

# DATA SHEET



## **BYD77 series** Ultra fast low-loss controlled avalanche rectifiers

Product specification  
Supersedes data of 1996 May 24

1999 Nov 15

## Ultra fast low-loss controlled avalanche rectifiers

## BYD77 series

### FEATURES

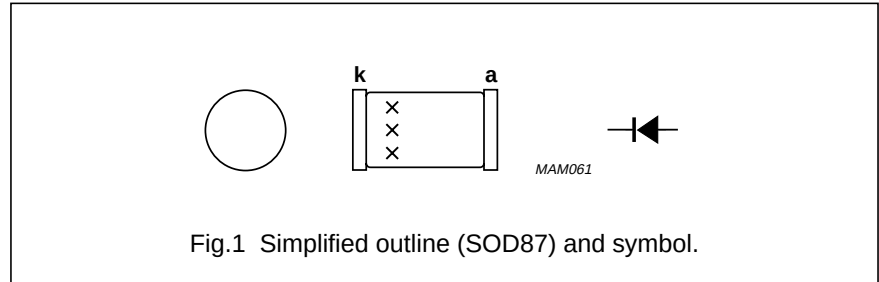
- Glass passivated
- High maximum operating temperature
- Low leakage current
- Excellent stability
- Guaranteed avalanche energy absorption capability
- Shipped in 8 mm embossed tape
- Smallest surface mount rectifier outline.

### DESCRIPTION

Cavity free cylindrical glass SOD87 package through Implotec™<sup>(1)</sup> technology. This package is

hermetically sealed and fatigue free as coefficients of expansion of all used parts are matched.

(1) Implotec is a trademark of Philips.



### LIMITING VALUES

In accordance with the Absolute Maximum Rating System (IEC 134).

| SYMBOL             | PARAMETER                       | CONDITIONS                                                                                                                     | MIN. | MAX. | UNIT |
|--------------------|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------|------|------|------|
| V <sub>RRM</sub>   | repetitive peak reverse voltage |                                                                                                                                |      |      |      |
|                    | BYD77A                          |                                                                                                                                | —    | 50   | V    |
|                    | BYD77B                          |                                                                                                                                | —    | 100  | V    |
|                    | BYD77C                          |                                                                                                                                | —    | 150  | V    |
|                    | BYD77D                          |                                                                                                                                | —    | 200  | V    |
|                    | BYD77E                          |                                                                                                                                | —    | 250  | V    |
|                    | BYD77F                          |                                                                                                                                | —    | 300  | V    |
|                    | BYD77G                          |                                                                                                                                | —    | 400  | V    |
| V <sub>R</sub>     | continuous reverse voltage      |                                                                                                                                |      |      |      |
|                    | BYD77A                          |                                                                                                                                | —    | 50   | V    |
|                    | BYD77B                          |                                                                                                                                | —    | 100  | V    |
|                    | BYD77C                          |                                                                                                                                | —    | 150  | V    |
|                    | BYD77D                          |                                                                                                                                | —    | 200  | V    |
|                    | BYD77E                          |                                                                                                                                | —    | 250  | V    |
|                    | BYD77F                          |                                                                                                                                | —    | 300  | V    |
|                    | BYD77G                          |                                                                                                                                | —    | 400  | V    |
| I <sub>F(AV)</sub> | average forward current         | T <sub>tp</sub> = 105 °C; see Figs 2 and 3; averaged over any 20 ms period; see also Figs 10 and 11                            | —    | 2.00 | A    |
|                    | BYD77A to D                     |                                                                                                                                | —    | 1.85 | A    |
| I <sub>F(AV)</sub> | average forward current         | T <sub>amb</sub> = 60 °C; PCB mounting (see Fig.16); see Figs 4 and 5; averaged over any 20 ms period; see also Figs 10 and 11 | —    | 0.85 | A    |
|                    | BYD77A to D                     |                                                                                                                                | —    | 0.80 | A    |
|                    | BYD77E to G                     |                                                                                                                                |      |      |      |

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| SYMBOL    | PARAMETER                                    | CONDITIONS                                                                                     | MIN. | MAX. | UNIT |
|-----------|----------------------------------------------|------------------------------------------------------------------------------------------------|------|------|------|
| $I_{FRM}$ | repetitive peak forward current              | $T_{tp} = 105\text{ °C}$ ; see Figs 6 and 7                                                    | –    | 15   | A    |
|           | BYD77A to D                                  |                                                                                                |      | 13   | A    |
| $I_{FRM}$ | repetitive peak forward current              | $T_{amb} = 60\text{ °C}$ ; see Figs 8 and 9                                                    | –    | 8.5  | A    |
|           | BYD77E to G                                  |                                                                                                |      | 8.0  | A    |
| $I_{FSM}$ | non-repetitive peak forward current          | $t = 10\text{ ms}$ half sine wave; $T_j = T_{j\text{ max}}$ prior to surge; $V_R = V_{RRMmax}$ | –    | 25   | A    |
| $E_{RSM}$ | non-repetitive peak reverse avalanche energy | $L = 120\text{ mH}$ ; $T_j = 25\text{ °C}$ prior to surge; inductive load switched off         | –    | 10   | mJ   |
| $T_{stg}$ | storage temperature                          |                                                                                                | –65  | +175 | °C   |
| $T_j$     | junction temperature                         |                                                                                                | –65  | +175 | °C   |

### ELECTRICAL CHARACTERISTICS

$T_j = 25\text{ °C}$  unless otherwise specified.

| SYMBOL      | PARAMETER                           | CONDITIONS                                                                                                     | MIN. | TYP. | MAX. | UNIT |
|-------------|-------------------------------------|----------------------------------------------------------------------------------------------------------------|------|------|------|------|
| $V_F$       | forward voltage                     | $I_F = 1\text{ A}$ ; $T_j = T_{j\text{ max}}$ ; see Figs 12 and 13                                             | –    | –    | 0.75 | V    |
|             | BYD77A to D                         |                                                                                                                | –    | –    | 0.83 | V    |
| $V_F$       | forward voltage                     | $I_F = 1\text{ A}$ ; see Figs 12 and 13                                                                        | –    | –    | 0.98 | V    |
|             | BYD77E to G                         |                                                                                                                | –    | –    | 1.05 | V    |
| $V_{(BR)R}$ | reverse avalanche breakdown voltage | $I_R = 0.1\text{ mA}$                                                                                          |      |      |      |      |
|             | BYD77A                              |                                                                                                                | 55   | –    | –    | V    |
|             | BYD77B                              |                                                                                                                | 110  | –    | –    | V    |
|             | BYD77C                              |                                                                                                                | 165  | –    | –    | V    |
|             | BYD77D                              |                                                                                                                | 220  | –    | –    | V    |
|             | BYD77E                              |                                                                                                                | 275  | –    | –    | V    |
|             | BYD77F                              |                                                                                                                | 330  | –    | –    | V    |
|             | BYD77G                              |                                                                                                                | 440  | –    | –    | V    |
| $I_R$       | reverse current                     | $V_R = V_{RRMmax}$ ; see Fig.14                                                                                | –    | –    | 1    | μA   |
|             |                                     | $V_R = V_{RRMmax}$ ; $T_j = 165\text{ °C}$ ; see Fig.14                                                        | –    | –    | 100  | μA   |
| $t_{rr}$    | reverse recovery time               | when switched from $I_F = 0.5\text{ A}$ to $I_R = 1\text{ A}$ ; measured at $I_R = 0.25\text{ A}$ ; see Fig.18 | –    | –    | 25   | ns   |
|             | BYD77A to D                         |                                                                                                                | –    | –    | 50   | ns   |
|             | BYD77E to G                         |                                                                                                                |      |      |      |      |

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| SYMBOL                           | PARAMETER                                    | CONDITIONS                                                                                                                       | MIN. | TYP. | MAX. | UNIT             |
|----------------------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|------|------|------|------------------|
| $C_d$                            | diode capacitance                            | $f = 1 \text{ MHz}$ ; $V_R = 0 \text{ V}$ ;<br>see Fig.15                                                                        | –    | 50   | –    | pF               |
|                                  | BYD77A to D<br>BYD77E to G                   |                                                                                                                                  | –    | 40   | –    | pF               |
| $\left  \frac{dI_R}{dt} \right $ | maximum slope of reverse recovery<br>current | when switched from<br>$I_F = 1 \text{ A}$ to $V_R \geq 30 \text{ V}$ and<br>$dI_F/dt = -1 \text{ A}/\mu\text{s}$ ;<br>see Fig.17 | –    | –    | 4    | A/ $\mu\text{s}$ |
|                                  | BYD77A to D<br>BYD77E to G                   |                                                                                                                                  | –    | –    | 5    | A/ $\mu\text{s}$ |

### THERMAL CHARACTERISTICS

| SYMBOL                | PARAMETER                                     | CONDITIONS | VALUE | UNIT |
|-----------------------|-----------------------------------------------|------------|-------|------|
| $R_{th \text{ j-tp}}$ | thermal resistance from junction to tie-point |            | 30    | K/W  |
| $R_{th \text{ j-a}}$  | thermal resistance from junction to ambient   | note 1     | 150   | K/W  |

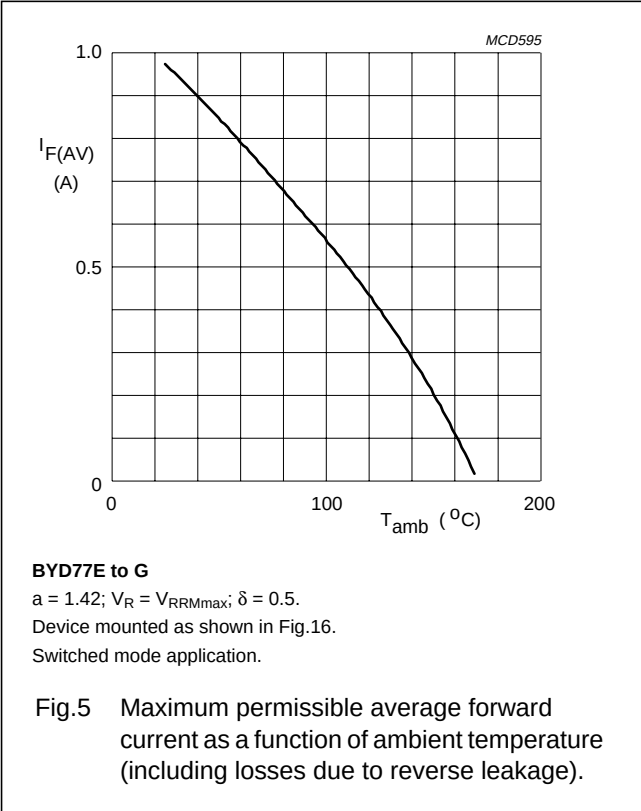
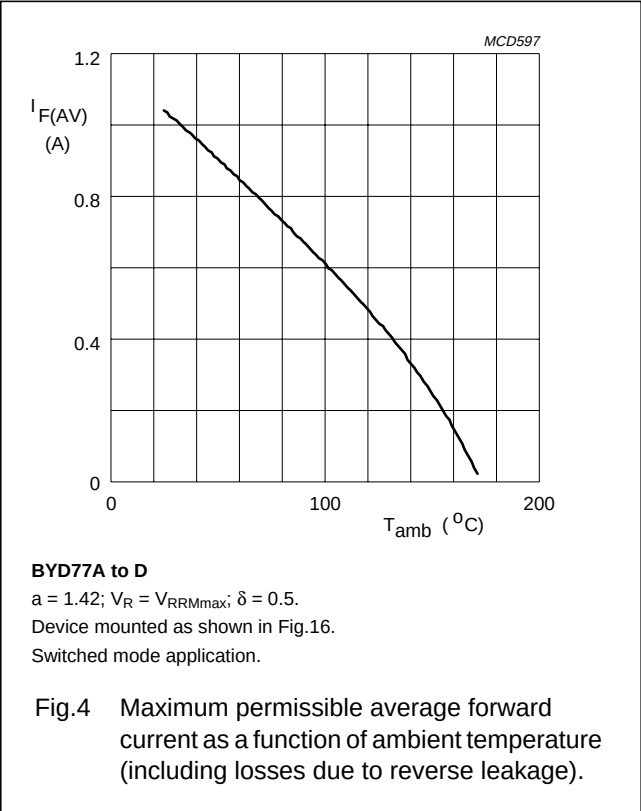
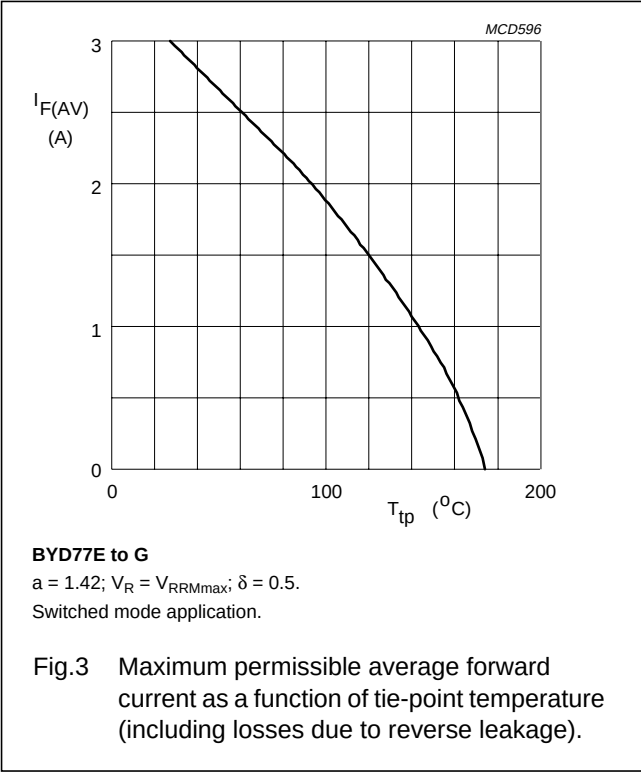
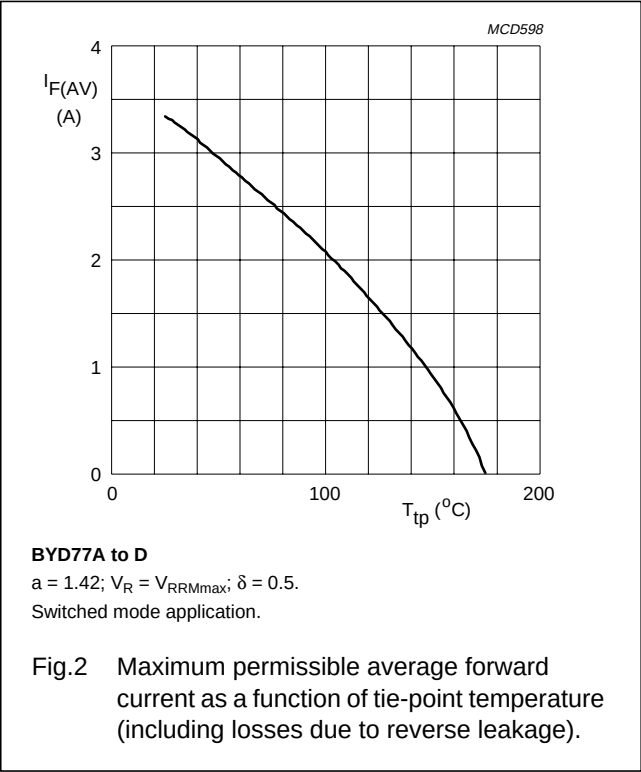
#### Note

1. Device mounted on an epoxy-glass printed-circuit board, 1.5 mm thick; thickness of Cu-layer  $\geq 40 \mu\text{m}$ , see Fig.16.  
For more information please refer to the "General Part of associated Handbook".

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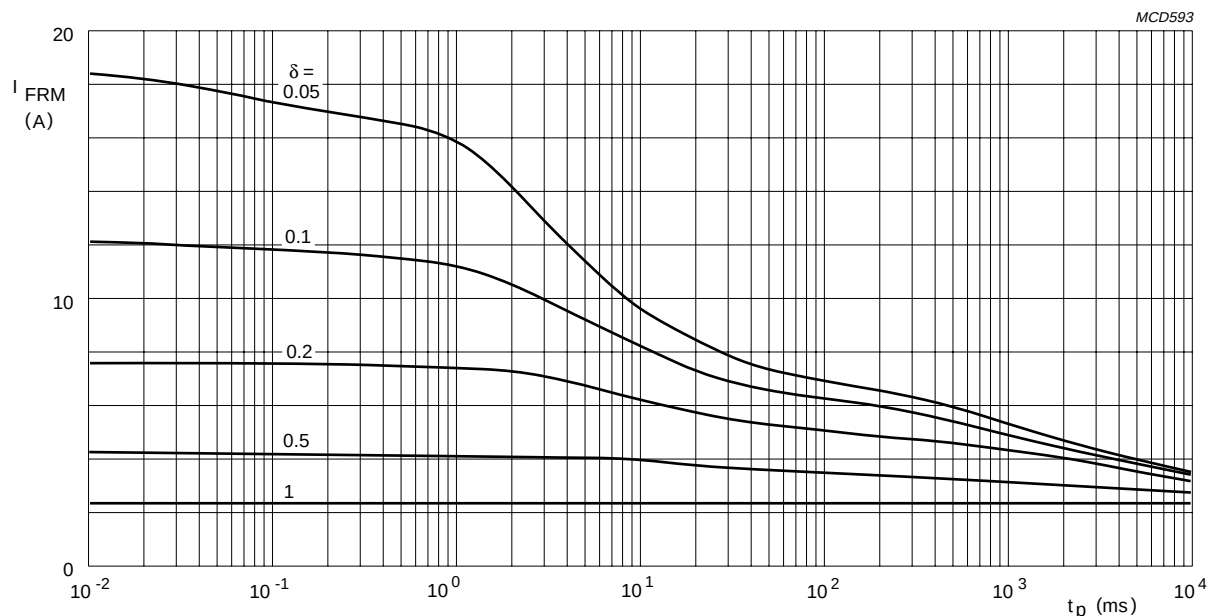
BYD77 series

GRAPHICAL DATA



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## BYD77 series

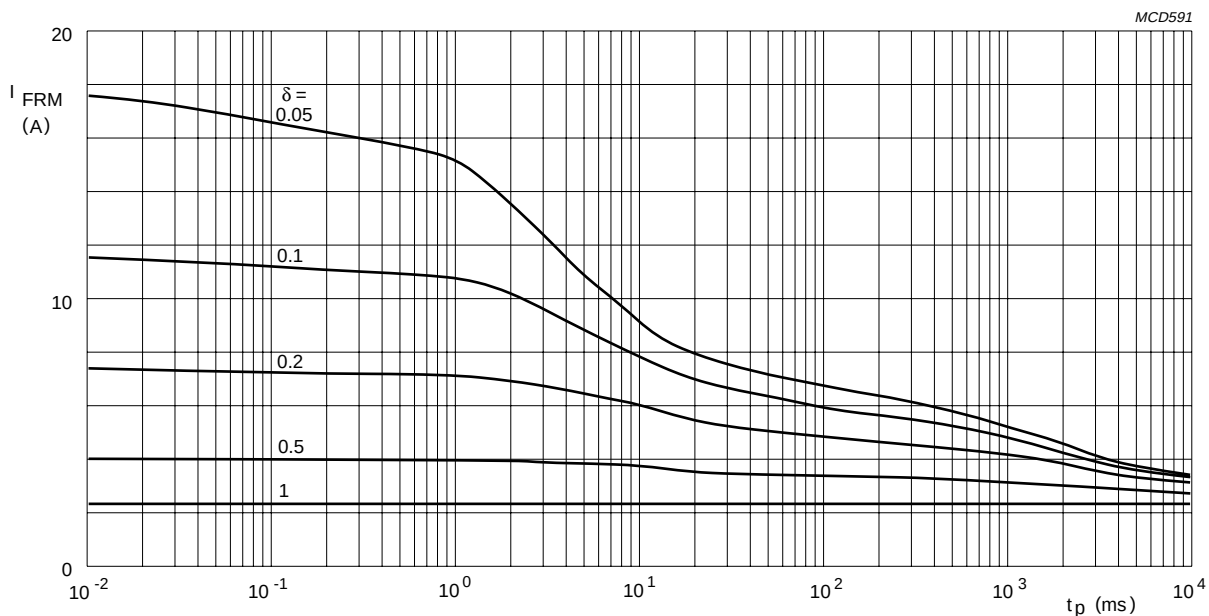


### BYD77A to D

$T_{ip} = 105^\circ\text{C}$ ;  $R_{thj-tp} = 30 \text{ K/W}$ .

$V_{RRMmax}$  during  $1 - \delta$ ; curves include derating for  $T_{jmax}$  at  $V_{RRM} = 200 \text{ V}$ .

Fig.6 Maximum repetitive peak forward current as a function of pulse time (square pulse) and duty factor.



### BYD77E to G

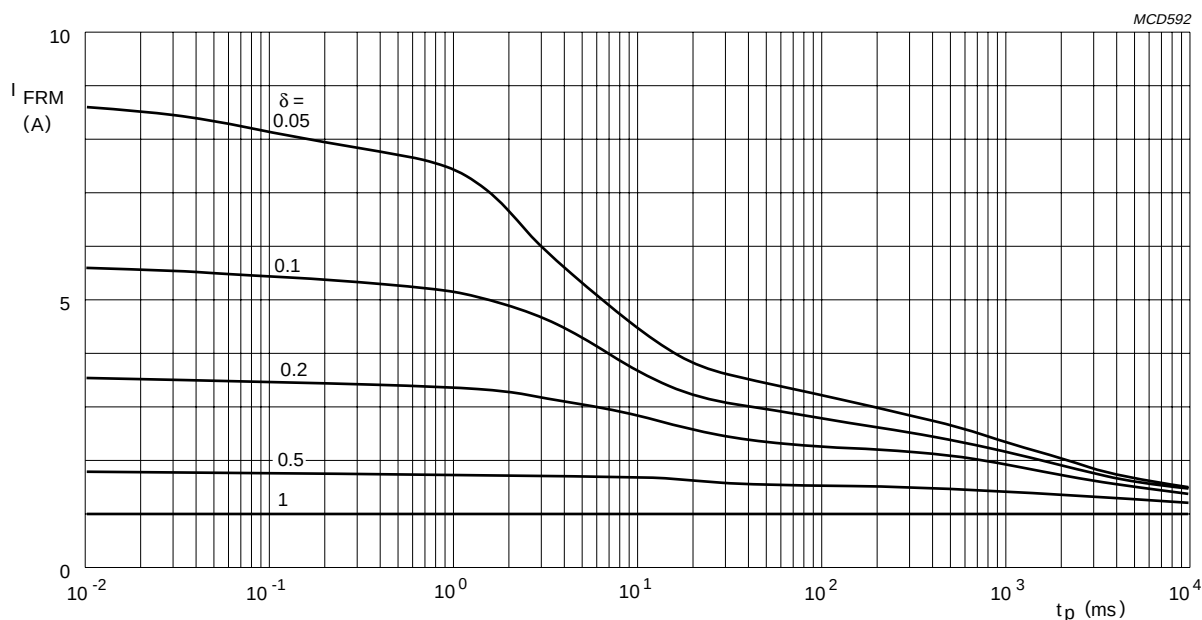
$T_{ip} = 105^\circ\text{C}$ ;  $R_{thj-tp} = 30 \text{ K/W}$ .

$V_{RRMmax}$  during  $1 - \delta$ ; curves include derating for  $T_{jmax}$  at  $V_{RRM} = 400 \text{ V}$ .

Fig.7 Maximum repetitive peak forward current as a function of pulse time (square pulse) and duty factor.

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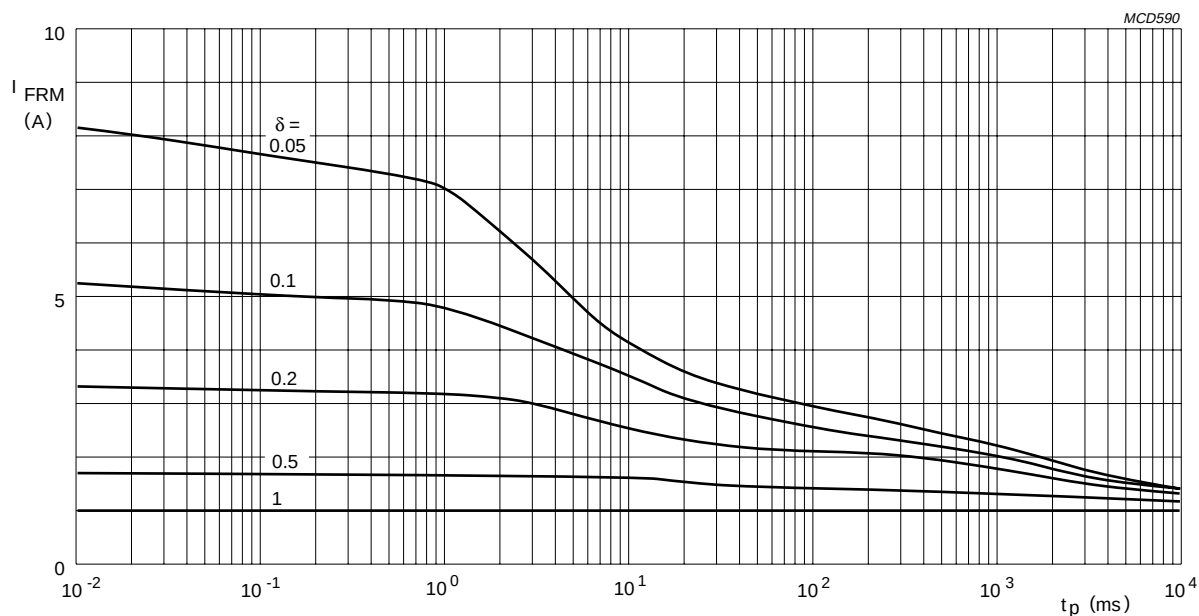


BYD77A to D

$$T_{\text{amb}} = 60\text{ }^{\circ}\text{C}; R_{\text{th j-a}} = 150\text{ K/W.}$$

$V_{RRMmax}$  during  $1 - \delta$ ; curves include derating for  $T_{jmax}$  at  $V_{RRM} = 200$  V.

Fig.8 Maximum repetitive peak forward current as a function of pulse time (square pulse) and duty factor.



**BYD77E to G**

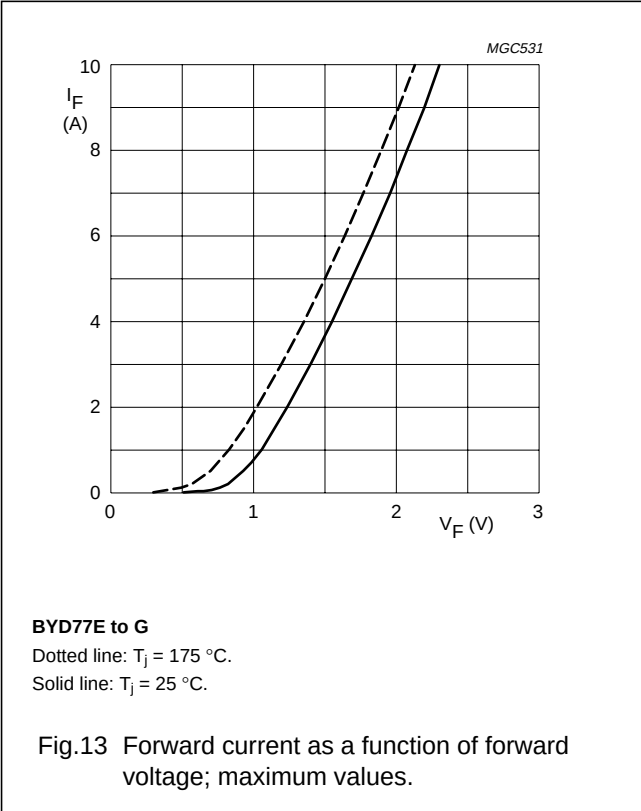
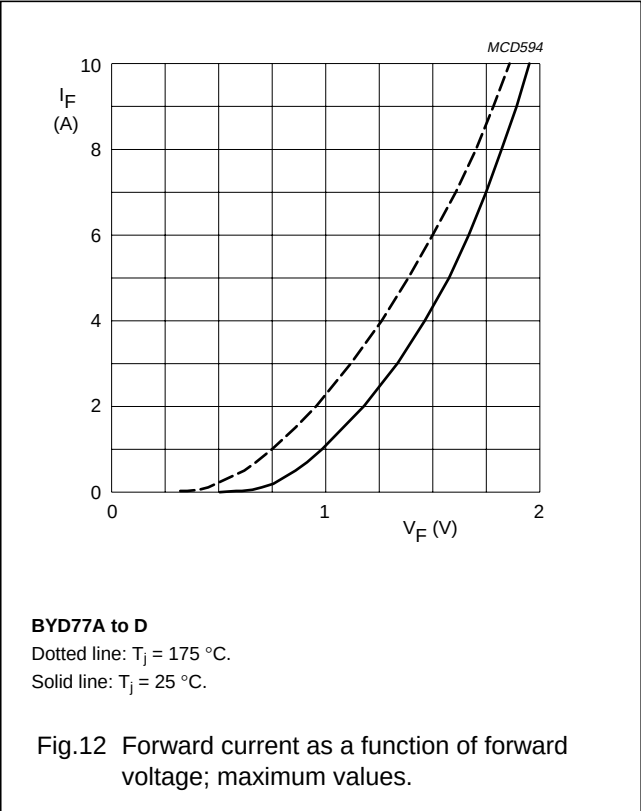
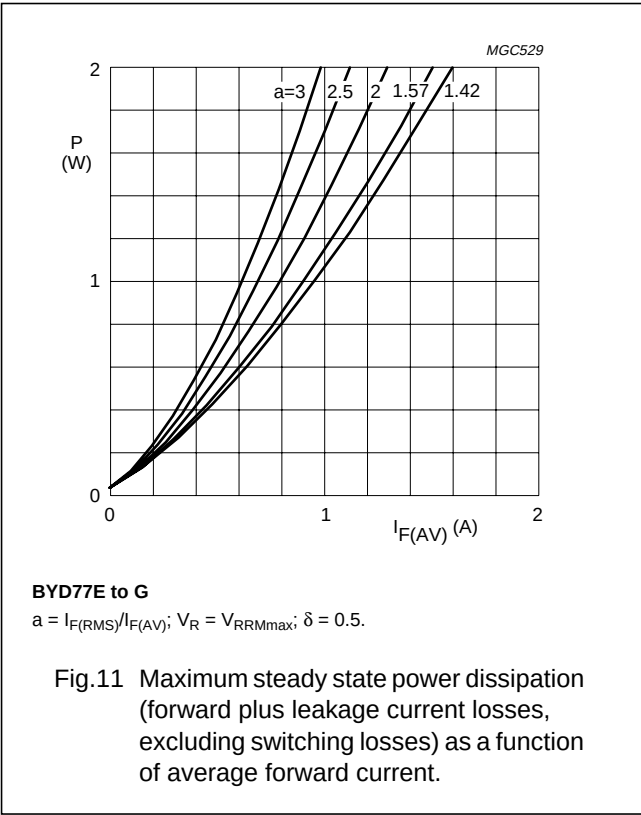
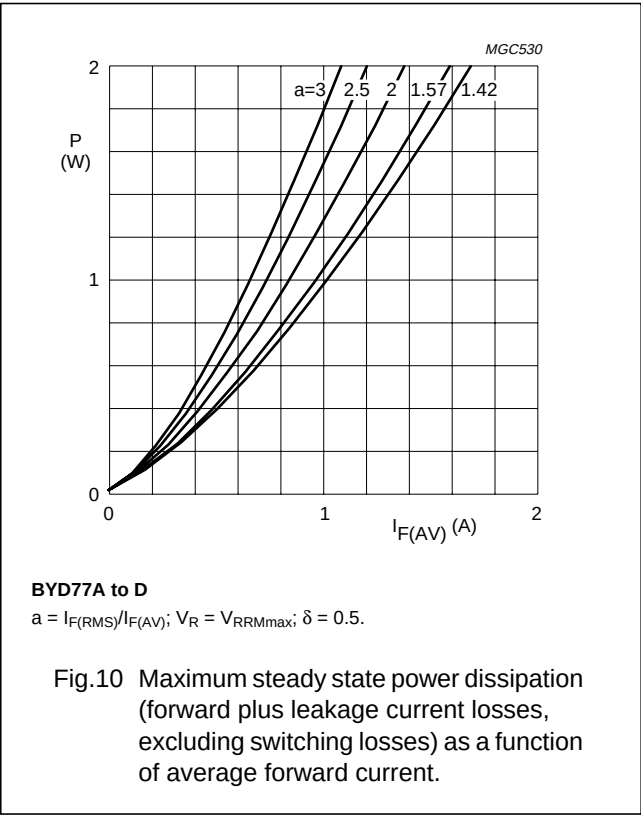
$$T_{\text{amb}} = 60\text{ }^{\circ}\text{C}; R_{\text{th i-a}} = 150\text{ K/W.}$$

$V_{RRMmax}$  during  $1 - \delta$ ; curves include derating for  $T_{jmax}$  at  $V_{RRM} = 400$  V.

Fig.9 Maximum repetitive peak forward current as a function of pulse time (square pulse) and duty factor.

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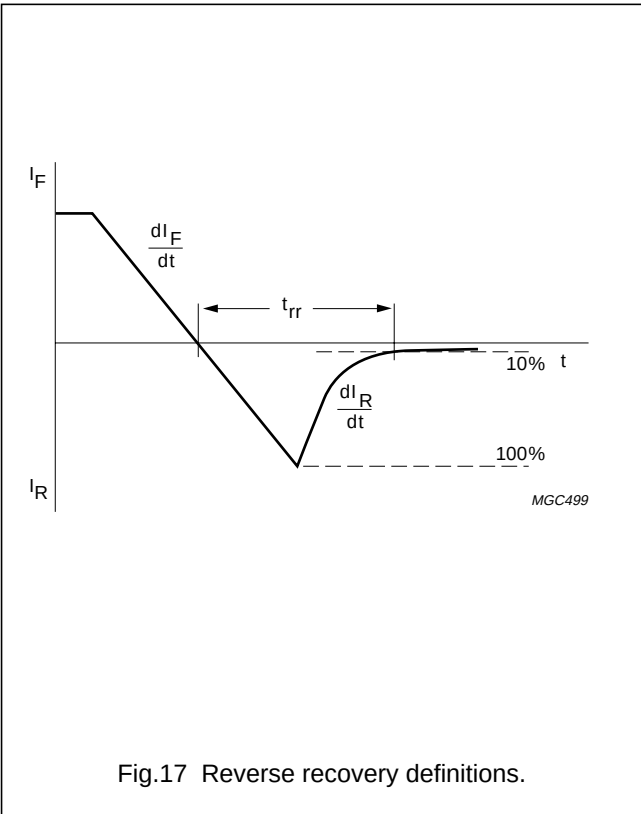
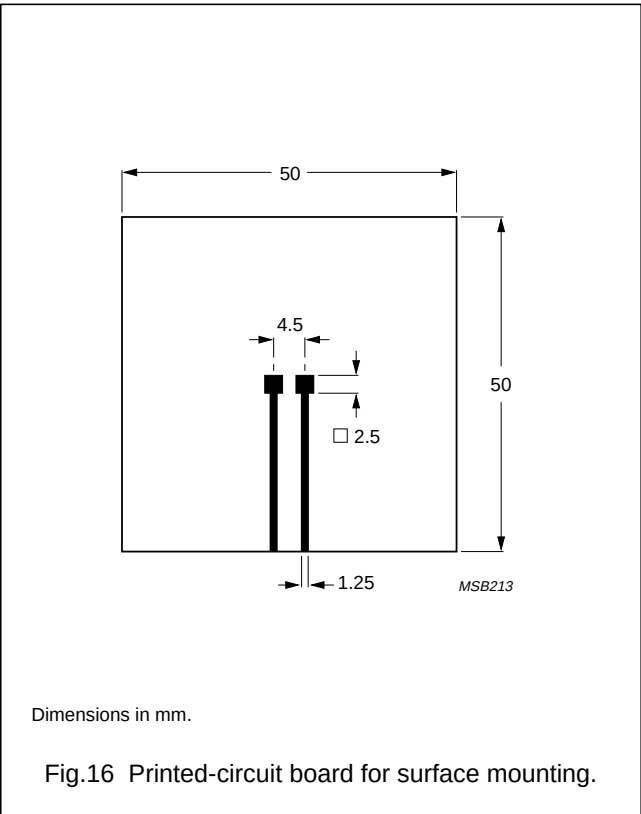
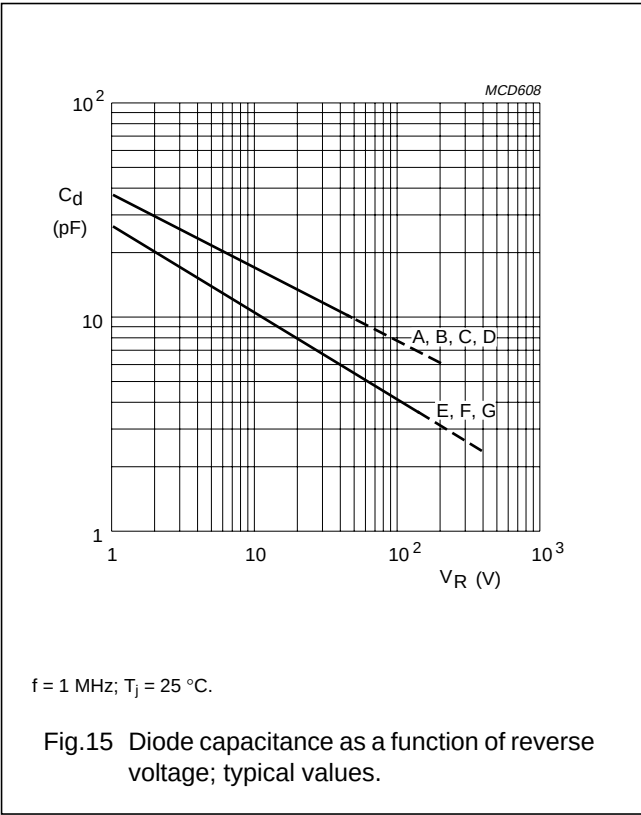
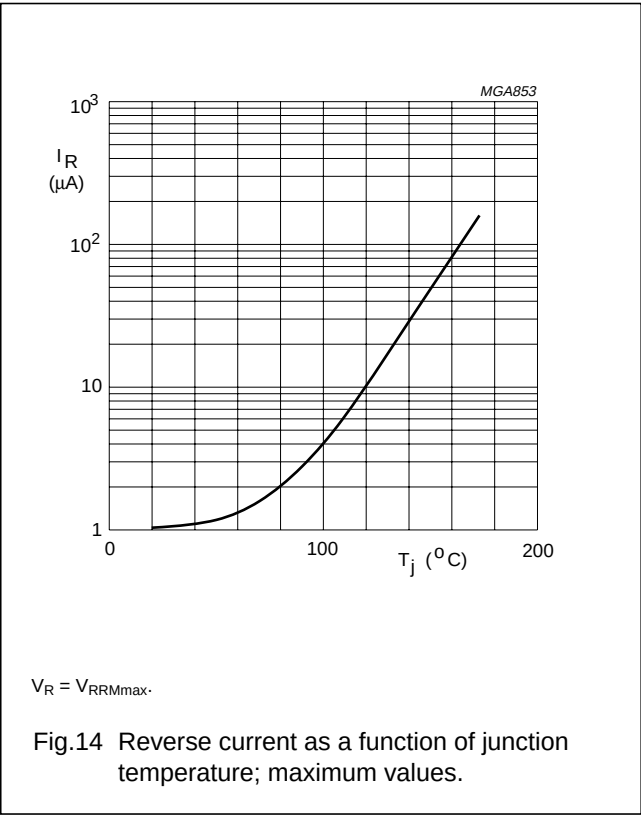
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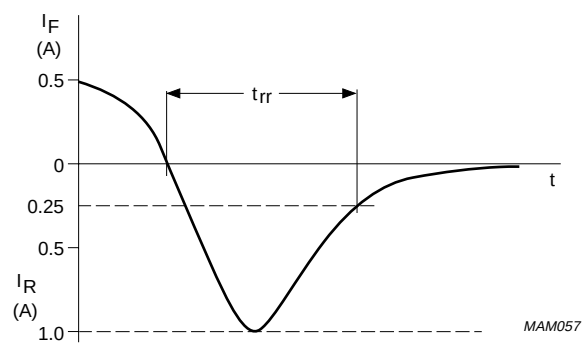
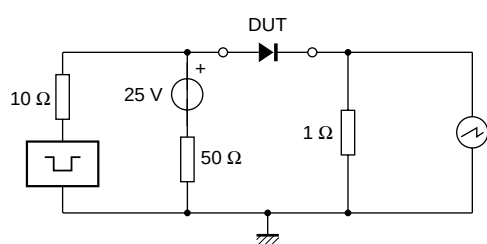
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Input impedance oscilloscope: 1 M $\Omega$ , 22 pF;  $t_r \leq 7$  ns.  
Source impedance: 50  $\Omega$ ;  $t_r \leq 15$  ns.

Fig.18 Test circuit and reverse recovery time waveform and definition.

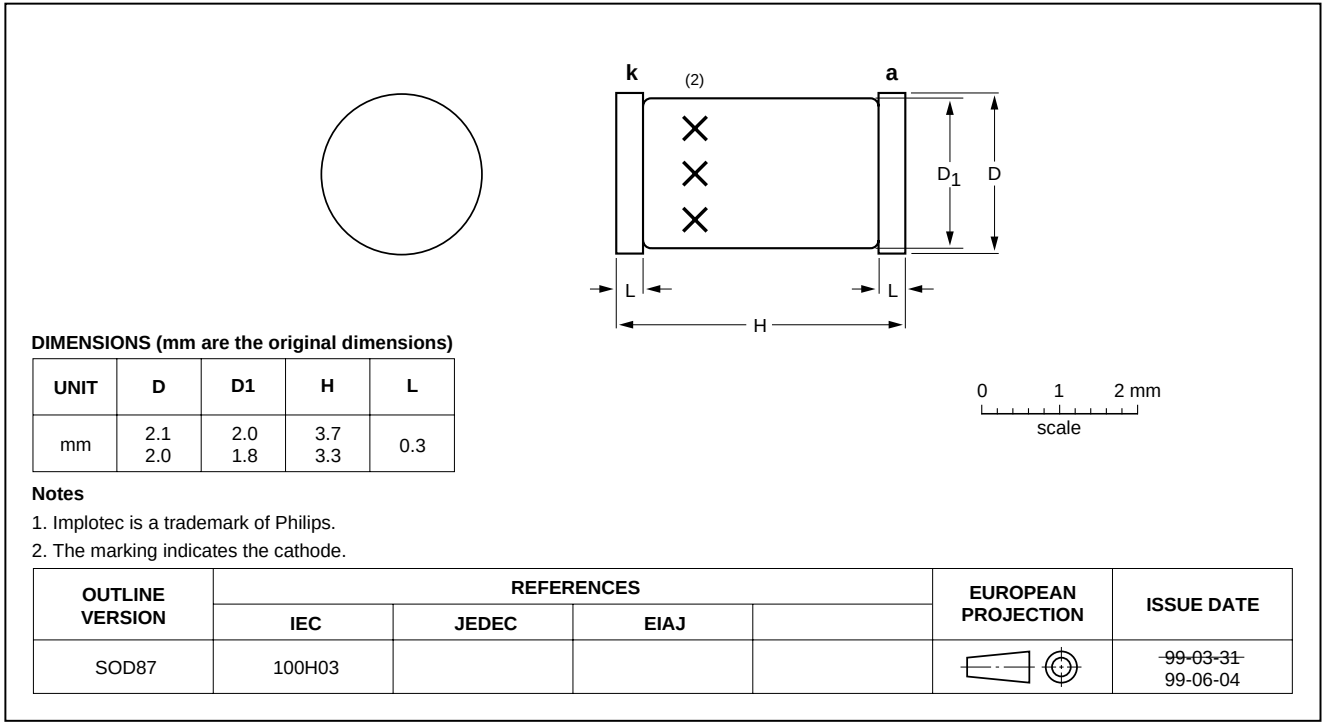
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PACKAGE OUTLINE

Hermetically sealed glass surface mounted package;  
Implotec™(1) technology; 2 connectors

SOD87



DEFINITIONS

| Data Sheet Status                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Objective specification                                                                                                                                                                                                                                                                                                                                                                                                                                   | This data sheet contains target or goal specifications for product development.       |
| Preliminary specification                                                                                                                                                                                                                                                                                                                                                                                                                                 | This data sheet contains preliminary data; supplementary data may be published later. |
| Product specification                                                                                                                                                                                                                                                                                                                                                                                                                                     | This data sheet contains final product specifications.                                |
| Limiting values                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                       |
| Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability. |                                                                                       |
| Application information                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                       |
| Where application information is given, it is advisory and does not form part of the specification.                                                                                                                                                                                                                                                                                                                                                       |                                                                                       |

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