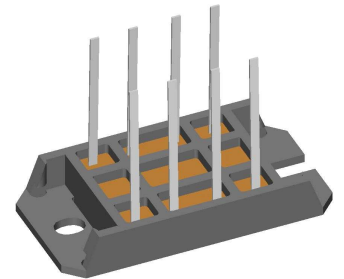


# Thyristor Module

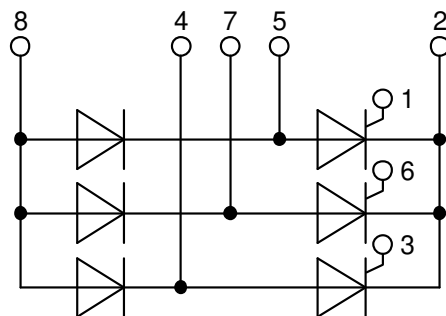
|                         |          |
|-------------------------|----------|
| <b>3~<br/>Rectifier</b> |          |
| $V_{RRM}$               | = 1600 V |
| $I_{DAV}$               | = 45 A   |
| $I_{FSM}$               | = 320 A  |

## 3~ Rectifier Bridge, half-controlled (high-side)

**Part number**
**VVZ40-16io1**


Backside: isolated

E72873


**Features / Advantages:**

- Package with DCB ceramic base plate
- Improved temperature and power cycling
- Planar passivated chips
- Very low forward voltage drop
- Very low leakage current

**Applications:**

- Line rectifying 50/60 Hz
- Drives
- SMPS
- UPS

**Package: V1-B-Pack**

- Isolation Voltage: 3600 V~
- Industry standard outline
- RoHS compliant
- Soldering pins for PCB mounting
- Height: 10 mm
- Base plate: DCB ceramic
- Reduced weight
- Advanced power cycling

**Terms and 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

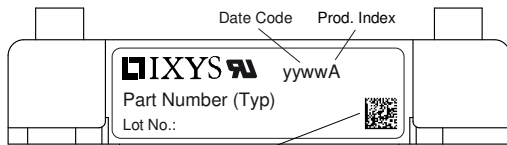
- to perform joint risk and quality assessments;

- 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.

| Rectifier      |                                                      |                                                                                                                                                                | Ratings                        |      |      |                  |
|----------------|------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------|------|------------------|
| Symbol         | Definition                                           | Conditions                                                                                                                                                     | min.                           | typ. | max. | Unit             |
| $V_{RSM/DSM}$  | max. non-repetitive reverse/forward blocking voltage | $T_{VJ} = 25^{\circ}\text{C}$                                                                                                                                  |                                |      | 1700 | V                |
| $V_{RRM/DRM}$  | max. repetitive reverse/forward blocking voltage     | $T_{VJ} = 25^{\circ}\text{C}$                                                                                                                                  |                                |      | 1600 | V                |
| $I_{RD}$       | reverse current, drain current                       | $V_{R/D} = 1600\text{ V}$                                                                                                                                      | $T_{VJ} = 25^{\circ}\text{C}$  |      | 300  | $\mu\text{A}$    |
|                |                                                      | $V_{R/D} = 1600\text{ V}$                                                                                                                                      | $T_{VJ} = 125^{\circ}\text{C}$ |      | 5    | mA               |
| $V_T$          | forward voltage drop                                 | $I_T = 15\text{ A}$                                                                                                                                            | $T_{VJ} = 25^{\circ}\text{C}$  |      | 1.12 | V                |
|                |                                                      | $I_T = 45\text{ A}$                                                                                                                                            |                                |      | 1.47 | V                |
|                |                                                      | $I_T = 15\text{ A}$                                                                                                                                            | $T_{VJ} = 125^{\circ}\text{C}$ |      | 1.07 | V                |
|                |                                                      | $I_T = 45\text{ A}$                                                                                                                                            |                                |      | 1.52 | V                |
| $I_{DAV}$      | bridge output current                                | $T_C = 100^{\circ}\text{C}$<br>rectangular $d = 1/3$                                                                                                           | $T_{VJ} = 125^{\circ}\text{C}$ |      | 45   | A                |
| $V_{T0}$       | threshold voltage                                    | } for power loss calculation only                                                                                                                              | $T_{VJ} = 125^{\circ}\text{C}$ |      | 0.85 | V                |
| $r_T$          | slope resistance                                     |                                                                                                                                                                |                                |      | 15   | m $\Omega$       |
| $R_{thJC}$     | thermal resistance junction to case                  |                                                                                                                                                                |                                |      | 1    | K/W              |
| $R_{thCH}$     | thermal resistance case to heatsink                  |                                                                                                                                                                |                                | 0.60 |      | K/W              |
| $P_{tot}$      | total power dissipation                              |                                                                                                                                                                | $T_C = 25^{\circ}\text{C}$     |      | 100  | W                |
| $I_{TSM}$      | max. forward surge current                           | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$                                                                                                               | $T_{VJ} = 45^{\circ}\text{C}$  |      | 320  | A                |
|                |                                                      | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$                                                                                                              | $V_R = 0\text{ V}$             |      | 345  | A                |
|                |                                                      | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$                                                                                                               | $T_{VJ} = 125^{\circ}\text{C}$ |      | 270  | A                |
|                |                                                      | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$                                                                                                              | $V_R = 0\text{ V}$             |      | 295  | A                |
| $I^2t$         | value for fusing                                     | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$                                                                                                               | $T_{VJ} = 45^{\circ}\text{C}$  |      | 510  | A <sup>2</sup> s |
|                |                                                      | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$                                                                                                              | $V_R = 0\text{ V}$             |      | 495  | A <sup>2</sup> s |
|                |                                                      | $t = 10\text{ ms}; (50\text{ Hz}), \text{ sine}$                                                                                                               | $T_{VJ} = 125^{\circ}\text{C}$ |      | 365  | A <sup>2</sup> s |
|                |                                                      | $t = 8,3\text{ ms}; (60\text{ Hz}), \text{ sine}$                                                                                                              | $V_R = 0\text{ V}$             |      | 360  | A <sup>2</sup> s |
| $C_J$          | junction capacitance                                 | $V_R = 400\text{ V}$ $f = 1\text{ MHz}$                                                                                                                        | $T_{VJ} = 25^{\circ}\text{C}$  |      | 16   | pF               |
| $P_{GM}$       | max. gate power dissipation                          | $t_p = 30\text{ }\mu\text{s}$                                                                                                                                  | $T_C = 125^{\circ}\text{C}$    |      | 10   | W                |
|                |                                                      | $t_p = 300\text{ }\mu\text{s}$                                                                                                                                 |                                |      | 1    | W                |
| $P_{GAV}$      | average gate power dissipation                       |                                                                                                                                                                |                                |      | 0.5  | W                |
| $(di/dt)_{cr}$ | critical rate of rise of current                     | $T_{VJ} = 125^{\circ}\text{C}; f = 50\text{ Hz}$ repetitive, $I_T = 45\text{ A}$                                                                               |                                |      | 150  | A/ $\mu\text{s}$ |
|                |                                                      | $t_p = 200\text{ }\mu\text{s}; di_G/dt = 0.3\text{ A}/\mu\text{s};$<br>$I_G = 0.3\text{ A}; V = 2/3 V_{DRM}$ non-repet., $I_T = 15\text{ A}$                   |                                |      | 500  | A/ $\mu\text{s}$ |
| $(dv/dt)_{cr}$ | critical rate of rise of voltage                     | $V = 2/3 V_{DRM}$<br>$R_{GK} = \infty$ ; method 1 (linear voltage rise)                                                                                        | $T_{VJ} = 125^{\circ}\text{C}$ |      | 1000 | V/ $\mu\text{s}$ |
| $V_{GT}$       | gate trigger voltage                                 | $V_D = 6\text{ V}$                                                                                                                                             | $T_{VJ} = 25^{\circ}\text{C}$  |      | 1    | V                |
|                |                                                      |                                                                                                                                                                | $T_{VJ} = -40^{\circ}\text{C}$ |      | 1.2  | V                |
| $I_{GT}$       | gate trigger current                                 | $V_D = 6\text{ V}$                                                                                                                                             | $T_{VJ} = 25^{\circ}\text{C}$  |      | 65   | mA               |
|                |                                                      |                                                                                                                                                                | $T_{VJ} = -40^{\circ}\text{C}$ |      | 80   | mA               |
| $V_{GD}$       | gate non-trigger voltage                             | $V_D = 2/3 V_{DRM}$                                                                                                                                            | $T_{VJ} = 125^{\circ}\text{C}$ |      | 0.2  | V                |
| $I_{GD}$       | gate non-trigger current                             |                                                                                                                                                                |                                |      | 5    | mA               |
| $I_L$          | latching current                                     | $t_p = 30\text{ }\mu\text{s}$                                                                                                                                  | $T_{VJ} = 25^{\circ}\text{C}$  |      | 150  | mA               |
|                |                                                      | $I_G = 0.3\text{ A}; di_G/dt = 0.3\text{ A}/\mu\text{s}$                                                                                                       |                                |      |      |                  |
| $I_H$          | holding current                                      | $V_D = 6\text{ V}$ $R_{GK} = \infty$                                                                                                                           | $T_{VJ} = 25^{\circ}\text{C}$  |      | 100  | mA               |
| $t_{gd}$       | gate controlled delay time                           | $V_D = 1/2 V_{DRM}$                                                                                                                                            | $T_{VJ} = 25^{\circ}\text{C}$  |      | 2    | $\mu\text{s}$    |
|                |                                                      | $I_G = 0.3\text{ A}; di_G/dt = 0.3\text{ A}/\mu\text{s}$                                                                                                       |                                |      |      |                  |
| $t_q$          | turn-off time                                        | $V_R = 100\text{ V}; I_T = 15\text{ A}; V = 2/3 V_{DRM}$<br>$di/dt = 10\text{ A}/\mu\text{s}$ $dv/dt = 20\text{ V}/\mu\text{s}$ $t_p = 300\text{ }\mu\text{s}$ | $T_{VJ} = 100^{\circ}\text{C}$ |      | 150  | $\mu\text{s}$    |

| Package V1-B-Pack |                                                              |                      |      | Ratings |      |      |
|-------------------|--------------------------------------------------------------|----------------------|------|---------|------|------|
| Symbol            | Definition                                                   | Conditions           | min. | typ.    | max. | Unit |
| $I_{RMS}$         | RMS current                                                  | per terminal         |      |         | 100  | A    |
| $T_{VJ}$          | virtual junction temperature                                 |                      | -40  |         | 125  | °C   |
| $T_{op}$          | operation temperature                                        |                      | -40  |         | 100  | °C   |
| $T_{stg}$         | storage temperature                                          |                      | -40  |         | 125  | °C   |
| <b>Weight</b>     |                                                              |                      |      | 30      |      | g    |
| $M_D$             | mounting torque                                              |                      | 2    |         | 2.5  | Nm   |
| $d_{Spp/App}$     | creepage distance on surface / striking distance through air | terminal to terminal | 6.0  |         |      | mm   |
| $d_{Spb/Apb}$     |                                                              | terminal to backside | 12.0 |         |      | mm   |
| $V_{ISOL}$        | isolation voltage                                            | t = 1 second         | 3600 |         |      | V    |
|                   |                                                              | t = 1 minute         | 3000 |         |      | V    |



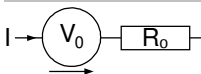
Data Matrix: Typ (1-19), DC+Prod.Index (20-25), FKT# (26-31)  
 Iser (33), Ild.# (33-36)

| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|----------|-----------------|--------------------|---------------|----------|----------|
| Standard | VVZ40-16io1     | VVZ40-16io1        | Box           | 5        | 466379   |

### Equivalent Circuits for Simulation

\* on die level

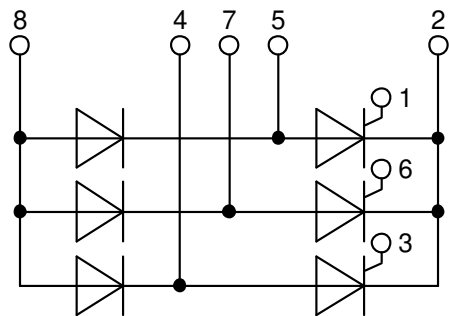
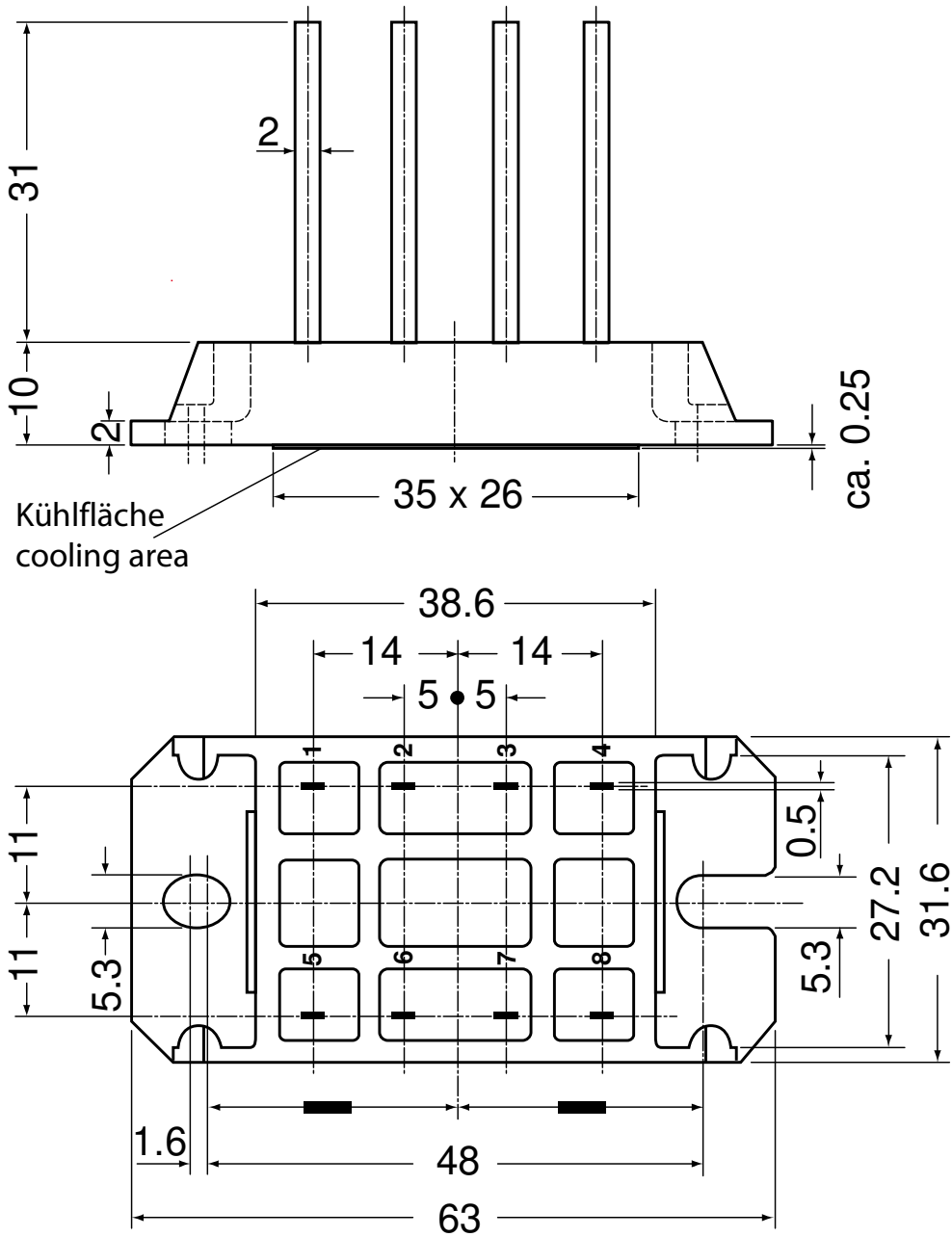
$T_{VJ} = 125\text{ °C}$



Thyristor

|              |                    |      |    |
|--------------|--------------------|------|----|
| $V_{0\ max}$ | threshold voltage  | 0.85 | V  |
| $R_{0\ max}$ | slope resistance * | 12.5 | mΩ |

**Outlines V1-B-Pack**



## Thyristor

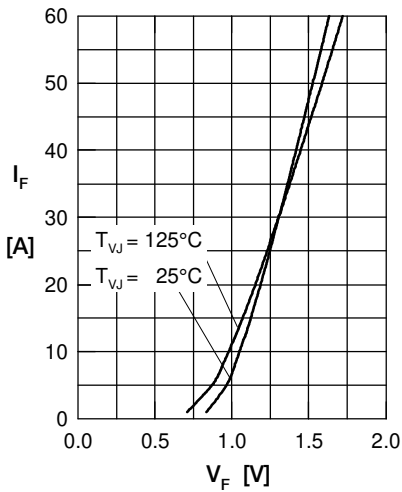


Fig. 1 Forward current vs. voltage drop per thyristor

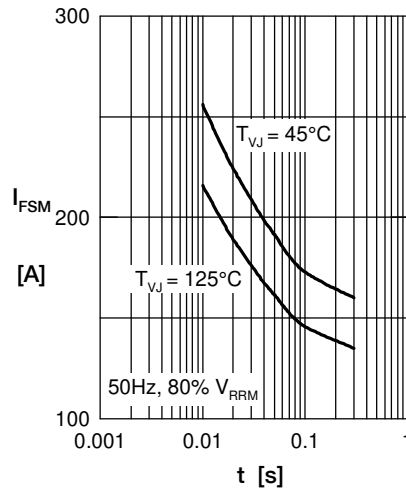


Fig. 2 Surge overload current vs. time per thyristor

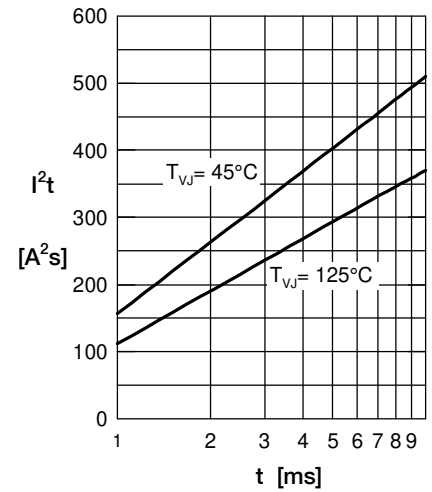


Fig. 3  $I^2t$  vs. time per thyristor

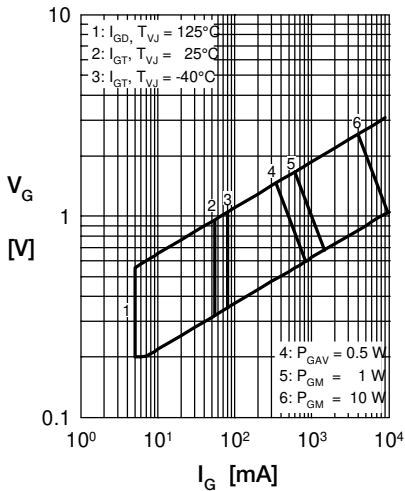


Fig. 4 Gate trigger characteristics

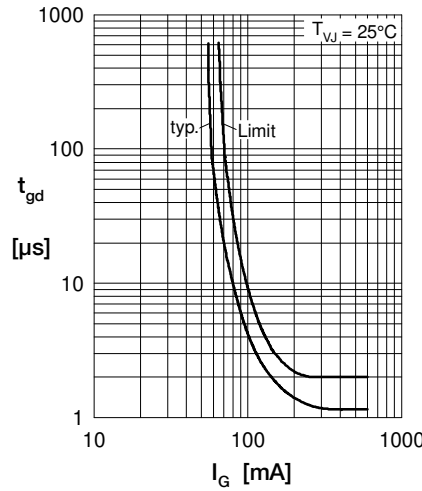


Fig. 5 Gate trigger delay time

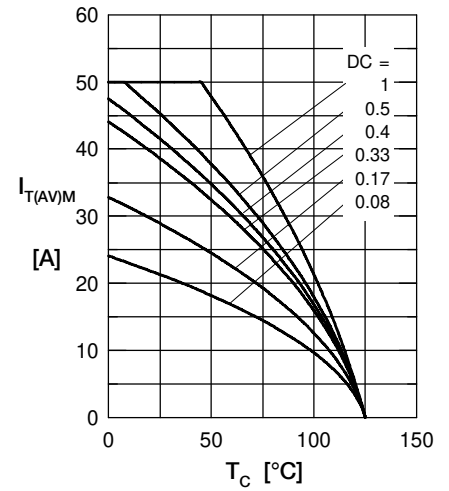


Fig. 5 Max. forward current vs. case temperature per thyristor

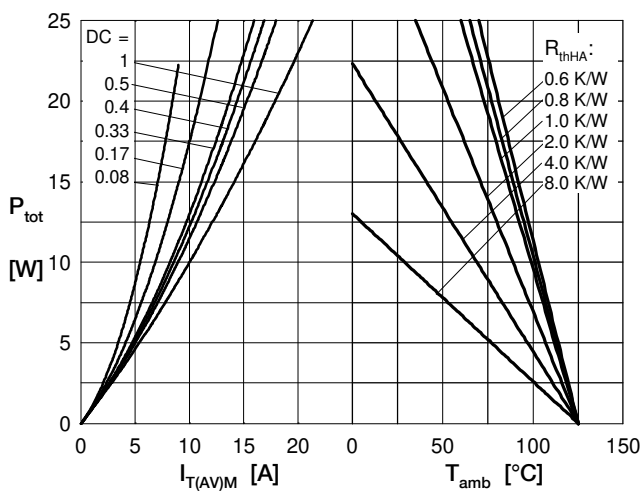


Fig. 4 Power dissipation vs. forward current and ambient temperature per thyristor

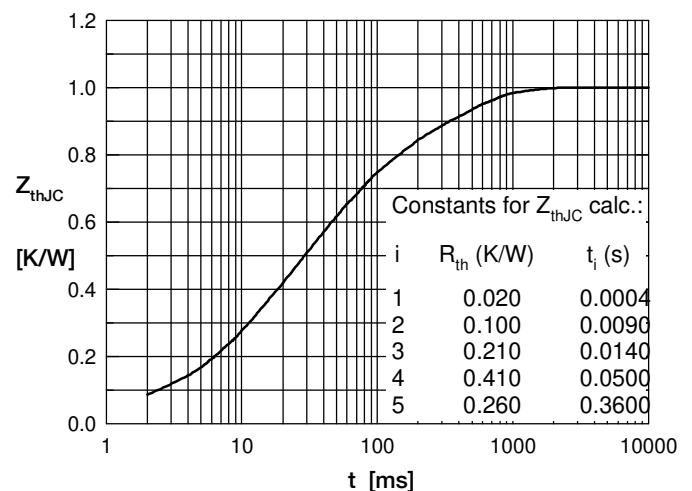


Fig. 6 Transient thermal impedance junction to case vs. time per thyristor