

# Standard Rectifier Module

$$V_{RRM} = 2 \times 1200 \text{ V}$$

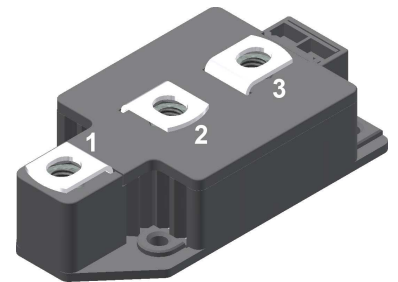
$$I_{FAV} = 300 \text{ A}$$

$$V_F = 1 \text{ V}$$

Phase leg

Part number

**MDD310-12N1**



Backside: isolated

 E72873



### Features / Advantages:

- Package with DCB ceramic
- Improved temperature and power cycling
- Planar passivated chips
- Very low forward voltage drop
- Very low leakage current

### 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: Y2

- Isolation Voltage: 3600 V~
- Industry standard outline
- RoHS compliant
- Height: 30 mm
- Base plate: DCB ceramic
- Reduced weight
- Advanced power cycling

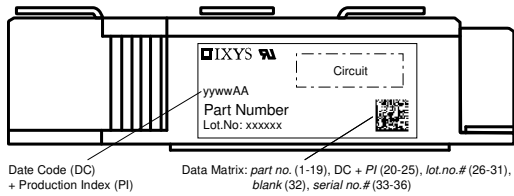
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| Rectifier    |  |   |                              | Ratings |       |                   |   |
|--------------|--|---|------------------------------|---------|-------|-------------------|---|
| Symbol       | Definition                                   | Conditions  | min.                         | typ.    | max.  | Unit              |   |
| $V_{RSM}$    | max. non-repetitive reverse blocking voltage |   |                              |         | 1300  | V                 |   |
| $V_{RRM}$    | max. repetitive reverse blocking voltage     |   |                              |         | 1200  | V                 |   |
| $I_R$        | reverse current                              | $V_R = 1200\text{ V}$                             |                              |         | 1     | mA                |   |
|              |  | $V_R = 1200\text{ V}$                             |                              |         | 20    | mA                |   |
| $V_F$        | forward voltage drop                         | $I_F = 300\text{ A}$                              |                              |         | 1.13  | V                 |   |
|              |  | $I_F = 600\text{ A}$                              |                              |         | 1.33  | V                 |   |
|              |  | $I_F = 300\text{ A}$                              | $T_{VJ} = 125^\circ\text{C}$ |         |       | 1.00              | V |
|              |  | $I_F = 600\text{ A}$                              | $T_{VJ} = 125^\circ\text{C}$ |         |       | 1.29              | V |
| $I_{FAV}$    | average forward current                      | $T_C = 100^\circ\text{C}$                         |                              |         | 300   | A                 |   |
| $I_{F(RMS)}$ | RMS forward current                          | 180° sine   |                              |         | 480   | A                 |   |
| $V_{F0}$     | threshold voltage                            | } for power loss calculation only                 |                              |         | 0.75  | V                 |   |
| $r_F$        | slope resistance                             |   |                              |         | 0.63  | mΩ                |   |
| $R_{thJC}$   | thermal resistance junction to case          |   |                              |         | 0.13  | K/W               |   |
| $R_{thCH}$   | thermal resistance case to heatsink          |   |                              | 0.04    |       | K/W               |   |
| $P_{tot}$    | total power dissipation                      |   |                              |         | 960   | W                 |   |
| $I_{FSM}$    | max. forward surge current                   | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$  | $T_{VJ} = 45^\circ\text{C}$  |         | 11.5  | kA                |   |
|              |  | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$           |         | 12.4  | kA                |   |
|              |  | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$  | $T_{VJ} = 150^\circ\text{C}$ |         | 9.78  | kA                |   |
|              |  | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$           |         | 10.6  | kA                |   |
| $I^2t$       | value for fusing                             | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$  | $T_{VJ} = 45^\circ\text{C}$  |         | 661.3 | kA <sup>2</sup> s |   |
|              |  | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$           |         | 641.7 | kA <sup>2</sup> s |   |
|              |  | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$  | $T_{VJ} = 150^\circ\text{C}$ |         | 477.8 | kA <sup>2</sup> s |   |
|              |  | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$           |         | 463.5 | kA <sup>2</sup> s |   |
| $C_J$        | junction capacitance                         | $V_R = 400\text{ V}; f = 1\text{ MHz}$            | $T_{VJ} = 25^\circ\text{C}$  |         | 381   | pF                |   |



| Package Y2    |  |                      | Ratings |      |      |      |
|---------------|--|----------------------|---------|------|------|------|
| Symbol        | Definition   | Conditions           | min.    | typ. | max. | Unit |
| $I_{RMS}$     | RMS current  | per terminal         |         |      | 600  | A    |
| $T_{VJ}$      | virtual junction temperature                                 |                      | -40     |      | 150  | °C   |
| $T_{op}$      | operation temperature  |                      | -40     |      | 125  | °C   |
| $T_{stg}$     | storage temperature  |                      | -40     |      | 125  | °C   |
| <b>Weight</b> |  |                      |         | 254  |      | g    |
| $M_D$         | mounting torque  |                      | 2.5     |      | 5    | Nm   |
| $M_T$         | terminal torque  |                      | 12      |      | 15   | Nm   |
| $d_{Spp/App}$ | creepage distance on surface   striking distance through air | terminal to terminal | 13.0    |      |      | mm   |
| $d_{Spb/Apb}$ |  | terminal to backside | 13.0    |      |      | mm   |
| $V_{ISOL}$    | isolation voltage  | t = 1 second         | 3600    |      |      | V    |
|               |  | t = 1 minute         | 3000    |      |      | V    |



| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|----------|-----------------|--------------------|---------------|----------|----------|
| Standard | MDD310-12N1     | MDD310-12N1        | Box           | 2        | 429155   |

**Equivalent Circuits for Simulation**

\* on die level

$T_{VJ} = 150^{\circ}C$

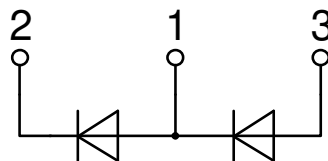
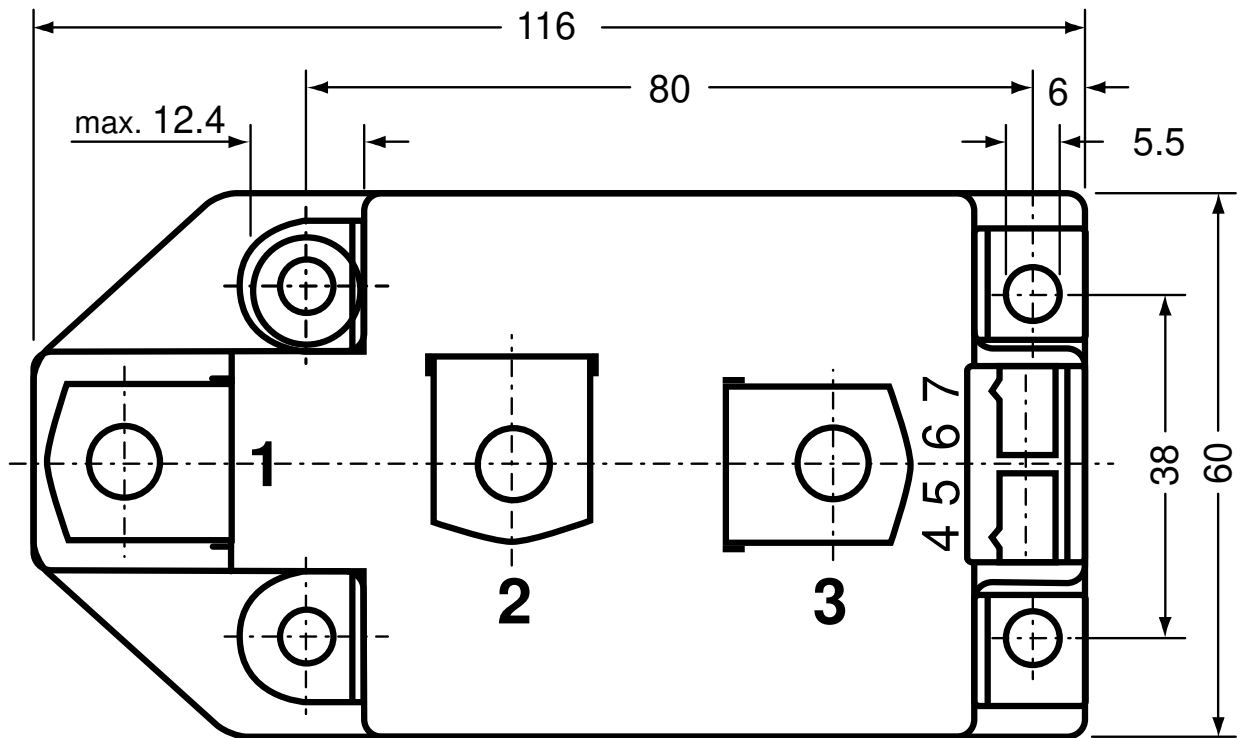
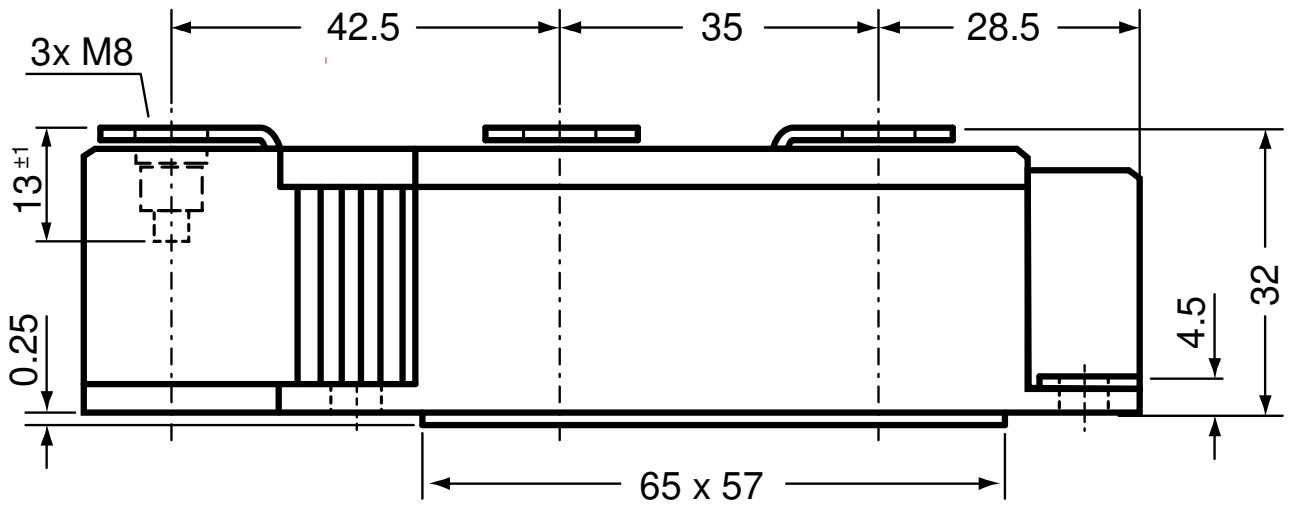


**Rectifier**

|              |                    |      |    |
|--------------|--------------------|------|----|
| $V_{0\ max}$ | threshold voltage  | 0.75 | V  |
| $R_{0\ max}$ | slope resistance * | 0.4  | mΩ |



Outlines Y2





**Rectifier**

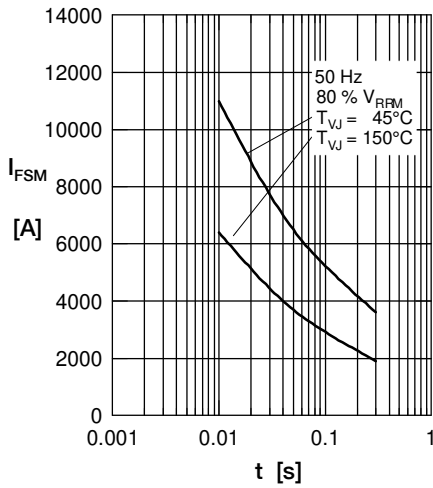


Fig. 1 Surge overload current  
 $I_{FSM}$ : Crest value,  $t$ : duration

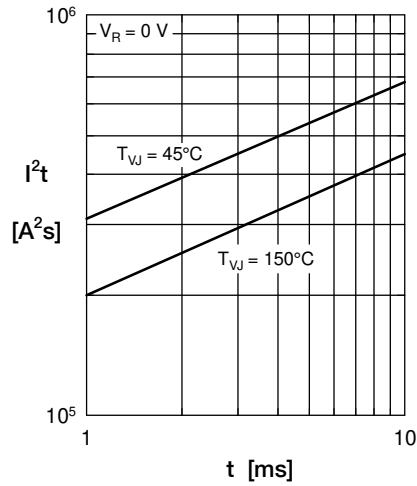


Fig. 2  $I^2t$  versus time (1-10 ms)

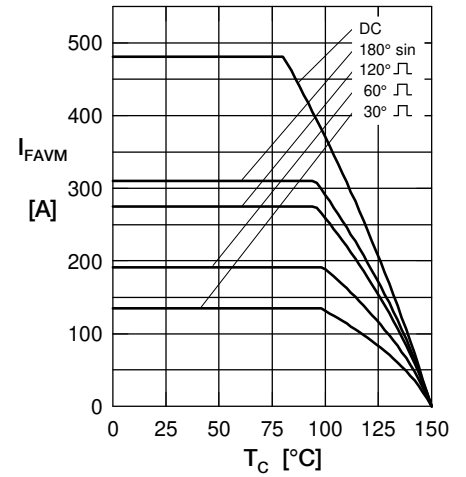


Fig. 3 Maximum forward current at case temperature

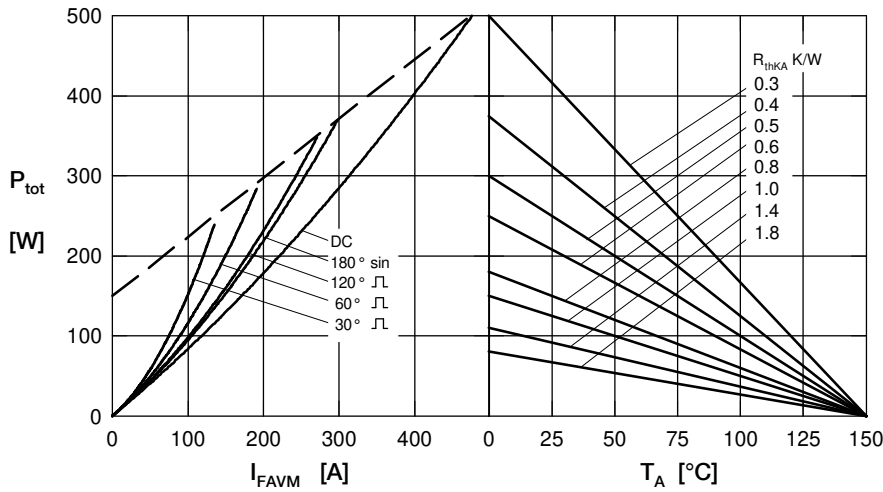


Fig. 4 Power dissipation versus forward current and ambient temperature (per diode)

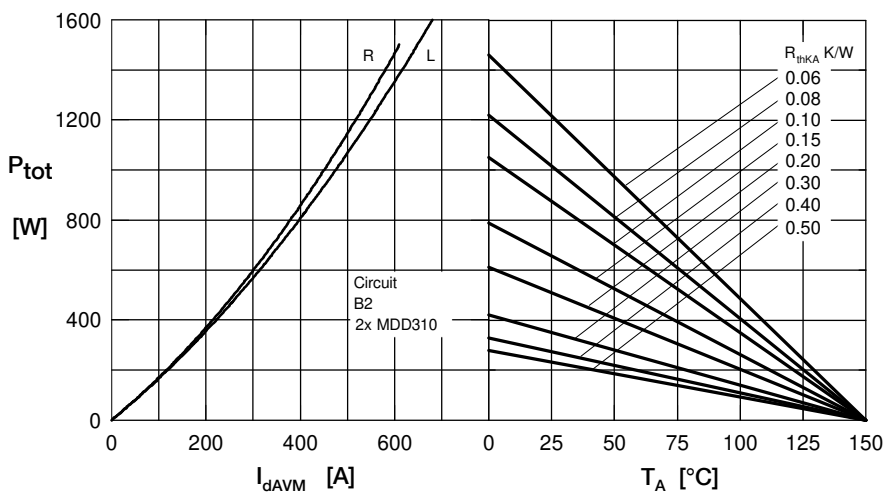


Fig. 5 Single phase rectifier bridge: Power dissipation vs. direct output current and ambient temperature  $R$  = resistive load,  $L$  = inductive load



**Rectifier**

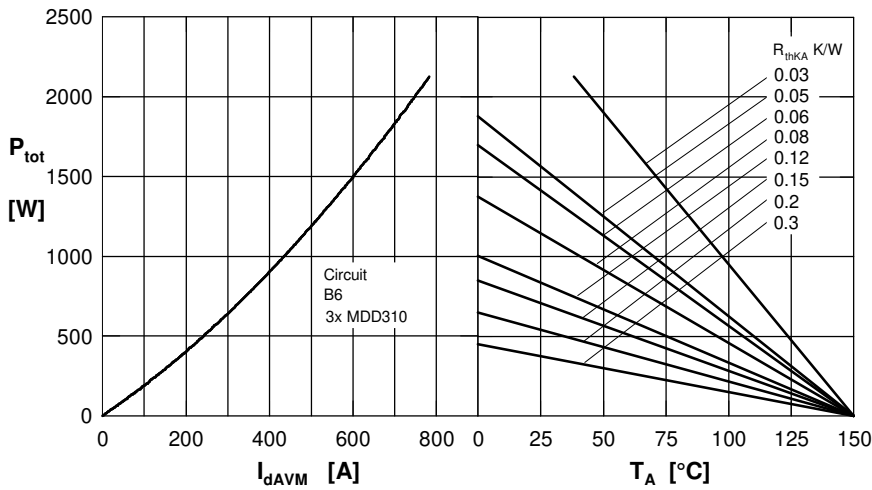


Fig.6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

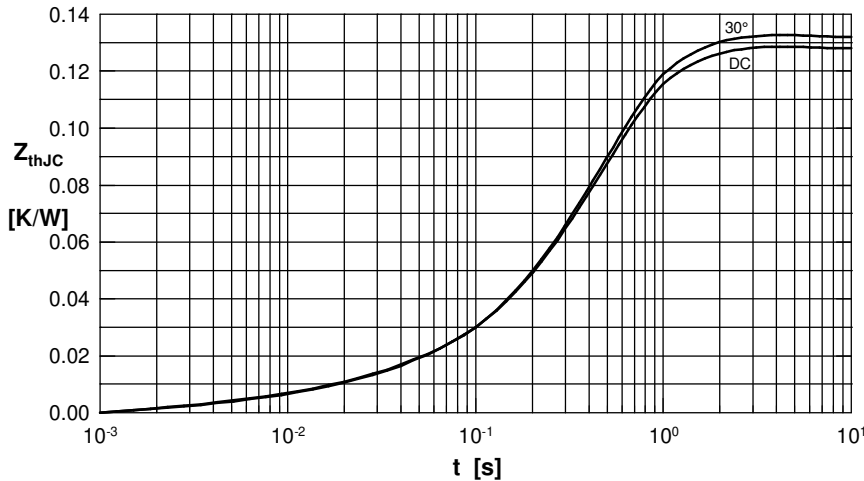


Fig. 7 Transient thermal impedance junction to case (per diode)

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

| $d$  | $R_{thJC}$ [K/W] |
|------|------------------|
| DC   | 0.129            |
| 180° | 0.131            |
| 120° | 0.132            |
| 60°  | 0.132            |
| 30°  | 0.133            |

Constants for  $Z_{thJC}$  calculation:

| $i$ | $R_{thi}$ [K/W] | $t_i$ [s] |
|-----|-----------------|-----------|
| 1   | 0.0035          | 0.0099    |
| 2   | 0.0165          | 0.1680    |
| 3   | 0.1091          | 0.4560    |

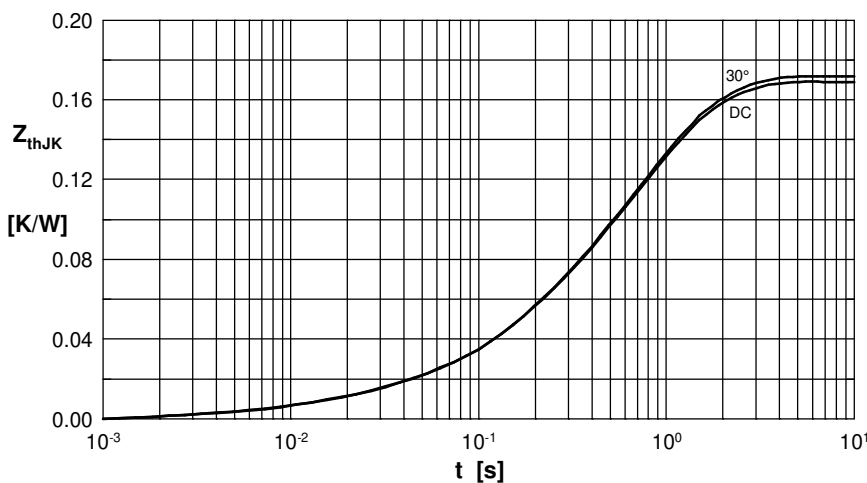


Fig. 8 Transient thermal impedance junction to heatsink (per diode)

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

| $d$  | $R_{thJK}$ [K/W] |
|------|------------------|
| DC   | 0.169            |
| 180° | 0.171            |
| 120° | 0.172            |
| 60°  | 0.172            |
| 30°  | 0.173            |

Constants for  $Z_{thJK}$  calculation:

| $i$ | $R_{thi}$ (K/W) | $t_i$ (s) |
|-----|-----------------|-----------|
| 1   | 0.0035          | 0.0099    |
| 2   | 0.0165          | 0.1680    |
| 3   | 0.1091          | 0.4560    |
| 4   | 0.0400          | 1.3600    |