

## 1. General description

Planar passivated Silicon Controlled Rectifier (SCR) in a SOT78 plastic package intended for use in applications requiring good bidirectional blocking voltage capability, high surge current capability and high thermal cycling performance.

## 2. Features and benefits

- Good bidirectional blocking voltage capability
- High surge current capability
- High thermal cycling performance

## 3. Applications

- Ignition circuits
- Motor control
- Protection circuits
- Voltage regulation

## 4. Quick reference data

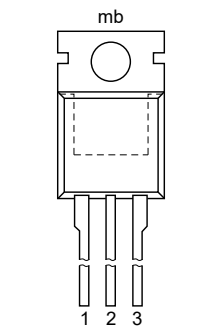

Table 1. Quick reference data

| Symbol                         | Parameter                            | Conditions  | Min | Typ | Max | Unit |
|--------------------------------|--------------------------------------|---|-----|-----|-----|------|
| $V_{DRM}$                      | repetitive peak off-state voltage    |   | -   | -   | 500 | V    |
| $V_{RRM}$                      | repetitive peak reverse voltage      |   | -   | -   | 500 | V    |
| $I_{TSM}$                      | non-repetitive peak on-state current | half sine wave; $T_{j(init)} = 25\text{ °C}$ ; $t_p = 10\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a> | -   | -   | 120 | A    |
|                                |                                      | half sine wave; $T_{j(init)} = 25\text{ °C}$ ; $t_p = 8.3\text{ ms}$  | -   | -   | 132 | A    |
| $T_j$                          | junction temperature                 |   | -   | -   | 125 | °C   |
| $I_{T(AV)}$                    | average on-state current             | half sine wave; $T_{mb} \leq 109\text{ °C}$ ; <a href="#">Fig. 1</a>  | -   | -   | 7.5 | A    |
| $I_{T(RMS)}$                   | RMS on-state current                 | half sine wave; $T_{mb} \leq 109\text{ °C}$ ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>                         | -   | -   | 12  | A    |
| <b>Static characteristics</b>  |                                      |   |     |     |     |      |
| $I_{GT}$                       | gate trigger current                 | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 25\text{ °C}$ ; <a href="#">Fig. 7</a>                            | -   | 2   | 15  | mA   |
| <b>Dynamic characteristics</b> |                                      |   |     |     |     |      |

| Symbol    | Parameter                         | Conditions   | Min | Typ  | Max | Unit       |
|-----------|-----------------------------------|--|-----|------|-----|------------|
| $dV_D/dt$ | rate of rise of off-state voltage | $V_{DM} = 335\text{ V}$ ; $T_j = 125\text{ °C}$ ; $R_{GK} = 100\ \Omega$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; Fig. 12 | 200 | 1000 | -   | V/ $\mu$ s |

## 5. Pinning information

Table 2. Pinning information

| Pin | Symbol | Description                       | Simplified outline   | Graphic symbol   |
|-----|--------|-----------------------------------|--|--|
| 1   | K      | cathode                           |  <p style="text-align: center;"><b>TO-220AB (SOT78)</b></p> |  <p style="text-align: center;"><i>sym037</i></p> |
| 2   | A      | anode                             |  |  |
| 3   | G      | gate                              |  |  |
| mb  | A      | mounting base; connected to anode |  |  |

## 6. Ordering information

Table 3. Ordering information

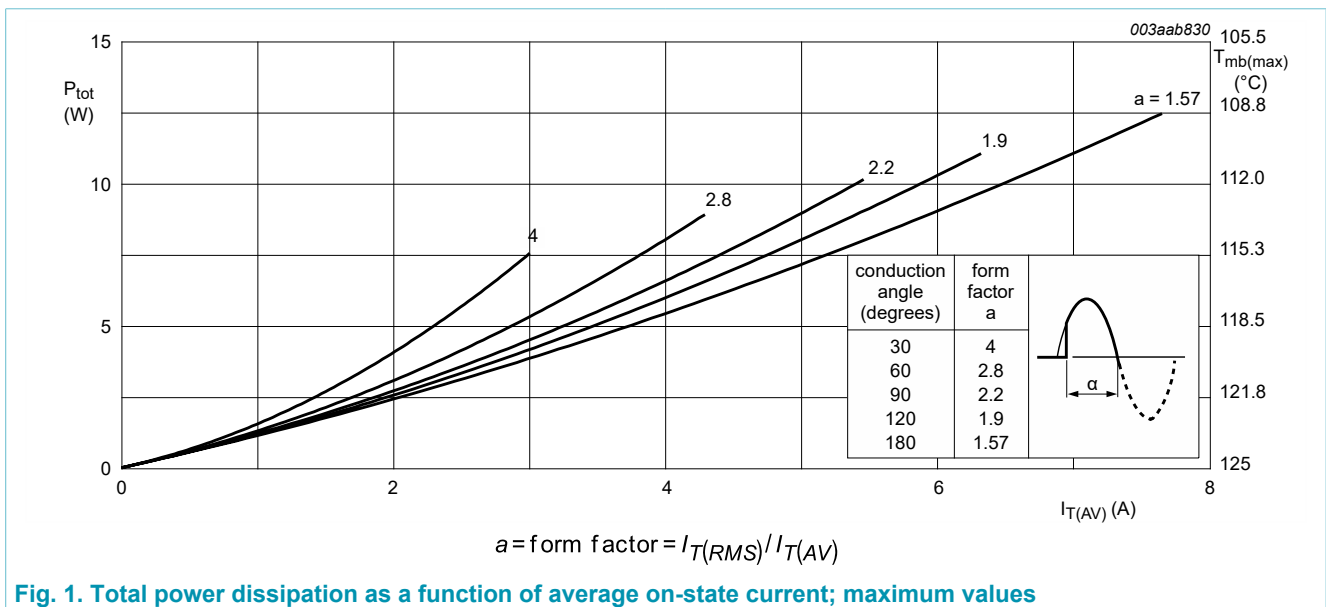
| Type number | Package  |  |         |
|-------------|----------|--|---------|
|             | Name     | Description  | Version |
| BT151-500R  | TO-220AB | plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB | SOT78   |

## 7. Limiting values

**Table 4. Limiting values**

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

| Symbol       | Parameter                            | Conditions   | Min | Max | Unit                   |
|--------------|--------------------------------------|--|-----|-----|------------------------|
| $V_{DRM}$    | repetitive peak off-state voltage    |  | -   | 500 | V                      |
| $V_{RRM}$    | repetitive peak reverse voltage      |  | -   | 500 | V                      |
| $I_{T(AV)}$  | average on-state current             | half sine wave; $T_{mb} \leq 109\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 1</a>   | -   | 7.5 | A                      |
| $I_{T(RMS)}$ | RMS on-state current                 | half sine wave; $T_{mb} \leq 109\text{ }^{\circ}\text{C}$ ; <a href="#">Fig. 2</a> ; <a href="#">Fig. 3</a>                                | -   | 12  | A                      |
| $I_{TSM}$    | non-repetitive peak on-state current | half sine wave; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 10\text{ ms}$ ; <a href="#">Fig. 4</a> ; <a href="#">Fig. 5</a> | -   | 120 | A                      |
|              |                                      | half sine wave; $T_{j(\text{init})} = 25\text{ }^{\circ}\text{C}$ ; $t_p = 8.3\text{ ms}$  | -   | 132 | A                      |
| $I^2t$       | $I^2t$ for fusing                    | $t_p = 10\text{ ms}$ ; SIN   | -   | 72  | $\text{A}^2\text{s}$   |
| $di_T/dt$    | rate of rise of on-state current     | $I_G = 30\text{ mA}$   | -   | 50  | $\text{A}/\mu\text{s}$ |
| $I_{GM}$     | peak gate current                    |  | -   | 2   | A                      |
| $V_{RGM}$    | peak reverse gate voltage            |  | -   | 5   | V                      |
| $P_{GM}$     | peak gate power                      |  | -   | 5   | W                      |
| $P_{G(AV)}$  | average gate power                   | over any 20 ms period  | -   | 0.5 | W                      |
| $T_{stg}$    | storage temperature                  |  | -40 | 150 | $^{\circ}\text{C}$     |
| $T_j$        | junction temperature                 |  | -   | 125 | $^{\circ}\text{C}$     |



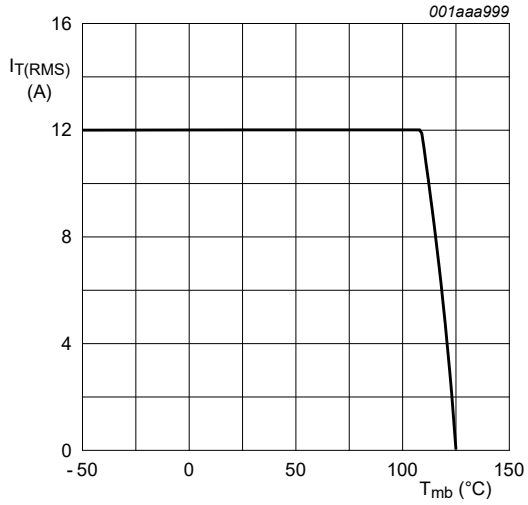


Fig. 2. RMS on-state current as a function of mounting base temperature; maximum values



$f = 50 \text{ Hz}, T_{mb} = 109^\circ\text{C}$

Fig. 3. RMS on-state current as a function of surge duration; maximum values

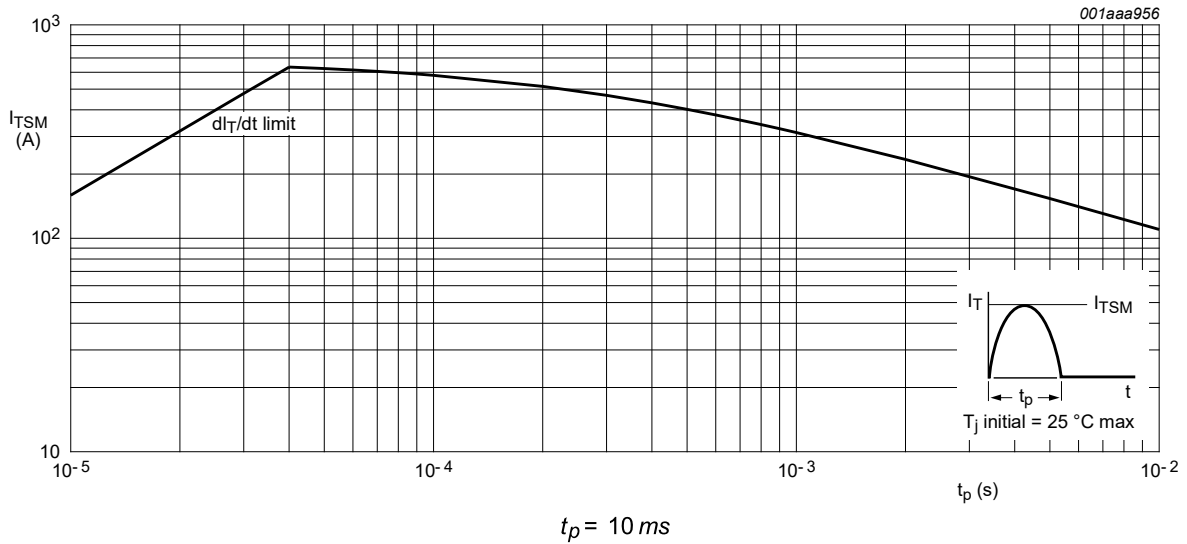
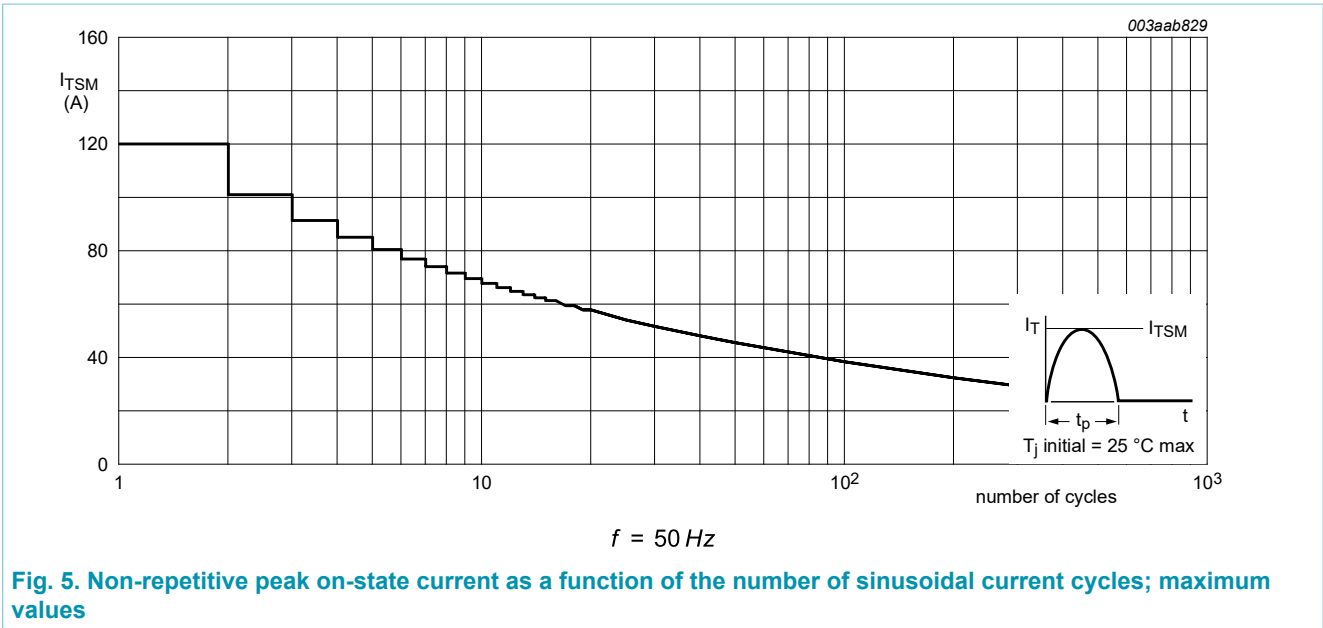


Fig. 4. Non-repetitive peak on-state current as a function of pulse width for sinusoidal currents; maximum values



## 8. Thermal characteristics

Table 5. Thermal characteristics

| Symbol         | Parameter  | Conditions             | Min | Typ | Max | Unit |
|----------------|--|------------------------|-----|-----|-----|------|
| $R_{th(j-mb)}$ | thermal resistance from junction to mounting base    | <a href="#">Fig. 6</a> | -   | -   | 1.3 | K/W  |
| $R_{th(j-a)}$  | thermal resistance from junction to ambient free air | in free air            | -   | 60  | -   | K/W  |



Fig. 6. Transient thermal impedance from junction to mounting base as a function of pulse width

## 9. Characteristics

Table 6. Characteristics

| Symbol                         | Parameter                         | Conditions  | Min  | Typ  | Max  | Unit             |
|--------------------------------|-----------------------------------|---|------|------|------|------------------|
| <b>Static characteristics</b>  |                                   |   |      |      |      |                  |
| $I_{GT}$                       | gate trigger current              | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 7</a>  | -    | 2    | 15   | mA               |
| $I_L$                          | latching current                  | $V_D = 12\text{ V}$ ; $I_G = 0.1\text{ A}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 8</a>  | -    | 10   | 40   | mA               |
| $I_H$                          | holding current                   | $V_D = 12\text{ V}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 9</a>   | -    | 7    | 20   | mA               |
| $V_T$                          | on-state voltage                  | $I_T = 23\text{ A}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 10</a>  | -    | 1.4  | 1.75 | V                |
| $V_{GT}$                       | gate trigger voltage              | $V_D = 12\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 25\text{ }^\circ\text{C}$ ; <a href="#">Fig. 11</a>   | -    | 0.6  | 1.5  | V                |
|                                |                                   | $V_D = 500\text{ V}$ ; $I_T = 0.1\text{ A}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; <a href="#">Fig. 11</a>   | 0.25 | 0.4  | -    | V                |
| $I_D$                          | off-state current                 | $V_D = 500\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$  | -    | 0.1  | 0.5  | mA               |
| $I_R$                          | reverse current                   | $V_R = 500\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$  | -    | 0.1  | 0.5  | mA               |
| <b>Dynamic characteristics</b> |                                   |   |      |      |      |                  |
| $dV_D/dt$                      | rate of rise of off-state voltage | $V_{DM} = 335\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; $R_{GK} = 100\text{ }\Omega$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; <a href="#">Fig. 12</a>  | 200  | 1000 | -    | V/ $\mu\text{s}$ |
|                                |                                   | $V_{DM} = 335\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ); exponential waveform; gate open circuit; <a href="#">Fig. 12</a>  | 50   | 130  | -    | V/ $\mu\text{s}$ |
| $t_{gt}$                       | gate-controlled turn-on time      | $I_{TM} = 40\text{ A}$ ; $V_D = 500\text{ V}$ ; $I_G = 0.1\text{ A}$ ; $dI_G/dt = 5\text{ A}/\mu\text{s}$ ; $T_j = 25\text{ }^\circ\text{C}$  | -    | 2    | -    | $\mu\text{s}$    |
| $t_q$                          | commutated turn-off time          | $V_{DM} = 335\text{ V}$ ; $T_j = 125\text{ }^\circ\text{C}$ ; $I_{TM} = 20\text{ A}$ ; $V_R = 25\text{ V}$ ; $(dI_T/dt)_M = 30\text{ A}/\mu\text{s}$ ; $dV_D/dt = 50\text{ V}/\mu\text{s}$ ; $R_{GK(ext)} = 100\text{ }\Omega$ ; ( $V_{DM} = 67\%$ of $V_{DRM}$ ) | -    | 70   | -    | $\mu\text{s}$    |



Fig. 7. Normalized gate trigger current as a function of junction temperature



Fig. 8. Normalized latching current as a function of junction temperature



**Fig. 9. Normalized holding current as a function of junction temperature**



$V_o = 1.06 \text{ V}; R_s = 0.0304 \ \Omega$

- (1)  $T_j = 125 \text{ }^\circ\text{C}$ ; typical values
- (2)  $T_j = 125 \text{ }^\circ\text{C}$ ; maximum values
- (3)  $T_j = 25 \text{ }^\circ\text{C}$ ; maximum values

**Fig. 10. On-state current as a function of on-state voltage**



**Fig. 11. Normalized gate trigger voltage as a function of junction temperature**



- (1)  $R_{GK} = 100 \ \Omega$ ;
- (2) gate open circuit

**Fig. 12. Critical rate of rise of off-state voltage as a function of junction temperature; minimum values**



### 10. Package outline

Plastic single-ended package; heatsink mounted; 1 mounting hole; 3-lead TO-220AB SOT78



**DIMENSIONS (mm are the original dimensions)**

| UNIT | A          | A <sub>1</sub> | b          | b <sub>1</sub> ( <sup>2</sup> ) | b <sub>2</sub> ( <sup>2</sup> ) | c          | D            | D <sub>1</sub> | E           | e    | L            | L <sub>1</sub> ( <sup>1</sup> ) | L <sub>2</sub> ( <sup>1</sup> ) max. | p          | q          | Q          |
|------|------------|----------------|------------|---------------------------------|---------------------------------|------------|--------------|----------------|-------------|------|--------------|---------------------------------|--------------------------------------|------------|------------|------------|
| mm   | 4.7<br>4.1 | 1.40<br>1.25   | 0.9<br>0.6 | 1.6<br>1.0                      | 1.3<br>1.0                      | 0.7<br>0.4 | 16.0<br>15.2 | 6.6<br>5.9     | 10.3<br>9.7 | 2.54 | 15.0<br>12.8 | 3.30<br>2.79                    | 3.0                                  | 3.8<br>3.5 | 3.0<br>2.7 | 2.6<br>2.2 |

**Notes**

- 1. Lead shoulder designs may vary.
- 2. Dimension includes excess dambar.

| OUTLINE VERSION | REFERENCES |                 |       | EUROPEAN PROJECTION | ISSUE DATE           |
|-----------------|------------|-----------------|-------|---------------------|----------------------|
|                 | IEC        | JEDEC           | JEITA |                     |                      |
| SOT78           |            | 3-lead TO-220AB | SC-46 |                     | 08-04-23<br>08-06-13 |

**Fig. 13. Package outline TO-220AB (SOT78)**

# 11. Legal information

## Data sheet status

| Document status [1][2]         | Product status [3] | Definition  |
|--------------------------------|--------------------|---|
| Objective [short] data sheet   | Development        | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification      | This document contains data from the preliminary specification.                       |
| Product [short] data sheet     | Production         | This document contains the product specification.                                     |

- [1] Please consult the most recently issued document before initiating or completing a design.
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## 12. Contents

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|                                 |    |
|---------------------------------|----|
| 1. General description.....     | 1  |
| 2. Features and benefits.....   | 1  |
| 3. Applications.....            | 1  |
| 4. Quick reference data.....    | 1  |
| 5. Pinning information.....     | 2  |
| 6. Ordering information.....    | 2  |
| 7. Limiting values.....         | 3  |
| 8. Thermal characteristics..... | 6  |
| 9. Characteristics.....         | 7  |
| 10. Package outline.....        | 9  |
| 11. Legal information.....      | 10 |

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Date of release: 22 February 2018

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