DISCRETE SEMICONDUCTORS

Power Diodes

Philips Components



PHILIPS

POWER DIODES

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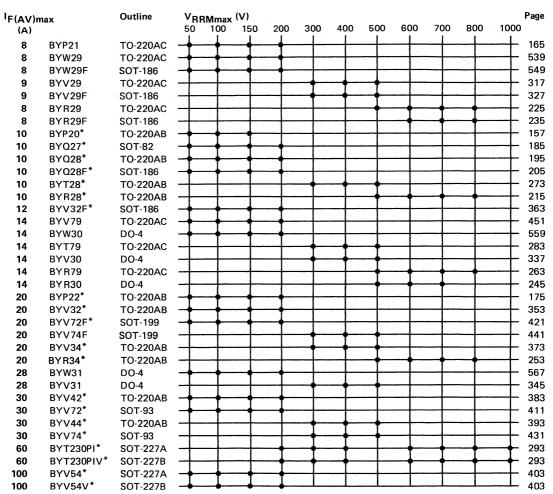


SELECTION GUIDE

FAST RECTIFIER DIODES

Ultra fast (epitaxial) types

(25 to 100 ns)



^{*}Dual rectifier diodes.

SELECTION GUIDE

FAST RECTIFIER DIODES (Cont.)

Very fast types (100 to 450 ns)

| I _{F(AV)m} | nax | Outline | | RRMi | nax (300 | V) 40 | 00 | 50 | 0 60 | 00 | 80 | 00 | 10 | 00 | 120 | Page 00 |
|---------------------|---------|----------|---|------|--------------|----------|----|----|------|----------|----|----------|----|----------|---------------|--------------|
| 7 | BY229 | TO-220AC | | | _ | _ | · | + | | - | | - | | ļ | | - 93 |
| 7 | BY229F | SOT-186 | _ | | - | _ | | + | | _ | | | | | \dashv | — 105 |
| 8 | BY329 | TO-220AC | | | | | | + | | ┞— | | - | | | - | — 131 |
| 12 | BYV24 | DO-4 | | | _ | | | + | | <u> </u> | | - | | | \rightarrow | — 309 |
| 14 | BYX30** | DO-4 | _ | | - | _ | | - | | _ | | <u> </u> | | | - | — 599 |
| 22 | BYX46** | DO-4 | _ | | - | | | - | | | | L | | <u> </u> | | — 625 |

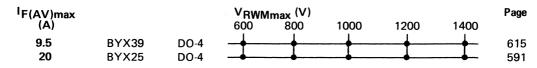
^{**}With avalanche characteristics

RECTIFIER DIODES

General purpose types

| IF(AV)max (A) | | Outline | V _{RRMmax} (V) 300 600 1200 | Page 1600 |
|------------------|--------|----------|---|--------------|
| 6 | BYX38 | DO-4 | | |
| 6.5 | BY249 | TO-220AC | | |
| 6.5 | BY249F | SOT-186 | | 123 |
| 10 | BYX98 | DO-4 | 199 N | 659 |
| 12 | BYX42 | DO-4 | | 621 |
| 15 | BYX99 | DO-4 | | 665 |
| 30 | BYX96 | DO-4 | | 647 |

Avalanche types



SCHOTTKY RECTIFIER DIODES

| IF(AV)max (A) | | Outline | V _{RRMmax} (V) 35 40 49 | 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

| ITSM ma | ıx | Outline | V _{(B} | O)nom 100 1 | (V) 20 | 140 | 160 | 180 | 200 | 220 | 240 | 260 | 280 | Page |
|---------|---------|----------|-----------------|----------------|--------------|--------------|-------------|-----|-----|----------|-----|-----|--------------|------|
| 40 | BR210 | TO-220AC | + | + | | + | + | _ | - | \dashv | + | - | + | 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.

SELECTION GUIDE

REGULATOR DIODES (page 683)

| Туре | Regulated voltage | Suppression stand-off voltage | Ptot max (regulator service) | PRSM max (suppressor service) |
|---------------|----------------------|-------------------------------------|------------------------------------|-------------------------------------|
| BZY93-C7V5(R) | 7.5 V | 5.6 V | 1 | A |
| 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 | 1 | |
| C24(R) | 24 V | 18 V | 20 W | 700 W |
| C27(R) | 27 V | 20 V | | |
| C30(R) | 30 V | 22 V | 144 | |
| 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 | | 100 pt |
| C68(R) | 68 V | 51 V | | |
| C75(R) | 75 V | 56 V | 1 | . |

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. | IF(AV) max. | V _{RWM} max. | Page | Configuration |
|----------------------|-----------------------|--------------------------|------|--------------------------------|
| OSS9115-3A to-36A | 3.5 A (6 A in oil) | 4.5 kV | 689 | anode cathode |
| OSS9215-3A to-36A | 5 A (20 A in oil) | 54 kV | 697 | V _{RWM} ——— |
| OSB9115-4A to-36A | 7 A (12 A in oil) | 3 kV | 689 | ~ 0 0 ~ |
| OSB9215-4A to-36A | 10 A (40 A in oil) | 27 kV | 697 | centre - tap |
| OSM9115-4A to-36A | 3.5 A (6 A in oil) | 3 kV | 689 | anode + cathode |
| OSM9215-4A to-36A | 5 A (20 A in oil) | 27 kV | 697 | V _{RWM} ——ocentre-tap |

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GENERAL

Type designation
Rating systems
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Quality conformance
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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 ($R_{th\,j-mb} > 15$ K/W)
- D. TRANSISTOR; power, audio frequency (R_{th i-mb} ≤ 15 K/W)
- E. DIODE; tunnel
- F. TRANSISTOR; low power, high frequency (Rth j-mb > 15 K/W)
- G. MULTIPLE OF DISSIMILAR DEVICES MISCELLANEOUS; e.g. oscillator
- H. DIODE; magnetic sensitive
- L. TRANSISTOR; power, high frequency (R_{th i-mb} ≤ 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-mb} > 15 K/W)
- S. TRANSISTOR; low power, switching (R_{th j-mb} > 15 K/W)
- T. CONTROL AND SWITCHING DEVICE; e.g. thyristor, power (R_{th i-mb} ≤ 15 K/W)
- U. TRANSISTOR; power, switching (R_{th i-mb} ≤ 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)

TYPE DESIGNATION

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 Vz.

- 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.

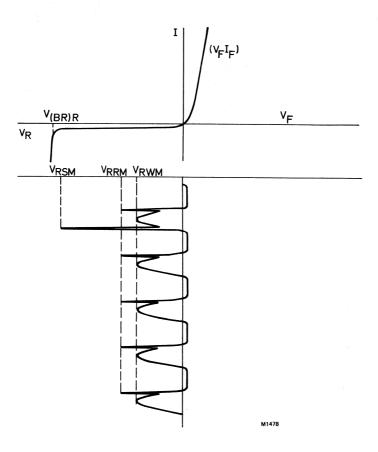
Subscripts

| amb | Ambient | | | | |
|--------------|---|--|--|--|--|
| (AV), (av) | Average value | | | | |
| (BO) | Breakover | | | | |
| (BR) | Breakdown | | | | |
| case | Case | | | | |
| С | Controllable | | | | |
| D,d | Forward off-state 1), non-triggered (gate voltage or current) | | | | |
| F,f | Forward ¹), fall | | | | |
| G,g | Gate terminal | | | | |
| Н | Holding | | | | |
| l,i | Input | | | | |
| J,j | Junction | | | | |
| Ľ | Latching | | | | |
| M,m | Peak or crest value | | | | |
| min | Minimum | | | | |
| 0,0 | 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 initial 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.

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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 microor 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 (IF); high currents increase recovery time.
- b. Reverse bias voltage (VR); 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_i); high temperatures increase both recovery time and stored charge.

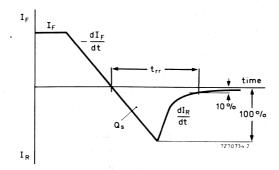


Fig. 1 Waveform showing the reverse recovery aspects.

GENERAL EXPLANATORY NOTES

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 (dlp/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 $p^+ - p n^+$ or $p^+ - n n^+$ 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_{i 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 IRRM.

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 (Ti); high temperature means high losses.

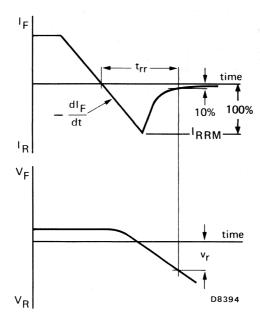


Fig.2 Waveforms showing the reverse switching losses aspects.

GENERAL EXPLANATORY NOTES

SWITCHING LOSSES (continued)

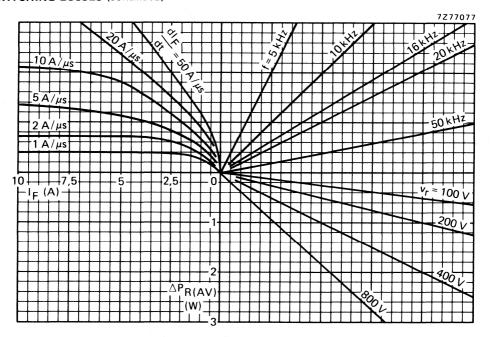


Fig. 3 Nomogram (example of reverse switching losses). Power loss $\Delta P_{R(AV)}$ due to switching only (to be added to steady-state power losses). I_F = forward current just before switching off; T_j = 150 °C.

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 (IF); high currents give high recovery voltages.
- b. Current pulse rise time (t_r); short rise times give high recovery voltages.
- c. Junction temperature (Ti); the influence of temperature is slight.

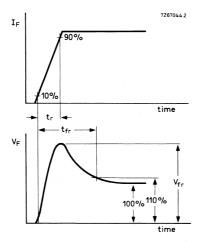


Fig. 4 Waveforms showing the forward recovery aspects.

GENERAL EXPLANATORY NOTES

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:

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

 $T = V_1/V_2$

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

 $V_{\mbox{\scriptsize RWM}}$ = 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

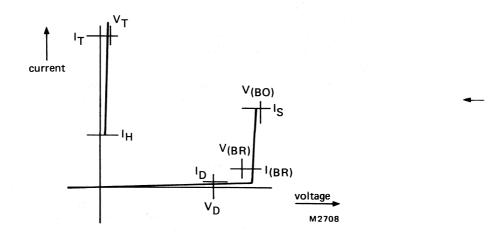


Fig. 1 Breakover diode characteristics (1st quadrant).

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

VD stand-off voltage, maximum normal operating voltage.

ID off-state current, normally quoted at VD.

V(BR) breakdown voltage, at which the BOD will commence avalanche breakdown.

I(BR) breakdown current, with V(BR) applied.

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

IT on-state current.

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

IH 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.

IS 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 Is maximum.

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.

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

TSM ITSM 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 T₁/T₂ μs waveform.

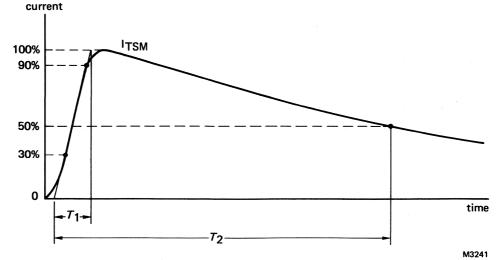


Fig.2 Definition of ITSM waveform.

Thermal conditions

Rth 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 Is maximum. When this current is reached the BOD will switch and generate heat in the on-state.

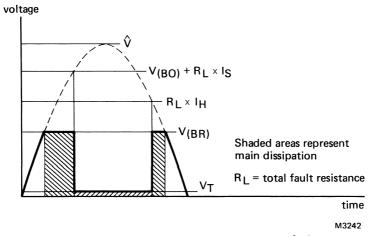


Fig.3 Voltage across BOD during mains contact fault,

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 500 Ω -5k Ω 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

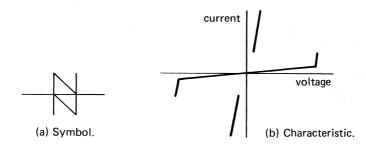


Fig.4 Symmetric BOD.

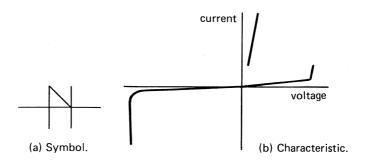


Fig.5 Reverse-blocking BOD.

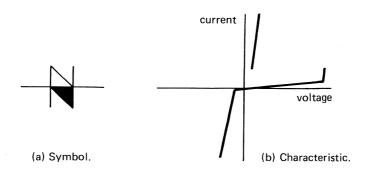


Fig.6 Reverse-conducting BOD.

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

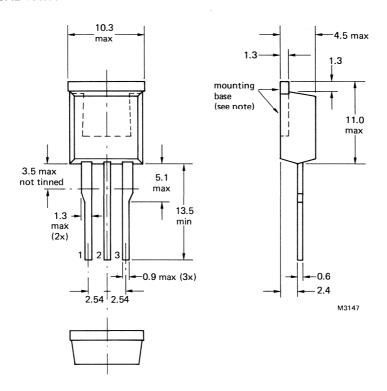


Fig.1 SOT-226, low-profile version of TO-220AB.

Net mass: 1.5 gram

Note: The exposed metal mounting base is directly connected to terminal 2.

MECHANICAL DATA (Cont)

Dimensions in mm

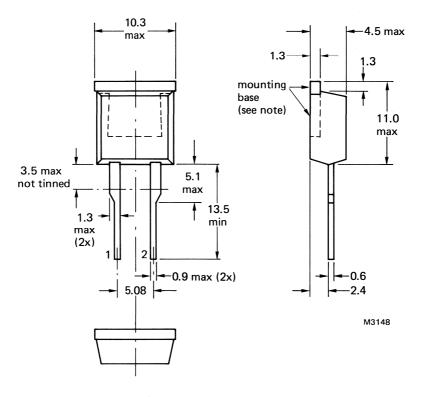


Fig.2 SOD-94, low-profile version of TO-220AC.

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.
- 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-h} | = | 0.3 | K/W |
|----|---|----------------------|---|-----|-----|
| b. | with heatsink compound and 0.06 mm maximum mica insulator | R _{th mb-h} | = | 1.4 | K/W |
| c. | with heatsink compound and 0.1 mm max. mica insulator | R _{th mb-h} | = | 2.2 | K/W |
| d. | with heatsink compound and 0.25 mm max. alumina insulator | R _{th mb-h} | = | 8.0 | K/W |
| e. | without heatsink compound | R _{th mb-h} | = | 1.4 | K/W |

2. 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 tie-point.

Thermal resistance from junction to ambient in free air:

mounted on a printed-circuit board at any lead length $R_{th j-a} = 75 \text{ K/W}$

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

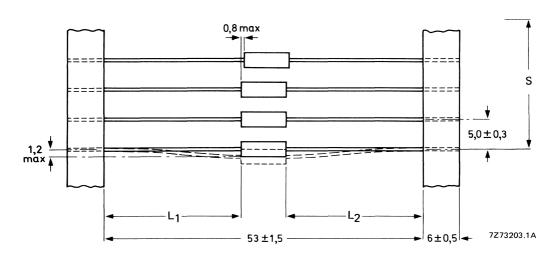


Fig. 1 Configuration of bandolier.

The cumulative space (S) measured over ten spacings = 50 \pm 2; for 26 mm: 20 spacings (= 100 \pm 2). The diodes are centred so that $|L_1 - L_2| \le 1,2$ 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.

Flat heatsink

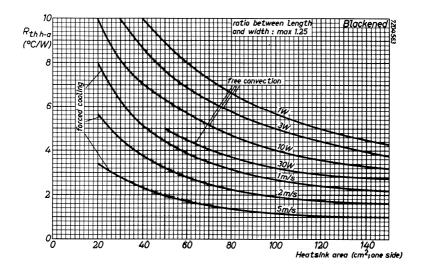
Thermal resistance of flat heatsinks of 2 mm copper or 3 mm aluminium. The graphs are valid for the combination of device and heatsink.

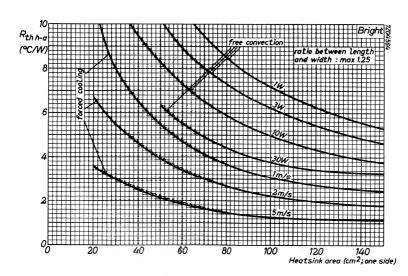




Studs: 10-32UNF

Mounting bases, across the flats: max. 11,0 mm

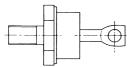




39

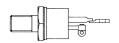
Flat heatsink

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



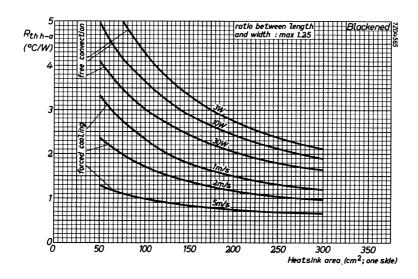
Stud: M6; 1/4" x 28 UNF

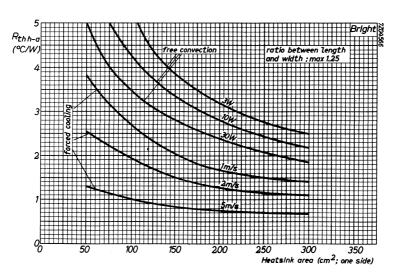
Mounting base across the flats: max. 17 mm



Stud: M6; 1/4" 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.

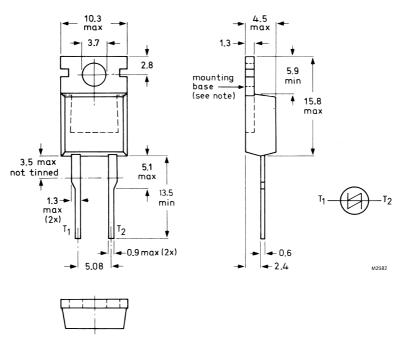
QUICK REFERENCE DATA

| | | | BR210 | 0-100 to 280 | |
|--|-------------------|------|-------|--------------|-----|
| Breakover voltage | V _(BO) | nom. | | 100 to 280 | V |
| Holding current | I _H | > | | 150 | mA |
| Transient peak current (10/320 μs impulse) | ITSM | max. | | 40 | Α - |

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.

BR210 SERIES

RATINGS

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

Voltages (either direction)

| | t a consider (account of the constant) | | | | | | |
|---|--|--------------------|------------------|------------------------|--------|--|--|
| | | | BR210-100 to 280 | | | | |
| - | Continuous voltages | V_{D} | max. | 75% of nom. voltage | | | |
| - | Currents | | | | | | |
| | (in either direction) | | | | | | |
| | Transient peak current (8/20 μs impulse) | ITSM1 | max. | 150 | Α | | |
| | Transient peak current (10/320 μ s impulse) equivalent to 10/700 μ s 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 | Α | | |
| | RMS AC on-state current | IT(RMS) | max. | 8 | Α | | |
| | Non-repetitive peak on-state current, T _j = 100 °C prior to surge; t = 10 ms; half sinewave | ^I TSM3 | max. | 30 | A | | |
| | I^2 t for fusing (t = 10 ms) | l² t | max. | 4.5 | A^2s | | |
| | Rate of rise of on-state current after $V(BO)$ turn-on $(t_p = 10 \mu s)$ | 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 | оС | | |
| | Operating temperature (off-state) | T _j | max. | 125 | oC | | |
| | Overload temperature (on-state) | T _{vj} | max. | 150 | оС | | |

| THER | MAL | RESIS | TAN | CE |
|------|-----|-------|-----|----|
| | | | | |

| From junction to ambient in free air mounted on a printed circuit board at any lead length | R _{th j-amb} | = | 60 | K/W |
|---|--|-------|------------|------------|
| From junction to mounting base bidirectional operation unidirectional operation | R _{th j-mb} R _{th j-mb} | = = = | 2.5 3.1 | K/W K/W |
| Transient thermal impedance (t = 1 ms) | Z _{th j-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-h} | = | 0.3 | K/W |
| with heatsink compound and 0.06 mm maximum mica insulator | R _{th mb-h} | = | 1.4 | K/W |
| c. with heatsink compound and 0.1 mm max. mica insulator (56369) | R _{th mb-h} | = | 2.2 | K/W |
| d. with heatsink compound and 0.25 mm max. alumina insulator (56367) | R _{th mb-h} | = | 8.0 | K/W |

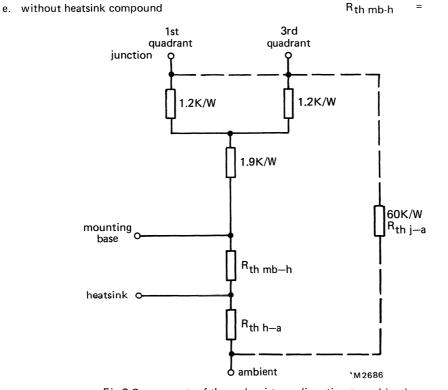


Fig.2 Components of thermal resistance (junction to ambient).

1.4

K/W

BR210 SERIES

CHARACTERISTICS

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); $(I \leq I_S)$: $(100 \, \mu s \, pulsed)$

| (100 μs pulsed) | | V(BR) min. | V(BO) max. | |
|--|---------------------|---------------|---------------|------|
| E | 3R210-100 | 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 _i = 25 ^O C | lн | > | 150 | mΑ |
| T _j = 25 ^o C T _j = 70 ^o C | ΙĤ | > | 100 | mΑ |
| Switching current (note 3) | IS | > | 10 | mΑ |
| (100 μs pulsed) | Is | typ. | 200 | mΑ |
| | IS | · < | 1000 | mΑ |
| Off-state current; $V_D = 85\% V_{(BR)min}$ (note 4) | | | | |
| $T_i = 70 {}^{\circ}C$ | ۱ _D | < | 50 | μΑ |
| T _j ' = 125 °C | ۱ _D | < | 250 | μΑ |
| Linear rate of rise of off-state voltage | | | | |
| that will not trigger any device; | | | | |
| $T_j = 70 {}^{o}C; V_{DM} = 85\% V_{(BR)min}$ | d∨ _D /dt | < | 2000 | V/μs |
| Off-state capacitance | | | | |
| $V_D = 0$; $f = 1$ kHz to 1 MHz | Сj | < | 300 | рF |
| | | | | |

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.

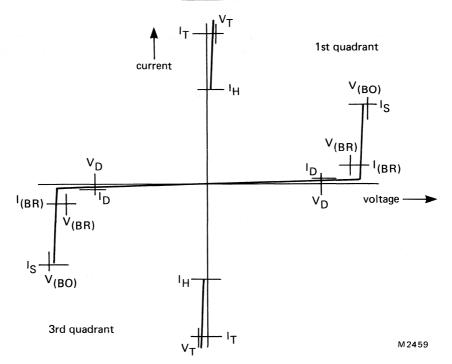
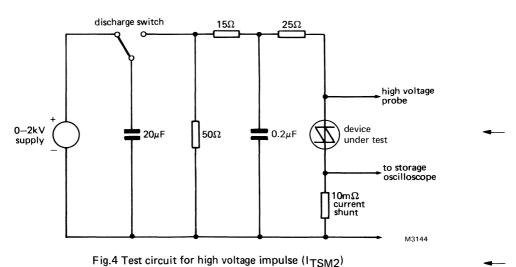


Fig.3 Breakover diode characteristics.



Notes:

The 10/700 μ s 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 .

(according to CCITT vol IX-Rec. K17)

MOUNTING INSTRUCTIONS

- The device may be soldered directly into the circuit. The maximum permissible soldering temperature is 275 °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.
- 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° 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

- 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.
- 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 $500-5~\mathrm{k}\Omega$, there may be excessive dissipation.

MAINS CONTACT

Calculation of power dissipation during mains contact fault.

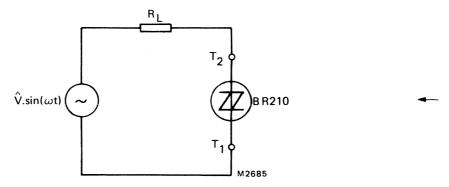


Fig.5 Equivalent circuit of BOD during mains contact fault; R_{\perp} = total fault resistance.

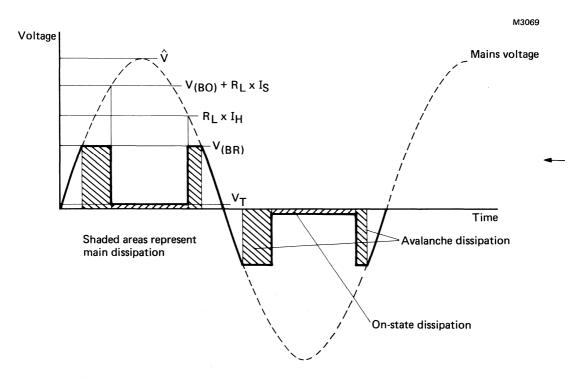


Fig.6 Dissipation during mains contact fault.

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.

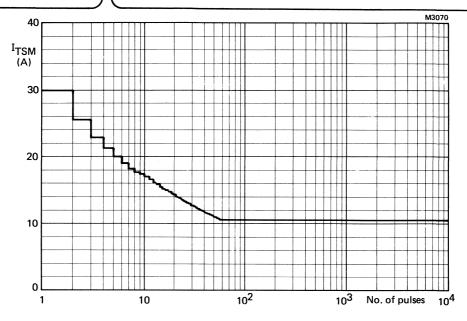
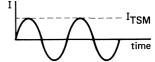


Fig.7 Maximum permissible non-repetitive on-state current based on sinusoidal currents (f = 50 Hz; device triggered at the start of each pulse). T_j = 125 °C prior to surge.



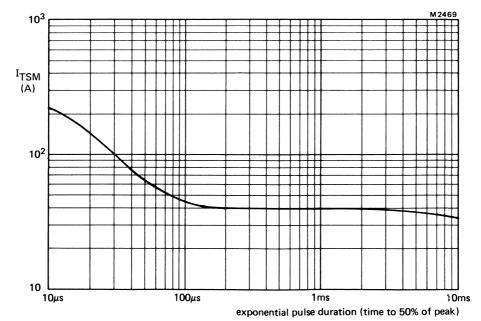


Fig.8 Maximum non-repetitive exponential waveform Impulse Current rating as a function of pulse duration (virtual front-time 10 μ s).

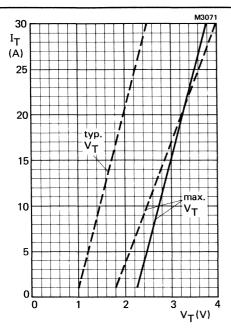


Fig.9 On-state voltage as a function of on-state current. (200 μ s pulsed condition to avoid excessive dissipation) — $T_j = 25, -- T_j = 125$ °C.

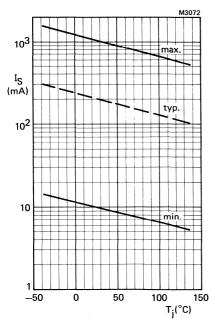


Fig.11 Switching current as a function of junction temperature.

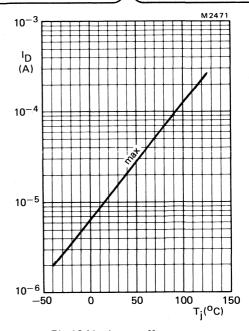


Fig. 10 Maximum off-state current as a function of temperature.

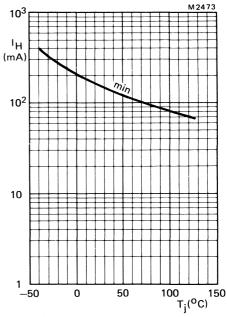


Fig. 12 Minimum holding current as a function of temperature.

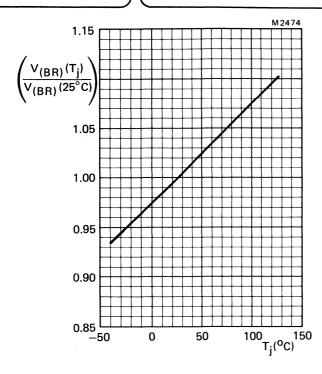


Fig.13 Normalised avalanche breakdown voltage as a function of temperature. Note: this figure may also be used to derive normalised V(BO).

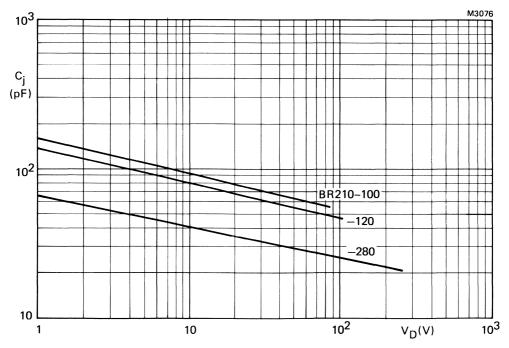


Fig.14 Typical junction capacitance as a function of off-state voltage; $T_j = 25$ °C; f = 1 MHz.

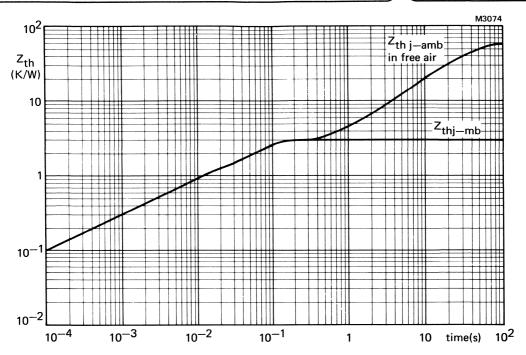


Fig.15 Transient thermal impedance as a function of time (rectangular pulse duration).

This data sheet contains advance information and specifications are subject to change without notice.

BREAKOVER DIODES

A range of bidirectional diodes in hermetically sealed axial-leaded implosion-diode glass outlines with a $\pm -12\%$ 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.

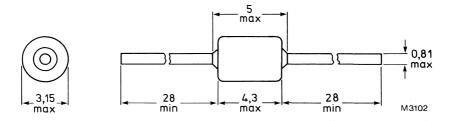
QUICK REFERENCE DATA

| | | | BR211-100 to 280 | |
|---|-------------------|------|------------------|----|
| Breakover voltage | V _(BO) | nom. | 100 to 280 | V |
| Holding current | lн | > | 150 | mΑ |
| Transient peak current (10/320 μs impulse) | ITSM | max. | 40 | Ą |

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.

BR211 SERIES

RATINGS

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

| Voltages | | | | |
|--|---------------------|------|------------------------|--------|
| (in either direction) | | В | R211-100 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) | ITSM1 | max. | 40 | A |
| Non-repetitive peak on-state current, T _j = 70 °C prior to surge; t = 10 ms; half sinewave | ITSM2 | max. | 15 | А |
| l^2t for fusing (t = 10 ms) | l ² t | max. | 1.1 | A^2s |
| Rate of rise of on-state current after $V_{(BO)}$ turn-on $(t_p = 10 \mu s)$ | dl _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 | РТМ | max. | 50 | W |
| Temperatures | | | | |
| Storage temperature | T_{stg} | | -65 to +150 | оС |
| Operating temperature (off-state) | T _{amb} | max. | 70 | oC |
| Overload temperature (on-state) | T_{vj} | max. | 150 | oC |
| | | | | |

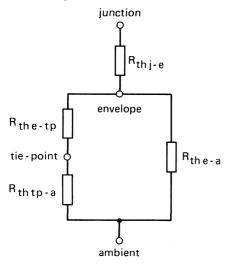
THERMAL RESISTANCE

| From junction to envelope | R _{th i-e} | = 1 | 22 | K/W |
|-----------------------------|----------------------|-----|------|-----|
| From envelope to tie point | | | | |
| lead length = 5 mm | R _{th e-tp} | = | 15 | K/W |
| lead length = 10 mm | R _{th e-tp} | = | 30 | K/W |
| From envelope to ambient | | | | |
| lead length = 5 mm | R _{th e-a} | . = | 440 | K/W |
| lead length = 10 mm | R _{th e-a} | = | 350 | K/W |
| Transient thermal impedance | | | | |
| t = 1 ms; | Z _{th j-a} | = | 2.62 | K/W |

Influence of mounting method

Device mounted on a 1.5 mm thick epoxy-glass pcb with a copper thickness \geq 40 μ m

- 1. Tie point to ambient thermal resistance
 - a. mounted as Fig.3
 - b. mounted with 1 cm² copper laminate per lead
 - c. mounted with 2.25 cm² copper laminate per lead
- 2. Junction to ambient thermal resistance, mounted as Fig.3



| R _{th tp-a} | = | 70 | K/W |
|----------------------|-----|-----|-----|
| R _{th tp-a} | = | 55 | K/W |
| R _{th tp-a} | = , | 45 | K/W |
| R _{th j-a} | = | 105 | K/W |

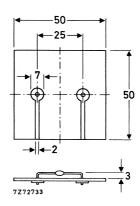


Fig.2 Components of thermal resistance.

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

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

Notes: All figures quoted assume symmetrical lead lengths.

For further information see data sheet Thermal Model of Axial Leaded Devices.

BR211 SERIES

CHARACTERISTICS

| T _j = 25 ^o C unless otherwise stated Voltages and currents (in either direction) | | | | |
|---|----------------------------------|--------------------------|--------------------------|----------------|
| On-state voltage (note 1) ITM = 2 A | v_{TM} | < | 2.5 | V |
| Avalanche voltage $V_{(BR)}$; ($I_{(BR)} = 10 \text{ mA}$), and Break over voltage $V_{(BO)}$; ($I \le I_S$): | - 1101 | | | |
| (100 μs pulsed) | | V(BR) min. | V(BO) max. | |
| | BR211—100 —120 —140 | 88 105 123 | 112 135 157 | V V V |
| | -160 -180 -200 | 140 158 176 | 180 202 224 | V V V |
| | -220 -240 -260 -280 | 193 211 228 246 | 247 269 292 314 | V V V |
| Temperature coefficient of V(BR) | S _(br) | typ. | +0.1 | %/K |
| Holding current (note 2) $T_j = 25 {}^{\circ}\text{C}$ $T_j = 70 {}^{\circ}\text{C}$ | I _Н I _Н | > > | 150 100 | mA mA |
| Switching current (note 3) (100 μs pulsed) | IS IS IS | > typ. | 10 200 1000 | mA mA mA |
| Off-state current; $V_D = 85\% V_{(BR)min}$ (note 4) $T_j = 70 ^{\circ}\text{C}$ | I _D | < | 10 | μΑ |
| Linear rate of rise of off-state voltage that will not trigger any device; $T_j = 70^{\circ}C; V_{DM} = 85\% V_{(BR)min}$ | 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 \leq 500 lux (daylight); relative humidity < 65%.

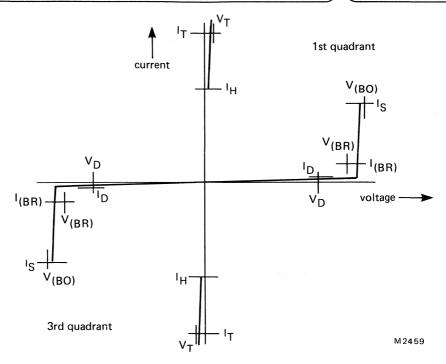


Fig.4 Breakover diode characteristics.

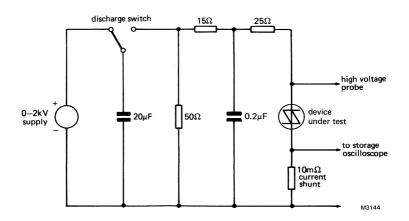


Fig.5 Test circuit for high voltage impulse (I_{TSM1}) (according to CCITT vol IX-Rec. K17)

Notes:

The $10/700~\mu s$ 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 $15~\Omega + 25~\Omega$ output impedance becomes effectively in parallel with the $50~\Omega$.

BR211 SERIES

MOUNTING INSTRUCTIONS

- 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.
- 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.
- 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

- 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 $500 \Omega 5 k\Omega$, there may be excessive dissipation.

MAINS CONTACT

Calculation of power dissipation during mains contact fault.

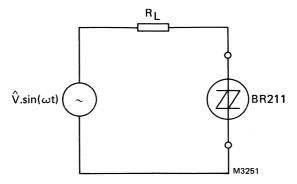


Fig.6 Equivalent circuit of BOD during mains contact fault; ${\bf R}_{\perp}$ = total fault resistance.

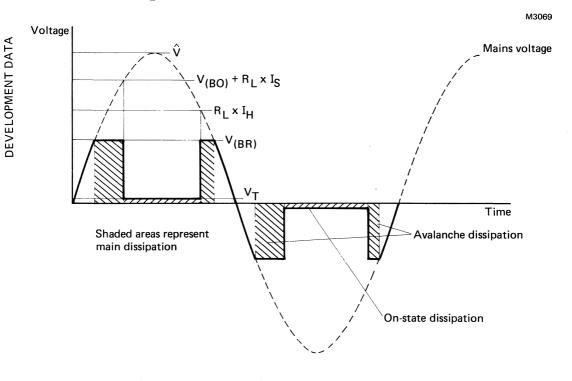


Fig.7 Dissipation during mains contact fault.

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.

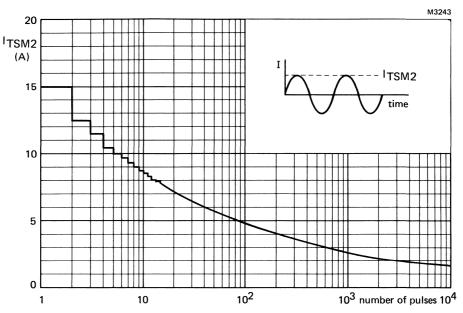


Fig.8 Maximum permissible non-repetitive on-state current based on sinusoidal currents (f = 50 Hz; device triggered at the start of each pulse). $T_j = 70$ °C prior to surge.

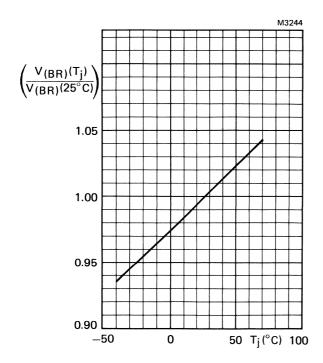


Fig.9 Normalized avalanche breakdown voltage as a function of temperature. Note: this figure may also be used to derive normalized V(BO).

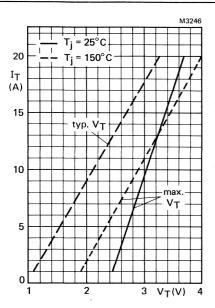


Fig. 10 On-state voltage as a function of on-state current. (200 μ s pulsed condition to avoid excessive dissipation)

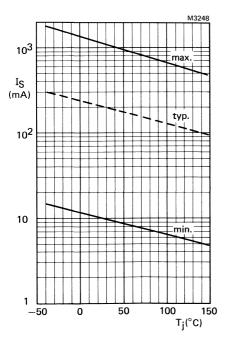


Fig.12 Switching current as a function of junction temperature.

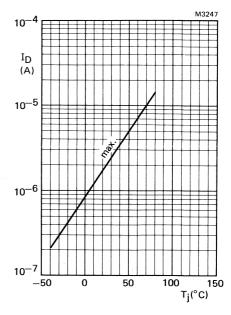


Fig.11 Maximum off-state current as a function of temperature.

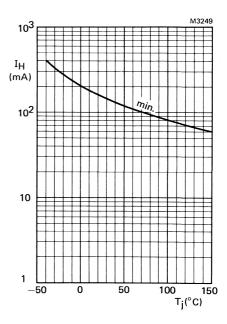


Fig.13 Minimum holding current as a function of temperature.

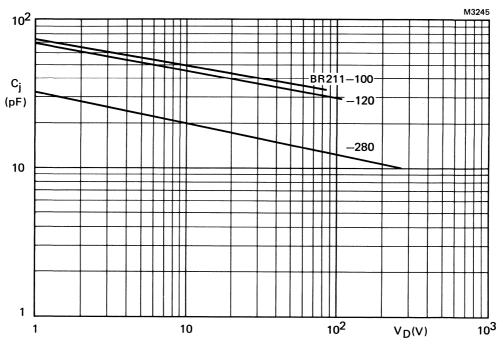


Fig.14 Typical junction capacitance as a function of off-state voltage; $T_i = 25$ °C; f = 1 MHz.

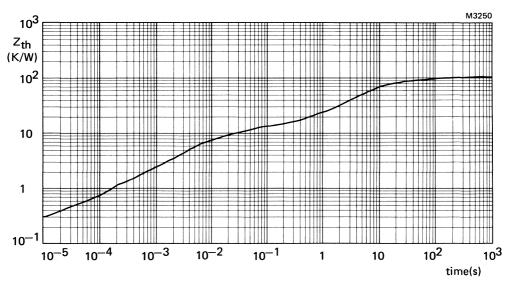


Fig. 15 Transient thermal impedance as a function of time (rectangular pulse duration). Mounted as Fig. 3.

DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

DUAL BREAKOVER DIODES

A range of monolithic dual bidirectional breakover diodes with $\pm 12\%$ 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.

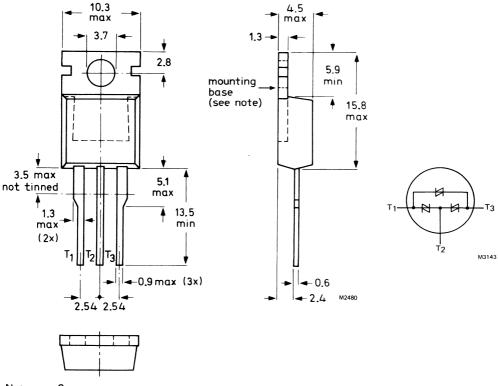
QUICK REFERENCE DATA

| | BR213 — 100 to 280 | | | | | |
|---|--------------------|------|--|------------|----|--|
| Breakover voltage per line | V _(BO) | nom. | | 100 to 280 | V | |
| Holding current | 1 _H | > | | 150 | mA | |
| Transient peak current (10/320 μs impulse) | ITSM | 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 T₂. Accessories supplied on request: see data sheet Mounting instructions and accessories for TO-220 envelopes.

BR213 SERIES

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 d | irection) | | | | |
| Transient peak current (8/20 μ s impulse) | ITSM1 | max. | 150 | Α | |
| Transient peak current (10/320 μ s impulse) equivalent to 10/700 μ s 1.6 kV voltage impulse (CCITT K17); (see Fig.3) | ITSM2 | 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 | IT(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^2 t for fusing (t = 10 ms) | I²t | max. | 4.5 | A^2s | |
| Rate of rise of on-state current after $V_{(BO)}$ turn-on $(t_p = 10 \mu s)$ | dl/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 | oC | |
| Operating temperature (off-state) | Тj | max. | 125 | oC | |
| Overload temperature (on-state) | T_{vj} | max. | 150 | oC | |

CHARACTERISTICS

 $T_i = 25$ °C unless otherwise stated

Each line to centre lead and between lines

| | ing the second of the second | | | | |
|--|------------------------------|---------------------|--------------------|---------------------------|------|
| Avalanche voltage $V_{(BR)}$; ($I_{(BR)} = 10$ mA), a Breakover voltage $V_{(BO)}$; ($I \le I_S$): (100 μ s pulsed) | nd | V _(BR) | V _{(B(O)} | V _(BO) max. | • |
| | | min. | max. | (line-line) | |
| | BR213 -100 | 88 | 112 | 125 | V |
| | -120 | 105 | 135 | 150 | V |
| | -140 | 123 | 157 | 175 | V |
| | -160 | 140 | 180 | 200 | ٧ _ |
| | -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) | | | | |
| $T_i = 70 {}^{\circ}\text{C}$ | | 1 _D | < | 50 | μΑ |
| T _i = 125 °C | | ۱D | < | 250 | μΑ |
| Linear rate of rise of off-state voltage that will not trigger any device; | | | | | |
| T _i = 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 | | Ci | < | 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 _i = 25 ^o C | | ¹ H | > | 150 | mA |
| $T_{i}^{\prime} = 70 {}^{\circ}\text{C}$ | | ¹H . | > | 100 | mA |
| Switching current (note 3) | | IS | > | 10 | mA |
| (100 µs pulsed) | | IS | typ. | 200 | mA |
| | | IS | < | 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.

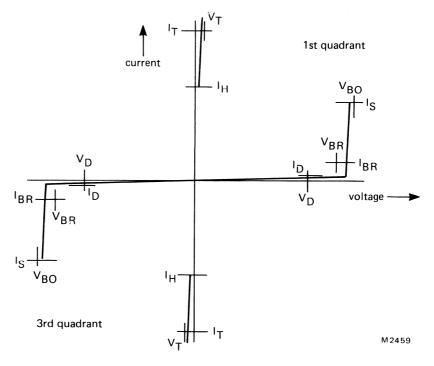


Fig.2 Breakover diode characteristics.

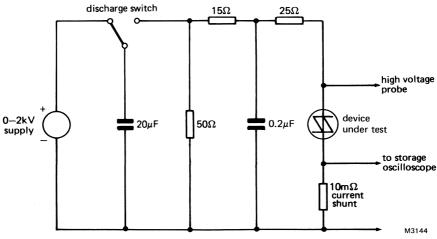


Fig.3 Test circuit for high voltage impulse (I_{TSM2}) (according to CCITT vol IX-Rec. K17).

Notes:

The 10/700 μ s 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.

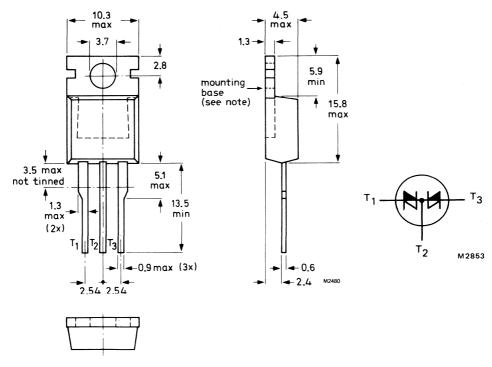
QUICK REFERENCE DATA

| COICK HEI ENENCE DATA | | | | | | |
|---|-------------------|------|-----|----|--|--|
| Breakover voltage per line | V _(BO) | < | 78 | V | | |
| Breakdown voltage per line | V _(BR) | > | 58 | V | | |
| Holding current | ¹ I _H | > | 150 | mA | | |
| Transient peak current (10/320 μ s impulse) | TSM | max. | 40 | Α | | |

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 μ s impulse) | TSM1/IFSM1 | max. | 150 | A |
| Transient peak current (10/320 μs impulse) equivalent to 10/700 μs 1.6 kV voltage impulse (CCITT K17) | l=0.00/1=0.00 | max. | 40 | A |
| | TSM2 [/] FSM2 | | 40 5 | |
| Average on-state current | ^I T(AV) | max. | 5 | Α |
| Average forward current (averaged over any 20 ms period); up to T _{mb} = 75 °C | l _{F(AV)} | max. | 5 | Α |
| RMS AC on-state current | ^I T(RMS) | max. | 8 | Α |
| Non-repetitive peak current; $T_i = 100$ °C prior to surge; | | | | |
| t = 10 ms; half sinewave | ITSM3/IFSM3 | max. | 40 | Α |
| I^2 t for fusing (t = 10 ms) | l²t | max. | 8 | A ² s |
| Rate of rise of on-state current after $V(BO)$ turn-on $(t_p = 10 \mu s)$ | 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 t | o +150 | oC |
| Operating temperature (off-state) | Tj | max. | 125 | oC |
| Overload temperature (on-state) | T _{vj} | max. | 150 | оС |

| THERMAL RESISTANCE | | | | |
|--|-----------------------|--|------|---------|
| From junction to ambient in free air mounted on a printed circuit board at any lead length | R _{th j-amb} | , | 60 | K/W |
| From junction to mounting base One line conducting | | | | |
| bidirectional operation | R _{th j-mb} | = | 2.7 | K/W |
| unidirectional operation | R _{th j-mb} | = | 3.5 | K/W |
| Both lines conducting | | | | |
| bidirectional operation | R _{th j-mb} | = | 1.85 | K/W |
| Transient thermal impedance (t = 1 ms) | Z _{th j-mb} | = | 0.9 | K/W |
| Influence of mounting method 1. Heatsink-mounted with clip (see mounting instructions) | | | | |
| | | | | |
| Thermal resistance from mounting base to heatsink | _ | | 0.0 | 14 /141 |
| a. with heatsink compound | R _{th mb-h} | = " | 0.3 | K/W |
| with heatsink compound and 0.06 mm maximum mica insulator | R _{th mb-h} | = | 1.4 | K/W |
| with heatsink compound and 0.1 mm max. mica insulator (56369) | R _{th mb-h} | = | 2.2 | K/W |
| d. with heatsink compound and 0.25 mm max. alumina insulator (56367) | R _{th mb-h} | = | 0.8 | K/W |
| e. without heatsink compound | R _{th mb-h} | . = | 1.4 | K/W |

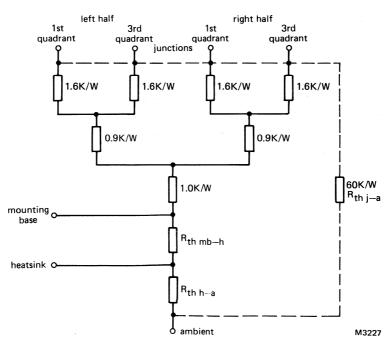


Fig.2 Components of thermal resistance (junction to ambient).

CHARACTERISTICS

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

| 1 20 0 4111000 0 41101 11 100 0 44110 47 0 4011 11110 10 10 | | | | |
|--|----------------------|--------|-----------|---------|
| On-state voltage (note 1) | | | | |
| I _{TM} = 5 A | v_{TM} | < | 3.0 | V |
| Forward voltage (note 1) | | | | |
| I _{FM} = 5 A | $v_{\sf FM}$ | < | 3.0 | V |
| Avalanche voltage | | | | |
| $I_{(BR)} = 10 \text{ mA}$ | V _(BR) | > | 58 | V |
| Breakover voltage | | | | |
| 100 μ s 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 ^o C T _i = 70 ^o C | ¹H | > > | 150 | mA. |
| $T_{j}^{c} = 70 {}^{\circ}\text{C}$ | I _H | > | 100 | mA |
| Switching current (note 3) | IS | > | 10 | mΑ |
| | ļ _S | typ. | 400 | mA |
| | ۱S | < | 1000 | mA |
| Off-state current; V _D = 50 V (note 4) | | _ | - 50 | • |
| T _j = 70 ^o C T _i = 125 ^o C | D | < < | 50 250 | μA ^ |
| , | ۱D | | 250 | μΑ |
| Linear rate of rise of off-state voltage that will not trigger any device; | | | | |
| $T_i = 70^{\circ}C; V_{DM} = 50 \text{ V}$ | dV _D /dt | < | 2000 | V/μs |
| Off-state capacitance | a v _D /at | | 2000 | ν, μο |
| $V_D = 0$; $f = 1$ kHz to 1 MHz | c _i | < | 500 | рF |
| _ | ٥j | | 555 | ρı |
| Forward recovery of diode when switched to $I_F = 1 \text{ A}$ with $dI_F/dt = 10 \text{ A}/\mu\text{s}$ | V _{fr} | typ. | 2.2 | V |
| 10 17 Williait/at 10 7/kg | v ir | · , p. | | ٧ |

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.

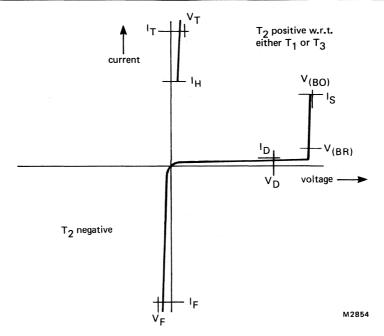


Fig.3 Breakover diode characteristics.

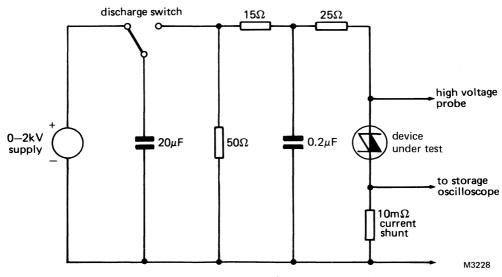


Fig.4 Test circuit for high-voltage impulse (I_{TSM2}/I_{FSM2}). (according to CCITT vol IX-Rec. K17).

Notes:

The 10/700 μ s 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

- The device may be soldered directly into the circuit. The maximum permissible soldering temperature is 275 °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.
- 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° maximum. The minimum bending radius is 1 mm.
- 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

- 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.
- Circuit connections to the common (T₂) 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 $500-5~\mathrm{k}\Omega$, there may be excessive dissipation.

M3229

MAINS CONTACT

Calculation of power dissipation during mains contact fault.

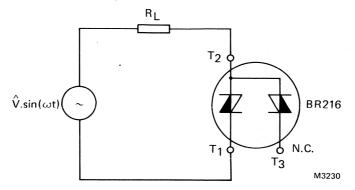


Fig.5 Equivalent circuit of BOD during mains contact fault; $R_L = \text{total}$ fault resistance.

 $V_{(BO)} + R_L \times I_S$ $R_L \times I_H$ $V_{(BR)}$ V_T V_T

Fig.6 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.

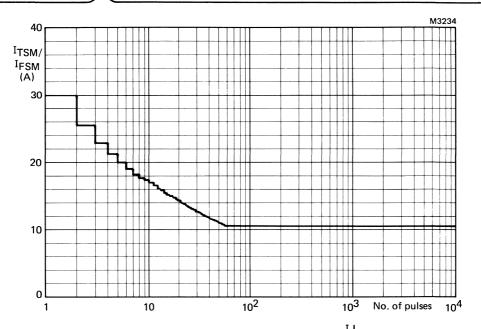
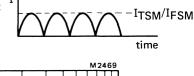


Fig.7 Maximum permissible non-repetitive on-state current based on sinusoidal currents (f = 50 Hz; device triggered at the start of each pulse). T_j = 125 $^{\rm O}$ C prior to surge.



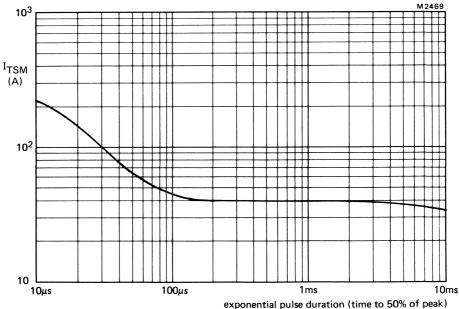


Fig.8 Maximum non-repetitive exponential waveform Impulse Current rating as a function of pulse duration (virtual front-time $10~\mu s$).

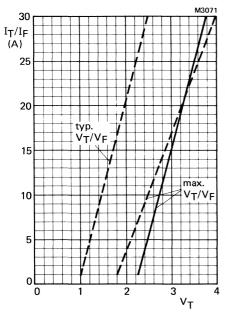


Fig.9 On-state voltage (V_T) and forward voltage (V_F) versus current. (200 μ s pulsed condition to avoid excessive dissipation)

— $T_j = 25, -- T_j = 125$ °C.

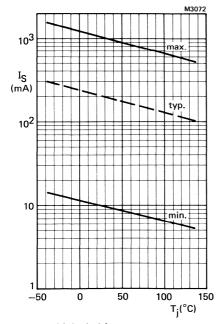


Fig.11 Switching current as a function of junction temperature

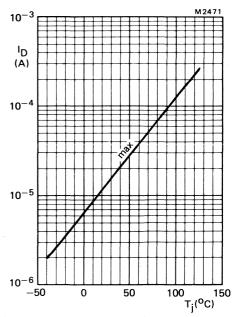


Fig. 10 Maximum off-state current as a function of temperature.

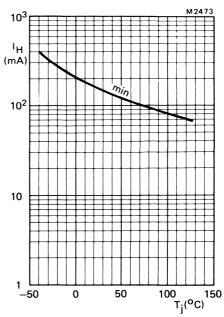


Fig. 12 Minimum holding current as a function of temperature.

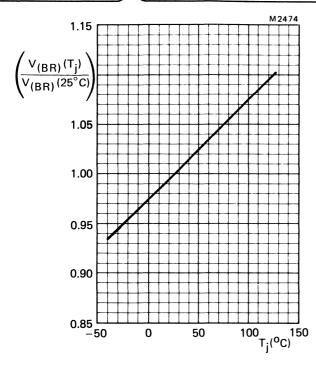


Fig. 13 Normalised avalanche breakdown voltage as a function of temperature. Note: this figure may also be used to derive normalised $V_{(BO)}$.

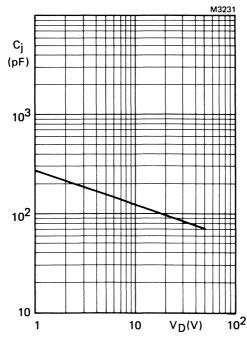


Fig. 14 Typical junction capacitance as a function of off-state voltage; $T_j = 25$ ^{O}C ; f = 1 MHz.

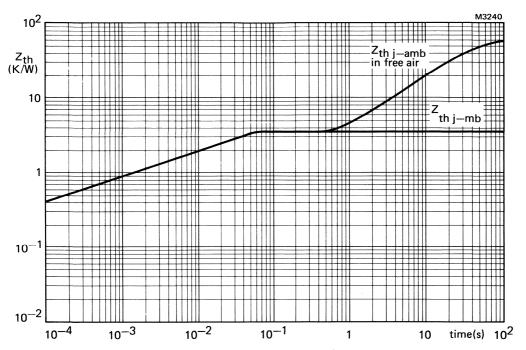


Fig.15 Transient thermal impedance as a function of time (rectangular pulse duration).

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.

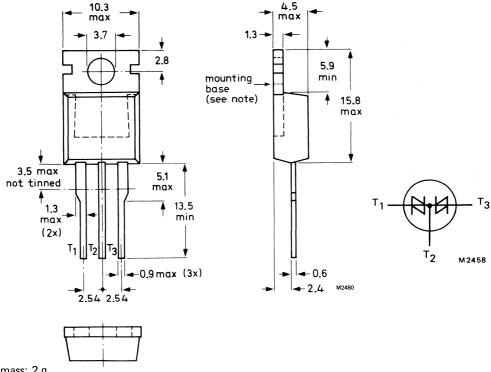
QUICK REFERENCE DATA

| | | BR | 220- 100 to 280 | |
|--|-------------------|------|-----------------|-----|
| Breakover voltage per line | V _(BO) | nom. | 100 to 280 | V |
| Holding current | IН | > | 150 | mA |
| Transient peak current (10/320 μs impulse) | ITSM | 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 T₂. Accessories supplied on request: see data sheet Mounting instructions and accessories for TO-220 envelopes.

BR220 SERIES

RATINGS

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

Voltages (Individually for each line in either direction)

| | | BR220-100 to 28 | | | | |
|---|--|-----------------|------|------------------------|------------------|--|
| - | Continuous voltages | V_{D} | max. | 75% of nom. voltage | | |
| - | Currents | | | | | |
| | (Individually for each line in either direction) | | | | | |
| | Transient peak current (8/20 μ s impulse) | ITSM1 | max. | 150 | Α | |
| | Transient peak current (10/320 μs impulse) equivalent to 10/700 μs 1.6 kV voltage impulse (CCITT K17); (see Fig.4) | ITSM2 | max. | 40 | A | |
| | Average on-state current (averaged over | 121/15 | max. | .0 | , , | |
| | any 20 ms period); up to T _{mb} = 75 °C | IT(AV) | max. | 5 | Α | |
| | RMS AC on-state current | IT(RMS) | max. | 8 | \mathbf{A}^{-} | |
| | Non-repetitive peak on-state current; $T_i = 100$ °C prior to surge; | | | | | |
| | t = 10 ms; half sinewave | ITSM3 | max. | 30 | Α | |
| | I^2 t for fusing (t = 10 ms) | l²t | max. | 4.5 | A^2 s | |
| | Rate of rise of on-state current after $V(BO)$ turn-on $(t_p = 10 \mu s)$ | 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 | РТМ | max. | 400 | W | |
| | Temperatures | | | | | |
| | Storage temperature | T_{stg} | | -40 to $+150$ | оС | |
| | Operating temperature (off-state) | Тj | max. | 125 | оС | |
| | Overload temperature (on-state) | T_{vj} | max. | 150 | оС | |

| THERMAL | RESIS | FANCE |
|---------|-------|-------|
|---------|-------|-------|

alumina insulator (56367)

| From junction to ambient in free air mounted on a printed circuit board at any lead length | R _{th} j-amb | = | 60 | K/W |
|--|-----------------------|---|------|--------|
| From junction to mounting base | | | | |
| One line conducting | | | 0.5 | 12/14/ |
| bidirectional operation | R _{th j-mb} | = | 2.5 | K/W |
| unidirectional operation | $R_{th\;j-mb}$ | = | 3.1 | K/W |
| Both lines conducting | | | | |
| bidirectional operation | R _{th j-mb} | = | 1.75 | K/W |
| Transient thermal impedance (t = 1 ms) | Z _{th j-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-h | = | 0.3 | K/W |
| b. with heatsink compound and 0.06 mm maximum | | | | |
| mica insulator | R _{th mb-h} | = | 1.4 | K/W |
| c. with heatsink compound and 0.1 mm max. | | | | |
| mica insulator (56369) | R + h h - h | = | 2.2 | K/W |
| | R _{th mb-h} | | ٠.٤ | 10,00 |
| d. with heatsink compound and 0.25 mm max. | | | | |

Rth mb-h

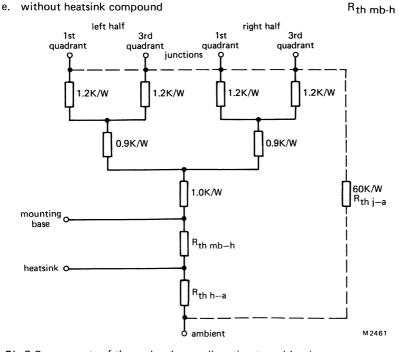


Fig.2 Components of thermal resistance (junction to ambient).

8.0

1.4

K/W

K/W

BR220 SERIES

CHARACTERISTICS

 $T_{\dot{I}}$ = 25 °C unless otherwise stated; each line to centre lead.

Voltages and currents (in either direction)

| On-state | voltage | (note 1) | ١ |
|----------|---------|----------|---|
| | | | |

$$I_{TM} = 5 \text{ A}$$
Avalanche voltage $V_{(BR)}$; ($I_{(BR)} = 10 \text{ mA}$), and Breakover voltage $V_{(BO)}$: ($I \le I_S$).

| reakover voltage $V_{(BO)}$; ($I \leq I_S$). | | | |
|---|-----------|---------------|---------------------------|
| (100 μs pulsed) | | V(BR) min. | V _(BO) max. |
| | BR220-100 | 88 | 112 |

 V_{TM}

-120

<

105

2.5

135

٧

V

| | -140 -160 -240 -260 -280 | 123 140 211 228 246 | 157 180 269 292 314 | V V V |
|---|--------------------------------------|---------------------------------|---------------------------------|--------------------------|
| Temperature coefficient of V _(BR) | S _(br) | typ. | +0.1 | %/K |
| Holding current (note 2) $T_{j} = 25 ^{\circ}\text{C}$ $T_{j} = 70 ^{\circ}\text{C}$ Switching current (note 3) $(100 \mu \text{s pulsed})$ | H H IS IS IS | > > > > typ. < < | 150 100 10 200 1000 | mA mA mA mA |
| Off-state current; $V_D = 85\% \ V_{(BR)min}$ (note 4) $T_j = 70 \ ^{\circ}C$ $T_j = 125 \ ^{\circ}C$ Linear rate of rise of off-state voltage | I _D | < < | 50 250 | μ Α μ Α |
| that will not trigger any device; T _j = 70 ^o 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 | Cj | < | 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.

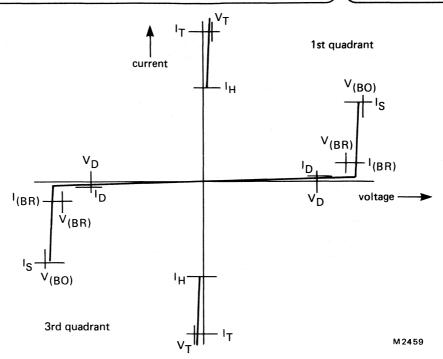
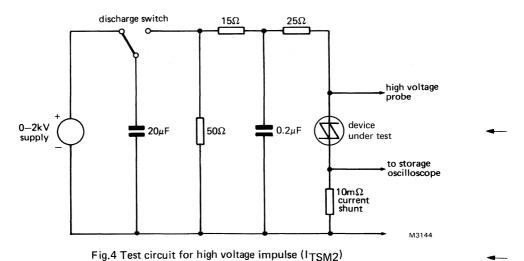


Fig.3 Breakover diode characteristics.



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 .

(according to CCITT vol IX-Rec. K17)

MOUNTING INSTRUCTIONS

- The device may be soldered directly into the circuit. The maximum permissible soldering temperature is 275 °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.
- 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° 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.
- 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

- 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.
- Circuit connections to the common (T₂) 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 $500-5~\mathrm{k}\Omega$, there may be excessive dissipation.

MAINS CONTACT

Calculation of power dissipation during mains contact fault.

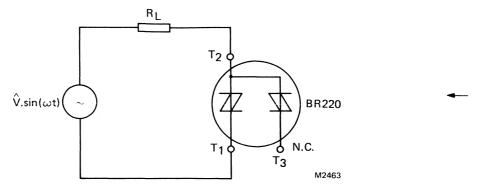


Fig.5 Equivalent circuit of BOD during mains contact fault; ${\bf R}_{\perp}$ = total fault resistance.

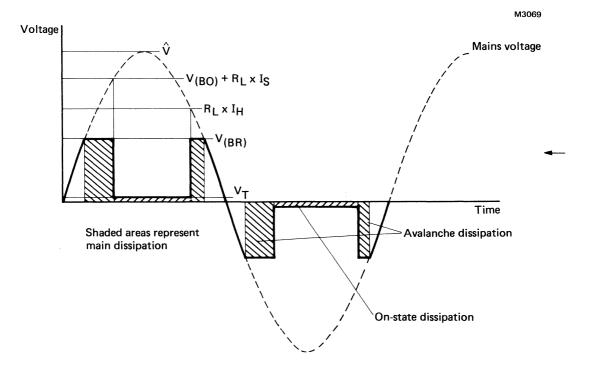


Fig.6 Dissipation during mains contact fault.

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.

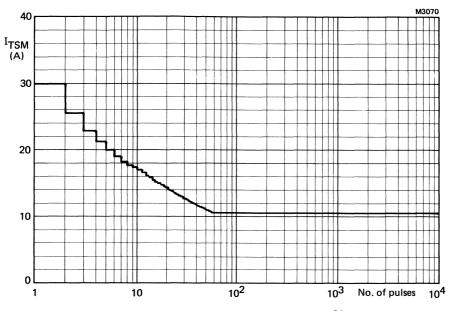
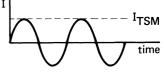


Fig.7 Maximum permissible non-repetitive on-state current based on sinusoidal currents (f = 50 Hz; device triggered at the start of each pulse). T_j = 125 $^{\circ}$ C prior to surge.



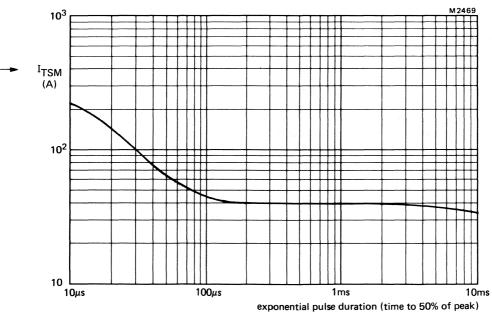


Fig.8 Maximum non-repetitive exponential waveform Impulse Current rating as a function of pulse duration (virtual front-time 10 μ s).

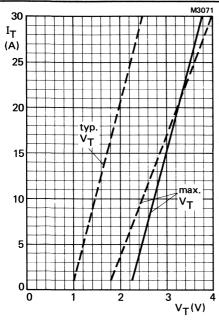


Fig.9 On-state voltage as a function of on-state current. (200 μ s pulsed condition to avoid excessive dissipation) — $T_i = 25, -- T_i = 125$ °C.

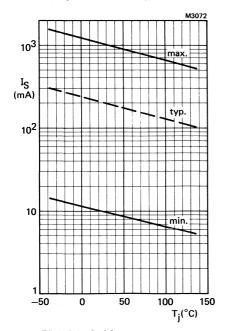


Fig.11 Switching current as a function of junction temperature.

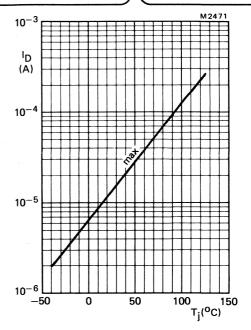


Fig. 10 Maximum off-state current as a function of temperature.

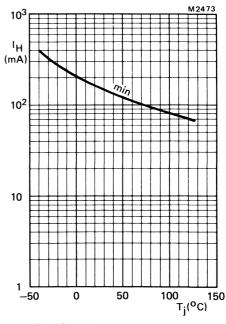


Fig.12 Minimum holding current as a function of temperature.

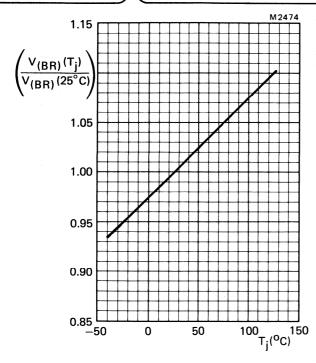


Fig.13 Normalised avalanche breakdown voltage as a function of temperature. Note: this figure may also be used to derive normalised $V_{(BO)}$.

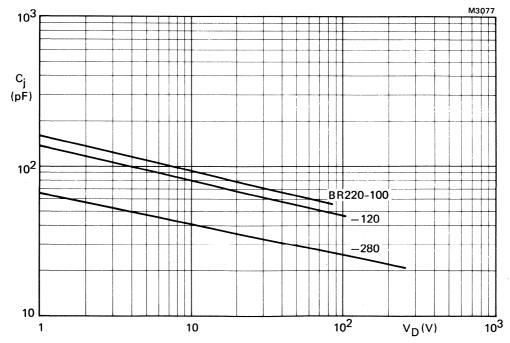


Fig.14 Typical junction capacitance as a function of off-state voltage; $T_j = 25$ °C; f = 1 MHz.

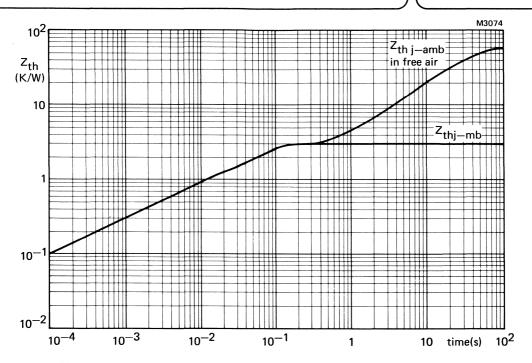


Fig.15 Transient thermal impedance as a function of time (rectangular pulse duration).



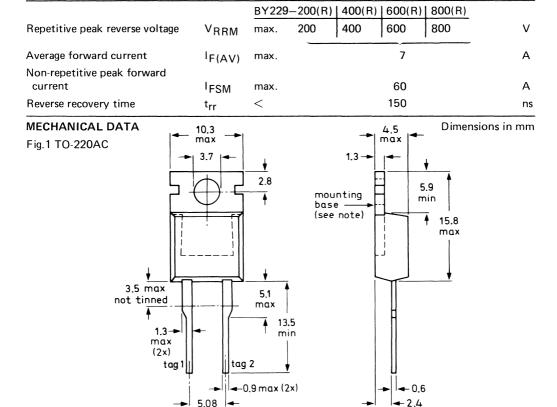
FAST SOFT-RECOVERY RECTIFIER DIODES



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



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.

M0272 tag 2

а

k

tag 1

k

normal

reverse

BY229 SERIES

RATINGS

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

| Voltages* | | BY229 | 9-200(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 | VRWM | 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 | lF(AV) | max. | | 7 | | | A |
| square-wave; δ = 0.5; at T_{mb} = 125 o C sinusoidal; up to T_{mb} = 100 o C | lF(AV) lF(AV) | max. max. | | 4.1 6.5 | | | A A |
| sinusoidal; at T _{mb} = 125 °C | I _F (AV) | max. | | 4 | | | A |
| R.M.S. forward current | F(RMS) | max. | | 10 | | | Α |
| Repetitive peak forward current $t_p = 20 \mu s$; $\delta \le 0.02$ | l _{FRM} | max. | | 135 | | | Α |
| Non-repetitive peak forward current t = 10 ms;half sine-wave; | | | | | | | |
| T _j = 150 ^o C prior to surge; with reapplied V _{RWM max} | ^I FSM | max. | | 60 | | | Α |
| 1 ² t for fusing (t = 10 ms) | l ² t | max. | | 18 | | | A^2s |
| Temperatues | | | | | | | |
| Storage temperature | T_{stg} | | -40 | to +150 | | | $^{\rm oC}$ |
| Junction temperature | Tj | max. | | 150 | | | оС |
| | | | | | | | |

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

| THERMAL RESISTANCE | | | | |
|--|----------------------|-----|-----|-----|
| From junction to mounting base | R _{th j-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-h} | = | 0.3 | K/W |
| b. with heatsink compound and 0.06 mm maximum mica insulator | R _{th mb-h} | = | 1.4 | K/W |
| c. with heatsink compound and 0.1 mm maximum mica insulator (56369) | R _{th mb-h} | = | 2.2 | K/W |
| d. with heatsink compound and 0.25 mm maximum alumina insulator (56367) | R _{th mb-h} | · = | 0.8 | K/W |
| e. without heatsink compound | R _{th mb-h} | = | 1.4 | K/W |
| 2. Free air operation | | | | |
| The quoted value of $R_{th\ j-a}$ should be used only when no leads of 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-a} | = | 60 | K/W |

MOUNTING INSTRUCTIONS

- 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-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-h} given for mounting with heatsink compound refer to the use of a metallic-oxide loaded compound. Ordinary silicone grease is not recommended.
- 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

 $I_F = 2 A, -dI_F/dt = 20 A/\mu s$

| $T_j = 25$ °C unless otherwise specified | | | | | |
|--|------------------|-----------------|----|------|----|
| Forward voltage I _F = 20 A | | ٧ _F | < | 1.85 | V* |
| Reverse current | | | | | |
| $V_R = V_{RWMmax}$; $T_i = 125$ °C | normal polarity | ^I R | < | 0.4 | mA |
| | reverse polarity | ^I R | < | 0.6 | mA |
| Reverse recovery when switched from $I_F = 1 \text{ A to } V_R \geqslant 30 \text{ V with } -dI_F/dI_F/dI_F/dI_F/dI_F/dI_F/dI_F/dI_F/$ | | | | | |
| recovery time | | t _{rr} | < | 150 | ns |
| $I_F = 2 A$ to $V_R \ge 30 V$ with $-dI_F/d$ recovered charge | dt = 20 A/μs | Q_s | <, | 0.7 | μC |
| Maximum slope of the reverse recovery current | | | | | |

normal polarity

reverse polarity

 $\left| \begin{array}{l} dI_R/dt \right| & < \\ \left| \begin{array}{l} dI_R/dt \end{array} \right| & < \end{array}$

60

75

D8403

 $A/\mu s$

A/μs

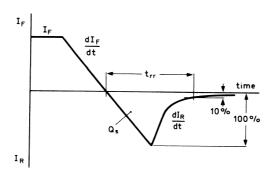


Fig.3 Definition of t_{rr} and Q_s .

^{*}Measured under pulse conditions to avoid excessive dissipation.

SQUARE-WAVE OPERATION

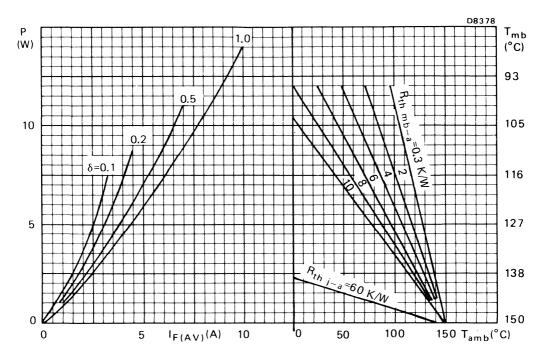


Fig. 4 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.

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

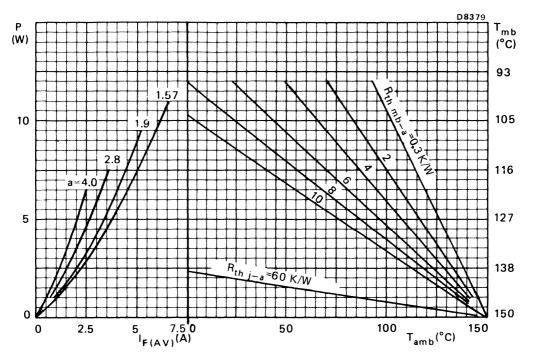
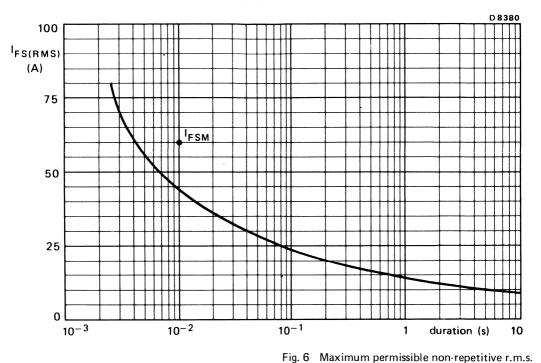
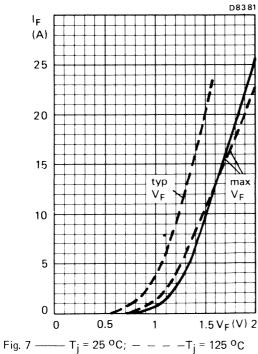


Fig. 5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.

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

 $a = form factor = I_F(RMS)/I_F(AV)$.





IFSM IFS(RMS) time

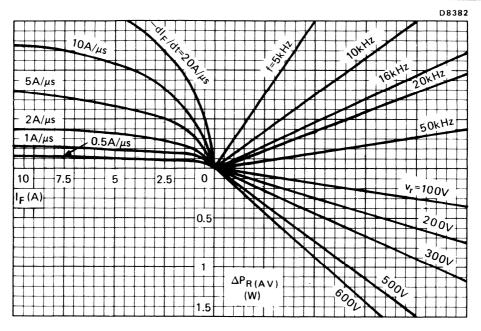
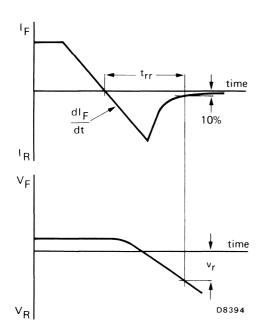
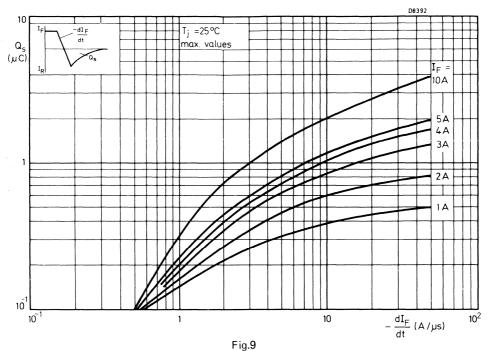
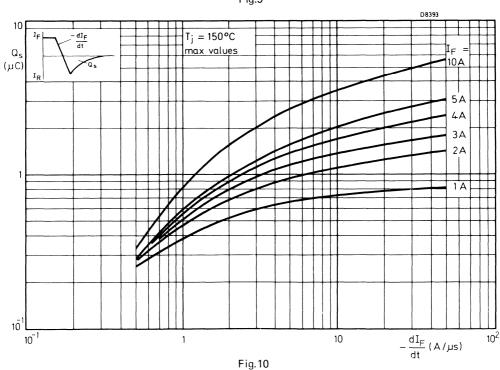


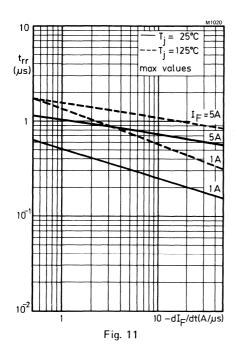
Fig. 8 NOMOGRAM

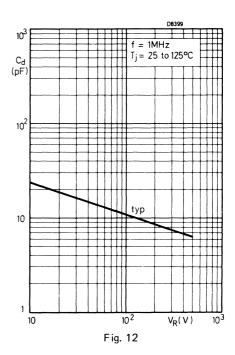
Power loss $\triangle P_{R(AV)}$ due to switching only (to be added to steady state power losses). I $_F$ = forward current just before switching off; T $_j$ = 150 $^{\rm o}C$

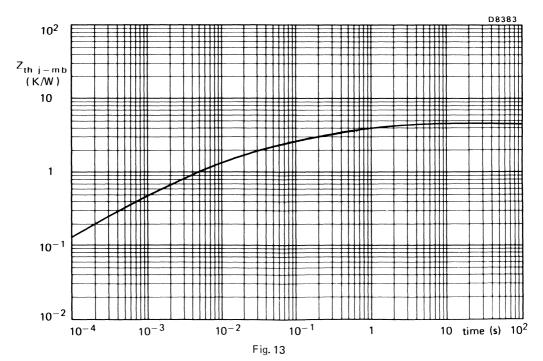












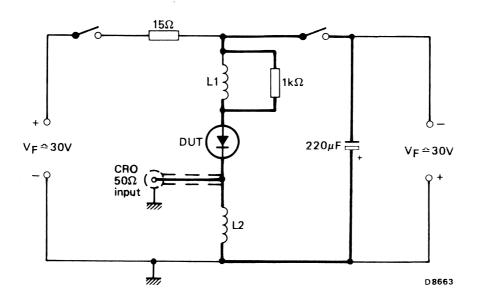


Fig.14 Simplified circuit diagram of practical apparatus to test softness of recovery.

NOTES

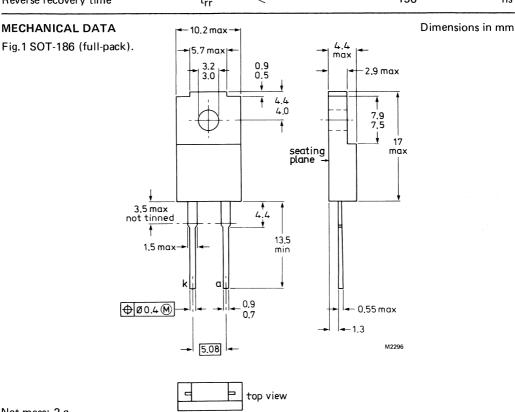
- 1. Duty factor of forward current should be low, <2%.
- 2. dI_F/dt is set by L1, 1.5 μ H gives 20 A/ μ s
- 3. dI_R/dt is measured across L2, 200 nH gives $5A/\mu s/V$.
- 4. Wiring shown in heavy should be kept as short as possible.

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

| | | E | 3Y229F-200 | 400 | 600 | 800 | |
|-------------------------------------|--------------------|------|------------|-----|-----|-----|----|
| Repetitive peak reverse voltage | V_{RRM} | max. | 200 | 400 | 600 | 800 | V |
| Average forward current | I _{F(AV)} | max. | | 7 | | | |
| Non-repetitive peak forward current | I _{FSM} | < | | 60 | | | |
| Reverse recovery time | t _{rr} | < | 150 | | | | ns |



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).

BY229F SERIES

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 | VR | 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 sinusoidal; up to T_{hs} = 93 °C | | lF(AV) lF(AV) | | max. max. | 7 6.25 | | A A |
| R.M.S. forward current | | IF(RMS) | | max. | 10 | | Α |
| Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ | | IFRM | | max. | 135 | | Α |
| Non-repetitive peak forward current half sine-wave; $T_j = 150^{\circ}$ C prior to surge; with reapplied $V_{RWM max}$ | | | | | | | |
| t = 10 ms | | ^I FSM | | max. | 60 | | Α |
| t = 8.3 ms | | IFSM | | max. | 65 | | Α |
| I^2 t for fusing (t = 10 ms) | | I²t | | max. | 18 | | A^2s |
| Temperatures | | | | | | | |
| Storage temperature | | T_{stg} | T _{stg} -40 to +150 | | | оС | |
| Junction temperature | | T_{j} | | max. | 150 | | oC |
| ISOLATION | | | | | | | |
| Peak isolation voltage from all terminals to external heatsink | | V _{isol} | | max. | 1000 | | V |
| Isolation capacitance from cathode to external heatsink (Note 3) | | C _p | | typ. | 12 | | pF |
| | | | | | | | |

Notes

- 1. To ensure thermal stability: $R_{\mbox{th j-a}} \! < \! 15 \mbox{ K/W}$ 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,

Thermal resistance from junction to ambient

| without heatsink compound | R _{th j-h} | = | 7.2 | K/W |
|---------------------------|---------------------|---|-----|-----|
| with heatsink compound | R _{th j-h} | = | 5.5 | 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.

| in free air, mounted on a printed circuit board | R _{th j-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 $V_R = V_{RWM max}$; $T_i = 125 ^{\circ}\text{C}$ | I _R | < | 0.4 | mA |
| Reverse recovery when switched from $I_F = 1 \text{ A to V}_R \geqslant 30 \text{ V with } -dI_F/dt = 50 \text{ A}/\mu\text{s}$, recovery time | t _{rr} | < | 150 | ns |
| $I_F = 2 \text{ A to V}_R \geqslant 30 \text{ V with } -dI_F/dt = 20 \text{ A}/\mu\text{s}$ recovered charge | Ω_{s} | < | 0.7 | μC |
| Maximum slope of the reverse recovery current $I_F = 2 A$, $-dI_F/dt = 20 A/\mu s$ | dl _R /dt | < | 60 | A/μs |

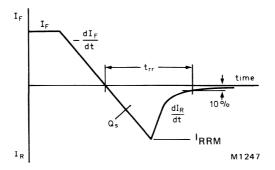


Fig.2 Definition of t_{rr} and Q_s .

^{*}Measured under pulse conditions to avoid excessive dissipation.

MOUNTING INSTRUCTIONS

- 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-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:

 Maximum torque to avoid damage to the device:

 5.5 kgf (0.55 Nm)

 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-h} given for mounting with heatsink compound refer to the use of a metallic-oxide loaded compound. Ordinary silicone grease is not recommended.
- 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.

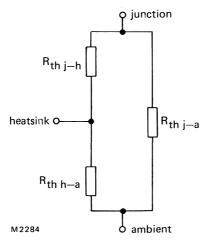
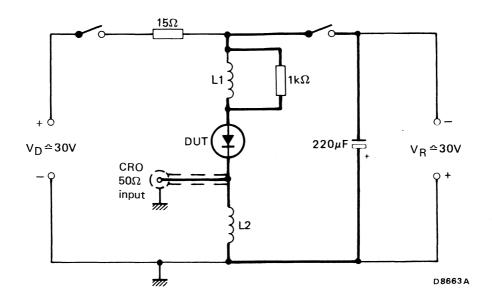


Fig.3.

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



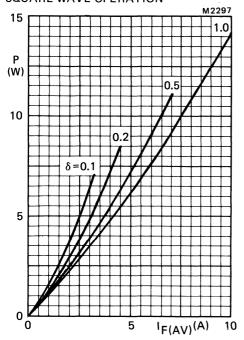
 $Fig. 4 \ Simplified \ circuit \ diagram \ of \ practical \ apparatus \ to \ test \ softness \ of \ recovery.$

NOTES

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

BY229F SERIES

SQUARE-WAVE OPERATION



SINUSOIDAL OPERATION

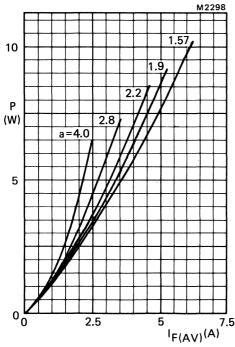


Fig.5 Power rating.

The power loss in the diode should first be determined from the required forward current on the IF(AV) axis and the appropriate duty cycle.

Having determined the power (P), use Fig.7 (if heatsink compound is not being used) or Fig.8 (if heatsink compound is being used) to determine the heatsink size and corresponding maximum ambient and heatsink temperatures.

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

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

$$V = I_F(RMS) \times \sqrt{\delta}$$

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.

$$a = form factor = I_F(RMS)/I_F(AV)$$

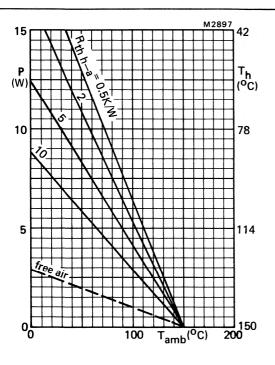


Fig.7 Heatsink rating; without heatsink compound.

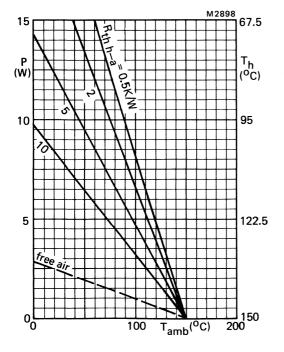


Fig.8 Heatsink rating; with heatsink compound.

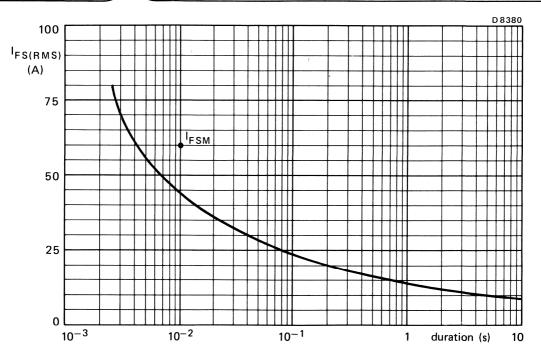


Fig.9 Maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz); T_j = 150 $^{\rm o}$ C prior to surge; with reapplied V_{RWMmax} .

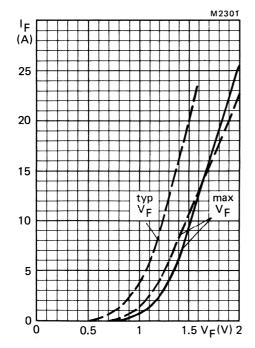




Fig.10 ———
$$T_j = 25$$
 °C; $--- T_j = 125$ °C.

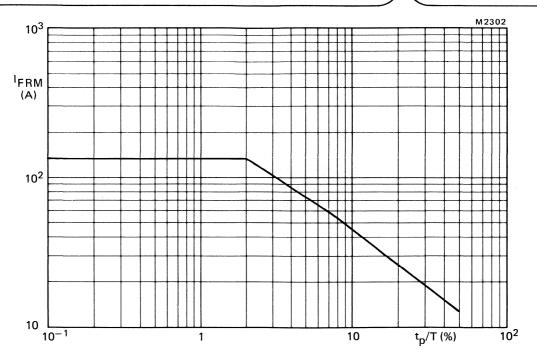
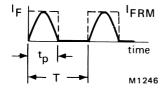


Fig.11 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 μ s < t $_p$ < 1 ms.



Definition of I_{FRM} and t_p/T .

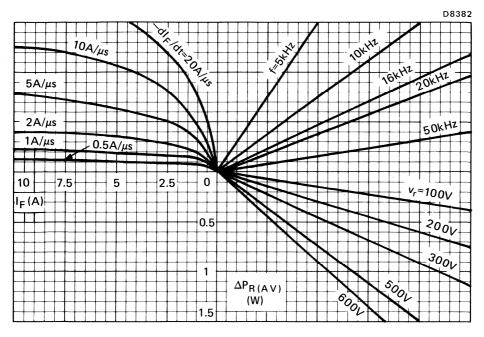
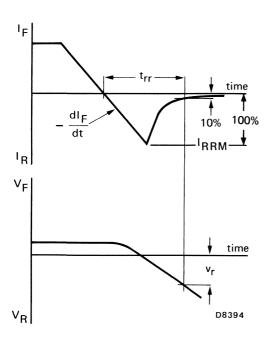
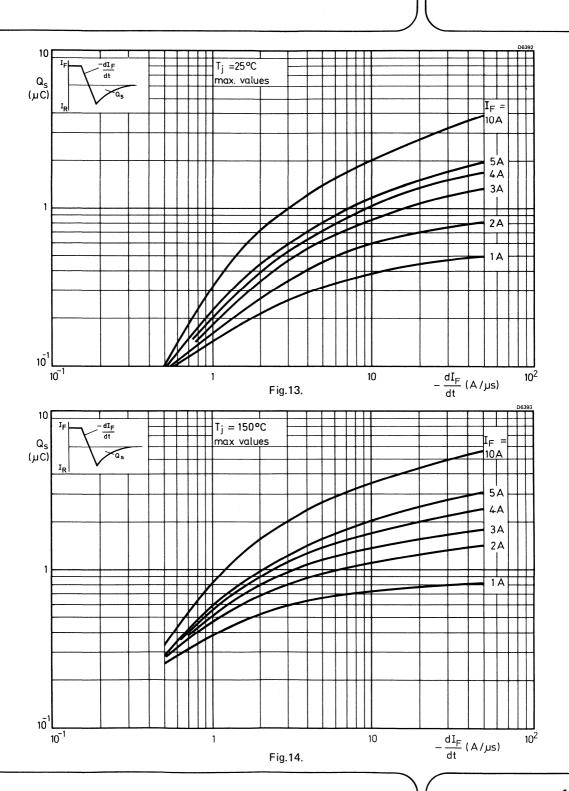
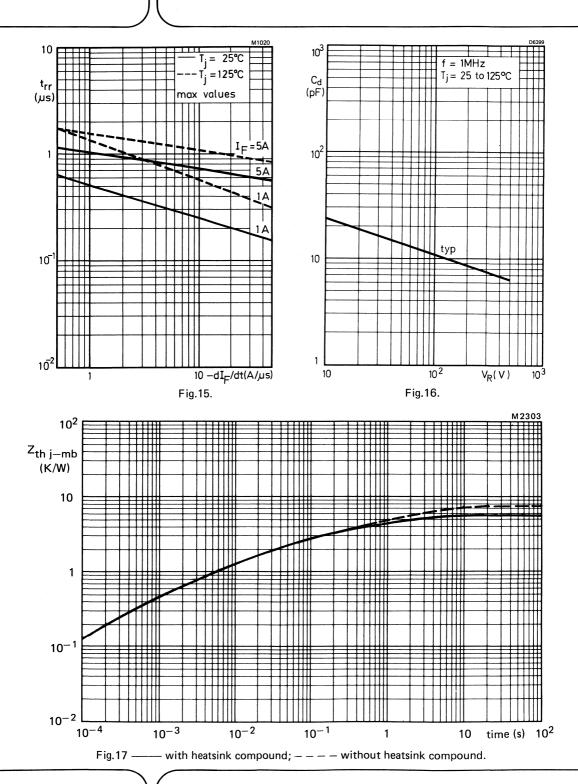


Fig.12 NOMOGRAM

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







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:

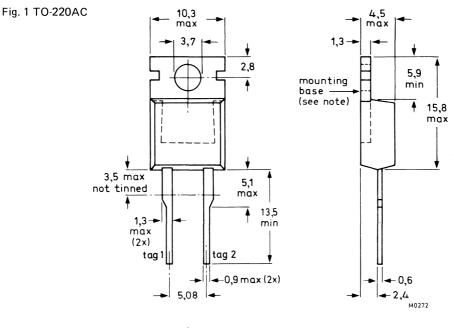
Normal polarity (cathode to base plate): BY249-300 and BY249-600. Reverse polarity (anode to base plate): BY249-300R and BY249-600R.

QUICK REFERENCE DATA

| | | | BY249-300(R) | 600(R) | |
|-------------------------------------|-----------|------|--------------|--------|---|
| Repetitive peak reverse voltage | v_{RRM} | max. | 300 | 600 | ٧ |
| Average forward current | lF(AV) | max. | 6. | 5 | Α |
| Non-repetitive peak forward current | IFSM | max. | 6 | 0 | Α |

MECHANICAL DATA (see next page for polarity of connections)

Dimensions in mm



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* | | BY2 | 49-300(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 $T_{mb} = 110 {}^{\circ}C$ | | IF(AV) | max. | 6.5 | Α |
| sinusoidal; at T _{mb} = 125 °C | | IF(AV) | max. | 4.0 | Α |
| R.M.S. forward current | | IF(RMS) | max. | 9.5 | Α |
| Repetitive peak forward current; | | | | | |
| t = 10 ms; half sine-wave | | IFRM | max. | 60 | Α |
| Non-repetitive peak forward current; | | | | | |
| t = 10 ms; half sine-wave; | | | | | |
| T _j = 150 ^o C prior to surge; | | | | | |
| with re-applied V _{RWMmax} | | FSM | max. | 60 | Α |
| I^2 t for fusing; t = 10 ms | | l ² t | max. | 18 | $A^2 s$ |
| Temperatures | | | | | |
| Storage temperature | | T_{stg} | -40 to | +150 | оС |
| Junction temperature | | Tj | max. | 150 | оС |
| CHARACTERISTICS | | | | | |
| Forward voltage | | | | | |
| $I_F = 20 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | | ٧ _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, $R_{\mbox{th j-a}}\!<\!15~\mbox{°C/W}$ for continuous reverse voltage.

^{**} Measured under pulse conditions to avoid excessive dissipation.

THERMAL RESISTANCE

| From junction to mounting base | $R_{th j-mb} = 4.2$ °C/W |
|---------------------------------------|--|
| Transient thermal impedance; t = 1 ms | $Z_{th}: mb = 0.46 ^{\circ}\text{C/W}$ |

Influence of mounting method

1. Heatsink mounted with clip (see mounting instructions)

Thermal resistance from mounting base to heatsink

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

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

D8397

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MOUNTING INSTRUCTIONS

- 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.
- 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 $R_{th\ mb-h}$ 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-h} given for mounting with heatsink compound refer to the use of a metallic-oxide loaded compound. Ordinary silicone grease is not recommended.
- 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.

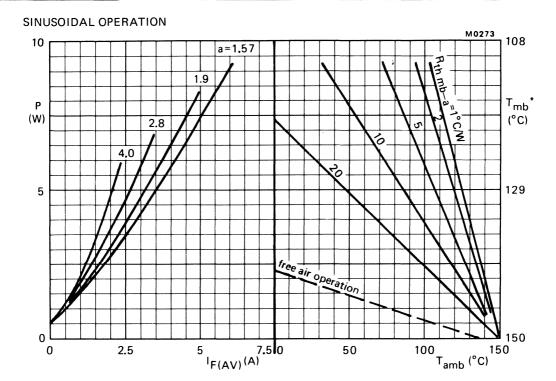


Fig. 3 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures. $a = form factor = I_F(RMS)/I_F(AV)$.

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

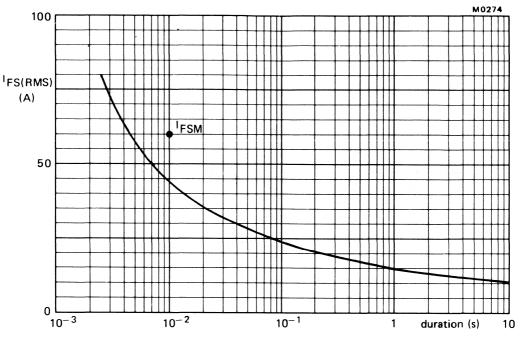
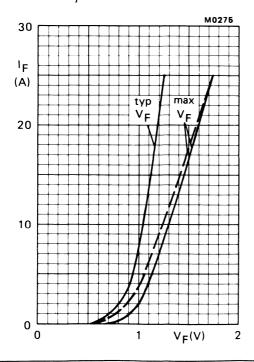


Fig. 4 Maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz); T_i = 150 $^{\circ}$ C prior to surge.



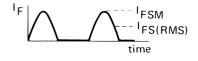


Fig. 5 —— $T_j = 25 \, {}^{\circ}\text{C}; --- T_j = 100 \, {}^{\circ}\text{C}$

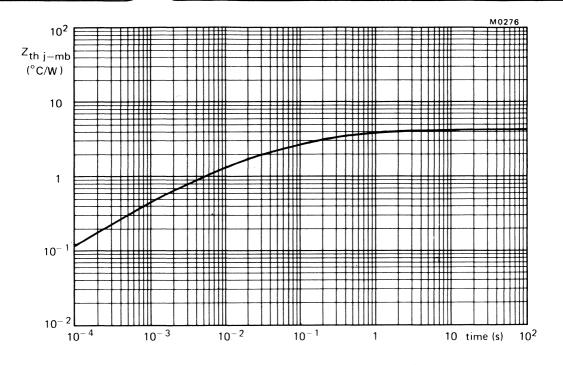


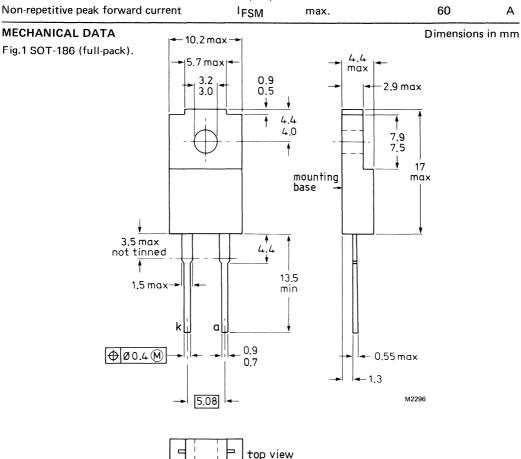
Fig. 6

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 | $^{\prime}$ V |
| Average forward current | IF(AV) | max. | 6. | 5 | Α |
| Non-repetitive peak forward current | FSM | max. | 6 | 0 | Α |



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).

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BY249F SERIES

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 | ٧ |
| Repetitive peak reverse voltage | VRRM | max. | 300 | 600 | ٧ |
| Crest working reverse voltage | VRWM | max. | 200 | 400 | V_{i} |
| Continuous reverse voltage | v_R | max. | 200 | 400 | V |
| Currents | | | | | _ |
| Average forward current; (note 2) sinusoidal; up to $T_h = 95$ °C sinusoidal; at $T_h = 125$ °C | IF(AV) IF(AV) | max. max. | | 6.5 3.2 | A A |
| RMS forward current | ^I F(RMS) | max. | 9 | 9.5 | Α |
| Repetitive peak forward current; t = 10 ms; half sinewave | IFRM | max. | | 60 | Α |
| Non-repetitive peak forward current; t = 10 ms; half sinewave; T _j = 150 ^O C prior to surge; | | | | 60 | ٨ |
| with re-applied V _{RWMmax} | IFSM | max. | | 60 | A |
| I ² t for fusing; t = 10 ms | l ² t | max. | | 18 | A ² s |
| Temperatures | | | | | |
| Storage temperature | T_{stg} | | -40 to +1 | 50 | oC |
| Junction temperature | T_{j} | max. | 1 | 50 | оС |
| ISOLATION | | | | | |
| Peak isolation voltage from all terminals to external heatsink | V _(isol) M | max. | 10 | 00 | ٧ |
| 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-h} | - = | 7.2 | K/W |
|---------------------------|---------------------|------------|-----|-----|
| with heatsink compound | R _{th j-h} | = | 5.5 | 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, mounted on a printed circuit board | R _{th j-a} | | 55 | K/W |
|---|---------------------|---|------|-----|
| CHARACTERISTICS | | | | |
| Forward voltage | | | | |
| $I_F = 20 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | V_{F} | < | 1.6 | V* |
| $I_F = 5 \text{ A}; T_j = 100 ^{\circ}\text{C}$ | ٧F | < | 1.05 | V* |

Reverse current

$$V_R = V_{RWMmax}$$
; $T_j = 125$ °C I_R < 0.4 mA

MOUNTING INSTRUCTIONS

- 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-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)
- For good thermal contact, heatsink compound should be used between mounting base and heatsink. Values of R_{th j-h} given for mounting with heatsink compound refer to the use of a metallic-oxide loaded compound. Ordinary silicone grease is not recommended.
- 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.

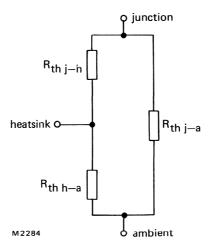


Fig.2.

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

SINUSOIDAL OPERATION

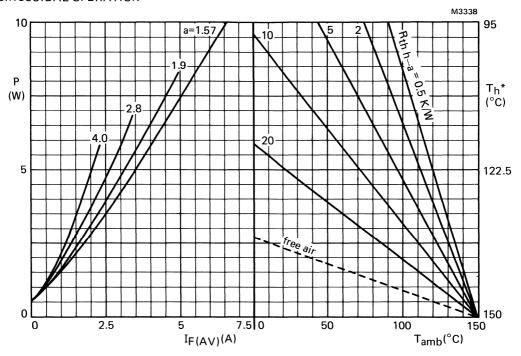


Fig.3 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures. $a = form \ factor = I_F(RMS)/I_F(AV)$.

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

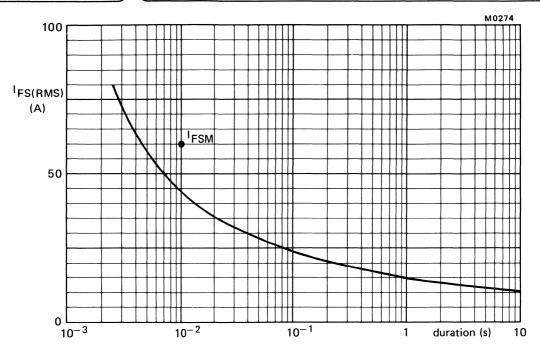


Fig.4 Maximum permissible non-repetitive RMS forward current based on sinusoidal currents (f = 50 Hz); T_i = 150 o C prior to surge.

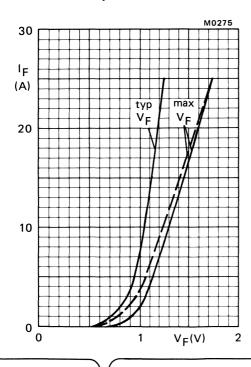




Fig.5 ——
$$T_j$$
 = 25 °C; $-- T_j$ = 100 °C.

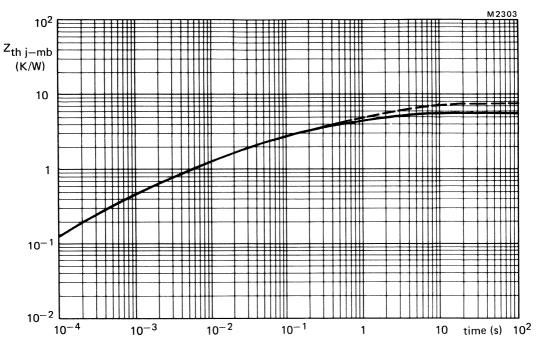


Fig.6 — with heatsink compound; --- without heatsink compound.

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).

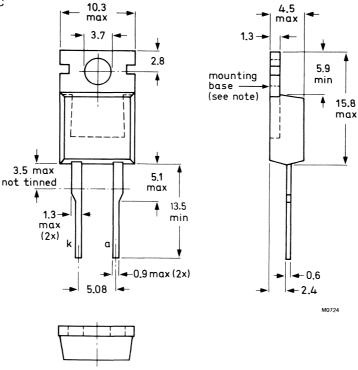
QUICK REFERENCE DATA

| | | BY329 | <u> 008</u> | 1000 | 1200 | |
|-------------------------------------|-----------------|-------|--------------|------|------|----|
| Repetitive peak reverse voltage | V_{RRM} | max. | 800 | 1000 | 1200 | V |
| Average forward current | IF(AV) | max. | | 8 | | Α |
| Non-repetitive peak forward current | IFSM | max. | | 80 | | Α |
| Reverse recovery time | t _{rr} | < - | | 150 | | ns |
| | | | | | | |

MECHANICAL DATA

Dimensions in mm





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.

BY329 SERIES

RATINGS

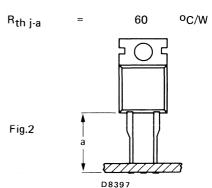
Limiting values in accordance with the Absolute Maximum System (IEC 134)

| Voltages | | BY329-800 1000 1200 | | | 1200 | |
|--|--|-------------------------|--------|---------------------------------|------|-------------------|
| Non-repetitive peak reverse voltage | V _{RSM} | max. | 800 | 1000 | 1200 | V |
| Repetitive peak reverse voltage | v_{RRM} | max. | 800 | 1000 | 1200 | \mathbf{V}^{-} |
| Crest working reverse voltage | V_{RWM} | max. | 600 | 800 | 1000 | V |
| Currents | | | | | | |
| Average forward current assuming zero switching losses | | | | | | |
| square-wave; δ = 0.5; up to T_{mb} = 108 °C | lF(AV) | max. | | 8 | | A |
| square-wave; δ = 0.5; at T _{mb} = 125 $^{\rm O}$ C sinusoidal; up to T _{mb} = 113 $^{\rm O}$ C | lF(AV) lF(AV) | max. max. | | 5.3 7 | | A A |
| sinusoidal; at T _{mb} = 125 °C | IF(AV) | max. | | 5.2 | | A |
| R.M.S. forward current | lF(RMS) | max. | | 11 | | A |
| Repetitive peak forward current | IFRM | max. | | 80 | | Α |
| Non-repetitive peak forward current: $t = 10 \text{ ms}$ half sine-wave; $T_j = 150 ^{\circ}\text{C}$ prior to surge; | | | | | | |
| with reapplied VRWM max | ^I FSM | max. | | 80 | | Α |
| I ² t for fusing (t = 10 ms) | l²t | max. | | 32 | | $A^2 s$ |
| Temperatues | | | | | | |
| Storage temperature | T_{stg} | | -40 to | o +150 | | оС |
| | 'stg | | | | | |
| Junction temperature | T _j | max. | | 150 | | οС |
| Junction temperature THERMAL RESISTANCE | | max. | | 150 | | oC |
| • | | max. | | 3.0 | | o _C |
| THERMAL RESISTANCE | Tj | | | | | |
| THERMAL RESISTANCE From junction to mounting base | T _j R _{th j-mb} | | | | | |
| THERMAL RESISTANCE From junction to mounting base Influence of mounting method | T _j R _{th j-mb} | | | | | |
| THERMAL RESISTANCE From junction to mounting base Influence of mounting method 1. Heatsink mounted with clip (see mounting instruction) | T _j R _{th j-mb} | | | | | |
| THERMAL RESISTANCE From junction to mounting base Influence of mounting method 1. Heatsink mounted with clip (see mounting instruction of the second of the | T _j R _{th j-mb} | = | | 3.0 | | K/W |
| THERMAL RESISTANCE From junction to mounting base Influence of mounting method 1. Heatsink mounted with clip (see mounting instruction of the mounting base to heatsink a. with heatsink compound b. with heatsink compound and 0.06 mm maximum | T _j R _{th j-mb} etions) R _{th mb-h} | = | | 3.0 | | K/W |
| THERMAL RESISTANCE From junction to mounting base Influence of mounting method 1. Heatsink mounted with clip (see mounting instruction of the mounting base to heatsink as with heatsink compound bout with heatsink compound and 0.06 mm maximum mica insulator c. with heatsink compound and 0.1 mm maximum mica insulator (56369) d. with heatsink compound and 0.25 mm maximum | R _{th j-mb} etions) R _{th mb-h} R _{th mb-h} R _{th mb-h} | = = = | | 3.0 0.3 1.4 2.2 | | K/W K/W K/W |
| THERMAL RESISTANCE From junction to mounting base Influence of mounting method 1. Heatsink mounted with clip (see mounting instruct Thermal resistance from mounting base to heatsink a. with heatsink compound b. with heatsink compound and 0.06 mm maximum mica insulator c. with heatsink compound and 0.1 mm maximum mica insulator (56369) d. with heatsink compound and 0.25 mm maximum alumina insulator (56367) | R _{th j-mb} etions) R _{th mb-h} R _{th mb-h} | = = = | | 3.0 0.3 1.4 2.2 0.8 | | K/W K/W K/W K/W |
| THERMAL RESISTANCE From junction to mounting base Influence of mounting method 1. Heatsink mounted with clip (see mounting instruction of the mounting base to heatsink as with heatsink compound bout with heatsink compound and 0.06 mm maximum mica insulator c. with heatsink compound and 0.1 mm maximum mica insulator (56369) d. with heatsink compound and 0.25 mm maximum | R _{th j-mb} etions) R _{th mb-h} R _{th mb-h} R _{th mb-h} | = = = | | 3.0 0.3 1.4 2.2 | | K/W K/W K/W |

THERMAL RESISTANCE (continued)

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



CHARACTERISTICS

| Forward voltage I _F = 20 A; T _i = 25 °C | V _F | < | 1.85 | V* |
|--|---------------------|---|------|------|
| Reverse current VR = VRWMmax; Tj = 125 °C | I _R | < | 1.0 | mA |
| Reverse recovery when switched from $I_F = 2 \text{ A to V}_R \geqslant 30 \text{ V with } -dI_F/dt = 20 \text{ A/}\mu\text{s}; T_j = 25 \text{ Recovered charge}$ $I_F = 1 \text{ A to V}_R \geqslant 30 \text{ V with } -dI_F/dt = 50 \text{ A/}\mu\text{s}; T_j = 25 \text{ A/}\mu\text{s}$ | Q_s | < | 0.7 | μC |
| Recovery time | t _{rr} | < | 150 | ns |
| Maximum slope of the reverse recovery current $I_F = 2 \text{ A}$; $-dI_F/dt = 20 \text{ A}/\mu \text{s}$; $T_i = 25 \text{ °C}$ | dl _R /dt | < | 60 | A/μs |

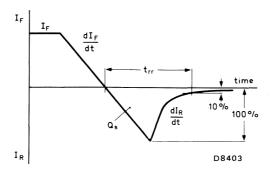


Fig.3 Definition of t_{rr} and Q_s

^{*}Measured under pulse conditions to avoid excessive dissipation

MOUNTING INSTRUCTIONS

- 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-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-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

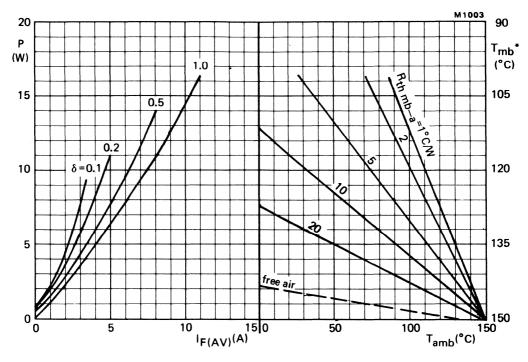


Fig.4 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.

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

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

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

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

SINUSOIDAL OPERATION

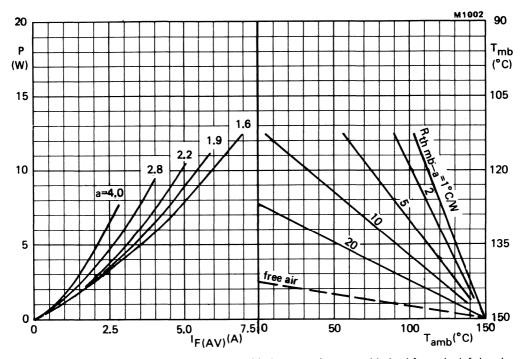


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.

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

a = form factor = IF(RMS)/IF(AV).

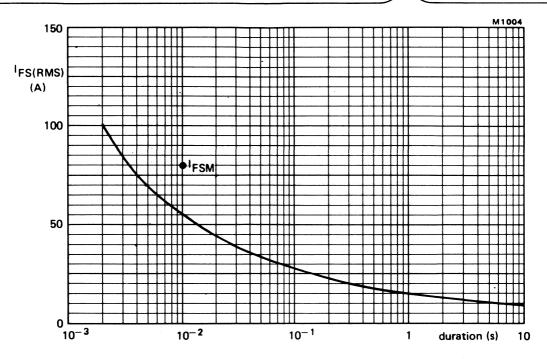
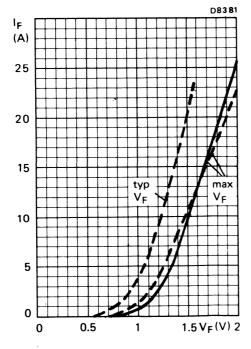


Fig.6 Maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz); T_j = 150 °C prior to surge; with reapplied V_{RWMmax} .



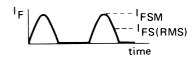


Fig.7 ———
$$T_j = 25$$
 °C; $---T_j = 125$ °C

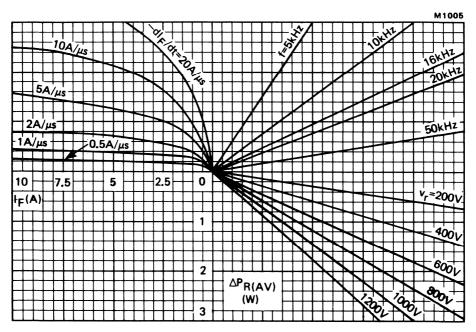
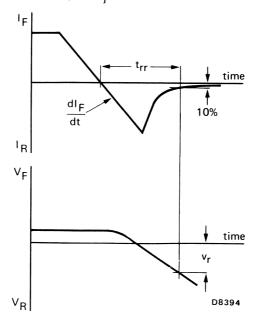
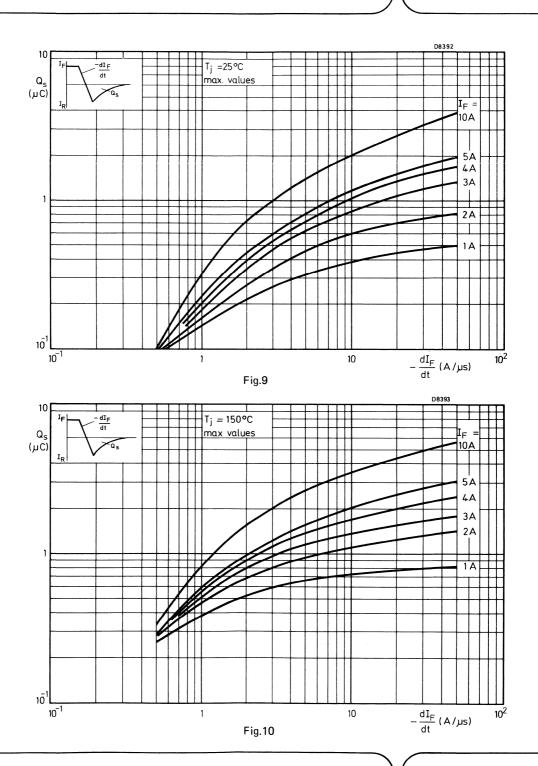


Fig.8 NOMOGRAM

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





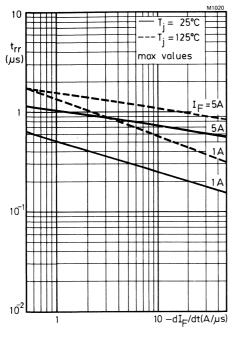
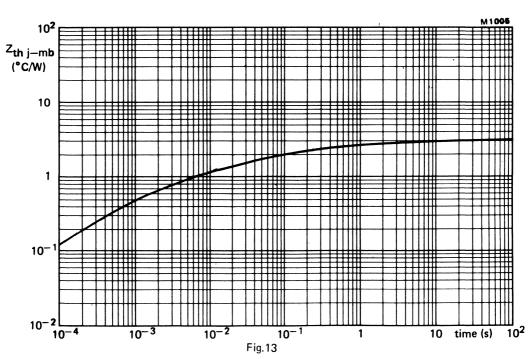




Fig.12



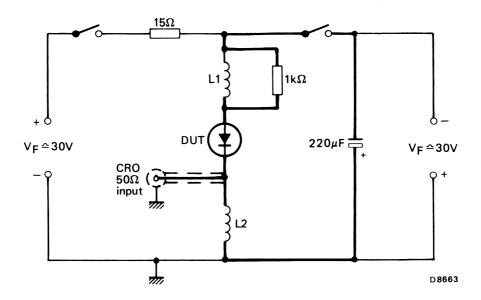


Fig.14 Simplified circuit diagram of practical apparatus to test softness of recovery.

NOTES

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

FAST HIGH-VOLTAGE RECTIFIER DIODES

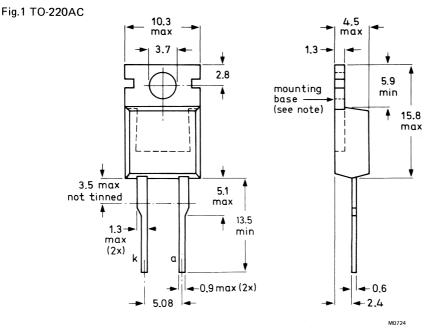
Glass-passivated double-diffused rectifier diodes in TO-220 plastic envelopes, featuring fast recovery times. They are intended for use as an anti-parallel diode to GTOs and similar high-voltage switches, in chopper applications such as Series Resonant Power Supplies (SRPS) and other high-voltage circuits. 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 | | Α |
| Non-repetitive peak forward current | IFSM | max. | | 60 | | Α |
| Reverse recovery time | t _{rr} | < | | 0.6 | | μs |

MECHANICAL DATA

Dimensions in mm



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* | | BY359-10 | 00 130 | 0 1500 | |
|--|------------------|----------------------|---------------------|----------|--------------|
| Non-repetitive peak reverse voltage | V _{RSM} | max. 11 | 00 150 | 0 1650 | |
| Repetitive peak reverse voltage | V _{RRM} | max. 10 | 00 130 | 0 1500 | V |
| Crest working reverse voltage | V _{RWM} | max. 8 | 00 120 | 0 1300 | V |
| Continuous reverse voltage | VR | max. 6 | 00 75 | 0 800 | ٧ |
| <u> </u> | | | | | _ |
| Currents | | | | | |
| Average forward current assuming zero switching losses sinusoidal; | | | | | |
| up to T _{mb} = 94 °C | | l _{F(AV)} | max. | 6.5 | Α |
| R.M.S. forward current | | F(RMS) | max. | 10 | Α |
| Repetitive peak froward current | | I _{FRM} | max. | 60 | Α |
| Non-repetitive peak forward current: t = 10 ms half sine-wave; T _i = 125 °C prior to surge; | | | | | |
| with reapplied V _{RWM} max | | ^I FSM | max. | 60 | Α |
| Temperatures | | | | | |
| Storage temperature | | T_{stg} | -40 t | o +150 | οС |
| Junction temperature | | T_{j} | max. | 125 | οС |
| THERMAL RESISTANCE | | | | | |
| From junction to mounting base | | R _{th j-mb} | = | 3.0 | oC/M |
| Influence of mounting method | | | | | |
| Heatsink mounted with clip (see mounting inst | tructions) | | | | |
| Thermal resistance from mounting base to heatsing | | | | | |
| a. with heatsink compound | | D | - · | 0.3 | oC/W |
| b. with heatsink compound and 0.06 mm maxim | um | R _{th mb-h} | | 0.5 | C/ VV |
| mica insulator | uiii, | R _{th mb-h} | = | 1.4 | oC/W |
| c. with heatsink compound and 0.1 mm maximur | m | | | | |
| mica insulator (56369) | | R _{th} mb-h | = | 2.2 | oC/M |
| d. with heatsink compound and 0.25 mm maximum | um | р | = | 0.8 | oC/W |
| alumina insulator (56367) | | R _{th mb-h} | = | 1.4 | °C/W |
| e. without heatsink compound | | Rth mb-h | _ | 1.4 | - 0/ 00 |

^{*}To ensure thermal stability: R $_{th~j\text{-}a} \leqslant$ 10.4 $^{o}\text{C/W}$ for continuous reverse voltage.

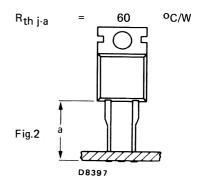
V*

mΑ

THERMAL RESISTANCE (continued)

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



CHARACTERISTICS

Forward voltage
$$I_F = 20 \text{ A}$$
; $T_j = 25 \text{ °C}$ Reverse current $V_R = V_{RWMmax}$; $T_i = 100 \text{ °C}$

Reverse recovery when switched from

I
$$_{F}$$
 = 2 A to V $_{R}$ \geqslant 30 V with $-dI_{F}/dt$ = 20 A/ $\mu s;$ T $_{j}$ = 25 °C recovered charge recovery time

Forward recovery when switched to $I_F = 5$ A with $t_r = 0.1 \,\mu s$; $T_j = 25$ °C recovery time

| $Q_{\mathbf{S}}$ | .< | 2.0 | μC |
|------------------|----|-----|----|
| t _{rr} | < | 0.6 | μs |

2.3

0.6

٧F

 ^{1}R

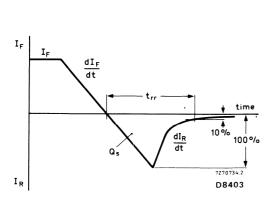


Fig.3 Definition of t_{rr} and Q_s .

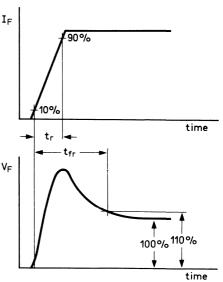


Fig.4 Definition of tfr.

^{*}Measured under pulse conditions to avoid excessive dissipation

MOUNTING INSTRUCTIONS

- 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.
- 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-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-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

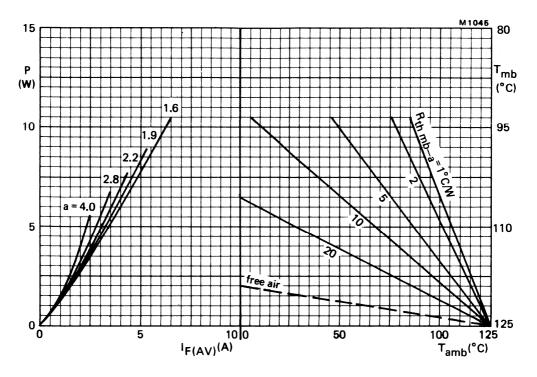


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.

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

a = form factor = IF(RMS)/IF(AV).

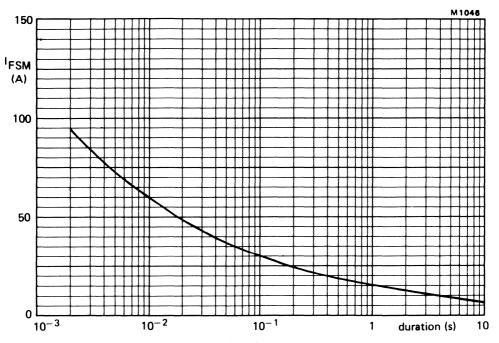


Fig.6 Maximum permissible non-repetitive peak forward current based on sinusoidal currents (f = 50 Hz); T_j = 125 °C prior to surge; with reapplied V_{RWMmax} .

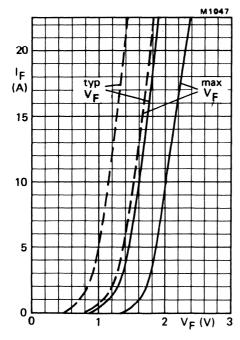




Fig.7 ———
$$T_j = 25$$
 °C; ——— $T_j = 100$ °C.

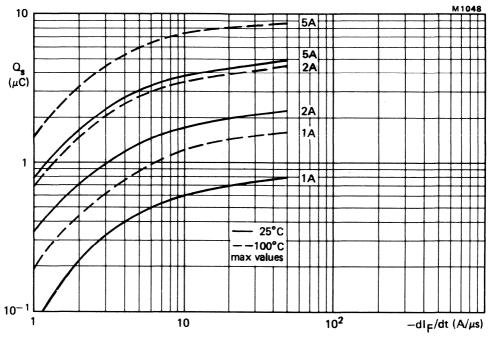


Fig.8

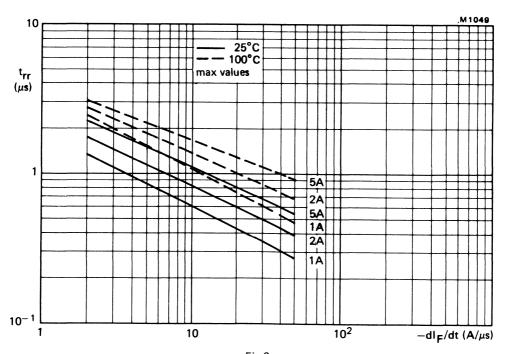


Fig.9

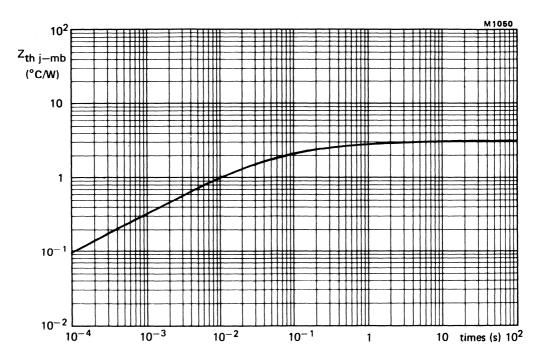


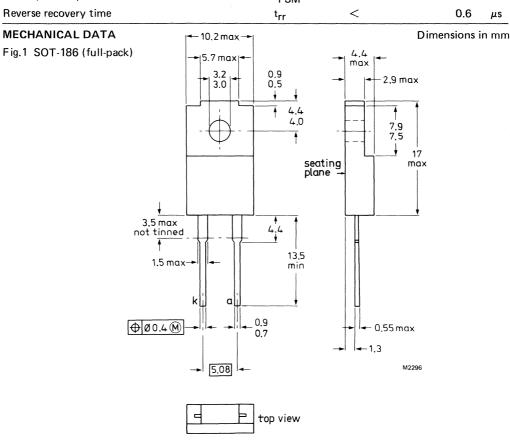
Fig.10

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 | VRRM | max. | 1500 | V |
|-------------------------------------|--------------------|------|------|----|
| Average forward current | ^I F(AV) | max. | 6.5 | Α |
| Non-repetitive peak forward current | IFSM | max. | 60 | Α |
| Reverse recovery time | t _{rr} | < | 0.6 | μs |



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 | VRWM | max. | 1300 | ٧ |
| Currents | | | | |
| Average forward current assuming zero switching losses (note 2) sinusoidal; up to T _h = 92 ^o C | ^I F(AV) | max. | 6.5 | A |
| RMS forward current | ^I F(RMS) | max. | 10 | Α |
| Repetitive peak forward current | ^I FRM | max. | 60 | Α |
| Non-repetitive peak forward current t = 10 ms; half sinewave; T _j = 125 ^O C prior to surge, with reapplied V _{RWM max} | IFSM | max. | 60 | A |
| Temperatures | | | | |
| Storage temperature | T_{stg} | | -40 to +150 | оС |
| Junction temperature | T_{j} | max. | 150 | oC |
| ISOLATION | | | | |
| Peak isolation voltage from all terminals to external heatsink (note 1) | V _{isol} | max. | 1500 | ٧ |
| Isolation capacitance from cathode to external heatsink (note 3) | C _{isol} | typ. | 12 | рF |

Notes

- 1. Repetitive peak operation with t_p < 15 μ s, δ < 0.2, at sea level with relative humidity \leq 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

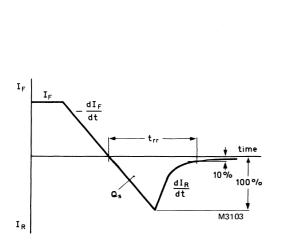
From junction to external heatsink with minimum of 2 kgf (20 newtons) pressure on the centre of the envelope,

| without heatsink compound | R _{th i-h} | | 7.2 | K/W |
|---------------------------|---------------------|---|-----|-----|
| with heatsink compound | R _{th j-h} | = | 5.5 | K/W |

Free-air operation

The quoted value of R $_{\mbox{th j-a}}$ 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, mounted on a printed circuit board | R _{th j-a} | ·, ·, · · = | 55 | K/W |
|--|---------------------|-------------|-----|-----|
| CHARACTERISTICS | | | | |
| Forward voltage $I_F = 20 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | ٧ _F | < | 2.3 | V* |
| Reverse current $V_R = V_{RWMmax}$; $T_i = 100 {}^{\circ}C$ | ^I R | < | 0.6 | mA |
| Reverse recovery when switched from $I_F = 2 \text{ A to V}_R \ge 30 \text{ V}$ with $-dI_F/dt = 20 \text{ A}/\mu\text{s}$; $T_i = 25 ^{\circ}\text{C}$ | | | | |
| recovered charge | O_s | < | 2.0 | μC |
| recovery time | t _{rr} | < | 0.6 | μs |
| Forward recovery when switched to $I_F = 5 \text{ A with } t_r = 0.1 \mu\text{s}; T_1 = 25 ^{\circ}\text{C}$ | | | | |
| recovery time | tfr | < | 1.0 | μs |





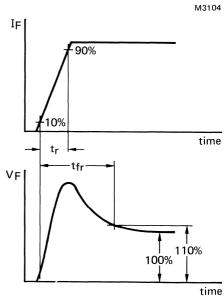


Fig.3 Definition of tfr.

^{*}Measured under pulse conditions to avoid excessive dissipation

MOUNTING INSTRUCTIONS

- 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-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:

 Maximum torque to avoid damage to the device:

 5.5 kgf (0.55 Nm)

 8.0 kgf (0.80 Nm)
- For good thermal contact, heatsink compound should be used between baseplate and heatsink.
 Values of R_{th j-h} given for mounting with heatsink compound refer to the use of a metallic-oxide loaded compound. Ordinary silicone grease is not recommended.
- 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.

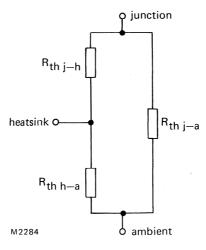


Fig.4.

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

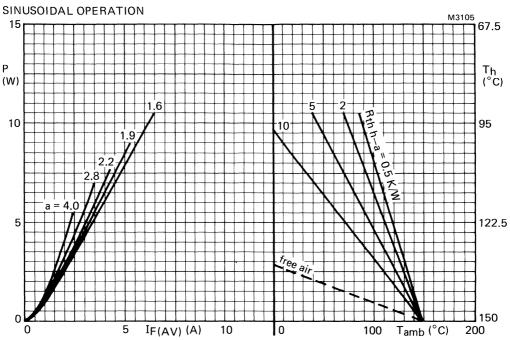


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.

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

 $a = form factor = I_F(RMS)/I_F(AV)$.

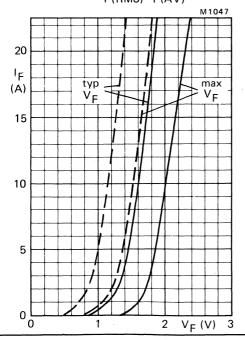
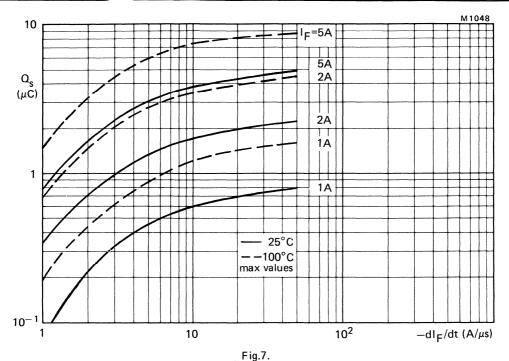


Fig.6 — $T_j = 25$ °C; $---T_j = 100$ °C.



. .9...

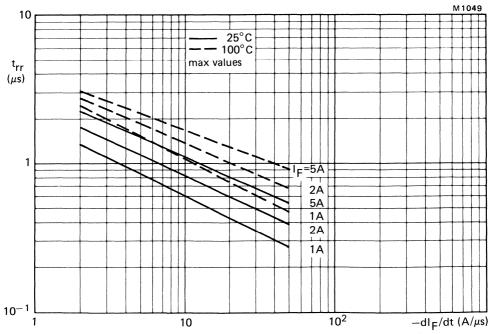


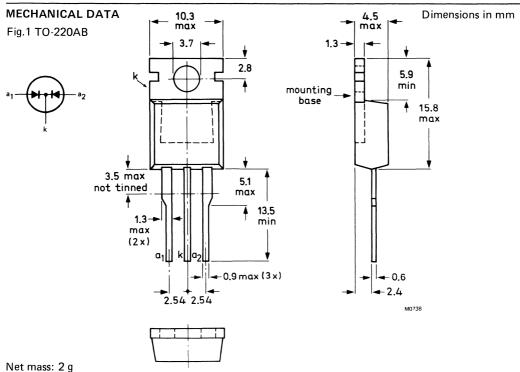
Fig.8.

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) | In | max. | | 10 | | А |
| Forward voltage | ۷ _F | < | | 0.9 | | V |
| Reverse recovery time | t _{rr} | < | | 30 | | ns |
| Reverse leakage current | 1 _R | < | | 5 | | μA |



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

BYP20 SERIES

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 °C | 10 | max. | | 10 | | Α |
| sinusoidal; up to T _{mb} = 150 ^o C | 10 | max. | | 10 | | Α |
| RMS forward current | IF(RMS) | max. | | 14 | | Α |
| Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ (note 2) | I _{FRM} | max. | | 80 | | Α |
| Non-repetitive peak forward current half sinewave; T _j = 175 °C prior to surge; with reapplied V _{RWMmax} (note 2) | | | | | | |
| t = 10 ms | ^I FSM | max. | | 60 | | Α |
| t = 8.3 ms | ^I FSM | max. | | 75 | | Α |
| I^2 t for fusing (t = 10 ms, note 2) | l²t | max. | | 18 | | A^2s |
| Temperatures | | | | | | |
| Storage temperature | T_{stg} | | -65 to | +175 | | oC |
| Junction temperature | т _ј | 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.

| CHA | RΔ | CTE | RI | STI | CS |
|-----|----|-----|----|-----|----|
| | | | | | |

| Forward voltage | | | | |
|---|-----------------|------|------|----|
| I _F = 3 A; T _j = 150 °C | VF | < | 0.9 | V* |
| $I_F = 3 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | VF | < | 1.0 | V* |
| $I_F = 10 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | ٧ _F | < | 1.25 | V* |
| Reverse current | | | | |
| $V_R = V_{RWMmax}$; $T_j = 150 {}^{\circ}C$ | 1 _R | < | 250 | μΑ |
| $T_{j} = 100 {}^{\circ}\text{C}$ | ۱ _R | < | 50 | μΑ |
| $T_j = 25 {}^{\circ}\text{C}$ | 1 _R | < | 5 | μΑ |
| Reverse recovery when switched from $I_F = 1 \text{ A to V}_R \geqslant 30 \text{ V with } -dI_F/dt = 100 \text{ A}/\mu\text{s};$ $T_j = 25 ^{\circ}\text{C}$; recovery time | t _{rr} | v | 30 | ns |
| Reverse recovery when switched from $I_F = 1 \text{ A to V}_R \geqslant 30 \text{ V with } -dI_F/dt = 50 \text{ A}/\mu\text{s};$ $T_j = 25 ^{\circ}\text{C};$ recovery time | t _{rr} | < | 35 | ns |
| $I_F = 2 \text{ A to V}_R \ge 30 \text{ V with } -dI_F/dt = 20 \text{ A}/\mu\text{s};$ $T_j = 25 ^{\circ}\text{C}; \text{ recovered charge}$ | Q_{s} | < | 6 | nC |
| I _F = 10 A to V _R \geqslant 30 V with $-dI_F/dt$ = 50 A/ μ s; T _j = 100 ^O C; peak recovery current | IRRM | < | 1.2 | Α |
| Forward recovery when switched to $I_F = 1 \text{ A}$ with $dI_F/dt = 10 \text{ A}/\mu\text{s}$; $T_j = 25 \text{ °C}$ | V _{fr} | typ. | 2 | V |

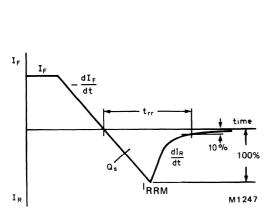


Fig.2 Definition of t_{rr} , Q_s and I_{RRM} .

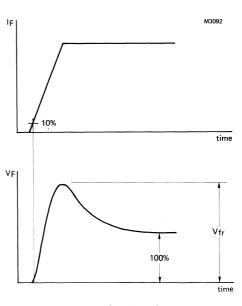


Fig.3 Definition of V_{fr} .

^{*}Measured under pulse conditions to avoid excessive dissipation.

BYP20 SERIES

| THERMAL RESISTANCE | | | | |
|--|----------------------|-----------|---------|--------|
| From junction to mounting base (both diodes conducting) | R _{th j-mb} | = | 2.8 | K/W |
| From junction to mounting base (per diode) | R _{th j-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-h} | = | 0.3 | K/W |
| with heatsink compound and 0.06 mm maximum mica insulator | R _{th mb-h} | = | 1.4 | K/W |
| with heatsink compound and 0.1 mm maximum mica insulator (56369) | R _{th mb-h} | = | 2.2 | K/W |
| d. with heatsink compound and 0.25 mm maximum alumina insulator (56367) | R _{th mb-h} | = | 0.8 | K/W |
| e. without heatsink compound | R _{th mb-h} | = " | 1.4 | K/W |
| 2. Free-air operation | | | | |
| The quoted values of R $_{th}$ $_{j\text{-}a}$ should be used only when no lead to the same tie point. | ds of other diss | ipating c | omponen | ts run |
| 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-a} | = | 60 | K/W |

MOUNTING INSTRUCTIONS

- 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 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.
- 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.

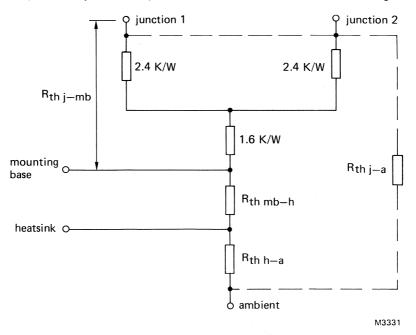


Fig.4.

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

SQUARE-WAVE OPERATION (PER DIODE)

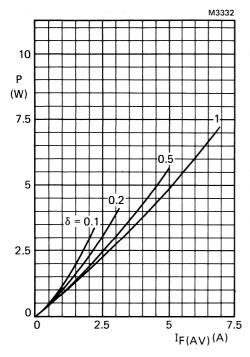
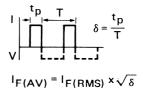


Fig.5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.



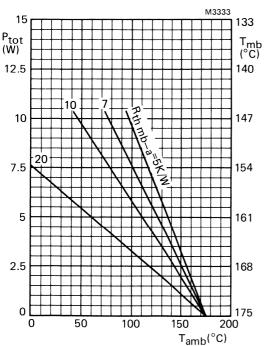


Fig.6.

SINUSOIDAL OPERATION (PER DIODE)

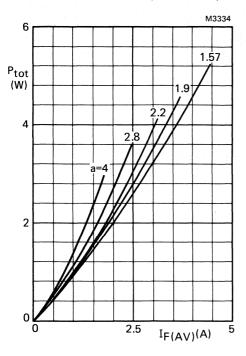


Fig.7 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.

 $a = form factor = I_F(RMS)/I_F(AV)$

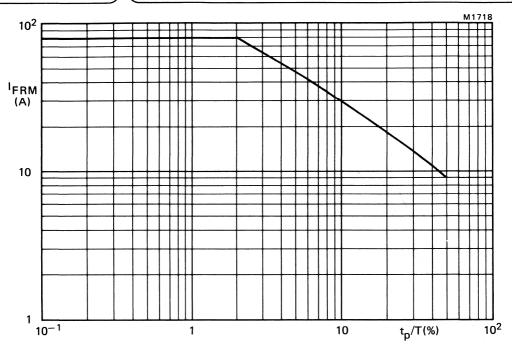
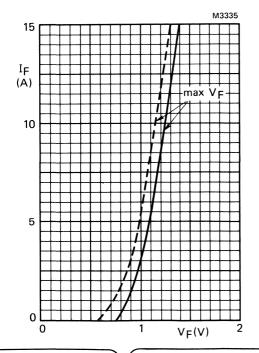
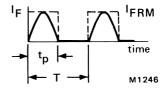


Fig.8 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 μ s < t $_D$ < 1 ms; per diode.





Definition of I $_{\mbox{\scriptsize FRM}}$ and t_p/T

Fig.9 —
$$T_j = 25 \text{ }^{o}\text{C}; --- T_j = 150 \text{ }^{o}\text{C};$$
 per diode.

ULTRA FAST-RECOVERY RECTIFIER DIODES FEATURING LOW REVERSE LEAKAGE

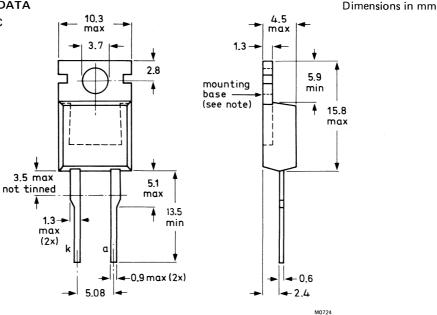
Glass-passivated, high-efficiency epitaxial rectifier diodes in plastic envelopes, featuring low reverse leakage current, low forward voltage drop, ultra fast reverse recovery times, very low stored charge and soft recovery characteristics. They are intended for use in switched-mode power supplies and 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

| | 31. | **. | BYP | 21-50 | 100 | 150 | 200 | |
|---------------------------------|--------------------|------|-----|-------|------|-----|-----|----|
| Repetitive peak reverse voltage | v_{RRM} | max. | | 50 | 100 | 150 | 200 | V |
| Average forward current | l _{F(AV)} | max. | | - | , | 8 | | Α |
| Forward voltage | VF | < | | | 0.89 | 95 | | V |
| Reverse recovery time | t _{rr} | < | | | 2 | 25 | | ns |
| Reverse leakage current | IR | < | | | | 5 | | μΑ |

MECHANICAL DATA

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.

July 1986

BYP21 SERIES

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 | ٧ |
| Continuous reverse voltage | VR | max. | 50 | 100 | 150 | 200 | V |
| Currents | | | | | | | _ |
| Average forward current; switching losses negligible up to 500 kHz square wave; δ = 0.5; | | | | | | | |
| up to $T_{mb} = 150 {}^{\circ}\text{C}$ | IF(AV) | max. | | | 8 | | Α |
| sinusoidal; up to $T_{mb} = 150 {}^{\circ}C$ | ^I F(AV) | max. | | 9. | .4 | | Α |
| R.M.S. forward current | IF(RMS) | max. | | 11. | .5 | | Α |
| Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ | I _{FRM} | max. | | 17 | 5 | | Α |
| Non-repetitive peak forward current half sine-wave; T _j = 175 ^O C prior to surge; with reapplied V _{RWMmax} | | | | | | | |
| t = 10 ms | I _{FSM} | max. | | 8 | 0 | | Α |
| t = 8.3 ms | ^I FSM | max. | | 10 | 0 | | Α |
| I^2 t for fusing (t = 10 ms) | I ² t | max. | | 3 | 2 | | A^2s |
| Temperatures | | | | | | | |
| Storage temperature | T_{stg} | | -6 | 5 to +17 | 5 | | οС |
| Junction temperature | Tj | max. | | 17 | 5 | | оС |

| THERMAL RESISTANCE | | | | |
|--|----------------------|-----------|---------|----------|
| From junction to mounting base | R _{th j-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-h} | = | 0.3 | K/W |
| b. with heatsink compound and 0.06 mm maximum mica insulator | R _{th mb-h} | = | 1.4 | K/W |
| with heatsink compound and 0.1 mm maximum mica washer (56369) | R _{th mb-h} | = | 2.2 | K/W |
| d. with heatsink compound and 0.25 mm maximum alumina insulator (56367) | R _{th mb-h} | = | 0.8 | K/W |
| e. without heatsink compound | R _{th mb-h} | _ = | 1.4 | K/W |
| 2. Free air operation | | | | |
| The quoted values of $R_{th\ j-a}$ should be used only when no leat to the same tie point. Thermal resistance from junction to ambient in free air: | ds of other dissi | oating co | omponen | ts run |
| mounted on a printed circuit board at a = any lead length | R | | 60 | K/W |
| a arry road rorriger | R _{th j-a} | | 50 | 1 < / ٧٧ |

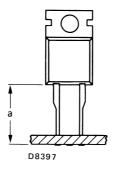
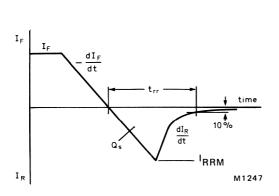
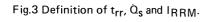


Fig.2

CHARACTERISTICS

| CHARACTERISTICS | | | | |
|---|-----------------|------|-------|-------|
| Forward voltage I _F = 8 A; T _i = 100 ^o C | VF | < | 0.895 | V* |
| I _F = 8 A; T _i = 25 °C | V _E | < | 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 | l _R | < | 500 | μΑ |
| T _j = 125 °C | I _R | < | 250 | μΑ |
| T _j = 100 °C | IR | < | 50 | μΑ |
| $T_j = 25$ °C | ۱ _R | < | 5 | μΑ |
| Reverse recovery when switched from IF = 1 A to $V_R \geqslant 30$ V with $-dI_F/dt = 100$ A/ μ s; $T_j = 25$ $^{\circ}$ C; recovery time | t _{rr} | < | 25 | ns |
| Step reverse recovery when switched from $I_F = 0.5 \text{ A}$ to $I_R = 1 \text{ A}$, measured at $I_{RR} = 0.25 \text{ A}$; recovery time | t _{rr} | < | 25 | ns |
| $I_F = 2 \text{ A to } V_R \geqslant 30 \text{ Vwith } -dI_F/dt = 20 \text{ A}/\mu\text{s};$ $T_j = 25 ^{\circ}\text{C}; \text{ recovered charge}$ | Q_{s} | < | 15 | nC |
| I _F = 10 A to $V_R \ge 30 V$ with $-dI_F/dt = 50 A/\mu s$; $T_j = 100 ^{\circ}C$; peak recovery current | IRRM | < | 2 | Α |
| Forward recovery when switched to $I_F = 1 \text{ A}$ with $dI_F/dt = 10 \text{ A}/\mu\text{s}$; $T_j = 25 ^{\circ}\text{C}$ | V_{fr} | typ. | 0.9 | ٧ |
| | | | MOO 1 | 210/2 |





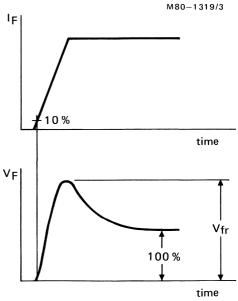


Fig.4 Definition of V_{fr}.

^{*}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 2.4mm 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-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 considerations:

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

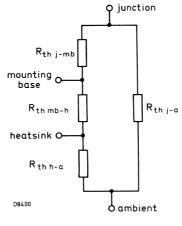


Fig.5

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-a}. The heatsink thermal resistance value (R_{th h-a}) can now be calculated from:

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

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

BYP21 SERIES

SQUARE-WAVE OPERATION

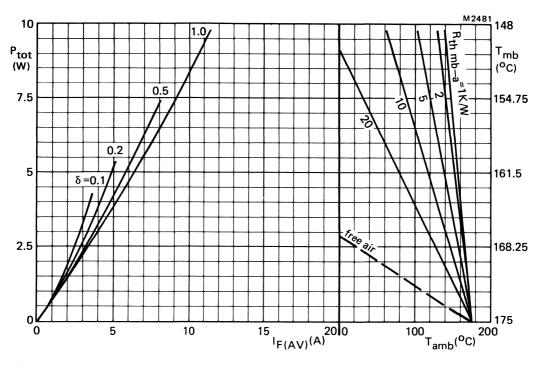


Fig.6 The right-hand part shows the relationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 500 kHz.

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

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

SINUSOIDAL OPERATION

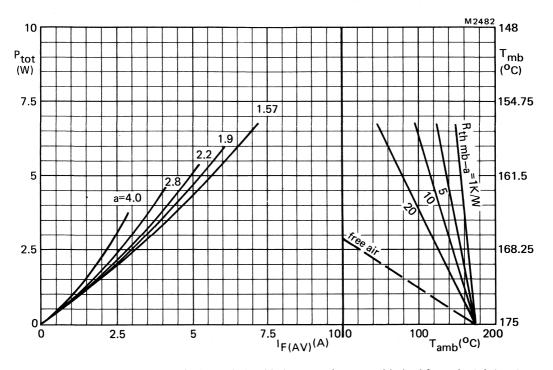


Fig.7 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures. $a = form \ factor = I_F(RMS)/I_F(AV)$.

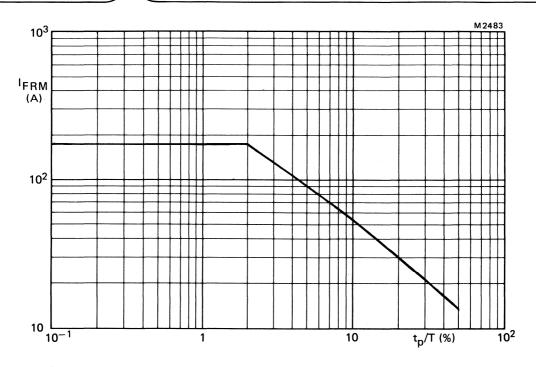
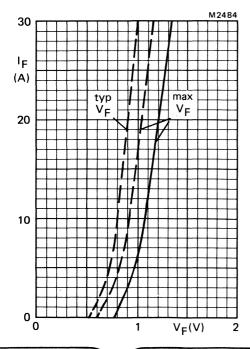
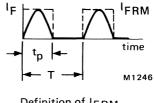


Fig.8 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 $\mu s < t_p < 1$ ms.





Definition of IFRM and t_p/T .

Fig.9 ——
$$T_j = 25 \text{ }^{o}\text{C}; --- T_j = 100 \text{ }^{o}\text{C}.$$

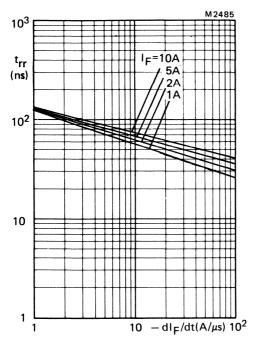


Fig. 10 Maximum t_{rr} at $T_i = 25$ °C.

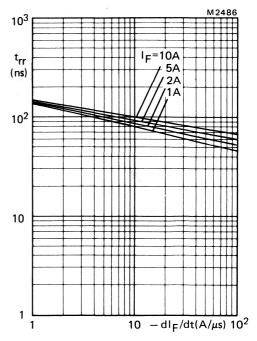


Fig.11 Maximum t_{rr} at $T_j = 100$ °C.

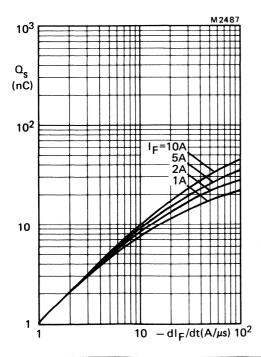


Fig.12 Maximum Q_s at $T_j = 25$ °C.

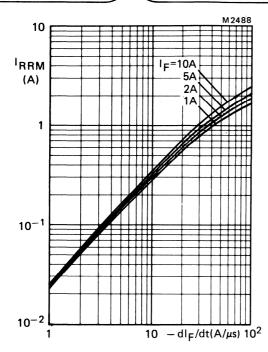


Fig. 13 Maximum I_{RRM} at $T_j = 25$ °C.

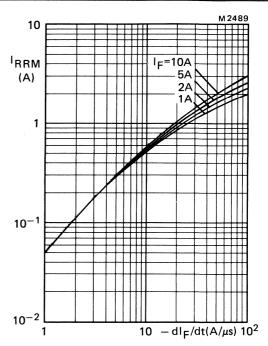


Fig.14 Maximum I_{RRM} at $T_j = 100$ °C.

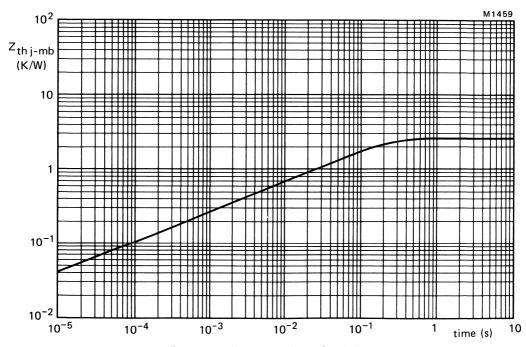


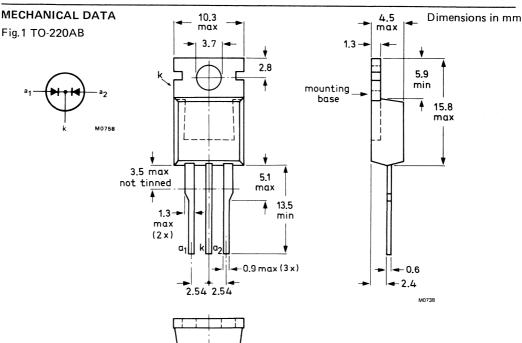
Fig.15 Transient thermal impedance.

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 | ٧ |
| Output current (both diodes conducting) | I _O | max. | 20 | | | | _ A |
| Forward voltage | ٧F | < | 0.895 | | | | V |
| Reverse recovery time | t _{rr} | < | | 2 | 25 | | ns |
| Reverse leakage current | I _R | < | | | 5 | | μΑ |



Net mass: 2 g

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

BYP22 SERIES

RATINGS

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

| | | | 100 | 150 | 200 | |
|--|----------|----|-----------|-----|-----|------------------|
| Repetitive peak reverse voltage VRR | M max. | 50 | 100 | 150 | 200 | V |
| Crest working reverse voltage VRW | /M 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 $T_{mb} = 150 {}^{\circ}C$ | max. | | 10 | 6 | | \mathbf{A}_{i} |
| square wave; δ = 0.5; up to T _{mb} = 143 °C I _O | max. | | 2 | 0 | | Α |
| sinusoidal; up to $T_{mb} = 150 {}^{\circ}C$ I_{O} | max. | | 10 | 6 | | Α |
| R.M.S. forward current IF(R | MS) max. | | 20 | 0 | | Α |
| Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ (note 2) | д max. | | 230 | 0 | | Α |
| Non-repetitive peak forward current half sine-wave; $T_j = 175 ^{\circ}\text{C}$ prior to surge; with reapplied V_{RWM} max. (note 2) | | | | | | |
| t = 10 ms | max. | | 140 | 0 | | Α |
| t = 8.3 ms | max. | | 150 | 0 | | Α |
| I^2 t for fusing (t = 10 ms; note 2) I^2 t | max. | | 98 | 3 | | A^2s |
| Temperatures | | | | | | |
| Storage temperature T _{stg} | | —6 | 5 to +175 | 5 | | οС |
| Junction temperature T_j | max. | | 179 | 5 | | оС |

Notes

- 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-mb} | = | 1.6 | K/W |
| per diode | R _{th j-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-h | = | 0.3 | K/W |
| with heatsink compound and 0.06 mm maximum mica insulator | R _{th mb-h} | = | 1.4 | K/W |
| with heatsink compound and 0.1 mm maximum mica washer (56369) | R _{th} mb-h | = | 2.2 | K/W |
| with heatsink compound and 0.25 mm maximum alumina insulator (56367) | R _{th mb-h} | · , · = · , · · | 0.8 | K/W |
| e. without heatsink compound | R _{th} mb-h | = | 1.4 | K/W |
| 2. Free air operation | | | | |
| The quoted values of $R_{\mbox{th}\ \mbox{j-a}}$ should be used only when no leato the same tie point. | ds of other dissip | oating co | mponen | ts run |
| Thermal resistance from junction to ambient in free air: | | | | |
| mounted on a printed circuit board at any lead length | R _{th j-a} | | 60 | K/W |

CHARACTERISTICS

| CHARACTERISTICS | | | | |
|---|------------------|------|-------|----|
| Forward voltage $I_F = 8 A; T_i = 100 ^{\circ}C$ | V= | < | 0.895 | V* |
| I _F = 8 A; T _i = 25 °C | V _F | < | | V* |
| • | VF | 1 | 0.975 | • |
| I _F = 20 A; T _j = 25 °C | VF | < | 1.15 | V* |
| Reverse current | | | | |
| $V_R = V_{RWMmax}$; $T_j = 175 {}^{\circ}C$ | I _R | < | 500 | μΑ |
| $T_j = 125 {}^{\circ}\text{C}$ | I _R | < | 250 | μΑ |
| T _j = 100 °C | IR | < | 50 | μΑ |
| T _j = 25 °C | IR | < | 5 | μΑ |
| Reverse recovery when switched from IF = 1 A to $V_R \ge 30$ V with $-dI_F/dt = 100$ A/ μ s; $T_j = 25$ °C; recovery time | t _{rr} | < | 25 | ns |
| Step reverse recovery when switched from $I_F = 0.5 \text{ A}$ to $I_R = 1 \text{ A}$, measured at $I_{RR} = 0.25 \text{ A}$; recovery time | t _{rr.} | < | 25 | ns |
| I _F = 2 A to V _R \geqslant 30 V with $-dI_F/dt$ = 20 A/ μ s; T _j = 25 °C; recovered charge | Ω_{s} | < | 15 | nC |
| IF = 10 A to $V_R \ge 30 V$ with $-dI_F/dt = 50 A/\mu s$; $T_j = 100 ^{\circ}C$; peak recovery current | IRRM | < | 2 | A |
| Forward recovery when switched to $I_F = 1 \text{ A}$ with $dI_F/dt = 10 \text{ A}/\mu s$; $T_j = 25 ^{\circ}\text{C}$ | V_{fr} | typ. | 0.9 | V |
| | | | | |

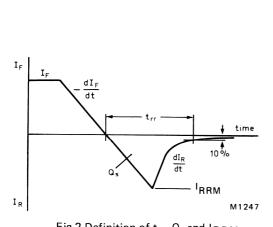


Fig.2 Definition of t_{rr} , Q_s and I_{RRM} .

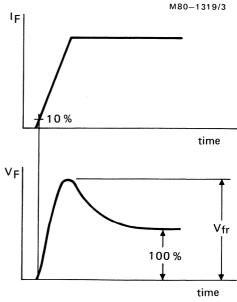


Fig.3 Definition of $V_{\mbox{fr}}$.

^{*}Measured under pulse conditions to avoid excessive dissipation.

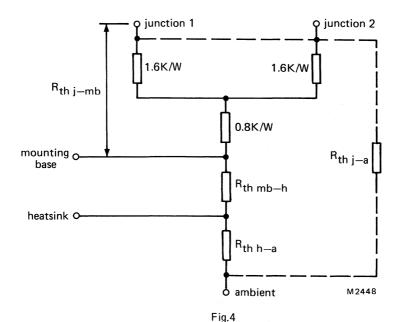
MOUNTING INSTRUCTIONS

- 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.
- 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:



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

SQUARE-WAVE OPERATION (PER DIODE)

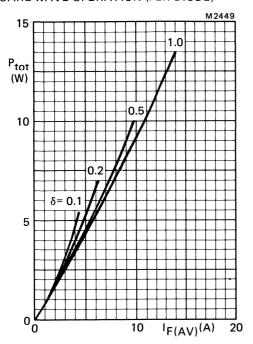
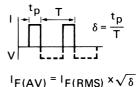


Fig.5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.



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

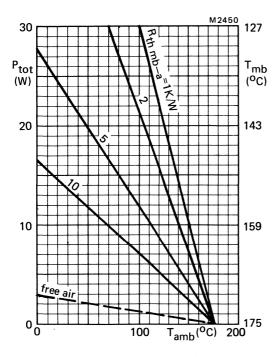


Fig.6

SINUSOIDAL OPERATION (PER DIODE)

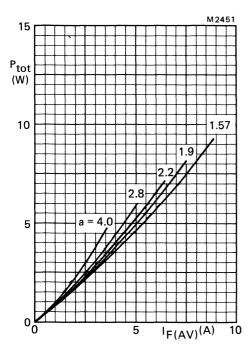


Fig.7 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temepratures.

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

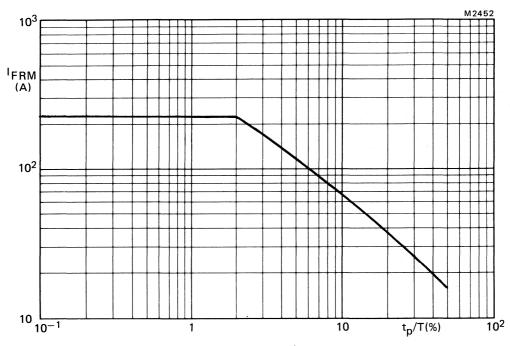
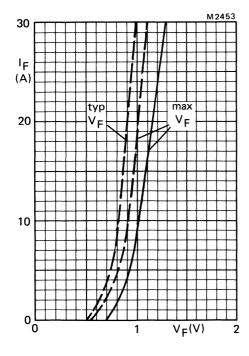
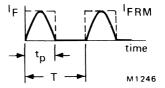


Fig.8 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 μ s < t $_p$ < 1 ms.





Definition of IFRM and t_p/T .

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

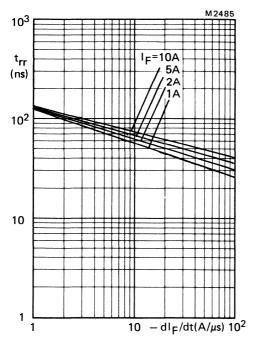
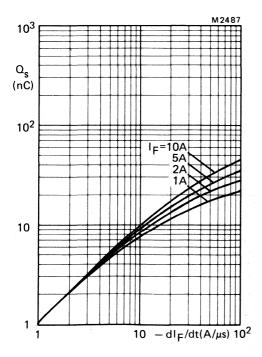


Fig.10 Maximum t_{rr} at $T_j = 25$ °C.



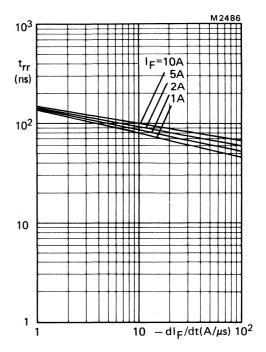


Fig.11 Maximum t_{rr} at $T_j = 100$ °C.

Fig.12 Maximum Q_s at T_j = 25 °C.

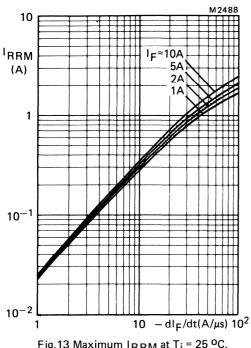


Fig. 13 Maximum I_{RRM} at $T_j = 25$ °C.

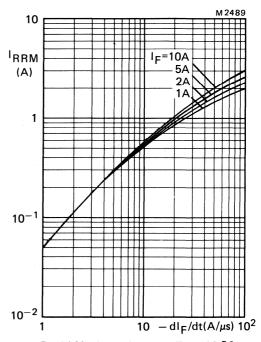


Fig.14 Maximum I_{RRM} at $T_j = 100$ °C.

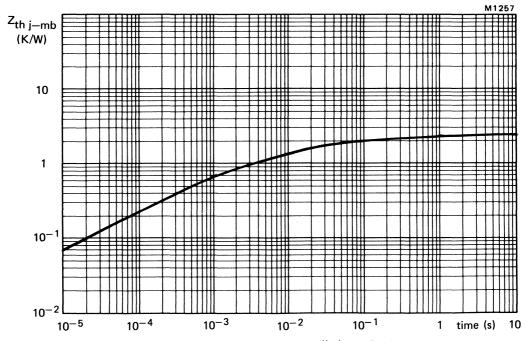


Fig.15 Transient thermal impedance; one diode conducting.

ULTRA FAST-RECOVERY DOUBLE RECTIFIER DIODES

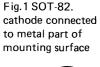
Glass-passivated, high-efficiency double rectifier diodes in plastic envelopes, featuring low forward voltage drop, ultra fast reverse recovery times and soft recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction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

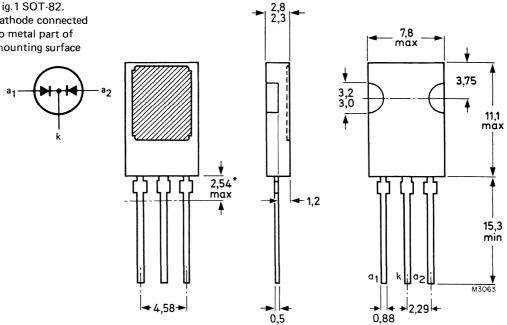
QUICK REFERENCE DATA

| | BYQ2 | 7–50 | 100 | 150 | 200 | |
|-----------------|----------------------------------|-----------------------|-----------------|---|--|---|
| v_{RRM} | max. | 50 | 100 | 150 | 200 | V |
| I _O | max. | | 1 | 10 | - | A |
| ٧ _F | < | | 0.8 | 1 5 | | V |
| t _{rr} | < | | 2 | 20 | | ns |
| | I _O V _F | V _{RRM} max. | IO max. VF < | V _{RRM} max. 50 100 I _O max. 1 V _F < 0.8 | V _{RRM} max. 50 100 150 I _O max. 10 V _F < 0.85 | V _{RRM} max. 50 100 150 200 1 _O max. 10 V _F < 0.85 |

MECHANICAL DATA

Dimensions in mm





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

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

max

BYQ27 SERIES

RATINGS

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

| | | | • | | | | |
|--|----------------------|--------------|--------|--------|-----|-----|------------------|
| Voltages (per diode) | | BYQ | 27–50 | 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 | ٧ |
| 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; | | | | | | | <u>.</u> |
| square wave; δ = 0.5; up to T _{mb} = 120 °C sinusoidal; up to T _{mb} = 118 °C | 10 10 | max. max. | | 1 | | | A A |
| R.M.S. forward current | IF(RMS) | max. | | 1 | | | A |
| Repetitive peak forward current | 'F(KIVIS) | mux. | | • | • | | ^ |
| $t_p = 20 \mu s$, $\delta = 0.02$ (per diode) | FRM | max. | | 8 | C | | Α |
| 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. | | 5 |) | | Α |
| t = 8.3 ms | IFSM | max. | | 6 | י כ | | Α |
| I^2 t for fusing (t = 10 ms, per diode) | l²t | max. | | 12. | 5 | | A ² s |
| Temperatures | | | | | | | |
| Storage temperature | T_{stg} | | -40 to | o +150 |) | | oC |
| Junction temperature | T_{j} | max. | | 150 |) | | oC |
| THERMAL RESISTANCE | | | | | | | |
| From junction to mounting base (both diodes conducting) | R _{th j-mb} | = | | 3. | 0 | | K/W |
| From junction to mounting base (per diode) | R _{th j-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-h} | = | | 0.3 | 3 | | K/W |
| b. with heatsink compound and 0.06 mm maximum mica insulator (56354) | R _{th mb-h} | _ | | 1.4 | 4 | | K/W |
| c. without heatsink compound | R _{th mb-h} | = 1 | | 1.4 | 4 | | K/W |
| 2. Free air operation | | | | | | | |

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 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

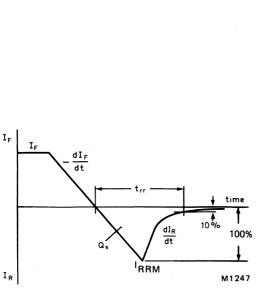
$$R_{th j-a} = 100 K/W$$

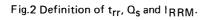
Notes:

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

CHARACTERISTICS (per diode)

| Forward voltage | | | | |
|---|-----------------|---|------|-------------|
| $I_F = 5 \text{ A}; T_j = 150 ^{\circ}\text{C}$ | VF | < | 0.85 | V* |
| $I_F = 10 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | VF | < | 1.25 | V* ← |
| Reverse current | | | | |
| $V_R = V_{RWM max}; T_j = 100 {}^{\circ}\text{C}$ | I _R | < | 0.2 | mA |
| $V_R = V_{RWM max}; T_j = 25 {}^{\circ}C$ | ^l R | < | 10 | μΑ |
| Reverse recovery when switched from | | | | |
| I _F = 1 A to V _R \geq 30 V with -dI _F /dt = 100 A/ μ s; 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 ^{o}C recovered charge | O _s | < 1 A D D D D D D D D D D D D D D D D D D | 5.5 | nC |
| IF = 5 A to $V_R \ge 30 V$ with $-dI_F/dt = 50 A/\mu s$; $T_j = 25 ^{O}C$ peak recovery current | IRRM | < | 0.7 | A |
| Forward recovery when switched to $I_F = 1 A$ with $dI_F/dt = 10 A/\mu s$; $T_i = 25 {}^{\circ}C$ | | | | |
| recovery voltage | v_{fr} | typ. | 1.0 | V |
| | | | | |





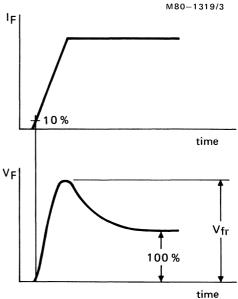


Fig.3 Definition of V_{fr} .

^{*}Measured under pulse conditions to avoid excessive dissipation.

MOUNTING INSTRUCTIONS

- 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-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.

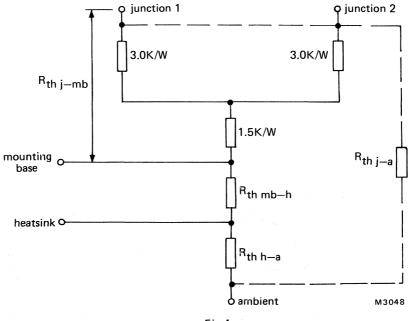


Fig.4.

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



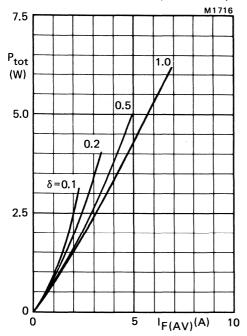
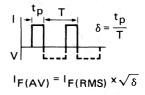


Fig.5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.



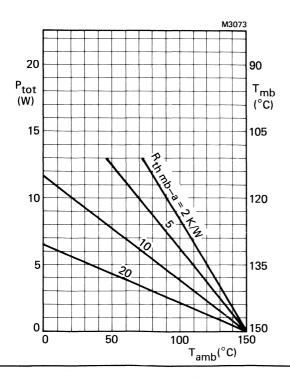


Fig.6.

SINUSOIDAL OPERATION (PER DIODE)

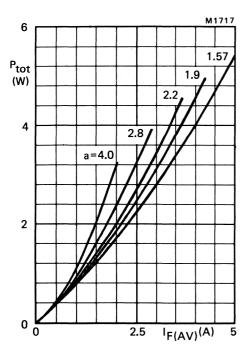


Fig.7 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.

 $a = form factor = I_F(RMS)/I_F(AV)$

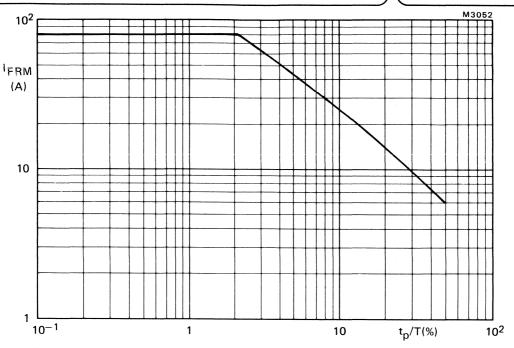
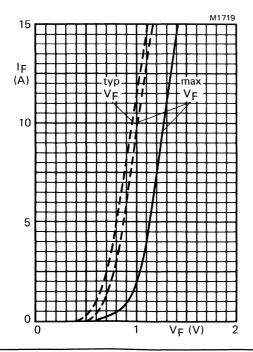
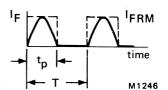


Fig.8 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 μ s < t $_p$ < 1 ms; per diode.





Definition of I $_{\mbox{\scriptsize FRM}}$ and t_p/T

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

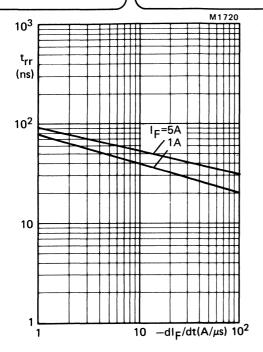


Fig. 10 Maximum t_{rr} at $T_j = 25$ °C.

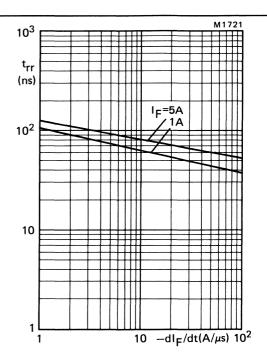


Fig.11 Maximum t_{rr} at $T_j = 100$ °C.

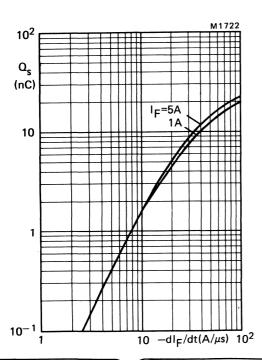


Fig.12 Maximum Q_s at T_j = 25 °C.

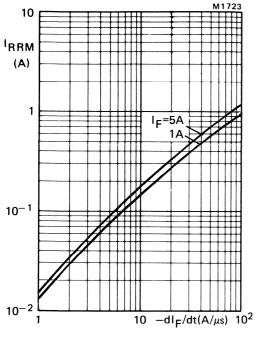


Fig.13 Maximum I_{RRM} at $T_i = 25$ °C.

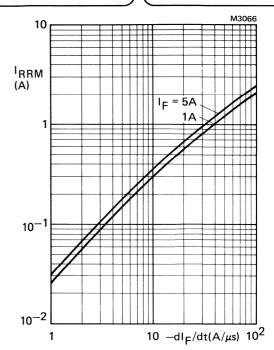


Fig.14 Maximum I_{RRM} at $T_j = 100$ °C.

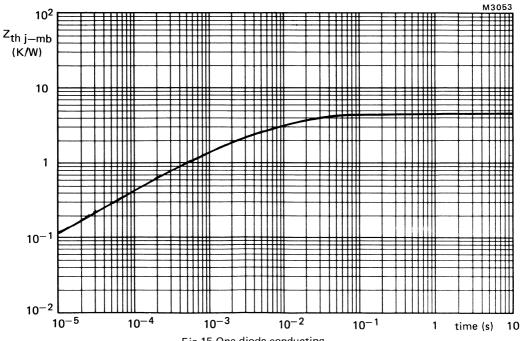


Fig. 15 One diode conducting.

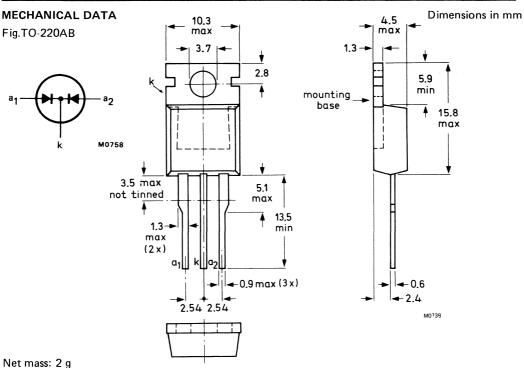


ULTRA FAST RECOVERY DOUBLE RECTIFIER DIODES

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 | 3–50 | 100 | 150 | 200 | |
|---|-------------------|-------|------|-----|-----|---------|----|
| Repetitive peak reverse voltage | V_{RRM} | max. | 50 | 100 | 150 | 200 | V |
| Output current (both diodes conducting) | Io | max. | | | 10 | <u></u> | Α |
| Forward voltage | ٧ _F | < | | 0. | 85 | | V |
| Reverse recovery time | t _{rr} . | < | | | 20 | | ns |



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.

BYQ28 SERIES

RATINGS

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

| | BYQ28 | –50 | 100 | 150 | 200 | |
|------------------|---|--|---|---|---|--|
| V_{RRM} | max. | 50 | 100 | 150 | 200 | V |
| | max. | 50 | 100 | 150 | 200 | V |
| V_{R} | max. | 50 | 100 | 150 | 200 | V |
| | | | | 3 | | |
| | | | | | | |
| l _O | max. | | 1 | 0 | | Α |
| lo | max. | | .1 | 0 | | Α |
| IF(RMS) | max. | | 1 | 4 | | Α |
| | | | | | | |
| IFRM | max. | | 8 | 0 | | Α |
| | | | | | | |
| | | | | | | |
| IESM | max. | | 5 | 0 | | Α |
| | max. | | . 6 | 0 | | Α |
| l ² t | max. | | 12. | 5 | | A^2s |
| | | | | | | |
| T_{stq} | | -4 | 0 to +15 | 0 | | оС |
| Tj | max. | | 15 | 0 | | oC |
| | IO IO IF(RMS) IFRM IFSM IFSM I ² t | VRRM max. VRWM max. VR max. IO max. IO max. IF(RMS) max. IFRM max. IFSM max. | VRWM max. 50 VR max. 50 IO max. IO max. IF(RMS) max. IFRM max. IFSM max. IFSM max. IFSM max. IFSM max. IFSM max. IFSM max. IFSM max. IFSM max. IFSM max. IFSM max. | VRRM max. 50 100 VRWM max. 50 100 VR max. 50 100 IO max. 1 IO max. 1 IF(RMS) max. 1 IFRM max. 8 IFSM max. 6 IFSM max. 6 IFSM max. 6 IFSM max. 12 Tstg -40 to +15 | VRRM max. 50 100 150 VRWM max. 50 100 150 VR max. 50 100 150 IO max. 10 IO max. 10 IF(RMS) max. 14 IFRM max. 80 IFSM max. 50 IFSM max. 60 If max. 12.5 Tstg -40 to +150 | VRRM max. 50 100 150 200 VRWM max. 50 100 150 200 VR max. 50 100 150 200 IO max. 10 IO max. 10 IF(RMS) max. 14 IFRM max. 80 IFSM max. 50 IFSM max. 60 I²t max. 12.5 Tstg —40 to +150 |

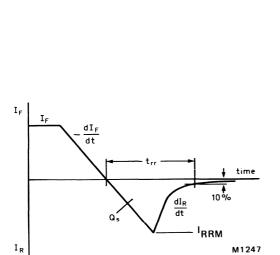
Notes:

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

CHARACTERISTICS (per diode)

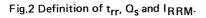
| F | or | wa | ard | VΩ | tage |
|---|----|----|-----|----|------|
| | | | | | |

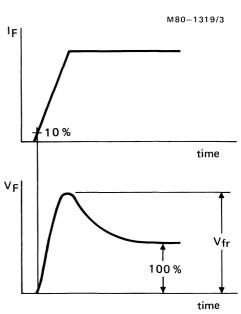
| I _F = 5 A; T _j = 150 °C | V _F | < | 0.85 | V* | |
|--|------------------|---|------|-------------------|--|
| $I_F = 10 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | VF | < | 1.25 | · ∨* · · - | |
| Reverse current | | | | | |
| $V_R = V_{RWM max}; T_j = 100 {}^{\circ}C$ | IR | < | 0.2 | mA | |
| $V_R = V_{RWM max}; T_j = 25 ^{\circ}\text{C}$ | IR | < | 10 | μΑ | |
| Reverse recovery when switched from | | | | | |
| I_F = 1 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 100 A/ μ s; T_j = 25 °C | | | | | |
| recovery time | t _{rr} | < | 20 | ns | |
| IF = 2 A to V $_R \geqslant$ 30 V with $-dI_F/dt$ = $$ 20 A/ $\mu s;$ T $_j$ = 25 ^{O}C recovered charge | O_{s} | < | 5.5 | nC | |
| IF = 5 A to $V_R \ge 30 V$ with $-dI_F/dt = 50 A/\mu s$; $T_j = 25 ^{O}C$ peak recovery current | ^I RRM | < | 0.7 | A - | |



Forward recovery when switched to $I_F = 1$ A with $dI_F/dt = 10$ A/ μ s; $T_j = 25$ °C

recovery voltage





 V_{fr}

1.0

typ.

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-mb} | = | 2.2 | K/W |
| From junction to mounting base (per diode) | R _{th j-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-h} | = " " | 0.3 | K/W |
| b. with heatsink compound and 0.06 mm maximum mica insulator | R _{th mb-h} | = | 1.4 | K/W |
| with heatsink compound and 0.1 mm maximum mica insulator (56369) | R _{th mb-h} | = | 2.2 | K/W |
| d. with heatsink compound and 0.25 mm maximum alumina insulator (56367) | R _{th mb-h} | :- = | 0.8 | K/W |
| e. without heatsink compound | R _{th mb-h} | = | 1.4 | K/W |
| 2. Free air operation | | | | |
| The quoted values of R _{th j-a} should be used only when no leads to the same tie point. Thermal resistance from junction to ambient in free air: | s of other dissip | ating cor | mponent | s run |
| mounted on a printed circuit board at any device lead length and with copper laminate on the board | R _{th j-a} | = . | 60 | K/W |

MOUNTING INSTRUCTIONS

- 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.
- 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 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.
- 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.

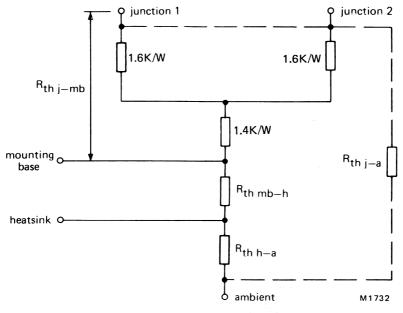


Fig.4.

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

SQUARE-WAVE OPERATION (PER DIODE)

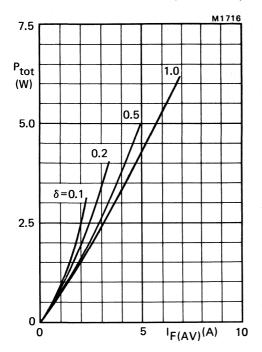
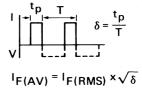


Fig.5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.



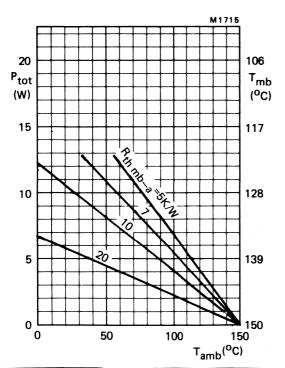


Fig.6

SINUSOIDAL OPERATION (PER DIODE)

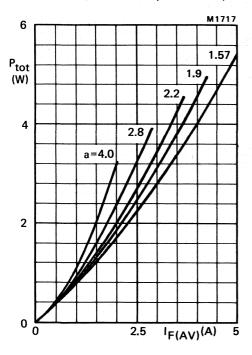


Fig.7 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.

 $a = form factor = I_F(RMS)/I_F(AV)$

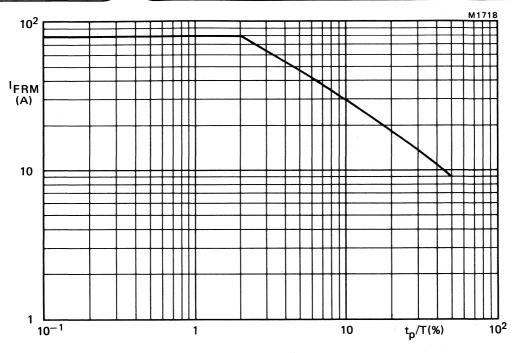
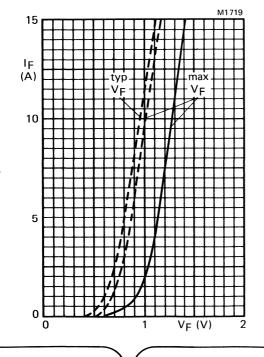
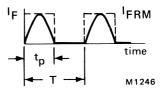


Fig.8 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 μs < t_p < 1 ms; per diode.





Definition of I $_{FRM}$ and t_p/T

Fig.9 ——
$$T_j = 25 \, {}^{\circ}\text{C}; --- T_j = 150 \, {}^{\circ}\text{C}$$
 per diode.

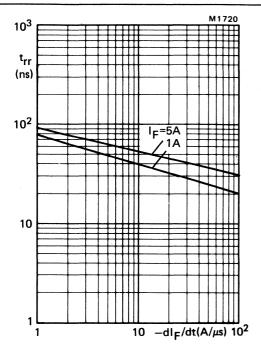


Fig.10 Maximum t_{rr} at T_j = 25 °C.

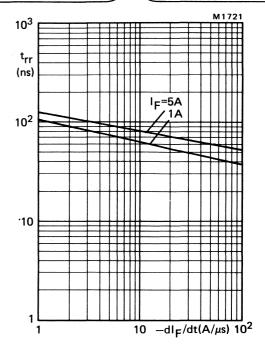


Fig.11 Maximum t_{rr} at $T_j = 100$ °C.

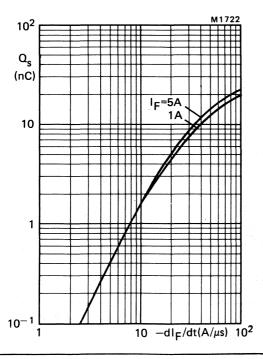


Fig.12 Maximum Q_s at T_j = 25 o C.

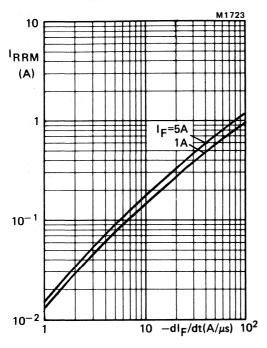


Fig.13 Maximum I_{RRM} at $T_i = 25$ °C

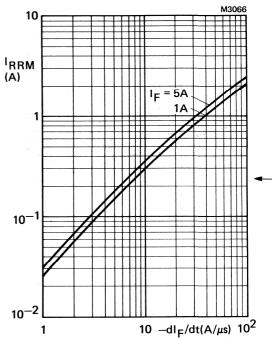


Fig. 14 Maximum I_{RRM} at $T_j = 100 \, {}^{o}C$;

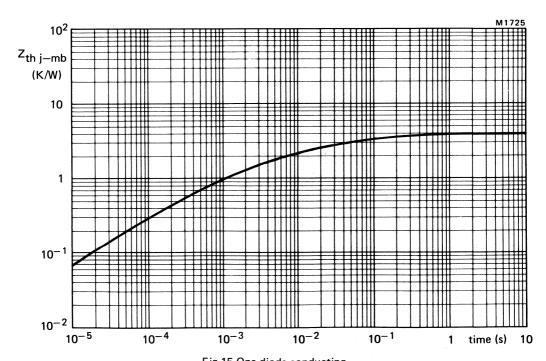


Fig.15 One diode conducting.

ULTRA FAST-RECOVERY ELECTRICALLY-ISOLATED DOUBLE RECTIFIER DIODES

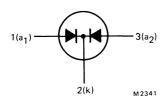
Glass-passivated, high-efficiency epitaxial double rectifier diodes in SOT-186 (full-pack) plastic envelopes, featuring low forward voltage drop, very fast reverse recovery times and soft-recovery characteristic. Their electrical isolation makes them ideal for mounting on a common heatsink along-side 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.

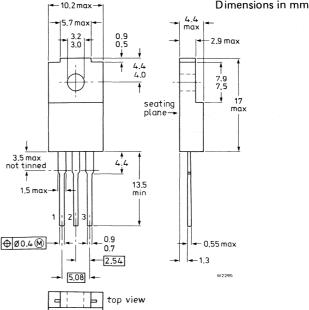
QUICK REFERENCE DATA

| Per diode, unless otherwise stated | | BYQ28 | 3F-50 | 100 | 150 | 200 | |
|---|-----------------|-------|-------|-----|------|-----------|----|
| Repetitive peak reverse voltage | v_{RRM} | max. | 50 | 100 | 150 | 200 | V |
| Output current (both diodes conducting) | 1 ₀ | max. | | | 10 | | Α |
| Forward voltage | VF | < | | 0. | .85 | | V |
| Reverse recovery time | t _{rr} | < | | | 20 | | ns |
| MEGUANUGAL DATA | 1 | 0.2 | | | Dimo | naiona ir | |

MECHANICAL DATA

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).

BYQ28F SERIES

RATINGS

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

| Voltages (per diode) | | BYQ28 | F-50 100 150 200 | |
|--|-------------------|-------|------------------------|------------------|
| Repetitive peak reverse voltage | VRRM | max. | 50 100 150 200 | V |
| Crest working reverse voltage | VRWM | max. | 50 100 150 200 | V |
| Continuous reverse voltage (see note 1) | VR | max. | 50 100 150 200 | V |
| Currents (see notes 2 and 3) | | | | |
| Output current, switching losses negligible up to 500 kHz | | | | |
| square wave; δ = 0.5; up to T _h = 93 °C | 10 | max. | 10 | Α |
| sinusoidal; up to T _h = 96 °C | I _O | max. | 10 | Α |
| R.M.S forward current | IF(RMS) | max. | 14 | Α |
| Repetitive peak forward current $t_p = 20 \mu s$, $\delta = 0.02$ (per diode) | ^I FRM | max. | 80 | Α |
| Non-repetitive peak forward current half sinewave; T _j = 150 ^O C prior to surge; with reapplied V _{RWM max} ; | | | | |
| t = 10 ms (per diode) | ^I FSM | max. | 50 | Α |
| t = 8.3 ms (per diode) | ^I FSM | max. | 60 | Α |
| I ² t for fusing (t = 10 ms; per diode) | l²t | max. | 12.5 | A ² s |
| Temperatures | | | | |
| Storage temperature | T_{stg} | | -40 to +150 | оС |
| Junction temperature | Τj | max. | 150 | οС |
| 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: $R_{\mbox{th}\mbox{ }j\mbox{-}a}\!<\!6.3\,\mbox{K/W}.$
- 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 \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,

total package:

without heatsink compound

with heatsink compound

| R _{th j-h} | = " | 6.7 | K/W |
|---------------------|-----|-----|-----|
| R _{th i-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

$$R_{th i-a} = 55 K/W$$

0.85 1.25

0.2

10

20

5.5

0.7

mΑ

μΑ

ns

nC

٧F

 I_R

 Q_{s}

IRRM

CHARACTERISTICS (per diode)

Forward voltage

$$I_F = 5 \text{ A}; T_j = 150 \,^{\circ}\text{C}$$

 $I_F = 10 \text{ A}; T_j = 25 \,^{\circ}\text{C}$

Reverse current

$$V_R = V_{RWM \text{ max}}; T_j = 100 \text{ }^{o}\text{C}$$

 $V_R = V_{RWM \text{ max}}; T_j = 25 \text{ }^{o}\text{C}$

Reverse recovery when switched from

I
$$_{F}$$
 = 1 A to V $_{R}$ \geqslant 30 V with $-dI_{F}/dt$ = 100 A/ $\mu s;$ T $_{j}$ = 25 ^{O}C recovery time

I_F = 2 A to
$$V_R \ge 30 \text{ V}$$
 with $-dI_F/dt = 20 \text{ A}/\mu\text{s}$; $T_j = 25 \text{ }^{O}\text{C}$ recovered charge

I_F = 5 A to
$$V_R \ge 30 \text{ V}$$
 with $-dI_F/dt = 50 \text{ A}/\mu\text{s}$; $T_j = 25 \text{ }^{OC}$ peak recovery current

Forward recovery when switched to $I_F = 1 \text{ A}$ with $dI_F/dt = 10 \text{ A}/\mu\text{s}$; $T_i = 25 \text{ }^{\circ}\text{C}$

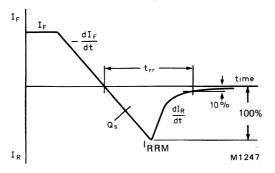


Fig.2 Definition of $t_{rr},\,\Omega_{s}$ and $I_{RRM}.$

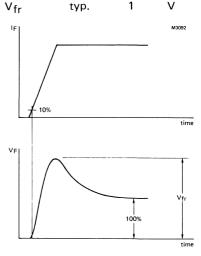


Fig.3 Definition of Vfr.

^{*}Measured under pulse conditions to avoid excessive dissipation.

MOUNTING INSTRUCTIONS

- 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-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: Maximum torque to avoid damage to the device:

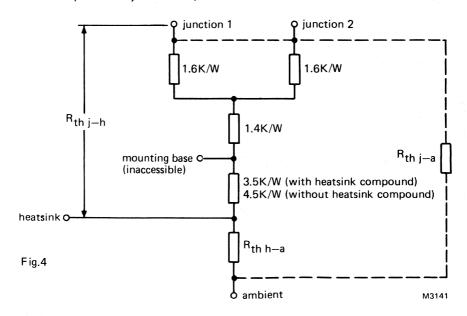
5.5 kgf (0.55 Nm) 8.0 kgf (0.80 Nm)

- 5. For good thermal contact, heatsink compound should be used between baseplate and heatsink. Values of R_{th j-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:



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

SQUARE-WAVE OPERATION (PER DIODE)

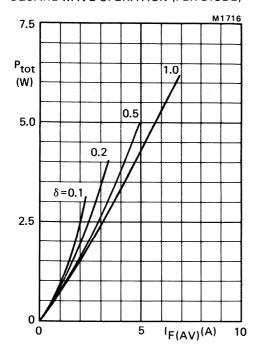
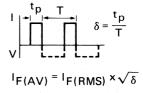


Fig.5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.



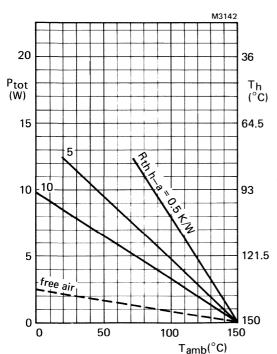


Fig.6

BYQ28F SERIES

SINUSOIDAL OPERATION (PER DIODE)

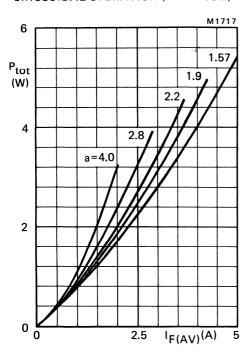


Fig.7 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.

 $a = form factor = I_F(RMS)/I_F(AV)$

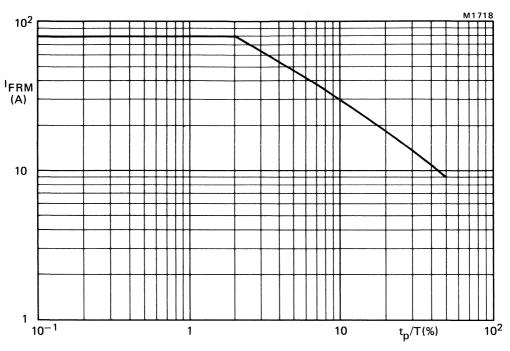
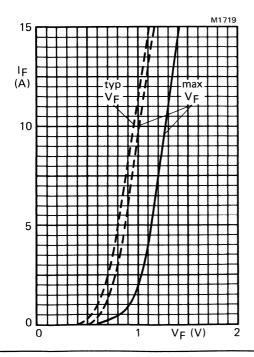
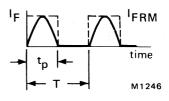
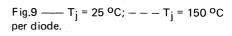


Fig.8 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 μ s < t_D < 1 ms; per diode.





Definition of IFRM and $t_{\mbox{\footnotesize{p}}}/\mbox{\footnotesize{T}}$



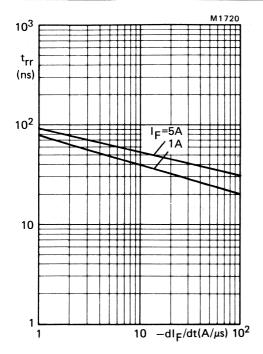
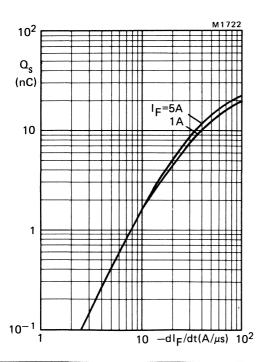


Fig.10 Maximum t_{rr} at $T_j = 25$ °C.



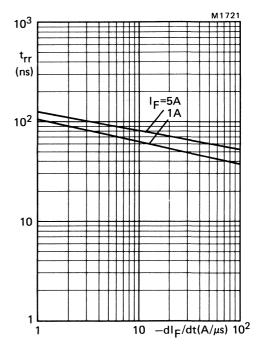


Fig.11 Maximum t_{rr} at $T_j = 100$ °C.

Fig.12 Maximum Q_s at $T_j = 25$ °C.

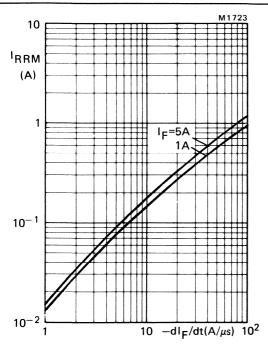


Fig.13 Maximum I_{RRM} at $T_i = 25$ °C.

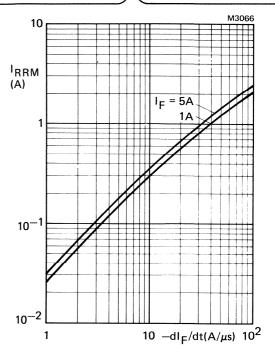


Fig.14 Maximum I_{RRM} at $T_j = 100$ °C.

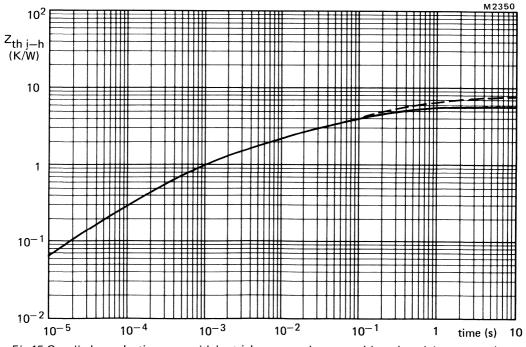


Fig.15 One diode conducting; —— with heatsink compound; — — without heatsink compound.



DEVELOPMENT DATA

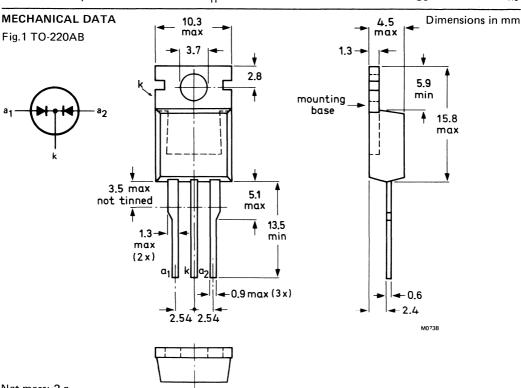
This data sheet contains advance information and specifications are subject to change without notice.

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 | VRRM | max. | 500 | 600 | 700 | 800 | ٧ |
| Output current (both diodes conducting) | I _O | max. | | | 10 | | Α |
| Forward voltage | VF | < | | 1 | .6 | | V |
| Reverse recovery time | t _{rr} | < | | , , , , , , { | 30 | | ns |



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.

BYR28 SERIES

RATINGS

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

| Voltages (per diode) | | | BYR28-500 | 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 | VR | 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 $T_{mb} = 95$ °C | 10 | max. | | . 1 | 0 . | | Α |
| RMS forward current | IF(RMS) | max. | | 1 | 4 | | Α |
| Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ (per diode) | ^I FRM | max. | | 9 | 0 | | 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. | | 5 | 0 | | A |
| Temperatures | | | | | | | |
| Storage temperature | T_{stq} | | -40 | to +15 | 0 | | оС |
| Junction temperature | Tj | max. | | 15 | 0 | | oC |
| | | | | | | | |

Notes:

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

| CHARACTERISTICS (per diode) | | | | |
|--|------------------|-----------------------------|-----|------|
| Forward voltage | | | | |
| $I_F = 5 \text{ A}; T_i = 150 ^{\circ}\text{C}$ | VF | < | 1.6 | V* |
| $I_F = 10 \text{ A}; T_1' = 25 ^{\circ}\text{C}$ | VF | < | 2.0 | V* |
| Reverse current | | | | |
| $V_R = V_{RWM max}$; $T_i = 100 {}^{\circ}C$ | . I _B | $^{\prime}$ $<$ $^{\prime}$ | 0.5 | · mA |
| $V_R = V_{RWM max}; T_j = 25 {}^{\circ}\text{C}$ | IR | < | 25 | μΑ |
| Reverse recovery when switched from | | | | |
| $I_F = 1 \text{ A to } V_R \ge 30 \text{ V with } -dI_F/dt = 100 \text{ A}/\mu\text{s};$ | | | | |
| T _j = 25 °C; recovery time | t _{rr} | < | 80 | ns |
| $I_F = 2 \text{ A to } V_B \ge 30 \text{ V with } -dI_F/dt = 20 \text{ A}/\mu\text{s};$ | | | | |
| T _i = 25 °C; recovered charge | Q_{s} | < | 190 | nC |
| $I_F = 10 \text{ A to } V_R \ge 30 \text{ V with } -dI_F/dt = 50 \text{ A}/\mu\text{s};$ | | | | |
| T _i = 100 °C; peak recovery current | IRRM | < | 6 | Α |

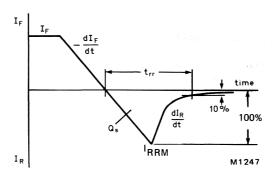


Fig.2 Definition of t_{rr} , Q_s and I_{RRM} .

^{*}Measured under pulse conditions to avoid excessive dissipation.

BYR28 SERIES

| ТН | ERMAL RESISTANCE | | | | |
|-----|--|----------------------|----------|-----------|-------|
| Fro | om junction to mounting base (both diodes conducting) | R _{th j-mb} | = | 2.5 | K/W |
| Fro | om junction to mounting base (per diode) | R _{th j-mb} | = | 3.0 | K/W |
| Inf | luence of mounting method | | | | |
| 1. | Heatsink mounted with clip (see mounting instructions) | | | | |
| Th | ermal resistance from mounting base to heatsink | | | | |
| a. | with heatsink compound | R _{th mb-h} | = | 0.3 | K/W |
| b. | with heatsink compound and 0.06 mm maximum mica insulator | R _{th mb-h} | = | 1.4 | K/W |
| c. | with heatsink compound and 0.1 mm maximum mica insulator (56369) | R _{th mb-h} | = , | 2.2 | K/W |
| d. | with heatsink compound and 0.25 mm maximum alumina insulator (56367) | R _{th mb-h} | = | 0.8 | K/W |
| e. | without heatsink compound | R _{th mb-h} | = | 1.4 | K/W |
| 2. | Free air operation | | | | |
| | e quoted value of R _{th j-a} should be used only when no leads of o the same tie point. ermal resistance from junction to ambient in free air: mounted on a printed circuit board at any device lead | other dissipatir | ng compo | onents ru | un to |
| | length and with copper laminate on the board | R _{th j-a} | = | 60 | K/W |

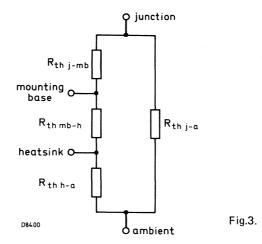
MOUNTING INSTRUCTIONS

- 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.
- 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.



- 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 I_{amb} scale. The intersection determines the I_{amb} The heatsink thermal resistance value (I_{amb}) can be calculated from.

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

SQUARE-WAVE OPERATION

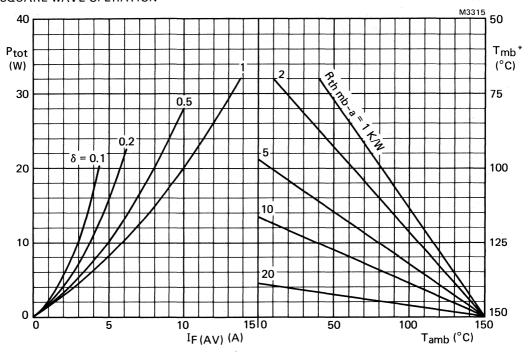


Fig.4 The right-hand part shows the relationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 100 kHz; per diode.

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

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

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

SINUSOIDAL OPERATION

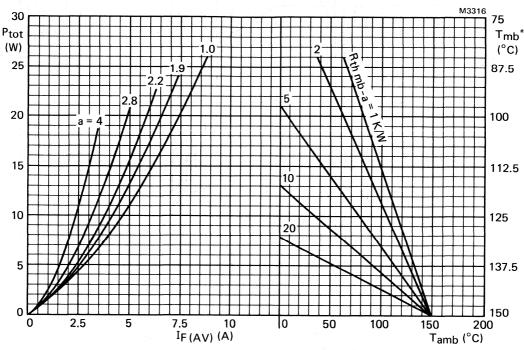


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures. $a = form factor = I_{F(RMS)}/I_{F(AV)}$; per diode.

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

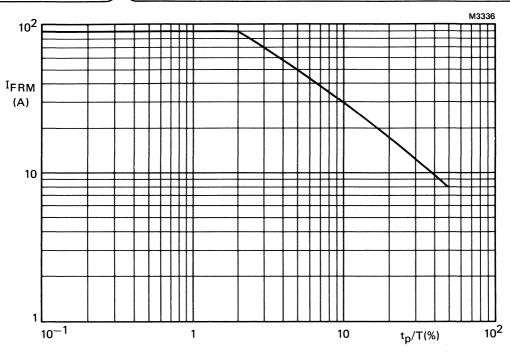
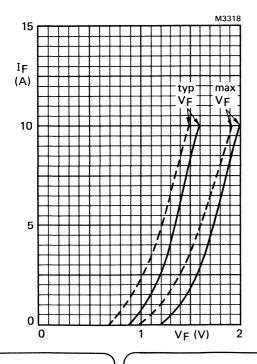
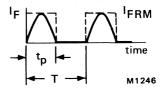


Fig.6 Maximum permissible repetitive peak forward current for square or sinusoidal currents; for 1 μ s < t $_p$ < 1 ms; per diode.





Definition of IFRM and t_p/T

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

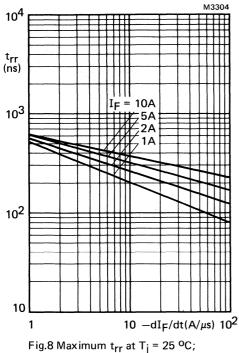
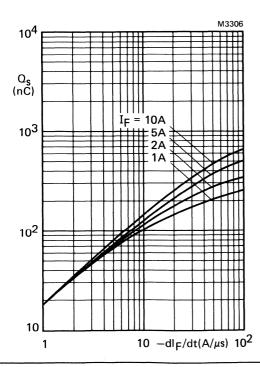


Fig.8 Maximum t_{rr} at $T_j = 25$ °C; per diode.

DEVELOPMENT DATA



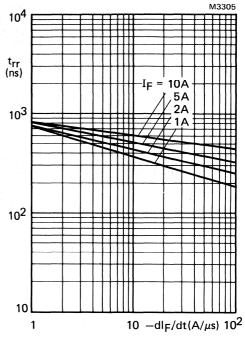


Fig.9 Maximum t_{rr} at $T_i = 100$ °C; per diode.

Fig.10 Maximum Q_s at $T_j = 25 \, {}^{\circ}C$; per diode.

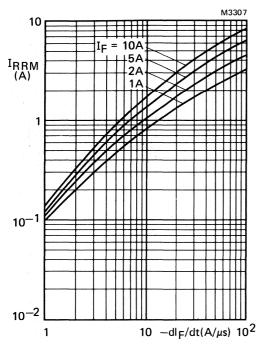


Fig.11 Maximum I_{RRM} at $T_j = 25$ °C; per diode.

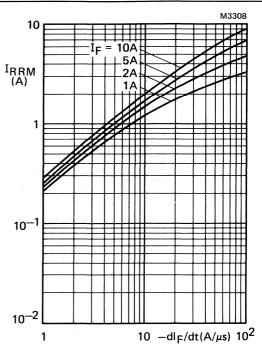


Fig.12 Maximum I_{RRM} at T_j = 100 o C; per diode.

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.

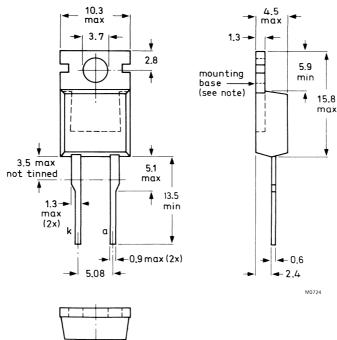
QUICK REFERENCE DATA

| | | | BYR29-500 | 600 | 700 | 800 | | - |
|---------------------------------|-----------------|------|-----------|-----|-----|-----|----|---|
| Repetitive peak reverse voltage | v_{RRM} | max. | 500 | 600 | 700 | 800 | ٧ | |
| Average forward current | IF(AV) | max. | | | 8 | | Α | |
| Forward voltage | VF | < | | 1. | 15 | | ٧ | • |
| 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 | | BYR2 | 9-500 | 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* | VR | max. | 400 | 500 | 500 | 600 | ٧ |
| Currents | | | | | | | |
| Average forward current; switching losses negligible up to 100 kHz | | | | | | | |
| square wave; δ = 0.5; up to T_{mb} up to T_{mb} | | lF(AV) lF(AV) | max max | | 8 6.5 | | A A |
| sinusoidal; up to T _{mb} = 120 °C | | IF(AV) | max | | 7.8 | | Α |
| up to T _{mb} = 125 °C | | IF(AV) | max | • | 7.2 | | Α |
| R.M.S. forward current | | IF(RMS) | max | | 11.5 | | Α |
| Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ | | ^I FRM | max | | 130 | | Α |
| Non-repetitive peak forward curren half sine-wave; T _j = 150 °C prior with reapplied V _{RWMmax} ; | | | | | | | |
| t = 10 ms | | FSM | max | | 60 | | Α |
| t = 8.3 ms | | ^I FSM | max | • | 72 | | Α |
| 1^2 t for fusing (t = 10 ms) | | l²t | max | | 18 | | A ² s |
| Temperatures | | | | | | | |
| Storage temperature | | T_{stg} | | -40 to | +150 | | oC |
| Junction temperature | | Тj | max | | 150 | | oC |

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

CHARACTERISTICS

| Forward voltage | | | | |
|---|------------------|------|------|-------------|
| I _F = 5 A; T _j = 150 ^o C I _F = 20 A; T _i = 25 ^o C | ٧F | < | 1.15 | V* ← |
| I _F = 20 A; T _j = 25 °C | ٧ _F | < | 1.65 | V* ← |
| | | | | |
| Reverse current | | | | |
| $V_R = V_{RWM \text{ max}}; T_j = 100 {}^{\circ}\text{C}$ $T_i = 25 {}^{\circ}\text{C}$ | ۱R | < | 0.2 | mΑ |
| T _j = 25 °C | ۱ _R | < | 10 | μA |
| Reverse recovery when switched from $I_F = 1 \text{ A to } V_R \geqslant 30 \text{ V with } - dI_F/dt = 100 \text{ A}/\mu\text{s};$ $T_i = 25 ^{\circ}\text{C};$ recovery time | • | | 75 | ns |
| • | t _{rr} | | 73 | 115 |
| I _F = 2 A to V _R \geqslant 30 V with $-dI_F/dt$ = 20 A/ μ s; T _j = 25 °C; recovered charge | O_s | < | 200 | nC |
| I _F = 10 A to V _R \geqslant 30 V with $-dI_F/dt$ = 50 A/ μ s; T _j = 100 °C; peak recovery current | I _{RRM} | < | 6 | А |
| Forward recovery when switched to $I_F = 10 \text{ A}$ with $dI_F/dt = 10 \text{ A}/\mu s$; $T_j = 25 ^{\circ}\text{C}$ | V _{fr} | typ. | 5 | V |

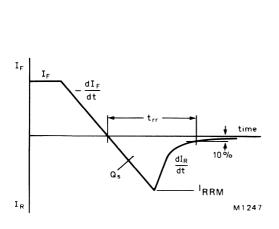


Fig.2 Definition of $t_{rr},\, Q_{s}$ and $I_{RRM}.$

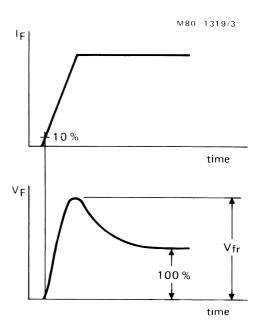


Fig.3 Definition of V_{fr}.

^{*}Measured under pulse conditions to avoid excessive dissipation.

| THERMAL RESISTANCE | | | | |
|--|----------------------|---------|---------|--------|
| From junction to mounting base | R _{th j-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-h} | = | 0.3 | K/W |
| b. with heatsink compound and 0.06 mm maximum mica | | | | |
| insulator | R _{th mb-h} | = | 1.4 | K/W |
| with heatsink compound and 0.1 mm maximum mica insulator (56369) | R46 6 -6 | - - | 2.2 | K/W |
| d. with heatsink compound and 0.25 mm maximum | R _{th} mb-h | | 2.2 | 12/ 77 |
| alumina insulator (56367) | R _{th mb-h} | = 1 | 0.8 | K/W |
| e. without heatsink compound | R _{th mb-h} | = | 1.4 | K/W |
| 2. Free air operation | | | | |
| The quoted value of $R_{th\ j\cdot a}$ should be used only when no leads of to the same tie point. | other dissipat | ing con | nponent | s run |
| 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-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 2.4mm 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-h} values than does screw mounting.
 - b. safe isolation for mains operation.

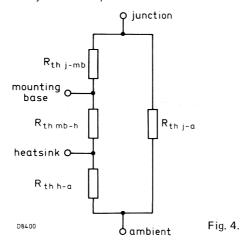
However, if a screw is used, it should be M3 cross-recess pan head. Care should be taken to avoid damage to the plastic body.

- 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.



- 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 I_{amb} scale. The intersection determines the I_{th} I_{th

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

SQUARE-WAVE OPERATION

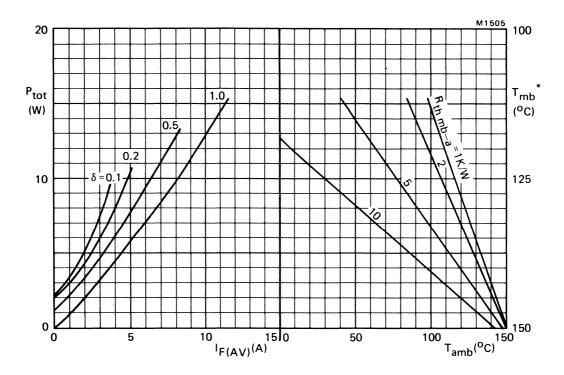


Fig.5 The right-hand part shows the relationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 100 kHz.

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

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

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

SINUSOIDAL OPERATION

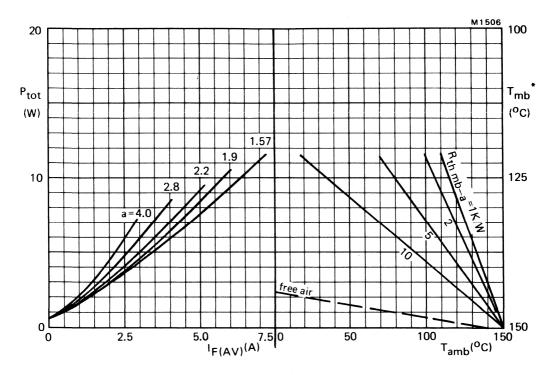


Fig.6 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures. $a = form \ factor = I_F(RMS)/I_F(AV)$.

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

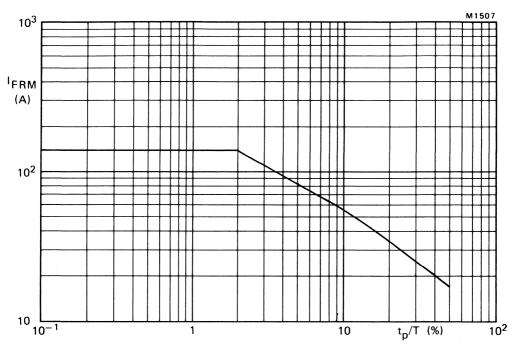
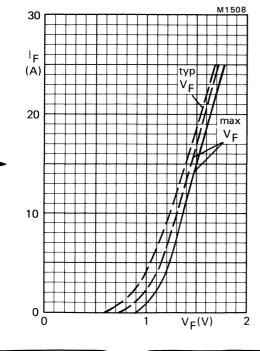
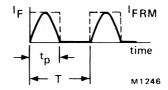


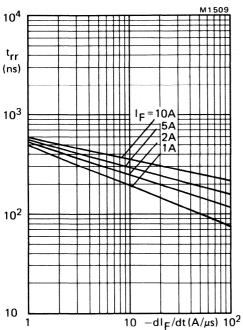
Fig.7 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 $\mu s < t_p < 1$ ms.

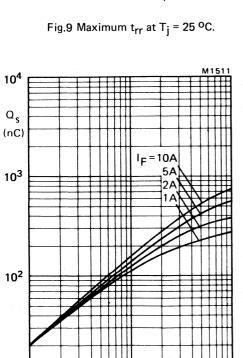




Definition of IFRM and t_p/T .

Fig.8 ——
$$T_j = 25 \, {}^{\circ}\text{C}; --- T_j = 150 \, {}^{\circ}\text{C}.$$





 $10 - dI_F/dt (A/\mu s) 10^2$

10

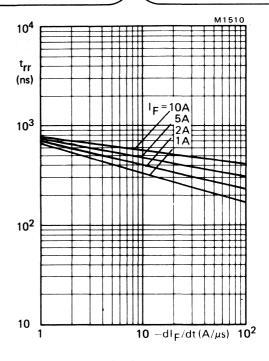


Fig.10 Maximum t_{rr} at $T_j = 100$ °C.

Fig.11 Maximum Q_s at $T_j = 25$ °C

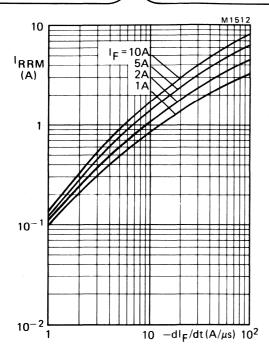


Fig.12 Maximum I_{RRM} at $T_j = 25$ °C.

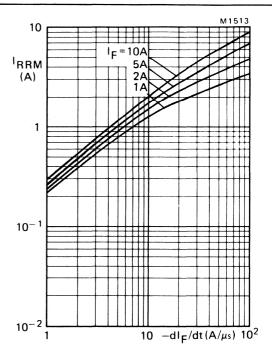


Fig.13 Maximum I_{RRM} at $T_i = 100$ °C.

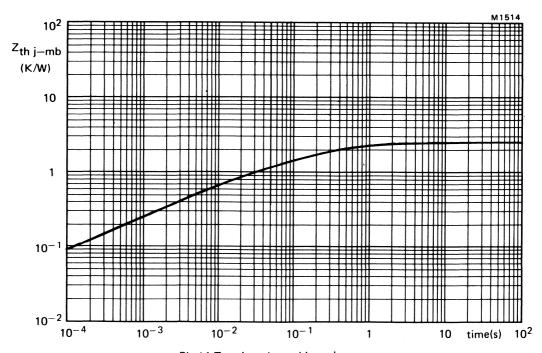


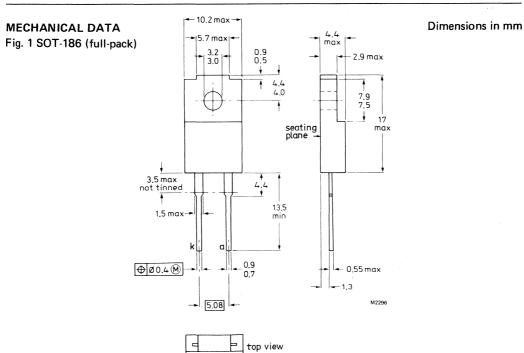
Fig.14 Transient thermal impedance.

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 | VRRM | max. | 600 | 700 800 | V |
| Average forward current | IF(AV) | max. | | 8 | Α |
| Forward voltage | VF | < | | 1.3 | V |
| Reverse recovery time | t _{rr} | < | | 75 | ns |



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).

235

BYR29F SERIES

RATINGS

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

| | Voltages | | | BYR2 | 9F-600 | 700 | 800 | |
|---|--|------|-------------------|--------------|--------------|---------------------------------------|-----|------------------|
| | Repetitive peak reverse voltage | VRRM | max. | 1 | 600 | 700 | 800 | V |
| | Crest working reverse voltage | VRWM | max. | | 5 0 0 | 500 | 600 | V |
| | Continuous reverse voltage (note 1) | VR | max. | | 500 | 500 | 600 | ٧ |
| | Currents | | | | | , . | | |
| | Average forward current; switching losses negligible up to 100 kHz (no square wave; $\delta = 0.5$; up to $T_h = 79$ | | 1 | may | | · · · · · · · · · · · · · · · · · · · | | Δ. |
| - | sinusoidal; up to $T_h = 87$ °C | , •0 | lF(AV) | max. max. | | 8 7.2 | | A A |
| | R.M.S. forward current | | IF(RMS) | max. | | 11.5 | | Α |
| | Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ | | IFRM | max. | | 130 | | A |
| | Non-repetitive peak forward current half sine-wave; $T_j = 150^{\circ}$ C prior to surge; with reapplied V RWM max | | | | | | | |
| | t = 10 ms t = 8.3 ms | | FSM | max. | | 60 | | Α |
| | · · · · · · · · · · · · · · · · · · · | | IFSM | max. | | 72 | | Α |
| | I^2 t for fusing (t = 10 ms) | | l ² t | max. | | 18 | | A ² s |
| | Temperatures | | | | | | | |
| | Storage temperature | | T _{stg} | | -40 to | +150 | | °C |
| | Junction temperature | | Tj | 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) | | Cp | typ. | | 12 | | рF |
| | | | | | | | | |

Notes:

- To ensure thermal stability: R_{th j-a} < 5.7 K/W.
 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 without heatsink compound

| R _{th j-a} | = | 5.5 | K/W |
|----------------------|---|-----|-----|
| R _{th i} -a | | 7.2 | K/W |

Free air operation

The quoted value of R_{th} $_{i-a}$ 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

55 K/W $R_{th i-a} =$

CHARACTERISTICS

T_i = 25°C unless otherwise stated

Forward voltage

$$I_F = 10 \text{ A}; T = 150^{\circ}\text{C}$$
 $V_F < 1.3$ V^* $I_F = 25 \text{ A}$ $V_F < 1.75$ V^*

Reverse current

Reverse recovery when switched from

IF = 1 A to VR
$$\geqslant$$
 30 V with -dIF/dt = 100 A/ μ s; recovery time t_{rr} < 75 ns

IF = 2 A to V
$$_{R}$$
 \geqslant 30 V with $-d$ IF/dt = 20 A/ μ s; recovered charge Q $_{s}$ < 200 nC

IF = 10 A to
$$V_R \ge 30 V$$
 with $-dI_F/dt = 50 A/\mu s$;
 $T_i = 100^{\circ}C$; peak recovery current IRRM < 6 A

Forward recovery when switched to IF = 10 A



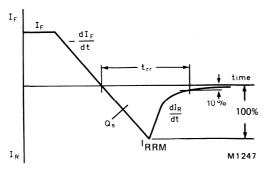


Fig. 2 Definition of trr, Qs and IRRM.

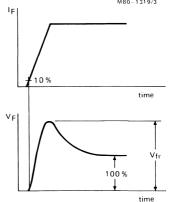


Fig. 3 Definition of Vfr.

^{*}Measured under pulse conditions to avoid excessive dissipation.

MOUNTING INSTRUCTIONS

- 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-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:

 Maximum torque to avoid damage to the device:

 5.5 kgf (0.55 Nm)

 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-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.

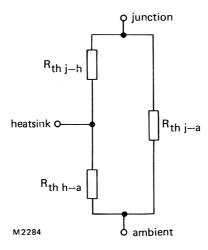
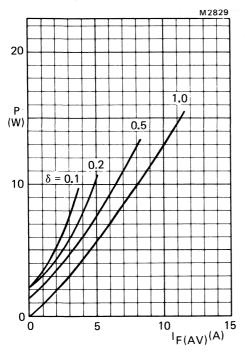


Fig.4.

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

SQUARE-WAVE OPERATION



SINUSOIDAL OPERATION

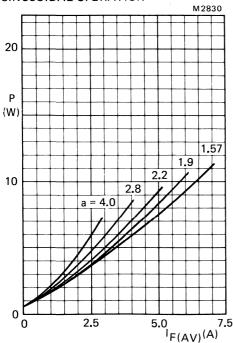


Fig. 5 Power rating.

The power loss in the diode should first be determined from the required forward current on the IF(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.

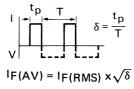


Fig. 6 Power rating.

The power loss in the diode should first be determined from the required forward current on the IF(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 = IF(RMS)/IF(AV)

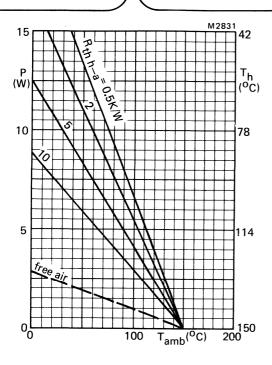


Fig. 7 Heatsink rating; without heatsink compound.

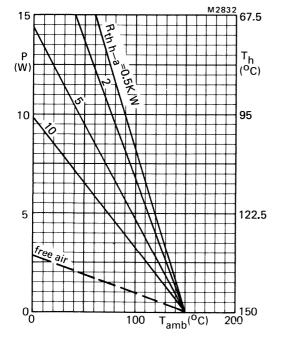


Fig. 8 Heatsink rating; with heatsink compound.

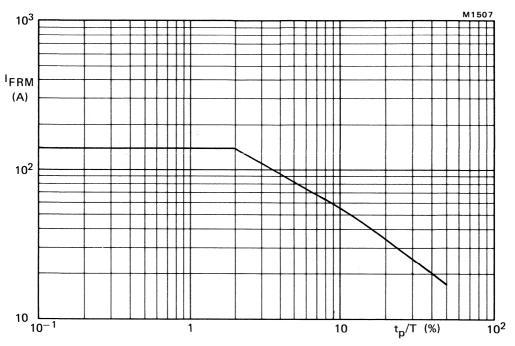
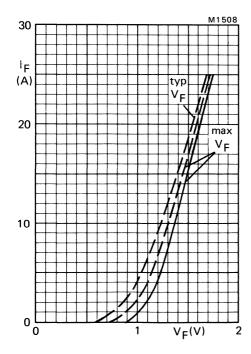


Fig. 9 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 $\mu s < t_p < 1$ ms.



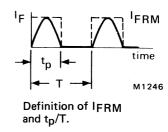


Fig. 10 ——
$$T_j = 25^{\circ}C$$
; —— $T_j = 150^{\circ}C$

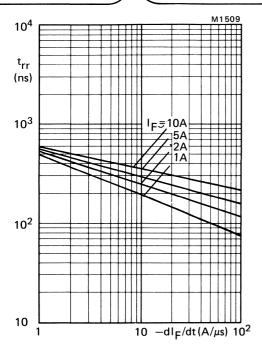


Fig. 11 Maximum t_{rr} at $T_j = 25^{\circ}C$

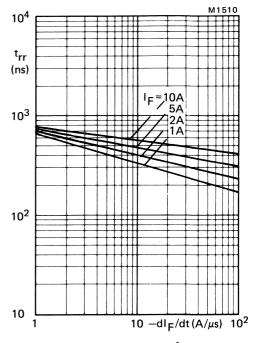


Fig. 12 Maximum t_{rr} at T_j = 100°C.

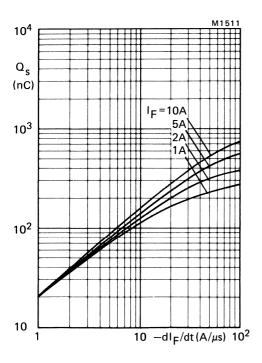
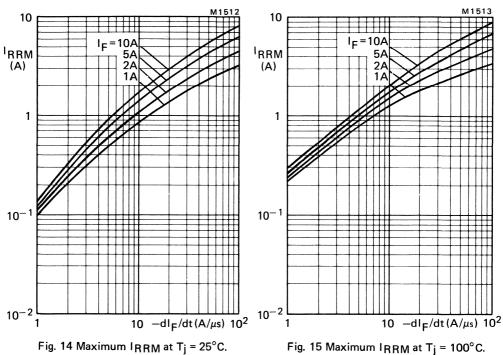


Fig. 13 Maximum Q_s at $T_j = 25$ °C.



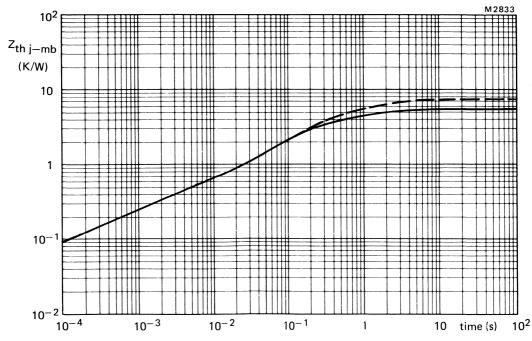


Fig. 16 Transient thermal impedance; — with heatsink compound; -- without heatsink compound.

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.

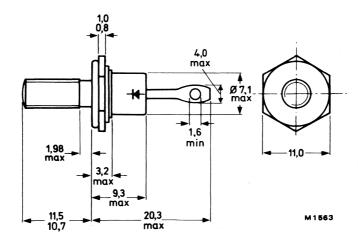
QUICK REFERENCE DATA

| | | BYR30-500 | | 600 | 700 | , , , , , , , , , , , , , , , , , , , |
|---------------------------------|-----------------|-----------|-----|-----|-----|---------------------------------------|
| Repetitive peak reverse voltage | v_{RRM} | max. | 500 | 600 | 700 | V |
| Average forward current | IF(AV) | max. | | 14 | | Α |
| Forward voltage | VF | < | | 1.5 | | V |
| Reverse recovery time | t _{rr} | < | | 100 | | ns |

MECHANICAL DATA

Dimensions in mm

Fig.1 DO-4: with metric M5 stud (ϕ 5 mm); e.g. BYR30-600. with 10-32 UNF stud (\$\phi 4.83 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

BYR30 SERIES

RATINGS

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

| Voltages | | BYR30 | BYR30-500 | | 700 | |
|--|--|--------------|-----------|------------|-----|----------|
| Repetitive peak reverse voltage | VRRM | max. | 500 | 600 | 700 | V |
| Crest working reverse voltage | V _{RWM} | max. | 400 | 500 | 500 | V |
| Continuous reverse voltage* | VR | 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 sinusoidal; up to T_{mb} = 106 °C | l _{F(AV)} l _{F(AV)} | max. max. | | 14 12.5 | | A A |
| R.M.S. forward current | F(RMS) | max. | | 20 | | Α |
| Repetitive peak forward current $t_p = 20 \mu s$, $\delta = 0.02$ | I _{FRM} | max. | | 360 | | Α |
| Non-repetitive peak forward current half sinewave; T _j = 150 ^O C prior to surge; with reapplied V _{RWM max} | | | | | | |
| t = 10 ms | IFSM | max. | | 150 | | Α |
| t = 8.3 ms | ^I FSM | max. | | 180 | | Α |
| I^2 t for fusing (t = 10 ms) | l² t | max. | | 112 | | A^2s |
| Temperatures | | | | | | |
| Storage temperature | T _{stg} | | -55 to | +150 | | оС |
| Junction temperature | Tj | max. | | 150 | | оС |
| THERMAL RESISTANCE | | | | | | |
| From junction to mounting base | R _{th j-mb} | | | 2.0 | | K/W |
| From mounting base to heatsink: | , | | | | | |
| a. with heatsink compound | R _{th mb-h} | = | | 0.3 | | K/W |
| b. without heatsink compound | R _{th mb-h} | = | | 0.6 | | K/W |
| Transient thermal impedance; t = 1 ms | Z _{th j-mb} | = " | | 0.3 | | K/W |

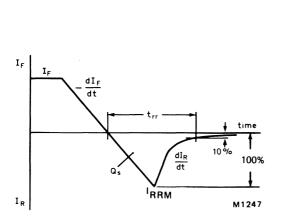
MOUNTING INSTRUCTIONS

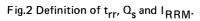
The top connector should be neither bent nor twisted; it should be soldered into the circuit so that there is no strain on it.

During soldering the heat conduction to the junction should be kept to a minimum.

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

| CHARACTERISTICS | | | | |
|--|----------------------------------|------|------------|----------|
| Forward voltage $I_F = 15 \text{ A}; T_j = 150 ^{\circ}\text{C}$ $I_F = 50 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | V _F V _F | < < | 1.5 2.0 | V* V* |
| Reverse current $V_R = V_{RWM \ max}$; $T_j = 100 ^{\circ}\text{C}$ $V_R = V_{RWM \ max}$; $T_j = 25 ^{\circ}\text{C}$ | I _R | < < | 0.4 25 | mΑ μΑ |
| Reverse recovery when switched from IF = 1 A to $V_R \ge 30 \text{ V}$ with $-dI_F/dt = 100 \text{ A}/\mu\text{s}$; $T_j = 25 ^{\circ}\text{C}$; recovery time | t _{rr} | < | 100 | ns |
| $I_F = 2 \text{ A to V}_R \geqslant 30 \text{ V with } -dI_F/dt = 20 \text{ A}/\mu\text{s};$ $T_j = 25 ^{\text{O}}\text{C}$; recovered charge | Os | < | 220 | nC |
| I _F = 10 A to V _R \geqslant 30 V with $-dI_F/dt$ = 50 A/ μ s; T _j = 100 °C; peak recovery current | IRRM | < | 8 | Α |
| Forward recovery when switched to $I_F = 10 \text{ A}$ with $dI_F/dt = 10 \text{ A}/\mu \text{s}$; $T_j = 25 ^{\circ}\text{C}$ | V _{fr} | typ. | 5.1 | V |





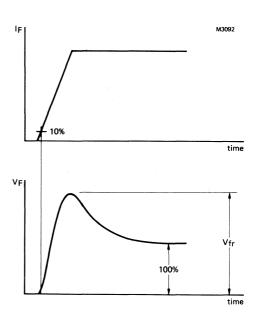


Fig.3 Definition of V_{fr} .

^{*}Measured under pulse conditions to avoid excessive dissipation.

SQUARE-WAVE OPERATION

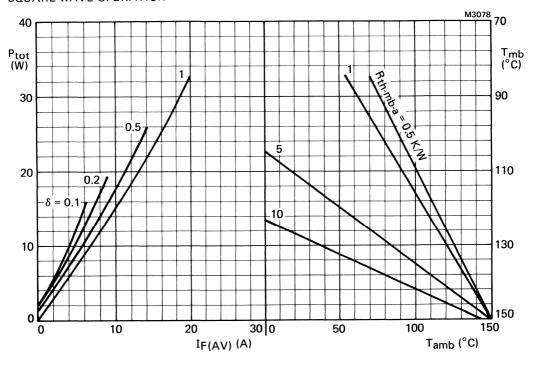


Fig.4 The right-hand part shows the relationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 100 kHz.

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

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

SINUSOIDAL OPERATION

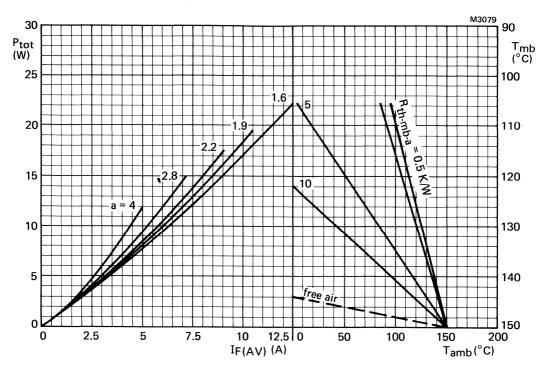


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures. $a = form\ factor = I_F(RMS)/I_F(AV)$.

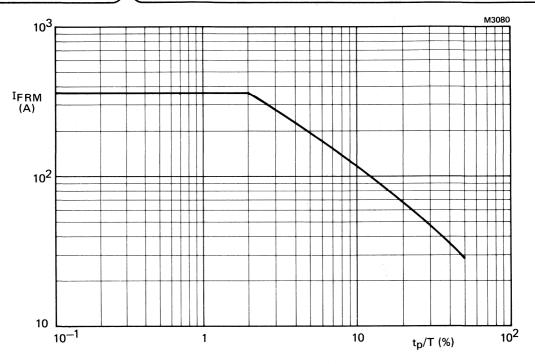
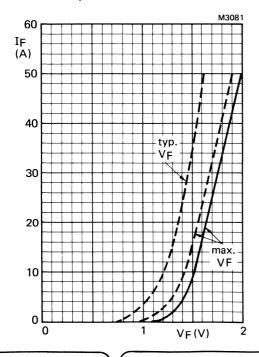


Fig.6 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 $\mu s < t_p < 1$ ms.



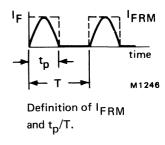


Fig.7 — $T_j = 25 \, {}^{o}C - - - T_j = 150 \, {}^{o}C$.

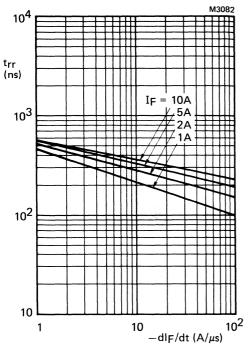
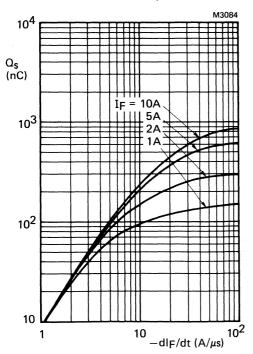


Fig.8 Maximum t_{rr} at $T_j = 25$ °C.



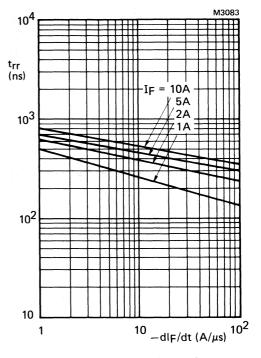
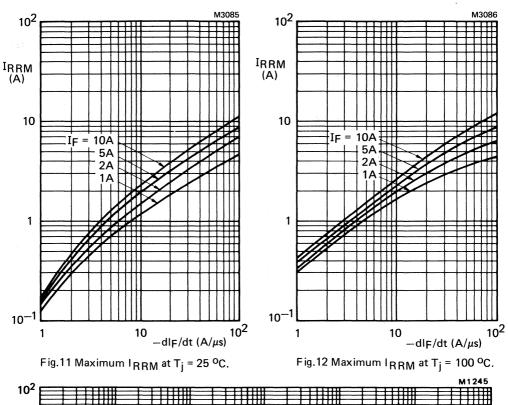


Fig.9 Maximum t_{rr} at $T_j = 100$ °C.

Fig.10 Maximum Q_s at $T_i = 25$ °C.



Zth j-mb (K/W)

10

10-2

10-4

10-3

10-2

10-1

10 time (s) 10²

Fig.13 Transient thermal impedance.

DEVELOPMENT DATA

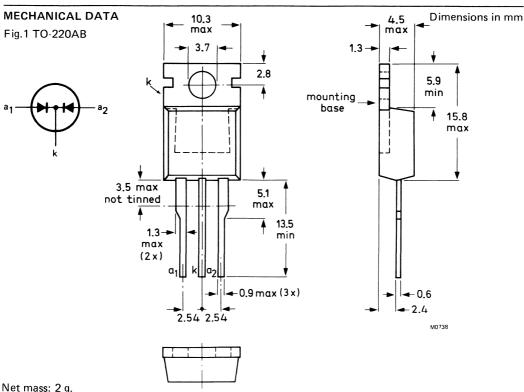
This data sheet contains advance information and specifications are subject to change without notice.

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

| -500 l | 600 | | | |
|----------|-----|---------|-----|------------|
| | 000 | 700 | 800 | |
| 500 | 600 | 700 | 800 | V |
| <u> </u> | | 20 | | Α |
| | 1.3 | 25 | | V |
| | | 80 | | ns |
| | | 500 600 | | 20 1.25 |



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.

BYR34 SERIES

RATINGS

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

| Voltages (per diode) | | | BYR34 | -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 (both diodes conducting; note 1) | | | | | | - | | |
| Output current; switching losses negligible up to 100 kHz; square wave; $\delta = 0.5$; | | | | | | | | |
| up to T _{mb} = 105 °C | IO | max. | | | 2 | 0 | | Α |
| RMS forward current (note 2) | IF(RMS) | max. | | | 2 | 8 | | Α |
| Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ (per diode) | FRM | max. | | | 18 | 5 | | Α |
| 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. | | | 10 | 0 | | Α |
| Temperatures | | | | | | | | |
| Storage temperature | T _{stg} | | | -40 | to +15 | 0 | | оС |
| Junction temperature | Tj | max. | | | 15 | 0 | | oC |
| | | | | | | | | |

Notes:

- 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 _i = 150 °C | ٧F | < | 1.25 | V* | |
| $I_F = 30 \text{ A}; T_j' = 25 ^{\circ}\text{C}$ | ٧F | < | 1.65 | V* | |
| Reverse current | | | | | |
| $V_R = V_{RWM max}$; $T_j = 100 {}^{\circ}C$ | ۱ _R | < | 1.0 | mΑ | |
| $V_R = V_{RWM max}; T_j = 25 {}^{\circ}C$ | I _R | < | 25 | μA | |
| Reverse recovery when switched from | | | | | |
| $I_F = 1 \text{ A to } V_R \ge 30 \text{ V with } -dI_F/dt = 100 \text{ A}/\mu\text{s};$ | | | | | |
| $T_j = 25$ °C; recovery time | t _{rr} | < | 80 | ns | |
| $I_F = 2 \text{ A to } V_R \geqslant 30 \text{ V with } -dI_F/dt = 20 \text{ A}/\mu\text{s};$ | | | | | |
| T _j = 25 °C; recovered charge | Q_s | < | 220 | nC | |

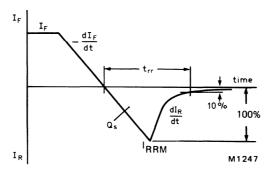


Fig.2 Definition of $t_{rr},\,\Omega_{\text{S}}$ and $I_{\mbox{\scriptsize RRM}}.$

^{*}Measured under pulse conditions to avoid excessive dissipation.

BYR34 SERIES

| тн | ERMAL RESISTANCE | | | | |
|-----|---|----------------------|-------|-----------|-------|
| Fro | m junction to mounting base (both diodes conducting) | R _{th j-mb} | = | 1.6 | K/W |
| Fro | om junction to mounting base (per diode) | R _{th j-mb} | = | 2.3 | K/W |
| Inf | luence of mounting method | | | | |
| 1. | Heatsink-mounted with clip (see mounting instructions) | | | | |
| The | ermal resistance from mounting base to heatsink | | | | |
| a. | with heatsink compound | R _{th mb-h} | = 12 | 0.3 | K/W |
| b. | with heatsink compound and 0.06 mm maximum mica insulator | R _{th mb-h} | = 10 | 1.4 | K/W |
| c. | with heatsink compound and 0.1 mm maximum mica insulator (56369) | R _{th mb-h} | = | 2.2 | K/W |
| d. | with heatsink compound and 0.25 mm maximum alumina insulator (56367) | R _{th mb-h} | = | 0.8 | K/W |
| e. | without heatsink compound | R _{th mb-h} | = | 1.4 | K/W |
| 2. | Free air operation | | | | |
| The | e quoted value of $R_{\mbox{th j-a}}$ should be used only when no leads of ot the same tie point. | her dissipating | compo | onents ru | ın to |
| The | ermal 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-a} | = | 60 | K/W |

MOUNTING INSTRUCTIONS

- 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.
- 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.

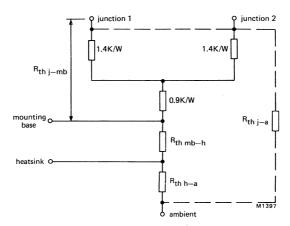


Fig.3.

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

SQUARE-WAVE OPERATION (PER DIODE)

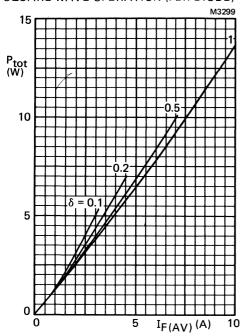
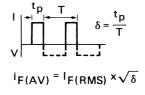


Fig.4 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.5 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.



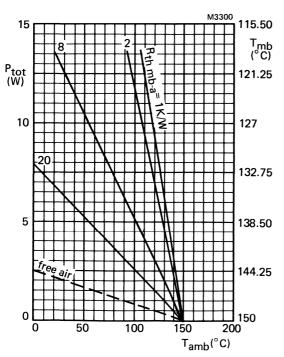


Fig.5.

SINUSOIDAL OPERATION (PER DIODE)

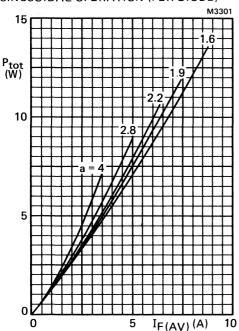


Fig.6 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.5 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.

 $a = form factor = I_F(RMS)/I_F(AV)$

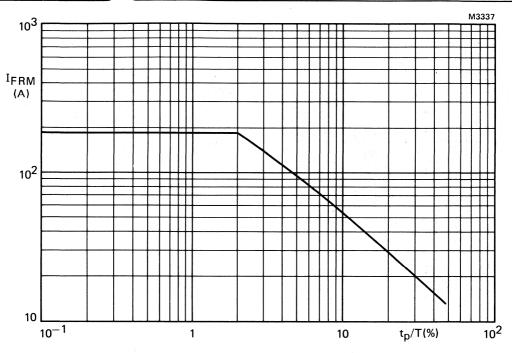
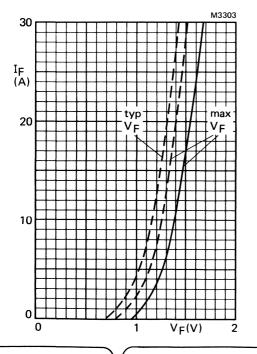
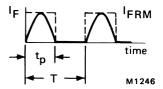


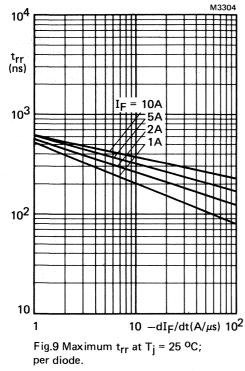
Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 μ s < t $_p$ < 1 ms; per diode.

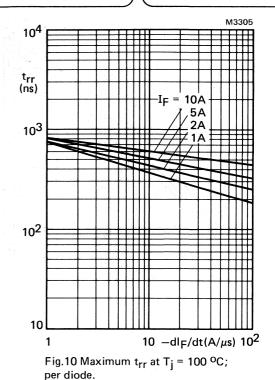


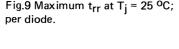


Definition of I $_{\mbox{\scriptsize FRM}}$ and $t_{\mbox{\scriptsize p}}/\mbox{\scriptsize T}$

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







DEVELOPMENT DATA

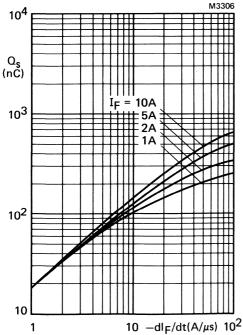


Fig.11 Maximum Q_s at $T_i = 25$ °C; per diode.

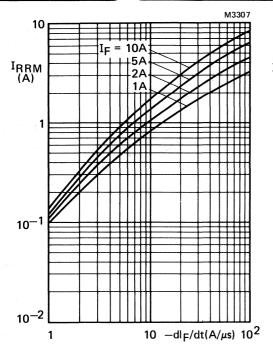


Fig.12 Maximum I_{RRM} at $T_j = 25$ °C; per diode.

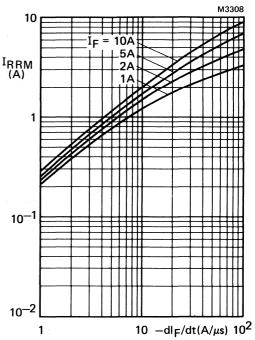


Fig.13 Maximum I_{RRM} at T_j = 100 o C; per diode.

ULTRA FAST-RECOVERY RECTIFIER DIODES

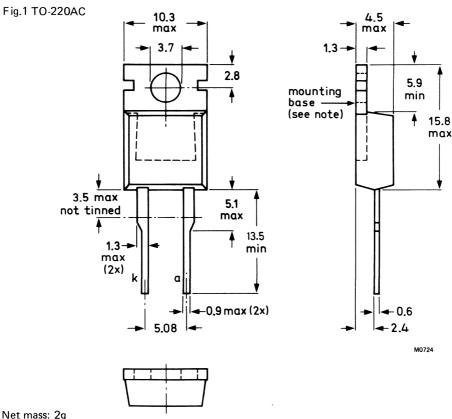
Glass-passivated, high-efficiency epitaxial rectifier diodes in plastic envelopes, featuring low forward voltage drop, ultra fast reverse recovery times with very low stored charge and soft-recovery characteristic. They are intended for use in switched-mode power supplies, SRPS and high-frequency circuits 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 | VRRM | max | 500 600 700 800 | V |
| Average forward current | lF(AV) | max. | 14 | Α |
| Foward voltage | ٧F | < | 1.5 | ٧ |
| Reverse recovery time | t _{rr} | < | 100 | ns |

MECHANICAL DATA

Dimensions in mm



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.

BYR79 SERIES

RATINGS

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

| | Voltages | | BYR79 | 9~500 | 600 | 700 | 800 | |
|---|--|--------------------|-------|------------|--------|-----|-----|----------|
| | Repetitive peak reverse voltage | VRRM | 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 $T_{mb} = 98$ °C | ^I F(AV) | max. | | 1 | 4 | | , A |
| | R.M.S. forward current | IF(RMS) | max. | | 2 | 0 | | Α |
| | Repetitive peak forward current $t_p = 20 \mu s$, $\delta = 0.02$ | I _{FRM} | max. | | 36 | 0 | | A |
| | Non-repetitive peak forward current half sinewave; $T_j = 150 ^{\circ}\text{C}$ prior to surge; with reapplied $V_{RWM\ max}$ | | | | | | | |
| | t = 10 ms | ^I FSM | max. | | 9 | 0 | | Α |
| | Temperatures | | | | | | | |
| | Storage temperature | T _{stq} | | -40 | to +15 | 0 | | oC |
| | Junction temperature | Tj | max. | | 15 | 0 | | оС |

CHARACTERISTICS

| Forward voltage | | | | |
|---|-----------------|---|-----|----|
| I _F = 15 A; T _i = 150 °C | ٧F | < | 1.5 | V* |
| $I_F = 50 \text{ A}; T_j' = 25 ^{\circ}\text{C}$ | ٧F | < | 2.0 | V* |
| Reverse current | | | | |
| $V_R = V_{RWM max}$; $T_i = 100 {}^{\circ}C$ | IR | < | 0.4 | mA |
| $V_R = V_{RWM max}$; $T_j = 100 {}^{\circ}\text{C}$ $V_R = V_{RWM max}$; $T_j = 25 {}^{\circ}\text{C}$ | ^I R | < | 25 | μΑ |
| Reverse recovery when switched from | | | | |
| $I_F = 1 \text{ A to } V_R \geqslant 30 \text{ V with } -dI_F/dt = 100 \text{ A}/\mu\text{s};$ | | | | |
| $T_j = 25$ °C; recovery time | t _{rr} | < | 100 | ns |
| $I_F = 2 \text{ A to } V_R \geqslant 30 \text{ V with } -dI_F/dt = 20 \text{ A}/\mu\text{s};$ | | | | |
| T _j = 25 °C; recovered charge | Q_{s} | < | 220 | nC |

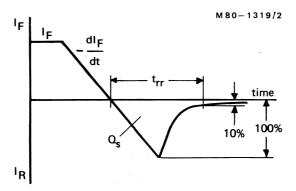


Fig.2 Definition of t_{rr} and Q_s

^{*}Measured under pulse conditions to avoid excessive dissipation.

| THERMAL RESISTANCE | | | | |
|---|----------------------|-----------|-----------|-----------|
| From junction to mounting base | R _{th j-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-h} | = | 0.3 | K/W |
| b. with heatsink compound and 0.06 mm maximum mica insulator | R _{th mb-h} | = ' | 1.4 | K/W |
| with heatsink compound and 0.1 mm maximum mica insulator (56369) | R _{th mb-h} | = | 2.2 | K/W |
| d. with heatsink compound and 0.25 mm maximum alumina insulator (56367) | R _{th mb-h} | = | 0.8 | K/W |
| e. without heatsink compound | R _{th mb-h} | = | 1.4 | K/W |
| 2. Free-air operation | | | | |
| The quoted value of $R_{th\ j-a}$ should be used only when no let the same tie-point. Thermal resistance from junction to ambient in free air: | eads of other di | ssipating | component | ts run to |
| mounted on a printed-circuit board at a = any lead length | R _{th j-a} | = | 60 | K/W |

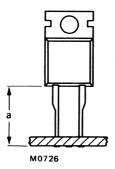


Fig. 3

MOUNTING INSTRUCTIONS

- 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.
- 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 $R_{\mbox{\scriptsize th}\mbox{\scriptsize mb-h}}$ values than screw mounting.
 - b. safe isolation for mains operation.

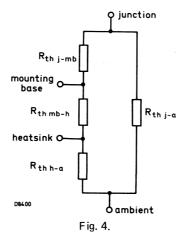
However, if a screw is used, it should be M3 cross-recess pan head. Care should be taken to avoid damage to the plastic body.

- 5. For good thermal contact heatsink compound should be used between base-plate and heatsink. Values of R_{th mb-h} given for mounting with heatsink compound refer to the use of a metallic-oxide loaded compound. Ordinary silicone grease is not recommended.
- 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:



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 I_{amb} scale. The intersection determines the I_{th} mb-a. The heatsink thermal resistance value (I_{th} h-a) can now be calculated from:

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

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

SQUARE-WAVE OPERATION

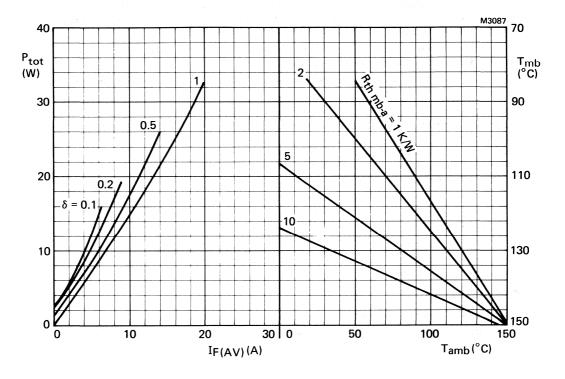


Fig.5 The right-hand part shows the relationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 100 kHz.

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

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

SINUSOIDAL OPERATION

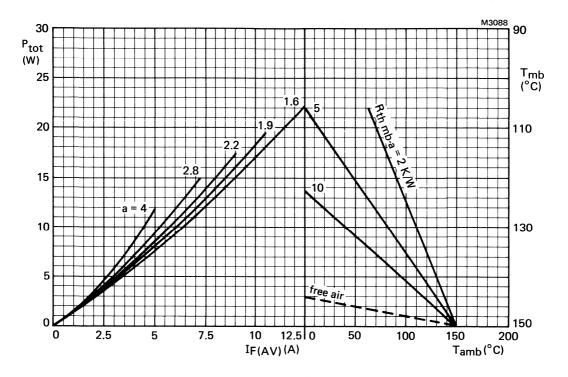


Fig.6 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures. $a = form \ factor = I_F(RMS)/I_F(AV)$.

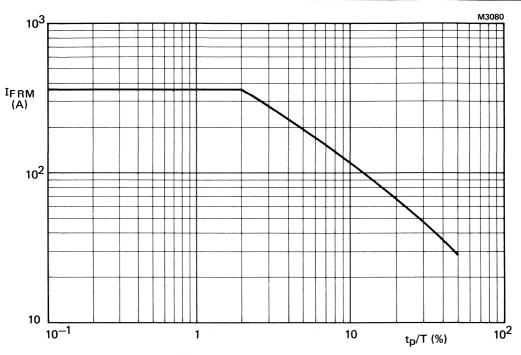
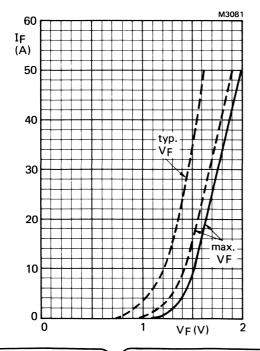
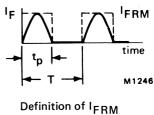


Fig.7 Maximum permissible repetitive peak forward current for square or sinusoidal currents, 1 $\mu s < t_p < 1$ ms.





Definition of I_{FRN} and t_p/T .

Fig.8 —
$$T_j = 25 \, {}^{\circ}\text{C} - - - T_j = 150 \, {}^{\circ}\text{C}$$
.

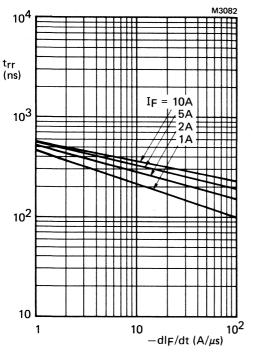
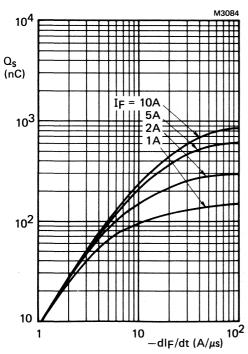


Fig.9 Maximum t_{rr} at $T_j = 25$ °C.



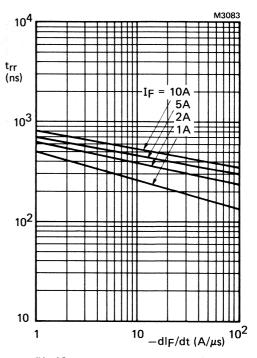


Fig.10 Maximum t_{rr} at $T_j = 100$ °C.

Fig.11 Maximum Q_s at $T_j = 25$ °C.

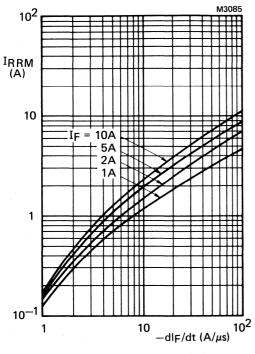


Fig.12 Maximum I_{RRM} at $T_j = 25$ °C.

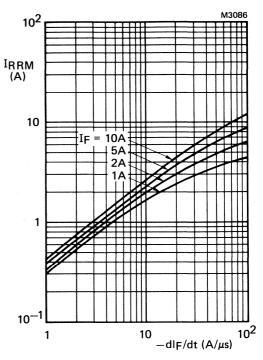


Fig.13 Maximum I_{RRM} at $T_j = 100$ °C.

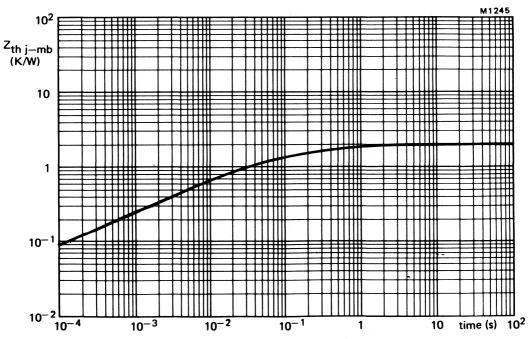


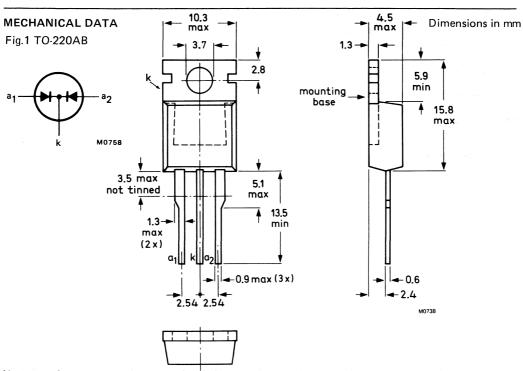
Fig. 14 Transient thermal impedance.

ULTRA FAST RECOVERY DOUBLE RECTIFIER DIODES

Glass-passivated, high-efficiency 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

| | The second secon | | the state of the s | | | |
|---|--|------|--|------|--------------|----|
| 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 | | Α |
| Forward voltage | VF | < | | 1.05 | | V |
| Reverse recovery time | t _{rr} | < | | 50 | | ns |



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.

BYT28 SERIES

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; δ = 0.5; up to T_{mb} = 117 ^{o}C | | 10 | ma | x. | 10 | Α | |
| | sinusoidal; up to $T_{mb} = 120 {}^{\circ}\text{C}$ | | IO | ma | x. | 10 | Α | |
| | R.M.S. forward current | | IF(RMS) | ma | ×. | 14 | Α | |
| | Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ (per diode) | | I _{FRM} | ma | ×. | 80 | Α | |
| | 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 | | IFSM | ma | ×. | 50 | Α | |
| | t = 8.3 ms | | ^I FSM | ma | x. | 60 | Α | |
| | I^2 t for fusing (t = 10 ms; per diode) | | l² t | ma | x. | 12.5 | $A^2 s$ | |
| | Temperatures | | | | | | | |
| | Storage temperature | | T _{stg} | | -40 to | +150 | oC | |
| | Junction temperature | | Tj | ma | x. | 150 | οС | |

Notes

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

CHARACTERISTICS (per diode)

| Forward v | oltage |
|-----------|--------|
|-----------|--------|

Reverse current

recovered charge

$$V_R = V_{RWM max}$$
; $T_j = 100 \, ^{\circ}C$ $I_R < 0.2 \, ^{\circ}MA$
 $V_R = V_{RWM max}$; $T_i = 25 \, ^{\circ}C$ $I_R < 10 \, ^{\prime}MA$

Reverse recovery when switched from

$$\begin{split} I_F = 1 \text{ A to V}_R \geqslant 30 \text{ V with } -dI_F/dt = 100 \text{ A}/\mu\text{s; T}_j = 25 \text{ °C} \\ \text{recovery time} & t_{rr} < 50 \quad \text{ns} \\ I_F = 2 \text{ A to V}_R \geqslant 30 \text{ V with } -dI_F/dt = 20 \text{ A}/\mu\text{s; T}_j = 25 \text{ °C} \end{split}$$

$$I_F$$
 = 5 A to V_R \geqslant 30 V with $-dI_F/dt$ = 50 A/ μ s; T_j = 100 o C peak recovery current I_{RRM} $<$

Forward recovery when switched to $I_F = 1$ A with $dI_F/dt = 10$ A/ μ s; $T_j = 25$ °C recovery voltage

V_{fr} typ. 2.5 V

<

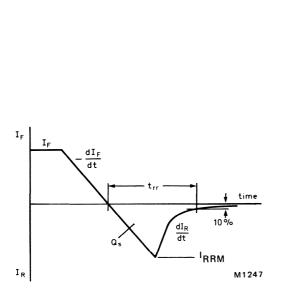
50

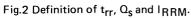
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nC

Α

Qç





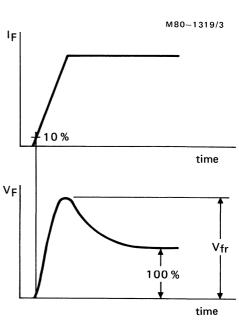


Fig.3 Definition of Vfr.

^{*}Measured under pulse conditions to avoid excessive dissipation.

| THERMAL RESISTANCE | | | | |
|--|----------------------|---------|---------|-------|
| From junction to mounting base (both diodes conducting) | R _{th j-mb} | = | 2.5 | K/W |
| From junction to mounting base (per diode) | R _{th j-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-h} | = | 0.3 | K/W |
| with heatsink compound and 0.06 mm maximum mica insulator | R _{th mb-h} | = | 1.4 | K/W |
| with heatsink compound and 0.1 mm maximum mica insulator (56369) | R _{th mb-h} | = - | 2.2 | K/W |
| with heatsink compound and 0.25 mm maximum alumina insulator (56367) | R _{th mb-h} | · = | 0.8 | K/W |
| e. without heatsink compound | R _{th mb-h} | = | 1.4 | K/W |
| 2. Free air operation | | | | |
| The quoted value of R _{th j-a} should be used only when no leads of | other dissipat | ing cor | nponent | s 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-a} | = | 60 | K/W |

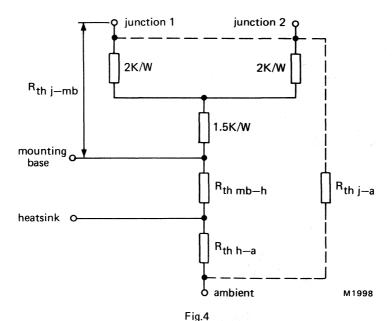
MOUNTING INSTRUCTIONS

- 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.
- 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



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

SQUARE-WAVE OPERATION (PER DIODE)

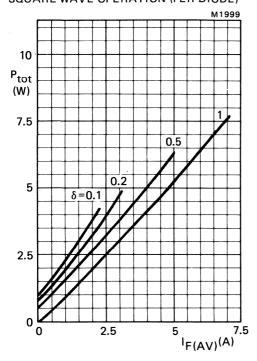
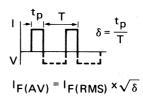


Fig.5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum

ambient and mounting base temperatures.



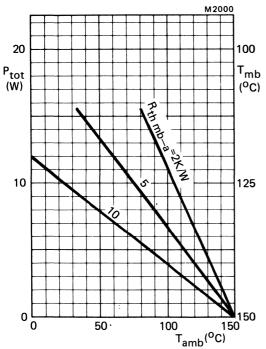


Fig.6

SINUSOIDAL OPERATION (PER DIODE)

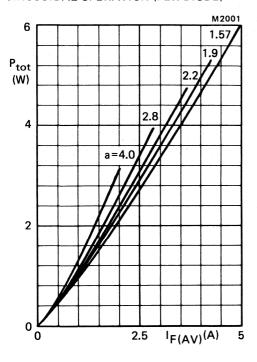


Fig.7 Power rating per diode.
The individual power loss in each diode should first be determined then both added together.
The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.

$$a = form factor = I_F(RMS)/I_F(AV)$$

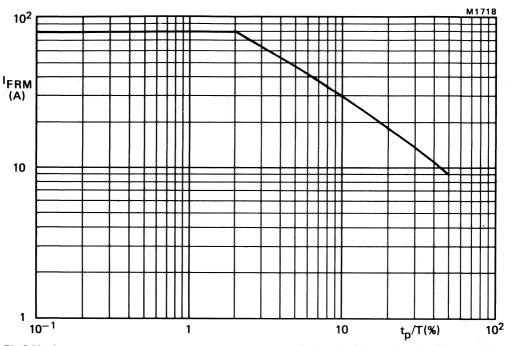
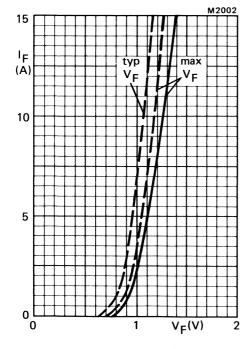
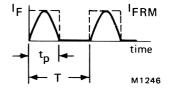


Fig.8 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 μ s < t $_p$ < 1 ms per diode.





Definition of I $_{\mbox{\scriptsize FRM}}$ and t_p/T

Fig.9
$$\longrightarrow$$
 T_j = 25 °C; $--$ T_j = 150 °C per diode.

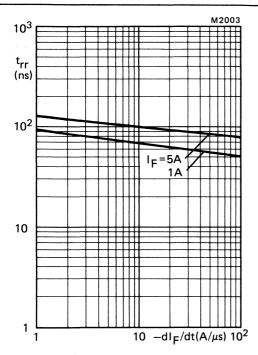
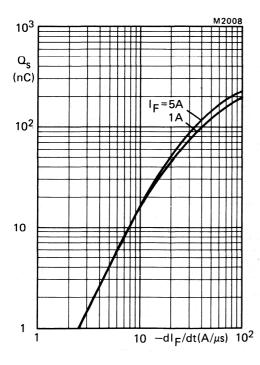
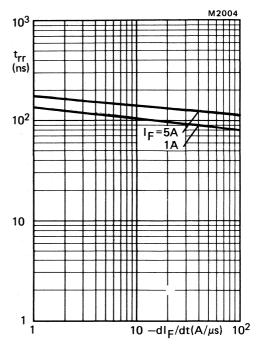


Fig. 10 Maximum t_{rr} at $T_j = 25$ °C; per diode.





/ Fig.11 Maximum t_{rr} at $T_j = 100$ °C; per diode.

Fig.12 Maximum Q_s at $T_j = 25$ °C; per diode.

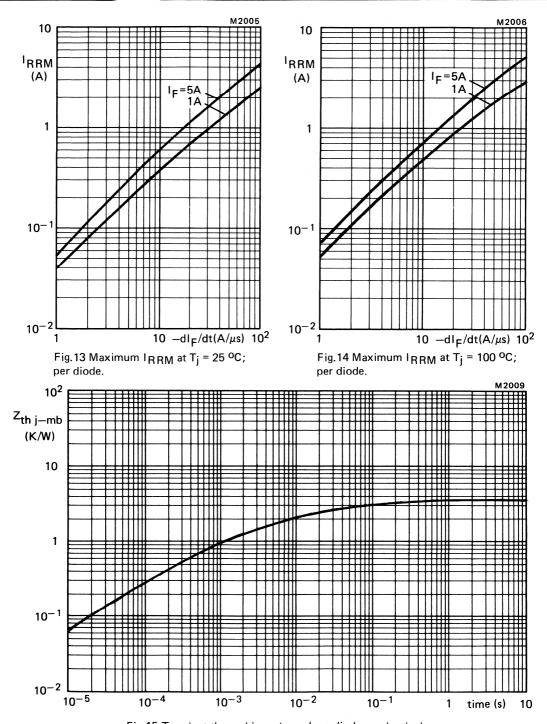


Fig. 15 Transient thermal impedance (one diode conducting).

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.

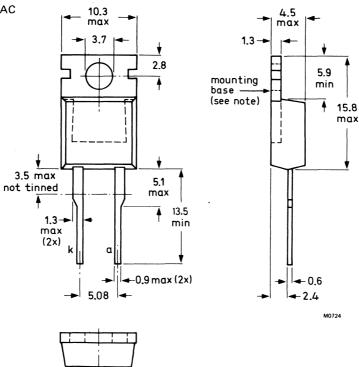
QUICK REFERENCE DATA

| | | | BYT79-300 | 400 | 500 | |
|---------------------------------|-----------------|------|-----------|------|-----|----|
| Repetitive peak reverse voltage | V_{RRM} | max. | 300 | 400 | 500 | V |
| Average forward current | IF(AV) | max. | | 14 | | Α |
| Forward voltage | VF | < | | 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.

BYT79 SERIES

RATINGS

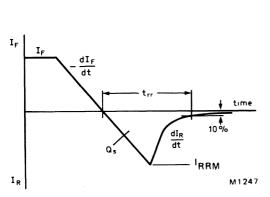
Limiting values in accordance with the Absolute Maximum System (IEC 134).

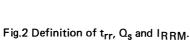
| | Voltages | | BYT79 | -300 | 400 | 500 | |
|---|--|--|--------------|--------|------------|-----|------------------|
| - | Non-repetitive peak reverse voltage | V _{RSM} | max. | 350 | 450 | 550 | V |
| | Repetitive peak reverse voltage | VRRM | max. | 300 | 400 | 500 | V |
| | Crest working reverse 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; δ = 0.5; up to T_{mb} = 113 o C up to T_{mb} = 125 o C | l _{F(AV)} l _{F(AV)} | max. max. | | 14 10 | | A A |
| | sinusoidal; up to $T_{mb} = 118 {}^{\circ}\text{C}$ up to $T_{mb} = 125 {}^{\circ}\text{C}$ | l _{F(AV)} l _{F(AV)} | max. max. | | 12.5 10 | | A A |
| | R.M.S. forward current | IF(RMS) | max. | | 20 | | Α |
| | Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ | I _{FRM} | max. | | 320 | | Α |
| | Non-repetitive peak forward current half sine-wave; T _j = 150 °C prior to surge; with reapplied V _{RWMmax} ; | | | | | | |
| | t = 10 ms | IFSM | max. | | 150 | | Α |
| | t = 8.3 ms | ^I FSM | max. | | 180 | | Α |
| | I ² t for fusing (t = 10 ms) | l²t | max. | | 112 | | A ² s |
| | Temperatures | | | | | | |
| | Storage temperature | T _{stg} | _ | -40 to | +150 | | oC |
| | Junction temperature | Tj | max. | | 150 | | oC |

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

CHARACTERISTICS

| Forward voltage $I_F = 15 \text{ A}; T_j = 150 ^{\circ}\text{C}$ $I_F = 50 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | V _F V _F | | 1.05 1.40 | V* V* |
|---|----------------------------------|-----------------------------------|--------------|----------|
| Reverse current | | | | |
| $V_R = V_{RWM max}$; $T_i = 100 {}^{\circ}C$ | I _R | < | 8.0 | mΑ |
| $V_R = V_{RWM \text{ max}}; T_j = 100 ^{\circ}\text{C}$ $T_j = 25 ^{\circ}\text{C}$ | I _R | < | 50 | μΑ |
| Reverse recovery when switched from $I_F = 1 \text{ A to } V_R \ge 30 \text{ V with } -dI_F/dt = 100 \text{ A}/\mu\text{s};$ | | | | |
| T _j = 25 °C; recovery time | t _{rr} | $<_{i},_{i},_{j},_{i}$ | 50 | ns |
| I _F = 2 A to $V_B \ge 30 \text{ V}$ withdI _F /dt = 20 A/ μ s; | | | | |
| T _j = 25 °C; recovered charge | O_{S} | $< \gamma - \gamma - \gamma_{ij}$ | 50 | nC |
| IF = 10 A to V _R \geqslant 30 V with $-dI_F/dt$ = 50 A/ μ s; T _j = 100 o C; peak recovery current | ^I RRM | < | 5.2 | A |
| Forward recovery when switched to $I_F = 10 \text{ A}$ with $dI_F/dt = 10 \text{ A}/\mu\text{s}$; $T_j = 25 ^{\circ}\text{C}$ | V_{fr} | typ. | 2.5 | ٧ |





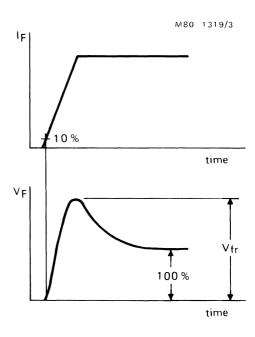


Fig.3 Definition of V_{fr} .

^{*}Measured under pulse conditions to avoid excessive dissipation.

BYT79 SERIES

| THERMAL RESISTANCE | | | | |
|--|----------------------|--------|---------|-----|
| From junction to mounting base | R _{th j-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-h} | = | 0.3 | K/W |
| with heatsink compound and 0.06 mm maximum mica insulator | R _{th mb-h} | = | 1.4 | K/W |
| c. with heatsink compound and 0.1 mm maximum mica insulator (56369) | R _{th mb-h} | = | 2.2 | K/W |
| with heatsink compound and 0.25 mm maximum alumina insulator (56367) | R _{th mb-h} | = | 0.8 | K/W |
| e. without heatsink compound | R _{th mb-h} | = | 1.4 | K/W |
| 2. Free air operation | | | | |
| The quoted value of R _{th j-a} should be used only when no leads of ot to the same tie point. Thermal resistance from junction to ambient in free air: mounted on a printed circuit board at any device lead | ther dissipatir | ng com | ponents | run |
| length and with copper laminate on the board | R _{th j-a} | = | 60 | K/W |

MOUNTING INSTRUCTIONS

- 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 2.4mm 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-h} values than does screw mounting.
 - b. safe isolation for mains operation.

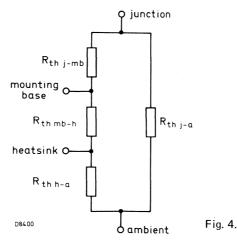
However, if a screw is used, it should be M3 cross-recess pan head. Care should be taken to avoid damage to the plastic body.

- 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.
- 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.



- 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 I_{amb} scale. The intersection determines the $I_{th\ mb-a}$. The heatsink thermal resistance value ($I_{th\ h-a}$) can be calculated from:

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

SQUARE-WAVE OPERATION

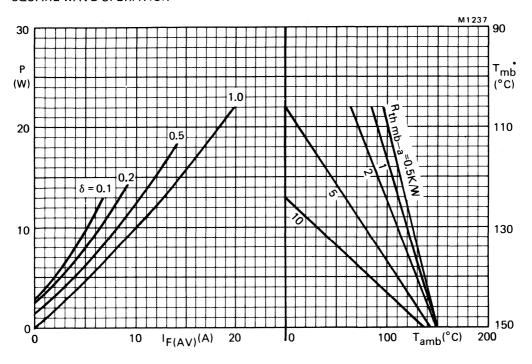


Fig.5 The right-hand part shows the relationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 200 kHz.

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

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

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

SINUSOIDAL OPERATION

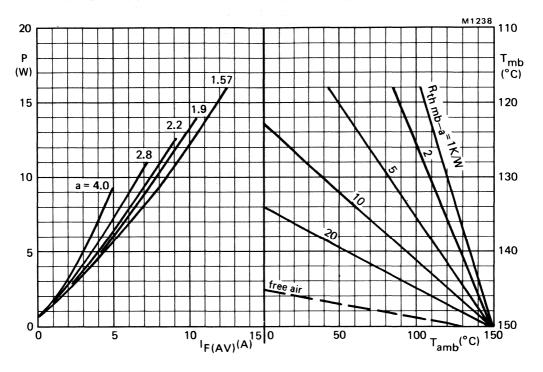


Fig.6 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures. $a = form \ factor = I_F(RMS)/I_F(AV)$.

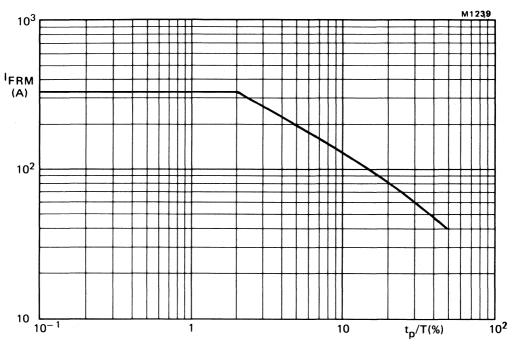
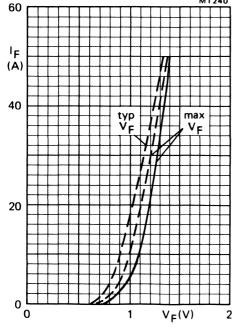
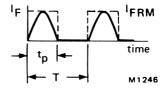


Fig.7 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 μ s < t $_p$ < 1 ms.





Definition of IFRM and t_p/T .

Fig.8 ——
$$T_j = 25$$
 °C; $---T_j = 150$ °C.

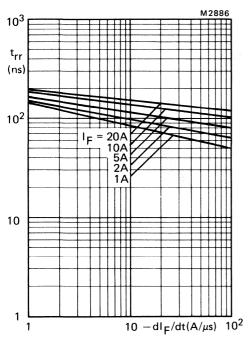


Fig.9 Maximum t_{rr} at $T_j = 25$ °C.

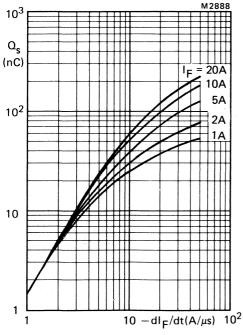


Fig.11 Maximum Q_s at T_i = 25 °C.

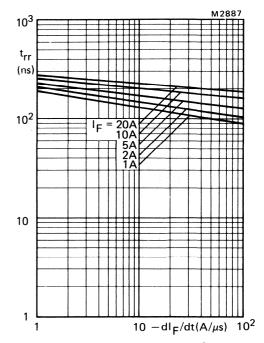
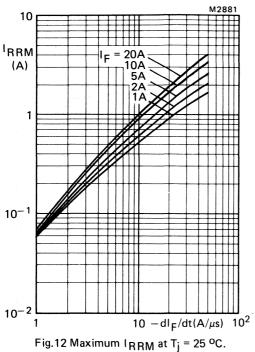


Fig.10 Maximum t_{rr} at $T_j = 100$ °C.



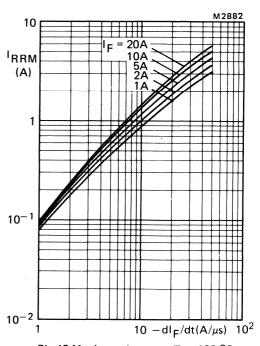


Fig.13 Maximum I_{RRM} at $T_i = 100$ °C.

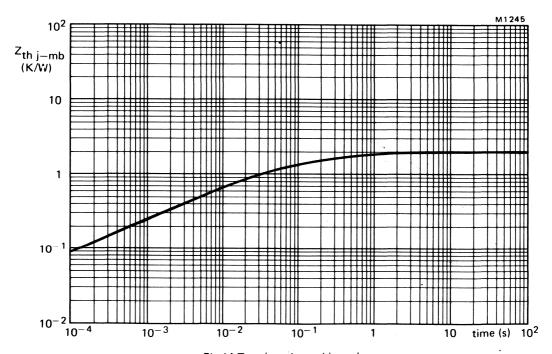


Fig.14 Transient thermal impedance.

DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

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

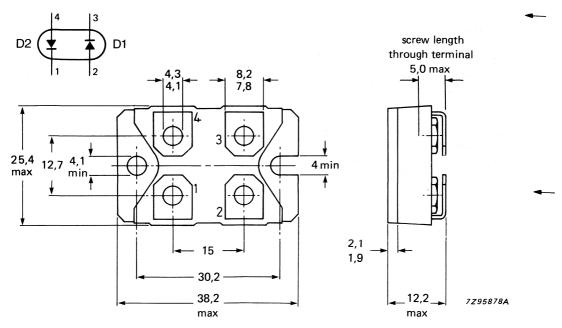
| | | BYT230PIV-200 | | 300 | 400 | |
|---------------------------------|-----------------|---------------|-----|--------|-----|----|
| Repetitive peak reverse voltage | V_{RRM} | max. | 200 | 300 | 400 | ٧ |
| Average forward current | TF(AV) | max. | | 2 x 30 | | Α |
| Forward voltage | VF | < | | 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.

BYT230PIV-200-400

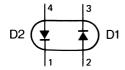
RATINGS

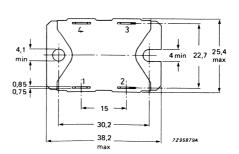
Limiting values in accordance with the Absolute Maximum System (IEC134).

| Voltages | | BYT230F | PIV-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) | | | 13.0 | | | |
| Average forward current; switching losses negligible up to 100 kHz | | | | | | |
| square-wave, δ = 0.5, up to T_{mb} = 60 ^{o}C | ^I F(AV) | max. | | 30 | | Α |
| R.M.S. forward current | F(RMS) | max. | | 50 | | Α |
| Repetitive peak forward current $t_p = 20 \mu s$, $\delta = 0.02$ | IFRM | max. | | 800 | | Α |
| Non-repetitive peak forward current half sine-wave | | | | | | |
| t = 10 ms | FSM | max. | | 500 | | A |
| t = 8.3 ms | ^I FSM | max. | | 600 | | Α |
| I ² t for fusing (t = 10 ms) | l ² t | max. | | 610 | | A ² s |
| Temperatures | | | | | | |
| Storage temperature | T _{stg} | | -40 to | +150 | | oC. |
| Junction temperature | Tj | | -40 to | +150 | | oC |
| THERMAL RESISTANCE | | | | | | |
| From junction to mounting base | 5 . | | | 4.5 | | 14 /14/ |
| per diode | R _{th j-mb} | = | | 1.5 | | .K/W |
| From junction to mounting base total | R _{th j-mb} | = | | 8.0 | | K/W |
| From mounting base to heatsink with heatsink compound | R _{th mb-h} | = | | 0.1 | | K/W |
| ORDERING NOTE | - | 6,4 | - Ø 2,6 | | | |
| Types with Faston terminals are available on request (see Fig.2). Omit suffix V from the type number | 6,35 (¼") Faston terminal (x4) | | | 20,7 | | |
| when ordering, e.g. BYT230PI-300. | 2,1 | | | max 9,1 1,9 | | |

Fig.2 SOT-227A.

Dimensions in mm.





CHARACTERISTICS

T_i = 25 °C unless otherwise stated.

| < < | 1.4 | V* |
|-----|-----|----------------------|
| · · | 1.4 | V* |
| < | | - |
| , | 1.5 | ٧* |
| | | |
| < | 6.0 | mA |
| < | 35 | μΑ |
| | | |
| < | 50 | ns |
| < | 100 | ns |
| < | 75 | nC |
| < | 4 | A |
| | | < 35 < 50 < 100 < 75 |

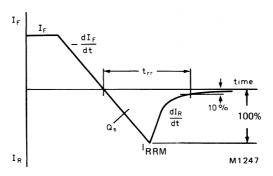


Fig.3 Definition of t_{rr} , Q_s and I_{RRM} .

^{*}Measured under pulse conditions to avoid excessive dissipation.

BYT230PIV-200-400

SQUARE-WAVE OPERATION

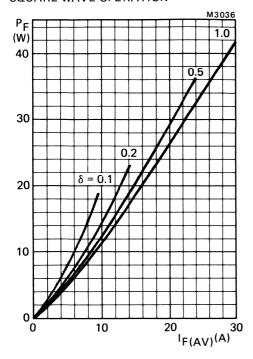


Fig.4 Forward power losses versus average forward current; per diode.

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

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

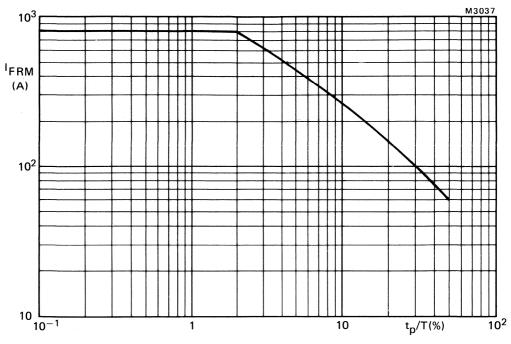
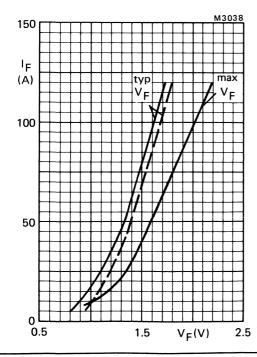
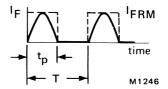


Fig.5 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 μ s < t $_p$ < 1 ms; per diode.





Definition of IFRM and t_p/T .

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

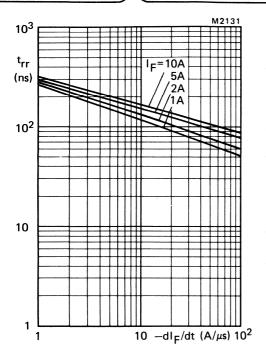
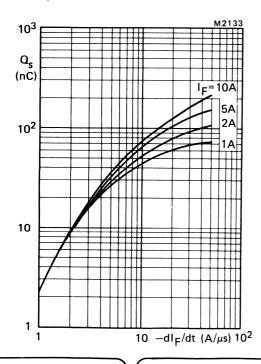


Fig.7 Maximum t_{rr} at T_j = 25 o C; per diode.



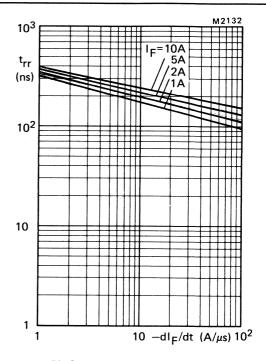
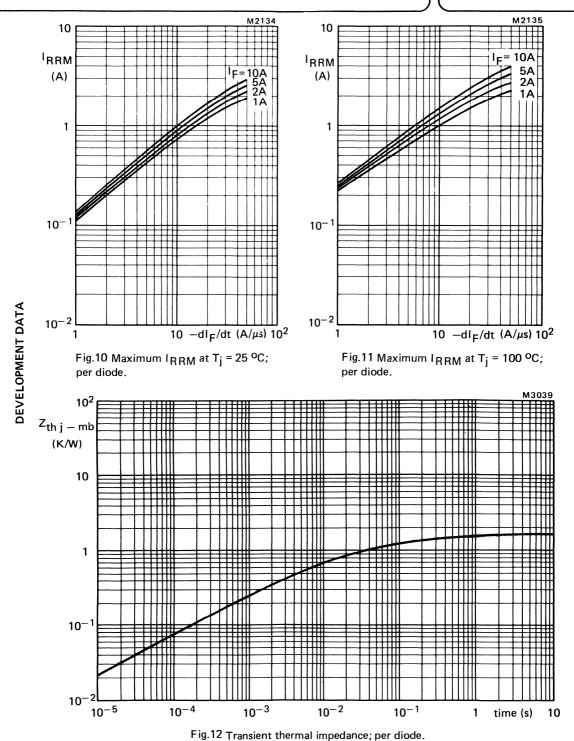


Fig.8 Maximum t_{rr} at $T_j = 100$ °C; per diode.

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



19.12 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

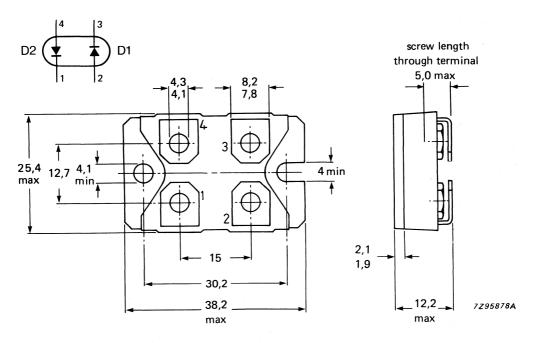
| | | BYT230P | IV- 600 700 800 | |
|---------------------------------|-----------------|---------|---------------------|----|
| Repetitive peak reverse voltage | VRRM | max. | 600 700 800 | V |
| Average forward current | IF(AV) | max. | 2 x 30 | Α |
| Forward voltage | ٧ _F | < | 1.8 | V |
| Reverse 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.

BYT230PIV-600 to 800

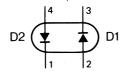
RATINGS

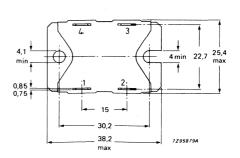
Limiting values in accordance with the Absolute Maximum System (IEC134).

| - | Voltages | | BYT230P | 1V- 600 700 8 | 800 |
|---|---|--------------------------------------|---------|-------------------|------------------|
| | Repetitive peak reverse voltage | V _{RRM} | max. | 600 700 8 | 800 V |
| | Non repetitive peak reverse voltage | V _{RSM} | max. | 640 750 8 | 350 V |
| | Currents (per diode) | | | | |
| | Average forward current; switching losses negligible up to 100 kHz square-wave, δ = 0.5, up to T_{mh} = 50 °C | ^I F(AV) | max. | 30 | A A |
| | RMS forward current | IF(RMS) | max. | 70 | Α |
| | 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 | FSM | max. | 200 | A |
| | t = 8.3 ms | IFSM | max. | 240 | Α |
| | 1^2 t for fusing (t = 10 ms) | l²t | max. | 200 | A ² s |
| | Temperatures | | | | |
| | Storage temperature | T_{stg} | - | -40 to +150 | oC |
| | Junction temperature | Тj | - | -40 to +150 | oC |
| | THERMAL RESISTANCE | | | | |
| | From junction to mounting base per diode | R _{th j-mb} | = , | 1.5 | K/W |
| | From junction to mounting base total | R _{th j-mb} | = | 8.0 | K/W |
| | From mounting base to heatsink with heatsink compound | R _{th mb-h} | · = | 0.1 | K/W |
| | ORDERING NOTE | 6,4 | - Ø 2, | 6 5 | |
| | Types with Faston terminals are available on request (see Fig.2). Omit suffix V from the type number when ordering, e.g. BYT230PI-600. | 6,35 (¼") Faston terminal (x4) | | 20,7 max | |



Dimensions in mm.





CHARACTERISTICS

 $T_j = 25$ °C unless otherwise stated.

| Forward voltage | | | | |
|---|-----------------|---|-----|----|
| $I_F = 30 \text{ A}; T_i = 100 ^{\circ}\text{C}$ | VF | < | 1.8 | V* |
| I _F = 30 A | VF | < | 1.9 | V* |
| Reverse current | | | | |
| $V_R = V_{RRM max}$; $T_j = 100 {}^{\circ}C$ | l _R | < | 5.0 | mA |
| VR = VRRM max | IR | < | 100 | μΑ |
| 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 $V_R \ge 30 V$ with $-dI_F/dt = 50 A/\mu s$; recovery time | t _{rr} | < | 100 | ns |
| IF = 2 A to $V_R \ge 30 V$ with $-dI_F/dt = 20 A/\mu s$; recovered charge | Ω_{s} | < | 150 | nC |

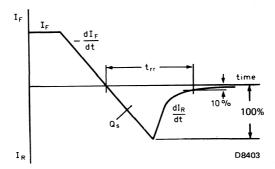


Fig.3 Definition of t_{rr} and Q_s .

^{*}Measured under pulse conditions to avoid excessive dissipation.

SQUARE-WAVE OPERATION

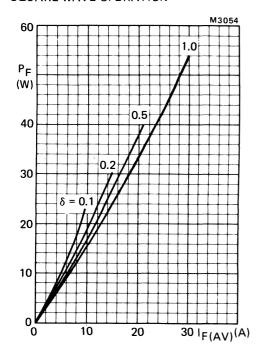
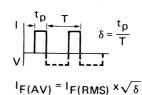


Fig.4 Forward power losses versus average forward current; per diode.



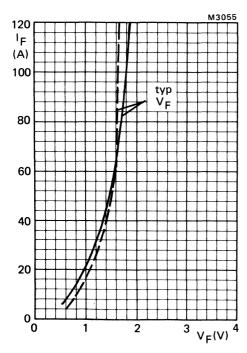


Fig.5 Typical forward voltage versus forward current; $---T_j = 25$ °C; $----T_j = 100$ °C.

This data sheet contains advance information and specifications are subject to change without notice.

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

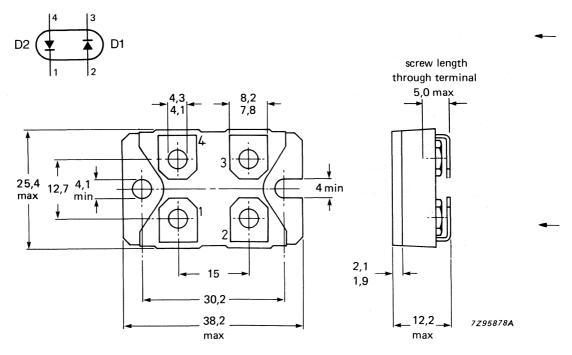
| Repetitive peak reverse voltage | v_{RRM} | max. | 1000 | V |
|---------------------------------|-----------------|------|--------|----|
| Average forward current | IF(AV) | max. | 2 x 30 | Α |
| Forward voltage | VF | < | 1.8 | V |
| Reverse recovery time | t _{rr} | < | 70 | ns |

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.

BYT230PIV-1000

RATINGS

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

| Vol | tages |
|-----|-------|
|-----|-------|

| Repetitive peak reverse voltage | v_{RRM} | max. | 1000 | V |
|-------------------------------------|------------------|------|------|---|
| Non repetitive peak reverse voltage | V _{RSM} | max. | 1000 | ٧ |
| O | | | | |

IF(AV)

max.

Currents (per diode)

Average forward current; switching losses negligible up to 100 kHz square wave; δ = 0.5; up to T_{mb} = 50 °C R.M.S. forward current

Repetitive peak forward current $t_0 = 20 \mu s$, $\delta = 0.02$

Non-repetitive peak forward current half sine-wave t = 10 ms

 I^2 t for fusing (t = 10 ms)

Temperatures

t = 8.3 ms

Storage temperature
Junction temperature

THERMAL RESISTANCE

From junction to mounting base per diode From junction to mounting base total From mounting base to heatsink with heatsink compound

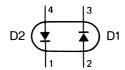
ORDERING NOTE

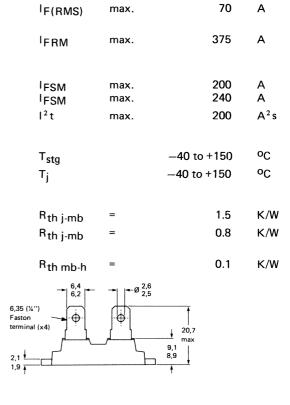
Types with Faston terminals are available on request (see Fig.2).

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



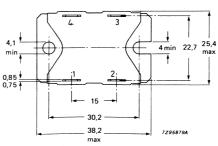
Dimensions in mm.





30

Α



CHARACTERISTICS

 $T_i = 25$ °C unless otherwise stated

| • | | | | |
|---|-----------------|---------|------|----|
| Forward voltage | | | | |
| $I_F = 30 \text{ A}; T_j = 100 ^{\circ}\text{C}$ | V _F | < | 1.8 | V* |
| I _F = 30 A | V _F | < | 1.9 | V* |
| Reverse current | | | | |
| $V_R = V_{RRM max}$; $T_j = 100 {}^{\circ}C$ | I _R | < | 5.0 | mΑ |
| VR = VRRM max | I _R | < | 100 | μΑ |
| 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 $V_R \ge 30 \text{ V}$ with $-dI_F/dt = 15 \text{ A}/\mu\text{s}$; | | | 1.45 | |
| recovery time | t _{rr} | < . · · | 145 | ns |
| $I_F = 2 \text{ A to } V_R \ge 30 \text{ V with } -dI_F/dt = 20 \text{ A}/\mu\text{s};$ | | | 250 | |
| recovered charge | O_{S} | < | 250 | nC |

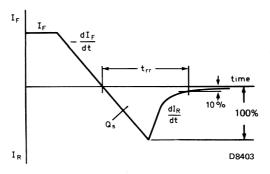


Fig.3 Definition of t_{rr} and Q_s .

^{*}Measured under pulse conditions to avoid excessive dissipation.

SQUARE - WAVE OPERATION

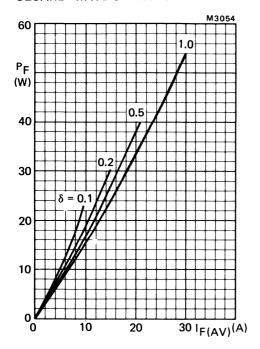
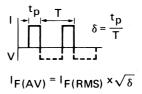


Fig.4 Forward power losses versus average forward current; per diode.



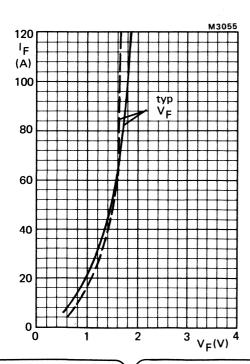


Fig.5 Typical forward voltage versus forward current; --- T_j = 25 °C; --- T_j = 100 °C.

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.

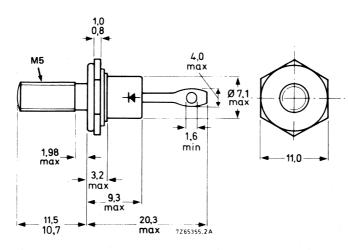
QUICK REFERENCE DATA

| | | BYV2 | 4-8 0 0(R) | 1000(R) | - | |
|-------------------------------------|--------------------|------|-------------------|---------|------------|--|
| Repetitive peak reverse voltage | V _{RRM} | max. | 800 | 1000 | V | |
| Average forward current | ^I F(AV) | max. | 1 | 2 | Α | |
| Non-repetitive peak forward current | ^I FSM | max. | 15 | 0 , , , | , A | |
| Reverse recovery time | ^t rr | < | 45 | 0 | ns | |

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO-4: with metric M5 stud (ϕ 5 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*

| · | | | | | | | |
|--|-----------|------|--|--------------|-------------|---------|------------------|
| | | | BYV2 | 4-800(1 | R) | 1000(R) | |
| Non-repetitive peak reverse voltage | v_{RSM} | max. | | 1000 | | 1200 | 1 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 |
| 0 | | | | | | | |
| Currents | | | | | | | |
| Average forward current | | | • | | 1: | 2 | • |
| sinusoidal; up to $T_{mb} = 103$ °C sinusoidal; at $T_{mb} = 125$ °C | | | IF(AV) | max. max. | | 7 | A |
| square-wave; $\delta = 0.5$; up to $T_{mb} = 10$ | 13 OC | | ^I F(AV) ^I F(AV) | max. | 14 | | A |
| square-wave; $\delta = 0.5$; at $T_{mb} = 125$ | C C | | IF(AV) | max. | | 3 | A |
| R.M.S. forward current | | | l _F (RMS) | max. | 20 |) | A A A A |
| Repetitive peak forward current | | | IFRM | max. | 120 |) | A |
| Non-repetitive peak forward current t = 10 ms; half sine-wave; T _j = 150 ^O C prior to surge; | | | | | | | |
| without re-applied voltage with re-applied VRWMmax | | | ^I FSM ^I FSM | max. max. | 150 120 | | A A |
| *************************************** | | | | mux. | | | |
| I^2 t for fusing (t = 10 ms) | | | l ² t | max. | 7: | 2 | A ² s |
| Temperatures | | | | | | | |
| Storage temperature | | | T _{stg} | −55 to | +15 | 0 | oC |
| Junction temperature | | | Tj | max. | 15 | 0 | οС |
| THERMAL RESISTANCE | | | | | | | |
| From junction to mounting base | | | R _{th j-mb} | = | 2. | 0 | °C/W |
| From mounting base to heatsink | | | D | | 0. | 2 | oc/w |
| with heatsink compound without heatsink compound | | | R _{th} mb-h R _{th} mb-h | = | 0. | - | oC/W |
| Transient thermal impedance; t = 1 ms | | | Z _{th j-mb} | = | 0.8 | | °C/W |
| | | | -ui j-iiib | | J. J | | 2, ** |

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 $_{th~j\text{-a}} \leqslant$ 8 $^{o}\text{C/W}$ (continuous reverse voltage).

| CHARACTERISTICS |
|-----------------|
|-----------------|

| Forward voltage | | | | |
|--|---------------------|---|-----|------|
| $I_F = 20 \text{ A; } T_j = 25 ^{\circ}\text{C}$ | VF | < | 1.7 | V* |
| Reverse current | | | | |
| $V_R = V_{RWMmax}$; $T_j = 125 {}^{\circ}C$ | 1 _R | < | 1.5 | mA |
| Reverse recovery when switched from IF = 10 A to VR \geq 30 V with -dIF/dt = 10 A/ μ s; Tj = 25 °C Recovery time | t _{rr} | | 450 | ns |
| I_F = 2 A to V_R \geqslant 30 V with $-dI_F/dt$ = 20 A/ μ s; T_j = 25 $^{\rm O}$ C Recovered charge | $Q_{\mathbf{s}}$ | | 800 | nC |
| Maximum slope of the reverse recovery current when switched from $I_F = 2 \text{ A to V}_R \ge 30 \text{ V}$; with $-\text{dI}_F/\text{dt} = 2 \text{ A}/\mu\text{s}$; $T_i = 25 ^{\circ}\text{C}$ | dl _R /dt | | 7 . | A/μs |

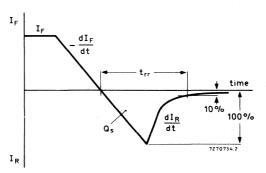


Fig.2 Definition of t_{rr} and Q_s .

^{*}Measured under pulse conditions to avoid excessive dissipation.

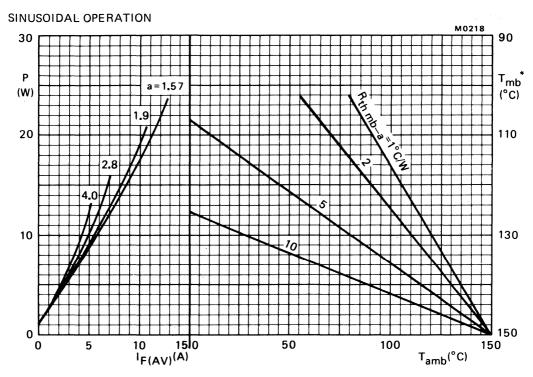


Fig.3 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.

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

a = form factor = IF(RMS)/IF(AV).

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

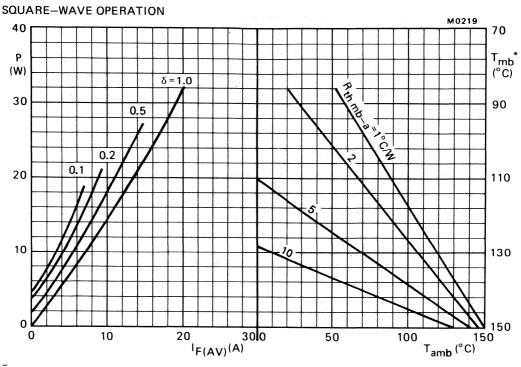


Fig.4 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.

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

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

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

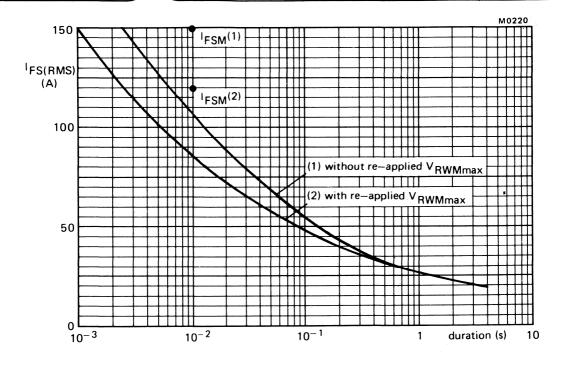


Fig.5 Maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz); T_i = 150 $^{\circ}$ C prior to surge.

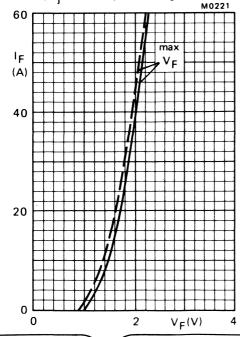




Fig.6. —
$$T_j = 25$$
 °C; — $T_j = 100$ °C.

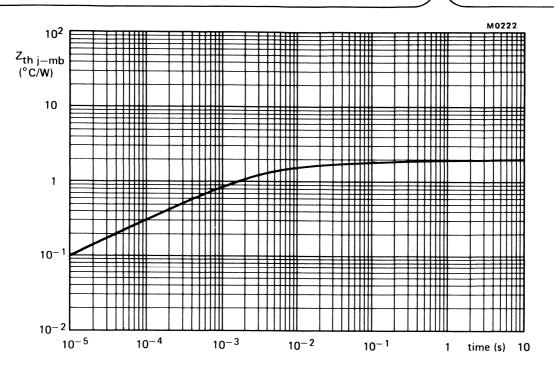


Fig.7

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.

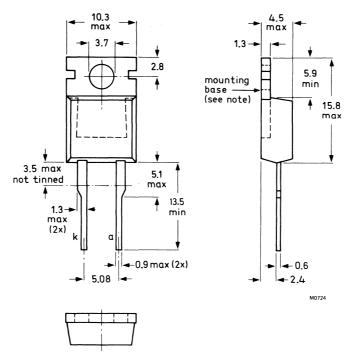
QUICK REFERENCE DATA

| | | | BYV29-300 | 400 | 500 | |
|---------------------------------|------------------|------|-----------|------|-----|----|
| Repetitive peak reverse voltage | V _{RRM} | max. | 300 | 400 | 500 | V |
| Average forward current | IF(AV) | max. | | 9 | | Α |
| Forward voltage | ٧ _F | < | | 1.05 | | V |
| Reverse recovery time | t _{rr} | < | | 50 | | ns |

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.

BYV29 SERIES

RATINGS

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

| Voltages | | BYV29 | 9–300 | 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 | VRWM | max. | 200 | 300 | 400 | V |
| Continuous reverse voltage (note 1) | v_R | max. | 200 | 300 | 400 | ٧ |
| Currents | | | | | | |
| Average forward current; switching losses negligible up to 200 kHz; square wave; δ = 0.5; up to T_{mb} = 116 °C sinusoidal; up to T_{mb} = 125 °C | F(AV) | max. max. | | 9 7.4 | | A |
| R.M.S. forward current | ^I F(AV) ^I F(RMS) | max. | | 13 | | Â |
| Repetitive peak forward current $t_p = 20 \ \mu s$; $\delta = 0.02$ | l _{FRM} | max. | | 200 | | 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. | | 100 | | A |
| t = 8.3 ms | IFSM | max. | | 110 | | Ā |
| I^2 t for fusing (t = 10 ms) | l ² t | max. | | 50 | | A^2s |
| Temperatures | | | | | | |
| Storage temperature | T _{stg} | | -40 to | +150 | | оС |
| Junction temperature | Tj | max. | | 150 | | оС |
| | • | | | | | |

Notes:

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

CHARACTERISTICS

| $T_i = 25$ °C unless otherwise | se stated |
|--------------------------------|-----------|
|--------------------------------|-----------|

Forward voltage

Reverse current

$$V_R = V_{RWM\ max}$$
; $T_j = 100\ ^{O}C$ $I_R < 0.35$ M_A $V_R = V_{RWM\ max}$ $I_R < 10$ μA

Reverse recovery when switched from

I_F = 1 A to
$$V_R \ge 30 \text{ V}$$
 with $-dI_F/dt = 100 \text{ A}/\mu\text{s}$; recovery time

I_F = 2 A to
$$V_R \ge 30 V$$
 with $-dI_F/dt = 20 A/\mu s$; recovered charge

I_F = 10 A to V_R
$$\geqslant$$
 30 V with $-dI_F/dt$ = 50 A/ μ s; T_i = 100 °C; peak recovery current

Forward recovery when switched to
$$I_F = 10 \text{ A}$$

with $dI_F/dt = 10 \text{ A}/\mu\text{s}$

| VF | < | 1.4 | V* |
|----------------------------------|-------|------------|----------|
| I _R I _R | < < < | 0.35 10 | mA μA |
| t _{rr} | < 1 | 50 | ns |
| Os | < | 55 | nC |
| ^I RRM | < | 5.5 | Α |
| V _{fr} | typ. | 2.5 | ٧ |

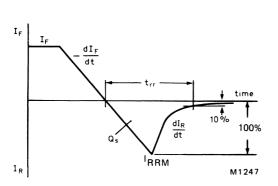


Fig.2 Definition of t_{rr} , Q_s and I_{RRM} .

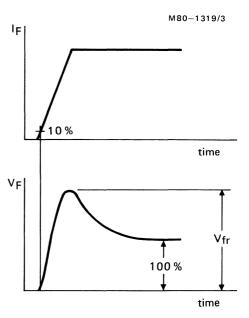


Fig.3 Definition of V_{fr}.

^{*}Measured under pulse conditions to avoid excessive dissipation.

| THERMAL RESISTANCE | | | | |
|---|----------------------|---------|--------|--------|
| From junction to mounting base | R _{th j-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-h} | = | 0.3 | K/W |
| with heatsink compound and 0.06 mm maximum mica insulator | R _{th mb-h} | = | 1.4 | K/W |
| with heatsink compound and 0.1 mm maximum mica insulator (56369) | R _{th mb-h} | = | 2.2 | K/W |
| with heatsink compound and 0.25 mm maximum alumina insulator (56367) | R _{th mb-h} | = " | 0.8 | K/W |
| e. without heatsink compound | R _{th mb-h} | = - | 1.4 | K/W |
| 2. Free air operation | | | | |
| The quoted value of $R_{th\ j-a}$ should be used only when no leads of to the same tie point. Thermal resistance from junction to ambient in free air: mounted on a printed circuit board at any device lead | f other dissipat | ing com | nponen | ts run |
| length and with copper laminate on the board | R _{th j-a} | = | 60 | K/W |

MOUNTING INSTRUCTIONS

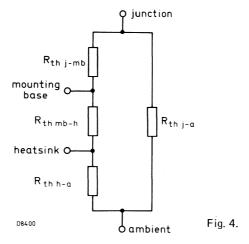
- 1. The device may be soldered directly into the circuit, but the maximum permissible temperature of the soldering iron or bath is 275°C; the heat source must not be in contact with the joint for more than 5 seconds. Soldered joints must be at least 4.7 mm from the seal.
- 2. The leads should not be bent less than 2.4mm 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-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.



- 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

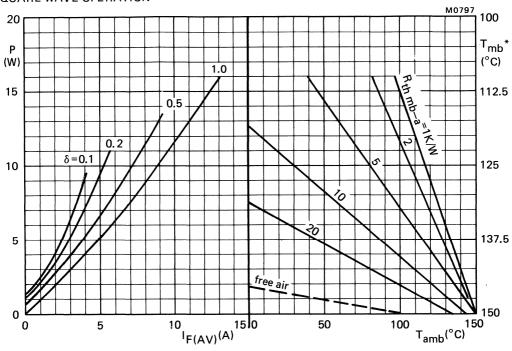


Fig.5 The right-hand part shows the relationship between the power (derived from the left-hand part) and the maximum permissible temperatures.

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

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

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

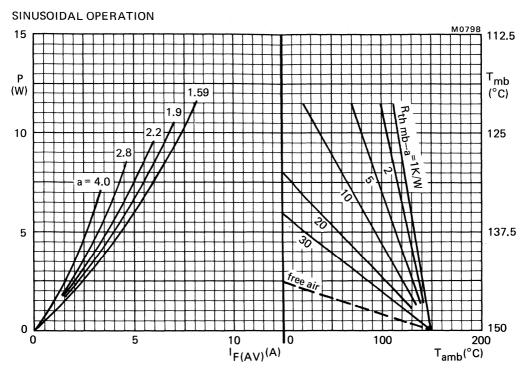


Fig.6 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures. $a = form \ factor = I_F(RMS)/I_F(AV)$.

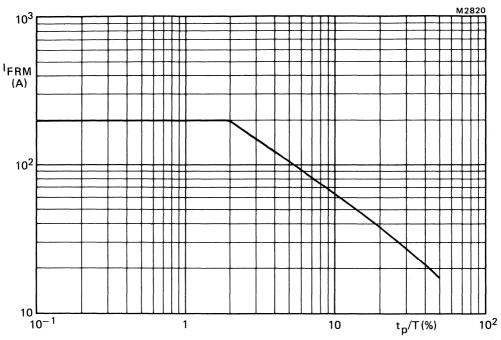
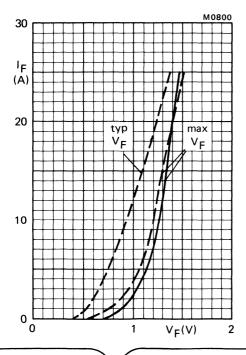


Fig.7 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 $\mu s < t_p < 1$ ms.



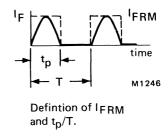


Fig.8 ——
$$T_j$$
 = 25 °C; $-- T_j$ = 100 °C.

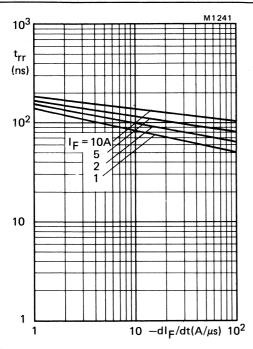


Fig.9 Maximum t_{rr} at T_j = 25 °C.

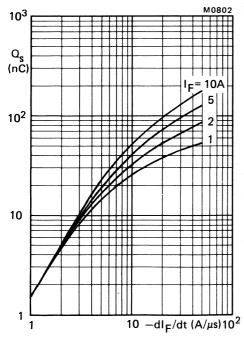


Fig.11 Maximum Q_s at $T_j = 25$ °C.

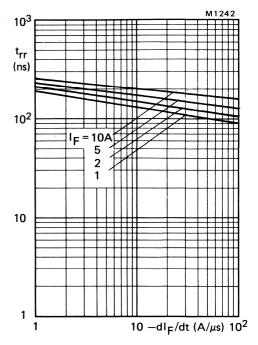


Fig. 10 Maximum t_{rr} at $T_j = 100$ °C.

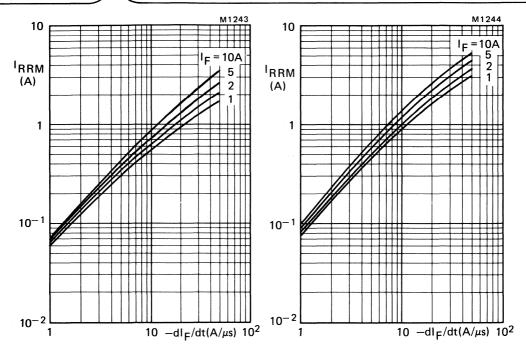


Fig.12 Maximum I_{RRM} at T_j = 25 o C.

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

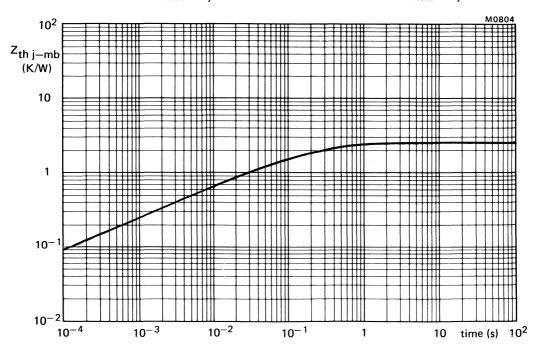


Fig.14 Transient thermal impedance.

ULTRA FAST-RECOVERY ELECTRICALLY ISOLATED RECTIFIER DIODES

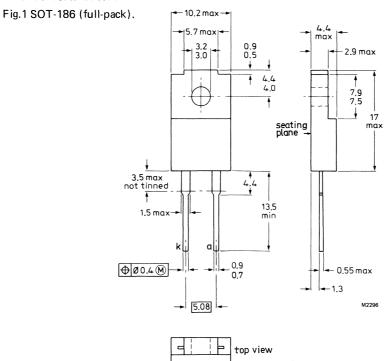
Glass-passivated, high-efficiency epitaxial rectifier diodes in full-pack envelopes, featuring low forward voltage drop, ultra fast reverse recovery times with very low stored charge and soft-recovery characteristic. Their electrical isolation makes them ideal for mounting on a common heatsink alongside 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

| | | BYV29 | F-300 | 400 | 500 | |
|---------------------------------|-----------------|-------|-------|------|-----|----|
| Repetitive peak reverse voltage | V_{RRM} | max. | 300 | 400 | 500 | V |
| Average foward current | IF(AV) | max. | | 9 | | Α |
| Forward voltage | ٧F | < | | 1.05 | | V |
| Reverse recovery time | t _{rr} | < | | 50 | | ns |

MECHANICAL DATA

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).

June 1988 **327**

BYV29F SERIES

→ RATINGS

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

| | BYV29 | F-300 | 400 | 500 | |
|---------------------|---|--|--|--|---|
| V _{RSM} | max. | 350 | 450 | 550 | V |
| VRRM | max. | 300 | 400 | 500 | V |
| VRWM | max. | 200 | 300 | 400 | V |
| VR | max. | 200 | 300 | 400 | V |
| | | | | | |
| | | | | | |
| F(AV) | max. | | | | A |
| ^I F(AV) | max. | | _ | | A |
| ^I F(RMS) | max. | | 13 | | Α |
| IFRM | max. | | 200 | | Α |
| | | | | | |
| ^I ESM | max. | | 100 | | Α |
| IFSM | max. | | 110 | | Α |
| l²t | max. | | 50 | | A ² s |
| | | | | | |
| T_{stq} | | -40 to | o +150 | | oC |
| Tj | max. | | 150 | | oC |
| | | | | | |
| V _{isol} | max. | | 1500 | | ٧ |
| C _{isol} | typ. | | 12 | | pF |
| | VRRM VRWM VR IF(AV) IF(AV) IF(RMS) IFRM IFSM IFSM I** | VRSM max. VRRM max. VRWM max. VR max. IF(AV) max. IF(AV) max. IF(RMS) max. IFSM max. IFSM max. IFSM max. IFSM max. IFSM max. IFSM max. IFSM max. IFSM max. IFSM max. IFSM max. IFSM max. IFSM max. IFSM max. IFSM max. IFSM max. IFSM max. IFSM max. IFSM max. | VRRM max. 300 VRWM max. 200 VR max. 200 IF(AV) max. IF(RMS) max. IFRM max. IFSM max. I2t max. Tj max. Visol max. | VRSM max. 350 450 VRRM max. 300 400 VRWM max. 200 300 VR max. 200 300 IF(AV) max. 8 IF(RMS) max. 13 IFRM max. 200 IFSM max. 100 IFSM max. 110 I*FSM max. 50 Tstg —40 to +150 Tj max. 1500 Visol max. 1500 | VRSM max. 350 450 550 VRRM max. 300 400 500 VRWM max. 200 300 400 VR max. 200 300 400 IF(AV) max. 8 IF(RMS) max. 13 IFRM max. 200 IFSM max. 100 IFSM max. 110 IFSM max. 50 Tstg —40 to +150 Tj max. 1500 Visol max. 1500 |

Notes

- 1. To ensure thermal stability: $R_{\mbox{th j-a}}\,{<}\,6.8$ 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 \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

| or the envelope, |
|---------------------------|
| with heatsink compound |
| without heatsink compound |

| R _{th j-h} | = | 5.5 | K/W |
|---------------------|---|-----|-----|
| R _{th i-h} | = | 7.2 | K/W |

Free-air operation

The quoted value of R_{th i-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-a} | = | 55 | K/W |
|---------------------|---|----|-----|

1.05

<

CHARACTERISTICS

Forward voltage

$$I_F = 5 \text{ A}; T_j = 100 \text{ }^{\circ}\text{C}$$
 $I_F = 20 \text{ A}; T_j = 25 \text{ }^{\circ}\text{C}$

VF

Reverse current

Reverse recovery when switched from

$$I_F = 1 \text{ A to V}_R \geqslant 30 \text{ V with } -dI_F/dt = 100 \text{ A}/\mu\text{s};$$

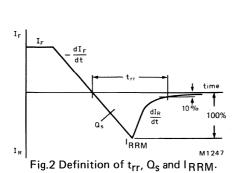
 $T_i = 25 \text{ }^{\circ}\text{C}; \text{ recovery time}$

$$I_F = 2 \text{ A to } V_R \geqslant 30 \text{ V with } -dI_F/dt = 20 \text{ A}/\mu\text{s};$$

I_F = 10 A to V_R
$$\geqslant$$
 30 V with -dI_F/dt = 50 A/ μ s; T_i = 100 ^oC; peak recovery current

Forward recovery when switched to $I_F = 10 \text{ A}$ with dI $F/dt = 10 A/\mu s$; $T_i = 25 \, {}^{\circ}C$

| | VF | < | 1.4 | V* |
|----|-----------------|------|------------|----------|
| | I _R | < < | 0.35 10 | mΑ μΑ |
| | t _{rr} | < | 50 | ns |
| | O_s | 1<1 | 55 | nC |
| | IRRM | < | 5.5 | Α |
| | V_{fr} | typ. | 2.5 | ٧ |
| -1 | | M | 30-1319/3 | |



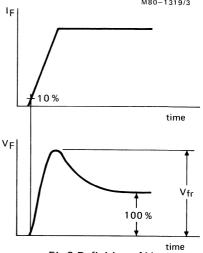


Fig.3 Definition of Vfr.

^{*}Measured under pulse conditions to avoid excessive dissipation.

MOUNTING INSTRUCTIONS

- 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-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:

 Maximum torque to avoid damage to the device:

 5.5 kgf (0.55 Nm)

 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-h} given for mounting with heatsink compound refer to the use of a metallic-oxide loaded compound. Ordinary silicone grease is not recommended.
- 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.
- 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.

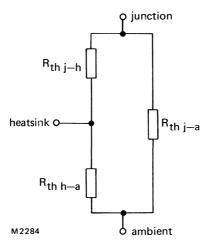


Fig.4.

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

SQUARE-WAVE OPERATION

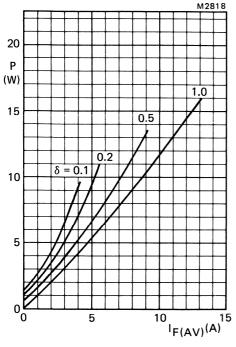
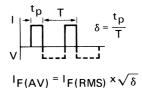


Fig.5 Power rating.

The power loss in the diode should first be determined from the required forward current on the IF(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.



SINUSOIDAL OPERATION

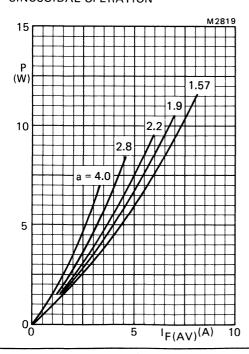


Fig.6 Power rating.

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.

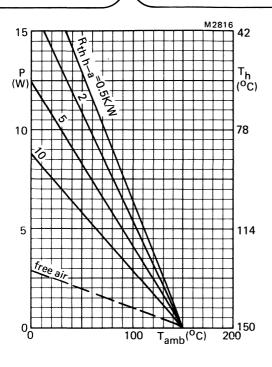


Fig.7 Heatsink rating; without heatsink compound.

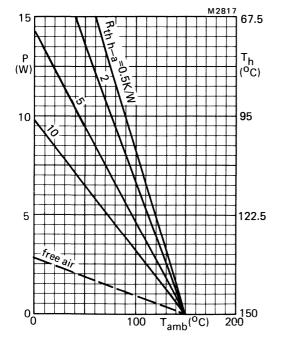


Fig.8 Heatsink rating; with heatsink compound.

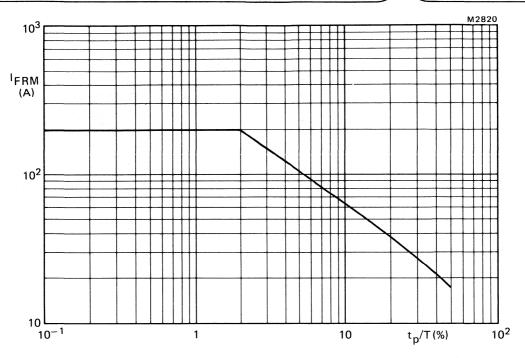
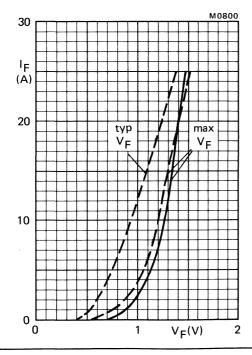


Fig.9 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 $\mu s < t_p < 1$ ms.



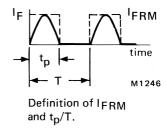


Fig.10 —— $T_j = 25$ °C; $---T_j = 100$ °C.

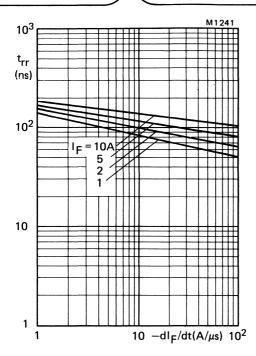
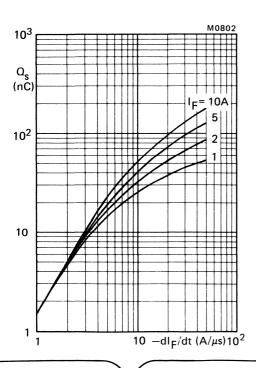


Fig.11 Maximum t_{rr} at $T_j = 25$ °C.



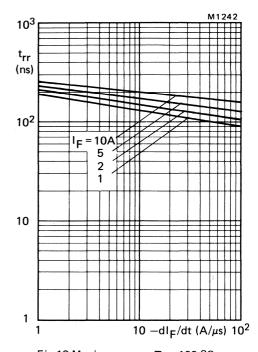


Fig.12 Maximum t_{rr} at $T_j = 100$ °C.

Fig.13 Maximum Q_s at T_j = 25 o C.

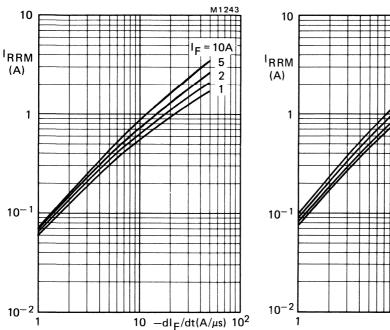


Fig.14 Maximum I $_{RRM}$ at T_{j} = 25 o C.

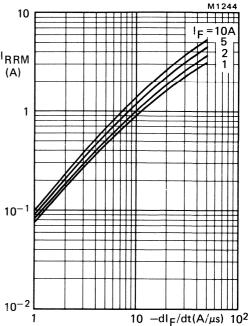


Fig.15 Maximum I_{RRM} at T_j = 100 °C.

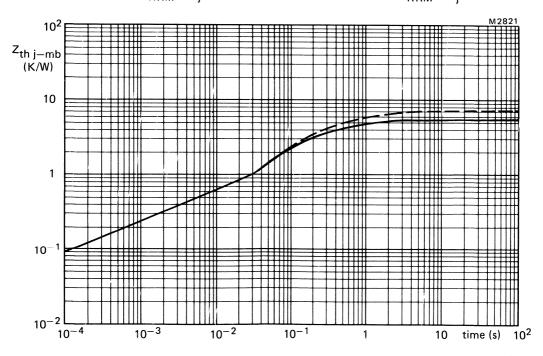


Fig. 16 Transient thermal impedance; —— with heatsink compound; -- without heatsink compound.



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

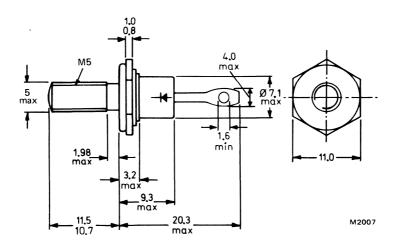
| | | | BYV30-300 | 400 | 500 | |
|---------------------------------|------------------|------|-----------|------|-----|----|
| Repetitive peak reverse voltage | V _{RRM} | max. | 300 | 400 | 500 | V |
| Average forward current | IF(AV) | max. | | 14 | | Α |
| Forward voltage | V_{F} | < | | 1.05 | | 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

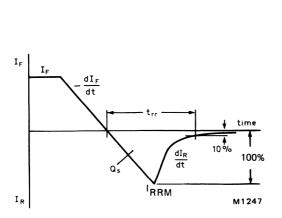
Limiting values in accordance with the Absolute Maximum System (IEC 134).

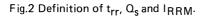
| Voltages | | BYV30-300 | 400 500 | V |
|--|----------------------|--------------|------------|---------|
| Non-repetitive peak reverse voltage | v_{RSM} | max. 350 | 450 550 | V |
| Repetitive peak reverse voltage | VRRM | max. 300 | 400 500 | V |
| Crest working reverse voltage | $v_{\sf RWM}$ | max. 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 | | | 4.4 | |
| square wave; δ = 0.5; up to T _{mb} = 113 °C up to T _{mb} = 125 °C | lF(AV) | max. max. | 14 10 | A |
| sinusoidal; up to T _{mb} = 118 ^o C up to T _{mb} = 125 ^o C | lF(AV) lF(AV) | max. max. | 12.5 10 | A A |
| R.M.S. forward current | IF(RMS) | max. | 20 | Α |
| Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ | ^I FRM | max. | 320 | Α |
| Non-repetitive peak forward current half sine-wave; $T_j = 150 ^{O}\text{C}$ prior to surge; with reapplied V_{RWMmax} ; $t = 10 \text{ms}$ $t = 8.3 \text{ms}$ | IFSM IFSM | max. max. | 150 180 | A A |
| I^2 t for fusing (t = 10 ms) | l²t | max. | 112 | $A^2 s$ |
| Temperatures | | | | |
| Storage temperature | T _{stg} | -6 | 65 to +175 | oC |
| Junction temperature | T_{j} | max. | 150 | oC |
| THERMAL RESISTANCE | | | | |
| From junction to mounting base | R _{th j-mb} | = 1 1 | 2.0 | K/W |
| From mounting base to heatsink with heatsink compound | R _{th mb-h} | = | 0.3 | K/W |
| From junction to ambient in free air | R _{th j-a} | = . | 50 | K/W |

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

CHARACTERISTICS

| Forward voltage $I_F = 15 \text{ A}$; $T_j = 150 ^{\circ}\text{C}$ $I_F = 50 \text{ A}$; $T_j = 25 ^{\circ}\text{C}$ | V _F V _F | < < | 1.05 1.40 | V* V* |
|---|----------------------------------|------|--------------|----------|
| Reverse current | | | | |
| $V_R = V_{RWM max}$; $T_j = 100 {}^{\circ}\text{C}$ $T_j = 25 {}^{\circ}\text{C}$ | I _R | < < | 0.8 50 | mA μA |
| Reverse recovery when switched from $I_F = 1$ A to $V_R \ge 30$ V with $-dI_F/dt = 100$ A/ μ s; $T_j = 25$ °C; recovery time | t _{rr} | < | 50 | ns |
| $I_F = 2 \text{ A to V}_R \geqslant 30 \text{ V with } -dI_F/dt = 20 \text{ A}/\mu\text{s};$ $T_j = 25 ^{\circ}\text{C}$; recovered charge | Os | < | 50 | nC |
| IF = 10 A to $V_R \ge 30 V$ with $-dI_F/dt = 50 A/\mu s$; $T_j = 100 ^{\circ}C$; peak recovery current | ^I RRM | | 5.2 | Α |
| Forward recovery when switched to $I_F = 10 \text{ A}$ with $dI_F/dt = 10 \text{ A}/\mu s$; $T_j = 25 ^{\circ}\text{C}$ | V _{fr} | typ. | 2.5 | V |





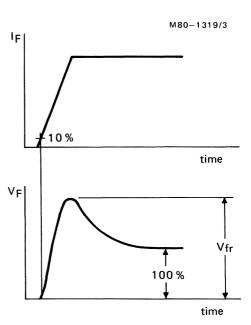


Fig.3 Definition of V_{fr} .

^{*}Measured under pulse conditions to avoid excessive dissipation.

SQUARE-WAVE OPERATION

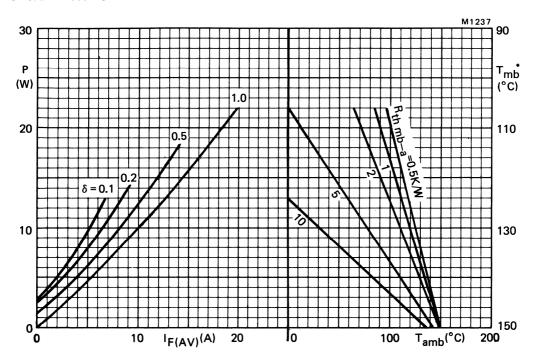


Fig.4 The right-hand part shows the relationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 100 kHz.

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

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

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

SINUSOIDAL OPERATION

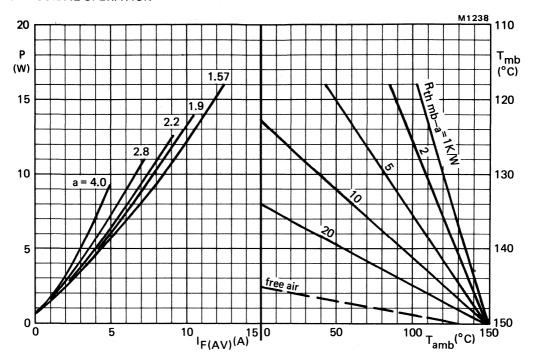


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures. $a = form \ factor = I_F(RMS)/I_F(AV)$.

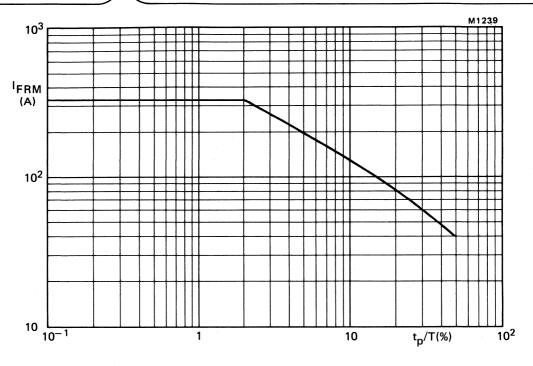
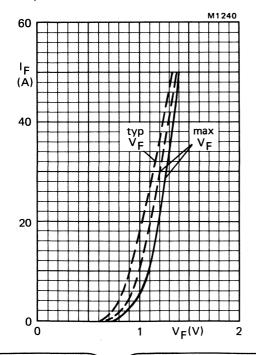
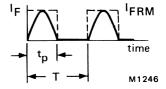


Fig.6 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 μ s < t $_p$ < 1 ms.





Definition of I_{FRM} and t_p/T .

Fig.7 —
$$T_j = 25 \, {}^{\circ}\text{C}; --- T_j = 150 \, {}^{\circ}\text{C}.$$

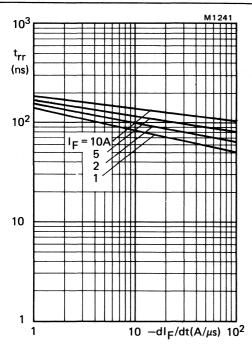
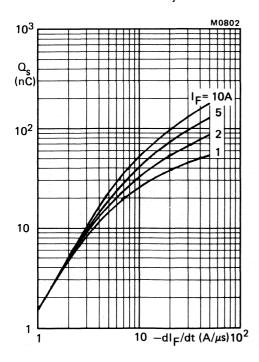


Fig.8 Maximum t_{rr} at $T_i = 25$ °C



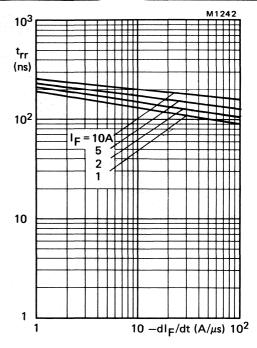


Fig.9 Maximum t_{rr} at $T_j = 100$ °C.

Fig.10 Maximum Q_s at $T_j = 25$ °C

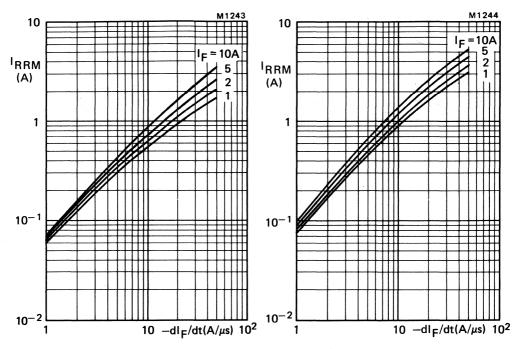


Fig.11 Maximum I_{RRM} at $T_j = 25$ °C

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

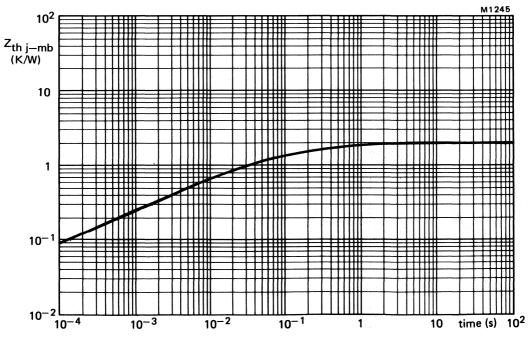


Fig. 13 Transient thermal impedance.

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 both low conduction and switching losses are essential. The series consists of normal polarity (cathode to stud) types.

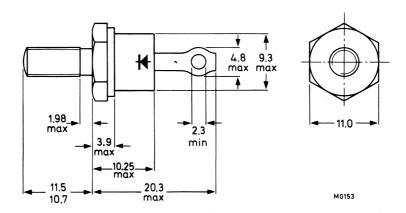
QUICK REFERENCE DATA

| | | | BYV31-300 | 400 | 500 | |
|---------------------------------|--------------------|------|-----------|------|-----|----|
| Repetitive peak reverse voltage | V _{RRM} | max | 300 | 400 | 500 | ٧ |
| Average forward current | I _{F(AV)} | max. | | 28 | | Α |
| Forward voltage | ٧F | < | | 1.05 | | V |
| Reverse recovery time | t _{rr} | < | | 50 | | ns |
| | | | | | | |

MECHANICAL DATA

Dimensions in mm

Fig.1 DO-4; with metric M5 stud (ϕ 5 mm); e.g. BYV31-500 with 10-32 UNF stud (ϕ 4.83 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 | ٧ |
| Repetitive peak reverse voltage | VRRM | max. | 300 | 400 | 500 | V |
| Crest working reverse voltage | VRWM | max. | 200 | 300 | 400 | V |
| Continuous reverse voltage* | VR | max. | 200 | 300 | 400 | V |
| Currents | | | | | | |
| Average forward current, switching losses negligible up to 100 kHz | | | | | | |
| square wave; $\delta = 0.5$; up to $T_{mb} = 11$ | | IF(AV) | | max. | 28 | Α |
| up to $T_{mb} = 12$ | 25 °C | IF(AV) | | max. | 20 | Α |
| sinusoidal; up to $T_{mb} = 119 {}^{\circ}C$ | | F(AV) | | max. | 25 | Α |
| up to T _{mb} = 125 °C | | IF(AV) | | max. | 21 | A |
| R.M.S. forward current | | IF(RMS) | | max. | 40 | Α |
| Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ | | IFRM | | max. | 550 | Α |
| Non-repetitive peak forward current half sine-wave; $T_j = 150$ °C prior to s with reapplied V_{RWMmax} ; | urge; | | | | | |
| t = 10 ms | | ^I FSM | | max. | 300 | Α |
| t = 8.3 ms | | ^I FSM | | max. | 360 | Α |
| l^2 t for fusing (t = 10 ms) | | l²t | | max. | 450 | A²s |
| Temperatures | | | | | | |
| Storage temperature | | T _{stg} | | -55 to | +150 | оС |
| Junction temperature | | Тj | | max. | 150 | оС |
| THERMAL RESISTANCE | | | | | | |
| From junction to mounting base | | R _{th j-mb} | | == | 1.0 | K/W |
| From mounting base to heatsink | | | | | | |
| a. with heatsink compound | | Rth mb-h | | = | 0.3 | K/W |
| b. without heatsink compound | | R _{th mb-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.

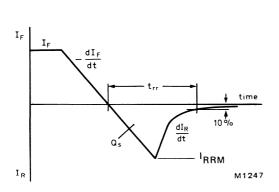
During soldering the heat conduction to the junction should be kept to a minimum.

^{*}To ensure thermal stability: R $_{th\ j\text{-}a}$ \leqslant 3.4 K/W.

CHARACTERISTICS

| Forward voltage $I_F = 30 \text{ A}; T_j = 150 ^{\circ}\text{C}$ $I_F = 100 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | (((|
|--|-------------|
| Reverse current $V_R = V_{RWM \ max}$; $T_j = 100 ^{o}\text{C}$ $T_j = 25 ^{o}\text{C}$ | 1 |
| Reverse recovery when switched from $I_F = 1 \text{ A to V}_R \geqslant 30 \text{ V with } -dI_F/dt = 100 \text{ A}/\mu\text{s};$ $T_j = 25 ^{\circ}\text{C};$ recovery time | 1 |
| $I_F = 2 \text{ A to } V_R \geqslant 30 \text{ V with } -dI_F/dt = 20 \text{ A}/\mu\text{s};$ $T_j = 25 ^{\circ}\text{C}$; recovered charge | (|
| I_F = 10 A to V_R \geqslant 30 V with $-dI_F/dt$ = 50 A/ μ s; T_j = 100 °C; peak recovery current | |
| Forward recovery when switched to I _F = 10 A with dI _F /dt = 10 A/ μ s; T _j = 25 °C | |

| V _F | < < < | 1.05 1.4 | V* V* |
|----------------------------------|-------|-------------|----------|
| I _R I _R | < | 2.0 50 | mΑ μΑ |
| | | | |
| t _{rr} | | 50 | ns |
| O _s | | 75 | nC |
| IRRM | | 4 | Α |
| V_{fr} | typ. | 2.5 | V |



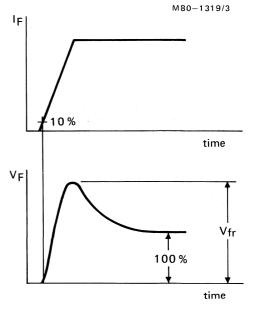


Fig.2 Definition of $t_{rr},\,\Omega_{s}$ and $I_{RRM}.$

Fig.3 Definition of V_{fr} .

^{*}Measured under pulse conditions to avoid excessive dissipation.

SQUARE-WAVE OPERATION

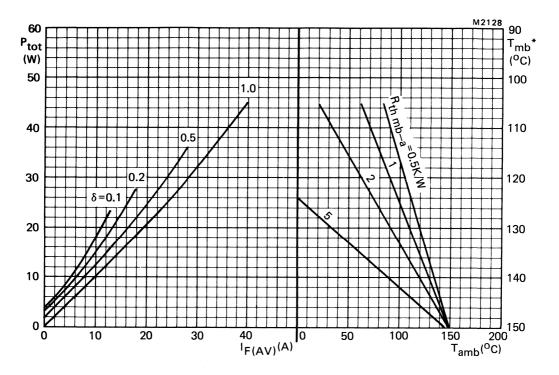


Fig.4 The right-hand part shows the relationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 100 kHz.

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

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

 $^{^*}T_{mb}$ scale is for comparison purposes and is correct only for R_{th mb-a} \leq 2.4 K/W.

SINUSOIDAL OPERATION

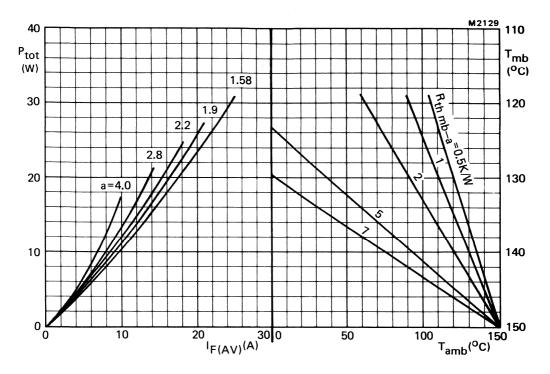


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures. $a = form \ factor = I_F(RMS)/I_F(AV)$.

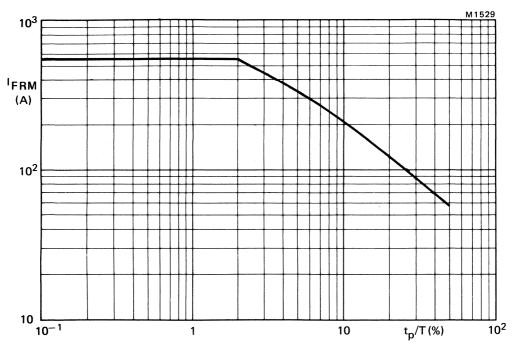
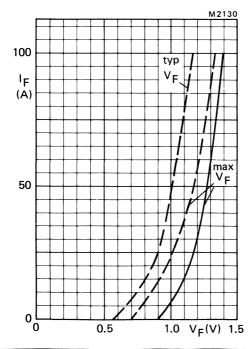


Fig.6 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 $\mu s < t_p < 1\, ms.$



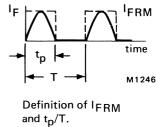


Fig.7 — $T_j = 25 \text{ }^{\circ}\text{C}; ---T_j = 150 \text{ }^{\circ}\text{C}.$

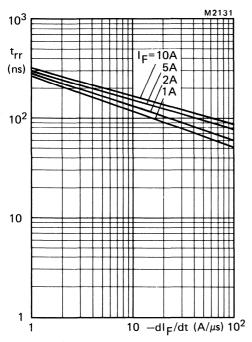


Fig.8 Maximum t_{rr} at $T_j = 25$ °C .

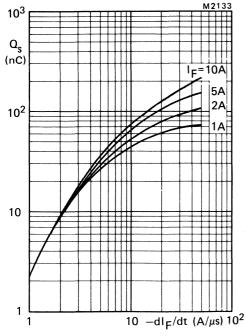


Fig.10 Maximum Q_s at $T_i = 25$ °C

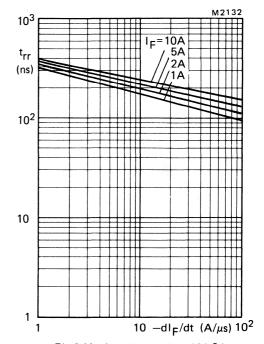
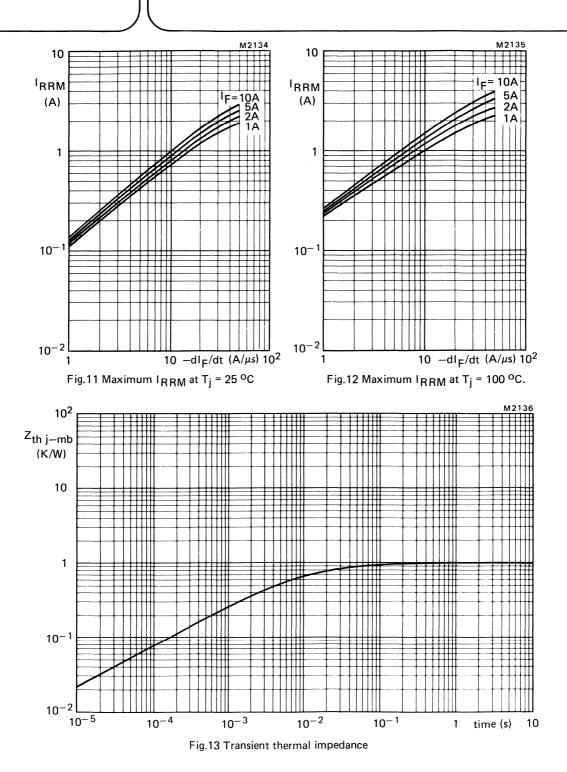


Fig.9 Maximum t_{rr} at $T_j = 100$ °C.



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ULTRA FAST RECOVERY DOUBLE RECTIFIER DIODES



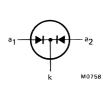
Glass-passivated, high-efficiency double rectifier diodes in plastic envelopes, featuring low forward voltage drop, ultra fast reverse recovery times and soft-recovery characteristic. They are intended for use in switched mode power supplies and high-frequency circuits in general, where both low conduction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

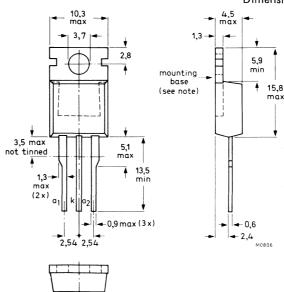
| Per diode, unless otherwise stated | | BYV32-50 | 100 | 150 | 200 | |
|---|-----------------|----------|-----|-----|-----|----|
| Repetitive peak reverse voltage | v_{RRM} | max. 50 | 100 | 150 | 200 | V |
| Output current (both diodes conducting) | l _O | max. | 2 | 0 | ; | Α |
| Forward Voltage | V _F | < | 8.0 | 5 | | V |
| Reverse recovery time | t _{rr} | < | 2 | 5 | | ns |

MECHANICAL DATA

Fig.1 TO-220AB.



Dimensions in mm



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.

BYV32 SERIES

RATINGS

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

| Voltages (per diode) | | BYV3 | 250 | 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 1 |
| Currents (both diodes conducting; note 2) | | | | | | | |
| Output current; switching | | | | | | | |
| losses negligible up to 500 kHz; | | | | | | | |
| square wave; $\delta = 0.5$; up to $T_{mb} = 118$ ^{O}C | l _O | max. | | 20 |) | | Α |
| square wave; $\delta = 0.5$; up to $T_{mb}^{mb} = 125$ °C | lo | max. | | 16.5 | 5 | | Α |
| sinusoidal; up to T _{mb} = 120 °C | lo | max. | | 18 | 3 | | Α |
| sinusoidal; up to $T_{mb} = 125$ ${}^{o}C$ | 10 | max. | | 16 | 6 | | Α |
| R.M.S. forward current | I _{F(RMS)} | max. | | 28 | 3 | | Α |
| Repetitive peak forward current | | | | | | | |
| t_p = 20 μ s, δ = 0.02 (per diode) | ^I FRM | max. | | 230 |) | | Α |
| 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 |) | | Α |
| t = 8.3 ms | ^I FSM | max. | | 160 |) , | | Α |
| I ² t for fusing (t = 10ms; per diode) | l ² t | max. | | 112 | 2 | | A²s |
| Temperatures | | | | | | | |
| Storage temperature | T _{stg} | | 40 | to +150 |) | | оС |
| Junction temperature | T _i | max. | | 150 |) | | οС |

Notes:

- 1. To ensure thermal stability, $R_{th\ j-a} <$ 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 | |
|---|--|
| $I_F = 5 A; T_i = 100 ^{O}C$ | |
| I _F = 20 A; T _i = 25 ^O C | |

V_F < 0.85 V* V_F < 1.15 V*

Reverse current

$$\begin{array}{lll} V_{R} = V_{RWM \; max}; \; T_{j} = 100 \; ^{O}C & I_{R} & < & 0.6 & mA \\ V_{R} = 200 \; V; \; T_{j} = 25 \; ^{O}C & I_{R} & < & 30 & \mu A \\ V_{R} \leqslant 150 \; V; \; T_{j} = 25 \; ^{O}C & I_{R} & < & 10 & \mu A \\ \end{array}$$

Reverse recovery when switched from

$$I_F = 1 \text{ A to V}_R \ge 30 \text{ V with } -dI_F/dt = 100 \text{ A}/\mu\text{s};$$

 $T_j = 25 \,^{O}\text{C}$; recovery time

I
$$_{F}$$
 = 2 A to V $_{R}$ \geqslant 30 V with —dI $_{F}/dt$ = 20 A/ μs ; T $_{i}$ = 25 ^{O}C ; recovered charge

$$I_F = 10 \text{ A to V}_F \geqslant 30 \text{ V with } -dI_F/dt = 50 \text{ A}/\mu\text{s};$$

 $T_i = 100 \,^{O}\text{C};$ peak recovery current

Forward recovery when switched to $I_F = 1A$ with $dI_F/dt = 10 A/\mu s$; $T_i = 25 \, ^{O}C$

M80-1319/3

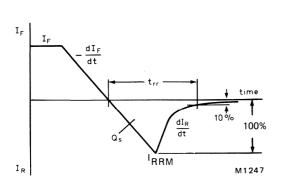


Fig.2 Definition of $t_{rr},\,Q_{s}$ and $I_{RRM}.$

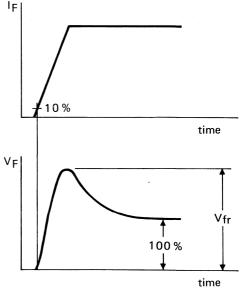


Fig.3 Definition of V_{fr} .

^{*}Measured under pulse conditions to avoid excessive dissipation

| THE | DM | VI D | FCICT | ANICE |
|-----|----|------|-------|-------|

| From junction to mounting base (both diodes conducting) | R _{th j-mb} | = | 1.6 | K/W | |
|---|----------------------|---|-----|-----|--|
| From junction to mounting base (per diode) | R _{th j-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-h} | = | 0.3 | K/W | |
| with heatsink compound and 0.06 mm maximum mica insulator | R _{th mb-h} | = | 1.4 | K/W | |
| c. with heatsink compound and 0.1 mm maximum mica insulator (56369) | R _{th mb-h} | = | 2.2 | K/W | |
| d. with heatsink compound and 0.25 mm maximum alumina insulator (56367) | R _{th mb-h} | = | 0.8 | K/W | |
| e. without heatsink compound | R _{th mb-h} | = | 1.4 | K/W | |
| 2. Free air operation | | | | | |
| The quoted values of $R_{th\ j-a}$ 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-a} | = | 60 | K/W | |

MOUNTING INSTRUCTIONS

- 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.
- 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:

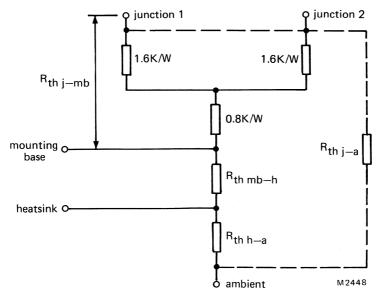


Fig.4

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

SQUARE-WAVE OPERATION (PER DIODE)

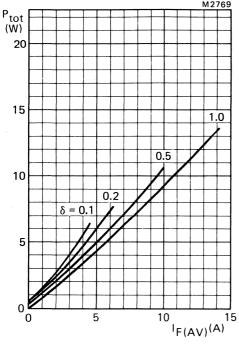
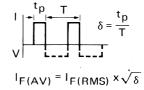


Fig. 5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.



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

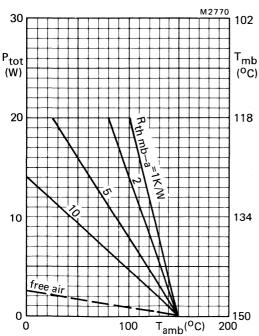


Fig.6

SINUSOIDAL OPERATION (PER DIODE)

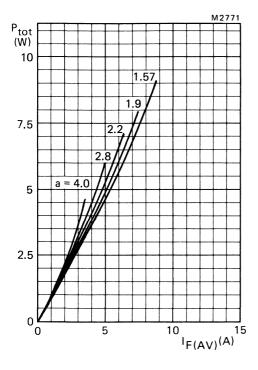


Fig.7 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.

 $a = form factor = I_F(RMS)/I_F(AV)$

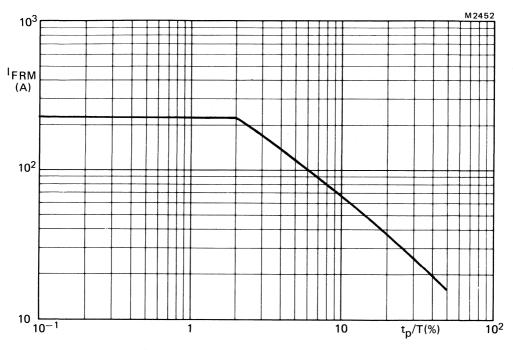
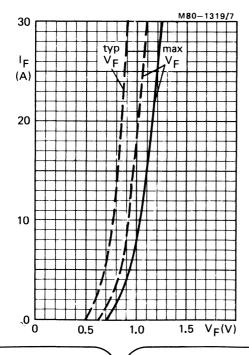
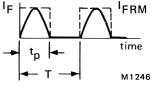


Fig.8 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 μ s < t $_p$ < 1 ms; per diode.





Definition of I_{FRM} and t_p/T .

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

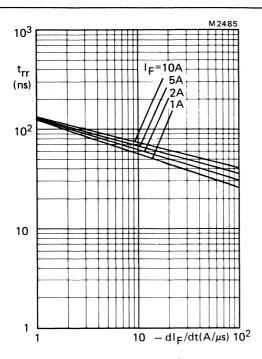
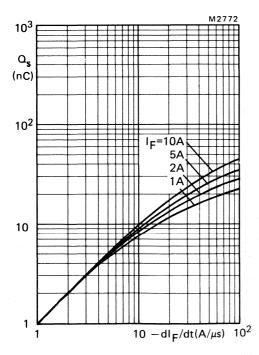


Fig.10 Maximum t_{rr} at $T_i = 25$ °C; per diode.



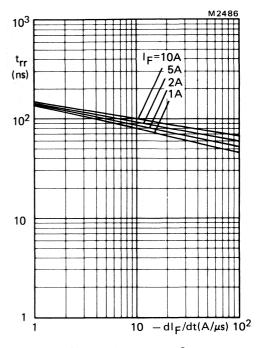


Fig.11 Maximum t_{rr} at $T_j = 100$ °C; per diode.

Fig.12 Maximum Q_s at $T_j = 25$ ^{o}C ; per diode.

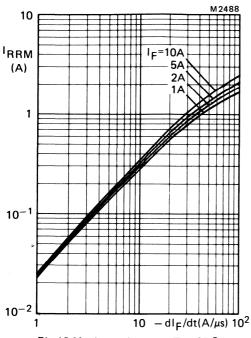


Fig.13 Maximum I_{RRM} at $T_j = 25$ °C; per diode.

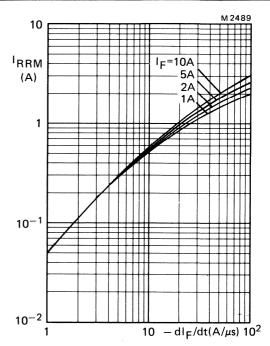


Fig.14 Maximum I_{RRM} at T_j = 100 °C; per diode.

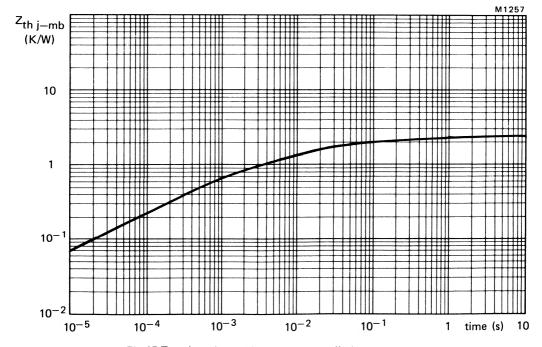


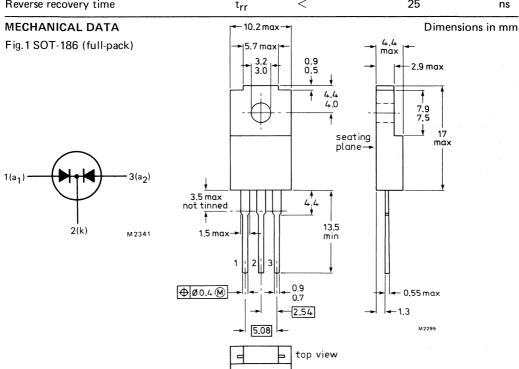
Fig.15 Transient thermal impedance; one diode conducting.

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 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 | | BYV3 | 2F-50 | 100 | 150 | 200 | |
|---|-----------------|------|-------|-----|-----|-----|----------|
| Repetitive peak reverse voltage | VRRM | max. | 50 | 100 | 150 | 200 | V |
| Output current (both diodes conducting) | IO | max. | 1000 | | 12 | | A |
| Forward voltage | VF | < | | 0.8 | 85 | | V |
| Reverse recovery time | t _{rr} | < | | | 25 | | ns |



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).

BYV32F SERIES

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 | VR | 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 $T_h = 92$ °C | 0 | max. | | | 2 | | Α |
| sinusoidal; up to T _h = 100 °C | 10 | max. | | 10 | .6 | | Α |
| R.M.S. forward current | ^I F(RMS) | max. | | . • | 12 | | Α |
| Repetitive peak forward current | l== | | | 1.5 | | | • |
| $t_p = 20 \ \mu s, \ \delta = 0.02 \ (per \ diode)$ | ^I FRM | max. | | 15 | 55 | | Α |
| Non-repetitive peak forward current half sine-wave; T _j = 150 °C prior to surge; with reapplied V _{RWM max} ; | | | | | | | |
| t = 10 ms (per diode) | ^I FSM | max. | | 15 | 0 | | Α |
| t = 8.3 ms (per diode) | ^I FSM | max. | | 16 | 0 | | Α |
| I^2 t for fusing (t = 10 ms; per diode) | l²t | max. | | 11 | 2 | | A^2s |
| Temperatures | | | | | | | |
| Storage temperature | T _{stg} | | -4 | 0 to +15 | 0 | | оС |
| Junction temperature | Tj | max. | | 15 | 0 | | оС |
| ISOLATION | | | | | | | |
| Peak isolation voltage from all | | | | | | | |
| terminals to external heatsink | V_{isol} | max. | | 100 | 0 | | V |
| Isolation capacitance from cathode | | | | | | | |
| to external heatsink (see note 4) | c_p | typ. | | 1 | 2 ; | | рF |

Notes

- 1. To ensure thermal stability: $R_{th\;j\text{-a}}\!<\!6.3$ K/W for continuous reverse voltage.
- 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

with heatsink compound

| R _{th j-h} | = | 7.0 | K/W |
|---------------------|---|-----|-----|
| R _{th i-h} | = | 5.0 | K/W |

<

<

<

<

55

0.85

1.15

0.6

30

10

25

12.5

2

K/W

μA **→**

µA ◆

ns

nC

Α

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.

R_{th i-a}

 V_{F}

٧F

۱R

1R

 I_{R}

trr

 Q_{s}

IRRM

Thermal resistance from junction to ambient

in free air, device mounted on a printed circuit board

| CHA | | |
|-----|--|--|
| | | |
| | | |

| Forward | vo | ltage |
|---------|----|-------|
|---------|----|-------|

$$I_F = 5 \text{ A}; T_j = 100 \text{ }^{\text{O}}\text{C}$$

 $I_F = 20 \text{ A}; T_j = 25 \text{ }^{\text{O}}\text{C}$

Reverse current

$$V_R = V_{RWM \ max}; T_j = 100 \, ^{o}C$$

 $V_R = 200 \, V; T_j = 25 \, ^{o}C$
 $V_R \le 150 \, V; T_j = 25 \, ^{o}C$

Reverse recovery when switched from

$$I_F$$
 = 1 A to $V_R \ge 30$ V with $-dI_F/dt$ = 100 A/ μ s; T_i = 25 o C; recovery time

$$I_F = 2 \text{ A to } V_R \geqslant 30 \text{ V with } -dI_F/dt = 20 \text{ A}/\mu\text{s};$$

$$I_F = 10 \text{ A to V}_R \geqslant 30 \text{ V with } -dI_F/dt = 50 \text{ A}/\mu\text{s};$$

$$T_j = 100$$
 °C; peak recovery current

Forward recovery when switched to
$$I_F = 1$$
 A with $dI_F/dt = 10$ A/ μ s; $T_j = 25$ °C

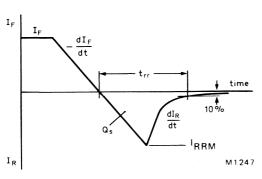


Fig.2 Definition of t_{rr} , Q_s and I_{RRM} .



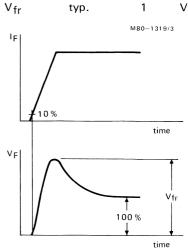


Fig.3 Definition of V_{fr}.

MOUNTING INSTRUCTIONS

- 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-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:

 Maximum torque to avoid damage to the device:

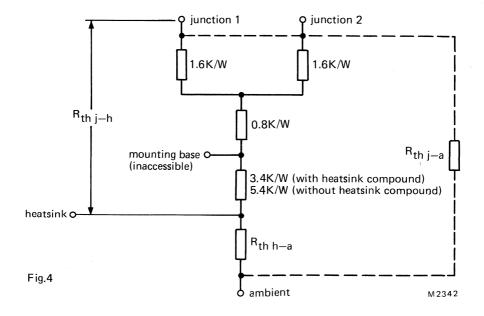
 5.5 kgf (0.55 Nm)

 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-h} given for mounting with heatsink compound refer to the use of a metallic-oxide loaded compound. Ordinary silicone grease is not recommended.
- 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

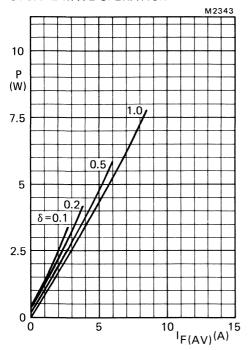
Dissipation and heatsink considerations:

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



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

SQUARE-WAVE OPERATION



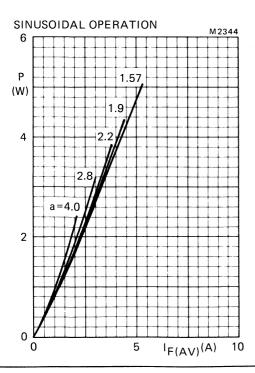


Fig.5 Power rating.

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.

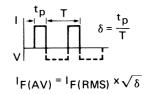


Fig.6 Power rating.

The individual power loss in each diode should first be determined from the required forward current on the IF(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.

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

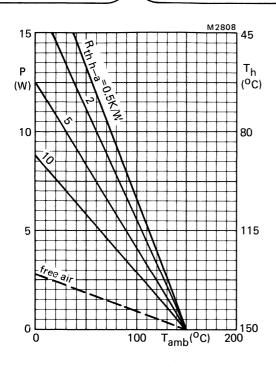


Fig.7 Heatsink rating. Without heatsink compound.

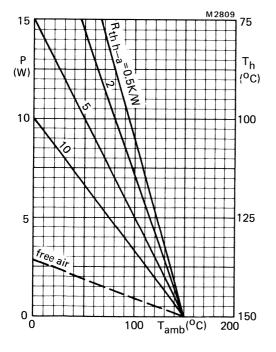


Fig.8 Heatsink rating. With heatsink compound.

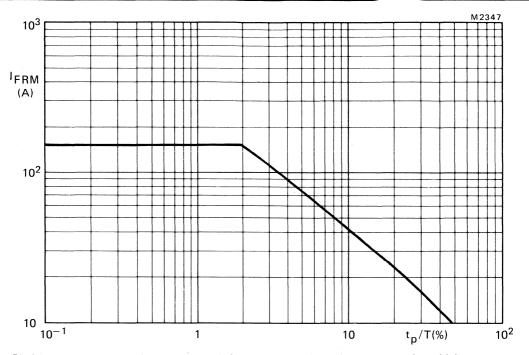
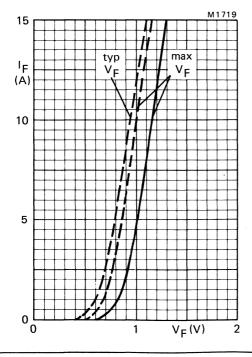
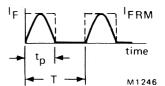


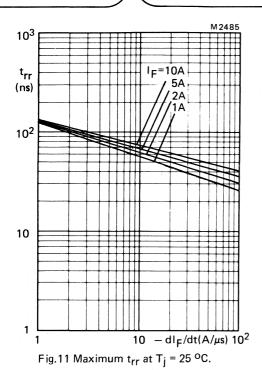
Fig.9 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 μs < t_p < 1 ms.

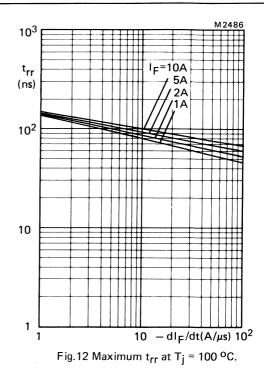




Definition of IFRM and $t_{\mbox{\footnotesize p}}/T$

Fig.10 —
$$T_j$$
 = 25 °C; $---T_j$ = 150 °C per diode.





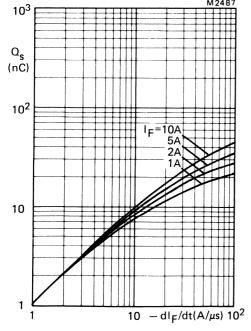


Fig.13 Maximum Q_s at $T_j = 25$ °C.

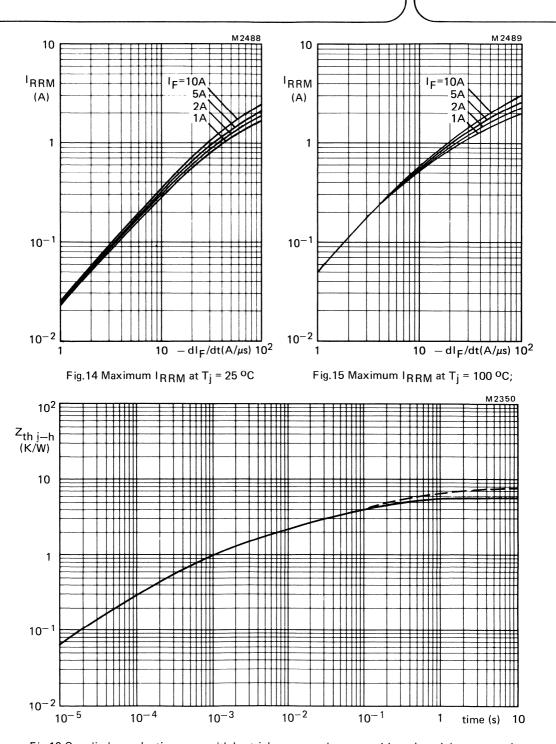


Fig.16 One diode conducting; —— with heatsink compound; -- without heatsink compound.

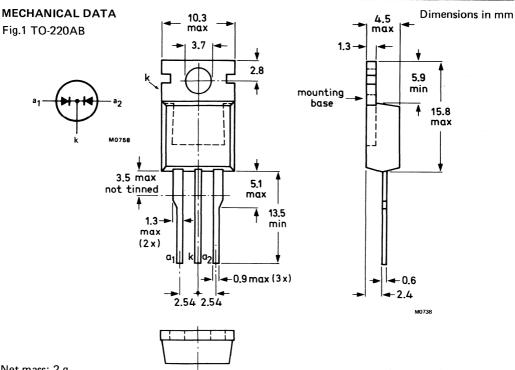


ULTRA FAST RECOVERY DOUBLE RECTIFIER DIODES

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 | ٧ |
| Output current (both diodes conducting) | 10 | max. | 20 | <u> </u> | А |
| Forward voltage | ٧F | < | 0.93 | | V |
| Reverse recovery time | t _{rr} | < | 50 | | ns |



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.

BYV34 SERIES

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 ${}^{o}C$ up to T_{mb} = 125 ${}^{o}C$ | 10 10 | max. max. | | 20 14 | | A A |
| sinusoidal; up to T_{mb} = 120 o C up to T_{mb} = 125 o C | l ₀ l ₀ | max. max. | | 17.5 14 | | A A |
| R.M.S. forward current | IF(RMS) | max. | | 28 | | Α |
| Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ (note 3) | I _{FRM} | max. | | 240 | | A |
| Non-repetitive peak forward current (per diode) half sine-wave; T _j = 150 ^O C prior to surge with re-applied V _{RWM max} | | | | | | |
| t = 10 ms t = 8.3 ms | I _{FSM} I _{FSM} | max. | | 120 150 | | A A |
| I^2 t for fusing (t = 10 ms; per diode) | l²t | max. | | 72 | | A^2s |
| Temperatures | | | | | | |
| Storage temperature | T _{stg} | | 40 to | +150 | | οС |
| Junction temperature | Tj | max. | | 150 | | oC |
| | | | | | | |

Notes

- 1. To ensure thermal stability: $\rm R_{th~j-a}\,{<}\,4.5~K/W.$
- 2. The limits for both diodes apply whether both diodes conduct simultaneously or on alternate half cycles.

CHARACTERISTICS (per diode)

| $I_F = 10 \text{ A}; T_j = 150 ^{\circ}\text{C}$ | V _F | < | 0.93 | ٧* |
|--|----------------|---------|------|----|
| $I_F = 30 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | ٧F | $_{1}<$ | 1.4 | V* |

Reverse current

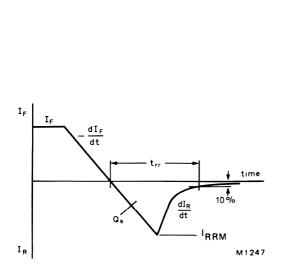
$$\begin{aligned} &\text{V}_{\text{R}} = \text{V}_{\text{RWM max}}; \text{T}_{j} = 100 \text{ }^{\text{O}\text{C}} & \text{I}_{\text{R}} & < & 0.6 & \text{mA} \\ &\text{V}_{\text{R}} = \text{V}_{\text{RWM max}}; \text{T}_{j} = 25 \text{ }^{\text{O}\text{C}} & \text{I}_{\text{R}} & < & 50 & \mu\text{A} \end{aligned}$$

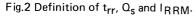
Reverse recovery when switched from

IF = 1 A to VR
$$\geqslant$$
 30 V with $-dI_F/dt$ = 100 A/ μ s; T $_j$ = 25 °C recovery time IF = 2 A to VR \geqslant 30 V with $-dI_F/dt$ = 20 A/ μ s; T $_j$ = 25 °C recovered charge IF = 10 A to VR \geqslant 30 V with $-dI_F/dt$ = 50 A/ μ s; T $_j$ = 100 °C peak recovery current

Forward recovery when switched to I_F = 10 A with dI_F/dt = 10 A/
$$\mu$$
s; T_j = 25 °C recovery voltage

$$t_{rr}$$
 < 0 0 0 ns





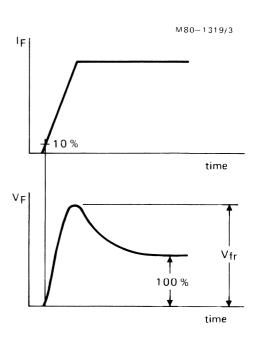


Fig.3 Definition of Vfr.

^{*}Measured under pulse conditions to avoid excessive dissipation.

| THERMAL RESISTANCE | | | | |
|--|----------------------|---------|---------|---------|
| From junction to mounting base (both diodes conducting) | R _{th j-mb} | = | 1.6 | K/W |
| From junction to mounting base (per diode) | R _{th j-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-h} | = | 0.3 | K/W |
| b. with heatsink compound and 0.06 mm maximum mica | | | | |
| insulator | R _{th mb-h} | _ | 1.4 | K/W |
| c. with heatsink compound and 0.1 mm maximum mica | _ | | | |
| insulator (56369) | R _{th} mb-h | = | 2.2 | K/W |
| d. with heatsink compound and 0.25 mm maximum | р | _ | 0.0 | L /M |
| alumina insulator (56367) | R _{th mb-h} | = | 8.0 | K/W |
| e. without heatsink compound | R _{th} mb-h | = | 1.4 | K/W |
| 2. Free air operation | | | | |
| The quoted value of $R_{th\ j-a}$ should be used only when no leads of | of other dissipat | ing cor | mponent | s 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 | | | 60 | 12 (14) |
| length and with copper laminate on the board | R _{th j-a} | = | 60 | K/W |

R_{th j-a}

MOUNTING INSTRUCTIONS

- 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.
- 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

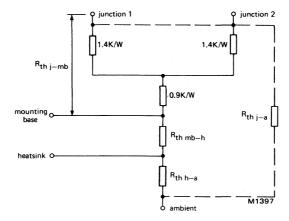


Fig.4

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

SQUARE-WAVE OPERATION (PER DIODE)

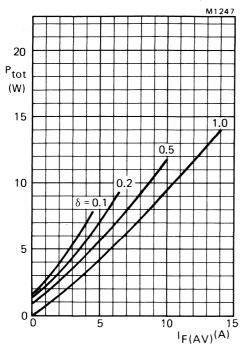
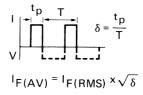


Fig.5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.



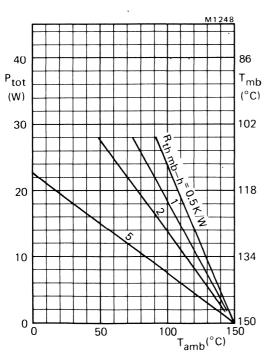


Fig.6



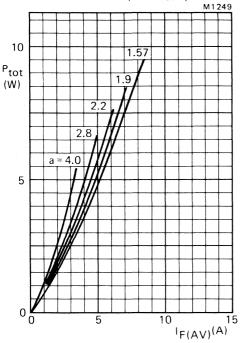


Fig.7 Power rating per diode. The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.

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

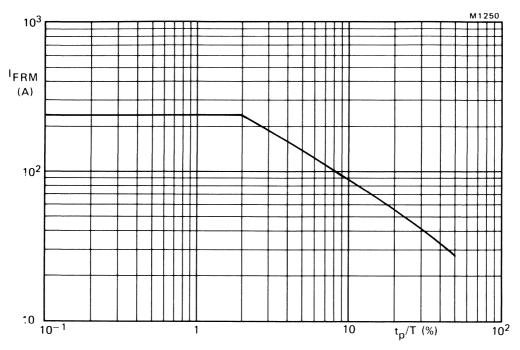
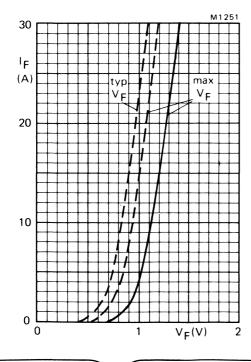
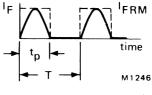


Fig.8 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 μ s < t $_p$ < 1 ms.(per diode).





Definition of IFRM and t_p/T

Fig. 9 —
$$T_j = 25$$
 °C; — $-T_j = 150$ °C (per diode).

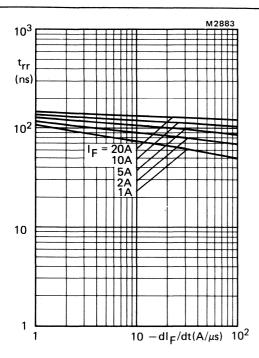
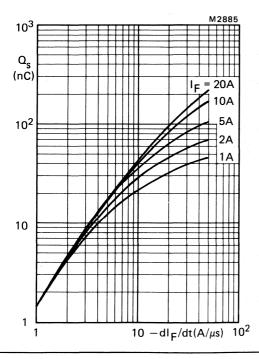


Fig. 10 Maximum t_{rr} at $T_j = 25$ °C. (per diode).



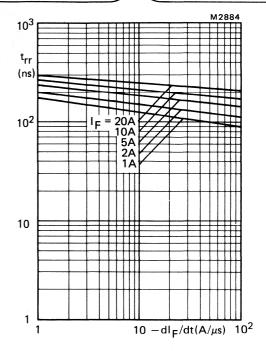


Fig.11 Maximum t_{rr} at $T_j = 100$ °C. (per diode).

Fig.12 Maximum Q_s at T_j = 25 °C. (per diode).

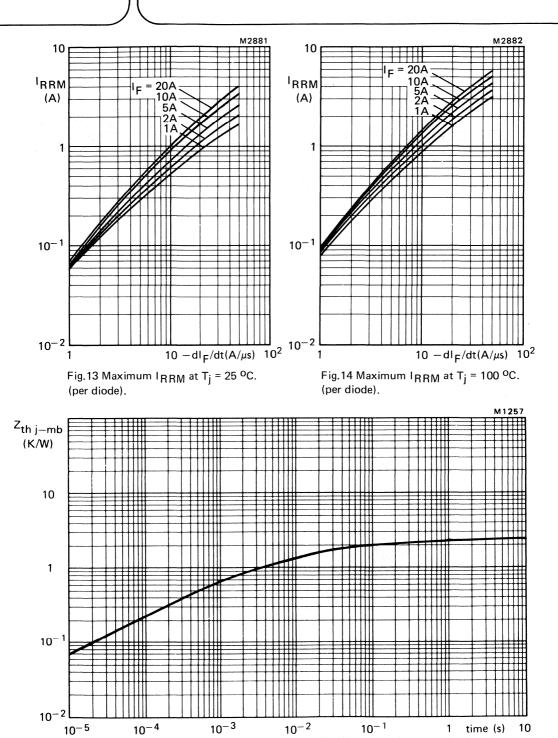


Fig. 15 One diode conducting (per diode).

time (s)

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.

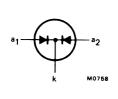
QUICK REFERENCE DATA

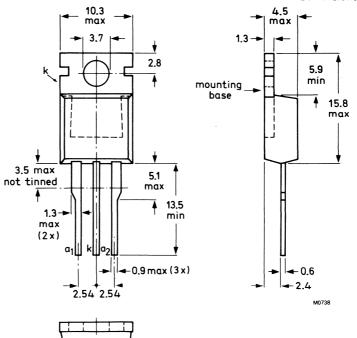
| | BYV4: | 2–50 | 100 | 150 | 200 | |
|-----------------|----------------------------------|--|---------|---|--|--|
| v_{RRM} | max. | 50 | 100 | 150 | 200 | V |
| 10 | max. | | | 30 | | А |
| ٧F | < | | 0.8 | 35 | | V |
| t _{rr} | < | | 2 | 28 | | ns |
| | I _O V _F | V _{RRM} max. I _O max. V _F < | IO max. | V _{RRM} max. 50 100 I _O max. 3 V _F < 0.8 | V _{RRM} max. 50 100 150 I _O max. 30 V _F < 0.85 | V _{RRM} max. 50 100 150 200 10 max. 30 V _F < 0.85 |

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.

BYV42 SERIES

RATINGS

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

| Voltages (per diode) | | BYV42 | -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 | ٧ |
| Currents (both diodes conducting: note 1) | | | *************************************** | | | | |
| Output current; switching losses negligible up to 500 kHz; square wave; $\delta = 0.5$; | | | | | | | |
| up to $T_{mb} = 104$ °C (note 2) | 10 | max. | | 3 | 30 | | Α |
| R.M.S. forward current (note 2) | IF(RMS) | max. | | 4 | 13 | | Α |
| Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ (per diode) | I _{FRM} | max. | | 32 | 20 | | Α |
| 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 | IFSM | max. | | 20 | 00 | | Α |
| t = 8.3 ms | ^I FSM | max. | | 22 | 20 | | Α |
| I^2 t for fusing (t = 10 ms; per diode) | l²t | max. | | 20 | 00 | | A^2s |
| Temperatures | | | | | | | |
| Storage temperature | T _{stg} | | -40 |) to +15 | 50 | | oC |
| Junction temperature | Tj | max. | | 15 | 50 | | оС |
| | | | | | | | |

Notes:

- 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_i = 25 °C unless otherwise stated

Forward voltage

| I _F = 10 A; T _j = 100 °C I _F = 30 A | |
|--|----|
| Reverse current $V_R = V_{RWM \ max}$; $T_j = 100 \ ^{o}C$ $V_R = V_{RWM \ max}$ | |
| Reverse recovery when switched from $I_F = 1 \text{ A to V}_R \geqslant 30 \text{ V with } -dI_F/dt = 100 \text{ A}/\mu\text{s}$ recovery time | 3; |
| I _F = 2 A to V _R \geqslant 30 V with -dI _F /dt = 20 A/ μ s; recovered charge | |
| $I_F = 10 \text{ A to V}_R \geqslant 30 \text{ V with } -dI_F/dt = 50 \text{ A/}\mu\text{s}$ $T_j = 100 ^{\circ}\text{C}$; peak recovery current | 3; |

Forward recovery when switched to $I_F = 1$ A

with $dI_F/dt = 10 A/\mu s$

| V _F | < < | 0.85 1.15 | V* V* |
|-----------------|------|--------------|----------|
| I _R | < < | 1.0 100 | mΑ μΑ |
| t _{rr} | < | 28 | ns |
| Os | < | 15 | nC |
| IRRM | < | 2.4 | A |
| V_{fr} | typ. | 1.0 | V |

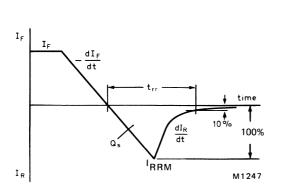


Fig.2 Definition of $t_{rr},\,\Omega_s$ and $I_{\mbox{\footnotesize{RRM}}}.$

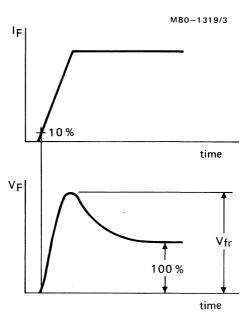


Fig.3 Definition of V_{fr} .

^{*}Measured under pulse conditions to avoid excessive dissipation.

BYV42 SERIES

| THERMAL RESISTANCE | | | | |
|--|----------------------|--------|---------|-------|
| From junction to mounting base (both diodes conducting) | R _{th j-mb} | = | 1.4 | K/W |
| From junction to mounting base (per diode) | R _{th j-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-h} | = | 0.3 | K/W |
| with heatsink compound and 0.06 mm maximum mica insulator | R _{th mb-h} | · = | 1.4 | K/W |
| with heatsink compound and 0.1 mm maximum mica insulator (56369) | R _{th mb-h} | = 1 | 2.2 | K/W |
| d. with heatsink compound and 0.25 mm maximum alumina insulator (56367) | R _{th mb-h} | = | 0.8 | K/W |
| e. without heatsink compound | R _{th mb-h} | = | 1.4 | K/W |
| 2. Free air operation | | | | |
| The quoted value of $R_{th\ j-a}$ should be used only when no leads of to the same tie point. Thermal resistance from junction to ambient in free air: mounted on a printed circuit board at any device lead | other dissipati | ng cor | nponent | s run |
| length and with copper laminate on the board | R _{th j-a} | = | 60 | K/W |

MOUNTING INSTRUCTIONS

- 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.
- 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

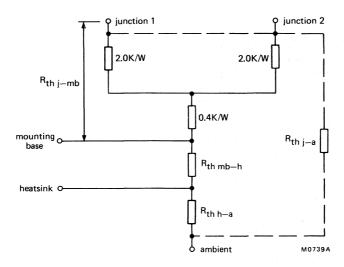


Fig. 4

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

SQUARE-WAVE OPERATION (PER DIODE)

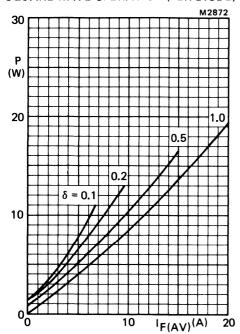
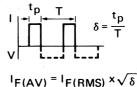


Fig.5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.



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

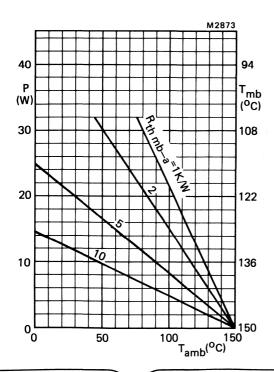


Fig.6.

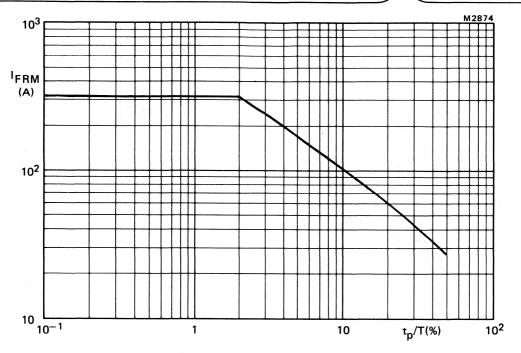
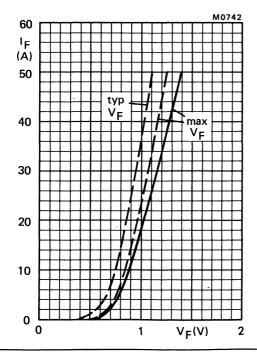
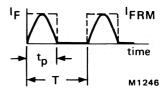


Fig.7 Maximum permissible repetitive peak forward current for square or sinusoidal currents for 1 μ s < t $_p$ < 1 ms; per diode.





Defintion of I $_{\mbox{\scriptsize FRM}}$ and $t_{\mbox{\scriptsize p}}/\mbox{\scriptsize T}.$

Fig.8 —
$$T_j$$
 = 25 °C; $---T_j$ = 100 °C; per diode.

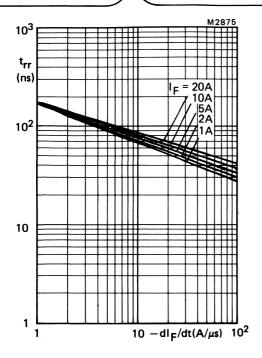
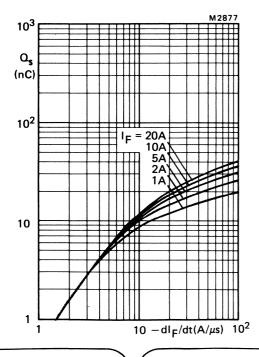


Fig.9 Maximum t_{rr} at T_j = 25 o C; per diode.



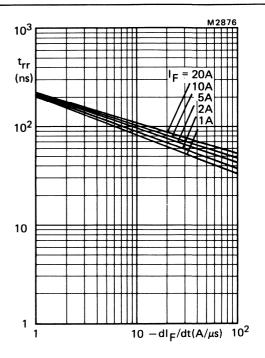


Fig. 10 Maximum t_{rr} at $T_j = 100$ °C; per diode.

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

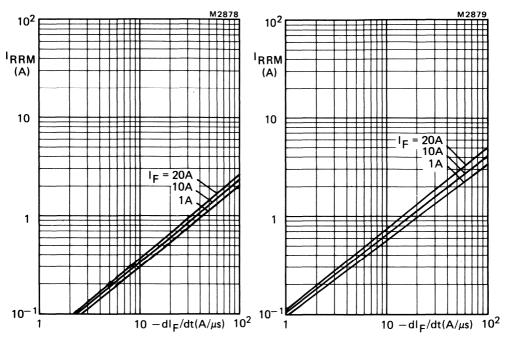


Fig.12 Maximum I_{RRM} at $T_j = 25$ °C; per diode.

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

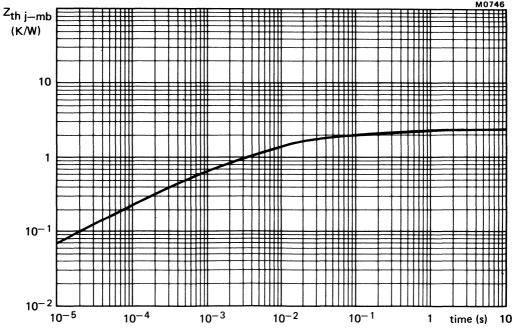


Fig. 14 Transient thermal impedance; one diode conducting.



Dimensions in mm

ULTRA FAST RECOVERY DOUBLE RECTIFIER DIODES

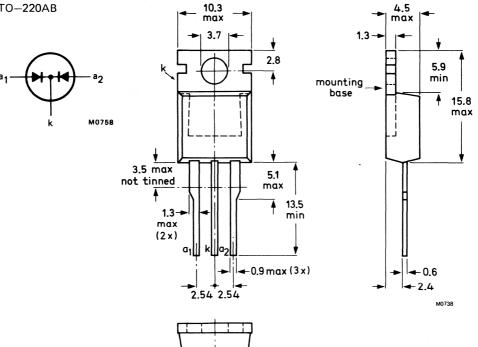
Glass-passivated, high-efficiency double rectifier diodes in plastic envelopes, featuring low forward voltage drop, ultra fast reverse recovery times and soft-recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction 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 | | BYV44-3 | 800 400 50 | <u>o</u> v |
| Repetitive peak reverse voltage | V _{RRM} | max. 3 | 800 400 50 | 0 V |
| Output current | | | | |
| (both diodes conducting) | 10 | max. | 30 | Α |
| Forward voltage | v_{F} | $<^{\frac{1}{2}}$ | 1.05 | V |
| Reverse recovery time | t _{rr} | < | 50 | ns |
| | | | | |

MECHANICAL DATA

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.

BYV44 SERIES

RATINGS

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

| | Voltages (per diode) | | BYV4 | 4-300 | 400 | 500 | | |
|---|---|------------------|------|--------|------|-----|------------------|---|
| - | Non-repetitive peak reverse voltage | V_{RSM} | max. | 350 | 450 | 550 | V | |
| | Repetitive peak reverse voltage | VRRM | max. | 300 | 400 | 500 | V | |
| | Crest working reverse voltage | V _{RWM} | max. | 200 | 300 | 400 | V | |
| | Continuous reverse voltage (note 1) | VR | max. | 200 | 300 | 400 | V | |
| | Currents (both diodes conducting; note 2) | | | | | | | |
| | Output current; switching losses negligible up to 200 kHz; | | | | | | | |
| | square wave; $\delta = 0.5$; up to $T_{mb} = 92$ °C (note 3) | 10 | max. | | 30 | | Α | |
| | sinusoidal; up to $T_{mb} = 103$ °C (note 3) | 10 | max. | | 26 | | Α | |
| - | R.M.S. forward current (note 3) | IF(RMS) | max. | | 30 | | Α | |
| | Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ (per diode) | ^I FRM | max. | | 320 | | Α | |
| | 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. | | 150 | | Α | |
| | t = 8.3 ms | ^I FSM | max. | | 180 | | Α | |
| | I^2 t for fusing (t = 10 ms; per diode) | 12 t | max. | | 112 | | A ² s | ; |
| | Temperatures | | | | | | | |
| | Storage temperature | T _{stg} | | -40 to | +150 | | oC | |
| | Junction temperature | Tj | max. | | 150 | | oC | |
| | | | | | | | | |

Notes:

- 1. To ensure thermal stability: $R_{\mbox{th j-a}} < 9.3 \mbox{ K/W}.$
- 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.

| Forward voltage | | | | |
|--|-------------------------|---|------|----|
| I _F = 15 A; T _i = 150 °C | VF | < | 1.05 | V* |
| I _F = 50 A | VF | < | 1.4 | V* |
| Reverse current | | | | |
| $V_R = V_{RWM max}$; $T_j = 100 {}^{\circ}C$ | IR | < | 0.8 | mA |
| $V_R = V_{RWM max}$ | I _R | < | 50 | μΑ |
| Reverse recovery when switched from | | | | |
| $I_F = 1 \text{ A to V}_R \geqslant 30 \text{ V with } -dI_F/dt = 100 \text{ A}/\mu\text{s};$ recovery time | t _{rr} a see a | , , <u>, , , , , , , , , , , , , , , , , </u> | 50 | ns |
| $I_F = 2 \text{ A to } V_R \geqslant 30 \text{ V with } -dI_F/dt = 20 \text{ A}/\mu\text{s};$ recovered charge | O _s | <_ | 50 | nC |
| I_F = 10 A to $V_R \ge 30$ V with $-dI_F/dt$ = 50 A/ μ s; T_j = 100 o C; peak recovery current | IRRM | < | 5.2 | A |
| Forward recovery when switched to $I_F = 10 \text{ A}$ with $dI_F/dt = 10 \text{ A}/\mu s$; | | | | |
| recovery voltage | V_{fr} | typ. | 2.5 | V |

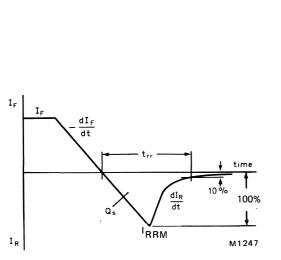


Fig.2 Definition of $t_{rr},\ Q_{s}$ and I_{RRM}

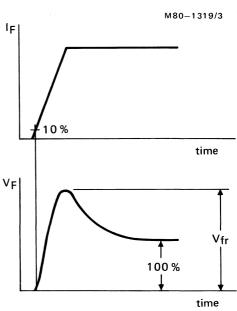


Fig.3 Definition of V_{fr} .

^{*}Measured under pulse conditions to avoid excessive dissipation.

| THERMAL RESISTANCE | | | | |
|---|----------------------|---------|---------|--------|
| From junction to mounting base (both diodes conducting) | R _{th j-mb} | = | 1.4 | K/W |
| From junction to mounting base (per diode) | R _{th j-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-h} | = | 0.3 | K/W |
| with heatsink compound and 0.06 mm maximum mica insulator | R _{th mb-h} | = | 1.4 | K/W |
| with heatsink compound and 0.1 mm maximum mica insulator (56369) | R _{th} mb-h | . = | 2.2 | K/W |
| d. with heatsink compound and 0.25 mm maximum alumina insulator (56367) | Rth mb-h | = | 0.8 | K/W |
| e. without heatsink compound | R _{th mb-h} | · . = | 1.4 | K/W |
| 2. Free-air operation | | | | |
| The quoted value of $R_{th\ j-a}$ should be used only when no leads of to the same tie point. Thermal resistance from junction to ambient in free air: mounted on a printed circuit board at any device lead | other dissipat | ing cor | mponent | ts run |
| length and with copper laminate on the board. | R _{th j-a} | = | 60 | K/W |

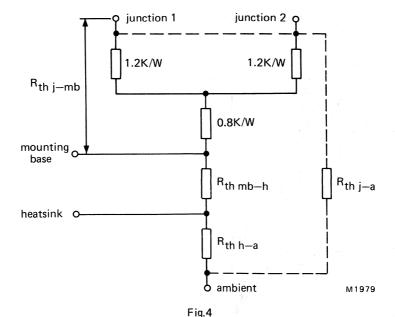
MOUNTING INSTRUCTIONS

- 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.
- 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:



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

SQUARE-WAVE OPERATION

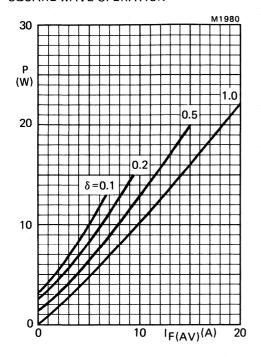
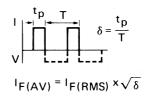


Fig.5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.

Power includes reverse current losses and switching losses up to f = 100 kHz.



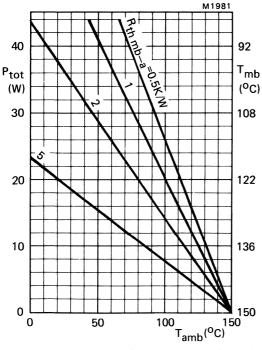


Fig.6

SINUSOIDAL OPERATION

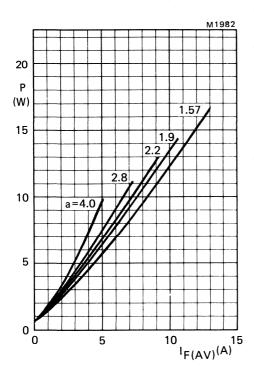


Fig.7 Power rating per diode.

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.

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

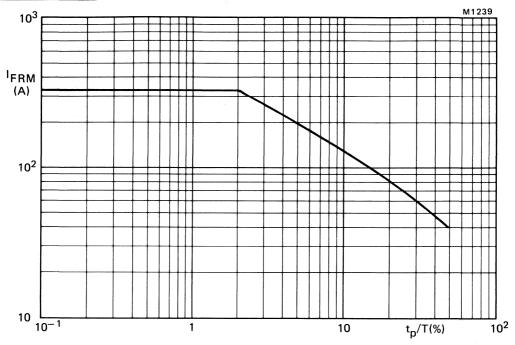
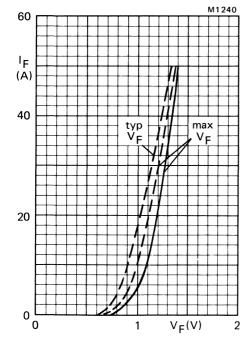
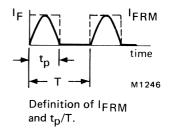


Fig.8 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 $\mu s < t_p < 1$ ms.





2 Fig.9 — $T_j = 25 \, {}^{\circ}\text{C}; --- T_j = 150 \, {}^{\circ}\text{C}.$

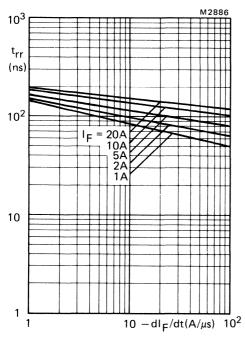
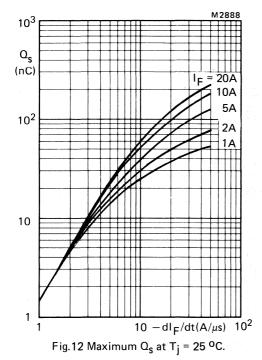


Fig.10 Maximum t_{rr} at T_j = 25 °C.



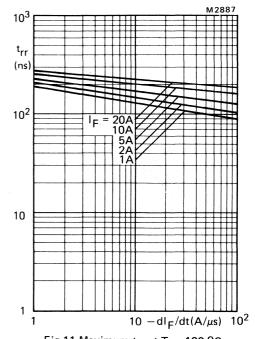


Fig.11 Maximum t_{rr} at T_j = 100 °C.

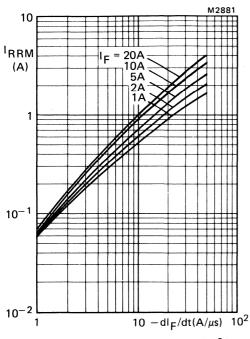


Fig.13 Maximum I_{RRM} at T_j = 25 °C.

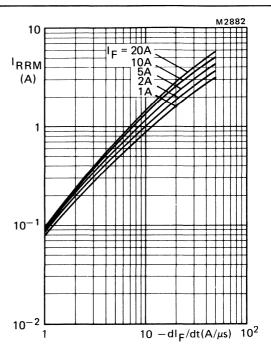


Fig.14 Maximum I_{RRM} at T_i = 100 °C.

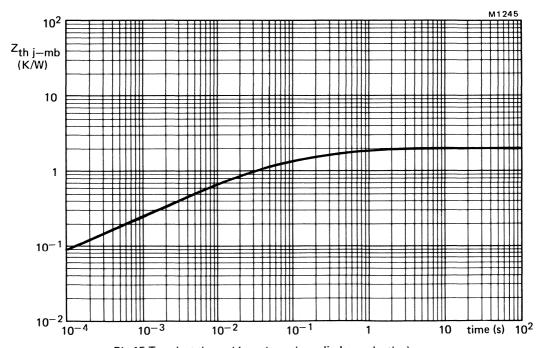


Fig.15 Transient thermal impedance (one diode conducting).

This data sheet contains advance information and specifications are subject to change without notice.

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

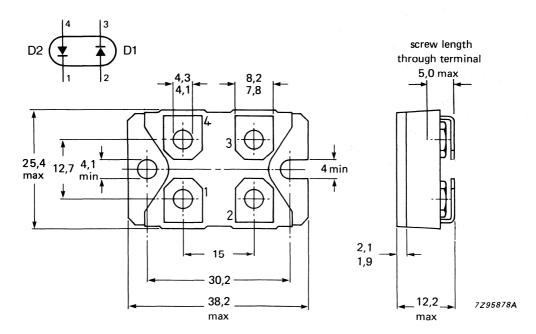
| Per diode, unless otherwise stated | | BYV54 | V – 50 | 100 | 150 | 200 | |
|------------------------------------|--------------------|-------|--------|-----|-----|-----|----|
| Repetitive peak reverse voltage | V _{RRM} | max. | 50 | 100 | 150 | 200 | V |
| Average forward current | F(AV) | max. | | 2 x | 50 | | Α |
| Forward voltage | VF | < | 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.

BYV54V SERIES

RATINGS

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

| Voltages (per diode) | | BYV54 | V-50 | 100 | 150 | 200 | |
|--|----------------------|-------|--------------|--------|-------|-----|------------------|
| Repetitive peak reverse voltage | VRRM | max. | 50 | 100 | 150 | 200 | V |
| Non repetitive peak reverse voltage | V _{RSM} | max. | 55 | 110 | 165 | 220 | V |
| Currents (per diode) | | | 1 20 | | | | |
| Average forward current; switching losses negligible up to 100 kHz | | | | | | | |
| square wave, δ = 0.5, up to T_{mb} = 92 ^{o}C | ^l F(AV) | max. | | 5 | 0 , , | | A |
| RMS forward current | IF(RMS) | max. | | 10 | 0 | | Α |
| Repetitive peak forward current $t_p = 10 \mu s$, $\delta = 0.02$ | I _{FRM} | max. | | 100 | 0 | | A |
| Non-repetitive peak forward current half sine-wave | | | | | | | |
| t = 10 ms | ^I FSM | max. | | 100 | 0 | | Α |
| I^2 t for fusing (t = 10 ms) | l²t | max. | | 320 | 0 | | A ² s |
| Temperatures | | | | | | | |
| Storage temperature | T_{stg} | | 40 1 | to +15 | 0 | | oC |
| Junction temperature | Tj | | -40 1 | to +15 | 0 | | оС |
| THERMAL RESISTANCE | | | | | | | |
| From junction to mounting base per diode | R _{th j-mb} | = | | 1.3 | 2 | | K/W |
| From junction to mounting base total | R _{th j-mb} | = | | 0.6 | 5 | | K/W |
| From mounting base to heatsink with heatsink compound | R _{th mb-h} | = | | 0. | 1 | | K/W |
| ORDERING NOTE Types with Faston terminals are available | - | 6,4 | Ø 2,6 2,5 | | | | |

6,35 (¼")

terminal (x4)

Faston

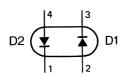
Fig.2 SOT-227A.

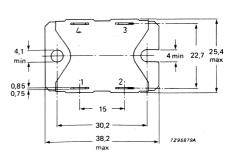
Dimensions in mm.

on request (see Fig.2).

Omit suffix V from the type number

when ordering, e.g. BYV54-100.





20,7

9,1 8,9

CHARACTERISTICS (per diode)

| T | = | 25 | oC | unless | otherwise | stated |
|---|---|----|----|--------|-----------|--------|
|---|---|----|----|--------|-----------|--------|

| I _j = 25 °C unless otherwise stated | | | |
|---|--------------------|--------------|----------|
| Forward voltage $I_F = 50 \text{ A}$; $T_j = 150 ^{\circ}\text{C}$ $I_F = 160 \text{ A}$ | V _F < | 0.80 1.25 | V* V* |
| Reverse current | | | |
| $V_R = V_{RRM max}$; $T_i = 100 {}^{\circ}C$ | I _R < | 5 | mA |
| $V_R = V_{RRM max}$ | I _R < | 200 | μA |
| Reverse recovery when switched from $I_F = 1 \text{ A to V}_R \geqslant 30 \text{ V with } -dI_F/dt = 50 \text{ A}/\mu\text{s};$ | | | |
| recovery time | t _{rr} | 60 | ns |
| I _F = 2 A to $V_R \ge 30 V$ with $-dI_F/dt = 20 A/\mu s$; recovered charge (see note 1) | O _s | 30 | nC |
| I _F = 10 A to V _R \geqslant 30 V with $-dI_F/dt$ = 50 A/ μ s; T _j = 100 °C; peak recovery current | I _{RRM} < | 6 | Α |

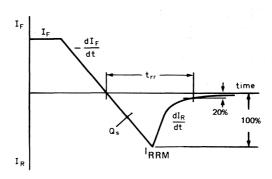


Fig.3 Definition of t_{rr} , Q_s and I_{RRM} .

Note 1: Ω_{S} is corrected for non-dissipative capacitance contribution

^{*}Measured under pulse conditions to avoid excessive dissipation.

BYV54V SERIES

SQUARE-WAVE OPERATION

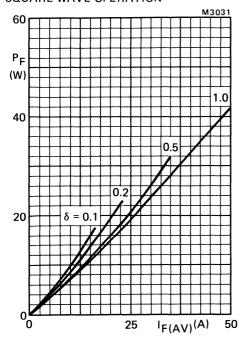


Fig.4 Forward power losses versus average forward current; per diode.

$$\begin{array}{c|c}
t & T \\
\hline
V & \delta = \frac{tp}{T}
\end{array}$$

$$\begin{array}{c|c}
I_{F(AV)} = I_{F(RMS)} \times \sqrt{\delta}$$

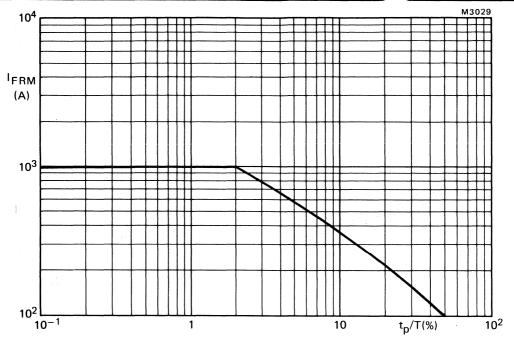
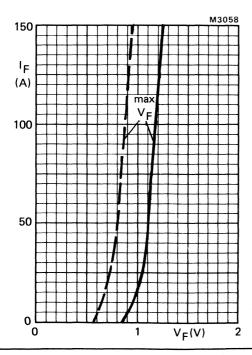
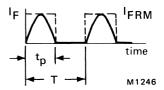


Fig.5 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 $\mu s < t_p < 1$ ms; per diode.





Definition of IFRM and t_p/T_{\cdot}

Fig.6 —
$$T_j = 25 \text{ °C}; - - - T_j = 150 \text{ °C};$$
 per diode.

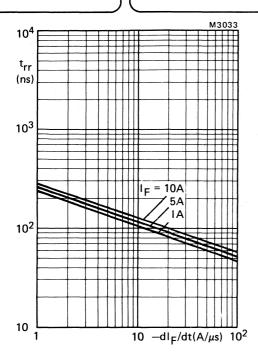
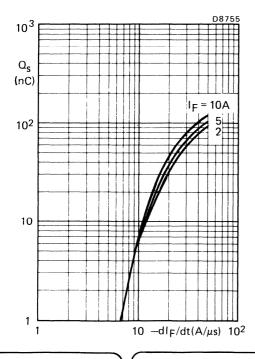


Fig.7 Maximum t_{rr} at $T_j = 25$ °C; per diode.



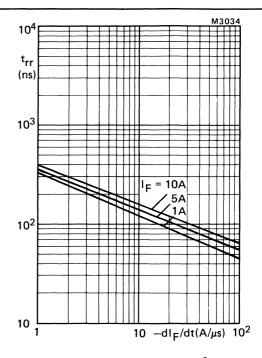


Fig.8 Maximum t_{rr} at $T_j = 100$ °C; per diode.

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

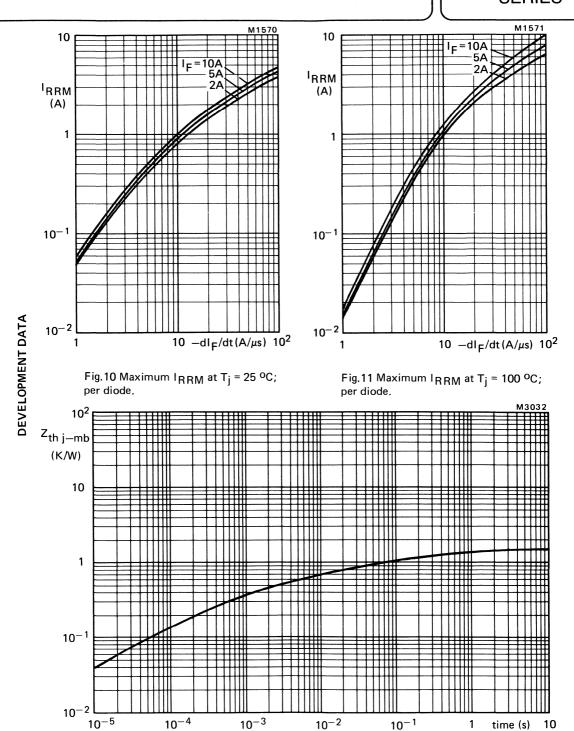


Fig. 12 Transient thermal impedance; per diode.

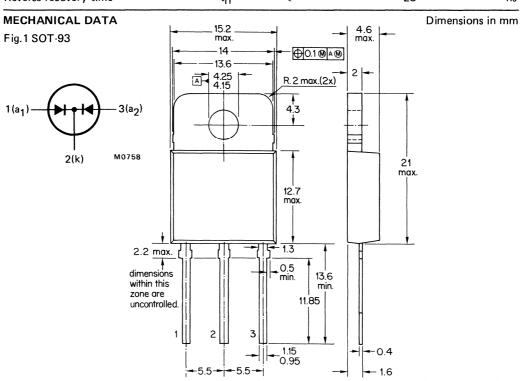


ULTRA FAST RECOVERY DOUBLE RECTIFIER DIODES

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

| | BYV7 | 2–50 | 100 | 150 | 200 | |
|-----------------|----------------------------------|-----------------------|---------|------------------------------|--|--|
| V_{RRM} | max. | 50 | 100 | 150 | 200 | V |
| Io | max. | | | 30 | | Α |
| ٧F | < | | 0. | .85 | | V |
| t _{rr} | < | | | 28 | | ns |
| | I _O V _F | V _{RRM} max. | IO max. | V _{RRM} max. 50 100 | V _{RRM} max. 50 100 150 I _O max. 30 V _F < 0.85 | V _{RRM} max. 50 100 150 200 I _O max. 30 V _F < 0.85 |



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.

BYV72 SERIES

RATINGS

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

| Voltages (per diod | e) | | BYV7 | 2–50 | 100 | 150 | 200 | | |
|--|--|--------------------------------------|------|------|------------|-----|-----|--------|--|
| Repetitive peak re | verse voltage | VRRM | max. | 50 | 100 | 150 | 200 | V | |
| Crest working reve | erse voltage | VRWM | max. | 50 | 100 | 150 | 200 | V | |
| Continuous reverse | e voltage | VR | max. | 50 | 100 | 150 | 200 | ٧ | |
| Currents (both dio | des conducting; note 1) | | | | | | | | |
| Output current; sw losses negligible square wave; δ = up to T_{mb} = 10 | up to 500 kHz; = 0.5; | I _O | max. | | 3 | | | A | |
| R.M.S. forward cu | | ^I F(RMS) | max. | | 3 | - | | A | |
| Repetitive peak for $t_p = 20 \mu s$; $\delta = 0$ | | I _{FRM} | max. | | 32 | | | Α | |
| half sine-wave; 7 | k forward current (per diode F _j = 150 ^o C prior to plied V _{RWM max} | ^I FSM ^I FSM | max. | | 150 160 | _ | | A A | |
| I^2 t for fusing (t = 1 | 10 ms; per diode) | l ² t | max. | | 11: | 2 | | A^2s | |
| Temperatures | | | | | | | | | |
| Storage temperatur | re | T _{stg} | | -40 | to +150 |) , | | οС | |
| Junction temperate | ure | Tj | max. | | 150 |) | | οС | |

Notes:

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

CHARACTERISTICS

T_i = 25 °C unless otherwise stated

Forward voltage

$$I_F = 10 \text{ A}; T_j = 100 \text{ }^{\circ}\text{C}$$

 $I_F = 30 \text{ A}$

Reverse current

$$V_R = V_{RWM max}$$
; $T_j = 100 \, {}^{\circ}\text{C}$
 $V_R = V_{RWM max}$

Reverse recovery when switched from

 $I_R = 1 \text{ A to V}_R \geqslant 30 \text{ V with } -dI_F/dt = 100 \text{ A}/\mu\text{s};$ recovery time

IF = 2 A to VR \geqslant 30 V with -dIF/dt = 20 A/ μ s; recovered charge

I_F = 10 A to V_R \geqslant 30 V with $-dI_F/dt$ = 50 A/ μ s; T_i = 100 o C; peak recovery current

Forward recovery when switched to $I_F = 1 A$ with $dI_F/dt = 10 A/\mu s$

| V _F | < | 0.85 1.15 | V* V* |
|---------------------------------|---------------------------------------|--------------|----------|
| I _R | < < | 1.0 25 | mΑ μΑ |
| | | | |
| t _{rr} t _{rr} | · · · · · · · · · · · · · · · · · · · | 28 | ns |
| Ω_{S} | < , | 15 | nC |
| I _{RRM} | < | 2.4 | Α |
| V _{fr} | typ. | 1.0 | V |

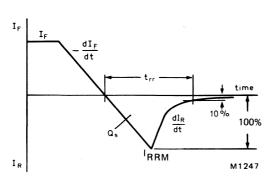


Fig.2 Definition of t_{rr} , Q_s and I_{RRM} .

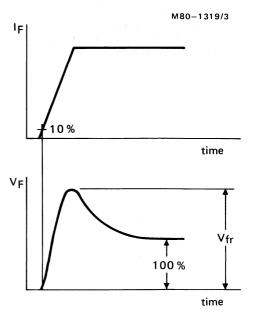


Fig.3 Definition of V_{fr} .

^{*}Measured under pulse conditions to avoid excessive dissipation.

| THERMAL RESISTANCE | | | | |
|--|----------------------|---------|---------|--------|
| From junction to mounting base (both diodes conducting) | R _{th j-mb} | = | 1.4 | K/W |
| From junction to mounting base (per diode) | R _{th j-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-h} | = | 0.2 | K/W |
| b. with heatsink compound and 0.06 mm maximum mica | | | | |
| insulator (56378) | R _{th mb-h} | = | 1.4 | K/W |
| c. with heatsink compound and 0.1 mm maximum mica | | | | |
| insulator | R _{th mb-h} | = | 2.2 | K/W |
| d. with heatsink compound and 0.25 mm maximum | _ | | | |
| alumina insulator | R _{th mb-h} | = ' | 8.0 | K/W |
| e. without heatsink compound | R _{th mb-h} | = | 1.4 | K/W |
| 2. Free air operation | | | | |
| The quoted value of R _{th j-a} should be used only when no leads of | of other dissipat | ing cor | nponent | ts 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 | р., | _ | 60 | LZ AM |
| length and with copper laminate on the board | R _{th j-a} | = | 60 | K/W |

R_{th j-a}

MOUNTING INSTRUCTIONS

- 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 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-h} given for mounting with heatsink compound refer to the use of a metallic-oxide loaded compound. Ordinary silicone grease is not recommended.
- 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

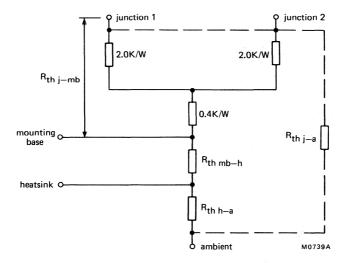


Fig.4

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

SQUARE-WAVE OPERATION (BOTH DIODES)

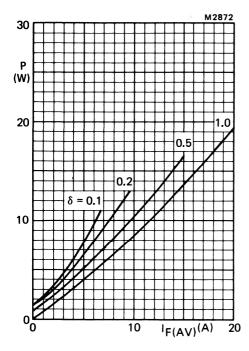
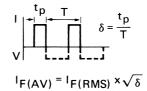


Fig.5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.



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

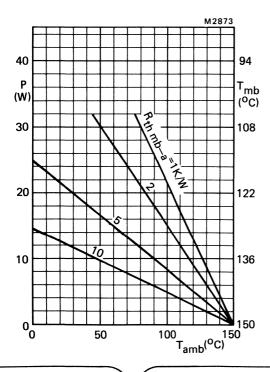


Fig.6

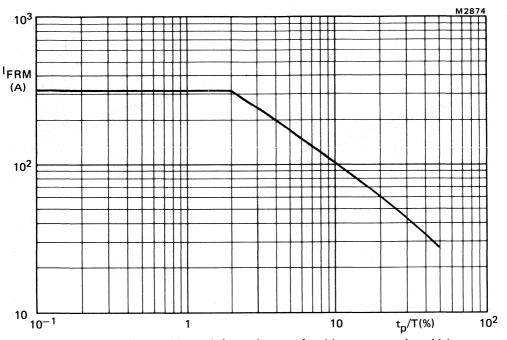
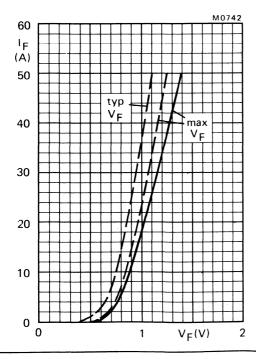
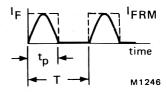


Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 μ s < t $_p$ < 1 ms; per diode.





Defintion of I $_{\mbox{\scriptsize FRM}}$ and $t_p/T.$

Fig.8 —
$$T_j$$
 = 25 °C; — — T_j = 100 °C. per diode.

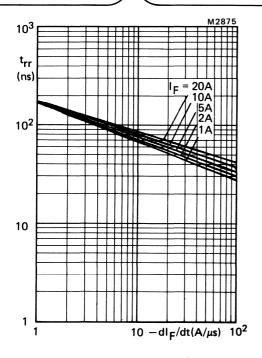
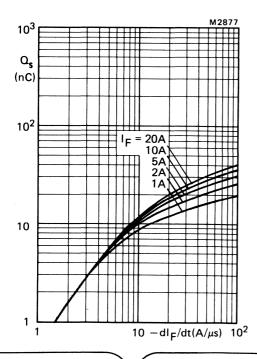


Fig.9 Maximum t_{rr} at T_j = 25 o C; per diode.



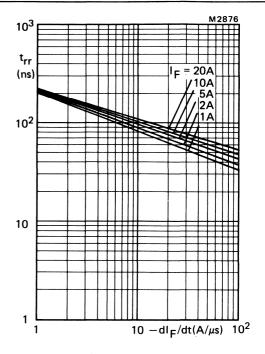


Fig. 10 Maximum t_{rr} at $T_j = 100$ °C; per diode.

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

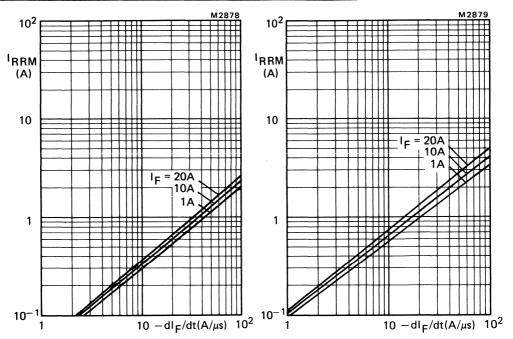


Fig. 12 Maximum I_{RRM} at $T_j = 25$ °C; per diode.

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

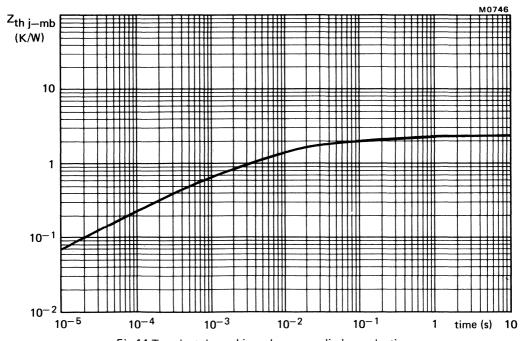


Fig.14 Transient thermal impedance; one diode conducting.

DEVELOPMENT DATA

This data sheet contains advance information and specifications are subject to change without notice.

ULTRA FAST-RECOVERY ELECTRICALLY-ISOLATED DOUBLE RECTIFIER DIODES

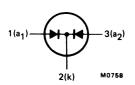
Glass-passivated, high-efficiency epitaxial double rectifier diodes in SOT-199 (full-pack) plastic envelopes, featuring low forward voltage drop, very fast reverse recovery times and soft-recovery characteristic. Their electrical isolation makes them ideal for mounting on a common heatsink along-side 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.

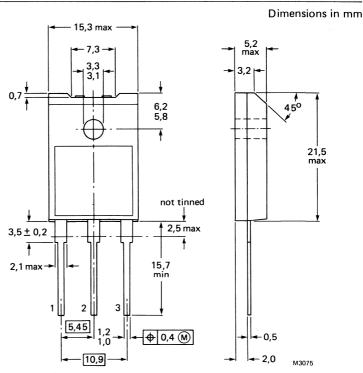
QUICK REFERENCE DATA

| Per diode, unless otherwise stated | | BYV72I | F-50 100 150 200 | |
|---|-----------------|--------|------------------------|----|
| Repetitive peak reverse voltage | v_{RRM} | max. | 50 100 150 200 | V |
| Output current (both diodes conducting) | IO | max. | 20 | A |
| Forward voltage | V _F | < | 0.85 | V |
| Reverse recovery time | t _{rr} | < | 28 | ns |

MECHANICAL DATA

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).

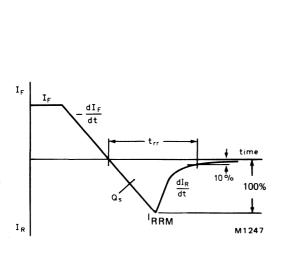
| Voltages (per diode) | | BYV72 | F-50 | 100 | 150 | 200 | |
|---|------------------|-------|------|--|------|-----|------------------|
| Repetitive peak reverse voltage | V _{RRM} | max. | 50 | 100 | 150 | 200 | V |
| Crest working reverse voltage | VR W M | max. | 50 | 100 | 150 | 200 | ٧ |
| Continuous reverse voltage | VR | max. | 50 | 100 | 150 | 200 | V |
| Currents (both diodes conducting; note 1) | | | | | N. 1 | | |
| Output current; switching losses negligible up to 500 kHz; square wave; $\delta = 0.5$; | | | | | | | |
| $T_h = 66$ °C (note 2) | 10 | max. | | 20 | | | Α |
| R.M.S. forward current | IF(RMS) | max. | | | 20 | | Α |
| Repetitive peak forward current $t_p = 20 \mu s; \delta = 0.02$ (per diode) | I _{FRM} | max. | | 3 2 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 | 20 | | A |
| Non-repetitive peak forward current (per di half sine-wave; T _j = 150 °C prior to surge; with reapplied V _{RWM max} | ode) | | | | | | |
| t = 10 ms | ^I FSM | max. | | | 50 | | Α |
| t = 8.3 ms | IFSM | max. | | | 60 | | Α |
| I^2 t for fusing (t = 10 ms; per diode) | l ² t | max. | | 1 | 12 | | A ² s |
| Temperatures | | | | | | | |
| Storage temperature | T_{stg} | | _ | 40 to +1 | 50 | | οС |
| Junction temperature | Тј | max. | | 1 | 50 | | оС |
| ISOLATION | | | | | | | |
| Peak isolation voltage from all terminals to external heatsink | V _{t-h} | max. | | 15 | 00 | | V |
| Isolation capacitance from centre lead to external heatsink (note 3) | C _{t-h} | typ. | | | 12 | | pF |
| | | | | | | | |

Notes:

- 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 _i = 100 °C | ٧ _F | < | 0.85 | ٧* |
| I _F = 30 A | ٧F | < | 1.15 | V* |
| Reverse current | | | | |
| $V_R = V_{RWM max}$; $T_i = 100 {}^{o}C$ | I _R | i < i | 1.0 | mA |
| $V_R = V_{RWM max}$ | I _R | < | 25 | μΑ |
| Reverse recovery when switched from | | | | |
| I _F = 1 A to $V_R \ge 30 \text{ V}$ with $-dI_F/dt = 100 \text{ A}/\mu\text{s}$; | | | | |
| recovery time | t _{rr} | < | 28 | ns |
| $I_F = 2 \text{ A to } V_R \geqslant 30 \text{ V with } -dI_F/dt = 20 \text{ A}/\mu\text{s};$ | | | | |
| recovered charge | Q_{s} | < | 15 | nC |
| $I_F = 10 \text{ A to } V_B \ge 30 \text{ V with } -dI_F/dt = 50 \text{ A}/\mu\text{s};$ | • | | | |
| T _j = 100 °C; peak recovery current | IRRM | < | 2.4 | Α |
| Forward recovery when switched to I _F = 1 A | | | | |
| with $dI_F/dt = 10 A/\mu s$ | V_{fr} | typ. | 1.0 | V |
| | | | | |



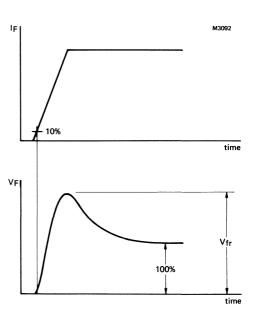


Fig.2 Definition of $t_{rr},\, Q_{s}$ and $I_{R\,RM}.$

Fig.3 Definition of V_{fr} .

^{*}Measured under pulse conditions to avoid excessive dissipation.

BYV72F SERIES

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 i-h} | = | 4 | K/W |
| without heatsink compound | R _{th j-h} | = | 8 | K/W |
| b. per diode: | • | | | |
| with heatsink compound | R _{th i-h} | = | 5 | K/W |
| without heatsink compound | R _{th j-h} | = , | 9 | 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 tie point.

| Thermal resistance from junction to ambient | | | | |
|---|---------------------|---|----|-----|
| in free air, mounted on a printed circuit board | R _{th j-a} | = | 35 | K/W |

MOUNTING INSTRUCTIONS

- 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-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: Maximum torque to avoid damage to the device:

5.5 kgf (0.55 Nm) 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-h} given for mounting with heatsink compound refer to the use of a metallic-oxide loaded compound. Ordinary silicone grease is not recommended.
- 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.

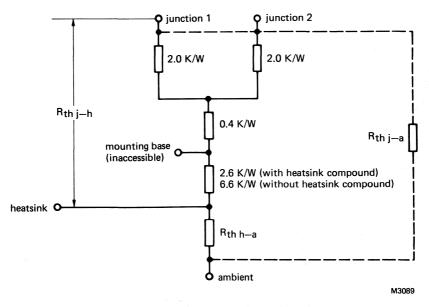


Fig.4.

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

SQUARE-WAVE OPERATION (BOTH DIODES)

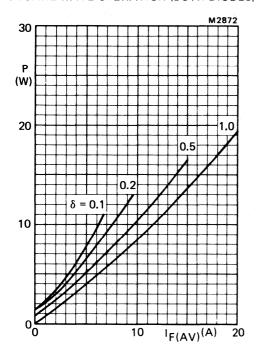
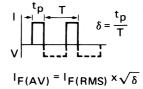


Fig.5 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.



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

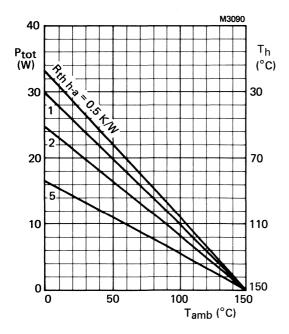


Fig.6.

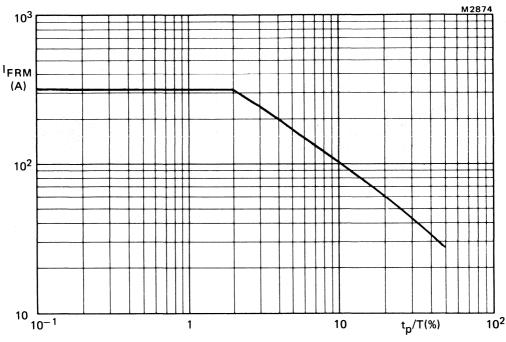
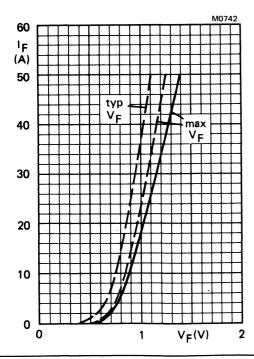
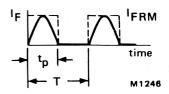


Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 μ s < t $_p$ < 1 ms; per diode.





Definition of I $_{\mbox{\scriptsize FRM}}$ and $t_p/T.$

Fig.8 ——
$$T_j$$
 = 25 °C; $---T_j$ = 100 °C. per diode.

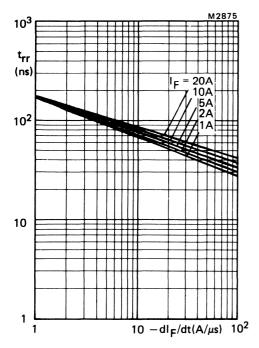
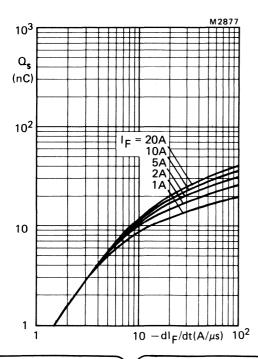


Fig.9 Maximum t_{rr} at $T_j = 25$ °C; per diode.



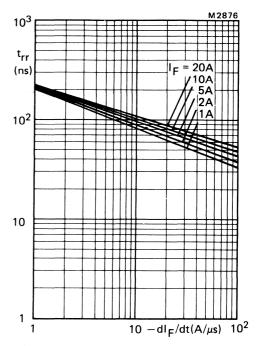
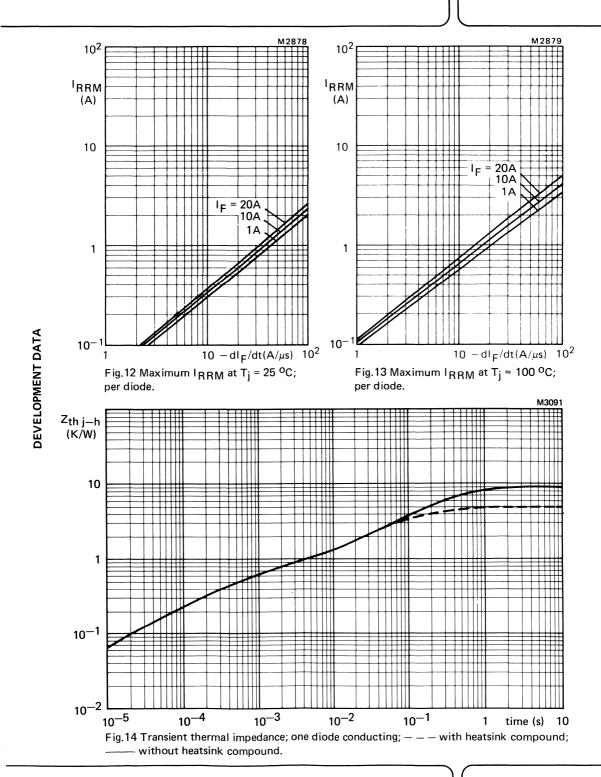


Fig.10 Maximum t_{rr} at $T_j = 100$ °C; per diode.

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



ULTRA FAST RECOVERY DOUBLE RECTIFIER DIODES

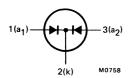
Glass-passivated, high-efficiency epitaxial double rectifier diodes in plastic envelopes which feature low forward voltage drop, very fast reverse recovery times and soft-recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where low 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.

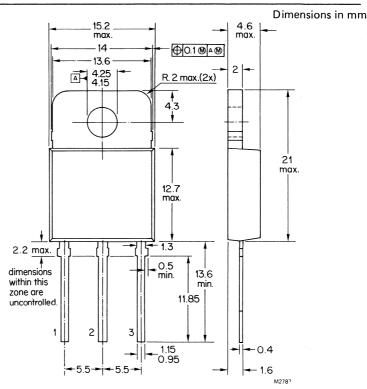
QUICK REFERENCE DATA

| Per diode, unless otherwise stated | | BYV7 | 4–300 | 400 | 500 | V | |
|---|-----------------|------|-------|------|-----|----|--|
| Repetitive peak reverse voltage VRRM | | max. | 300 | 400 | 500 | V | |
| Output current (both diodes conducting) | Io | max. | | 30 | | A | |
| Forward voltage | ٧ _F | < | | 1.05 | | V | |
| Reverse recovery time | t _{rr} | < | | 50 | | ns | |

MECHANICAL DATA

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.

BYV74 SERIES

RATINGS

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

| 00 | |
|----------------|------------------|
| 50 V | |
| 00 V | |
| 00 V | |
| 00 V | |
| _ | |
| | |
| Α | |
| Α | |
| Α | |
| | |
| Α | |
| | |
| | |
| A | |
| Α | |
| A ² | 2 s |
| | |
| oC | ; |
| oC | ; |
| | A A A A |

Notes

- 1. To ensure thermal stability: $R_{th\ j-a} < 9.3\ K/W$.
- 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 d | (lode | |
|------------------------|-------|--|
|------------------------|-------|--|

T_i = 25 ^oC unless otherwise stated

Forward voltage

Reverse current

$$V_R = V_{RWM max}$$
; $T_j = 100 \, ^{O}C$ $I_R < 0.8 \, ^{MA}$ $V_R = V_{RWM max}$ $I_R < 50 \, ^{MA}$

Reverse recovery when switched from

IF = 1 A to
$$V_R \ge 30 \text{ V}$$
 with $-dI_F/dt = 100 \text{ A}/\mu\text{s}$; recovery time

I_F = 2 A to
$$V_R \ge 30 \text{ V}$$
 with $-dI_F/dt = 20 \text{ A}/\mu s$; recovered charge

I_F = 10 A to V_R
$$\geqslant$$
 30 V with -dI_F/dt = 50 A/ μ s; T_i = 100 °C; peak recovery current

| V _F V _F | < < < | 1.05 1.6 | V* V* |
|----------------------------------|---------------------------------------|-------------|----------|
| I _R | < < < < < < < < < < < < < < < < < < < | 0.8 50 | mΑ μΑ |
| t _{rr} | | 50 | ns |
| Os | < ,,,,,,, | 50 | nC |
| IRRM | < | 5.2 | Α |
| V_{fr} | typ. | 2.5 | V |

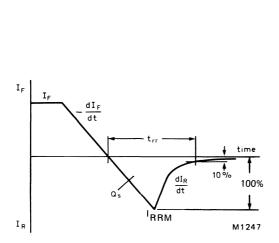


Fig.2 Definition of $t_{rr},\,\Omega_{\textrm{S}}$ and $I_{\mbox{\footnotesize{RRM}}}.$

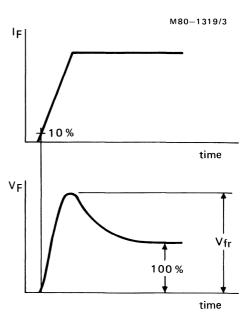


Fig.3 Definition of V_{fr}.

^{*}Measured under pulse conditions to avoid excessive dissipation.

| THERMAL RESISTANCE | | | | |
|--|----------------------|----------|----------|--------|
| From junction to mounting base; total package | R _{th j-mb} | 4 = | 1.4 | K/W |
| per diode | R _{th j-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-h} | = | 0.2 | K/W |
| b. with heatsink compound and 0.06 mm maximum mica | | | | |
| insulator (56378) | R _{th mb-h} | · '= · · | 1.4 | K/W |
| c. without heatsink compound | R _{th mb-h} | = | 1.4 | K/W |
| 2. Free air operation | | | | |
| The quoted value of $R_{th\ j-a}$ should be used only when no leads of the same tie point. | of other dissipa | ting cor | nponents | run to |
| 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-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 2.4mm 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-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-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.

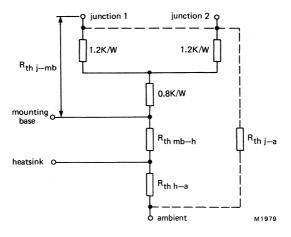


Fig. 4.

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 I_{amb} scale. The intersection determines the I_{th} mb-a. The heatsink thermal resistance value (I_{th} h-a) can be calculated from:

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

BYV74 SERIES

SQUARE-WAVE OPERATION

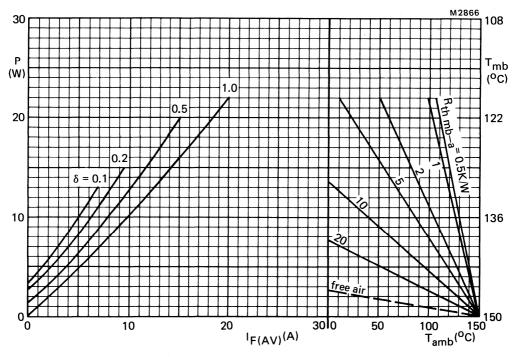


Fig.5 The right-hand part shows the relationship between the power (derived from the left-hand part) and the maximum permissible temperatures (per diode).

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

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

SINUSOIDAL OPERATION

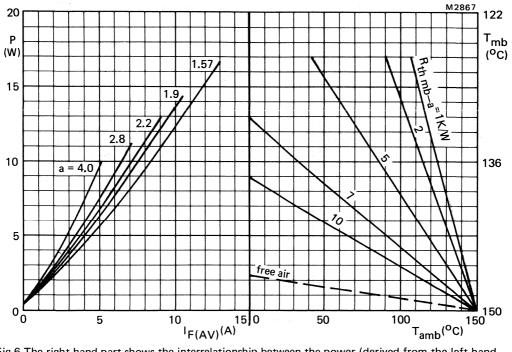


Fig.6 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures (per diode).

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

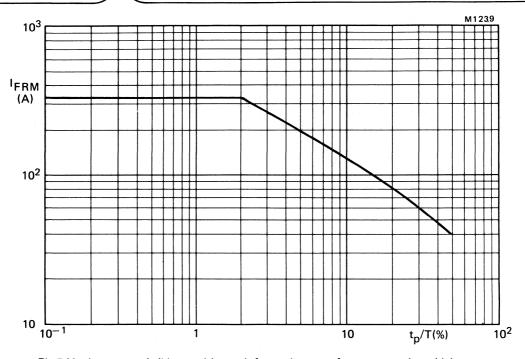
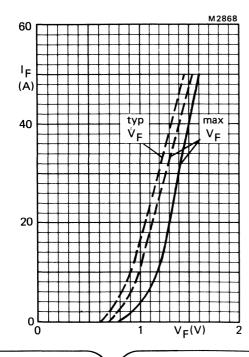


Fig.7 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 $\mu s < t_p < 1$ ms (per diode).



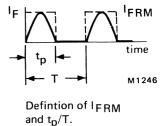


Fig.8 — T_j = 25 °C; — $-T_j$ = 150 °C (per diode).

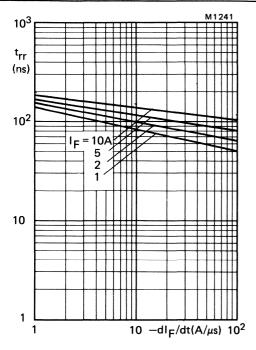
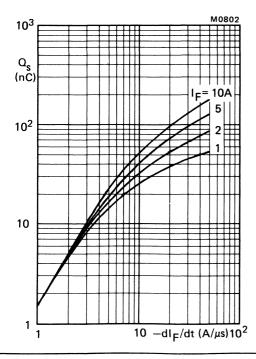


Fig.9 Maximum t_{rr} at $T_j = 25$ °C. (per diode).



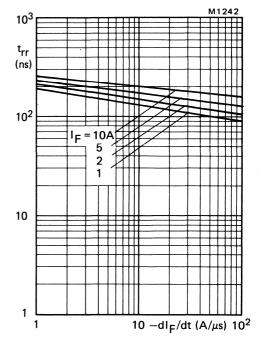


Fig.10 Maximum t_{rr} at $T_j = 100$ °C. (per diode).

Fig.11 Maximum Q_s at T_j = 25 ^{o}C . (per diode).



DEVELOPMENT DATA

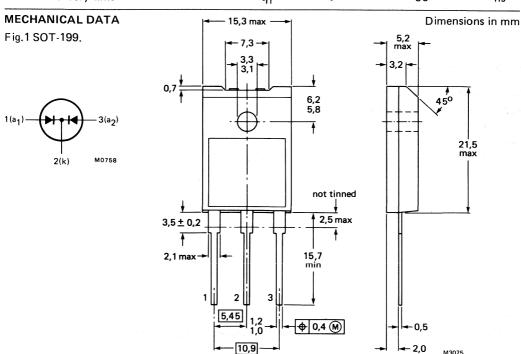
This data sheet contains advance information and specifications are subject to change without notice.

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 | ٧ |
| Output current (both diodes conducting) | I _O | max. | | 20 | | Α |
| Forward voltage | V _F | < | | 1.05 | | V |
| Reverse recovery time | t _{rr} | < | | 50 | | ns |



Note: Accessories supplied on request: see data sheets Mounting instructions and accessories for SOT-93 envelopes.

BYV74F SERIES

RATINGS

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

| | 250 | | | |
|---|--------------|--|-----|------------------|
| Non-repetitive peak reverse voltage VRSM m | max. 350 | 450 | 550 | · V |
| Repetitive peak reverse voltage VRRM m | max. 300 | 400 | 500 | ٧ |
| Crest working reverse voltage VRWM m | max. 200 | 300 | 400 | ٧ |
| Continuous reverse voltage VR m | max. 200 | 300 | 400 | ٧ |
| Currents (both diodes conducting; note 1) | | - 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. | | - , , |
| 50.00 | nax. nax. | 20 20 | | A A |
| R.M.S. forward current IF(RMS) m | nax. | 20 | | Α |
| Repetitive peak forward current t_p = 20 μ s; δ = 0.02 (per diode) | nax. | 320 | | Α |
| Non-repetitive peak forward current half sinewave; $T_j = 150$ °C prior to surge; with reapplied $V_{RWM\ max}$ (per diode) | | | | |
| 1 OW | · · | 130 | | A |
| - FSIM | | 140 | | A |
| I^2 t for fusing (t = 10 ms; per diode) I^2 t m | nax. | 84 | | A ² s |
| Temperatures | | | | |
| Storage temperature T _{stg} | -40 to + | 150 | | оС |
| _ | nax. | 150 | | оС |
| ISOLATION | | | | |
| Peak isolation voltage from all terminals to external heatsink V_{t-h} m | nax. 1! | 500 | | V |
| Isolation capacitance from centre | ур. | 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.

with $dI_F/dt = 10 A/\mu s$ recovery voltage

CHARACTERISTICS (per diode) T_i = 25 °C unless otherwise stated Forward voltage $I_F = 15 A; T_i = 150 \, {}^{\circ}\text{C}$ ٧F 1.05 IF = 50 A 1.6 Reverse current $V_R = V_{RWM max}$; $T_i = 100 \, {}^{\circ}C$ 8.0 mΑ I_{R} $V_R = V_{RWM max}$ I_R 50 μΑ Reverse recovery when switched from $I_F = 1 \text{ A to } V_R \ge 30 \text{ V with } -dI_F/dt = 100 \text{ A}/\mu\text{s};$ recovery time < 50 trr ns $I_F = 2 \text{ A to } V_R \geqslant 30 \text{ V with } -dI_F/dt = 20 \text{ A}/\mu\text{s};$ 50 nC Qs recovered charge I_F = 10 A to V_R \geqslant 30 V with $-dI_F/dt$ = 50 A/ μ s; T_j = 100 $^{\rm O}$ C; peak recovery current < 5.2 Α IRRM Forward recovery when switched to $I_F = 10 A$

 V_{fr}

typ.

2.5

٧

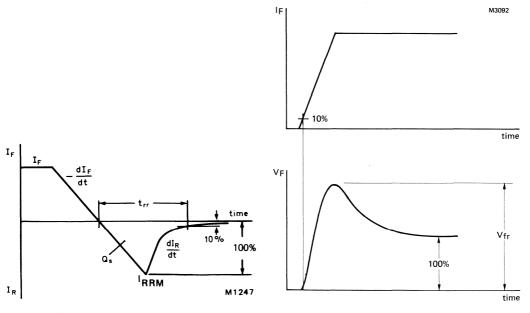


Fig.2 Definition of t_{rr} , Q_{s} and I_{RRM} .

Fig.3 Definition of V_{fr}.

^{*}Measured under pulse conditions to avoid excessive dissipation.

BYV74F SERIES

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 i-h} | = | | 4 | K/W |
| without heatsink compound | R _{th j-h} | = | | 8 | K/W |
| b. per diode: | | | | | |
| with heatsink compound | R _{th i-h} | = ' | | 5 | K/W |
| without heatsink compound | R_{th}_{j-h} | = _ | | 9 | 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 tie point.

| Thermal resistance from junction to ambient | | | | |
|---|---------------------|---|----|-----|
| in free air, mounted on a printed circuit board | R _{th j-a} | = | 35 | K/W |

MOUNTING INSTRUCTIONS

- 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-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: Maximum torque to avoid damage to the device:

5.5 kgf (0.55 Nm) 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-h} given for mounting with heatsink compound refer to the use of a metallic-oxide loaded compound. Ordinary silicone grease is not recommended.
- 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.

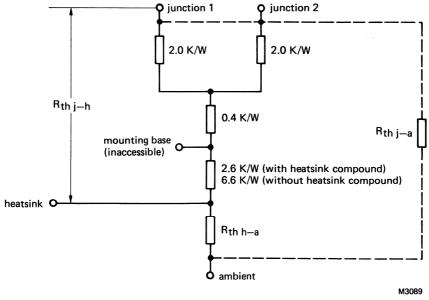


Fig.4.

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

SQUARE-WAVE OPERATION

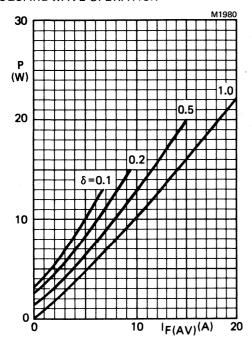


Fig.5 Power rating per diode.

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.

$$\begin{vmatrix}
t & T & T \\
V & & \delta = \frac{tp}{T}
\end{vmatrix}$$

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

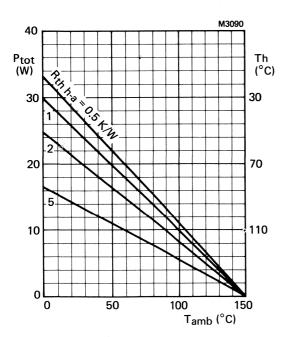


Fig.6.

SINUSOIDAL OPERATION

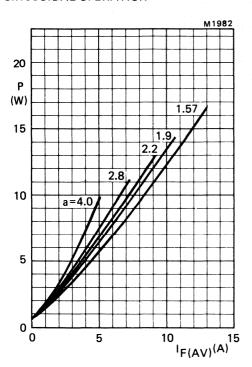


Fig.7 Power rating per diode.
The individual power loss in each diode should first be determined then both added together. The resulting total power loss is then used in conjunction with Fig.6 to determine the heatsink size and corresponding maximum ambient and mounting base temperatures.

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

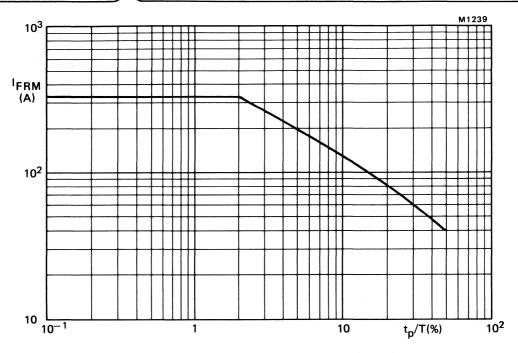
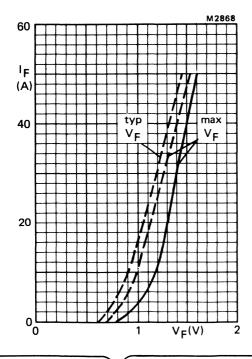


Fig.8 Maximum permissible repetitive peak forward current for square or sinusoidal currents; $1 \mu s < t_p < 1 ms$.



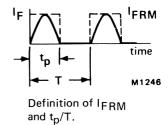


Fig.9 —— $T_j = 25 \text{ °C}; ---T_j = 150 \text{ °C}.$

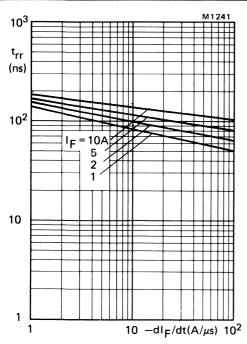
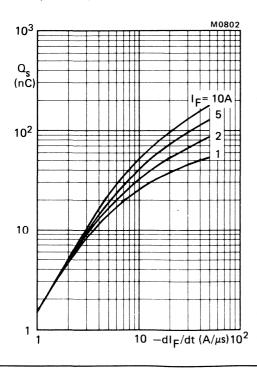


Fig. 10 Maximum t_{rr} at $T_j = 25$ °C. (per diode).



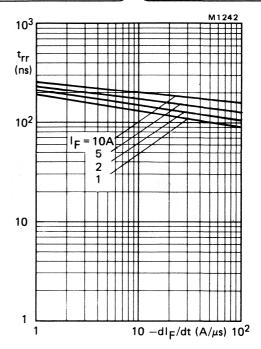


Fig.11 Maximum t_{rr} at $T_j = 100$ °C. (per diode).

Fig.12 Maximum Q_s at T_j = 25 o C. (per diode).

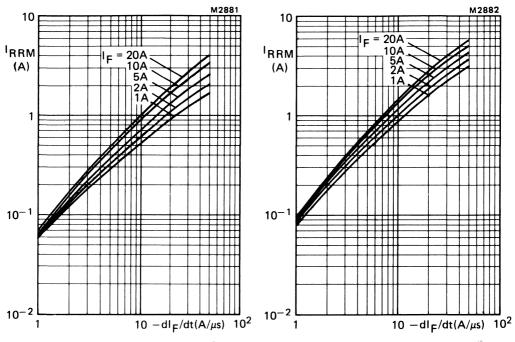


Fig.13 Maximum I_{RRM} at $T_j = 25$ °C.

Fig.14 Maximum I_{RRM} at $T_j = 100 \, ^{\circ}C$.

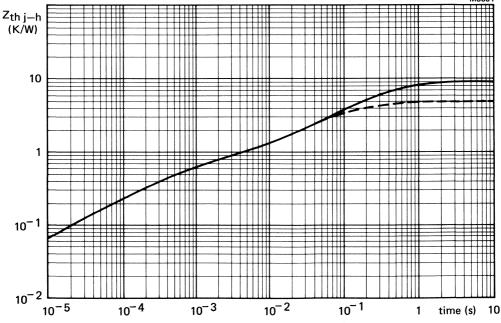


Fig.15 Transient thermal impedance; one diode conducting; -- with heatsink compound; —— without heatsink compound.

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.

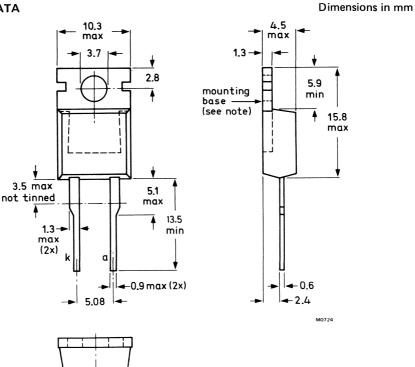
The series consists of normal polarity (cathode to mounting base) types.

QUICK REFERENCE DATA

| | | BYV79 | -50 100 150 200 |
|---------------------------------|-----------------|-------|-----------------------|
| Repetitive peak reverse voltage | v_{RRM} | max. | 50 100 150 200 V |
| Average forward current | IF(AV) | max. | 14 A |
| Forward voltage | V_{F} | < | 0.85 V |
| Reverse recovery time | t _{rr} | < | 30 ns |

MECHANICAL DATA

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.

BYV79 SERIES

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 | ∨ _{RWM} | max. | 50 | 100 | 150 | 200 | ٧ |
| Continuous reverse voltage (note 1) | v_R | max. | 50 | 100 | 150 | 200 | V |
| Currents | | | - | <u> </u> | | · | |
| Average forward current; switching losses negligible up to 500 kHz; | | | | | | | |
| square wave; $\delta = 0.5$; up to $T_{mb} = 115$ °C | ^I F(AV) | max. | | 1 | 14 | | Α |
| sinusoidal; up to $T_{mb} = 122 ^{\circ}C$ | ^I F(AV) | max. | | 1 | 12 | | Α |
| R.M.S. forward current | IF(RMS) | max. | | 2 | 20 | | Α |
| Repetitive peak forward current | | | | | | | |
| $t_p = 20 \ \mu s; \ \delta = 0.02$ | ^I FRM | max. | | 42 | 20 | | Α |
| Non-repetitive peak forward current half sine-wave; $T_j = 150$ °C prior to surge; with reapplied $V_{RWM\ max}$ | | | | | | | |
| t = 10 ms | IFSM | max. | | 18 | 30 | | Α |
| t = 8.3 ms | IFSM | max. | | 20 | 00 | | Α |
| I^2 t for fusing (t = 10 ms) | l²t | max. | | 16 | 60 | | A^2s |
| Temperatures | | | | | | | |
| Storage temperature | T _{stg} | | -40 |) to +15 | 0 | | оС |
| Junction temperature | Tj | max. | | 15 | 0 | | oC |
| | | | | | | | |

Notes:

1. To ensure thermal stability: $R_{\mbox{th}\ j\mbox{-}a} \leqslant 8$ K/W.

CHARACTERISTICS

| Ti | = 25 | oC | unless | otherwise | stated |
|----|------|----|--------|-----------|--------|
|----|------|----|--------|-----------|--------|

Forward voltage

$$I_F = 10 \text{ A}; T_j = 100 \text{ }^{\text{O}}\text{C}$$

 $I_F = 50 \text{ A}$

Reverse current

Reverse recovery when switched from

I_F = 1 A to V_R
$$\geqslant$$
 30 V with -dI_F/dt = 100 A/ μ s; recovery time

I_F = 2 A to V_R
$$\geqslant$$
 30 V with -dI_F/dt = 20 A/ μ s; recovered charge

I_F = 10 A to V_R
$$\geqslant$$
 30 V with $-dI_F/dt$ = 50 A/ μ s; T_i = 100 o C; peak recovery current

Forward recovery when switched to
$$I_F = 10 \text{ A}$$

with $dI_F/dt = 10 \text{ A}/\mu\text{s}$

| V _F | < < < | 0.85 1.3 | V* V* |
|----------------------------------|--|-------------|----------|
| I _R I _R | < < | 1.3 50 | mΑ μΑ |
| t _{rr} | | 30 | ns |
| O_s | $\frac{1}{2} \left(\frac{1}{2} \right)^{-1} = \frac{1}{2} \left(1$ | 15 | nC |
| IRRM | | 4 | Α |
| V _{fr} | typ. | 1.0 | V |

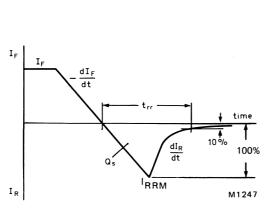


Fig.2 Definition of t_{rr} , Q_s and I_{RRM} .

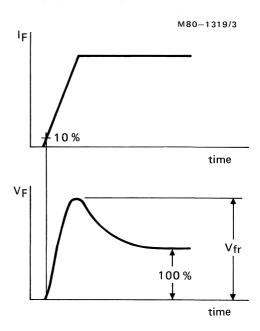


Fig.3 Definition of V_{fr}.

^{*}Measured under pulse conditions to avoid excessive dissipation.

| THERMAL RESISTANCE | | | | |
|--|----------------------|---------|---------|-------|
| From junction to mounting base | R _{th j-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-h} | = | 0.3 | K/W |
| with heatsink compound and 0.06 mm maximum mica insulator | R _{th mb-h} | = , | 1.4 | K/W |
| c. with heatsink compound and 0.1 mm maximum mica insulator (56369) | R _{th mb-h} | _ | 2.2 | K/W |
| d. with heatsink compound and 0.25 mm maximum alumina insulator (56367) | R _{th mb-h} | = | 0.8 | K/W |
| e. without heatsink compound | R _{th mb-h} | = | 1.4 | K/W |
| 2. Free air operation | | | | |
| The quoted value of $R_{th\ j-a}$ should be used only when no leads o to the same tie point. Thermal resistance from junction to ambient in free air: | f other dissipat | ing cor | mponent | s run |
| mounted on a printed circuit board at any device lead | | | | |

R_{th j-a}

K/W

length and with copper laminate on the board

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 2.4mm 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-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.

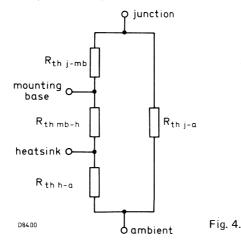
- 4. For good thermal contact, heatsink compound should be used between mounting base and heatsink. Values of R_{th mb-h} given for mounting with heatsink compound refer to the use of a metallic oxide-loaded compound. Ordinary silicone grease is not recommended.
- 5. Rivet mounting (only possible for 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.



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 I_{amb} scale. The intersection determines the I_{th} mb-a. The heatsink thermal resistance value (I_{th} h-a) can be calculated from:

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

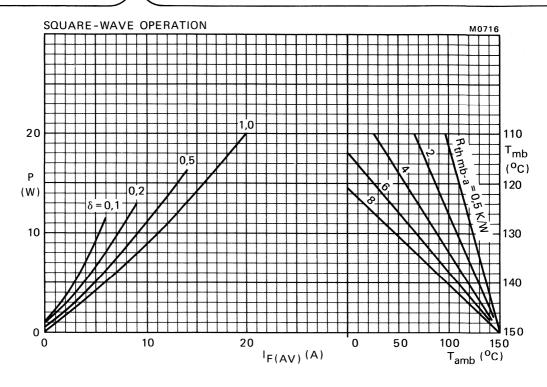


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.

P = power including reverse current losses and switching losses up to f = 500 kHz.

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

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

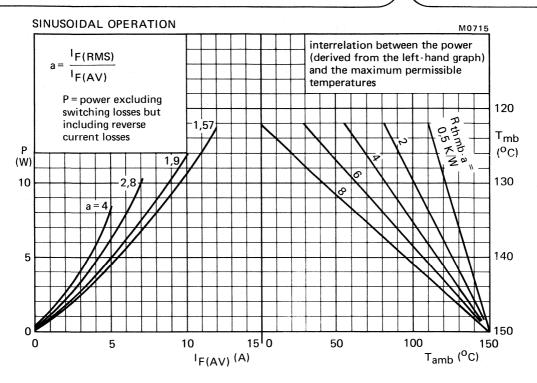


Fig.6

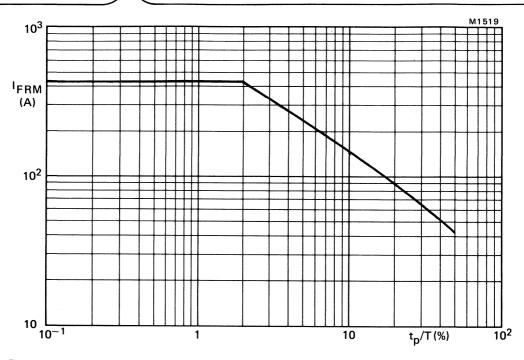
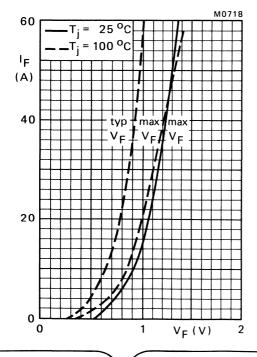
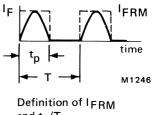


Fig.7 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 μ s < t_p < 1 ms.





and t_p/T .

Fig.8.

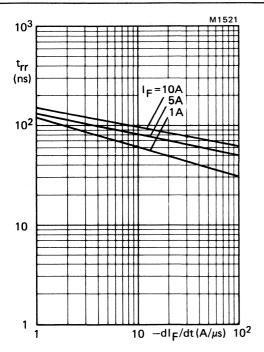
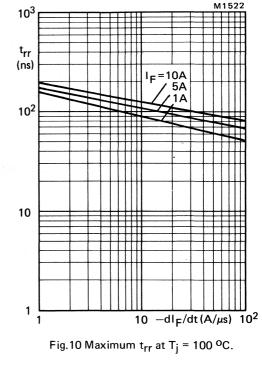


Fig.9 Maximum t_{rr} at $T_j = 25$ °C.



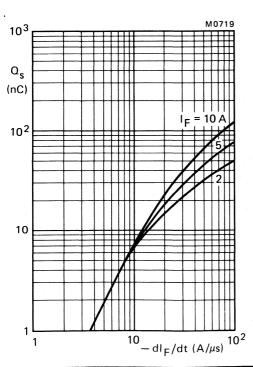


Fig.11 Maximum Q_s at $T_j = 25$ °C.

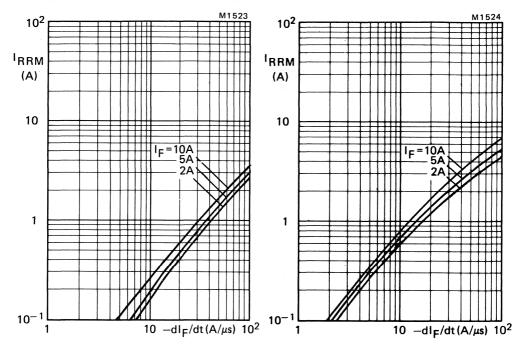


Fig. 12 Maximum I_{RRM} at $T_i = 25$ °C.

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

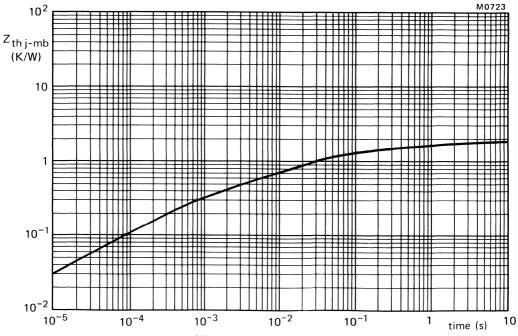


Fig.14 Transient thermal impedance.

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.

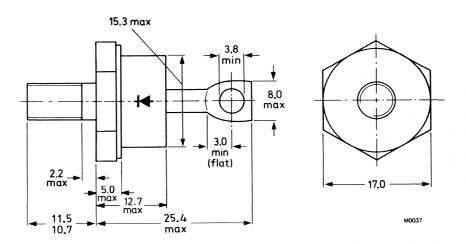
QUICK REFERENCE DATA

| | | BYV92-300 | 400 | 500 | |
|---------------------------------|-----------------|-----------|------|-----|----|
| Repetitive peak reverse voltage | v_{RRM} | max. 300 | 400 | 500 | V |
| Average forward current | lF(AV) | max. | 35 | | Α |
| Forward voltage | VF | < | 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 $\frac{1}{4}$ 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.

BYV92 SERIES

RATINGS

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

| Voltages | | BYV9 | 2-300 | 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* | VR | 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} = 100 °C up to T_{mb} = 125 °C | lF(AV) lF(AV) | max. max. | | 38 21 | | A A |
| sinusoidal, up to T_{mb} = 106 o C up to T_{mb} = 125 o C | lF(AV) lF(AV) | max. max. | | 34 21 | | A A |
| R.M.S. forward current | IF(RMS) | max. | | 55 | | Α |
| Repetitive peak forward current $t_p = 20 \mu s$, $\delta = 0.02$ | FRM | max. | | 800 | | A |
| Non-repetitive peak forward current half sine-wave, T _j = 150 ^O C prior to surge | | | | | | |
| t = 10 ms | FSM | max. | | 500 | | Α |
| t = 8.3 ms | ^I FSM | max. | | 600 | | Α |
| with reapplied V _{RWM max} t = 10 ms | | | | 0=0 | | _ |
| t = 8.3 ms | FSM | max. max. | | 350 440 | | A A |
| I^2 t for fusing (t = 10 ms) | IFSM I ² t | max. | | 610 | | A A²s |
| | 1 (| max. | | 610 | | A-s |
| Temperatures | | | | | | |
| Storage temperature | T_{stg} | -55 to +150 | | | °C | |
| Junction temperature | Тj | | | 150 | | οС |
| THERMAL RESISTANCE | | | | | | |
| From junction to mounting base | R _{th j-mb} | = | | 1.0 | | K/W |
| From mounting base to heatsink | , | | | | | |
| with heatsink compound | R _{th mb-h} | = | | 0.3 | | K/W |
| without heatsink compound | R _{th mb-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 $I_F = 35 \text{ A}; T_j = 150 ^{\circ}\text{C}$ $I_F = 100 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | V _F | < < < < < | 1.05 1.4 | V* V* |
|---|-----------------|-----------|-------------|----------|
| Reverse current | | | | |
| $V_R = V_{RWM \text{ max}}; T_j = 100 {}^{\circ}\text{C}$ $T_j = 25 {}^{\circ}\text{C}$ | I _R | < < | 2.0 50 | mΑ μΑ |
| Reverse recovery when switched from | | | | |
| I _F = 1 A to V _R \geq 30 V with $-dI_F/dt = 100 A/\mu s$; T _j = 25 ^O C; recovery time | t _{rr} | < | 50 | ns |
| $I_F = 2 \text{ A to } V_R \geqslant 30 \text{ V with } -dI_F/dt = 20 \text{ A}/\mu s;$ $T_j = 25 ^{\circ}\text{C}$; recovered charge | O_{S} | < | 75 | nC |
| I_F = 10 A to $V_R \geqslant$ 30 V with $-dI_F/dt$ = 50 A/ μ s; T_j = 100 °C; peak recovery current | IRRM | < | 4 | Α |
| Forward recovery when switched to I _F = 10 A with dI _F /dt = 10 A/ μ s; T _j = 25 °C | V _{fr} | typ. | 2.5 | V |

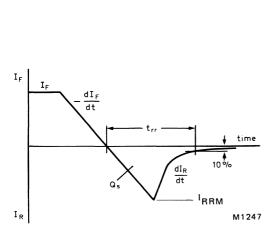


Fig.2 Definition of $t_{rr},\,\Omega_{s}$ and $I_{RRM}.$

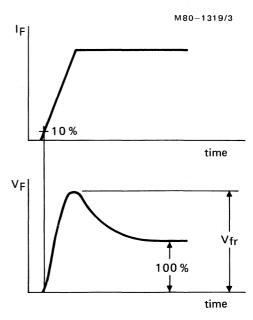


Fig.3 Definition of V_{fr} .

^{*}Measured under pulse conditions to avoid excessive dissipation.

BYV92 SERIES

SQUARE-WAVE OPERATION

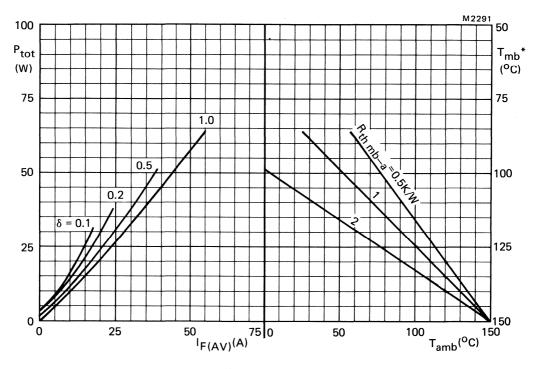


Fig.4 The right-hand part shows the relationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 100 kHz.

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

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

 $^{^*}T_{mb}$ scale is for comparison purposes and is correct only for R_{th mb-a} < 2.4 K/W.

SINUSOIDAL OPERATION

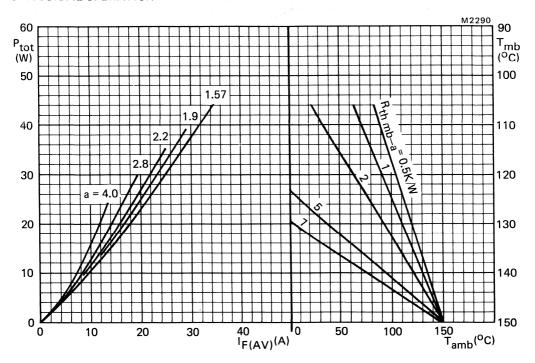


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.

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

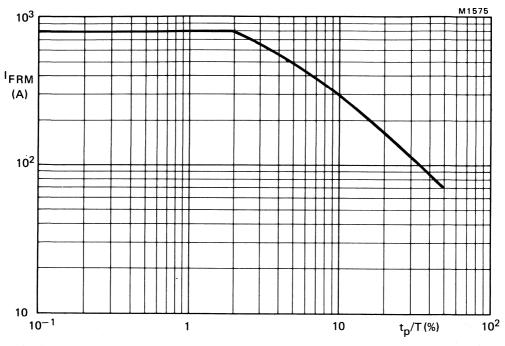
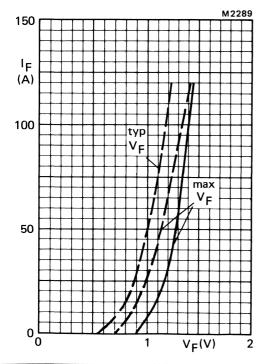
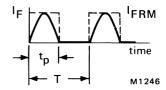


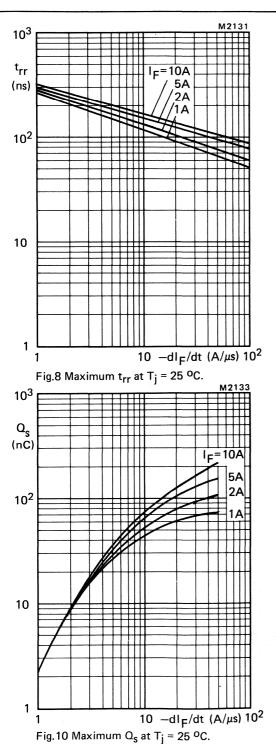
Fig.6 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 $\mu s < t_p < 1$ ms.

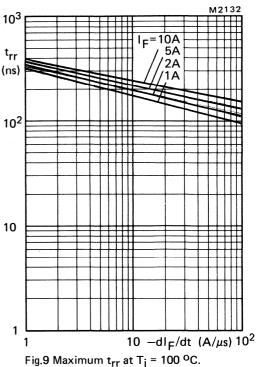


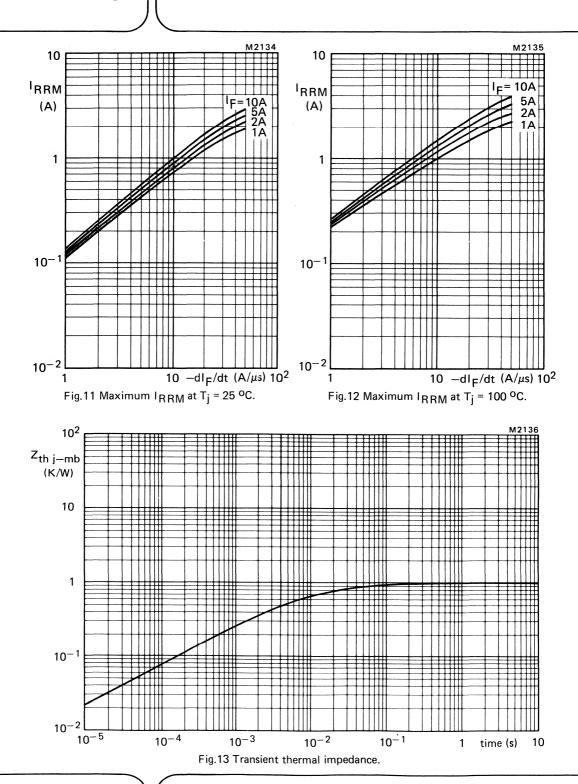


Definition of IFRM and $t_{\mbox{\footnotesize p}}/T$.

Fig.7 —
$$T_j = 25$$
 °C; — — $T_j = 150$ °C.







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.

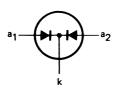
QUICK REFERENCE DATA

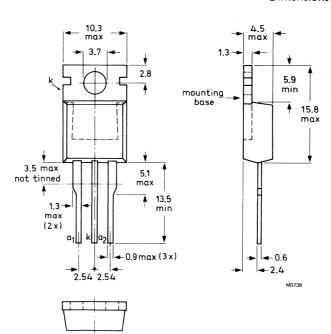
| Per diode, unless otherwise stated | | | BYV118-35 | 40 | 45 | - |
|---|------------------|------|-----------|-----|------|---|
| Repetitive peak reverse voltage | V _{RRM} | max. | 35 | 40 | 45 V | |
| Output current (both diodes conducting) | 10 | max. | | 10 | A | |
| Forward voltage | ٧ _F | < ' | | 0.6 | V | |
| Junction temperature | Тj | max. | | 150 | оС | |

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.

BYV118 SERIES

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 | ٧ |
| | 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; δ = 0.5; up to T_{mb} = 136 °C (note 2) sinusoidal; up to T_{mb} = 138 °C (note 2) | 1 ₀ | max. | | 10 8.8 | | A A |
| | R.M.S. forward current | I _{F(RMS)} | max. | | 14 | | Α |
| | Repetitive peak forward current $t_p = 20 \mu s$, $\delta = 0.02$ (per diode) | I _{FRM} | max. | | 90 | | Α |
| | Non-repetitive peak forward current (per dioc half sine-wave; T_j = 125 $^{\rm O}$ C prior to surge; with reapplied $^{\rm V}$ RWM max t = 10 ms t = 8.3 ms | de) ^I FSM ^I FSM | max. max. | | 100 110 | | A A |
| | I^2 t for fusing (t = 10 ms, per diode) | l² t | max. | | 50 | | A^2s |
| | Reverse surge current $t_p = 2 \mu s$, $\delta = 0.001$ $t_p = 100 \mu s$ | IRRM IRSM | max. max. | | 1.0 1.0 | | A A |
| | Temperatures | | | | | | |
| | Storage temperature | T_{stg} | | -40 to + | 150 | | оС |
| | Junction temperature | Tj | max. | | 150 | | οС |

Notes:

- 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 I _F = 10 A; T _j = 25 °C | VF | < | 0.6 | V* |
| $I_F = 10 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | VF | < | 0.87 | V* |
| Reverse current | | | | |
| $V_R = V_{RWM max}; T_j = 125 {}^{\circ}\text{C}$ $V_R = V_{RWM max}; T_j = 25 {}^{\circ}\text{C}$ | · I _R | < | 15 | mΑ |
| $V_R = V_{RWM max}$; $T_j = 25 {}^{\circ}C$ | ^I R | < | 100 | μΑ |
| Junction capacitance at f = 1 MHz | | | | |
| $V_R = 5 \text{ V}; T_j = 25 \text{ to } 125 ^{\circ}\text{C}$ | C _d | typ. | 200 | pF |
| THERMAL RESISTANCE | | | | |
| From junction to mounting base (both diodes conducting) | R _{th j-mb} | = | 1.7 | K/W |
| From junction to mounting base (per diode) | R _{th j-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-h} | = | 0.3 | K/W |
| b. with heatsink compound and 0.06 mm maximum mica insulator | р | = ' | 1.4 | V /\A/ |
| | R _{th mb-h} | | 1.4 | K/W |
| c. with heatsink compound and 0.1 mm maximum mica insulator (56369) | | | 2.0 | 12 /141 |
| . , | R _{th mb-h} | = | 2.2 | K/W |
| d. with heatsink compound and 0.25 mm maximum | | | 0.0 | |
| alumina insulator (56367) | R _{th mb-h} | = | 0.8 | K/W |
| e. without heatsink compound | R _{th mb-h} | = | 1.4 | K/W |
| 2. Free-air operation | | | | |
| The quoted value of $R_{th j-a}$ should be used only when no l to the same tie point. | eads of other o | lissipating | componer | nts run |
| 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-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-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.
- 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.

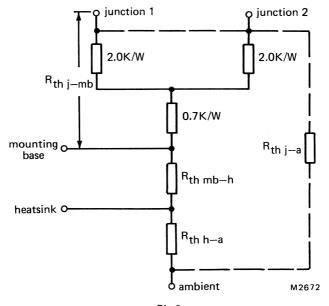


Fig.2.

OPERATING NOTES

Dissipation and heatsink calculations

Overall thermal resistance, Rth j-a = Rth j-mb + Rth mb-h + Rth h-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 (VRWM)

The total power dissipation in the diode has two components:

P_F - forward conduction dissipation

From the above it can be seen that:

$$R_{th h-a} = \frac{T_{jmax} - T_{amb}}{P_F + P_B} - (R_{th j-mb} + R_{th mb-h}) \qquad 2).$$

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 $R_{th\ i\text{-mb}}$ of 2.7 K/W.

Substituting equations 3) and 4) into equation 2) enables the calculation of the required heatsink.

To ensure thermal stability, $(R_{th\ j-mb} + R_{th\ mb-h} + R_{th\ h-a}) \times P_R$ must be less than 12 °C. If the calculated value of $R_{th\ h-a}$ does not permit this, then it must be reduced (heatsink size increased or $R_{th\ mb-h}$ improved) to enable this criterion to be met.

EXAMPLE: square-wave operation, using BYV118-35 and heatsink compound;

 $T_{amb} = 50$ °C; 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, $R_{th\ i\text{-}mb}$ = 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 $P_F = 2 \times 4 = 8 \text{ W}$ (from equation 4)

If desired T_{imax} is chosen to be 140 °C, then, from Fig.3, P_{R} (per diode) = 0.2 W

Therefore total $P_R = 2 \times 0.2 = 0.4 \text{ W}$ (from equation 3)

Using equation 2) we have:

$$R_{th\ h-a} = \frac{140\ ^{\circ}\text{C} - 50\ ^{\circ}\text{C}}{4\ \text{W} + 0.4\ \text{W}} - (1.7 + 0.3) = 18.5\ \text{K/W}$$

To check for thermal stability:

$$(R_{th i-a}) \times P_R = (1.7 + 0.3 + 18.5) \times 0.4 = 8.2 \text{ °C}.$$

This is less than 12 °C, hence thermal stability is ensured.

SQUARE WAVE OPERATION (Fig.3 and 4)

M3174

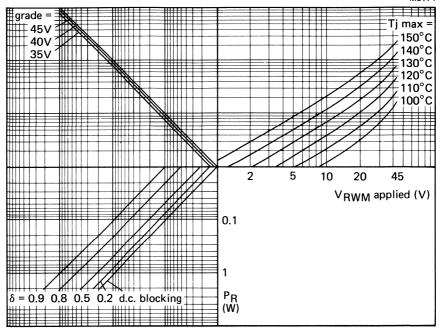
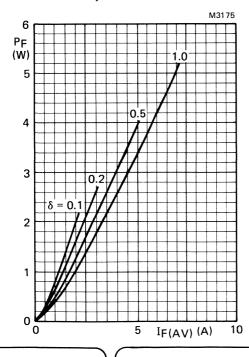


Fig.3 NOMOGRAM: for calculation of P_{R} (reverse leakage power dissipation) for a given $T_{\hat{j}}$ max., V_{RWM} applied, voltage grade and duty cycle; per diode.



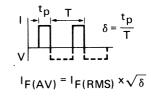


Fig.4 Forward current power rating; per diode.



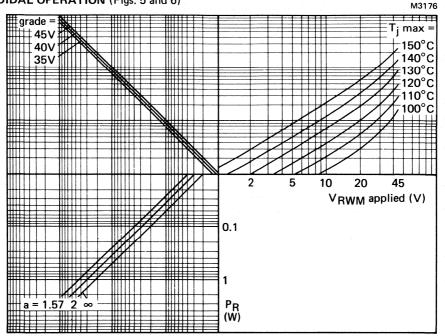
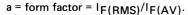


Fig.5 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_i max., V_{RWM} applied, voltage grade and form factor; per diode.



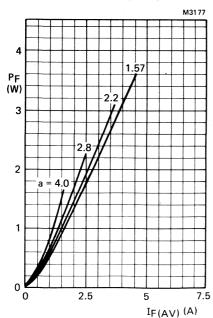


Fig.6 Forward current power rating; per diode.

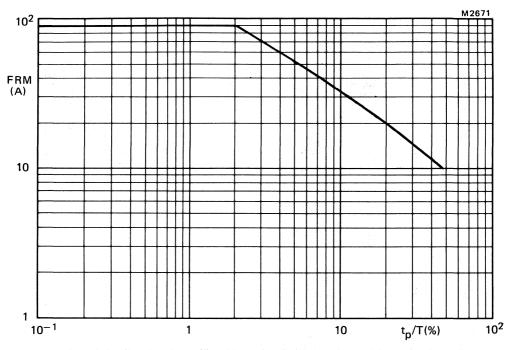
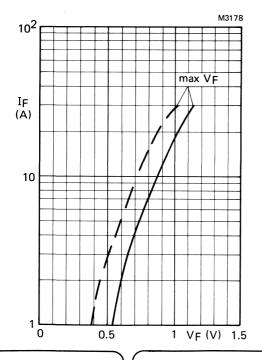
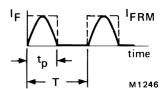


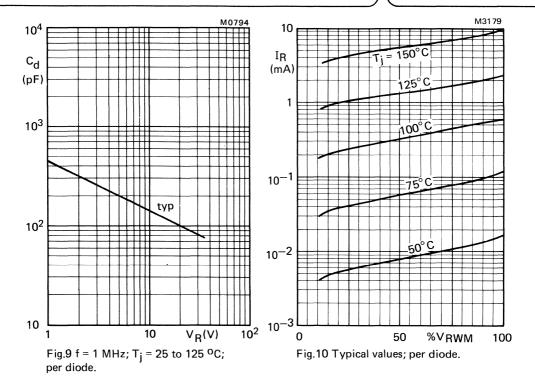
Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal current for 1 μ s < t $_p$ < 1 ms; per diode.

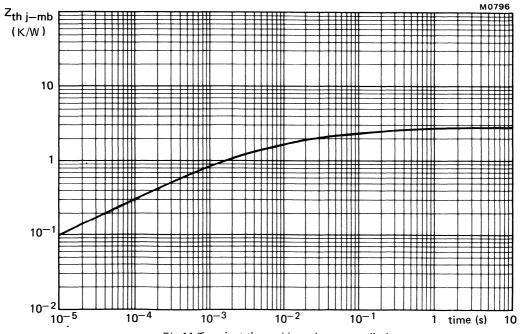




Definition of IFRM and t_p/T .

Fig.8
$$\longrightarrow$$
 T_j = 25 °C; \longrightarrow T_j = 150 °C; 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) | 10 | max. | | 10 | | А |
| Forward voltage | VF | < | | 0.6 | | V |
| Junction temperature | Тj | max. | | 150 | | oC |

MECHANICAL DATA Dimensions in mm -10.2 max -Fig.1 SOT-186 (full-pack). 4.4 5,7 max max 0.9 -2,9 max 3.0 40 7.9 7.5 3(a2) 17 mounting max base 2(k) M 2341 3.5 max 4.4 not tinned 13,5 1.5 max min 2

⊕Ø0.4 **M**

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).

5.08

0.9

2,54

top view

0,55 max

M2295

1.3

BYV118F SERIES

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 | VR | max. | 35 40 45 | V |
| Currents (both diodes conducting: note 1) | | | | |
| Output current: square wave; $\delta = 0.5$; | | | | |
| up to T _h = 110 °C (note 2) | l _O | max. | 10 | Α |
| sinusoidal; up to $T_h = 110$ °C (note 2) | lo | max. | 8.8 | Α |
| RMS forward current | IF(RMS) | max. | 14 | Α |
| Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ (per diode) | I _{FRM} | max. | 90 | Α |
| Non-repetitive peak forward current (per diode) half sinewave; T _j = 125 °C prior to surge; with reapplied V _{RWM max} | | | | |
| t = 10 ms | IFSM | max. | 100 | Α |
| t = 8.3 ms | IFSM | max. | 110 | A |
| I ² t for fusing (t = 10 ms; per diode) | l ² t | max. | 50 | A ² s |
| Reverse surge current | • | | 4.0 | |
| $t_{p} = 2 \mu s; \delta = 0.001$ $t_{p} = 100 \mu s$ | IRF:M | max. max. | 1.0 1.0 | A A |
| • | ^I RSM | max. | 1.0 | , , |
| Temperatures | | | | |
| Storage temperature | T_{stg} | | -40 to +150 | oC |
| Junction temperature | Tj | 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 | рF |
| | | | | |

Notes:

- 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 \leq 65% under clean and dust-free conditions.

| CHARACTERISTICS (per diode) | | | | |
|---|--|------------|------------------|----------------|
| Forward voltage $I_F = 5 A; T_j = 150 {}^{O}C$ $I_F = 10 A; T_j = 25 {}^{O}C$ | V _F | < < | 0.6 0.87 | V* V* |
| Reverse current $V_R = V_{RWM\ max}; T_j = 125\ ^{o}C$ $V_R = V_{RWM\ max}; T_j = 25\ ^{o}C$ Junction capacitance at f = 1 MHz $V_R = 5\ V; T_j = 25\ to\ 125\ ^{o}C$ | I _R I _R C _d | < < < typ. | 15 100 200 | mΑ μΑ 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-h} | | 5.5 | K/W |
| b. per diode with heatsink compound | R _{th j-h} | = , | 6.5 | K/W |
| Free air operation | | | | |
| The quoted value of R _{th j-a} should be used only when n tie point. | o leads of other c | omponents | run to the | e same |
| Thermal resistance from junction to ambient in free air, mounted on a printed circuit board | R _{th j-a} | = | 55 | K/W |

^{*}Measured under pulse conditions to avoid excessive dissipation.

MOUNTING INSTRUCTIONS

- 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-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:
 Maximum torque to avoid damage to the device:
 5.5 kgf (0.55 Nm)
 8.0 kgf (0.80 Nm)
- For good thermal contact, heatsink compound should be used between mounting base and heatsink.
 Values of R_{th j-h} given for mounting with heatsink compound refer to the use of a metallic oxide-loaded compound. Ordinary silicone grease is not recommended.
- 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.

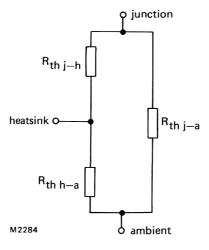


Fig.2.

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.

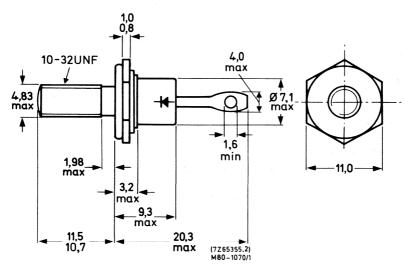
QUICK REFERENCE DATA

| | | | BYV120- 35 | 40 | 45 | - |
|---------------------------------|--------------------|------|------------|-----|------|---|
| Repetitive peak reverse voltage | VRRM | max. | 35 | 40 | 45 V | |
| Average forward current | F(AV) | max. | | 15 | - A | |
| Forward voltage | VF | < | | 0.6 | V | |
| Junction temperature | T_{j} | max. | | 150 | οС | |
| | | | | | | |

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO-4 with 10-32 UNF stud (ϕ 4.83 mm) as standard. Metric M5 stud (ϕ 5 mm) is available on request; e.g. BYV120-35M.



Net mass: 6 q

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.

BYV120 SERIES

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 | VRWM | max. | 35 | 40 | 45 | V |
| Continuous reverse voltage | V _R | max. | 35 | 40 | 45 | V |
| Currents | | | ta a see <u>-</u> | | | |
| Average forward current square wave; δ = 0.5; up to T _{mb} = 123 °C (note 1) sinusoidal; up to T _{mb} = 125 °C (note 1) | IF(AV) | max. | | 15 13.5 | | A A |
| R.M.S. forward current | IF(RMS) | max. | | 21 | | Α |
| Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ | I _{FRM} | max. | | 260 | | Α |
| Non-repetitive peak forward current half sine-wave; T _j = 125 ^O C prior to surge; with reapplied V _{RWM max} | | | | | | |
| t = 10 ms | I _{FSM} | max. | | 300 | | Α |
| t = 8.3 ms | IFSM | max. | | 330 | | Α |
| I^2 t for fusing (t = 10 ms) | l²t | max. | | 450 | | A^2s |
| Reverse surge current $t_p = 2 \mu s$; $\delta = 0.001$ $t_p = 100 \mu s$ | IRRM IRSM | max. max. | | 1.0 1.0 | | A A |
| Temperatures | | | | | | |
| Storage temperature | T _{stg} | | -55 to | +150 | | оС |
| Junction temperature | Тj | max. | | 150 | | οС |

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.

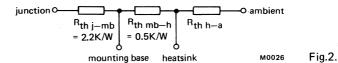
| THERMAL RESISTANCE | | | | |
|---|----------------------|-----------------|------|-----|
| From junction to mounting base From mounting base to heatsink | R _{th j-mb} | = | 2.2 | K/W |
| with heatsink compound | R _{th mb-h} | = | 0.5 | K/W |
| Transient thermal impedance; $t = 1 \text{ ms}$ | Z _{th j-mb} | = | 0.85 | K/W |
| CHARACTERISTICS | | | | |
| Forward voltage | | | | |
| I _F = 15 A; T _j = 150 °C I _F = 30 A; T _j = 25 °C | VF | < - | 0.6 | V* |
| $I_F = 30 \text{ A}; T_j' = 25 {}^{\circ}\text{C}$ | V _F | <pre><</pre> | 0.85 | V* |
| Reverse current | | | | |
| $V_R = V_{RWM max}; T_j = 125^{\circ}C$ $V_R = V_{RWM max}; T_j = 25^{\circ}C$ | I _R | < | 30 | mA |
| $V_R = V_{RWM max}$; $T_j = 25 {}^{\circ}C$ | ^I R | < | 0.1 | mA |
| Junction capacitance at f = 1 MHz | | | | |
| $V_R = 5 V; T_i = 25 \text{ to } 125 ^{\circ}\text{C}$ | Cd | 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:



Overall thermal resistance, Rth j-a = Rth j-mb + Rth mb-h + Rth h-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 (VRWM)

The total power dissipation in the diode has two components:

$$P_{tot} = P_R + P_F \dots 1$$
.

P_F – forward conduction dissipation

From the above it can be seen that:

$$R_{th h-a} = \frac{T_{jmax} - T_{amb}}{P_R + P_F} - (R_{th j-mb} + R_{th mb-h}) \dots 2).$$

Values for R $_{th\ j\text{-mb}}$ and R $_{th\ mb\text{-}h}$ can be found under Thermal Resistance. PR and PF 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_B 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 PR and PF into equation 2) enables the calculation of the required heatsink.

To ensure thermal stability, $(R_{th\ j-mb} + R_{th\ mb-h} + R_{th\ h-a}) \times P_R$ must be less than 12 °C. If the calculated value of $R_{th\ h-a}$ does not permit this, then it must be reduced (heatsink size increased or $R_{th\ mb-h}$ improved) to enable this criterion to be met.

EXAMPLE: square-wave operation, using BYV120-35 and heatsink compound

$$T_{amb} = 50 \, {}^{\circ}\text{C}; \, \delta = 0.5; \, |_{F(AV)} = 12 \, A$$

V_{RWM} = 12 V; voltage grade of device = 35 V.

From data, $R_{th j-mb} = 2.2 \text{ K/W}$ and $R_{th mb-h} = 0.5 \text{ K/W}$.

From Fig.4, it is found that $P_F = 9.0 \text{ W}$

If the desired T_{jmax} is chosen to be 130 °C, then, from Fig.3, $P_R = 0.1 \text{ W}$

Using equation 2) we have:

$$R_{\text{th h-a}} = \frac{130 \text{ }^{\circ}\text{C} - 50 \text{ }^{\circ}\text{C}}{9.0 \text{ W} + 0.1 \text{ W}} - (2.2 + 0.5) = 6.1 \text{ K/W}$$

To check for thermal stability:

$$(R_{th j-a}) \times P_R = (2.2 + 0.5 + 6.1) \times 0.1 = 0.9 \text{ °C}.$$

This is less than 12 °C, hence thermal stability is ensured.



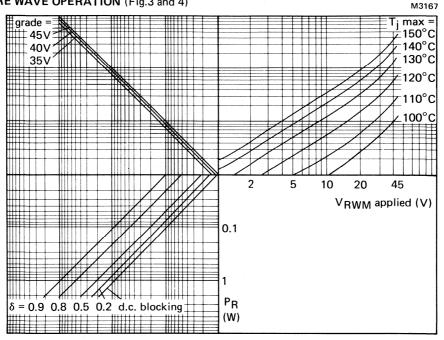
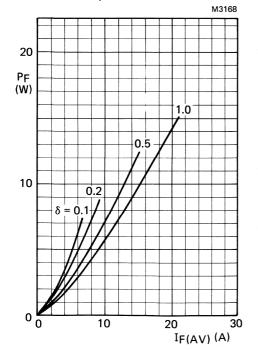


Fig.3 NOMOGRAM: for calculation of P_{R} (reverse leakage power dissipation) for a given T_{j} max., V_{RWM} applied, voltage grade and duty cycle,



$$\begin{array}{c|c}
t & T \\
\hline
V & \delta = \frac{t p}{T}
\end{array}$$

$$\delta = \frac{t p}{T}$$

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

Fig.4 Forward current power rating.

SINUSOIDAL OPERATION (Figs. 5 and 6)

M3169

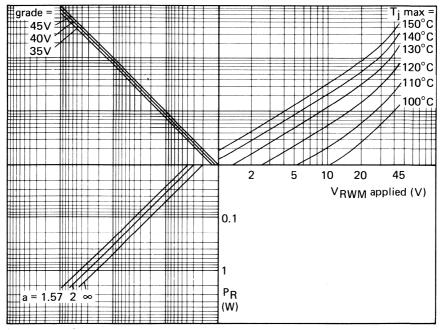


Fig.5 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and form factor. a = form factor = $I_{F(RMS)}/I_{F(AV)}$.

15 PF (W) 10 2.2 3 4.0

10

IF(AV)(A)

Fig.6 Forward current power rating.

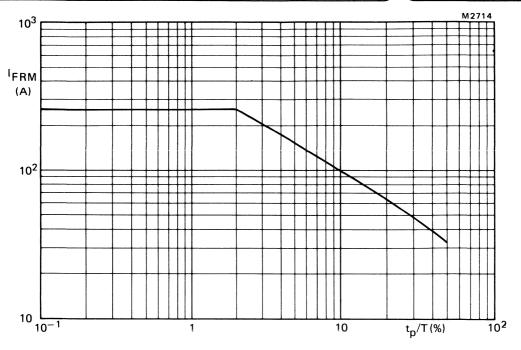
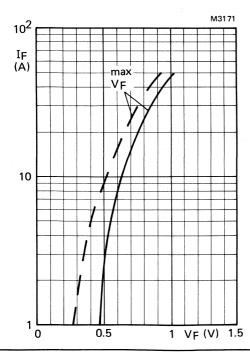
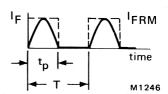


Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal current for 1 μ s < t $_p$ < 1 ms.





Definition of I $_{\mbox{\scriptsize FRM}}$ and $t_{\mbox{\scriptsize p}}/\mbox{\scriptsize T}.$

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

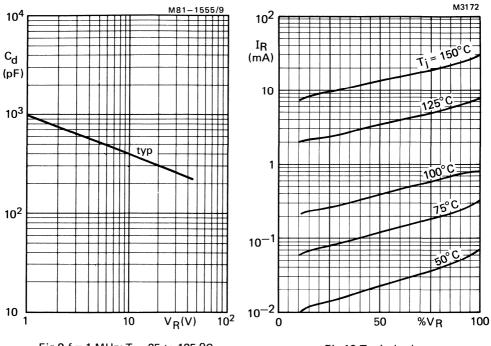


Fig.9 f = 1 MHz; T_i = 25 to 125 °C.

Fig.10 Typical values.

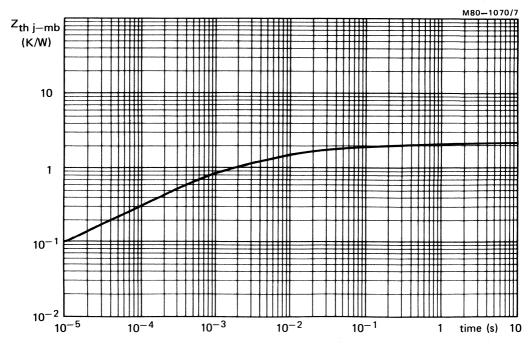


Fig.11 Transient thermal impedance.

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.

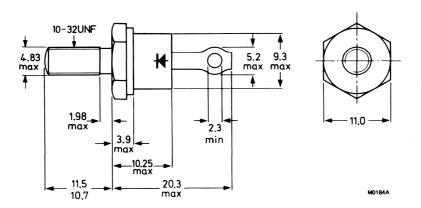
QUICK REFERENCE DATA

| | | BYV121 | – 35 | 40 | 45 | • |
|---------------------------------|---------|--------|-------------|-----|----------|---|
| Repetitive peak reverse voltage | VRRM | max. | 35 | 40 | 45 V | |
| Average forward current | IF(AV) | max. | | 30 | , A | |
| Forward voltage | VF | < | | 0.6 | V | |
| Junction temperature | T_{j} | max. | | 150 | оС | |

MECHANICAL DATA

Dimensions in mm

Fig. 1 DO-4 with 10-32 UNF stud (ϕ 4.83 mm) as standard. Metric M5 stud (ϕ 5 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.

BYV121 SERIES

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 | ٧ |
| | 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} = 120 °C (note 1) sinusoidal; up to T_{mb} = 122 °C (note 1) | IF(AV) IF(AV) | max. max. | | 30 27 | | A A |
| | R.M.S. forward current | IF(RMS) | max. | | 42.5 | | Α |
| | Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ | IFRM | max. | | 500 | | A , |
| | Non-repetitive peak forward current half sine-wave; $T_j = 125$ °C prior to surge; with reapplied V_{RWM} max $t = 10$ ms $t = 8.3$ ms | ^I FSM ^I FSM | max. | | 600 650 | | A A |
| | I^2 t for fusing (t = 10 ms) | l² t | max. | | 1800 | | A ² s |
| | Reverse surge current $t_p = 2 \mu s$; $\delta = 0.001$ $t_p = 100 \mu s$ | IRRM IRSM | max. max. | | 2.0 2.0 | | A A |
| | Temperatures | | | | | | |
| | Storage temperature | T _{stg} | | -55 to | +150 | | оС |
| | Junction temperature | Tj | max. | | 150 | | οС |
| | | | | | | | |

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.

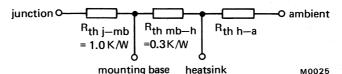
| THERMAL RESISTANCE | | | | |
|---|--|---|--------------------|-------------------|
| From junction to mounting base | R _{th j-mb} | - | 1.0 | K/W |
| From mounting base to heatsink with heatsink compound without heatsink compound Transient thermal impedance; t = 1 ms | R _{th mb-h} R _{th mb-h} Z _{th j-mb} | ======================================= | 0.3 0.5 0.15 | K/W K/W K/W |
| CHARACTERISTICS | | | | |
| Forward voltages $I_F = 34 \text{ A}$; $T_j = 150 ^{\text{O}}\text{C}$ $I_F = 60 \text{A}$; $T_j = 25 ^{\text{O}}\text{C}$ | V _F V _F | < < | 0.6 0.83 | V* V* |
| Reverse current $V_R = V_{RWM \ max}$; $T_j = 125^{\circ}C$ $V_R = V_{RWM \ max}$; $T_j = 25^{\circ}C$ | I _R | < < | 200 0.1 | mA mA |
| Junction capacitance at $f = 1 \text{ MHz}$ 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:



Overall thermal resistance, Rth i-a = Rth i-mb + Rth mb-h + Rth h-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 (VRWM)

The total power dissipation in the diode has two components:

$$P_{tot} = P_R + P_F \dots 1$$
).

Fig.2.

P_F – forward conduction dissipation

From the above it can be seen that:

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 PR and PF into equation 2) enables the calculation of the required heatsink.

To ensure thermal stability, $(R_{th\ j-mb} + R_{th\ mb-h} + R_{th\ h-a}) \times P_R$ must be less than 12 °C. If the calculated value of $R_{th\ h-a}$ does not permit this, then it must be reduced (heatsink size increased or $R_{th\ mb-h}$ improved) to enable this criterion to be met.

EXAMPLE: square-wave operation, using BYV121-35 and heatsink compound;

$$T_{amb} = 30 \, {}^{\circ}\text{C}; \, \delta = 0.5; \, I_{F(AV)} = 20 \, A$$

V_{RWM} = 12 V; voltage grade of device = 35 V.

From data, $R_{th j-mb} = 1.0 \text{ K/W}$ and $R_{th mb-h} = 0.3 \text{ K/W}$.

From Fig.4, it is found that $P_F = 12 \text{ W}$

If desired T_{jmax} is chosen to be 120 °C, then, from Fig.3, P_R = 0.4 W

Using equation 2) we have:

$$R_{\text{th h-a}} = \frac{120 \, ^{\circ}\text{C} - 30 \, ^{\circ}\text{C}}{12 \, \text{W} + 0.4 \, \text{W}} - (1.0 + 0.3) = 6 \, \text{K/W}$$

To check for thermal stability:

$$(R_{th i-a}) \times P_R = (1.0 + 0.3 + 6) \times 0.4 = 2.9 \text{ °C}.$$

This is less than 12 °C, hence thermal stability is ensured.

SQUARE WAVE OPERATION (Fig.3 and 4)

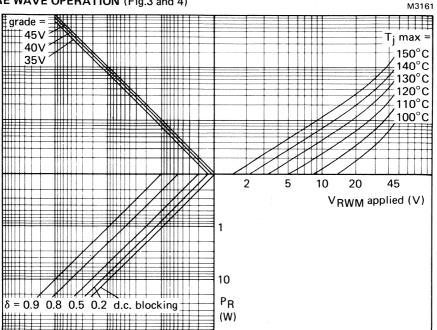
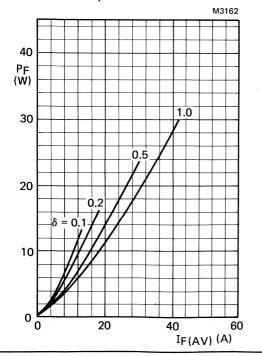


Fig.3 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_i max., V_{RWM} applied, voltage grade and duty cycle.



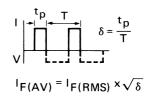


Fig.4 Forward current power rating.

SINUSOIDAL OPERATION (Figs. 5 and 6)



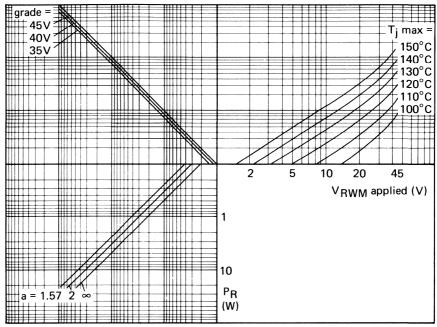


Fig.5 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and form factor.

 $a = form factor = I_F(RMS)/I_F(AV)$

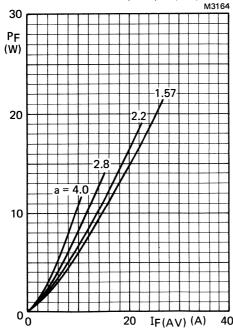


Fig.6 Forward current power rating.

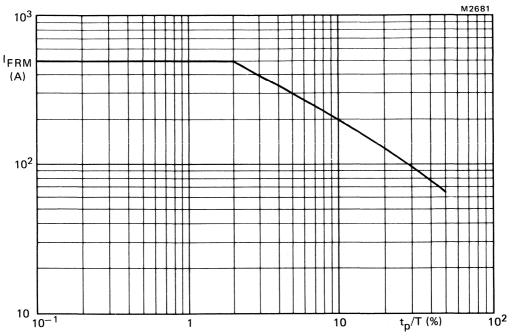
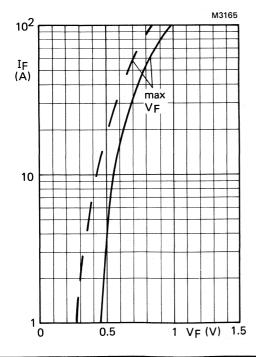
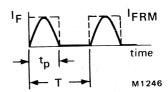


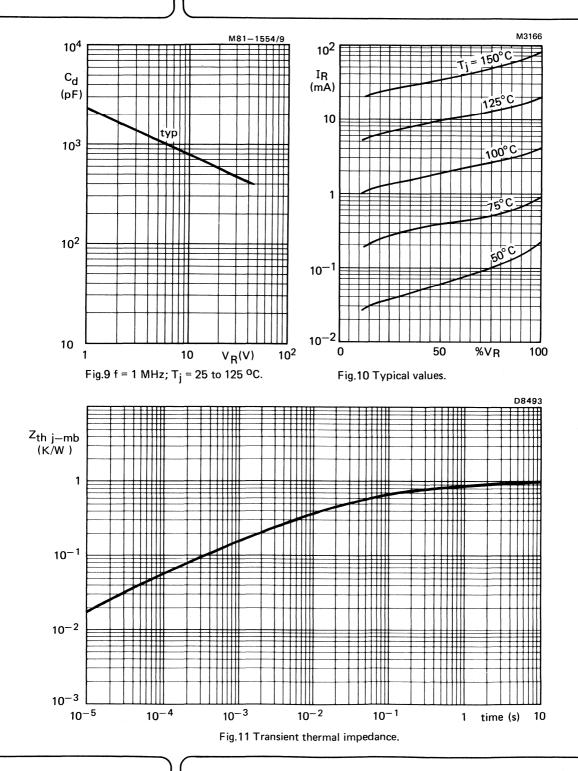
Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal current for 1 μ s < t $_D$ < 1 ms.





Definition of I $_{\mbox{\scriptsize FRM}}$ and $t_p/\mbox{\scriptsize T}.$

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



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.

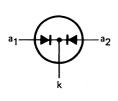
QUICK REFERENCE DATA

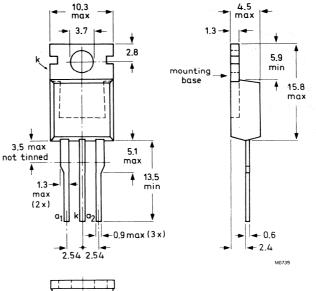
| Per diode, unless otherwise stated | | BYV 133-35 | | 40 | 45 | - | | |
|--|-----------|------------|----|-----|----|----------|--|--|
| Repetitive peak reverse voltage | v_{RRM} | max. | 35 | 40 | 45 | V | | |
| Output current (both diodes conducting) | 10 | max. | | 20 | | A | | |
| Forward voltage | VF | < | | 0.6 | | V | | |
| Junction temperature | Тj | max. | | 150 | | оС | | |

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.

BYV133 SERIES

RATINGS

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

| - | Voltages (per diode) | | BYV1 | 33-35 | 40 | 45 | |
|---|--|------------------|--------------|--------|------------|----|---------|
| | Repetitive peak reverse voltage | V _{RRM} | max. | 35 | 40 | 45 | ٧ |
| | Crest working reverse voltage | V _{RWM} | max. | 35 | 40 | 45 | ٧ |
| | Continuous reverse voltage | v_R | max. | 35 | 40 | 45 | V |
| | Currents (both diodes conducting: note 1) | | | | | | |
| | Output current: square wave; δ = 0.5; up to T_{mb} = 121 °C | | | | | | |
| | (note 2) | 10 | max. | | 20 | | Α |
| | sinusoidal; up to $T_{mb} = 124$ °C (note 2) | 10 | max. | | 18 | | Α |
| | RMS forward current (note 3) | IF(RMS) | max. | | 28 | | Α |
| | Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ (per diode) | IFRM | max. | | 200 | | Α |
| | Non-repetitive peak forward current (per diode) half sinewave; T _j = 125 ^o C prior to surge; with reapplied V _{RWM max} | | | | | | |
| | t = 10 ms | ^I FSM | max. | | 100 | | Α |
| | t = 8.3 ms | ^I FSM | max. | | 110 | | Α |
| | I ² t for fusing (t = 10 ms, per diode) | l ² t | max. | | 50 | | $A^2 s$ |
| | Reverse surge current $t_p = 2 \mu s; \delta = 0.001$ $t_p = 100 \mu s$ | RRM RSM | max. max. | | 1.0 1.0 | | A A |
| | Temperatures | | | | | | |
| | Storage temperature | T_{stg} | | -40 to | +150 | | оС |
| | Junction temperature | $T_{j_{\perp}}$ | max. | | 150 | | οС |

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 $I_F = 7 \text{ A}; T_j = 150 ^{\circ}\text{C}$ $I_F = 20 \text{ A}; T_i = 25 ^{\circ}\text{C}$ | V _F V _F | < < | 0.6 0.94 | V* V* |
| Reverse current | • F | | | |
| $V_R = V_{RWM max}$; $T_j = 125 {}^{O}C$ $V_R = V_{RWM max}$; $T_j = 25 {}^{O}C$ | I _R | < < | 15 0.1 | mA mA |
| Junction capacitance at $f = 1 \text{ MHz}$ V _R = 5 V; T _j = 25 to 125 °C | C _d | typ. | 300 | pF |
| THERMAL RESISTANCE | | | | |
| From junction to mounting base (both diodes conducting) | R _{th j-mb} | · | 1.6 | K/W |
| From junction to mounting base (per diode) | R _{th j-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-h} | = | 0.2 | K/W |
| b. with heatsink compound and 0.06 mm maximum mica insulator | R _{th mb-h} | · · · = | 1.4 | K/W |
| with heatsink compound and 0.1 mm maximum mica insulator (56369) | R _{th mb-h} | = | 2.2 | K/W |
| d. with heatsink compound and 0.25 mm maximum alumina insulator (56367) | R _{th mb-h} | = | 0.8 | K/W |
| e. without heatsink compound | R _{th mb-h} | = | 1.4 | K/W |
| 2. Free-air operation | | | | |
| The quoted value of R _{th j-a} should be used only when no to the same tie point. Thermal resistance from junction to ambient in free air: mounted on a printed-circuit board at any device lead | leads of other o | dissipating | g componei | nts run |
| length and with copper laminate on the board. | R _{th j-a} | = | 60 | K/W |

^{*}Measured under pulse conditions to avoid excessive dissipation.

MOUNTING INSTRUCTIONS

- 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.
- 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 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.
- 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.

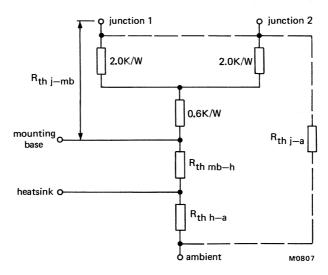


Fig.2

OPERATING NOTES

Dissipation and heatsink calculations (continued)

Overall thermal resistance, Rth j-a = Rth j-mb + Rth mb-h + Rth h-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 (VRWM)

The total power dissipation in the diode has two components:

P_R - reverse leakage dissipation

$$P_{tot} = P_R + P_F \dots 1$$
).

P_F - forward conduction dissipation

From the above it can be seen that:

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:

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).

NOTE:— If both halves of the diode are being used (as is assumed above), the value of R_{th j-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-mb} of 2.6 K/W.

To ensure thermal stability, $(R_{th j-mb} + R_{th mb-h} + R_{th h-a}) \times P_R$ must be less than 12 °C. If the calculated value of $R_{th h-a}$ does not permit this, then it must be reduced (heatsink size increased or $R_{th mb-h}$ improved) to enable this criterion to be met.

EXAMPLE: square-wave operation, using BYV133-35 and heatsink compound;

 $T_{amb} = 50 \text{ °C}; \delta \text{ (diode 1)} = 0.5; \delta \text{ (diode 2)} = 0.5;$

 $I_{F(AV)}$ (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, $R_{th i-mb} = 1.6 \text{ K/W}$ and $R_{th mb-h} = 0.2 \text{ K/W}$.

For each diode from Fig.4, it is found that $P_F = 5.75 \text{ W}$;

hence total $P_F = 2 \times 5.75 = 11.5 \text{ W}$ (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 $P_R = 2 \times 0.06 = 0.12 \text{ W (from equation 3)}$

Using equation 2) we have:

$$R_{\text{th h-a}} = \frac{130 \text{ }^{\circ}\text{C} - 50 \text{ }^{\circ}\text{C}}{11.5 \text{ W} + 0.12 \text{ W}} - (1.6 + 0.2) = 5.1 \text{ K/W}$$

To check for thermal stability:

$$(R_{th i-a}) \times P_R = (1.6 + 0.2 + 5.1) \times 0.12 = 0.8 \, ^{\circ}C.$$

This is less than 12 °C, hence thermal stability is ensured.

SQUARE WAVE OPERATION (Fig.3 and 4)

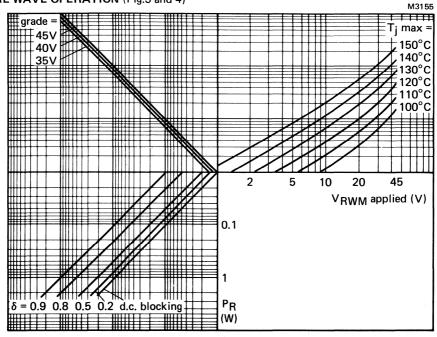
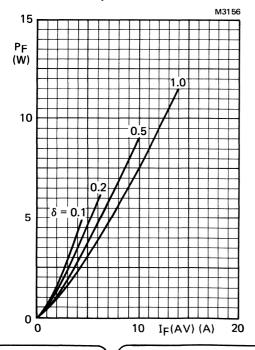


Fig.3 NOMOGRAM: for calculation of PR (reverse leakage power dissipation) for a given T $_{\rm i}$ max., V $_{\rm RWM}$ applied, voltage grade and duty cycle; per diode.



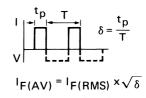


Fig.4 Forward current power rating; per diode.



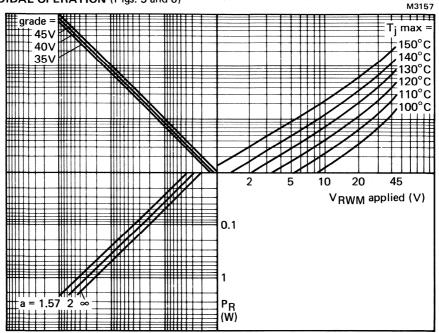


Fig.5 NOMOGRAM: for calculation of $P_{\hbox{\scriptsize R}}$ (reverse leakage power dissipation) for a given T_j max., $V_{\hbox{\scriptsize RWM}}$ applied, voltage grade and form factor; per diode.

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

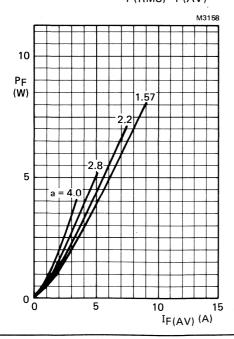


Fig.6 Forward current power rating; per diode.

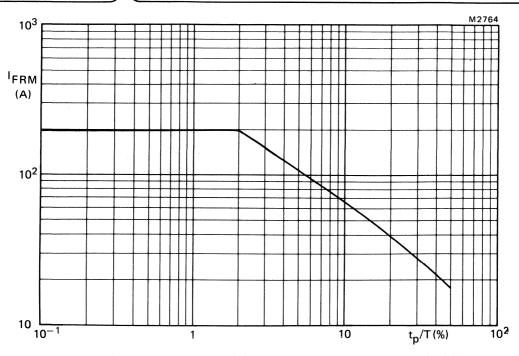
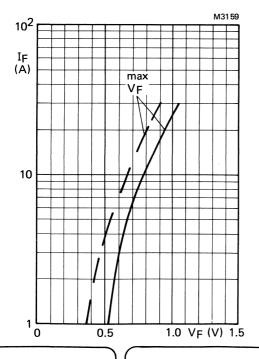
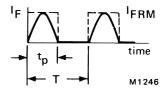


Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal current for 1 μ s < t $_p$ < 1 ms; per diode.





Definition of IFRM and $t_p/\text{T}. \label{eq:tpm}$

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

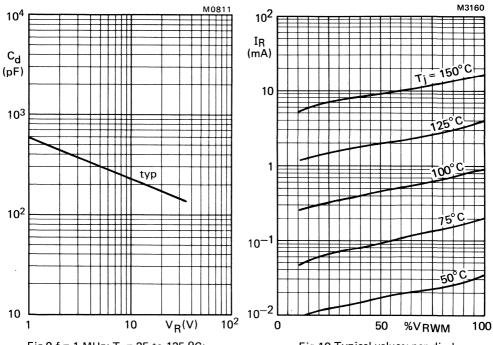
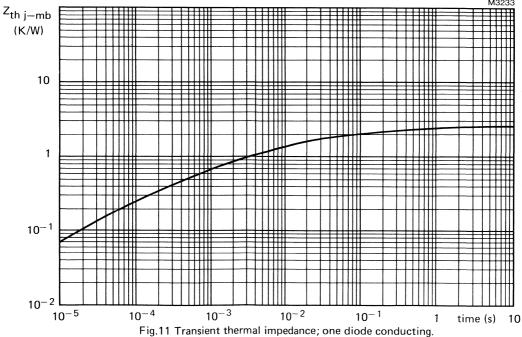


Fig.9 f = 1 MHz; T_i = 25 to 125 °C; per diode.

Fig.10 Typical values; per diode.



This data sheet contains advance information and specifications are subject to change without notice.

SCHOTTKY-BARRIER ELECTRICALLY-ISOLATED DOUBLE RECTIFIER DIODES

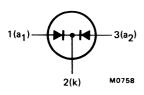
Low-leakage, platinum-barrier double rectifier diodes in SOT-186 (full-pack) plastic envelopes featuring low forward voltage drop, low capacitance and absence of stored charge. Their electrical isolation makes them ideal for mounting on a common heatsink alongside other components without the need for 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;

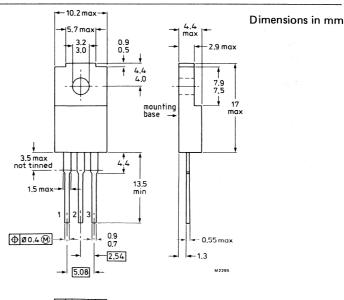
QUICK REFERENCE DATA

| Per diode, unless otherwise stated | | BYV133F- | 35 40 | 45 | |
|---|---------|----------|---------|----|----|
| Repetitive peak reverse voltage | VRRM | max. | 35 40 | 45 | V |
| Output current (both diodes conducting) | IO | max. | 20 | | A |
| Forward voltage | VF | < | 0.6 | | ٧ |
| Junction temperature | T_{j} | max. | 150 | | οС |

MECHANICAL DATA

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





top view

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).

BYV133F SERIES

RATINGS

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

| Voltages (per diode) | | BYV13 | 33F-35 | 40 | 45 | |
|---|-------------------|-------|--------|----------|----|----------------|
| Repetitive peak reverse voltage | V_{RRM} | max. | 35 | 40 | 45 | ٧ |
| Crest working reverse voltage | V _{RWM} | max. | 35 | 40 | 45 | ٧ |
| Continuous reverse voltage | VR | max. | 35 | 40 | 45 | V |
| Currents (both diodes conducting: notes 1 a | nd 3) | | | | | |
| Output current: square wave; $\delta = 0.5$; up to $T_h = 61$ °C | | | | | | |
| (note 2) | | max. | | 20 18 | | A |
| sinusoidal; up to $T_h = 80$ °C (note 2) | 10 | max. | | 4.7 | | А |
| RMS forward current | F(RMS) | max. | | 20 | | Α |
| Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ (per diode) | FRM | max. | | 100 | | Α |
| Non-repetitive peak forward current (per dic half sinewave; T _j = 125 °C prior to surge; with reapplied V _{RWM max} | ode) | | | | | |
| t = 10 ms | ¹ FSM | max. | | 100 | | Α |
| t = 8.3 ms | ¹ FSM | max. | | 110 | | Α |
| I^2 t for fusing (t = 10 ms, per diode) | 1 ² t | max. | | 50 | | A ² |
| Reverse surge current | 1 | max. | | 1.0 | | Α |
| $t_p = 2 \mu s; \delta = 0.001$ $t_p = 100 \mu s$ | IRRM IRSM | max. | | 1.0 | | A |
| Temperatures | | | | | | |
| Storage temperature | T_{stg} | | -40 to | +150 | | oC |
| Junction temperature | Tj | 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) | Cp | typ. | | 12 | | рF |
| | ٣ | | | | | |

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.

5.0

K/W

CHARACTERISTICS (per diode)

| Forward voltage | | | | |
|--|----------------|------|------|----|
| I _F = 7 A; T _i = 150 °C | v_F | < | 0.6 | V* |
| I _F = 20 A; T _j = 25 °C | V _F | < | 0.94 | V* |
| Reverse current | | | | |
| $V_R = V_{RWM max}$; $T_j = 125 {}^{\circ}C$ | I _R | < | 15 | mA |
| $V_R = V_{RWM max}; T_j = 25 {}^{\circ}C$ | I _R | < | 0.1 | mA |
| Junction capacitance at f = 1 MHz | | | | |
| $V_R = 5 V$; $T_i = 25 \text{ to } 125 {}^{\circ}\text{C}$ | Cd | typ. | 300 | рF |

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

| • | u1 j-11 | | | |
|---------------------------|---------------------|---|-----|-----|
| without heatsink compound | R _{th j-h} | = | 7.0 | K/W |
| b. per diode: | | | | |
| with heatsink compound | R _{th j-h} | = | 6.0 | K/W |
| without heatsink compound | R _{th j-h} | = | 8.0 | K/W |

Rth i-h

Free-air operation

The quoted value of R_{th j-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 K/W 55 R_{th i-a}

^{*}Measured under pulse conditions to avoid excessive dissipation.

MOUNTING INSTRUCTIONS

- 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-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)
- For good thermal contact, heatsink compound should be used between mounting base and heatsink.
 Values of R_{th j-h} given for mounting with heatsink compound refer to the use of a metallic oxide-loaded compound. Ordinary silicone grease is not recommended.
- 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.

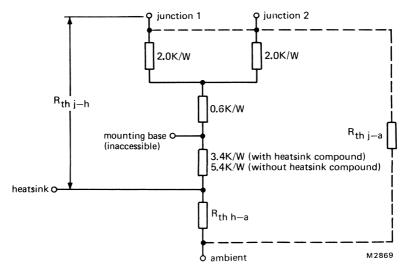


Fig.2

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

OPERATING NOTES

Dissipation and heatsink calculations (continued)

Overall thermal resistance, R_{th i-a} = R_{th i-h} + R_{th h-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:

$$P_{tot} = P_R + P_F \dots 1$$
).

From the above it can be seen that:

$$R_{th\ h-a} = \frac{T_{jmax} - T_{amb}}{P_E + P_B} - (R_{th\ j-h}) \dots 2).$$

The value of $R_{th\ j-h}$ 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:

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 $R_{th j-h} = 5 \text{ K/W}$ (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 $R_{th\ j-h}$ of 6 K/W (with heatsink compound) or 8 K/W (without heasink compound).

To ensure thermal stability, $(R_{th\ j-h}+R_{th\ h-a}) \times P_R$ must be less than 12 o C. If the calculated value of $R_{th\ h-a}$ does not permit this, then it must be reduced (heatsink size increased or $R_{th\ j-a}$ improved) to enable this criterion to be met.

EXAMPLE: square wave operation, using BYV133F-35 and heatsink compound;

 $T_{amb} = 40 \, {}^{\circ}\text{C}; \, \delta \, (\text{diode 1}) = 0.5; \, \delta \, (\text{diode 2}) = 0.5;$

 $I_{F(AV)}$ (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, $R_{th i-h} = 5 \text{ K/W}$.

For each diode from Fig.4, it is found that $P_F = 5.75 \text{ W}$;

hence total $P_F = 2 \times 5.75 = 11.5 \text{ W}$. (from equation 4)

If the desired T_{imax} is chosen to be 130 °C, then, from Fig.3, P_R (per diode) = 0.06 W.

Therefore total $P_R = 2 \times 0.06 = 0.12 \text{ W}$. (from equation 3)

Using equation 2) we have:

$$R_{\text{th h-a}} = \frac{130 \text{ °C} - 40 \text{ °C}}{11.5 \text{ W} + 0.12 \text{ W}} - (5.0) = 2.7 \text{ K/W}$$

To check for thermal stability:

$$(R_{th j-a}) \times P_R = (5.0 + 2.7) \times 0.12 = 0.9 \, ^{O}C.$$

This is less than 12 °C, hence thermal stability is ensured.



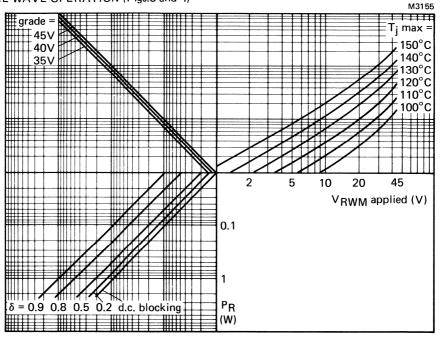
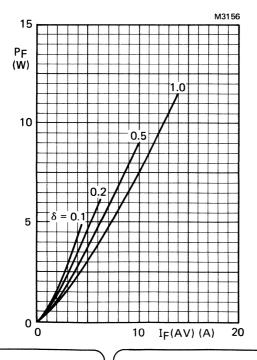


Fig.3 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and duty cycle (per diode).



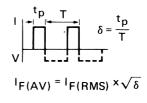


Fig.4 Foward current power rating (per diode).

SINUSOIDAL OPERATION (Figs.5 and 6)

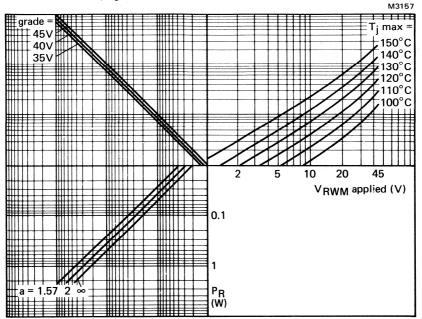


Fig.5 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and form factor; per diode.

a = form factor = IF(RMS)/IF(AV).

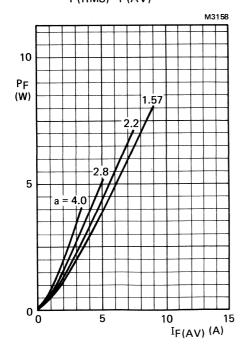


Fig.6 Foward current power rating; per diode.

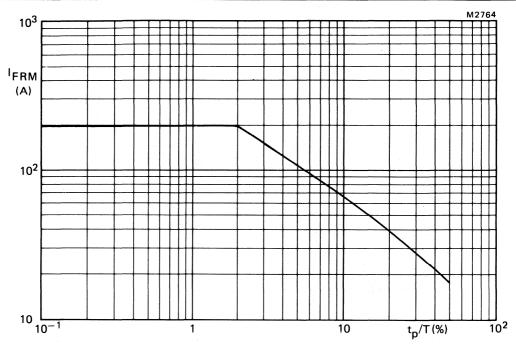
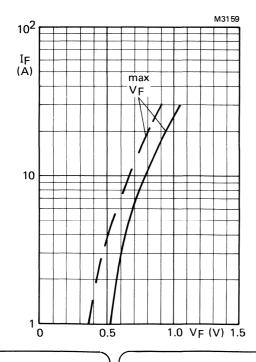
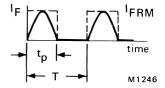


Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 μs < t_p < 1 ms; per diode.





Definition of IFRM and t_p/T .

Fig.8 —
$$T_j = 25 \text{ }^{\circ}\text{C}; --- T_j = 150 \text{ }^{\circ}\text{C};$$
 per diode.

DEVELOPMENT DATA

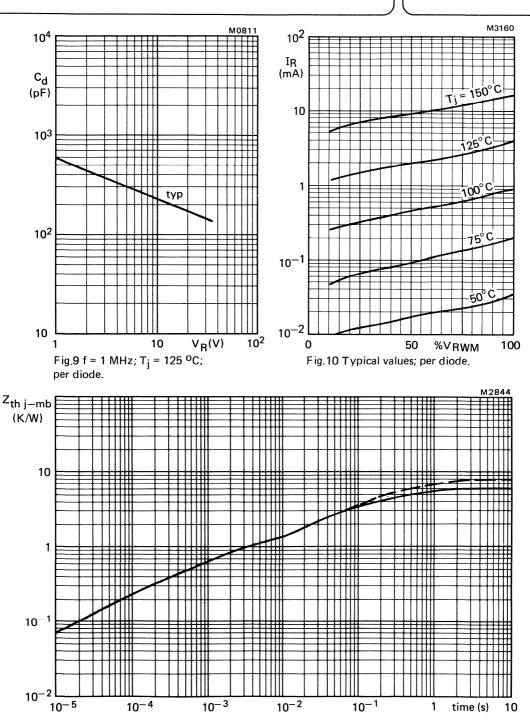


Fig.11 Transient thermal impedance; one diode conducting; —— with heatsink compound; —— without heatsink compound.

SCHOTTKY-BARRIER DOUBLE RECTIFIER DIODES

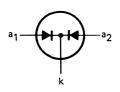
Low-leakage, platinum-barrier double rectifier diodes in plastic envelopes featuring low forward voltage drop, low capacitance and absence of stored charge. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and zero switching 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.

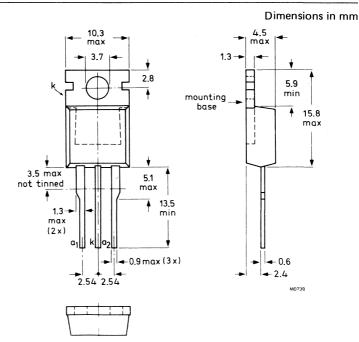
QUICK REFERENCE DATA

| Per diode, unless otherwise stated | | BYV14 | 3-35 40 | 45 - | |
|---|------------------|-------|-----------|------|--|
| Repetitive peak reverse voltage | V _{RRM} | max. | 35 40 | 45 V | |
| Output current (both diodes conducting) | 10 | max. | 30 | A | |
| Forward voltage | VF | < | 0.6 | V | |
| Junction temperature | Тj | max. | 150 | oC | |

MECHANICAL DATA

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.

BYV143 SERIES

RATINGS

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

| - | Voltages (per diode) | | | BYV14 | 3-35 | 40 | 45 | |
|---|--|--------------------------------------|--------------|-------|--------|------------|----|--------|
| | Repetitive peak reverse voltage | V _{RRM} | | | 35 | 40 | 45 | ٧ |
| | Crest working reverse voltage | V_{RWM} | | | 35 | 40 | 45 | V |
| | Continuous reverse voltage | V _R | | | 35 | 40 | 45 | ٧ |
| | Currents (both diodes conducting: note 1) | | | | | | | , |
| | Output current: square wave; δ = 0.5; up to T_{mb} = 116 °C (note 2) sinusoidal; up to T_{mb} = 120 °C (note 2) | 1 ₀ | max. max. | | | 30 26 | | A A |
| | RMS forward current (note 3) | I _F (RMS) | max. | | | 40 | | Α |
| | Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ (per diode) | IFRM | max. | | | 250 | | Α |
| | Non-repetitive peak forward current (per dioc half sinewave; T _j = 125 °C prior to surge; with reapplied V _{RWM max} | de) | | | | | | |
| | t = 10 ms | ^I FSM | max. | | | 200 | | Α |
| | t = 8.3 ms | FSM | max. | | | 220 | | Α |
| | I ² t for fusing (t = 10 ms, per diode) | l ² t | max. | | | 200 | | A^2s |
| | Reverse surge current $t_p = 2 \mu s; \delta = 0.001$ $t_p = 100 \mu s$ | I _{RRM} I _{RSM} | max. max. | | | 2.0 2.0 | | A A |
| | Temperatures | | | | | | | |
| | Storage temperature | T_{stg} | | - | -40 to | +150 | | oC |
| | Junction temperature | Tj | max. | | | 150 | | оС |

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 °C I _F = 20 A; T _j = 25 °C | V _F *** | < < | 0.6 | V* |
| $I_F = 20 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | VF | < | 0.77 | V* |
| Reverse current | | | 00 | |
| $V_R = V_{RWM max}$; $T_j = 125 {}^{o}C$ $V_R = V_{RWM max}$; $T_j = 25 {}^{o}C$ | l R | < < | 30 200 | mA |
| | ^I R | | 200 | μΑ |
| Junction capacitance at f = 1 MHz | C . | tun | E00 | n E |
| $V_R = 5 \text{ V}; T_j = 25 \text{ to } 125 ^{\circ}\text{C}$ | C _d | typ. | 500 | pF |
| THERMAL RESISTANCE | | | | |
| From junction to mounting base (both diodes conducting) | R _{th j-mb} | = | 1.4 | K/W |
| From junction to mounting base (per diode) | R _{th j-mb} | | 2.3 | K/W |
| Influence of mounting method | | | | |
| 1. Heatsink mounted with clip | | | | |
| Thermal resistance from mounting base to heatsink | | | | |
| · | р | = | 0.2 | K/W |
| a. with heatsink compound | R _{th mb-h} | _ | 0.2 | N/VV |
| b. with heatsink compound and 0.06 mm maximum mica insulator | D., | _ | 1.4 | K/W |
| | R _{th mb-h} | | 1.7 | IX/ VV |
| c. with heatsink compound and 0.1 mm maximum mica insulator (56369) | D., | = | 2.2 | K/W |
| · | R _{th} mb-h | _ | 2.2 | IX/ VV |
| d. with heatsink compound and 0.25 mm maximum alumina insulator (56367) | R., | = | 0.8 | K/W |
| , , , , , , , , , , , , , , , , , , , | R _{th mb-h} | = | 1.4 | K/W |
| e. without heatsink compound | R _{th mb-h} | _ | 1.4 | N/VV |
| 2. Free-air operation | | | | |
| The quoted value of R _{th j-a} should be used only when no I | eads of other o | dissipating | 3 componer | nts 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-a} | = | 60 | K/W |
| iongai and trici ooppor farmingto on the sounds | rui j-a | | | , |

^{*}Measured under pulse conditions to avoid excessive dissipation.

MOUNTING INSTRUCTIONS

- 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.
- 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.

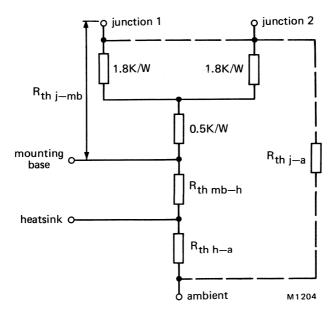


Fig.2.

OPERATING NOTES

Dissipation and heatsink calculations (continued)

Overall thermal resistance, R_{th j-a} = R_{th j-mb} + R_{th mb-h} + R_{th h-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 (VRWM)

The total power dissipation in the diode has two components:

$$P_{tot} = P_R + P_F \dots 1$$
.

P_F – forward conduction dissipation

From the above it can be seen that:

Values for R $_{th\ j\text{-}mb}$ and R $_{th\ mb\text{-}h}$ can be found under Thermal Resistance. PR and PF 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.

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 $R_{th\ i\text{-mb}}$ of 2.3 K/W.

To ensure thermal stability, $(R_{th\ j-mb} + R_{th\ mb-h} + R_{th\ h-a}) \times P_R$ must be less than 12 °C. If the calculated value of $R_{th\ h-a}$ does not permit this, then it must be reduced (heatsink size increased or $R_{th\ mb-h}$ improved) to enable this criterion to be met.

EXAMPLE: square-wave operation, using BYV143-35 and heatsink compound;

 $T_{amb} = 50 \text{ °C}; \delta \text{ (diode 1)} = 0.5; \delta \text{ (diode 2)} = 0.5;$

 $I_{F(AV)}$ (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, $R_{th j-mb} = 1.4 \text{ K/W}$ and $R_{th mb-h} = 0.2 \text{ K/W}$.

For each diode from Fig.4, it is found that $P_F = 8.9 \text{ W}$;

hence total $P_F = 2 \times 8.9 = 17.8 \text{ W (from equation 4)}$

If the desired T_{imax} is chosen to be 130 °C, then, from Fig.3, P_R (per diode) = 0.13 W

Therefore total $P_R = 2 \times 0.13 = 0.26 \text{ W}$ (from equation 3)

Using equation 2) we have:

$$R_{th h-a} = \frac{130 \text{ }^{\circ}\text{C} - 50 \text{ }^{\circ}\text{C}}{17.8 \text{ W} + 0.26 \text{ W}} - (1.4 + 0.2) = 2.8 \text{ K/W}$$

To check for thermal stability:

$$(R_{th j-a}) \times P_R = (1.4 + 0.2 + 2.8) \times 0.26 = 1.1 \text{ }^{\circ}C.$$

This is less than 12 °C, hence thermal stability is ensured.

SQUARE WAVE OPERATION (Fig.3 and 4)

M3149

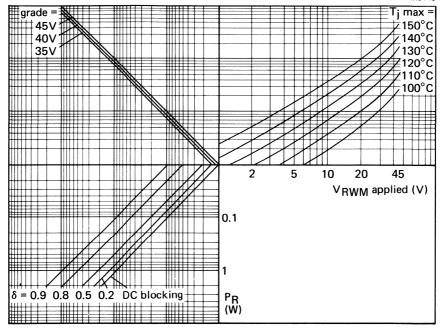
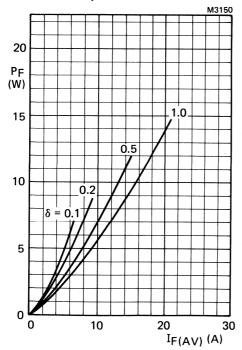


Fig.3 NOMOGRAM: for calculation of $P_{\hbox{\scriptsize R}}$ (reverse leakage power dissipation) for a given $T_{\hbox{\scriptsize i}}$ max., $V_{\hbox{\scriptsize RWM}}$ applied, voltage grade and duty cycle; per diode.



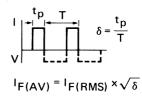


Fig.4 Forward current power rating; per diode.

SINUSOIDAL OPERATION (Figs. 5 and 6)

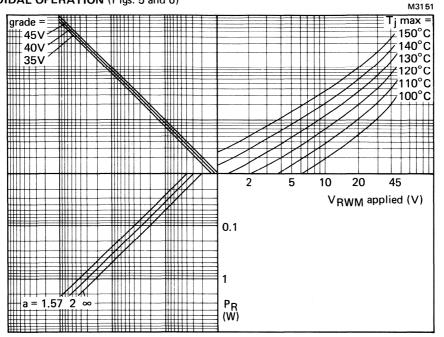


Fig.5 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_i max., V_{RWM} applied, voltage grade and form factor; per diode.

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

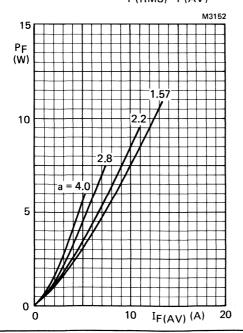


Fig.6 Forward current power rating; per diode.

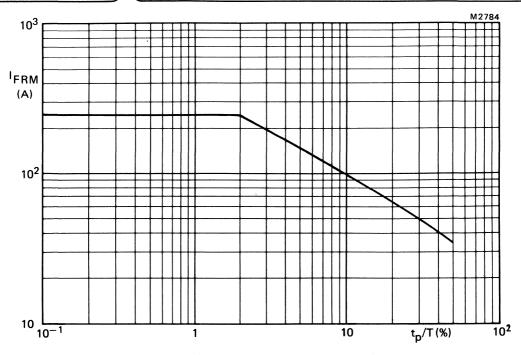
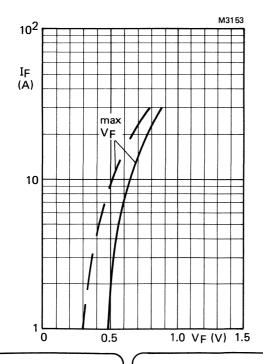
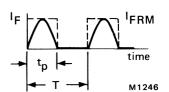


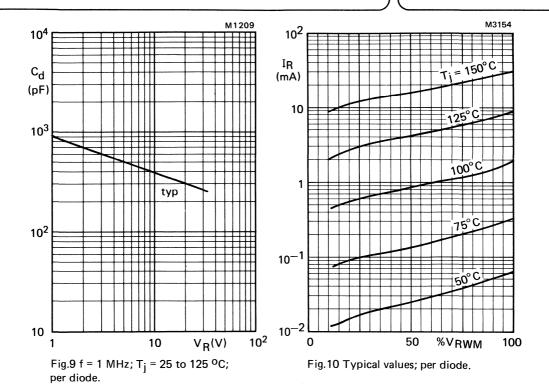
Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal current for 1 μ s < t $_p$ < 1 ms; per diode.

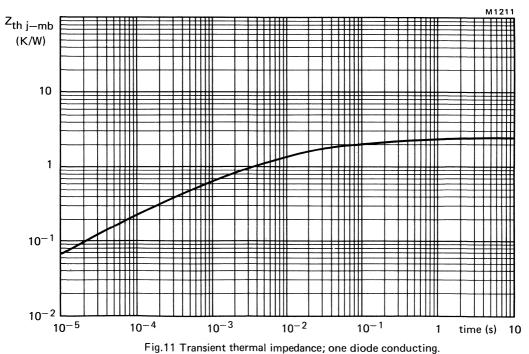




Definition of I $_{\mbox{\scriptsize FRM}}$ and $t_{\mbox{\scriptsize p}}/T.$

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





SCHOTTKY-BARRIER, ELECTRICALLY-ISOLATED DOUBLE RECTIFIER DIODES

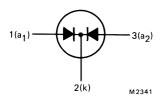
Low-leakage platinum-barrier double rectifier diodes in SOT-186 (full-pack) plastic envelopes featuring low forward voltage drop, low capacitance and absence of stored charge. Their electrical isolation makes them ideal for mounting on a common heatsink alongside other components without the need for 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.

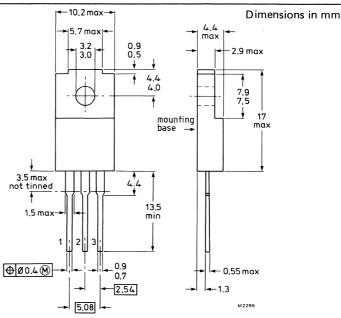
QUICK REFERENCE DATA

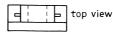
| Per diode, unless otherwise stated | · · · · · · · · · · · · · · · · · · · | | BYV143F-35 | 40 | 45 | |
|---|---------------------------------------|------|------------|-----|----|----|
| Repetitive peak reverse voltage | V_{RRM} | max. | 35 | 40 | 45 | V |
| Output current (both diodes conducting) | 10 | max. | | 20 | | Α |
| Forward voltage | ٧F | < | | 0.6 | | V |
| Junction temperature | , Tj | max. | | 150 | | oC |

MECHANICAL DATA

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).

BYV143F SERIES

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 | VRWM | max. | 35 | 40 | 45 | V |
| Continuous reverse voltage | v_{R} | max. | 35 | 40 | 45 | V |
| Currents (both diodes conducting; notes 1 ar | nd 3) | | | · | | |
| Output current: square wave; $\delta = 0.5$; | | | | | | |
| up to $T_h = 84$ °C (note 2) | lo | max. | | 20 | | A |
| sinusoidal; up to T _h = 90 °C (note 2) RMS forward current | 10 | max. | | 18 | | A |
| | ^I F(RMS) | max. | | 20 | | Α |
| Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ (per diode) | IFRM | max. | | 250 | | Α |
| Non-repetitive peak forward current (per diode) half sinewave; T _j = 125 °C prior to surge; with reapplied V _{RWM max} | | | | | | |
| t = 10 ms | IFSM | max. | | 200 | | Α |
| t = 8.3 ms | ^I FSM | max. | | 220 | | Α |
| I^2 t for fusing (t = 10 ms; per diode) | l ² t | max. | | 200 | | A^2s |
| Reverse surge current | | | | | | |
| $t_p = 2 \mu s; \delta = 0.001$ | RRM | max. | | 2.0 | | A |
| $t_p = 100 \mu s$ | IRSM | max. | | 2.0 | | Α |
| 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 (note 4) | V _(isol) M | max. | | 1500 | | V |
| Isolation capacitance between all terminals and external heatsink (note 4) | C _(isol) | typ. | | 12 | | pF |
| | | | | | | |

Notes:

- 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 \leq 65% under clean and dust-free conditions.

K/W

55

Thermal resistance from junction to ambient in free air, mounted on a printed circuit board

| CHARACTERISTICS (per diode) | | | | |
|--|----------------------------------|----------|-------------|----------|
| Forward voltage $I_F = 15 \text{ A}; T_j = 150 ^{\circ}\text{C}$ $I_F = 20 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | V _F V _F | < < | 0.6 0.77 | V* V* |
| Reverse current $V_R = V_{RWM max}$; $T_j = 125 {}^{O}C$ $V_R = V_{RWM max}$; $T_j = 25 {}^{O}C$ | I _R | < < | 30 0.2 | mA mA |
| Junction capacitance at $f = 1 \text{ MHz}$ $V_R = 5 \text{ V}$; $T_j = 25 \text{ to } 125 ^{\circ}\text{C}$ | 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-h} | | 4.8 | K/W |
| b. per diodewith heatsink compound | R _{th j-h} | = 7, 1 | 5.7 | K/W |
| Free air operation | | | | |
| The quoted value of R _{th j-a} should be used only wh | en no leads of other co | mponents | run to the | same |

R_{th j-a}

^{*}Measured under pulse conditions to avoid excessive dissipation.

MOUNTING INSTRUCTIONS

- 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-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)
- For good thermal contact, heatsink compound should be used between mounting base and heatsink.
 Values of R_{th j-h} given for mounting with heatsink compound refer to the use of a metallic oxide-loaded compound. Ordinary silicone grease is not recommended.
- 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.
- 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.

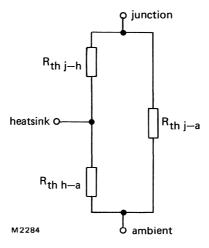


Fig.2.

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.

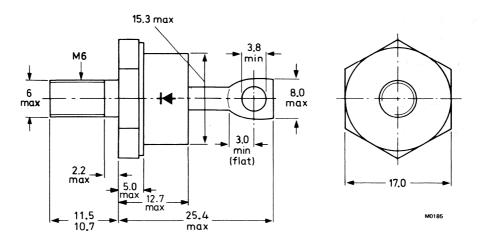
QUICK REFERENCE DATA

| | | | BYW25-800(R) | 1000(R) | |
|---------------------------------|------------------|------|--------------|---------|----------|
| Repetitive peak reverse voltage | v_{RRM} | max. | 800 | 1000 | V |
| Average forward current | IF(AV) | max. | 4 | 0 | A |
| Repetitive peak forward current | FRM | max. | 60 | 0 | Α |
| Reverse recovery time | t _{rr} | < | 45 | 0 | ns |
| | | | | | |

MECHANICAL DATA

Dimensions in mm

Fig.1 DO-5: with metric M6 stud (ϕ 6 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

BYW25 SERIES

RATINGS

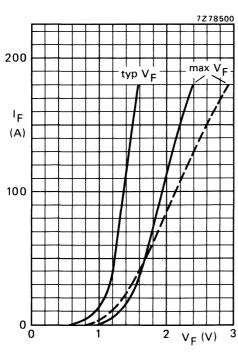
Limiting values in accordance with the Absolute Maximum System (IEC 134)

| Voltages* | | BYW25-80 | 00(R) | 1000(R |) |
|---|----------------|--|-------|------------|------------------|
| Non-repetitive peak reverse voltage | V_{RSM} | max. 100 | 00 | 1200 | ٧ |
| Repetitive peak reverse voltage | VRRM | max. 80 | 00 | 1000 | V 1 |
| Crest working reverse voltage | V_{RWM} | max. 65 | 60 | 850 | ٧ |
| Continuous reverse voltage | v _R | max. 65 | 0 | 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 | Α |
| sinusoidal; at T _{mb} = 125 ^o C | | IF(AV) | max. | 23 | Α |
| R.M.S. forward current | | IF(RMS) | max. | 60 | Α |
| Repetitive peak forward current | | IFRM | max. | 600 | Α. |
| Non-repetitive peak forward current; t = 10 ms; half sine-wave; | | | | | |
| T _j = 150 ^o C prior to surge | | ^I FSM | max. | 550 | Α |
| $I^2 t$ for fusing (t = 10 ms) | | l ² t | max. | 1500 | A ² s |
| Temperatures | | | | | |
| Storage temperature | | T _{stg} | -55 | to +150 | °C |
| Junction temperature | | Tj | max. | 150 | оС |
| THERMAL RESISTANCE | | | | | |
| From junction to mounting base | | R _{th j-mb} | = | 0.6 | oC/M |
| From mounting base to heatsink with heatsink compound without heatsink compound | | R _{th mb-h} R _{th mb-h} | = , | 0.3 0.5 | oC/W |

^{*}To ensure thermal stability: R $_{th\ j\text{-}a}$ \leqslant 1 $^{o}\text{C/W}$ (continuous reverse voltage).

CHARACTERISTICS

| Forward voltage | | | |
|---|-----------------|---|----------|
| $I_F = 35 \text{ A}$; $T_i = 25 {}^{\circ}\text{C}$ | VF | < | 1,55 V * |
| I _F = 35 A; T _j = 25 °C I _F = 150 A; T _j = 25 °C | V _F | < | 2,25 V * |
| Reverse current | | | |
| $V_R = 650 \text{ V}; T_j = 125 ^{\circ}\text{C}$ | I _R | < | 7 mA |
| Reverse recovery when switched from | | | |
| $I_F = 10 \text{ A to V}_R = 30 \text{ V with } -dI_F/dt = 50 \text{ A}/\mu\text{s}; T_i = 25 ^{\circ}\text{C}$ | | | |
| Recovery time | t _{rr} | < | 450 ns |
| $I_F = 600 \text{ A to V}_R \ge 30 \text{ V with } -dI_F/dt = 70 \text{ A/}\mu\text{s}; T_{mb} = 85 ^{\circ}\text{C}$ | | | |
| Recovery time | t _{rr} | < | 1 μs |
| Maximum slope of the reverse recovery current | | | |
| when switched from $I_F = 600 \text{ A}$ to $V_R \ge 30 \text{ V}$; | | | |
| with $-dl_F/dt = 35 A/\mu s$: T; = 25 °C | dlp/dt | < | 100 A/us |



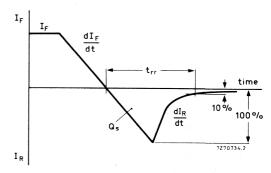


Fig. 2 Definitions of Q_s , t_{rr} and dI_R/dt .

Fig. 3 — $T_j = 25 \text{ °C}; --- T_j = 150 \text{ °C}.$

^{*} Measured under pulse conditions to avoid excessive dissipation.

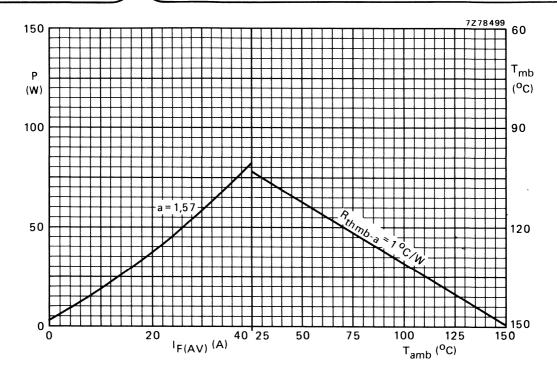


Fig. 4 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.

P = power including reverse current losses and switching losses up to f = 20 kHz.

 $a = I_F(RMS)/I_F(AV)$

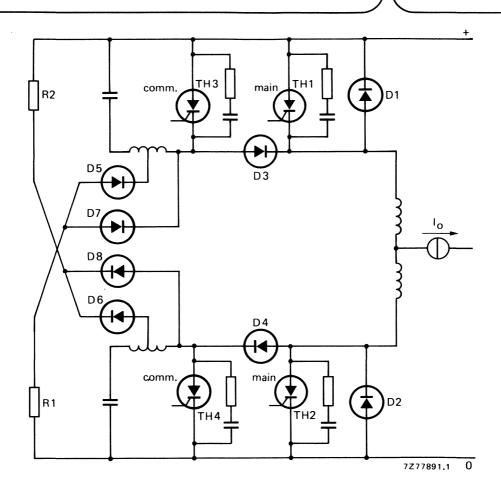


Fig. 5 One phase of a three-phase inverter for a.c. motor speed control. D1 to D4 are BYW25 types.



ULTRA FAST RECOVERY RECTIFIER DIODES



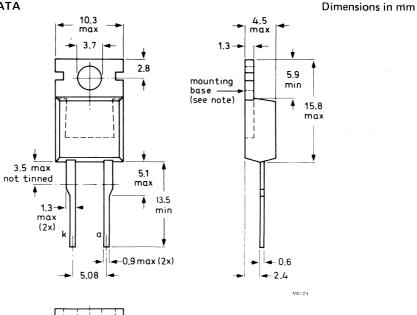
Glass-passivated, high-efficiency epitaxial rectifier diodes in plastic envelopes, featuring low forward voltage drop, ultra fast reverse recovery times with very low stored charge and soft-recovery characteristic. They are intended for use in switched-mode power supplies and high-frequency circuits 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

| | X 114 | BYW29-50 | | 100 | 150 200 | | in jeta dik | |
|---------------------------------|--------------------|----------|----|------|-----------|-----|-------------|--|
| Repetitive peak reverse voltage | V_{RRM} | max. | 50 | 100 | 150 | 200 | V | |
| Average forward current | I _{F(AV)} | max. | | | 8 | - | Α | |
| Forward voltage | VF | < | | 2000 | 0.8 | | ٧ | |
| Reverse recovery time | t _{rr} | < | | | 25 | | ns | |

MECHANICAL DATA

Fig.1 TO-220AC



Net mass: 2 q

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.

BYW29 SERIES

RATINGS

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

| Voltages | | BYW2 | 950 | 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) | VR | max. | 50 | 100 | 150 | 200 | V , |
| Currents | | | | | | | |
| Average forward current; switching losses negligible up to 500 kHz | 105.00 | | | | | | |
| square wave; $\delta = 0.5$; up to T_{mb} | = 125 °C | lF(AV |) | max. | 8 | 5 | Α |
| sinusoidal; up to T _{mb} = 125 °C | | lF(AV |) | max. | 7.3 | } | Α |
| R.M.S. forward current | | IF(RM | S) | max. | 11.5 | , | A |
| Repetitive peak forward current $t_p = 20 \ \mu s$; $\delta = 0.02$ | | IFRM | | max. | 240 | . · · · · · · · · · · · · · · · · · · · | Α |
| Non-repetitive peak forward current half sine-wave; T _j = 150 ^o C prior with reapplied V _{RWMmax} ; | to surge; | | | | | | |
| t = 10 ms | | ^I FSM | | max. | 80 |) | Α |
| t = 8.3 ms | | IFSM | | max. | 100 |) | Α |
| I^2 t for fusing (t = 10 ms) | | l²t | | max. | 32 | | A^2s |
| Temperatures | | | | | | | |
| Storage temperature | | T_{stg} | | | 40 to +150 |) | oC |
| Junction temperature | | Tj | | max. | 150 |) | oC |

Notes:

1. To ensure thermal stability: $R_{th\ j-a} < 11.6\ K/W$

CHARACTERISTICS

| Forward voltage | | | | |
|---|------------------|--|------|----|
| I _F = 8 A; T _j = 150 °C | VF | < | 0.8 | V* |
| $I_F = 20 \text{ A}; T'_j = 25 ^{\circ}\text{C}$ | VF | < | 1.3 | V* |
| Reverse current | | | | |
| $V_R = V_{RWM max}; T_j = 100 {}^{\circ}\text{C}$ $T_i = 25 {}^{\circ}\text{C}$ | I _R | < | 0.6 | mΑ |
| $T_j' = 25 {}^{\circ}C$ | 1 _R | < | 10 | μΑ |
| Reverse recovery when switched from | | | | |
| $I_F = 1 \text{ A to } V_R \geqslant 30 \text{ V with } - dI_F/dt = 100 \text{ A}/\mu\text{s};$ | | | | |
| $T_j = 25$ °C; recovery time | t _{rr} | | 25 | ns |
| $I_F = 2 \text{ A to } V_R \geqslant 30 \text{ V with } -dI_F/dt = 20 \text{ A/}\mu\text{s};$ | | | | |
| $T_j = 25$ °C; recovered charge | O _s | 0< 0 < 0 < 0 < 0 < 0 < 0 < 0 < 0 < 0 < | . 11 | nC |
| $I_F = 10 \text{ A to } V_R \geqslant 30 \text{ V with } -dI_F/dt = 50 \text{ A}/\mu\text{s};$ | | | | |
| T _j = 100 °C; peak recovery current | ^I RRM | < | 2 | A |
| Forward recovery when switched to I _F = 1 A | | | | |
| with $dI_F/dt = 10 A/\mu s$; $T_i = 25 {}^{\circ}C$ | v_{fr} | typ. | 0.9 | V |

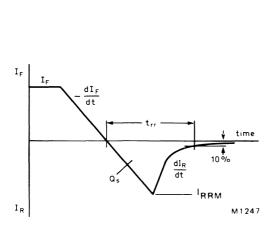


Fig.2 Definition of $t_{\mbox{\scriptsize rr}},\, \mbox{\scriptsize Q}_{\mbox{\scriptsize S}}$ and $\mbox{\scriptsize I}_{\mbox{\scriptsize RRM}}.$

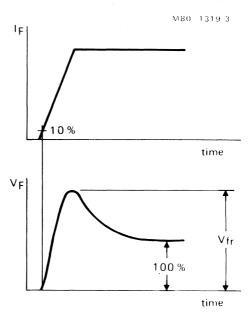


Fig.3 Definition of V_{fr} .

^{*}Measured under pulse conditions to avoid excessive dissipation.

| | ERMAL RESISTANCE om junction to mounting base | R _{th j-mb} | - 1 | 2.7 | K/W |
|-----|--|----------------------|----------|----------|--------|
| Inf | luence of mounting method | | | | |
| 1. | Heatsink mounted with clip (see mounting instructions) | | | | |
| Th | ermal resistance from mounting base to heatsink | | | | |
| a. | with heatsink compound | R _{th mb-h} | = | 0.3 | K/W |
| b. | with heatsink compound and 0.06 mm maximum mica insulator | R _{th mb-h} | = , | 1.4 | K/W |
| C. | with heatsink compound and 0.1 mm maximum mica insulator (56369) | R _{th mb-h} | = ' | 2.2 | K/W |
| d. | with heatsink compound and 0.25 mm maximum alumina insulator (56367) | R _{th mb-h} | = | 0.8 | K/W |
| e. | without heatsink compound | R _{th mb-h} | = | 1.4 | K/W |
| 2. | Free-air operation | | | | |
| | e quoted value of $R_{\mbox{th }j\mbox{-a}}$ should be used only when no leads a same tie-point. | of other dissipa | ting con | nponents | run to |
| | ermal resistance from junction to ambient in free air: | | | | |
| mo | ounted on a printed circuit board at any device lead | R _{th j-a} | = | 60 | K/W |

length and with copper laminate on the board

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 2.4mm 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 oxideloaded 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.

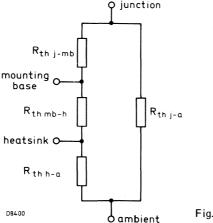


Fig. 4.

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 IF(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 Tamb scale. The intersection determines the R_{th mb-a}. The heatsink thermal resistance value (Rth h-a) can be calculated from:

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



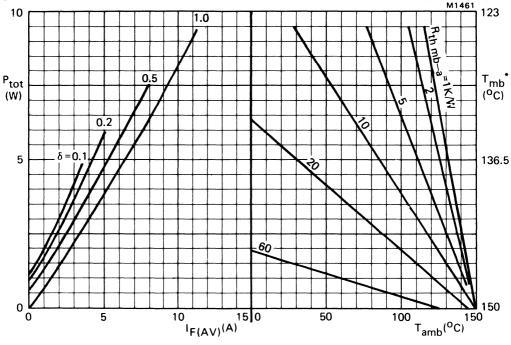


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.

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

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

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

 $^{^*\}text{T}_{mb}$ scale is for comparison purposes and is correct only for R_{th mb-a} < 8.9 K/W.

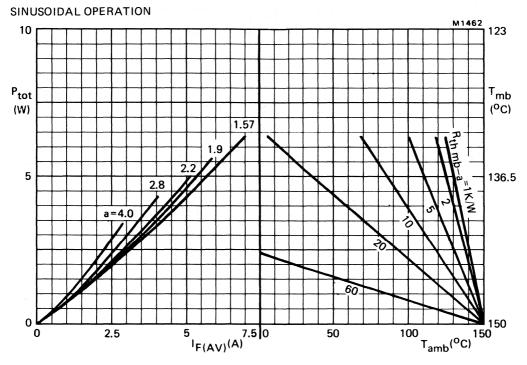


Fig.6 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.

Power includes reverse current losses and switching losses up to f = 500 kHz. $a = \text{form factor} = I_F(RMS)/I_F(AV)$.

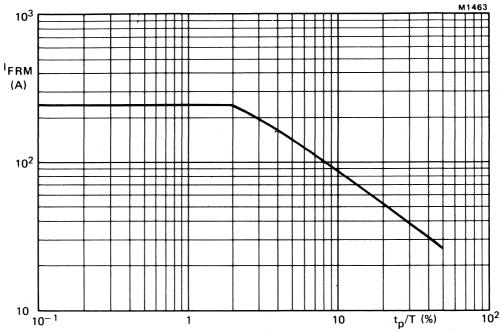
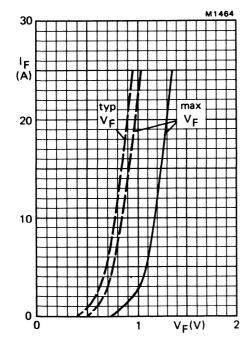
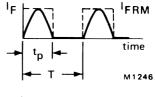


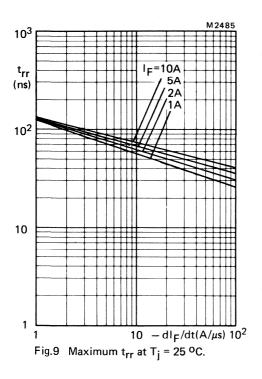
Fig.7 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 $\mu s < t_p < 1 ms.$

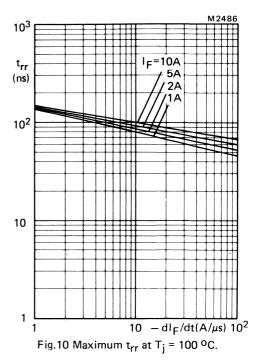




Definition of IFRM and t_p/T .

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





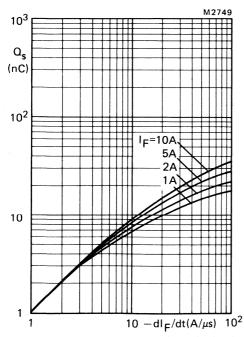
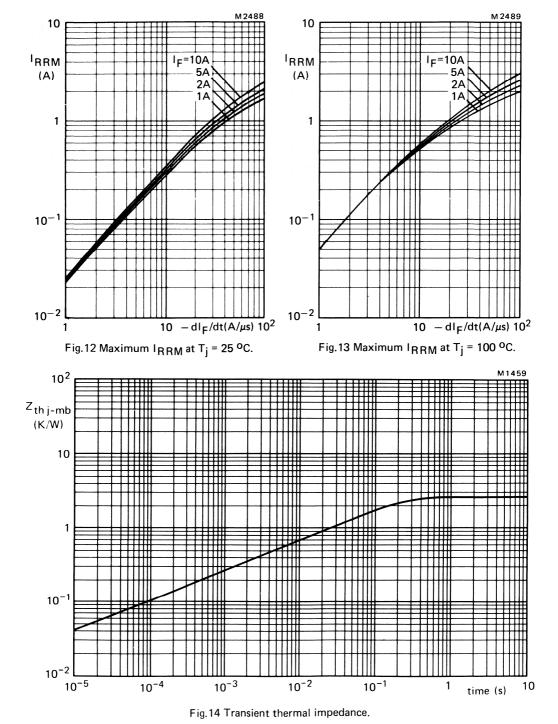


Fig.11 Maximum Q_s at T_j = 25 °C.



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.

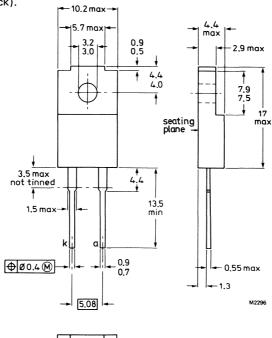
QUICK REFERENCE DATA

| | BYW2 | | 9F-50 100 | | 150 | 200 | |
|---------------------------------|-----------------|------|-------------|-----|-----|-----|----|
| Repetitive peak reverse voltage | V_{RRM} | max. | 50 | 100 | 150 | 200 | V |
| Average forward current | IF(AV) | max. | | | 8 | | Α |
| Forward voltage | ٧F | < | | | 0.8 | | ٧ |
| Reverse recovery time | t _{rr} | < | | | 25 | | ns |

MECHANICAL DATA

Dimensions in mm

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



Net mass: 2 q.

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).

top view

BYW29F SERIES

RATINGS

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

| | BYW29 | F-50 | 100 | 150 | 200 | |
|---------------------|--|--|--|---|--|---|
| VRRM | max. | 50 | 100 | 150 | 200 | V |
| v_{RWM} | max. | 50 | 100 | 150 | 200 | V |
| VR | max. | 50 | 100 | 150 | 200 | V |
| | | | | | | |
| 2); | | | | | | |
| °C F(AV) F(AV) | max. max. | | 7 | 8 7.3 | | A A |
| IF(RMS) | max. | | 11 | .5 | | \mathbf{A}_{ij} |
| IFRM | max. | | 2 | 40 | | Α |
| | | | | | | |
| ^I FSM | max. | | | | | Α |
| ^I FSM | max. | | 1 | 00 | | Α |
| I² t | max. | | ; | 32 | | A ² s |
| | | | | | | |
| T _{stg} | | -40 |) to +1 | 50 | | oC |
| T_{j} | max. | | 1 | 50 | | oC |
| | | | | | | |
| V _{isol} | max. | | 10 | 00 | | V |
| C _p | typ. | | | 12 | | pF |
| | VRWM VR 2); OC F(AV) F(AV) F(RMS) FRM FSM FSM F | VRRM max. VRWM max. VR max. VR max. 2); oC IF(AV) max. IF(AV) max. IF(RMS) max. IFRM max. IFSM max. IFSM max. I²t max. Visol max. | VRWM max. 50 VR max. 50 VR max. 50 2); oC IF(AV) max. IF(RMS) max. IFRM max. IFSM max. IFSM max. I²t max. Tstg —40 Tj max. | VRRM max. 50 100 VRWM max. 50 100 VR max. 50 100 VR max. 50 100 2); C IF(AV) max. 7 IF(RMS) max. 11 IFRM max. 2 IFSM max. 1 IFSM max. 1 I²t max. 1 Visol max. 10 | VRRM max. 50 100 150 VRWM max. 50 100 150 VR max. 50 100 150 VR max. 50 100 150 2); C IF(AV) max. 7.3 IF(RMS) max. 11.5 IFRM max. 240 IFSM max. 100 I²t max. 32 Tstg —40 to +150 Tj max. 150 Visol max. 1000 | VRRM max. 50 100 150 200 VRWM max. 50 100 150 200 VR max. 50 100 150 200 VR max. 50 100 150 200 2); OC IF(AV) max. 7.3 IF(RMS) max. 11.5 IFRM max. 240 IFSM max. 100 I²t max. 32 Tstg —40 to +150 Tj max. 150 Visol max. 1000 |

Notes:

- 1. To ensure thermal stability: $R_{th\ j-a} < 11.6\ K/W$.
- 2. The quoted temperatures assume heatsink compound is used.
- 3. Mounted without heatsink compound and 20 Newtons pressure on the centre of the envelope.

V*

V*

THERMAL RESISTANCE

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

with heatsink compound 5.5 K/W Rth i-h without heatsink compound 7.2 K/W Rth j-h

Free air operation

The quoted value of Rth i-a should be used only when no leads of other dissipating components run to the same tie point.

٧F

٧F

Thermal resistance from junction to ambient in free air, mounted on a printed circuit board

55 K/W Rth i-a

8.0

1.3

CHARACTERISTICS

T_i = 25 °C unless otherwise stated

Forward voltage

Reverse current

$$V_R = V_{RWM max}$$
; $T_j = 100 \, ^{O}C$
 $V_R = V_{RWM max}$
Reverse recovery when switched from

IF = 1 A to
$$V_R \ge 30 V$$
 with $-dI_F/dt = 100 A/\mu s$; recovery time

$$I_F = 2 \text{ A to V}_R \geqslant 30 \text{ V with } -dI_F/dt = 20 \text{ A}/\mu\text{s};$$
 recovered charge

I_F = 10 A to V_R
$$\geqslant$$
 30 V with $-dI_F/dt$ = 50 A/ μ s; T_i = 100 $^{\circ}$ C; peak recovery current

Forward recovery when switched to
$$I_F = 1 \text{ A}$$
 with $dI_F/dt = 10 \text{ A}/\mu\text{s}$

0.6 ١R <mA 10 1_R μΑ <25 trr ns Qç < 11 nC < 2 IRRM Α V_{fr} 0.9 typ.

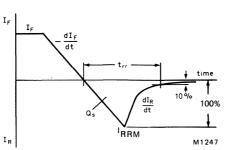


Fig.2 Definition of t_{rr} , Q_s and I_{RRM} .

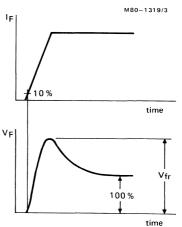


Fig.3 Definition of Vfr.

^{*}Measured under pulse conditions to avoid excessive dissipation.

MOUNTING INSTRUCTIONS

- 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-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:

 Maximum torque to avoid damage to the device:

 5.5 kgf (0.55 Nm)

 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-h} given for mounting with heatsink compound refer to the use of a metallic oxide-loaded compound. Ordinary silicone grease is not recommended.
- 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.
- 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.

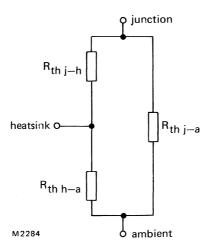
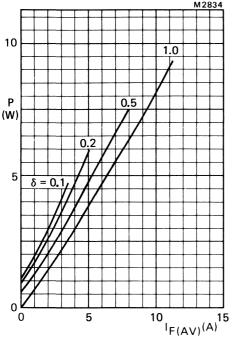


Fig.4.

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





SINUSOIDAL OPERATION

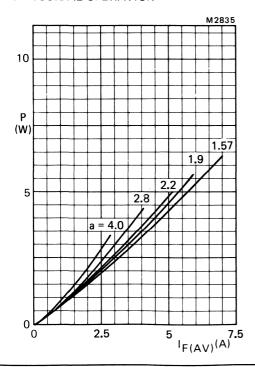


Fig.5 Power rating.

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.

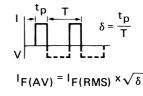


Fig.6 Power rating.

The power loss in the diode should first be determined from the required forward current on the IF(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.

$$a = form factor = I_F(RMS)/I_F(AV)$$

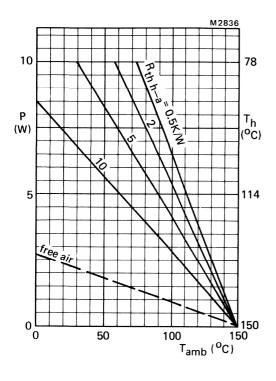


Fig.7 Heatsink rating; without heatsink compound.

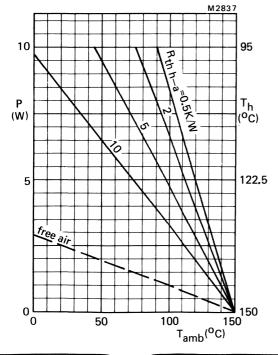


Fig.8 Heatsink rating; with heatsink compound.

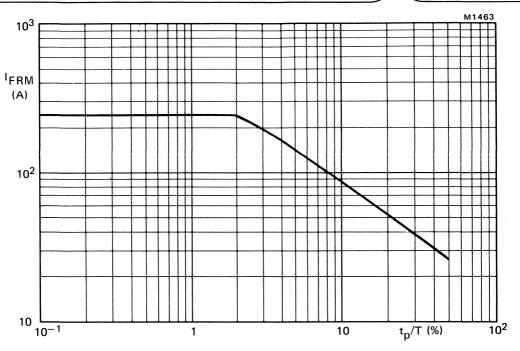
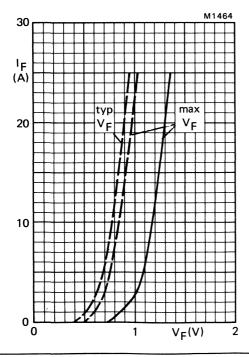
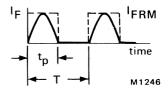


Fig.9 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 $\mu s < t_p < 1$ ms.





Definition of IFRM and $t_{\mbox{\footnotesize p}}/T$.

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

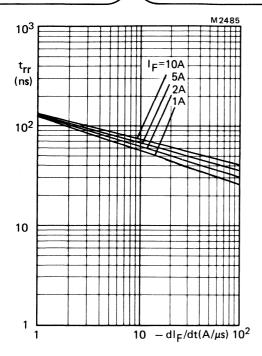


Fig.11 Maximum t_{rr} at $T_i = 25$ °C.

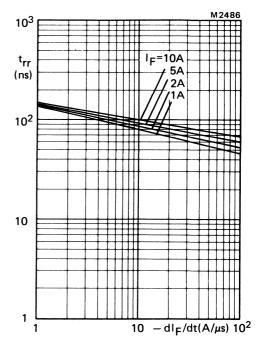


Fig.12 Maximum t_{rr} at $T_j = 100$ °C.

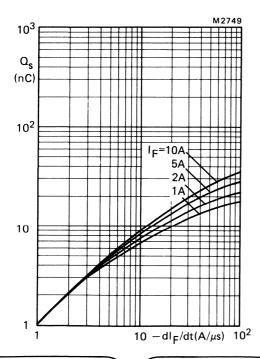
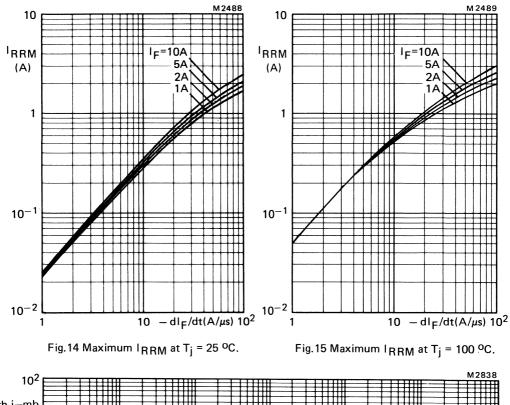


Fig.13 Maximum Q_s at $T_j = 25$ °C.



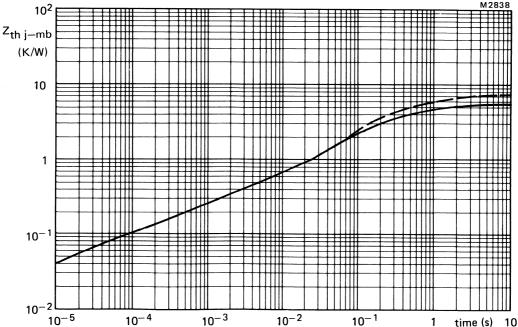


Fig. 16 Transient thermal impedance: —— with heatsink compound; — — without heatsink compound.



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.

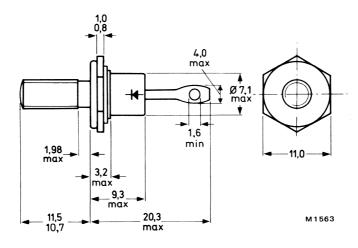
QUICK REFERENCE DATA

| | | BYW30-50 | | 100 150 | | 200 | |
|---------------------------------|-----------------|----------|---------|-----------|-----|-----|----|
| Repetitive peak reverse voltage | VRRM | max. | 50 | 100 | 150 | 200 | V |
| Average forward current | IF(AV) | max. | max. 14 | | | | Α |
| Forward voltage | VF | < | 0.8 | | | | ٧ |
| Reverse recovery time | t _{rr} | < | | | 30 | | ns |

MECHANICAL DATA

Dimensions in mm

Fig.1 DO-4: with metric M5 stud (ϕ 5 mm); e.g. BYW30-50. with 10-32 UNF stud (ϕ 4.83 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 | VR | max. | 50 | 100 | 150 | 200 | , V |
| Currents | | | | | <u> </u> | | ٠. |
| Average forward current; switching losses negligible up to 500 kHz | | | | | | | |
| square wave; $\delta = 0.5$; up to $T_{mb} = 1$ | | F(AV) | | max. | | 14 | A |
| up to T _{mb} = 1 | 25 °C | lF(AV) | | max. | | 12 | Α . |
| sinusoidal; up to T _{mb} = 125 °C | | lF(AV) | | max. | 1: | 2.5 | Α |
| R.M.S. forward current | | IF(RMS | S) | max. | | 20 | Α |
| Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ | | IFRM | | max. | 4 | 20 | A |
| Non-repetitive peak forward current half sine-wave; T _j = 150 °C prior to with reapplied V _{RWMmax} ; | surge; | | | | | | |
| t = 10 ms | | ^I FSM | | max. | | 00 | Α |
| t = 8.3 ms | | IFSM | | max. | 2 | 40 | Α |
| I^2 t for fusing (t = 10 ms) | | l² t | | max. | 2 | 00 | A^2s |
| Temperatures | | | | | | | |
| Storage temperature | | T_{stg} | | | 55 to +1 | 50 | οС |
| Junction temperature | | Tj | | max. | 1 | 50 | oC |
| THERMAL RESISTANCE | | | | | | | |
| From junction to mounting base | | R _{th j-m} | b | = | : | 2.2 | K/W |
| From mounting base to heatsink | | • | | | | | |
| a. with heatsink compound | | R _{th mb} | -h | = | (| 0.5 | K/W |
| b. without heatsink compound | | R _{th mb} | | = | (| 0.6 | K/W |
| Transient thermal impedance; t = 1 ms | | Z _{th j-m} | | = | . (| 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: $R_{th\ j\text{-a}} \leqslant 5.6\ \text{K/W}$ (continuous reverse voltage).

CHARACTERISTICS

| _ | | | | | | |
|---|--------|-----|----|---|----|------|
| _ | \sim | MAI | or | А | vo | tage |
| | v | vv | aı | u | VU | Lauc |

| I _F = 15 A; T _i = 150 °C | VF | < | 0.8 | V* |
|--|----|---|-----|----|
| I _F = 50 A; T _i = 25 °C | VF | < | 1.3 | V* |

Reverse current

$$V_R = V_{RWM max}$$
; $T_j = 100 \, ^{o}C$ I_R $<$ 1.3 mA $_{IR}$ $<$ 25 $_{\mu}A$

Reverse recovery when switched from

I_F = 1 A to V_R
$$\geqslant$$
 30 V with $-dI_F/dt$ = 100 A/ μ s;
T_j = 25 °C; recovery time
I_F = 2 A to V_R \geqslant 30 V with $-dI_F/dt$ = 20 A/ μ s;
T_j = 25 °C; recovered charge
I_F = 10 A to V_R \geqslant 30 V with $-dI_F/dt$ = 50 A/ μ s;

Forward recovery when switched to I_F = 10 A with dI_F/dt = 10 A/ μ s; T_j = 25 °C

T_i = 100 °C; peak recovery current

| t _{rr} | < | 30 | ns |
|-----------------|------|-----|----|
| O _s | < | 15 | nC |
| IRRM | < | 4 | Α |
| V _{fr} | typ. | 1.0 | V |

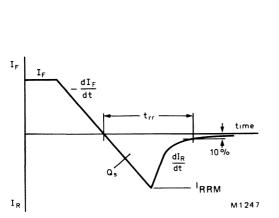


Fig.2 Definition of $t_{rr},\,\Omega_s$ and $I_{RRM}.$

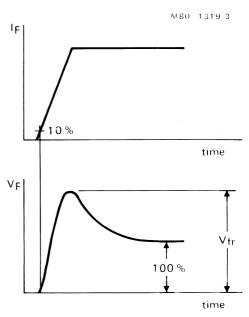


Fig.3 Definition of V_{fr}.

^{*}Measured under pulse conditions to avoid excessive dissipation.

SQUARE-WAVE OPERATION

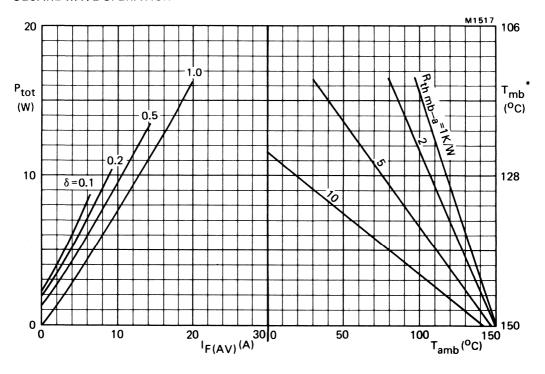


Fig.4 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 500 kHz.

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

$$V = I_F(RMS) \times \sqrt{\delta}$$

 $^{^*}T_{mb}$ scale is for comparison purposes and is correct only for R_{th mb-a} < 3.1 K/W.

SINUSOIDAL OPERATION

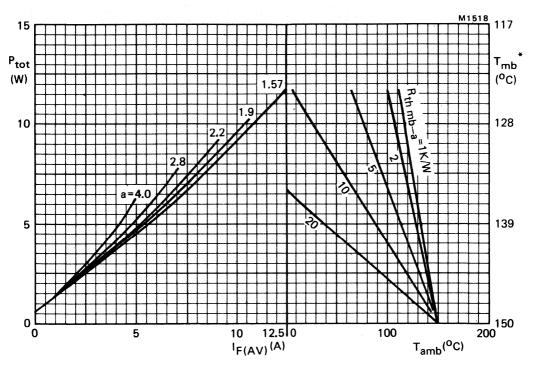


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures. $a = form \ factor = I_F(RMS)/I_F(AV)$.

 $^{^*} T_{\mbox{mb}}$ scale is for comparison purposes and is correct only for R $_{\mbox{th}}$ mb-a < 17 K/W.

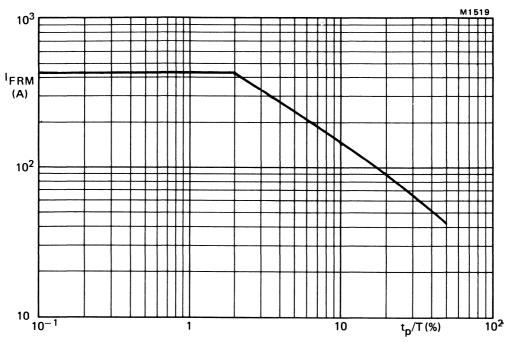
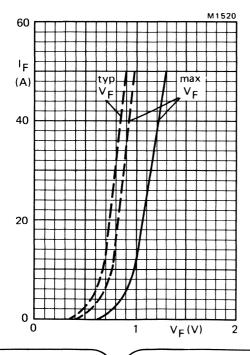
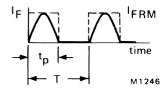


Fig.6 Maximum permissible repetitive peak forward current for square or sinusoidal currents; $\mu s < t_p < 1$ ms.





Definition of I_{FRM} and t_p/T .

Fig.7 -----
$$T_j = 25 \, {}^{o}C; --- T_j = 150 \, {}^{o}C.$$

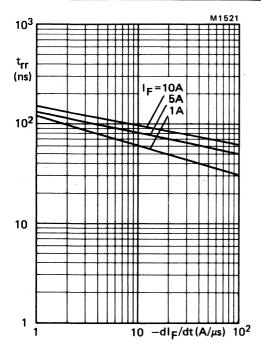
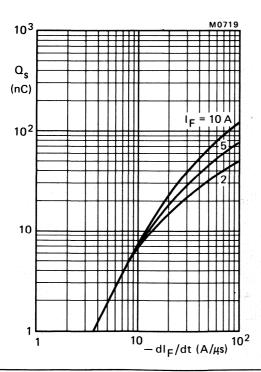


Fig.8 Maximum t_{rr} at T_j = 25 °C.



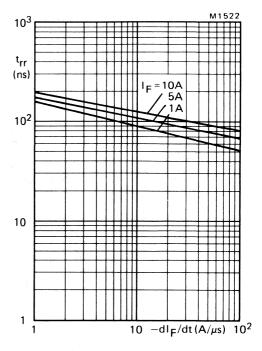


Fig.9 Maximum t_{rr} at $T_j = 100$ °C.

Fig.10 Maximum Q_s at T_j = 25 °C.

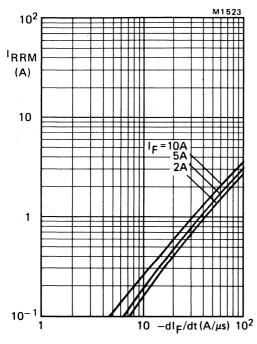


Fig.11 Maximum I_{RRM} at $T_j = 25$ °C.

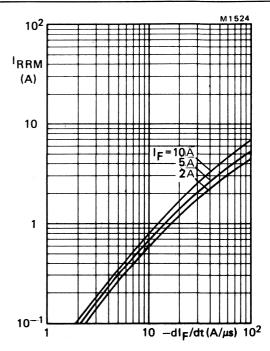


Fig.12 Maximum I_{RRM} at $T_j = 100$ °C.

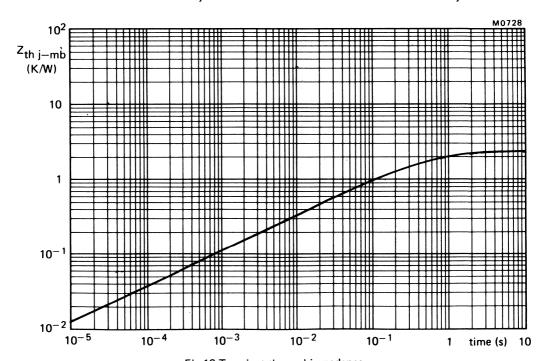


Fig.13 Transient thermal impedance.

ULTRA FAST RECOVERY RECTIFIER DIODES



Glass-passivated, high-efficiency epitaxial rectifier diodes in DO-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.

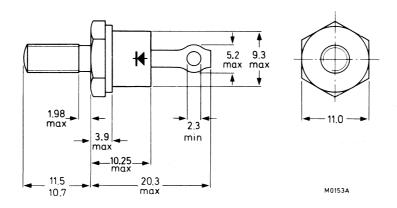
QUICK REFERENCE DATA

| | | BYW31-50 100 150 | | | | 200 | 200 | |
|---------------------------------|-----------------|----------------------|-----|-----|-----|-----|-----|--|
| Repetitive peak reverse voltage | V_{RRM} | max. | 50 | 100 | 150 | 200 | V | |
| Average forward current | IF(AV) | max. | • | | 28 | | Α | |
| 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 (ϕ 5 mm); e.g. BYW31–50. with 10-32 UNF stud (ϕ 4.83 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.

BYW31 SERIES

RATINGS

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

| Voltages | | BYW31- | BYW31-50 | | 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 | ٧ |
| Continuous reverse voltage* | VR | 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 ${}^{o}C$ up to T_{mb} = 125 ${}^{o}C$ | | IF(AV) IF(AV) | | max. max. | 28 26 | | A A |
| sinsusoidal; up to T_{mb} = 127 ${}^{o}C$ | | I _{F(AV)} | | max. | 25 | | Α |
| R.M. S. forward current | | IF(RMS |) | max. | 40 | | Α |
| Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ | | FRM | | max. | 550 | | Α |
| Non-repetitive peak forward current half sine-wave; $T_j = 150 ^{\circ}\text{C}$ prior to with reapplied V_{RWMmax} ; | o surge; | | | | | | |
| t = 10 ms | | ^I FSM | | max. | 320 | | Α |
| t = 8.3 ms | | ^I FSM | | max. | 380 | | Α |
| I ² t for fusing (t = 10 ms) | | I²t | | max. | 500 | | A ² s |
| Temperatures | | | | | | | |
| Storage temperature | | T_{stg} | | - | -55 to +150 | | оС |
| Junction temperature | | Tj | | max. | 150 | | oC |
| THERMAL RESISTANCE | | | | | | | |
| From junction to mounting base | | R _{th j-mb} |) | = | 1.0 | | K/W |
| From mounting base to heatsink | | , | | | | | |
| a. with heatsink compound | | R _{th mb-} | h | = | 0.3 | | K/W |
| b. without heatsink compound | | R _{th mb} | | = , | 0.5 | | K/W |
| Transient thermal impedance: t = 1 m | ns | Z _{th j-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 (continuous reverse voltage).

CHARACTERISTICS

| Forward voltage | | | | |
|--|------------------|------|-----|----|
| I _F = 30 A; T _i = 150 °C | VF | < | 0.8 | V* |
| $I_F = 30 \text{ A}; T_j = 150 ^{\circ}\text{C}$ $I_F = 100 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | VF | · < | 1.3 | V* |
| Reverse current | | | | |
| $V_R = V_{RWM max}; T_j = 100 {}^{\circ}\text{C}$ $T_i = 25 {}^{\circ}\text{C}$ | I _R | < | 1.5 | mΑ |
| $T_j' = 25 {}^{\circ}\text{C}$ | I _R | < ' | 100 | μΑ |
| Reverse recovery when switched from | | | | |
| IF = 1 A to $V_R \ge 30 \text{ V}$ with $-dI_F/dt = 100 \text{ A}/\mu\text{s}$; | | | | |
| T _j = 25 °C; recovery time | t _{rr} | < 1 | 40 | ns |
| $I_F = 2 \text{ A to } V_B \ge 30 \text{ V with } -dI_F/dt = 20 \text{ A/}\mu\text{s};$ | | | | |
| T _i = 25 °C; recovered charge | $Q_{\mathbf{s}}$ | < | 20 | nC |
| $I_F = 10 \text{ A to } V_B \ge 30 \text{ V with } -dI_F/dt = 50 \text{ A}/\mu s;$ | | | | |
| T _i = 100 °C; peak recovery current | IRRM | < | 4 | Α |
| | | | | |
| Forward recovery when switched to I _F = 10 A | | | | ., |
| with $dI_F/dt = 10 A/\mu s$; $T_j = 25 {}^{\circ}C$ | v_{fr} | typ. | 1 | V |

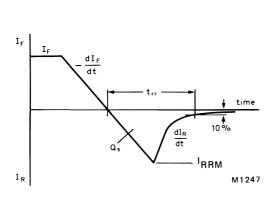


Fig.2 Definition of t_{rr} , Q_s and I_{RRM} .

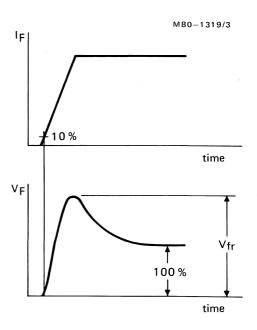


Fig.3 Definition of V_{fr} .

^{*}Measured under pulse conditions to avoid excessive dissipation.



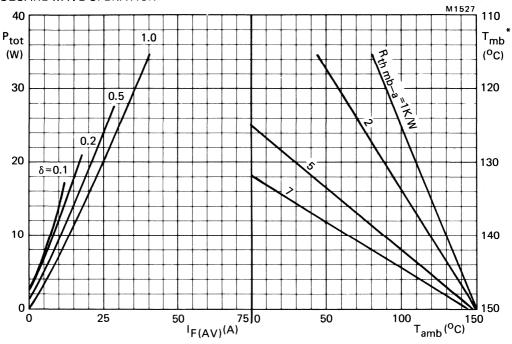


Fig.4 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 500 kHz.

$$\begin{array}{c|c}
 & T & T \\
\hline
 & & \delta = \frac{tp}{T}
\end{array}$$

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

 $^{^*\}text{T}_{mb}$ scale is for comparison purposes and is correct only for R_{th mb-a} < 3.6 K/W.



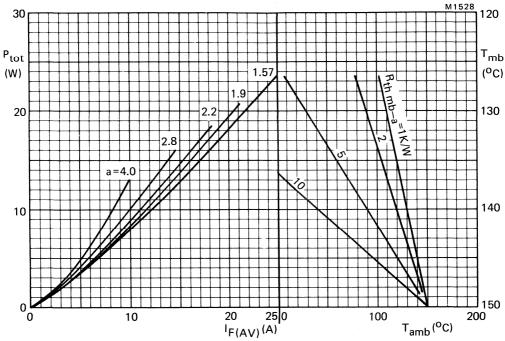


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 500 kHz.

a = form factor = IF(RMS)/IF(AV).

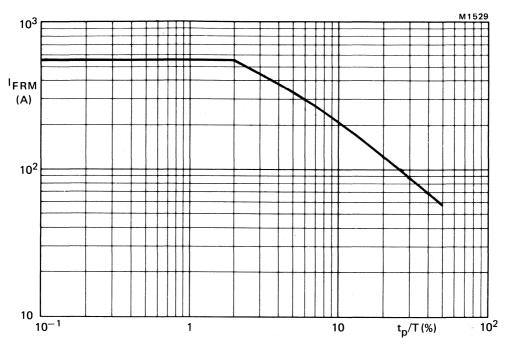
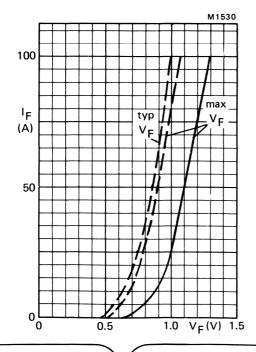
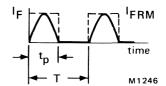


Fig.6 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 $\mu s < t_p < 1$ ms.





Definition of IFRM and t_p/T .

Fig.7 ——
$$T_j$$
 = 25 °C; $---T_j$ = 150 °C.

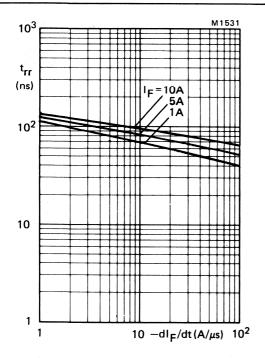
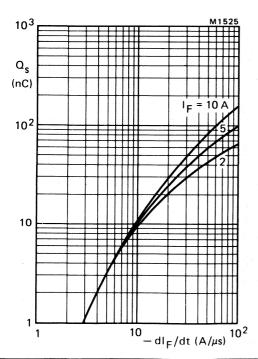


Fig.8 Maximum t_{rr} at $T_j = 25$ °C.



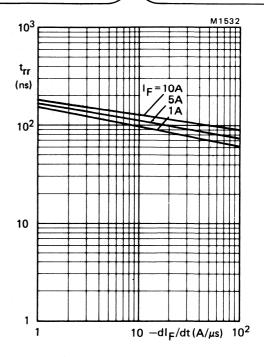


Fig.9 Maximum t_{rr} at $T_j = 100 \, {}^{\circ}\text{C}$.

Fig.10 Maximum Q_s at $T_j = 25$ °C.

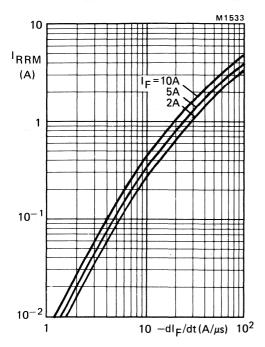


Fig.11 Maximum IRRM at T $_j$ = 25 ^oC .

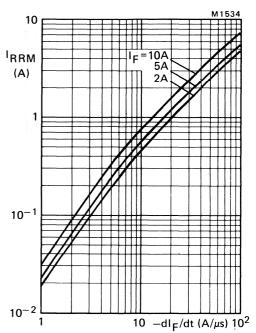


Fig.12 Maximum I_{RRM} at $T_j = 100$ °C.

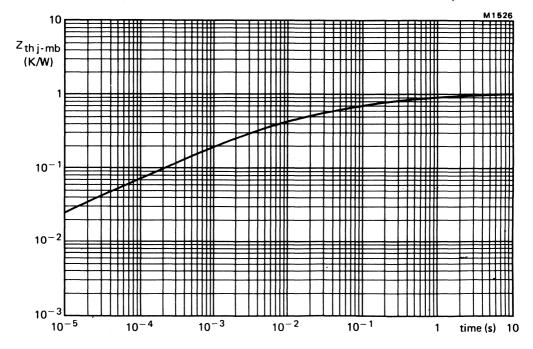


Fig.13 Transient thermal impedance.

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.

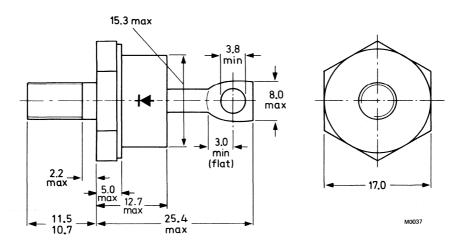
QUICK REFERENCE DATA

| | | BYW92-50 | | 100 | 150 | 200 | |
|---------------------------------|-----------------|----------|----|-----|-----|-----|----|
| Repetitive peak reverse voltage | v_{RRM} | max. | 50 | 100 | 150 | 200 | V |
| Average forward current | IF(AV) | max. | 40 | | | | Α |
| Forward voltage | ٧ _F | < | | 0 | .8 | | ٧ |
| Reverse recovery time | t _{rr} | < | | 4 | 10 | | ns |

MECHANICAL DATA

Dimensions in mm

Fig.1 DO-5: with metric M6 stud (ϕ 6 mm); e.g. BYW92-50. with $\frac{1}{4}$ in x 28 UNF stud (ϕ 6.35 mm); e.g. BYW92-50U.



Net mass: 22 q

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.

BYW92 SERIES

RATINGS

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

| Voltages | | BYW9 | 2–50 | 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; switchin losses negligible up to 500 kHz | | | | | | | |
| square wave; δ = 0.5; up to T_{ml} up to T_{ml} | _o = 110 °C _o = 125 °C | lF(AV lF(AV | | max. max. | 40 27 | | A A |
| sinusoidal; up to $T_{mb} = 115 {}^{\circ}C$ | | lF(AV |) | max. | 35 | | Α |
| up to T _{mb} = 125 °C | ; | lF(AV |) | max. | 26 | | Α |
| R.M.S. forward current | | ^I F(RM | S) | max. | 55 | | Α |
| Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ | | IFRM | | max. | 800 | | A |
| Non-repetitive peak forward curre half sine-wave; T _j = 150 °C prio with reapplied V _{RWMmax} ; | | | | | | | |
| t = 10 ms | | IFSM | | max. | 500 | | Α |
| t = 8.3 ms | | ^I FSM | | max. | 600 | | Α |
| l^2t for fusing (t = 10 ms) | | l²t | | max. 1250 | | | A^2s |
| Temperatures | | | | | | | |
| Storage temperature | | T_{stg} | | - | 55 to +150 | | oC |
| Junction temperature | | Тj | | max. | 150 |) | oC |
| THERMAL RESISTANCE | | | | | | | |
| From junction to mounting base | | R _{th j-n} | nb | = | 1.0 |) | K/W |
| From mounting base to heatsink | | | | | | | |
| a. with heatsink compound | | R _{th m} | b-h | = | 0.3 | | K/W |
| b. without heatsink compound | | R _{th mi} | | = ' | 0.5 | | K/W |
| Transient thermal impedance; t = | 1 ms | Z _{th j-n} | | = , | 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: $R_{th j-a} \le 4.9 \text{ K/W}$

CHARACTERISTICS

| Forward voltage $I_F = 35 \text{ A}; T_j = 150 ^{\circ}\text{C}$ $I_F = 100 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | V _F | < < | 0.8 1.3 | V* V* |
|---|-----------------|-------|------------|----------|
| Reverse current | | | | |
| $V_R = V_{RRMmax}; T_j = 100 {}^{\circ}C$ $T_j = 25 {}^{\circ}C$ | I _R | < < < | 2.5 100 | mΑ μΑ |
| Reverse recovery when switched from | | | | |
| I _F = 1 A to V _R \geq 30 V with $-dI_F/dt = 100 A/\mu s$; T _j = 25 °C; recovery time | t _{rr} | < | 40 | ns |
| IF = 2 A to $V_R \ge 30 \text{ V}$ with $-dI_F/dt = 20 \text{ A}/\mu\text{s}$; $T_j = 25 ^{\circ}\text{C}$; recovered charge | Q_{s} | < | 20 | nC |
| I _F = 10 A to $V_R \ge 30 \text{ V}$ with $-dI_F/dt = 50 \text{ A}/\mu\text{s}$; $T_j = 100 ^{\circ}\text{C}$; peak recovery current | IRRM | < 1 | 4.5 | Α |
| Forward recovery when switched to $I_F = 10 \text{ A}$ with $dI_F/dt = 10 \text{ A}/\mu s$; $T_j = 25 ^{\circ}\text{C}$ | V _{fr} | typ. | 1.0 | V |

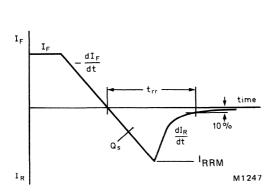


Fig.2 Definition of $t_{rr},\,\Omega_{\textrm{S}}$ and $I_{\textrm{RRM}}.$

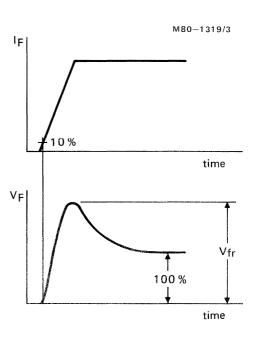


Fig.3 Definition of V_{fr} .

^{*}Measured under pulse conditions to avoid axcessive dissipation.

SQUARE-WAVE OPERATION

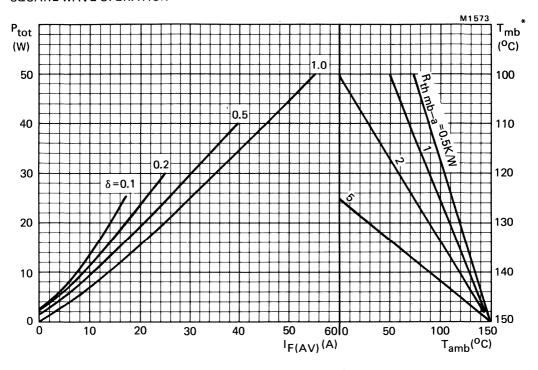


Fig.4 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 500 kHz.

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

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

 $^{^*}T_{mb}$ scale is for comparison purposes and is correct only for R_{th mb-a} < 3.6 K/W.

SINUSOIDAL OPERATION

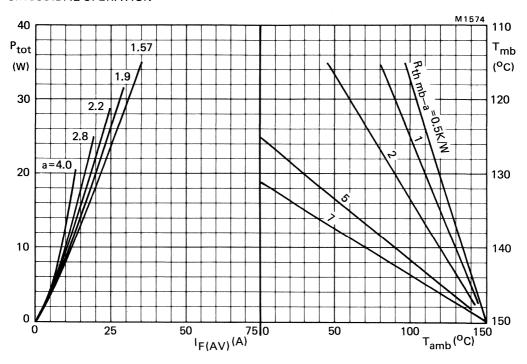


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses and switching losses up to f = 500 kHz.

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

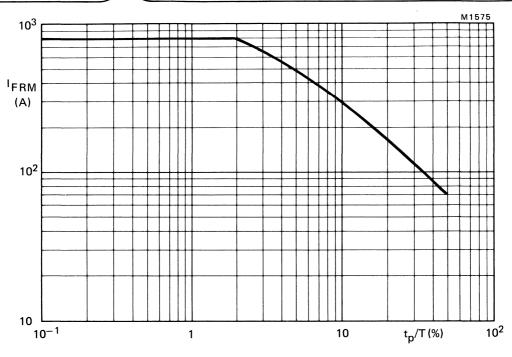
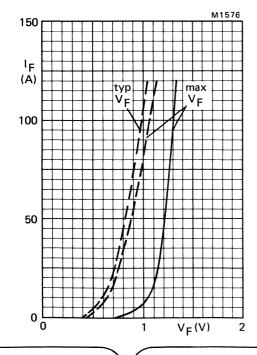
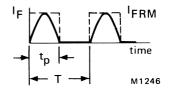


Fig.6 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 $\mu s < t_p < 1$ ms.





Definition of IFRM and t_p/T .

Fig.7 ——
$$T_j = 25$$
 °C; $- - T_j = 150$ °C.

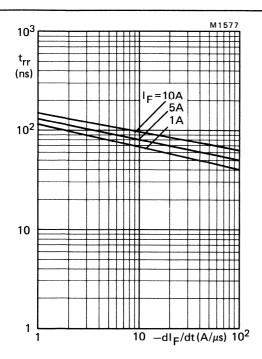
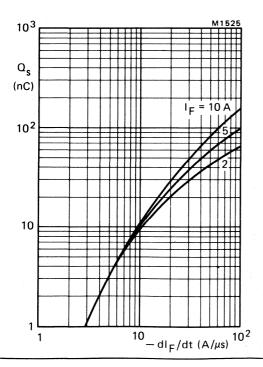


Fig.8 Maximum t_{rr} at T_i = 25 °C.



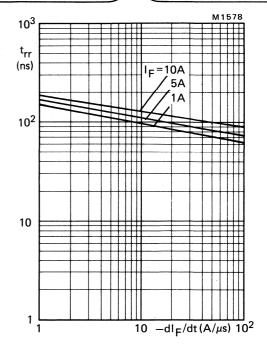


Fig.9 Maximum t_{rr} at $T_j = 100$ °C.

Fig. 10 Maximum Q_s at $T_j = 25$ °C.

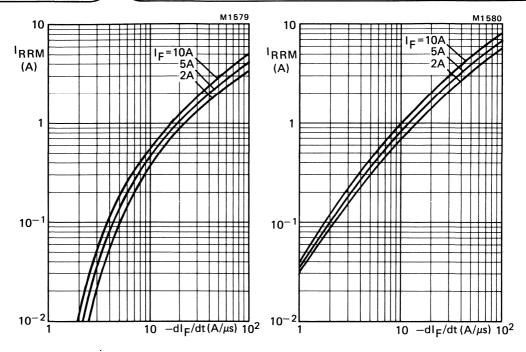


Fig.11 Maximum I_{RRM} at $T_i = 25$ °C.

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

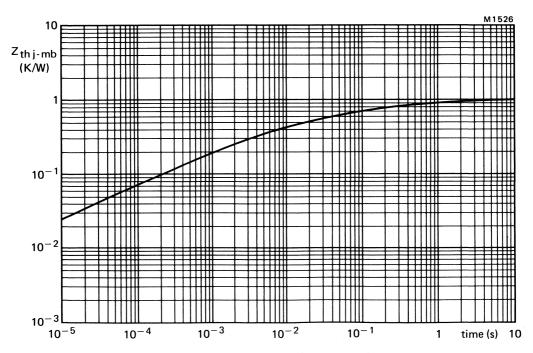


Fig. 13 Transient thermal impedance.

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.

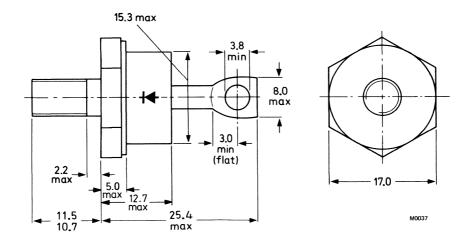
QUICK REFERENCE DATA

| | | BYW93-50 | | 100 | 150 | 200 | |
|---------------------------------|------------------|----------|----|-----|-----|-----|----|
| Repetitive peak reverse voltage | V _{RRM} | max. | 50 | 100 | 150 | 200 | V |
| Average forward current | IF(AV) | max. | | | 60 | | Α |
| Forward voltage | VF | < | | C |).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 $\frac{1}{4}$ in x 28 UNF stud (ϕ 6.35 mm); e.g. BYW93–50U



Net mass: 22 q

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.

BYW93 SERIES

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 1 |
| Crest working reverse voltage | V_{RWM} | max. | 50 | 100 | 150 | 200 | V |
| Continuous reverse voltage* | V_{R} | max. | 50 | 100 | 150 | 200 | V |
| Currents | | | | | | THE RESERVE OF THE PERSON NAMED IN COLUMN | |
| Average forward current; switchin losses negligible up to 500 kHz | | | | | | | |
| square wave; δ = 0.5; up to T_{ml} up to T_{ml} | o = 110 °C o = 125 °C | F(AV) | | max. max. | 60 40 | | A |
| sinusoidal; up to $T_{mb} = 115 {}^{\circ}C$ up to $T_{mb} = 125 {}^{\circ}C$ | | lF(AV) lF(AV) | | max. max. | 50 38 | | A A |
| R.M.S. forward current | IF(RM: | S) | max. | 85 | 5 | A | |
| Repetitive peak forward current t_p = 20 μ s; δ = 0.02 | | IFRM | | max. | 1500 |) . | Α |
| Non-repetitive peak forward curre half sine-wave; T _j = 150 ^o C prio with reapplied V _{RWMmax} ; | | | | | | | |
| t = 10 ms | | IFSM | | max. | 800 |) | Α |
| t = 8.3 ms | | IFSM | | max. | 1000 |) | Α |
| I^2 t for fusing (t = 10 ms) | | l²t | | max. | max. 3200 | | A^2s |
| Temperatures | | | | | | | |
| Storage temperature | | T _{stg} | | <u> </u> | 55 to +150 |) | oC |
| Junction temperature | | T_{j} | | max. | 150 |) | οС |
| THERMAL RESISTANCE | | | | | | | |
| From junction to mounting base | | R _{th j-m} | nb | = | 0.7 | 7 | K/W |
| From mounting base to heatsink | | | | | | | |
| a. with heatsink compound | | R _{th mb} | o-h | = , | 0.2 | 2 | K/W |
| b. without heatsink compound | | R _{th mb} | o-h | = , | 0.3 | 3 | K/W |
| Transient thermal impedance; t = | 1 ms | Z _{th j-m} | nb | = | 0.32 | 2 | K/W |

MOUNTING INSTRUCTIONS

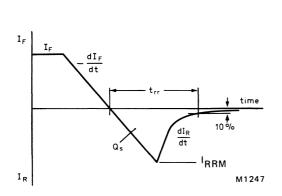
The top connector should be neither bent nor twisted; it should be soldered into the circuit so that there is no strain on it.

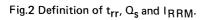
During soldering the heat conduction to the junction should be kept to a minimum.

^{*}To ensure thermal stability: R $_{th\ j\text{-}a} \,{\leqslant}\, 3.0\ \text{K/W}.$

CHARACTERISTICS

| Forward voltage $I_F = 50 \text{ A; } T_j = 150 ^{\circ}\text{C}$ $I_F = 150 \text{ A; } T_j = 25 ^{\circ}\text{C}$ | V _F V _F | < < | 0.8 1.3 | V* V* |
|--|----------------------------------|------|------------|----------|
| Reverse current $V_R = V_{RWM max}$; $T_j = 100 ^{\circ}\text{C}$ $T_i = 25 ^{\circ}\text{C}$ | I _R | < < | 5 250 | mΑ μΑ |
| Reverse recovery when switched from $I_F = 1 \text{ A to V}_R \geqslant 30 \text{ V with } -dI_F/dt = 100 \text{ A}/\mu\text{s};$ $T_j = 25 \text{ °C};$ recovery time | t _{rr} | < | 45 | ns |
| I_F = 2 A to V_R \geqslant 30 V with $-dI_F/dt$ = 20 A/ μ s T_j = 25 $^{\rm O}$ C; recovered charge | $Q_{\mathbf{s}}$ | < | 35 | nC |
| I_F = 10 A to $V_R \ge 30$ V with $-dI_F/dt$ = 50 A/ μ s; T_j = 100 $^{\rm O}$ C; peak recovery current | I _{RRM} | < | 6 | A |
| Forward recovery when switched to I _F = 10 A with dI _F /dt = 10 A/ μ s; T _j = 25 °C | v _{fr} | typ. | 1.0 | V |





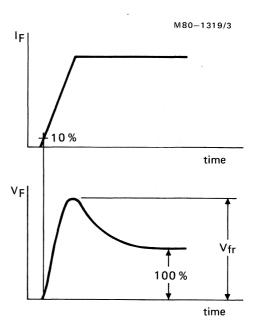


Fig.3 Definition of V_{fr} .

^{*}Measured under pulse conditions to avoid excessive dissipation.

SQUARE-WAVE OPERATION

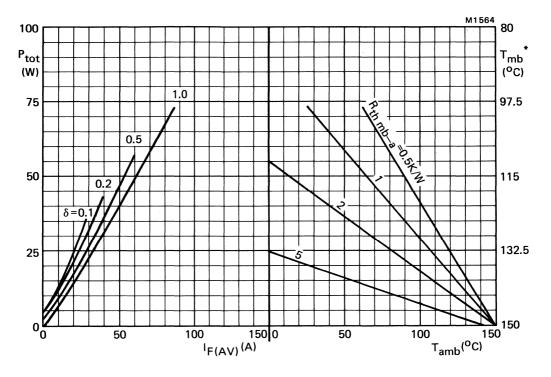


Fig.4 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures.

Power includes reverse current losses.

$$\begin{array}{c|c}
t & T \\
\hline
V & \delta = \frac{tp}{T}
\end{array}$$

$$1_{F(AV)} = 1_{F(RMS)} \times \sqrt{\delta}$$

 $^{^*}T_{mb}$ scale is for comparison purposes and is correct only for R_{th mb-a} < 2.1 K/W

SINUSOIDAL OPERATION

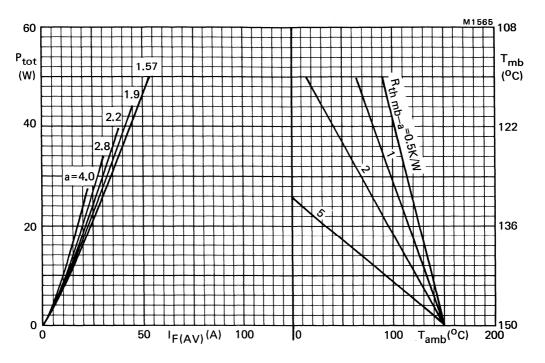


Fig.5 The right-hand part shows the interrelationship between the power (derived from the left-hand part) and the maximum permissible temperatures. Power includes reverse current losses.

a = form factor = IF(RMS)/IF(AV).

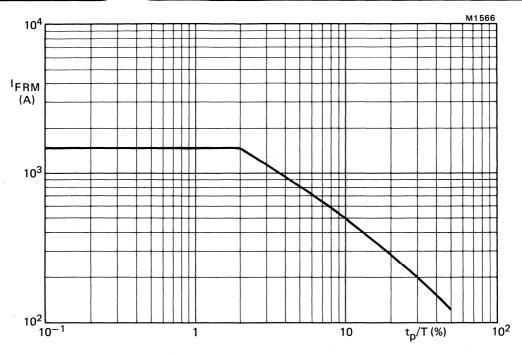
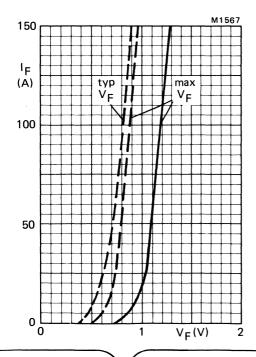
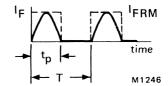


Fig.6 Maximum permissible repetitive peak forward current for square or sinusoidal currents; 1 $\mu s < t_p < 1$ ms.





Definition of IFRM and t_p/T .

Fig.7 ——
$$T_j = 25 \text{ °C}; ---T_j = 150 \text{ °C}.$$

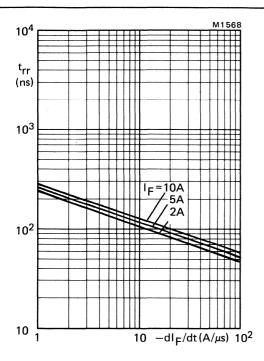
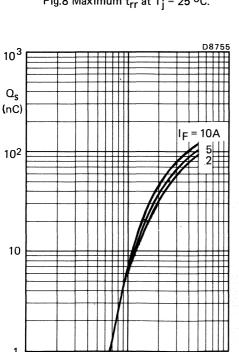


Fig.8 Maximum t_{rr} at $T_i = 25$ °C.



 $10 - dI_F/dt(A/\mu s) 10^2$

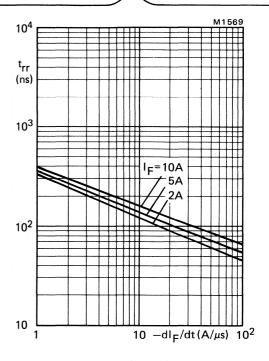


Fig.9 Maximum t_{rr} at $T_i = 100$ °C.

Fig.10 Maximum Q_s at T_j = 25 °C.

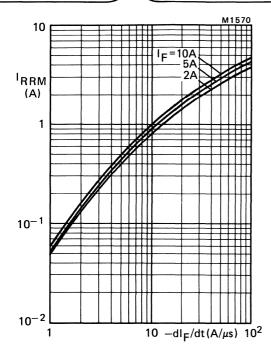


Fig.11 Maximum I_{RRM} at $T_j = 25$ °C.

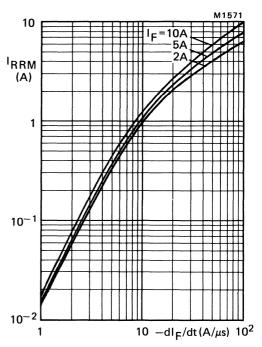


Fig.12 Maximum I_{RRM} at T_i = 100 °C.

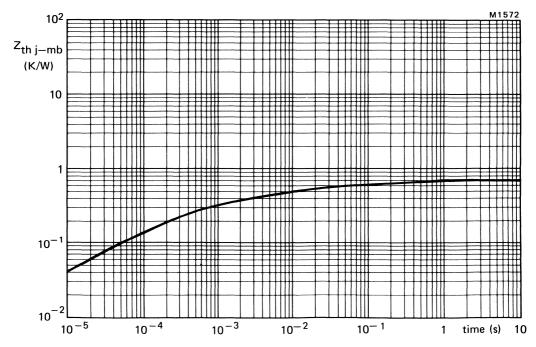


Fig.13 Transient thermal impedance.

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.

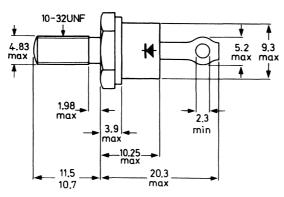
Reverse polarity (anode to stud): BYX25-600R to BYX25-1400R.

QUICK REFERENCE DATA

| | | BYX25- | -600(R) | 800(R) | 1000(R) | 1200(R) | 1400(F | ?) |
|--|--------------------|--------|---------|--------|---------|---------|--------|----|
| Crest working reverse voltage Reverse avalanche breakdown | v_{RWM} | max. | 600 | 800 | 1000 | 1200 | 1400 | V |
| voltage | V _{(BR)R} | > | 750 | 1000 | 1250 | 1450 | 1650 | V |
| Average forward current | I _{F(AV)} | max. | | | 20 | | | Α |
| Non-repetitive peak forward current | ^I FSM | max. | | | 360 | | | Α |
| Non-repetitive peak reverse power | P _{RSM} | max. | | | 18 | | | kW |

MECHANICAL DATA

Fig. 1 DO-4.



Net mass: 7 q.

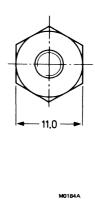
Diameter of clearance hole: max. 5.2 mm.

Accessories supplied on request: see ACCESSORIES section

Supplied with device: 1 nut, 1 lock washer. Nut dimensions across the flats: 9.5 mm

Products approved to CECC 50 009-022 available on request,

Dimensions in mm



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

The mark shown applies to to the normal polarity types.

BYX25 SERIES

RATINGS

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

| Voltages* | | BYX25 | -600(R) | 800(R) | 1000(R) | 1200(R) | 1400(| <u>R</u>) |
|--|-------------|------------------|------------|-------------------|---------|---------------------------------------|-------|------------|
| Crest working reverse voltage | v_{RWM} | max. | 600 | 800 | 1000 | 1200 | 1400 | V |
| Continuous reverse voltage | v_R | max. | 600 | 800 | 1000 | 1200 | 1400 | ٧ |
| | | | | | | | | |
| Currents | | | | | | | | |
| Average forward current (aver up to T _{mb} = 125 °C | aged over | any 20 m | ns period) | I _{F(AV} | /) max | ς. | 20 | Α |
| Repetitive peak forward curre | nt | | | ¹ FRM | max | ζ. | 440 | Α |
| Non-repetitive peak forward c t = 10 ms (half sine-wave); with reapplied VRWMmax | o surge; | l _{FSM} | max | ζ. | 360 | Α | | |
| | | | | | | | | |
| I ² t for fusing | | | | l ² t | max | C. | 650 | A^2 s |
| Reverse power dissipation | | | | | | | | |
| Average reverse power dissipation (averaged over any 20 ms p | | = 175 °C | | P _{R(A} | V) max | , , , , , , , , , , , , , , , , , , , | 38 | W |
| Repetitive peak reverse power $t = 10 \mu s$ (square-wave; $f = 10 \mu s$ | | | | PRRM ma | | ζ. | 3 | kW |
| Non-repetitive peak reverse po $t = 10 \mu s$ (square-wave) | ower dissip | ation | | | | | | |
| $T_j = 25$ °C prior to surge | | | | PRSM | | c. | 18 | kW |
| T _j = 175 °C prior to surge | | | | PRSM | max | C. | 3 | kW |
| Temperatures | | | | | | | | |
| Storage temperature | | | | T_{stg} | | -55 to + | 175 | οС |
| Junction temperature | | | | Tj | max | ζ. | 175 | oC |
| | | | | | | | | |

^{*}To ensure thermal stability: $R_{\mbox{th j-a}} \! < \! 5$ K/W (a.c.)

THERMAL RESISTANCE

| From junction to ambient in free air | R _{th j-a} | = | 50 | oC/M |
|--------------------------------------|----------------------|---|-----|------|
| From junction to mounting base | R _{th j-mb} | = | 1.3 | °C/W |
| From mounting base to heatsink | R _{th mb-h} | = | 0.5 | oc/w |

CHARACTERISTICS

| | | BYX25 | 600(R) | 800(R) | 1000(R) | 1200(R) | 1400(R) |
|---|--------------------|-------|-------------|--------------|--------------|--------------|------------------|
| Forward voltage $I_F = 50 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | ٧ _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 2400 | 1000 2400 | 1250 2400 | 1450 2400 | 1650 V 2400 V |
| Peak reverse current VR = VRWMmax; T _j = 125 °C | 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 IFAV = 10 A (per diode) ambient temperature Tamb = 40 $^{\circ}$ C repetitive peak reverse power dissipation in the avalanche region PRRM = 2 kW (per diode) duration of PRRM t = 40 $^{\mu}$ S

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:

$$P_{RAV} = \delta \times P_{RRM}$$
, where the duty cycle $\delta = \frac{40 \ \mu s}{20 \ ms} = 0.002$

Thus: $P_{RAV} = 0.002 \times 2 \text{ kW} = 4 \text{ W}$

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 μ s; 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).

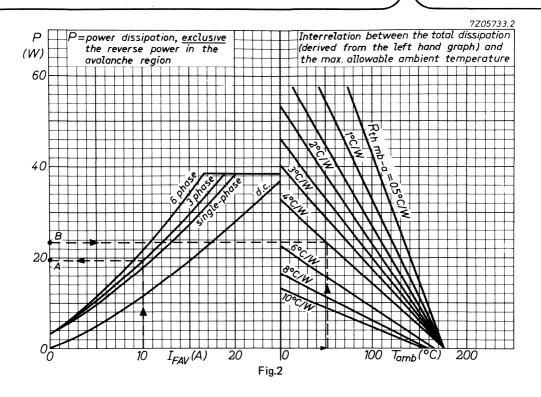
Allowance can be made for this by assuming an ambient temperature 12 °C higher than before, in this case 52 °C instead of 40 °C.

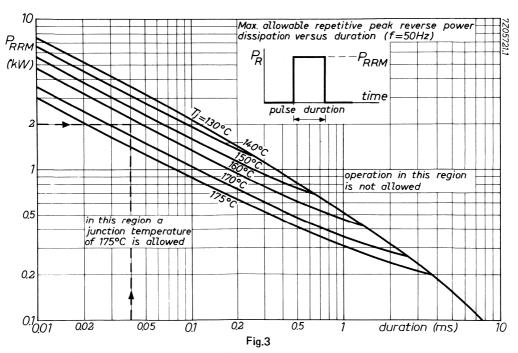
Using this in the curve leads to a thermal resistance

 $$\rm R_{th~mb\text{-}a}\approx~4~^{o}C/W$$ The contact thermal resistance $\rm R_{th~mb\text{-}h}$ = 0.5 $^{o}C/W$

Hence the heatsink thermal resistance should be:

$$R_{th h-a} = R_{th mb-a} - R_{th mb-h} = (4 - 0.5) \circ C/W = 3.5 \circ C/W$$





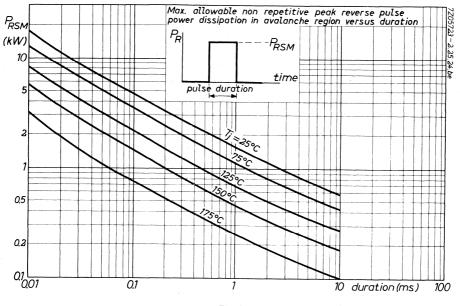


Fig.4

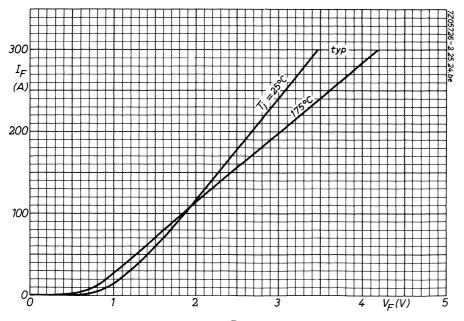
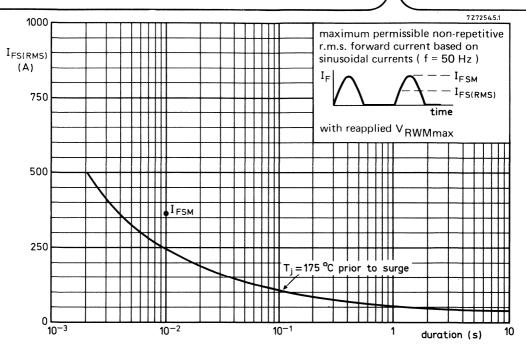


Fig.5



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:

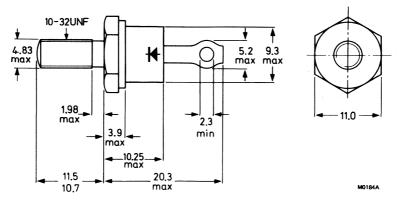
Normal polarity (cathode to stud): BYX30-200 to BYX30-600 Reverse polarity (anode to stud): BYX30-200R to BYX30-600R.

| 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 volta <i>g</i> e V _{(BR)R} | > 250 | 375 | 500 | 625 | 750 | V | | | |
| Average forward current | I _{F(A} | V) n | nax. | 14 | | A | | | |
| Non-repetitive peak forward current | I_{FSM} | I _{FSM} max. | | | | Α | | | |
| Non-repetitive peak reverse power | P _{RSM} r | | nax. | 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: 7g 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 acc | cordance | with the Abs | olute | Maximum | System | (IEC | 134) |
|--|---------------|--|--------|--------------------------------------|-----------------------|-----------|---------------------------|
| Voltages 1) | В | YX 30 - 200 (R) | 300 (F | R) 400 (R) | 500(R) | 600(F | <u>(Y</u> |
| Crest working reverse voltage | v_{RWM} | max. 200 | 300 | 400 | 500 | 600 | V |
| Continuous reverse voltage | v_R | max. 200 | 300 | 400 | 500 | 600 | $\mathbf{v}_{\mathbf{v}}$ |
| Currents | | | | | | | |
| Average forward current (average over any 20 ms period) up to $^{\circ}$ at $^{\circ}T_{ml}$ | | I _{F(AV)} I _{F(AV)} | max. | 14 7.5 | A A | | |
| R.M.S. forward current | | | | I _F (RMS) | max. | 22 | Α |
| Repetitive peak forward current | | | | I _{FRM} | max. | 310 | Α |
| Non-repetitive peak forward cur (t = 10 ms; half-sinewave) T_j with reapplied V_{RWM} max. | | prior to surg | | I | max. | 250 | Α |
| $I^{2}t$ for fusing (t = 10 ms) | | ^I FSM 12 _t | max. | 312 | $^{\Lambda}$ 2 s | | |
| Reverse power dissipation | | | | 1~(| max. | 312 | ЛВ |
| Repetitive peak reverse power d | liccinatio | v n | | | | | |
| $t = 10 \mu s$ (square wave; $f = 50$ | | | | PRRM | max. | 5.5 | kW |
| Non-repetitive peak reverse pow $t = 10 \ \mu s$ (square wave) $T_j = 2$ $T_j = 1$ | 5 °C pri | • | | ^P RSM ^P RSM | max. max. | 18 5.5 | kW kW |
| Temperatures | | | | | | | |
| Storage temperature | | | | $\mathrm{T_{stg}}$ | -55 to | +150 | $^{\mathbf{o}}\mathbf{C}$ |
| Junction temperature | | | | Т _j | max. | 150 | °C |
| THERMAL RESISTANCE | | | | | | | |
| From junction to ambient in free | e ai r | | | 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: $R_{th\ j-a} < 2.5\ ^{o}{\rm C/W}$ (continuous reverse voltage) or $< 5\ ^{o}{\rm C/W}$ (a.c.).

For smaller heatsinks T_j max should be derated. For a.c. see page 5. For continuous reverse voltage: if $R_{th \ j-a} = 5 \, ^{\circ}\text{C/W}$, then T_j max = 135 $^{\circ}\text{C}$. if $R_{th \ j-a} = 10 \, ^{\circ}\text{C/W}$, then T_j max = 120 $^{\circ}\text{C}$.

CHARACTERISTICS

| | BYX3 | 0-2 | 00(R) | 300(R) | 400(R) | 500(R) | 600(R) | |
|--|--------------------|-----|-------------|--------|--------|--------|--------|--------------------|
| Forward voltage | | | | | | | | |
| $I_F = 50 \text{ A}$; $T_j = 25 ^{\circ}\text{C}$ | v_F | < | 3. 2 | 3. 2 | 3. 2 | 3. 2 | 3. 2 | (V ₁ 1) |
| Reverse breakdown voltage | | | | | | | | |
| I = 5 mA : T = 25 0C | V | > | 250 1050 | 375 | 500 | 625 | 750 | v |
| $I_R = 5 \text{ mA}; T_j = 25 ^{\circ}\text{C}$ | V _{(BR)R} | < | 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 |

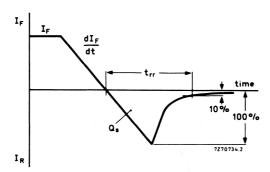
Reverse recovery charge when switched from

$$I_F = 2 \text{ A to } V_R \ge 30 \text{ V};$$

with $-dI_F/dt = 100 \text{ A}/\mu s$; $T_j = 25 \,^{\circ}\text{C}$ $Q_s < 0.70 \,\mu\text{C}$

Reverse recovery time when switched from

$$I_F$$
 = 1 A to $V_R \ge 30$ V;
$$-dI_F/dt = 50 \text{ A}/\mu s; \ T_j = 25 \, ^{o}\text{C} \qquad \qquad t_{rr} \qquad < \qquad 200 \qquad \text{ns}$$



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.

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 $^{\rm O}$ C). Starting from IF = 12 A on the horizontal scale trace upwards until the appropriate line

 $-\frac{dI}{dt}$ = 20 A/ μ s. 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.

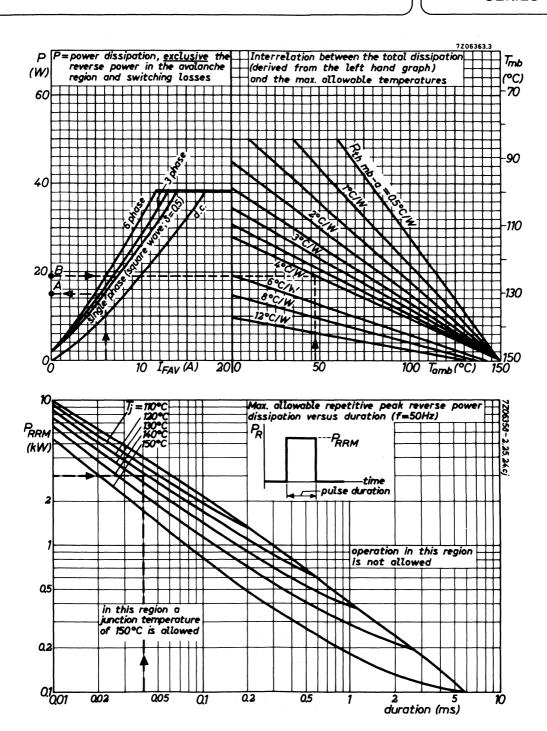
Therefore the total power dissipation P_{tot} = 15 W + 4 W = 19 W (point B of the upper graph on page 5). From the right hand part follows the thermal resistance, required at T_{amb} = 45 °C.

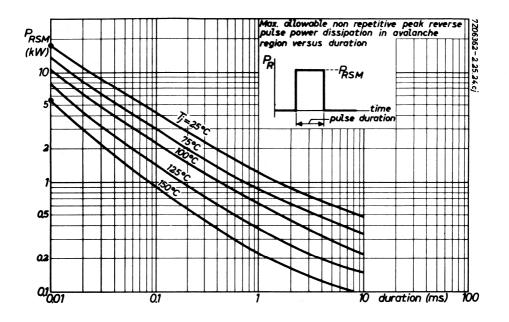
$$R_{th mb-a} \approx 4 \, {}^{\circ}C/W$$

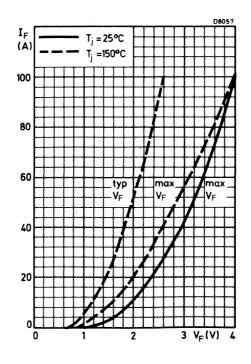
The contact thermal resistance $R_{th mb-h} = 0.5 \, {}^{\circ}\text{C/W}$.

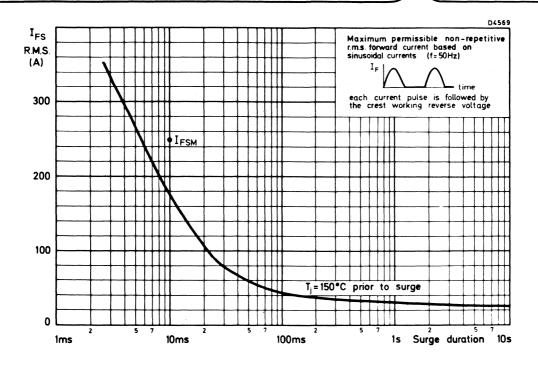
Hence the heatsink thermal resistance should be:

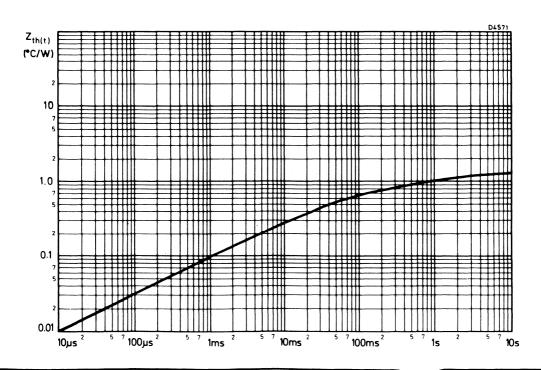
$$R_{th\ h-a} = R_{th\ mb-a} - R_{th\ mb-h} = (4 - 0.5) \circ C/W = 3.5 \circ C/W$$
.

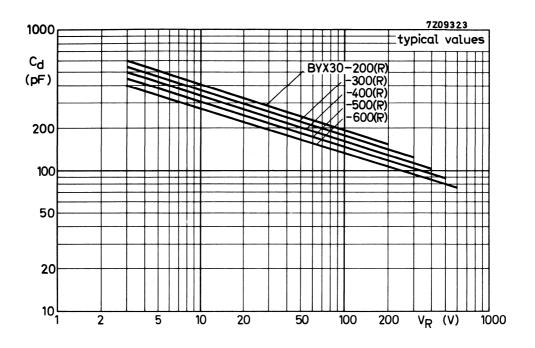


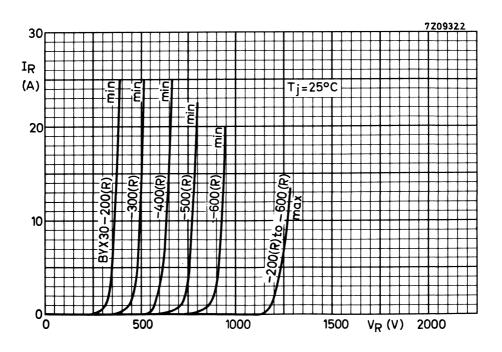


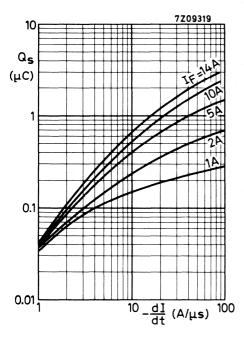




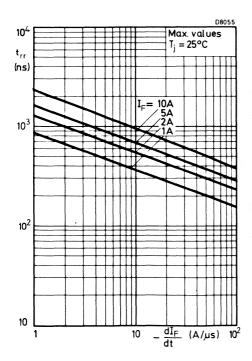


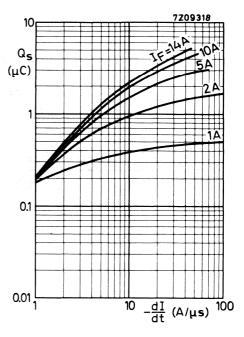




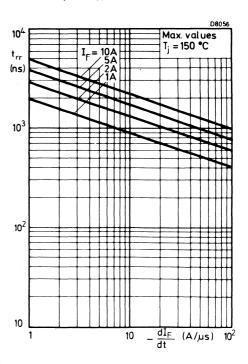


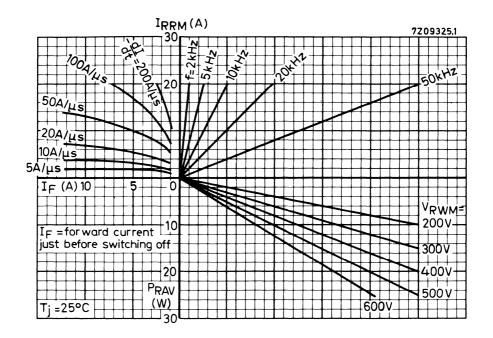
Maximum values; T $_{j}$ = 25 $^{o}\text{C};$ switched from I $_{F}$ to V $_{R}$ \geqslant 30 V.

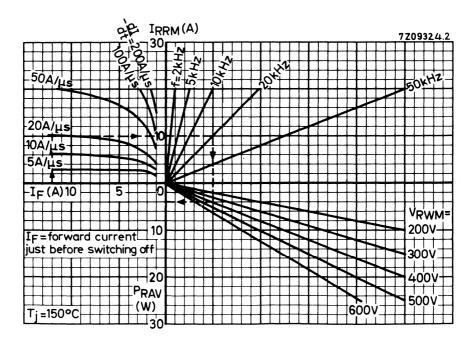




Maximum values; T $_{j}$ = 150 $^{o}\text{C};$ switched from I $_{F}$ to V $_{R}$ \geqslant 30 V.







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.

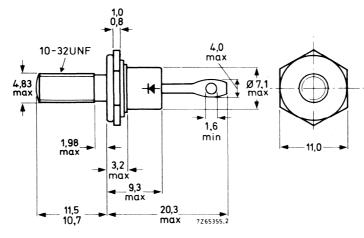
QUICK REFERENCE DATA

| | | 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 | Α |
| Non-repetitive peak forward current | FSM | max. | 50 | Α |

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 A | bsolute | Maximu | m Syste | em (IEC | 134) |
|---|------------------------|---------|----------------|---------------|---------|---------------------------|
| Voltages | | BYX3 | 8-300(R) | 600(R) | 1200(R) | 1 |
| Non-repetitive peak reverse voltage (t ≤ 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 | \mathbf{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 $^{\rm o}{\rm C}$ at T_{mb} = 125 $^{\rm o}{\rm C}$ | | | F(AV) F(AV) | max. max. | 6 | A A |
| R.M.S. forward current | R.M.S. forward current | | | max. | 10 | A |
| Repetitive peak forward current | | | FRM | max. | 50 | A |
| Non-repetitive peak forward current (t = 10 ms; half sine-wave) $T_j = 150$ °C p with reapplied V_{RWMmax} | orior to su | | ₹SM | max. | 50 | A |
| I^2t for fusing (t = 10 ms) | | I^2 | t | max. | 13 | ${\rm A^2s}$ |
| Temperatures | | | | | | |
| Storage temperature | | | stg | -55 to $+150$ | | $^{\mathrm{o}}\mathrm{C}$ |
| Junction temperature | | T | j | max. | 150 | $^{\mathrm{o}}\mathrm{C}$ |
| THERMAL RESISTANCE | | | | | | |
| From junction to ambient in free air | | R | th j-a | = | 50 | oC/W |
| From junction to mounting base | | R | th j-mb | = | 4 | oC/W |
| From mounting base to heatsink with heatsink compound | | R | th mb-h | = | 0,5 | oc/W |
| without heatsink compound | | R | th mb-h | = | 0,6 | oC/W |
| Transient thermal impedance; t = 1 ms | | | th j-mb | = | 0,3 | oC/W |
| | | | . • | | | |

CHARACTERISTICS

Forward voltage

$$I_F = 20 A; T_i = 25 \text{ }^{\circ}\text{C}$$

 V_{F}

 $1,7 V^{1}$

Reverse current

$$V_R = V_{RWMmax}$$
; $T_j = 125$ °C

 $I_{\mathbf{R}}$

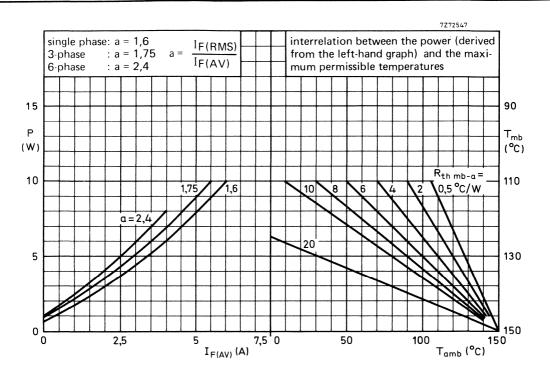
200 μA

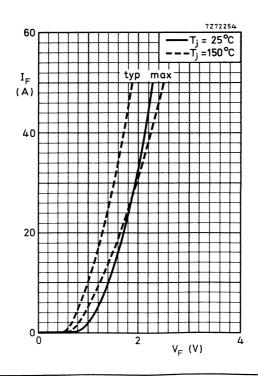
OPERATING NOTES

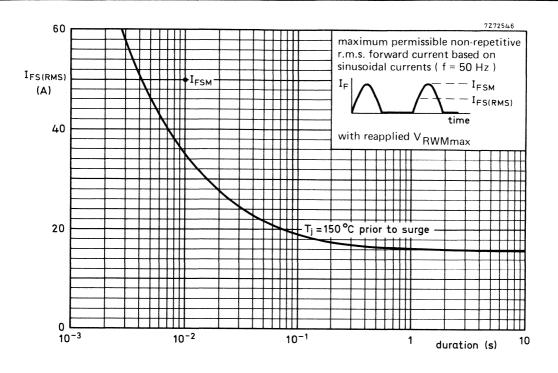
- The top connector should neither be bent nor twisted; it should be soldered into the circuit so that there is no strain on it.
 During soldering the heat conduction to the junction should be kept to a minimum.
- 2. Where there is a possibility that transients, due to the energy stored in the transformer, will exceed the maximum permissible non-repetitive peak reverse voltage, see General Section for information on damping circuits.

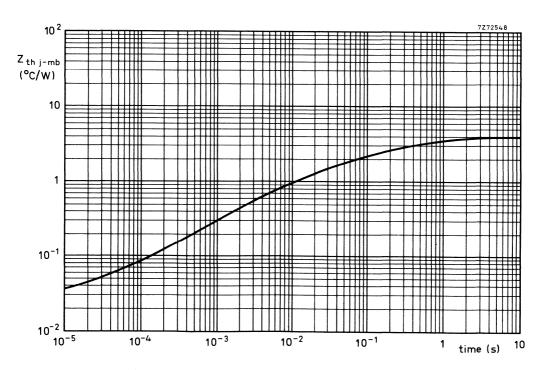
November 1975 | | 611

¹⁾ Measured under pulse conductions to avoid excessive dissipation.











CONTROLLED AVALANCHE RECTIFIER DIODES

Also available to BS9333-F005

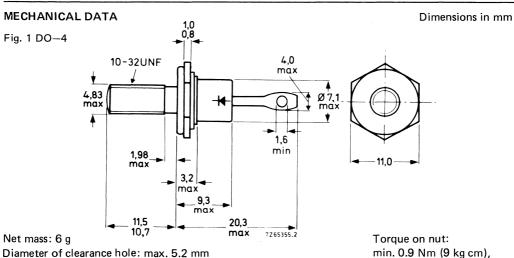
Silicon diodes in a DO-4 metal envelope, capable of absorbing transients and intended for use in power rectifier application.

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(F | <u>R)</u> |
|---|--------------------|--------|--------------------|--------|---------|---------|--------|-----------|
| 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 | | Α |
| Non-repetitive peak forward current | | | ^I FSM | | max. | 125 | | Α |
| Non-repetitive peak reverse power dissipation | | | P _{RSM} | | max. | 4 | | kW |



Supplied with device: 1 nut, 1 lock-washer. Nut dimensions across the flats: $9.5\ mm$.

Accessories supplied on request:

see ACCESSORIES section

The mark shown applies to normal polarity types.

max. 1.7 Nm (17 kg cm).

BYX39 SERIES

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 | ٧ |
| Crest working reverse voltage | v_{RWM} | max. | 600 | 800 | 1000 | 1200 | 1400 | ٧ |
| Currents Average forward current (aver 20 ms period) up to T _{mb} = at T _{mb} = | 85 °C | any | | IF(AV | | == | 9.5 6.0 | A A |
| R.M.S. forward current | | | | lF(RM | (S) max | c. | 15 | Α |
| Repetitive peak forward curre | nt | | | IFRM | max | ζ. | 100 | Α |
| Non-repetitive peak forward of t = 10 ms (half sine-wave); with reapplied VRWMmax I ² t for fusing (t = 10 ms) | | °C prior t | o surge; | I _{FSM} | max max | | 125 78 | A A ² s |
| Reverse power dissipation | | | | | | | | |
| Average reverse power dissipation (averaged over any 20 ms p | | = 125 °C | ; | P _R (A) | √) max | (. | 10 | w |
| Repetitive peak reverse power t = 10 μs (square-wave; f = 9 | | | С | PRRM | max | ζ. | 2 , | kW |
| Non-repetitive peak reverse po $t = 10 \mu s$ (square-wave) $T_j = 25 ^{\circ}\text{C}$ prior to surge $T_j = 175 ^{\circ}\text{C}$ prior to surge | ower dissip | oation | | PRSM PRSM | | | 4 0.8 | kW kW |
| Temperatures | | | | _ | | | | 0.0 |
| Storage temperature | | | | T _{stg} | | -55 to + | 175 | οС |
| Junction temperature | | | | т _ј | max | ί. | 175 | oC |

^{*}To ensure thermal stability: R $_{th~j\text{-}a}\!\leqslant\!5$ °C/W (continuouse reverse voltage) or $\!\leqslant\!20$ °C/W (a.c.)

THERMAL RESISTANCE

| From junction to ambient in free air | R _{th j-a} | - = | 50 | oC/W |
|--|--|-----|-------------------|--------------|
| From junction to mounting base | R _{th j-mb} | = | 4.5 | oc/w |
| From mounting base to heatsink without heatsink compound with heatsink compound with mica washer | R _{th} mb-h R _{th} mb-h R _{th} mb-h | | 1.0 0.5 2.0 | °C/W °C/W |
| Transient thermal impedance; t = 1 ms | Z _{th j-mb} | = | 0.35 | oC/W |

CHARACTERISTICS

| | | BYX39-600(R) 8 | | 800(R) | 1000(R) | 1200(R) | 1400(| R) |
|---|--------------------|----------------|-------------|--------|--------------|--------------|--------------|--------|
| Forward voltage $I_F = 20 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | VF | < | 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 2400 | 1000 | 1250 2400 | 1450 2400 | 1650 2400 | v v |
| Reverse current $V_R = V_{RWMmax};$ $T_j = 125 ^{\circ}C$ | I _R | < | 200 | 200 | 200 | 200 | 200 | μΑ |

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.

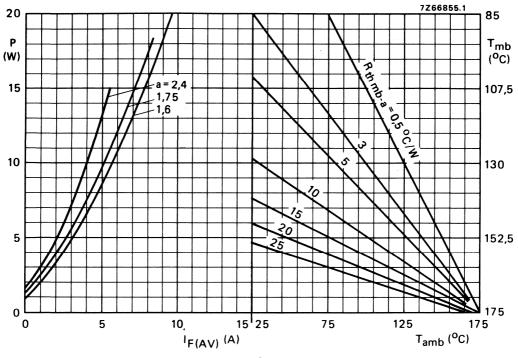
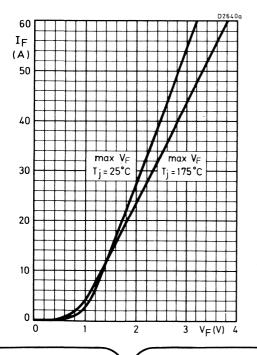


Fig.2



The right-hand part shows the interrelationship 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 = 1.63-phase: a = 1.756-phase: a = 2.4

 $a = I_F(RMS)/I_F(AV)$

Fig.3

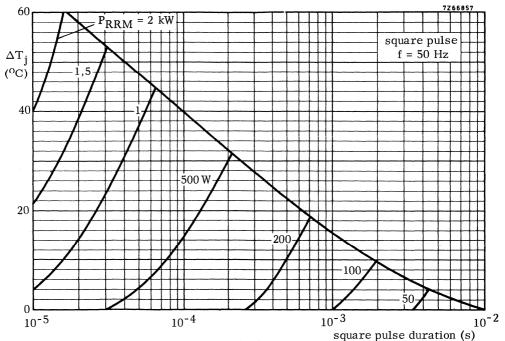
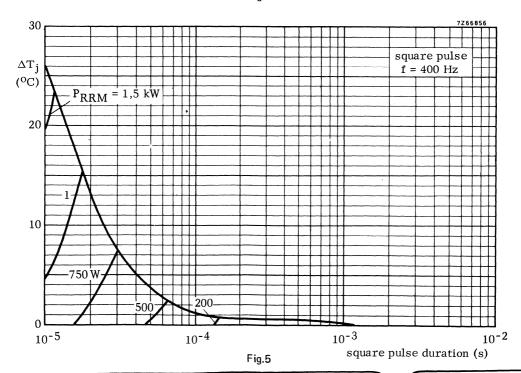
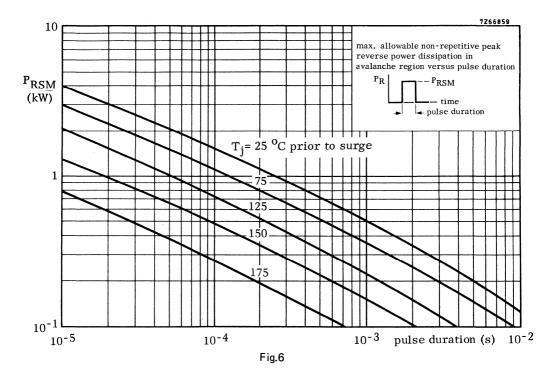
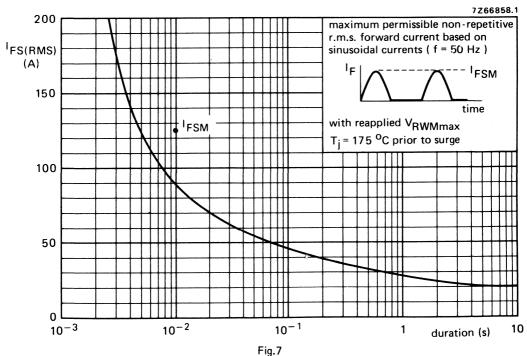


Fig.4







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.

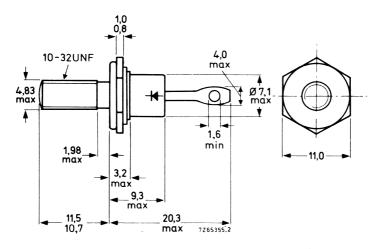
QUICK REFERENCE DATA

| | | BYX4 | 2-300(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 | Α |

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 S | vstem (| (IEC 134) |
|---------|----------|--------|---------------|----------|----------|-----------|---------|-----------|
|---------|----------|--------|---------------|----------|----------|-----------|---------|-----------|

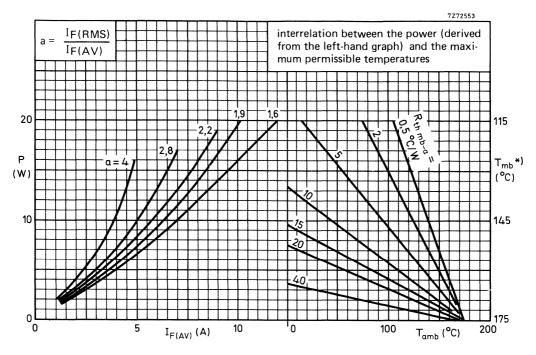
| Voltages | | BYX4 | 2-300(R) | 600(R) | 1200(R | <u>)</u> |
|---|---------------------------|--------|----------------------|--------------|----------|------------------|
| Non-repetitive peak reverse voltage (t ≤ 10 ms) | v_{RSM} | max. | 300 | 600 | 1200 | V |
| Repetitive peak reverse voltage (δ ≤ 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} = at T_{mb} = | = 115 °C = 125 °C | | I _F (AV) | max. max. | 12 10 | A 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 with reapplied V_{RWMmax} | ^o C prior to | surge; | I_{FSM} | max. | 125 | A |
| Temperatures | | | | | | |
| Storage temperature | | | T_{stg} | -55 1 | to +175 | °C |
| Junction temperature | | | Тj | max. | 175 | oС |
| 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 | | | | n = | 0,5 | oC/W |
| CHARACTERISTICS | | | | | | |
| Forward voltage at $I_F = 15 \text{ A}$; $T_j = 25$ | $^{\mathrm{o}}\mathrm{C}$ | | v_{F} | < | 1, 4 | V ¹) |
| Reverse current at $V_R = V_{RWMmax}$; | T _j = 125 °C | C | $I_{\mathbf{R}}$ | < | 200 | μΑ |

MOUNTING INSTRUCTIONS

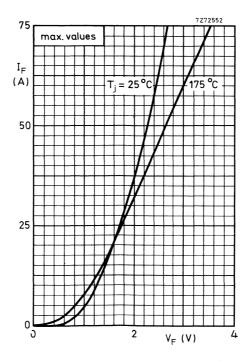
The top connector should neither be bent nor twisted; it should be soldered into the circuit so that there is no strain on it.

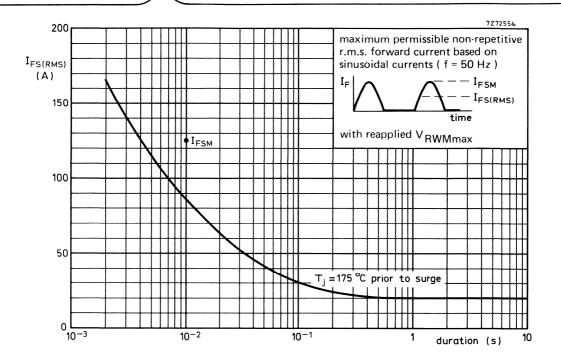
During soldering the heat conduction to the junction should be kept to a minimum.

¹⁾ Measured under pulse conditions to avoid excessive dissipation.



*) Tmb-scale is for comparison purposes only and is correct only for $R_{th\ mb-a} \leq 22~^{o}\text{C/W}$





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

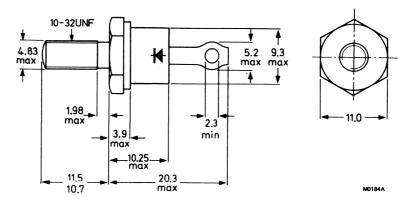
QUICK REFERENCE DATA

| | | BYX46-2 | 200(R) 3 | 00(R) | 400(R) | 500(R) | 600(R) | |
|-------------------------------------|--------------------|---------|----------|-------|--------|--------|--------|----|
| Crest working reverse voltage | v_{RWM} | max. | 200 | 300 | 400 | 500 | 600 | ٧ |
| Reverse avalanche breakdown voltage | V _{(BR)R} | > | 250 | 375 | 500 | 625 | 750 | V |
| Average forward current | l _{F(AV)} | max. | | | 22 | | | Α |
| Non-repetitive peak forward current | ^I FSM | max. | | | 300 | ı | | Α |
| Non-repetitive peak reverse power | PRSM | max. | | | 18 | | | kW |
| Reverse recovery time | t _{rr} | < | | | 200 | 1 | | 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

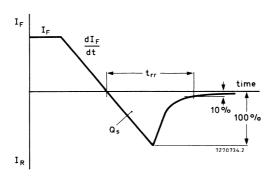
Limiting values in accordance with the Absolute Maximum System (IEC 134)

| Voltages * | | BYX46-20 | 00(R)3 | 00(R) | 400(R) | 500(R) | 600(R) | |
|---|----------------------|----------|--------|-------------|--------|--------|--------|--------|
| Crest working reverse voltage | V_{RWM} | max. | 200 | 300 | 400 | 500 | 600 | ٧ |
| Continuous reverse voltage | V_{R} | max. | 200 | 300 | 400 | 500 | 600 | ٧ |
| Currents | | | | | | | | |
| Average forward current (averaged over any 20 ms period) | | | | | | | | |
| up to T _{mb} = 100 °C | F(AV) | max. | | | 22 | | | A |
| at T _{mb} = 125 °C | IF(AV) | max. | | | 15 | | | A |
| R.M.S. forward current | IF(RMS) | | | | 35 | | | A |
| Repetitive peak forward current | IFRM | max. | | | 400 | | | Α |
| Non-repetitive peak forward current (t = 10 ms; half-sinewave) $T_j = 165^{\circ}$ prior to surge; with reapplied | С | | | | | | | |
| V _{RWMmax} | IFSM | max. | | | 300 | | | Α |
| I^2 t for fusing (t = 10 ms) | l² t | max. | | | 450 | | | A^2s |
| Reverse power dissipation | | | | | | | | |
| Repetitive peak reverse power dissipation $t = 10 \mu s$ (square wave; $f = 50 Hz$) | | | | | | | | |
| T _j = 100 °C | P_{RRM} | max. | | | 9,5 | | | kW |
| Non-repetitive peak reverse power dissipation $t = 10 \mu s$ (square wave) | | | | | | | | |
| $T_j = 25$ °C prior to surge | PRSM | max. | | | 18 | | | kW |
| $T'_j = 165$ °C prior to surge | PRSM | max. | | | 4 | | | kW |
| Temperatures | | | | | | | | |
| Storage temperature | T_{stg} | | | -55 to | +165 | | | оС |
| Junction temperature | тј | max. | | | 165 | | | оС |
| THERMAL RESISTANCE | | | | | | | | |
| From junction to ambient in free air | R _{th j-a} | = " | | | 50 | | | oC/W |
| From junction to mounting base | R _{th j-mb} | = | | | 1,3 | | | oC/M |
| From mounting base to heatsink | R _{th mb-h} | | | | 0,5 | | | oC/W |
| | | | | | | | | |

^{*} To ensure thermal stability: $R_{th\ j-a} < 2.5\ ^{\circ}C/W$ (continuous reverse voltage) or $< 5\ ^{\circ}C/W$ (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 $^{\circ}C/W$, then $T_{j\ max}$ = 135 $^{\circ}C$; if $R_{th\ j-a}$ = 10 $^{\circ}C/W$, then $T_{j\ max}$ = 125 $^{\circ}C$.

| CHA | RA | CTE | DIC | TICS |
|-----|----|-----|-----|------|
| | | | | |

| CHARACTERISTICS | | | | | | | | |
|---|-----------------|-------|----------|--------|----------|--------------|----------|---------|
| | | BYX46 | 6-200(R) | 300(R) | 400(R) | 500(R) | 600(R) | |
| Forward voltage | | | | | | | | |
| $I_F = 50 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | ٧F | < | 2,0 | 2,0 | 2,0 | 2,0 | 2,0 | V * |
| Reverse breakdown voltage | | | 050 | 075 | 500 | 205 | 750 | ., |
| I _R = 5 mA; T _i = 25 °C | V/ | > | 250 | 375 | 500 | 625 | 750 | V |
| 1R - 5 111A, 1j = 25 °C | V(BR)R | < | 1050 | 1050 | 1050 | 1050 | 1050 | ٧ |
| Reverse current | | | | | | | | |
| $V_R = V_{RWMmax}$; $T_j = 125 {}^{\circ}C$ | ^I R | < | 4,0 | 4,0 | 4,0 | 4,0 | 4,0 | mΑ |
| Reverse recovery charge when switched | from | | | | <u>'</u> | ' | <u>'</u> | |
| $I_F = 2 A \text{ to } V_R \geqslant 30 V$; | | | | | | | | |
| $-dI_F/dt = 100 A/\mu s; T_j = 25 °C$ | O_s | < | | | 0,70 | | | μ C |
| Reverse recovery time when switched fr | rom | | | | | | | |
| $I_F = 1 \text{ A to } V_R \geqslant 30 \text{ V};$ | | | | | | | | |
| $-dI_F/dt = 50 A/\mu s; T_i = 25 °C$ | 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 | \mathbf{f} | = | 20 | kHz |
|---------------------|------------------|---|------------|------------------|
| duty cycle | δ | = | 0.5 | |
| ambient temperature | T_{amb} | = | 4 0 | $^{\rm o}{ m C}$ |
| switched from | $_{ m I_F}$ | = | 12 | Α |
| to | v_R | = | 300 | V |
| at a rate | $-\frac{dI}{dt}$ | = | 50 | 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 $I_{\rm FAV}$ = 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 $^{\rm O}$ C). Starting from I_F = 12 A on the horizontal scale trace upwards until the appropriate line $-\frac{{\rm d}I}{{\rm d}r}$ =50 A/ μ s. 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 $P_{tot} = 13 \text{ W} + 6 \text{ W} = 19 \text{ W}$ (point B of the upper graph on page 5).

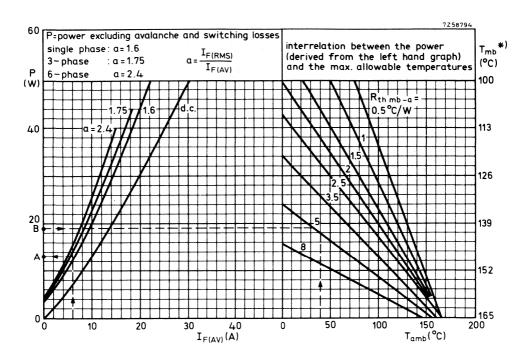
From the right hand part of the upper graph on page 5 follows the thermal resistance, required at T_{amb} = 40 °C.

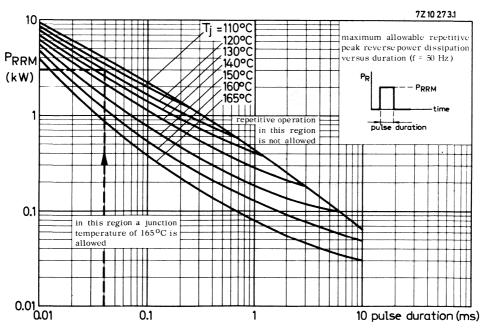
$$R_{th mb-a} \approx 5 \, {}^{\circ}C/W$$

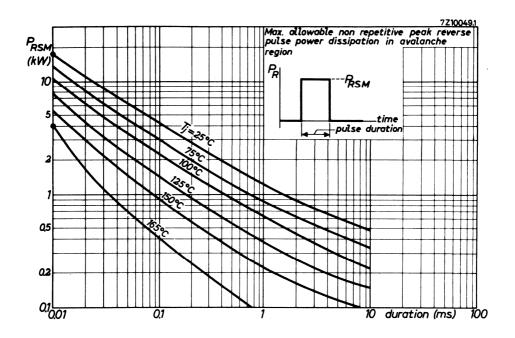
The contact thermal resistance R_{th} mb-h = 0.5 °C/W.

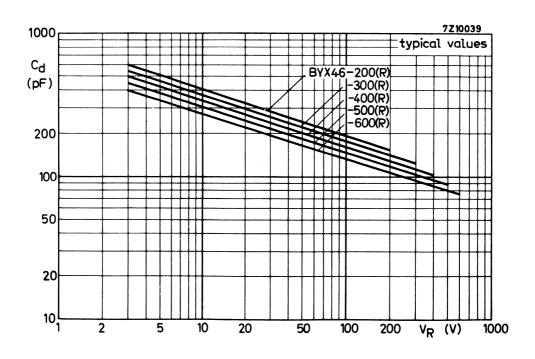
Hence the heatsink thermal resistance should be:

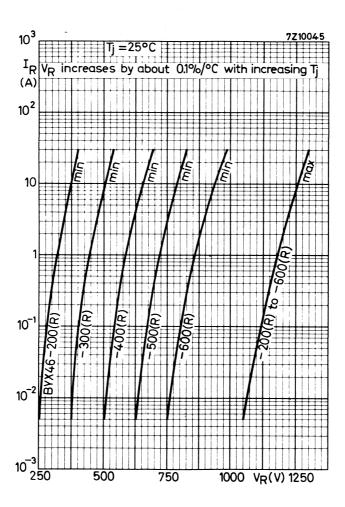
$$R_{th\ h-a} = R_{th\ mb-a} - R_{th\ mb-h} = (5 - 0.5) \circ C/W = 4.5 \circ C/W.$$

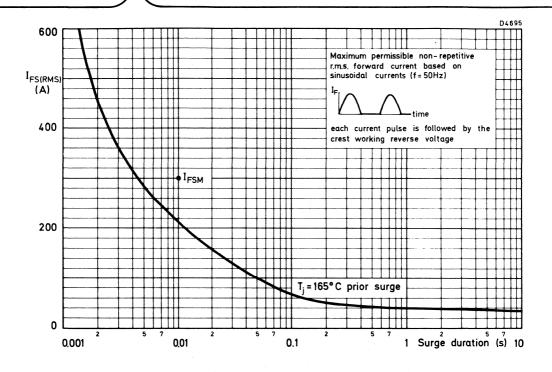


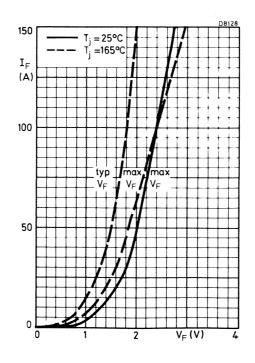


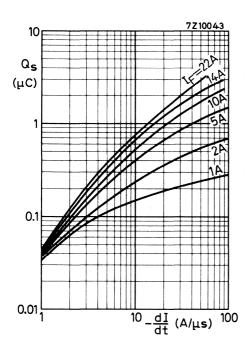


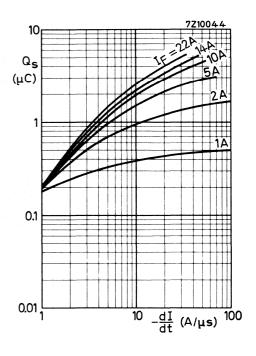


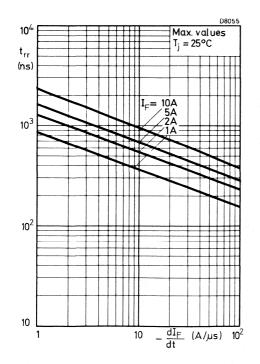


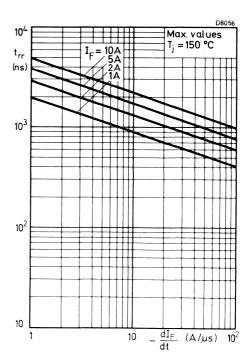


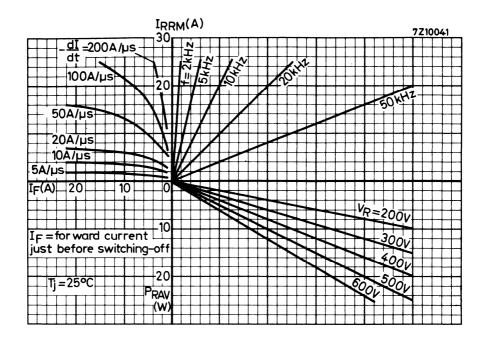


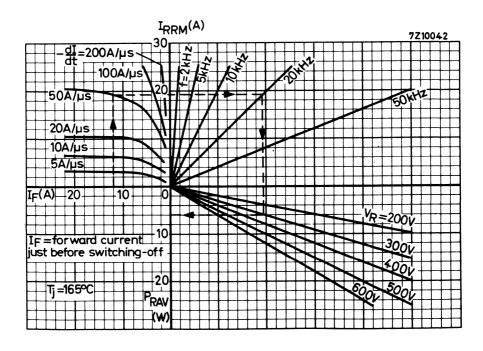




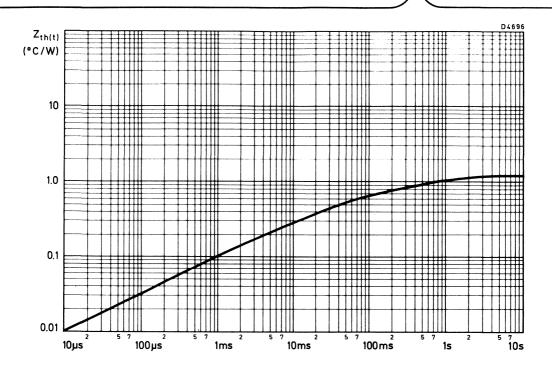








Nomogram: Power loss $P_{\mbox{\scriptsize RAV}}$ due to switching only (square wave operation)



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.

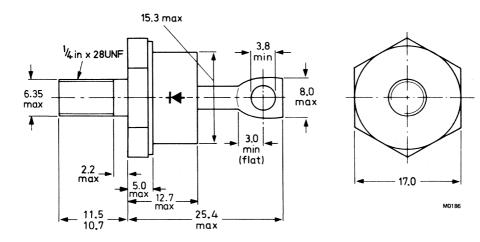
QUICK REFERENCE DATA

| | | BYX52 | -300(R) | 600(R) | 1200(R) | |
|-------------------------------------|-----------|---------------------|---------|--------|---------|---|
| Repetitive peak reverse voltage | V_{RRM} | max. | 300 | 600 | 1200 | ٧ |
| Average forward current | | I _F (AV) | | max. | 48 | Α |
| Non-repetitive peak forward current | | ^I FSM | | max. | 800 | Α |

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 q

Diameter of clearance hole: max. 6.5 mm

Accessories supplied on request:

see ACCESSORIES section

The mark shown applies to the normal polarity types

Torque on nut: min, 1.7 Nm (17 kg cm) max. 3.5 Nm (35 kg cm)



Products approved to CECC 50 009-024 available on request.

RATINGS

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

| Voltages | | BYX5 | 2-300(R) | 600(R |) 1200(R | <u>)</u> |
|---|--------------------------|------|----------------------|--------------|------------|----------|
| Non-repetitive peak reverse voltage ($t \le 10 \text{ ms}$) | 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 | VRWM | max. | 200 | 400 | 800 | V |
| Currents | | | | | | |
| Average forward current (averaged over any 20 ms period) up to T _{ml} at T _{mb} | o = 112 °C o = 125 °C | | lF(AV) | max. max. | 48 40 | A A |
| R.M.S. forward current | | | I _F (RMS) | max. | 75 | Α |
| Repetitive peak forward current | | | | | | Α |
| Non-repetitive peak forward current (t = 10 ms; half-sinewave) $T_j = 17$ | IFSM | max. | 800 | Α | | |
| I^2 t for fusing (t = 10 ms) | l²t | max. | 3200 | A^2s | | |
| Temperatures | | | | | | |
| Storage temperature | | | T_{stg} | -55 to | oC | |
| Junction temperature | Junction temperature | | | | 175 | oC |
| THERMAL RESISTANCE | | | | | | |
| From junction to mounting base | | | R _{th j-mb} | = | 0.8 | oC/M |
| From mounting base to heatsink | R _{th mb-h} | = | 0.2 | oC/M | | |
| CHARACTERISTICS | | | | | | |
| Forward voltage I _F = 150 A; T _j = 25 °C | | | VF | < | 1.8 | V* |
| Reverse current $V_R = V_{RWM max}$; $T_j = 125 {}^{\circ}\text{C}$ | | | IR | < | 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.

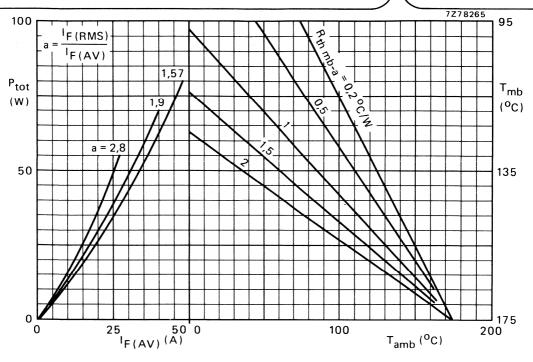
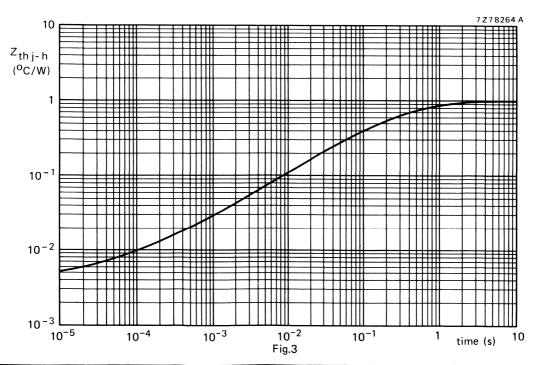


Fig.2 Interrelation between the power(derived from the left-hand part) and the maximum permissible temperatures.



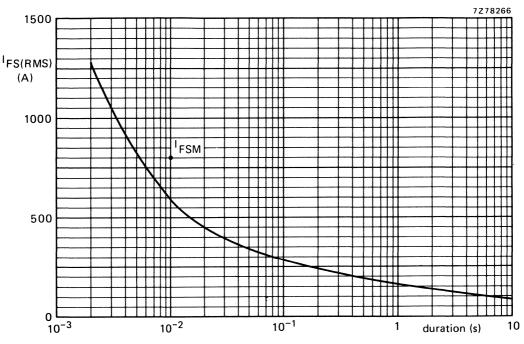


Fig.4 Maximum permissible non-repetitive r.m.s. forward current based on sinusoidal currents (f = 50 Hz); $T_j = 175$ °C prior to surge; with reapplied $V_{RWM\ max}$.

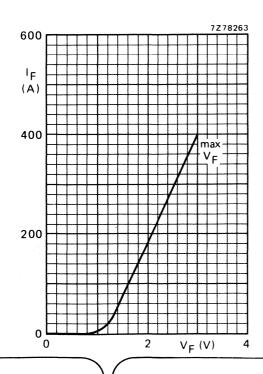




Fig.5

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:

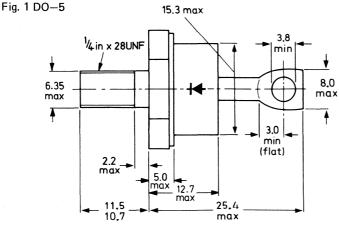
Normal polarity (cathode to stud): BYX56-600 to BYX56-1400. Reverse polarity (anode to stud): BYX56-600R to BYX56-1400R.

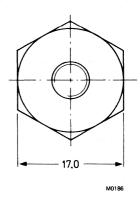
QUICK REFERENCE DATA

| | | BYX56- | -600(R) | 800(R) | 1000(R) | 1200(R) | 1400(F | ۲) |
|---|--------------------|--------|---------|--------|---------|---------|--------|----|
| Crest working reverse voltage | v_{RWM} | max. | 600 | 800 | 1000 | 1200 | 1400 | ٧ |
| Reverse avalanche breakdown voltage | V _{(BR)R} | > | 750 | 1000 | 1250 | 1450 | 1650 | V |
| Average forward current | IF(AV) | max. | | | 48 | | | Α |
| Non-repetitive peak forward current | I _{FSM} | max. | | | 800 | | | Α |
| Non-repetitive peak reverse power dissipation | PRSM | max. | | | 40 | | | kW |

MECHANICAL DATA

Dimensions in mm





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.

Products approved to CECC 50 009-023 available on request.

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.

RATINGS

Voltages*

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

| Crest working reverse voltage | V_{RWM} | max. | 600 | 800 | 1000 | 1200 | 1400 | ٧ |
|--|------------|--------|-----|---------------------|------------------|------------|-----------|----------|
| Continuous reverse voltage | V_{R} | max. | 600 | 800 | 1000 | 1200 | 1400 | ٧ |
| Currents Average forward current (averaged over any 20 ms p | eriod) | | | 1 | | | 48 | A |
| up to $T_{mb} = 112 {}^{O}C$ at $T_{mb} = 125 {}^{O}C$ | | | | lF(AV | | | 40 | A |
| R.M.S. forward current | | | | IF(RM | IS) max | k. | 75 | Α |
| Repetitive peak forward curre | ent | | | ^I FRM | max | ĸ. | 450 | Α |
| Non-repetitive peak forward of t = 10 ms (half sine-wave); T _j = 175 °C prior to surge; with reapplied VRWMmax | current | | | ^I FSM | ma | x . | 800 | A |
| l^2 t for fusing (t \leq 10 ms) | | | | l ² t | max | κ. | 3200 | A^2s |
| Reverse power dissipation | | | | | | | | |
| Repetitive peak reverse power $t = 10 \mu s$ (square-wave; $f = T_j = 175 ^{\circ}\text{C}$ | • | on | | PRRM | _l max | ×. | 6.5 | kW |
| Non-repetitive peak reverse po $t = 10 \mu s$ (square-wave) | ower dissi | pation | | | | | | |
| $T_j = 25$ °C prior to surge $T_j = 175$ °C prior to surge | | | | PRSM PRSM | ma: ma: | | 40 6.5 | kW kW |
| Temperatures | | | | | | | | |
| Storage temperature | | | | T_{stg} | | -55 to | +175 | oC |
| Junction temperature | | | | T_{j} | ma | x. | 175 | оС |
| THERMAL RESISTANCE | | | | | | | | |
| From junction to mounting b | ase | | | R _{th j-r} | mb = | | 8.0 | oC/W |
| From mounting base to heats | | | | R _{th m} | | | 0.2 | oC/W |
| Transient thermal impedance | . + - 1 mc | | | Z _{th i-} | . = | | 0.03 | oC/W |

BYX56-600(R) | 800(R) | 1000(R) | 1200(R) | 1400(R)

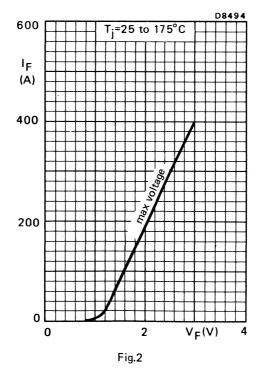
^{*}To ensure thermal stability: $\rm R_{th~j-a}$ < 2.2 $^{\rm o}\rm C/W$ (a.c.)

| CHARACTERISTICS | | | | | | | | |
|---|--------------------------|--------------|------|--------|---------|---------|---------|----|
| | | BYX56-600(R) | | 800(R) | 1000(R) | 1200(R) | 1400(R) | |
| Forward voltage IF = 150 A; T _j = 25 °C | VF | < | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | V* |
| Reverse avalanche breakdo voltage I _R = 5 mA; T _i = 25 °C | wn V _{(BR)R} | > | 750 | 1000 | 1250 | 1450 | 1650 | V |
| | (DIT/IT | < 1 | 2400 | 2400 | 2400 | 2400 | 2400 | V |
| Reverse current VR = VRWMmax; | | | | | | | | |
| $T_j = 125 ^{\circ}C$ | I _R | < | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | mΑ |

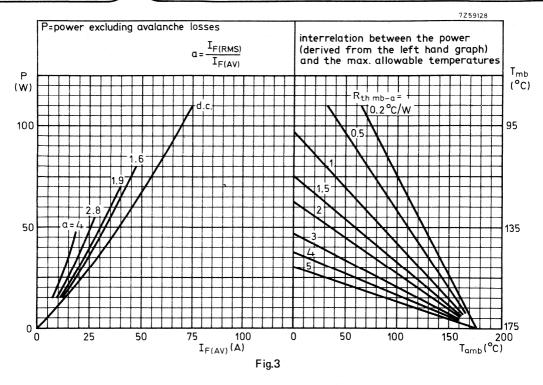
OPERATING NOTES

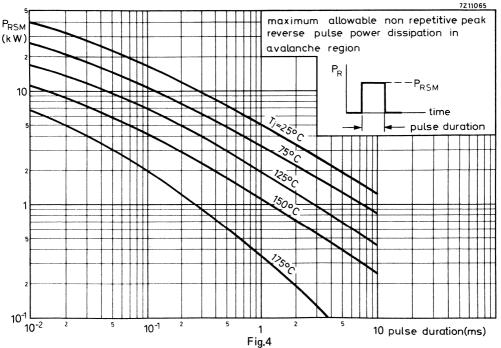
The top connector should neither be bent nor twisted; it should be soldered into the circuit so that there is no strain on it.

During soldering the heat conduction to the junction should be kept to a minimum by using a thermal shunt.



^{*}Measured under pulsed conditions to avoid excessive dissipation.





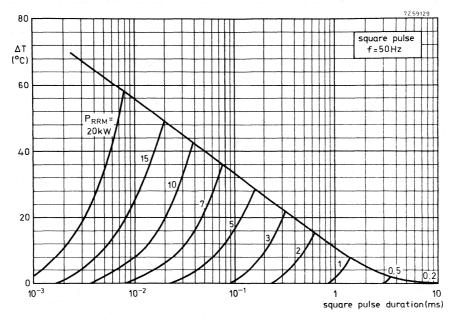


Fig.5

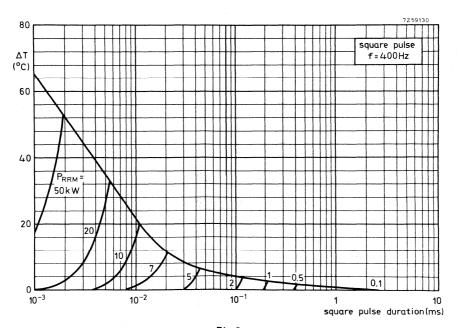
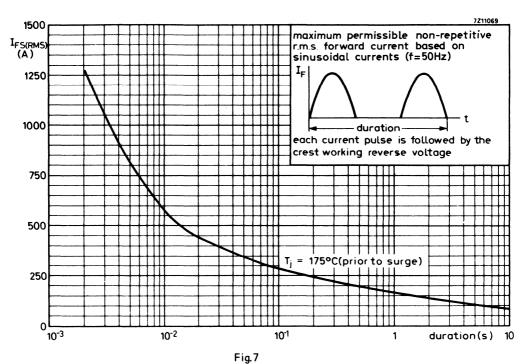


Fig.6

 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.



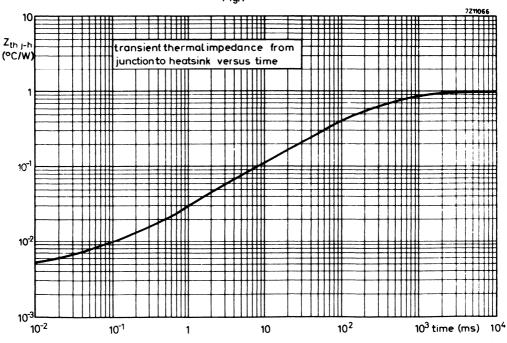


Fig.8

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

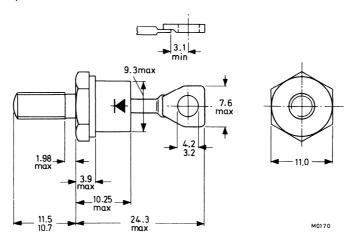
| | | BYX96 | -300(R) | 600(R) | 1200(R) | 1600(R) | |
|-------------------------------------|-----------|------------------|---------|--------|---------|---------|---|
| Repetitive peak reverse voltage | V_{RRM} | max. | 300 | 600 | 1200 | 1600 | ٧ |
| Average forward current | | lF(AV) | | max. | | 30 | Α |
| Non-repetitive peak forward current | | ^I FSM | | max. | | 400 | Α |

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 |) 160 | 0(R) |
|--|-----------|-----------|------|------------------|--------|----------|---------|---------------------------|
| Non-repetitive peak reverse voltage (t ≤ 10 ms) | v_{RSM} | max. | 300 | | 600 | 1200 | 160 | 0 V |
| Repetitive peak reverse voltage ($\delta \le 0,01$) | v_{RRM} | max. | 300 | | 600 | 1200 | 160 | 0 V |
| Crest working reverse voltage | v_{RWM} | max. | 200 | | 400 | 800 | 80 | 0 V |
| Continuous reverse voltage | v_R | max. | 200 | | 400 | 800 | 80 | 0 V |
| Currents | | | | | | | | |
| Average forward current (average over any 20 ms period) up to 7 | | °C | | I _F (| AV) | max. | 30 | A |
| R.M.S. forward current | | | | I _F (| RMS) | max. | 48 | A |
| Repetitive peak forward current | | | | I_{FF} | RM | max. | 400 | \mathbf{A}^{-1} |
| Non-repetitive peak forward cur- (t = 10 ms; half sine-wave) T_j = with reapplied V_{RWMmax} | | ior to su | rge; | I_{FS} | M | max. | 400 | A |
| I^2 t for fusing (t = 10 ms) | | | | I ² t | | max. | 800 | A^2s |
| Temperatures | | | | | | | | |
| Storage temperature | | | | T_{st} | g | -55 to + | 175 | $^{\mathrm{o}}\mathrm{C}$ |
| Junction temperature | | | | T_{j} | | max. | 175 | $^{\mathrm{o}}\mathrm{C}$ |
| THERMAL RESISTANCE | | | | | | | | |
| From junction to mounting base | | | | R _{th} | j-mb | = | 1,0 | °C/W |
| From mounting base to heatsink without heatsink compound | | | | R _{th} | mb-h | = | 0,5 | °C/W |
| with heatsink compound | | | | R _{th} | mb-h | = | 0,3 | °C/W |
| Transient thermal impedance; t | = 1 ms | | | Z _{th} | j-mb | = | 0,2 | °C/W |

 $^{^{1}\!)}$ To ensure thermal stability: $R_{th~j-a} \le 2~^{o}\text{C/W}$ (continuous reverse voltage) or $\leq 8 \text{ oC/W (a.c.)}$ For smaller heatsinks $T_{j\;max}$ should be derated. For a.c. see page 4. For continuous reverse voltage: if $R_{th\;j-a}$ = 4 °C/W, then $T_{j\;max}$ = 138 °C, if $R_{th\;j-a}$ = 6 °C/W, then $T_{j\;max}$ = 125 °C.

CHARACTERISTICS

Forward voltage

$$I_F = 100 \text{ A}; T_i = 25 \text{ oC}$$

 $V_{\rm F}$ < 1,7 $^{\circ}$ $^{\circ}$ $^{\circ}$

Reverse current

$$V_R = V_{RWMmax}$$
; $T_i = 125$ °C

 I_R < 1 mA

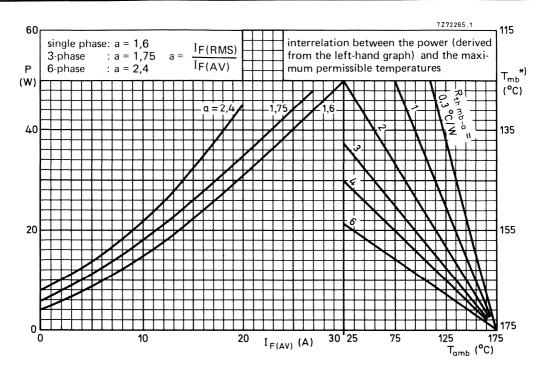
OPERATING NOTES

- 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.

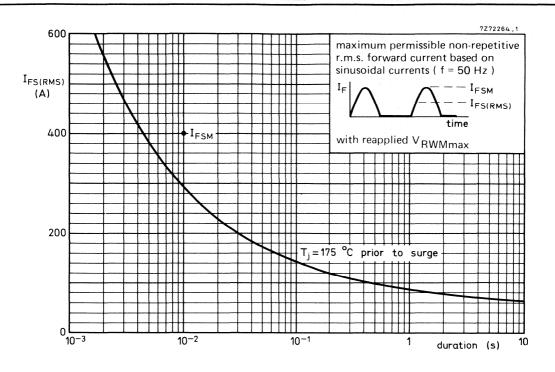
 During soldering the heat conduction to the junction should be kept to a minimum.
- 2. Where there is a possibility that transients, due to the energy stored in the transformer, will exceed the maximum permissible non-repetitive peak reverse voltage, see General Section for information on damping circuits.

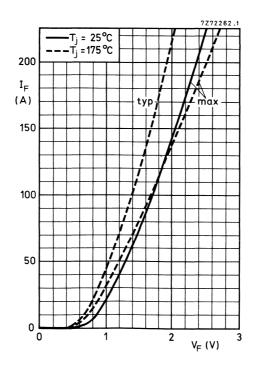
649

¹) Measured under pulse conditions to avoid excessive dissipation.

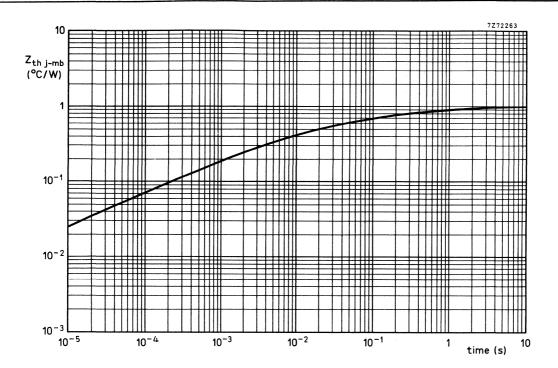


*) T_{mb} -scale is for comparison purposes only and is correct only for $R_{th\ mb-a} \le 6,5$ °C/W





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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.

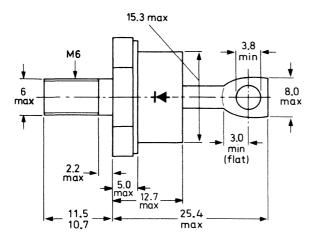
QUICK REFERENCE DATA

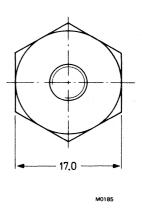
| | | BYX9 | 7-300(R) | 600(R) | 1200(R) | 1600(R) | |
|-------------------------------------|-----------|--------------------|------------|--------|---------|---------|---|
| Repetitive peak reverse voltage | V_{RRM} | max. | 300 | 600 | 1200 | 1600 | ٧ |
| Average forward current | | l _F (AV | <u>'</u>) | max. | | 47 | Α |
| Non-repetitive peak forward current | | IFSM | | max. | | 800 | Α |

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 | 7-300(R) | 600(R) | 1200(R) | 160 | 00(R) |
|---|------------------|------------|------------------|--------------|----------|-------------|---------------------------|
| Non-repetitive peak reverse voltage (t ≤ 10 ms) | v_{RSM} | max. | 300 | 600 | 1200 | 160 | 00 V |
| Repetitive peak reverse voltage ($\delta \leq 0,01$) | v _{RRM} | max. | 300 | 600 | 1200 | 160 | 00 V |
| Crest working reverse voltage | v_{RWM} | max. | 200 | 400 | 800 | 80 | 00 V |
| Continuous reverse voltage | v_R | max. | 200 | 400 | 800 | 80 | 00 V |
| Currents | | | | ~ | | | |
| Average forward current (average any 20 ms period) up to T_{mb} = at T_{mb} = | 120 °C | | | (AV) (AV) | max. | 47 40 | A A |
| R.M.S. forward current | | | $I_{\mathbf{F}}$ | (RMS) | max. | 75 | A |
| Repetitive peak forward current | | | $I_{\mathbf{F}}$ | RM | max. | 550 | A |
| Non-repetitive peak forward cur (t = 10 ms; half sine-wave) T _j with reapplied V _{RWMmax} | | rior to sı | | SM | max. | 800 | A |
| I^2t for fusing (t = 10 ms) | | | I^{2t} | | max. | 3200 | ${\rm A^2s}$ |
| Temperatures | | | | | | | |
| Storage temperature | | | T_s | tg | -55 to - | ⊦150 | $^{\mathrm{o}\mathrm{C}}$ |
| Junction temperature | | | $T_{\mathbf{j}}$ | | max. | 150 | $^{\rm o}$ C |
| THERMAL RESISTANCE | | | | | | | |
| From junction to mounting base | | | Rt | h j-mb | = | 0,6 | oC/W |
| From mounting base to heatsink without heatsink compound | | | Rt | h mb-h | = . | 0,3 | oC/W |
| with heatsink compound | | | R _t | h mb-h | = | 0,2 | oC/W |
| Transient thermal impedance; t | = 1 ms | | z_t | h j-mb | = | 0,1 | oC/W |

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 $^{^{1})}$ To ensure thermal stability: $R_{th\ j-a} \le 1\ ^{o}\text{C/W}$ (continuous reverse voltage) or $\le 4\ ^{o}\text{C/W}$ (a.c.) For smaller heatsinks $T_{j\ max}$ should be derated. For a.c. see page 4. For continuous reverse voltage: if $R_{th\ j-a}$ = 2 $^{o}\text{C/W}$, then $T_{j\ max}$ = 138 ^{o}C , if $R_{th\ j-a}$ = 3 $^{o}\text{C/W}$, then $T_{j\ max}$ = 125 ^{o}C .

CHARACTERISTICS

Forward voltage

$$I_F = 150 \text{ A}; T_i = 25 \text{ }^{\circ}\text{C}$$

$$V_{\rm F}$$
 < 1, 45 V^{-1})

Reverse current

$$V_R = V_{RWMmax}$$
; $T_i = 125$ °C

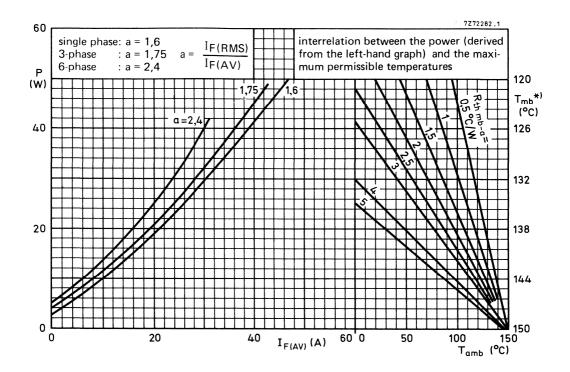
I_R < 4 mA

OPERATING NOTES

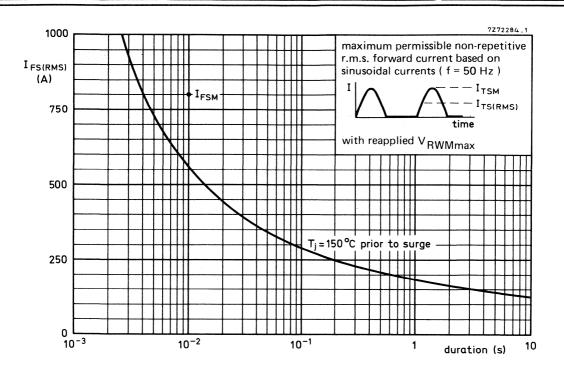
- The top connector should neither be bent nor twisted; it should be soldered into the circuit so that there is no strain on it.
 During soldering the heat conduction to the junction should be kept to a minimum.
- 2. Where there is a possibility that transients, due to the energy stored in the transformer, will exceed the maximum permissible non-repetitive peak reverse voltage, see General Section for information on damping circuits.

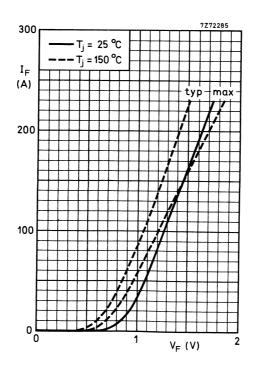
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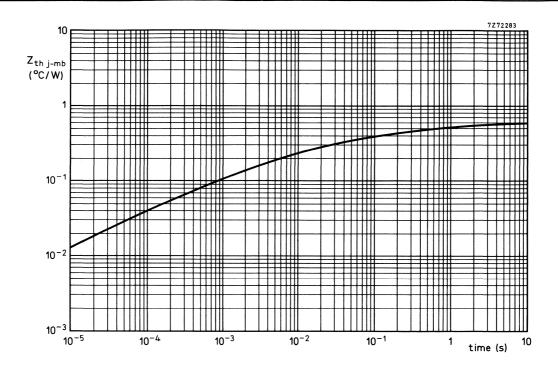
¹⁾ Measured under pulse conditions to avoid excessive dissipation.



*) Tmb-scale is for comparison purposes only and is correct only for Rth mb-a \leq 3,4 °C/W







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.

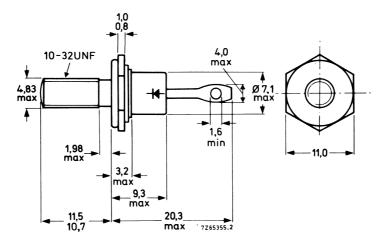
QUICK REFERENCE DATA

| | | BYX98-300(R) | 600(R) | 1200(R) | | |
|-------------------------------------|-----------|------------------|--------|---------|---|--|
| Repetitive peak reverse voltage | V_{RRM} | max. 300 | 600 | 1200 | V | |
| Average forward current | | IF(AV) | max. | 10 | Α | |
| Non-repetitive peak forward current | | ^I FSM | max. | 75 | Α | |

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 | e with the A | Absolute | Maximun | n System | (IEC 134 | 4) |
|--|------------------|----------|--|----------|----------|---------------------------|
| Voltages | | BYX9 | 8-300(R) | 600(R) | 1200(R |) |
| Non-repetitive peak reverse voltage (t ≤ 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 | \mathbf{v} |
| Currents | | | | | | |
| Average forward current (averaged over any 20 ms period) up to $T_{mb} = 97 ^{\circ}\text{C}$ at $T_{mb} = 125 ^{\circ}\text{C}$ | 2 | | I _F (AV) I _F (AV) | max. | 10 6 | A A |
| R.M.S. forward current | | | I _F (RMS) | max. | 16 | A |
| Repetitive peak forward current | | | I_{FRM} | max. | 75 | Α |
| Non-repetitive peak forward current (t = 10 ms; half sine-wave) T _j = 150 °C | C prior to | surge; | T | | 75 | ٨ |
| with reapplied V _{RWMmax} $I^{2}t \text{ for fusing (t = 10 ms)}$ | | | ^I FSM I ² t | max. | 75 20 | A A ² s |
| Temperatures | | | 1-τ | max. | 28 | A ² S |
| Storage temperature | | | T_{stg} | -55 t | o + 150 | $^{\mathrm{o}}\mathrm{C}$ |
| Junction temperature | | | Тj | max. | 150 | $^{\mathrm{o}}\mathrm{C}$ |
| THERMAL RESISTANCE | | | | | | |
| From junction to ambient in free air | | | R _{th j-a} | = | 50 | °C/V |
| From junction to mounting base | | | R _{th j-ml} |) = | 3 | °C/V |
| From mounting base to heatsink with heatsink compound | | | R _{th mb} - | h = | 0,5 | °C/V |
| without heatsink compound | | | R _{th mb} - | | 0,6 | °C/V |
| | | | | | ٠, - | -/ . |

Transient thermal impedance; t = 1 ms

°C/W

0,3

 $z_{th\ j\text{-}mb}$

CHARACTERISTICS

Forward voltage

$$I_F = 20 \text{ A}; T_i = 25 \text{ }^{\circ}\text{C}$$

 $V_{\mathbf{F}}$

1,7 V 1

Reverse current

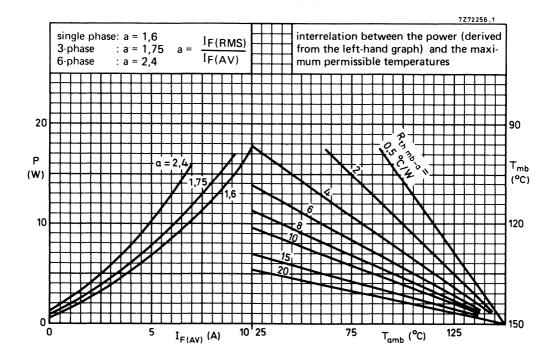
 $V_R = V_{RWMmax}$; $T_i = 125$ °C

 I_R

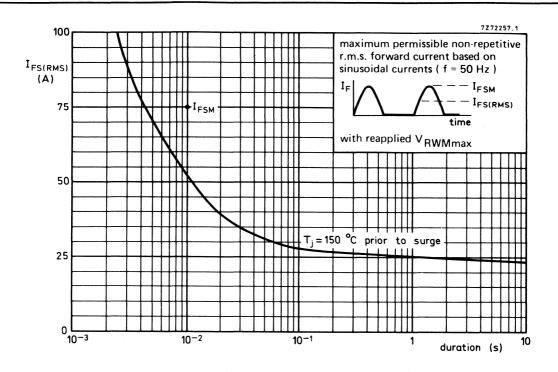
<u>2</u>00 ہے A

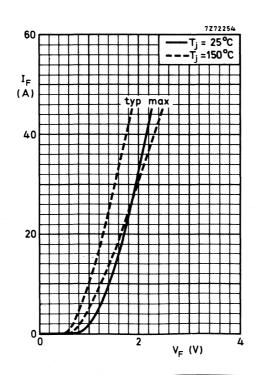
OPERATING NOTES

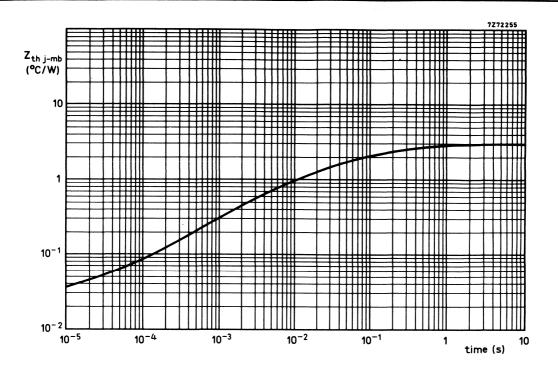
- The top connector should neither be bent nor twisted; it should be soldered into the circuit so that there is no strain on it.
 During soldering the heat conduction to the junction should be kept to a minimum.
- 2. Where there is a possibility that transients, due to the energy stored in the transformer, 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.







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.

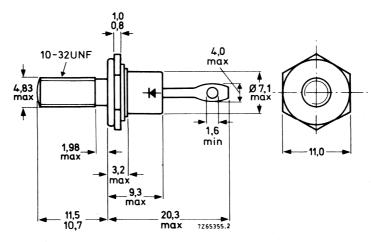
QUICK REFERENCE DATA

| | | BYX99-300 | (R) 600(R) | 1200(R) | |
|-------------------------------------|-----------|-----------|------------|---------|---|
| Repetitive peak reverse voltage | v_{RRM} | max. 300 | 600 | 1200 | V |
| Average forward current | | IF(AV) | max. | 15 | Α |
| Non-repetitive peak forward current | | IFSM | max. | 180 | Α |

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 accord | dance with th | ne Absolute Maxi | mum Syst | em (IEC | 134) |
|---|------------------|----------------------------|----------|---------|---------------------------|
| Voltages | | BYX99-300(R) | 600(R) | 1200(R |) |
| Non-repetitive peak reverse voltage (t ≤ 10 ms) | V _{RSM} | max. 300 | 600 | 1200 | v |
| Repetitive peak reverse voltage ($\delta \le 0,01$) | V _{RRM} | max. 300 | 600 | 1200 | y . |
| Crest working reverse voltage | v_{RWM} | max. 200 | 400 | 800 | \mathbf{v} |
| Continuous reverse voltage | v_R | max. 200 | 400 | 800 | \mathbf{v} |
| Currents | | | | | |
| Average forward current (averaged any 20 ms period) up to $T_{mb} = 12$ | | ^I F(AV) | max. | 15 | A |
| R.M.S. forward current | | I _F (RMS) | max. | 24 | Α |
| Repetitive peak forward current | | I _{FRM} | max. | 180 | Α |
| Non-repetitive peak forward curren (t = 10 ms; half sine-wave) T _j = 175 with reapplied V _R WMmax | | surge; ^I FSM | max. | 180 | A |
| I^2 t for fusing (t = 10 ms) | | I ² t | max. | 162 | A^2s |
| Temperatures | | | | | |
| Storage temperature | | ${	t T_{	t stg}}$ | -55 t | o + 175 | $^{\mathrm{o}}\mathrm{C}$ |
| Junction temperature | | ${f T_j}$ | max. | 175 | °С |
| THERMAL RESISTANCE | | | • | | |
| From junction to ambient in free air | r | R _{th j-a} | = | 50 | °C/W |
| From junction to mounting base | | R _{th j-mb} | = | 2,3 | °C/W |
| From mounting base to heatsink with heatsink compound | | R _{th mb-h} | = | 0,5 | °C/W |

 $R_{th\ mb-h}$

 $z_{th\ j-mb}$

without heatsink compound

Transient thermal impedance; t = 1 ms

0,6

0, 13

 $^{o}C/W$

oC/W

CHARACTERISTICS

Forward voltage

$$I_F = 50 \text{ A}; T_i = 25 ^{\circ}\text{C}$$

 $V_{\mathbf{F}}$

< 1,55 V 1)

Reverse current

$$V_R = V_{RWMmax}$$
; $T_j = 125$ °C

 I_{R}

200 μA

<

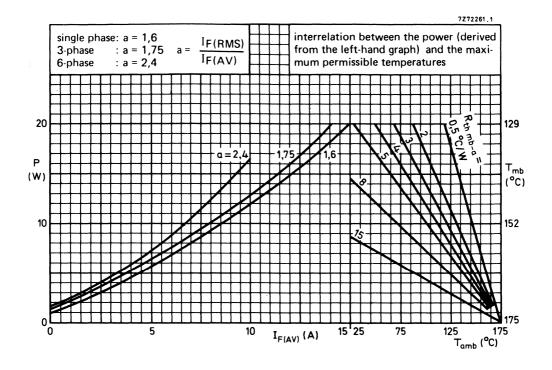
OPERATING NOTES

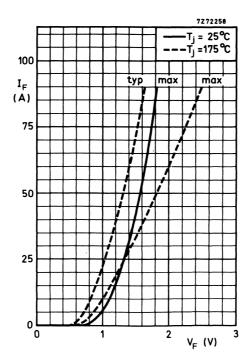
 The top connector should neither be bent nor twisted; it should be soldered into the circuit so that there is no strain on it.
 During soldering the heat conduction to the junction should be kept to a minimum.

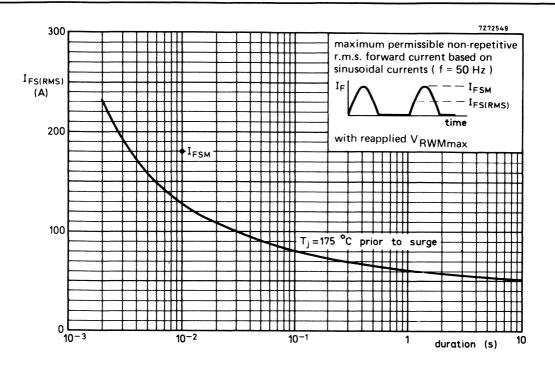
2. Where there is a possibility that transients, due to the energy stored in the transformer, will exceed the maximum permissible non-repetitive peak reverse voltage, see General Section for information on damping circuits.

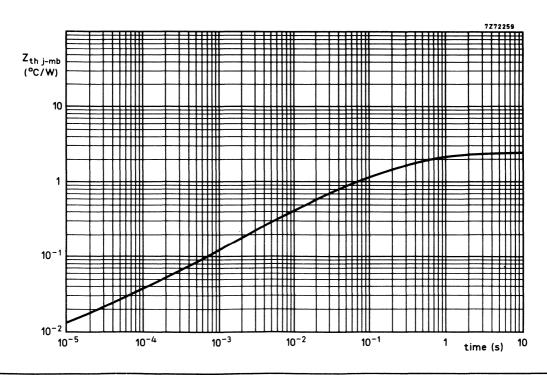
667

¹⁾ Measured under pulse conductions to avoid excessive dissipation.









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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

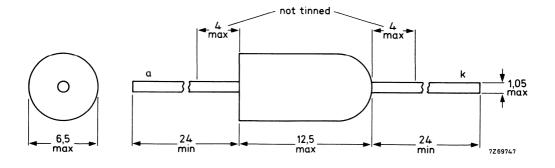
| | | | voltage regulator | transient suppresso | or |
|---|------------------|------|-------------------|---------------------|----|
| Working voltage (5% range) | V_{Z} | nom. | 7,5 to 75 | _ | |
| Stand-off voltage | v _R | | - | 5,6 to 56 | V |
| Total power dissipation | P _{tot} | max. | 2,5 | | W |
| Non-repetitive peak reverse power dissipation | PRSM | max. | <u>-</u> | 700 | W |

MECHANICAL DATA

Fig. 1 SOD-18.

The rounded end indicates the cathode.

Dimensions in mm



BZX70 SERIES

RATINGS

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

| , , , , , , , , , , , , , , , , , , , | • | | | | |
|---|---|--------------------|---------|--------|----|
| Peak working current | | IZM | max. | 5 | Α |
| Average forward current (averaged over any 20 ms period) | | ^I F(AV) | max. | 1 | Α |
| 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 | 4 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 | οС |
| Junction temperature | | Tj | max. | 150 | οС |
| | | | | | |

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

<

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

$$P_{s max} = \frac{T_{j max} - T_{amb}}{R_{th j-a}}$$

where: Timax is the maximum permissible operating junction temperature

Tamb is the ambient temperature

Rth i-a is the total thermal resistance from junction to ambient

b. Pulse conditions (see Fig. 2)

The maximum permissible pulse power Pp max is given by the formula

$$P_{p max} = \frac{(T_{j max} - T_{amb}) - (P_s \cdot R_{th j-a})}{R_{th t}}$$

where: Ps 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_D and duty factor δ .

 δ is the duty factor (t_D/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.

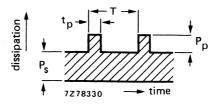


Fig. 2.

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.
- Maximum clamping voltage is the maximum reverse avalanche breakdown voltage which will appear across the diode at the specified pulse duration and junction temperature.
- 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 | vol: *V | king tage Z | resis *r | rential tance Z | temperature coefficient *S _Z mV/°C | test I _Z | reverse current ⁶ I _R μΑ | reverse at 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 |
| C8V2 | 8.5 | 9.6 | 0.45 | 4.0 | 5.5 | 50 50 | 10 | 6.2 |
| C10 | 9.4 | 10.6 | 0.75 | 4.0 | 7.0 | 50 | 10 | 6.8 |
| C10 | 10.4 | 11.6 | 0.75 | 4.5 | 7.5 | 50 | 10 | 7.5 |
| C12 | 11.4 | 12.7 | 0.85 | 5.0 | 8.0 | 50 | 10 | 8.2 |
| C12 | 12.4 | 14.1 | 0.03 | 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 | 3.0 11 | 12 | 20 | 10 | 12 |
| C20 | 18.8 | 21.2 | 2.8 | 12 | 14 | 20 | 10 | 13 |
| C20 | 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 | 2 5 | 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 | 72 79 | 20 | 100 | 70 | 10 | 10 | 51 |
| | " | 73 | 20 | 100 | ,, | | | <u> </u> |

^{*}At test Iz; measured using a pulse method with t_p \leq 100 μs and $\delta \leq$ 0.001 so that the values correspond to a T_j of approximately 25 ^{o}C .

CHARACTERISTICS — WHEN USED AS TRANSIENT SUPPRESSOR DIODES; T_{amb} = 25 °C

| | nended | reverse of at recommendations of the stand-off | non-repetitive peak reverse current | clamping voltage $t_p = 500 \mu s$ exp. pulse | |
|-------|---------------------|--|---|---|------|
| BZX70 | V _R V | I _R mA | IRSM A | L)R | V(C) |
| | | max. | | max. | typ. |
| | | | | | |
| C7V5 | 5.6 | 0.5 | 20 | 10 | 9 |
| C8V2 | 6.2 | 0.5 | 20 | 11.2 | 10 |
| C9V1 | 6.8 | 0.5 | 20 | 12.5 | 11 |
| C10 | 7.5 | 0.1 | 20 | 14 | 12 |
| C11 | 8.2 | 0.1 | 20 | 15.5 | 13.5 |
| C12 | 9.1 | 0.1 | 20 | 17.5 | 15 |
| C13 | 10 | 0.1 | 20 | 19 | 17 |
| C15 | 11 | 0.1 | 20 | 21 | 19 |
| C16 | 12 | 0.1 | 20 | 23 | 21 |
| C18 | 13 | 0.1 | 20 | 26 | 23 |
| C20 | 15 | 0.1 | 10 | 26 | 22 |
| C22 | 16 | 0.1 | 10 | 29 | 25 |
| C24 | 18 | 0.1 | 10 | 33 | 28 |
| C27 | 20 | 0.1 | 10 | 38 | 32 |
| C30 | 22 | 0.1 | 10 | 43 | 36 |
| C33 | 24 | 0.1 | 10 | 48 | 41 |
| C36 | 27 | 0.1 | 10 | 54 | 47 |
| C39 | 30 | 0.1 | 5 | 52 | 44 |
| C43 | 33 | 0.1 | 5 | 58 | 49 |
| C47 | 36 | 0.1 | 5 | 65 | 56 |
| C51 | 39 | 0.1 | 5 | 72 | 63 |
| C56 | 43 | 0.1 | 5 | 82 | 71 |
| C62 | 47 | 0.1 | 5 | 93 | 80 |
| C68 | 51 | 0.1 | 5 | 104 | 89 |
| C75 | 56 | 0.1 | 5 | 116 | 98 |

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.
- 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.

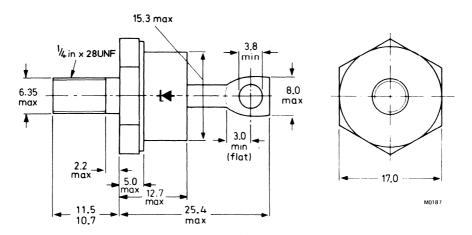
QUICK REFERENCE DATA

| | | | 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

Torque on nut: min. 1,7 Nm (17 kg cm)

Diameter of clearance hole: max. 6,5 mm

max. 3,5 Nm (35 kg cm)

Accessories supplied on request:

see ACCESSORIES section

Supplied with device: 1 nut, 1 lock washer Nut dimensions across the flats: 11,1 mm

RATINGS

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

| Elittering values in description with the Absolute Maxim | iam oyotom (i'Lo | , | | |
|---|----------------------|--------------|-----------|------|
| Peak working current | ^I ZM | max. | 400 | Α |
| Average forward current (averaged over any 20 ms period) | l _{F(AV)} | max. | 20 | Α |
| 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. 100 | 00 to 85 | A |
| Total power dissipation up to $T_{mb} = 25$ °C at $T_{mb} = 65$ °C | P _{tot} | max. max. | 100 75 | |
| 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 _{sta} | 55 t | o + 175 | oC |
| Junction temperature | Тj | max. | 175 | oC |
| THERMAL RESISTANCE | | | | |
| From junction to mounting base | R _{th j-mb} | = | 1,5 | oC/M |
| From mounting base to heatsink | R _{th mb-h} | = | 0,2 | oC/W |
| CHARACTERISTICS | | | | |
| Forward voltage I _F = 10 A; T _{mb} = 25 °C | VF | < | 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

$$P_{s max} = \frac{T_{j max} - T_{amb}}{R_{th j-a}}$$

where: T_{i max} is the maximum permissible operating junction temperature

T_{amb} is the ambient temperature

R_{th j-a} is the total thermal resistance from junction to ambient

$$R_{th j-a} = R_{th j-mb} + R_{th mb-h} + R_{th h-a}$$

 $R_{th\ mb-h}$ is the thermal resistance from mounting base to heatsink, that is, 0,2 °C/W. $R_{th\ h-a}$ 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:

$$R_{th j-a} = \frac{T_{j max} - T_{amb} - \Delta T}{P_{s} + \delta \cdot P_{p}}$$

where: T_{i 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)

 $R_{th j-a} = R_{th j-mb} + R_{th mb-h} + R_{th h-a} = 1.5 + 0.2 + R_{th h-a} \circ C/W.$

Thus Rth h-a can be found.

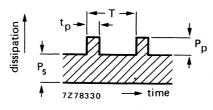


Fig. 2.

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:

$$R_{th j-mb} + R_{th mb-h} + R_{th h-a} = \frac{T_{j max} - T_{amb}}{P_s + \delta \cdot P_{RRM}}$$

where: $T_{i \text{ max}} = 175 \text{ }^{\circ}\text{C}$

Tamb = ambient temperature

P_e = any steady-state dissipation excluding that in pulses

 δ = duty factor (t_D/T)

 $R_{th i-mb} = 1.5 \, ^{\circ}C/W$

 $R_{th mb-h} = 0.2 \text{ oC/W}$

Thus Rth h-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.
- 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.

 $\textbf{CHARACTERISTICS} - \textbf{WHEN USED AS VOLTAGE REGULATOR DIODES; T}_{mb} = 25~\text{°C}$

| | vo | rking Itage | differential resistance | temperature coefficient | test IZ | current | reverse voltage |
|---------|------|----------------|----------------------------|----------------------------|---------|----------------|---------------------|
| BZY91 | l | V _Z | *rz Ω | *S _Z %/°C | Α | I _R | V _R V |
| DZ 131 | | • | u b | 70, 3 | | "" \ | • |
| | 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 Iz; measured using a pulse method $\,$ with t $_p \leqslant$ 100 μs 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 at non-repetitive voltage tp = $500 \mu s$ current exp. pulse | | | reverse at recom stand-off | | | |
|--|------|-----------|----------------------------------|---------------------|---------|--|
| V(CL)R | | IRSM A | 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) | |

BZY91 SERIES

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.

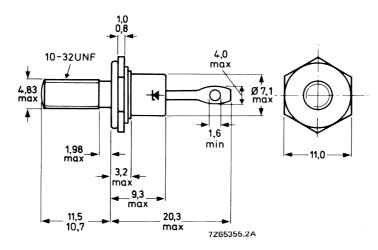
QUICK REFERENCE DATA

| | | | voltage regulator | transient suppress | sor |
|--|------------------|------|-------------------|--------------------|-----|
| Working voltage (5% range) | VZ | 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)

BZY93 SERIES

RATINGS

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

| Limiting values in accordance with the Absolute Maximu | im System (IEC 13 | 4) | | |
|---|----------------------|------|----------|--------|
| Peak working current | IZM | max. | 20 | Α |
| Average forward current (averaged over any 20 ms period) | lF(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 | |
| Non-repetitive peak reverse power dissipation $T_j = 25$ °C prior to surge; $t_p = 1$ ms (exponential pulse) | PRSM | max. | 700 | W |
| Storage temperature | T _{stg} | -55 | to + 175 | οС |
| Junction temperature | Tj | max. | 175 | оС |
| THERMAL RESISTANCE | | | | |
| From junction to mounting base | R _{th j-mb} | = | 5 | oC/W |
| From junction to ambient | R _{th j-a} | = | 50 | oC/W |
| From mounting base to heatsink (minimum torque: 0,9 Nm) | R _{th mb-h} | = | 0,6 | oC/W |
| CHARACTERISTICS | | | | |
| Forward voltage I _F = 5 A; T _{mb} = 25 °C | ٧ _F | < | 1,5 | V |

OPERATION AS A VOLTAGE REGULATOR

Dissipation and heatsink considerations

a. Steady-state conditions

The maximum permissible steady-state dissipation $P_{\text{S}\,\text{max}}$ is given by the relationship

$$P_{s max} = \frac{T_{j max} - T_{amb}}{R_{th j-a}}$$

where: $\underline{T_{j}}_{\text{max}}$ is the maximum permissible operating junction temperature

T_{amb} is the ambient temperature

Rth i-a is the total thermal resistance from junction to ambient

$$R_{th j-a} = R_{th j-mb} + R_{th mb-h} + R_{th h-a}$$

 $R_{th\ mb-h}$ is the thermal resistance from mounting base to heatsink, that is, 0,6 °C/W. $R_{th\ h-a}$ is the thermal resistance of the heatsink.

b. Pulse conditions (see Fig. 2)

The maximum permissible pulse power Pp max is given by the formula

$$P_{p max} = \frac{(T_{j max} - T_{amb}) - (P_s \cdot R_{th j-a})}{R_{th t} + \delta \cdot R_{th mb-a}}$$

where: Ps 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_{D} and duty factor δ .

 δ is duty factor (t_D/T)

 $R_{th\ mb-a}$ is the total thermal resistance between the mounting base and ambient ($R_{th\ mb-a} = R_{th\ mb-h} + R_{th\ h-a}$).

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.

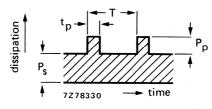


Fig. 2.

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:

$$R_{th j-mb} + R_{th mb-h} + R_{th h-a} = \frac{T_{j max} - T_{amb}}{P_s + \delta \cdot P_{RRM}}$$

where: T_{i max} = 175 °C

T_{amb} = ambient temperature

P_s = any steady-state dissipation excluding that in pulses

 δ = duty factor (t_0/T)

 $R_{th i-mb} = 5 \text{ °C/W}$

 $R_{th mb-h} = 0.6 \, {}^{\circ}C/W$

Thus Rth h-a can be found.

Notes

- The stand-off voltage is the maximum reverse voltage recommended for continuous operation; at this value non-conduction is ensured.
- 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.

 $\textbf{CHARACTERISTICS} - \textbf{WHEN USED AS VOLTAGE REGULATOR DIODES; T}_{mb} = 25 \, ^{o}\text{C}$

| BZY93 | work volta *V V | age ′Z | resis * | rential tance 'Ζ Ω | temperature coefficient *Sz mV/°C | test I _Z | reverse current I _R μA | reverse at voltage VR 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 Iz; measured using a pulse method with t $_p$ \leq 100 μs and δ \leq 0.001 so that the values correspond to a T $_j$ of approximately 25 o C.

CHARACTERISTICS — WHEN USED AS TRANSIENT SUPPRESSOR DIODES; T_{mb} = 25 °C

| clamping at voltage t _p = 500 μs exp. pulse | | non-repetitive peak reverse current | revers at recoi stand-o | man ye. | |
|--|------|---|-------------------------------|----------------|---------|
| V(C | | IRSM A | I _R mA | V _R | 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) |

BZY93 SERIES

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

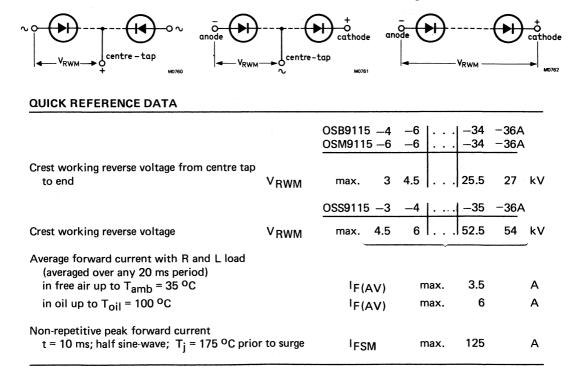


Fig. 2 OSM9115 A

MECHANICAL DATA see page 4

Fig. 3 OSS9115 A

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 | | -34 -34 | -36A -36A | |
|---|-------------------------------|--------------------------|-----------|-------------|--------------|----------|
| Crest working reverse voltage | V_{RWM} | max. 3 | 4.5 | 25.5 | 27 | kV |
| | | OSS9115 -3 | -4 | <u> -35</u> | -36A | |
| Crest working reverse voltage | v_{RWM} | OSS9115 -3 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 | | Α |
| in oil up to T _{Oil} = 100 °C | | F(AV) | max. | 6 | | Α |
| Repetitive peak forward current | | IFRM | max. | 120 | | Α |
| Non-repetitive peak forward current $t = 10 \text{ ms}$; half sine-wave; $T_j = 175$ | ^O C prior to surge | I _{FSM} | max. | 125 | | Α |
| Reverse power dissipation | | | | | | |
| | | OSB9115 -4 | | -34 | -36A | |
| Repetitive peak reverse power | | OSM9115 -4 | <u>–6</u> | -34 | -36A | |
| t = 10 μ s (square-wave; f = 50 Hz) T _j = 175 °C | PRRM | max. 1.2 | 1.8 | 10.2 | 10.8 | kW |
| Non-repetitive peak reverse power $t = 10 \mu s$ (square -wave) | | | | | | |
| $T_j = 25$ °C prior to surge | PRSM | max. 6 max. 1.2 | 9 1.8 | 51 | 54 10.8 | kW kW |
| $T_j' = 125$ °C prior to surge | PRSM | IIIdx. 1.2 | 1.0 | 110.2 | 10.6 | NVV |
| Repetitive peak reverse | | OSS9115 -3 | -4 | -35 | <u>-36</u> A | |
| power dissipation | | | | | | |
| t = 10 μs (square-wave; f = 50 Hz) $T_j = 175$ °C | PRRM | max. 1.8 | 2.4 | 21 | 21.6 | kW |
| Non-repetitive peak reverse power dissipation | | | | | | |
| t = 10 μ s (square-wave) T _i = 25 °C prior to surge | PRSM | max. 9 | 12 | 105 | 108 | kW |
| $T_j = 175$ °C prior to surge | PRSM | max. 1.8 | 2.4 | 21 | 21.6 | kW |
| Temperatures | | - | | | | |
| Storage temperature | | T _{stg} | -55 to | +150 | | oC |
| Junction temperature | | T _i | max. | 175 | | οС |
| | | J | | | | |

| CHARACTERISTICS (See note 1) | | | | | | | |
|---|--------------------|-------|-----------------|------|-----|------|--------------------|
| | | OSB91 | 15 -4 | -6 | | -34 | -36A |
| | | OSM9 | 15 –4 115 –4 | 6 | | -34 | -36A |
| Forward voltage | | | | | | - | |
| $I_F = 20 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | VF | < | 4 | 6 | | 34 | 36 V |
| Reverse avalanche breakdown voltage* | | | | | | | |
| I _R = 5 mA; T _i = 25 °C | V _{(BR)R} | > | 3.3 | 4.95 | | 28 | 29.7 kV 43.2 kV |
| 1R = 3 mA, 1j = 23 ° 0 | *(BH)H | < | 4.8 | 7.2 | ۱ ا | 40.8 | 43.2 kV |
| | | | | | | | |
| | | OSS91 | 15 –3 | _4 | | -35 | <u>-36</u> A |
| Forward voltage | | | | | | | |
| $I_F = 20 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | VF | < | 6 | 8 | | 70 | 72 V |
| Reverse avalanche breakdown voltage* | | | | | | | |
| In = 5 m A · T · = 25 0C | V _{(BR)R} | > | 4.95 | 6.6 | | 57.8 | 59.4 kV 68.4 kV |
| I _R = 5 mA; T _j = 25 °C | ▼(BR)R | < | 7.2 | 9.6 | | 84 | 68.4 kV |
| Reverse current | | | | | | | |
| $V_{RM} = V_{RWM max}$; $T_j = 125 {}^{\circ}C$ | | ł | 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

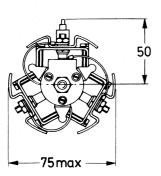
The rectifier units can be operated at their maximum ratings when mounted in any position.

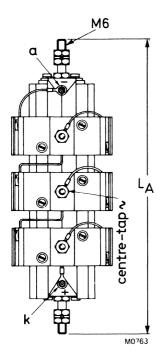
^{*}The breakdown voltage increases by approximately 0.1% per ^OC with increasing junction temperature.

MECHANICAL DATA

n = total number of diodes

Fig.4 OSM9115 -nA





Dimensions in mm

Table of lengths and weights (mm and g)

| | | The second second |
|-------------|---------------------------|-------------------|
| number of | maximum | weights |
| diodes n | lengths L _A | 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 \sim ; the centre-tap is marked + (instead of \sim as in the drawings).

OSS9115 series - has no centre-tap.

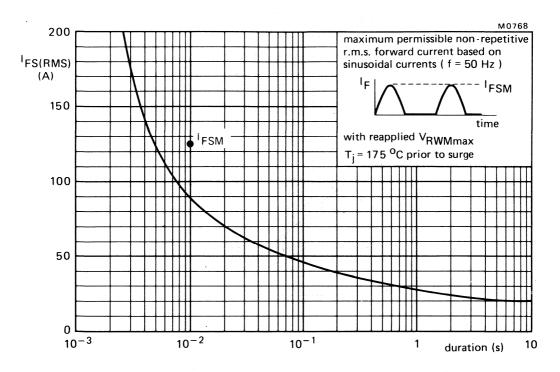


Fig. 5

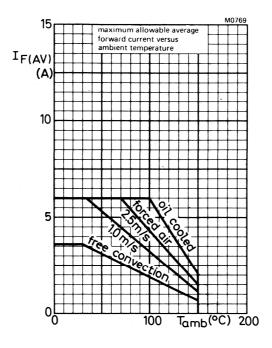
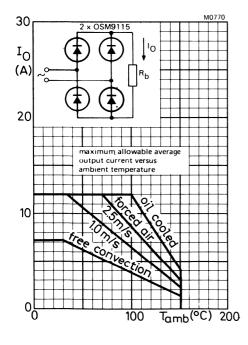


Fig. 6



30

I O (A)

Rb

Rb

10

10

Tamb(°C) 200

Fig. 7

Fig. 8

APPLICATION INFORMATION

Fig. 9 OSB9115 -4

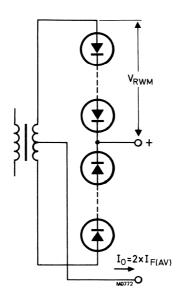
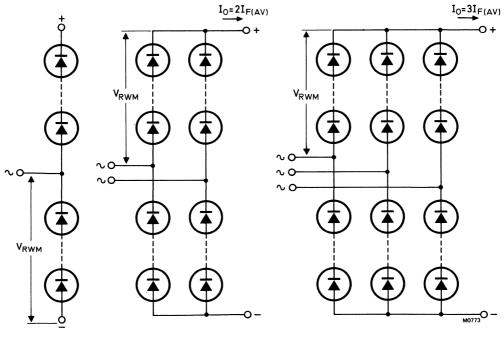


Fig. 10 OSM9115 series



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).

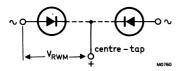
The maximum crest working voltages of the OSB9215 and OSM9215 series cover the range from 3 kV to 27 kV, and of the OSS9215 series the range from 4.5 kV to 54 kV in 1.5 kV steps.

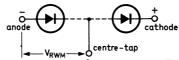
Configuration:

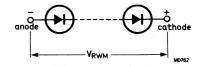
Fig. 1 OSB9215 A

Fig. 2 OSM9215....A

Fig. 3 OSS9215 A







QUICK REFERENCE DATA

| | | OSB9215 OSM9215 | -4 -4 | -6 -6 | | -34 -34 | -36 <i>A</i> | |
|---|------------------|--------------------|-----------------|------------|-----|------------|--------------|-----------------|
| Crest working reverse voltage from centre tap to end | V _{RWM} | max. | 3 | 4.5 | | 25.5 | 27 | kV |
| | | OSS9215 | -3 | -4 | | -35 | -36 | A = 0.00 |
| 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 in oil up to $T_{oil} = 30$ °C | | | | AV) AV) | ma: | - | 5 20 | A |
| Non-repetitive peak forward current t = 10 ms; half sine-wave; T _j = 175 °C pri | or to surg | e | 1 _{FS} | · | max | | 60 | 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 -634 -36 OSM9215 -4 -634 -36 | |
|---|-----|
| Crest working reverse voltage V _{RWM} max. 3.0 4.5 25.5 27 | kV |
| OSS9215 -3 -4 -35 -36 | A |
| Crest working reverse voltage VRWM 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 | Α |
| in oil up to $T_{oil} = 30$ °C $I_{F(AV)}$ max. 20 | Α |
| Repetitive peak forward current IFRM max. 440 | Α |
| Non-repetitive peak forward current $t = 10 \text{ ms}$; half sine-wave; $T_j = 175 ^{\circ}\text{C}$ prior to surge IFSM max. 360 | Α |
| Reverse power dissipation | |
| Repetitive peak reverse power $t = 10 \ \mu s$ (square-wave; f = 50 Hz) OSB9215 -4 -6 -34 -36 -34 -34 -36 -34 -36 -34 -36 -34 -34 -34 -34 | |
| $T_j = 175 ^{\circ}\text{C}$ P_{RRM} max. 4 6 34 36 | kW |
| Non-repetitive peak reverse power $t = 10 \mu s$ (square-wave) | |
| $T_j = 25$ °C prior to surge PRSM max. 26 39 221 234 | |
| $T_j = 175$ °C prior to surge PRSM max. 4 6 34 36 | kW |
| Repetitive peak reverse power dissipation $0SS9215 -3 -4 -35 -36 $ $t = 10 \mu s$ (square-wave; $f = 50 Hz$) | Α |
| $T_j = 175 ^{\circ}\text{C}$ PRRM max. 6 8 70 72 | kW |
| Non-repetitive peak reverse power dissipation t = 10 \(\mu s \) (square-wave) | |
| $T_i = 25$ °C prior to surge P_{RSM} max. 39 52 455 468 | kW |
| $T_j^2 = 175$ °C prior to surge PRSM max. 6 8 70 72 | kW |
| Temperatures | _ |
| Storage temperature T _{stg} -55 to +150 | оС |
| Junction temperature T _j max. 175 | оС |

| CHARAC | CTERISTICS (| see note 1) |
|--------|--------------|-------------|
|--------|--------------|-------------|

| ., | | | | | | | | |
|--|--------------------|--------|-------------|------------|----------|------|--------------|------------|
| | | OSB921 | 5 –4 | 6 | | -34 | -36A | ١ |
| | | OSM921 | 5 –4 | -6 | | -34 | -36A | |
| Forward voltage | | 2. · | | | | | | |
| I _F = 50 A; T _j = 25 °C | ٧ _F | < | 3.6 | 5.4 | | 30.6 | 32.4 | V |
| Reverse breakdown voltage* | | | | | | | | |
| | | > | 3.3 | 4.95 | | 28 | 29.7 | kV |
| $I_R = 5 \text{ mA; } T_j = 25 ^{\circ}\text{C}$ | V _{(BR)R} | < | 3.3 4.8 | 7.2 | | 40.8 | 43.2 | kV |
| | | OSS921 | 5 –3 | -4 | | -35 | -364 | A , |
| Forward voltage | | | | | | | | |
| I _F = 50 A; T _i = 25 °C | VF | < | 5.4 | 7.2 | | 63 | 64.8 | V |
| Reverse breakdown voltage* | | | | | | | | |
| _ | | > | 4.95 | 6.6 | l | 57.8 | 59.4 | kV |
| I _R = 5 mA; T _j = 25 °C | $V_{(BR)R}$ | < | 4.95 7.2 | 6.6 9.6 | | 84 | 59.4 86.4 | kV |
| Reverse current | | | | | <u> </u> | | | |
| $V_{RM} = V_{RWMmax}$; $T_j = 125$ °C | | | IRI | VI | < | (| 0.6 | mΑ |

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

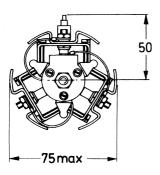
The rectifier units can be operated at their maximum ratings when mounted in any position.

^{*}The breakdown voltage increases by approximately 0.1% per ^OC with increasing junction temperature.

MECHANICAL DATA

n = total number of diodes

Fig. 4 OSM9215-nA



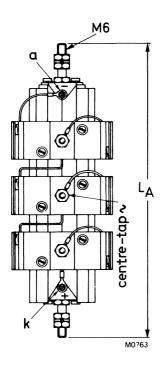


Table of lengths and weights (mm and g)

| number of diodes | maximum lengths | weights |
|------------------|--------------------|---------|
| n | L _A | 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 \sim ;

the centre-tap is marked + (instead of \sim as in the drawings).

OSS9215 series - has no centre-tap.

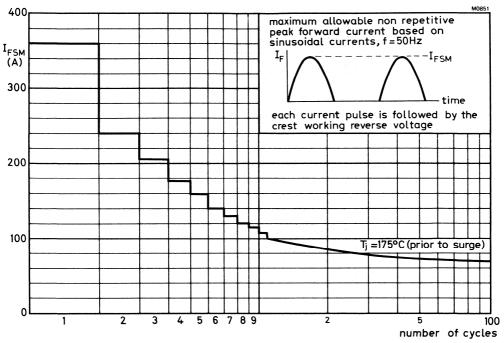


Fig. 5

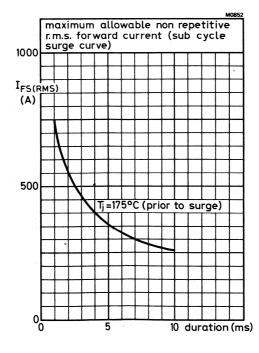


Fig. 6

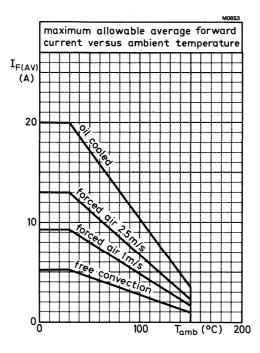
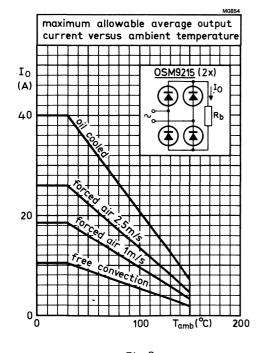


Fig. 7



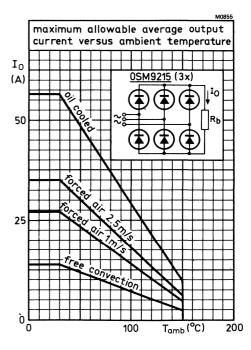


Fig. 8

Fig. 9

APPLICATION INFORMATION

Fig. 10 OSB9215-4

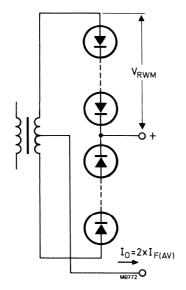
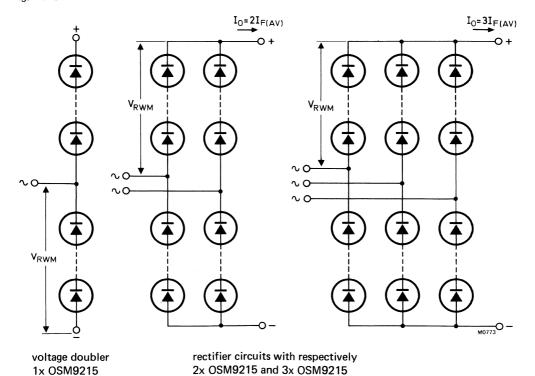


Fig. 11 OSM9215 series



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).

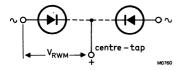
The maximum crest working voltages of the OSB9415 and OSM9415 series cover the range from 3 kV to 27 kV, and of the OSS9415 series the range from 4.5 kV to 54 kV, in 1.5 kV steps.

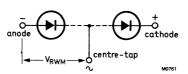
Configuration:

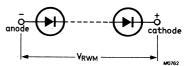
Fig. 1 OSB9415 A

Fig. 2 OSM9415 A

Fig. 3 OSS9415 A







QUICK REFERENCE DATA

| Non-repetitive peak forward cu $t = 10$ ms; half sine wave; $T_j = 10$ | | to surge | IFS | M | ma | x. 8 | 800 | A |
|---|------------------|----------------------------|---------|-------------------|----|-------------|------------------------------|----|
| in oil up to T _{oil} = 35 °C | | | ۱F | (AV) | ma | х. | 30 | A |
| Average forward current with R and L load (averaged over any 20 ms period) in free air up to T _{amb} = 35 °C | | ۱F | (AV) | ma | ×. | 10 | A | |
| Crest working reverse voltage | V _{RWM} | max. | 4.5 | 6 | | 52.5 | 54 | kV |
| Crest working reverse voltage from centre tap to end | V _{RWM} | OSM9415 max. OSS9415 | 3 -3 | -6 4.5 -4 | | 25.5 -35 | -36A -36A 27 -36A | kV |
| | | OSB9415 | 1 | l –6 | 1 | –34 | I -36A | |

All information applies to frequencies up to 400 Hz

RATINGS

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

| Voltages | | OSB9415 OSM9415 | -4 4 | -6 -6 | | -34 -34 | -36A -36A | |
|---|--------------------------------------|--------------------|------------------|---|------------|------------|--------------|----------|
| Crest working reverse voltage | VRWM | max. | 3 | 4.5 | | 25.5 | 27 | kV |
| | | OSS9415 | -3 | -4 | <u> </u> | -35 | -36A | |
| Crest working reverse voltage | v_{RWM} | max. | 4.5 | 6 | | 52.5 | 54 | kV |
| Currents | | | | | | | | |
| Average forward current (average over any 20 ms period) in free air up to T _{amb} = 35 °C | | | 1. | F(AV) | ma | ¥ | 10 | Α |
| in oil up to T _{oil} = 35 °C | C | | | F(AV) | ma | | 30 | Α |
| Repetitive peak forward current | | | | FRM | ma | x. 4 | 50 | Α |
| Non-repetitive peak forward curre t = 10 ms; half sine-wave; T _j = 175 ^O C prior to surge | | ij | ^I FSM | | max. 800 | | A | |
| Reverse power dissipation | | | | | | | | |
| Repetitive peak revetse power dis | sipation | OSB9415 OSM9415 | -4 -4 | 6 6 | | -34 -34 | -36A -36A | |
| t = 10 μ s (square-wave; f = 50 l T _j = 175 °C | ^{Iz)} PRRM | max. | 9 | 13.5 | | 76.5 | 81 | kW |
| Non-repetitive peak reverse powe | r dissipation | | | | | | | |
| t = 10 μ s (square-wave) $T_j = 25$ °C prior to surge $T_j = 175$ °C prior to surge | PRSM PRSM | max. max. | 55 8.5 | 82 13 | | 467 72 | 495 77 | kW kW |
| | | OSS9415 | -3 | _4 | | -35 | -36A | |
| Repetitive peak reverse power dis | | | | | | | | |
| t = 10 μ s (square-wave; f = 50 l T _j = 175 °C | PRRM | max. | 13.5 | 18 | | 157 | 162 | kW |
| Non-repetitive peak reverse power dissipation $t = 10 \mu s$ (square-wave) | | | | | | | | |
| T _j = 25 ^o C prior to surge T _j = 175 ^o C prior to surge | P _{RSM} P _{RSM} | max. max. | 80 13 | 105 17 | ::: | 919 | 945 153 | kW kW |
| Temperatures | | | | *************************************** | | | | |
| Storage temperature | | | | stg | _ | 5 to +1 | | oC |
| Junction temperature | | | Т | j | ma | x. 1 | 75 | οС |

| CHARACTERISTICS (See note 1 |) |
|-----------------------------|---|
|-----------------------------|---|

| Forward voltage | | OSB9415 OSM9415 | 4 4 | -6 -6 | | -34 -34 | -36A -36A | |
|---|--------------------------------------|--------------------|-------------|-------------|-------|------------|--------------|----------|
| $I_F = 150 \text{ A; } T_j = 25 ^{\circ}\text{C}$ | V _F | < | 3.6 | 5.4 | | 30.6 | 32.4 | V |
| Reverse avalanche breakdown voltag $I_R = 5 \text{ mA}; T_j = 25 ^{\circ}\text{C}$ | je* V _{(BR)R} | > < | 3.3 4.8 | 4.95 7.2 | • • • | 28 40.8 | 29.7 43.2 | kV kV |
| Forward voltage | | OSS9415 | -3 | _4 | | -35 | -36A | |
| | VF | < | 5.4 | 7.2 | | 63 | 64.8 | ٧ |
| Reverse avalanche breakdown voltag $I_R = 5 \text{ mA}; T_j = 25 ^{\circ}\text{C}$ | _{je*} V _{(BR)R} | > < | 4.95 7.2 | 6.6 9.6 | • • • | 57.8 84 | 59.4 86.4 | kV kV |

Reverse current

$$V_{RM} = V_{RWMmax}$$
; $T_i = 125 \, {}^{\circ}C$

1.6

mΑ

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.

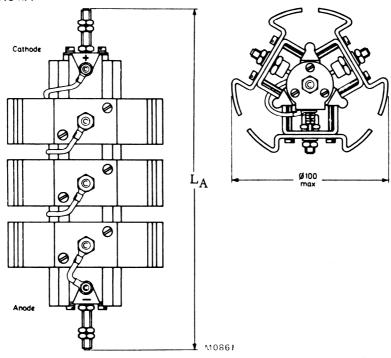
^{*} The breakdown voltage increases, by approximately 0.1% per OC with increasing junction temperature.

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 \sim .

OSM9415 series — has a centre tap marked \sim .

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 | LA | 143 | 184 | 224 | 264 | 305 | - | |
| weights | WA | 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 | LA | 345 | 385 | 426 | 466 | 506 | 546 | 586 |
| weights | WA | 1208 | 1406 | 1604 | 1802 | 2000 | 2198 | 2396 |

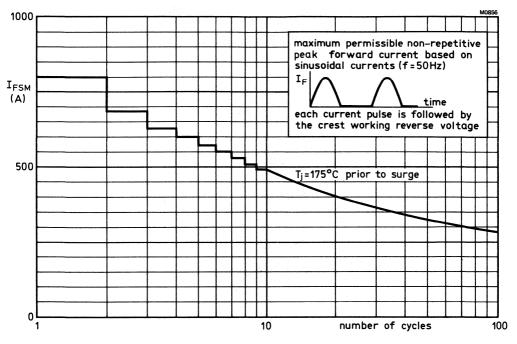


Fig.5

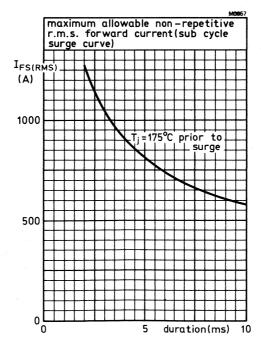


Fig.6

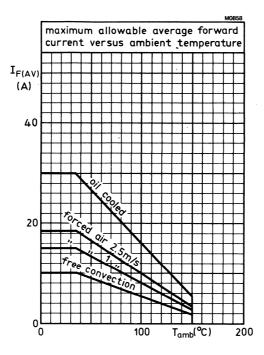
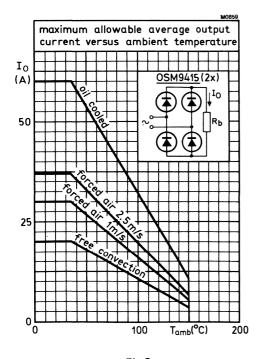


Fig.7



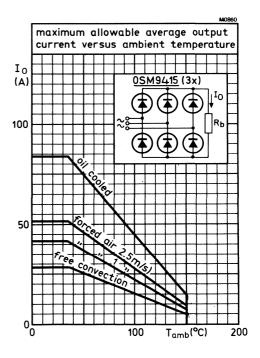


Fig.8 Fig.9

APPLICATION INFORMATION

Fig.10 OSB9415 series

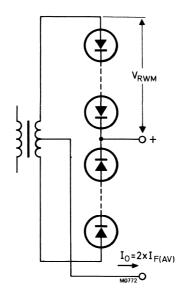
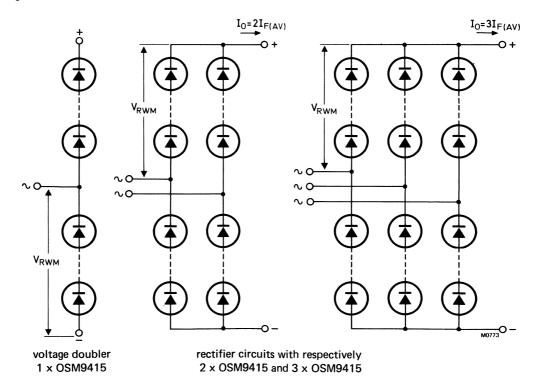


Fig.11 OSM9415 series



HIGH-VOLTAGE RECTIFIER STACK

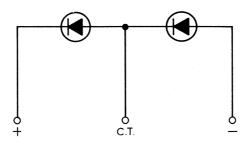
The OSM9510-12 is a silicon rectifier stack for high voltage applications, up to 12kV in half-wave circuits, or up to 6kV as one of the arms of a bridge configuration, where the centre-tap is utilised. Because of its controlled avalanche characteristics it is capable of withstanding reverse transients 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, $T_{amb} = 50^{\circ}C$ | 1.5 | Α |
| $P_{RSM} = 10\mu s, T_{amb} = 25^{\circ} C$ | 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, Tamb < 50°C, 180° conduction | 1.5 | A |
| I _{FRM} max. | Repetitive peak forward current, 30° 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 $(10\mu s \text{ square wave, } T_j = 25^{\circ} C)$ | 20 | kW |
| P _{RRM} max. | 50Hz repetitive peak reverse transient power (10 μ s square wave, $T_i = 150^{\circ}$ C) | 5.0 | kW |
| Temperature | 3 | | |
| ${ m T_{stg}}$ | Storage temperature | -55 to 150 | °C |
| T, | Junction temperature | -55 to 150 | $^{\rm o}{ m C}$ |

ELECTRICAL CHARACTERISTICS (T $_{j} = 25^{\circ}$ C unless otherwise stated)

| | | Min. | Max. | |
|--------------------|--|------|------|----|
| *V_F | Forward voltage at I _F =5A | _ | 17.5 | v |
| $^{ m I}{}_{ m R}$ | Reverse current at V_{RWM} , $T_j^{=125}^{O}C$ | - | 100 | μΑ |
| V _{(DD)D} | **Avalanche breakdown voltage, | | | |
| (BK)K | **Avalanche breakdown voltage, I (BR)R | 15 | 25 | kV |

^{*}Measured under pulsed conditions so that T_i is at, or near, the stated value.

MECHANICAL DATA

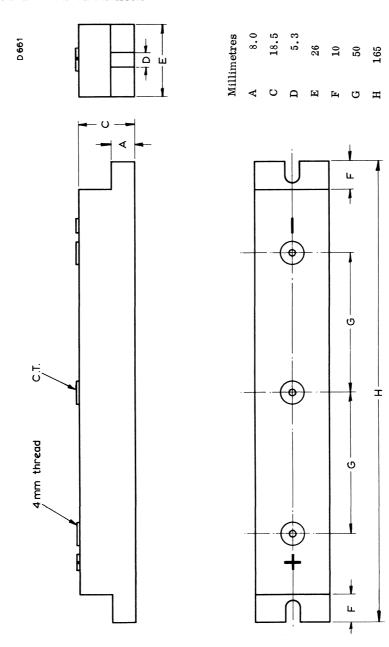
Weight 130 g

MOUNTING POSITION

The rectifier units can be operated at their maximum ratings when mounted in any position.

^{**}The avalanche voltage increases by approximately 0.1%/degC with increasing $\rm T_{\dot{1}}.$

OUTLINE AND DIMENSIONS





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 | | | PB | | 'R635CT | 640CT | 645CT |
|---|----------------|------|----|--|---------|-------|-------|
| Repetitive peak reverse voltage | v_{RRM} | max. | | | 35 | 40 | 45 |
| Output current (both diodes conducting) | 10 | max. | | | | 10 | A |
| Forward voltage | ٧ _F | < | | | | 0.6 | V |
| Junction temperature | T_{j} | max. | | | | 150 | оС |

MECHANICAL DATA Dimensions in mm Fig. 1 SOT-82. Cathode connected 7,8 to metal part of max mounting surface. 3,75 11,1 máx 2,54 max 15,3 min M3063 **4**4.58**→ →**|2,29|**→** 0,5 0,88 max

* 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.

PBYR635CT PBYR640CT PBYR645CT

RATINGS

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

| Voltages (per diode) | | PBY | R635CT | 640CT | 6450 | т | |
|--|-------------------------|--------------|--------|------------|------|---------|--|
| Repetitive peak reverse voltage | VRRM | max. | 35 | 40 | 45 | | |
| Crest working reverse voltage | VRWM | max. | 35 | 40 | 45 | ٧ | |
| Continuous reverse voltage | VR | max. | 35 | 40 | 45 | ٧ | |
| Currents (both diodes conducting: note 1) | | | | | | | |
| Output current: square wave; δ = 0.5; up to T_{mb} = 118 °C (note 2) sinusoidal; up to T_{mb} =121 °C (note 2) | 1 ₀ | max. max | | 10 8.8 | | A | |
| RMS forward current | I _{F(RMS)} | max. | | 14 | | Α | |
| Repetitive peak forward current $t_p = 20 \ \mu s$; $\delta = 0.02$ (per diode) | I _{FRM} | max. | | 90 | | Α | |
| Non-repetitive peak forward current (per dioc half sinewave; $T_j = 125$ °C prior to surge; with reapplied $V_{RWM\ max}$ t = 10 ms | de) ^I FSM | max. | | 80 | | Å | |
| t = 8.3 ms | FSM | max. | | 90 | | Α | |
| I^2t for fusing (t = 10 ms, per diode) | l²t | max. | | 32 | | $A^2 s$ | |
| Reverse surge current $t_p = 2 \mu s$; $\delta = 0.001$ $t_p = 100 \mu s$ | IRRM IRSM | max. max. | | 1.0 1.0 | | A A | |
| Temperatures | | | • | | | | |
| Storage temperature | T_{stg} | | _4 | 0 to +150 | | оС | |
| Junction temperature | Tj | max. | | 150 | | οС | |
| | | | | | | | |

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 | | | | |
| $I_F = 5 \text{ A}; T_j = 150 ^{\circ}\text{C}$ | V _F | < | 0.6 | V* |
| $I_F = 10 \text{ A}; \hat{T}_j = 25 ^{\circ}\text{C}$ | VF | < | 0.87 | V* |
| Reverse current | | | | |
| $V_R = V_{RWM \ max}; T_j = 125 {}^{0}C$ $V_R = V_{RWM \ max}; T_j = 25 {}^{0}C$ | l _R | < | 15 | mA ^ |
| VR = VRWM max; $Ij = 25 °C$ | ^I R | | 100 | μΑ |
| Junction capacitance at f = 1 MHz | _ | | | _ |
| $V_R = 5 V; T_j = 25 \text{ to } 125 ^{\circ}\text{C}$ | Cd | typ. | 200 | pF |
| THERMAL RESISTANCE | | | | |
| From junction to mounting base (both diodes conducting) | R _{th j-mb} | = | 4.0 | K/W |
| From junction to mounting base (per diode) | R _{th j-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-h} | = | 0.3 | K/W |
| b. with heatsink compound and 0.06 mm maximum mica | | | | |
| insulator (56354) | R _{th mb-h} | = | 1.4 | K/W |
| c. without heatsink compound | R _{th mb-h} | = | 1.4 | K/W |
| 2. 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 tie p | oint. | | | |
| 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-a} | = | 100 | K/W |

^{*}Measured under pulse conditions to avoid excessive dissipation.

MOUNTING INSTRUCTIONS

- 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-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.

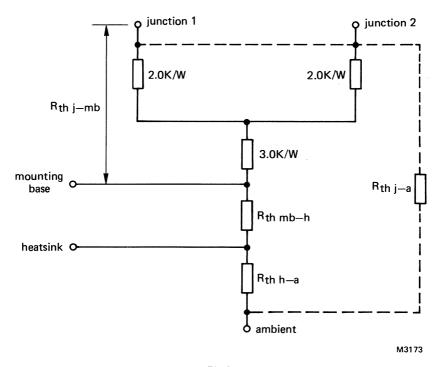


Fig.2.

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

OPERATING NOTES

Dissipation and heatsink calculations

Overall thermal resistance, Rth j-a = Rth j-mb + Rth mb-h + Rth h-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 (VRWM)

The total power dissipation in the diode has two components:

P_R - reverse leakage dissipation

$$P_{tot} = P_R + P_F \dots 1$$
.

P_F - forward conduction dissipation

From the above it can be seen that:

$$R_{th h-a} = \frac{T_{jmax} - T_{amb}}{P_E + P_B} - (R_{th j-mb} + R_{th mb-h}) \dots 2).$$

Values for R $_{th\ j\text{-mb}}$ and R $_{th\ mb\text{-}h}$ can be found under Thermal Resistance. PR and PF 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 V_{III} required V_{III} . 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 V_{III} axis. From this calculation, V_{III} axis V_{III} for the known average current V_{III} and duty cycle (or form factor) for each diode is easily derived from Fig.4 (or Fig.6).

NOTE:— If both halves of the diode are being used (as is assumed above), the value of R_{th j-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-mb} of 5.0 K/W.

To ensure thermal stability, $(R_{th} j_{-mb} + R_{th} m_{b-h} + R_{th} m_{b-a}) \times P_R$ must be less than 12 °C. If the calculated value of $R_{th} m_{b-h}$ does not permit this, then it must be reduced (heatsink size increased or $R_{th} m_{b-h}$ improved) to enable this criterion to be met.

EXAMPLE: square-wave operation, using PBYR635CT and heatsink compound;

 $T_{amb} = 50$ °C; 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, $R_{th j-mb} = 4.0 \text{ K/W}$ and $R_{th mb-h} = 0.3 \text{ K/W}$.

For each diode from Fig.4, it is found that $P_F = 4 W$;

hence total $P_F = 2 \times 4 = 8 \text{ W (from equation 4)}$

If desired T_{jmax} is chosen to be 140 °C, then, from Fig.3, P_{R} (per diode) = 0.2 W

Therefore total $P_R = 2 \times 0.2 = 0.4 \text{ W}$ (from equation 3)

Using equation 2) we have:

$$R_{th\ h-a} = \frac{140\ ^{\circ}C - 50\ ^{\circ}C}{4\ W + 0.4\ W} - (4.0 + 0.3) = 16.2\ K/W$$

To check for thermal stability:

$$(R_{th i-a}) \times P_R = (4.0 + 0.3 + 16.2) \times 0.4 = 8.2 \, ^{\circ}C.$$

This is less than 12 °C, hence thermal stability is ensured.

SQUARE WAVE OPERATION (Fig.3 and 4)

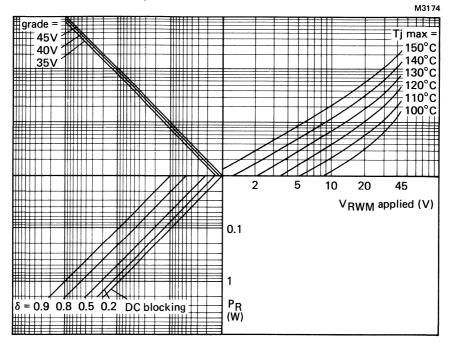
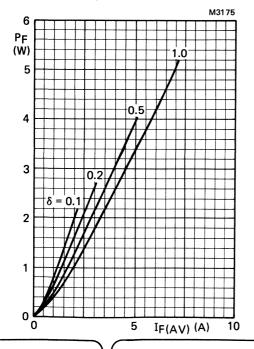


Fig.3 NOMOGRAM: for calculation of $P_{\hbox{\scriptsize R}}$ (reverse leakage power dissipation) for a given $T_{\hbox{\scriptsize j}}$ max., $V_{\hbox{\scriptsize RWM}}$ applied, voltage grade and duty cycle; per diode.



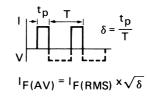


Fig.4 Forward current power rating; per diode.

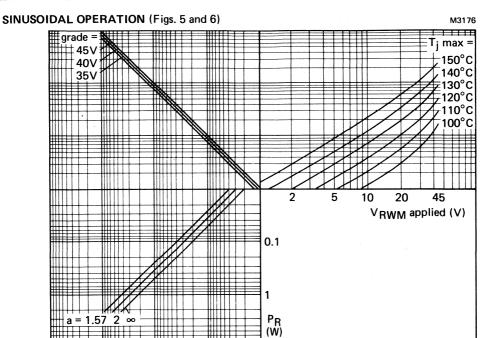


Fig.5 NOMOGRAM: for calculation of $P_{\hbox{\scriptsize R}}$ (reverse leakage power dissipation) for a given $T_{\hbox{\scriptsize j}}$ max., $V_{\hbox{\scriptsize RWM}}$ applied, voltage grade and form factor; per diode.

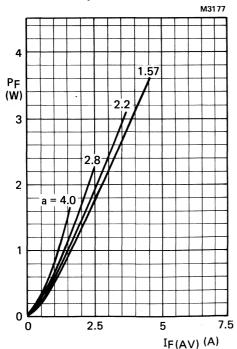


Fig.6 Forward current power rating; per diode.

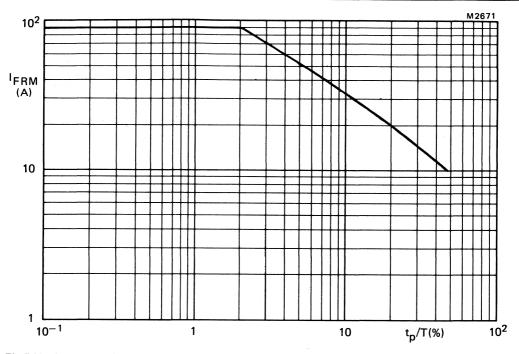
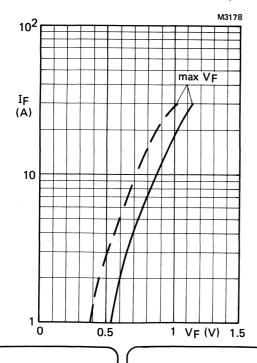
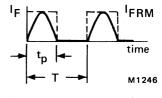


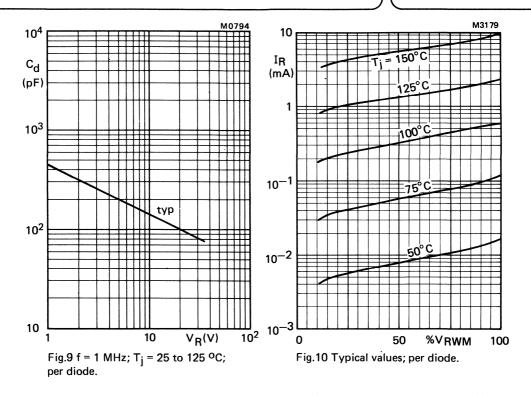
Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal current for 1 μ s < t $_p$ < 1 ms; per diode.





Definition of IFRM and t_p/T .

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



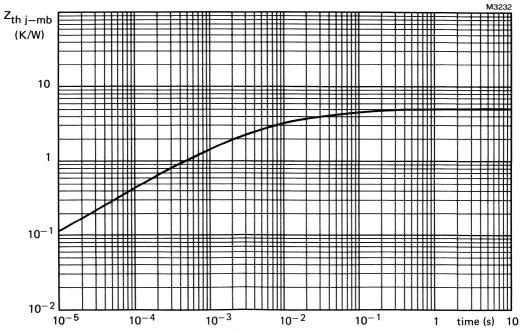


Fig.11 Transient thermal impedance; per diode.



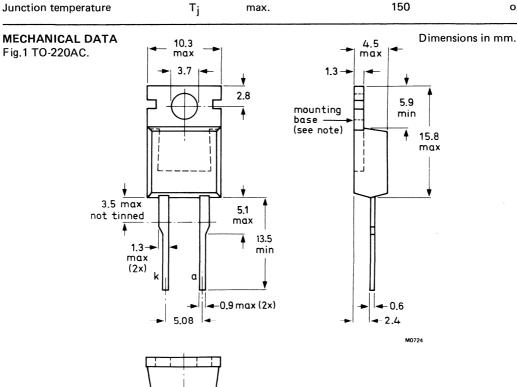
SCHOTTKY-BARRIER RECTIFIER DIODES

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 | | Α |
| Forward voltage | VF | < | | 0.57 | | V |
| Junction temperature | T_{j} , j^{r} | max. | | 150 | | оС |



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 | | PBY | /R735 | 740 | 745 | |
|---|--|-------------|-------|----------------------|--------|------------------|
| Repetitive peak reverse voltage | V _{RRM} | max. | 35 | 40 | 45 | v |
| Crest working reverse voltage | v_{RWM} | max. | 35 | 40 | 45 | ٧ |
| Continuous reverse voltage | VR | max. | 35 | 40 | 45 | ٧ |
| Currents | | | | | | |
| Average forward current square wave; δ = 0.5; up to T _{mb} = 130 °C (note 1) | ^I F(AV) | max. | | 7.5 | | Α |
| Repetitive peak forward current (note 1) $t_p = 25 \mu s; \delta = 0.5; T_{mb} = 130 ^{\circ}C$ | IFRM | max. | | 15 | | Α |
| Non-repetitive peak forward current half sinewave; T _j = 125 °C prior to surge; with reapplied V _{RWM max} t=10ms | !FSM | max. | | 135 | | A |
| t=8.3ms | ^I FSM | max. | | 150 | | A 2 - |
| I ² t for fusing (t=10ms) | l ² t | max. | | 93 | | A ² s |
| Reverse surge current $t_p = 2 \mu s; \delta = 0.001$ $t_D = 100 \mu s$ | I _{RRM} I _{RSM} | max. | | 1.0 1.0 | | A A |
| Temperatures | | | | | | |
| Storage temperature | T _{stg} | | -65 t | to +175 | | οС |
| Junction temperature | Tj : | max. | | 150 | | оС |
| CHARACTERISTICS | | | | | | |
| Forward voltage (note 2) $I_F=7.5A$; $T_j=125$ °C $I_F=15A$; $T_j=125$ °C $I_F=15A$; $T_j=25$ °C | V _F V _F V _F | < < < | | 0.57 0.72 0.84 | | V V V |
| Reverse current VR=VRWM max; Tj=125 °C VR=VRWM max; Tj =25 °C | I _R | < < < | | 15 0.1 | | mA 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-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-h} | = | 0.5 | K/W |
| with heatsink compound and 0.06mm maximum mica insulator | R _{th mb-h} | = | 1.4 | K/W |
| c. with heatsink compound and 0.1mm maximum mica insulator (56369) | R _{th mb-h} | * | 2.2 | K/W |
| d. with heatsink compound and 0.25mm maximum alumina insulator (56367) | R _{th mb-h} | = | 0.8 | K/W |
| e. without heatsink compound | R _{th mb-h} | - 1 · | 1.4 | K/W |
| 2 Free air operation | | | | |

2. 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 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

 $R_{th j-a} = 60 K/W$

MOUNTING INSTRUCTIONS

- 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-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.
- 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

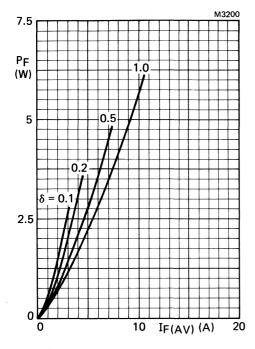
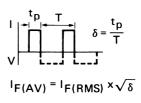


Fig.2 Forward current power rating;



SINUSOIDAL OPERATION

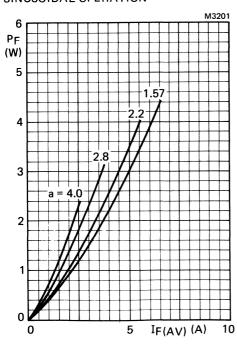


Fig.3 Forward current power rating;

$$a = form factor = I_F(RMS)/I_F(AV)$$

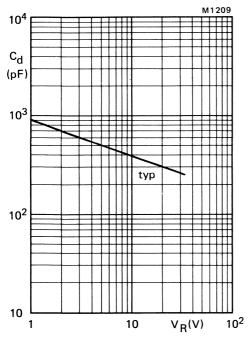
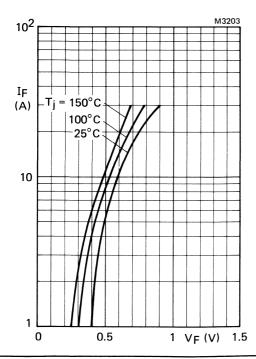


Fig.4 Typical junction capacitance at f = 1 MHz; T_j = 25 to 125 °C.



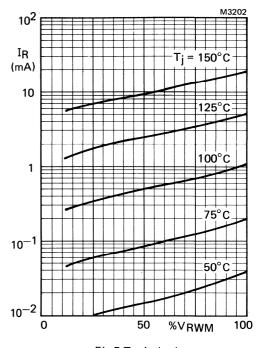


Fig.5 Typical values.

Fig.6 Typical forward voltage.

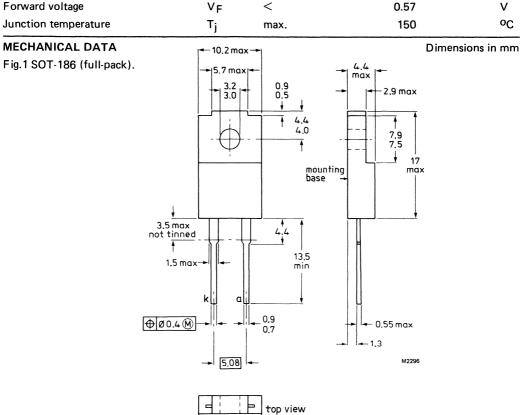


SCHOTTKY-BARRIER RECTIFIER DIODES

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 | IF(AV) | max. | | 7.5 | | Α |
| Forward voltage | VF | < | | 0.57 | | V |
| Junction temperature | T_{j} | max. | | 150 | | oC |



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 | VRWM | max. | 35 | 40 | 45 | V |
| Continuous reverse voltage | V_{R} | max. | 35 | 40 | 45 | \mathbf{V}_{i} |
| Currents | | | | | | |
| Average forward current square wave; δ = 0.5; up to T _h = 120 °C | lF(AV) | max. | | 7.5 | | A |
| Repetitive peak forward current (note 1) $t_p = 25 \mu s$; $\delta = 0.5$; $T_h = 120 ^{o}C$ | I _{FRM} | max. | | 15 | | Α |
| Non-repetitive peak forward current half sinewave; $T_j = 125$ °C prior to surge; with reapplied $V_{RWM\ max}$ | | | | 405 | | |
| t = 10 ms t = 8.3 ms | IFSM IFSM | max. max. | | 135 150 | | A |
| I^2 t for fusing (t = 10 ms) | 12 t | max. | | 93 | | A ² s |
| Reverse surge current | | | | | | |
| $t_p = 20 \mu s; \delta = 0.001$ | ^I RRM | max. | | 1.0 | | Α |
| $t_{\mathbf{p}}^{'} = 100 \ \mu s$ | IRSM | max. | | 1.0 | | Α |
| Temperatures | | | | | | |
| Storage temperature | T_{stg} | | -65 to | +175 | | oC |
| Junction temperature | T_{j} | max. | | 150 | | оС |
| CHARACTERSTICS | | | | | | |
| Forward voltage (note 2) $I_F = 7.5 \text{ A}; T_j = 125 ^{\circ}\text{C}$ $I_F = 15 \text{ A}; T_j = 125 ^{\circ}\text{C}$ $I_F = 15 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | V _F V _F V _F | < < < | | 0.57 0.72 0.84 | | V V V |
| Reverse current $V_R = V_{RWM \ max}$; $T_j = 125 {}^{o}\text{C}$ $V_R = V_{RWM \ max}$; $T_j = 25 {}^{o}\text{C}$ | I _R | < < | | 15 0.1 | | mA 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 VR.
- 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,

with heatsink compound

Rth j-h

5.5

55

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 tie point.

Thermal resistance from junction to ambient

in free air, mounted on a printed circuit board

R_{th i-a}

= "

K/W

MOUNTING INSTRUCTIONS

- 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-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:

 Maximum torque to avoid damage to the device:

 5.5 kgf (0.55 Nm)

 8.0 kgf (0.80 Nm)
- For good thermal contact, heatsink compound should be used between mounting base and heatsink.
 Values of R_{th j-h} given for mounting with heatsink compound refer to the use of a metallic oxide-loaded compound. Ordinary silicone grease is not recommended.
- 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.
- 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.

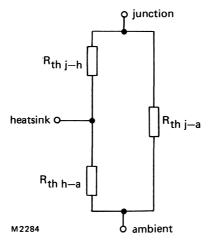


Fig.2.

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

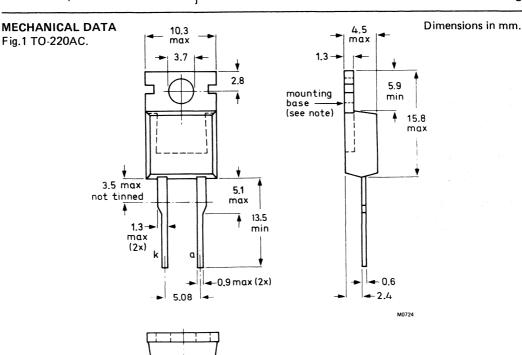
SCHOTTKY-BARRIER RECTIFIER DIODES

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 | l _{F(AV)} | max. | | 10 | | Α |
| Forward voltage | VF | < | | 0.57 | | V |
| Junction temperature | Tj | max. | | 150 | | οС |



Net mass: 2 q.

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 a | accordance with the | Absolute Maxim | um System | (IEC 134). |
|----------------------|---------------------|----------------|-----------|------------|
| = | | | | |

| Voltages | | PBY | R 1035 | 1040 | 1045 | |
|---|----------------------------------|-------------|--------|----------------------|------|------------------|
| Repetitive peak reverse voltage | VRRM | max. | 35 | 40 | 45 | V |
| Crest working reverse voltage | VRWM | max. | 35 | 40 | 45 | ٧ |
| Continuous reverse voltage | VR | max. | 35 | 40 | 45 | V |
| Currents | | | | | | |
| Average forward current square wave; δ = 0.5; up to T _{mb} = 135 °C (note 1) | l _{F(AV)} | max. | | 10 | | Α |
| Repetitive peak forward current (note 1) $t_p = 25 \mu s$; $\delta = 0.5$; $T_{mb} = 135 ^{\circ}C$ | IFRM | max. | | 20 | | Α |
| Non-repetitive peak forward current half sinewave ; T _j = 125 °C prior to surge; with reapplied V _{RWM max} | | | | | | |
| t=10ms | IFSM | max. | | 135 | | Α |
| t=8.3ms | ^I FSM | max. | | 150 | | Α |
| I ² t for fusing (t=10ms) | l ² t | max. | | 93 | | A ² s |
| Reverse surge current | | | | | | |
| $t_p = 2 \mu s; \delta = 0.001$ | IRRM | max. | | 1.0 | | A |
| t _p = 100 μs | ^I RSM | max. | | 1.0 | | Α |
| Temperatures | | | | | | |
| Storage temperature | T _{stg} | | 65 1 | to +175 | | оС |
| Junction temperature | Tj | max. | | 150 | | оС |
| CHARACTERISTICS | | | | | | |
| Forward voltage (note 2) $I_F=10A$; $T_j=125$ °C $I_F=20A$; $T_j=125$ °C $I_F=20A$; $T_i=25$ °C | VF VF VF | < < < | | 0.57 0.72 0.84 | | V V V |
| Reverse current VR=VRWM max; Tj=125 °C VR=VRWM max; Tj= 25 °C | I _R I _R | < < < | | 15 0.1 | | mA mA |

Notes:

- At rated reverse voltage V_R.
 Measured under pulse conditions to avoid excessive dissipation.

| TH | ERMAL RESISTANCE | | | | |
|-----|---|----------------------|-------|-----|-----|
| Fro | om junction to mounting base | R _{th j-mb} | = | 2.0 | K/W |
| Inf | luence of mounting method | | | | |
| 1. | Heatsink-mounted with clip (see mounting instructions) | | | | |
| The | ermal resistance from mounting base to heatsink | | | | |
| a. | with heatsink compound | R _{th mb-h} | = | 0.5 | K/W |
| b. | with heatsink compound and 0.06mm maximum mica insulator | R _{th mb-h} | .= | 1.4 | K/W |
| c. | with heatsink compound and 0.1mm maximum mica insulator (56369) | R _{th mb-h} | · = · | 2.2 | K/W |
| d. | with heatsink compound and 0.25mm maximum alumina insulator (56367) | R _{th mb-h} | = | 0.8 | K/W |
| e. | without heatsink compound | R _{th mb-h} | = , . | 1.4 | K/W |
| 2. | 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 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

60 K/W R_{th i-a}

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 Rth 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.

SQUARE-WAVE OPERATION

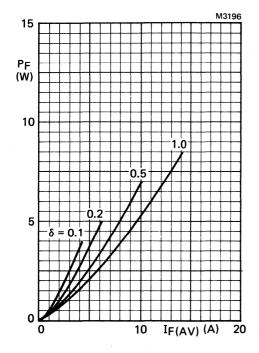
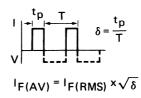


Fig.2 Forward current power rating;



SINUSOIDAL OPERATION

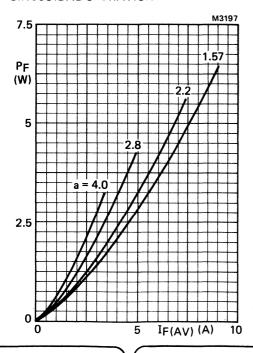


Fig.3 Forward current power rating;

$$a = form factor = I_F(RMS)/I_F(AV)$$

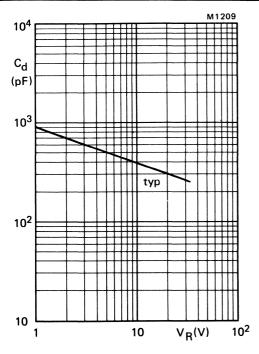
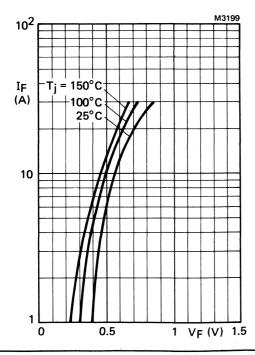


Fig.4 Typical junction capacitance at f = 1 MHz; T_j = 25 to 125 $^{\circ}$ C.



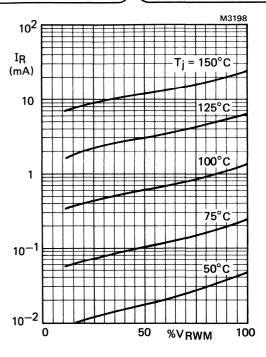


Fig.5 Typical values.

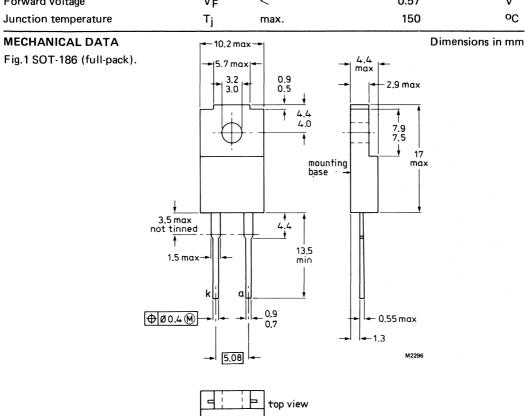
Fig.6 Typical forward voltage.

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 | ٧ |
| Average forward current | I _{F(AV)} | max. | | 10 | | Α |
| Forward voltage | VF | < | | 0.57 | | V |
| Junction temperature | T_{j} | max. | | 150 | | oC |



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).

PBYR1035F PBYR1040F PBYR1045F

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 | VR | max. | 35 | 40 | 45 | V |
| Currents | | | | | | |
| Average forward current square wave; δ = 0.5; up to T _h = 114 °C (note 1) | l _{F(AV)} | max. | | 10 | | Α |
| Repetitive peak forward current (note 1) $t_p = 25 \mu s; \delta = 0.5; T_h = 114 ^{\circ}C$ | IFRM | max. | | 20 | | Α |
| 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. | | 135 | | A |
| t = 8.3 ms | IFSM | max. | | 150 | | Α' |
| I^2 t for fusing (t = 10 ms) | l²t | max. | | 93 | | A ² s |
| Reverse surge current $t_p = 2 \mu s$; $\delta = 0.001$ $t_p = 100 \mu s$ | RRM | max. max. | | 1.0 1.0 | | A A |
| Temperatures | | | | | | |
| Storage temperature | T_{stg} | | 65 t | o +175 | | οС |
| Junction temperature | Тj | max. | | 150 | | оС |
| CHARACTERSTICS | | | | | | |
| Forward voltage (note 2) $I_F = 10 \text{ A}; T_j = 125 ^{\text{O}}\text{C}$ $I_F = 20 \text{ A}; T_j = 125 ^{\text{O}}\text{C}$ $I_F = 20 \text{ A}; T_j = 25 ^{\text{O}}\text{C}$ | V _F V _F V _F | < < < | | 0.57 0.72 0.84 | | V V V |
| Reverse current $V_R = V_{RWM \ max}$; $T_j = 125 {}^{o}\text{C}$ $V_R = V_{RWM \ max}$; $T_j = 25 {}^{o}\text{C}$ | I _R | < < < | | 15 0.1 | | mA mA |
| ISOLATION | | | | | | |
| Isolation voltage from all terminals to external heatsink (peak value) (note 3) | V _(isol) M | max. | | 1500 | | ٧ |
| 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, with heatsink compound

R_{th j-h}

5.5

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 tie point.

Thermal resistance from junction to ambient

in free air, mounted on a printed circuit board

Rth j-a

55

K/W

MOUNTING INSTRUCTIONS

- 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-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:

 Maximum torque to avoid damage to the device:

 5.5 kgf (0.55 Nm)

 8.0 kgf (0.80 Nm)
- For good thermal contact, heatsink compound should be used between mounting base and heatsink.
 Values of R_{th j-h} given for mounting with heatsink compound refer to the use of a metallic oxide-loaded compound. Ordinary silicone grease is not recommended.
- 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.
- 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.

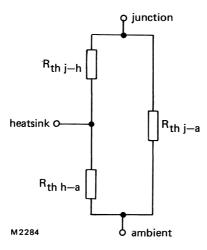


Fig.2.

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

SCHOTTKY-BARRIER DOUBLE RECTIFIER DIODES

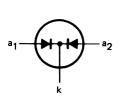
Low-leakage platinum-barrier double rectifier diodes in plastic envelopes, featuring low forward voltage drop, low capacitance, and absence of stored charge. They are intended for use in switched-mode power supplies and high-frequency circuits in general, where both low conduction losses and zero switching 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.

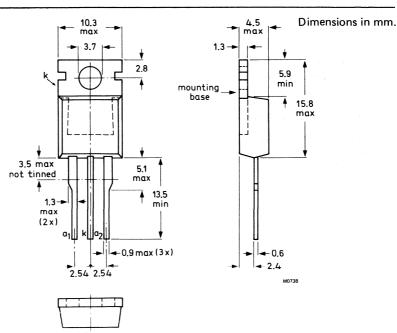
The series consists of common-cathode types.

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) | 10 | max. | | 15 | | Α |
| Forward voltage | VF | < | | 0.57 | | V |
| Junction temperature | Tj | max. | | 150 | | οС |

MECHANICAL DATA 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) | ı | PBYR1535CT | 1540CT | 1545CT | |
|--|---------------------|--------------|-------------|---------|--------|
| Repetitive peak reverse voltage | V _{RRM} | max. 35 | 40 | 45 | ٧ |
| Crest working reverse voltage | V_{RWM} | max. 35 | 40 | 45 | V |
| Continuous reverse voltage | V _R | max. 35 | 40 | 45 | ٧ |
| Currents | | | | | |
| Average forward current square wave; δ = 0.5; up to T _{mb} = 130 °C (note 1) | | | 7.5 | r. 1 6. | A |
| per diode per device | l _F (AV) | max. max. | 7.5 15 | | A |
| Repetitive peak forward current per diode (note 1) | .0 | mux. | | • | • • |
| $t_p = 25 \mu s$; $\delta = 0.5$; $T_{mb} = 130 {}^{\circ}C$ | ^I FRM | max. | 15 | ; | Α |
| Non-repetitive peak forward current (per device) half sinewave; $T_j = 125$ °C prior to surge; with reapplied $V_{RWM\ max}$ | | | | | |
| t=10ms | IFSM | max. | 135 | , | Α |
| t=8.3ms | FSM | max. | 150 |) - | Α |
| I ² t for fusing (t=10ms; per device) | l²t | max. | 93 | 3 | A^2s |
| Reverse surge current (per diode) | | | | | |
| $t_p = 2 \mu s; \delta = 0.001$ | IRRM | max. | 1.0 | | Α |
| $t_{p} = 100 \ \mu s$ | IRSM | max. | 1.0 |) | Α |
| Temperatures | | | | | |
| Storage temperature | T _{stg} | | -65 to +175 | 5 | οС |
| Junction temperature | Τj | max. | 150 |) | οС |
| CHARACTERISTICS (per diode) | • | | | | |
| Forward voltage (note 2) | | | | | |
| I _F =7.5A; T _i =125 °C | ٧ _F | < | 0.57 | 7 | ٧ |
| I _F =15A; T _i =125 °C | VF | < < < | 0.72 | | V |
| I _F =15A; T _j = 25 °C | ٧F | < | 0.8 | 4 | V |
| Reverse current | | | | | |
| V _R =V _{RWM max} ; T _j =125 °C | 1 _R | < < | 15 | | mΑ |
| V _R =V _{RWM max} ; T _j = 25 °C | IR | < | 0.1 | | mΑ |

- 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-mb} | = | 2.0 | K/W |
| From junction to mounting base (per diode) | R _{th j-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-h} | = | 0.5 | K/W |
| with heatsink compound and 0.06mm maximum mica insulator | R _{th mb-h} | , = , | 1.4 | K/W |
| with heatsink compound and 0.1mm maximum mica insulator (56369) | R _{th mb-h} | | 2.2 | K/W |
| d. with heatsink compound and 0.25mm maximum alumina insulator (56367) | R _{th mb-h} | = | 0.8 | K/W |
| e. without heatsink compound | R _{th mb-h} | = | 1.4 | K/W |
| 2. Free air operation | | | | |
| The quoted value of R_{th} $_{j-a}$ should be used only when no leads same tie point. | of other dissipa | ting com | ponents ru | n to the |
| 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-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-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.
- 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

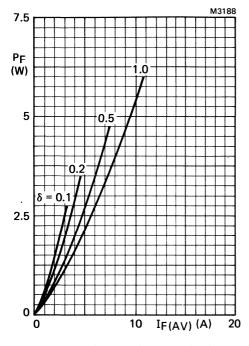
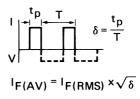


Fig.2 Forward current power rating; per diode.



SINUSOIDAL OPERATION

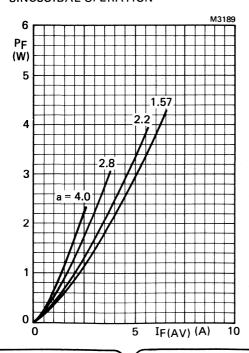


Fig.3 Forward current power rating; per diode.

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

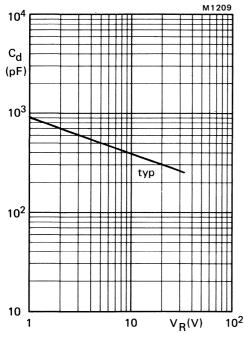
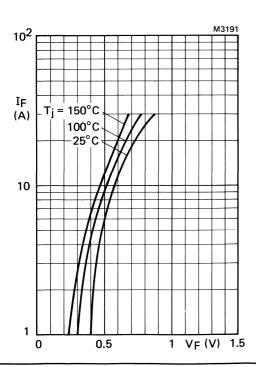


Fig.4 Typical junction capacitance at f = 1 MHz; per diode; T_j = 25 to 125 $^{\circ}$ C.



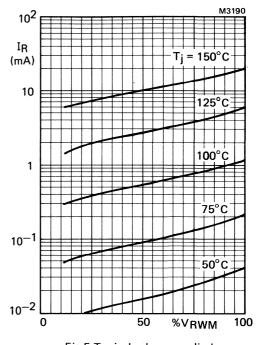


Fig.5 Typical values; per diode.

Fig.6 Typical forward voltage; per diode.

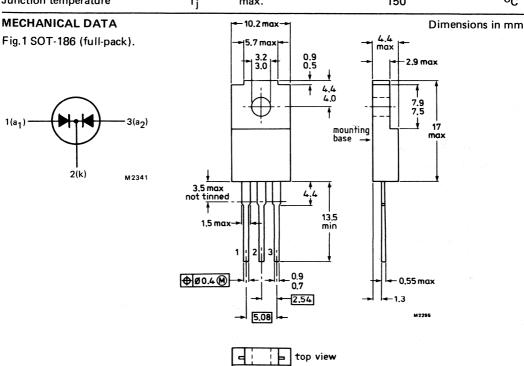
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SCHOTTKY-BARRIER DOUBLE RECTIFIER DIODES

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 | | | PBYR | 1535CTF | 1540CTF | 1545CTF | |
|---|-----------|------|------|---------|---------|---------|----|
| Repetitive peak reverse voltage | V_{RRM} | max. | | 35 | 40 | 45 | V |
| Output current (both diodes conducting) | Io | max. | | | 15 | · | A |
| Forward voltage | ٧F | < | | | 0.57 | | V |
| Junction temperature | T_{j} | max. | | | 150 | | оС |



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 | 1545CT | F |
|--|--|-------------|-------------|----------------------|-------------|------------------|
| Repetitive peak reverse voltage | V_{RRM} | max. | 35 | 40 | 45 | _ v |
| Crest working reverse voltage | VRWM | max. | 35 | 40 | 45 | V |
| Continuous reverse voltage | VR | max. | 35 | 40 | 45 | V |
| Currents | | | | | | |
| Average forward current square wave; $\delta = 0.5$; up to $T_h = 100$ °C per diode | lezavo | max. | | 7.5 | | A |
| per device | lF(AV) | max. | | 7.5 15 | | A |
| Repetitive peak forward current per diode (note 1) $t_p = 25 \mu s$; $\delta = 0.5$; $T_h = 100 ^{\circ}C$ | 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 = 10 ms | FSM | max. | | 135 | | Α |
| t = 8.3 ms | IFSM | max. | | 150 | | A |
| I ² t for fusing (t = 10 ms; per device) | l ² ,t | max. | | 93 | | A ² s |
| Reverse surge current (per diode) $t_p = 2 \mu s; \delta = 0.001$ $t_D = 100 \mu s$ | IRRM IRSM | max. | | 1.0 1.0 | | A A |
| Temperatures | | | | | | |
| Storage temperature | T _{stg} | | -65 to | +175 | | οС |
| Junction temperature | T _i | max. | | 150 | | оС |
| CHARACTERSTICS (per diode) | , | | | | | |
| Forward voltage (note 2) $I_F = 7.5 \text{ A}; T_j = 125 ^{\circ}\text{C}$ $I_F = 15 \text{ A}; T_j = 125 ^{\circ}\text{C}$ $I_F = 15 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | V _F V _F V _F | < < < | | 0.57 0.72 0.84 | | V V V |
| Reverse current | *F | | | 0.04 | | • |
| $V_R = V_{RWM \ max}; T_j = 125 {}^{o}C$ $V_R = V_{RWM \ max}; T_j = 25 {}^{o}C$ | I _R | < < | | 15 0.1 | | mA 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

 $R_{th j-h} = 5.2 K/W$

b. per diode:

with heatsink compound

 $R_{th j-h} = 6.1$

K/W

K/W

Free air operation

The quoted value of R_{th j-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

 $R_{th j-a} = 55$

MOUNTING INSTRUCTIONS

- 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-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:

 Maximum torque to avoid damage to the device:

 5.5 kgf (0.55 Nm)

 8.0 kgf (0.80 Nm)
- For good thermal contact, heatsink compound should be used between mounting base and heatsink.
 Values of R_{th j-h} given for mounting with heatsink compound refer to the use of a metallic oxide-loaded compound. Ordinary silicone grease is not recommended.
- 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.
- 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.

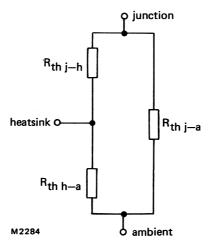


Fig.2.

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

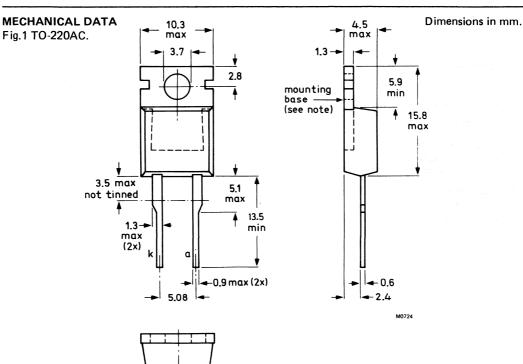
SCHOTTKY-BARRIER RECTIFIER DIODES

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 | IF(AV) | max. | | 16 | | |
| Forward voltage | VF | < | | 0.57 | | |
| Junction temperature | T_{j} | max. | 150 | | | οС |



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.

| Limiting values in accordance with the Absolute Maxin Voltages | num System | (IEC 134). PBYF | 1635 | 1640 | 1645 | |
|--|--------------------|--------------------|-------|--------------|------|------------------|
| Repetitive peak reverse voltage | V _{RRM} | max. | 35 | 40 | 45 | V |
| Crest working reverse voltage | v_{RWM} | max. | 35 | 40 | 45 | ٧ |
| Continuous reverse voltage | V_{R} | max. | 35 | 40 | 45 | ٧ |
| Currents | | | | 48.00 | | |
| Average forward current square wave; δ = 0.5; up to T _{mb} = 125 °C (note 1) | I _{F(AV)} | max. | | 16 | | Α |
| Repetitive peak forward current (note 1) $t_p = 25 \mu s$; $\delta = 0.5$; $T_{mb} = 125 {}^{\circ}\text{C}$ | ^I FRM | max. | | 32 | | Α |
| Non-repetitive peak forward current half sinewave; T _j = 125 ^O C prior to surge; with reapplied V _{RWM max} | | | | | | |
| t=10ms | IFSM | max. | | 135 | | Α |
| t=8.3ms | ^I FSM | max. | | 150 | | Α |
| I ² t for fusing (t=10ms) | l ² t | max. | | 93 | | A ² s |
| Reverse surge current $t_p = 2 \mu s$; $\delta = 0.001$ $t_p = 100 \mu s$ | IRRM IRSM | max. max. | | 1.0 1.0 | | A A |
| Temperatures | | | | | | |
| Storage temperature | T _{stg} | | -65 t | to +175 | | оС |
| Junction temperature | T_{j} | max. | | 150 | | oC |
| CHARACTERISTICS | | | | | | |
| Forward voltage (note 2) $I_F=16A$; $I_j=125$ °C $I_F=16A$; $I_i=25$ °C | V _F | < < | | 0.57 0.63 | | V V |
| Reverse current | | | | | | |
| V _R =V _{RWM max} ; T _j =125 °C | I _R | < | | 40 | | mΑ |
| V _R =V _{RWM max} ; T _j = 25 °C | ^I R | < | | 0.2 | | mΑ |

Notes:

At rated reverse voltage V_R.
 Measured under pulse conditions to avoid excessive dissipation.

| THERMAL RESISTANCE | | | | |
|--|----------------------|--------|-----|-----|
| From junction to mounting base | R _{th j-mb} | = 1 | 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-h} | = ' | 0.5 | K/W |
| with heatsink compound and 0.06mm maximum mica insulator | Rth mb-h | ,= | 1.4 | K/W |
| c. with heatsink compound and 0.1mm maximum mica insulator (56369) | R _{th mb-h} | = | 2.2 | K/W |
| d. with heatsink compound and 0.25mm maximum alumina insulator (56367) | R _{th mb-h} | = | 0.8 | K/W |
| e. without heatsink compound | R _{th mb-h} | - - | 1.4 | K/W |
| 2 Free air operation | | | | |

2. 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 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

 $R_{th i-a} = 60 K/W$

MOUNTING INSTRUCTIONS

- 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-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.
- 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

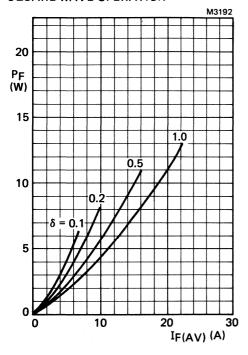


Fig.2 Forward current power rating;

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

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

SINUSOIDAL OPERATION

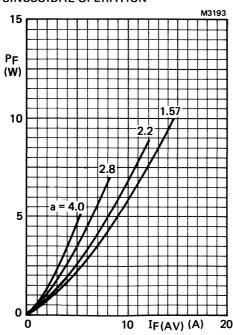


Fig.3 Forward current power rating;

$$a = form factor = I_F(RMS)/I_F(AV)$$

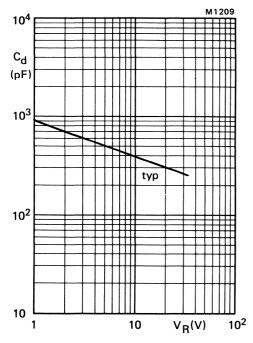
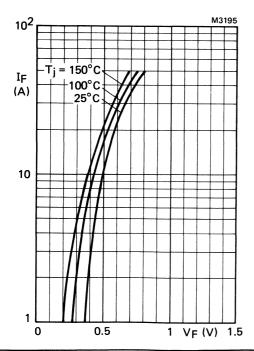


Fig.4 Typical junction capacitance at f = 1 MHz; $T_j = 25 \text{ to } 125 \text{ }^{\circ}\text{C}$.



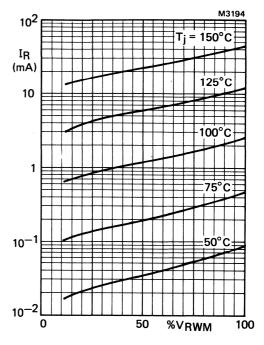


Fig.5 Typical values.

Fig.6 Typical forward voltage.

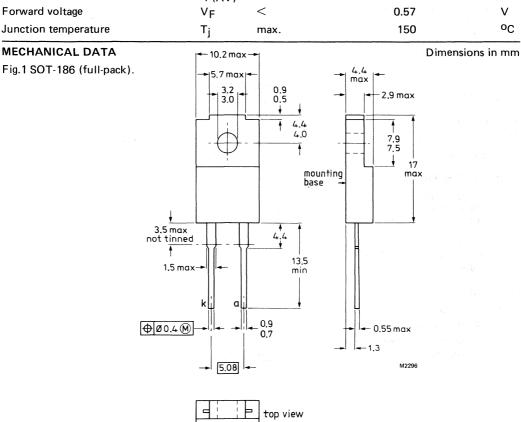


SCHOTTKY-BARRIER RECTIFIER DIODES

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 | ٧ |
| Average forward current | I _{F(AV)} | max. | | 16 | | Α |
| Forward voltage | VF | < | | 0.57 | | V |
| Junction temperature | T_{j} | max. | | 150 | | оС |



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).

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 | VR | max. | 35 | 40 | 45 | V |
| Currents | | | | | | |
| Average forward current square wave; $\delta = 0.5$; up to T _h = 110 °C (note 1) | l= (a) n | max. | | 16 | | Α |
| Repetitive peak forward current (note 1) | ^I F(AV) | IIIax. | | | | |
| $t_p = 25 \ \mu s; \ \delta = 0.5; \ T_h = 110 \ ^{o}C$ | ^I FRM | max. | | 32 | | Α |
| Non-repetitive peak forward current half sinewave; T _j = 125 °C prior to surge; with reapplied V _{RWM} max t = 10 ms | lFSM | max. | | 135 | | A |
| t = 8.3 ms | IFSM | max. | | 150 | | Α |
| I^2 t for fusing (t = 10 ms) | l²t | max. | | 93 | | A ² s |
| Reverse surge current $t_p = 2 \mu s$; $\delta = 0.001$ $t_p = 100 \mu s$ | IRRM IRSM | max. max. | | 1.0 1.0 | | A |
| Temperatures | | | | | | |
| Storage temperature | T _{stg} | | 65 to | +175 | | оС |
| Junction temperature | Tj | max. | | 150 | | оС |
| CHARACTERSTICS | | | | | | |
| Forward voltage (note 2) $I_F = 16 A; T_j = 125 {}^{\circ}\text{C}$ $I_F = 16 A; T_j = 25 {}^{\circ}\text{C}$ | V _F | < < < | | 0.57 0.63 | | V V |
| Reverse current $V_R = V_{RWM \ max}$; $T_j = 125 {}^{O}C$ $V_R = V_{RWM \ max}$; $T_j = 25 {}^{O}C$ | I _R | < < | | 40 0.2 | | mA 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.

PBYR1635F PBYR1640F PBYR1645F

THERMAL RESISTANCE

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

 $R_{th i-h} = 4.2 K/W$

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 tie point.

Thermal resistance from junction to ambient

in free air, mounted on a printed circuit board

R_{th j-a}

55

K/W

MOUNTING INSTRUCTIONS

- 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-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: Maximum torque to avoid damage to the device:

5.5 kgf (0.55 Nm) 8.0 kgf (0.80 Nm)

- For good thermal contact, heatsink compound should be used between mounting base and heatsink.
 Values of R_{th j-h} given for mounting with heatsink compound refer to the use of a metallic oxide-loaded compound. Ordinary silicone grease is not recommended.
- 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.

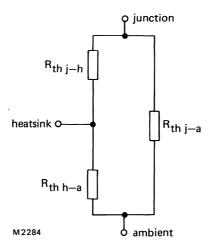


Fig.2.

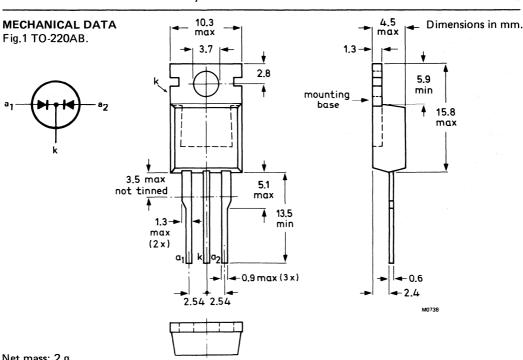
Any measurement of heatsink temperature should be immediately adjacent to the device.

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 | ٧ |
| Output current (both diodes conducting) | Io | max. | | 20 | | Α |
| Forward voltage | VF | < | | 0.57 | | V |
| Junction temperature | Тj | max. | | 150 | | οС |



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.

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

| Voltages (per diode) | | PBYR2035CT | 2040CT | 2045CT | |
|--|------------------|------------|-------------|--------|----------|
| Repetitive peak reverse voltage | VRRM | | 40 | 45 | - |
| Crest working reverse voltage | VRWM | | 40 | 45 | V |
| Continuous reverse voltage | VR | max. 35 | 40 | 45 | V |
| Currents | | | | | |
| Average forward current square wave; δ = 0.5; up to T_{mb} = 135 o C (note 1) | | | | | |
| per diode | F(AV) | | 10 20 | | A A |
| per device | Ю | max. | 20 | | ^ |
| Repetitive peak forward current per diode (note 1) $t_p = 25 \mu s$; $\delta = 0.5$; $T_{mb} = 135 ^{O}C$ | IFRM | max. | 20 | | Α |
| Non-repetitive peak forward current (per device) half sinewave ; T _j = 125 ^o C prior to surge; with reapplied V _{RWM max} | | | | | |
| t=10ms | ^I FSM | max. | 135 | | Α |
| t=8.3ms | IFSM | max. | 150 | 1 | Α |
| I ² t for fusing (t=10ms; per device) | l²t | max. | 93 | | A^2s |
| Reverse surge current (per diode) | | | | | |
| $t_{\rm D} = 2 \mu {\rm s}; \delta = 0.001$ | IRRM | max. | 1.0 | | Α |
| $t_p^r = 100 \mu s$ | IRSM | max. | 1.0 |) | Α |
| Temperatures | | | | | |
| Storage temperature | T _{stg} | | -65 to +175 | i . | οС |
| Junction temperature | Тј | max. | 150 |) | °C |
| CHARACTERISTICS (per diode) | | | | | |
| Forward voltage (note 2) | | | | | |
| I _F =10A; T _j =125 °C | ٧F | < | 0.57 | | ٧ |
| I _F =20A; T _i =125 °C | VF | < | 0.72 | | V V |
| I _F =20A; T _j = 25 °C | ٧F | < | 0.8 | 4 | V |
| Reverse current | | | | | 2 |
| $V_R = V_{RWM max}$; $T_j = 125 {}^{O}C$ $V_R = V_{RWM max}$; $T_j = 25 {}^{O}C$ | I _R | < < | 15 0. | | mA 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-mb} | = | 1.0 | K/W |
| From junction to mounting base (per diode) | R _{th j-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-h} | = | 0.5 | K/W |
| with heatsink compound and 0.06mm maximum mica insulator | R _{th mb-h} | = | 1.4 | K/W |
| c. with heatsink compound and 0.1mm maximum mica insulator (56369) | R _{th mb-h} | = | 2.2 | K/W |
| d. with heatsink compound and 0.25mm maximum alumina insulator (56367) | R _{th mb-h} | = | 0.8 | K/W |
| e. without heatsink compound | R _{th mb-h} | = | 1.4 | K/W |
| 2 Free air operation | | | | |

2. 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 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

 $R_{th j-a} = 60 K/W$

MOUNTING INSTRUCTIONS

- 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.
- 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 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.
- 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

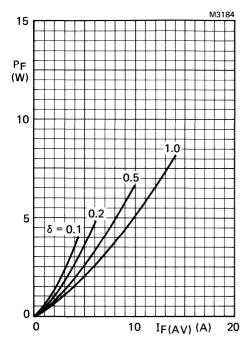
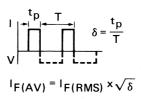


Fig.2 Forward current power rating; per diode.



SINUSOIDAL OPERATION

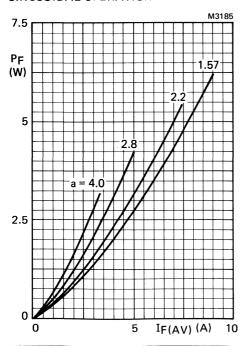


Fig.3 Forward current power rating; per diode.

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

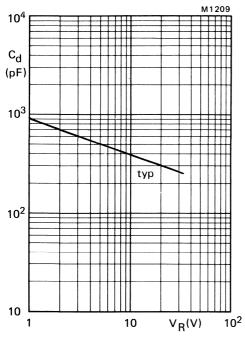


Fig.4 Typical junction capacitance at f = 1 MHz; per diode; $T_i = 25$ to 125 °C.

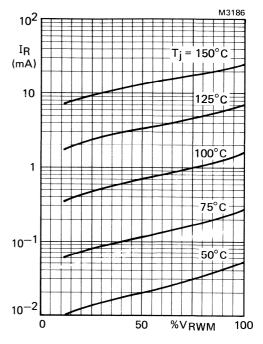


Fig.5 Typical values; per diode.

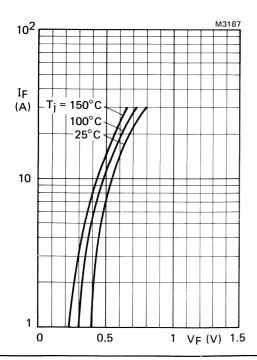


Fig.6 Typical forward voltage; per diode.

SCHOTTKY-BARRIER DOUBLE RECTIFIER DIODES

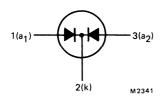
Low-leakage platinum-barrier double rectifier diodes in SOT-186 (full-pack) plastic envelopes featuring low forward voltage drop, low capacitance and absence of stored charge. Their electrical isolation makes them ideal for mounting on a common heatsink alongside other components without the need for 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.

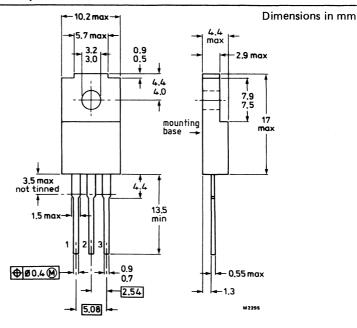
QUICK REFERENCE DATA

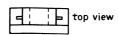
| Per diode, unless otherwise stated | | | PBYR2035CTF | 2040CTF | 2045CTF | |
|---|-----------|------|-------------|---------|---------|----|
| Repetitive peak reverse voltage | v_{RRM} | max. | 35 | 40 | 45 | V |
| Output current (both diodes conducting) | 10 | max. | | 20 | | Α |
| Forward voltage | ٧F | < | | 0.57 | | V |
| Junction temperature | Τj | max. | | 150 | | oC |

MECHANICAL DATA

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).

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

| Voltages (per diode) | | | PBYR20 | 035CTF | 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 | VR | max. | | 35 | 40 | 45 | V |
| Currents | | | | | | | |
| Average forward current square wave; $\delta = 0.5$; up to $T_h = 82$ °C (note 1) per diode per device | IF(AV) | max. max. | | | 10 20 | | A |
| Repetitive peak forward current per diode (note 1) | | | | | | | |
| t_p = 25 μ s; δ = 0.5; T_h = 82 o C Non-repetitive peak forward current (per device) half sinewave; T_i = 125 o C | I _{FRM} | max. | | | 20 | | Α |
| prior to surge; with reapplied V _{RWM max} | | | | | | | |
| t = 10 ms t = 8.3 ms | IFSM | max. max. | | | 135 150 | | A |
| I^2 t for fusing (t = 10 ms; per device) | IFSM I²t | max. | | | 93 | | A ² s |
| Reverse surge current (per diode) | , . | max. | | | 33 | | |
| $t_p = 2 \mu s; \delta = 0.001$ $t_p = 100 \mu s$ | IRRM IRSM | max. max. | | | 1.0 1.0 | | A A |
| Temperatures | | | | | | | |
| Storage temperature | T _{stg} | | | -65 to | +175 | | оС |
| Junction temperature | Tj | max. | | | 150 | | оС |
| CHARACTERSTICS (per diode) | | | | | | | |
| Forward voltage (note 2) | | | | | | | |
| $I_F = 10 \text{ A}; T_j = 125 ^{\circ}\text{C}$ | VF | < , | | | 0.57 | | ٧ |
| I _F = 20 A; T _j = 125 °C I _F = 20 A; T _j = 25 °C | V _F | < < | | | 0.72 0.84 | | V V |
| Reverse current | ٧- | | | | 0.04 | | V |
| $V_R = V_{RWM \text{ max}}; T_j = 125 ^{\circ}\text{C}$ | I _R | ·< | | | 15 | | mA |
| $V_R = V_{RWM max}$; $T_j = 25$ °C | I _R | < | | | 0.1 | | mΑ |
| ISOLATION | | | | | | | |
| Isolation voltage from all terminals to external heatsink (peak value) (note 3) | V(isoI)M | max. | | | 1500 | | V |
| Isolation capacitance between all terminals and external heatsink | C _(isol) | typ. | | | 12 | | рF |
| Notes: | 1.5/ | | | | | | |
| 1 At rated rayona valtage Va | | | | | | | |

- 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

 $R_{th j-h} = 5.0 K/W$

b. per diode with heatsink compound

 $R_{th j-h} = 5.9 K/W$

Free air operation

The quoted value of $R_{th\ j-a}$ 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 $R_{th j-a} = 55$ K/W

MOUNTING INSTRUCTIONS

- 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-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:

 Maximum torque to avoid damage to the device:

 5.5 kgf (0.55 Nm)

 8.0 kgf (0.80 Nm)
- For good thermal contact, heatsink compound should be used between mounting base and heatsink.
 Values of R_{th j-h} given for mounting with heatsink compound refer to the use of a metallic oxide-loaded compound. Ordinary silicone grease is not recommended.
- 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.

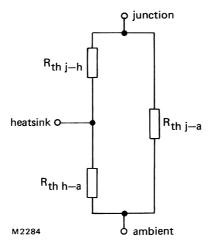


Fig.2.

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

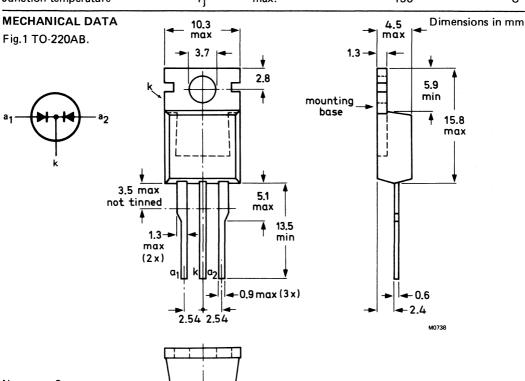
SCHOTTKY-BARRIER DOUBLE RECTIFIER DIODES

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) | 10 | max. | | 30 | | Α |
| Forward voltage | V_{F} | < | | 0.73 | | V |
| Junction temperature | Τį | max. | | 150 | | оС |



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.

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

| Voltages (per diode) | | | PBYR2 | 535CT | 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 | VR | max. | | 35 | 40 | 45 | V |
| Currents | | | | | | | |
| Average forward current square wave; $\delta = 0.5$; | | | | | | | |
| up to T _h = 130 °C (note 1) | | | | | | | |
| per diode | lF(AV) | max. | | | 15 | | Α |
| per device | 10 | max. | | | 30 | | Α |
| Repetitive peak forward current per diode (note 1) | | | | | | | |
| $t_p = 25 \ \mu s; \ \delta = 0.5, \ T_h = 130 \ ^{o}C$ | ^I FRM | max. | | | 30 | | Α |
| Non-repetitive peak forward current (per device) half sinewave; T _j = 125 °C prior to surge with reapplied V _{RWM max} | | | | | | | |
| t = 10 ms | IFSM | max. | | | 135 | | Α |
| t = 8.3 ms | ^I FSM | max. | | | 150 | | Α |
| I^2 t for fusing (t = 10 ms; per device) | l²t | max. | | | 93 | | A ² s |
| Reverse surge current (per diode) | | | | | | | |
| $t_p = 2 \mu s; \delta = 0.001$ | RRM | max. | | | 1.0 | | Α |
| $t_p = 100 \mu s$ | IRSM | max. | | | 1.0 | | Α |
| Temperatures | | | | | | | |
| Storage temperature | T_{stg} | | | -65 to | +175 | | οС |
| Junction temperature | тj | max. | | | 150 | | оС |
| CHARACTERISTICS (per diode) | | | | | | | |
| Forward voltage (note 2) | | | | | | | |
| $I_F = 30 \text{ A}; T_j = 125 ^{\circ}\text{C}$ | VF | < < | | | 0.73 | | V |
| $I_F = 30 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | VF | < | | | 0.82 | | V |
| Reverse current | | | | | 40 | | |
| $V_R = V_{RWM max}$; $T_j = 125 {}^{o}C$ $V_R = V_{RWM max}$; $T_j = 25 {}^{o}C$ | IR IR | < . | | | 40 0.2 | | mA mA |
| The Trivivi maxing 200 | .u | | | | 0.2 | | 111/-1 |

Notes:

- 1. At rated reverse voltage $V_{\hbox{\scriptsize R}}.$ 2. Measured under pulse conditions to avoid excessive dissipation.

K/W

60

R_{th j-a}

| THERMAL RESISTANCE | | | | |
|---|----------------------|---|--------|--------|
| From junction to mounting base (both diodes conducting) | R _{th j-mb} | = | 1.0 | K/W |
| From junction to mounting base (per diode) | R _{th j-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-h | = | 0.5 | K/W |
| with heatsink compound and 0.06 mm maximum mica insulator | R _{th mb-h} | = | 1.4 | K/W |
| with heatsink compound and 0.1 mm maximum mica insulator (56369) | R _{th mb-h} | . · · · · · · · · · · · · · · · · · · · | 2.2 | K/W |
| d. with heatsink compound and 0.25 mm maximum | | | | |
| alumina insulator (56367) | R _{th mb-h} | = | 8.0 | K/W |
| e. without heatsink compound | R _{th mb-h} | = | 1.4 | K/W |
| 2. Free air operation | | | | |
| The quoted value of R _{th j-a} should be used only when no leads of on the same tie point. Thermal resistance from junction to ambient in free air: | other dissipatii | ng comp | onents | run to |

MOUNTING INSTRUCTIONS

- 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.
- 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.

mounted on a printed circuit board at any device lead

length and with copper laminate on the board

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.
- 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

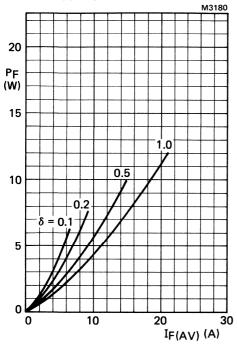
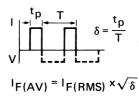


Fig.2 Forward current power rating; per diode.



SINUSOIDAL OPERATION

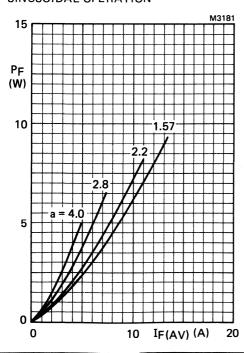


Fig.3 Forward current power rating; per diode.

$$a = form factor = I_F(RMS)/I_F(AV)$$

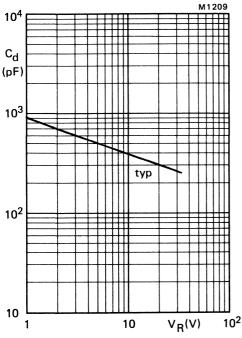


Fig.4 Typical junction capacitance at f = 1 MHz; per diode; $T_j = 25$ to 125 °C.

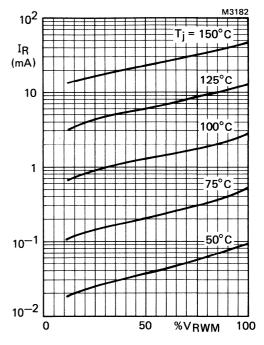


Fig.5 Typical values; per diode.

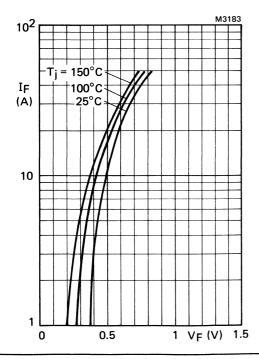


Fig.6 Typical forward voltage; per diode.

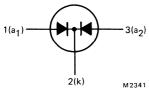
SCHOTTKY-BARRIER DOUBLE RECTIFIER DIODES

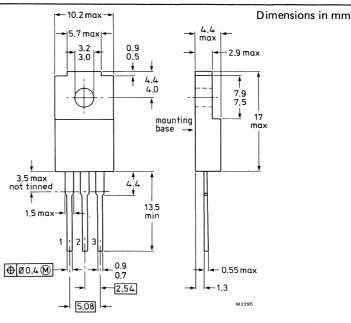
Low-leakage platinum-barrier double rectifier diodes in SOT-186 (full-pack) plastic envelopes featuring low forward voltage drop, low capacitance and absence of stored charge. Their electrical isolation makes them ideal for mounting on a common heatsink alongside other components without the need for 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.

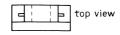
QUICK REFERENCE DATA

| Per diode, unless otherwise stated | | | PBYR2535CTF | 2540CTF | 2545CTF | |
|---|-----------|------|-------------|---------|---------|----|
| Repetitive peak reverse voltage | v_{RRM} | max. | 35 | 40 | 45 | V |
| Output current (both diodes conducting) | 10 | max. | · | 20 | | Α |
| Forward voltage | ٧F | < | | 0.51 | | V |
| Junction temperature | Tj | max. | | 150 | | oC |

MECHANICAL DATA 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).

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 | VRWM | max. | 35 | 40 | 45 | ٧ |
| Continuous reverse voltage | V _R | max. | 35 | 40 | 45 | V |
| Currents | | | | | | |
| Average forward current square wave; δ = 0.5; up to T _h = 100 °C (note 1) per diode per device | IF(AV) | max. max. | | 15 20 | | A A |
| Repetitive peak forward current per diode (note 1) | | | | | | • |
| t_p = 25 μ s; δ = 0.5; T_h = 100 o C Non-repetitive peak forward current (per device) half sinewave; T_j = 125 o C prior to surge; with reapplied $V_{RWM\ max}$ | | max. | | 30 | | A |
| t = 10 ms t = 8,3 ms | FSM | max. max. | | 135 150 | | A A |
| l^2 t for fusing (t = 10 ms; per device) | IFSM I ² t | max. | | 93 | | A ² s |
| Reverse surge current (per diode) | , , | mux. | | 00 | | , , , , |
| $t_p = 2 \mu s; \delta = 0.001$ $t_p = 100 \mu s$ | IRRM IRSM | max. max. | | 1.0 1.0 | | A A |
| Temperatures | | | | | | |
| Storage temperature | T_{stg} | | -65 to | +175 | | οС |
| Junction temperature | Tj | max. | | 150 | | oC |
| CHARACTERSTICS (per diode) | | | | | | |
| Forward voltage (note 2) $I_F = 20 \text{ A}; T_j = 125 ^{\circ}\text{C}$ $I_F = 20 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | V _F | < < | | 0.51 0.68 | | V V |
| Reverse current $V_R = V_{RWM \ max}$; $T_j = 125 {}^{\circ}\text{C}$ $V_R = V_{RWM \ max}$; $T_j = 25 {}^{\circ}\text{C}$ | I _R | < < | | 40 0.2 | | mA mA |
| ISOLATION | | | | | | |
| Isolation voltage from all terminals to external heatsink (peak value) (note 3) | ViscINA | max. | | 1500 | | V |
| Isolation capacitance between all terminals and external heatsink | C _(isol) | typ. | | 12 | | pF |

Notes:

- 1. At rated reverse voltage VR.
- 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

 $R_{th j-h} = 4.0 K/W$

b. per diode with heatsink compound

 $R_{th j-h} = 4.8 K/W$

Free air operation

The quoted value of $R_{th\ j-a}$ 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 $R_{th j-a} = 55$ K/W

MOUNTING INSTRUCTIONS

- 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-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)
- For good thermal contact, heatsink compound should be used between mounting base and heatsink.
 Values of R_{th j-h} given for mounting with heatsink compound refer to the use of a metallic oxide-loaded compound. Ordinary silicone grease is not recommended.
- 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.

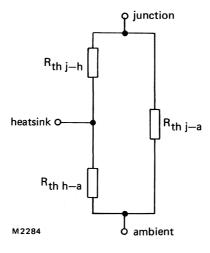


Fig.2.

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

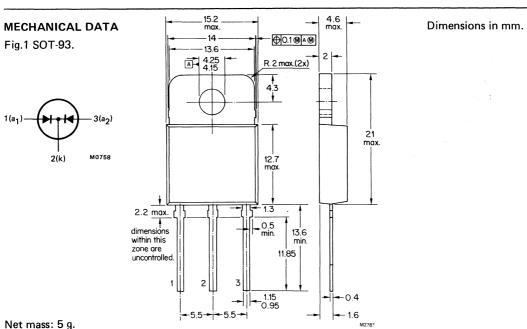
SCHOTTKY-BARRIER DOUBLE RECTIFIER DIODES

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) | 10 | max. | | 30 | | Α |
| Forward voltage | ٧F | < | | 0.60 | | V |
| Junction temperature | Τj | max. | | 150 | | оС |



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.

| Limiting values in accordance with the Absolute Maxin | num Syste | em (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 | | Α |
| per device | 10 | max. | 30 | | Α |
| Repetitive peak forward current per diode (note 1) $t_p = 25 \mu s$; $\delta = 0.5$; $T_{mb} = 130 ^{o}\text{C}$ | I _{FRM} | max. | 30 | | Α |
| 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 | | Α |
| t=8.3ms | IFSM | max. | 200 | | Α |
| I ² t for fusing (t=10ms; per device) | l ² t | max. | 165 | | A^2s |
| Reverse surge current (per diode) $t_p = 2 \mu s$; $\delta = 0.001$ $t_p = 100 \mu s$ | I _{RRM} I _{RSM} | max. max. | 2.0 2.0 | | A A |
| Temperatures | | | | | |
| Storage temperature | T _{stq} | | 65 to +175 | | οС |
| Junction temperature | Тj | max. | 150 | | oC |
| CHARACTERISTICS (per diode) | | | | | |
| Forward voltage (note 2) | | | | | |
| I _F =20A; T _i =125 °C | VF | < | 0.60 |) | V |
| I _F =30A; T _i =125 °C | V _F | < < < | 0.72 | ? | ٧ |
| I _F =30A; T _j = 25 °C | v _F | < | 0.76 | 3 | V |
| Reverse current | | | | | |
| | | | | | |

۱R

IR

100

1.0

mΑ

mΑ

Notes:

1. At rated reverse voltage V_R.

 $V_R = V_{RWM~max}$; $T_j = 125$ °C $V_R = V_{RWM~max}$; $T_j = 25$ °C

2. Measured under pulse conditions to avoid excessive dissipation.

THEDMAL DECICEANCE

| TI | HERMAL RESISTANCE | | | | |
|----|--|----------------------|-----|-----|-----|
| Fr | om junction to mounting base (both diodes conducting) | R _{th j-mb} | = | 1.0 | K/W |
| Fr | om junction to mounting base (per diode) | R _{th j-mb} | = | 1.4 | K/W |
| ln | fluence of mounting method | | | | |
| 1. | Heatsink mounted with clip (see mounting instructions) | | | | |
| TH | nermal resistance from mounting base to heatsink | | | | |
| a. | with heatsink compound | R _{th mb-h} | = | 0.2 | K/W |
| b. | with heatsink compound and 0.06mm maximum mica insulator (56378) | R _{th mb-h} | = | 1.4 | K/W |
| C. | with heatsink compound and 0.1mm maximum mica insulator | R _{th mb-h} | = | 2.2 | K/W |
| d. | with heatsink compound and 0.25mm maximum | | | | |
| | alumina insulator | R _{th mb-h} | = 1 | 0.8 | K/W |
| e. | without heatsink compound | R _{th mb-h} | | 1.4 | K/W |
| | | | | | |

2. 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 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

 $R_{th j-a} = 40 K/W$

MOUNTING INSTRUCTIONS

- 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.
- 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-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-h} given for mounting with heatsink compound refer to the use of a metallic-oxide loaded compound. Ordinary silicone grease is not recommended.
- 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

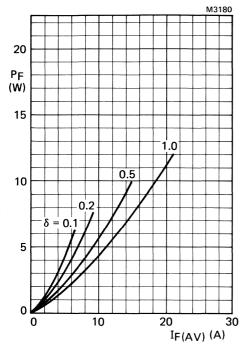
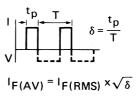


Fig.2 Forward current power rating; per diode.



SINUSOIDAL OPERATION

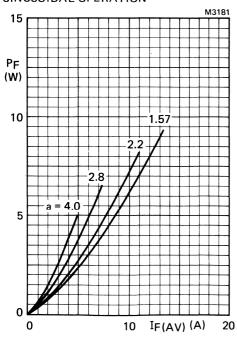


Fig.3 Forward current power rating; per diode.

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

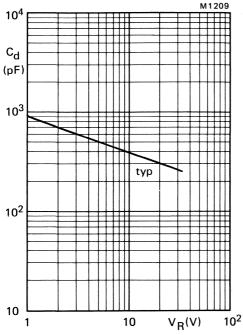
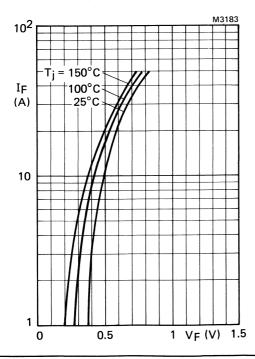


Fig.4 Typical junction capacitance at f = 1 MHz; per diode; T_j = 25 to 125 $^{\rm O}$ C.



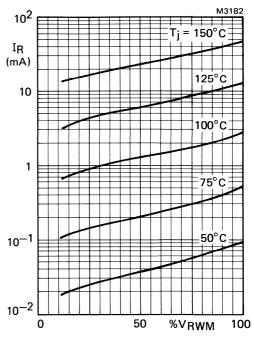
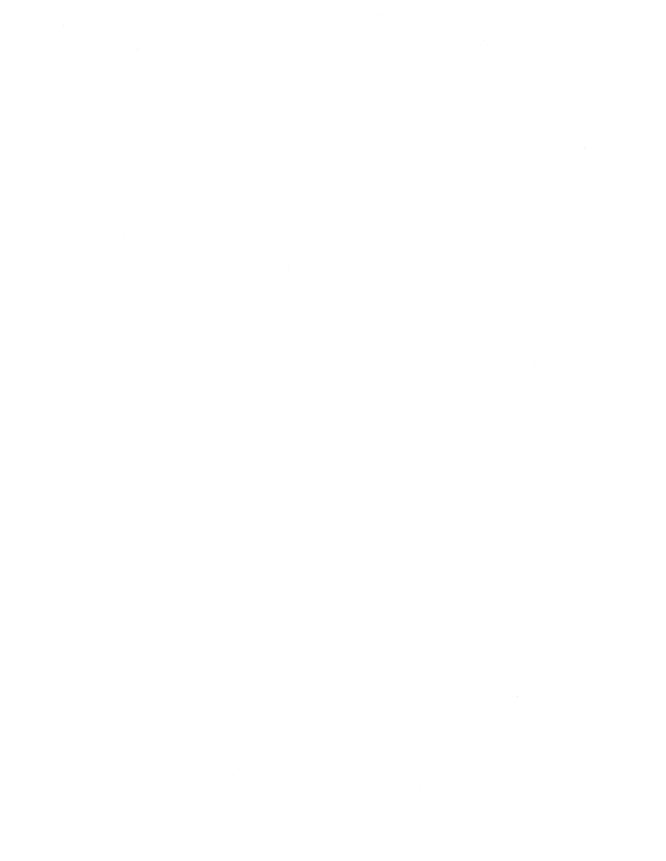


Fig.5 Typical values; per diode.

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

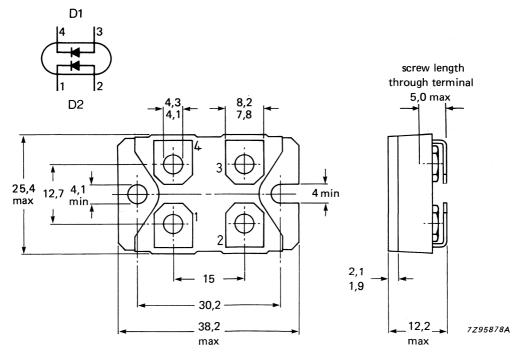
| | | PBYI | R 12035 | 40 | 45TV | |
|---------------------------------|-----------|------|---------|--------|------|-----|
| Repetitive peak reverse voltage | V_{RRM} | max. | 35 | 40 | 45 | \ \ |
| Average forward current | lF(AV) | max. | | 2 × 60 | | Α |
| Forward voltage | VF | < | | 0.67 | | V |
| Junction temperature | T_{j} | max. | | 150 | | оС |

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.

PBYR12035TV PBYR12040TV PBYR12045TV

RATINGS

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

| Voltages | | | PBYR12035 | 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) | | | 5 | | | |
| Average forward current square wave; $\delta = 0.5$; up to | | | | | | |
| $T_{mb} = 90 ^{\circ}C$ | I _{F(AV)} | max. | | 60 | | Α |
| RMS forward current | ^I F(RMS) | max. | | 85 | | Α |
| Repetitive peak forward current $t_p = 20 \mu s$; $\delta = 0.02$ | IFRM | max. | | 652 | | 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. | | 600 | | Α |
| t = 8.3 ms | IFSM | max. | | 720 | | Α |
| I^2 t for fusing (t = 10 ms) | l²t | max. | | 1800 | | A ² s |
| Reverse surge current | | | | | | |
| $t_p = 100 \ \mu s$ | ^I RSM | max. | | 2.0 | | Α |
| t _p = 2 μs | IRRM | max. | | 2.0 | | Α |
| Temperatures | | | | | | |
| Storage temperature | T _{stg} | | -40 to | +150 | | оС |
| Junction temperature | т _ј | max. | | 150 | | oC |
| ORDERING NOTE | | | 6.4 | ~ 2.6 | | |

6,35 (%")

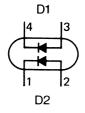
Faston terminal (x4)

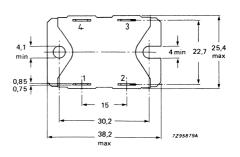
ORDERING NOTE

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.





20,7

9,1 8,9

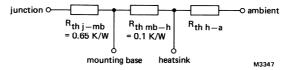
| THERMAL RESISTANCE | | | | |
|--|----------------------|--------------------------|------|-----|
| From junction to mounting base per diode | R _{th j-mb} | <u> </u> | 1.2 | K/W |
| From junction to mounting base total | R _{th j-mb} | = | 0.65 | K/W |
| From mounting base to heatsink with heatsink compound | R _{th mb-h} | = | 0.1 | K/W |
| CHARACTERISTICS (per diode) | | | | |
| Forward voltage | | | | |
| $I_F = 60 \text{ A}; T_j = 150 ^{\circ}\text{C}$ | VF | 1 < 1 | 0.67 | V* |
| $I_F = 120 \text{ A}; T_j = 25 ^{\circ}\text{C}$ | V _F | < 1 / 1 | 0.96 | V* |
| Reverse current | | | | |
| $V_R = V_{RWMmax}$; $T_j = 125 {}^{\circ}C$ | I _R | < | 150 | mΑ |
| $V_R = V_{RWMmax}$; $T_j = 25$ °C | I _R | $<$ $_{1}$ $_{2}$ $_{3}$ | 2.0 | mΑ |
| Capacitance at f = 1 MHz | | | | |
| $V_R = 5 V; T_i = 25 \text{ to } 125 ^{\circ}\text{C}$ | C _d | typ. | 2100 | рF |

^{*}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, $R_{th j-a} = R_{th j-mb} - R_{th mb-h} - R_{th h-a}$

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 (VRWM)

The total power dissipation in the diode has two components:

$$P_{tot} = P_R + P_F \dots 1$$
).

From the above it can be seen that:

$$R_{th\ h-a} = \frac{T_{jmax} - T_{amb}}{P_B + P_F} - (R_{th\ j-mb} + R_{th\ mb-h}) \dots 2).$$

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 PR and PF into equation 2) enables the calculation of the required heatsink.

To ensure thermal stability, $(R_{th\ j-mb} + R_{th\ mb-h} + R_{th\ h-a}) \times P_R$ must be less than 12 °C. If the calculated value of $R_{th\ h-a}$ does not permit this, then it must be reduced (heatsink size increased or $R_{th\ mb-h}$ improved) to enable this criterion to be met.

EXAMPLE: square-wave operation, using PBYR12035TV and heatsink compound;

$$T_{amb} = 40 \, {}^{\circ}\text{C}; \, \delta = 0.5; \, I_{F(AV)} = 30 \, A$$

V_{RWM} = 12 V; voltage grade of device = 35 V

From data, $R_{th j-mb} = 0.65 \text{ K/W}$ and $R_{th mb-h} = 0.1 \text{ K/W}$.

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:

$$R_{\text{th h-a}} = \frac{130 \text{ }^{\circ}\text{C} - 40 \text{ }^{\circ}\text{C}}{18 \text{ W} + 0.9 \text{ W}} - (0.65 + 0.1) = 3.6 \text{ K/W}$$

To check for thermal stability:

$$(R_{th j-a}) \times P_R = (0.65 + 0.1 + 3.6) \times 0.9 = 3.9 \, ^{o}C.$$

This is less than 12 °C, hence thermal stability is ensured.

SQUARE-WAVE OPERATION (Figs.3 and 4)

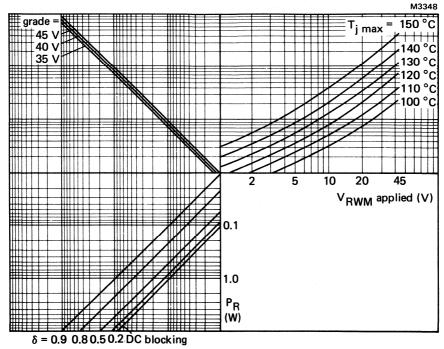
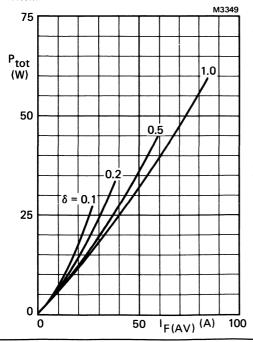


Fig.3 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and duty cycle; per diode.



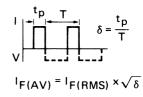


Fig.4 Foward current power rating; per diode.





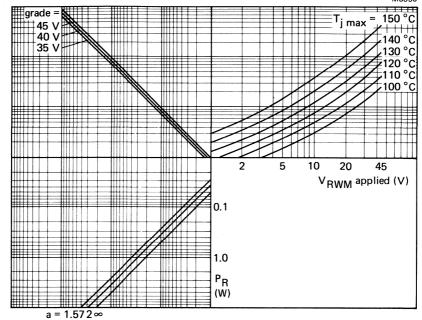


Fig.5 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and form factor; per diode.

 $a = form factor = I_F(RMS)/I_F(AV)$

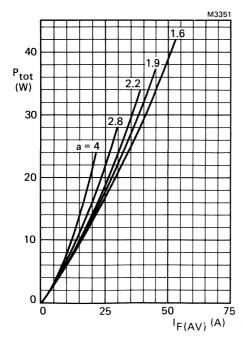


Fig.6 Foward current power rating; per diode.

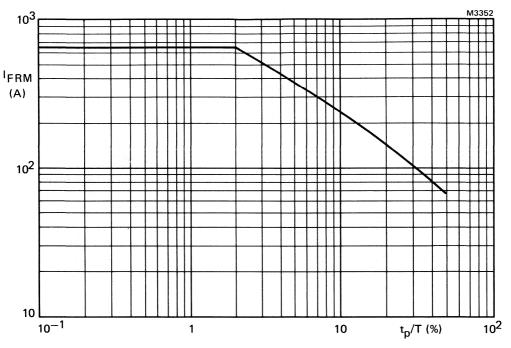
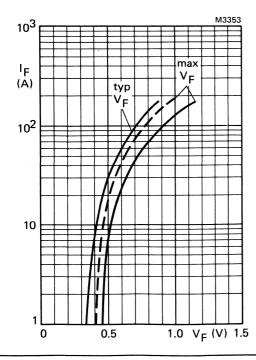
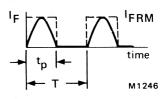


Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal currents for 1 $\mu s < t_p < 1$ ms; per diode.





Definition of $I_{\mbox{\scriptsize FRM}}$ and $t_p/T.$

Fig.8 Forward voltage; per diode; $T_j = 25 \, ^{\rm o}{\rm C}; ---T_j = 100 \, ^{\rm o}{\rm C}.$

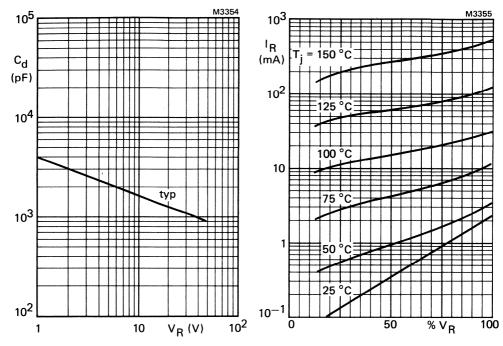


Fig.9 f = 1 MHz; T_j = 25 to 125 $^{\rm o}$ C; per diode.

Fig.10 Typical values; per diode.

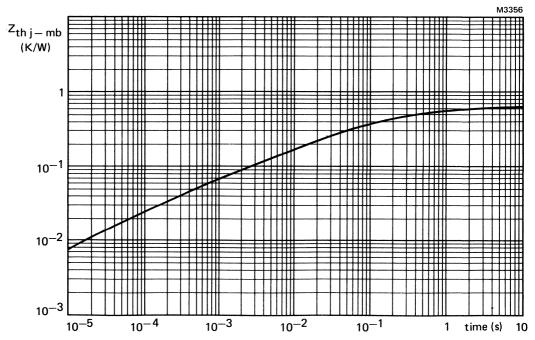


Fig.11 Transient thermal impedance; both diodes conducting.

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

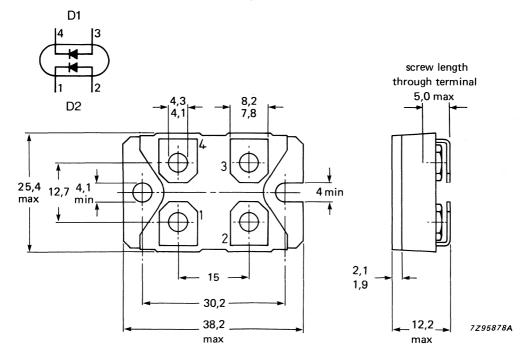
| | | PBYR | 16035 | 16040 | 16045TV | |
|---------------------------------|--------------------|------|-------|--------|---------|----|
| Repetitive peak reverse voltage | V_{RRM} | max. | 35 | 40 | 45 | V |
| Average forward current | I _{F(AV)} | max. | | 2 x 80 | | Α |
| Forward voltage | VF | < | | 0.69 | | V |
| Junction temperature | Тj | max. | | 150 | | οС |

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.

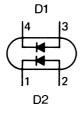
RATINGS

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

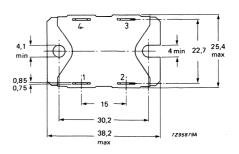
| Voltages | | PBY | R 16035 | 40 | 45TV | |
|---|--------------------|--------------------------------|---------|--------------------|------|--------|
| Repetitive peak reverse voltage | V _{RRM} | | 35 | 40 | 45 | V |
| Crest working reverse voltage | V_{RWM} | | 35 | 40 | 45 | V |
| Continuous reverse voltage | VR | | 35 | 40 | 45 | ٧ |
| Currents (per diode) | | | | | | |
| Average forward current square wave; $\delta = 0.5$; up to | | | | | | |
| $T_{mb} = 75 {}^{\circ}C$ | lF(AV) | max. | | 80 | | Α |
| sinusoidal; up to T _{mb} = 73 ^o C | ^I F(AV) | max. | | 70 | | Α |
| RMS forward current | IF(RMS) | max. | | 113 | | Α |
| Repetitive peak forward current | | | | | | |
| $t_p = 20 \ \mu s; \ \delta = 0.02$ | ^I FRM | max. | | 900 | | Α |
| 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 | | Α |
| t = 8.3 ms | IFSM | max. | | 1080 | | Α |
| I^2 t for fusing (t = 10 ms) | l²t | max. | | 4000 | | A^2s |
| Reverse surge current | | | | | | |
| $t_{p} = 100 \ \mu s$ | IRSM | max. | | 2.0 | | Α |
| $t_p = 2 \mu s$ | IRRM | max. | | 2.0 | | Α |
| Temperatures | | | | | | |
| Storage temperature | T _{stg} | | -40 to | o +150 | | оС |
| Junction temperature | Tj | max. | | 150 | | оС |
| ORDERING NOTE | | - | 6,4 | - Ø 2,6 2,5 | | |
| Types with Faston terminals are available on request (see Fig.2). | • | 6,35 (¼") Faston terminal (x4) | | • | 20.7 | |

Fig.2 SOT-227A.

Dimensions in mm.



Omit suffix V from the type number when ordering, e.g. PBYR16045T.



| THERMAL RESISTANCE | | | | |
|--|----------------------|---------------|------|-----|
| From junction to mounting base per diode | R _{th j-mb} | * | 1.1 | K/W |
| From junction to mounting base total | R _{th j-mb} | = 1 1 1 1 1 1 | 0.6 | K/W |
| From mounting base to heatsink with heatsink compound | R _{th} mb-h | | 0.1 | K/W |
| CHARACTERISTICS (per diode) | | | | |
| Forward voltage | | | | |
| $I_F = 80 \text{ A}; T_j = 150 ^{\circ}\text{C}$ | VF | < | 0.69 | V* |
| I _F = 160 A; T _j = 25 °C | VF | < | 1.0 | V* |
| Reverse current | | | | |
| $V_R = V_{RWMmax}$; $T_j = 125 {}^{\circ}C$ | I _R | < | 200 | mΑ |
| $V_R = V_{RWMmax}$; $T_j = 25$ °C | ^I R | < | 2.0 | mA |
| Capacitance at f = 1 MHz | | | | |
| $V_R = 5 V; T_j = 25 \text{ to } 125 ^{\circ}\text{C}$ | c _d | typ. | 2500 | рF |

^{*}Measured under pulse conditions to avoid excessive dissipation.

SQUARE-WAVE OPERATION (Figs.3 and 4)

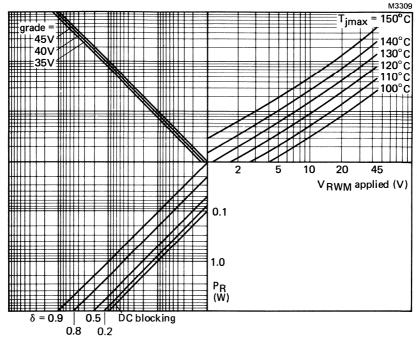
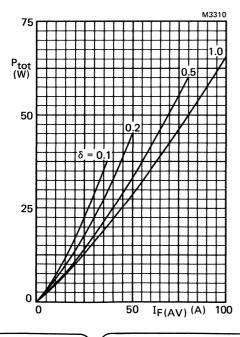


Fig.3 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_{jmax} . V_{RWM} applied, voltage grade and duty cycle; per diode.



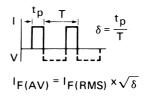


Fig.4 Forward current power rating; per diode.

SINE-WAVE OPERATION (Figs.5 and 6)

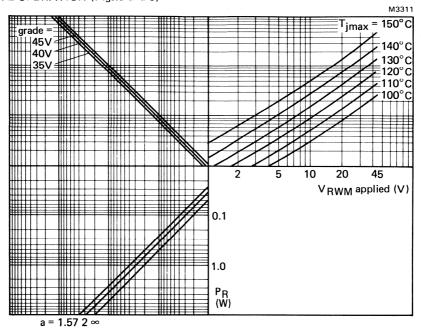


Fig.5 NOMOGRAM: for calculation of $P_{\hbox{\scriptsize R}}$ (reverse leakage power dissipation) for a given $T_{\hbox{\scriptsize jmax}}$. $V_{\hbox{\scriptsize RWM}}$ applied, voltage grade and form factor; per diode.

 $a = form factor = I_F(RMS)/I_F(AV)$.

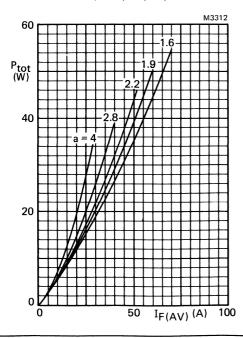


Fig.6 Forward current power rating; per diode.

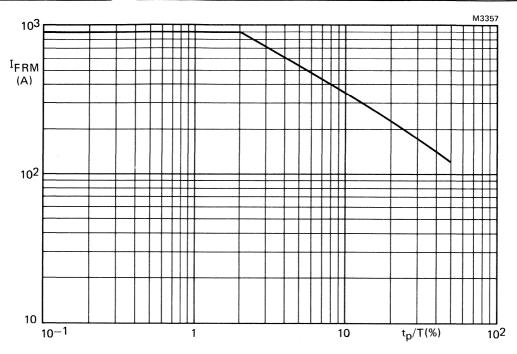
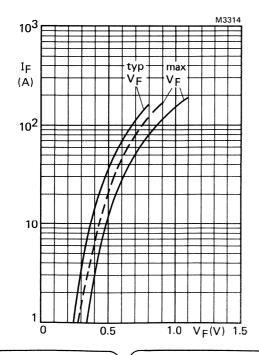
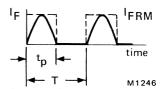


Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal current for 1 μ s < t $_p$ < 1 ms; per diode.

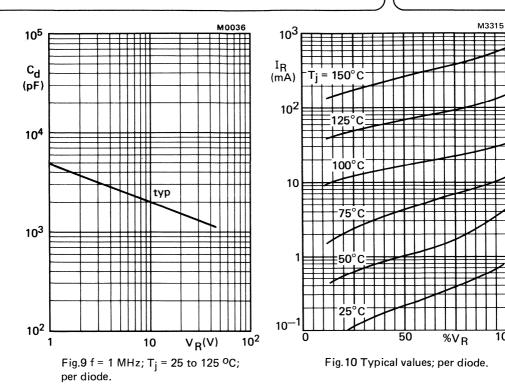




Definition of IFRM and t_p/T .

Fig.8 Forward voltage; per diode; $T_j = 25$ °C; $--T_j = 150$ °C.

100



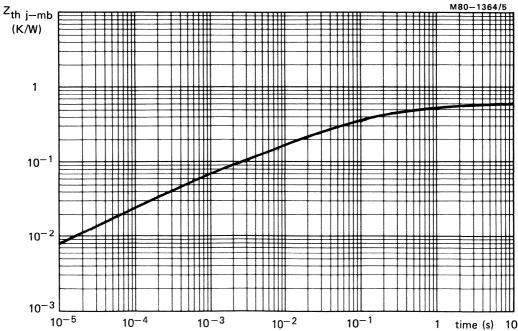


Fig.11 Transient thermal impedance; both diodes conducting.



This data sheet contains advance information and specifications are subject to change without notice.

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,

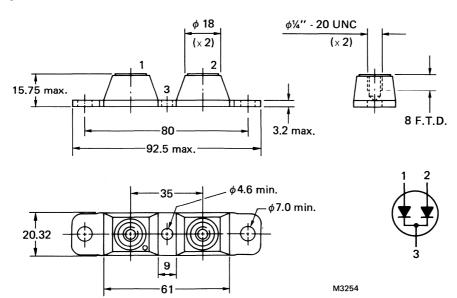
QUICK REFERENCE DATA

| | | | PBYR30035 | 40 | 45 CT | |
|---|----------------------------------|--------------|-----------|------|-------|--------|
| Repetitive peak reverse voltage | v_{RRM} | max. | 35 | 40 | 45 | ٧ |
| Output current (both diodes conducting) | lo | may | | 300 | | . ^ |
| Forward voltage | ι _Ο V _E | max. typ. | | 0.62 | | A V |
| Junction temperature | Τj | max. | | 150 | | оС |

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

Net mass: 73 q.

Mounting base torque:

35 — 46 kg cm

30 - 40 lb in

RATINGS

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

| Voltages (per diode) | | PBYR3 | 30035 | 40 | 45 CT | |
|--|----------------------------------|-------|----------|--------------|-------|--------|
| Repetitive peak reverse voltage | V_{RRM} | max. | 35 | 40 | 45 | V |
| Crest working reverse voltage | VRWM | max. | 35 | 40 | 45 | V |
| Continuous reverse voltage | VR | max. | 35 | 40 | 45 | V |
| Currents | | | | <u> </u> | | |
| Average forward current squarewave; δ = 0.5; up to T_{mb} = 100 o C (note 1) | | | | | | |
| per diode | IF(AV) | max. | | 150 | | A |
| per device | lo | max. | | 300 | | Α |
| Repetitive peak forward current per diode (note 1) $t_D = 20 \mu s$; $\delta = 0.02$ | ^I FRM | max. | : | 2500 | | Α |
| Non-repetitive peak forward current half sinewave; T _j = 125 °C prior to surge; with reapplied V _{RWM} max | | | | | | |
| t = 8.3 ms | IFSM | max. | : | 2500 | | Α |
| t = 10 ms | ^I FSM | max. | | 2000 | | Α |
| I ² t for fusing (t = 10 ms; per device) | l²t | max. | 20 | 0000 | | A^2s |
| Reverse surge current (per diode) | | | | | | |
| $t_p = 2 \mu s; \delta = 0.001$ | IRRM | max. | | 2.0 | | A |
| $t_p = 100 \mu s$ | IRSM | max. | | 2.0 | | Α |
| Temperatures | | | | | | |
| Storage temperature | T _{stg} | - | -65 to - | +175 | | oC |
| Junction temperature | Tj | max. | | 150 | | oC |
| CHARACTERISTICS (per diode) | | | | | | |
| Forward voltage (note 2) | | | | | | |
| I _F = 150 A; T _j = 150 °C I _F = 300 A; T _j = 125 °C | VF | < | | 0.66 | | V |
| $I_F = 300 \text{ A}; T_j = 125 ^{\circ}\text{C}$ | VF | typ. | | 0.77 | | V V |
| I _F = 150 A; T _j = 125 °C I _F = 150 A; T _j = 25 °C | V _F V _F | typ. | | 0.62 0.72 | | V |
| Reverse current | *F | | | 0., 2 | | • |
| | I _R | < | | 300 | | mA |
| $V_R = V_{RWM max}; T_j = 125 {}^{o}C$ $V_R = V_{RWM max}; T_j = 25 {}^{o}C$ | I _R | < | | 4.0 | | mΑ |
| THERMAL RESISTANCE | | | | | | |
| Junction to mounting-base (per diode) | R _{th j-mb} | < | | 0.4 | | K/W |

Notes

- 1. Assuming no reverse leakage losses.
- 2. Measured under pulse conditions to avoid excessive dissipation.



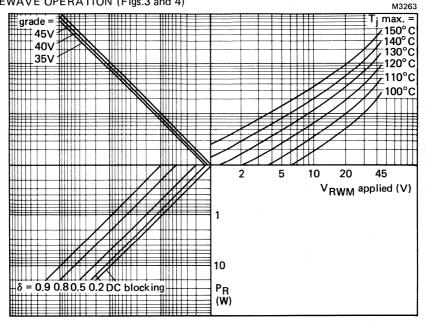
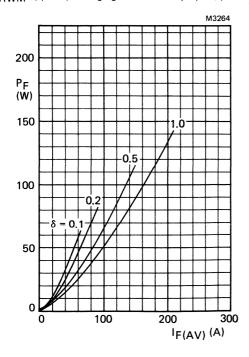


Fig.3 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and duty cycle; per diode.



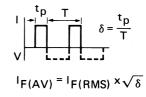


Fig.4 Forward current power rating; per diode.

SINUSOIDAL OPERATION (Figs.5 and 6)

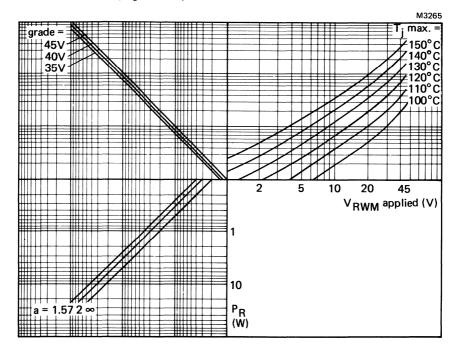


Fig.5 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and form factor; per diode. $a = form factor = I_F(RMS)/I_F(AV)$.

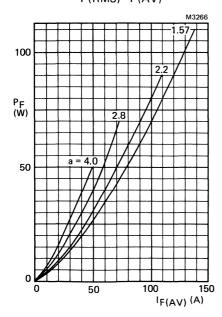


Fig.6 Forward current power rating, per diode.



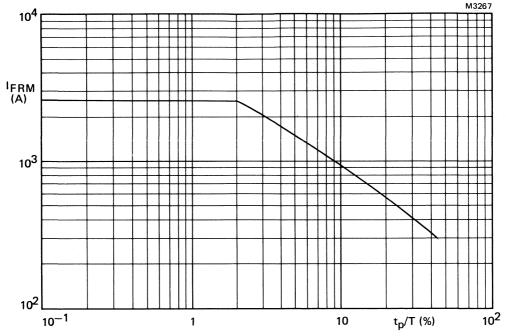
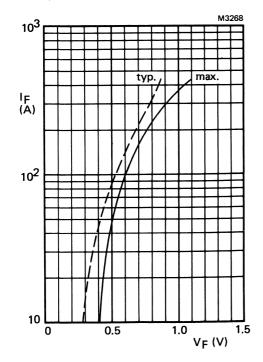
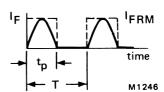


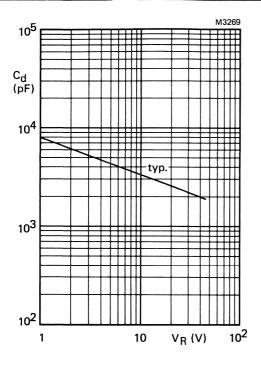
Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal current for 1 μ s < t $_p$ < 1 ms; per diode.





Definition of $I_{\mbox{\scriptsize FRM}}$ and $t_p/T.$

Fig.8 Forward voltage; per diode; —— $T_j = 25$ °C; —— $T_j = 125$ °C.



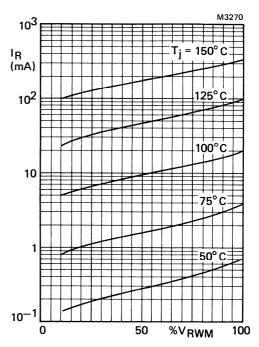


Fig.9 f = 1 MHz; T_j = 25 to 125 $^{\circ}$ C · per diode.

Fig.10 Typical values; per diode.

This data sheet contains advance information and specifications are subject to change without notice.

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.

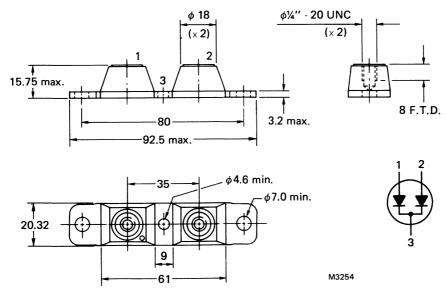
QUICK REFERENCE DATA

| | | | PBYR40035 | 40 | 45 CT | |
|---|----------------|------|-----------|------|-------|----------|
| Repetitive peak reverse voltage | V_{RRM} | max. | 35 | 40 | 45 | V |
| Output current (both diodes conducting) | 10 | max. | | 400 | | Α |
| Forward voltage | ٧ _F | typ. | | 0.58 | | V |
| Junction temperature | T_{j} | max. | | 150 | | oC |

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) | | PBYR | 40035 | 40 | 45 CT | |
|--|--|---------------|----------|------------------------------|-------|------------------|
| Repetitive peak reverse voltage | V_{RRM} | max. | 35 | 40 | 45 | V |
| Crest working reverse voltage | v_{RWM} | max. | 35 | 40 | 45 | ٧ |
| Continuous reverse voltage | ٧ _R | max. | 35 | 40 | 45 | V |
| Currents | | | | | | |
| Average forward current squarewave; δ = 0.5; up to T_{mb} = 85 °C (note 1) per diode per device | IF(AV) | max. max. | | 200 400 | | A |
| Repetitive peak forward current per diode (note 1) $t_p = 20 \mu s$; $\delta = 0.02$ | l _{FRM} | max. | ; | 3000 | | A |
| Non-repetitive peak forward current half sinewave; T _j = 125 °C prior to surge; with reapplied V _{RWM} max t = 8.3 ms t = 10 ms | I _{FSM} I _{FSM} | max. max. | | 3000 2500 | | A A |
| I ² t for fusing (t = 10 ms; per device) | l ² t | max. | | 1250 | | A ² s |
| Reverse surge current (per diode) | | | _ | | | |
| $t_p = 2 \mu s; \delta = 0.001$ $t_p = 100 \mu s$ | IRRM IRSM | max. max. | | 2.0 2.0 | | A A |
| Temperatures | | | | | | |
| Storage temperature | T_{stg} | - | -65 to - | +175 | | οС |
| Junction temperature | Tj | max. | | 150 | | oC |
| CHARACTERISTICS (per diode) | | | | | | |
| Forward voltage (note 2) $I_F = 200 \text{ A}; T_j = 150 \text{ °C}$ $I_F = 400 \text{ A}; T_j = 125 \text{ °C}$ $I_F = 200 \text{ A}; T_j = 125 \text{ °C}$ $I_F = 200 \text{ A}; T_j = 25 \text{ °C}$ Reverse current $V_R = V_{RWM\ max}; T_j = 125 \text{ °C}$ $V_R = V_{RWM\ max}; T_j = 25 \text{ °C}$ | V _F V _F V _F | < typ. typ. < | | 0.63 0.75 0.58 0.69 | | V V V |
| $V_R = V_{RWM max}; T_j = 25 {}^{\circ}C$ | ^I R | < | | 4.0 | | mA |
| THERMAL RESISTANCE | | | | | | |
| Junction to mounting-base (per diode) | R _{th j-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)

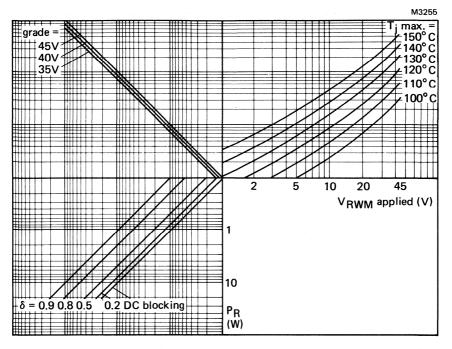
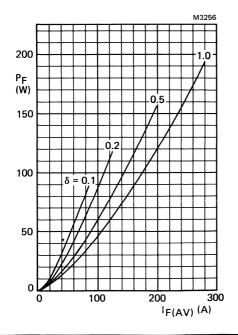


Fig.3 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and duty cycle; per diode.



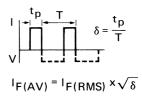


Fig.4 Forward current power rating; per diode.

SINUSOIDAL OPERATION (Figs.5 and 6)

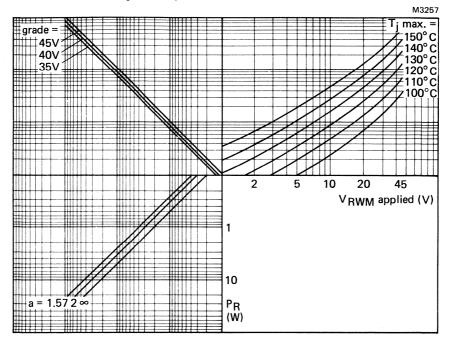


Fig.5 NOMOGRAM: for calculation of P_R (reverse leakage power dissipation) for a given T_j max., V_{RWM} applied, voltage grade and form factor; per diode. $a = form factor = I_F(RMS)/I_F(AV)$.

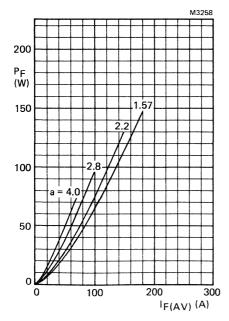


Fig.6 Forward current power rating; per diode.

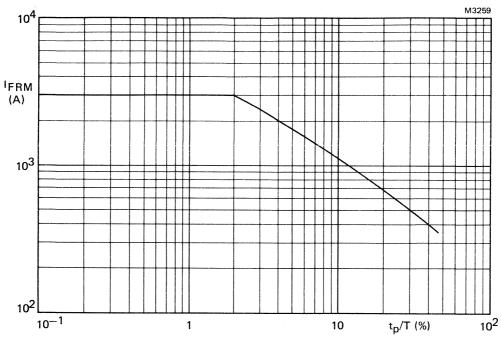
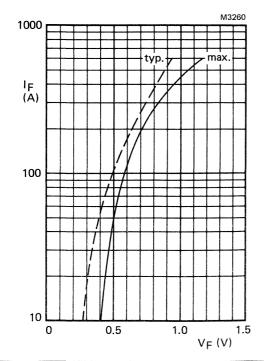
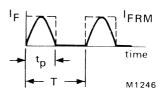


Fig.7 Maximum permissible repetitive peak forward current for either square or sinusoidal current for 1 μ s < t_p < 1 ms; per diode.





Definition of IFRM and $t_{\mbox{\footnotesize{p}}}/\mbox{\footnotesize{T}}.$

Fig.8 Forward voltage; per diode; —— $T_j = 25$ °C; — — $T_j = 125$ °C.

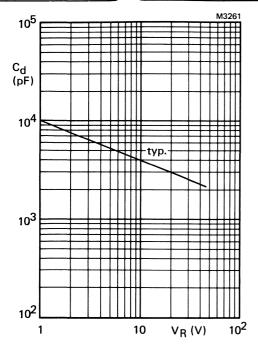


Fig.9 f = 1 MHz; T_j = 25 to 125 o C; per diode.

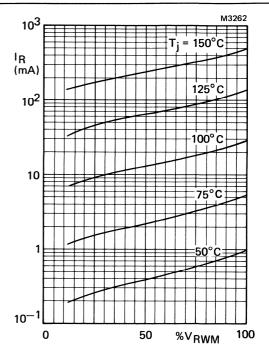


Fig.10 Typical values; per diode.

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 |
| 5635 9 b | mica washer (up to 1000 V) | TO-220 |
| 6359c | insulating bush (up to 800 V) | TO-220 |
| 66359d | rectangular insulating bush (up to 1000 V) | TO-220 |
| 6360a | rectangular washer | TO-220 |
| 6363 | spring clip (direct mounting) | TO-220, SOT-186 |
| 6364 | spring clip (insulated mounting) | TO-220 |
| 66367 | alumina insulator (up to 2000 V) | TO-220 |
| 6368b | insulating bush (up to 800 V) | SOT-93 |
| 66368c | mica insulator (up to 800 V) | SOT-93 |
| 6369 | mica insulator (up to 2000 V) | TO-220 |
| 66378 | mica insulator (up to 1500 V) | SOT-93 |
| 6379 | spring clip | SOT-93, SOT-199 |

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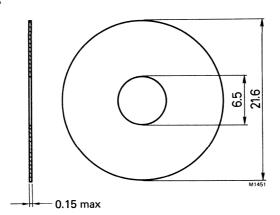
ACCESSORIES for DO-5 and TO-48

56264a

MICA WASHER

Insulator up to 2000 V

MECHANICAL DATA

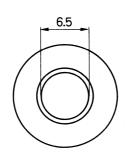


Dimensions in mm

56264b

INSULATING BUSH

MECHANICAL DATA



Dimensions in mm

THERMAL RESISTANCE

From mounting base to heatsink

with mica washer, without heatsink compound with mica washer, with heatsink compound

=

5 K/W 2.5 K/W

TEMPERATURE

Maximum allowable temperature

T_{max}

Rth mb-h

Rth mb-h

175

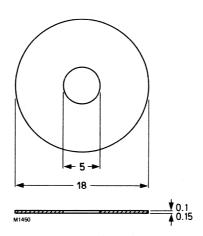
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56295a

MICA WASHER

Insulator up to 2 kV.

MECHANICAL DATA

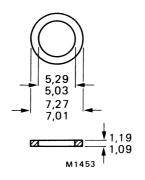


Dimensions in mm

56295b PTFE RING

MECHANICAL DATA

Dimensions in mm



THERMAL RESISTANCE

From mounting base to heatsink without heatsink compound with heatsink compound

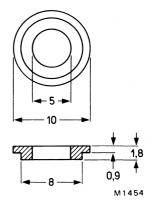
TEMPERATURE

Maximum allowable temperature

56295c INSULATING BUSH

MECHANICAL DATA

Dimensions in mm



| R _{th mb-h} R _{th mb-h} | = | 5 | K/W |
|--|---|-----|-----|
| | = | 2.5 | K/W |

 $T_{\text{max}} = 175$ °C

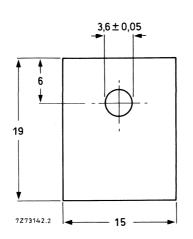
ACCESSORIES for TO-220

56359b

MICA WASHER

Insulator up to 1000 V.

MECHANICAL DATA



Dimensions in mm



2,7

56359c

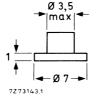
INSULATING BUSH

Insulator up to 800 V.

MECHANICAL DATA

Material: polyester

TEMPERATURE Maximum pemissible temperature



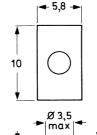
 $T_{max} = 150 \, {}^{o}C$

Dimensions in mm

RECTANGULAR INSULATING BUSH 56359d

Insulator up to 1000 V.

MECHANICAL DATA



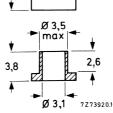
Ø 3,1

Dimensions in mm

TEMPERATURE

Maximum permissible temperature

 $T_{max} = 150 \, {}^{\circ}\text{C}$



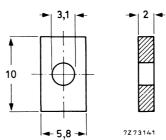
56360a

RECTANGULAR WASHER (For TO-220)

For direct and insulated mounting.

MECHANICAL DATA

Material: brass; nickel plated.



Dimensions in mm

56363

SPRING CLIP (For TO-220 and SOT-186)

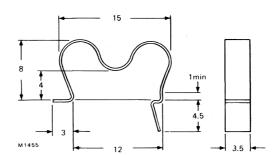
For direct mounting.

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)

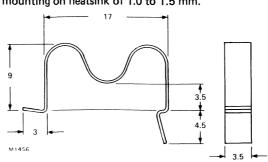
For insulated mounting.

MECHANICAL DATA

WEST WITH STATE OF THE

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).



Dimensions in mm

To be used in conjunction with insulators **56367** or **56369**

56367

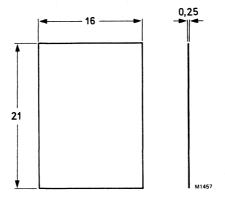
ALUMINA INSULATOR

For insulated clip mounting up to 2 kV.

MECHANICAL DATA

Material: 96-alumina.

Dimensions in mm



^{*}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

21 M1458

Dimensions in mm

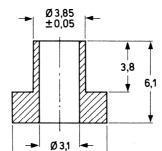
56368b

INSULATING BUSH

For insulated screw mounting up to 800 V.

MECHANICAL DATA

Material: polyester



7Z75331

Dimensions in mm

TEMPERATURE

Maximum permissible temperature

 $T_{max} = 150 \, {}^{\circ}\text{C}$

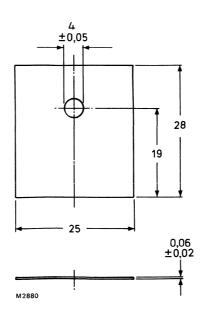
56368c

MICA INSULATOR

Ø7

For insulated screw mounting up to 800 V.

MECHANICAL DATA



Dimensions in mm

56369: see preceding page.

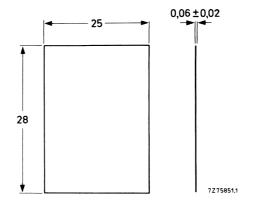
56378

MICA INSULATOR

For clip mounting up to 1500 V.

MECHANICAL DATA

Dimensions in mm



56379

SPRING CLIP

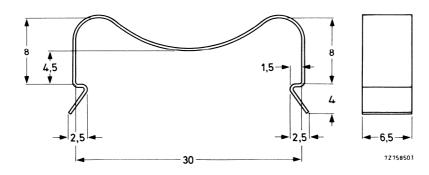
For direct and insulated mounting of SOT-93 envelopes and for direct mounting of SOT-199 envelopes.

MECHANICAL DATA

Dimensions in mm

Material:

CrNi steel NLN-939; thickness 0.4 ± 0.04.





MOUNTING INSTRUCTIONS 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-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-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)

MOUNTING INSTRUCTIONS TO-220

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 From mounting base to heatsink | type). | | ip inting | screw mounting | |
|---|--|----------------|--------------|-------------------|------------|
| with heatsink compound, direct mounting | R _{th mb-h} | = , | 0,3 | 0,5 | K/W |
| without heatsink compound, direct mounting | R _{th mb-h} | = | 1,4 | 1,4 | K/W |
| with heatsink compound and 0,1 mm maximum mica washer | R _{th mb-h} | = | 2,2 | _ | K/W |
| with heatsink compound and 0,25 mm maximum alumina insulator | R _{th mb-h} | = | 0,8 | | K/W |
| with heatsink compound and 0,05 mm mica washer insulated up to 500 V insulated up to 800 V/1000 V $$ | R _{th} mb-h R _{th} mb-h | = | · | 1,4 1,6 | K/W K/W |
| without heatsink compound and 0,05 mm mica washer insulated up to 500 V insulated up to 800 V/1000 V $$ | R _{th mb-h} R _{th mb-h} | = ¹ | | 3,0 4,5 | K/W 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 $_{j~max} \le 175$ °C, soldering temperature T $_{sld~max} = 275$ °C. Devices with T $_{j~max} \le 110$ °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 \leq 165 ^{o}C at a duration \leq 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.

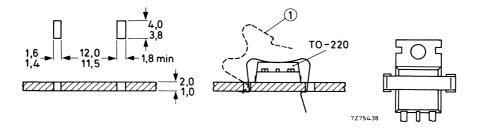


Fig. 1 Heatsink requirements.

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.

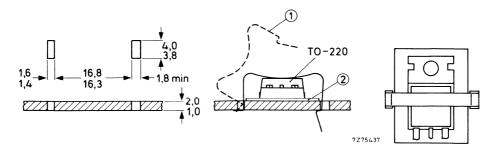


Fig. 3 Heatsink requirements.

Fig. 4 Mounting. (1) spring clip 56364. (2) insulator 56369 or 56367.

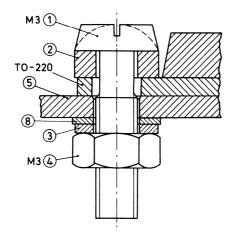
Fig.4a Position of device (top view).

INSTRUCTIONS FOR SCREW MOUNTING

Dimensions in mm

Direct mounting with screw and spacing washer

• through heatsink with nut



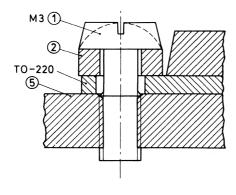
Ø 3,5 max 1,5 min 7269693.2

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



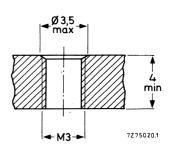


Fig. 7 Assembly.

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

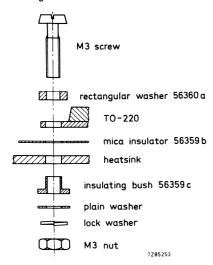


Fig. 9 Insulated screw mounting with rectangular washer. Known as a "bottom mounting".

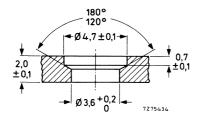


Fig. 10 Heatsink requirements for 500 V insulation.

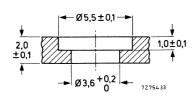


Fig. 11 Heatsink requirements for 800 V insulation.

• into tapped heatsink

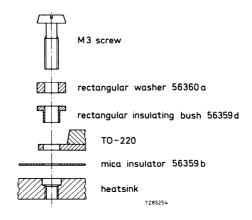


Fig. 12 Insulated screw mounting with rectangular washer into tapped heatsink. Known as a "top mounting".

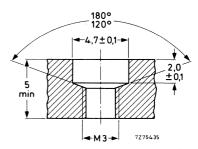


Fig. 13 Heatsink requirements for 500 V insulation.

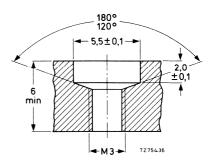


Fig. 14 Heatsink requirements for 1000 V insulation.

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 oxideloaded 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.

MOUNTING INSTRUCTIONS E-PACK

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 $^{\rm O}$ maximum. The minimum bending radius is 1mm.

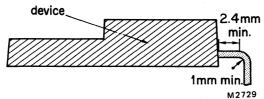


Fig.1 Lead bending of devices.

Soldering

Lead soldering temperature at >3mm from body for t_{sld} <5 seconds:

Devices with T_i max. ≤175 °C, T_{sld} max. = 275 °C.

Devices with T_i max. \leq 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).

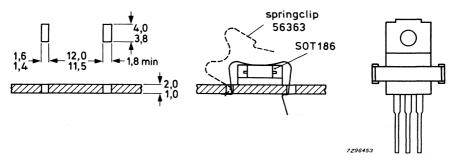


Fig.2 Heatsink requirements

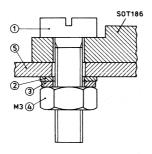
Fig.3 Mounting.

Fig.3a Position of device (top view).

INSTRUCTIONS FOR SCREW MOUNTING

Screw through heatsink with nut

Dimensions in mm



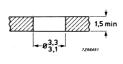
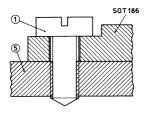


Fig.4 Assembly.

- (1) M3 screw
- (2) plain washer
- (3) lock washer
- (4) M3 nut
- (5) heatsink

Fig.5 Heatsink requirements.

Into tapped heatsink



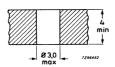


Fig.6 Assembly.

- (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.

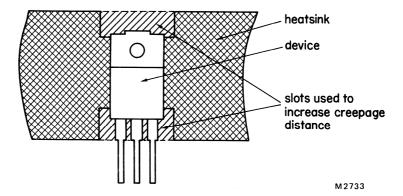


Fig.8 Slots formed in heatsink to increase creepage distance.

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-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 o | 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 $^{\rm OC}$ 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 $^{\rm oC}$ 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.

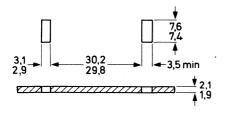
Thermal data

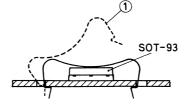
| (Typical figures, for exact figures see data for each device type | oe). | | clip untina | screw mounting | |
|--|--|---|----------------|-------------------|---------|
| Thermal resistance from mounting base to heatsink direct mounting with heatsink compound | R _{th mb-h} | = | 0,3 | 0,3 K/ | - /W |
| without heatsink compound | R _{th mb-h} | = | 1,5 | 0,8 K | /W |
| with 0,05 mm mica washer with heatsink compound without heatsink compound | R _{th mb-h} R _{th mb-h} | = | 0,8 3,0 | 0,8 K/ 2,2 K/ | |

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)).





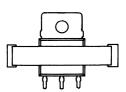


Fig. 1a Heatsink requirements.

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 200 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.

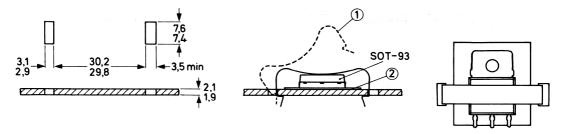
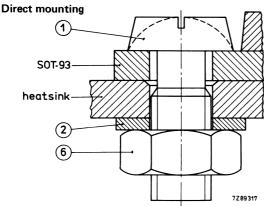


Fig. 2a Heatsink requirements.

Fig. 2b Mounting.

Fig. 2c Position (1) = spring clip 56379 of the device. (2) = insulator 56378

INSTRUCTIONS FOR SCREW MOUNTING



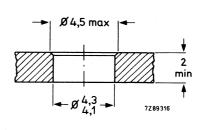


Fig. 3a Assembly through heatsink with nut.

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.

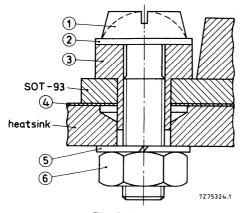


Fig. 4 Assembly. See also Fig. 9.

- (1) M3 screw
- (2) plain washer
- (3) insulating bush (56368b)
- (4) mica insulator (56368c)
- (5) lock washer
- (6) M3 nut

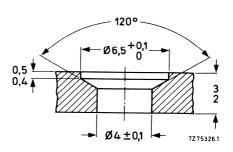


Fig. 5 Heatsink requirements up to 800 V insulation.

Insulated screw mounting with tapped hole; up to 800 V.

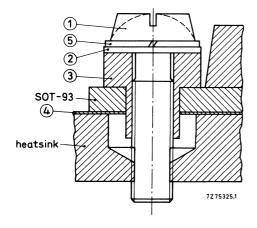


Fig. 6 Assembly. See also Fig. 9.

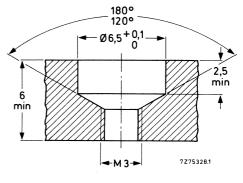


Fig. 7 Heatsink requirements up to 800 V insulation.

- (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

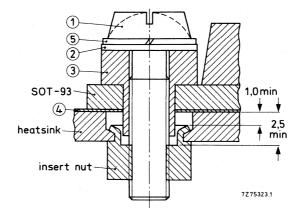


Fig. 8 Assembly and heatsink requirements for 500 V insulation. See also Fig. 3.

- (1) M3 screw
- (2) plain washer
- (3) insulating bush (56368b)
- (4) mica insulator (56368c)
- (5) lock washer

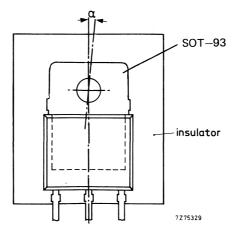


Fig. 9 Mica insulator.

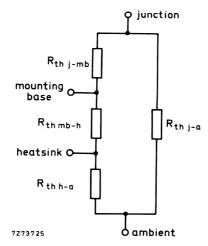
The axial deviation (α) between SOT-93 and mica should not exceed 5°.

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-mb}. The second is the contact thermal resistance R_{th mb-h} and finally there is the thermal resistance of the heatsink R_{th h-a}.

In the rating curves, the contact thermal resistance and heatsink thermal resistances are combined as a single figure - $R_{th\ mb-a}$.

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 $Z_{\text{th i-mb}}$ as a function of time is given in each data sheet.



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

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) Maximum torque (to avoid damaging device) 0.9 Nm (9 kg cm) 1.7 Nm (17 kg cm)

K/W

K/W

THERMAL DATA

The thermal resistance from mounting base to heatsink (Rth 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 56295a mica washer) without heatsink compound

Rth mb-h R_{th} mb-h 2.5

with heatsink compound

MOUNTING INSTRUCTIONS FOR UP TO 2000 V INSULATION

Using 56295c insulating bush and 56295a mica washer.

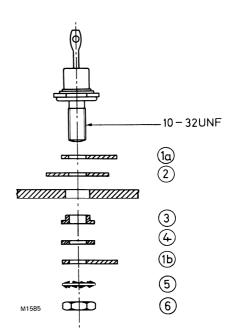


Fig.1 (1a);(1b) tag - alternative positions (2) mica washer 56295a (3)insulating bush 56295c (4)plain washer (may be omitted if tag used in position 1b) (5) toothed lock washer (supplied with device) (6)10-32 UNF nut (supplied with device)

MOUNTING INSTRUCTIONS DO-4; TO-64

MOUNTING INSTRUCTIONS FOR UP TO 2000 V INSULATION

Using insulating ring 56295b and two mica washers 56295a.

10 - 32UNF

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)
Maximum torque (to avoid damaging device)

1.7 Nm (17 kg cm) 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
with heatsink compound

 $R_{th mb-h} = 5$ K/W $R_{th mb-h} = 2.5$ K/W

MOUNTING INSTRUCTIONS FOR UP TO 2000 V INSULATION

Using insulating bush 56264b and mica washer 56264a.

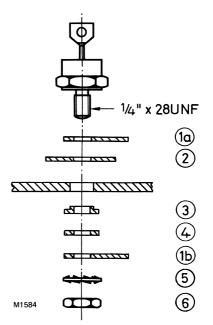


Fig.1
(1a); (1b) tag — alternative positions
(2) mica washer 56264a
(3) insulating bush 56264b

(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.

| Type no. | book | section | Type no. | book | section | Type no. | book | section |
|----------|---------|---------|----------|---------|------------|----------|---------|----------|
| BA220 | SC01 | SD | BAS28 | SC01/10 | SD/Mm | BAV45 | SC01 | Sp |
| BA221 | SC01 | SD | BAS29 | SC01/10 | SD/Mm | BAV70 | SC01/10 | SD/Mm |
| BA223 | SC01 | T | BAS31 | SC01/10 | SD/Mm | BAV74 | SC01 | SD |
| BA281 | SC01 | SD | BAS32 | SC01/10 | SD/Mm | BAV99 | SC01/10 | SD/Mm |
| BA314 | SC01 | Vrg | BAS32L | SC01/10 | SD/Mm | BAV100 | SC01/10 | SD/Mm |
| BA315 | SC01 | Vrg | BAS35 | SC01/10 | SD/Mm | BAV101 | SC01/10 | SD/Mm |
| BA316 | SC01 | SD | BAS45 | SC01 | SD | BAV102 | SC01/10 | SD/Mm |
| BA317 | SC01 | SD | BAS45L | SC01/10 | SD/Mm | BAV103 | SC01/10 | SD/Mm |
| BA318 | SC01 | SD | BAS56 | SC01/10 | SD/Mm | BAV105 | SC01/10 | SD/Mm |
| BA423 | SC01 | T | BAS85 | SC01 | SD | BAW56 | SC01/10 | SD/Mm |
| BA423L | SC01 | Т | BAT17 | SC01/10 | T/Mm | BAW62 | SC01 | SD |
| BA480 | SC01 | T | BAT18 | SC01/10 | T/Mm | BAX12 | SC01 | SD |
| BA481 | SC01 | T | BAT54 | SC01/10 | SD/Mm | BAX14 | SC01 | SD |
| BA482 | SC01 | T | BAT74 | SC01/10 | SD/Mm | BAX18 | SC01 | SD |
| BA483 | SC01 | Т | BAT81 | SC01 | T " | BAY80 | SC01 | SD |
| BA484 | SC01 | т | BAT82 | SC01 | Т | BB112 | SC01 | Т |
| BA682 | SC01/10 | T/Mm | BAT83 | SC01 | Т | BB119 | SC01 | T |
| BA683 | SC01/10 | T/Mm | BAT85 | SC01 | T | BB130 | SC01 | T |
| BAS11 | SC01 | SD | BAT86 | SC01 | T | BB204B | SC01 | T |
| BAS15 | SC01 | SD | BAV10 | SC01 | SD | BB204G | SC01 | T |
| BAS16 | SC01/10 | SD/Mm | BAV18 | SC01 | SD | BB212 | SC01 | T |
| BAS17 | SC01/10 | • | BAV19 | SC01 | SD | BB215 | SC01/10 | SD/Mm |
| BAS19 | | SD/Mm | BAV20 | SC01 | SD | BB219 | SC01/10 | SD/Mm |
| BAS20 | | SD/Mm | BAV21 | SC01 | SD | BB240 | SC01/10 | T/Mm |
| BAS21 | | SD/Mm | BAV23 | SC01/10 | | BB241 | SC01/10 | |

Key to handbook sections

PM = PowerMOS transistors

= Rectifier diodes

| Key 1 | :O I | andbook sections | | | |
|-------|------|---------------------------------|-----|---|-----------------------------|
| Α | = | Accessories | SEN | = | Semiconductor sensors |
| FET | = | Field-effect transistors | SD | = | Small-signal diodes |
| 1 | = | Infrared devices | Sm | = | Small-signal transistors |
| LED | = | Light-emitting diodes | Sp | = | Special diodes |
| LCD | = | Liquid crystal displays | SP | = | Low-frequency switching |
| Mm | = | Surface-mounted devices | | | power diodes |
| M | = | Microwave transistors | St | = | Rectifier stacks |
| Р | = | Low-frequency power transistors | T | = | Tuner diodes |
| | | and modules | Th | = | Thyristors |
| PDT | = | Photodiodes or transistors | Tri | = | Triacs |
| Ph | = | Photoconductive devices | TS | = | Transient suppressor diodes |
| PhC | = | Photocouplers | Vrf | = | Voltage reference diodes |
| | | | | | |

RFP = RF power transistors and modules transistors
RT = Triplers
WBM = Wideband hybrid IC modules

Vrg = Voltage regulator diodes WBT = Wideband hybrid IC

^{*} series.

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|----------|---------|---------|-----------|------|---------|-----------|------|---------|
| Type no. | book | section | Type no. | book | section | Type no. | book | section |
| BB405B | SC01 | T | BC557 | SC04 | Sm | ВСР69 | SC10 | Mm |
| BB417 | SC01 | T | BC558 | SC04 | Sm | BCV26 | SC10 | Mm |
| BB804 | SC01/10 | | BC559 | SC04 | Sm | BCV27 | SC10 | Mm |
| BB809 | SC01 | T | BC560 | SC04 | Sm | BCV28 | SC10 | Mm |
| BB909A | SC01 | Ť | BC635 | SC04 | Sm | BCV29 | SC10 | Mm |
| BBOOK | 0001 | • | 00003 | 3004 | Oill | D0123 | 3010 | IVIIII |
| BB909B | SC01 | T | BC636 | SC04 | Sm | BCV46 | SC10 | Mm |
| BB910 | SC01 | T | BC637 | SC04 | Sm | BCV47 | SC10 | Mm |
| BB911 | SC01 | T | BC638 | SC04 | Sm | BCV48 | SC10 | Mm |
| BBY31 | SC01/10 | | BC639 | SC04 | Sm | BCV49 | SC10 | Mm |
| BBY39 | SC01 | Τ | BC640 | SC04 | Sm | BCV61 | SC10 | Mm |
| | | | | | | | | |
| BBY40 | SC01/10 | | BC807 | SC10 | Mm | BCV62 | SC10 | Mm |
| BBY42 | SC01 | T | BC808 | SC10 | Mm | BCV63 | SC10 | Mm |
| BBY62 | SC01 | T | BC817 | SC10 | Mm | BCV64 | SC10 | Mm |
| BC107 | SC04 | Sm | BC818 | SC10 | Mm | BCV65 | SC10 | Mm |
| BC108 | SC04 | Sm | BC846 | SC10 | Mm | BCV71 | SC10 | Mm |
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| BC109 | SC04 | Sm | BC847 | SC10 | Mm | BCV71R | SC10 | Mm |
| BC140 | SC04 | Sm | BC848 | SC10 | Mm | BCV72 | SC10 | Mm |
| BC141 | SC04 | Sm | BC849 | SC10 | Mm | BCV72R | SC10 | Mm |
| BC160 | SC04 | Sm | BC850 | SC10 | Mm | BCW29 | SC10 | Mm |
| BC161 | SC04 | Sm | BC856 | SC10 | Mm | BCW29R | SC10 | Mm |
| 20177 | | | | | | | | |
| BC177 | SC04 | Sm | BC857 | SC10 | Mm | BCW30 | SC10 | Mm |
| BC178 | SC04 | Sm | BC858 | SC10 | Mm | BCW30R | SC10 | Mm |
| BC179 | SC04 | Sm | BC859 | SC10 | Mm | BCW31 | SC10 | Mm |
| BC264A | SC07 | FET | BC860 | SC10 | Mm | BCW31R | SC10 | Mm |
| BC264B | SC07 | FET | BC868 | SC10 | Mm | BCW32 | SC10 | Mm |
| DC34CC | 0.007 | FFT | D C C C C | 0010 | | D CLAYOOD | 0010 | |
| BC246C | SC07 | FET | BC869 | SC10 | Mm | BCW32R | SC10 | Mm |
| BC264D | SC07 | FET | BCF29 | SC10 | Mm | BCW33 | SC10 | Mm |
| BC327 | SC04 | Sm | BCF29R | SC10 | Mm | BCW33R | SC10 | Mm |
| BC327A | SC04 | Sm | BCF30 | SC10 | Mm | BCW60* | SC10 | Mm |
| BC328 | SC04 | Sm | BCF30R | SC10 | Mm | BCW61* | SC10 | Mm |
| BC337 | SC04 | C | BCF32 | SC10 | | D CM/CO | 0010 | 14 |
| E . | | Sm | | | Mm | BCW69 | SC10 | Mm |
| BC337A | SC04 | Sm | BCF32R | SC10 | Mm | BCW69R | SC10 | Mm |
| BC338 | SC04 | Sm | BCF33 | SC10 | Mm | BCW70 | SC10 | Mm |
| BC368 | SC04 | Sm | BCF33R | SC10 | Mm | BCW70R | SC10 | Mm |
| BC369 | SC04 | Sm | BCF70 | SC10 | Mm | BCW71 | SC10 | Mm |
| BC375 | SC04 | Sm | BCF70R | SC10 | Mm | BCW71R | SC10 | Mm |
| BC376 | | ^ | 20504 | 0010 | | | 00.0 | |
| | SC04 | Sm C | BCF81 | SC10 | Mm | BCW/2 | SC10 | Mm |
| BC516 | SC04 | Sm | BCF81R | SC10 | Mm | BCW72R | SC10 | Mm |
| BC517 | SC04 | Sm | BCP51 | SC10 | Mm | BCW81 | SC10 | Mm |
| BC546 | SC04 | Sm | BCP52 | SC10 | Mm | BCW81R | SC10 | Mm |
| BC547 | SC04 | Sm | BCP53 | SC10 | Mm | BCW89 | SC10 | Mm |
| BC548 | SC04 | Sm | BCP54 | SC10 | Mm | BCW89R | SC10 | Mm |
| BC549 | | | 1 | | | l l | | |
| | SC04 | Sm | BCP55 | SC10 | Mm | BCX17 | SC10 | Mm |
| BC550 | SC04 | Sm | BCP56 | SC10 | Mm | BCX17R | SC10 | Mm |
| BC556 | SC04 | Sm | BCP68 | SC10 | Mm | BCX18 | SC10 | Mm |

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| BCX18R | SC10 | Mm | BD204F | SC05 | Р | BD337 | SC05 | Р |
| BCX19 | SC10 | Mm | BD226 | SC05 | Р | BD338 | SC05 | Р |
| BCX19R | SC10 | Mm | BD227 | SC05 | Р | BD433 | SC05 | Р |
| BCX20 | SC10 | Mm | BD228 | SC05 | P | BD434 | SC05 | P |
| | | | | | | | | P |
| BCX20R | SC10 | Mm | BD229 | SC05 | P ' ' | BD435 | SC05 | r |
| BCX51 | SC10 | Mm | BD230 | SC05 | Р | BD436 | SC05 | P |
| BCX52 | SC10 | Mm | BD231 | SC05 | Р | BD437 | SC05 | Р |
| BCX53 | SC10 | Mm | BD233 | SC05 | Р | BD438 | SC05 | Р |
| BCX54 | SC10 | Mm | BD234 | SC05 | Р | BD643 | SC05 | P |
| BCX55 | SC10 | Mm | BD235 | SC05 | P | BD643F | SC05 | P |
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| BCX56 | SC10 | Mm | BD236 | SC05 | Р | BD644 | SC05 | Р |
| BCX58 | SC04 | Sm | BD237 | SC05 | Р | BD644F | SC05 | Р |
| BCX59 | SC04 | Sm | BD238 | SC05 | Р | BD645 | SC05 | Р |
| BCX70* | SC10 | Mm | BD239 | SC05 | Р | BD645F | SC05 | Р |
| BCX71* | SC10 | Mm | BD239A | SC05 | P | BD646 | SC05 | Р |
| BCX78 | SC04 | Sm | BD239B | SC05 | Р | BD646F | SC05 | Р |
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| BCX79 | SC04 | Sm | BD239C | SC05 | P | BD647 | SC05 | P |
| BCY56 | SC04 | Sm | BD240 | SC05 | Р | BD647F | SC05 | Р |
| BCY57 | SC04 | Sm | BD240A | SC05 | Р | BD648 | SC05 | Р |
| BCY58 | SC04 | Sm | BD240B | SC05 | Р | BD648F | SC05 | Р |
| BCY59 | SC04 | Sm | BD240C | SC05 | Р | BD649 | SC05 | Р |
| BCY65 | SC04 | Sm | BD241 | SC05 | Р | BD649F | SC05 | P |
| | | | 1 | SC05 | | BD650 | SC05 | |
| BCY70 | SC04 | Sm | BD241A | | P | | | P |
| BCY71 | SC04 | Sm | BD241B | SC05 | P | BD650F | SC05 | Р |
| BCY72 | SC04 | Sm | BD241C | SC05 | Р | BD651 | SC05 | Р |
| BCY78 | SC04 | Sm | BD242 | SC05 | Р | BD651F | SC05 | Р |
| BCY79 | SC04 | Sm | BD242A | SC05 | Р | BD652 | SC05 | Р |
| BCY87 | SC04 | Sm | BD242B | SC05 | P | BD652F | SC05 | Р |
| | | | ı | | | 1 | SC05 | |
| BCY88 | SC04 | Sm | BD242C | SC05 | P | BD675 | | Р |
| BCY89 | SC04 | Sm | BD243 | SC05 | P | BD676 | SC05 | P |
| BD131 | SC05 | Р | BD243A | SC05 | Р | BD677 | SC05 | P |
| BD132 | SC05 | Р | BD243B | SC05 | Р | BD678 | SC05 | Р |
| BD135 | SC05 | Р | BD243C | SC05 | P | BD679 | SC05 | Р |
| BD136 | SC05 | Р | BD244 | SC05 | P | BD680 | SC05 | P |
| BD137 | SC05 | P | BD244A | SC05 | P | BD681 | SC05 | P |
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| BD138 | SC05 | P | BD244B | SC05 | Р | BD682 | SC05 | Р |
| BD139 | SC05 | Р | BD244C | SC05 | Р | BD683 | SC05 | Р |
| BD140 | SC05 | Р | BD329 | SC05 | P | BD684 | SC05 | Р |
| BD201 | SC05 | Р | BD330 | SC05 | Р | BD719 | SC05 | Р |
| BD201F | SC05 | Р | BD331 | SC05 | P | BD720 | SC05 | Р |
| PD 202 | SC05 | D | BD332 | COUL | D . | PD721 | e cor | D |
| BD202 | | P | | SC05 | P | BD721 | SC05 | P |
| BD202F | SC05 | P | BD333 | SC05 | P | BD722 | SC05 | P |
| BD203 | SC05 | Р | BD334 | SC05 | Р | BD723 | SC05 | Р |
| BD203F | SC05 | Р | BD335 | SC05 | Р | BD724 | SC05 | Р |
| DDLOOI | SC05 | P | BD336 | SC05 | Р | BD725 | SC05 | Р |

| Tuno no | book | section | Tuna na | book | | T | haal. | |
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| Type no. | | | Type no. | book | section | Type no. | book | section |
| BD726 | SC05 | P | BD949 | SC05 | P | BDT32AF | SC05 | P |
| BD825 | SC05 | P | BD949F | SC05 | P | BDT32B | SC05 | P |
| BD826 | SC05 | P | BD950 | SC05 | P | BDT32BF | SC05 | P |
| BD827 | SC05 | Р | BD950F | SC05 | Р | BDT32C | SC05 | Р |
| BD828 | SC05 | Р | BD951 | SC05 | Р | BDT32CF | SC05 | P |
| BD020 | CCOE | n | DD0C1E | CCOF | В | DDTOOD | 0.005 | |
| BD829 | SC05 | P | BD951F | SC05 | P | BDT32D | SC05 | P |
| BD830 | SC05 | P | BD952 | SC05 | P | BDT32DF | SC05 | P |
| BD839 | SC05 | P | BD952F | SC05 | Р | BDT41A | SC05 | Р |
| BD840 | SC05 | Р | BD953 | SC05 | Р | BDT41AF | SC05 | Р |
| BD841 | SC05 | P | BD953F | SC05 | P | BDT41B | SC05 | P |
| BD842 | SC05 | Р | BD954 | SC05 | Р | BDT41BF | SC05 | Р |
| BD843 | SC05 | P | BD954F | SC05 | Р | BDT41C | SC05 | P |
| BD844 | SC05 | P | BD955 | SC05 | P | BDT41CF | SC05 | P |
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| BD933 | SC05 | P | BD955F | SC05 | P | BDT42 | SC05 | P |
| BD933F | SC05 | Р | BD956 | SC05 | Р | BDT42F | SC05 | P |
| BD934 | SC05 | Р | BD956F | SC05 | P | BDT42A | SC05 | Р |
| BD934F | SC05 | P | BDT29 | SC05 | P | BDT42AF | SC05 | Р |
| BD935 | SC05 | Р | BDT29F | SC05 | Р : | BDT42B | SC05 | Р |
| BD935F | SC05 | P | BDT29A | SC05 | P | BDT42BF | SC05 | Р |
| BD936 | SC05 | P | BDT29AF | SC05 | P | BDT42C | SC05 | P |
| DD350 | 3003 | • | DDTZJAI | 3003 | | BD1420 | 3003 | r |
| BD936F | SC05 | Р | BDT29B | SC05 | Р | BDT42CF | SC05 | Р |
| BD937 | SC05 | Р | BDT29BF | SC05 | Ρ . | BDT60 | SC05 | P |
| BD937F | SC05 | P. | BDT29C | SC05 | Ρ . | BDT60F | SC05 | Р |
| BD938 | SC05 | Р | BDT29CF | SC05 | Р | BDT60A | SC05 | Р |
| BD938F | SC05 | Р | BDT30 | SC05 | P | BDT60AF | SC05 | Р |
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| BD939 | SC05 | P | BDT30F | SC05 | P | BDT60B | SC05 | P |
| BD939F | SC05 | P | BDT30A | SC05 | P | BDT60BF | SC05 | P |
| BD940 | SC05 | P | BDT30AF | SC05 | P | BDT60C | SC05 | Р |
| BD940F | SC05 | P | BDT30B | SC05 | P | BDT60CF | SC05 | P |
| BD941 | SC05 | Р | BDT30BF | SC05 | P | BDT61 | SC05 | Р |
| BD941F | SC05 | Р . | BDT30C | SC05 | Р | BDT61F | SC05 | Р |
| BD942 | SC05 | P | BDT30CF | SC05 | P | BDT61A | SC05 | P |
| BD942F | SC05 | P | BDT31 | SC05 | P | BDT61AF | SC05 | P |
| BD943 | SC05 | P | | | | | | |
| 1 | | | BDT31F | SC05 | P | BDT61B | SC05 | P |
| BD943F | SC05 | Р | BDT31A | SC05 | Р | BDT61BF | SC05 | Р |
| BD944 | SC05 | Р | BDT31AF | SC05 | Р | BDT61C | SC05 | P |
| BD944F | SC05 | Р | BDT31B | SC05 | Р | BDT61CF | SC05 | P |
| BD945 | SC05 | P | BDT31BF | SC05 | P | BDT62 | SC05 | P |
| BD945F | SC05 | Р | BDT31C | SC05 | P | BDT62F | SC05 | P |
| BD946 | SC05 | Р | BDT31CF | SC05 | Р | BDT62A | SC05 | Р |
| DDOMEE | CCOF | n | DDT21D | 000= | | DDTCOAF | 0.00= | |
| BD946F | SC05 | P | BDT31D | SC05 | P | BDT62AF | SC05 | P |
| BD947 | SC05 | P | BDT31DF | SC05 | Р | BDT62B | SC05 | P |
| BD947F | SC05 | Р | BDT32 | SC05 | Ρ | BDT62BF | SC05 | P |
| BD948 | SC05 | Р | BDT32F | SC05 | Р | BDT62C | SC05 | Р |
| BD948F | | | BDT32A | SC05 | Р . | BDT62CF | SC05 | |

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| BDT63 | SC05 | Р | BDT93F | SC05 | P | BDX63C | SC05 | Р |
| BDT63F | SC05 | P | BDT94 | SC05 | Р | BDX64 | SC05 | P |
| BDT63A | SC05 | P | BDT94F | SC05 | Р | BDX64A | SC05 | Р |
| BDT63AF | SC05 | Р | BDT95 | SC05 | P · | BDX64B | SC05 | P |
| BDT63B | SC05 | P | BDT95F | SC05 | P | BDX64C | SC05 | P |
| BD 103B | 3600 | Г | ו מסו שטר | 3000 | г | DDA04C | 3003 | F |
| BDT63BF | SC05 | P · | BDT96 | SC05 | P | BDX65 | SC05 | Р |
| BDT63C | SC05 | P | BDT96F | SC05 | P | BDX65A | SC05 | P |
| BDT63CF | SC05 | P | BDV64 | SC05 | P | BDX65B | SC05 | Р |
| BDT64 | SC05 | P | BDV64A | SC05 | Р | BDX65C | SC05 | P |
| BDT64F | SC05 | P | BDV64B | SC05 | P | BDX66 | SC05 | Р |
| BDT64A | SC05 | P | BDV64C | SC05 | Р | BDX66A | SC05 | Р |
| BDT64AF | | P | BDV65 | | P | | | P |
| | SC05 | | 1 | SC05 | | BDX66B | SC05 | |
| BDT64B | SC05 | P | BDV65A | SC05 | P : | BDX66C | SC05 | P |
| BDT64BF | SC05 | P | BDV65B | SC05 | Р | BDX67 | SC05 | Р |
| BDT64C | SC05 | Р | BDV65C | SC05 | Р | BDX67A | SC05 | Р |
| BDT64CF | SC05 | Р | BDV66A | SC05 | Р | BDX67B | SC05 | Р |
| BDT65 | SC05 | Р | BDV66B | SC05 | P . | BDX67C | SC05 | Р |
| BDT65F | SC05 | P | BDV66C | SC05 | P | BDX68 | SC05 | P |
| BDT65A | SC05 | P | BDV66D | SC05 | P | BDX68A | SC05 | P |
| | | | ı | | | I . | | |
| BDT65AF | SC05 | Р | BDV67A | SC05 | Р | BDX68B | SC05 | Р |
| BDT65B | SC05 | Р | BDV67B | SC05 | Р | BDX68C | SC05 | Р |
| BDT65BF | SC05 | P | BDV67C | SC05 | Р | BDX69 | SC05 | Р |
| BDT65C | SC05 | Р | BDV67D | SC05 | Р | BDX69A | SC05 | P |
| BDT65CF | SC05 | P | BDV91 | SC05 | Р | BDX69B | SC05 | Р |
| BDT81 | SC05 | P | BDV92 | SC05 | P | BDX69C | SC05 | P |
| BDT81F | CCOF | Р | BDV93 | SC05 | Р | DDV77 | SC05 | Р |
| | SC05 | | | | | BDX77 | | |
| BDT82 | SC05 | P | BDV94 | SC05 | P | BDX77F | SC05 | Р |
| BDT82F | SC05 | Р | BDV95 | SC05 | P | BDX78 | SC05 | Р |
| BDT83 | SC05 | Р | BDV96 | SC05 | P | BDX78F | SC05 | P |
| BDT83F | SC05 | Р | BDX35 | SC05 | P | BDX91 | SC05 | Р |
| BDT84 | SC05 | Р | BDX36 | SC05 | P | BDX92 | SC05 | Р |
| BDT84F | SC05 | P | BDX37 | SC05 | P | BDX93 | SC05 | P |
| | | P | 1 | | P | 1 | | P |
| BDT85 | SC05 | | BDX42 | SC05 | | BDX94 | SC05 | |
| BDT85F | SC05 | P | BDX43 | SC05 | P | BDX95 | SC05 | P |
| BDT86 | SC05 | Р | BDX44 | SC05 | P | BDX96 | SC05 | Р |
| BDT86F | SC05 | Р | BDX45 | SC05 | P | BDY90 | SC05 | Р |
| BDT87 | SC05 | Р | BDX46 | SC05 | Р | BDY91 | SC05 | Р |
| BDT87F | SC05 | P | BDX47 | SC05 | P | BDY92 | SC05 | P |
| BDT88 | SC05 | P | BDX62 | SC05 | Р | BF198 | SC04 | Sm |
| BDT88F | SC05 | P | BDX62A | SC05 | P | BF199 | SC04 | Sm |
| DDT01 | 0.00= | ъ | DDVCCD | 000= | В | DEDAG | 000* | 0 |
| BDT91 | SC05 | P | BDX62B | SC05 | P | BF240 | SC04 | Sm |
| BDT91F | SC05 | Р | BDX62C | SC05 | Р | BF241 | SC04 | Sm |
| BDT92 | SC05 | P | BDX63 | SC05 | P | BF245A | SC07 | FET |
| BDT92F | SC05 | P | BDX63A | SC05 | Р | BF245B | SC07 | FET |
| | SC05 | P | BDX63B | SC05 | | | | |

| Type no. | book | section | Type no. | book | section | Type no. | book | section |
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| | | | | | | | | |
| BF247A | SC07 | FET | BF820 | SC10 | Mm | BFG97 | | WBT/Mm |
| BF247B | SC07 | FET | BF821 | SC10 | Mm | BFG135 | | WBT/Mm |
| BF247C | SC07 | FET | BF822 | SC10 | Mm | BFG195 | SC14 | WBT |
| BF256A | SC07 | FET | BF823 | SC10 | Mm | BFG198 | | WBT/Mm |
| BF256B | SC07 | FET | BF824 | SC10 | Mm | BFP90A | SC14 | WBT. |
| BF256C | SC07 | FET | BF840 | SC10 | Mm | BFP91A | SC14 | WBT |
| BF324 | SC04 | Sm | BF841 | SC10 | Mm | BFP96 | SC14 | WBT |
| | | | | | | | | |
| BF370 | SC04 | Sm | BF926 | SC04 | Sm | BFQ10 | SC07 | FET |
| BF410A | SC07 | FET | BF936 | SC04 | Sm | BFQ11 | SC07 | FET |
| BF410B | SC07 | FET | BF939 | SC04 | Sm | BFQ12 | SC07 | FET |
| BF410C | SC07 | FET | BF960 | SC07 | FET | BFQ13 | SC07 | FET ' |
| BF410D | SC07 | FET | BF964S | SC07 | FET | BFQ14 | SC07 | FET |
| BF420 | SC04 | Sm | BF965 | SC07 | FET | BFQ15 | SC07 | FET |
| BF421 | SC04 | Sm | BF966S | SC07 | FET | BFQ16 | SC07 | FET |
| BF422 | SC04 | Sm | BF967 | SC04 | Sm | BFQ17 | | WBT/Mm |
| DI 722 | 5004 | 5111 | | JUU4 | 5 | J. 417 | 3014/10 | *V D I/IVIII |
| BF423 | SC04 | Sm | BF970 | SC04 | Sm | BFQ18A | SC14/10 | WBT/Mm |
| BF450 | SC04 | Sm | BF970A | SC04 | Sm | BFQ19 | SC14/10 | WBT/Mm |
| BF451 | SC04 | Sm | BF979 | SC04 | Sm | BFQ22S | SC14 | WBT |
| BF483 | SC04 | Sm | BF980 | SC07 | FET | BFQ23 | SC14 | WBT |
| BF485 | SC04 | Sm | BF980A | SC07 | FET | BFQ23C | SC14 | WBT |
| DI 403 | 3004 | Sili | DI 300A | 3007 | ''' | D1 0230 | 3014 | VVDI |
| BF487 | SC04 | Sm | BF981 | SC07 | FET | BFQ24 | SC14 | WBT |
| BF494 | SC04 | Sm | BF982 | SC07 | FET | BFQ32 | SC14 | WBT . |
| BF495 | SC04 | Sm | BF989 | SC07/10 | FET/Mm | BFQ32C | SC14 | WBT |
| BF496 | SC04 | Sm | BF990A | SC07/10 | FET/Mm | BFQ32M | SC14 | WBT |
| BF510 | SC07/10 | FET/Mm | BF990AR | SC07/10 | | BFQ32S | SC14 | WBT |
| BF511 | SC07/10 | EET/Mm | BF991 | SC07/10 | EET/Mm | BFQ33 | SC14 | WBT |
| BF512 | | | | | | | | |
| | SC07/10 | | BF992 | SC07/10 | | BFQ33C | SC14 | WBT |
| BF513 | | FET/Mm | BF992R | SC07/10 | | BFQ34 | SC14 | WBT |
| BF550 | SC10 | Mm | BF994S | SC07/10 | | BFQ34T | SC14 | WBT |
| BF550R | SC10 | Mm | BF994SR | SC07/10 | FET/Mm | BFQ42 | SC08 | RFP |
| BF569 | SC10 | Mm | BF996S | SC07/10 | FET/Mm | BFQ43 | SC08 | RFP |
| BF570 | SC10 | Mm | BF996SR | SC07/10 | | BFQ43S | SC08 | RFP |
| BF579 | SC10 | Mm | BF997 | | FET/Mm | BFQ51 | SC14 | WBT |
| BF620 | SC10 | Mm | BFG23 | SC14 | WBT | BFQ51C | SC14 | WBT |
| BF621 | SC10 | Mm | BFG32 | SC14 | WBT | BFQ52 | SC14 | WBT |
| DEC.22 | 0010 | | DE004 | 004: | | DEOLO | 004: | \4/D* |
| BF622 | SC10 | Mm | BFG34 | SC14 | WBT | BFQ53 | SC14 | WBT |
| BF623 | SC10 | Mm | BFG35 | | WBT/Mm | | SC14 | WBT |
| BF660 | SC10 | Mm | BFG51 | SC14 | WBT | BFQ65 | SC14 | WBT |
| BF660R | SC10 | Mm | BFG65 | SC14 | WBT | BFQ66 | SC14 | WBT |
| BF689K | SC14 | WBT | BFG67 | SC14/10 | WBT/Mm | BFQ67 | SC14/10 | WBT/Mm |
| BF720 | SC10 | Mm | BFG90A | SC14 | WBT | BFQ68 | SC14 | WBT |
| BF721 | SC10 | Mm | BFG91A | SC14 | WBT | BFQ136 | SC14 | WBT |
| BF722 | SC10 | Mm | BFG92A | SC14 | WBT | BFR29 | SC07 | FET |
| BF723 | | | | | 1 | | | |
| | SC10 | Mm | BFG93A | SC14 | WBT | BFR30 | | FET/Mm |
| BF763 | SC14 | WBT | BFG96 | SC14 | WBT | BFR31 | SC0//10 | FET/Mm |

| Type no. | book | section | Type no. | book | section | Type no. | book | section |
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| BFR49 | SC14 | WBT | BFW30 | SC14 | WBT | BGY49B | SC09 | RFP |
| BFR53 | | WBT/Mm | BFW61 | SC07 | FET | BGY50 | SC14 | WBM |
| BFR54 | SC04 | Sm | BFW92 | SC14 | WBT | BGY51 | SC14 | WBM |
| BFR64 | SC14 | WBT | BFW92A | SC14 | WBT | BGY52 | SC14 | WBM |
| | | | | | | | | |
| BFR65 | SC14 | WBT | BFW93 | SC14 | WBT | BGY53 | SC14 | WBM |
| BFR84 | SC07 | FET | BFX34 | SC04 | Sm | BGY54 | SC14 | WBM |
| BFR90 | SC14 | WBT | BFX89 | SC14 | WBT | BGY55 | SC14 | WBM |
| BFR90A | SC14 | WBT | BFY50 | SC04 | Sm | BGY56 | SC14 | WBM |
| BFR91 | SC14 | WBT | BFY51 | SC04 | Sm | BGY57 | SC14 | WBM |
| BFR91A | SC14 | WBT | BFY52 | SC04 | Sm | BGY58 | SC14 | WBM |
| | | | | | | | | |
| BFR92 | | WBT/Mm | BFY55 | SC04 | Sm | BGY58A | SC14 | WBM |
| BFR92A | SC14/10 | WBT/Mm | BFY90 | SC14 | WBT | BGY59 | SC14 | WBM |
| BFR93 | SC14/10 | WBT/Mm | BG2000 | SC01 | RT | BGY60 | SC14 | WBM |
| BFR93A | | WBT/Mm | BG2097 | SC01 | RT | BGY61 | SC14 | WBM |
| BFR94 | SC14 | WBT | BGD102 | SC14 | WBM | BGY65 | SC14 | WBM |
| DEDCE | | WD7 | DODASSE | 0044 | 14/000 | D 01/0- | 0011 | |
| BFR95 | SC14 | WBT | BGD102E | SC14 | WBM | BGY67 | SC14 | WBM |
| BFR96 | SC14 | WBT | BGD104 | SC14 | WBM | BGY67A | SC14 | WBM |
| BFR96S | SC14 | WBT | BGD104E | SC14 | WBM | BGY70 | SC14 | WBM |
| BFR101A | SC07/10 | FET/Mm | BGD502 | SC14 | WBM | BGY71 | SC14 | WBM |
| BFR101B | • | FET/Mm | BGD504 | SC14 | WBM | BGY74 | SC14 | WBM |
| DE047 | 0044/40 | WDT | D O VOOE | 0044 | 14/014 | DOVE | 0014 | 14/044 |
| BFS17 | SC14/10 | | BGX885 | SC14 | WBM | BGY75 | SC14 | WBM |
| BFS17A | SC14 | WBT | BGY22 | SC09 | RFP | BGY78 | SC14 | WBM |
| BFS18 | SC10 | Mm | BGY22A | SC09 | RFP | BGY84 | SC14 | WBM |
| BFS18R | SC10 | Mm | BGY23 | SC09 | RFP | BGY84A | SC14 | WBM |
| BFS19 | SC10 | Mm | BGY23A | SC09 | RFP | BGY85 | SC14 | WBM |
| BFS19R | SC10 | Mm | BGY32 | SC09 | RFP | BGY85A | SC14 | WBM |
| BFS20 | SC10 | Mm | BGY33 | SC09 | RFP | BGY86 | SC14 | WBM |
| | | | | | | 1 | | |
| BFS20R | SC10 | Mm | BGY35 | SC09 | RFP | BGY87 | SC14 | WBM |
| BFS21 | SC07 | FET | BGY36 | SC09 | RFP | BGY88 | SC14 | WBM |
| BFS21A | SC07 | FET | BGY40A | SC09 | RFP | BGY90A | SC09 | RFP |
| BFS22A | SC08 | RFP | BGY40B | SC09 | RFP | BGY90B | SC09 | RFP |
| BFS23A | SC08 | RFP | BGY41A | SC09 | RFP | BGY91A | SC09 | RFP |
| | | | | | | | | |
| BFT24 | SC14 | WBT | BGY41B | SC09 | RFP | BGY91B | SC09 | RFP |
| BFT25 | | WBT/Mm | BGY43 | SC09 | RFP | BGY93A | SC09 | RFP |
| BFT44 | SC04 | Sm | BGY45A | SC09 | RFP | BGY93B | SC09 | RFP |
| BFT45 | SC04 | Sm | BGY45B | SC09 | RFP | BGY93C | SC09 | RFP |
| BFT46 | 0.00=/40 | | D 01/4-0 | SC09 | 050 | 1 | | |
| BFT92 | | WBT/Mm | BGY45C BGY46A | SC09 | KFP RED | BGY94A BGY94B | SC09 | RFP |
| | | | | | RFP | 1 | SC09 | RFP |
| BFT93 | | WBT/Mm | | SC09 | RFP | BGY94C | SC09 | RFP |
| BFW10 | SC07 | FET | BGY47A | SC09 | RFP | BGY95A | SC09 | RFP |
| BFW11 | SC07 | FET | BGY47F | SC09 | RFP | BGY95B | SC09 | RFP |
| BFW12 | SC07 | FET | BGY48A | SC09 | RFP | BGY96A | SC09 | RFP |
| BFW13 | SC07 | FET | BGY48B | SC09 | RFP | BGY96B | SC09 | RFP |
| BFW16A | SC14 | | 1 | SC09 | | BGY110A | | |
| BFW17A | | WBT | BGY48C | | RFP | | SC09 | RFP |
| | SC14 | WBT | BGY49A | SC09 | RFP | BGY110B | SC09 | RFP |

| Type no. book section Type no. book section Type no. boo BGY584A SC14 WBM BLV25 SC08 RFP BLW89 SC0 BGY585A SC14 WBM BLV30 SC08 RFP BLW90 SC0 BGY586 SC14 WBM BLV30/12 SC08 RFP BLW91 SC0 BGY587 SC14 WBM BLV31 SC08 RFP BLW95 SC0 BLF145 SC08 RFP/FET BLV31 SC08 RFP BLW95 SC0 BLF147 SC08 RFP/FET BLV32F SC08 RFP BLW96 SC0 BLF175 SC08 RFP/FET BLV33 SC08 RFP BLW97 SC0 BLF177 SC08 RFP/FET BLV36 SC08 RFP BLW99 SC0 BLF221 SC08 RFP/FET BLV37 SC08 RFP BLX13 SC0 BLF242 < | 8 RFP 8 RFP |
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| BGY585A SC14 WBM BLV30 SC08 RFP BLW90 SC0 BGY586 SC14 WBM BLV30/12 SC08 RFP BLW91 SC0 BGY587 SC14 WBM BLV31 SC08 RFP BLW95 SC0 BLF145 SC08 RFP/FET BLV32F SC08 RFP BLW95 SC0 BLF147 SC08 RFP/FET BLV32F SC08 RFP BLW96 SC0 BLF175 SC08 RFP/FET BLV33 SC08 RFP BLW97 SC0 BLF177 SC08 RFP/FET BLV36 SC08 RFP BLW98 SC0 BLF221 SC08 RFP/FET BLV37 SC08 RFP BLX13 SC0 BLF241 SC08 RFP/FET BLV38 SC08 RFP BLX13 SC0 BLF242 SC08 RFP/FET BLV57 SC08 RFP BLX14 SC0 BLF245 SC08< | 8 RFP |
| BGY585A SC14 WBM BLV30 SC08 RFP BLW90 SC0 BGY586 SC14 WBM BLV30/12 SC08 RFP BLW91 SC0 BGY587 SC14 WBM BLV31 SC08 RFP BLW95 SC0 BLF145 SC08 RFP/FET BLV32F SC08 RFP BLW95 SC0 BLF147 SC08 RFP/FET BLV33F SC08 RFP BLW96 SC0 BLF175 SC08 RFP/FET BLV33 SC08 RFP BLW97 SC0 BLF177 SC08 RFP/FET BLV36 SC08 RFP BLW98 SC0 BLF221 SC08 RFP/FET BLV37 SC08 RFP BLX13 SC0 BLF241 SC08 RFP/FET BLV38 SC08 RFP BLX13 SC0 BLF242 SC08 RFP/FET BLV57 SC08 RFP BLX14 SC0 BLF245 SC08< | 8 RFP |
| BGY586 SC14 WBM BLV30/12 SC08 RFP BLW91 SC0 BGY587 SC14 WBM BLV31 SC08 RFP BLW95 SC0 BLF145 SC08 RFP/FET BLV32F SC08 RFP BLW95 SC0 BLF147 SC08 RFP/FET BLV33 SC08 RFP BLW97 SC0 BLF175 SC08 RFP/FET BLV33F SC08 RFP BLW98 SC0 BLF177 SC08 RFP/FET BLV36 SC08 RFP BLW99 SC0 BLF221 SC08 RFP/FET BLV37 SC08 RFP BLX13 SC0 BLF241 SC08 RFP/FET BLV38 SC08 RFP BLX13 SC0 BLF242 SC08 RFP/FET BLV5712 SC08 RFP BLX14 SC0 BLF245 SC08 RFP/FET BLV59 SC08 RFP BLX39 SC0 BLF246 | 8 RFP |
| BGY587 SC14 WBM BLV31 SC08 RFP BLW95 SC0 BLF145 SC08 RFP/FET BLV32F SC08 RFP BLW96 SC0 BLF147 SC08 RFP/FET BLV33 SC08 RFP BLW97 SC0 BLF175 SC08 RFP/FET BLV33F SC08 RFP BLW98 SC0 BLF177 SC08 RFP/FET BLV36 SC08 RFP BLW99 SC0 BLF221 SC08 RFP/FET BLV37 SC08 RFP BLX13 SC0 BLF241 SC08 RFP/FET BLV38 SC08 RFP BLX13C SC0 BLF242 SC08 RFP/FET BLV57 SC08 RFP BLX14 SC0 BLF244 SC08 RFP/FET BLV57 SC08 RFP BLX39 SC0 BLF245 SC08 RFP/FET BLV59 SC08 RFP BLX39 SC0 BLF246 | RFP |
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| BLF147 SC08 RFP/FET BLV33 SC08 RFP BLW97 SC0 BLF175 SC08 RFP/FET BLV33F SC08 RFP BLW98 SC0 BLF177 SC08 RFP/FET BLV36 SC08 RFP BLW99 SC0 BLF221 SC08 RFP/FET BLV37 SC08 RFP BLX13 SC0 BLF241 SC08 RFP/FET BLV38 SC08 RFP BLX13 SC0 BLF242 SC08 RFP/FET BLV38 SC08 RFP BLX14 SC0 BLF244 SC08 RFP/FET BLV57 SC08 RFP BLX15 SC0 BLF245 SC08 RFP/FET BLV59 SC08 RFP BLX39 SC0 BLF246 SC08 RFP/FET BLV75/12 SC08 RFP BLX65 SC0 BLF278 SC08 RFP/FET BLV80/28 SC08 RFP BLX65E SC0 BLF368 | 8 RFP 8 RFP 8 RFP 8 RFP 8 RFP 8 RFP 8 RFP 8 RFP |
| BLF175 SC08 RFP/FET BLV33F SC08 RFP BLW98 SC0 BLF177 SC08 RFP/FET BLV36 SC08 RFP BLW99 SC0 BLF221 SC08 RFP/FET BLV37 SC08 RFP BLX13 SC0 BLF241 SC08 RFP/FET BLV38 SC08 RFP BLX13 SC0 BLF242 SC08 RFP/FET BLV38 SC08 RFP BLX14 SC0 BLF244 SC08 RFP/FET BLV57 SC08 RFP BLX15 SC0 BLF245 SC08 RFP/FET BLV59 SC08 RFP BLX39 SC0 BLF246 SC08 RFP/FET BLV75/12 SC08 RFP BLX65 SC0 BLF278 SC08 RFP/FET BLV80/28 SC08 RFP BLX65E SC0 BLF368 SC08 RFP/FET BLV90 SC08 RFP BLX65ES SC0 BLF378 | 8 RFP 8 RFP 8 RFP 8 RFP 8 RFP 8 RFP 8 RFP 8 RFP |
| BLF175 SC08 RFP/FET BLV33F SC08 RFP BLW98 SC0 BLF177 SC08 RFP/FET BLV36 SC08 RFP BLW99 SC0 BLF221 SC08 RFP/FET BLV37 SC08 RFP BLX13 SC0 BLF241 SC08 RFP/FET BLV38 SC08 RFP BLX13 SC0 BLF242 SC08 RFP/FET BLV38 SC08 RFP BLX14 SC0 BLF244 SC08 RFP/FET BLV57 SC08 RFP BLX15 SC0 BLF245 SC08 RFP/FET BLV59 SC08 RFP BLX39 SC0 BLF246 SC08 RFP/FET BLV75/12 SC08 RFP BLX65 SC0 BLF278 SC08 RFP/FET BLV80/28 SC08 RFP BLX65E SC0 BLF368 SC08 RFP/FET BLV90 SC08 RFP BLX65ES SC0 BLF378 | 8 RFP 8 RFP 8 RFP 8 RFP 8 RFP 8 RFP 8 RFP 8 RFP |
| BLF177 SC08 RFP/FET BLV36 SC08 RFP BLW99 SC0 BLF221 SC08 RFP/FET BLV37 SC08 RFP BLX13 SC0 BLF241 SC08 RFP/FET BLV38 SC08 RFP BLX13C SC0 BLF242 SC08 RFP/FET BLV45/12 SC08 RFP BLX14 SC0 BLF244 SC08 RFP/FET BLV57 SC08 RFP BLX15 SC0 BLF245 SC08 RFP/FET BLV59 SC08 RFP BLX39 SC0 BLF246 SC08 RFP/FET BLV75/12 SC08 RFP BLX65 SC0 BLF278 SC08 RFP/FET BLV80/28 SC08 RFP BLX65E SC0 BLF368 SC08 RFP/FET BLV90 SC08 RFP BLX65ES SC0 BLF378 SC08 RFP/FET BLV90/SL SC08 RFP BLX67 SC0 | RFP RFP RFP RFP RFP RFP RFP RFP RFP |
| BLF221 SC08 RFP/FET BLV37 SC08 RFP BLX13 SC0 BLF241 SC08 RFP/FET BLV38 SC08 RFP BLX13C SC0 BLF242 SC08 RFP/FET BLV45/12 SC08 RFP BLX14 SC0 BLF244 SC08 RFP/FET BLV57 SC08 RFP BLX15 SC0 BLF245 SC08 RFP/FET BLV59 SC08 RFP BLX39 SC0 BLF246 SC08 RFP/FET BLV75/12 SC08 RFP BLX65 SC0 BLF278 SC08 RFP/FET BLV80/28 SC08 RFP BLX65E SC0 BLF368 SC08 RFP/FET BLV90 SC08 RFP BLX65ES SC0 BLF378 SC08 RFP/FET BLV90/SL SC08 RFP BLX67 SC0 | RFP RFP RFP RFP RFP RFP RFP |
| BLF241 SC08 RFP/FET BLV38 SC08 RFP BLX13C SC0 BLF242 SC08 RFP/FET BLV45/12 SC08 RFP BLX14 SC0 BLF244 SC08 RFP/FET BLV57 SC08 RFP BLX15 SC0 BLF245 SC08 RFP/FET BLV59 SC08 RFP BLX39 SC0 BLF246 SC08 RFP/FET BLV75/12 SC08 RFP BLX65 SC0 BLF278 SC08 RFP/FET BLV80/28 SC08 RFP BLX65E SC0 BLF368 SC08 RFP/FET BLV90 SC08 RFP BLX65ES SC0 BLF378 SC08 RFP/FET BLV90/SL SC08 RFP BLX67 SC0 | RFP RFP RFP RFP RFP |
| BLF242 SC08 RFP/FET BLV45/12 SC08 RFP BLX14 SC0 BLF244 SC08 RFP/FET BLV57 SC08 RFP BLX15 SC0 BLF245 SC08 RFP/FET BLV59 SC08 RFP BLX39 SC0 BLF246 SC08 RFP/FET BLV75/12 SC08 RFP BLX65 SC0 BLF278 SC08 RFP/FET BLV80/28 SC08 RFP BLX65E SC0 BLF368 SC08 RFP/FET BLV90 SC08 RFP BLX65ES SC0 BLF378 SC08 RFP/FET BLV90/SL SC08 RFP BLX67 SC0 | RFP RFP RFP RFP |
| BLF244 SC08 RFP/FET BLV57 SC08 RFP BLX15 SC0 BLF245 SC08 RFP/FET BLV59 SC08 RFP BLX39 SC0 BLF246 SC08 RFP/FET BLV75/12 SC08 RFP BLX65 SC0 BLF278 SC08 RFP/FET BLV80/28 SC08 RFP BLX65E SC0 BLF368 SC08 RFP/FET BLV90 SC08 RFP BLX65ES SC0 BLF378 SC08 RFP/FET BLV90/SL SC08 RFP BLX67 SC0 | RFP RFP RFP |
| BLF245 SC08 RFP/FET BLV59 SC08 RFP BLX39 SC0 BLF246 SC08 RFP/FET BLV75/12 SC08 RFP BLX65 SC0 BLF278 SC08 RFP/FET BLV80/28 SC08 RFP BLX65E SC0 BLF368 SC08 RFP/FET BLV90 SC08 RFP BLX65ES SC0 BLF378 SC08 RFP/FET BLV90/SL SC08 RFP BLX67 SC0 | RFP RFP |
| BLF245 SC08 RFP/FET BLV59 SC08 RFP BLX39 SC0 BLF246 SC08 RFP/FET BLV75/12 SC08 RFP BLX65 SC0 BLF278 SC08 RFP/FET BLV80/28 SC08 RFP BLX65E SC0 BLF368 SC08 RFP/FET BLV90 SC08 RFP BLX65ES SC0 BLF378 SC08 RFP/FET BLV90/SL SC08 RFP BLX67 SC0 | RFP RFP |
| BLF246 SC08 RFP/FET BLV75/12 SC08 RFP BLX65 SC0 BLF278 SC08 RFP/FET BLV80/28 SC08 RFP BLX65E SC0 BLF368 SC08 RFP/FET BLV90 SC08 RFP BLX65ES SC0 BLF378 SC08 RFP/FET BLV90/SL SC08 RFP BLX67 SC0 | RFP . |
| BLF278 SC08 RFP/FET BLV80/28 SC08 RFP BLX65E SC0 BLF368 SC08 RFP/FET BLV90 SC08 RFP BLX65ES SC0 BLF378 SC08 RFP/FET BLV90/SL SC08 RFP BLX67 SC0 | |
| BLF368 | 3 RFP |
| BLF378 SC08 RFP/FET BLV90/SL SC08 RFP BLX67 SC0 | , , , , , , |
| | RFP |
| | 3 RFP |
| BLF521 SC08 RFP/FET BLV91 SC08 RFP BLX68 SC0 | |
| BLF522 SC08 RFP/FET BLV91/SL SC08 RFP BLX69A SC0 | |
| BLF543 SC08 RFP/FET BLV92 SC08 RFP BLX91A SC0 | |
| SET SET | |
| BLF544 SC08 RFP/FET BLV93 SC08 RFP BLX91CB SC0 | 3 RFP |
| BLF545 SC08 RFP/FET BLV94 SC08 RFP BLX92A SC0 | |
| BLF547 SC08 RFP/FET BLV95 SC08 RFP BLX93A SC0 | |
| BLF548 SC08 RFP/FET BLV97 SC08 RFP BLX94A SC0 | |
| BLT90/SL | |
| DE130/3E 3000 III DEV30 3000 III DEX340 300 | , 1111 |
| BLT91/SL SC08 RFP BLV99 SC08 RFP BLX95 SC0 | 3 RFP |
| BLT92/SL SC08 RFP BLW29 SC08 RFP BLX96 SC0 | |
| BLT93/SL SC08 RFP BLW31 SC08 RFP BLX97 SC0 | |
| BLU20/12 SC08 RFP BLW32 SC08 RFP BLX98 SC0 | |
| BLU30/12 SC08 RFP BLW33 SC08 RFP BLY87A SC0 | |
| DE000/12 3000 1111 DE107A 300 | , 101 |
| BLU30/28 SC08 RFP BLW34 SC08 RFP BLY87C SC0 | 3 RFP |
| BLU45/12 SC08 RFP BLW50F SC08 RFP BLY88A SC0 | 3 RFP |
| BLU50 SC08 RFP BLW60 SC08 RFP BLY88C SC0 | 3 RFP |
| BLU51 SC08 RFP BLW60C SC08 RFP BLY89A SC0 | |
| BLU52 SC08 RFP BLW76 SC08 RFP BLY89C SC0 | |
| | , |
| BLU53 SC08 RFP BLW77 SC08 RFP BLY90 SC0 | |
| BLU60/12 SC08 RFP BLW78 SC08 RFP BLY91A SC0 | RFP . |
| BLU60/28 SC08 RFP BLW79 SC08 RFP BLY91C SC0 | 3 RFP |
| BLU97 SC08 RFP BLW80 SC08 RFP BLY92A SC0 | RFP |
| BLU98 SC08 RFP BLW81 SC08 RFP BLY92C SC0 | 3 RFP |
| DILION ORD DED DILION ORD DED DILION | |
| BLU99 SC08 RFP BLW83 SC08 RFP BLY93A SC0 | |
| BLV10 SC08 RFP BLW84 SC08 RFP BLY93C SC0 | |
| BLV11 SC08 RFP BLW85 SC08 RFP BLY94 SC0 | |
| BLV20 SC08 RFP BLW86 SC08 RFP BR100/03 S2b | Th |
| BLV21 SC08 RFP BLW87 SC08 RFP BR101 SC0 | 1 Sm |

| Type no. | book | section | Type no. | book | section | Type no. | book | section |
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| BR210* | SC02 | R | BSP51 | SC10 | Mm | BSR62 | SC04 | Sm |
| BR211* | SC02 | R | BSP52 | | Mm | BSR111 | SC07/10 | |
| BR213* | SC02 | R | BSP60 | SC10 | Mm | BSR112 | SC07/10 | |
| BR216* | SC02 | R | BSP61 | SC10 | Mm | BSR113 | | FET/Mm |
| BR220* | SC02 | R | BSP62 | SC10 | Mm | BSR174 | SC07/10 | FET/Mm |
| BRY39 | SC04 | Sm | BSP204 | SC07 | FET | BSR175 | SC07/10 | FET/Mm |
| BRY56 | SC04 | Sm | BSP204A | SC07 | FET | BSR176 | | FET/Mm |
| BRY61 | SC10 | Mm | BSR12 | SC10 | Mm | BSR177 | | FET/Mm |
| BRY62 | SC10 | Mm | BSR12R | SC10 | Mm | BSS38 | SC04 | Sm |
| BS107 | SC07 | FET | BSR13 | SC10 | Mm | BSS50 | SC04 | Sm |
| BS107A | SC07 | FET | BSR13R | SC10 | Mm | BSS51 | SC04 | Sm |
| 1 | SC07 | | | | | | | |
| BS170 | | FET | BSR14 | SC10 | Mm | BSS52 | SC04 | Sm S |
| BS250 | SC07 | FET | BSR14R | SC10 | Mm | BSS60 | SC04 | Sm |
| BSD10 | SC07 | FET | BSR15 | SC10 | Mm | BSS61 | SC04 | Sm |
| BSD12 | SC07 | FET | BSR15R | SC10 | Mm | BSS62 | SC04 | Sm |
| BSD20 | SC07/10 | FET/m | BSR16 | SC10 | Mm | BSS63 | SC10 | Mm |
| BSD22 | SC07/10 | | BSR16R | SC10 | Mm | BSS63R | SC10 | Mm |
| BSD212 | SC07 | FET | BSR17 | SC10 | Mm | BSS64 | SC10 | Mm |
| BSD213 | SC07 | FET | BSR17R | SC10 | Mm | BSS64R | SC10 | Mm |
| BSD214 | SC07 | FET | BSR17A | SC10 | Mm | BSS68 | SC04 | Sm |
| BCDate | 0.007 | rrt | D0D474D | 0010 | 14 | D.C.C.C.C | 0.007/10 | FFT/8.4 |
| BSD215 | SC07 | FET | BSR17AR | SC10 | Mm | BSS83 | | FET/Mm |
| BSJ111 | SC07 | FET | BSR18 | SC10 | Mm | BSS87 | SC07 | FET |
| BSJ112 | SC07 | FET | BSR18R | SC10 | Mm | BSS89 | SC07 | FET |
| BSJ113 | SC07 | FET | BSR18A | SC10 | Mm | BSS91 | SC07 | FET |
| BSJ174 | SC07 | FET | BSR18AR | SC10 | Mm | BSS92 | SC07 | FET |
| BSJ175 | SC07 | FET | BSR19 | SC10 | Mm | BST15 | SC10 | Mm |
| BSJ176 | SC07 | FET | BSR19A | SC10 | Mm | BST16 | SC10 | Mm |
| BSJ177 | SC07 | FET | BSR20 | SC10 | Mm | BST39 | SC10 | Mm |
| BSN205 | SC07 | FET | BSR20A | SC10 | Mm | BST40 | SC10 | Mm |
| BSN205A | SC07 | FET | BSR30 | SC10 | Mm | BST50 | SC10 | Mm |
| BSN254 | SC07 | FET | BSR31 | SC10 | Mm | BST51 | SC10 | Mm |
| BSN254A | SC07 | FET | BSR32 | SC10 | Mm | BST52 | SC10 | Mm |
| BSP15 | SC10 | Mm | BSR33 | SC10 | Mm | BST60 | SC10 | Mm |
| BSP16 | SC10 | Mm | BSR40 | SC10 | Mm | BST61 | SC10 | Mm |
| BSP19 | SC10 | Mm | BSR41 | SC10 | Mm | BST62 | SC10 | Mm |
| Donos | 0040 | | | 0010 | | DOTTO | 0.00= | rr |
| BSP20 | SC10 | Mm | BSR42 | SC10 | Mm | BST70A | SC07 | FET |
| BSP30 | SC10 | Mm | BSR43 | SC10 | Mm | BST72A | SC07 | FET |
| BSP31 | SC10 | Mm | BSR50 | SC04 | Sm | BST74A | SC07 | FET |
| BSP32 | SC10 | Mm | BSR51 | SC04 | Sm | BST76A | SC07 | FET |
| BSP33 | SC10 | Mm | BSR52 | SC04 | Sm | BST78 | SC07 | FET |
| BSP40 | SC10 | Mm | BSR56 | SC07/10 | FET/Mm | BST80 | SC07/10 | FET/Mm |
| BSP41 | SC10 | Mm | BSR57 | | FET/Mm | BST82 | | FET/Mm |
| BSP42 | SC10 | Mm | BSR58 | | FET/Mm | BST84 | - | FET/Mm |
| BSP43 | SC10 | Mm | BSR60 | SC04 | Sm | BST86 | | FET/Mm |
| BSP50 | SC10 | Mm | BSR61 | SC04 | Sm | BST95 | SC07 | FET |
| 30.00 | 0010 | 171111 | 301.01 | J007 | J | 20100 | | 161 |

| Туре по. | book | section | Туре по. | book | section | Type no. | book | section |
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| BST97 | SC07 | FET | BTR59* | S2b | Tri | BUS14A | SC06 | SP |
| BST100 | SC07 | FET | BTS59* | S2b | Tri | BUS21* | SC06 | SP |
| BST110 | SC07 | FET | BTV58* | S2b | Th | BUS22* | SC06 | SP |
| BST120 | | FET/Mm | BTV59* | S2b | Th | BUS23* | SC06 | SP |
| BST122 | | FET/Mm | BTV59D* | S2b | Th | BUS24* | SC06 | SP |
| D31122 | 3607/10 | re i / iviiii | B1 V39D | 320 | ''' | BU324 | 3000 | SI . |
| BSV15 | SC04 | Sm | BTV60* | S2b | Th | BUS131* | SC06 | SP |
| BSV16 | SC04 | Sm | BTV60D* | S2b | Th | BUS132* | SC06 | SP |
| BSV17 | SC04 | Sm | BTV70* | S2b | Th | BUS133* | SC06 | SP |
| BSV52 | SC10 | Mm | BTV70D* | S2b | Th | BUT11 | SC06 | SP |
| BSV52R | SC10 | Mm | BTW23* | S2b | Th | BUT11A | SC06 | SP |
| BSV64 | SC04 | C.m. | BTW38* | Cah | Th | BUT11F | SC06 | SP |
| | | Sm | | S2b | | | | |
| BSV78 | SC07 | FET | BTW40* | S2b | Th | BUT11AF | SC06 | SP |
| BSV79 | SC07 | FET | BTW42* | S2b | Th | BUT12 | SC06 | SP |
| BSV80 | SC07 | FET | BTW43* | S2b | Tri | BUT12A | SC06 | SP |
| BSV81 | SC07 | FET | BTW45* | S2b | Th | BUT12F | SC06 | SP |
| BSW66A | SC04 | Sm | BTW58* | S2b | Th | BUT12AF | SC06 | SP |
| BSW67A | SC04 | Sm | BTW62* | S2b | Th | BUT18 | SC06 | SP |
| | | | | | | | | |
| BSW68A | SC04 | Sm | BTW62D* | S2b | Th | BUT18A | SC06 | SP |
| BSX19 | SC04 | Sm | BTW63* | S2b | Th | BUT18F | SC06 | SP |
| BSX20 | SC04 | Sm | BTY79* | S2b | Th | BUT18AF | SC06 | SP |
| BSX32 | SC04 | Sm | BTY91* | S2b | Th | BUT21B | SC06 | SP |
| BSX45 | SC04 | Sm | BU306 | SC06 | SP | BUT21C | SC06 | SP |
| BSX46 | SC04 | Sm | BU306F | SC06 | SP | BUT21BF | SC06 | SP |
| | | | i e | | | | | |
| BSX47 | SC04 | Sm | BU505 | SC06 | SP | BUT21CF | SC06 | SP |
| BSX59 | SC04 | Sm | BU506 | SC06 | SP | BUT22B | SC06 | SP |
| BSX60 | SC04 | Sm | BU506D | SC06 | SP | BUT22C | SC06 | SP |
| BSX61 | SC04 | Sm | BU508A | SC06 | SP | BUT22BF | SC06 | SP |
| BT136* | S2b | Tri | BU508D | SC06 | SP | BUT22CF | SC06 | SP |
| BT136F* | S2b | Tri | BU705 | SC06 | SP | BUT131 | SC06 | SP |
| BT137* | S2b | Tri | BU706 | SC06 | SP | BUV26 | SC06 | SP |
| | | | = 5.55 | | | | | |
| BT137F* | S2b | Tri | BU706D | SC06 | SP | BUV26A | SC06 | SP |
| BT138* | S2b | Tri | BU806 | SC06 | SP | BUV26F | SC06 | SP |
| BT138F* | S2b | Tri | BU807 | SC06 | SP | BUV26AF | SC06 | SP |
| BT139* | S2b | Tri | BU808 | SC06 | SP | BUV27 | SC06 | SP |
| BT139F* | S2b | Tri | BU824 | SC06 | SP | BUV27A | SC06 | SP |
| DT145* | O O I | Tut | DUIGOS | 0.000 | CD. | DUIVOZE | 0.000 | CD. |
| BT145* | S2b | Tri | BU826 | SC06 | SP | BUV27F | SC06 | SP |
| BT149* | S2b | Th | BUP22* | SC06 | SP | BUV27AF | SC06 | SP |
| BT150 | S2b | Th | BUP23* | SC06 | SP | BUV28 | SC06 | SP |
| BT151* | S2b | Th | BUS11 | SC06 | SP | BUV28A | SC06 | SP |
| BT151F* | S2b | Th | BUS11A | SC06 | SP | BUV28F | SC06 | SP |
| BT152* | S2b | Th | BUS12 | SC06 | SP | BUV28AF | SC06 | SP |
| | | | i | | | BUV47 | | SP |
| BT153 | S2b | Th | BUS12A | SC06 | SP | | SC06 | |
| BT157* | S2b | Th | BUS13 | SC06 | SP | BUV47A | SC06 | SP |
| BT169* | S2b | Th | BUS13A | SC06 | SP | BUV48 | SC06 | SP |
| BTA140* | S2b | Tri | BUS14 | SC06 | SP | BUV48A | SC06 | SP |

| Type no. | book | section | Type no. | | book | section | Type no. | book | section |
|----------------------|-------|---------|----------|-----|------|---------|----------|------|---------|
| BUV82 | SC06 | SP | BUZ11 | 176 | S9 | PM | BUZ90 | S9 | PM |
| BUV83 | SC06 | SP | BUZ11A | | S9 | PM | BUZ90A | S9 | PM · |
| BUV89 | SC06 | SP | BUZ14 | | S9 | PM | BUZ94 | S9 | PM |
| BUV90 | SC06 | SP | BUZ15 | | S9 | PM | BUZ211 | S9 | PM |
| 30 V 30 3U V 90 F | | | | | | | | | |
| 30 V90F | SC06 | SP | BUZ20 | | S9 | PM | BUZ307 | S9 | PM |
| 3UV98(V) | SC06 | SP | BUZ21 | | S9 | PM : | BUZ308 | S9 | PM |
| BUV98A | SC06 | SP | BUZ23 | | S9 | PM | BUZ310 | S9 | PM |
| 3UV298(V) | SC06 | SP | BUZ24 | | S9 | PM | BUZ311 | S9 | PM |
| BUV298A | SC06 | SP | BUZ25 | | S9 | PM | BUZ326 | S9 | PM |
| BUW11 | SC06 | SP | BUZ31 | | S9 | PM | BUZ330 | S9 | PM |
| BUW11A | SC06 | SP | BUZ32 | | S9 | PM | BUZ331 | S9 | PM |
| BUW12 | | | | | | | | | |
| | SC06 | SP | BUZ34 | | S9 | PM | BUZ347 | S9 | PM |
| BUW12A | SC06 | SP | BUZ35 | | S9 | PM | BUZ348 | S9 | PM |
| BUW12F | SC06 | SP | BUZ36 | | S9 | PM | BUZ349 | S9 | PM |
| BUW12AF | SC06 | SP | BUZ41A | | S9 | PM | BUZ350 | S9 | PM |
| BUW13 | SC06 | SP | BUZ42 | | S9 | PM | BUZ351 | S9 | PM |
| BUW13A | SC06 | SP | BUZ45 | | S9 | PM | BUZ355 | S9 | PM |
| BUW13F | SC06 | SP | BUZ45A | | S9 | PM | BUZ356 | S9 | PM |
| BUW13AF | SC06 | SP | BUZ45B | | S9 | PM | BUZ357 | S9 | PM |
| BUW84 | SC06 | SP | BUZ50A | | S9 | PM | BUZ358 | S9 | PM |
| 2104/05 | 0.000 | 00 | DUZEOD | | 00 | D14 | BUZOOA | 00 | D4.6 |
| BUW85 | SC06 | SP | BUZ50B | | S9 | PM | BUZ384 | S9 | PM |
| BUW86 | SC06 | SP | BUZ50C | | S9 | PM | BUZ385 | S9 | PM |
| 3UW87 | SC06 | SP | BUZ53A | | S9 | PM | BY228 | SC01 | R |
| BUW87A | SC06 | SP | BUZ54 | | S9 | PM | BY229* | SC02 | R |
| BUW131* | SC06 | SP | BUZ54A | | S9 | PM | BY229F* | SC02 | R |
| BUW132* | SC06 | SP | BUZ60 | | S9 | PM | BY249* | SC02 | R |
| BUW133* | SC06 | SP | BUZ63 | | S9 | PM | BY249F* | SC02 | R |
| BUX46 | SC06 | SP | BUZ64 | | S9 | PM | BY260* | SC02 | R |
| BUX46A | SC06 | SP | BUZ71 | | S9 | PM | BY328 | SC02 | SD |
| BUX47 | SC06 | SP | BUZ71A | | S9 | PM | BY329* | SC02 | R . |
| | | | | | | | | | _ |
| BUX47A | SC06 | SP | BUZ72 | | S9 | PM | BY359* | SC02 | R |
| BUX48 | SC06 | SP | BUZ72A | | S9 | PM | BY359F | SC02 | R |
| BUX48A | SC06 | SP | BUZ73 | | S9 | PM | BY438 | SC01 | R |
| BUX84 | SC06 | SP | BUZ73A | | S9 | PM | BY448 | SC01 | R |
| BUX84F | SC06 | SP | BUZ74 | | S9 | PM | BY458 | SC01 | R |
| BUX85 | SC06 | SP | BUZ74A | | S9 | PM | BY505 | SC01 | R |
| BUX85F | SC06 | SP | BUZ76 | | S9 | PM | BY509 | SC01 | R |
| BUX86 | SC06 | SP | BUZ76A | | S9 | PM: | BY527 | SC01 | |
| | | | | | | | | | R |
| BUX87 | SC06 | SP | BUZ78 | | S9 | PM | BY584 | SC01 | R |
| BUX88 | SC06 | SP | BUZ80 | | S9 | PM | BY588 | SC01 | R |
| BUX98 | SC06 | SP | BUZ80A | | S9 | PM | BY609 | SC01 | R |
| BUX98A | SC06 | SP | BUZ83 | | S9 | PM | BY610 | SC01 | R |
| BUX99 | SC06 | SP | BUZ83A | | S9 | PM | BY614 | SC01 | R |
| BUY89 | SC06 | SP | BUZ84 | | S9 | PM | BY619 | SC01 | R |
| BUZ10 | S9 | PM | BUZ84A | | S9 | PM | BY620 | SC01 | R |
| DULIU | 33 | 1 141 | DOLOGA | | J | I IVI | D 1020 | 3001 | 11 |

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| BY627 | SC01 | R | BYR34* | SC02 | R | BYW54 | SC01 | R |
| BY705 | SC01 | R | BYR79* | SC02 | R | BYW55 | SC01 | R |
| BY706 | SC01 | R | BYT28* | SC02 | R | BYW56 | SC01 | R |
| BY707 | SC01 | R | BYT79* | SC02 | R | BYW92* | SC02 | R |
| BY708 | SC01 | R | | | | 1 | | |
| D1708 | 3601 | n | BYT230PIV | SC02 | R | BYW93* | SC02 | R |
| BY709 | SC01 | R | BYV10* | SC01 | R | BYW95A | SC01 | R |
| BY710 | SC01 | R | BYV24* | SC02 | R | BYW95B | SC01 | R |
| BY711 | SC01 | R | BYV26* | SC01 | R | BYW95C | SC01 | R |
| BY712 | SC01 | R | BYV27* | SC01 | R | BYW96D | SC01 | R |
| BY713 | SC01 | R | BYV28* | SC01 | R | BYW96E | SC01 | R |
| | | _ | | | | | | |
| BY714 | SC01 | R | BYV29* | SC02 | R | BYX10G | SC01 | R |
| BY715 | SC01 | R | BYV29F* | SC02 | R | BYX25* | SC02 | R |
| BY716 | SC01 | R | BYV30* | SC02 | R | BYX30* | SC02 | R |
| BY717 | SC01 | R | BYV31* | SC02 | R | BYX38* | SC02 | R |
| BY718 | SC01 | R | BYV32* | SC02 | R | BYX39* | SC02 | R |
| | | _ | | | _ | | | |
| BY719 | SC01 | R | BYV32F* | SC02 | R | BYX42* | SC02 | R |
| BY720 | SC01 | R | BYV34* | SC02 | R | BYX46* | SC02 | R |
| BY721 | SC01 | R | BYV36* | SC01 | R | BYX52* | SC02 | R |
| BY722 | SC01 | R | BYV42* | SC02 | R | BYX56* | SC02 | R |
| BY723 | SC01 | R | BYV44* | SC02 | R | BYX90G | SC01 | R |
| DV704 | 0001 | n | DVA (F.A) (| 0000 | | D10/00# | 0000 | _ |
| BY724 | SC01 | R | BYV54V | SC02 | R | BYX96* | SC02 | R |
| BYD11* | SC01 | R | BYV72* | SC02 | R | BYX97* | SC02 | R |
| BYD13* | SC01 | R | BYV72F* | SC02 | R | BYX98* | SC02 | R |
| BYD14* | SC01 | R | BYV74* | SC02 | R | BYX99* | SC02 | R |
| BYD17* | SC01/10 | R/Mm | BYV74F* | SC02 | R | BZD23 | SC01 | Vrg |
| BYD31* | SC01 | R | BYV79* | SC02 | R | BZD27 | SC01/10 | Vrg/Mm |
| BYD33* | SC01 | R | BYV92* | SC02 | R | BZT03 | | |
| | | | | | | | SC01 | Vrg |
| BYD34* | SC01 | R | BYV95A | SC01 | R | BZV10 | SC01 | Vrf |
| BYD37* | SC01/10 | R/Mm | BYV95B | SC01 | R | BZV11 | SC01 | Vrf |
| BYD73* | SC01 | R | BYV95C | SC01 | R | BZV12 | SC01 | Vrf |
| BYD74* | SC01 | R | BYV96D | SC01 | R | BZV13 | SC01 | Vrf |
| BYD77* | SC01 | R | BYV96E | SC01 | R | | | |
| | | | i | | | BZV14 | SC01 | Vrf |
| BYM26* | SC01 | R | BYV118* | SC02 | R | BZV37 | SC01 | Vrf |
| BYM36* | SC01 | R | BYV118F* | SC02 | R | BZV49* | SC01/10 | Vrg/Mm |
| BYM56* | SC01 | R | BYV120* | SC02 | R | BZV55* | SC10 | Mm |
| BYP20* | SC02 | R | BYV121* | SC02 | R | BZV60 | SC01 | Vrg |
| BYP21* | SC02 | R | BYV133* | SC02 | R | BZV80 | SC01 | Vrf |
| BYP22* | SC02 | | | | | | | |
| | | R | BYV133F* | SC02 | R | BZV81 | SC01 | Vrf |
| BYQ27* | SC01 | R | BYV143* | SC02 | R · | BZV85* | SC01 | Vrg |
| BYQ28* | SC02 | R | BYV143F* | SC02 | R | BZV86 | SC01 | SD |
| BYQ28F* | SC02 | R | BYW25* | SC02 | R | BZW03* | SC01 | Vrg |
| BYR28* | SC02 | R | BYW29* | SC02 | R | BZW14 | SC01 | Vrg |
| BYR29* | SC02 | r R | BYW29F* | SC02 | R | BZW86* | SC02 | TS |
| BYR29F* | SC02 | R | BYW30* | | | | | |
| | | | | SC02 | R | BZX55* | SC01 | Vrg |
| BYR30* | SC02 | R . | BYW31* | SC02 | R | BZX70* | SC02 | Vrg |

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| Type no. | book | section | Type no. | book | section | Type no. | book | sectio |
| BZX75* | SC01 | Vrg | ESM5045D(V) | SC06 | SP | LCE1004R | SC15 | M |
| BZX79* | SC01 | Vrg | | SC06 | SP | LCE1010R | SC15 | M |
| | 3001 | | ESM6045A(V) | | | | | |
| BZX84* | | Vrg/Mm | ESM6045D(V) | SC06 | SP | LCE2003S | SC15 | М |
| BZY91* | SC02 | Vrg | Fresnel-lens | SC12 | Α | LCE2005Q | SC15 | M |
| BZY93* | SC02 | Vrg | H11A1 | SC12 | PhC | LCE2008T | SC15 | M |
| CNG35 | SC12 | PhC | H11A2 | SC12 | PhC | LCE2009S | SC15 | М |
| CNG36 | SC12 | PhC | H11A3 | SC12 | PhC | LJE42002T | SC15 | M |
| CNG40 | SC12 | PhC | H11A4 | SC12 | PhC | LKE1004R | SC15 | M |
| CNG82 | SC12 | PhC | H11A5 | SC12 | PhC | LKE2002T | SC15 | M |
| CNG83 | SC12 | PhC | H11B1 | SC12 | PhC | LKE2004T | SC15 | M |
| CNR36 | SC12 | PhC | H11B2 | SC12 | PhC | LKE2015T | SC15 | М |
| CNS35 | SC12 | PhC | • | SC12 | PhC | LKE21004R | SC15 | M |
| | | | H11B3 | | | • | | |
| CNW82 | SC12 | PhC | H11B255 | SC12 | PhC | LKE21015T | SC15 | M |
| CNW83 | SC12 | PhC | KGZ10 | SC17 | SEN | LKE21050T | SC15 | M |
| CNX21 | SC12 | PhC | KGZ20 | SC17 | SEN | LKE27010R | SC15 | М |
| CNX35 | SC12 | PhC | KGZ21 | SC17 | SEN | LKE27025R | SC15 | М |
| CNX35U | SC12 | PhC | KMZ10A | SC17 | SEN | LKE32002T | SC15 | М |
| CNX36 | SC12 | PhC | KMZ10B | SC17 | SEN | LKE32004T | SC15 | М |
| CNX36U | SC12 | PhC | KMZ10C | SC17 | SEN | LTE21009R | SC15 | M |
| CNX38 | SC12 | PhC | KP100A | SC17 | SEN | LTE21015R | SC15 | M |
| CNIVOOLI | 0010 | DLC | KD10041 | 0017 | SEN | LTC2102ED | SC15 | М |
| CNX38U | SC12 | PhC | KP100A1 | SC17 | | LTE21025R | | |
| CNX39 | SC12 | PhC | KP101A | SC17 | SEN | LTE4002S | SC15 | М |
| CNX39U | SC12 | PhC | KPZ20G | SC17 | SEN | LTE42005S | SC15 | М |
| CNX48 | SC12 | PhC | KPZ21G | SC17 | SEN | LTE42008R | SC15 | М |
| CNX48U | SC12 | PhC | KPZ21GE | SC17 | SEN | LTE42012R | SC15 | М |
| CNX62 | SC12 | PhC | KRX10 | SC17 | SEN | LUE2003S | SC15 | М |
| CNX62A | SC12 | PhC | KRX11 | SC17 | SEN | LUE2009S | SC15 | M |
| CNX71 | SC12 | PhC | KTY81-100* | SC17 | SEN | LV172E50R | SC15 | М |
| CNX72A | SC12 | PhC | KTY81-200* | SC17 | SEN | LV2024E45R | SC15 | М |
| CNX82A | SC12 | PhC | KTY83-100* | SC17 | SEN | LV2327E40R | SC15 | M |
| CNIVOOA | 0010 | DL O | I/T/04 100* | 0017 | CEN | 17/30312205 | 0015 | |
| CNX83A | SC12 | PhC | KTY84-100* | SC17 | SEN | LV2931E50S | SC15 | М |
| CNY17-1 | SC12 | PhC | KTY85-100* | SC10/17 | | LV3742E16R | SC15 | M |
| CNY17-2 | SC12 | PhC | KTY86-205 | SC17 | SEN | LV3742E24R | SC15 | М |
| CNY17-3 | SC12 | PhC | KTY87-205 | SC17 | SEN | LVE21050R | SC15 | М |
| CNY17-4 | SC12 | PhC | LAE2001R | SC15 | М | LWE2015R | SC15 | М |
| CQW58A | S8a | 1 | LAE4000Q | SC15 | M | LWE2025R | SC15 | М |
| CQW89A | S8a | i | LAE4001R | SC15 | М | LZ1418E100R | SC15 | M |
| CQW89B | S8a | i | LAE4002S | SC15 | М | MCA230 | SC12 | PhC |
| CQY58A | S8a | 1 | LAE6000Q | SC15 | M | MCA231 | SC12 | PhC |
| CQY89A | S8a | 1 | LBE1004R | SC15 | M | MCA255 | SC12 | PhC |
| OOVOOT. | 00 | | I DE10102 | 0045 | | MOTO | 0040 | DI C |
| CQY89F | S8a | 1 | LBE1010R | SC15 | М | MCT2 | SC12 | PhC |
| ESM3045A(V) | SC06 | SP | LBE2003S | SC15 | M | MCT26 | SC12 | PhC |
| ESM3045D(V) | SC06 | SP | LBE2005Q | SC15 | M | MJE13004 | SC06 | SP |
| ESM4045A(V) | SC06 | SP | LBE2008T | SC15 | M | MJE13005 | SC06 | SP |
| | | SP | LBE2009S | SC15 | | MJE13006 | SC06 | SP |

| Type no. | book | section | Type no. | book | section | Type no. | book | section |
|---------------|------|---------|-------------------|------|---------|-------------------------|-------------|----------|
| MJE13007 | SC06 | SP | OM320 | SC14 | WBM | PBYR16035/40/45TV | SC02 | R |
| MJE13008 | SC06 | SP | 0M321 | SC14 | WBM | PBYR30035/40/45CT | | R |
| MJE13009 | SC06 | SP | 0M322 | SC14 | WBM | PBYR40035/40/45CT | | R |
| MKB12040WS | SC15 | M | OM323 | SC14 | WBM | PDE1001U | SC15 | M |
| MKB12100WS | SC15 | M | 0M323A | SC14 | WBM | PDE1003U | SC15 | M |
| WIND 12100VV3 | 3013 | IVI", | ONIOZOA | 3014 | VVDIVI | FDEI0030 | 3613 | IVI |
| MKB12140W | SC15 | M | OM335 | SC14 | WBM | PDE1005U | SC15 | M |
| M06075B200Z | SC15 | M | OM336 | SC14 | WBM | PDE1010U | SC15 | M |
| M06075B400Z | SC15 | M | OM337 | SC14 | WBM | PEE1001U | SC15 | М |
| MPS6513 | SC04 | Sm | OM337A | SC14 | WBM | PEE1003U | SC15 | М |
| MPS6514 | SC04 | Sm | OM339 | SC14 | WBM | PEE1005U | SC15 | М |
| MPS6515 | SC04 | Sm | OM345 | SC14 | WBM | PEE1010U | SC15 | М |
| MPS6517 | SC04 | Sm | OM350 | SC14 | WBM | | | |
| MPS6518 | SC04 | | · · | | | PH2222/A | SC04 | Sm |
| | | Sm | OM360 | SC14 | WBM | PH2369 | SC04 | Sm |
| MPS6519 | SC04 | Sm | OM361 | SC14 | WBM | PH2907 | SC04 | Sm |
| MPS6520 | SC04 | Sm | OM370 | SC14 | WBM | PH2907A | SC04 | Sm |
| MPS6521 | SC04 | Sm | OM386B | SC17 | SEN | PH5415 | SC04 | Sm |
| MPS6522 | SC04 | Sm | OM386M | SC17 | SEN | PH5416 | SC04 | Sm |
| MPS6523 | SC04 | Sm | OM387B | SC17 | SEN | PH6659 | SC07 | FET |
| MPSA05 | SC04 | Sm | OM387M | SC17 | SEN | PH6660 | SC07 | FET |
| MPSA06 | SC04 | Sm | OM388B | SC17 | SEN | PH6661 | | |
| WII SAU | 3004 | Sili | UNISOOD | 3617 | SEIN | PR0001 | SC07 | FET |
| MPSA13 | SC04 | Sm | OM389B | SC17 | SEN | PH13002 | SC06 | SP |
| MPSA14 | SC04 | Sm | OM390 | SC17 | SEN | PH13003 | SC06 | SP |
| MPSA42 | SC04 | Sm | OM391 | SC17 | SEN | PKB3001U | SC15 | M |
| MPSA43 | SC04 | Sm | OM931 | SC05 | P | PKB3003U | SC15 | M |
| MPSA55 | SC04 | Sm | OM961 | SC05 | P | PKB3005U | SC15 | М |
| MPSA56 | SC04 | Sm | OSB/M/S9115* | SC02 | St | PKB12005U | SC15 | М |
| MPSA63 | SC04 | Sm | OSB/M/S9215* | | | | | |
| | | | 1 | SC02 | St | PKB20010U | SC15 | М |
| MPSA64 | SC04 | Sm | OSB/M/S9415* | SC02 | St | PKB23001U | SC15 | М |
| MPSA92 | SC04 | Sm | OSM9510-12 | SC02 | St | PKB23003U | SC15 | М |
| MPSA93 | SC04 | Sm | P2105 | SC17 | SEN | PKB23005U | SC15 | М |
| MRB11080Y | SC15 | М | PBYR635/40/45CT | SC02 | R | PKB25006T | SC15 | М |
| MRB11175Y | SC15 | M | PBYR735/40/45 | SC02 | R | PKB32001U | SC15 | M |
| MRB11350Y | SC15 | M | PBYR735/40/45F | SC02 | R | PKB32003U | SC15 | M |
| MRB12175YR | SC15 | M | PBYR1035/40/45 | SC02 | | | | |
| MRB12350YR | SC15 | M | PBYR1035/40/45F | SC02 | R R | PKB32005U PLED-G313A | SC15 S8a | M LED |
| | | | | | | | Jou | LLU |
| MS1011B700Y | SC15 | M | PBYR1535/40/45CT | SC02 | R | PLED-G313N | S8a | LED |
| MS6075B800Z | SC15 | M | PBYR1535/40/45CTF | SC02 | R | PLED-G314A | S8a | LED |
| MSB11900Y | SC15 | M | PBYR1635/40/45 | SC02 | R | PLED-G314N | S8a | LED |
| MSB12900Y | SC15 | М | PBYR1635/40/45F | SC02 | R | | S8a | LED |
| MZ0912B75Y | SC15 | М | PBYR2035/40/45CT | | R | PLED-G513C | S8a | LED |
| M70012D1E0V | CC15 | | DDVD005/40/450= | 0000 | _ | DIED OFFE | | |
| MZ0912B150Y | SC15 | M | PBYR2035/40/45CTF | | R | PLED-G513M | S8a | LED |
| OM286 | SC17 | SEN | PBYR2535/40/45CT | | R | PLED-G514B | S8a | LED |
| OM286M | SC17 | SEN | PBYR2535/40/45CTF | | R | | S8a | LED |
| OM287 | SC17 | SEN | PBYR3035/40/45PT | SC02 | R | | S8a | LED |
| OM287M | SC17 | SEN | PBYR12035/40/45TV | SC02 | R | | S8a | LED |

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|-------------------------------------|------|---------|--------------|---------|-----------|---------------|---------|-------------|
| Type no. | book | section | Type no. | book | section | Type no. | book | section |
| PLED-GR14E | S8a | LED | PMBD2837 | SC01 | SD | PMLL4153 | SC10/10 | SD/Mm |
| PLED-GR14F | S8a | LED | PMBD2838 | SC01 | SD | PMLL4446 | SC10/10 | SD/Mm |
| PLED-GR14G | S8a | LED | PMBD6050 | SC01 | SD | PMLL4448 | SC10/10 | SD/Mm |
| PLED-GR44DL | S8a | LED | PMBD6100 | SC01 | SD | PMLL5225B to | | SD/Mm |
| PLED-H313A | S8a | LED | PMBD7000 | SC01 | SD | PMLL5267B | | SD/Mm |
| 1 223 1101011 | 000 | | 1 | 000. | - | | 5551,15 | C =, |
| PLED-H314A | S8a | LED | PMBF170 | SC07/10 | FET/Mm | PN2222 | SC04 | Sm |
| PLED-H511C | S8a | LED | PMBF4391 | - | FET/Mm | PN2222A | SC04 | Sm |
| PLED-H514B | S8a | LED | PMBF4392 | | FET/Mm | PN2369 | SC04 | Sm |
| PLED-H544KL | S8a | LED | PMBF4393 | | FET/Mm | PN2907 | SC04 | Sm |
| PLED-H544LL | S8a | LED | PMBFJ174 | - | FET/Mm | PN2907A | SC04 | Sm |
| 1.223 1101122 | 000 | LLU | 1 | 0007710 | | 111200771 | 0001 | · · · |
| PLED-HR14E | S8a | LED | PMBJF175 | SC07/10 | FET/Mm | PN3439 | SC04 | Sm |
| PLED-HR14F | S8a | LED | PMBJF176 | | FET/Mm | PN3440 | SC04 | Sm |
| PLED-HR14G | S8a | LED | PMBJF177 | - | FET/Mm | PN4391 | SC07 | FET |
| PLED-HR44DL | S8a | LED | PMBT2222 | SC10 | Mm | PN4392 | SC07 | FET |
| PLED-0313N | S8a | LED | PMBT2222A | SC10 | Mm | PN4393 | SC07 | FET |
| FEED-0313W | Soa | LEU | FIVIDIZZZZA | 3010 | IVIIII | F 104555 | 3607 | 161 |
| PLED-0314N | S8a | LED | PMBT2369 | SC10 | Mm | PN5415 | SC04 | Sm |
| PLED-0513M | S8a | LED | PMBT2907 | SC10 | Mm | PN5416 | SC04 | Sm |
| PLED-0514M | S8a | LED | PMBT2907A | SC10 | Mm | P044 | SC12 | PhC |
| 1 | S8a | LED | PMBT3903 | SC10 | Mm | P044A | SC12 | PhC |
| PLED-P313N PLED-P314N | S8a | LED | PMBT3904 | SC10 | Mm | PPC5001T | SC12 | M |
| PLED-P314N | Soa | LED | PIVIB 1 3904 | 3610 | IVIIII | PPC30011 | 3613 | IVI |
| PLED-P513M | S8a | LED | PMBT3906 | SC10 | Mm | PQC5001T | SC15 | М |
| PLED-P514M | S8a | LED | PMBT4401 | SC10 | Mm | PTB23001X | SC15 | M |
| PLED-T512B | S8a | LED | PMBT4403 | SC10 | Mm | PTB23003X | SC15 | M |
| PLED-TR12E | S8a | LED | PMBT5088 | SC10 | Mm | PTB23005X | SC15 | M |
| PLED-TR12F | S8a | LED | PMBT5401 | SC10 | Mm | PTB32001X | SC15 | M |
| reco-inizr | Soa | LLD | FIVID 1 5401 | 3010 | IVIIII | 1 1032001X | 3013 | IVI |
| PLED-TR12G | S8a | LED | PMBT5550 | SC10 | Mm | PTB32003X | SC15 | M |
| PLED-TR42DL | S8a | LED | PMBT5551 | SC10 | Mm | PTB32005X | SC15 | M |
| PLED-Y313A | S8a | LED | PMBT6428 | SC10 | Mm | PTB42001X | SC15 | M |
| PLED-1313A | S8a | LED | PMBT6429 | SC10 | Mm | PTB42002X | SC15 | M |
| PLED-Y314A | S8a | LED | PMBTA05 | SC10 | Mm | PTB42003X | SC15 | M |
| T LLD-1314A | 304 | LLU | 1 MIDI AUS | 3010 | 141111 | 110420000 | 5015 | 141 |
| PLED-Y314N | S8a | LED | PMBTA06 | SC10 | Mm | PV3742B4X | SC15 | M |
| PLED-1514N | S8a | LED | PMBTA13 | SC10 | Mm | PVB42004X | SC15 | M |
| PLED-Y513C | S8a | LED | PMBTA14 | SC10 | Mm | PXT2222 | SC10 | Mm |
| PLED-Y513M | S8a | LED | PMBTA42 | SC10 | Mm | PXT2222A | SC10 | Mm |
| PLED-Y514B | S8a | LED | PMBTA43 | SC10 | Mm | PXT2907 | SC10 | Mm |
| FLED-13146 | 304 | LLU | LIMID I M42 | 3010 | IVIIII | 1 1 1 2 3 0 7 | 3010 | IVIIII |
| PLED-Y514M | S8a | LED | PMBTA55 | SC10 | Mm | PXT2907A | SC10 | Mm |
| PLED-Y544KL | S8a | LED | PMBTA56 | SC10 | Mm | PXT3904 | SC10 | Mm |
| PLED-Y544LL | S8a | LED | PMBTA63 | SC10 | Mm | PXT3906 | SC10 | Mm |
| PLED-YR14E | S8a | LED | PMBTA64 | SC10 | Mm | PXT4401 | SC10 | Mm |
| PLED-YR14F | S8a | LED | PMBTA92 | SC10 | Mm | PXT4403 | SC10 | Mm |
| , , , , , , , , , , , , , , , , , , | υσα | LLU | INDIAGE | 0010 | 171111 | 1.711100 | 5510 | 171111 |
| PLED-YR14G | S8a | LED | PMBTA93 | SC10 | Mm | PXTA14 | SC10 | Mm |
| PLED-YR44DL | S8a | LED | PMBZ5226 | SC01 | SD | PXTA27 | SC10 | Mm |
| PMBD914 | SC01 | SD | PMLL4148 | | SD/Mm | PXTA64 | SC10 | Mm |
| PMBD2835 | SC01 | SD | PMLL4150 | | SD/Mm | PXTA77 | SC10 | Mm |
| PMBD2836 | SC01 | SD | PMLL4151 | - | SD/Mm | PZ1418B15U | SC15 | M |
| 1 141002000 | | | INILLTIJI | 0010/10 | JUJIVIIII | 1 217100130 | | 141 |
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| Type no. | book | section | Type no. | book | section | Type no. | book | section |
|-------------|------|---------|------------|------|---------|----------|------|------------|
| PZ1418B30U | SC15 | М | RZ2731B60W | SC15 | М | TIP136 | SC05 | Р |
| PZ1721B12U | SC15 | М | RZ2833B15W | SC15 | М | TIP137 | SC05 | P |
| PZ1721B25U | SC15 | M | RZ2833B30W | SC15 | M | TIP140 | SC05 | P |
| | | | 1 | | | | | Р |
| PZ2024B10U | SC15 | М | RZ2833B45W | SC15 | M · | TIP141 | SC05 | |
| PZ2024B20U | SC15 | М | RZ2833B60W | SC15 | М | TIP142 | SC05 | Р ., |
| PZ2327B15U | SC15 | M | RZ3135B15W | SC15 | M | TIP145 | SC05 | Р |
| PZB16035U | SC15 | М | RZ3135B30W | SC15 | M | TIP146 | SC05 | P |
| PZB16040U | SC15 | M | RZ3135B40W | SC15 | M | TIP147 | SC05 | Р |
| | | | I . | SC15 | | | SC05 | P |
| PZB27020U | SC15 | M | RZ3135B50W | | М | TIP2955 | | |
| PZT2222 | SC10 | Mm | RZB12050Y | SC15 | M | TIP2955T | SC05 | P |
| PZT2222A | SC10 | Mm | RZB12100Y | SC15 | М | TIP3055 | SC05 | Р |
| PZT2907 | SC10 | Mm | RZB12250Y | SC15 | M | TIP3055T | SC05 | P |
| PZT2907A | SC10 | Mm | SL5500 | SC12 | PhC | 1N821 | SC01 | Vrf |
| PZT3904 | SC10 | Mm | SL5501 | SC12 | PhC | 1N821A | SC01 | Vrf |
| | | | 1 | | | | | |
| PZT3906 | SC10 | Mm | SL5504 | SC12 | PhC | 1N823 | SC01 | Vrf |
| PZTA13 | SC10 | Mm | SL5505S | SC12 | PhC | 1N823A | SC01 | Vrf |
| PZTA14 | SC10 | Mm | SL5511 | SC12 | PhC | 1N825 | SC01 | Vrf |
| PZTA42 | SC10 | Mm | TIP29* | SC05 | P | 1N825A | SC01 | Vrf |
| | SC10 | Mm | TIP30* | SC05 | P | 1N827 | SC01 | Vrf |
| PZTA43 | | | 1 | | | | | |
| PZTA63 | SC10 | Mm | TIP31* | SC05 | Р | 1N827A | SC01 | Vrf |
| PZTA64 | SC10 | Mm | TIP32* | SC05 | Р | 1N829 | SC01 | Vrf |
| PZTA92 | SC10 | Mm | TIP33* | SC05 | Р | 1N829A | SC01 | Vrf |
| PZTA93 | SC10 | Mm | TIP34* | SC05 | P | 1N914 | SC01 | SD |
| RPW100 | SC17 | SEN | TIP41* | SC05 | P | 1N916 | SC01 | SD |
| | | | 1 | | | | | |
| RPW101 | SC17 | SEN | TIP42* | SC05 | Р | 1N4001D | SC01 | R |
| RPW102 | SC17 | SEN | TIP47 | SC06 | Р | 1N4002D | SC01 | R |
| RPY100 | SC17 | SEN | TIP48 | SC06 | P | 1N4003D | SC01 | R |
| RPY102 | SC17 | SEN | TIP49 | SC06 | P | 1N4004D | SC01 | R |
| RPY107 | SC17 | SEN | TIP50 | SC06 | P | 1N4005D | SC01 | R |
| RPY109 | SC17 | SEN | TIP110 | SC05 | P | 1N4005D | SC01 | R |
| | | | | | | | | |
| RPY222 | SC17 | SEN | TIP111 | SC05 | Р | 1N4007D | SC01 | R |
| RV2833B5X | SC15 | M | TIP112 | SC05 | P | 1N4001G | SC01 | R |
| RV3135B5X | SC15 | M | TIP115 | SC05 | Р | 1N4002G | SC01 | R |
| RX1011B250Y | SC15 | M | TIP116 | SC05 | P | 1N4003G | SC01 | R |
| RX1011B350Y | SC15 | М | TIP117 | SC05 | P | 1N4004G | SC01 | R |
| | | | | | _ | | | _ |
| RX1214B150Y | SC15 | М | TIP120 | SC05 | P | 1N4005G | SC01 | R . |
| RX1214B300Y | SC15 | M | TIP121 | SC05 | P | 1N4006G | SC01 | , R |
| RX2731B90W | SC15 | M | TIP122 | SC05 | P | 1N4007G | SC01 | R |
| RX3034B70W | SC15 | M | TIP125 | SC05 | Р | 1N4148 | SC01 | SD |
| RXB12350Y | SC15 | M | TIP126 | SC05 | P | 1N4150 | SC01 | SD |
| D71214D2EV | CC1F | 1.4 | TID127 | ccor | В | 18/4151 | 0001 | c n |
| RZ1214B35Y | SC15 | М | TIP127 | SC05 | Ρ. | 1N4151 | SC01 | SD |
| RZ1214B65Y | SC15 | М | TIP130 | SC05 | Р | 1N4153 | SC01 | SD |
| RZ1214B125Y | SC15 | M | TIP131 | SC05 | P | 1N4446 | SC01 | SD |
| RZ1214B150Y | SC15 | М | TIP132 | SC05 | Р | 1N4448 | SC01 | SD |
| RZ2731B45W | SC15 | М | TIP135 | SC05 | Р | 1N4531 | SC01 | SD |
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| Type no. | book | section | Type no. | book | section | Type no. | book | section |
|-----------|---------|---------|------------------|--------------|----------------|---------------|---------|---------|
| 1N4532 | SC01 | SD | 2N3927 | SC08 | RFP | 4N29 | SC12 | PhC |
| | SC01 | R | 2N3927 2N3966 | SC07 | FET | 4N30 | SC12 | PhC |
| 1N4933 | | | 2N4030 | SC07 | | 4N30 4N31 | SC12 | PhC |
| 1N5059 | SC01 | R | | | Sm | | | |
| 1N5060 | SC01 | R | 2N4031 | SC04 | Sm | 4N32 | SC12 | PhC |
| 1N5061 | SC01 | R | 2N4032 | SC04 | Sm | 4N33 | SC12 | PhC |
| 1N5062 | SC01 | R | 2N4033 | SC04 | Sm | 4N35 | SC12 | PhC |
| 1N5225 to | SC01 | R | 2N4091 | SC07 | FET | 4N36 | SC12 | PhC |
| 1N5267B | SC01 | R | 2N4092 | SC07 | FET | 4N37 | SC12 | PhC |
| 2N918 | SC14 | WBT | 2N4093 | SC07 | FET | 4N38 | SC12 | PhC |
| 2N930 | SC04 | Sm | 2N4123 | SC04 | Sm | 4N38A | SC12 | PhC |
| 2011612 | C C O 4 | C.m. | 2014124 | SC04 | C _m | ANAG | SC12 | PhC |
| 2N1613 | SC04 | Sm | 2N4124 | SC04 | Sm Sm | 4N46 6N135 | SC12 | |
| 2N1711 | SC04 | Sm | 2N4125 | SC04 | Sm | | SC12 | PhC |
| 2N1893 | SC04 | Sm | 2N4126 | SC04 | Sm | 6N136 | SC12 | PhC |
| 2N2219 | SC04 | Sm | 2N4391 | SC07 | FET | 56201d | SC06 | Α |
| 2N2219A | SC04 | Sm | 2N4392 | SC07 | FET | 56201j | SC06 | Α |
| 2N2222 | SC04 | Sm | 2N4393 | SC07 | FET | 56245 | SC04/14 | Α |
| 2N2222A | SC04 | Sm | 2N4400 | SC04 | Sm | 56246 | SC04/14 | Α |
| 2N2297 | SC04 | Sm | 2N4401 | SC04 | Sm | 56261a | SC06 | Α |
| 2N2369 | SC04 | Sm | 2N4402 | SC04 | Sm | 56264 | S2b | A |
| 2N2369A | SC04 | Sm | 1 | SC04 | Sm | 56264a | SC02 | A |
| ZN2309A | 3004 | SIII | 2N4403 | 3004 | SIII | 30204a | 3002 | А |
| 2N2483 | SC04 | Sm | 2N4427 | SC08 | RFP | 56264b | SC02 | Α |
| 2N2484 | SC04 | Sm | 2N4856 | SC07 | FET | 56295 | SC2b | Α |
| 2N2904 | SC04 | Sm | 2N4857 | SC07 | FET | 56295a | SC02 | Α |
| 2N2904A | SC04 | Sm | 2N4858 | SC07 | FET | 56295b | SC02 | Α |
| 2N2905 | SC04 | Sm | 2N4859 | SC07 | FET | 56295c | SC02 | Α |
| 2N2905A | SC04 | Sm | 2N4860 | SC07 | FET | 56326 | SC06 | Α |
| 2N2906 | SC04 | Sm | 2N4861 | SC07 | FET | 56339 | SC06 | Â |
| 2N2906A | SC04 | Sm | 2N5086 | SC04 | Sm | 56352 | SC06 | Ā |
| 2N2907 | SC04 | Sm | 2N5087 | SC04 | Sm | 56353 | SC06 | Â |
| 3 | | | 1 | | | | | |
| 2N2907A | SC04 | Sm | 2N5088 | SC04 | Sm | 56354 | SC06 | Α |
| 2N3019 | SC04 | Sm | 2N5089 | SC04 | Sm | 56359b | SC02 | Α |
| 2N3020 | SC04 | Sm | 2N5400 | SC04 | Sm | 56359c | SC02 | Α |
| 2N3053 | SC04 | Sm | 2N5401 | SC04 | Sm | 56359d | SC02 | Α |
| 2N3375 | SC08 | RFP | 2N5415 | SC04 | Sm | 56360a | SC02 | Α |
| 2N3553 | SC08 | RFP | 2N5416 | SC04 | Sm | 56363 | SC02 | Α |
| 2N3632 | SC08 | RFP | 2N5550 | SC04 | Sm | 56364 | SC02 | Α |
| 0 | 0.00- | | | | _ | | | |
| 2N3822 | SC07 | FE I | 2N5551 | SC04 SC07 | Sm | 56367 | SU02 | A |
| 2N3823 | SC07 | FET | 2N6659 | SC07 | FET | 56368b | SC02 | A |
| 2N3866 | SC08 | RFP | 2N6660 | SC07 | FET | 56368c | SC02 | A |
| 2N3903 | SC04 | Sm | 2N6661 | SC07 | FET | 56369 | SC02 | Α |
| 2N3904 | SC04 | Sm | 4N25 | SC12 | PhC | 56378 | SC02 | Α |
| 2N3905 | SC04 | Sm | 4N25A | SC12 | PhC | 56379 | SC02 | Α |
| 2N3906 | SC04 | Sm | 4N26 | SC12 | PhC | 56387a | SC06 | Α |
| 2N3924 | SC08 | RFP | 4N27 | SC12 | PhC | 56387b | SC06 | Α |
| 2N3926 | SC08 | RFP | 4N28 | SC12 | PhC | 56397 | SC01 | A |
| | | | | | | L | | |



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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^{*} 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 ² C-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 |

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DISCRETE SEMICONDUCTORS

| 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

| current code | new code | handbook title | |
|-----------------|-------------|---|--|
| T8 | DC01 | Colour display components | |
| 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

| current code | new code | handbook title |
|-----------------|-------------|--|
| C14 | PA01 | Electrolytic capacitors; solid and non-solid |
| 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.

PROFESSIONAL COMPONENTS

| current code | new code | handbook title |
|-----------------|-------------|--|
| T1 | * | Power tubes for RF heating and communications |
| T2a | * | Transmitting tubes for communications, glass types |
| T2b | * | Transmitting tubes for communications, ceramic types |
| Т3 | PC01** | High-power klystrons |
| T4 | * | Magnetrons for microwave heating |
| T5 | PC02** | Cathode-ray tubes |
| Т6 | PC03** | Geiger-Müller tubes |
| Т9 | 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

| current code | new code | handbook title | | | |
|-----------------|------------------|---|--|--|--|
| C4 } | MA01* | Soft Ferrites | | | |
| C16 C19 | MA02** MA03** | Permanent magnet materials Piezoelectric ceramics | | | |

^{*} Handbooks C4 and C5 will be reissued as one handbook having the new code MA01.

^{**} Not yet issued with the new code in this series of handbooks.

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