

High Voltage Standard Rectifier Module

$$V_{RRM} = 2 \times 2000 \text{ V}$$

$$I_{FAV} = 310 \text{ A}$$

$$V_F = 1,03 \text{ V}$$

Phase leg

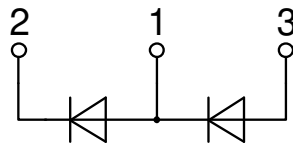
Part number

MDD312-20N1



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: Y1

- Isolation Voltage: 4800 V~
- Industry standard outline
- RoHS compliant
- Base plate: Copper internally DCB isolated
- Advanced power cycling

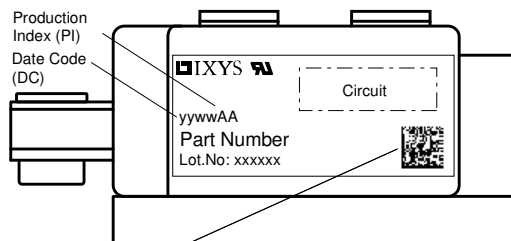
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| Rectifier | | | | Ratings | | | |
|--------------|--|--|---------|-------------------------|------|-------|-------------------|
| Symbol | Definition | Conditions | | min. | typ. | max. | Unit |
| V_{RSM} | max. non-repetitive reverse blocking voltage | | | $T_{VJ} = 25^{\circ}C$ | | 2100 | V |
| V_{RRM} | max. repetitive reverse blocking voltage | | | $T_{VJ} = 25^{\circ}C$ | | 2000 | V |
| I_R | reverse current | $V_R = 2000\text{ V}$ | | $T_{VJ} = 25^{\circ}C$ | | 500 | μA |
| | | $V_R = 2000\text{ V}$ | | $T_{VJ} = 150^{\circ}C$ | | 30 | mA |
| V_F | forward voltage drop | $I_F = 300\text{ A}$ | | $T_{VJ} = 25^{\circ}C$ | | 1,13 | V |
| | | $I_F = 600\text{ A}$ | | | | 1,33 | V |
| | | $I_F = 300\text{ A}$ | | $T_{VJ} = 125^{\circ}C$ | | 1,03 | V |
| | | $I_F = 600\text{ A}$ | | | | 1,29 | V |
| I_{FAV} | average forward current | $T_C = 100^{\circ}C$ | | $T_{VJ} = 150^{\circ}C$ | | 310 | A |
| $I_{F(RMS)}$ | RMS forward current | 180° sine | d = 0.5 | | | 520 | A |
| V_{F0} | threshold voltage | } for power loss calculation only | | $T_{VJ} = 150^{\circ}C$ | | 0,80 | V |
| r_F | slope resistance | | | | | 0,6 | m Ω |
| R_{thJC} | thermal resistance junction to case | | | | | 0,12 | K/W |
| R_{thCH} | thermal resistance case to heatsink | | | | 0,04 | | K/W |
| P_{tot} | total power dissipation | | | $T_C = 25^{\circ}C$ | | 1040 | W |
| I_{FSM} | max. forward surge current | t = 10 ms; (50 Hz), sine | | $T_{VJ} = 45^{\circ}C$ | | 10,8 | kA |
| | | t = 8,3 ms; (60 Hz), sine | | $V_R = 0\text{ V}$ | | 11,7 | kA |
| | | t = 10 ms; (50 Hz), sine | | $T_{VJ} = 150^{\circ}C$ | | 9,18 | kA |
| | | t = 8,3 ms; (60 Hz), sine | | $V_R = 0\text{ V}$ | | 9,92 | kA |
| I^2t | value for fusing | t = 10 ms; (50 Hz), sine | | $T_{VJ} = 45^{\circ}C$ | | 583,2 | kA ² s |
| | | t = 8,3 ms; (60 Hz), sine | | $V_R = 0\text{ V}$ | | 566,1 | kA ² s |
| | | t = 10 ms; (50 Hz), sine | | $T_{VJ} = 150^{\circ}C$ | | 421,4 | kA ² s |
| | | t = 8,3 ms; (60 Hz), sine | | $V_R = 0\text{ V}$ | | 409,0 | kA ² s |
| C_J | junction capacitance | $V_R = 700\text{ V}; f = 1\text{ MHz}$ | | $T_{VJ} = 25^{\circ}C$ | | 288 | pF |

| Package Y1 | | | 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 | | | | 680 | | g |
| M_D | mounting torque | | 4,5 | | 7 | Nm |
| M_T | terminal torque | | 11 | | 13 | Nm |
| $d_{Spp/App}$ | creepage distance on surface striking distance through air | terminal to terminal | 16,0 | | | mm |
| $d_{Spb/Apb}$ | | terminal to backside | 16,0 | | | mm |
| V_{ISOL} | isolation voltage | t = 1 second | 4800 | | | V |
| | | t = 1 minute | 4000 | | | 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 | MDD312-20N1 | MDD312-20N1 | Box | 3 | 467251 |

| Similar Part | Package | Voltage class |
|--------------|---------|---------------|
| MDD312-12N1 | Y1-CU | 1200 |
| MDD312-14N1 | Y1-CU | 1400 |
| MDD312-16N1 | Y1-CU | 1600 |
| MDD312-18N1 | Y1-CU | 1800 |

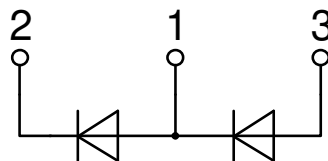
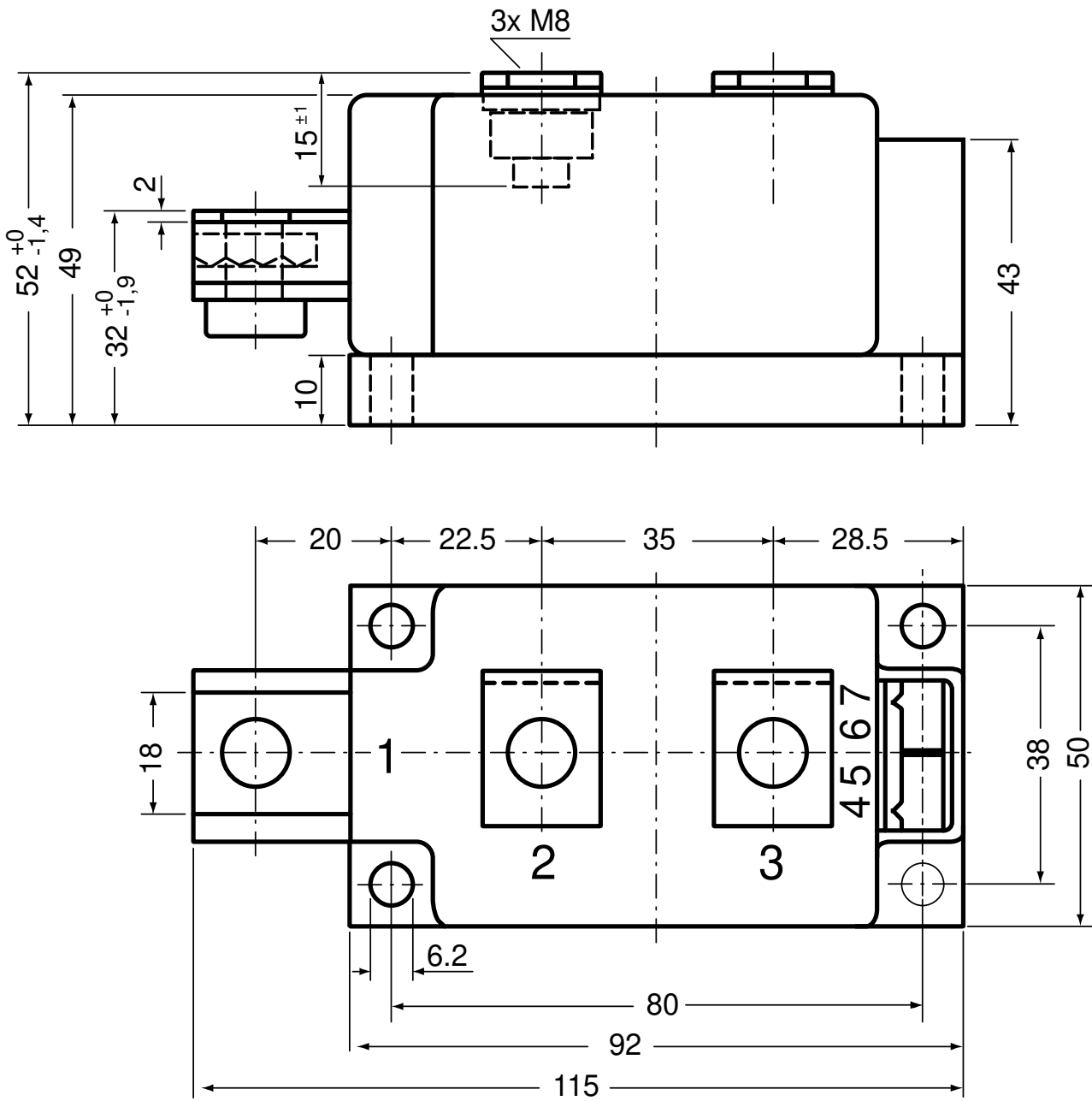
| | | |
|-------------|-------|------|
| MDD312-22N1 | Y1-CU | 2200 |
|-------------|-------|------|

Equivalent Circuits for Simulation * on die level $T_{VJ} = 150^{\circ}\text{C}$

| Symbol | Definition | Value | Unit |
|--------|--------------------|-------|------|
| V_0 | threshold voltage | 0,8 | V |
| R_0 | slope resistance * | 0,4 | mΩ |



Outlines Y1





Rectifier

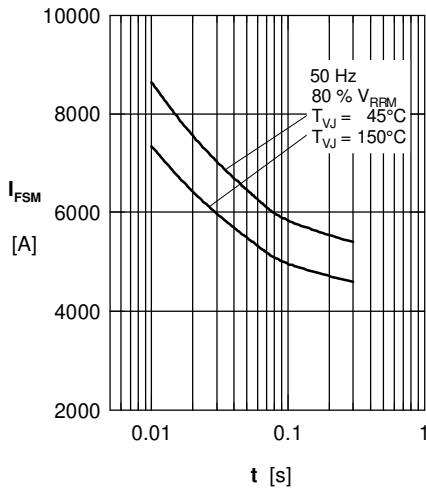


Fig. 1 Surge overload current
 I_{FSM} : Crest value, t : duration

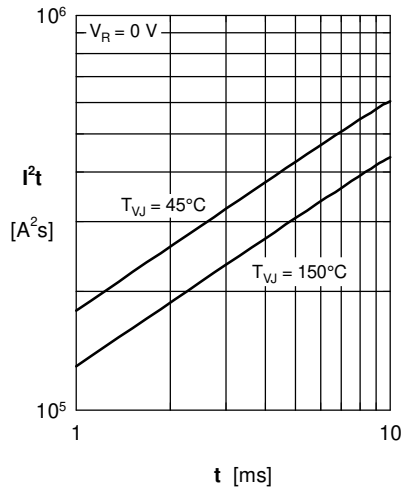


Fig. 2 I^2t versus time (1-10 ms)

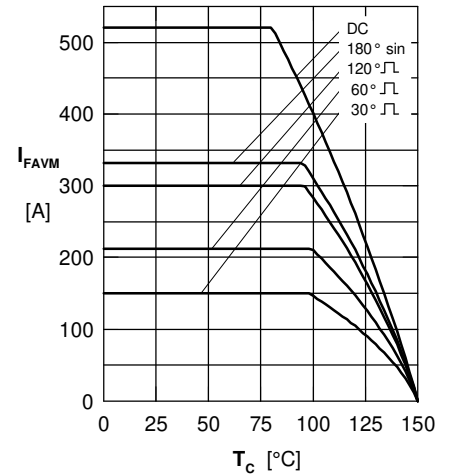


Fig. 3 Maximum forward current at case temperature

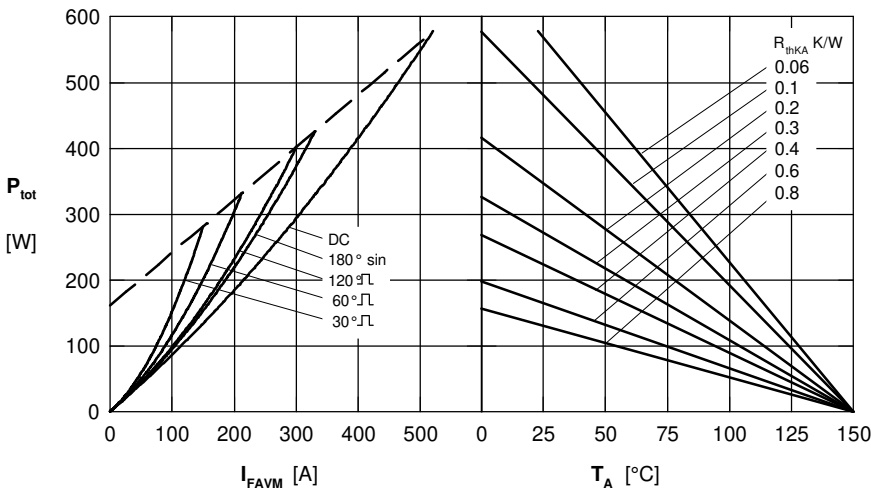


Fig. 4 Power dissipation vs. forward current & ambient temperature (per diode)

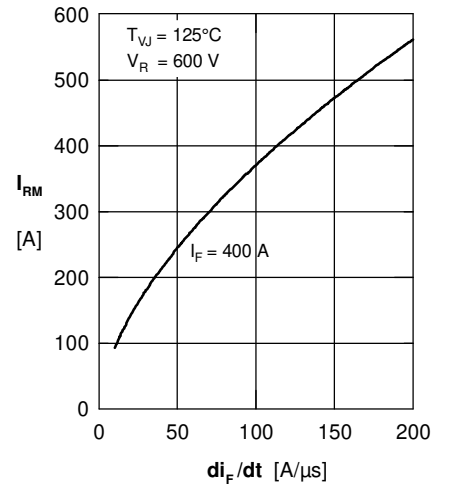


Fig. 5 Typ. peak reverse current

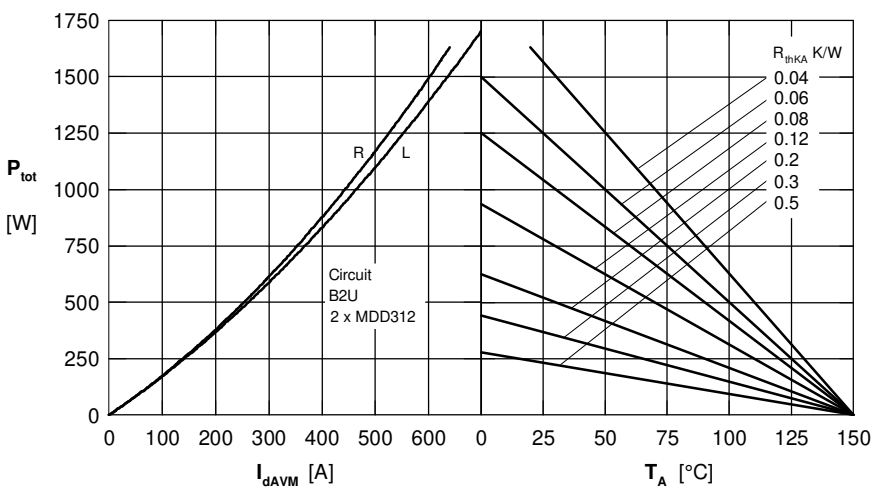


Fig. 6 Single phase rectifier bridge: Power dissipation vs. direct output current and ambient temperature R = resistive load, L = inductive load

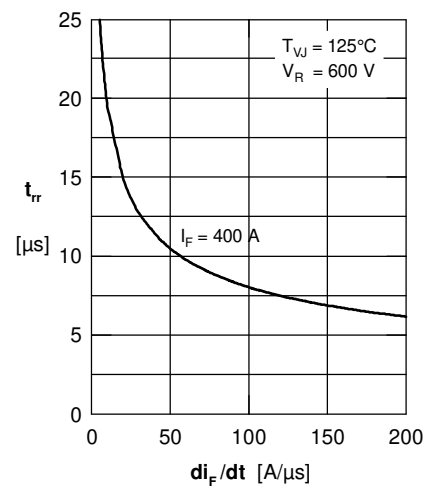


Fig. 7 Typ. recovery time t_{rr} versus $-di_F/dt$



Rectifier

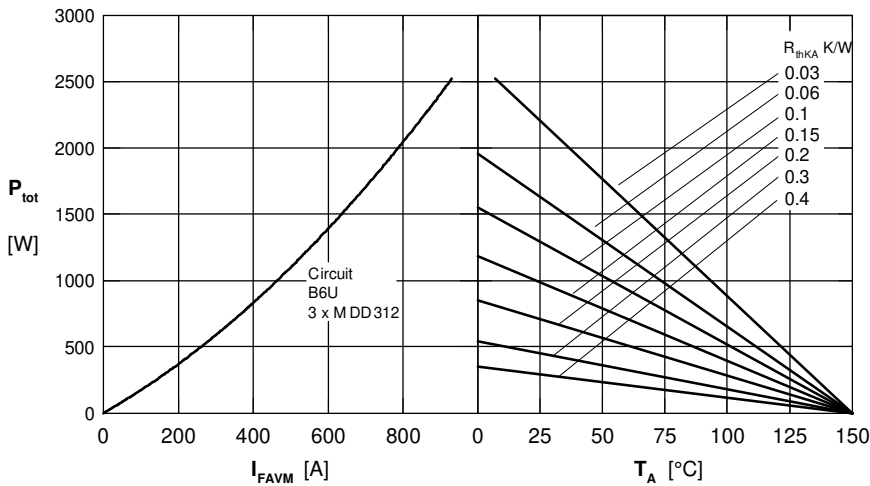
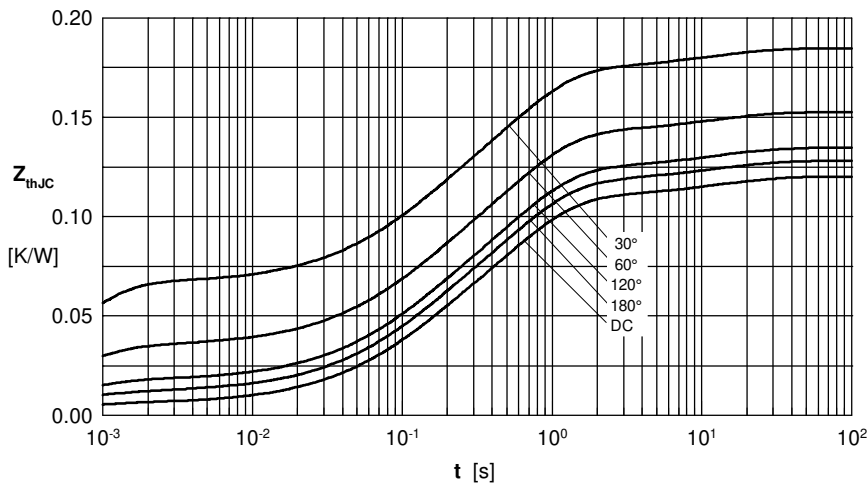


Fig. 8 Three phase rectifier bridge: Power dissipation vs. direct output current & ambient temperature



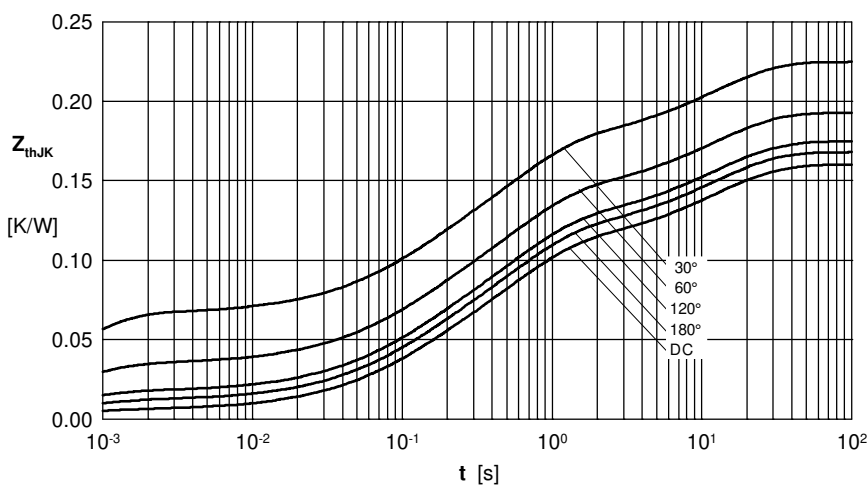
R_{thJC} for various conduction angles d :

| d | R_{thJC} [K/W] |
|------|------------------|
| DC | 0.120 |
| 180° | 0.128 |
| 120° | 0.135 |
| 60° | 0.153 |
| 30° | 0.185 |

Constants for Z_{thJC} calculation:

| i | R_{thi} (K/W) | t_i (s) |
|-----|-----------------|-----------|
| 1 | 0.0058 | 0.00054 |
| 2 | 0.0310 | 0.09800 |
| 3 | 0.0720 | 0.54000 |
| 4 | 0.0112 | 12.0000 |

Fig. 9 Transient thermal impedance junction to case (per diode)



R_{thJK} for various conduction angles d :

| d | R_{thJK} [K/W] |
|------|------------------|
| DC | 0.160 |
| 180° | 0.168 |
| 120° | 0.175 |
| 60° | 0.193 |
| 30° | 0.225 |

Constants for Z_{thJK} calculation:

| i | R_{thi} (K/W) | t_i (s) |
|-----|-----------------|-----------|
| 1 | 0.0058 | 0.00054 |
| 2 | 0.0310 | 0.09800 |
| 3 | 0.0720 | 0.54000 |
| 4 | 0.0112 | 12.0000 |
| 5 | 0.0400 | 12.0000 |

Fig. 10 Transient thermal impedance junction to heatsink (per diode)