

Thyristor Module

$V_{RRM} = 2 \times 1400 \text{ V}$

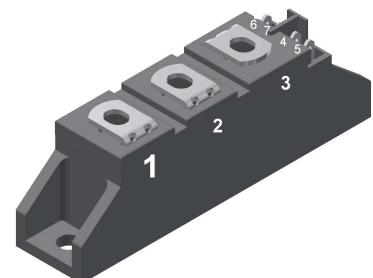
$I_{TAV} = 27 \text{ A}$

$V_T = 1.27 \text{ V}$

Phase leg

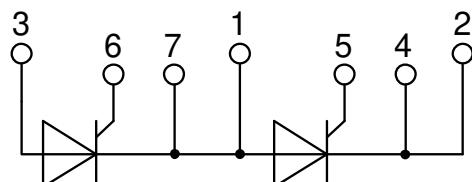
Part number

MCC26-14io1



Backside: isolated

 E72873



Features / Advantages:

- Thyristor for line frequency
- Planar passivated chip
- Long-term stability
- Direct Copper Bonded Al₂O₃-ceramic

Applications:

- Line rectifying 50/60 Hz
- Softstart AC motor control
- DC Motor control
- Power converter
- AC power control
- Lighting and temperature control

Package: TO-240AA

- Isolation Voltage: 4800 V~
- Industry standard outline
- RoHS compliant
- Soldering pins for PCB mounting
- Base plate: DCB ceramic
- Reduced weight
- Advanced power cycling

Disclaimer Notice

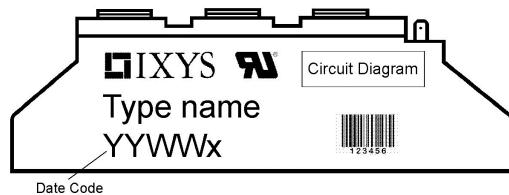
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Thyristor

| Symbol | Definition | Conditions | Ratings | | | |
|----------------|--|--|---|------|----------|---------------|
| | | | min. | typ. | max. | |
| $V_{RSM/DSM}$ | max. non-repetitive reverse/forward blocking voltage | $T_{VJ} = 25^\circ C$ | | | 1500 | V |
| $V_{RRM/DRM}$ | max. repetitive reverse/forward blocking voltage | $T_{VJ} = 25^\circ C$ | | | 1400 | V |
| $I_{R/D}$ | reverse current, drain current | $V_{R/D} = 1400 V$ $V_{R/D} = 1400 V$ | $T_{VJ} = 25^\circ C$ $T_{VJ} = 125^\circ C$ | | 100 3 | μA mA |
| V_T | forward voltage drop | $I_T = 40 A$ | $T_{VJ} = 25^\circ C$ | | 1.27 | V |
| | | $I_T = 80 A$ | | | 1.64 | V |
| | | $I_T = 40 A$ | $T_{VJ} = 125^\circ C$ | | 1.27 | V |
| | | $I_T = 80 A$ | | | 1.65 | V |
| I_{TAV} | average forward current | $T_C = 85^\circ C$ | $T_{VJ} = 125^\circ C$ | | 27 | A |
| $I_{T(RMS)}$ | RMS forward current | 180° sine | | | 42 | A |
| V_{T0} | threshold voltage | r_T slope resistance } for power loss calculation only | $T_{VJ} = 125^\circ C$ | | 0.85 | V |
| | slope resistance | | | | 11 | $m\Omega$ |
| R_{thJC} | thermal resistance junction to case | | | | 0.88 | K/W |
| R_{thCH} | thermal resistance case to heatsink | | | 0.2 | | K/W |
| P_{tot} | total power dissipation | | $T_C = 25^\circ C$ | | 115 | W |
| I_{TSM} | max. forward surge current | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{sine}$ | $T_{VJ} = 45^\circ C$ | | 520 | A |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{sine}$ | $V_R = 0 V$ | | 560 | A |
| | | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{sine}$ | $T_{VJ} = 125^\circ C$ | | 440 | A |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{sine}$ | $V_R = 0 V$ | | 475 | A |
| I^2t | value for fusing | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{sine}$ | $T_{VJ} = 45^\circ C$ | | 1.35 | kA^2s |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{sine}$ | $V_R = 0 V$ | | 1.31 | kA^2s |
| | | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{sine}$ | $T_{VJ} = 125^\circ C$ | | 970 | A^2s |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{sine}$ | $V_R = 0 V$ | | 940 | A^2s |
| C_J | junction capacitance | $V_R = 400 V$ $f = 1 \text{ MHz}$ | $T_{VJ} = 25^\circ C$ | 22 | | pF |
| P_{GM} | max. gate power dissipation | $t_p = 30 \mu s$ | $T_C = 125^\circ C$ | | 10 | W |
| | | $t_p = 300 \mu s$ | | | 5 | W |
| P_{GAV} | average gate power dissipation | | | | 0.5 | W |
| $(di/dt)_{cr}$ | critical rate of rise of current | $T_{VJ} = 125^\circ C; f = 50 \text{ Hz}$ | repetitive, $I_T = 45 A$ | | 150 | $A/\mu s$ |
| | | $t_p = 200 \mu s; di_G/dt = 0.45 A/\mu s;$ | | | | |
| | | $I_G = 0.45 A; V = \frac{2}{3} V_{DRM}$ | non-repet., $I_T = 27 A$ | | 500 | $A/\mu s$ |
| $(dv/dt)_{cr}$ | critical rate of rise of voltage | $V = \frac{2}{3} V_{DRM}$ | $T_{VJ} = 125^\circ C$ | | 1000 | $V/\mu s$ |
| | | $R_{GK} = \infty$; method 1 (linear voltage rise) | | | | |
| V_{GT} | gate trigger voltage | $V_D = 6 V$ | $T_{VJ} = 25^\circ C$ | | 1.5 | V |
| | | | $T_{VJ} = -40^\circ C$ | | 1.6 | V |
| I_{GT} | gate trigger current | $V_D = 6 V$ | $T_{VJ} = 25^\circ C$ | | 100 | mA |
| | | | $T_{VJ} = -40^\circ C$ | | 200 | mA |
| V_{GD} | gate non-trigger voltage | $V_D = \frac{2}{3} V_{DRM}$ | $T_{VJ} = 125^\circ C$ | | 0.2 | V |
| I_{GD} | gate non-trigger current | | | | 10 | mA |
| I_L | latching current | $t_p = 10 \mu s$ $I_G = 0.45 A; di_G/dt = 0.45 A/\mu s$ | $T_{VJ} = 25^\circ C$ | | 450 | mA |
| I_H | holding current | $V_D = 6 V$ $R_{GK} = \infty$ | $T_{VJ} = 25^\circ C$ | | 200 | mA |
| t_{gd} | gate controlled delay time | $V_D = \frac{1}{2} V_{DRM}$ | $T_{VJ} = 25^\circ C$ | | 2 | μs |
| | | $I_G = 0.45 A; di_G/dt = 0.45 A/\mu s$ | | | | |
| t_q | turn-off time | $V_R = 100 V; I_T = 20 A; V = \frac{2}{3} V_{DRM}$ $T_{VJ} = 100^\circ C$ $di/dt = 10 A/\mu s$ $dv/dt = 20 V/\mu s$ $t_p = 200 \mu s$ | | 150 | | μs |

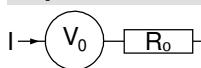
Package TO-240AA

| Symbol | Definition | Conditions | Ratings | | | |
|---------------|---|---|--------------|------|------|--------|
| | | | min. | typ. | max. | |
| I_{RMS} | <i>RMS current</i> | per terminal | | | 200 | A |
| T_{VJ} | <i>virtual junction temperature</i> | | -40 | | 125 | °C |
| T_{op} | <i>operation temperature</i> | | -40 | | 100 | °C |
| T_{stg} | <i>storage temperature</i> | | -40 | | 125 | °C |
| Weight | | | | 81 | | g |
| M_D | <i>mounting torque</i> | | 2.5 | | 4 | Nm |
| M_T | <i>terminal torque</i> | | 2.5 | | 4 | Nm |
| $d_{Spp/App}$ | <i>creepage distance on surface / striking distance through air</i> | <i>terminal to terminal</i> | 13.0 | 9.7 | | mm |
| $d_{Spb/Apb}$ | | <i>terminal to backside</i> | 16.0 | 16.0 | | mm |
| V_{ISOL} | <i>isolation voltage</i> | $t = 1 \text{ second}$ $t = 1 \text{ minute}$ 50/60 Hz, RMS; $I_{ISOL} \leq 1 \text{ mA}$ | 4800 4000 | | | V V |



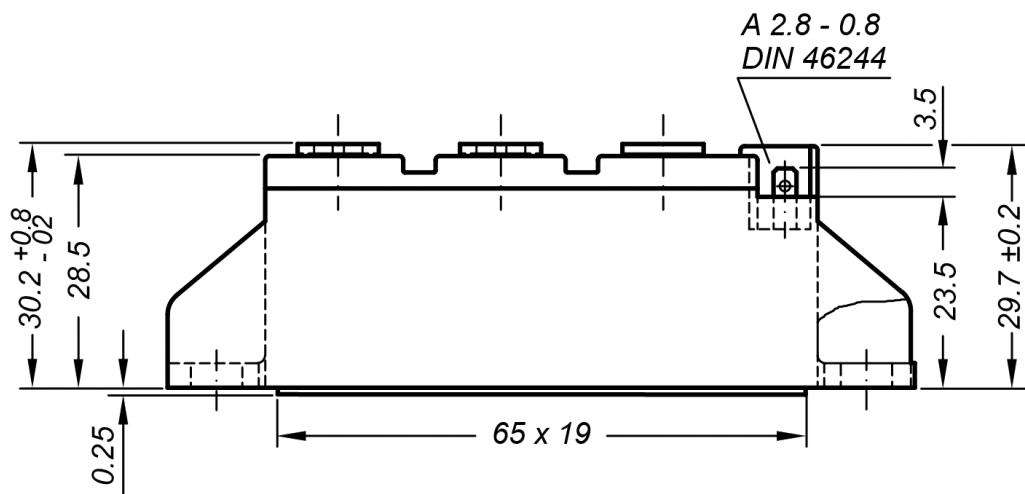
| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|----------|-----------------|--------------------|---------------|----------|----------|
| Standard | MCC26-14io1 | MCC26-14io1 | Box | 36 | 442348 |

Equivalent Circuits for Simulation
^{*}on die level

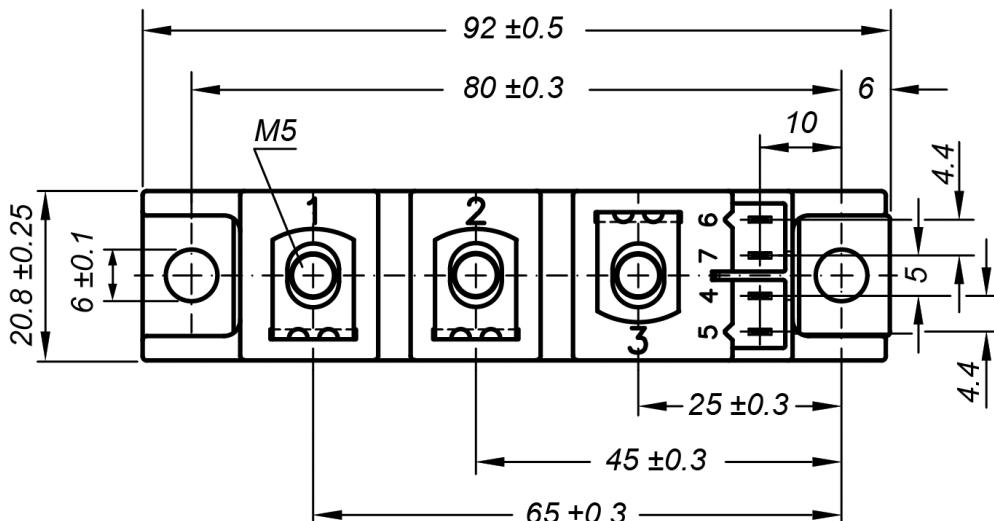
 $T_{VJ} = 125^\circ\text{C}$

Thyristor

$V_{0\max}$ threshold voltage 0.85 V
 $R_{0\max}$ slope resistance * 9.8 mΩ

Outlines TO-240AA

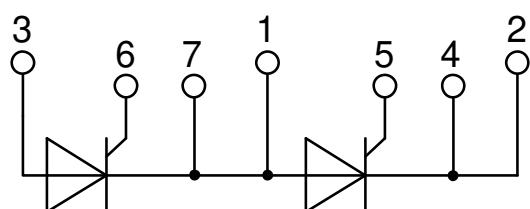


General tolerance: DIN ISO 2768 class „c“



Optional accessories for modules

Keyed gate/cathode twin plugs with wire length = 350 mm, gate = white, cathode = red
Type ZY 200L (L = Left for pin pair 4/5) } UL 758, style 3751
Type ZY 200R (R = Right for pin pair 6/7) }



Thyristor

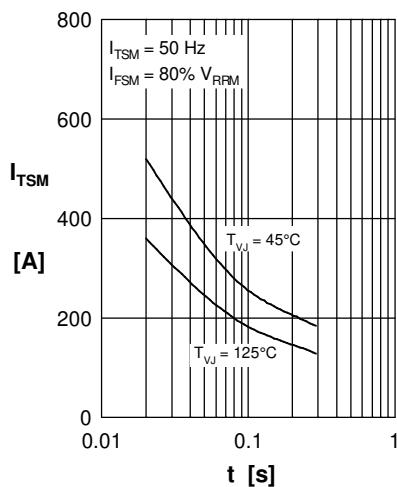


Fig. 1 Surge overload current I_{TSM} ,
 I_{FSM} : Crest value, t: duration

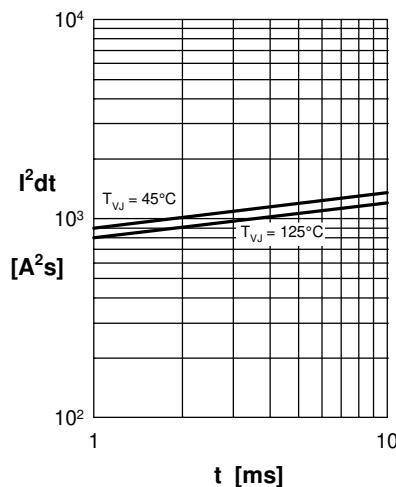


Fig. 2 I^2t versus time (1-10 ms)

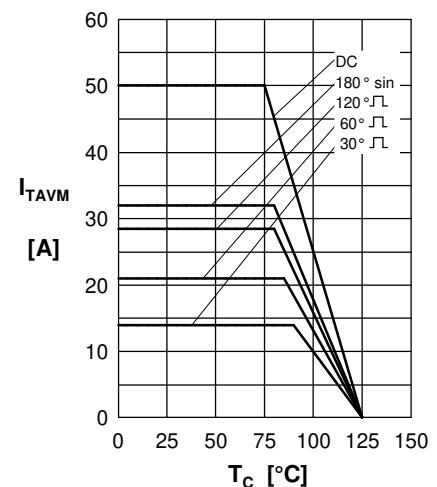


Fig. 3 Max. forward current
at case temperature

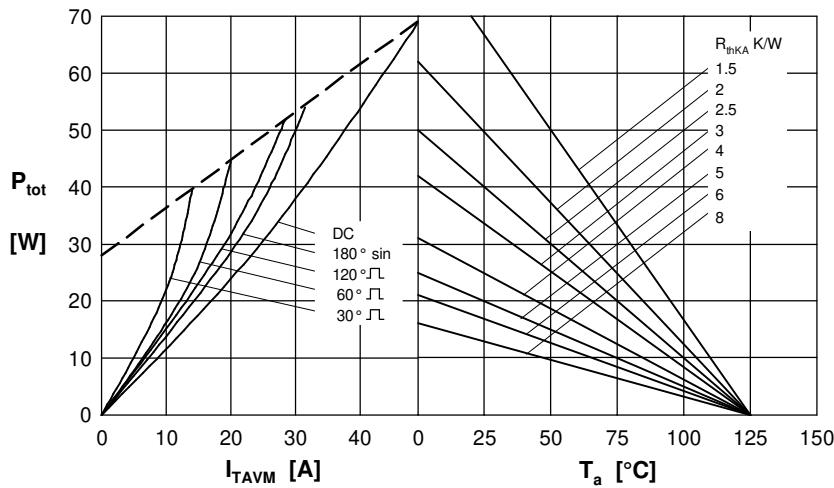


Fig. 4 Power dissipation vs. on-state current & ambient temperature
(per thyristor or diode)

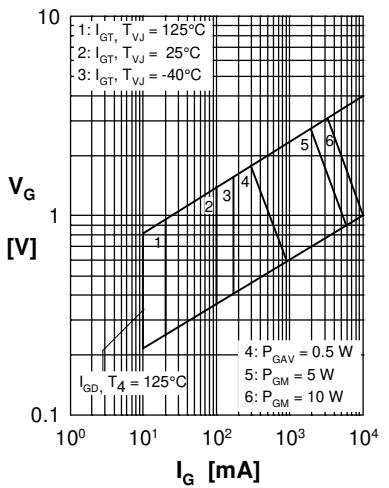


Fig. 5 Gate trigger characteristics

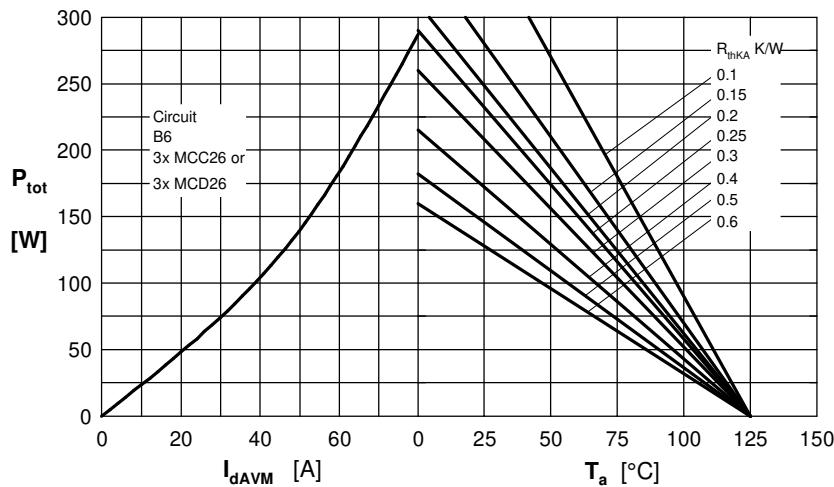


Fig. 6 Three phase rectifier bridge: Power dissipation versus direct
output current and ambient temperature

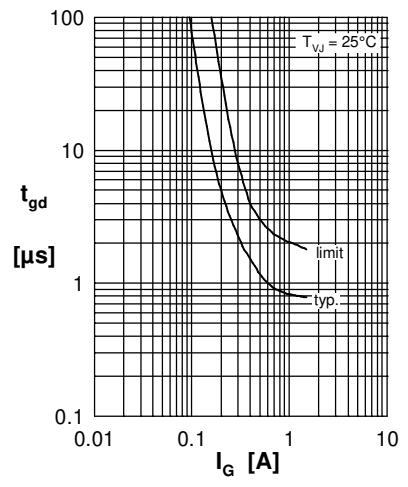


Fig. 7 Gate trigger delay time

Thyristor

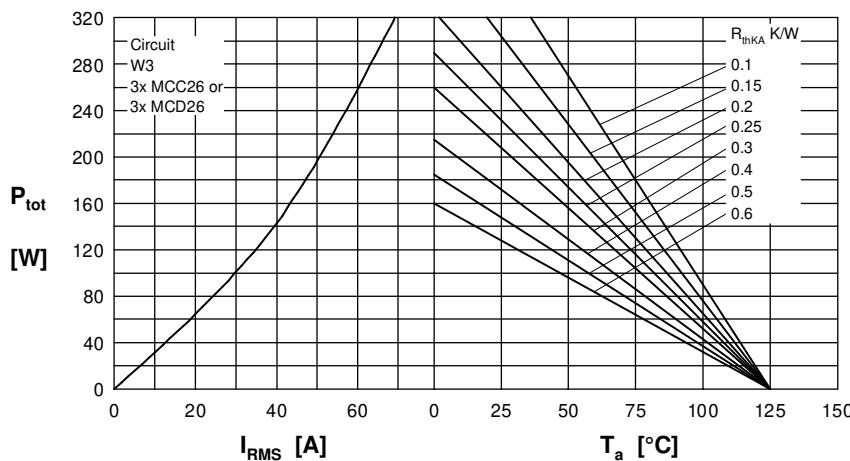


Fig. 8 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

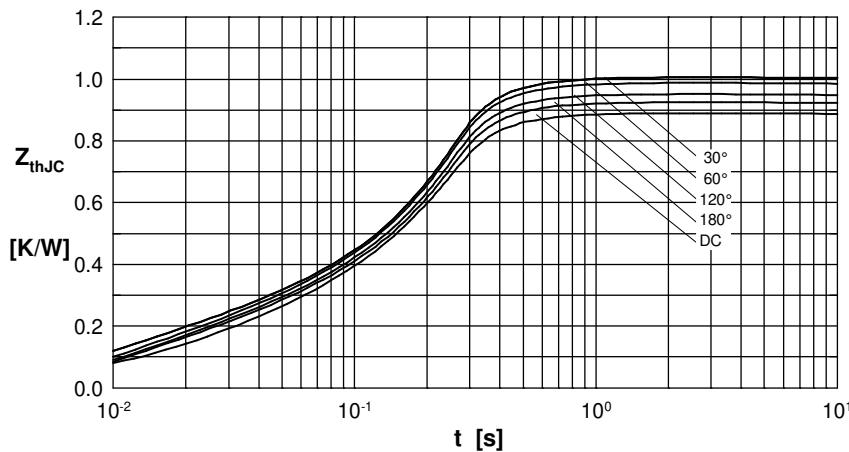


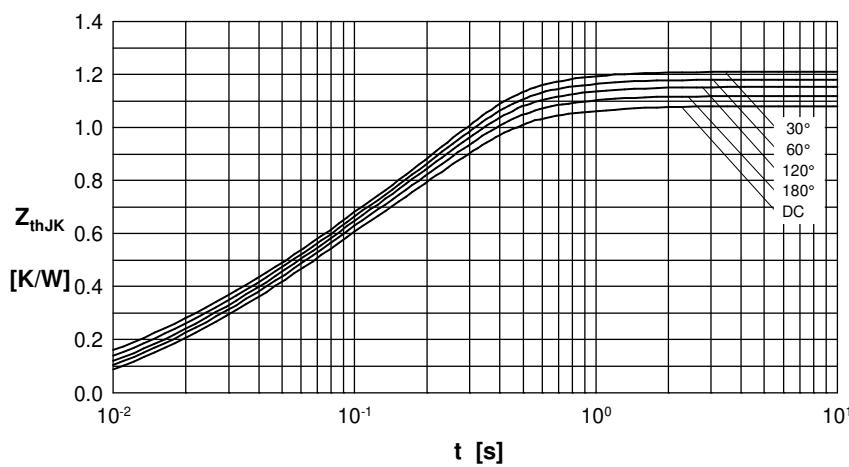
Fig. 9 Transient thermal impedance junction to case (per thyristor/diode)

R_{thJC} for various conduction angles d:

| d | R_{thJC} [K/W] |
|------|------------------|
| DC | 0.88 |
| 180° | 0.92 |
| 120° | 0.95 |
| 60° | 0.98 |
| 30° | 1.01 |

Constants for Z_{thJC} calculation:

| i | R_{thi} [K/W] | t_i [s] |
|---|-----------------|-----------|
| 1 | 0.019 | 0.0031 |
| 2 | 0.029 | 0.0216 |
| 3 | 0.832 | 0.1910 |



R_{thJK} for various conduction angles d:

| d | R_{thJK} [K/W] |
|------|------------------|
| DC | 1.08 |
| 180° | 1.12 |
| 120° | 1.15 |
| 60° | 1.18 |
| 30° | 1.21 |

Constants for Z_{thJK} calculation:

| i | R_{thi} [K/W] | t_i [s] |
|---|-----------------|-----------|
| 1 | 0.019 | 0.0031 |
| 2 | 0.029 | 0.0216 |
| 3 | 0.832 | 0.1910 |
| 4 | 0.200 | 0.4500 |



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