

# Standard Rectifier Module

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

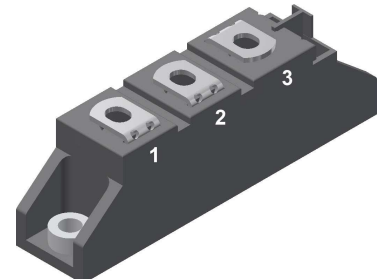
$$I_{FAV} = 59 \text{ A}$$

$$V_F = 1.26 \text{ V}$$

Phase leg

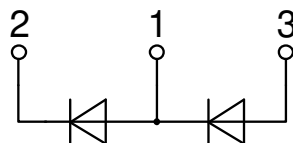
Part number

**MDD44-12N1B**



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: TO-240AA

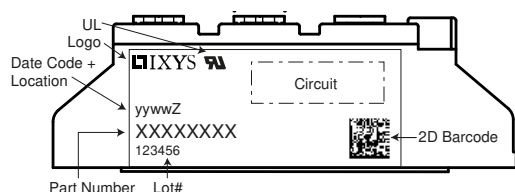
- Isolation Voltage: 4800 V~
- Industry standard outline
- RoHS compliant
- Height: 30 mm
- Base plate: DCB ceramic
- Reduced weight
- Advanced power cycling

## Disclaimer Notice

Information furnished is believed to be accurate and reliable. However, users should independently evaluate the suitability of and test each product selected for their own applications. Littelfuse products are not designed for, and may not be used in, all applications. Read complete Disclaimer Notice at [www.littelfuse.com/disclaimer-electronics](http://www.littelfuse.com/disclaimer-electronics).

| Rectifier    |                                              |                                                   |                                | Ratings |      |      |                   |
|--------------|----------------------------------------------|---------------------------------------------------|--------------------------------|---------|------|------|-------------------|
| Symbol       | Definition                                   | Conditions                                        |                                | min.    | typ. | max. | Unit              |
| $V_{RSM}$    | max. non-repetitive reverse blocking voltage | $T_{VJ} = 25^{\circ}\text{C}$                     |                                |         |      | 1300 | V                 |
| $V_{RRM}$    | max. repetitive reverse blocking voltage     | $T_{VJ} = 25^{\circ}\text{C}$                     |                                |         |      | 1200 | V                 |
| $I_R$        | reverse current                              | $V_R = 1200\text{ V}$                             | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 100  | $\mu\text{A}$     |
|              |                                              | $V_R = 1200\text{ V}$                             | $T_{VJ} = 150^{\circ}\text{C}$ |         |      | 10   | mA                |
| $V_F$        | forward voltage drop                         | $I_F = 100\text{ A}$                              | $T_{VJ} = 25^{\circ}\text{C}$  |         |      | 1.30 | V                 |
|              |                                              | $I_F = 200\text{ A}$                              |                                |         |      | 1.60 | V                 |
|              |                                              | $I_F = 100\text{ A}$                              | $T_{VJ} = 125^{\circ}\text{C}$ |         |      | 1.26 | V                 |
|              |                                              | $I_F = 200\text{ A}$                              |                                |         |      | 1.67 | V                 |
| $I_{FAV}$    | average forward current                      | $T_C = 100^{\circ}\text{C}$                       | $T_{VJ} = 150^{\circ}\text{C}$ |         |      | 59   | A                 |
| $I_{F(RMS)}$ | RMS forward current                          | 180° sine                                         |                                |         |      | 100  | A                 |
| $V_{F0}$     | threshold voltage                            | } for power loss calculation only                 | $T_{VJ} = 150^{\circ}\text{C}$ |         |      | 0.80 | V                 |
| $r_F$        | slope resistance                             |                                                   |                                |         |      | 4.3  | m $\Omega$        |
| $R_{thJC}$   | thermal resistance junction to case          |                                                   |                                |         |      | 0.59 | K/W               |
| $R_{thCH}$   | thermal resistance case to heatsink          |                                                   |                                |         | 0.2  |      | K/W               |
| $P_{tot}$    | total power dissipation                      |                                                   | $T_C = 25^{\circ}\text{C}$     |         |      | 212  | W                 |
| $I_{FSM}$    | max. forward surge current                   | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$  | $T_{VJ} = 45^{\circ}\text{C}$  |         |      | 1.15 | kA                |
|              |                                              | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$             |         |      | 1.24 | kA                |
|              |                                              | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$  | $T_{VJ} = 150^{\circ}\text{C}$ |         |      | 980  | A                 |
|              |                                              | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$             |         |      | 1.06 | kA                |
| $I^2t$       | value for fusing                             | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$  | $T_{VJ} = 45^{\circ}\text{C}$  |         |      | 6.62 | kA <sup>2</sup> s |
|              |                                              | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$             |         |      | 6.40 | kA <sup>2</sup> s |
|              |                                              | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$  | $T_{VJ} = 150^{\circ}\text{C}$ |         |      | 4.80 | kA <sup>2</sup> s |
|              |                                              | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$             |         |      | 4.63 | kA <sup>2</sup> s |
| $C_J$        | junction capacitance                         | $V_R = 400\text{ V}; f = 1\text{ MHz}$            | $T_{VJ} = 25^{\circ}\text{C}$  |         | 27   |      | pF                |

| Package TO-240AA |                                                              |                      |                                     | Ratings |      |      |      |
|------------------|--------------------------------------------------------------|----------------------|-------------------------------------|---------|------|------|------|
| Symbol           | Definition                                                   | Conditions           |                                     | min.    | typ. | max. | Unit |
| $I_{RMS}$        | RMS current                                                  | per terminal         |                                     |         |      | 200  | 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>    |                                                              |                      |                                     |         | 76   |      | g    |
| $M_D$            | mounting torque                                              |                      |                                     | 2.5     |      | 4    | Nm   |
| $M_T$            | terminal torque                                              |                      |                                     | 2.5     |      | 4    | Nm   |
| $d_{Spp/App}$    | creepage distance on surface   striking distance through air | terminal to terminal | 13.0                                | 9.7     |      |      | mm   |
| $d_{Spb/Apb}$    |                                                              | terminal to backside | 16.0                                | 16.0    |      |      | mm   |
| $V_{ISOL}$       | isolation voltage                                            | t = 1 second         | 50/60 Hz, RMS; $I_{ISOL} \leq 1$ mA | 4800    |      |      | V    |
|                  |                                                              | t = 1 minute         |                                     | 4000    |      |      | V    |



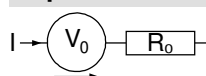
| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|----------|-----------------|--------------------|---------------|----------|----------|
| Standard | MDD44-12N1B     | MDD44-12N1B        | Box           | 36       | 458023   |

| Similar Part | Package  | Voltage class |
|--------------|----------|---------------|
| MDD44-08N1B  | TO-240AA | 800           |
| MDD44-14N1B  | TO-240AA | 1400          |
| MDD44-16N1B  | TO-240AA | 1600          |
| MDD44-18N1B  | TO-240AA | 1800          |

### Equivalent Circuits for Simulation

\* on die level

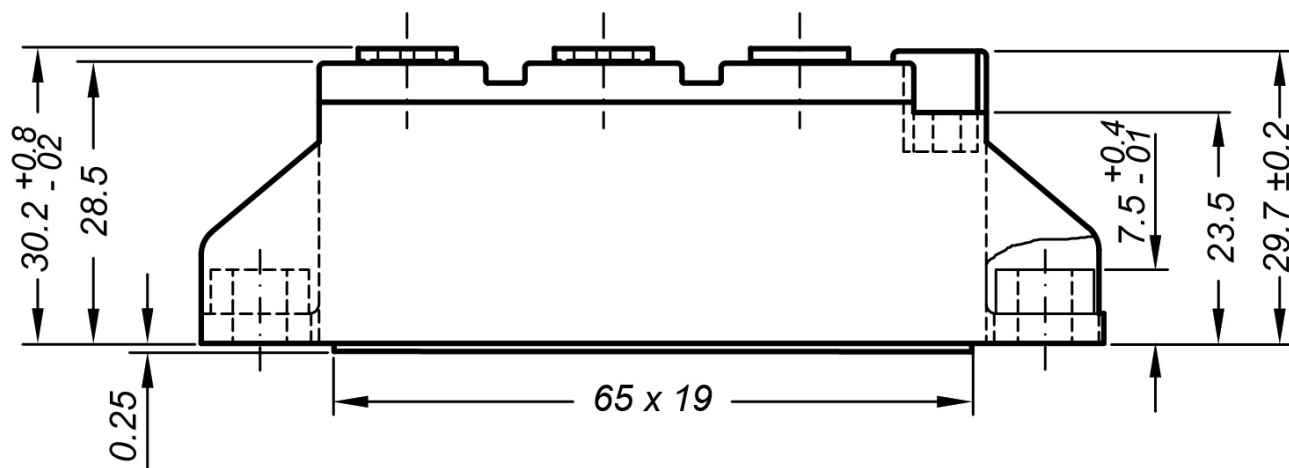
$T_{VJ} = 150^{\circ}\text{C}$



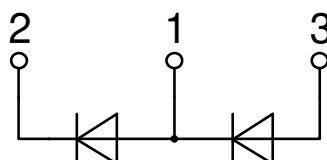
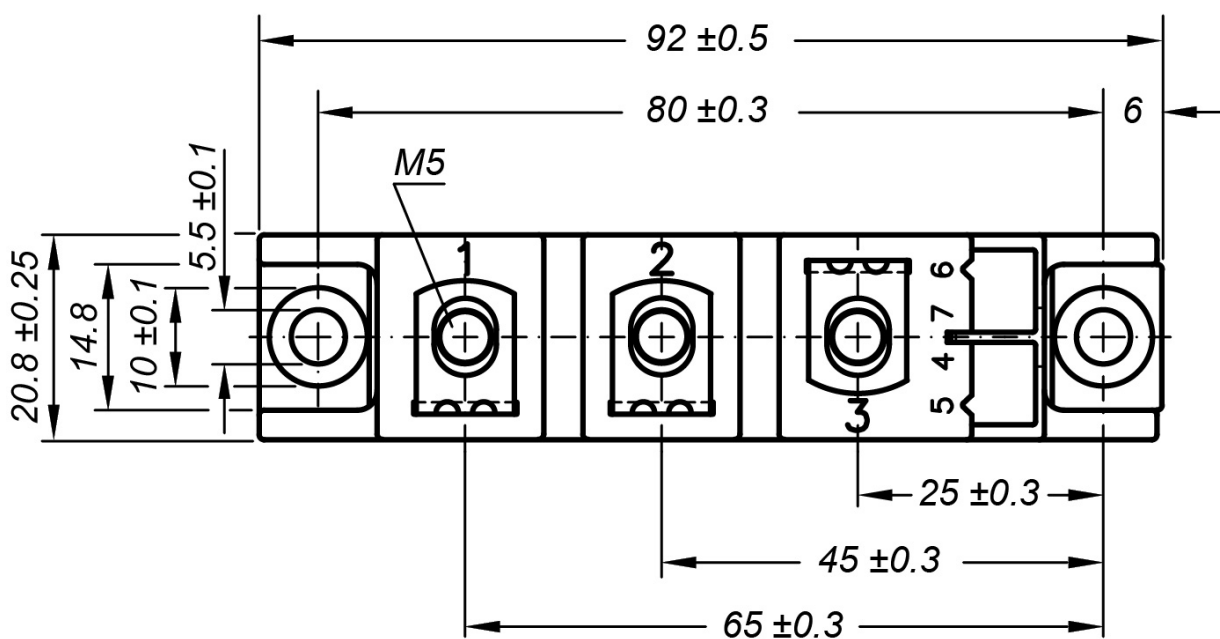
Rectifier

|              |                    |     |    |
|--------------|--------------------|-----|----|
| $V_{0 \max}$ | threshold voltage  | 0.8 | V  |
| $R_{0 \max}$ | slope resistance * | 3.1 | mΩ |

Outlines TO-240AA



General tolerance: DIN ISO 2768 class „c“



**Rectifier**

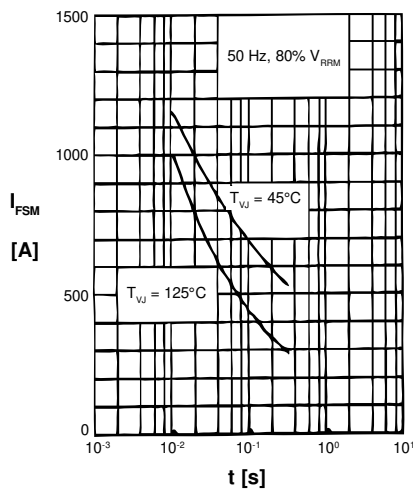


Fig. 1 Surge overload current  
 $I_{TSM}$ ,  $I_{FSM}$ : Crest value,  $t$ : duration

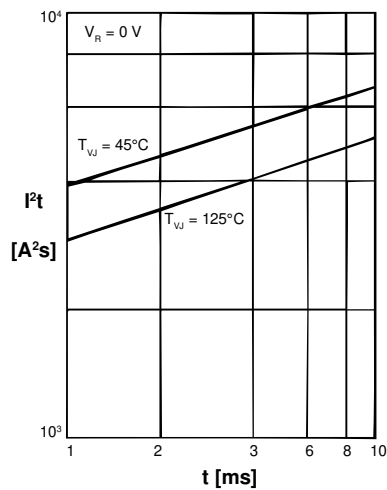


Fig. 2  $I^2t$  versus time (1-10 ms)

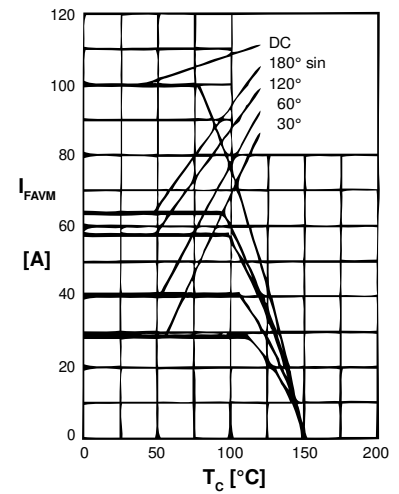


Fig. 3 Maximum forward current at case temperature

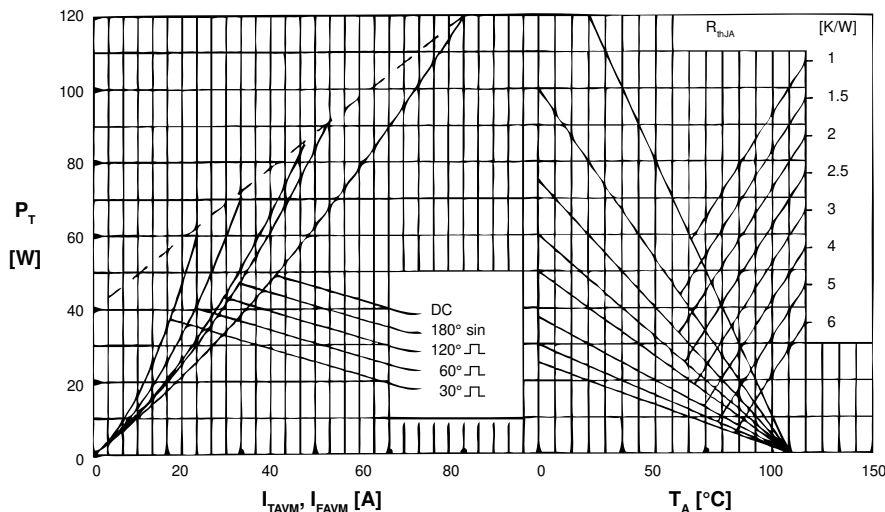


Fig. 4 Power dissipation vs. onstate current and ambient temperature (per diode)

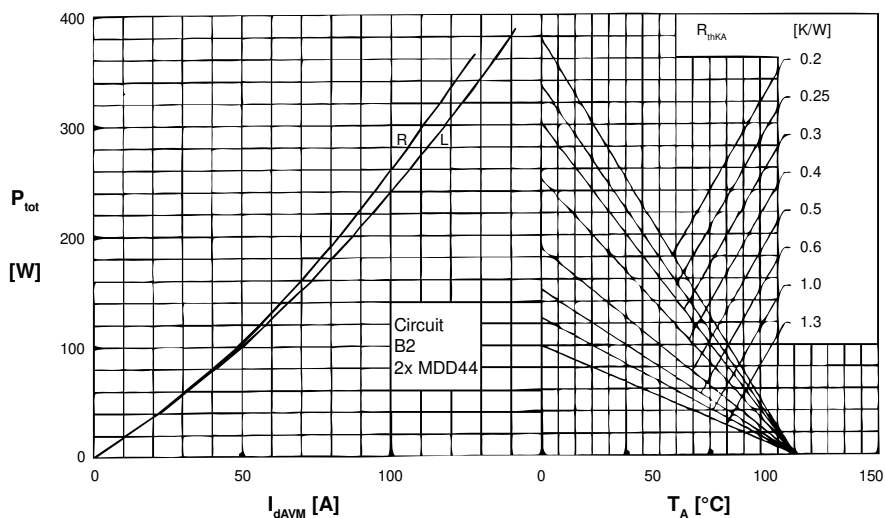


Fig. 6 Single phase rectifier bridge: Power dissipation versus direct output current and ambient temperature; R = resistive load, L = inductive load

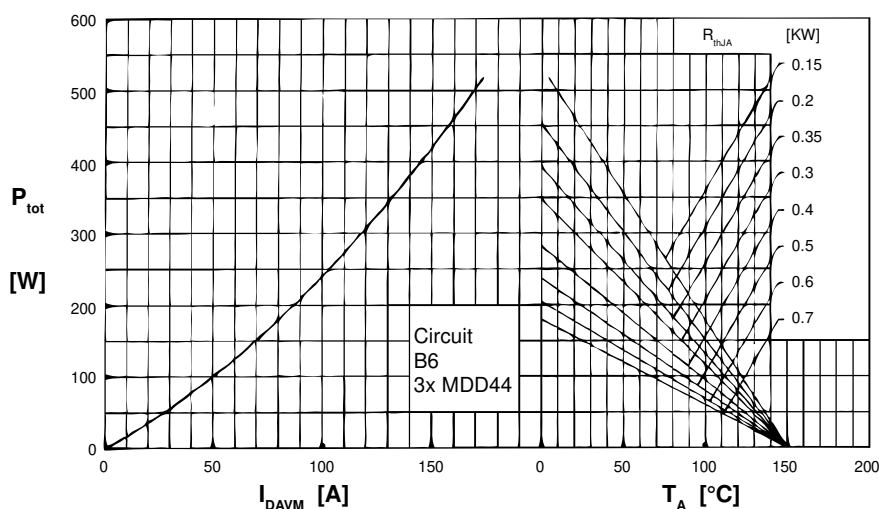
**Rectifier**


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

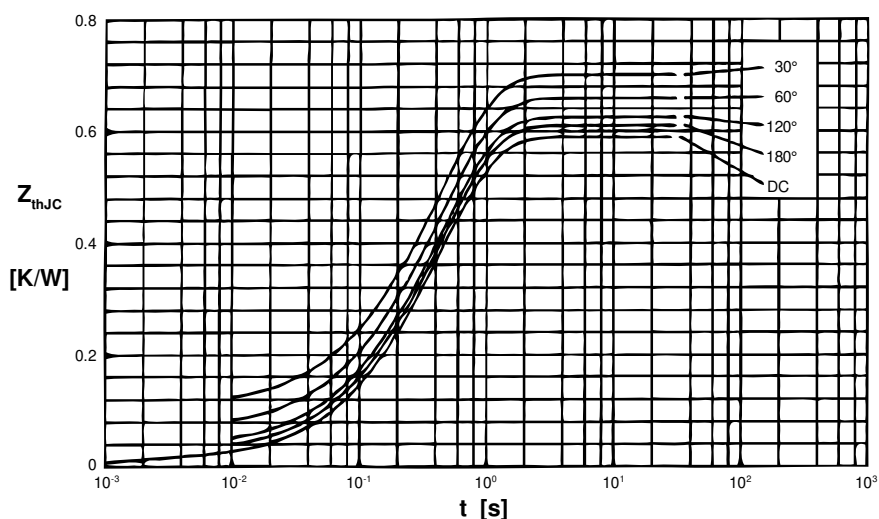


Fig. 7 Transient thermal impedance junction to case (per diode)

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

| d    | $R_{thJC}$ [K/W] |
|------|------------------|
| DC   | 0.59             |
| 180° | 0.61             |
| 120° | 0.63             |
| 60°  | 0.66             |
| 30°  | 0.70             |

Constants for  $Z_{thJC}$  calculation:

| i | $R_{thi}$ [K/W] | $t_i$ [s] |
|---|-----------------|-----------|
| 1 | 0.012           | 0.0012    |
| 2 | 0.045           | 0.0950    |
| 3 | 0.533           | 0.4550    |

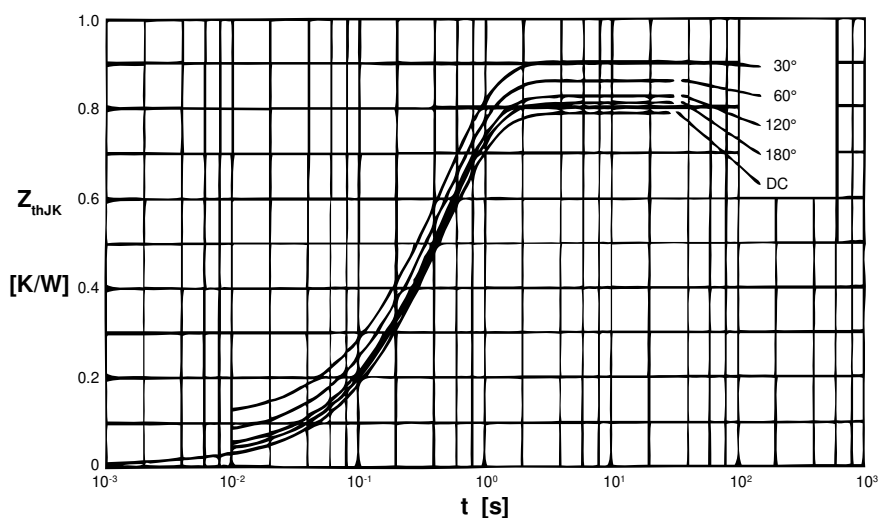


Fig. 8 Transient thermal impedance junction to heatsink (per thyristor)

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

| d    | $R_{thJK}$ [K/W] |
|------|------------------|
| DC   | 0.79             |
| 180° | 0.81             |
| 120° | 0.83             |
| 60°  | 0.86             |
| 30°  | 0.90             |

Constants for  $Z_{thJK}$  calculation:

| i | $R_{thi}$ [K/W] | $t_i$ [s] |
|---|-----------------|-----------|
| 1 | 0.012           | 0.0012    |
| 2 | 0.045           | 0.0950    |
| 3 | 0.533           | 0.4550    |
| 4 | 0.200           | 0.4950    |