

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 ² s | |
| | | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$ | | 641.7 | kA ² s | |
| | | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$ | $T_{VJ} = 150^\circ\text{C}$ | | 477.8 | kA ² s | |
| | | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$ | | 463.5 | kA ² 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 |
| Weight | | | | 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 |

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