

# Thyristor Modules

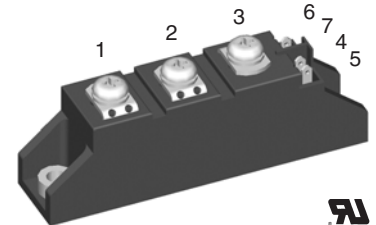
## Thyristor/Diode Modules

$$I_{TRMS} = 2 \times 180 \text{ A}$$

$$I_{TAVM} = 2 \times 116 \text{ A}$$

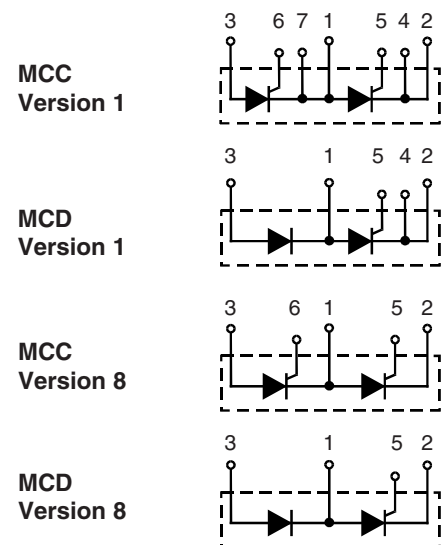
$$V_{RRM} = 800-1800 \text{ V}$$

| $V_{RSM}$<br>$V_{DSM}$<br>V | $V_{RRM}$<br>$V_{DRM}$<br>V | Type      |               |     |           |               |     |  |
|-----------------------------|-----------------------------|-----------|---------------|-----|-----------|---------------|-----|--|
|                             |                             | Version   | 1 B           | 8 B | Version   | 1 B           | 8 B |  |
| 900                         | 800                         | MCC 95-08 | io1 B / io8 B |     | MCD 95-08 | io1 B / io8 B |     |  |
| 1300                        | 1200                        | MCC 95-12 | io1 B / io8 B |     | MCD 95-12 | io1 B / io8 B |     |  |
| 1500                        | 1400                        | MCC 95-14 | io1 B / io8 B |     | MCD 95-14 | io1 B / io8 B |     |  |
| 1700                        | 1600                        | MCC 95-16 | io1 B / io8 B |     | MCD 95-16 | io1 B / io8 B |     |  |
| 1900                        | 1800                        | MCC 95-18 | io1 B / io8 B |     | MCD 95-18 | io1 B / io8 B |     |  |

**TO-240 AA**


| Symbol                                       | Conditions                                                                                                                                                             | Maximum Ratings                                                         |                                       |
|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|---------------------------------------|
| $I_{TRMS}, I_{FRMS}$<br>$I_{TAVM}, I_{FAVM}$ | $T_{VJ} = T_{VJM}$<br>$T_C = 85^\circ\text{C}; 180^\circ \text{ sine}$                                                                                                 | 180<br>116                                                              | A<br>A                                |
| $I_{TSM}, I_{FSM}$                           | $T_{VJ} = 45^\circ\text{C}$<br>$V_R = 0$                                                                                                                               | $t = 10 \text{ ms (50 Hz), sine}$<br>$t = 8.3 \text{ ms (60 Hz), sine}$ | 2250<br>2400 A                        |
|                                              | $T_{VJ} = T_{VJM}$<br>$V_R = 0$                                                                                                                                        | $t = 10 \text{ ms (50 Hz), sine}$<br>$t = 8.3 \text{ ms (60 Hz), sine}$ | 2000<br>2150 A                        |
|                                              | $T_{VJ} = 45^\circ\text{C}$<br>$V_R = 0$                                                                                                                               | $t = 10 \text{ ms (50 Hz), sine}$<br>$t = 8.3 \text{ ms (60 Hz), sine}$ | 25 300<br>23 900 $\text{A}^2\text{s}$ |
|                                              | $T_{VJ} = T_{VJM}$<br>$V_R = 0$                                                                                                                                        | $t = 10 \text{ ms (50 Hz), sine}$<br>$t = 8.3 \text{ ms (60 Hz), sine}$ | 20 000<br>19 100 $\text{A}^2\text{s}$ |
| $j^2dt$                                      | $T_{VJ} = 45^\circ\text{C}$<br>$V_R = 0$                                                                                                                               | $t = 10 \text{ ms (50 Hz), sine}$<br>$t = 8.3 \text{ ms (60 Hz), sine}$ | 25 300<br>23 900 $\text{A}^2\text{s}$ |
| $(di/dt)_{cr}$                               | $T_{VJ} = T_{VJM};$<br>$f = 50 \text{ Hz}; t_p = 200 \mu\text{s}$<br>$V_D = \frac{2}{3} V_{DRM};$<br>$I_G = 0.45 \text{ A};$<br>$di_G/dt = 0.45 \text{ A}/\mu\text{s}$ | repetitive, $I_T = 250 \text{ A}$                                       | 150 $\text{A}/\mu\text{s}$            |
|                                              |                                                                                                                                                                        | non repetitive, $I_T = I_{TAVM}$                                        | 500 $\text{A}/\mu\text{s}$            |
| $(dv/dt)_{cr}$                               | $T_{VJ} = T_{VJM};$<br>$R_{GK} = \infty; \text{method 1 (linear voltage rise)}$                                                                                        | $V_{DR} = \frac{2}{3} V_{DRM}$                                          | 1000 $\text{V}/\mu\text{s}$           |
| $P_{GM}$                                     | $T_{VJ} = T_{VJM};$<br>$I_T = I_{TAVM};$                                                                                                                               | $t_p = 30 \mu\text{s}$<br>$t_p = 300 \mu\text{s}$                       | 10<br>5 W                             |
|                                              |                                                                                                                                                                        |                                                                         |                                       |
| $P_{GAV}$                                    |                                                                                                                                                                        |                                                                         | 0.5 W                                 |
| $V_{RGM}$                                    |                                                                                                                                                                        |                                                                         | 10 V                                  |
| $T_{VJ}$                                     |                                                                                                                                                                        |                                                                         | -40...+125 $^\circ\text{C}$           |
| $T_{VJM}$                                    |                                                                                                                                                                        |                                                                         | 125 $^\circ\text{C}$                  |
| $T_{stg}$                                    |                                                                                                                                                                        |                                                                         | -40...+125 $^\circ\text{C}$           |
| $V_{ISOL}$                                   | 50/60 Hz, RMS;                                                                                                                                                         | $t = 1 \text{ min}$                                                     | 3000 V~                               |
|                                              | $I_{ISOL} \leq 1 \text{ mA};$                                                                                                                                          | $t = 1 \text{ s}$                                                       | 3600 V~                               |
| $M_d$                                        | Mounting torque (M5)                                                                                                                                                   |                                                                         | 2.5-4.0/22-35 Nm/lb.in.               |
|                                              | Terminal connection torque (M5)                                                                                                                                        |                                                                         | 2.5-4.0/22-35 Nm/lb.in.               |
| Weight                                       | Typical including screws                                                                                                                                               |                                                                         | 90 g                                  |

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



### Features

- International standard package, JEDEC TO-240 AA
- Direct copper bonded  $\text{Al}_2\text{O}_3$  -ceramic base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered, E72873
- Gate-cathode twin pins for version 1

### Applications

- DC motor control
- Softstart AC motor controller
- Light, heat and temperature control

### Advantages

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

| Symbol             | Conditions                                                                                                                                                                              | Characteristic Values |
|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| $I_{RRM}, I_{DRM}$ | $T_{VJ} = T_{VJM}; V_R = V_{RRM}; V_D = V_{DRM}$                                                                                                                                        | 5 mA                  |
| $V_T, V_F$         | $I_T/I_F = 300 \text{ A}; T_{VJ} = 25^\circ\text{C}$                                                                                                                                    | 1.5 V                 |
| $V_{T0}$           | For power-loss calculations only ( $T_{VJ} = 125^\circ\text{C}$ )                                                                                                                       | 0.8 V                 |
| $r_T$              |                                                                                                                                                                                         | 2.4 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                |
| $V_{GD}$           | $T_{VJ} = T_{VJM}; V_D = \frac{2}{3} V_{DRM}$                                                                                                                                           | 0.2 V                 |
| $I_{GD}$           |                                                                                                                                                                                         | 10 mA                 |
| $I_L$              | $T_{VJ} = 25^\circ\text{C}; t_p = 10 \mu\text{s}; V_D = 6 \text{ V}$<br>$I_G = 0.45 \text{ A}; di_G/dt = 0.45 \text{ A}/\mu\text{s}$                                                    | 450 mA                |
| $I_H$              | $T_{VJ} = 25^\circ\text{C}; V_D = 6 \text{ V}; R_{GK} = \infty$                                                                                                                         | 200 mA                |
| $t_{gd}$           | $T_{VJ} = 25^\circ\text{C}; V_D = \frac{1}{2} V_{DRM}$<br>$I_G = 0.45 \text{ A}; di_G/dt = 0.45 \text{ A}/\mu\text{s}$                                                                  | 2 μs                  |
| $t_q$              | $T_{VJ} = T_{VJM}; I_T = 150 \text{ A}; t_p = 200 \mu\text{s}; -di/dt = 10 \text{ A}/\mu\text{s}$<br>$V_R = 100 \text{ V}; dv/dt = 20 \text{ V}/\mu\text{s}; V_D = \frac{2}{3} V_{DRM}$ | typ. 185 μs           |
| $Q_S$              | $T_{VJ} = T_{VJM}; I_T/I_F = 50 \text{ A}; -di/dt = 6 \text{ A}/\mu\text{s}$                                                                                                            | 170 μC                |
| $I_{RM}$           |                                                                                                                                                                                         | 45 A                  |
| $R_{thJC}$         | per thyristor/diode; DC current per module                                                                                                                                              | 0.22 K/W              |
| $R_{thJK}$         | per thyristor/diode; DC current per module                                                                                                                                              | 0.11 K/W              |
|                    | other values see Fig. 8/9                                                                                                                                                               | 0.42 K/W              |
|                    |                                                                                                                                                                                         | 0.21 K/W              |
| $d_s$              | Creepage distance on surface                                                                                                                                                            | 12.7 mm               |
| $d_A$              | Strike distance through air                                                                                                                                                             | 9.6 mm                |
| $a$                | Maximum allowable acceleration                                                                                                                                                          | 50 m/s <sup>2</sup>   |

Optional accessories for module-type MCC 95 version 1 B

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

Type **ZY 200L** (L = Left for pin pair 4/5) } UL 758, style 1385,

Type **ZY 200R** (R = right for pin pair 6/7) } CSA class 5851, guide 460-1-1

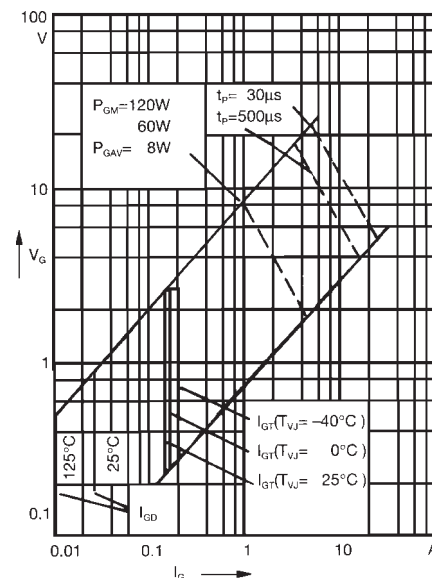


Fig. 1 Gate trigger characteristics

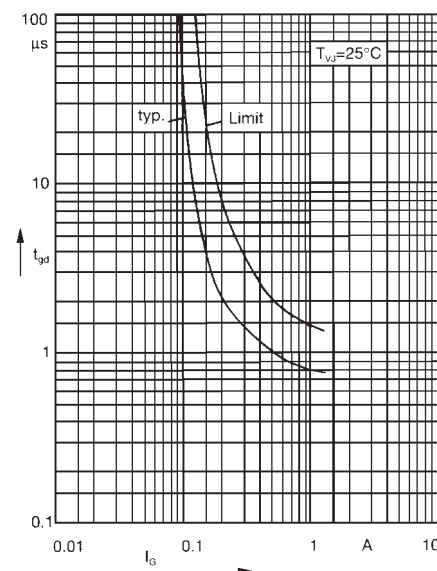
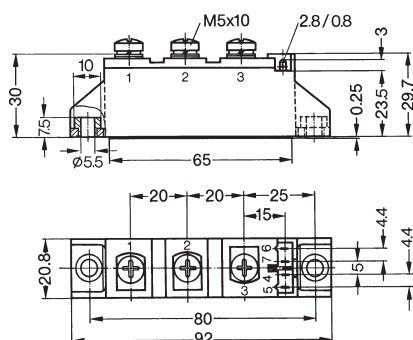


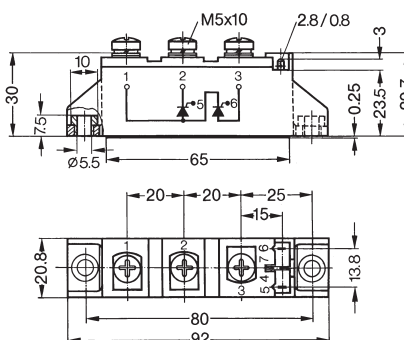
Fig. 2 Gate trigger delay time

Dimensions in mm (1 mm = 0.0394")

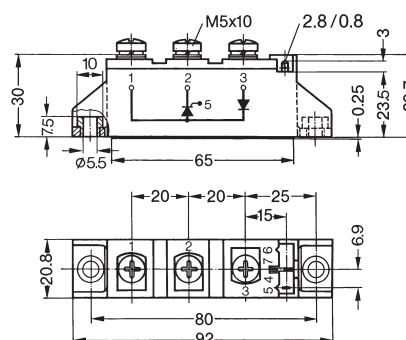
## MCC / MCD Version 1 B



## MCC Version 8 B



## MCD Version 8 B



Version 1 or 8 without B in typ designation = without insert in mounting holes

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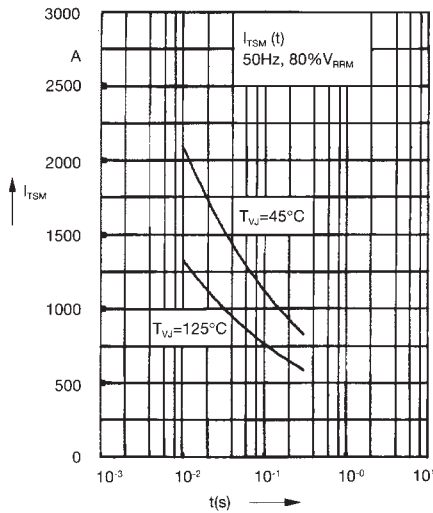


Fig. 3 Surge overload current  
 $I_{TSM}$ ,  $I_{FSM}$ : Crest value,  $t$ : duration

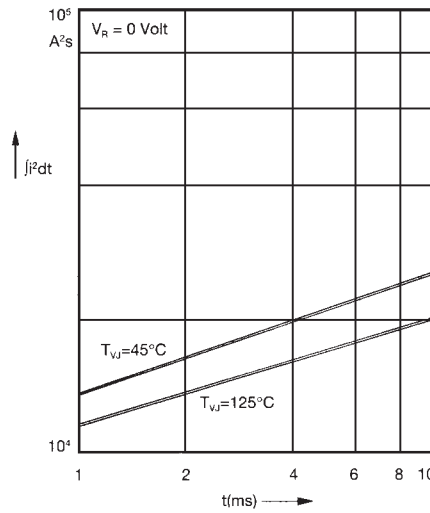


Fig. 4  $j^2dt$  versus time (1-10 ms)

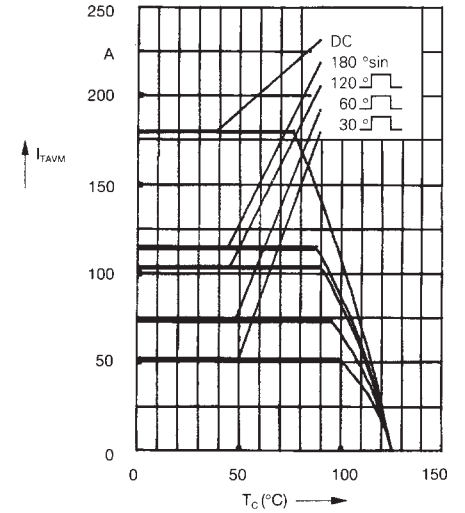


Fig. 4a Maximum forward current at case temperature

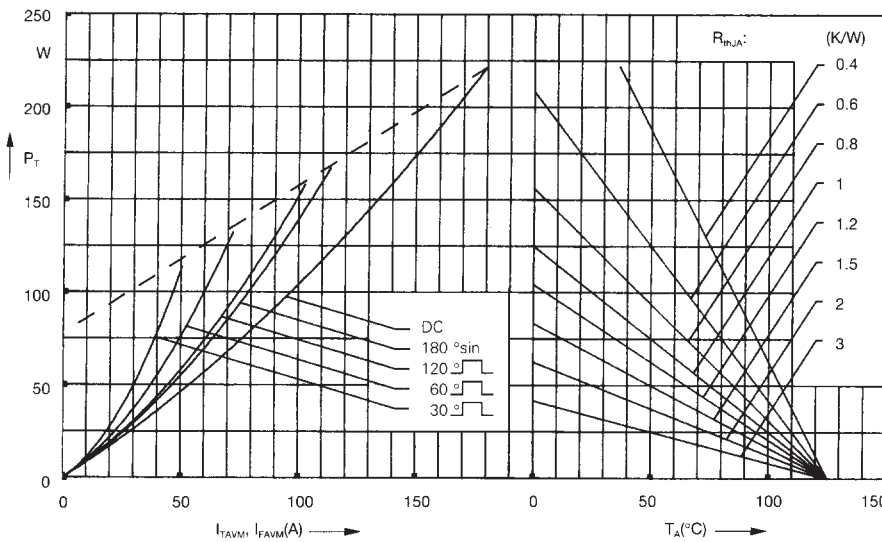


Fig. 5 Power dissipation versus on-state current and ambient temperature (per thyristor or diode)

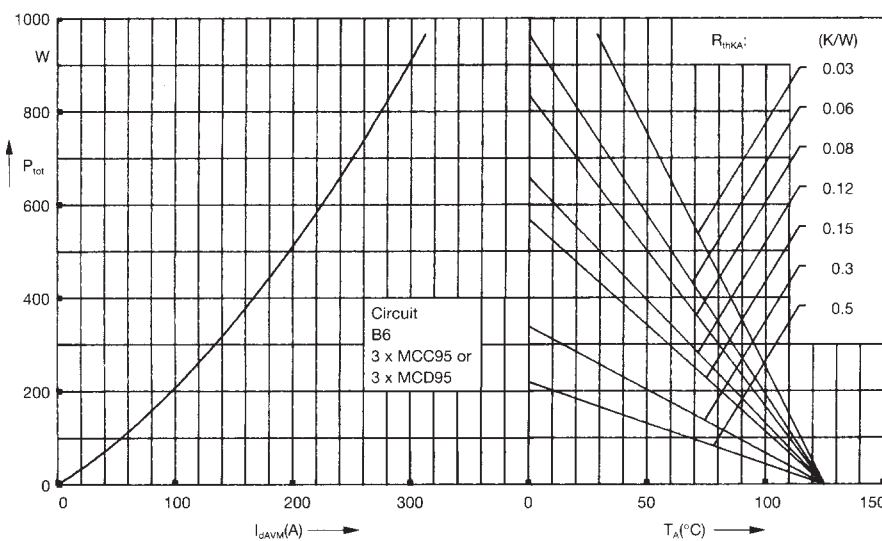


Fig. 6 Three phase rectifier bridge:  
Power dissipation versus direct output current and ambient temperature

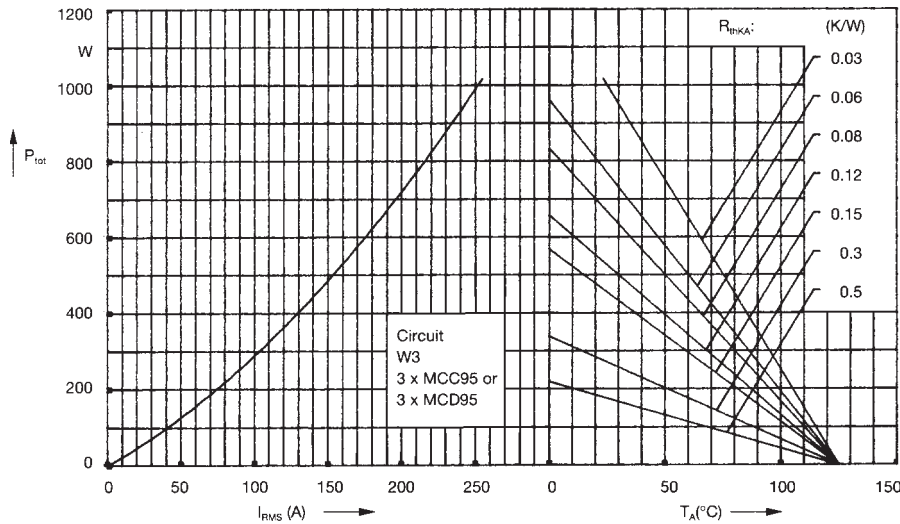


Fig. 7 Three phase AC-controller:  
Power dissipation versus RMS  
output current and ambient  
temperature

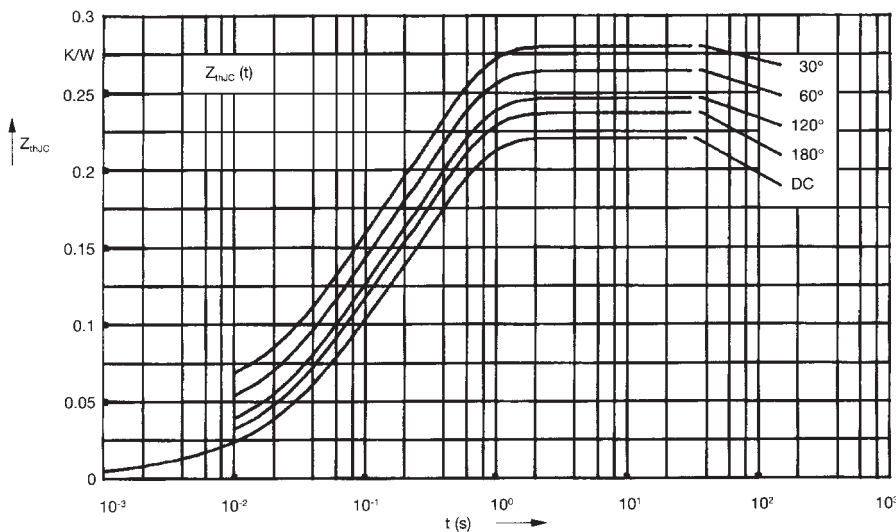


Fig. 8 Transient thermal impedance  
junction to case (per thyristor or  
diode)

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

| d    | $R_{thJC}$ (K/W) |
|------|------------------|
| DC   | 0.22             |
| 180° | 0.23             |
| 120° | 0.25             |
| 60°  | 0.27             |
| 30°  | 0.28             |

Constants for  $Z_{thJC}$  calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|-----------------|-----------|
| 1 | 0.0066          | 0.0019    |
| 2 | 0.0678          | 0.0477    |
| 3 | 0.1456          | 0.344     |

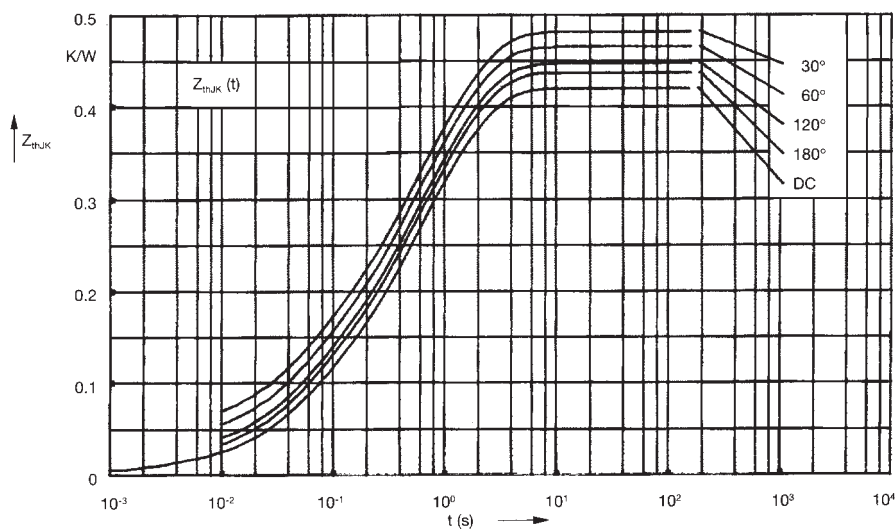


Fig. 9 Transient thermal impedance  
junction to heatsink (per thyristor  
or diode)

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

| d    | $R_{thJK}$ (K/W) |
|------|------------------|
| DC   | 0.42             |
| 180° | 0.43             |
| 120° | 0.45             |
| 60°  | 0.47             |
| 30°  | 0.48             |

Constants for  $Z_{thJK}$  calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|-----------------|-----------|
| 1 | 0.0066          | 0.0019    |
| 2 | 0.0678          | 0.0477    |
| 3 | 0.1456          | 0.344     |
| 4 | 0.2             | 1.32      |

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