BYD13 series
Controlled avalanche rectifiers

Product specification
Supersedes data of April 1992
File under Discrete Semiconductors, SC01

1996 May 24
Controlled avalanche rectifiers  
BYD13 series

FEATURES
- Glass passivated
- High maximum operating temperature
- Low leakage current
- Excellent stability
- Guaranteed avalanche energy absorption capability
- Available in ammo-pack.

DESCRIPTION
Cavity free cylindrical glass package through Implotec\textsuperscript{(1)} technology.
This package is hermetically sealed and fatigue free as coefficients of expansion of all used parts are matched.

\textsuperscript{(1)} Implotec is a trademark of Philips.

MARKING

<table>
<thead>
<tr>
<th>TYPE NUMBER</th>
<th>MARKING CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>BYD13D</td>
<td>13D PH</td>
</tr>
<tr>
<td>BYD13G</td>
<td>13G PH</td>
</tr>
<tr>
<td>BYD13J</td>
<td>13J PH</td>
</tr>
<tr>
<td>BYD13K</td>
<td>13K PH</td>
</tr>
<tr>
<td>BYD13M</td>
<td>13M PH</td>
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LIMITING VALUES
In accordance with the Absolute Maximum Rating System (IEC 134).

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>PARAMETER</th>
<th>CONDITIONS</th>
<th>MIN.</th>
<th>MAX.</th>
<th>UNIT</th>
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<tbody>
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<td>200 V</td>
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<tr>
<td>BYD13G</td>
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<td>400 V</td>
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<td>BYD13J</td>
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<td>600 V</td>
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<td></td>
<td></td>
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<tr>
<td>BYD13K</td>
<td>–</td>
<td>800 V</td>
<td></td>
<td></td>
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<td>$V_{R\text{WM}}$</td>
<td>crest working reverse voltage</td>
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<tr>
<td>BYD13D</td>
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<td>200 V</td>
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<td></td>
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<tr>
<td>BYD13G</td>
<td>–</td>
<td>400 V</td>
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<td></td>
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<td>BYD13J</td>
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<tr>
<td>BYD13K</td>
<td>–</td>
<td>800 V</td>
<td></td>
<td></td>
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<tr>
<td>BYD13M</td>
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<td>$V_R$</td>
<td>continuous reverse voltage</td>
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<td>BYD13D</td>
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<td>200 V</td>
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<tr>
<td>BYD13M</td>
<td>–</td>
<td>1000 V</td>
<td></td>
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</tr>
</tbody>
</table>

Fig.1 Simplified outline (SOD81) and symbol.
Controlled avalanche rectifiers

### ELECTRICAL CHARACTERISTICS

#### CONDITIONS

**T<sub>j</sub>** = 25 °C; unless otherwise specified.

#### SYMBOL | PARAMETER | CONDITIONS | MIN. | TYP. | MAX. | UNIT
---|---|---|---|---|---|---
I<sub>F(AV)</sub> | average forward current | T<sub>tp</sub> = 55 °C; lead length = 10 mm; averaged over any 20 ms period; see Figs 2 and 4 | – | 1.40 A | – | A
|  |  | T<sub>amb</sub> = 65 °C; PCB mounting (see Fig.9); averaged over any 20 ms period; see Figs 3 and 4 | – | 0.75 A | – | A
I<sub>FSM</sub> | non-repetitive peak forward current | t = 10 ms half sinewave; T<sub>j</sub> = T<sub>j max</sub> prior to surge; V<sub>R</sub> = V<sub>RRMmax</sub> | – | 20 A | – | A
E<sub>RSM</sub> | non-repetitive peak reverse avalanche energy | L = 120 mH; T<sub>j</sub> = T<sub>j max</sub> prior to surge; inductive load switched off | – | 7 mJ | – | mJ
T<sub>stg</sub> | storage temperature | –65 °C | +175 °C | °C
T<sub>j</sub> | junction temperature | see Fig.5 | –65 °C | +175 °C | °C

#### SYMBOL | PARAMETER | CONDITIONS | VALUE | UNIT
---|---|---|---|---
V<sub>F</sub> | forward voltage | I<sub>F</sub> = 1 A; T<sub>j</sub> = T<sub>j max</sub>; see Fig.6 | 0.93 V | V
|  |  | I<sub>F</sub> = 1 A; see Fig.6 | 1.05 V | V
V<sub>(BR)R</sub> | reverse avalanche breakdown voltage | I<sub>R</sub> = 0.1 mA | 225 V | V
BYD13D |  |  | 450 V | V
BYD13G |  |  | 650 V | V
BYD13J |  |  | 900 V | V
BYD13K |  |  | 1100 V | V
BYD13M |  |  |  | V
I<sub>R</sub> | reverse current | V<sub>R</sub> = V<sub>RRMmax</sub>; see Fig.7 | – | 1 μA | μA
|  |  | V<sub>R</sub> = V<sub>RRMmax</sub>; T<sub>j</sub> = 165 °C; see Fig.7 | – | 100 μA | μA
I<sub>rr</sub> | reverse recovery time | when switched from I<sub>F</sub> = 0.5 A to I<sub>R</sub> = 1 A; measured at I<sub>R</sub> = 0.25 A; see Fig.10 | – | 3 μs | μs
C<sub>d</sub> | diode capacitance | V<sub>R</sub> = 0 V; f = 1 MHz; see Fig.8 | – | 21 pF | pF

#### THERMAL CHARACTERISTICS

#### SYMBOL | PARAMETER | CONDITIONS | VALUE | UNIT
---|---|---|---|---
R<sub>th j-tp</sub> | thermal resistance from junction to tie-point | lead length = 10 mm | 60 K/W | K/W
R<sub>th j-a</sub> | thermal resistance from junction to ambient | note 1 | 120 K/W | K/W

**Note**

1. Device mounted on epoxy-glass printed-circuit board, 1.5 mm thick; thickness of copper ≥40 μm, see Fig.9.
   For more information please refer to the “General Part of Handbook SC01”.

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**GRAPHICAL DATA**

**Fig. 2** Maximum permissible average forward current as a function of tie-point temperature (including losses due to reverse leakage).

\[ a = 1.57; V_R = V_{RRMmax}; \delta = 0.5. \]

Lead length 10 mm.

**Fig. 3** Maximum permissible average forward current as a function of ambient temperature (including losses due to reverse leakage).

\[ a = 1.57; V_R = V_{RRMmax}; \delta = 0.5. \]

Device mounted as shown in Fig.9.

**Fig. 4** Maximum steady state power dissipation (forward plus leakage current losses, excluding switching losses) as a function of average forward current.

\[ a = I_{f(RMS)}/I_{f(AV)}; V_R = V_{RRMmax}; \delta = 0.5. \]

**Fig. 5** Maximum permissible junction temperature as a function of reverse voltage.

Solid line = \( V_R \).

Dotted line = \( V_{RRM} \); \( \delta = 0.5 \).
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Fig.6 Forward current as a function of forward voltage; maximum values.

Solid line: $T_j = 25 \, ^\circ\text{C}$.
Dotted line: $T_j = 175 \, ^\circ\text{C}$.

Fig.7 Reverse current as a function of junction temperature; maximum values.

$V_R = V_{RRMmax}$.

Fig.8 Diode capacitance as a function of reverse voltage; typical values.

$f = 1 \, \text{MHz}; T_j = 25 \, ^\circ\text{C}$.

Fig.9 Device mounted on a printed-circuit board.

Dimensions in mm.
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Fig. 10 Test circuit and reverse recovery time waveform and definition.

Input impedance oscilloscope: 1 MΩ, 22 pF; t ≤ 7 ns.
Source impedance: 50 Ω; t ≤ 15 ns.
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PACKAGE OUTLINE

Fig.11 SOD81.

DEFINITIONS

Data sheet status

<table>
<thead>
<tr>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective specification</td>
<td>This data sheet contains target or goal specifications for product development.</td>
</tr>
<tr>
<td>Preliminary specification</td>
<td>This data sheet contains preliminary data; supplementary data may be published later.</td>
</tr>
<tr>
<td>Product specification</td>
<td>This data sheet contains final product specifications.</td>
</tr>
</tbody>
</table>

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.

LIFE SUPPORT APPLICATIONS

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips for any damages resulting from such improper use or sale.