

High Voltage Thyristor Module

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

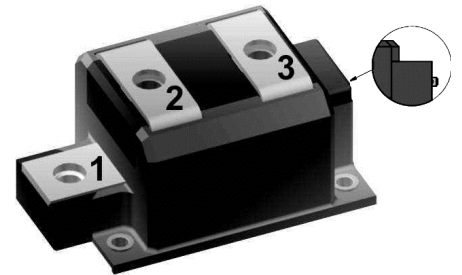
$$I_{TAV} = 650 \text{ A}$$

$$V_T = 1.16 \text{ V}$$

Phase leg

Part number

MCNA650P2200CA



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: ComPack

- Isolation Voltage: 4800 V~
- Industry standard outline
- RoHS compliant
- Soldering pins for PCB mounting
- Base plate: Copper internally DCB isolated
- Advanced power cycling
- Phase Change Material available

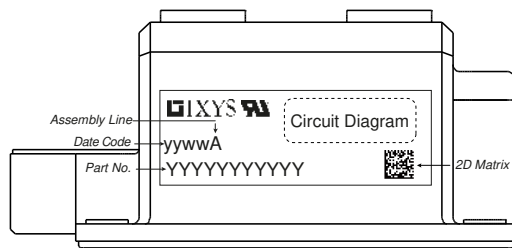
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| Rectifier | | | Ratings | | | |
|----------------|--|--|----------------------------|------|-------|-------------------|
| Symbol | Definition | Conditions | min. | typ. | max. | Unit |
| $V_{RSM/DSM}$ | max. non-repetitive reverse/forward blocking 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 | $V_{R/D} = 2200 V$ | $T_{VJ} = 25^{\circ}C$ | | 2 | mA |
| | | $V_{R/D} = 2200 V$ | $T_{VJ} = 125^{\circ}C$ | | 40 | mA |
| V_T | forward voltage drop | $I_T = 650 A$ | $T_{VJ} = 25^{\circ}C$ | | 1.19 | V |
| | | $I_T = 1300 A$ | | | 1.53 | V |
| | | $I_T = 650 A$ | $T_{VJ} = 125^{\circ}C$ | | 1.16 | V |
| | | $I_T = 1300 A$ | | | 1.59 | V |
| I_{TAV} | average forward current | $T_C = 85^{\circ}C$ | $T_{VJ} = 140^{\circ}C$ | | 650 | A |
| $I_{T(RMS)}$ | RMS forward current | 180° sine | | | 1020 | A |
| V_{T0} | threshold voltage | } for power loss calculation only | $T_{VJ} = 140^{\circ}C$ | | 0.75 | V |
| r_T | slope resistance | | | | 0.63 | mΩ |
| R_{thJC} | thermal resistance junction to case | | | | 0.045 | K/W |
| R_{thCH} | thermal resistance case to heatsink | | | 0.02 | | K/W |
| P_{tot} | total power dissipation | | $T_C = 25^{\circ}C$ | | 2555 | W |
| I_{TSM} | max. forward surge current | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$ | $T_{VJ} = 45^{\circ}C$ | | 16.0 | kA |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$ | $V_R = 0 V$ | | 17.3 | kA |
| | | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$ | $T_{VJ} = 140^{\circ}C$ | | 13.6 | kA |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$ | $V_R = 0 V$ | | 14.7 | kA |
| I^2t | value for fusing | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$ | $T_{VJ} = 45^{\circ}C$ | | 1.28 | MA ² s |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$ | $V_R = 0 V$ | | 1.24 | MA ² s |
| | | $t = 10 \text{ ms}; (50 \text{ Hz}), \text{ sine}$ | $T_{VJ} = 140^{\circ}C$ | | 924.8 | kA ² s |
| | | $t = 8,3 \text{ ms}; (60 \text{ Hz}), \text{ sine}$ | $V_R = 0 V$ | | 897.7 | kA ² s |
| C_J | junction capacitance | $V_R = 700 V \quad f = 1 \text{ MHz}$ | $T_{VJ} = 25^{\circ}C$ | | 469 | 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 | | | | 30 | W |
| $(di/dt)_{cr}$ | critical rate of rise of current | $T_{VJ} = 140^{\circ}C; f = 50 \text{ Hz}$ | repetitive, $I_T = 1950 A$ | | 100 | A/μs |
| | | $t_p = 200 \mu s; di_G/dt = 1 A/\mu s;$ $I_G = 1 A; V = \frac{2}{3} V_{DRM}$ | non-repet., $I_T = 650 A$ | | 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 | $V_R = 100 V; I_T = 650 A; V = \frac{2}{3} V_{DRM}$ $di/dt = 10 A/\mu s \quad dv/dt = 50 V/\mu s \quad t_p = 200 \mu s$ | $T_{VJ} = 125^{\circ}C$ | | 350 | μs |



| Package ComPack | | Ratings | | | | |
|-----------------|--|----------------------|------|------|------|------|
| Symbol | Definition | Conditions | min. | typ. | max. | Unit |
| I_{RMS} | RMS current | per terminal | | | 1200 | A |
| T_{VJ} | virtual junction temperature | | -40 | | 140 | °C |
| T_{op} | operation temperature | | -40 | | 125 | °C |
| T_{stg} | storage temperature | | -40 | | 125 | °C |
| Weight | | | | 500 | | g |
| M_D | mounting torque | | 3 | | 5 | Nm |
| M_T | terminal torque | | 12 | | 14 | Nm |
| $d_{Spp/Apb}$ | creepage distance on surface striking distance through air | terminal to terminal | 21.0 | | | mm |
| $d_{Spb/Apb}$ | | terminal to backside | 18.0 | | | mm |
| V_{ISOL} | isolation voltage | t = 1 second | 4800 | | | V |
| | | t = 1 minute | 4000 | | | V |



Part description

- M = Module
- C = Thyristor (SCR)
- N = High Voltage Thyristor
- A = (>= 2000V)
- 650 = Current Rating [A]
- P = Phase leg
- 2200 = Reverse Voltage [V]
- CA = ComPack

| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|----------|-----------------|--------------------|---------------|----------|----------|
| Standard | MCNA650P2200CA | MCNA650P2200CA | Box | 3 | 523321 |

Equivalent Circuits for Simulation

* on die level

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

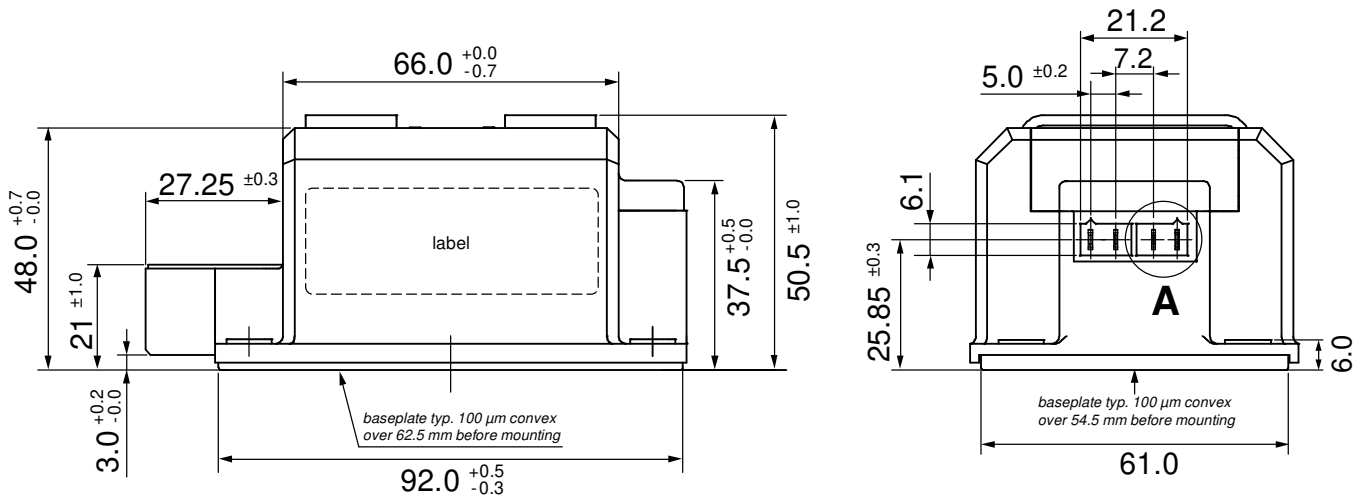


Thyristor

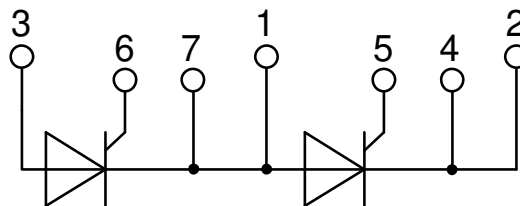
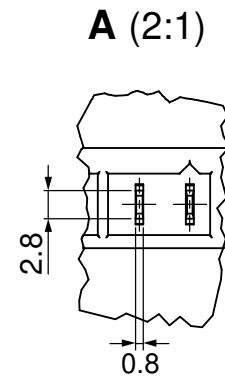
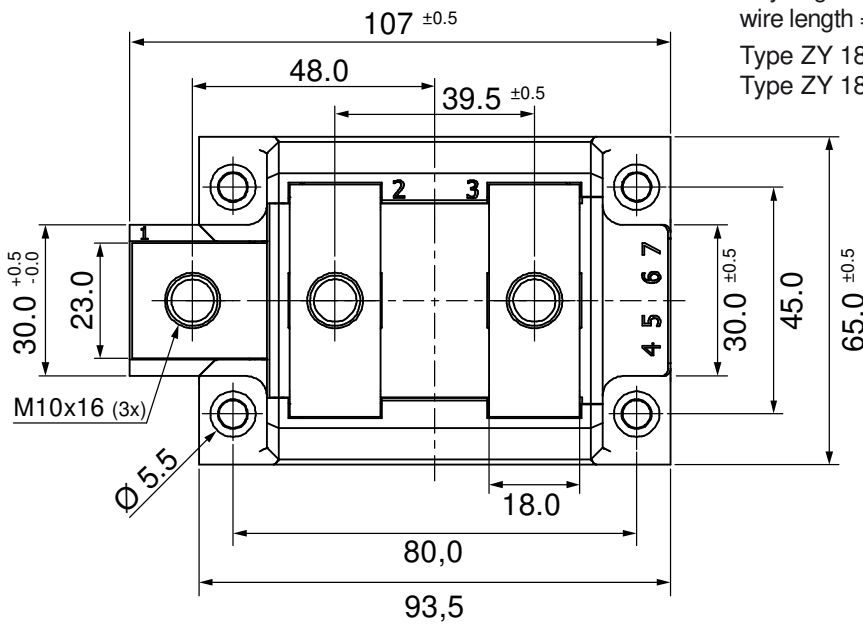
| | | | |
|--------------|--------------------|------|----|
| $V_{0\ max}$ | threshold voltage | 0.75 | V |
| $R_{0\ max}$ | slope resistance * | 0.44 | mΩ |



Outlines ComPack



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,
 Type ZY 180R (R = Right for pin pair 6/7) } style 3751



Thyristor

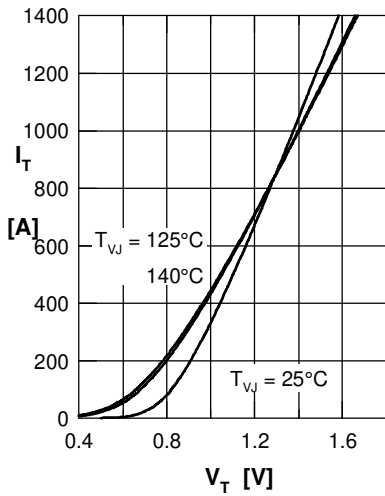


Fig. 1 Forward characteristics

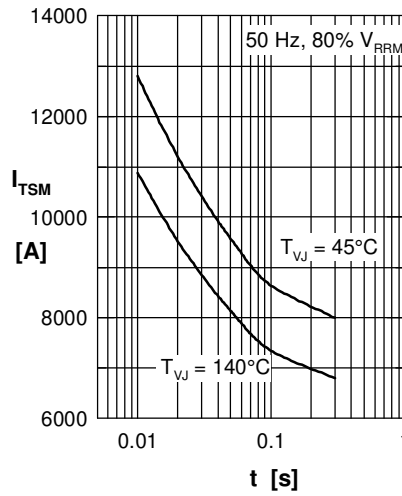


Fig. 2 Surge overload current
 I_{TSM} : crest value, t : duration

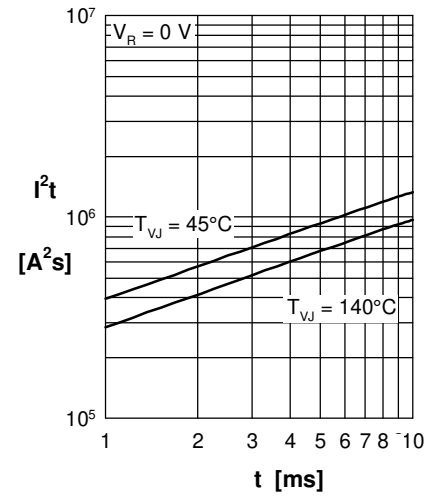


Fig. 3 I^2t versus time (1-10 s)

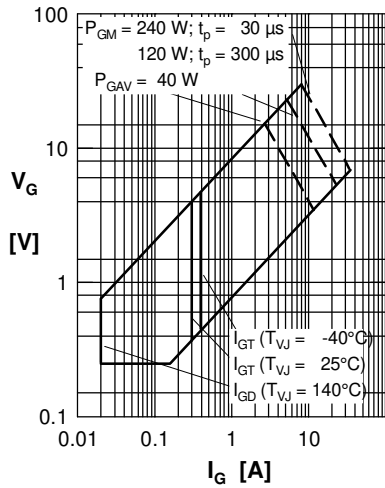


Fig. 4 Gate voltage & gate current

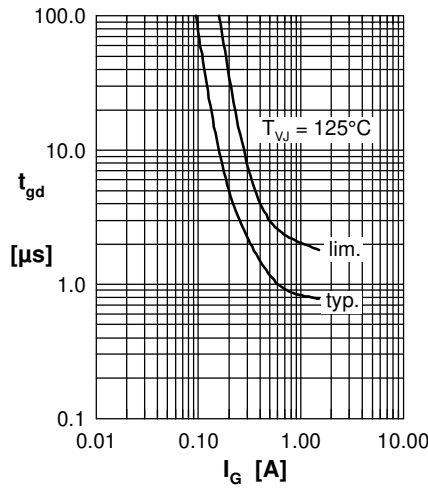


Fig. 5 Gate controlled delay time t_{gd}

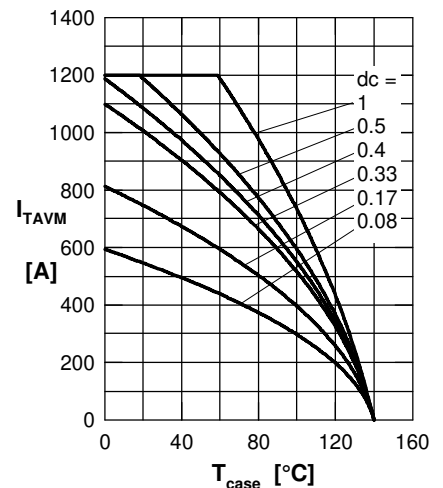


Fig. 6 Max. forward current at case temperature

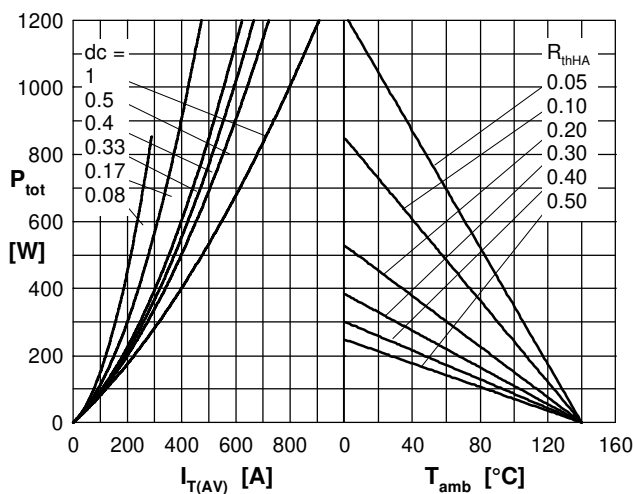


Fig. 7a Power dissipation versus direct output current
 Fig. 7b and ambient temperature

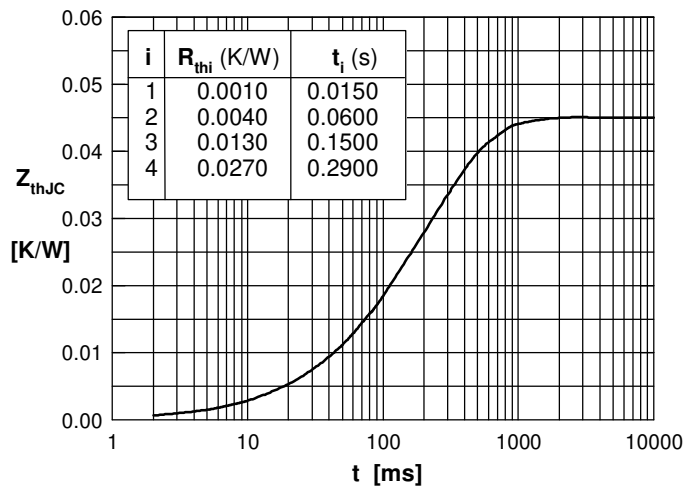


Fig. 8 Transient thermal impedance junction to case