

Standard Rectifier Module

$$V_{RRM} = 2 \times 1400 \text{ V}$$

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

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

Phase leg

Part number

MDD142-14N1



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

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| Rectifier | | | | Ratings | | | |
|--------------|--|---|------------------------------|---------|-------|-------------------|---|
| Symbol | Definition | Conditions | min. | typ. | max. | Unit | |
| V_{RSM} | max. non-repetitive reverse blocking voltage | | | | 1500 | V | |
| V_{RRM} | max. repetitive reverse blocking voltage | | | | 1400 | V | |
| I_R | reverse current | $V_R = 1400\text{ V}$ | | | 1 | mA | |
| | | $V_R = 1400\text{ V}$ | | | 20 | mA | |
| V_F | forward voltage drop | $I_F = 150\text{ A}$ | | | 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 | $T_C = 100^\circ\text{C}$ | | | 165 | A | |
| $I_{F(RMS)}$ | RMS forward current | 180° sine | | | 300 | A | |
| V_{F0} | threshold voltage | } for power loss calculation only | | | 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 | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$ | $T_{VJ} = 45^\circ\text{C}$ | | 4.70 | kA | |
| | | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$ | | 5.08 | kA | |
| | | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$ | $T_{VJ} = 150^\circ\text{C}$ | | 4.00 | kA | |
| | | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$ | | 4.32 | kA | |
| I^2t | value for fusing | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$ | $T_{VJ} = 45^\circ\text{C}$ | | 110.5 | kA ² s | |
| | | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$ | | 107.1 | kA ² s | |
| | | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$ | $T_{VJ} = 150^\circ\text{C}$ | | 79.8 | kA ² s | |
| | | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$ | | 77.5 | kA ² 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_{RMS} | RMS current | per terminal | | | 300 | A | |
| T_{VJ} | virtual junction temperature | | -40 | | 150 | °C | |
| T_{op} | operation temperature | | -40 | | 125 | °C | |
| T_{stg} | storage temperature | | -40 | | 125 | °C | |
| Weight | | | | | 150 | g | |
| M_D | mounting torque | | 2.25 | | 2.75 | Nm | |
| M_T | terminal torque | | 4.5 | | 5.5 | Nm | |
| $d_{Spp/App}$ | creepage distance on surface striking distance through air | terminal to terminal | 14.0 | 10.0 | | mm | |
| $d_{Spb/Apb}$ | | terminal to backside | 16.0 | 16.0 | | mm | |
| V_{ISOL} | isolation voltage | t = 1 second | | | 3600 | V | |
| | | t = 1 minute | 50/60 Hz, RMS; $I_{ISOL} \leq 1$ mA | | 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 | MDD142-14N1 | MDD142-14N1 | Box | 6 | 430676 |

Equivalent Circuits for Simulation

* on die level

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



Rectifier

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



Outlines Y4



| Dim. | MIN [mm] | MAX [mm] | MIN [inch] | MAX [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 | |





Rectifier

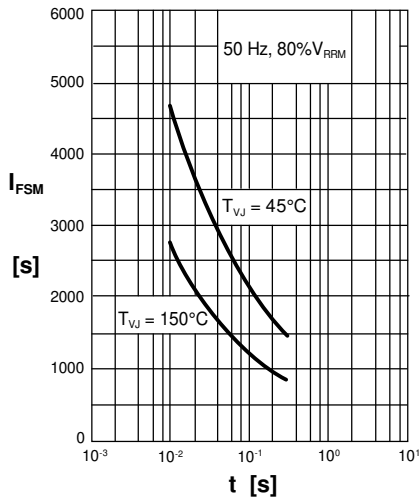


Fig. 1 Surge overload current
 I_{FSM} : Crest value, t : duration

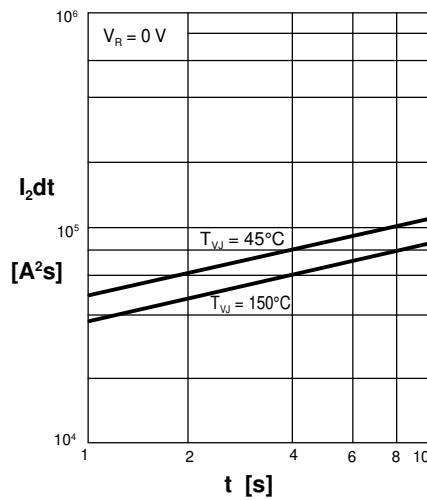


Fig. 2 I^2dt versus time (1-10 ms)

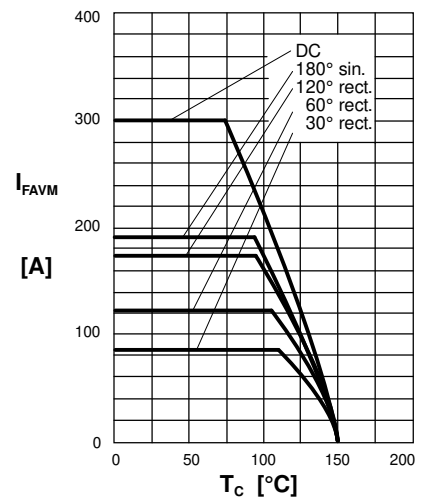


Fig. 2a Maximum forward current at case temperature

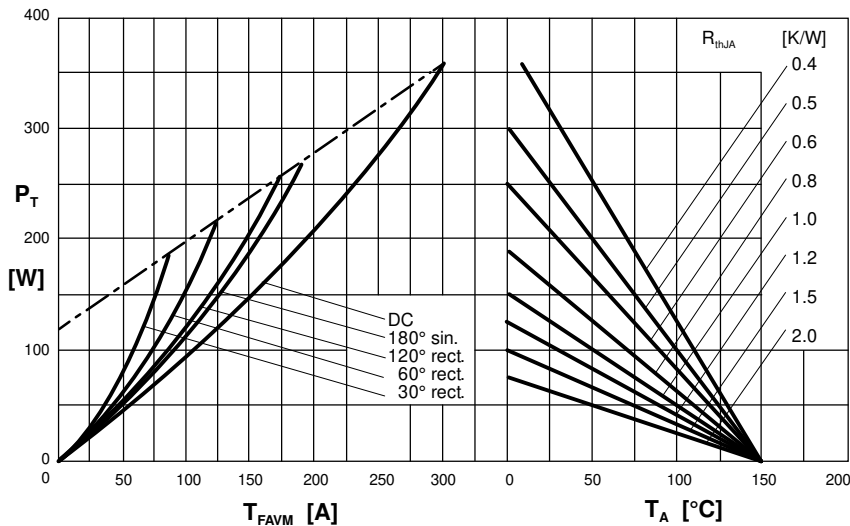


Fig. 3 Power dissipation vs. forward current and ambient temperature (per diode)

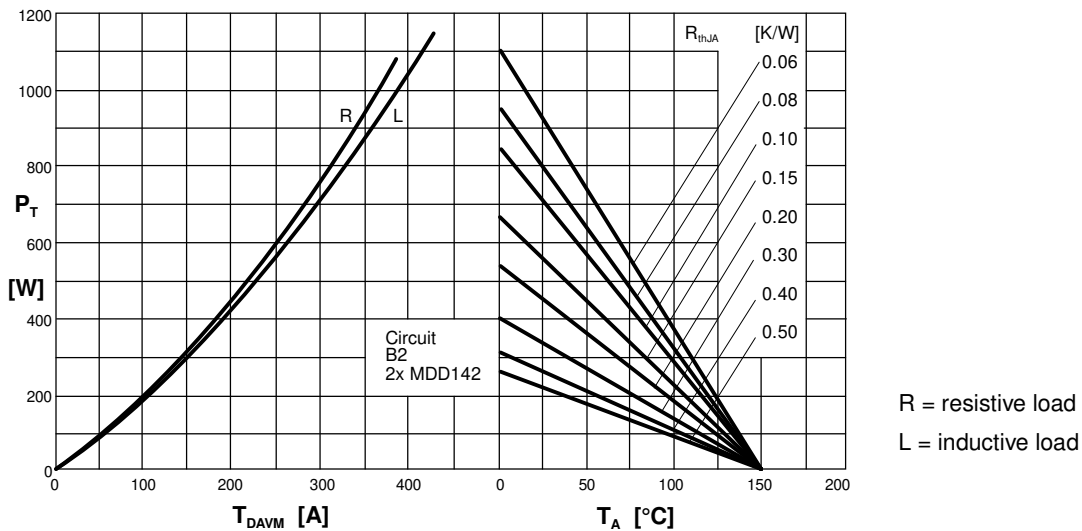


Fig. 4 Single phase rectifier bridge: Power dissipation vs. direct output current and ambient



Rectifier

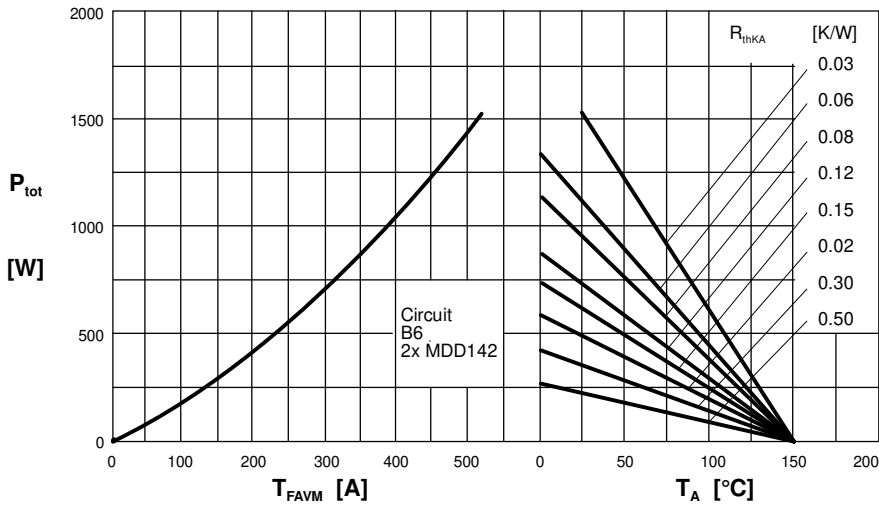


Fig. 5 Three phase rectifier bridge: Power dissipation vs. direct output current and ambient temperature

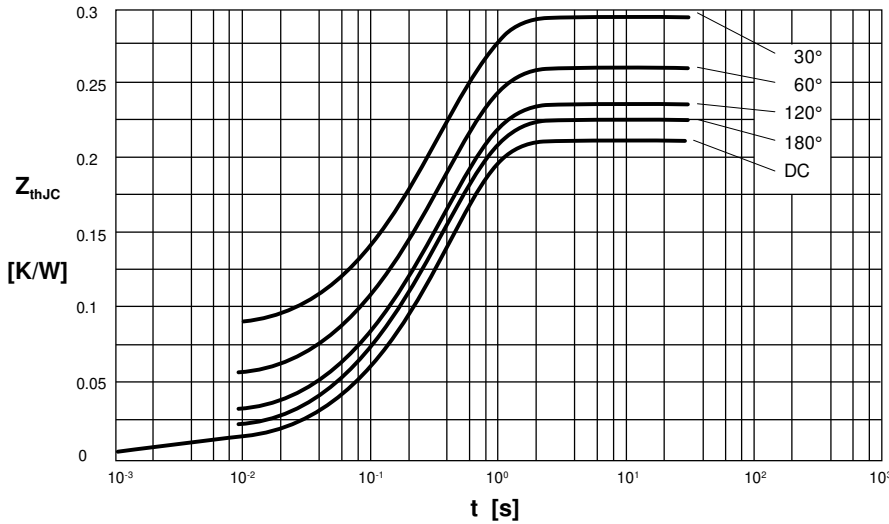


Fig. 6 Transient thermal impedance junction to case (per diode)

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 |

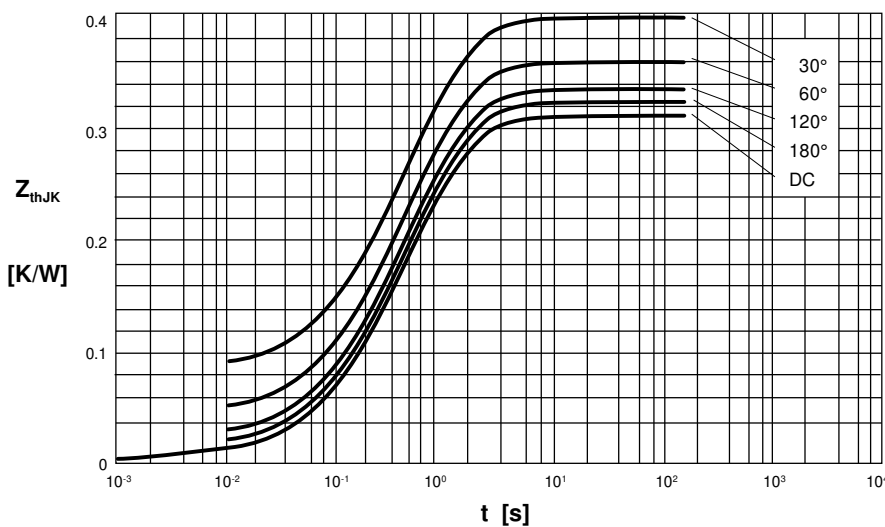


Fig. 7 Transient thermal impedance junction to heatsink (per diode)

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 |