

Standard Rectifier Module

$$V_{RRM} = 2 \times 1600 \text{ V}$$

$$I_{FAV} = 71 \text{ A}$$

$$V_F = 1.14 \text{ V}$$

Phase leg

Part number

MDD56-16N1B



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

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| Rectifier | | | | Ratings | | | |
|--------------|--|---|------------------------------|---------|------|---------------|-------------------|
| Symbol | Definition | Conditions | min. | typ. | max. | Unit | |
| V_{RSM} | max. non-repetitive reverse blocking voltage | | | | 1700 | V | |
| V_{RRM} | max. repetitive reverse blocking voltage | | | | 1600 | V | |
| I_R | reverse current | $V_R = 1600\text{ V}$ | | | 200 | μA | |
| | | $V_R = 1600\text{ V}$ | | | 10 | mA | |
| V_F | forward voltage drop | $I_F = 100\text{ A}$ | | | 1.21 | V | |
| | | $I_F = 200\text{ A}$ | | | 1.48 | V | |
| | | $I_F = 100\text{ A}$ | $T_{VJ} = 125^\circ\text{C}$ | | | 1.14 | V |
| | | $I_F = 200\text{ A}$ | $T_{VJ} = 125^\circ\text{C}$ | | | 1.45 | V |
| I_{FAV} | average forward current | $T_C = 100^\circ\text{C}$ | | | 71 | A | |
| $I_{F(RMS)}$ | RMS forward current | 180° sine | | | 150 | A | |
| V_{F0} | threshold voltage | } for power loss calculation only | | | 0.80 | V | |
| r_F | slope resistance | | | | 3 | m Ω | |
| R_{thJC} | thermal resistance junction to case | | | | 0.51 | K/W | |
| R_{thCH} | thermal resistance case to heatsink | | | 0.2 | | K/W | |
| P_{tot} | total power dissipation | | | | 245 | W | |
| I_{FSM} | max. forward surge current | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$ | $T_{VJ} = 45^\circ\text{C}$ | | | 1.40 | kA |
| | | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$ | | | 1.51 | kA |
| | | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$ | $T_{VJ} = 150^\circ\text{C}$ | | | 1.19 | kA |
| | | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$ | | | 1.29 | kA |
| I^2t | value for fusing | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$ | $T_{VJ} = 45^\circ\text{C}$ | | | 9.80 | kA ² s |
| | | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$ | | | 9.49 | kA ² s |
| | | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$ | $T_{VJ} = 150^\circ\text{C}$ | | | 7.08 | kA ² s |
| | | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$ | $V_R = 0\text{ V}$ | | | 6.87 | kA ² 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 | |
| Weight | | | | | 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 | | 4800 | | V | |
| | | t = 1 minute | 50/60 Hz, RMS; $I_{ISOL} \leq 1$ mA | 4000 | | V | |



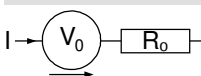
| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|----------|-----------------|--------------------|---------------|----------|----------|
| Standard | MDD56-16N1B | MDD56-16N1B | Box | 36 | 458082 |

| Similar Part | Package | Voltage class |
|--------------|----------|---------------|
| MDD56-08N1B | TO-240AA | 800 |
| MDD56-12N1B | TO-240AA | 1200 |
| MDD56-14N1B | TO-240AA | 1400 |
| MDD56-18N1B | 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 * | 1.8 | mΩ |



Outlines TO-240AA



General tolerance: DIN ISO 2768 class „c“



Rectifier

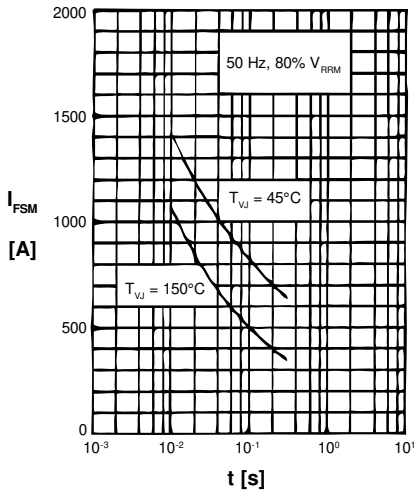


Fig. 1 Surge overload current
 I_{TSM}, I_{FSM} : Crest value, t : duration

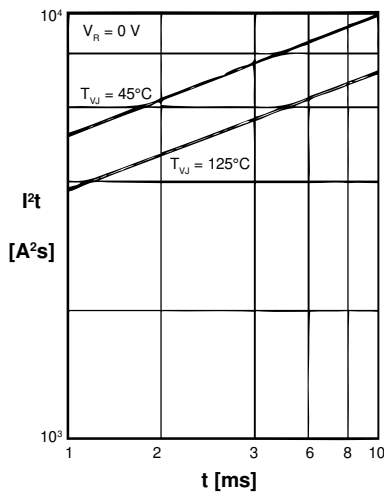


Fig. 2 I^2t versus time (1-10 ms)

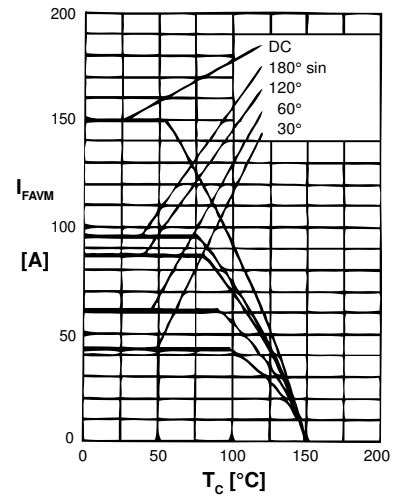


Fig. 3 Maximum forward current at case temperature

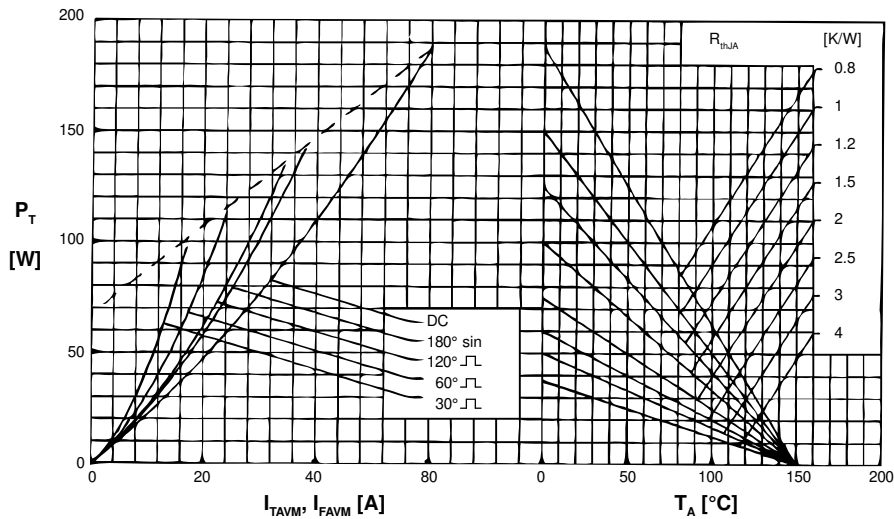


Fig. 4 Power dissipation vs. onstate current and ambient temperature (per diode)

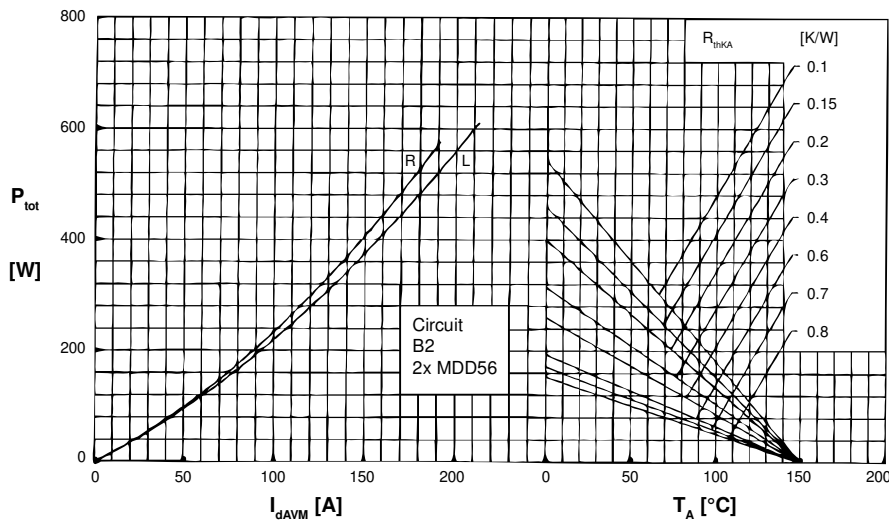


Fig. 6 Single phase rectifier bridge: Power dissipation versus direct output current and ambient temperature; R = resistive load, L = inductive load

Rectifier

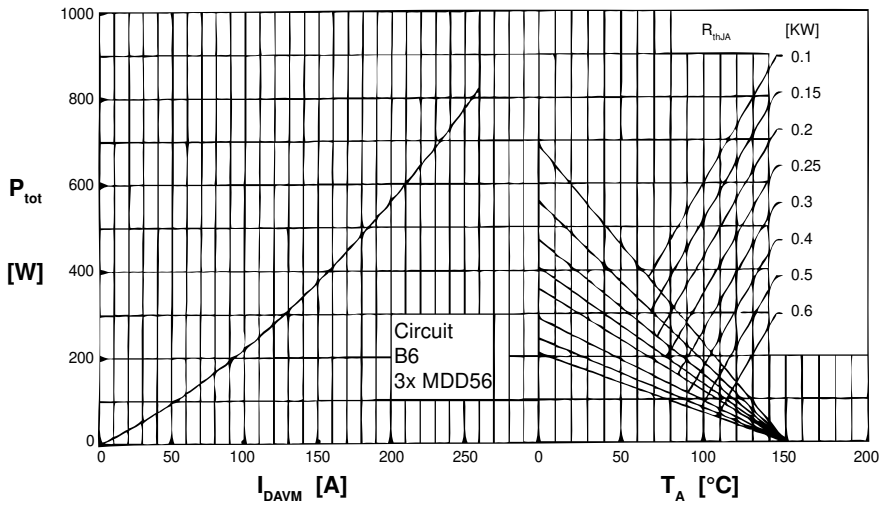


Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

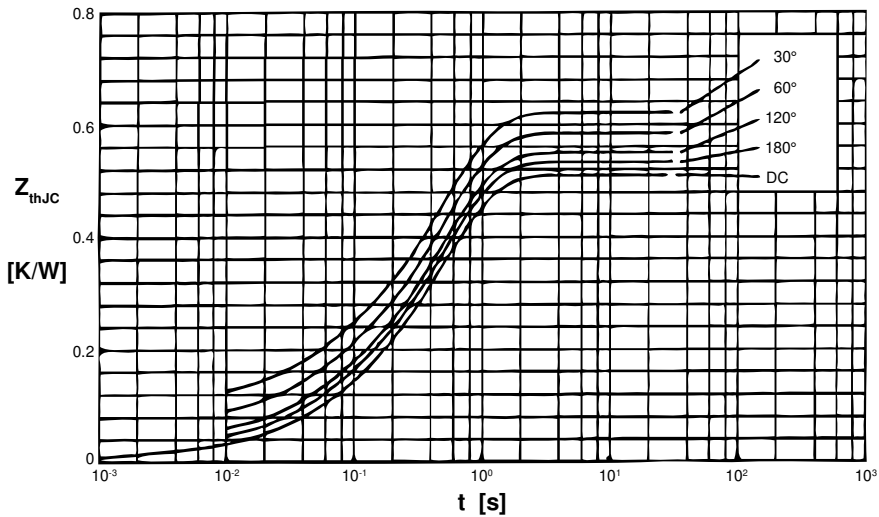


Fig. 7 Transient thermal impedance junction to case (per diode)

R_{thJC} for various conduction angles d:

| d | R_{thJC} [K/W] |
|------|------------------|
| DC | 0.51 |
| 180° | 0.53 |
| 120° | 0.55 |
| 60° | 0.58 |
| 30° | 0.62 |

Constants for Z_{thJC} calculation:

| i | R_{thi} [K/W] | t_i [s] |
|---|-----------------|-----------|
| 1 | 0.013 | 0.0015 |
| 2 | 0.055 | 0.0450 |
| 3 | 0.442 | 0.4850 |

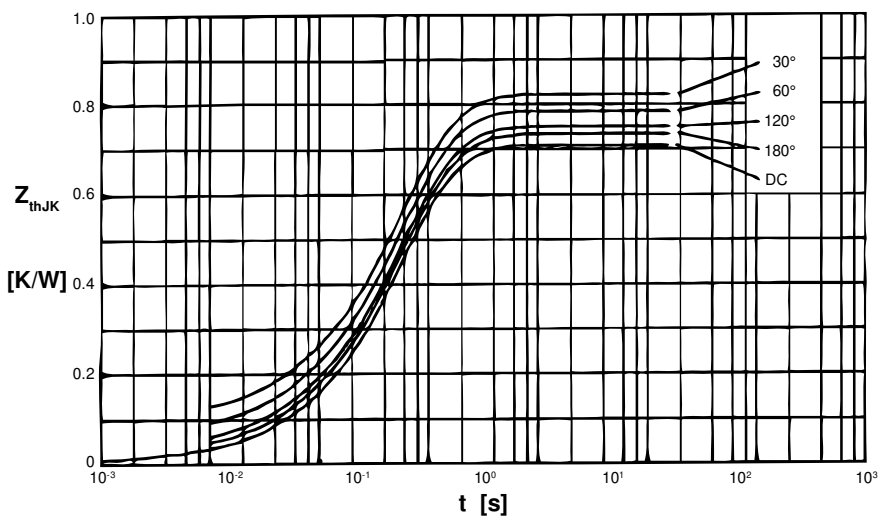


Fig. 8 Transient thermal impedance junction to heatsink (per thyristor)

R_{thJK} for various conduction angles d:

| d | R_{thJK} [K/W] |
|------|------------------|
| DC | 0.71 |
| 180° | 0.73 |
| 120° | 0.75 |
| 60° | 0.78 |
| 30° | 0.82 |

Constants for Z_{thJK} calculation:

| i | R_{thi} [K/W] | t_i [s] |
|---|-----------------|-----------|
| 1 | 0.013 | 0.0015 |
| 2 | 0.055 | 0.0450 |
| 3 | 0.442 | 0.4850 |
| 4 | 0.200 | 1.2500 |