

# Standard Rectifier Module

$$V_{RRM} = 2 \times 1800 \text{ V}$$

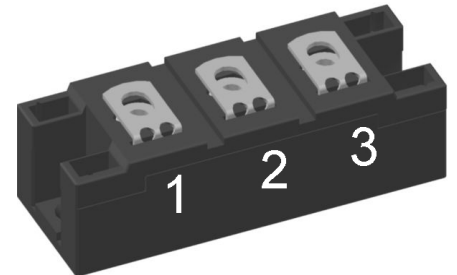
$$I_{FAV} = 165 \text{ A}$$

$$V_F = 1.05 \text{ V}$$

Phase leg

Part number

**MDD142-18N1**



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: Y4

- Isolation Voltage: 3600 V~
- Industry standard outline
- RoHS compliant
- Soldering pins for PCB mounting
- Base plate: DCB ceramic
- Reduced weight
- Advanced power cycling

## Disclaimer Notice

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| Rectifier    |                                              |                                        |                                | Ratings |      |       |                   |
|--------------|----------------------------------------------|----------------------------------------|--------------------------------|---------|------|-------|-------------------|
| Symbol       | Definition                                   | Conditions                             |                                | min.    | typ. | max.  | Unit              |
| $V_{RSM}$    | max. non-repetitive reverse blocking voltage | $T_{VJ} = 25^{\circ}\text{C}$          |                                |         |      | 1900  | V                 |
| $V_{RRM}$    | max. repetitive reverse blocking voltage     | $T_{VJ} = 25^{\circ}\text{C}$          |                                |         |      | 1800  | V                 |
| $I_R$        | reverse current                              | $V_R = 1800\text{ V}$                  | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 1     | mA                |
|              |                                              | $V_R = 1800\text{ V}$                  | $T_{VJ} = 150^{\circ}\text{C}$ |         |      | 20    | mA                |
| $V_F$        | forward voltage drop                         | $I_F = 150\text{ A}$                   | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 1.12  | V                 |
|              |                                              | $I_F = 300\text{ A}$                   |                                |         |      | 1.30  | V                 |
|              |                                              | $I_F = 150\text{ A}$                   | $T_{VJ} = 125^{\circ}\text{C}$ |         |      | 1.05  | V                 |
|              |                                              | $I_F = 300\text{ A}$                   |                                |         |      | 1.26  | V                 |
| $I_{FAV}$    | average forward current                      | $T_C = 100^{\circ}\text{C}$            | $T_{VJ} = 150^{\circ}\text{C}$ |         |      | 165   | A                 |
| $I_{F(RMS)}$ | RMS forward current                          | 180° sine                              |                                |         |      | 300   | A                 |
| $V_{F0}$     | threshold voltage                            | for power loss calculation only        | $T_{VJ} = 150^{\circ}\text{C}$ |         |      | 0.80  | V                 |
| $r_F$        | slope resistance                             |                                        |                                |         |      | 1.3   | mΩ                |
| $R_{thJC}$   | thermal resistance junction to case          |                                        |                                |         |      | 0.21  | K/W               |
| $R_{thCH}$   | thermal resistance case to heatsink          |                                        |                                |         | 0.08 |       | K/W               |
| $P_{tot}$    | total power dissipation                      |                                        | $T_C = 25^{\circ}\text{C}$     |         |      | 600   | W                 |
| $I_{FSM}$    | max. forward surge current                   | t = 10 ms; (50 Hz), sine               | $T_{VJ} = 45^{\circ}\text{C}$  |         |      | 4.70  | kA                |
|              |                                              | t = 8,3 ms; (60 Hz), sine              | $V_R = 0\text{ V}$             |         |      | 5.08  | kA                |
|              |                                              | t = 10 ms; (50 Hz), sine               | $T_{VJ} = 150^{\circ}\text{C}$ |         |      | 4.00  | kA                |
|              |                                              | t = 8,3 ms; (60 Hz), sine              | $V_R = 0\text{ V}$             |         |      | 4.32  | kA                |
| $I^2t$       | value for fusing                             | t = 10 ms; (50 Hz), sine               | $T_{VJ} = 45^{\circ}\text{C}$  |         |      | 110.5 | kA <sup>2</sup> s |
|              |                                              | t = 8,3 ms; (60 Hz), sine              | $V_R = 0\text{ V}$             |         |      | 107.1 | kA <sup>2</sup> s |
|              |                                              | t = 10 ms; (50 Hz), sine               | $T_{VJ} = 150^{\circ}\text{C}$ |         |      | 79.8  | kA <sup>2</sup> s |
|              |                                              | t = 8,3 ms; (60 Hz), sine              | $V_R = 0\text{ V}$             |         |      | 77.5  | kA <sup>2</sup> s |
| $C_J$        | junction capacitance                         | $V_R = 400\text{ V}; f = 1\text{ MHz}$ | $T_{VJ} = 25^{\circ}\text{C}$  |         | 238  |       | pF                |

| Package Y4           |                                                              |                      |                                         | Ratings |      |      |      |
|----------------------|--------------------------------------------------------------|----------------------|-----------------------------------------|---------|------|------|------|
| Symbol               | Definition                                                   | Conditions           |                                         | min.    | typ. | max. | Unit |
| I <sub>RMS</sub>     | RMS current                                                  | per terminal         |                                         |         |      | 300  | A    |
| T <sub>VJ</sub>      | virtual junction temperature                                 |                      |                                         | -40     |      | 150  | °C   |
| T <sub>op</sub>      | operation temperature                                        |                      |                                         | -40     |      | 125  | °C   |
| T <sub>stg</sub>     | storage temperature                                          |                      |                                         | -40     |      | 125  | °C   |
| Weight               |                                                              |                      |                                         |         | 150  |      | g    |
| M <sub>D</sub>       | mounting torque                                              |                      |                                         | 2.25    |      | 2.75 | Nm   |
| M <sub>T</sub>       | terminal torque                                              |                      |                                         | 4.5     |      | 5.5  | Nm   |
| d <sub>Spp/App</sub> | creepage distance on surface   striking distance through air | terminal to terminal | 14.0                                    | 10.0    |      |      | mm   |
| d <sub>Spb/Apb</sub> |                                                              | terminal to backside | 16.0                                    | 16.0    |      |      | mm   |
| V <sub>ISOL</sub>    | isolation voltage                                            | t = 1 second         | 50/60 Hz, RMS; I <sub>ISOL</sub> ≤ 1 mA | 3600    |      |      | V    |
|                      |                                                              | t = 1 minute         |                                         | 3000    |      |      | V    |



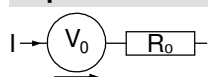
Data Matrix: part no. (1-19), DC + PI (20-25), lot.no.# (26-31), blank (32), serial no.# (33-36)

| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|----------|-----------------|--------------------|---------------|----------|----------|
| Standard | MDD142-18N1     | MDD142-18N1        | Box           | 6        | 454435   |

### Equivalent Circuits for Simulation

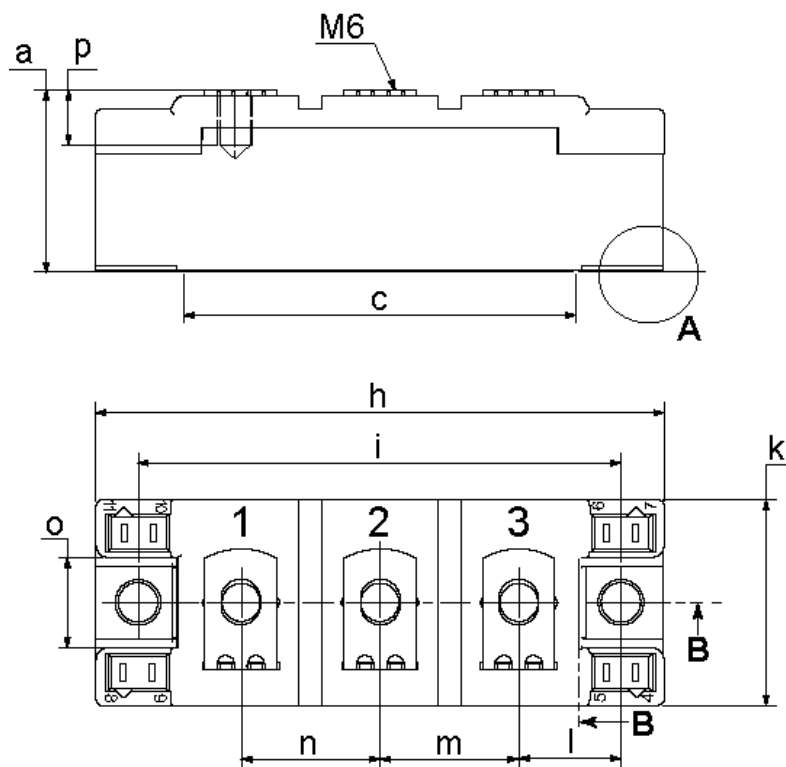
\* on die level

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



**Rectifier**

|             |                    |     |    |
|-------------|--------------------|-----|----|
| $V_{0\max}$ | threshold voltage  | 0.8 | V  |
| $R_{0\max}$ | slope resistance * | 0.7 | mΩ |

**Outlines Y4**


| Dim. | MIN<br>[mm] | MAX<br>[mm] | MIN<br>[inch] | MAX<br>[inch] |
|------|-------------|-------------|---------------|---------------|
| a    | 30.0        | 30.6        | 1.181         | 1.205         |
| b    | typ. 0.25   |             | typ. 0.010    |               |
| c    | 64.0        | 65.0        | 2.520         | 2.559         |
| d    | 6.5         | 7.0         | 0.256         | 0.275         |
| e    | 4.9         | 5.1         | 0.193         | 0.201         |
| h    | 93.5        | 94.5        | 3.681         | 3.720         |
| i    | 79.5        | 80.5        | 3.130         | 3.169         |
| k    | 33.4        | 34.0        | 1.315         | 1.339         |
| l    | 16.7        | 17.3        | 0.657         | 0.681         |
| m    | 22.7        | 23.3        | 0.894         | 0.917         |
| n    | 22.7        | 23.3        | 0.894         | 0.917         |
| o    | 14.0        | 15.0        | 0.551         | 0.591         |
| p    | typ. 10.5   |             | typ. 0.413    |               |


**B-B (1:1)**

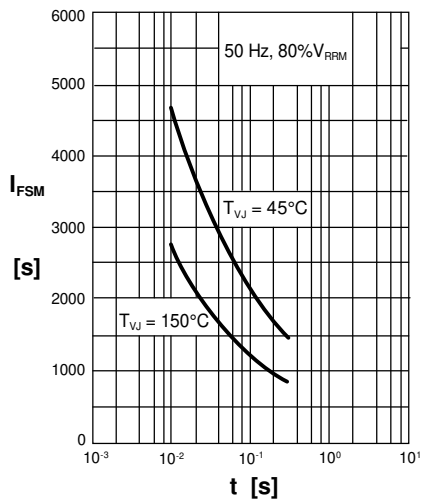

**Rectifier**


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

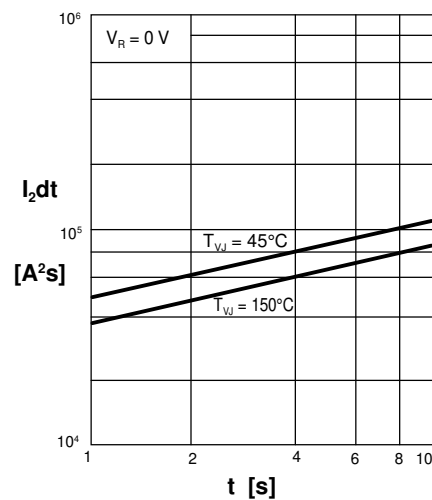


Fig. 2  $I^2dt$  versus time (1-10 ms)

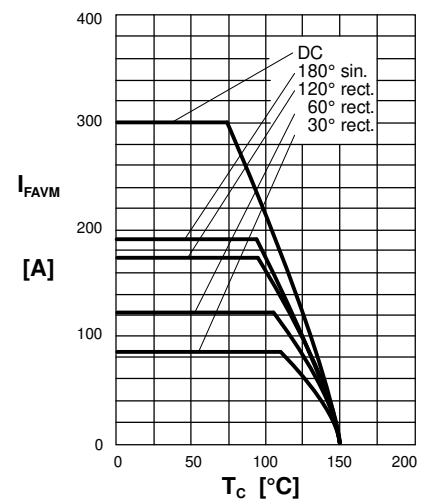


Fig. 2a Maximum forward current  
 at case temperature

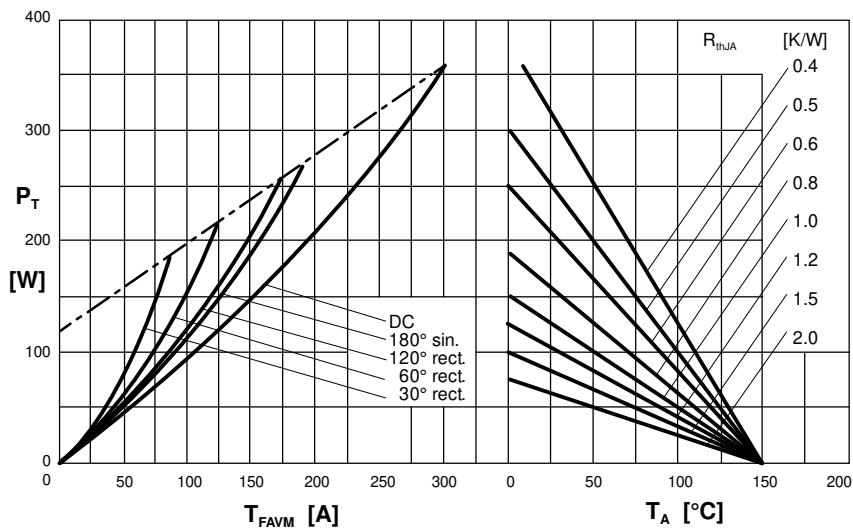


Fig. 3 Power dissipation vs. forward current and ambient temperature (per diode)

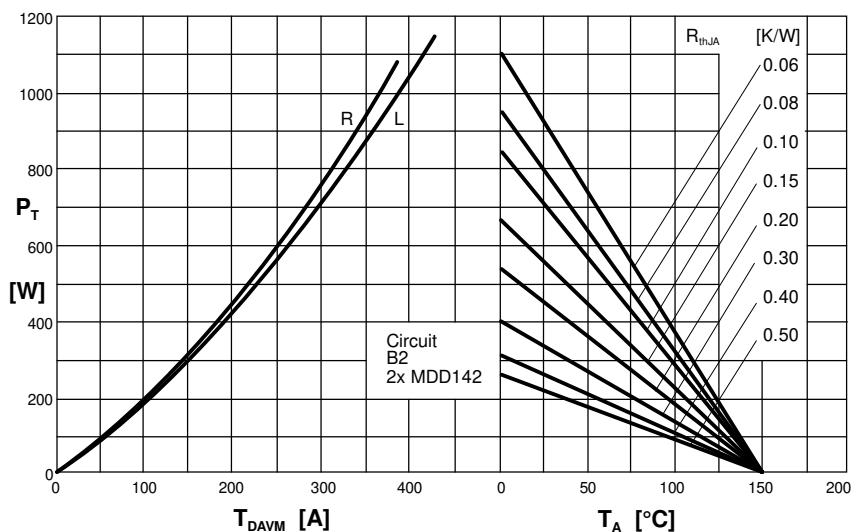


Fig. 4 Single phase rectifier bridge: Power dissipation vs. direct output current and ambient

R = resistive load  
 L = inductive load

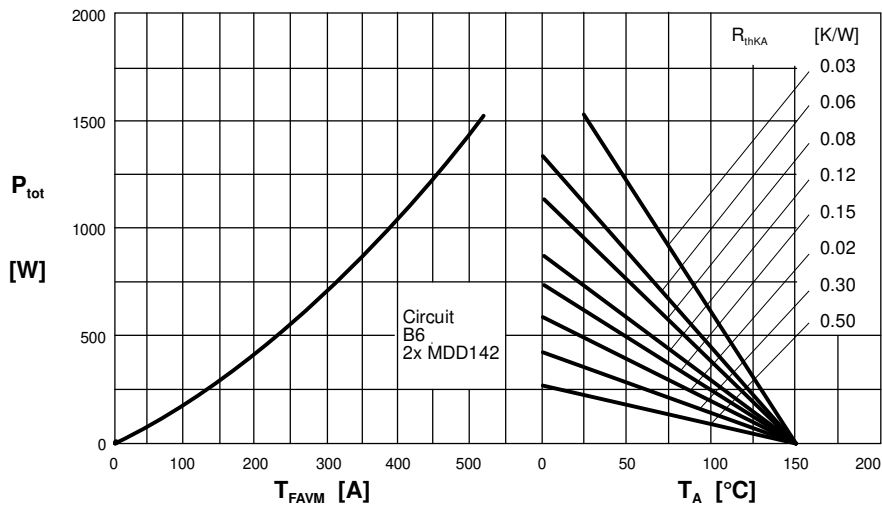
**Rectifier**


Fig. 5 Three phase rectifier bridge: Power dissipation vs. direct output current and ambient temperature

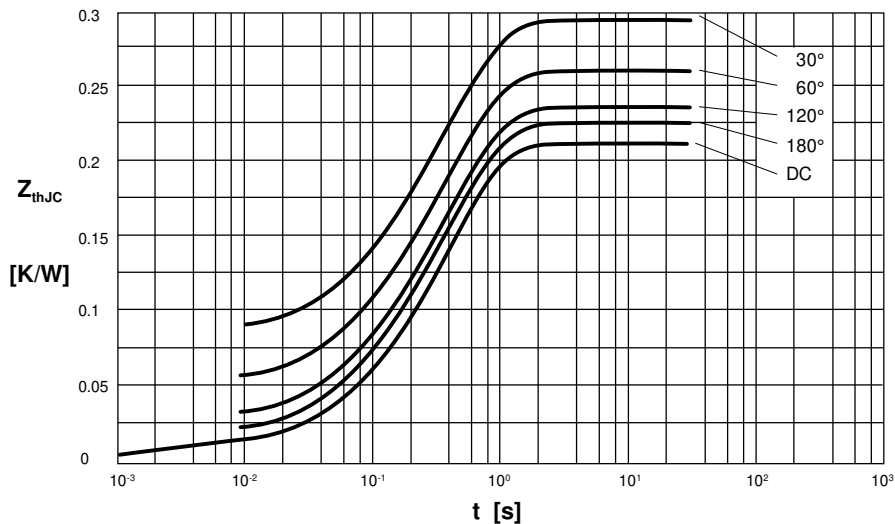


Fig. 6 Transient thermal impedance junction to case (per diode)

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

| $d$  | $R_{thJC}$ [K/W] |
|------|------------------|
| DC   | 0.210            |
| 180° | 0.223            |
| 120° | 0.233            |
| 60°  | 0.260            |
| 30°  | 0.295            |

Constants for  $Z_{thJC}$  calculation:

| $i$ | $R_{thi}$ [K/W] | $t_i$ [s] |
|-----|-----------------|-----------|
| 1   | 0.0087          | 0.001     |
| 2   | 0.0163          | 0.065     |
| 3   | 0.1850          | 0.400     |

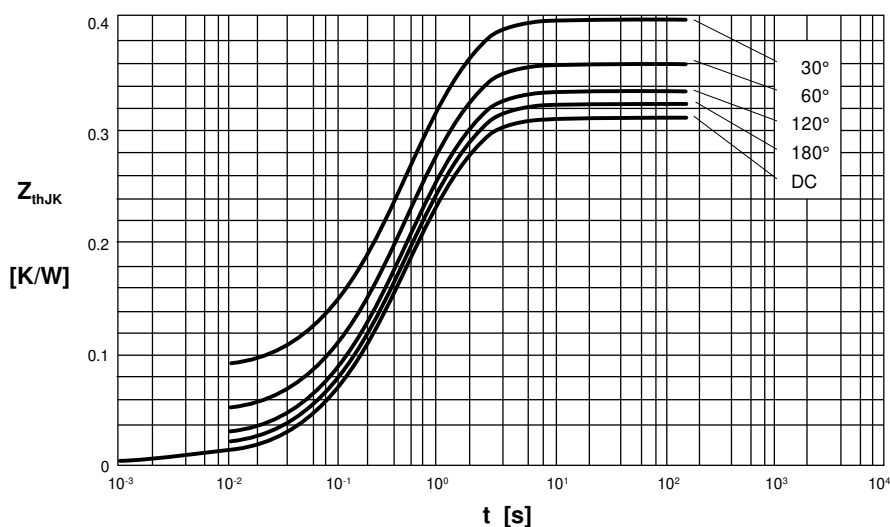


Fig. 7 Transient thermal impedance junction to heatsink (per diode)

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

| $d$  | $R_{thJK}$ [K/W] |
|------|------------------|
| DC   | 0.310            |
| 180° | 0.323            |
| 120° | 0.333            |
| 60°  | 0.360            |
| 30°  | 0.395            |

Constants for  $Z_{thJK}$  calculation:

| $i$ | $R_{thi}$ [K/W] | $t_i$ [s] |
|-----|-----------------|-----------|
| 1   | 0.0087          | 0.001     |
| 2   | 0.0163          | 0.065     |
| 3   | 0.1850          | 0.400     |
| 4   | 0.1000          | 1.290     |