FAST SOFT-RECOVERY RECTIFIER DIODES

Silicon double-diffused rectifier diodes in plastic envelopes. 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 devices feature non-snap-off characteristics. Normal and reverse polarity types are available.

### QUICK REFERENCE DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>BYX71-350(R)</th>
<th>600(R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repetitive peak reverse voltage</td>
<td>V_{RRM} max.</td>
<td>350</td>
</tr>
<tr>
<td>Average forward current</td>
<td>I_{F(AV)} max.</td>
<td>7</td>
</tr>
<tr>
<td>Non-repetitive peak forward current</td>
<td>I_{FSM} max.</td>
<td>60</td>
</tr>
<tr>
<td>Reverse recovery time</td>
<td>t_{rr} &lt;</td>
<td>450</td>
</tr>
</tbody>
</table>

### MECHANICAL DATA (see also page 2)

SOD-38

Dimensions in mm

The exposed metal base-plate is directly connected to tag 1.
MECHANICAL DATA (continued)

Net mass: 2,5 g

Recommended diameter of fixing screw: 3,5 mm

Torque on screw
  when using washer and heatsink compound: min. 0,95 Nm (9,5 kg cm)
  max. 1,5 Nm (15 kg cm)

Accessories:
  supplied with the device: 56355 (washer)
  available on request: 56316 (mica insulating washer)

POLARITY OF CONNECTIONS

<table>
<thead>
<tr>
<th>BYX71-350 and BYX71-600</th>
<th>BYX71-350R and BYX71-600R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base-plate: cathode</td>
<td>anode</td>
</tr>
<tr>
<td>Tag 1: cathode</td>
<td>anode</td>
</tr>
<tr>
<td>Tag 2: anode</td>
<td>cathode</td>
</tr>
</tbody>
</table>
**RATINGS** Limiting values in accordance with the Absolute Maximum System (IEC134)

<table>
<thead>
<tr>
<th>VOLTAGES</th>
<th>BYX71-350(R)</th>
<th>600(R)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous reverse voltage</td>
<td>$V_R$ max. 300</td>
<td>500 V</td>
</tr>
<tr>
<td>Working reverse voltage</td>
<td>$V_{RW}$ max. 300</td>
<td>500 V</td>
</tr>
<tr>
<td>Repetitive peak reverse voltage ($\delta \leq 0.01$)</td>
<td>$V_{RRM}$ max. 350</td>
<td>600 V</td>
</tr>
<tr>
<td>Non-repetitive peak reverse voltage ($t \leq 10$ ms)</td>
<td>$V_{RSMM}$ max. 350</td>
<td>600 V</td>
</tr>
</tbody>
</table>

**Currents**

Average on-state current assuming zero switching losses

- Square wave: $\delta = 0.5$; up to $T_{mb} = 85^\circ C$ without heatsink at $T_{amb} = 50^\circ C$
- Sinusoidal: at $T_{mb} = 85^\circ C$

<table>
<thead>
<tr>
<th>Average on-state current</th>
<th>I_{F(AV)} max. 7 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without heatsink at $T_{amb} = 50^\circ C$</td>
<td>I_{F(AV)} max. 1.4 A</td>
</tr>
<tr>
<td>Sinusoidal at $T_{mb} = 85^\circ C$</td>
<td>I_{F(AV)} max. 6.5 A</td>
</tr>
</tbody>
</table>

R.M.S. forward current

<table>
<thead>
<tr>
<th>R.M.S. forward current</th>
<th>I_{F(RMS)} max. 10 A</th>
</tr>
</thead>
</table>

Repetitive peak forward current

<table>
<thead>
<tr>
<th>Repetitive peak forward current</th>
<th>I_{F(RM)} max. 25 A</th>
</tr>
</thead>
</table>

Non-repetitive peak forward current

- Half sine wave; $t = 10$ ms; $T_j = 150^\circ C$ prior to surge
- Square pulse; $t = 5$ ms; $T_j = 150^\circ C$ prior to surge

<table>
<thead>
<tr>
<th>Non-repetitive peak forward current</th>
<th>I_{FSM} max. 60 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Half sine wave; $t = 10$ ms; $T_j = 150^\circ C$ prior to surge</td>
<td>I_{FSM} max. 60 A</td>
</tr>
<tr>
<td>Square pulse; $t = 5$ ms; $T_j = 150^\circ C$ prior to surge</td>
<td>-$rac{dI}{dt}$ max. 50 A/\mu s</td>
</tr>
</tbody>
</table>

**Temperatures**

- Storage temperature: $T_{stg} = -55$ to $+125$ °C
- Junction temperature: $T_j$ max. 150 °C

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THERMAL RESISTANCE

From junction to mounting base

\[ R_{th\ j-mb} = 6.5 \, ^\circ\text{C/W} \]
\[ Z_{th\ j-mb} = 0.3 \, ^\circ\text{C/W} \]

Transient thermal impedance; \( t = 1 \, \text{ms} \)

Influence of mounting method

1. Heatsink mounted

   From mounting base to heatsink:
   a. with heatsink compound
   b. with heatsink compound and 56316 mica washer
   c. without heatsink compound
   d. without heatsink compound; with 56316 mica washer

\[ R_{th\ mb-h} = 1.5 \, ^\circ\text{C/W} \]
\[ R_{th\ mb-h} = 2.7 \, ^\circ\text{C/W} \]
\[ R_{th\ mb-h} = 2.7 \, ^\circ\text{C/W} \]
\[ R_{th\ mb-h} = 5 \, ^\circ\text{C/W} \]

2. Free air operation

The quoted values of \( R_{th\ j-a} \) should be used only when no other leads run to the tie-points.

From junction to ambient in free air mounted on a printed circuit board

at \( a = \text{maximum lead length} \)
and with a copper laminate
a. \( > 1 \, \text{cm}^2 \)
   \[ R_{th\ j-a} = 50 \, ^\circ\text{C/W} \]
   \[ R_{th\ j-a} = 55 \, ^\circ\text{C/W} \]

at a lead-length \( a = 3 \, \text{mm} \)
and with a copper laminate
b. \( < 1 \, \text{cm}^2 \)
   \[ R_{th\ j-a} = 55 \, ^\circ\text{C/W} \]
   \[ R_{th\ j-a} = 60 \, ^\circ\text{C/W} \]

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SOLDERING AND MOUNTING NOTES

1. Soldered joints must be at least 2,5 mm from the seal.

2. The maximum permissible temperature of the soldering iron or bath is 270 °C; contact with the joint must not exceed 3 seconds.

3. The device should not be immersed in oil, and few potting resins are suitable for re-encapsulation. Advice on these materials is available on request.

4. Leads should not be bent less than 2,5 mm from the seal; exert no axial pull when bending.

5. For good thermal contact heatsink compound should be used between base-plate and heatsink.

CHARACTERISTICS

Forward voltage

\[ I_F = 5 \, \text{A}; \quad T_j = 25 \, \text{°C} \]

\[ V_F < 1,25 \, \text{V} \]

Reverse current

\[ V_R = V_{R\text{Wmax}}; \quad T_j = 125 \, \text{°C} \]

\[ I_R < 0,4 \, \text{mA} \]

Reverse recovery when switched from

\[ I_F = 2 \, \text{A to } V_R = 30 \, \text{V with} \]

\[ -\frac{dI_F}{dt} = 20 \, \text{A/µs}; \quad T_j = 25 \, \text{°C} \]

Recovery charge

\[ Q_S < 700 \, \text{nC} \]

Recovery time

\[ t_{rr} < 450 \, \text{ns} \]

Max. slope of the reverse recovery current

\[ |\frac{dI_R}{dt}| < 5 \, \text{A/µs} \]

\[ 1) \text{Measured under pulse conditions to avoid excessive dissipation.} \]
CHARACTERISTICS (continued)

Forward recovery when switched to

\[ I_F = 25 \, A \text{ with } t_r = 0,5 \, \mu s \text{ at } T_j = 25 \, ^\circ C \]

Recovery time
Recovery voltage

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>( t_{fr} )</td>
<td>&lt; 0,8 ( \mu s )</td>
</tr>
<tr>
<td>( V_{fr} )</td>
<td>&lt; 3,5 ( V )</td>
</tr>
</tbody>
</table>

Forward output waveform
OPERATING NOTES

Dissipation and heatsink considerations:

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

b. The method of using the graph on page 8 is as follows:
Starting with the curve of maximum dissipation as a function of $I_F(AV)$, for a particular current trace horizontally to meet the appropriate form factor; upwards to the operating duty cycle ($\delta$) line; horizontally until the $R_{th\ mb\ -a}$ curve is reached. Finally trace upwards from the $T_{amb}$ scale. The intersection determines the $R_{th\ mb\ -a}$ required.

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

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

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

c. The heatsink curves are optimised to allow the junction temperature to run up to 150 °C ($T_{j\ max}$) whilst limiting $T_{mb}$ to 125 °C (or less).
CHOPPER APPLICATIONS

\[ \delta = \frac{t_p}{T} \]

\[ \delta = 0, 0.25, 0.50, 0.75, 1 \]

\[ I_p \]

\[ V \]

\[ T \]

\[ P \ (W) \]

\[ P \ (W) \]

\[ T_{amb} \ (\degree C) \]

\[ T_{mb} \ (\degree C) \]

\[ a = \frac{I_F(RMS)}{I_F(AV)} \ per \ diode \]

\[ I_F(AV) \ (A) \]

\[ a = \frac{I_F(RMS)}{I_F(AV)} \ per \ diode \]

\[ P = \text{power excluding switching losses} \]
SWITCHED-MODE APPLICATION

- $P = \text{power excluding switching losses}$
- $a = \frac{I_F(RMS)}{I_F(AV)} \text{ per diode}$
- $b = \text{IF(AV)} \text{ per diode}$

The interrelation between the dissipation (derived from the left hand graph) and the max. allowable ambient temperature.

Mounting method:
- $2a$
- $2b; 2c$
- $2d$

SCAN RECTIFICATION

- $P = \text{power excluding switching losses}$
- $a = \frac{I_F(RMS)}{I_F(AV)} \text{ per diode}$
- $b = \text{IF(AV)} \text{ per diode}$

The interrelation between the dissipation (derived from the left hand graph) and the max. allowable ambient temperature.

Mounting method:
- $2a$
- $2b; 2c$
- $2d$
maximum permissible non-repetitive peak forward current based on sinusoidal currents ($f = 50$ Hz)

Each current pulse is followed by the working reverse voltage

$T_j = 150 \, ^\circ\text{C}$ prior to surge
Nomogram: power loss $\Delta P_{R(AV)}$ due to switching only (to be added to forward and reverse power losses).
BYX71
SERIES

$Q_S$ (μC)

$-\frac{dI}{dt}$ (A/μs)

$T_J = 25 \, ^\circ C$
max. values

$I_F = 10 \, A$

5 A
4 A
3 A
2 A
1 A

$Q_S$ (μC)

$-\frac{dI}{dt}$ (A/μs)

$T_J = 150 \, ^\circ C$
max. values

$I_F = 10 \, A$

5 A
4 A
3 A
2 A
1 A

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