

# Thyristor Modules

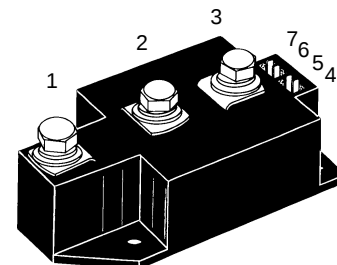
## Thyristor/Diode Modules

$$I_{TRMS} = 2 \times 500 \text{ A}$$

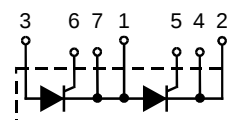
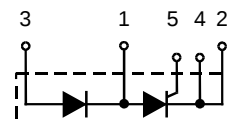
$$I_{TAVM} = 2 \times 320 \text{ A}$$

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

| $V_{RSM}$<br>$V_{DSM}$<br>V | $V_{RRM}$<br>$V_{DRM}$<br>V | Type          |               |
|-----------------------------|-----------------------------|---------------|---------------|
|                             |                             | Version 1     | Version 1     |
| 900                         | 800                         | MCC 310-08io1 | MCD 310-08io1 |
| 1300                        | 1200                        | MCC 310-12io1 | MCD 310-12io1 |
| 1500                        | 1400                        | MCC 310-14io1 | MCD 310-14io1 |
| 1700                        | 1600                        | MCC 310-16io1 | MCD 310-16io1 |
| 1900                        | 1800                        | MCC 310-18io1 | MCD 310-18io1 |



| Symbol                                       | Test Conditions                                                                                                                                       | Maximum Ratings                                                                                                            |
|----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| $I_{TRMS}, I_{FRMS}$<br>$I_{TAVM}, I_{FAVM}$ | $T_{VJ} = T_{VJM}$<br>$T_C = 85^\circ\text{C}; 180^\circ \text{ sine}$                                                                                | 500 A<br>320 A                                                                                                             |
| $I_{TSM}, I_{FSM}$                           | $T_{VJ} = 45^\circ\text{C};$<br>$V_R = 0$<br>$t = 10 \text{ ms (50 Hz), sine}$<br>$t = 8.3 \text{ ms (60 Hz), sine}$                                  | 9200 A<br>9800 A                                                                                                           |
|                                              | $T_{VJ} = T_{VJM}$<br>$V_R = 0$<br>$t = 10 \text{ ms (50 Hz), sine}$<br>$t = 8.3 \text{ ms (60 Hz), sine}$                                            | 8000 A<br>8600 A                                                                                                           |
| $\int i^2 dt$                                | $T_{VJ} = 45^\circ\text{C}$<br>$V_R = 0$<br>$t = 10 \text{ ms (50 Hz), sine}$<br>$t = 8.3 \text{ ms (60 Hz), sine}$                                   | 420 000 A <sup>2</sup> s<br>400 000 A <sup>2</sup> s                                                                       |
|                                              | $T_{VJ} = T_{VJM}$<br>$V_R = 0$<br>$t = 10 \text{ ms (50 Hz), sine}$<br>$t = 8.3 \text{ ms (60 Hz), sine}$                                            | 320 000 A <sup>2</sup> s<br>306 000 A <sup>2</sup> s                                                                       |
| $(di/dt)_{cr}$                               | $T_{VJ} = T_{VJM}$<br>$f = 50 \text{ Hz}, t_p = 200 \mu\text{s}$<br>$V_D = 2/3 V_{DRM}$<br>$I_G = 1 \text{ A}$<br>$di_G/dt = 1 \text{ A}/\mu\text{s}$ | repetitive, $I_T = 960 \text{ A}$<br>100 A/ $\mu\text{s}$<br>non repetitive, $I_T = 320 \text{ A}$<br>500 A/ $\mu\text{s}$ |
| $(dv/dt)_{cr}$                               | $T_{VJ} = T_{VJM};$<br>$R_{GK} = \infty; \text{ method 1 (linear voltage rise)}$<br>$V_{DR} = 2/3 V_{DRM}$                                            | 1000 V/ $\mu\text{s}$                                                                                                      |
| $P_{GM}$                                     | $T_{VJ} = T_{VJM}$<br>$I_T = I_{TAVM}$                                                                                                                | $t_p = 30 \mu\text{s}$<br>120 W<br>$t_p = 500 \mu\text{s}$<br>60 W                                                         |
| $P_{GAV}$                                    |                                                                                                                                                       | 20 W                                                                                                                       |
| $V_{RGM}$                                    |                                                                                                                                                       | 10 V                                                                                                                       |
| $T_{VJ}$                                     |                                                                                                                                                       | -40...+140 °C                                                                                                              |
| $T_{VJM}$                                    |                                                                                                                                                       | 140 °C                                                                                                                     |
| $T_{stg}$                                    |                                                                                                                                                       | -40...+125 °C                                                                                                              |
| $V_{ISOL}$                                   | 50/60 Hz, RMS<br>$I_{ISOL} \leq 1 \text{ mA}$                                                                                                         | $t = 1 \text{ min}$<br>3000 V~<br>$t = 1 \text{ s}$<br>3600 V~                                                             |
| $M_d$                                        | Mounting torque (M5)<br>Terminal connection torque (M8)                                                                                               | 2.5-5/22-44 Nm/lb.in.<br>12-15/106-132 Nm/lb.in.                                                                           |
| Weight                                       | Typical including screws                                                                                                                              | 320 g                                                                                                                      |

**MCC**

**MCD**


### 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

Data according to IEC 60747 and refer to a single thyristor/diode unless otherwise stated.  
 IXYS reserves the right to change limits, test conditions and dimensions

| Symbol     | Test Conditions                                                                                                                                                                 | Characteristic Values |                  |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------------------|
| $I_{RRM}$  | $T_{VJ} = T_{VJM}; V_R = V_{RRM}; V_D = V_{DRM}$                                                                                                                                | 70                    | mA               |
| $I_{DRM}$  |                                                                                                                                                                                 | 40                    | mA               |
| $V_T, V_F$ | $I_T, I_F = 600 \text{ A}; T_{VJ} = 25^\circ\text{C}$                                                                                                                           | 1.32                  | V                |
| $V_{T0}$   | For power-loss calculations only ( $T_{VJ} = 140^\circ\text{C}$ )                                                                                                               | 0.8                   | V                |
| $r_T$      |                                                                                                                                                                                 | 0.82                  | mΩ               |
| $V_{GT}$   | $V_D = 6 \text{ V}; T_{VJ} = 25^\circ\text{C}$                                                                                                                                  | 2                     | V                |
|            | $T_{VJ} = -40^\circ\text{C}$                                                                                                                                                    | 3                     | V                |
| $I_{GT}$   | $V_D = 6 \text{ V}; T_{VJ} = 25^\circ\text{C}$                                                                                                                                  | 150                   | mA               |
|            | $T_{VJ} = -40^\circ\text{C}$                                                                                                                                                    | 200                   | mA               |
| $V_{GD}$   | $T_{VJ} = T_{VJM}; V_D = 2/3 V_{DRM}$                                                                                                                                           | 0.25                  | V                |
| $I_{GD}$   |                                                                                                                                                                                 | 10                    | mA               |
| $I_L$      | $T_{VJ} = 25^\circ\text{C}; t_p = 30 \mu\text{s}; V_D = 6 \text{ V}$<br>$I_G = 0.45 \text{ A}; di_G/dt = 0.45 \text{ A}/\mu\text{s}$                                            | 200                   | mA               |
| $I_H$      | $T_{VJ} = 25^\circ\text{C}; V_D = 6 \text{ V}; R_{GK} = \infty$                                                                                                                 | 150                   | mA               |
| $t_{gd}$   | $T_{VJ} = 25^\circ\text{C}; V_D = 1/2 V_{DRM}$<br>$I_G = 1 \text{ A}; di_G/dt = 1 \text{ A}/\mu\text{s}$                                                                        | 2                     | μs               |
| $t_q$      | $T_{VJ} = T_{VJM}; I_T = 300 \text{ A}, t_p = 200 \mu\text{s}; -di/dt = 10 \text{ A}/\mu\text{s}$<br>$V_R = 100 \text{ V}; dv/dt = 50 \text{ V}/\mu\text{s}; V_D = 2/3 V_{DRM}$ | typ. 200              | μs               |
| $Q_S$      | $T_{VJ} = 125^\circ\text{C}; I_T, I_F = 400 \text{ A}, -di/dt = 50 \text{ A}/\mu\text{s}$                                                                                       | 760                   | μC               |
| $I_{RM}$   |                                                                                                                                                                                 | 275                   | A                |
| $R_{thJC}$ | per thyristor/diode; DC current per module                                                                                                                                      | 0.112                 | K/W              |
| $R_{thJK}$ | per thyristor/diode; DC current per module                                                                                                                                      | 0.056                 | K/W              |
|            |                                                                                                                                                                                 | 0.152                 | K/W              |
|            |                                                                                                                                                                                 | 0.076                 | 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 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

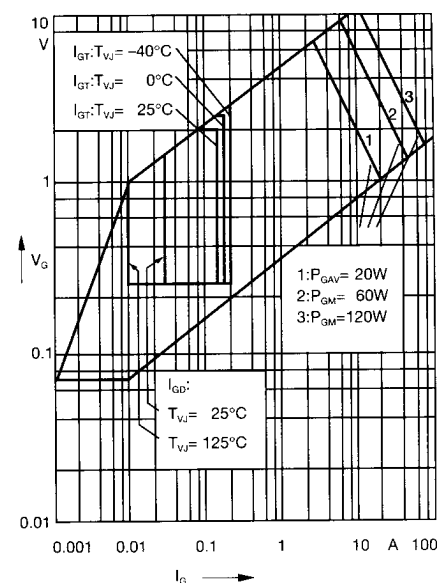


Fig. 1 Gate trigger characteristics

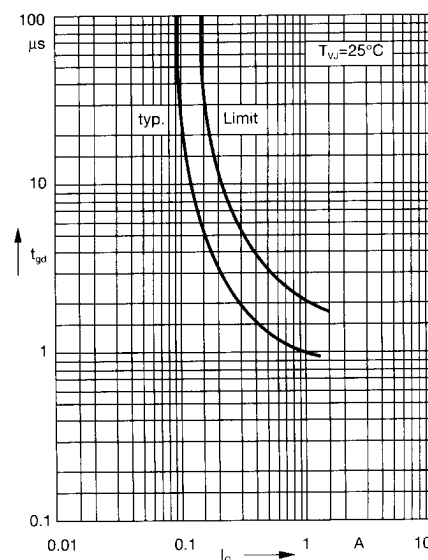
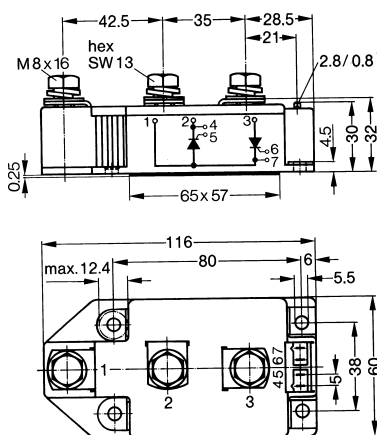


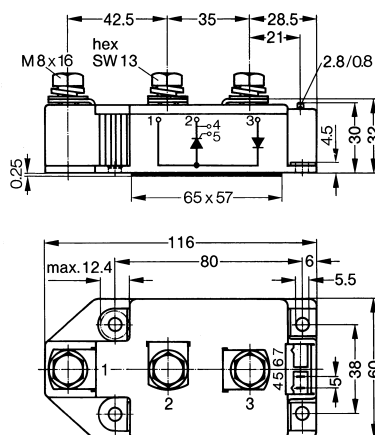
Fig. 2 Gate trigger delay time

**Dimensions in mm (1 mm = 0.0394")**

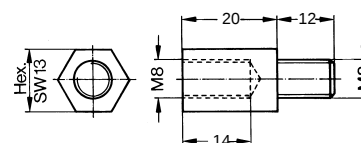
## MCC



**MCD**



Threaded spacer for higher Anode/  
Cathode construction:  
Type **ZY 250**, material brass



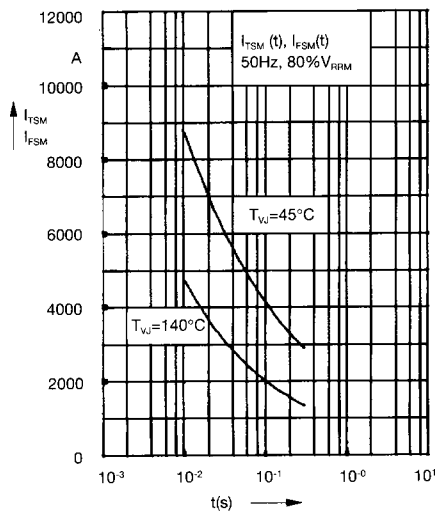


Fig. 3 Surge overload current  
 $I_{TSM}, I_{FSM}$ : Crest value,  $t$ : duration

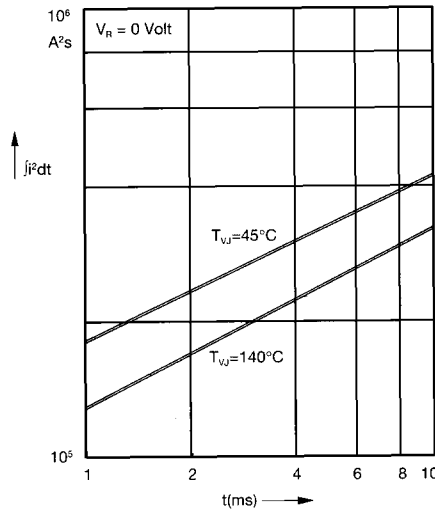


Fig. 4  $\int i^2 dt$  versus time (1-10 ms)

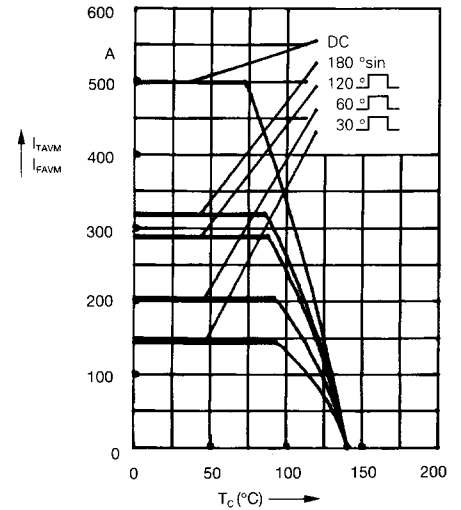


Fig. 4a Maximum forward current at case temperature

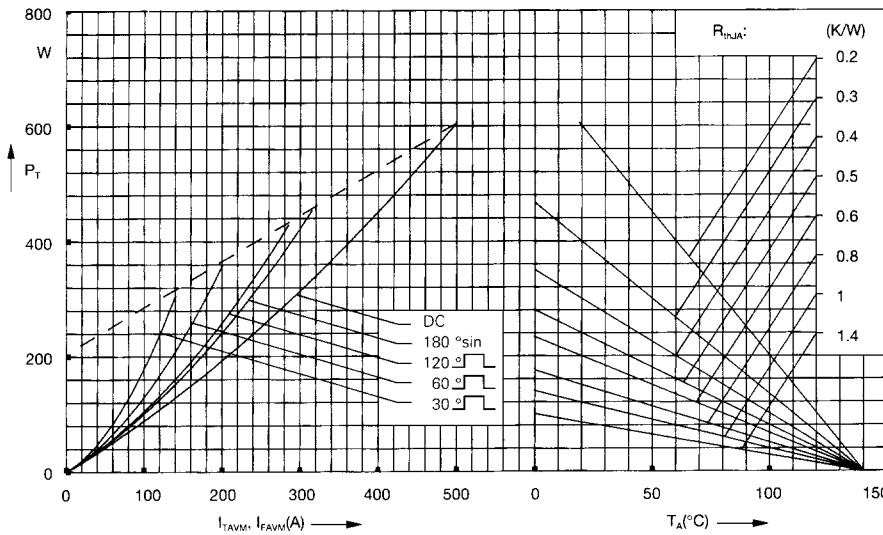


Fig. 5 Power dissipation versus on-state current and ambient temperature (per thyristor or diode)

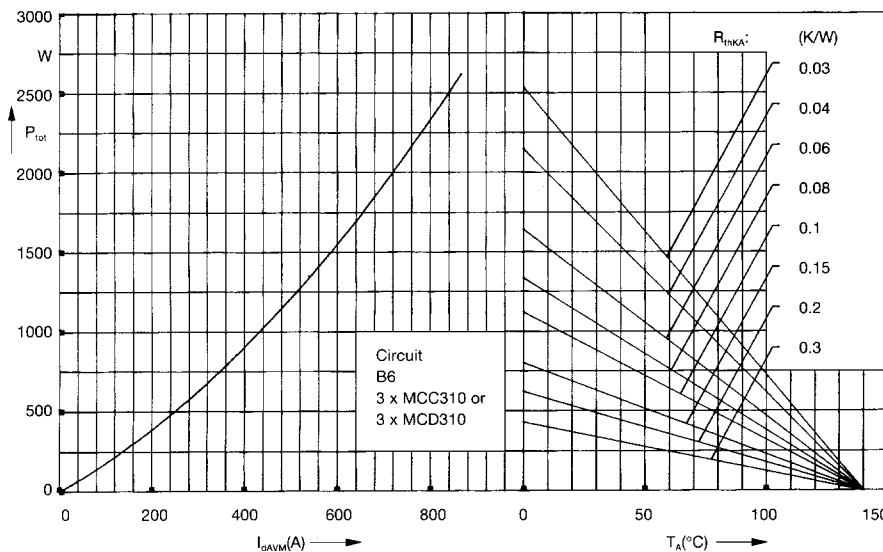


Fig. 6 Three phase rectifier bridge:  
Power dissipation versus direct output current and ambient temperature

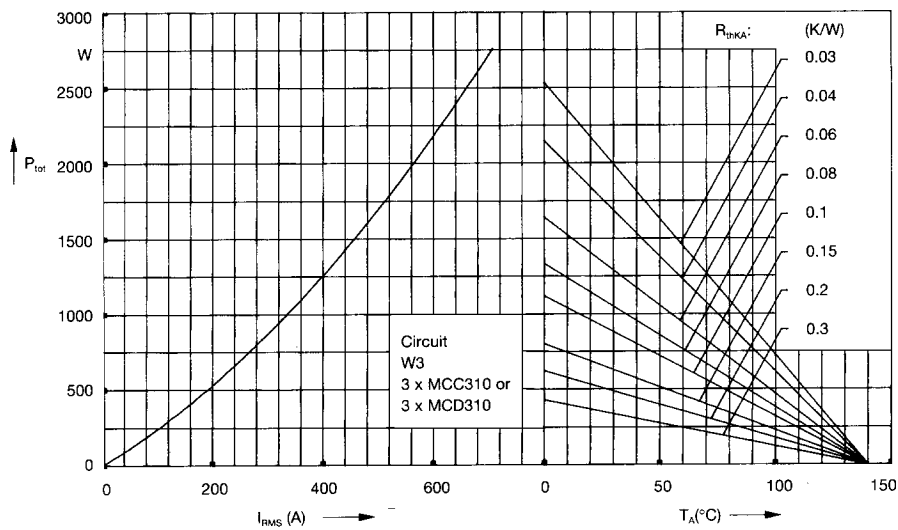


Fig. 7 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

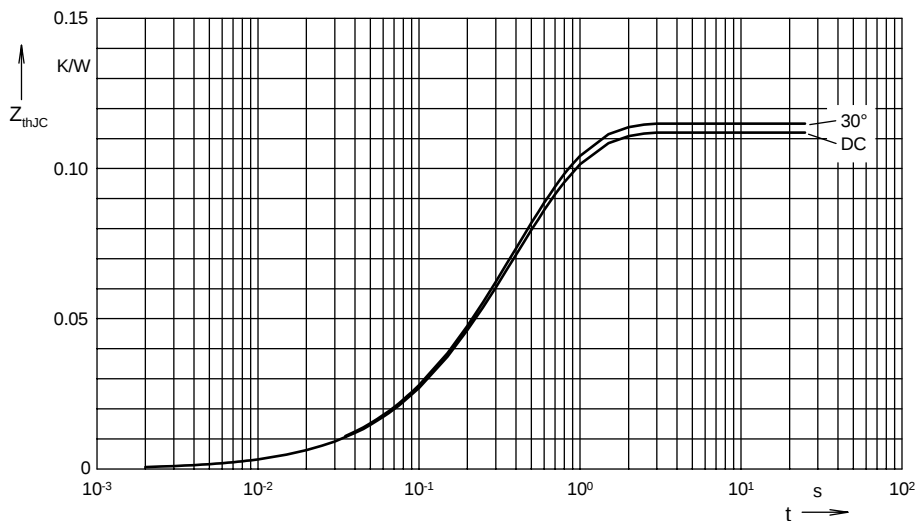


Fig. 8 Transient thermal impedance junction to case (per thyristor or diode)

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

| $d$   | $R_{thJC}$ (K/W) |
|-------|------------------|
| DC    | 0.112            |
| 180°C | 0.113            |
| 120°C | 0.114            |
| 60°C  | 0.115            |
| 30°C  | 0.115            |

Constants for  $Z_{thJC}$  calculation:

| $i$ | $R_{thi}$ (K/W) | $t_i$ (s) |
|-----|-----------------|-----------|
| 1   | 0.003           | 0.099     |
| 2   | 0.0143          | 0.168     |
| 3   | 0.0947          | 0.456     |

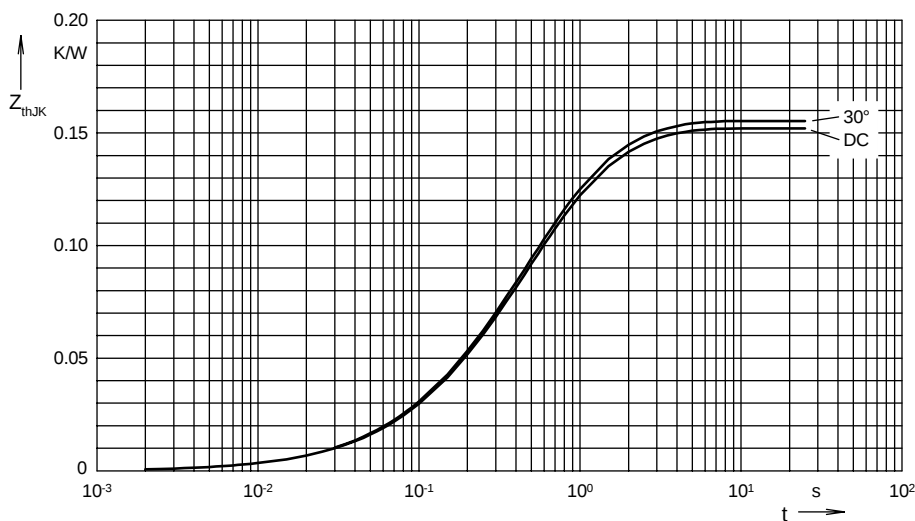


Fig. 9 Transient thermal impedance junction to heatsink (per thyristor or diode)

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

| $d$   | $R_{thJK}$ (K/W) |
|-------|------------------|
| DC    | 0.152            |
| 180°C | 0.154            |
| 120°C | 0.154            |
| 60°C  | 0.155            |
| 30°C  | 0.155            |

Constants for  $Z_{thJK}$  calculation:

| $i$ | $R_{thi}$ (K/W) | $t_i$ (s) |
|-----|-----------------|-----------|
| 1   | 0.003           | 0.099     |
| 2   | 0.0143          | 0.168     |
| 3   | 0.0947          | 0.456     |
| 4   | 0.04            | 1.36      |

# AMEYA360

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