



Thyristor Module

$V_{RRM} = 1200\text{ V}$

$I_{TAV} = 560\text{ A}$

$V_T = 1.01\text{ V}$

Single Thyristor

Part number

MCO500-12io1



Backside: isolated



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: Y1

- Isolation Voltage: 3600 V~
- Industry standard outline
- RoHS compliant
- Soldering pins for PCB mounting
- Base plate: Copper internally DCB isolated
- Advanced power cycling

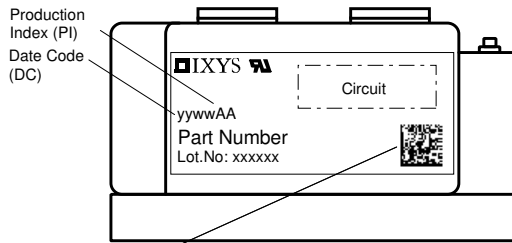
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| Thyristor | | | Ratings | | | |
|----------------|--|---|----------------------------|-------|-------|-------------------|
| Symbol | Definition | Conditions | min. | typ. | max. | Unit |
| $V_{RSM/DSM}$ | max. non-repetitive reverse/forward blocking voltage | $T_{VJ} = 25^{\circ}C$ | | | 1300 | V |
| $V_{RRM/DRM}$ | max. repetitive reverse/forward blocking voltage | $T_{VJ} = 25^{\circ}C$ | | | 1200 | V |
| I_{RD} | reverse current, drain current | $V_{R/D} = 1200 V$ | $T_{VJ} = 25^{\circ}C$ | | 2 | mA |
| | | $V_{R/D} = 1200 V$ | $T_{VJ} = 125^{\circ}C$ | | 40 | mA |
| V_T | forward voltage drop | $I_T = 500 A$ | $T_{VJ} = 25^{\circ}C$ | | 1.08 | V |
| | | $I_T = 1000 A$ | | | 1.27 | V |
| | | $I_T = 500 A$ | $T_{VJ} = 125^{\circ}C$ | | 1.01 | V |
| | | $I_T = 1000 A$ | | | 1.24 | V |
| I_{TAV} | average forward current | $T_C = 85^{\circ}C$ | $T_{VJ} = 140^{\circ}C$ | | 560 | A |
| $I_{T(RMS)}$ | RMS forward current | 180° sine | | | 880 | A |
| V_{T0} | threshold voltage | } for power loss calculation only | $T_{VJ} = 140^{\circ}C$ | | 0.80 | V |
| r_T | slope resistance | | | | 0.38 | mΩ |
| R_{thJC} | thermal resistance junction to case | | | | 0.072 | K/W |
| R_{thCH} | thermal resistance case to heatsink | | | 0.024 | | K/W |
| P_{tot} | total power dissipation | | $T_C = 25^{\circ}C$ | | 1600 | W |
| I_{TSM} | max. forward surge current | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$ | $T_{VJ} = 45^{\circ}C$ | | 17.0 | kA |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$ | $V_R = 0 V$ | | 18.4 | kA |
| | | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$ | $T_{VJ} = 140^{\circ}C$ | | 14.5 | kA |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$ | $V_R = 0 V$ | | 15.6 | kA |
| I^2t | value for fusing | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$ | $T_{VJ} = 45^{\circ}C$ | | 1.45 | MA ² s |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$ | $V_R = 0 V$ | | 1.40 | MA ² s |
| | | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$ | $T_{VJ} = 140^{\circ}C$ | | 1.04 | MA ² s |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$ | $V_R = 0 V$ | | 1.01 | MA ² s |
| C_J | junction capacitance | $V_R = 400 V \quad f = 1 \text{ MHz}$ | $T_{VJ} = 25^{\circ}C$ | | 876 | pF |
| P_{GM} | max. gate power dissipation | $t_p = 30 \mu s$ | $T_C = 140^{\circ}C$ | | 120 | W |
| | | $t_p = 300 \mu s$ | | | 60 | W |
| P_{GAV} | average gate power dissipation | | | | 20 | W |
| $(di/dt)_{cr}$ | critical rate of rise of current | $T_{VJ} = 140^{\circ}C; f = 50 \text{ Hz}$ | repetitive, $I_T = 1500 A$ | | 100 | A/μs |
| | | $t_p = 200 \mu s; di_G/dt = 1 A/\mu s;$ | non-repet., $I_T = 500 A$ | | 500 | A/μs |
| $(dv/dt)_{cr}$ | critical rate of rise of voltage | $V = \frac{2}{3} V_{DRM}$ | $T_{VJ} = 140^{\circ}C$ | | 1000 | V/μs |
| | | $R_{GK} = \infty; \text{method 1 (linear voltage rise)}$ | | | | |
| V_{GT} | gate trigger voltage | $V_D = 6 V$ | $T_{VJ} = 25^{\circ}C$ | | 2 | V |
| | | | $T_{VJ} = -40^{\circ}C$ | | 3 | V |
| I_{GT} | gate trigger current | $V_D = 6 V$ | $T_{VJ} = 25^{\circ}C$ | | 300 | mA |
| | | | $T_{VJ} = -40^{\circ}C$ | | 400 | mA |
| V_{GD} | gate non-trigger voltage | $V_D = \frac{2}{3} V_{DRM}$ | $T_{VJ} = 140^{\circ}C$ | | 0.25 | V |
| I_{GD} | gate non-trigger current | | | | 10 | mA |
| I_L | latching current | $t_p = 30 \mu s$ | $T_{VJ} = 25^{\circ}C$ | | 400 | mA |
| | | $I_G = 1 A; di_G/dt = 1 A/\mu s$ | | | | |
| I_H | holding current | $V_D = 6 V \quad R_{GK} = \infty$ | $T_{VJ} = 25^{\circ}C$ | | 300 | mA |
| t_{gd} | gate controlled delay time | $V_D = \frac{1}{2} V_{DRM}$ | $T_{VJ} = 25^{\circ}C$ | | 2 | μs |
| | | $I_G = 1 A; di_G/dt = 1 A/\mu s$ | | | | |
| t_q | turn-off time | $V_R = 100 V; I_T = 500 A; V = \frac{2}{3} V_{DRM}$ | $T_{VJ} = 125^{\circ}C$ | | 350 | μs |
| | | $di/dt = 10 A/\mu s \quad dv/dt = 50 V/\mu s \quad t_p = 200 \mu s$ | | | | |



| Package Y1 | | | Ratings | | | |
|---------------|--|----------------------|---------|------|------|------|
| Symbol | Definition | Conditions | min. | typ. | max. | Unit |
| I_{RMS} | RMS current | per terminal | | | 600 | A |
| T_{VJ} | virtual junction temperature | | -40 | | 140 | °C |
| T_{op} | operation temperature | | -40 | | 125 | °C |
| T_{stg} | storage temperature | | -40 | | 125 | °C |
| Weight | | | | 650 | | g |
| M_D | mounting torque | | 4.5 | | 7 | Nm |
| M_T | terminal torque | | 11 | | 13 | Nm |
| $d_{Spp/APP}$ | creepage distance on surface striking distance through air | terminal to terminal | 16.0 | | | mm |
| $d_{Spb/APb}$ | | terminal to backside | 25.0 | | | mm |
| V_{ISOL} | isolation voltage | t = 1 second | 3600 | | | V |
| | | t = 1 minute | 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 | MCO500-12io1 | MCO500-12io1 | Box | 2 | 463728 |

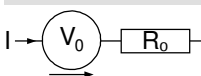
| Similar Part | Package | Voltage class |
|--------------|---------|---------------|
| MCO500-14io1 | Y1-2-CU | 1400 |
| MCO500-16io1 | Y1-2-CU | 1600 |
| MCO500-18io1 | Y1-2-CU | 1800 |
| MCO600-20io1 | Y1-2-CU | 2000 |

| | | |
|--------------|---------|------|
| MCO600-22io1 | Y1-2-CU | 2200 |
|--------------|---------|------|

Equivalent Circuits for Simulation

* on die level

$T_{VJ} = 140^{\circ}C$



Thyristor

| | | | |
|--------------|--------------------|------|----|
| $V_{0\ max}$ | threshold voltage | 0.8 | V |
| $R_{0\ max}$ | slope resistance * | 0.22 | mΩ |



Outlines Y1



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) UL 758, style 3751



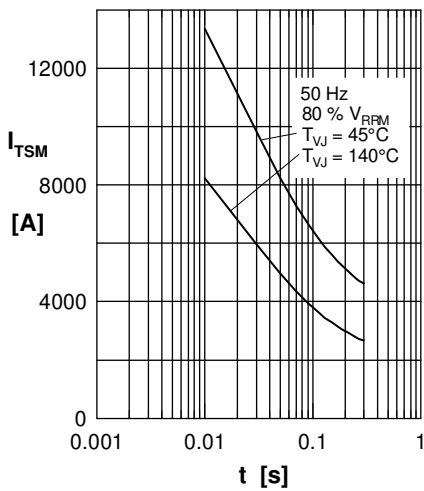
Thyristor


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

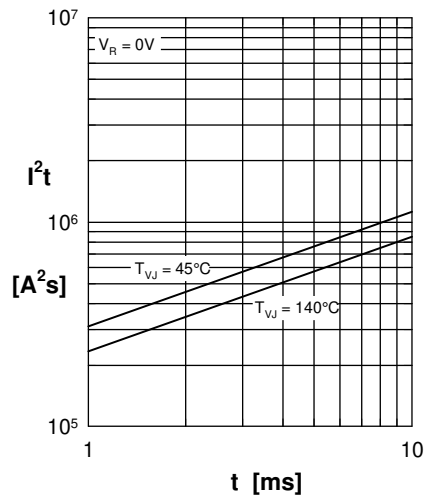


Fig. 2 I^2t versus time (1-10 ms)

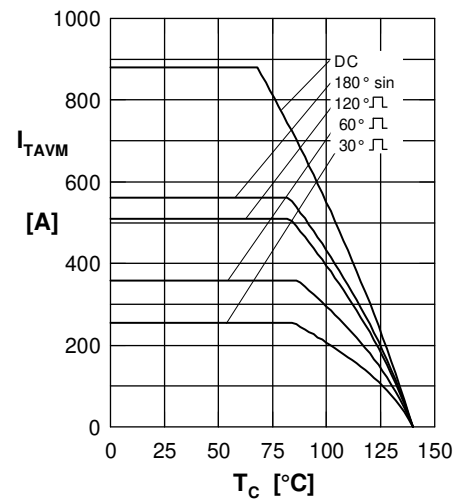


Fig. 3 Maximum forward current at case temperature

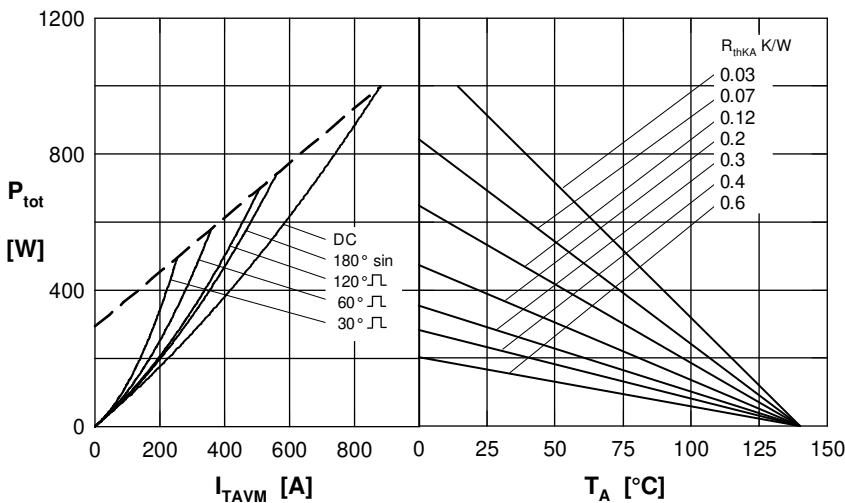


Fig. 4 Power dissipation versus on-state current & ambient temperature

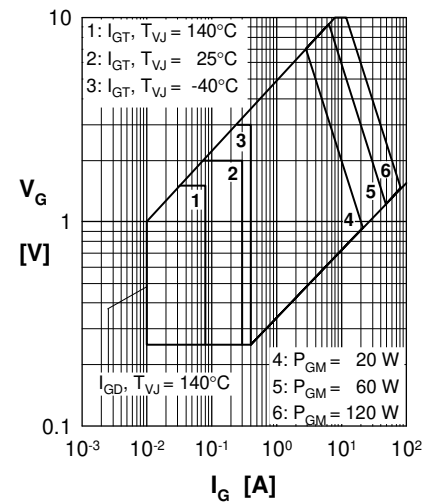


Fig. 5 Gate trigger characteristics

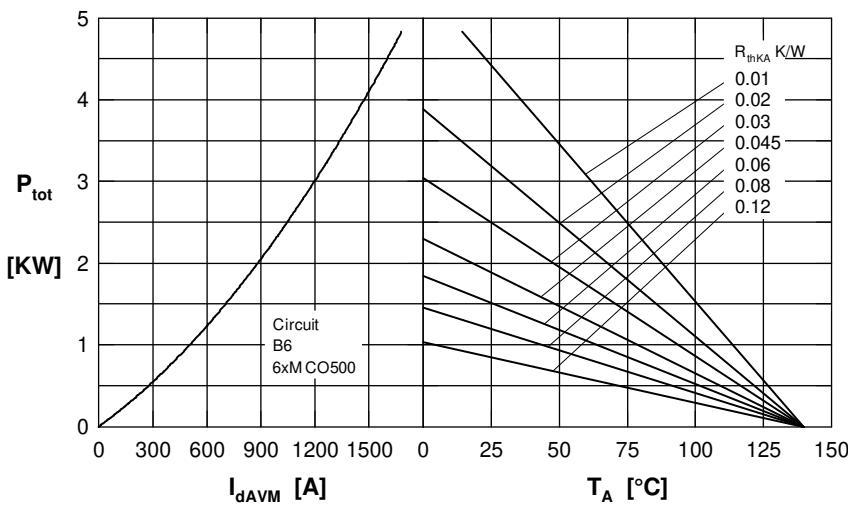


Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

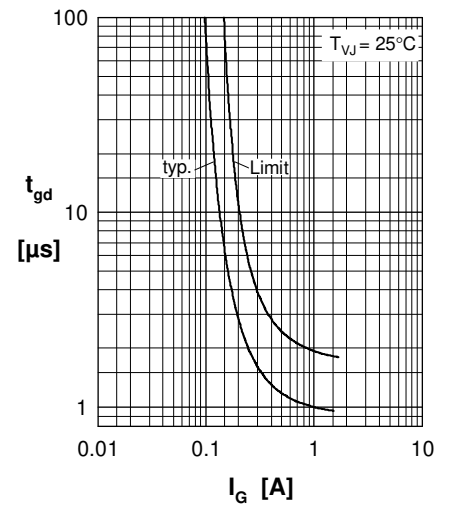


Fig. 7 Gate trigger delay time



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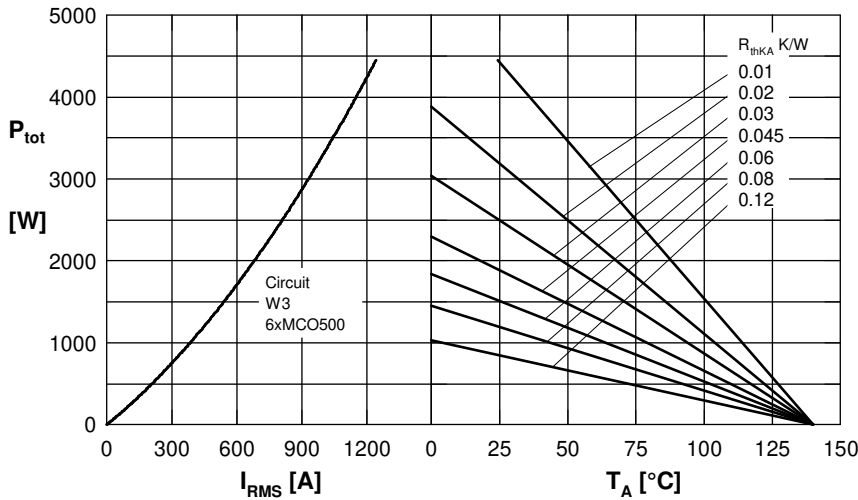


Fig. 8 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

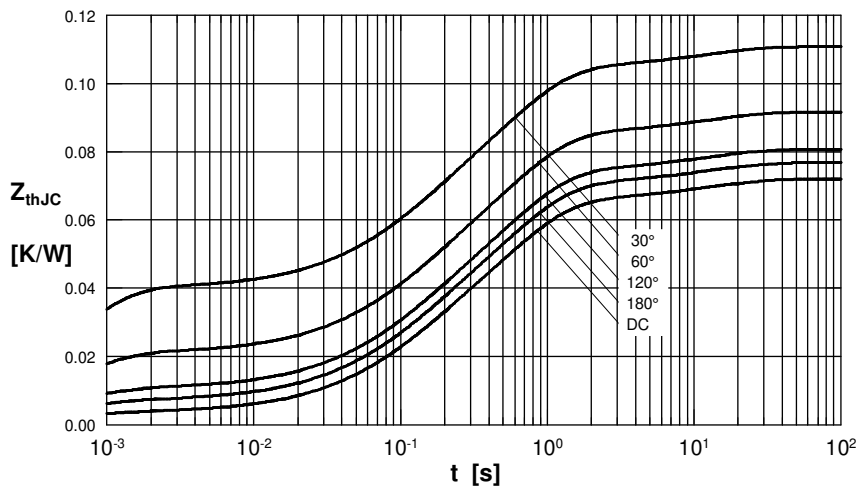


Fig. 9 Transient thermal impedance junction to case

R_{thJC} for various conduction angles d:

| d | R_{thJC} (K/W) |
|------|------------------|
| DC | 0.072 |
| 180° | 0.0768 |
| 120° | 0.081 |
| 60° | 0.092 |
| 30° | 0.111 |

Constants for Z_{thJC} calculation:

| i | R_{thi} (K/W) | t_i (s) |
|---|-----------------|-----------|
| 1 | 0.0035 | 0.0054 |
| 2 | 0.0186 | 0.098 |
| 3 | 0.0432 | 0.54 |
| 4 | 0.0067 | 12 |

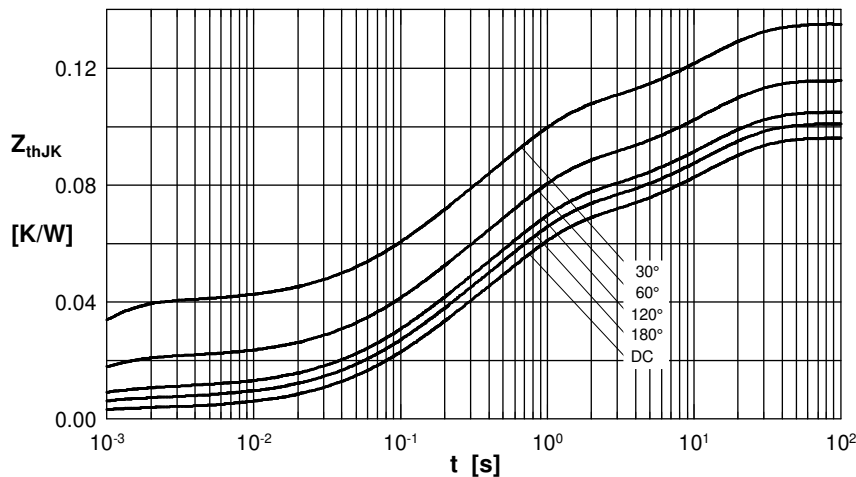


Fig.10 Transient thermal impedance junction to heatsink

R_{thJK} for various conduction angles d:

| d | R_{thJK} (K/W) |
|------|------------------|
| DC | 0.096 |
| 180° | 0.1 |
| 120° | 0.105 |
| 60° | 0.116 |
| 30° | 0.135 |

Constants for Z_{thJK} calculation:

| i | R_{thi} (K/W) | t_i (s) |
|---|-----------------|-----------|
| 1 | 0.0035 | 0.0054 |
| 2 | 0.0186 | 0.098 |
| 3 | 0.0432 | 0.54 |
| 4 | 0.0067 | 12 |
| 5 | 0.024 | 12 |

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