# High Voltage Thyristor \ Diode Module

$V_{RRM}$ = 2x 2200 V
$I_{TAV}$ = 180 A
$V_T$ = 1.18 V

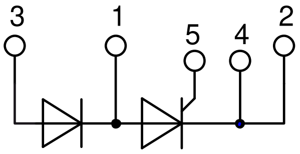
Phase leg

**Part number**

**MCNA180PD2200YB**


Backside: isolated

E72873




**Features / Advantages:**

- Thyristor for line frequency
- Planar passivated chip
- Long-term stability

**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: 4800 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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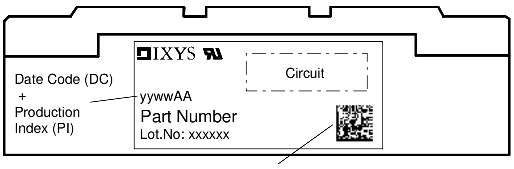
## Rectifier

| Symbol | Definition | Conditions | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{RSM/DSM}$ | *max. non-repetitive reverse/forward blocking voltage* | | $T_{VJ}$ = 25°C | | | 2300 | V |
| $V_{RRM/DRM}$ | *max. repetitive reverse/forward blocking voltage* | | $T_{VJ}$ = 25°C | | | 2200 | V |
| $I_{R/D}$ | *reverse current, drain current* | $V_{R/D}$ = 2200 V | $T_{VJ}$ = 25°C | | | 400 | µA |
| | | $V_{R/D}$ = 2200 V | $T_{VJ}$ = 125°C | | | 30 | mA |
| $V_T$ | *forward voltage drop* | $I_T$ = 180 A | $T_{VJ}$ = 25°C | | | 1.24 | V |
| | | $I_T$ = 360 A | | | | 1.49 | V |
| | | $I_T$ = 180 A | $T_{VJ}$ = 125°C | | | 1.18 | V |
| | | $I_T$ = 360 A | | | | 1.51 | V |
| $I_{TAV}$ | *average forward current* | $T_C$ = 85°C | $T_{VJ}$ = 140°C | | | 180 | A |
| $I_{T(RMS)}$ | *RMS forward current* | 180° sine | | | | 280 | A |
| $V_{T0}$ | *threshold voltage* | *for power loss calculation only* | $T_{VJ}$ = 140°C | | | 0.85 | V |
| $r_T$ | *slope resistance* | | | | | 1.8 | mΩ |
| $R_{thJC}$ | *thermal resistance junction to case* | | | | | 0.17 | K/W |
| $R_{thCH}$ | *thermal resistance case to heatsink* | | | | 0.09 | | K/W |
| $P_{tot}$ | *total power dissipation* | | $T_C$ = 25°C | | | 675 | W |
| $I_{TSM}$ | *max. forward surge current* | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 45°C | | | 5.40 | kA |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 5.83 | kA |
| | | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 140°C | | | 4.59 | kA |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 4.96 | kA |
| $I^2t$ | *value for fusing* | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 45°C | | | 145.8 | kA²s |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 141.4 | kA²s |
| | | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 140°C | | | 105.3 | kA²s |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 102.1 | kA²s |
| $C_J$ | *junction capacitance* | $V_R$ = 700 V f = 1 MHz | $T_{VJ}$ = 25°C | | 146 | | pF |
| $P_{GM}$ | *max. gate power dissipation* | $t_P$ = 30 µs | $T_C$ = 140°C | | | 120 | W |
| | | $t_P$ = 300 µs | | | | 60 | W |
| $P_{GAV}$ | *average gate power dissipation* | | | | | 8 | W |
| $(di/dt)_{cr}$ | *critical rate of rise of current* | $T_{VJ}$ = 140 °C; f = 50 Hz | repetitive, $I_T$ = 540 A | | | 150 | A/µs |
| | | $t_P$ = 200 µs; $di_G/dt$ = 0.5 A/µs; | | | | | |
| | | $I_G$ = 0.5 A; V = ⅔ $V_{DRM}$ | non-repet., $I_T$ = 180 A | | | 500 | A/µs |
| $(dv/dt)_{cr}$ | *critical rate of rise of voltage* | V = ⅔ $V_{DRM}$ | $T_{VJ}$ = 140°C | | | 1000 | V/µs |
| | | $R_{GK}$ = ∞; method 1 (linear voltage rise) | | | | | |
| $V_{GT}$ | *gate trigger voltage* | $V_D$ = 6 V | $T_{VJ}$ = 25°C | | | 2 | V |
| | | | $T_{VJ}$ = -40°C | | | 2.6 | V |
| $I_{GT}$ | *gate trigger current* | $V_D$ = 6 V | $T_{VJ}$ = 25°C | | | 150 | mA |
| | | | $T_{VJ}$ = -40°C | | | 200 | mA |
| $V_{GD}$ | *gate non-trigger voltage* | $V_D$ = ⅔ $V_{DRM}$ | $T_{VJ}$ = 140°C | | | 0.2 | V |
| $I_{GD}$ | *gate non-trigger current* | | | | | 10 | mA |
| $I_L$ | *latching current* | $t_p$ = 30 µs | $T_{VJ}$ = 25°C | | | 200 | mA |
| | | $I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | | | | |
| $I_H$ | *holding current* | $V_D$ = 6 V $R_{GK}$ = ∞ | $T_{VJ}$ = 25°C | | | 200 | mA |
| $t_{gd}$ | *gate controlled delay time* | $V_D$ = ½ $V_{DRM}$ | $T_{VJ}$ = 25°C | | | 2 | µs |
| | | $I_G$ = 0.5 A; $di_G/dt$ = 0.5 A/µs | | | | | |
| $t_q$ | *turn-off time* | $V_R$ = 100 V; $I_T$ = 180A; V = ⅔ $V_{DRM}$ | $T_{VJ}$ = 125 °C | | 200 | | µs |
| | | di/dt = 10 A/µs dv/dt = 20 V/µs $t_p$ = 200 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 | | 140 | °C |
| $T_{op}$ | *operation temperature* | | | -40 | | 125 | °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; 50/60 Hz, RMS; $I_{ISOL} \leq 1$ mA | | 4800 | | | V |
| | | t = 1 minute | | 4000 | | | V |




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

**Part description**

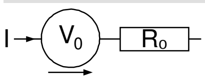
- M = Module
- C = Thyristor (SCR)
- N = High Voltage Thyristor
- A = (>= 2000V)
- 180 = Current Rating [A]
- PD = Phase leg
- 2200 = Reverse Voltage [V]
- YB = Y4-M6

| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|---|---|---|---|---|---|
| Standard | MCNA180PD2200YB | MCNA180PD2200YB | Box | 6 | 520502 |

| Similar Part | Package | Voltage class |
|---|---|---|
| MCNA150PD2200YB | Y4-M6 | 2200 |
| MCNA220PD2200YB | Y4-M6 | 2200 |

## Equivalent Circuits for Simulation

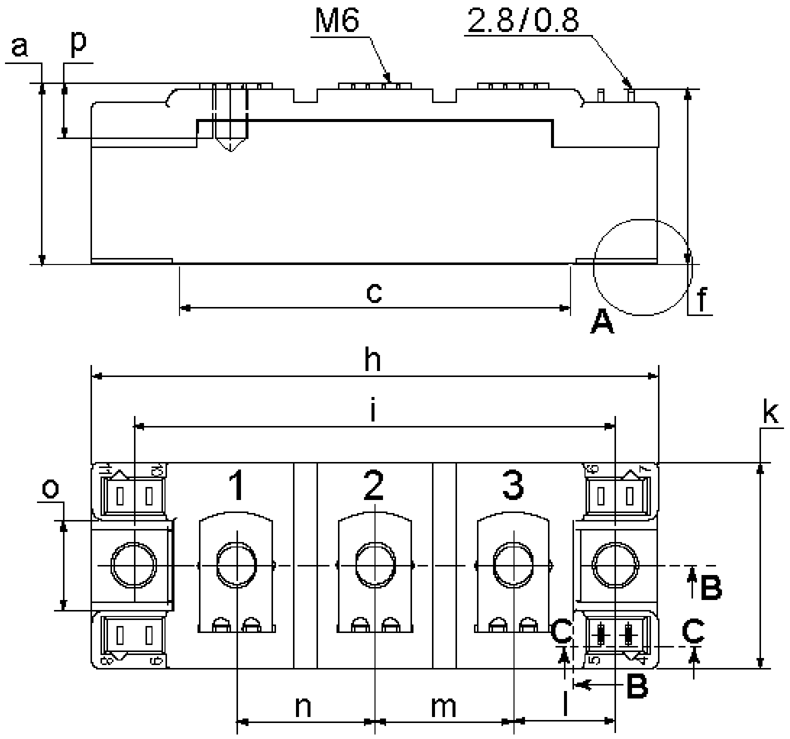
** on die level* $T_{VJ} = 140°C$




**Thyristor**

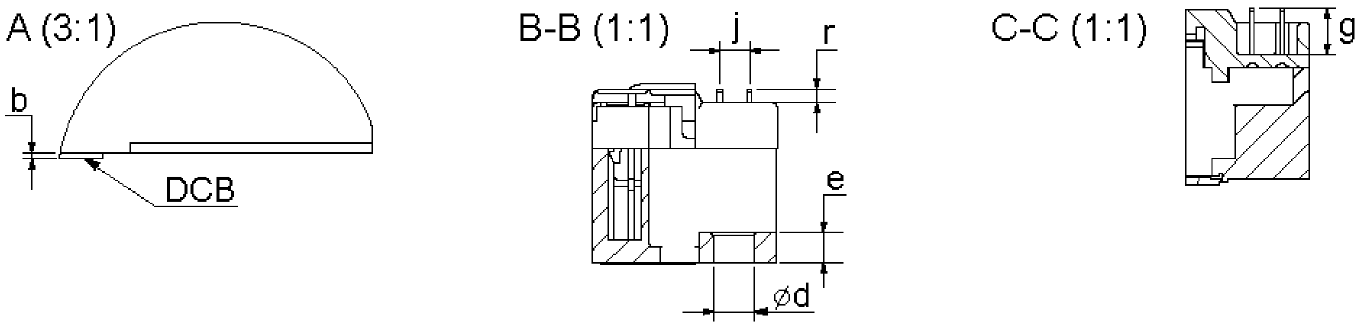
| | | | |
|---|---|---|---|
| $V_{0\,max}$ | *threshold voltage* | 0.85 | V |
| $R_{0\,max}$ | *slope resistance ** | 1.18 | mΩ |

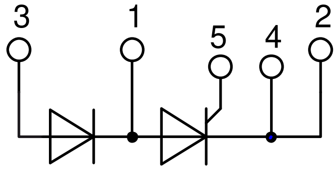
## Outlines Y4




| 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 | |
| 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) UL 758, style 3751



## Thyristor

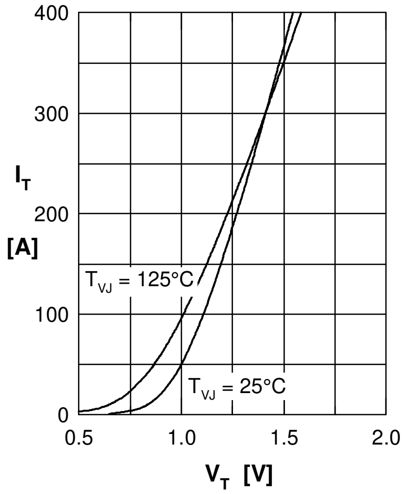



Fig. 1 Forward characteristics

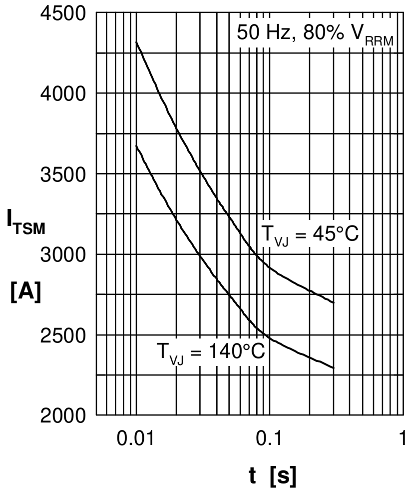



Fig. 2 Surge overload current
$I_{TSM}$: crest value, t: duration

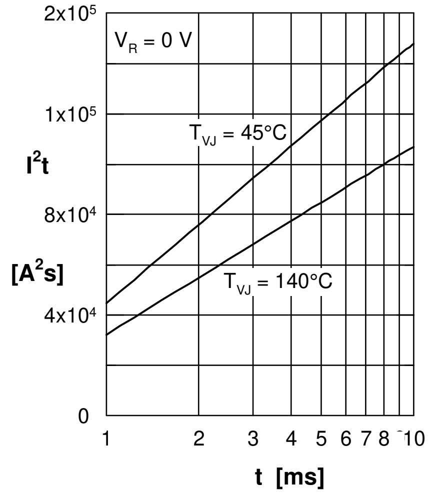



Fig. 3 $I^2t$ versus time (1-10 s)

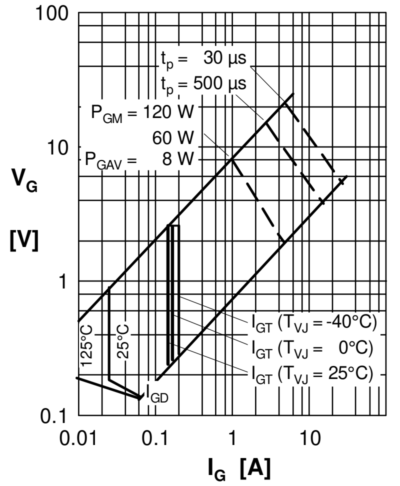



Fig. 4 Gate voltage & gate current

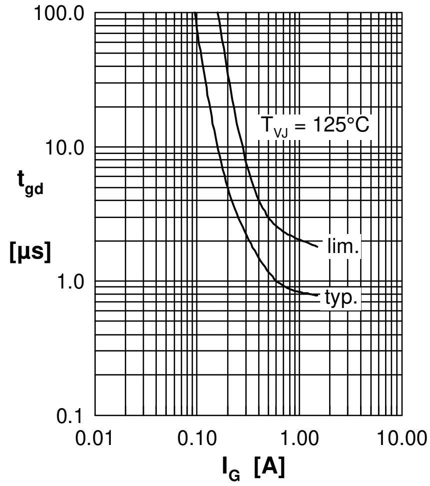



Fig. 5 Gate controlled delay time $t_{gd}$

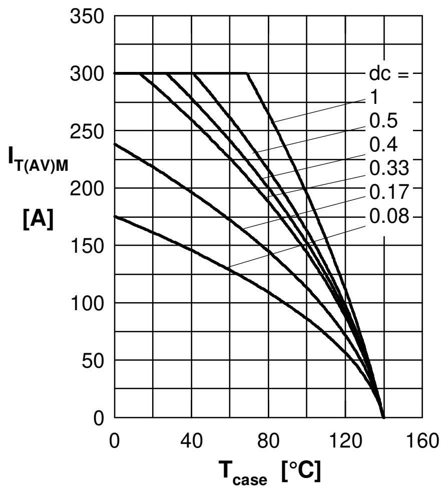



Fig. 6 Max. forward current at case temperature

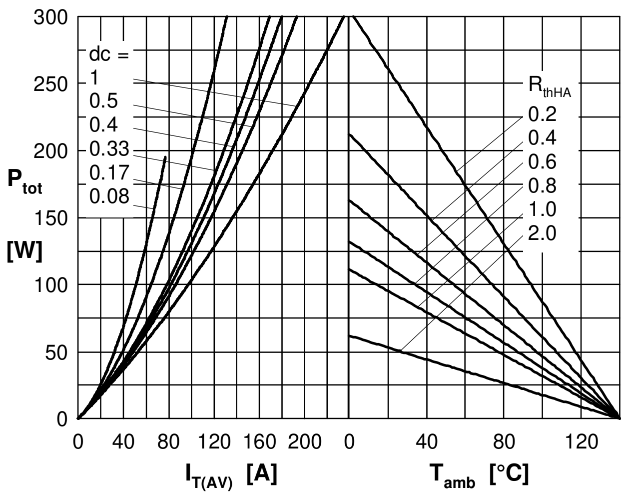
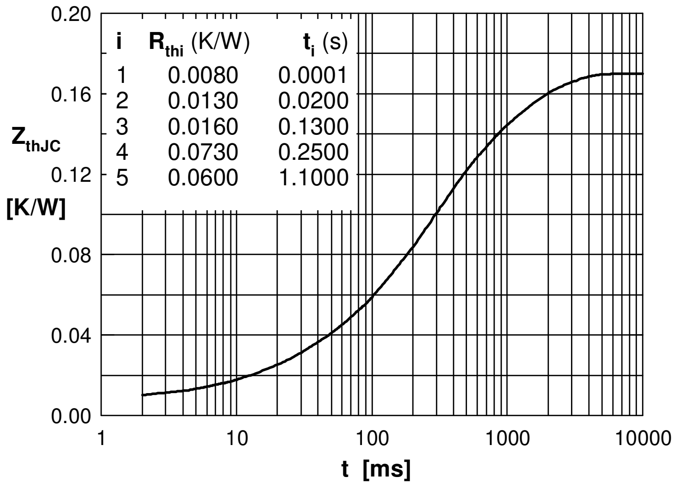



Fig. 7a Power dissipation versus direct output current
Fig. 7b and ambient temperature




| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0080 | 0.0001 |
| 2 | 0.0130 | 0.0200 |
| 3 | 0.0160 | 0.1300 |
| 4 | 0.0730 | 0.2500 |
| 5 | 0.0600 | 1.1000 |

Fig. 8 Transient thermal impedance junction to case