

Thyristor Module

$V_{RRM} = 2 \times 1600 \text{ V}$

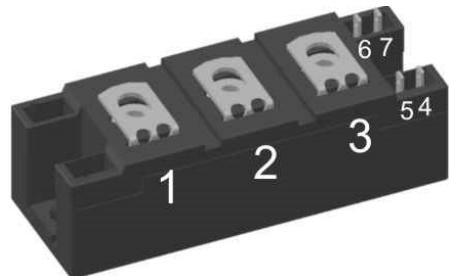
$I_{TAV} = 181 \text{ A}$

$V_T = 1.03 \text{ V}$

Phase leg

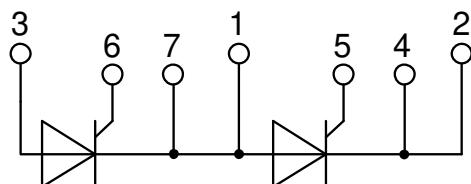
Part number

MCC162-16io1



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: Y4

- Isolation Voltage: 3600 V~
- Industry standard outline
- RoHS compliant
- Soldering pins for PCB mounting
- Base plate: DCB ceramic
- Reduced weight
- Advanced power cycling

Disclaimer Notice

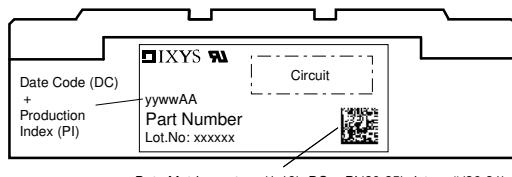
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Thyristor

| Symbol | Definition | Conditions | Ratings | | | |
|----------------|--|--|---|------|--------------|---------------|
| | | | min. | typ. | max. | |
| $V_{RSM/DSM}$ | max. non-repetitive reverse/forward blocking voltage | $T_{VJ} = 25^\circ C$ | | | 1700 | V |
| $V_{RRM/DRM}$ | max. repetitive reverse/forward blocking voltage | $T_{VJ} = 25^\circ C$ | | | 1600 | V |
| $I_{R/D}$ | reverse current, drain current | $V_{R/D} = 1600 V$ $V_{R/D} = 1600 V$ | $T_{VJ} = 25^\circ C$ $T_{VJ} = 125^\circ C$ | | 300 10 | μA mA |
| V_T | forward voltage drop | $I_T = 150 A$ | $T_{VJ} = 25^\circ C$ | | 1.09 | V |
| | | $I_T = 300 A$ | | | 1.25 | V |
| | | $I_T = 150 A$ $I_T = 300 A$ | $T_{VJ} = 125^\circ C$ | | 1.03 1.25 | V |
| I_{TAV} | average forward current | $T_C = 85^\circ C$ | $T_{VJ} = 125^\circ C$ | | 181 | A |
| $I_{T(RMS)}$ | RMS forward current | 180° sine | | | 300 | A |
| V_{T0} | threshold voltage | r_T slope resistance } for power loss calculation only | $T_{VJ} = 125^\circ C$ | | 0.88 | V |
| | slope resistance | | | | 1.15 | $m\Omega$ |
| R_{thJC} | thermal resistance junction to case | | | | 0.155 | K/W |
| R_{thCH} | thermal resistance case to heatsink | | | 0.07 | | K/W |
| P_{tot} | total power dissipation | | $T_C = 25^\circ C$ | | 645 | W |
| I_{TSM} | max. forward surge current | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{sine}$ | $T_{VJ} = 45^\circ C$ | | 6.00 | kA |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{sine}$ | $V_R = 0 V$ | | 6.48 | kA |
| | | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{sine}$ | $T_{VJ} = 125^\circ C$ | | 5.10 | kA |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{sine}$ | $V_R = 0 V$ | | 5.51 | kA |
| I^2t | value for fusing | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{sine}$ | $T_{VJ} = 45^\circ C$ | | 180.0 | kA^2s |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{sine}$ | $V_R = 0 V$ | | 174.7 | kA^2s |
| | | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{sine}$ | $T_{VJ} = 125^\circ C$ | | 130.1 | kA^2s |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{sine}$ | $V_R = 0 V$ | | 126.3 | kA^2s |
| C_J | junction capacitance | $V_R = 400 V$ $f = 1 \text{ MHz}$ | $T_{VJ} = 25^\circ C$ | 273 | | pF |
| P_{GM} | max. gate power dissipation | $t_p = 30 \mu s$ | $T_C = 125^\circ C$ | | 120 | W |
| | | $t_p = 500 \mu s$ | | | 60 | W |
| | | | | | 8 | W |
| P_{GAV} | average gate power dissipation | | | | | |
| $(di/dt)_{cr}$ | critical rate of rise of current | $T_{VJ} = 125^\circ C; f = 50 \text{ Hz}$ repetitive, $I_T = 540 A$ | | | 150 | $A/\mu s$ |
| | | $t_p = 200 \mu s; di_G/dt = 0.5 A/\mu s;$ | | | | |
| | | $I_G = 0.5 A; V = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 180 A$ | | | 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 | $V_D = 6 V$ | $T_{VJ} = 25^\circ C$ | | 2.5 | V |
| | | | $T_{VJ} = -40^\circ C$ | | 2.6 | V |
| I_{GT} | gate trigger current | $V_D = 6 V$ | $T_{VJ} = 25^\circ C$ | | 150 | 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 | $t_p = 30 \mu s$ | $T_{VJ} = 25^\circ C$ | | 300 | mA |
| | | $I_G = 0.5 A; di_G/dt = 0.5 A/\mu s$ | | | | |
| 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 |
| | | $I_G = 0.5 A; di_G/dt = 0.5 A/\mu s$ | | | | |
| t_q | turn-off time | $V_R = 100 V; I_T = 300 A; V = \frac{2}{3} V_{DRM}$ $T_{VJ} = 100^\circ C$ | | 150 | | μs |
| | | $di/dt = 10 A/\mu s$ $dv/dt = 20 V/\mu s$ $t_p = 200 \mu s$ | | | | |

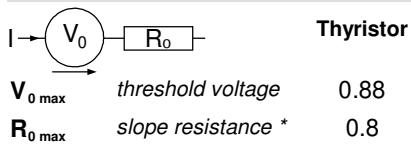
Package Y4

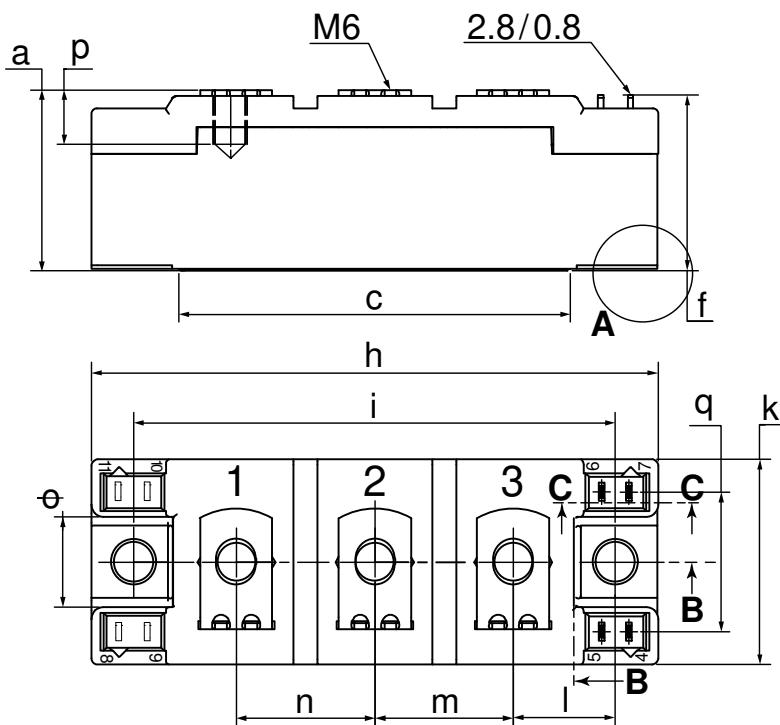
| Conditions | | | min. | typ. | max. | Unit |
|---------------|---|--|---|------|--------------|--------|
| I_{RMS} | <i>RMS current</i> | per terminal | | | 300 | A |
| T_{VJ} | <i>virtual junction temperature</i> | | -40 | | 125 | °C |
| T_{op} | <i>operation temperature</i> | | -40 | | 100 | °C |
| T_{stg} | <i>storage temperature</i> | | -40 | | 125 | °C |
| Weight | | | | 150 | | g |
| M_D | <i>mounting torque</i> | | 2.25 | | 2.75 | Nm |
| M_T | <i>terminal torque</i> | | 4.5 | | 5.5 | Nm |
| $d_{Spp/App}$ | <i>creepage distance on surface / striking distance through air</i> | | <i>terminal to terminal</i> | 14.0 | 10.0 | 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; $I_{ISOL} \leq 1 \text{ mA}$ | | 3600 3000 | V V |



Data Matrix: part no. (1-19), DC + PI (20-25), lot.no.# (26-31), blank (32), serial no.#(33-36)

| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|----------|-----------------|--------------------|---------------|----------|----------|
| Standard | MCC162-16io1 | MCC162-16io1 | Box | 6 | 429619 |

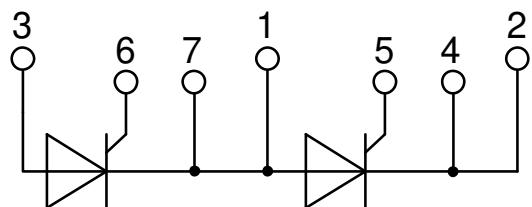
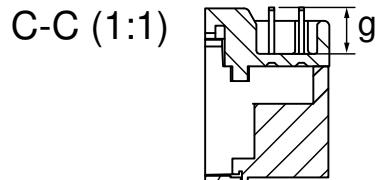
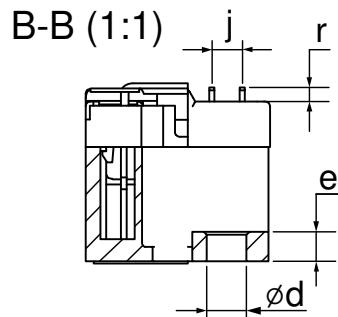
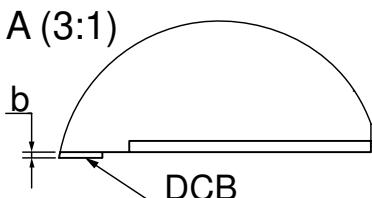
Equivalent Circuits for Simulation
* on die level
 $T_{VJ} = 125^\circ\text{C}$


Outlines Y4


Optional accessories for modules

Keyed gate/cathode twin plugs with wire length = 350 mm, gate = white, cathode = red
Type ZY 180L (L = Left for pin pair 4/5)
Type ZY 180R (R = Right for pin pair 6/7) } UL 758, style 3751

| Dim. | MIN [mm] | MAX [mm] | MIN [inch] | MAX [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 |



Thyristor

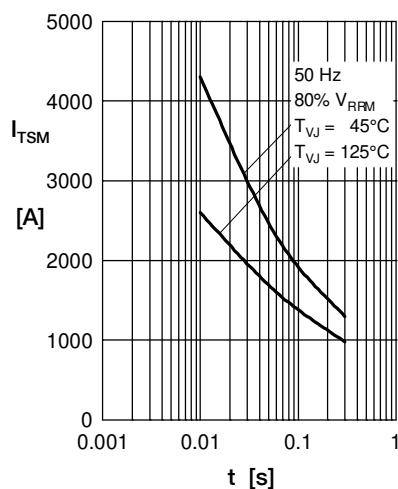


Fig. 1 Surge overload current I_{TSM} ,
 I_{FSM} : Crest value, t: duration

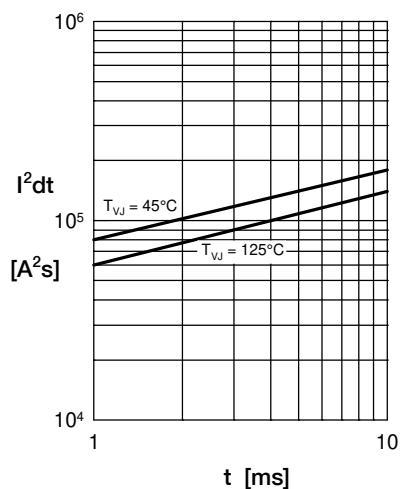


Fig. 2 I^2t versus time (1-10 ms)

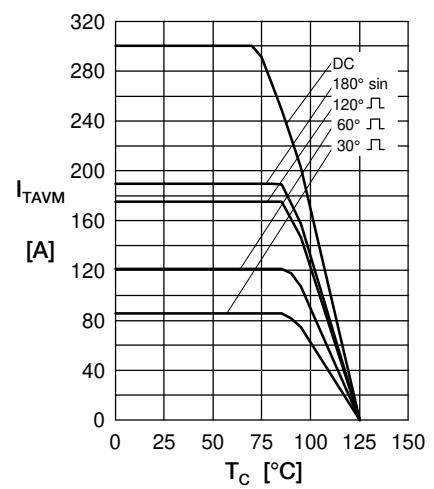


Fig. 3 Max. forward current
at case temperature

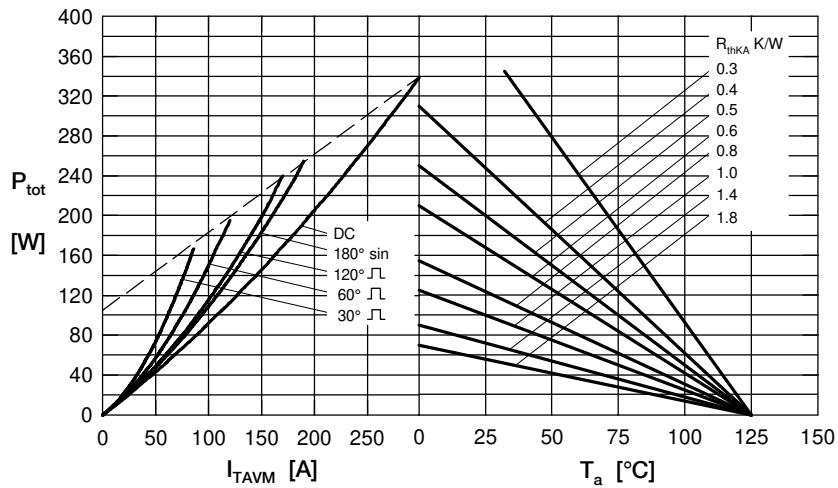


Fig. 4 Power dissipation vs. on-state current & ambient temperature
(per thyristor or diode)

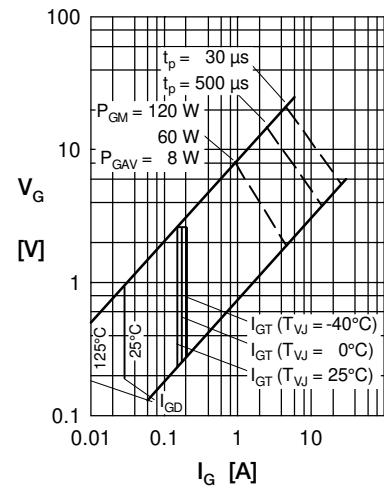


Fig. 5 Gate trigger characteristics

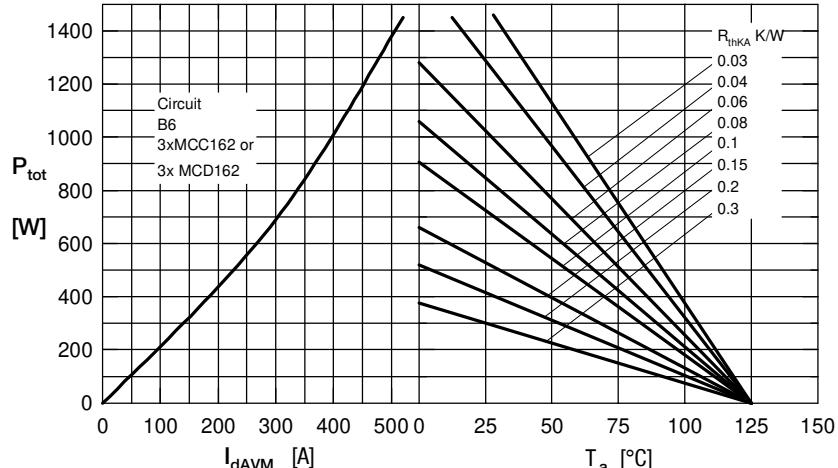


Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

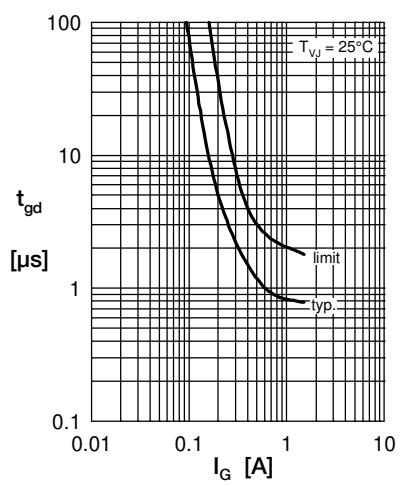


Fig. 7 Gate trigger delay time

Thyristor

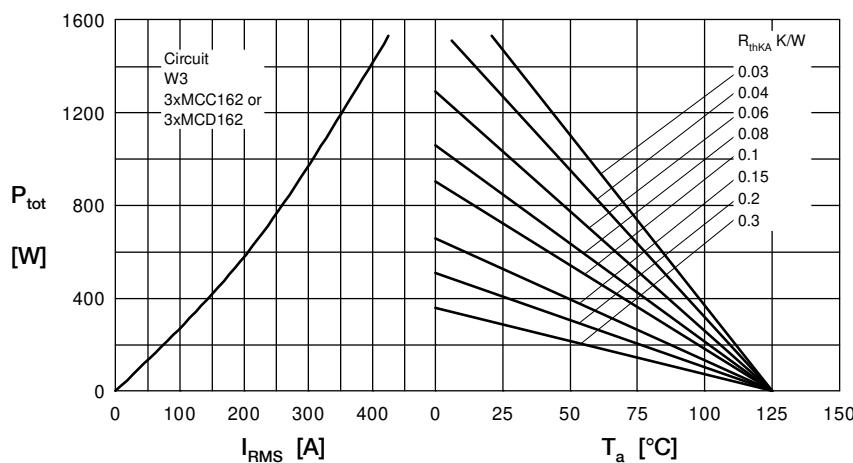


Fig. 8 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

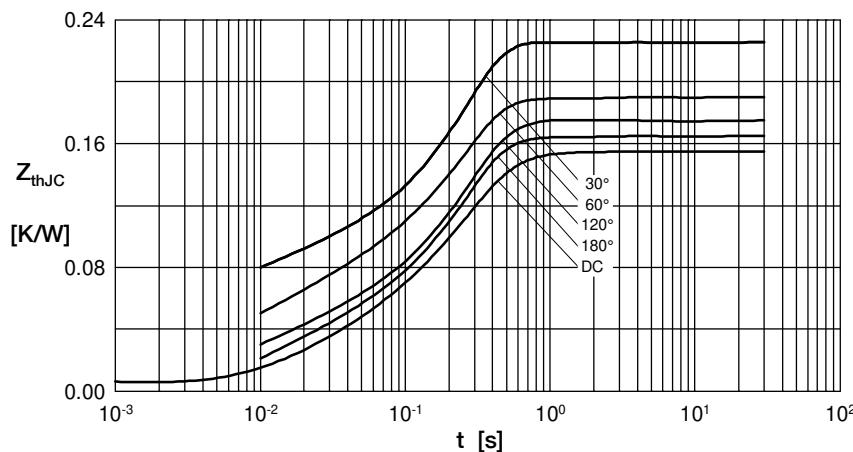


Fig. 9 Transient thermal impedance junction to case (per thyristor/diode)

R_{thJC} for various conduction angles d:

| d | R_{thJC} [K/W] |
|------|------------------|
| DC | 0.155 |
| 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 |

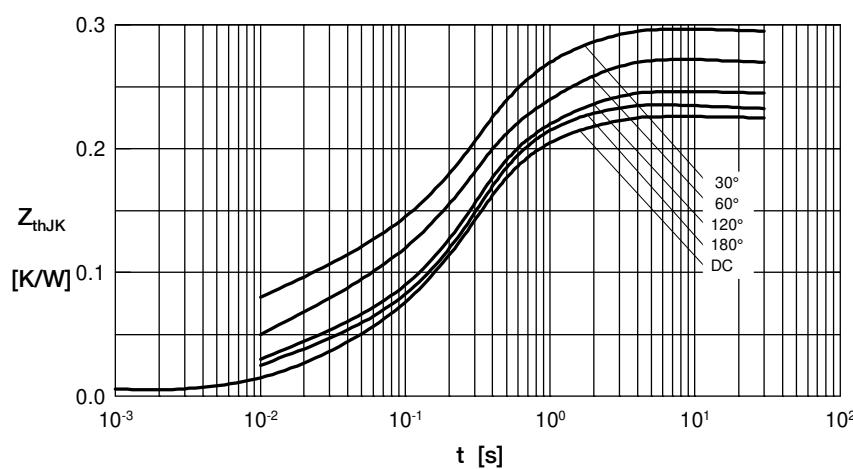


Fig. 10 Transient thermal impedance junction to heatsink (per thyristor/diode)

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 |

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