

Thyristor Module

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

$$I_{TAV} = 130 \text{ A}$$

$$V_T = 1.08 \text{ V}$$

Phase leg

Part number

MCC132-14io1



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: Y4

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

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| Thyristor | | | Ratings | | | |
|----------------|------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-------------------------|------|-------|-------------------|
| Symbol | Definition | Conditions | min. | typ. | max. | Unit |
| $V_{RSM/DSM}$ | 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_{RD} | reverse current, drain current | $V_{R/D} = 1400 V$ | $T_{VJ} = 25^{\circ}C$ | | 200 | μA |
| | | $V_{R/D} = 1400 V$ | $T_{VJ} = 125^{\circ}C$ | | 10 | mA |
| V_T | forward voltage drop | $I_T = 150 A$ | $T_{VJ} = 25^{\circ}C$ | | 1.14 | V |
| | | $I_T = 300 A$ | | | 1.36 | V |
| | | $I_T = 150 A$ | $T_{VJ} = 125^{\circ}C$ | | 1.08 | V |
| | | $I_T = 300 A$ | | | 1.36 | V |
| I_{TAV} | average forward current | $T_C = 85^{\circ}C$ | $T_{VJ} = 125^{\circ}C$ | | 130 | A |
| $I_{T(RMS)}$ | RMS forward current | 180° sine | | | 300 | A |
| V_{T0} | threshold voltage | } for power loss calculation only | $T_{VJ} = 125^{\circ}C$ | | 0.80 | V |
| r_T | slope resistance | | | | 1.5 | m Ω |
| R_{thJC} | thermal resistance junction to case | | | | 0.23 | K/W |
| R_{thCH} | thermal resistance case to heatsink | | | 0.1 | | K/W |
| P_{tot} | total power dissipation | | $T_C = 25^{\circ}C$ | | 435 | W |
| I_{TSM} | max. forward surge current | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$ | $T_{VJ} = 45^{\circ}C$ | | 4.75 | kA |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$ | $V_R = 0 V$ | | 5.13 | kA |
| | | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$ | $T_{VJ} = 125^{\circ}C$ | | 4.04 | kA |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$ | $V_R = 0 V$ | | 4.36 | kA |
| I^2t | value for fusing | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$ | $T_{VJ} = 45^{\circ}C$ | | 112.8 | kA ² s |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$ | $V_R = 0 V$ | | 109.5 | kA ² s |
| | | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$ | $T_{VJ} = 125^{\circ}C$ | | 81.6 | kA ² s |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$ | $V_R = 0 V$ | | 79.1 | kA ² s |
| C_J | junction capacitance | $V_R = 400 V \quad f = 1 \text{ MHz}$ | $T_{VJ} = 25^{\circ}C$ | 211 | | 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 |
| P_{GAV} | average gate power dissipation | | | | 8 | W |
| $(di/dt)_{cr}$ | critical rate of rise of current | $T_{VJ} = 125^{\circ}C; f = 50 \text{ Hz}$ repetitive, $I_T = 500 A$ | | | 150 | A/ μs |
| | | $t_p = 200 \mu s; di_G/dt = 0.5 A/\mu s;$ $I_G = 0.5 A; V = \frac{2}{3} V_{DRM}$ non-repet., $I_T = 160 A$ | | | 500 | A/ μs |
| $(dv/dt)_{cr}$ | critical rate of rise of voltage | $V = \frac{2}{3} V_{DRM}$ $R_{GK} = \infty; \text{ method 1 (linear voltage rise)}$ | $T_{VJ} = 125^{\circ}C$ | | 1000 | V/ μs |
| 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 | $V_D = 6 V \quad R_{GK} = \infty$ | $T_{VJ} = 25^{\circ}C$ | | 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 | $V_R = 100 V; I_T = 160 A; V = \frac{2}{3} V_{DRM}$ $di/dt = 10 A/\mu s \quad dv/dt = 20 V/\mu s \quad t_p = 200 \mu s$ | $T_{VJ} = 100^{\circ}C$ | 150 | | μs |



| Package Y4 | | | | Ratings | | | |
|---------------|--------------------------------------------------------------|----------------------|-------------------------------------|---------|------|------|--|
| Symbol | Definition | Conditions | min. | typ. | max. | Unit | |
| I_{RMS} | RMS current | per terminal | | | 300 | A | |
| T_{VJ} | virtual junction temperature | | -40 | | 125 | °C | |
| T_{op} | operation temperature | | -40 | | 100 | °C | |
| T_{stg} | storage temperature | | -40 | | 125 | °C | |
| Weight | | | | | 150 | g | |
| M_D | mounting torque | | 2.25 | | 2.75 | Nm | |
| M_T | terminal torque | | 4.5 | | 5.5 | Nm | |
| $d_{Spp/App}$ | creepage distance on surface striking distance through air | terminal to terminal | 14.0 | 10.0 | | mm | |
| $d_{Spb/Apb}$ | | terminal to backside | 16.0 | 16.0 | | mm | |
| V_{ISOL} | isolation voltage | t = 1 second | | | 3600 | V | |
| | | t = 1 minute | 50/60 Hz, RMS; $I_{ISOL} \leq 1$ mA | | 3000 | 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 | MCC132-14io1 | MCC132-14io1 | Box | 6 | 430560 |

Equivalent Circuits for Simulation

* on die level

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



Thyristor

| | | | |
|--------------|--------------------|-----|----|
| $V_{0\ max}$ | threshold voltage | 0.8 | V |
| $R_{0\ max}$ | slope resistance * | 0.8 | mΩ |



Outlines Y4



| 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 |

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



Thyristor

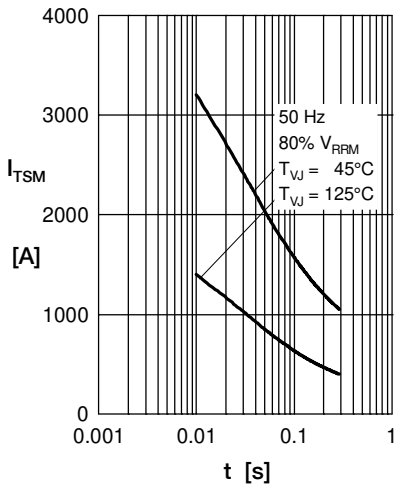


Fig. 1 Surge overload current I_{TSM} , I_{FSM} : Crest value, t : duration



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

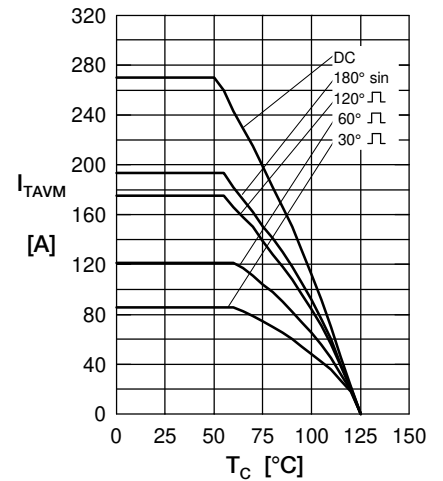


Fig. 3 Max. forward current at case temperature

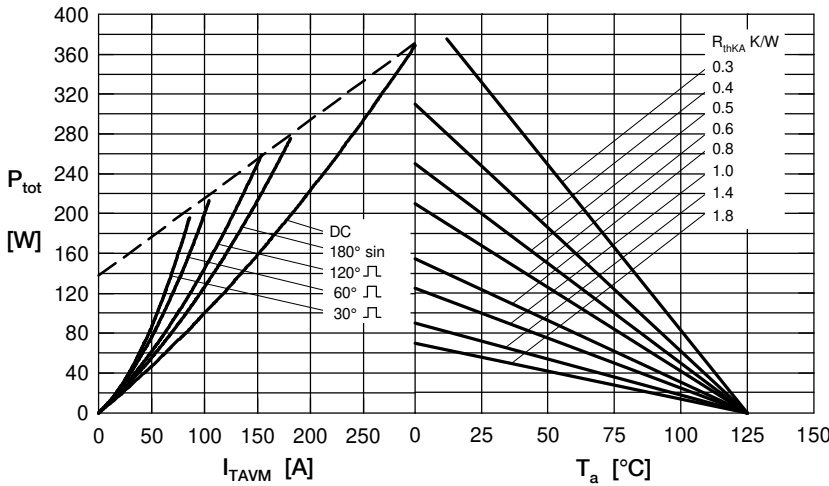


Fig. 4 Power dissipation vs. on-state current & ambient temperature (per thyristor or diode)



Fig. 5 Gate trigger characteristics

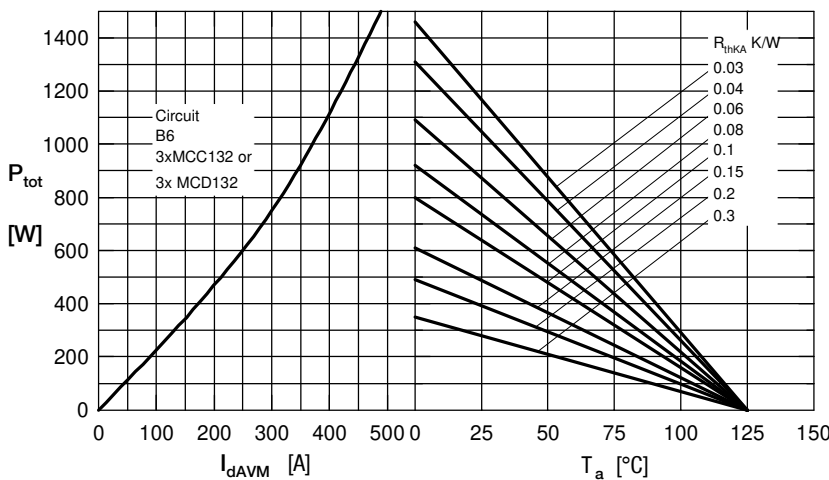


Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature



Fig. 7 Gate trigger delay time

Thyristor


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

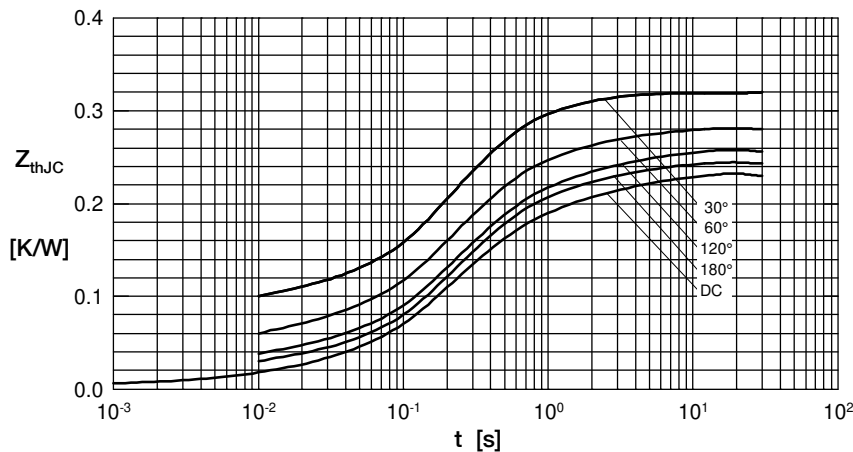


Fig. 9 Transient thermal impedance junction to case (per thyristor/diode)

 R_{thJC} for various conduction angles d :

| d | R_{thJC} [K/W] |
|------|------------------|
| DC | 0.230 |
| 180° | 0.244 |
| 120° | 0.255 |
| 60° | 0.283 |
| 30° | 0.321 |

 Constants for Z_{thJC} calculation:

| i | R_{thi} [K/W] | t_i [s] |
|-----|-----------------|-----------|
| 1 | 0.0095 | 0.001 |
| 2 | 0.0175 | 0.065 |
| 3 | 0.2030 | 0.400 |

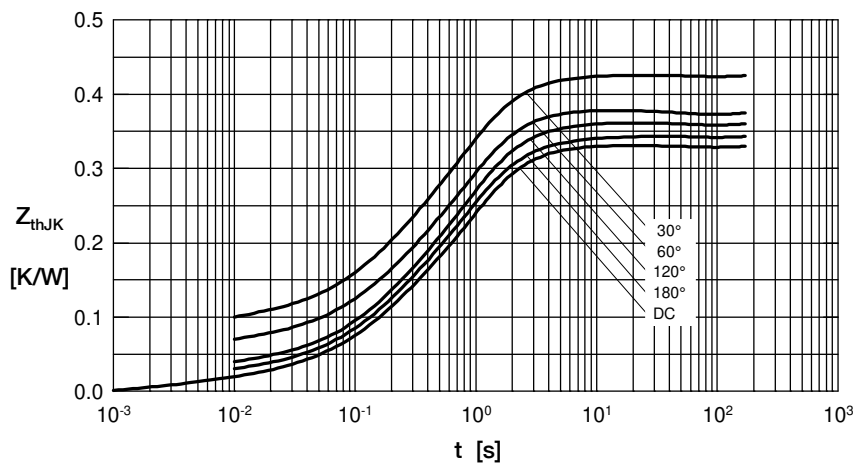


Fig. 10 Transient thermal impedance junction to heatsink (per thyristor/diode)

 R_{thJK} for various conduction angles d :

| d | R_{thJK} [K/W] |
|------|------------------|
| DC | 0.330 |
| 180° | 0.344 |
| 120° | 0.355 |
| 60° | 0.383 |
| 30° | 0.421 |

 Constants for Z_{thJK} calculation:

| i | R_{thi} [K/W] | t_i [s] |
|-----|-----------------|-----------|
| 1 | 0.0095 | 0.001 |
| 2 | 0.0175 | 0.065 |
| 3 | 0.2030 | 0.400 |
| 4 | 0.1000 | 1.290 |