

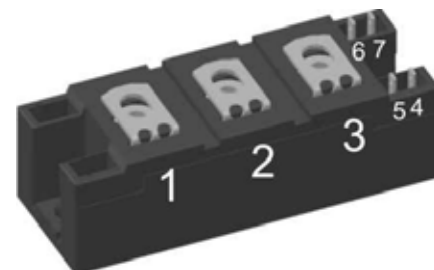
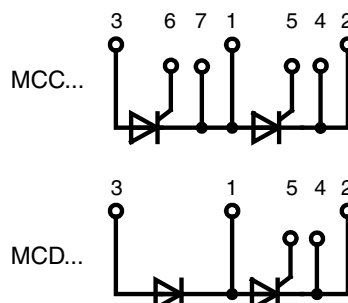
# Thyristor Modules

$$I_{TRMS} = 2 \times 300 \text{ A}$$

$$I_{TAVM} = 2 \times 190 \text{ A}$$

$$V_{RRM} = 1400-1800 \text{ V}$$

| $V_{RSM}$ | $V_{RRM}$ | Type           |
|-----------|-----------|----------------|
| $V_{DSM}$ | $V_{DRM}$ |                |
| V         | V         |                |
| 1500      | 1400      | MCC 162-14io1B |
| 1700      | 1600      | MCC 162-16io1B |
| 1900      | 1800      | MCC 162-18io1B |
| 1700      | 1600      | MCD 162-16io1B |



MCD... version without pins 6 & 7

| Symbol         | Conditions                                                                                                                            | Maximum Ratings |                  |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------|
| $I_{TRMS}$     | $T_{VJ} = T_{VJM}$                                                                                                                    | 300             | A                |
| $I_{TAVM}$     | $T_C = 80^\circ\text{C}; 180^\circ \text{ sine}$                                                                                      | 190             | A                |
|                | $T_C = 85^\circ\text{C}; 180^\circ \text{ sine}$                                                                                      | 181             | A                |
| $I_{TSM}$      | $T_{VJ} = 45^\circ\text{C}; t = 10 \text{ ms}$ (50 Hz)                                                                                | 6000            | A                |
|                | $V_R = 0; t = 8.3 \text{ ms}$ (60 Hz)                                                                                                 | 6400            | A                |
|                | $T_{VJ} = T_{VJM}; t = 10 \text{ ms}$ (50 Hz)                                                                                         | 5250            | A                |
|                | $V_R = 0; t = 8.3 \text{ ms}$ (60 Hz)                                                                                                 | 6500            | A                |
| $I^2t$         | $T_{VJ} = 45^\circ\text{C}; t = 10 \text{ ms}$ (50 Hz)                                                                                | 180 000         | A <sup>2</sup> s |
|                | $V_R = 0; t = 8.3 \text{ ms}$ (60 Hz)                                                                                                 | 170 000         | A <sup>2</sup> s |
|                | $T_{VJ} = T_{VJM}; t = 10 \text{ ms}$ (50 Hz)                                                                                         | 137 000         | A <sup>2</sup> s |
|                | $V_R = 0; t = 8.3 \text{ ms}$ (60 Hz)                                                                                                 | 128 000         | A <sup>2</sup> s |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM};$ repetitive, $I_T = 500 \text{ A}$<br>$f = 50 \text{ Hz}; t_p = 200 \mu\text{s};$                                  | 150             | A/ $\mu\text{s}$ |
|                | $V_D = \frac{2}{3} V_{DRM};$ non repetitive, $I_T = 500 \text{ A}$<br>$I_G = 0.5 \text{ A};$<br>$di_G/dt = 0.5 \text{ A}/\mu\text{s}$ | 500             | A/ $\mu\text{s}$ |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}; V_D = \frac{2}{3} V_{DRM};$<br>$R_{GK} = \infty;$ method 1 (linear voltage rise)                                   | 1000            | V/ $\mu\text{s}$ |
| $P_{GM}$       | $T_{VJ} = T_{VJM}; t_p = 30 \mu\text{s}$                                                                                              | 120             | W                |
|                | $I_T = I_{T(AV)M}; t_p = 500 \mu\text{s}$                                                                                             | 60              | W                |
| $P_{GAV}$      |                                                                                                                                       | 8               | W                |
| $V_{RGM}$      |                                                                                                                                       | 10              | V                |
| $T_{VJ}$       |                                                                                                                                       | -40...+125      | °C               |
| $T_{VJM}$      |                                                                                                                                       | 125             | °C               |
| $T_{stg}$      |                                                                                                                                       | -40...+125      | °C               |
| $V_{ISOL}$     | 50/60 Hz, RMS $t = 1 \text{ min}$                                                                                                     | 3000            | V~               |
|                | $I_{ISOL} \leq 1 \text{ mA} \quad t = 1 \text{ s}$                                                                                    | 3600            | V~               |
| $M_d$          | Mounting torque (M5)                                                                                                                  | 4 - 5           | Nm               |
|                | Mounting torque (M6)                                                                                                                  | 4 - 5           | Nm               |
|                | Terminal connection torque (M6)                                                                                                       | 4.5 - 5.5       | Nm               |
| Weight         | Typical including screws                                                                                                              | 125             | g                |

Data according to IEC 60747 and refer to a single diode unless otherwise stated.

## Features

- International standard package
- Direct copper bonded  $\text{Al}_2\text{O}_3$  -ceramic base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered, E 72873
- Keyed gate/cathode twin pins

## Applications

- Motor control
- Power converter
- Heat and temperature control for industrial furnaces and chemical processes
- Lighting control
- Contactless switches

## Advantages

- Space and weight savings
- Simple mounting
- Improved temperature and power cycling
- Reduced protection circuits

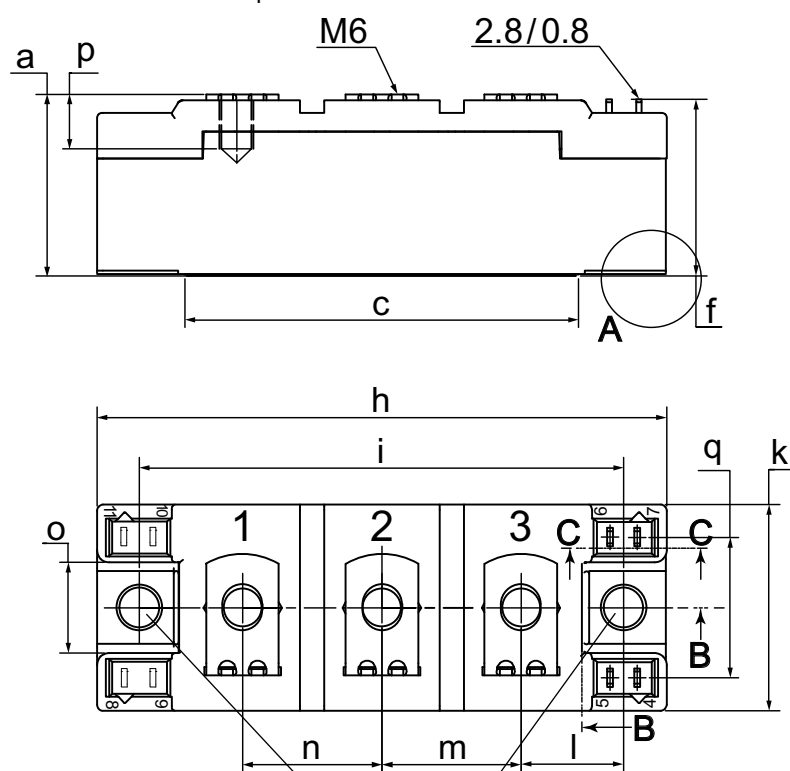
| Symbol             | Conditions                                                                                                                                                                | Characteristic Values        |                     |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|---------------------|
|                    |                                                                                                                                                                           | typ.                         | max.                |
| $I_{RRM}, I_{DRM}$ | $V_R / V_D = V_{RRM} / V_{DRM}$                                                                                                                                           | $T_{VJ} = T_{VJM}$           | 10 mA               |
| $V_T$              | $I_T = 300 \text{ A}$                                                                                                                                                     | $T_{VJ} = 25^\circ\text{C}$  | 1.25 V              |
| $V_{T0}$           | For power-loss calculations only                                                                                                                                          |                              | 0.88 V              |
| $r_t$              |                                                                                                                                                                           | $T_{VJ} = T_{VJM}$           | 1.15 mΩ             |
| $V_{GT}$           | $V_D = 6 \text{ V}$                                                                                                                                                       | $T_{VJ} = 25^\circ\text{C}$  | 2.5 V               |
|                    |                                                                                                                                                                           | $T_{VJ} = -40^\circ\text{C}$ | 2.6 V               |
| $I_{GT}$           | $V_D = 6 \text{ V}$                                                                                                                                                       | $T_{VJ} = 25^\circ\text{C}$  | 150 mA              |
|                    |                                                                                                                                                                           | $T_{VJ} = -40^\circ\text{C}$ | 200 mA              |
| $V_{GD}$           | $V_D = \frac{2}{3} V_{DRM}$                                                                                                                                               | $T_{VJ} = T_{VJM}$           | 0.2 V               |
| $I_{GD}$           |                                                                                                                                                                           |                              | 10 mA               |
| $I_L$              | $t_p = 30 \mu\text{s}; V_D = 6 \text{ V}$<br>$I_G = 0.5 \text{ A}; di_G/dt = 0.5 \text{ A}/\mu\text{s}$                                                                   | $T_{VJ} = 25^\circ\text{C}$  | 300 mA              |
| $I_H$              | $V_D = 6 \text{ V}; R_{GK} = \infty;$                                                                                                                                     | $T_{VJ} = 25^\circ\text{C}$  | 200 mA              |
| $t_{gd}$           | $V_D = \frac{1}{2} V_{DRM}$<br>$I_G = 0.5 \text{ A}; di_G/dt = 20 \text{ A}/\mu\text{s}$                                                                                  | $T_{VJ} = 25^\circ\text{C}$  | 2 μs                |
| $t_q$              | $V_D = \frac{2}{3} V_{DRM}$<br>$dv/dt = 20 \text{ V}/\mu\text{s}; -di/dt = 10 \text{ A}/\mu\text{s}$<br>$I_T = 160 \text{ A}; V_R = 100 \text{ V}; t_p = 200 \mu\text{s}$ | $T_{VJ} = T_{VJM}$           | 150 μs              |
| $Q_S$              | $I_T = 300 \text{ A}; -di/dt = 50 \text{ A}/\mu\text{s}$                                                                                                                  | $T_{VJ} = T_{VJM}$           | 550 μC              |
| $I_{RM}$           |                                                                                                                                                                           |                              | 235 A               |
| $R_{thJC}$         | per thyristor; DC current<br>per module                                                                                                                                   | other values<br>see Fig. 8/9 | 0.155 K/W           |
| $R_{thJK}$         | per thyristor; DC current<br>per module                                                                                                                                   |                              | 0.0775 K/W          |
|                    |                                                                                                                                                                           |                              | 0.255 K/W           |
|                    |                                                                                                                                                                           |                              | 0.1125 K/W          |
| $d_s$              | Creeping distance on surface                                                                                                                                              |                              | 12.7 mm             |
| $d_A$              | Creepage distance in air                                                                                                                                                  |                              | 9.6 mm              |
| $a$                | Maximum allowable acceleration                                                                                                                                            |                              | 50 m/s <sup>2</sup> |

Optional accessories for modules

Keyed gate/cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red

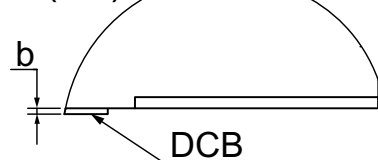
Type **ZY 180L** (L = Left for pin pair 4/5) } UL 758, style 1385,  
Type **ZY 180R** (R = right for pin pair 6/7) } CSA class 5851, guide 460-1-1

MCC... MCD... w/o pins 6 and 7

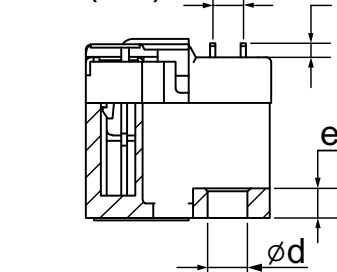


| Dim. | MIN<br>[mm] | MIN<br>[mm] | MIN<br>[inch] | MIN<br>[inch] |
|------|-------------|-------------|---------------|---------------|
| a    | 30.0        | 30.6        | 1.181         | 1.205         |
| b    | typ. 0.25   |             | typ. 0.010    |               |
| c    | 64.0        | 65.0        | 2.520         | 2.559         |
| d    | 6.5         | 7.0         | 0.256         | 0.275         |
| e    | 4.9         | 5.1         | 0.193         | 0.201         |
| f    | 28.6        | 29.2        | 1.126         | 1.150         |
| g    | 7.3         | 7.7         | 0.287         | 0.303         |
| h    | 93.5        | 94.5        | 3.681         | 3.720         |
| i    | 79.5        | 80.5        | 3.130         | 3.169         |
| j    | 4.8         | 5.2         | 0.189         | 0.205         |
| 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    |               |
| q    | 22.8        | 23.3        | 0.898         | 0.917         |
| r    | 1.8         | 2.4         | 0.071         | 0.041         |

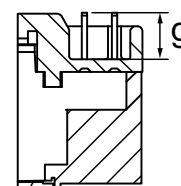
A (3:1)



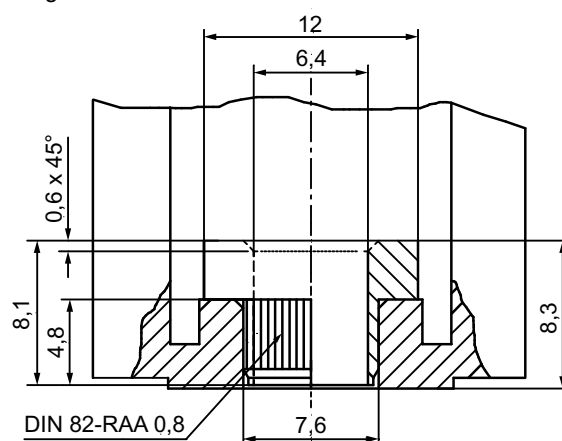
B-B (1:1)



C-C (1:1)



Plug socket



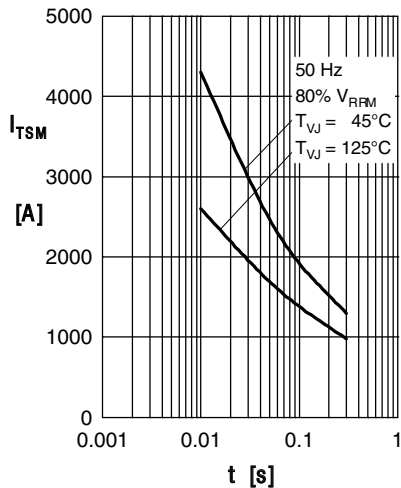


Fig. 1 Surge overload current  $I_{TSM}$ ,  
 $I_{FSM}$ : Crest value,  $t$ : duration

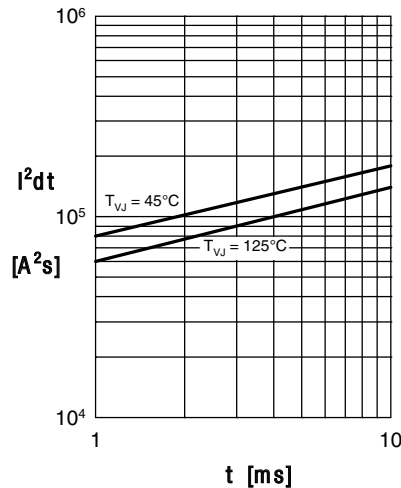


Fig. 2  $I^2t$  versus time (1-10 ms)

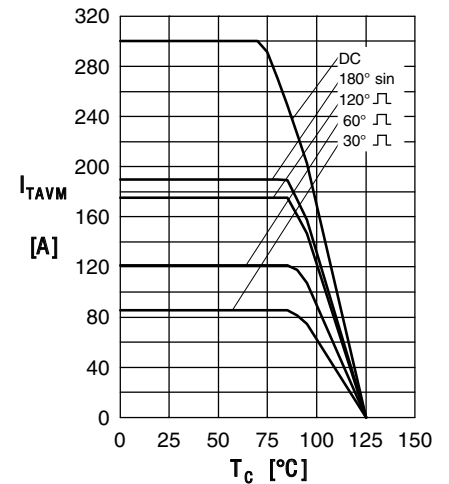


Fig. 3 Max. forward current  
at case temperature

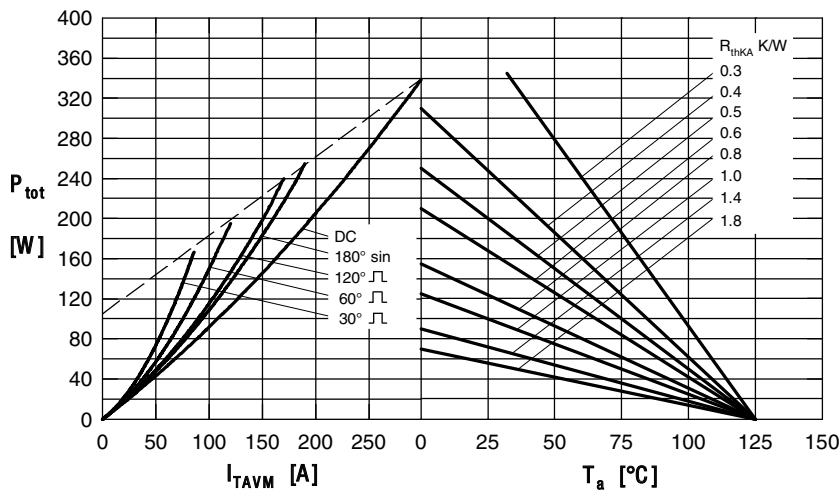


Fig. 4 Power dissipation vs. on-state current & ambient temperature  
(per thyristor or diode)

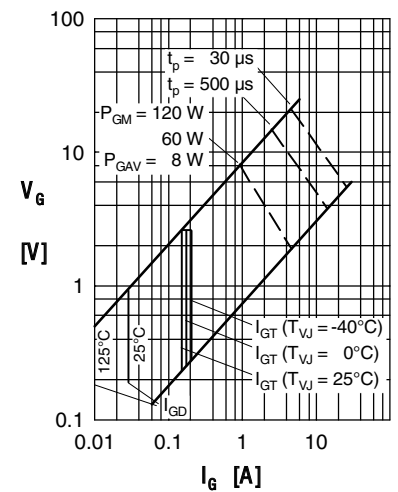


Fig. 5 Gate trigger characteristics

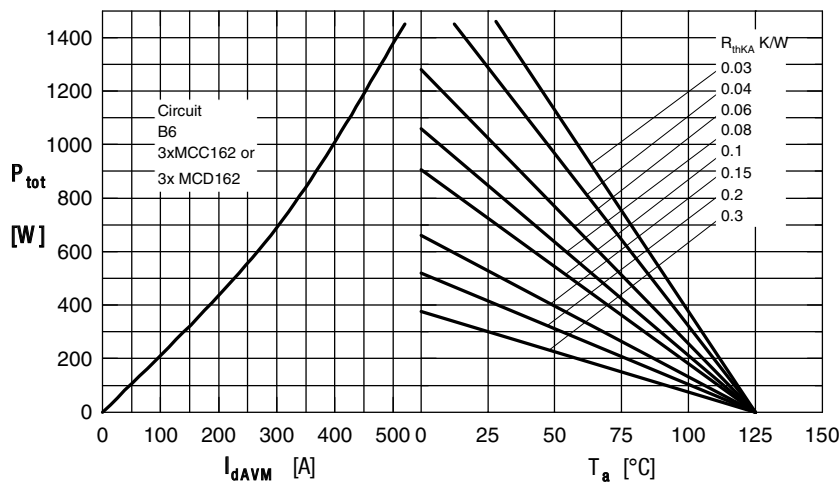


Fig. 6 Three phase rectifier bridge: Power dissipation versus direct  
output current and ambient temperature

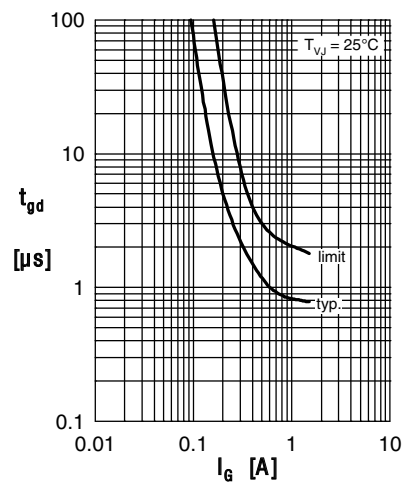


Fig. 7 Gate trigger delay time

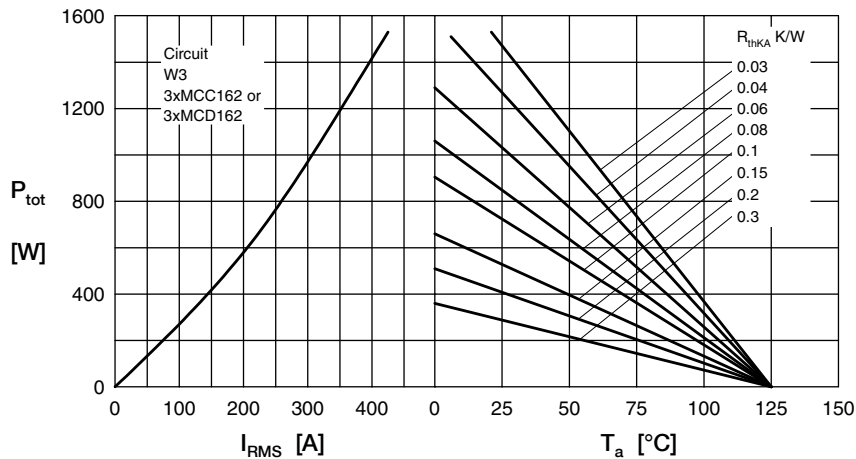


Fig. 8 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

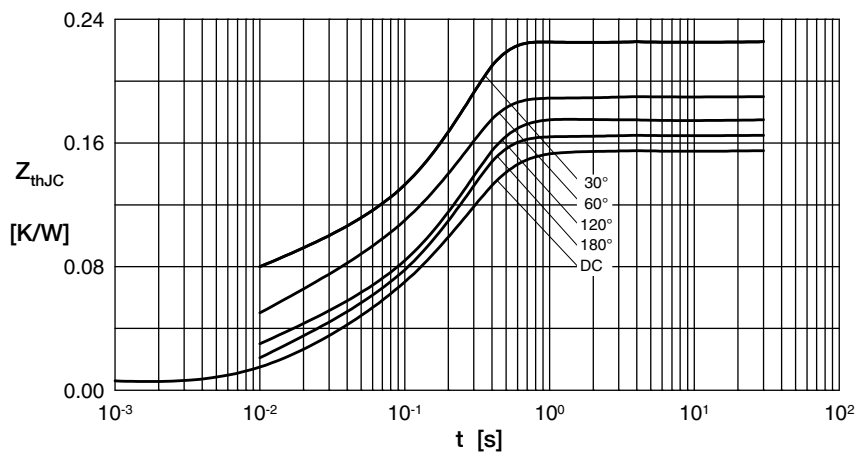


Fig. 9 Transient thermal impedance junction to case (per thyristor/diode)

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

| d    | $R_{thJC}$ [K/W] |
|------|------------------|
| DC   | 0.155            |
| 180° | 0.167            |
| 120° | 0.176            |
| 60°  | 0.197            |
| 30°  | 0.227            |

Constants for  $Z_{thJC}$  calculation:

| i | $R_{thi}$ [K/W] | $t_i$ [s] |
|---|-----------------|-----------|
| 1 | 0.0072          | 0.001     |
| 2 | 0.0188          | 0.080     |
| 3 | 0.1290          | 0.200     |

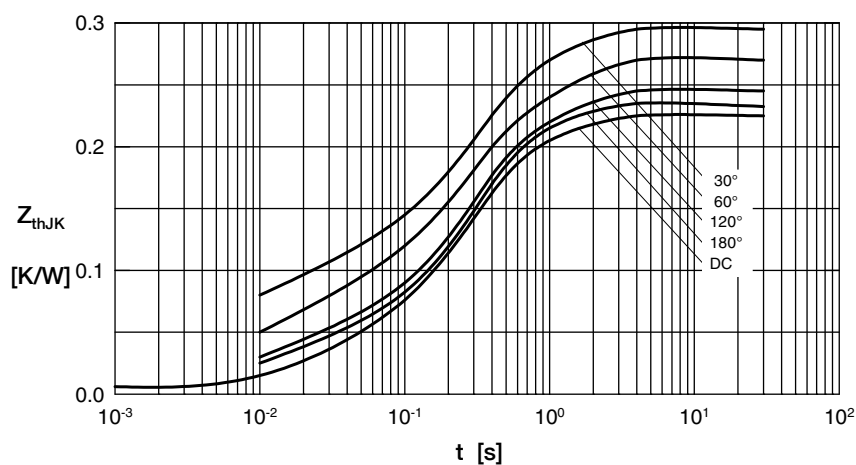


Fig. 10 Transient thermal impedance junction to heatsink (per thyristor/diode)

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

| d    | $R_{thJK}$ [K/W] |
|------|------------------|
| DC   | 0.225            |
| 180° | 0.237            |
| 120° | 0.246            |
| 60°  | 0.267            |
| 30°  | 0.297            |

Constants for  $Z_{thJK}$  calculation:

| i | $R_{thi}$ [K/W] | $t_i$ [s] |
|---|-----------------|-----------|
| 1 | 0.0072          | 0.001     |
| 2 | 0.0188          | 0.080     |
| 3 | 0.1290          | 0.200     |
| 4 | 0.0700          | 1.000     |