

## Breakover diodes

## BR211 series

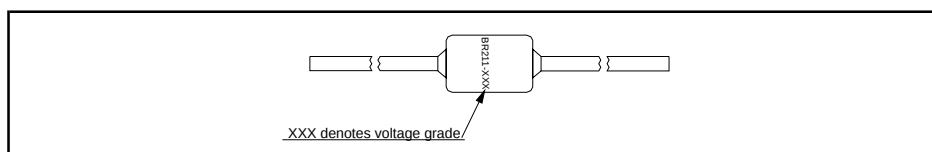
## GENERAL DESCRIPTION

A range of bidirectional, breakover diodes in an axial, hermetically sealed, glass envelope. These devices feature controlled breakover voltage and high holding current together with high peak current handling capability. Typical applications include transient overvoltage protection in telecommunications equipment.

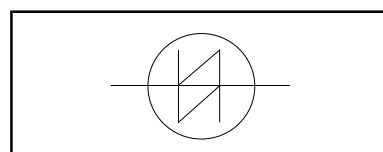
## QUICK REFERENCE DATA

| SYMBOL     | PARAMETER                                    | MIN. | MAX. | UNIT |
|------------|----------------------------------------------|------|------|------|
| $V_{(BO)}$ | <b>BR211-140 to 280</b><br>Breakover voltage | 140  | 280  | V    |
| $I_H$      | Holding current                              | 150  | -    | mA   |
| $I_{TSM}$  | Non-repetitive peak current                  | -    | 40   | A    |

## OUTLINE - SOD84



## SYMBOL



## LIMITING VALUES

Limiting values in accordance with the Absolute Maximum System (IEC 134).

| SYMBOL     | PARAMETER                                                 | CONDITIONS                                                                              | MIN. | MAX.                 | UNIT                   |
|------------|-----------------------------------------------------------|-----------------------------------------------------------------------------------------|------|----------------------|------------------------|
| $V_D$      | Continuous voltage                                        |                                                                                         | -    | 75% of $V_{(BO)typ}$ | V                      |
| $I_{TSM1}$ | Non repetitive peak current                               | 10/320 $\mu$ s impulse equivalent to 10/700 $\mu$ s, 1.6 kV voltage impulse (CCITT K17) | -    | 40                   | A                      |
| $I_{TSM2}$ | Non repetitive on-state current                           | half sine wave; $t = 10$ ms;<br>$T_J = 70^\circ\text{C}$ prior to surge                 | -    | 15                   | A                      |
| $I^2t$     | $I^2t$ for fusing                                         | $t_p = 10$ ms                                                                           | -    | 1.1                  | $\text{A}^2\text{s}$   |
| $di_T/dt$  | Rate of rise of on-state current after $V_{(BO)}$ turn-on | $t_p = 10$ $\mu$ s                                                                      | -    | 50                   | $\text{A}/\mu\text{s}$ |
| $P_{tot}$  | Continuous dissipation                                    | $T_a = 25^\circ\text{C}$                                                                | -    | 1.2                  | W                      |
| $P_{TM}$   | Peak dissipation                                          | $t_p = 1$ ms; $T_a = 25^\circ\text{C}$                                                  | -    | 50                   | W                      |
| $T_{stg}$  | Storage temperature                                       |                                                                                         | -65  | 150                  | $^\circ\text{C}$       |
| $T_a$      | Operating ambient temperature                             | off-state                                                                               | -    | 70                   | $^\circ\text{C}$       |
| $T_{vj}$   | Overload junction temperature                             | on-state                                                                                | -    | 150                  | $^\circ\text{C}$       |

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## THERMAL RESISTANCES

| SYMBOL         | PARAMETER                                | CONDITIONS                                                 | MIN. | TYP. | MAX. | UNIT |
|----------------|------------------------------------------|------------------------------------------------------------|------|------|------|------|
| $R_{th\ j-e}$  | Thermal resistance junction to envelope  |                                                            | -    | 22   | -    | K/W  |
| $R_{th\ j-a}$  | Thermal resistance junction to ambient   | mounted as fig:12                                          | -    | 105  | -    | K/W  |
| $Z_{th\ j-a}$  | Thermal impedance junction to ambient    | $t_p = 1\ ms$                                              | -    | 2.62 | -    | K/W  |
| $R_{th\ e-tp}$ | Thermal resistance envelope to tie point | lead length = 5 mm                                         | -    | 15   | -    | K/W  |
|                |                                          | lead length = 10 mm                                        | -    | 30   | -    | K/W  |
| $R_{th\ e-a}$  | Thermal resistance envelope to ambient   | lead length = 5 mm                                         | -    | 440  | -    | K/W  |
|                |                                          | lead length = 10 mm                                        | -    | 350  | -    | K/W  |
| $R_{th\ tp-a}$ | Thermal resistance tie point to ambient  | mounted as fig:12                                          | -    | 70   | -    | K/W  |
|                |                                          | mounted with 1 cm <sup>2</sup> copper laminate per lead.   | -    | 55   | -    | K/W  |
|                |                                          | mounted with 2.25 cm <sup>2</sup> copper laminate per lead | -    | 45   | -    | K/W  |

## STATIC CHARACTERISTICS

$T_j = 25\ ^\circ\text{C}$  unless otherwise stated

| SYMBOL           | PARAMETER                             | CONDITIONS                                         | MIN. | TYP. | MAX. | UNIT    |
|------------------|---------------------------------------|----------------------------------------------------|------|------|------|---------|
| $V_{TM}^1$       | On-state voltage                      | $I_{TM} = 2\ A$                                    | -    | -    | 2.5  | V       |
| $V_{(BR)}$       | Avalanche voltage (min)               | $I_{(BR)} = 10\ mA$                                |      |      |      |         |
| $V_{(BO)}$       | Breakover voltage (max)               | $I \leq I_S, t_p = 100\ \mu s$                     |      |      |      |         |
|                  |                                       | BR211-140                                          | 123  | 140  | 157  | V       |
|                  |                                       | BR211-160                                          | 140  | 160  | 180  | V       |
|                  |                                       | BR211-180                                          | 158  | 180  | 202  | V       |
|                  |                                       | BR211-200                                          | 176  | 200  | 224  | V       |
|                  |                                       | BR211-220                                          | 193  | 220  | 247  | V       |
|                  |                                       | BR211-240                                          | 211  | 240  | 269  | V       |
|                  |                                       | BR211-260                                          | 228  | 260  | 292  | V       |
|                  |                                       | BR211-280                                          | 246  | 280  | 314  | V       |
| $S_{(pr)}^{(2)}$ | Temperature coefficient of $V_{(BR)}$ |                                                    | -    | +0.1 | -    | %/K     |
| $I_H$            | Holding current                       | $T_j = 25\ ^\circ\text{C}$                         | 150  | -    | -    | mA      |
|                  |                                       | $T_j = 70\ ^\circ\text{C}$                         | 100  | -    | -    | mA      |
| $I_{S4}^3$       | Switching current                     | $t_p = 100\ \mu s$                                 | 10   | 200  | 1000 | mA      |
| $I_D$            | Off-state current                     | $V_D = 85\% V_{(BR)min}, T_j = 70\ ^\circ\text{C}$ | -    | -    | 10   | $\mu A$ |

1 Measured under pulsed conditions to avoid excessive dissipation

2 The minimum current at which the diode will remain in the on-state

3 The avalanche current required to switch the diode to the on-state

4 Measured at maximum recommended continuous voltage. Illuminance  $\leq 500\ lux$  (daylight); relative humidity  $< 65\%$ .

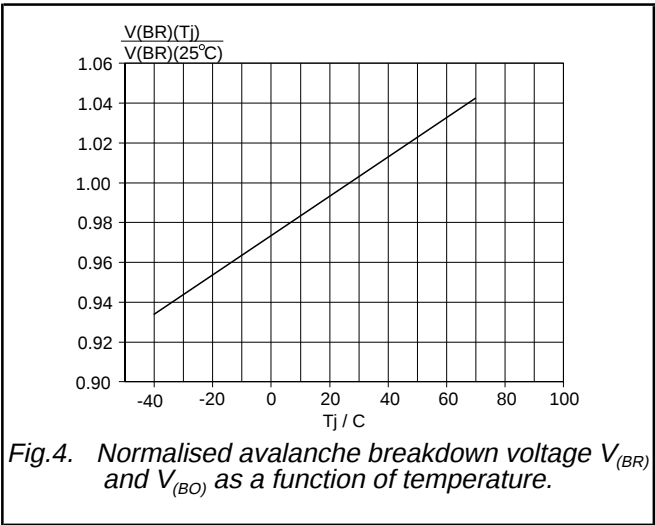
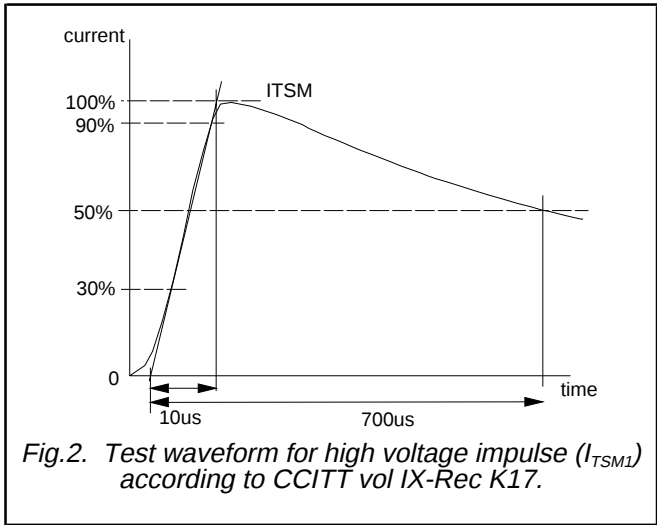
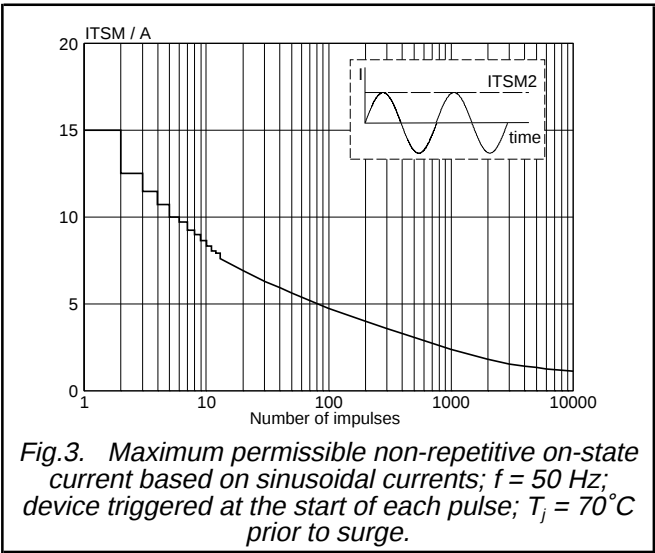
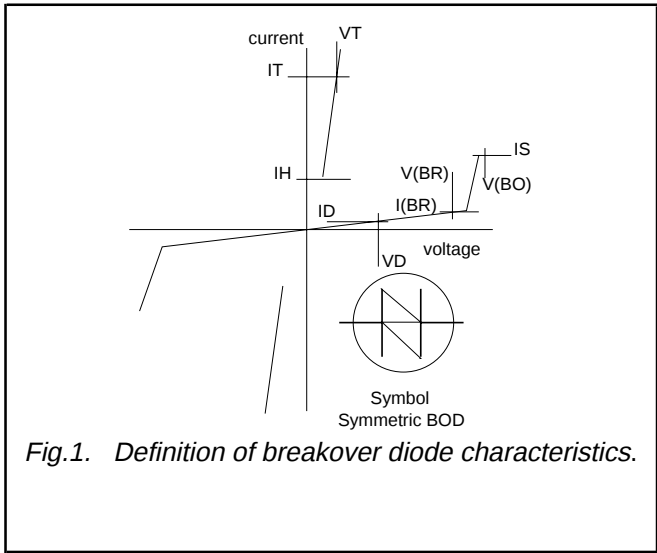
Breakover diodes

BR211 series

DYNAMIC CHARACTERISTICS

T<sub>j</sub> = 25 °C unless otherwise stated

| SYMBOL              | PARAMETER                                                                 | CONDITIONS                                                            | MIN. | TYP. | MAX. | UNIT |
|---------------------|---------------------------------------------------------------------------|-----------------------------------------------------------------------|------|------|------|------|
| dV <sub>D</sub> /dt | Linear rate of rise of off-state voltage that will not trigger any device | V <sub>(DM)</sub> = 85% V <sub>(BR)min</sub> ; T <sub>j</sub> = 70 °C | -    | -    | 2000 | V/μs |
| C <sub>j</sub>      | Off-state capacitance                                                     | V <sub>D</sub> = 0 V; f = 1 kHz to 1 MHz                              | -    | -    | 100  | pF   |



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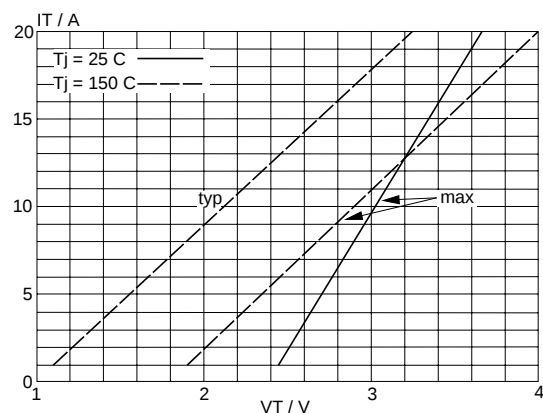


Fig.5. On-state current as a function of on-state voltage;  $t_p = 200\ \mu\text{s}$  to avoid excessive dissipation.

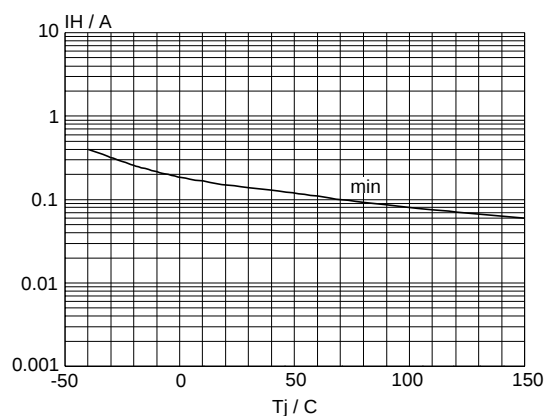


Fig.8. Minimum holding current as a function of temperature.

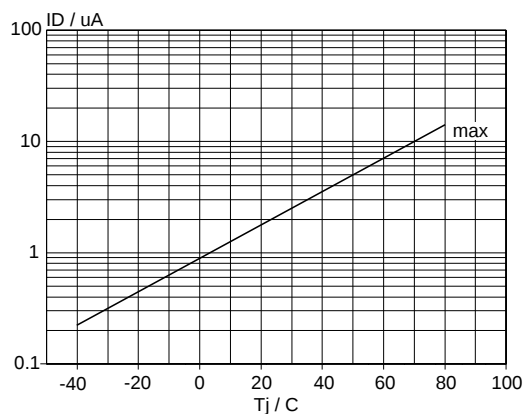


Fig.6. Maximum off-state current as a function of temperature.

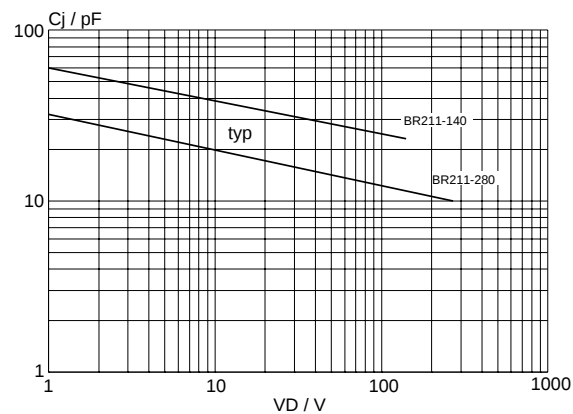


Fig.9. Typical junction capacitance as a function of off-state voltage,  $f = 1\ \text{MHz}$ ;  $T_J = 25^\circ\text{C}$ .

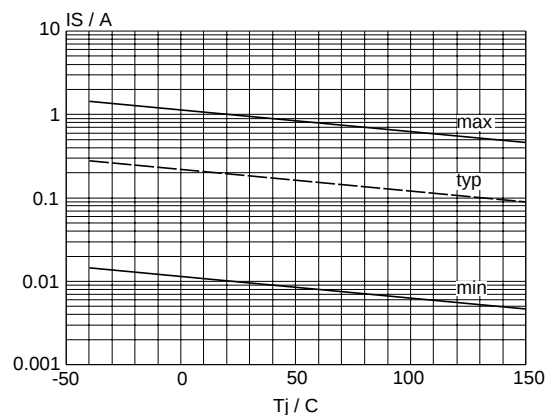


Fig.7. Switching current as a function of junction temperature.

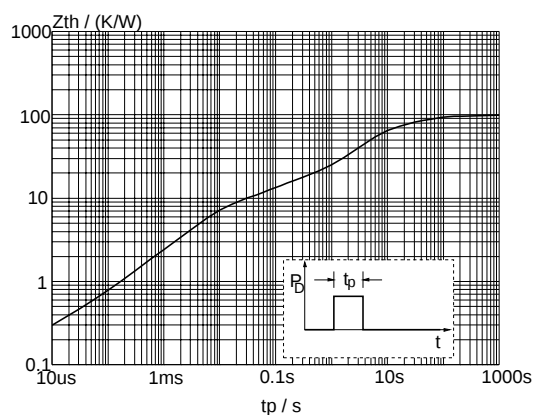


Fig.10. Transient thermal impedance.  $Z_{th\ j-a} = f(t_p)$ .

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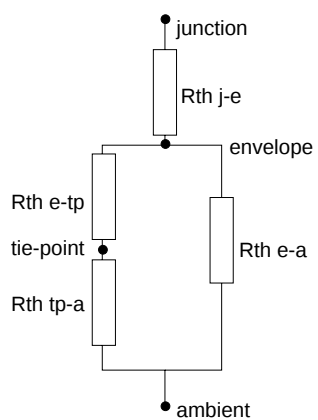


Fig.11. Components of thermal resistance,

$$R_{th\ j-a} = R_{th\ j-e} + \frac{R_{th\ e-a} \cdot (R_{th\ e-tp} + R_{th\ tp-a})}{(R_{th\ e-a} + R_{th\ e-tp} + R_{th\ tp-a})}$$

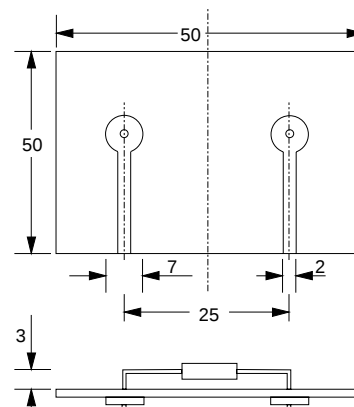
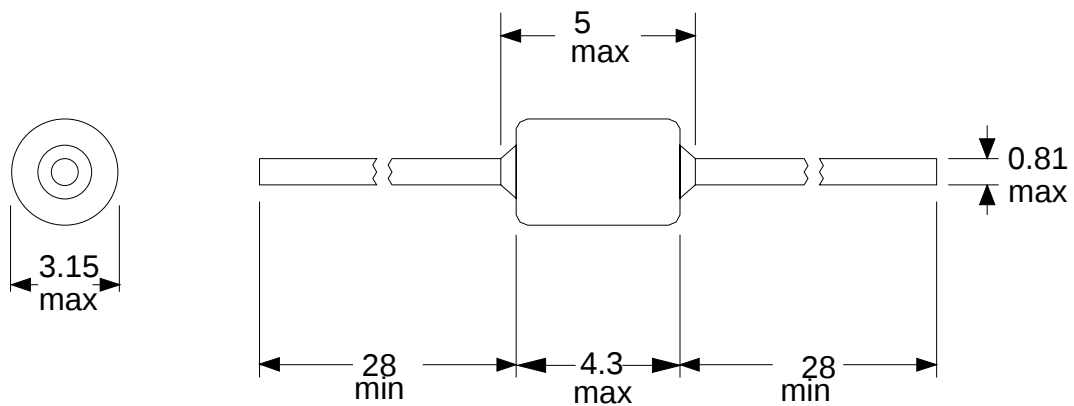


Fig.12. Mounting on pcb used for  $R_{th}$  measurement.

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## MECHANICAL DATA

*Dimensions in mm**Fig.13. SOD84.*

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**DEFINITIONS**

| <b>Data sheet status</b>                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Objective specification                                                                                                                                                                                                                                                                                                                                                                                                                                    | This data sheet contains target or goal specifications for product development.       |
| Preliminary specification                                                                                                                                                                                                                                                                                                                                                                                                                                  | This data sheet contains preliminary data; supplementary data may be published later. |
| Product specification                                                                                                                                                                                                                                                                                                                                                                                                                                      | This data sheet contains final product specifications.                                |
| <b>Limiting values</b>                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                       |
| Limiting values are given 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 this specification is not implied. Exposure to limiting values for extended periods may affect device reliability. |                                                                                       |
| <b>Application information</b>                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                       |
| Where application information is given, it is advisory and does not form part of the specification.                                                                                                                                                                                                                                                                                                                                                        |                                                                                       |
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