

High Voltage Thyristor Module

$$V_{RRM} = 2 \times 2200 \text{ V}$$

$$I_{TAV} = 120 \text{ A}$$

$$V_T = 1.34 \text{ V}$$

Phase leg

Part number

MCNA120P2200TA



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

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| Thyristor | | | Ratings | | | |
|----------------|--|--|---------------------------|------|------|-------------------|
| Symbol | Definition | Conditions | min. | typ. | max. | Unit |
| $V_{RSM/DSM}$ | max. non-repetitive reverse/forward blocking voltage | $T_{VJ} = 25^{\circ}C$ | | | 2300 | V |
| $V_{RRM/DRM}$ | max. repetitive reverse/forward blocking voltage | $T_{VJ} = 25^{\circ}C$ | | | 2200 | V |
| I_{RD} | reverse current, drain current | $V_{R/D} = 2200 V$ | $T_{VJ} = 25^{\circ}C$ | | 100 | μA |
| | | $V_{R/D} = 2200 V$ | $T_{VJ} = 140^{\circ}C$ | | 10 | mA |
| V_T | forward voltage drop | $I_T = 120 A$ | $T_{VJ} = 25^{\circ}C$ | | 1.36 | V |
| | | $I_T = 240 A$ | | | 1.69 | V |
| | | $I_T = 120 A$ | $T_{VJ} = 125^{\circ}C$ | | 1.34 | V |
| | | $I_T = 240 A$ | | | 1.78 | V |
| I_{TAV} | average forward current | $T_C = 85^{\circ}C$ | $T_{VJ} = 140^{\circ}C$ | | 120 | A |
| $I_{T(RMS)}$ | RMS forward current | 180° sine | | | 190 | A |
| V_{T0} | threshold voltage | } for power loss calculation only | $T_{VJ} = 140^{\circ}C$ | | 0.90 | V |
| r_T | slope resistance | | | | 3.7 | m Ω |
| R_{thJC} | thermal resistance junction to case | | | | 0.22 | K/W |
| R_{thCH} | thermal resistance case to heatsink | | | 0.2 | | K/W |
| P_{tot} | total power dissipation | | $T_C = 25^{\circ}C$ | | 520 | W |
| I_{TSM} | max. forward surge current | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$ | $T_{VJ} = 45^{\circ}C$ | | 2.20 | kA |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$ | $V_R = 0 V$ | | 2.38 | kA |
| | | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$ | $T_{VJ} = 140^{\circ}C$ | | 1.87 | kA |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$ | $V_R = 0 V$ | | 2.02 | kA |
| I^2t | value for fusing | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$ | $T_{VJ} = 45^{\circ}C$ | | 24.2 | kA ² s |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$ | $V_R = 0 V$ | | 23.5 | kA ² s |
| | | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$ | $T_{VJ} = 140^{\circ}C$ | | 17.5 | kA ² s |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$ | $V_R = 0 V$ | | 17.0 | kA ² s |
| C_J | junction capacitance | $V_R = 700 V \quad f = 1 \text{ MHz}$ | $T_{VJ} = 25^{\circ}C$ | | 83 | pF |
| P_{GM} | max. gate power dissipation | $t_p = 30 \mu s$ | $T_C = 140^{\circ}C$ | | 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 | $T_{VJ} = 140^{\circ}C; f = 50 \text{ Hz}$ | repetitive, $I_T = 360 A$ | | 150 | A/ μs |
| | | $t_p = 200 \mu s; di_G/dt = 0.45 A/\mu s;$ $I_G = 0.45 A; V = \frac{2}{3} V_{DRM}$ | non-repet., $I_T = 120 A$ | | 500 | A/ μs |
| $(dv/dt)_{cr}$ | critical rate of rise of voltage | $V = \frac{2}{3} V_{DRM}$ $R_{GK} = \infty; \text{ method 1 (linear voltage rise)}$ | $T_{VJ} = 140^{\circ}C$ | | 1000 | V/ μs |
| 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 | $V_D = 6 V$ | $T_{VJ} = 25^{\circ}C$ | | 150 | mA |
| | | | $T_{VJ} = -40^{\circ}C$ | | 200 | 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 | $t_p = 10 \mu s$ | $T_{VJ} = 25^{\circ}C$ | | 200 | mA |
| | | $I_G = 0.45 A; di_G/dt = 0.45 A/\mu s$ | | | | |
| I_H | holding current | $V_D = 6 V \quad R_{GK} = \infty$ | $T_{VJ} = 25^{\circ}C$ | | 150 | 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 | $V_R = 100 V; I_T = 120 A; V = \frac{2}{3} V_{DRM}$ $di/dt = 10 A/\mu s \quad dv/dt = 20 V/\mu s \quad t_p = 200 \mu s$ | $T_{VJ} = 125^{\circ}C$ | | 185 | μs |



| Package TO-240AA | | | | Ratings | | | |
|------------------|--|----------------------|-------------------------------------|---------|------|------|--|
| Symbol | Definition | Conditions | min. | typ. | max. | Unit | |
| I_{RMS} | RMS current | per terminal | | | 200 | A | |
| T_{VJ} | virtual junction temperature | | -40 | | 140 | °C | |
| T_{op} | operation temperature | | -40 | | 125 | °C | |
| T_{stg} | storage temperature | | -40 | | 125 | °C | |
| Weight | | | | | 81 | g | |
| M_D | mounting torque | | 2.5 | | 4 | Nm | |
| M_T | terminal torque | | 2.5 | | 4 | Nm | |
| $d_{Spp/App}$ | creepage distance on surface striking distance through air | terminal to terminal | 13.0 | 9.7 | | mm | |
| $d_{Spb/Apb}$ | | terminal to backside | 16.0 | 16.0 | | mm | |
| V_{ISOL} | isolation voltage | t = 1 second | | 4800 | | V | |
| | | t = 1 minute | 50/60 Hz, RMS; $I_{ISOL} \leq 1$ mA | 4000 | | V | |



Part description

- M = Module
- C = Thyristor (SCR)
- N = High Voltage Thyristor
- A = ($\geq 2000V$)
- 120 = Current Rating [A]
- P = Phase leg
- 2200 = Reverse Voltage [V]
- TA = TO-240AA-1B

| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|----------|-----------------|--------------------|---------------|----------|----------|
| Standard | MCNA120P2200TA | MCNA120P2200TA | Box | 36 | 515076 |

Equivalent Circuits for Simulation

* on die level

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



Thyristor

| | | | |
|--------------|--------------------|-----|----|
| $V_{0\ max}$ | threshold voltage | 0.9 | V |
| $R_{0\ max}$ | slope resistance * | 2.5 | mΩ |

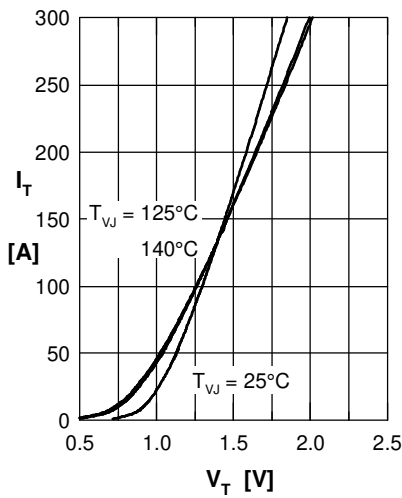
Thyristor


Fig. 1 Forward characteristics

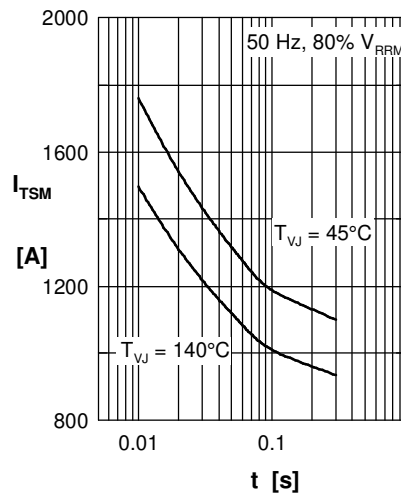
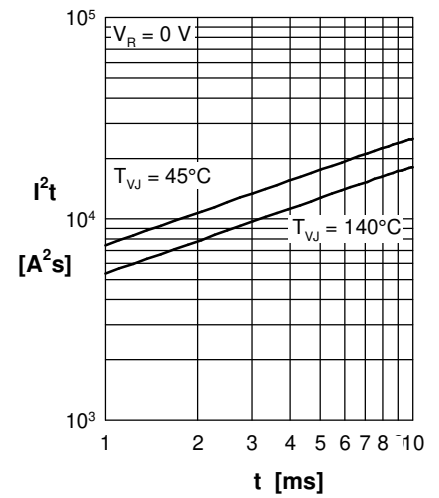
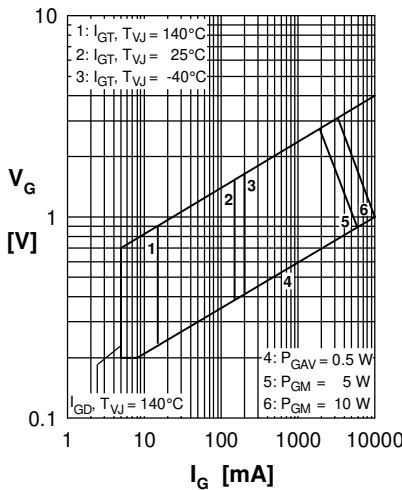

 Fig. 2 Surge overload current
 I_{TSM} : crest value, t : duration

 Fig. 3 I^2t versus time (1-10 s)


Fig. 4 Gate voltage & gate current

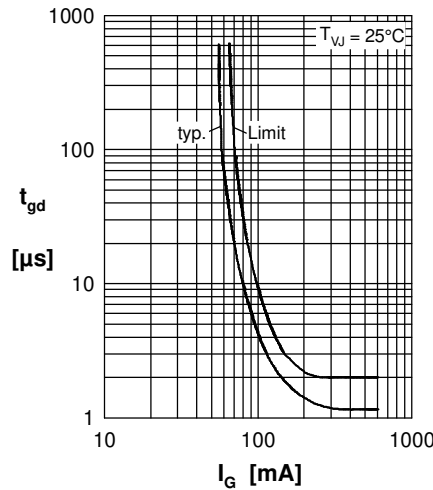
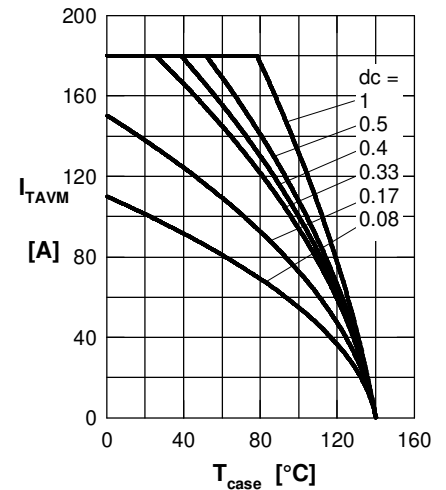

 Fig. 5 Gate controlled delay time t_{gd}


Fig. 6 Max. forward current at case temperature

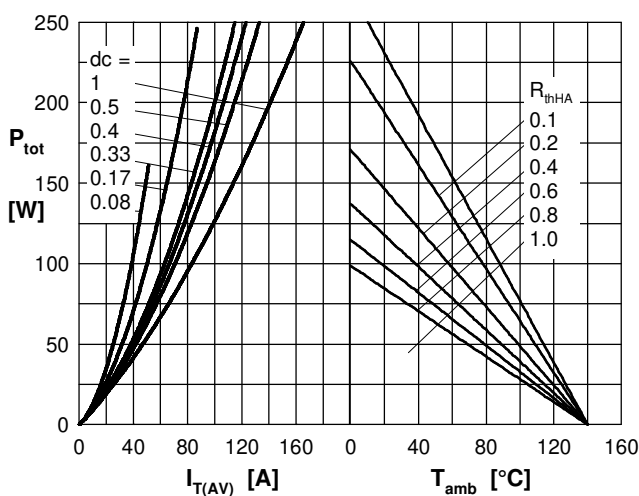
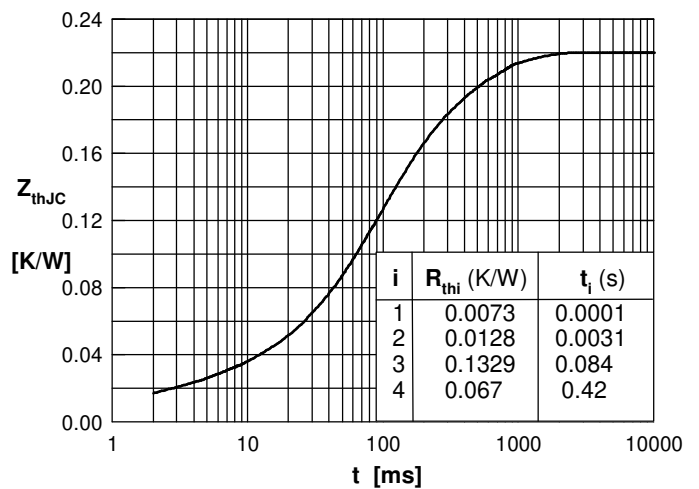

 Fig. 7a Power dissipation versus direct output current
 Fig. 7b and ambient temperature


Fig. 8 Transient thermal impedance junction to case