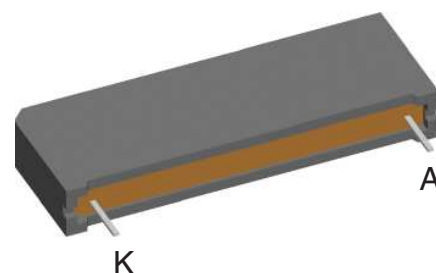


# Breakover Diode Modules (BOD1)

$$V_{BO} = 1200 - 4200 \text{ V}$$

$$I_{AVM} = 0.2 - 1.25 \text{ A}$$

| Number of BODs | Types                           |
|----------------|---------------------------------|
| 2              | IXBOD1-12R(D) ... IXBOD1-19R(D) |
| 3              | IXBOD1-20R(D) ... IXBOD1-32R(D) |
| 4              | IXBOD1-34R ... IXBOD1-42R       |



## Features / Advantages:

- Fast turn on
- Low temperature dependence
- Low leakage current

## Applications:

- High voltage circuit protection
- Transient voltage protection
- Trigger device
- Power pulse generators
- Lightning and arcing protection
- Energy discharge circuits
- Battery overvoltage protection
- Solar array protection

## Package: BOD-Package

- Industry standard outline
- RoHS compliant
- Epoxy meets UL 94V-0
- Soldering pins for PCB mounting
- Reduced weight

## Disclaimer Notice

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| IXBOD1 several values |                                        |                                                                                                                                                     |                              | Ratings |      |                   |                  |
|-----------------------|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|---------|------|-------------------|------------------|
| Symbol                | Definitions                            | Conditions                                                                                                                                          |                              | min.    | typ. | max.              |                  |
| $I_D$                 | drain current                          | $V_D = 0.8 \cdot V_{BO}$                                                                                                                            | $T_{VJ} = 125^\circ\text{C}$ |         |      | 100               | $\mu\text{A}$    |
| $I_{BO}$              | breakover current                      |                                                                                                                                                     | $T_{VJ} = 25^\circ\text{C}$  |         |      | 15                | mA               |
| $I_H$                 | holding current                        |                                                                                                                                                     | $T_{VJ} = 25^\circ\text{C}$  |         |      | 30                | mA               |
| $V_H$                 | holding voltage                        |                                                                                                                                                     | $T_{VJ} = 25^\circ\text{C}$  | 4       |      | 8                 | V                |
| $(di/dt)_C$           | maximum pulsed source current          | $V_D = V_{BO}; I_T = 80 \text{ A}; f = 50 \text{ Hz}$                                                                                               | $T_{VJ} = 125^\circ\text{C}$ |         |      | 200               | A/ $\mu\text{s}$ |
| $t_q$                 | turn-off time                          | $V_D = 0.67 \cdot V_{BO}; V_R = 0 \text{ V}; I_T = 80 \text{ A}$<br>$dv/dt_{(lin.)} = 200 \text{ V}/\mu\text{s}; di/dt = -10 \text{ A}/\mu\text{s}$ | $T_{VJ} = 125^\circ\text{C}$ |         | 150  |                   | $\mu\text{s}$    |
| $K_T$                 | temperature coefficient of $V_{BO}$    |                                                                                                                                                     |                              |         |      | $2 \cdot 10^{-3}$ | $\text{K}^{-1}$  |
| $K_P$                 | coefficient for energy per pulse $E_P$ | (material constant)                                                                                                                                 |                              |         |      | 700               | K/Ws             |

| IXBOD1 - 12R... - 19R (2 Elements) |                                 |                                                                                   |                              | Ratings |      |      |                      |
|------------------------------------|---------------------------------|-----------------------------------------------------------------------------------|------------------------------|---------|------|------|----------------------|
| Symbol                             | Definitions                     | Conditions                                                                        |                              | min.    | typ. | max. |                      |
| $V_{BO}$                           | breakover voltage               | $V_{BO}(T_{VJ}) = V_{BO, 25^\circ\text{C}} [1 + K_T (T_{VJ} - 25^\circ\text{C})]$ |                              |         |      |      |                      |
|                                    |                                 | IXBOD 1 -12R                                                                      |                              | 1150    | 1200 | 1250 | V                    |
|                                    |                                 | IXBOD 1 -13R                                                                      |                              | 1250    | 1300 | 1350 | V                    |
|                                    |                                 | IXBOD 1 -14R                                                                      |                              | 1350    | 1400 | 1450 | V                    |
|                                    |                                 | IXBOD 1 -15R                                                                      |                              | 1450    | 1500 | 1550 | V                    |
|                                    |                                 | IXBOD 1 -16R                                                                      |                              | 1550    | 1600 | 1650 | V                    |
|                                    |                                 | IXBOD 1 -17R                                                                      |                              | 1650    | 1700 | 1750 | V                    |
|                                    |                                 | IXBOD 1 -18R                                                                      |                              | 1750    | 1800 | 1850 | V                    |
|                                    |                                 | IXBOD 1 -19R                                                                      |                              | 1850    | 1900 | 1950 | V                    |
| $I_{RMS}$                          | RMS current                     | $f = 50 \text{ Hz}$<br>pins soldered to printed circuit (conductor 0.035x2mm)     | $T_{amb} = 50^\circ\text{C}$ |         |      | 2.0  | A                    |
| $I_{FAVM}$                         | maximum average forward current |                                                                                   |                              |         |      | 1.25 | A                    |
| $I_{SM}$                           | maximum pulsed source current   | $t_p = 0.1 \text{ ms}; \text{non repetitive}$                                     | $T_{amb} = 50^\circ\text{C}$ |         |      | 200  | A                    |
| $I^2t$                             | $I^2t$ value for fusing         | $t_p = 0.1 \text{ ms}$                                                            | $T_{amb} = 50^\circ\text{C}$ |         |      | 2    | $\text{A}^2\text{s}$ |
| $V_T$                              | forward voltage drop            | $I_T = 5 \text{ A}$                                                               | $T_{VJ} = 125^\circ\text{C}$ |         |      | 3.4  | V                    |
| $V_{T0}$                           | threshold voltage               | for power-loss calculation only                                                   |                              |         |      | 2.2  | V                    |
| $r_T$                              | slope resistance                |                                                                                   |                              |         |      | 0.24 | $\Omega$             |

| IXBOD1 - 12RD... - 19RD (2 Elements) |                                        |                                                                                                          | Ratings |      |       |                  |
|--------------------------------------|----------------------------------------|----------------------------------------------------------------------------------------------------------|---------|------|-------|------------------|
| Symbol                               | Definitions                            | Conditions                                                                                               | min.    | typ. | max.  |                  |
| $V_{BO}$                             | <i>breakover voltage</i>               | $V_{BO} (T_{VJ}) = V_{BO, 25^{\circ}C} [1 + K_T (T_{VJ} - 25^{\circ}C)]$                                 |         |      |       |                  |
|                                      |                                        | IXBOD 1 -12RD                                                                                            | 1150    | 1200 | 1250  | V                |
|                                      |                                        | IXBOD 1 -13RD                                                                                            | 1250    | 1300 | 1350  | V                |
|                                      |                                        | IXBOD 1 -14RD                                                                                            | 1350    | 1400 | 1450  | V                |
|                                      |                                        | IXBOD 1 -15RD                                                                                            | 1450    | 1500 | 1550  | V                |
|                                      |                                        | IXBOD 1 -16RD                                                                                            | 1550    | 1600 | 1650  | V                |
|                                      |                                        | IXBOD 1 -17RD                                                                                            | 1650    | 1700 | 1750  | V                |
|                                      |                                        | IXBOD 1 -18RD                                                                                            | 1750    | 1800 | 1850  | V                |
|                                      |                                        | IXBOD 1 -19RD                                                                                            | 1850    | 1900 | 1950  | V                |
| $I_{RMS}$                            | <i>RMS current</i>                     | $f = 50 \text{ Hz}$<br>pins soldered to printed circuit (conductor 0.035x2mm)<br>$T_{amb} = 50^{\circ}C$ |         |      | 0.3   | A                |
| $I_{FAVM}$                           | <i>maximum average forward current</i> |                                                                                                          |         |      | 0.2   | A                |
| $I_{SM}$                             | <i>maximum pulsed source current</i>   | $t_p = 0.1 \text{ ms}$ ; non repetitive<br>$T_{amb} = 50^{\circ}C$                                       |         |      | 50    | A                |
| $I^2t$                               | <i>I<sup>2</sup>t value for fusing</i> | $t_p = 0.1 \text{ ms}$<br>$T_{amb} = 50^{\circ}C$                                                        |         |      | 0.125 | A <sup>2</sup> s |
| $V_T$                                | <i>forward voltage drop</i>            | $I_T = 5 \text{ A}$<br>$T_{VJ} = 125^{\circ}C$                                                           |         |      | 27    | V                |
| $V_{TO}$                             | <i>threshold voltage</i>               | for power-loss calculation only                                                                          |         |      | 17.5  | V                |
| $r_T$                                | <i>slope resistance</i>                |                                                                                                          |         |      | 3     | $\Omega$         |

| IXBOD1 - 20R... - 32R (3 Elements) |                                        |                                                                                                          | Ratings |      |      |                  |
|------------------------------------|----------------------------------------|----------------------------------------------------------------------------------------------------------|---------|------|------|------------------|
| Symbol                             | Definitions                            | Conditions                                                                                               | min.    | typ. | max. |                  |
| $V_{BO}$                           | <i>breakover voltage</i>               | $V_{BO} (T_{VJ}) = V_{BO, 25^{\circ}C} [1 + K_T (T_{VJ} - 25^{\circ}C)]$                                 |         |      |      |                  |
|                                    |                                        | IXBOD 1 -20R                                                                                             | 1950    | 2000 | 2050 | V                |
|                                    |                                        | IXBOD 1 -21R                                                                                             | 2050    | 2100 | 2150 | V                |
|                                    |                                        | IXBOD 1 -22R                                                                                             | 2150    | 2200 | 2250 | V                |
|                                    |                                        | IXBOD 1 -23R                                                                                             | 2250    | 2300 | 2350 | V                |
|                                    |                                        | IXBOD 1 -24R                                                                                             | 2350    | 2400 | 2450 | V                |
|                                    |                                        | IXBOD 1 -25R                                                                                             | 2450    | 2500 | 2550 | V                |
|                                    |                                        | IXBOD 1 -26R                                                                                             | 2500    | 2600 | 2700 | V                |
|                                    |                                        | IXBOD 1 -28R                                                                                             | 2700    | 2800 | 2900 | V                |
|                                    |                                        | IXBOD 1 -30R                                                                                             | 2900    | 3000 | 3100 | V                |
|                                    |                                        | IXBOD 1 -32R                                                                                             | 3100    | 3200 | 3300 | V                |
| $I_{RMS}$                          | <i>RMS current</i>                     | $f = 50 \text{ Hz}$<br>pins soldered to printed circuit (conductor 0.035x2mm)<br>$T_{amb} = 50^{\circ}C$ |         |      | 1.4  | A                |
| $I_{FAVM}$                         | <i>maximum average forward current</i> |                                                                                                          |         |      | 0.9  | A                |
| $I_{SM}$                           | <i>maximum pulsed source current</i>   | $t_p = 0.1 \text{ ms}$ ; non repetitive<br>$T_{amb} = 50^{\circ}C$                                       |         |      | 200  | A                |
| $I^2t$                             | <i>I<sup>2</sup>t value for fusing</i> | $t_p = 0.1 \text{ ms}$<br>$T_{amb} = 50^{\circ}C$                                                        |         |      | 2    | A <sup>2</sup> s |
| $V_T$                              | <i>forward voltage drop</i>            | $I_T = 5 \text{ A}$<br>$T_{VJ} = 125^{\circ}C$                                                           |         |      | 5.1  | V                |
| $V_{TO}$                           | <i>threshold voltage</i>               | for power-loss calculation only                                                                          |         |      | 3.3  | V                |
| $r_T$                              | <i>slope resistance</i>                |                                                                                                          |         |      | 0.36 | $\Omega$         |

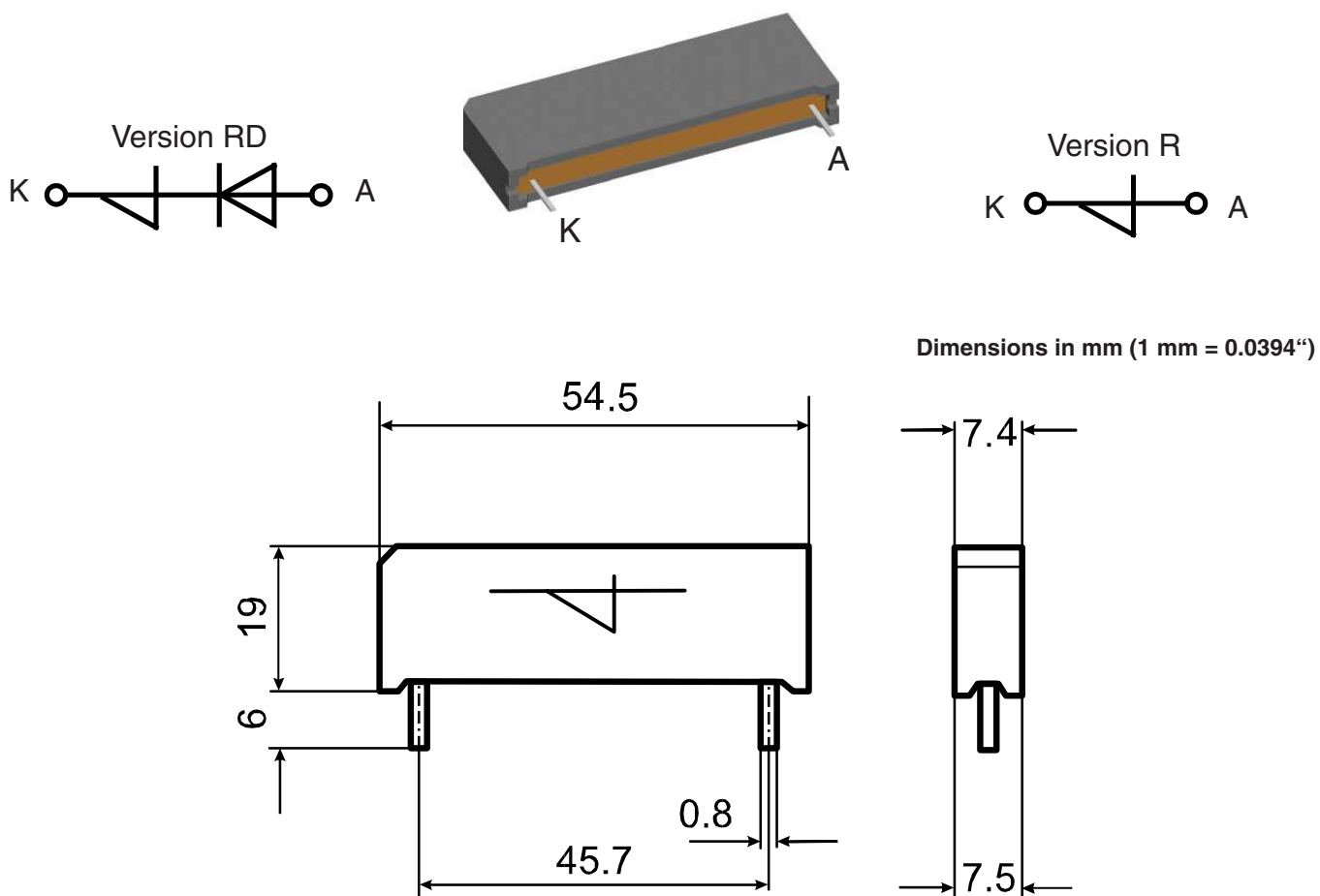
| IXBOD1 - 20RD... - 32RD (3 Elements) |                                        |                                                                                                          | Ratings |      |       |                  |
|--------------------------------------|----------------------------------------|----------------------------------------------------------------------------------------------------------|---------|------|-------|------------------|
| Symbol                               | Definitions                            | Conditions                                                                                               | min.    | typ. | max.  |                  |
| $V_{BO}$                             | <i>breakover voltage</i>               | $V_{BO} (T_{VJ}) = V_{BO, 25^{\circ}C} [1 + K_T (T_{VJ} - 25^{\circ}C)]$                                 |         |      |       |                  |
|                                      |                                        | IXBOD 1 -20RD                                                                                            | 1950    | 2000 | 2050  | V                |
|                                      |                                        | IXBOD 1 -21RD                                                                                            | 2050    | 2100 | 2150  | V                |
|                                      |                                        | IXBOD 1 -22RD                                                                                            | 2150    | 2200 | 2250  | V                |
|                                      |                                        | IXBOD 1 -23RD                                                                                            | 2250    | 2300 | 2350  | V                |
|                                      |                                        | IXBOD 1 -24RD                                                                                            | 2350    | 2400 | 2450  | V                |
|                                      |                                        | IXBOD 1 -25RD                                                                                            | 2450    | 2500 | 2550  | V                |
|                                      |                                        | IXBOD 1 -26RD                                                                                            | 2500    | 2600 | 2700  | V                |
|                                      |                                        | IXBOD 1 -28RD                                                                                            | 2700    | 2800 | 2900  | V                |
|                                      |                                        | IXBOD 1 -30RD                                                                                            | 2900    | 3000 | 3100  | V                |
|                                      |                                        | IXBOD 1 -32RD                                                                                            | 3100    | 3200 | 3300  | V                |
| $I_{RMS}$                            | <i>RMS current</i>                     | $f = 50 \text{ Hz}$<br>pins soldered to printed circuit (conductor 0.035x2mm)<br>$T_{amb} = 50^{\circ}C$ |         |      | 0.3   | A                |
| $I_{FAVM}$                           | <i>maximum average forward current</i> |                                                                                                          |         |      | 0.2   | A                |
| $I_{SM}$                             | <i>maximum pulsed source current</i>   | $t_p = 0.1 \text{ ms}$ ; non repetitive<br>$T_{amb} = 50^{\circ}C$                                       |         |      | 50    | A                |
| $I^2t$                               | <i>I<sup>2</sup>t value for fusing</i> | $t_p = 0.1 \text{ ms}$<br>$T_{amb} = 50^{\circ}C$                                                        |         |      | 0.125 | A <sup>2</sup> s |
| $V_T$                                | <i>forward voltage drop</i>            | $I_T = 5 \text{ A}$<br>$T_{VJ} = 125^{\circ}C$                                                           |         |      | 27    | V                |
| $V_{T0}$                             | <i>threshold voltage</i>               | for power-loss calculation only                                                                          |         |      | 17.5  | V                |
| $r_T$                                | <i>slope resistance</i>                |                                                                                                          |         |      | 3     | $\Omega$         |

| IXBOD1 - 34... - 42R (4 Elements) |                                        |                                                                                                          | Ratings |      |      |                  |
|-----------------------------------|----------------------------------------|----------------------------------------------------------------------------------------------------------|---------|------|------|------------------|
| Symbol                            | Definitions                            | Conditions                                                                                               | min.    | typ. | max. |                  |
| $V_{BO}$                          | <i>breakover voltage</i>               | $V_{BO} (T_{VJ}) = V_{BO, 25^{\circ}C} [1 + K_T (T_{VJ} - 25^{\circ}C)]$                                 |         |      |      |                  |
|                                   |                                        | IXBOD 1 -34R                                                                                             | 3300    | 3400 | 3500 | V                |
|                                   |                                        | IXBOD 1 -36R                                                                                             | 3500    | 3600 | 3700 | V                |
|                                   |                                        | IXBOD 1 -38R                                                                                             | 3700    | 3800 | 4000 | V                |
|                                   |                                        | IXBOD 1 -40R                                                                                             | 3900    | 4000 | 4100 | V                |
|                                   |                                        | IXBOD 1 -42R                                                                                             | 4100    | 4200 | 4300 | V                |
| $I_{RMS}$                         | <i>RMS current</i>                     | $f = 50 \text{ Hz}$<br>pins soldered to printed circuit (conductor 0.035x2mm)<br>$T_{amb} = 50^{\circ}C$ |         |      | 1.1  | A                |
| $I_{FAVM}$                        | <i>maximum average forward current</i> |                                                                                                          |         |      | 0.7  | A                |
| $I_{SM}$                          | <i>maximum pulsed source current</i>   | $t_p = 0.1 \text{ ms}$ ; non repetitive<br>$T_{amb} = 50^{\circ}C$                                       |         |      | 200  | A                |
| $I^2t$                            | <i>I<sup>2</sup>t value for fusing</i> | $t_p = 0.1 \text{ ms}$<br>$T_{amb} = 50^{\circ}C$                                                        |         |      | 2    | A <sup>2</sup> s |
| $V_T$                             | <i>forward voltage drop</i>            | $I_T = 5 \text{ A}$<br>$T_{VJ} = 125^{\circ}C$                                                           |         |      | 6.8  | V                |
| $V_{T0}$                          | <i>threshold voltage</i>               | for power-loss calculation only                                                                          |         |      | 4.4  | V                |
| $r_T$                             | <i>slope resistance</i>                |                                                                                                          |         |      | 0.48 | $\Omega$         |

| Package FP-Case |                                        |                                            | Ratings |      |          |            |
|-----------------|----------------------------------------|--------------------------------------------|---------|------|----------|------------|
| Symbol          | Definitions                            | Conditions                                 | min.    | typ. | max.     |            |
| $T_{amb}$       | ambient temperature (cooling medium)   |                                            | -40     |      | 125      | °C         |
| $T_{stg}$       | storage temperature                    |                                            | -40     |      | 125      | °C         |
| $T_{VJM}$       | maximum virtual junction temperature   |                                            | -40     |      | 125      | °C         |
| $R_{thJA}$      | thermal resistance junction to ambient | natural convection<br>with air speed 2 m/s |         |      | 20<br>16 | K/W<br>K/W |
| Weight          |                                        |                                            |         | 14   |          | g          |



## Outlines FP-case



| Ordering | Part Name     | Marking on Product | Delivering Mode | Base Qty | Ordering Code |
|----------|---------------|--------------------|-----------------|----------|---------------|
| Standard | IXBOD 1 -12R  | IXBOD 1 -12R       | Box             | 20       | 468649        |
| Standard | IXBOD 1 -12RD | IXBOD 1 -12RD      | Box             | 20       | 472948        |
| Standard | IXBOD 1 -13R  | IXBOD 1 -13R       | Box             | 20       | 468657        |
| Standard | IXBOD 1 -13RD | IXBOD 1 -13RD      | Box             | 20       | 472956        |
| Standard | IXBOD 1 -14R  | IXBOD 1 -14R       | Box             | 20       | 468665        |
| Standard | IXBOD 1 -14RD | IXBOD 1 -14RD      | Box             | 20       | 472964        |
| Standard | IXBOD 1 -15R  | IXBOD 1 -15R       | Box             | 20       | 468673        |
| Standard | IXBOD 1 -15RD | IXBOD 1 -15RD      | Box             | 20       | 472972        |
| Standard | IXBOD 1 -16R  | IXBOD 1 -16R       | Box             | 20       | 468681        |
| Standard | IXBOD 1 -16RD | IXBOD 1 -16RD      | Box             | 20       | 472794        |
| Standard | IXBOD 1 -17R  | IXBOD 1 -17R       | Box             | 20       | 468703        |
| Standard | IXBOD 1 -17RD | IXBOD 1 -17RD      | Box             | 20       | 472980        |
| Standard | IXBOD 1 -18R  | IXBOD 1 -18R       | Box             | 20       | 468711        |
| Standard | IXBOD 1 -18RD | IXBOD 1 -18RD      | Box             | 20       | 472999        |
| Standard | IXBOD 1 -19R  | IXBOD 1 -19R       | Box             | 20       | 468738        |
| Standard | IXBOD 1 -19RD | IXBOD 1 -19RD      | Box             | 20       | 473006        |
| Standard | IXBOD 1 -20R  | IXBOD 1 -20R       | Box             | 20       | 468746        |
| Standard | IXBOD 1 -20RD | IXBOD 1 -20RD      | Box             | 20       | 473014        |
| Standard | IXBOD 1 -21R  | IXBOD 1 -21R       | Box             | 20       | 468754        |
| Standard | IXBOD 1 -21RD | IXBOD 1 -21RD      | Box             | 20       | 473022        |
| Standard | IXBOD 1 -22R  | IXBOD 1 -22R       | Box             | 20       | 468762        |
| Standard | IXBOD 1 -22RD | IXBOD 1 -22RD      | Box             | 20       | 473030        |
| Standard | IXBOD 1 -23R  | IXBOD 1 -23R       | Box             | 20       | 468770        |
| Standard | IXBOD 1 -23RD | IXBOD 1 -23RD      | Box             | 20       | 472786        |
| Standard | IXBOD 1 -24R  | IXBOD 1 -24R       | Box             | 20       | 468789        |
| Standard | IXBOD 1 -24RD | IXBOD 1 -24RD      | Box             | 20       | 473049        |
| Standard | IXBOD 1 -25R  | IXBOD 1 -25R       | Box             | 20       | 468797        |
| Standard | IXBOD 1 -25RD | IXBOD 1 -25RD      | Box             | 20       | 473057        |
| Standard | IXBOD 1 -26R  | IXBOD 1 -26R       | Box             | 20       | 468800        |
| Standard | IXBOD 1 -26RD | IXBOD 1 -26RD      | Box             | 20       | 473065        |
| Standard | IXBOD 1 -28R  | IXBOD 1 -28R       | Box             | 20       | 468819        |
| Standard | IXBOD 1 -28RD | IXBOD 1 -28RD      | Box             | 20       | 473073        |
| Standard | IXBOD 1 -30R  | IXBOD 1 -30R       | Box             | 20       | 468827        |
| Standard | IXBOD 1 -30RD | IXBOD 1 -30RD      | Box             | 20       | 473081        |
| Standard | IXBOD 1 -32R  | IXBOD 1 -32R       | Box             | 20       | 468835        |
| Standard | IXBOD 1 -32RD | IXBOD 1 -32RD      | Box             | 20       | 473103        |
| Standard | IXBOD 1 -34R  | IXBOD 1 -34R       | Box             | 20       | 468843        |
| Standard | IXBOD 1 -36R  | IXBOD 1 -36R       | Box             | 20       | 468851        |
| Standard | IXBOD 1 -38R  | IXBOD 1 -38R       | Box             | 20       | 468878        |
| Standard | IXBOD 1 -40R  | IXBOD 1 -40R       | Box             | 20       | 468886        |
| Standard | IXBOD 1 -42R  | IXBOD 1 -42R       | Box             | 20       | 468894        |



**Curves**

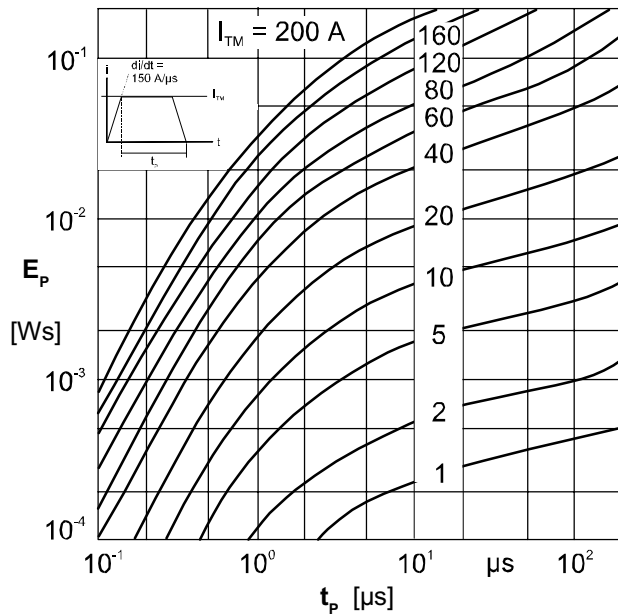


Fig. 1 Energy per pulse for single BOD element for trapezoidal wave current.  $E_p$  must be multiplied by number of elements for total energy

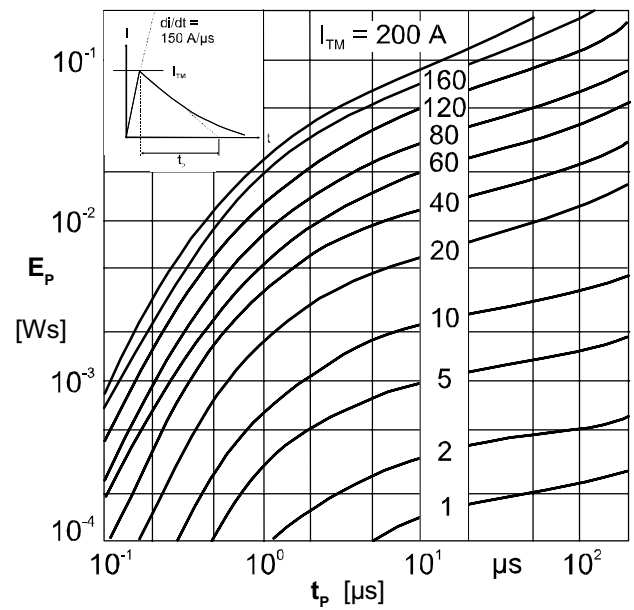


Fig. 2 Energy per pulse for single BOD element for exponentially decaying current pulse.  $E_p$  must be multiplied by number of elements for total energy

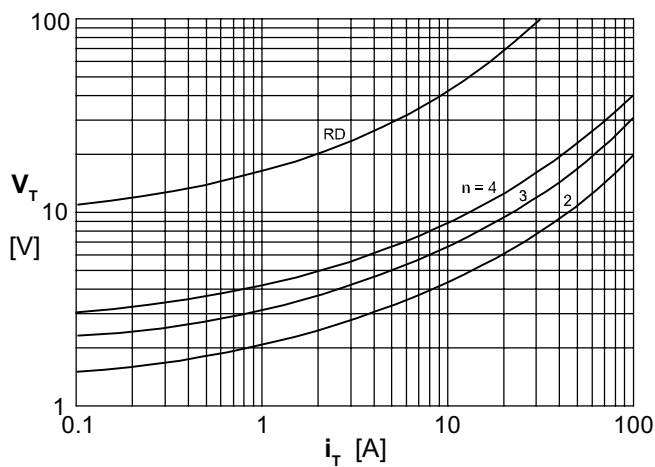


Fig. 3 On-state voltage at  $T_{vj} = 125^\circ\text{C}$

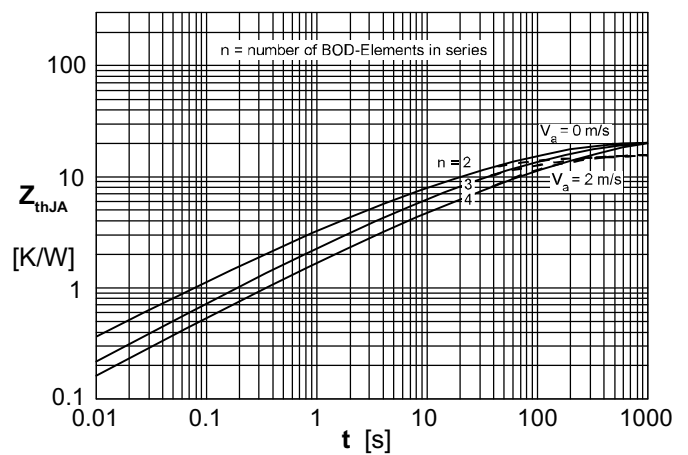


Fig. 4 Transient thermal resistance