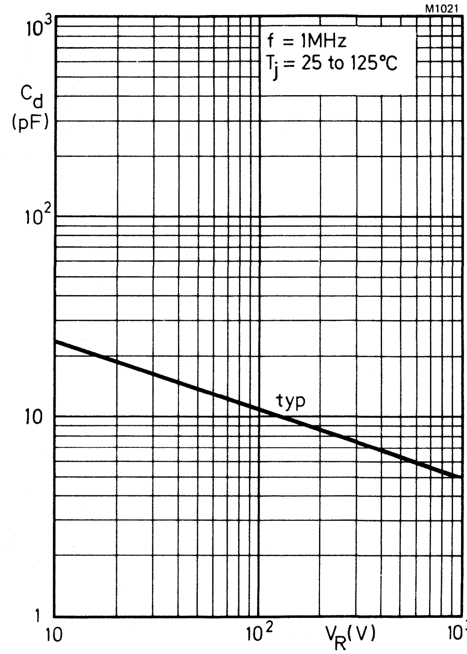


Fig.12

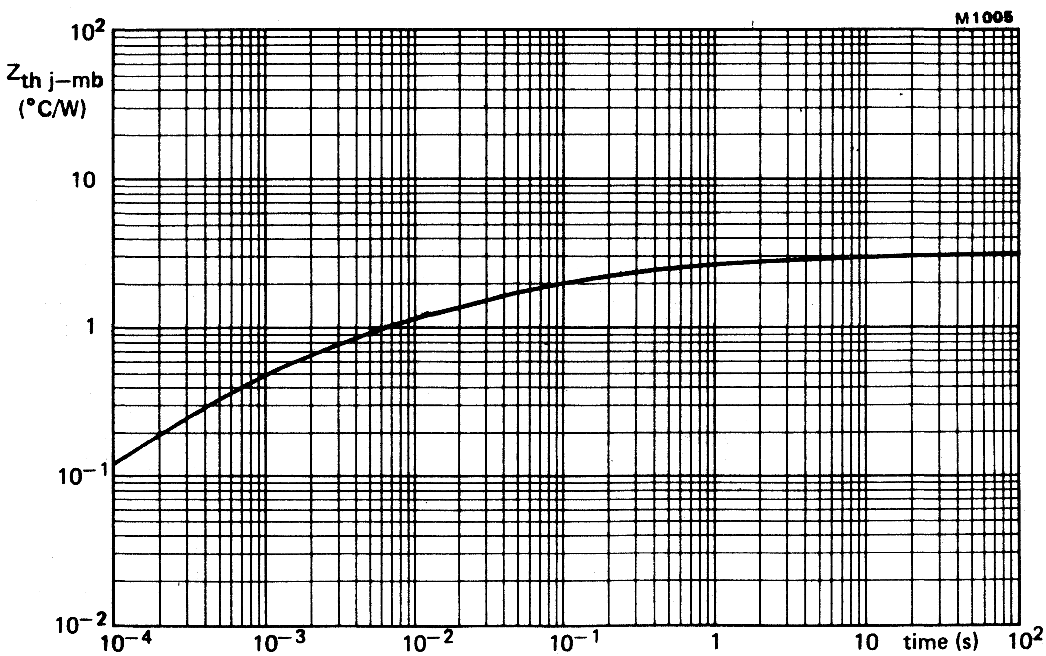


Fig.13

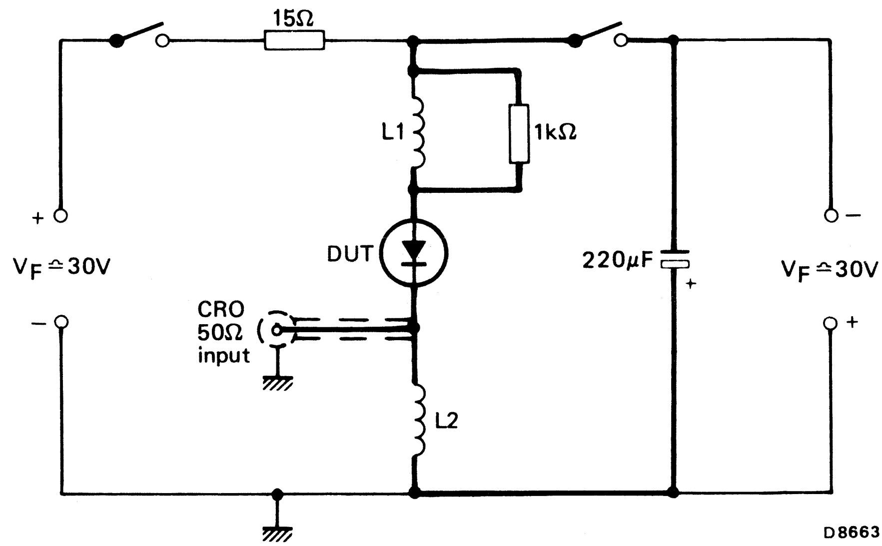


Fig.14 Simplified circuit diagram of practical apparatus to test softness of recovery.

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 5A/μs/V.
4. Wiring shown in heavy should be kept as short as possible.

FAST HIGH-VOLTAGE RECTIFIER DIODES

Glass-passivated double-diffused rectifier diodes in TO-220 plastic envelopes, featuring fast recovery times. They are intended for use as an anti-parallel diode to GTOs and similar high-voltage switches, in chopper applications such as Series Resonant Power Supplies (SRPS) and other high-voltage circuits. The series consists of normal polarity types (cathode to mounting base).

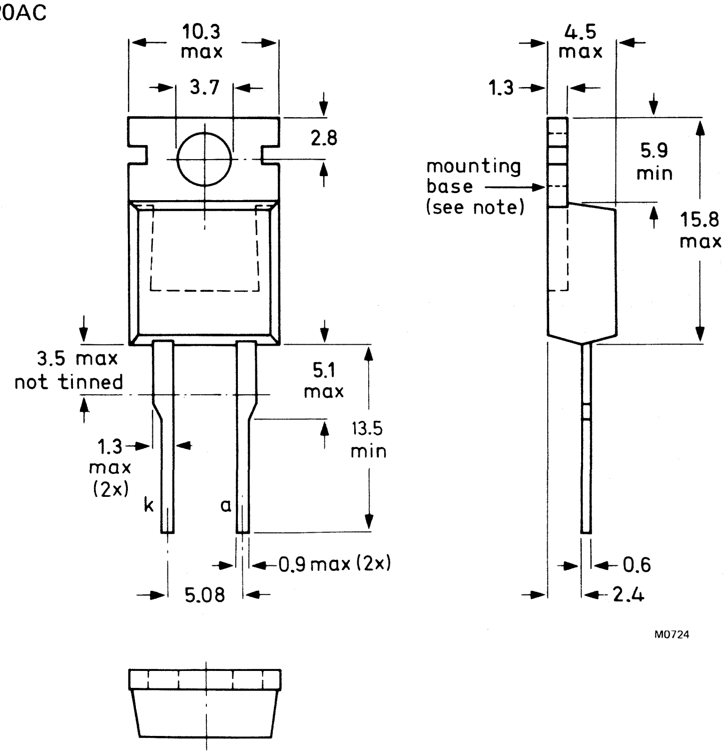
QUICK REFERENCE DATA

			BY359–1000	1300	1500	
Repetitive peak reverse voltage	V_{RRM}	max.	1000	1300	1500	V
Average forward current	$I_{F(AV)}$	max.		6.5		A
Non-repetitive peak forward current	I_{FSM}	max.		60		A
Reverse recovery time	t_{rr}	<		0.6		μs

MECHANICAL DATA

Dimensions in mm

Fig.1 TO-220AC



Note: The exposed metal mounting base is directly connected to the cathode.Accessories supplied on request: see data sheets Mounting instructions and accessories for TO–220 envelopes.

RATINGS

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

Voltages*

			BY359–1000	1300	1500	
Non-repetitive peak reverse voltage	V_{RSM}	max.	1100	1500	1650	
Repetitive peak reverse voltage	V_{RRM}	max.	1000	1300	1500	V
Crest working reverse voltage	V_{RWM}	max.	800	1200	1300	V
Continuous reverse voltage	V_R	max.	600	750	800	V

Currents

Average forward current assuming zero switching losses sinusoidal; up to T_{mb} = 94 °C	$I_{F(AV)}$	max.	6.5	A
R.M.S. forward current	$I_{F(RMS)}$	max.	10	A
Repetitive peak froward current	I_{FRM}	max.	60	A
Non-repetitive peak forward current: t = 10 ms half sine-wave; T_j = 125 °C prior to surge; with reapplied $V_{RWM\ max}$	I_{FSM}	max.	60	A

Temperatures

Storage temperature	T_{stg}		−40 to +150	°C
Junction temperature	T_j	max.	125	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	3.0	°C/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	°C/W
b. with heatsink compound and 0.06 mm maximum mica insulator	$R_{th\ mb\text{-}h}$	=	1.4	°C/W
c. with heatsink compound and 0.1 mm maximum mica insulator (56369)	$R_{th\ mb\text{-}h}$	=	2.2	°C/W
d. with heatsink compound and 0.25 mm maximum alumina insulator (56367)	$R_{th\ mb\text{-}h}$	=	0.8	°C/W
e. without heatsink compound	$R_{th\ mb\text{-}h}$	=	1.4	°C/W

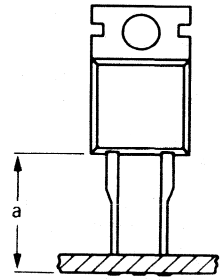
*To ensure thermal stability: $R_{th\ j\text{-}a} \leqslant 10.4$ °C/W for continuous reverse voltage.

THERMAL RESISTANCE (continued)

2. Free-air operation $R_{th\ j\text{-}a}$ = 60 °C/W

   The quoted value 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 a = any lead length

Fig.2



CHARACTERISTICS

Forward voltage				
I_F = 20 A; T_j = 25 °C	V_F	<	2.3	V*
Reverse current				
$V_R = V_{RWMmax}$; T_j = 100 °C	I_R	<	0.6	mA
Reverse recovery when switched from				
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	<	2.0	μC
recovery time	t_{rr}	<	0.6	μs
Forward recovery when switched to				
I_F = 5 A with t_r = 0.1 μs; T_j = 25 °C				
recovery time	t_{fr}	<	1.0	μs

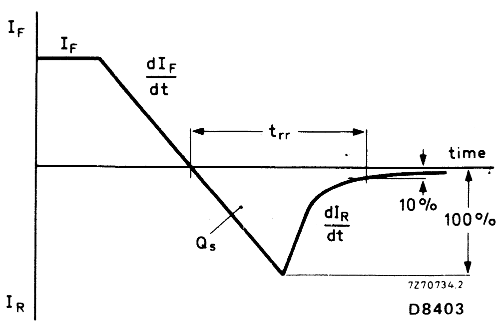


Fig.3 Definition of t_{rr} and Q_s.

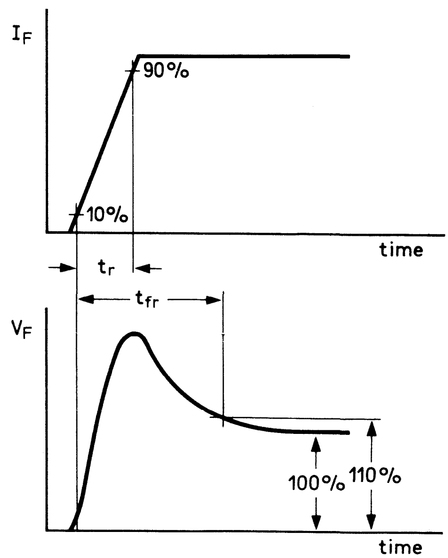


Fig.4 Definition of t_{fr}.

*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; it 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. It is recommended that the circuit connection be made to the cathode tag, rather than direct to the heatsink.
4. 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 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.
5. For good thermal contact heatsink compound should be used between base-plate 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.
6. 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.

SINUSOIDAL OPERATION

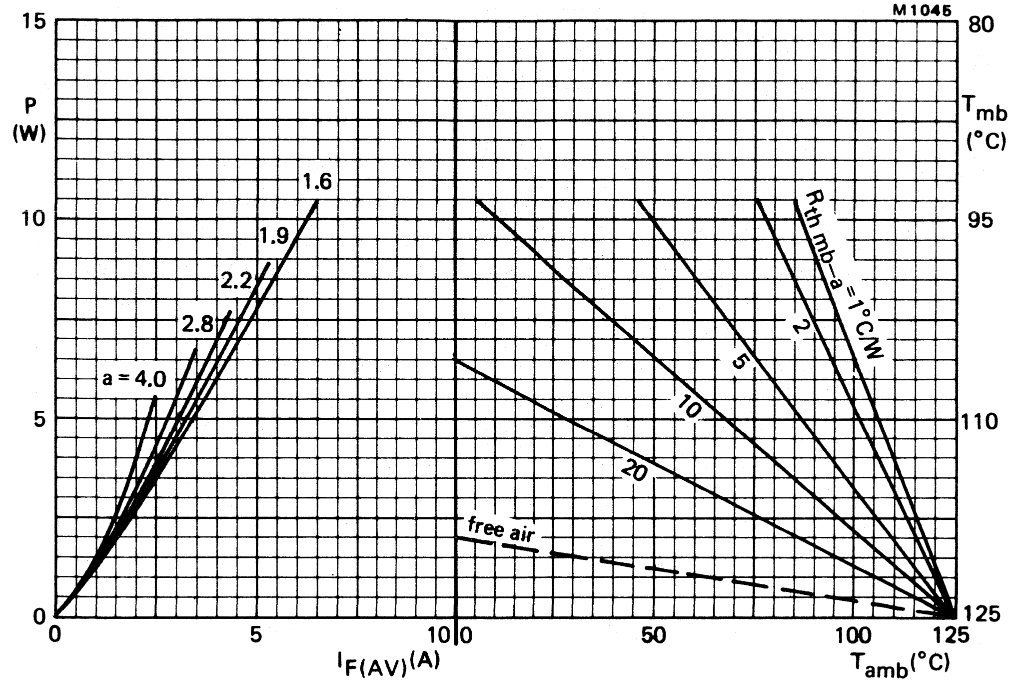


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
P = power including reverse current losses but excluding switching losses.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

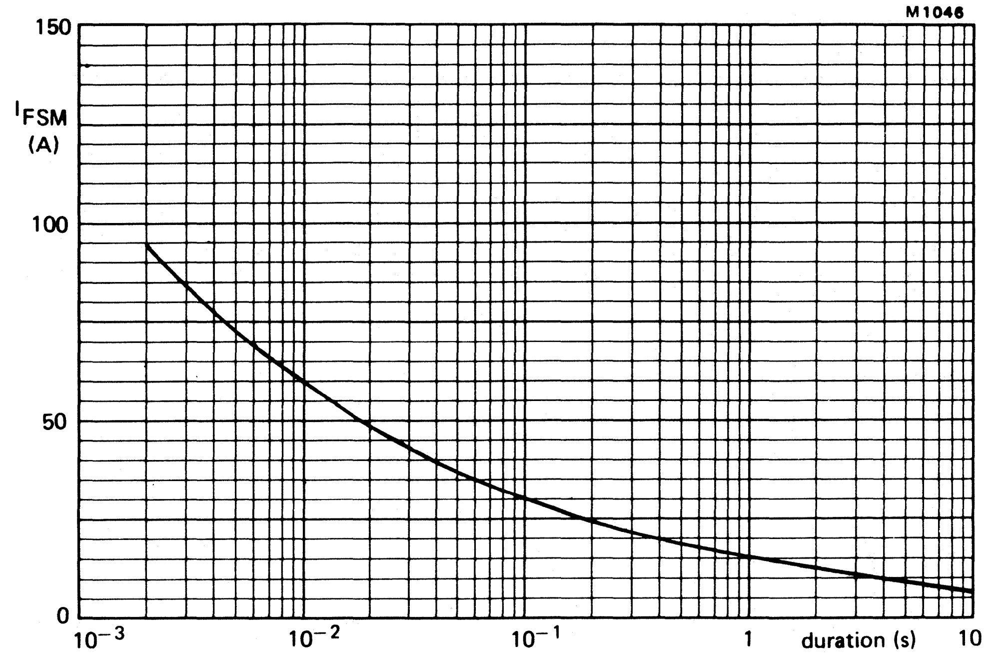
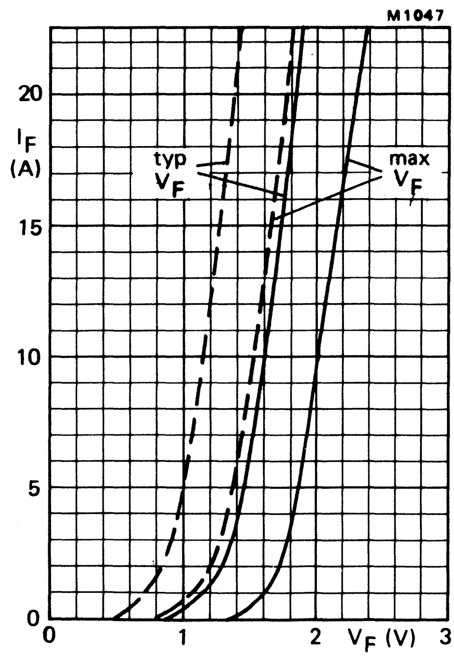


Fig.6 Maximum permissible non-repetitive peak forward current based on sinusoidal currents (f = 50 Hz); T_j = 125 °C prior to surge; with reapplied V_{RWMmax}.



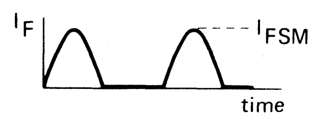


Fig.7 ——— T_j = 25 °C; – – – – T_j = 100 °C.

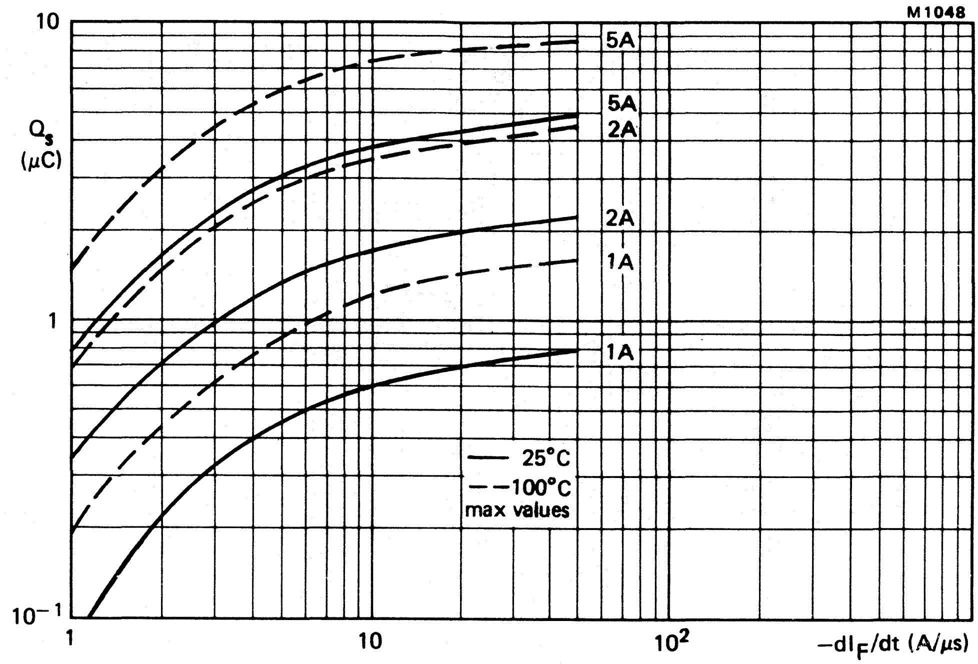

M1048
10
Q_s
(μC)
1
10^{-1}
1
10
10^2
$-dI_F/dt$ (A/μs)
5A
5A
2A
2A
1A
1A
25°C
100°C
max values

Fig.8

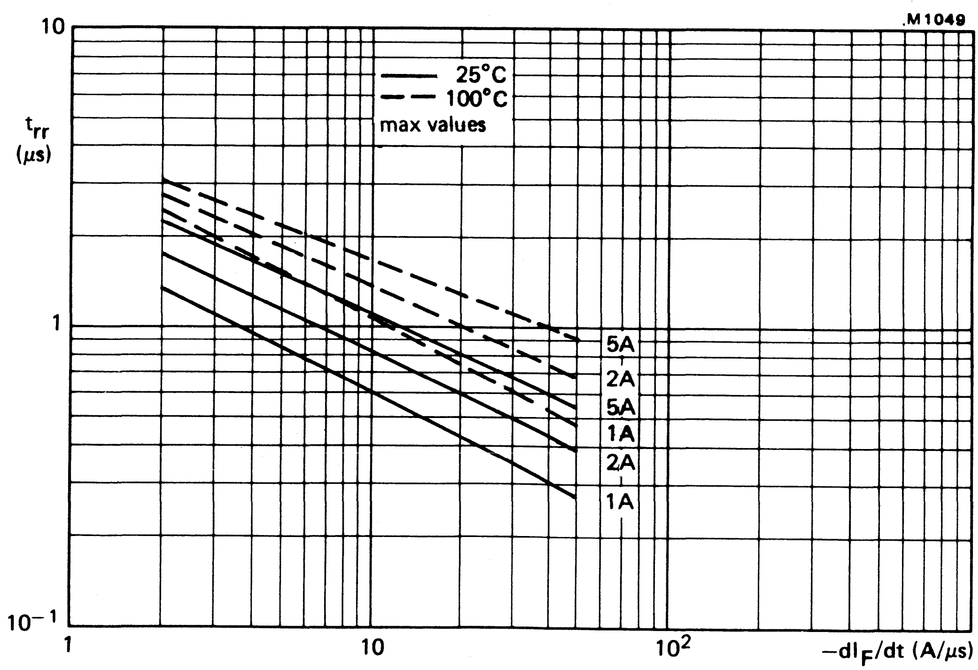

M1049
10
t_{rr}
(μs)
1
10^{-1}
1
10
10^2
$-dI_F/dt$ (A/μs)
25°C
100°C
max values
5A
2A
5A
1A
2A
1A

Fig.9

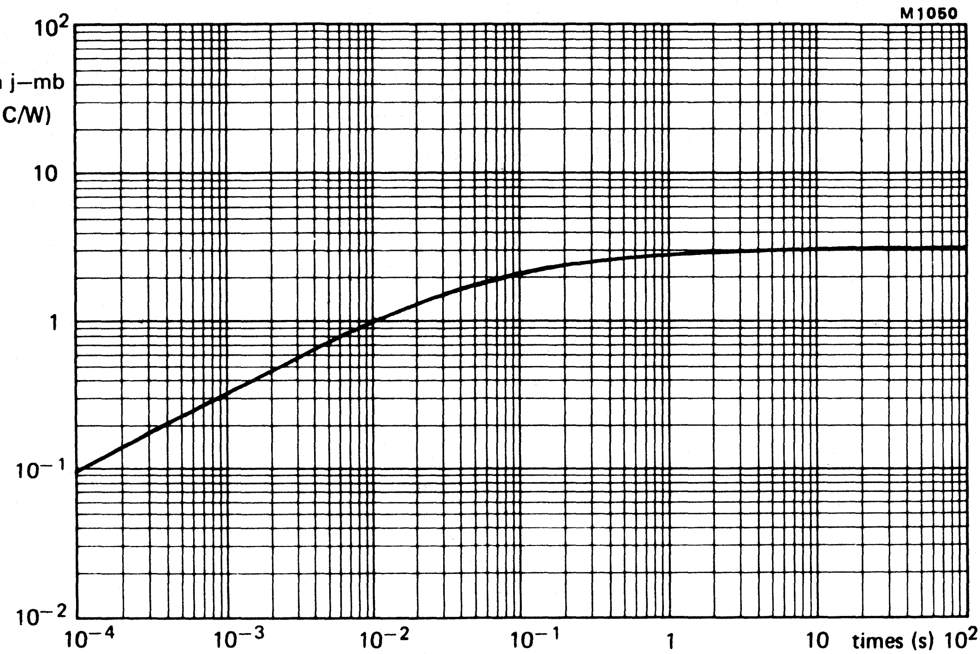


Fig.10

FAST HIGH-VOLTAGE, ELECTRICALLY-ISOLATED RECTIFIER DIODES

Glass-passivated double-diffused rectifier diodes in full-pack plastic envelopes, featuring fast recovery times. 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 as efficiency diodes in television receivers.

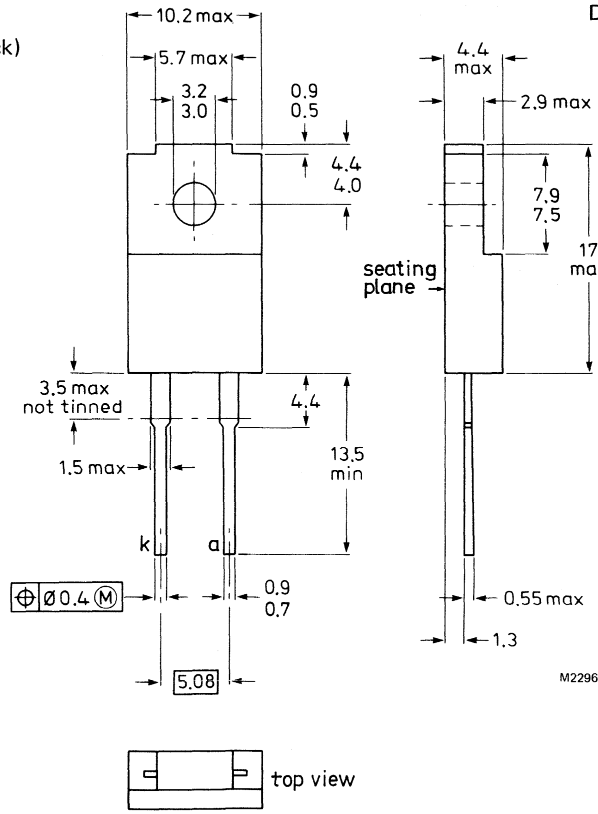
QUICK REFERENCE DATA

Repetitive peak reverse voltage	V_{RRM}	max.	1500	V
Average forward current	$I_{F(AV)}$	max.	6.5	A
Non-repetitive peak forward current	I_{FSM}	max.	60	A
Reverse recovery time	t_{rr}	<	0.6	μs

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)				
Non-repetitive peak reverse voltage	V_{RSM}	max.	1500	V
Repetitive peak reverse voltage	V_{RRM}	max.	1500	V
Crest working reverse voltage	V_{RWM}	max.	1300	V
Currents				
Average forward current assuming zero switching losses (note 2) sinusoidal; up to T_h = 92 °C	$I_{F(AV)}$	max.	6.5	A
RMS forward current	$I_{F(RMS)}$	max.	10	A
Repetitive peak forward current	I_{FRM}	max.	60	A
Non-repetitive peak forward current t = 10 ms; half sinewave; T_j = 125 °C prior to surge, with reapplied $V_{RWM\,max}$	I_{FSM}	max.	60	A
Temperatures				
Storage temperature	T_{stg}		−40 to +150	°C
Junction temperature	T_j	max.	150	°C

ISOLATION

Peak isolation voltage from all terminals to external heatsink (note 1)	V_{isol}	max.	1500	V
Isolation capacitance from cathode to external heatsink (note 3)	C_{isol}	typ.	12	pF

Notes

1. Repetitive peak operation with $t_p < 15\ \mu s$, $\delta < 0.2$, at sea level with relative humidity ⩽ 65% under clean and dust-free conditions.
2. The quoted temperatures assume heatsink compound is used.
3. Mounted without heatsink compound and with 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

Forward voltage				
$I_F = 20$ A; $T_j = 25\ ^oC$	V_F	<	2.3	V*
Reverse current				
$V_R = V_{RWMmax}$; $T_j = 100\ ^oC$	I_R	<	0.6	mA
Reverse recovery when switched from $I_F = 2$ A to $V_R \geqslant 30$ V with $-dI_F/dt = 20$ A/μs; $T_j = 25\ ^oC$				
recovered charge	Q_s	<	2.0	μC
recovery time	t_{rr}	<	0.6	μs
Forward recovery when switched to $I_F = 5$ A with $t_r = 0.1\ \mu$s; $T_j = 25\ ^oC$				
recovery time	t_{fr}	<	1.0	μs

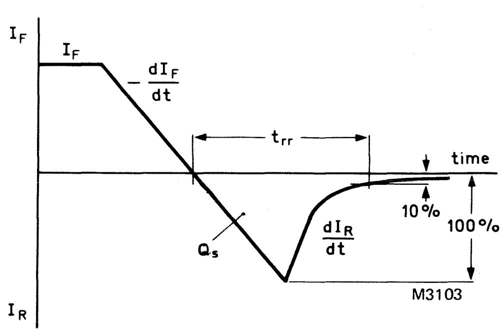


Fig.2 Definition of t_{rr} and Q_s.

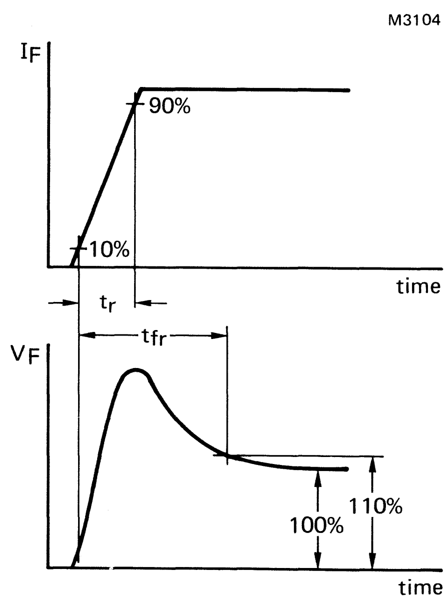


Fig.3 Definition of t_{fr}.

*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 ^{o}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.4.

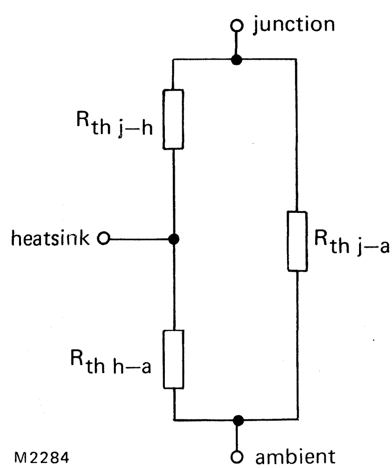


Fig.4.

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

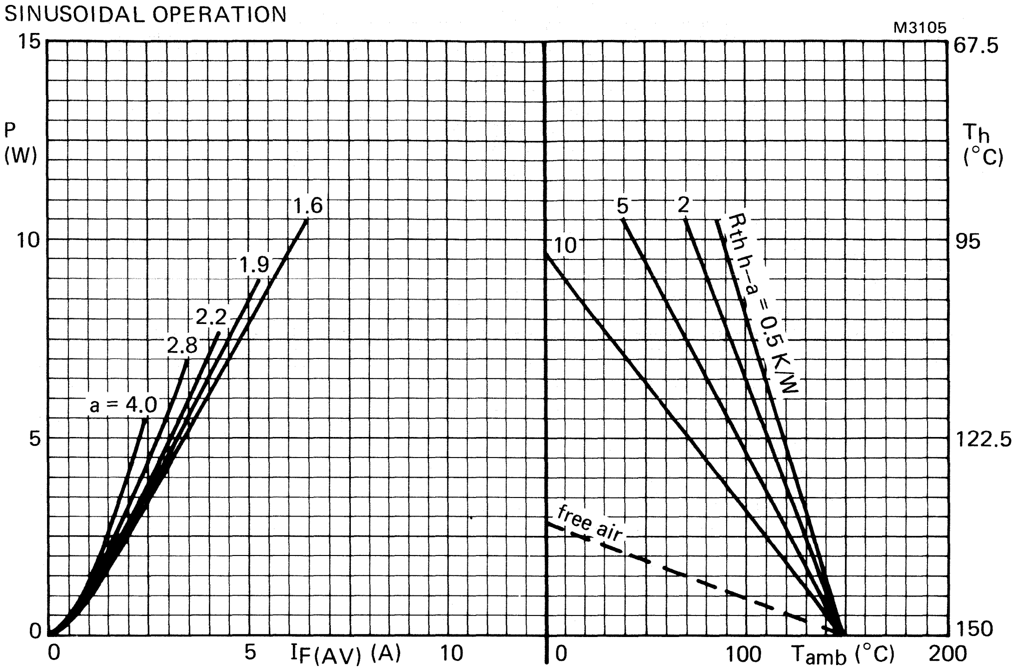


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
P = power including reverse current losses but excluding switching losses.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

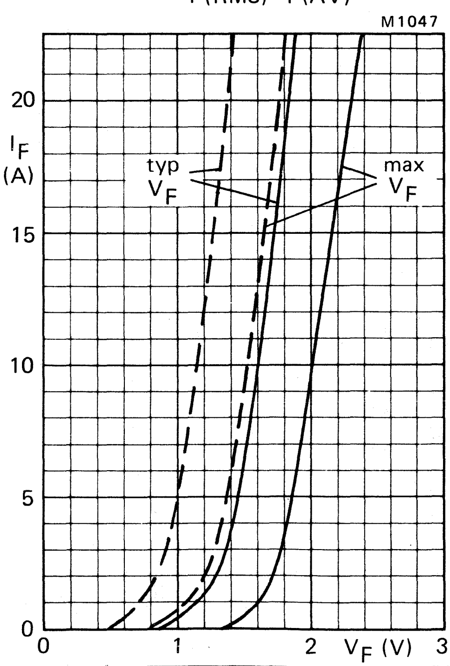


Fig.6 ——— T_j = 25 °C; – – – – T_j = 100 °C.

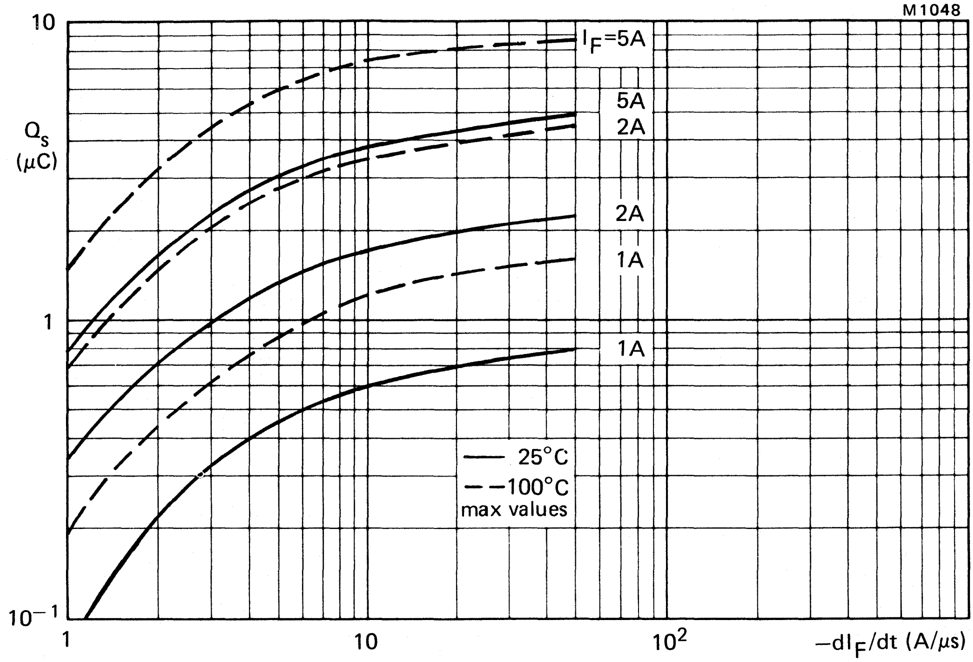

M1048
10
Q_s
(μC)
1
10^{-1}
1
10
10^2
$-dI_F/dt$ (A/μs)
I_F=5A
5A
2A
2A
1A
1A
25°C
100°C
max values

Fig.7.

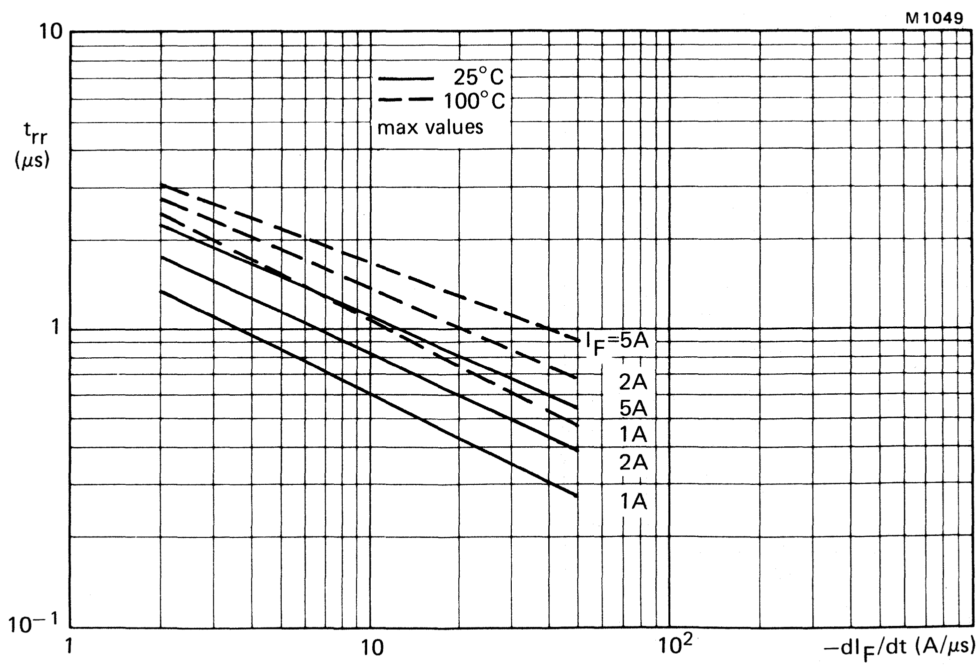

M1049
10
t_{rr}
(μs)
1
10^{-1}
1
10
10^2
$-dI_F/dt$ (A/μs)
25°C
100°C
max values
I_F=5A
2A
5A
1A
2A
1A

Fig.8.

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.

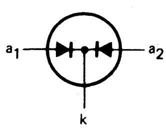
QUICK REFERENCE DATA

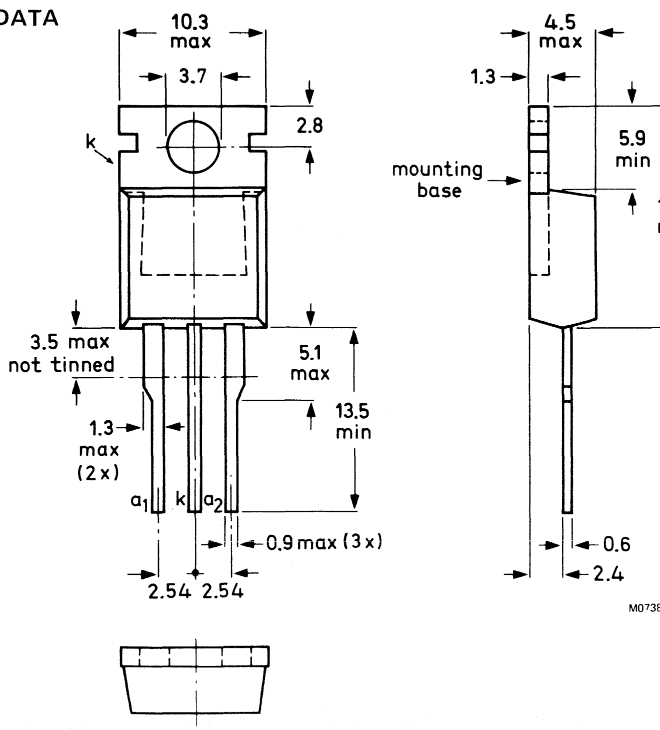
Per diode, unless otherwise stated			BYP20–50	100	150	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	V
Output current (both diodes conducting)	I_O	max.		10		A
Forward voltage	V_F	<		0.9		V
Reverse recovery time	t_{rr}	<		30		ns
Reverse leakage current	I_R	<		5		μA

MECHANICAL DATA

Dimensions in mm

Fig.1 TO-220AB





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 Absolute Maximum System (IEC 134).

Voltages

			BYP20–50	100	150	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	V
Crest working reverse voltage	V_{RWM}	max.	50	100	150	V
Continuous reverse voltage	V_R	max.	50	100	150	V

Currents (both diodes conducting; note 1)

Output current; switching losses negligible up to 500 kHz; square wave; $\delta = 0.5$; up to $T_{mb} = 143\ ^oC$	I_O	max.	10	A
sinusoidal; up to $T_{mb} = 150\ ^oC$	I_O	max.	10	A
RMS forward current	$I_{F(RMS)}$	max.	14	A
Repetitive peak forward current $t_p = 20\ \mu s$; $\delta = 0.02$ (note 2)	I_{FRM}	max.	80	A
Non-repetitive peak forward current half sinewave; $T_j = 175\ ^oC$ prior to surge; with reapplied V_{RWMmax} (note 2) t = 10 ms	I_{FSM}	max.	60	A
t = 8.3 ms	I_{FSM}	max.	75	A
I^2t for fusing (t = 10 ms, note 2)	I^2t	max.	18	A^2s

Temperatures

Storage temperature	T_{stg}		–65 to +175	^oC
Junction temperature	T_j	max.	175	^oC

Notes

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

CHARACTERISTICS

Forward voltage				
I_F = 3 A; T_j = 150 °C	V_F	<	0.9	V*
I_F = 3 A; T_j = 25 °C	V_F	<	1.0	V*
I_F = 10 A; T_j = 25 °C	V_F	<	1.25	V*
Reverse current				
$V_R = V_{RWMmax}$; T_j = 150 °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 $V_R \geq$ 30 V with $-dI_F/dt$ = 100 A/μs; T_j = 25 °C; recovery time	t_{rr}	<	30	ns
Reverse recovery when switched from I_F = 1 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 50 A/μs; T_j = 25 °C; recovery time	t_{rr}	<	35	ns
I_F = 2 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 20 A/μs; T_j = 25 °C; recovered charge	Q_s	<	6	nC
I_F = 10 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 50 A/μs; T_j = 100 °C; peak recovery current	I_{RRM}	<	1.2	A
Forward recovery when switched to I_F = 1 A with dI_F/dt = 10 A/μs; T_j = 25 °C	V_{fr}	typ.	2	V

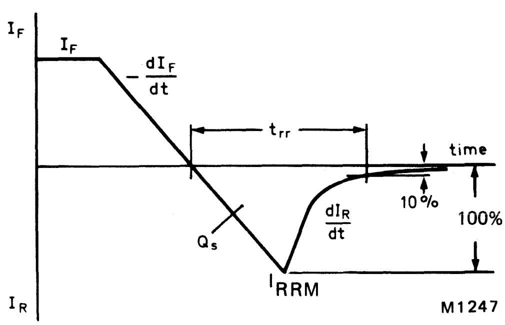


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

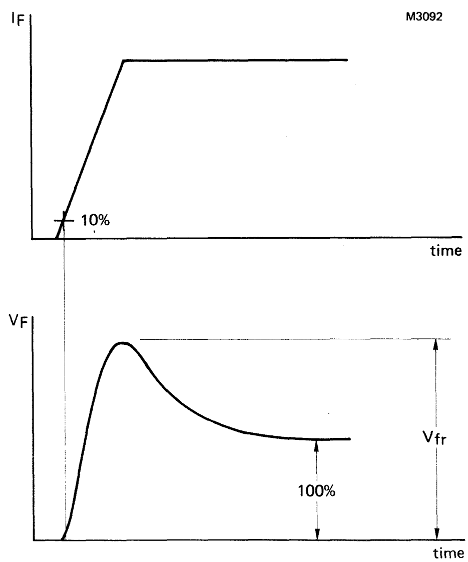


Fig.3 Definition of V_{fr}.

*Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

From junction to mounting base (both diodes conducting)	$R_{th\ j\text{-}mb}$	=	2.8	K/W
From junction to mounting base (per diode)	$R_{th\ j\text{-}mb}$	=	4.0	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 insulator (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 device lead length and with copper laminate on the board	$R_{th\ j\text{-}a}$	=	60	K/W

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 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 calculations

The various components of junction temperature rise above ambient are illustrated in Fig.4.

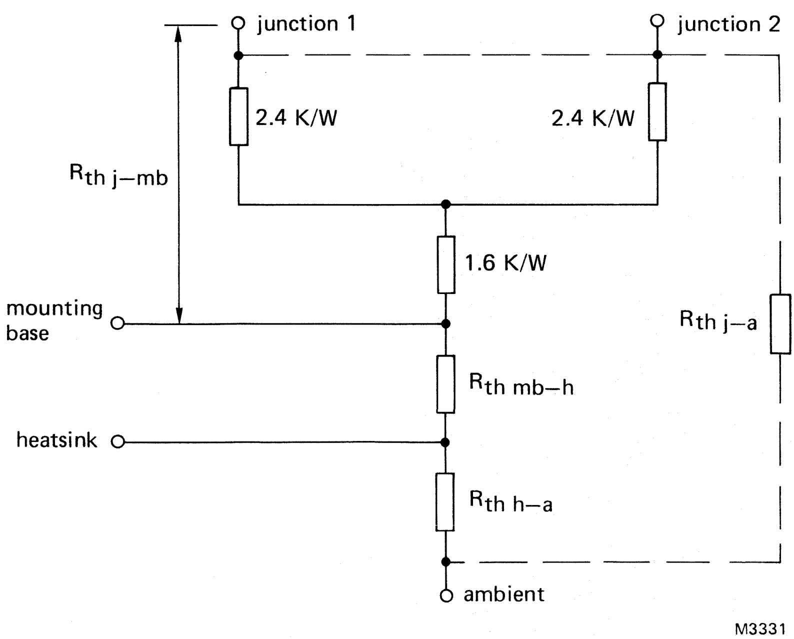


Fig.4.

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

SQUARE-WAVE OPERATION (PER DIODE)

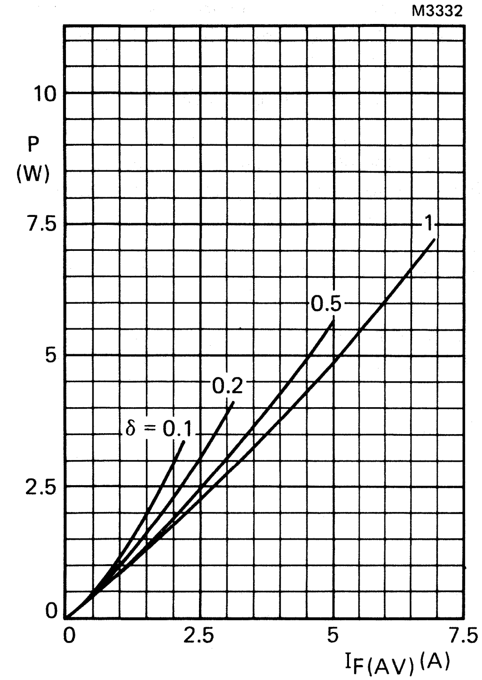
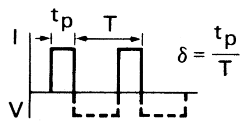


Fig.5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.



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

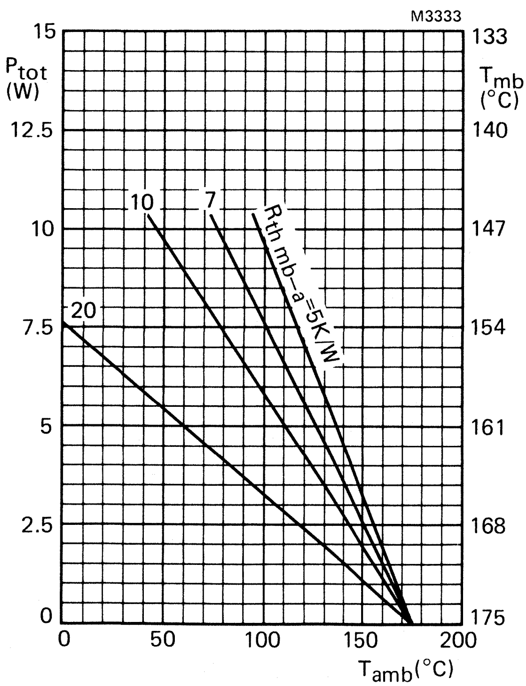


Fig.6.

SINUSOIDAL OPERATION (PER DIODE)

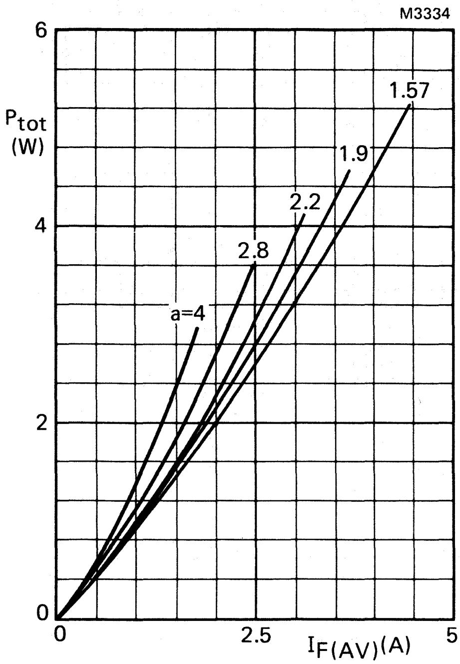


Fig.7 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.

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

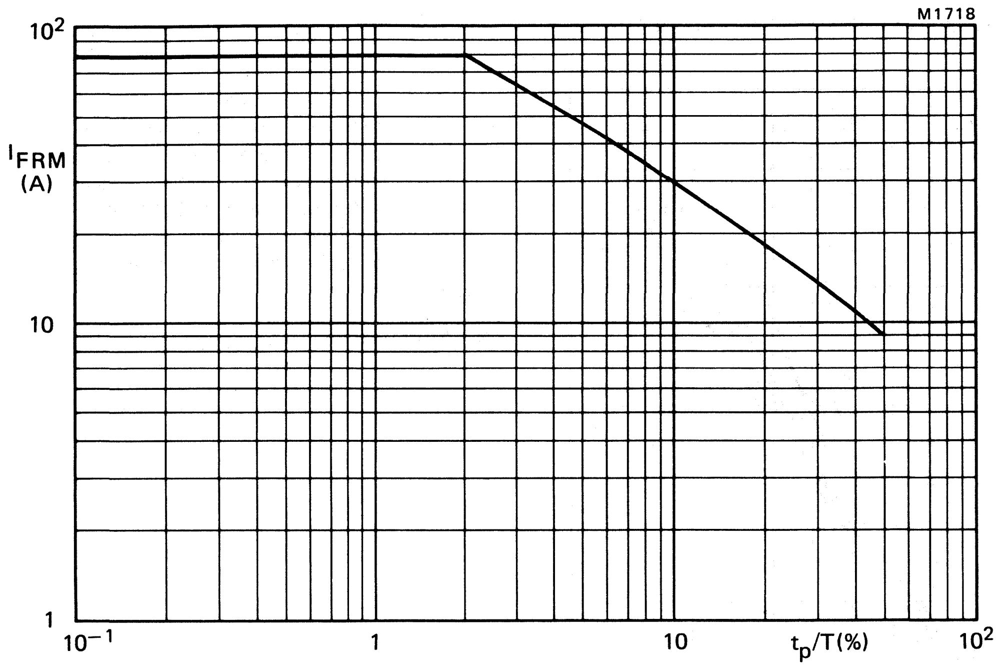
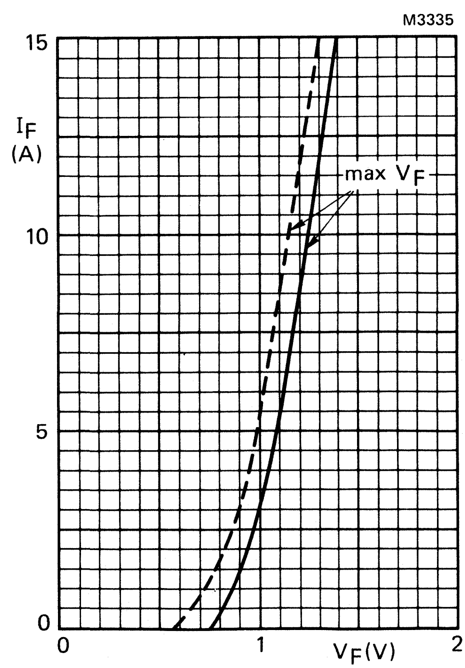
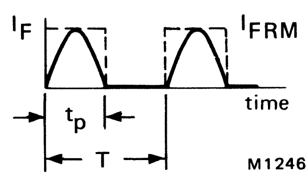


Fig.8 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 $\mu s < t_p <$ 1 ms; per diode.





Definition of I_{FRM} and t_p/T

Fig.9 —— T_j = 25 °C; – – – T_j = 150 °C; per diode.

ULTRA FAST-RECOVERY 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, 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. The series consists of normal polarity (cathode to mounting base) types.

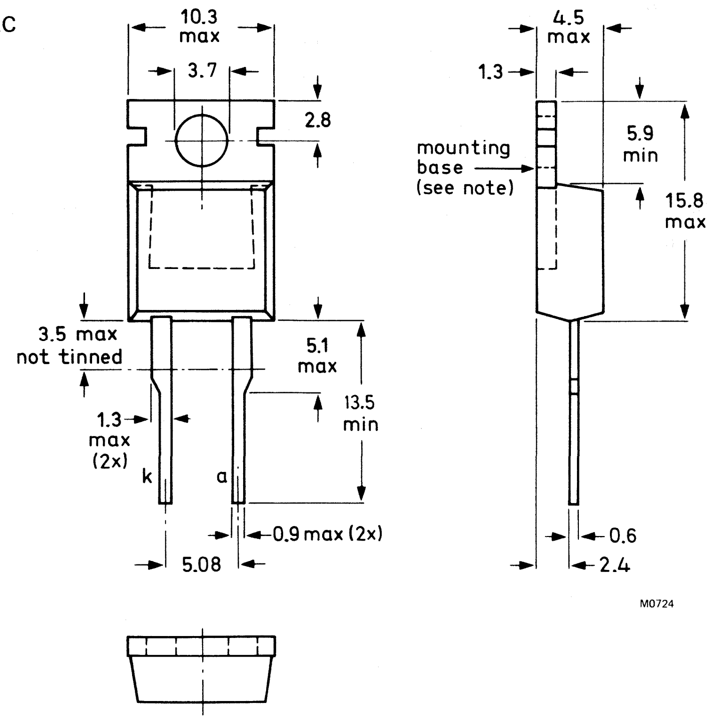
QUICK REFERENCE DATA

			BYP21-50	100	150	200	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	200	V
Average forward current	$I_{F(AV)}$	max.		8			A
Forward voltage	V_F	<		0.895			V
Reverse recovery time	t_{rr}	<		25			ns
Reverse leakage current	I_R	<		5			μA

MECHANICAL DATA

Dimensions in mm

Fig.1 TO-220AC



Net mass: 2 g

Note: The exposed metal mounting base is directly connected to the cathode.

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			BYP21-50	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				
Average forward current; switching losses negligible up to 500 kHz square wave; δ = 0.5; up to T_{mb} = 150 ^oC	$I_{F(AV)}$	max.	8	A
sinusoidal; up to T_{mb} = 150 ^oC	$I_{F(AV)}$	max.	9.4	A
R.M.S. forward current	$I_{F(RMS)}$	max.	11.5	A
Repetitive peak forward current t_p = 20 μs; δ = 0.02	I_{FRM}	max.	175	A
Non-repetitive peak forward current half sine-wave; T_j = 175 ^oC prior to surge; with reapplied V_{RWMmax}				
t = 10 ms	I_{FSM}	max.	80	A
t = 8.3 ms	I_{FSM}	max.	100	A
I^2t for fusing (t = 10 ms)	I^2t	max.	32	A^2s
Temperatures				
Storage temperature	T_{stg}		−65 to +175	^oC
Junction temperature	T_j	max.	175	^oC

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	2.7	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

a = any lead length	$R_{th\ j\text{-}a}$	60	K/W

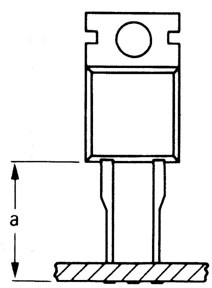


Fig.2

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	<	1.045	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 $V_R \geq$ 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 $V_R \geq$ 30 Vwith $-dI_F/dt$ = 20 A/μs; T_j = 25 °C; recovered charge	Q_s	<	15	nC
I_F = 10 A to $V_R \geq$ 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

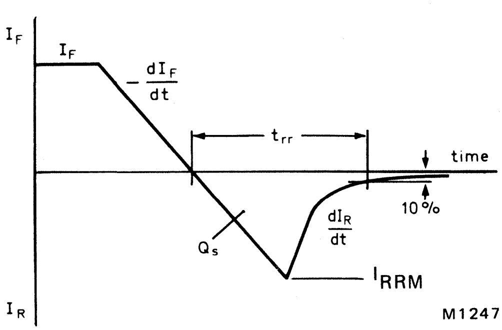


Fig.3 Definition of t_{rr}, Q_s and I_{RRM}.

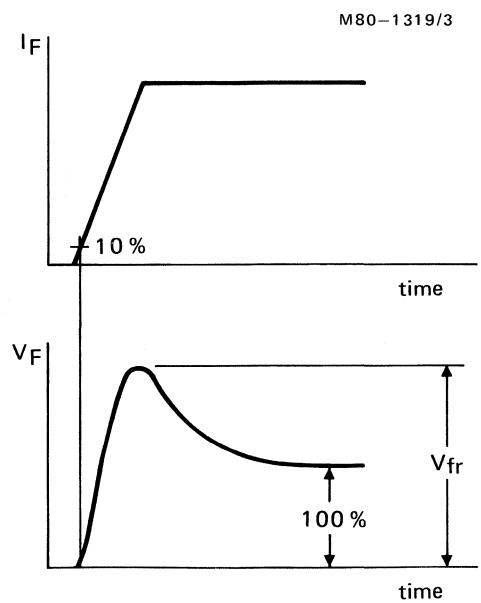


Fig.4 Definition of V_{fr}.

*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:

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

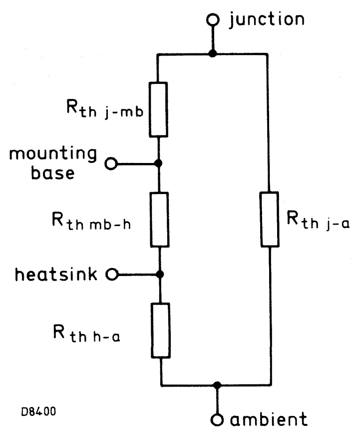


Fig.5

b. The method of using Figs.6 and 7 is as follows:
   Starting with the required current on the $I_{F(AV)}$ axis, trace upwards to meet the appropriate duty factor or form factor curve. Trace right horizontally and upwards from the appropriate value on the T_{amb} scale. The intersection determines the $R_{th\ mb\text{-}a}$. The heatsink thermal resistance value ($R_{th\ h\text{-}a}$) can now be calculated from:
   $R_{th\ h\text{-}a} = R_{th\ mb\text{-}a} - R_{th\ mb\text{-}h}$.

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

SQUARE-WAVE OPERATION

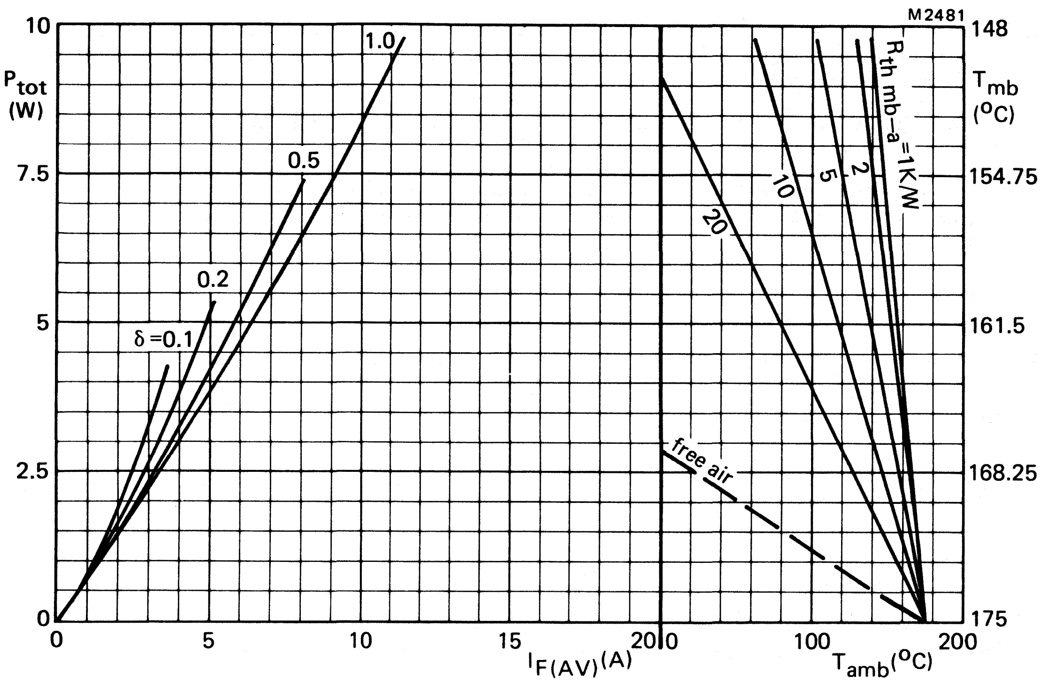
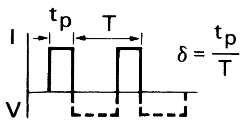


Fig.6 The right-hand part shows the relationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 500 kHz.



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

SINUSOIDAL OPERATION

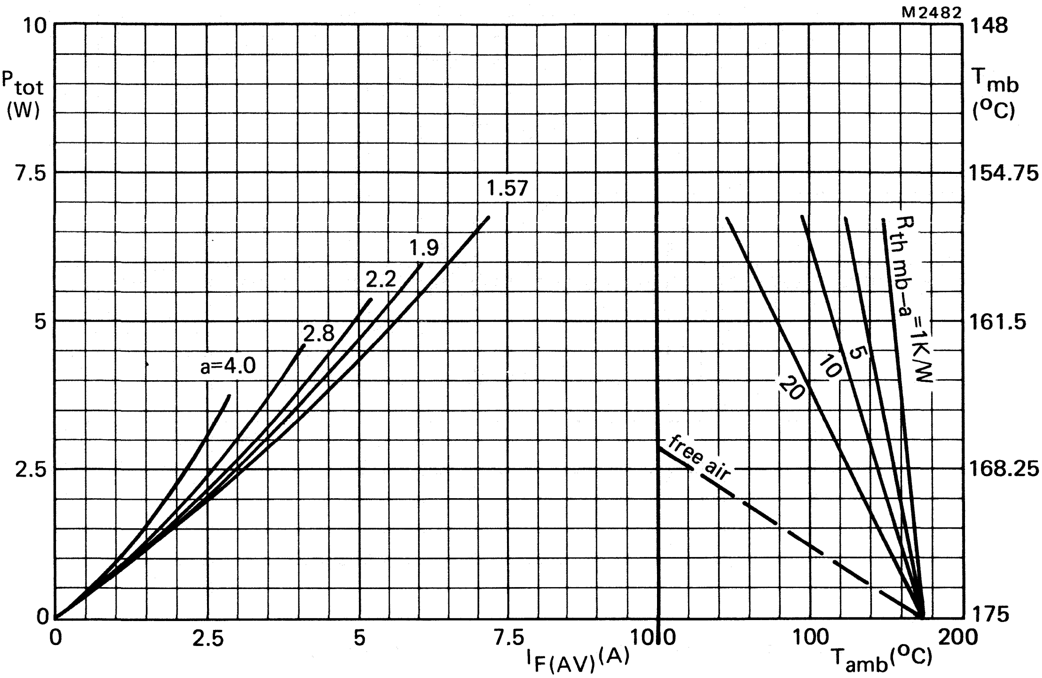


Fig.7 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

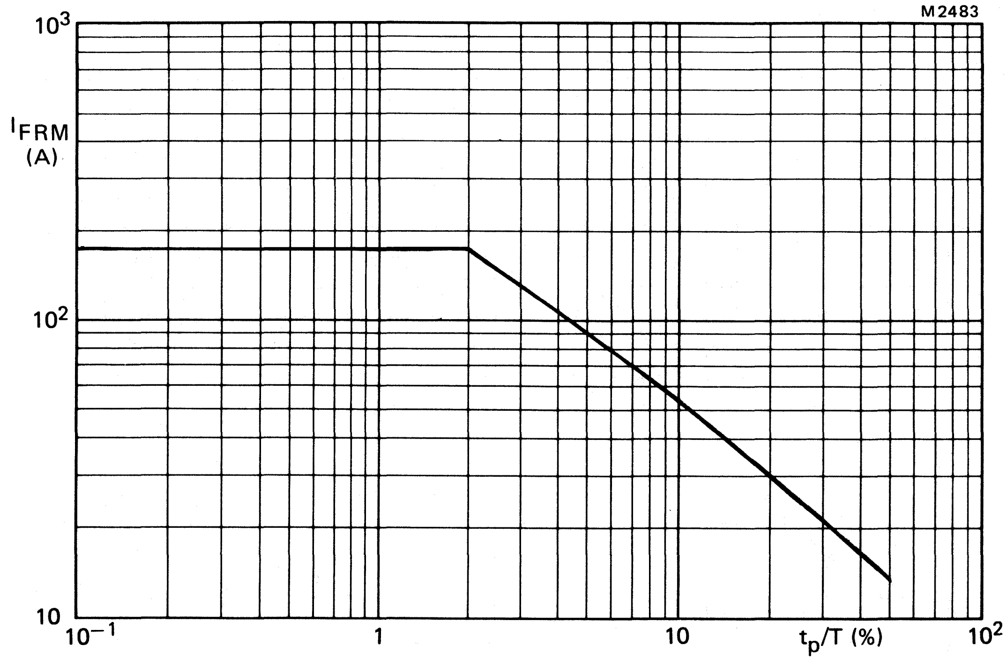
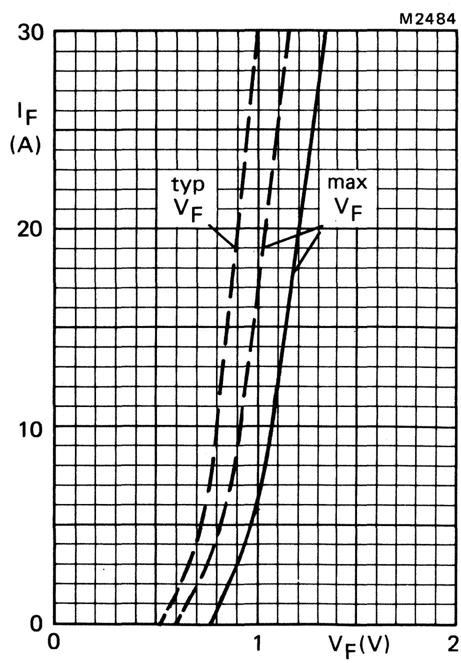
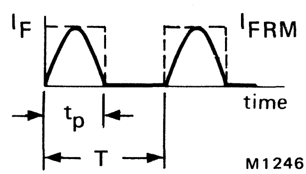


Fig.8 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 $\mu s < t_p < 1$ ms.





Definition of I_{FRM} and t_p/T.

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

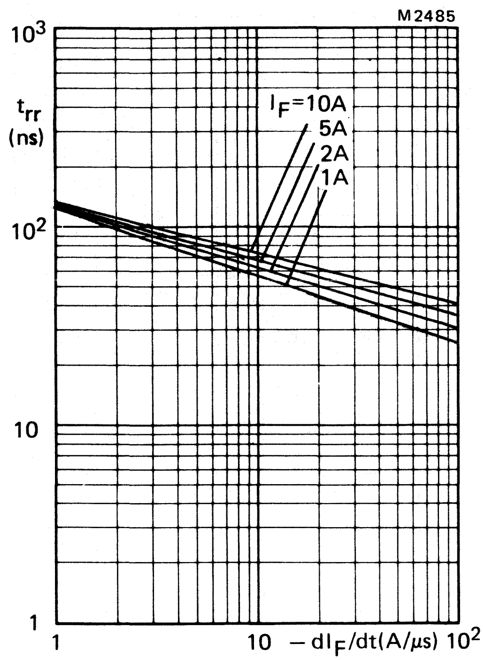


Fig.10 Maximum t_{rr} at T_j = 25 °C.

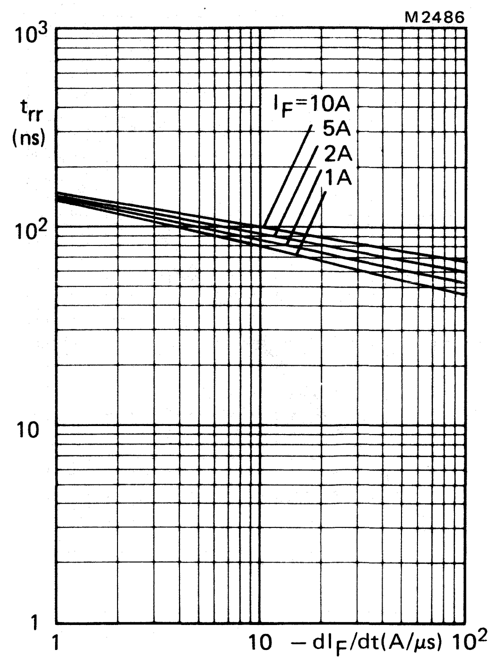


Fig.11 Maximum t_{rr} at T_j = 100 °C.

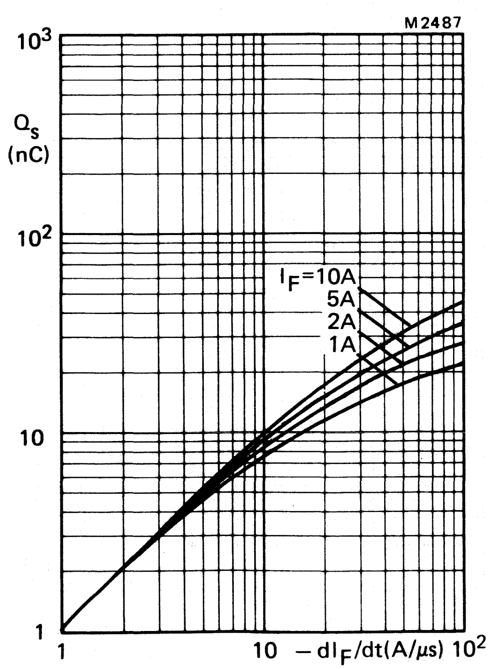


Fig.12 Maximum Q_s at T_j = 25 °C.

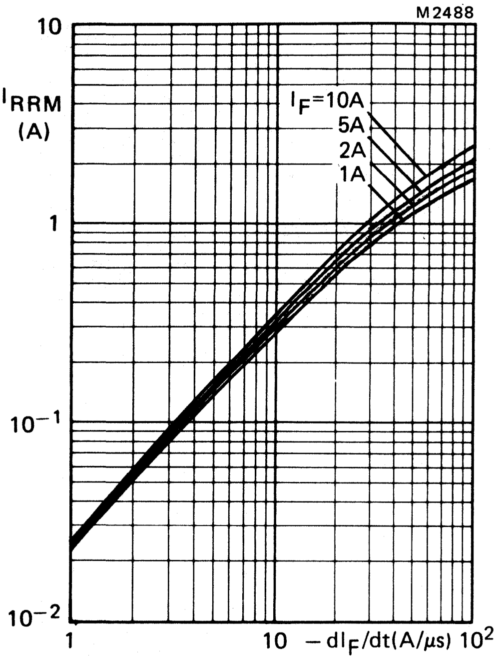


Fig.13 Maximum I_{RRM} at T_j = 25 °C.

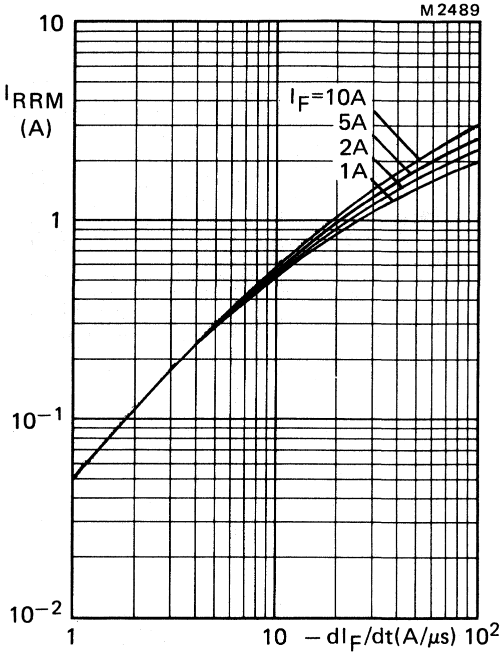


Fig.14 Maximum I_{RRM} at T_j = 100 °C.

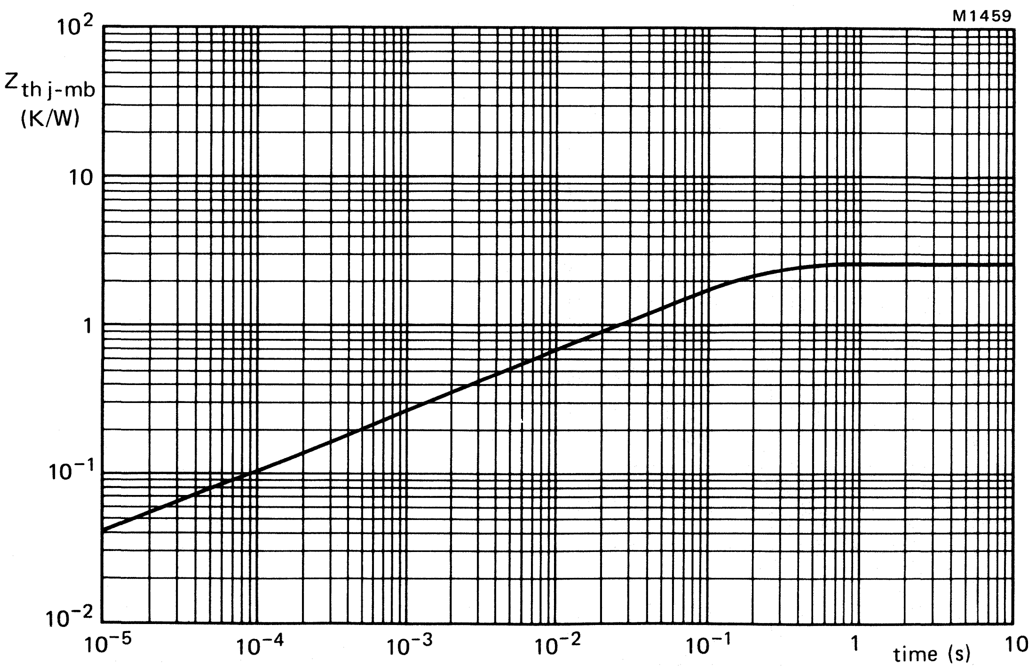


Fig.15 Transient thermal impedance.

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.

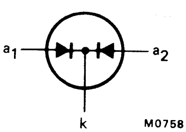
QUICK REFERENCE DATA

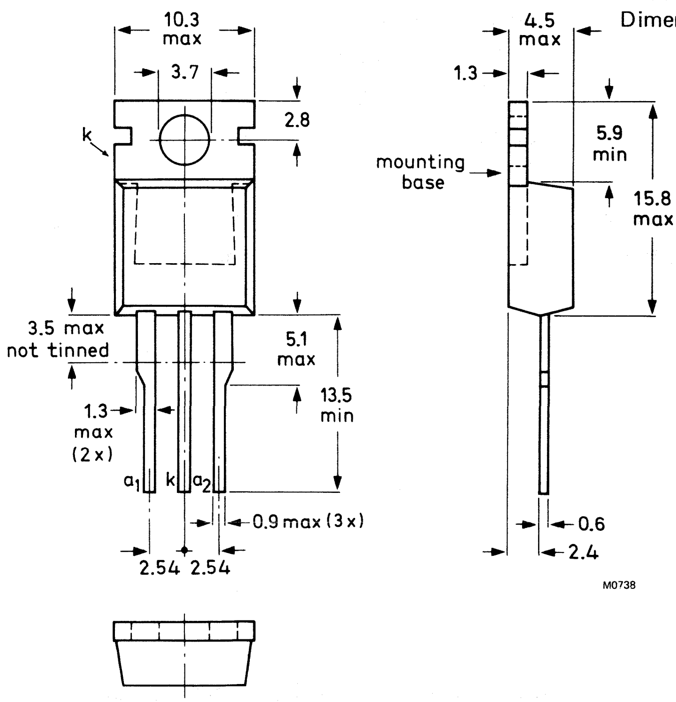
Per diode, unless otherwise stated			BYP22-50	100	150	200	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	200	V
Output current (both diodes conducting)	I_O	max.		20			A
Forward voltage	V_F	<		0.895			V
Reverse recovery time	t_{rr}	<		25			ns
Reverse leakage current	I_R	<		5			μA

MECHANICAL DATA

Dimensions in mm

Fig.1 TO-220AB





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 $T_{mb} = 150\ ^oC$	I_O	max.	16	A
square wave; $\delta = 0.5$; up to $T_{mb} = 143\ ^oC$	I_O	max.	20	A
sinusoidal; up to $T_{mb} = 150\ ^oC$	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; $T_j = 175\ ^oC$ 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	^oC
Junction temperature	T_j	max.	175	^oC

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 $V_R \geq 30$ 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 $V_R \geq 30$ V with $-dI_F/dt$ = 20 A/μs; T_j = 25 °C; recovered charge	Q_s	<	15	nC
I_F = 10 A to $V_R \geq 30$ 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

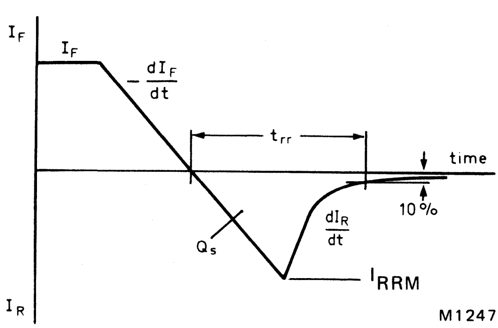


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

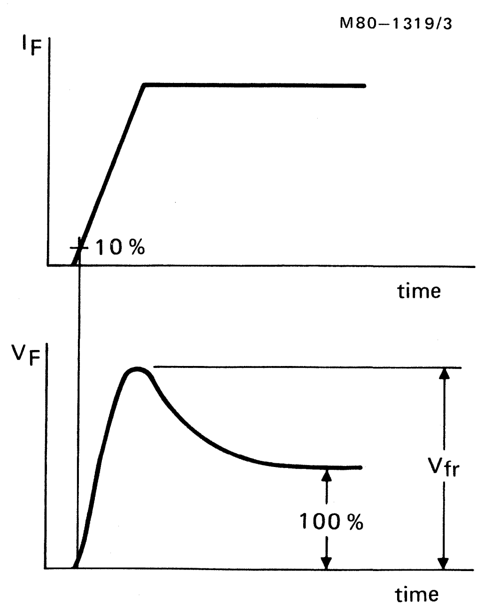


Fig.3 Definition of V_{fr}.

*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 ^{o}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:

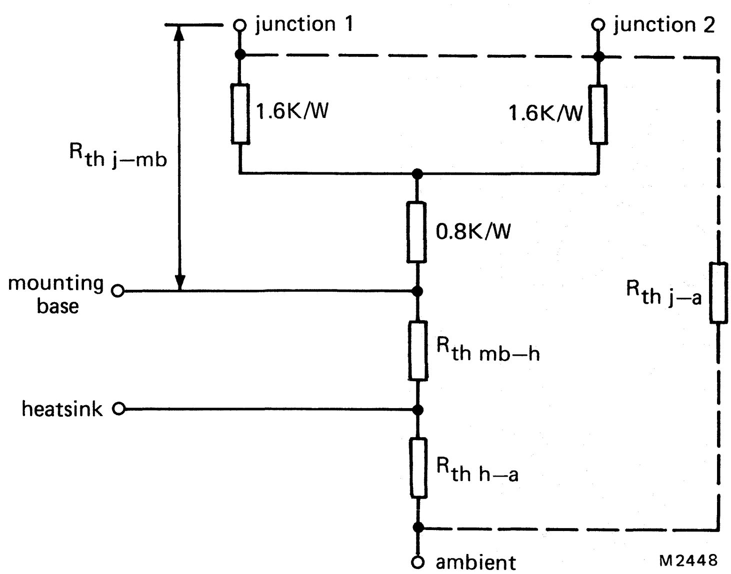


Fig.4

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

SQUARE-WAVE OPERATION (PER DIODE)

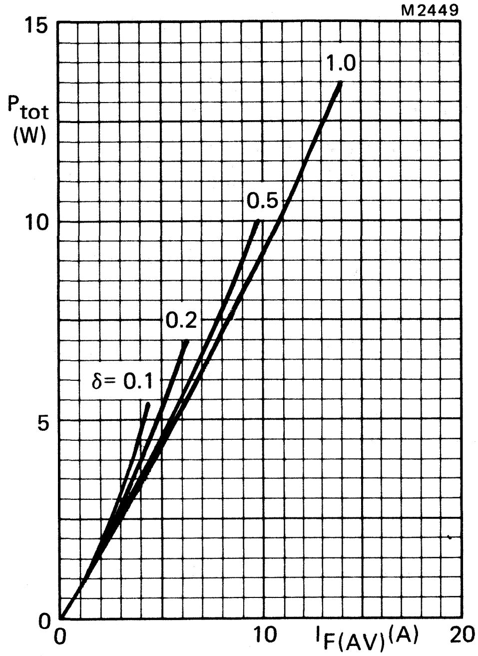
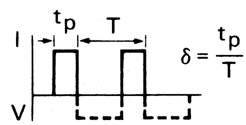


Fig.5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.



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

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

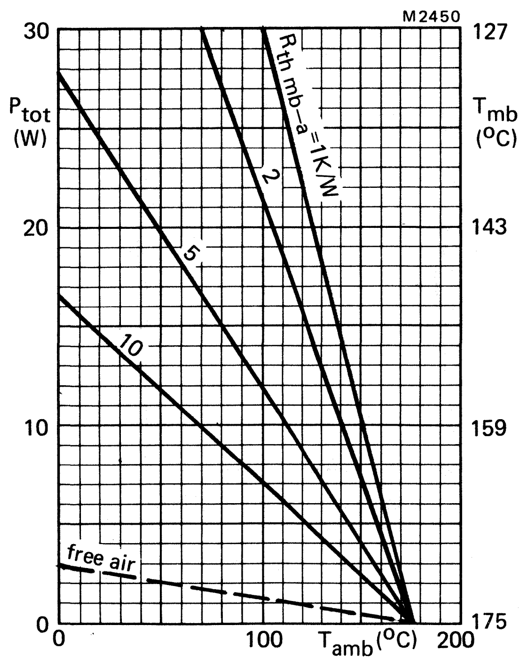


Fig.6

SINUSOIDAL OPERATION (PER DIODE)

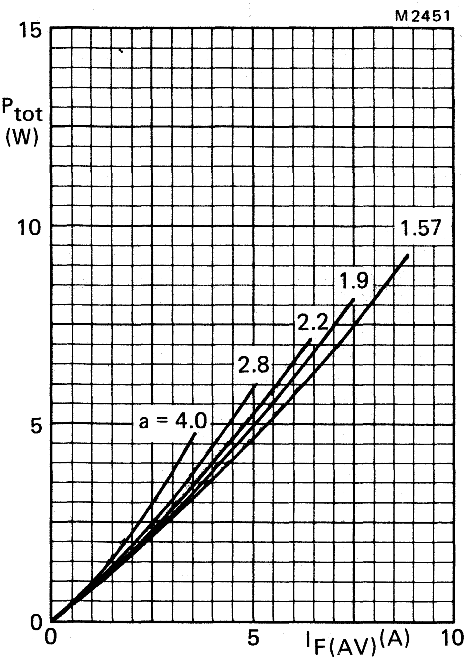


Fig.7 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temepratures.

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

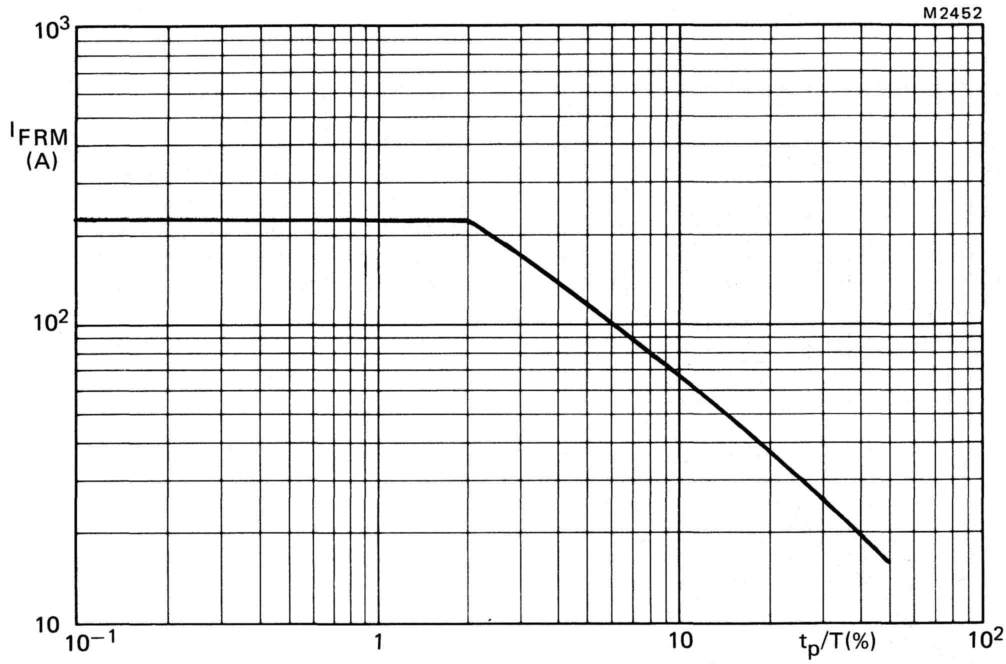
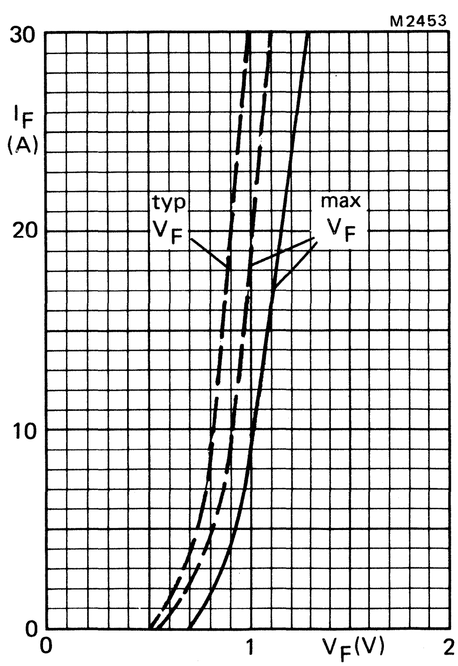
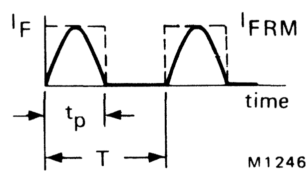


Fig.8 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 $\mu s < t_p < 1$ ms.





Definition of I_{FRM} and t_p/T.

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

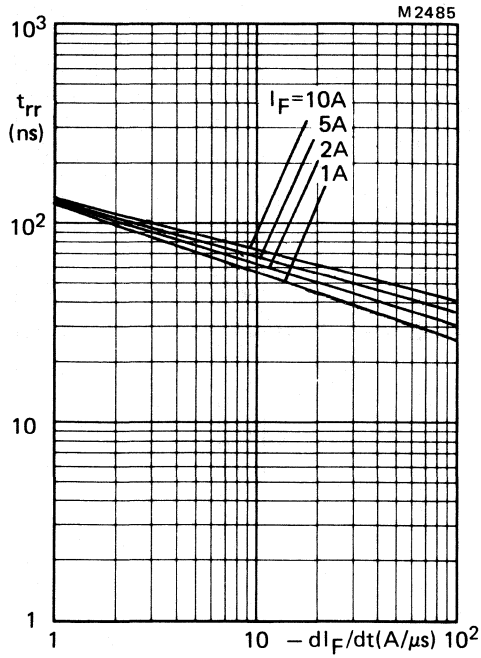


Fig.10 Maximum t_{rr} at T_j = 25 °C.

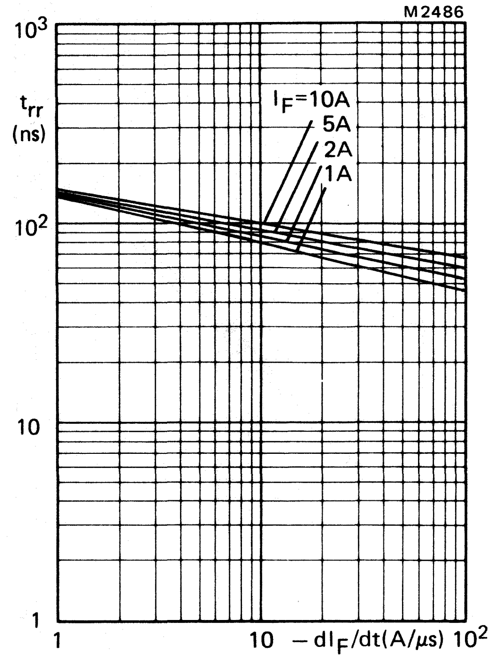


Fig.11 Maximum t_{rr} at T_j = 100 °C.

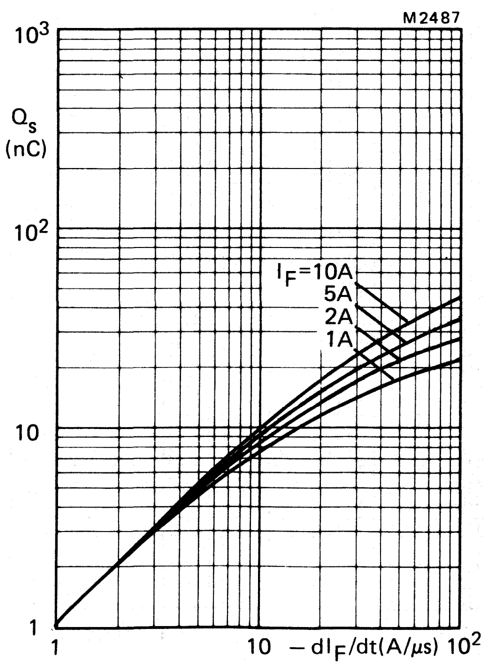


Fig.12 Maximum Q_s at T_j = 25 °C.

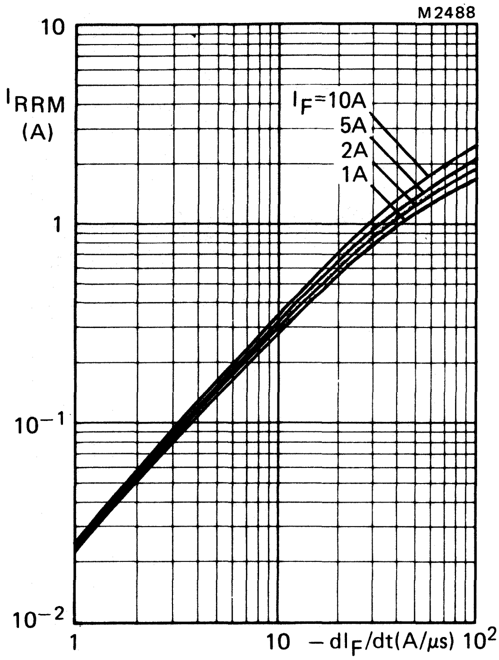


Fig.13 Maximum I_{RRM} at T_j = 25 °C.

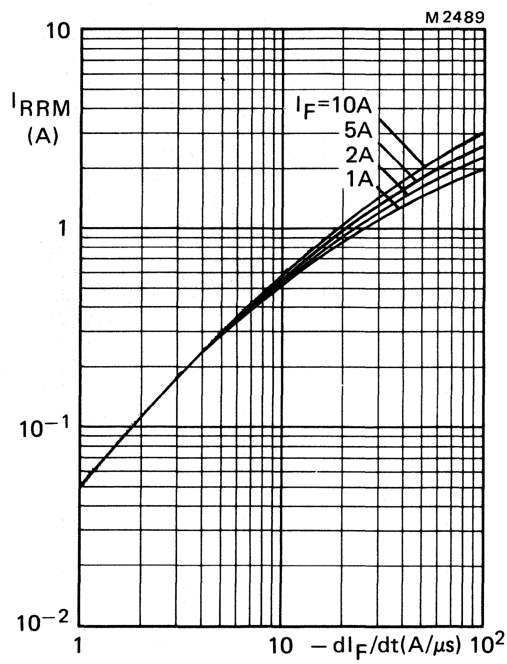


Fig.14 Maximum I_{RRM} at T_j = 100 °C.

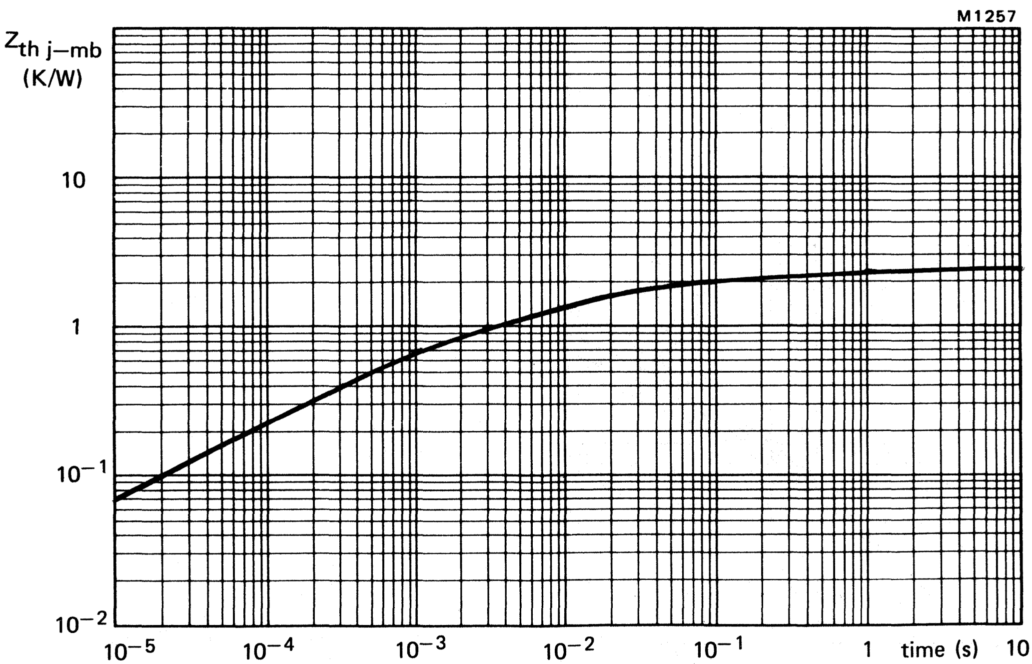


Fig.15 Transient thermal impedance; one diode conducting.

ULTRA FAST-RECOVERY DOUBLE RECTIFIER DIODES

Glass-passivated, high-efficiency double rectifier diodes in plastic envelopes, featuring low forward voltage drop, ultra fast reverse recovery times and soft recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and low switching losses are essential. Their single chip (monolithic) 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.

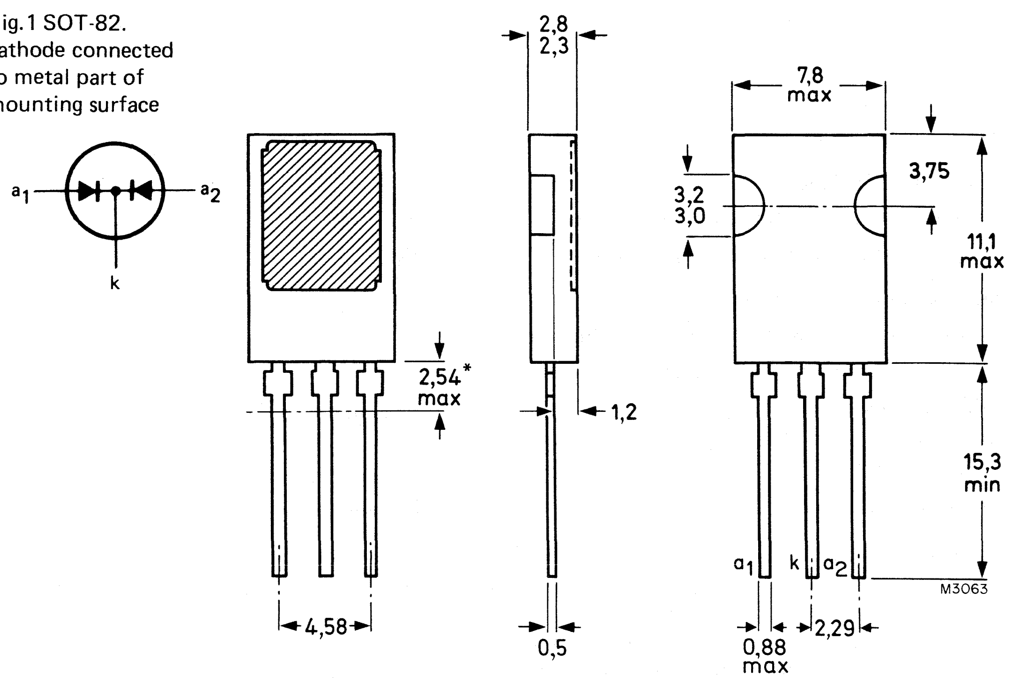
QUICK REFERENCE DATA

Per diode, unless otherwise stated			BYQ27–50	100	150	200	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	200	V
Output current (both diodes conducting)	I_O	max.		10			A
Forward voltage	V_F	<		0.85			V
Reverse recovery time	t_{rr}	<		20			ns

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-82.
cathode connected to metal part of mounting surface



*Within this region the cross-section of the leads is uncontrolled.

Net mass: 2 g
Accessories supplied on request: see data sheets Mounting instructions and accessories for SOT-82 envelopes.

RATINGS

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

Voltages (per diode)			BYQ27–50	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 $T_{mb} = 120\ ^{o}C$	I_O	max.	10	A
sinusoidal; up to $T_{mb} = 118\ ^{o}C$	I_O	max.	10	A
R.M.S. forward current	$I_{F(RMS)}$	max.	14	A
Repetitive peak forward current $t_p = 20\ \mu s$, $\delta = 0.02$ (per diode)	I_{FRM}	max.	80	A
Non-repetitive peak forward current (per diode) half sine-wave; $T_j = 150\ ^{o}C$ prior to surge; with reapplied $V_{RWM\ max}$				
t = 10 ms	I_{FSM}	max.	50	A
t = 8.3 ms	I_{FSM}	max.	60	A
I^2t for fusing (t = 10 ms, per diode)	I^2t	max.	12.5	A^2s

Temperatures

Storage temperature	T_{stg}		–40 to +150	^{o}C
Junction temperature	T_j	max.	150	^{o}C

THERMAL RESISTANCE

From junction to mounting base (both diodes conducting)	$R_{th\ j\text{-}mb}$	=	3.0	K/W
From junction to mounting base (per diode)	$R_{th\ j\text{-}mb}$	=	4.5	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 (56354)	$R_{th\ mb\text{-}h}$	=	1.4	K/W
c. without heatsink compound	$R_{th\ mb\text{-}h}$	=	1.4	K/W

2. 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 tie point.

Thermal resistance from junction to ambient in free air: mounted on a printed circuit board at any device lead length and with copper laminate on the board — $R_{th\ j\text{-}a}$ = 100 K/W

Notes:

1. The limits for both diodes apply whether both diodes conduct simultaneously or on alternate half cycles.

CHARACTERISTICS (per diode)

Forward voltage				
I_F = 5 A; T_j = 150 °C	V_F	<	0.85	V*
I_F = 10 A; T_j = 25 °C	V_F	<	1.25	V* ←
Reverse current				
$V_R = V_{RWM\,max}$; T_j = 100 °C	I_R	<	0.2	mA
$V_R = V_{RWM\,max}$; T_j = 25 °C	I_R	<	10	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}	<	20	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	<	5.5	nC
I_F = 5 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 50 A/μs; T_j = 25 °C peak recovery current	I_{RRM}	<	0.7	A
Forward recovery when switched to I_F = 1 A with dI_F/dt = 10 A/μs; T_j = 25 °C recovery voltage	V_{fr}	typ.	1.0	V

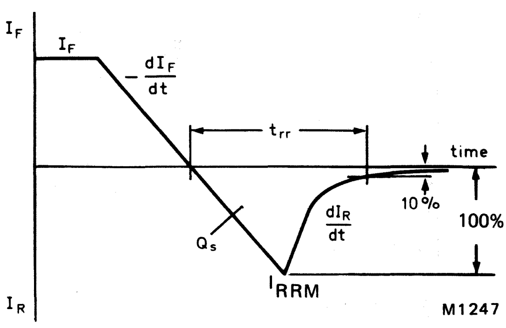


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

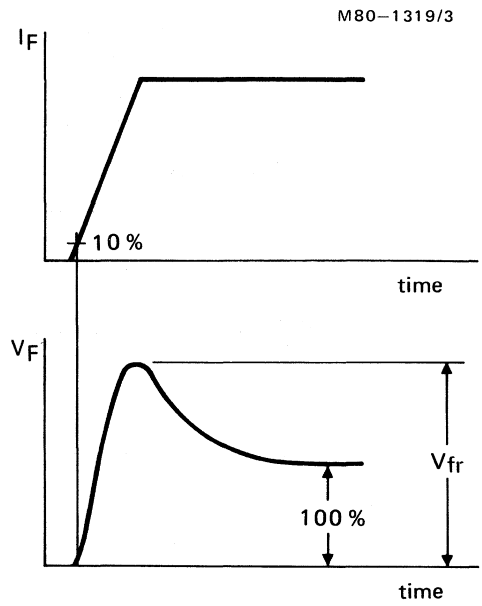


Fig.3 Definition of V_{fr}.

*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 recommended.
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. Body mounting.

   A SOT-82 envelope can be adhesive-mounted or soldered into a hybrid circuit.
   For soldering, a copper plate or an anodized aluminium plate with copper layer is recommended.
   When adhesive mounting is applied also a ceramic substrate may be used.

OPERATING NOTES

Dissipation and heatsink calculations.

The various components of junction temperature rise above ambient are illustrated in Fig.4.

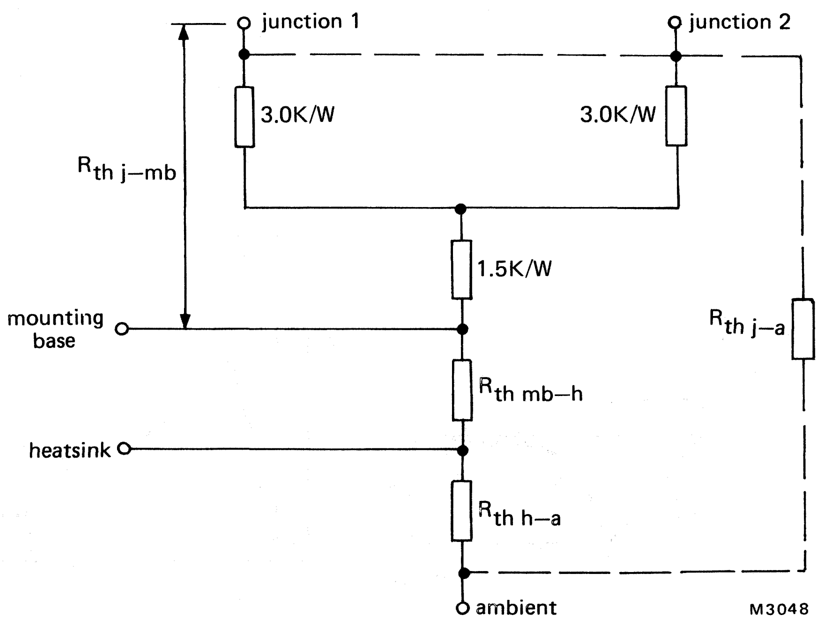


Fig.4.

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

SQUARE-WAVE OPERATION (PER DIODE)

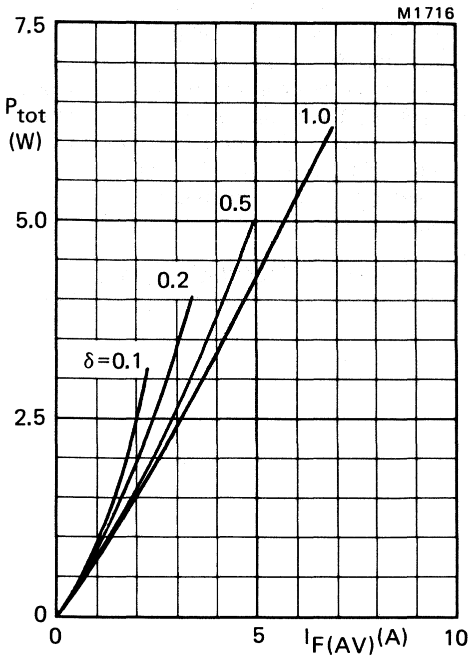
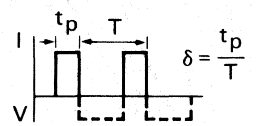


Fig.5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.



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

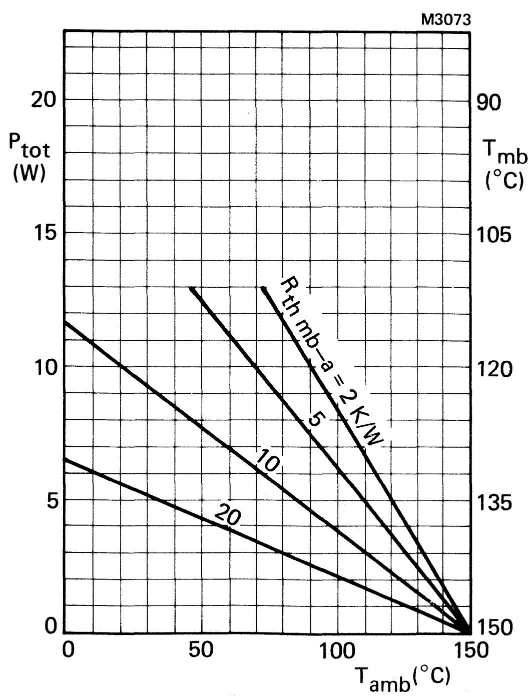


Fig.6.

SINUSOIDAL OPERATION (PER DIODE)

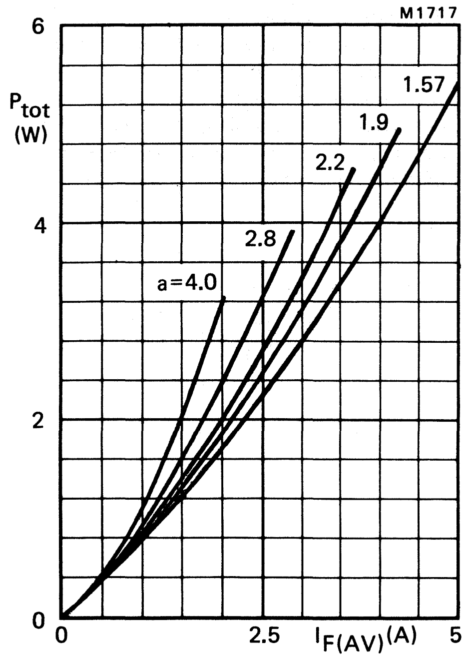


Fig.7 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.

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

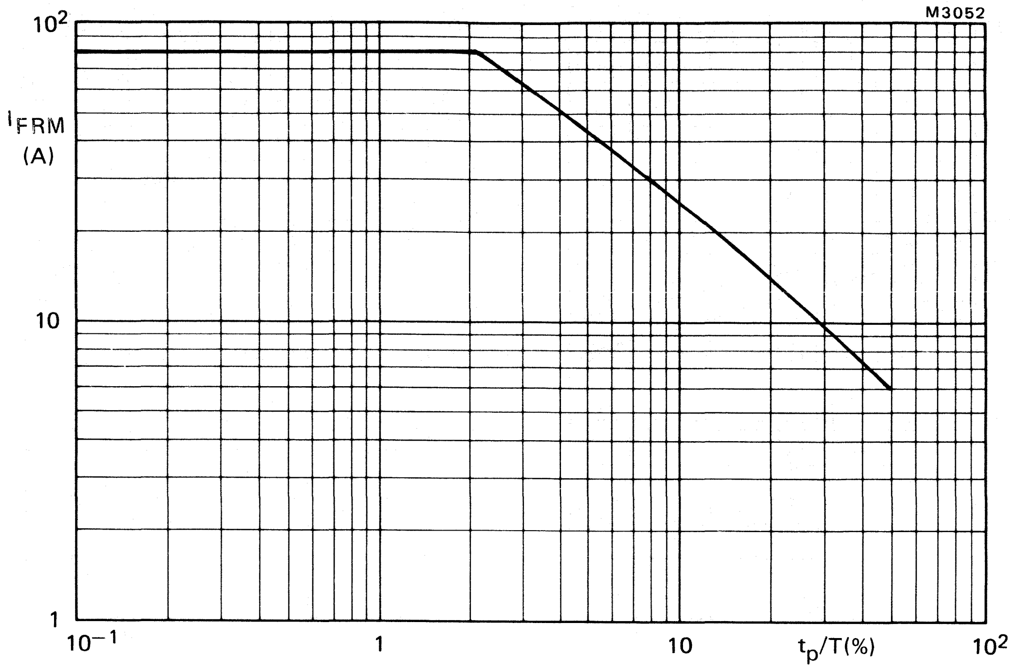
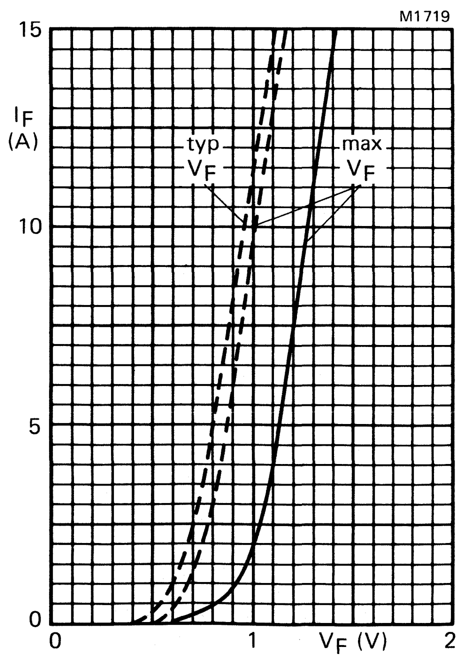
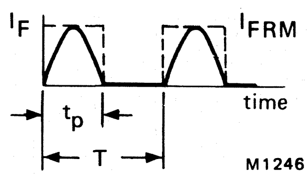


Fig.8 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 $\mu s < t_p <$ 1 ms; per diode.





Definition of I_{FRM} and t_p/T

Fig.9 —— T_j = 25 °C; – – – T_j = 150 °C per diode.

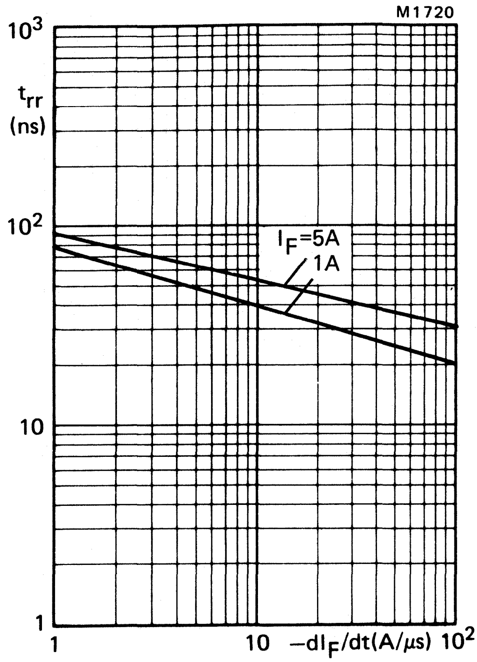


Fig.10 Maximum t_{rr} at T_j = 25 °C.

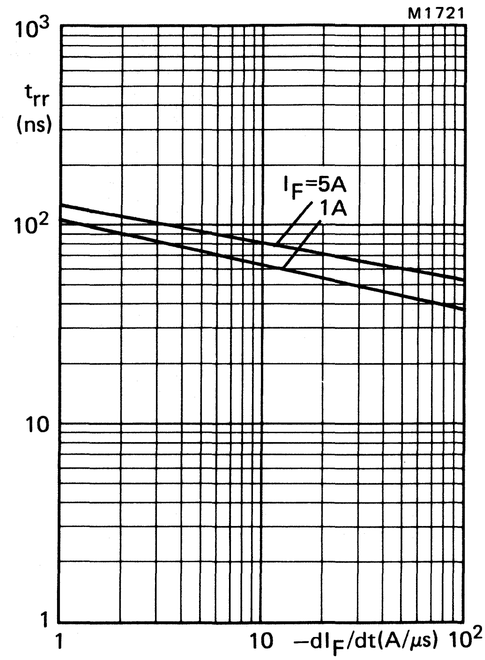


Fig.11 Maximum t_{rr} at T_j = 100 °C.

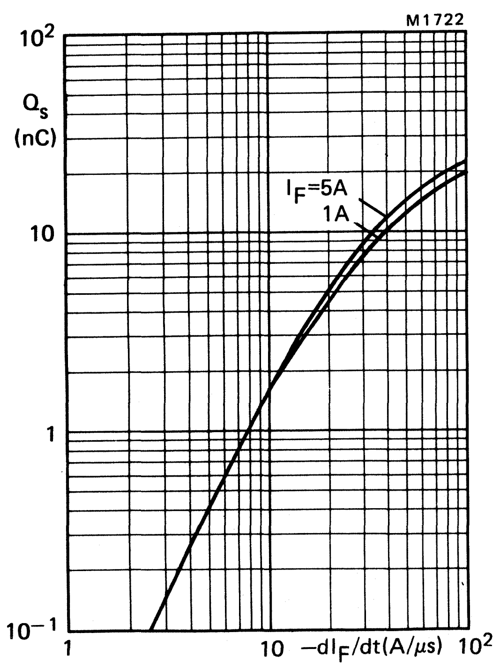


Fig.12 Maximum Q_s at T_j = 25 °C.

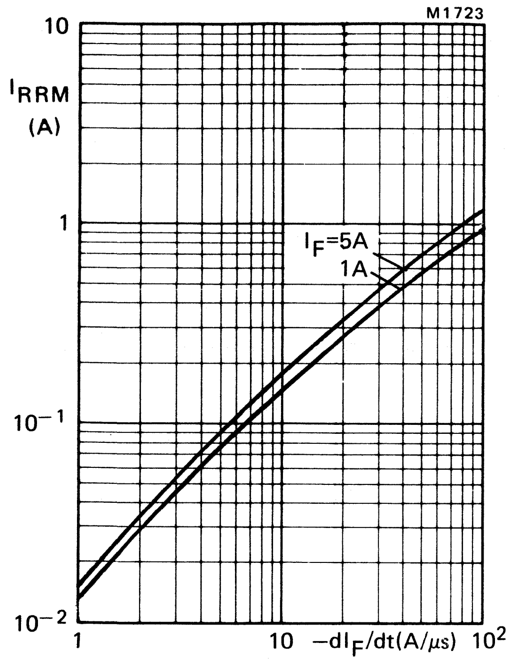


Fig.13 Maximum I_{RRM} at T_j = 25 °C.

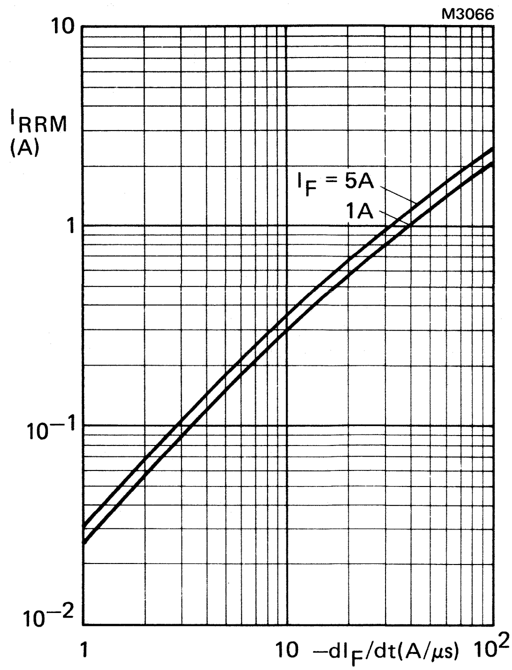


Fig.14 Maximum I_{RRM} at T_j = 100 °C.

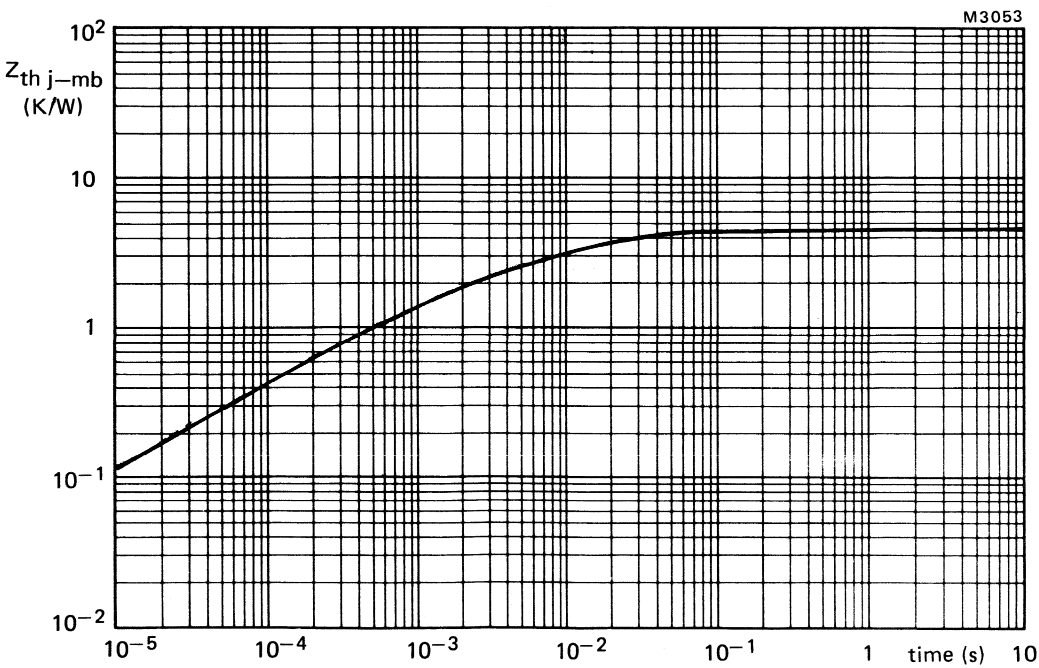


Fig.15 One diode conducting.

ULTRA FAST RECOVERY DOUBLE RECTIFIER DIODES

Glass-passivated, high-efficiency double rectifier diodes in plastic envelopes, featuring low forward voltage drop, ultra fast reverse recovery times and soft recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and low switching losses are essential. Their single chip (monolithic) 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.

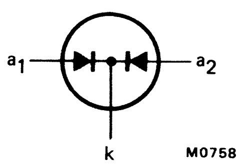
QUICK REFERENCE DATA

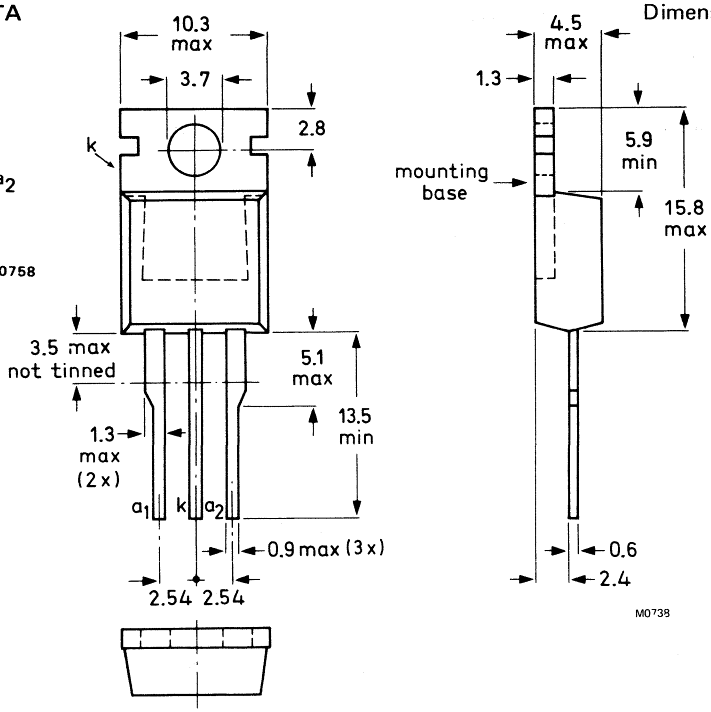
Per diode, unless otherwise stated			BYQ28–50	100	150	200	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	200	V
Output current (both diodes conducting)	I_O	max.	10				A
Forward voltage	V_F	<	0.85				V
Reverse recovery time	t_{rr}	<	20				ns

MECHANICAL DATA

Dimensions in mm

Fig.TO-220AB





Net mass: 2 g

Note: the exposed metal mounting base is directly connected to the common cathode.

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

RATINGS

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

Voltages (per diode)			BYQ28–50	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; δ = 0.5; up to T_{mb} = 128 °C	I_O	max.	10	A
sinusoidal; up to T_{mb} = 130 °C	I_O	max.	10	A
R.M.S. forward current	$I_{F(RMS)}$	max.	14	A
Repetitive peak forward current t_p = 20 μs, δ = 0.02 (per diode)	I_{FRM}	max.	80	A
Non-repetitive peak forward current (per diode) half sine-wave; T_j = 150 °C prior to surge; with reapplied $V_{RWM\,max}$				
t = 10 ms	I_{FSM}	max.	50	A
t = 8.3 ms	I_{FSM}	max.	60	A
I^2t for fusing (t = 10 ms, per diode)	I^2t	max.	12.5	A^2s

Temperatures

Storage temeprature	T_{stg}		−40 to +150	°C
Junction temperature	T_j	max.	150	°C

Notes:

1. The limits for both diodes apply whether both diodes conduct simultaneously or on alternate half cycles.

CHARACTERISTICS (per diode)

Forward voltage					
I_F = 5 A; T_j = 150 °C	V_F	<	0.85	V*	
I_F = 10 A; T_j = 25 °C	V_F	<	1.25	V*	←
Reverse current					
$V_R = V_{RWM\,max}$; T_j = 100 °C	I_R	<	0.2	mA	
$V_R = V_{RWM\,max}$; T_j = 25 °C	I_R	<	10	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}	<	20	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	<	5.5	nC	
I_F = 5 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 50 A/μs; T_j = 25 °C peak recovery current	I_{RRM}	<	0.7	A	←
Forward recovery when switched to I_F = 1 A with dI_F/dt = 10 A/μs; T_j = 25 °C recovery voltage	V_{fr}	typ.	1.0	V	

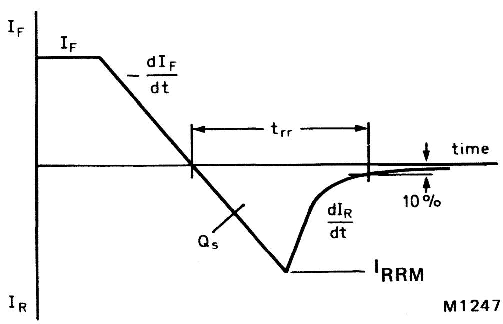


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

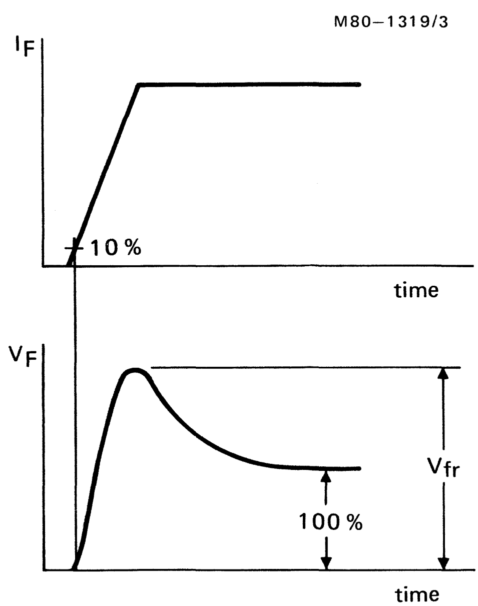


Fig.3 Definition of V_{fr}.

*Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

From junction to mounting base (both diodes conducting)	$R_{th\ j\text{-}mb}$	=	2.2	K/W
From junction to mounting base (per diode)	$R_{th\ j\text{-}mb}$	=	3.0	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 insulator (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 device lead length and with copper laminate on the board — $R_{th\ j\text{-}a}$ = 60 K/W

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 calculations

The various components of junction temperature rise above ambient are illustrated in Fig.4.

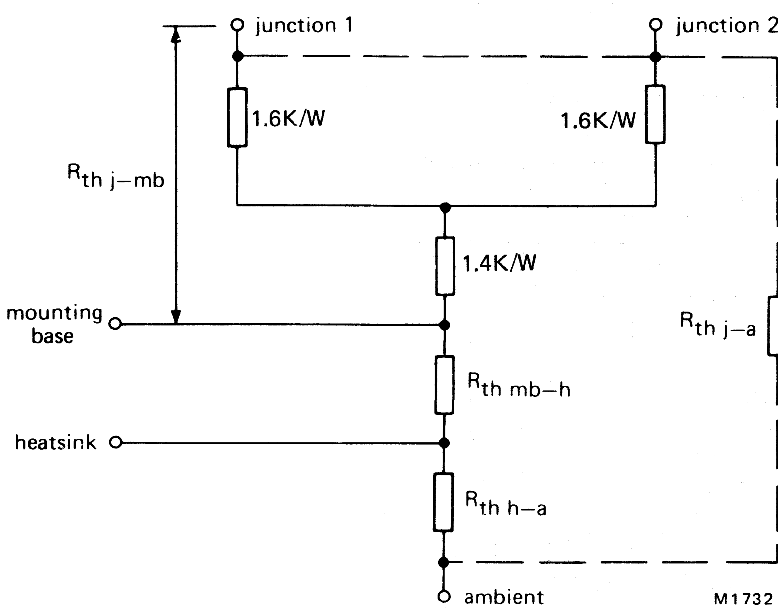


Fig.4.

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

SQUARE-WAVE OPERATION (PER DIODE)

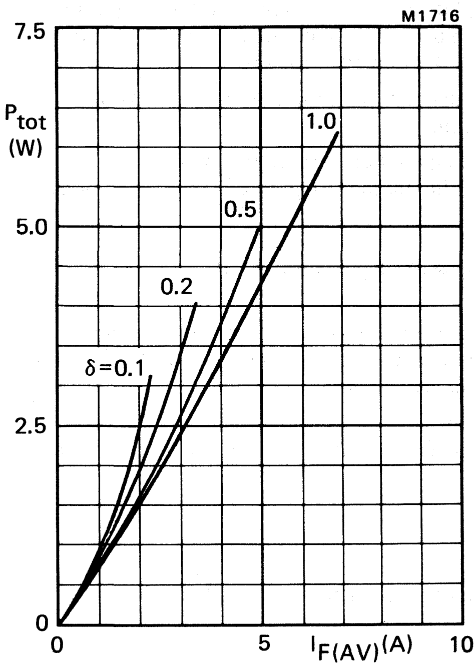
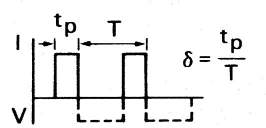


Fig.5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.



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

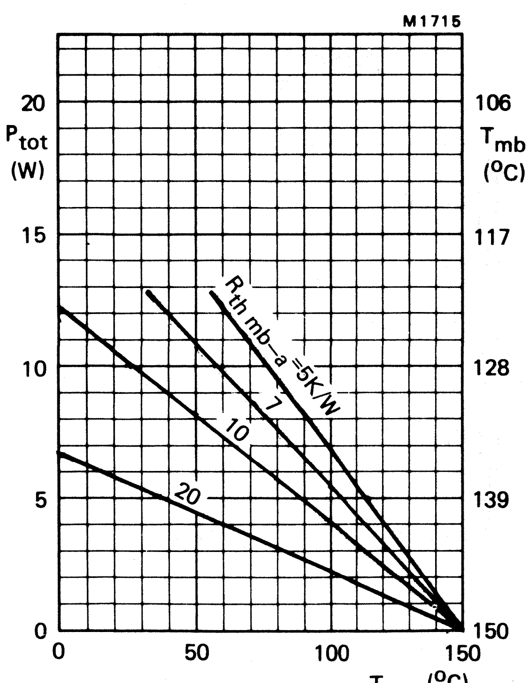


Fig.6

SINUSOIDAL OPERATION (PER DIODE)

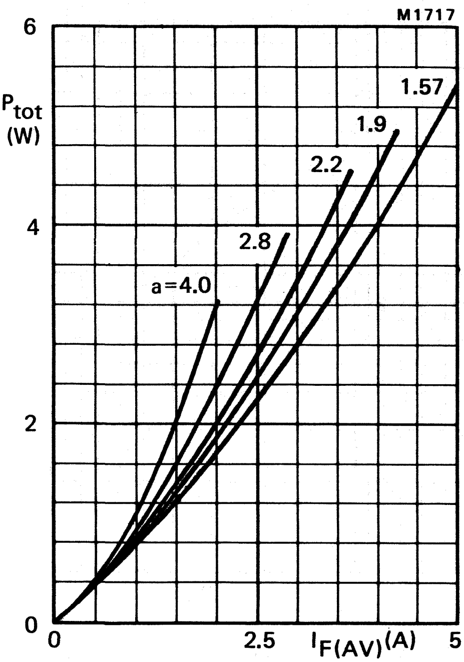


Fig.7 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.

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

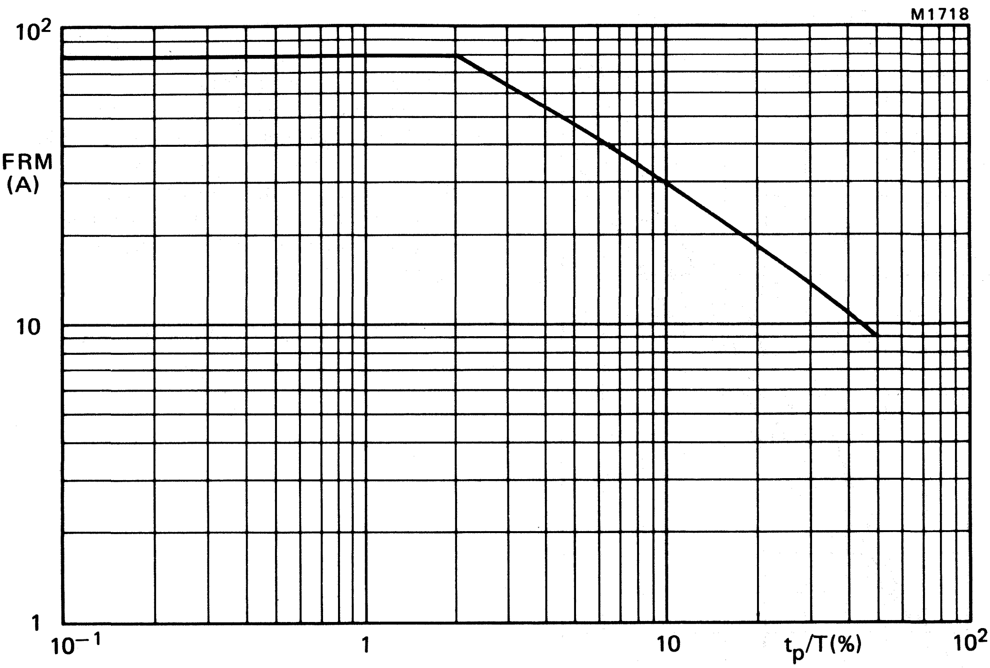
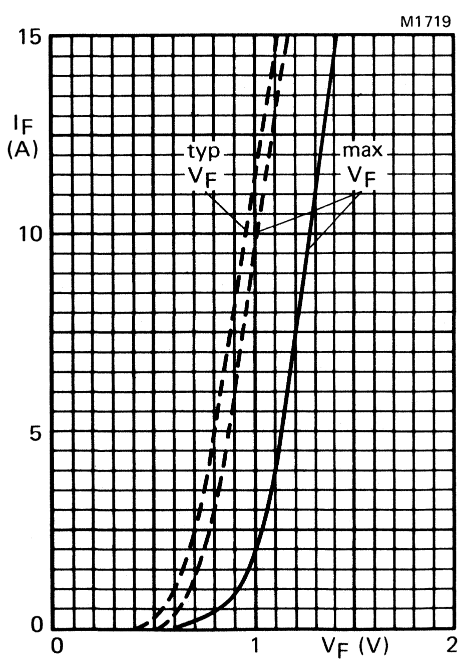
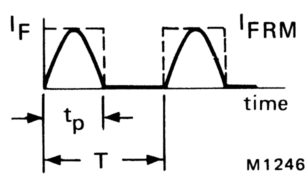


Fig.8 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 $\mu s < t_p < 1$ ms; per diode.





Definition of I_{FRM} and t_p/T

Fig.9 —— T_j = 25 °C; – – – T_j = 150 °C per diode.

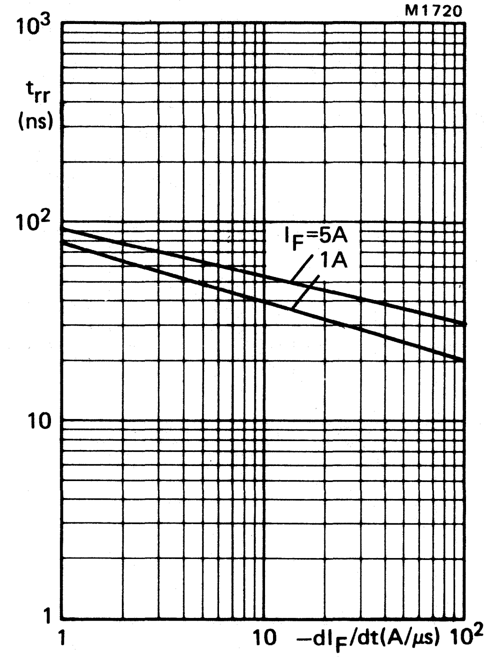


Fig.10 Maximum t_{rr} at T_j = 25 °C.

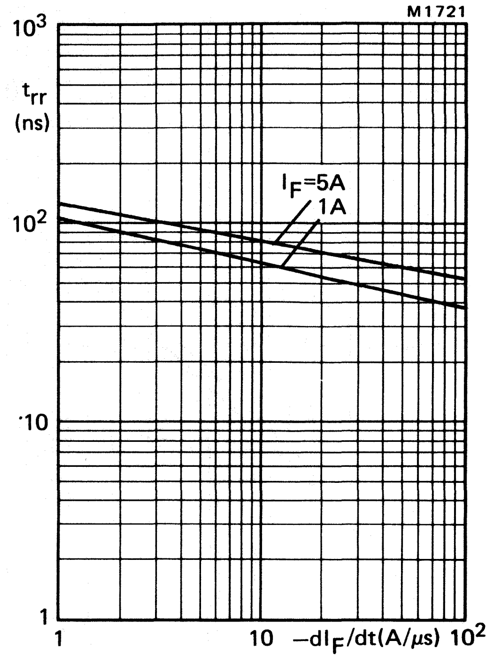


Fig.11 Maximum t_{rr} at T_j = 100 °C.

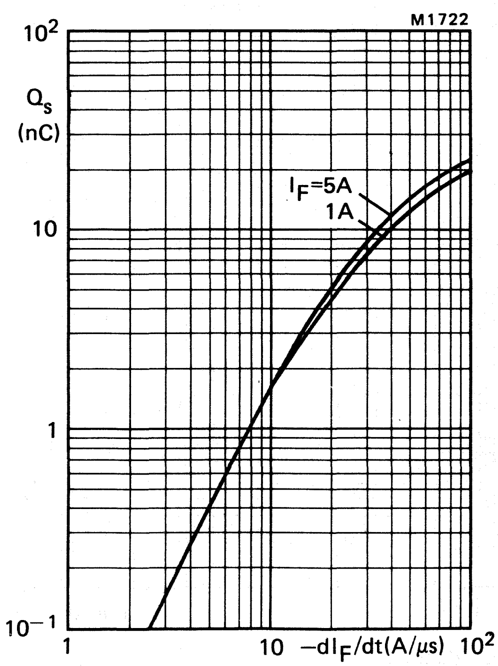


Fig.12 Maximum Q_s at T_j = 25 °C.

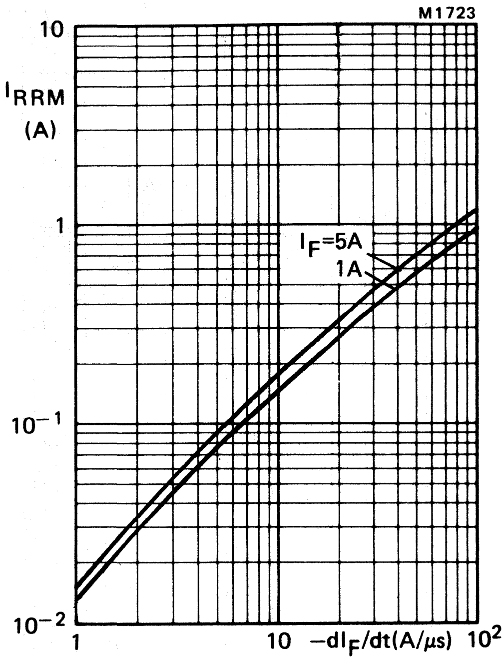


Fig.13 Maximum I_{RRM} at T_j = 25 °C

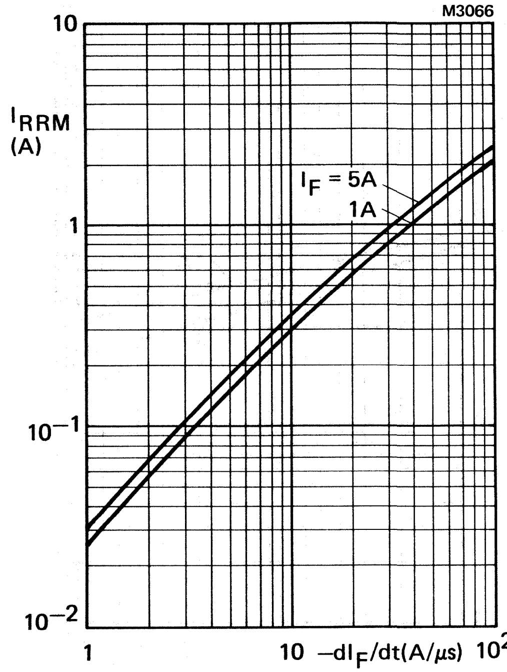


Fig.14 Maximum I_{RRM} at T_j = 100 °C;

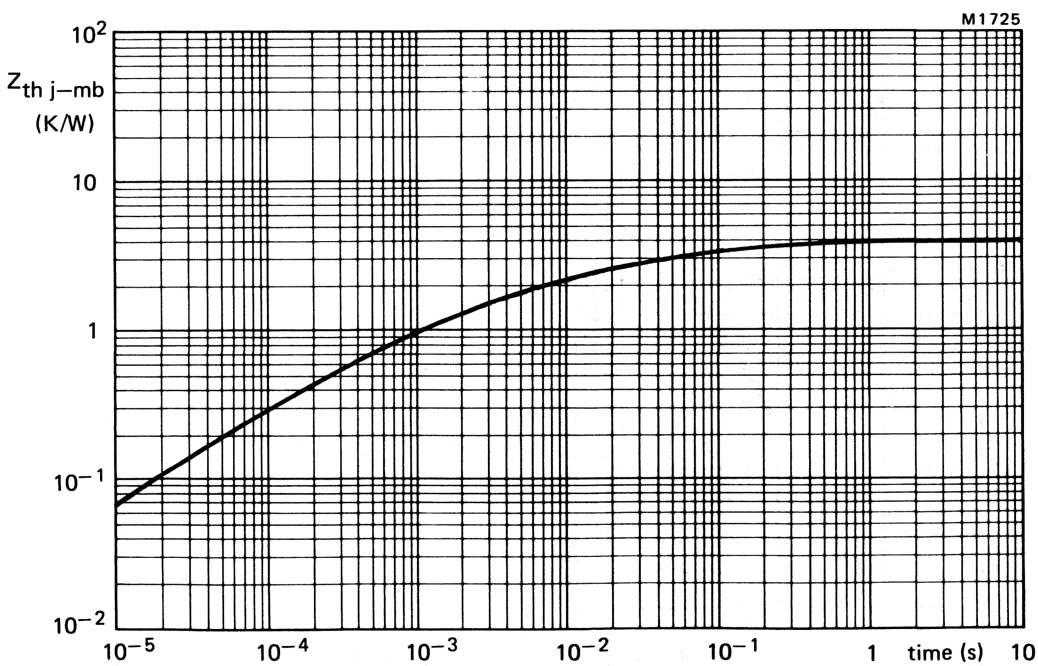


Fig.15 One diode conducting.

ULTRA FAST-RECOVERY ELECTRICALLY-ISOLATED DOUBLE RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial double rectifier diodes in SOT-186 (full-pack) plastic envelopes, featuring low forward voltage drop, very fast reverse recovery times and soft-recovery characteristic. Their electrical isolation makes them ideal for mounting on a common heatsink along-side other components without the need for additional insulators. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction and 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.

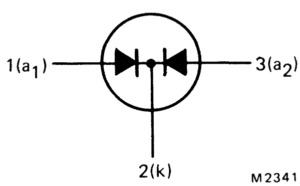
QUICK REFERENCE DATA

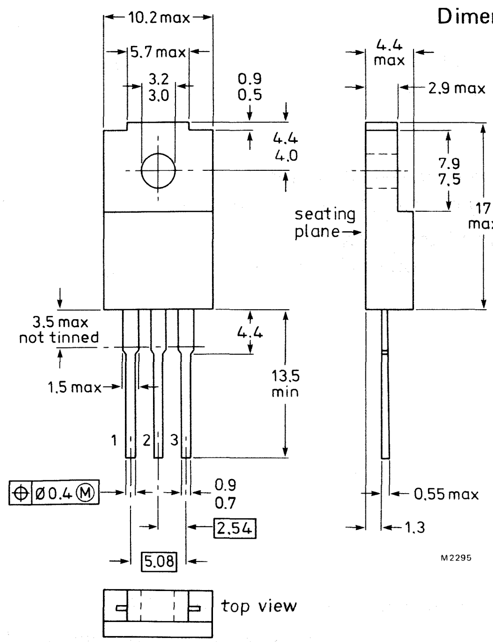
Per diode, unless otherwise stated			BYQ28F-50	100	150	200	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	200	V
Output current (both diodes conducting)	I_O	max.		10			A
Forward voltage	V_F	<		0.85			V
Reverse recovery time	t_{rr}	<		20			ns

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 (IEC 134).

Voltages (per diode)			BYQ28F-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 (see note 1)	V_R	max.	50	100	150	200	V

Currents (see notes 2 and 3)				
Output current, switching losses negligible up to 500 kHz				
square wave; $\delta = 0.5$; up to $T_h = 93\,^oC$	I_O	max.	10	A
sinusoidal; up to $T_h = 96\,^oC$	I_O	max.	10	A
R.M.S forward current	$I_{F(RMS)}$	max.	14	A
Repetitive peak forward current $t_p = 20\,\mu s$, $\delta = 0.02$ (per diode)	I_{FRM}	max.	80	A
Non-repetitive peak forward current half sinewave; $T_j = 150\,^oC$ prior to surge; with reapplied $V_{RWM\,max}$;				
t = 10 ms (per diode)	I_{FSM}	max.	50	A
t = 8.3 ms (per diode)	I_{FSM}	max.	60	A
I^2t for fusing (t = 10 ms; per diode)	I^2t	max.	12.5	A^2s
Temperatures				
Storage temperature	T_{stg}		−40 to +150	^oC
Junction temperature	T_j	max.	150	^oC

ISOLATION

Voltage allowed between all terminals and external heatsink, peak value (note 4)	V_{isol}	max.	1500	V
Insulation capacitance between all terminals and external heatsink	C_{isol}	typ.	12	pF

Notes

1. To ensure thermal stability: $R_{th\,j\text{-}a} < 6.3$ K/W.
2. The limits for both diodes apply whether both diodes conduct simultaneously or on alternate half cycles.
3. The quoted temperatures assume heatsink compound is used.
4. Repetitive peak operation with relative humidity $\leqslant 65\%$ under clean and dust-free conditions.

THERMAL RESISTANCE

From junction to external heatsink with minimum of 2 kgf (20 newtons) pressure on the centre of the envelope, total package:				
without heatsink compound	$R_{th\ j-h}$	=	6.7	K/W
with heatsink compound	$R_{th\ j-h}$	=	5.7	K/W

Free-air operation

The quoted value of $R_{th\ j-a}$ 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, device mounted on a printed circuit board	$R_{th\ j-a}$	=	55	K/W

CHARACTERISTICS (per diode)

Forward voltage				
I_F = 5 A; T_j = 150 °C	V_F	<	0.85	V*
I_F = 10 A; T_j = 25 °C	V_F	<	1.25	V* ←
Reverse current				
$V_R = V_{RWM\ max}$; T_j = 100 °C	I_R	<	0.2	mA
$V_R = V_{RWM\ max}$; T_j = 25 °C	I_R	<	10	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}	<	20	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	<	5.5	nC
I_F = 5 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 50 A/μs; T_j = 25 °C peak recovery current	I_{RRM}	<	0.7	A ←
Forward recovery when switched to I_F = 1 A with dI_F/dt = 10 A/μs; T_j = 25 °C	V_{fr}	typ.	1	V

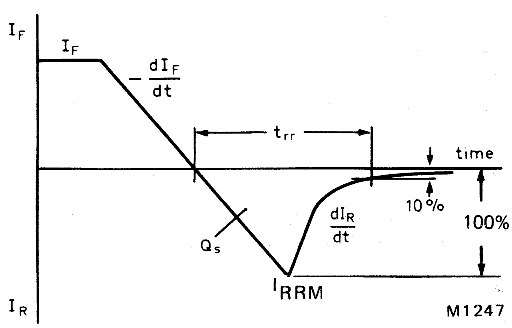


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

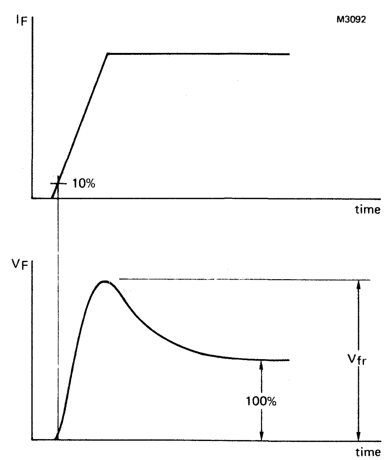


Fig.3 Definition of V_{fr}.

*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

Dissipation and heatsink considerations:

a. The various components of junction temperature rise above ambient are illustrated in Fig.4:

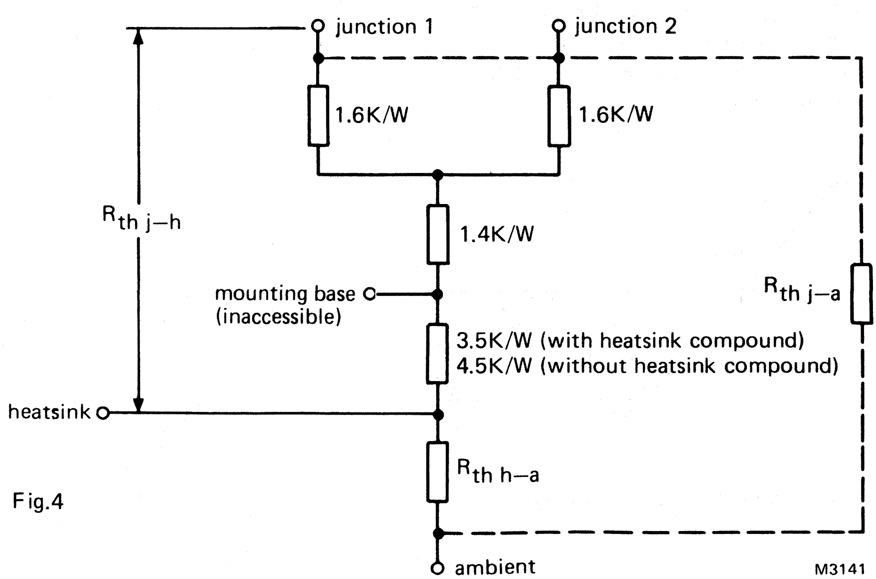


Fig.4

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

SQUARE-WAVE OPERATION (PER DIODE)

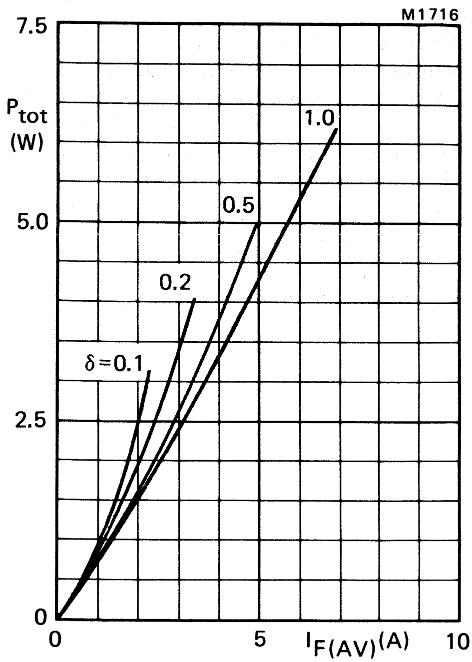
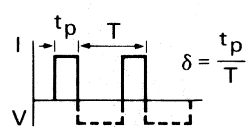


Fig.5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.



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

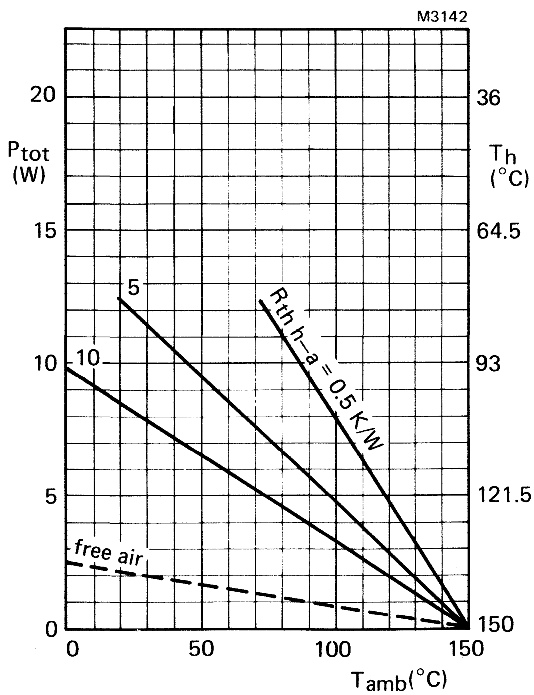


Fig.6

SINUSOIDAL OPERATION (PER DIODE)

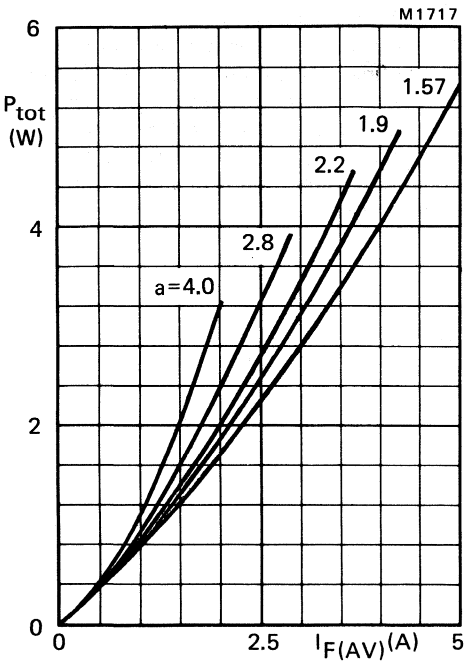


Fig.7 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.

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

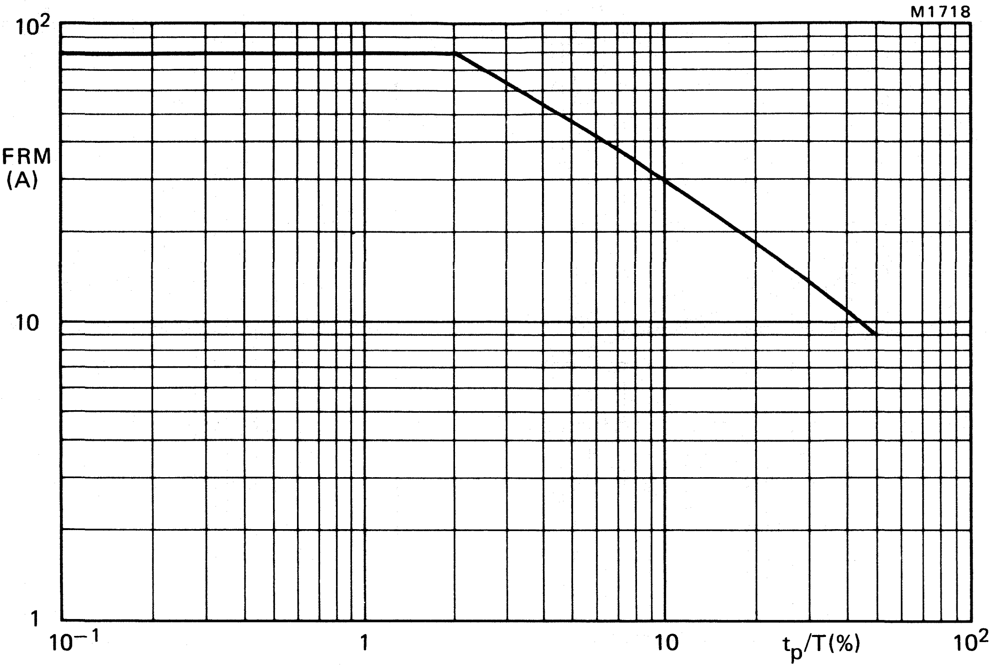
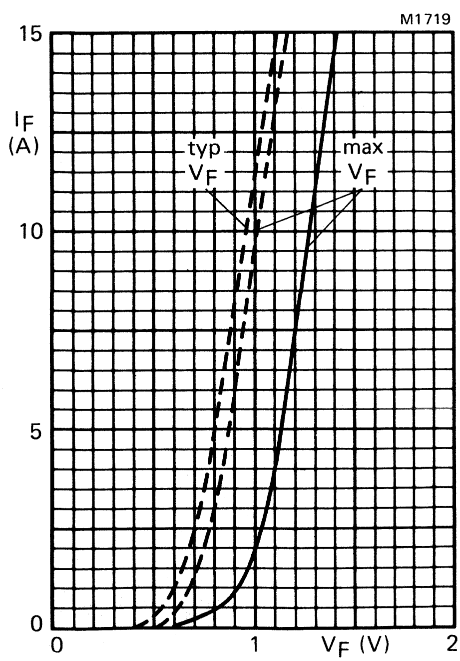
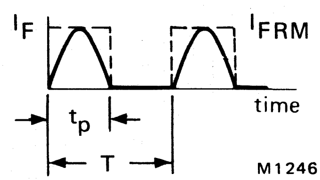


Fig.8 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 $\mu s < t_p <$ 1 ms; per diode.





Definition of I_{FRM} and t_p/T

Fig.9 —— T_j = 25 °C; – – – T_j = 150 °C per diode.

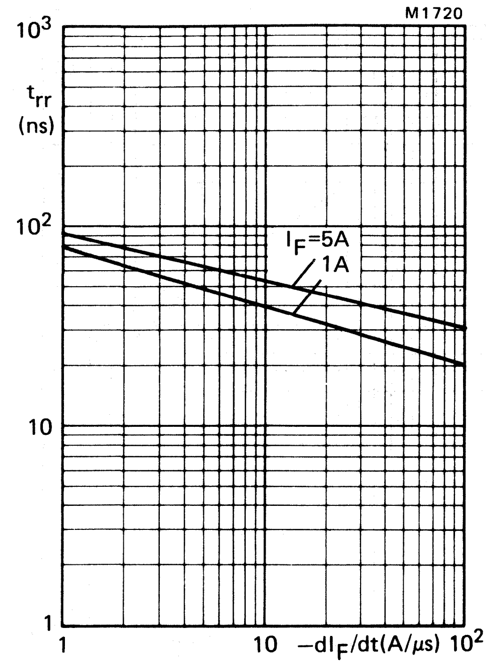


Fig.10 Maximum t_{rr} at T_j = 25 °C.

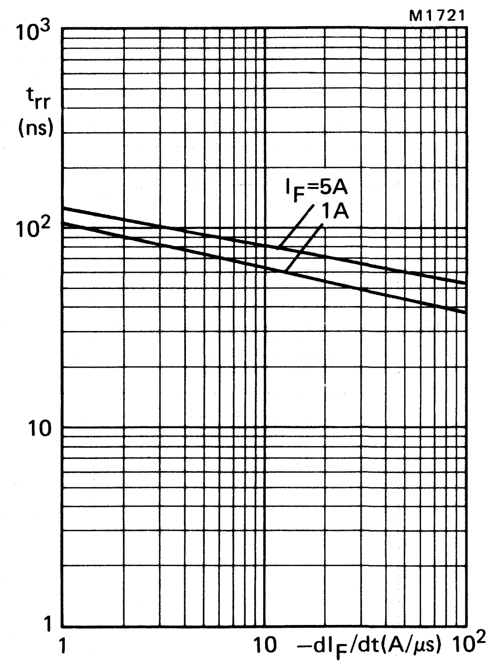


Fig.11 Maximum t_{rr} at T_j = 100 °C.

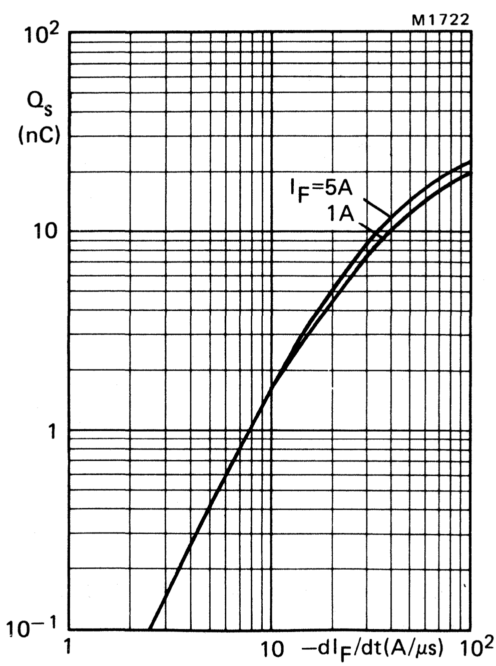


Fig.12 Maximum Q_s at T_j = 25 °C.

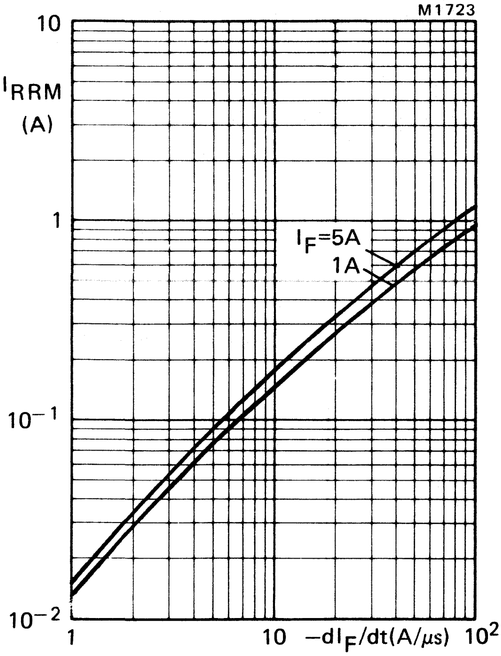


Fig.13 Maximum I_{RRM} at T_j = 25 °C.

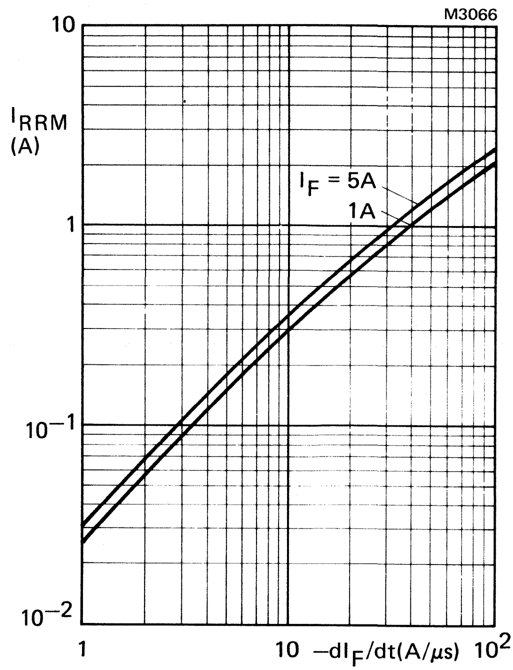


Fig.14 Maximum I_{RRM} at T_j = 100 °C.

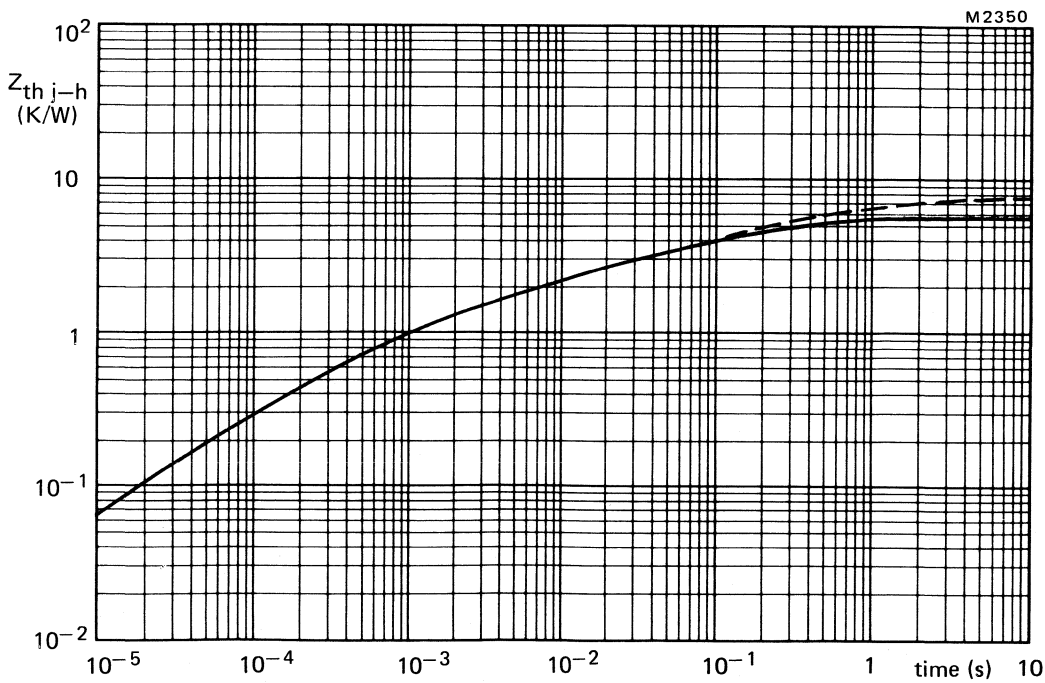


Fig.15 One diode conducting; —— with heatsink compound; — — — without heatsink compound.

ULTRA FAST RECOVERY DOUBLE RECTIFIER DIODES

Glass-passivated, high-efficiency double rectifier diodes in plastic envelopes, featuring low forward voltage drop, ultra fast reverse recovery times and soft-recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and low switching losses are essential. Their single chip (monolithic) 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.

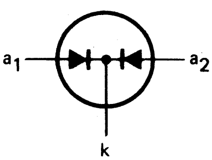
QUICK REFERENCE DATA

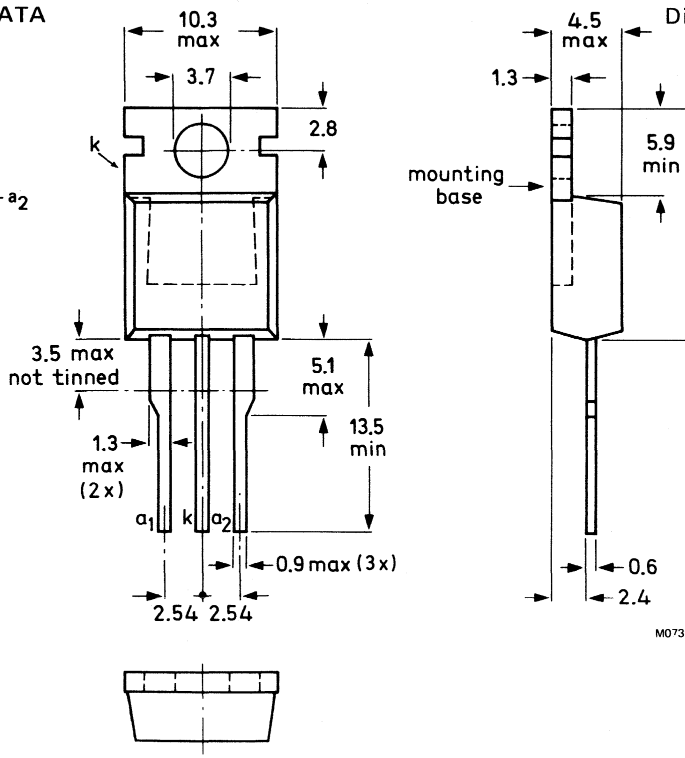
Per diode, unless otherwise stated			BYR28–500	600	700	800	
Repetitive peak reverse voltage	V_{RRM}	max.	500	600	700	800	V
Output current (both diodes conducting)	I_O	max.	10				A
Forward voltage	V_F	<	1.6				V
Reverse recovery time	t_{rr}	<	80				ns

MECHANICAL DATA

Fig.1 TO-220AB

Dimensions in mm





Net mass: 2 g.

Note: the exposed metal mounting base is directly connected to the common-cathode.

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

RATINGS

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

			BYR28–500	600	700	800	
Voltages (per diode)							
Repetitive peak reverse voltage	V_{RRM}	max.	500	600	700	800	V
Crest working reverse voltage	V_{RWM}	max.	400	500	500	600	V
Continuous reverse voltage	V_R	max.	400	500	500	600	V
Currents (both diodes conducting; note 1)							
Output current; switching losses negligible up to 100 kHz; square wave; $\delta = 0.5$; up to $T_{mb} = 95\ ^oC$	I_O	max.	10				A
RMS forward current	$I_{F(RMS)}$	max.	14				A
Repetitive peak forward current $t_p = 20\ \mu s$; $\delta = 0.02$ (per diode)	I_{FRM}	max.	90				A
Non-repetitive peak forward current (per diode) half sinewave; $T_j = 150\ ^oC$ prior to surge with reapplied $V_{RWM\ max}$ t = 10 ms	I_{FSM}	max.	50				A
Temperatures							
Storage temperature	T_{stg}		−40 to +150				^oC
Junction temperature	T_j	max.	150				^oC

Notes:

1. The limits for both diodes apply whether both diodes conduct simultaneously or on alternate half cycles.

CHARACTERISTICS (per diode)

Forward voltage				
I_F = 5 A; T_j = 150 °C	V_F	<	1.6	V*
I_F = 10 A; T_j = 25 °C	V_F	<	2.0	V*
Reverse current				
$V_R = V_{RWM\,max}$; T_j = 100 °C	I_R	<	0.5	mA
$V_R = V_{RWM\,max}$; T_j = 25 °C	I_R	<	25	μA
Reverse recovery when switched from				
I_F = 1 A to $V_R \geq 30$ V with $-dI_F/dt$ = 100 A/μs; T_j = 25 °C; recovery time	t_{rr}	<	80	ns
I_F = 2 A to $V_R \geq 30$ V with $-dI_F/dt$ = 20 A/μs; T_j = 25 °C; recovered charge	Q_s	<	190	nC
I_F = 10 A to $V_R \geq 30$ V with $-dI_F/dt$ = 50 A/μs; T_j = 100 °C; peak recovery current	I_{RRM}	<	6	A

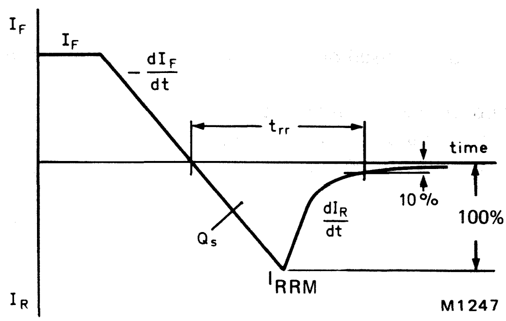


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

*Measured under pulse conditions to avoid excessive dissipation.

DEVELOPMENT DATA

THERMAL RESISTANCE

From junction to mounting base (both diodes conducting)	$R_{th\ j\text{-}mb}$	=	2.5	K/W
From junction to mounting base (per diode)	$R_{th\ j\text{-}mb}$	=	3.0	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 insulator (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 value 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 device lead length and with copper laminate on the board — $R_{th\ j\text{-}a}$ = 60 K/W

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 calculations

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

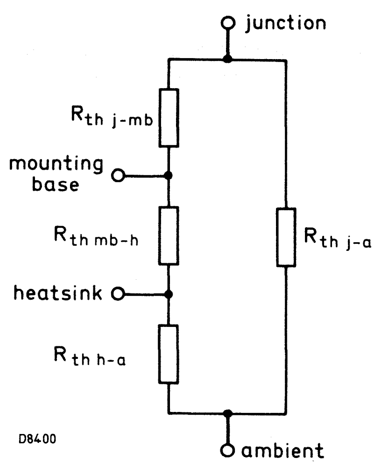


Fig.3.

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

c. The method of using Figs.4 and 5 is as follows:
   Starting with the required current on the $I_{F(AV)}$ axis, trace upwards to meet the appropriate duty cycle or form factor curve. Trace right horizontally and upwards from the required value on the T_{amb} scale. The intersection determines the $R_{th\ mb\text{-}a}$. The heatsink thermal resistance value ($R_{th\ h\text{-}a}$) can be calculated from.

   $R_{th\ h\text{-}a} = R_{th\ mb\text{-}a} - R_{th\ mb\text{-}h}$.

SQUARE-WAVE OPERATION

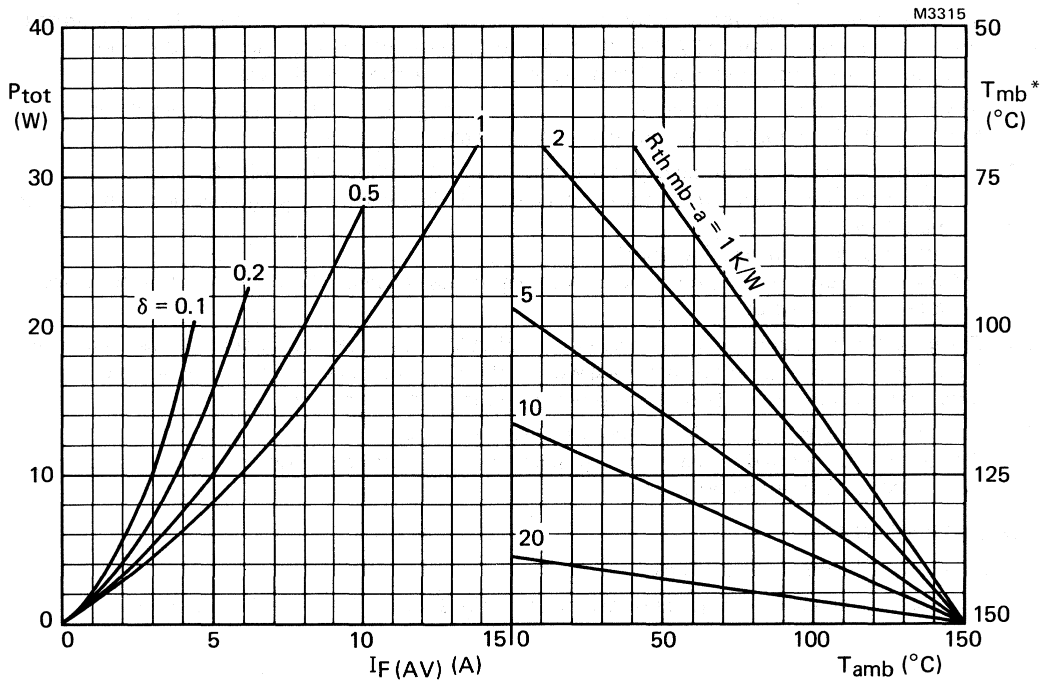
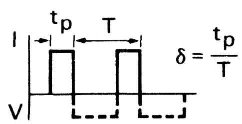


Fig.4 The right-hand part shows the relationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 100 kHz; per diode.



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

*T_{mb} scale is for comparison purposes and is correct only for $R_{th\ mb\text{-}a} < 3.2$ K/W.

SINUSOIDAL OPERATION

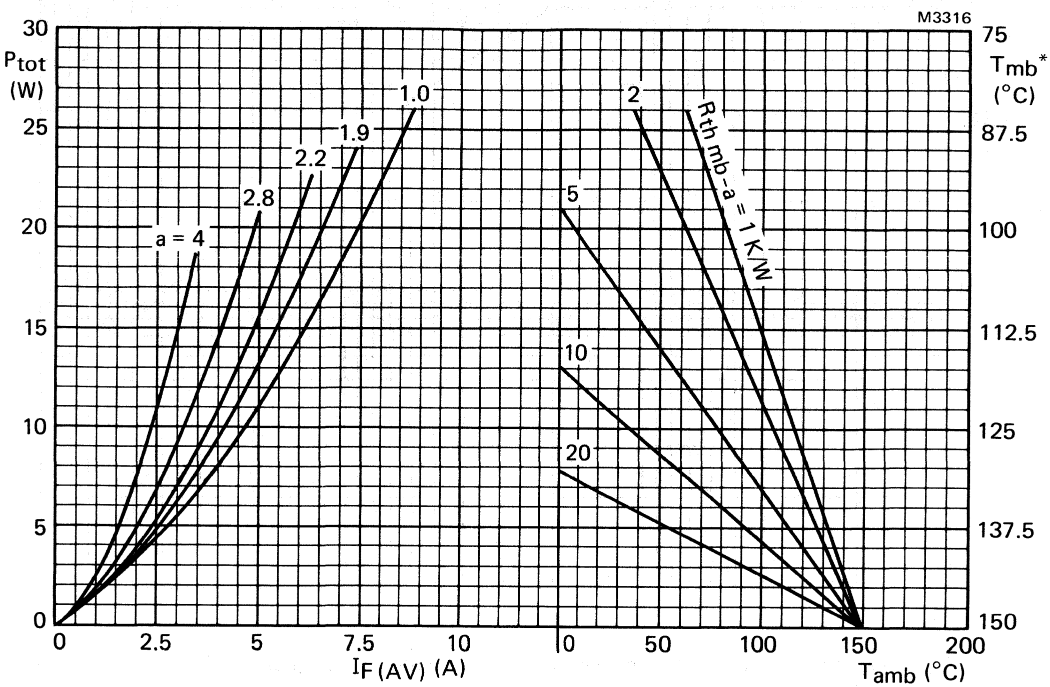


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$; per diode.

DEVELOPMENT DATA

*T_{mb} scale is for comparison purposes and is correct only for $R_{th\ mb\text{-}a} < 16$ K/W.

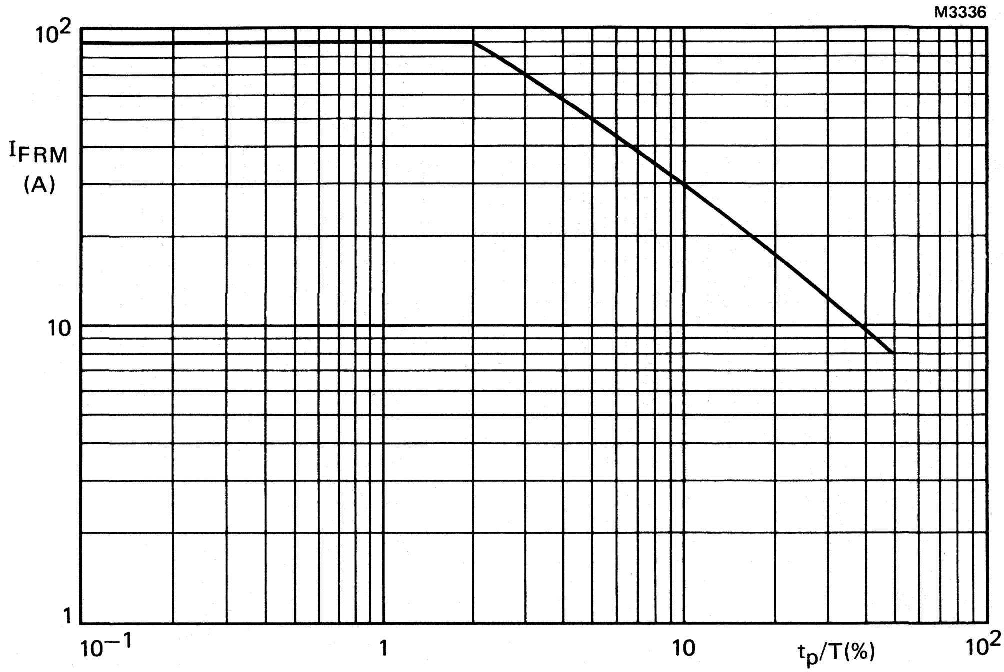
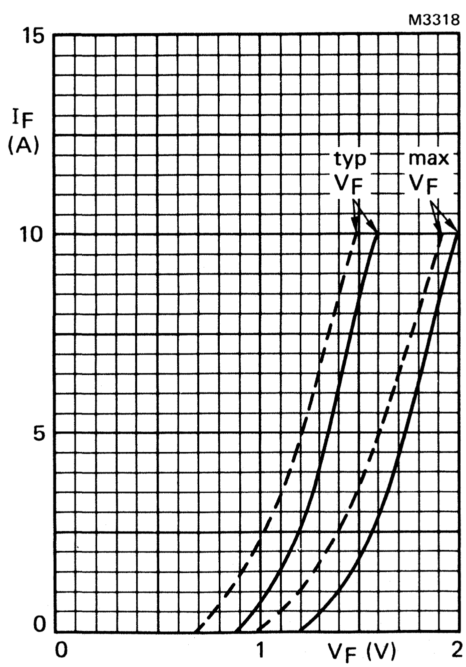
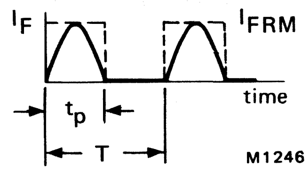


Fig.6 Maximum permissible repetitive peak forward current for square or sinusoidal currents; for 1 μs $< t_p <$ 1 ms; per diode.





Definition of I_{FRM} and t_p/T

Fig.7 —— T_j = 25 °C; – – – T_j = 150 °C; per diode.

DEVELOPMENT DATA

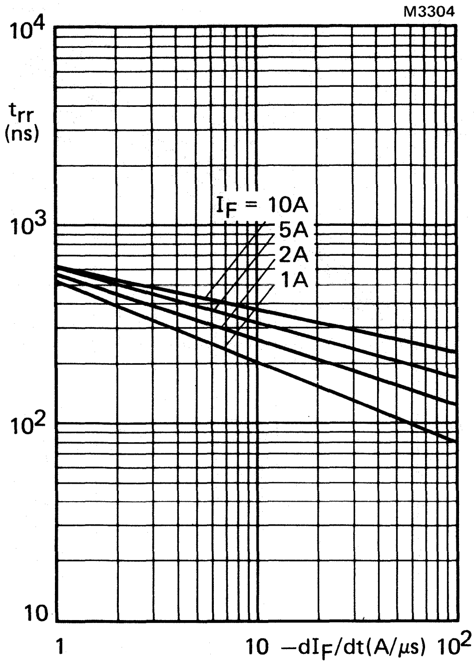


Fig.8 Maximum t_{rr} at T_j = 25 °C; per diode.

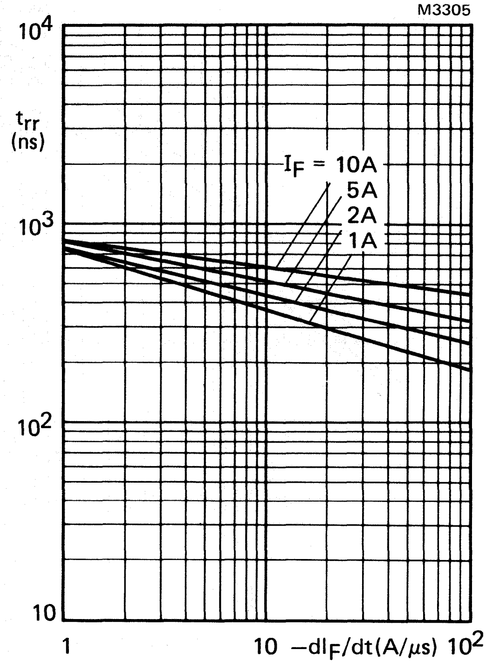


Fig.9 Maximum t_{rr} at T_j = 100 °C; per diode.

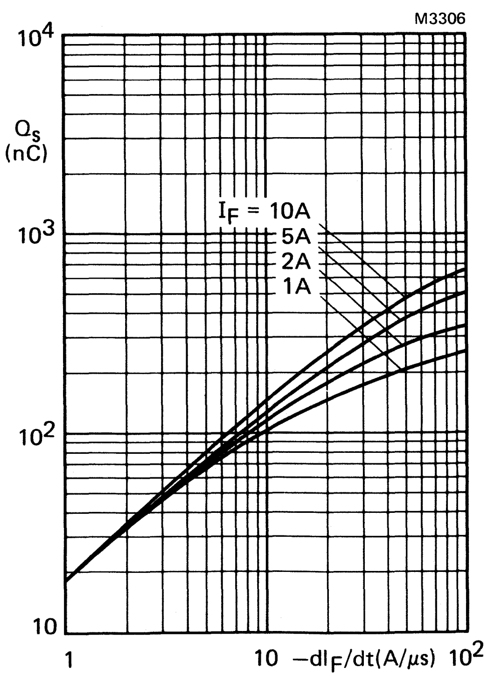


Fig.10 Maximum Q_s at T_j = 25 °C; per diode.

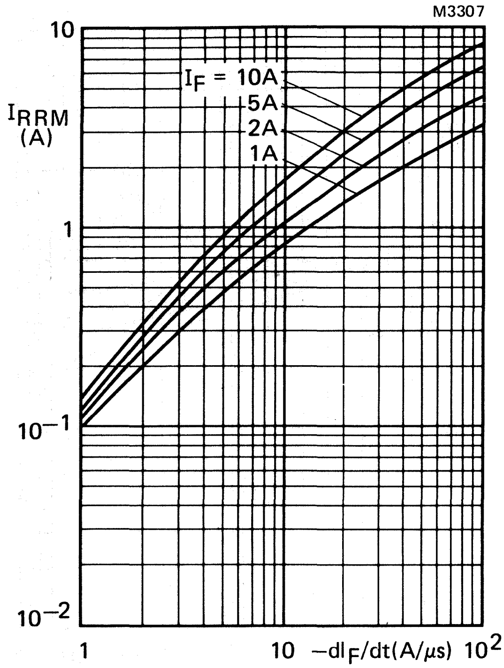


Fig.11 Maximum I_{RRM} at T_j = 25 °C; per diode.

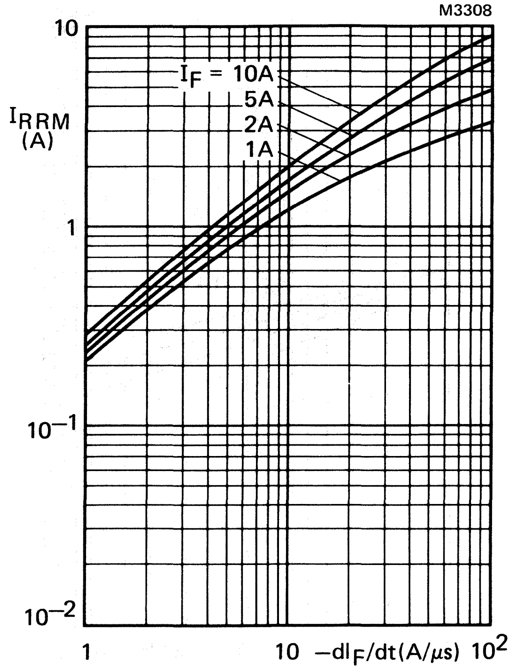


Fig.12 Maximum I_{RRM} at T_j = 100 °C; per diode.

ULTRA FAST RECOVERY RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial rectifier diodes in plastic envelopes, featuring low forward voltage drop, ultra fast reverse recovery times with very low stored charge and soft-recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and low switching losses are essential.
The series consists of normal polarity (cathode to mounting base) types.

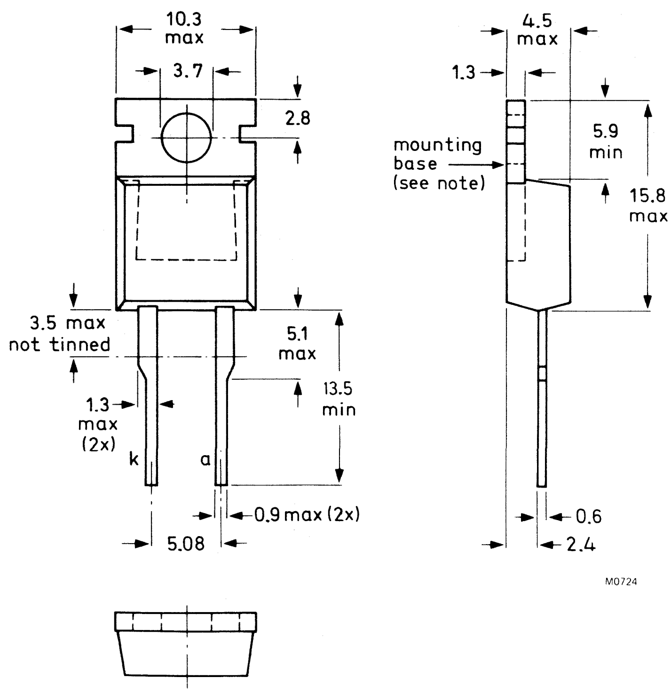
QUICK REFERENCE DATA

			BYR29-500	600	700	800	
Repetitive peak reverse voltage	V_{RRM}	max.	500	600	700	800	V
Average forward current	$I_{F(AV)}$	max.		8			A
Forward voltage	V_F	<		1.15			V
Reverse recovery time	t_{rr}	<		75			ns

MECHANICAL DATA

Dimensions in mm

Fig.1 TO-220AC



Net mass: 2 g

Note: The exposed metal mounting base is directly connected to the cathode.

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

RATINGS

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

Voltages

			BYR29-500	600	700	800	
Repetitive peak reverse voltage	V_{RRM}	max.	500	600	700	800	V
Crest working reverse voltage	V_{RWM}	max.	400	500	500	600	V
Continuous reverse voltage*	V_R	max.	400	500	500	600	V

Currents

Average forward current; switching losses negligible up to 100 kHz				
square wave; $\delta = 0.5$; up to $T_{mb} = 117\ ^oC$	$I_{F(AV)}$	max.	8	A
up to $T_{mb} = 125\ ^oC$	$I_{F(AV)}$	max.	6.5	A
sinusoidal; up to $T_{mb} = 120\ ^oC$	$I_{F(AV)}$	max.	7.8	A
up to $T_{mb} = 125\ ^oC$	$I_{F(AV)}$	max.	7.2	A
R.M.S. forward current	$I_{F(RMS)}$	max.	11.5	A
Repetitive peak forward current $t_p = 20\ \mu s$; $\delta = 0.02$	I_{FRM}	max.	130	A
Non-repetitive peak forward current half sine-wave; $T_j = 150\ ^oC$ prior to surge; with reapplied V_{RWMmax};				
t = 10 ms	I_{FSM}	max.	60	A
t = 8.3 ms	I_{FSM}	max.	72	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

*To ensure thermal stability: $R_{th\ j\text{-}a} \leqslant 5.7$ K/W.

CHARACTERISTICS

Forward voltage					
I_F = 5 A; T_j = 150 °C	V_F	<	1.15	V*	←
I_F = 20 A; T_j = 25 °C	V_F	<	1.65	V*	←
Reverse current					
$V_R = V_{RWM\,max}$; T_j = 100 °C	I_R	<	0.2	mA	
T_j = 25 °C	I_R	<	10	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}	<	75	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	<	200	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}	<	6	A	
Forward recovery when switched to I_F = 10 A with dI_F/dt = 10 A/µs; T_j = 25 °C	V_{fr}	typ.	5	V	

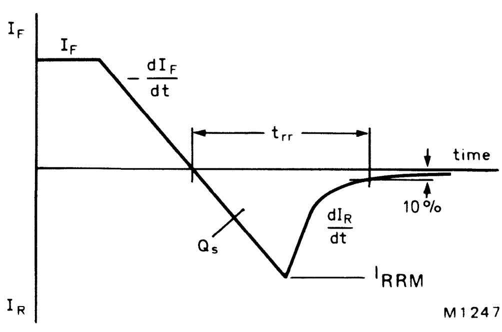


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

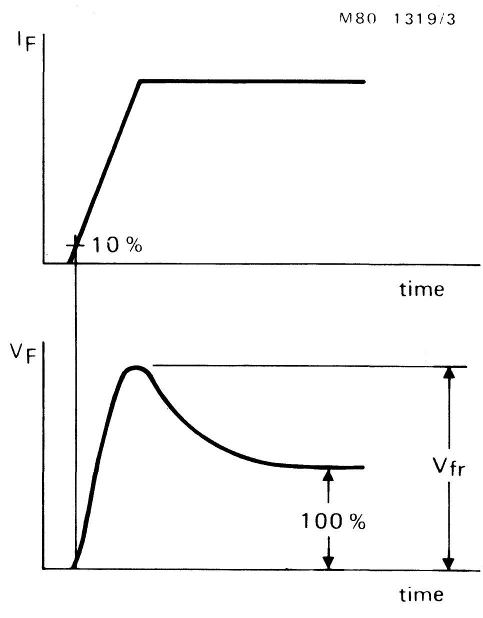


Fig.3 Definition of V_{fr}.

*Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	2.5	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 insulator (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 value 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 device lead length and with copper laminate on the board	$R_{th\ j\text{-}a}$	=	60	K/W

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 $R_{th\ mb-h}$ 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 $R_{th\ mb-h}$ 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 calculations

a. The various components of junction temperature rise above ambient are illustrated in Fig.4.

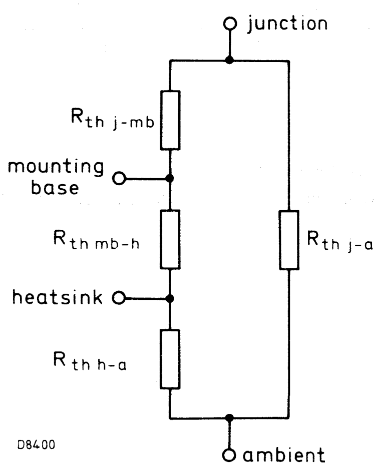


Fig. 4.

b. Any measurement of heatsink temperature should be made immediately adjacent to the device.
c. The method of using Figs. 5 and 6 is as follows:
Starting with the required current on the $I_{F(AV)}$ axis, trace upwards to meet the appropriate duty cycle or form factor curve. Trace right horizontally and upwards from the required value on the T_{amb} scale. The intersection determines the $R_{th\ mb-a}$. The heatsink thermal resistance value ($R_{th\ h-a}$) can be calculated from:

$$R_{th\ h-a} = R_{th\ mb-a} - R_{th\ mb-h}.$$

SQUARE-WAVE OPERATION

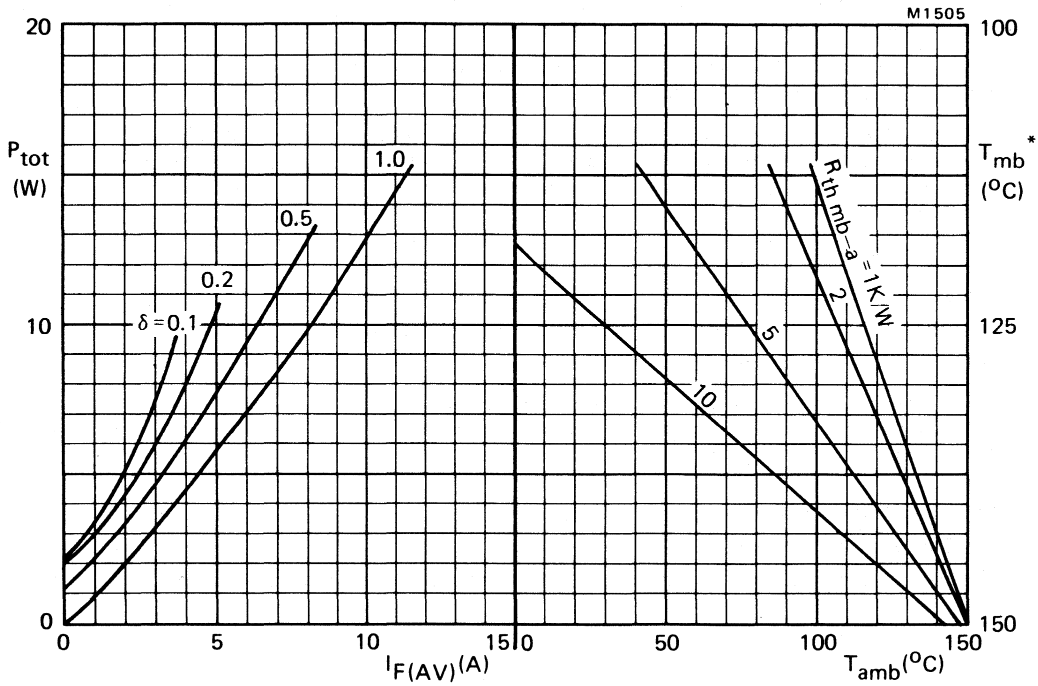
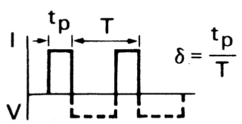


Fig.5 The right-hand part shows the relationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 100 kHz.



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

*T_{mb} scale is for comparison purposes and is correct only for $R_{th\ mb\text{-}a} < 3.2$ K/W.

SINUSOIDAL OPERATION

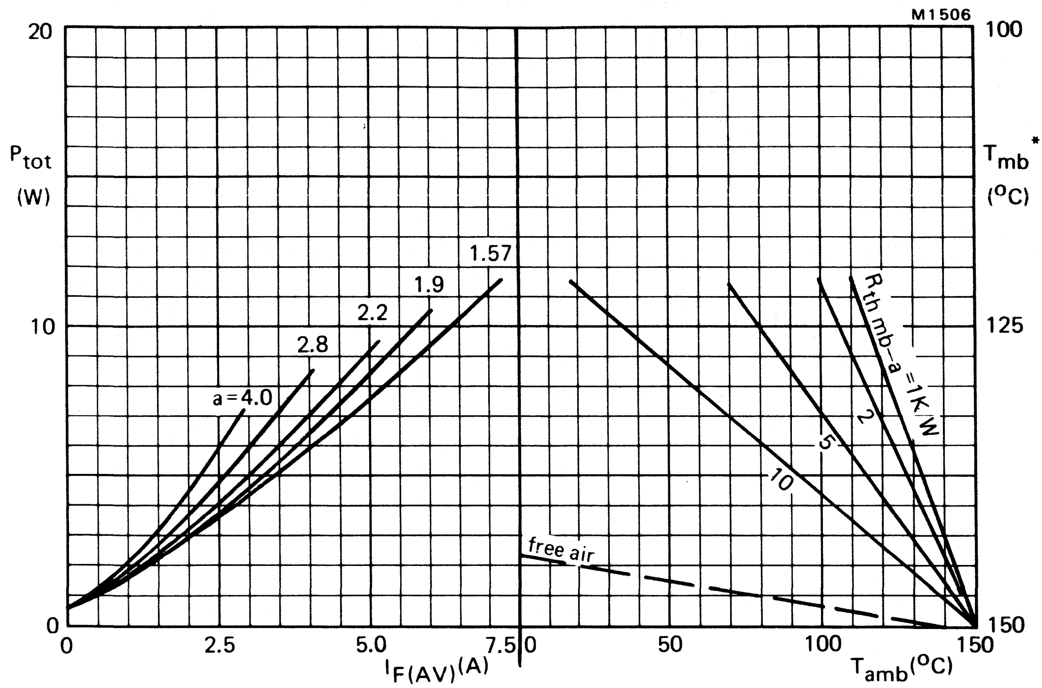


Fig.6 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

*T_{mb} scale is for comparison purposes and is correct only for $R_{th\ mb\text{-}a} < 16$ K/W.

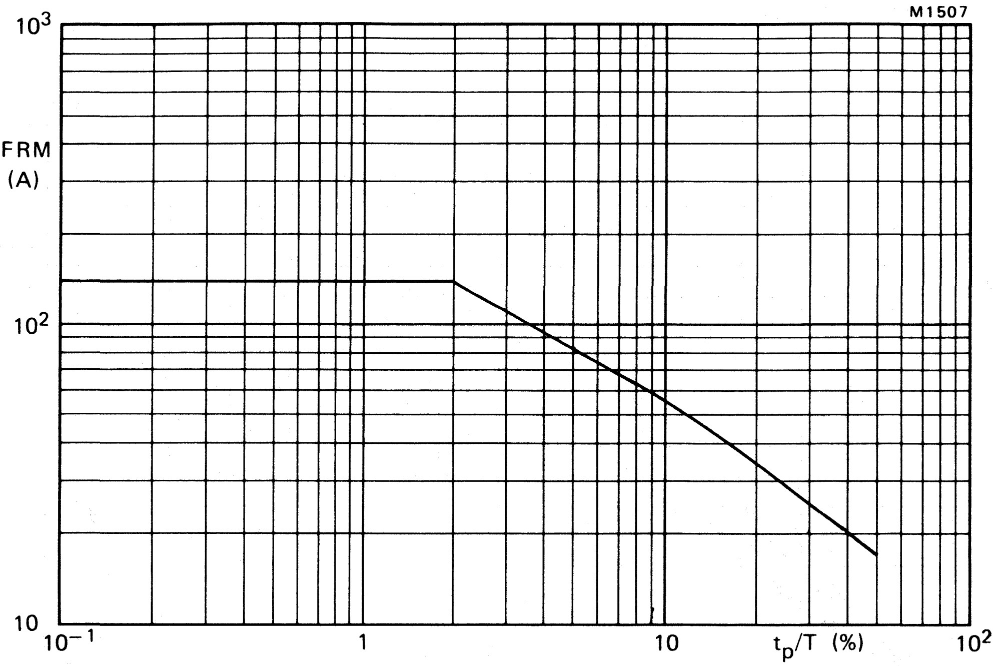
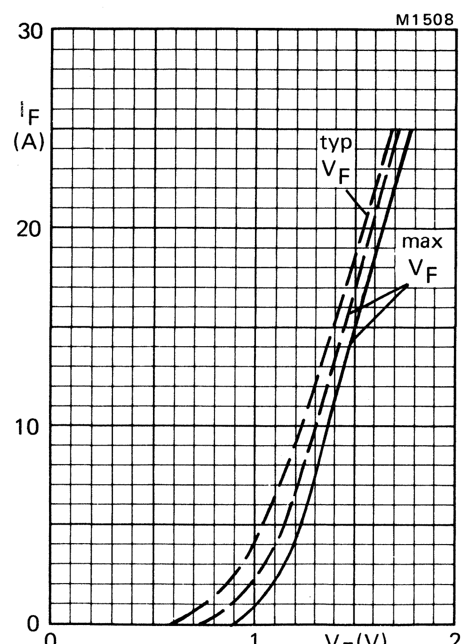
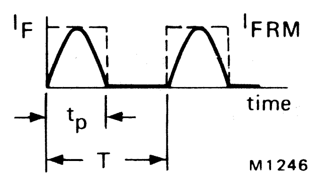


Fig.7 Maximum permissible repetitive peak forward current for square or sinusoidal currents; $1\ \mu s < t_p < 1$ ms.





Definition of I_{FRM} and t_p/T.

Fig.8 —— $T_j = 25\ ^oC$; – – – $T_j = 150\ ^oC$.

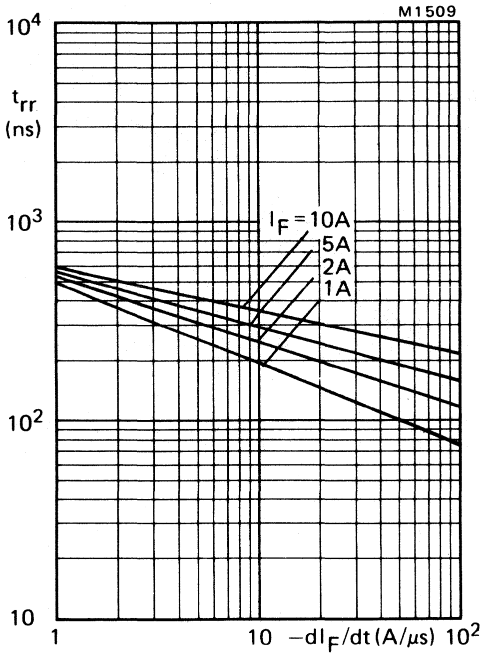


Fig.9 Maximum t_{rr} at T_j = 25 °C.

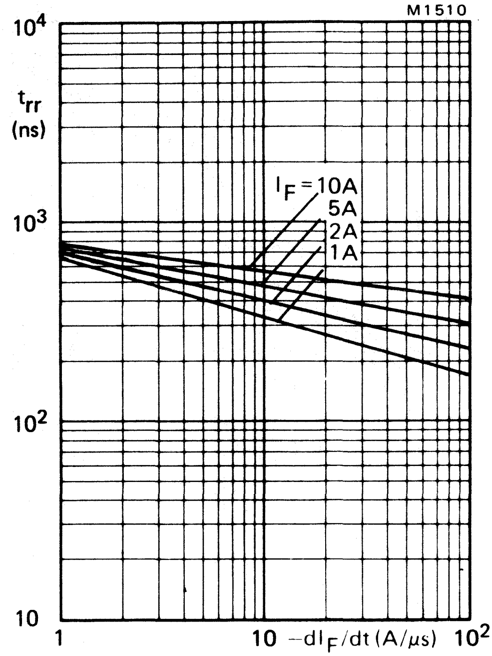


Fig.10 Maximum t_{rr} at T_j = 100 °C.

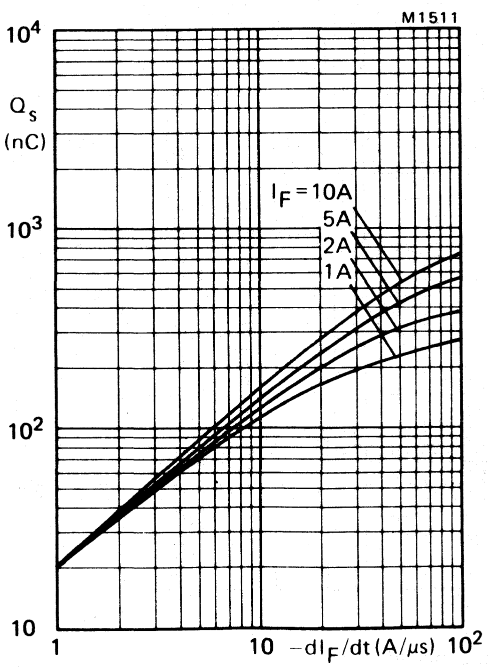


Fig.11 Maximum Q_s at T_j = 25 °C

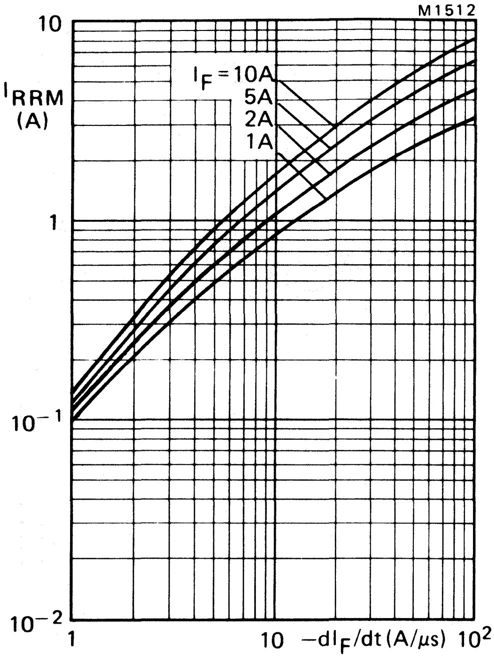


Fig.12 Maximum I_{RRM} at T_j = 25 °C.

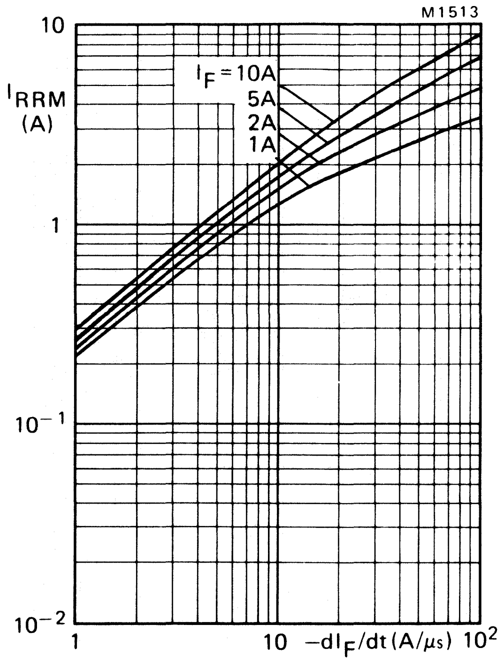


Fig.13 Maximum I_{RRM} at T_j = 100 °C.

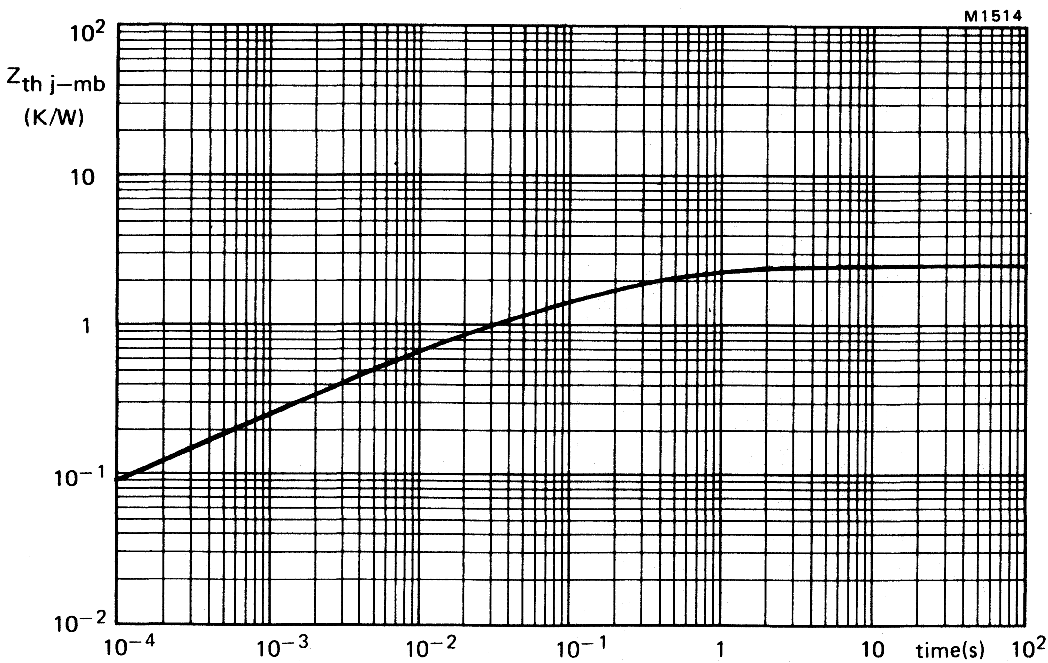


Fig.14 Transient thermal impedance.

ULTRA FAST RECOVERY ELECTRICALLY-ISOLATED RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial rectifier diodes in SOT-186 (full-pack) envelopes, featuring low forward voltage drop, ultra fast reverse recovery times with very low stored charge and soft-recovery characteristic. 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 switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and low switching losses are essential.

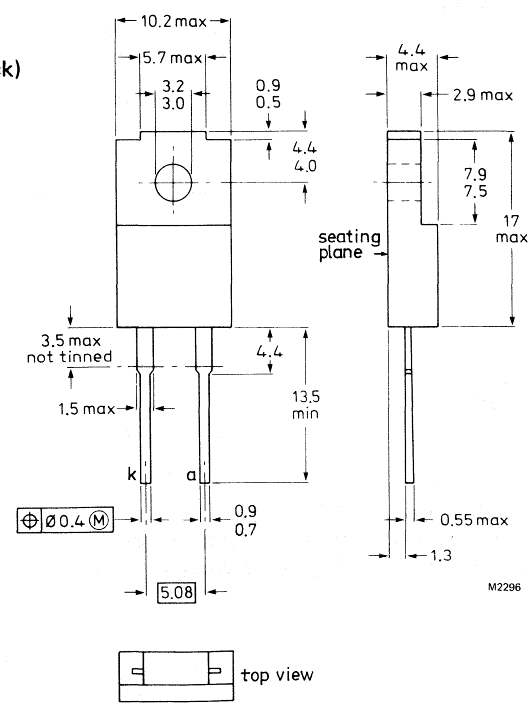
QUICK REFERENCE DATA

			BYR29F-600	700	800	
Repetitive peak reverse voltage	V_{RRM}	max.	600	700	800	V
Average forward current	$I_{F(AV)}$	max.		8		A
Forward voltage	V_F	<		1.3		V
Reverse recovery time	t_{rr}	<		75		ns

MECHANICAL DATA

Fig. 1 SOT-186 (full-pack)

Dimensions in mm



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 (IEC 134).

Voltages

			BYR29F-600	700	800	
Repetitive peak reverse voltage	V_{RRM}	max.	600	700	800	V
Crest working reverse voltage	V_{RWM}	max.	500	500	600	V
Continuous reverse voltage (note 1)	V_R	max.	500	500	600	V

Currents

Average forward current; switching losses negligible up to 100 kHz (note 2);				
→ square wave; $\delta = 0.5$; up to $T_h = 79\ ^{o}C$	$I_{F(AV)}$	max.	8	A
→ sinusoidal; up to $T_h = 87\ ^{o}C$	$I_{F(AV)}$	max.	7.2	A
R.M.S. forward current	$I_{F(RMS)}$	max.	11.5	A
Repetitive peak forward current $t_p = 20\ \mu s$; $\delta = 0.02$	I_{FRM}	max.	130	A
Non-repetitive peak forward current half sine-wave; $T_j = 150°C$ prior to surge; with reapplied $V_{RWM\ max}$				
t = 10 ms	I_{FSM}	max.	60	A
t = 8.3 ms	I_{FSM}	max.	72	A
I^2t for fusing (t = 10 ms)	I^2t	max.	18	A^2s

Temperatures

Storage temperature	T_{stg}		−40 to +150	°C
Junction temperature	T_j	max.	150	°C

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: $R_{th\ j\text{-}a} < 5.7$ K/W.
2. The quoted temperatures assume heatsink compound is used.
3. Mounted without heatsink compound and 20 Newtons pressure on the centre of the evelope.

THERMAL RESISTANCE

From junction to external heatsink with minimum of 2 kgf (20 Newtons) pressure on the centre of the envelope,				
with heatsink compound	$R_{th\ j\text{-}a}$	=	5.5	K/W
without heatsink compound	$R_{th\ j\text{-}a}$	=	7.2	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 stated

Forward voltage				
I_F = 10 A; T = 150°C	V_F	<	1.3	V*
I_F = 25 A	V_F	<	1.75	V*
Reverse current				
$V_R = V_{RWM}$ max; T_j = 100°C	I_R	<	0.2	mA
$V_R = V_{RWM}$ max	I_R	<	10	µA
Reverse recovery when switched from				
I_F = 1 A to $V_R \geq 30$ V with $-dI_F/dt$ = 100 A/µs; recovery time	t_{rr}	<	75	ns
I_F = 2 A to $V_R \geq 30$ V with $-dI_F/dt$ = 20 A/µs; recovered charge	Q_s	<	200	nC
I_F = 10 A to $V_R \geq 30$ V with $-dI_F/dt$ = 50 A/µs; T_j = 100°C; peak recovery current	I_{RRM}	<	6	A
Forward recovery when switched to I_F = 10 A with dI_F/dt = 10 A/µs	V_{fr}	typ.	5	V

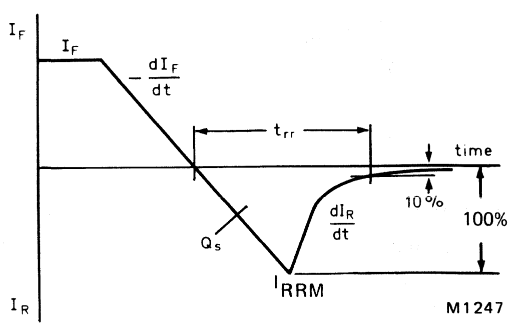


Fig. 2 Definition of t_{rr}, Q_s and I_{RRM}.

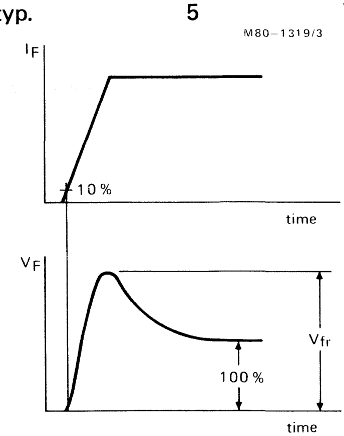


Fig. 3 Definition of V_{fr}.

*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 ^{o}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.4.

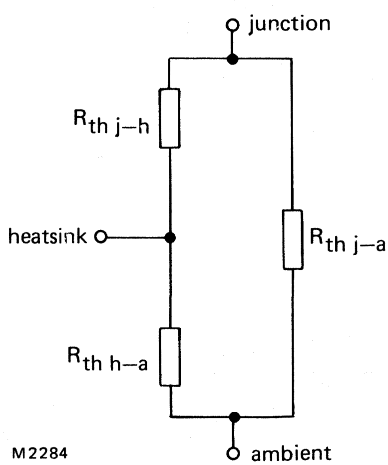


Fig.4.

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

SQUARE-WAVE OPERATION

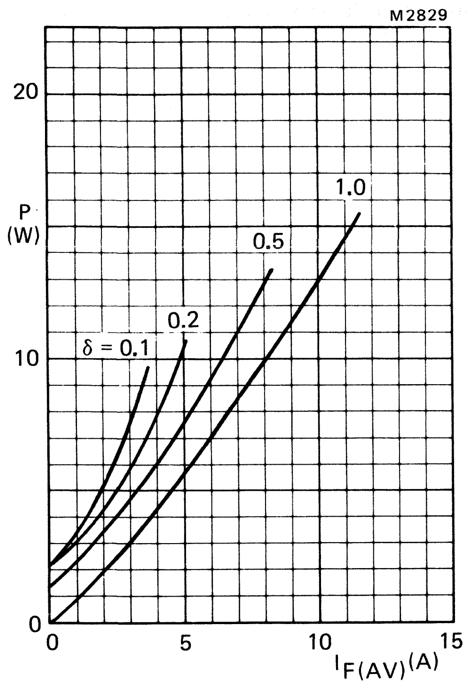
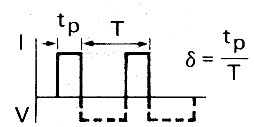


Fig. 5 Power rating.

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.



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

SINUSOIDAL OPERATION

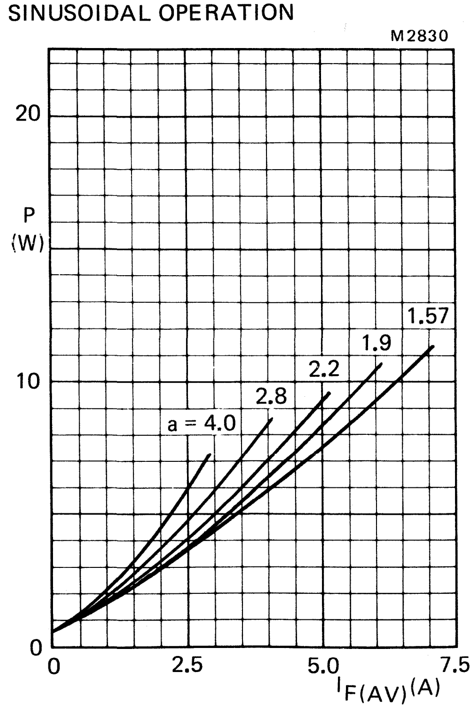


Fig. 6 Power rating.

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 = $I_{F(RMS)}/I_{F(AV)}$

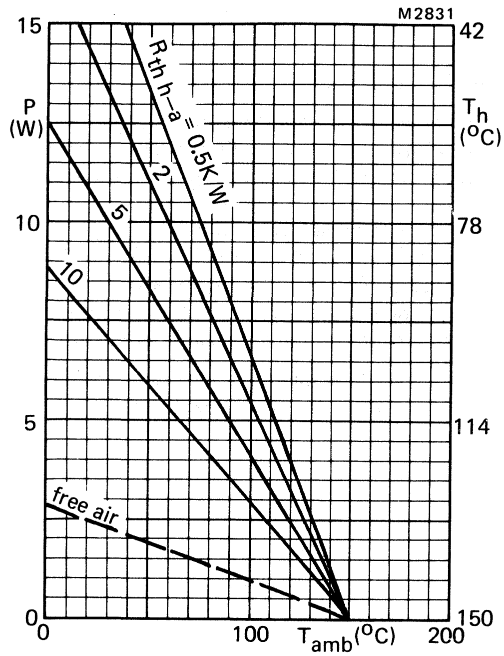


Fig. 7 Heatsink rating; without heatsink compound.

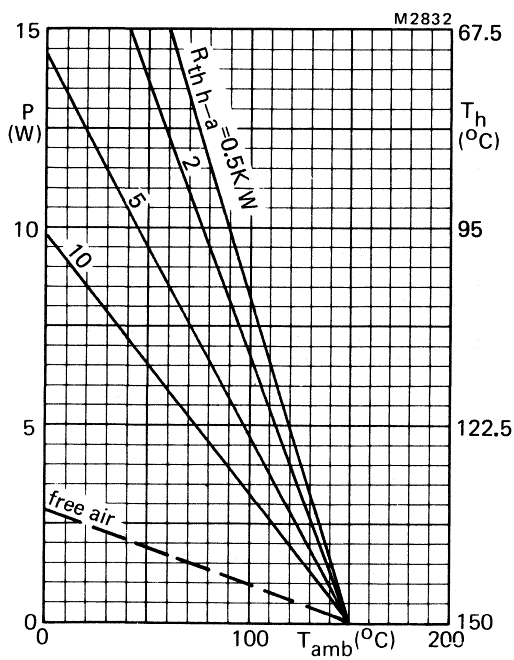


Fig. 8 Heatsink rating; with heatsink compound.

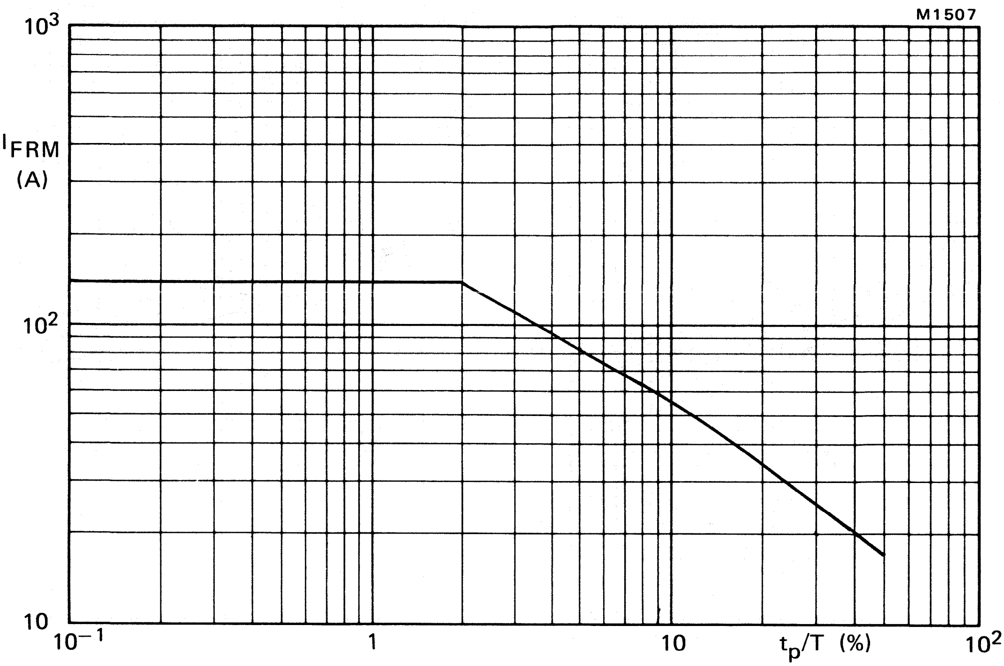
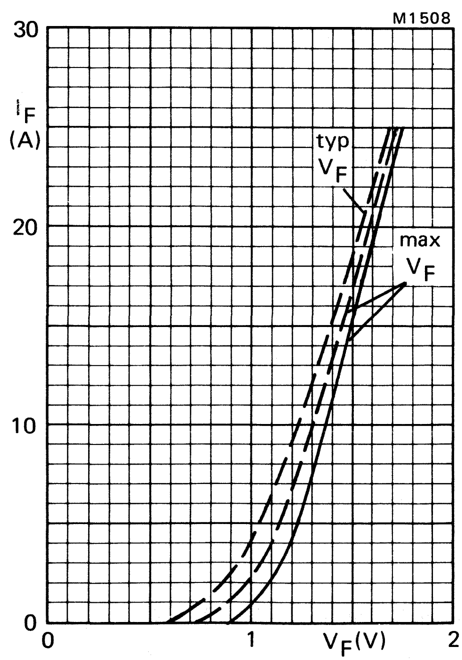
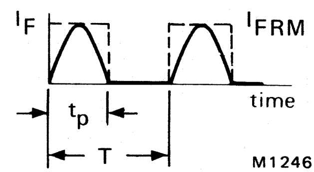


Fig. 9 Maximum permissible repetitive peak forward current for square or sinusoidal currents; $1\ \mu s < t_p < 1$ ms.





Definition of I_{FRM} and t_p/T.

Fig. 10 —— $T_j = 25°C$; – – – $T_j = 150°C$

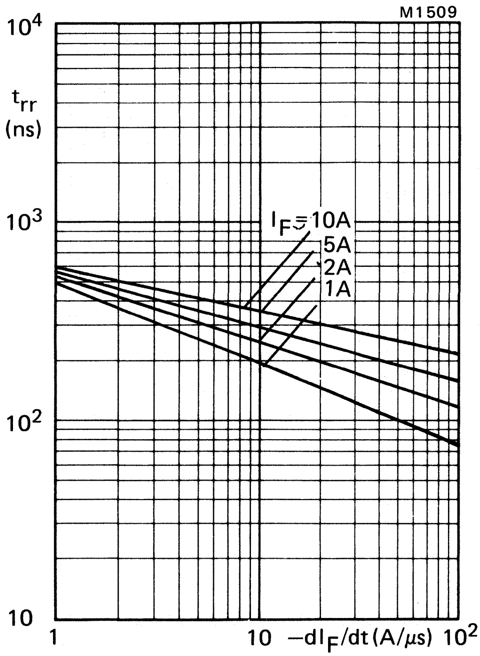


Fig. 11 Maximum t_{rr} at T_j = 25°C

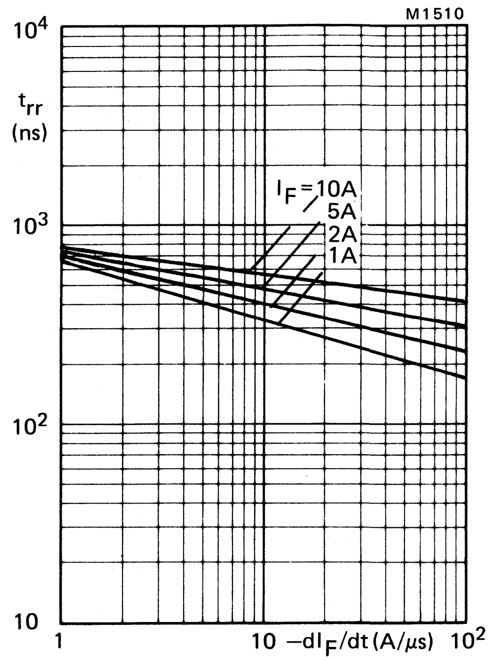


Fig. 12 Maximum t_{rr} at T_j = 100°C.

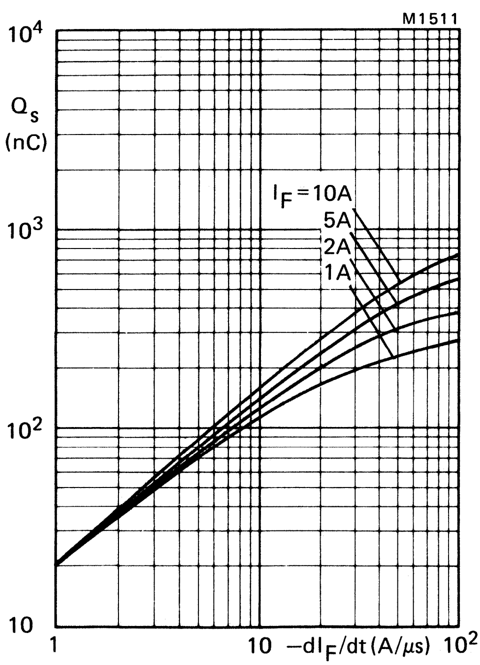


Fig. 13 Maximum Q_s at T_j = 25°C.

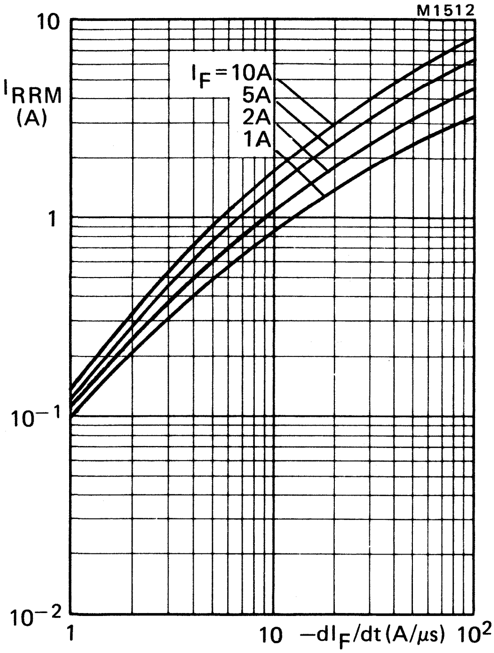


Fig. 14 Maximum I_{RRM} at T_j = 25°C.

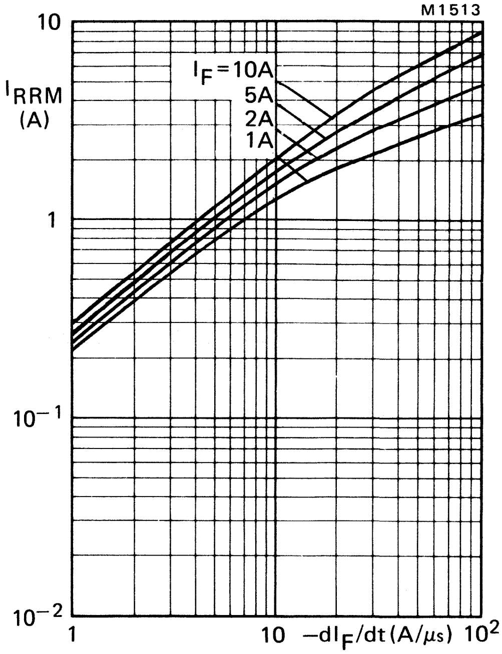


Fig. 15 Maximum I_{RRM} at T_j = 100°C.

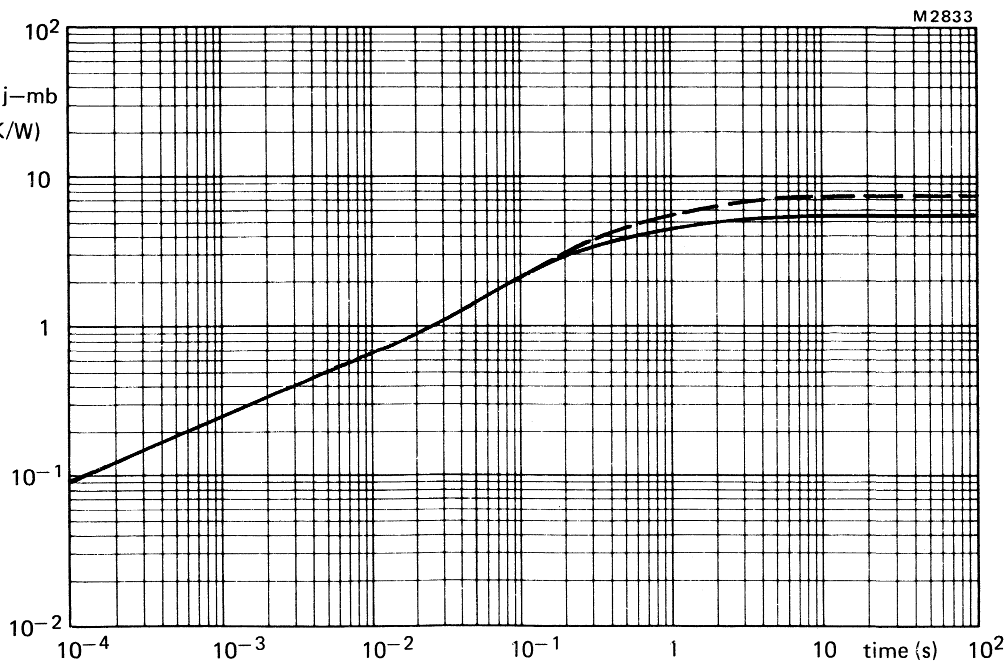


Fig. 16 Transient thermal impedance; —— with heatsink compound; – – – without heatsink compound.

ULTRA FAST-RECOVERY RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial rectifier diodes in DO-4 metal envelopes, featuring low forward voltage drop, ultra fast reverse recovery times, very low stored charge and soft-recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and low switching losses are essential. The series consists of normal polarity (cathode to stud) types.

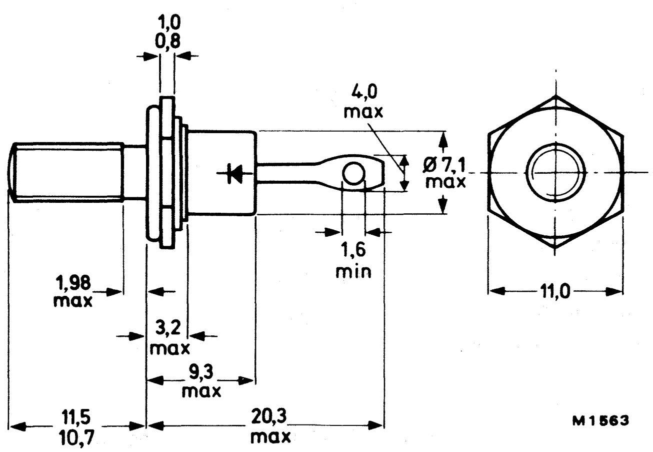
QUICK REFERENCE DATA

			BYR30–500	600	700	
Repetitive peak reverse voltage	V_{RRM}	max.	500	600	700	V
Average forward current	$I_{F(AV)}$	max.		14		A
Forward voltage	V_F	<		1.5		V
Reverse recovery time	t_{rr}	<		100		ns

MECHANICAL DATA

Dimensions in mm

Fig.1 DO-4: with metric M5 stud (ϕ5 mm); e.g. BYR30-600.
with 10-32 UNF stud (ϕ4.83 mm) e.g. BYR30-600U.



Net mass: 6 g

Diameter of clearance hole: max. 5.2 mm

Accessories supplied on request:
56295a (mica washer);
56295b (PTFE ring);
56295c (insulating bush).

Supplied with device: 1 nut, 1 lock washer

Torque on nut: min. 0.9 Nm (9 kg cm)
max. 1.7 Nm (17 kg cm)

Nut dimensions across the flats:
M5: 8.0 mm; 10-32 UNF: 9.5 mm

RATINGS

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

Voltages			BYR30–500	600	700	
Repetitive peak reverse voltage	V_{RRM}	max.	500	600	700	V
Crest working reverse voltage	V_{RWM}	max.	400	500	500	V
Continuous reverse voltage*	V_R	max.	400	500	500	V

Currents

Average forward current; switching losses negligible up to 100 kHz;				
→ square wave; δ = 0.5; up to T_{mb} = 98 °C	$I_{F(AV)}$	max.	14	A
→ sinusoidal; up to T_{mb} = 106 °C	$I_{F(AV)}$	max.	12.5	A
R.M.S. forward current	$I_{F(RMS)}$	max.	20	A
Repetitive peak forward current t_p = 20 μs, δ = 0.02	I_{FRM}	max.	360	A
Non-repetitive peak forward current half sinewave; T_j = 150 °C prior to surge; with reapplied $V_{RWM\,max}$				
t = 10 ms	I_{FSM}	max.	150	A
t = 8.3 ms	I_{FSM}	max.	180	A
I^2t for fusing (t = 10 ms)	I^2t	max.	112	A^2s

Temperatures

Storage temperature	T_{stg}		–55 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	2.0	K/W
From mounting base to heatsink:				
a. with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.3	K/W
b. without heatsink compound	$R_{th\ mb\text{-}h}$	=	0.6	K/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0.3	K/W

MOUNTING INSTRUCTIONS

The top connector should be neither bent nor twisted; it should be soldered into the circuit so that there is no strain on it.
During soldering the heat conduction to the junction should be kept to a minimum.

*To ensure thermal stability: $R_{th\ j\text{-}a} \leqslant$ 5.6 K/W.

CHARACTERISTICS

Forward voltage				
I_F = 15 A; T_j = 150 °C	V_F	<	1.5	V*
I_F = 50 A; T_j = 25 °C	V_F	<	2.0	V*
Reverse current				
$V_R = V_{RWM\,max}$; T_j = 100 °C	I_R	<	0.4	mA
$V_R = V_{RWM\,max}$; T_j = 25 °C	I_R	<	25	μA
Reverse recovery when switched from				
I_F = 1 A to $V_R \geq 30$ V with $-dI_F/dt$ = 100 A/μs; T_j = 25 °C; recovery time	t_{rr}	<	100	ns
I_F = 2 A to $V_R \geq 30$ V with $-dI_F/dt$ = 20 A/μs; T_j = 25 °C; recovered charge	Q_s	<	220	nC
I_F = 10 A to $V_R \geq 30$ V with $-dI_F/dt$ = 50 A/μs; T_j = 100 °C; peak recovery current	I_{RRM}	<	8	A
Forward recovery when switched to I_F = 10 A with dI_F/dt = 10 A/μs; T_j = 25 °C	V_{fr}	typ.	5.1	V

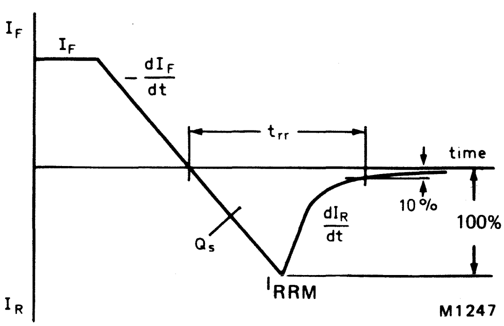


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

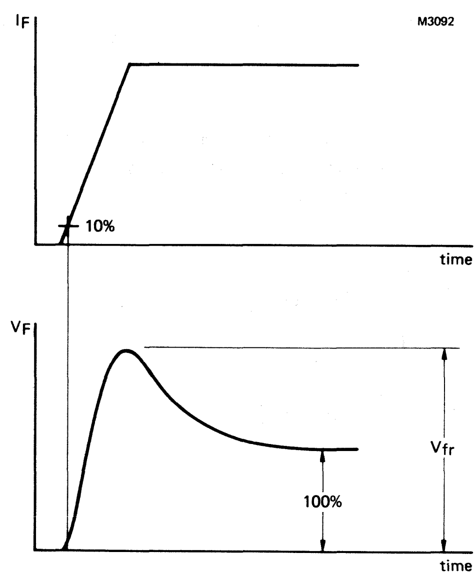


Fig.3 Definition of V_{fr}.

*Measured under pulse conditions to avoid excessive dissipation.

SQUARE-WAVE OPERATION

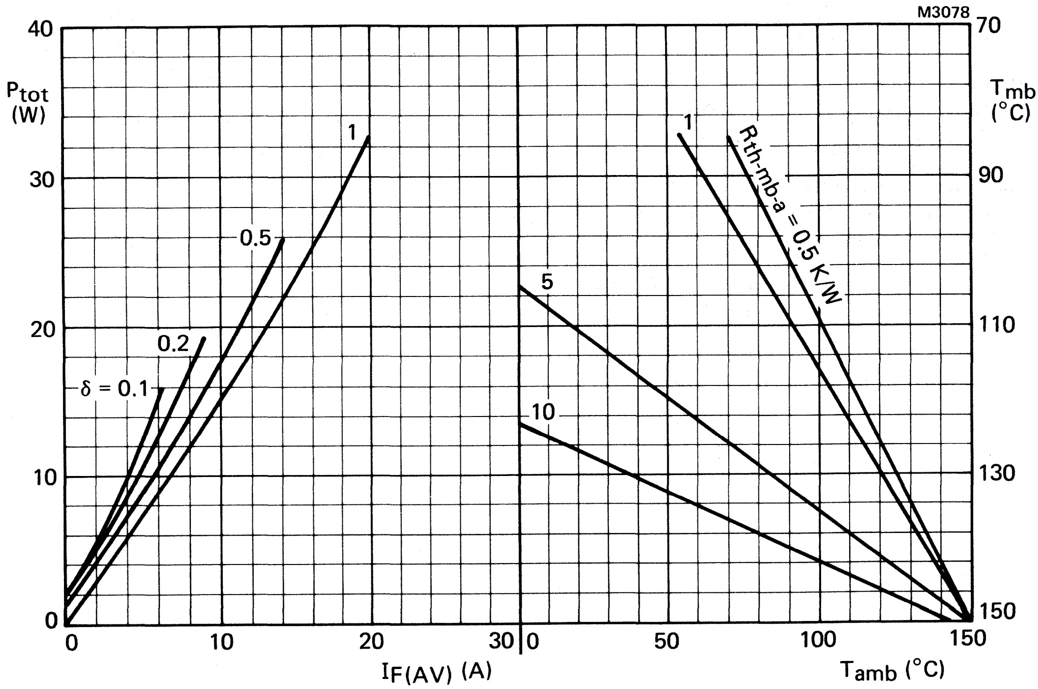
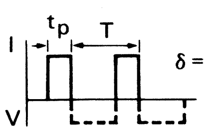


Fig.4 The right-hand part shows the relationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 100 kHz.



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

SINUSOIDAL OPERATION

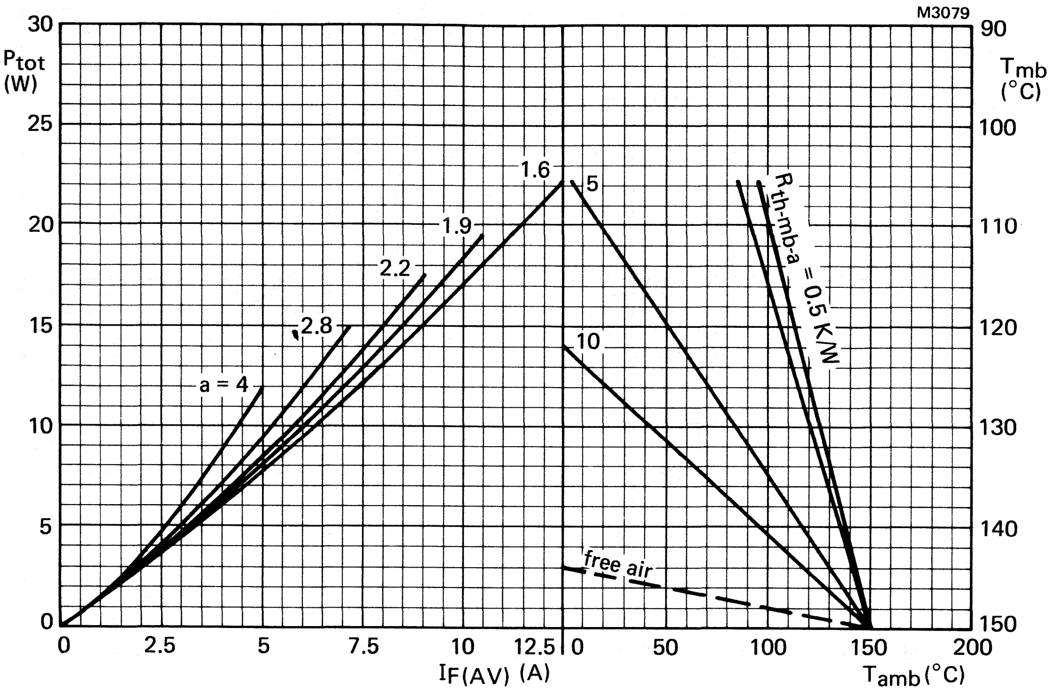


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

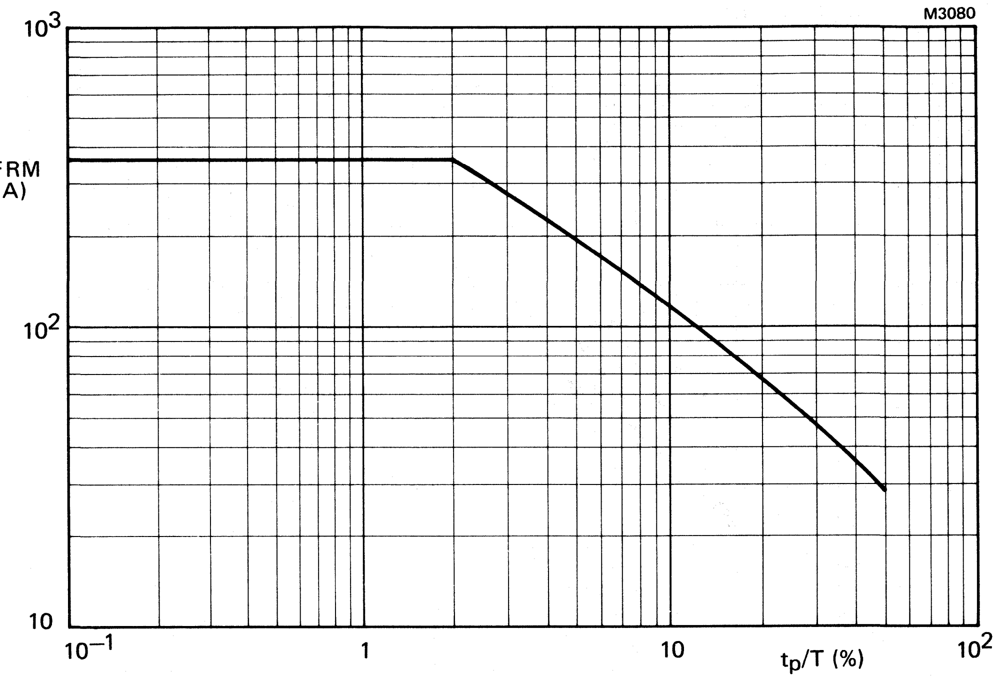
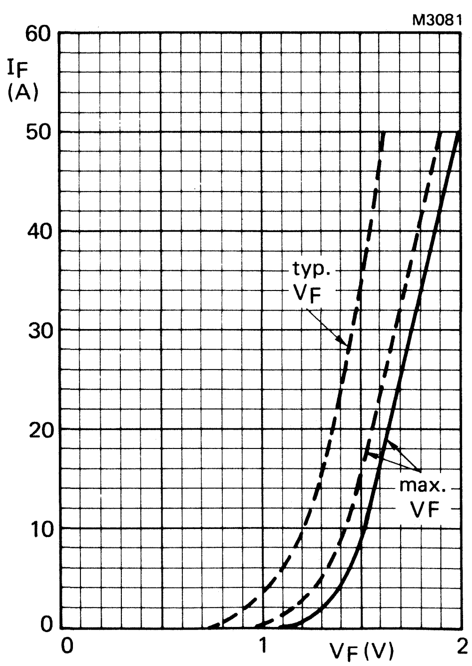
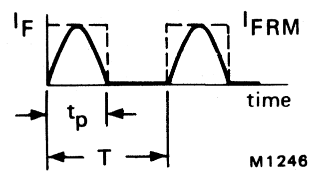


Fig.6 Maximum permissible repetitive peak forward current for square or sinusoidal currents; $1\ \mu s < t_p < 1$ ms.





Definition of I_{FRM} and t_p/T.

Fig.7 —— T_j = 25 °C – – – T_j = 150 °C.

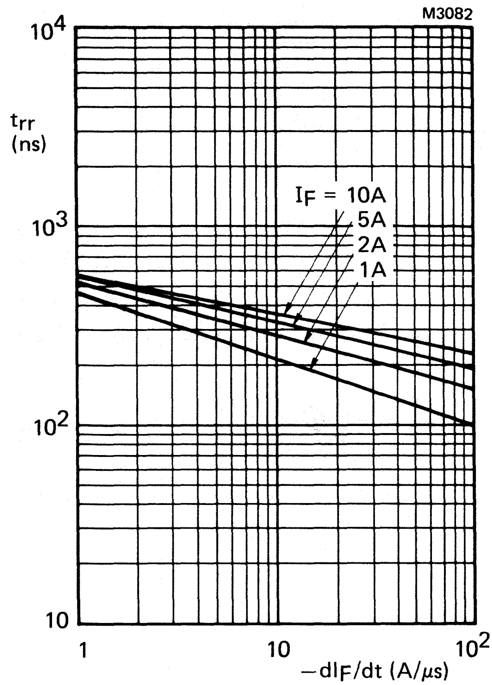


Fig.8 Maximum t_{rr} at T_j = 25 °C.

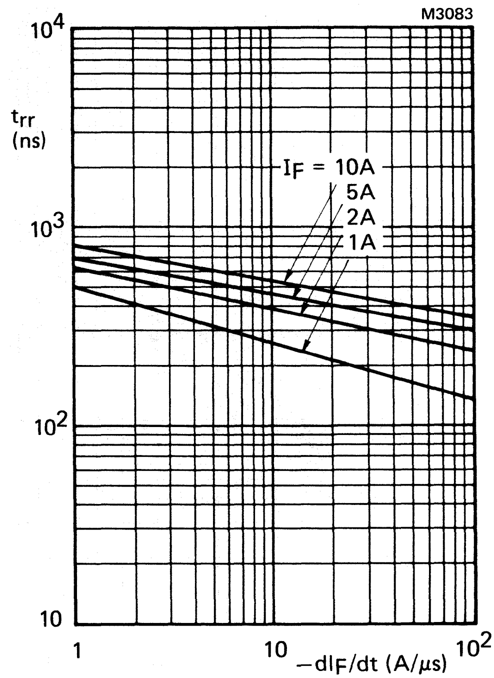


Fig.9 Maximum t_{rr} at T_j = 100 °C.

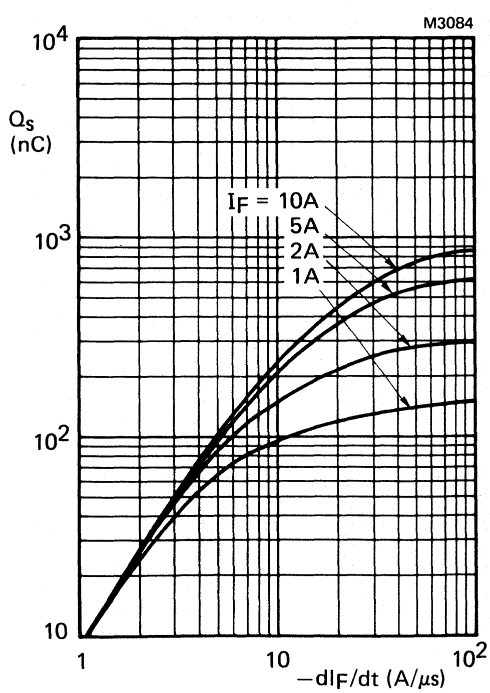


Fig.10 Maximum Q_s at T_j = 25 °C.

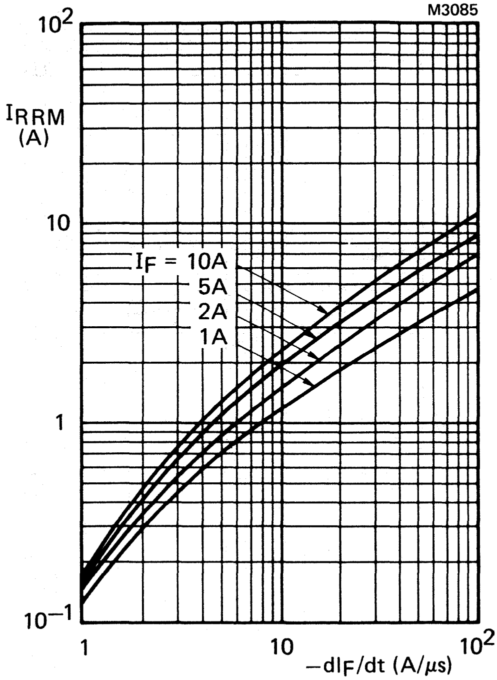


Fig.11 Maximum I_{RRM} at T_j = 25 °C.

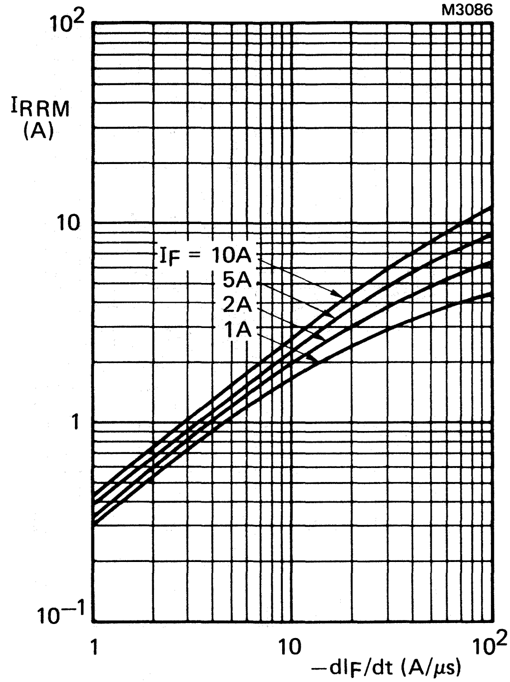


Fig.12 Maximum I_{RRM} at T_j = 100 °C.

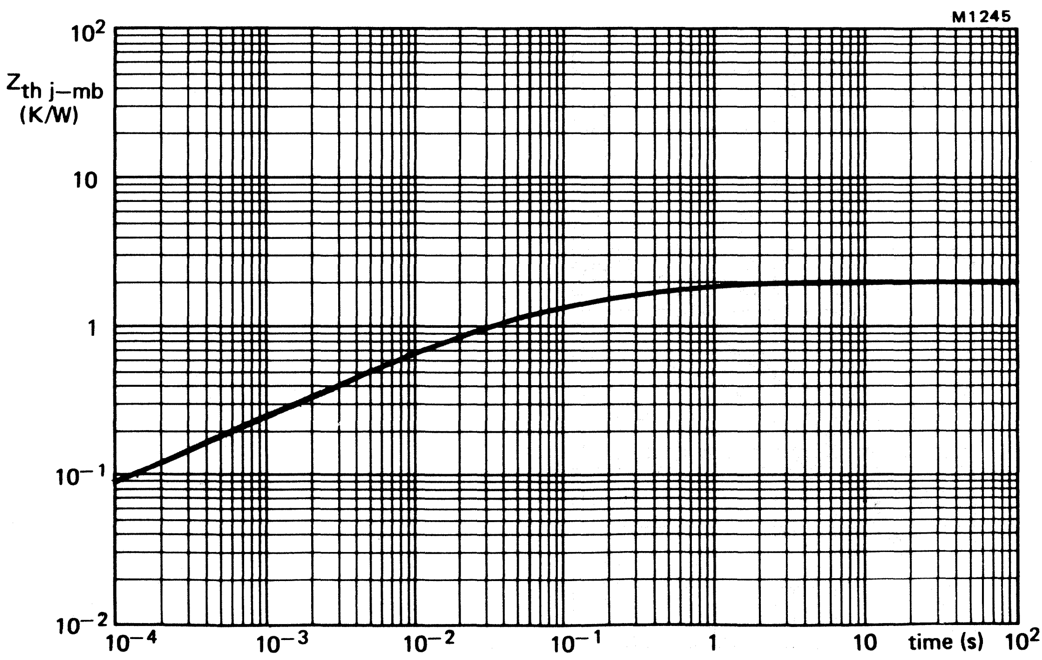


Fig.13 Transient thermal impedance.

ULTRA FAST RECOVERY DOUBLE RECTIFIER DIODES

Glass-passivated, high-efficiency double rectifier diodes in plastic envelopes, featuring low forward voltage drop, ultra fast reverse recovery times and soft-recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and low switching losses are essential. Their single chip (monolithic) 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.

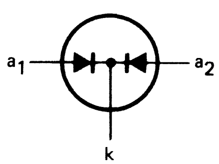
QUICK REFERENCE DATA

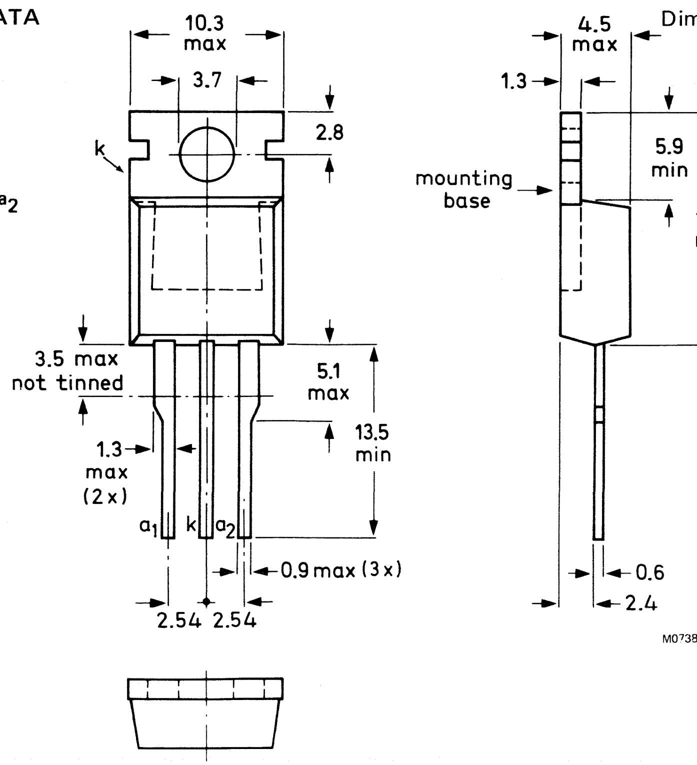
Per diode, unless otherwise stated			BYR34–500	600	700	800	
Repetitive peak reverse voltage	V_{RRM}	max.	500	600	700	800	V
Output current (both diodes conducting)	I_O	max.	20				A
Forward voltage	V_F	<	1.25				V
Reverse recovery time	t_{rr}	<	80				ns

MECHANICAL DATA

Dimensions in mm

Fig.1 TO-220AB





Net mass: 2 g.
Note: the exposed metal mounting base is directly connected to the common-cathode.
Accessories supplied on request: see data sheets Mounting instructions and accessories for TO-220 envelopes.

RATINGS

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

			BYR34–500	600	700	800	
Voltages (per diode)							
Repetitive peak reverse voltage	V_{RRM}	max.	500	600	700	800	V
Crest working reverse voltage	V_{RWM}	max.	400	500	500	600	V
Continuous reverse voltage	V_R	max.	400	500	500	600	V

Currents (both diodes conducting; note 1)

Output current; switching losses negligible up to 100 kHz; square wave; δ = 0.5; up to T_{mb} = 105 °C	I_O	max.	20	A
RMS forward current (note 2)	$I_{F(RMS)}$	max.	28	A
Repetitive peak forward current t_p = 20 μs; δ = 0.02 (per diode)	I_{FRM}	max.	185	A
Non-repetitive peak forward current (per diode) half sinewave; T_j = 150 °C prior to surge; with reapplied $V_{RWM\,max}$ t = 10 ms	I_{FSM}	max.	100	A

Temperatures

Storage temperature	T_{stg}		−40 to +150	°C
Junction temperature	T_j	max.	150	°C

Notes:

1. The limits for both diodes apply whether both diodes conduct simultaneously or on alternate half cycles.
2. For output currents in excess of 20 A, connection should be made to the exposed metal mounting base.

CHARACTERISTICS (per diode)

Forward voltage				
I_F = 10 A; T_j = 150 °C	V_F	<	1.25	V*
I_F = 30 A; T_j = 25 °C	V_F	<	1.65	V*
Reverse current				
$V_R = V_{RWM\,max}$; T_j = 100 °C	I_R	<	1.0	mA
$V_R = V_{RWM\,max}$; T_j = 25 °C	I_R	<	25	μA
Reverse recovery when switched from				
I_F = 1 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 100 A/μs; T_j = 25 °C; recovery time	t_{rr}	<	80	ns
I_F = 2 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 20 A/μs; T_j = 25 °C; recovered charge	Q_s	<	220	nC

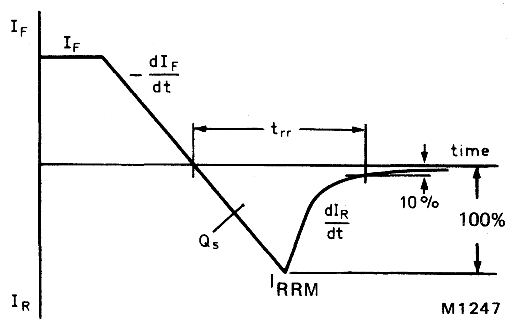


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

DEVELOPMENT DATA

*Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

From junction to mounting base (both diodes conducting)	$R_{th\ j\text{-}mb}$	=	1.6	K/W
From junction to mounting base (per diode)	$R_{th\ j\text{-}mb}$	=	2.3	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 insulator (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 value 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 device lead length and with copper laminate on the board	$R_{th\ j\text{-}a}$	=	60	K/W

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 calculations

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

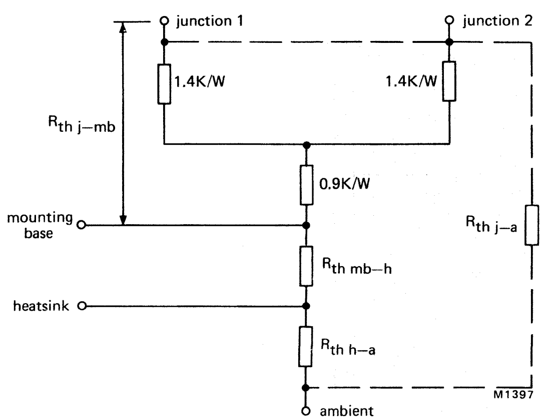


Fig.3.

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

SQUARE-WAVE OPERATION (PER DIODE)

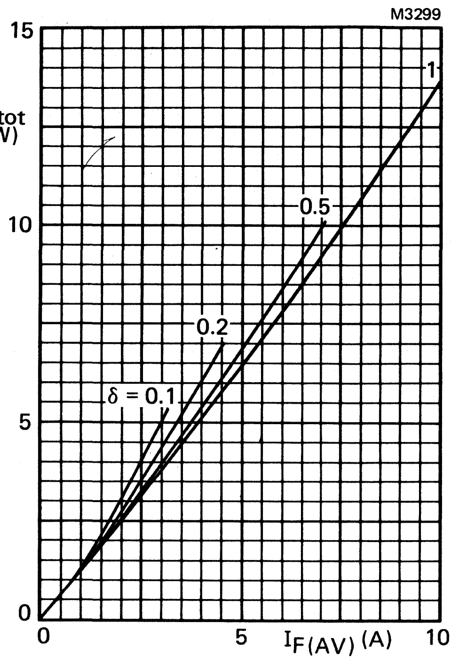
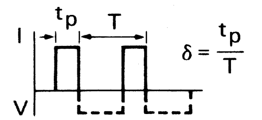


Fig.4 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.5 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.



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

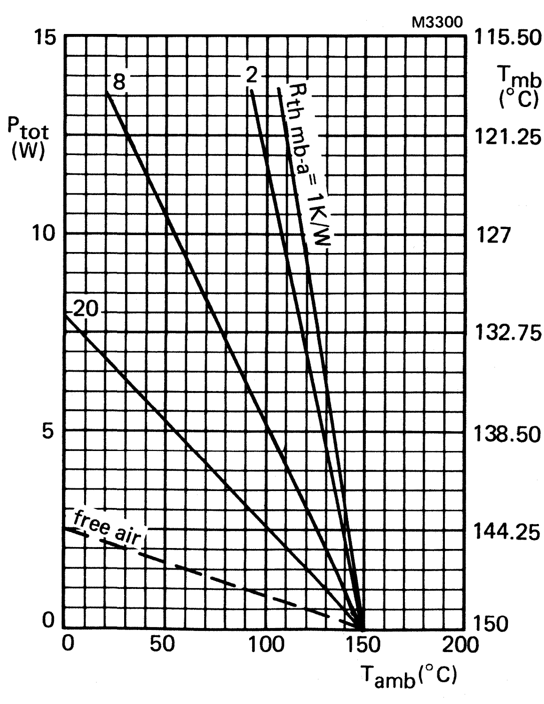


Fig.5.

SINUSOIDAL OPERATION (PER DIODE)

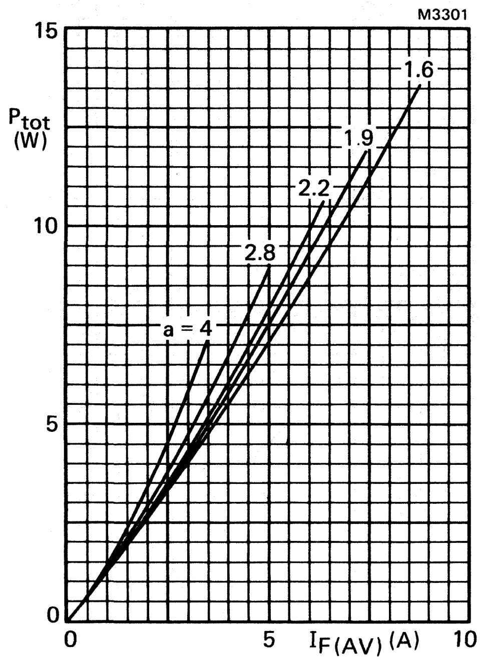


Fig.6 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.5 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.

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

DEVELOPMENT DATA

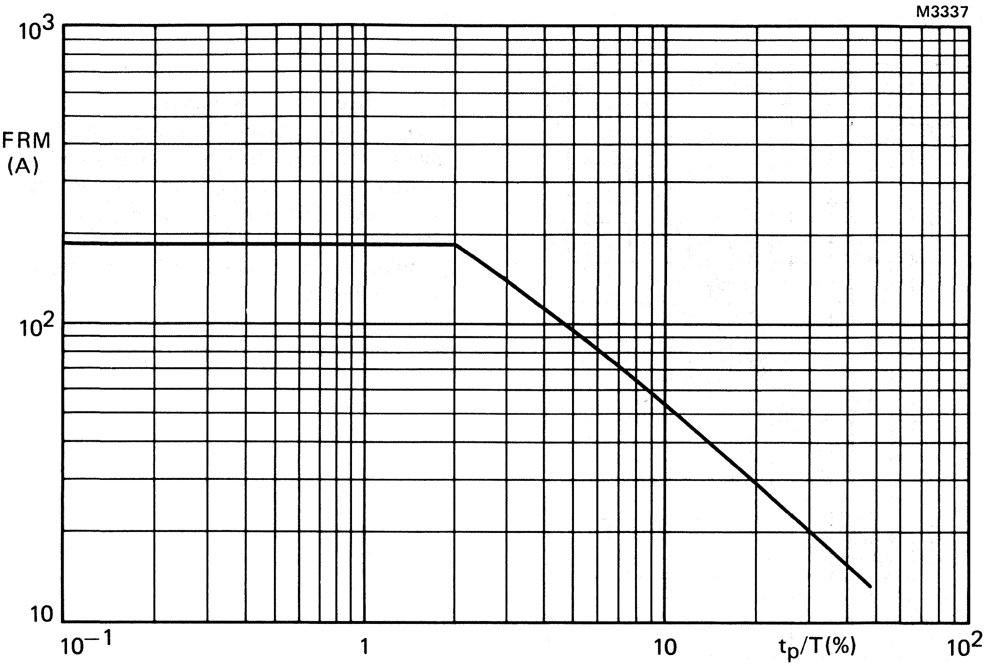
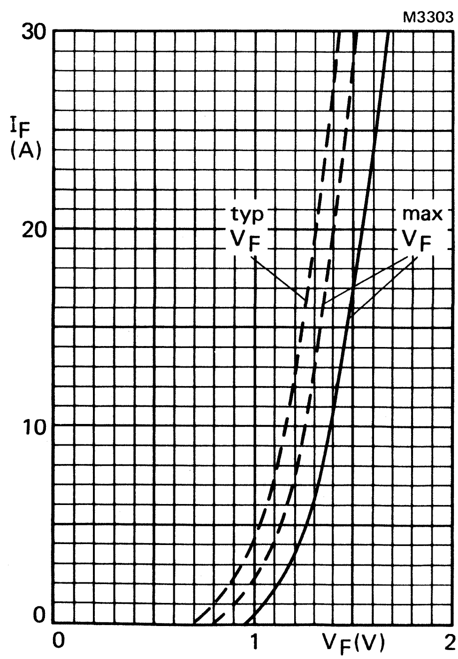
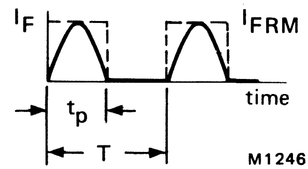


Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 $\mu s < t_p < 1$ ms; per diode.





Definition of I_{FRM} and t_p/T

Fig.8 —— T_j = 25 °C; – – – T_j = 150 °C; per diode.

DEVELOPMENT DATA

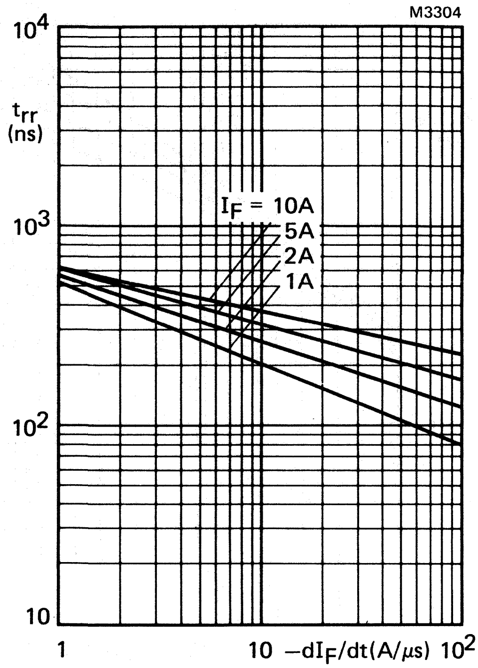


Fig.9 Maximum t_{rr} at T_j = 25 °C; per diode.

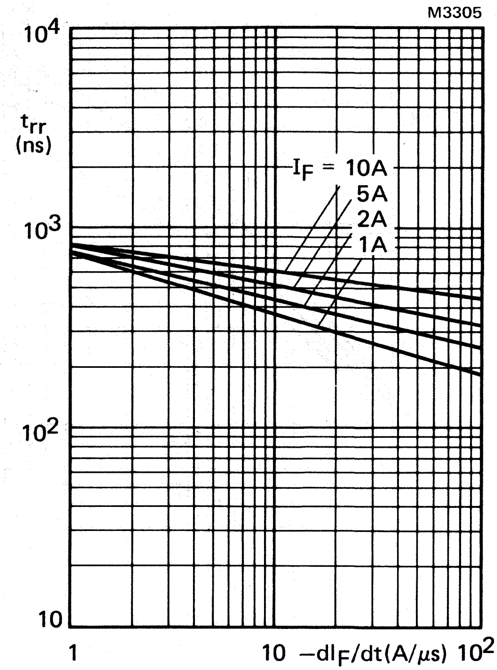


Fig.10 Maximum t_{rr} at T_j = 100 °C; per diode.

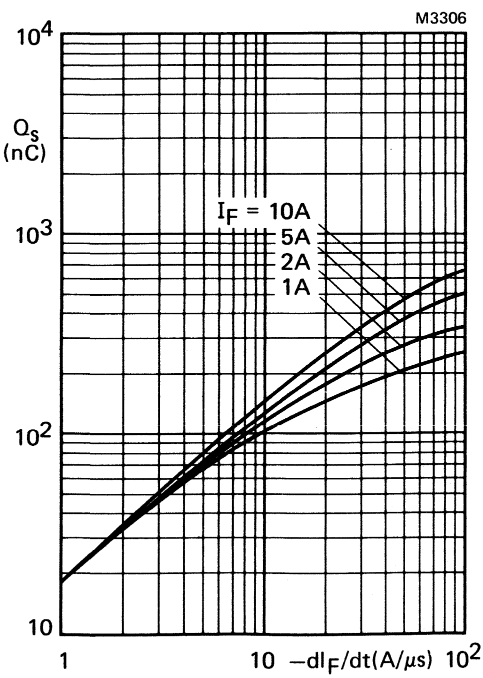


Fig.11 Maximum Q_s at T_j = 25 °C; per diode.

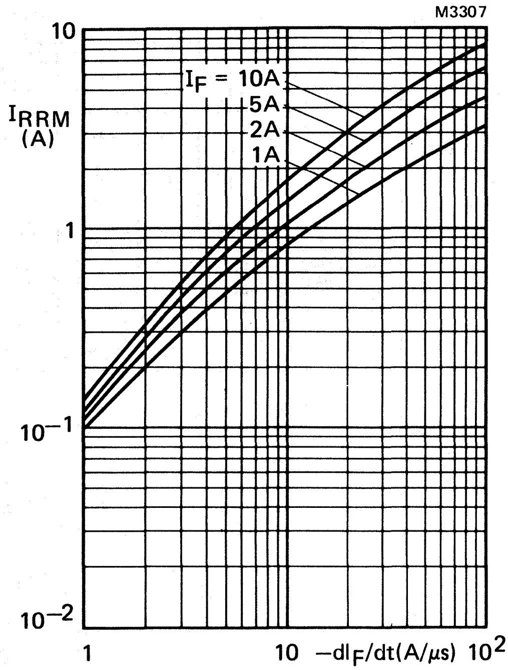


Fig.12 Maximum I_{RRM} at T_j = 25 °C; per diode.

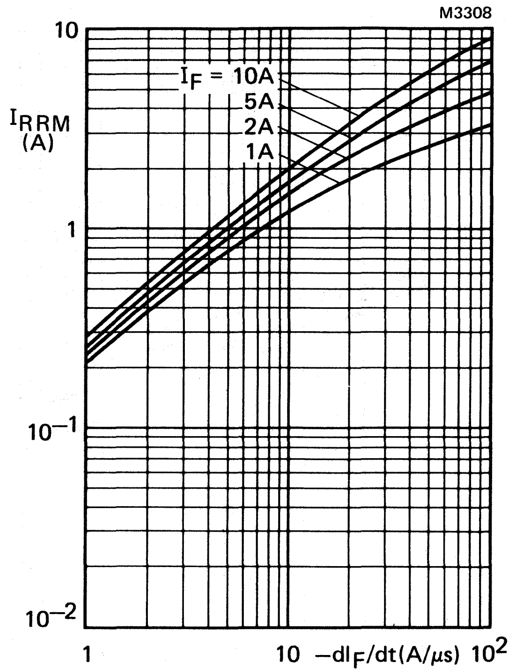


Fig.13 Maximum I_{RRM} at T_j = 100 °C; per diode.

ULTRA FAST-RECOVERY RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial rectifier diodes in plastic envelopes, featuring low forward voltage drop, ultra fast reverse recovery times with very low stored charge and soft-recovery characteristic. They are intended for use in switched-mode power supplies, SRPS and high-frequency circuits in general, where both low conduction losses and low switching losses are essential.
The series consists of normal polarity (cathode to mounting base) types.

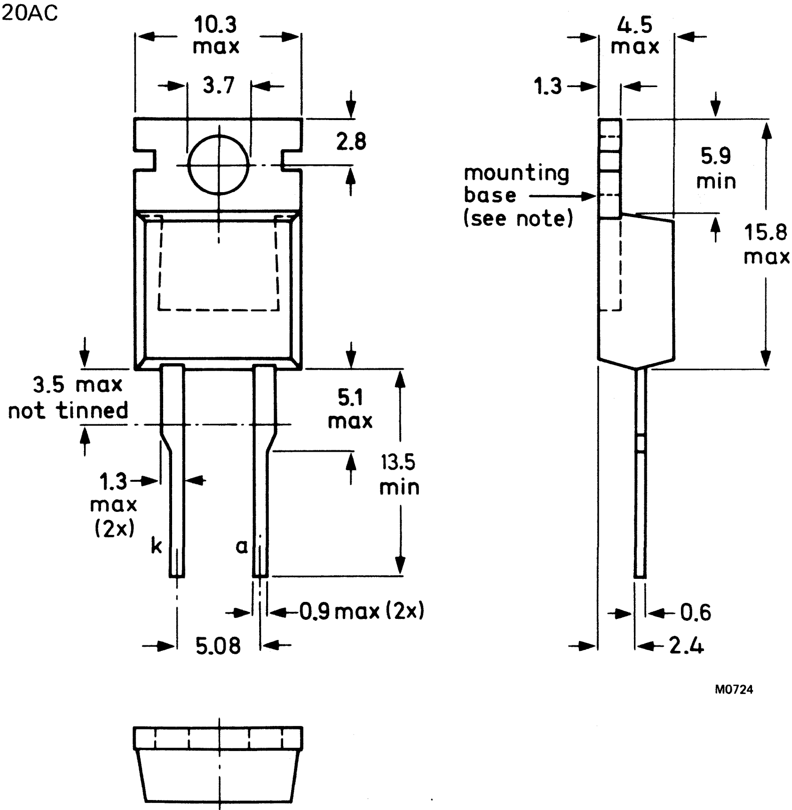
QUICK REFERENCE DATA

			BYR79–500	600	700	800	
Repetitive peak reverse voltage	V_{RRM}	max	500	600	700	800	V
Average forward current	$I_{F(AV)}$	max.	14				A
Foward voltage	V_F	$<$	1.5				V
Reverse recovery time	t_{rr}	$<$	100				ns

MECHANICAL DATA

Dimensions in mm

Fig.1 TO-220AC



Net mass: 2g
Note: the exposed metal mounting base is directly connected to the cathode.
Accessories supplied on request: see data sheets Mounting Instructions and accessories for TO-220 envelopes.

RATINGS

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

Voltages			BYR79–500	600	700	800	
Repetitive peak reverse voltage	V_{RRM}	max.	500	600	700	800	V
Crest working reverse voltage	V_{RWM}	max.	400	500	500	600	V
Continuous reverse voltage	V_R	max.	400	500	500	600	V

Currents				
Average forward current; switching losses negligible up to 100 kHz; → square wave; $\delta = 0.5$; up to $T_{mb} = 98\ ^oC$	$I_{F(AV)}$	max.	14	A
R.M.S. forward current	$I_{F(RMS)}$	max.	20	A
Repetitive peak forward current $t_p = 20\ \mu s$, $\delta = 0.02$	I_{FRM}	max.	360	A
Non-repetitive peak forward current half sinewave; $T_j = 150\ ^oC$ prior to surge; with reapplied $V_{RWM\ max}$ t = 10 ms	I_{FSM}	max.	90	A

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

CHARACTERISTICS

Forward voltage				
I_F = 15 A; T_j = 150 °C	V_F	<	1.5	V*
I_F = 50 A; T_j = 25 °C	V_F	<	2.0	V*
Reverse current				
$V_R = V_{RWM\ max}$; T_j = 100 °C	I_R	<	0.4	mA
$V_R = V_{RWM\ max}$; T_j = 25 °C	I_R	<	25	μA
Reverse recovery when switched from				
I_F = 1 A to $V_R \geq 30$ V with $-dI_F/dt$ = 100 A/μs; T_j = 25 °C; recovery time	t_{rr}	<	100	ns
I_F = 2 A to $V_R \geq 30$ V with $-dI_F/dt$ = 20 A/μs; T_j = 25 °C; recovered charge	Q_s	<	220	nC

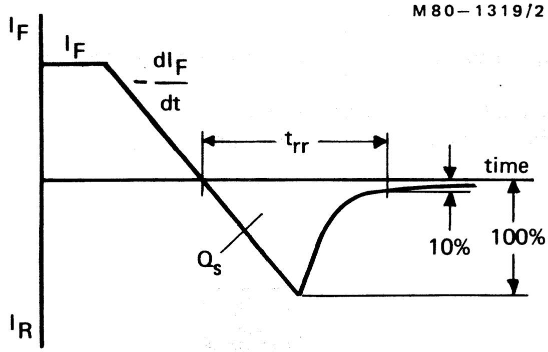


Fig.2 Definition of t_{rr} and Q_s

*Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	2.0	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 insulator (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 value 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 a = any lead length	$R_{th\ j\text{-}a}$	=	60	K/W

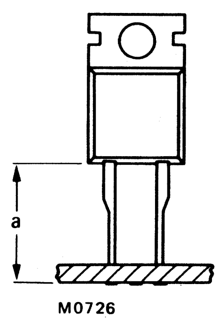


Fig. 3

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 ^{o}C; it 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 not less than 1.0 mm.
3. It is recommended that the circuit connection be made to the cathode tag, rather than direct to the heatsink.
4. 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 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.
5. For good thermal contact heatsink compound should be used between base-plate 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.
6. 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:

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

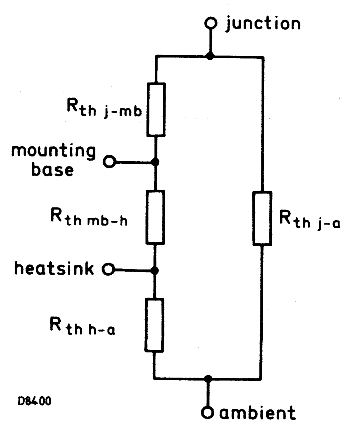


Fig. 4.

b. The method of using Figs. 5 and 6 is as follows:
   Starting with the required current on the $I_{F(AV)}$ axis, trace upwards to meet the appropriate duty factor or form factor curve. Trace right horizontally and upwards from the appropriate value on the T_{amb} scale. The intersection determines the $R_{th\ mb\text{-}a}$. The heatsink thermal resistance value ($R_{th\ h\text{-}a}$) can now be calculated from:

   $R_{th\ h\text{-}a} = R_{th\ mb\text{-}a} - R_{th\ mb\text{-}h}$.

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

SQUARE-WAVE OPERATION

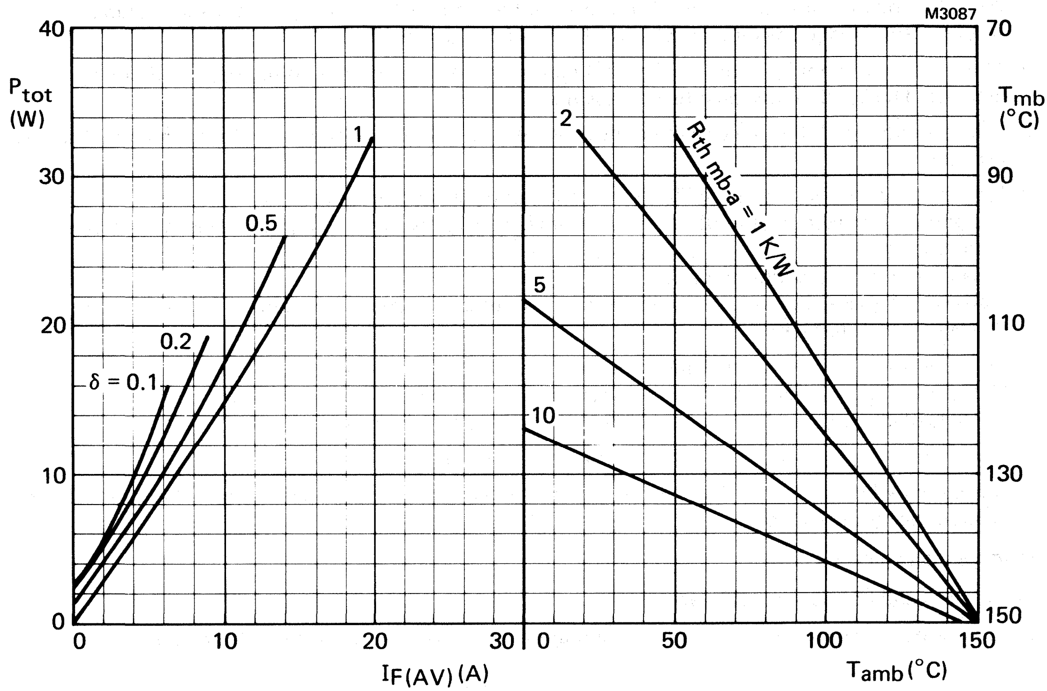
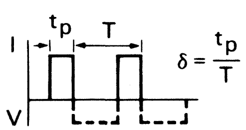


Fig.5 The right-hand part shows the relationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 100 kHz.



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

SINUSOIDAL OPERATION

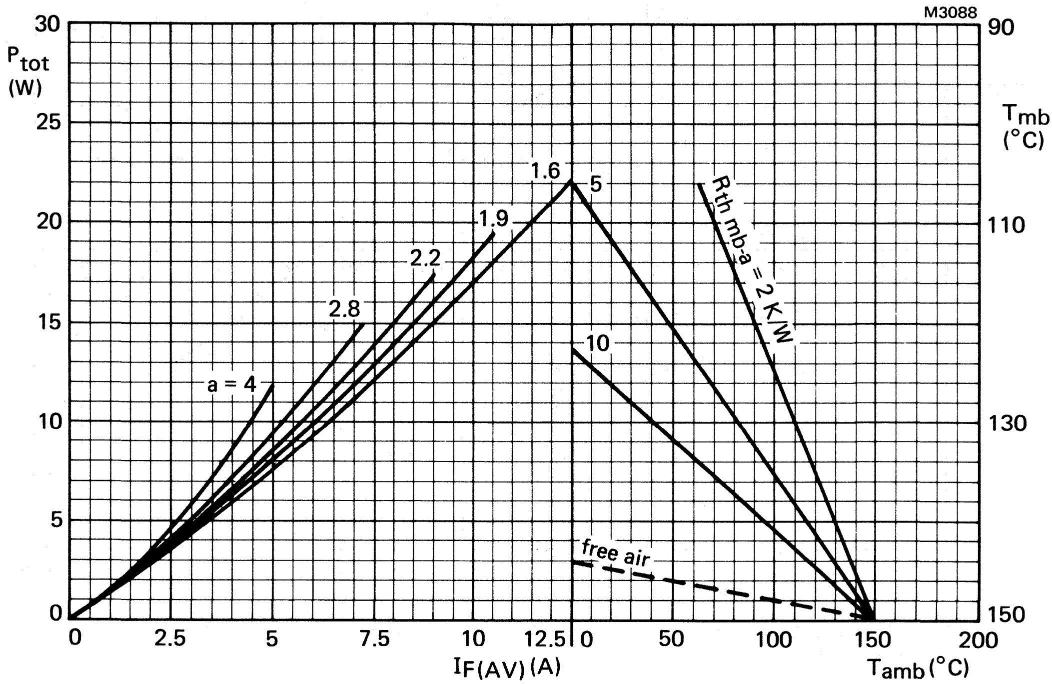


Fig.6 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

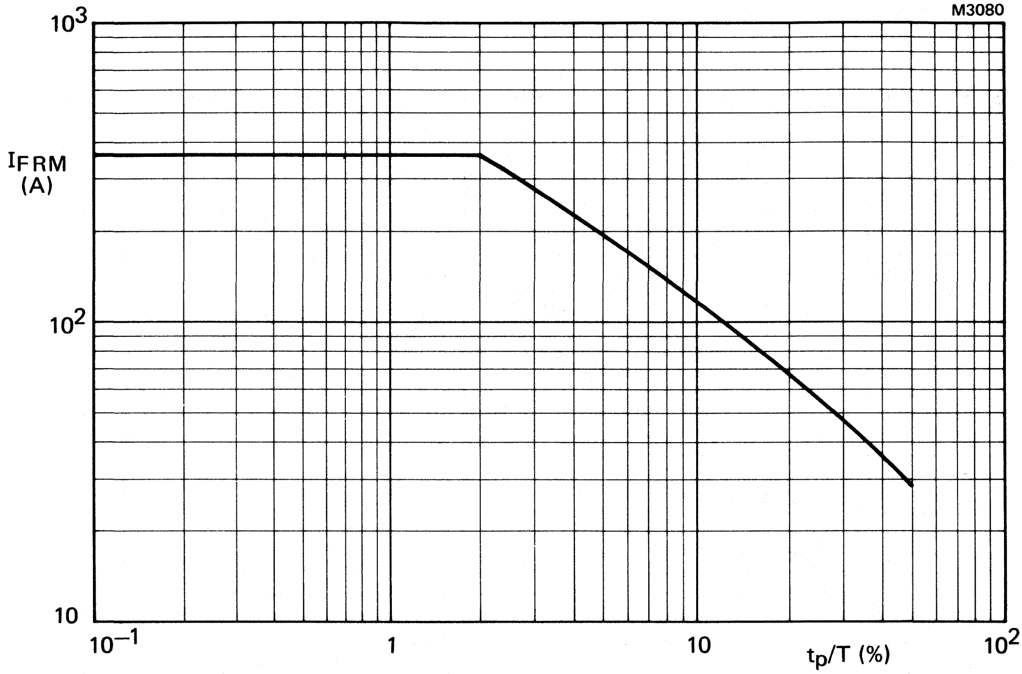
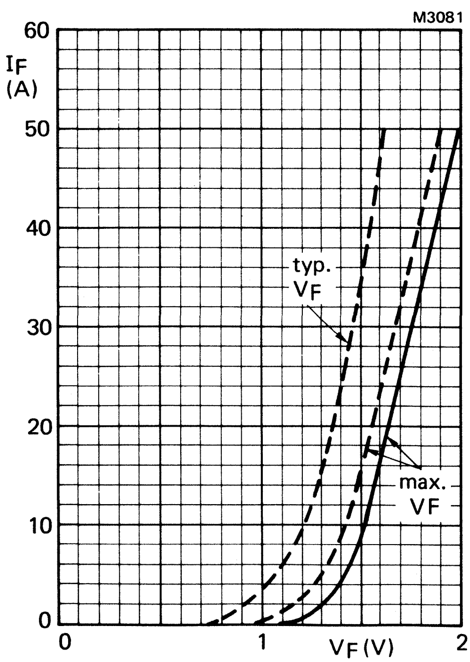
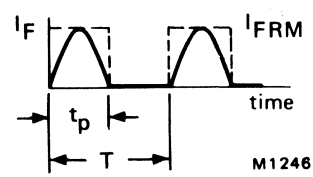


Fig.7 Maximum permissible repetitive peak forward current for square or sinusoidal currents, $1\ \mu s < t_p < 1$ ms.





Definition of I_{FRM} and t_p/T.

Fig.8 —— $T_j = 25\ ^oC$ – – – $T_j = 150\ ^oC$.

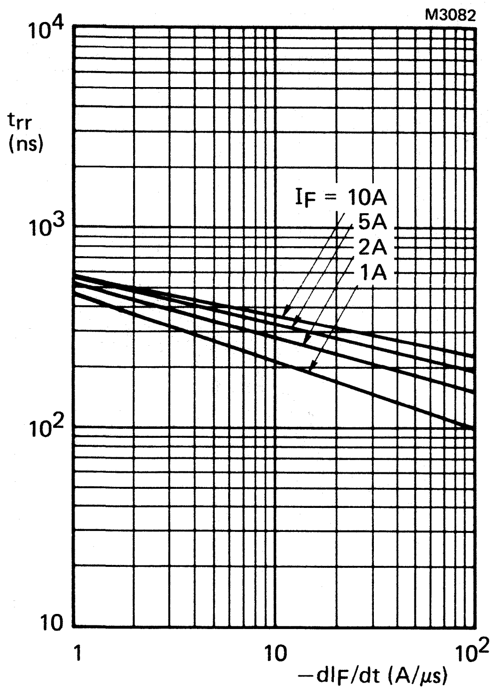


Fig.9 Maximum t_{rr} at T_j = 25 °C.

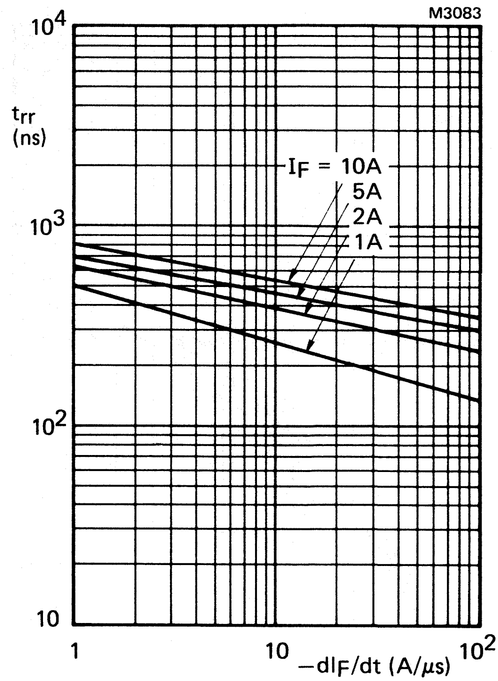


Fig.10 Maximum t_{rr} at T_j = 100 °C.

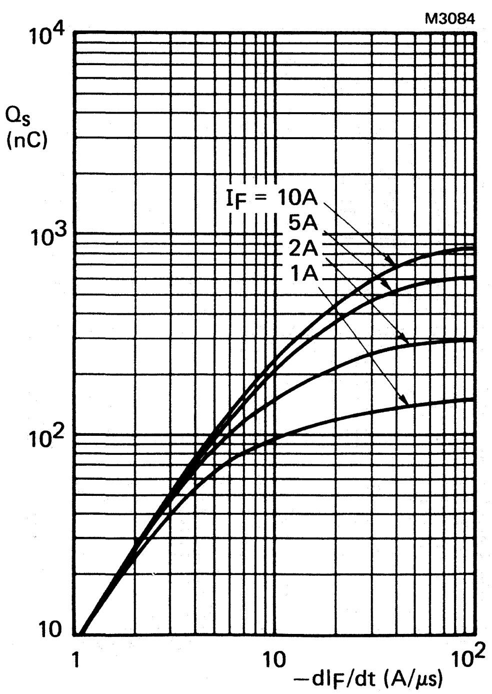


Fig.11 Maximum Q_s at T_j = 25 °C.

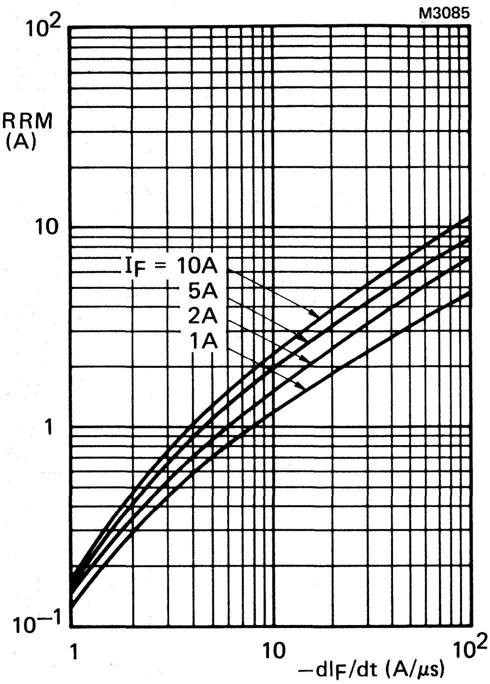


Fig.12 Maximum I_{RRM} at T_j = 25 °C.

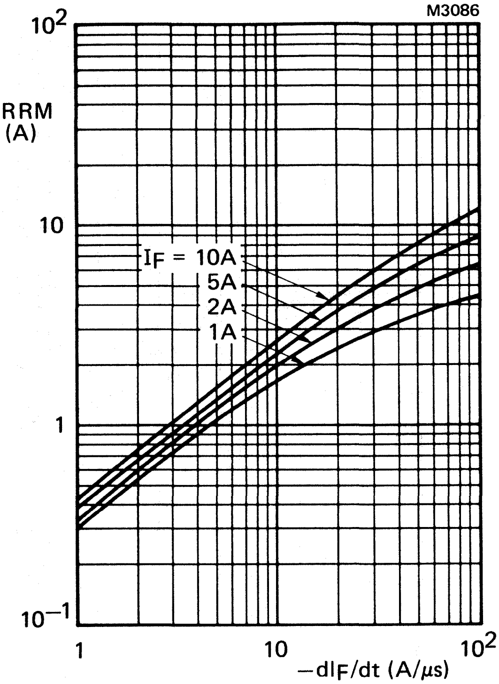


Fig.13 Maximum I_{RRM} at T_j = 100 °C.

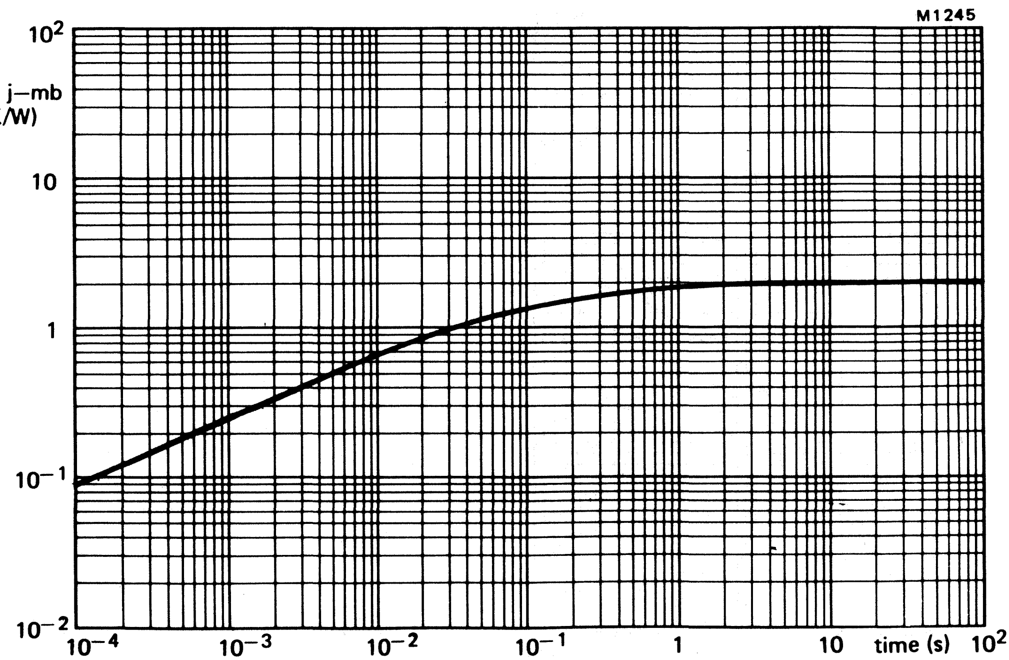


Fig. 14 Transient thermal impedance.

ULTRA FAST RECOVERY DOUBLE RECTIFIER DIODES

Glass-passivated, high-efficiency double rectifier diodes in plastic envelopes, featuring low forward voltage drop, ultra fast reverse recovery times and soft-recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and low switching losses are essential. Their single chip (monolithic) contruction 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.

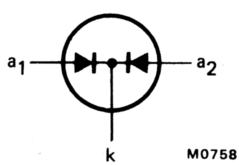
QUICK REFERENCE DATA

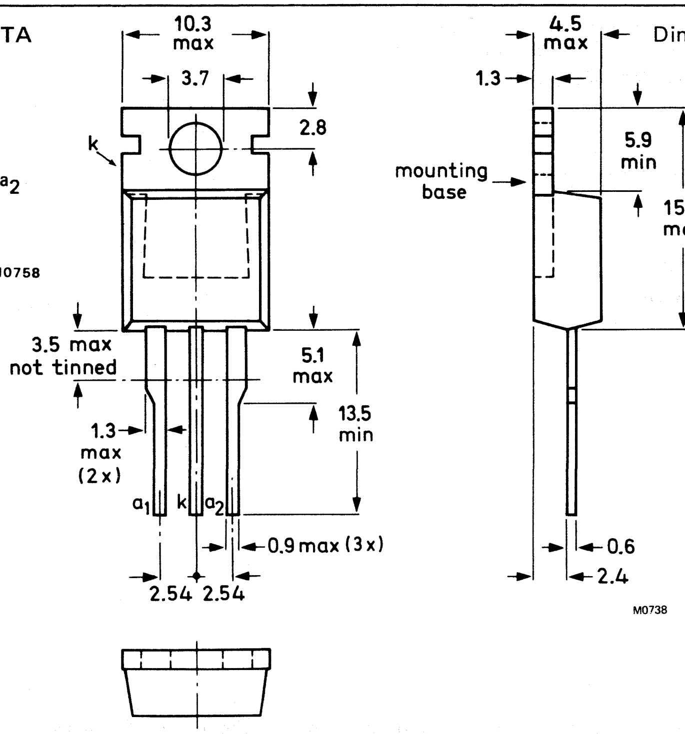
Per diode, unless otherwise stated			BYT28–300	400	500	
Repetitive peak reverse voltage	V_{RRM}	max.	300	400	500	V
Output current (both diodes conducting)	I_O	max.		10		A
Forward voltage	V_F	<		1.05		V
Reverse recovery time	t_{rr}	<		50		ns

MECHANICAL DATA

Fig.1 TO-220AB

Dimensions in mm





Net mass: 2 g

Note: the exposed metal mounting base is directly connected to the common cathode.

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

RATINGS

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

Voltages (per diode)			BYT28–300	400	500	
→ Non-repetitive peak reverse voltage	V_{RSM}	max.	350	450	550	V
Repetitive peak reverse voltage	V_{RRM}	max.	300	400	500	V
Crest working reverse voltage	V_{RWM}	max.	200	300	400	V
Continuous reverse voltage	V_R	max.	200	300	400	V

Currents (both diodes conducting: note 1)

Output current; switching losses negligible up to 200 kHz;				
square wave; $\delta = 0.5$; up to $T_{mb} = 117\ ^oC$	I_O	max.	10	A
sinusoidal; up to $T_{mb} = 120\ ^oC$	I_O	max.	10	A
R.M.S. forward current	$I_{F(RMS)}$	max.	14	A
Repetitive peak forward current $t_p = 20\ \mu s$; $\delta = 0.02$ (per diode)	I_{FRM}	max.	80	A
Non-repetitive peak forward current (per diode) half sine-wave, $T_j = 150\ ^oC$ prior to surge with re-applied $V_{RWM\ max}$				
t = 10 ms	I_{FSM}	max.	50	A
t = 8.3 ms	I_{FSM}	max.	60	A
I^2t for fusing (t = 10 ms; per diode)	I^2t	max.	12.5	A^2s

Temperatures

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

Notes

1. The limits for both diodes apply whether both diodes conduct simultaneously or on alternate half cycles.

CHARACTERISTICS (per diode)

Forward voltage				
I_F = 5 A; T_j = 150 °C	V_F	<	1.05	V*
I_F = 15 A; T_j = 25 °C	V_F	<	1.4	V*
Reverse current				
$V_R = V_{RWM\ max}$; T_j = 100 °C	I_R	<	0.2	mA
$V_R = V_{RWM\ max}$; T_j = 25 °C	I_R	<	10	μA
Reverse recovery when switched from				
I_F = 1 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 100 A/μs; T_j = 25 °C recovery time	t_{rr}	<	50	ns
I_F = 2 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 20 A/μs; T_j = 25 °C recovered charge	Q_s	<	50	nC
I_F = 5 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 50 A/μs; T_j = 100 °C peak recovery current	I_{RRM}	<	3.0	A
Forward recovery when switched to I_F = 1 A with dI_F/dt = 10 A/μs; T_j = 25 °C recovery voltage	V_{fr}	typ.	2.5	V

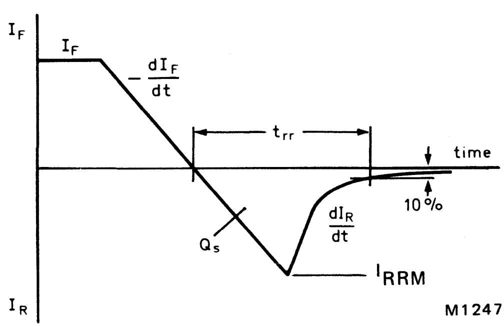


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

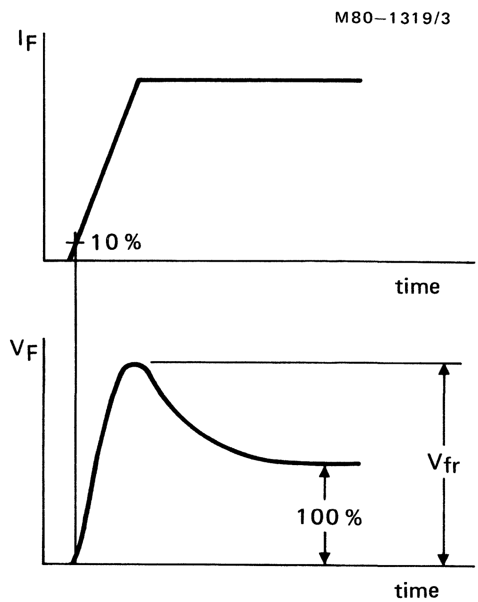


Fig.3 Definition of V_{fr}.

*Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

From junction to mounting base (both diodes conducting)	$R_{th\ j\text{-}mb}$	=	2.5	K/W
From junction to mounting base (per diode)	$R_{th\ j\text{-}mb}$	=	3.5	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 insulator (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 value 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 device lead length and with copper laminate on the board	$R_{th\ j\text{-}a}$	=	60	K/W

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 calculations

The various components of junction temperature rise above ambient are illustrated in Fig.4

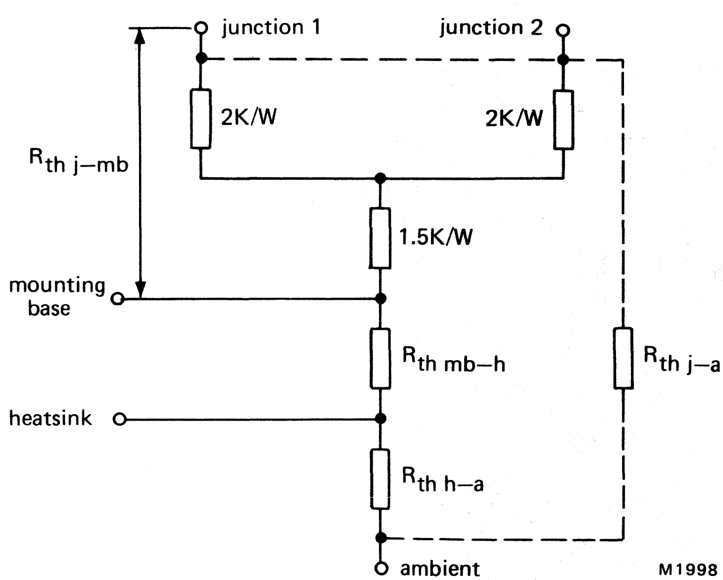


Fig.4

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

SQUARE-WAVE OPERATION (PER DIODE)

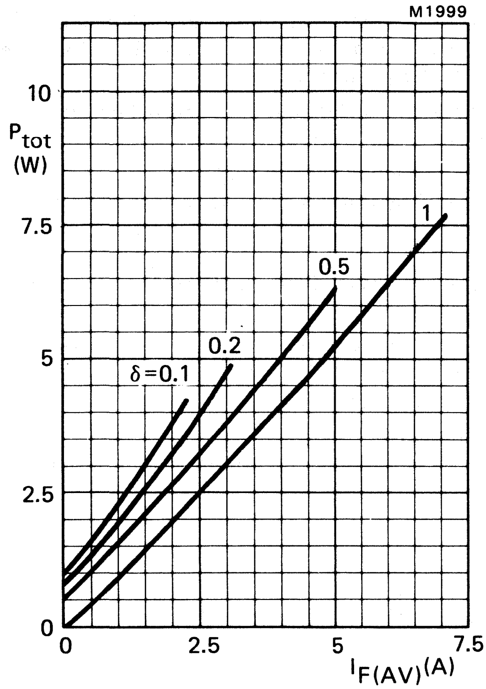
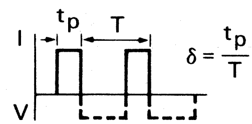


Fig.5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.



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

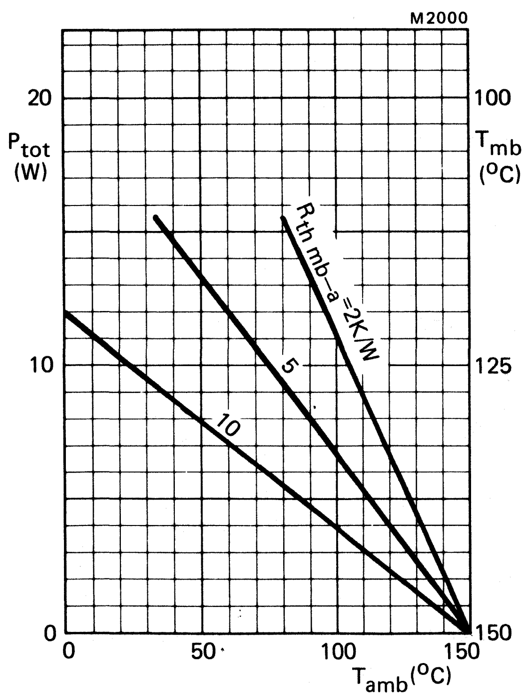


Fig.6

SINUSOIDAL OPERATION (PER DIODE)

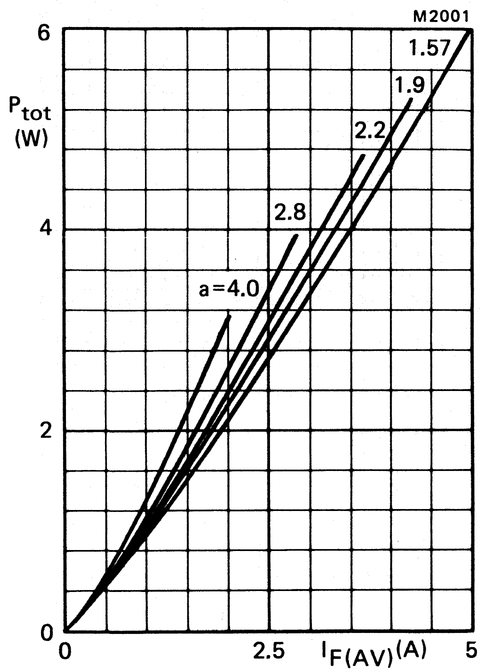


Fig.7 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.

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

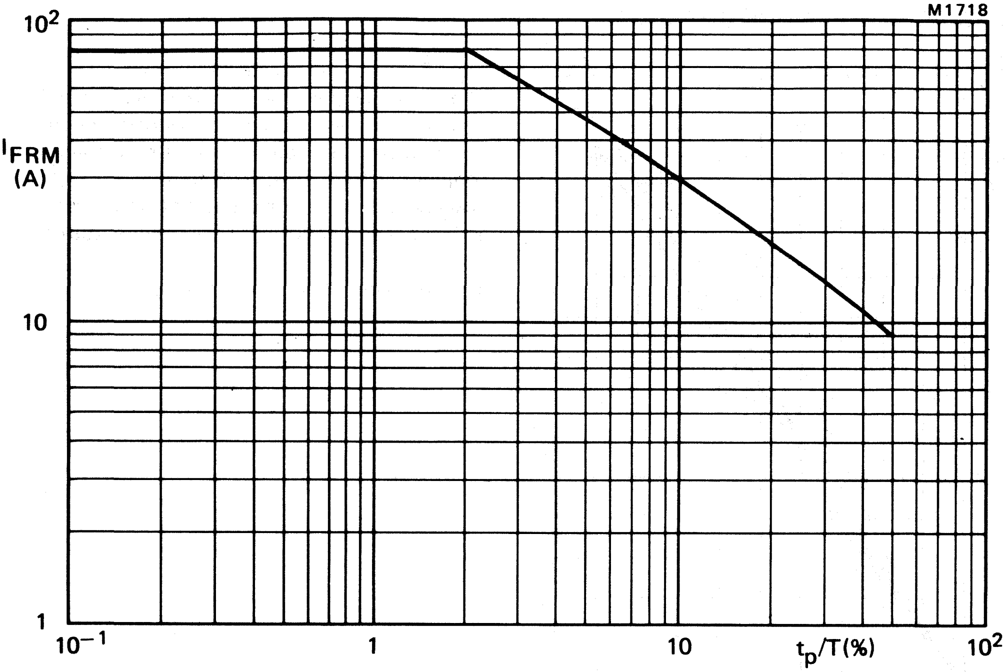
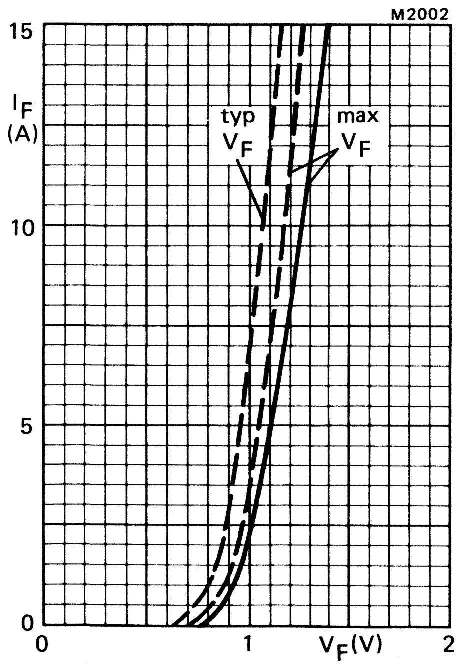
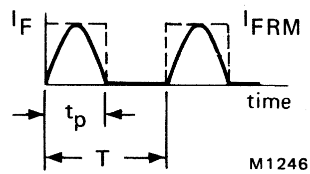


Fig.8 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 μs < t_p < 1 ms per diode.





Definition of I_{FRM} and t_p/T

Fig.9 —— T_j = 25 °C; – – – T_j = 150 °C per diode.

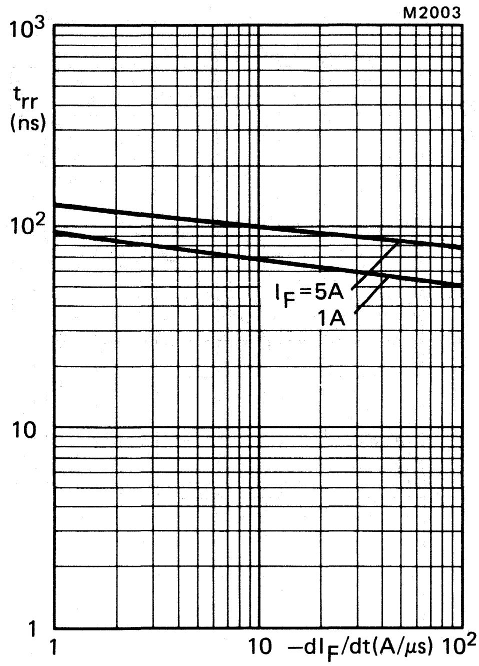


Fig.10 Maximum t_{rr} at T_j = 25 ^oC; per diode.

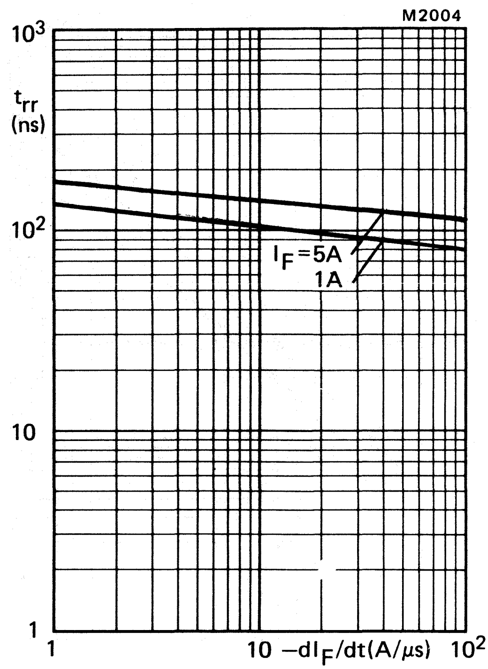


Fig.11 Maximum t_{rr} at T_j = 100 ^oC; per diode.

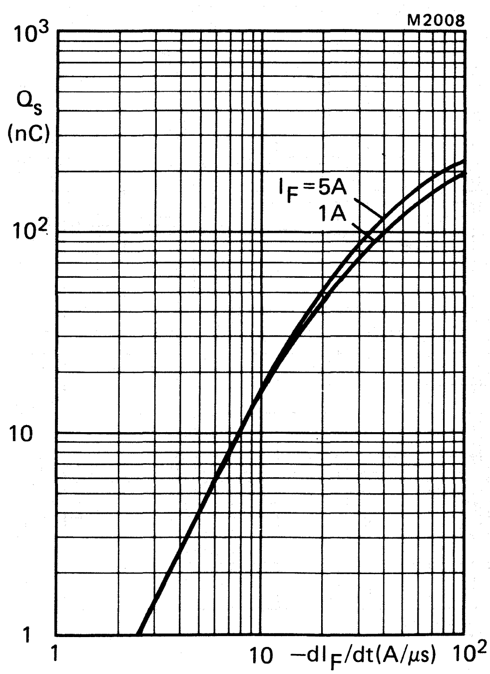


Fig.12 Maximum Q_s at T_j = 25 ^oC; per diode.

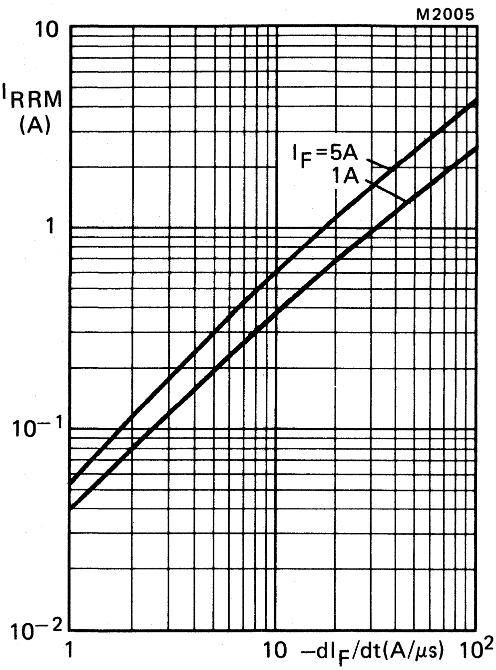


Fig.13 Maximum I_{RRM} at T_j = 25 °C; per diode.

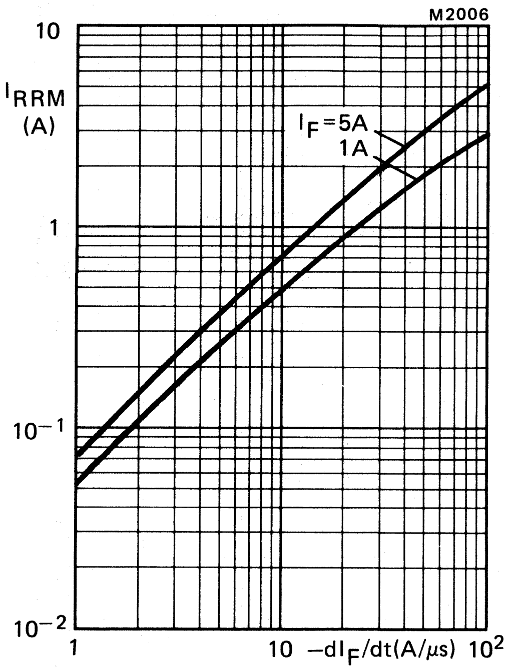


Fig.14 Maximum I_{RRM} at T_j = 100 °C; per diode.

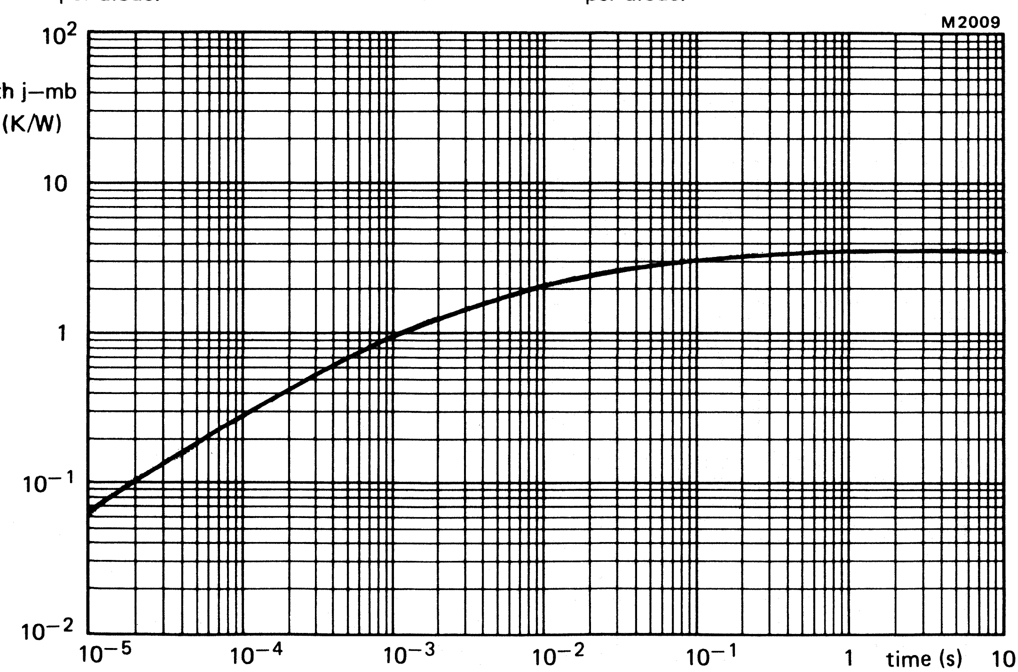


Fig.15 Transient thermal impedance (one diode conducting).

ULTRA FAST RECOVERY RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial rectifier diodes in plastic envelopes, featuring low forward voltage drop, ultra fast reverse recovery times with very low stored charge and soft-recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and low switching losses are essential.
The series consists of normal polarity (cathode to mounting base) types.

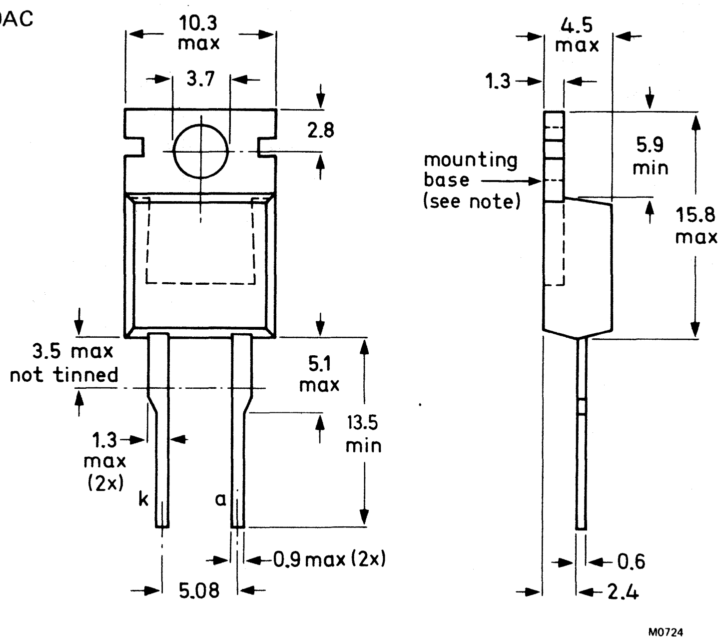
QUICK REFERENCE DATA

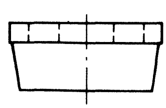
			BYT79–300	400	500	
Repetitive peak reverse voltage	V_{RRM}	max.	300	400	500	V
Average forward current	$I_{F(AV)}$	max.		14		A
Forward voltage	V_F	<		1.05		V
Reverse recovery time	t_{rr}	<		50		ns

MECHANICAL DATA

Dimensions in mm

Fig.1 TO-220AC





Net mass: 2 g

Note: The exposed metal mounting base is directly connected to the cathode.

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

RATINGS

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

Voltages			BYT79–300	400	500	
→ Non-repetitive peak reverse voltage	V_{RSM}	max.	350	450	550	V
Repetitive peak reverse voltage	V_{RRM}	max.	300	400	500	V
Crest working reverse voltage	V_{RWM}	max.	200	300	400	V
Continuous reverse voltage*	V_R	max.	200	300	400	V

Currents				
Average forward current; switching losses negligible up to 200 kHz; square wave; $\delta = 0.5$; up to $T_{mb} = 113\ ^oC$	$I_{F(AV)}$	max.	14	A
up to $T_{mb} = 125\ ^oC$	$I_{F(AV)}$	max.	10	A
sinusoidal; up to $T_{mb} = 118\ ^oC$	$I_{F(AV)}$	max.	12.5	A
up to $T_{mb} = 125\ ^oC$	$I_{F(AV)}$	max.	10	A
R.M.S. forward current	$I_{F(RMS)}$	max.	20	A
Repetitive peak forward current $t_p = 20\ \mu s$; $\delta = 0.02$	I_{FRM}	max.	320	A
Non-repetitive peak forward current half sine-wave; $T_j = 150\ ^oC$ prior to surge; with reapplied V_{RWMmax}; t = 10 ms	I_{FSM}	max.	150	A
t = 8.3 ms	I_{FSM}	max.	180	A
I^2t for fusing (t = 10 ms)	I^2t	max.	112	A^2s

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

*To ensure thermal stability: $R_{th\ j\text{-}a} \leqslant 4.6$ K/W.

CHARACTERISTICS

Forward voltage				
I_F = 15 A; T_j = 150 °C	V_F	<	1.05	V*
I_F = 50 A; T_j = 25 °C	V_F	<	1.40	V*
Reverse current				
$V_R = V_{RWM\,max}$; T_j = 100 °C	I_R	<	0.8	mA
T_j = 25 °C	I_R	<	50	µA
Reverse recovery when switched from				
I_F = 1 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 100 A/µs; T_j = 25 °C; recovery time	t_{rr}	<	50	ns
I_F = 2 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 20 A/µs; T_j = 25 °C; recovered charge	Q_s	<	50	nC
I_F = 10 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 50 A/µs; T_j = 100 °C; peak recovery current	I_{RRM}	<	5.2	A
Forward recovery when switched to I_F = 10 A with dI_F/dt = 10 A/µs; T_j = 25 °C	V_{fr}	typ.	2.5	V

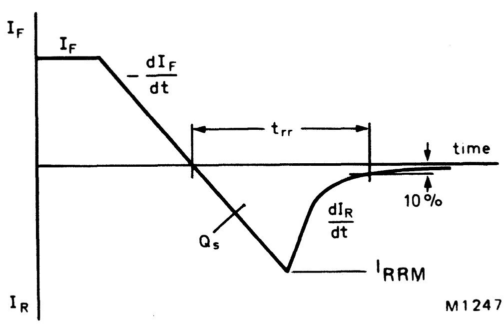


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

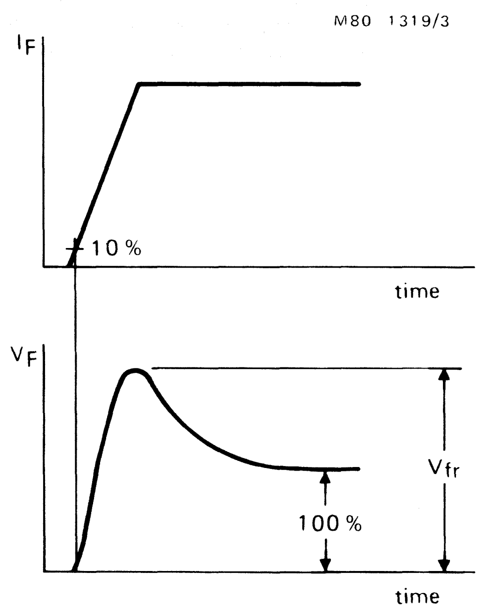


Fig.3 Definition of V_{fr}.

*Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	2	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 insulator (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 value 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 device lead length and with copper laminate on the board $R_{th\ j\text{-}a}$ = 60 K/W

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 calculations

a. The various components of junction temperature rise above ambient are illustrated in Fig.4.

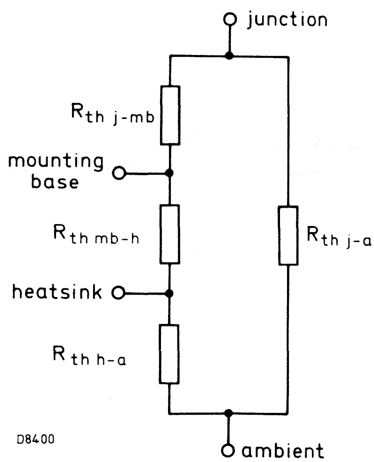


Fig. 4.

b. Any measurement of heatsink temperature should be made immediately adjacent to the device.
c. The method of using Figs. 5 and 6 is as follows:
Starting with the required current on the $I_{F(AV)}$ axis, trace upwards to meet the appropriate duty cycle or form factor curve. Trace right horizontally and upwards from the required value on the T_{amb} scale. The intersection determines the $R_{th\ mb\text{-}a}$. The heatsink thermal resistance value ($R_{th\ h\text{-}a}$) can be calculated from:

$$R_{th\ h\text{-}a} = R_{th\ mb\text{-}a} - R_{th\ mb\text{-}h}.$$

SQUARE-WAVE OPERATION

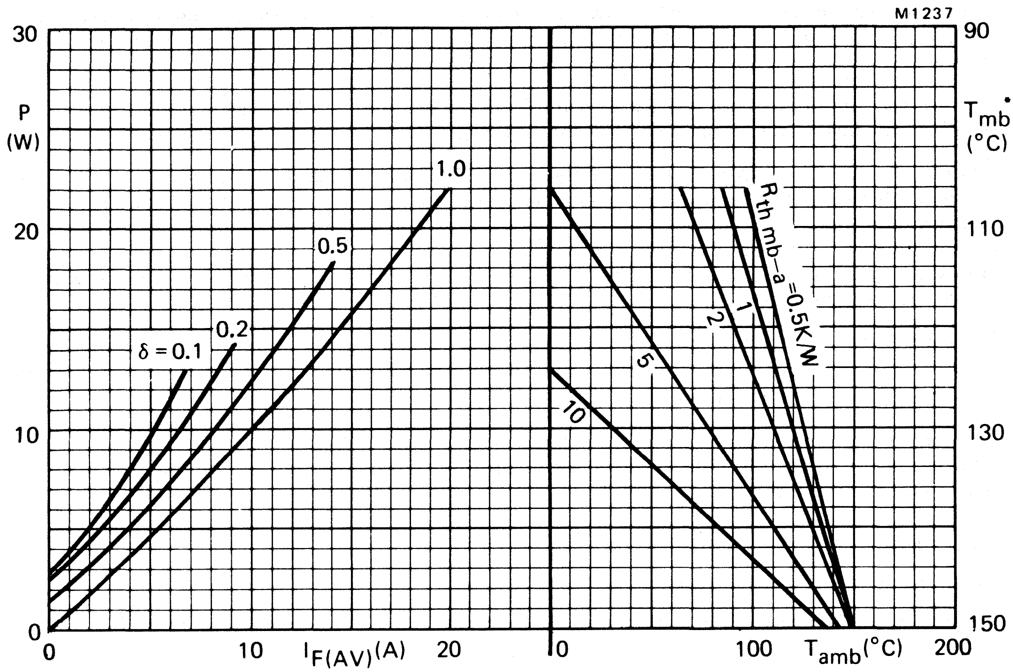
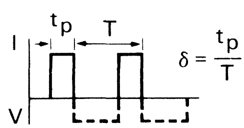


Fig.5 The right-hand part shows the relationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 200 kHz.



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

*T_{mb} scale is for comparison purposes and is correct only for $R_{th\ mb\text{-}a} < 4.1$ K/W.

SINUSOIDAL OPERATION

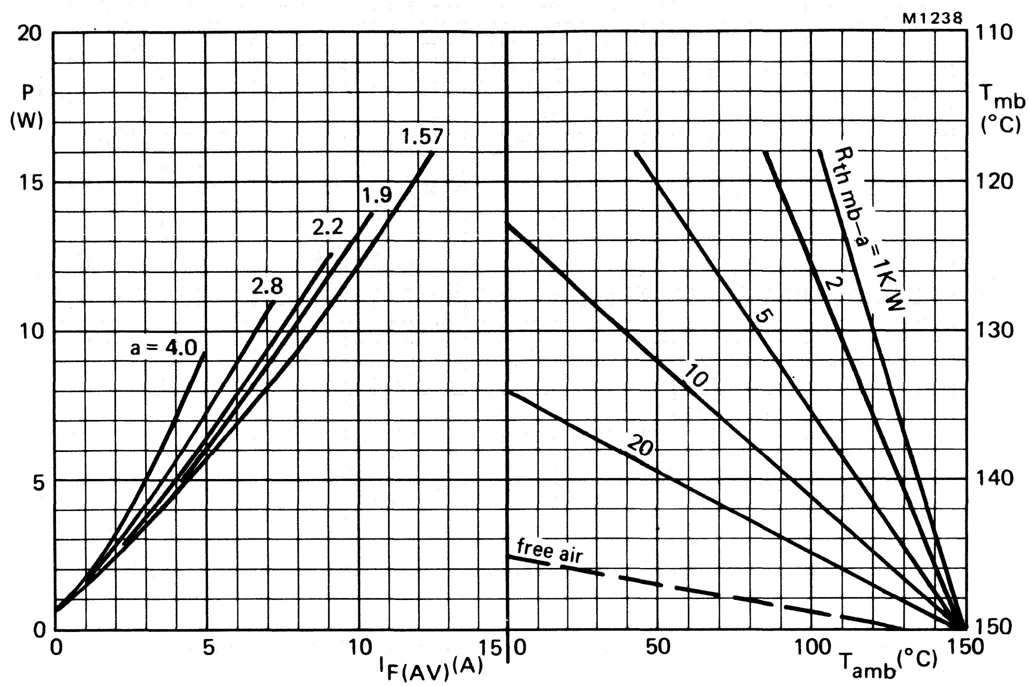


Fig.6 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

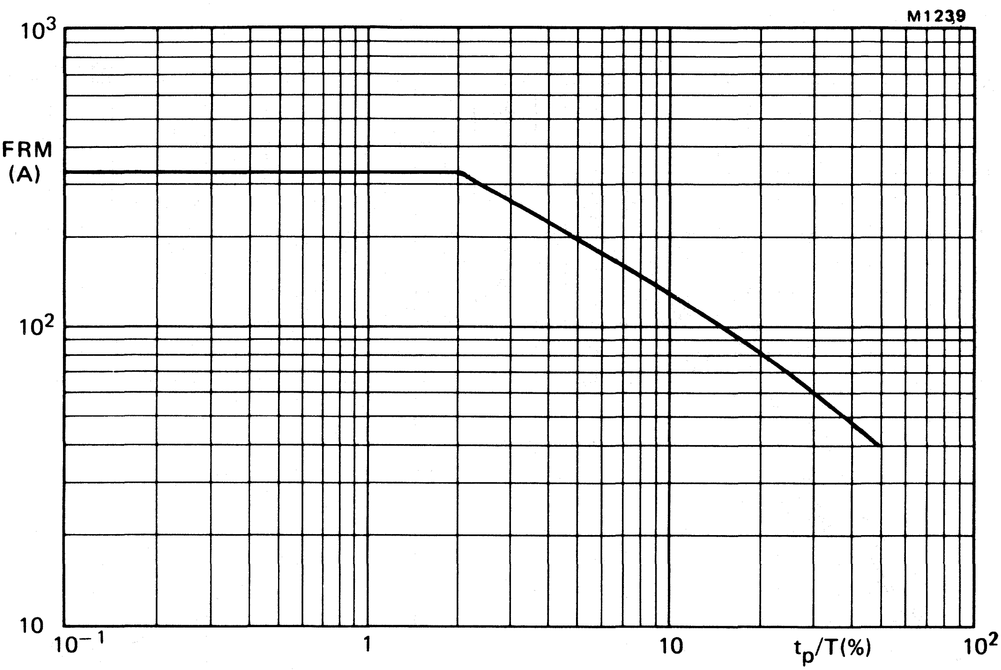
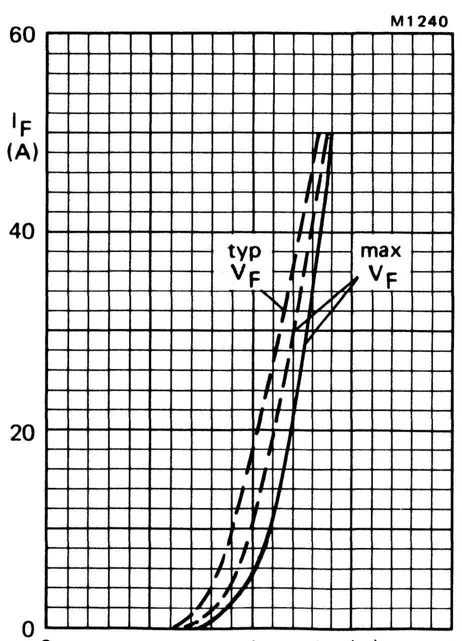
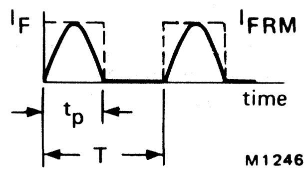


Fig.7 Maximum permissible repetitive peak forward current for square or sinusoidal currents; $1\ \mu s < t_p < 1$ ms.





Definition of I_{FRM} and t_p/T.

Fig.8 —— T_j = 25 °C; – – – T_j = 150 °C.

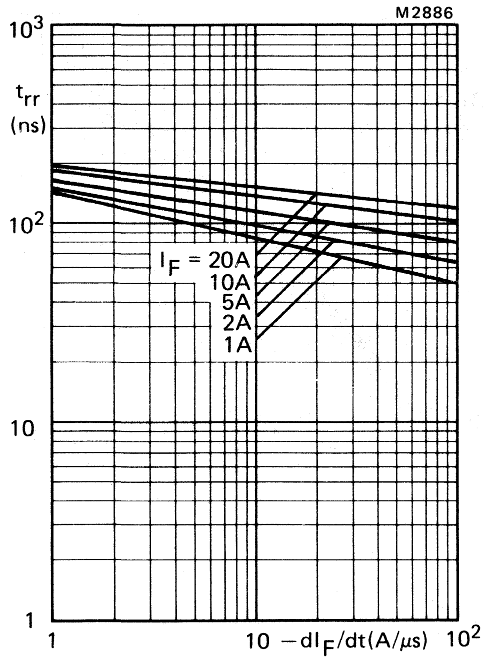


Fig.9 Maximum t_{rr} at T_j = 25 °C.

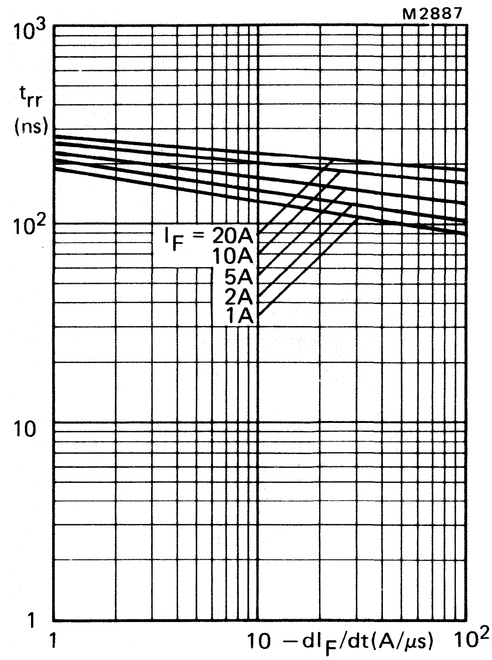


Fig.10 Maximum t_{rr} at T_j = 100 °C.

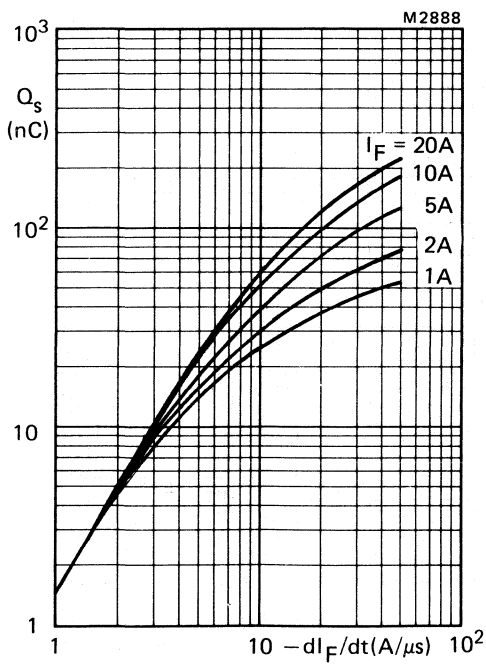


Fig.11 Maximum Q_s at T_j = 25 °C.

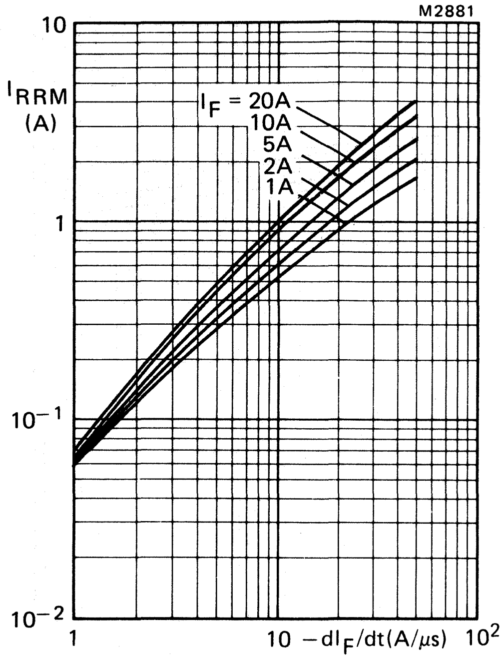


Fig.12 Maximum I_{RRM} at T_j = 25 °C.

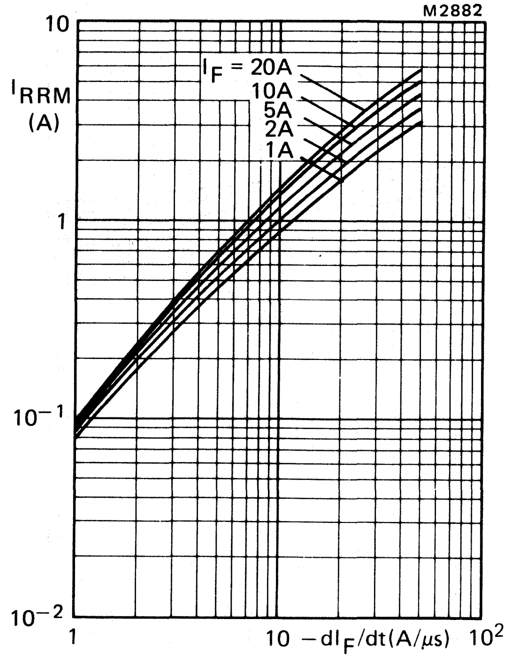


Fig.13 Maximum I_{RRM} at T_j = 100 °C.

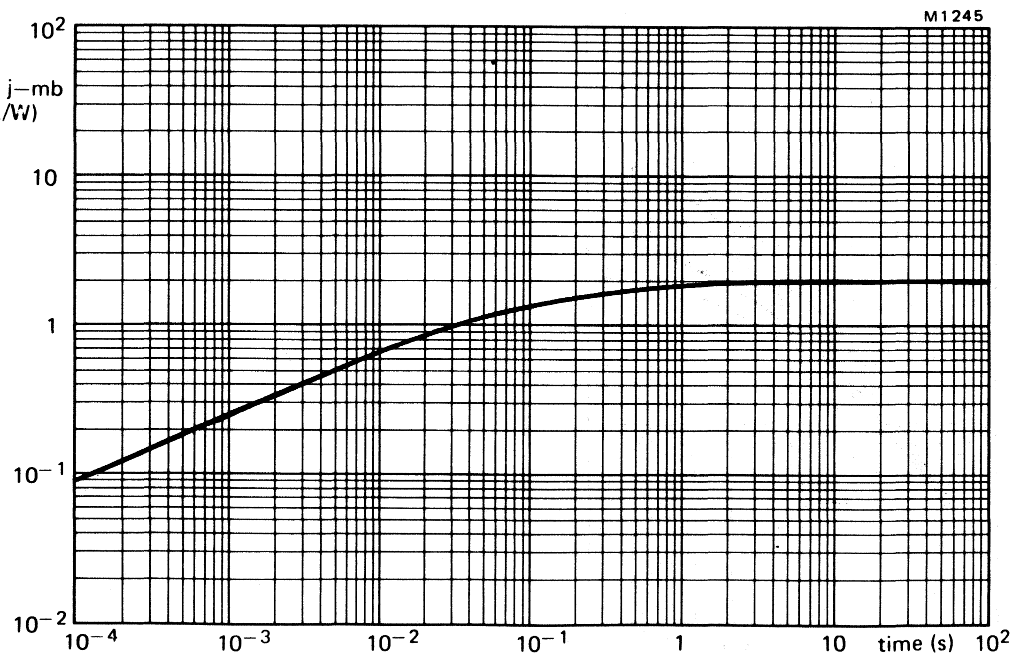


Fig.14 Transient thermal impedance.

ULTRA FAST-RECOVERY DOUBLE RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial rectifier diodes in ISOTOP envelopes, featuring low forward voltage drop, ultra fast reverse recovery times, very low stored charge and soft-recovery characteristic. 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 electrical isolation makes them ideal for mounting on a common heatsink alongside other components without the need for additional insulators.

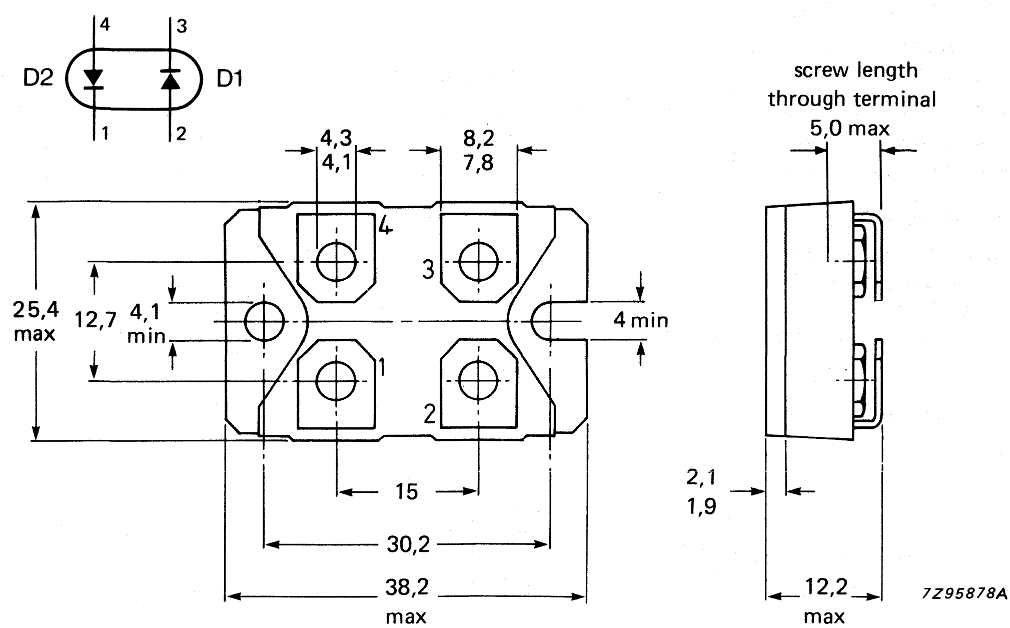
QUICK REFERENCE DATA

			BYT230PIV-200	300	400	
Repetitive peak reverse voltage	V_{RRM}	max.	200	300	400	V
Average forward current	$I_{F(AV)}$	max.		2 x 30		A
Forward voltage	V_F	<		1.4		V
Reverse recovery time	t_{rr}	<		50		ns

MECHANICAL DATA

Dimensions in mm

Fig.1 SOT-227B.
Types with Faston terminals are available on request (see overleaf).



Baseplate is electrically isolated.
Isolation voltage: 2500 V r.m.s.
Capacitance: 45 pF.

Supplied with device: 4 x M4 screws.

RATINGS

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

Voltages			BYT230PIV-200	300	400	
Repetitive peak reverse voltage	V_{RRM}	max.	200	300	400	V
Non repetitive peak reverse voltage	V_{RSM}	max.	250	350	450	V

Currents (per diode)				
Average forward current; switching losses negligible up to 100 kHz square-wave, δ = 0.5, up to T_{mb} = 60 °C	$I_{F(AV)}$	max.	30	A
R.M.S. forward current	$I_{F(RMS)}$	max.	50	A
Repetitive peak forward current t_p = 20 μs, δ = 0.02	I_{FRM}	max.	800	A
Non-repetitive peak forward current half sine-wave				
t = 10 ms	I_{FSM}	max.	500	A
t = 8.3 ms	I_{FSM}	max.	600	A
I^2t for fusing (t = 10 ms)	I^2t	max.	610	A^2s
Temperatures				
Storage temperature	T_{stg}		−40 to +150	°C
Junction temperature	T_j		−40 to +150	°C

THERMAL RESISTANCE

From junction to mounting base per diode	$R_{th\ j\text{-}mb}$	=	1.5	K/W
From junction to mounting base total	$R_{th\ j\text{-}mb}$	=	0.8	K/W
From mounting base to heatsink with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.1	K/W

ORDERING NOTE

Types with Faston terminals are available on request (see Fig.2).
Omit suffix V from the type number when ordering, e.g. BYT230PI-300.

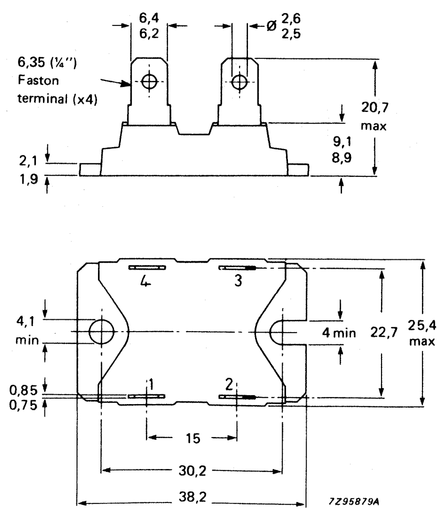
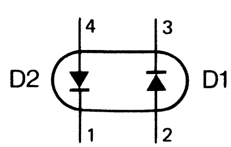


Fig.2 SOT-227A.
Dimensions in mm.



DEVELOPMENT DATA

CHARACTERISTICS

T_j = 25 °C unless otherwise stated.

Forward voltage				
I_F = 30 A; T_j = 100 °C	V_F	<	1.4	V*
I_F = 30 A	V_F	<	1.5	V*
Reverse current				
$V_R = V_{RRM\,max}$; T_j = 100 °C	I_R	<	6.0	mA
$V_R = V_{RRM\,max}$	I_R	<	35	μA
Reverse recovery when switched from				
I_F = 1 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 100 A/μs; recovery time	t_{rr}	<	50	ns
I_F = 1 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 15 A/μs; recovery time	t_{rr}	<	100	ns
I_F = 2 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 20 A/μs; recovered charge	Q_s	<	75	nC
I_F = 10 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 50 A/μs; T_j = 100 °C; peak recovery current	I_{RRM}	<	4	A

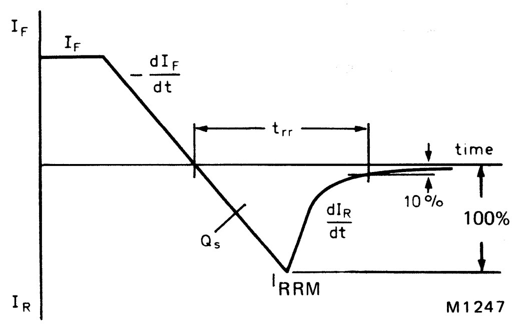


Fig.3 Definition of t_{rr}, Q_s and I_{RRM}.

*Measured under pulse conditions to avoid excessive dissipation.

SQUARE-WAVE OPERATION

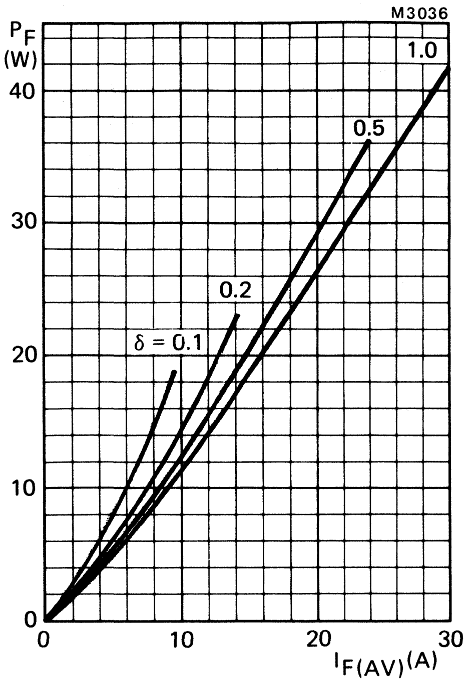
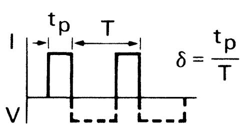


Fig.4 Forward power losses versus average forward current; per diode.



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

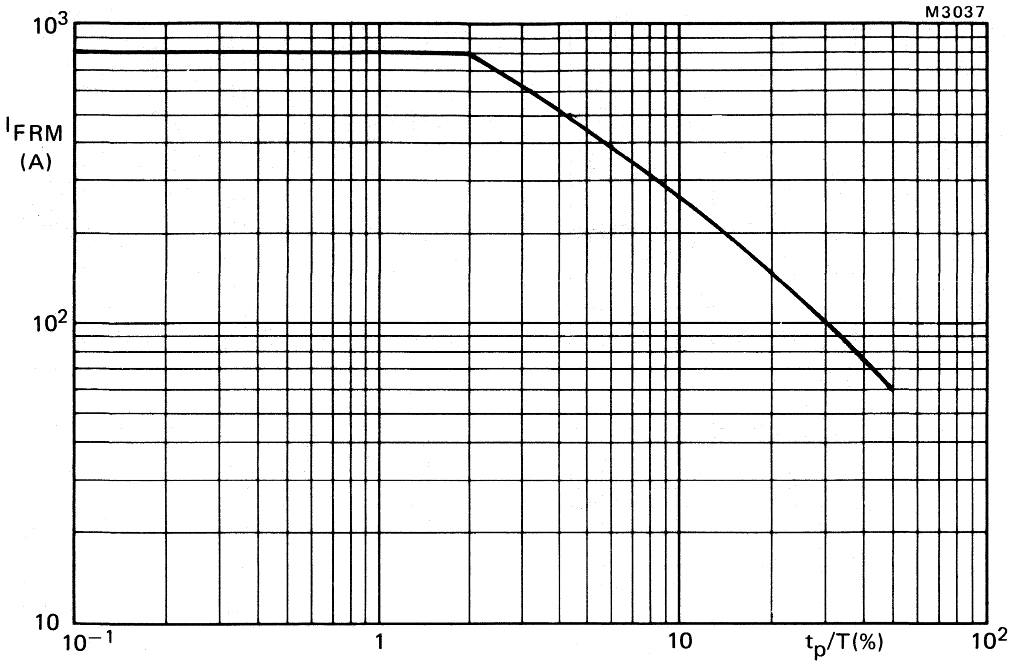
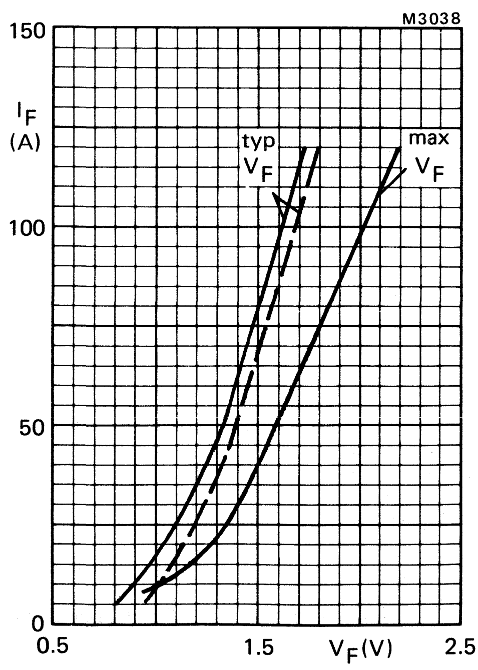
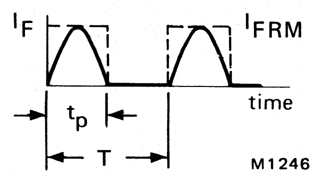


Fig.5 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 $\mu s < t_p < 1$ ms; per diode.





Definition of I_{FRM} and t_p/T.

Fig.6 — — — T_j = 25 °C; —— T_j = 100 °C; per diode.

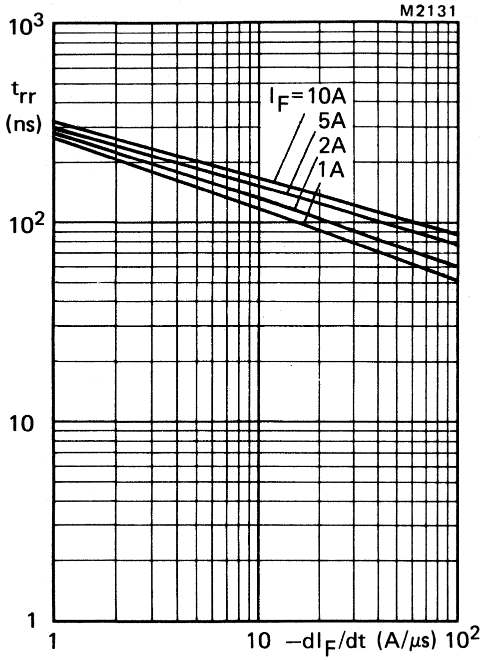


Fig.7 Maximum t_{rr} at T_j = 25 °C;
per diode.

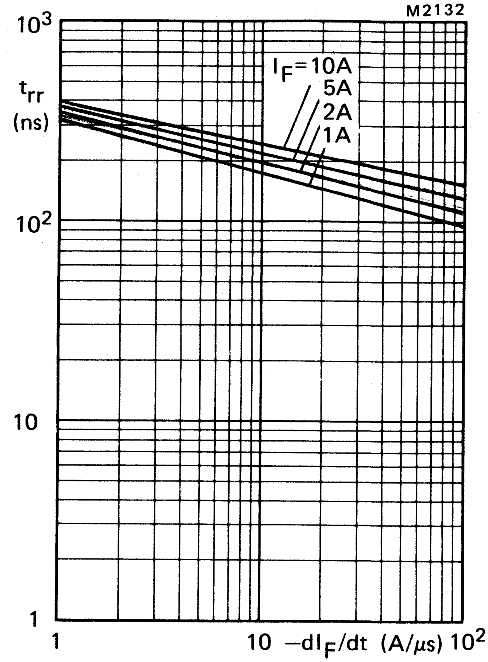


Fig.8 Maximum t_{rr} at T_j = 100 °C;
per diode.

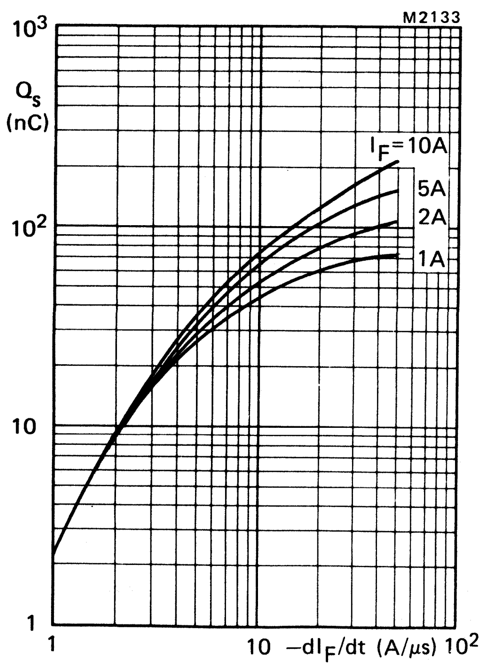


Fig.9 Maximum Q_s at T_j = 25 °C; per diode.

DEVELOPMENT DATA

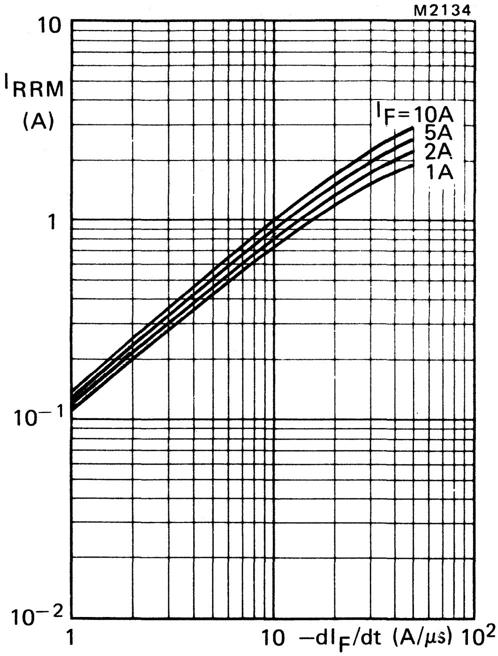


Fig.10 Maximum I_{RRM} at T_j = 25 °C; per diode.

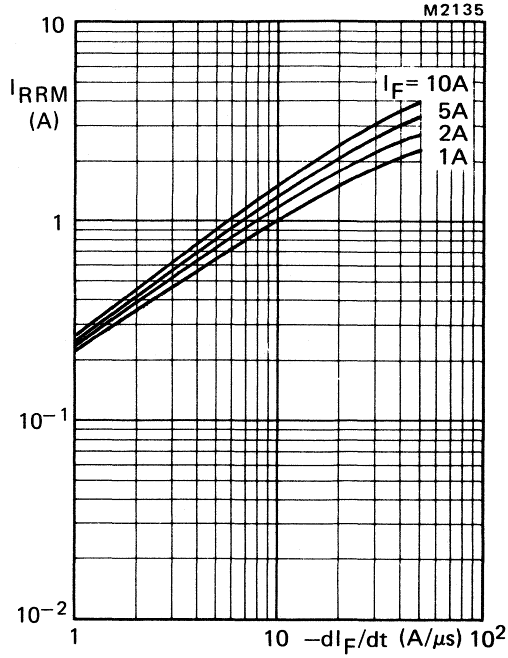


Fig.11 Maximum I_{RRM} at T_j = 100 °C; per diode.

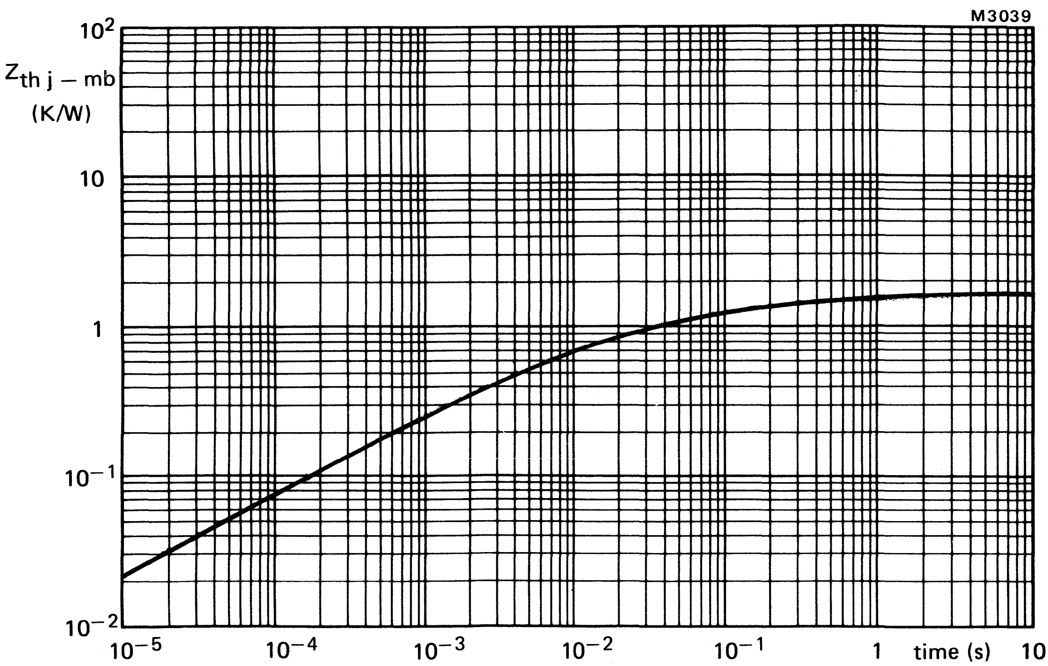


Fig.12 Transient thermal impedance; per diode.

ULTRA FAST-RECOVERY DOUBLE RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial rectifier diodes in ISOTOP envelopes, featuring low forward voltage drop, ultra fast reverse recovery times, very low stored charge and soft-recovery characterisitc. 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 electrical isolation makes them ideal for mounting on a common heatsink alongside other components without the need for additional insulators.

QUICK REFERENCE DATA

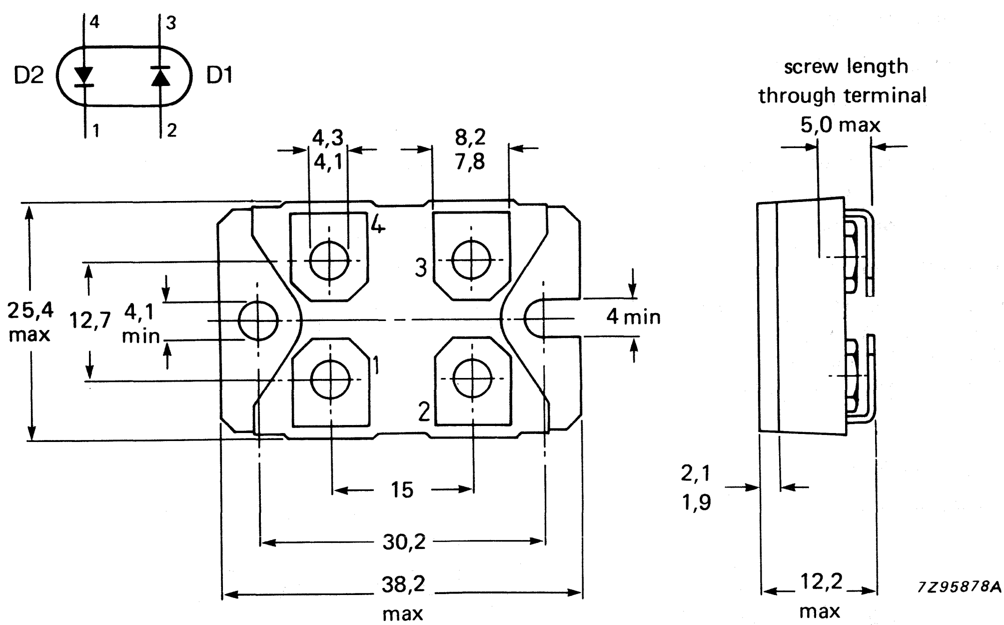
			BYT230PIV– 600	700	800	
Repetitive peak reverse voltage	V_{RRM}	max.	600	700	800	V
Average forward current	$I_{F(AV)}$	max.	2 x 30			A
Forward voltage	V_F	<	1.8			V
Reverse recovery time	t_{rr}	<	55			ns

MECHANICAL DATA

Dimensions in mm

Fig.1 SOT-227B.

Types with Faston terminals are available on request (see overleaf).



Baseplate is electrically isolated.
Isolation voltage: 2500 V RMS.
Capacitance: 45 pF.

Supplied with device: 4 x M4 screws.

RATINGS

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

Voltages

			BYT230PIV–600	700	800	
Repetitive peak reverse voltage	V_{RRM}	max.	600	700	800	V
Non repetitive peak reverse voltage	V_{RSM}	max.	640	750	850	V

Currents (per diode)

Average forward current; switching losses negligible up to 100 kHz square-wave, $\delta = 0.5$, up to $T_{mb} = 50\ ^oC$	$I_{F(AV)}$	max.	30	A
RMS forward current	$I_{F(RMS)}$	max.	70	A
Repetitive peak forward current $t_p = 20\ \mu s$, $\delta = 0.02$	I_{FRM}	max.	375	A
Non-repetitive peak forward current half sine-wave				
t = 10 ms	I_{FSM}	max.	200	A
t = 8.3 ms	I_{FSM}	max.	240	A
I^2t for fusing (t = 10 ms)	I^2t	max.	200	A^2s

Temperatures

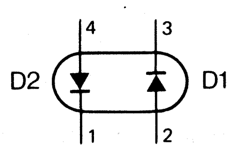
Storage temperature	T_{stg}		−40 to +150	^oC
Junction temperature	T_j		−40 to +150	^oC

THERMAL RESISTANCE

From junction to mounting base per diode	$R_{th\ j\text{-}mb}$	=	1.5	K/W
From junction to mounting base total	$R_{th\ j\text{-}mb}$	=	0.8	K/W
From mounting base to heatsink with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.1	K/W

ORDERING NOTE

Types with Faston terminals are available on request (see Fig.2).
Omit suffix V from the type number when ordering, e.g. BYT230PI-600.



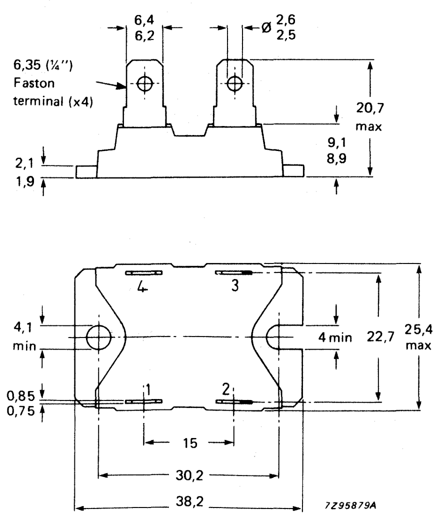


Fig.2 SOT-227A.
Dimensions in mm.

CHARACTERISTICS

T_j = 25 °C unless otherwise stated.

Forward voltage				
I_F = 30 A; T_j = 100 °C	V_F	<	1.8	V*
I_F = 30 A	V_F	<	1.9	V*
Reverse current				
$V_R = V_{RRM\,max}$; T_j = 100 °C	I_R	<	5.0	mA
$V_R = V_{RRM\,max}$	I_R	<	100	μA
Reverse recovery when switched from				
I_F = 0.5 A to I_R = 1 A measured at I_R = 0.25 A recovery time	t_{rr}	<	55	ns
I_F = 1 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 50 A/μs; recovery time	t_{rr}	<	100	ns
I_F = 2 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 20 A/μs; recovered charge	Q_s	<	150	nC

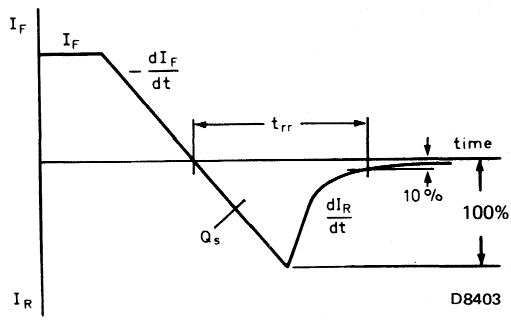


Fig.3 Definition of t_{rr} and Q_s.

*Measured under pulse conditions to avoid excessive dissipation.

SQUARE-WAVE OPERATION

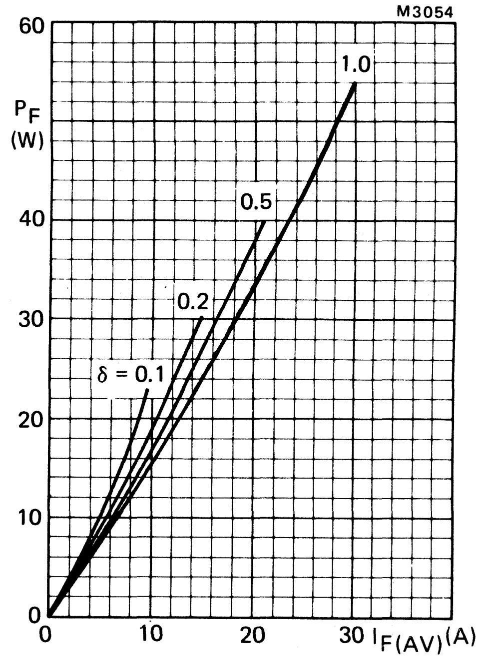
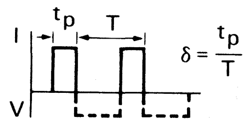


Fig.4 Forward power losses versus average forward current; per diode.



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

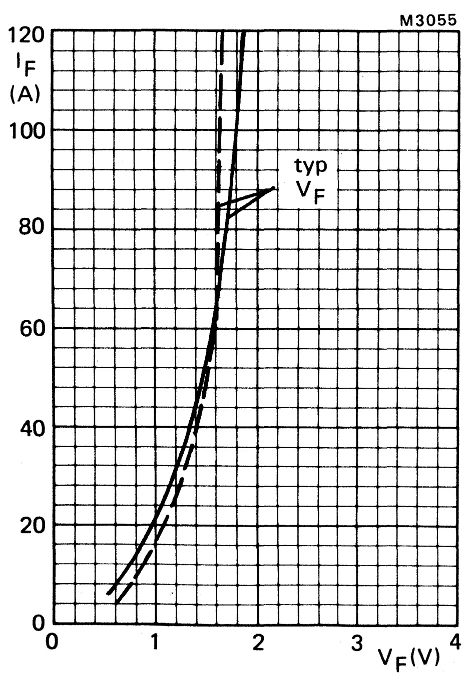


Fig.5 Typical forward voltage versus forward current;
– – – T_j = 25 °C; —— T_j = 100 °C.

ULTRA FAST-RECOVERY DOUBLE RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial rectifier diodes in ISOTOP envelopes, featuring low forward voltage drop, ultra fast reverse recovery times, very low stored charge and soft-recovery characteristic. 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 electrical isolation makes them ideal for mounting on a common heatsink alongside other components without the need for additional insulators.

QUICK REFERENCE DATA

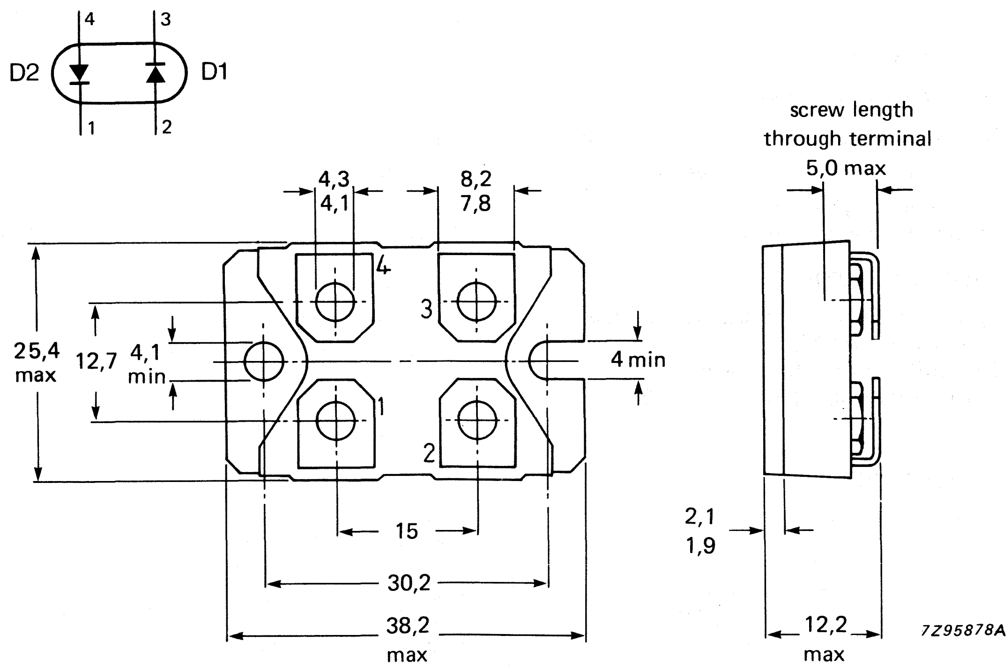
Repetitive peak reverse voltage	V_{RRM}	max.	1000	V
Average forward current	$I_{F(AV)}$	max.	2 x 30	A
Forward voltage	V_F	$<$	1.8	V
Reverse recovery time	t_{rr}	$<$	70	ns

MECHANICAL DATA

Dimensions in mm

Fig.1 SOT-227B.

Types with Faston terminals are available on request (see overleaf).



Baseplate is electrically isolated.
Isolation voltage: 2500 V r.m.s.
Capacitance: 45 pF.

Supplied with device: 4 x M4 screws.

RATINGS

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

Voltages				
Repetitive peak reverse voltage	V_{RRM}	max.	1000	V
Non repetitive peak reverse voltage	V_{RSM}	max.	1000	V
Currents (per diode)				
Average forward current; switching losses negligible up to 100 kHz square wave; $\delta = 0.5$; up to $T_{mb} = 50\ ^oC$	$I_{F(AV)}$	max.	30	A
R.M.S. forward current	$I_{F(RMS)}$	max.	70	A
Repetitive peak forward current $t_p = 20\ \mu s$, $\delta = 0.02$	I_{FRM}	max.	375	A
Non-repetitive peak forward current half sine-wave				
t = 10 ms	I_{FSM}	max.	200	A
t = 8.3 ms	I_{FSM}	max.	240	A
I^2t for fusing (t = 10 ms)	I^2t	max.	200	A^2s
Temperatures				
Storage temperature	T_{stg}		−40 to +150	^oC
Junction temperature	T_j		−40 to +150	^oC

THERMAL RESISTANCE

From junction to mounting base per diode	$R_{th\ j\text{-}mb}$	=	1.5	K/W
From junction to mounting base total	$R_{th\ j\text{-}mb}$	=	0.8	K/W
From mounting base to heatsink with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.1	K/W

ORDERING NOTE

Types with Faston terminals are available on request (see Fig.2).

Omit suffix V from the type number when ordering, e.g. BYT230PI-1000.

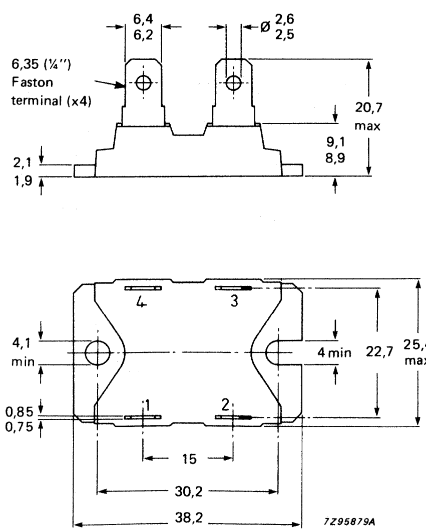
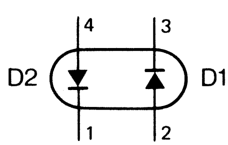


Fig.2 SOT-227A.

Dimensions in mm.



CHARACTERISTICS

T_j = 25 °C unless otherwise stated

Forward voltage				
I_F = 30 A; T_j = 100 °C	V_F	<	1.8	V*
I_F = 30 A	V_F	<	1.9	V*
Reverse current				
$V_R = V_{RRM\,max}$; T_j = 100 °C	I_R	<	5.0	mA
$V_R = V_{RRM\,max}$	I_R	<	100	μA
Reverse recovery when switched from				
I_F = 0.5 A to I_R = 1 A measured at I_R = 0.25 A; recovery time	t_{rr}	<	70	ns
I_F = 1 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 15 A/μs; recovery time	t_{rr}	<	145	ns
I_F = 2 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 20 A/μs; recovered charge	Q_s	<	250	nC

DEVELOPMENT DATA

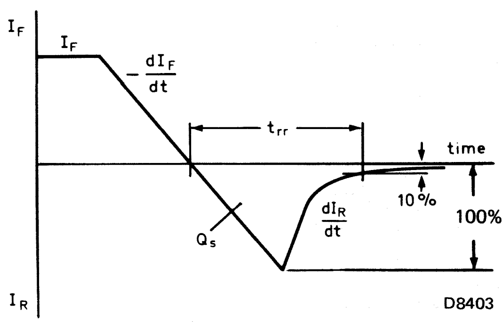


Fig.3 Definition of t_{rr} and Q_s.

*Measured under pulse conditions to avoid excessive dissipation.

SQUARE - WAVE OPERATION

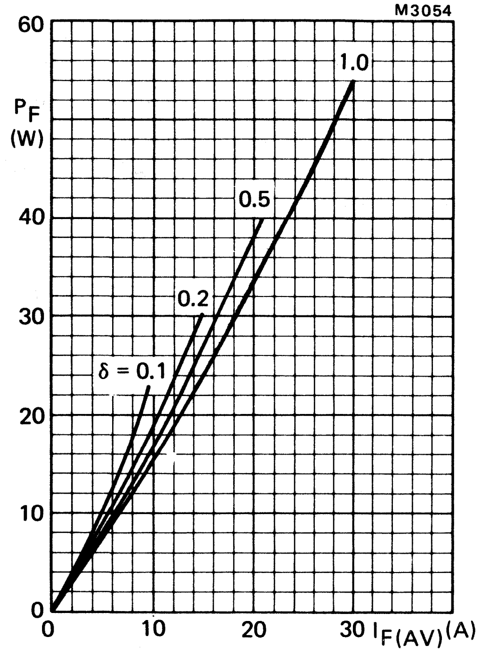
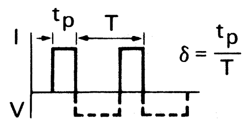


Fig.4 Forward power losses versus average forward current; per diode.



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

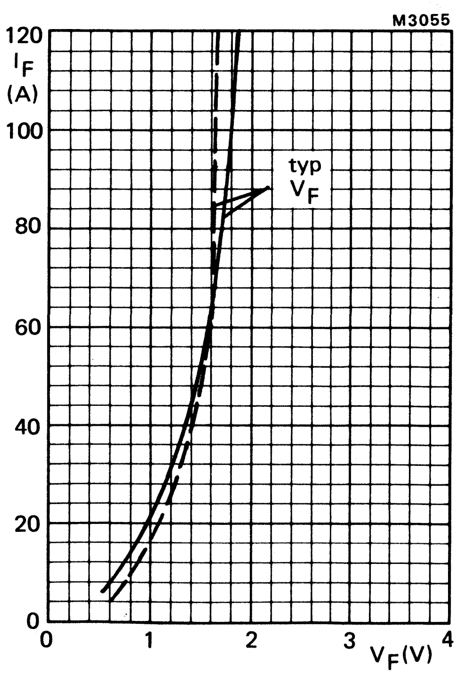


Fig.5 Typical forward voltage versus forward current;
— — — T_j = 25 °C; —— T_j = 100 °C.

FAST SOFT-RECOVERY RECTIFIER DIODES

Fast soft-recovery diodes in DO-4 metal envelopes especially suitable for operation as main and commutating diodes in 3-phase a.c. motor speed control inverters and in high frequency power supplies in general.

The series consists of the following types:
Normal polarity (cathode to stud): BYV24-800 and BYV24-1000.
Reverse polarity (anode to stud): BYV24-800R and BYV24-1000R.

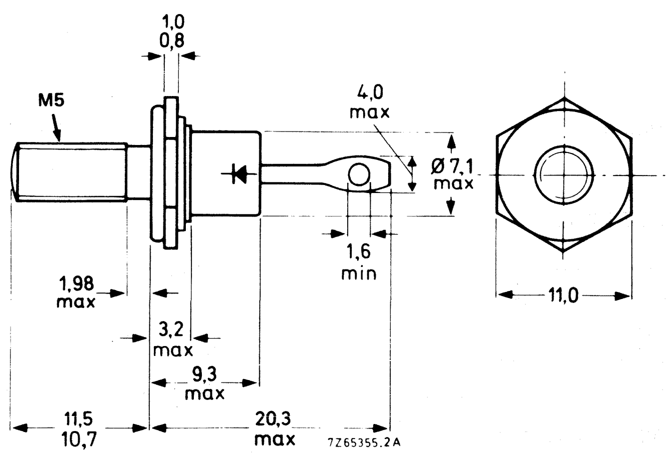
QUICK REFERENCE DATA

			BYV24-800(R)	1000(R)	
Repetitive peak reverse voltage	V_{RRM}	max.	800	1000	V
Average forward current	$I_{F(AV)}$	max.	12		A
Non-repetitive peak forward current	I_{FSM}	max.	150		A
Reverse recovery time	t_{rr}	<	450		ns

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO–4: with metric M5 stud (ϕ5 mm)



Net mass: 6 g
Diameter of clearance hole: max 5.2 mm
Accessories supplied on request:
see ACCESSORIES section

Supplied with device: 1 nut, 1 lock washer.
Torque on nut: min. 0.9 Nm (9 kg cm)
max. 1.7 Nm (17 kg cm)
Nut dimensions across the flats: 8.0 mm.

The mark shown applies to the normal polarity types.

RATINGS

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

Voltages*

			BYV24–800(R)	1000(R)	
Non-repetitive peak reverse voltage	V_{RSM}	max.	1000	1200	V
Repetitive peak reverse voltage	V_{RRM}	max.	800	1000	V
Crest working reverse voltage	V_{RWM}	max.	650	850	V
Continuous reverse voltage	V_R	max.	650	850	V

Currents

Average forward current				
sinusoidal; up to T_{mb} = 103 °C	$I_{F(AV)}$	max.	12	A
sinusoidal; at T_{mb} = 125 °C	$I_{F(AV)}$	max.	7	A
square-wave; δ = 0.5; up to T_{mb} = 103 °C	$I_{F(AV)}$	max.	14	A
square-wave; δ = 0.5; at T_{mb} = 125 °C	$I_{F(AV)}$	max.	8	A
R.M.S. forward current	$I_{F(RMS)}$	max.	20	A
Repetitive peak forward current	I_{FRM}	max.	120	A
Non-repetitive peak forward current t = 10 ms; half sine-wave; T_j = 150 °C prior to surge;				
without re-applied voltage	I_{FSM}	max.	150	A
with re-applied V_{RWMmax}	I_{FSM}	max.	120	A
I^2t for fusing (t = 10 ms)	I^2t	max.	72	A^2s

Temperatures

Storage temperature	T_{stg}	−55 to +150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	2.0	°C/W
From mounting base to heatsink				
with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.3	°C/W
without heatsink compound	$R_{th\ mb\text{-}h}$	=	0.5	°C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0.85	°C/W

MOUNTING INSTRUCTIONS

The top connector should neither be bent nor twisted; it should be soldered into the circuit so that there is no strain on it.
During soldering the heat conduction to the junction should be kept to a minimum.

*To ensure thermal stability: $R_{th\ j\text{-}a} \leq 8$ °C/W (continuous reverse voltage).

CHARACTERISTICS

Forward voltage				
$I_F = 20$ A; $T_j = 25$ °C	V_F	<	1.7	V*
Reverse current				
$V_R = V_{RWMmax}$; $T_j = 125$ °C	I_R	<	1.5	mA
Reverse recovery when switched from				
$I_F = 10$ A to $V_R \geqslant 30$ V with $-dI_F/dt = 10$ A/μs; $T_j = 25$ °C				
Recovery time	t_{rr}	<	450	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	<	800	nC
Maximum slope of the reverse recovery current when switched from $I_F = 2$ A to $V_R \geqslant 30$ V; with $-dI_F/dt = 2$ A/μs; $T_j = 25$ °C	$\vert dI_R/dt \vert$	<	7	A/μs

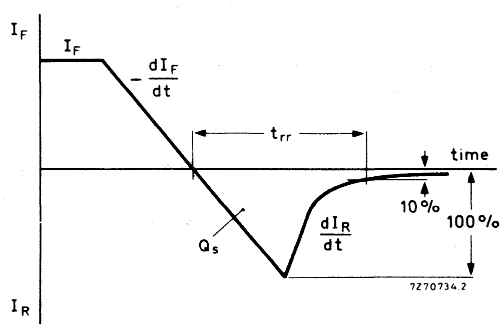


Fig.2 Definition of t_{rr} and Q_s.

*Measured under pulse conditions to avoid excessive dissipation.

SINUSOIDAL OPERATION

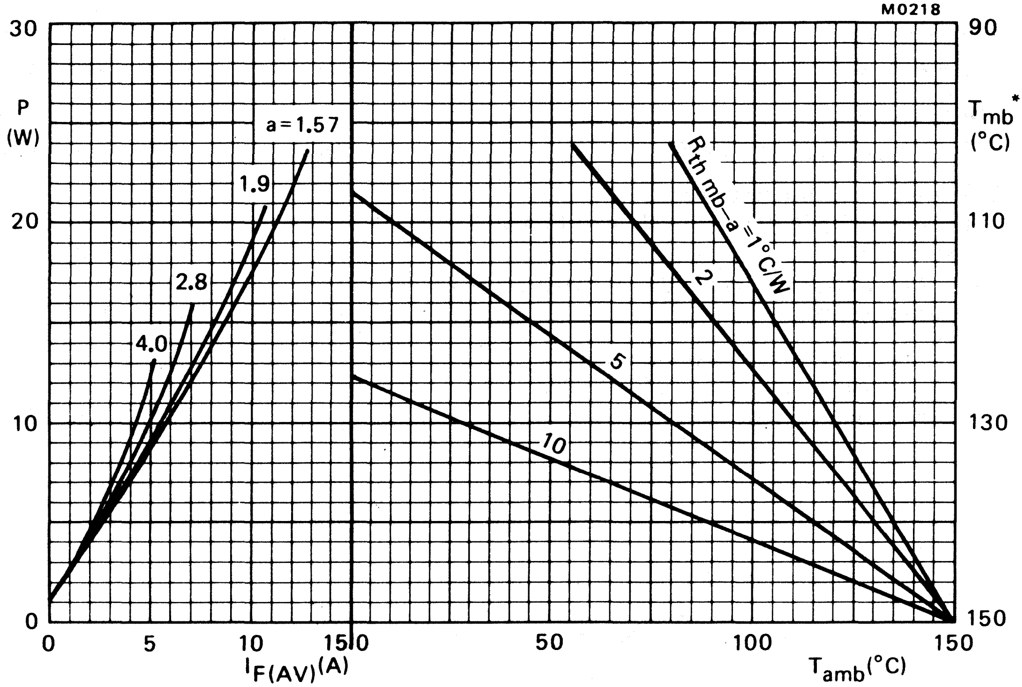


Fig.3 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
P = power including reverse current losses but excluding switching losses.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

*T_{mb} scale is for comparison purposes and is correct only for $R_{th\ mb-a} < 8$ °C/W.

SQUARE–WAVE OPERATION

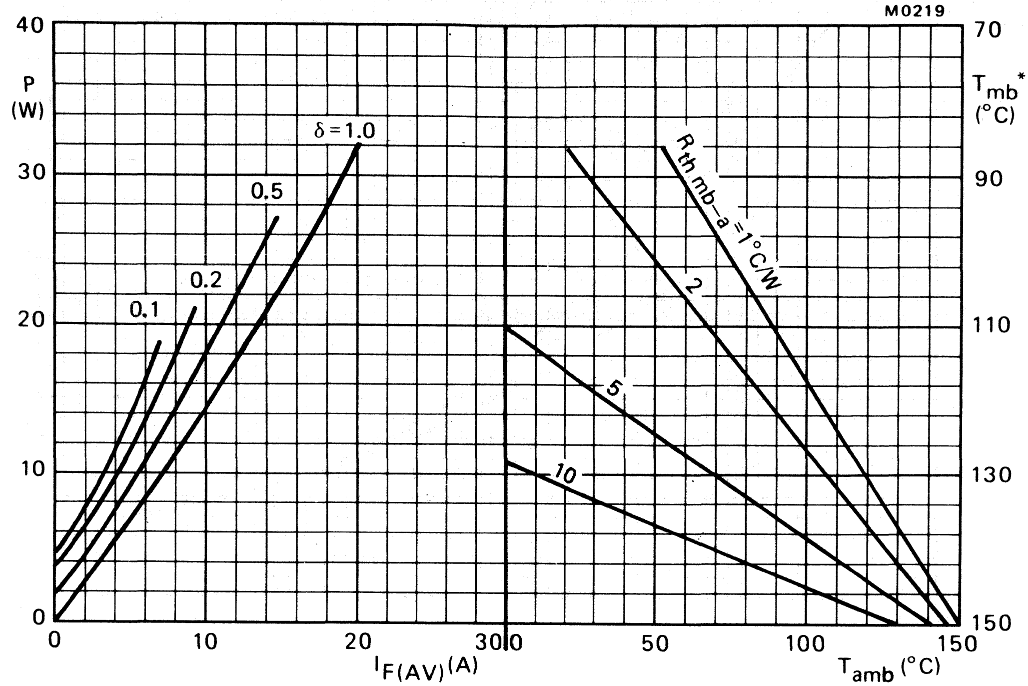
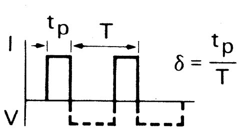


Fig.4 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
P = power including reverse current losses but excluding switching losses.



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

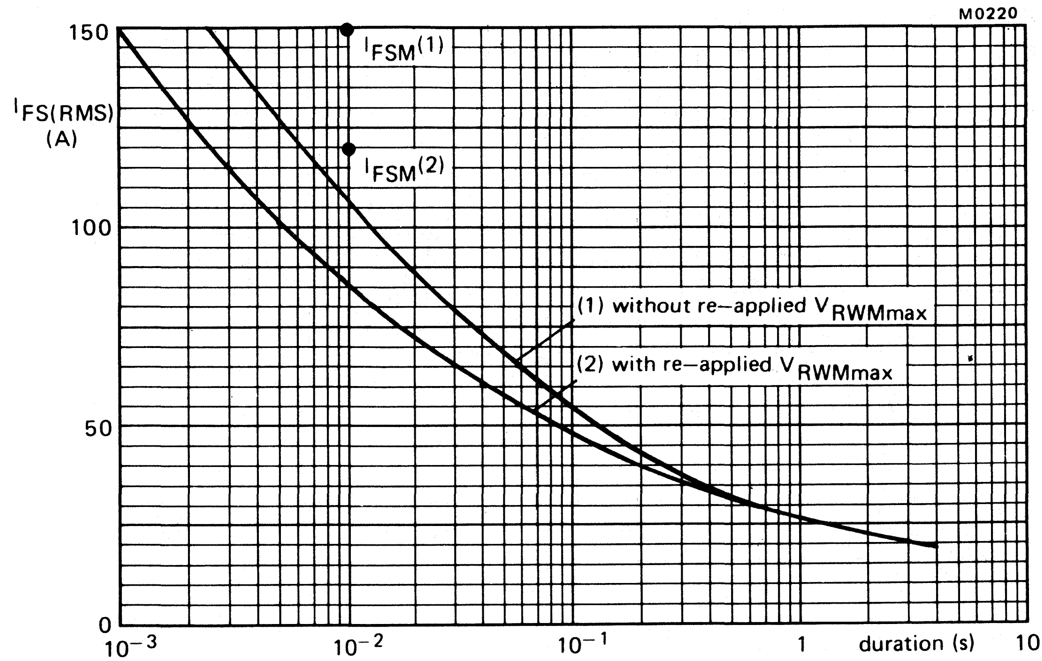
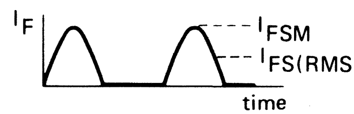


Fig.5 Maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz); T_j = 150 °C prior to surge.



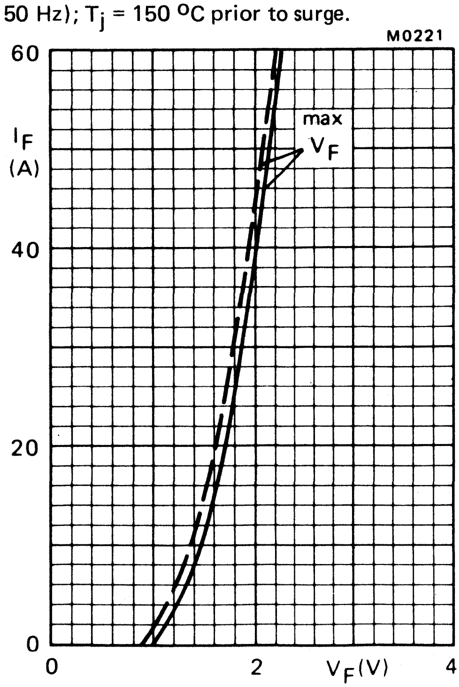


Fig.6 . —— T_j = 25 °C; – – – T_j = 100 °C.

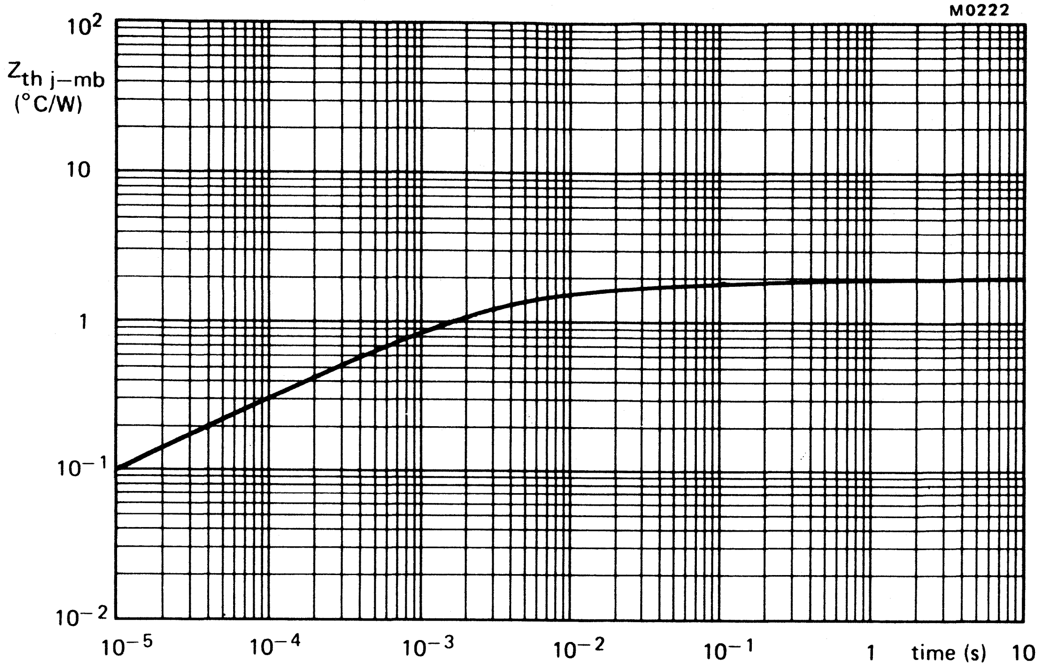


Fig.7

ULTRA FAST RECOVERY RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial rectifier diodes in plastic envelopes, featuring low forward voltage drop, ultra fast reverse recovery times with very low stored charge and soft-recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and switching losses are essential.
The series consists of normal polarity (cathode to mounting base) types.

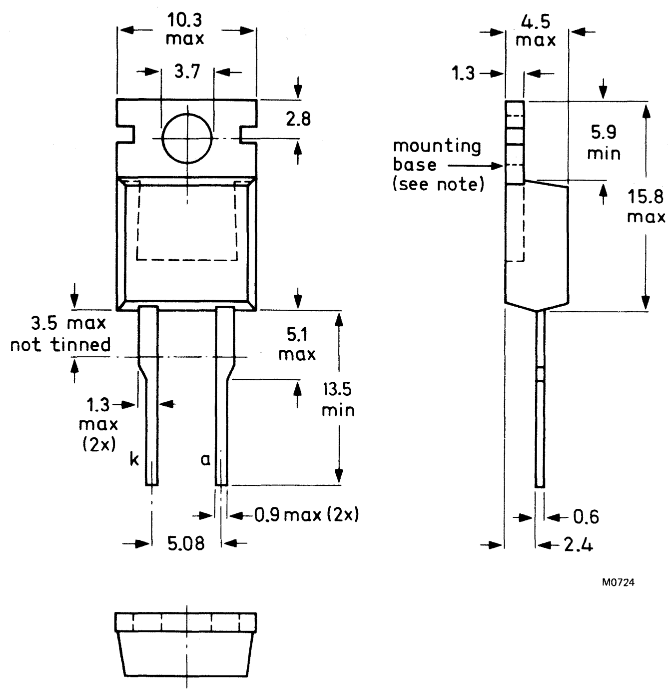
QUICK REFERENCE DATA

			BYV29–300	400	500	
Repetitive peak reverse voltage	V_{RRM}	max.	300	400	500	V
Average forward current	$I_{F(AV)}$	max.		9		A
Forward voltage	V_F	<		1.05		V
Reverse recovery time	t_{rr}	<		50		ns

MECHANICAL DATA

Dimensions in mm

Fig.1 TO-220AC



Net mass: 2 g

Note: The exposed metal mounting base is directly connected to the cathode.

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

RATINGS

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

Voltages			BYV29–300	400	500	
→ Non-repetitive peak reverse voltage	V_{RSM}	max.	350	450	550	V
Repetitive peak reverse voltage	V_{RRM}	max.	300	400	500	V
Crest working reverse voltage	V_{RWM}	max.	200	300	400	V
Continuous reverse voltage (note 1)	V_R	max.	200	300	400	V

Currents				
Average forward current; switching losses negligible up to 200 kHz;				
square wave; $\delta = 0.5$; up to $T_{mb} = 116\ ^oC$	$I_{F(AV)}$	max.	9	A
sinusoidal; up to $T_{mb} = 125\ ^oC$	$I_{F(AV)}$	max.	7.4	A
R.M.S. forward current	$I_{F(RMS)}$	max.	13	A
Repetitive peak forward current $t_p = 20\ \mu s$; $\delta = 0.02$	I_{FRM}	max.	200	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.	100	A
t = 8.3 ms	I_{FSM}	max.	110	A
I^2t for fusing (t = 10 ms)	I^2t	max.	50	A^2s

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

Notes:

1. To ensure thermal stability: $R_{th\ j\text{-}a} < 6.8$ K/W.

CHARACTERISTICS

$T_j = 25\ ^oC$ unless otherwise stated

Forward voltage				
$I_F = 5$ A; $T_j = 100\ ^oC$	V_F	<	1.05	V*
$I_F = 20$ A	V_F	<	1.4	V*
Reverse current				
$V_R = V_{RWM\,max}$; $T_j = 100\ ^oC$	I_R	<	0.35	mA
$V_R = V_{RWM\,max}$	I_R	<	10	µA
Reverse recovery when switched from				
$I_F = 1$ A to $V_R \geqslant 30$ V with $-dI_F/dt = 100$ A/µs; recovery time	t_{rr}	<	50	ns
$I_F = 2$ A to $V_R \geqslant 30$ V with $-dI_F/dt = 20$ A/µs; recovered charge	Q_s	<	55	nC
$I_F = 10$ A to $V_R \geqslant 30$ V with $-dI_F/dt = 50$ A/µs; $T_j = 100\ ^oC$; peak recovery current	I_{RRM}	<	5.5	A
Forward recovery when switched to $I_F = 10$ A with $dI_F/dt = 10$ A/µs	V_{fr}	typ.	2.5	V

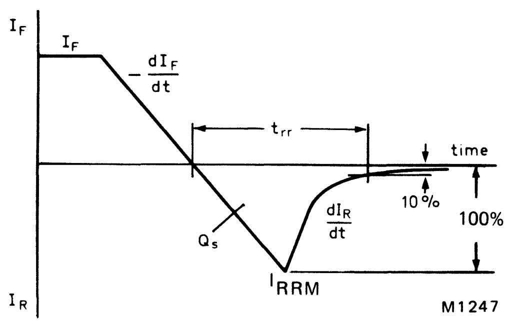


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

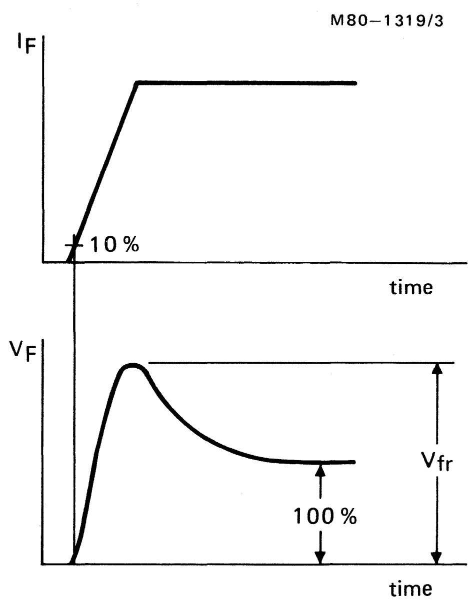


Fig.3 Definition of V_{fr}.

*Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	2.5	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 insulator (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 value 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 device lead length and with copper laminate on the board	$R_{th\ j\text{-}a}$	=	60	K/W

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 calculations

a. The various components of junction temperature rise above ambient are illustrated in Fig.4.

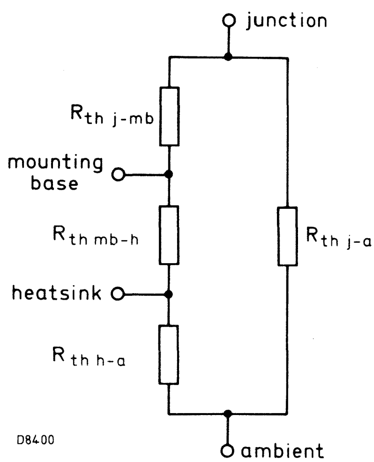


Fig. 4.

b. Any measurement of heatsink temperature should be made immediately adjacent to the device.
c. The method of using Figs. 5 and 6 is as follows:
Starting with the required current on the $I_{F(AV)}$ axis, trace upwards to meet the appropriate duty cycle or form factor curve. Trace right horizontally and upwards from the required value on the T_{amb} scale. The intersection determines the $R_{th\ mb\text{-}a}$. The heatsink thermal resistance value ($R_{th\ h\text{-}a}$) can be calculated from:

$$R_{th\ h\text{-}a} = R_{th\ mb\text{-}a} - R_{th\ mb\text{-}h}.$$

SQUARE-WAVE OPERATION

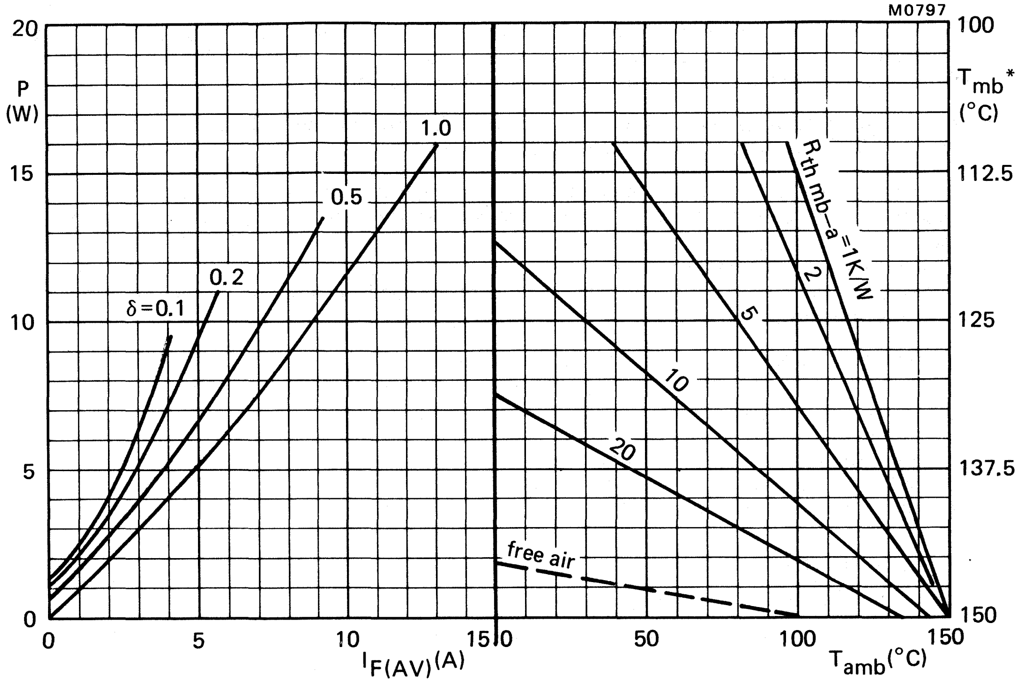
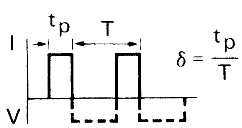


Fig.5 The right-hand part shows the relationship between the power (derived from the left-hand part) and the maximum permissible temperatures.



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

*T_{mb} scale is for comparison purposes and is correct only for $R_{th\ mb-a} < 4.1$ °K/W.

SINUSOIDAL OPERATION

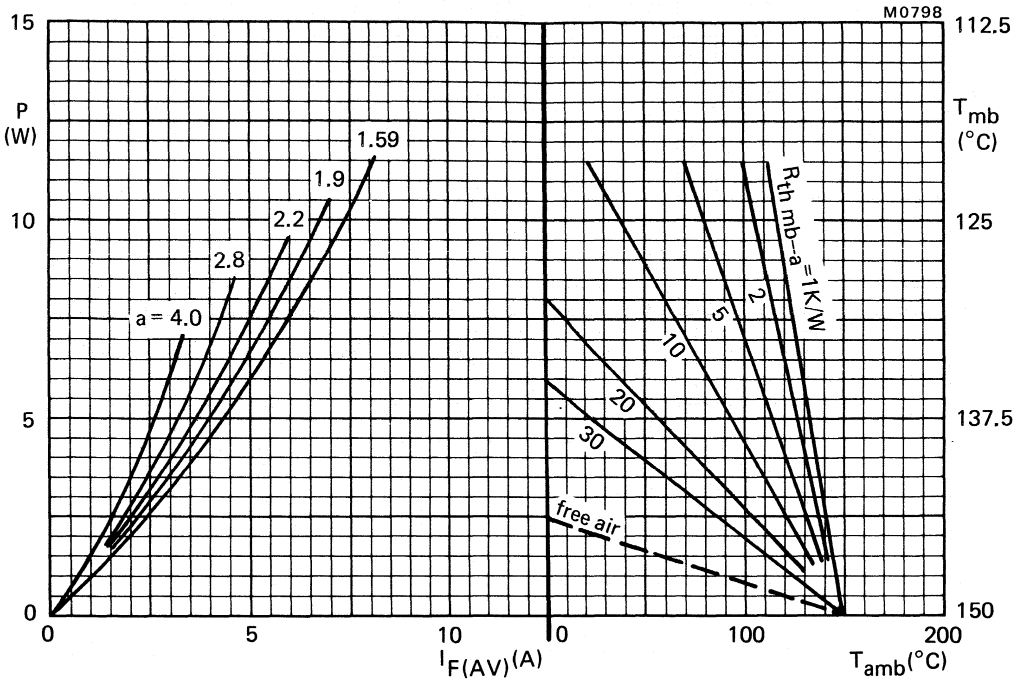


Fig.6 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

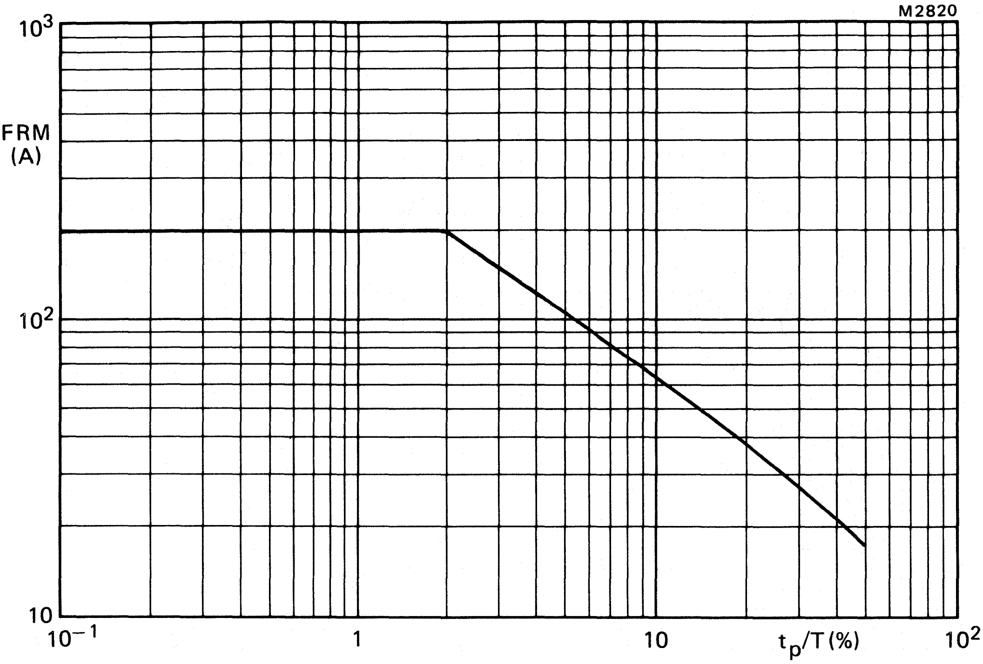
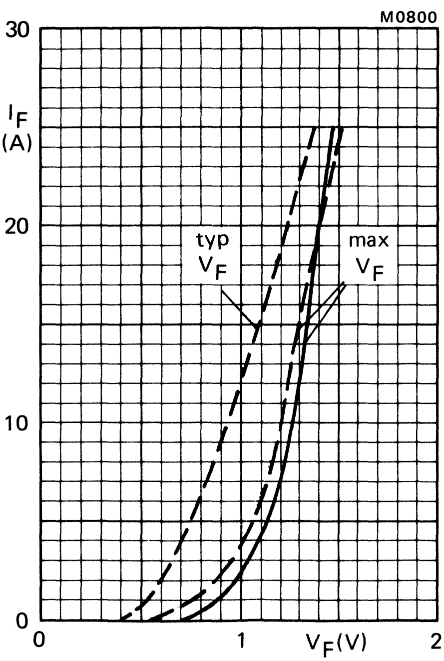
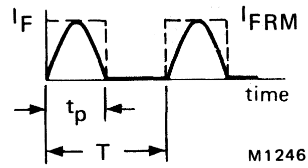


Fig.7 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 μs < t_p < 1 ms.





Defintion of I_{FRM} and t_p/T.

Fig.8 —— T_j = 25 °C; – – – T_j = 100 °C.

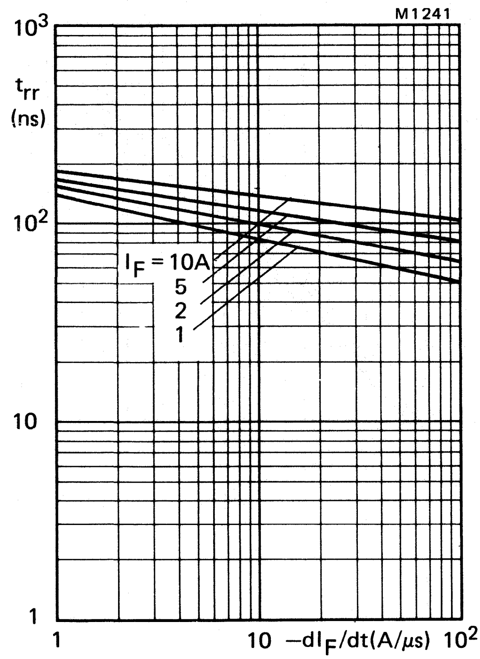


Fig.9 Maximum t_{rr} at T_j = 25 °C.

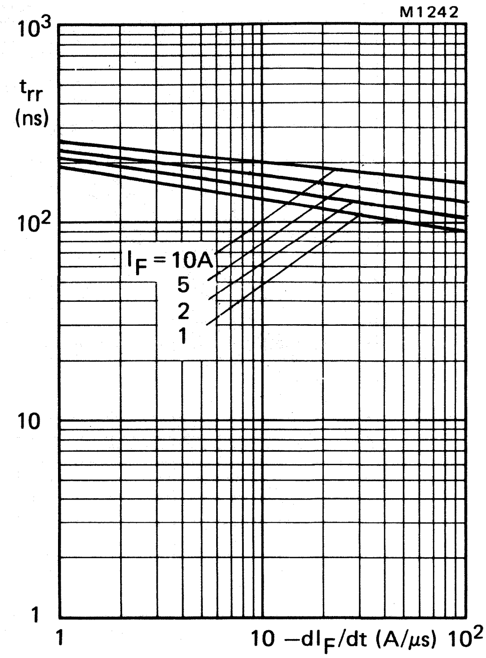


Fig.10 Maximum t_{rr} at T_j = 100 °C.

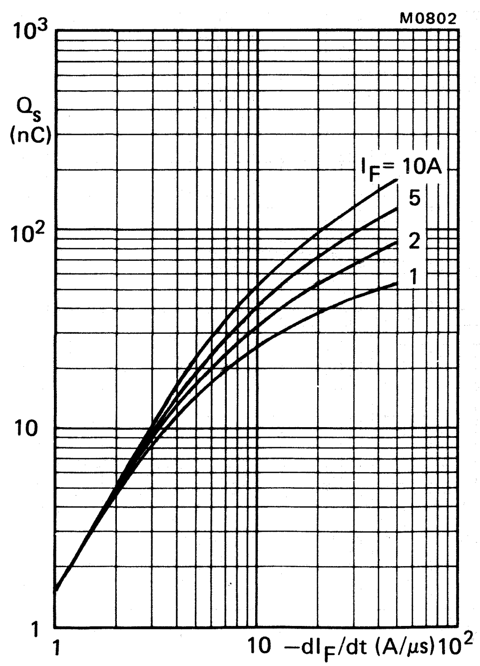


Fig.11 Maximum Q_s at T_j = 25 °C.

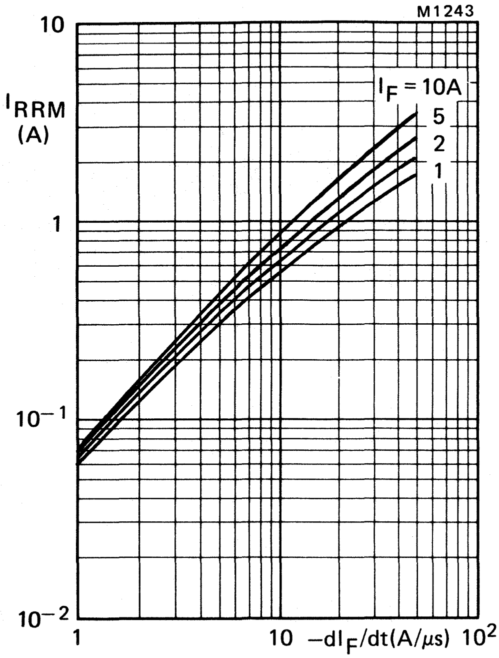


Fig.12 Maximum I_{RRM} at T_j = 25 °C.

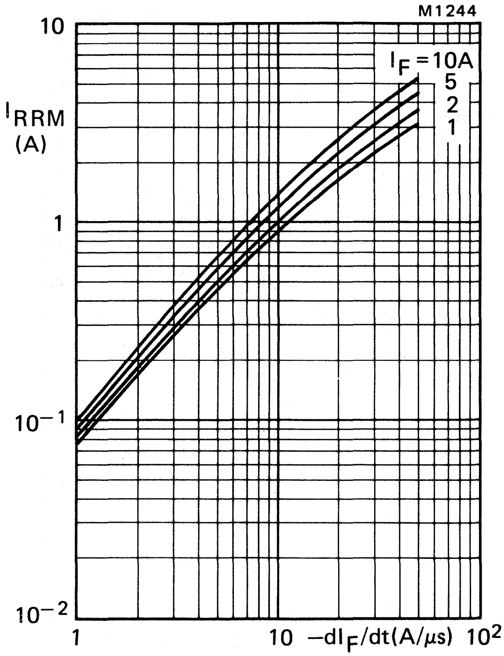


Fig.13 Maximum I_{RRM} at T_j = 100 °C.

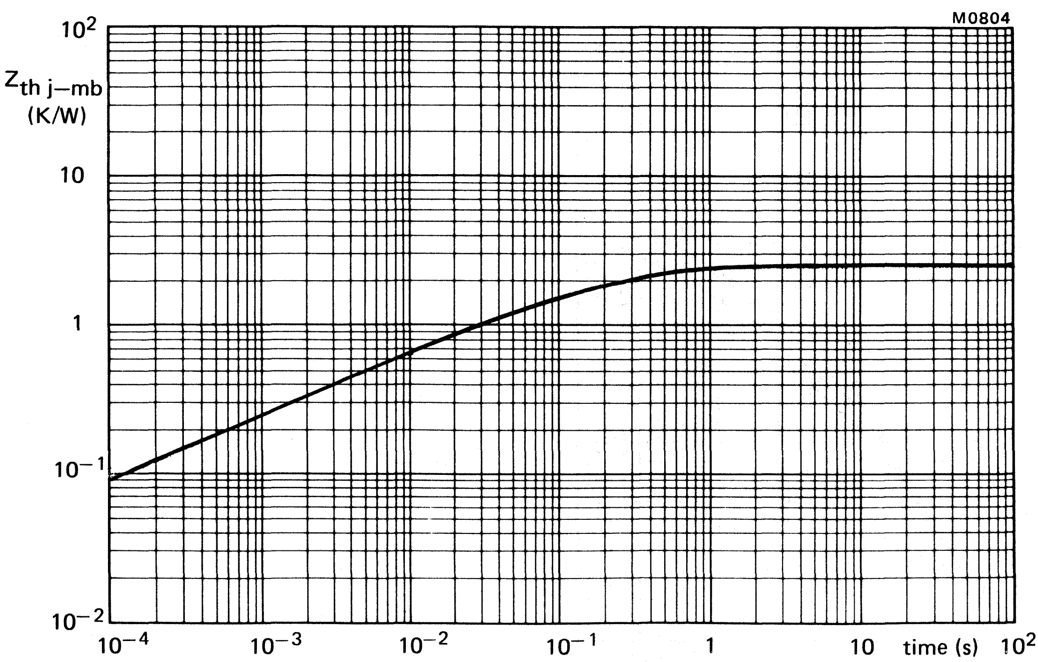


Fig.14 Transient thermal impedance.

ULTRA FAST-RECOVERY ELECTRICALLY ISOLATED RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial rectifier diodes in full-pack envelopes, featuring low forward voltage drop, ultra fast reverse recovery times with very low stored charge and soft-recovery characteristic. 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 switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and low switching losses are essential.

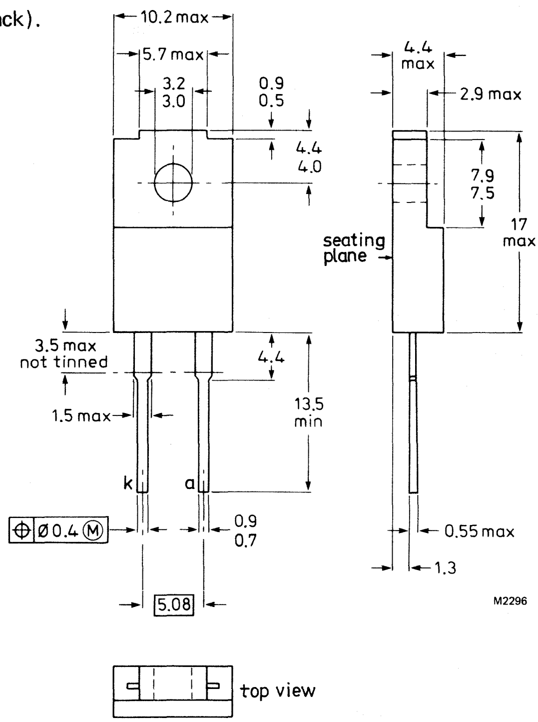
QUICK REFERENCE DATA

			BYV29F–300	400	500	
Repetitive peak reverse voltage	V_{RRM}	max.	300	400	500	V
Average foward current	$I_{F(AV)}$	max.		9		A
Forward voltage	V_F	<		1.05		V
Reverse recovery time	t_{rr}	<		50		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 (IEC 134).

Voltages

			BYV29F–300	400	500	
Non-repetitive peak reverse voltage	V_{RSM}	max.	350	450	550	V
Repetitive peak reverse voltage	V_{RRM}	max.	300	400	500	V
Crest working reverse voltage	V_{RWM}	max.	200	300	400	V
Continuous reverse voltage (note 1)	V_R	max.	200	300	400	V

Currents

Average forward current; switching losses negligible up to 200 kHz (note 2);				
square wave; $\delta = 0.5$; up to $T_h = 76\ ^oC$	$I_{F(AV)}$	max.	9	A
sinusoidal; up to $T_h = 87\ ^oC$	$I_{F(AV)}$	max.	8	A
R.M.S. forward current	$I_{F(RMS)}$	max.	13	A
Repetitive peak forward current $t_p = 20\ \mu s$; $\delta = 0.02$	I_{FRM}	max.	200	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.	100	A
t = 8.3 ms	I_{FSM}	max.	110	A
I^2t for fusing (t = 10 ms)	I^2t	max.	50	A^2s

Temperatures

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

ISOLATION

Voltage allowed between all terminals and external heatsink, peak value (note 4)	V_{isol}	max.	1500	V
Insulation capacitance between all terminals and external heatsink	C_{isol}	typ.	12	pF

Notes:

1. To ensure thermal stability: $R_{th\ j\text{-}a} < 6.8$ K/W.
2. The quoted temperatures assume heatsink compound is used.
3. Mounted without heatsink compound and 20 newtons pressure on the centre of the envelope.
4. Repetitive peak operation with relative humidity ≤ 65% under clean and dust-free conditions.

THERMAL RESISTANCE

From junction to external heatsink with minimum of 2 kgf (20 newtons) pressure on the centre of the envelope,				
with heatsink compound	$R_{th\ j\text{-}h}$	=	5.5	K/W
without heatsink compound	$R_{th\ j\text{-}h}$	=	7.2	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

Forward voltage				
I_F = 5 A; T_j = 100 °C	V_F	<	1.05	V*
I_F = 20 A; T_j = 25 °C	V_F	<	1.4	V*
Reverse current				
$V_R = V_{RWM\ max}$; T_j = 100 °C	I_R	<	0.35	mA
$V_R = V_{RWM\ max}$; T_j = 25 °C	I_R	<	10	μA
Reverse recovery when switched from				
I_F = 1 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 100 A/μs; T_j = 25 °C; recovery time	t_{rr}	<	50	ns
I_F = 2 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 20 A/μs; T_j = 25 °C; recovered charge	Q_s	<	55	nC
I_F = 10 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 50 A/μs; T_j = 100 °C; peak recovery current	I_{RRM}	<	5.5	A
Forward recovery when switched to I_F = 10 A with dI_F/dt = 10 A/μs; T_j = 25 °C	V_{fr}	typ.	2.5	V

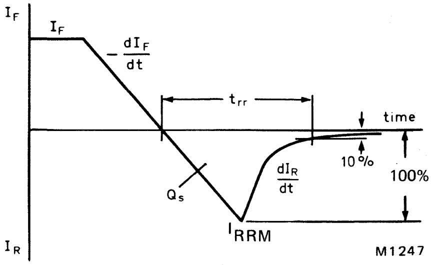


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

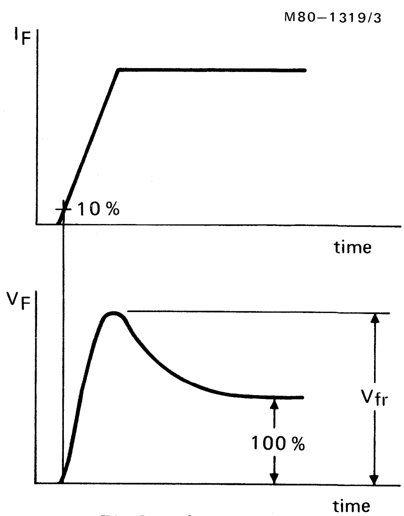


Fig.3 Definition of V_{fr}.

*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.4.

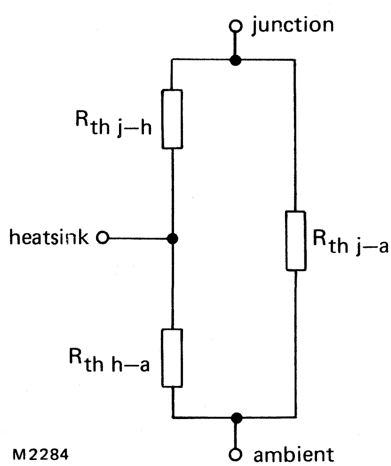


Fig.4.

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

SQUARE-WAVE OPERATION

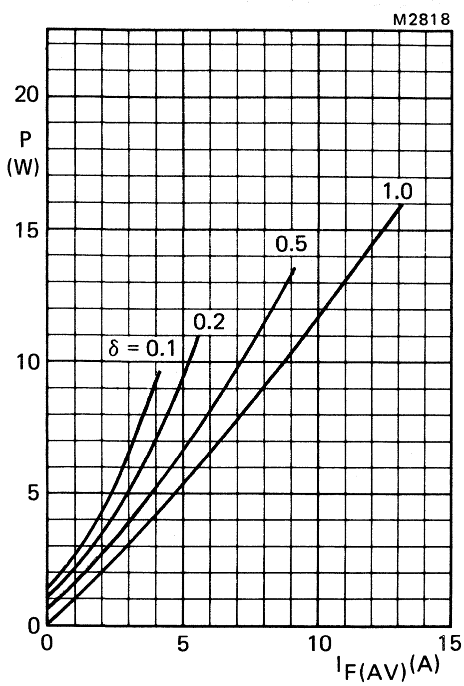
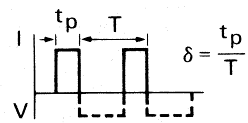


Fig.5 Power rating.

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.



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

SINUSOIDAL OPERATION

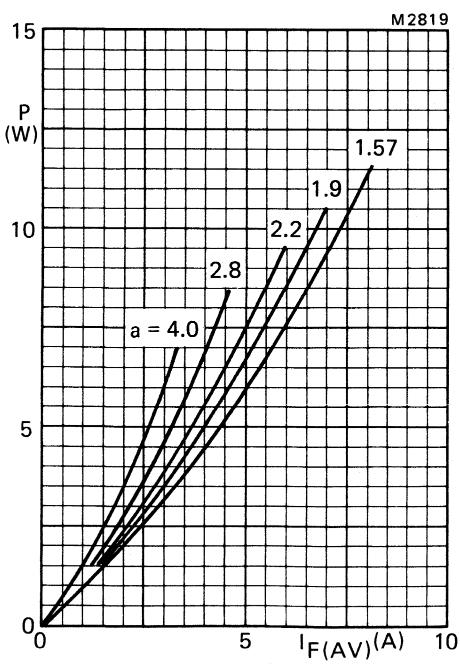


Fig.6 Power rating.

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 = $I_{F(RMS)}/I_{F(AV)}$

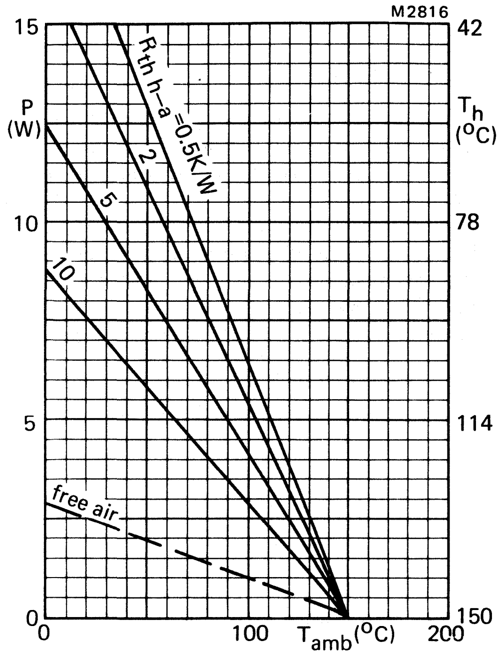


Fig.7 Heatsink rating; without heatsink compound.

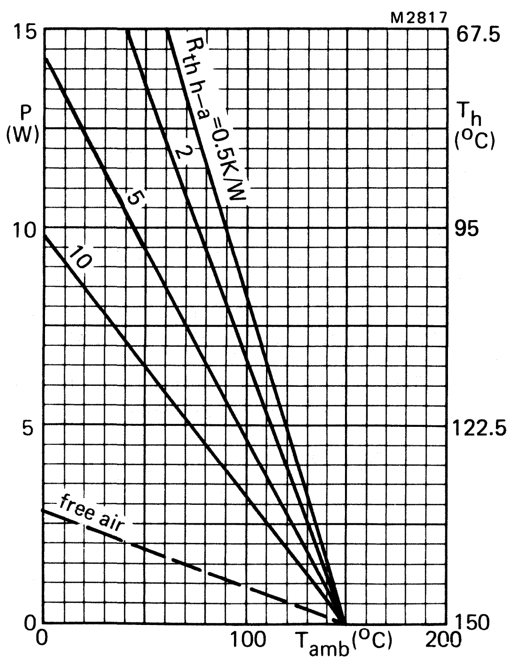


Fig.8 Heatsink rating; with heatsink compound.

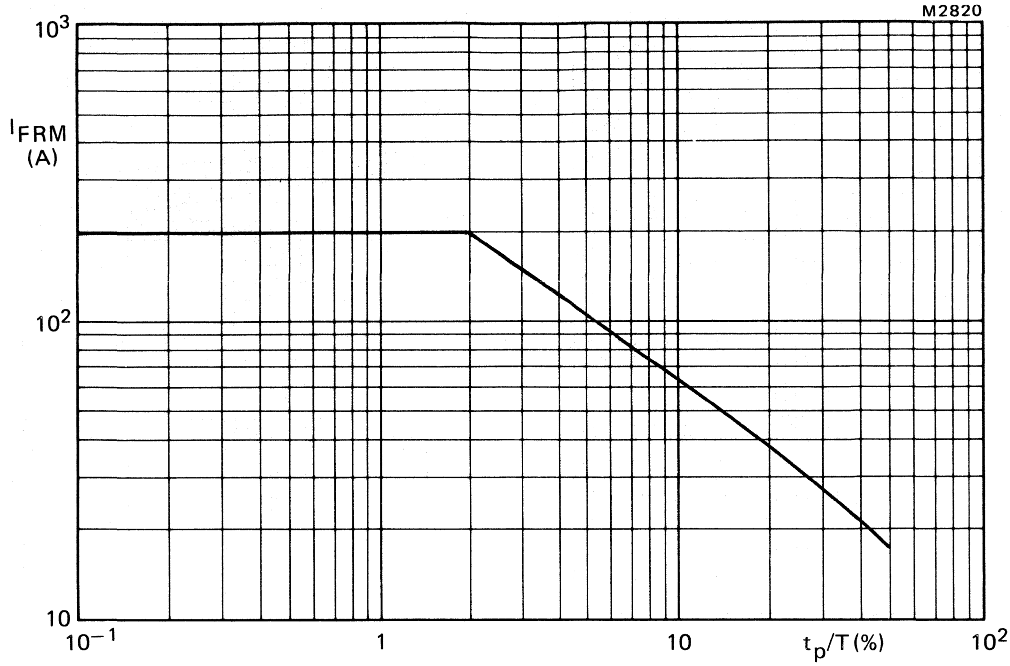
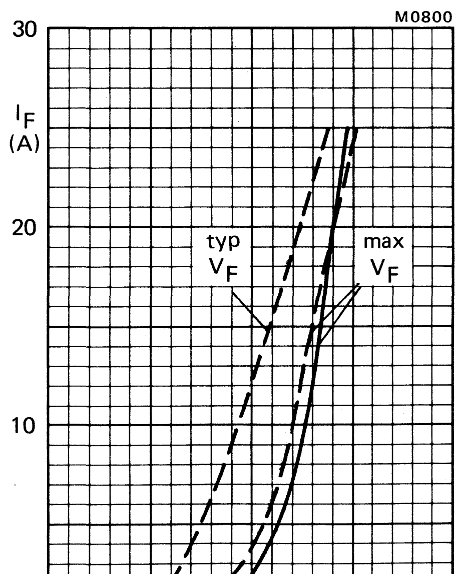
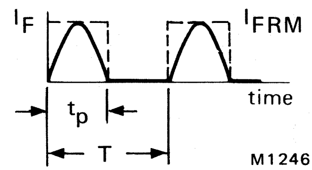


Fig.9 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 $\mu s < t_p < 1$ ms.





Definition of I_{FRM} and t_p/T.

Fig.10 —— T_j = 25 °C; – – – T_j = 100 °C.

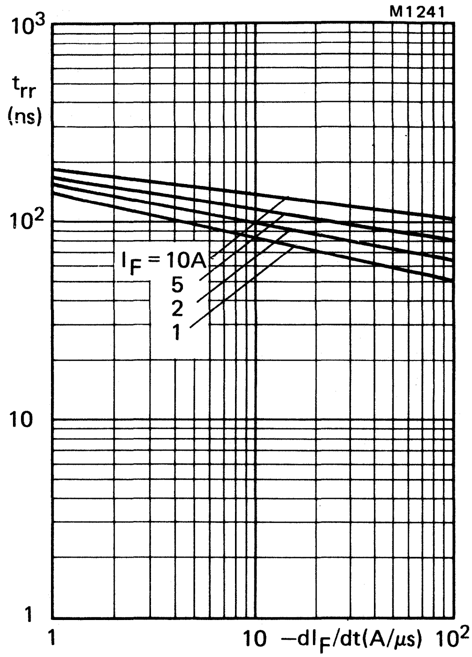


Fig.11 Maximum t_{rr} at T_j = 25 °C.

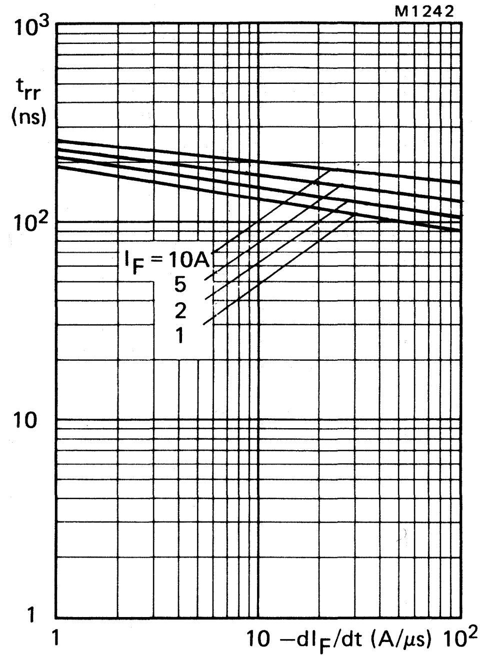


Fig.12 Maximum t_{rr} at T_j = 100 °C.

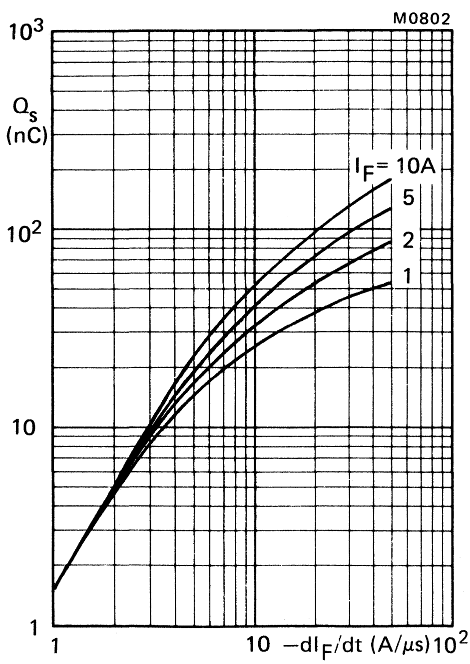


Fig.13 Maximum Q_s at T_j = 25 °C.

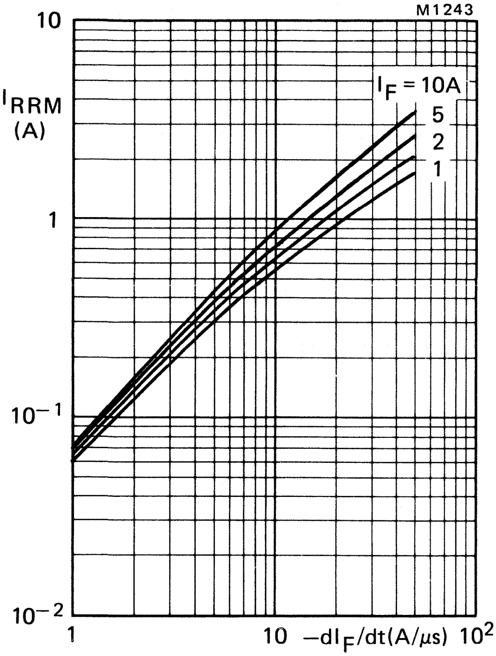


Fig.14 Maximum I_{RRM} at T_j = 25 °C.

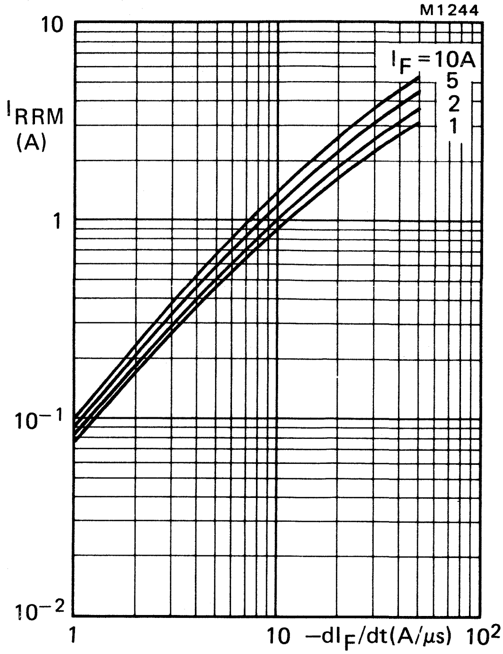


Fig.15 Maximum I_{RRM} at T_j = 100 °C.

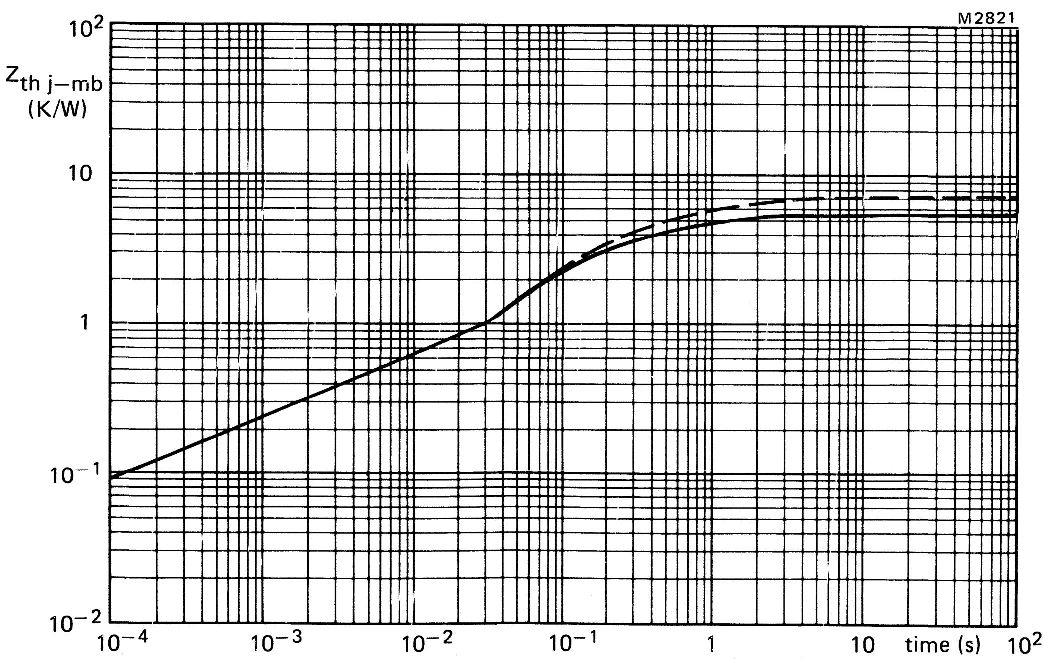


Fig.16 Transient thermal impedance; —— with heatsink compound; – – – without heatsink compound.

ULTRA FAST RECOVERY RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial rectifier diodes in DO–4 metal envelopes, featuring low forward voltage drop, ultra fast reverse recovery times, very low stored charge and soft recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where low conduction and switching losses are essential. The series consists of normal polarity (cathode to stud) types.

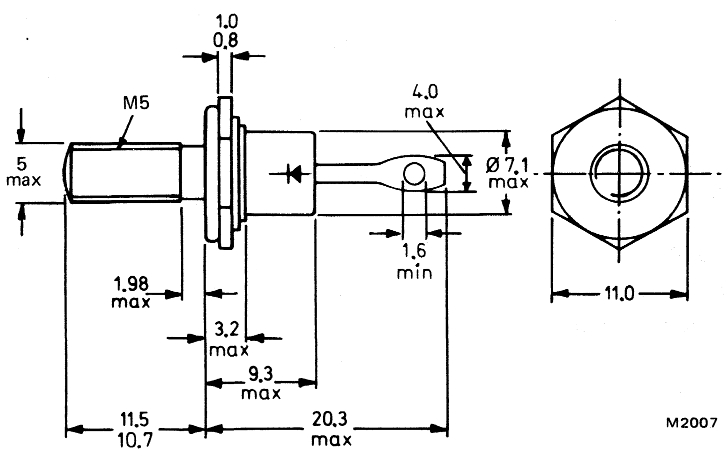
QUICK REFERENCE DATA

			BYV30–300	400	500	
Repetitive peak reverse voltage	V_{RRM}	max.	300	400	500	V
Average forward current	$I_{F(AV)}$	max.		14		A
Forward voltage	V_F	<		1.05		V
Reverse recovery time	t_{rr}	<		50		ns

MECHANICAL DATA

Dimensions in mm

Fig.1 DO-4 with metric (M5) stud as standard.
10-32 UNF is available upon request with suffix U (e.g. BYV30-400U).



Net mass: 6 g

Diameter of clearance hole: max. 5.2 mm

Accessories supplied on request: see data sheets Mounting instructions and Accessories for DO-4 envelopes.

Supplied with device: 1 nut, 1 lock washer.

Nut dimensions across the flats: 9.5 mm

Torque on nut:
min. 0.9 Nm (9 kg cm)
max. 1.7 Nm (17 kg cm)

RATINGS

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

Voltages

			BYV30–300	400	500	
→ Non-repetitive peak reverse voltage	V_{RSM}	max.	350	450	550	V
Repetitive peak reverse voltage	V_{RRM}	max.	300	400	500	V
Crest working reverse voltage	V_{RWM}	max.	200	300	400	V
Continuous reverse voltage*	V_R	max.	200	300	400	V

Currents

Average forward current; switching losses negligible up to 100 kHz				
square wave; δ = 0.5; up to T_{mb} = 113 °C	$I_{F(AV)}$	max.	14	A
up to T_{mb} = 125 °C	$I_{F(AV)}$	max.	10	A
sinusoidal; up to T_{mb} = 118 °C	$I_{F(AV)}$	max.	12.5	A
up to T_{mb} = 125 °C	$I_{F(AV)}$	max.	10	A
R.M.S. forward current	$I_{F(RMS)}$	max.	20	A
Repetitive peak forward current t_p = 20 μs; δ = 0.02	I_{FRM}	max.	320	A
Non-repetitive peak forward current half sine-wave; T_j = 150 °C prior to surge; with reapplied V_{RWMmax};				
t = 10 ms	I_{FSM}	max.	150	A
t = 8.3 ms	I_{FSM}	max.	180	A
I^2t for fusing (t = 10 ms)	I^2t	max.	112	A^2s

Temperatures

Storage temperature	T_{stg}		−65 to +175	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	2.0	K/W
From mounting base to heatsink with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.3	K/W
From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	50	K/W

*To ensure thermal stability: $R_{th\ j\text{-}a} \leqslant 4.6$ K/W.

CHARACTERISTICS

Forward voltage				
I_F = 15 A; T_j = 150 °C	V_F	<	1.05	V*
I_F = 50 A; T_j = 25 °C	V_F	<	1.40	V*
Reverse current				
$V_R = V_{RWM\,max}$; T_j = 100 °C	I_R	<	0.8	mA
T_j = 25 °C	I_R	<	50	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}	<	50	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	<	50	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}	<	5.2	A
Forward recovery when switched to I_F = 10 A with dI_F/dt = 10 A/μs; T_j = 25 °C	V_{fr}	typ.	2.5	V

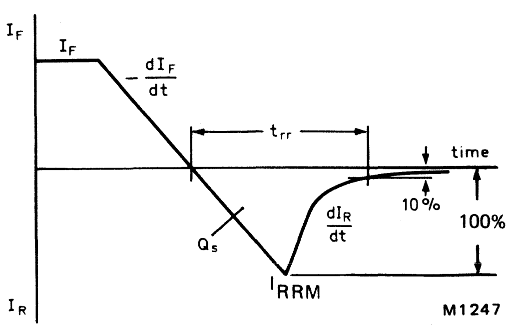


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

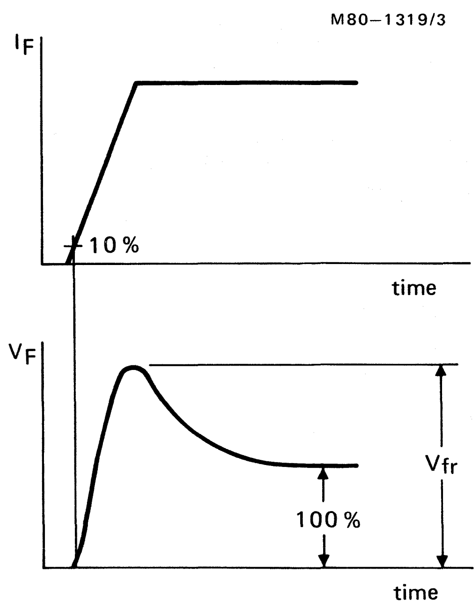


Fig.3 Definition of V_{fr}.

*Measured under pulse conditions to avoid excessive dissipation.

SQUARE-WAVE OPERATION

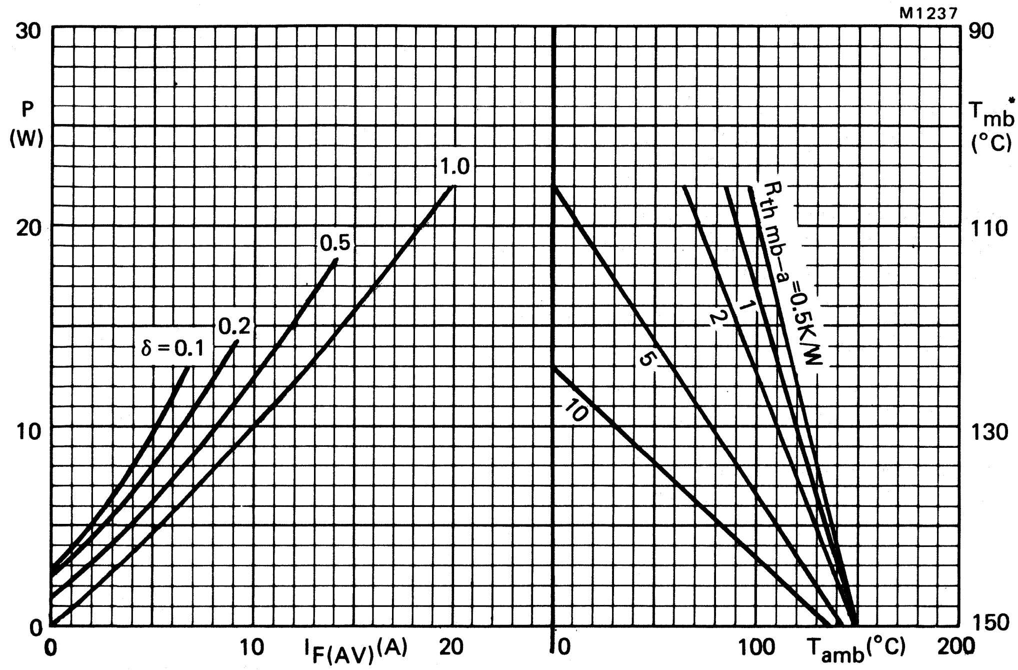
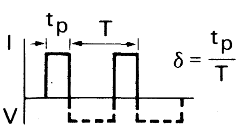


Fig.4 The right-hand part shows the relationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 100 kHz.



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

*T_{mb} scale is for comparison purposes and is correct only for $R_{th\ mb\text{-}a} < 4.1$ K/W.

SINUSOIDAL OPERATION

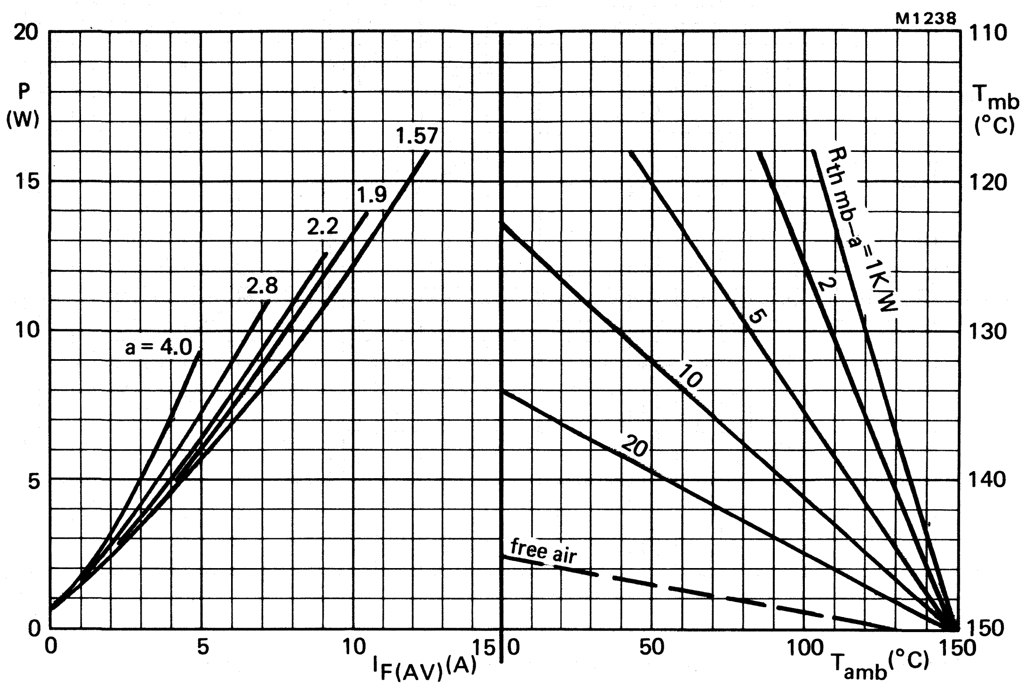


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

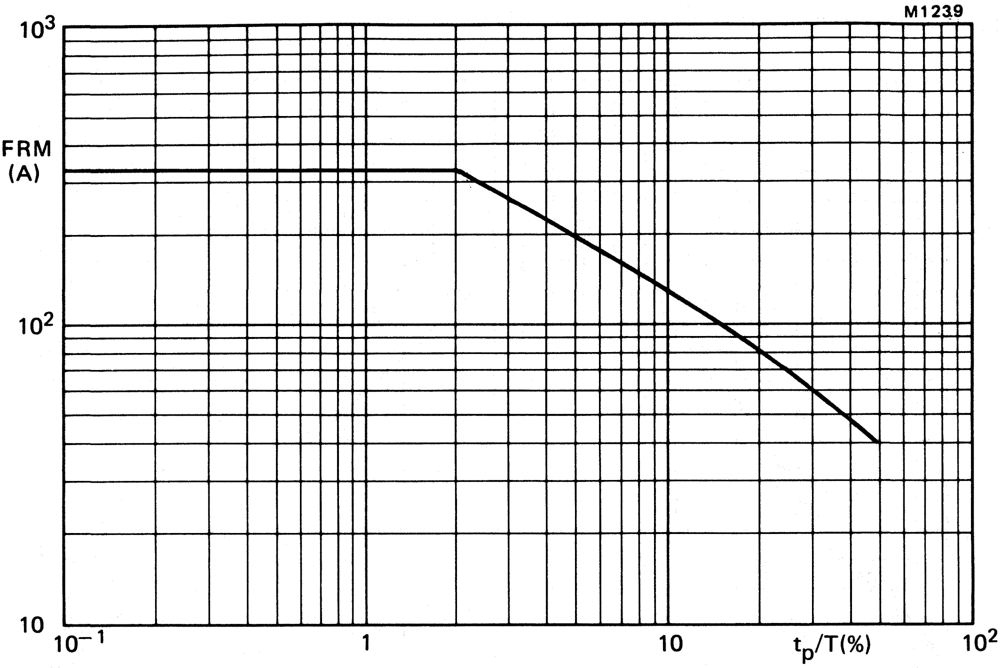
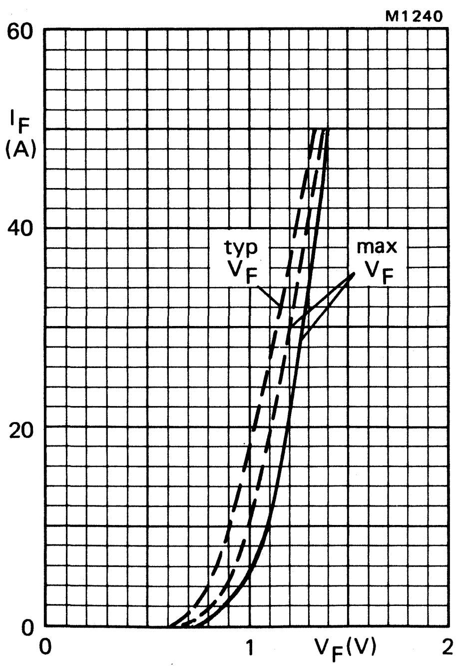
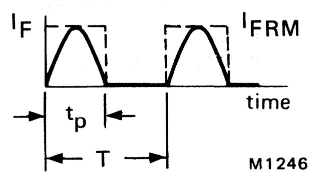


Fig.6 Maximum permissible repetitive peak forward current for square or sinusoidal currents; $1\ \mu s < t_p < 1$ ms.





Definition of I_{FRM} and t_p/T.

Fig.7 —— $T_j = 25\ ^oC$; – – – $T_j = 150\ ^oC$.

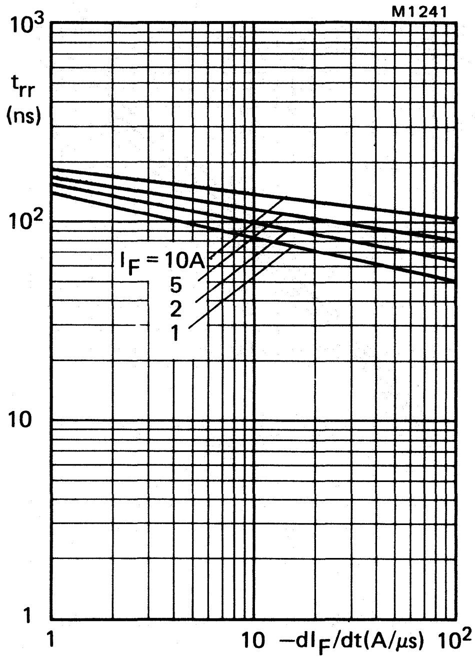


Fig.8 Maximum t_{rr} at T_j = 25 °C

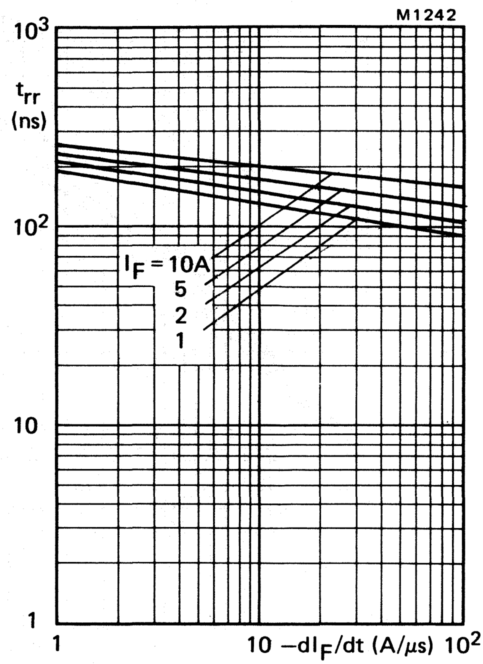


Fig.9 Maximum t_{rr} at T_j = 100 °C.

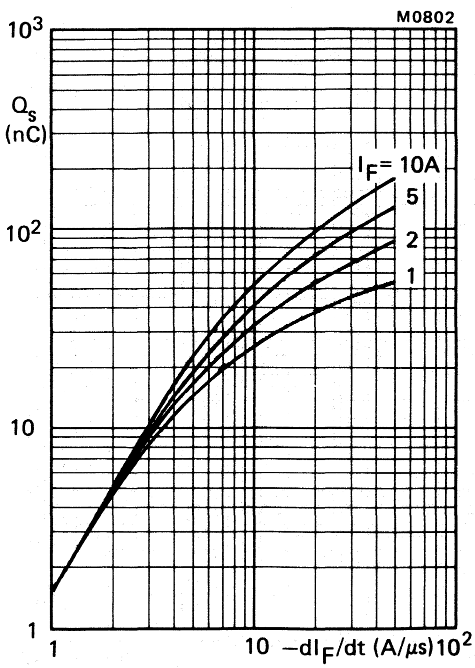


Fig.10 Maximum Q_s at T_j = 25 °C

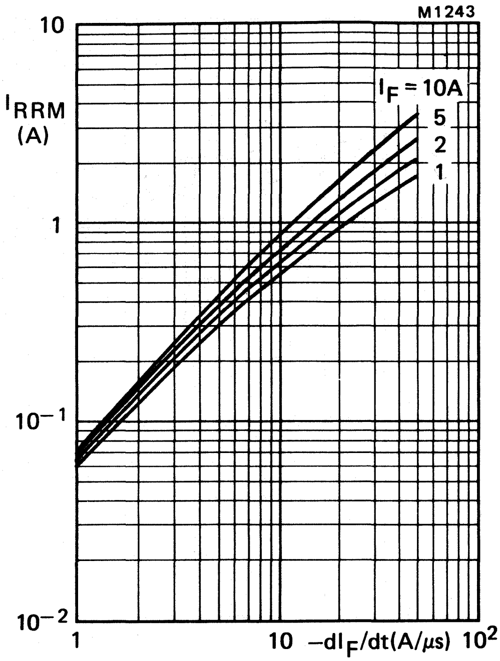


Fig.11 Maximum I_{RRM} at $T_j = 25\ ^oC$

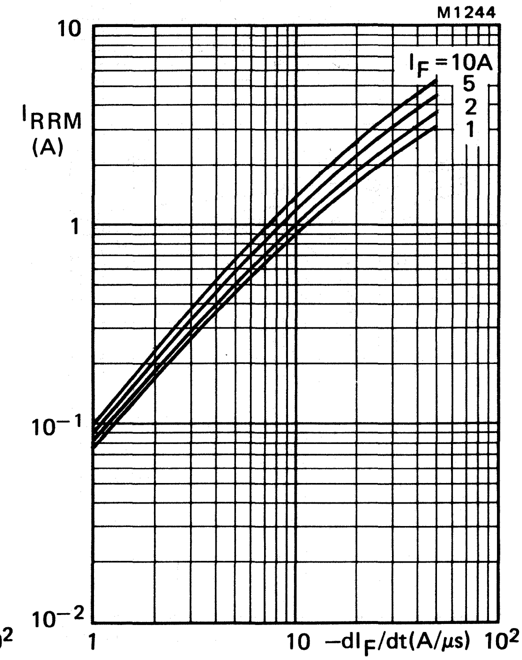


Fig.12 Maximum I_{RRM} at $T_j = 100\ ^oC$.

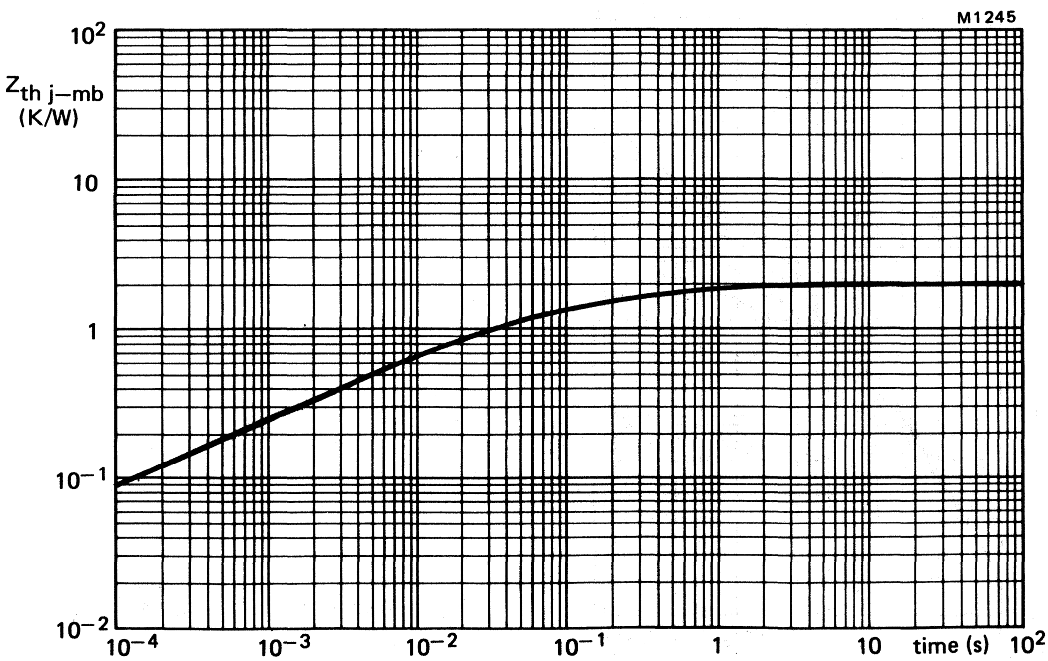


Fig.13 Transient thermal impedance.

ULTRA FAST RECOVERY RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial rectifier diodes in DO—4 metal envelopes, featuring low forward voltage drop, ultra fast reverse recovery times, very low stored charge and soft recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction and switching losses are essential. The series consists of normal polarity (cathode to stud) types.

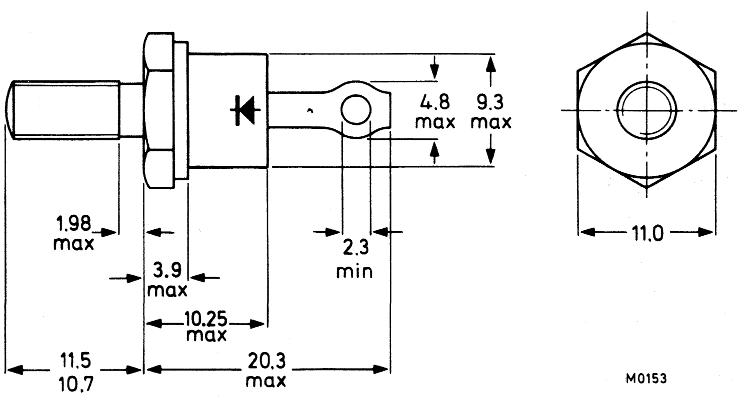
QUICK REFERENCE DATA

			BYV31—300	400	500	
Repetitive peak reverse voltage	V_{RRM}	max	300	400	500	V
Average forward current	$I_{F(AV)}$	max.		28		A
Forward voltage	V_F	<		1.05		V
Reverse recovery time	t_{rr}	<		50		ns

MECHANICAL DATA

Dimensions in mm

Fig.1 DO—4; with metric M5 stud (ϕ5 mm); e.g. BYV31—500
with 10-32 UNF stud (ϕ4.83 mm); e.g. BYV31—500U



Net mass: 7 g

Diameter of clearance hole: max. 5.2 mm

Accessories supplied on request:
mica washer (56295a);
PTFE ring (56295b); insulating bush (56295c).

Supplied with device: 1 nut, 1 lock washer

Torque on nut: min. 0.9 Nm (9 kg cm)
max. 1.7 Nm (17 kg cm)

Nut dimensions across the flats;
M5: 8.0 mm, 10-32 UNF: 9.5 mm

RATINGS

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

Voltages

			BYV31–300	400	500	
→ Non-repetitive peak reverse voltage	V_{RSM}	max.	350	450	550	V
Repetitive peak reverse voltage	V_{RRM}	max.	300	400	500	V
Crest working reverse voltage	V_{RWM}	max.	200	300	400	V
Continuous reverse voltage*	V_R	max.	200	300	400	V

Currents

Average forward current, switching losses negligible up to 100 kHz				
square wave; δ = 0.5; up to T_{mb} = 114 °C	$I_{F(AV)}$	max.	28	A
up to T_{mb} = 125 °C	$I_{F(AV)}$	max.	20	A
sinusoidal; up to T_{mb} = 119 °C	$I_{F(AV)}$	max.	25	A
up to T_{mb} = 125 °C	$I_{F(AV)}$	max.	21	A
R.M.S. forward current	$I_{F(RMS)}$	max.	40	A
Repetitive peak forward current t_p = 20 μs; δ = 0.02	I_{FRM}	max.	550	A
Non-repetitive peak forward current half sine-wave; T_j = 150 °C prior to surge; with reapplied V_{RWMmax};				
t = 10 ms	I_{FSM}	max.	300	A
t = 8.3 ms	I_{FSM}	max.	360	A
I^2t for fusing (t = 10 ms)	I^2t	max.	450	A^2s

Temperatures

Storage temperature	T_{stg}		–55 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1.0	K/W
From mounting base to heatsink				
a. with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.3	K/W
b. without heatsink compound	$R_{th\ mb\text{-}h}$	=	0.5	K/W

MOUNTING INSTRUCTIONS

The top connector should be neither bent nor twisted; it should be soldered into the circuit so that there is no strain on it.

During soldering the heat conduction to the junction should be kept to a minimum.

*To ensure thermal stability: $R_{th\ j\text{-}a} \leqslant 3.4$ K/W.

CHARACTERISTICS

Forward voltage				
I_F = 30 A; T_j = 150 °C	V_F	<	1.05	V*
I_F = 100 A; T_j = 25 °C	V_F	<	1.4	V*
Reverse current				
$V_R = V_{RWM\ max}$; T_j = 100 °C	I_R	<	2.0	mA
T_j = 25 °C	I_R	<	50	μA
Reverse recovery when switched from				
I_F = 1 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 100 A/μs; T_j = 25 °C; recovery time	t_{rr}	<	50	ns
I_F = 2 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 20 A/μs; T_j = 25 °C; recovered charge	Q_s	<	75	nC
I_F = 10 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 50 A/μs; T_j = 100 °C; peak recovery current	I_{RRM}	<	4	A
Forward recovery when switched to I_F = 10 A with dI_F/dt = 10 A/μs; T_j = 25 °C	V_{fr}	typ.	2.5	V

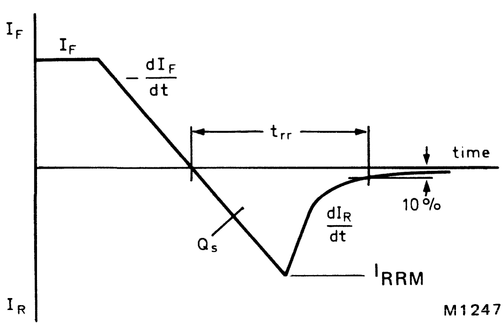


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

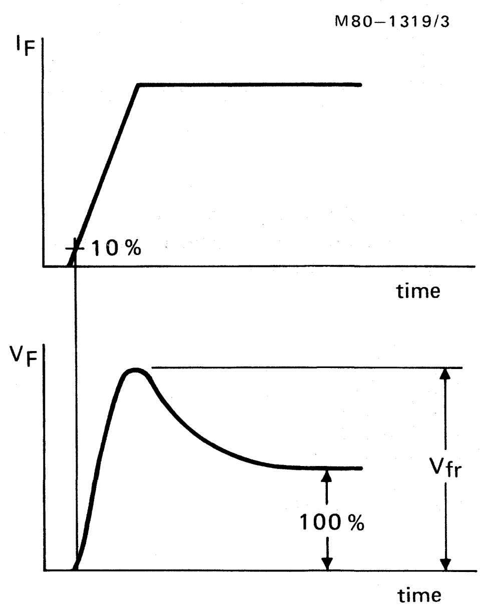


Fig.3 Definition of V_{fr}.

*Measured under pulse conditions to avoid excessive dissipation.

SQUARE-WAVE OPERATION

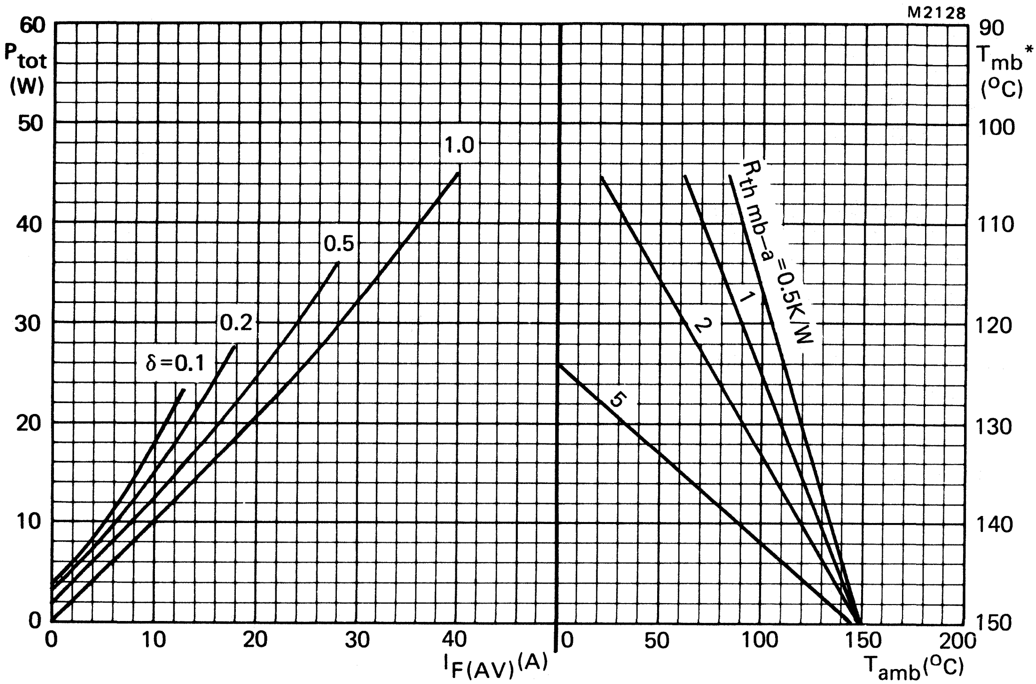
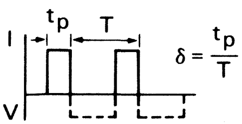


Fig.4 The right-hand part shows the relationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 100 kHz.



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

*T_{mb} scale is for comparison purposes and is correct only for $R_{th\ mb\text{-}a} < 2.4$ K/W.

SINUSOIDAL OPERATION

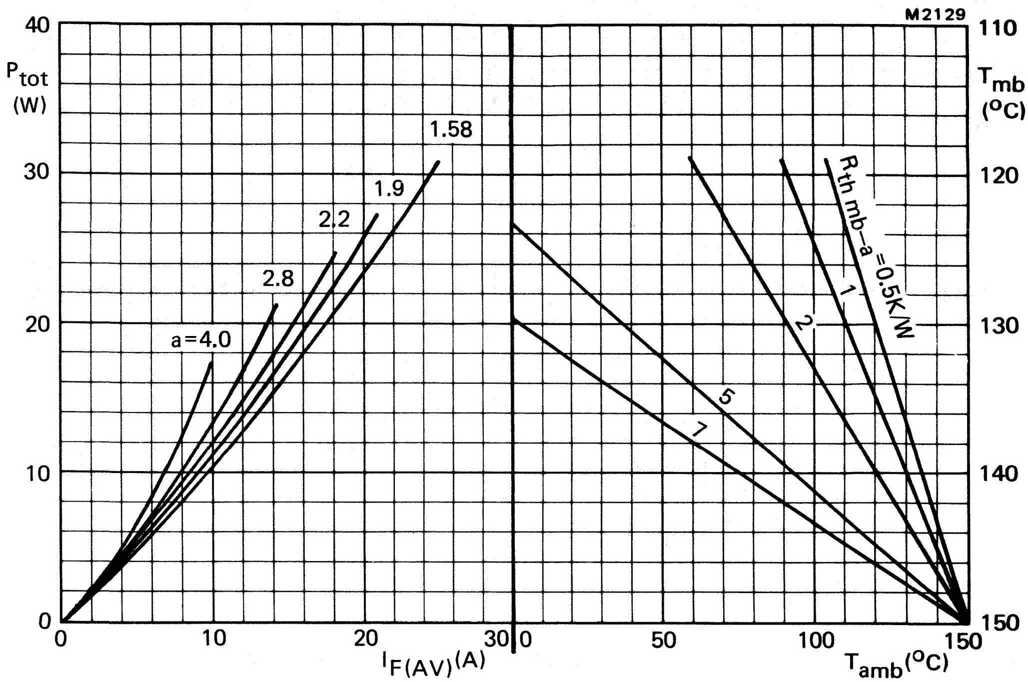


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

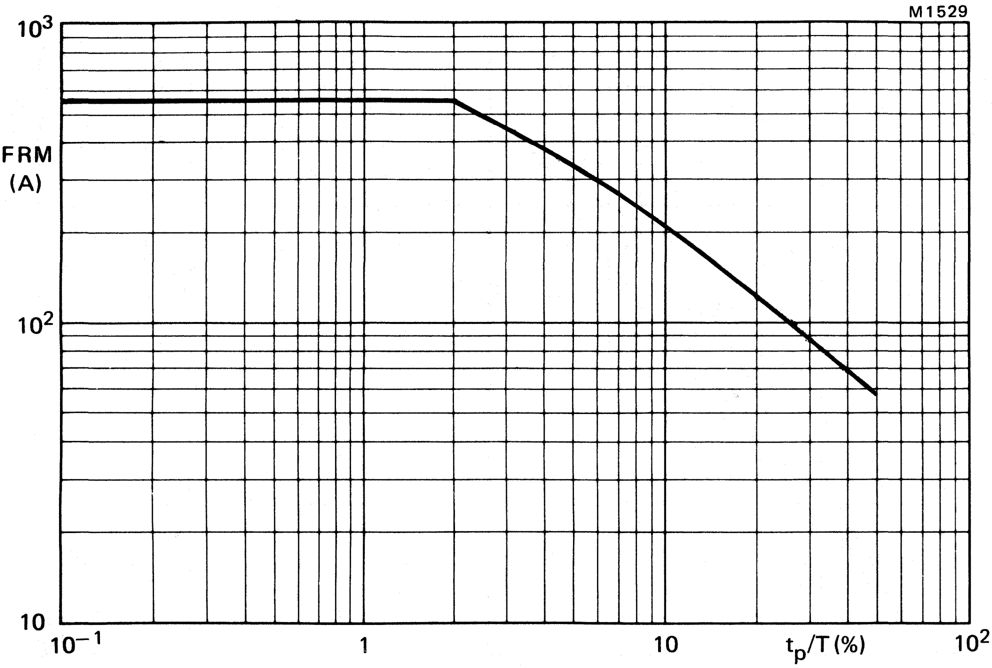
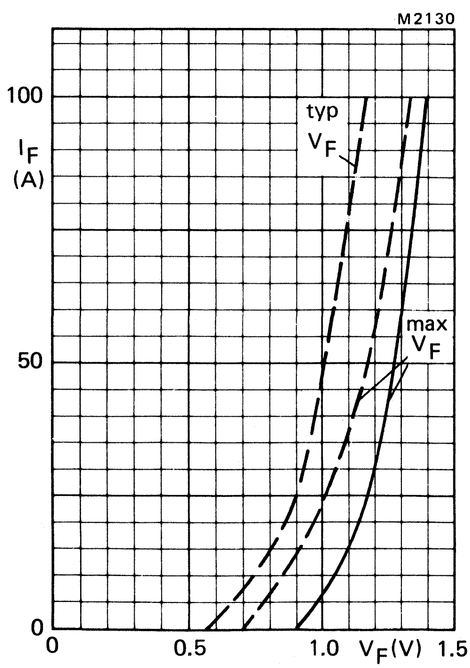
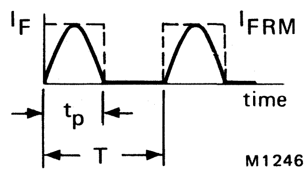


Fig.6 Maximum permissible repetitive peak forward current for square or sinusoidal currents;
$1\ \mu s < t_p < 1 ms$.





Definition of I_{FRM}
and t_p/T.

Fig.7 —— T_j = 25 °C; – – – T_j = 150 °C.

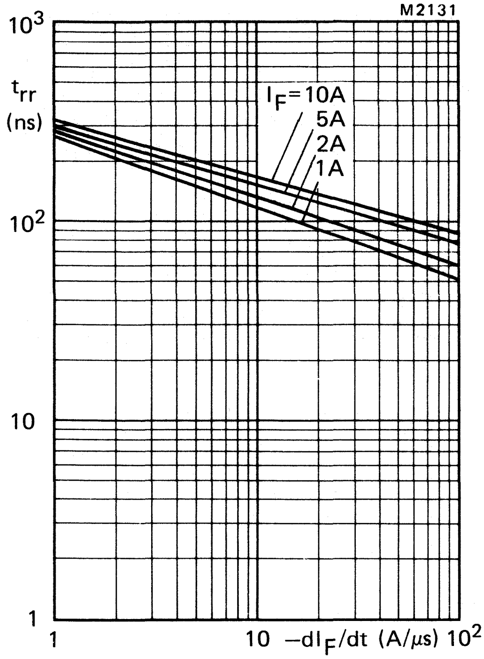


Fig.8 Maximum t_{rr} at T_j = 25 °C.

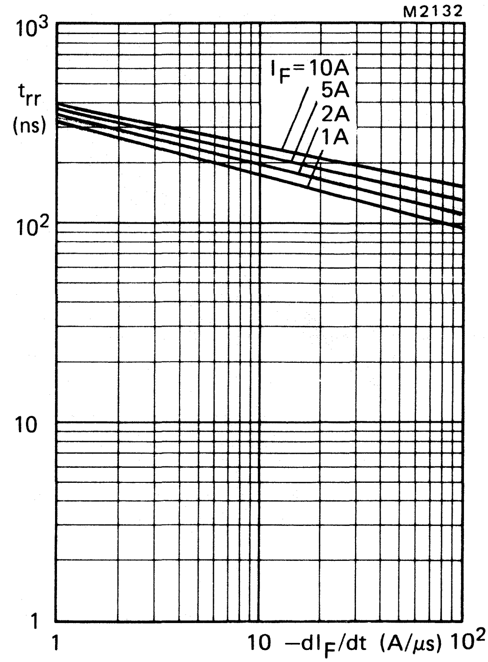


Fig.9 Maximum t_{rr} at T_j = 100 °C.

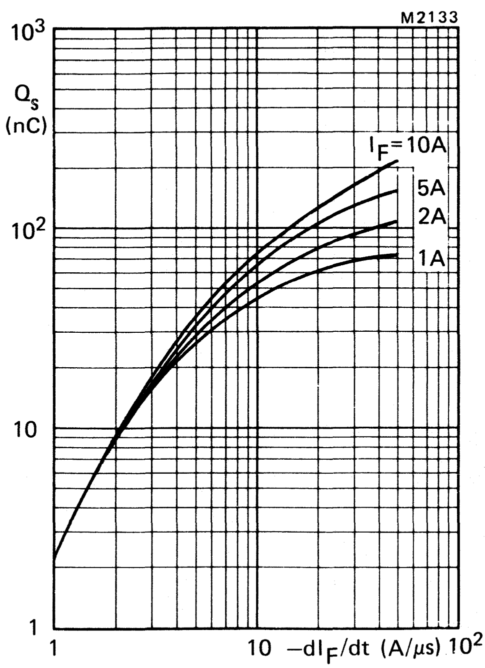


Fig.10 Maximum Q_s at T_j = 25 °C

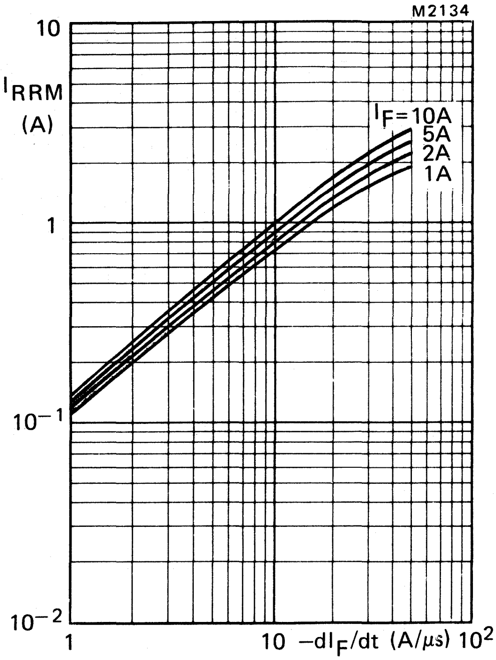


Fig.11 Maximum I_{RRM} at T_j = 25 °C

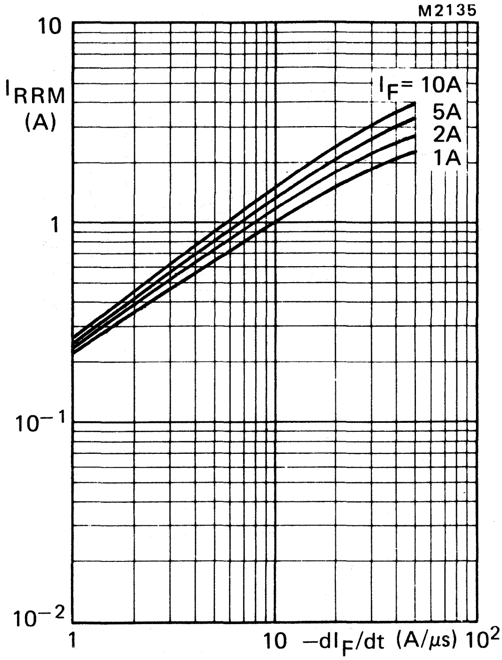


Fig.12 Maximum I_{RRM} at T_j = 100 °C.

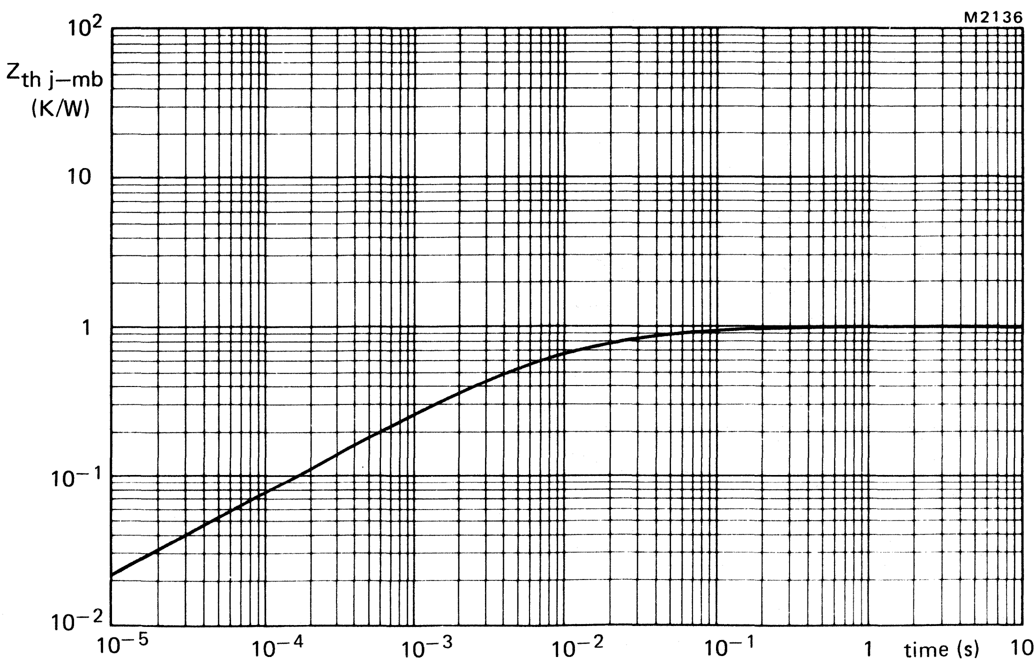


Fig.13 Transient thermal impedance

ULTRA FAST RECOVERY DOUBLE RECTIFIER DIODES

Glass-passivated, high-efficiency double rectifier diodes in plastic envelopes, featuring low forward voltage drop, ultra fast reverse recovery times and soft-recovery characteristic. They are intended for use in switched mode power supplies and high-frequency circuits in general, where both low conduction losses and low switching losses are essential. Their single chip (monolithic) 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.

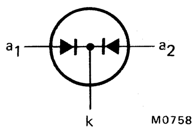
QUICK REFERENCE DATA

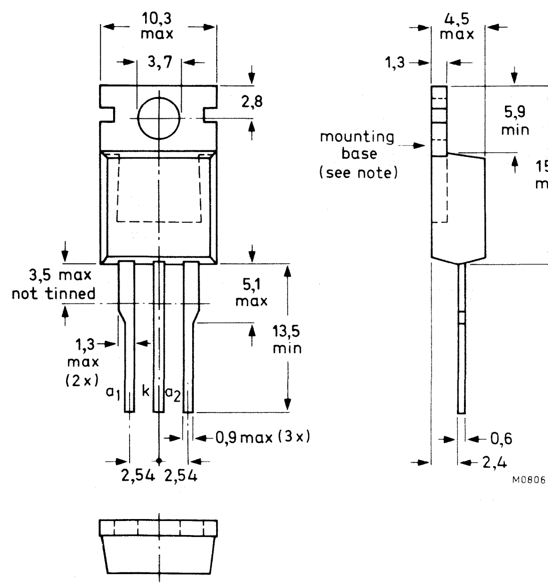
Per diode, unless otherwise stated			BYV32–50	100	150	200	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	200	V
Output current (both diodes conducting)	I_O	max.	20				A
Forward Voltage	V_F	<	0.85				V
Reverse recovery time	t_{rr}	<	25				ns

MECHANICAL DATA

Dimensions in mm

Fig.1 TO-220AB.





Net mass: 2g

Note: the exposed metal mounting base is directly connected to the common cathode.

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

Products approved to CECC 50 009-026 available on request.

RATINGS

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

Voltages (per diode)			BYV32–50	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 (note 1)	V_R	max.	50	100	150	200	V

Currents (both diodes conducting; note 2)

Output current; switching losses negligible up to 500 kHz;				
square wave; δ = 0.5; up to T_{mb} = 118 °C	I_O	max.	20	A
square wave; δ = 0.5; up to T_{mb} = 125 °C	I_O	max.	16.5	A
sinusoidal; up to T_{mb} = 120 °C	I_O	max.	18	A
sinusoidal; up to T_{mb} = 125 °C	I_O	max.	16	A
R.M.S. forward current	$I_{F(RMS)}$	max.	28	A
Repetitive peak forward current t_p = 20 μs, δ = 0.02 (per diode)	I_{FRM}	max.	230	A
Non-repetitive peak forward current (per diode) half sine-wave; T_j = 150 °C prior to surge; with reapplied V_{RWM} max				
t = 10 ms	I_{FSM}	max.	150	A
t = 8.3 ms	I_{FSM}	max.	160	A
I^2t for fusing (t = 10ms; per diode)	I^2t	max.	112	A^2s

Temperatures

Storage temperature	T_{stg}		–40 to +150	°C
Junction temperature	T_j	max.	150	°C

Notes:

1. To ensure thermal stability, $R_{th\ j\text{-}a} < 14$ K/W.
2. The limits for both diodes apply whether both diodes conduct simultaneously or on alternate half cycles.

CHARACTERISTICS (per diode)

Forward voltage				
$I_F = 5$ A; $T_j = 100\ ^oC$	V_F	<	0.85	V*
$I_F = 20$ A; $T_j = 25\ ^oC$	V_F	<	1.15	V*
Reverse current				
$V_R = V_{RWM\ max}$; $T_j = 100\ ^oC$	I_R	<	0.6	mA
$V_R = 200$ V; $T_j = 25\ ^oC$	I_R	<	30	μA ←
$V_R \leqslant 150$ V; $T_j = 25\ ^oC$	I_R	<	10	μA ←
Reverse recovery when switched from				
$I_F = 1$ A to $V_R \geqslant 30$ V with $-dI_F/dt = 100$ A/μs; $T_j = 25\ ^oC$; recovery time	t_{rr}	<	25	ns
$I_F = 2$ A to $V_R \geqslant 30$ V with $-dI_F/dt = 20$ A/μs; $T_j = 25\ ^oC$; recovered charge	Q_s	<	12.5	nC
$I_F = 10$ A to $V_F \geqslant 30$ V with $-dI_F/dt = 50$ A/μs; $T_j = 100\ ^oC$; peak recovery current	I_{RRM}	<	2	A
Forward recovery when switched to $I_F = 1$A with $dI_F/dt = 10$ A/μs; $T_j = 25\ ^oC$	V_{fr}	typ.	0.9	V

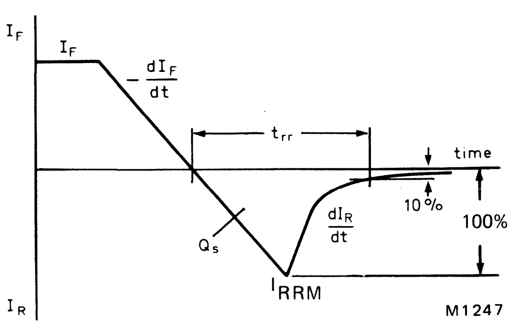


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

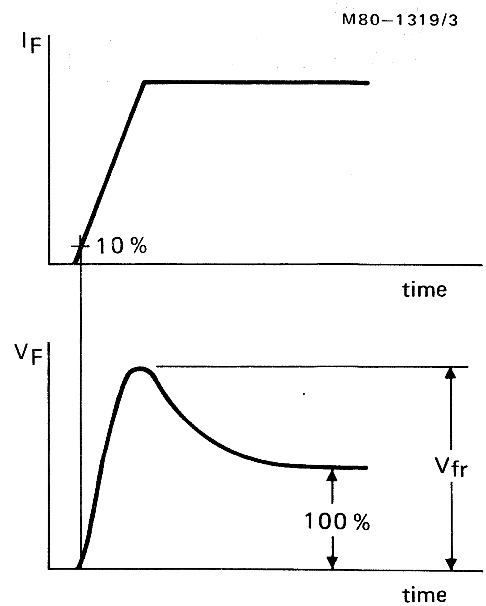


Fig.3 Definition of V_{fr}.

*Measured under pulse conditions to avoid excessive dissipation

THERMAL RESISTANCE

From junction to mounting base (both diodes conducting)	$R_{th\ j\text{-}mb}$	=	1.6	K/W
From junction to mounting base (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 insulator (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 device lead length and with copper laminate on the board — $R_{th\ j\text{-}a}$ = 60 K/W

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 ^{o}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 $R_{th\ mb-h}$ 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 $R_{th\ mb-h}$ 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 calculations

The various components of junction temperature rise above ambient are illustrated in Fig.4:

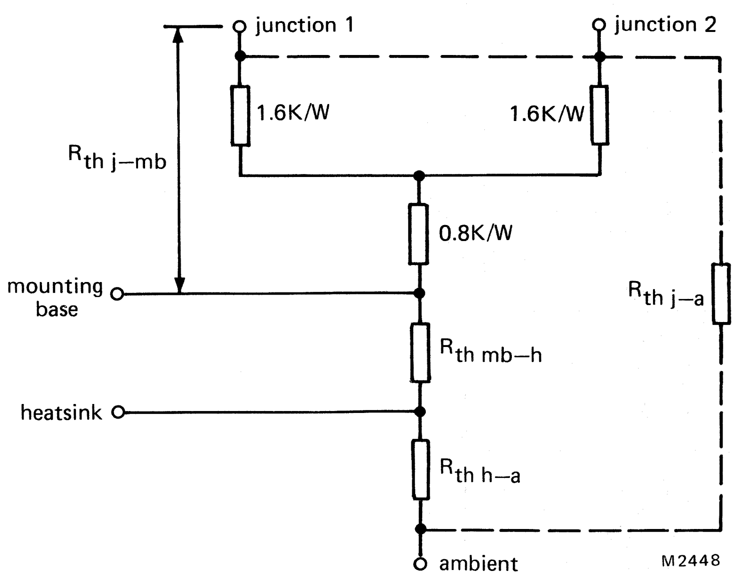


Fig.4

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

SQUARE-WAVE OPERATION (PER DIODE)

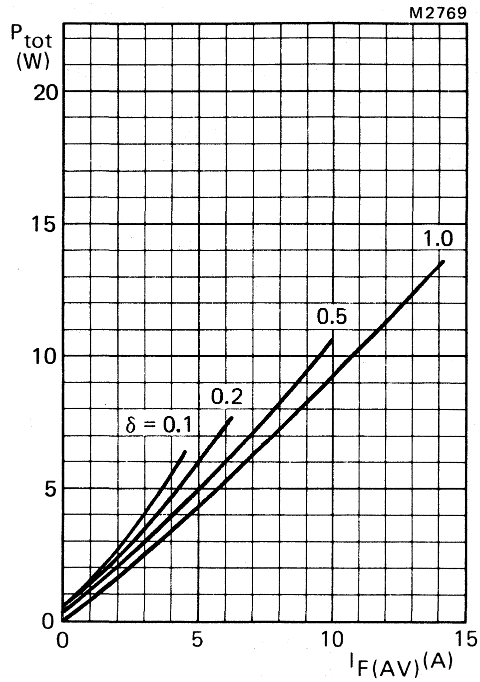
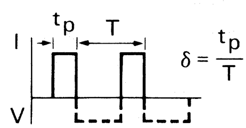


Fig. 5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.



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

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

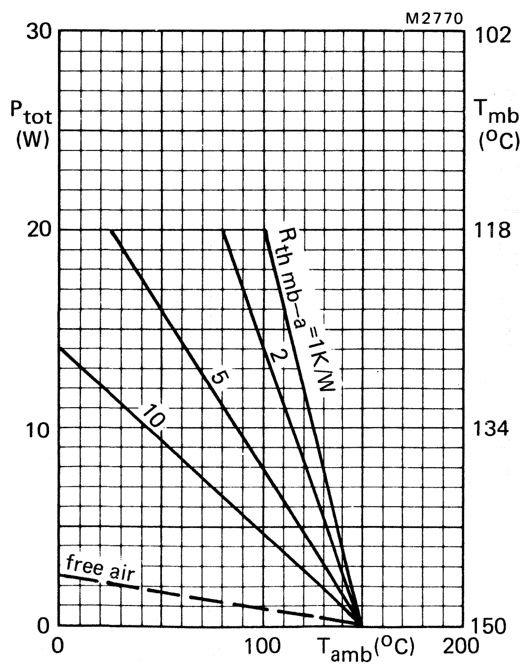


Fig.6

SINUSOIDAL OPERATION (PER DIODE)

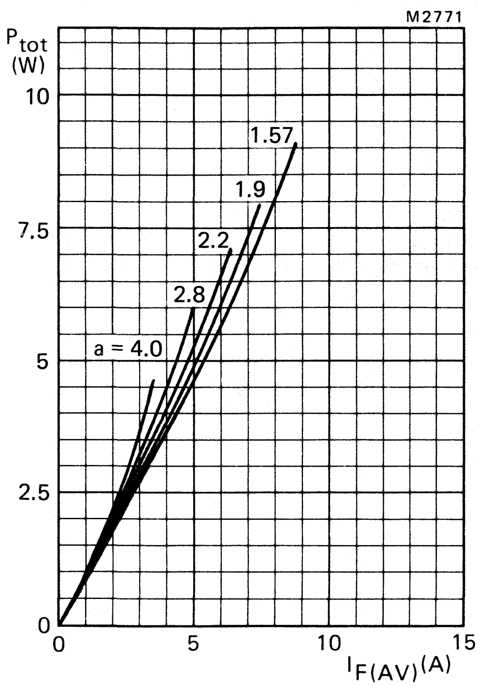


Fig.7 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.

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

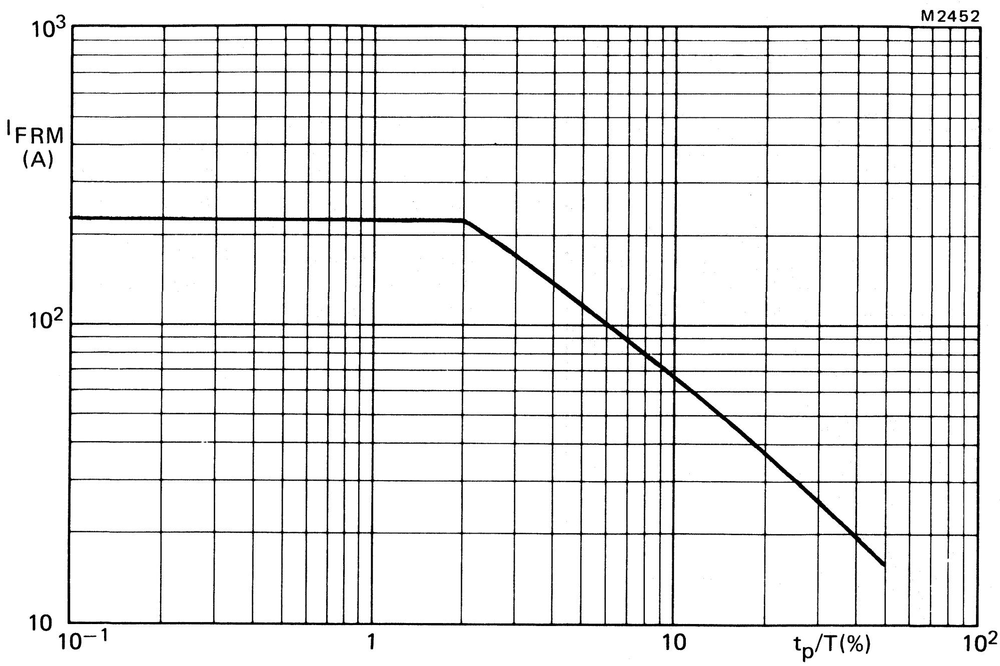
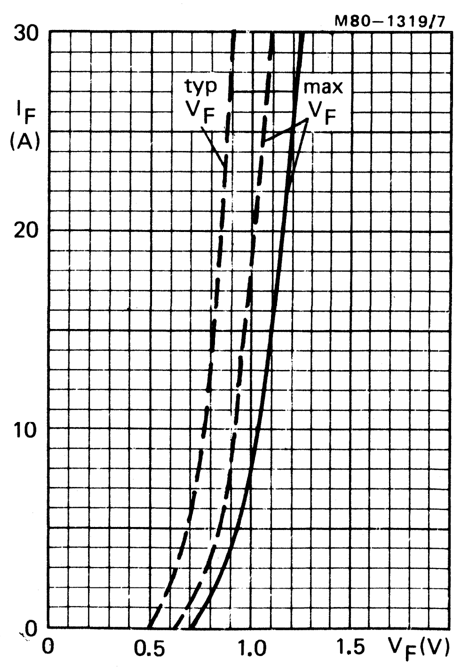
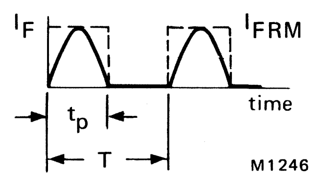


Fig.8 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 μs < t_p < 1 ms; per diode.





Definition of I_{FRM} and t_p/T.

Fig.9 —— T_j = 25 ^oC; – – – T_j = 100 ^oC; per diode.

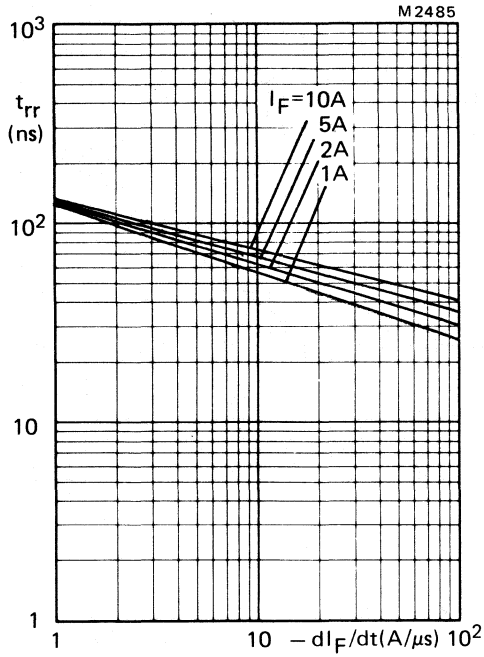


Fig.10 Maximum t_{rr} at T_j = 25 °C; per diode.

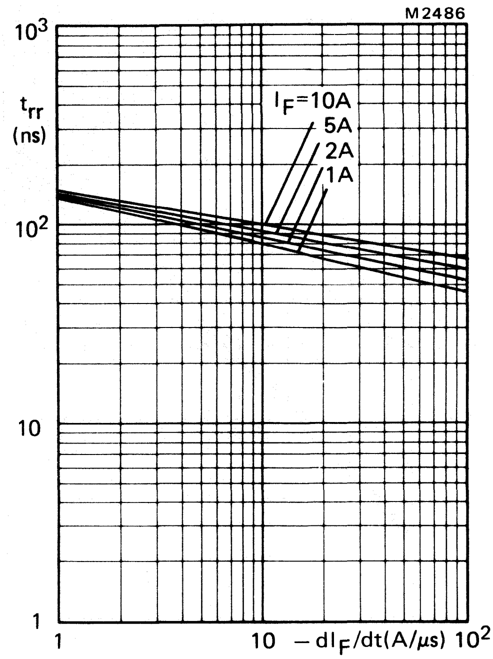


Fig.11 Maximum t_{rr} at T_j = 100 °C; per diode.

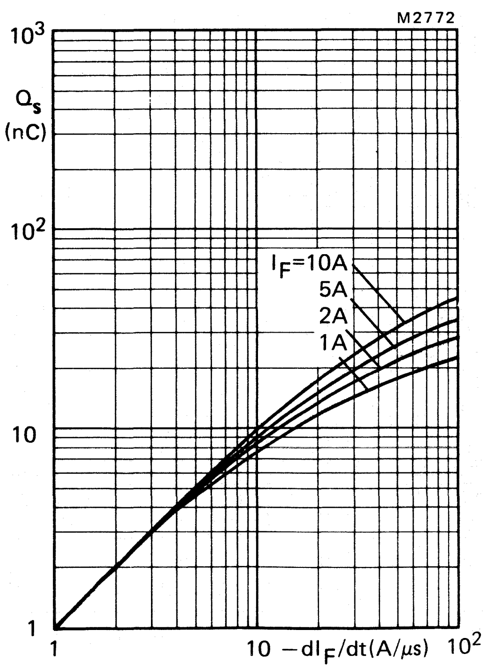


Fig.12 Maximum Q_s at T_j = 25 °C; per diode.

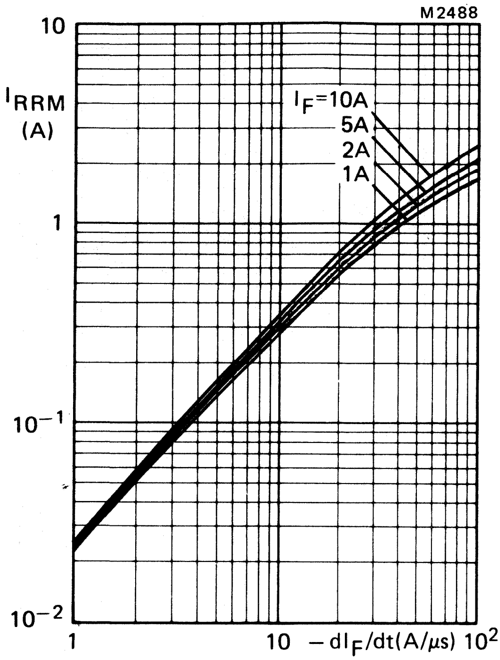


Fig.13 Maximum I_{RRM} at T_j = 25 °C; per diode.

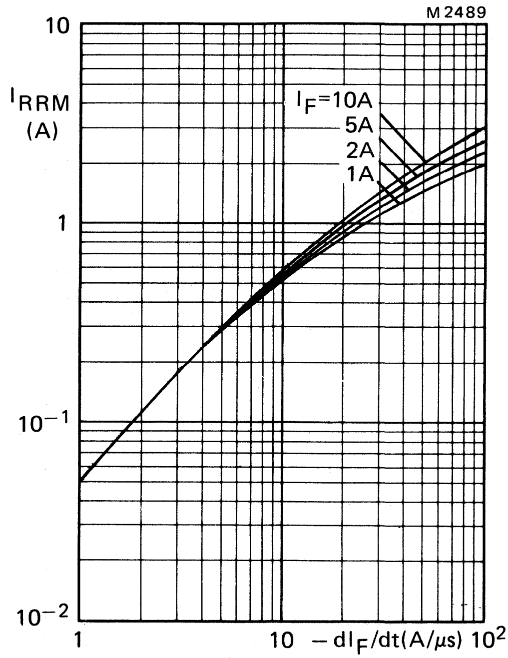


Fig.14 Maximum I_{RRM} at T_j = 100 °C; per diode.

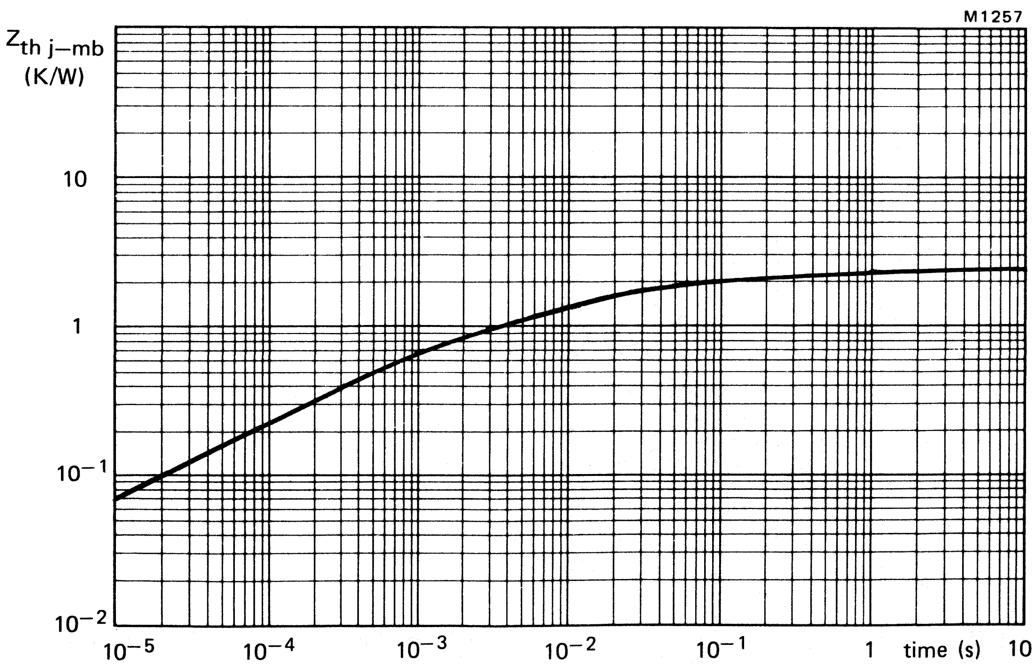


Fig.15 Transient thermal impedance; one diode conducting.

ULTRA FAST–RECOVERY ELECTRICALLY–ISOLATED DOUBLE RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial double rectifier diodes in SOT-186 (full-pack) plastic envelopes, featuring low forward voltage drop, very fast reverse recovery times and soft-recovery characteristic. 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 switched-mode power supplies and high-frequency circuits in general, where both low conduction and 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.

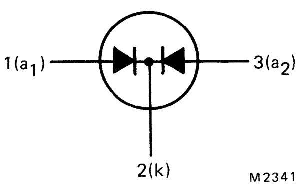
QUICK REFERENCE DATA

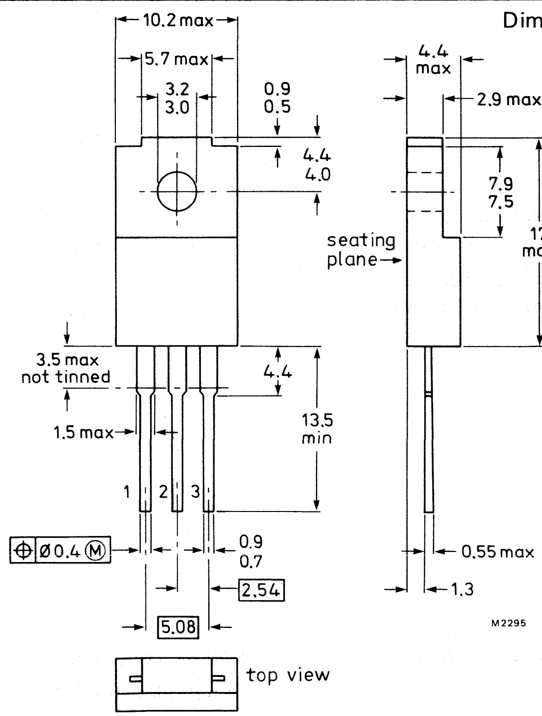
Per diode, unless otherwise stated			BYV32F-50	100	150	200	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	200	V
Output current (both diodes conducting)	I_O	max.		12			A
Forward voltage	V_F	<		0.85			V
Reverse recovery time	t_{rr}	<		25			ns

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 (IEC 134).

Voltages (per diode; see note 1)			BYV32F-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 (see notes 2 and 3)				
Output current, switching losses negligible up to 500 kHz				
square wave; $\delta = 0.5$; up to $T_h = 92\ ^oC$	I_O	max.	12	A
sinusoidal; up to $T_h = 100\ ^oC$	I_O	max.	10.6	A
R.M.S. forward current	$I_{F(RMS)}$	max.	12	A
Repetitive peak forward current $t_p = 20\ \mu s$, $\delta = 0.02$ (per diode)	I_{FRM}	max.	155	A
Non-repetitive peak forward current half sine-wave; $T_j = 150\ ^oC$ prior to surge; with reapplied $V_{RWM\ max}$;				
t = 10 ms (per diode)	I_{FSM}	max.	150	A
t = 8.3 ms (per diode)	I_{FSM}	max.	160	A
I^2t for fusing (t = 10 ms; per diode)	I^2t	max.	112	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 (see note 4)	C_p	typ.	12	pF

Notes

1. To ensure thermal stability: $R_{th\ j\text{-}a} < 6.3$ K/W for continuous reverse voltage.
2. The limits for both diodes apply whether both diodes conduct simultaneously or on alternate half cycles.
3. The quoted temperatures assume heatsink compound is used.
4. Mounted without heatsink compound and with 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, total package:				
without heatsink compound	$R_{th\ j\text{-}h}$	=	7.0	K/W
with heatsink compound	$R_{th\ j\text{-}h}$	=	5.0	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, device mounted on a printed circuit board	$R_{th\ j\text{-}a}$	=	55	K/W

CHARACTERISTICS

Forward voltage				
I_F = 5 A; T_j = 100 °C	V_F	<	0.85	V*
I_F = 20 A; T_j = 25 °C	V_F	<	1.15	V*
Reverse current				
$V_R = V_{RWM\ max}$; T_j = 100 °C	I_R	<	0.6	mA
V_R = 200 V; T_j = 25 °C	I_R	<	30	μA ←
$V_R \leq$ 150 V; T_j = 25 °C	I_R	<	10	μA ←
Reverse recovery when switched from				
I_F = 1 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 100 A/μs; T_j = 25 °C; recovery time	t_{rr}	<	25	ns
I_F = 2 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 20 A/μs; T_j = 25 °C; recovered charge	Q_s	<	12.5	nC
I_F = 10 A to $V_R \geq$ 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.	1	V

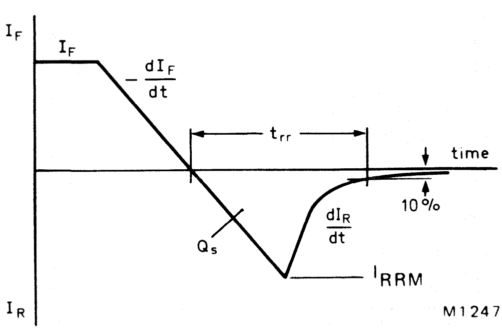


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

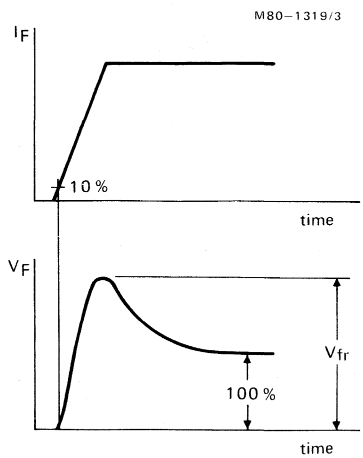


Fig.3 Definition of V_{fr}.

*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

Dissipation and heatsink considerations:

a. The various components of junction temperature rise above ambient are illustrated in Fig.4:

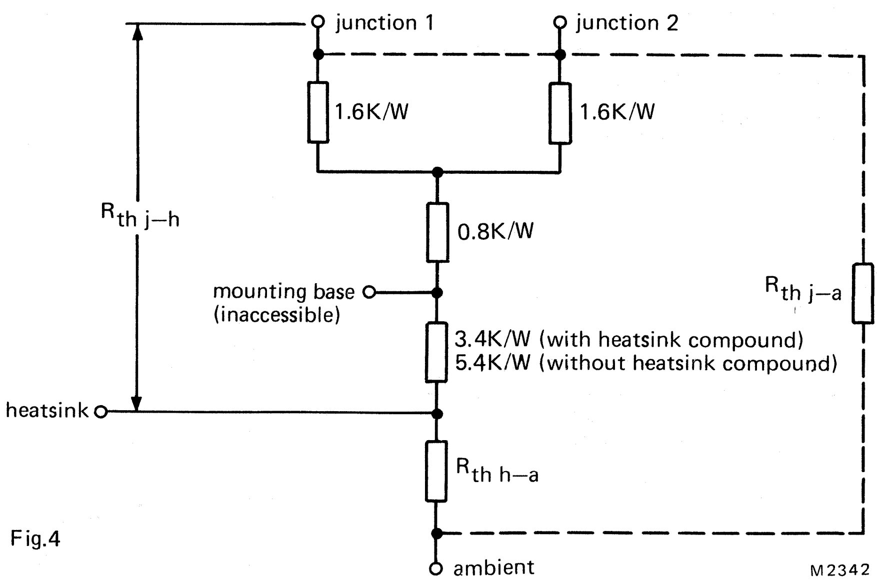


Fig.4

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

SQUARE-WAVE OPERATION

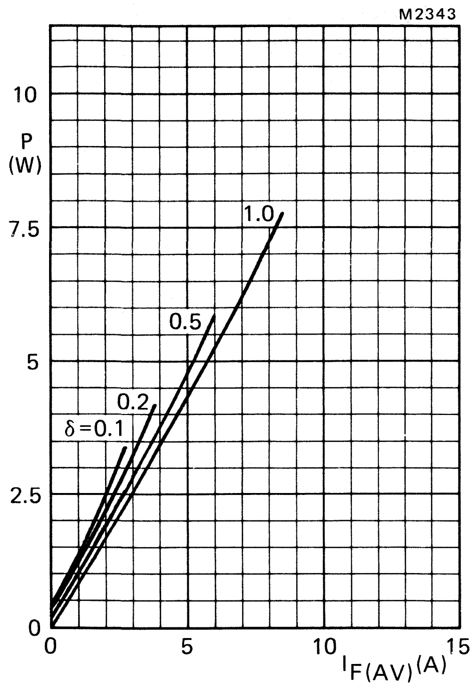
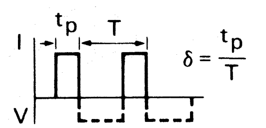


Fig.5 Power rating.

The individual power loss in each diode should first be determined from the required forward current on the $I_{F(AV)}$ axis and the appropriate duty cycle, then both added together to give a total power loss for the whole device.
Having determined this 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.



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

SINUSOIDAL OPERATION

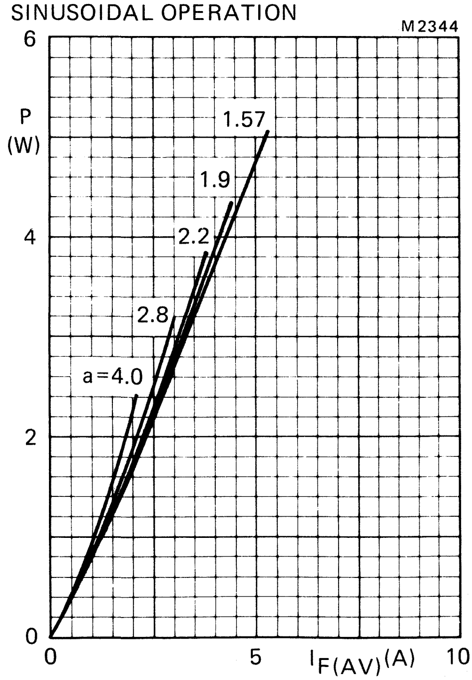


Fig.6 Power rating.

The individual power loss in each diode should first be determined from the required forward current on the $I_{F(AV)}$ axis and the appropriate form factor, then both added together to give a total power loss for the whole device.
Having determined this 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 = $I_{F(RMS)}/I_{F(AV)}$

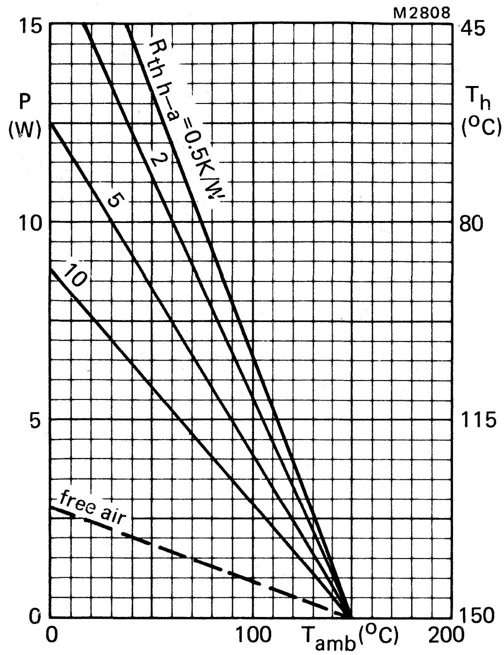


Fig.7 Heatsink rating.
Without heatsink compound.

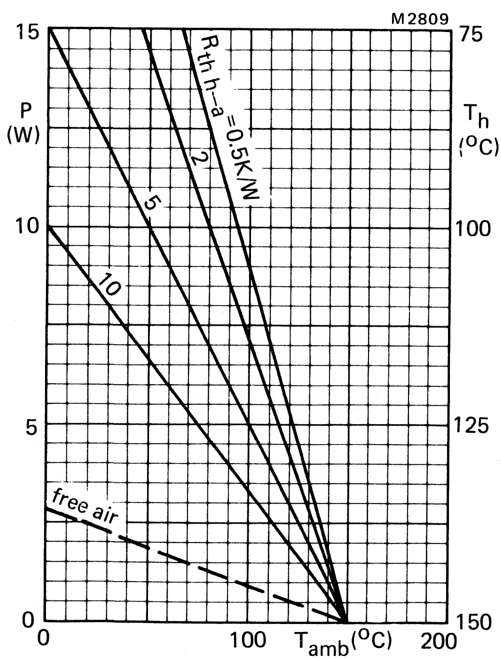


Fig.8 Heatsink rating.
With heatsink compound.

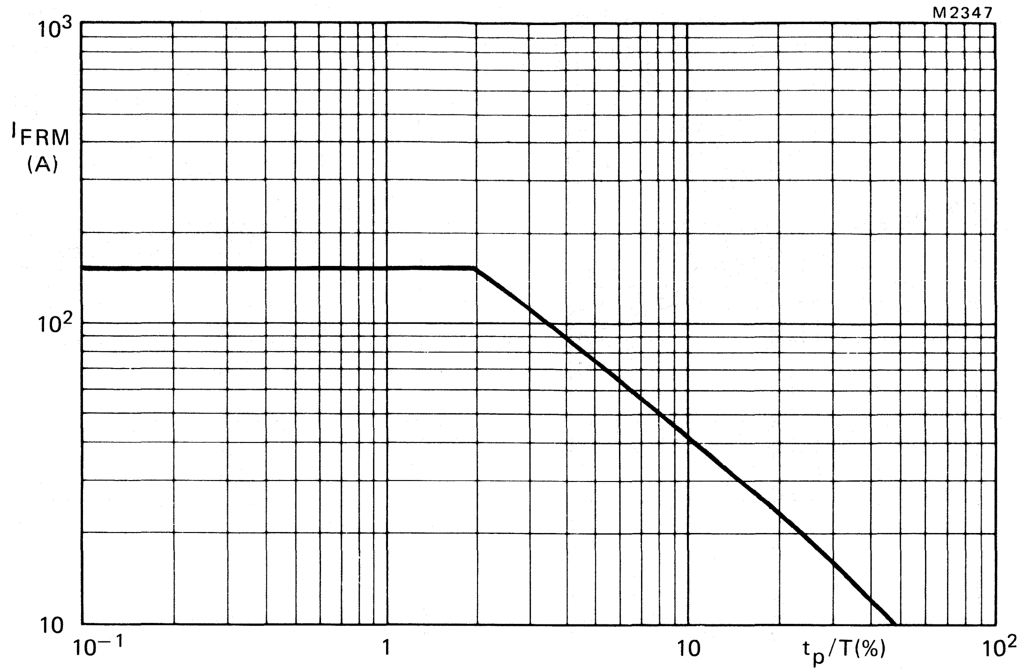
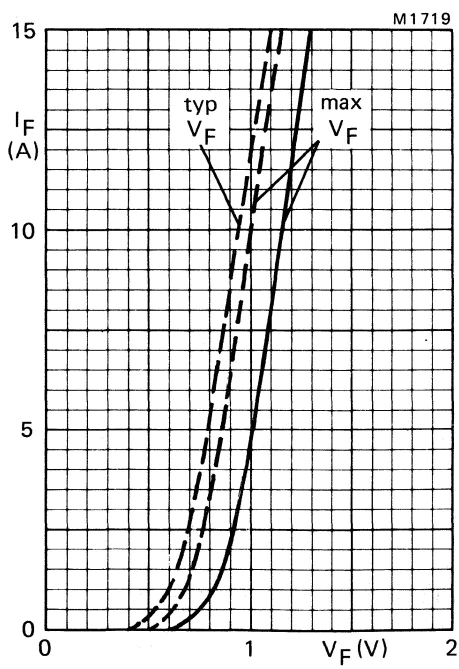
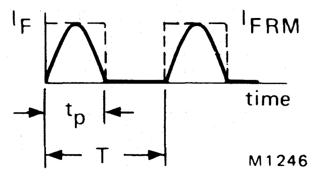


Fig.9 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for $1\ \mu s < t_p < 1$ ms.





Definition of I_{FRM} and t_p/T

Fig.10 —— $T_j = 25\ ^oC$; – – – $T_j = 150\ ^oC$ per diode.

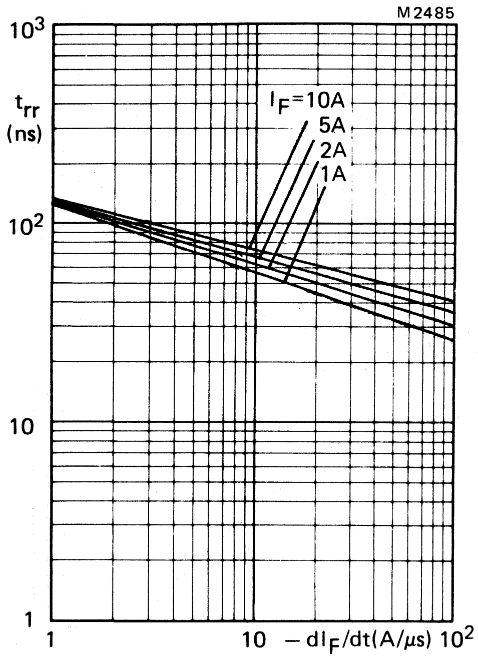


Fig.11 Maximum t_{rr} at T_j = 25 °C.

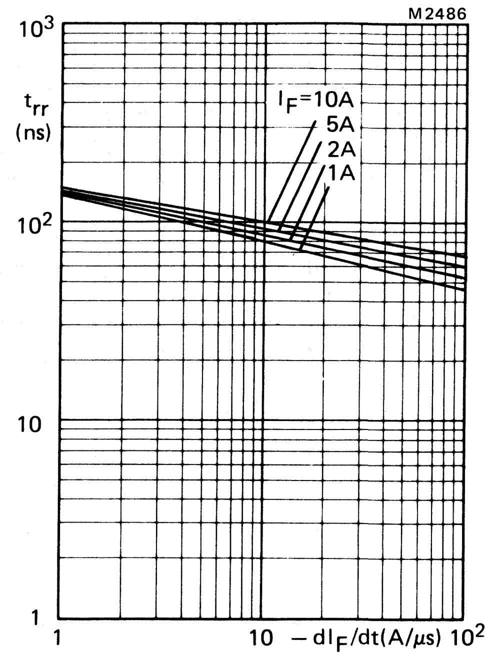


Fig.12 Maximum t_{rr} at T_j = 100 °C.

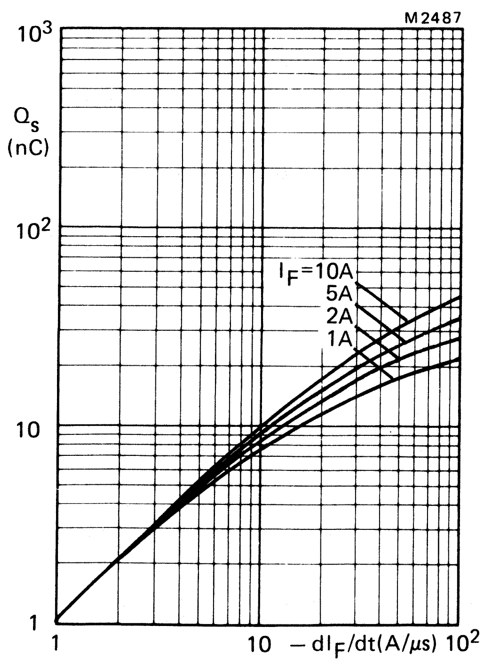


Fig.13 Maximum Q_s at T_j = 25 °C.

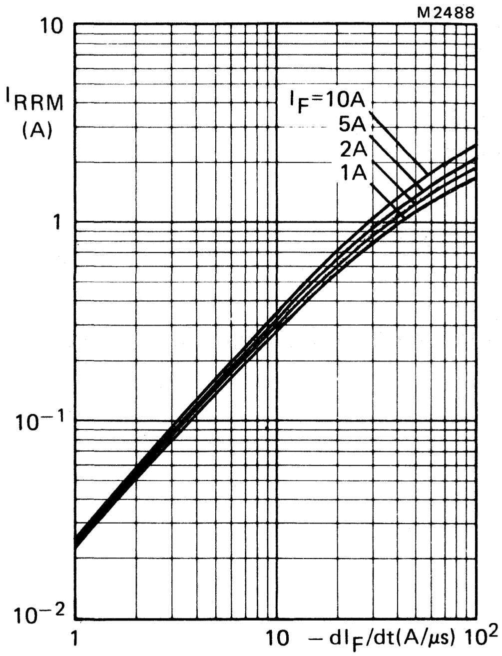


Fig.14 Maximum I_{RRM} at T_j = 25 °C

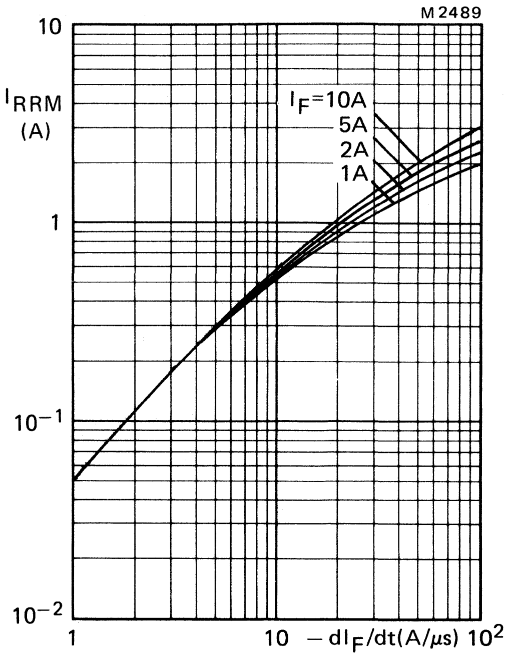


Fig.15 Maximum I_{RRM} at T_j = 100 °C;

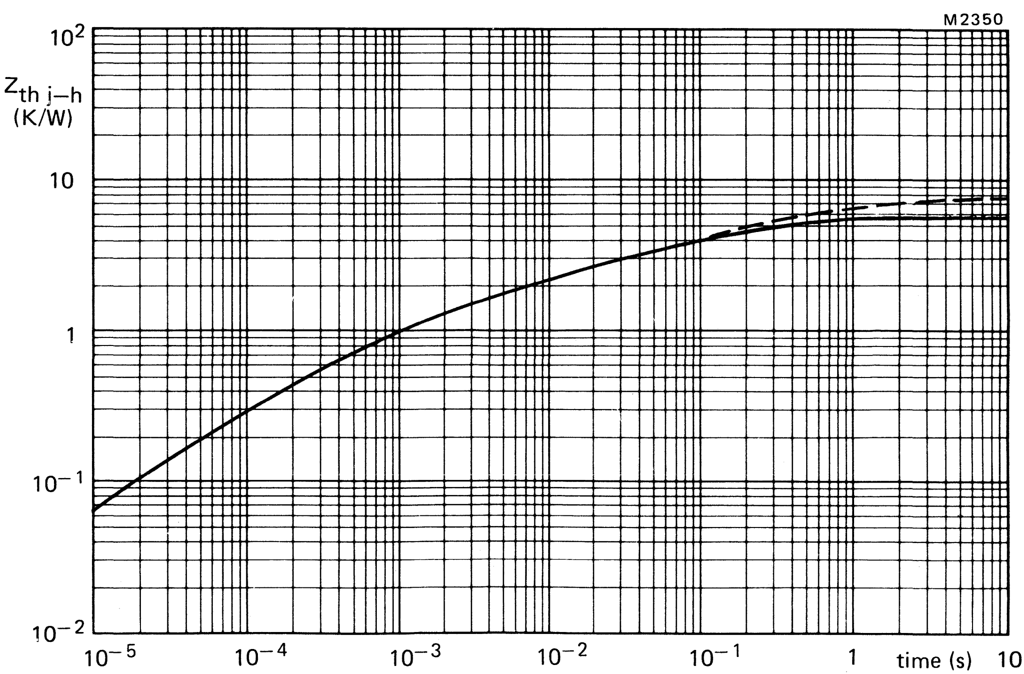


Fig.16 One diode conducting; —— with heatsink compound; – – – without heatsink compound.

ULTRA FAST RECOVERY DOUBLE RECTIFIER DIODES

Glass-passivated, high-efficiency double rectifier diodes in plastic envelopes, featuring low forward voltage drop, ultra fast reverse recovery times and soft-recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and low switching losses are essential. Their single chip (monolithic) 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.

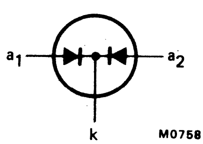
QUICK REFERENCE DATA

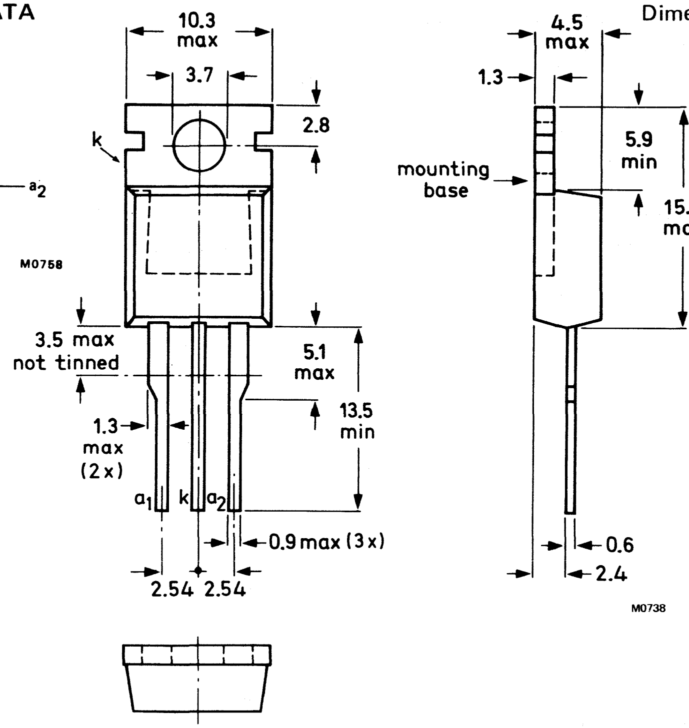
Per diode, unless otherwise stated			BYV34–300	400	500	
Repetitive peak reverse voltage	V_{RRM}	max.	300	400	500	V
Output current (both diodes conducting)	I_O	max.		20		A
Forward voltage	V_F	<		0.93		V
Reverse recovery time	t_{rr}	<		50		ns

MECHANICAL DATA

Fig.1 TO-220AB

Dimensions in mm





Net mass: 2 g

Note: the exposed metal mounting base is directly connected to the common cathode.

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

RATINGS

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

Voltages (per diode)			BYV34–300	400	500	
→ Non-repetitive peak reverse voltage	V_{RSM}	max.	350	450	550	V
Repetitive peak reverse voltage	V_{RRM}	max.	300	400	500	V
Crest working reverse voltage	V_{RWM}	max.	200	300	400	V
Continuous reverse voltage (note 1)	V_R	max.	200	300	400	V

Currents (both diodes conducting; note 2)				
Output current; switching losses negligible up to 200 kHz;				
square wave; δ = 0.5; up to T_{mb} = 113 °C	I_O	max.	20	A
up to T_{mb} = 125 °C	I_O	max.	14	A
sinusoidal; up to T_{mb} = 120 °C	I_O	max.	17.5	A
up to T_{mb} = 125 °C	I_O	max.	14	A
R.M.S. forward current	$I_{F(RMS)}$	max.	28	A
Repetitive peak forward current t_p = 20 μs; δ = 0.02 (note 3)	I_{FRM}	max.	240	A
Non-repetitive peak forward current (per diode) half sine-wave; T_j = 150 °C prior to surge with re-applied $V_{RWM\,max}$				
t = 10 ms	I_{FSM}	max.	120	A
t = 8.3 ms	I_{FSM}	max.	150	A
I^2t for fusing (t = 10 ms; per diode)	I^2t	max.	72	A^2s

Temperatures				
Storage temperature	T_{stg}		−40 to +150	°C
Junction temperature	T_j	max.	150	°C

Notes

1. To ensure thermal stability: $R_{th\,j\text{-}a} < 4.5$ K/W.
2. The limits for both diodes apply whether both diodes conduct simultaneously or on alternate half cycles.

CHARACTERISTICS (per diode)

Forward voltage				
I_F = 10 A; T_j = 150 °C	V_F	<	0.93	V*
I_F = 30 A; T_j = 25 °C	V_F	<	1.4	V*
Reverse current				
$V_R = V_{RWM\ max}$; T_j = 100 °C	I_R	<	0.6	mA
$V_R = V_{RWM\ max}$; T_j = 25 °C	I_R	<	50	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}	<	50	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	<	45	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}	<	5.0	A
Forward recovery when switched to I_F = 10 A with dI_F/dt = 10 A/μs; T_j = 25 °C recovery voltage	V_{fr}	typ.	2.5	V

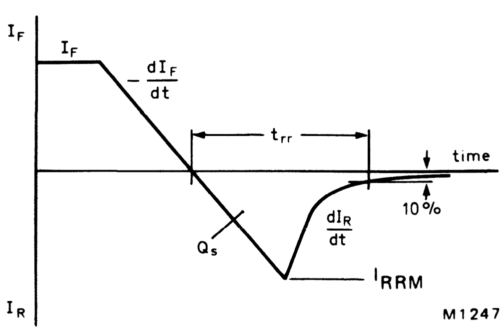


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

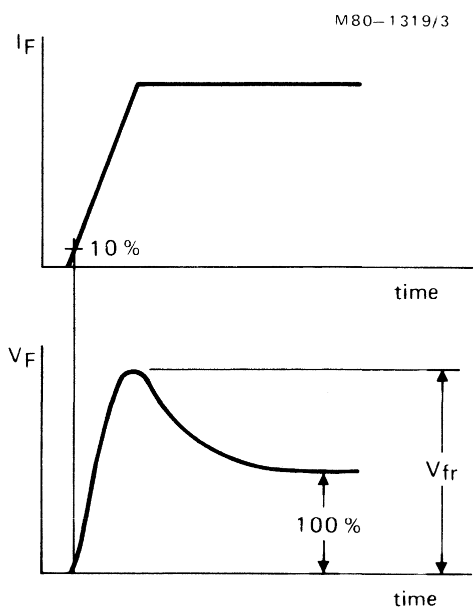


Fig.3 Definition of V_{fr}.

*Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

From junction to mounting base (both diodes conducting)	$R_{th\ j\text{-}mb}$	=	1.6	K/W
From junction to mounting base (per diode)	$R_{th\ j\text{-}mb}$	=	2.3	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 insulator (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 value 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 device lead length and with copper laminate on the board	$R_{th\ j\text{-}a}$	=	60	K/W

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 calculations

a. The various components of junction temperature rise above ambient are illustrated in Fig.4

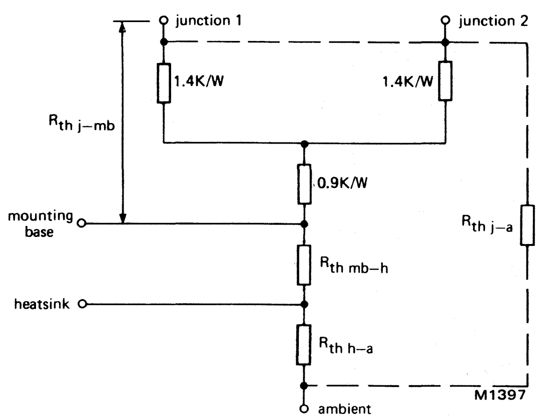


Fig.4

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

SQUARE-WAVE OPERATION (PER DIODE)

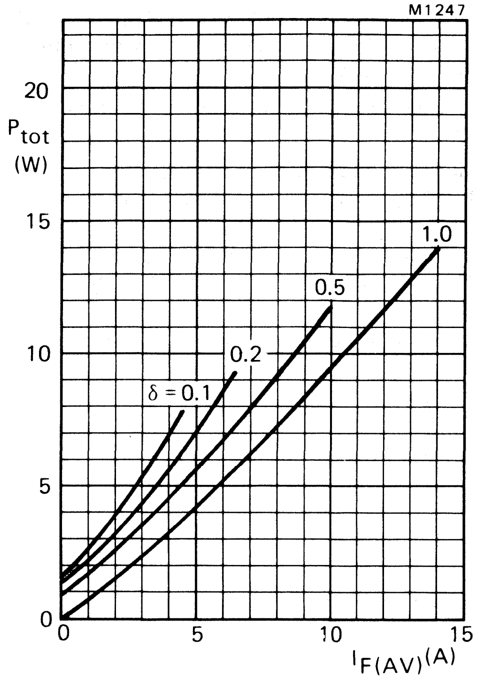
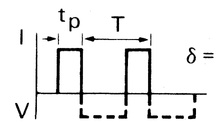


Fig.5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.



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

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

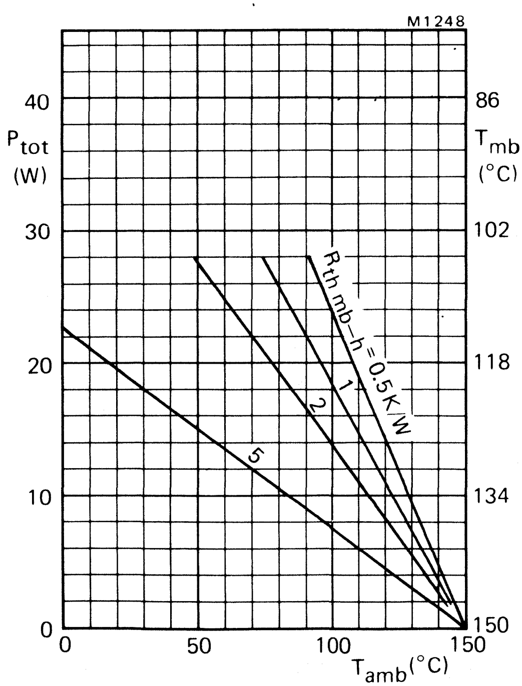


Fig.6

SINUSOIDAL OPERATION (PER DIODE)

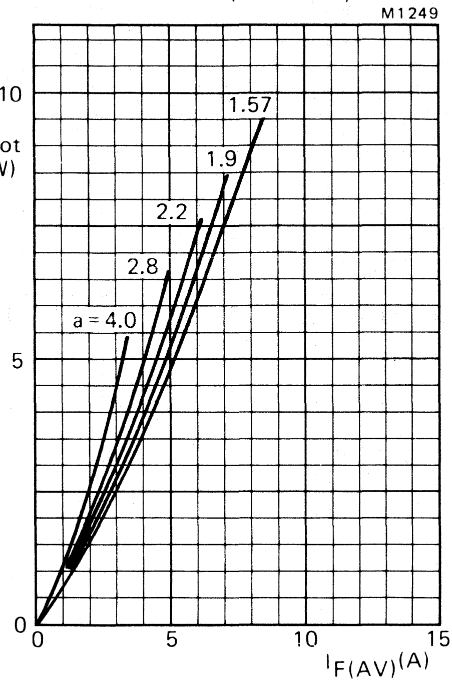


Fig.7 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.

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

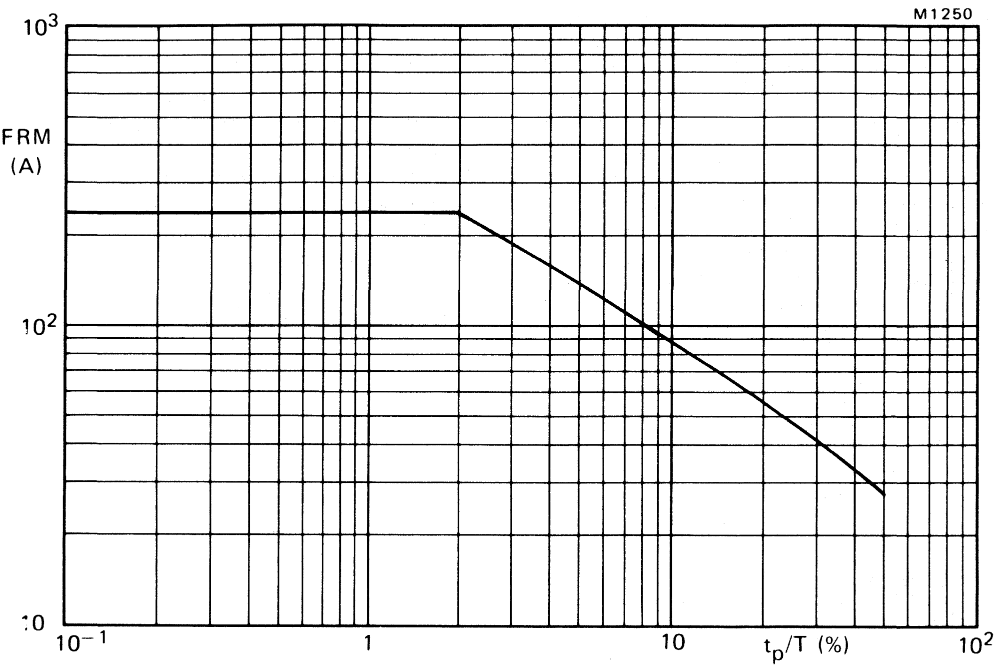
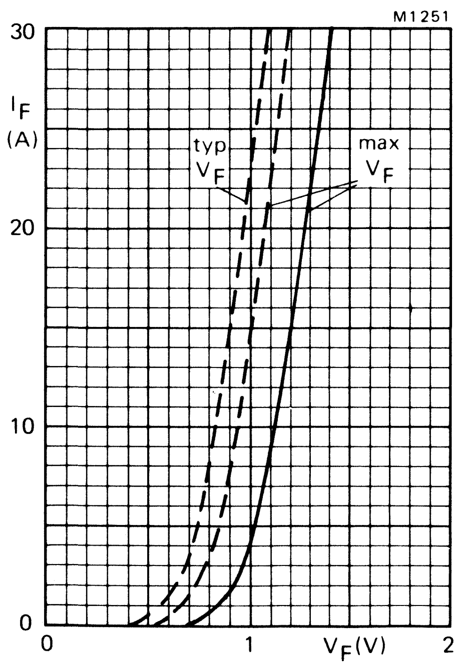
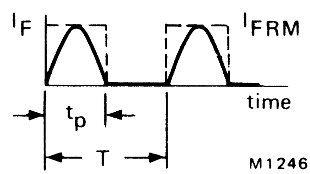


Fig.8 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 $\mu s < t_p <$ 1 ms.(per diode).





Definition of I_{FRM} and t_p/T

Fig. 9 —— T_j = 25 °C; – – – T_j = 150 °C (per diode).

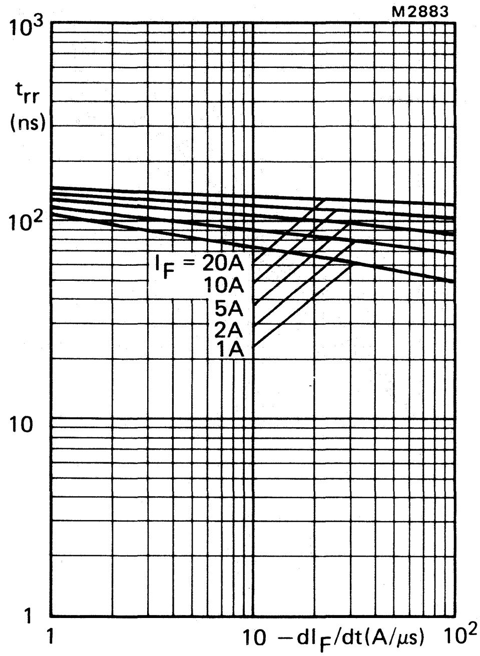


Fig.10 Maximum t_{rr} at T_j = 25 °C.
(per diode).

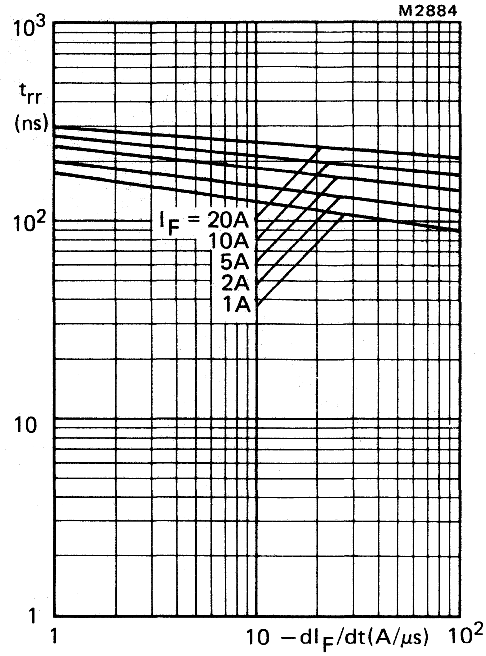


Fig.11 Maximum t_{rr} at T_j = 100 °C.
(per diode).

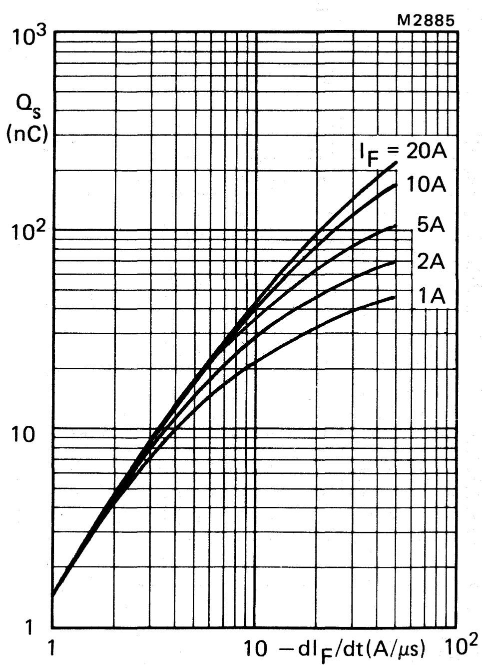


Fig.12 Maximum Q_s at T_j = 25 °C.
(per diode).

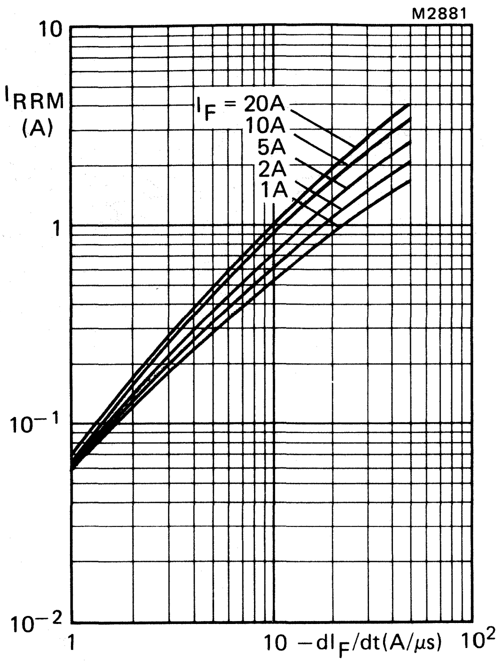


Fig.13 Maximum I_{RRM} at T_j = 25 °C. (per diode).

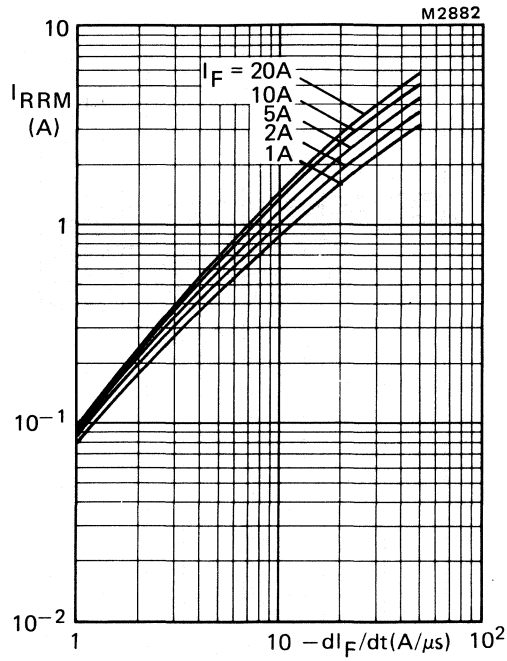


Fig.14 Maximum I_{RRM} at T_j = 100 °C. (per diode).

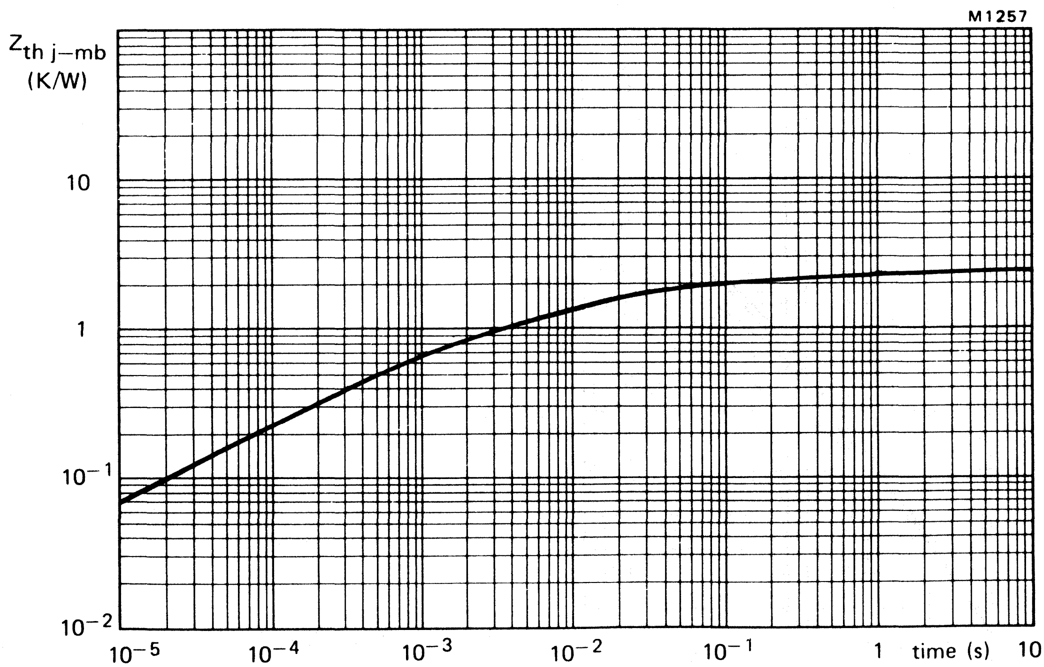


Fig.15 One diode conducting (per diode).

ULTRA FAST RECOVERY DOUBLE RECTIFIER DIODES

Glass-passivated, high-efficiency double rectifier diodes in plastic envelopes, featuring low forward voltage drop, ultra fast reverse recovery times and soft-recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and low switching losses are essential. Their single chip (monolithic) 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.

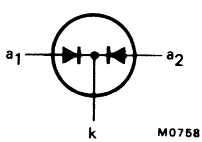
QUICK REFERENCE DATA

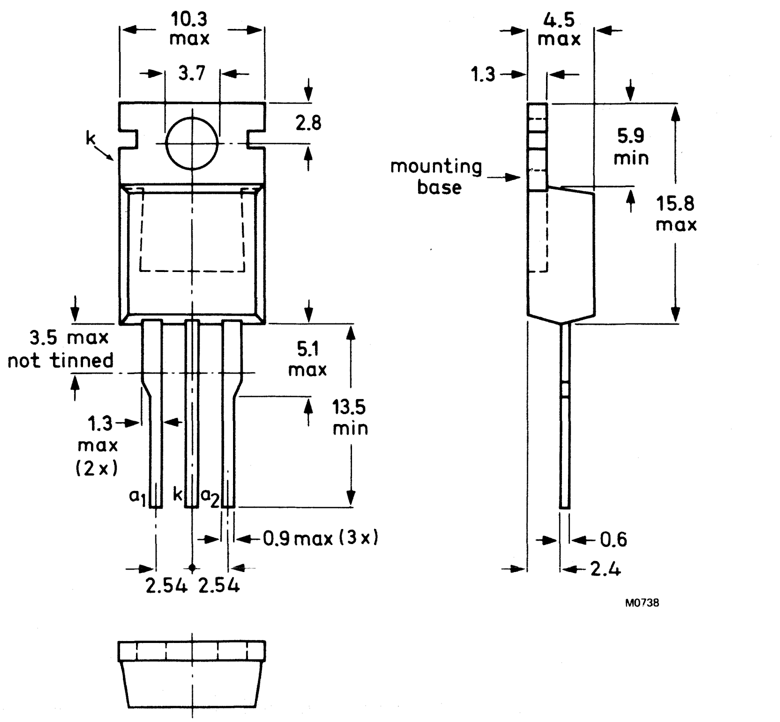
Per diode, unless otherwise stated			BYV42–50	100	150	200	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	200	V
Output current (both diodes conducting)	I_O	max.		30			A
Forward voltage	V_F	<		0.85			V
Reverse recovery time	t_{rr}	<		28			ns

MECHANICAL DATA

Dimensions in mm

Fig.1 TO-220AB





Net mass: 2 g

Note: the exposed metal mounting base is directly connected to the common-cathode.

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

RATINGS

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

			BYV42–50	100	150	200	
Voltages (per diode)							
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 $T_{mb} = 104\ ^{o}C$ (note 2)	I_O	max.	30	A
R.M.S. forward current (note 2)	$I_{F(RMS)}$	max.	43	A
Repetitive peak forward current $t_p = 20\ \mu s$; $\delta = 0.02$ (per diode)	I_{FRM}	max.	320	A
Non-repetitive peak forward current (per diode) half sine-wave; $T_j = 150\ ^{o}C$ prior to surge; with reapplied $V_{RWM\ max}$				
t = 10 ms	I_{FSM}	max.	200	A
t = 8.3 ms	I_{FSM}	max.	220	A
I^2t for fusing (t = 10 ms; per diode)	I^2t	max.	200	A^2s

Temperatures

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

Notes:

1. The limits for both diodes apply whether both diodes conduct simultaneously or on alternate half cycles.
2. For output currents in excess of 20 A, connection should be made to the exposed metal mounting base.

CHARACTERISTICS

T_j = 25 °C unless otherwise stated

Forward voltage				
I_F = 10 A; T_j = 100 °C	V_F	<	0.85	V*
I_F = 30 A	V_F	<	1.15	V*
Reverse current				
$V_R = V_{RWM\,max}$; T_j = 100 °C	I_R	<	1.0	mA
$V_R = V_{RWM\,max}$	I_R	<	100	µA
Reverse recovery when switched from				
I_F = 1 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 100 A/µs; recovery time	t_{rr}	<	28	ns
I_F = 2 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 20 A/µs; recovered charge	Q_s	<	15	nC
I_F = 10 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 50 A/µs; T_j = 100 °C; peak recovery current	I_{RRM}	<	2.4	A
Forward recovery when switched to I_F = 1 A with dI_F/dt = 10 A/µs	V_{fr}	typ.	1.0	V

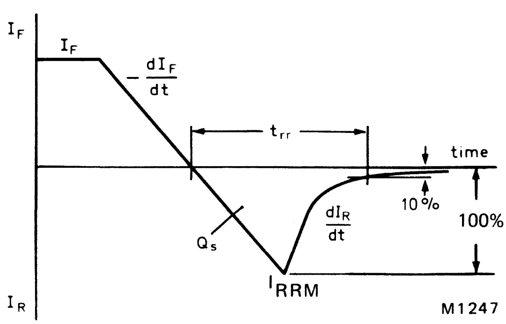


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

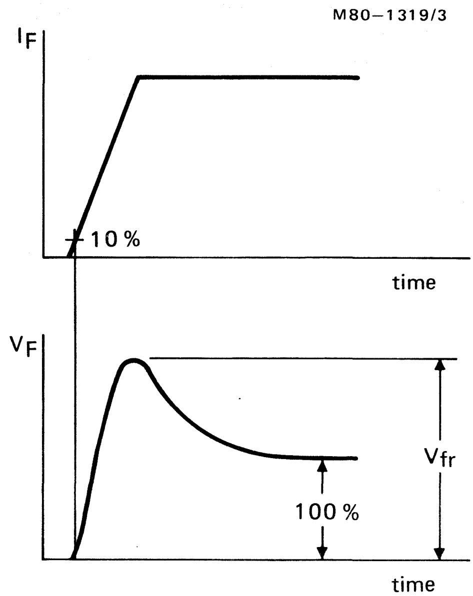


Fig.3 Definition of V_{fr}.

*Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

From junction to mounting base (both diodes conducting)	$R_{th\ j\text{-}mb}$	=	1.4	K/W
From junction to mounting base (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 insulator (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 value 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 device lead length and with copper laminate on the board — $R_{th\ j\text{-}a}$ = 60 K/W

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 calculations

The various components of junction temperature rise above ambient are illustrated in Fig.4

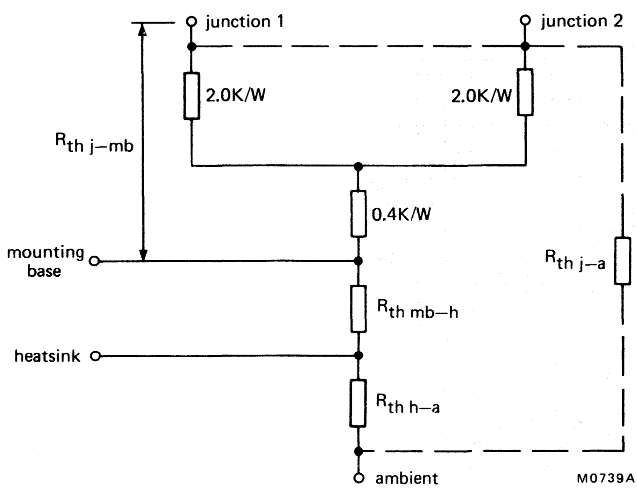


Fig. 4

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

SQUARE-WAVE OPERATION (PER DIODE)

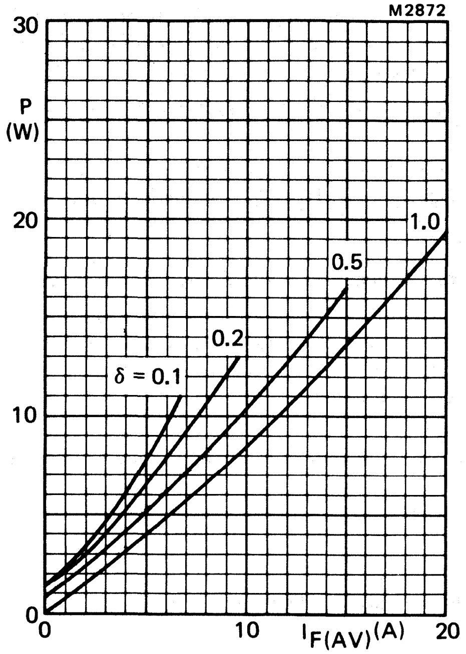
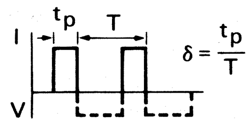


Fig.5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.



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

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

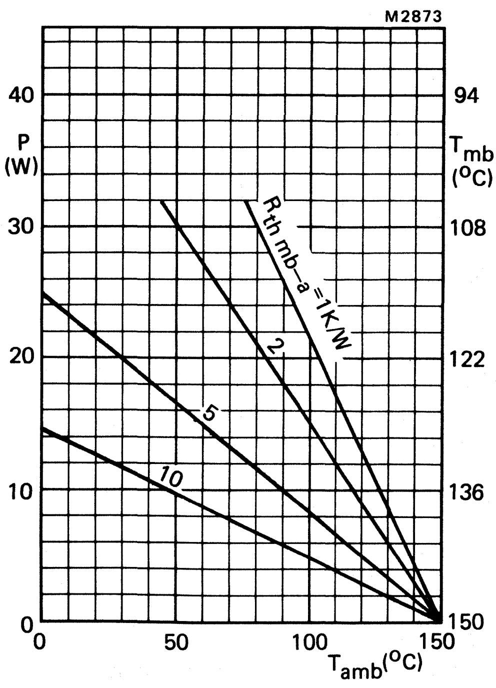


Fig.6.

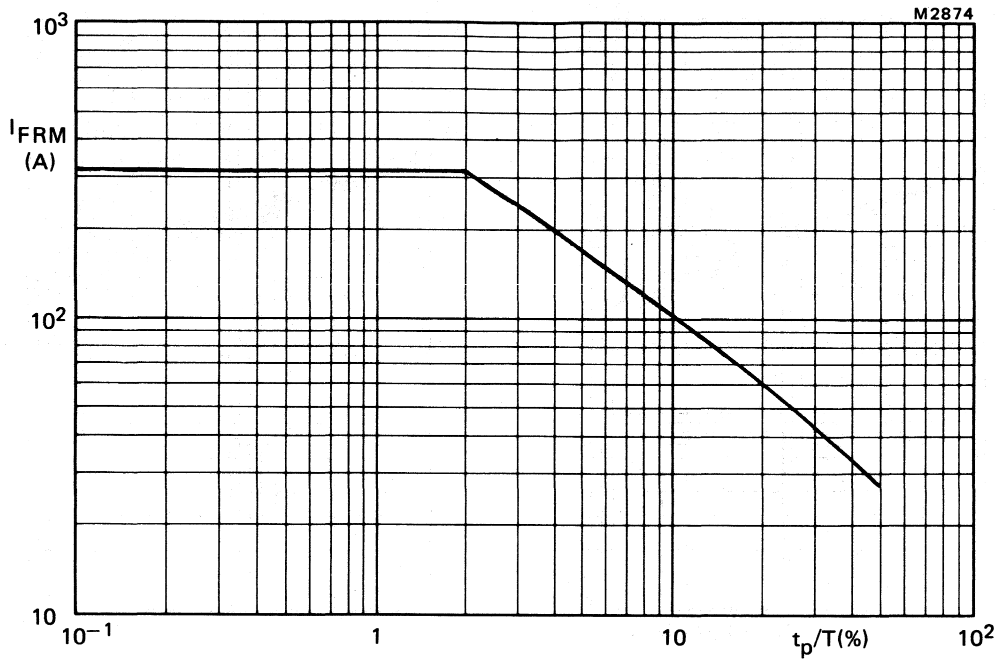
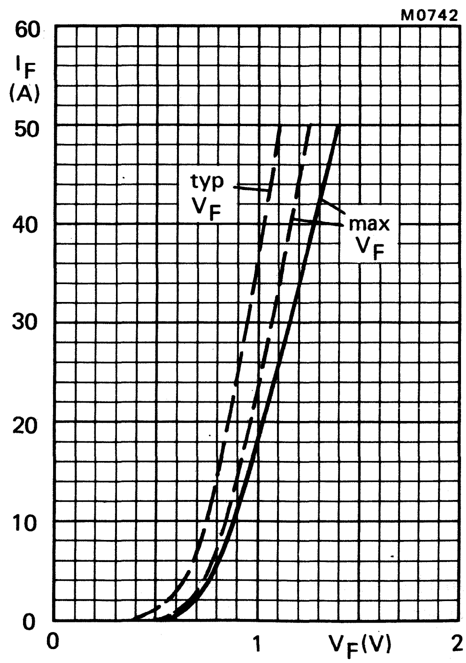
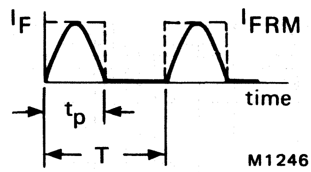


Fig.7 Maximum permissible repetitive peak forward current for square or sinusoidal currents for 1 $\mu s < t_p < 1$ ms; per diode.





Defintion of I_{FRM} and t_p/T.

Fig.8 —— T_j = 25 °C; – – – T_j = 100 °C; per diode.

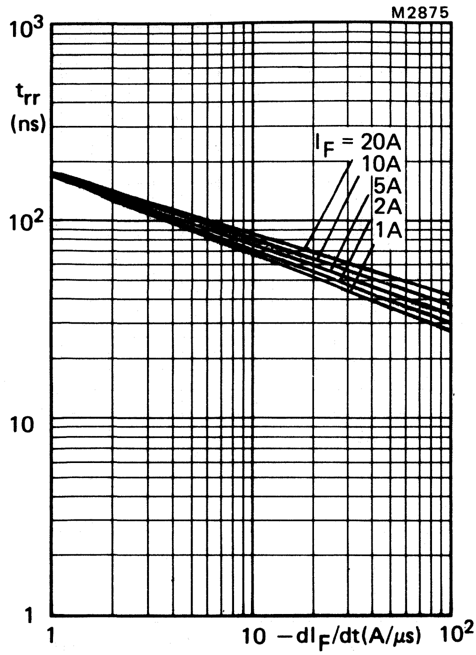


Fig.9 Maximum t_{rr} at T_j = 25 °C; per diode.

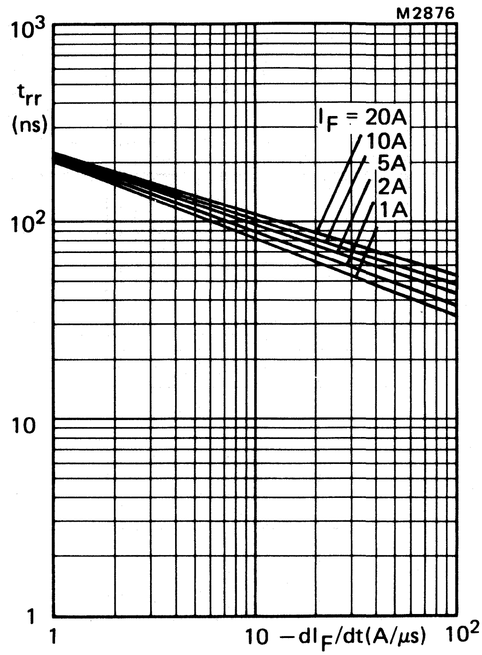


Fig.10 Maximum t_{rr} at T_j = 100 °C; per diode.

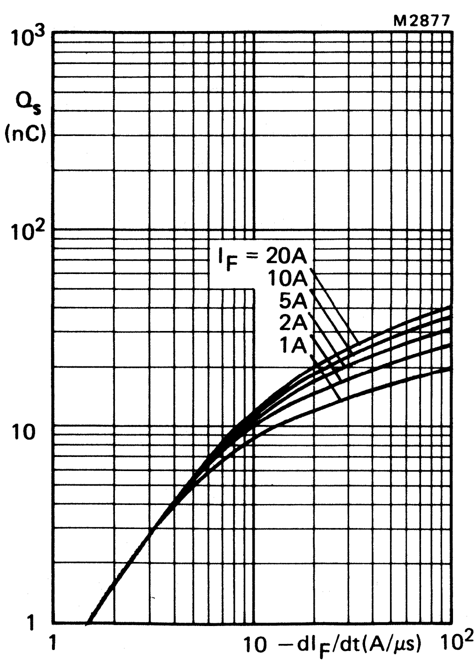


Fig.11 Maximum Q_s at T_j = 25 °C; per diode.

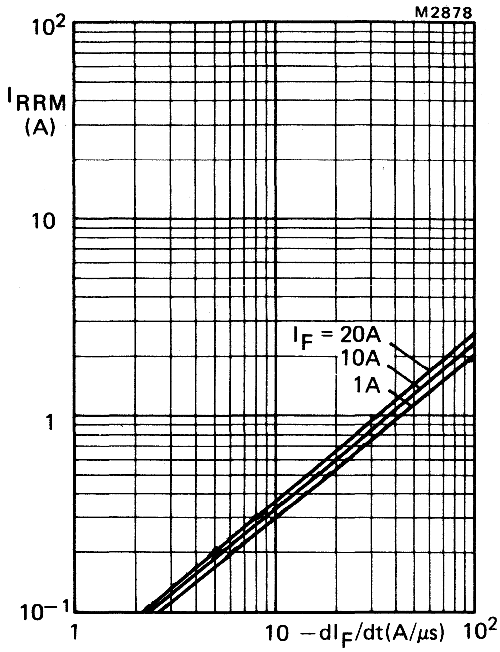


Fig.12 Maximum I_{RRM} at T_j = 25 °C; per diode.

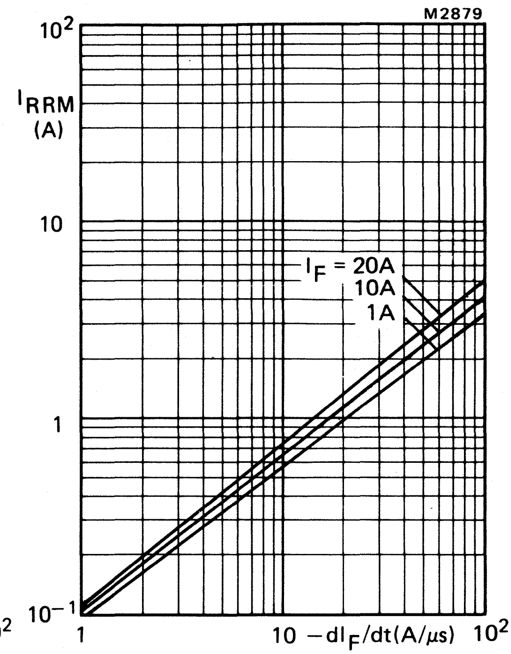


Fig.13 Maximum I_{RRM} at T_j = 100 °C; per diode.

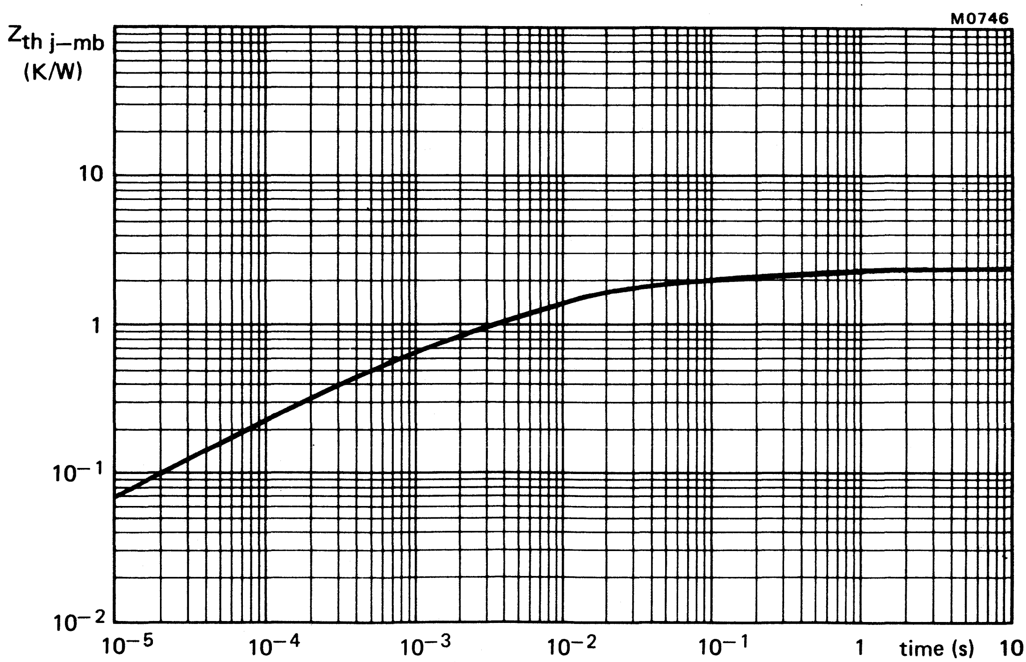


Fig.14 Transient thermal impedance; one diode conducting.

ULTRA FAST RECOVERY DOUBLE RECTIFIER DIODES

Glass-passivated, high-efficiency double rectifier diodes in plastic envelopes, featuring low forward voltage drop, ultra fast reverse recovery times and soft-recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and low switching losses are essential. Their single chip (monolithic) 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.

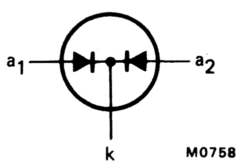
QUICK REFERENCE DATA

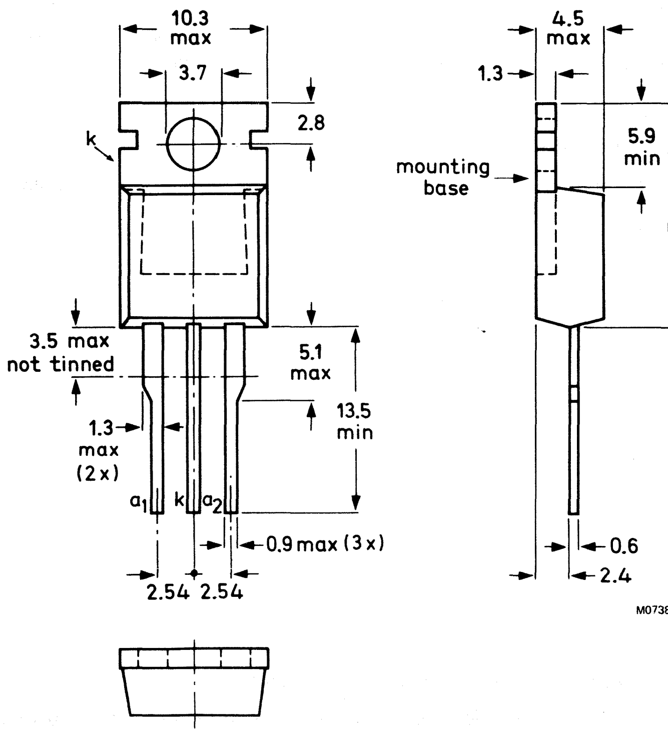
Per diode, unless otherwise stated			BYV44–300	400	500	V
Repetitive peak reverse voltage	V_{RRM}	max.	300	400	500	V
Output current (both diodes conducting)	I_O	max.		30		A
Forward voltage	V_F	<		1.05		V
Reverse recovery time	t_{rr}	<		50		ns

MECHANICAL DATA

Dimensions in mm

Fig. TO–220AB





Net mass: 2 g

Note: the exposed metal mounting base is directly connected to the common cathode.

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

RATINGS

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

			BYV44–300	400	500	
Voltages (per diode)						
→ Non-repetitive peak reverse voltage	V_{RSM}	max.	350	450	550	V
Repetitive peak reverse voltage	V_{RRM}	max.	300	400	500	V
Crest working reverse voltage	V_{RWM}	max.	200	300	400	V
Continuous reverse voltage (note 1)	V_R	max.	200	300	400	V
Currents (both diodes conducting; note 2)						
Output current; switching losses negligible up to 200 kHz;						
square wave; δ = 0.5; up to T_{mb} = 92 °C (note 3)	I_O	max.		30		A
sinusoidal; up to T_{mb} = 103 °C (note 3)	I_O	max.		26		A
→ R.M.S. forward current (note 3)	$I_{F(RMS)}$	max.		30		A
Repetitive peak forward current t_p = 20 μs; δ = 0.02 (per diode)	I_{FRM}	max.		320		A
Non-repetitive peak forward current (per diode) half sine-wave; T_j = 150 °C prior to surge; with reapplied $V_{RWM\,max}$						
t = 10 ms	I_{FSM}	max.		150		A
t = 8.3 ms	I_{FSM}	max.		180		A
I^2t for fusing (t = 10 ms; per diode)	I^2t	max.		112		A^2s
Temperatures						
Storage temperature	T_{stg}			−40 to +150		°C
Junction temperature	T_j	max.		150		°C

Notes:

1. To ensure thermal stability: $R_{th\,j\text{-}a} < 9.3$ K/W.
2. The limits for both diodes apply whether both diodes conduct simultaneously or on alternate half cycles.
3. For output currents in excess of 20 A, connection should be made to the exposed metal mounting base.

CHARACTERISTICS (per diode; T_j = 25 °C unless otherwise stated)

Forward voltage				
I_F = 15 A; T_j = 150 °C	V_F	<	1.05	V*
I_F = 50 A	V_F	<	1.4	V*
Reverse current				
$V_R = V_{RWM\,max}$; T_j = 100 °C	I_R	<	0.8	mA
$V_R = V_{RWM\,max}$	I_R	<	50	μA
Reverse recovery when switched from				
I_F = 1 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 100 A/μs; recovery time	t_{rr}	<	50	ns
I_F = 2 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 20 A/μs; recovered charge	Q_s	<	50	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}	<	5.2	A
Forward recovery when switched to I_F = 10 A with dI_F/dt = 10 A/μs; recovery voltage	V_{fr}	typ.	2.5	V

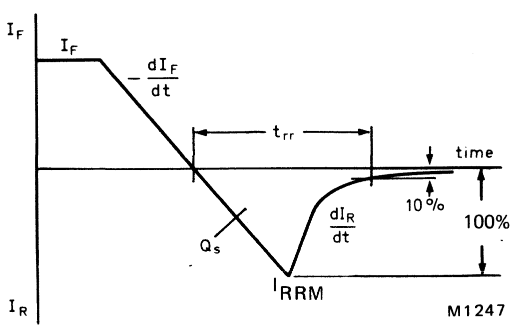


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}

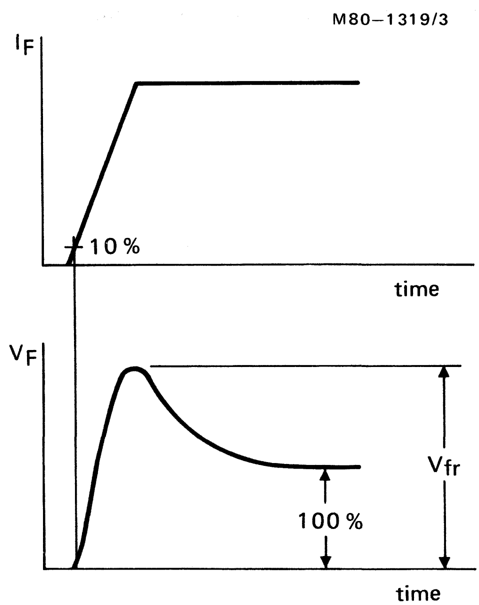


Fig.3 Definition of V_{fr}.

*Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

From junction to mounting base (both diodes conducting)	$R_{th\ j\text{-}mb}$	=	1.4	K/W
From junction to mounting base (per diode)	$R_{th\ j\text{-}mb}$	=	2.0	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 insulator (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 value 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 device lead length and with copper laminate on the board.	$R_{th\ j\text{-}a}$	=	60	K/W

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 calculations

The various components of junction temperature rise above ambient are illustrated in Fig.4:

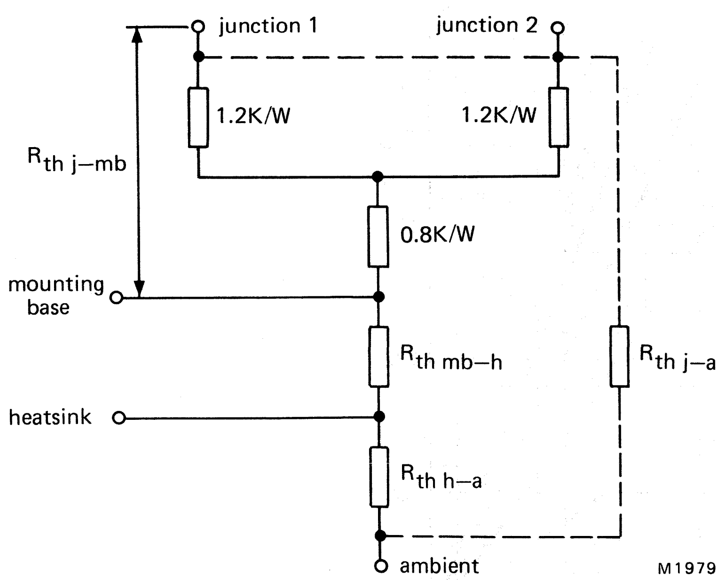


Fig.4

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

SQUARE-WAVE OPERATION

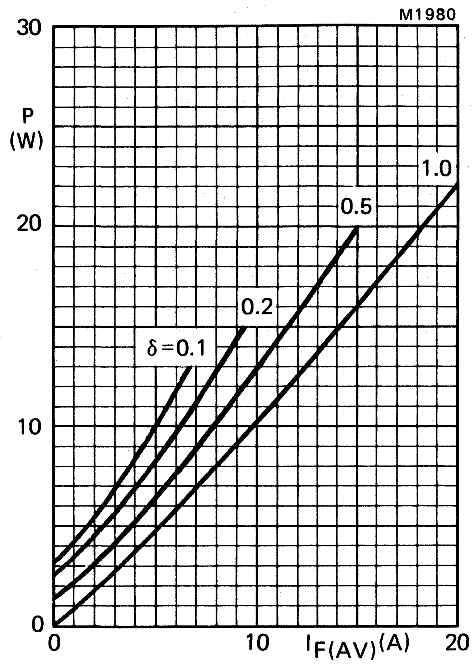
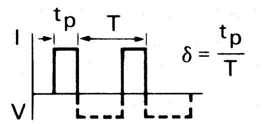


Fig.5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.

Power includes reverse current losses and switching losses up to f = 100 kHz.



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

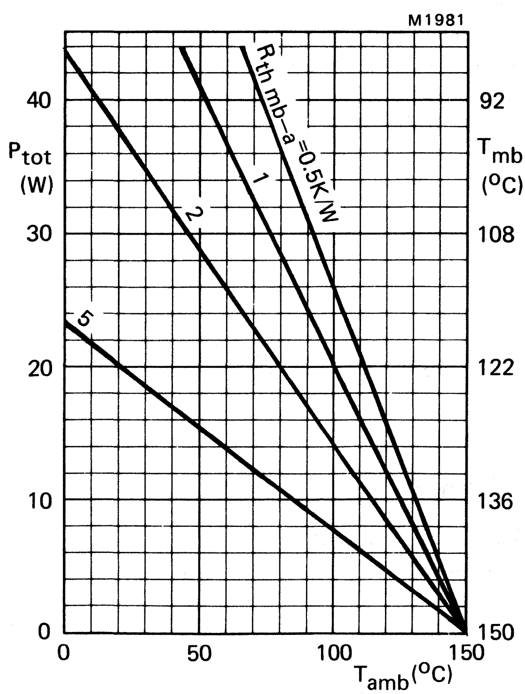


Fig.6

SINUSOIDAL OPERATION

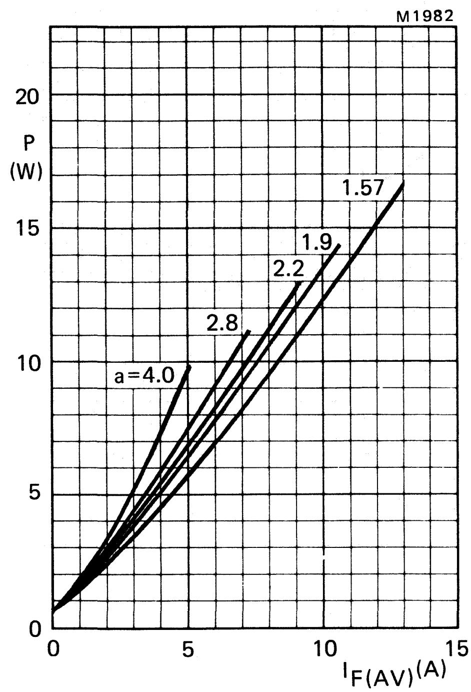


Fig.7 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.

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

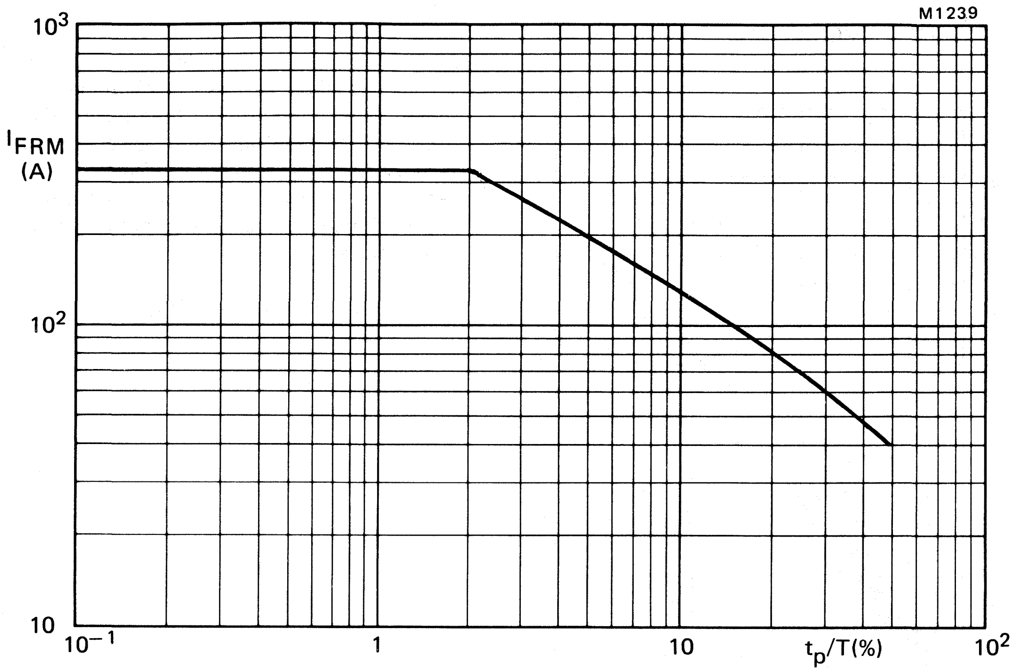


Fig.8 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 $\mu s < t_p < 1$ ms.

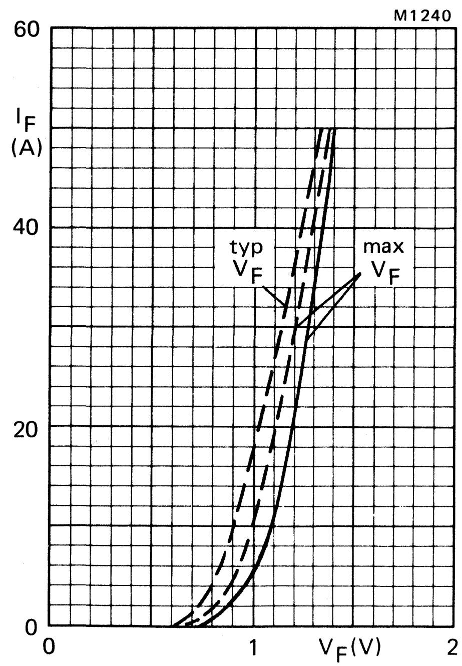
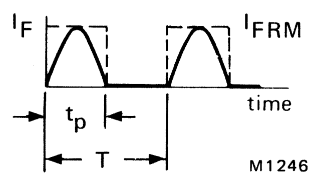


Fig.9 —— T_j = 25 °C; – – – T_j = 150 °C.



Definition of I_{FRM} and t_p/T.

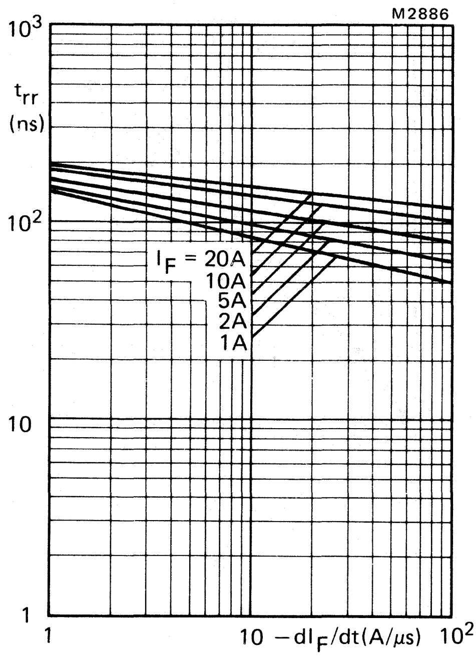


Fig.10 Maximum t_{rr} at T_j = 25 °C.

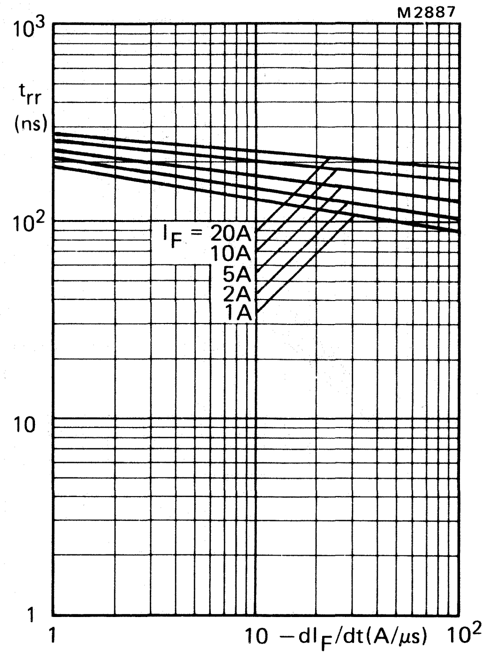


Fig.11 Maximum t_{rr} at T_j = 100 °C.

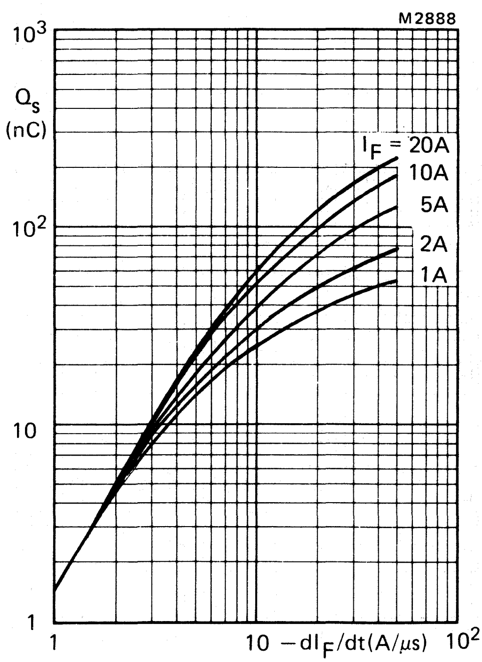


Fig.12 Maximum Q_s at T_j = 25 °C.

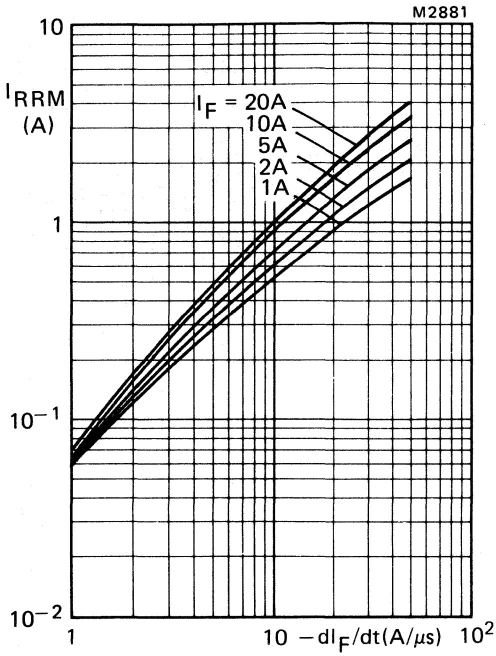


Fig.13 Maximum I_{RRM} at T_j = 25 °C.

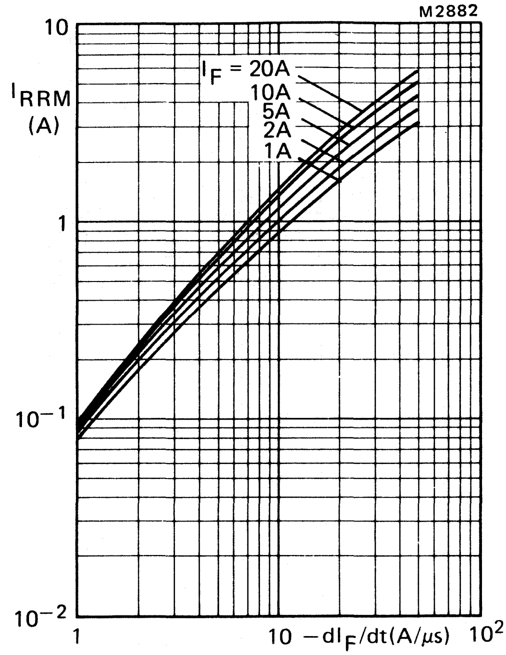


Fig.14 Maximum I_{RRM} at T_j = 100 °C.

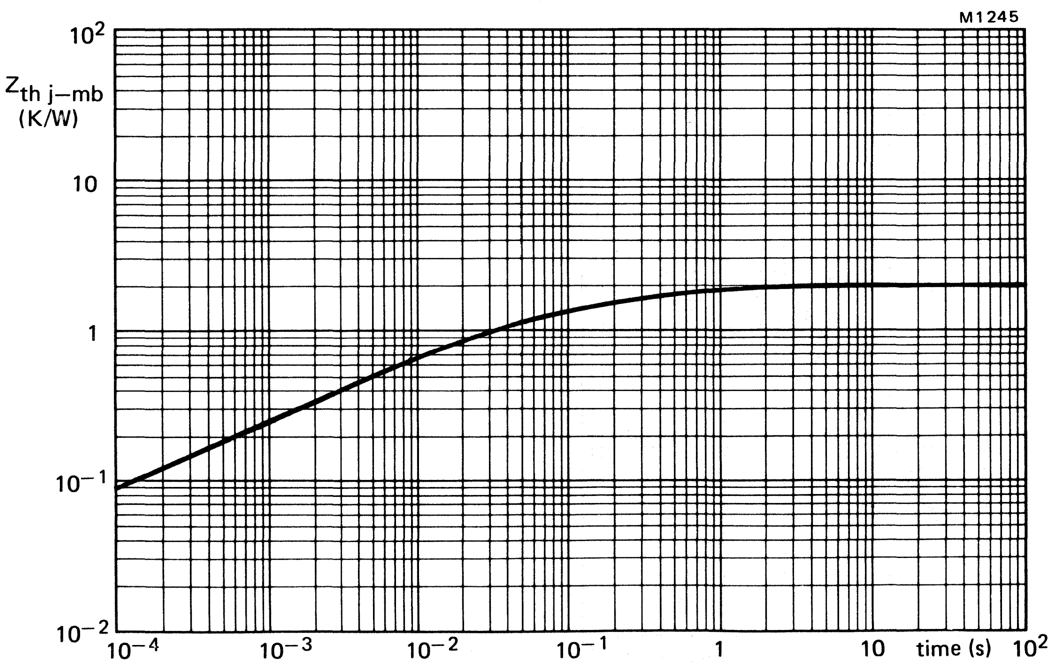


Fig.15 Transient thermal impedance (one diode conducting).

ULTRA FAST-RECOVERY DOUBLE RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial rectifier diodes in ISOTOP envelopes, featuring low forward voltage drop, ultra fast reverse recovery times, very low stored charge and soft-recovery characteristic. 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 electrical isolation makes them ideal for mounting on a common heatsink alongside other components without the need for additional insulators.

QUICK REFERENCE DATA

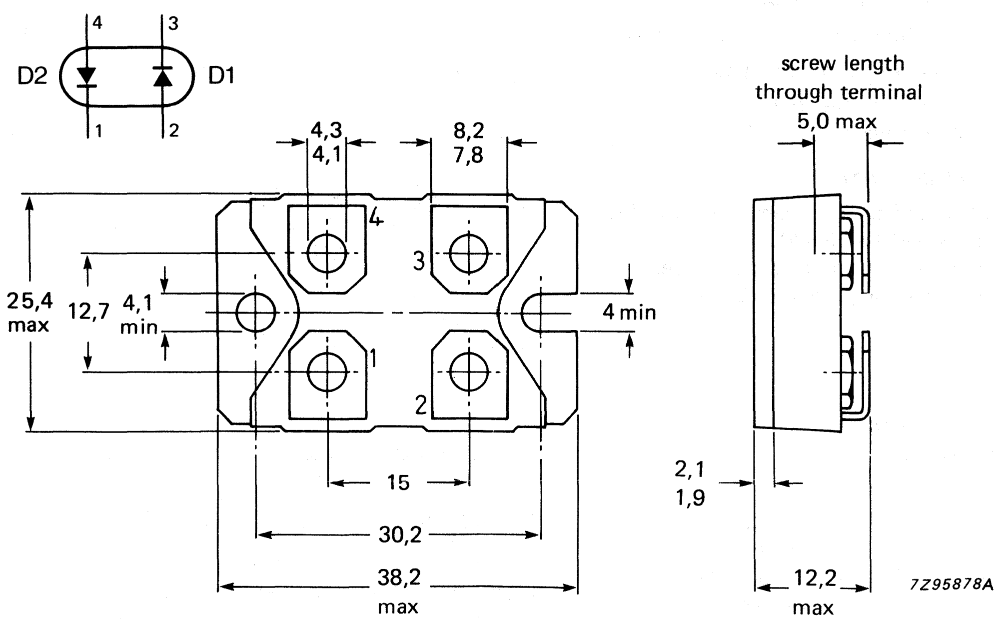
Per diode, unless otherwise stated			BYV54V–50	100	150	200	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	200	V
Average forward current	$I_{F(AV)}$	max.	2 x 50				A
Forward voltage	V_F	<	0.80				V
Reverse recovery time	t_{rr}	<	60				ns

MECHANICAL DATA

Dimensions in mm

Fig.1 SOT-227B.

Types with Faston terminals are available on request (see overleaf).



Baseplate is electrically isolated.
Isolation voltage: 2500 V RMS.
Capacitance: 45 pF.

Supplied with device: 4 x M4 screws.

RATINGS

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

Voltages (per diode)			BYV54V–50	100	150	200	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	200	V
Non repetitive peak reverse voltage	V_{RSM}	max.	55	110	165	220	V

Currents (per diode)				
Average forward current; switching losses negligible up to 100 kHz square wave, $\delta = 0.5$, up to $T_{mb} = 92\ ^{o}C$	$I_{F(AV)}$	max.	50	A
RMS forward current	$I_{F(RMS)}$	max.	100	A
Repetitive peak forward current $t_p = 10\ \mu s$, $\delta = 0.02$	I_{FRM}	max.	1000	A
Non-repetitive peak forward current half sine-wave t = 10 ms	I_{FSM}	max.	1000	A
I^2t for fusing (t = 10 ms)	I^2t	max.	3200	A^2s

Temperatures			
Storage temperature	T_{stg}	–40 to +150	^{o}C
Junction temperature	T_j	–40 to +150	^{o}C

THERMAL RESISTANCE

From junction to mounting base per diode	$R_{th\ j\text{-}mb}$	=	1.2	K/W
From junction to mounting base total	$R_{th\ j\text{-}mb}$	=	0.65	K/W
From mounting base to heatsink with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.1	K/W

ORDERING NOTE

Types with Faston terminals are available on request (see Fig.2).
Omit suffix V from the type number when ordering, e.g. BYV54-100.

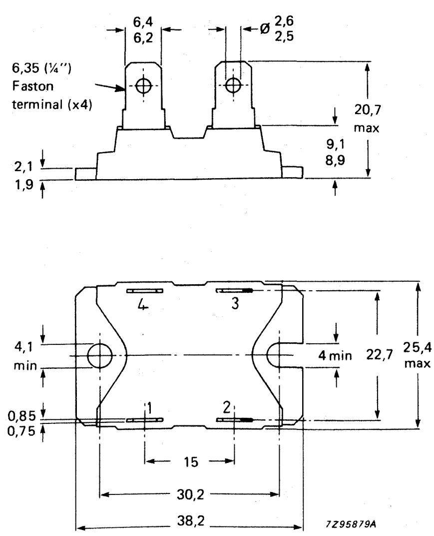
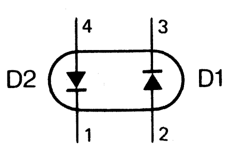


Fig.2 SOT-227A.
Dimensions in mm.



CHARACTERISTICS (per diode)

T_j = 25 °C unless otherwise stated

Forward voltage				
I_F = 50 A; T_j = 150 °C	V_F	<	0.80	V*
I_F = 160 A	V_F	<	1.25	V*
Reverse current				
$V_R = V_{RRM\,max}$; T_j = 100 °C	I_R	<	5	mA
$V_R = V_{RRM\,max}$	I_R	<	200	µA
Reverse recovery when switched from				
I_F = 1 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 50 A/µs; recovery time	t_{rr}	<	60	ns
I_F = 2 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 20 A/µs; recovered charge (see note 1)	Q_s	<	30	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}	<	6	A

DEVELOPMENT DATA

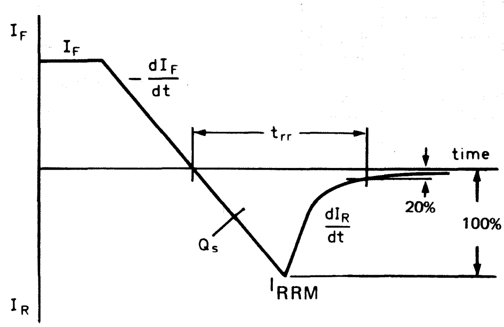


Fig.3 Definition of t_{rr}, Q_s and I_{RRM}.

Note 1: Q_s is corrected for non-dissipative capacitance contribution

*Measured under pulse conditions to avoid excessive dissipation.

SQUARE-WAVE OPERATION

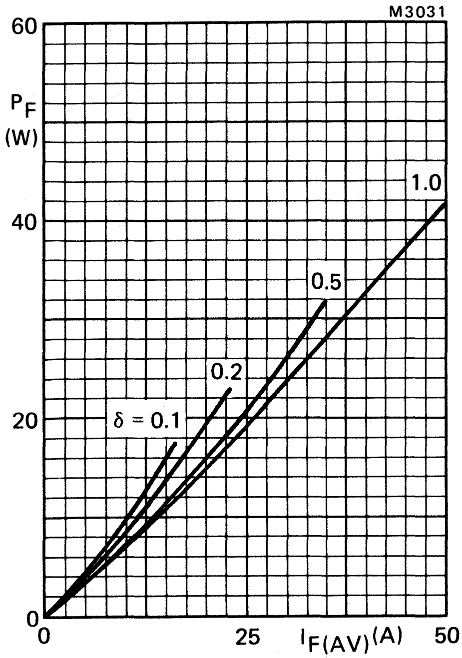
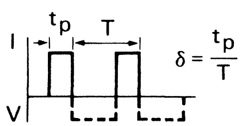


Fig.4 Forward power losses versus average forward current; per diode.



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

DEVELOPMENT DATA

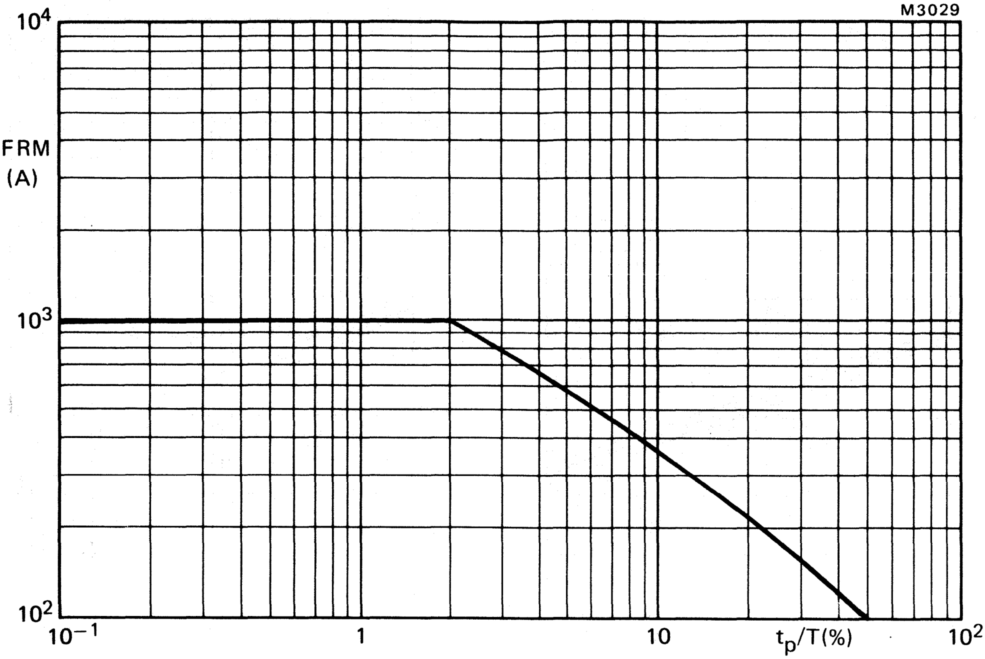
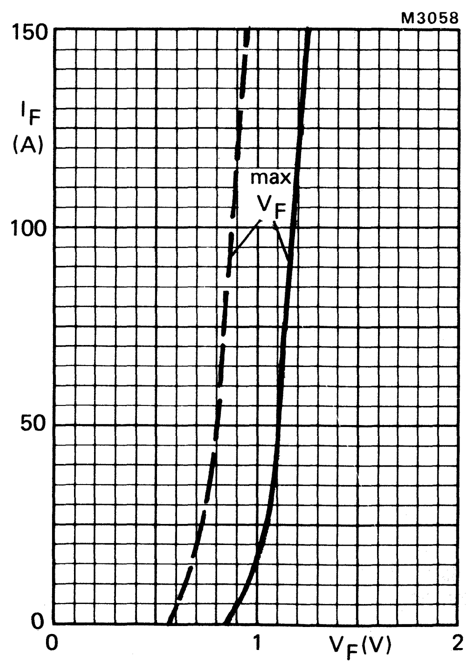
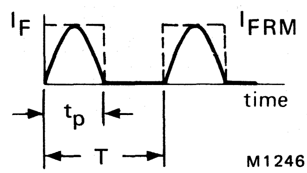


Fig.5 Maximum permissible repetitive peak forward current for square or sinusoidal currents; $1\ \mu s < t_p < 1$ ms; per diode.





Definition of I_{FRM} and t_p/T.

Fig.6 —— $T_j = 25\ ^oC$; – – – $T_j = 150\ ^oC$; per diode.

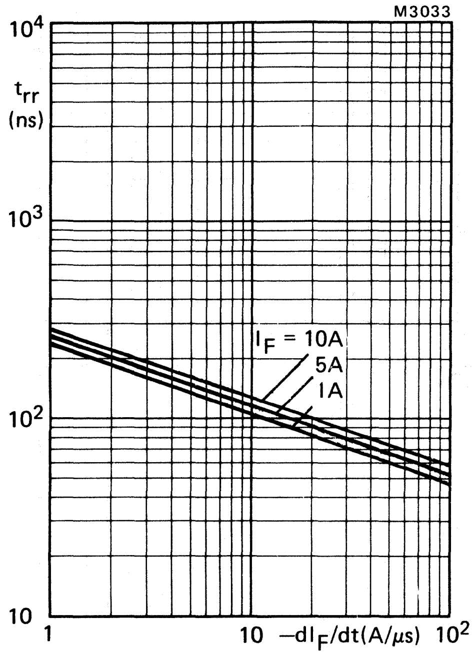


Fig.7 Maximum t_{rr} at T_j = 25 °C;
per diode.

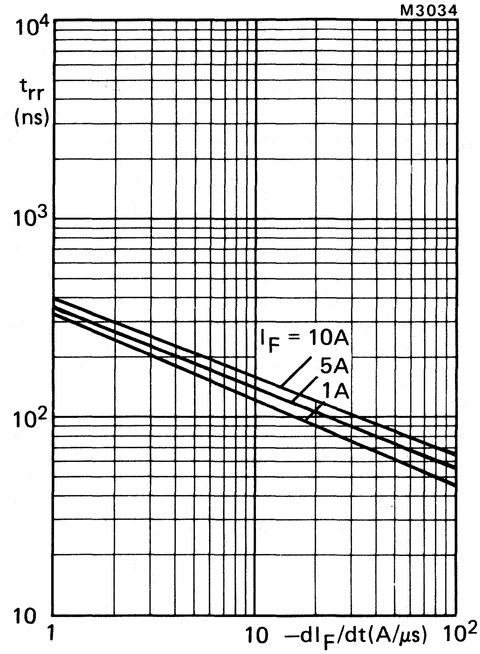


Fig.8 Maximum t_{rr} at T_j = 100 °C;
per diode.

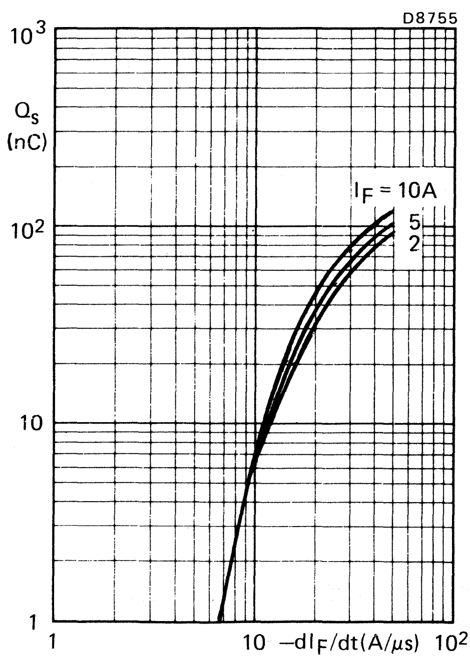


Fig.9 Maximum Q_s at T_j = 25 °C;
per diode.

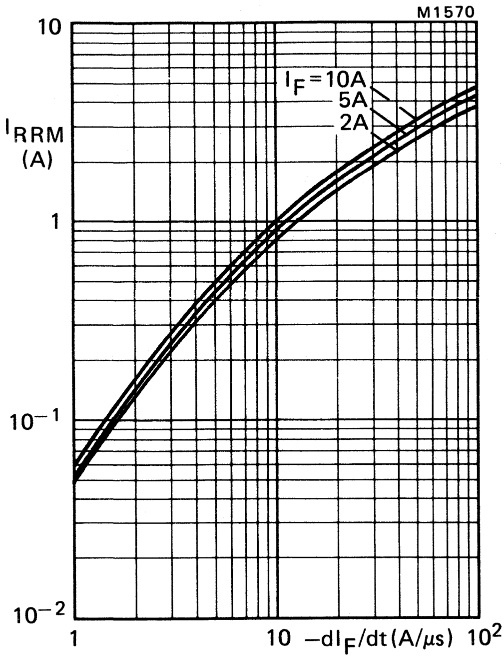


Fig.10 Maximum I_{RRM} at T_j = 25 °C; per diode.

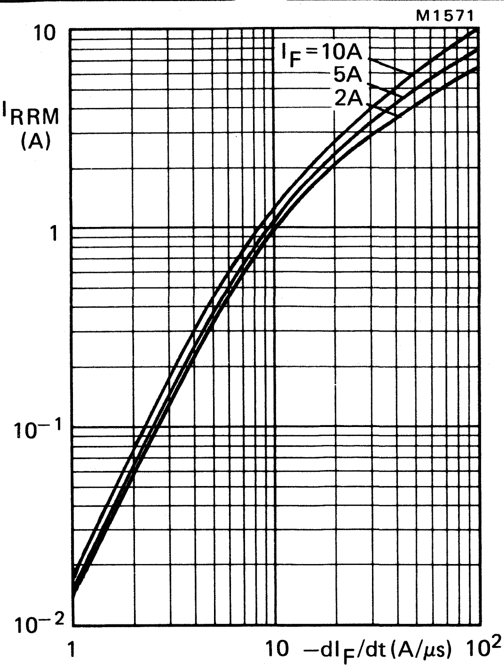


Fig.11 Maximum I_{RRM} at T_j = 100 °C; per diode.

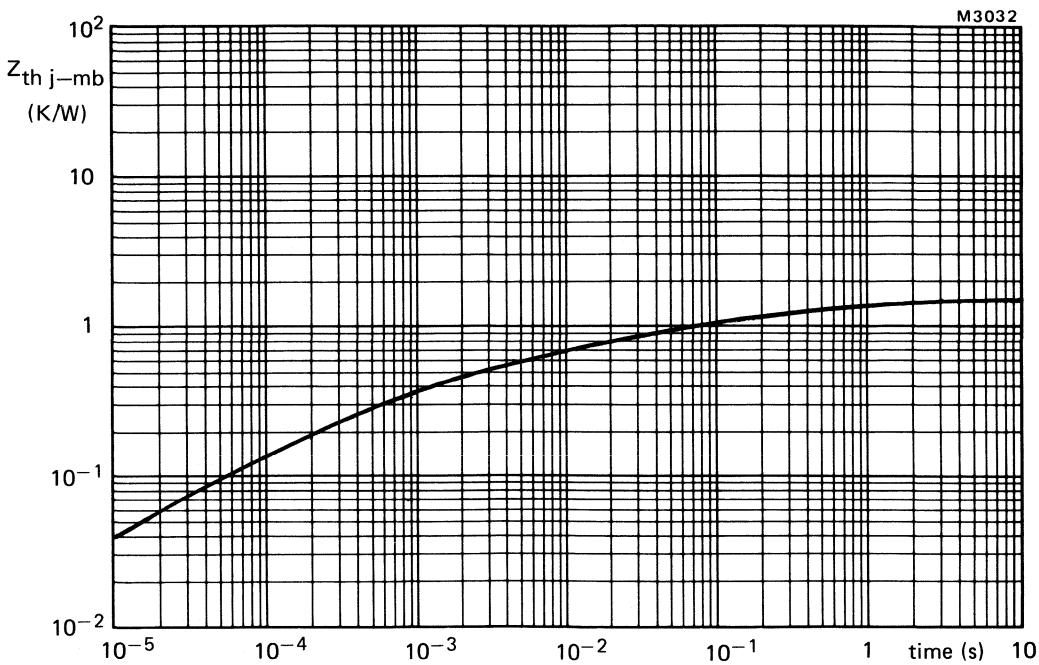


Fig.12 Transient thermal impedance; per diode.

ULTRA FAST RECOVERY DOUBLE RECTIFIER DIODES

Glass-passivated, high-efficiency double rectifier diodes in plastic envelopes, featuring low forward voltage drop, ultra fast reverse-recovery times and soft-recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and low switching losses are essential. Their single chip (monolithic) 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.

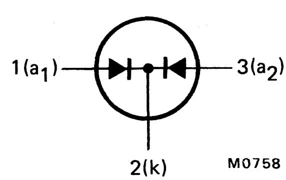
QUICK REFERENCE DATA

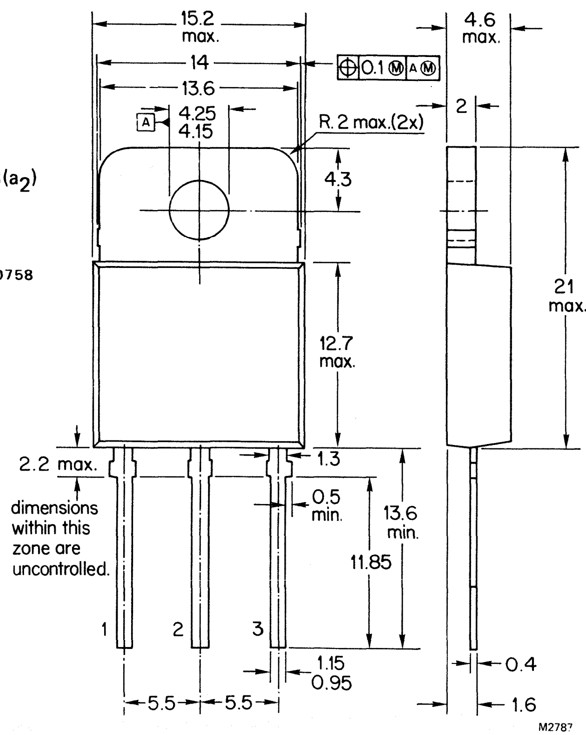
Per diode, unless otherwise stated		BYV72–50		100	150	200	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	200	V
Output current (both diodes conducting)	I_O	max.		30			A
Forward voltage	V_F	<		0.85			V
Reverse recovery time	t_{rr}	<		28			ns

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-93





Net mass: 5 g

Note: the exposed metal mounting base is directly connected to the common cathode.

Accessories supplied on request: see data sheets Mounting instructions and accessories for SOT-93 envelopes.

RATINGS

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

Voltages (per diode)			BYV72–50	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 $T_{mb} = 104\ ^oC$ (note 2)	I_O	max.	30	A
→ R.M.S. forward current (note 2)	$I_{F(RMS)}$	max.	30	A
Repetitive peak forward current $t_p = 20\ \mu s$; $\delta = 0.02$ (per diode)	I_{FRM}	max.	320	A
Non-repetitive peak forward current (per diode) half sine-wave; $T_j = 150\ ^oC$ prior to surge; with reapplied $V_{RWM\,max}$				
$t = 10$ ms	I_{FSM}	max.	150	A
$t = 8.3$ ms	I_{FSM}	max.	160	A
I^2t for fusing ($t = 10$ ms; per diode)	I^2t	max.	112	A^2s
Temperatures				
Storage temperature	T_{stg}		−40 to +150	^oC
Junction temperature	T_j	max.	150	^oC

Notes:

1. The limits for both diodes apply whether both diodes conduct simultaneously or on alternate half cycles.
2. For output currents in excess of 20 A, connection should be made to the exposed metal mounting base.

CHARACTERISTICS

T_j = 25 °C unless otherwise stated

Forward voltage				
I_F = 10 A; T_j = 100 °C	V_F	<	0.85	V*
I_F = 30 A	V_F	<	1.15	V*
Reverse current				
$V_R = V_{RWM\,max}$; T_j = 100 °C	I_R	<	1.0	mA
$V_R = V_{RWM\,max}$	I_R	<	25	μA
Reverse recovery when switched from				
I_R = 1 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 100 A/μs; recovery time	t_{rr}	<	28	ns
I_F = 2 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 20 A/μs; recovered charge	Q_s	<	15	nC
I_F = 10 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 50 A/μs; T_j = 100 °C; peak recovery current	I_{RRM}	<	2.4	A
Forward recovery when switched to I_F = 1 A with dI_F/dt = 10 A/μs	V_{fr}	typ.	1.0	V

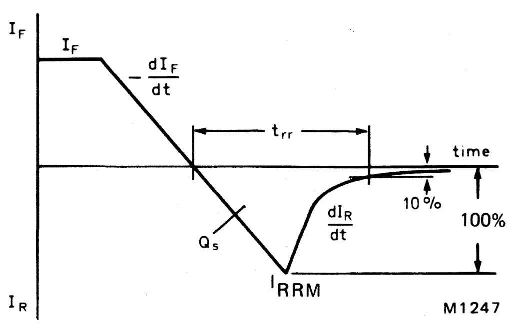


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

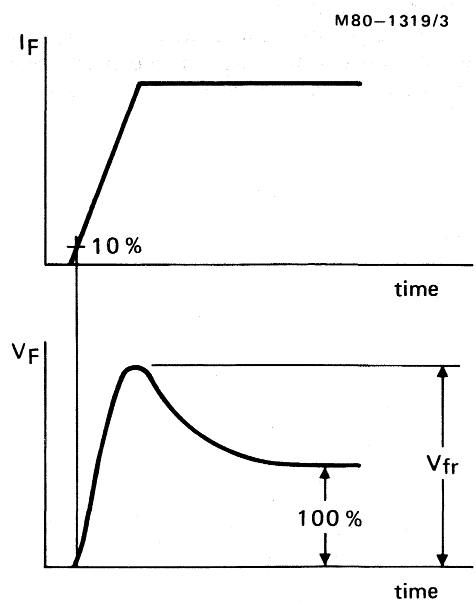


Fig.3 Definition of V_{fr}.

*Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

From junction to mounting base (both diodes conducting)	$R_{th\ j\text{-}mb}$	=	1.4	K/W
From junction to mounting base (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	$R_{th\ mb\text{-}h}$	=	0.2	K/W
b. with heatsink compound and 0.06 mm maximum mica insulator (56378)	$R_{th\ mb\text{-}h}$	=	1.4	K/W
c. with heatsink compound and 0.1 mm maximum mica insulator	$R_{th\ mb\text{-}h}$	=	2.2	K/W
d. with heatsink compound and 0.25 mm maximum alumina insulator	$R_{th\ mb\text{-}h}$	=	0.8	K/W
e. without heatsink compound	$R_{th\ mb\text{-}h}$	=	1.4	K/W

2. Free air operation

The quoted value 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 device lead length and with copper laminate on the board — $R_{th\ j\text{-}a}$ = 60 K/W

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 M4 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 calculations

The various components of junction temperature rise above ambient are illustrated in Fig.4

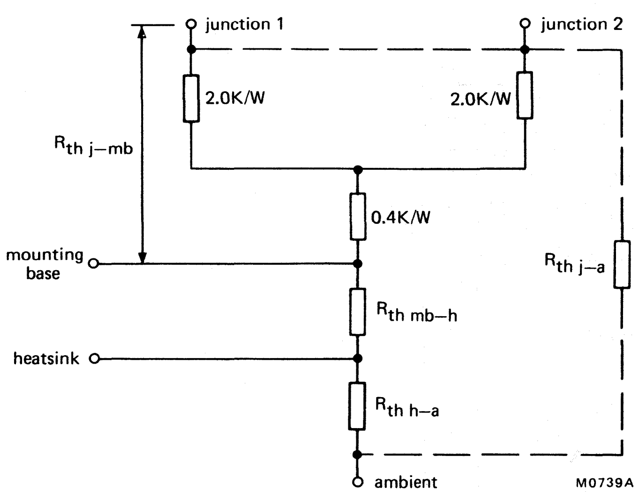


Fig.4

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

SQUARE-WAVE OPERATION (BOTH DIODES)

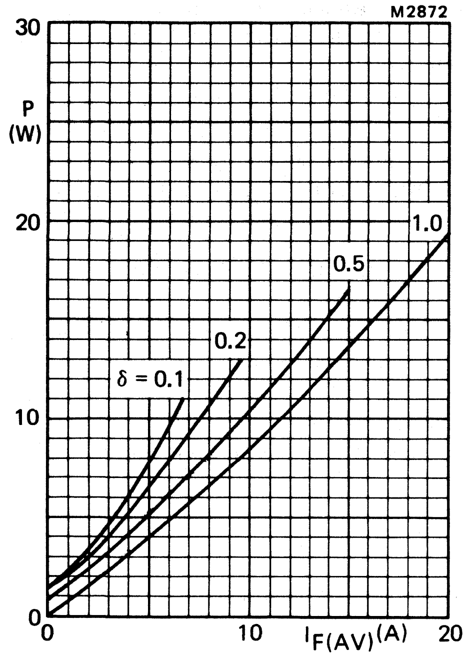
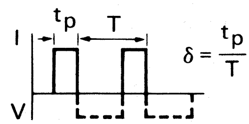


Fig.5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.



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

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

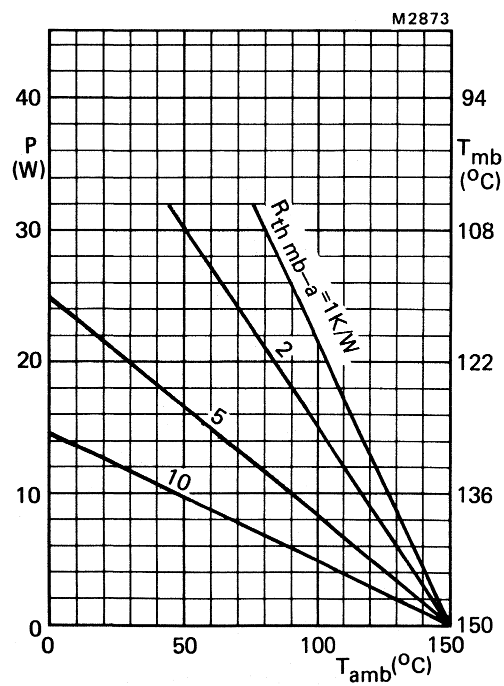


Fig.6

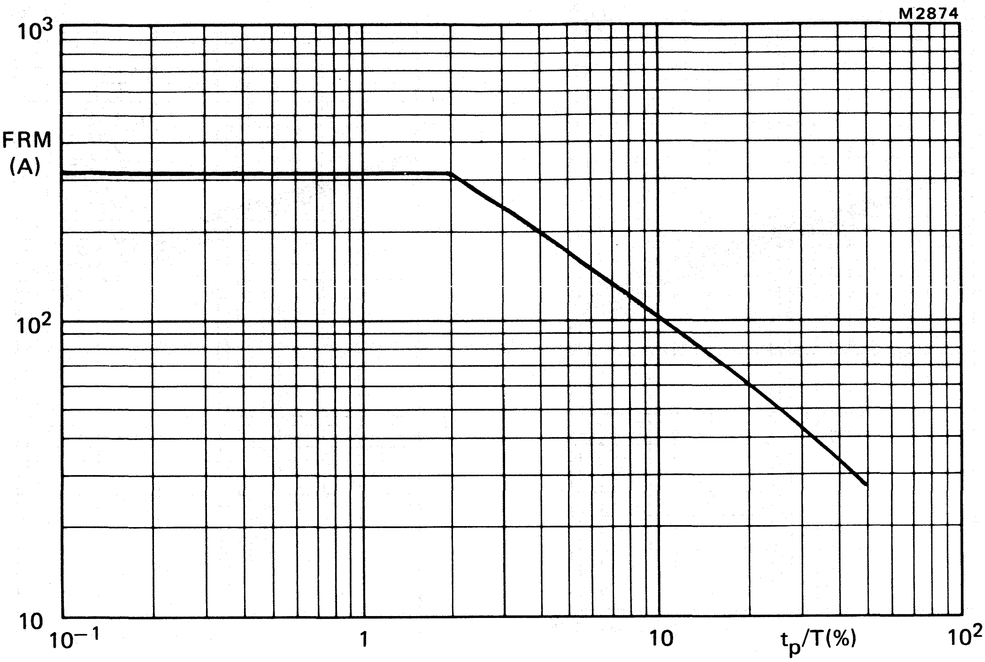
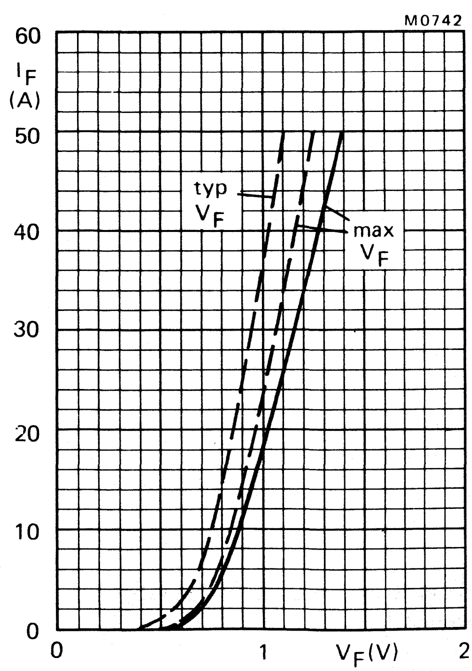
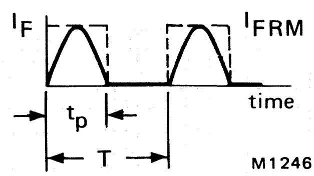


Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 $\mu s < t_p <$ 1 ms; per diode.





Defintion of I_{FRM} and t_p/T.

Fig.8 —— T_j = 25 °C; – – – T_j = 100 °C.
per diode.

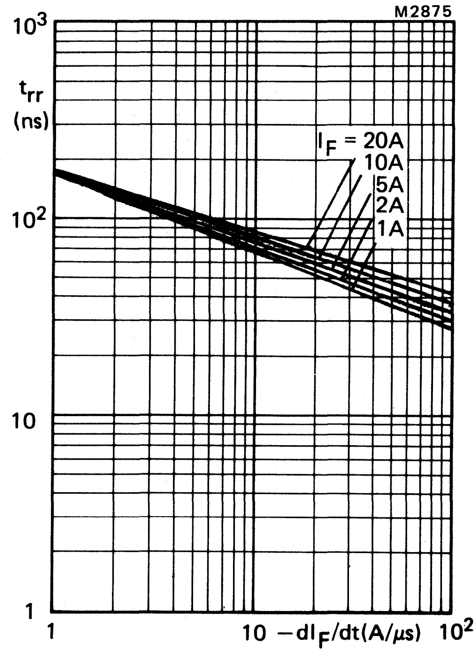


Fig.9 Maximum t_{rr} at T_j = 25 ^oC;
per diode.

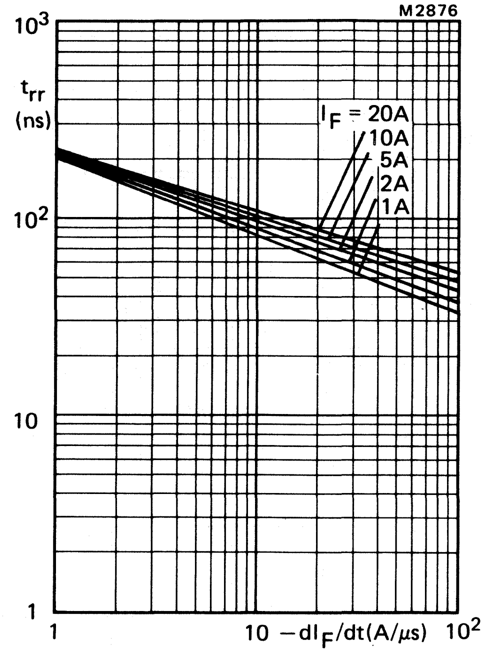


Fig.10 Maximum t_{rr} at T_j = 100 ^oC;
per diode.

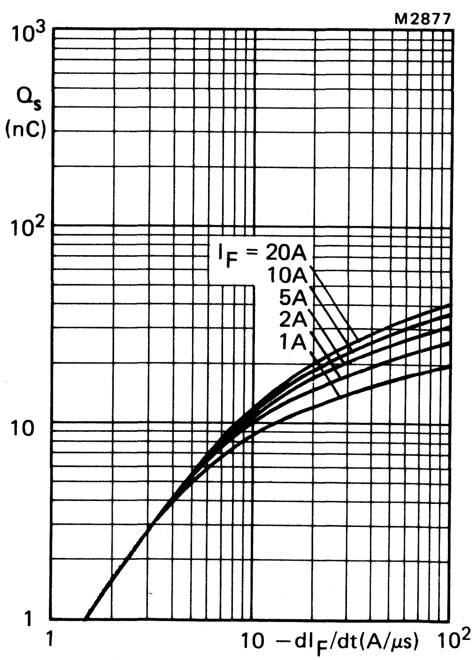


Fig.11 Maximum Q_s at T_j = 25 ^oC;
per diode.

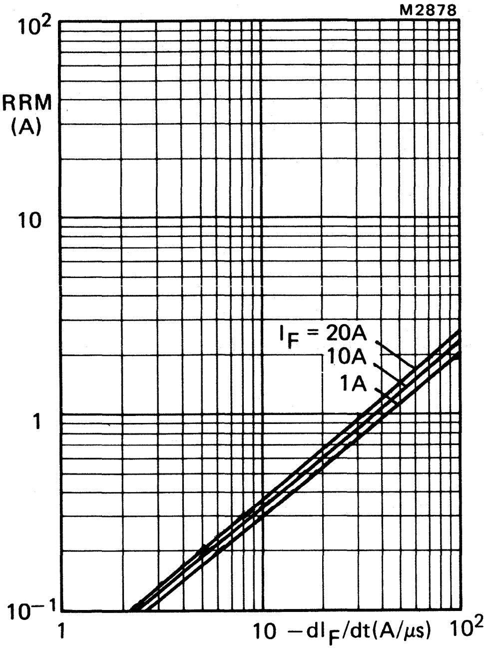


Fig.12 Maximum I_{RRM} at T_j = 25 °C; per diode.

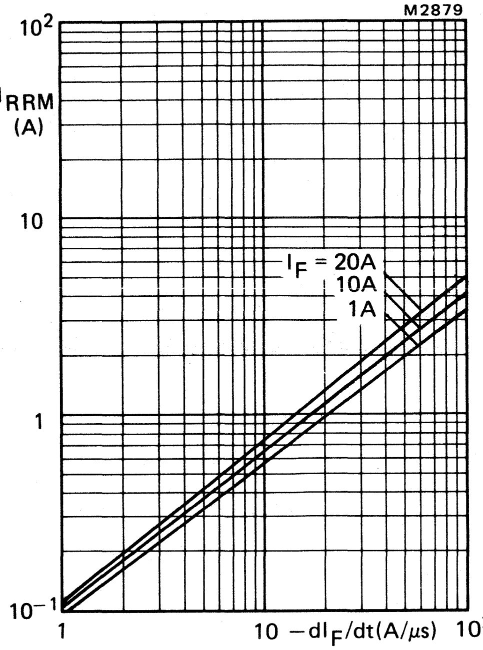


Fig.13 Maximum I_{RRM} at T_j = 100 °C; per diode.

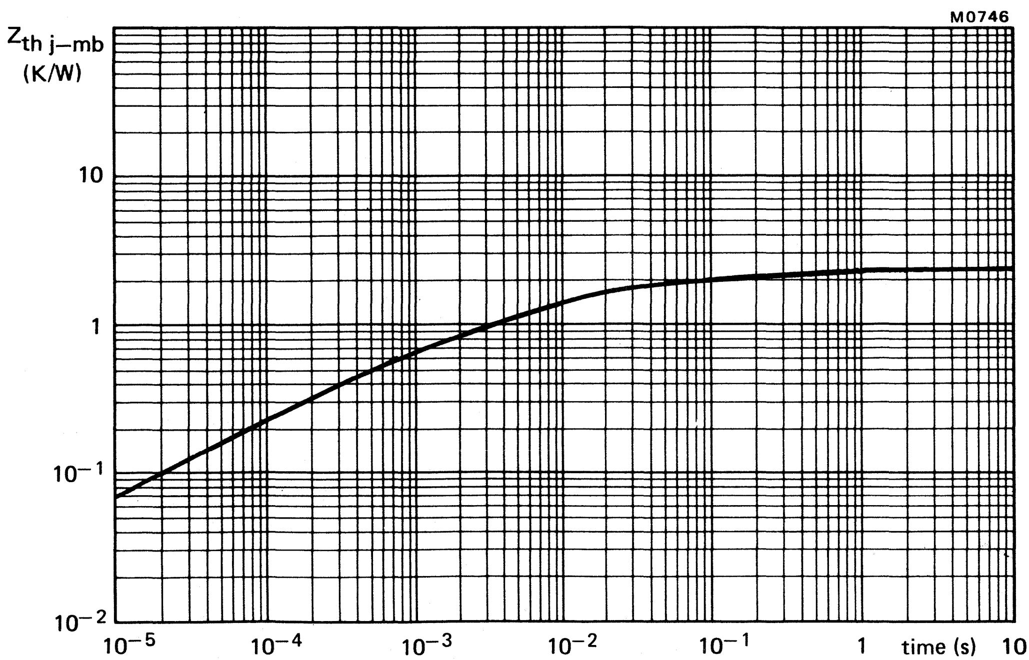


Fig.14 Transient thermal impedance; one diode conducting.

ULTRA FAST-RECOVERY ELECTRICALLY-ISOLATED DOUBLE RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial double rectifier diodes in SOT-199 (full-pack) plastic envelopes, featuring low forward voltage drop, very fast reverse recovery times and soft-recovery characteristic. 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 switched-mode power supplies and high-frequency circuits in general, where both low conduction and 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.

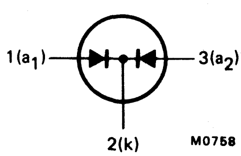
QUICK REFERERENCE DATA

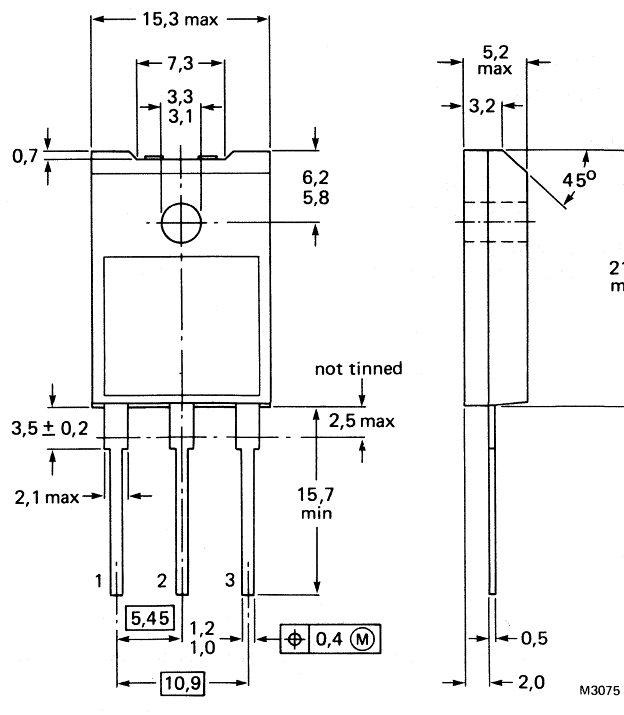
Per diode, unless otherwise stated			BYV72F-50	100	150	200	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	200	V
Output current (both diodes conducting)	I_O	max.		20			A
Forward voltage	V_F	<		0.85			V
Reverse recovery time	t_{rr}	<		28			ns

MECHANICAL DATA

Dimensions in mm

Fig.1 SOT-199





Note: Accessories supplied on request: see data sheets Mounting instructions and accessories for SOT-93 envelopes.

RATINGS

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

Voltages (per diode)			BYV72F-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; δ = 0.5; T_h = 66 °C (note 2)	I_O	max.	20	A
R.M.S. forward current	$I_{F(RMS)}$	max.	20	A
Repetitive peak forward current t_p = 20 μs; δ = 0.02 (per diode)	I_{FRM}	max.	320	A
Non-repetitive peak forward current (per diode) half sine-wave; T_j = 150 °C prior to surge; with reapplied $V_{RWM\,max}$				
t = 10 ms	I_{FSM}	max.	150	A
t = 8.3 ms	I_{FSM}	max.	160	A
I^2t for fusing (t = 10 ms; per diode)	I^2t	max.	112	A^2s

Temperatures

Storage temperature	T_{stg}		−40 to +150	°C
Junction temperature	T_j	max.	150	°C

ISOLATION

Peak isolation voltage from all terminals to external heatsink	$V_{t\text{-}h}$	max.	1500	V
Isolation capacitance from centre lead to external heatsink (note 3)	$C_{t\text{-}h}$	typ.	12	pF

Notes:

1. The limits for both diodes apply whether both diodes conduct simultaneously or on alternate half cycles.
2. The quoted temperatures assume heatsink compound is used.
3. Mounted without heatsink compound and with 20 newtons force on the centre of the envelope.

CHARACTERISTICS

T_j = 25 °C unless otherwise stated

Forward voltage				
I_F = 10 A; T_j = 100 °C	V_F	<	0.85	V*
I_F = 30 A	V_F	<	1.15	V*
Reverse current				
$V_R = V_{RWM\,max}$; T_j = 100 °C	I_R	<	1.0	mA
$V_R = V_{RWM\,max}$	I_R	<	25	μA
Reverse recovery when switched from				
I_F = 1 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 100 A/μs; recovery time	t_{rr}	<	28	ns
I_F = 2 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 20 A/μs; recovered charge	Q_s	<	15	nC
I_F = 10 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 50 A/μs; T_j = 100 °C; peak recovery current	I_{RRM}	<	2.4	A
Forward recovery when switched to I_F = 1 A with dI_F/dt = 10 A/μs	V_{fr}	typ.	1.0	V

DEVELOPMENT DATA

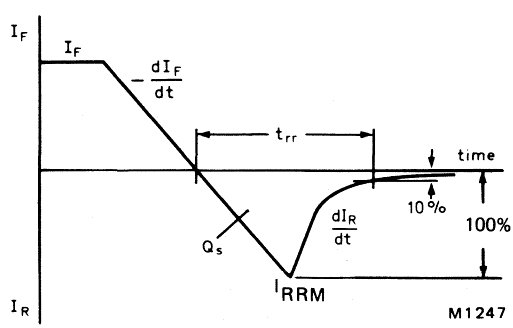


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

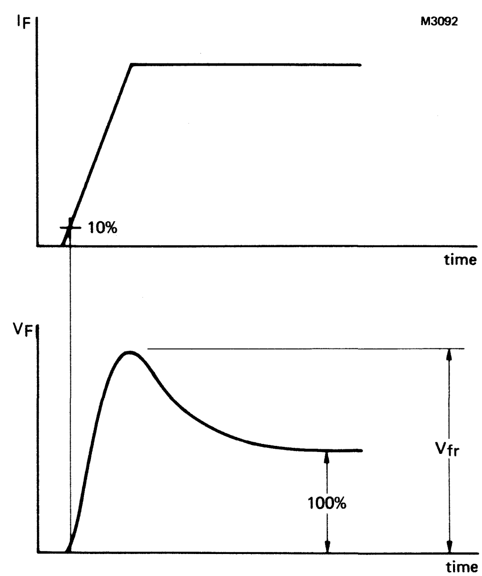


Fig.3 Definition of V_{fr}.

*Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

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

a. both diodes conducting:				
with heatsink compound	$R_{th\ j\text{-}h}$	=	4	K/W
without heatsink compound	$R_{th\ j\text{-}h}$	=	8	K/W
b. per diode:				
with heatsink compound	$R_{th\ j\text{-}h}$	=	5	K/W
without heatsink compound	$R_{th\ j\text{-}h}$	=	9	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 tie point.

Thermal resistance from junction to ambient in free air, mounted on a printed circuit board	$R_{th\ j\text{-}a}$	=	35	K/W

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 not 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.4.

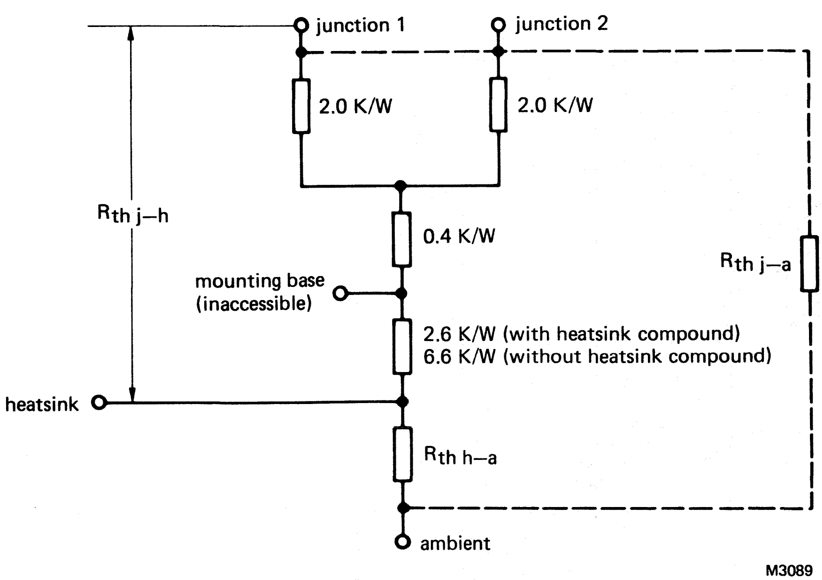


Fig.4.

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

SQUARE-WAVE OPERATION (BOTH DIODES)

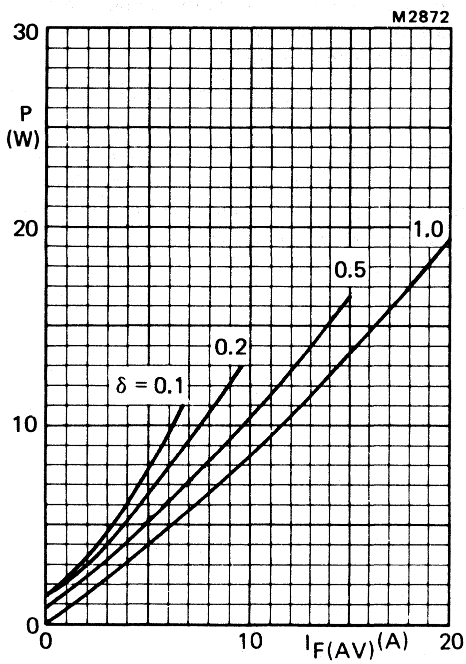
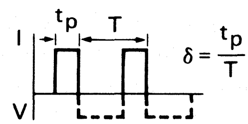


Fig.5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.



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

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

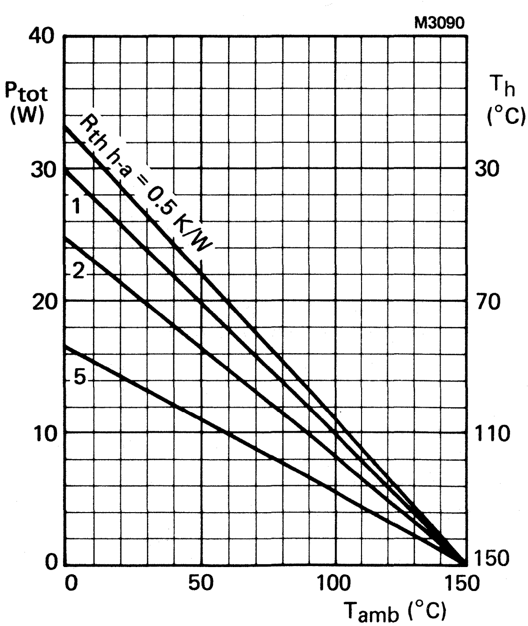


Fig.6.

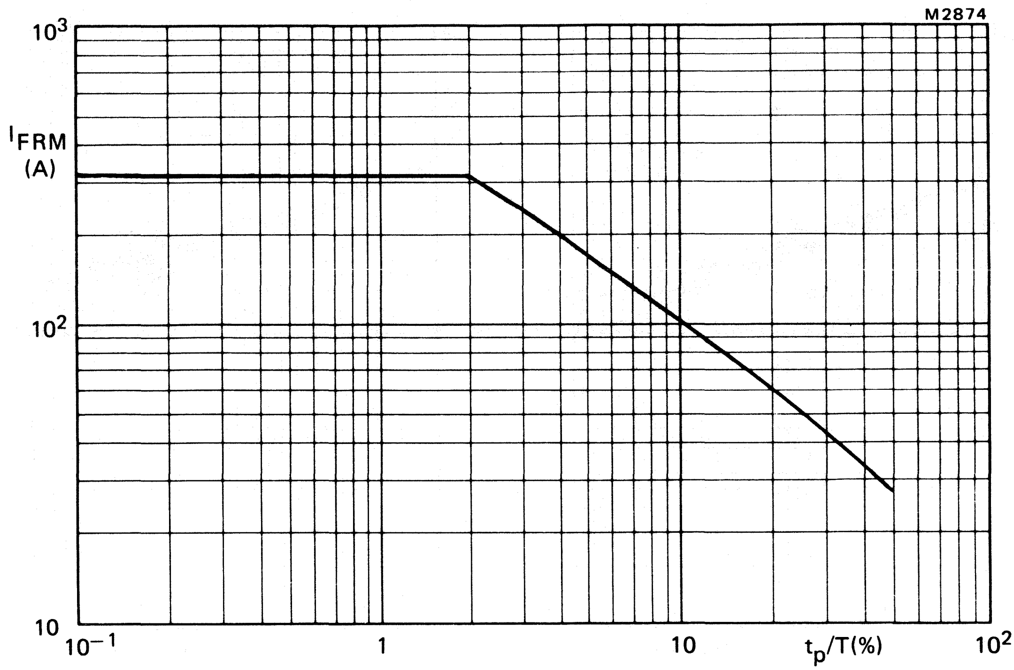
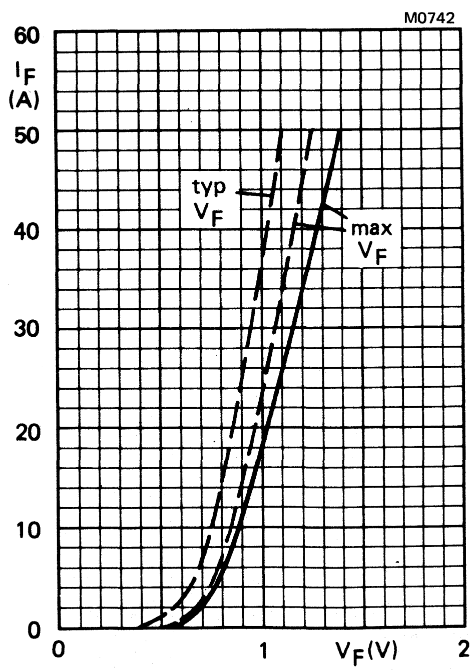
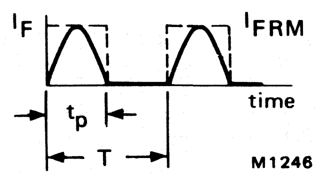


Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 $\mu s < t_p < 1$ ms; per diode.





Definition of I_{FRM} and t_p/T.

Fig.8 ——— T_j = 25 °C; – – – T_j = 100 °C.
per diode.

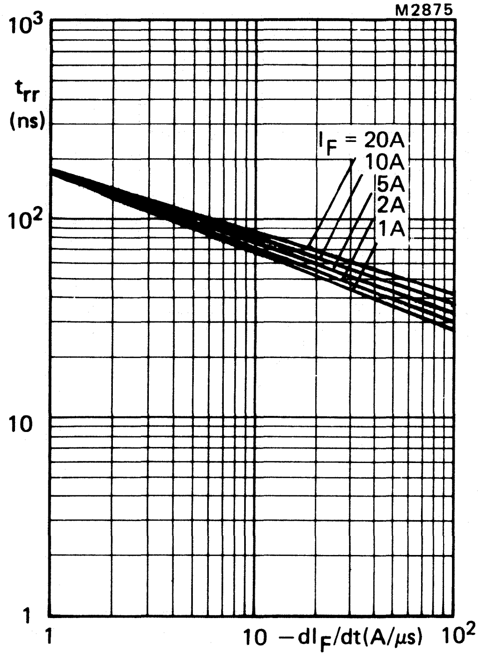


Fig.9 Maximum t_{rr} at T_j = 25 °C; per diode.

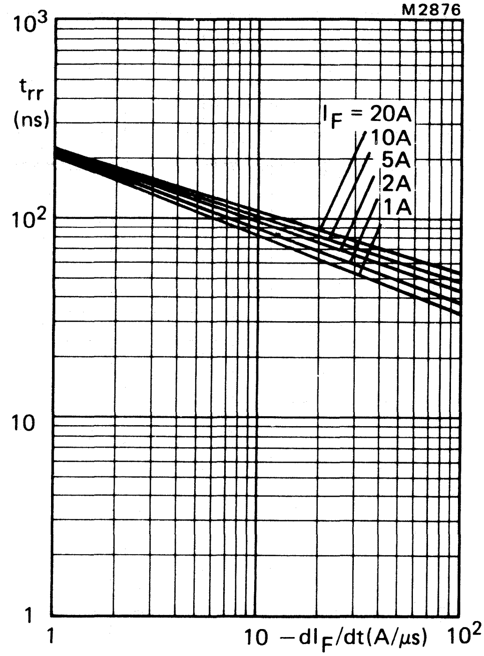


Fig.10 Maximum t_{rr} at T_j = 100 °C; per diode.

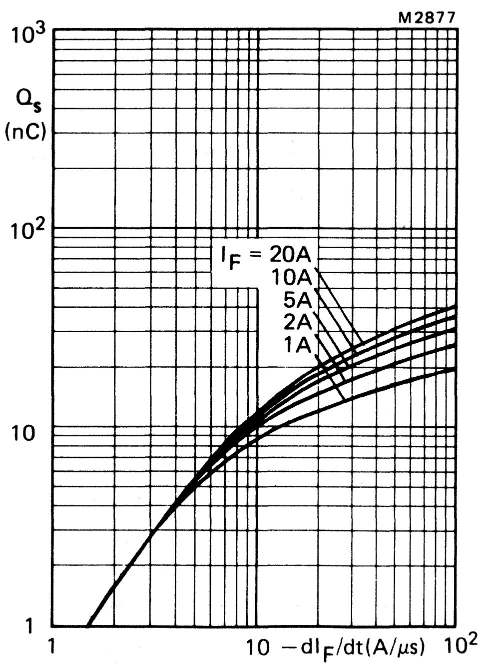


Fig.11 Maximum Q_s at T_j = 25 °C; per diode.

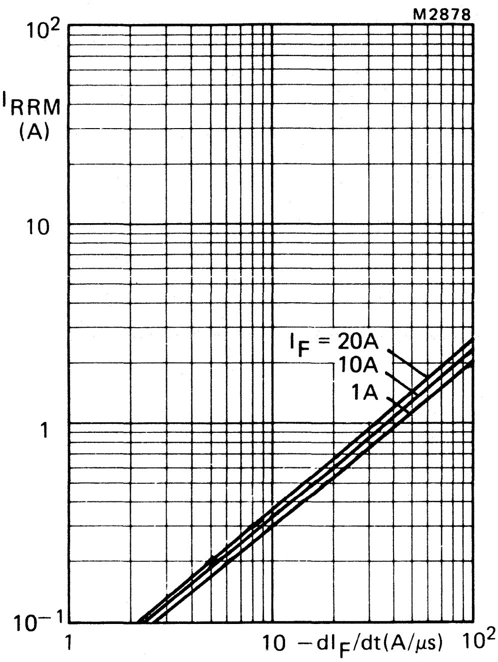


Fig.12 Maximum I_{RRM} at T_j = 25 °C; per diode.

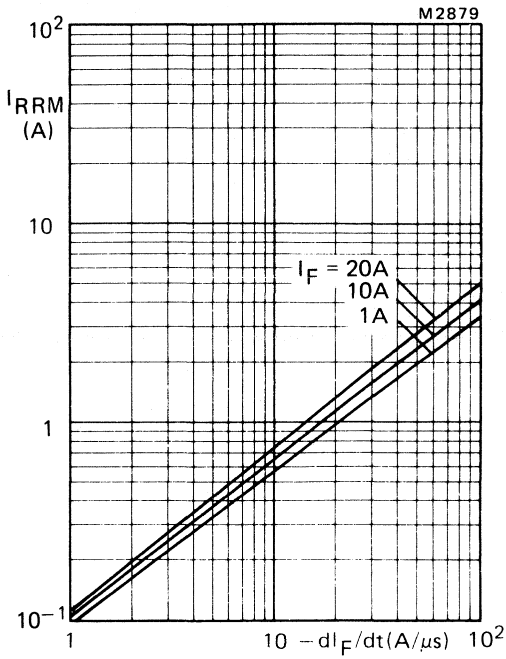


Fig.13 Maximum I_{RRM} at T_j = 100 °C; per diode.

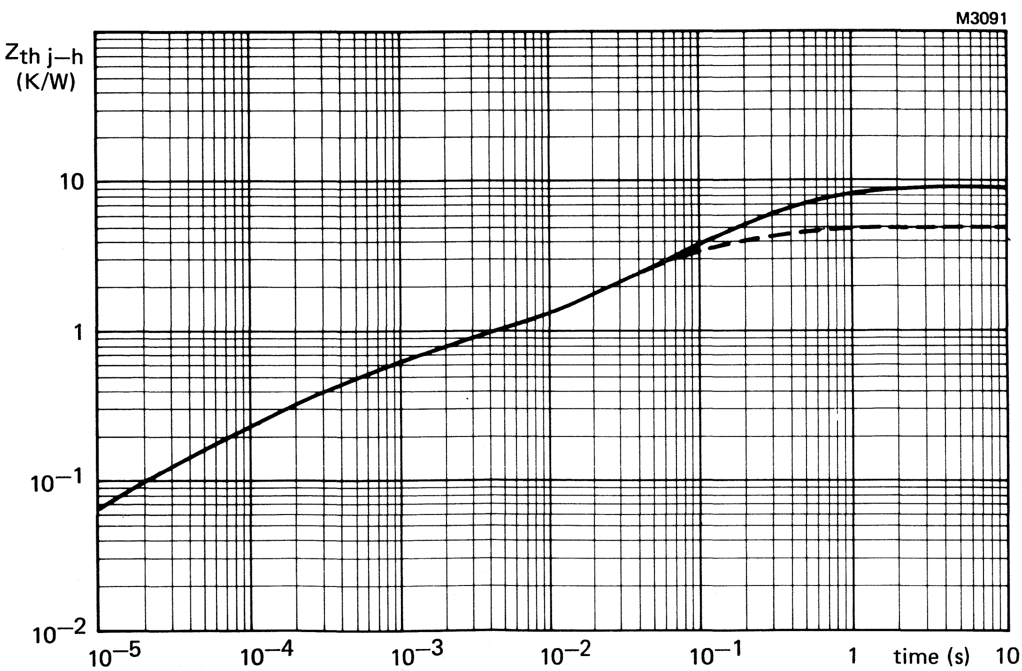


Fig.14 Transient thermal impedance; one diode conducting; — — — with heatsink compound; ——— without heatsink compound.

ULTRA FAST RECOVERY DOUBLE RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial double rectifier diodes in plastic envelopes which feature low forward voltage drop, very fast reverse recovery times and soft-recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where low conduction losses and 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 derating. The series consists of common-cathode types.

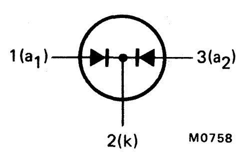
QUICK REFERENCE DATA

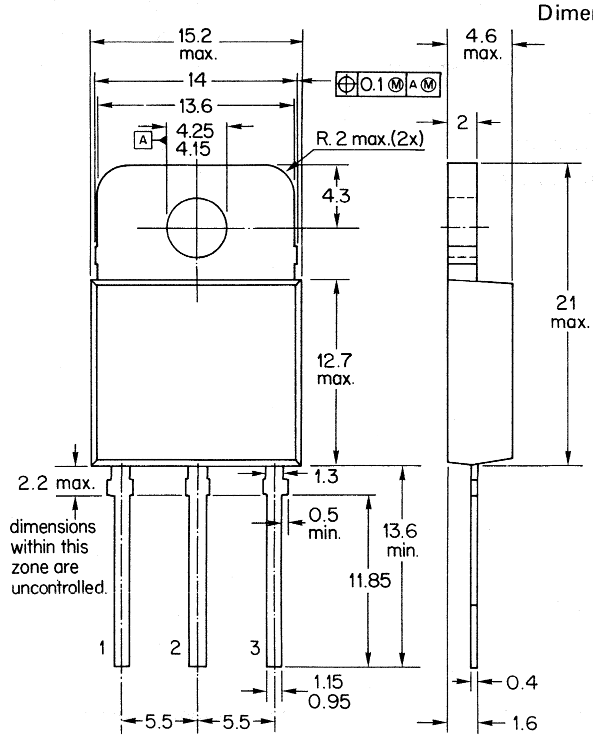
Per diode, unless otherwise stated			BYV74–300	400	500	V
Repetitive peak reverse voltage	V_{RRM}	max.	300	400	500	V
Output current (both diodes conducting)	I_O	max.		30		A
Forward voltage	V_F	<		1.05		V
Reverse recovery time	t_{rr}	<		50		ns

MECHANICAL DATA

Dimensions in mm

Fig.1 SOT-93





Net mass: 5 g

Note: the exposed metal mounting base is directly connected to the common-cathode.

Accessories supplied on request: see data sheets Mounting instructions and accessories for SOT-93 envelopes.

RATINGS

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

			BYV74–300	400	500	
Voltages (per diode)						
→ Non-repetitive peak reverse voltage	V_{RSM}	max.	350	450	550	V
Repetitive peak reverse voltage	V_{RRM}	max.	300	400	500	V
Crest working reverse voltage	V_{RWM}	max.	200	300	400	V
Continuous reverse voltage (note 1)	V_R	max.	200	300	400	V

Currents (both diodes conducting; note 2)				
Output current (note 3)				
square wave; $\delta = 0.5$; up to $T_{mb} = 92\ ^oC$	I_O	max.	30	A
sinusoidal; up to $T_{mb} = 103\ ^oC$	I_O	max.	26	A
R.M.S. forward current	$I_{F(RMS)}$	max.	30	A
Repetitive peak forward current $t_p = 20\ \mu s$; $\delta = 0.02$ (note 4)	I_{FRM}	max.	320	A
Non-repetitive peak forward current half sine-wave; $T_j = 150\ ^oC$ prior to surge; with reapplied $V_{RWM\ max}$ (note 4)				
t = 10 ms	I_{FSM}	max.	130	A
t = 8.3 ms	I_{FSM}	max.	140	A
I^2t for fusing (t = 10 ms; note 4)	I^2t	max.	84	A^2s
Temperatures				
Storage temperature	T_{stg}		−40 to +150	^oC
Junction temperature	T_j	max.	150	^oC

Notes:

1. To ensure thermal stability: $R_{th\ j\text{-}a} < 9.3$ K/W.
2. The limits for both diodes apply whether both diodes conduct simultaneously or on alternate half cycles.
3. For output currents in excess of 20 A, connection should be made to the exposed metal mounting base.
4. Figures apply to each diode.

CHARACTERISTICS (per diode)

T_j = 25 °C unless otherwise stated

Forward voltage				
I_F = 15 A; T_j = 150 °C	V_F	<	1.05	V*
I_F = 50 A	V_F	<	1.6	V*
Reverse current				
$V_R = V_{RWM\,max}$; T_j = 100 °C	I_R	<	0.8	mA
$V_R = V_{RWM\,max}$	I_R	<	50	μA
Reverse recovery when switched from				
I_F = 1 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 100 A/μs; recovery time	t_{rr}	<	50	ns
I_F = 2 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 20 A/μs; recovered charge	Q_s	<	50	nC
I_F = 10 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 50 A/μs; T_j = 100 °C; peak recovery current	I_{RRM}	<	5.2	A
Forward recovery when switched to I_F = 10 A with dI_F/dt = 10 A/μs recovery voltage	V_{fr}	typ.	2.5	V

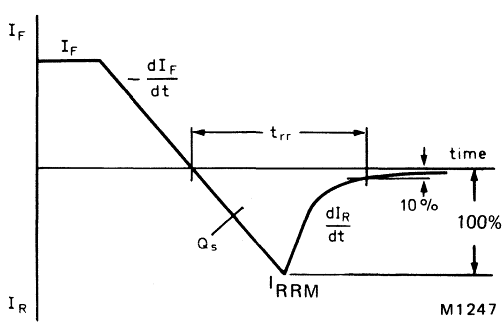


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

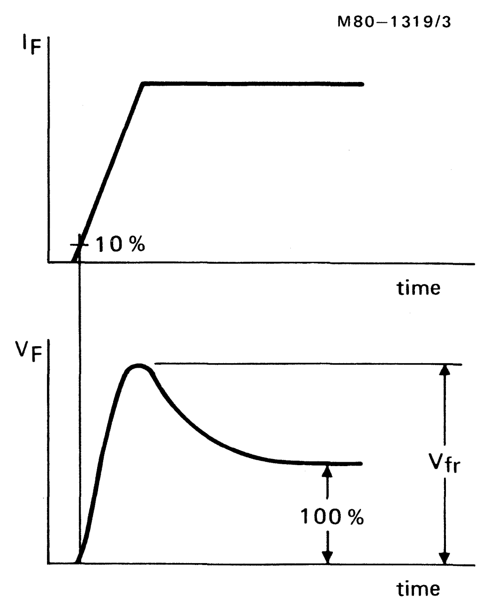


Fig.3 Definition of V_{fr}.

*Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

From junction to mounting base; total package	$R_{th\ j\text{-}mb}$	=	1.4	K/W
per diode	$R_{th\ j\text{-}mb}$	=	2.0	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	$R_{th\ mb\text{-}h}$	=	0.2	K/W
b. with heatsink compound and 0.06 mm maximum mica insulator (56378)	$R_{th\ mb\text{-}h}$	=	1.4	K/W
c. without heatsink compound	$R_{th\ mb\text{-}h}$	=	1.4	K/W

2. 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 tie point.

Thermal resistance from junction to ambient in free air: mounted on a printed circuit board at any device lead length and with copper laminate on the board $R_{th\ j\text{-}a}$ = 60 K/W

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^{o}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 2.4mm from the seal, and should be supported during bending. The bend radius must be no less than 1.0mm.
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 M4 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 calculations

a. The various components of junction temperature rise above ambient are illustrated in Fig.4.

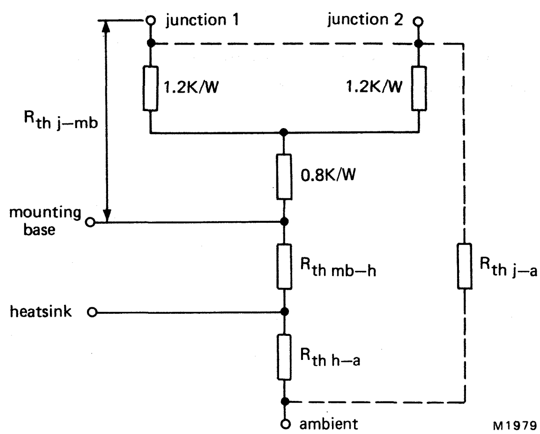


Fig. 4.

b. Any measurement of heatsink temperature should be made immediately adjacent to the device.
c. The method of using Figs. 5 and 6 is as follows:
Starting with the required current on the $I_{F(AV)}$ axis, trace upwards to meet the appropriate duty cycle or form factor curve. Trace right horizontally and upwards from the required value on the T_{amb} scale. The intersection determines the $R_{th\ mb\text{-}a}$. The heatsink thermal resistance value ($R_{th\ h\text{-}a}$) can be calculated from:

$R_{th\ h\text{-}a} = R_{th\ mb\text{-}a} - R_{th\ mb\text{-}h}$.

SQUARE-WAVE OPERATION

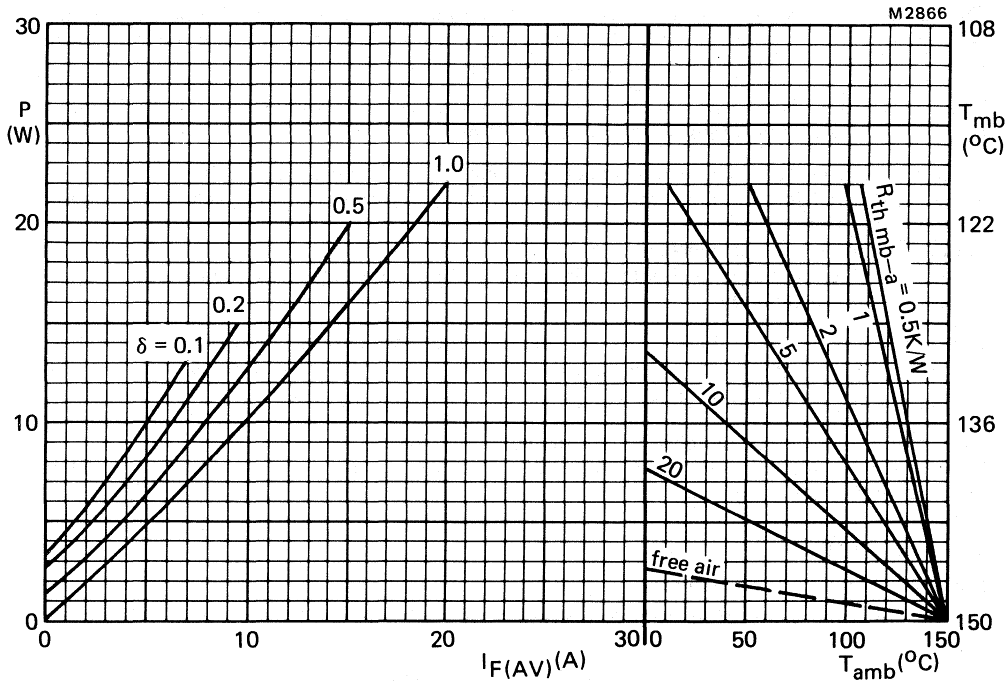
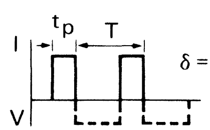


Fig.5 The right-hand part shows the relationship between the power (derived from the left-hand part) and the maximum permissible temperatures (per diode).



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

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

SINUSOIDAL OPERATION

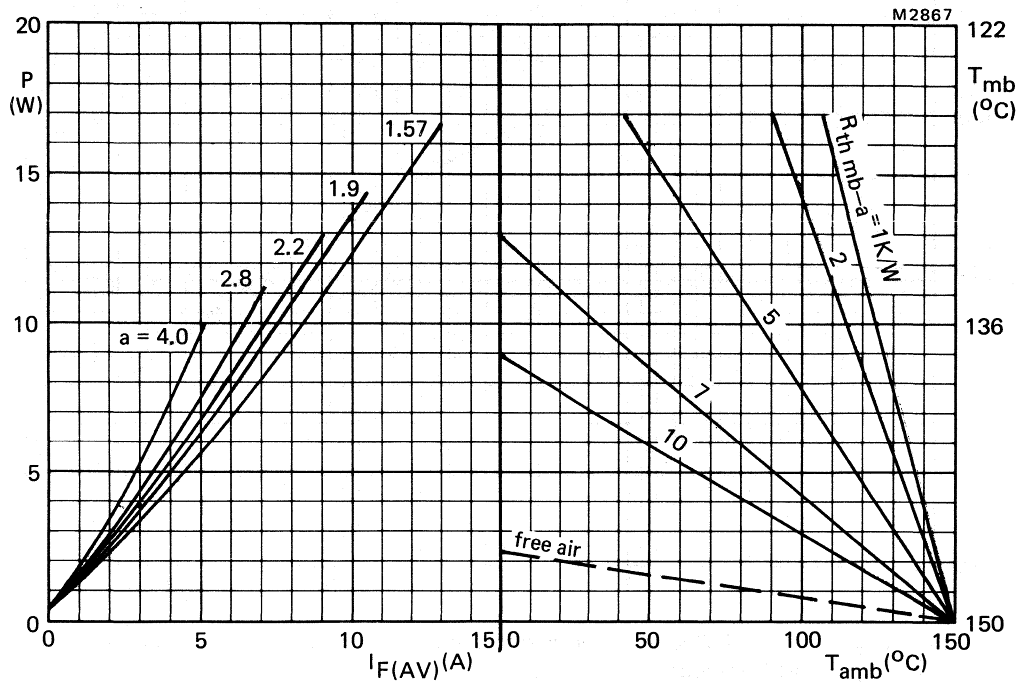


Fig.6 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures (per diode).

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

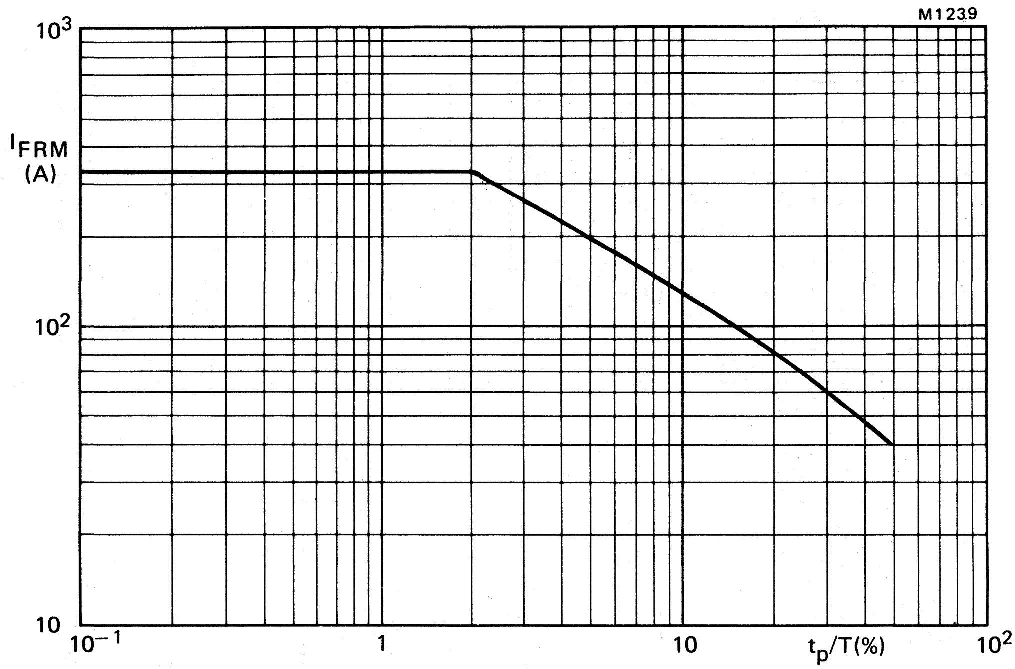
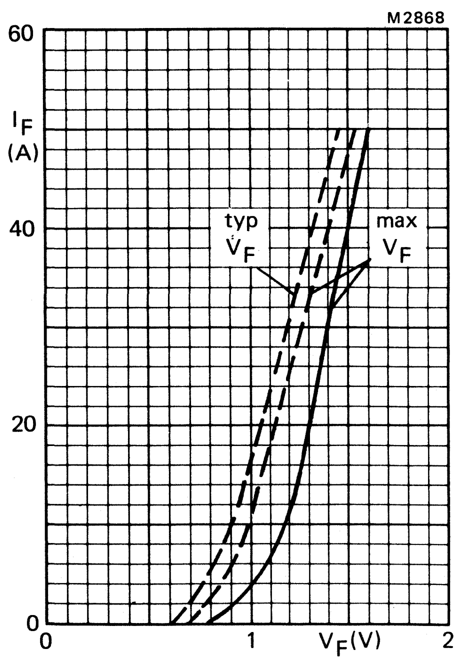
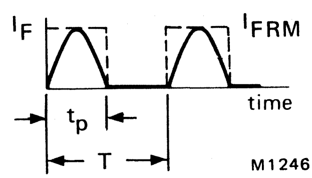


Fig.7 Maximum permissible repetitive peak forward current for square or sinusoidal currents; $1\ \mu s < t_p < 1$ ms (per diode).





Defintion of I_{FRM} and t_p/T.

Fig.8 —— T_j = 25 °C; – – – T_j = 150 °C (per diode).

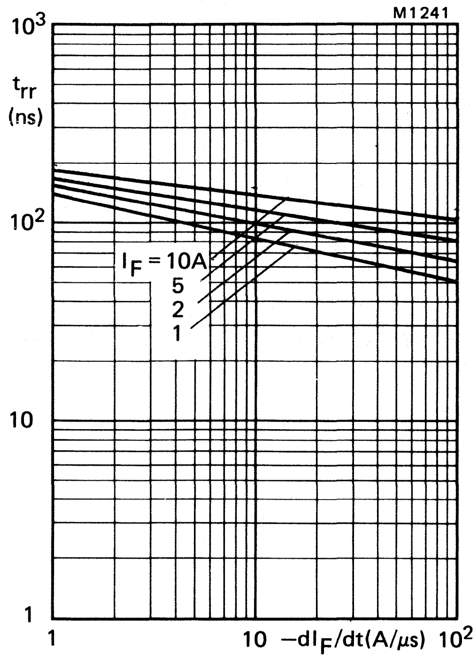


Fig.9 Maximum t_{rr} at T_j = 25 °C.
(per diode).

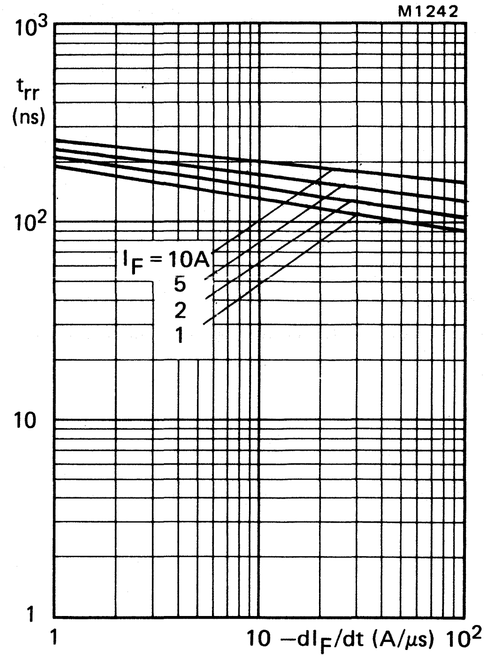


Fig.10 Maximum t_{rr} at T_j = 100 °C.
(per diode).

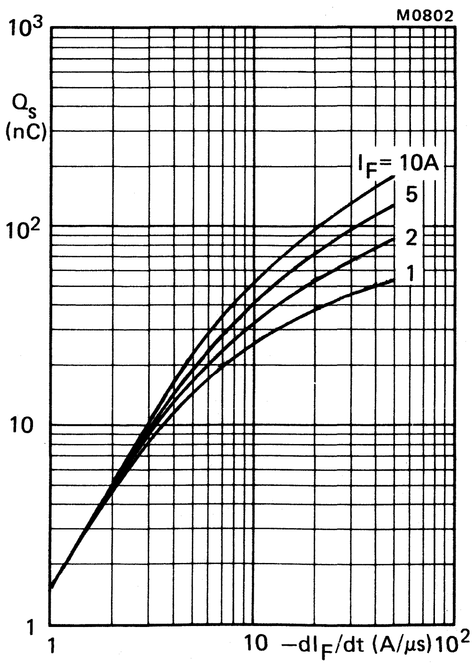


Fig.11 Maximum Q_s at T_j = 25 °C.
(per diode).

ULTRA FAST-RECOVERY ELECTRICALLY-ISOLATED DOUBLE RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial double rectifier diodes in SOT-199 (full-pack) plastic envelopes, featuring low forward voltage drop, very fast reverse recovery times and soft-recovery characteristic. Their electrical isolation makes them ideal for mounting on a common heatsink along-side other components without the need for additional insulators. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction and 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.

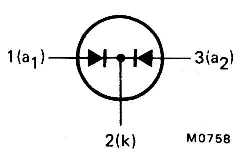
QUICK REFERENCE DATA

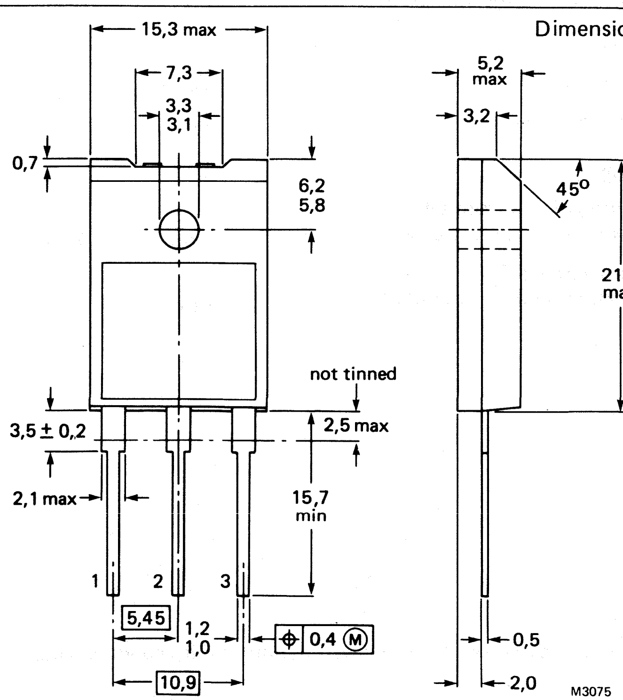
Per diode, unless otherwise stated			BYV74F–300	400	500	V
Repetitive peak reverse voltage	V_{RRM}	max.	300	400	500	V
Output current (both diodes conducting)	I_O	max.		20		A
Forward voltage	V_F	<		1.05		V
Reverse recovery time	t_{rr}	<		50		ns

MECHANICAL DATA

Dimensions in mm

Fig.1 SOT-199.





Note: Accessories supplied on request: see data sheets Mounting instructions and accessories for SOT-93 envelopes.

RATINGS

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

Voltages (per diode)			BYV74F–300	400	500	
Non-repetitive peak reverse voltage	V_{RSM}	max.	350	450	550	V
Repetitive peak reverse voltage	V_{RRM}	max.	300	400	500	V
Crest working reverse voltage	V_{RWM}	max.	200	300	400	V
Continuous reverse voltage	V_R	max.	200	300	400	V

Currents (both diodes conducting; note 1)

Output current (note 2)				
square wave; $\delta = 0.5$; $T_h = 46\ ^oC$	I_O	max.	20	A
sinusoidal; $T_h = 50\ ^oC$	I_O	max.	20	A
R.M.S. forward current	$I_{F(RMS)}$	max.	20	A
Repetitive peak forward current $t_p = 20\ \mu s$; $\delta = 0.02$ (per diode)	I_{FRM}	max.	320	A
Non-repetitive peak forward current half sinewave; $T_j = 150\ ^oC$ prior to surge; with reapplied $V_{RWM\ max}$ (per diode)				
t = 10 ms	I_{FSM}	max.	130	A
t = 8.3 ms	I_{FSM}	max.	140	A
I^2t for fusing (t = 10 ms; per diode)	I^2t	max.	84	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	$V_{t\text{-}h}$	max.	1500	V
Isolation capacitance from centre lead to external heatsink (note 3)	$C_{t\text{-}h}$	typ.	12	pF

Notes:

1. The limits for both diodes apply whether both diodes conduct simultaneously or on alternate half cycles.
2. The quoted temperatures assume heatsink compound is used.
3. Mounted without heatsink compound and with 20 newtons force on the centre of the envelope.

CHARACTERISTICS (per diode)

T_j = 25 °C unless otherwise stated

Forward voltage				
I_F = 15 A; T_j = 150 °C	V_F	<	1.05	V*
I_F = 50 A	V_F	<	1.6	V*
Reverse current				
$V_R = V_{RWM\,max}$; T_j = 100 °C	I_R	<	0.8	mA
$V_R = V_{RWM\,max}$	I_R	<	50	μA
Reverse recovery when switched from				
I_F = 1 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 100 A/μs; recovery time	t_{rr}	<	50	ns
I_F = 2 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 20 A/μs; recovered charge	Q_s	<	50	nC
I_F = 10 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 50 A/μs; T_j = 100 °C; peak recovery current	I_{RRM}	<	5.2	A
Forward recovery when switched to I_F = 10 A with dI_F/dt = 10 A/μs recovery voltage	V_{fr}	typ.	2.5	V

DEVELOPMENT DATA

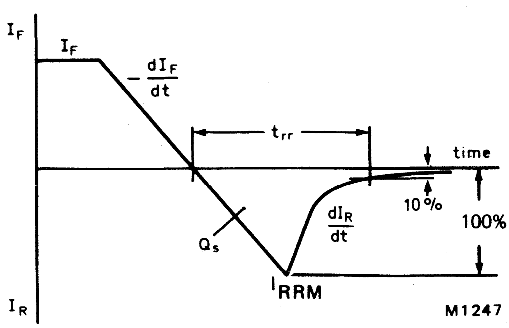


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

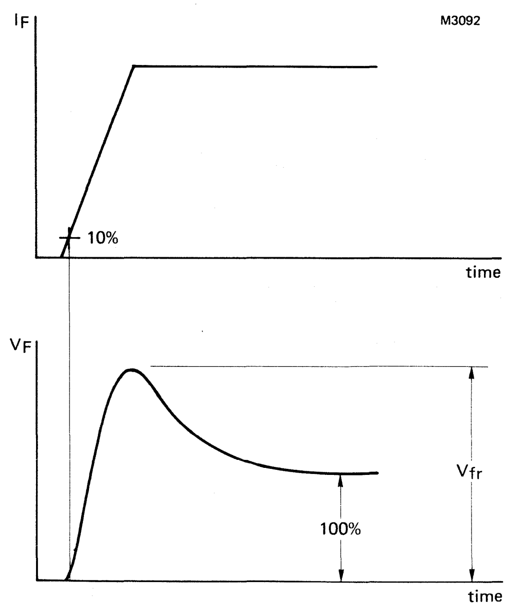


Fig.3 Definition of V_{fr}.

*Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

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

a. both diodes conducting:				
with heatsink compound	$R_{th\ j\text{-}h}$	=	4	K/W
without heatsink compound	$R_{th\ j\text{-}h}$	=	8	K/W
b. per diode:				
with heatsink compound	$R_{th\ j\text{-}h}$	=	5	K/W
without heatsink compound	$R_{th\ j\text{-}h}$	=	9	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 tie point.

Thermal resistance from junction to ambient in free air, mounted on a printed circuit board	$R_{th\ j\text{-}a}$	=	35	K/W

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 not 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 are 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 illustated in Fig.4.

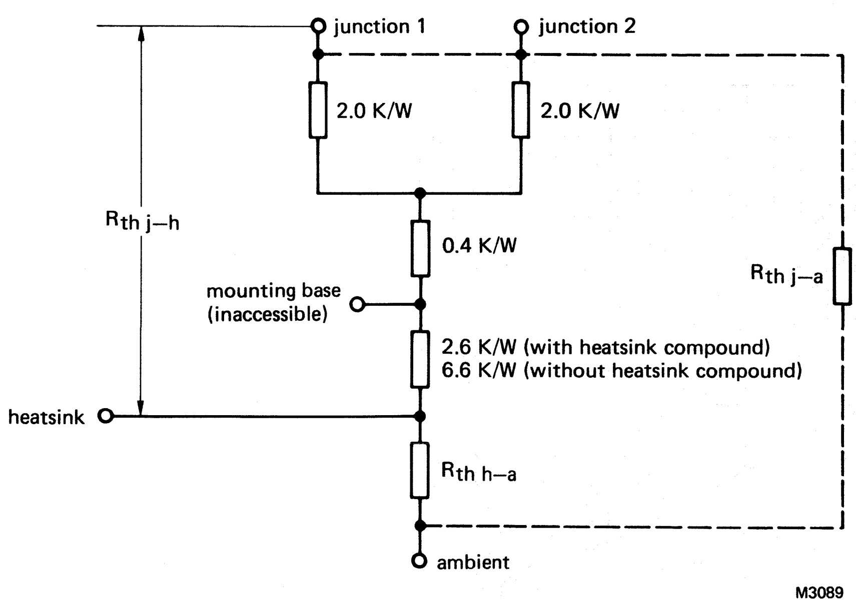


Fig.4.

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

SQUARE-WAVE OPERATION

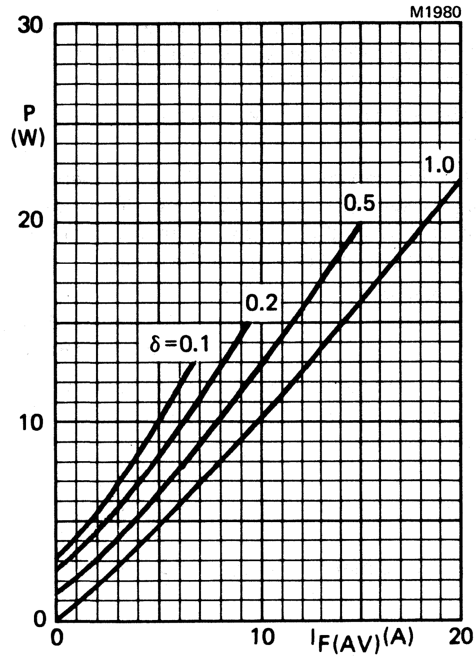
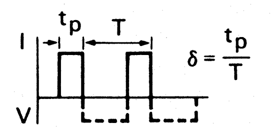


Fig.5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.

Power includes reverse current losses and switching losses up to f = 100 kHz.



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

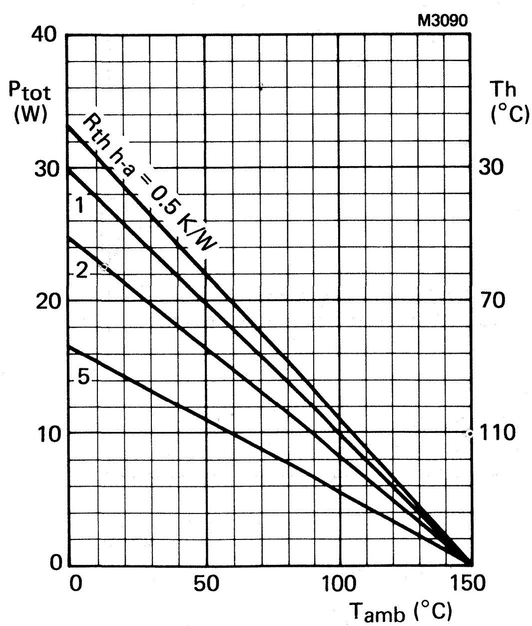


Fig.6.

SINUSOIDAL OPERATION

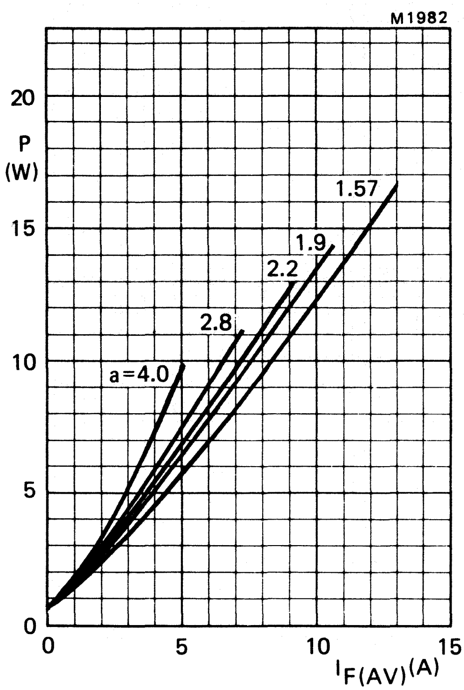


Fig.7 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.

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

DEVELOPMENT DATA

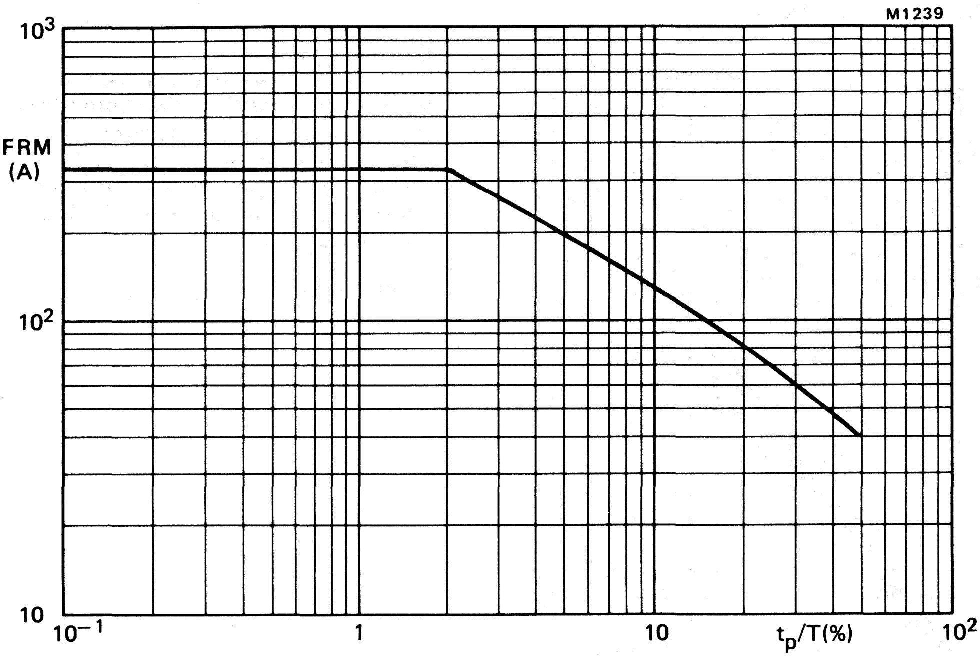
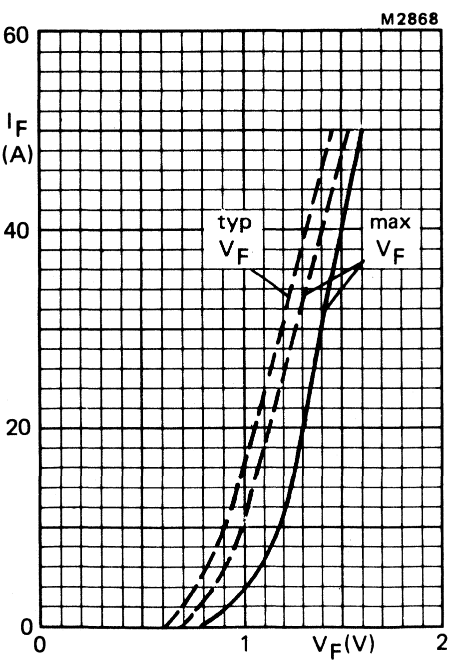
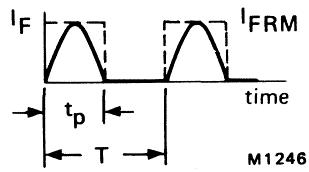


Fig.8 Maximum permissible repetitive peak forward current for square or sinusoidal currents; $1\ \mu s < t_p < 1$ ms.





Definition of I_{FRM} and t_p/T.

Fig.9 ——— $T_j = 25\ ^oC$; – – – $T_j = 150\ ^oC$.

DEVELOPMENT DATA

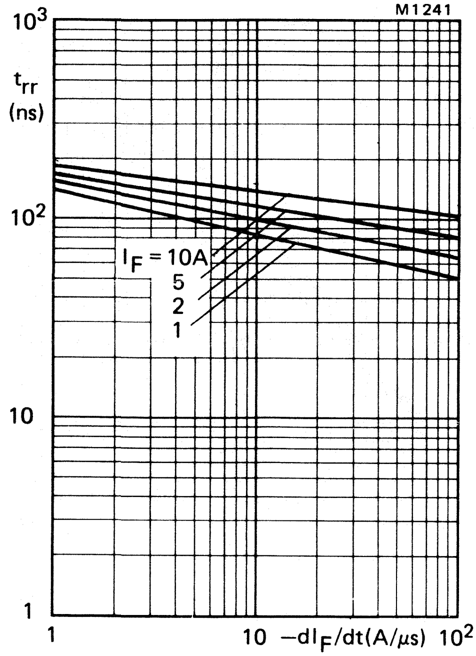


Fig.10 Maximum t_{rr} at T_j = 25 °C. (per diode).

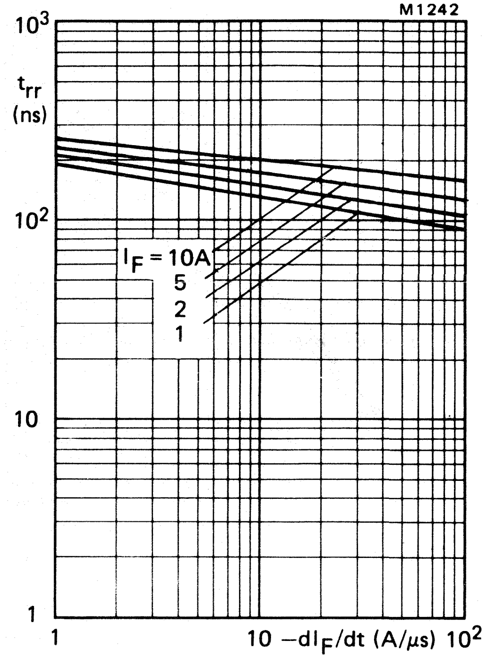


Fig.11 Maximum t_{rr} at T_j = 100 °C. (per diode).

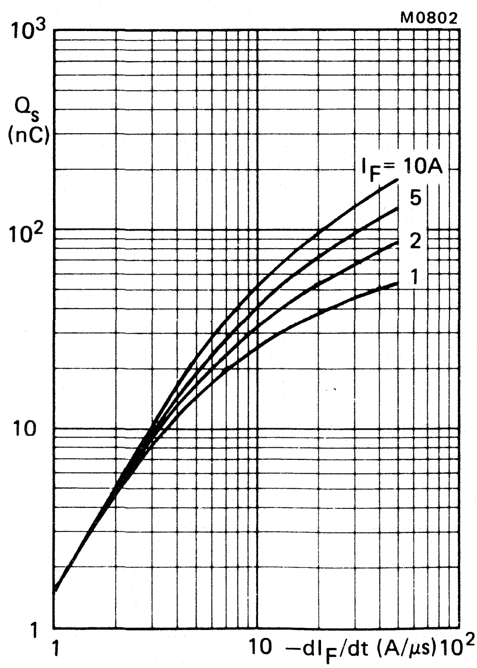


Fig.12 Maximum Q_s at T_j = 25 °C. (per diode).

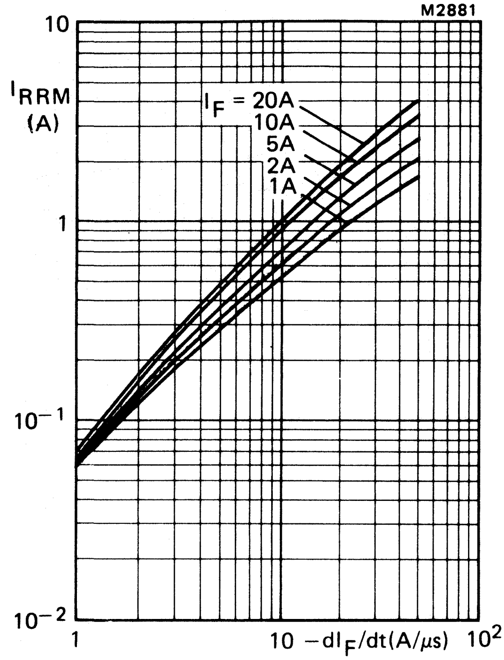


Fig.13 Maximum I_{RRM} at $T_j = 25\ ^oC$.

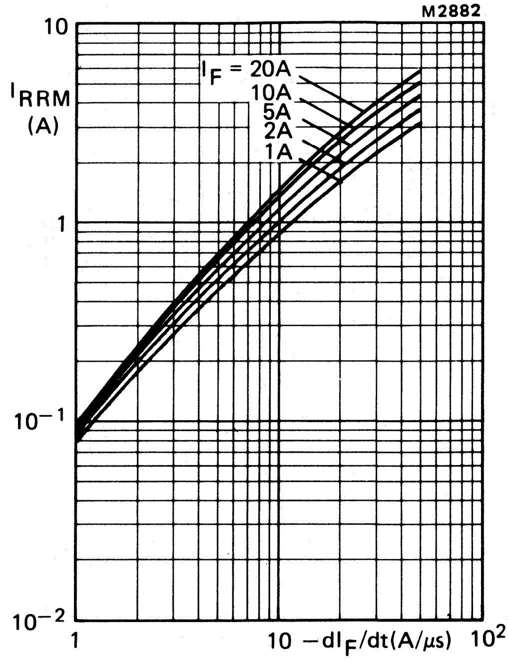


Fig.14 Maximum I_{RRM} at $T_j = 100\ ^oC$.

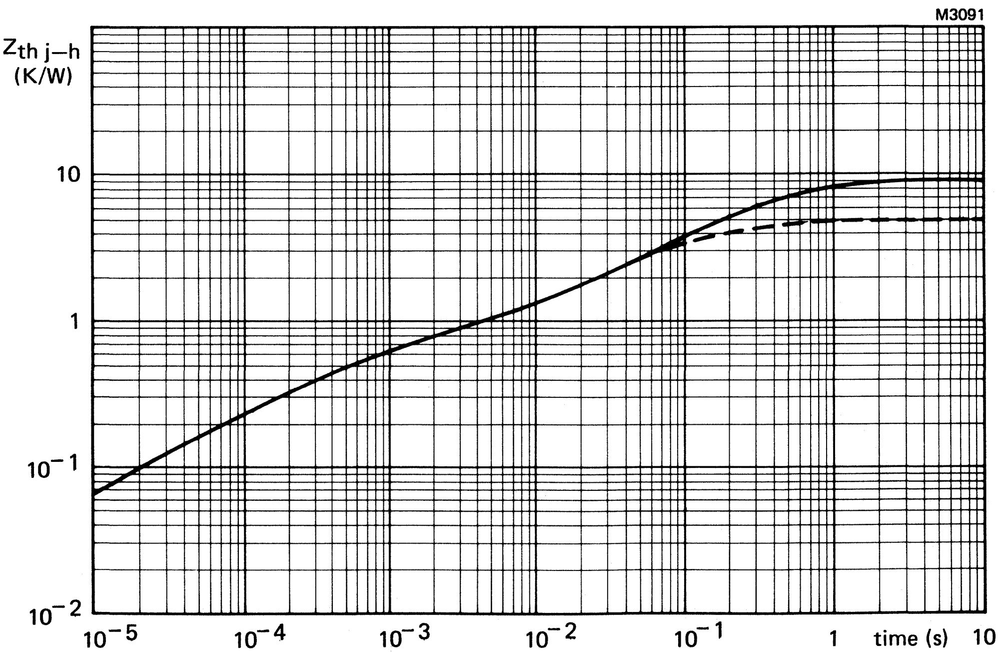


Fig.15 Transient thermal impedance; one diode conducting; — — — with heatsink compound; ——— without heatsink compound.

ULTRA FAST RECOVERY RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial rectifier diodes in plastic envelopes, featuring low forward voltage drop, ultra fast reverse recovery times with very low stored charge and soft-recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and low switching losses are essential.
The series consists of normal polarity (cathode to mounting base) types.

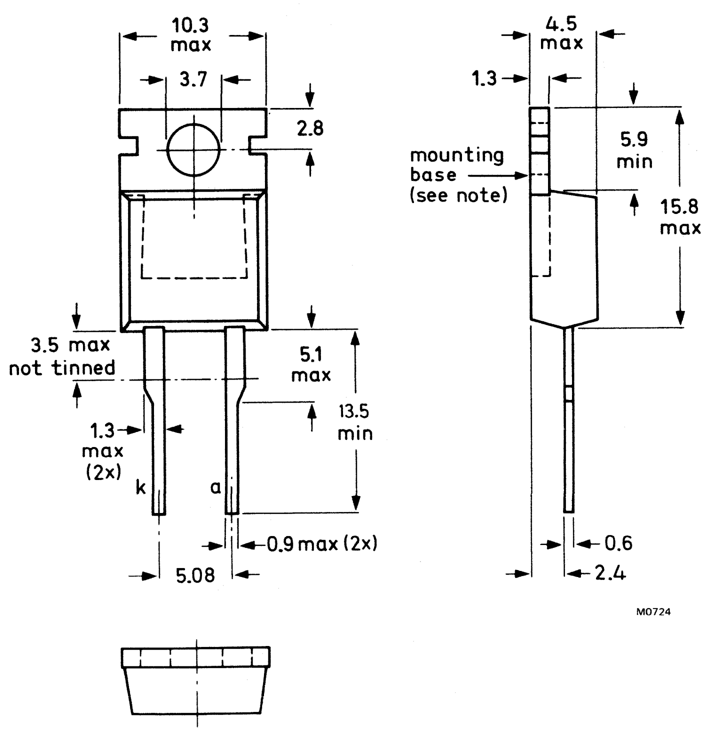
QUICK REFERENCE DATA

			BYV79—50	100	150	200	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	200	V
Average forward current	$I_{F(AV)}$	max.	14				A
Forward voltage	V_F	<	0.85				V
Reverse recovery time	t_{rr}	<	30				ns

MECHANICAL DATA

Dimensions in mm

Fig.1 TO-220AC



Net mass: 2 g

Note: The exposed metal mounting base is directly connected to the cathode.

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

RATINGS

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

Voltages			BYV79–50	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 (note 1)	V_R	max.	50	100	150	200	V

Currents

Average forward current; switching losses negligible up to 500 kHz;				
square wave; $\delta = 0.5$; up to $T_{mb} = 115\ ^oC$	$I_{F(AV)}$	max.	14	A
sinusoidal; up to $T_{mb} = 122\ ^oC$	$I_{F(AV)}$	max.	12	A
R.M.S. forward current	$I_{F(RMS)}$	max.	20	A
Repetitive peak forward current $t_p = 20\ \mu s$; $\delta = 0.02$	I_{FRM}	max.	420	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.	180	A
t = 8.3 ms	I_{FSM}	max.	200	A
I^2t for fusing (t = 10 ms)	I^2t	max.	160	A^2s

Temperatures

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

Notes:

1. To ensure thermal stability: $R_{th\ j\text{-}a} \leqslant 8$ K/W.

CHARACTERISTICS

T_j = 25 °C unless otherwise stated

Forward voltage				
I_F = 10 A; T_j = 100 °C	V_F	<	0.85	V*
I_F = 50 A	V_F	<	1.3	V*
Reverse current				
$V_R = V_{RWM\,max}$; T_j = 100 °C	I_R	<	1.3	mA
$V_R = V_{RWM\,max}$	I_R	<	50	μA
Reverse recovery when switched from				
I_F = 1 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 100 A/μs; recovery time	t_{rr}	<	30	ns
I_F = 2 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 20 A/μs; recovered charge	Q_s	<	15	nC
I_F = 10 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 50 A/μs; T_j = 100 °C; peak recovery current	I_{RRM}	<	4	A
Forward recovery when switched to I_F = 10 A with dI_F/dt = 10 A/μs	V_{fr}	typ.	1.0	V

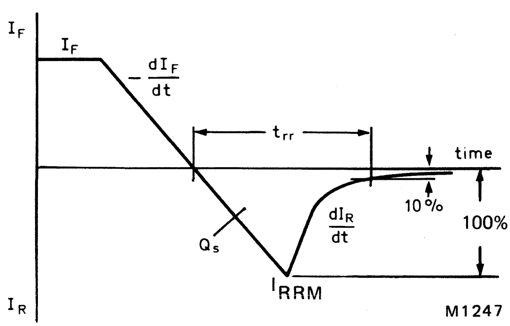


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

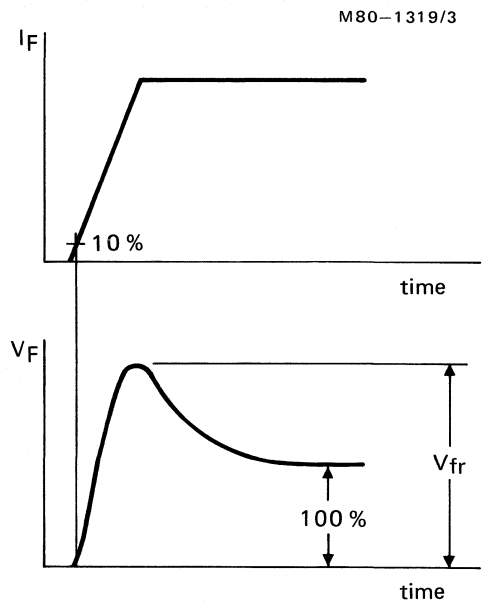


Fig.3 Definition of V_{fr}.

*Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	= 2	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 insulator (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 value 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 device lead length and with copper laminate on the board	$R_{th\ j\text{-}a}$	= 60	K/W

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 calculations

a. The various components of junction temperature rise above ambient are illustrated in Fig.4.

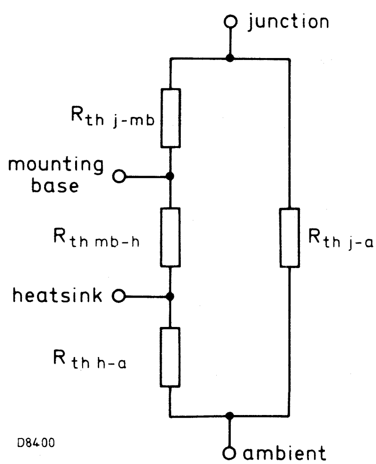


Fig. 4.

b. Any measurement of heatsink temperature should be made immediately adjacent to the device.
c. The method of using Figs. 5 and 6 is as follows:
Starting with the required current on the $I_{F(AV)}$ axis, trace upwards to meet the appropriate duty cycle or form factor curve. Trace right horizontally and upwards from the required value on the T_{amb} scale. The intersection determines the $R_{th\ mb\text{-}a}$. The heatsink thermal resistance value ($R_{th\ h\text{-}a}$) can be calculated from:

$$R_{th\ h\text{-}a} = R_{th\ mb\text{-}a} - R_{th\ mb\text{-}h}.$$

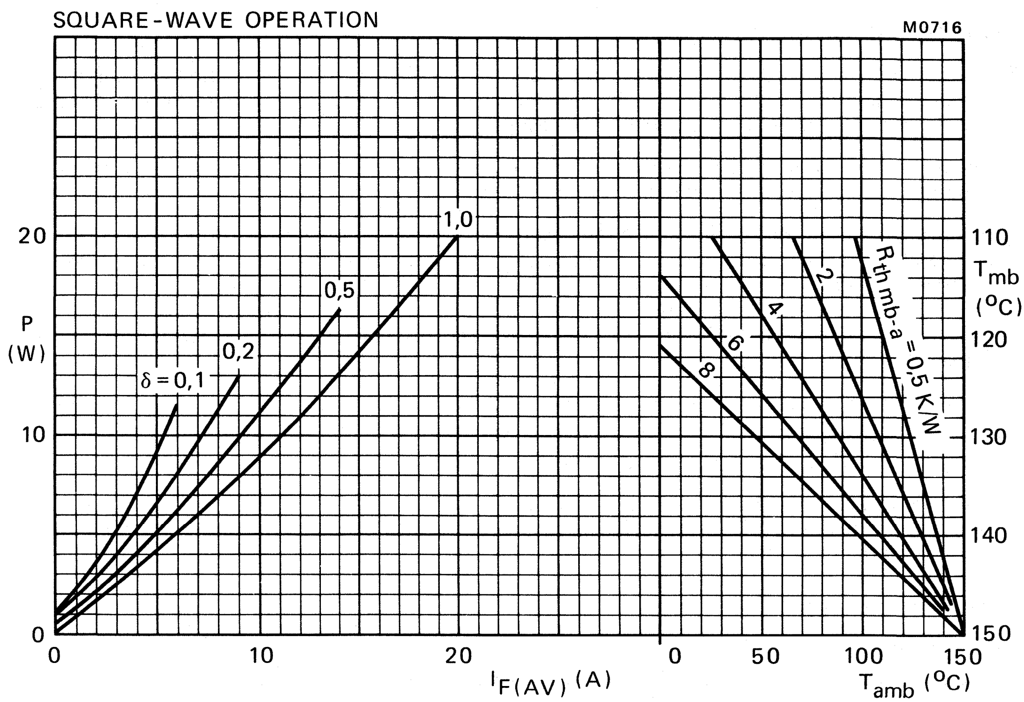
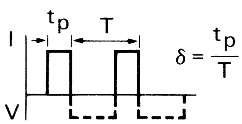


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
P = power including reverse current losses and switching losses up to f = 500 kHz.



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

SINUSOIDAL OPERATION

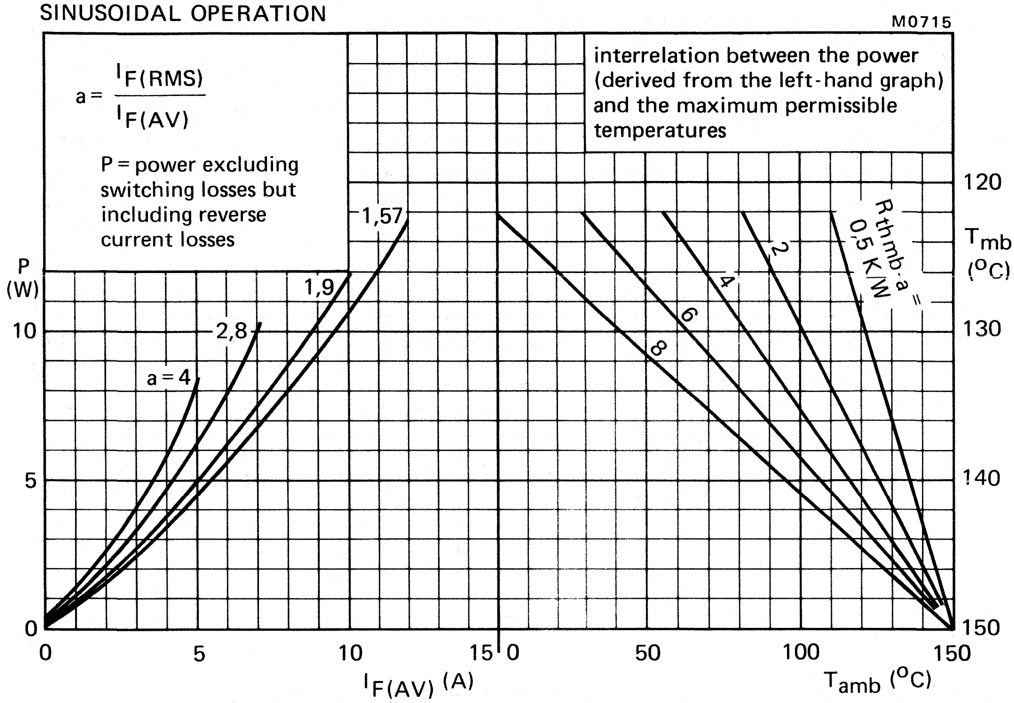


Fig.6

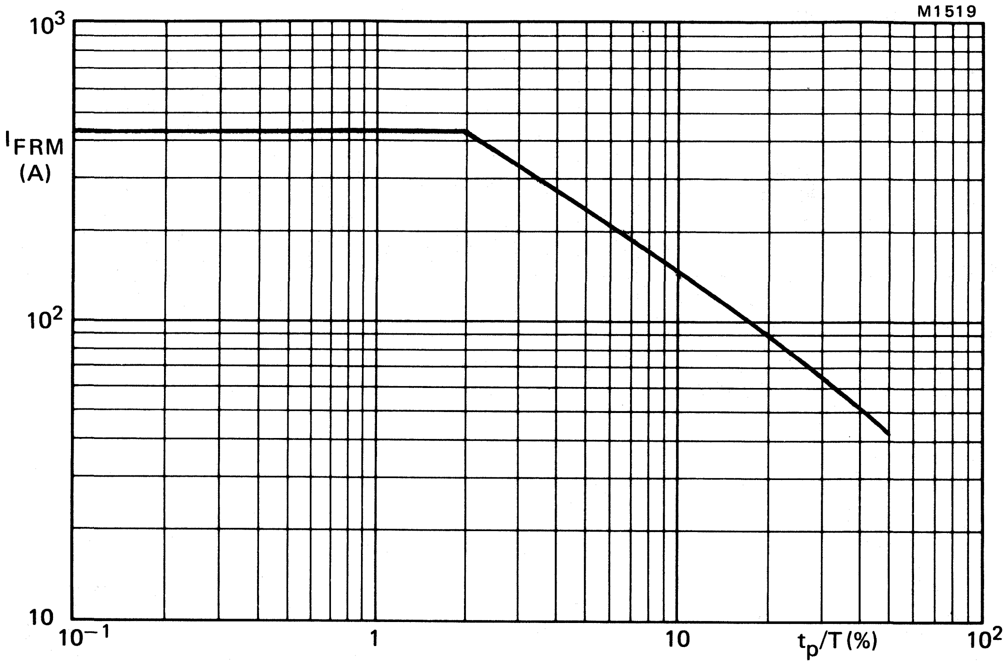


Fig.7 Maximum permissible repetitive peak forward current for square or sinusoidal currents;
1 $\mu s < t_p <$ 1 ms.

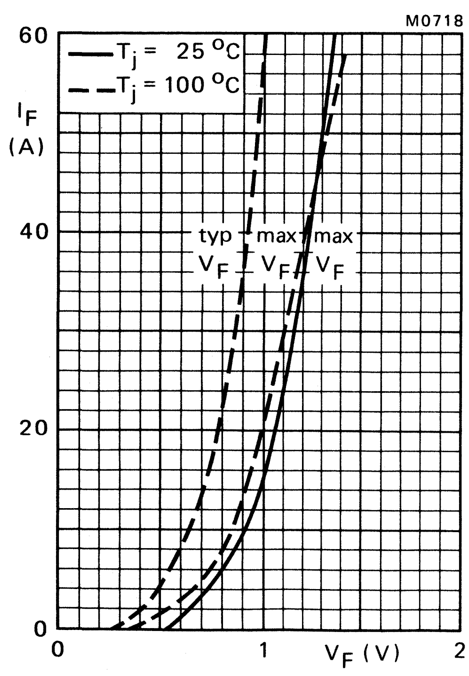
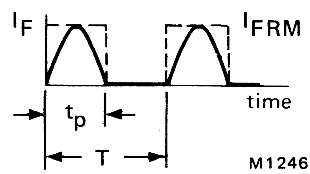


Fig.8.



Definition of I_{FRM} and t_p/T.

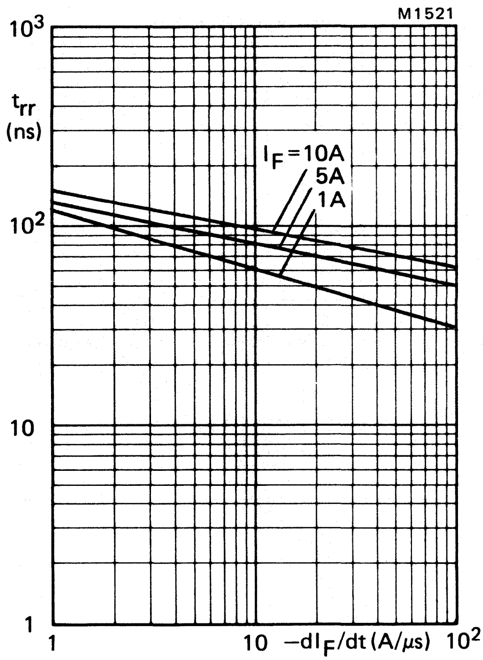


Fig.9 Maximum t_{rr} at T_j = 25 °C.

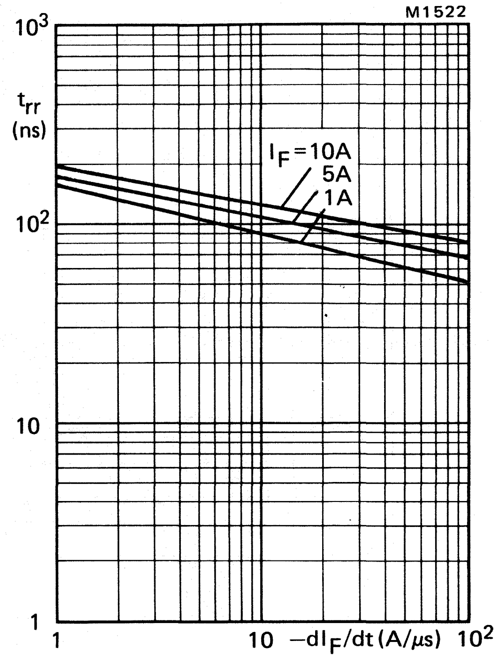


Fig.10 Maximum t_{rr} at T_j = 100 °C.

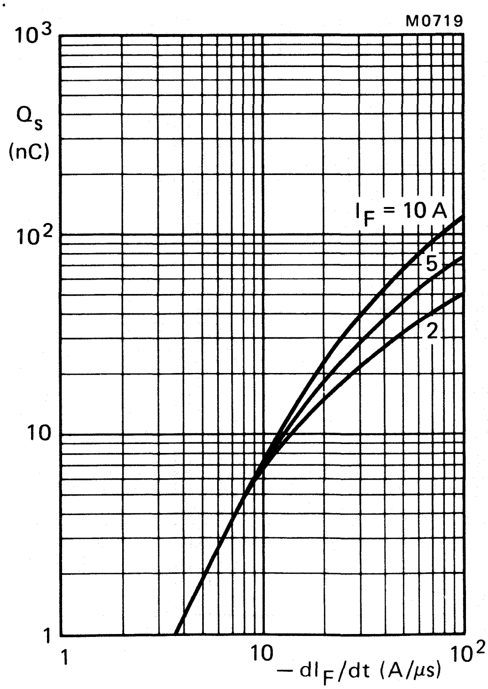


Fig.11 Maximum Q_s at T_j = 25 °C.

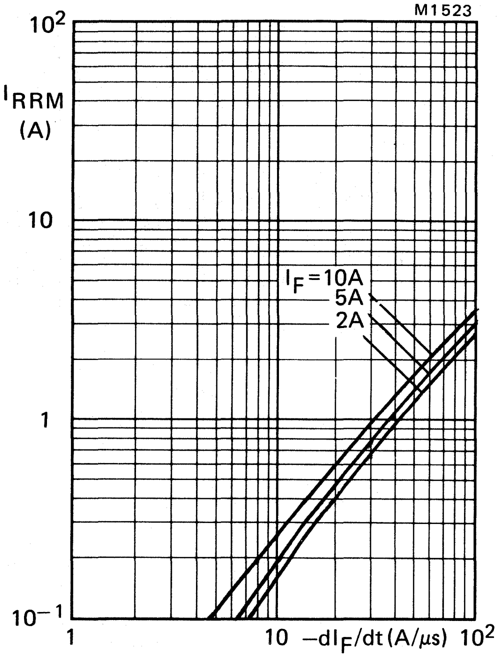


Fig.12 Maximum I_{RRM} at T_j = 25 °C.

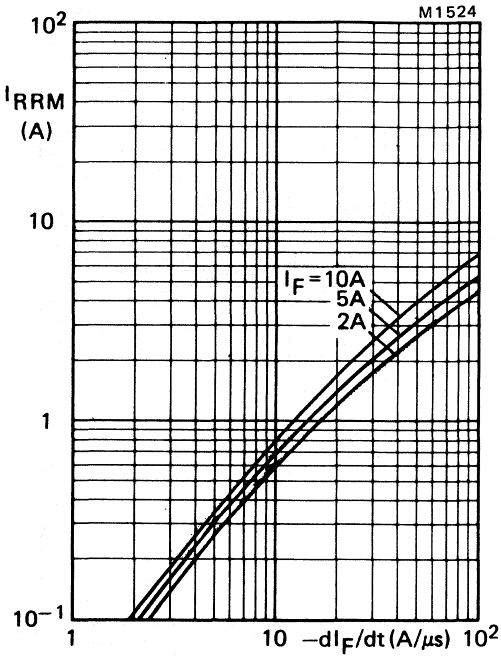


Fig.13 Maximum I_{RRM} at T_j = 100 °C.

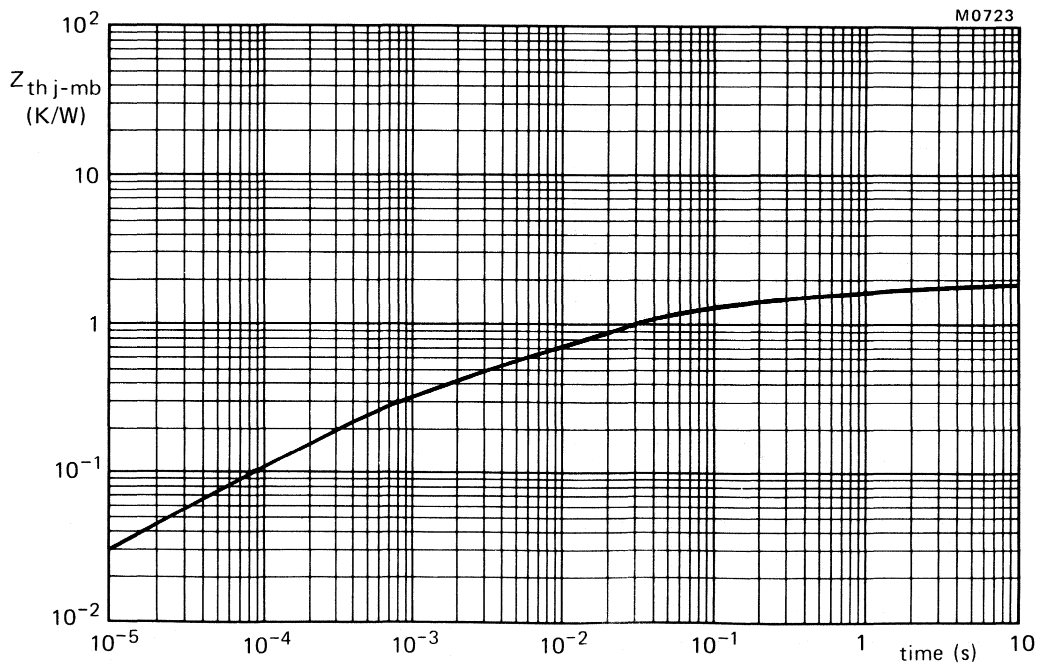


Fig.14 Transient thermal impedance.

ULTRA FAST RECOVERY RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial rectifier diodes in DO-5 metal envelopes, featuring low forward voltage drop, ultra fast reverse recovery times, very low stored charge and soft recovery characteristic. 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.
The series consists of normal polarity (cathode to stud) types.

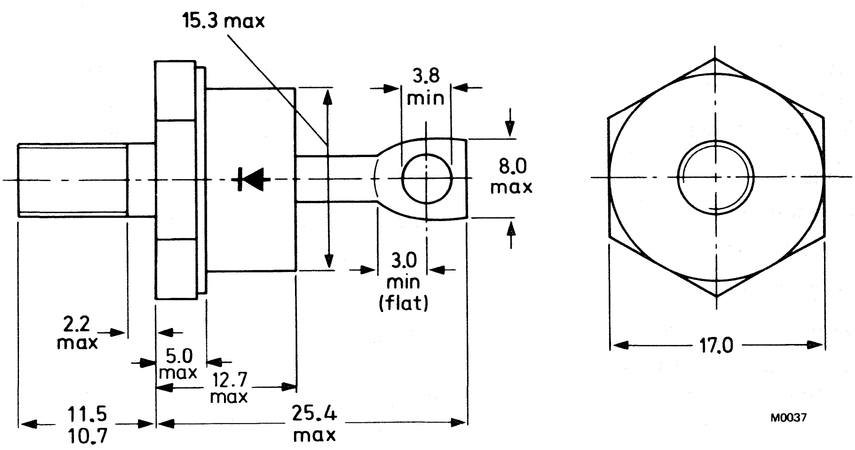
QUICK REFERENCE DATA

			BYV92-300	400	500	
Repetitive peak reverse voltage	V_{RRM}	max.	300	400	500	V
Average forward current	$I_{F(AV)}$	max.		35		A
Forward voltage	V_F	<		1.05		V
Reverse recovery time	t_{rr}	<		50		ns

MECHANICAL DATA

Dimensions in mm

Fig.1 DO-5: with metric M6 stud (ϕ 6 mm); e.g. BYV92-500M;
with ¼ in x 28UNF stud (ϕ 6.35 mm), e.g. BYV92-500U.



Net mass: 22 g
Diameter of clearance hole:
max. 6.5 mm
Accessories supplied on request:
56264a (mica washer),
56264b (insulating bush).

Supplied with device:
1 nut, 1 lock washer.
Torque on nut:
min. 1.7 Nm (17 kg cm);
max. 3.5 Nm (35 kg cm).
Nut dimensions across flats:
M6: 10 mm; ¼ in x 28UNF: 11.1 mm.

RATINGS

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

Voltages

			BYV92-300	400	500	
Non-repetitive peak reverse voltage	V_{RSM}	max.	350	450	550	V
Repetitive peak reverse voltage	V_{RRM}	max.	300	400	500	V
Crest working reverse voltage	V_{RWM}	max.	200	300	400	V
Continuous reverse voltage*	V_R	max.	200	300	400	V

Currents

Average forward current; switching losses negligible up to 100 kHz				
square wave, $\delta = 0.5$, up to $T_{mb} = 100\ ^oC$	$I_{F(AV)}$	max.	38	A
up to $T_{mb} = 125\ ^oC$	$I_{F(AV)}$	max.	21	A
sinusoidal, up to $T_{mb} = 106\ ^oC$	$I_{F(AV)}$	max.	34	A
up to $T_{mb} = 125\ ^oC$	$I_{F(AV)}$	max.	21	A
R.M.S. forward current	$I_{F(RMS)}$	max.	55	A
Repetitive peak forward current $t_p = 20\ \mu s$, $\delta = 0.02$	I_{FRM}	max.	800	A
Non-repetitive peak forward current half sine-wave, $T_j = 150\ ^oC$ prior to surge				
t = 10 ms	I_{FSM}	max.	500	A
t = 8.3 ms	I_{FSM}	max.	600	A
with reapplied $V_{RWM\ max}$				
t = 10 ms	I_{FSM}	max.	350	A
t = 8.3 ms	I_{FSM}	max.	440	A
I^2t for fusing (t = 10 ms)	I^2t	max.	610	A^2s

Temperatures

Storage temperature	T_{stg}	−55 to +150	^oC
Junction temperature	T_j	150	^oC

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1.0	K/W
From mounting base to heatsink				
with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.3	K/W
without heatsink compound	$R_{th\ mb\text{-}h}$	=	0.5	K/W

MOUNTING INSTRUCTIONS

The top connector should be neither bent nor twisted; it should be soldered into the circuit so that there is no strain on it. During soldering the heat conduction to the junction should be kept to a minimum.

*To ensure thermal stability: $R_{th\ j\text{-}a} \leqslant 3.4$ K/W.

CHARACTERISTICS

Forward voltage				
I_F = 35 A; T_j = 150 °C	V_F	<	1.05	V*
I_F = 100 A; T_j = 25 °C	V_F	<	1.4	V*
Reverse current				
$V_R = V_{RWM\ max}$; T_j = 100 °C	I_R	<	2.0	mA
T_j = 25 °C	I_R	<	50	μA
Reverse recovery when switched from				
I_F = 1 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 100 A/μs; T_j = 25 °C; recovery time	t_{rr}	<	50	ns
I_F = 2 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 20 A/μs; T_j = 25 °C; recovered charge	Q_s	<	75	nC
I_F = 10 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 50 A/μs; T_j = 100 °C; peak recovery current	I_{RRM}	<	4	A
Forward recovery when switched to I_F = 10 A with dI_F/dt = 10 A/μs; T_j = 25 °C	V_{fr}	typ.	2.5	V

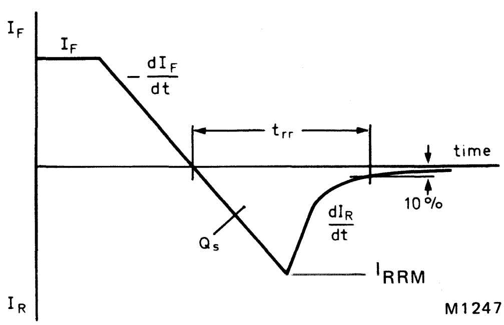


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

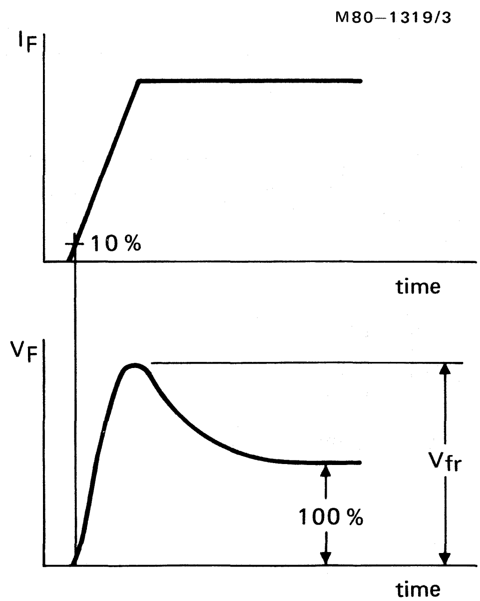


Fig.3 Definition of V_{fr}.

*Measured under pulse conditions to avoid excessive dissipation.

SQUARE-WAVE OPERATION

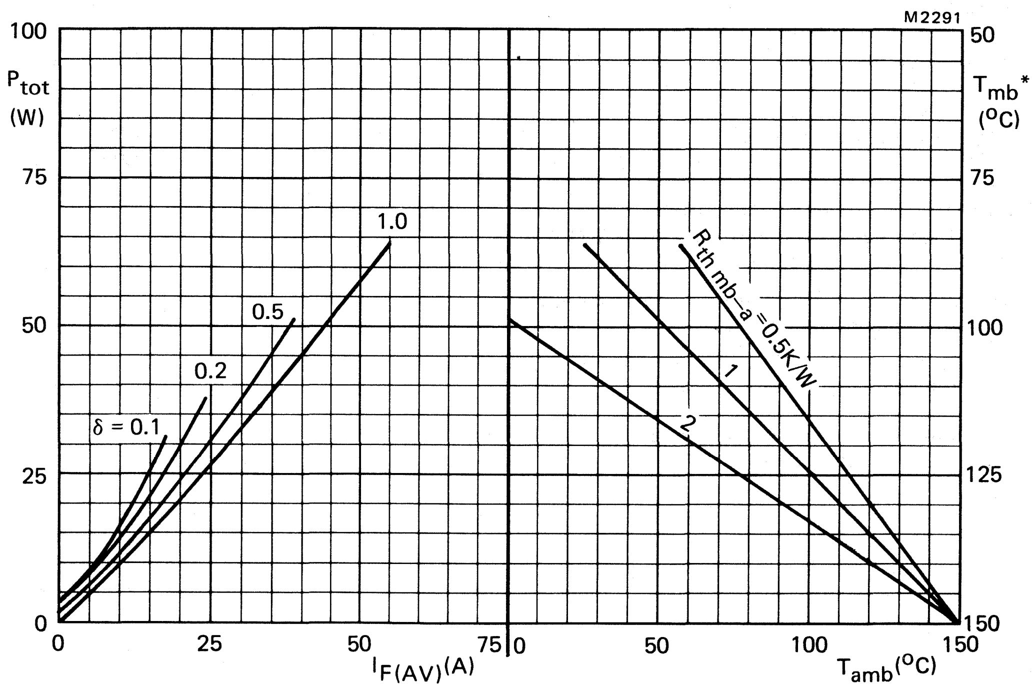
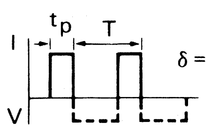


Fig.4 The right-hand part shows the relationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 100 kHz.



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

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

*T_{mb} scale is for comparison purposes and is correct only for $R_{th\ mb\text{-}a} < 2.4$ K/W.

SINUSOIDAL OPERATION

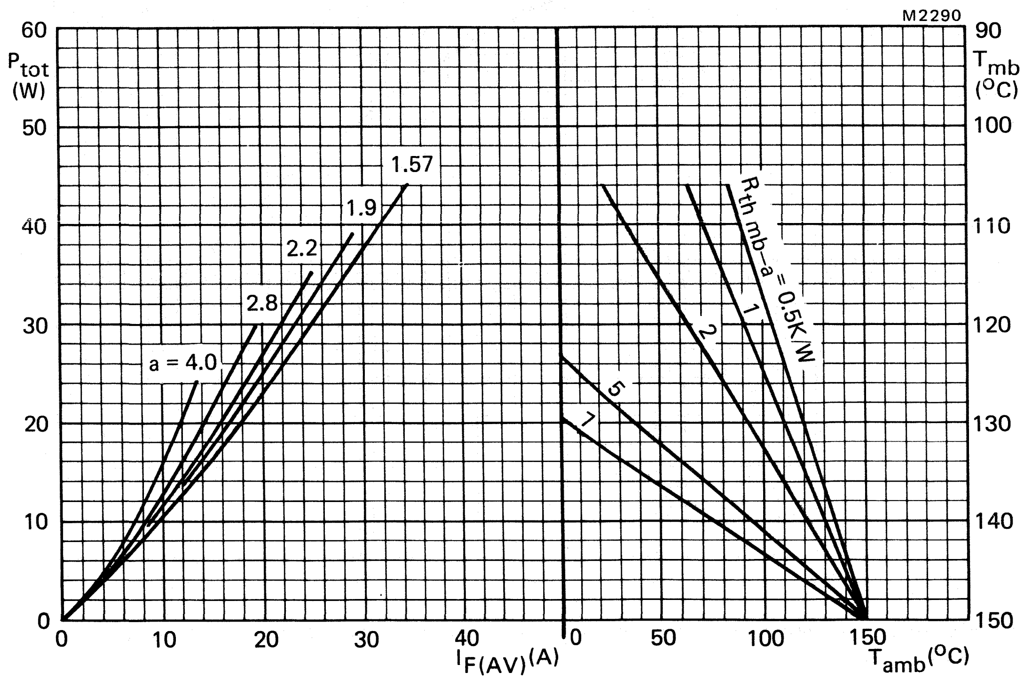


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

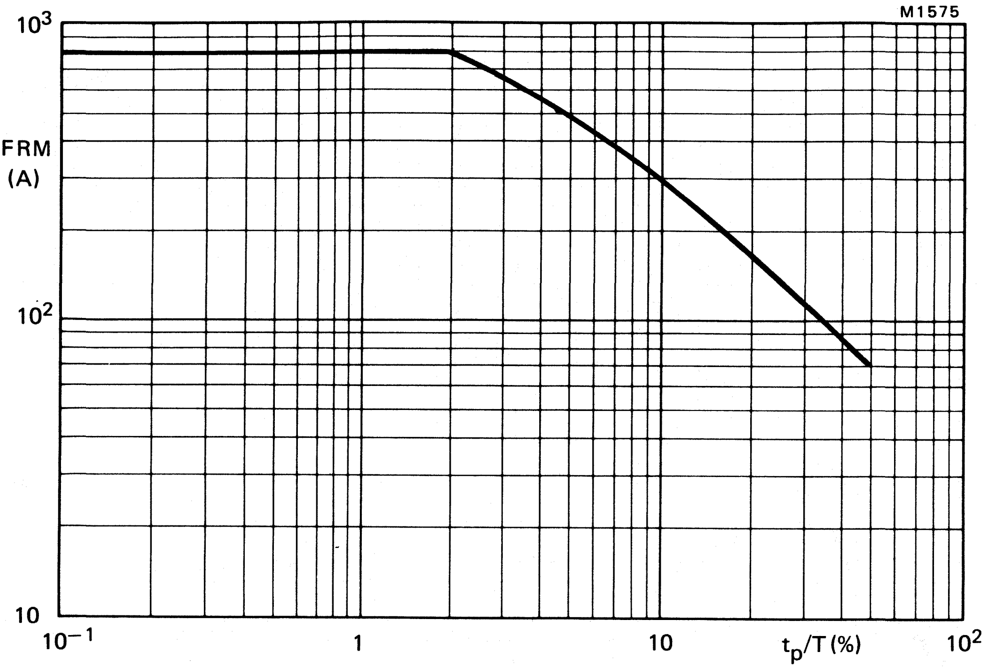
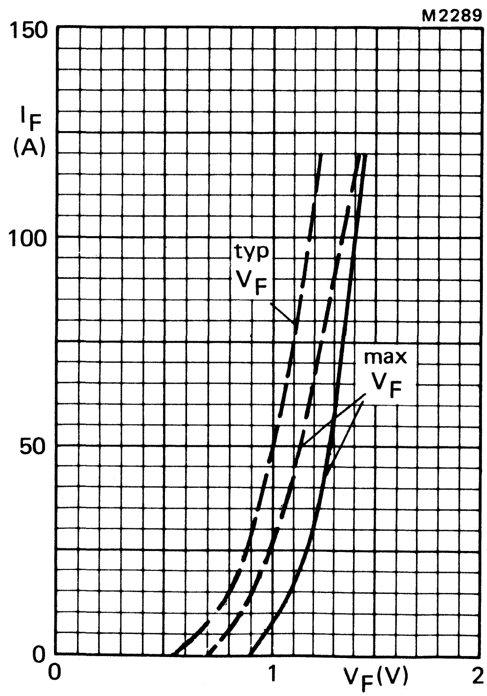
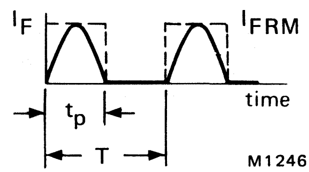


Fig.6 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 μs < t_p < 1 ms.





Definition of I_{FRM} and t_p/T.

Fig.7 —— T_j = 25 °C; – – – T_j = 150 °C.

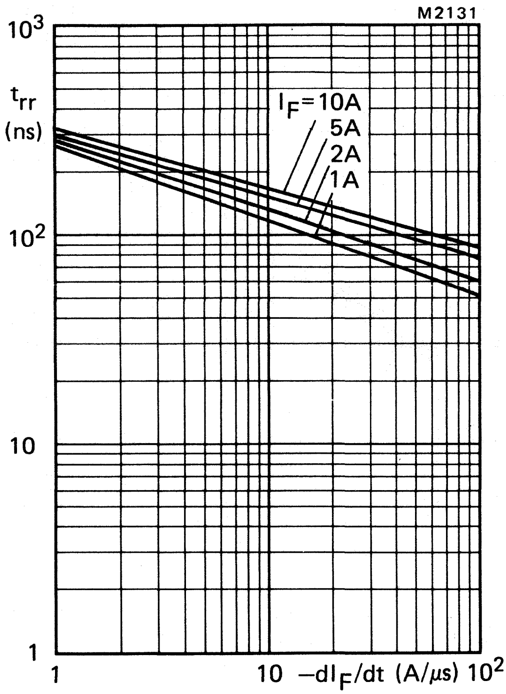


Fig.8 Maximum t_{rr} at T_j = 25 °C.

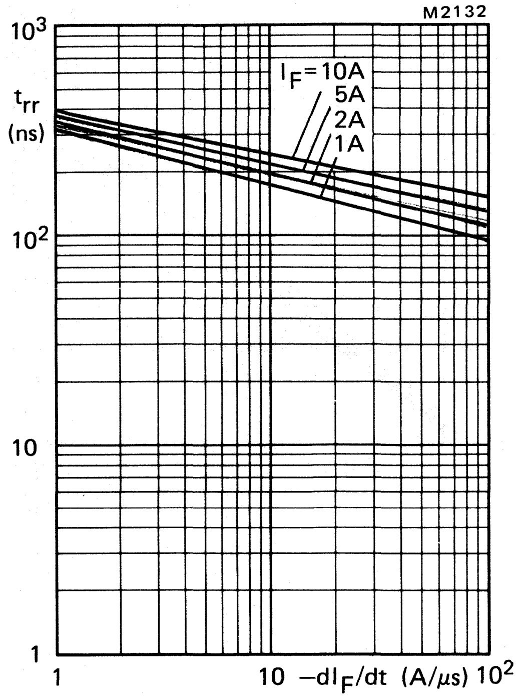


Fig.9 Maximum t_{rr} at T_j = 100 °C.

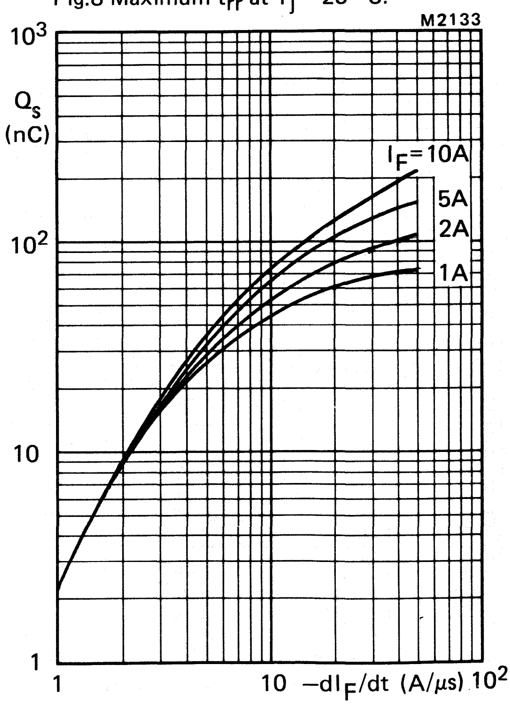


Fig.10 Maximum Q_s at T_j = 25 °C.

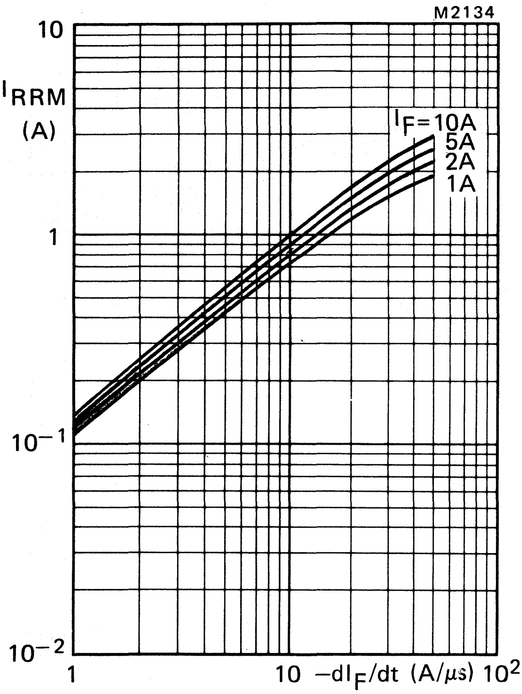


Fig.11 Maximum I_{RRM} at T_j = 25 °C.

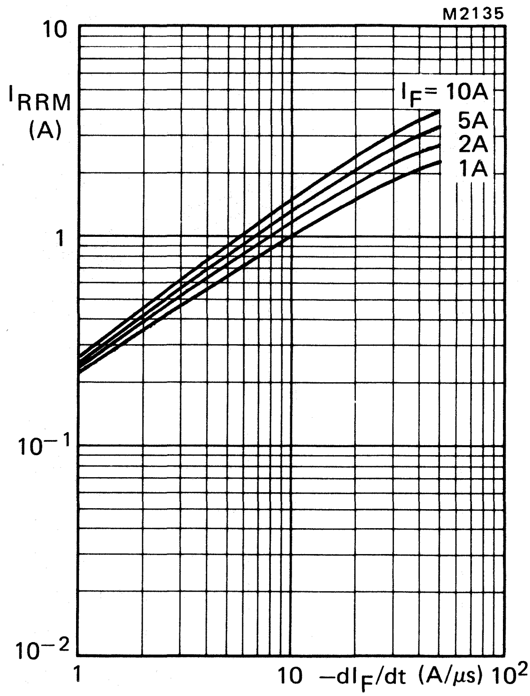


Fig.12 Maximum I_{RRM} at T_j = 100 °C.

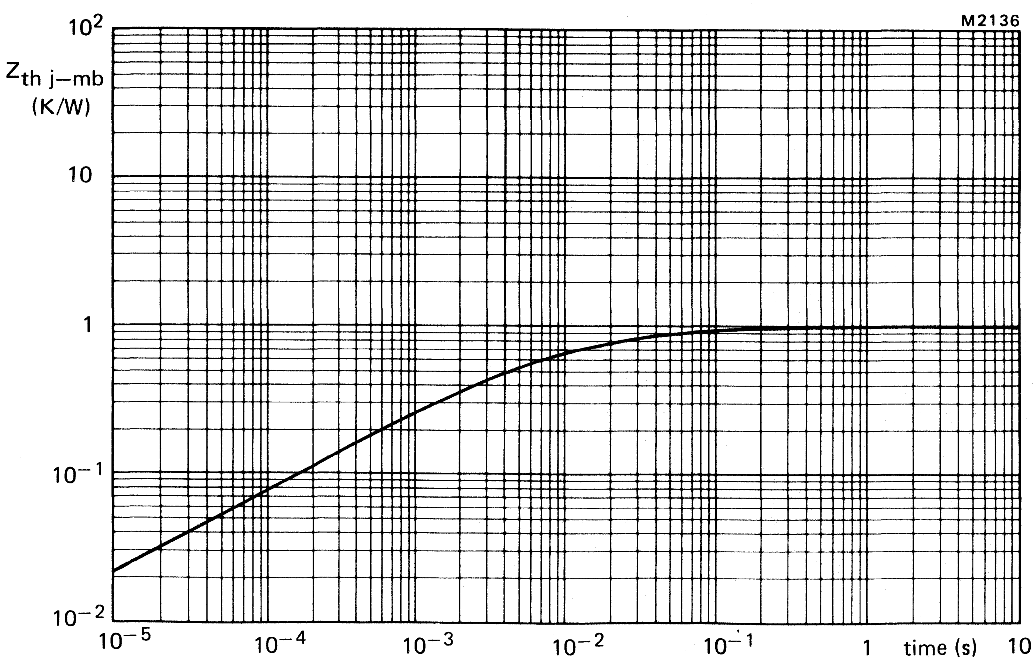


Fig.13 Transient thermal impedance.

SCHOTTKY–BARRIER DOUBLE RECTIFIER DIODES

Low-leakage, platinum-barrier double rectifier diodes in plastic envelopes featuring low forward voltage drop, low capacitance and absence of stored charge. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and zero switching losses are essential. Their single chip (monolithic) construction allows both diodes to be paralleled without the need for derating. They can also withstand reverse voltage transients and have guaranteed reverse avalanche surge capability. The series consists of common-cathode types.

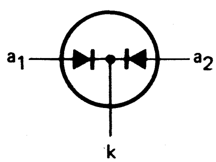
QUICK REFERENCE DATA

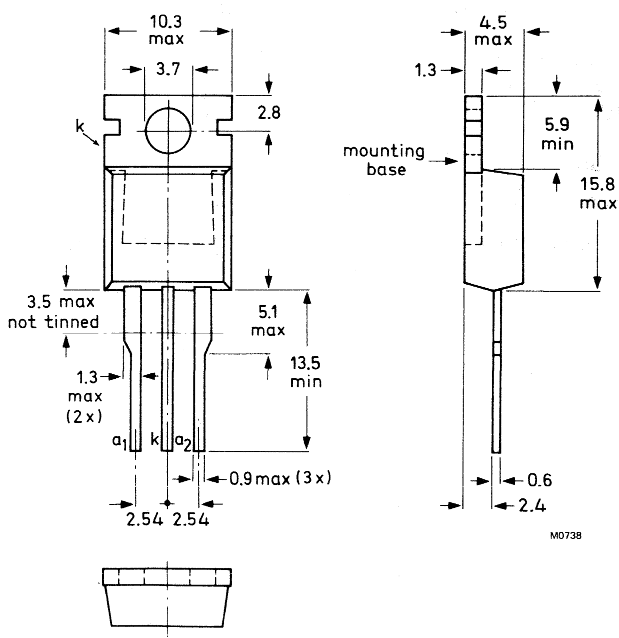
Per diode, unless otherwise stated			BYV118–35	40	45	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Output current (both diodes conducting)	I_O	max.		10		A
Forward voltage	V_F	<		0.6		V
Junction temperature	T_j	max.		150		°C

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-220AB.





Net mass: 2 g

Note: the exposed metal mounting base is directly connected to the common cathode.

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

RATINGS

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

Voltages (per diode)			BYV118–35	40	45	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Crest working reverse voltage	V_{RWM}	max.	35	40	45	V
Continuous reverse voltage	V_R	max.	35	40	45	V

Currents (both diodes conducting: note 1)

Output current: square wave; $\delta = 0.5$; up to $T_{mb} = 136\ ^oC$ (note 2)	I_O	max.	10	A
sinusoidal; up to $T_{mb} = 138\ ^oC$ (note 2)	I_O	max.	8.8	A
R.M.S. forward current	$I_{F(RMS)}$	max.	14	A
Repetitive peak forward current $t_p = 20\ \mu s$, $\delta = 0.02$ (per diode)	I_{FRM}	max.	90	A
Non-repetitive peak forward current (per diode) half sine-wave; $T_j = 125\ ^oC$ prior to surge; with reapplied $V_{RWM\ max}$ $t = 10$ ms	I_{FSM}	max.	100	A
$t = 8.3$ ms	I_{FSM}	max.	110	A
I^2t for fusing ($t = 10$ ms, per diode)	I^2t	max.	50	A^2s
Reverse surge current $t_p = 2\ \mu s$, $\delta = 0.001$	I_{RRM}	max.	1.0	A
$t_p = 100\ \mu s$	I_{RSM}	max.	1.0	A

Temperatures

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

Notes:
1. The limits for both diodes apply whether both diodes conduct simultaneously or on alternate half cycles.
2. Assuming no reverse leakage current losses.

CHARACTERISTICS (per diode)

Forward voltage				
$I_F = 5$ A; $T_j = 150\ ^oC$	V_F	<	0.6	V*
$I_F = 10$ A; $T_j = 25\ ^oC$	V_F	<	0.87	V*
Reverse current				
$V_R = V_{RWM\ max}$; $T_j = 125\ ^oC$	I_R	<	15	mA
$V_R = V_{RWM\ max}$; $T_j = 25\ ^oC$	I_R	<	100	μA
Junction capacitance at f = 1 MHz				
$V_R = 5$ V; $T_j = 25$ to $125\ ^oC$	C_d	typ.	200	pF

THERMAL RESISTANCE

From junction to mounting base (both diodes conducting)	$R_{th\ j\text{-}mb}$	=	1.7	K/W
From junction to mounting base (per diode)	$R_{th\ j\text{-}mb}$	=	2.7	K/W

Influence of mounting method

1. Heatsink mounted with clip

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 insulator (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 value 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 device lead length and with copper laminate on the board.	$R_{th\ j\text{-}a}$	=	60	K/W

*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 holes.

OPERATING NOTES

Dissipation and heatsink calculations.

The various components of junction temperature rise above ambient are illustrated in Fig.2.

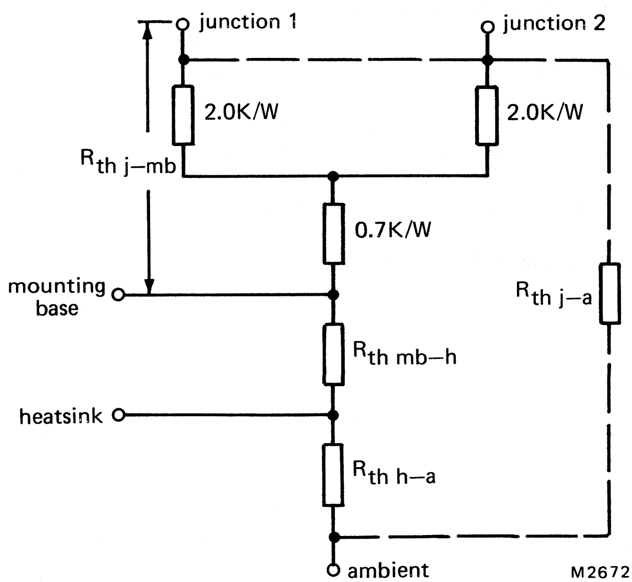


Fig.2.

OPERATING NOTES

Dissipation and heatsink calculations

Overall thermal resistance, $R_{th\ j\text{-}a} = R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h} + R_{th\ h\text{-}a}$

To choose a suitable heatsink, the following information is required for each half of the dual diode:

(i) maximum operating ambient temperature
(ii) duty cycle or form factor of forward current (δ or a)
(iii) average forward current per diode
(iv) crest working reverse voltage (V_{RWM})

The total power dissipation in the diode has two components:

P_R — reverse leakage dissipation

$P_{tot} = P_R + P_F$ . . . . 1).

P_F — forward conduction dissipation

From the above it can be seen that:

$$R_{th\ h\text{-}a} = \frac{T_{jmax} - T_{amb}}{P_F + P_R} - (R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h}) \quad \text{. . . . . 2).}$$

Values for $R_{th\ j\text{-}mb}$ and $R_{th\ mb\text{-}h}$ can be found under Thermal Resistance. P_R and P_F are derived from Figs.3 and 4 for square-wave operation (and Figs.5 and 6 for sine-wave) as follows:
Look at each half of the dual diode separately; for each diode, starting at the V_{RWM} axis of Fig.3, (or Fig.5), and from a knowledge of the required V_{RWM}, trace upwards to meet the curve that matches the required T_{jmax}. From this point trace horizontally left until the curve of the voltage grade of the device being used is met. From this point trace downwards to meet the required duty cycle (δ) or form factor (a). From this point trace right and read the actual reverse power dissipation on the P_R axis.
From this calculation, $P_R = P_R$ (diode 1) + P_R (diode 2) . . . . 3).
Foward conduction dissipation (P_F) for the known average current $I_{F(AV)}$ and duty cycle (or form factor) for each diode is easily derived from Fig.4 (or Fig.6).
Similarly, $P_F = P_F$ (diode 1) + P_F (diode 2) . . . . 4).
Substituting equations 3) and 4) into equation 2) enables the calculation of the required heatsink.

NOTE:— If both halves of the diode are being used (as is assumed above), the value of $R_{th\ j\text{-}mb}$ = 1.7 K/W. If only one half of the diode is used, follow the above procedure for one diode only, and use the value of $R_{th\ j\text{-}mb}$ of 2.7 K/W.

To ensure thermal stability, $(R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h} + R_{th\ h\text{-}a}) \times P_R$ must be less than 12 ^oC. If the calculated value of $R_{th\ h\text{-}a}$ does not permit this, then it must be reduced (heatsink size increased or $R_{th\ mb\text{-}h}$ improved) to enable this criterion to be met.

EXAMPLE: square-wave operation, using BYV118-35 and heatsink compound;
T_{amb} = 50 ^oC; δ (diode 1) = 0.5; δ (diode 2) = 0.5;
$I_{F(AV)}$ (diode 1) = 5 A; $I_{F(AV)}$ (diode 2) = 5 A;
V_{RWM} (both diodes) = 20 V; voltage grade of device = 35 V.
From data, $R_{th\ j\text{-}mb}$ = 1.7 K/W and $R_{th\ mb\text{-}h}$ = 0.3 K/W.
For each diode from Fig.4, it is found that P_F = 4 W;
hence total P_F = 2 x 4 = 8 W (from equation 4)
If desired T_{jmax} is chosen to be 140 ^oC, then, from Fig.3, P_R (per diode) = 0.2 W
Therefore total P_R = 2 x 0.2 = 0.4 W (from equation 3)
Using equation 2) we have:

$$R_{th\ h\text{-}a} = \frac{140\ ^oC - 50\ ^oC}{4\ W + 0.4\ W} - (1.7 + 0.3) = 18.5\ K/W$$

To check for thermal stability:

$$(R_{th\ j\text{-}a}) \times P_R = (1.7 + 0.3 + 18.5) \times 0.4 = 8.2\ ^oC.$$

This is less than 12 ^oC, hence thermal stability is ensured.

SQUARE WAVE OPERATION (Fig.3 and 4)

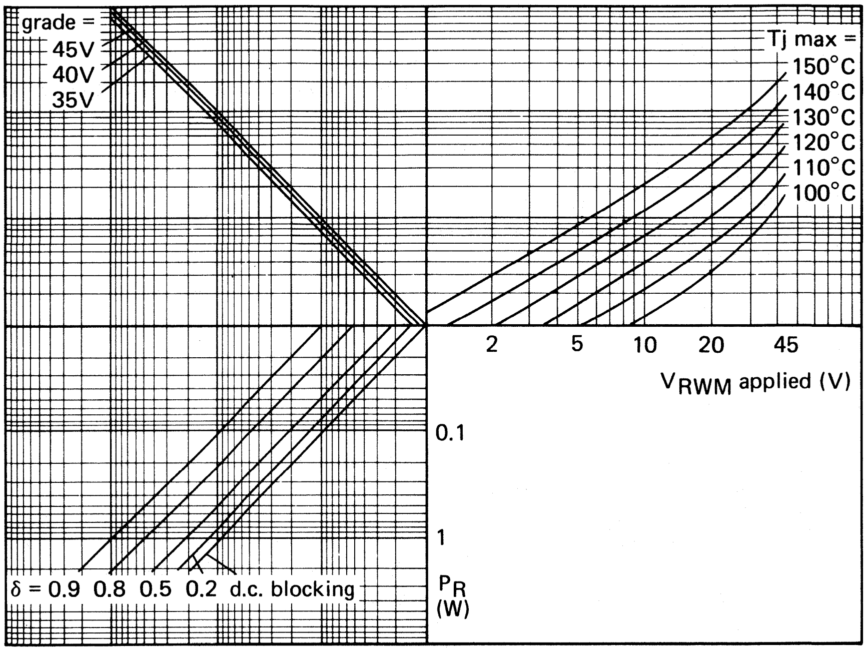
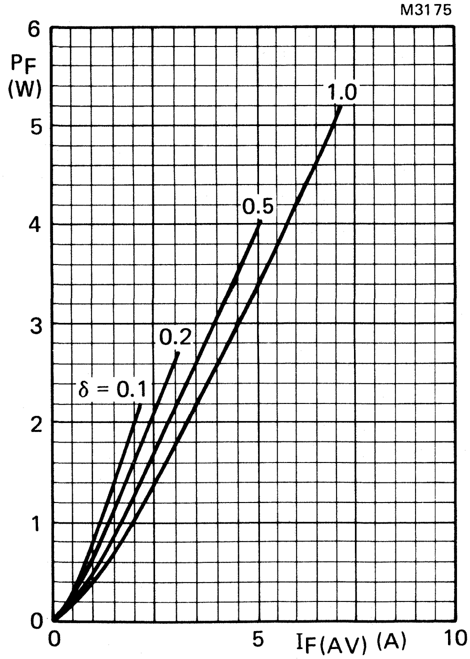
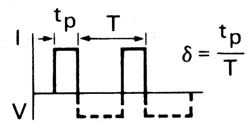


Fig.3 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and duty cycle; per diode.





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

Fig.4 Forward current power rating; per diode.

SINUSOIDAL OPERATION (Figs. 5 and 6)

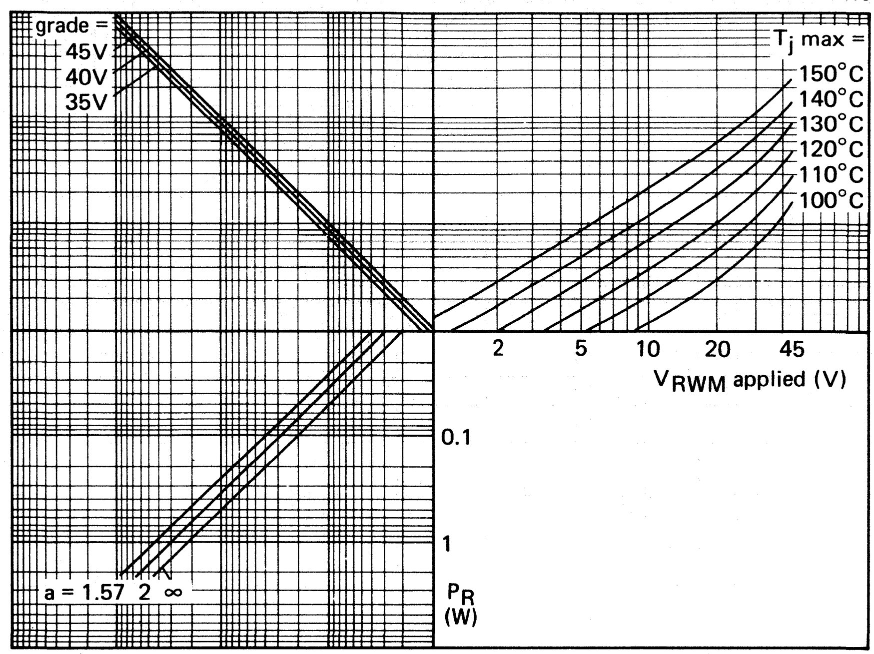


Fig.5 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and form factor; per diode.

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

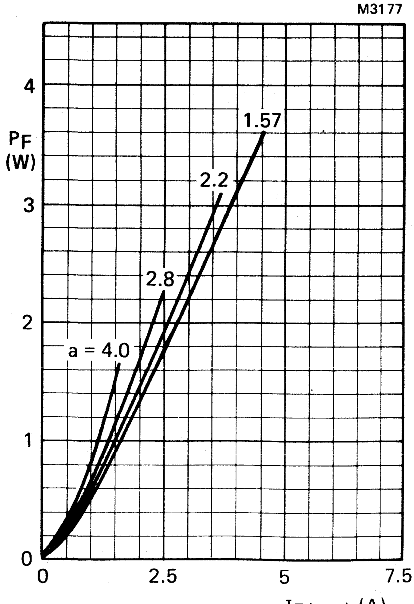


Fig.6 Forward current power rating; per diode.

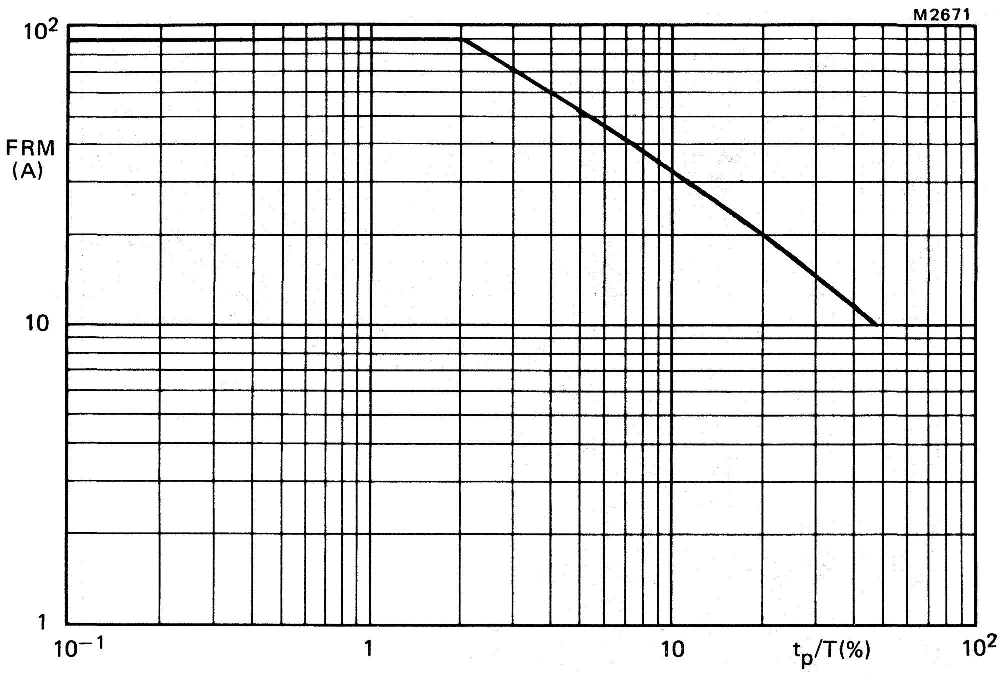
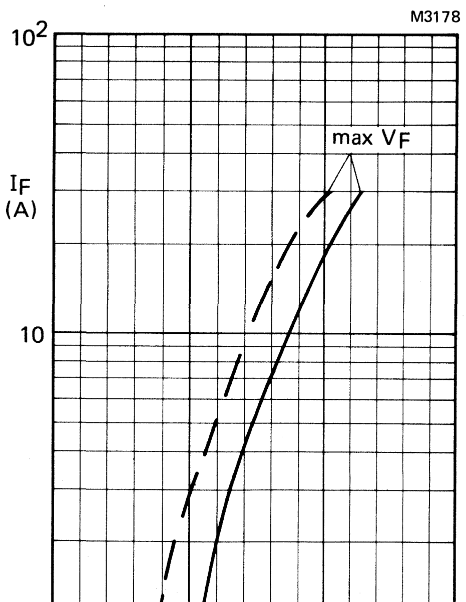
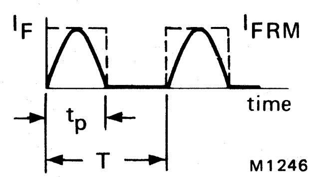


Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal current for $1\ \mu s < t_p < 1$ ms; per diode.





Definition of I_{FRM} and t_p/T.

Fig.8 —— $T_j = 25\ ^oC$; ---- $T_j = 150\ ^oC$; per diode.

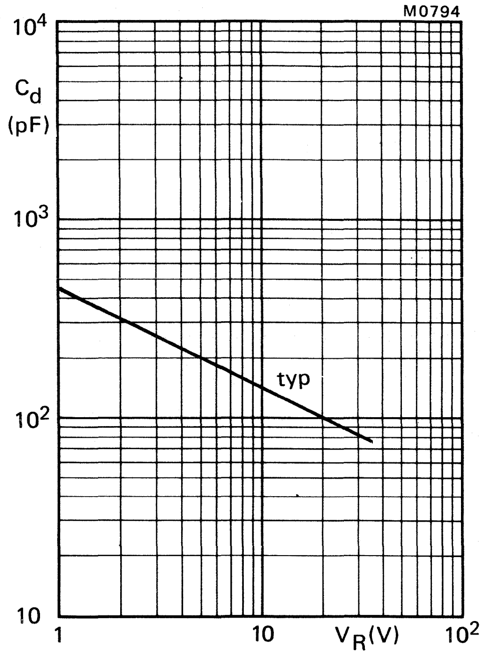


Fig.9 f = 1 MHz; T_j = 25 to 125 °C; per diode.

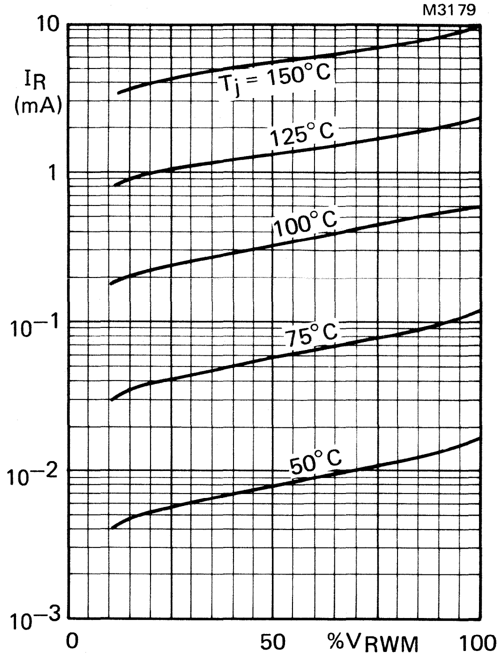


Fig.10 Typical values; per diode.

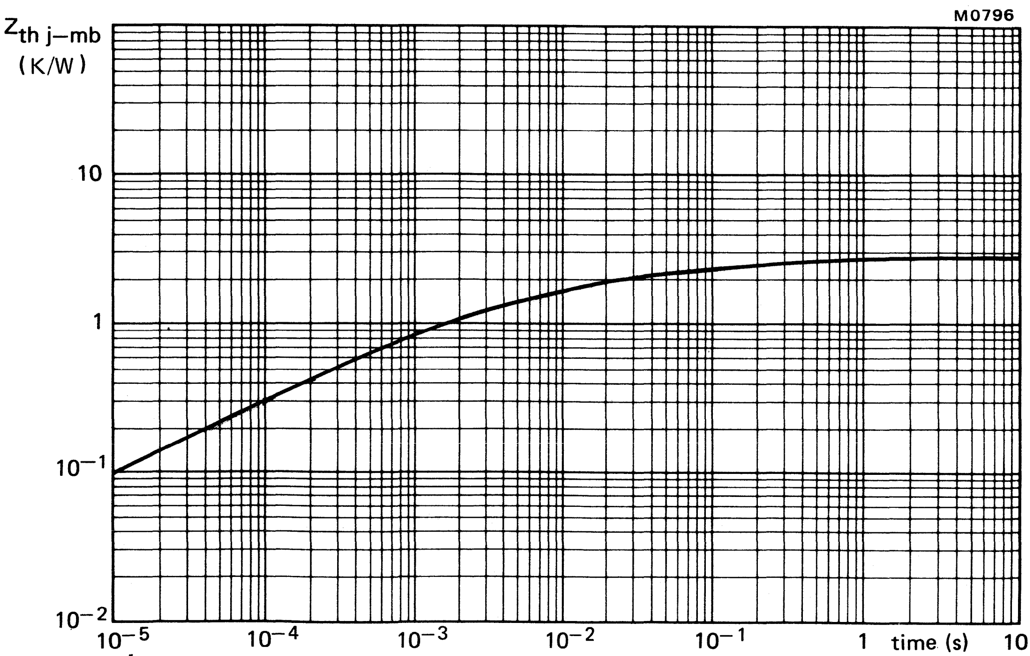


Fig.11 Transient thermal impedance; per diode.

SCHOTTKY-BARRIER DOUBLE RECTIFIER DIODES

Low-leakage platinum-barrier double rectifier diodes in SOT-186 (full-pack) plastic envelopes featuring low forward voltage drop, low capacitance and absence of stored charge. 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 switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and absence of stored charge are essential. Their single chip (monolithic) construction allows both diodes to be paralleled without the need for derating. They can also withstand reverse voltage transients and have guaranteed reverse avalanche surge capability. The series consists of common-cathode types.

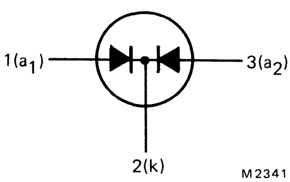
QUICK REFERENCE DATA

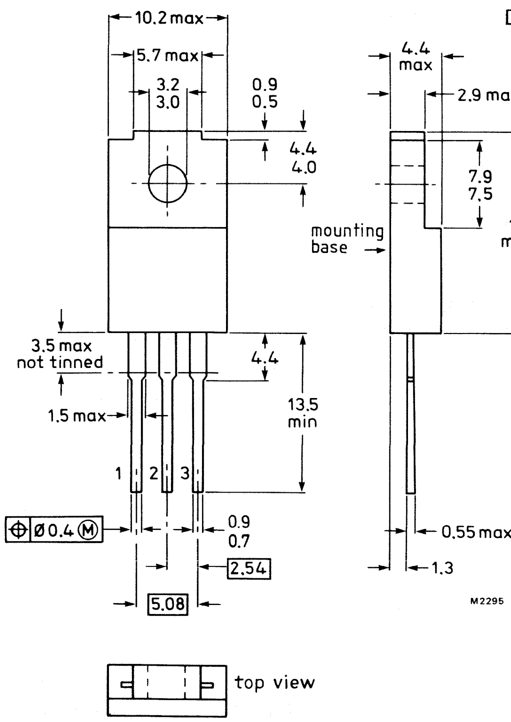
Per diode, unless otherwise stated			BYV118F−35	40	45	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Output current (both diodes conducting)	I_O	max.		10		A
Forward voltage	V_F	<		0.6		V
Junction temperature	T_j	max.		150		°C

MECHANICAL DATA

Dimensions in mm

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





Net mass: 2 g.
The mounting base 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 (per diode)			BYV118F–35	40	45	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Crest working reverse voltage	V_{RWM}	max.	35	40	45	V
Continuous reverse voltage	V_R	max.	35	40	45	V

Currents (both diodes conducting: note 1)				
Output current:				
square wave; $\delta = 0.5$;				
up to $T_h = 110\ ^oC$ (note 2)	I_O	max.	10	A
sinusoidal; up to $T_h = 110\ ^oC$ (note 2)	I_O	max.	8.8	A
RMS forward current	$I_{F(RMS)}$	max.	14	A
Repetitive peak forward current				
$t_p = 20\ \mu s$; $\delta = 0.02$ (per diode)	I_{FRM}	max.	90	A
Non-repetitive peak forward current				
(per diode) half sinewave; $T_j = 125\ ^oC$				
prior to surge; with reapplied $V_{RWM\ max}$				
t = 10 ms	I_{FSM}	max.	100	A
t = 8.3 ms	I_{FSM}	max.	110	A
I^2t for fusing (t = 10 ms; per diode)	I^2t	max.	50	A^2s
Reverse surge current				
$t_p = 2\ \mu s$; $\delta = 0.001$	I_{RRM}	max.	1.0	A
$t_p = 100\ \mu s$	I_{RSM}	max.	1.0	A
Temperatures				
Storage temperature	T_{stg}		–40 to +150	^oC
Junction temperature	T_j	max.	150	^oC

ISOLATION

Isolation voltage from all terminals to external heatsink (peak value) (note 3)	$V_{(isol)M}$	max.	1500	V
Isolation capacitance between all terminals and external heatsink	$C_{(isol)}$	typ.	12	pF

Notes:

1. The limits for both diodes apply whether both diodes conduct simultaneously or on alternate half cycles.
2. Assuming no reverse leakage current losses.
3. Repetitive peak operation with RH $\leqslant$ 65% under clean and dust-free conditions.

CHARACTERISTICS (per diode)

Forward voltage				
I_F = 5 A; T_j = 150 °C	V_F	<	0.6	V*
I_F = 10 A; T_j = 25 °C	V_F	<	0.87	V*
Reverse current				
$V_R = V_{RWM\ max}$; T_j = 125 °C	I_R	<	15	mA
$V_R = V_{RWM\ max}$; T_j = 25 °C	I_R	<	100	µA
Junction capacitance at f = 1 MHz				
V_R = 5 V; T_j = 25 to 125 °C	C_d	typ.	200	pF

THERMAL RESISTANCE

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

a. both diodes conducting with heatsink compound	$R_{th\ j\text{-}h}$	=	5.5	K/W
b. per diode with heatsink compound	$R_{th\ j\text{-}h}$	=	6.5	K/W

Free air operation

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

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

*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 mounting base 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.2.

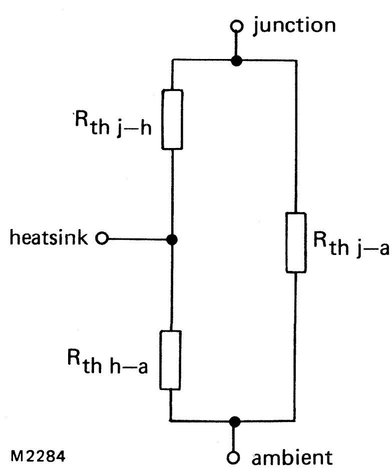


Fig.2.

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

SCHOTTKY–BARRIER RECTIFIER DIODES

Low-leakage, platinum-barrier rectifier diodes in metal envelopes, featuring low forward voltage drop, low capacitance, absence of stored charge and high temperature stability. They are intended for use in low output voltage switched-mode power supplies and high frequency circuits in general, where both low conduction losses and zero switching losses are important. They can also withstand reverse voltage transients and have guaranteed reverse avalanche surge capability. The series consists of normal polarity (cathode to stud) types.

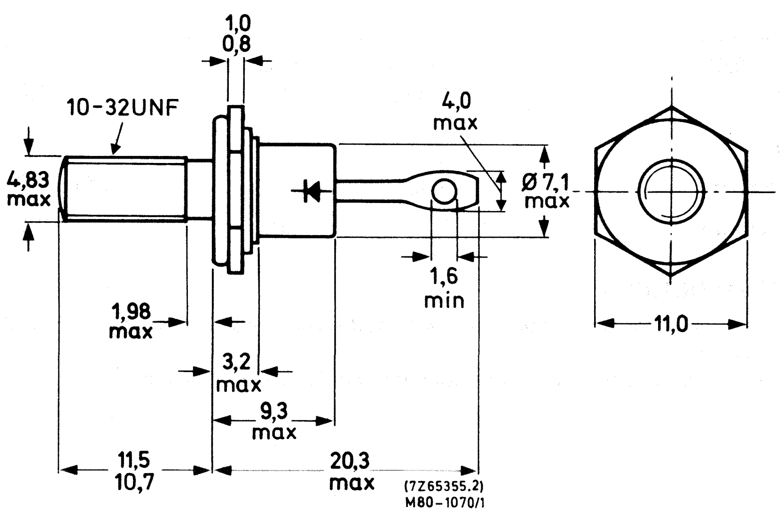
QUICK REFERENCE DATA

			BYV120–35	40	45	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Average forward current	$I_{F(AV)}$	max.		15		A
Forward voltage	V_F	<		0.6		V
Junction temperature	T_j	max.		150		^oC

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO-4 with 10-32 UNF stud (ϕ4.83 mm) as standard.
Metric M5 stud (ϕ5 mm) is available on request; e.g. BYV120-35M.



Net mass: 6 g

Diameter of clearance hole: 5.2 mm

Accessories supplied on request:
56295a (mica washer); 56295b (PTFE ring);
56295c (insulating bush).

Supplied with device: 1 nut, 1 lock washer.
Torque on nut:
min. 0.9 Nm (9 kg cm),
max. 1.7 Nm (17 kg cm).
Nut dimensions across the flats:
10-32 UNF, 9.5 mm; M5, 8.0 mm.

RATINGS

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

Voltages			BYV120– 35	40	45	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Crest working reverse voltage	V_{RWM}	max.	35	40	45	V
Continuous reverse voltage	V_R	max.	35	40	45	V

Currents				
Average forward current				
square wave; δ = 0.5; up to T_{mb} = 123 °C (note 1)	$I_{F(AV)}$	max.	15	A
sinusoidal; up to T_{mb} = 125 °C (note 1)	$I_{F(AV)}$	max.	13.5	A
R.M.S. forward current	$I_{F(RMS)}$	max.	21	A
Repetitive peak forward current				
t_p = 20 µs; δ = 0.02	I_{FRM}	max.	260	A
Non-repetitive peak forward current				
half sine-wave; T_j = 125 °C prior to surge; with reapplied $V_{RWM\,max}$				
t = 10 ms	I_{FSM}	max.	300	A
t = 8.3 ms	I_{FSM}	max.	330	A
I^2t for fusing (t = 10 ms)	I^2t	max.	450	A^2s
Reverse surge current				
t_p = 2 µs; δ = 0.001	I_{RRM}	max.	1.0	A
t_p = 100 µs	I_{RSM}	max.	1.0	A
Temperatures				
Storage temperature	T_{stg}		−55 to +150	°C
Junction temperature	T_j	max.	150	°C

MOUNTING INSTRUCTIONS

The top connector should be neither bent nor twisted; it should be soldered into the circuit so that there is no strain on it.
During soldering, the heat conduction to the junction should be kept to a minimum.

Note:
1. Assuming no reverse leakage current losses.

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	2.2	K/W
From mounting base to heatsink with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.5	K/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0.85	K/W

CHARACTERISTICS

Forward voltage				
I_F = 15 A; T_j = 150 °C	V_F	<	0.6	V*
I_F = 30 A; T_j = 25 °C	V_F	<	0.85	V*
Reverse current				
$V_R = V_{RWM\ max}$; T_j = 125°C	I_R	<	30	mA
$V_R = V_{RWM\ max}$; T_j = 25 °C	I_R	<	0.1	mA
Junction capacitance at f = 1 MHz				
V_R = 5 V; T_j = 25 to 125 °C	C_d	typ.	520	pF

*Measured under pulse conditions to avoid excessive dissipation.

OPERATING NOTES

Dissipation and Heatsink Calculations

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

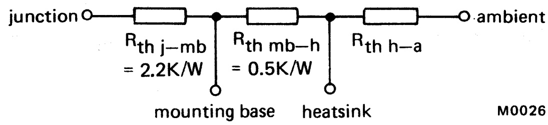


Fig.2.

Overall thermal resistance, $R_{th\ j\text{-}a} = R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h} + R_{th\ h\text{-}a}$

To choose a suitable heatsink, the following information is required:

(i) maximum operating ambient temperature
(ii) duty cycle or form factor of forward current (δ or a)
(iii) average forward current
(iv) crest working reverse voltage (V_{RWM})

The total power dissipation in the diode has two components:

P_R — reverse leakage dissipation

$$P_{tot} = P_R + P_F \quad \text{.........} \quad 1).$$

P_F — forward conduction dissipation

From the above it can be seen that:

$$R_{th\ h\text{-}a} = \frac{T_{jmax} - T_{amb}}{P_R + P_F} - (R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h}) \quad \text{..............................} \quad 2).$$

Values for $R_{th\ j\text{-}mb}$ and $R_{th\ mb\text{-}h}$ can be found under Thermal Resistance. P_R and P_F are derived from Figs.3 and 4 for square-wave operation (and Figs.5 and 6 for sine-wave) as follows:
Starting at the V_{RWM} axis of Fig.3 (or Fig.5), and from a knowledge of the required V_{RWM}, trace upwards to meet the curve that matches the required T_{jmax}. From this point trace horizontally left until the curve of the voltage grade of the device being used is met. From this point trace downwards to meet the required duty cycle (δ) or form factor (a). From this point trace right and read the actual reverse power dissipation on the P_R axis.
Foward conduction dissipation (P_F) for the known average current $I_{F(AV)}$ and duty cycle (or form factor) is easily derived from Fig.4 (or Fig.6).
Substituting the values of P_R and P_F into equation 2) enables the calculation of the required heatsink.

To ensure thermal stability, $(R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h} + R_{th\ h\text{-}a}) \times P_R$ must be less than 12 °C. If the calculated value of $R_{th\ h\text{-}a}$ does not permit this, then it must be reduced (heatsink size increased or $R_{th\ mb\text{-}h}$ improved) to enable this criterion to be met.

EXAMPLE: square-wave operation, using BYV120-35 and heatsink compound
T_{amb} = 50 °C; δ = 0.5; $I_{F(AV)}$ = 12 A
V_{RWM} = 12 V; voltage grade of device = 35 V.
From data, $R_{th\ j\text{-}mb}$ = 2.2 K/W and $R_{th\ mb\text{-}h}$ = 0.5 K/W.
From Fig.4, it is found that P_F = 9.0 W
If the desired T_{jmax} is chosen to be 130 °C, then, from Fig.3, P_R = 0.1 W
Using equation 2) we have:

$$R_{th\ h\text{-}a} = \frac{130\ ^{\circ}C - 50\ ^{\circ}C}{9.0\ W + 0.1\ W} - (2.2 + 0.5) = 6.1\ K/W$$

To check for thermal stability:

$$(R_{th\ j\text{-}a}) \times P_R = (2.2 + 0.5 + 6.1) \times 0.1 = 0.9\ ^{\circ}C.$$

This is less than 12 °C, hence thermal stability is ensured.

SQUARE WAVE OPERATION (Fig.3 and 4)

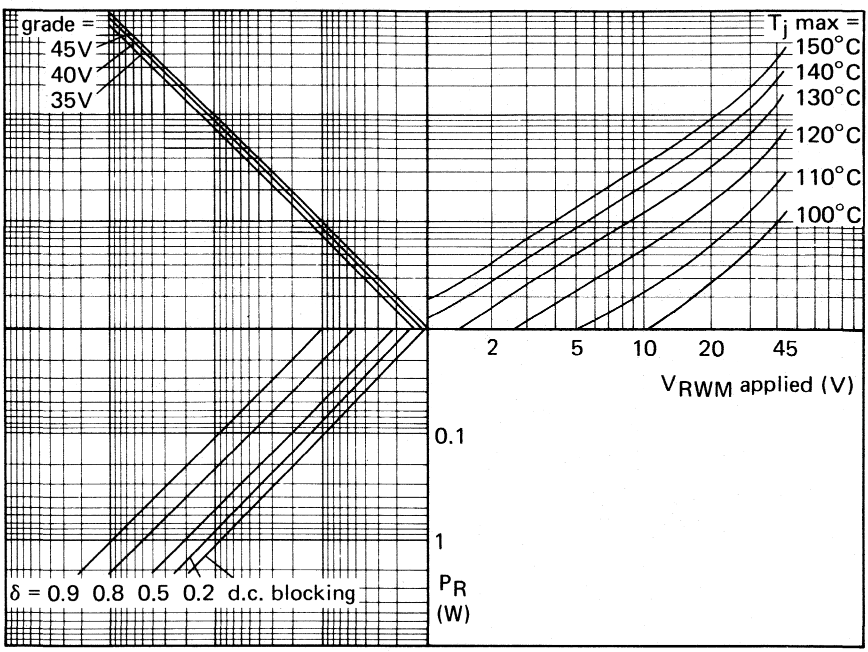
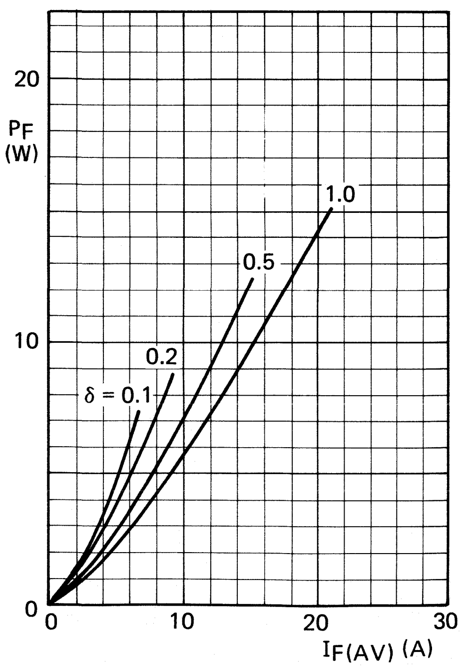
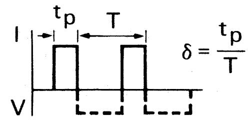


Fig.3 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and duty cycle.





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

Fig.4 Forward current power rating.

SINUSOIDAL OPERATION (Figs. 5 and 6)

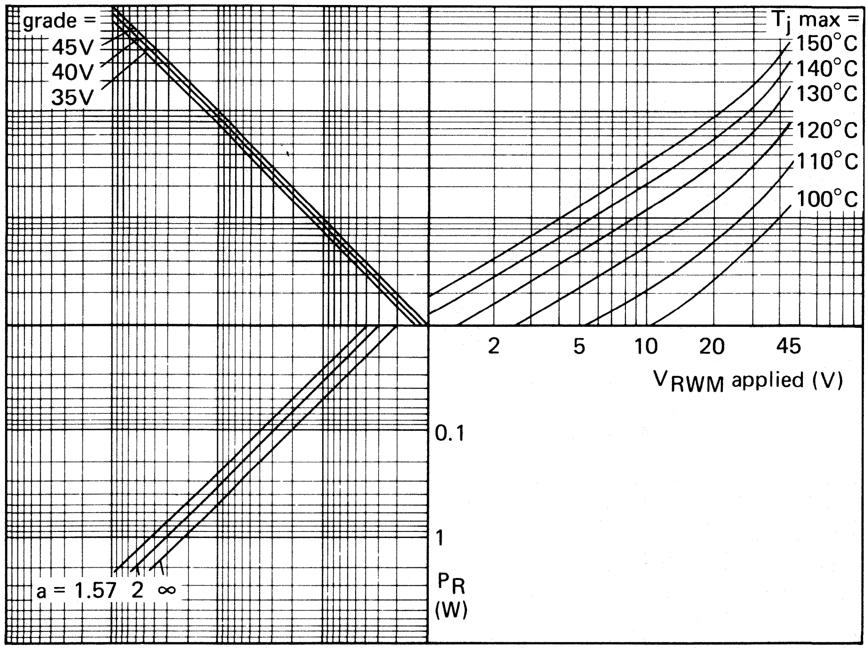


Fig.5 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and form factor.

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

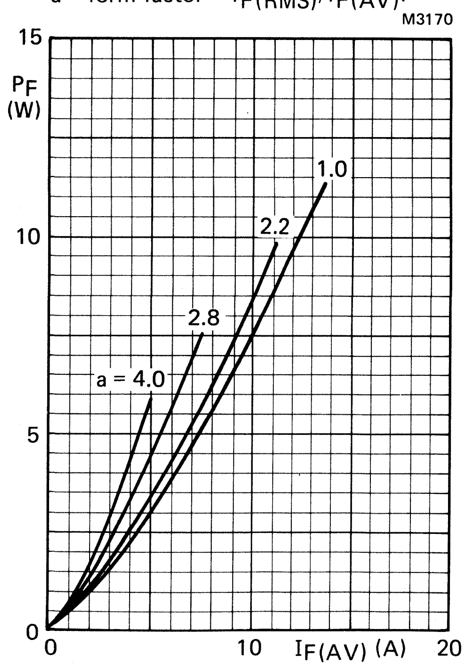


Fig.6 Forward current power rating.

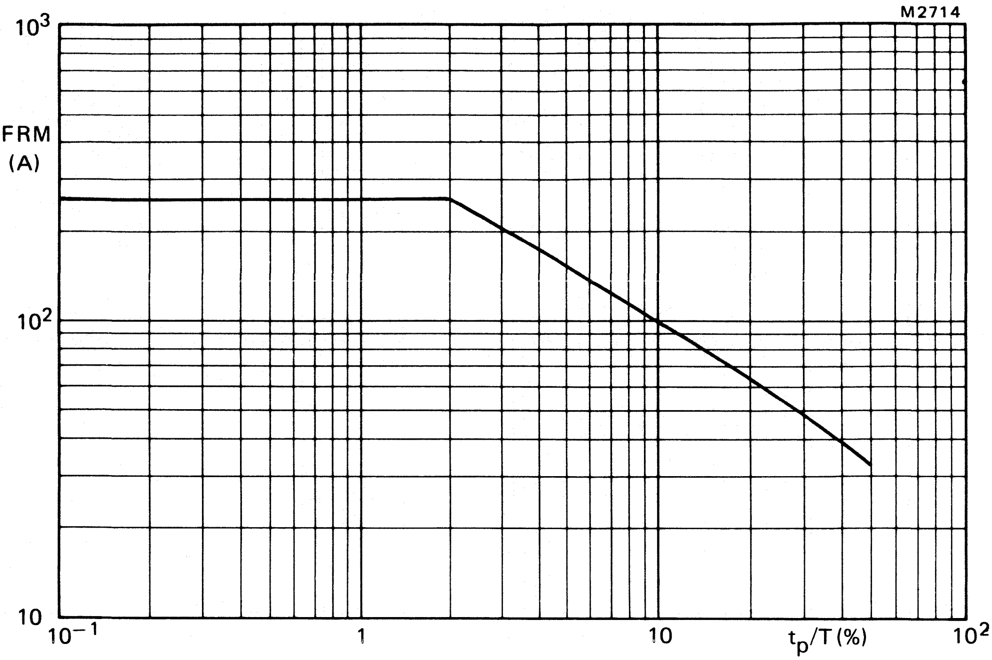
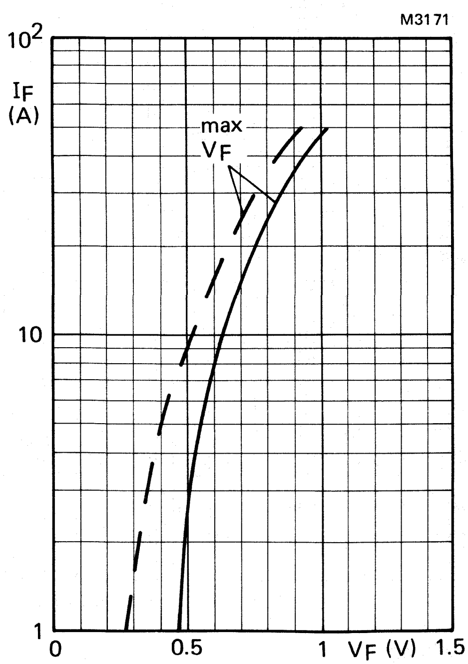
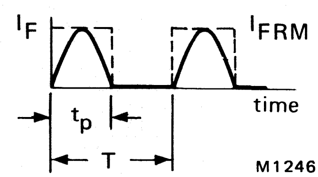


Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal current for $1\ \mu s < t_p < 1$ ms.





Definition of I_{FRM} and t_p/T.

Fig.8 —— $T_j = 25\ ^oC$; - - - $T_j = 150\ ^oC$.

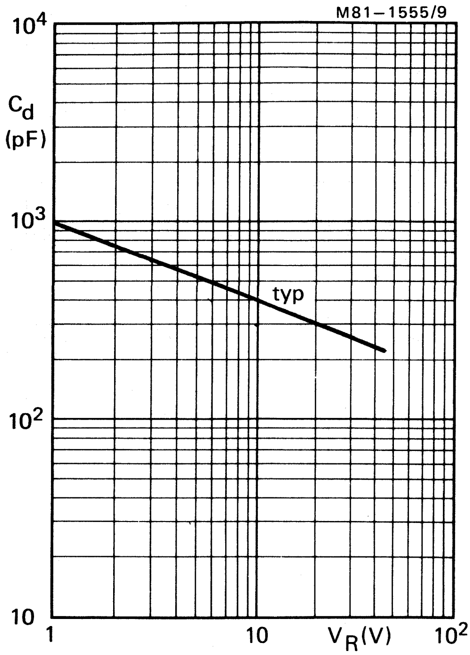


Fig.9 f = 1 MHz; T_j = 25 to 125 °C.

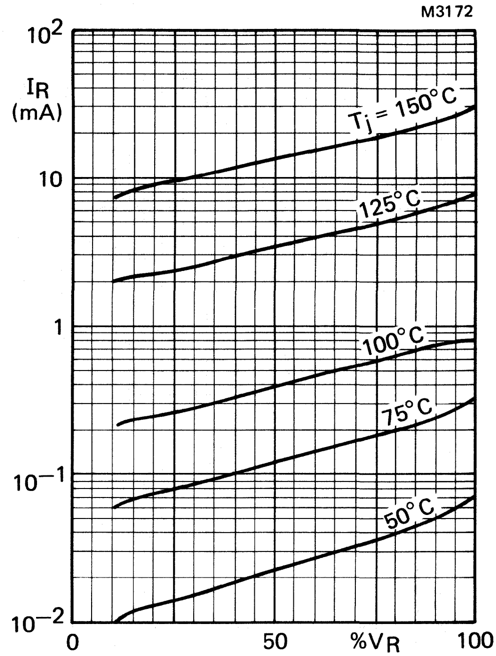


Fig.10 Typical values.

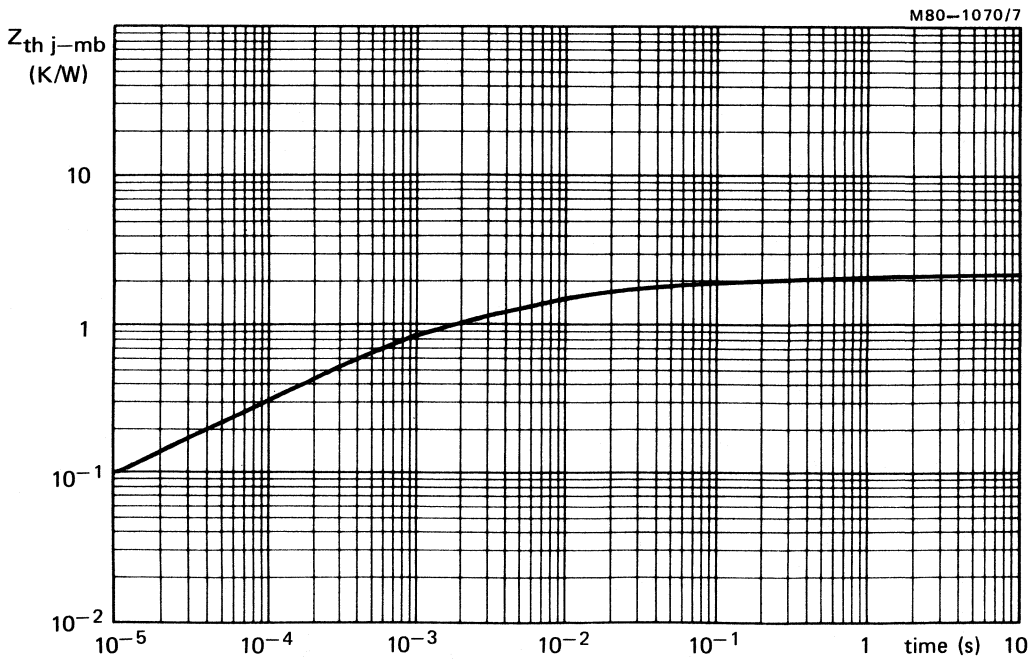


Fig.11 Transient thermal impedance.

SCHOTTKY–BARRIER RECTIFIER DIODES

Low-leakage, platinum-barrier rectifier diodes in metal envelopes, featuring low forward voltage drop, low capacitance, absence of stored charge and high temperature stability. They are intended for use in low output voltage switched-mode power supplies and high frequency circuits in general, where both low conduction losses and zero switching losses are important. They can also withstand reverse voltage transients and have guaranteed reverse avalanche surge capability. The series consists of normal polarity (cathode to stud) types.

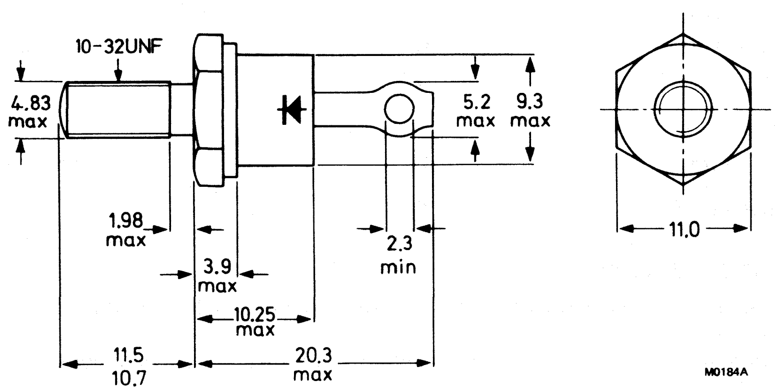
QUICK REFERENCE DATA

			BYV121– 35	40	45	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Average forward current	$I_{F(AV)}$	max.		30		A
Forward voltage	V_F	<		0.6		V
Junction temperature	T_j	max.		150		°C

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO-4 with 10-32 UNF stud (ϕ4.83 mm) as standard.
Metric M5 stud (ϕ5 mm) is available on request; e.g. BYV121-35M.



Net mass: 7 g

Diameter of clearance hole: 5.2 mm

Accessories supplied on request:
56295a (mica washer); 56295b (PTFE ring);
56295c (insulating bush).

Supplied with device: 1 nut, 1 lock washer.
Torque on nut:
min. 0.9 Nm (9 kg cm),
max. 1.7 Nm (17 kg cm).
Nut dimensions across the flats:
10-32 UNF, 9.5 mm; M5, 8.0 mm.

RATINGS

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

Voltages			BYV121– 35	40	45	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Crest working reverse voltage	V_{RWM}	max.	35	40	45	V
Continuous reverse voltage	V_R	max.	35	40	45	V

Currents				
Average forward current				
square wave; $\delta = 0.5$; up to $T_{mb} = 120\ ^oC$ (note 1)	$I_{F(AV)}$	max.	30	A
sinusoidal; up to $T_{mb} = 122\ ^oC$ (note 1)	$I_{F(AV)}$	max.	27	A
R.M.S. forward current	$I_{F(RMS)}$	max.	42.5	A
Repetitive peak forward current $t_p = 20\ \mu s$; $\delta = 0.02$	I_{FRM}	max.	500	A
Non-repetitive peak forward current half sine-wave; $T_j = 125\ ^oC$ prior to surge; with reapplied $V_{RWM\ max}$				
$t = 10$ ms	I_{FSM}	max.	600	A
$t = 8.3$ ms	I_{FSM}	max.	650	A
I^2t for fusing ($t = 10$ ms)	I^2t	max.	1800	A^2s
Reverse surge current				
$t_p = 2\ \mu s$; $\delta = 0.001$	I_{RRM}	max.	2.0	A
$t_p = 100\ \mu s$	I_{RSM}	max.	2.0	A

Temperatures				
Storage temperature	T_{stg}		–55 to +150	^oC
Junction temperature	T_j	max.	150	^oC

MOUNTING INSTRUCTIONS

The top connector should be neither bent nor twisted; it should be soldered into the circuit so that there is no strain on it.
During soldering, the heat conduction to the junction should be kept to a minimum.

Note:
1. Assuming no reverse leakage current losses.

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1.0	K/W
From mounting base to heatsink				
with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.3	K/W
without heatsink compound	$R_{th\ mb\text{-}h}$	=	0.5	K/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0.15	K/W

CHARACTERISTICS

Forward voltages				
I_F = 34 A; T_j = 150 °C	V_F	<	0.6	V*
I_F = 60 A; T_j = 25 °C	V_F	<	0.83	V*
Reverse current				
$V_R = V_{RWM\ max}$; T_j = 125°C	I_R	<	200	mA
$V_R = V_{RWM\ max}$; T_j = 25 °C	I_R	<	0.1	mA
Junction capacitance at f = 1 MHz				
V_R = 5 V; T_j = 25 to 125 °C	C_d	typ.	1150	pF

*Measured under pulse conditions to avoid excessive dissipation.

OPERATING NOTES

Dissipation and Heatsink Calculations

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

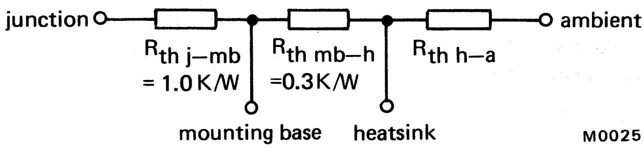


Fig.2.

Overall thermal resistance, $R_{th\ j\text{-}a} = R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h} + R_{th\ h\text{-}a}$

To choose a suitable heatsink, the following information is required:

(i) maximum operating ambient temperature
(ii) duty cycle or form factor of forward current (δ or a)
(iii) average forward current
(iv) crest working reverse voltage (V_{RWM})

The total power dissipation in the diode has two components:

P_R — reverse leakage dissipation

$$P_{tot} = P_R + P_F \quad \text{.........} \quad 1).$$

P_F — forward conduction dissipation

From the above it can be seen that:

$$R_{th\ h\text{-}a} = \frac{T_{jmax} - T_{amb}}{P_R + P_F} - (R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h}) \quad \text{..............................} \quad 2).$$

Values for $R_{th\ j\text{-}mb}$ and $R_{th\ mb\text{-}h}$ can be found under Thermal Resistance. P_R and P_F are derived from Figs.3 and 4 for square-wave operation (and Figs.5 and 6 for sine-wave) as follows:
Starting at the V_{RWM} axis of Fig.3 (or Fig.5), and from a knowledge of the required V_{RWM}, trace upwards to meet the curve that matches the required T_{jmax}. From this point trace horizontally left until the curve of the voltage grade of the device being used is met. From this point trace downwards to meet the required duty cycle (δ) or form factor (a). From this point trace right and read the actual reverse power dissipation on the P_R axis.
Foward conduction dissipation (P_F) for the known average current $I_{F(AV)}$ and duty cycle (or form factor) is easily derived from Fig.4 (or Fig.6).
Substituting the values of P_R and P_F into equation 2) enables the calculation of the required heatsink.

To ensure thermal stability, $(R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h} + R_{th\ h\text{-}a}) \times P_R$ must be less than 12 °C. If the calculated value of $R_{th\ h\text{-}a}$ does not permit this, then it must be reduced (heatsink size increased or $R_{th\ mb\text{-}h}$ improved) to enable this criterion to be met.

EXAMPLE: square-wave operation, using BYV121-35 and heatsink compound;
T_{amb} = 30 °C; δ = 0.5; $I_{F(AV)}$ = 20 A
V_{RWM} = 12 V; voltage grade of device = 35 V.
From data, $R_{th\ j\text{-}mb}$ = 1.0 K/W and $R_{th\ mb\text{-}h}$ = 0.3 K/W.
From Fig.4, it is found that P_F = 12 W
If desired T_{jmax} is chosen to be 120 °C, then, from Fig.3, P_R = 0.4 W
Using equation 2) we have:

$$R_{th\ h\text{-}a} = \frac{120\ ^{o}C - 30\ ^{o}C}{12\ W + 0.4\ W} - (1.0 + 0.3) = 6\ K/W$$

To check for thermal stability:

$$(R_{th\ j\text{-}a}) \times P_R = (1.0 + 0.3 + 6) \times 0.4 = 2.9\ ^{o}C.$$

This is less than 12 °C, hence thermal stability is ensured.

SQUARE WAVE OPERATION (Fig.3 and 4)

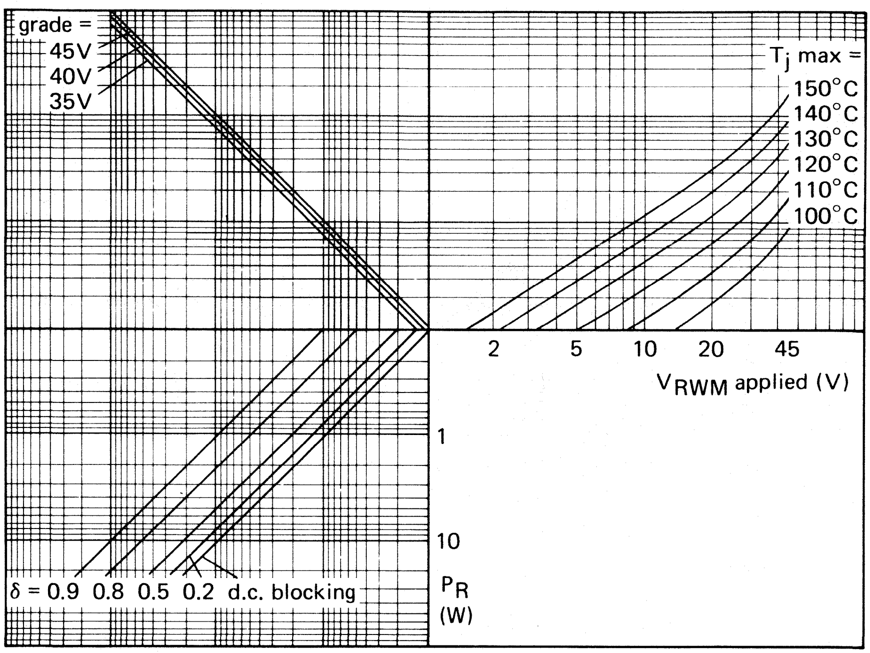
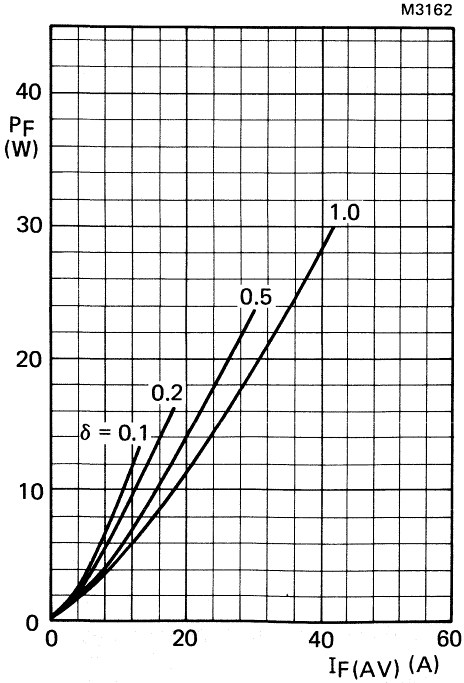
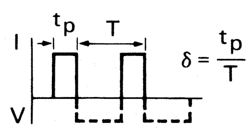


Fig.3 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and duty cycle.





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

Fig.4 Forward current power rating.

SINUSOIDAL OPERATION (Figs. 5 and 6)

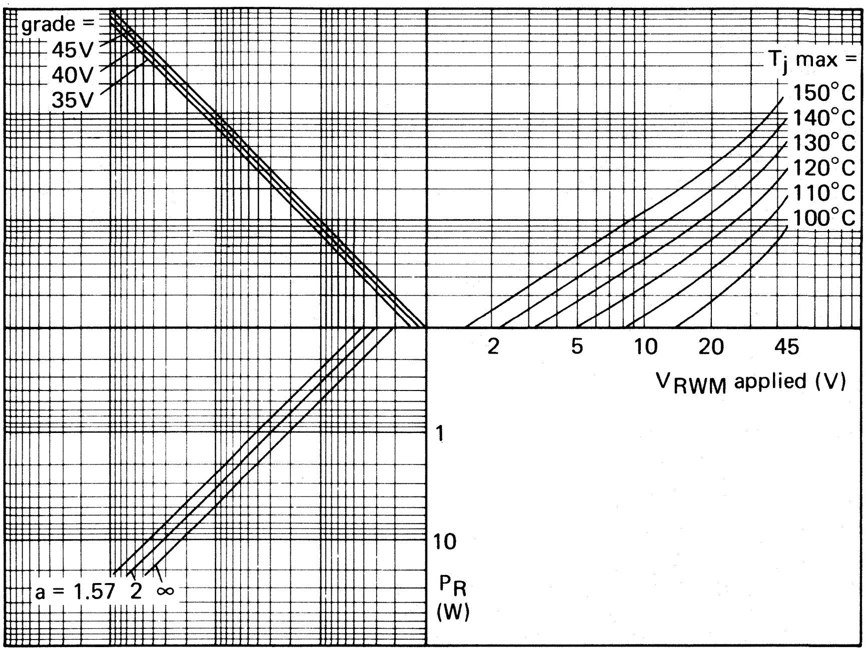


Fig.5 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and form factor.

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

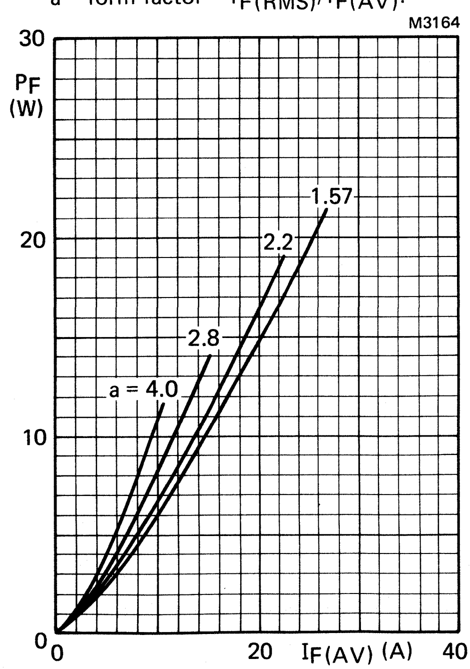


Fig.6 Forward current power rating.

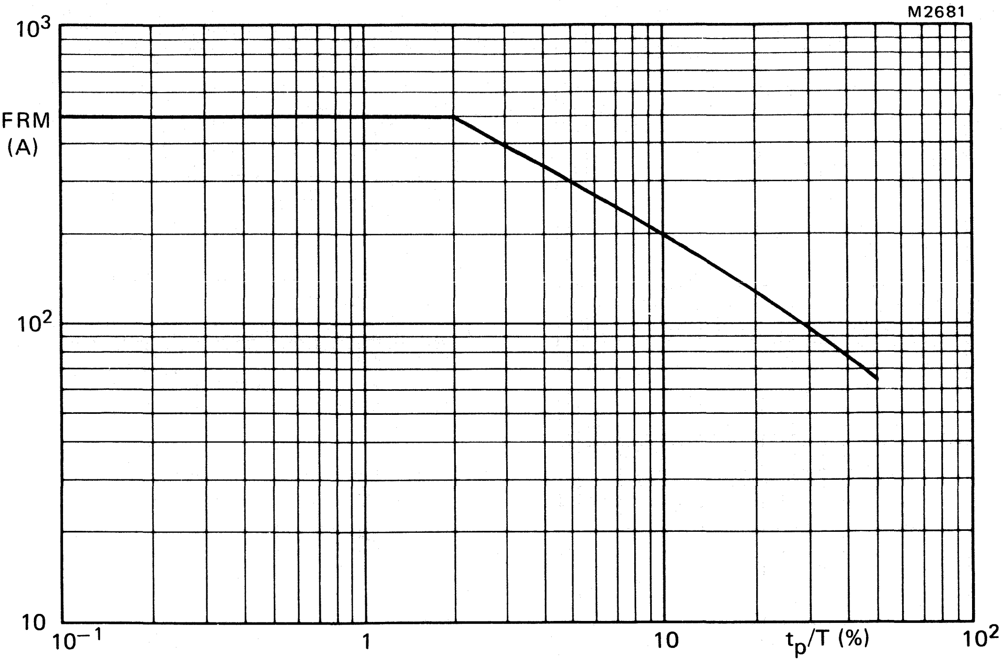
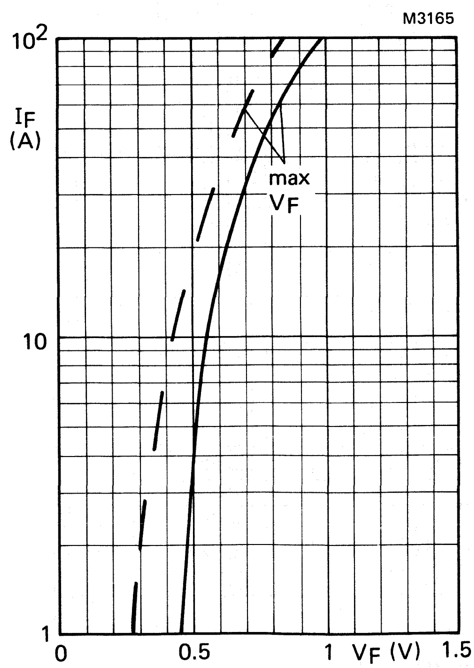
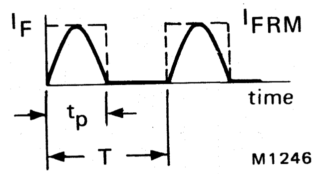


Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal current for 1 $\mu s < t_p < 1$ ms.





Definition of I_{FRM} and t_p/T.

Fig.8 —— T_j = 25 °C; ---- T_j = 150 °C.

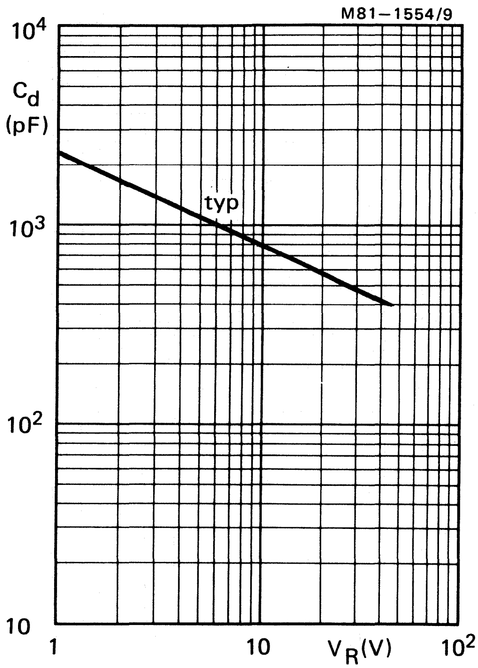


Fig.9 f = 1 MHz; T_j = 25 to 125 °C.

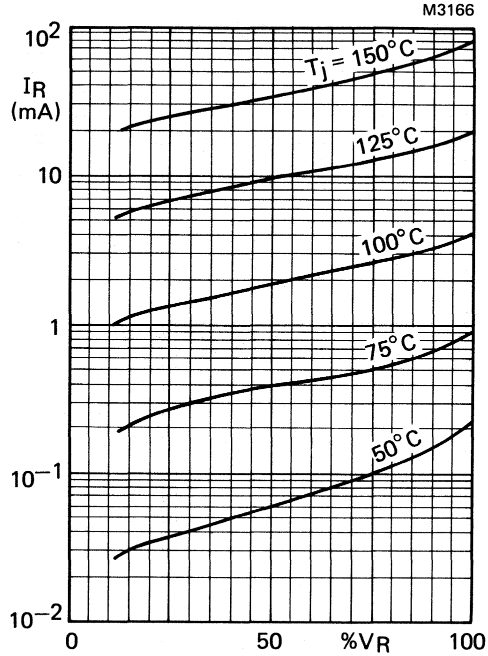


Fig.10 Typical values.

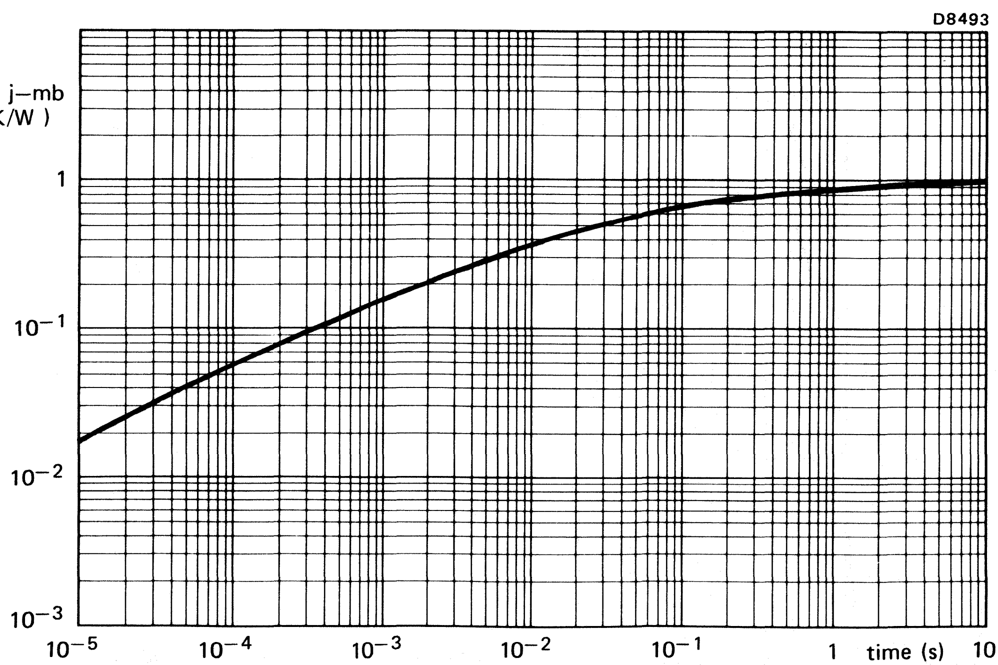


Fig.11 Transient thermal impedance.

SCHOTTKY-BARRIER DOUBLE RECTIFIER DIODES

Low-leakage, platinum-barrier rectifier diodes in plastic envelopes, featuring low forward voltage drop, low capacitance and absence of stored charge. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and zero switching losses are essential. Their single chip (monolithic) construction allows both diodes to be paralleled without the need for derating. They can also withstand reverse voltage transients and have guaranteed reverse avalanche surge capability. The series consists of common-cathode types.

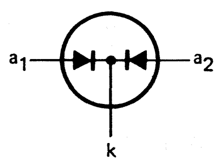
QUICK REFERENCE DATA

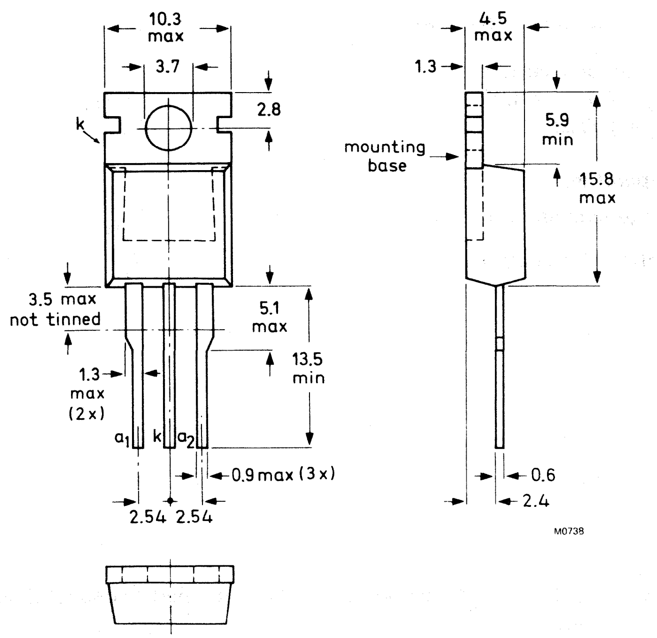
Per diode, unless otherwise stated			BYV133-35	40	45	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Output current (both diodes conducting)	I_O	max.		20		A
Forward voltage	V_F	<		0.6		V
Junction temperature	T_j	max.		150		°C

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-220AB.





Net mass: 2 g

Note: the exposed metal mounting base is directly connected to the common cathode.

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

RATINGS

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

Voltages (per diode)			BYV133-35	40	45	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Crest working reverse voltage	V_{RWM}	max.	35	40	45	V
Continuous reverse voltage	V_R	max.	35	40	45	V

Currents (both diodes conducting: note 1)				
Output current:				
square wave; $\delta = 0.5$; up to $T_{mb} = 121\ ^oC$ (note 2)	I_O	max.	20	A
sinusoidal; up to $T_{mb} = 124\ ^oC$ (note 2)	I_O	max.	18	A
RMS forward current (note 3)	$I_{F(RMS)}$	max.	28	A
Repetitive peak forward current $t_p = 20\ \mu s$; $\delta = 0.02$ (per diode)	I_{FRM}	max.	200	A
Non-repetitive peak forward current (per diode) half sinewave; $T_j = 125\ ^oC$ prior to surge; with reapplied $V_{RWM\ max}$				
t = 10 ms	I_{FSM}	max.	100	A
t = 8.3 ms	I_{FSM}	max.	110	A
I^2t for fusing (t = 10 ms, per diode)	I^2t	max.	50	A^2s
Reverse surge current				
$t_p = 2\ \mu s$; $\delta = 0.001$	I_{RRM}	max.	1.0	A
$t_p = 100\ \mu s$	I_{RSM}	max.	1.0	A
Temperatures				
Storage temperature	T_{stg}		−40 to +150	^oC
Junction temperature	T_j	max.	150	^oC

Notes:
1. The limits for both diodes apply whether both diodes conduct simultaneously or on alternate half cycles.
2. Assuming no reverse leakage current losses.
3. For output currents in excess of 20 A RMS, connection should be made to the exposed metal mounting base.

CHARACTERISTICS (per diode)

Forward voltage				
$I_F = 7$ A; $T_j = 150\ ^oC$	V_F	<	0.6	V*
$I_F = 20$ A; $T_j = 25\ ^oC$	V_F	<	0.94	V*
Reverse current				
$V_R = V_{RWM\ max}$; $T_j = 125\ ^oC$	I_R	<	15	mA
$V_R = V_{RWM\ max}$; $T_j = 25\ ^oC$	I_R	<	0.1	mA
Junction capacitance at f = 1 MHz				
$V_R = 5$ V; $T_j = 25$ to $125\ ^oC$	C_d	typ.	300	pF

THERMAL RESISTANCE

From junction to mounting base (both diodes conducting)	$R_{th\ j\text{-}mb}$	=	1.6	K/W
From junction to mounting base (per diode)	$R_{th\ j\text{-}mb}$	=	2.6	K/W

Influence of mounting method

1. Heatsink mounted with clip

Thermal resistance from mounting base to heatsink

a. with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.2	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 insulator (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 value 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 device lead length and with copper laminate on the board. $R_{th\ j\text{-}a}$ = 60 K/W

*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 holes.

OPERATING NOTES

Dissipation and heatsink calculations.

The various components of junction temperature rise above ambient are illustrated in Fig.2.

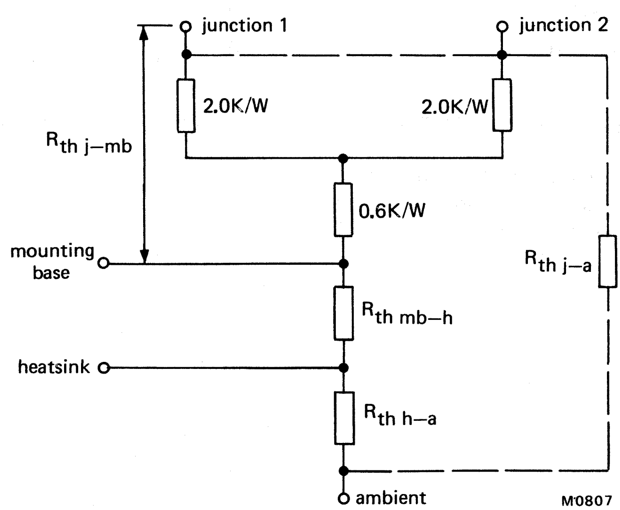


Fig.2

OPERATING NOTES

Dissipation and heatsink calculations (continued)

Overall thermal resistance, $R_{th\ j\text{-}a} = R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h} + R_{th\ h\text{-}a}$

To choose a suitable heatsink, the following information is required for each half of the dual diode:

(i) maximum operating ambient temperature
(ii) duty cycle or form factor of forward current (δ or a)
(iii) average forward current per diode
(iv) crest working reverse voltage (V_{RWM})

The total power dissipation in the diode has two components:

P_R — reverse leakage dissipation

$$P_{tot} = P_R + P_F \quad \text{.........} \quad 1).$$

P_F — forward conduction dissipation

From the above it can be seen that:

$$R_{th\ h\text{-}a} = \frac{T_{jmax} - T_{amb}}{P_F + P_R} - (R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h}) \quad \text{..............} \quad 2).$$

Values for $R_{th\ j\text{-}mb}$ and $R_{th\ mb\text{-}h}$ can be found under Thermal Resistance. P_R and P_F are derived from Figs.3 and 4 for square-wave operation (and Figs.5 and 6 for sine-wave) as follows:
Look at each half of the dual diode separately; for each diode, starting at the V_{RWM} axis of Fig.3, (or Fig.5), and from a knowledge of the required V_{RWM}, trace upwards to meet the curve that matches the required T_{jmax}. From this point trace horizontally left until the curve of the voltage grade of the device being used is met. From this point trace downwards to meet the required duty cycle (δ) or form factor (a). From this point trace right and read the actual reverse power dissipation on the P_R axis.
From this calculation, $P_R = P_R$ (diode 1) + P_R (diode 2) .... 3).
Foward conduction dissipation (P_F) for the known average current $I_{F(AV)}$ and duty cycle (or form factor) for each diode is easily derived from Fig.4 (or Fig.6).
Similarly, $P_F = P_F$ (diode 1) + P_F (diode 2) .... 4).
Substituting equations 3) and 4) into equation 2) enables the calculation of the required heatsink.

NOTE:— If both halves of the diode are being used (as is assumed above), the value of $R_{th\ j\text{-}mb}$ = 1.6 K/W. If only one half of the diode is used, follow the above procedure for one diode only, and use the value of $R_{th\ j\text{-}mb}$ of 2.6 K/W.

To ensure thermal stability, $(R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h} + R_{th\ h\text{-}a}) \times P_R$ must be less than 12 °C. If the calculated value of $R_{th\ h\text{-}a}$ does not permit this, then it must be reduced (heatsink size increased or $R_{th\ mb\text{-}h}$ improved) to enable this criterion to be met.

EXAMPLE: square-wave operation, using BYV133-35 and heatsink compound;
T_{amb} = 50 °C; δ (diode 1) = 0.5; δ (diode 2) = 0.5;
$I_{F(AV)}$ (diode 1) = 7 A; $I_{F(AV)}$ (diode 2) = 7 A;
V_{RWM} (both diodes) = 12 V; voltage grade of device = 35 V.
From data, $R_{th\ j\text{-}mb}$ = 1.6 K/W and $R_{th\ mb\text{-}h}$ = 0.2 K/W.
For each diode from Fig.4, it is found that P_F = 5.75 W;
hence total P_F = 2 x 5.75 = 11.5 W (from equation 4)
If the desired T_{jmax} is chosen to be 130 °C, then, from Fig.3, P_R (per diode) = 0.06 W
Therefore total P_R = 2 x 0.06 = 0.12 W (from equation 3)
Using equation 2) we have:

$$R_{th\ h\text{-}a} = \frac{130\ ^{\circ}C - 50\ ^{\circ}C}{11.5\ W + 0.12\ W} - (1.6 + 0.2) = 5.1\ K/W$$

To check for thermal stability:

$$(R_{th\ j\text{-}a}) \times P_R = (1.6 + 0.2 + 5.1) \times 0.12 = 0.8\ ^{\circ}C.$$

This is less than 12 °C, hence thermal stability is ensured.

SQUARE WAVE OPERATION (Fig.3 and 4)

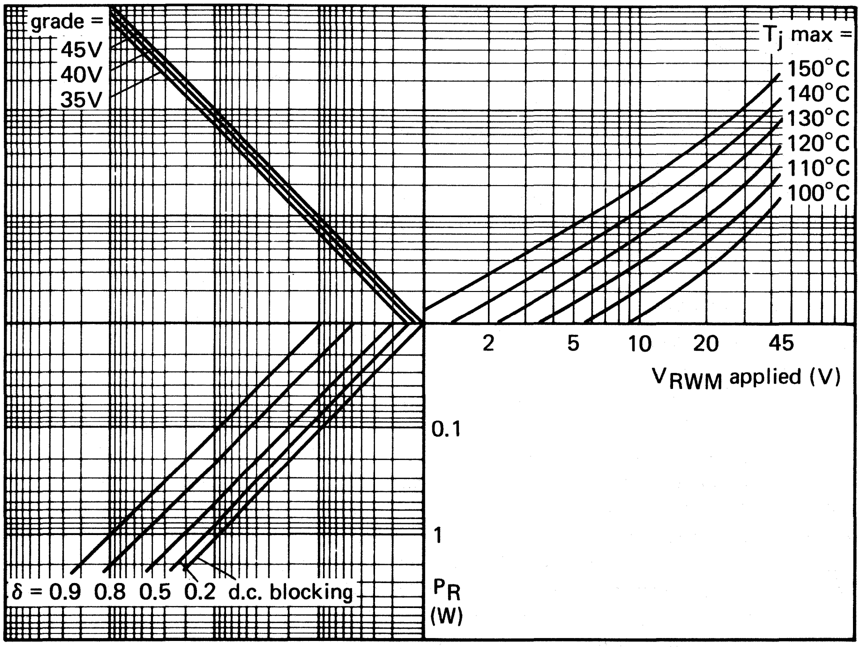
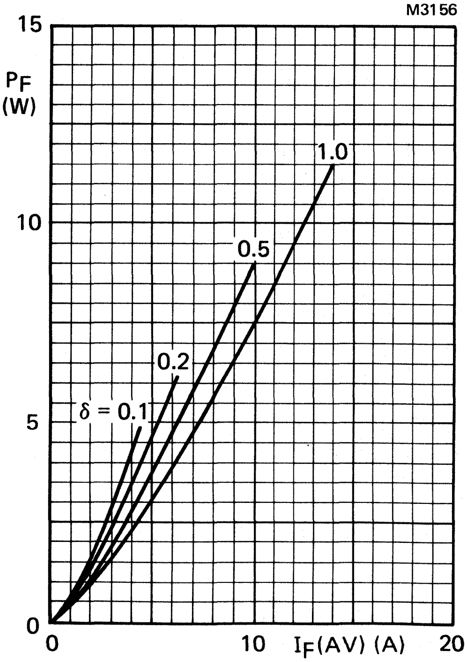
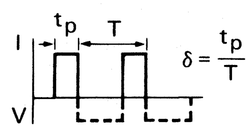


Fig.3 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and duty cycle; per diode.





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

Fig.4 Forward current power rating; per diode.

SINUSOIDAL OPERATION (Figs. 5 and 6)

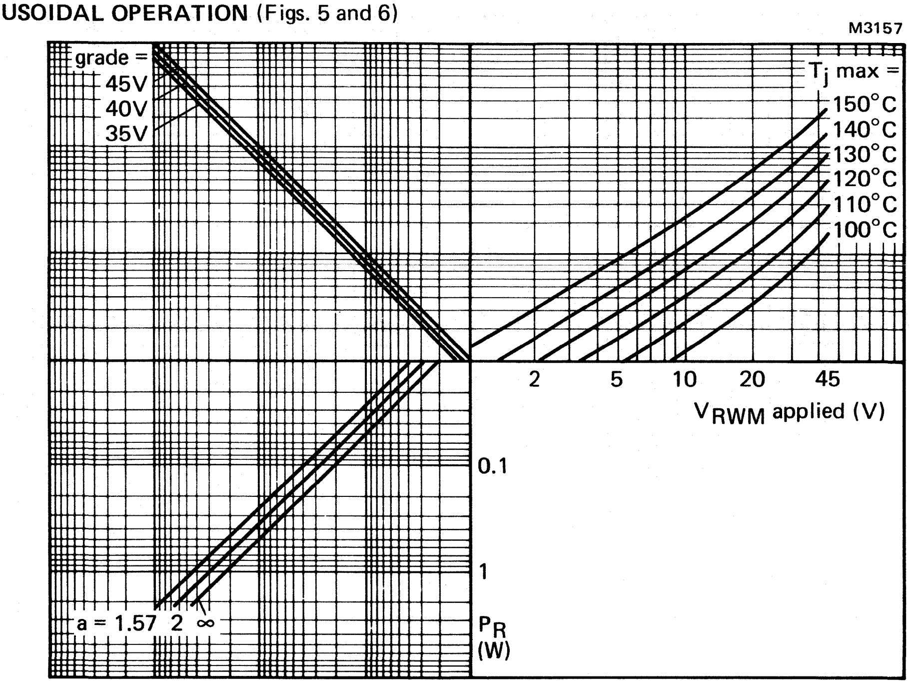


Fig.5 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and form factor; per diode.

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

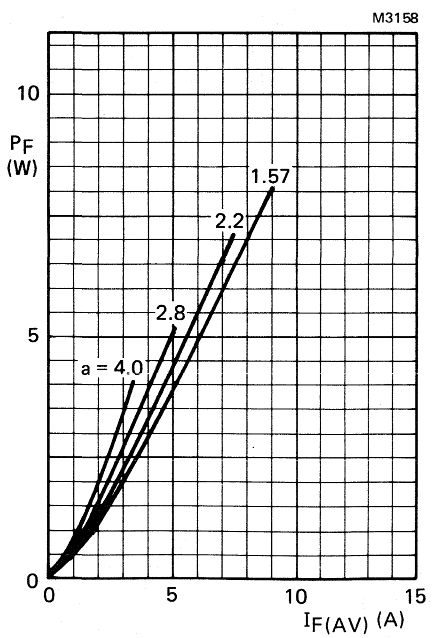


Fig.6 Forward current power rating; per diode.

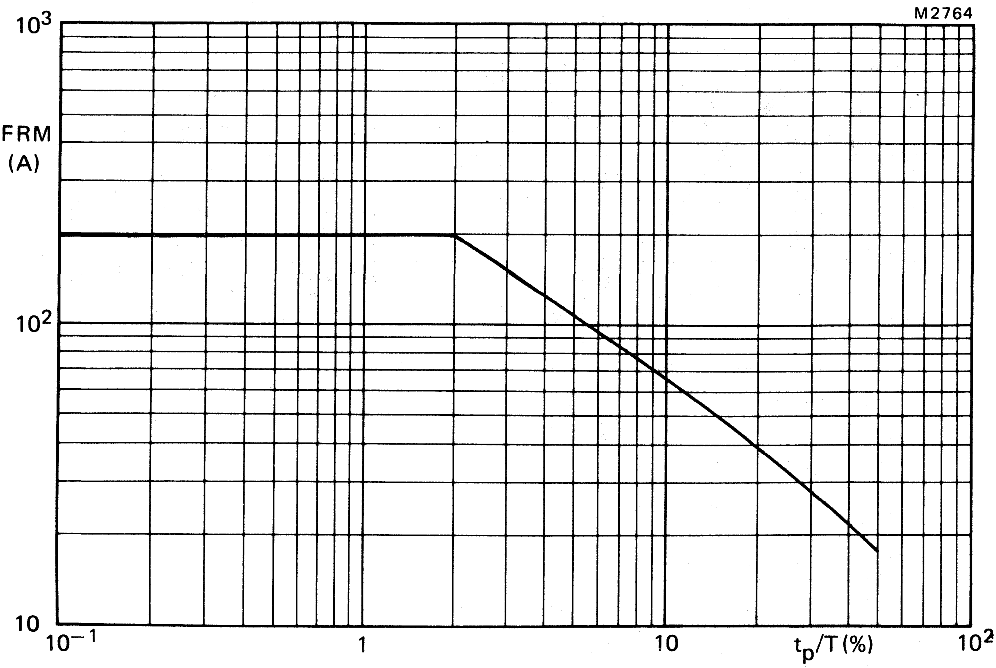
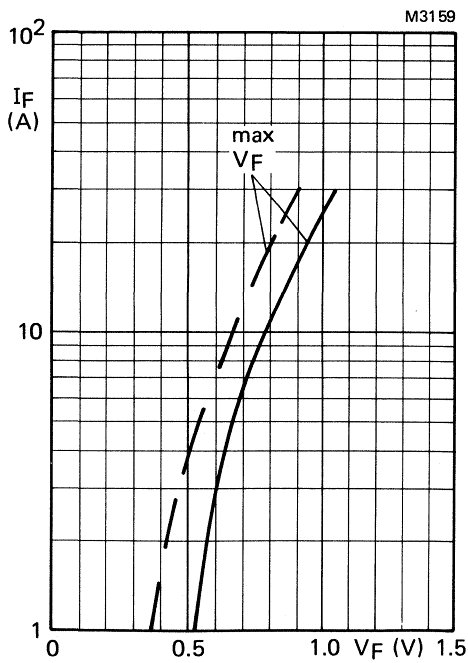
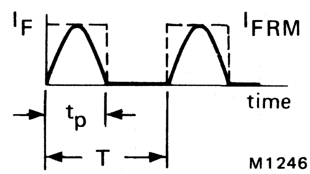


Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal current for 1 $\mu s < t_p < 1$ ms; per diode.





Definition of I_{FRM} and t_p/T.

Fig.8 —— $T_j = 25\ ^oC$; - - - $T_j = 150\ ^oC$; per diode.

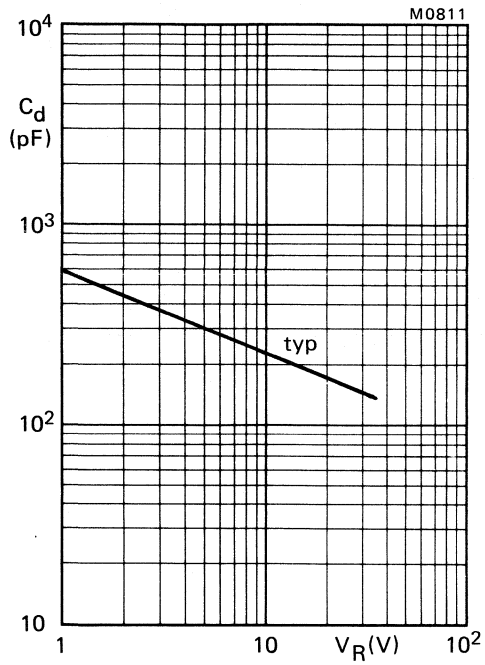


Fig.9 f = 1 MHz; T_j = 25 to 125 °C; per diode.

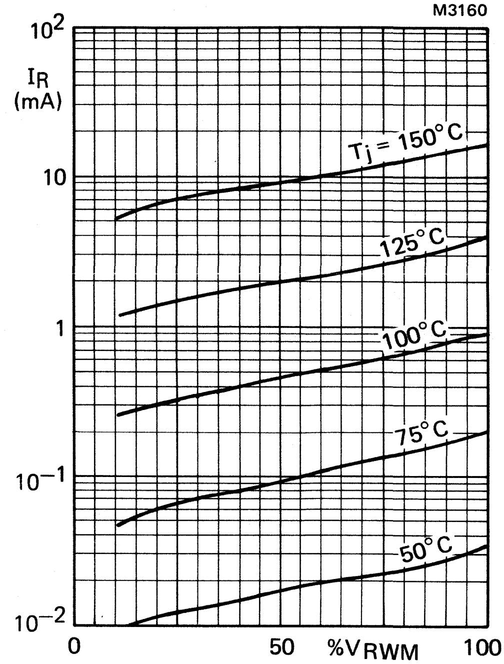


Fig.10 Typical values; per diode.

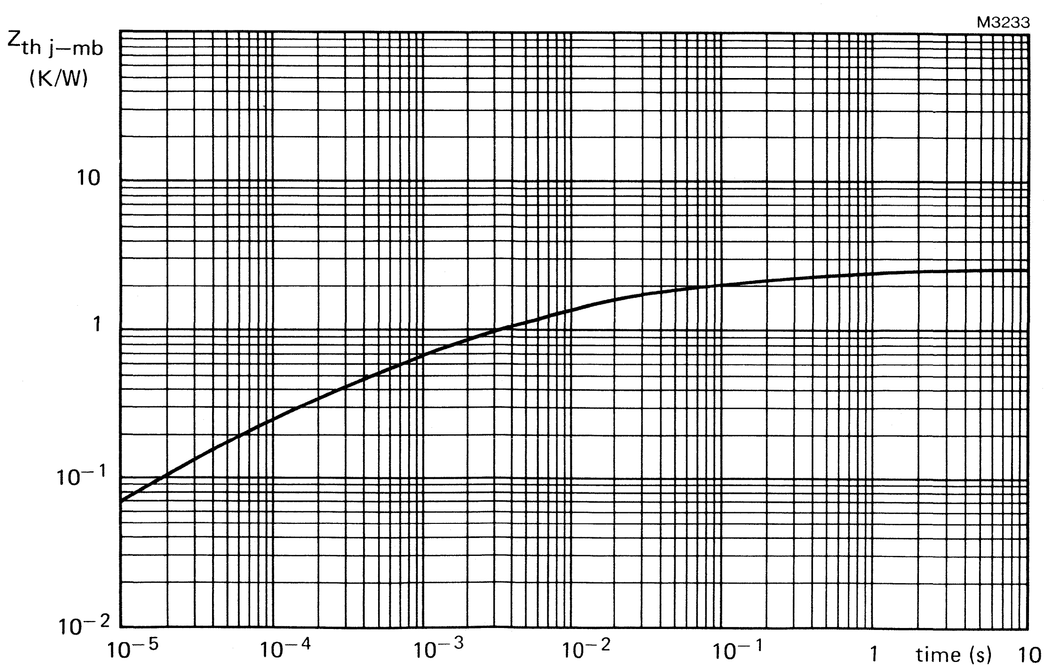


Fig.11 Transient thermal impedance; one diode conducting.

SCHOTTKY-BARRIER ELECTRICALLY-ISOLATED DOUBLE RECTIFIER DIODES

Low-leakage, platinum-barrier double rectifier diodes in SOT-186 (full-pack) plastic envelopes featuring low forward voltage drop, low capacitance and absence of stored charge. 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 switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and absence of stored charge are essential. Their single chip (monolithic) construction allows both diodes to be paralleled without the need for derating. They can also withstand reverse voltage transients and have guaranteed reverse avalanche surge capability. The series consists of common-cathode types;

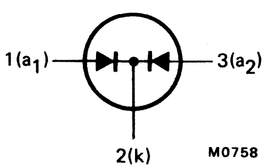
QUICK REFERENCE DATA

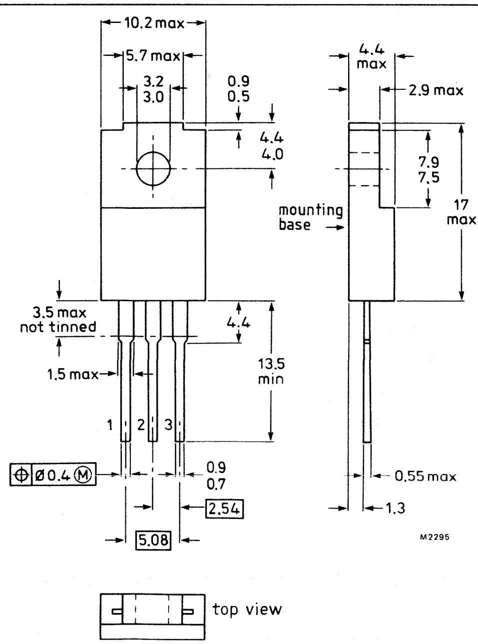
Per diode, unless otherwise stated			BYV133F—35	40	45	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Output current (both diodes conducting)	I_O	max.		20		A
Forward voltage	V_F	<		0.6		V
Junction temperature	T_j	max.		150		°C

MECHANICAL DATA

Dimensions in mm

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





Net mass: 2 g.
The mounting base 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 (IEC 134).

Voltages (per diode)			BYV133F-35	40	45	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Crest working reverse voltage	V_{RWM}	max.	35	40	45	V
Continuous reverse voltage	V_R	max.	35	40	45	V

Currents (both diodes conducting: notes 1 and 3)

Output current:				
square wave; $\delta = 0.5$; up to $T_h = 61\ ^oC$ (note 2)	I_O	max.	20	A
sinusoidal; up to $T_h = 80\ ^oC$ (note 2)	I_O	max.	18	A
RMS forward current	$I_{F(RMS)}$	max.	20	A
Repetitive peak forward current $t_p = 20\ \mu s$; $\delta = 0.02$ (per diode)	I_{FRM}	max.	100	A
Non-repetitive peak forward current (per diode) half sinewave; $T_j = 125\ ^oC$ prior to surge; with reapplied $V_{RWM\ max}$				
$t = 10$ ms	I_{FSM}	max.	100	A
$t = 8.3$ ms	I_{FSM}	max.	110	A
I^2t for fusing ($t = 10$ ms, per diode)	I^2t	max.	50	A^2
Reverse surge current				
$t_p = 2\ \mu s$; $\delta = 0.001$	I_{RRM}	max.	1.0	A
$t_p = 100\ \mu s$	I_{RSM}	max.	1.0	A

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 centre lead to external heatsink (note 4)	C_p	typ.	12	pF

Notes:
1. The limits for both diodes apply whether both diodes conduct simultaneously or on alternate half cycles.
2. Assuming no reverse leakage current losses.
3. The quoted temperatures assume heatsink compound is used.
4. Mounted without heatsink compound and 20 newtons pressure on the centre of the envelope.

CHARACTERISTICS (per diode)

Forward voltage				
$I_F = 7$ A; $T_j = 150$ °C	V_F	<	0.6	V*
$I_F = 20$ A; $T_j = 25$ °C	V_F	<	0.94	V*
Reverse current				
$V_R = V_{RWM\,max}$; $T_j = 125$ °C	I_R	<	15	mA
$V_R = V_{RWM\,max}$; $T_j = 25$ °C	I_R	<	0.1	mA
Junction capacitance at f = 1 MHz				
$V_R = 5$ V; $T_j = 25$ to 125 °C	C_d	typ.	300	pF

THERMAL RESISTANCE

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

a. both diodes conducting:				
with heatsink compound	$R_{th\,j\text{-}h}$	=	5.0	K/W
without heatsink compound	$R_{th\,j\text{-}h}$	=	7.0	K/W
b. per diode:				
with heatsink compound	$R_{th\,j\text{-}h}$	=	6.0	K/W
without heatsink compound	$R_{th\,j\text{-}h}$	=	8.0	K/W

Free-air operation

The quoted value of $R_{th\,j\text{-}h}$ 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	$R_{th\,j\text{-}a}$	=	55	K/W

DEVELOPMENT DATA

*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 mounting base 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.2.

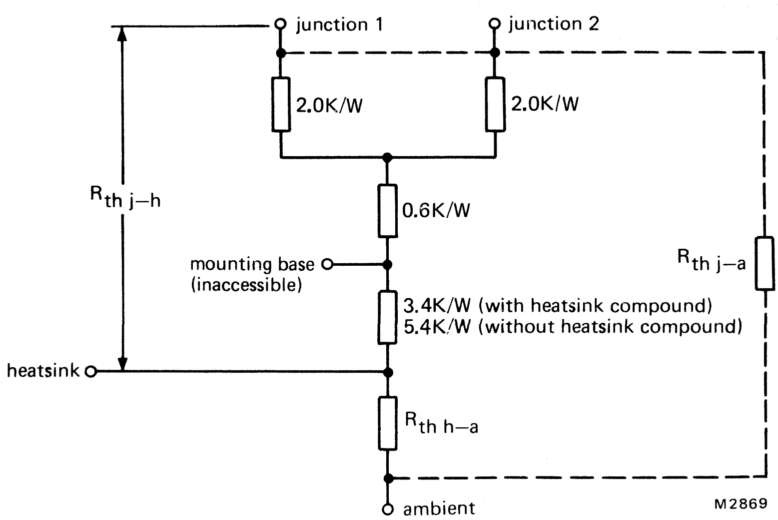


Fig.2

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

OPERATING NOTES

Dissipation and heatsink calculations (continued)

Overall thermal resistance, $R_{th\ j\text{-}a} = R_{th\ j\text{-}h} + R_{th\ h\text{-}a}$

To choose a suitable heatsink, the following information is required for each half of the dual diode:

(i) maximum operating ambient temperature
(ii) duty cycle or form factor of foward current (δ or a)
(iii) average forward current per diode
(iv) crest working reverse voltage (V_{RWM})

The total power dissipation in the diode has two components:

P_R — reverse leakage dissipation
P_F — forward conduction dissipation

$$P_{tot} = P_R + P_F \quad \text{1).}$$

From the above it can be seen that:

$$R_{th\ h\text{-}a} = \frac{T_{jmax} - T_{amb}}{P_F + P_R} - (R_{th\ j\text{-}h}) \quad \text{2).}$$

The value of $R_{th\ j\text{-}h}$ can be found under Thermal Resistance and will depend upon whether or not heatsink compound is used. P_R and P_F are derived from Figs.3 and 4 for square-wave operation (and Figs.5 and 6 for sinewave) as follows:

Look at each half of the dual diode separately; for each diode, starting at the V_{RWM} axis of Fig.3 (or Fig.5), and from a knowledge of the required V_{RWM}, trace upwards to meet the curve that matches the required T_{jmax}. From this point trace horizontally left until the curve of the voltage grade of the device being used is met. From this point trace downwards to meet the required duty cycle (δ) or form factor (a). From this point trace right and read the actual reverse power dissipation on the P_R axis.

From this calculation, $P_R = P_R$ (diode 1) + P_R (diode 2) . . . . 3).

Forward conduction dissipation (P_F) for the known average current $I_{F(AV)}$ and duty cycle (or form factor) for each diode is easily derived from Fig.4 (or Fig.6).

Similarly, $P_F = P_F$ (diode 1) + P_F (diode 2) . . . . 4).

Substituting equations 3) and 4) into equation 2) enables the calculation of the required heatsink.

NOTE:— If both halves of the diode are being used (as is assumed above), the value of $R_{th\ j\text{-}h}$ = 5 K/W (with heatsink compound) or 7 K/W (without heatsink compound).

If only one half of the diode is used, follow the above procedure for one diode only, and use the value of $R_{th\ j\text{-}h}$ of 6 K/W (with heatsink compound) or 8 K/W (without heasink compound).

To ensure thermal stability, $(R_{th\ j\text{-}h} + R_{th\ h\text{-}a}) \times P_R$ must be less than 12 °C. If the calculated value of $R_{th\ h\text{-}a}$ does not permit this, then it must be reduced (heatsink size increased or $R_{th\ j\text{-}a}$ improved) to enable this criterion to be met.

EXAMPLE: square wave operation, using BYV133F—35 and heatsink compound;

T_{amb} = 40 °C; δ (diode 1) = 0.5; δ (diode 2) = 0.5;
$I_{F(AV)}$ (diode 1) = 7 A; $I_{F(AV)}$ (diode 2) = 7 A;
V_{RWM} (both diodes) =12 V; voltage grade of device = 35 V.
From data, $R_{th\ j\text{-}h}$ = 5 K/W.
For each diode from Fig.4, it is found that P_F = 5.75 W;
hence total $P_F = 2 \times 5.75 = 11.5$ W. (from equation 4)
If the desired T_{jmax} is chosen to be 130 °C, then, from Fig.3, P_R (per diode) = 0.06 W.
Therefore total $P_R = 2 \times 0.06 = 0.12$ W. (from equation 3)
Using equation 2) we have:

$$R_{th\ h\text{-}a} = \frac{130\ ^{\circ}C - 40\ ^{\circ}C}{11.5\ W + 0.12\ W} - (5.0) = 2.7\ K/W$$

To check for thermal stability:

$$(R_{th\ j\text{-}a}) \times P_R = (5.0 + 2.7) \times 0.12 = 0.9\ ^{\circ}C.$$

This is less than 12 °C, hence thermal stability is ensured.

DEVELOPMENT DATA

SQUARE-WAVE OPERATION (Figs.3 and 4)

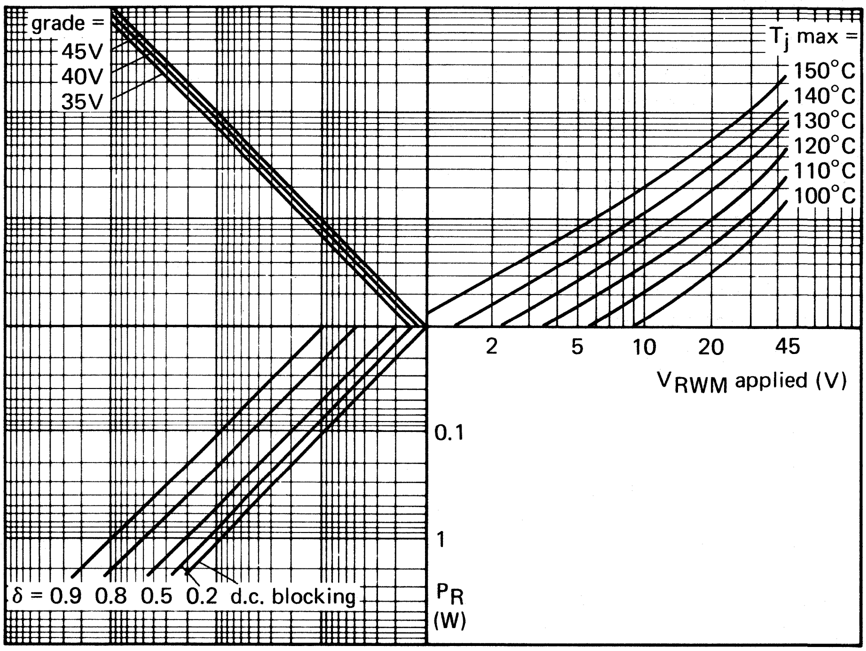
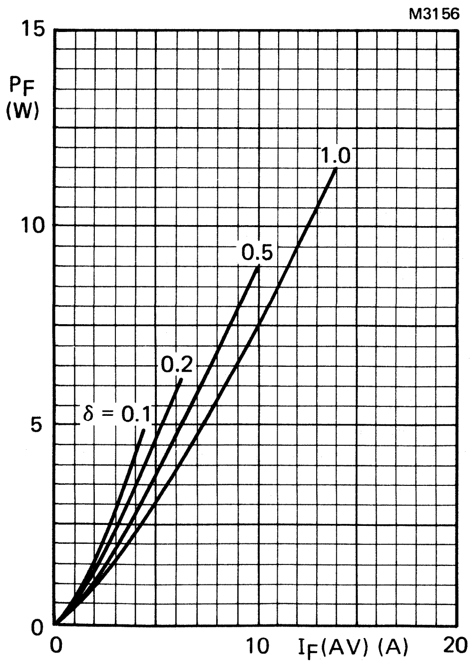
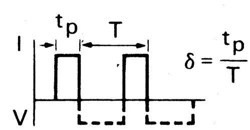


Fig.3 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and duty cycle (per diode).





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

Fig.4 Foward current power rating (per diode).

SINUSOIDAL OPERATION (Figs.5 and 6)

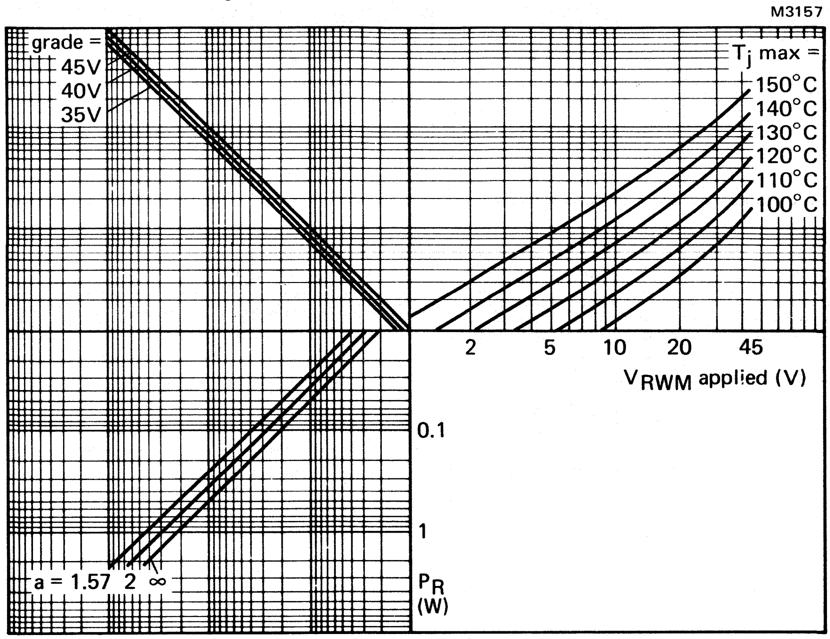


Fig.5 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and form factor; per diode.

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

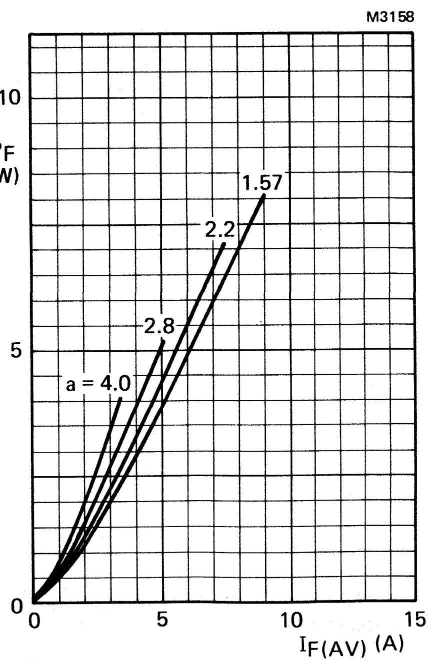


Fig.6 Foward current power rating; per diode.

DEVELOPMENT DATA

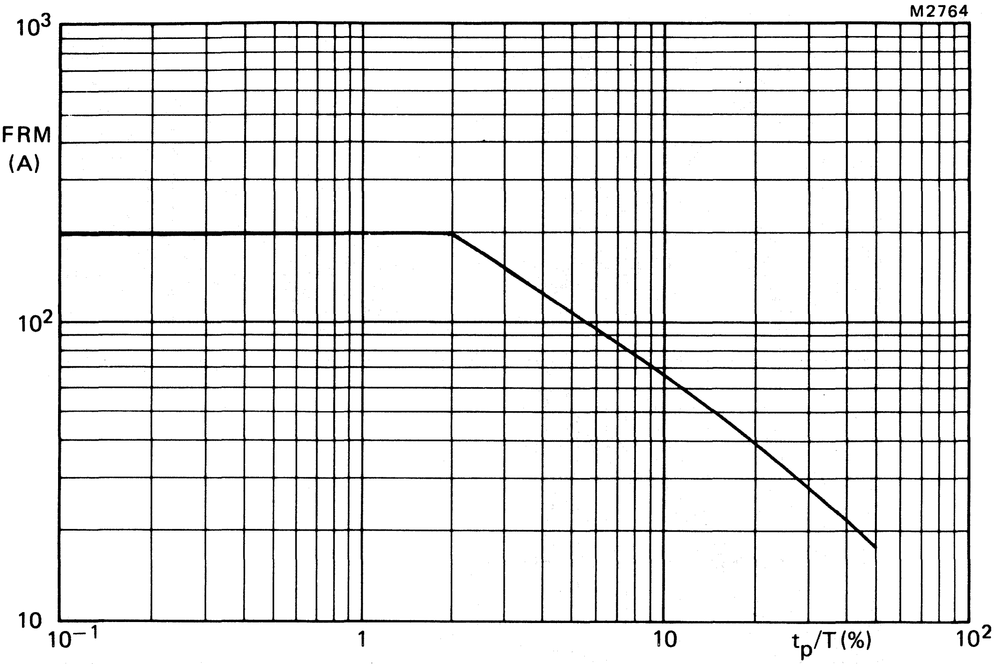
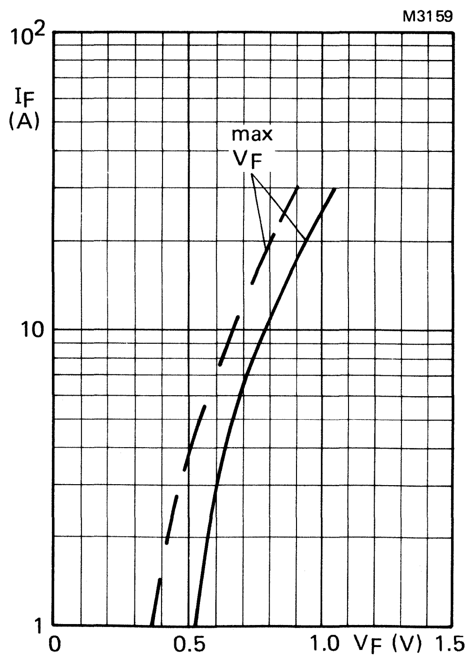
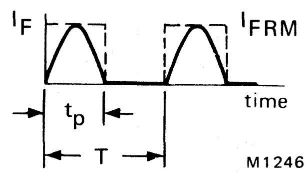


Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 $\mu s < t_p <$ 1 ms; per diode.





Definition of I_{FRM} and t_p/T.

Fig.8 —— T_j = 25 °C; – – – T_j = 150 °C; per diode.

DEVELOPMENT DATA

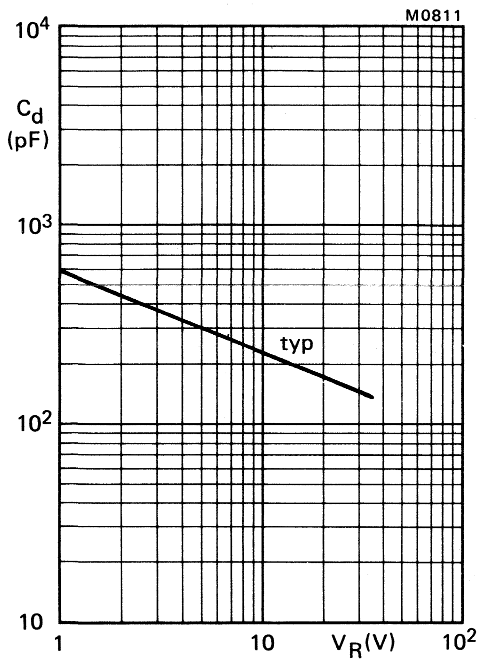


Fig.9 f = 1 MHz; T_j = 125 °C; per diode.

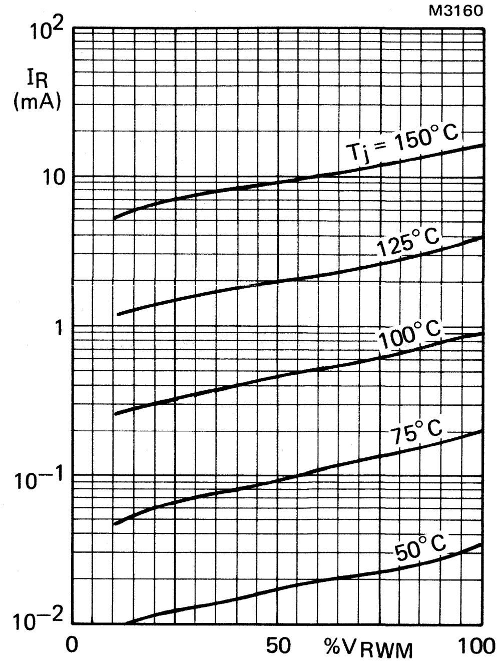


Fig.10 Typical values; per diode.

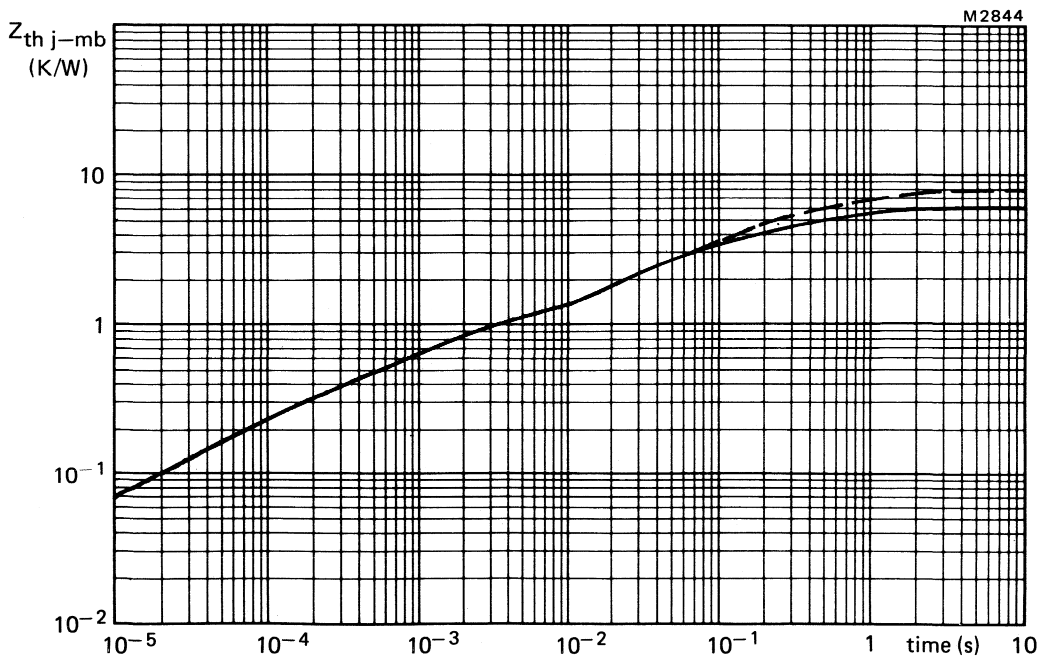


Fig.11 Transient thermal impedance; one diode conducting; —— with heatsink compound; – – – without heatsink compound.

SCHOTTKY–BARRIER DOUBLE RECTIFIER DIODES

Low-leakage, platinum-barrier double rectifier diodes in plastic envelopes featuring low forward voltage drop, low capacitance and absence of stored charge. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and zero switching losses are essential. Their single chip (monolithic) construction allows both diodes to be paralleled without the need for derating. They can also withstand reverse voltage transients and have guaranteed reverse avalanche surge capability. The series consists of common-cathode types.

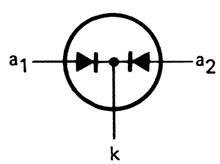
QUICK REFERENCE DATA

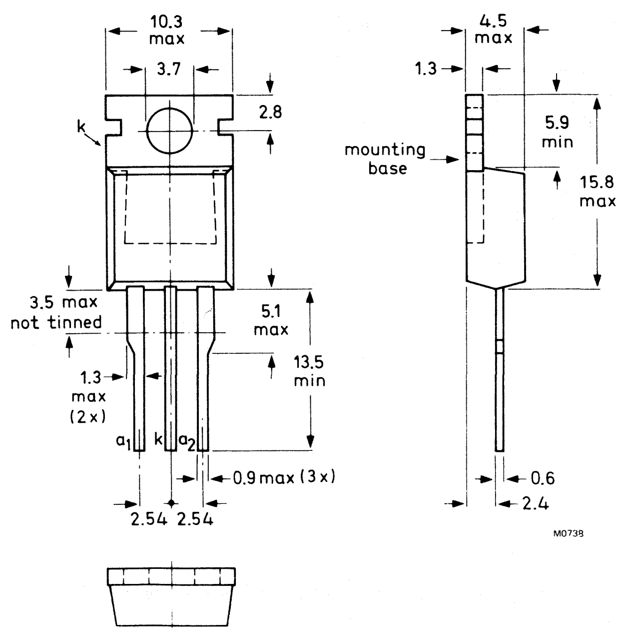
Per diode, unless otherwise stated			BYV143–35	40	45	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Output current (both diodes conducting)	I_O	max.		30		A
Forward voltage	V_F	<		0.6		V
Junction temperature	T_j	max.		150		°C

MECHANICAL DATA

Dimensions in mm

Fig. 1 TO-220AB.





Net mass: 2 g.

Note: the exposed metal mounting base is directly connected to the common cathode.

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

RATINGS

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

			BYV143-35	40	45	
Voltages (per diode)						
Repetitive peak reverse voltage	V_{RRM}		35	40	45	V
Crest working reverse voltage	V_{RWM}		35	40	45	V
Continuous reverse voltage	V_R		35	40	45	V

Currents (both diodes conducting: note 1)

Output current: square wave; $\delta = 0.5$; up to $T_{mb} = 116\ ^oC$ (note 2)	I_O	max.	30	A
sinusoidal; up to $T_{mb} = 120\ ^oC$ (note 2)	I_O	max.	26	A
RMS forward current (note 3)	$I_{F(RMS)}$	max.	40	A
Repetitive peak forward current $t_p = 20\ \mu s$; $\delta = 0.02$ (per diode)	I_{FRM}	max.	250	A
Non-repetitive peak forward current (per diode) half sinewave ; $T_j = 125\ ^oC$ prior to surge; with reapplied $V_{RWM\ max}$ $t = 10$ ms	I_{FSM}	max.	200	A
$t = 8.3$ ms	I_{FSM}	max.	220	A
I^2t for fusing ($t = 10$ ms, per diode)	I^2t	max.	200	A^2s
Reverse surge current $t_p = 2\ \mu s$; $\delta = 0.001$	I_{RRM}	max.	2.0	A
$t_p = 100\ \mu s$	I_{RSM}	max.	2.0	A

Temperatures

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

Notes:
1. The limits for both diodes apply whether both diodes conduct simultaneously or on alternate half cycles.
2. Assuming no reverse leakage current losses.
3. For output currents in excess of 20 A RMS , connection should be made to the exposed metal mounting base.

CHARACTERISTICS (per diode)

Forward voltage				
$I_F = 15$ A; $T_j = 150\ ^oC$	V_F	<	0.6	V*
$I_F = 20$ A; $T_j = 25\ ^oC$	V_F	<	0.77	V*
Reverse current				
$V_R = V_{RWM\ max}$; $T_j = 125\ ^oC$	I_R	<	30	mA
$V_R = V_{RWM\ max}$; $T_j = 25\ ^oC$	I_R	<	200	μA
Junction capacitance at f = 1 MHz				
$V_R = 5$ V; $T_j = 25$ to $125\ ^oC$	C_d	typ.	500	pF

THERMAL RESISTANCE

From junction to mounting base (both diodes conducting)	$R_{th\ j\text{-}mb}$	=	1.4	K/W
From junction to mounting base (per diode)	$R_{th\ j\text{-}mb}$	=	2.3	K/W

Influence of mounting method

1. Heatsink mounted with clip

Thermal resistance from mounting base to heatsink

a. with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.2	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 insulator (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 value 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 device lead length and with copper laminate on the board.	$R_{th\ j\text{-}a}$	=	60	K/W

*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 holes.

OPERATING NOTES

Dissipation and heatsink calculations.

The various components of junction temperature rise above ambient are illustrated in Fig.2.

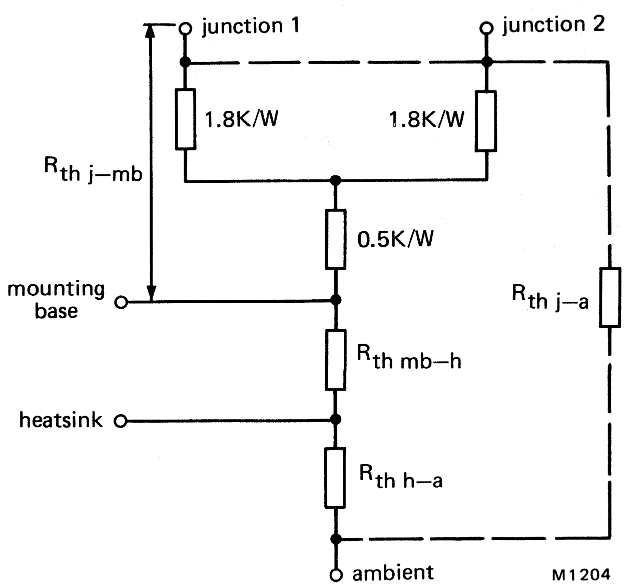


Fig.2.

OPERATING NOTES

Dissipation and heatsink calculations (continued)

Overall thermal resistance, $R_{th\ j\text{-}a} = R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h} + R_{th\ h\text{-}a}$

To choose a suitable heatsink, the following information is required for each half of the dual diode:

(i) maximum operating ambient temperature
(ii) duty cycle of forward current (δ)
(iii) average forward current per diode
(iv) crest working reverse voltage (V_{RWM})

The total power dissipation in the diode has two components:

P_R — reverse leakage dissipation

$$P_{tot} = P_R + P_F \quad \text{1).}$$

P_F — forward conduction dissipation

From the above it can be seen that:

$$R_{th\ h\text{-}a} = \frac{T_{jmax} - T_{amb}}{P_F + P_R} - (R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h}) \quad \text{2).}$$

Values for $R_{th\ j\text{-}mb}$ and $R_{th\ mb\text{-}h}$ can be found under Thermal Resistance. P_R and P_F are derived from Figs.3 and 4 as follows:

Look at each half of the dual diode separately; for each diode, starting at the V_{RWM} axis of Fig.3, and from a knowledge of the required V_{RWM}, trace upwards to meet the curve that matches the required T_{jmax}. From this point trace horizontally left until the curve of the voltage grade of the device being used is met. From this point trace downwards to meet the required duty cycle (δ). From this point trace right and read the actual reverse power dissipation on the P_R axis.

From this calculation, $P_R = P_R$ (diode 1) + P_R (diode 2) .... 3).

Foward conduction dissipation (P_F) for the known average current $I_{F(AV)}$ and duty cycle for each diode is easily derived from Fig.4.

Similarly, $P_F = P_F$ (diode 1) + P_F (diode 2) .... 4).

Substituting equations 3) and 4) into equation 2) enables the calculation of the required heatsink.

NOTE:— If both halves of the diode are being used (as is assumed above), the value of $R_{th\ j\text{-}mb}$ = 1.4 K/W. If only one half of the diode is used, follow the above procedure for one diode only, and use the value of $R_{th\ j\text{-}mb}$ of 2.3 K/W.

To ensure thermal stability, $(R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h} + R_{th\ h\text{-}a}) \times P_R$ must be less than 12 °C. If the calculated value of $R_{th\ h\text{-}a}$ does not permit this, then it must be reduced (heatsink size increased or $R_{th\ mb\text{-}h}$ improved) to enable this criterion to be met.

EXAMPLE: square-wave operation, using BYV143-35 and heatsink compound;
T_{amb} = 50 °C; δ (diode 1) = 0.5; δ (diode 2) = 0.5;
$I_{F(AV)}$ (diode 1) = 12 A; $I_{F(AV)}$ (diode 2) = 12 A;
V_{RWM} (both diodes) = 12 V; voltage grade of device = 35 V.
From data, $R_{th\ j\text{-}mb}$ = 1.4 K/W and $R_{th\ mb\text{-}h}$ = 0.2 K/W.
For each diode from Fig.4, it is found that P_F = 8.9 W;
hence total P_F = 2 x 8.9 = 17.8 W (from equation 4)
If the desired T_{jmax} is chosen to be 130 °C, then, from Fig.3, P_R (per diode) = 0.13 W
Therefore total P_R = 2 x 0.13 = 0.26 W (from equation 3)
Using equation 2) we have:

$$R_{th\ h\text{-}a} = \frac{130\ ^{o}C - 50\ ^{o}C}{17.8\ W + 0.26\ W} - (1.4 + 0.2) = 2.8\ K/W$$

To check for thermal stability:

$$(R_{th\ j\text{-}a}) \times P_R = (1.4 + 0.2 + 2.8) \times 0.26 = 1.1\ ^{o}C.$$

This is less than 12 °C, hence thermal stability is ensured.

SQUARE WAVE OPERATION (Fig.3 and 4)

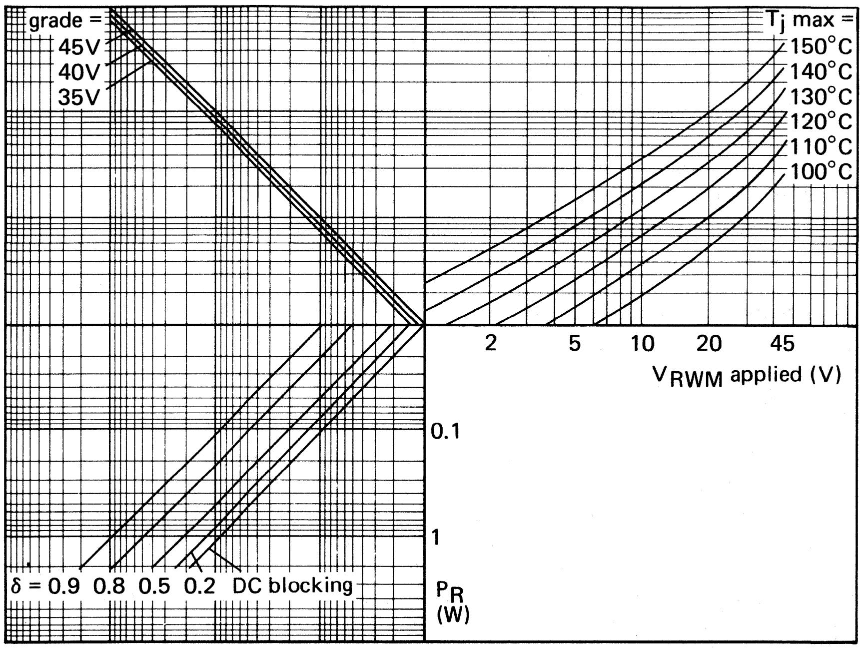


Fig.3 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and duty cycle; per diode.

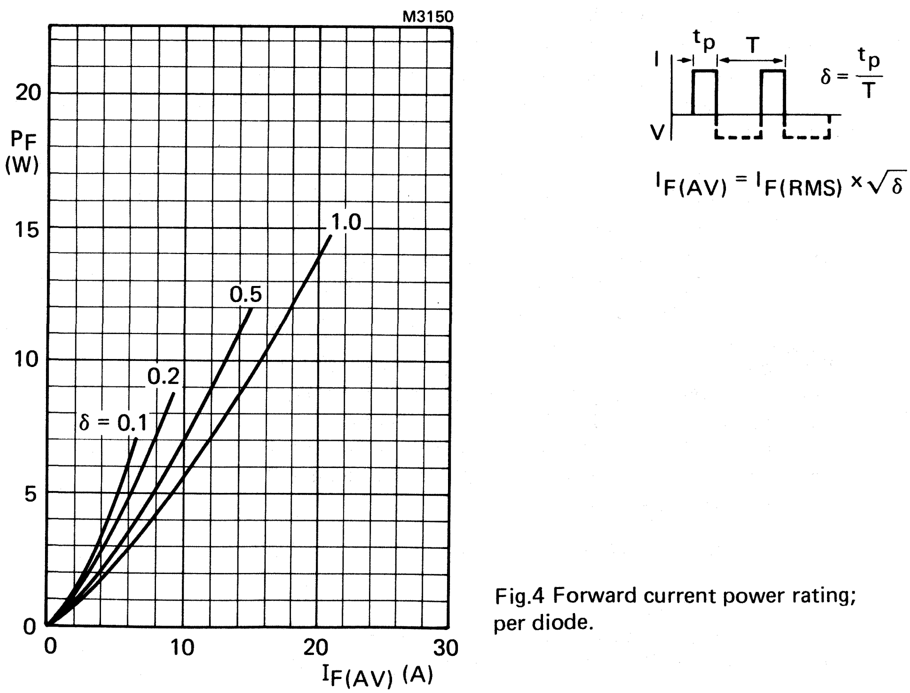


Fig.4 Forward current power rating; per diode.

SINUSOIDAL OPERATION (Figs. 5 and 6)

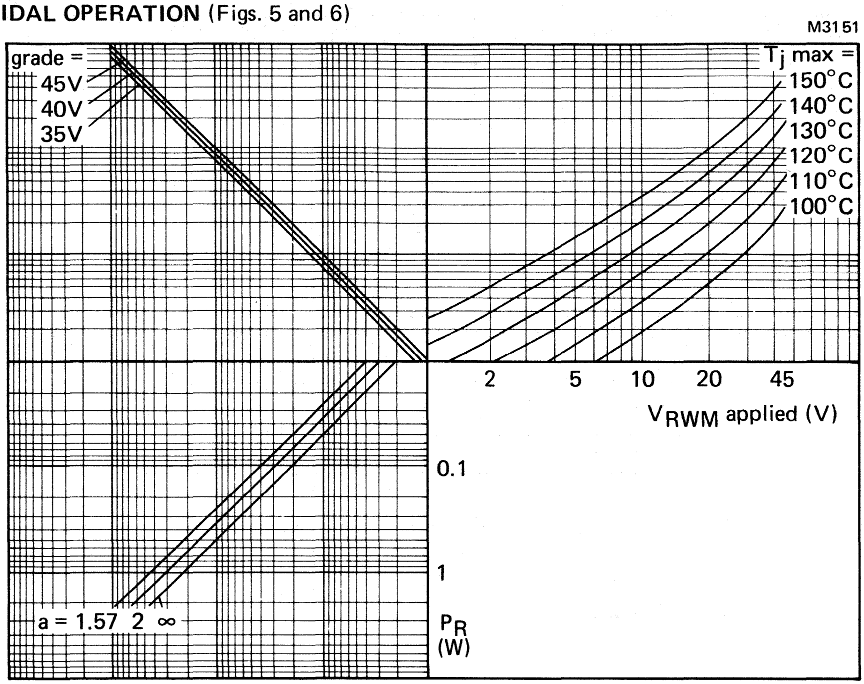


Fig.5 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and form factor; per diode.

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

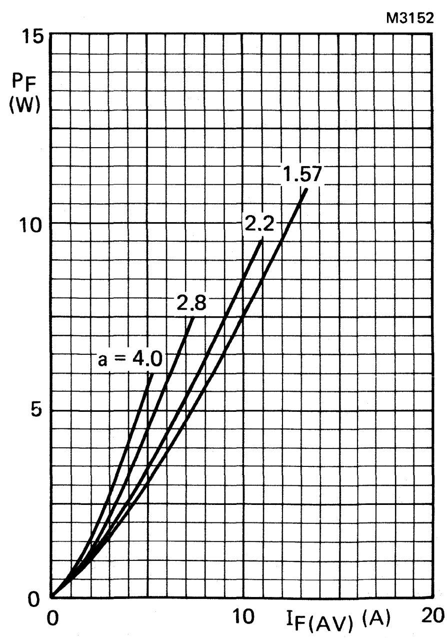


Fig.6 Forward current power rating; per diode.

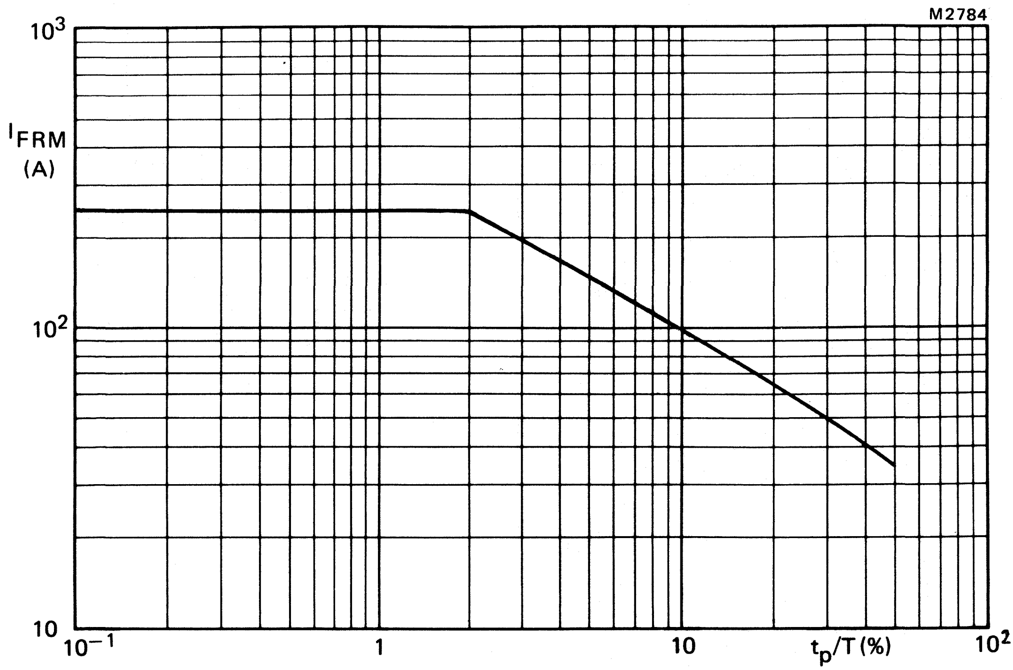
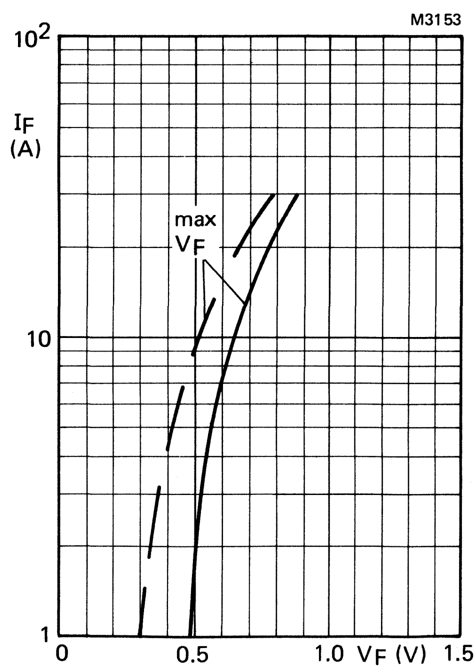
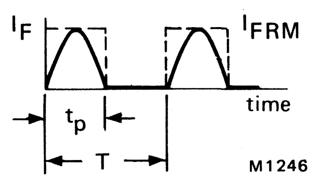


Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal current for $1\ \mu s < t_p < 1$ ms; per diode.





Definition of I_{FRM} and t_p/T.

Fig.8 —— T_j = 25 °C; – – – T_j = 150 °C; per diode.

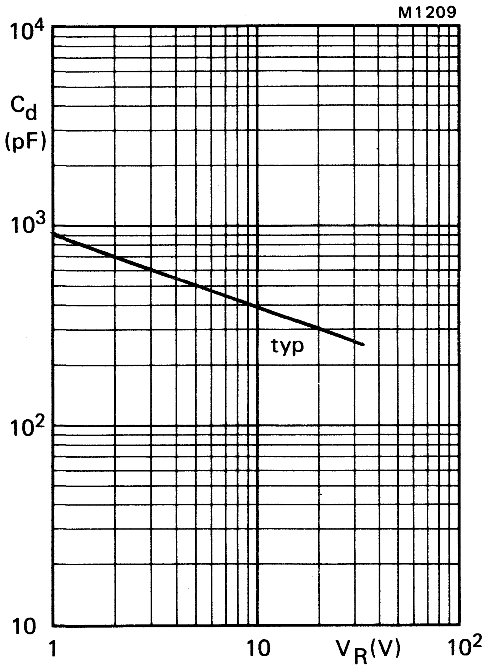


Fig.9 f = 1 MHz; T_j = 25 to 125 °C; per diode.

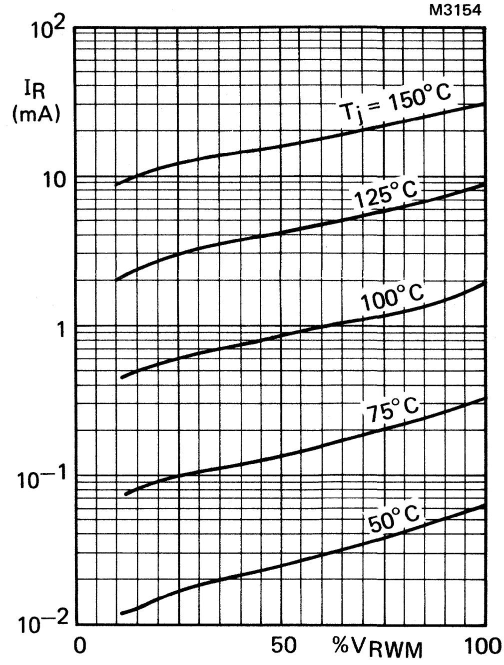


Fig.10 Typical values; per diode.

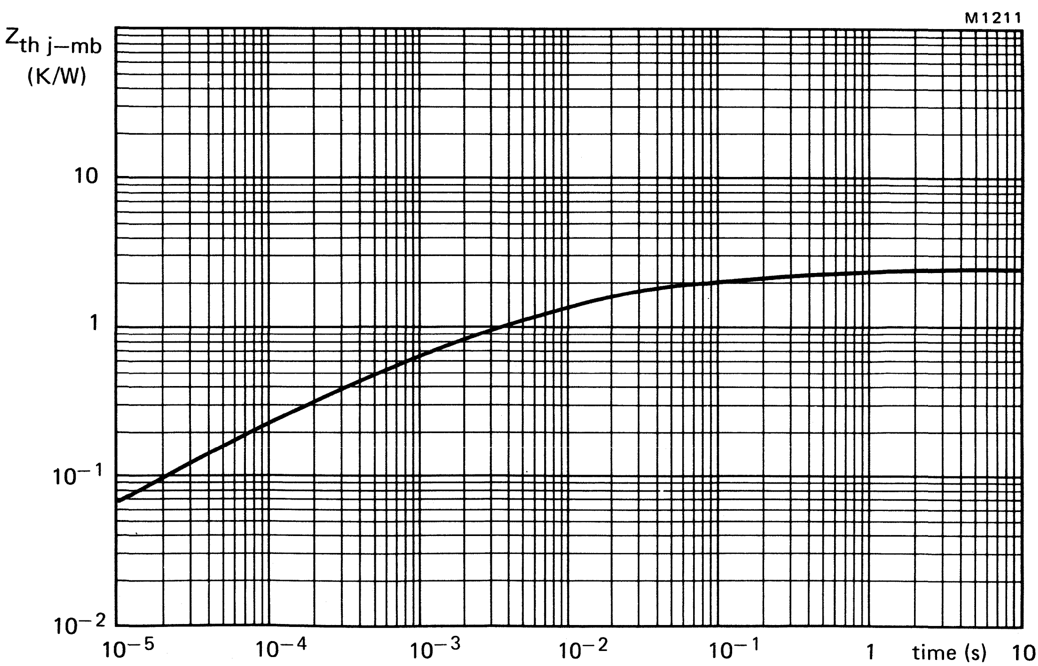


Fig.11 Transient thermal impedance; one diode conducting.

SCHOTTKY-BARRIER, ELECTRICALLY-ISOLATED DOUBLE RECTIFIER DIODES

Low-leakage platinum-barrier double rectifier diodes in SOT-186 (full-pack) plastic envelopes featuring low forward voltage drop, low capacitance and absence of stored charge. 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 switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and absence of stored charge are essential. Their single chip (monolithic) construction allows both diodes to be paralleled without the need for derating. They can also withstand reverse voltage transients and have guaranteed reverse avalanche surge capability. The series consists of common-cathode types.

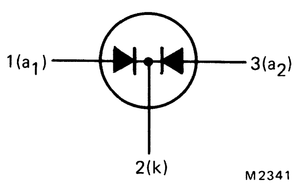
QUICK REFERENCE DATA

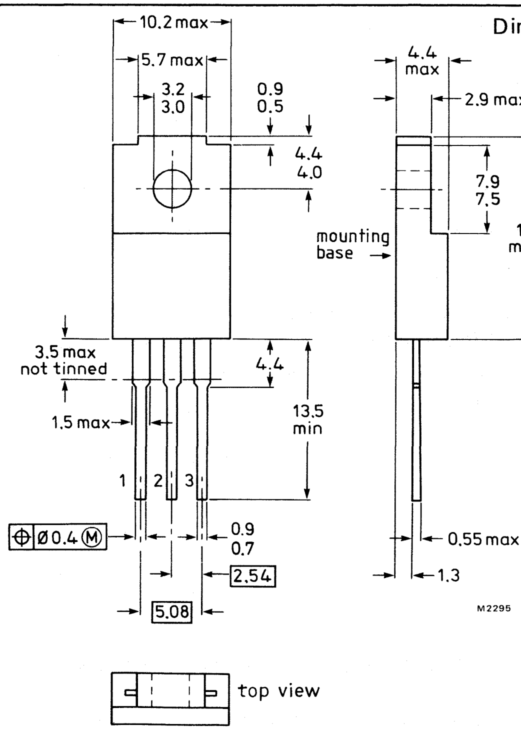
Per diode, unless otherwise stated			BYV143F–35	40	45	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Output current (both diodes conducting)	I_O	max.		20		A
Forward voltage	V_F	<		0.6		V
Junction temperature	T_j	max.		150		°C

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-186.





Net mass: 2 g.
The mounting base 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 (per diode)			BYV143F–35	40	45	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Crest working reverse voltage	V_{RWM}	max.	35	40	45	V
Continuous reverse voltage	V_R	max.	35	40	45	V

Currents (both diodes conducting; notes 1 and 3)

Output current: square wave; δ = 0.5; up to T_h = 84 °C (note 2)	I_O	max.	20	A
sinusoidal; up to T_h = 90 °C (note 2)	I_O	max.	18	A
RMS forward current	$I_{F(RMS)}$	max.	20	A
Repetitive peak forward current t_p = 20 μs; δ = 0.02 (per diode)	I_{FRM}	max.	250	A
Non-repetitive peak forward current (per diode) half sinewave; T_j = 125 °C prior to surge; with reapplied $V_{RWM\ max}$ t = 10 ms	I_{FSM}	max.	200	A
t = 8.3 ms	I_{FSM}	max.	220	A
I^2t for fusing (t = 10 ms; per diode)	I^2t	max.	200	A^2s
Reverse surge current t_p = 2 μs; δ = 0.001	I_{RRM}	max.	2.0	A
t_p = 100 μs	I_{RSM}	max.	2.0	A

Temperatures

Storage temperature	T_{stg}		–40 to +150	°C
Junction temperature	T_j	max.	150	°C

ISOLATION

Peak isolation voltage from all terminals to external heatsink (note 4)	$V_{(isol)M}$	max.	1500	V
Isolation capacitance between all terminals and external heatsink (note 4)	$C_{(isol)}$	typ.	12	pF

Notes:

1. The limits for both diodes apply whether both diodes conduct simultaneously or on alternate half cycles.
2. Assuming no reverse leakage current losses.
3. The quoted temperatures assume heatsink compound is used.
4. Mounted without heatsink compound and 20 newtons pressure on the centre of the envelope. Repetitive peak operation with RH ⩽ 65% under clean and dust-free conditions.

CHARACTERISTICS (per diode)

Forward voltage				
I_F = 15 A; T_j = 150 °C	V_F	<	0.6	V*
I_F = 20 A; T_j = 25 °C	V_F	<	0.77	V*
Reverse current				
$V_R = V_{RWM\ max}$; T_j = 125 °C	I_R	<	30	mA
$V_R = V_{RWM\ max}$; T_j = 25 °C	I_R	<	0.2	mA
Junction capacitance at f = 1 MHz				
V_R = 5 V; T_j = 25 to 125 °C	C_d	typ.	500	pF

THERMAL RESISTANCE

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

a. both diodes conducting with heatsink compound	$R_{th\ j\text{-}h}$	=	4.8	K/W
b. per diode with heatsink compound	$R_{th\ j\text{-}h}$	=	5.7	K/W

Free air operation

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

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

*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 ^{o}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 mounting base 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.2.

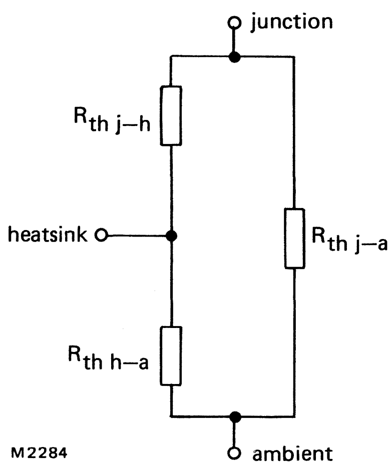


Fig.2.

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

FAST SOFT-RECOVERY RECTIFIER DIODES

Fast soft-recovery diodes in DO-5 metal envelopes especially suitable for operation as main and commutating diodes in 3-phase a.c. motor speed control inverters and in high frequency power supplies in general.
The series consists of the following types:
Normal polarity (cathode to stud): BYW25–800 and BYW25–1000.
Reverse polarity (anode to stud): BYW25–800R and BYW25–1000R.

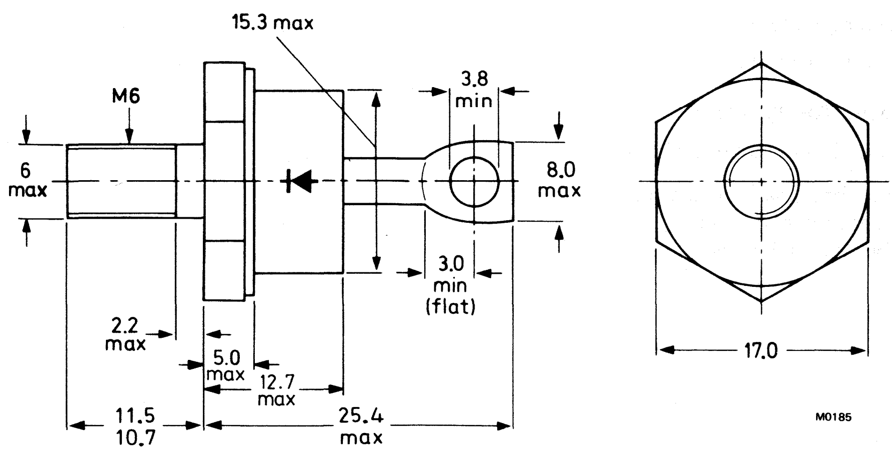
QUICK REFERENCE DATA

			BYW25–800(R)	1000(R)	
Repetitive peak reverse voltage	V_{RRM}	max.	800	1000	V
Average forward current	$I_{F(AV)}$	max.	40		A
Repetitive peak forward current	I_{FRM}	max.	600		A
Reverse recovery time	t_{rr}	<	450		ns

MECHANICAL DATA

Dimensions in mm

Fig.1 DO-5: with metric M6 stud (ϕ6 mm)



Net mass: 22 g
Diameter of clearance hole: max. 6.5 mm
Accessories supplied on request:
see ACCESSORIES section
The mark shown applies to normal polarity types.

Supplied with device: 1 nut, 1 lock washer
Torque on nut: min. 1.7 Nm (17 kg cm)
max. 3.5 Nm (35 kg cm)
Nut dimensions across the flats: 10 mm

RATINGS

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

Voltages*

			BYW25–800(R)	1000(R)	
Non-repetitive peak reverse voltage	V_{RSM}	max.	1000	1200	V
Repetitive peak reverse voltage	V_{RRM}	max.	800	1000	V
Crest working reverse voltage	V_{RWM}	max.	650	850	V
Continuous reverse voltage	V_R	max.	650	850	V

Currents

Average forward current; switching losses negligible up to 20 kHz				
sinusoidal; up to T_{mb} = 100 °C	$I_{F(AV)}$	max.	40	A
sinusoidal; at T_{mb} = 125 °C	$I_{F(AV)}$	max.	23	A
R.M.S. forward current	$I_{F(RMS)}$	max.	60	A
Repetitive peak forward current	I_{FRM}	max.	600	A
Non-repetitive peak forward current; t = 10 ms; half sine-wave; T_j = 150 °C prior to surge	I_{FSM}	max.	550	A
I^2t for fusing (t = 10 ms)	I^2t	max.	1500	A^2s

Temperatures

Storage temperature	T_{stg}		−55 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	0.6	°C/W
From mounting base to heatsink				
with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.3	°C/W
without heatsink compound	$R_{th\ mb\text{-}h}$	=	0.5	°C/W

*To ensure thermal stability: $R_{th\ j\text{-}a} \leq 1$ °C/W (continuous reverse voltage).

CHARACTERISTICS

Forward voltage			
I_F = 35 A; T_j = 25 °C	V_F	<	1,55 V *
I_F = 150 A; T_j = 25 °C	V_F	<	2,25 V *
Reverse current			
V_R = 650 V; T_j = 125 °C	I_R	<	7 mA
Reverse recovery when switched from			
I_F = 10 A to V_R = 30 V with $-dI_F/dt$ = 50 A/µs; T_j = 25 °C			
Recovery time	t_{rr}	<	450 ns
I_F = 600 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 70 A/µs; T_{mb} = 85 °C			
Recovery time	t_{rr}	<	1 µs
Maximum slope of the reverse recovery current			
when switched from I_F = 600 A to $V_R \geq$ 30 V;			
with $-dI_F/dt$ = 35 A/µs; T_j = 25 °C	$\|dI_R/dt\|$	<	100 A/µs

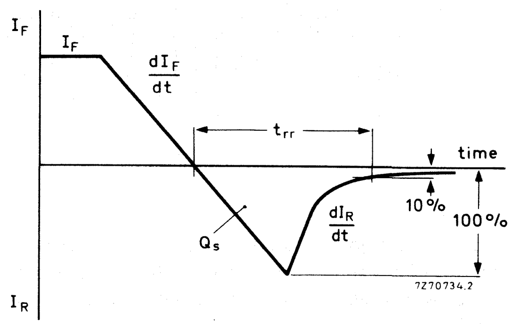


Fig. 2 Definitions of Q_s, t_{rr} and dI_R/dt.

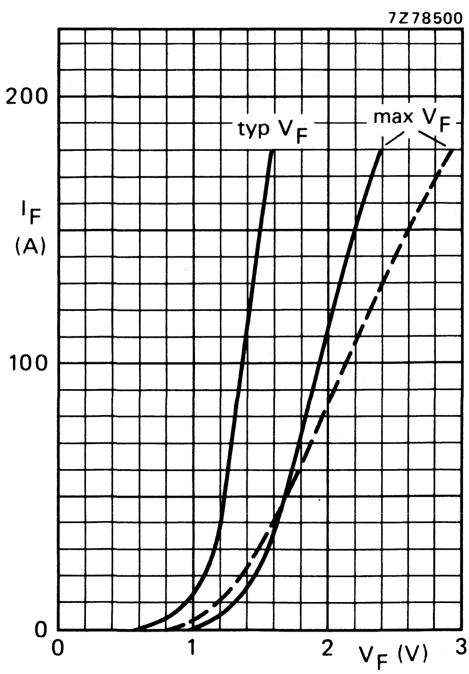


Fig. 3 —— T_j = 25 °C; – – – T_j = 150 °C.

* Measured under pulse conditions to avoid excessive dissipation.

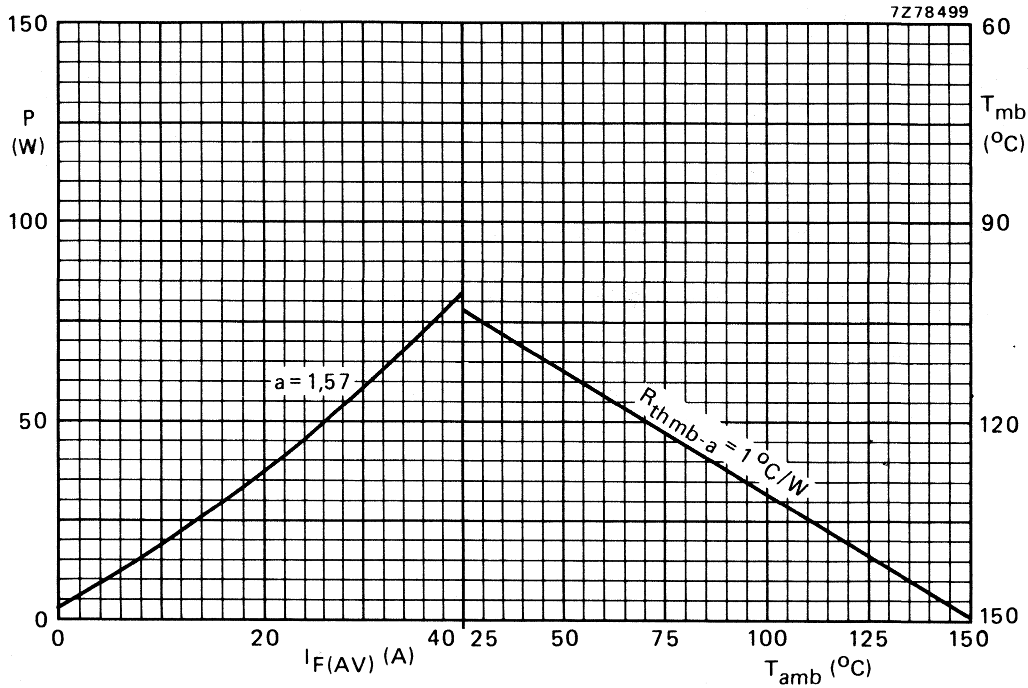


Fig. 4 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
P = power including reverse current losses and switching losses up to f = 20 kHz.
a = $I_{F(RMS)}/I_{F(AV)}$.

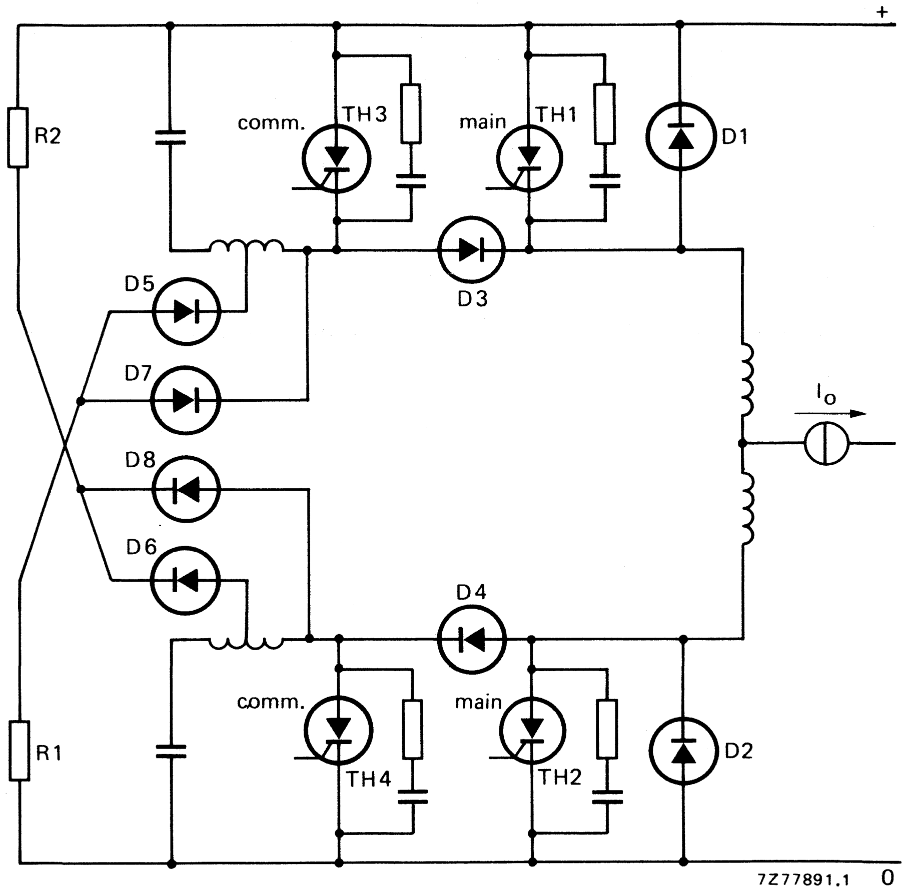


Fig. 5 One phase of a three-phase inverter for a.c. motor speed control.
D1 to D4 are BYW25 types.

ULTRA FAST RECOVERY RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial rectifier diodes in plastic envelopes, featuring low forward voltage drop, ultra fast reverse recovery times with very low stored charge and soft-recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and low switching losses are essential.
The series consists of normal polarity (cathode to mounting base) types.

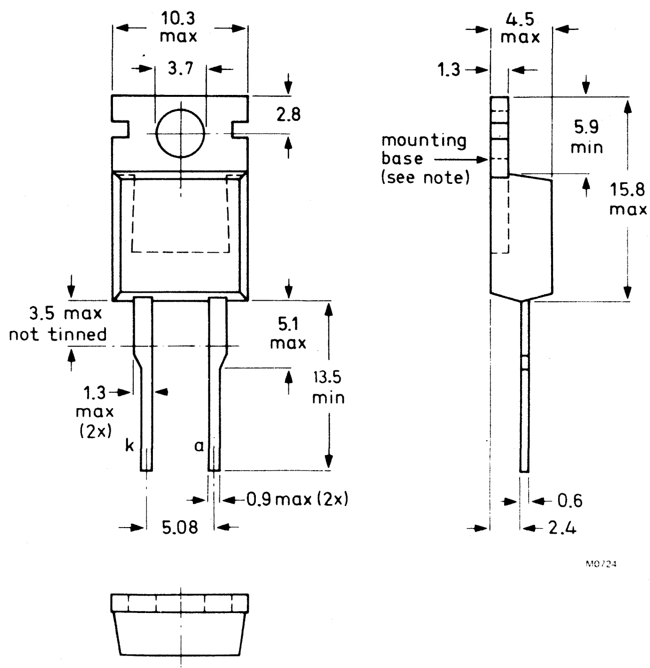
QUICK REFERENCE DATA

			BYW29–50	100	150	200	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	200	V
Average forward current	$I_{F(AV)}$	max.		8			A
Forward voltage	V_F	<		0.8			V
Reverse recovery time	t_{rr}	<		25			ns

MECHANICAL DATA

Dimensions in mm

Fig.1 TO-220AC



Net mass: 2 g
Note: The exposed metal mounting base is directly connected to the cathode.
Accessories supplied on request: see data sheets Mounting instructions and accessories for TO-220 envelopes.

Products approved to CECC 50 009-014 available on request.

RATINGS

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

Voltages

			BYW29--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 (note 1)	V_R	max.	50	100	150	200	V

Currents

Average forward current; switching losses negligible up to 500 kHz				
square wave; $\delta = 0.5$; up to $T_{mb} = 125$ °C	$I_{F(AV)}$	max.	8	A
sinusoidal; up to $T_{mb} = 125$ °C	$I_{F(AV)}$	max.	7.3	A
R.M.S. forward current	$I_{F(RMS)}$	max.	11.5	A
Repetitive peak forward current $t_p = 20\ \mu s$; $\delta = 0.02$	I_{FRM}	max.	240	A
Non-repetitive peak forward current half sine-wave; $T_j = 150$ °C prior to surge; with reapplied V_{RWMmax};				
t = 10 ms	I_{FSM}	max.	80	A
t = 8.3 ms	I_{FSM}	max.	100	A
I^2t for fusing (t = 10 ms)	I^2t	max.	32	A^2s

Temperatures

Storage temperature	T_{stg}		−40 to +150	°C
Junction temperature	T_j	max.	150	°C

Notes:

1. To ensure thermal stability: $R_{th\ j\text{-}a} < 11.6$ K/W

CHARACTERISTICS

Forward voltage				
I_F = 8 A; T_j = 150 °C	V_F	<	0.8	V*
I_F = 20 A; T_j = 25 °C	V_F	<	1.3	V*
Reverse current				
$V_R = V_{RWM\,max}$; T_j = 100 °C	I_R	<	0.6	mA
T_j = 25 °C	I_R	<	10	μA
Reverse recovery when switched from				
I_F = 1 A to $V_R \geq 30$ V with $-dI_F/dt$ = 100 A/μs; T_j = 25 °C; recovery time	t_{rr}	<	25	ns
I_F = 2 A to $V_R \geq 30$ V with $-dI_F/dt$ = 20 A/μs; T_j = 25 °C; recovered charge	Q_s	<	11	nC
I_F = 10 A to $V_R \geq 30$ 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

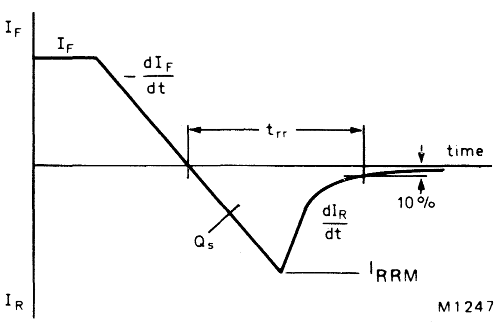


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

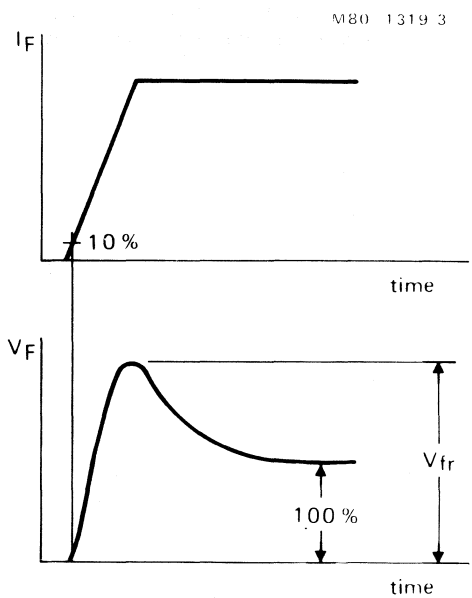


Fig.3 Definition of V_{fr}.

*Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	2.7	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 insulator (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 value 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 device lead length and with copper laminate on the board	$R_{th\ j\text{-}a}$	=	60	K/W

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 calculations

a. The various components of junction temperature rise above ambient are illustrated in Fig.4.

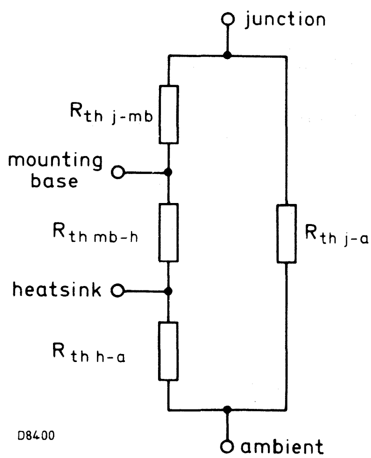


Fig. 4.

b. Any measurement of heatsink temperature should be made immediately adjacent to the device.
c. The method of using Figs. 5 and 6 is as follows:
Starting with the required current on the $I_{F(AV)}$ axis, trace upwards to meet the appropriate duty cycle or form factor curve. Trace right horizontally and upwards from the required value on the T_{amb} scale. The intersection determines the $R_{th\ mb\text{-}a}$. The heatsink thermal resistance value ($R_{th\ h\text{-}a}$) can be calculated from:

$$R_{th\ h\text{-}a} = R_{th\ mb\text{-}a} - R_{th\ mb\text{-}h}.$$

SQUARE-WAVE OPERATION

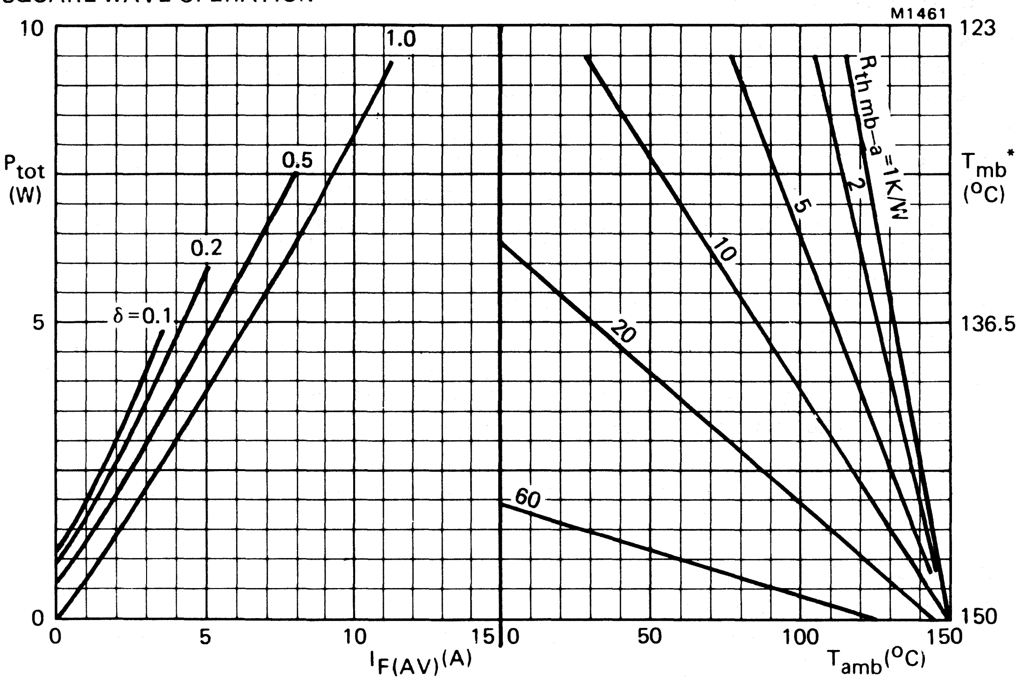
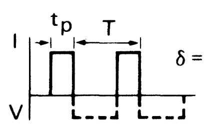


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
Power includes reverse current losses and switching losses up to f = 500 kHz.



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

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

*T_{mb} scale is for comparison purposes and is correct only for $R_{th\ mb\text{-}a} < 8.9$ K/W.

SINUSOIDAL OPERATION

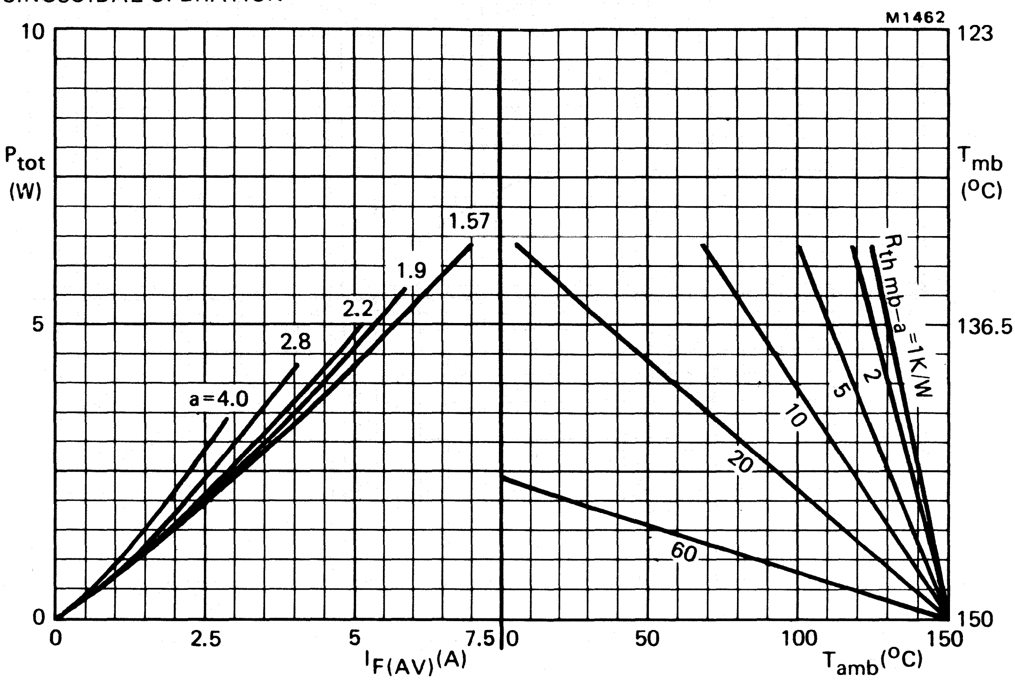


Fig.6 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
Power includes reverse current losses and switching losses up to f = 500 kHz.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

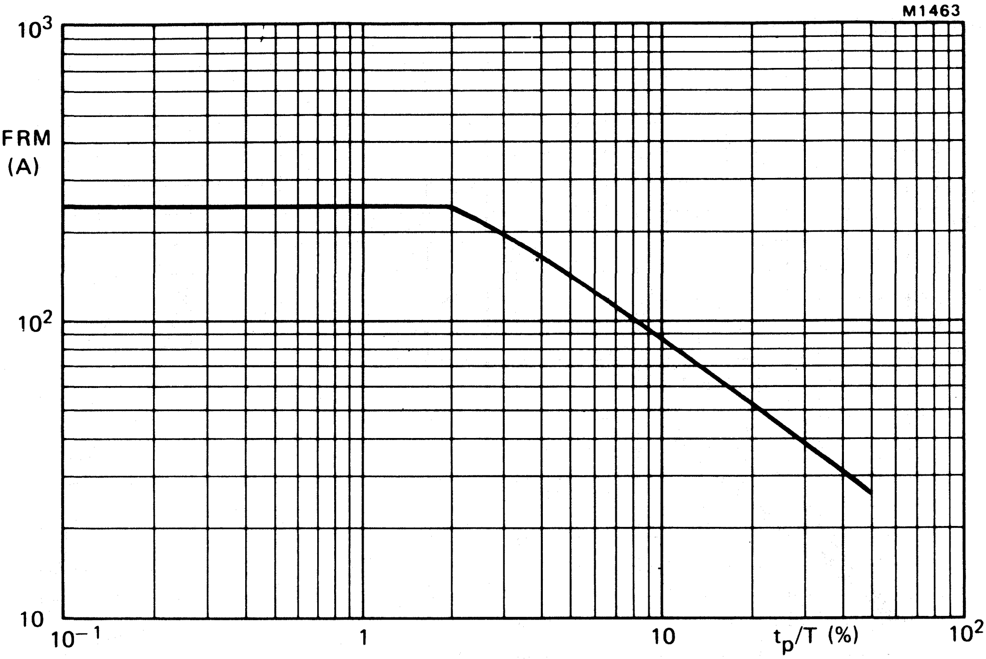
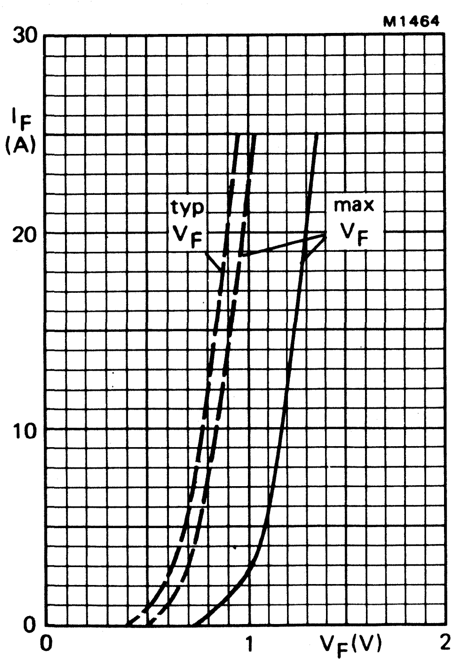
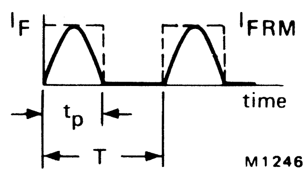


Fig.7 Maximum permissible repetitive peak forward current for square or sinusoidal currents; $1\ \mu s < t_p < 1 ms$.





Definition of I_{FRM} and t_p/T.

Fig.8 —— T_j = 25 °C; – – – T_j = 150 °C.

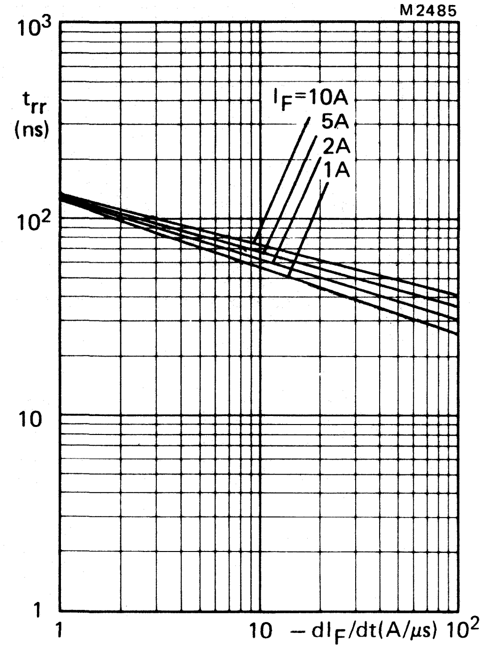


Fig.9 Maximum t_{rr} at T_j = 25 °C.

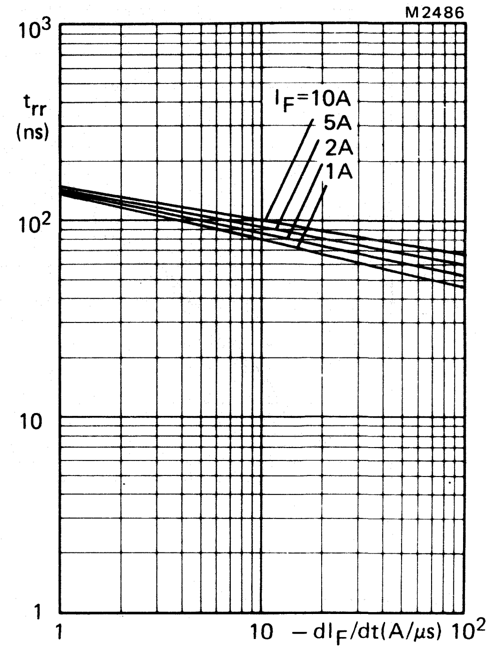


Fig.10 Maximum t_{rr} at T_j = 100 °C.

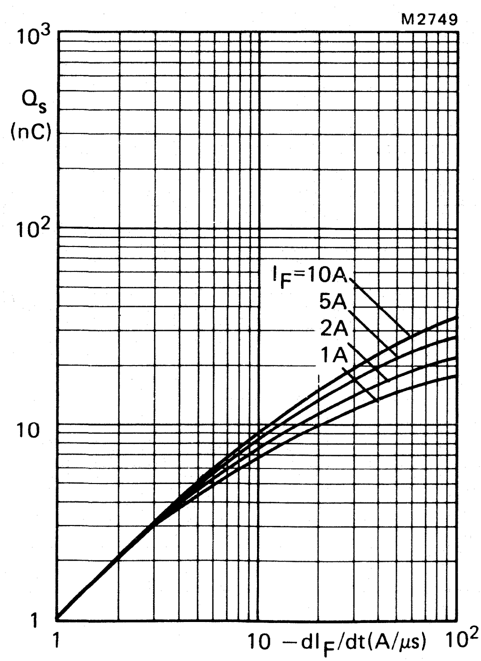


Fig.11 Maximum Q_s at T_j = 25 °C.

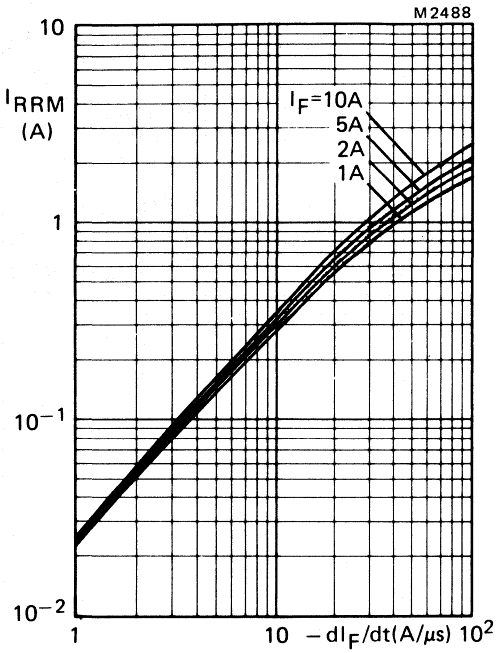


Fig. 12 Maximum I_{RRM} at T_j = 25 °C.

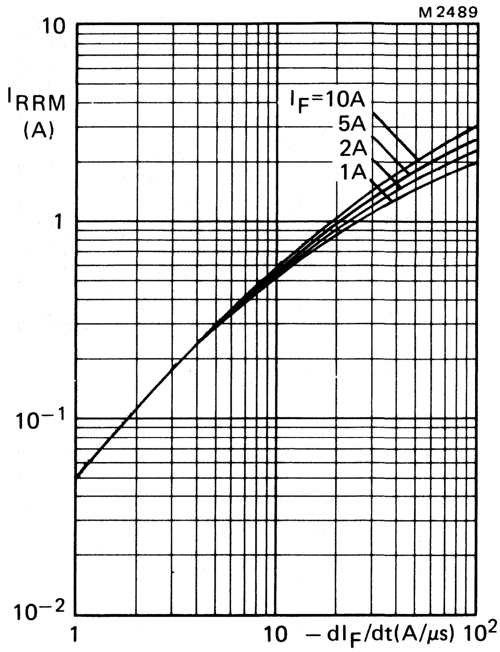


Fig. 13 Maximum I_{RRM} at T_j = 100 °C.

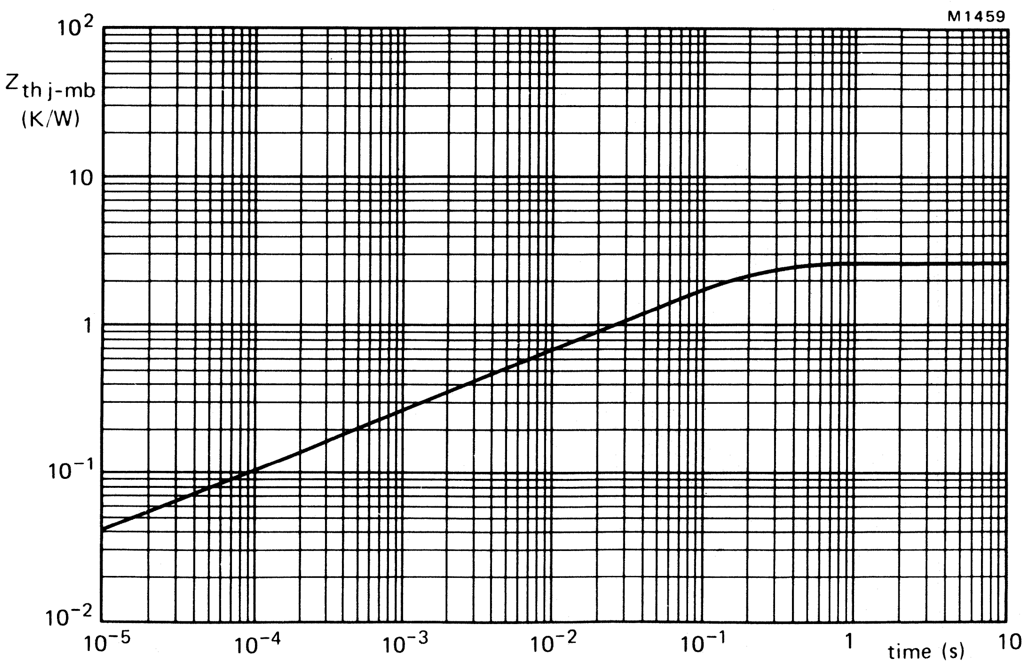


Fig. 14 Transient thermal impedance.

ULTRA FAST RECOVERY, ELECTRICALLY-ISOLATED RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial rectifier diodes in SOT-186 (full-pack) envelopes, featuring low forward voltage drop, ultra fast reverse recovery times with very low stored charge and soft-recovery characteristic. 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 switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and low switching losses are essential.

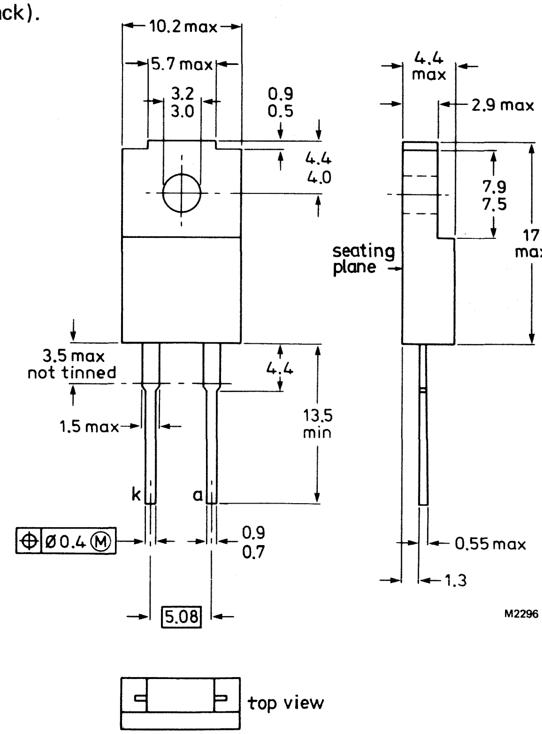
QUICK REFERENCE DATA

			BYW29F–50	100	150	200	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	200	V
Average forward current	$I_{F(AV)}$	max.	8				A
Forward voltage	V_F	<	0.8				V
Reverse recovery time	t_{rr}	<	25				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 (IEC 134).

Voltages

			BYW29F–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 (note 1)	V_R	max.	50	100	150	200	V

Currents

Average forward current; switching losses negligible up to 500 kHz (note 2);				
→ square wave; δ = 0.5; up to T_h = 108 °C	$I_{F(AV)}$	max.	8	A
→ sinusoidal; up to T_h = 114 °C	$I_{F(AV)}$	max.	7.3	A
R.M.S. forward current	$I_{F(RMS)}$	max.	11.5	A
Repetitive peak forward current t_p = 20 µs, δ = 0.02	I_{FRM}	max.	240	A
Non-repetitive peak forward current half sine-wave; T_j = 150 °C prior to surge; with reapplied $V_{RWM\ max}$				
t = 10 ms	I_{FSM}	max.	80	A
t = 8.3 ms	I_{FSM}	max.	100	A
I^2t for fusing (t = 10 ms)	I^2t	max.	32	A^2s

Temperatures

Storage temperature	T_{stg}		–40 to +150	°C
Junction temperature	T_j	max.	150	°C

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: $R_{th\ j\text{-}a} < 11.6$ K/W.
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,				
with heatsink compound	$R_{th\ j\text{-}h}$	=	5.5	K/W
without heatsink compound	$R_{th\ j\text{-}h}$	=	7.2	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 tie 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 stated

Forward voltage				
I_F = 8 A; T_j = 150 °C	V_F	<	0.8	V*
I_F = 20 A	V_F	<	1.3	V*
Reverse current				
$V_R = V_{RWM\ max}$; T_j = 100 °C	I_R	<	0.6	mA
$V_R = V_{RWM\ max}$	I_R	<	10	μA
Reverse recovery when switched from				
I_F = 1 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 100 A/μs; recovery time	t_{rr}	<	25	ns
I_F = 2 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 20 A/μs; recovered charge	Q_s	<	11	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	V_{fr}	typ.	0.9	V

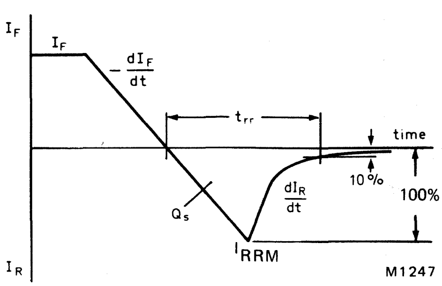


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

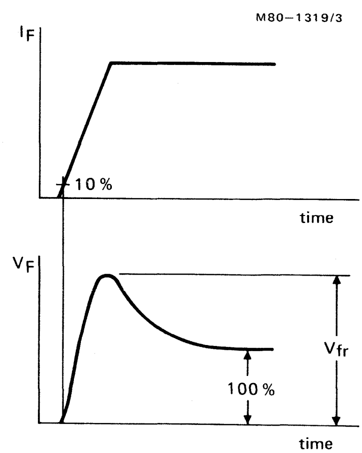


Fig.3 Definition of V_{fr}.

*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 ^{o}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.4.

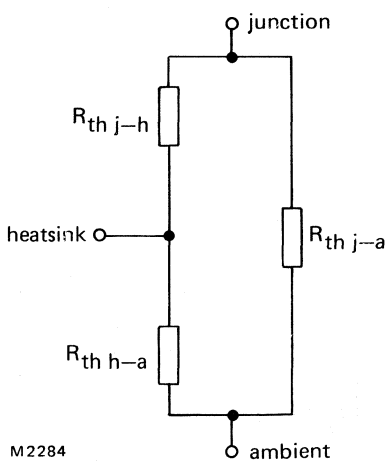


Fig.4.

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

SQUARE-WAVE OPERATION

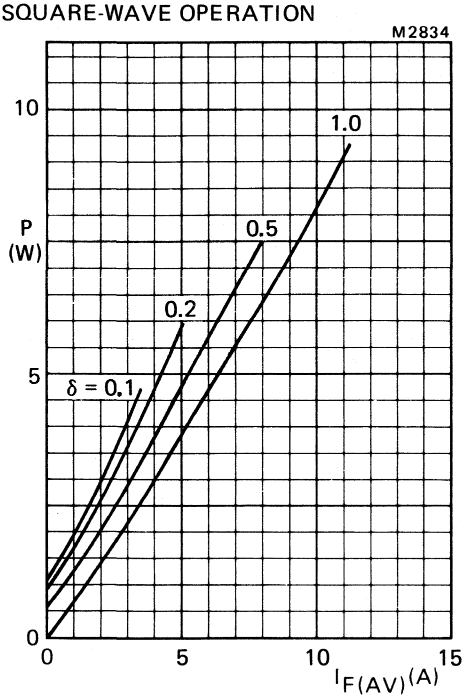
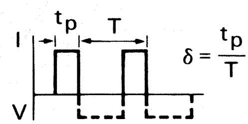


Fig.5 Power rating.

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.



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

SINUSOIDAL OPERATION

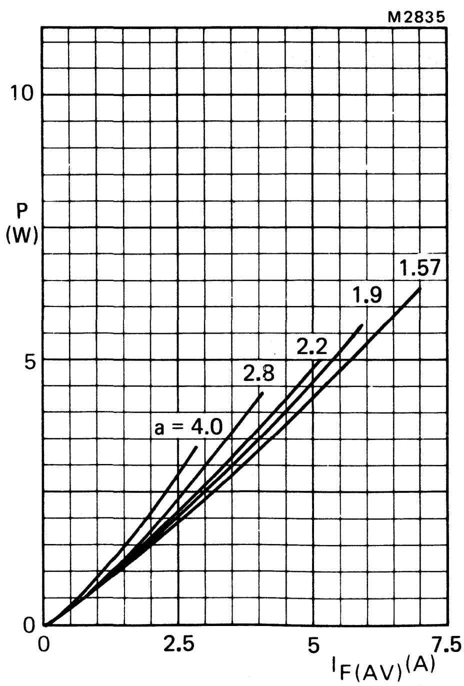


Fig.6 Power rating.

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 = $I_{F(RMS)}/I_{F(AV)}$

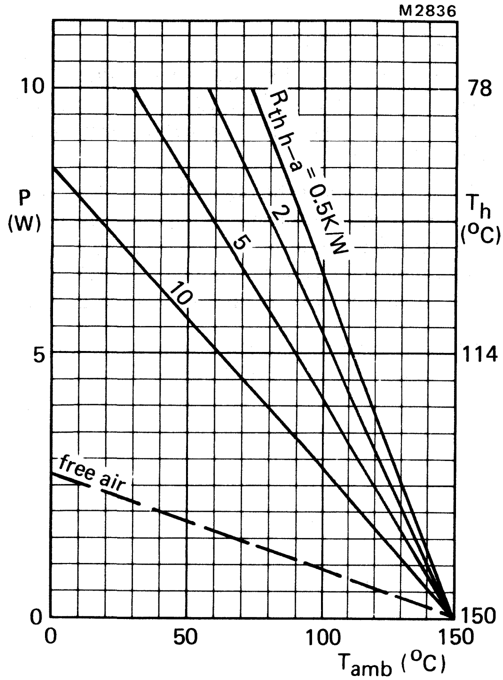


Fig.7 Heatsink rating; without heatsink compound.

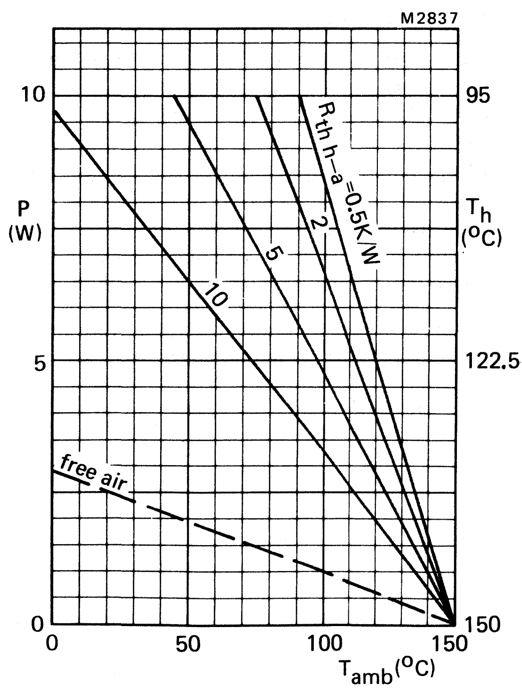


Fig.8 Heatsink rating; with heatsink compound.

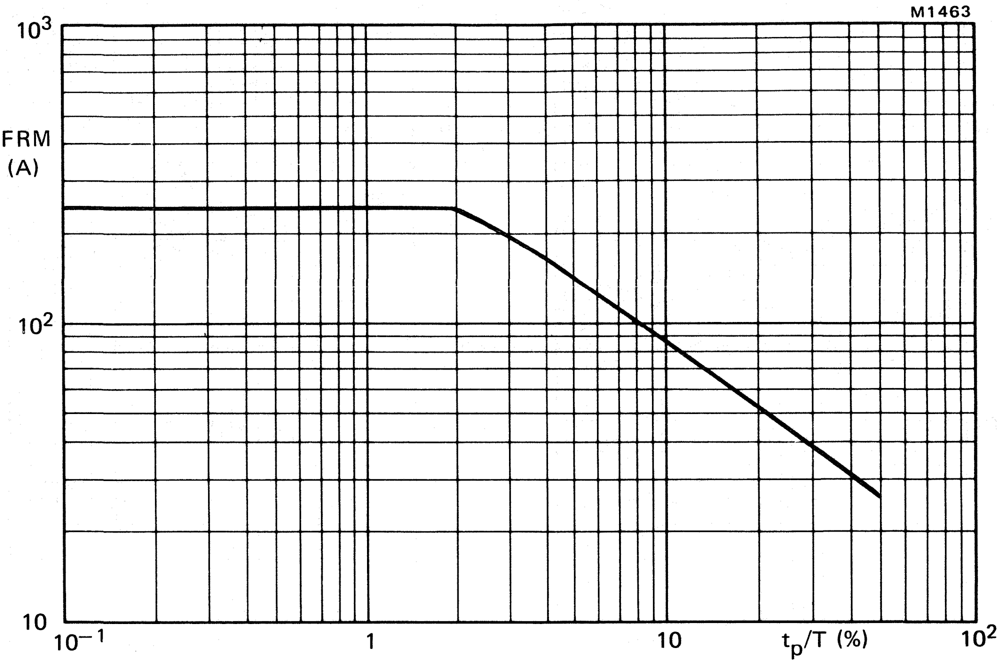
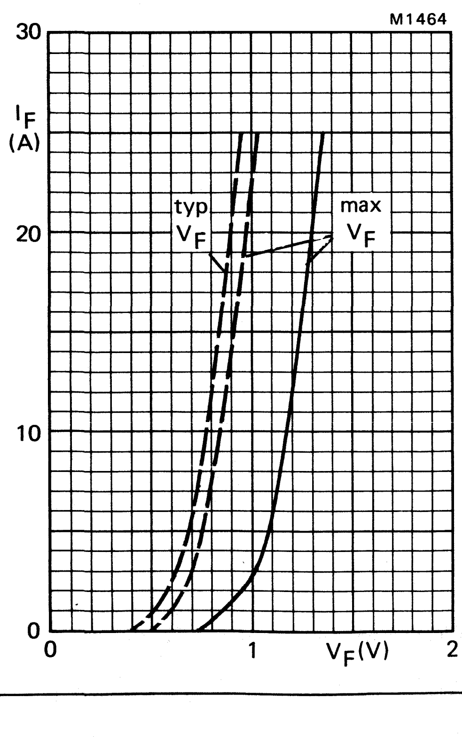
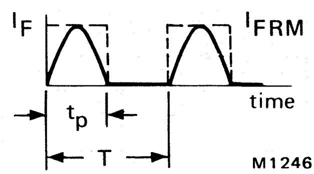


Fig.9 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 μs $< t_p <$ 1 ms.





Definition of I_{FRM} and t_p/T.

Fig.10 —— T_j = 25 °C; – – – T_j = 150 °C.

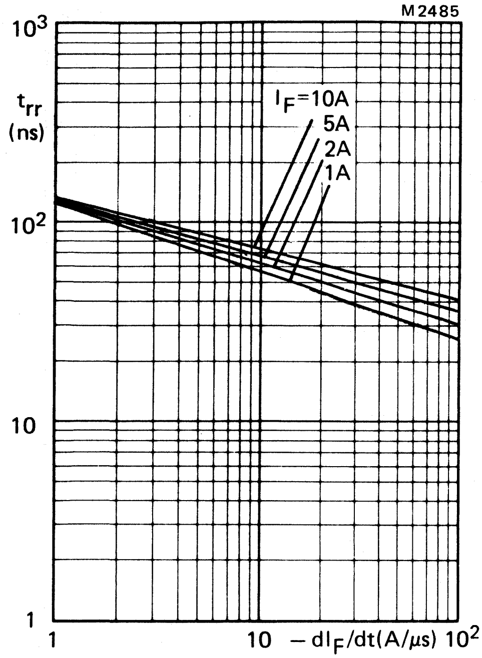


Fig.11 Maximum t_{rr} at T_j = 25 °C.

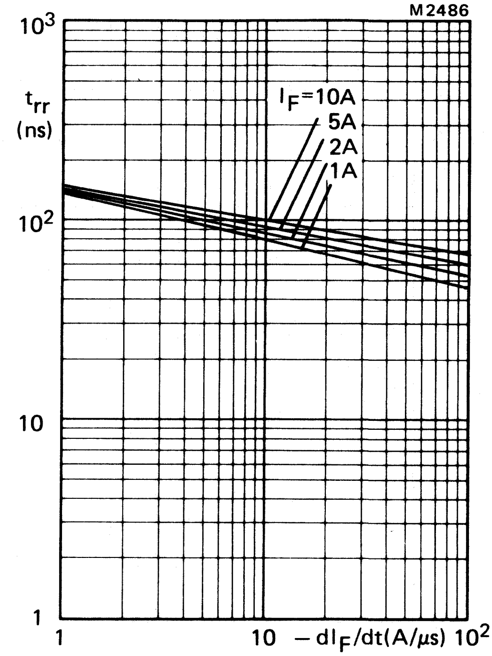


Fig.12 Maximum t_{rr} at T_j = 100 °C.

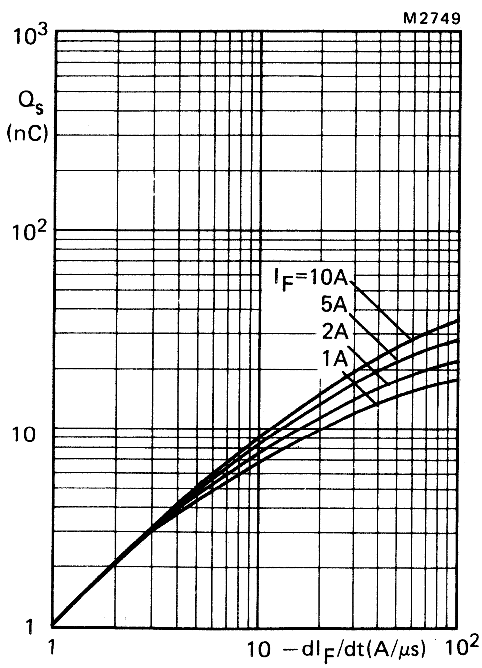


Fig.13 Maximum Q_s at T_j = 25 °C.

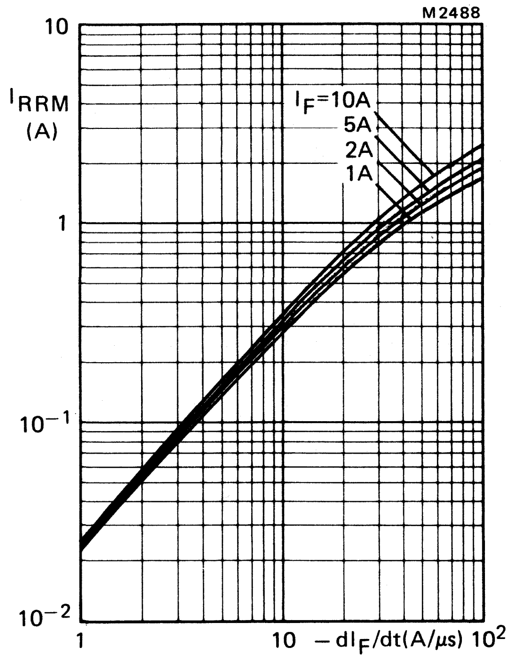


Fig.14 Maximum I_{RRM} at T_j = 25 °C.

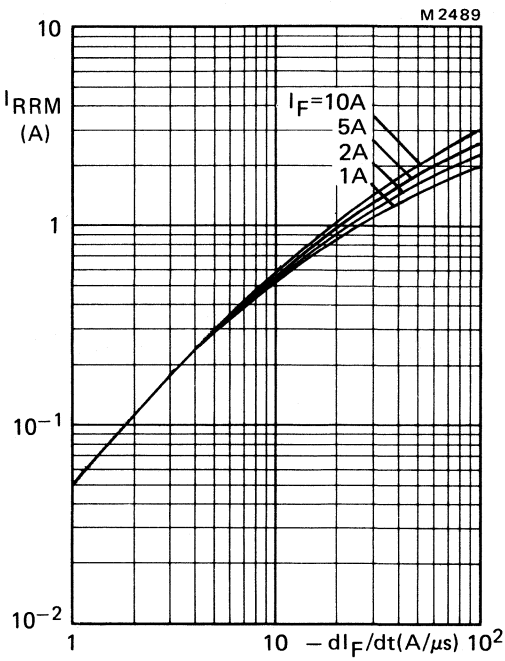


Fig.15 Maximum I_{RRM} at T_j = 100 °C.

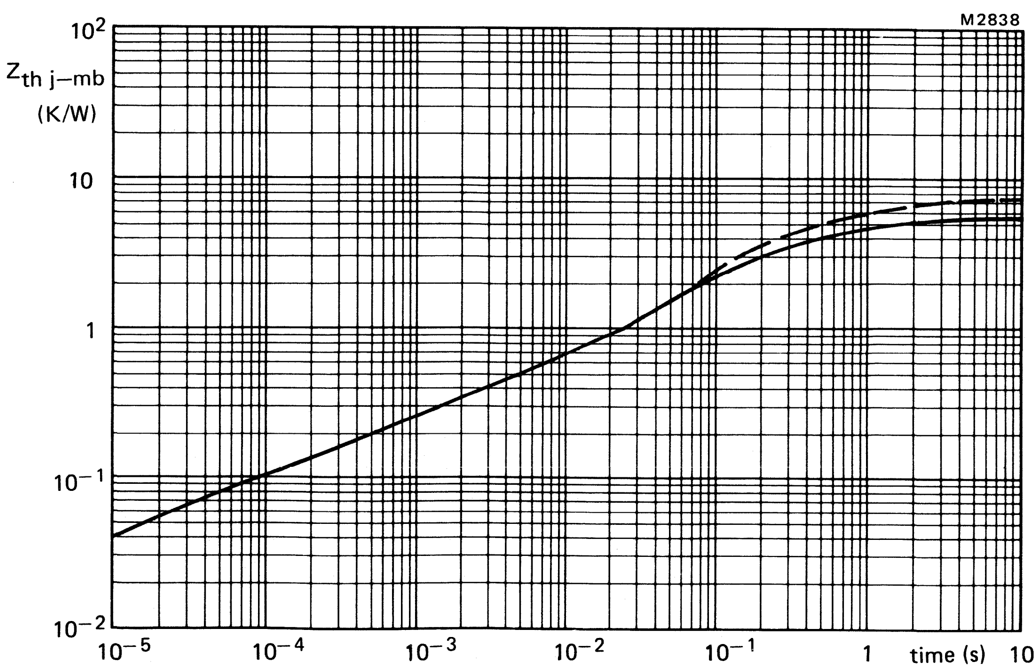


Fig.16 Transient thermal impedance: —— with heatsink compound; – – – without heatsink compound.

ULTRA FAST RECOVERY RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial rectifier diodes in DO-4 metal envelopes, featuring low forward voltage drop, ultra fast reverse recovery times, very low stored charge and soft recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where low conduction and switching losses are essential. The series consists of normal polarity (cathode to stud) types.

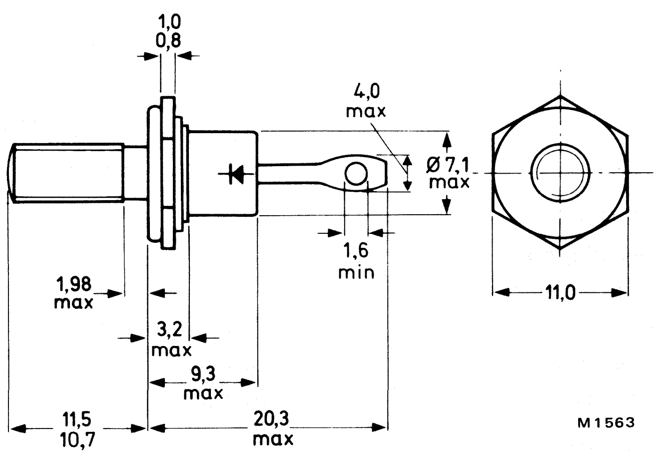
QUICK REFERENCE DATA

			BYW30–50	100	150	200	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	200	V
Average forward current	$I_{F(AV)}$	max.	14				A
Forward voltage	V_F	<	0.8				V
Reverse recovery time	t_{rr}	<	30				ns

MECHANICAL DATA

Dimensions in mm

Fig.1 DO-4: with metric M5 stud (ϕ5 mm); e.g. BYW30–50.
with 10-32 UNF stud (ϕ4.83 mm); e.g. BYW30-50U.



Net mass: 6 g

Diameter of clearance hole: max. 5.2 mm

Accessories supplied on request:
see ACCESSORIES section.

Supplied with device: 1 nut, 1 lock washer

Torque on nut: min. 0.9 Nm (9 kg cm)
max. 1.7 Nm (17 kg cm)

Nut dimensions across the flats:
M5: 8.0 mm; 10-32 UNF: 9.5 mm.

Products approved to CECC 50 009-001, available on request.

RATINGS

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

Voltages*			BYW30–50	100	150	200	
Repetititve 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

Average forward current; switching losses negligible up to 500 kHz				
square wave; δ = 0.5; up to T_{mb} = 120 °C	$I_{F(AV)}$	max.	14	A
up to T_{mb} = 125 °C	$I_{F(AV)}$	max.	12	A
sinusoidal; up to T_{mb} = 125 °C	$I_{F(AV)}$	max.	12.5	A
R.M.S. forward current	$I_{F(RMS)}$	max.	20	A
Repetitive peak forward current t_p = 20 μs; δ = 0.02	I_{FRM}	max.	420	A
Non-repetitive peak forward current half sine-wave; T_j = 150 °C prior to surge; with reapplied V_{RWMmax};				
t = 10 ms	I_{FSM}	max.	200	A
t = 8.3 ms	I_{FSM}	max.	240	A
I^2t for fusing (t = 10 ms)	I^2t	max.	200	A^2s

Temperatures

Storage temperature	T_{stg}		–55 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	2.2	K/W
From mounting base to heatsink				
a. with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.5	K/W
b. without heatsink compound	$R_{th\ mb\text{-}h}$	=	0.6	K/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0.3	K/W

MOUNTING INSTRUCTIONS

The top connector should be neither bent nor twisted; it should be soldered into the circuit so that there is no strain on it.

During soldering the heat conduction to the junction should be kept to a minimum.

*To ensure thermal stability: $R_{th\ j\text{-}a} \leq 5.6$ K/W (continuous reverse voltage).

CHARACTERISTICS

Forward voltage				
I_F = 15 A; T_j = 150 °C	V_F	<	0.8	V*
I_F = 50 A; T_j = 25 °C	V_F	<	1.3	V*
Reverse current				
$V_R = V_{RWM\,max}$; T_j = 100 °C	I_R	<	1.3	mA
T_j = 25 °C	I_R	<	25	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}	<	30	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}	<	4	A
Forward recovery when switched to I_F = 10 A with dI_F/dt = 10 A/μs; T_j = 25 °C	V_{fr}	typ.	1.0	V

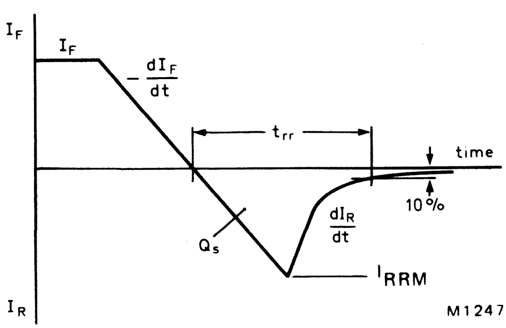


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

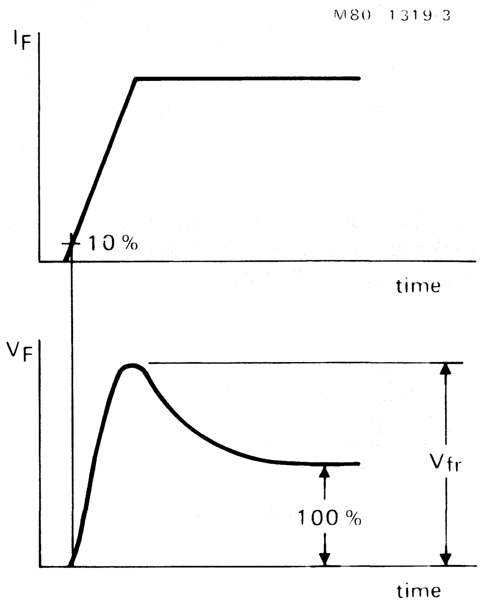


Fig.3 Definition of V_{fr}.

*Measured under pulse conditions to avoid excessive dissipation.

SQUARE-WAVE OPERATION

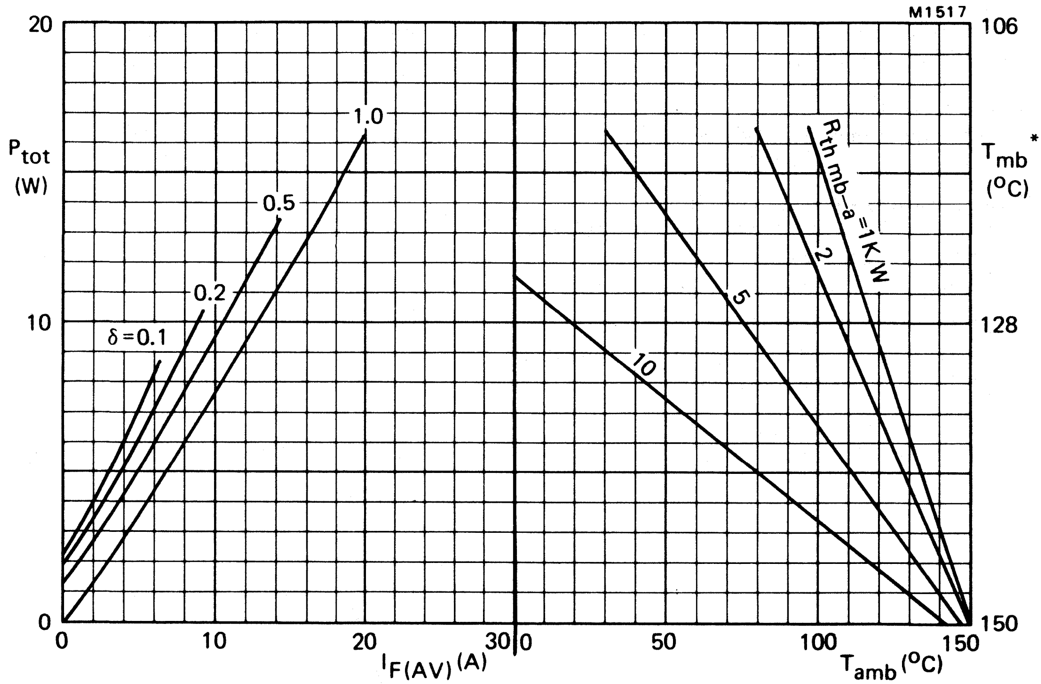
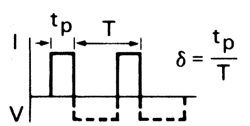


Fig.4 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 500 kHz.



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

*T_{mb} scale is for comparison purposes and is correct only for $R_{th\ mb\text{-}a} < 3.1$ K/W.

SINUSOIDAL OPERATION

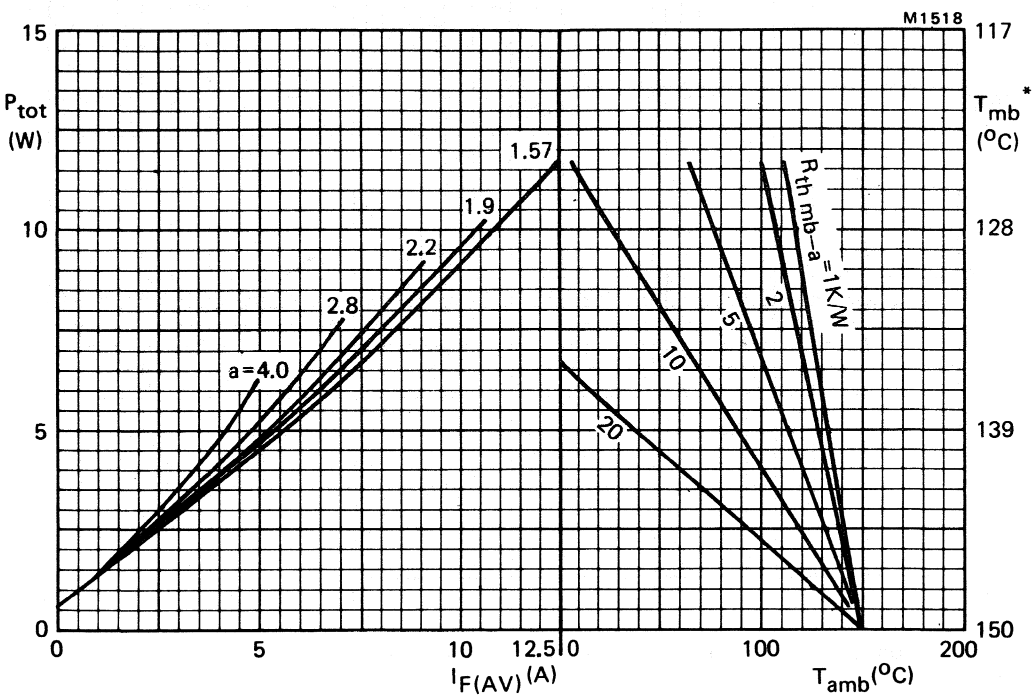


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

*T_{mb} scale is for comparison purposes and is correct only for $R_{th\ mb\text{-}a} < 17$ K/W.

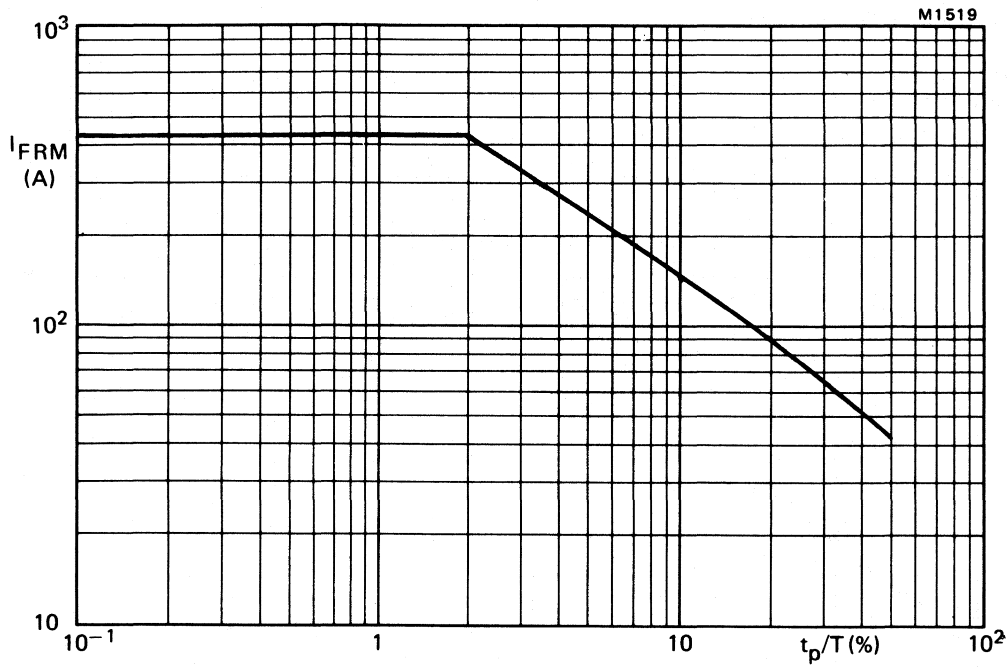
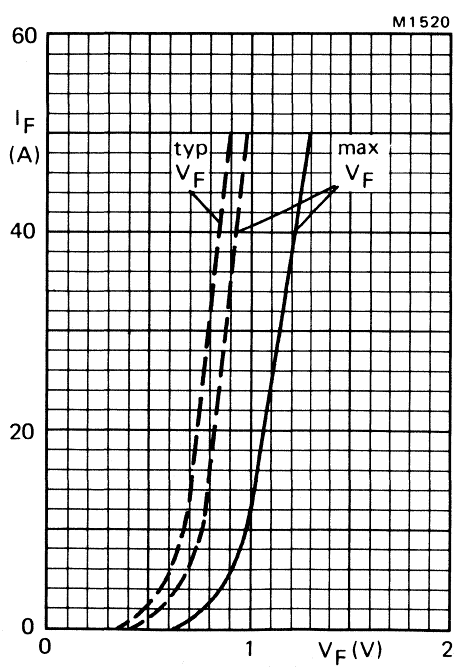
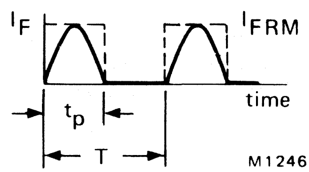


Fig.6 Maximum permissible repetitive peak forward current for square or sinusoidal currents; $\mu s < t_p < 1$ ms.





Definition of I_{FRM} and t_p/T.

Fig.7 —— $T_j = 25\ ^oC$; – – – $T_j = 150\ ^oC$.

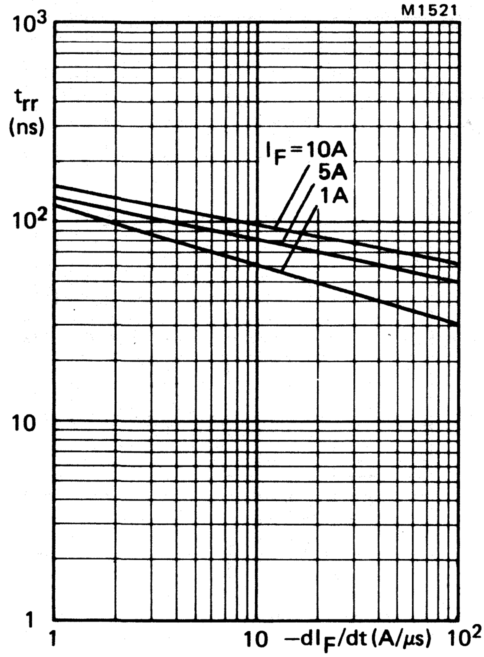


Fig.8 Maximum t_{rr} at T_j = 25 °C.

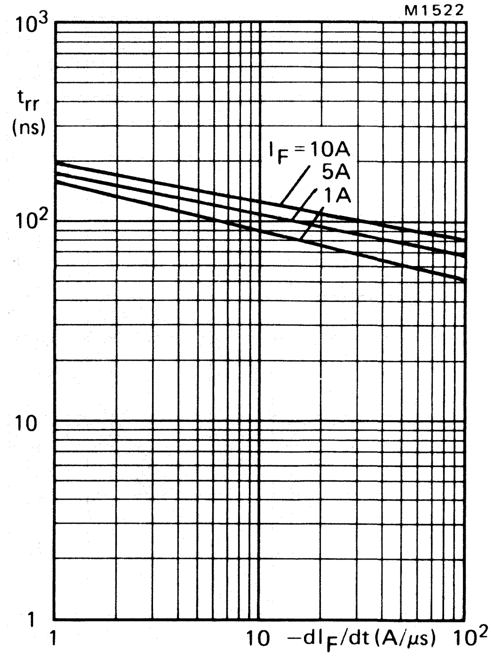


Fig.9 Maximum t_{rr} at T_j = 100 °C.

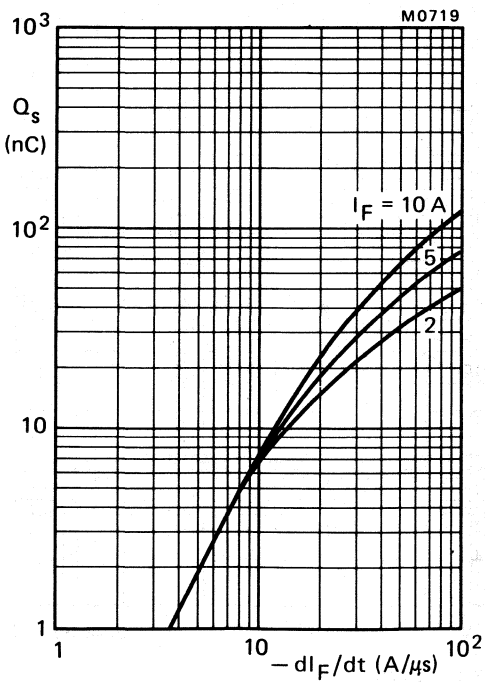


Fig.10 Maximum Q_s at T_j = 25 °C.

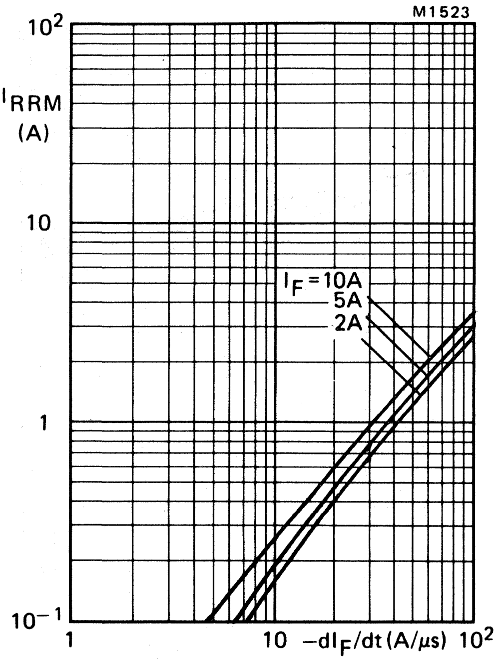


Fig.11 Maximum I_{RRM} at T_j = 25 °C.

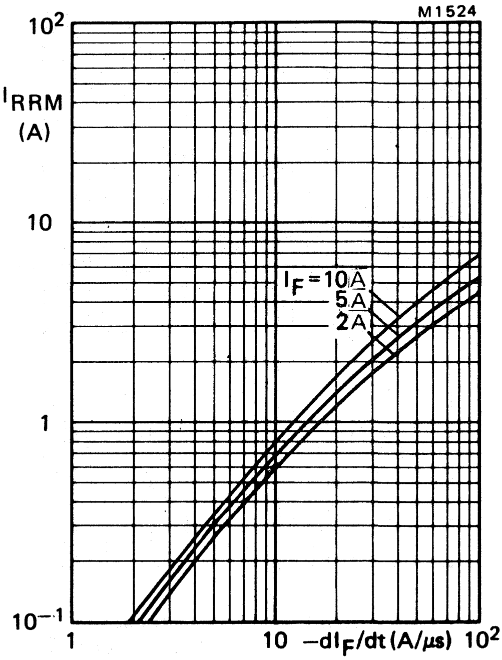


Fig.12 Maximum I_{RRM} at T_j = 100 °C.

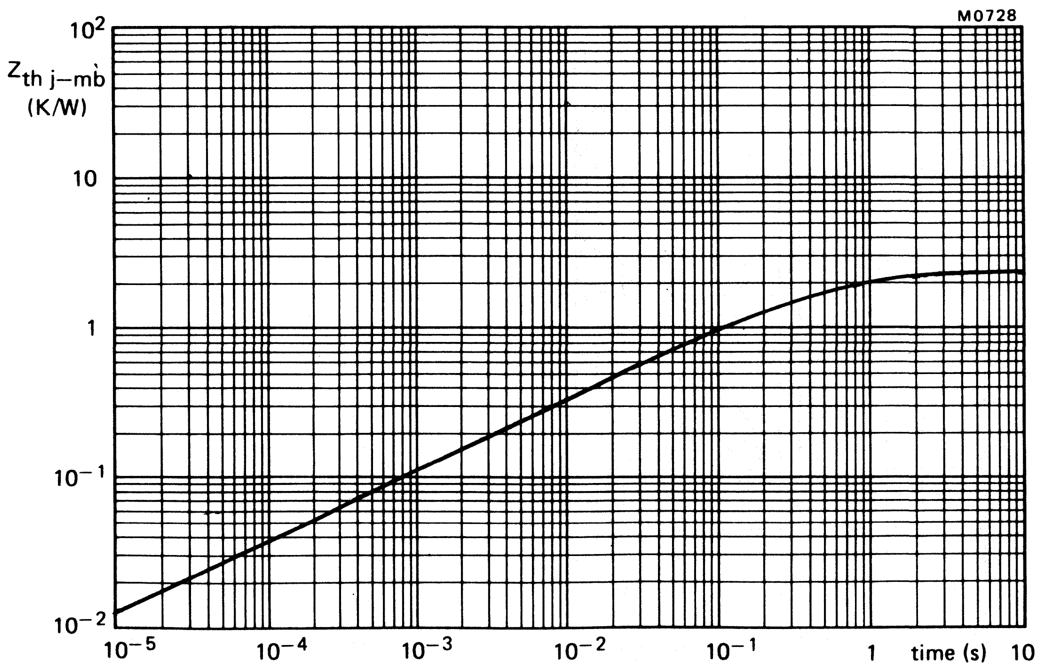


Fig.13 Transient thermal impedance.

ULTRA FAST RECOVERY RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial rectifier diodes in DO-4 metal envelopes, featuring low forward voltage drop, ultra fast reverse recovery times, very low stored charge and soft recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where low conduction and switching losses are essential. The series consists of normal polarity (cathode to stud) types.

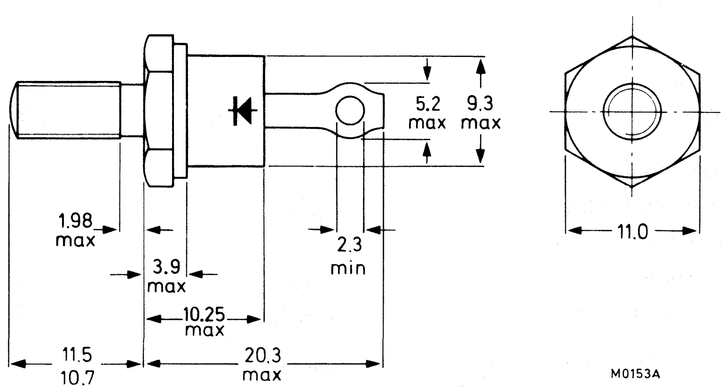
QUICK REFERENCE DATA

			BYW31–50	100	150	200	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	200	V
Average forward current	$I_{F(AV)}$	max.		28			A
Forward voltage	V_F	<		0.8			V
Reverse recovery time	t_{rr}	<		40			ns

MECHANICAL DATA

Dimensions in mm

Fig.1 DO-4; with metric M5 stud (ϕ5 mm); e.g. BYW31–50.
with 10-32 UNF stud (ϕ4.83 mm); e.g. BYW31–50U.



Net mass: 7 g

Diameter of clearance hole: max. 5.2 mm

Accessories supplied on request:
see ACCESSORIES section.

Supplied with device: 1 nut, 1 lock washer

Torque on nut: min. 0.9 Nm (9 kg cm)
max. 1.7 Nm (17 kg cm)

Nut dimensions across the flats;
M5: 8.0 mm; 10-32 UNF: 9.5 mm

Products approved to CECC 50 009-002, available on request.

RATINGS

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

Voltages

			BYW31–50	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

Average forward current; switching losses negligible up to 500 kHz				
square wave; δ = 0.5; up to T_{mb} = 122 °C	$I_{F(AV)}$	max.	28	A
up to T_{mb} = 125 °C	$I_{F(AV)}$	max.	26	A
sinsusoidal; up to T_{mb} = 127 °C	$I_{F(AV)}$	max.	25	A
R.M. S. forward current	$I_{F(RMS)}$	max.	40	A
Repetitive peak forward current t_p = 20 μs; δ = 0.02	I_{FRM}	max.	550	A
Non-repetitive peak forward current half sine-wave; T_j = 150 °C prior to surge; with reapplied V_{RWMmax};				
t = 10 ms	I_{FSM}	max.	320	A
t = 8.3 ms	I_{FSM}	max.	380	A
I^2t for fusing (t = 10 ms)	I^2t	max.	500	A^2s

Temperatures

Storage temperature	T_{stg}		–55 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1.0	K/W
From mounting base to heatsink				
a. with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.3	K/W
b. without heatsink compound	$R_{th\ mb\text{-}h}$	=	0.5	K/W
Transient thermal impedance: t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0.2	K/W

MOUNTING INSTRUCTIONS

The top connector should be neither bent nor twisted; it should be soldered into the circuit so that there is no strain on it.

During soldering the heat conduction to the junction should be kept to a minimum.

*To ensure thermal stability: $R_{th\ j\text{-}a} \leq 4.9$ K/W (continuous reverse voltage).

CHARACTERISTICS

Forward voltage				
I_F = 30 A; T_j = 150 °C	V_F	<	0.8	V*
I_F = 100 A; T_j = 25 °C	V_F	<	1.3	V*
Reverse current				
$V_R = V_{RWM\,max}$; T_j = 100 °C	I_R	<	1.5	mA
T_j = 25 °C	I_R	<	100	μA
Reverse recovery when switched from				
I_F = 1 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 100 A/μs; T_j = 25 °C; recovery time	t_{rr}	<	40	ns
I_F = 2 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 20 A/μs; T_j = 25 °C; recovered charge	Q_s	<	20	nC
I_F = 10 A to $V_R \geq$ 30 V with $-dI_F/dt$ = 50 A/μs; T_j = 100 °C; peak recovery current	I_{RRM}	<	4	A
Forward recovery when switched to I_F = 10 A with dI_F/dt = 10 A/μs; T_j = 25 °C	V_{fr}	typ.	1	V

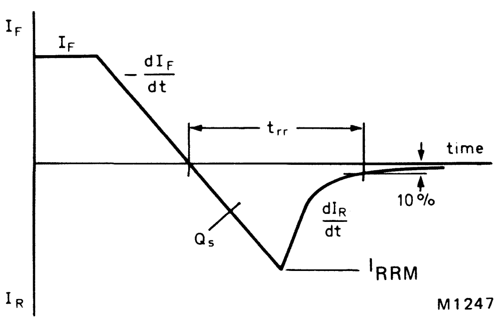


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

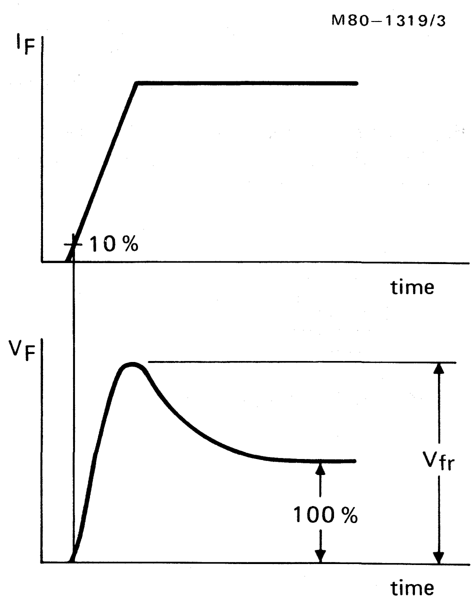


Fig.3 Definition of V_{fr}.

*Measured under pulse conditions to avoid excessive dissipation.

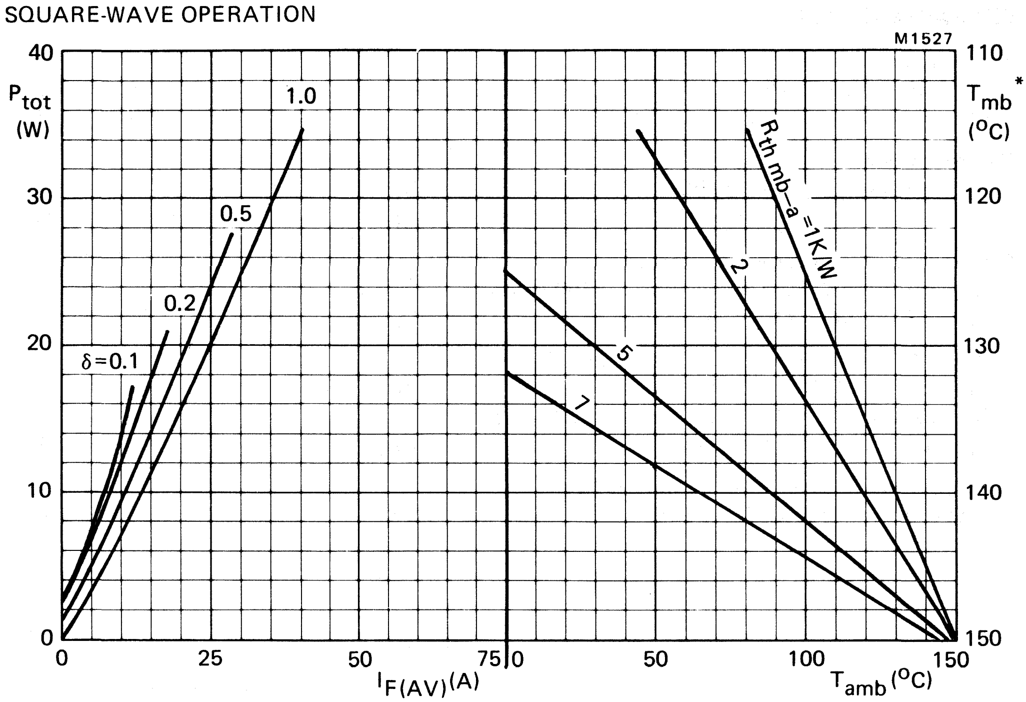
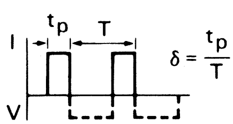


Fig.4 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 500 kHz.



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

*T_{mb} scale is for comparison purposes and is correct only for $R_{th\ mb\text{-}a} < 3.6$ K/W.

SINUSOIDAL OPERATION

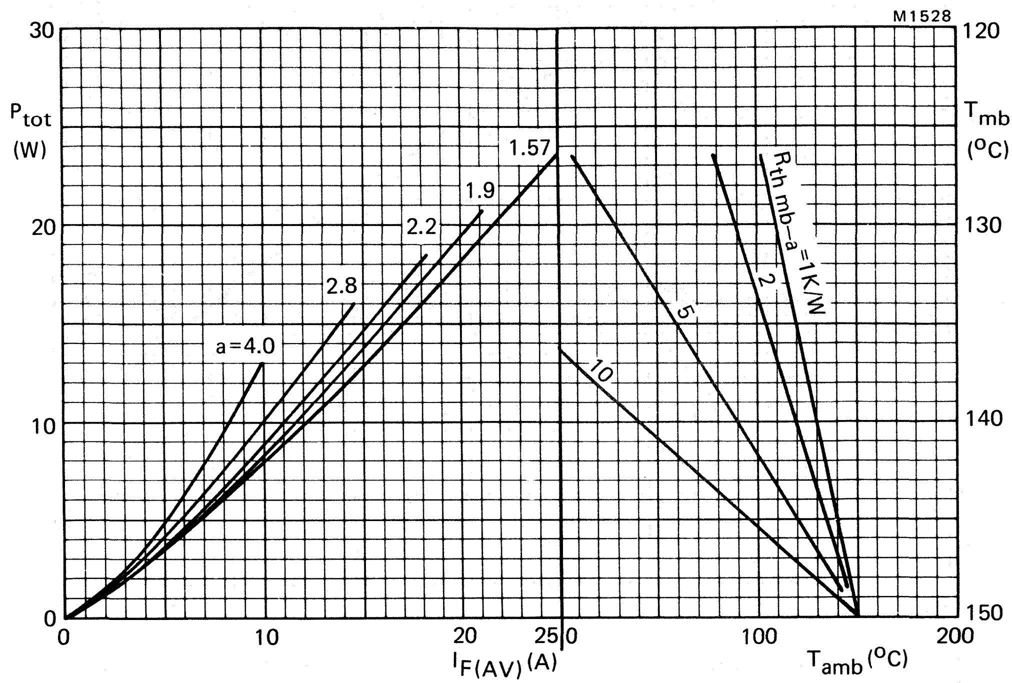


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 500 kHz.

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

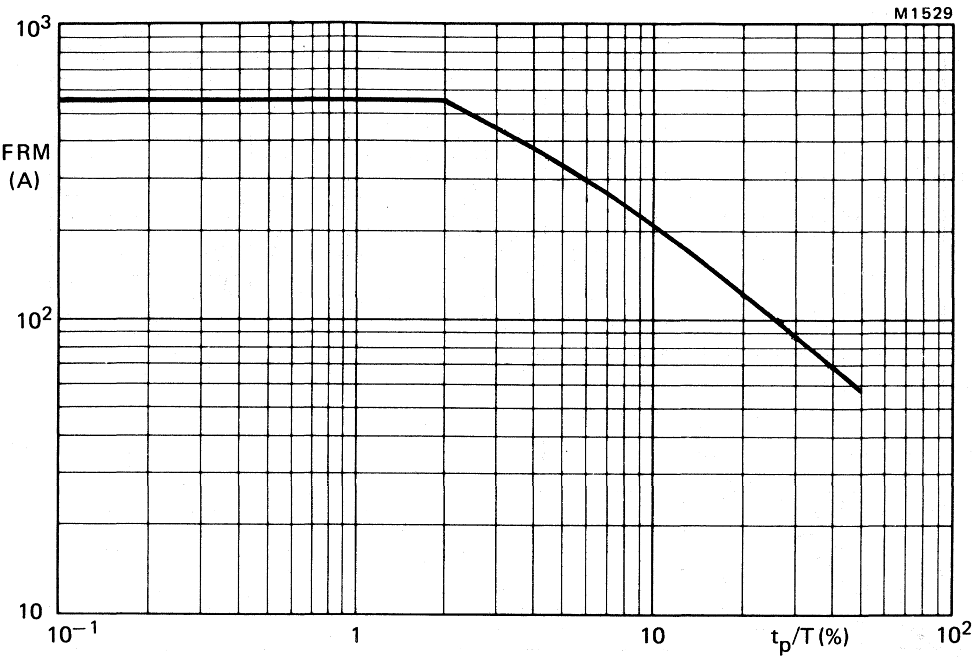
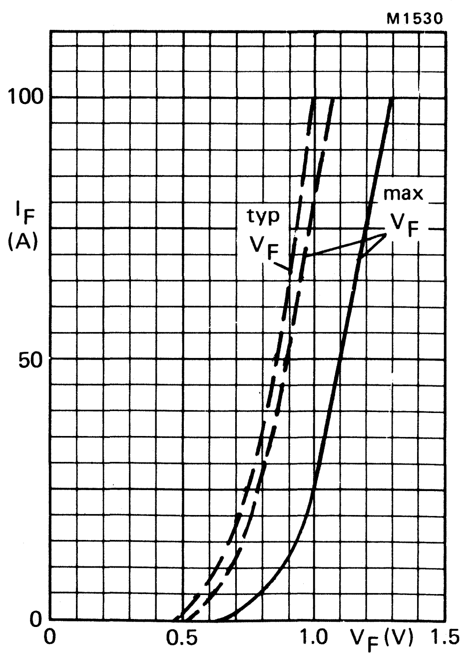
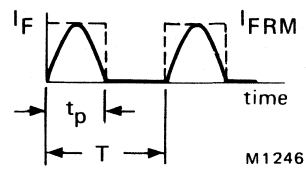


Fig.6 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 μs $< t_p <$ 1 ms.





Definition of I_{FRM} and t_p/T.

Fig.7 ——— T_j = 25 °C; – – – T_j = 150 °C.

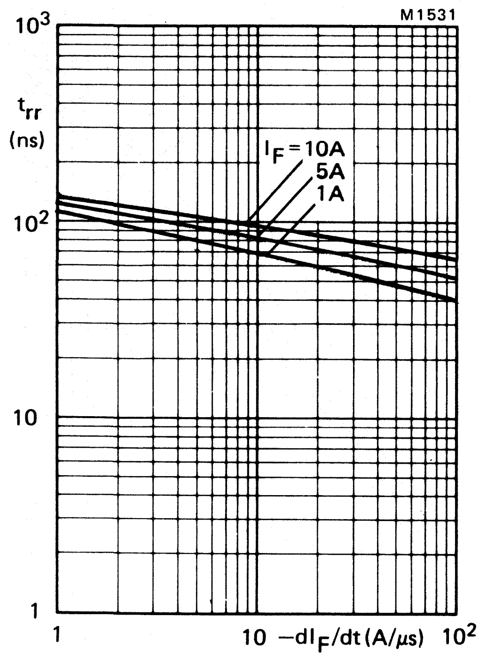


Fig.8 Maximum t_{rr} at T_j = 25 °C.

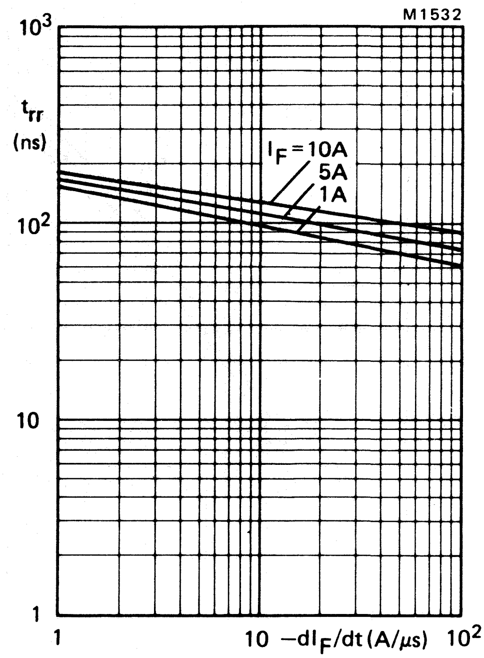


Fig.9 Maximum t_{rr} at T_j = 100 °C.

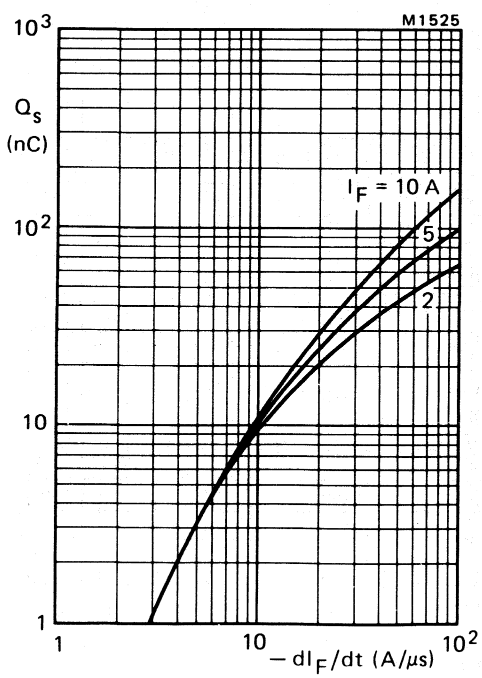


Fig.10 Maximum Q_s at T_j = 25 °C.

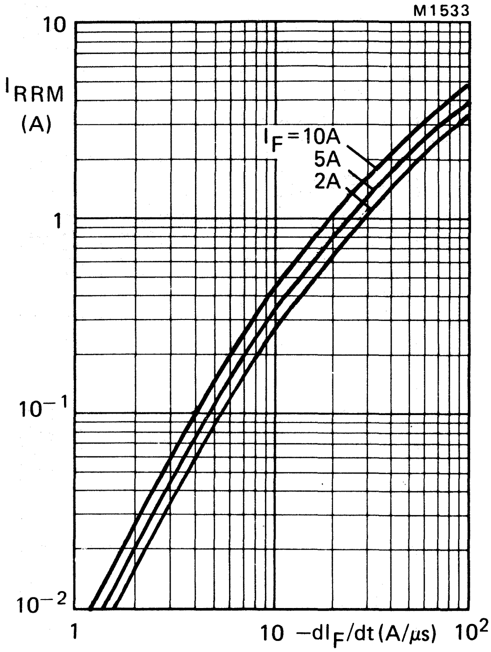


Fig.11 Maximum I_{RRM} at T_j = 25 °C.

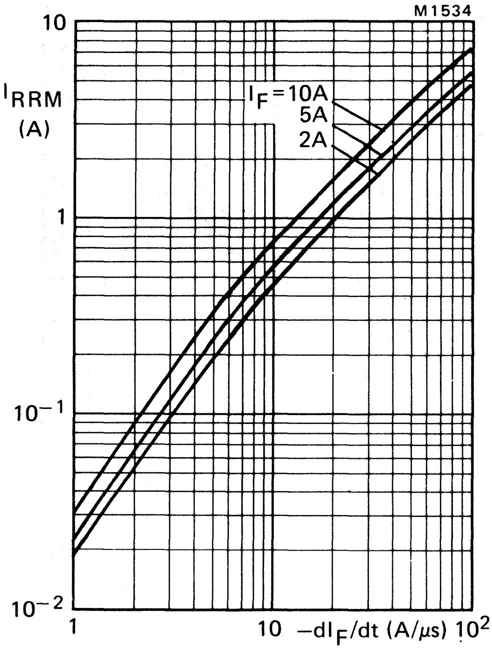


Fig.12 Maximum I_{RRM} at T_j = 100 °C.

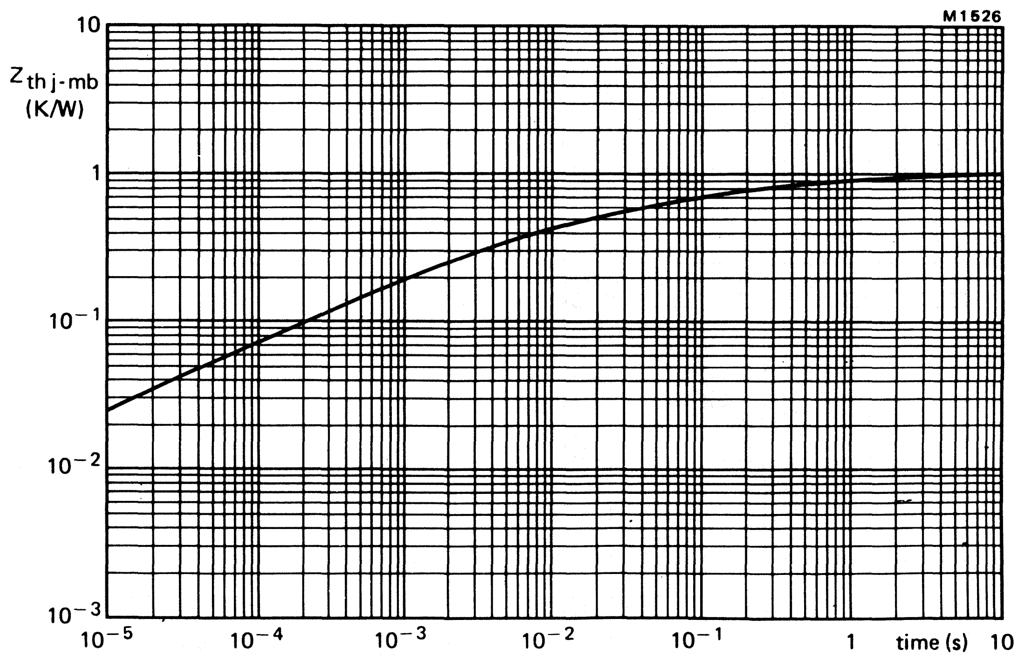


Fig.13 Transient thermal impedance.

ULTRA FAST RECOVERY RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial rectifier diodes in DO-5 metal envelopes, featuring low forward voltage drop, ultra fast reverse recovery times, very low stored charge and soft recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where low conduction and switching losses are essential. The series consists of normal polarity (cathode to stud) types.

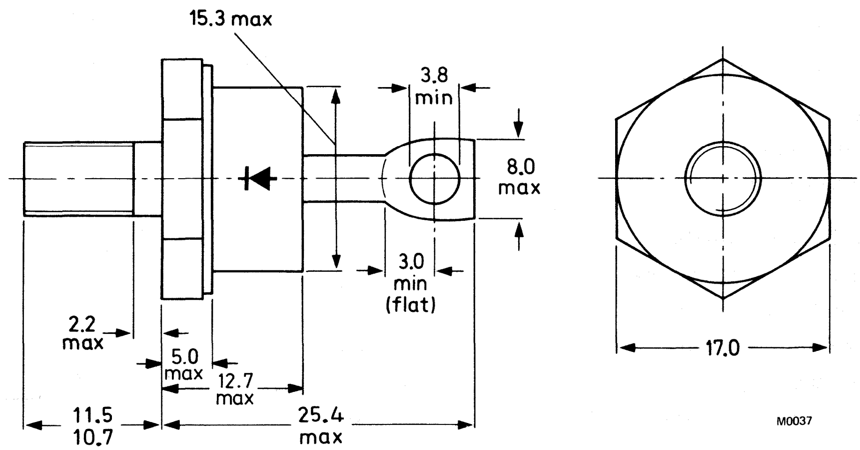
QUICK REFERENCE DATA

			BYW92–50	100	150	200	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	200	V
Average forward current	$I_{F(AV)}$	max.	40				A
Forward voltage	V_F	<	0.8				V
Reverse recovery time	t_{rr}	<	40				ns

MECHANICAL DATA

Dimensions in mm

Fig.1 DO-5: with metric M6 stud (ϕ 6 mm); e.g. BYW92-50.
with ¼ in x 28 UNF stud (ϕ 6.35 mm); e.g. BYW92–50U.



Net mass: 22 g
Diameter of clearance hole: max. 6.5 mm
Accessories supplied on request:
see ACCESSORIES section.

Supplied with device: 1 nut. 1 lock washer
Torque on nut: min. 1.7 Nm (17 kg cm)
max. 3.5 Nm (35 kg cm)
Nut dimensions across the flats:
M6: 10 mm; ¼ in x 28 UNF: 11.1 mm

Products approved to CECC 50 009-003, available on request.

RATINGS

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

Voltages

			BYW92–50	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

Average forward current; switching losses negligible up to 500 kHz				
square wave; δ = 0.5; up to T_{mb} = 110 °C	$I_{F(AV)}$	max.	40	A
up to T_{mb} = 125 °C	$I_{F(AV)}$	max.	27	A
sinusoidal; up to T_{mb} = 115 °C	$I_{F(AV)}$	max.	35	A
up to T_{mb} = 125 °C	$I_{F(AV)}$	max.	26	A
R.M.S. forward current	$I_{F(RMS)}$	max.	55	A
Repetitive peak forward current t_p = 20 μs; δ = 0.02	I_{FRM}	max.	800	A
Non-repetitive peak forward current half sine-wave; T_j = 150 °C prior to surge; with reapplied V_{RWMmax};				
t = 10 ms	I_{FSM}	max.	500	A
t = 8.3 ms	I_{FSM}	max.	600	A
I^2t for fusing (t = 10 ms)	I^2t	max.	1250	A^2s

Temperatures

Storage temperature	T_{stg}		−55 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1.0	K/W
From mounting base to heatsink				
a. with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.3	K/W
b. without heatsink compound	$R_{th\ mb\text{-}h}$	=	0.5	K/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0.2	K/W

MOUNTING INSTRUCTIONS

The top connector should be neither bent nor twisted; it should be soldered into the circuit so that there is no strain on it.

During soldering the heat conduction to the junction should be kept to a minimum.

*To ensure thermal stability: $R_{th\ j\text{-}a} \leqslant 4.9$ K/W

CHARACTERISTICS

Forward voltage				
I_F = 35 A; T_j = 150 °C	V_F	<	0.8	V*
I_F = 100 A; T_j = 25 °C	V_F	<	1.3	V*
Reverse current				
$V_R = V_{RRMmax}$; T_j = 100 °C	I_R	<	2.5	mA
T_j = 25 °C	I_R	<	100	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}	<	40	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	<	20	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}	<	4.5	A
Forward recovery when switched to I_F = 10 A with dI_F/dt = 10 A/μs; T_j = 25 °C	V_{fr}	typ.	1.0	V

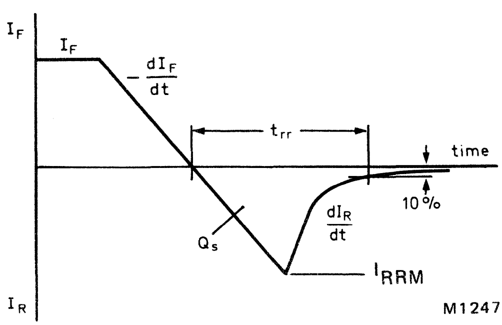


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

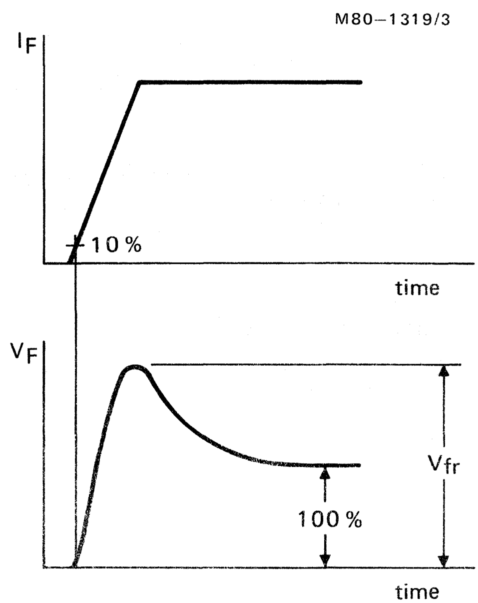


Fig.3 Definition of V_{fr}.

*Measured under pulse conditions to avoid axcessive dissipation.

SQUARE-WAVE OPERATION

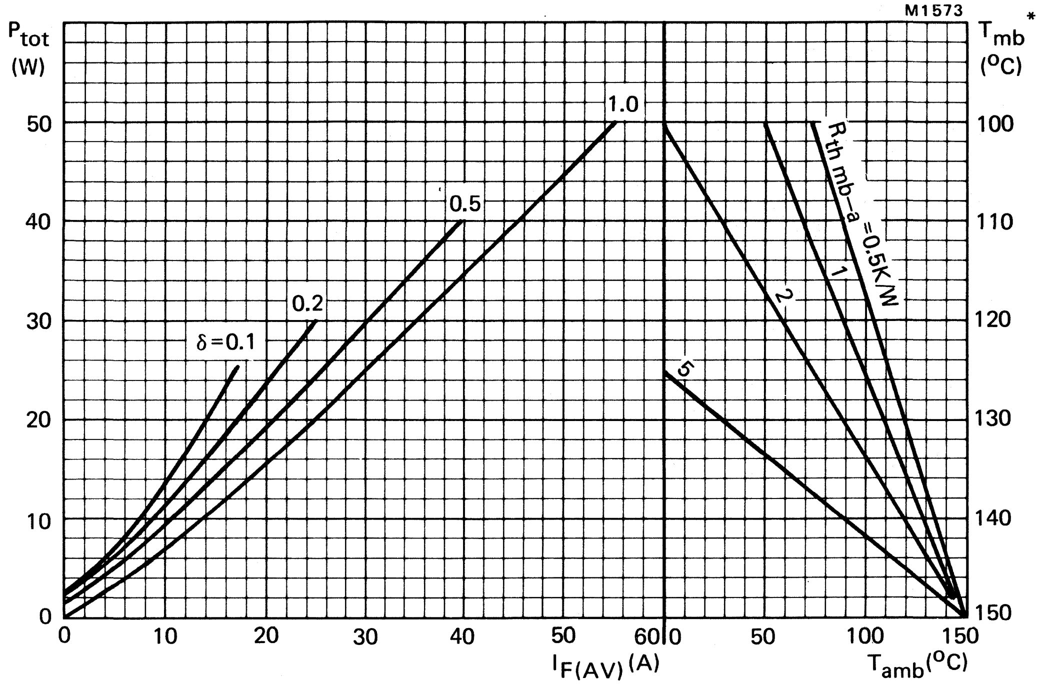
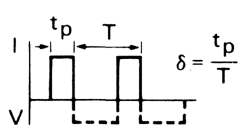


Fig.4 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 500 kHz.



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

*T_{mb} scale is for comparison purposes and is correct only for $R_{th\ mb\text{-}a} < 3.6$ K/W.

SINUSOIDAL OPERATION

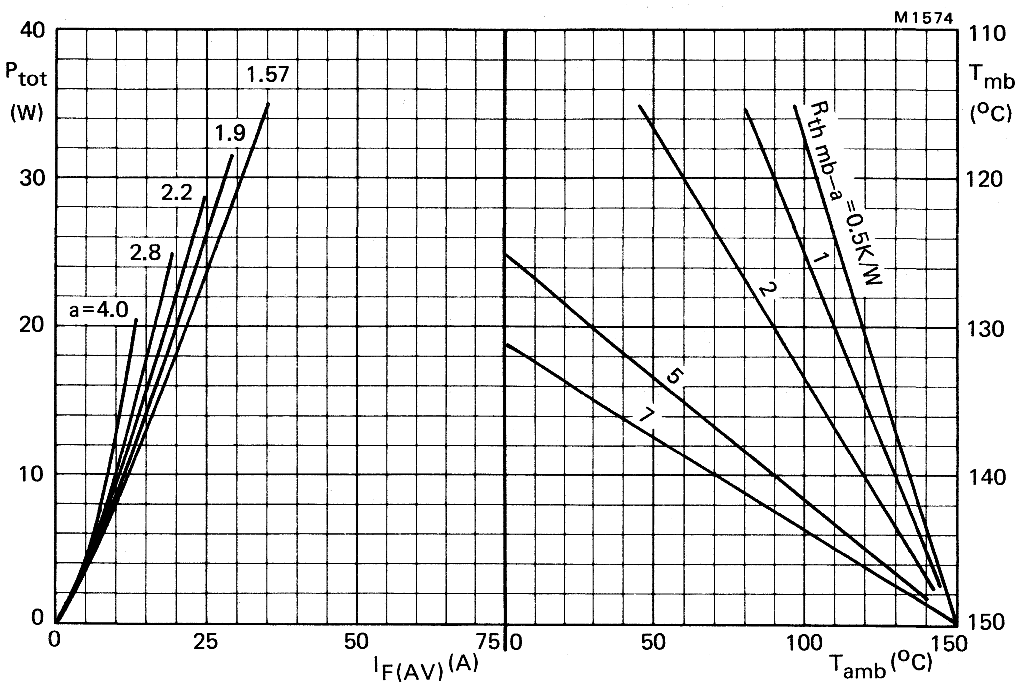


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 500 kHz.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

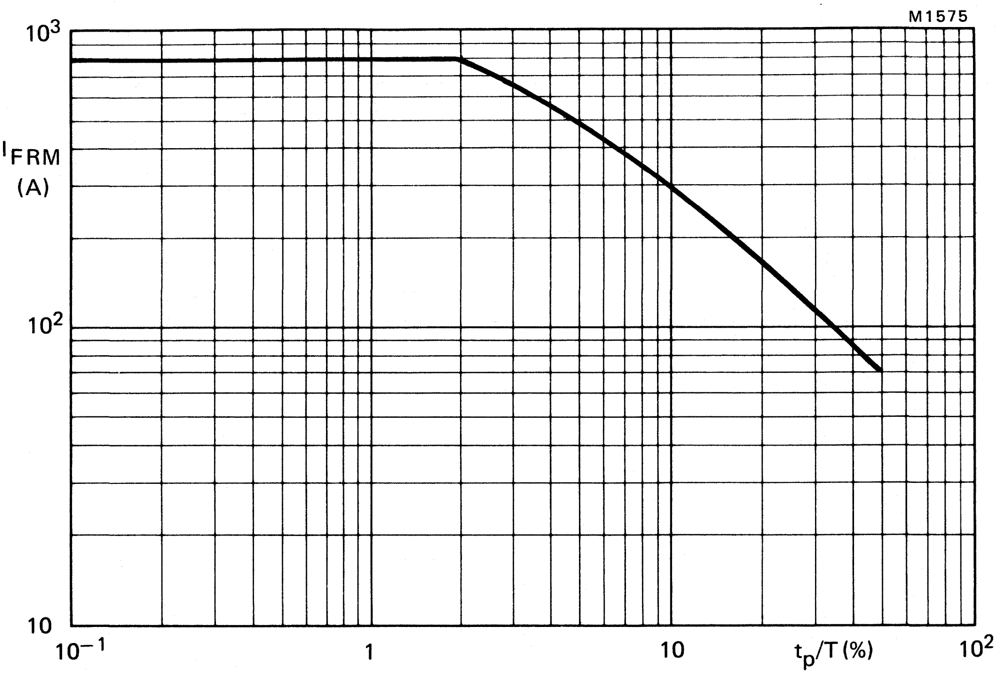
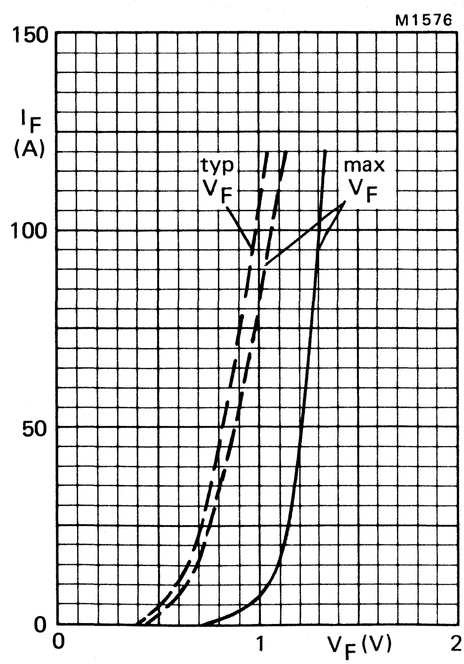
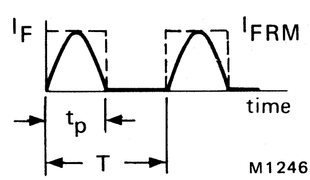


Fig.6 Maximum permissible repetitive peak forward current for square or sinusoidal currents; $1\ \mu s < t_p < 1$ ms.





Definition of I_{FRM} and t_p/T.

Fig.7 —— $T_j = 25\ ^oC$; – – – $T_j = 150\ ^oC$.

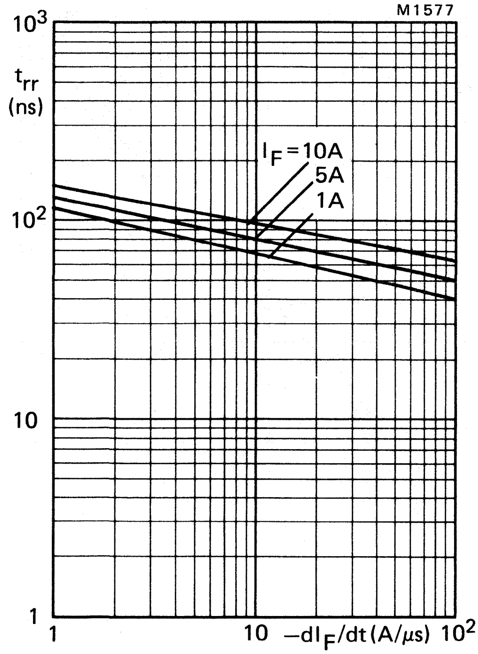


Fig.8 Maximum t_{rr} at T_j = 25 °C.

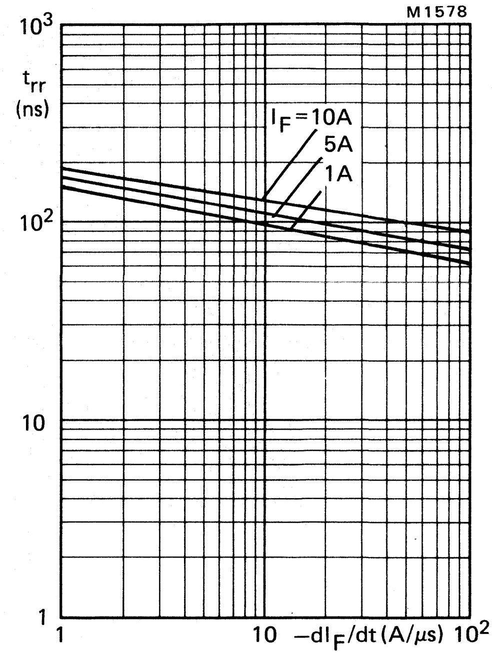


Fig.9 Maximum t_{rr} at T_j = 100 °C.

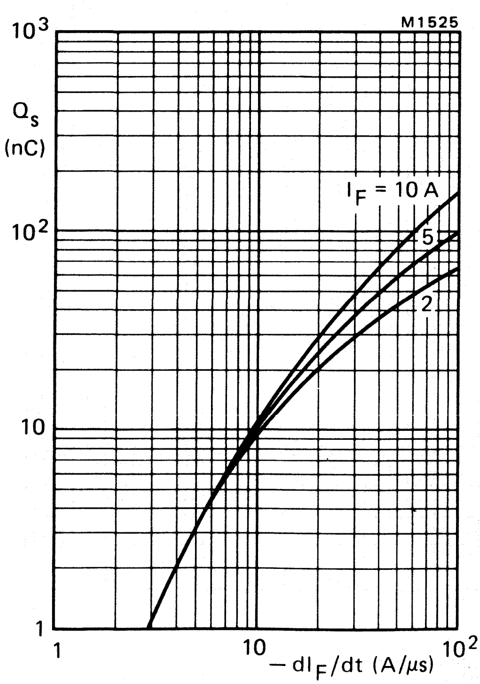


Fig.10 Maximum Q_s at T_j = 25 °C.

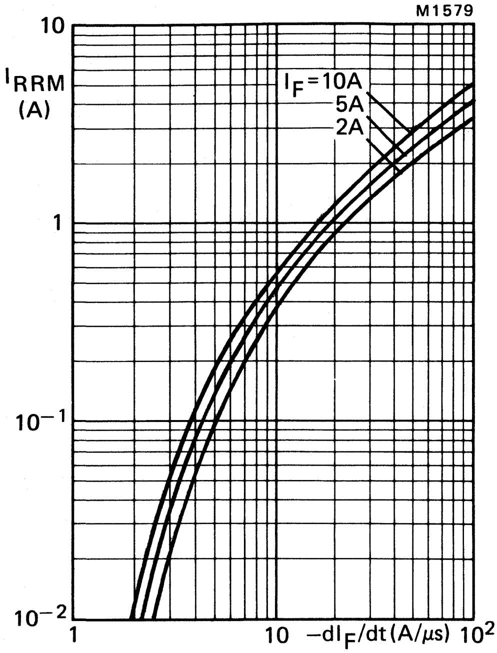


Fig.11 Maximum I_{RRM} at T_j = 25 °C.

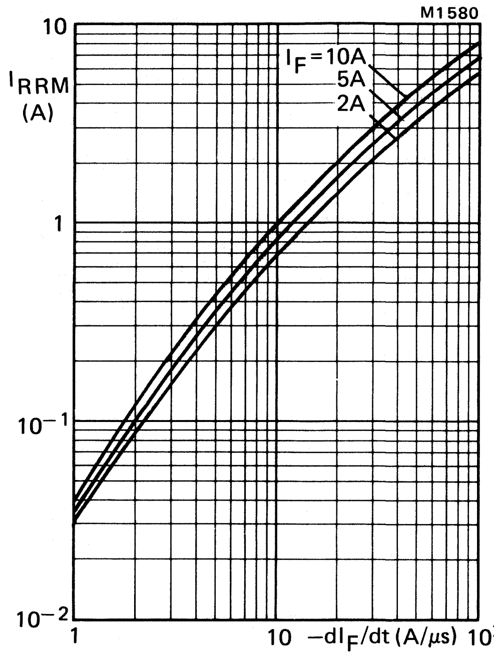


Fig.12 Maximum I_{RRM} at T_j = 100 °C.

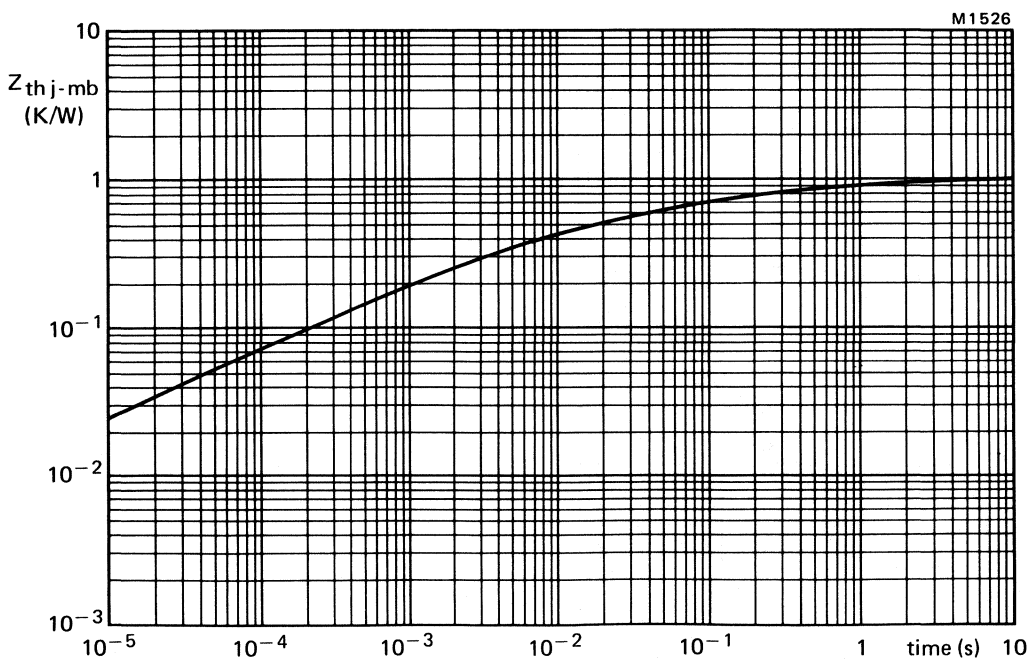


Fig.13 Transient thermal impedance.

ULTRA FAST RECOVERY RECTIFIER DIODES

Glass-passivated, high-efficiency epitaxial rectifier diodes in DO-5 metal envelopes, featuring low forward voltage drop, ultra fast reverse recovery times, very low stored charge and soft recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where low conduction and switching losses are essential. The series consists of normal polarity (cathode to stud) types.

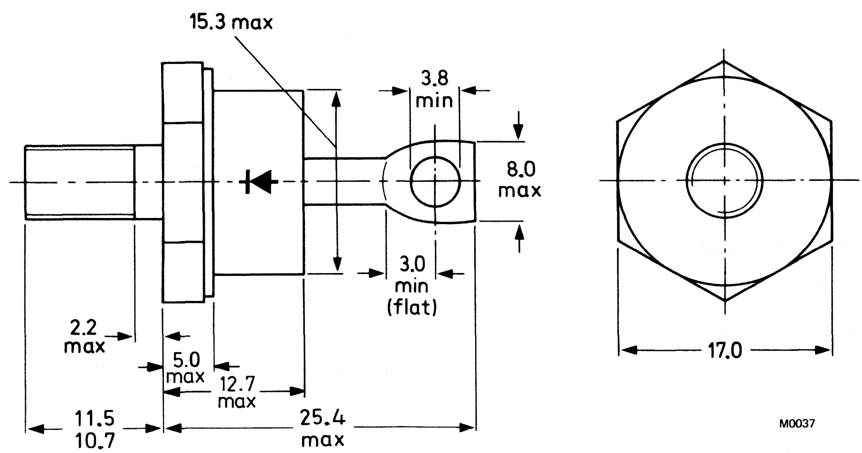
QUICK REFERENCE DATA

			BYW93–50	100	150	200	
Repetitive peak reverse voltage	V_{RRM}	max.	50	100	150	200	V
Average forward current	$I_{F(AV)}$	max.		60			A
Forward voltage	V_F	<		0.8			V
Reverse recovery time	t_{rr}	<		45			ns

MECHANICAL DATA

Dimensions in mm

Fig.1 DO-5; with metric M6 stud (ϕ 6 mm): e.g. BYW93–50
with ¼ in x 28 UNF stud (ϕ 6.35 mm); e.g. BYW93–50U



Net mass: 22 g

Diameter of clearance hole: max. 6.5 mm

Accessories supplied on request:
see ACCESSORIES section.

Supplied with device: 1 nut, 1 lock washer

Torque on nut: min. 1.7 Nm (17 kg cm)
max. 3.5 Nm (35 kg cm)

Nut dimensions across the flats: M6: 10 mm,
¼ in x 28 UNF: 11.1 mm

Products approved to CECC 50 009-028, available on request.

RATINGS

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

Voltages

			BYW93–50	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

Average forward current; switching losses negligible up to 500 kHz				
square wave; δ = 0.5; up to T_{mb} = 110 °C	$I_{F(AV)}$	max.	60	A
up to T_{mb} = 125 °C	$I_{F(AV)}$	max.	40	A
sinusoidal; up to T_{mb} = 115 °C	$I_{F(AV)}$	max.	50	A
up to T_{mb} = 125 °C	$I_{F(AV)}$	max.	38	A
R.M.S. forward current	$I_{F(RMS)}$	max.	85	A
Repetitive peak forward current t_p = 20 μs; δ = 0.02	I_{FRM}	max.	1500	A
Non-repetitive peak forward current half sine-wave; T_j = 150 °C prior to surge; with reapplied V_{RWMmax};				
t = 10 ms	I_{FSM}	max.	800	A
t = 8.3 ms	I_{FSM}	max.	1000	A
I^2t for fusing (t = 10 ms)	I^2t	max.	3200	A^2s

Temperatures

Storage temperature	T_{stg}		–55 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	0.7	K/W
From mounting base to heatsink				
a. with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.2	K/W
b. without heatsink compound	$R_{th\ mb\text{-}h}$	=	0.3	K/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0.32	K/W

MOUNTING INSTRUCTIONS

The top connector should be neither bent nor twisted; it should be soldered into the circuit so that there is no strain on it.

During soldering the heat conduction to the junction should be kept to a minimum.

*To ensure thermal stability: $R_{th\ j\text{-}a} \leq 3.0$ K/W.

CHARACTERISTICS

Forward voltage				
I_F = 50 A; T_j = 150 °C	V_F	<	0.8	V*
I_F = 150 A; T_j = 25 °C	V_F	<	1.3	V*
Reverse current				
$V_R = V_{RWM\,max}$; T_j = 100 °C	I_R	<	5	mA
T_j = 25 °C	I_R	<	250	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}	<	45	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	<	35	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}	<	6	A
Forward recovery when switched to I_F = 10 A with dI_F/dt = 10 A/μs; T_j = 25 °C	V_{fr}	typ.	1.0	V

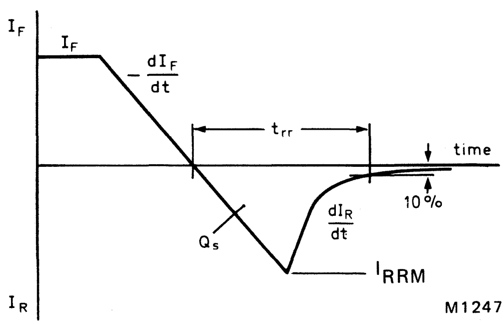


Fig.2 Definition of t_{rr}, Q_s and I_{RRM}.

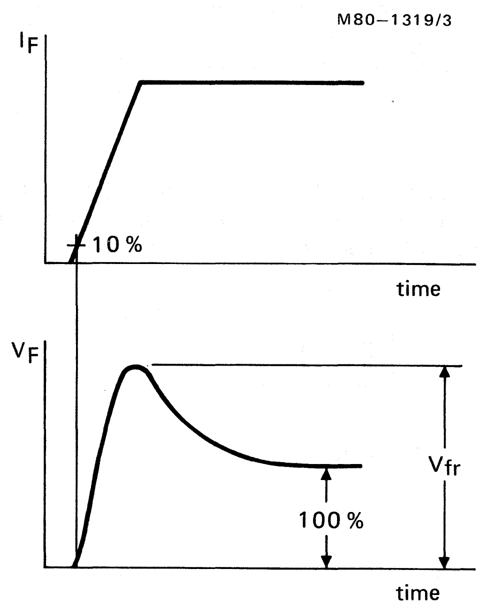


Fig.3 Definition of V_{fr}.

*Measured under pulse conditions to avoid excessive dissipation.

SQUARE-WAVE OPERATION

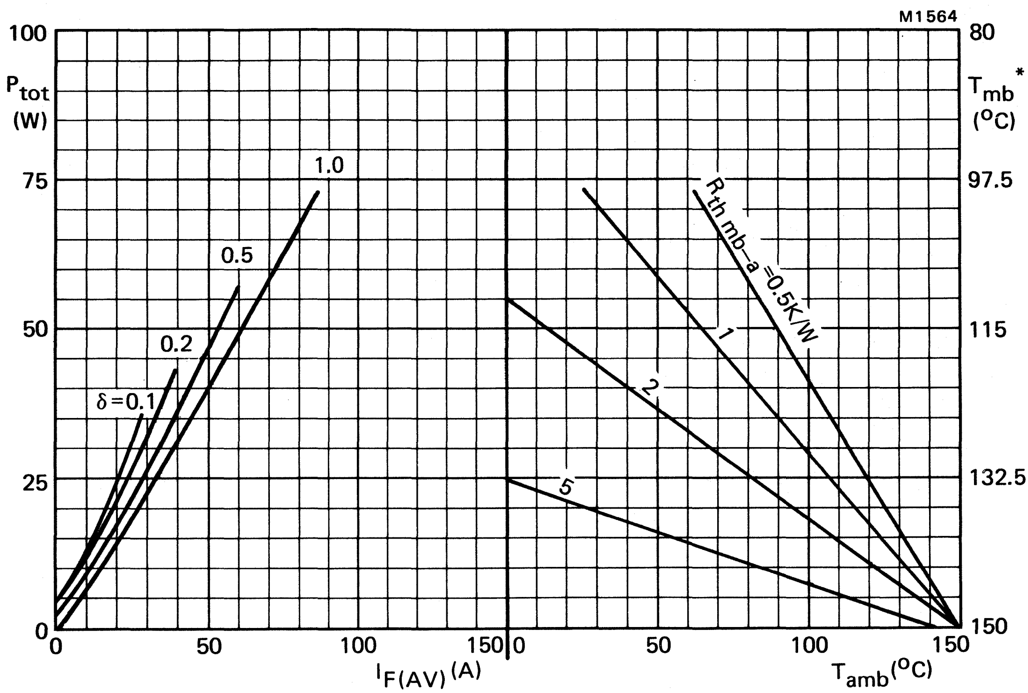
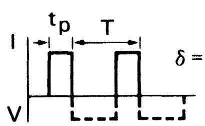


Fig.4 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
Power includes reverse current losses.



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

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

*T_{mb} scale is for comparison purposes and is correct only for $R_{th\ mb\text{-}a} < 2.1$ K/W

SINUSOIDAL OPERATION

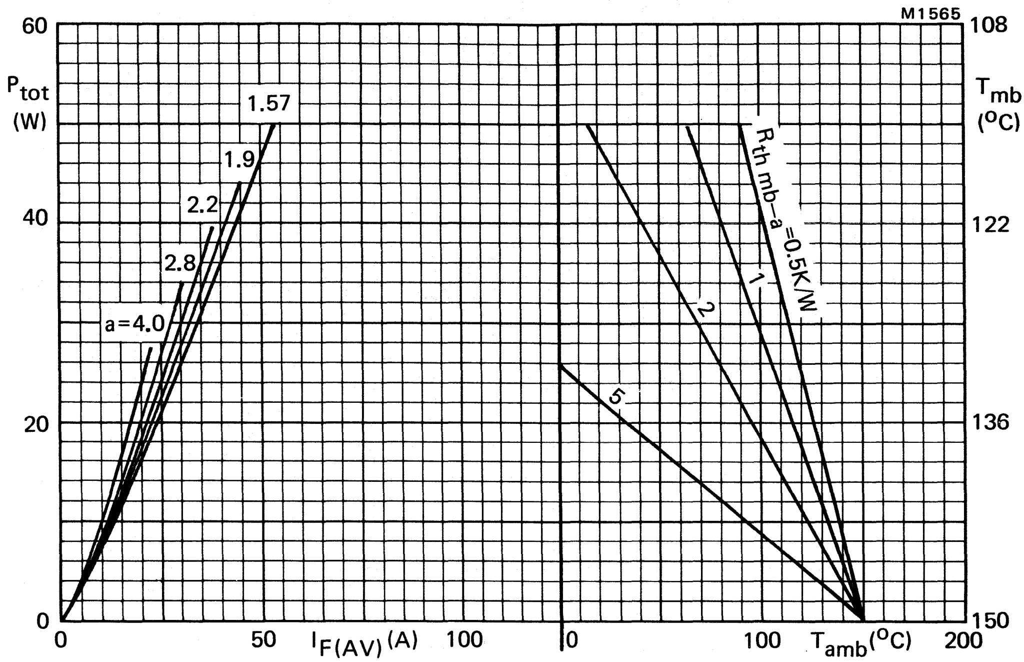


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
Power includes reverse current losses.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

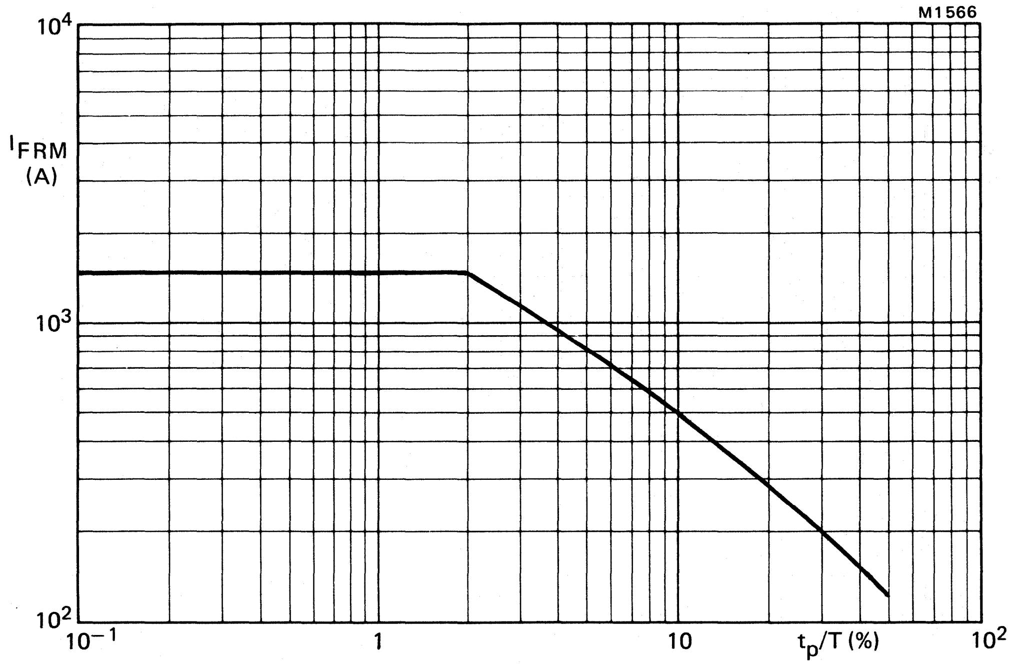
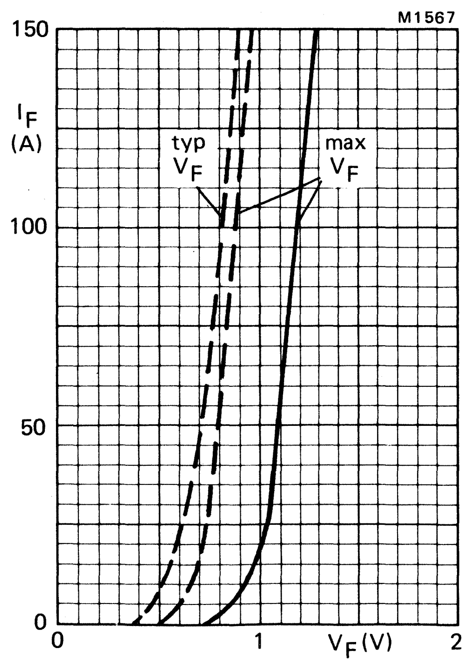
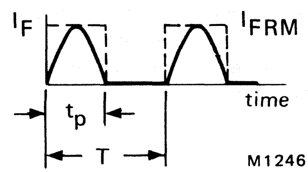


Fig.6 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 $\mu s < t_p < 1$ ms.





Definition of I_{FRM} and t_p/T.

Fig.7 —— T_j = 25 °C; – – – T_j = 150 °C.

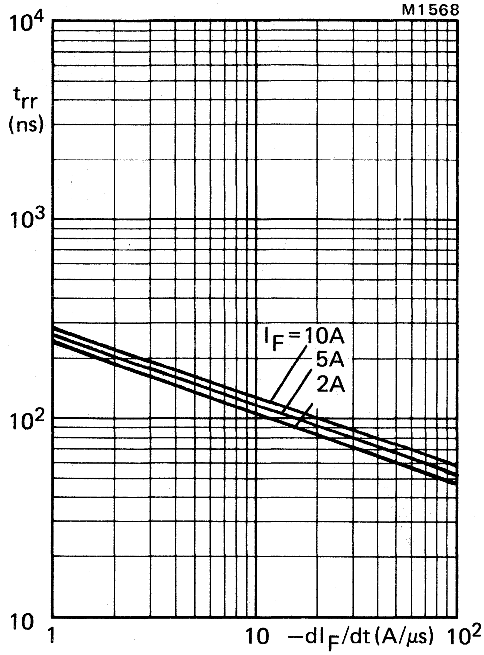


Fig.8 Maximum t_{rr} at T_j = 25 °C.

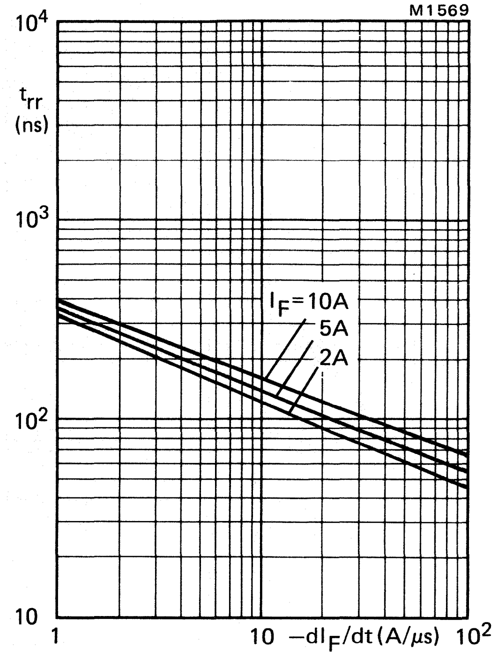


Fig.9 Maximum t_{rr} at T_j = 100 °C.

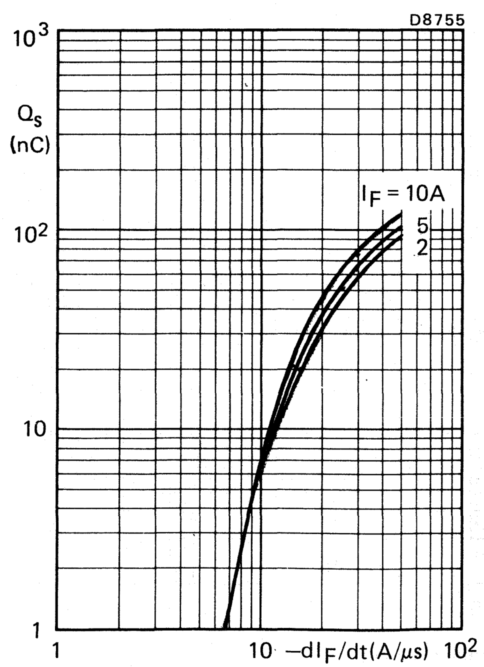


Fig.10 Maximum Q_s at T_j = 25 °C.

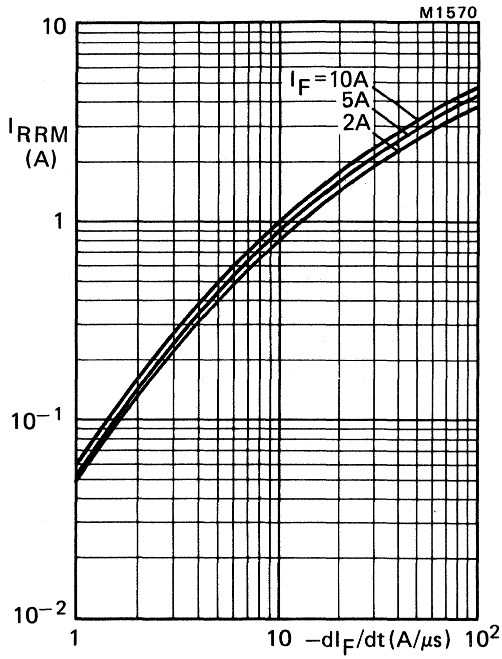


Fig.11 Maximum I_{RRM} at T_j = 25 °C.

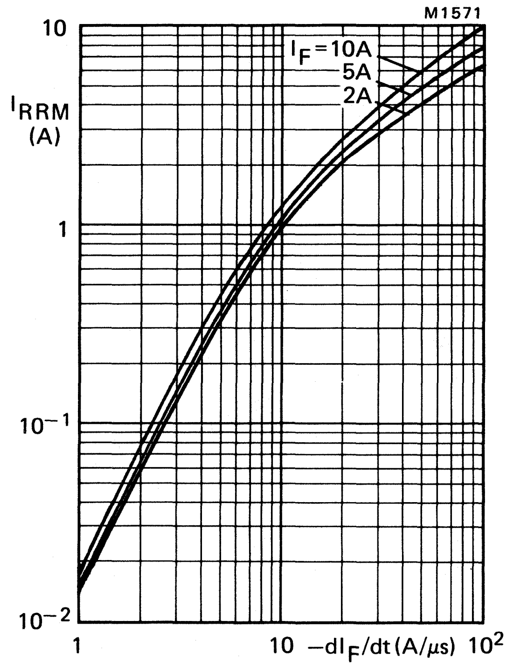


Fig.12 Maximum I_{RRM} at T_j = 100 °C.

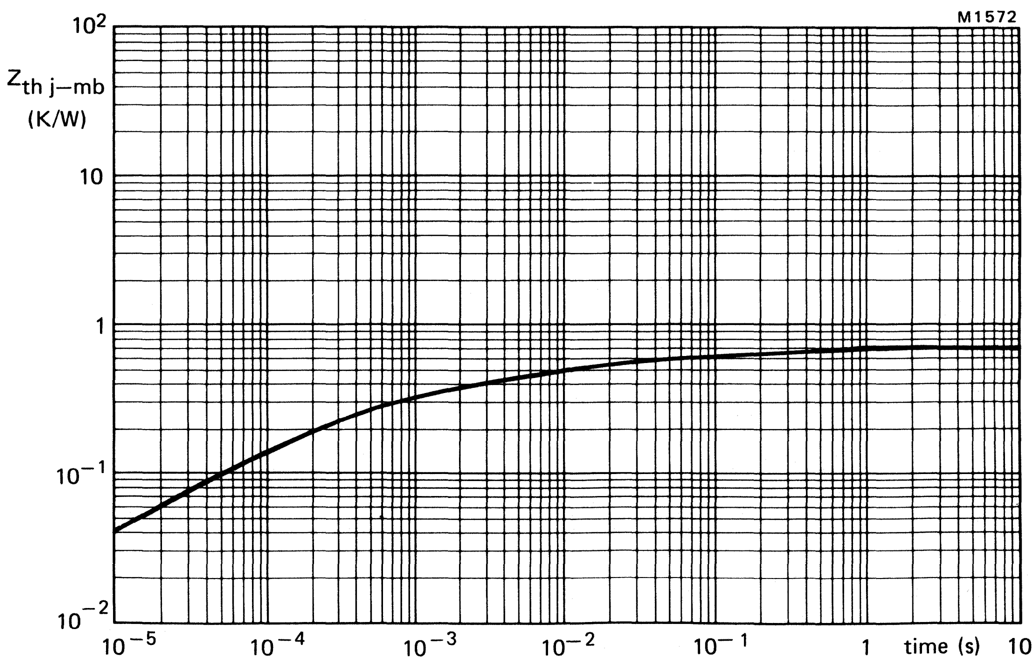


Fig.13 Transient thermal impedance.

CONTROLLED AVALANCHE RECTIFIER DIODES

Diffused silicon diodes in DO–4 metal envelopes, capable of absorbing transients and intended for power rectifier applications. The series consists of the following types:
Normal polarity (cathode to stud): BYX25–600 to BYX25–1400.
Reverse polarity (anode to stud): BYX25–600R to BYX25–1400R.

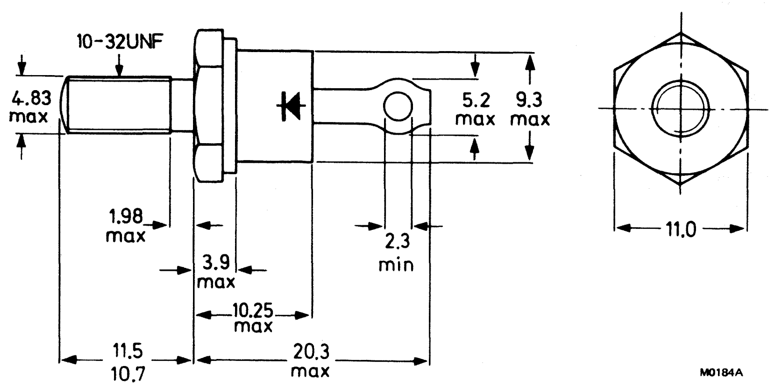
QUICK REFERENCE DATA

			BYX25–600(R)	800(R)	1000(R)	1200(R)	1400(R)	
Crest working reverse voltage	V_{RWM}	max.	600	800	1000	1200	1400	V
Reverse avalanche breakdown voltage	$V_{(BR)R}$	>	750	1000	1250	1450	1650	V
Average forward current	$I_{F(AV)}$	max.			20			A
Non-repetitive peak forward current	I_{FSM}	max.			360			A
Non-repetitive peak reverse power	P_{RSM}	max.			18			kW

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO–4.



Net mass: 7 g.

Diameter of clearance hole: max. 5.2 mm.

Accessories supplied on request:
see ACCESSORIES section

Supplied with device: 1 nut, 1 lock washer.

Nut dimensions across the flats: 9.5 mm

Torque on nut:
min. 0.9 Nm (9 kg cm),
max. 1.7 Nm (17 kg cm).

The mark shown applies to the normal polarity types.

Products approved to CECC 50 009–022 available on request.

RATINGS

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

Voltages*

			BYX25–600(R)	800(R)	1000(R)	1200(R)	1400(R)	
Crest working reverse voltage	V_{RWM}	max.	600	800	1000	1200	1400	V
Continuous reverse voltage	V_R	max.	600	800	1000	1200	1400	V

Currents

Average forward current (averaged over any 20 ms period) up to T_{mb} = 125 °C	$I_{F(AV)}$	max.	20	A
Repetitive peak forward current	I_{FRM}	max.	440	A
Non-repetitive peak forward current t = 10 ms (half sine-wave); T_j = 175 °C prior to surge; with reapplied V_{RWMmax}	I_{FSM}	max.	360	A
I^2t for fusing	I^2t	max.	650	A^2s

Reverse power dissipation

Average reverse power dissipation (averaged over any 20 ms period); T_j = 175 °C	$P_{R(AV)}$	max.	38	W
Repetitive peak reverse power dissipation t = 10 μs (square-wave; f = 50 Hz); T_j = 175 °C	P_{RRM}	max.	3	kW
Non-repetitive peak reverse power dissipation t = 10 μs (square-wave)				
T_j = 25 °C prior to surge	P_{RSM}	max.	18	kW
T_j = 175 °C prior to surge	P_{RSM}	max.	3	kW

Temperatures

Storage temperature	T_{stg}		–55 to +175	°C
Junction temperature	T_j	max.	175	°C

*To ensure thermal stability: $R_{th\ j\text{-}a} < 5$ K/W (a.c.)

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	50	$^oC/W$
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1.3	$^oC/W$
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.5	$^oC/W$

CHARACTERISTICS

			BYX25–600(R)	800(R)	1000(R)	1200(R)	1400(R)	
Forward voltage I_F = 50 A; T_j = 25 ^oC	V_F	<	1.8	1.8	1.8	1.8	1.8	V*
Reverse avalanche breakdown voltage I_R = 5 mA; T_j = 25 ^oC	$V_{(BR)R}$	>	750	1000	1250	1450	1650	V
		<	2400	2400	2400	2400	2400	V
Peak reverse current $V_R = V_{RWMmax}$; T_j = 125 ^oC	I_R	<	1.0	0.8	0.6	0.5	0.5	mA

*Measured under pulse conditions to avoid excessive dissipation.

OPERATING NOTES

1. **Voltage sharing of series connected controlled avalanche diodes.**

   If diodes with avalanche characteristics are connected in series, the usual R and C elements for voltage sharing can be omitted.

2. The top connector should not be bent; it should be soldered into the circuit so that there is no strain on it.
   During soldering the heat conduction to the junction should be kept to a minimum by using a thermal shunt.

Determination of the heatsink thermal resistance

Example:

Assume a diode, used in a three phase rectifier circuit.

frequency	f	= 50 Hz
average forward current	I_{FAV}	= 10 A (per diode)
ambient temperature	T_{amb}	= 40 °C
repetitive peak reverse power dissipation in the avalanche region	P_{RRM}	= 2 kW (per diode)
duration of P_{RRM}	t	= 40 μs

From the left hand part of the upper graph on page 5 it follows that at I_{FAV} = 10 A in a three phase rectifier circuit the average forward power + average leakage power = 19.5 W per diode (point A). The average reverse power in the avalanche region, averaged over any cycle, follows from:

$$P_{RAV} = \delta \times P_{RRM}, \text{ where the duty cycle } \delta = \frac{40\ \mu s}{20\ ms} = 0.002$$

Thus: $P_{RAV} = 0.002 \times 2\ kW = 4\ W$

Therefore the total device power dissipation P_{tot} = (19.5 + 4) W = 23.5 W (point B).

In order to avoid excessive peak junction temperatures resulting from the pulse character of the repetitive peak reverse power in the avalanche region, the value of the maximum junction temperature should be reduced. If the repetitive peak reverse power in the avalanche region is 2 kW; t = 40 μs; f = 50 Hz, the maximum allowable junction temperature should be 163 °C instead of 175 °C, thus 12 °C lower (see the lower graph on page 5).

Allowance can be made for this by assuming an ambient temperature 12 °C higher than before, in this case 52 °C instead of 40 °C.

Using this in the curve leads to a thermal resistance

$$R_{th\ mb\text{-}a} \approx 4\ °C/W$$

The contact thermal resistance $R_{th\ mb\text{-}h}$ = 0.5 °C/W

Hence the heatsink thermal resistance should be:

$$R_{th\ h\text{-}a} = R_{th\ mb\text{-}a} - R_{th\ mb\text{-}h} = (4 - 0.5)\ °C/W = 3.5\ °C/W$$

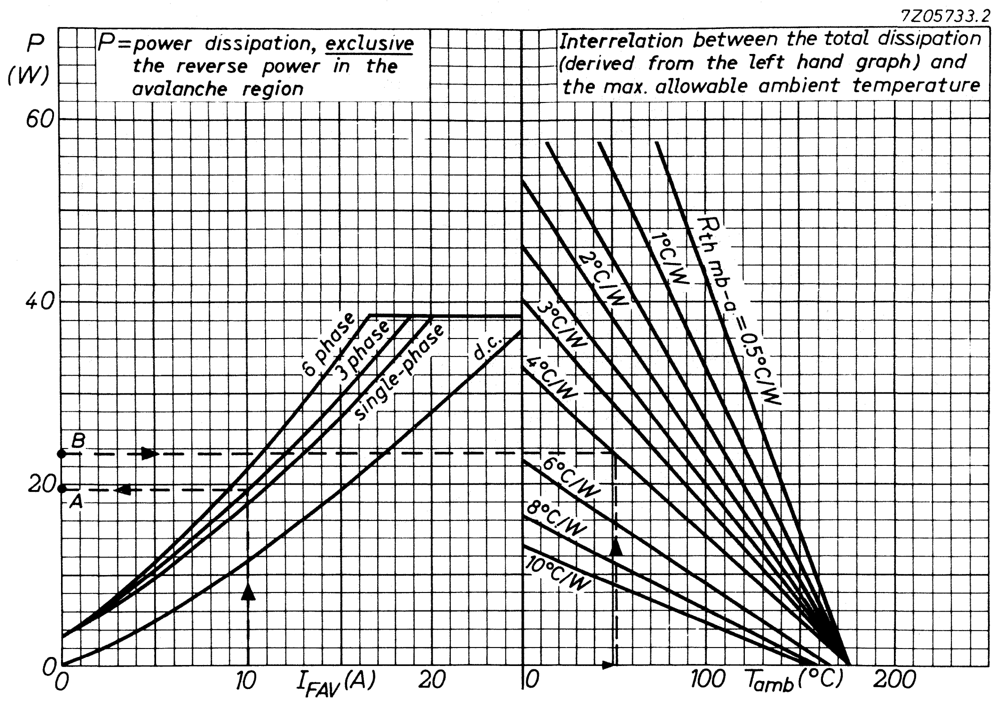

7Z05733.2
P (W)
P = power dissipation, exclusive the reverse power in the avalanche region
Interrelation between the total dissipation (derived from the left hand graph) and the max. allowable ambient temperature
60
40
20
0
B
A
6 phase
3 phase
single-phase
d.c.
Rth mb-a = 0.5°C/W
1°C/W
2°C/W
3°C/W
4°C/W
6°C/W
8°C/W
10°C/W
0
10
IFAV (A)
20
0
100
Tamb (°C)
200

Fig.2

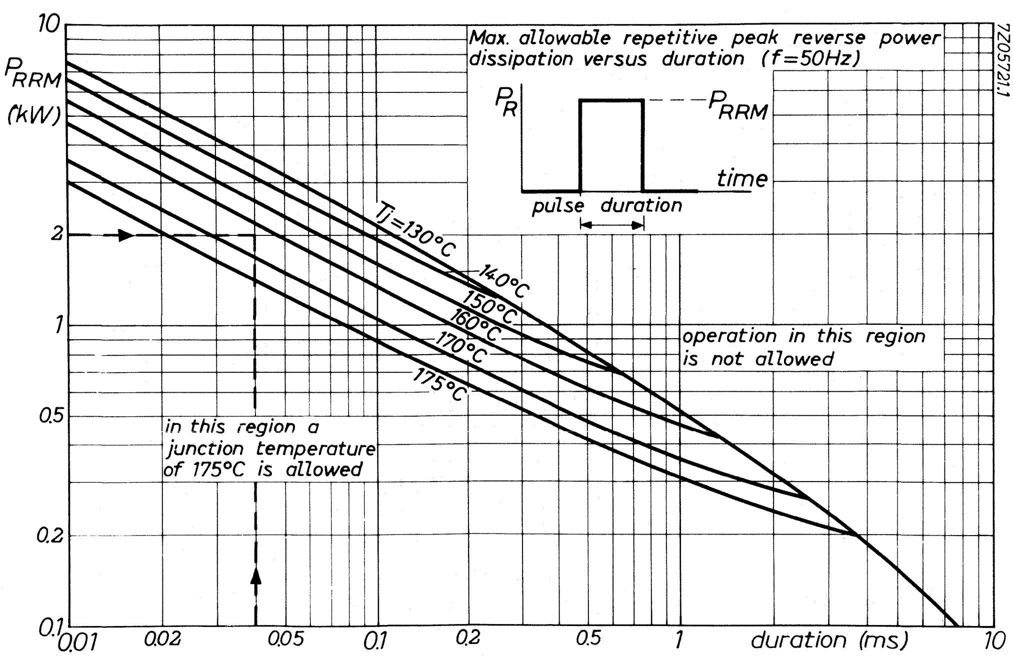

7Z05721.1
10
PRRM (kW)
Max. allowable repetitive peak reverse power dissipation versus duration (f=50Hz)
PR
PRRM
time
pulse duration
Tj=130°C
140°C
150°C
160°C
170°C
175°C
operation in this region is not allowed
in this region a junction temperature of 175°C is allowed
2
1
0.5
0.2
0.1
0.01
0.02
0.05
0.1
0.2
0.5
1
duration (ms)
10

Fig.3

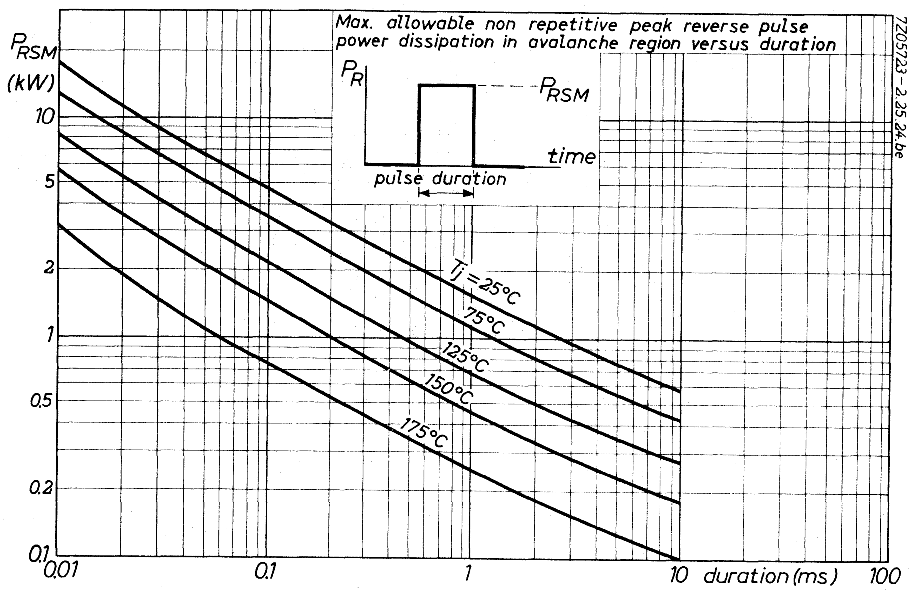

Max. allowable non repetitive peak reverse pulse power dissipation in avalanche region versus duration
P_{RSM} (kW)
P_R
P_{RSM}
time
pulse duration
T_j = 25 °C
75 °C
125 °C
150 °C
175 °C
duration (ms)
7Z05723-2.25.24.be

Fig.4

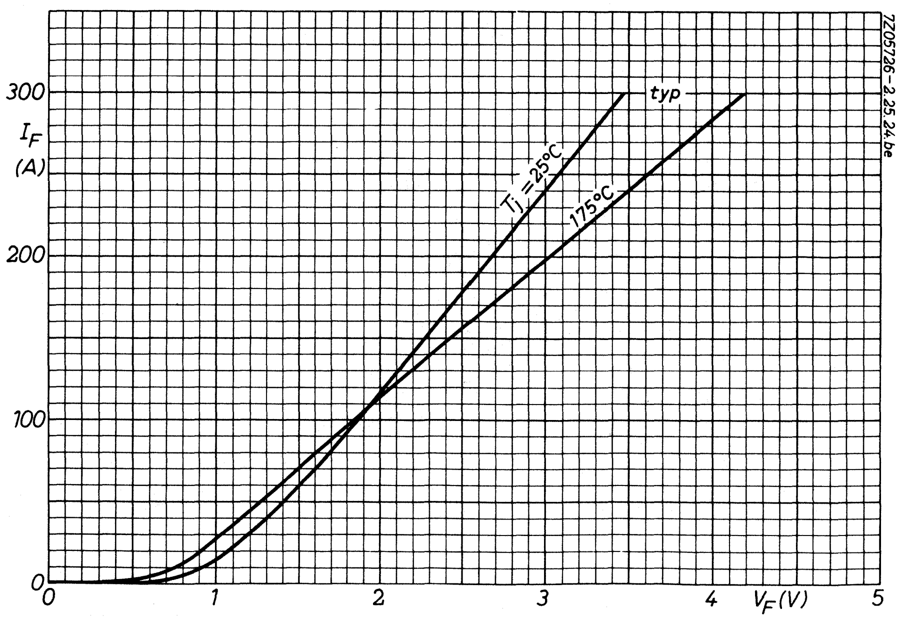

I_F (A)
V_F (V)
typ
T_j = 25 °C
175 °C
7Z05726-2.25.24.be

Fig.5

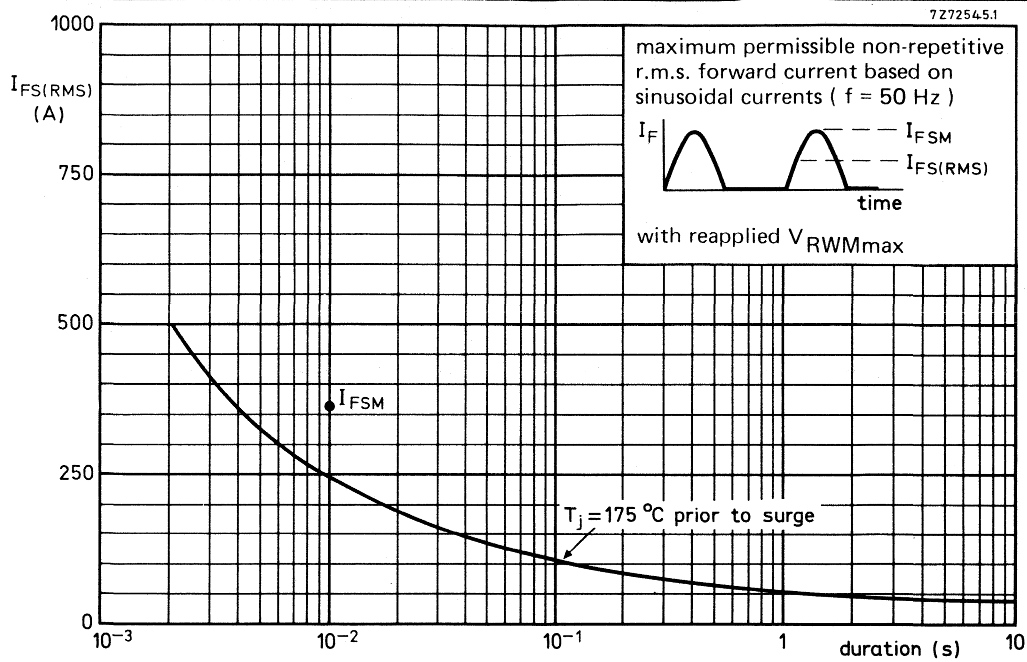

7Z72545.1
1000
$I_{FS(RMS)}$ (A)
750
500
250
0
10^{-3}
10^{-2}
10^{-1}
1
10
duration (s)
maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz)
I_F
I_{FSM}
$I_{FS(RMS)}$
time
with reapplied V_{RWMmax}
I_{FSM}
T_j = 175 °C prior to surge

Fig.6

FAST SOFT-RECOVERY RECTIFIER DIODES

- **With controlled avalanche**

Also available to BS9333-F002

Diffused silicon diodes in DO-4 metal envelopes, capable of absorbing transients. They are primarily intended for use in high-frequency power supplies, thyristor inverters and multi-phase power rectifier applications.
The series consists of the following types:
Normal polarity (cathode to stud): BYX30-200 to BYX30-600
Reverse polarity (anode to stud): BYX30-200R to BYX30-600R.

QUICK REFERENCE DATA

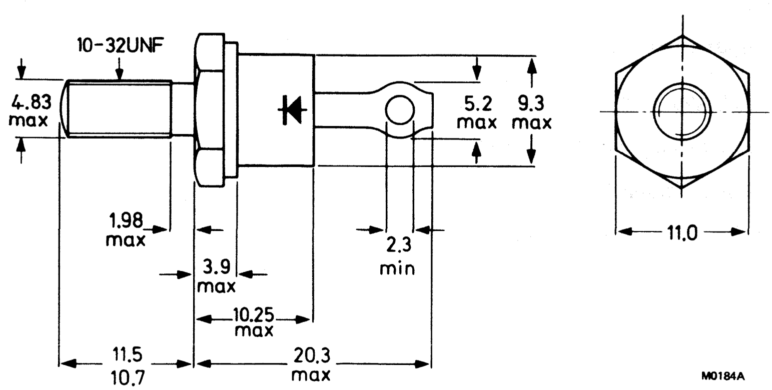
			BYX30-200(R)	300(R)	400(R)	500(R)	600(R)	
Crest working reverse voltage	V_{RWM}	max.	200	300	400	500	600	V
Reverse avalanche breakdown voltage	$V_{(BR)R}$	>	250	375	500	625	750	V

Average forward current	$I_{F(AV)}$	max.	14	A
Non-repetitive peak forward current	I_{FSM}	max.	250	A
Non-repetitive peak reverse power	P_{RSM}	max.	18	kW
Reverse recovery time	t_{rr}	<	200	ns

MECHANICAL DATA

Dimensions in mm

DO-4; Supplied with device: 1 nut, 1 lock-washer
Nut dimensions across the flats: 9.5 mm



Net mass: 7 g
Diameter of clearance hole: max. 5.2 mm
Accessories supplied on request:
see ACCESSORIES section

Torque on nut: min. 0.9 Nm (9 kg cm)
max. 1.7 Nm (17 kg cm)

The mark shown applies to the normal polarity types.

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

Voltages [1]		BYX30-200(R)	300(R)	400(R)	500(R)	600(R)	
Crest working reverse voltage	V_{RWM}	max. 200	300	400	500	600	V
Continuous reverse voltage	V_R	max. 200	300	400	500	600	V

Currents

Average forward current (averaged over any 20 ms period) up to T_{mb} = 100 °C	$I_{F(AV)}$	max.	14	A
at T_{mb} = 125 °C	$I_{F(AV)}$	max.	7.5	A
R.M.S. forward current	$I_{F(RMS)}$	max.	22	A
Repetitive peak forward current	I_{FRM}	max.	310	A
Non-repetitive peak forward current (t = 10 ms; half-sinewave) T_j = 150 °C prior to surge; with reapplied V_{RWM} max.	I_{FSM}	max.	250	A
I^2t for fusing (t = 10 ms)	I^2t	max.	312	A^2s

Reverse power dissipation

Repetitive peak reverse power dissipation t = 10 µs (square wave; f = 50 Hz) T_j = 150 °C	P_{RRM}	max.	5.5	kW
Non-repetitive peak reverse power dissipation t = 10 µs (square wave) T_j = 25 °C prior to surge	P_{RSM}	max.	18	kW
T_j = 150 °C prior to surge	P_{RSM}	max.	5.5	kW

Temperatures

Storage temperature	T_{stg}	-55 to +150		°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j-a}$	=	50	°C/W
From junction to mounting base	$R_{th\ j-mb}$	=	1.3	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0.5	°C/W

[1] To ensure thermal stability: $R_{th\ j-a} < 2.5$ °C/W (continuous reverse voltage) or < 5 °C/W (a.c.).
For smaller heatsinks T_j max should be derated. For a.c. see page 5.
For continuous reverse voltage: if $R_{th\ j-a}$ = 5 °C/W, then T_j max = 135 °C.
if $R_{th\ j-a}$ = 10 °C/W, then T_j max = 120 °C.

CHARACTERISTICS

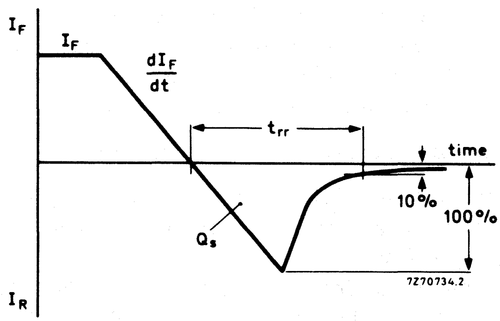
			BYX30-200(R)	300(R)	400(R)	500(R)	600(R)	
Forward voltage								
I_F = 50 A; T_j = 25 °C	V_F	<	3.2	3.2	3.2	3.2	3.2	V [1]
Reverse breakdown voltage								
I_R = 5 mA; T_j = 25 °C	$V_{(BR)R}$	>	250	375	500	625	750	V
		<	1050	1050	1050	1050	1050	V
Reverse current								
$V_R = V_{RWMmax}$; T_j = 125 °C	I_R	<	4.0	4.0	4.0	4.0	4.0	mA

Reverse recovery charge when switched from

I_F = 2 A to $V_R \geq$ 30 V;
with $-dI_F/dt$ = 100 A/µs; T_j = 25 °C — Q_s < 0.70 µC

Reverse recovery time when switched from

I_F = 1 A to $V_R \geq$ 30 V;
$-dI_F/dt$ = 50 A/µs; T_j = 25 °C — t_{rr} < 200 ns



OPERATING NOTES

1. Square-wave operation

When I_F has been flowing sufficiently long for the steady state to be established, there will be a charge due to minority carriers present. Before the device can block in the reverse direction this charge must be extracted. This extraction takes the form of a reverse transient (see figure above). The majority of the power dissipation due to the reverse transient occurs during fall time as the rectifier gradually becomes reverse biased, and the mean power will be proportional to the operating frequency. The mean value of this power loss can be derived from the graphs on page 10.

[1]) Measured under pulse conditions to avoid excessive dissipation.

OPERATING NOTES (continued)

2. Sine wave operation

Power loss in sine wave operation will be considerably less owing to the much slower rate of change of the applied voltage (and consequently lower values of I_{RRM}), so that power loss due to reverse recovery may be safely ignored for frequencies up to 20 kHz.

3. Determination of the heatsink thermal resistance

Example:
Assume a diode, used in an inverter.

frequency	f	=	20	kHz
duty cycle	δ	=	0.5	
ambient temperature	T_{amb}	=	45	^{o}C
switched from	I_F	=	12	A
to	V_R	=	400	V
at a rate	$-\frac{dI}{dt}$	=	20	A/μs

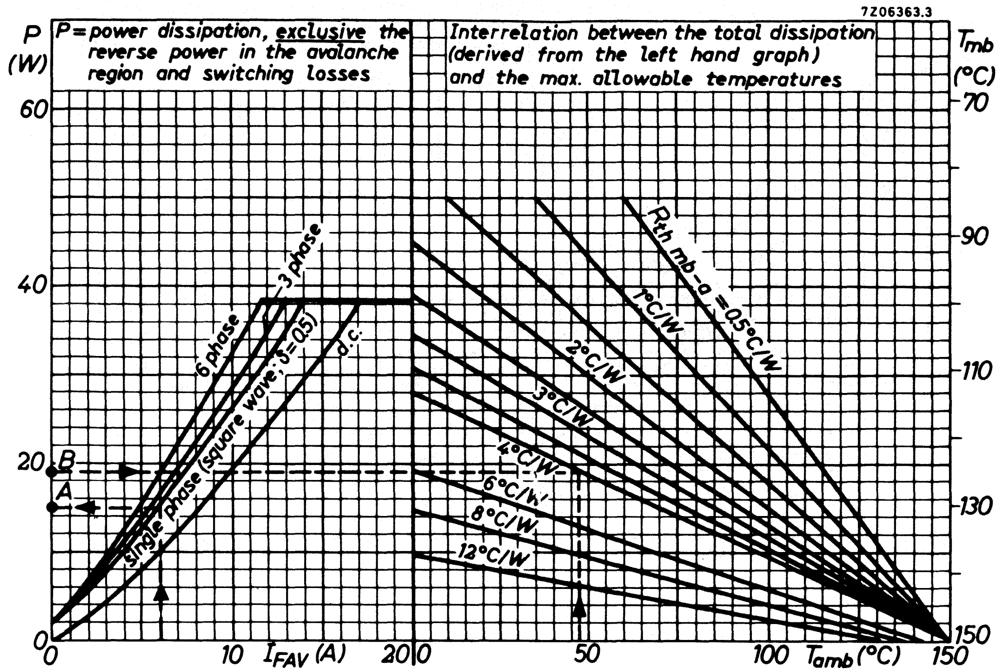
At a duty cycle δ = 0.5 the average forward current I_{FAV} = 6 A.
From the upper graph on page 5 it follows, that at I_{FAV} = 6 A the average forward power + average leakage power = 15 W (point A).
The additional power losses due to switching-off can be read from the nomogram on page 10 (the example being based on optimum use, i.e. T_j = 150 ^{o}C). Starting from I_F = 12 A on the horizontal scale trace upwards until the appropriate line $-\frac{dI}{dt}$ = 20 A/μs. From the intersection trace horizontally to the right until the line for f = 20 kHz. Then trace downwards to the line V_R = 400 V and ultimately trace horizontally to the left and on the vertical axis read the additional average power dissipation P_{RAV} = 4 W.
Therefore the total power dissipation P_{tot} = 15 W + 4 W = 19 W (point B of the upper graph on page 5). From the right hand part follows the thermal resistance, required at T_{amb} = 45 ^{o}C.

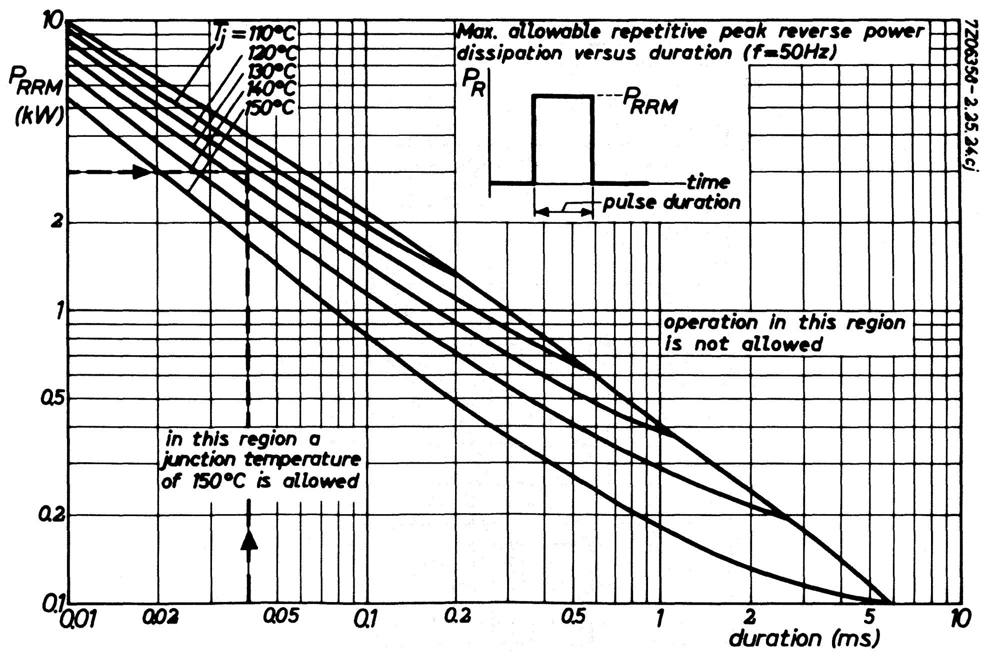
$$R_{th\ mb\text{-}a} \approx 4\ ^{o}C/W$$

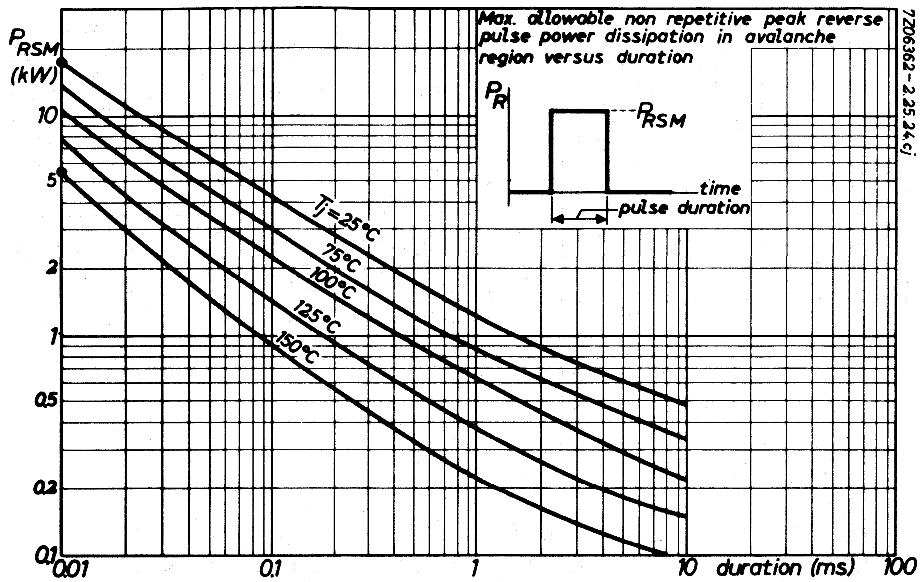
The contact thermal resistance $R_{th\ mb\text{-}h}$ = 0.5 $^{o}C/W$.

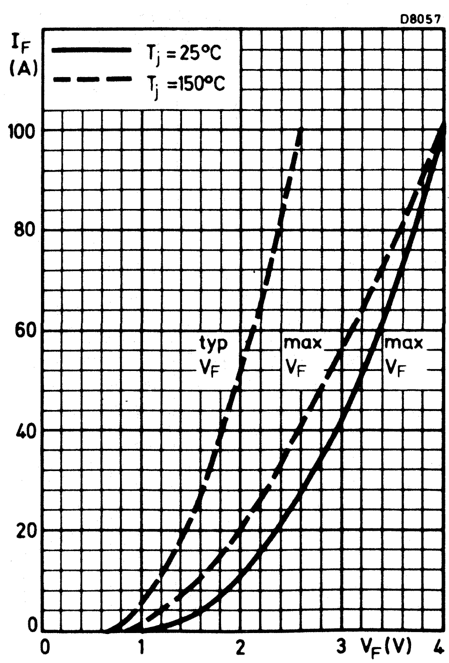
Hence the heatsink thermal resistance should be:

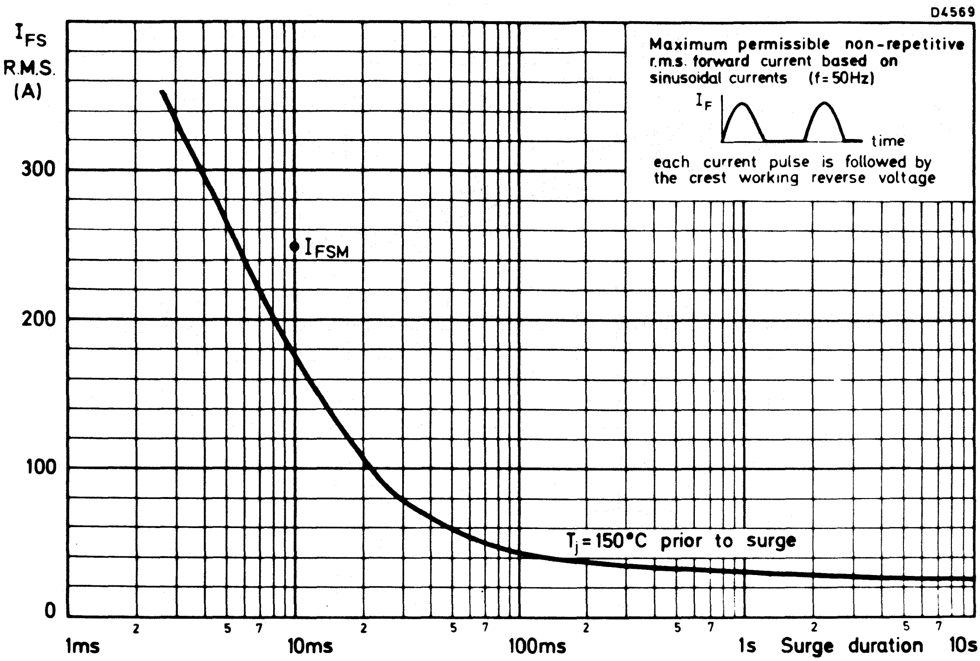
$$R_{th\ h\text{-}a} = R_{th\ mb\text{-}a} - R_{th\ mb\text{-}h} = (4 - 0.5)\ ^{o}C/W = 3.5\ ^{o}C/W.$$

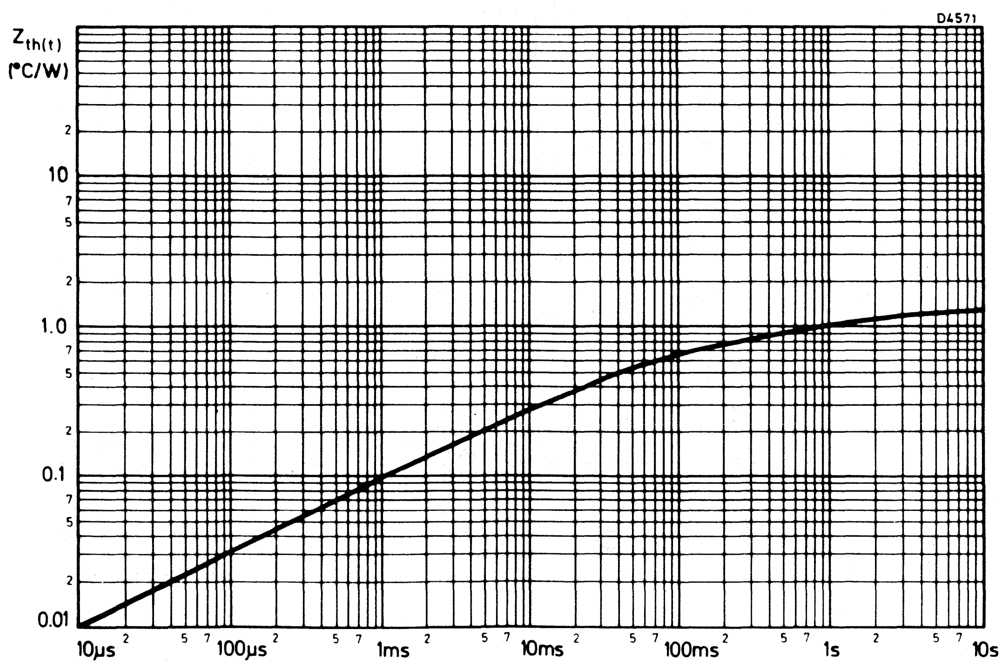

7Z06363.3
P (W)
P = power dissipation, exclusive the reverse power in the avalanche region and switching losses
Interrelation between the total dissipation (derived from the left hand graph) and the max. allowable temperatures
T_{mb} (°C)
6 phase
3 phase
single phase (square wave; δ = 0.5)
d.c.
B
A
$R_{th\ mb-a}$ = 0.5°C/W
1°C/W
2°C/W
3°C/W
4°C/W
6°C/W
8°C/W
12°C/W
I_{FAV} (A)
T_{amb} (°C)

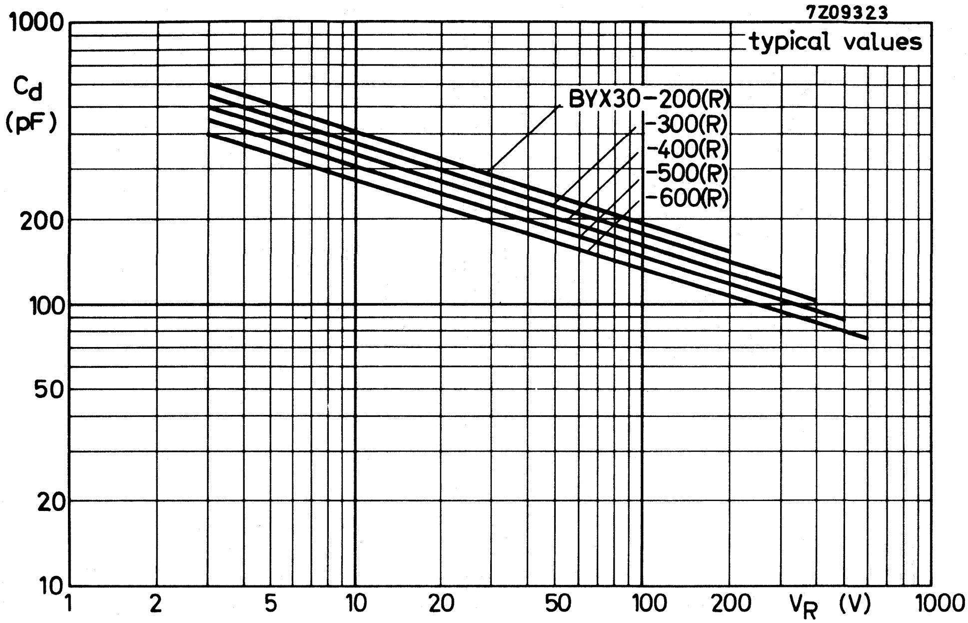

7Z06350-2.25.24.c)
P_{RRM} (kW)
T_j = 110°C
120°C
130°C
140°C
150°C
Max. allowable repetitive peak reverse power dissipation versus duration (f = 50Hz)
P_R
P_{RRM}
time
pulse duration
operation in this region is not allowed
in this region a junction temperature of 150°C is allowed
duration (ms)

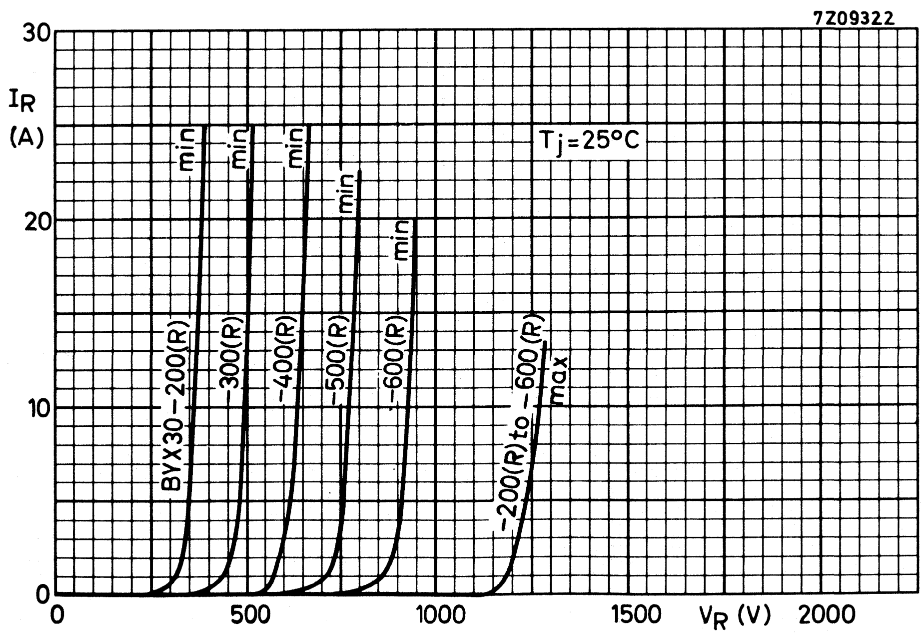

Max. allowable non repetitive peak reverse pulse power dissipation in avalanche region versus duration
7Z06362-2.25.24.cj
P_{RSM} (kW)
10
5
2
1
0.5
0.2
0.1
0.01
0.1
1
10
100
duration (ms)
T_j = 25 °C
75 °C
100 °C
125 °C
150 °C
P_R
P_{RSM}
time
pulse duration

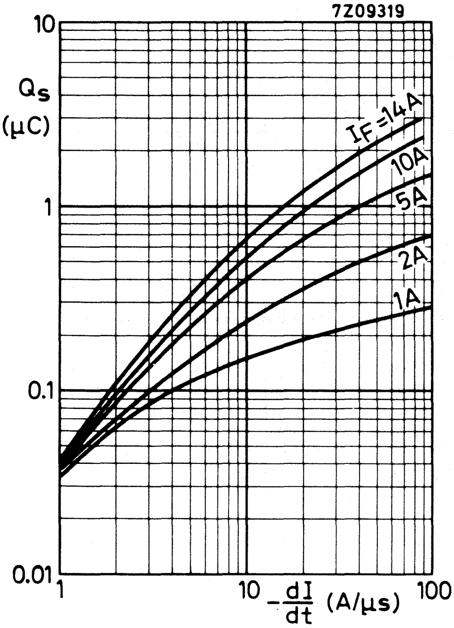

D8057
I_F (A)
T_j = 25 °C
T_j = 150 °C
100
80
60
40
20
0
0
1
2
3
4
V_F (V)
typ V_F
max V_F
max V_F


D4569
I_{FS}
R.M.S.
(A)
300
200
100
0
Maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50Hz)
I_F
time
each current pulse is followed by the crest working reverse voltage
I_{FSM}
T_j = 150 °C prior to surge
1ms
10ms
100ms
1s
Surge duration
10s

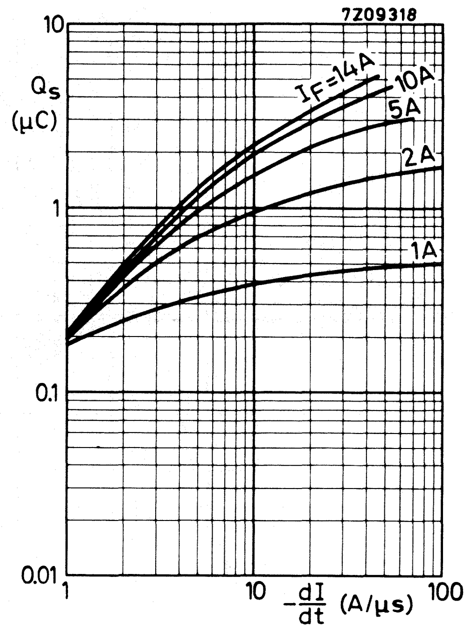

D4571
$Z_{th(t)}$
(°C/W)
10
1.0
0.1
0.01
10µs
100µs
1ms
10ms
100ms
1s
10s


7Z09323
typical values
C_d
(pF)
1000
200
100
50
20
10
BYX30-200(R)
-300(R)
-400(R)
-500(R)
-600(R)
1
2
5
10
20
50
100
200
V_R (V)
1000

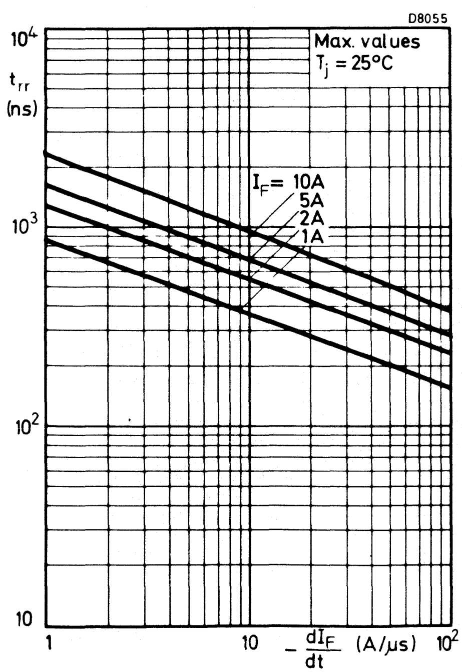

7Z09322
I_R
(A)
30
20
10
0
T_j=25°C
min
BYX30-200(R)
-300(R)
-400(R)
-500(R)
-600(R)
-200(R) to -600(R)
max
0
500
1000
1500
V_R (V)
2000

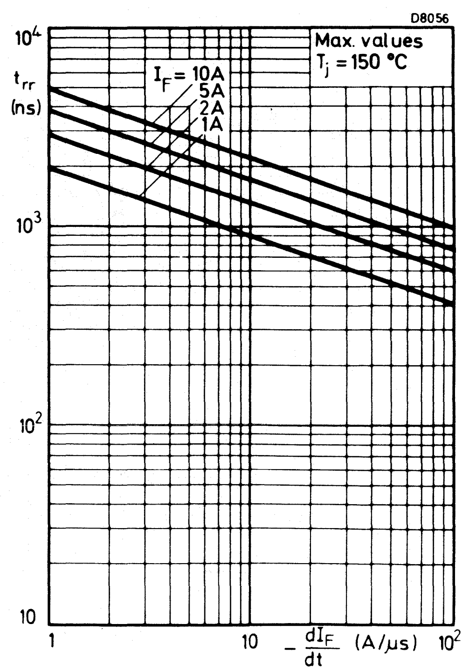


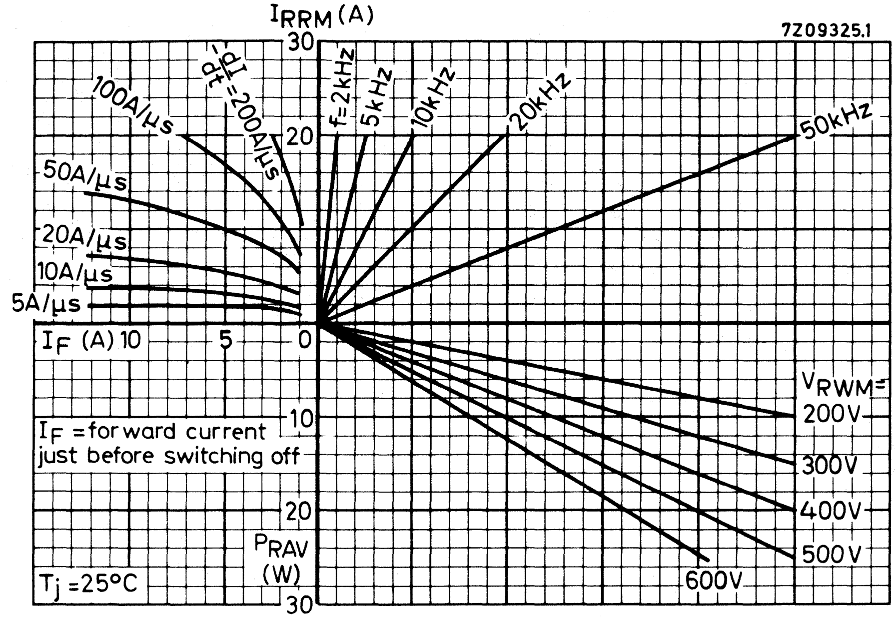
Maximum values; T_j = 25 °C; switched from I_F to $V_R \geqslant 30$ V.

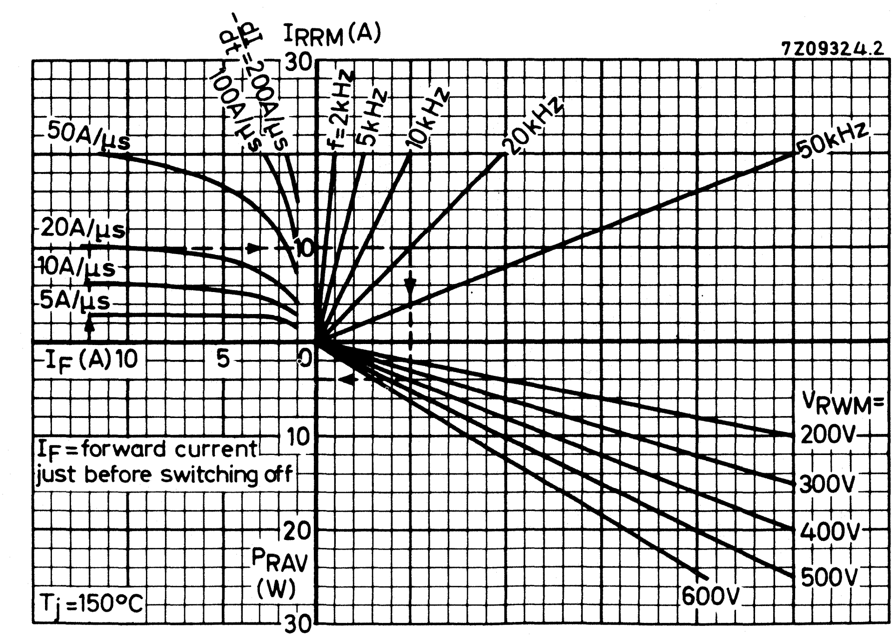


Maximum values; T_j = 150 °C; switched from I_F to $V_R \geqslant 30$ V.









Nomogram: Power loss P_{RAV} due to switching only (square wave operation)

SILICON RECTIFIER DIODES

Silicon rectifier diodes in DO-4 metal envelopes, intended for use in power rectifier applications. The series consists of the following types:
Normal polarity (cathode to stud): BYX38-300 to 1200.
Reverse polarity (anode to stud): BYX38-300R to 1200R.

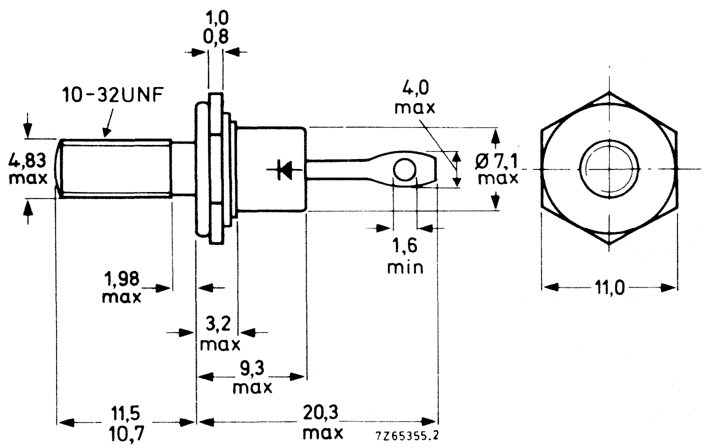
QUICK REFERENCE DATA

			BYX38-300(R)	600(R)	1200(R)	
Repetitive peak reverse voltage	V_{RRM}	max.	300	600	1200	V
Average forward current	$I_{F(AV)}$	max.		6		A
Non-repetitive peak forward current	I_{FSM}	max.		50		A

MECHANICAL DATA

Dimensions in mm

DO-4



Net mass: 6 g

Diameter of clearance hole: max. 5,2 mm

Accessories supplied on request:
see ACCESSORIES section

Torque on nut: min. 0,9 Nm (9 kg cm)
max. 1,7 Nm (17 kg cm)

Supplied with device: 1 nut, 1 lock washer
Nut dimensions across the flats: 9,5 mm

The mark shown applies to normal polarity types.

Products approved to CECC 50 009-019 available on request.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

			BYX38-300(R)	600(R)	1200(R)	
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	300	600	1200	V
Repetitive peak reverse voltage ($\delta \leq 0,01$)	V_{RRM}	max.	300	600	1200	V
Crest working reverse voltage	V_{RWM}	max.	200	400	800	V
Continuous reverse voltage	V_R	max.	200	400	800	V

Currents

Average forward current (averaged over any 20 ms period) up to T_{mb} = 110 °C	$I_{F(AV)}$	max.	6	A
at T_{mb} = 125 °C	$I_{F(AV)}$	max.	4	A
R.M.S. forward current	$I_{F(RMS)}$	max.	10	A
Repetitive peak forward current	I_{FRM}	max.	50	A
Non-repetitive peak forward current (t = 10 ms; half sine-wave) T_j = 150 °C prior to surge; with reapplied V_{RWMmax}	I_{FSM}	max.	50	A
I^2t for fusing (t = 10 ms)	I^2t	max.	13	A^2s

Temperatures

Storage temperature	T_{stg}		−55 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	50	°C/W
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	4	°C/W
From mounting base to heatsink with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,5	°C/W
without heatsink compound	$R_{th\ mb\text{-}h}$	=	0,6	°C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0,3	°C/W

CHARACTERISTICS

Forward voltage

$I_F = 20\ A; T_j = 25\ ^oC$	V_F	<	1,7	V [1]

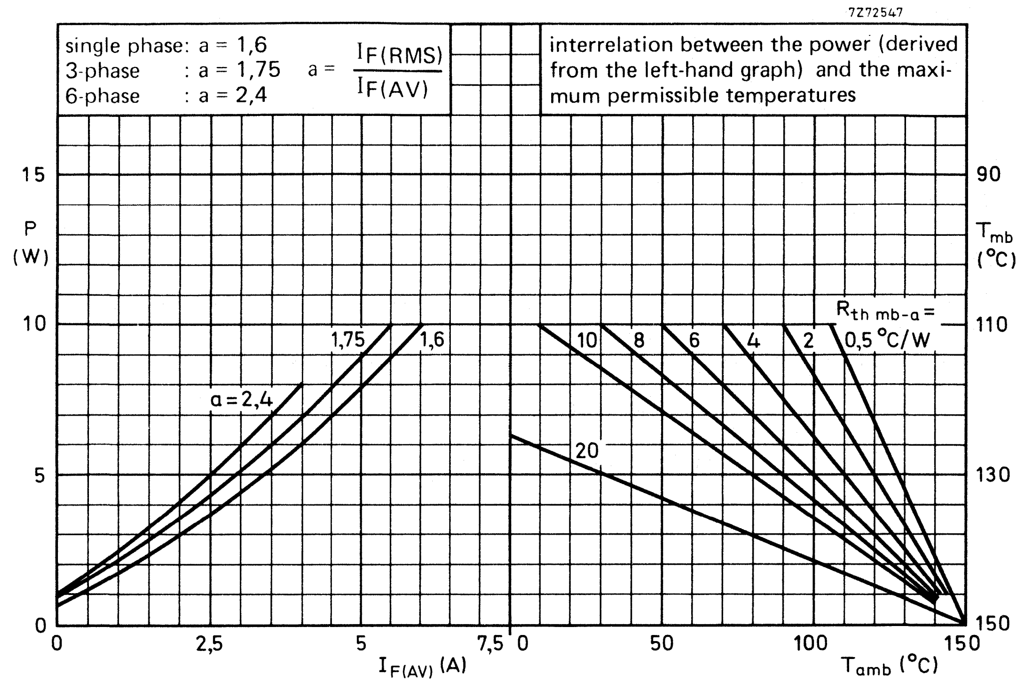
Reverse current

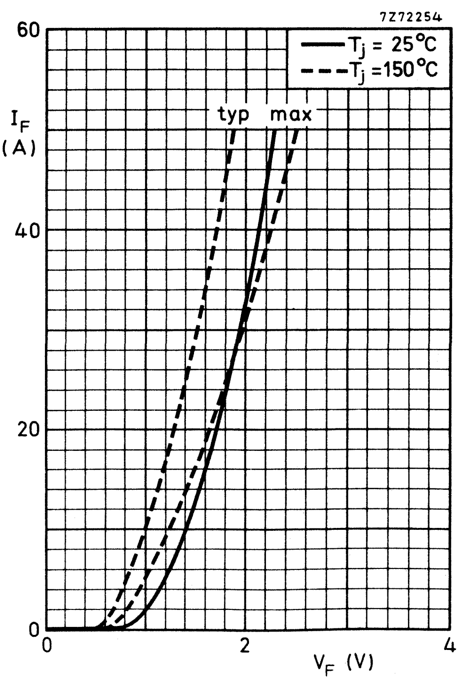
$V_R = V_{RWMmax}; T_j = 125\ ^oC$	I_R	<	200	μA

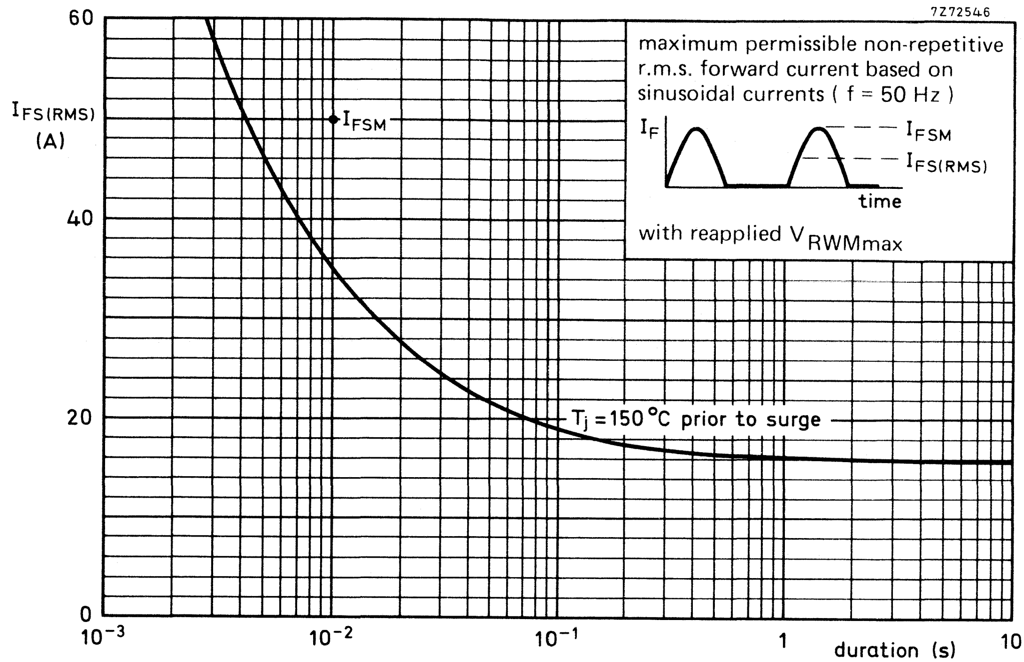
OPERATING NOTES

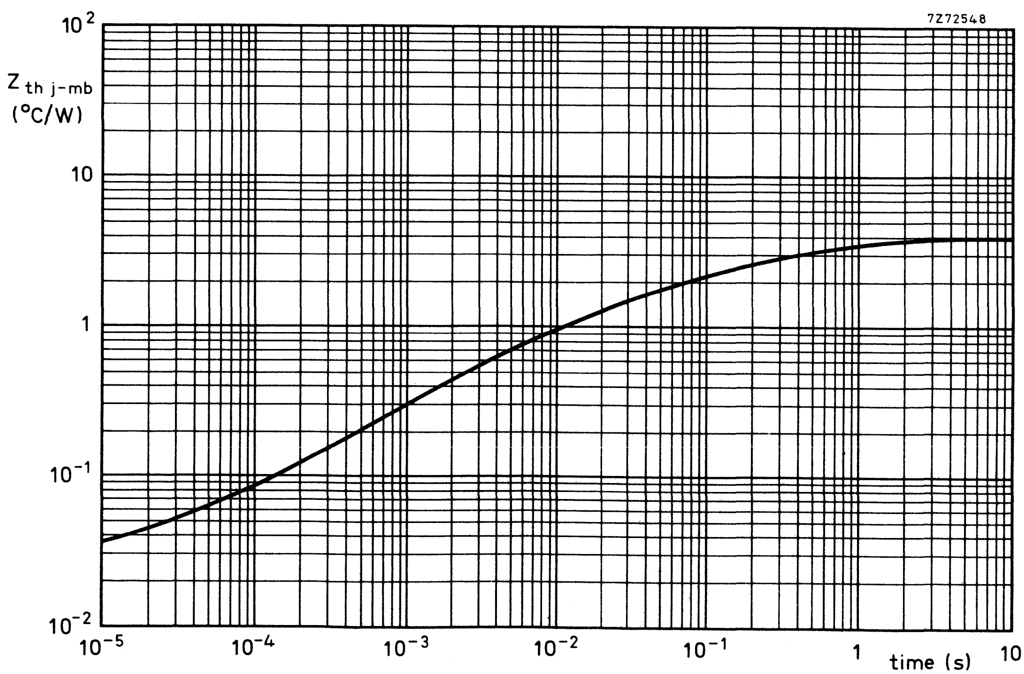
1. The top connector should neither be bent nor twisted; it should be soldered into the circuit so that there is no strain on it.
   During soldering the heat conduction to the junction should be kept to a minimum.
2. Where there is a possibility that transients, due to the energy stored in the transformer, will exceed the maximum permissible non-repetitive peak reverse voltage, see General Section for information on damping circuits.

[1]) Measured under pulse conductions to avoid excessive dissipation.


7Z72547
single phase: a = 1,6
3-phase : a = 1,75
6-phase : a = 2,4
a = I F(RMS) / I F(AV)
interrelation between the power (derived from the left-hand graph) and the maximum permissible temperatures
P (W)
15
10
5
0
a = 2,4
1,75
1,6
0
2,5
5
7,5
I F(AV) (A)
R th mb-a = 0,5 °C/W
10
8
6
4
2
20
0
50
100
150
T amb (°C)
T mb (°C)
90
110
130
150


7Z72254
T j = 25 °C
T j = 150 °C
typ
max
I F (A)
60
40
20
0
0
2
4
V F (V)


7Z72546
$I_{FS(RMS)}$ (A)
60
40
20
0
10^{-3}
10^{-2}
10^{-1}
1
10
duration (s)
I_{FSM}
maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz)
I_F
I_{FSM}
$I_{FS(RMS)}$
time
with reapplied V_{RWMmax}
T_j = 150 °C prior to surge


7Z72548
$Z_{th\ j\text{-}mb}$ (°C/W)
10^2
10
1
10^{-1}
10^{-2}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
10
time (s)

CONTROLLED AVALANCHE RECTIFIER DIODES

Also available to BS9333–F005

Silicon diodes in a DO–4 metal envelope, capable of absorbing transients and intended for use in power rectifier application.
The series consists of the following types:
Normal polarity (cathode to stud): BYX39–600 to BYX39–1400.
Reverse polarity (anode to stud): BYX39–600R to BYX39–1400R.

QUICK REFERENCE DATA

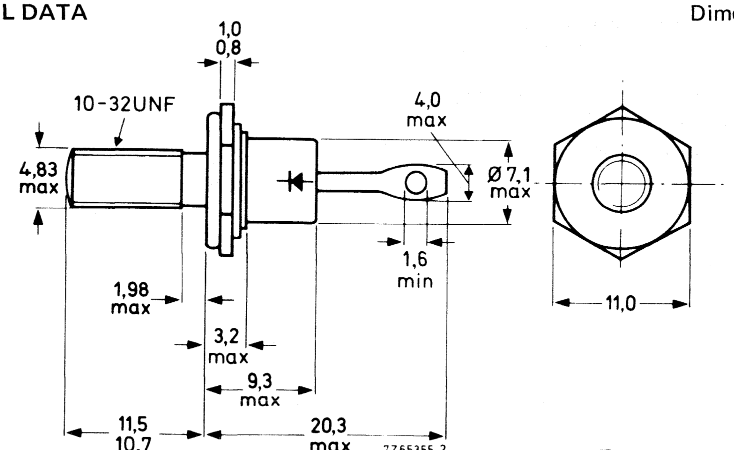
			BYX39–600(R)	800(R)	1000(R)	1200(R)	1400(R)	
Crest working reverse voltage	V_{RWM}	max.	600	800	1000	1200	1400	V
Reverse avalanche breakdown voltage	$V_{(BR)R}$	>	750	1000	1250	1450	1650	V

Average forward current	$I_{F(AV)}$	max.	9.5	A
Non-repetitive peak forward current	I_{FSM}	max.	125	A
Non-repetitive peak reverse power dissipation	P_{RSM}	max.	4	kW

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO–4



Net mass: 6 g
Diameter of clearance hole: max. 5.2 mm
Accessories supplied on request:
see ACCESSORIES section

Torque on nut:
min. 0.9 Nm (9 kg cm),
max. 1.7 Nm (17 kg cm).

Supplied with device: 1 nut, 1 lock-washer.

Nut dimensions across the flats: 9.5 mm.

The mark shown applies to normal polarity types.

RATINGS

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

Voltages*			BYX39–600(R)	800(R)	1000(R)	1200(R)	1400(R)	
Continuous reverse voltage	V_R	max.	600	800	1000	1200	1400	V
Crest working reverse voltage	V_{RWM}	max.	600	800	1000	1200	1400	V

Currents

Average forward current (averaged over any 20 ms period) up to T_{mb} = 85 °C	$I_{F(AV)}$	max.	9.5	A
at T_{mb} = 125 °C	$I_{F(AV)}$	max.	6.0	A
R.M.S. forward current	$I_{F(RMS)}$	max.	15	A
Repetitive peak forward current	I_{FRM}	max.	100	A
Non-repetitive peak forward current t = 10 ms (half sine-wave); T_j = 175 °C prior to surge; with reapplied V_{RWMmax}	I_{FSM}	max.	125	A
I^2t for fusing (t = 10 ms)	I^2t	max.	78	A^2s

Reverse power dissipation

Average reverse power dissipation (averaged over any 20 ms period); T_j = 125 °C	$P_{R(AV)}$	max.	10	W
Repetitive peak reverse power dissipation t = 10 µs (square-wave; f = 50 Hz); T_j = 125 °C	P_{RRM}	max.	2	kW
Non-repetitive peak reverse power dissipation t = 10 µs (square-wave) T_j = 25 °C prior to surge	P_{RSM}	max.	4	kW
T_j = 175 °C prior to surge	P_{RSM}	max.	0.8	kW

Temperatures

Storage temperature	T_{stg}		−55 to +175	°C
Junction temperature	T_j	max.	175	°C

*To ensure thermal stability: $R_{th\ j\text{-}a} \leq 5$ °C/W (continuouse reverse voltage) or ≤ 20 °C/W (a.c.)

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j-a}$	=	50	°C/W
From junction to mounting base	$R_{th\ j-mb}$	=	4.5	°C/W
From mounting base to heatsink				
without heatsink compound	$R_{th\ mb-h}$	=	1.0	°C/W
with heatsink compound	$R_{th\ mb-h}$	=	0.5	°C/W
with mica washer	$R_{th\ mb-h}$	=	2.0	°C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j-mb}$	=	0.35	°C/W

CHARACTERISTICS

			BYX39–600(R)	800(R)	1000(R)	1200(R)	1400(R)	
Forward voltage I_F = 20 A; T_j = 25 °C	V_F	<	1.7	1.7	1.7	1.7	1.7	V*
Reverse avalanche breakdown voltage I_R = 5 mA; T_j = 25 °C	$V_{(BR)R}$	>	750	1000	1250	1450	1650	V
		<	2400	2400	2400	2400	2400	V
Reverse current $V_R = V_{RWMmax}$; T_j = 125 °C	I_R	<	200	200	200	200	200	µA

OPERATING NOTES

The top connector should neither be bent nor twisted; it should be soldered into the circuit so that there is no strain on it.

During soldering the heat conduction to the junction should be kept to a minimum.

*Measured under pulse conditions to avoid excessive dissipation.

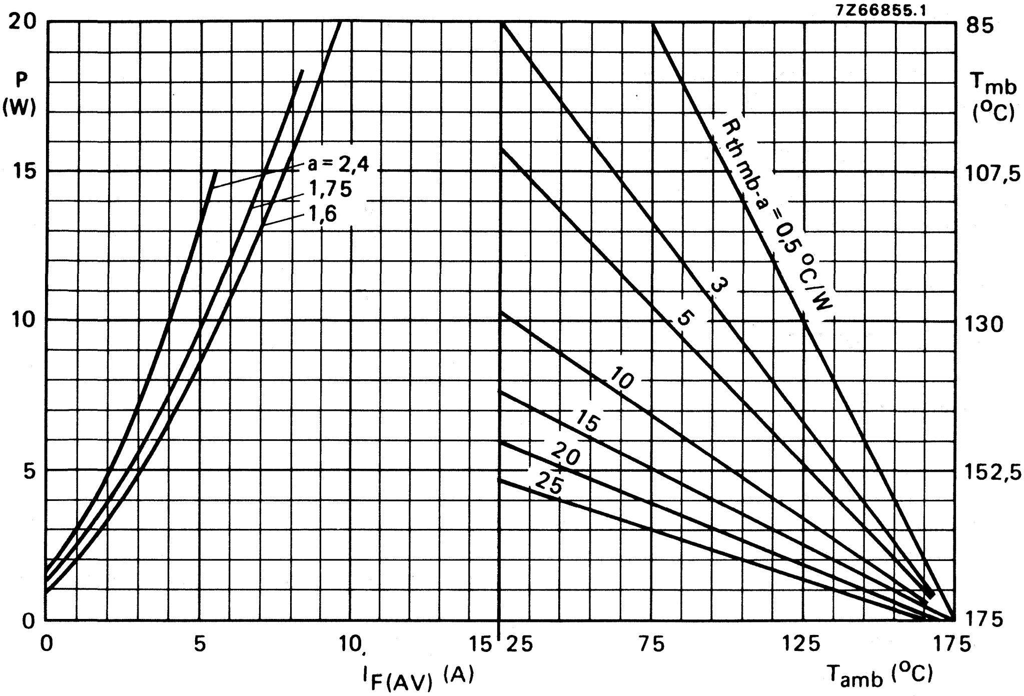


Fig.2

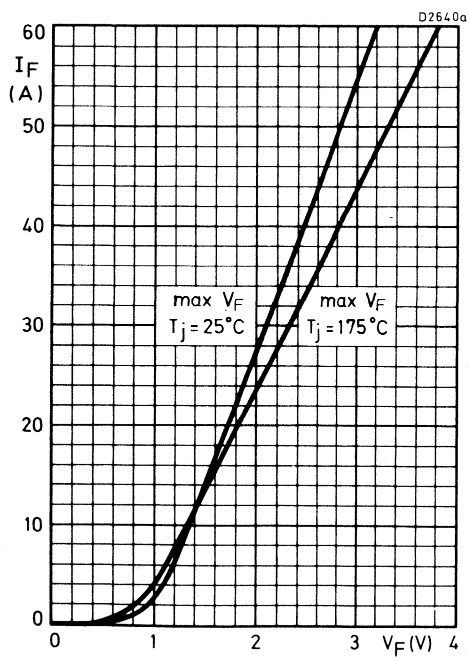


Fig.3

The right-hand part shows the inter-relationship between the power (derived from the left-hand part) and the maximum permissible temperatures.
P = dissipation excluding power in the avalanche region.

single phase: a = 1.6
3-phase : a = 1.75
6-phase : a = 2.4

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

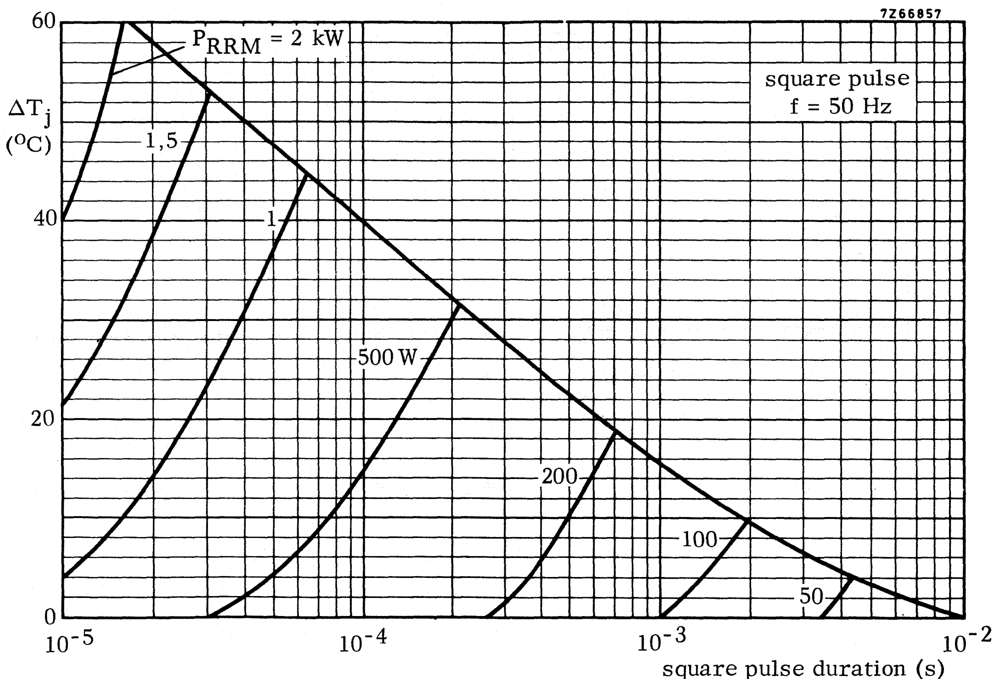

7Z66857
ΔT_j (^oC)
60
40
20
0
P_{RRM} = 2 kW
1,5
1
500 W
200
100
50
square pulse
f = 50 Hz
10^{-5}
10^{-4}
10^{-3}
10^{-2}
square pulse duration (s)

Fig.4

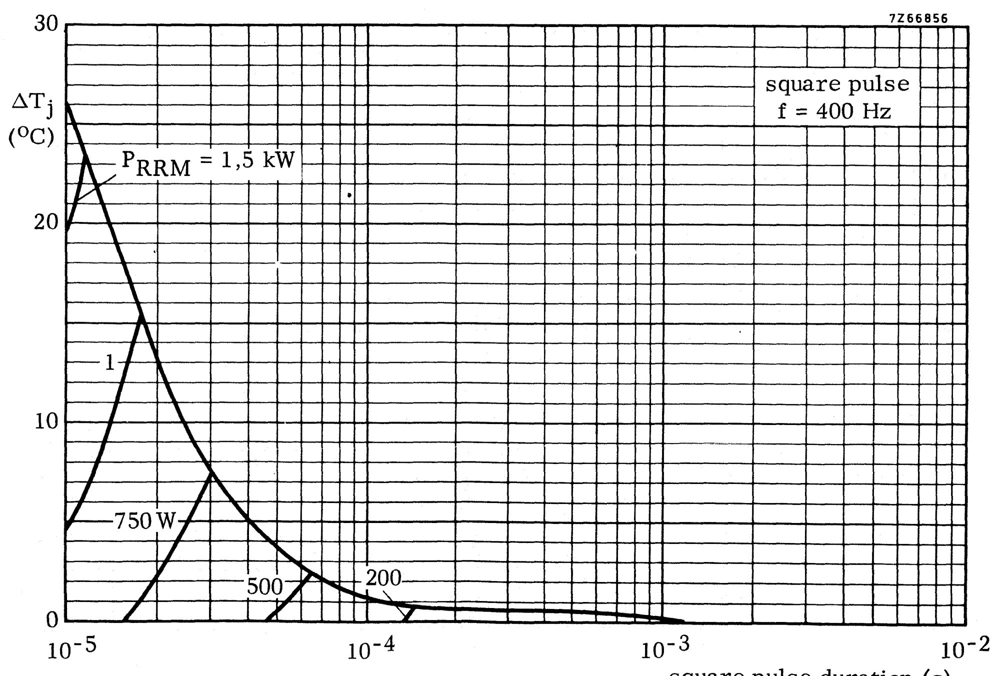

7Z66856
ΔT_j (^oC)
30
20
10
0
P_{RRM} = 1,5 kW
1
750 W
500
200
square pulse
f = 400 Hz
10^{-5}
10^{-4}
10^{-3}
10^{-2}
square pulse duration (s)

Fig.5

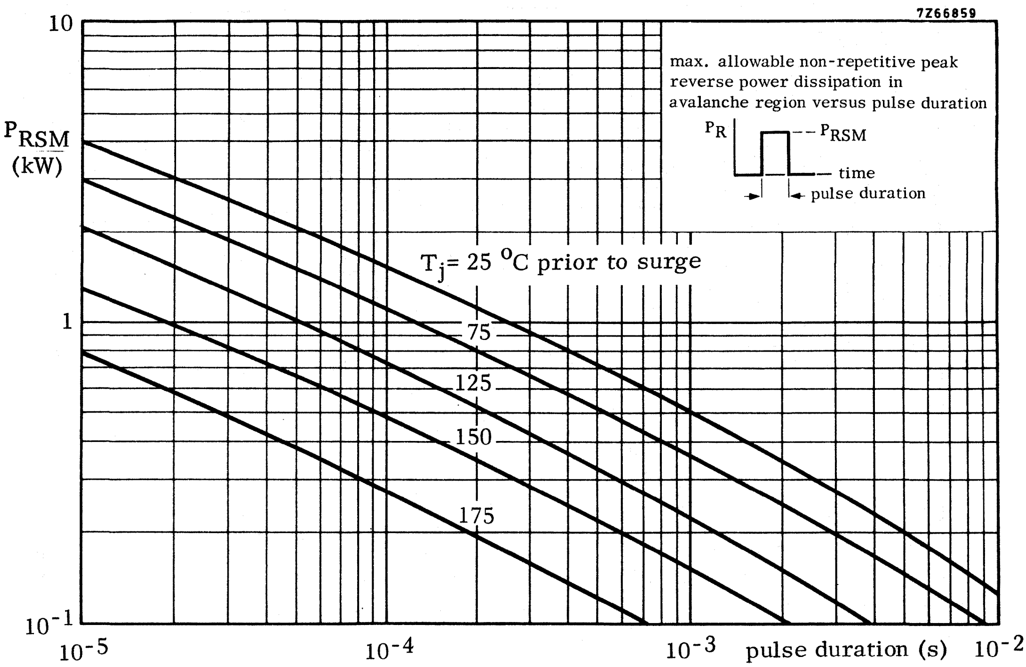

7Z66859
max. allowable non-repetitive peak reverse power dissipation in avalanche region versus pulse duration
P_R
P_{RSM}
time
pulse duration
P_{RSM} (kW)
T_j = 25 °C prior to surge
75
125
150
175
10
1
10^{-1}
10^{-5}
10^{-4}
10^{-3}
pulse duration (s)
10^{-2}

Fig.6

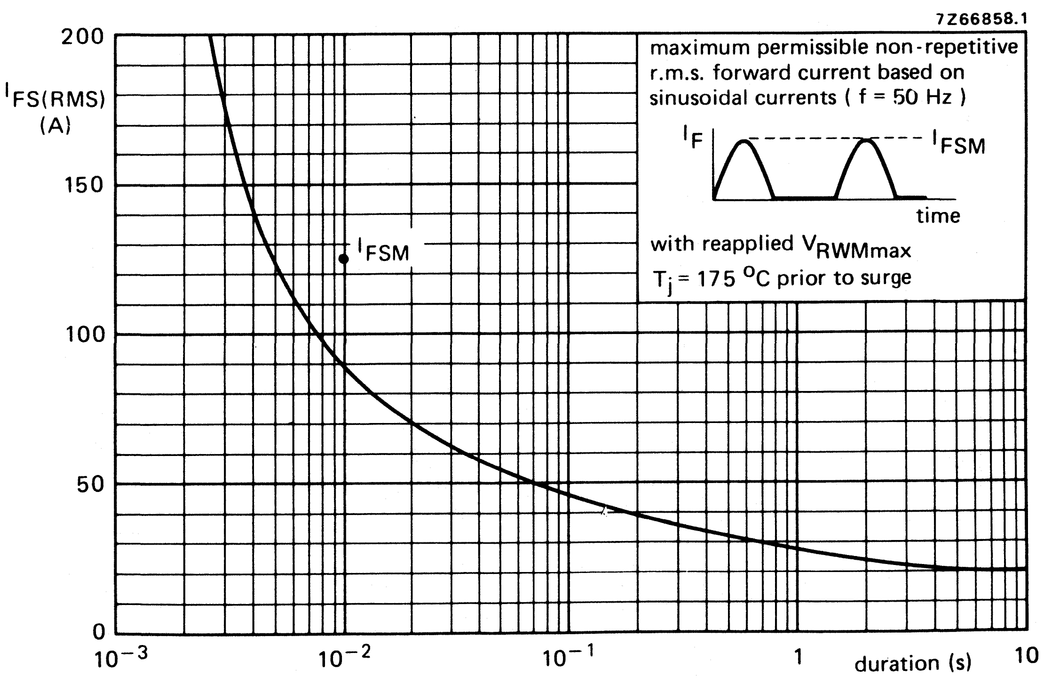

7Z66858.1
maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz)
I_F
I_{FSM}
time
with reapplied V_{RWMmax}
T_j = 175 °C prior to surge
$I_{FS(RMS)}$ (A)
I_{FSM}
200
150
100
50
0
10^{-3}
10^{-2}
10^{-1}
1
duration (s)
10

Fig.7

SILICON RECTIFIER DIODES

Diffused silicon rectifier diodes in DO-4 metal envelopes, intended for power rectifier applications.
The series consists of the following types:
Normal polarity (cathode to stud): BYX42-300 to 1200.
Reserve polarity (anode to stud): BYX42-300R to 1200R.

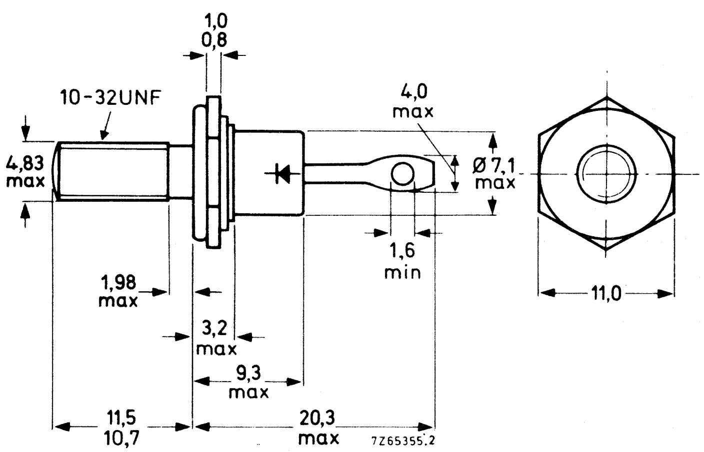
QUICK REFERENCE DATA

			BYX42-300(R)	600(R)	1200(R)	
Repetitive peak reverse voltage	V_{RRM}	max.	300	600	1200	V
Average forward current	$I_{F(AV)}$	max.		12		A
Non-repetitive peak forward current	I_{FSM}	max.		125		A

MECHANICAL DATA

Dimensions in mm

DO-4



Net mass: 6 g

Diameter of clearance hole: 5,2 mm

Accessories supplied on request:
see ACCESSORIES section

Torque on nut: min. 0,9 Nm
(9 kg cm)
max. 1,7 Nm
(17 kg cm)

Supplied with device: 1 nut, 1 lock washer
Nut dimensions accross the flats: 9,5 mm

The mark shown applies to normal polarity types.

Products approved to CECC 50 009-020 available on request.

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages			BYX42-300(R)	600(R)	1200(R)	
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	300	600	1200	V
Repetitive peak reverse voltage ($\delta \leq 0,01$)	V_{RRM}	max.	300	600	1200	V
Crest working reverse voltage	V_{RWM}	max.	200	400	800	V
Continuous reverse voltage	V_R	max.	200	400	800	V

Currents				
Average forward current (averaged over any 20 ms period) up to T_{mb} = 115 °C	$I_{F(AV)}$	max.	12	A
at T_{mb} = 125 °C	$I_{F(AV)}$	max.	10	A
R.M.S. forward current	$I_{F(RMS)}$	max.	20	A
Repetitive peak forward current	I_{FRM}	max.	60	A
Non-repetitive peak forward current (t = 10 ms; half sine-wave) T_j = 175 °C prior to surge; with reapplied V_{RWMmax}	I_{FSM}	max.	125	A

Temperatures				
Storage temperature	T_{stg}		−55 to +175	°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j-a}$	=	50	°C/W
From junction to mounting base	$R_{th\ j-mb}$	=	3	°C/W
From mounting base to heatsink	$R_{th\ mb-h}$	=	0,5	°C/W

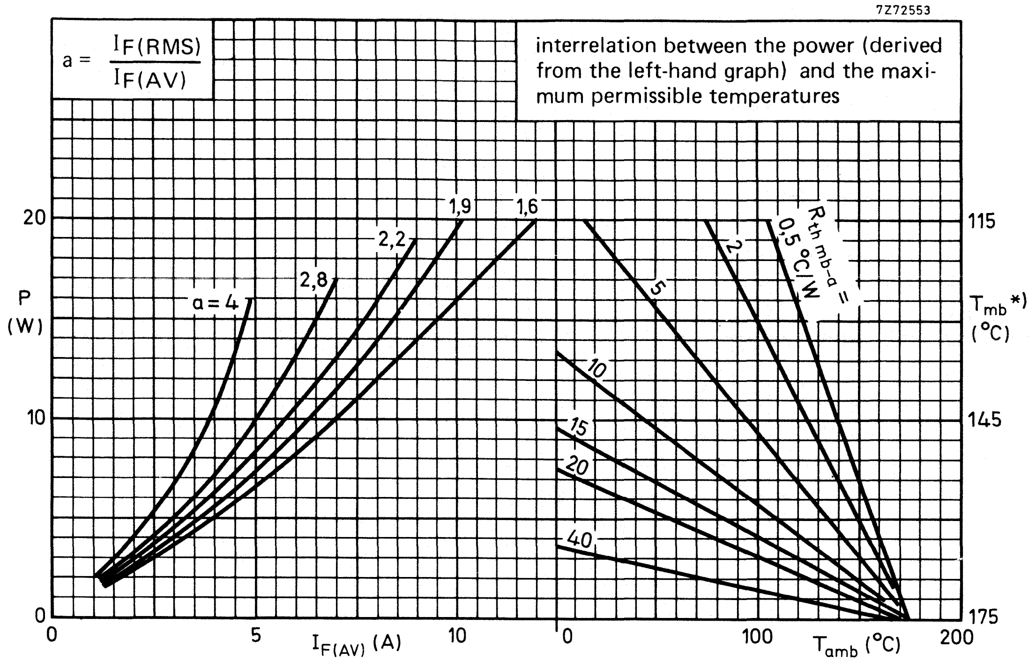
CHARACTERISTICS

Forward voltage at I_F = 15 A; T_j = 25 °C	V_F	<	1,4	V [1]
Reverse current at $V_R = V_{RWMmax}$; T_j = 125 °C	I_R	<	200	μA

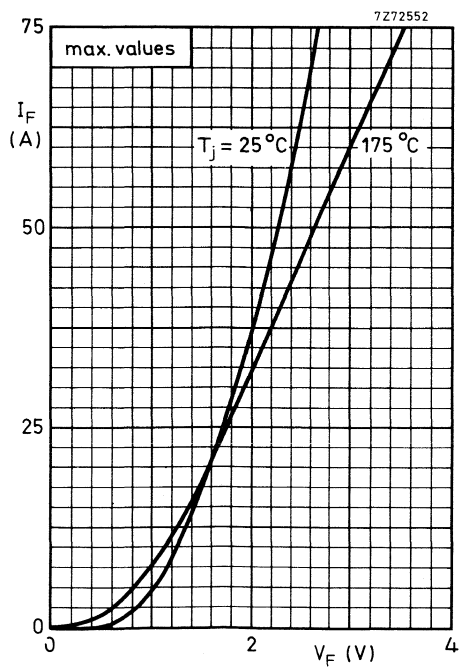
MOUNTING INSTRUCTIONS

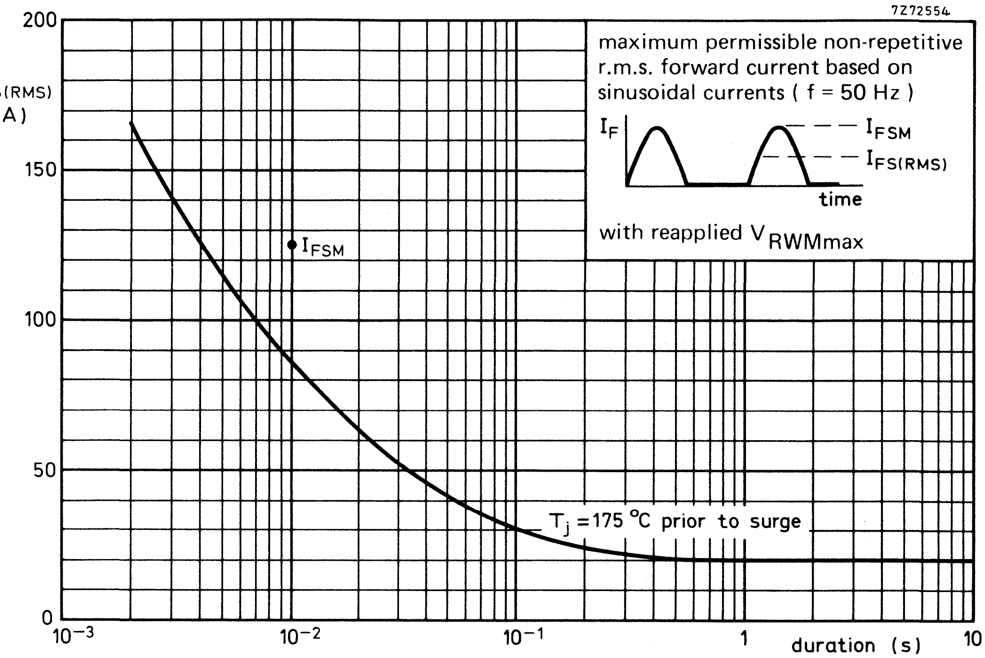
The top connector should neither be bent nor twisted; it should be soldered into the circuit so that there is no strain on it.
During soldering the heat conduction to the junction should be kept to a minimum.

[1]) Measured under pulse conditions to avoid excessive dissipation.



*) T_{mb}-scale is for comparison purposes only and is correct only for $R_{th\ mb\text{-}a} \leq 22\ ^{o}C/W$




7Z72554
maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz)
I_F
I_{FSM}
I_{FS(RMS)}
time
with reapplied V_{RWMmax}
I_{FS(RMS)} (A)
200
150
100
50
0
I_{FSM}
T_j = 175 °C prior to surge
10^{−3}
10^{−2}
10^{−1}
1
duration (s)
10

FAST SOFT-RECOVERY RECTIFIER DIODES

- With controlled avalanche

Diffused silicon diodes in DO-4 metal envelopes, capable of absorbing transients. They are primarily intended for use in high-frequency power supplies, thyristor inverters and multi-phase power rectifier applications.

The series consists of the following types:
Normal polarity (cathode to stud): BYX46-200 to BYX46-600.
Reverse polarity (anode to stud): BYX46-200R to BYX46-600R

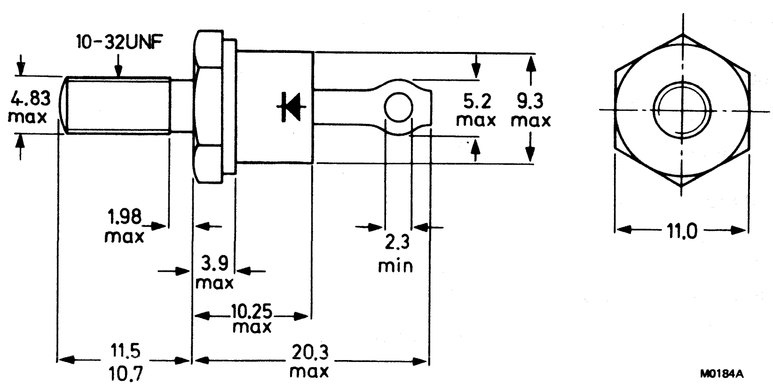
QUICK REFERENCE DATA

			BYX46-200(R)	300(R)	400(R)	500(R)	600(R)	
Crest working reverse voltage	V_{RWM}	max.	200	300	400	500	600	V
Reverse avalanche breakdown voltage	$V_{(BR)R}$	>	250	375	500	625	750	V
Average forward current	$I_{F(AV)}$	max.			22			A
Non-repetitive peak forward current	I_{FSM}	max.			300			A
Non-repetitive peak reverse power	P_{RSM}	max.			18			kW
Reverse recovery time	t_{rr}	<			200			ns

MECHANICAL DATA

Dimensions in mm

DO-4 Supplied with device: 1 nut, 1 lock-washer
Nut dimensions across the flats: 9,5 mm



Net mass: 7 g
Diameter of clearance hole: max. 5,2 mm
Accessories supplied on request:
see ACCESSORIES section

Torque on nut: min. 0,9 Nm (9 kg cm)
max. 1,7 Nm (17 kg cm)

The mark shown applies to the normal polarity types.

RATINGS

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

Voltages *			BYX46-200(R)	300(R)	400(R)	500(R)	600(R)	
Crest working reverse voltage	V_{RWM}	max.	200	300	400	500	600	V
Continuous reverse voltage	V_R	max.	200	300	400	500	600	V

Currents

Average forward current (averaged over any 20 ms period)				
up to T_{mb} = 100 °C	$I_{F(AV)}$	max.	22	A
at T_{mb} = 125 °C	$I_{F(AV)}$	max.	15	A
R.M.S. forward current	$I_{F(RMS)}$	max.	35	A
Repetitive peak forward current	I_{FRM}	max.	400	A
Non-repetitive peak forward current (t = 10 ms; half-sinewave) T_j = 165 °C prior to surge; with reapplied V_{RWMmax}	I_{FSM}	max.	300	A
I^2t for fusing (t = 10 ms)	I^2t	max.	450	A^2s

Reverse power dissipation

Repetitive peak reverse power dissipation t = 10 μs (square wave; f = 50 Hz) T_j = 100 °C	P_{RRM}	max.	9,5	kW
Non-repetitive peak reverse power dissipation t = 10 μs (square wave)				
T_j = 25 °C prior to surge	P_{RSM}	max.	18	kW
T_j = 165 °C prior to surge	P_{RSM}	max.	4	kW

Temperatures

Storage temperature	T_{stg}		−55 to +165	°C
Junction temperature	T_j	max.	165	°C

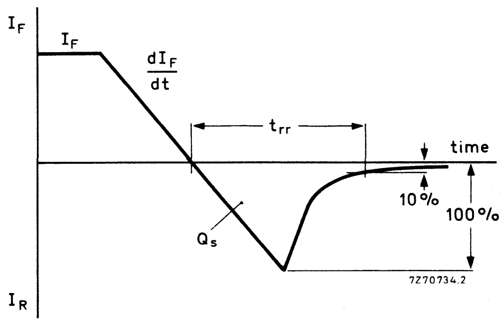
THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	50	°C/W
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1,3	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,5	°C/W

* To ensure thermal stability: $R_{th\ j\text{-}a} < 2{,}5$ °C/W (continuous reverse voltage) or < 5 °C/W (a.c.). For smaller heatsinks $T_{j\ max}$ should be derated. For a.c. see page 5. For continuous reverse voltage: if $R_{th\ j\text{-}a}$ = 5 °C/W, then $T_{j\ max}$ = 135 °C; if $R_{th\ j\text{-}a}$ = 10 °C/W, then $T_{j\ max}$ = 125 °C.

CHARACTERISTICS

			BYX46-200(R)	300(R)	400(R)	500(R)	600(R)	
Forward voltage $I_F = 50$ A; $T_j = 25$ °C	V_F	<	2,0	2,0	2,0	2,0	2,0	V *
Reverse breakdown voltage $I_R = 5$ mA; $T_j = 25$ °C	$V_{(BR)R}$	>	250	375	500	625	750	V
		<	1050	1050	1050	1050	1050	V
Reverse current $V_R = V_{RWMmax}$; $T_j = 125$ °C	I_R	<	4,0	4,0	4,0	4,0	4,0	mA
Reverse recovery charge when switched from $I_F = 2$ A to $V_R \geqslant 30$ V; $-dI_F/dt = 100$ A/µs; $T_j = 25$ °C	Q_s	<			0,70			µC
Reverse recovery time when switched from $I_F = 1$ A to $V_R \geqslant 30$ V; $-dI_F/dt = 50$ A/µs; $T_j = 25$ °C	t_{rr}	<			200			ns



OPERATING NOTES

1. Square-wave operation

When I_F has been flowing sufficiently long for the steady state to be established, there will be a charge due to minority carriers present. Before the device can block in the reverse direction this charge must be extracted. This extraction takes the form of a reverse transient (see figure above). The majority of the power dissipation due to the reverse transient occurs during fall time as the rectifier gradually becomes reverse biased, and the mean power will be proportional to the operating frequency. The mean value of this power loss can be derived from the graphs on page 10.

* Measured under pulse conditions to avoid excessive dissipation.

OPERATING NOTES (continued)

2. Sine wave operation

Power loss in sine wave operation will be considerably less owing to the much slower rate of change of the applied voltage (and consequently lower values of I_{RRM}), so that power loss due to reverse recovery may be safely ignored for frequencies up to 50 kHz.

3. Determination of the heatsink thermal resistance

Example:

Assume a diode, used in an inverter.

frequency	f	=	20	kHz
duty cycle	δ	=	0.5	
ambient temperature	T_{amb}	=	40	°C
switched from	I_F	=	12	A
to	V_R	=	300	V
at a rate	$-\frac{dI}{dt}$	=	50	A/µs

At a duty cycle $\delta = 0.5$ the average forward current $I_{FAV} = 6$ A.
From the upper graph on page 5 it follows, that at $I_{FAV} = 6$ A the average forward power + average leakage power = 13 W (point A).
The additional power losses due to switching-off can be read from the nomogram on page 10 (the example being based on optimum use, i.e. $T_j = 165$ °C). Starting from $I_F = 12$ A on the horizontal scale trace upwards until the appropriate line $-\frac{dI}{dt} = 50$ A/µs. From the intersection trace horizontally to the right until the line for f = 20 kHz. Then trace downwards to the line $V_R = 300$ V and ultimately trace horizontally to the left and on the vertical axis read the additional average power dissipation $P_{RAV} = 6$ W.
Therefore the total power dissipation $P_{tot} = 13\ W + 6\ W = 19\ W$ (point B of the upper graph on page 5).

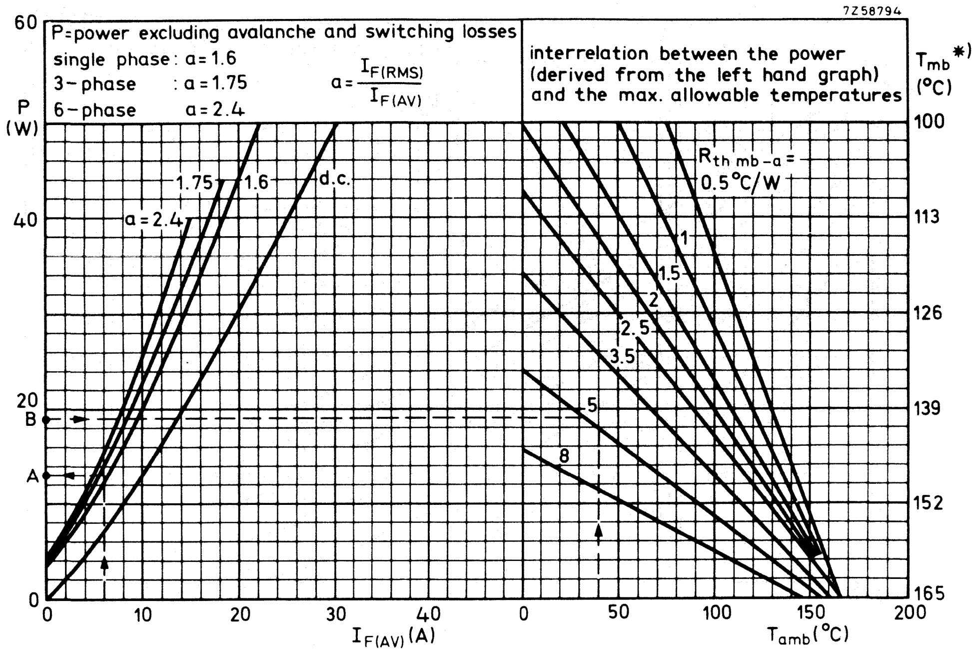
From the right hand part of the upper graph on page 5 follows the thermal resistance, required at $T_{amb} = 40$ °C.

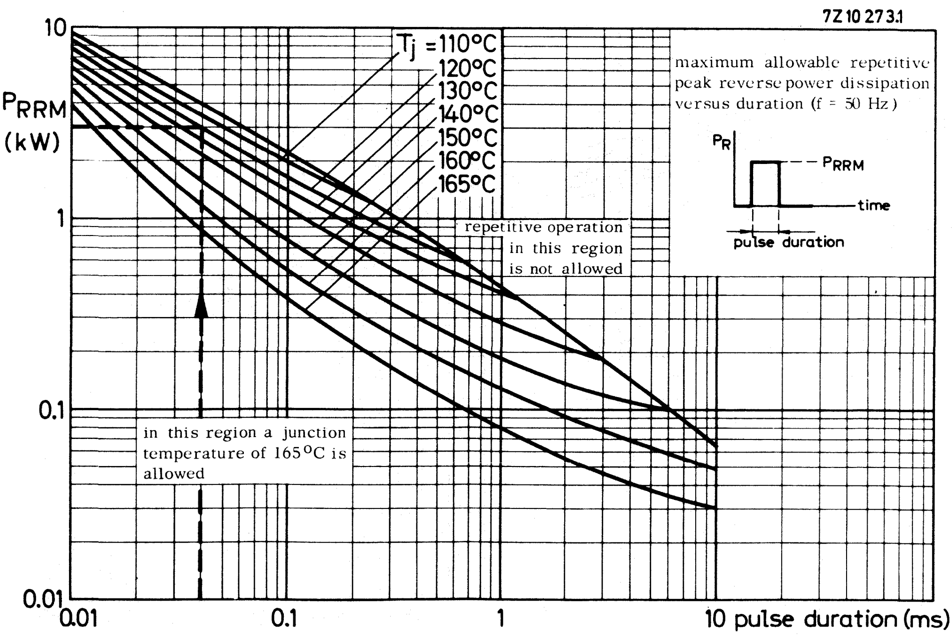
$$R_{th\ mb\text{-}a} \approx 5\ ^{\circ}C/W$$

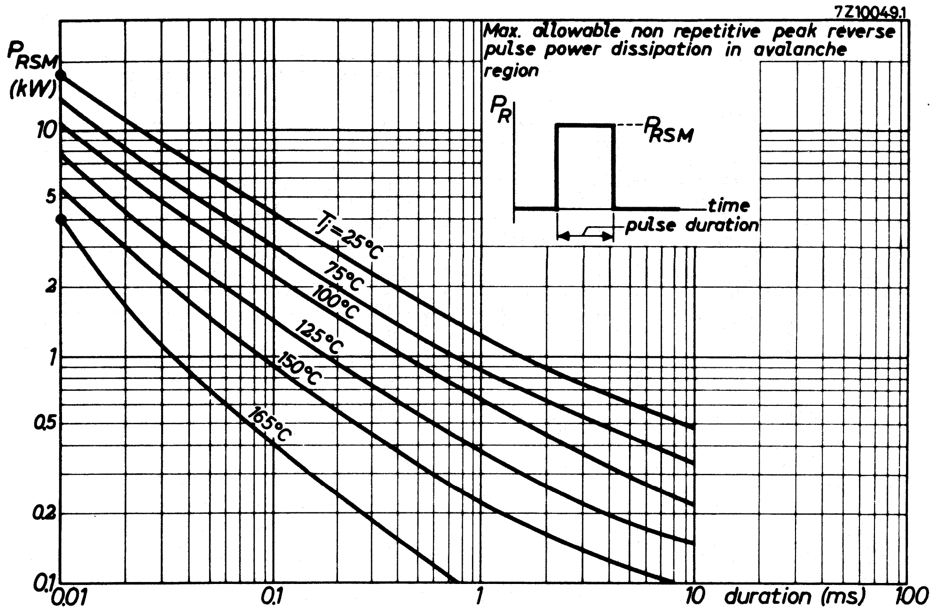
The contact thermal resistance $R_{th\ mb\text{-}h} = 0.5$ °C/W.

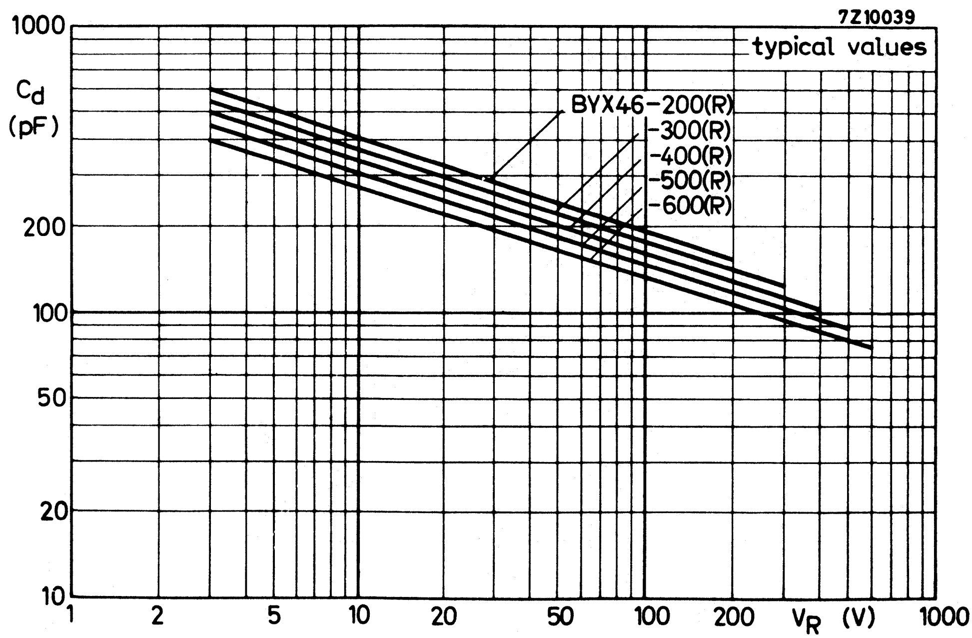
Hence the heatsink thermal resistance should be:

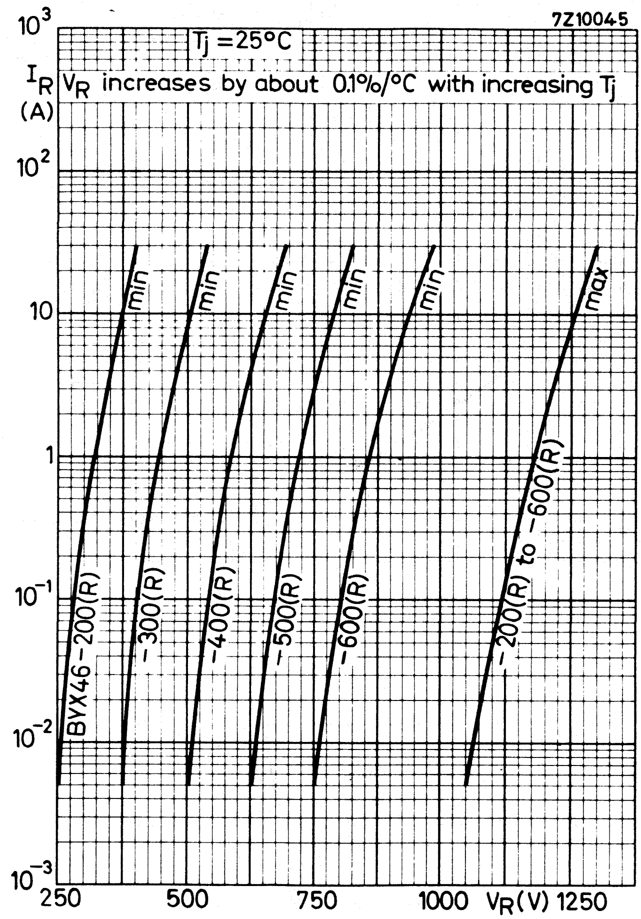
$$R_{th\ h\text{-}a} = R_{th\ mb\text{-}a} - R_{th\ mb\text{-}h} = (5 - 0.5)\ ^{\circ}C/W = 4.5\ ^{\circ}C/W.$$

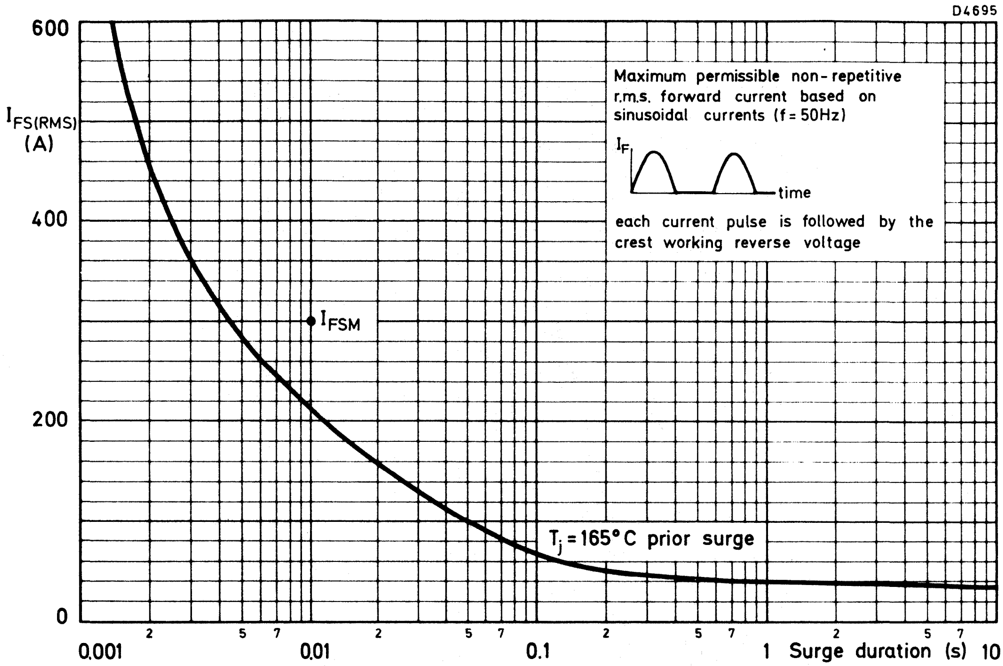

7Z58794
P=power excluding avalanche and switching losses
single phase: a = 1.6
3-phase : a = 1.75
6-phase a = 2.4
a = $\frac{I_{F(RMS)}}{I_{F(AV)}}$
interrelation between the power (derived from the left hand graph) and the max. allowable temperatures
P (W)
T_{mb} *) (°C)
1.75
1.6
d.c.
a = 2.4
$R_{th\ mb-a}$ = 0.5 °C/W
1
1.5
2
2.5
3.5
5
8
B
A
$I_{F(AV)}$ (A)
T_{amb} (°C)

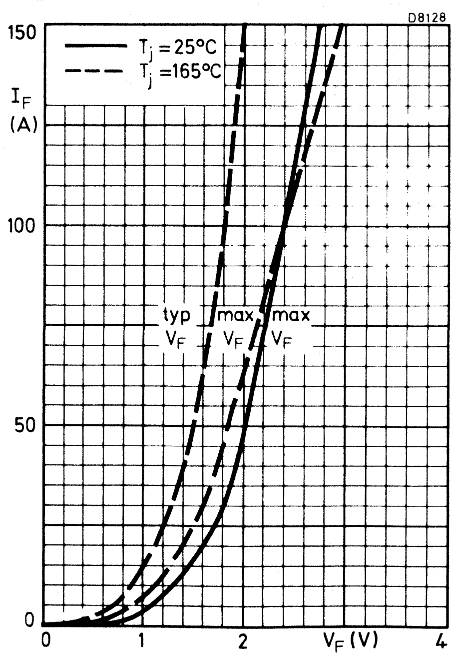

7Z10273.1
P_{RRM} (kW)
T_j = 110°C
120°C
130°C
140°C
150°C
160°C
165°C
maximum allowable repetitive peak reverse power dissipation versus duration (f = 50 Hz)
P_R
P_{RRM}
time
pulse duration
repetitive operation in this region is not allowed
in this region a junction temperature of 165 °C is allowed
pulse duration (ms)

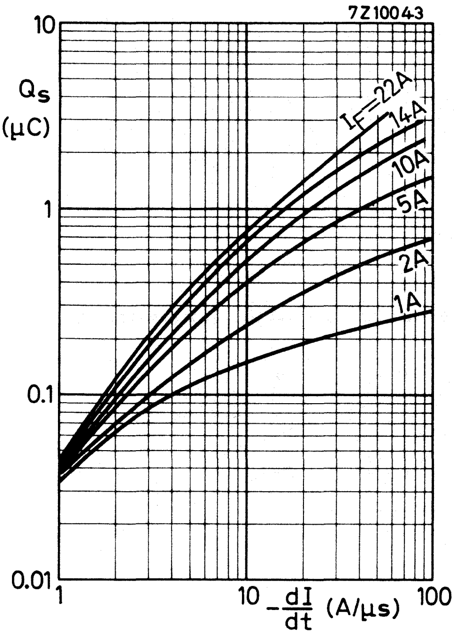

7Z10049.1
Max. allowable non repetitive peak reverse pulse power dissipation in avalanche region
P_{RSM} (kW)
10
5
2
1
0.5
0.2
0.1
0.01
0.1
1
10
duration (ms)
100
T_j = 25 °C
75 °C
100 °C
125 °C
150 °C
165 °C
P_R
P_{RSM}
time
pulse duration

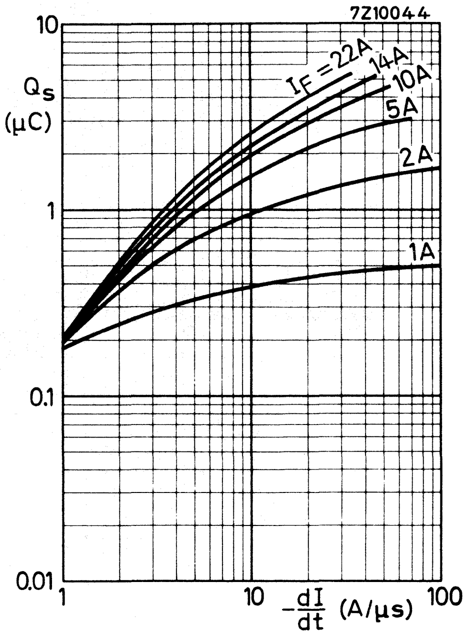

7Z10039
typical values
C_d (pF)
1000
200
100
50
20
10
1
2
5
10
20
50
100
200
V_R (V)
1000
BYX46-200(R)
-300(R)
-400(R)
-500(R)
-600(R)

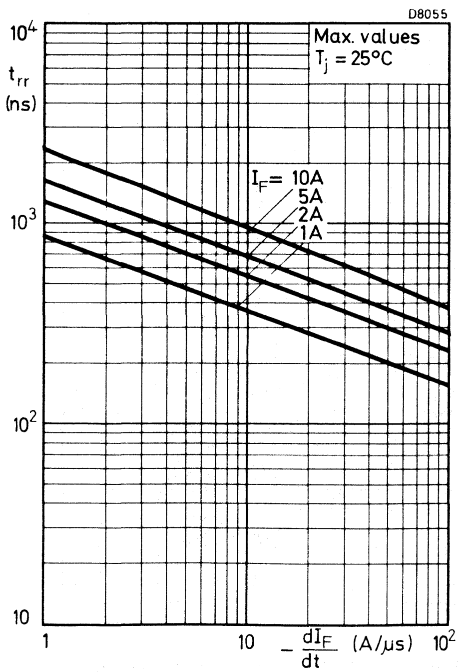

7Z10045
T_j = 25°C
V_R increases by about 0.1%/°C with increasing T_j
I_R (A)
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
250
500
750
1000
V_R(V)
1250
min
min
min
min
min
max
BYX46−200(R)
−300(R)
−400(R)
−500(R)
−600(R)
−200(R) to −600(R)

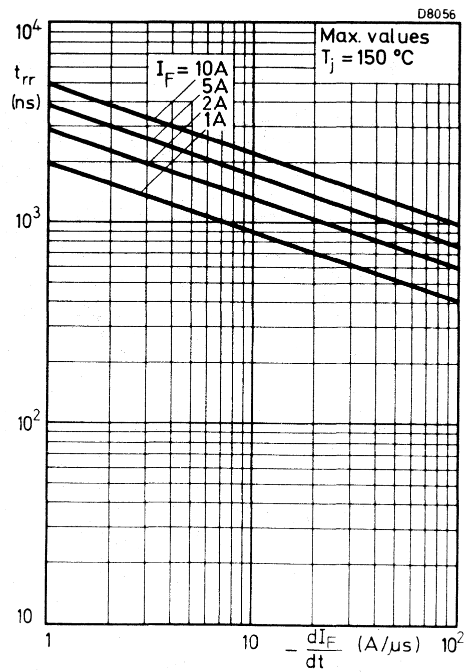

D4695
600
400
200
0
$I_{FS(RMS)}$
(A)
Maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50Hz)
I_F
time
each current pulse is followed by the crest working reverse voltage
I_{FSM}
T_j = 165° C prior surge
0.001
0.01
0.1
1
Surge duration (s)
10

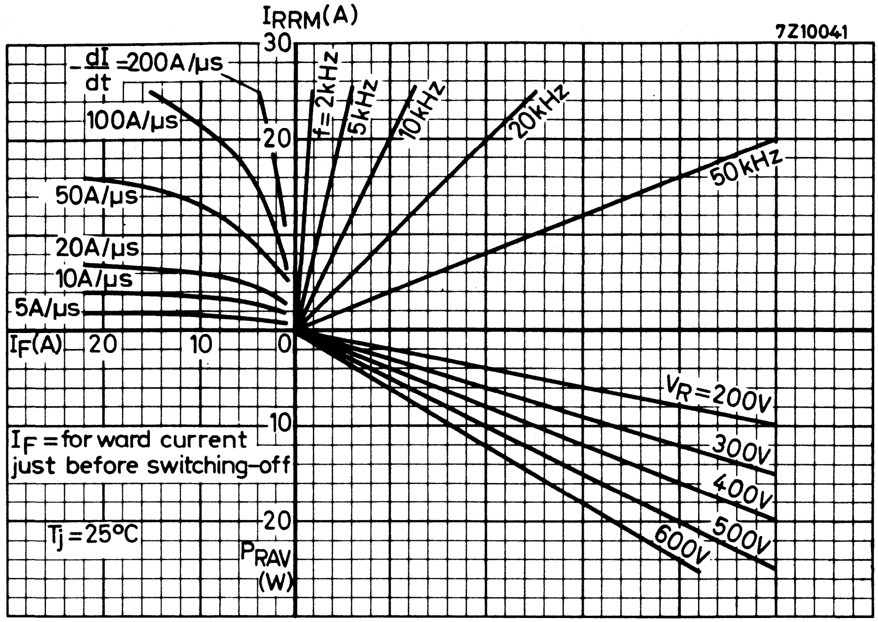

D8128
150
100
50
0
I_F
(A)
T_j = 25°C
T_j = 165°C
typ V_F
max V_F
max V_F
0
1
2
V_F (V)
4

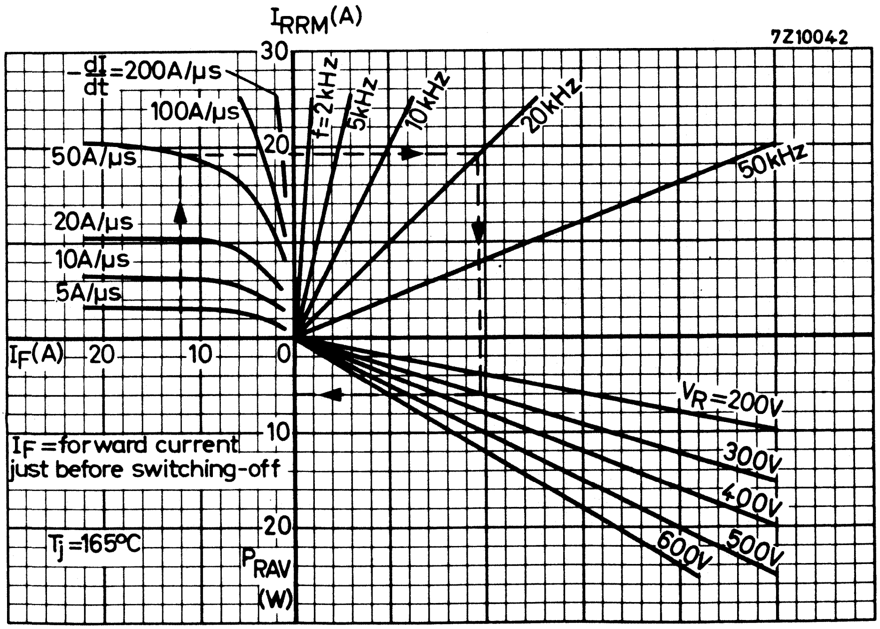

7Z10043
Q_s (μC)
I_F = 22A
14A
10A
5A
2A
1A
10
1
0.1
0.01
1
10
100
$-\frac{dI}{dt}$ (A/μs)


7Z10044
Q_s (μC)
I_F = 22A
14A
10A
5A
2A
1A
10
1
0.1
0.01
1
10
100
$-\frac{dI}{dt}$ (A/μs)

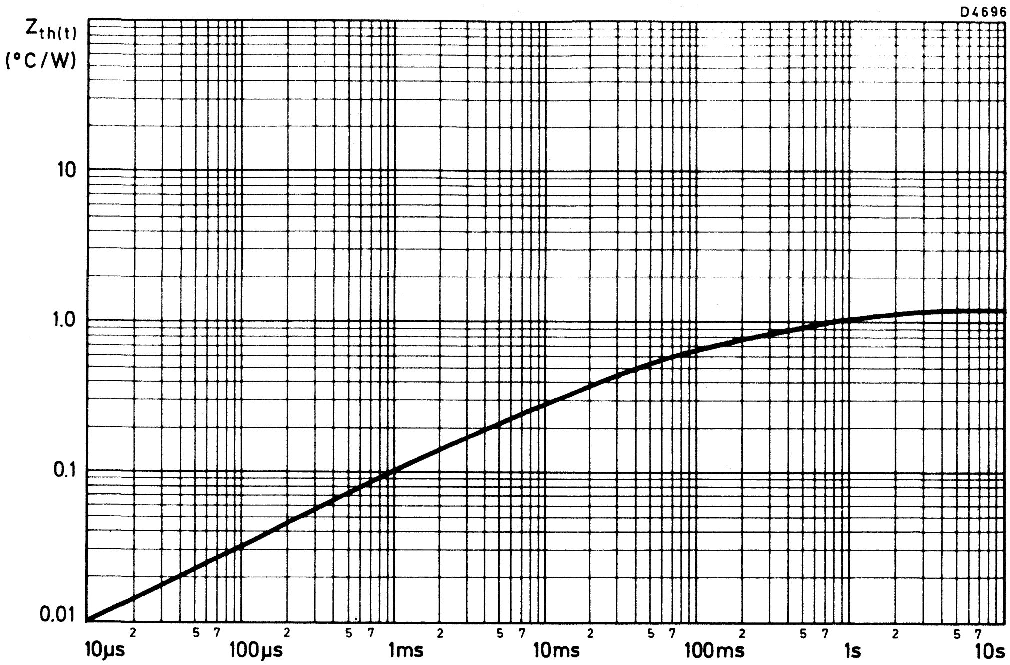

D8055
Max. values
T_j = 25°C
t_{rr} (ns)
I_F = 10A
5A
2A
1A
10^4
10^3
10^2
10
1
10
10^2
$-\frac{dI_F}{dt}$ (A/μs)


D8056
Max. values
T_j = 150 °C
t_{rr} (ns)
I_F = 10A
5A
2A
1A
10^4
10^3
10^2
10
1
10
10^2
$-\frac{dI_F}{dt}$ (A/μs)





Nomogram: Power loss P_{RAV} due to switching only (square wave operation)


D4696
$Z_{th(t)}$
(°C/W)
10
1.0
0.1
0.01
10µs
100µs
1ms
10ms
100ms
1s
10s
2
5
7

RECTIFIER DIODES

Silicon rectifier diodes in DO-5 metal envelopes, intended for use in power rectifier applications.
The series consists of the following types:
Normal polarity (cathode to stud): BYX52–300, BYX52–600, BYX52–1200.
Reverse polarity (anode to stud): BYX52–300R, BYX52–600R, BYX52–1200R.

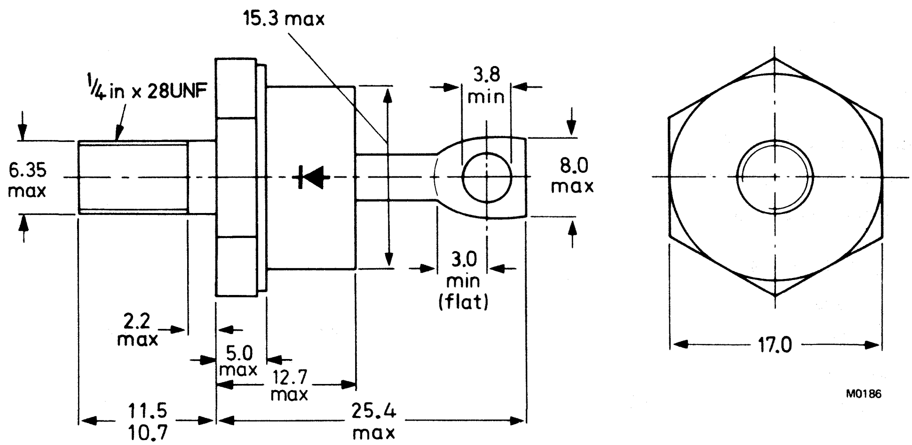
QUICK REFERENCE DATA

			BYX52–300(R)	600(R)	1200(R)	
Repetitive peak reverse voltage	V_{RRM}	max.	300	600	1200	V
Average forward current	$I_{F(AV)}$	max.		48		A
Non-repetitive peak forward current	I_{FSM}	max.		800		A

MECHANICAL DATA

Dimensions in mm

Fig.1 DO-5 Supplied with device: 1 nut, 1 lock-washer
Nut dimensions across the flats: 11.1 mm



Net mass: 22 g
Diameter of clearance hole: max. 6.5 mm
Accessories supplied on request:
see ACCESSORIES section

Torque on nut: min. 1.7 Nm (17 kg cm)
max. 3.5 Nm (35 kg cm)

The mark shown applies to the normal polarity types

Products approved to CECC 50 009-024 available on request.

RATINGS

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

Voltages			BYX52–300(R)	600(R)	1200(R)	
Non-repetitive peak reverse voltage ($t \leqslant 10$ ms)	V_{RSM}	max.	300	600	1200	V
Repetitive peak reverse voltage ($\delta = 0.01$)	V_{RRM}	max.	300	600	1200	V
Crest working reverse voltage	V_{RWM}	max.	200	400	800	V

Currents

Average forward current (averaged over any 20 ms period) up to $T_{mb} = 112\ ^oC$	$I_{F(AV)}$	max.	48	A
at $T_{mb} = 125\ ^oC$	$I_{F(AV)}$	max.	40	A
R.M.S. forward current	$I_{F(RMS)}$	max.	75	A
Repetitive peak forward current	I_{FRM}	max.	450	A
Non-repetitive peak forward current ($t = 10$ ms; half-sinewave) $T_j = 175\ ^oC$ prior to surge	I_{FSM}	max.	800	A
I^2t for fusing ($t = 10$ ms)	I^2t	max.	3200	A^2s

Temperatures

Storage temperature	T_{stg}		–55 to +175	^oC
Junction temperature	T_j	max.	175	^oC

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	0.8	$^oC/W$
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.2	$^oC/W$

CHARACTERISTICS

Forward voltage $I_F = 150$ A; $T_j = 25\ ^oC$	V_F	<	1.8	V*
Reverse current $V_R = V_{RWM\,max}$; $T_j = 125\ ^oC$	I_R	<	1.6	mA

OPERATING NOTE

The top connector should be neither bent nor twisted; it should be soldered into the circuit so that there is no strain on it.

*Measured under pulse conditions to avoid excessive dissipation.

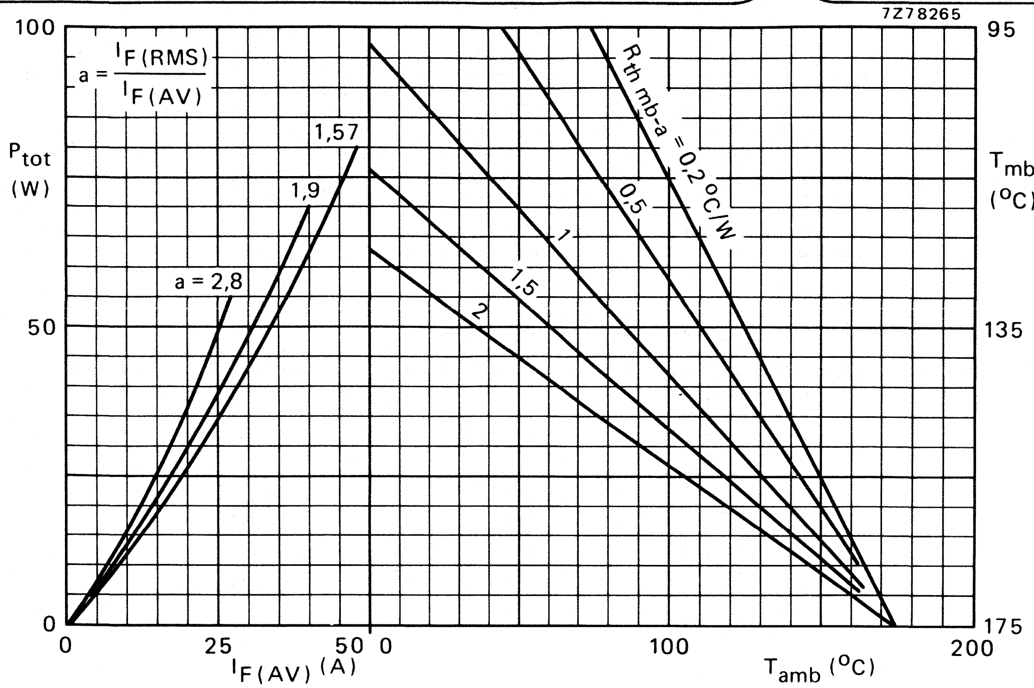


Fig.2 Interrelation between the power(derived from the left-hand part) and the maximum permissible temperatures.

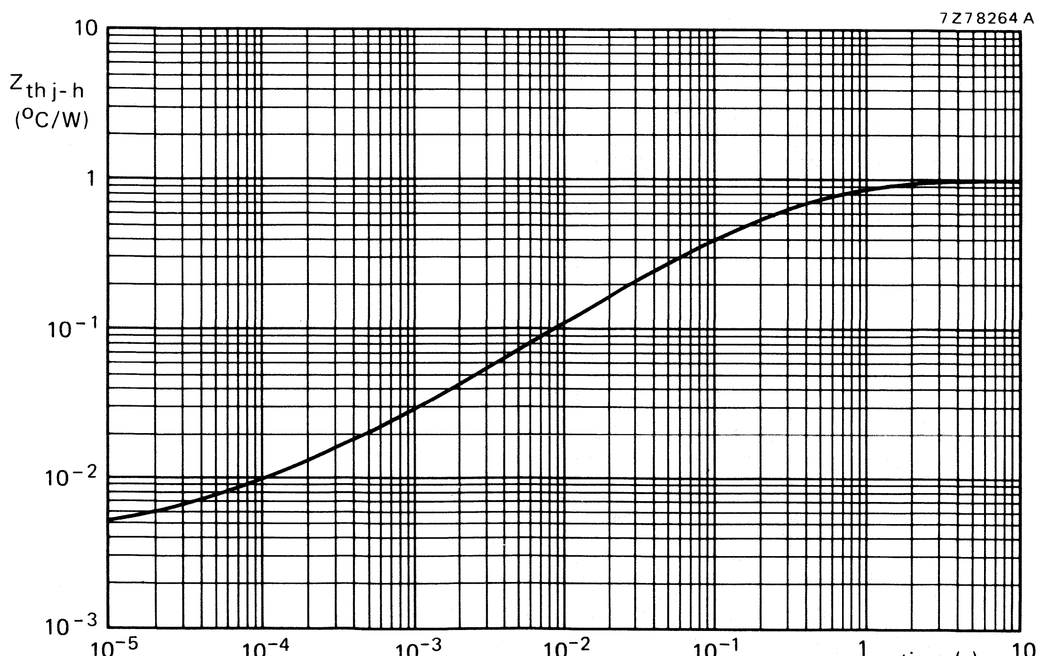


Fig.3

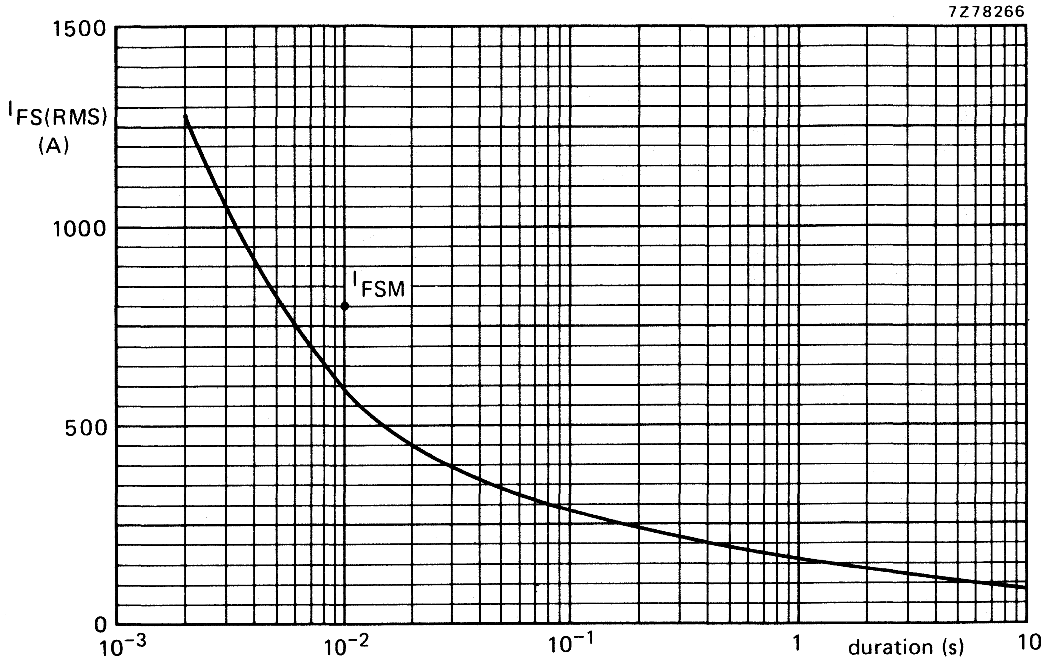
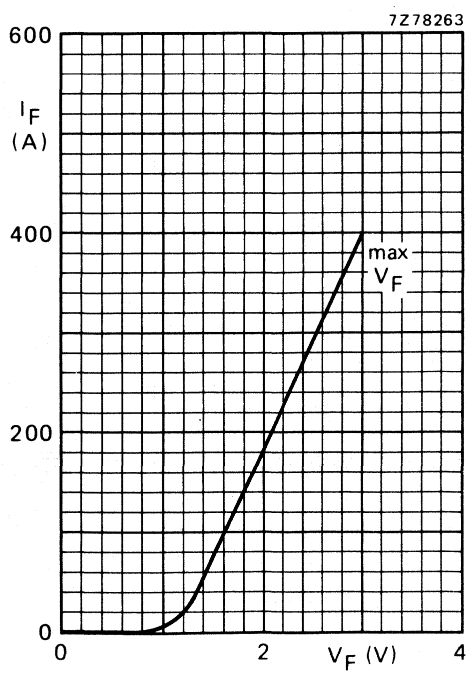


Fig.4 Maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz); T_j = 175 °C prior to surge; with reapplied $V_{RWM\ max}$.



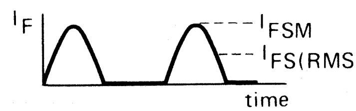


Fig.5

CONTROLLED AVALANCHE RECTIFIER DIODES

Silicon diodes in a DO–5 metal envelope, capable of absorbing transients and intended for power rectifier applications.
The series consists of the following types:
Normal polarity (cathode to stud): BYX56–600 to BYX56–1400.
Reverse polarity (anode to stud): BYX56–600R to BYX56–1400R.

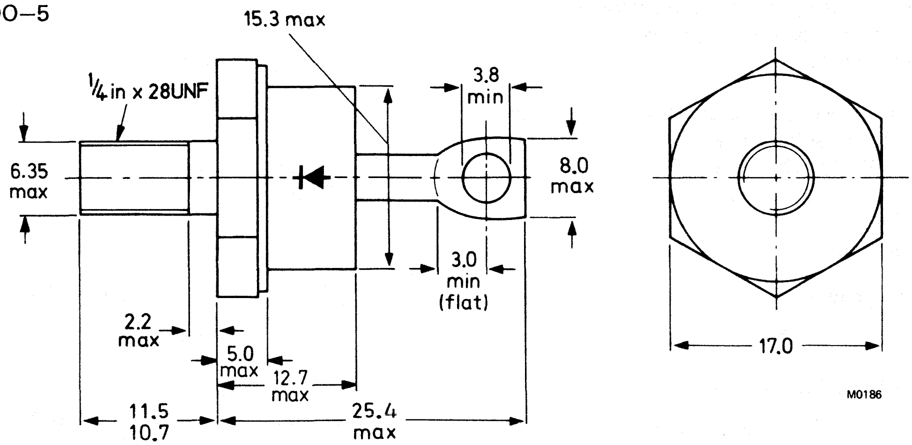
QUICK REFERENCE DATA

			BYX56–600(R)	800(R)	1000(R)	1200(R)	1400(R)	
Crest working reverse voltage	V_{RWM}	max.	600	800	1000	1200	1400	V
Reverse avalanche breakdown voltage	$V_{(BR)R}$	>	750	1000	1250	1450	1650	V
Average forward current	$I_{F(AV)}$	max.	48					A
Non-repetitive peak forward current	I_{FSM}	max.	800					A
Non-repetitive peak reverse power dissipation	P_{RSM}	max.	40					kW

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO–5



Net mass: 22 g
Diameter of clearance hole: max. 6.5 mm
Accessories supplied on request:
see ACCESSORIES section

Supplied with device: 1 nut, 1 lock washer.

Nut dimensions across the flats: 11.1 mm.

Torque on nut:
min. 1.7 Nm (17 kg cm),
max. 3.5 Nm (35 kg cm).

The mark shown applies to normal polarity types.

Products approved to CECC 50 009-023 available on request.

RATINGS

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

Voltages*			BYX56–600(R)	800(R)	1000(R)	1200(R)	1400(R)	
Crest working reverse voltage	V_{RWM}	max.	600	800	1000	1200	1400	V
Continuous reverse voltage	V_R	max.	600	800	1000	1200	1400	V

Currents

Average forward current (averaged over any 20 ms period)				
up to T_{mb} = 112 °C	$I_{F(AV)}$	max.	48	A
at T_{mb} = 125 °C	$I_{F(AV)}$	max.	40	A
R.M.S. forward current	$I_{F(RMS)}$	max.	75	A
Repetitive peak forward current	I_{FRM}	max.	450	A
Non-repetitive peak forward current t = 10 ms (half sine-wave); T_j = 175 °C prior to surge; with reapplied V_{RWMmax}	I_{FSM}	max.	800	A
I^2t for fusing (t ⩽ 10 ms)	I^2t	max.	3200	A^2s

Reverse power dissipation

Repetitive peak reverse power dissipation t = 10 μs (square-wave; f = 50 Hz); T_j = 175 °C	P_{RRM}	max.	6.5	kW
Non-repetitive peak reverse power dissipation t = 10 μs (square-wave)				
T_j = 25 °C prior to surge	P_{RSM}	max.	40	kW
T_j = 175 °C prior to surge	P_{RSM}	max.	6.5	kW

Temperatures

Storage temperature	T_{stg}		–55 to +175	°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	0.8	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0.2	°C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}h}$	=	0.03	°C/W

*To ensure thermal stability: $R_{th\ j\text{-}a}$ < 2.2 °C/W (a.c.)

CHARACTERISTICS

			BYX56–600(R)	800(R)	1000(R)	1200(R)	1400(R)	
Forward voltage I_F = 150 A; T_j = 25 °C	V_F	<	1.8	1.8	1.8	1.8	1.8	V*
Reverse avalanche breakdown voltage I_R = 5 mA; T_j = 25 °C	$V_{(BR)R}$	>	750	1000	1250	1450	1650	V
		<	2400	2400	2400	2400	2400	V
Reverse current $V_R = V_{RWMmax}$; T_j = 125 °C	I_R	<	1.6	1.6	1.6	1.6	1.6	mA

OPERATING NOTES

The top connector should neither be bent nor twisted; it should be soldered into the circuit so that there is no strain on it.

During soldering the heat conduction to the junction should be kept to a minimum by using a thermal shunt.

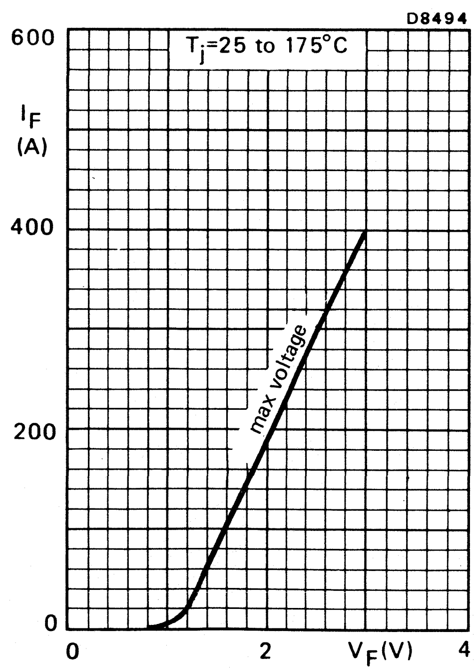


Fig.2

*Measured under pulsed conditions to avoid excessive dissipation.

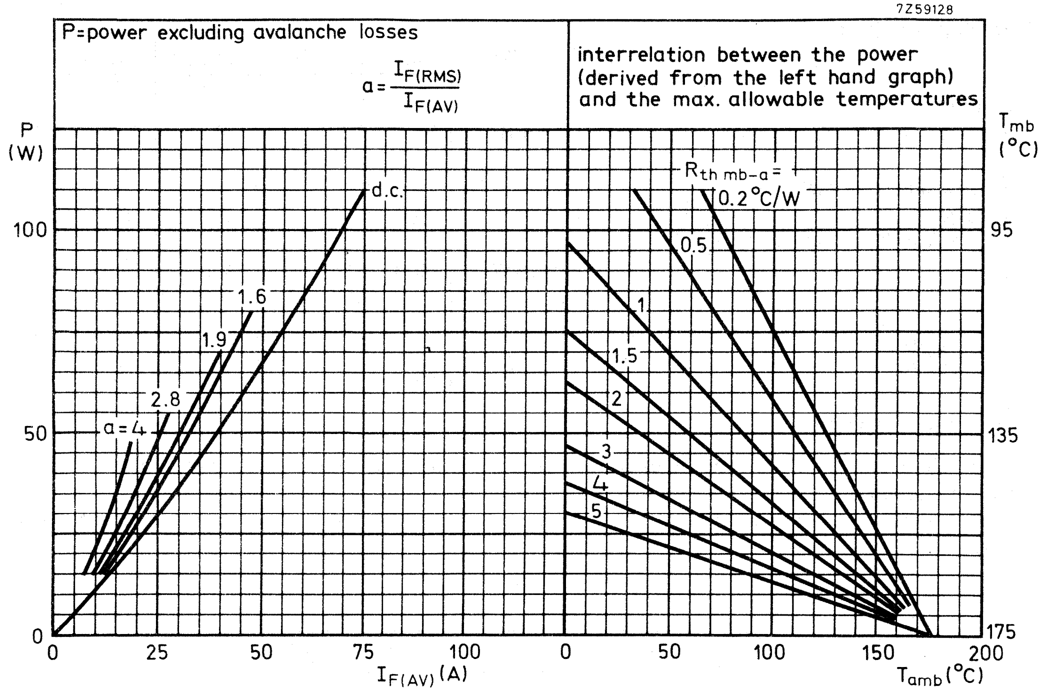

7Z59128
P=power excluding avalanche losses
$a = \frac{I_{F(RMS)}}{I_{F(AV)}}$
interrelation between the power (derived from the left hand graph) and the max. allowable temperatures
P (W)
T_{mb} (°C)
d.c.
1.6
1.9
2.8
a=4
$R_{th\ mb-a}$ = 0.2 °C/W
0.5
1
1.5
2
3
4
5
$I_{F(AV)}$ (A)
T_{amb} (°C)

Fig.3

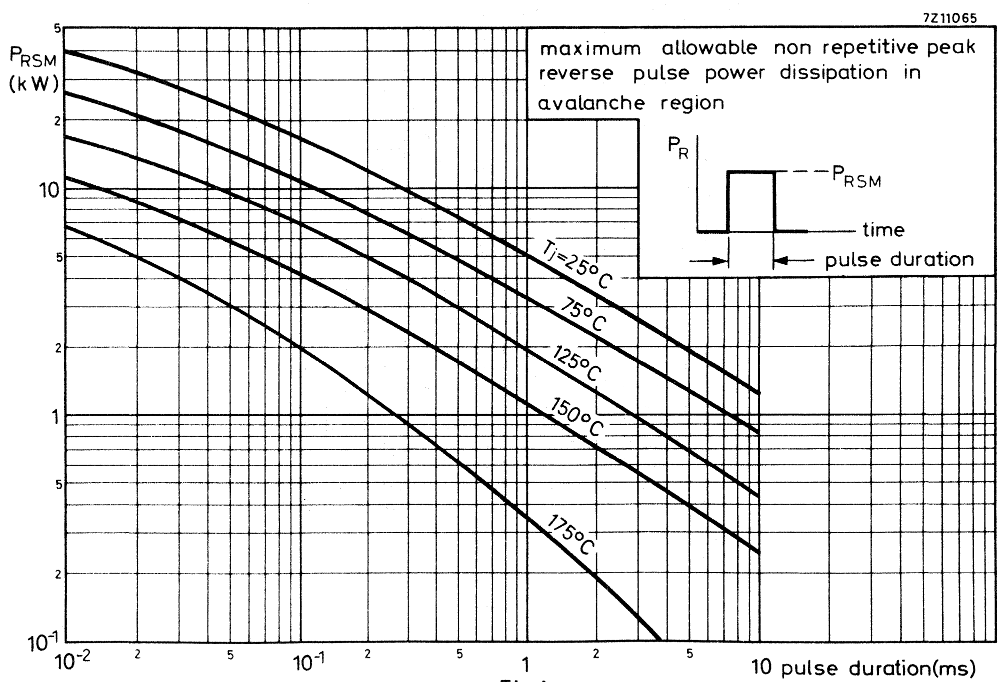

7Z11065
maximum allowable non repetitive peak reverse pulse power dissipation in avalanche region
P_{RSM} (kW)
P_R
P_{RSM}
time
pulse duration
T_j=25°C
75°C
125°C
150°C
175°C
10 pulse duration(ms)

Fig.4

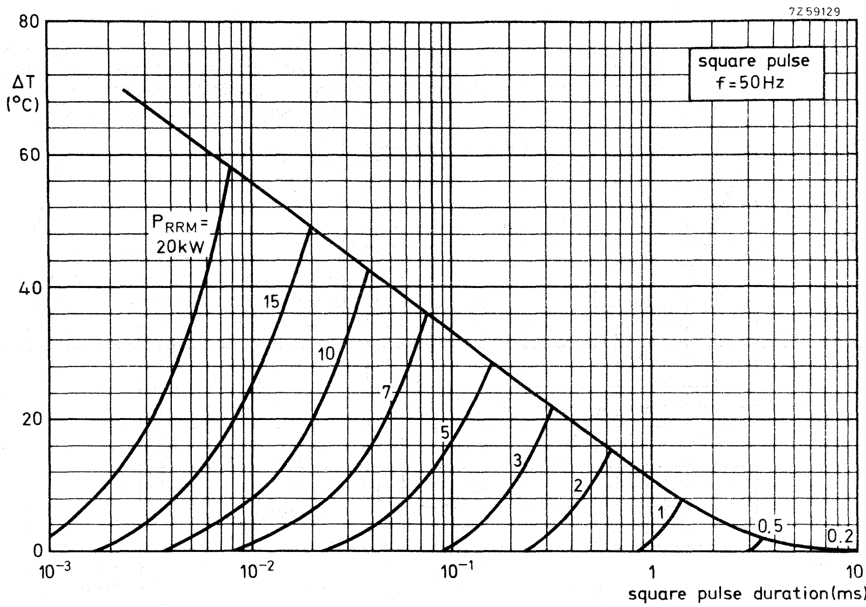


Fig.5

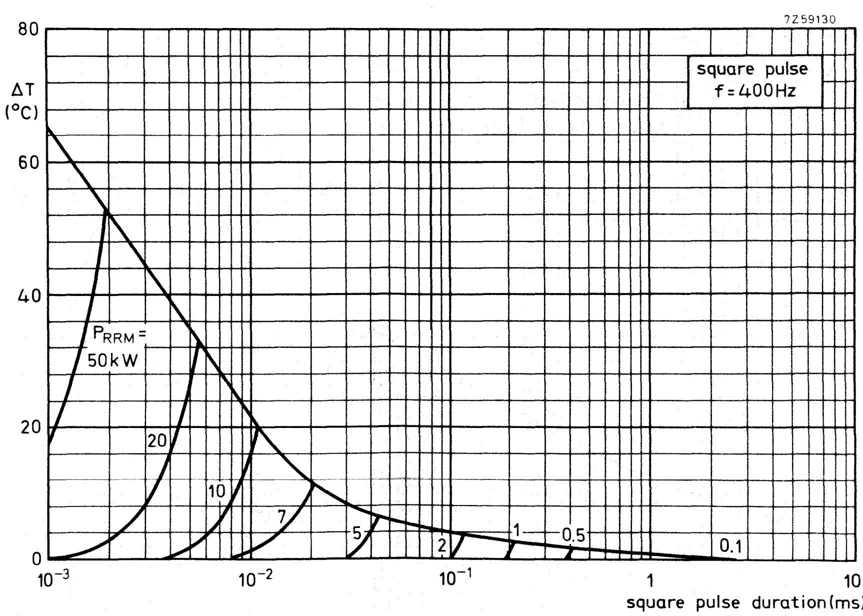


Fig.6

ΔT = neccessary derating of T_{jmax} to accommodate repetitive transients in the reverse direction. Allowance can be made for this by assuming the ambient temperature ΔT higher.

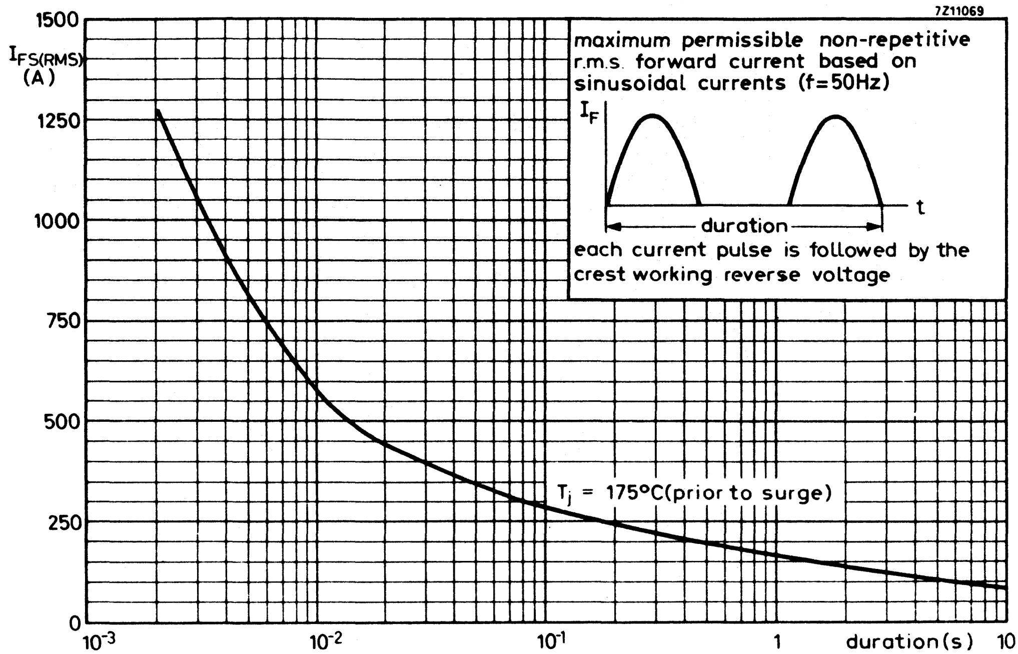

7Z11069
1500
1250
1000
750
500
250
0
$I_{FS(RMS)}$
(A)
maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f=50Hz)
I_F
t
duration
each current pulse is followed by the crest working reverse voltage
T_j = 175°C(prior to surge)
10^{-3}
10^{-2}
10^{-1}
1
duration(s)
10

Fig.7

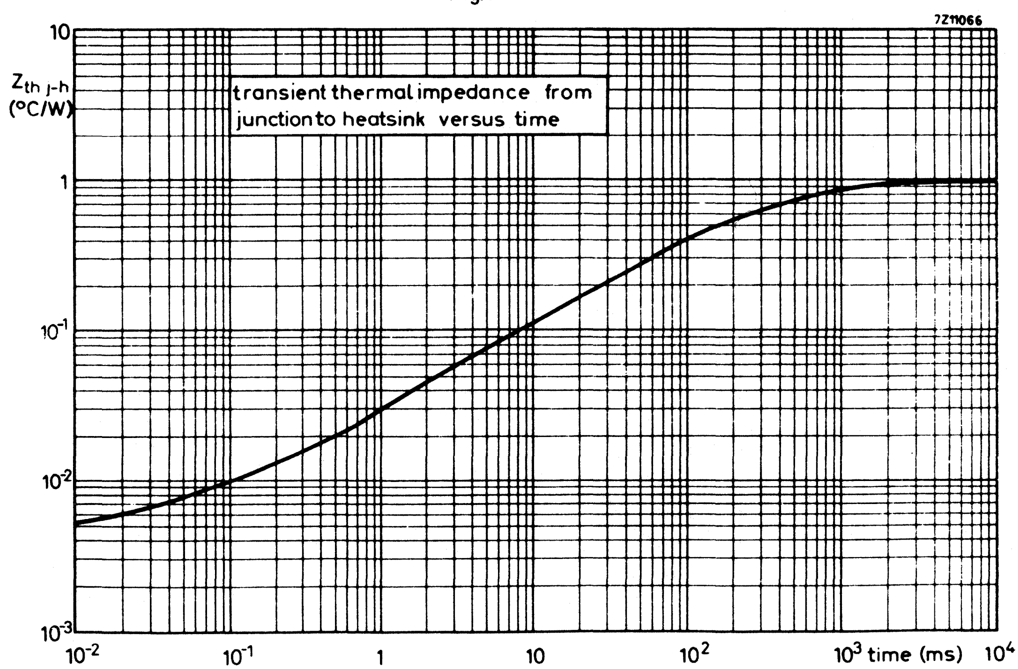

7Z11066
10
$Z_{th\ j\text{-}h}$
(°C/W)
transient thermal impedance from junction to heatsink versus time
1
10^{-1}
10^{-2}
10^{-3}
10^{-2}
10^{-1}
1
10
10^2
10^3 time (ms)
10^4

Fig.8

RECTIFIER DIODES

Also available to BS9331-F129

Silicon rectifier diodes in metal envelopes similar to DO-4, intended for use in power rectifier applications.
The series consists of the following types:
Normal polarity (cathode to stud): BYX96-300 to 1600.
Reverse polarity (anode to stud): BYX96-300R to 1600R.

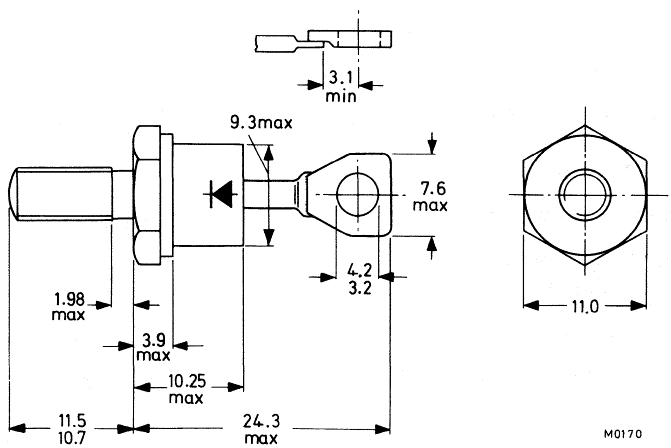
QUICK REFERENCE DATA

			BYX96-300(R)	600(R)	1200(R)	1600(R)	
Repetitive peak reverse voltage	V_{RRM}	max.	300	600	1200	1600	V
Average forward current	$I_{F(AV)}$	max.				30	A
Non-repetitive peak forward current	I_{FSM}	max.				400	A

MECHANICAL DATA

Dimensions in mm

Fig.1 DO-4: with metric M5 stud (ϕ 5 mm); e.g. BYX96-300(R).
Types with 10-32 UNF stud (ϕ 4,83 mm) are available on request. These are indicated by the suffix U; e.g. BYX96-300U(RU).



Supplied with device: 1 nut, 1 lock-washer
Nut dimensions across the flats, M5 thread: 8 mm, 10-32 UNF thread: 9.5 mm

Net mass: 7 g
Diameter of clearance hole: max. 5.2 mm
Supplied on request: see ACCESSORIES section
a version with insulated flying leads
The mark shown applies to normal polarity types.

Torque on nut: min. 0.9 Nm
(9 kg cm)
max. 1.7 Nm
(17 kg cm)

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages [1]			BYX96-300(R)	600(R)	1200(R)	1600(R)	
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	300	600	1200	1600	V
Repetitive peak reverse voltage ($\delta \leq 0,01$)	V_{RRM}	max.	300	600	1200	1600	V
Crest working reverse voltage	V_{RWM}	max.	200	400	800	800	V
Continuous reverse voltage	V_R	max.	200	400	800	800	V

Currents				
Average forward current (averaged over any 20 ms period) up to T_{mb} = 125 °C	$I_{F(AV)}$	max.	30	A
R.M.S. forward current	$I_{F(RMS)}$	max.	48	A
Repetitive peak forward current	I_{FRM}	max.	400	A
Non-repetitive peak forward current (t = 10 ms; half sine-wave) T_j = 175 °C prior to surge; with reapplied V_{RWMmax}	I_{FSM}	max.	400	A
I^2t for fusing (t = 10 ms)	I^2t	max.	800	A^2s

Temperatures				
Storage temperature	T_{stg}		−55 to +175	°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1,0	°C/W
From mounting base to heatsink without heatsink compound	$R_{th\ mb\text{-}h}$	=	0,5	°C/W
with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,3	°C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j\text{-}mb}$	=	0,2	°C/W

[1] To ensure thermal stability: $R_{th\ j\text{-}a} \leq 2$ °C/W (continuous reverse voltage) or ≤ 8 °C/W (a.c.)
For smaller heatsinks $T_{j\ max}$ should be derated. For a.c. see page 4.
For continuous reverse voltage: if $R_{th\ j\text{-}a}$ = 4 °C/W, then $T_{j\ max}$ = 138 °C,
if $R_{th\ j\text{-}a}$ = 6 °C/W, then $T_{j\ max}$ = 125 °C.

CHARACTERISTICS

Forward voltage

I_F = 100 A; T_j = 25 °C	V_F	<	1,7	V	[1]

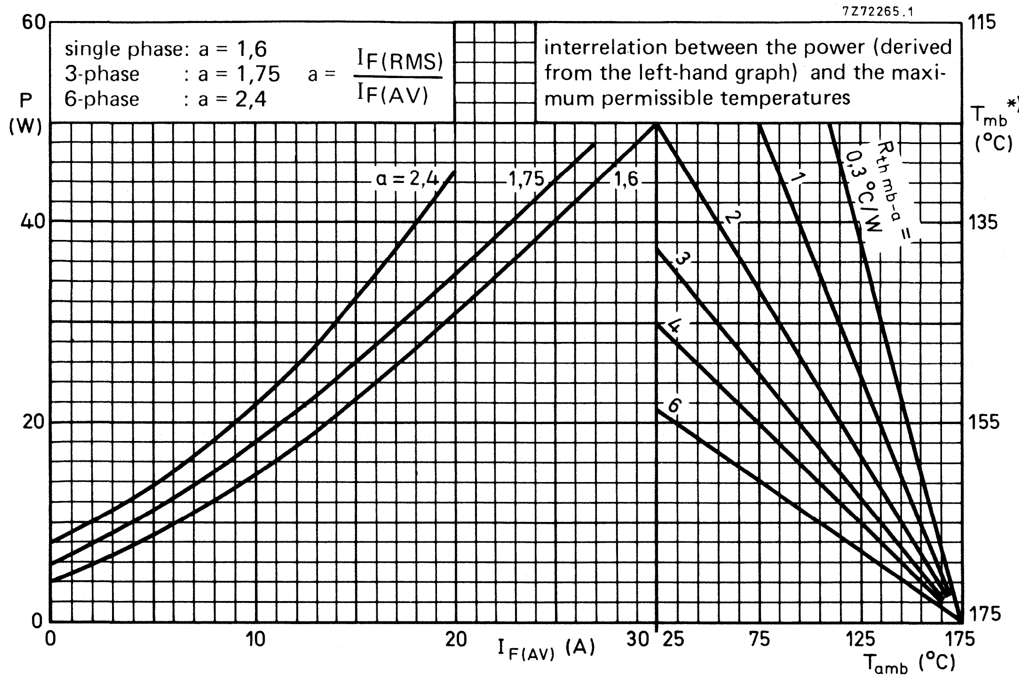
Reverse current

$V_R = V_{RWMmax}$; T_j = 125 °C	I_R	<	1	mA

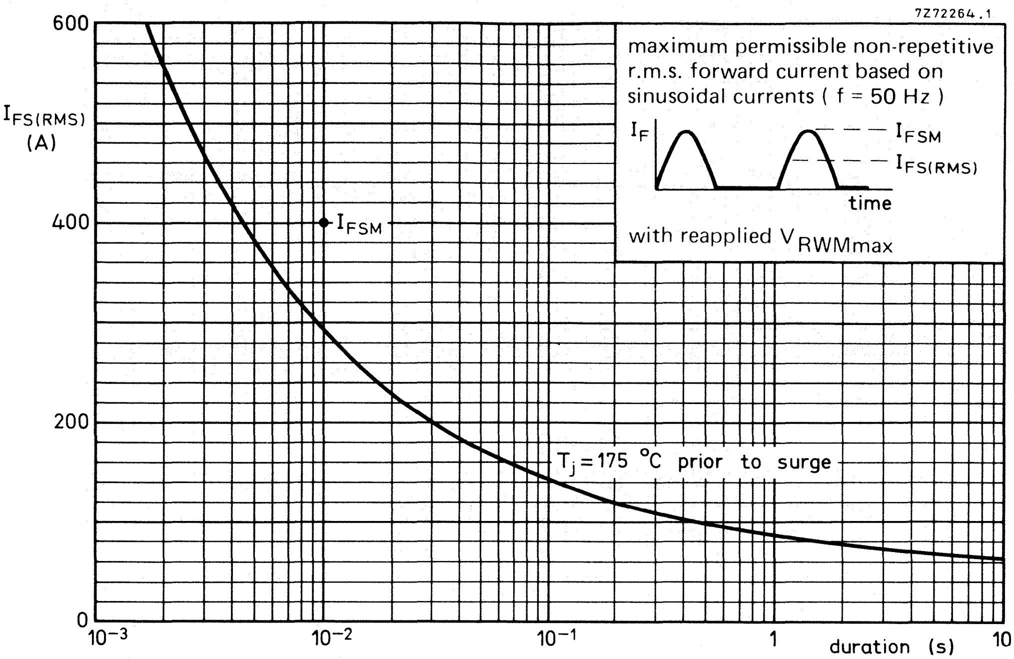
OPERATING NOTES

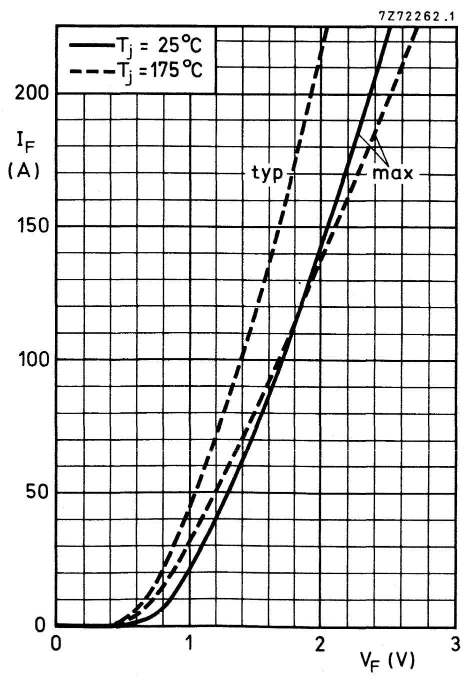
1. The top connector should neither be bent nor twisted; it should be soldered into the circuit so that there is no strain on it.
   During soldering the heat conduction to the junction should be kept to a minimum.
2. Where there is a possibility that transients, due to the energy stored in the transformer, will exceed the maximum permissible non-repetitive peak reverse voltage, see General Section for information on damping circuits.

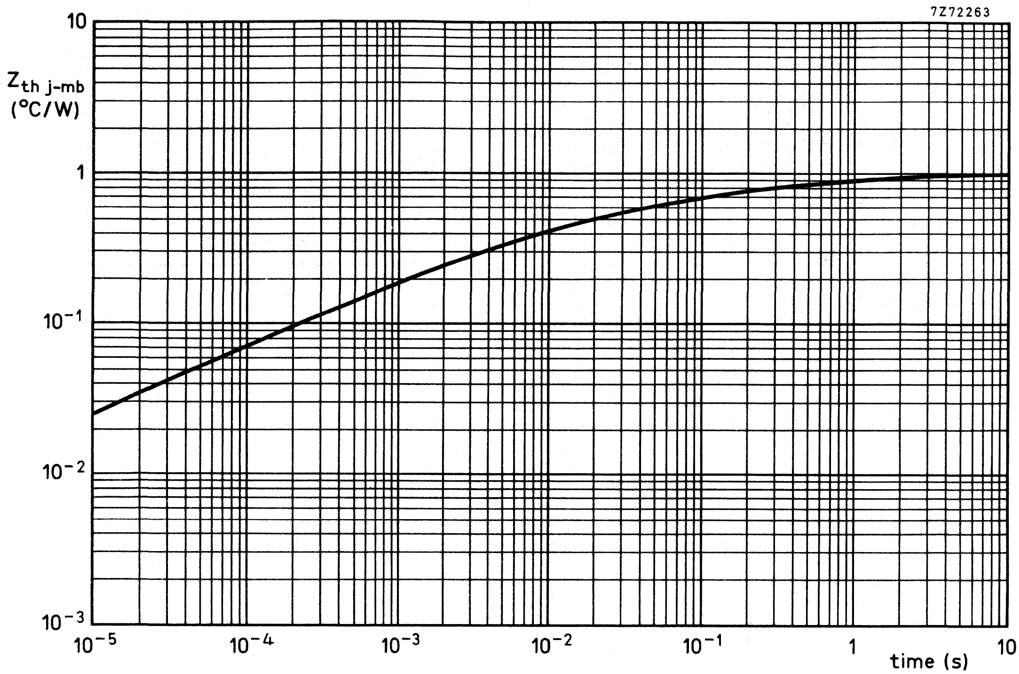
[1]) Measured under pulse conditions to avoid excessive dissipation.



*) T_{mb}-scale is for comparison purposes only and is correct only for $R_{th\ mb\text{-}a} \leq 6,5\ ^{o}C/W$


7Z72264.1
maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz)
I_F
I_{FSM}
$I_{FS(RMS)}$
time
with reapplied V_{RWMmax}
$I_{FS(RMS)}$ (A)
600
400
200
0
I_{FSM}
$T_j = 175\ °C$ prior to surge
10^{-3}
10^{-2}
10^{-1}
1
10
duration (s)


7Z72262.1
T_j = 25°C
T_j = 175°C
200
150
100
50
0
I_F (A)
typ
max
0
1
2
3
V_F (V)


7Z72263
10
Zth j-mb
(°C/W)
1
10−1
10−2
10−3
10−5
10−4
10−3
10−2
10−1
1
10
time (s)

RECTIFIER DIODES

Also available to BS9331-F130

Silicon rectifier diodes in metal envelopes similar to DO-5, intended for use in power rectifier applications.
The series consists of the following types:
Normal polarity (cathode to stud): BYX97-300 to 1600.
Reverse polarity (anode to stud): BYX97-300R to 1600R.

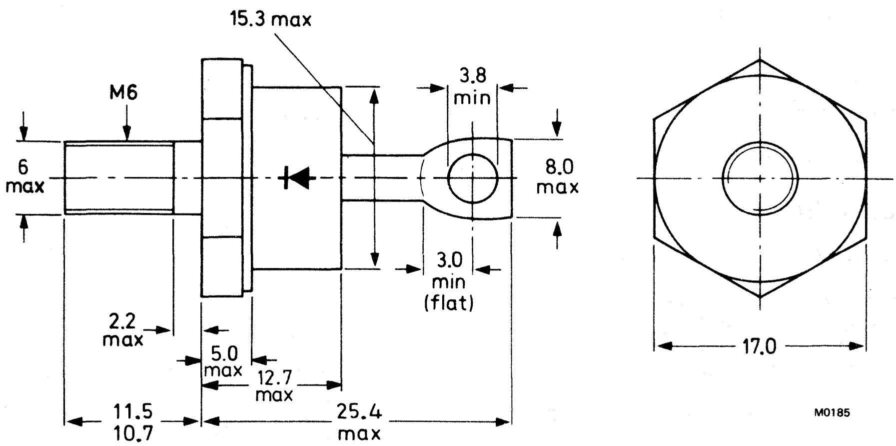
QUICK REFERENCE DATA

			BYX97-300(R)	600(R)	1200(R)	1600(R)	
Repetitive peak reverse voltage	V_{RRM}	max.	300	600	1200	1600	V
Average forward current	$I_{F(AV)}$	max.				47	A
Non-repetitive peak forward current	I_{FSM}	max.				800	A

MECHANICAL DATA

Dimensions in mm

DO-5 (except for M6 stud); Supplied with device: 1 nut, 1 lock-washer
Nut dimensions across the flats: 10 mm



Net mass: 22 g
Diameter of clearance hole: max. 6.5 mm
Supplied on request: see ACCESSORIES section
a version with insulated flying leads
The mark shown applies to normal polarity types.

Torque on nut: min. 1.7 Nm
(17 kg cm)
max. 3.5 Nm
(35 kg cm)

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages [1]			BYX97-300(R)	600(R)	1200(R)	1600(R)	
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	300	600	1200	1600	V
Repetitive peak reverse voltage ($\delta \leq 0,01$)	V_{RRM}	max.	300	600	1200	1600	V
Crest working reverse voltage	V_{RWM}	max.	200	400	800	800	V
Continuous reverse voltage	V_R	max.	200	400	800	800	V

Currents

Average forward current (averaged over any 20 ms period) up to $T_{mb} = 120$ °C	$I_{F(AV)}$	max.	47	A
at $T_{mb} = 125$ °C	$I_{F(AV)}$	max.	40	A
R.M.S. forward current	$I_{F(RMS)}$	max.	75	A
Repetitive peak forward current	I_{FRM}	max.	550	A
Non-repetitive peak forward current ($t = 10$ ms; half sine-wave) $T_j = 150$ °C prior to surge; with reapplied V_{RWMmax}	I_{FSM}	max.	800	A
I^2t for fusing ($t = 10$ ms)	I^2t	max.	3200	A^2s

Temperatures

Storage temperature	T_{stg}		−55 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	0,6	°C/W
From mounting base to heatsink without heatsink compound	$R_{th\ mb\text{-}h}$	=	0,3	°C/W
with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,2	°C/W
Transient thermal impedance; $t = 1$ ms	$Z_{th\ j\text{-}mb}$	=	0,1	°C/W

[1]) To ensure thermal stability: $R_{th\ j\text{-}a} \leq 1$ °C/W (continuous reverse voltage) or ≤ 4 °C/W (a.c.)
For smaller heatsinks $T_{j\ max}$ should be derated. For a.c. see page 4.
For continuous reverse voltage: if $R_{th\ j\text{-}a} = 2$ °C/W, then $T_{j\ max} = 138$ °C,
if $R_{th\ j\text{-}a} = 3$ °C/W, then $T_{j\ max} = 125$ °C.

CHARACTERISTICS

Forward voltage

$I_F = 150$ A; $T_j = 25$ °C	V_F	<	1,45	V [1]

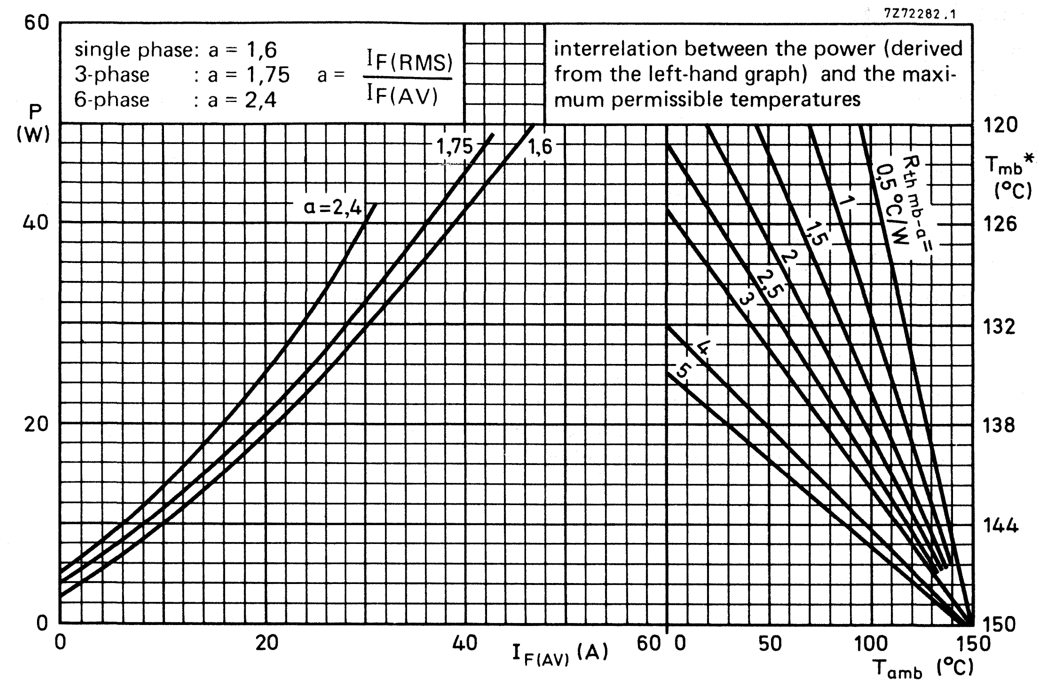
Reverse current

$V_R = V_{RWMmax}$; $T_j = 125$ °C	I_R	<	4	mA

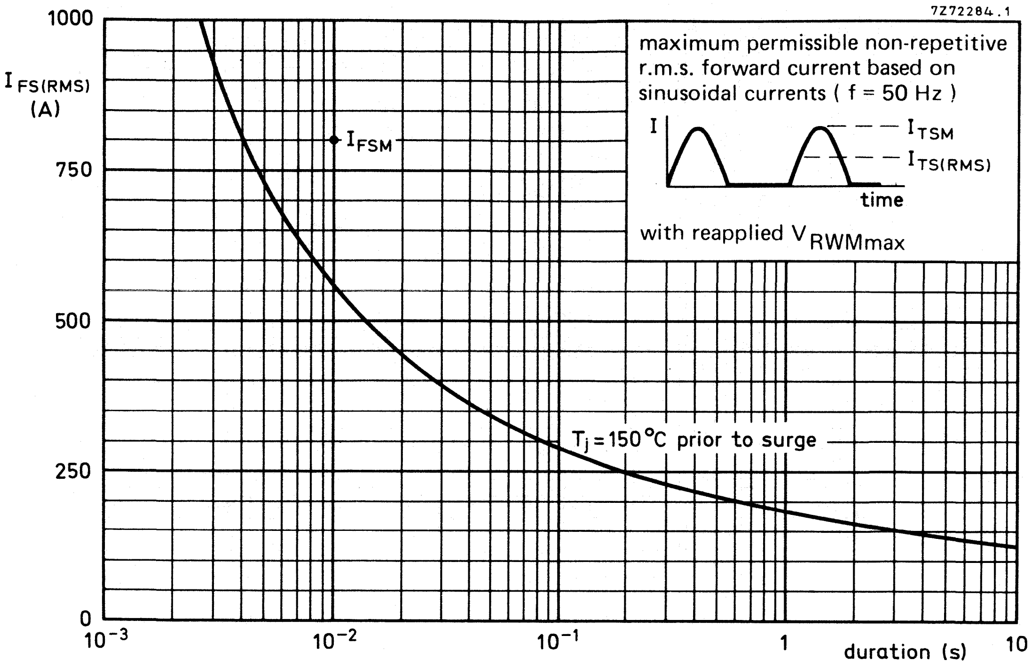
OPERATING NOTES

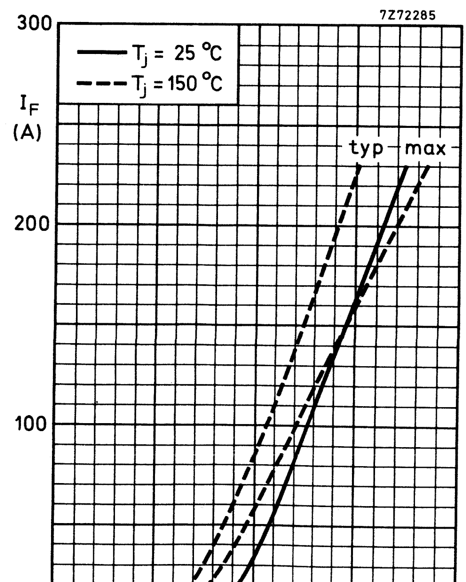
1. The top connector should neither be bent nor twisted; it should be soldered into the circuit so that there is no strain on it.
   During soldering the heat conduction to the junction should be kept to a minimum.
2. Where there is a possibility that transients, due to the energy stored in the transformer, will exceed the maximum permissible non-repetitive peak reverse voltage, see General Section for information on damping circuits.

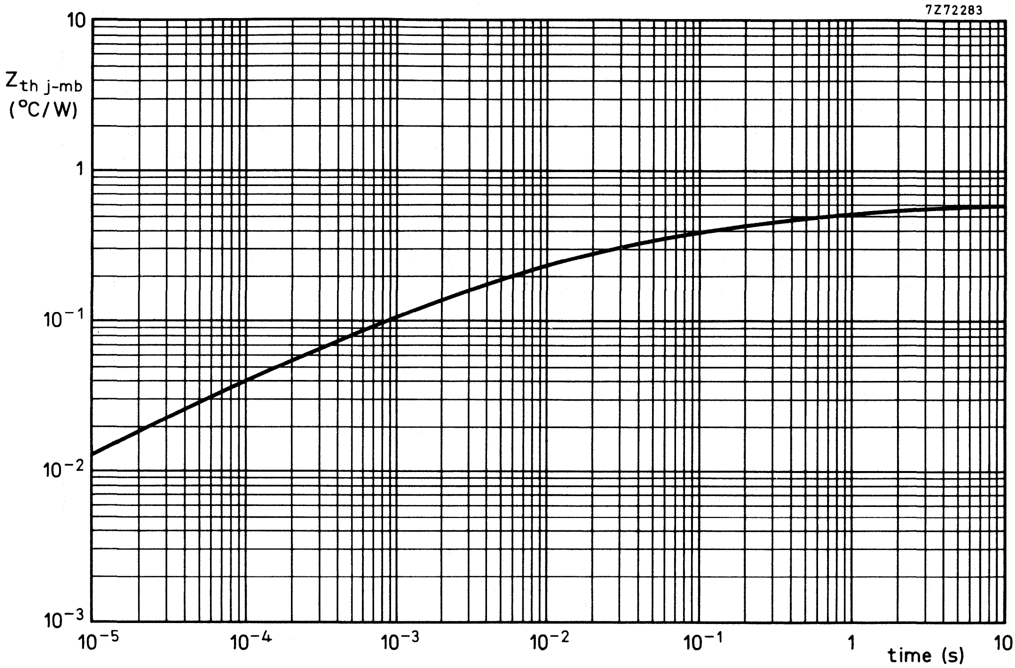
[1]) Measured under pulse conditions to avoid excessive dissipation.



*) T_{mb}-scale is for comparison purposes only and is correct only for $R_{th\ mb\text{-}a} \leq 3{,}4\,^{o}C/W$


7Z72284.1
maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz)
I
I_TSM
I_TS(RMS)
time
with reapplied V_RWMmax
I_FS(RMS) (A)
1000
750
500
250
0
I_FSM
Tj = 150 °C prior to surge
10^-3
10^-2
10^-1
1
10
duration (s)


7Z72285
Tj = 25 °C
Tj = 150 °C
I_F (A)
300
200
100
0
typ
max
0
1
2
V_F (V)


7Z72283
10
$Z_{th\ j\text{-}mb}$
(°C/W)
1
10^{-1}
10^{-2}
10^{-3}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
time (s)
10

RECTIFIER DIODES

Silicon rectifier diodes in DO-4 metal envelopes, intended for use in power rectifier applications.
The series consists of the following types:
Normal polarity (cathode to stud): BYX98-300 to 1200.
Reverse polarity (anode to stud): BYX98-300R to 1200R.

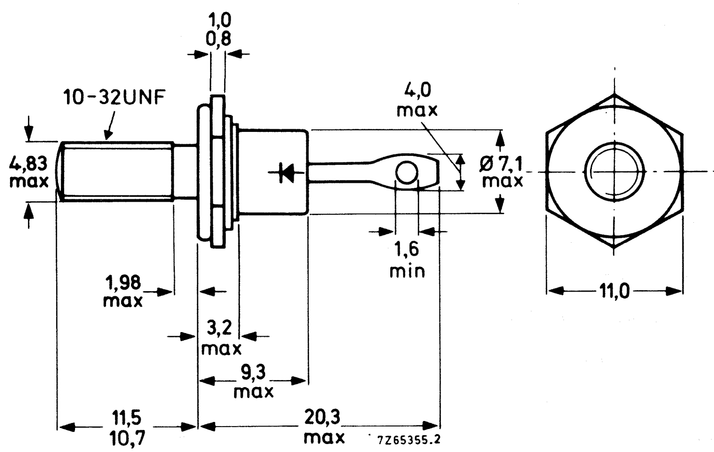
QUICK REFERENCE DATA

			BYX98-300(R)	600(R)	1200(R)	
Repetitive peak reverse voltage	V_{RRM}	max.	300	600	1200	V
Average forward current	$I_{F(AV)}$	max.			10	A
Non-repetitive peak forward current	I_{FSM}	max.			75	A

MECHANICAL DATA

Dimensions in mm

DO-4: Supplied with device: 1 nut, 1 lock-washer
Nut dimensions across the flats: 9.5 mm



Net mass: 6 g
Diameter of clearance hole: max. 5.2 mm
Accessories supplied on request:
see ACCESSORIES section
The mark shown applies to normal polarity types.

Torque on nut: min. 0.9 Nm (9 kg cm)
max. 1.7 Nm (17 kg cm)

Products approved to CECC 50 009-004, available on request

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages			BYX98-300(R)	600(R)	1200(R)	
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	300	600	1200	V
Repetitive peak reverse voltage ($\delta \leq 0,01$)	V_{RRM}	max.	300	600	1200	V
Crest working reverse voltage	V_{RWM}	max.	200	400	800	V
Continuous reverse voltage	V_R	max.	200	400	800	V

Currents				
Average forward current (averaged over any 20 ms period) up to T_{mb} = 97 °C	$I_{F(AV)}$	max.	10	A
at T_{mb} = 125 °C	$I_{F(AV)}$	max.	6	A
R.M.S. forward current	$I_{F(RMS)}$	max.	16	A
Repetitive peak forward current	I_{FRM}	max.	75	A
Non-repetitive peak forward current (t = 10 ms; half sine-wave) T_j = 150 °C prior to surge; with reapplied V_{RWMmax}	I_{FSM}	max.	75	A
I^2t for fusing (t = 10 ms)	I^2t	max.	28	A^2s

Temperatures				
Storage temperature	T_{stg}		−55 to +150	°C
Junction temperature	T_j	max.	150	°C

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j-a}$	=	50	°C/W
From junction to mounting base	$R_{th\ j-mb}$	=	3	°C/W
From mounting base to heatsink with heatsink compound	$R_{th\ mb-h}$	=	0,5	°C/W
without heatsink compound	$R_{th\ mb-h}$	=	0,6	°C/W
Transient thermal impedance; t = 1 ms	$Z_{th\ j-mb}$	=	0,3	°C/W

CHARACTERISTICS

Forward voltage

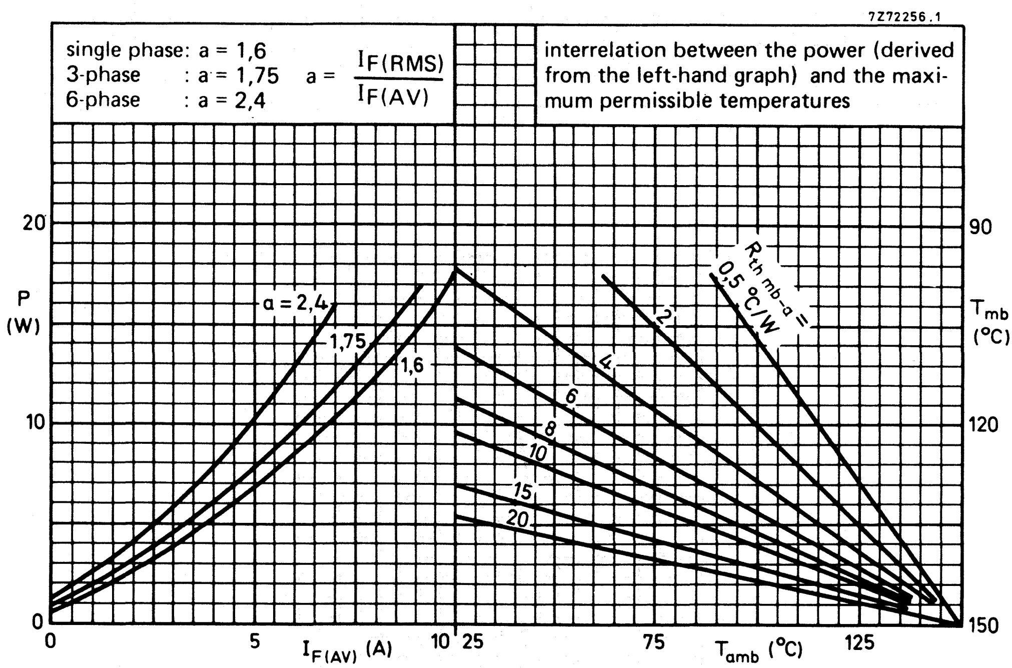
I_F = 20 A; T_j = 25 °C	V_F	<	1,7	V	1)

Reverse current

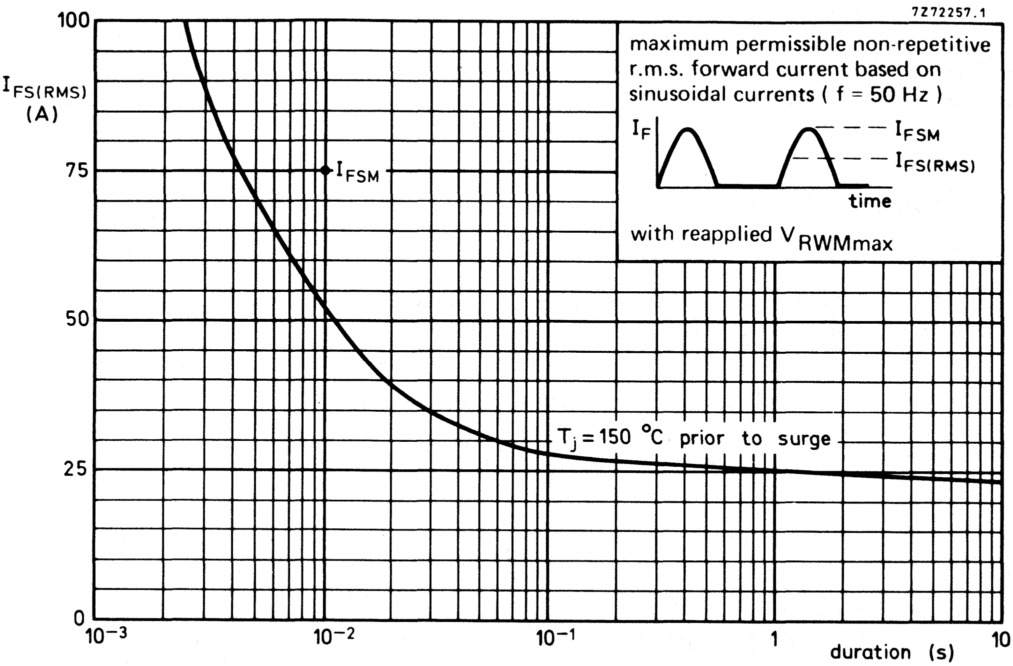
V_R = V_{RWMmax}; T_j = 125 °C	I_R	<	200	μA

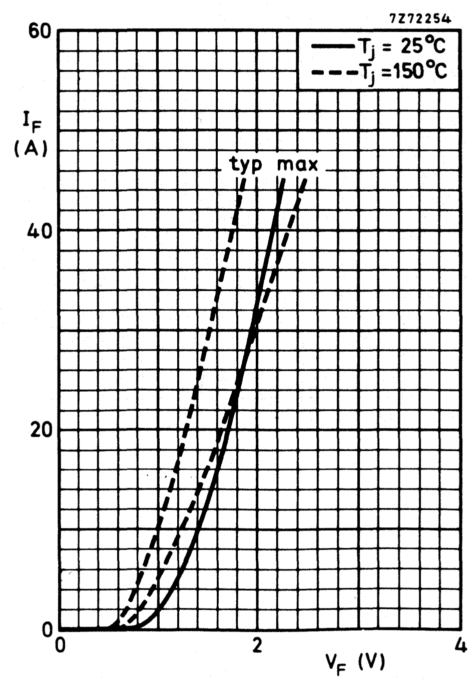
OPERATING NOTES

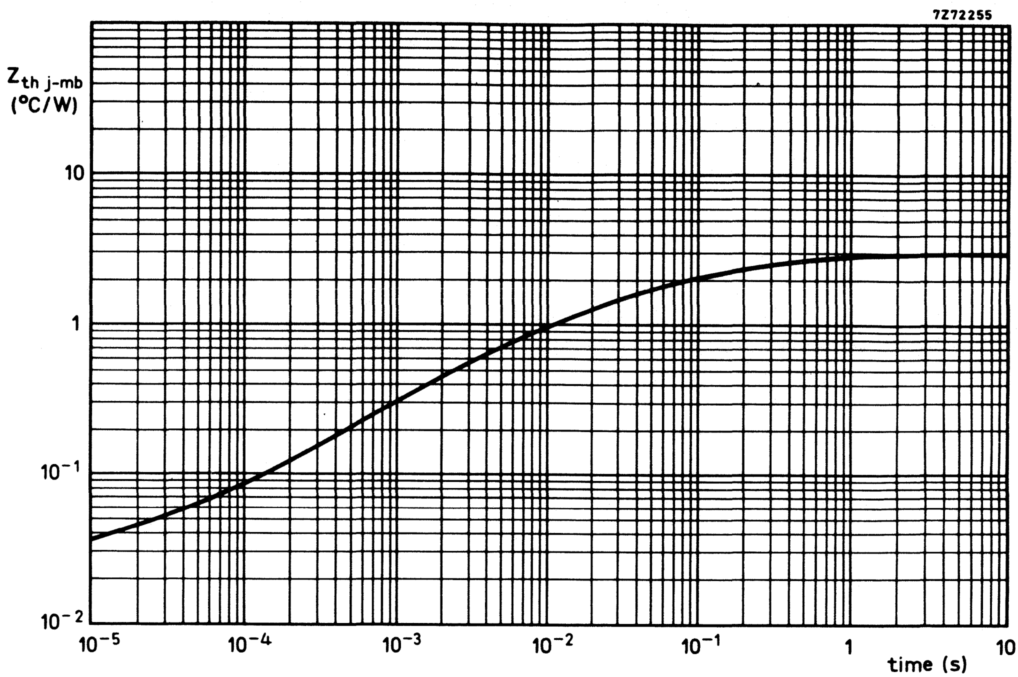
1. The top connector should neither be bent nor twisted; it should be soldered into the circuit so that there is no strain on it.
   During soldering the heat conduction to the junction should be kept to a minimum.
2. Where there is a possibility that transients, due to the energy stored in the transformer, will exceed the maximum permissible non-repetitive peak reverse voltage, see General Section for information on damping circuits.



1) Measured under pulse conditions to avoid excessive dissipation.


7Z72257.1
maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz)
I_F
I_FSM
I_FS(RMS)
time
with reapplied V_RWMmax
I_FS(RMS) (A)
100
75
50
25
0
I_FSM
T_j = 150 °C prior to surge
10^-3
10^-2
10^-1
1
10
duration (s)


7Z72254
T_j = 25°C
T_j =150°C
I_F (A)
60
40
20
0
typ
max
0
2
4
V_F (V)


7Z72255
$Z_{th\ j\text{-}mb}$ (°C/W)
10
1
10^{-1}
10^{-2}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
10
time (s)

RECTIFIER DIODES

Silicon rectifier diodes in DO-4 metal envelopes, intended for use in power rectifier applications.
The series consists of the following types:
Normal polarity (cathode to stud): BYX99-300 to 1200.
Reverse polarity (anode to stud): BYX99-300R to 1200R.

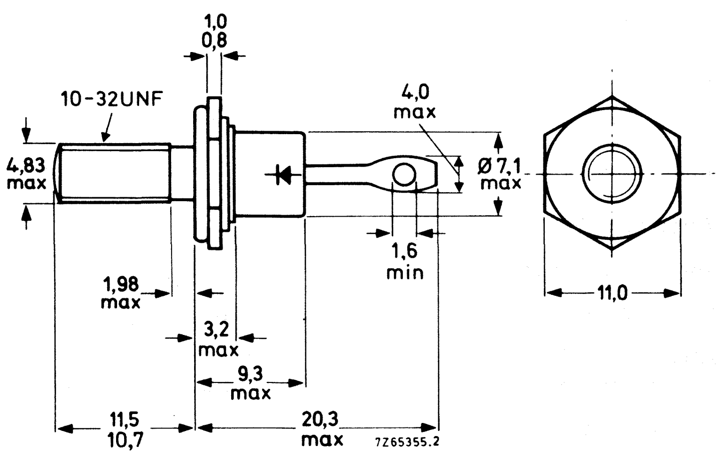
QUICK REFERENCE DATA

			BYX99-300(R)	600(R)	1200(R)	
Repetitive peak reverse voltage	V_{RRM}	max.	300	600	1200	V
Average forward current	$I_{F(AV)}$	max.			15	A
Non-repetitive peak forward current	I_{FSM}	max.			180	A

MECHANICAL DATA

Dimensions in mm

DO-4: Supplied with device: 1 nut, 1 lock-washer
Nut dimensions across the flats: 9.5 mm



Net mass: 6 g
Diameter of clearance hole: 5.2 mm
Accessories supplied on request:
see ACCESSORIES section
The mark shown applies to normal polarity types.

Torque on nut: min. 0.9 Nm (9 kg cm)
max. 1.7 Nm (17 kg cm)

Products approved to CECC 50 009-005, available on request

RATINGS Limiting values in accordance with the Absolute Maximum System (IEC 134)

Voltages

			BYX99-300(R)	600(R)	1200(R)	
Non-repetitive peak reverse voltage ($t \leq 10$ ms)	V_{RSM}	max.	300	600	1200	V
Repetitive peak reverse voltage ($\delta \leq 0,01$)	V_{RRM}	max.	300	600	1200	V
Crest working reverse voltage	V_{RWM}	max.	200	400	800	V
Continuous reverse voltage	V_R	max.	200	400	800	V

Currents

Average forward current (averaged over any 20 ms period) up to $T_{mb} = 129\ ^oC$	$I_{F(AV)}$	max.	15	A
R.M.S. forward current	$I_{F(RMS)}$	max.	24	A
Repetitive peak forward current	I_{FRM}	max.	180	A
Non-repetitive peak forward current ($t = 10$ ms; half sine-wave) $T_j = 175\ ^oC$ prior to surge; with reapplied V_{RWMmax}	I_{FSM}	max.	180	A
I^2t for fusing ($t = 10$ ms)	I^2t	max.	162	A^2s

Temperatures

Storage temperature	T_{stg}		−55 to +175	^oC
Junction temperature	T_j	max.	175	^oC

THERMAL RESISTANCE

From junction to ambient in free air	$R_{th\ j\text{-}a}$	=	50	$^oC/W$
From junction to mounting base	$R_{th\ j\text{-}mb}$	=	2,3	$^oC/W$
From mounting base to heatsink with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,5	$^oC/W$
without heatsink compound	$R_{th\ mb\text{-}h}$	=	0,6	$^oC/W$
Transient thermal impedance; $t = 1$ ms	$Z_{th\ j\text{-}mb}$	=	0,13	$^oC/W$

CHARACTERISTICS

Forward voltage

$I_F = 50$ A; $T_j = 25$ °C	V_F	<	1,55	V [1]

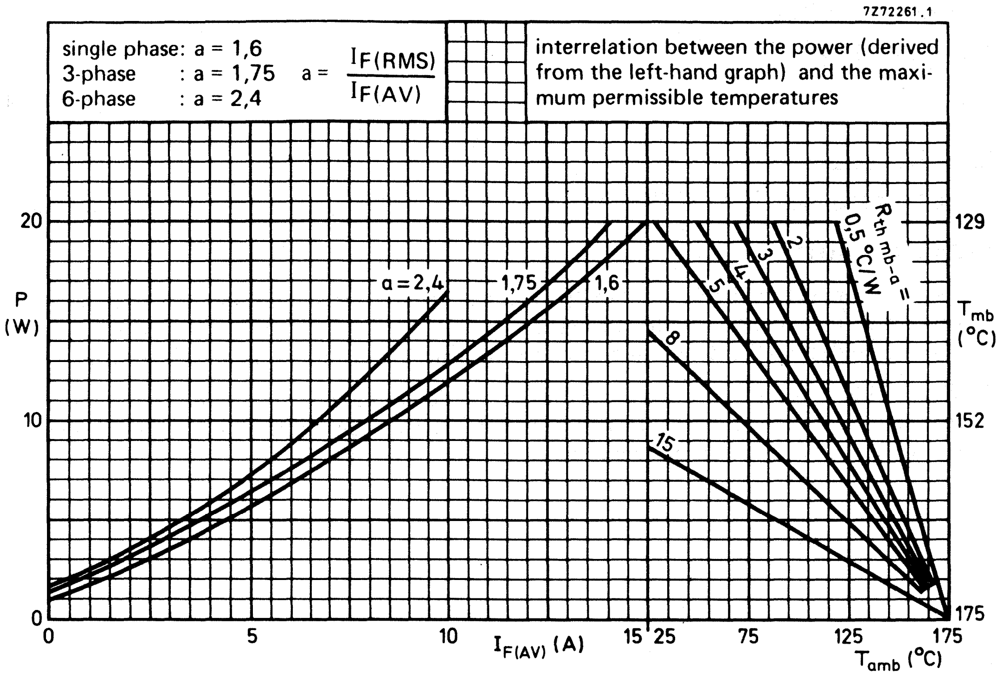
Reverse current

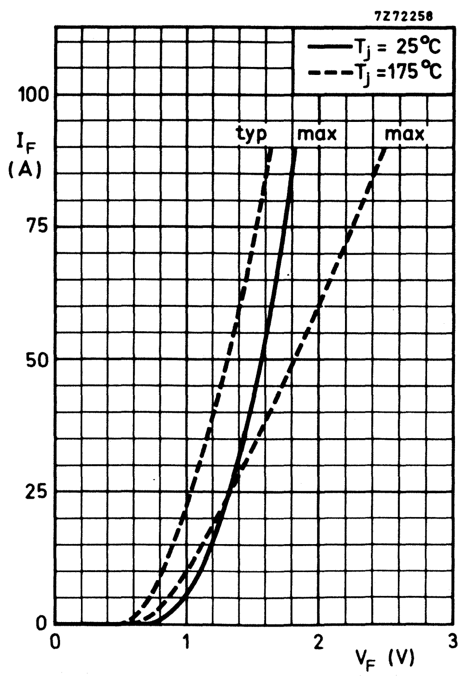
$V_R = V_{RWMmax}$; $T_j = 125$ °C	I_R	<	200	μA

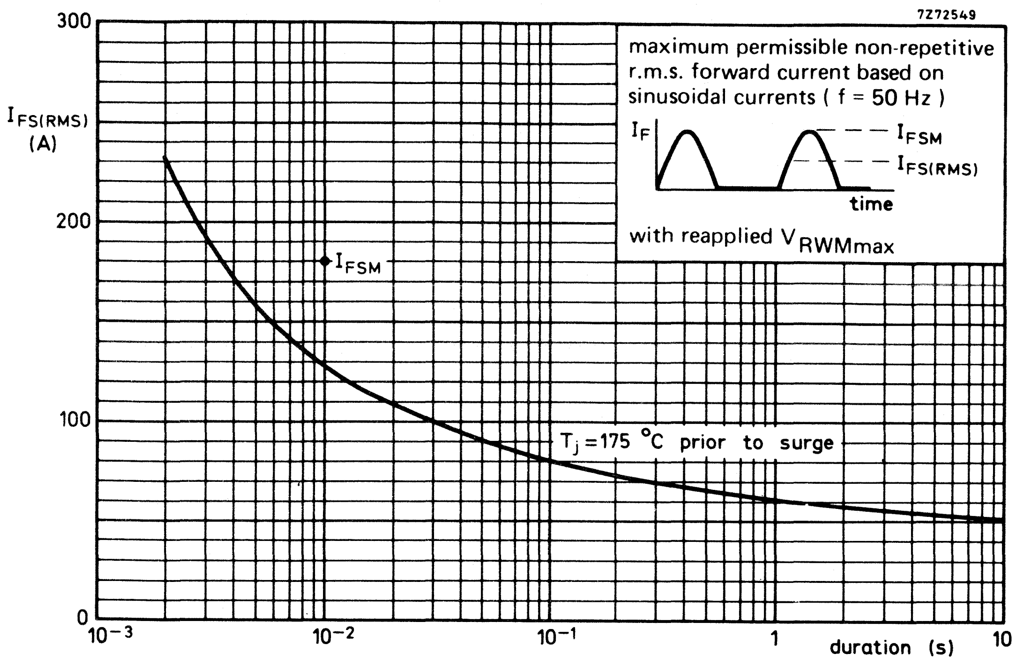
OPERATING NOTES

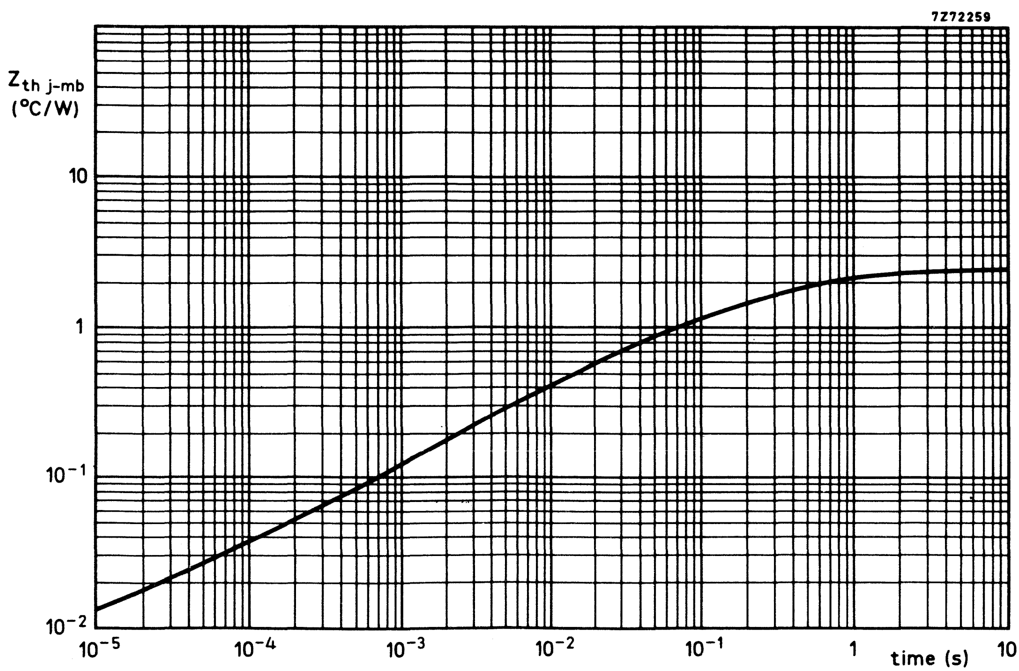
1. The top connector should neither be bent nor twisted; it should be soldered into the circuit so that there is no strain on it.
   During soldering the heat conduction to the junction should be kept to a minimum.
2. Where there is a possibility that transients, due to the energy stored in the transformer, will exceed the maximum permissible non-repetitive peak reverse voltage, see General Section for information on damping circuits.

[1]) Measured under pulse conductions to avoid excessive dissipation.


7Z72261.1
single phase: a = 1,6
3-phase : a = 1,75
6-phase : a = 2,4
a = IF(RMS) / IF(AV)
interrelation between the power (derived from the left-hand graph) and the maximum permissible temperatures
P (W)
20
10
0
a = 2,4
1,75
1,6
Rth mb-a = 0,5 °C/W
2
3
4
5
8
15
Tmb (°C)
129
152
175
0
5
10
15
IF(AV) (A)
25
75
125
175
Tamb (°C)


7Z72258
Tj = 25 °C
Tj = 175 °C
IF (A)
100
75
50
25
0
typ
max
max
0
1
2
3
VF (V)


7Z72549
maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz)
IF
IFSM
IFS(RMS)
time
with reapplied VRWMmax
IFS(RMS) (A)
300
200
100
0
IFSM
Tj = 175 °C prior to surge
10−3
10−2
10−1
1
duration (s)
10


7Z72259
Zth j-mb (°C/W)
10
1
10−1
10−2
10−5
10−4
10−3
10−2
10−1
1
time (s)
10

REGULATOR DIODES

A range of diffused silicon diodes in plastic envelopes, intended for use as voltage regulator and transient suppressor diodes in medium power regulators and transient suppression circuits.

The series consists of the following types: BZX70-C7V5 to BZX70-C75.

QUICK REFERENCE DATA

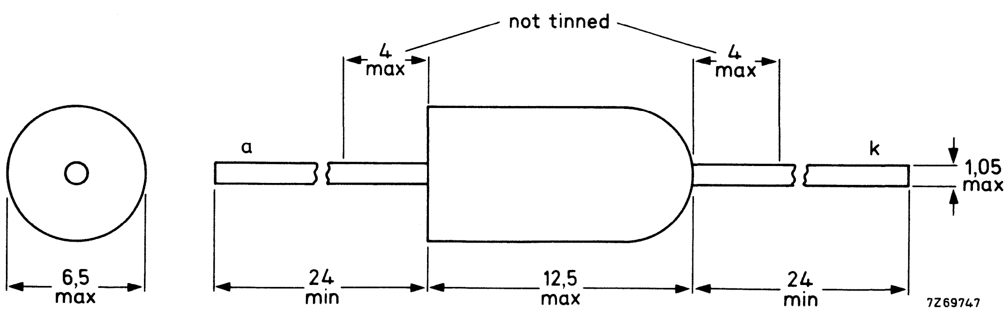
			voltage regulator	transient suppressor	
Working voltage (5% range)	V_Z	nom.	7,5 to 75	–	V
Stand-off voltage	V_R		–	5,6 to 56	V
Total power dissipation	P_{tot}	max.	2,5	–	W
Non-repetitive peak reverse power dissipation	P_{RSM}	max.	–	700	W

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOD-18.

The rounded end indicates the cathode.



Products approved to CECC 50 005-015 available on request.

RATINGS

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

Peak working current	I_{ZM}	max.	5 A
Average forward current (averaged over any 20 ms period)	$I_{F(AV)}$	max.	1 A
Non-repetitive peak reverse current T_j = 25 °C prior to surge; t_p = 1 ms (exponential pulse); BZX70-C7V5 to BZX70-C75	I_{RSM}	max.	44 to 6 A
Total power dissipation at T_{amb} = 25 °C; with 10 mm tie-points	P_{tot}	max.	2,5 W
Non-repetitive peak reverse power dissipation T_j = 25 °C prior to surge; t_p = 1 ms (exponential pulse)	P_{RSM}	max.	700 W
Storage temperature	T_{stg}		−55 to + 150 °C
Junction temperature	T_j	max.	150 °C

THERMAL RESISTANCE

From junction to ambient in free air — see Figs 4 and 5

CHARACTERISTICS

Forward voltage I_F = 1 A; T_{amb} = 25 °C	V_F	$<$	1,5 V

OPERATION AS A VOLTAGE REGULATOR

Dissipation and heatsink considerations

a. Steady-state conditions

The maximum permissible steady-state dissipation $P_{s\,max}$ is given by the relationship

$$P_{s\,max} = \frac{T_{j\,max} - T_{amb}}{R_{th\,j\text{-}a}}$$

where: $T_{j\,max}$ is the maximum permissible operating junction temperature
T_{amb} is the ambient temperature
$R_{th\,j\text{-}a}$ is the total thermal resistance from junction to ambient

b. Pulse conditions (see Fig. 2)

The maximum permissible pulse power $P_{p\,max}$ is given by the formula

$$P_{p\,max} = \frac{(T_{j\,max} - T_{amb}) - (P_s \cdot R_{th\,j\text{-}a})}{R_{th\,t}}$$

where: P_s is any steady-state dissipation excluding that in pulses
$R_{th\,t}$ is the effective transient thermal resistance of the device between junction and ambient. It is a function of the pulse duration t_p and duty factor δ.
δ is the duty factor (t_p/T)

The steady-state power P_s when biased in the zener direction at a given zener current can be found from Fig. 3. With the additional pulse power dissipation $P_{p\,max}$ calculated from the above expression, the total peak zener power dissipation $P_{tot} = P_{ZRM} = P_s + P_p$. From Fig. 3 the corresponding maximum repetitive peak zener current at P_{tot} can now be read. This repetitive peak zener current is subject to the absolute maximum rating. For pulse durations longer than the temperature stabilization time of the diode t_{stab}, the maximum permissible repetitive peak dissipation P_{ZRM} is equal to the steady-state power P_s. The temperature stabilization time for the BZX70 is 100 seconds.

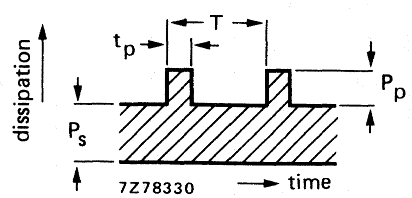


Fig. 2.

NOTES WHEN OPERATING AS A TRANSIENT SUPPRESSOR

1. Recommended stand-off voltage is defined as being the maximum reverse voltage to be applied without causing conduction in the avalanche mode or significant reverse dissipation.
2. Maximum clamping voltage is the maximum reverse avalanche breakdown voltage which will appear across the diode at the specified pulse duration and junction temperature.
3. Duration of an exponential pulse is defined as the time taken for the pulse to fall to 37% of its initial value. It is assumed that energy content does not continue beyond twice this time.

CHARACTERISTICS – WHEN USED AS VOLTAGE REGULATOR DIODES; T_{amb} = 25 °C

BZX70-. . .	working voltage *V_Z V		differential resistance *r_Z Ω		temperature coefficient *S_Z mV/°C	test I_Z mA	reverse current I_R μA	at reverse voltage V_R V
	min.	max.	typ.	max.	typ.		max.	
C7V5	7.0	7.9	0.45	3.5	3.0	50	50	2.0
C8V2	7.7	8.7	0.45	3.5	4.0	50	20	5.6
C9V1	8.5	9.6	0.55	4.0	5.5	50	10	6.2
C10	9.4	10.6	0.75	4.0	7.0	50	10	6.8
C11	10.4	11.6	0.8	4.5	7.5	50	10	7.5
C12	11.4	12.7	0.85	5.0	8.0	50	10	8.2
C13	12.4	14.1	0.9	6.0	8.5	50	10	9.1
C15	13.8	15.6	1.0	8.0	10	50	10	10
C16	15.3	17.1	2.4	9.0	11	20	10	11
C18	16.8	19.1	2.5	11	12	20	10	12
C20	18.8	21.2	2.8	12	14	20	10	13
C22	20.8	23.3	3.0	13	16	20	10	15
C24	22.7	25.9	3.4	14	18	20	10	16
C27	25.1	28.9	3.8	18	20	20	10	18
C30	28	32	4.5	22	25	20	10	20
C33	31	35	5.0	25	30	20	10	22
C36	34	38	5.5	30	32	20	10	24
C39	37	41	12	35	35	10	10	27
C43	40	46	13	40	40	10	10	30
C47	44	50	14	50	45	10	10	33
C51	48	54	15	55	50	10	10	36
C56	52	60	17	63	55	10	10	39
C62	58	66	18	75	60	10	10	43
C68	64	72	18	90	65	10	10	47
C75	70	79	20	100	70	10	10	51

*At test I_Z; measured using a pulse method with $t_p \leqslant 100\ \mu s$ and $\delta \leqslant 0.001$ so that the values correspond to a T_j of approximately 25 °C.

CHARACTERISTICS – WHEN USED AS TRANSIENT SUPPRESSOR DIODES; $T_{amb} = 25\ ^oC$

clamping voltage at $t_p = 500\ \mu s$ exp. pulse $V_{(CL)R}$ V		non-repetitive peak reverse current I_{RSM} A	reverse current at recommended stand-off voltage I_R mA	V_R V	BZX70-. . .
typ.	max.		max.		
9	10	20	0.5	5.6	C7V5
10	11.2	20	0.5	6.2	C8V2
11	12.5	20	0.5	6.8	C9V1
12	14	20	0.1	7.5	C10
13.5	15.5	20	0.1	8.2	C11
15	17.5	20	0.1	9.1	C12
17	19	20	0.1	10	C13
19	21	20	0.1	11	C15
21	23	20	0.1	12	C16
23	26	20	0.1	13	C18
22	26	10	0.1	15	C20
25	29	10	0.1	16	C22
28	33	10	0.1	18	C24
32	38	10	0.1	20	C27
36	43	10	0.1	22	C30
41	48	10	0.1	24	C33
47	54	10	0.1	27	C36
44	52	5	0.1	30	C39
49	58	5	0.1	33	C43
56	65	5	0.1	36	C47
63	72	5	0.1	39	C51
71	82	5	0.1	43	C56
80	93	5	0.1	47	C62
89	104	5	0.1	51	C68
98	116	5	0.1	56	C75

SOLDERING AND MOUNTING INSTRUCTIONS

1. When using a soldering iron, diodes may be soldered directly into the circuit, but heat conducted to the junction should be kept to a minimum.
2. Diodes may be dip-soldered at a solder temperature of 245 °C for a maximum soldering time of 5 seconds. The case temperature during dip-soldering must not at any time exceed the maximum storage temperature. These recommendations apply to a diode with the anode end mounted flush on a printed-circuit board having punched-through holes. For mounting the anode end onto a printed-circuit board, the diode must be spaced at least 5 mm from the underside of the printed-circuit board having punched-through holes, or 5 mm from the top of the printed circuit board having plated-through holes.
3. Care should be taken not to bend the leads nearer than 1,5 mm from the seal; exert no axial pull when bending.

REGULATOR DIODES

Also available to BS9305–F052

A range of diffused silicon diodes in DO-5 metal envelopes, intended for use as voltage regulator and transient suppressor diodes in power stabilization and transient suppression circuits.

The series consists of the following types:
Normal polarity (cathode to stud): BZY91-C7V5 to BZY91-C75.
Reverse polarity (anode to stud): BZY91-C7V5R to BZY91-C75R.

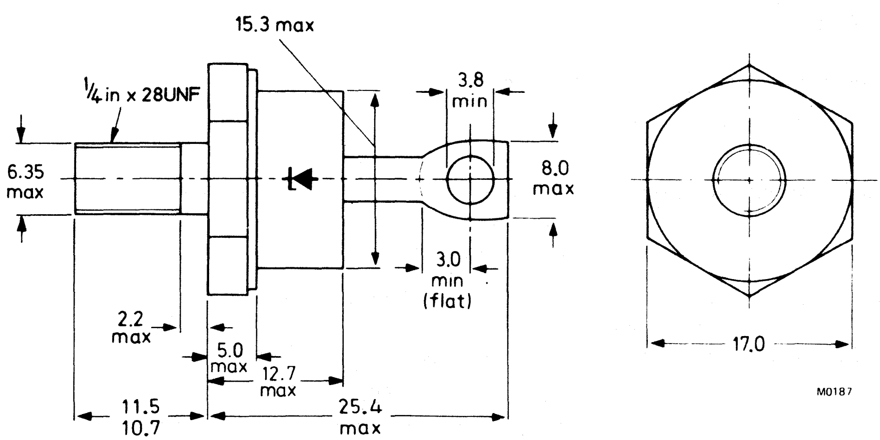
QUICK REFERENCE DATA

			voltage regulator	transient suppressor	
Working voltage (5% range)	V_Z	nom.	7,5 to 75	–	V
Stand-off voltage	V_R		–	5,6 to 56	V
Total power dissipation	P_{tot}	max.	100	–	W
Non-repetitive peak reverse power dissipation	P_{RSM}	max.	–	9,5	kW

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO-5.



Net mass: 22 g

Diameter of clearance hole: max. 6,5 mm

Accessories supplied on request:
see ACCESSORIES section

Supplied with device: 1 nut, 1 lock washer
Nut dimensions across the flats: 11,1 mm

Torque on nut: min. 1,7 Nm (17 kg cm)
max. 3,5 Nm (35 kg cm)

RATINGS

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

Peak working current	I_{ZM}	max.	400	A
Average forward current (averaged over any 20 ms period)	$I_{F(AV)}$	max.	20	A
Non-repetitive peak reverse current T_j = 25 °C prior to surge; t_p = 1 ms (exponential pulse); BZY91-C7V5(R) to BZY91-C75(R)	I_{RSM}	max.	1000 to 85	A
Total power dissipation up to T_{mb} = 25 °C	P_{tot}	max.	100	W
at T_{mb} = 65 °C	P_{tot}	max.	75	W
Non-repetitive peak reverse power dissipation T_j = 25 °C prior to surge; t_p = 1 ms (exponential pulse)	P_{RSM}	max.	9,5	kW
Storage temperature	T_{stg}		−55 to + 175	°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1,5	°C/W
From mounting base to heatsink	$R_{th\ mb\text{-}h}$	=	0,2	°C/W

CHARACTERISTICS

Forward voltage I_F = 10 A; T_{mb} = 25 °C	V_F	<	1,5	V

OPERATION AS A VOLTAGE REGULATOR

Dissipation and heatsink considerations

a. Steady-state conditions

The maximum permissible steady-state dissipation $P_{s\,max}$ is given by the relationship

$$P_{s\,max} = \frac{T_{j\,max} - T_{amb}}{R_{th\ j\text{-}a}}$$

where: $T_{j\,max}$ is the maximum permissible operating junction temperature
T_{amb} is the ambient temperature
$R_{th\ j\text{-}a}$ is the total thermal resistance from junction to ambient

$$R_{th\ j\text{-}a} = R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h} + R_{th\ h\text{-}a}$$

$R_{th\ mb\text{-}h}$ is the thermal resistance from mounting base to heatsink, that is, 0,2 °C/W.
$R_{th\ h\text{-}a}$ is the thermal resistance of the heatsink.

b. Pulse conditions (see Fig. 2)

The heating effect of repetitive power pulses can be found from the curves in Figs 5 and 6 which are given for operation as a transient suppressor at 50 Hz and 400 Hz respectively. This value ΔT is in addition to the mean heating effect. The value of ΔT found from the curves for the particular operating condition should be added to the known value for ambient temperature used in calculating the required heatsink.

The required heatsink is calculated as follows:

$$R_{th\ j\text{-}a} = \frac{T_{j\ max} - T_{amb} - \Delta T}{P_s + \delta \cdot P_p}$$

where: $T_{j\ max}$ = 175 °C
T_{amb} = ambient temperature
ΔT = from Fig. 5 or 6
P_s = any steady-state dissipation excluding that in pulses
P_p = peak pulse power
δ = duty factor (t_p/T)
$R_{th\ j\text{-}a} = R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h} + R_{th\ h\text{-}a} = 1{,}5 + 0{,}2 + R_{th\ h\text{-}a}$ °C/W.

Thus $R_{th\ h\text{-}a}$ can be found.

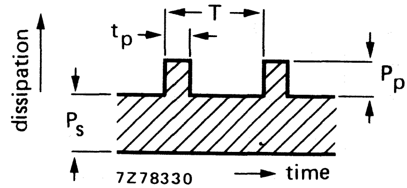


Fig. 2.

OPERATION AS A TRANSIENT SUPPRESSOR

Heatsink considerations

a. For non-repetitive transients, the device may be used without a heatsink for pulses up to 10 ms in duration.
b. For repetitive transients which fall within the permitted operating range shown in Figs 26 and 27 the required heatsink is found as follows:

$$R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h} + R_{th\ h\text{-}a} = \frac{T_{j\ max} - T_{amb}}{P_s + \delta \cdot P_{RRM}}$$

where: $T_{j\ max}$ = 175 °C
T_{amb} = ambient temperature
P_s = any steady-state dissipation excluding that in pulses
δ = duty factor (t_p/T)
$R_{th\ j\text{-}mb}$ = 1,5 °C/W
$R_{th\ mb\text{-}h}$ = 0,2 °C/W

Thus $R_{th\ h\text{-}a}$ can be found.

Notes

1. The stand-off voltage is the maximum reverse voltage recommended for continuous operation; at this value non-conduction is ensured.
2. The maximum clamping voltage is the maximum reverse voltage which appears across the diode at the specified pulse duration and junction temperature.
3. Duration of an exponential pulse is defined as the time taken for the pulse to fall to 37% of its initial value. It is assumed that the energy content does not continue beyond twice this time.
4. Surge suppressor diodes are extremely fast in clamping, switching on in less than 5 ns.

CHARACTERISTICS – WHEN USED AS VOLTAGE REGULATOR DIODES; T_{mb} = 25 °C

BZY91-. . .	working voltage *V_Z V		differential resistance *r_Z Ω	temperature coefficient *S_Z %/°C	test I_Z A	reverse current at I_R mA	reverse voltage V_R V
	min.	max.	max.	typ.		max.	
C7V5(R)	7.0	7.9	0.2	0.09	5.0	5.0	2.0
C8V2(R)	7.7	8.7	0.3	0.09	5.0	5.0	5.6
C9V1(R)	8.5	9.6	0.4	0.07	2.0	5.0	6.2
C10(R)	9.4	10.6	0.4	0.07	2.0	1.0	6.8
C11(R)	10.4	11.6	0.4	0.07	2.0	1.0	7.5
C12(R)	11.4	12.7	0.5	0.07	2.0	1.0	8.2
C13(R)	12.4	14.1	0.5	0.07	2.0	1.0	9.1
C15(R)	13.8	15.6	0.6	0.075	2.0	1.0	10
C16(R)	15.3	17.1	0.6	0.075	2.0	1.0	11
C18(R)	16.8	19.1	0.7	0.075	2.0	1.0	12
C20(R)	18.8	21.2	0.8	0.075	1.0	1.0	13
C22(R)	20.8	23.3	0.8	0.075	1.0	1.0	15
C24(R)	22.7	25.9	0.9	0.08	1.0	1.0	16
C27(R)	25.1	28.9	1.0	0.082	1.0	1.0	18
C30(R)	28	32	1.1	0.085	1.0	1.0	20
C33(R)	31	35	1.2	0.088	1.0	1.0	22
C36(R)	34	38	1.3	0.09	1.0	1.0	24
C39(R)	37	41	1.4	0.09	0.5	1.0	27
C43(R)	40	46	1.5	0.092	0.5	1.0	30
C47(R)	44	50	1.7	0.093	0.5	1.0	33
C51(R)	48	54	1.8	0.093	0.5	1.0	36
C56(R)	52	60	2.0	0.094	0.5	1.0	39
C62(R)	58	66	2.2	0.094	0.5	1.0	43
C68(R)	64	72	2.4	0.094	0.5	1.0	47
C75(R)	70	79	2.6	0.095	0.5	1.0	51

*At test I_Z; measured using a pulse method with $t_p \leqslant 100\ \mu s$ and $\delta \leqslant 0.001$ so that the values correspond to a T_j of approximately 25 °C.

CHARACTERISTICS — WHEN USED AS TRANSIENT SUPPRESSOR DIODES; T_{mb} = 25 °C

clamping voltage at t_p = 500 µs exp. pulse $V_{(CL)R}$ V		non-repetitive peak reverse current I_{RSM} A	reverse current at recommended stand-off voltage I_R mA	V_R V	BZY91-. . .
typ.	max.		max.		
—	—	—	—	—	C7V5(R)
9.5	10.5	150	20	6.2	C8V2(R)
10	11	150	20	6.8	C9V1(R)
11	12.5	150	5	7.5	C10(R)
12	13.5	150	5	8.2	C11(R)
13	15	150	5	9.1	C12(R)
14.5	17	150	5	10	C13(R)
16	19	150	5	11	C15(R)
17.5	22	150	5	12	C16(R)
19	26	150	5	13	C18(R)
22	28	100	5	15	C20(R)
24	31	100	5	16	C22(R)
26	34	100	5	18	C24(R)
28	37	100	5	20	C27(R)
31	40	100	5	22	C30(R)
34	44	100	5	24	C33(R)
38	48	100	5	27	C36(R)
40	52	50	5	30	C39(R)
44	56	50	10	33	C43(R)
49	61	50	10	36	C47(R)
54	66	50	10	39	C51(R)
60	72	50	10	43	C56(R)
66	79	50	10	47	C62(R)
72	87	50	10	51	C68(R)
79	97	50	10	56	C75(R)

MOUNTING INSTRUCTIONS

The top connector should neither be bent not twisted; it should be soldered into the circuit so that there is no strain on it.

During soldering the heat conduction to the junction should be kept to a minimum.

REGULATOR DIODES

Also available to BS9305–F051

A range of diffused silicon diodes in DO-4 metal envelopes, intended for use as voltage regulator and transient suppressor diodes in power stabilization and transient suppression circuits.

The series consists of the following types:
Normal polarity (cathode to stud): BZY93-C7V5 to BZY93-C75.
Reverse polarity (anode to stud): BZY93-C7V5R to BZY93-C75R.

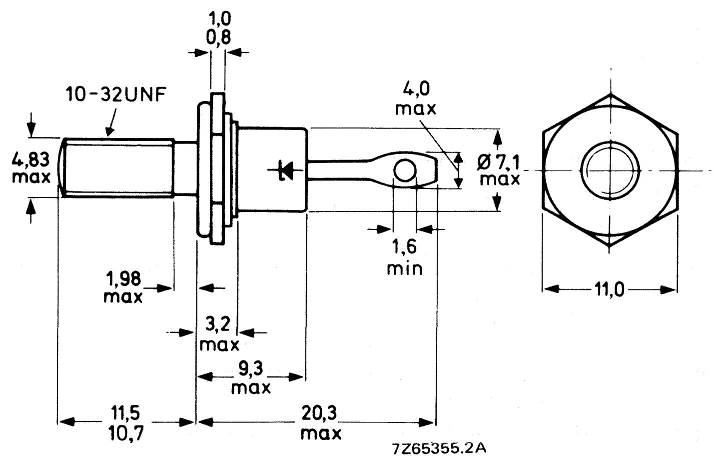
QUICK REFERENCE DATA

			voltage regulator	transient suppressor	
Working voltage (5% range)	V_Z	nom.	7,5 to 75	–	V
Stand-off voltage	V_R		–	5,6 to 56	V
Total power dissipation	P_{tot}	max.	20	–	W
Non-repetitive peak reverse power dissipation	P_{RSM}	max.	–	700	W

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO-4.



Net mass: 6 g

Diameter of clearance hole: max. 5,2 mm

Accessories supplied on request:
see ACCESSORIES section

Supplied with device: 1 nut, 1 lock washer

Nut dimensions across the flats: 9,5 mm

Torque on nut: min. 0,9 Nm (9 kg cm)
max. 1,7 Nm (17 kg cm)

RATINGS

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

Peak working current	I_{ZM}	max.	20	A
Average forward current (averaged over any 20 ms period)	$I_{F(AV)}$	max.	5	A
Non-repetitive peak reverse current T_j = 25 °C prior to surge; t_p = 1 ms (exponential pulse); BZY93-C7V5(R) to BZY93-C75(R)	I_{RSM}	max.	55 to 6	A
Total power dissipation up to T_{mb} = 75 °C	P_{tot}	max.	20	W
Non-repetitive peak reverse power dissipation T_j = 25 °C prior to surge; t_p = 1 ms (exponential pulse)	P_{RSM}	max.	700	W
Storage temperature	T_{stg}		−55 to + 175	°C
Junction temperature	T_j	max.	175	°C

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	5	°C/W
From junction to ambient	$R_{th\ j\text{-}a}$	=	50	°C/W
From mounting base to heatsink (minimum torque: 0,9 Nm)	$R_{th\ mb\text{-}h}$	=	0,6	°C/W

CHARACTERISTICS

Forward voltage I_F = 5 A; T_{mb} = 25 °C	V_F	<	1,5	V

OPERATION AS A VOLTAGE REGULATOR

Dissipation and heatsink considerations

a. Steady-state conditions

The maximum permissible steady-state dissipation $P_{s\,max}$ is given by the relationship

$$P_{s\,max} = \frac{T_{j\,max} - T_{amb}}{R_{th\ j\text{-}a}}$$

where: $T_{j\,max}$ is the maximum permissible operating junction temperature
T_{amb} is the ambient temperature
$R_{th\ j\text{-}a}$ is the total thermal resistance from junction to ambient

$$R_{th\ j\text{-}a} = R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h} + R_{th\ h\text{-}a}$$

$R_{th\ mb\text{-}h}$ is the thermal resistance from mounting base to heatsink, that is, 0,6 °C/W.
$R_{th\ h\text{-}a}$ is the thermal resistance of the heatsink.

b. Pulse conditions (see Fig. 2)

The maximum permissible pulse power $P_{p\,max}$ is given by the formula

$$P_{p\,max} = \frac{(T_{j\,max} - T_{amb}) - (P_s \cdot R_{th\ j\text{-}a})}{R_{th\ t} + \delta \cdot R_{th\ mb\text{-}a}}$$

where: P_s is any steady-state dissipation excluding that in pulses
$R_{th\ t}$ is the effective transient thermal resistance of the device between junction and mounting base. It is a function of the pulse duration t_p and duty factor δ.
δ is duty factor (t_p/T)
$R_{th\ mb\text{-}a}$ is the total thermal resistance between the mounting base and ambient ($R_{th\ mb\text{-}a} = R_{th\ mb\text{-}h} + R_{th\ h\text{-}a}$).

The steady-state power P_s when biased in the zener direction at a given zener current can be found from Fig. 14. With the additional pulse power dissipation $P_{p\ max}$ calculated from the above expression, the total peak zener power dissipation $P_{tot} = P_{ZRM} = P_s + P_p$. From Fig. 14 the corresponding maximum repetitive peak zener current at P_{ZRM} can now be read. This repetitive peak zener current is subject to the absolute maximum rating. For pulse durations larger than the temperature stabilization time of the diode t_{stab}, the maximum permissible repetitive peak dissipation P_{ZRM} is equal to the steady-state power P_s. The temperature stabilization time for the BZY93 is 5 seconds.

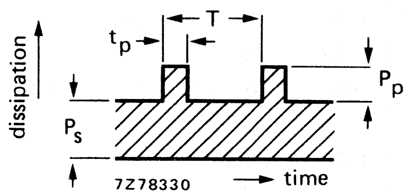


Fig. 2.

OPERATION AS A TRANSIENT SUPPRESSOR

Heatsink considerations

a. For non-repetitive transients, the device may be used without a heatsink for pulses up to 10 ms in duration.
b. For repetitive transients which fall within the permitted operating range shown in Figs 19 and 20 the required heatsink is found as follows:

$$R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h} + R_{th\ h\text{-}a} = \frac{T_{j\ max} - T_{amb}}{P_s + \delta \cdot P_{RRM}}$$

where: $T_{j\ max}$ = 175 °C
T_{amb} = ambient temperature
P_s = any steady-state dissipation excluding that in pulses
δ = duty factor (t_p/T)
$R_{th\ j\text{-}mb}$ = 5 °C/W
$R_{th\ mb\text{-}h}$ = 0,6 °C/W

Thus $R_{th\ h\text{-}a}$ can be found.

Notes

1. The stand-off voltage is the maximum reverse voltage recommended for continuous operation; at this value non-conduction is ensured.
2. The maximum clamping voltage is the maximum reverse voltage which appears across the diode at the specified pulse duration and junction temperature.
3. Duration of an exponential pulse is defined as the time taken for the pulse to fall to 37% of its initial value. It is assumed that the energy content does not continue beyond twice this time.
4. Surge suppressor diodes are extremely fast in clamping, switching on in less than 5 ns.

CHARACTERISTICS – WHEN USED AS VOLTAGE REGULATOR DIODES; T_{mb} = 25 °C

BZY93-. . .	working voltage $*V_Z$ V		differential resistance $*r_Z$ Ω		temperature coefficient $*S_Z$ mV/°C	test I_Z A	reverse current I_R µA	at reverse voltage V_R V
	min.	max.	typ.	max.	typ.		max.	
C7V5(R)	7.0	7.9	0.04	0.3	3.0	2.0	100	2.0
C8V2(R)	7.7	8.7	0.05	0.3	4.0	2.0	100	5.6
C9V1(R)	8.5	9.6	0.07	0.5	5.0	1.0	50	6.2
C10(R)	9.4	10.6	0.07	0.5	7.0	1.0	50	6.8
C11(R)	10.4	11.6	0.08	1.0	7.5	1.0	50	7.5
C12(R)	11.4	12.7	0.08	1.0	8.0	1.0	50	8.2
C13(R)	12.4	14.1	0.08	1.0	8.5	1.0	50	9.1
C15(R)	13.8	15.6	0.10	1.2	10	1.0	50	10
C16(R)	15.3	17.1	0.18	1.2	11	0.5	50	11
C18(R)	16.8	19.1	0.2	1.5	12	0.5	50	12
C20(R)	18.8	21.2	0.2	1.5	14	0.5	50	13
C22(R)	20.8	23.3	0.21	1.8	16	0.5	50	15
C24(R)	22.7	25.9	0.22	2.0	18	0.5	50	16
C27(R)	25.1	28.9	0.25	2.0	21	0.5	50	18
C30(R)	28	32	0.3	2.5	25	0.5	50	20
C33(R)	31	35	0.32	3.0	30	0.5	50	22
C36(R)	34	38	0.75	4.0	32	0.2	50	24
C39(R)	37	41	0.85	5.0	35	0.2	50	27
C43(R)	40	46	0.90	6.5	40	0.2	50	30
C47(R)	44	50	1.0	7.0	45	0.2	50	33
C51(R)	48	54	1.2	7.5	50	0.2	50	36
C56(R)	52	60	1.3	8.0	55	0.2	50	39
C62(R)	58	66	1.5	9.0	60	0.2	50	43
C68(R)	64	72	1.8	10	65	0.2	50	47
C75(R)	70	79	2.0	10.5	70	0.2	50	51

*At test I_Z; measured using a pulse method with $t_p \leqslant 100\ \mu s$ and $\delta \leqslant 0.001$ so that the values correspond to a T_j of approximately 25 °C.

CHARACTERISTICS – WHEN USED AS TRANSIENT SUPPRESSOR DIODES; T_{mb} = 25 °C

clamping voltage at t_p = 500 μs exp. pulse $V_{(CL)R}$ V		non-repetitive peak reverse current I_{RSM} A	reverse current at recommended stand-off voltage I_R mA	V_R V	BZY93-. . .
typ.	max.		max.		
8	9.2	20	0.5	5.6	C7V5(R)
9	10.2	20	0.5	6.2	C8V2(R)
10	11.5	20	0.5	6.8	C9V1(R)
11	12.5	20	0.1	7.5	C10(R)
12.3	14	20	0.1	8.2	C11(R)
14	16	20	0.1	9.1	C12(R)
15.3	17.5	20	0.1	10	C13(R)
17	19.5	20	0.1	11	C15(R)
19.3	22	20	0.1	12	C16(R)
21	24	20	0.1	13	C18(R)
23	27	10	0.1	15	C20(R)
26	30	10	0.1	16	C22(R)
29	34	10	0.1	18	C24(R)
33	39	10	0.1	20	C27(R)
38	44	10	0.1	22	C30(R)
42	50	10	0.1	24	C33(R)
47	56	10	0.1	27	C36(R)
40	47	5	0.1	30	C39(R)
45	52	5	0.1	33	C43(R)
51	59	5	0.1	36	C47(R)
57	66	5	0.1	39	C51(R)
64	75	5	0.1	43	C56(R)
73	85	5	0.1	47	C62(R)
81	94	5	0.1	51	C68(R)
90	105	5	0.1	56	C75(R)

MOUNTING INSTRUCTIONS

The top connector should neither be bent nor twisted; it should be soldered into the circuit so that there is no strain on it.

During soldering the heat conduction to the junction should be kept to a minimum.

HIGH-VOLTAGE RECTIFIER STACKS

The OSB9115, OSM9115 and OSS9115 series are ranges of high-voltage rectifier assemblies incorporating controlled avalanche diodes mounted on fire-proof triangular formers.
They are supplied with M6 studs.
The OSB9115 series is intended for application in two-phase half-wave rectifier circuits.
The OSM9115 series is intended for application in single-phase or three-phase bridges or in voltage doubler circuits.
The OSS9115 series is intended for all kinds of high-voltage rectification.
The OSB9115 series and OSM9115 series are supplied with a centre tap (8-32UNC).
The maximum crest working voltages of the OSB9115 and OSM9115 series cover the range from 3 kV to 27 kV, and of the OSS9115 series the range from 4.5 kV to 54 kV in 1.5 kV steps.

Configuration:

Fig. 1 OSB9115 . . . . A

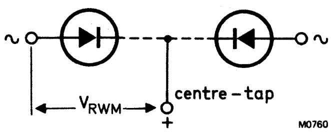


Fig. 2 OSM9115 . . . . A

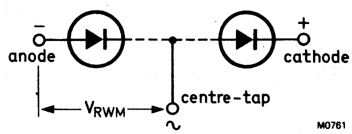
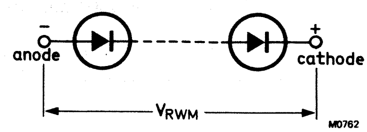


Fig. 3 OSS9115 . . . . A



QUICK REFERENCE DATA

		OSB9115	−4	−6	. . .	−34	−36A	
		OSM9115	−6	−6	. . .	−34	−36A	
Crest working reverse voltage from centre tap to end	V_{RWM}	max.	3	4.5	. . .	25.5	27	kV
		OSS9115	−3	−4	. . .	−35	−36A	
Crest working reverse voltage	V_{RWM}	max.	4.5	6	. . .	52.5	54	kV

Average forward current with R and L load (averaged over any 20 ms period)				
in free air up to T_{amb} = 35 °C	$I_{F(AV)}$	max.	3.5	A
in oil up to T_{oil} = 100 °C	$I_{F(AV)}$	max.	6	A
Non-repetitive peak forward current t = 10 ms; half sine-wave; T_j = 175 °C prior to surge	I_{FSM}	max.	125	A

MECHANICAL DATA see page 4

All information applies to frequencies up to 400 Hz

RATINGS

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

Voltages

			OSB9115 –4 OSM9115 –4	–6 –6	. . .	–34 –34	–36A –36A	
Crest working reverse voltage	V_{RWM}	max.	3	4.5	. . .	25.5	27	kV

			OSS9115 –3	–4	. . .	–35	–36A	
Crest working reverse voltage	V_{RWM}	max.	4.5	6	. . .	52.5	54	kV

Currents

Average forward current (averaged over any 20 ms period)				
in free air up to T_{amb} = 35 °C	$I_{F(AV)}$	max.	3.5	A
in oil up to T_{oil} = 100 °C	$I_{F(AV)}$	max.	6	A
Repetitive peak forward current	I_{FRM}	max.	120	A
Non-repetitive peak forward current t = 10 ms; half sine-wave; T_j = 175 °C prior to surge	I_{FSM}	max.	125	A

Reverse power dissipation

			OSB9115 –4 OSM9115 –4	–6 –6	. . .	–34 –34	–36A –36A	
Repetitive peak reverse power t = 10 μs (square-wave; f = 50 Hz) T_j = 175 °C	P_{RRM}	max.	1.2	1.8	. . .	10.2	10.8	kW
Non-repetitive peak reverse power t = 10 μs (square -wave)								
T_j = 25 °C prior to surge	P_{RSM}	max.	6	9	. . .	51	54	kW
T_j = 125 °C prior to surge	P_{RSM}	max.	1.2	1.8	. . .	10.2	10.8	kW

			OSS9115 –3	–4	. . .	–35	–36A	
Repetitive peak reverse power dissipation t = 10 μs (square-wave; f = 50 Hz) T_j = 175 °C	P_{RRM}	max.	1.8	2.4	. . .	21	21.6	kW
Non-repetitive peak reverse power dissipation t = 10 μs (square-wave)								
T_j = 25 °C prior to surge	P_{RSM}	max.	9	12	. . .	105	108	kW
T_j = 175 °C prior to surge	P_{RSM}	max.	1.8	2.4	. . .	21	21.6	kW

Temperatures

Storage temperature	T_{stg}		–55 to +150	°C
Junction temperature	T_j	max.	175	°C

CHARACTERISTICS (See note 1)

			OSB9115 –4 / OSM9115 –4	–6	. . .	–34	–36A	
Forward voltage I_F = 20 A; T_j = 25 °C	V_F	<	4	6	. . .	34	36	V
Reverse avalanche breakdown voltage* I_R = 5 mA; T_j = 25 °C	$V_{(BR)R}$	>	3.3	4.95	. . .	28	29.7	kV
		<	4.8	7.2	. . .	40.8	43.2	kV

			OSS9115 –3	–4	. . .	–35	–36A	
Forward voltage I_F = 20 A; T_j = 25 °C	V_F	<	6	8	. . .	70	72	V
Reverse avalanche breakdown voltage* I_R = 5 mA; T_j = 25 °C	$V_{(BR)R}$	>	4.95	6.6	. . .	57.8	59.4	kV
		<	7.2	9.6	. . .	84	68.4	kV

Reverse current $V_{RM} = V_{RWM\,max}$; T_j = 125 °C	I_{RM}	<	0.6	mA

NOTES

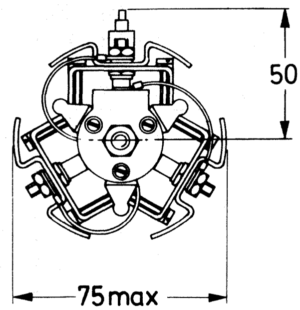
1. The Ratings and Characteristics given apply **from centre tap to end.** (Not for OSS9115 series).
2. **Type number suffix**
   The suffix consists of a figure indicating the total number of diodes, and the letter 'A' denoting M6 studs at the ends.
3. **Operating position**
   The rectifier units can be operated at their maximum ratings when mounted in any position.

*The breakdown voltage increases by approximately 0.1% per °C with increasing junction temperature.

MECHANICAL DATA Dimensions in mm

n = total number of diodes

Fig.4 OSM9115 –nA



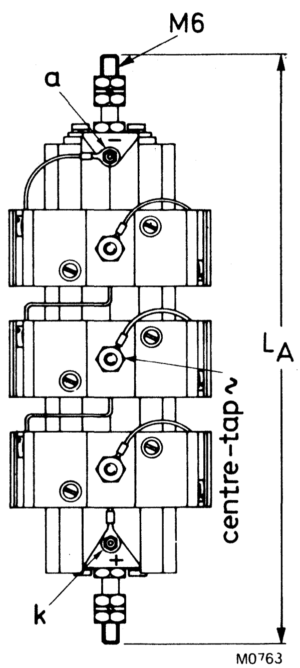


Table of lengths and weights (mm and g)

number of diodes n	maximum lengths L_A	weights W_A
3	143	153
4 to 6	184	286
7 to 9	224	419
10 to 12	264	552
13 to 15	305	685
16 to 18	345	818
19 to 21	385	951
22 to 24	426	1048
25 to 27	466	1217
28 to 30	506	1350
31 to 33	546	1483
34 to 36	586	1616

The drawings show the OSM9115 series; the OSB9115 and OSS9115 series differ in the following respects:

OSB9115 series – terminals marked a (–) and k (+) in the drawings are both marked ∿;
the centre-tap is marked + (instead of ∿ as in the drawings).

OSS9115 series – has no centre-tap.

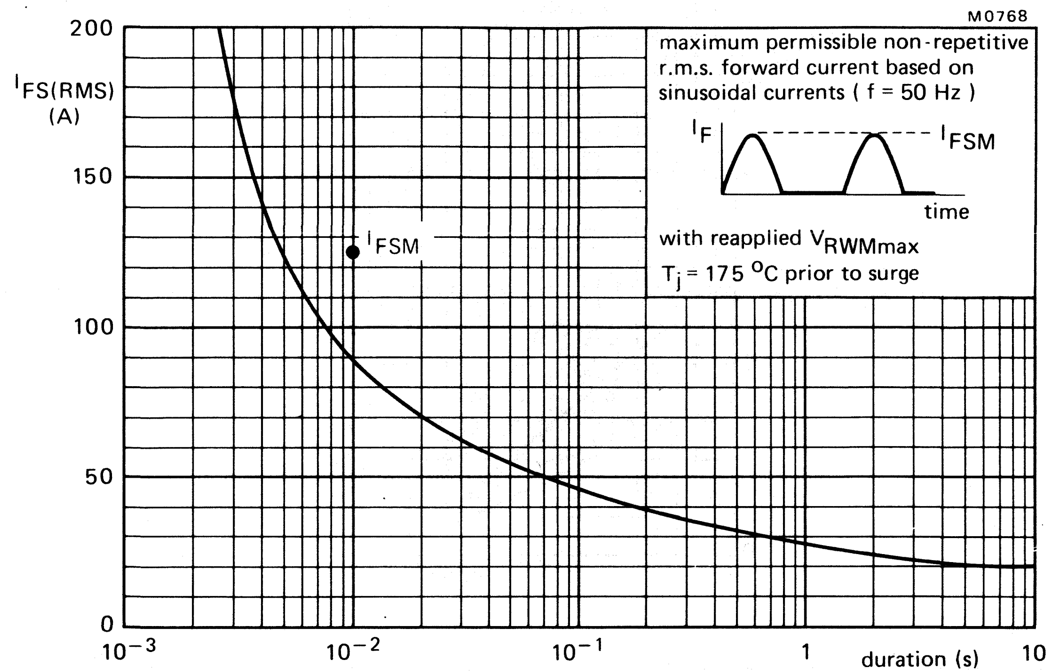

M0768
200
$I_{FS(RMS)}$
(A)
150
100
50
0
10^{-3}
10^{-2}
10^{-1}
1
duration (s)
10
I_{FSM}
maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz)
I_F
I_{FSM}
time
with reapplied V_{RWMmax}
T_j = 175 °C prior to surge

Fig. 5

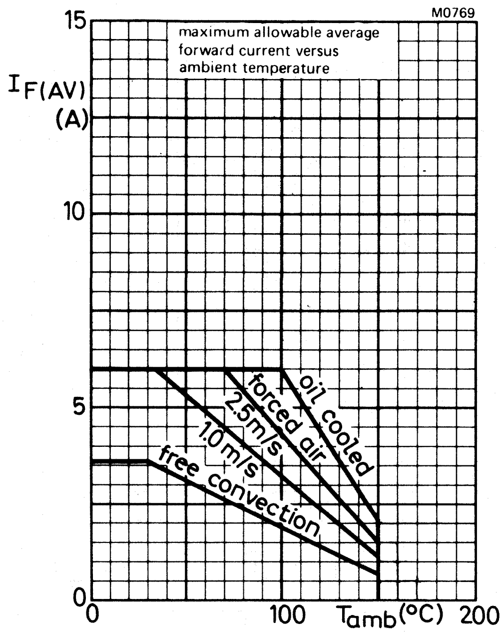


Fig. 6

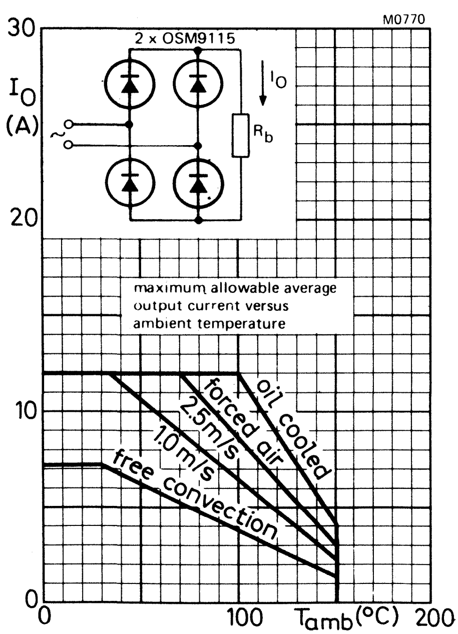


Fig. 7

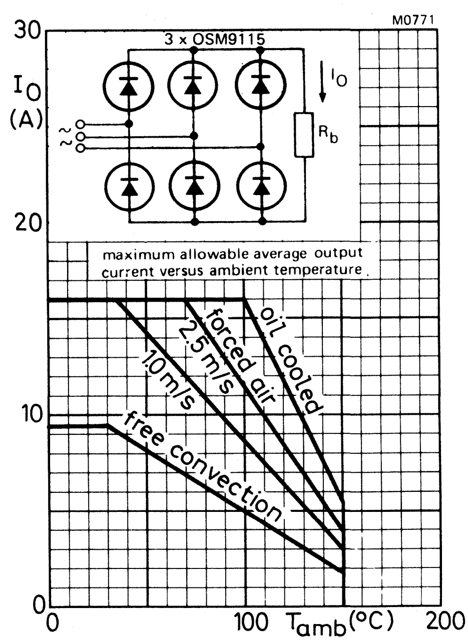


Fig. 8

APPLICATION INFORMATION

Fig. 9 OSB9115 -4

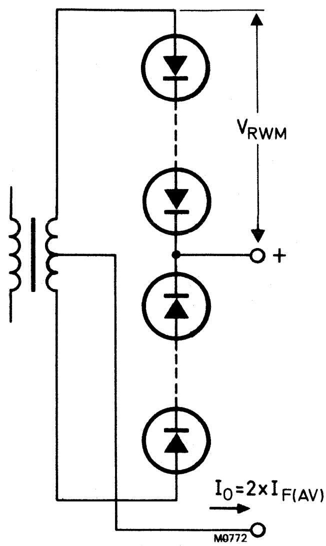
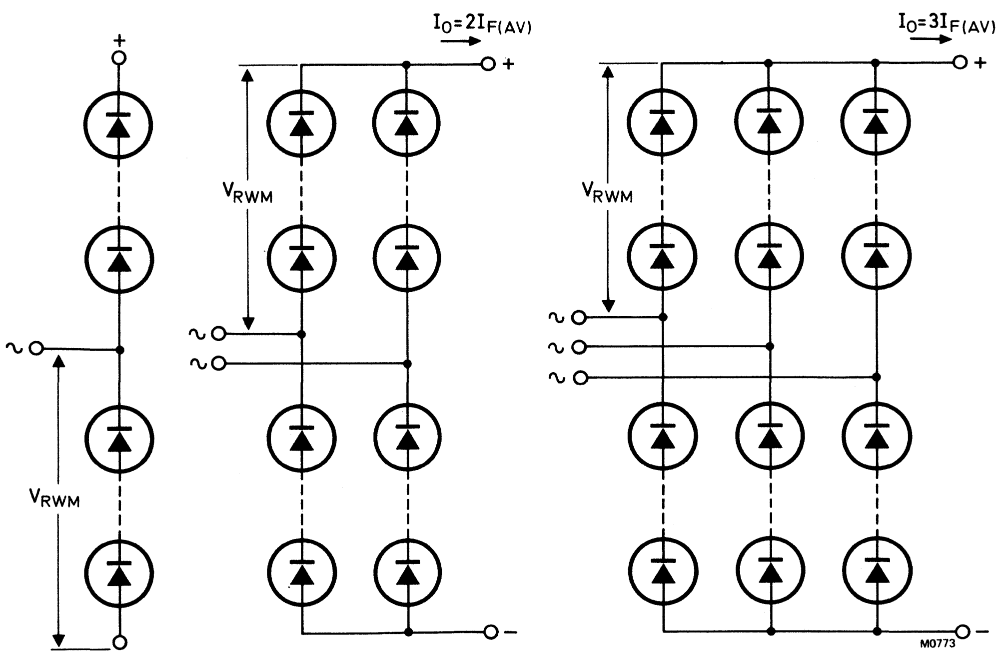


Fig. 10 OSM9115 series



voltage doubler
1 x OSM9115

rectifier circuits with respectively
2 x OSM9115 and 3 x OSM9115

HIGH-VOLTAGE RECTIFIER STACKS

The OSB9215, OSM9215 and OSS9215 series are ranges of high-voltage rectifier assemblies, incorporating controlled avalanche diodes mounted on fire-proof triangular formers.
They are supplied with M6 studs.
The OSB9215 series is intended for application in two-phase half-wave rectifier circuits.
The OSM9215 series is intended for application in single-phase or three-phase bridges or in voltage doubler circuits.
The OSS9215 series is intended for all kinds of high-voltage rectification.
The OSB9215 series and OSM9215 series are supplied with a centre tap (8-32UNC).
The maximum crest working voltages of the OSB9215 and OSM9215 series cover the range from 3 kV to 27 kV, and of the OSS9215 series the range from 4.5 kV to 54 kV in 1.5 kV steps.

Configuration:

Fig. 1 OSB9215 . . . . A

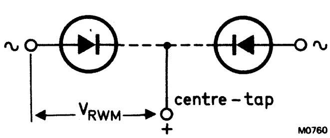


Fig. 2 OSM9215 . . . . A

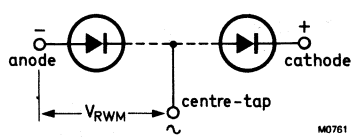
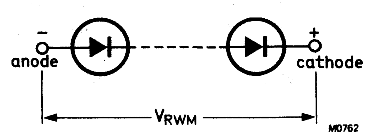


Fig. 3 OSS9215 . . . . A



QUICK REFERENCE DATA

		OSB9215	–4	–6	. . .	–34	–36A	
		OSM9215	–4	–6	. . .	–34	–36A	
Crest working reverse voltage from centre tap to end	V_{RWM}	max.	3	4.5	. . .	25.5	27	kV
		OSS9215	–3	–4	. . .	–35	–36A	
Crest working reverse voltage	V_{RWM}	max.	4.5	6	. . .	52.5	54	kV

Average forward current with R and L load (averaged over any 20 ms period)				
in free air up to T_{amb} = 35 °C	$I_{F(AV)}$	max.	5	A
in oil up to T_{oil} = 30 °C	$I_{F(AV)}$	max.	20	A
Non-repetitive peak forward current				
t = 10 ms; half sine-wave; T_j = 175 °C prior to surge	I_{FSM}	max.	360	A

MECHANICAL DATA see page 4

All information applies to frequencies up to 400 Hz

RATINGS

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

Voltages

		OSB9215	–4	–6	...	–34	–36A	
		OSM9215	–4	–6	...	–34	–36A	
Crest working reverse voltage	V_{RWM}	max.	3.0	4.5	...	25.5	27	kV
		OSS9215	–3	–4	...	–35	–36A	
Crest working reverse voltage	V_{RWM}	max.	4.5	6	...	52.5	54	kV

Currents

Average forward current (averaged over any 20 ms period)				
in free air up to T_{amb} = 35 °C	$I_{F(AV)}$	max.	5	A
in oil up to T_{oil} = 30 °C	$I_{F(AV)}$	max.	20	A
Repetitive peak forward current	I_{FRM}	max.	440	A
Non-repetitive peak forward current t = 10 ms; half sine-wave; T_j = 175 °C prior to surge	I_{FSM}	max.	360	A

Reverse power dissipation

		OSB9215	–4	–6	...	–34	–36A	
		OSM9215	–4	–6	...	–34	–36A	
Repetitive peak reverse power t = 10 µs (square-wave; f = 50 Hz) T_j = 175 °C	P_{RRM}	max.	4	6	...	34	36	kW
Non-repetitive peak reverse power t = 10 µs (square-wave)								
T_j = 25 °C prior to surge	P_{RSM}	max.	26	39	...	221	234	kW
T_j = 175 °C prior to surge	P_{RSM}	max.	4	6	...	34	36	kW
		OSS9215	–3	–4	...	–35	–36A	
Repetitive peak reverse power dissipation t = 10 µs (square-wave; f = 50 Hz) T_j = 175 °C	P_{RRM}	max.	6	8	...	70	72	kW
Non-repetitive peak reverse power dissipation t = 10 µs (square-wave)								
T_j = 25 °C prior to surge	P_{RSM}	max.	39	52	...	455	468	kW
T_j = 175 °C prior to surge	P_{RSM}	max.	6	8		70	72	kW

Temperatures

Storage temperature	T_{stg}		–55 to +150	°C
Junction temperature	T_j	max.	175	°C

CHARACTERISTICS (see note 1)

			OSB9215	–4	–6	. . .	–34	–36A	
			OSM9215	–4	–6	. . .	–34	–36A	
Forward voltage I_F = 50 A; T_j = 25 °C	V_F	<		3.6	5.4	. . .	30.6	32.4	V
Reverse breakdown voltage* I_R = 5 mA; T_j = 25 °C	$V_{(BR)R}$	>		3.3	4.95	. . .	28	29.7	kV
		<		4.8	7.2	. . .	40.8	43.2	kV
			OSS9215	–3	–4	. . .	–35	–36A	
Forward voltage I_F = 50 A; T_j = 25 °C	V_F	<		5.4	7.2	. . .	63	64.8	V
Reverse breakdown voltage* I_R = 5 mA; T_j = 25 °C	$V_{(BR)R}$	>		4.95	6.6	. . .	57.8	59.4	kV
		<		7.2	9.6	. . .	84	86.4	kV
Reverse current $V_{RM} = V_{RWMmax}$; T_j = 125 °C	I_{RM}	<				0.6			mA

Notes

1. The Ratings and Characteristics given apply **from centre tap to end.** (Not for OSS9215 series).

2. **Type number suffix**

   The suffix consists of a figure indicating the total number of diodes, and the letter 'A' denoting M6 studs at the ends.

3. **Operating position**

   The rectifier units can be operated at their maximum ratings when mounted in any position.

*The breakdown voltage increases by approximately 0.1% per °C with increasing junction temperature.

MECHANICAL DATA

n = total number of diodes

Fig. 4 OSM9215-nA

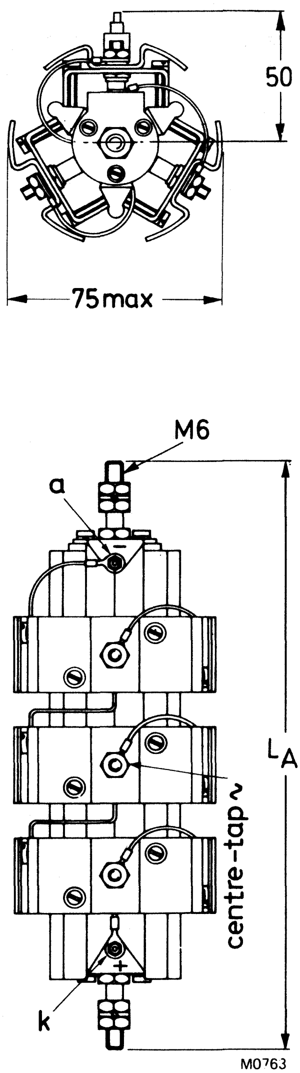


Table of lengths and weights (mm and g)

number of diodes n	maximum lengths L_A	weights W_A
3	143	153
4 to 6	184	286
7 to 9	224	419
10 to 12	264	552
13 to 15	305	685
16 to 18	345	818
19 to 21	385	951
22 to 24	426	1048
25 to 27	466	1217
28 to 30	506	1350
31 to 33	546	1483
34 to 36	586	1616

The drawings show the OSM9215 series; the OSB9215 and OSS9215 series differ in the following respects:

OSB9215 series — terminals marked a(—) and k(+) in the drawings are both marked ∿; the centre-tap is marked + (instead of ∿ as in the drawings).

OSS9215 series — has no centre-tap.

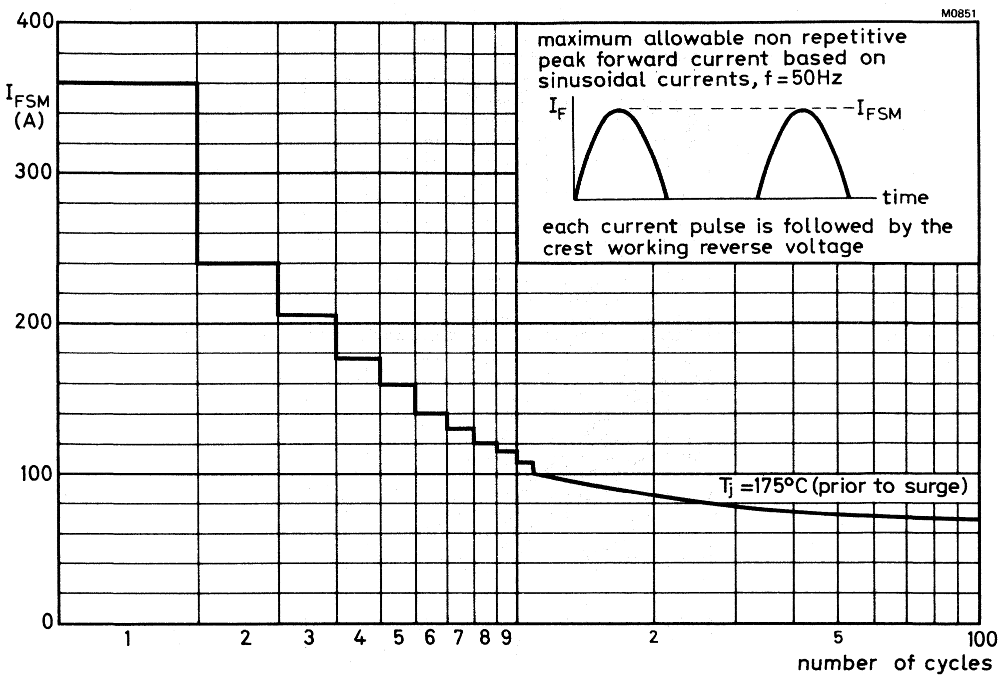

M0851
maximum allowable non repetitive peak forward current based on sinusoidal currents, f = 50Hz
I_F
I_{FSM}
time
each current pulse is followed by the crest working reverse voltage
400
I_{FSM} (A)
300
200
100
0
T_j = 175°C (prior to surge)
1
2
3
4
5
6
7
8
9
2
5
100
number of cycles

Fig. 5

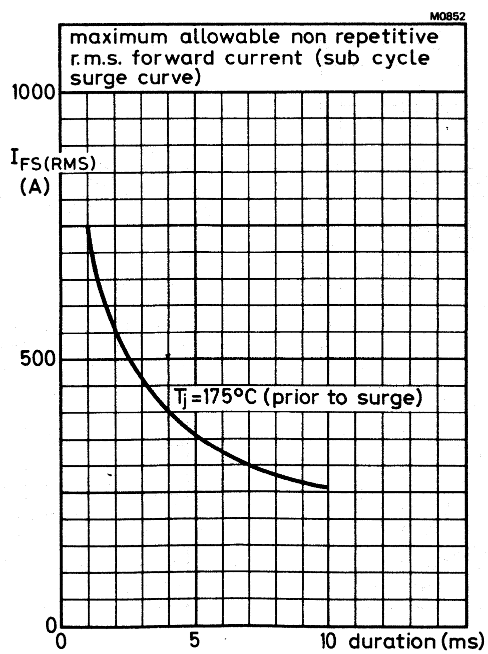

M0852
maximum allowable non repetitive r.m.s. forward current (sub cycle surge curve)
1000
$I_{FS(RMS)}$ (A)
500
0
T_j = 175°C (prior to surge)
0
5
10
duration (ms)

Fig. 6

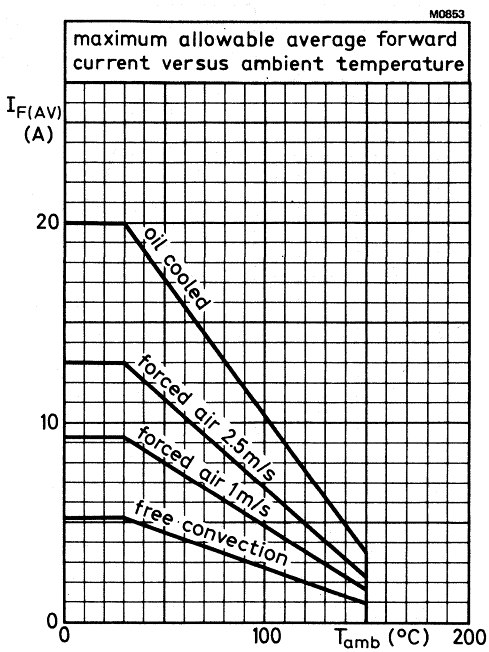


Fig. 7

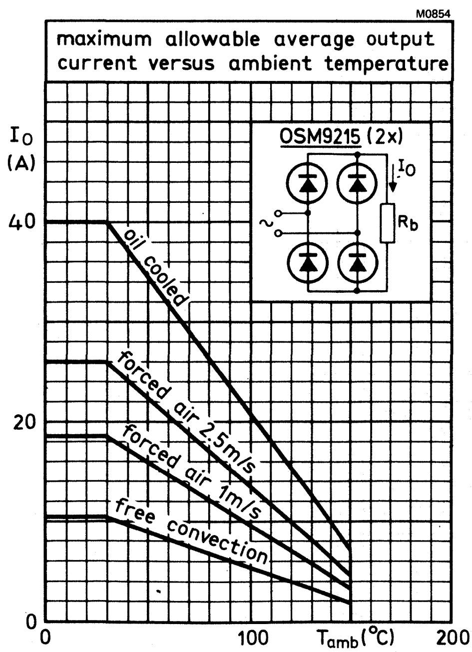


Fig. 8

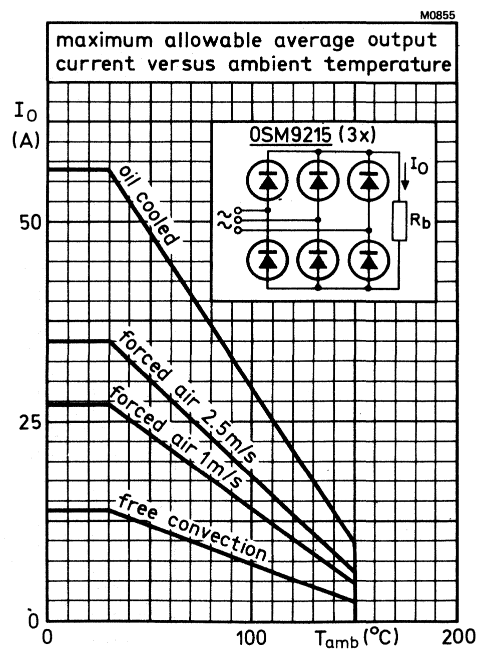


Fig. 9

APPLICATION INFORMATION

Fig. 10 OSB9215-4

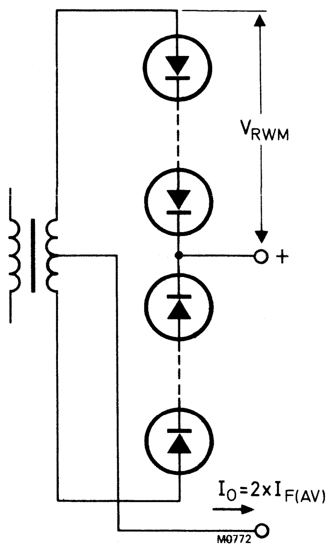
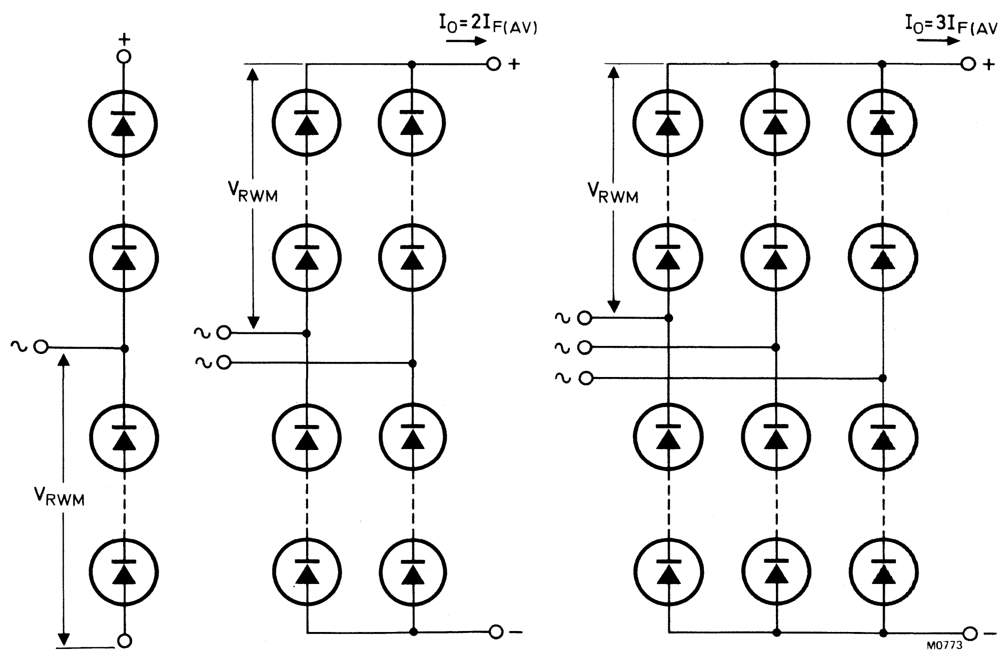


Fig. 11 OSM9215 series



voltage doubler
1x OSM9215

rectifier circuits with respectively
2x OSM9215 and 3x OSM9215

HIGH-VOLTAGE RECTIFIER STACKS

Ranges of high-voltage rectifier assemblies, incorporating controlled avalanche diodes mounted on fire-proof triangular formers. They are supplied with M6 studs.
The OSB9415 series is intended for application in two-phase half-wave rectifier circuits.
The OSM9415 series is intended for application in single-phase or three-phase bridges or in voltage doubler circuits.
The OSS9415 series is intended for all kinds of high-voltage rectification.
The OSB9415 series and OSM9415 series are supplied with a centre tap (8–32UNC).
The maximum crest working voltages of the OSB9415 and OSM9415 series cover the range from 3 kV to 27 kV, and of the OSS9415 series the range from 4.5 kV to 54 kV, in 1.5 kV steps.

Configuration:

Fig. 1 OSB9415 . . . . A

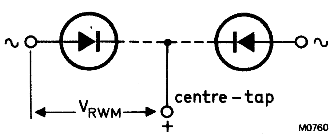


Fig. 2 OSM9415 . . . . A

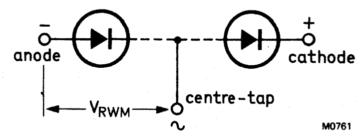
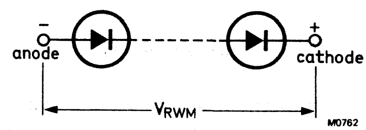


Fig. 3 OSS9415 . . . . A



QUICK REFERENCE DATA

		OSB9415	–4	–6	. . .	–34	–36A	
		OSM9415	–4	–6	. . .	–34	–36A	
Crest working reverse voltage from centre tap to end	V_{RWM}	max.	3	4.5		25.5	27	kV
		OSS9415	–3	–4	. . .	–35	–36A	
Crest working reverse voltage	V_{RWM}	max.	4.5	6	. . .	52.5	54	kV

Average forward current with R and L load (averaged over any 20 ms period)				
in free air up to T_{amb} = 35 °C	$I_{F(AV)}$	max.	10	A
in oil up to T_{oil} = 35 °C	$I_{F(AV)}$	max.	30	A
Non-repetitive peak forward current t = 10 ms; half sine wave; T_j = 175 °C prior to surge	I_{FSM}	max.	800	A

MECHANICAL DATA see page 4

All information applies to frequencies up to 400 Hz

RATINGS

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

Voltages

		OSB9415	−4	−6	. . .	−34	−36A	
		OSM9415	−4	−6		−34	−36A	
Crest working reverse voltage	V_{RWM}	max.	3	4.5	. . .	25.5	27	kV
		OSS9415	−3	−4	. . .	−35	−36A	
Crest working reverse voltage	V_{RWM}	max.	4.5	6	. . .	52.5	54	kV

Currents

Average forward current (averaged over any 20 ms period) in free air up to T_{amb} = 35 °C	$I_{F(AV)}$	max.	10	A
in oil up to T_{oil} = 35 °C	$I_{F(AV)}$	max.	30	A
Repetitive peak forward current	I_{FRM}	max.	450	A
Non-repetitive peak forward current t = 10 ms; half sine-wave; T_j = 175 °C prior to surge	I_{FSM}	max.	800	A

Reverse power dissipation

		OSB9415	−4	−6	. . .	−34	−36A	
		OSM9415	−4	−6	. . .	−34	−36A	
Repetitive peak reverse power dissipation t = 10 µs (square-wave; f = 50 Hz) T_j = 175 °C	P_{RRM}	max.	9	13.5	. . .	76.5	81	kW
Non-repetitive peak reverse power dissipation t = 10 µs (square-wave) T_j = 25 °C prior to surge	P_{RSM}	max.	55	82	. . .	467	495	kW
T_j = 175 °C prior to surge	P_{RSM}	max.	8.5	13	. . .	72	77	kW
		OSS9415	−3	−4	. . .	−35	−36A	
Repetitive peak reverse power dissipation t = 10 µs (square-wave; f = 50 Hz) T_j = 175 °C	P_{RRM}	max.	13.5	18	. . .	157	162	kW
Non-repetitive peak reverse power dissipation t = 10 µs (square-wave) T_j = 25 °C prior to surge	P_{RSM}	max.	80	105	. . .	919	945	kW
T_j = 175 °C prior to surge	P_{RSM}	max.	13	17	. . .	149	153	kW

Temperatures

Storage temperature	T_{stg}	−55 to +150		°C
Junction temperature	T_j	max.	175	°C

CHARACTERISTICS (See note 1)

		OSB9415	−4	−6	. . .	−34	−36A	
		OSM9415	−4	−6	. . .	−34	−36A	
Forward voltage								
I_F = 150 A; T_j = 25 °C	V_F	<	3.6	5.4	. . .	30.6	32.4	V
Reverse avalanche breakdown voltage*								
I_R = 5 mA; T_j = 25 °C	$V_{(BR)R}$	>	3.3	4.95	. . .	28	29.7	kV
		<	4.8	7.2	. . .	40.8	43.2	kV

		OSS9415	−3	−4	. . .	−35	−36A	
Forward voltage								
I_F = 150 A; T_j = 25 °C	V_F	<	5.4	7.2	. . .	63	64.8	V
Reverse avalanche breakdown voltage*								
I_R = 5 mA; T_j = 25 °C	$V_{(BR)R}$	>	4.95	6.6	. . .	57.8	59.4	kV
		<	7.2	9.6	. . .	84	86.4	kV

Reverse current				
$V_{RM} = V_{RWMmax}$; T_j = 125 °C	I_{RM}	<	1.6	mA

NOTES

1. The Ratings and Characteristics given apply **from centre tap to end**. (Not for OSS9415 series).
2. **Type number suffix**

   The suffix consists of a figure indicating the total number of diodes, and the letter 'A' denoting M6 studs at the ends.
3. **Operating position**

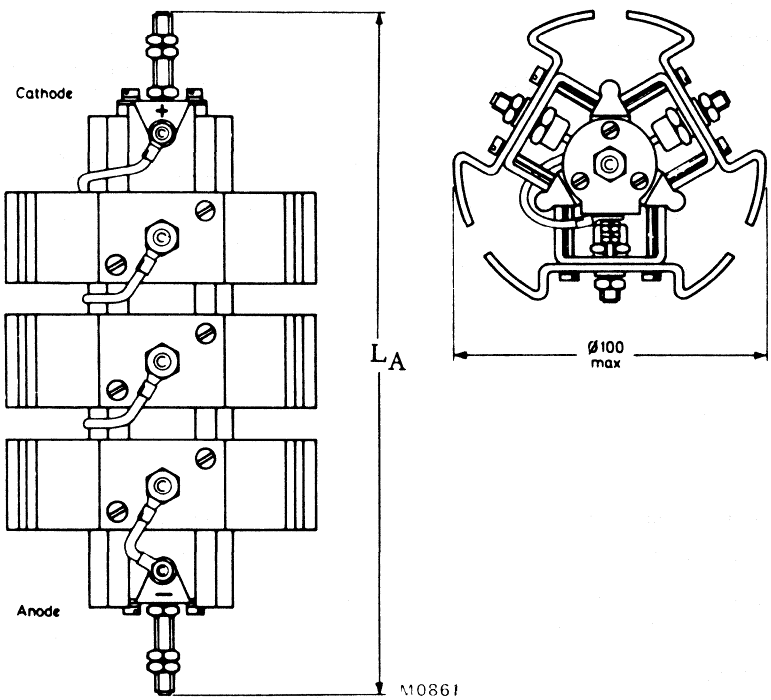
   The rectifier units can be operated at their maximum ratings when mounted in any position.

* The breakdown voltage increases, by approximately 0.1% per °C with increasing junction temperature.

MECHANICAL DATA Dimensions in mm

n = total number of diodes.

Fig.4 OSS9415-nA



The drawing shows the OSS9415 series.
The OSB9415 and OSM9415 series differ in the following respects:
OSB9415 series — has a centre tap marked +; anode and cathode terminals are both marked ∿.
OSM9415 series — has a centre tap marked ∿.

Table of lengths and weights (mm and g)

number of diodes n	3	4 to 6	7 to 9	10 to 12	13 to 15
maximum lengths L_A	143	184	224	264	305
weights W_A	215	413	611	809	1007

number of diodes n	16 to 18	19 to 21	22 to 24	25 to 27	28 to 30	31 to 33	34 to 36
maximum lengths L_A	345	385	426	466	506	546	586
weights W_A	1208	1406	1604	1802	2000	2198	2396

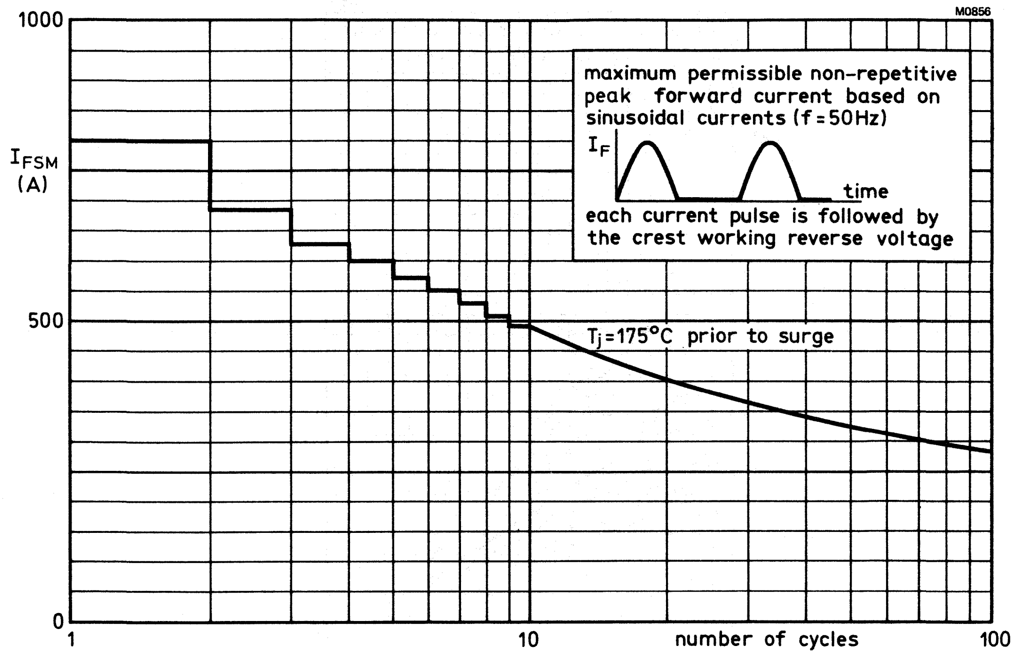

M0856
1000
I_{FSM}
(A)
500
0
1
10
number of cycles
100
maximum permissible non-repetitive peak forward current based on sinusoidal currents (f = 50Hz)
I_F
time
each current pulse is followed by the crest working reverse voltage
T_j = 175°C prior to surge

Fig.5

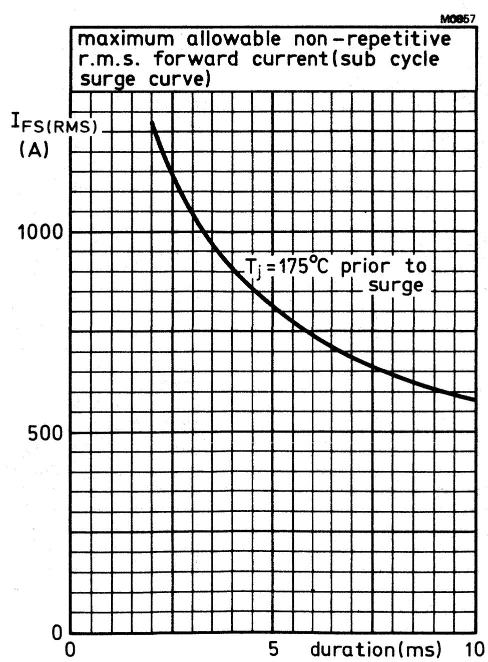

maximum allowable non-repetitive r.m.s. forward current (sub cycle surge curve)
$I_{FS(RMS)}$
(A)
1000
500
0
0
5
duration (ms)
10
T_j = 175°C prior to surge

Fig.6

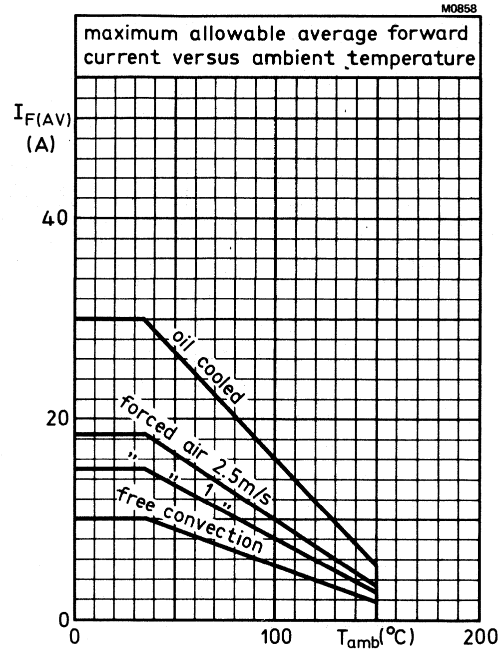


Fig.7

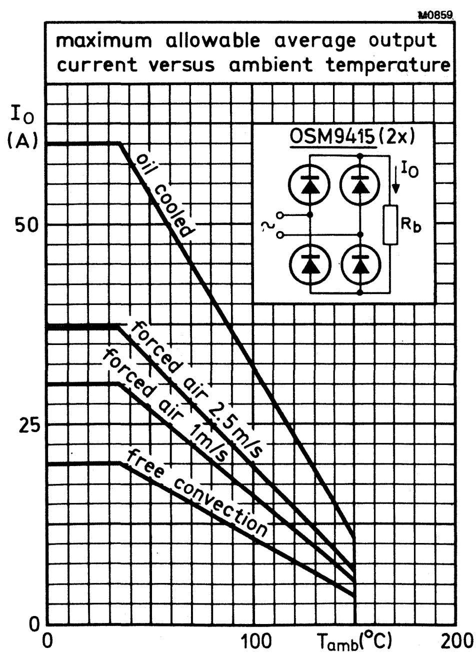


Fig.8

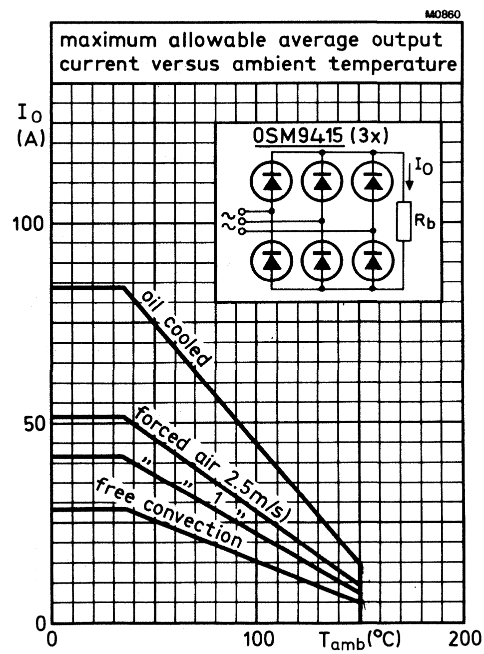


Fig.9

APPLICATION INFORMATION

Fig.10 OSB9415 series

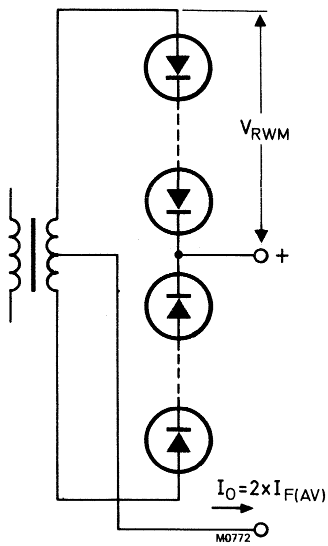
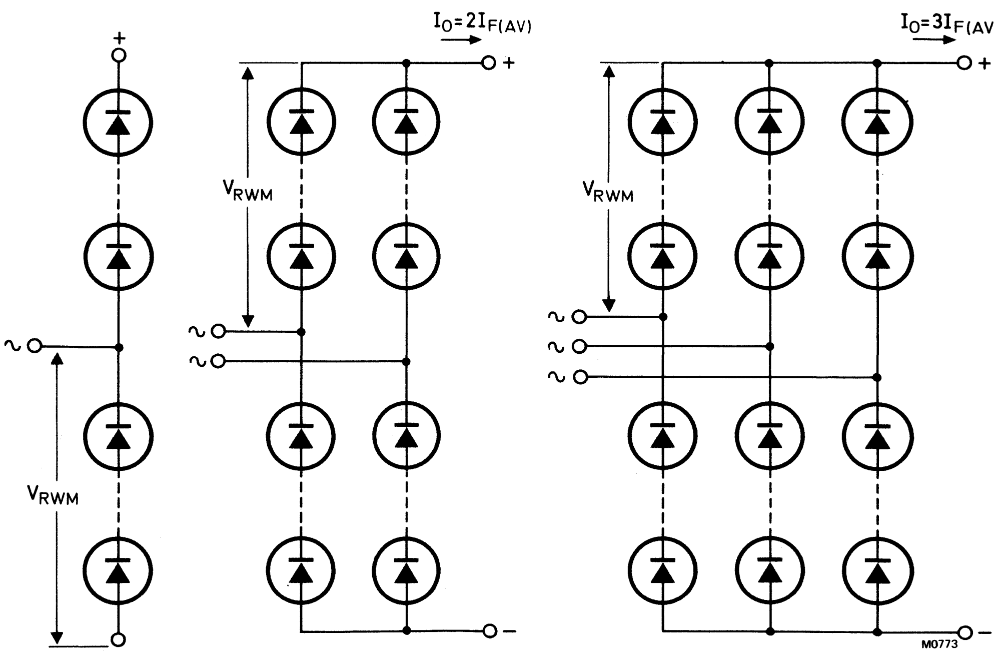


Fig.11 OSM9415 series



voltage doubler
1 x OSM9415

rectifier circuits with respectively
2 x OSM9415 and 3 x OSM9415

HIGH-VOLTAGE RECTIFIER STACK

The OSM9510-12 is a silicon rectifier stack for high voltage applications; up to 12kV in half-wave circuits, or up to 6kV as one of the arms of a bridge configuration, where the centre-tap is utilised. Because of its controlled avalanche characteristics it is capable of withstanding reverse transients generated in the circuit.

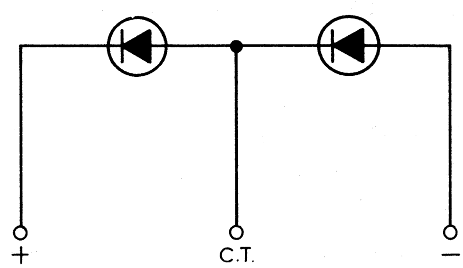
QUICK REFERENCE DATA

V_{RWM} max.	12	kV
$V_{(BR)R}$ min.	15	kV
$I_{F(AV)}$ max., in free air, $T_{amb} = 50^{o}C$	1.5	A
P_{RSM} max., $t = 10 \mu s$, $T_{amb} = 25^{o}C$	20	kW

OUTLINE AND DIMENSIONS

For details see page 3

CIRCUIT DIAGRAM



RATINGS

Limiting values of operation according to the absolute maximum system.
These ratings apply for the frequency range 50 to 400Hz.
Simultaneous application of all ratings is inferred unless otherwise stated.

Electrical

V_{RWM}	max.	Crest working reverse voltage	12	kV
$I_{F(AV)}$	max.	Mean forward current in free air, $T_{amb} \leq 50^{o}C$, 180^{o} conduction	1.5	A
I_{FRM}	max.	Repetitive peak forward current, 30^{o} conduction	15	A
I_{FSM}	max.	Surge forward current, 1 cycle (10ms peak of half sinewave)	35	A
P_{RSM}	max.	Non-repetitive peak reverse power (10μs square wave, $T_j = 25^{o}C$)	20	kW
P_{RRM}	max.	50Hz repetitive peak reverse transient power (10μs square wave, $T_j = 150^{o}C$)	5.0	kW

Temperature

T_{stg}	Storage temperature	-55 to 150	^{o}C
T_j	Junction temperature	-55 to 150	^{o}C

ELECTRICAL CHARACTERISTICS ($T_j = 25^{o}C$ unless otherwise stated)

		Min.	Max.	
$*V_F$	Forward voltage at $I_F = 5A$	-	17.5	V
I_R	Reverse current at V_{RWM}, $T_j = 125^{o}C$	-	100	μA
$V_{(BR)R}$	**Avalanche breakdown voltage, $I_{(BR)R} = 1mA$	15	25	kV

*Measured under pulsed conditions so that T_j is at, or near, the stated value.

**The avalanche voltage increases by approximately 0.1%/degC with increasing T_j.

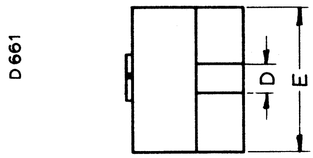
MECHANICAL DATA

Weight	130	g

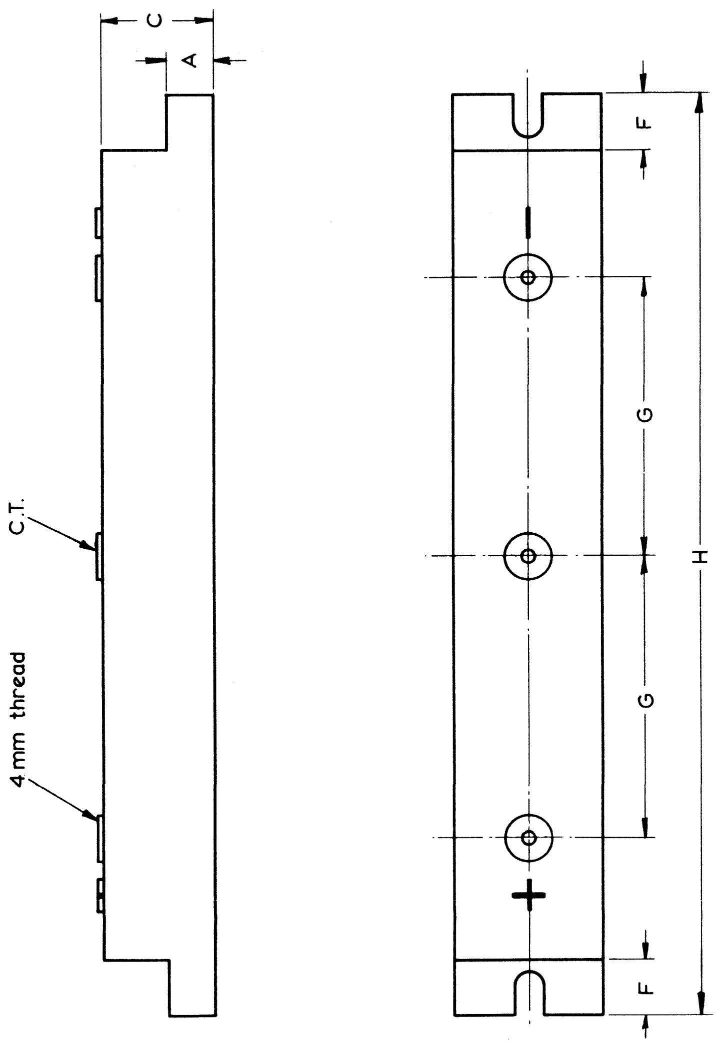
MOUNTING POSITION

The rectifier units can be operated at their maximum ratings when mounted in any position.

OUTLINE AND DIMENSIONS



Millimetres	
A	8.0
C	18.5
D	5.3
E	26
F	10
G	50
H	165



SCHOTTKY-BARRIER DOUBLE RECTIFIER DIODES

Low-leakage, platinum-barrier double rectifier diodes in plastic envelopes featuring low forward voltage drop, low capacitance and absence of stored charge. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and zero switching losses are essential. Their single chip (monolithic) construction allows both diodes to be paralleled without the need for derating. They can also withstand reverse voltage transients and have guaranteed reverse avalanche surge capability. The series consists of common-cathode types.

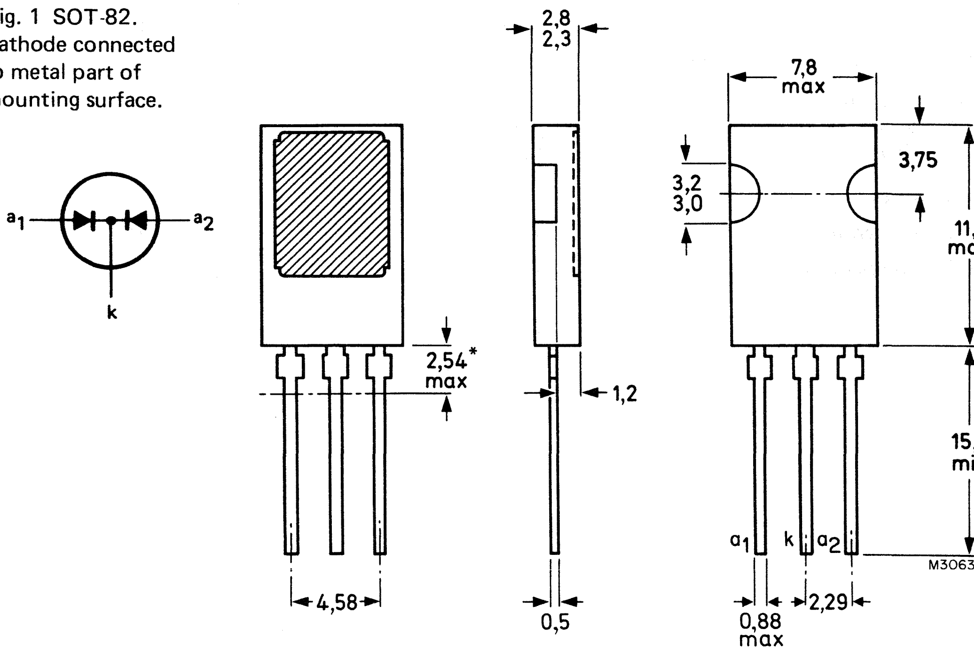
QUICK REFERENCE DATA

Per diode, unless otherwise stated			PBYR635CT	640CT	645CT	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	
Output current (both diodes conducting)	I_O	max.		10		A
Forward voltage	V_F	<		0.6		V
Junction temperature	T_j	max.		150		°C

MECHANICAL DATA

Dimensions in mm

Fig. 1 SOT-82.
Cathode connected to metal part of mounting surface.



* Within this region the cross-section of the leads is uncontrolled.

Net mass: 2 g
Accessories supplied on request: see data sheets Mounting instructions and accessories for SOT-82 envelopes.

RATINGS

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

			PBYR635CT	640CT	645CT	
Voltages (per diode)						
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Crest working reverse voltage	V_{RWM}	max.	35	40	45	V
Continuous reverse voltage	V_R	max.	35	40	45	V
Currents (both diodes conducting: note 1)						
Output current: square wave; $\delta = 0.5$; up to $T_{mb} = 118\ ^oC$ (note 2)	I_O	max.		10		A
sinusoidal; up to $T_{mb} = 121\ ^oC$ (note 2)	I_O	max		8.8		A
RMS forward current	$I_{F(RMS)}$	max.		14		A
Repetitive peak forward current $t_p = 20\ \mu s$; $\delta = 0.02$ (per diode)	I_{FRM}	max.		90		A
Non-repetitive peak forward current (per diode) half sinewave ; $T_j = 125\ ^oC$ prior to surge; with reapplied $V_{RWM\ max}$						
t = 10 ms	I_{FSM}	max.		80		A
t = 8.3 ms	I_{FSM}	max.		90		A
I^2t for fusing (t = 10 ms, per diode)	I^2t	max.		32		A^2s
Reverse surge current $t_p = 2\ \mu s$; $\delta = 0.001$	I_{RRM}	max.		1.0		A
$t_p = 100\ \mu s$	I_{RSM}	max.		1.0		A
Temperatures						
Storage temperature	T_{stg}			−40 to +150		^oC
Junction temperature	T_j	max.		150		^oC

Notes:
1. The limits for both diodes apply whether both diodes conduct simultaneously or on alternate half cycles.
2. Assuming no reverse leakage current losses.

CHARACTERISTICS (per diode)

Forward voltage				
$I_F = 5$ A; $T_j = 150$ °C	V_F	<	0.6	V*
$I_F = 10$ A; $T_j = 25$ °C	V_F	<	0.87	V*
Reverse current				
$V_R = V_{RWM\,max}$; $T_j = 125$ °C	I_R	<	15	mA
$V_R = V_{RWM\,max}$; $T_j = 25$ °C	I_R	<	100	µA
Junction capacitance at f = 1 MHz				
$V_R = 5$ V; $T_j = 25$ to 125 °C	C_d	typ.	200	pF

THERMAL RESISTANCE

From junction to mounting base (both diodes conducting)	$R_{th\ j\text{-}mb}$	=	4.0	K/W
From junction to mounting base (per diode)	$R_{th\ j\text{-}mb}$	=	5.0	K/W

Influence of mounting method

1. Heatsink mounted with clip

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 (56354)	$R_{th\ mb\text{-}h}$	=	1.4	K/W
c. without heatsink compound	$R_{th\ mb\text{-}h}$	=	1.4	K/W

2. 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 tie point.

Thermal resistance from junction to ambient in free air: mounted on a printed-circuit board at any device lead length and with copper laminate on the board.	$R_{th\ j\text{-}a}$	=	100	K/W

*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 recommended.
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. Body mounting.

   A SOT-82 envelope can be adhesive-mounted or soldered into a hybrid circuit.
   For soldering, a copper plate or an anodized aluminium plate with copper layer is recommended.
   When adhesive mounting is applied also a ceramic substrate may be used.

OPERATING NOTES

Dissipation and heatsink calculations.

The various components of junction temperature rise above ambient are illustrated in Fig.2.

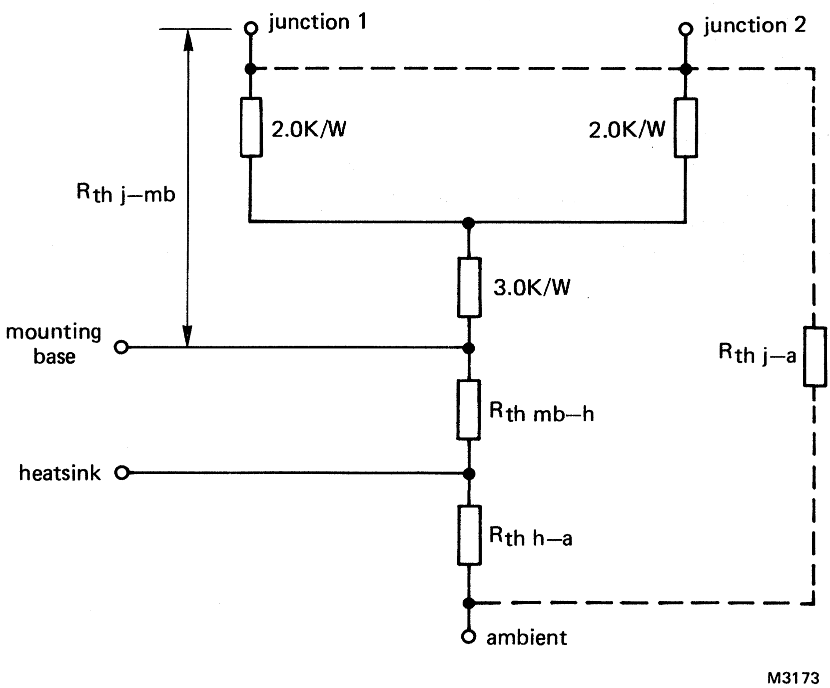


Fig.2.

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

OPERATING NOTES

Dissipation and heatsink calculations

Overall thermal resistance, $R_{th\ j\text{-}a} = R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h} + R_{th\ h\text{-}a}$

To choose a suitable heatsink, the following information is required for each half of the dual diode:

(i) maximum operating ambient temperature
(ii) duty cycle or form factor of forward current (δ or a)
(iii) average forward current per diode
(iv) crest working reverse voltage (V_{RWM})

The total power dissipation in the diode has two components:

P_R — reverse leakage dissipation

$$P_{tot} = P_R + P_F \quad \ldots\ldots\ldots \quad 1).$$

P_F — forward conduction dissipation

From the above it can be seen that:

$$R_{th\ h\text{-}a} = \frac{T_{jmax} - T_{amb}}{P_F + P_R} - (R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h}) \quad \ldots\ldots \quad 2).$$

Values for $R_{th\ j\text{-}mb}$ and $R_{th\ mb\text{-}h}$ can be found under Thermal Resistance. P_R and P_F are derived from Figs.3 and 4 for square-wave operation (and Figs.5 and 6 for sine-wave) as follows:
Look at each half of the dual diode separately; for each diode, starting at the V_{RWM} axis of Fig.3, (or Fig.5), and from a knowledge of the required V_{RWM}, trace upwards to meet the curve that matches the required T_{jmax}. From this point trace horizontally left until the curve of the voltage grade of the device being used is met. From this point trace downwards to meet the required duty cycle (δ) or form factor (a). From this point trace right and read the actual reverse power dissipation on the P_R axis.
From this calculation, $P_R = P_R$ (diode 1) + P_R (diode 2) . . . . 3).
Foward conduction dissipation (P_F) for the known average current $I_{F(AV)}$ and duty cycle (or form factor) for each diode is easily derived from Fig.4 (or Fig.6).
Similarly, $P_F = P_F$ (diode 1) + P_F (diode 2) . . . . 4).
Substituting equations 3) and 4) into equation 2) enables the calculation of the required heatsink.

NOTE:— If both halves of the diode are being used (as is assumed above), the value of $R_{th\ j\text{-}mb}$ = 4.0 K/W. If only one half of the diode is used, follow the above procedure for one diode only, and use the value of $R_{th\ j\text{-}mb}$ of 5.0 K/W.

To ensure thermal stability, $(R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h} + R_{th\ h\text{-}a}) \times P_R$ must be less than 12 ^oC. If the calculated value of $R_{th\ h\text{-}a}$ does not permit this, then it must be reduced (heatsink size increased or $R_{th\ mb\text{-}h}$ improved) to enable this criterion to be met.

EXAMPLE: square-wave operation, using PBYR635CT and heatsink compound;
T_{amb} = 50 ^oC; δ (diode 1) = 0.5; δ (diode 2) = 0.5;
$I_{F(AV)}$ (diode 1) = 5 A; $I_{F(AV)}$ (diode 2) = 5 A;
V_{RWM} (both diodes) = 20 V; voltage grade of device = 35 V.
From data, $R_{th\ j\text{-}mb}$ = 4.0 K/W and $R_{th\ mb\text{-}h}$ = 0.3 K/W.
For each diode from Fig.4, it is found that P_F = 4 W;
hence total $P_F = 2 \times 4 = 8$ W (from equation 4)
If desired T_{jmax} is chosen to be 140 ^oC, then, from Fig.3, P_R (per diode) = 0.2 W
Therefore total $P_R = 2 \times 0.2 = 0.4$ W (from equation 3)
Using equation 2) we have:

$$R_{th\ h\text{-}a} = \frac{140\ ^oC - 50\ ^oC}{4\ W + 0.4\ W} - (4.0 + 0.3) = 16.2\ K/W$$

To check for thermal stability:

$$(R_{th\ j\text{-}a}) \times P_R = (4.0 + 0.3 + 16.2) \times 0.4 = 8.2\ ^oC.$$

This is less than 12 ^oC, hence thermal stability is ensured.

SQUARE WAVE OPERATION (Fig.3 and 4)

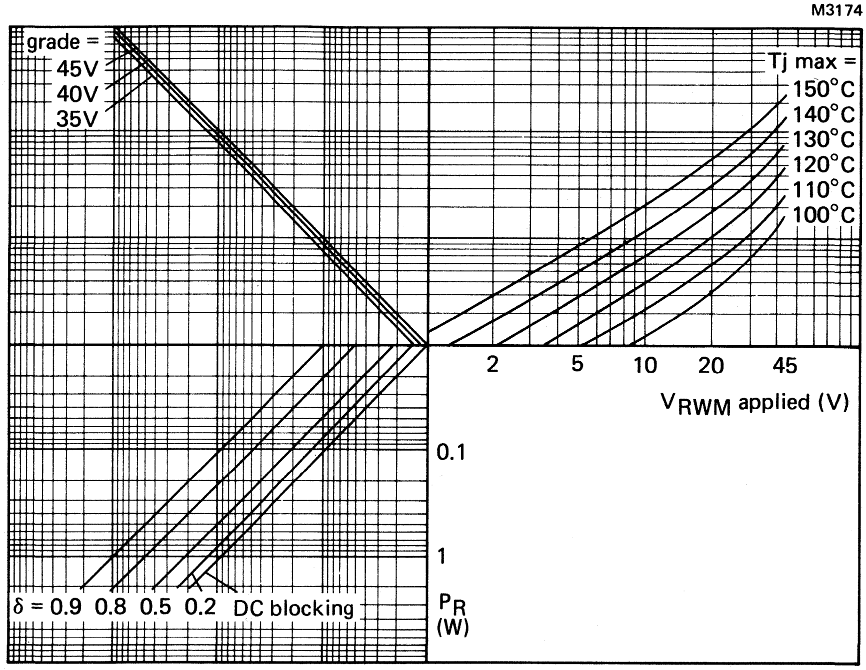
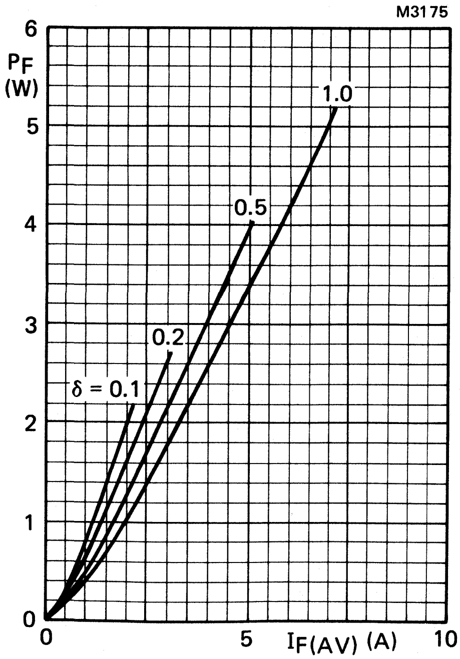
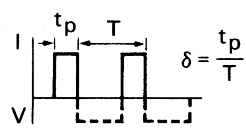


Fig.3 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and duty cycle; per diode.





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

Fig.4 Forward current power rating; per diode.

SINUSOIDAL OPERATION (Figs. 5 and 6)

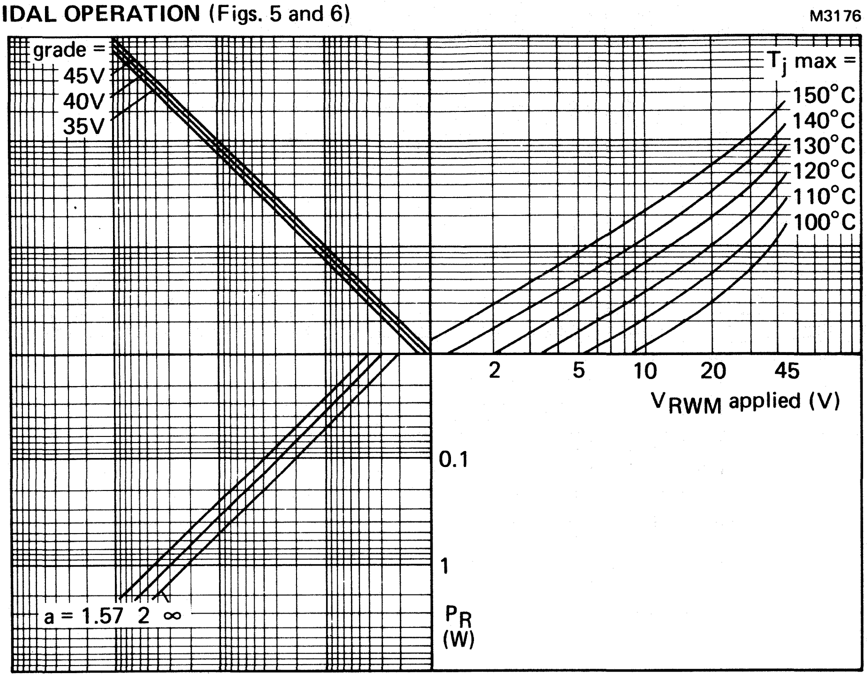


Fig.5 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and form factor; per diode.

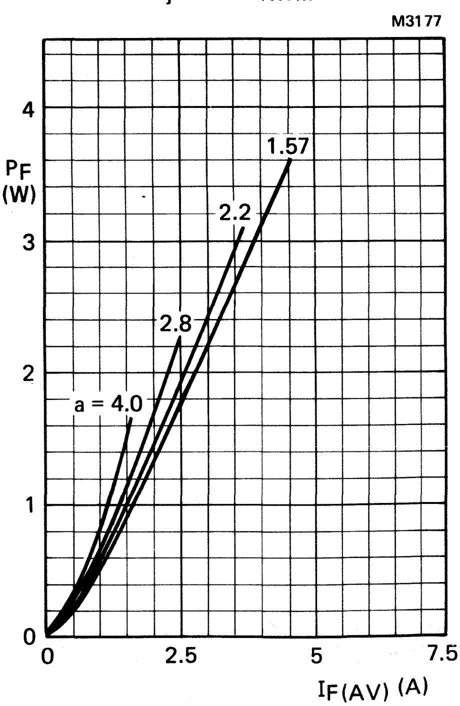


Fig.6 Forward current power rating; per diode.

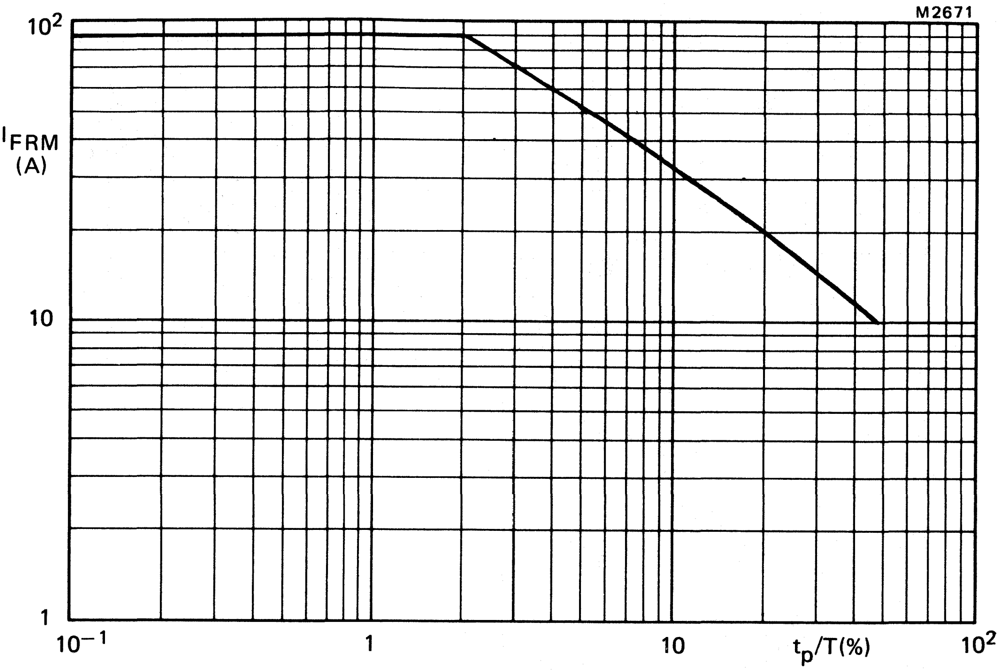
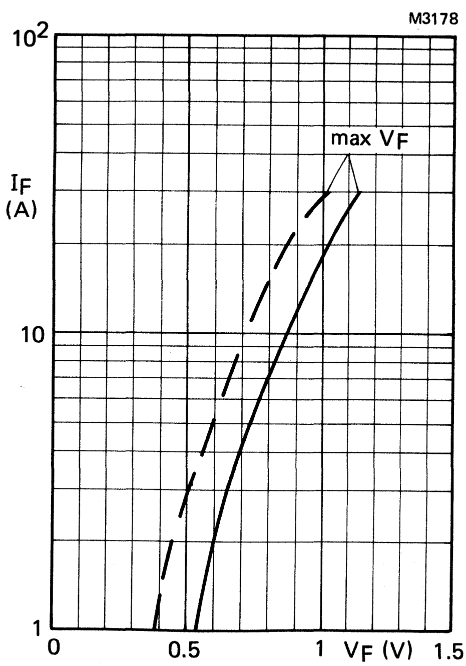
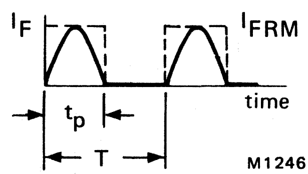


Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal current for 1 $\mu s < t_p <$ 1 ms; per diode.





Definition of I_{FRM} and t_p/T.

Fig.8 —— T_j = 25 °C; – – – T_j = 150 °C; per diode.

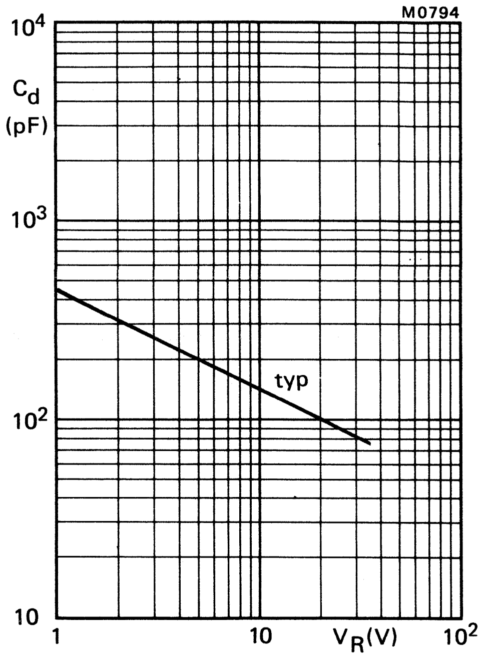


Fig.9 f = 1 MHz; T_j = 25 to 125 °C; per diode.

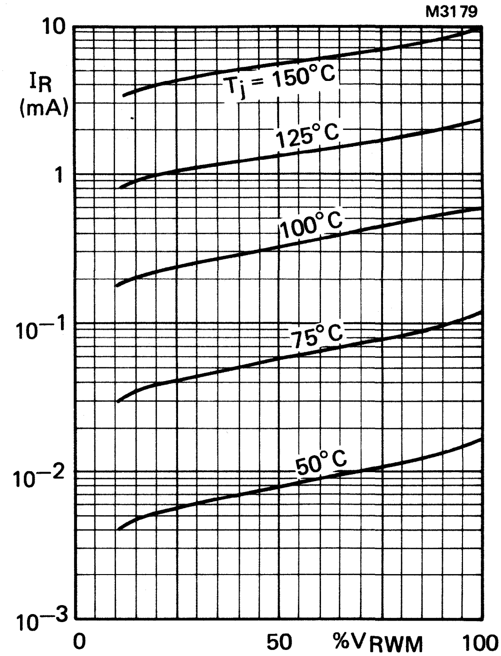


Fig.10 Typical values; per diode.

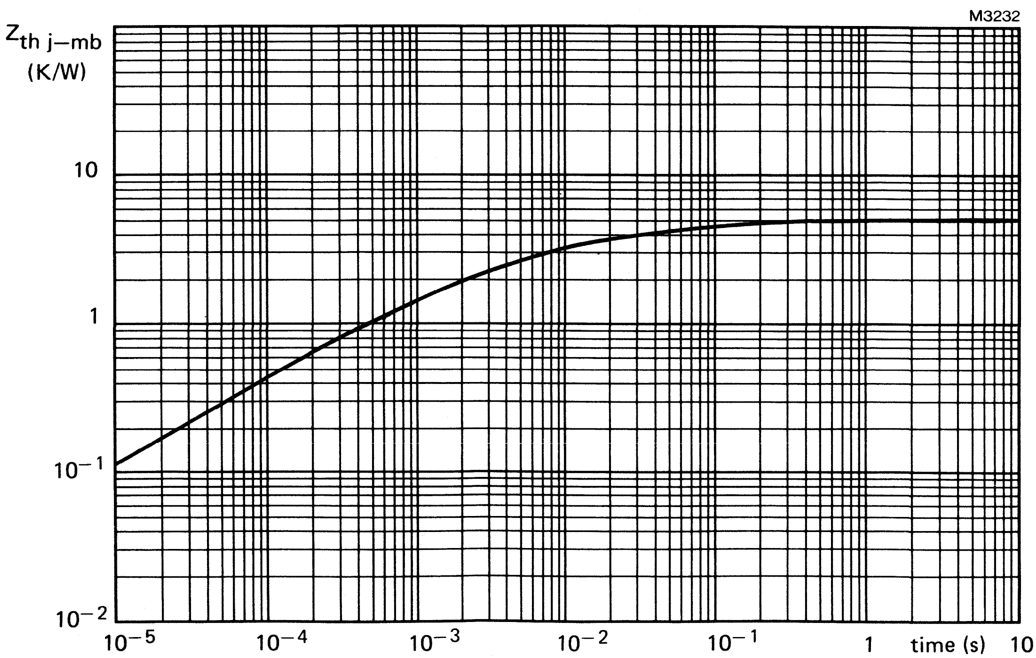


Fig.11 Transient thermal impedance; per diode.

SCHOTTKY–BARRIER RECTIFIER DIODES

Low-leakage platinum-barrier rectifier diodes in plastic envelopes, featuring low forward voltage drop, low capacitance, and absence of stored charge. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and zero switching losses are important. They can also withstand reverse voltage transients and have guaranteed reverse avalanche surge capability.
The series consists of normal polarity (cathode to mounting-base) types.

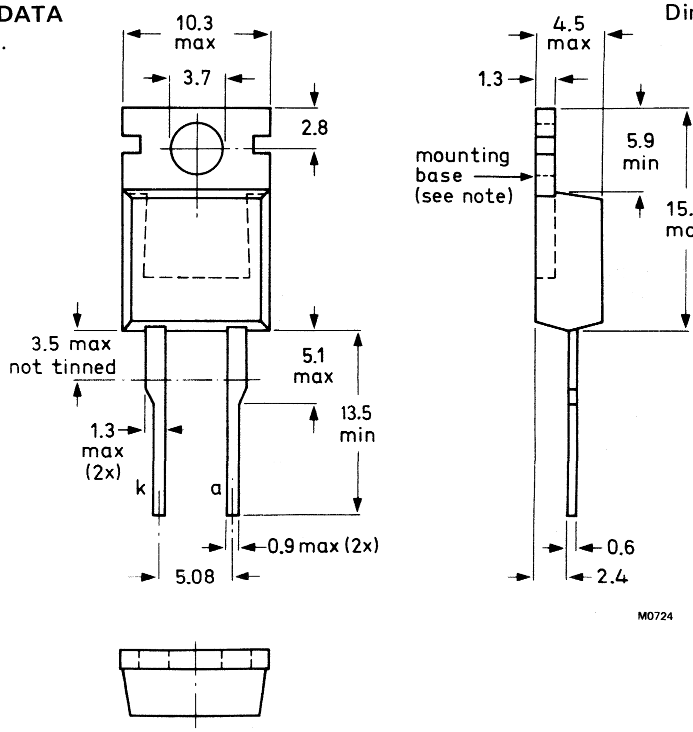
QUICK REFERENCE DATA

			PBYR735	740	745	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Average forward current	$I_{F(AV)}$	max.		7.5		A
Forward voltage	V_F	<		0.57		V
Junction temperature	T_j	max.		150		^oC

MECHANICAL DATA

Fig.1 TO-220AC.

Dimensions in mm.



Net mass: 2 g.
Note: the exposed metal mounting base is directly connected to the cathode.
Accessories supplied on request: see data sheets Mounting instructions and accessories for TO-220 envelopes.

RATINGS

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

Voltages			PBYR735	740	745	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Crest working reverse voltage	V_{RWM}	max.	35	40	45	V
Continuous reverse voltage	V_R	max.	35	40	45	V

Currents

Average forward current square wave; δ = 0.5; up to T_{mb} = 130 ^{o}C (note 1)	$I_{F(AV)}$	max.	7.5	A
Repetitive peak forward current (note 1) t_p = 25 μs; δ = 0.5; T_{mb} = 130 ^{o}C	I_{FRM}	max.	15	A
Non-repetitive peak forward current half sinewave ; T_j = 125 ^{o}C prior to surge; with reapplied $V_{RWM\ max}$ t=10ms	I_{FSM}	max.	135	A
t=8.3ms	I_{FSM}	max.	150	A
I^2t for fusing (t=10ms)	I^2t	max.	93	A^2s
Reverse surge current t_p = 2 μs; δ = 0.001	I_{RRM}	max.	1.0	A
t_p = 100 μs	I_{RSM}	max.	1.0	A

Temperatures

Storage temperature	T_{stg}		−65 to +175	^{o}C
Junction temperature	T_j	max.	150	^{o}C

CHARACTERISTICS

Forward voltage (note 2) I_F=7.5A; T_j=125 ^{o}C	V_F	<	0.57	V
I_F=15A; T_j=125 ^{o}C	V_F	<	0.72	V
I_F=15A; T_j= 25 ^{o}C	V_F	<	0.84	V
Reverse current V_R=$V_{RWM\ max}$; T_j=125 ^{o}C	I_R	<	15	mA
V_R=$V_{RWM\ max}$; T_j =25 ^{o}C	I_R	<	0.1	mA

Notes:
1. At rated reverse voltage V_R.
2. Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	3.0	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	$R_{th\ mb\text{-}h}$	=	0.5	K/W
b. with heatsink compound and 0.06mm maximum mica insulator	$R_{th\ mb\text{-}h}$	=	1.4	K/W
c. with heatsink compound and 0.1mm maximum mica insulator (56369)	$R_{th\ mb\text{-}h}$	=	2.2	K/W
d. with heatsink compound and 0.25mm 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 value 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 device lead length and with copper laminate on the board	$R_{th\ j\text{-}a}$	=	60	K/W

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 ^{o}C; the heat source must not be in contact with the joint for more than 5 seconds. Soldered joints must be at least 4.7mm from the seal.
2. The leads should not be bent less than 2.4mm from the seal, and should be supported during bending. The bend radius must be no less than 1.0mm.
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.

SQUARE-WAVE OPERATION

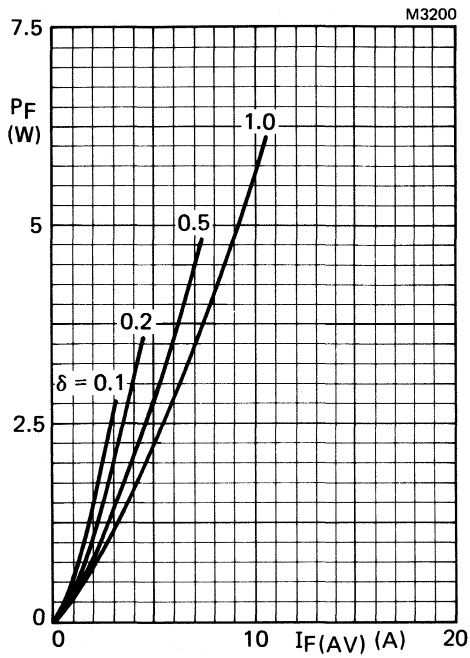
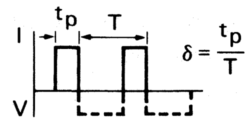


Fig.2 Forward current power rating;



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

SINUSOIDAL OPERATION

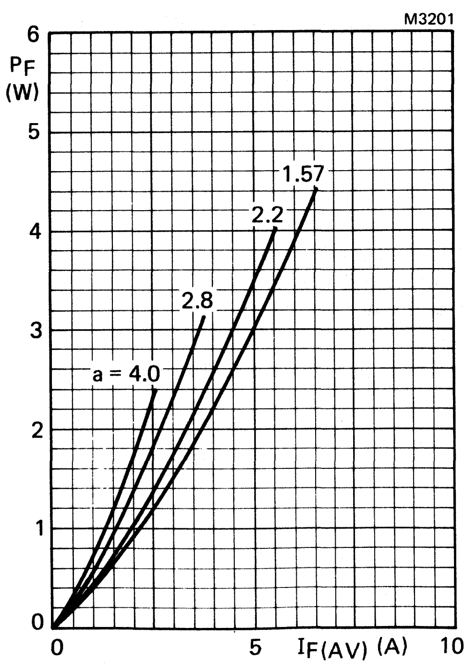


Fig.3 Forward current power rating;

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

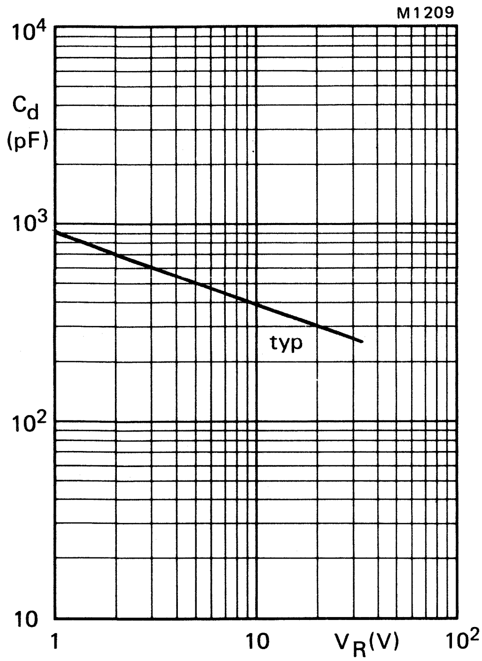


Fig.4 Typical junction capacitance at f = 1 MHz; T_j = 25 to 125 °C.

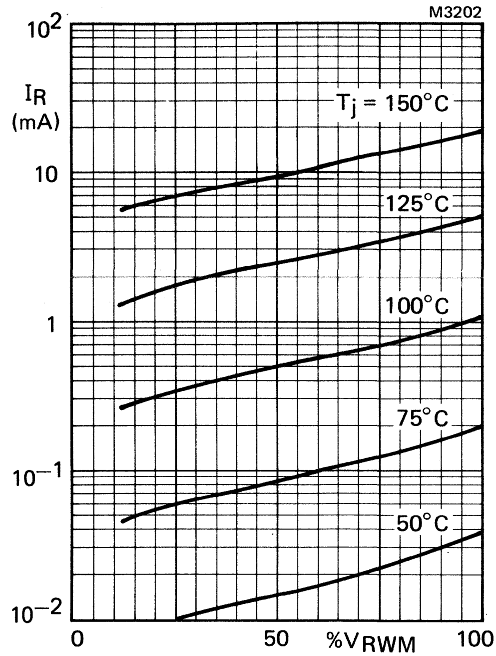


Fig.5 Typical values.

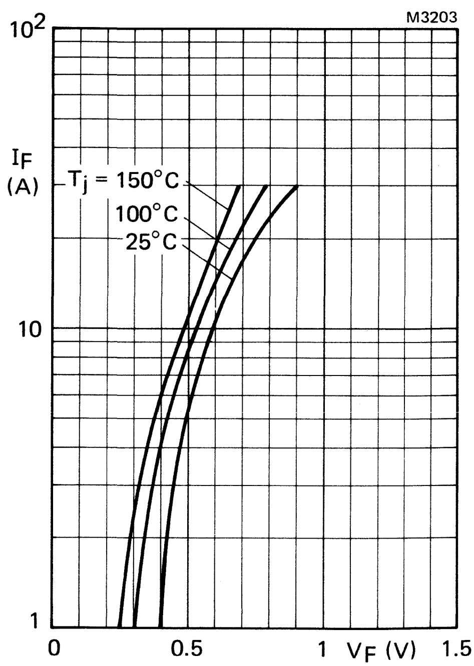


Fig.6 Typical forward voltage.

SCHOTTKY-BARRIER RECTIFIER DIODES

Low-leakage platinum-barrier rectifier diodes in SOT-186 (full-pack) plastic envelopes, featuring low forward voltage drop, low capacitance, and absence of stored charge. 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 switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and zero switching losses are important. They can also withstand reverse voltage transients and have guaranteed reverse avalanche surge capability.

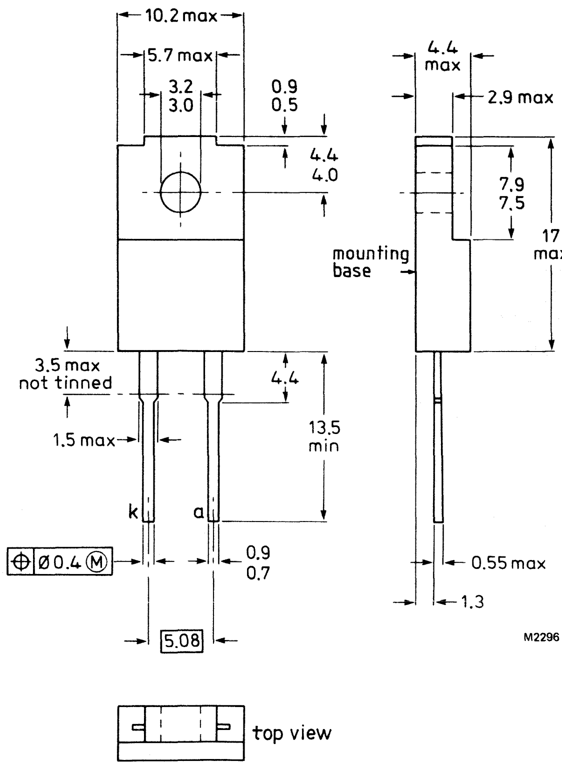
QUICK REFERENCE DATA

			PBYR735F	740F	745F	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Average forward current	$I_{F(AV)}$	max.		7.5		A
Forward voltage	V_F	<		0.57		V
Junction temperature	T_j	max.		150		°C

MECHANICAL DATA

Dimensions in mm

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



Net mass: 2 g.
The mounting base 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			PBYR735F	740F	745F	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Crest working reverse voltage	V_{RWM}	max.	35	40	45	V
Continuous reverse voltage	V_R	max.	35	40	45	V

Currents				
Average forward current square wave; $\delta = 0.5$; up to $T_h = 120\ ^oC$	$I_{F(AV)}$	max.	7.5	A
Repetitive peak forward current (note 1) $t_p = 25\ \mu s$; $\delta = 0.5$; $T_h = 120\ ^oC$	I_{FRM}	max.	15	A
Non-repetitive peak forward current half sinewave; $T_j = 125\ ^oC$ prior to surge; with reapplied $V_{RWM\ max}$ t = 10 ms	I_{FSM}	max.	135	A
t = 8.3 ms	I_{FSM}	max.	150	A
I^2t for fusing (t = 10 ms)	I^2t	max.	93	A^2s
Reverse surge current $t_p = 20\ \mu s$; $\delta = 0.001$	I_{RRM}	max.	1.0	A
$t_p = 100\ \mu s$	I_{RSM}	max.	1.0	A
Temperatures				
Storage temperature	T_{stg}		−65 to +175	^oC
Junction temperature	T_j	max.	150	^oC

CHARACTERSTICS

Forward voltage (note 2) $I_F = 7.5$ A; $T_j = 125\ ^oC$	V_F	<	0.57	V
$I_F = 15$ A; $T_j = 125\ ^oC$	V_F	<	0.72	V
$I_F = 15$ A; $T_j = 25\ ^oC$	V_F	<	0.84	V
Reverse current $V_R = V_{RWM\ max}$; $T_j = 125\ ^oC$	I_R	<	15	mA
$V_R = V_{RWM\ max}$; $T_j = 25\ ^oC$	I_R	<	0.1	mA

ISOLATION

Isolation voltage from all terminals to external heatsink (peak value) (note 3)	$V_{(isol)M}$	max.	1500	V
Isolation capacitance between all terminals and external heatsink	$C_{(isol)}$	typ.	12	pF

Notes:

1. At rated reverse voltage V_R.
2. Measured under pulse conditions to avoid excessive dissipation.
3. Repetitive peak operation with RH ⩽ 65% under clean and dust-free conditions.

THERMAL RESISTANCE

From junction to external heatsink with minimum of 2 kgf (20 newtons) pressure on the centre of the envelope, 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 tie point.

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

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 mounting base 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.2.

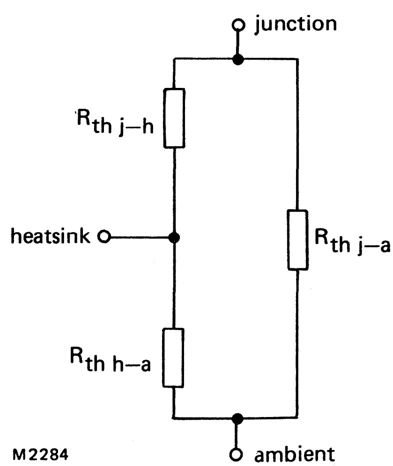


Fig.2.

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

SCHOTTKY–BARRIER RECTIFIER DIODES

Low-leakage platinum-barrier rectifier diodes in plastic envelopes, featuring low forward voltage drop, low capacitance, and absence of stored charge. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and zero switching losses are important. They can also withstand reverse voltage transients and have guaranteed reverse avalanche surge capability.
The series consists of normal polarity (cathode to mounting-base) types.

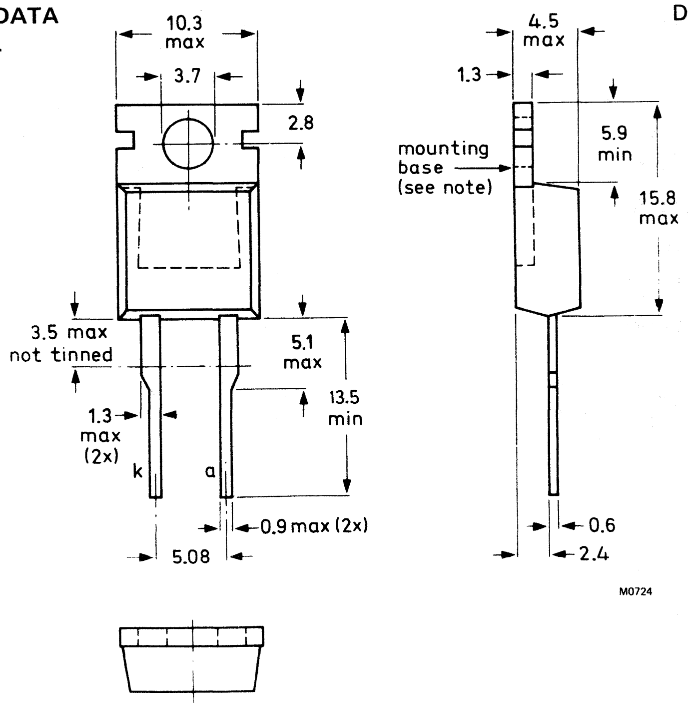
QUICK REFERENCE DATA

			PBYR1035	1040	1045	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Average forward current	$I_{F(AV)}$	max.		10		A
Forward voltage	V_F	<		0.57		V
Junction temperature	T_j	max.		150		^oC

MECHANICAL DATA

Fig.1 TO-220AC.

Dimensions in mm.



Net mass: 2 g.
Note: the exposed metal mounting base is directly connected to the cathode.
Accessories supplied on request: see data sheets Mounting instructions and accessories for TO-220 envelopes.

RATINGS

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

Voltages

			PBYR1035	1040	1045	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Crest working reverse voltage	V_{RWM}	max.	35	40	45	V
Continuous reverse voltage	V_R	max.	35	40	45	V

Currents

Average forward current square wave; $\delta = 0.5$; up to $T_{mb} = 135\ ^oC$ (note 1)	$I_{F(AV)}$	max.	10	A
Repetitive peak forward current (note 1) $t_p = 25\ \mu s$; $\delta = 0.5$; $T_{mb} = 135\ ^oC$	I_{FRM}	max.	20	A
Non-repetitive peak forward current half sinewave ; $T_j = 125\ ^oC$ prior to surge; with reapplied $V_{RWM\ max}$ t=10ms	I_{FSM}	max.	135	A
t=8.3ms	I_{FSM}	max.	150	A
I^2t for fusing (t=10ms)	I^2t	max.	93	A^2s
Reverse surge current $t_p = 2\ \mu s$; $\delta = 0.001$	I_{RRM}	max.	1.0	A
$t_p = 100\ \mu s$	I_{RSM}	max.	1.0	A

Temperatures

Storage temperature	T_{stg}		−65 to +175	^oC
Junction temperature	T_j	max.	150	^oC

CHARACTERISTICS

Forward voltage (note 2) I_F=10A; T_j=125 ^oC	V_F	<	0.57	V
I_F=20A; T_j=125 ^oC	V_F	<	0.72	V
I_F=20A; T_j= 25 ^oC	V_F	<	0.84	V
Reverse current $V_R=V_{RWM\ max}$; T_j=125 ^oC	I_R	<	15	mA
$V_R=V_{RWM\ max}$; T_j= 25 ^oC	I_R	<	0.1	mA

Notes:
1. At rated reverse voltage V_R.
2. Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	2.0	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	$R_{th\ mb\text{-}h}$	=	0.5	K/W
b. with heatsink compound and 0.06mm maximum mica insulator	$R_{th\ mb\text{-}h}$	=	1.4	K/W
c. with heatsink compound and 0.1mm maximum mica insulator (56369)	$R_{th\ mb\text{-}h}$	=	2.2	K/W
d. with heatsink compound and 0.25mm 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 value 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 device lead length and with copper laminate on the board	$R_{th\ j\text{-}a}$	=	60	K/W

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 4.7mm from the seal.
2. The leads should not be bent less than 2.4mm from the seal, and should be supported during bending. The bend radius must be no less than 1.0mm.
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.

SQUARE-WAVE OPERATION

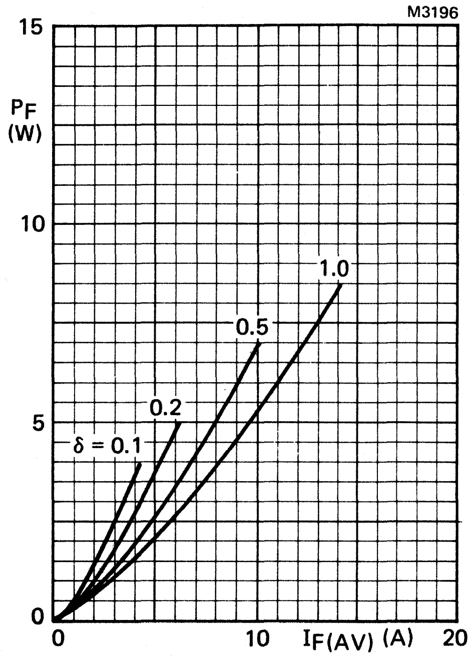
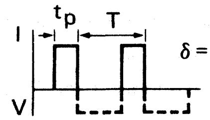


Fig.2 Forward current power rating;



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

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

SINUSOIDAL OPERATION

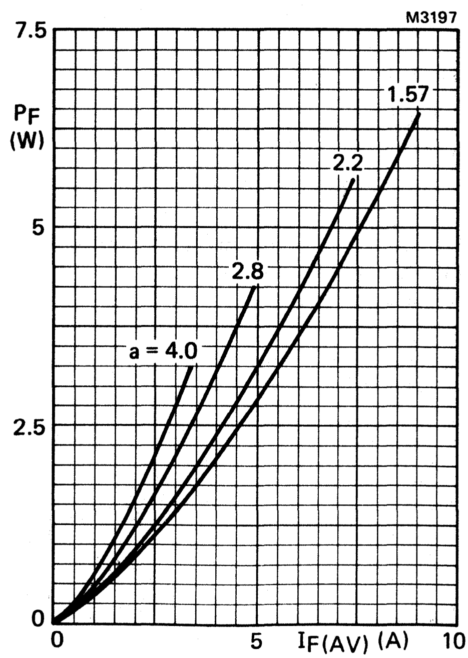


Fig.3 Forward current power rating;

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

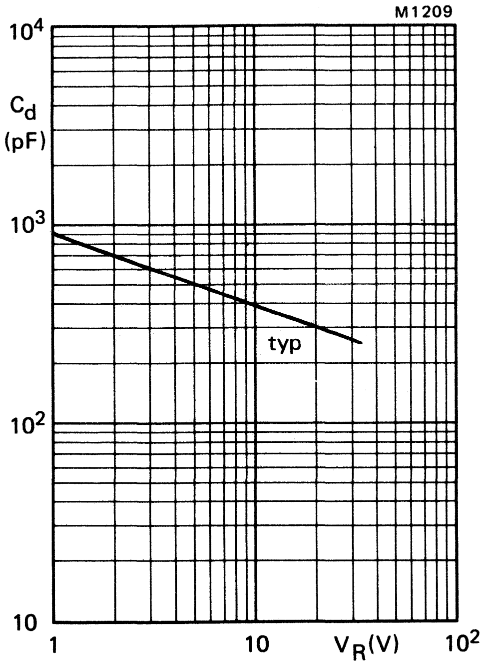


Fig.4 Typical junction capacitance at f = 1 MHz; T_j = 25 to 125 °C.

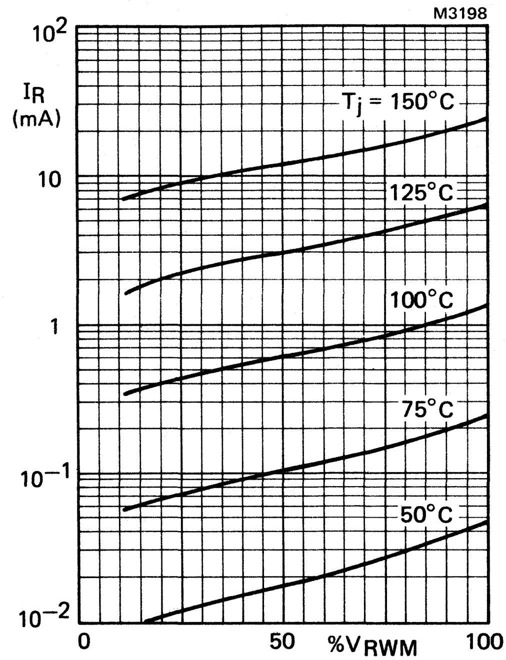


Fig.5 Typical values.

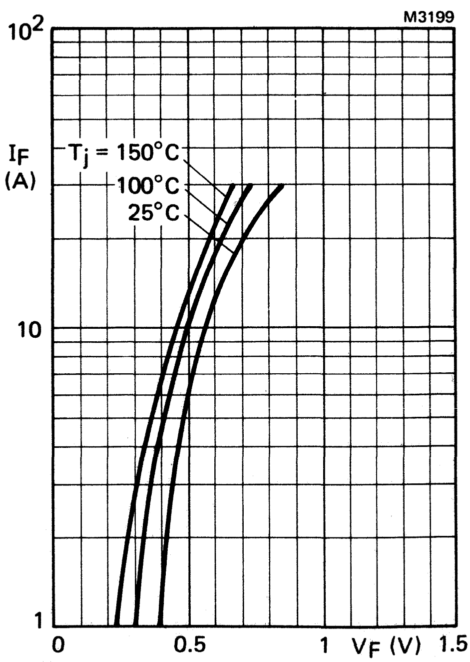


Fig.6 Typical forward voltage.

SCHOTTKY-BARRIER RECTIFIER DIODES

Low-leakage platinum-barrier rectifier diodes in SOT-186 (full-pack) plastic envelopes, featuring low forward voltage drop, low capacitance, and absence of stored charge. 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 switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and zero switching losses are important. They can also withstand reverse voltage transients and have guaranteed reverse avalanche surge capability.

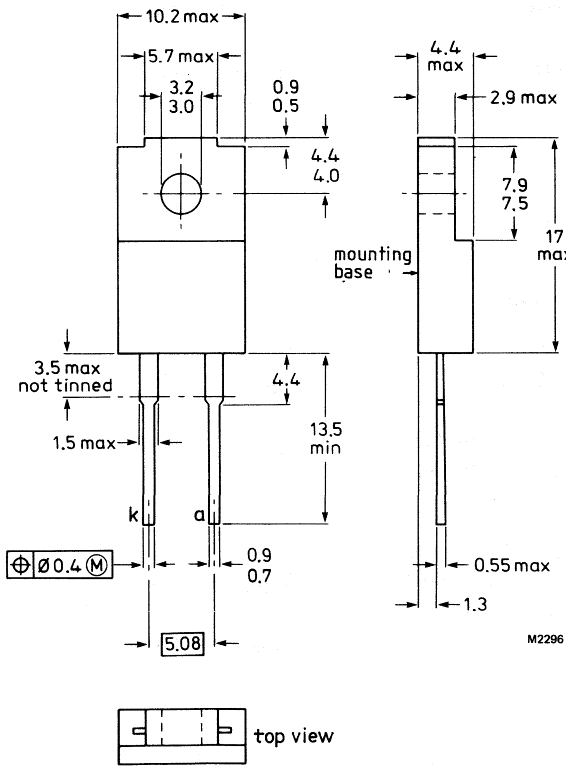
QUICK REFERENCE DATA

			PBYR1035F	1040F	1045F	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Average forward current	$I_{F(AV)}$	max.		10		A
Forward voltage	V_F	<		0.57		V
Junction temperature	T_j	max.		150		°C

MECHANICAL DATA

Dimensions in mm

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



Net mass: 2 g.
The mounting base 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			PBYR1035F	1040F	1045F	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Crest working reverse voltage	V_{RWM}	max.	35	40	45	V
Continuous reverse voltage	V_R	max.	35	40	45	V

Currents				
Average forward current square wave; $\delta = 0.5$; up to $T_h = 114\ ^oC$ (note 1)	$I_{F(AV)}$	max.	10	A
Repetitive peak forward current (note 1) $t_p = 25\ \mu s$; $\delta = 0.5$; $T_h = 114\ ^oC$	I_{FRM}	max.	20	A
Non-repetitive peak forward current half sinewave; $T_j = 125\ ^oC$ prior to surge; with reapplied $V_{RWM\ max}$				
$t = 10$ ms	I_{FSM}	max.	135	A
$t = 8.3$ ms	I_{FSM}	max.	150	A
I^2t for fusing ($t = 10$ ms)	I^2t	max.	93	A^2s
Reverse surge current				
$t_p = 2\ \mu s$; $\delta = 0.001$	I_{RRM}	max.	1.0	A
$t_p = 100\ \mu s$	I_{RSM}	max.	1.0	A
Temperatures				
Storage temperature	T_{stg}		−65 to +175	^oC
Junction temperature	T_j	max.	150	^oC

CHARACTERSTICS

Forward voltage (note 2)				
$I_F = 10$ A; $T_j = 125\ ^oC$	V_F	<	0.57	V
$I_F = 20$ A; $T_j = 125\ ^oC$	V_F	<	0.72	V
$I_F = 20$ A; $T_j = 25\ ^oC$	V_F	<	0.84	V
Reverse current				
$V_R = V_{RWM\ max}$; $T_j = 125\ ^oC$	I_R	<	15	mA
$V_R = V_{RWM\ max}$; $T_j = 25\ ^oC$	I_R	<	0.1	mA

ISOLATION

Isolation voltage from all terminals to external heatsink (peak value) (note 3)	$V_{(isol)M}$	max.	1500	V
Isolation capacitance between all terminals and external heatsink	$C_{(isol)}$	typ.	12	pF

Notes:

1. At rated reverse voltage V_R.
2. Measured under pulse conditions to avoid excessive dissipation.
3. Repetitive peak operation with RH $\leqslant$ 65% under clean and dust-free conditions.

THERMAL RESISTANCE

From junction to external heatsink with minimum of 2 kgf (20 newtons) pressure on the centre of the envelope, 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 tie point.

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

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 mounting base 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.2.

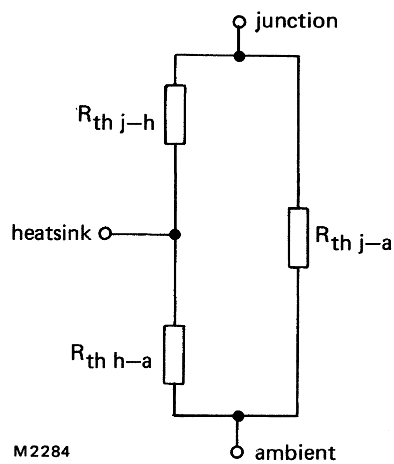


Fig.2.

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

SCHOTTKY–BARRIER DOUBLE RECTIFIER DIODES

Low-leakage platinum-barrier double rectifier diodes in plastic envelopes, featuring low forward voltage drop, low capacitance, and absence of stored charge. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and zero switching losses are important. Their single chip (monolithic) construction allows both diodes to be paralleled without the need for derating. They can also withstand reverse voltage transients and have guaranteed reverse avalanche surge capability.
The series consists of common-cathode types.

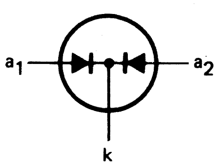
QUICK REFERENCE DATA

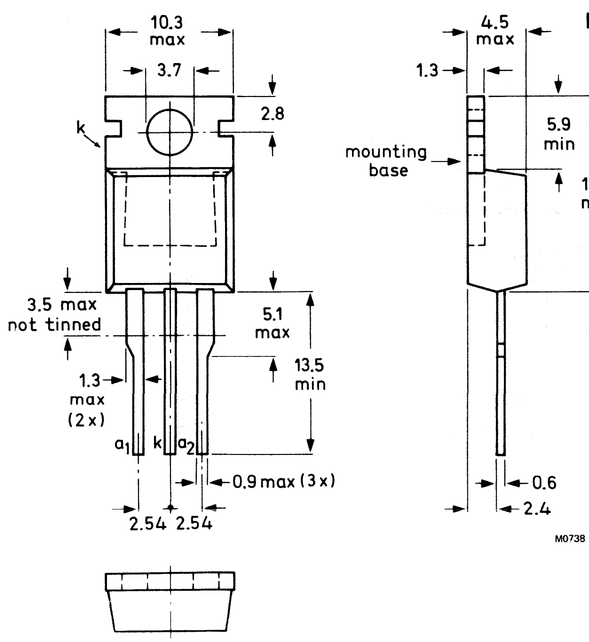
Per diode, unless otherwise stated			PBYR1535CT	1540CT	1545CT	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Output current (both diodes conducting)	I_O	max.		15		A
Forward voltage	V_F	$<$		0.57		V
Junction temperature	T_j	max.		150		^oC

MECHANICAL DATA

Fig.1 TO-220AB.

Dimensions in mm.





Net mass: 2 g.
Note: the exposed metal mounting base is directly connected to the common cathode.
Accessories supplied on request: see data sheets Mounting instructions and accessories for TO-220 envelopes.

RATINGS

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

Voltages (per diode)

			PBYR1535CT	1540CT	1545CT	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Crest working reverse voltage	V_{RWM}	max.	35	40	45	V
Continuous reverse voltage	V_R	max.	35	40	45	V

Currents

Average forward current				
square wave; δ = 0.5; up to T_{mb} = 130 °C (note 1)				
per diode	$I_{F(AV)}$	max.	7.5	A
per device	I_O	max.	15	A
Repetitive peak forward current per diode (note 1)				
t_p = 25 μs; δ = 0.5; T_{mb} = 130 °C	I_{FRM}	max.	15	A
Non-repetitive peak forward current (per device)				
half sinewave ; T_j = 125 °C prior to				
surge; with reapplied $V_{RWM\ max}$				
t=10ms	I_{FSM}	max.	135	A
t=8.3ms	I_{FSM}	max.	150	A
I^2t for fusing (t=10ms; per device)	I^2t	max.	93	A^2s
Reverse surge current (per diode)				
t_p = 2 μs; δ = 0.001	I_{RRM}	max.	1.0	A
t_p = 100 μs	I_{RSM}	max.	1.0	A

Temperatures

Storage temperature	T_{stg}		−65 to +175	°C
Junction temperature	T_j	max.	150	°C

CHARACTERISTICS (per diode)

Forward voltage (note 2)				
I_F=7.5A; T_j=125 °C	V_F	<	0.57	V
I_F=15A; T_j=125 °C	V_F	<	0.72	V
I_F=15A; T_j= 25 °C	V_F	<	0.84	V
Reverse current				
V_R=$V_{RWM\ max}$; T_j=125 °C	I_R	<	15	mA
V_R=$V_{RWM\ max}$; T_j= 25 °C	I_R	<	0.1	mA

Notes:
1. At rated reverse voltage V_R.
2. Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

From junction to mounting base (both diodes conducting)	$R_{th\ j\text{-}mb}$	=	2.0	K/W
From junction to mounting base (per diode)	$R_{th\ j\text{-}mb}$	=	3.0	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	$R_{th\ mb\text{-}h}$	=	0.5	K/W
b. with heatsink compound and 0.06mm maximum mica insulator	$R_{th\ mb\text{-}h}$	=	1.4	K/W
c. with heatsink compound and 0.1mm maximum mica insulator (56369)	$R_{th\ mb\text{-}h}$	=	2.2	K/W
d. with heatsink compound and 0.25mm 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 value 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 device lead length and with copper laminate on the board	$R_{th\ j\text{-}a}$	=	60	K/W

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 4.7mm from the seal.
2. The leads should not be bent less than 2.4mm from the seal, and should be supported during bending. The bend radius must be no less than 1.0mm.
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.

SQUARE-WAVE OPERATION

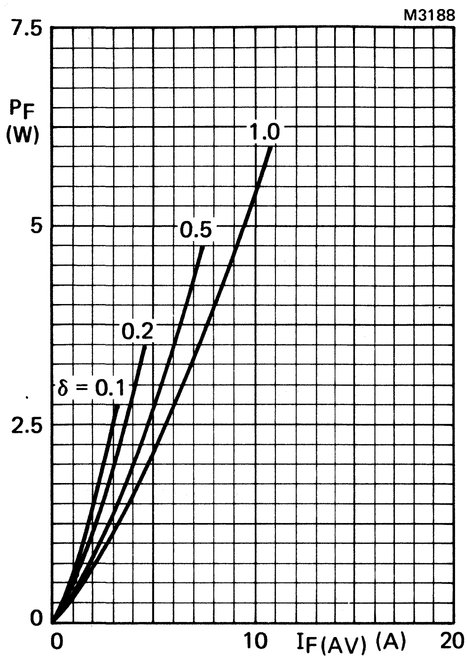
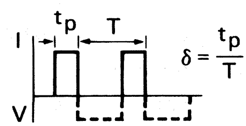


Fig.2 Forward current power rating; per diode.



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

SINUSOIDAL OPERATION

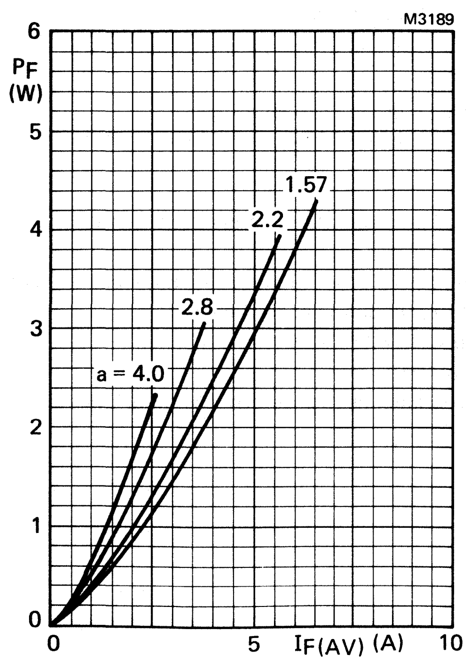


Fig.3 Forward current power rating; per diode.

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

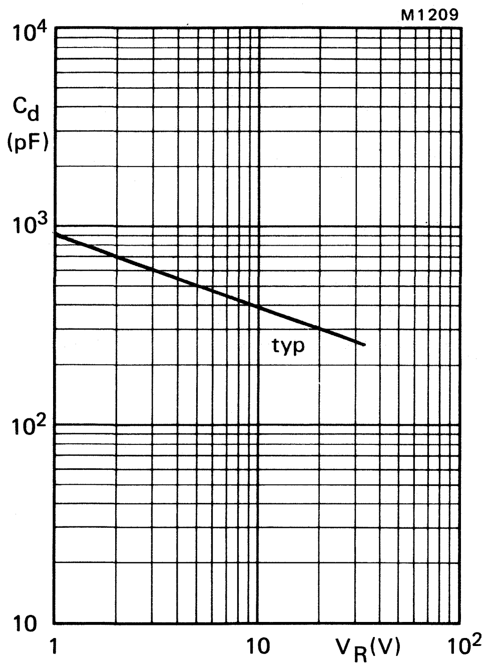


Fig.4 Typical junction capacitance at f = 1 MHz; per diode; T_j = 25 to 125 °C.

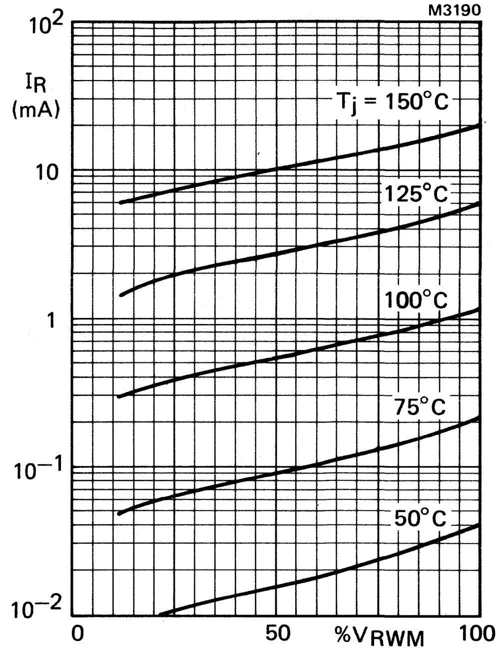


Fig.5 Typical values; per diode.

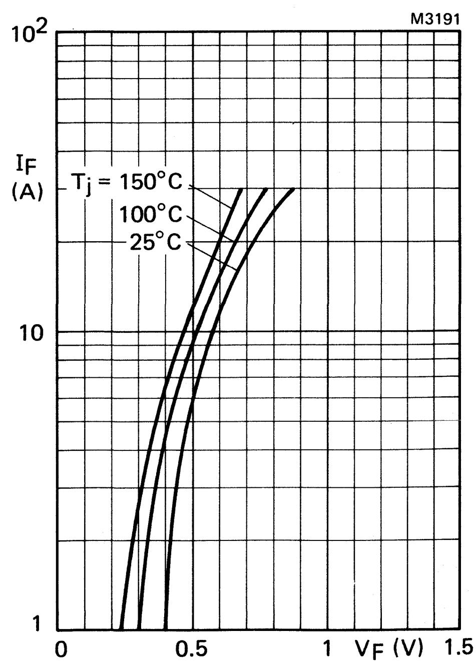


Fig.6 Typical forward voltage; per diode.

SCHOTTKY-BARRIER DOUBLE RECTIFIER DIODES

Low-leakage platinum-barrier double rectifier diodes in SOT-186 (full-pack) plastic envelopes featuring low forward voltage drop, low capacitance and absence of stored charge. 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 switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and absence of stored charge are essential. Their single chip (monolithic) construction allows both diodes to be paralleled without the need for derating. They can also withstand reverse voltage transients and have guaranteed reverse avalanche surge capability. The series consists of common-cathode types.

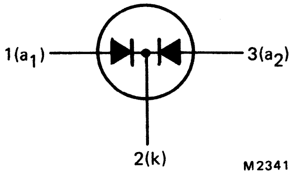
QUICK REFERENCE DATA

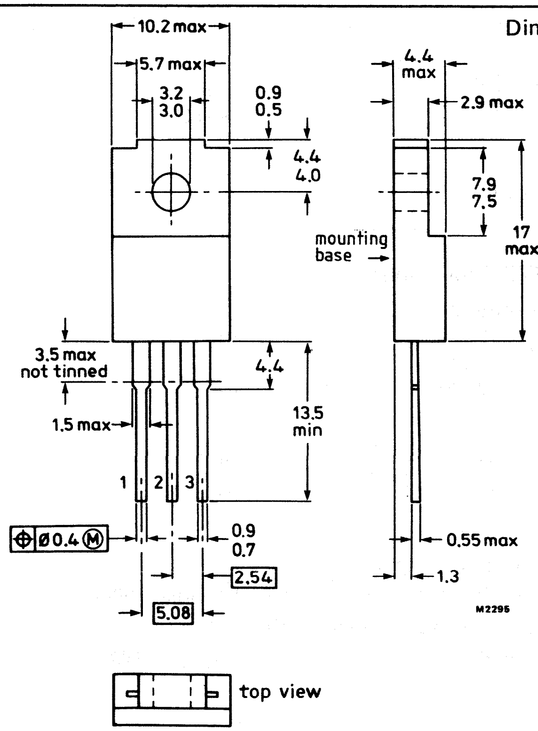
Per diode, unless otherwise stated			PBYR1535CTF	1540CTF	1545CTF	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Output current (both diodes conducting)	I_O	max.		15		A
Forward voltage	V_F	<		0.57		V
Junction temperature	T_j	max.		150		°C

MECHANICAL DATA

Dimensions in mm

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





Net mass: 2 g.
The mounting base 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 (per diode)

			PBYR1535CTF	1540CTF	1545CTF	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Crest working reverse voltage	V_{RWM}	max.	35	40	45	V
Continuous reverse voltage	V_R	max.	35	40	45	V

Currents

Average forward current				
square wave; $\delta = 0.5$; up to $T_h = 100\ ^oC$				
per diode	$I_{F(AV)}$	max.	7.5	A
per device	I_O	max.	15	A
Repetitive peak forward current				
per diode (note 1)				
$t_p = 25\ \mu s$; $\delta = 0.5$; $T_h = 100\ ^oC$	I_{FRM}	max.	15	A
Non-repetitive peak forward current				
(per device) half sinewave, $T_j = 125\ ^oC$				
prior to surge; with reapplied $V_{RWM\ max}$				
t = 10 ms	I_{FSM}	max.	135	A
t = 8.3 ms	I_{FSM}	max.	150	A
I^2t for fusing (t = 10 ms; per device)	I^2t	max.	93	A^2s
Reverse surge current (per diode)				
$t_p = 2\ \mu s$; $\delta = 0.001$	I_{RRM}	max.	1.0	A
$t_p = 100\ \mu s$	I_{RSM}	max.	1.0	A

Temperatures

Storage temperature	T_{stg}		−65 to +175	^oC
Junction temperature	T_j	max.	150	^oC

CHARACTERSTICS (per diode)

Forward voltage (note 2)				
$I_F = 7.5$ A; $T_j = 125\ ^oC$	V_F	$<$	0.57	V
$I_F = 15$ A; $T_j = 125\ ^oC$	V_F	$<$	0.72	V
$I_F = 15$ A; $T_j = 25\ ^oC$	V_F	$<$	0.84	V
Reverse current				
$V_R = V_{RWM\ max}$; $T_j = 125\ ^oC$	I_R	$<$	15	mA
$V_R = V_{RWM\ max}$; $T_j = 25\ ^oC$	I_R	$<$	0.1	mA

ISOLATION

Isolation voltage from all terminals to external heatsink (peak value) (note 3)	$V_{(isol)M}$	max.	1500	V
Isolation capacitance between all terminals and external heatsink	$C_{(isol)}$	typ.	12	pF

Notes:

1. At rated reverse voltage V_R.
2. Measured under pulse conditions to avoid excessive dissipation.
3. Repetitive peak operation with RH $\leq$ 65% under clean and dust-free conditions.

THERMAL RESISTANCE

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

a. both diodes conducting: with heatsink compound	$R_{th\ j\text{-}h}$	=	5.2	K/W
b. per diode: with heatsink compound	$R_{th\ j\text{-}h}$	=	6.1	K/W

Free air operation

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

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

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 ^{o}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 mounting base 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.2.

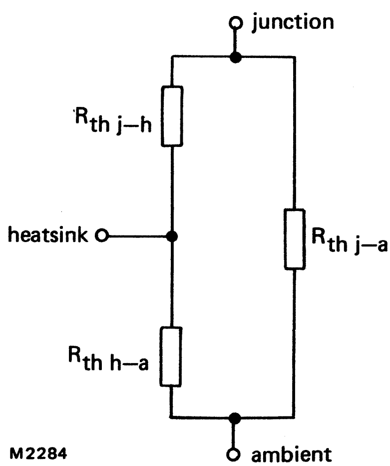


Fig.2.

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

SCHOTTKY–BARRIER RECTIFIER DIODES

Low-leakage platinum-barrier rectifier diodes in plastic envelopes, featuring low forward voltage drop, low capacitance, and absence of stored charge. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and zero switching losses are important. They can also withstand reverse voltage transients and have guaranteed reverse avalanche surge capability.
The series consists of normal polarity (cathode to mounting-base) types.

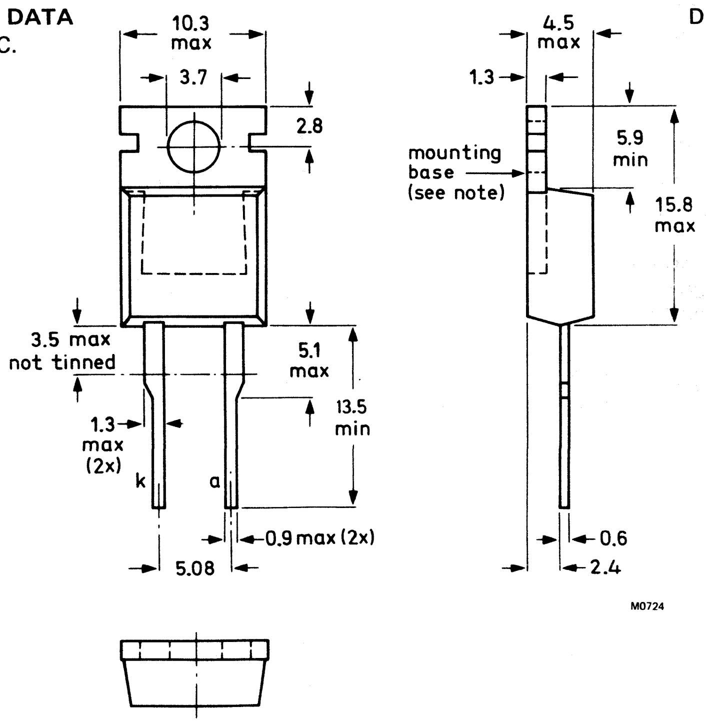
QUICK REFERENCE DATA

			PBYR1635	1640	1645	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Average forward current	$I_{F(AV)}$	max.		16		A
Forward voltage	V_F	<		0.57		V
Junction temperature	T_j	max.		150		^oC

MECHANICAL DATA

Fig.1 TO-220AC.

Dimensions in mm.



Net mass: 2 g.
Note: the exposed metal mounting base is directly connected to the cathode.
Accessories supplied on request: see data sheets Mounting instructions and accessories for TO-220 envelopes.

RATINGS

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

Voltages

			PBYR1635	1640	1645	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Crest working reverse voltage	V_{RWM}	max.	35	40	45	V
Continuous reverse voltage	V_R	max.	35	40	45	V

Currents

Average forward current square wave; $\delta = 0.5$; up to $T_{mb} = 125\ ^oC$ (note 1)	$I_{F(AV)}$	max.	16	A
Repetitive peak forward current (note 1) $t_p = 25\ \mu s$; $\delta = 0.5$; $T_{mb} = 125\ ^oC$	I_{FRM}	max.	32	A
Non-repetitive peak forward current half sinewave; $T_j = 125\ ^oC$ prior to surge; with reapplied $V_{RWM\ max}$ t=10ms	I_{FSM}	max.	135	A
t=8.3ms	I_{FSM}	max.	150	A
I^2t for fusing (t=10ms)	I^2t	max.	93	A^2s
Reverse surge current $t_p = 2\ \mu s$; $\delta = 0.001$	I_{RRM}	max.	1.0	A
$t_p = 100\ \mu s$	I_{RSM}	max.	1.0	A

Temperatures

Storage temperature	T_{stg}		−65 to +175	^oC
Junction temperature	T_j	max.	150	^oC

CHARACTERISTICS

Forward voltage (note 2) I_F=16A; T_j=125 ^oC	V_F	<	0.57	V
I_F=16A; T_j= 25 ^oC	V_F	<	0.63	V
Reverse current $V_R=V_{RWM\ max}$; T_j=125 ^oC	I_R	<	40	mA
$V_R=V_{RWM\ max}$; T_j= 25 ^oC	I_R	<	0.2	mA

Notes:
1. At rated reverse voltage V_R.
2. Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

From junction to mounting base	$R_{th\ j\text{-}mb}$	=	1.5	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	$R_{th\ mb\text{-}h}$	=	0.5	K/W
b. with heatsink compound and 0.06mm maximum mica insulator	$R_{th\ mb\text{-}h}$	=	1.4	K/W
c. with heatsink compound and 0.1mm maximum mica insulator (56369)	$R_{th\ mb\text{-}h}$	=	2.2	K/W
d. with heatsink compound and 0.25mm 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 value 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 device lead length and with copper laminate on the board	$R_{th\ j\text{-}a}$	=	60	K/W

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 4.7mm from the seal.
2. The leads should not be bent less than 2.4mm from the seal, and should be supported during bending. The bend radius must be no less than 1.0mm.
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.

SQUARE-WAVE OPERATION

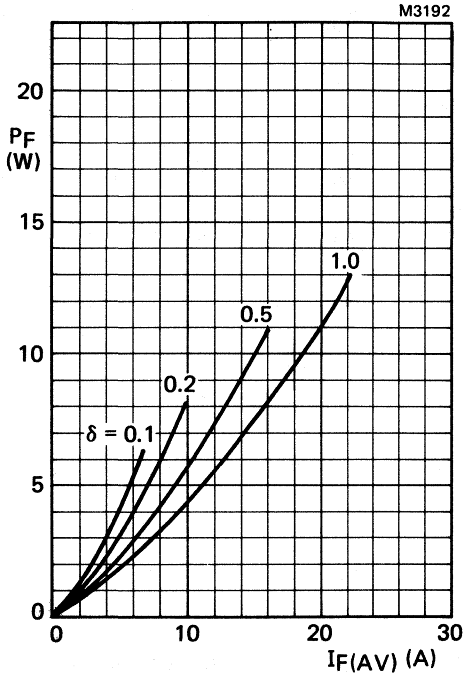
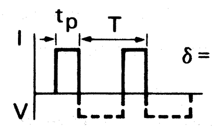


Fig.2 Forward current power rating;



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

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

SINUSOIDAL OPERATION

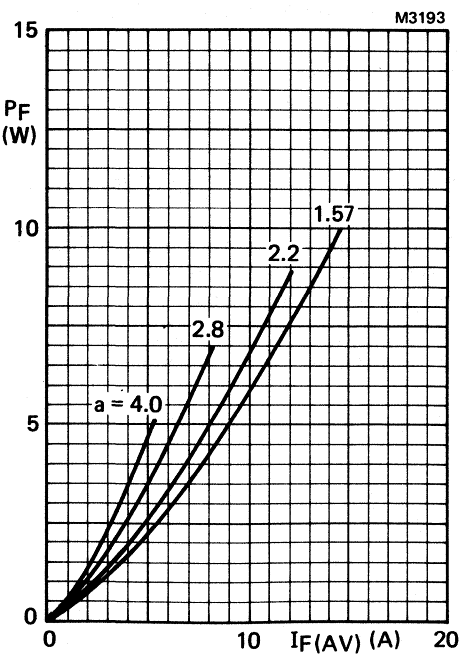


Fig.3 Forward current power rating;

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

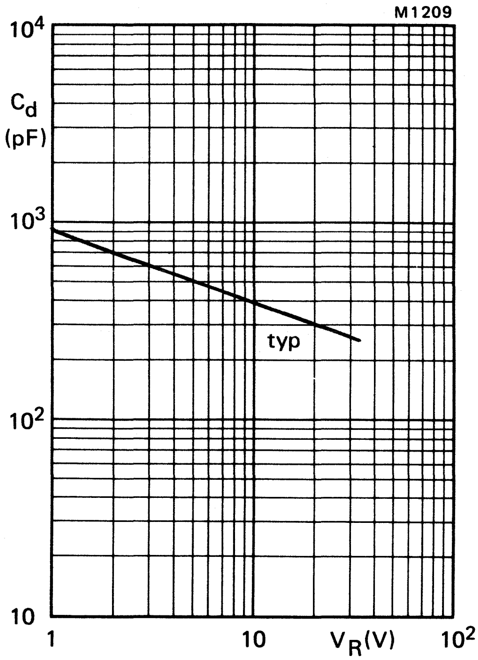


Fig.4 Typical junction capacitance at f = 1 MHz; T_j = 25 to 125 °C.

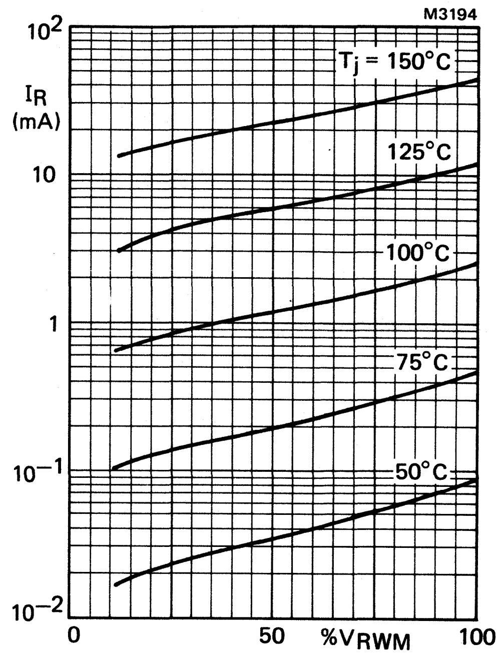


Fig.5 Typical values.

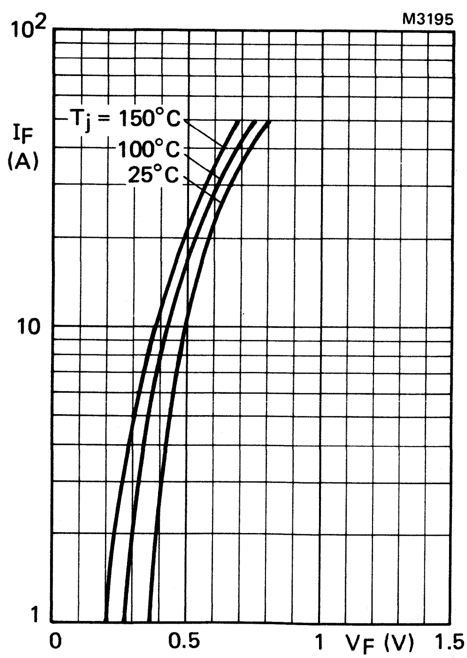


Fig.6 Typical forward voltage.

SCHOTTKY-BARRIER RECTIFIER DIODES

Low-leakage platinum-barrier rectifier diodes in SOT-186 (full-pack) plastic envelopes, featuring low forward voltage drop, low capacitance, and absence of stored charge. 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 switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and zero switching losses are important. They can also withstand reverse voltage transients and have guaranteed reverse avalanche surge capability.

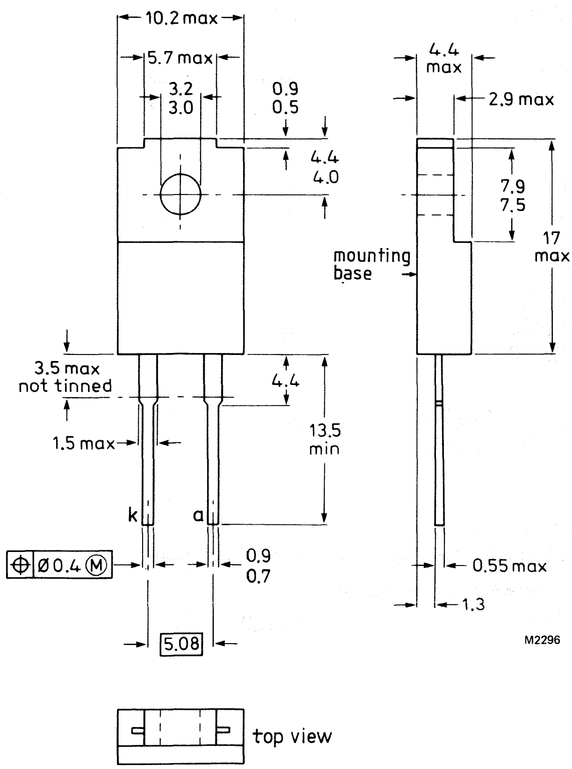
QUICK REFERENCE DATA

			PBYR1635F	1640F	1645F	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Average forward current	$I_{F(AV)}$	max.		16		A
Forward voltage	V_F	<		0.57		V
Junction temperature	T_j	max.		150		°C

MECHANICAL DATA

Dimensions in mm

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



Net mass: 2 g.
The mounting base 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			PBYR1635F	1640F	1645F	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Crest working reverse voltage	V_{RWM}	max.	35	40	45	V
Continuous reverse voltage	V_R	max.	35	40	45	V

Currents				
Average forward current square wave; $\delta = 0.5$; up to $T_h = 110\ ^oC$ (note 1)	$I_{F(AV)}$	max.	16	A
Repetitive peak forward current (note 1) $t_p = 25\ \mu s$; $\delta = 0.5$; $T_h = 110\ ^oC$	I_{FRM}	max.	32	A
Non-repetitive peak forward current half sinewave; $T_j = 125\ ^oC$ prior to surge; with reapplied $V_{RWM\ max}$ t = 10 ms	I_{FSM}	max.	135	A
t = 8.3 ms	I_{FSM}	max.	150	A
I^2t for fusing (t = 10 ms)	I^2t	max.	93	A^2s
Reverse surge current $t_p = 2\ \mu s$; $\delta = 0.001$	I_{RRM}	max.	1.0	A
$t_p = 100\ \mu s$	I_{RSM}	max.	1.0	A

Temperatures				
Storage temperature	T_{stg}		−65 to +175	^oC
Junction temperature	T_j	max.	150	^oC

CHARACTERSTICS

Forward voltage (note 2) $I_F = 16$ A; $T_j = 125\ ^oC$	V_F	<	0.57	V
$I_F = 16$ A; $T_j = 25\ ^oC$	V_F	<	0.63	V
Reverse current $V_R = V_{RWM\ max}$; $T_j = 125\ ^oC$	I_R	<	40	mA
$V_R = V_{RWM\ max}$; $T_j = 25\ ^oC$	I_R	<	0.2	mA

ISOLATION

Isolation voltage from all terminals to external heatsink (peak value) (note 3)	$V_{(isol)M}$	max.	1500	V
Isolation capacitance between all terminals and external heatsink	$C_{(isol)}$	typ.	12	pF

Notes:

1. At rated reverse voltage V_R.
2. Measured under pulse conditions to avoid excessive dissipation.
3. Repetitive peak operation with RH ≤ 65% under clean and dust-free conditions.

THERMAL RESISTANCE

From junction to external heatsink with minimum of 2 kgf (20 newtons) pressure on the centre of the envelope, with heatsink compound	$R_{th\ j\text{-}h}$	=	4.2	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 tie point.

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

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 mounting base 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.2.

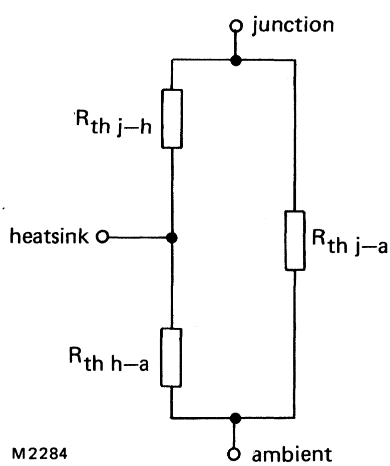


Fig.2.

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

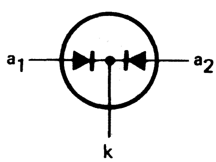
SCHOTTKY–BARRIER DOUBLE RECTIFIER DIODES

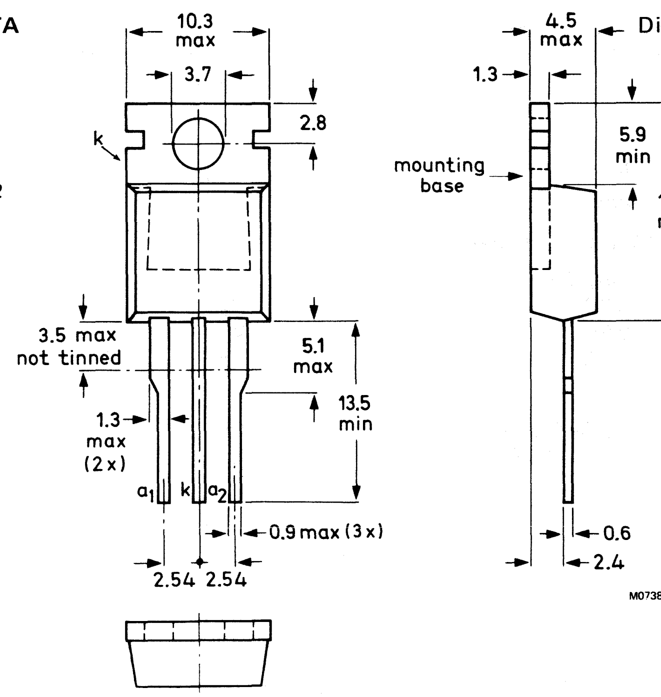
Low-leakage platinum-barrier double rectifier diodes in plastic envelopes, featuring low forward voltage drop, low capacitance, and absence of stored charge. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and zero switching losses are important. Their single chip (monolithic) construction allows both diodes to be paralleled without the need for derating. They can also withstand reverse voltage transients and have guaranteed reverse avalanche surge capability.
The series consists of common-cathode types.

QUICK REFERENCE DATA

Per diode, unless otherwise stated			PBYR2035CT	2040CT	2045CT	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Output current (both diodes conducting)	I_O	max.		20		A
Forward voltage	V_F	<		0.57		V
Junction temperature	T_j	max.		150		^oC

MECHANICAL DATA
Fig.1 TO-220AB.





Dimensions in mm.

Net mass: 2 g.
Note: the exposed metal mounting base is directly connected to the common cathode.
Accessories supplied on request: see data sheets Mounting instructions and accessories for TO-220 envelopes.

RATINGS

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

Voltages (per diode)

			PBYR2035CT	2040CT	2045CT	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Crest working reverse voltage	V_{RWM}	max.	35	40	45	V
Continuous reverse voltage	V_R	max.	35	40	45	V

Currents

Average forward current square wave; δ = 0.5; up to T_{mb} = 135 °C (note 1)				
per diode	$I_{F(AV)}$	max.	10	A
per device	I_O	max.	20	A
Repetitive peak forward current per diode (note 1) t_p = 25 μs; δ = 0.5; T_{mb} = 135 °C	I_{FRM}	max.	20	A
Non-repetitive peak forward current (per device) half sinewave ; T_j = 125 °C prior to surge; with reapplied $V_{RWM\ max}$				
t=10ms	I_{FSM}	max.	135	A
t=8.3ms	I_{FSM}	max.	150	A
I^2t for fusing (t=10ms; per device)	I^2t	max.	93	A^2s
Reverse surge current (per diode)				
t_p = 2 μs; δ = 0.001	I_{RRM}	max.	1.0	A
t_p = 100 μs	I_{RSM}	max.	1.0	A

Temperatures

Storage temperature	T_{stg}		−65 to +175	°C
Junction temperature	T_j	max.	150	°C

CHARACTERISTICS (per diode)

Forward voltage (note 2)				
I_F=10A; T_j=125 °C	V_F	<	0.57	V
I_F=20A; T_j=125 °C	V_F	<	0.72	V
I_F=20A; T_j= 25 °C	V_F	<	0.84	V
Reverse current				
V_R=$V_{RWM\ max}$; T_j=125 °C	I_R	<	15	mA
V_R=$V_{RWM\ max}$; T_j= 25 °C	I_R	<	0.1	mA

Notes:
1. At rated reverse voltage V_R.
2. Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

From junction to mounting base (both diodes conducting)	$R_{th\ j\text{-}mb}$	=	1.0	K/W
From junction to mounting base (per diode)	$R_{th\ j\text{-}mb}$	=	2.0	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	$R_{th\ mb\text{-}h}$	=	0.5	K/W
b. with heatsink compound and 0.06mm maximum mica insulator	$R_{th\ mb\text{-}h}$	=	1.4	K/W
c. with heatsink compound and 0.1mm maximum mica insulator (56369)	$R_{th\ mb\text{-}h}$	=	2.2	K/W
d. with heatsink compound and 0.25mm 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 value 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 device lead length and with copper laminate on the board	$R_{th\ j\text{-}a}$	=	60	K/W

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 4.7mm from the seal.
2. The leads should not be bent less than 2.4mm from the seal, and should be supported during bending. The bend radius must be no less than 1.0mm.
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.

SQUARE-WAVE OPERATION

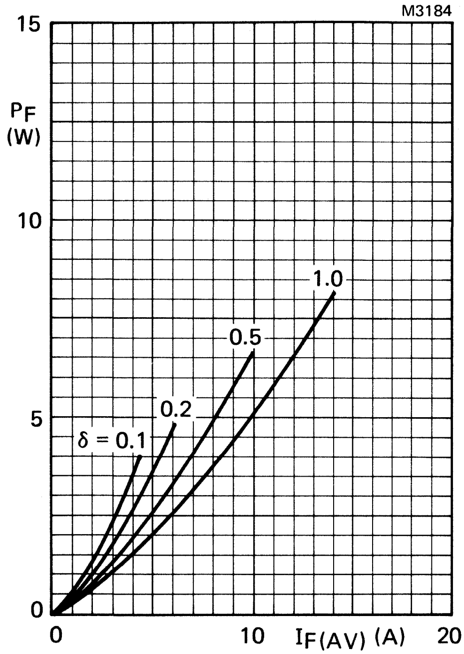
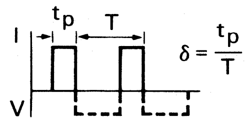


Fig.2 Forward current power rating; per diode.



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

SINUSOIDAL OPERATION

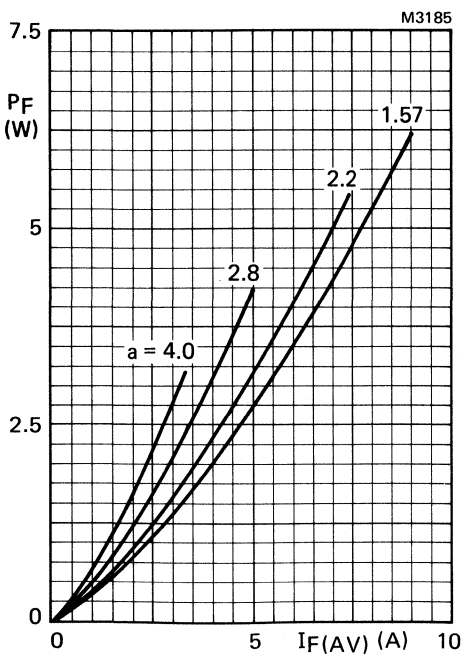


Fig.3 Forward current power rating; per diode.

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

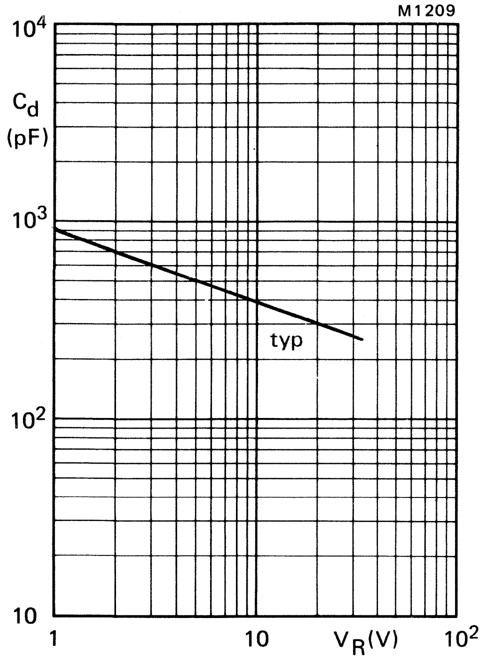


Fig.4 Typical junction capacitance at f = 1 MHz; per diode; T_j = 25 to 125 °C.

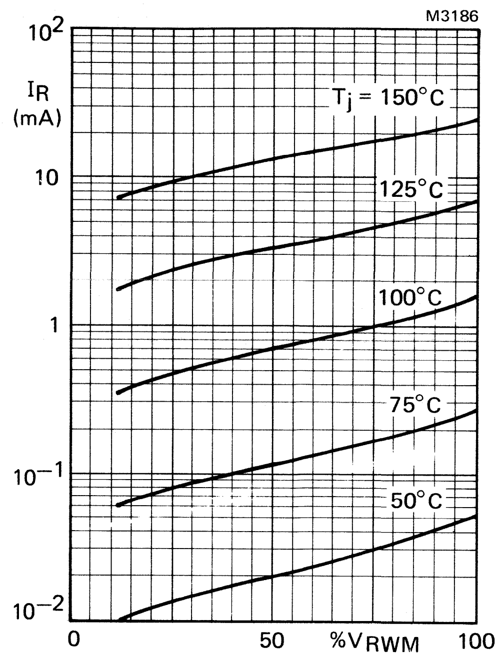


Fig.5 Typical values; per diode.

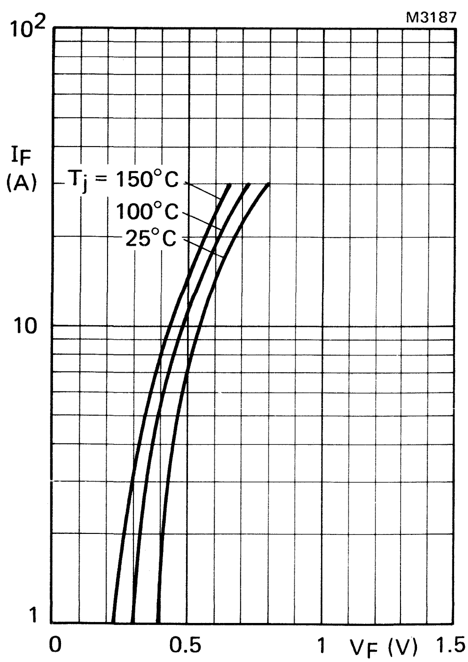


Fig.6 Typical forward voltage; per diode.

SCHOTTKY-BARRIER DOUBLE RECTIFIER DIODES

Low-leakage platinum-barrier double rectifier diodes in SOT-186 (full-pack) plastic envelopes featuring low forward voltage drop, low capacitance and absence of stored charge. 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 switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and absence of stored charge are essential. Their single chip (monolithic) construction allows both diodes to be paralleled without the need for derating. They can also withstand reverse voltage transients and have guaranteed reverse avalanche surge capability. The series consists of common-cathode types.

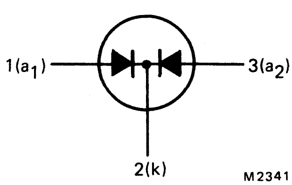
QUICK REFERENCE DATA

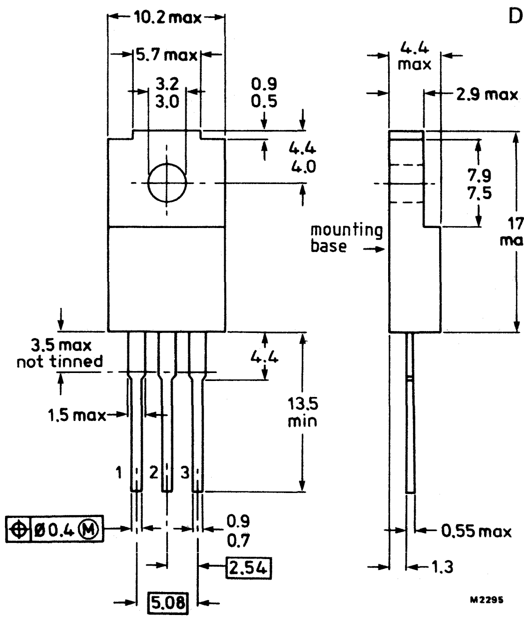
Per diode, unless otherwise stated			PBYR2035CTF	2040CTF	2045CTF	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Output current (both diodes conducting)	I_O	max.		20		A
Forward voltage	V_F	<		0.57		V
Junction temperature	T_j	max.		150		°C

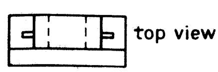
MECHANICAL DATA

Dimensions in mm

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







Net mass: 2 g.
The mounting base 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 (per diode)			PBYR2035CTF	2040CTF	2045CTF	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Crest working reverse voltage	V_{RWM}	max.	35	40	45	V
Continuous reverse voltage	V_R	max.	35	40	45	V

Currents

Average forward current square wave; $\delta = 0.5$; up to $T_h = 82\ ^oC$ (note 1)				
per diode	$I_{F(AV)}$	max.	10	A
per device	I_O	max.	20	A
Repetitive peak forward current per diode (note 1) $t_p = 25\ \mu s$; $\delta = 0.5$; $T_h = 82\ ^oC$	I_{FRM}	max.	20	A
Non-repetitive peak forward current (per device) half sinewave; $T_j = 125\ ^oC$ prior to surge; with reapplied $V_{RWM\ max}$				
$t = 10$ ms	I_{FSM}	max.	135	A
$t = 8.3$ ms	I_{FSM}	max.	150	A
I^2t for fusing ($t = 10$ ms; per device)	I^2t	max.	93	A^2s
Reverse surge current (per diode)				
$t_p = 2\ \mu s$; $\delta = 0.001$	I_{RRM}	max.	1.0	A
$t_p = 100\ \mu s$	I_{RSM}	max.	1.0	A

Temperatures

Storage temperature	T_{stg}		−65 to +175	^oC
Junction temperature	T_j	max.	150	^oC

CHARACTERSTICS (per diode)

Forward voltage (note 2)				
$I_F = 10$ A; $T_j = 125\ ^oC$	V_F	$<$	0.57	V
$I_F = 20$ A; $T_j = 125\ ^oC$	V_F	$<$	0.72	V
$I_F = 20$ A; $T_j = 25\ ^oC$	V_F	$<$	0.84	V
Reverse current				
$V_R = V_{RWM\ max}$; $T_j = 125\ ^oC$	I_R	$<$	15	mA
$V_R = V_{RWM\ max}$; $T_j = 25\ ^oC$	I_R	$<$	0.1	mA

ISOLATION

Isolation voltage from all terminals to external heatsink (peak value) (note 3)	$V_{(isol)M}$	max.	1500	V
Isolation capacitance between all terminals and external heatsink	$C_{(isol)}$	typ.	12	pF

Notes:

1. At rated reverse voltage V_R.
2. Measured under pulse conditions to avoid excessive dissipation.
3. Repetitive peak operation with RH $\leqslant$ 65% under clean and dust-free conditions.

THERMAL RESISTANCE

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

a. both diodes conducting with heatsink compound	$R_{th\ j\text{-}h}$	=	5.0	K/W
b. per diode with heatsink compound	$R_{th\ j\text{-}h}$	=	5.9	K/W

Free air operation

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

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

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 mounting base 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.2.

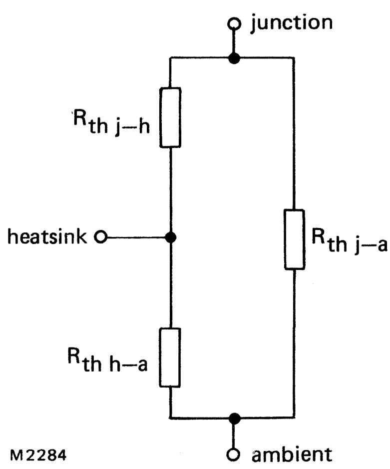


Fig.2.

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

SCHOTTKY-BARRIER DOUBLE RECTIFIER DIODES

Low-leakage platinum-barrier double rectifier diodes in plastic envelopes, featuring low forward voltage drop, low capacitance, and absence of stored charge. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and zero switching losses are important. Their single chip (monolithic) construction allows both diodes to be paralleled without the need for derating. They can also withstand reverse voltage transients and have guaranteed reverse avalanche surge capability.
The series consists of common-cathode types.

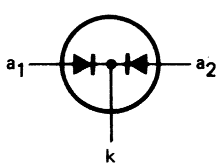
QUICK REFERENCE DATA

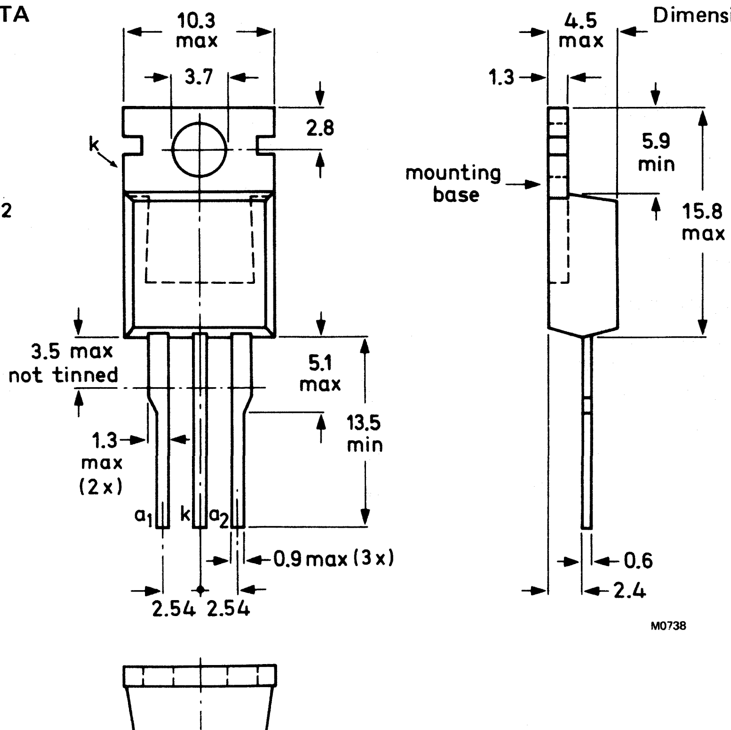
Per diode, unless otherwise stated			PBYR2535CT	2540CT	2545CT	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Output current (both diodes conducting)	I_O	max.		30		A
Forward voltage	V_F	<		0.73		V
Junction temperature	T_j	max.		150		°C

MECHANICAL DATA

Fig.1 TO-220AB.

Dimensions in mm





Net mass: 2 g.
Note: the exposed metal mounting base is directly connected to the common cathode.
Accessories supplied on request: see data sheets Mounting instructions and accessories for TO-220 envelopes.

RATINGS

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

Voltages (per diode)			PBYR2535CT	2540CT	2545CT	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Crest working reverse voltage	V_{RWM}	max.	35	40	45	V
Continuous reverse voltage	V_R	max.	35	40	45	V

Currents				
Average forward current square wave; δ = 0.5; up to T_h = 130 °C (note 1)				
per diode	$I_{F(AV)}$	max.	15	A
per device	I_O	max.	30	A
Repetitive peak forward current per diode (note 1) t_p = 25 μs; δ = 0.5, T_h = 130 °C	I_{FRM}	max.	30	A
Non-repetitive peak forward current (per device) half sinewave; T_j = 125 °C prior to surge with reapplied $V_{RWM\,max}$				
t = 10 ms	I_{FSM}	max.	135	A
t = 8.3 ms	I_{FSM}	max.	150	A
I^2t for fusing (t = 10 ms; per device)	I^2t	max.	93	A^2s
Reverse surge current (per diode)				
t_p = 2 μs; δ = 0.001	I_{RRM}	max.	1.0	A
t_p = 100 μs	I_{RSM}	max.	1.0	A

Temperatures				
Storage temperature	T_{stg}		−65 to +175	°C
Junction temperature	T_j	max.	150	°C

CHARACTERISTICS (per diode)

Forward voltage (note 2)				
I_F = 30 A; T_j = 125 °C	V_F	$<$	0.73	V
I_F = 30 A; T_j = 25 °C	V_F	$<$	0.82	V
Reverse current				
$V_R = V_{RWM\,max}$; T_j = 125 °C	I_R	$<$	40	mA
$V_R = V_{RWM\,max}$; T_j = 25 °C	I_R	$<$	0.2	mA

Notes:

1. At rated reverse voltage V_R.
2. Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

From junction to mounting base (both diodes conducting)	$R_{th\ j\text{-}mb}$	=	1.0	K/W
From junction to mounting base (per diode)	$R_{th\ j\text{-}mb}$	=	1.5	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	$R_{th\ mb\text{-}h}$	=	0.5	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 insulator (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 value 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 device lead length and with copper laminate on the board — $R_{th\ j\text{-}a}$ = 60 K/W

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 ^{o}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.

SQUARE-WAVE OPERATION

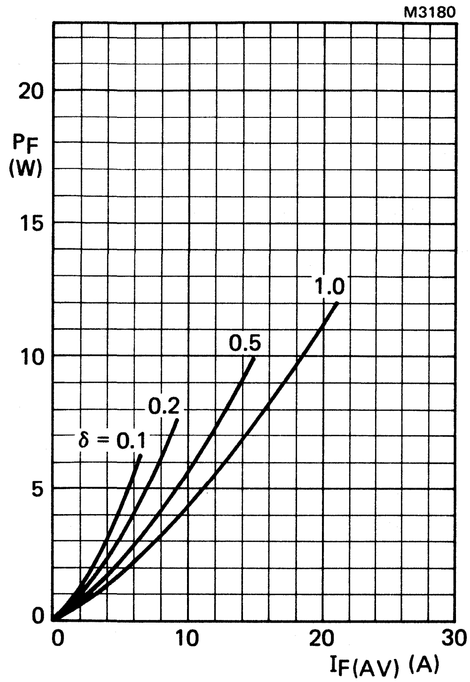
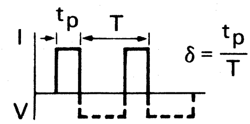


Fig.2 Forward current power rating; per diode.



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

SINUSOIDAL OPERATION

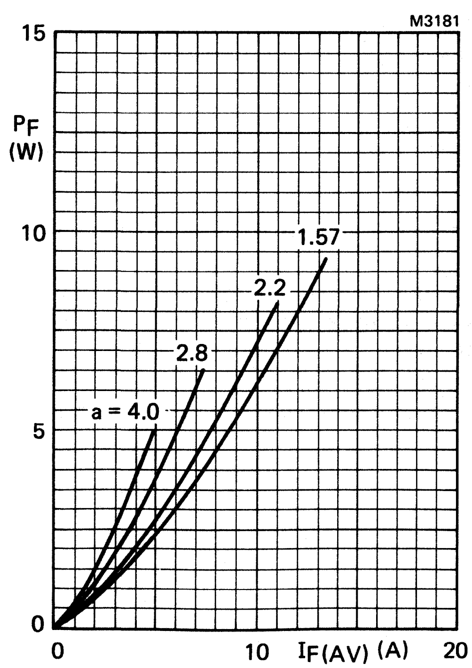


Fig.3 Forward current power rating; per diode.

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

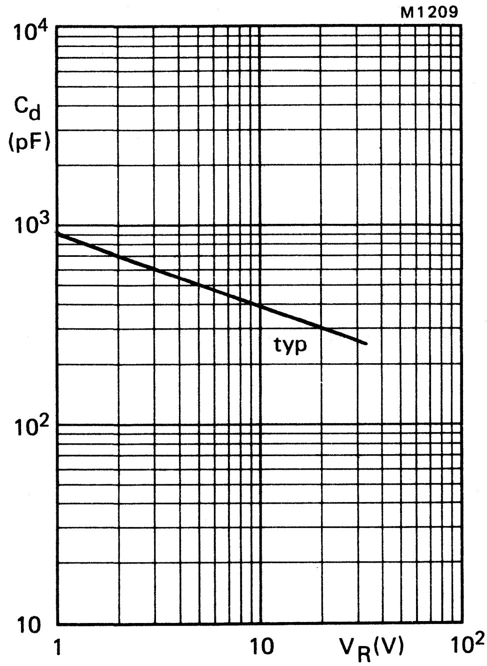


Fig.4 Typical junction capacitance at f = 1 MHz; per diode; T_j = 25 to 125 °C.

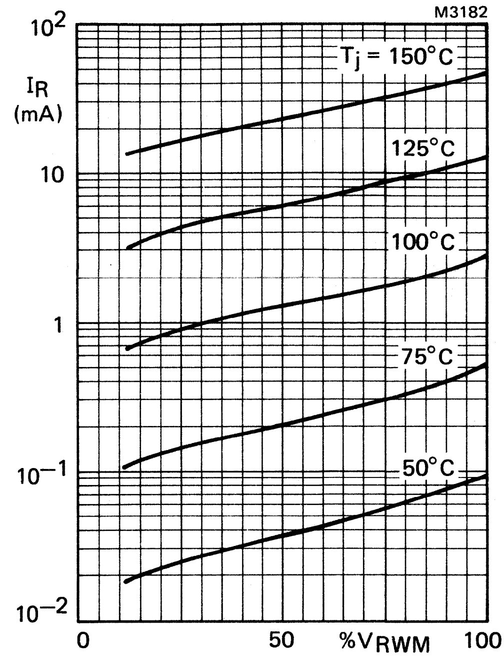


Fig.5 Typical values; per diode.

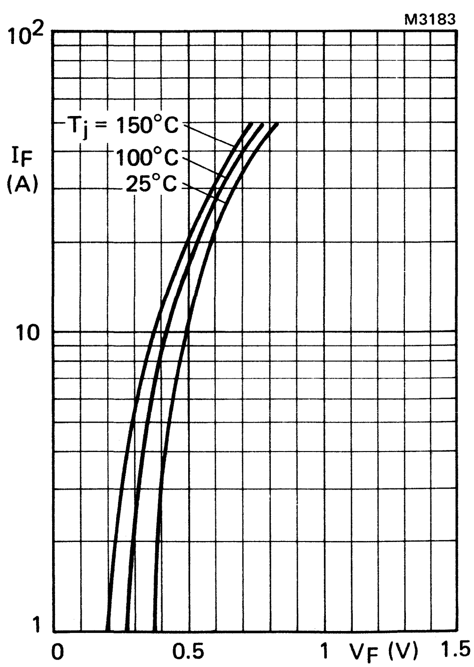


Fig.6 Typical forward voltage; per diode.

SCHOTTKY-BARRIER DOUBLE RECTIFIER DIODES

Low-leakage platinum-barrier double rectifier diodes in SOT-186 (full-pack) plastic envelopes featuring low forward voltage drop, low capacitance and absence of stored charge. 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 switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and absence of stored charge are essential. Their single chip (monolithic) construction allows both diodes to be paralleled without the need for derating. They can also withstand reverse voltage transients and have guaranteed reverse avalanche surge capability. The series consists of common-cathode types.

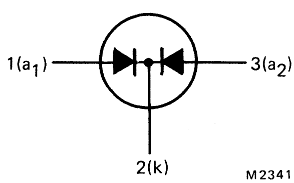
QUICK REFERENCE DATA

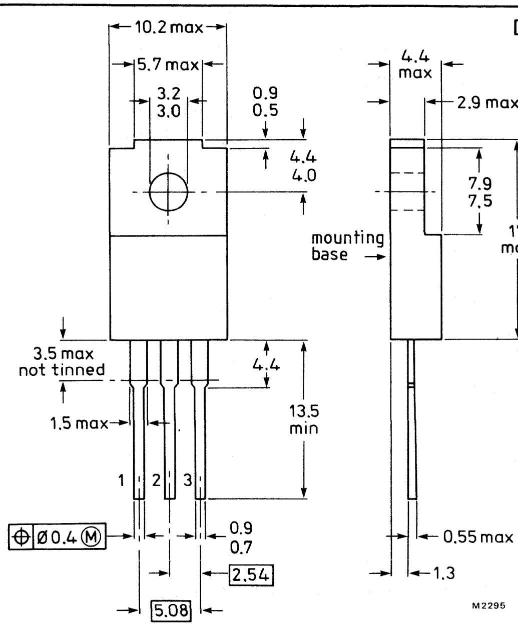
Per diode, unless otherwise stated			PBYR2535CTF	2540CTF	2545CTF	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Output current (both diodes conducting)	I_O	max.		20		A
Forward voltage	V_F	<		0.51		V
Junction temperature	T_j	max.		150		°C

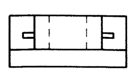
MECHANICAL DATA

Dimensions in mm

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







Net mass: 2 g.
The mounting base 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 (per diode)			PBYR2535CTF	2540CTF	2545CTF	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Crest working reverse voltage	V_{RWM}	max.	35	40	45	V
Continuous reverse voltage	V_R	max.	35	40	45	V

Currents				
Average forward current square wave; $\delta = 0.5$; up to $T_h = 100\ ^oC$ (note 1)				
per diode	$I_{F(AV)}$	max.	15	A
per device	I_O	max.	20	A
Repetitive peak forward current per diode (note 1)				
$t_p = 25\ \mu s$; $\delta = 0.5$; $T_h = 100\ ^oC$	I_{FRM}	max.	30	A
Non-repetitive peak forward current (per device) half sinewave; $T_j = 125\ ^oC$ prior to surge; with reapplied $V_{RWM\ max}$				
t = 10 ms	I_{FSM}	max.	135	A
t = 8.3 ms	I_{FSM}	max.	150	A
I^2t for fusing (t = 10 ms; per device)	I^2t	max.	93	A^2s
Reverse surge current (per diode)				
$t_p = 2\ \mu s$; $\delta = 0.001$	I_{RRM}	max.	1.0	A
$t_p = 100\ \mu s$	I_{RSM}	max.	1.0	A
Temperatures				
Storage temperature	T_{stg}		−65 to +175	^oC
Junction temperature	T_j	max.	150	^oC

CHARACTERSTICS (per diode)

Forward voltage (note 2)				
$I_F = 20$ A; $T_j = 125\ ^oC$	V_F	<	0.51	V
$I_F = 20$ A; $T_j = 25\ ^oC$	V_F	<	0.68	V
Reverse current				
$V_R = V_{RWM\ max}$; $T_j = 125\ ^oC$	I_R	<	40	mA
$V_R = V_{RWM\ max}$; $T_j = 25\ ^oC$	I_R	<	0.2	mA

ISOLATION

Isolation voltage from all terminals to external heatsink (peak value) (note 3)	$V_{(isol)M}$	max.	1500	V
Isolation capacitance between all terminals and external heatsink	$C_{(isol)}$	typ.	12	pF

Notes:

1. At rated reverse voltage V_R.
2. Measured under pulse conditions to avoid excessive dissipation.
3. Repetitive peak operation with RH $\leqslant$ 65% under clean and dust-free conditions.

THERMAL RESISTANCE

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

a. both diodes conducting with heatsink compound	$R_{th\ j\text{-}h}$	=	4.0	K/W
b. per diode with heatsink compound	$R_{th\ j\text{-}h}$	=	4.8	K/W

Free air operation

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

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

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 ^{o}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 mounting base 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.2.

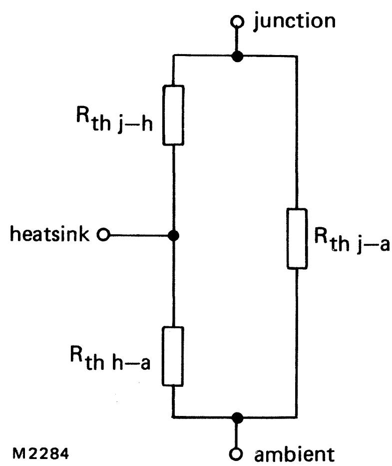


Fig.2.

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

SCHOTTKY–BARRIER DOUBLE RECTIFIER DIODES

Low-leakage platinum-barrier double rectifier diodes in plastic envelopes, featuring low forward voltage drop, low capacitance, and absence of stored charge. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and zero switching losses are important. Their single chip (monolithic) construction allows both diodes to be paralleled without the need for derating. They can also withstand reverse voltage transients and have guaranteed reverse avalanche surge capability.
The series consists of common-cathode types.

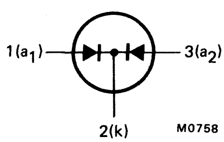
QUICK REFERENCE DATA

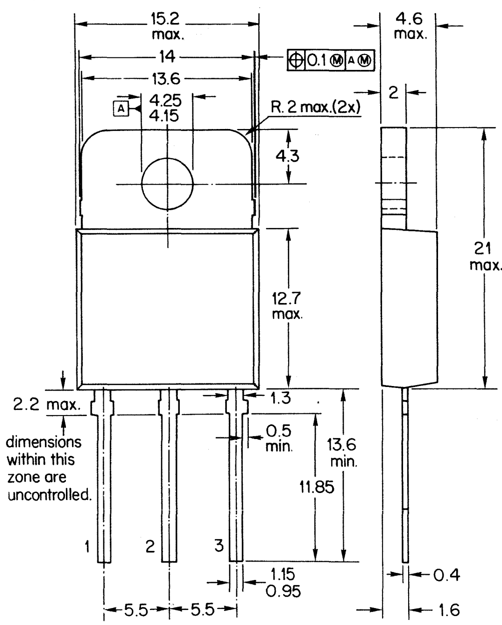
Per diode, unless otherwise stated			PBYR3035PT	3040PT	3045PT	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Output current (both diodes conducting)	I_O	max.		30		A
Forward voltage	V_F	<		0.60		V
Junction temperature	T_j	max.		150		°C

MECHANICAL DATA

Fig.1 SOT-93.

Dimensions in mm.





Net mass: 5 g.
Note: the exposed metal mounting base is directly connected to the common cathode.
Accessories supplied on request: see data sheets Mounting instructions and accessories for SOT-93 envelopes.

RATINGS

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

Voltages (per diode)			PBYR3035PT	3040PT	3045PT	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Crest working reverse voltage	V_{RWM}	max.	35	40	45	V
Continuous reverse voltage	V_R	max.	35	40	45	V

Currents

Average forward current				
square wave; δ = 0.5; up to T_{mb} = 130 °C (note 1)				
per diode	$I_{F(AV)}$	max.	15	A
per device	I_O	max.	30	A
Repetitive peak forward current per diode (note 1)				
t_p = 25 μs; δ = 0.5; T_{mb} = 130 °C	I_{FRM}	max.	30	A
Non-repetitive peak forward current (per device)				
half sinewave ; T_j = 125 °C prior to				
surge; with reapplied $V_{RWM\ max}$				
t=10ms	I_{FSM}	max.	180	A
t=8.3ms	I_{FSM}	max.	200	A
I^2t for fusing (t=10ms; per device)	I^2t	max.	165	A^2s
Reverse surge current (per diode)				
t_p = 2 μs; δ = 0.001	I_{RRM}	max.	2.0	A
t_p = 100 μs	I_{RSM}	max.	2.0	A

Temperatures

Storage temperature	T_{stg}		−65 to +175	°C
Junction temperature	T_j	max.	150	°C

CHARACTERISTICS (per diode)

Forward voltage (note 2)				
I_F=20A; T_j=125 °C	V_F	<	0.60	V
I_F=30A; T_j=125 °C	V_F	<	0.72	V
I_F=30A; T_j= 25 °C	V_F	<	0.76	V
Reverse current				
V_R=$V_{RWM\ max}$; T_j=125 °C	I_R	<	100	mA
V_R=$V_{RWM\ max}$; T_j= 25 °C	I_R	<	1.0	mA

Notes:
1. At rated reverse voltage V_R.
2. Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

From junction to mounting base (both diodes conducting)	$R_{th\ j\text{-}mb}$	=	1.0	K/W
From junction to mounting base (per diode)	$R_{th\ j\text{-}mb}$	=	1.4	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	$R_{th\ mb\text{-}h}$	=	0.2	K/W
b. with heatsink compound and 0.06mm maximum mica insulator (56378)	$R_{th\ mb\text{-}h}$	=	1.4	K/W
c. with heatsink compound and 0.1mm maximum mica insulator	$R_{th\ mb\text{-}h}$	=	2.2	K/W
d. with heatsink compound and 0.25mm maximum alumina insulator	$R_{th\ mb\text{-}h}$	=	0.8	K/W
e. without heatsink compound	$R_{th\ mb\text{-}h}$	=	1.4	K/W

2. Free air operation

The quoted value 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 device lead length and with copper laminate on the board — $R_{th\ j\text{-}a}$ = 40 K/W

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 4.7mm from the seal.
2. The leads should not be bent less than 2.4mm from the seal, and should be supported during bending. The bend radius must be no less than 1.0mm.
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 M4 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.

SQUARE-WAVE OPERATION

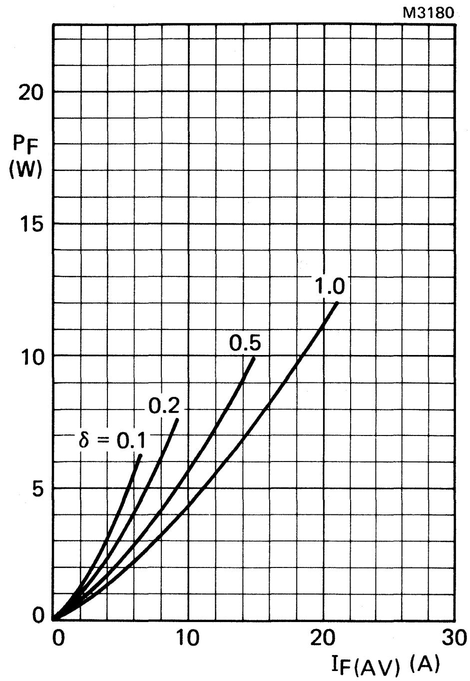
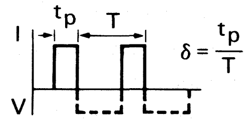


Fig.2 Forward current power rating; per diode.



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

SINUSOIDAL OPERATION

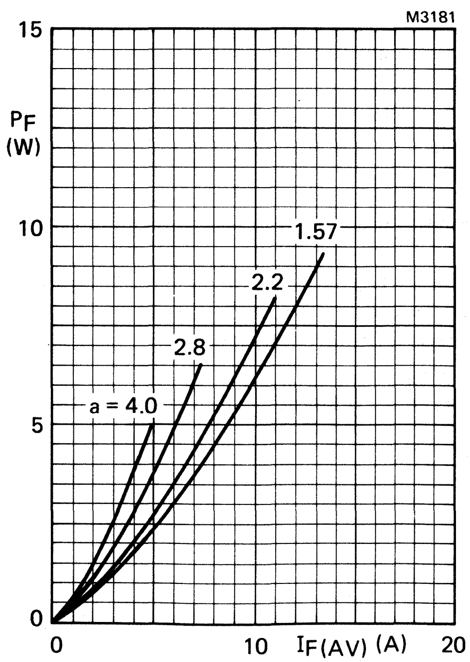


Fig.3 Forward current power rating; per diode.

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

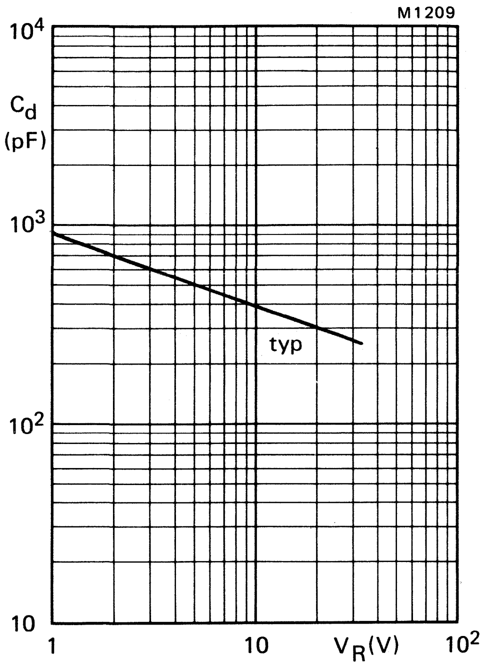


Fig.4 Typical junction capacitance at f = 1 MHz; per diode; T_j = 25 to 125 °C.

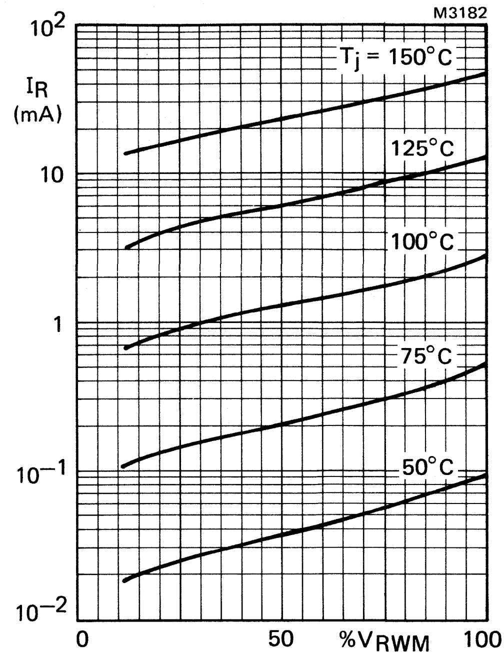


Fig.5 Typical values; per diode.

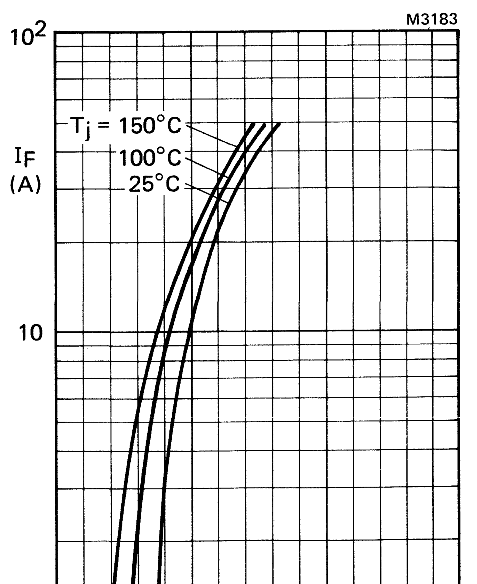


Fig.6 Typical forward voltage; per diode.

SCHOTTKY-BARRIER DOUBLE RECTIFIER DIODES

Low-leakage, platinum-barrier double rectifier diodes in ISOTOP envelopes, featuring low forward voltage drop, low capacitance and absence of stored charge. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and low switching losses are essential.
They can withstand reverse voltage transients and have guaranteed reverse avalanche surge capability.

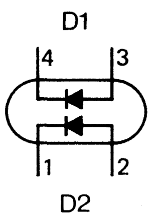
QUICK REFERENCE DATA

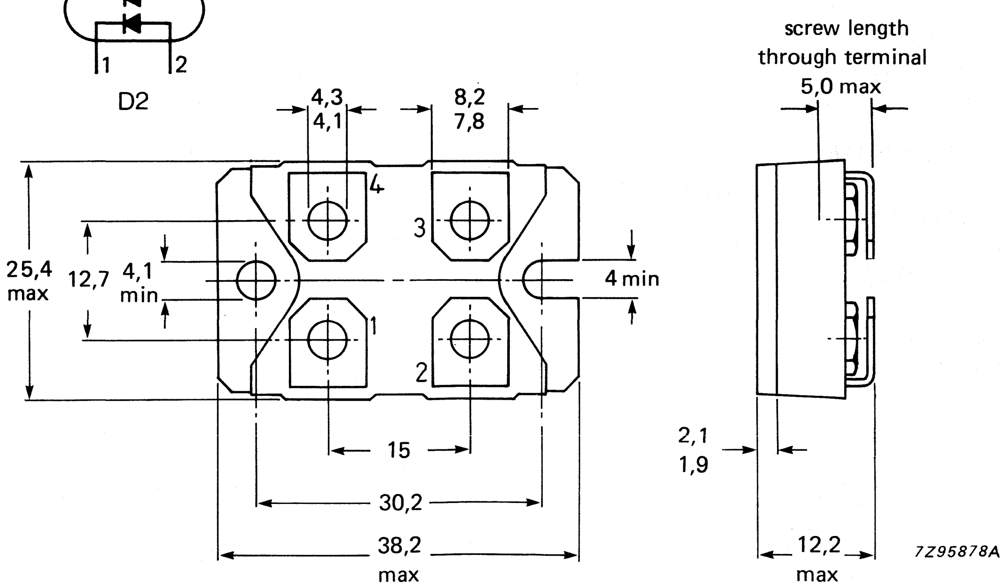
			PBYR12035	40	45TV	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Average forward current	$I_{F(AV)}$	max.		2 x 60		A
Forward voltage	V_F	<		0.67		V
Junction temperature	T_j	max.		150		°C

MECHANICAL DATA

Dimensions in mm

Fig.1 SOT-227B.
Types with Faston terminals are available on request (see overleaf).





Baseplate is electrically isolated.
Isolation voltage: 2500 V RMS.
Capacitance: 45 pF.

Supplied with device: 4 x M4 screws.

RATINGS

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

			PBYR12035	40	45TV	
Voltages						
Repetitive peak reverse voltage	V_{RRM}		35	40	45	V
Crest working reverse voltage	V_{RWM}		35	40	45	V
Continuous reverse voltage	V_R		35	40	45	V
Currents (per diode)						
Average forward current square wave; $\delta = 0.5$; up to $T_{mb} = 90\ ^oC$	$I_{F(AV)}$	max.	60			A
RMS forward current	$I_{F(RMS)}$	max.	85			A
Repetitive peak forward current $t_p = 20\ \mu s$; $\delta = 0.02$	I_{FRM}	max.	652			A
Non-repetitive peak forward current half sinewave ; $T_j = 125\ ^oC$ prior to surge; with reapplied $V_{RWM\ max}$						
$t = 10$ ms	I_{FSM}	max.	600			A
$t = 8.3$ ms	I_{FSM}	max.	720			A
I^2t for fusing ($t = 10$ ms)	I^2t	max.	1800			A^2s
Reverse surge current						
$t_p = 100\ \mu s$	I_{RSM}	max.	2.0			A
$t_p = 2\ \mu s$	I_{RRM}	max.	2.0			A
Temperatures						
Storage temperature	T_{stg}		−40 to +150			^oC
Junction temperature	T_j	max.	150			^oC

ORDERING NOTE

Types with Faston terminals are available on request (see Fig.2).
Omit suffix V from the type number when ordering, e.g. PBYR12045T

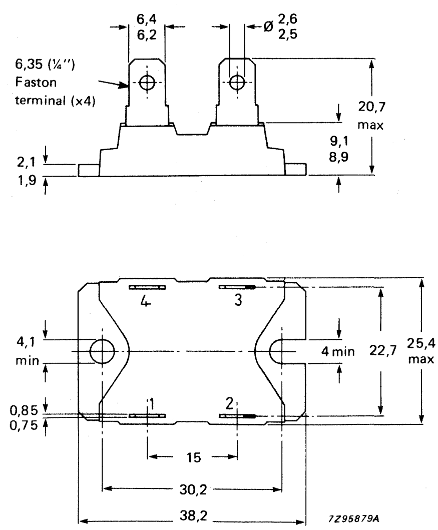
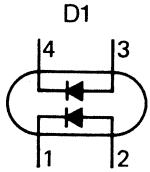


Fig.2 SOT-227A.
Dimensions in mm.



THERMAL RESISTANCE

From junction to mounting base per diode	$R_{th\ j\text{-}mb}$	=	1.2	K/W
From junction to mounting base total	$R_{th\ j\text{-}mb}$	=	0.65	K/W
From mounting base to heatsink with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.1	K/W

CHARACTERISTICS (per diode)

Forward voltage				
I_F = 60 A; T_j = 150 °C	V_F	<	0.67	V*
I_F = 120 A; T_j = 25 °C	V_F	<	0.96	V*
Reverse current				
$V_R = V_{RWMmax}$; T_j = 125 °C	I_R	<	150	mA
$V_R = V_{RWMmax}$; T_j = 25 °C	I_R	<	2.0	mA
Capacitance at f = 1 MHz				
V_R = 5 V; T_j = 25 to 125 °C	C_d	typ.	2100	pF

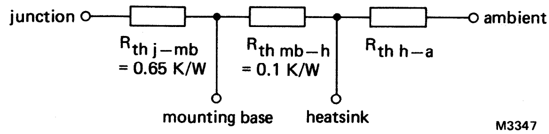
DEVELOPMENT DATA

*Measured under pulse conditions to avoid excessive dissipation.

OPERATING NOTES

Dissipation and Heatsink Calculations

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



Overall thermal resistance, $R_{th\ j\text{-}a} = R_{th\ j\text{-}mb} - R_{th\ mb\text{-}h} - R_{th\ h\text{-}a}$

To choose a suitable heatsink, the following information is required:

(i) maximum operating ambient temperature
(ii) duty cycle or form factor of foward current (δ or a)
(iii) average forward current
(iv) crest working reverse voltage (V_{RWM})

The total power dissipation in the diode has two components:

P_R — reverse leakage dissipation
P_F — forward conduction dissipation

$$P_{tot} = P_R + P_F \quad \ldots\ldots\ldots\ldots \quad 1).$$

From the above it can be seen that:

$$R_{th\ h\text{-}a} = \frac{T_{jmax} - T_{amb}}{P_R + P_F} - (R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h}) \quad \ldots\ldots\ldots\ldots \quad 2).$$

The value of $R_{th\ j\text{-}mb}$ and $R_{th\ mb\text{-}h}$ can be found under Thermal Resistance. P_R and P_F are derived from Figs.3 and 4 for square-wave operation (and Figs.5 and 6 for sinewave) as follows:
Starting at the V_{RWM} axis of Fig.3 (or Fig.5), and from a knowledge of the required V_{RWM}, trace upwards to meet the curve that matches the required T_{jmax}. From this point trace horizontally left until the curve of the voltage grade of the device being used is met. From this point trace downwards to meet the required duty cycle (δ) or form factor (a). From this point trace right and read the actual reverse power dissipation on the P_R axis.
Forward conduction dissipation (P_F) for the known average current $I_{F(AV)}$ and duty cycle (or form factor) is easily derived from Fig.4 (or Fig.6).
Substituting the values of P_R and P_F into equation 2) enables the calculation of the required heatsink.

To ensure thermal stability, $(R_{th\ j\text{-}mb} + R_{th\ mb\text{-}h} + R_{th\ h\text{-}a}) \times P_R$ must be less than 12 °C. If the calculated value of $R_{th\ h\text{-}a}$ does not permit this, then it must be reduced (heatsink size increased or $R_{th\ mb\text{-}h}$ improved) to enable this criterion to be met.

EXAMPLE: square-wave operation, using PBYR12035TV and heatsink compound;
T_{amb} = 40 °C; δ = 0.5; $I_{F(AV)}$ = 30 A
V_{RWM} = 12 V; voltage grade of device = 35 V
From data, $R_{th\ j\text{-}mb}$ = 0.65 K/W and $R_{th\ mb\text{-}h}$ = 0.1 K/W.
From Fig.4, it is found that P_F = 18 W
If the desired T_{jmax} is chosen to be 130 °C, then, from Fig.3, P_R = 0.9 W
Using equation 2) we have:

$$R_{th\ h\text{-}a} = \frac{130\ ^{\circ}C - 40\ ^{\circ}C}{18\ W + 0.9\ W} - (0.65 + 0.1) = 3.6\ K/W$$

To check for thermal stability:

$$(R_{th\ j\text{-}a}) \times P_R = (0.65 + 0.1 + 3.6) \times 0.9 = 3.9\ ^{\circ}C.$$

This is less than 12 °C, hence thermal stability is ensured.

SQUARE-WAVE OPERATION (Figs.3 and 4)

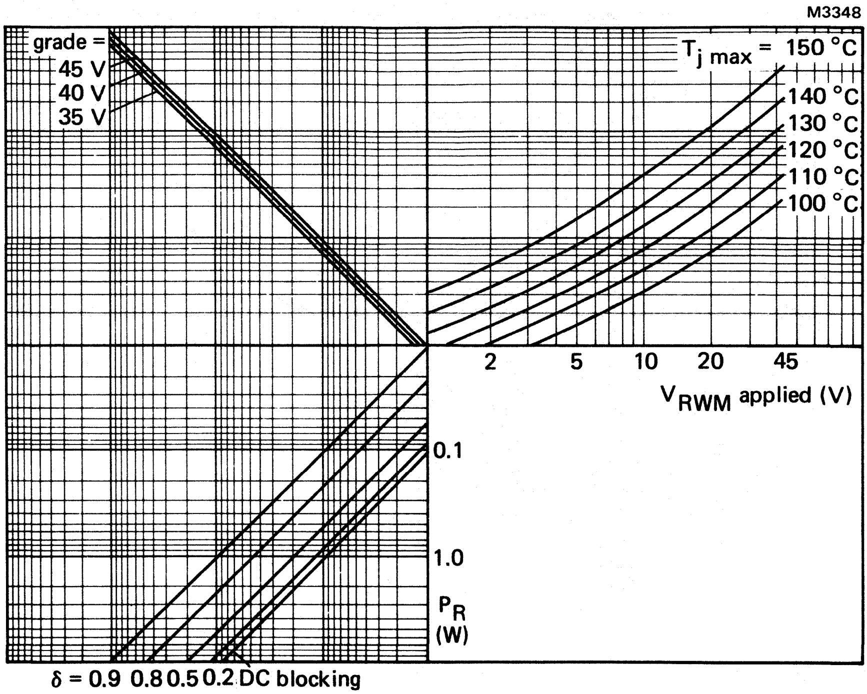
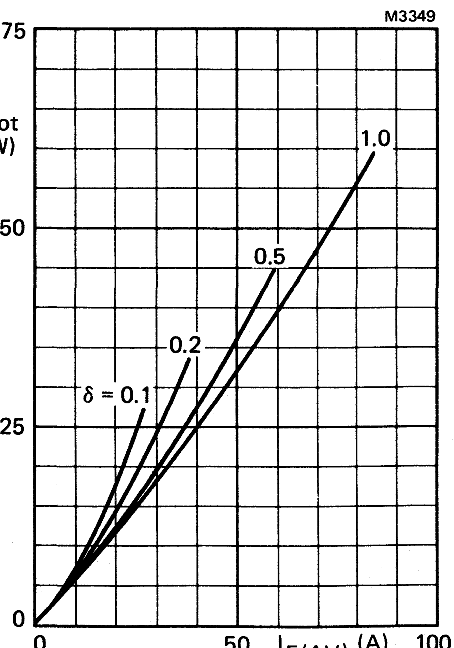
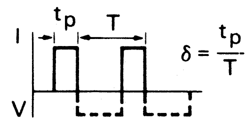


Fig.3 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and duty cycle; per diode.





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

Fig.4 Foward current power rating; per diode.

DEVELOPMENT DATA

SINEWAVE OPERATION (Figs.5 and 6)

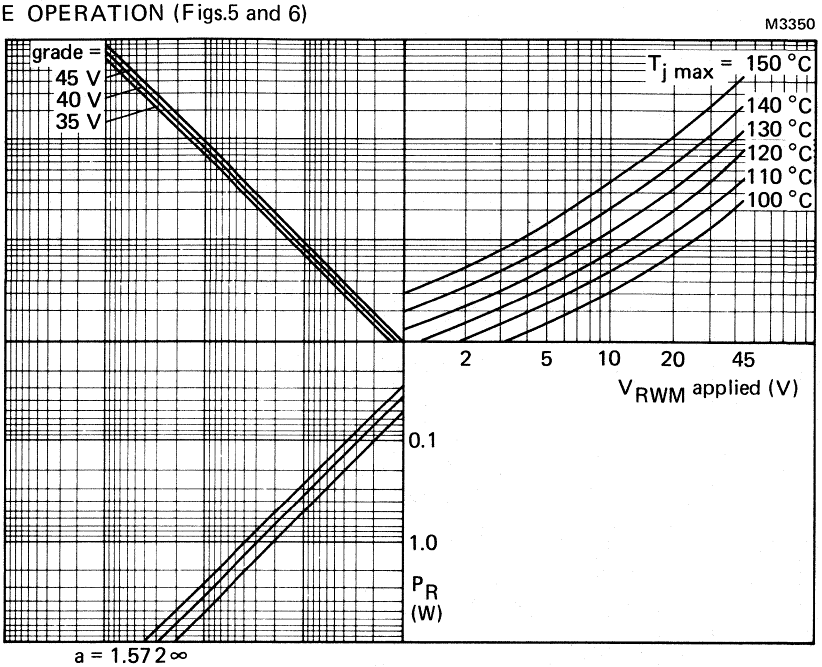


Fig.5 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and form factor; per diode.

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

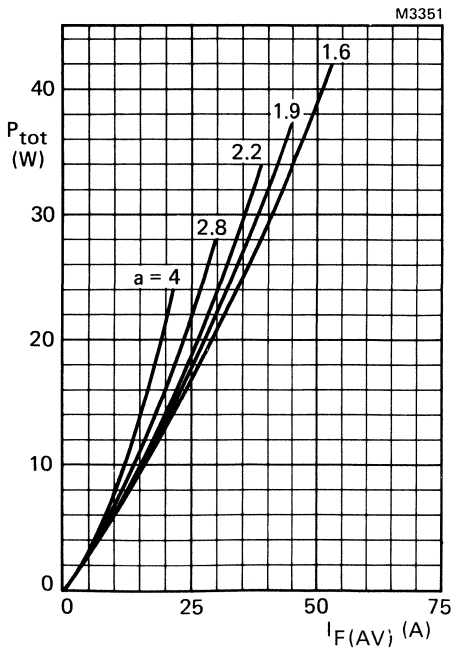


Fig.6 Foward current power rating; per diode.

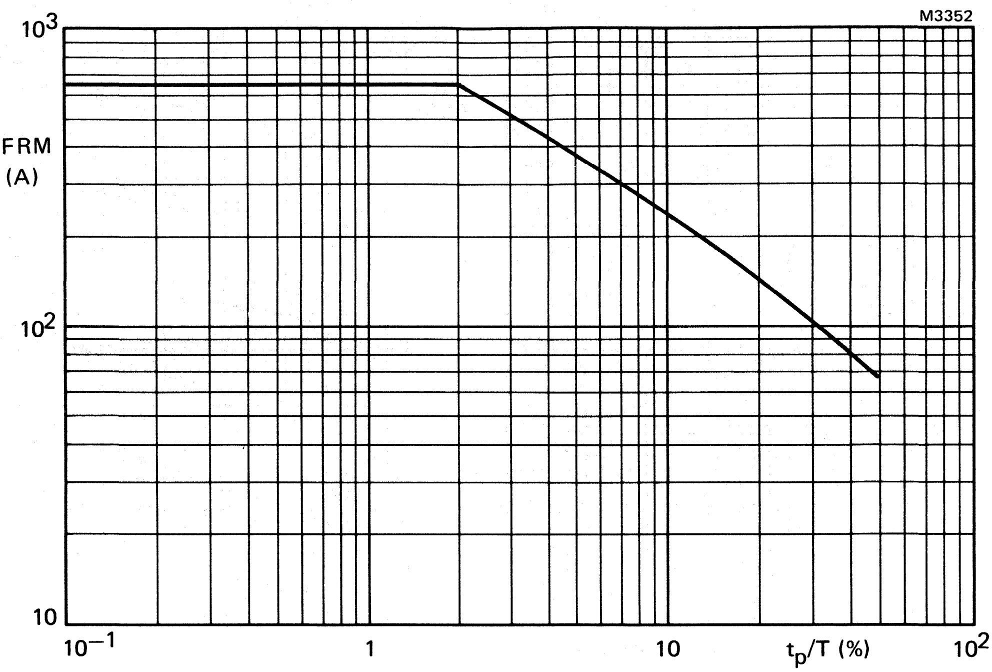
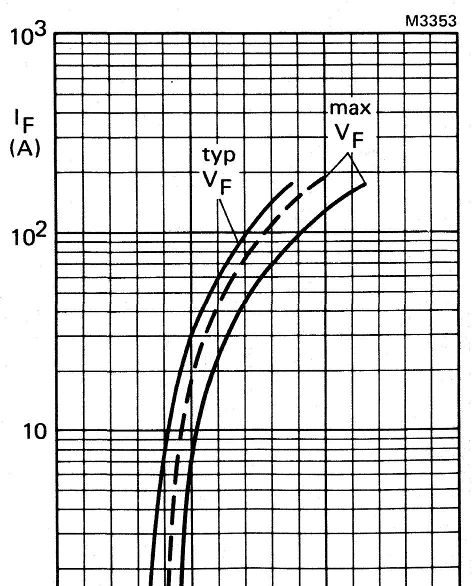
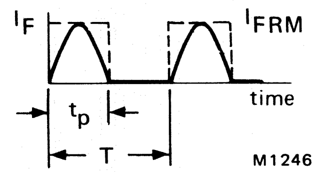


Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 $\mu s < t_p < 1$ ms; per diode.





Definition of I_{FRM} and t_p/T.

Fig.8 Forward voltage; per diode;
—— T_j = 25 °C; – – – T_j = 100 °C.

DEVELOPMENT DATA

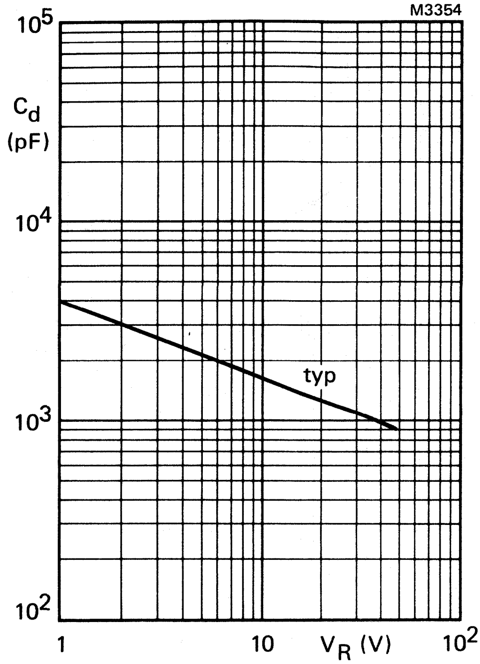


Fig.9 f = 1 MHz; T_j = 25 to 125 °C; per diode.

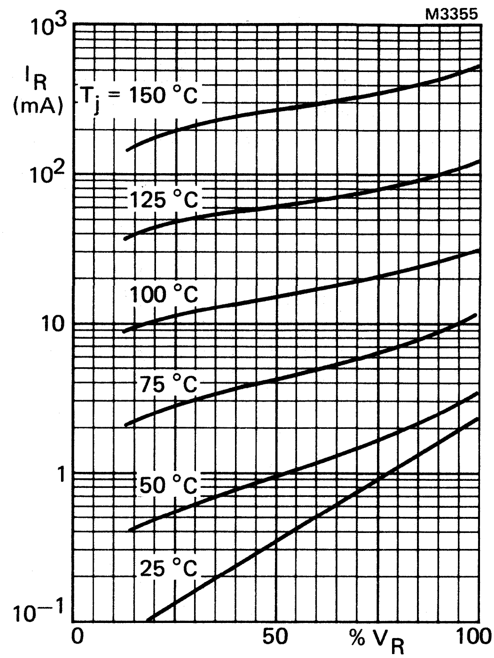


Fig.10 Typical values; per diode.

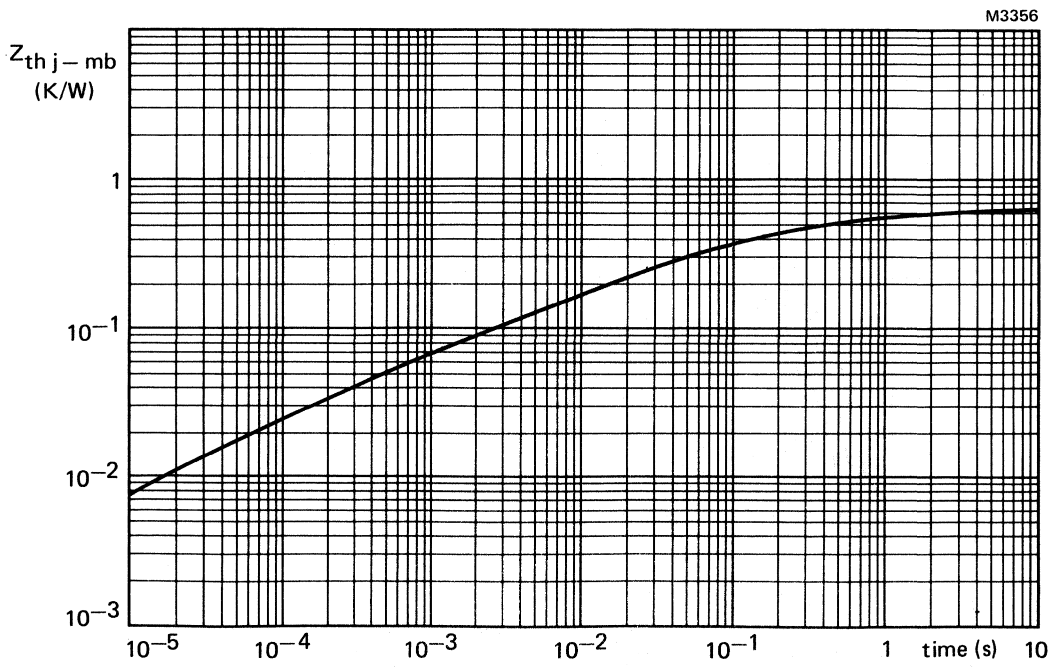


Fig.11 Transient thermal impedance; both diodes conducting.

SCHOTTKY-BARRIER DOUBLE RECTIFIER DIODES

Low-leakage, platinum-barrier double rectifier diodes in ISOTOP envelopes, featuring low forward voltage drop, low capacitance and absence of stored charge. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and low switching losses are essential.
They can withstand reverse voltage transients and have guaranteed reverse avalanche surge capability.

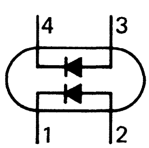
QUICK REFERENCE DATA

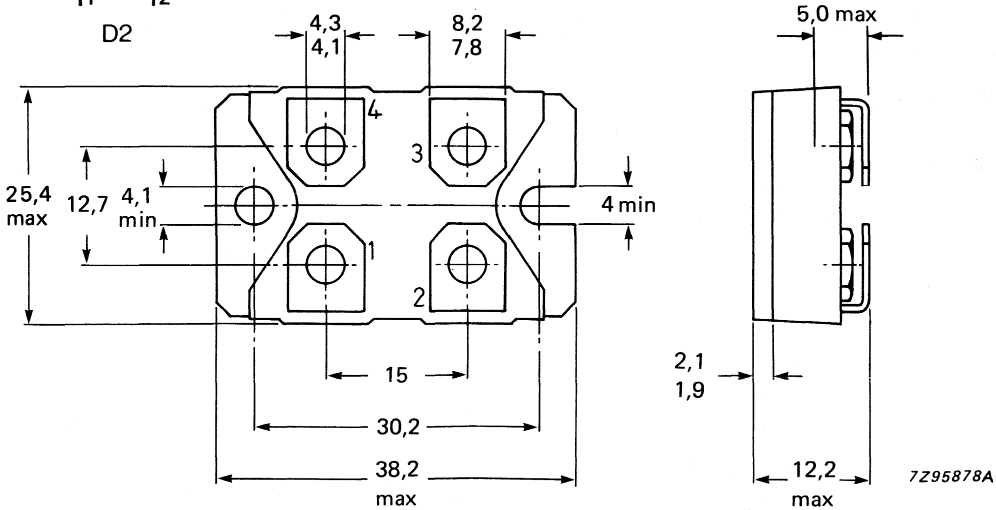
			PBYR16035	16040	16045TV	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Average forward current	$I_{F(AV)}$	max.		2 x 80		A
Forward voltage	V_F	<		0.69		V
Junction temperature	T_j	max.		150		°C

MECHANICAL DATA

Dimensions in mm

Fig.1 SOT-227B.
Types with Faston terminals are available on request (see overleaf).





Baseplate is electrically isolated.
Isolation voltage: 2500 V RMS.
Capacitance: 45 pF.

Supplied with device: 4 x M4 screws.

RATINGS

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

Voltages		PBYR16035	40	45TV	
Repetitive peak reverse voltage	V_{RRM}	35	40	45	V
Crest working reverse voltage	V_{RWM}	35	40	45	V
Continuous reverse voltage	V_R	35	40	45	V

Currents (per diode)				
Average forward current				
square wave; δ = 0.5; up to T_{mb} = 75 °C	$I_{F(AV)}$	max.	80	A
sinusoidal; up to T_{mb} = 73 °C	$I_{F(AV)}$	max.	70	A
RMS forward current	$I_{F(RMS)}$	max.	113	A
Repetitive peak forward current t_p = 20 μs; δ = 0.02	I_{FRM}	max.	900	A
Non-repetitive peak forward current half sinewave ; T_j = 125 °C prior to surge; with reapplied $V_{RWM\,max}$				
t = 10 ms	I_{FSM}	max.	900	A
t = 8.3 ms	I_{FSM}	max.	1080	A
I^2t for fusing (t = 10 ms)	I^2t	max.	4000	A^2s
Reverse surge current				
t_p = 100 μs	I_{RSM}	max.	2.0	A
t_p = 2 μs	I_{RRM}	max.	2.0	A
Temperatures				
Storage temperature	T_{stg}		−40 to +150	°C
Junction temperature	T_j	max.	150	°C

ORDERING NOTE

Types with Faston terminals are available on request (see Fig.2).
Omit suffix V from the type number when ordering, e.g. PBYR16045T.

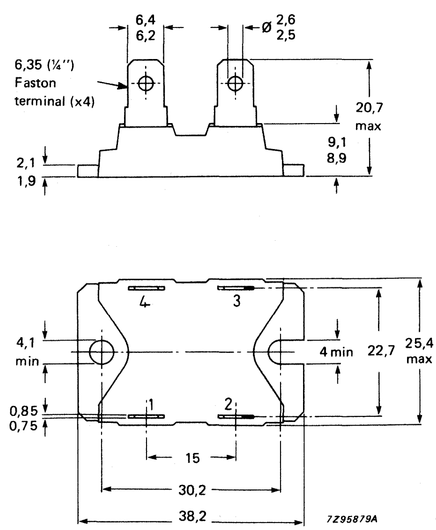
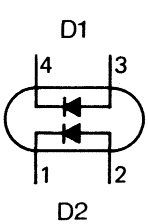


Fig.2 SOT-227A.
Dimensions in mm.



THERMAL RESISTANCE

From junction to mounting base per diode	$R_{th\ j\text{-}mb}$	=	1.1	K/W
From junction to mounting base total	$R_{th\ j\text{-}mb}$	=	0.6	K/W
From mounting base to heatsink with heatsink compound	$R_{th\ mb\text{-}h}$	=	0.1	K/W

CHARACTERISTICS (per diode)

Forward voltage				
I_F = 80 A; T_j = 150 °C	V_F	<	0.69	V*
I_F = 160 A; T_j = 25 °C	V_F	<	1.0	V*
Reverse current				
$V_R = V_{RWMmax}$; T_j = 125 °C	I_R	<	200	mA
$V_R = V_{RWMmax}$; T_j = 25 °C	I_R	<	2.0	mA
Capacitance at f = 1 MHz				
V_R = 5 V; T_j = 25 to 125 °C	C_d	typ.	2500	pF

DEVELOPMENT DATA

*Measured under pulse conditions to avoid excessive dissipation.

SQUARE-WAVE OPERATION (Figs.3 and 4)

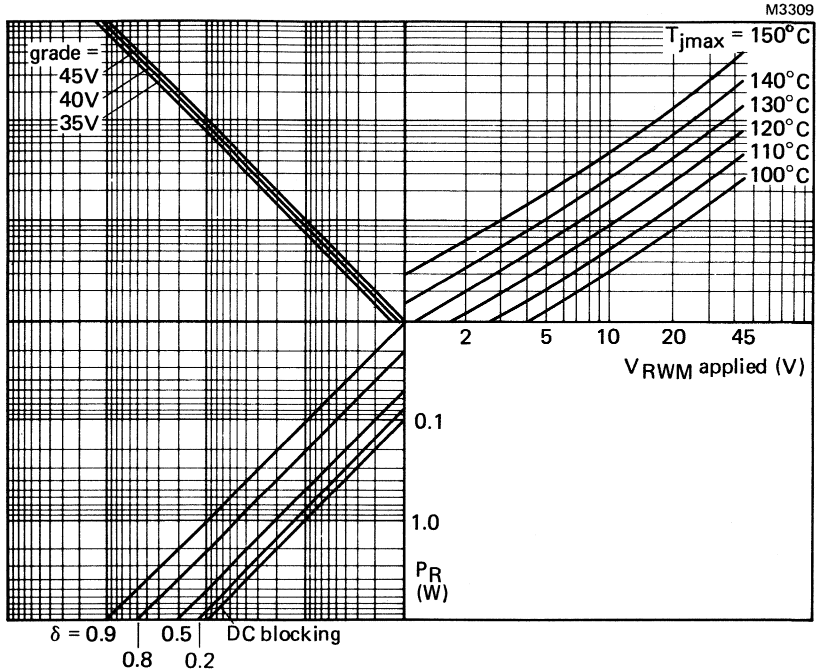
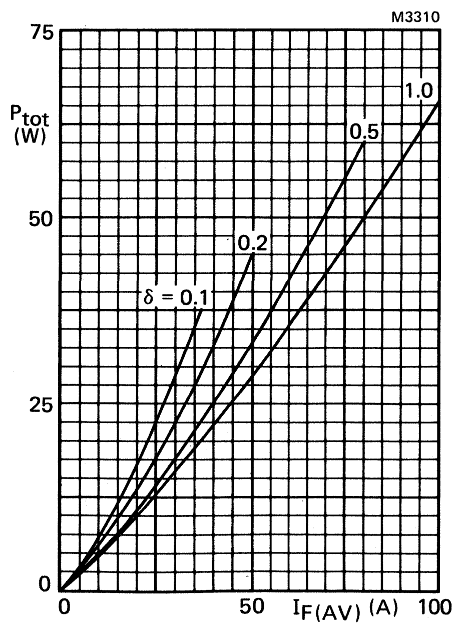
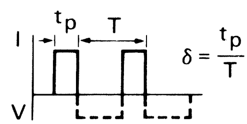


Fig.3 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_{jmax}. V_{RWM} applied, voltage grade and duty cycle; per diode.





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

Fig.4 Forward current power rating; per diode.

SINE-WAVE OPERATION (Figs.5 and 6)

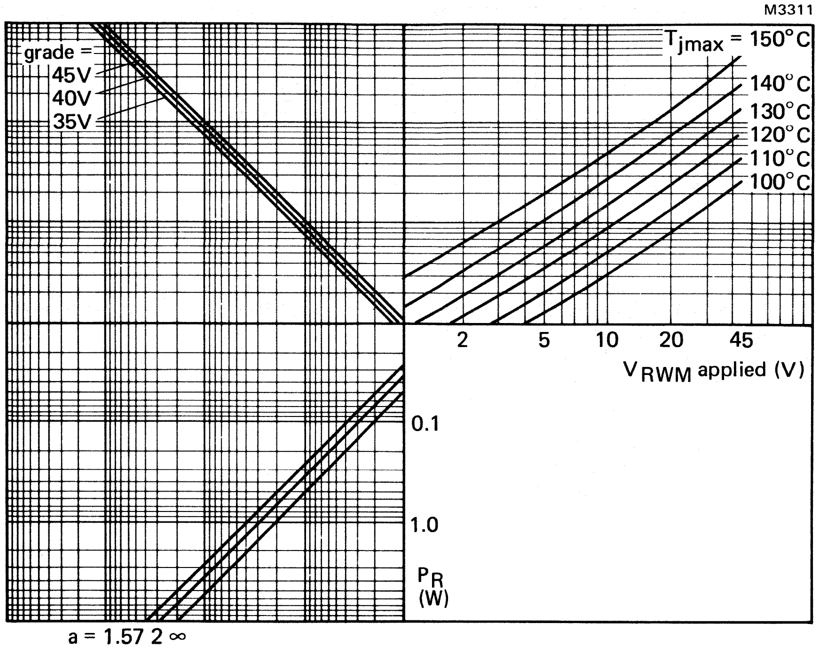


Fig.5 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_{jmax}. V_{RWM} applied, voltage grade and form factor; per diode.

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

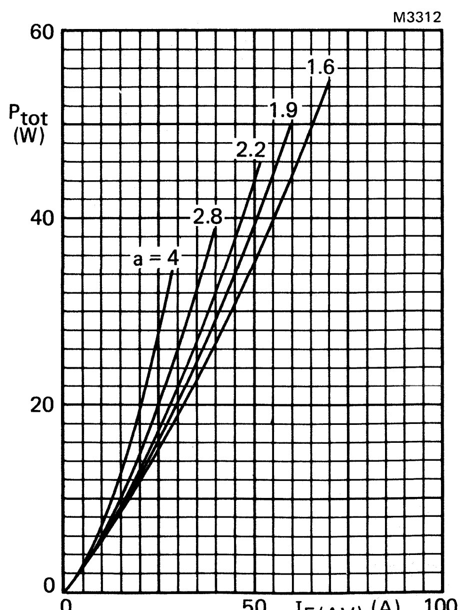


Fig.6 Forward current power rating; per diode.

DEVELOPMENT DATA

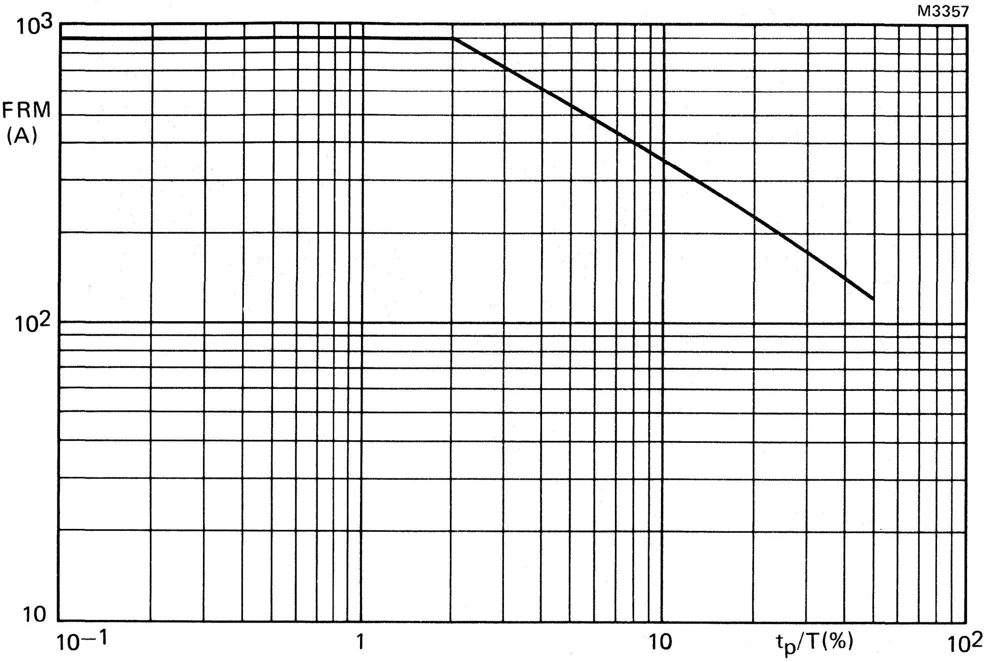
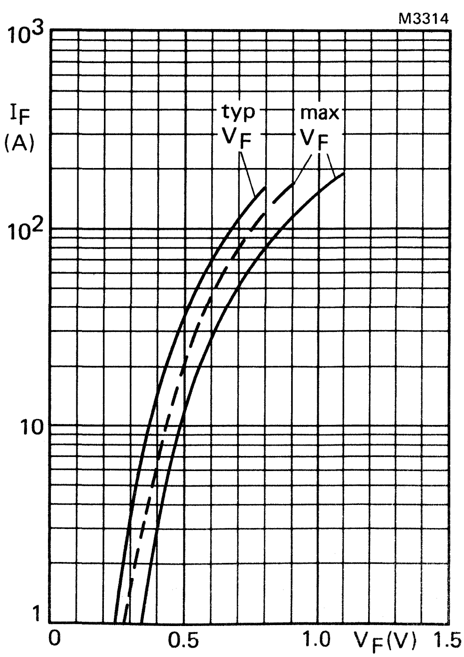
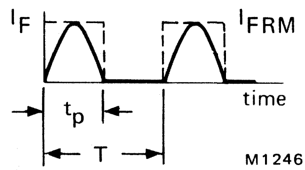


Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal current for $1\ \mu s < t_p < 1$ ms; per diode.





Definition of I_{FRM} and t_p/T.

Fig.8 Forward voltage; per diode;
—— $T_j = 25\ ^oC$; — — — $T_j = 150\ ^oC$.

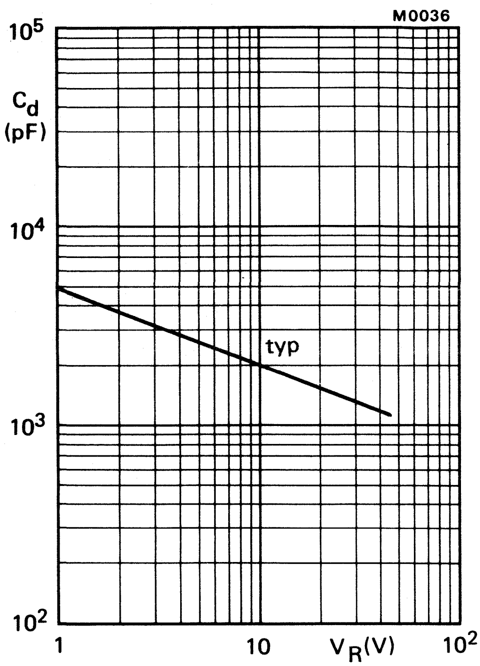


Fig.9 f = 1 MHz; T_j = 25 to 125 °C; per diode.

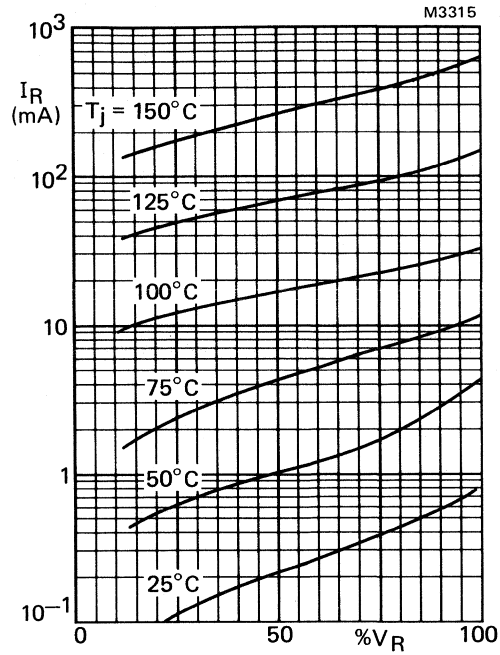


Fig.10 Typical values; per diode.

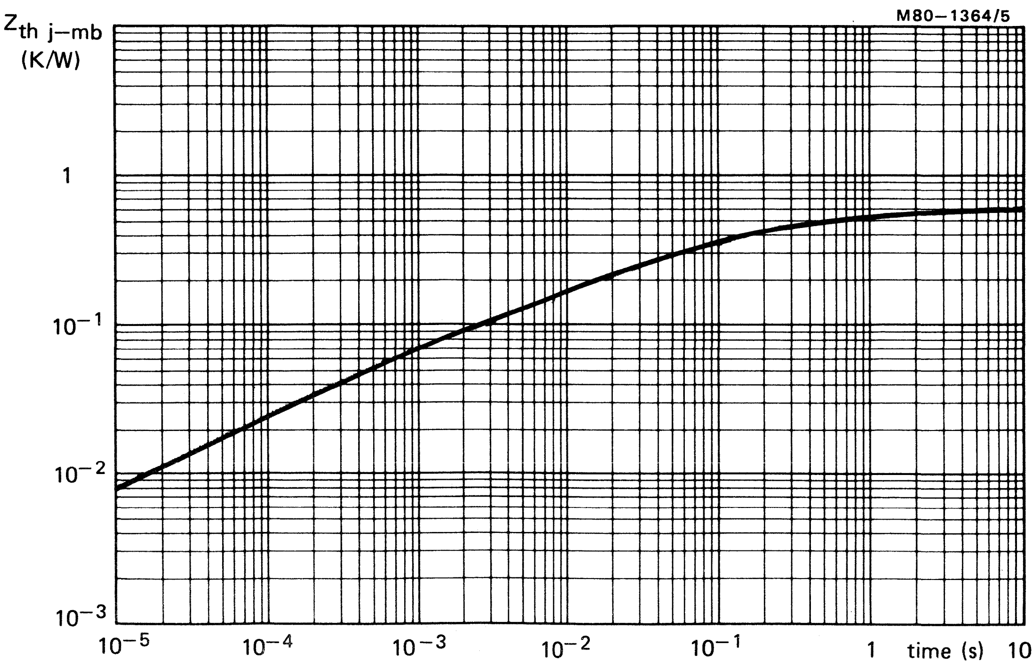


Fig.11 Transient thermal impedance; both diodes conducting.

SCHOTTKY–BARRIER DOUBLE RECTIFIER DIODES

Low-leakage platinum-barrier double rectifier diodes in TO-244 envelopes, featuring low forward voltage drop, low capacitance, and absence of stored charge. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and zero switching losses are important.
They can withstand reverse voltage transients and have guaranteed reverse avalanche surge capability.
The series consists of common-catode types.

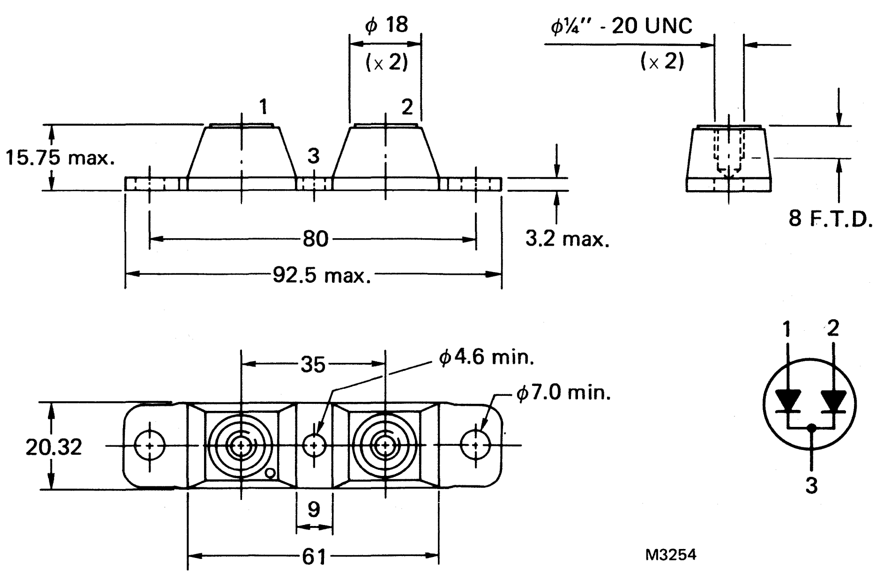
QUICK REFERENCE DATA

			PBYR30035	40	45 CT	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Output current (both diodes conducting)	I_O	max.		300		A
Forward voltage	V_F	typ.		0.62		V
Junction temperature	T_j	max.		150		°C

MECHANICAL DATA

Dimensions in mm

Fig.1 TO-244.



Terminal penetration: 7.0 mm max.
Terminal torque: 29 – 46 kg cm; 25 – 40 lb in
Mounting base torque: 35 – 46 kg cm; 30 – 40 lb in

Net mass: 73 g.

RATINGS

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

Voltages (per diode)			PBYR30035	40	45 CT	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Crest working reverse voltage	V_{RWM}	max.	35	40	45	V
Continuous reverse voltage	V_R	max.	35	40	45	V

Currents

Average forward current				
squarewave; $\delta = 0.5$; up to $T_{mb} = 100\ ^oC$ (note 1)				
per diode	$I_{F(AV)}$	max.	150	A
per device	I_O	max.	300	A
Repetitive peak forward current per diode (note 1)				
$t_p = 20\ \mu s$; $\delta = 0.02$	I_{FRM}	max.	2500	A
Non-repetitive peak forward current				
half sinewave; $T_j = 125\ ^oC$ prior to surge; with reapplied $V_{RWM\ max}$				
t = 8.3 ms	I_{FSM}	max.	2500	A
t = 10 ms	I_{FSM}	max.	2000	A
I^2t for fusing (t = 10 ms; per device)	I^2t	max.	20000	A^2s
Reverse surge current (per diode)				
$t_p = 2\ \mu s$; $\delta = 0.001$	I_{RRM}	max.	2.0	A
$t_p = 100\ \mu s$	I_{RSM}	max.	2.0	A

Temperatures

Storage temperature	T_{stg}		−65 to +175	^oC
Junction temperature	T_j	max.	150	^oC

CHARACTERISTICS (per diode)

Forward voltage (note 2)				
$I_F = 150$ A; $T_j = 150\ ^oC$	V_F	$<$	0.66	V
$I_F = 300$ A; $T_j = 125\ ^oC$	V_F	typ.	0.77	V
$I_F = 150$ A; $T_j = 125\ ^oC$	V_F	typ.	0.62	V
$I_F = 150$ A; $T_j = 25\ ^oC$	V_F	$<$	0.72	V
Reverse current				
$V_R = V_{RWM\ max}$; $T_j = 125\ ^oC$	I_R	$<$	300	mA
$V_R = V_{RWM\ max}$; $T_j = 25\ ^oC$	I_R	$<$	4.0	mA

THERMAL RESISTANCE

Junction to mounting-base (per diode)	$R_{th\ j\text{-}mb}$	$<$	0.4	K/W

Notes:

1. Assuming no reverse leakage losses.
2. Measured under pulse conditions to avoid excessive dissipation.

SQUAREWAVE OPERATION (Figs.3 and 4)

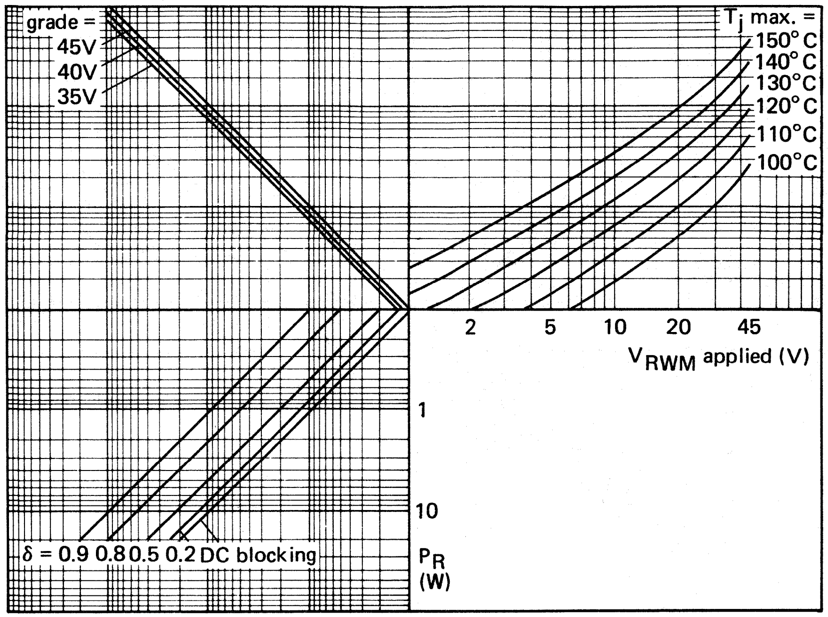
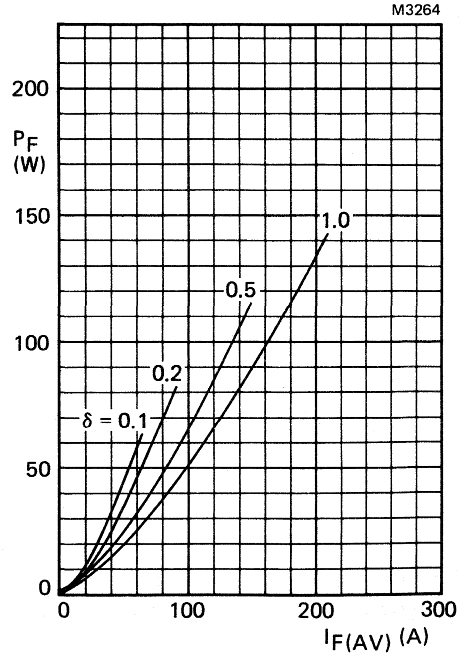


Fig.3 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and duty cycle; per diode.



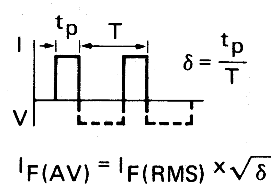


Fig.4 Forward current power rating; per diode.

DEVELOPMENT DATA

SINUSOIDAL OPERATION (Figs.5 and 6)

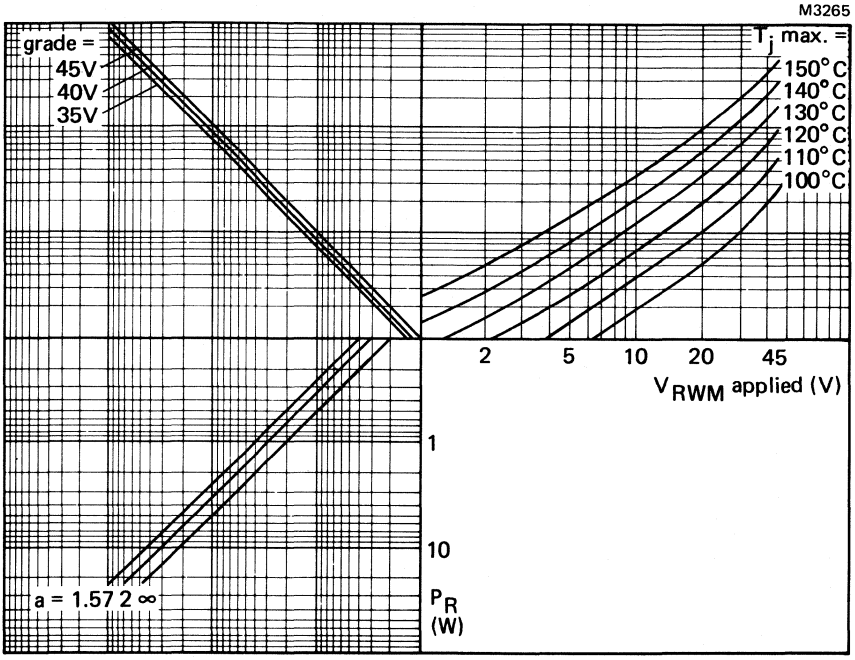


Fig.5 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and form factor; per diode.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

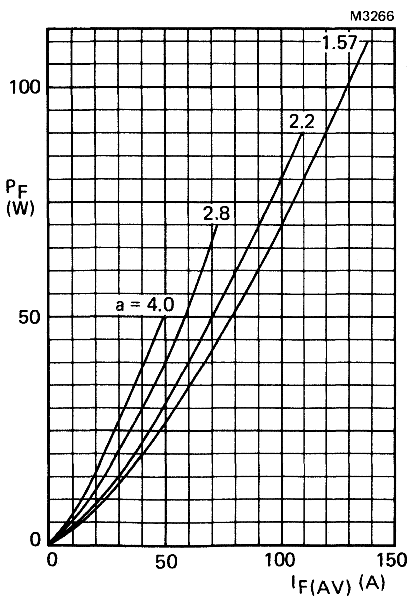


Fig.6 Forward current power rating, per diode.

DEVELOPMENT DATA

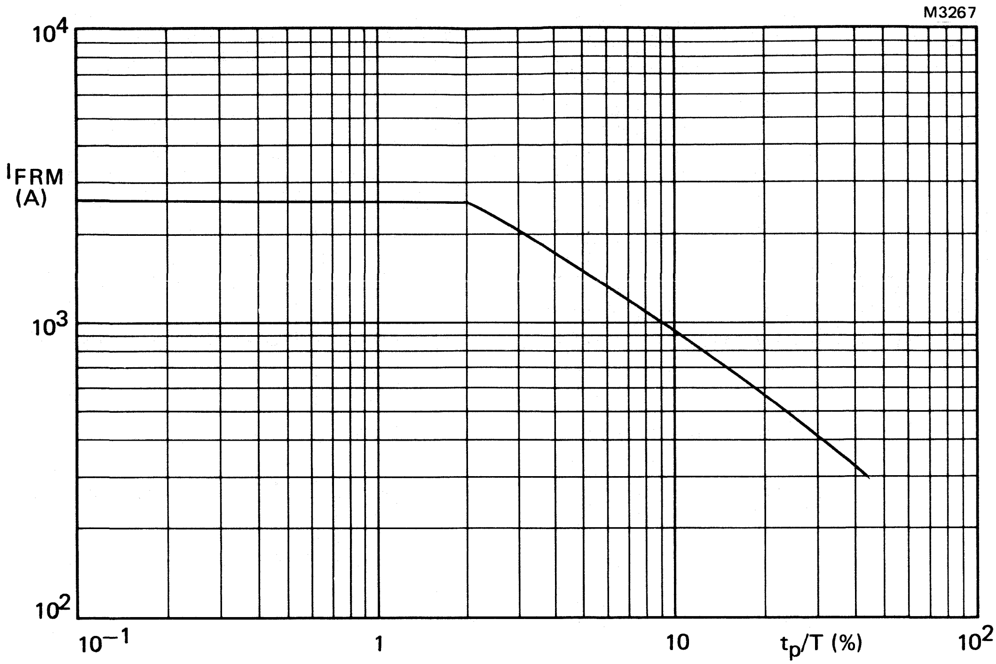
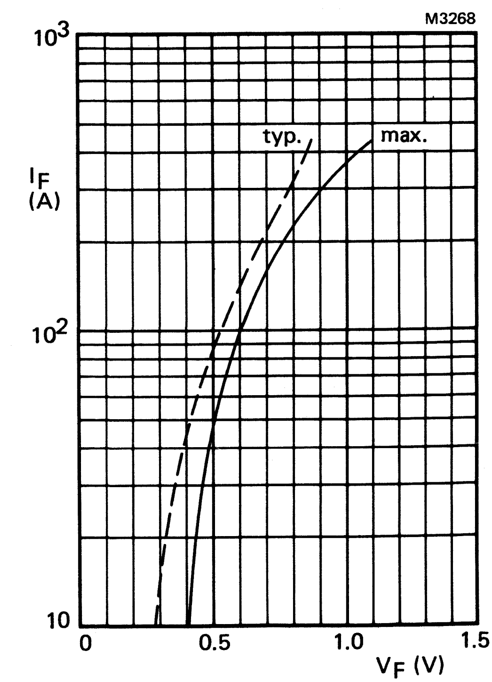
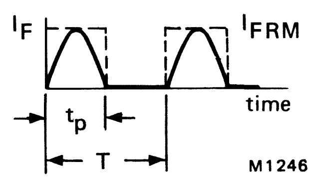


Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal current for $1\ \mu s < t_p < 1$ ms; per diode.





Definition of I_{FRM} and t_p/T.

Fig.8 Forward voltage; per diode;
—— $T_j = 25\ ^oC$; – – – $T_j = 125\ ^oC$.

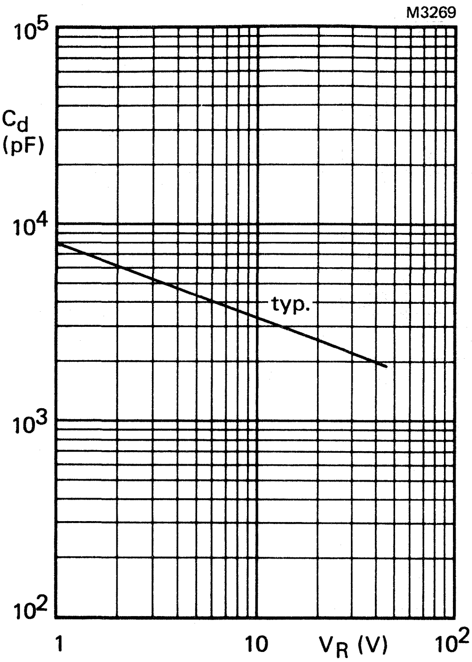


Fig.9 f = 1 MHz; T_j = 25 to 125 °C·
per diode.

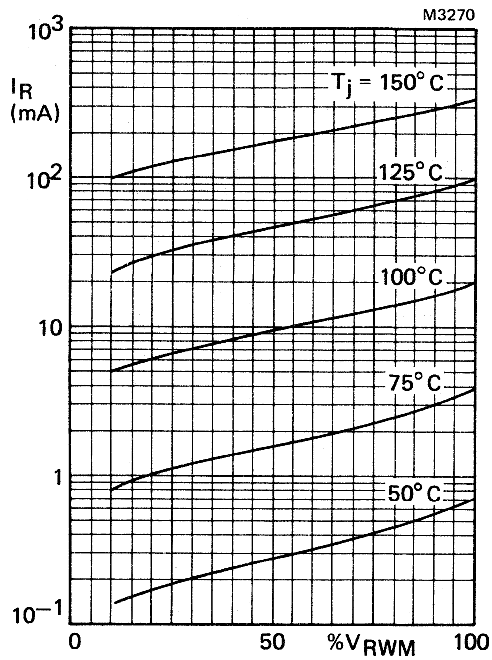


Fig.10 Typical values; per diode.

SCHOTTKY – BARRIER DOUBLE RECTIFIER DIODES

Low-leakage platinum-barrier double rectifier diodes in TO-244 envelopes, featuring low forward voltage drop, low capacitance, and absence of stored charge. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and zero switching losses are important.
They can withstand reverse voltage transients and have guaranteed reverse avalanche surge capability.
The series consists of common-catode types.

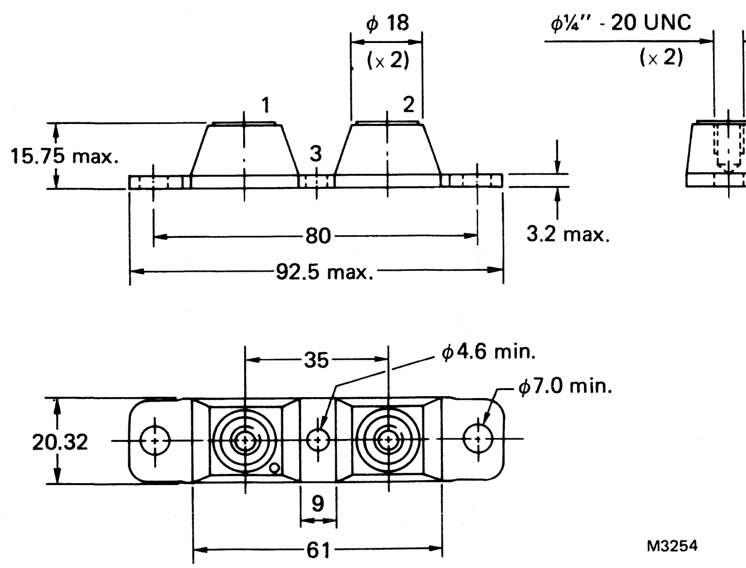
QUICK REFERENCE DATA

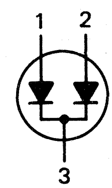
			PBYR40035	40	45 CT	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Output current (both diodes conducting)	I_O	max.		400		A
Forward voltage	V_F	typ.		0.58		V
Junction temperature	T_j	max.		150		°C

MECHANICAL DATA

Dimensions in mm

Fig.1 TO-244.





Terminal penetration: 7.0 mm max.
Terminal torque: 29 – 46 kg cm
25 – 40 lb in
Mounting base torque: 35 – 46 kg cm
30 – 40 lb in

Net mass: 73 g.

RATINGS

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

Voltages (per diode)			PBYR40035	40	45 CT	
Repetitive peak reverse voltage	V_{RRM}	max.	35	40	45	V
Crest working reverse voltage	V_{RWM}	max.	35	40	45	V
Continuous reverse voltage	V_R	max.	35	40	45	V

Currents

Average forward current				
squarewave; $\delta = 0.5$; up to $T_{mb} = 85\ ^{o}C$ (note 1)				
per diode	$I_{F(AV)}$	max.	200	A
per device	I_O	max.	400	A
Repetitive peak forward current per diode (note 1)				
$t_p = 20\ \mu s$; $\delta = 0.02$	I_{FRM}	max.	3000	A
Non-repetitive peak forward current				
half sinewave; $T_j = 125\ ^{o}C$ prior to surge; with reapplied $V_{RWM\ max}$				
t = 8.3 ms	I_{FSM}	max.	3000	A
t = 10 ms	I_{FSM}	max.	2500	A
I^2t for fusing (t = 10 ms; per device)	I^2t	max.	31250	A^2s
Reverse surge current (per diode)				
$t_p = 2\ \mu s$; $\delta = 0.001$	I_{RRM}	max.	2.0	A
$t_p = 100\ \mu s$	I_{RSM}	max.	2.0	A

Temperatures

Storage temperature	T_{stg}		−65 to +175	^{o}C
Junction temperature	T_j	max.	150	^{o}C

CHARACTERISTICS (per diode)

Forward voltage (note 2)				
$I_F = 200$ A; $T_j = 150\ ^{o}C$	V_F	<	0.63	V
$I_F = 400$ A; $T_j = 125\ ^{o}C$	V_F	typ.	0.75	V
$I_F = 200$ A; $T_j = 125\ ^{o}C$	V_F	typ.	0.58	V
$I_F = 200$ A; $T_j = 25\ ^{o}C$	V_F	<	0.69	V
Reverse current				
$V_R = V_{RWM\ max}$; $T_j = 125\ ^{o}C$	I_R	<	400	mA
$V_R = V_{RWM\ max}$; $T_j = 25\ ^{o}C$	I_R	<	4.0	mA

THERMAL RESISTANCE

Junction to mounting-base (per diode)	$R_{th\ j\text{-}mb}$	<	0.4	K/W

Notes:

1. Assuming no reverse leakage losses.
2. Measured under pulse conditions to avoid excessive dissipation.

SQUAREWAVE OPERATION (Figs.3 and 4)

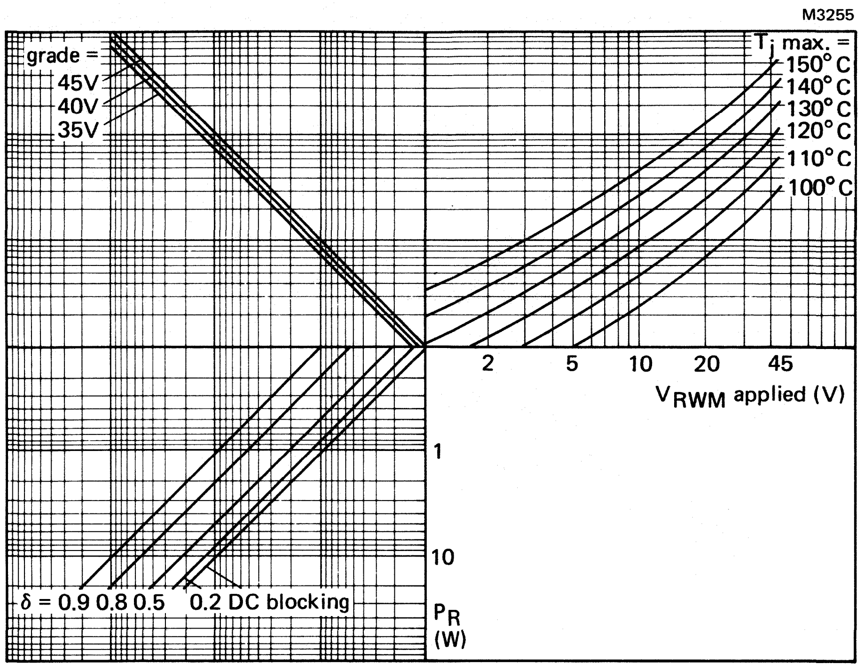
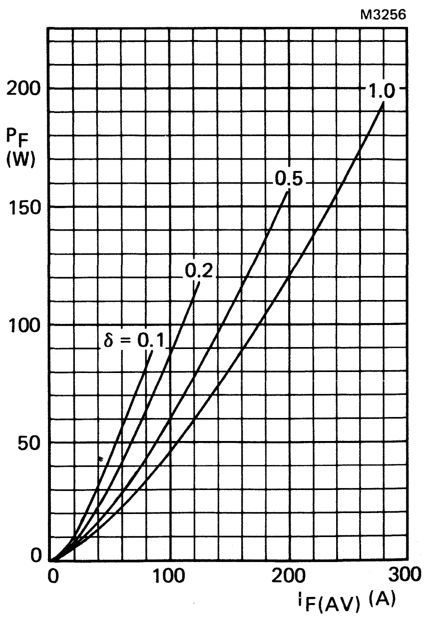
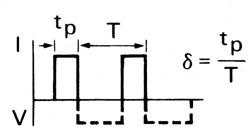


Fig.3 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and duty cycle; per diode.





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

Fig.4 Forward current power rating; per diode.

SINUSOIDAL OPERATION (Figs.5 and 6)

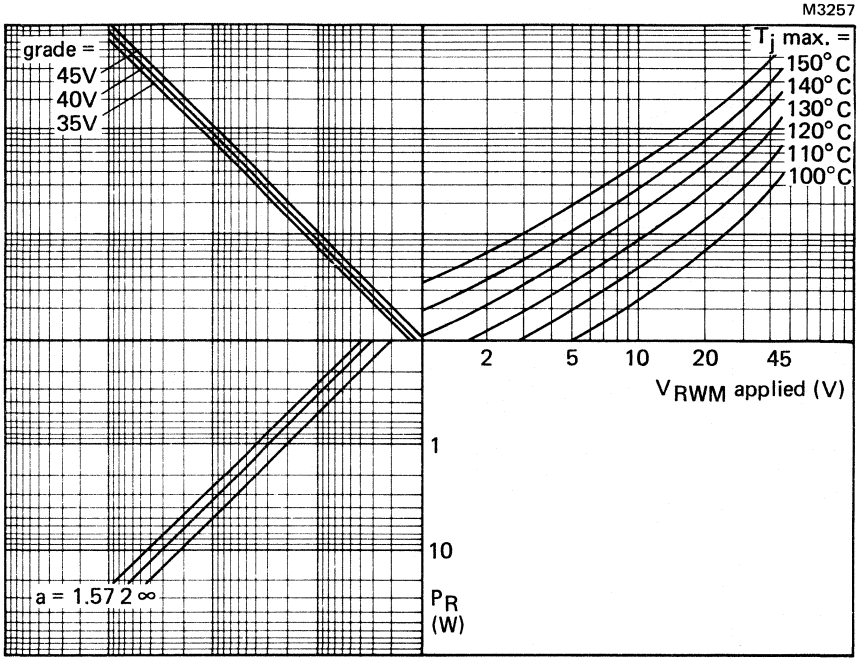


Fig.5 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and form factor; per diode.
a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

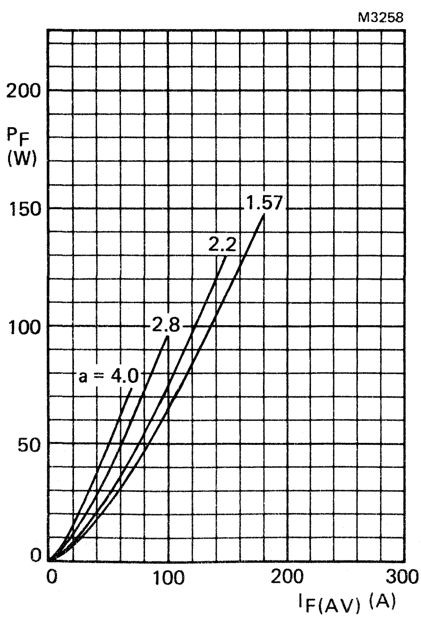


Fig.6 Forward current power rating; per diode.

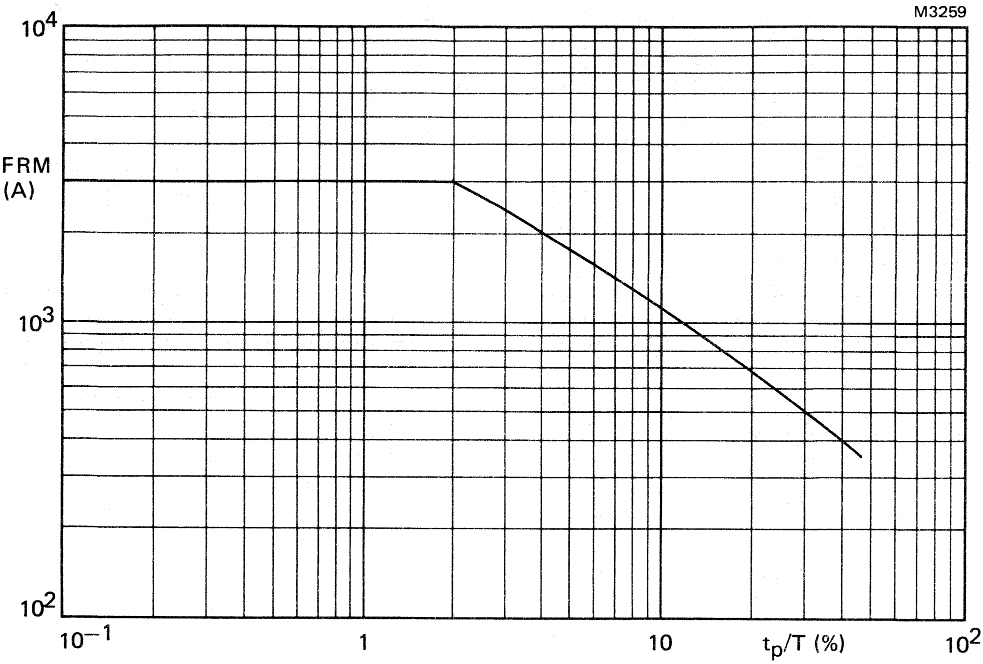
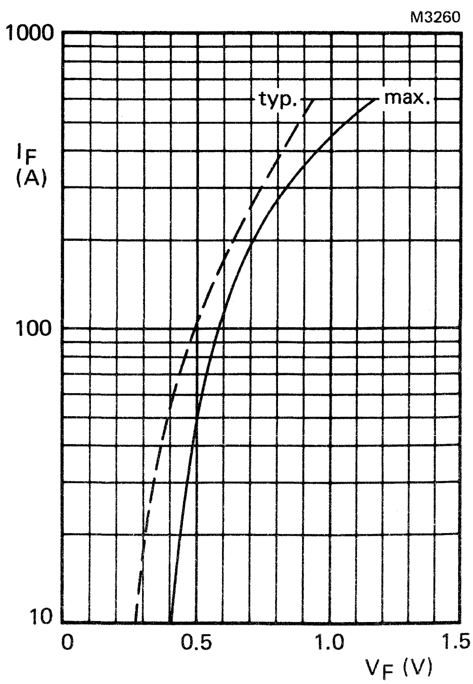
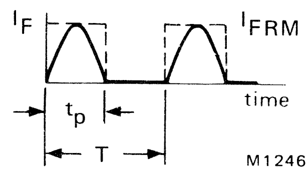


Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal current for $1\ \mu s < t_p < 1$ ms; per diode.





Definition of I_{FRM} and t_p/T.

Fig.8 Forward voltage; per diode;
—— T_j = 25 °C; – – – T_j = 125 °C.

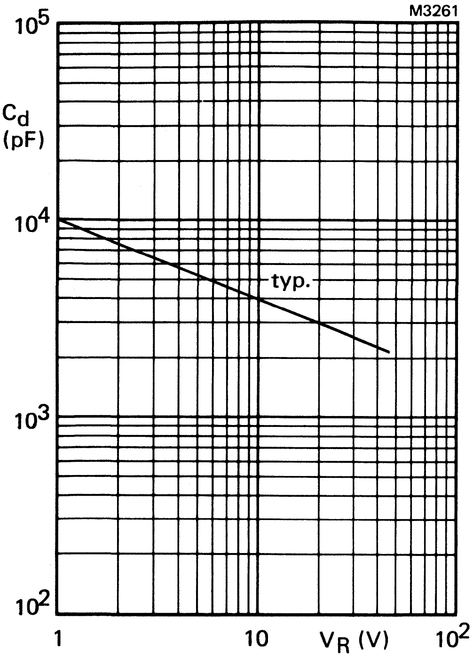


Fig.9 f = 1 MHz; T_j = 25 to 125 °C; per diode.

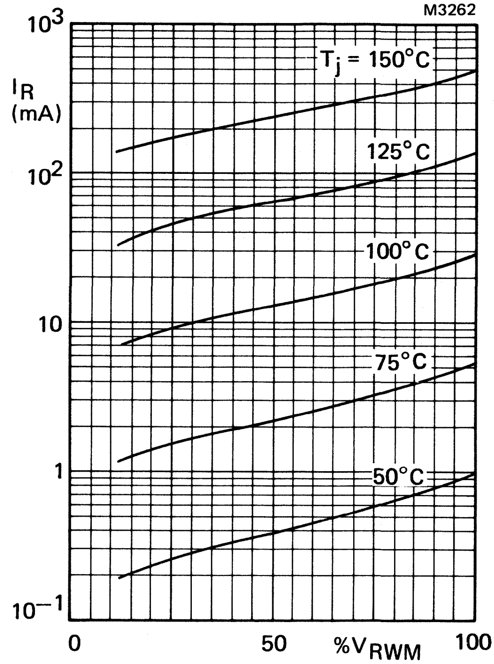


Fig.10 Typical values; per diode.

ACCESSORIES

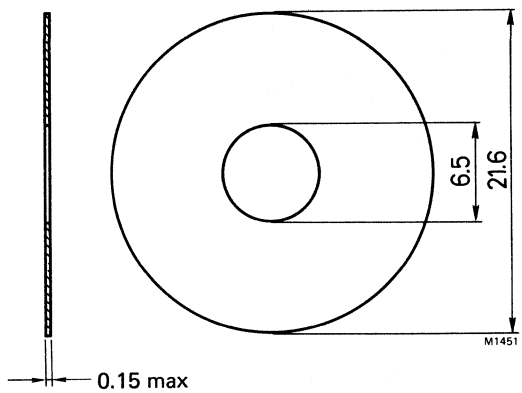
TYPE NUMBER SUMMARY

type number	description	envelope
56264a	mica washer (up to 2000 V)	DO-5, TO-48
56264b	insulating bush	DO-5, TO-48
56295a	mica washer (up to 2000 V)	DO-4, TO-64
56295b	PTFE ring	DO-4, TO-64
56295c	insulating bush	DO-4, TO-64
56359b	mica washer (up to 1000 V)	TO-220
56359c	insulating bush (up to 800 V)	TO-220
56359d	rectangular insulating bush (up to 1000 V)	TO-220
56360a	rectangular washer	TO-220
56363	spring clip (direct mounting)	TO-220, SOT-186
56364	spring clip (insulated mounting)	TO-220
56367	alumina insulator (up to 2000 V)	TO-220
56368b	insulating bush (up to 800 V)	SOT-93
56368c	mica insulator (up to 800 V)	SOT-93
56369	mica insulator (up to 2000 V)	TO-220
56378	mica insulator (up to 1500 V)	SOT-93
56379	spring clip	SOT-93, SOT-199 ←

56264a MICA WASHER

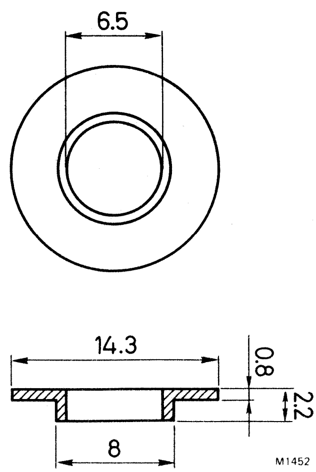
Insulator up to 2000 V

MECHANICAL DATA Dimensions in mm



56264b INSULATING BUSH

MECHANICAL DATA Dimensions in mm



THERMAL RESISTANCE

From mounting base to heatsink

with mica washer, without heatsink compound	$R_{th\ mb\text{-}h}$	=	5	K/W
with mica washer, with heatsink compound	$R_{th\ mb\text{-}h}$	=	2.5	K/W

TEMPERATURE

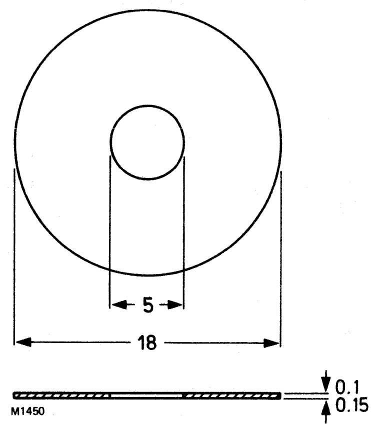
Maximum allowable temperature	T_{max}	=	175	°C

56295a MICA WASHER

Insulator up to 2 kV.

MECHANICAL DATA

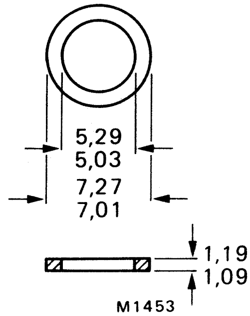
Dimensions in mm



56295b PTFE RING

MECHANICAL DATA

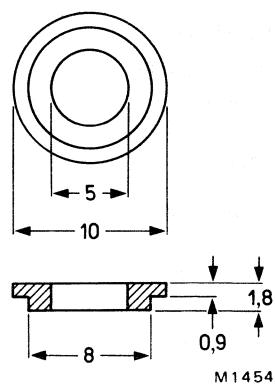
Dimensions in mm



56295c INSULATING BUSH

MECHANICAL DATA

Dimensions in mm



THERMAL RESISTANCE

From mounting base to heatsink				
without heatsink compound	$R_{th\ mb\text{-}h}$	=	5	K/W
with heatsink compound	$R_{th\ mb\text{-}h}$	=	2.5	K/W

TEMPERATURE

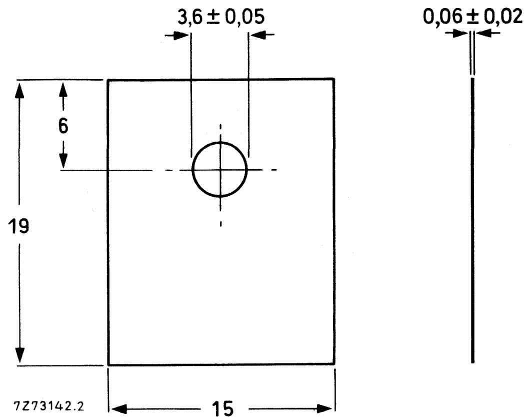
Maximum allowable temperature	T_{max}	=	175	^{o}C

56359b MICA WASHER

Insulator up to 1000 V.

MECHANICAL DATA

Dimensions in mm



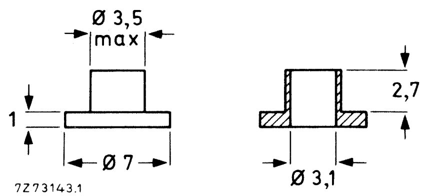
56359c INSULATING BUSH

Insulator up to 800 V.

MECHANICAL DATA

Material: polyester

Dimensions in mm



TEMPERATURE

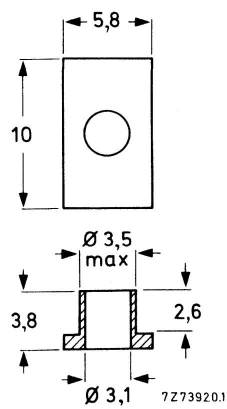
Maximum pemissible temperature T_{max} = 150 °C

56359d RECTANGULAR INSULATING BUSH

Insulator up to 1000 V.

MECHANICAL DATA

Dimensions in mm



TEMPERATURE

Maximum permissible temperature T_{max} = 150 °C

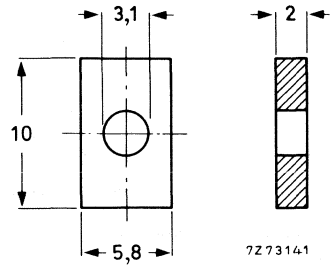
56360a RECTANGULAR WASHER (For TO-220)

For direct and insulated mounting.

MECHANICAL DATA

Dimensions in mm

Material: brass; nickel plated.



56363 SPRING CLIP (For TO-220 and SOT-186)

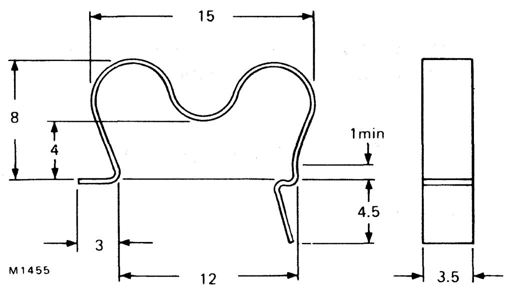
For direct mounting.

MECHANICAL DATA

Dimensions in mm

Material: stainless steel; for mounting on heatsink of 1.0 to 2.0 mm.

Recommended force of clip on device is 20 N (2 kgf).



56364 SPRING CLIP (For TO-220)

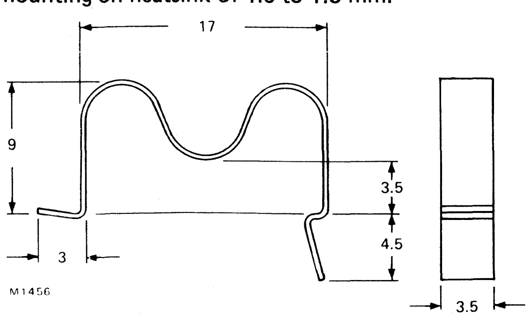
For insulated mounting.

MECHANICAL DATA

Dimensions in mm

Material: stainless steel; for mounting on heatsink of 1.0 to 1.5 mm.

Recommended force of clip on device is 20 N (2 kgf).



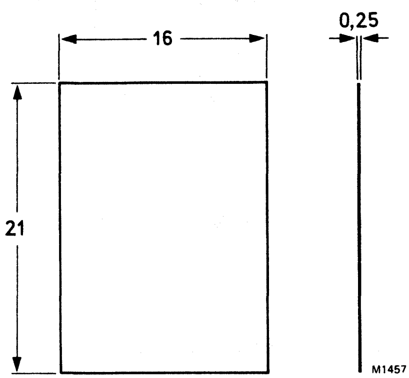
To be used in conjunction with insulators **56367** or **56369**

56367 ALUMINA INSULATOR

For insulated clip mounting up to 2 kV.

MECHANICAL DATA Dimensions in mm

Material: 96-alumina.

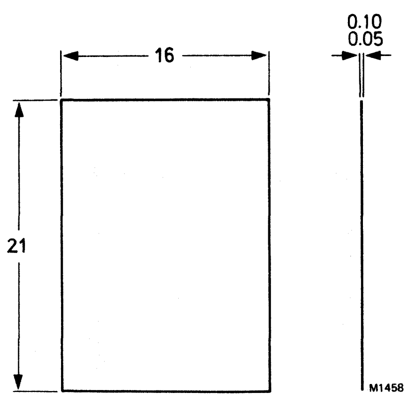


*Because alumina is brittle, extreme care must be taken when mounting devices not to crack the alumina, particularly when used without heatsink compound.

56369 MICA INSULATOR

For insulated clip mounting up to 2 kV.

MECHANICAL DATA Dimensions in mm



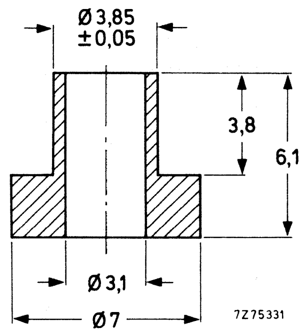
56368b INSULATING BUSH

For insulated screw mounting up to 800 V.

MECHANICAL DATA

Dimensions in mm

Material: polyester



TEMPERATURE

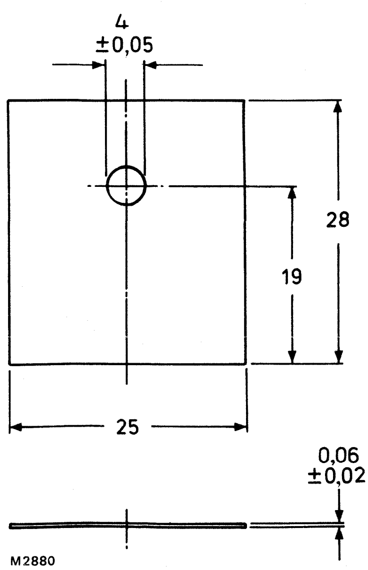
Maximum permissible temperature T_{max} = 150 °C

56368c MICA INSULATOR

For insulated screw mounting up to 800 V.

MECHANICAL DATA

Dimensions in mm

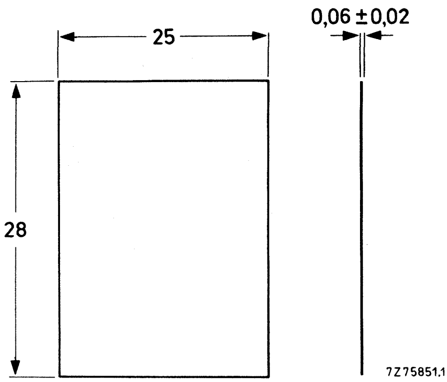


56369: see preceding page.

56378 MICA INSULATOR

For clip mounting up to 1500 V.

MECHANICAL DATA Dimensions in mm

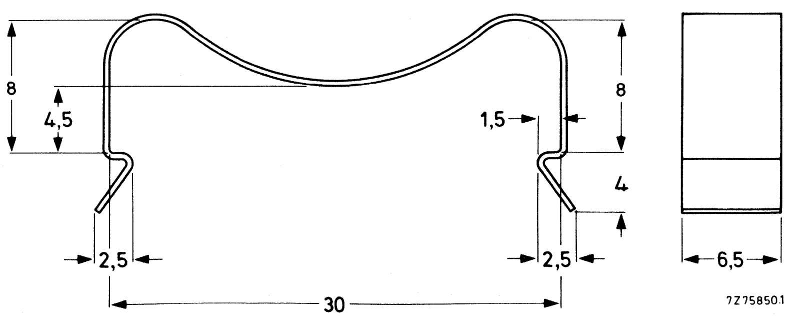


56379 SPRING CLIP

→ For direct and insulated mounting of SOT-93 envelopes and for direct mounting of SOT-199 envelopes.

MECHANICAL DATA Dimensions in mm

Material:
CrNi steel NLN-939;
thickness 0.4 ± 0.04.



MOUNTING INSTRUCTIONS

MOUNTING INSTRUCTIONS FOR TO-220 ENVELOPES

GENERAL DATA AND INSTRUCTIONS

General rules

1. First fasten the device to the heatsink before soldering the leads.
2. Avoid axial stress to the leads.
3. Keep mounting tool (e.g. screwdriver) clear of the plastic body.
4. The rectangular washer may only touch the plastic part of the body; it should not exert any force on that part (screw mounting).

Heatsink requirements

Flatness in the mounting area: 0,02 mm maximum per 10 mm.
Mounting holes must be deburred, see further mounting instructions.

Heatsink compound

Values of the thermal resistance from mounting base to heatsink ($R_{th\ mb\text{-}h}$) given for mounting with heatsink compound refer to the use of a metallic oxide-loaded compound. Ordinary silicone grease is not recommended.

For insulated mounting, the compound should be applied to the bottom of both device and insulator.

Mounting methods for power devices

1. Clip mounting

   Mounting with a spring clip gives:

   a. A good thermal contact under the crystal area, and slightly lower $R_{th\ mb\text{-}h}$ values than screw mounting.
   b. Safe insulation for mains operation.

2. M3 screw mounting

   It is recommended that the rectangular spacing washer is inserted between screw head and mounting tab.

   Mounting torque for screw mounting:

   (For thread-forming screws these are final values. Do not use self-tapping screws.)

Minimum torque (for good heat transfer)	0,55 Nm (5,5 kgcm)
Maximum torque (to avoid damaging the device)	0,80 Nm (8,0 kgcm)

N.B.: When a nut or screw is not driven direct against a curved spring washer or lock washer (not for thread-forming screw), the torques are as follows:

Minimum torque (for good heat transfer)	0,4 Nm (4 kgcm)
Maximum torque (to avoid damaging the device)	0,6 Nm (6 kgcm)

3. Rivet mounting non-insulated

The device should not be pop-rivetted to the heatsink. However, it is permissible to press-rivet providing that eyelet rivets of soft material are used, and the press forces are slowly and carefully controlled so as to avoid shock and deformation of either heatsink or mounting tab.

→ Devices may be rivetted to flat heatsinks; such a process must neither deform the mounting tab, nor enlarge the mounting hole. The maximum recommended hole size for rivet mounting is 3.5 mm. The pre-formed head of the rivet should be on the device side and any rivet tool used should not damage the plastic body of the device.

Thermal data

(Typical figures, for exact figures see data for each device type).

From mounting base to heatsink			clip mounting	screw mounting	
with heatsink compound, direct mounting	$R_{th\ mb\text{-}h}$	=	0,3	0,5	K/W
without heatsink compound, direct mounting	$R_{th\ mb\text{-}h}$	=	1,4	1,4	K/W
with heatsink compound and 0,1 mm maximum mica washer	$R_{th\ mb\text{-}h}$	=	2,2	–	K/W
with heatsink compound and 0,25 mm maximum alumina insulator	$R_{th\ mb\text{-}h}$	=	0,8	–	K/W
with heatsink compound and 0,05 mm mica washer					
insulated up to 500 V	$R_{th\ mb\text{-}h}$	=	–	1,4	K/W
insulated up to 800 V/1000 V	$R_{th\ mb\text{-}h}$	=	–	1,6	K/W
without heatsink compound and 0,05 mm mica washer					
insulated up to 500 V	$R_{th\ mb\text{-}h}$	=	–	3,0	K/W
insulated up to 800 V/1000 V	$R_{th\ mb\text{-}h}$	=	–	4,5	K/W

Lead bending

Maximum permissible tensile force on the body, for 5 seconds is 20 N (2 kgf).

The leads can be bent through 90° maximum, twisted or straightened. To keep forces within the above-mentioned limits, the leads are generally clamped near the body, using pliers. The leads should neither be bent nor twisted less than 2,4 mm from the body.

Soldering

Lead soldering temperature at > 3 mm from the body; $t_{sld} < 5$ s:

Devices with $T_{j\ max} \leqslant 175$ °C, soldering temperature $T_{sld\ max} = 275$ °C.
Devices with $T_{j\ max} \leqslant 110$ °C, soldering temperature $T_{sld\ max} = 240$ °C.

Avoid any force on body and leads during or after soldering: do not correct the position of the device or of its leads after soldering.

It is not permitted to solder the metal tab of the device to a heatsink, otherwise its junction temperature rating will be exceeded.

Mounting base soldering

Recommended metal-alloy of solder paste (85% metal weight)
62 Sm/36 Pb/2 Ag or 60 Sn/40 Pb.
Maximum soldering temperature ⩽ 200 °C (tab-temperature).
Soldering cycle duration including pre-heating ⩽ 30 sec.

For good soldering and avoiding damage to the encapsulation pre-heating is recommended to a temperature ⩽ 165 °C at a duration ⩽ 10 s.

INSTRUCTIONS FOR CLIP MOUNTING

Direct mounting with clip 56363

1. Apply heatsink compound to the mounting base, then place the device on the heatsink.
2. Push the short end of the clip into the narrow slot in the heatsink with clip at an angle of 10° to 30° to the vertical (see Figs 1 and 2).
3. Push down the clip over the device until the long end of the clip snaps into the wide slot in the heatsink. The clip should bear on the plastic body, not on the tab (see Fig.2a).
   Do not insert more than 1 mm beyond final position.

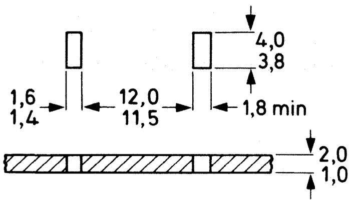


Fig. 1 Heatsink requirements.

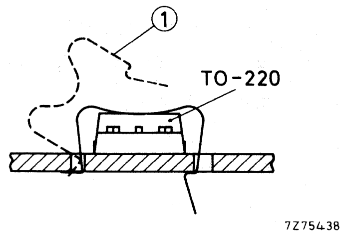


Fig. 2 Mounting.
(1) spring clip 56363.

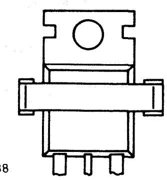


Fig. 2a Position of device (top view).

Insulated mounting with clip 56364

With the insulators 56367 or 56369 insulation up to 2 kV is obtained.

1. Apply heatsink compound to the bottom of both device and insulator, then place the device with the insulator on the heatsink.
2. Push the short end of the clip into the narrow slot in the heatsink with the clip at an angle of 10° to 30° to the vertical (see Figs 3 and 4).
3. Push down the clip over the device until the long end of the clip snaps into the wide slot in the heatsink. The clip should bear on the plastic body, not on the tab. Ensure that the device is centred on the mica insulator to prevent creepage.
   Do not insert more than 1 mm beyond final position.

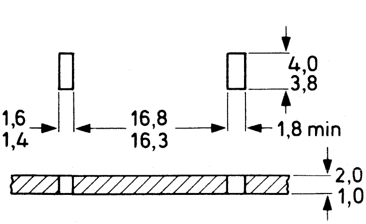


Fig. 3 Heatsink requirements.

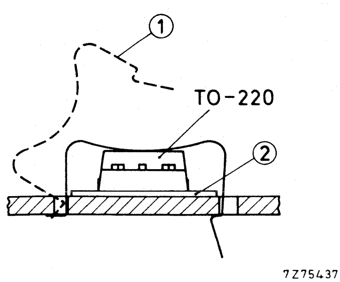


Fig. 4 Mounting.
(1) spring clip 56364.
(2) insulator 56369 or 56367.

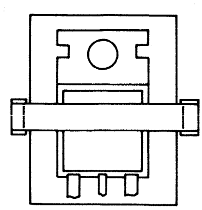


Fig.4a Position of device (top view).

INSTRUCTIONS FOR SCREW MOUNTING

Dimensions in mm

Direct mounting with screw and spacing washer

- *through heatsink with nut*

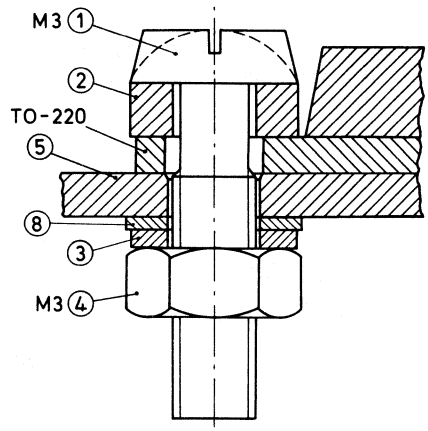


Fig. 5 Assembly.

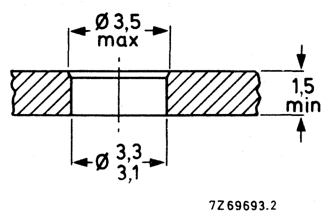


Fig. 6 Heatsink requirements.

(1) M3 screw.
(2) rectangular washer (56360a).
(3) lock washer.
(4) M3 nut.
(5) heatsink.
(8) plain washer.

- *into tapped heatsink*

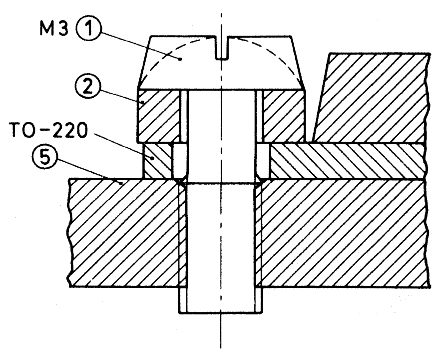


Fig. 7 Assembly.

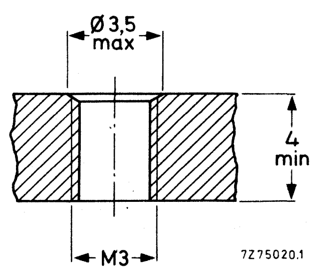


Fig. 8 Heatsink requirements.

(1) M3 screw.
(2) rectangular washer 56360a.
(5) heatsink.

Insulated mounting with screw and spacing washer
(not recommended where mounting tab is on mains voltage)

Dimensions in mm

- *through heatsink with nut*

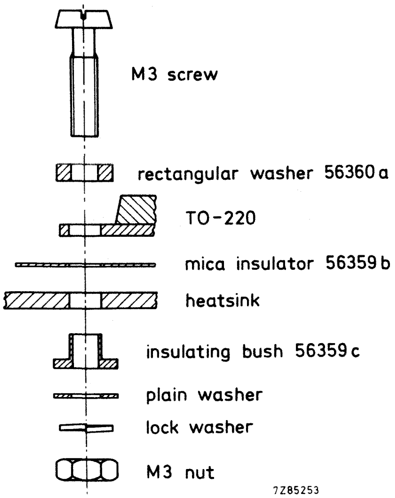


Fig. 9 Insulated screw mounting with rectangular washer. Known as a "bottom mounting".

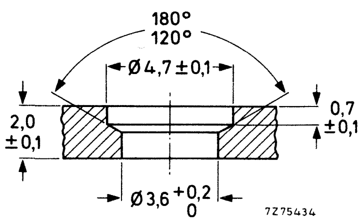


Fig. 10 Heatsink requirements for 500 V insulation.

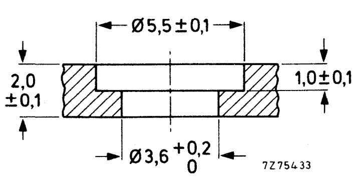


Fig. 11 Heatsink requirements for 800 V insulation.

- *into tapped heatsink*

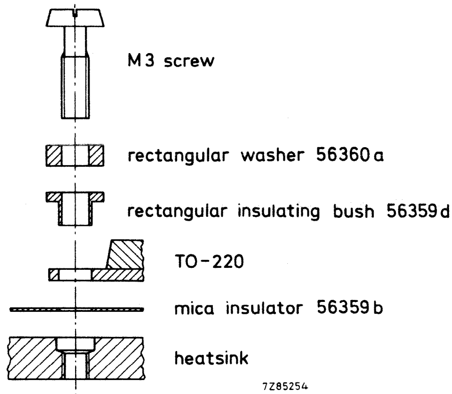


Fig. 12 Insulated screw mounting with rectangular washer into tapped heatsink. Known as a "top mounting".

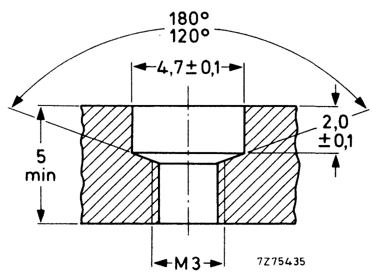


Fig. 13 Heatsink requirements for 500 V insulation.

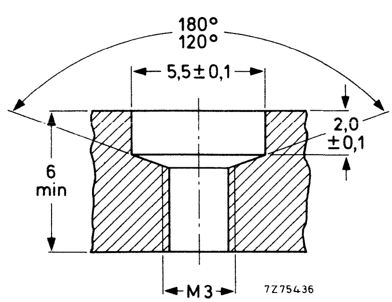


Fig. 14 Heatsink requirements for 1000 V insulation.

MOUNTING INSTRUCTIONS FOR TO-220 FULL-PACK (SOT-186) DEVICES

Use of full-pack (SOT-186 envelope) devices allows an insulated mounting with up to 1kV isolation. These devices require the assembly of less components than TO-220 devices with insulating washers.

GENERAL DATA AND INSTRUCTIONS

General rules

1. Mounting instructions for voltage isolation are given for guidance. Users should aquaint themselves with the relevant statutory and mandatory regulations if the heatsink is earthed or may be touched.
2. Fasten device to heatsink before soldering the leads.
3. Avoid axial stress to the leads.
4. Be careful to avoid damaging plastic with mounting tool (e.g. screwdriver).

Heatsink requirements

Flatness in the mounting area: 0.02mm maximum per 10mm.

Mounting holes must be deburred.

Heatsink compound

Values of thermal resistance given using heatsink compound refer to the use of a metallic oxide-loaded compound. Ordinary silicone grease is not recommended.

Mounting methods for power devices

1. Clip mounting:
   This gives better thermal contact under the crystal area than screw mounting.
   For details of mounting force for spring clip mounting see data sheet "Accesories for TO-220".
2. M3 screw mounting:
   It is recommended that a rectangular spacing washer (part no. 56360a) is inserted between the screw head and plastic mounting tab.

N.B. Data on accessories are given in separate data sheet "Accesories for TO-220".

Mounting torque for screw mounting:

(For thread-forming screws these are final values. Do not use self-tapping screws.)

Minimum torque (for good heat transfer)	0.55 Nm (5.5 kgcm)
Maximum torque (to avoid damaging the device)	0.80 Nm (8.0 kgcm)

N.B. When a nut or screw is not driven against a curved spring washer or lock washer (not for thread-forming screws) the torques are as follows:

Minimum torque (for good heat transfer)	0.40 Nm (4.0 kgcm)
Maximum torque (to avoid damaging device)	0.60 Nm (6.0 kgcm)

3. Rivet mounting:
   This method is **NOT** recommended because it will damage the plastic encapsulation.

Lead bending

(Maximum permissible tensile force on the body, for 5 seconds is 20N (2kgf).

The leads should not be bent less than 2.4mm from the seal, and should be supported during bending.
The leads can be bent, twisted or straightened by 90 ^{o} maximum. The minimum bending radius is 1mm.

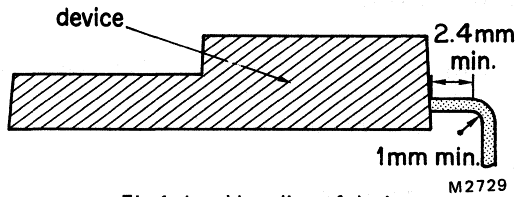


Fig.1 Lead bending of devices.

Soldering

Lead soldering temperature at >3mm from body for t_{sld} <5 seconds:

Devices with T_j max. ≤175 °C, T_{sld} max. = 275 °C.

Devices with T_j max. ≤110 °C, T_{sld} max. = 240 °C.

Avoid any force on body and leads during or after soldering. Do not correct the position of the devices or of its leads after soldering.

INSTRUCTIONS FOR CLIP MOUNTING

1. Apply heatsink compound to the mounting base, then place device on heatsink.
2. Push the short end of clip (part no. 56363) into the narrow slot in the heatsink with the clip at an angle of between 10° to 30° to the vertical (see Figs.2 & 3).
3. Push down the clip over the device until the long end of the clip snaps into the wide slot in the heatsink. The clip should bear down on the main part of the body, not on the tab (see Fig.3a).

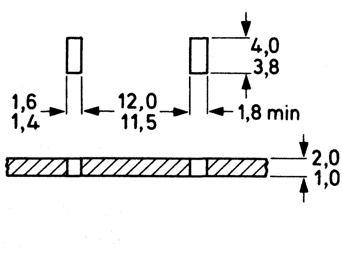


Fig.2 Heatsink requirements

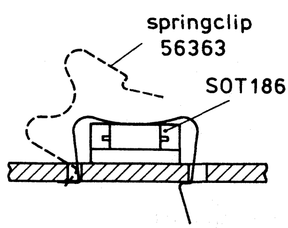


Fig.3 Mounting.

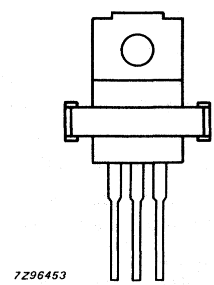


Fig.3a Position of device (top view).

INSTRUCTIONS FOR SCREW MOUNTING

Screw through heatsink with nut

Dimensions in mm

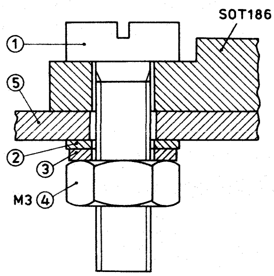


Fig.4 Assembly.

(1) M3 screw
(2) plain washer
(3) lock washer
(4) M3 nut
(5) heatsink

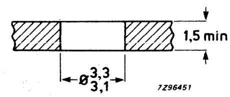


Fig.5 Heatsink requirements.

Into tapped heatsink

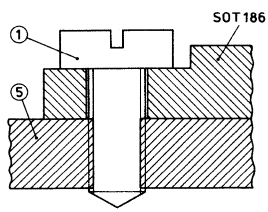


Fig.6 Assembly.

(1) M3 screw
(5) heatsink

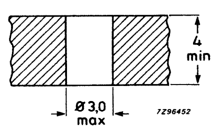


Fig.7 Heatsink requirements.

MOUNTING REQUIREMENTS FOR VOLTAGE ISOLATION

Full-pack devices may be used to maintain voltage isolation between the heatsink and the electrical circuit. However, users must ensure that there is a sufficient creepage distance between the exposed metal of the device (at both the lead and tab ends) and the heatsink. The distance required will vary according to the application and the regulations that may apply.

To increase the creepage distances the heatsink may be formed with slots or holes around the lead and tab ends of the device. The dimensions of the holes will vary according to the creepage distances required. For detail see Fig.8.

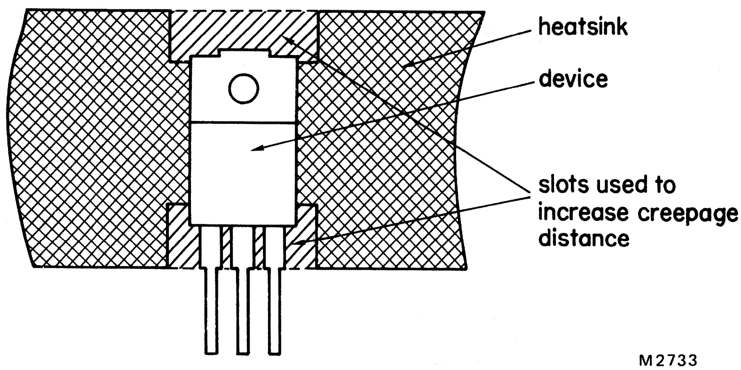


Fig.8 Slots formed in heatsink to increase creepage distance.

MOUNTING INSTRUCTIONS FOR SOT-93 ENVELOPES

GENERAL DATA AND INSTRUCTIONS

General rule

Avoid any sudden forces on leads and body; these forces, such as from falling on a hard surface, are easily underestimated. In the direct screw mounting an M4 screw must be used; an M3 screw in the insulating mounting.

Heatsink requirements

Flatness in the mounting area: 0,02 mm maximum per 10 mm.
The mounting hole must be deburred.

Heatsink compound

The thermal resistance from mounting base to heatsink ($R_{th\ mb\text{-}h}$) can be reduced by applying a metallic-oxide heatsink compound between the contact surfaces. For insulated mounting the compound should be applied to the bottom of both device and insulator.

Maximum play

The bush or the washer may only just touch the plastic part of the body, but should not exert any force on that part. Keep mounting tool (e.g. screwdriver) clear of the plastic body.

Mounting torques

For M3 screw (insulated mounting):	
Minimum torque (for good heat transfer)	0,4 Nm (4 kgcm)
Maximum torque (to avoid damaging the device)	0,6 Nm (6 kgcm)
For M4 screw (direct mounting only):	
Minimum torque (for good heat transfer)	0,4 Nm (4 kgcm)
Maximum torque (to avoid damaging the device)	1,0 Nm (10 kgcm)

Note: The M4 screw head should not touch the plastic part of the envelope.

Lead bending

Maximum permissible tensile force on the body for 5 s — 20 N (2 kgf)

No torsion is permitted at the emergence of the leads.

Bending or twisting is not permitted within a lead length of 0,3 mm from the body of the device.

The leads can be bent through 90° maximum, twisted or straightened; to keep forces within the above-mentioned limits, the leads should be clamped near the body.

Soldering

Recommendations for devices with a maximum junction temperature rating ⩽ 175 °C:

a. Dip or wave soldering

Maximum permissible solder temperature is 260 °C at a distance from the body of > 5 mm and for a total contact time with soldering bath or waves of < 7 s.

b. Hand soldering

Maximum permissible temperature is 275 °C at a distance from the body of > 3 mm and for a total contact time with the soldering iron of < 5 s.

The body of the device must not touch anything with a temperature > 200 °C.

It is not permitted to solder the metal tab of the device to a heatsink, otherwise the junction temperature rating will be exceeded.

Avoid any force on body and leads during or after soldering; do not correct the position of the device or of its leads after soldering.

Thermal data

(Typical figures, for exact figures see data for each device type).

			clip mounting	screw mounting
Thermal resistance from mounting base to heatsink				
direct mounting				
with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,3	0,3 K/W
without heatsink compound	$R_{th\ mb\text{-}h}$	=	1,5	0,8 K/W
with 0,05 mm mica washer				
with heatsink compound	$R_{th\ mb\text{-}h}$	=	0,8	0,8 K/W
without heatsink compound	$R_{th\ mb\text{-}h}$	=	3,0	2,2 K/W

INSTRUCTIONS FOR CLIP MOUNTING

Direct mounting with clip 56379

1. Place the device on the heatsink, applying heatsink compound to the mounting base.
2. Push the short end of the clip into the narrow slot in the heatsink with the clip at an angle of 10° to 20° to the vertical (see Fig. 1b).
3. Push down the clip over the device until the long end of the clip snaps into the wide slot in the heatsink. The clip should bear on the plastic body, not on the tab (see Fig. 1(c)).

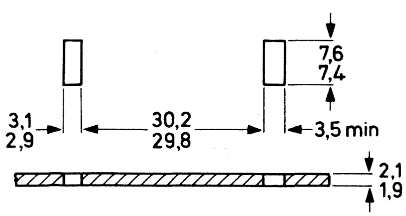


Fig. 1a Heatsink requirements.

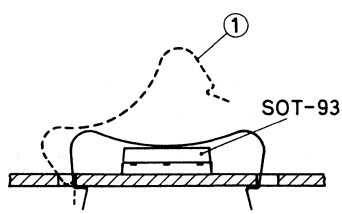


Fig. 1b Mounting.
(1) = spring clip 56379.

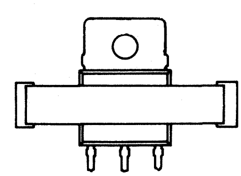


Fig. 1c Position of the device.

Insulated mounting with clip 56379

With the mica 56378 insulation up to 1500 V is obtained.

1. Place the device with the insulator on the heatsink, applying heatsink compound to the bottom of both device and insulator.
2. Push the short end of the clip into the narrow slot in the heatsink with the clip at an angle of 10° to 20° to the vertical (see Figs 2a and 2b).
3. Push down the clip over the device until the long end of the clip snaps into the wide slot in the heatsink. The clip should bear on the plastic body, not on the tab (see Fig. 2c). There should be minimum 3 mm distance between the device and the edge of the insulator for adequate creepage.

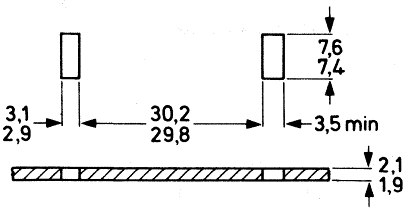


Fig. 2a Heatsink requirements.

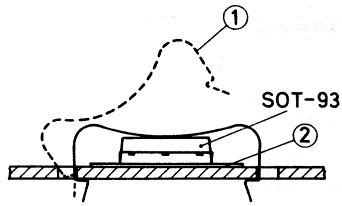


Fig. 2b Mounting.
(1) = spring clip 56379
(2) = insulator 56378

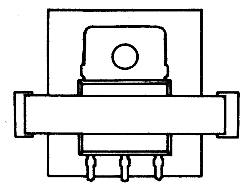


Fig. 2c Position of the device.

INSTRUCTIONS FOR SCREW MOUNTING

Direct mounting

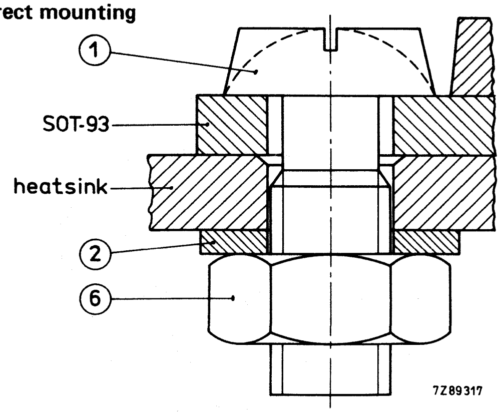


Fig. 3a Assembly through heatsink with nut.

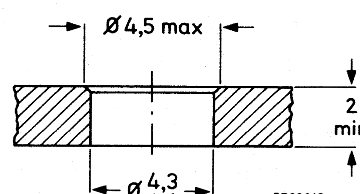


Fig. 3b Heatsink requirements.

When screw mounting the SOT-93 envelope, it is particularly important to apply a thin, even layer of heatsink compound to the mounting base, and to apply torque to the screw slowly so that the compound has time to flow and the mounting base is not deformed. Most SOT-93 envelopes contain a crystal larger than that in the other plastic envelopes, and it is more likely to crack if the mounting base is deformed.

Legend: (1) M4 screw; (2) plain washer; (6) M4 nut.
Where vibrations are to be expected the use of a lock washer or of a curved spring washer is recommended, with a plain washer between aluminium heatsink and spring washer.

Insulated screw mounting with nut; up to 800 V.

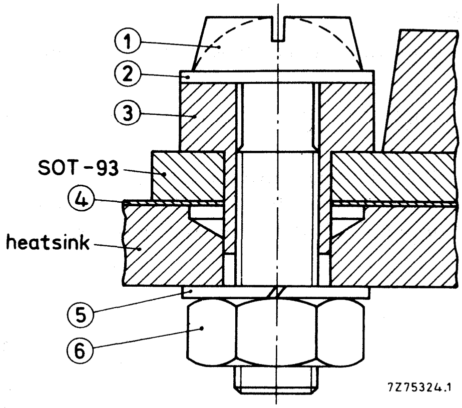


Fig. 4 Assembly.
See also Fig. 9.

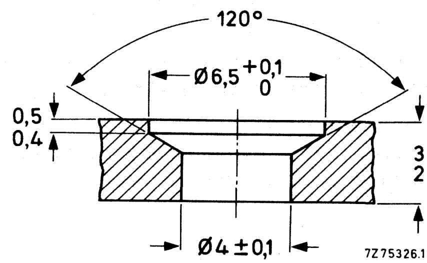


Fig. 5 Heatsink requirements up to 800 V insulation.

(1) M3 screw
(2) plain washer
(3) insulating bush (56368b)
(4) mica insulator (56368c)
(5) lock washer
(6) M3 nut

Insulated screw mounting with tapped hole; up to 800 V.

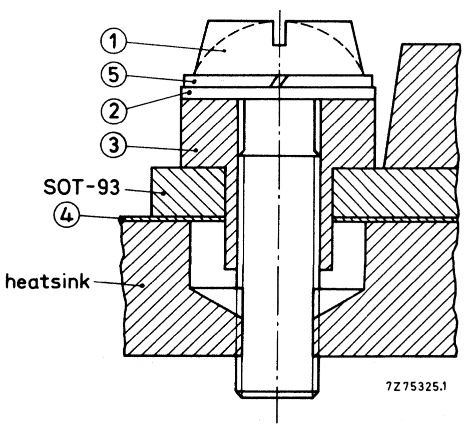


Fig. 6 Assembly.
See also Fig. 9.

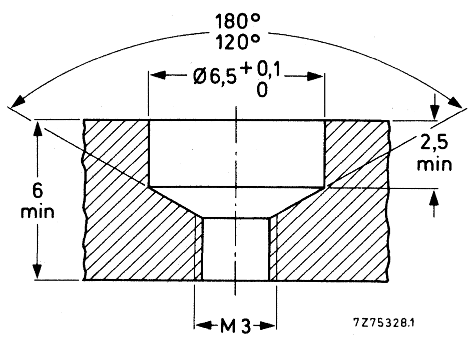


Fig. 7 Heatsink requirements up to 800 V insulation.

(1) M3 screw
(2) plain washer
(3) insulating bush (56368b)
(4) mica insulator (56368c)
(5) lock washer

Insulated screw mounting with insert nut; up to 500 V

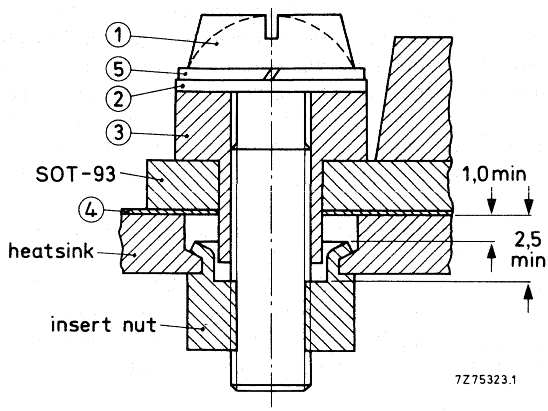


Fig. 8 Assembly and heatsink requirements for 500 V insulation. See also Fig. 3.

(1) M3 screw
(2) plain washer
(3) insulating bush (56368b)
(4) mica insulator (56368c)
(5) lock washer

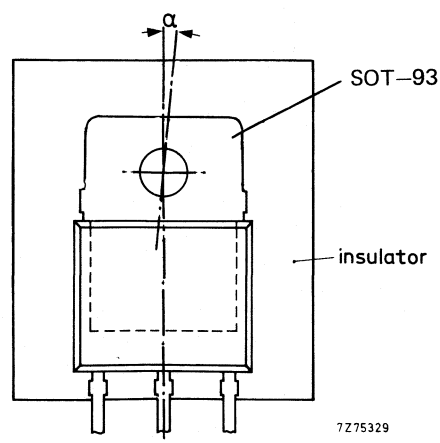
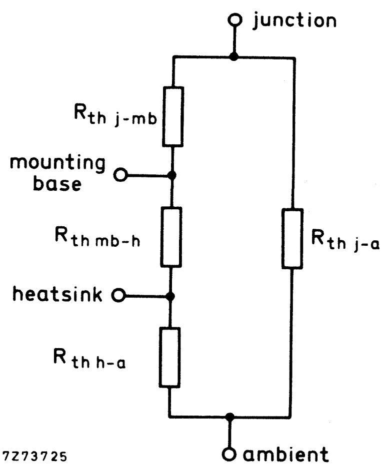


Fig. 9 Mica insulator.

The axial deviation (α) between SOT-93 and mica should not exceed 5°.

MOUNTING CONSIDERATIONS FOR STUD-MOUNTED DEVICES

Losses generated in a silicon device must flow through the case and to a lesser extent the leads. The greatest proportion of the losses flow out through the case into a heat exchanger which can be either free convection cooled, forced convection or even liquid cooled. For the majority of devices in our range natural convection is generally adequate, however, where other considerations such as space saving must be taken into account then methods such as forced convection etc. can be considered. The thermal path from junction to ambient may be considered as a number of resistances in series. The first thermal resistance will be that of junction to mounting base, usually denoted by $R_{th\ j\text{-}mb}$. The second is the contact thermal resistance $R_{th\ mb\text{-}h}$ and finally there is the thermal resistance of the heatsink $R_{th\ h\text{-}a}$.
In the rating curves, the contact thermal resistance and heatsink thermal resistances are combined as a single figure - $R_{th\ mb\text{-}a}$.
In addition to the steady state thermal conditions of the system, consideration should also be given to the possibility of any transient thermal excursions. These can be caused for example by starting conditions or overloads and in order to calculate the effect on the device, a graph of transient thermal resistance $Z_{th\ j\text{-}mb}$ as a function of time is given in each data sheet.



7Z73725

When mounting the device on the heatsink, care should be taken that the contact surfaces are free from burrs or projections of any kind and must be thoroughly clean.
In the case where an anodised heatsink is used, the anodising should be removed from the contact surface ensuring good electrical and thermal contact.
The contact surfaces should be smeared with a metallic oxide-loaded grease to ensure good heat transfer. Where the device is mounted in a tapped hole, care should be taken that the hole is perpendicular to the surface of the heatsink. When mounting the device to the heatsink, it is essential that a proper torque wrench is used, applying the correct amount of torque as specified in the published data.
Excessive torque can distort the threads of the device and may even cause mechanical stress on the wafer, leading to the possible failure.
Where isolation of the device from the heatsink is required, it is common practice to use a mica washer between contact surfaces, and where a clearance hole is used, a p.t.f.e. insulating bush is inserted. A metallic oxide-loaded heatsink compound should be smeared on all contact surfaces, including the mica washer, to ensure optimum heat transfer. The use of ordinary silicone grease is not recommended.

MOUNTING INSTRUCTIONS FOR DO-4 AND TO-64 ENVELOPES

GENERAL DATA AND INSTRUCTIONS

Mounting instructions for up to 2000 V insulation using 56295c insulating bush and 56295a mica washer.

Mounting instructions for up to 2000 V insulation using 56295b insulating ring and two 56295a mica washers.

HEATSINK REQUIREMENTS

Mounting holes must be deburred.

MOUNTING TORQUES

Minimum torque (for good heat transfer)	0.9 Nm (9 kg cm)
Maximum torque (to avoid damaging device)	1.7 Nm (17 kg cm)

THERMAL DATA

The thermal resistance from mounting base to heatsink ($R_{th\ mb\text{-}h}$) can be reduced by applying a heat conducting compound between device and heatsink. For insulated mounting the compound should be applied to the bottom of both device and insulator.

Thermal resistance from mounting base to heatsink (insulated mounting using 56295a mica washer)

without heatsink compound	$R_{th\ mb\text{-}h}$	=	5	K/W
with heatsink compound	$R_{th\ mb\text{-}h}$	=	2.5	K/W

MOUNTING INSTRUCTIONS FOR UP TO 2000 V INSULATION

Using 56295c insulating bush and 56295a mica washer.

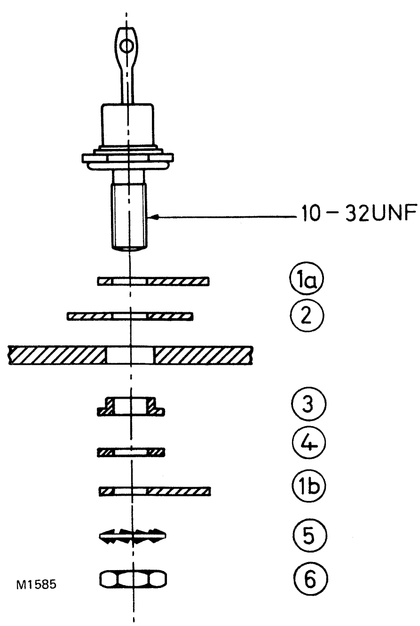


Fig.1

(1a);(1b) tag — alternative positions
(2) mica washer 56295a
(3) insulating bush 56295c
(4) plain washer (may be omitted if tag used in position 1b)
(5) toothed lock washer (supplied with device)
(6) 10-32 UNF nut (supplied with device)

MOUNTING INSTRUCTIONS FOR UP TO 2000 V INSULATION

Using insulating ring 56295b and two mica washers 56295a.

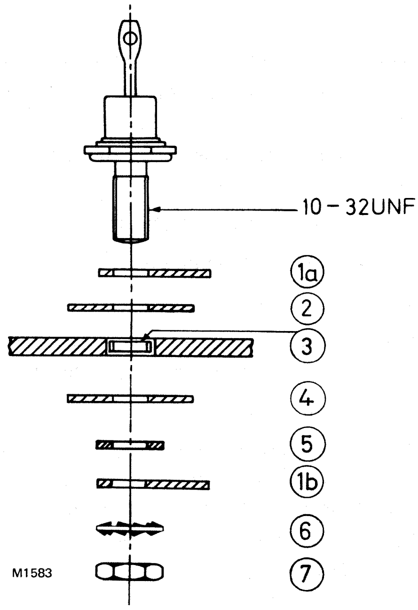


Fig. 2

(1a); (1b)	tag — alternative positions
(2)	mica washer 56295a
(3)	insulating ring 56295b
(4)	mica washer 56295a
(5)	plain washer (may be omitted if tag used in position 1b)
(6)	toothed lock washer (supplied with device)
(7)	10-32 nut (supplied with device)

MOUNTING INSTRUCTIONS FOR DO-5 AND TO-48 ENVELOPES

GENERAL DATA AND INSTRUCTIONS

Mounting instructions for up to 2000 V insulation using 56264b insulating bush and 56264a mica washer.

HEATSINK REQUIREMENTS

Mounting holes must be deburred.

MOUNTING TORQUES

Minimum torque (for good heat transfer)	1.7 Nm (17 kg cm)
Maximum torque (to avoid damaging device)	3.5 Nm (35 kg cm)

THERMAL DATA

The thermal resistance from mounting base to heatsink ($R_{th\ mb-h}$) can be reduced by applying a heat conducting compound between device and heatsink. For insulated mounting the compound should be applied to the bottom of both device and insulator.

Thermal resistance from mounting base
to heatsink (insulated mounting using 56264a mica washer)

without heatsink compound	$R_{th\ mb-h}$	=	5	K/W
with heatsink compound	$R_{th\ mb-h}$	=	2.5	K/W

MOUNTING INSTRUCTIONS FOR UP TO 2000 V INSULATION

Using insulating bush 56264b and mica washer 56264a.

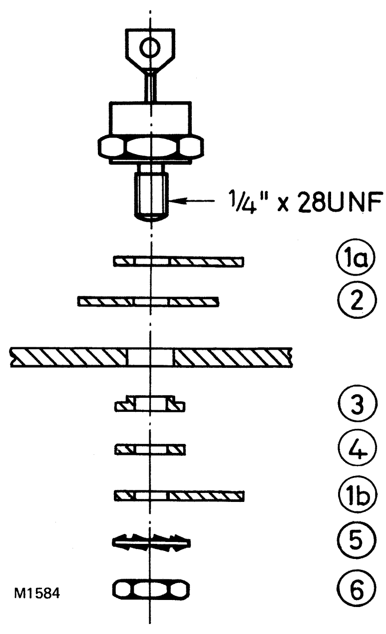


Fig.1

(1a); (1b) tag — alternative positions
(2) mica washer 56264a
(3) insulating bush 56264b
(4) plain washer (may be omitted if tag used in position 1b)
(5) toothed lock washer (supplied with device)
(6) ¼" x 28 UNF nut (supplied with device)

INDEX OF TYPE NUMBERS

The inclusion of a type number in this publication does not necessarily imply its availability.

Key to handbook sections

A = Accessories
FET = Field-effect transistors
I = Infrared devices
LED = Light-emitting diodes
LCD = Liquid crystal displays
Mm = Surface-mounted devices
M = Microwave transistors
P = Low-frequency power transistors and modules
PDT = Photodiodes or transistors
Ph = Photoconductive devices
PhC = Photocouplers
PM = PowerMOS transistors
R = Rectifier diodes
RFP = RF power transistors and modules
RT = Triplers
SEN = Semiconductor sensors
SD = Small-signal diodes
Sm = Small-signal transistors
Sp = Special diodes
SP = Low-frequency switching power diodes
St = Rectifier stacks
T = Tuner diodes
Th = Thyristors
Tri = Triacs
TS = Transient suppressor diodes
Vrf = Voltage reference diodes
Vrg = Voltage regulator diodes
WBT = Wideband hybrid IC transistors
WBM = Wideband hybrid IC modules

* series.

NOTES

DATA HANDBOOK SYSTEM

DATA HANDBOOK SYSTEM

Our Data Handbook System comprises more than 60 books with specifications on electronic components, subassemblies and materials. It is made up of six series of handbooks:

INTEGRATED CIRCUITS

DISCRETE SEMICONDUCTORS

DISPLAY COMPONENTS

PASSIVE COMPONENTS*

PROFESSIONAL COMPONENTS**

MATERIALS*

The contents of each series are listed on pages iii to viii.

The data handbooks contain all pertinent data available at the time of publication, and each is revised and reissued periodically.

When ratings or specifications differ from those published in the preceding edition they are indicated with arrows in the page margin. Where application is given it is advisory and does not form part of the product specification.

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Product specialists are at your service and enquiries will be answered promptly.

* Will replace the Components and materials (green) series of handbooks.
** Will replace the Electron tubes (blue) series of handbooks.

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This series of handbooks comprises:

code	handbook title
IC01	**Radio, audio and associated systems** Bipolar, MOS
IC02a/b	**Video and associated systems** Bipolar, MOS
IC03	**ICs for Telecom** Bipolar, MOS Subscriber sets, Cordless Telephones
IC04	**HE4000B logic family** CMOS
IC05	**Advanced Low-power Schottky (ALS) Logic Series**
IC06	**High-speed CMOS; PC74HC/HCT/HCU** Logic family
IC07	**Advanced CMOS logic (ACL)**
IC08	**ECL 10K and 100K logic families**
IC09N	**TTL logic series**
IC10	**Memories** MOS, TTL, ECL
IC11	**Linear Products**
IC12	**I^2C-bus compatible ICs**
IC13	**Semi-custom** Programmable Logic Devices (PLD)
IC14	**Microcontrollers** NMOS, CMOS
IC15	**FAST TTL logic series**
Supplement to IC15	**FAST TTL logic series**
IC16	**CMOS integrated circuits for clocks and watches**
IC17	**ICs for Telecom** Bipolar, MOS Radio pagers Mobile telephones ISDN
IC18	**Microprocessors and peripherals**
IC19	**Data communication products**

DISCRETE SEMICONDUCTORS

This series of data handbooks comprises:

current code	new code	handbook title
S1	**SC01**	**Diodes** High-voltage tripler units
S2a	**SC02**	**Power diodes**
S2b	**SC03***	**Thyristors and triacs**
S3	**SC04**	**Small-signal transistors**
S4a	**SC05**	**Low-frequency power transistors and hybrid IC power modules**
S4b	**SC06**	**High-voltage and switching power transistors**
S5	**SC07**	**Small-signal field-effect transistors**
S6	**SC08** **SC09**	**RF power transistors** **RF power modules**
S7	**SC10**	**Surface mounted semiconductors**
S8a	**SC11***	**Light emitting diodes**
S8b	**SC12**	**Optocouplers**
S9	**SC13***	**PowerMOS transistors**
S10	**SC14**	**Wideband transistors and wideband hybrid IC modules**
S11	**SC15**	**Microwave transistors**
S15**	**SC16**	**Laser diodes**
S13	**SC17**	**Semiconductor sensors**
S14	**SC18***	**Liquid crystal displays and driver ICs for LCDs**

* Not yet issued with the new code in this series of handbooks.
** New handbook in this series; will be issued shortly.

DISPLAY COMPONENTS

This series of data handbooks comprises:

current code	new code	handbook title
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T16	**DC02**	**Monochrome monitor tubes and deflection units**
C2	**DC03***	**Television tuners, coaxial aerial input assemblies**
C3	**DC04***	**Loudspeakers**
C20	**DC05**	**Flyback transformers, mains transformers and general-purpose FXC assemblies**

* These handbooks are currently issued in another series; they are not yet issued in the Display Components series of handbooks.

PASSIVE COMPONENTS

This series of data handbooks comprises:

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C11	**PA02**	**Varistors, thermistors and sensors**
C12	**PA03**	**Potentiometers and switches**
C7	**PA04**	**Variable capacitors**
C22	**PA05***	**Film capacitors**
C15	**PA06***	**Ceramic capacitors**
C9	**PA07***	**Piezoelectric quartz devices**
C13	**PA08***	**Fixed resistors**

* Not yet issued with the new code in this series of handbooks.

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T2a	*	**Transmitting tubes for communications, glass types**
T2b	*	**Transmitting tubes for communications, ceramic types**
T3	**PC01****	**High-power klystrons**
T4	*	**Magnetrons for microwave heating**
T5	**PC02****	**Cathode-ray tubes**
T6	**PC03****	**Geiger-Müller tubes**
T9	**PC04****	**Photo and electron multipliers**
T10	**PC05**	**Plumbicon camera tubes and accessories**
T11	**PC06**	**Circulators and Isolators**
T12	**PC07**	**Vidicon and Newvicon camera tubes and deflection units**
T13	**PC08**	**Image intensifiers**
T15	**PC09****	**Dry reed switches**
C8	**PC10**	**Variable mains transformers; annular fixed transformers**
	PC11	**Solid state image sensors and peripheral integrated circuits**

* These handbooks will not be reissued.

** Not yet issued with the new code in this series of handbooks.

MATERIALS

This series of data handbooks comprises:

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C16	MA02**	**Permanent magnet materials**
C19	MA03**	**Piezoelectric ceramics**

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