

# Thyristor Modules

## Thyristor/Diode Modules

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

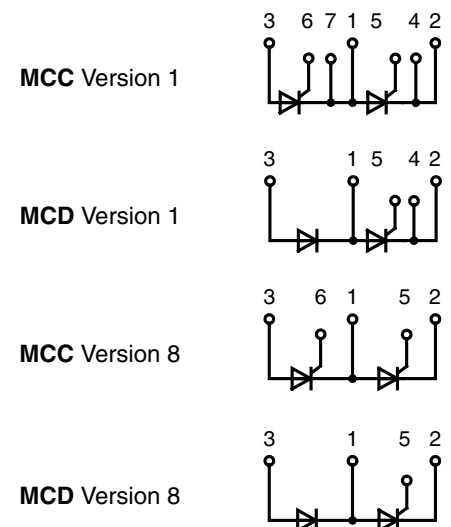
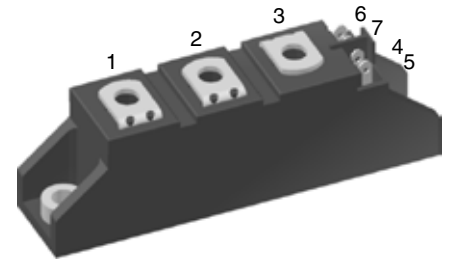
$$I_{TAVM} = 2 \times 116 \text{ A}$$

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

| $V_{RSM}$<br>$V_{DSM}$<br>V | $V_{RRM}$<br>$V_{DRM}$<br>V | Type      | Version     | 1B | 8B | Version   | 1B          | 8B |
|-----------------------------|-----------------------------|-----------|-------------|----|----|-----------|-------------|----|
| 900                         | 800                         | MCC 95-08 | io1B / io8B |    |    | MCD 95-08 | io1B / io8B |    |
| 1300                        | 1200                        | MCC 95-12 | io1B / io8B |    |    | MCD 95-12 | io1B / io8B |    |
| 1500                        | 1400                        | MCC 95-14 | io1B / io8B |    |    | MCD 95-14 | io1B / io8B |    |
| 1700                        | 1600                        | MCC 95-16 | io1B / io8B |    |    | MCD 95-16 | io1B / io8B |    |
| 1900                        | 1800                        | MCC 95-18 | io1B / io8B |    |    | MCD 95-18 | io1B / io8B |    |

| 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 A<br>116 A                                                                                                  |
| $I_{TSM}, I_{FSM}$                           | $T_{VJ} = 45^\circ\text{C}$<br>$V_R = 0$<br>$t = 10 \text{ ms}$ (50 Hz)<br>$t = 8.3 \text{ ms}$ (60 Hz)                                                              | 2250 A<br>2400 A                                                                                                |
| $I^2t$                                       | $T_{VJ} = 45^\circ\text{C}$<br>$V_R = 0$<br>$t = 10 \text{ ms}$ (50 Hz)<br>$t = 8.3 \text{ ms}$ (60 Hz)                                                              | 25 300 A <sup>2</sup> s<br>23 900 A <sup>2</sup> 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 A/ $\mu\text{s}$<br>non repetitive, $I_T = I_{TAVM}$ 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/ $\mu\text{s}$                                                                                           |
| $P_{GM}$                                     | $T_{VJ} = T_{VJM}; t_p = 30 \mu\text{s}$<br>$I_T = I_{T(AV)M}; t_p = 500 \mu\text{s}$                                                                                | 10 W<br>5 W                                                                                                     |
| $P_{GAV}$                                    |                                                                                                                                                                      | 0.5 W                                                                                                           |
| $V_{RGM}$                                    |                                                                                                                                                                      | 10 V                                                                                                            |
| $T_{VJ}$<br>$T_{VJM}$<br>$T_{stg}$           |                                                                                                                                                                      | -40...+125 °C<br>125 °C<br>-40...+125 °C                                                                        |
| $V_{ISOL}$                                   | 50/60 Hz, RMS $t = 1 \text{ min}$<br>$I_{ISOL} \leq 1 \text{ mA}$ $t = 1 \text{ s}$                                                                                  | 3000 V~<br>3600 V~                                                                                              |
| $M_d$                                        | Mounting torque (M5)<br>Terminal connection torque (M5)                                                                                                              | 2.5 - 4 Nm<br>2.5 - 4 Nm                                                                                        |
| Weight                                       | Typical including screws                                                                                                                                             | 85 g                                                                                                            |

Data according to IEC 60747 and refer to a single 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, E 72873
- 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 & power cycling
- Reduced protection circuits

| Symbol             | Conditions                                                                                                                                     | Characteristic Values        |                     |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|---------------------|
|                    |                                                                                                                                                | typ.                         | max.                |
| $I_{RRM}, I_{DRM}$ | $V_R / V_D = V_{RRM} / V_{DRM}$                                                                                                                | $T_{VJ} = T_{VJM}$           | 5 mA                |
| $V_T, V_F$         | $I_T / I_F = 300$ A                                                                                                                            | $T_{VJ} = 25^\circ\text{C}$  | 1.5 V               |
| $V_{T0}$           | For power-loss calculations only                                                                                                               |                              | 0.8 V               |
| $r_t$              |                                                                                                                                                | $T_{VJ} = T_{VJM}$           | 2.4 mΩ              |
| $V_{GT}$           | $V_D = 6$ V                                                                                                                                    | $T_{VJ} = 25^\circ\text{C}$  | 2.5 V               |
|                    |                                                                                                                                                | $T_{VJ} = -40^\circ\text{C}$ | 2.6 V               |
| $I_{GT}$           | $V_D = 6$ V                                                                                                                                    | $T_{VJ} = 25^\circ\text{C}$  | 150 mA              |
|                    |                                                                                                                                                | $T_{VJ} = -40^\circ\text{C}$ | 200 mA              |
| $V_{GD}$           | $V_D = 2/3 V_{DRM}$                                                                                                                            | $T_{VJ} = T_{VJM}$           | 0.2 V               |
| $I_{GD}$           |                                                                                                                                                |                              | 10 mA               |
| $I_L$              | $t_p = 10 \mu\text{s}; V_D = 6$ V<br>$I_G = 0.45$ A; $di_G/dt = 0.45$ A/ $\mu\text{s}$                                                         | $T_{VJ} = 25^\circ\text{C}$  | 450 mA              |
| $I_H$              | $V_D = 6$ V; $R_{GK} = \infty$ ;                                                                                                               | $T_{VJ} = 25^\circ\text{C}$  | 200 mA              |
| $t_{gd}$           | $V_D = 1/2 V_{DRM}$<br>$I_G = 0.45$ A; $di_G/dt = 0.45$ A/ $\mu\text{s}$                                                                       | $T_{VJ} = 25^\circ\text{C}$  | 2 $\mu\text{s}$     |
| $t_q$              | $V_D = 2/3 V_{DRM}$<br>$dv/dt = 20$ V/ $\mu\text{s}$ ; $-di/dt = 10$ A/ $\mu\text{s}$<br>$I_T = 150$ A; $V_R = 100$ V; $t_p = 200 \mu\text{s}$ | $T_{VJ} = T_{VJM}$           | 185 $\mu\text{s}$   |
| $Q_S$              | $I_T / I_F = 50$ A; $-di/dt = 6$ A/ $\mu\text{s}$                                                                                              | $T_{VJ} = T_{VJM}$           | 170 $\mu\text{C}$   |
| $I_{RM}$           |                                                                                                                                                |                              | 45 A                |
| $R_{thJC}$         | per thyristor; DC current                                                                                                                      | other values<br>see Fig. 8/9 | 0.22 K/W            |
|                    | per module                                                                                                                                     |                              | 0.11 K/W            |
| $R_{thJK}$         | per thyristor; DC current                                                                                                                      |                              | 0.42 K/W            |
|                    | per module                                                                                                                                     |                              | 0.21 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

Coded 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

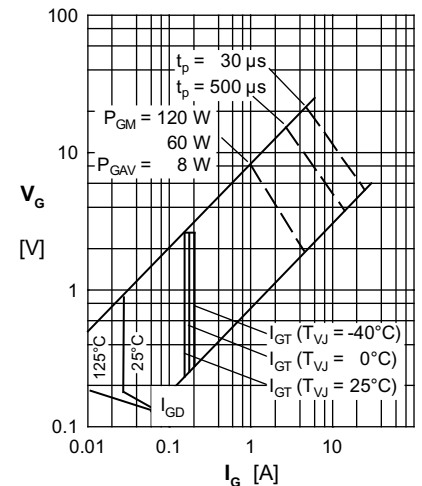


Fig. 1 Gate trigger characteristics

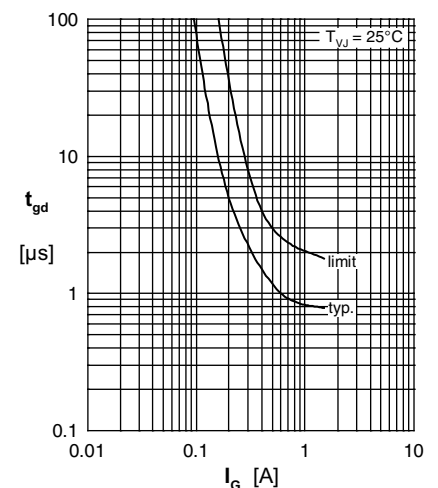
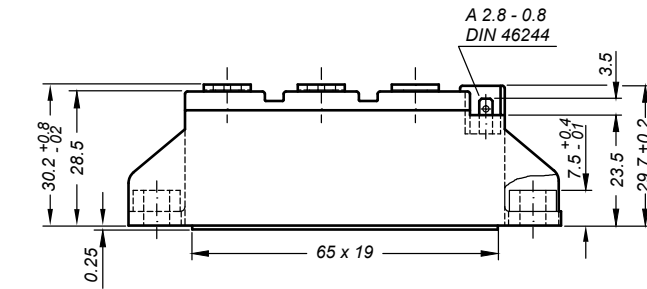


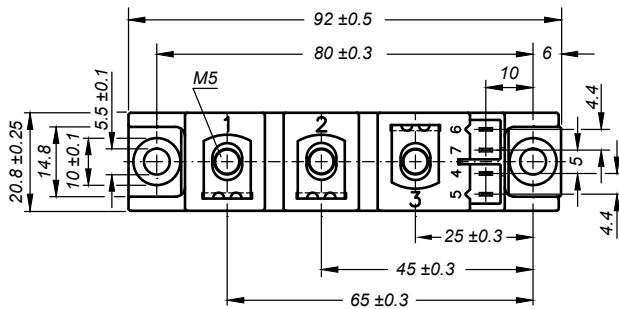
Fig. 2 Gate trigger delay time

Dimensions in mm (1 mm = 0.0394")

### MCC... Version 1B

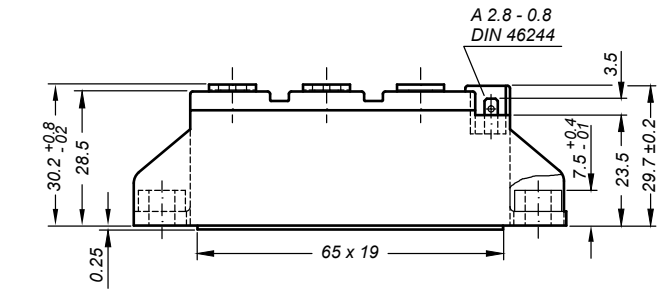


General tolerance: DIN ISO 2768 class „c“

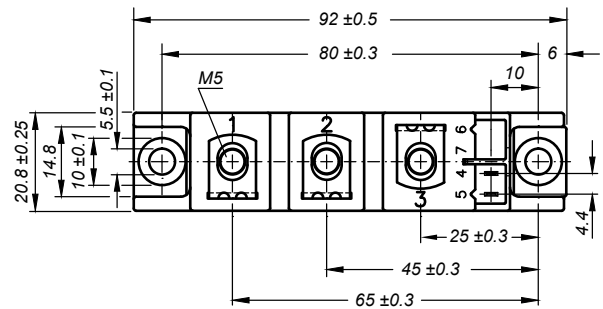


Optional accessories: Keyed gate/cathode twin plugs  
 Wire length: 350 mm, gate = yellow, cathode = red  
 UL 758, style 1385, CSA class 5851, guide 460-1-1  
 Type ZY 200L (L = Left for pin pair 4/5)  
 Type ZY 200R (R = Right for pin pair 6/7)

### MCD... Version 1B

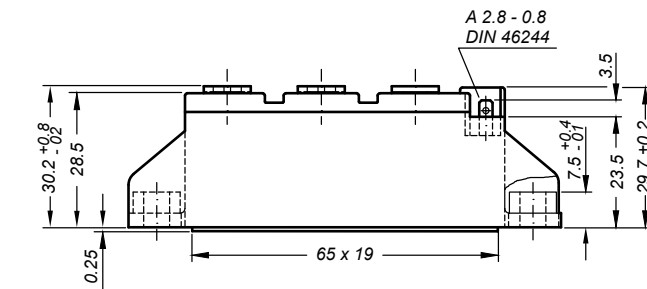


General tolerance: DIN ISO 2768 class „c“

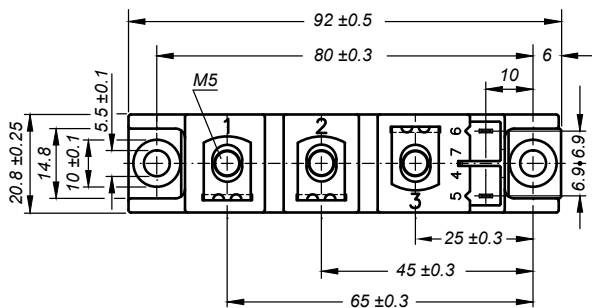


Optional accessories: Keyed gate/cathode twin plugs  
 Wire length: 350 mm, gate = yellow, cathode = red  
 UL 758, style 1385, CSA class 5851, guide 460-1-1  
 Type ZY 200L (L = Left for pin pair 4/5)

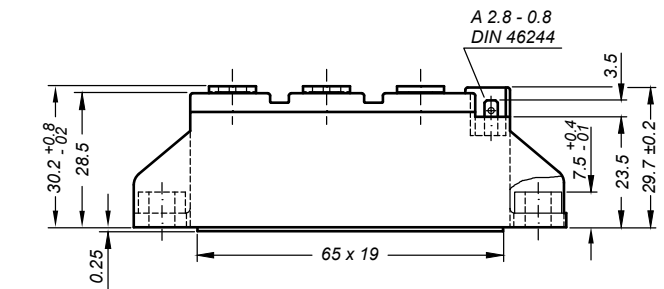
### MCC... Version 8B



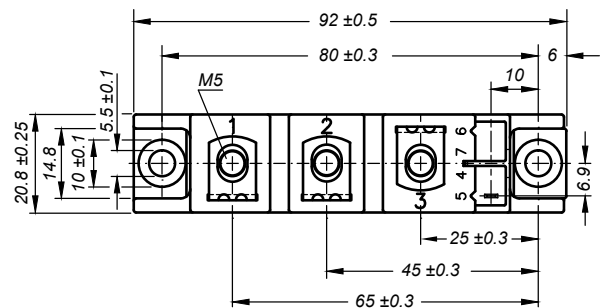
General tolerance: DIN ISO 2768 class „c“



### MCD... Version 8B



General tolerance: DIN ISO 2768 class „c“



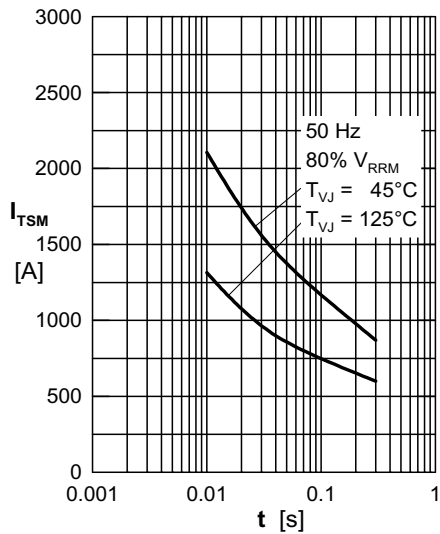


Fig. 3 Surge overload current  $I_{TSM}$ ,  
 $I_{FSM}$ : Crest value,  $t$ : duration

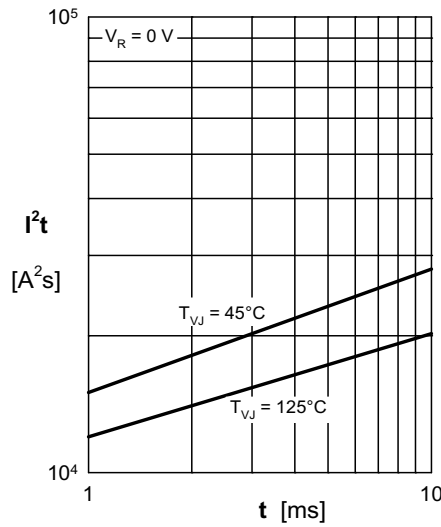


Fig. 4  $I^2t$  versus time (1-10 ms)

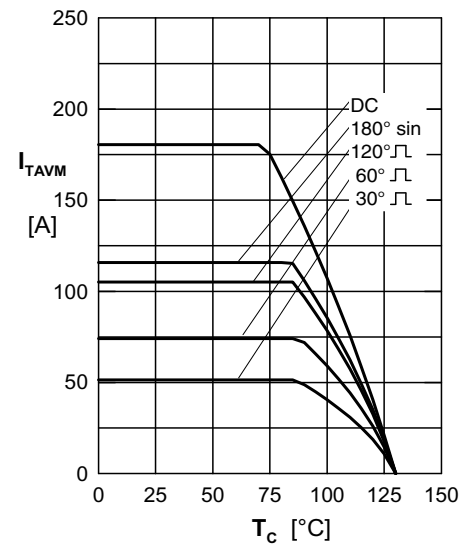


Fig. 4a Maximum forward current  
at case temperature

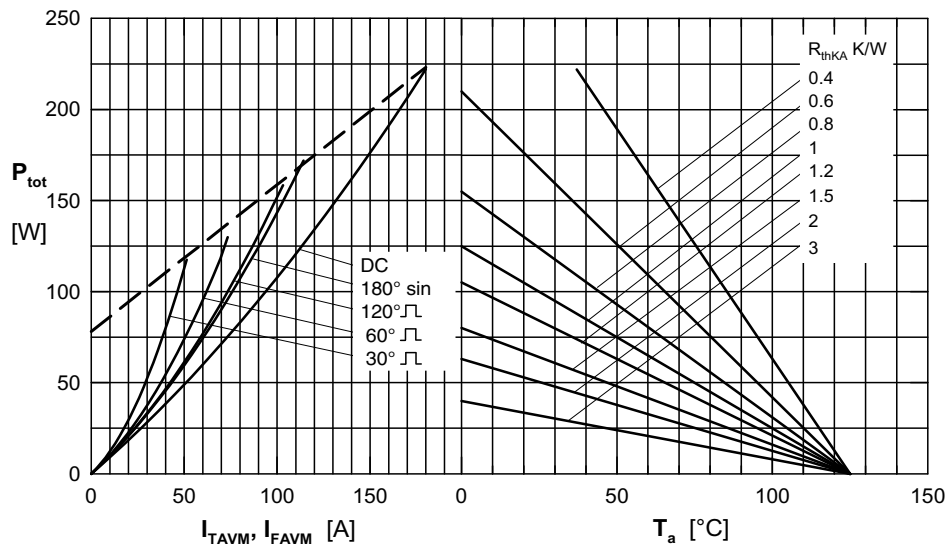


Fig. 5 Power dissipation versus  
on-state current & ambient  
temperature  
(per thyristor or diode)

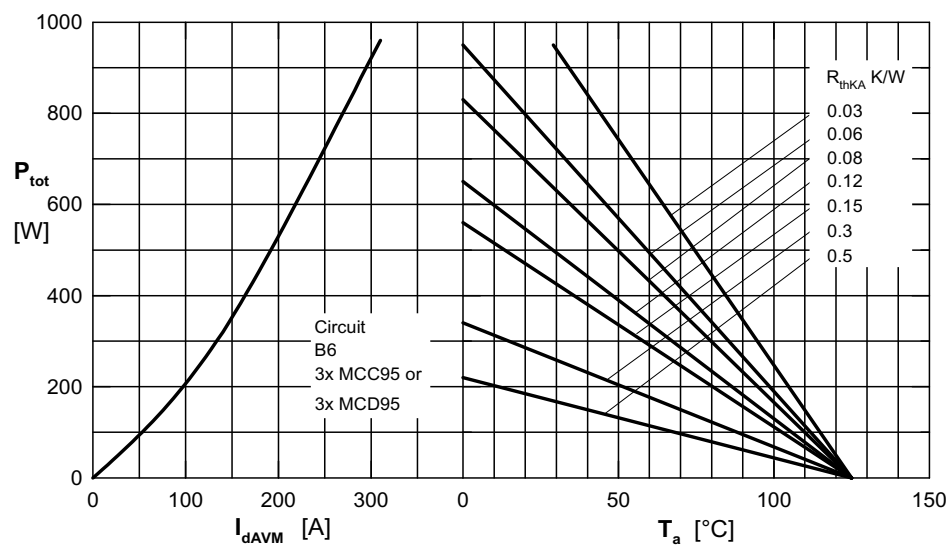


Fig. 6 Three phase rectifier bridge:  
Power dissipation vs. direct  
output current and ambient  
temperature

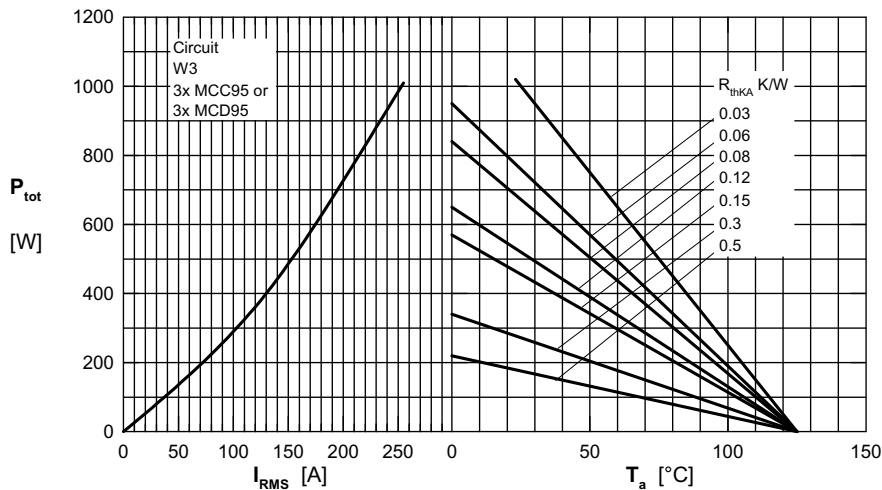


Fig. 7 Three phase AC-controller:  
Power dissipation versus RMS  
output current and ambient  
temperature

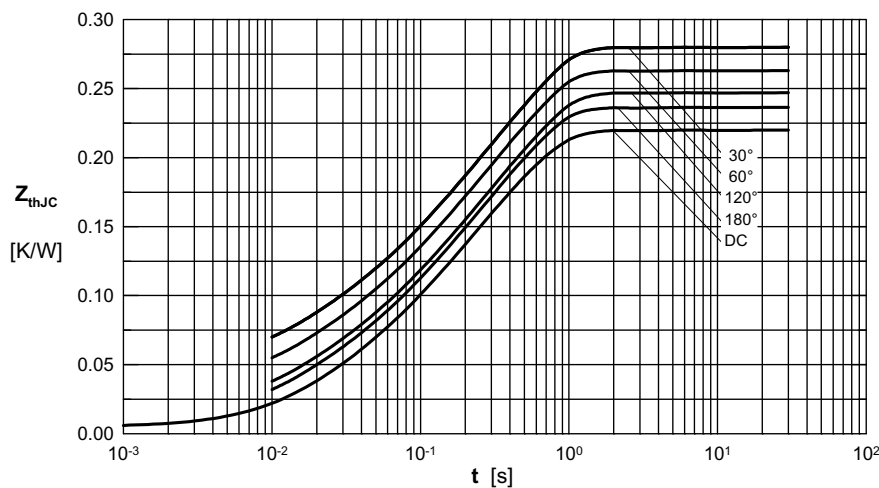


Fig. 8 Transient thermal impedance  
junction to case  
(per thyristor or diode)

$R_{thJC}$  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     |

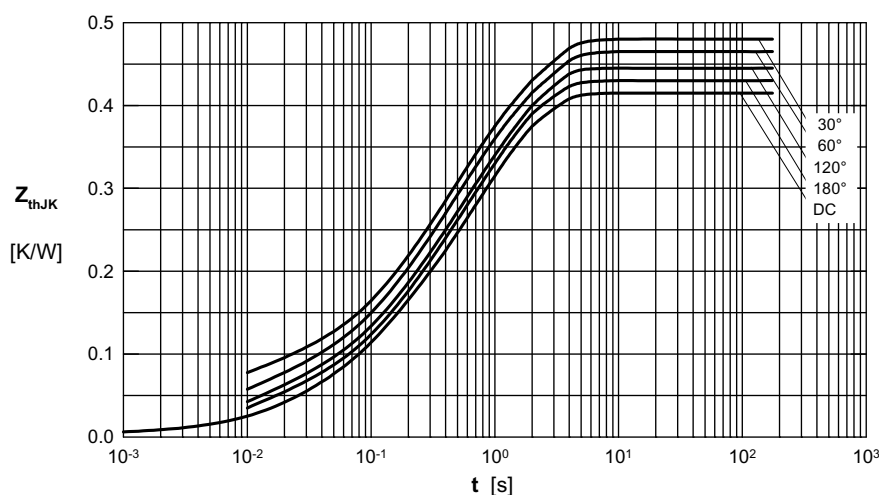


Fig. 9 Transient thermal impedance  
junction to heatsink  
(per thyristor or diode)

$R_{thJK}$  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      |