1. General description

Medium power Schottky barrier rectifier with an integrated guard ring for stress protection, encapsulated in a very small SOD323 (SC-76) Surface-Mounted Device (SMD) plastic package.

2. Features and benefits

- Forward current: $I_F \leq 0.75$ A
- Reverse voltage: $V_R \leq 40$ V
- Low forward voltage typ. $V_F = 640$ mV
- Low reverse current typ. $I_R = 1.5$ µA
- Very small SMD plastic package
- AEC-Q101 qualified

3. Applications

- Low voltage rectification
- High efficiency DC-to-DC conversion
- Switch mode power supply
- Reverse polarity protection
- Low power consumption application
- Automotive applications

Table 1. Quick reference data

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_F$</td>
<td>forward current</td>
<td>$T_{sp} \leq 93$ °C; $\delta = 1$</td>
<td>-</td>
<td>-</td>
<td>0.75</td>
<td>A</td>
</tr>
<tr>
<td>$V_R$</td>
<td>reverse voltage</td>
<td>$T_j = 25$ °C</td>
<td>-</td>
<td>-</td>
<td>40</td>
<td>V</td>
</tr>
<tr>
<td>$V_F$</td>
<td>forward voltage</td>
<td>$I_F = 750$ mA; $t_p \leq 300$ µs; $\delta \leq 0.02$ ; $T_j = 25$ °C</td>
<td>-</td>
<td>640</td>
<td>740</td>
<td>mV</td>
</tr>
<tr>
<td>$I_R$</td>
<td>reverse current</td>
<td>$V_R = 40$ V; pulsed; $T_j = 25$ °C</td>
<td>-</td>
<td>1.5</td>
<td>8</td>
<td>µA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$V_R = 40$ V; pulsed; $T_j = 65$ °C</td>
<td>-</td>
<td>30</td>
<td>900</td>
<td>µA</td>
</tr>
</tbody>
</table>
4. Pinning information

Table 2. Pinning information

<table>
<thead>
<tr>
<th>Pin</th>
<th>Symbol</th>
<th>Description</th>
<th>Simplified outline</th>
<th>Graphic symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>K</td>
<td>cathode</td>
<td></td>
<td><img src="simplified_outline.png" alt="" /></td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td>anode</td>
<td></td>
<td><img src="graphic_symbol.png" alt="" /></td>
</tr>
</tbody>
</table>

5. Ordering information

Table 3. Ordering information

<table>
<thead>
<tr>
<th>Type number</th>
<th>Package</th>
<th>Name</th>
<th>Description</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAT165A</td>
<td>SOD323</td>
<td>plastic surface-mounted package; 2 leads</td>
<td>SOD323</td>
<td></td>
</tr>
</tbody>
</table>

6. Marking

Table 4. Marking codes

<table>
<thead>
<tr>
<th>Type number</th>
<th>Marking code</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAT165A</td>
<td>2G</td>
</tr>
</tbody>
</table>

7. Limiting values

Table 5. Limiting values

*In accordance with the Absolute Maximum Rating System (IEC 60134).*

<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&lt;sub&gt;R&lt;/sub&gt;</td>
<td>reverse voltage</td>
<td>T&lt;sub&gt;j&lt;/sub&gt; = 25 °C</td>
<td>-</td>
<td>40</td>
<td>V</td>
</tr>
<tr>
<td>I&lt;sub&gt;F&lt;/sub&gt;</td>
<td>forward current</td>
<td>T&lt;sub&gt;sp&lt;/sub&gt; ≤ 93 °C; δ = 1</td>
<td>-</td>
<td>0.75</td>
<td>A</td>
</tr>
<tr>
<td>I&lt;sub&gt;F(AV)&lt;/sub&gt;</td>
<td>average forward current</td>
<td>50 Hz ≤ f ≤ 60 Hz; T&lt;sub&gt;amb&lt;/sub&gt; ≤ 93 °C; pulsed sinusoidal</td>
<td>-</td>
<td>0.5</td>
<td>A</td>
</tr>
<tr>
<td>I&lt;sub&gt;FSM&lt;/sub&gt;</td>
<td>non-repetitive peak forward current</td>
<td>T&lt;sub&gt;p&lt;/sub&gt; = 8 ms; T&lt;sub&gt;j(init)&lt;/sub&gt; = 25 °C; square wave</td>
<td>-</td>
<td>8</td>
<td>A</td>
</tr>
<tr>
<td>P&lt;sub&gt;tot&lt;/sub&gt;</td>
<td>total power dissipation</td>
<td>T&lt;sub&gt;amb&lt;/sub&gt; ≤ 25 °C</td>
<td>[1]</td>
<td>380</td>
<td>mW</td>
</tr>
<tr>
<td>T&lt;sub&gt;j&lt;/sub&gt;</td>
<td>junction temperature</td>
<td></td>
<td>-</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td>T&lt;sub&gt;amb&lt;/sub&gt;</td>
<td>ambient temperature</td>
<td></td>
<td>-55</td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td>T&lt;sub&gt;stg&lt;/sub&gt;</td>
<td>storage temperature</td>
<td></td>
<td>-65</td>
<td>150</td>
<td>°C</td>
</tr>
</tbody>
</table>


[2] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for cathode 1 cm<sup>2</sup>.
8. Thermal characteristics

Table 6. Thermal characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R_{th(j-a)}$</td>
<td>thermal resistance from junction to ambient</td>
<td>in free air</td>
<td>[1][2]</td>
<td>-</td>
<td>-</td>
<td>330 K/W</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>[1][3]</td>
<td>-</td>
<td>-</td>
<td>225 K/W</td>
</tr>
<tr>
<td>$R_{th(j-sp)}$</td>
<td>thermal resistance from junction to solder point</td>
<td></td>
<td>[4]</td>
<td>-</td>
<td>-</td>
<td>45 K/W</td>
</tr>
</tbody>
</table>

[1] For Schottky barrier diodes thermal runaway has to be considered, as in some applications the reverse power losses $P_R$ are a significant part of the total power losses.

Fig. 1. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values
9. Characteristics

### Table 7. Characteristics

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Conditions</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{(BR)R}$</td>
<td>reverse breakdown voltage</td>
<td>$I_R = 1 \text{ mA}; \ t_p \leq 300 \mu \text{s}; \ \delta \leq 0.02; \ \ T_j = 25 ^\circ \text{C}; \ \text{pulsed}$</td>
<td>40</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>$V_F$</td>
<td>forward voltage</td>
<td>$I_F = 10 \text{ mA}; \ t_p \leq 300 \mu \text{s}; \ \delta \leq 0.02 ; \ \ T_j = 25 ^\circ \text{C}$</td>
<td>-</td>
<td>300</td>
<td>380</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_F = 100 \text{ mA}; \ t_p \leq 300 \mu \text{s}; \ \delta \leq 0.02 ; \ \ T_j = 25 ^\circ \text{C}$</td>
<td>-</td>
<td>390</td>
<td>470</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_F = 250 \text{ mA}; \ t_p \leq 300 \mu \text{s}; \ \delta \leq 0.02 ; \ \ T_j = 25 ^\circ \text{C}$</td>
<td>-</td>
<td>455</td>
<td>540</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_F = 500 \text{ mA}; \ t_p \leq 300 \mu \text{s}; \ \delta \leq 0.02 ; \ \ T_j = 25 ^\circ \text{C}$</td>
<td>-</td>
<td>550</td>
<td>640</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$I_F = 750 \text{ mA}; \ t_p \leq 300 \mu \text{s}; \ \delta \leq 0.02 ; \ \ T_j = 25 ^\circ \text{C}$</td>
<td>-</td>
<td>640</td>
<td>740</td>
<td>mV</td>
</tr>
<tr>
<td>$I_R$</td>
<td>reverse current</td>
<td>$V_R = 30 \text{ V}; \ \text{pulsed}; \ \ T_j = 25 ^\circ \text{C}$</td>
<td>-</td>
<td>1</td>
<td>5</td>
<td>µA</td>
</tr>
<tr>
<td>$V_R$</td>
<td></td>
<td>$V_R = 40 \text{ V}; \ \text{pulsed}; \ \ T_j = 25 ^\circ \text{C}$</td>
<td>-</td>
<td>1.5</td>
<td>8</td>
<td>µA</td>
</tr>
<tr>
<td>$V_R$</td>
<td></td>
<td>$V_R = 40 \text{ V}; \ \text{pulsed}; \ \ T_j = 65 ^\circ \text{C}$</td>
<td>-</td>
<td>30</td>
<td>900</td>
<td>µA</td>
</tr>
<tr>
<td>$V_R$</td>
<td></td>
<td>$V_R = 5 \text{ V}; \ \text{pulsed}; \ \ T_j = 125 ^\circ \text{C}$</td>
<td>-</td>
<td>290</td>
<td>700</td>
<td>µA</td>
</tr>
<tr>
<td>$V_R$</td>
<td></td>
<td>$V_R = 40 \text{ V}; \ \text{pulsed}; \ \ T_j = 125 ^\circ \text{C}$</td>
<td>-</td>
<td>1</td>
<td>8</td>
<td>mA</td>
</tr>
<tr>
<td>$C_d$</td>
<td>diode capacitance</td>
<td>$V_R = 10 \text{ V}; \ f = 1 \text{ MHz}; \ \ T_j = 25 ^\circ \text{C}$</td>
<td>-</td>
<td>9</td>
<td>12</td>
<td>pF</td>
</tr>
</tbody>
</table>

FR4 PCB, mounting pad for cathode 1 cm²

Fig. 2. Transient thermal impedance from junction to ambient as a function of pulse duration; typical values
**Fig. 3.** Forward current as a function of forward voltage; typical values

- Pulsed condition:
  1. $T_j = 150 \, ^\circ C$
  2. $T_j = 125 \, ^\circ C$
  3. $T_j = 85 \, ^\circ C$
  4. $T_j = 25 \, ^\circ C$
  5. $T_j = -40 \, ^\circ C$

**Fig. 4.** Reverse current as a function of reverse voltage; typical values

- Pulsed condition:
  1. $T_j = 150 \, ^\circ C$
  2. $T_j = 125 \, ^\circ C$
  3. $T_j = 85 \, ^\circ C$
  4. $T_j = 65 \, ^\circ C$
  5. $T_j = 25 \, ^\circ C$
  6. $T_j = -40 \, ^\circ C$

**Fig. 5.** Diode capacitance as a function of reverse voltage; typical values

- $f = 1 \, MHz; T_{amb} = 25 \, ^\circ C$

**Fig. 6.** Average forward power dissipation as a function of average forward current; typical values

- $T_j = 150 \, ^\circ C$
  1. $\delta = 0.5$ sinusoidal
  2. $\delta = 1$
**BAT165A**

40 V, 0.75 A medium power Schottky barrier rectifier

---

**Fig. 7.** Average reverse power dissipation as a function of reverse voltage; typical values

- **T<sub>j</sub>** = 125 °C
  - (1) δ = 1; DC
  - (2) δ = 0.9; f = 20 kHz
  - (3) δ = 0.8; f = 20 kHz
  - (4) δ = 0.5; f = 20 kHz

**FR4 PCB, standard footprint**

- **T<sub>j</sub>** = 150 °C
  - (1) δ = 1; DC
  - (2) δ = 0.5; f = 50 Hz/60 Hz; pulsed sinusoidal

---

**Fig. 8.** Average forward current as a function of ambient temperature; typical values

- **FR4 PCB, mounting pad for cathode 1 cm<sup>2</sup>**
  - **T<sub>j</sub>** = 150 °C
    - (1) δ = 1; DC
    - (2) δ = 0.5; f = 50 Hz/60 Hz; pulsed sinusoidal

**Fig. 9.** Average forward current as a function of ambient temperature; typical values

- **T<sub>j</sub>** = 150 °C
  - (1) δ = 1; DC
  - (2) δ = 0.5; f = 50 Hz/60 Hz; pulsed sinusoidal

**Fig. 10.** Average forward current as a function of solder point temperature; typical values

- **T<sub>j</sub>** = 150 °C
  - (1) δ = 1; DC
  - (2) δ = 0.5; f = 50 Hz/60 Hz; pulsed sinusoidal
10. Test information

Fig. 11. Duty cycle definition: sinusoidal

The current ratings for the sinusoidal waveforms are calculated according to the equations: $I_{F(AV)} = I_M \times 0.3183$ with $I_M$ defined as peak current, $I_{RMS} = I_{F(AV)}$ at DC, and $I_{RMS} = I_M \times \sqrt{\delta/2}$ with $I_{RMS}$ defined as RMS current.

Fig. 12. Duty cycle definition: square wave

10.1 Quality information

This product has been qualified in accordance with the Automotive Electronics Council (AEC) standard Q101 - Stress test qualification for discrete semiconductors, and is suitable for use in automotive applications.
11. Package outline

Fig. 13. Package outline SOD323

12. Soldering

Fig. 14. Reflow soldering footprint for SOD323
Fig. 15. Wave soldering footprint for SOD323
13. Revision history

<table>
<thead>
<tr>
<th>Data sheet ID</th>
<th>Release date</th>
<th>Data sheet status</th>
<th>Change notice</th>
<th>Supersedes</th>
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<td>20160502</td>
<td>Product data sheet</td>
<td>-</td>
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14. Legal information

14.1 Data sheet status

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<tr>
<th>Document status</th>
<th>Product status</th>
<th>Definition</th>
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<td>Objective [short] data sheet</td>
<td>Development</td>
<td>This document contains data from the objective specification for product development.</td>
</tr>
<tr>
<td>Preliminary [short] data sheet</td>
<td>Qualification</td>
<td>This document contains data from the preliminary specification.</td>
</tr>
<tr>
<td>Product [short] data sheet</td>
<td>Production</td>
<td>This document contains the product specification.</td>
</tr>
</tbody>
</table>

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[2] The term "short data sheet" is explained in section "Definitions".
[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at URL http://www.nexperia.com.

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