

# **Thyristor \ Diode Module**

= 2x 1600 V

27 A

 $V_{T}$ 1.27 V

## Phase leg

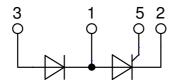
#### Part number

#### MCD26-16io8B



Backside: isolated





#### Features / Advantages:

- Thyristor for line frequency
- Planar passivated chip
- Long-term stability
- Direct Copper Bonded Al2O3-ceramic

#### **Applications:**

- Line rectifying 50/60 Hz
- Softstart AC motor control
- DC Motor control
- Power converter
- AC power control
- Lighting and temperature control

#### Package: TO-240AA

- Isolation Voltage: 3600 V~
- Industry standard outline
- RoHS compliant
- Soldering pins for PCB mounting
- Base plate: DCB ceramic
- · Reduced weight
- Advanced power cycling

#### Terms \_Conditions of usage:

The data contained in this product data sheet is exclusively intended for technically trained staff. The user will have to evaluate the suitability of the product for the intended application and the completeness of the product data with respect to his application. The specifications of our components may not be considered as an assurance of component characteristics. The information in the valid application- and assembly notes must be considered. Should you require product information in excess of the data given in this product data sheet or which concerns the specific application of your product, please contact your local sales office.

Due to technical requirements our product may contain dangerous substances. For information on the types in question please contact your local sales office.

Should you intend to use the product in aviation, in health or life endangering or life support applications, please notify. For any such application we urgently recommend

to perform joint risk and quality assessments;
the conclusion of quality agreements;

- to establish joint measures of an ongoing product survey, and that we may make delivery dependent on the realization of any such measures.

IXYS reserves the right to change limits, conditions and dimensions.

Data according to IEC 60747 and per semiconductor unless otherwise specified

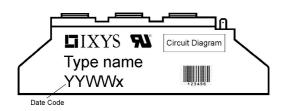
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| Rectifier             |                                    |  |   |      | Ratings |      | ! <u>-</u> -      |
|-----------------------|------------------------------------|--|---|------|---------|------|-------------------|
| Symbol                | Definition                         | Conditions   |   | min. | typ.    | max. | Uni               |
| V <sub>RSM/DSM</sub>  | max. non-repetitive reverse/forwa  | rd blocking voltage  | $T_{VJ} = 25^{\circ}C$  |      |         | 1700 | ٧                 |
| V <sub>RRM/DRM</sub>  | max. repetitive reverse/forward bl |  | $T_{VJ} = 25^{\circ}C$  |      |         | 1600 | ٧                 |
| I <sub>R/D</sub>      | reverse current, drain current     | $V_{R/D} = 1600 \text{ V}$   | $T_{VJ} = 25^{\circ}C$  |      |         | 100  | μA                |
|                       |                                    | $V_{R/D} = 1600 \text{ V}$   | $T_{VJ} = 125^{\circ}C$   |      |         | 3    | mA                |
| $V_{T}$               | forward voltage drop               | $I_T = 40 \text{ A}$   | $T_{VJ} = 25^{\circ}C$  |      |         | 1.27 | ٧                 |
|                       |                                    | I <sub>T</sub> = 80 A  |   |      |         | 1.64 | ٧                 |
|                       |                                    | $I_T = 40 \text{ A}$   | $T_{VJ} = 125$ °C   |      |         | 1.27 | ٧                 |
|                       |                                    | $I_{T} = 80 \text{ A}$   |   |      |         | 1.65 | ٧                 |
| ITAV                  | average forward current            | $T_c = 85^{\circ}C$  | $T_{VJ} = 125$ °C   |      |         | 27   | Δ                 |
| I <sub>T(RMS)</sub>   | RMS forward current                | 180° sine  |   |      |         | 42   | Α                 |
| $V_{T0}$              | threshold voltage                  | oss calculation only   | $T_{VJ} = 125$ °C   |      |         | 0.85 | ٧                 |
| r <sub>T</sub>        | slope resistance                   | oss calculation only   |   |      |         | 11   | mΩ                |
| R <sub>thJC</sub>     | thermal resistance junction to cas | e  |   |      |         | 0.88 | K/W               |
| R <sub>thCH</sub>     | thermal resistance case to heatsi  | nk   |   |      | 0.20    |      | K/W               |
| P <sub>tot</sub>      | total power dissipation            |  | $T_{C} = 25^{\circ}C$   |      |         | 115  | W                 |
| I <sub>TSM</sub>      | max. forward surge current         | t = 10 ms; (50 Hz), sine   | $T_{VJ} = 45^{\circ}C$  |      |         | 520  | Δ                 |
|                       |                                    | t = 8,3  ms; (60 Hz), sine   | $V_R = 0 V$   |      |         | 560  | Δ                 |
|                       |                                    | t = 10 ms; (50 Hz), sine   | T <sub>vJ</sub> = 125°C   |      |         | 440  | Δ                 |
|                       |                                    | t = 8,3 ms; (60 Hz), sine  | $V_R = 0 V$   |      |         | 475  | Δ                 |
| l²t                   | value for fusing                   | t = 10 ms; (50 Hz), sine   | $T_{VJ} = 45^{\circ}C$  |      |         | 1.35 | kA <sup>2</sup> s |
|                       |                                    | t = 8,3 ms; (60 Hz), sine  | $V_R = 0 V$   |      |         | 1.31 | kA <sup>2</sup> s |
|                       |                                    | t = 10 ms; (50 Hz), sine   | T <sub>vJ</sub> = 125°C   |      |         | 970  | A <sup>2</sup> s  |
|                       |                                    | t = 8,3 ms; (60 Hz), sine  | $V_R = 0 V$   |      |         | 940  | A <sup>2</sup> s  |
| C <sub>J</sub>        | junction capacitance               | $V_R = 400 V$ f = 1 MHz  | $T_{VJ} = 25^{\circ}C$  |      | 22      |      | pF                |
| P <sub>GM</sub>       | max. gate power dissipation        | t <sub>P</sub> = 30 μs   | T <sub>C</sub> = 125°C  |      |         | 10   | W                 |
| <b></b>               | , ,                                | t <sub>P</sub> = 300 μs  |   |      |         | 5    | W                 |
| $P_{GAV}$             | average gate power dissipation     | ' '  |   |      |         | 0.5  | W                 |
| (di/dt) <sub>cr</sub> | critical rate of rise of current   | T <sub>v,i</sub> = 125°C; f = 50 Hz re   | epetitive. $I_{\tau} = 45 \text{ A}$                            |      |         | 150  | A/μs              |
| (and any cr           |                                    | $t_{\rm p} = 200 \mu \rm s; di_{\rm G}/dt = 0.45 A/\mu s; -$                             | •   |      |         |      | 7.4 p.c           |
|                       |                                    |  | on-repet., $I_T = 27 A$   |      |         | 500  | A/μs              |
| (dv/dt) <sub>cr</sub> | critical rate of rise of voltage   | $V = \frac{2}{3} V_{DRM}$  | $T_{VJ} = 125^{\circ}C$   |      |         | 1000 | <u> </u>          |
| (av/at/cr             | embarrate of mod of voltage        | $R_{GK} = \infty$ ; method 1 (linear volta   |   |      |         | 1000 | ν/μο              |
| V <sub>GT</sub>       | gate trigger voltage               | $V_D = 6 \text{ V}$  | $T_{VJ} = 25^{\circ}C$  |      |         | 1.5  | ٧                 |
| <b>V</b> GT           | gate ingger vertage                | <b>v</b> <sub>D</sub> = 0 <b>v</b>   | $T_{VJ} = -40$ °C   |      |         | 1.6  | ٧                 |
|                       | gate trigger current               | $V_D = 6 \text{ V}$  | $T_{VJ} = 25^{\circ}C$  |      |         | 100  | mA                |
| I <sub>GT</sub>       | gate trigger current               | $\mathbf{v}_{D} = \mathbf{o} \ \mathbf{v}$   | $T_{VJ} = 23 \text{ C}$ $T_{VJ} = -40 \text{ °C}$               |      |         | 200  | !                 |
| V                     | gate non-trigger voltage           | $V_D = \frac{2}{3} V_{DBM}$  | $T_{VJ} = -40^{\circ} \text{C}$ $T_{VJ} = 125^{\circ} \text{C}$ |      |         | 0.2  | mA<br>V           |
| V <sub>GD</sub>       |                                    | $\mathbf{v}_{\mathrm{D}} = 73  \mathbf{v}_{\mathrm{DRM}}$                                | 1 <sub>VJ</sub> = 125 C   |      |         |      |                   |
| I <sub>GD</sub>       | gate non-trigger current           | 10   | T 05.00   |      |         | 10   | mA                |
| I <sub>L</sub>        | latching current                   | $t_p = 10 \mu s$<br>$I_G = 0.45 A$ ; $di_G/dt = 0.45 A/\mu s$                            | $T_{VJ} = 25$ °C  |      |         | 450  | mA                |
| I <sub>H</sub>        | holding current                    | $V_D = 6 \text{ V}  R_{GK} = \infty$   | $T_{VJ} = 25$ °C  |      |         | 200  | mA                |
| t <sub>gd</sub>       | gate controlled delay time         | $V_D = \frac{1}{2} V_{DRM}$  | T <sub>VJ</sub> = 25°C  |      |         | 2    | μs                |
| gu                    | - ,                                | $I_{\rm G} = 0.45  \text{A};  \text{di}_{\rm G}/\text{dt} = 0.45  \text{A}/\mu \text{s}$ |   |      |         | _    | F                 |
| tq                    | turn-off time                      | $V_{\rm R} = 100 \text{ V}; \ I_{\rm T} = 20 \text{ A}; \ V = ^{2}$                      |   |      | 150     |      | με                |
| •q                    |                                    | $di/dt = 10 \text{ A}/\mu \text{s} \text{ dv/dt} = 20 \text{ V}$                         |   |      | .00     |      | μι                |



| Package              | TO-240AA                     |                               |                             |      | ı    | Ratings | S    |      |
|----------------------|------------------------------|-------------------------------|-----------------------------|------|------|---------|------|------|
| Symbol               | Definition                   | Conditions                    |                             |      | min. | typ.    | max. | Unit |
| RMS                  | RMS current                  | per terminal                  |                             |      |      |         | 200  | Α    |
| T <sub>vJ</sub>      | virtual junction temperature |                               |                             |      | -40  |         | 125  | °C   |
| Top                  | operation temperature        |                               |                             |      | -40  |         | 100  | °C   |
| T <sub>stg</sub>     | storage temperature          |                               |                             |      | -40  |         | 125  | °C   |
| Weight               |                              |                               |                             |      |      | 81      |      | g    |
| M <sub>D</sub>       | mounting torque              |                               |                             |      | 2.5  |         | 4    | Nm   |
| $\mathbf{M}_{_{T}}$  | terminal torque              |                               |                             |      | 2.5  |         | 4    | Nm   |
| d <sub>Spp/App</sub> | creepage distance on surface | striking distance through air | terminal to terminal        | 13.0 | 9.7  |         |      | mm   |
| $d_{\text{Spb/Apb}}$ | creepage distance on surface | Striking distance through an  | terminal to backside        |      | 16.0 |         |      | mm   |
| V <sub>ISOL</sub>    | isolation voltage            | t = 1 second                  |                             |      | 3600 |         |      | V    |
| .002                 | t = 1 minute                 |                               | 50/60 Hz, RMS; lisoL ≤ 1 mA |      | 3000 |         |      | ٧    |



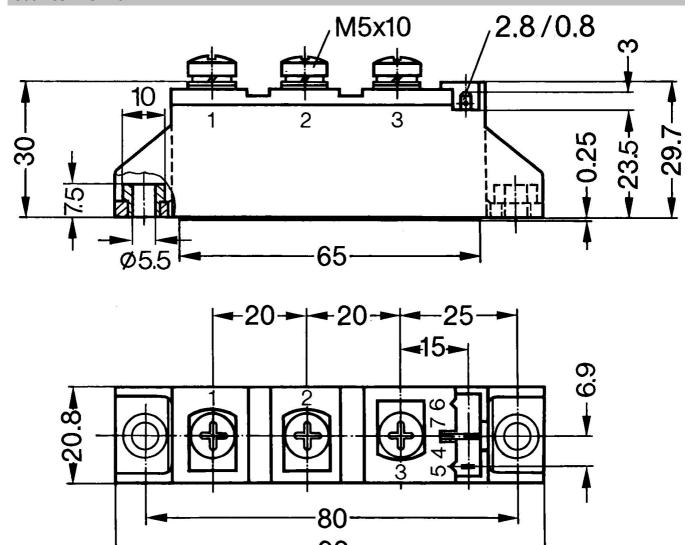
| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|----------|-----------------|--------------------|---------------|----------|----------|
| Standard | MCD26-16io8B    | MCD26-16io8B       | Box           | 36       | 453277   |

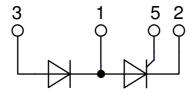
| Similar Part   | Package     | Voltage class |
|----------------|-------------|---------------|
| MCMA35PD1600TB | TO-240AA-1B | 1600          |
| MCMA50PD1600TB | TO-240AA-1B | 1600          |

| Equiva              | alent Circuits for | Simulation | * on die level | T <sub>VJ</sub> = 125 °C |
|---------------------|--------------------|------------|----------------|--------------------------|
| $I \rightarrow V_0$ | )— <u>R</u> o      | Thyristor  |                |                          |
| V <sub>0 max</sub>  | threshold voltage  | 0.85       |                | V                        |
| $R_{0 \text{ max}}$ | slope resistance * | 9.8        |                | $m\Omega$                |



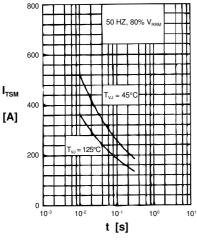
### Outlines TO-240AA

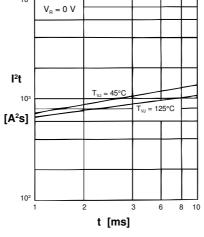






#### **Thyristor**





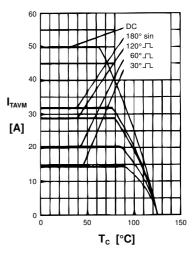
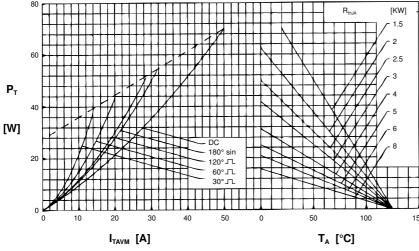


Fig. 1 Surge overload current  $I_{\text{TSM}}$ : Crest value, t: duration

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

Fig. 3 Max. forward current at case temperature



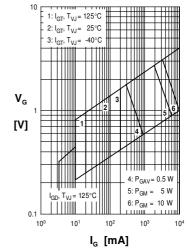
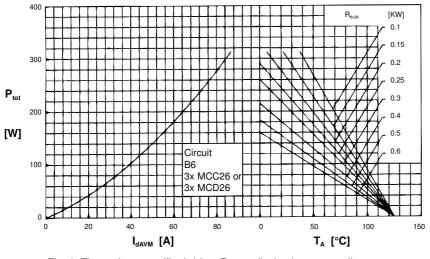


Fig. 4 Power dissipation versus onstate current & ambient temp. (per thyristor)

Fig. 5 Gate trigger charact.



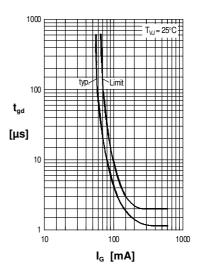


Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

Fig. 7 Gate trigger delay time



#### Rectifier

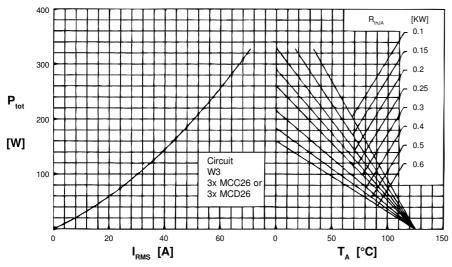


Fig. 8 Three phase AC-controller: Power dissipation vs. RMS output current and ambient temperature

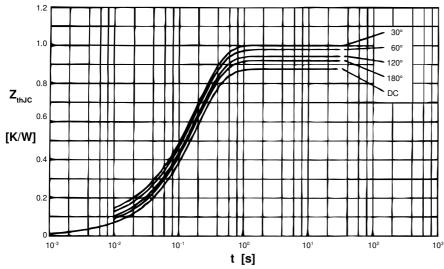


Fig. 9 Transient thermal impedance junction to case (per thyristor)

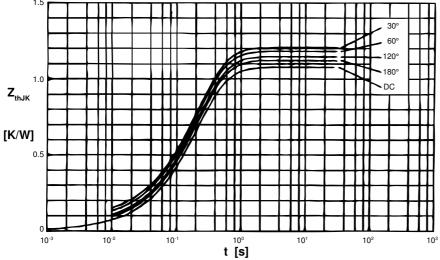


Fig. 10 Transient thermal impedance junction to heatsink (per thyristor)

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

| (  | d R | R <sub>thJC</sub> [K/W] |
|----|-----|-------------------------|
| D  | С   | 0.88                    |
| 18 | 0°  | 0.92                    |
| 12 | 0°  | 0.95                    |
| 6  | 0°  | 0.98                    |
| 3  | 0°  | 1.01                    |

Constants for  $Z_{thJC}$  calculation:

| i I | R <sub>thi</sub> [K/W] | t <sub>i</sub> [s] |
|-----|------------------------|--------------------|
| 1   | 0.019                  | 0.0031             |
| 2   | 0.029                  | 0.0216             |
| 3   | 0.832                  | 0.1910             |

 $\boldsymbol{R}_{\text{\tiny thJK}}$  for various conduction angles d:

| d    | R <sub>thJK</sub> [K/ |
|------|-----------------------|
| DC   | 1.08                  |
| 180° | 1.12                  |
| 120° | 1.15                  |
| 60°  | 1.18                  |
| 30°  | 1.21                  |

Constants for  $Z_{thJK}$  calculation:

| i | R <sub>thi</sub> [K/W] | t <sub>i</sub> [s] |
|---|------------------------|--------------------|
| 1 | 0.019                  | 0.0031             |
| 2 | 0.029                  | 0.0216             |
| 3 | 0.832                  | 0.1910             |
| 4 | 0.200                  | 0.4500             |