# High Voltage Standard Rectifier Module

$V_{RRM}$ = 2200 V
$I_{FAV}$ = 560 A
$V_F$ = 0,98 V

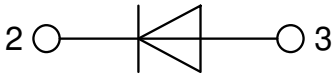
Single Diode

**Part number**

**MDO500-22N1**


Backside: isolated

E72873




**Features / Advantages:**

- Planar passivated chips
- Very low leakage current
- Very low forward voltage drop
- Improved thermal behaviour

**Applications:**

- Diode for main rectification
- For single and three phase bridge configurations
- Supplies for DC power equipment
- Input rectifiers for PWM inverter
- Battery DC power supplies
- Field supply for DC motors

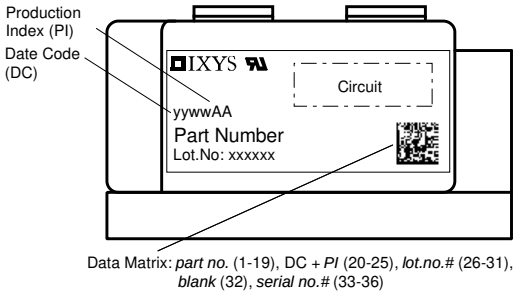
**Package:** Y1

- Isolation Voltage: 4800 V~
- Industry standard outline
- RoHS compliant
- Base plate: Copper internally DCB isolated
- Advanced power cycling

## Rectifier

| Symbol | Definition | Conditions | | Ratings min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{RSM}$ | *max. non-repetitive reverse blocking voltage* | | $T_{VJ}$ = 25°C | | | 2300 | V |
| $V_{RRM}$ | *max. repetitive reverse blocking voltage* | | $T_{VJ}$ = 25°C | | | 2200 | V |
| $I_R$ | *reverse current* | $V_R$ = 2200 V | $T_{VJ}$ = 25°C | | | 1 | mA |
| | | $V_R$ = 2200 V | $T_{VJ}$ = 140°C | | | 30 | mA |
| $V_F$ | *forward voltage drop* | $I_F$ = 500 A | $T_{VJ}$ = 25°C | | | 1,09 | V |
| | | $I_F$ = 1000 A | | | | 1,24 | V |
| | | $I_F$ = 500 A | $T_{VJ}$ = 125°C | | | 0,98 | V |
| | | $I_F$ = 1000 A | | | | 1,17 | V |
| $I_{FAV}$ | *average forward current* | $T_C$ = 85°C | $T_{VJ}$ = 140°C | | | 560 | A |
| $I_{F(RMS)}$ | *RMS forward current* | 180° sine d = 0.5 | | | | | A |
| $V_{F0}$ | *threshold voltage* } *for power loss calculation only* | | $T_{VJ}$ = 140°C | | | 0,80 | V |
| $r_F$ | *slope resistance* } | | | | | 0,38 | mΩ |
| $R_{thJC}$ | *thermal resistance junction to case* | | | | | 0,072 | K/W |
| $R_{thCH}$ | *thermal resistance case to heatsink* | | | | 0,024 | | K/W |
| $P_{tot}$ | *total power dissipation* | | $T_C$ = 25°C | | | 1600 | W |
| $I_{FSM}$ | *max. forward surge current* | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 45°C | | | 15,0 | kA |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 16,2 | kA |
| | | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 140°C | | | 12,8 | kA |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 13,8 | kA |
| $I^2t$ | *value for fusing* | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 45°C | | | 1,13 | $MA^2s$ |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 1,09 | $MA^2s$ |
| | | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 140°C | | | 812,8 | $kA^2s$ |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 788,8 | $kA^2s$ |
| $C_J$ | *junction capacitance* | $V_R$ = 700 V; f = 1 MHz | $T_{VJ}$ = 25°C | | 576 | | pF |

| Package Y1 | | | | Ratings | | | |
|---|---|---|---|---|---|---|---|
| **Symbol** | **Definition** | **Conditions** | | **min.** | **typ.** | **max.** | **Unit** |
| $I_{RMS}$ | *RMS current* | per terminal | | | | 600 | A |
| $T_{VJ}$ | *virtual junction temperature* | | | -40 | | 140 | °C |
| $T_{op}$ | *operation temperature* | | | -40 | | 125 | °C |
| $T_{stg}$ | *storage temperature* | | | -40 | | 125 | °C |
| **Weight** | | | | | 650 | | g |
| $M_D$ | *mounting torque* | | | 4,5 | | 7 | Nm |
| $M_T$ | *terminal torque* | | | 11 | | 13 | Nm |
| $d_{Spp/App}$ | *creepage distance on surface \| striking distance through air* | | *terminal to terminal* | 16,0 | | | mm |
| $d_{Spb/Apb}$ | | | *terminal to backside* | 25,0 | | | mm |
| $V_{ISOL}$ | *isolation voltage* | t = 1 second | 50/60 Hz, RMS; $I_{ISOL}$ ≤ 1 mA | 4800 | | | V |
| | | t = 1 minute | | 4000 | | | V |

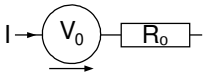



| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|---|---|---|---|---|---|
| Standard | MDO500-22N1 | MDO500-22N1 | Box | 2 | 467219 |

| Similar Part | Package | Voltage class |
|---|---|---|
| MDO500-12N1 | Y1-2-CU | 1200 |
| MDO500-14N1 | Y1-2-CU | 1400 |
| MDO500-16N1 | Y1-2-CU | 1600 |
| MDO500-18N1 | Y1-2-CU | 1800 |
| MDO500-20N1 | Y1-2-CU | 2000 |

## Equivalent Circuits for Simulation

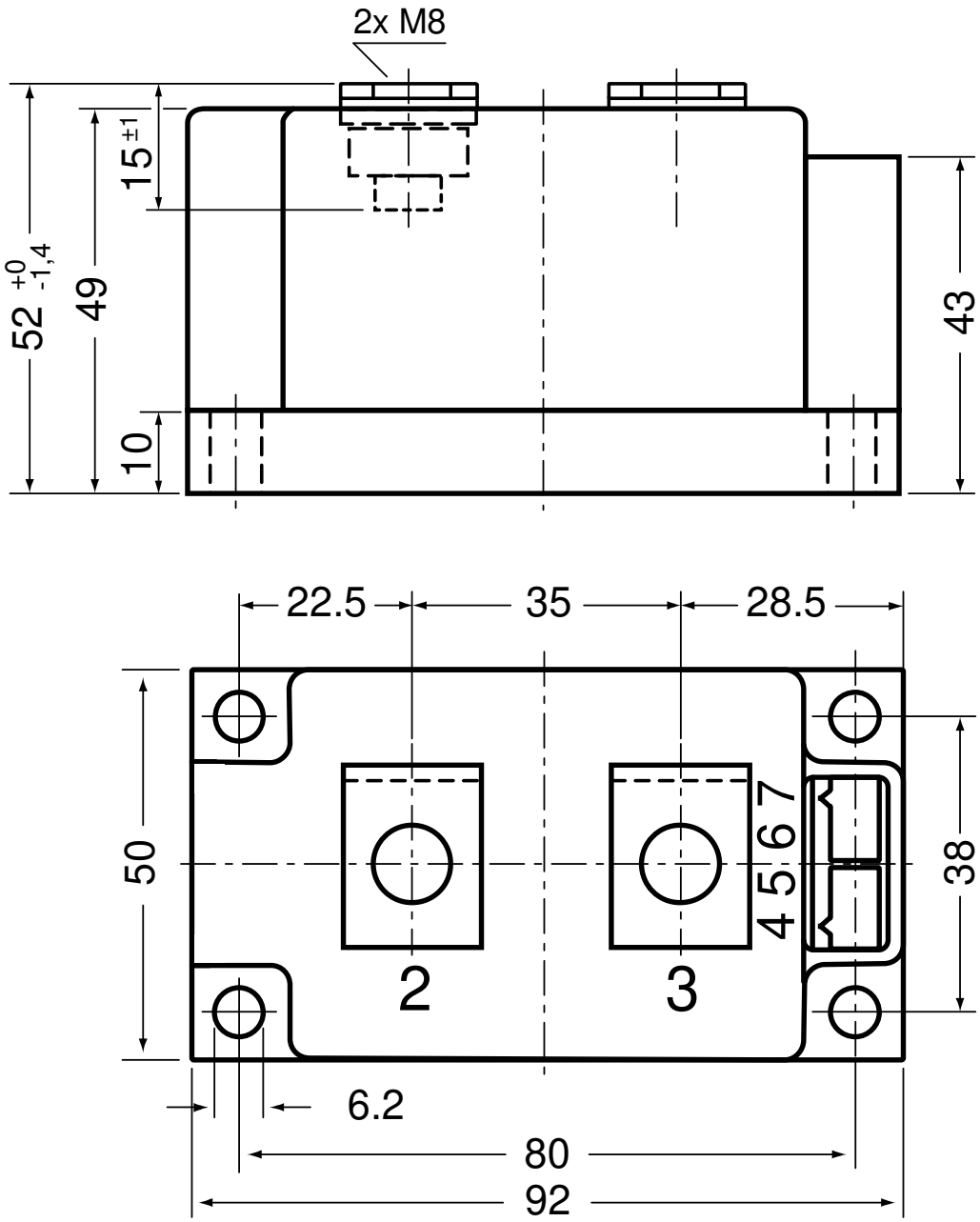
** on die level* $T_{VJ}$ = 140°C

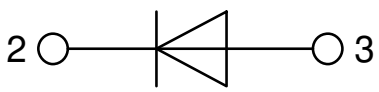



**Rectifier**

| | | | |
|---|---|---|---|
| $V_{0\,max}$ | *threshold voltage* | 0,8 | V |
| $R_{0\,max}$ | *slope resistance ** | 0,19 | mΩ |

## Outlines Y1



## Rectifier

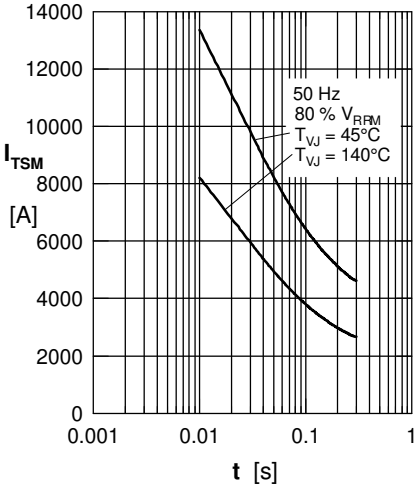



Fig. 1 Surge overload current
$I_{FSM}$: Crest value, t: duration

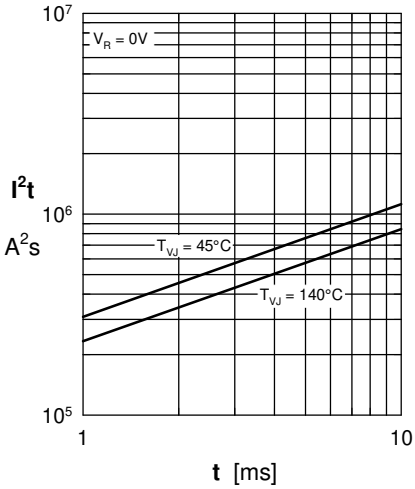



Fig. 2 $I^2t$ versus time (1-10 ms)

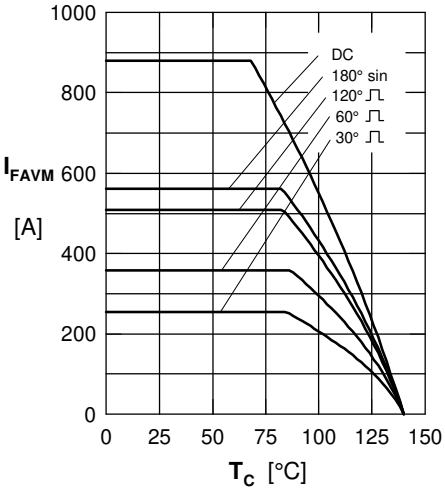



Fig. 3 Maximum forward current at case temperature

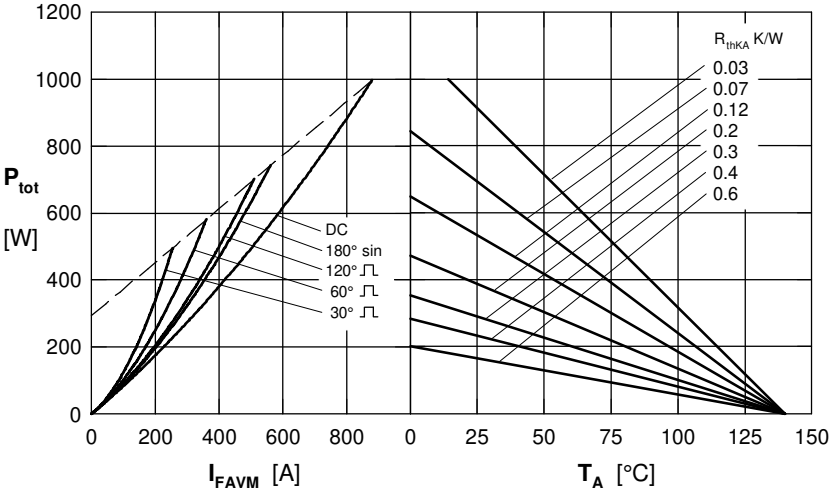



Fig. 4 Power dissipation vs. forward current and ambient temperature

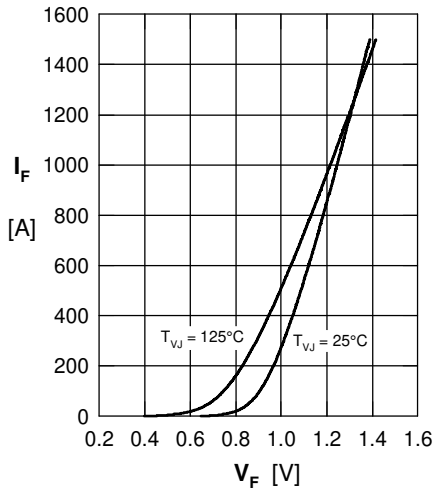



Fig. 5 Forward current
$I_F$ versus $V_F$

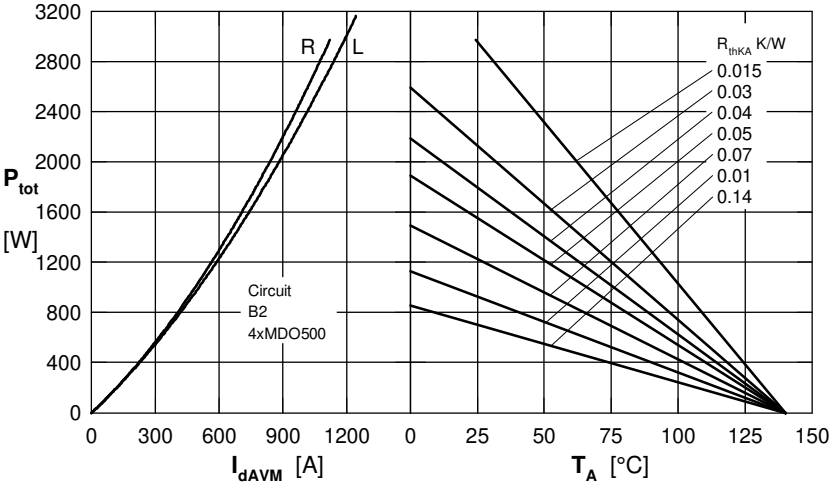



Fig. 6 Single phase rectifier bridge: Power dissipation vs. direct output current and ambient temperature. R = resistive load, L = inductive load

## Rectifier

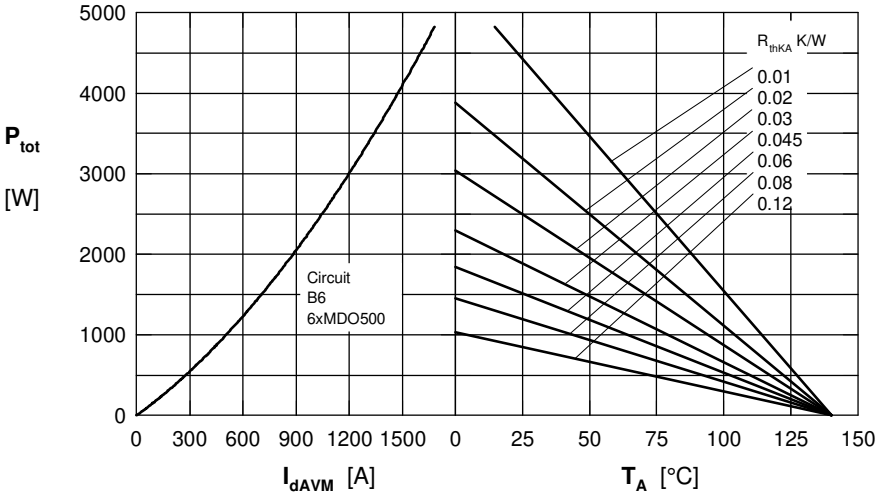
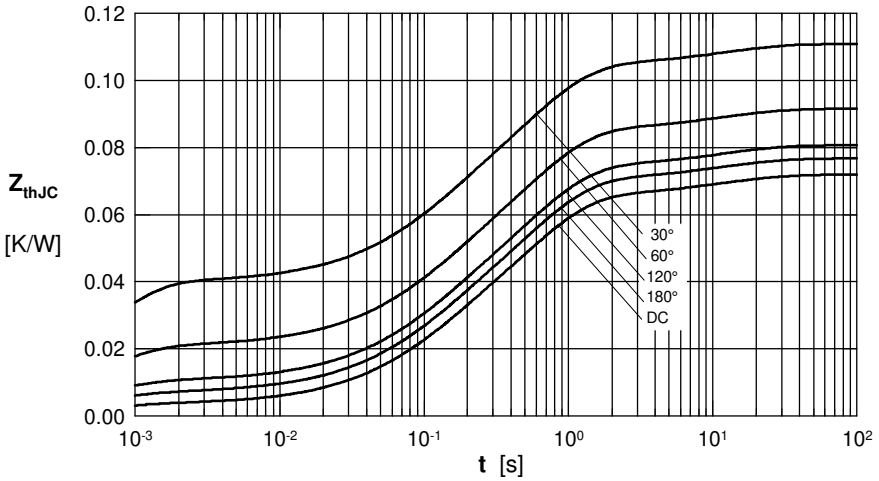



Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature



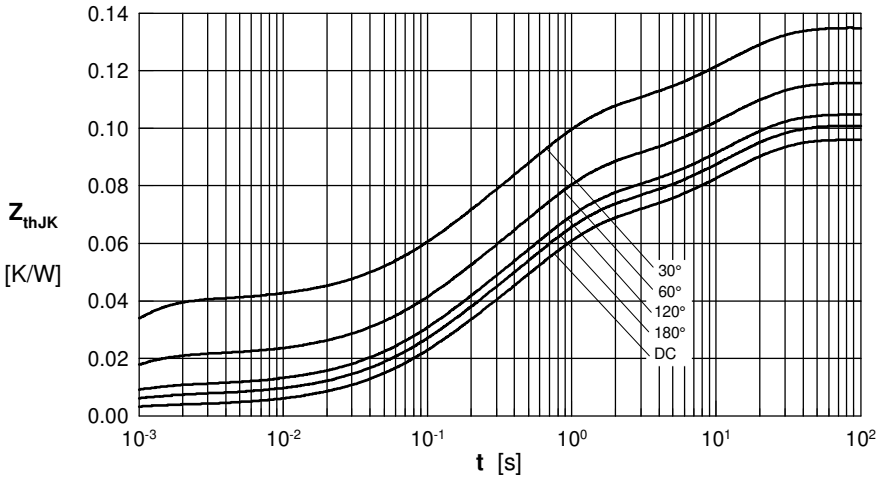

$R_{thJC}$ for various conduction angles d:

| d | $R_{thJC}$ (K/W) |
|---|---|
| DC | 0.072 |
| 180° | 0.0768 |
| 120° | 0.081 |
| 60° | 0.092 |
| 30° | 0.111 |

Constants for $Z_{thJC}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0035 | 0.0054 |
| 2 | 0.0186 | 0.098 |
| 3 | 0.0432 | 0.54 |
| 4 | 0.0067 | 12 |

Fig. 7 Transient thermal impedance junction to case




$R_{thJK}$ for various conduction angles d:

| d | $R_{thJK}$ (K/W) |
|---|---|
| DC | 0.096 |
| 180° | 0.1 |
| 120° | 0.105 |
| 60° | 0.116 |
| 30° | 0.135 |

Constants for $Z_{thJK}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0035 | 0.0054 |
| 2 | 0.0186 | 0.098 |
| 3 | 0.0432 | 0.54 |
| 4 | 0.0067 | 12 |
| 5 | 0.024 | 12 |

Fig. 8 Transient thermal impedance junction to heatsink