BYX90G
High-voltage soft-recovery controlled avalanche rectifier

Product specification
Supersedes data of June 1996
File under Discrete Semiconductors, SC01
High-voltage soft-recovery controlled avalanche rectifier

FEATURES
• Glass passivated
• High maximum operating temperature
• Low leakage current
• Excellent stability
• Soft-recovery switching characteristics
• Guaranteed avalanche energy absorption capability.

APPLICATIONS
• High-voltage rectification at high frequencies
• Sub-component for very high voltage rectifiers, for example, in X-ray and radar equipment.

DESCRIPTION
Rugged glass package, using a high temperature alloyed construction.
This package is hermetically sealed and fatigue free as coefficients of expansion of all used parts are matched.

The package is designed to be used in an insulating medium such as resin, oil or SF6 gas.
See also the chapter on custom made high-voltage rectifiers in the “General Part of Handbook SC01”.

Fig. 1 Simplified outline (SOD83A) and symbol.

The cathode is marked by a black band on the body.

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>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{RRM}$</td>
<td>repetitive peak reverse voltage</td>
<td></td>
<td>–</td>
<td>7.5</td>
<td>kV</td>
</tr>
<tr>
<td>$V_{RWM}$</td>
<td>crest working reverse voltage</td>
<td></td>
<td>–</td>
<td>6</td>
<td>kV</td>
</tr>
<tr>
<td>$I_{(AV)}$</td>
<td>average forward current</td>
<td>averaged over any 20 ms period; $T_{oil} = 45 , ^\circ\mathrm{C}$; see Fig.2; see also Fig.3</td>
<td>–</td>
<td>550</td>
<td>mA</td>
</tr>
<tr>
<td>$I_{FRM}$</td>
<td>repetitive peak forward current</td>
<td></td>
<td>–</td>
<td>5</td>
<td>A</td>
</tr>
<tr>
<td>$I_{FSM}$</td>
<td>non-repetitive peak forward current</td>
<td>$t = 10 , \mu\mathrm{s}$ half sinewave; $T_{j} = T_{j\max}$ prior to surge; $V_{R} = V_{RWM\max}$; see Fig.4</td>
<td>–</td>
<td>20</td>
<td>A</td>
</tr>
<tr>
<td>$P_{RSM}$</td>
<td>non-repetitive peak reverse power dissipation</td>
<td>$t = 10 , \mu\mathrm{s}$ triangular pulse; $T_{j} = T_{j\max}$ prior to surge</td>
<td>–</td>
<td>5</td>
<td>kW</td>
</tr>
<tr>
<td>$T_{stg}$</td>
<td>storage temperature</td>
<td></td>
<td>–65</td>
<td>+165</td>
<td>°C</td>
</tr>
<tr>
<td>$T_{j}$</td>
<td>junction temperature</td>
<td></td>
<td>–65</td>
<td>+165</td>
<td>°C</td>
</tr>
</tbody>
</table>
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ELECTRICAL CHARACTERISTICS

$T_J = 25 \, ^\circ C$; unless otherwise specified.

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<tr>
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<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_F$</td>
<td>forward voltage</td>
<td>$I_F = 2 , A$; see Fig.5</td>
<td>–</td>
<td>–</td>
<td>14.5</td>
<td>V</td>
</tr>
<tr>
<td>$V_{(BR)R}$</td>
<td>reverse avalanche breakdown voltage</td>
<td>$I_R = 0.1 , mA$</td>
<td>8</td>
<td>–</td>
<td>–</td>
<td>kV</td>
</tr>
<tr>
<td>$I_R$</td>
<td>reverse current</td>
<td>$V_R = V_{RWM_{\text{max}}}; T_J = T_{J_{\text{max}}}$</td>
<td>–</td>
<td>–</td>
<td>50</td>
<td>µA</td>
</tr>
<tr>
<td>$I_{tr}$</td>
<td>reverse recovery time</td>
<td>when switched from $I_F = 0.5 , A$ to $I_R = 1 , A$; measured at $I_R = 0.25 , A$; see Fig.7</td>
<td>–</td>
<td>–</td>
<td>350</td>
<td>ns</td>
</tr>
</tbody>
</table>

THERMAL CHARACTERISTICS

<table>
<thead>
<tr>
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<th>CONDITIONS</th>
<th>VALUE</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{th,j-o}$</td>
<td>thermal resistance from junction to oil</td>
<td>note 1; see also Fig.6</td>
<td>20</td>
<td>K/W</td>
</tr>
</tbody>
</table>

Note

1. 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 oil temperature (including losses due to reverse leakage).

\[ a = 1.57; \delta = 0.5; V_R = V_{RW\text{max}}. \]

**Fig.3** Maximum steady state power dissipation (forward plus leakage losses) as a function of average forward current.

\[ a = I_{FRMS}/I_{F(AV)}; \delta = 0.5; V_R = V_{RW\text{max}}. \]

50 Hz half sinewave current burst.

\[ T_j = 165 \, ^\circ\text{C prior to surge.} \]

\[ V_R = V_{RW\text{max}}. \]

**Fig.4** Maximum non-repetitive peak forward current as a function of burst duration.

\[ 10^{-2} \quad 10^{-1} \quad 1 \quad 10 \quad 10^{2} \]

\[ 1 \quad 10 \quad 10^{2} \]

\[ I_{FSM} \quad (A) \]

\[ \text{duration (s)} \]

Dotted lines: \[ T_j = 165 \, ^\circ\text{C}. \]

Solid line: \[ T_j = 25 \, ^\circ\text{C}. \]

**Fig.5** Forward current as a function of maximum forward voltage.
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Fig.6 Thermal impedance in oil as a function of time.

Fig.7 Test circuit and reverse recovery time waveform and definition.

Input impedance oscilloscope: 1 MΩ, 22 pF; \( t_r \leq 7 \) ns.
Source impedance: 50 Ω; \( t_c \leq 15 \) ns.
APPLICATION INFORMATION

Typical 3-phase bridge application information

Fig. 8 Maximum permissible output current in a 3-phase rectifier bridge with a minimum time between exposures of 20 s; T_{oil} = 50 °C.
Fig. 9  Maximum current through a 3-phase bridge rectifier versus pulse duration; exposure time $T = 1$ s; $T_{oil} = 50$ °C.
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Fig. 10 Maximum current through a 3-phase bridge rectifier versus pulse duration; exposure time $T = 3$ s; $T_{oil} = 50$ °C.
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PACKAGE OUTLINE

DEFINITIONS

<table>
<thead>
<tr>
<th>Data Sheet Status</th>
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<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.