# Thyristor Module

| | | |
|---|---|---|
| $V_{RRM}$ | = | 2x 1600 V |
| $I_{TAV}$ | = | 140 A |
| $V_{T}$ | = | 1.28 V |

## Phase leg

**Part number**

MCMA140PD1600TB
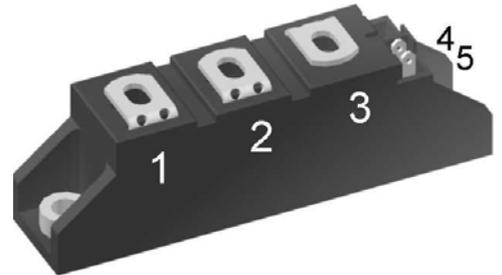


Backside: isolated
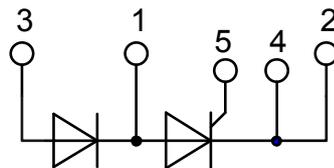


**Features / Advantages:**
- Thyristor for line frequency
- Planar passivated chip
- Long-term stability
- Direct Copper Bonded Al2O3-ceramic

**Applications:**
- Line rectifying 50/60 Hz
- Softstart AC motor control
- DC Motor control
- Power converter
- AC power control
- Lighting and temperature control

**Package:** 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

Data according to IEC 60747and per semiconductor unless otherwise specified

20120802b

# IXYS

# MCMA140PD1600TB

## Rectifier | | | | | Ratings

| Symbol | Definition | Conditions | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| $V_{RSM/DSM}$ | max. non-repetitive reverse/forward blocking voltage | $T_{VJ}$ = 25°C | | | | 1700 | V |
| $V_{RRM/DRM}$ | max. repetitive reverse/forward blocking voltage | $T_{VJ}$ = 25°C | | | | 1600 | V |
| $I_{R/D}$ | reverse current, drain current | $V_{R/D}$ = 1600 V | $T_{VJ}$ = 25°C | | | 100 | µA |
| | | $V_{R/D}$ = 1600 V | $T_{VJ}$ = 140°C | | | 10 | mA |
| $V_T$ | forward voltage drop | $I_T$ = 150 A | $T_{VJ}$ = 25°C | | | 1.29 | V |
| | | $I_T$ = 300 A | | | | 1.63 | V |
| | | $I_T$ = 150 A | $T_{VJ}$ = 125°C | | | 1.28 | V |
| | | $I_T$ = 300 A | | | | 1.70 | V |
| $I_{TAV}$ | average forward current | $T_C$ = 85°C | $T_{VJ}$ = 140°C | | | 140 | A |
| $I_{T(RMS)}$ | RMS forward current | 180° sine | | | | 220 | A |
| $V_{T0}$ | threshold voltage | for power loss calculation only | $T_{VJ}$ = 140°C | | | 0.85 | V |
| $r_T$ | slope resistance | | | | | 2.8 | mΩ |
| $R_{thJC}$ | thermal resistance junction to case | | | | | 0.22 | K/W |
| $R_{thCH}$ | thermal resistance case to heatsink | | | | 0.20 | | K/W |
| $P_{tot}$ | total power dissipation | $T_C$ = 25°C | | | | 520 | W |
| $I_{TSM}$ | max. forward surge current | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 45°C | | | 2.40 | kA |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 2.59 | kA |
| | | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 140°C | | | 2.04 | kA |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 2.21 | kA |
| $I^2t$ | value for fusing | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 45°C | | | 28.8 | kA²s |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 27.9 | kA²s |
| | | t = 10 ms; (50 Hz), sine | $T_{VJ}$ = 140°C | | | 20.8 | kA²s |
| | | t = 8,3 ms; (60 Hz), sine | $V_R$ = 0 V | | | 20.2 | kA²s |
| $C_J$ | junction capacitance | $V_R$ = 400 V   f = 1 MHz | $T_{VJ}$ = 25°C | | 119 | | pF |
| $P_{GM}$ | max. gate power dissipation | $t_P$ = 30 µs | $T_C$ = 140°C | | | 10 | W |
| | | $t_P$ = 300 µs | | | | 5 | W |
| $P_{GAV}$ | average gate power dissipation | | | | | 0.5 | W |
| $(di/dt)_{cr}$ | critical rate of rise of current | $T_{VJ}$ = 140°C; f = 50 Hz    repetitive, $I_T$ = 450 A | | | | 150 | A/µs |
| | | $t_P$ = 200 µs; $di_G/dt$ = 0.45 A/µs | | | | | |
| | | $I_G$ = 0.45A; $V_D$ = ⅔ $V_{DRM}$    non-repet., $I_T$ = 150 A | | | | 500 | A/µs |
| $(dv/dt)_{cr}$ | critical rate of rise of voltage | $V_D$ = 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 | | | 1.5 | V |
| | | | $T_{VJ}$ = -40°C | | | 1.6 | 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 | $t_p$ = 10 µs | $T_{VJ}$ = 25°C | | | 200 | mA |
| | | $I_G$ = 0.45A; $di_G/dt$ = 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 |
| | | $I_G$ = 0.45A; $di_G/dt$ = 0.45 A/µs | | | | | |
| $t_q$ | turn-off time | $V_R$ = 100 V; $I_T$ = 150 A; $V_D$ = ⅔ $V_{DRM}$  $T_{VJ}$ = 140°C | | | 185 | | µs |
| | | di/dt = 10 A/µs; dv/dt = 20 V/µs; $t_p$ = 200 µs | | | | | |

## Package    TO-240AA

| Symbol | Definition | Conditions | | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| I$_{RMS}$ | RMS current | per terminal | | | | 200 | A |
| T$_{stg}$ | storage temperature | | | -40 | | 125 | °C |
| T$_{VJ}$ | virtual junction temperature | | | -40 | | 140 | °C |
| Weight | | | | | 90 | | g |
| M$_D$ | mounting torque | | | 2.5 | | 4 | Nm |
| M$_T$ | terminal torque | | | 2.5 | | 4 | Nm |
| V$_{ISOL}$ | isolation voltage | t = 1 second | 50/60 Hz, RMS; I$_{ISOL}$ ≤ 1 mA | 4800 | | | V |
| | | t = 1 minute | | 4000 | | | V |
| 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 |
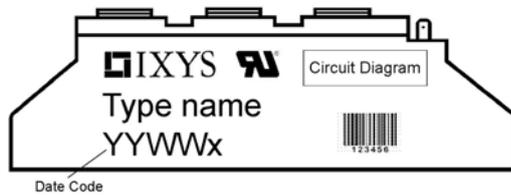
**Ratings**



**Part number**

M = Module
C = Thyristor (SCR)
M = Thyristor
A = (up to 1800V)
140 = Current Rating [A]
PD = Phase leg
1600 = Reverse Voltage [V]
TB = TO-240AA-1B

| Ordering | Part Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|---|---|---|---|---|---|
| Standard | MCMA140PD1600TB | MCMA140PD1600TB | Box | 6 | 509348 |

| Similar Part | Package | Voltage class |
|---|---|---|
| MCMA140P1600TA | TO-240AA-1B | 1600 |

## Equivalent Circuits for Simulation    *on die level*    T$_{VJ}$ = 140°C
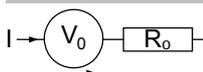


**Thyristor**

| | | | |
|---|---|---|---|
| V$_{0 max}$ | threshold voltage | 0.85 | V |
| R$_{0 max}$ | slope resistance * | 1.6 | mΩ |

**Outlines   TO-240AA**

A 2.8 - 0.8
DIN 46244
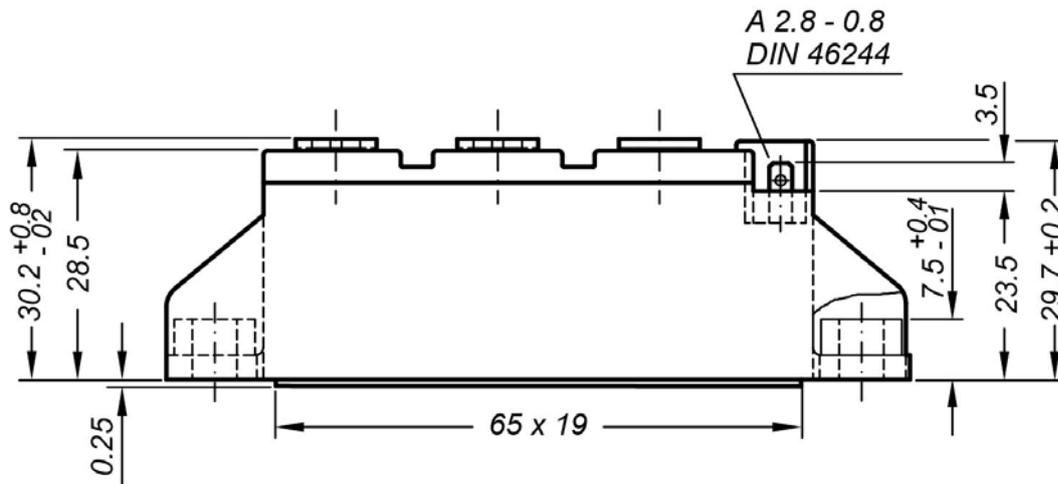
General tolerance: DIN ISO 2768 class „c"

M5
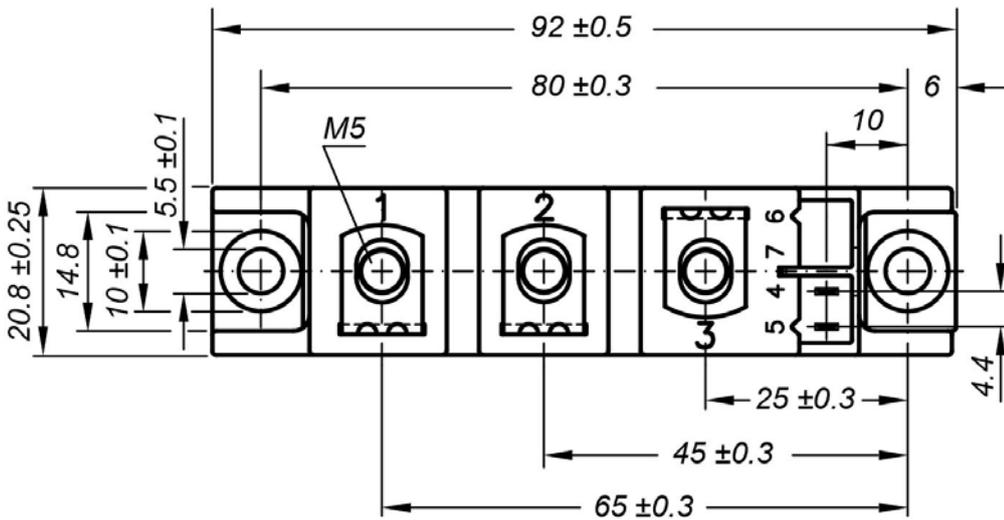
Optional accessories: Keyed gate/cathode twin plugs
Wire length: 350 mm, gate = white, cathode = red
UL 758, style 3751
Type **ZY 200L**  (L = Left   for pin pair 4/5)

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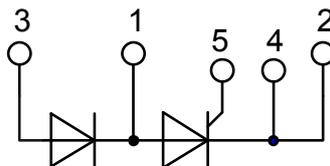
**Thyristor**
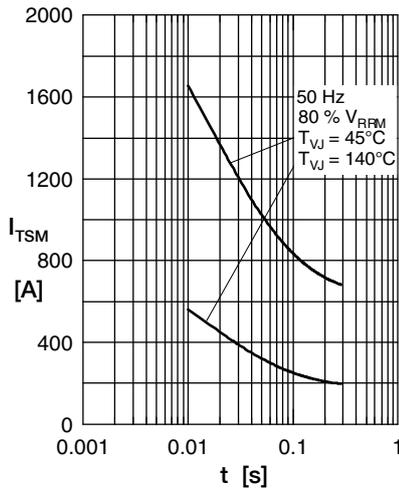


Fig. 1 Surge overload current
$I_{TSM}$: Crest value, t: duration

50 Hz
80 % $V_{RRM}$
$T_{VJ}$ = 45°C
$T_{VJ}$ = 140°C
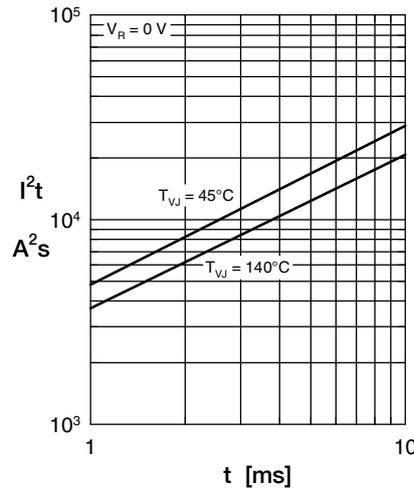


Fig. 2 $I^2t$ versus time (1-10 ms)

$V_R$ = 0 V
$T_{VJ}$ = 45°C
$T_{VJ}$ = 140°C
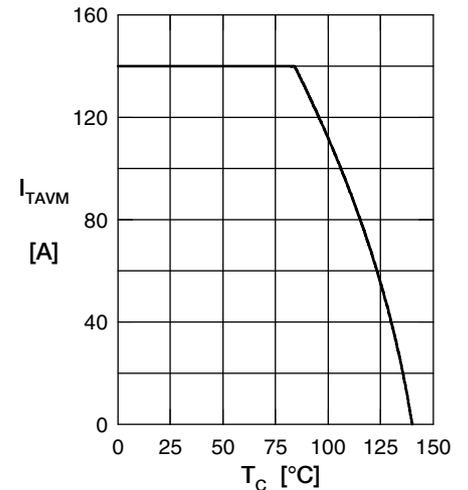


Fig. 3 Maximum forward current
at case temperature
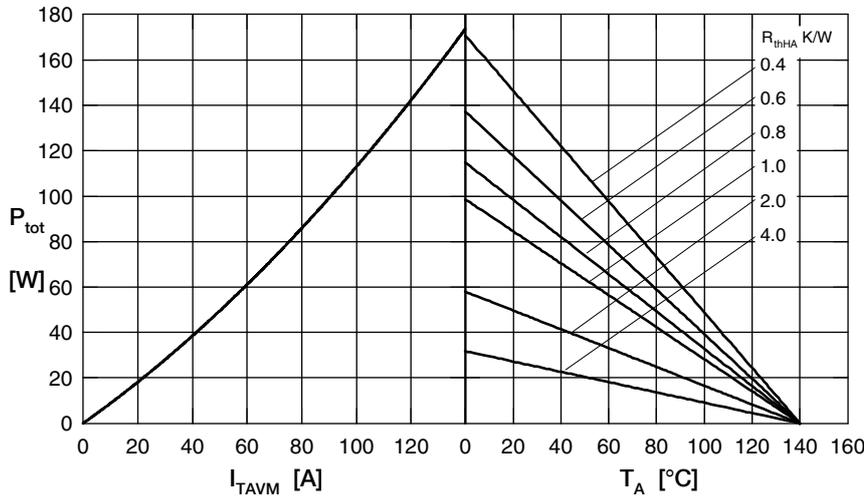


Fig. 4 Power dissipation vs. forward current and ambient temperature

$R_{thHA}$ K/W
0.4
0.6
0.8
1.0
2.0
4.0
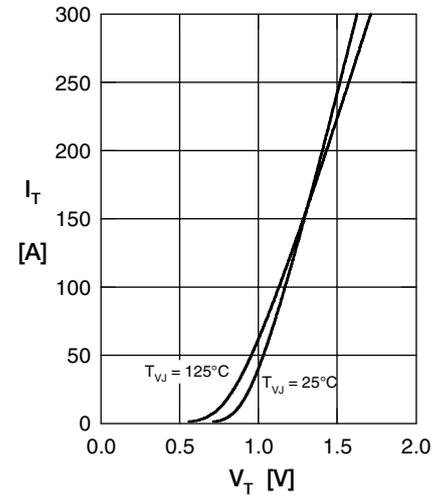


Fig. 5 Forward current
$I_T$ versus $V_T$

$T_{VJ}$ = 125°C   $T_{VJ}$ = 25°C
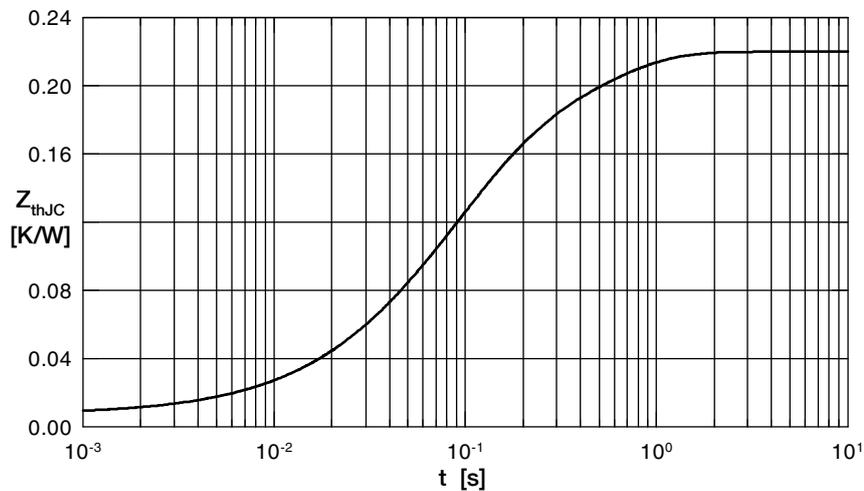


Fig. 6 Transient thermal impedance junction to case

Constants for $Z_{thJC}$ calculation:

| i | $R_{thi}$ [ K/W ] | $t_i$ [s] |
|---|---|---|
| 1 | 0.0073 | 0.0001 |
| 2 | 0.0128 | 0.031 |
| 3 | 0.1329 | 0.084 |
| 4 | 0.067 | 0.42 |

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