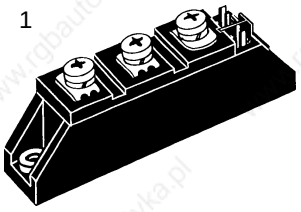
# Contents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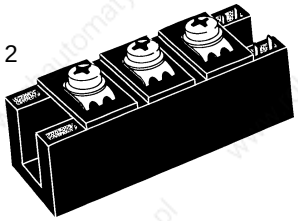
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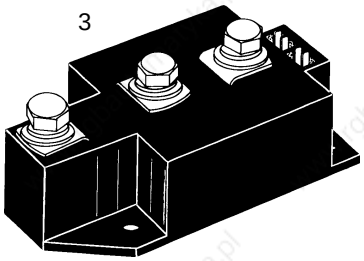
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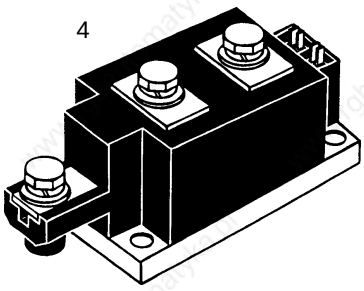
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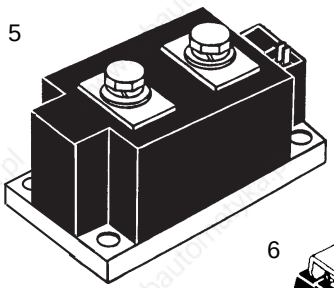
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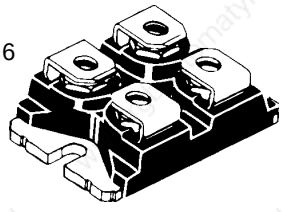
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| Package style | $I_{TAVM}$ $I_{FAVM}$ A | $V_{RRM}/V_{DRM}$ (V) 800 | 1200 | 1400 | 1600 | 1800 | 2000 | 2200 | Type | Page |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Thyristor Modules** | | | | | | | | | |
| 1 | 25 | ● | ● | ● | ● | | | | MCC 19 | E2 - 2 |
| 1 | 21 | | | ● | ● | | | | MCC 21 *new* | E2 - 6 |
| 1 | 32 | ● | ● | ● | ● | | | | MCC 26 | E2 - 8 |
| 1 | 51 | ● | ● | ● | ● | ● | | | MCC 44 | E2 - 14 |
| 1 | 60 | ● | ● | ● | ● | ● | | | MCC 56 | E2 - 18 |
| 1 | 64 | | | | ● | | | | MCC 60 *new* | E2 - 22 |
| 1 | 115 | ● | ● | ● | ● | ● | | | MCC 72 | E2 - 24 |
| 1 | 104 | | | | | | ● | ● | MCC 94 | E2 - 28 |
| 1 | 116 | ● | ● | ● | ● | ● | | | MCC 95 | E2 - 30 |
| 2 | 130 | ● | ● | ● | ● | ● | | | MCC 122 *new* | E2 - 34 |
| 2 | 130 | ● | ● | ● | ● | ● | | | MCC 132 | E2 - 36 |
| 2 | 165 | | | | | | ● | ● | MCC 161 | E2 - 40 |
| 2 | 190 | ● | ● | ● | ● | ● | | | MCC 162 | E2 - 42 |
| 4 | 203 | | ● | ● | ● | ● | | | MCC 170 | E2 - 46 |
| 3 | 250 | ● | ● | ● | ● | | | | MCC 220 | E2 - 50 |
| 4 | 240 | | | | | | ● | ● | MCC 224 | E2 - 54 |
| 4 | 221 | | ● | ● | ● | ● | | | MCC 225 | E2 - 58 |
| 3 | 287 | ● | ● | ● | ● | ● | | | MCC 250 | E2 - 62 |
| 4 | 250 | | ● | ● | ● | ● | | | MCC 255 | E2 - 66 |
| 3 | 320 | ● | ● | ● | ● | ● | | | MCC 310 | E2 - 70 |
| 4 | 320 | | ● | ● | ● | ● | | | MCC 312 | E2 - 74 |
| 5 | 464 | | | | | | ● | ● | MCO 450 | E2 - 78 |
| 5 | 560 | | ● | ● | ● | ● | | | MCO 500 | E2 - 82 |
| 5 | 600 | | | | | | ● | ● | MCO 600 | E2 - 82 |
| 5 | **Thyristor / Diode Modules** | | | | | | | | | |
| 1 | 32 | ● | ● | ● | ● | | | | MCD 26 | E2 - 8 |
| 6 | 38 | | ● | | ● | | | | MCD 40 | E2 - 12 |
| 1 | 51 | ● | ● | ● | ● | ● | | | MCD 44 | E2 - 14 |
| 1 | 64 | ● | ● | ● | ● | ● | | | MCD 56 | E2 - 18 |
| 1 | 64 | 600 | | | | | | | MDC 56 *new* | E2 - 18 |
| 1 | 115 | ● | ● | ● | ● | ● | | | MCD 72 | E2 - 24 |
| 1 | 104 | | | | | | ● | ● | MCD 94 | E2 - 28 |
| 1 | 116 | ● | ● | ● | ● | ● | | | MCD 95 | E2 - 30 |
| 2 | 130 | ● | ● | ● | ● | ● | | | MCD 132 | E2 - 36 |
| 2 | 165 | | | | | | ● | ● | MCD 161 | E2 - 40 |
| 2 | 190 | ● | ● | ● | ● | ● | | | MCD 162 | E2 - 42 |
| 3 | 240 | | | | | | ● | ● | MCD 224 *new* | E2 - 54 |
| 4 | 250 | ● | ● | ● | ● | | | | MCD 220 | E2 - 50 |
| 3 | 221 | | ● | ● | ● | ● | | | MCD 225 | E2 - 58 |
| 4 | 287 | ● | ● | ● | ● | | | | MCD 250 | E2 - 62 |
| 3 | 250 | | ● | ● | ● | ● | | | MCD 255 | E2 - 66 |
| 4 | 320 | ● | ● | ● | ● | ● | | | MCD 310 | E2 - 70 |
| 4 | 320 | | ● | ● | ● | ● | | | MCD 312 | E2 - 74 |

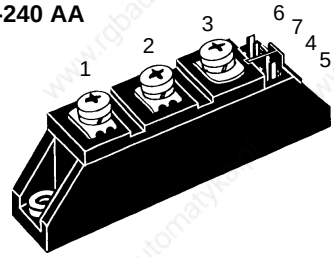
**See also *section E1***
***page 1 Discrete Thyristors***

# Thyristor Modules

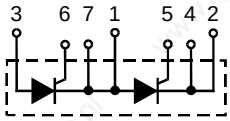
$I_{TRMS}$ = 2x 40 A
$I_{TAVM}$ = 2x 25 A
$V_{RRM}$ = 800-1600 V

| $V_{RSM}$ $V_{DSM}$ V | $V_{RRM}$ $V_{DRM}$ V | Type Version 1 B | Version 8 B |
|---|---|---|---|
| 900 | 800 | MCC 19-08io1 B | MCC 19-08io8 B |
| 1300 | 1200 | MCC 19-12io1 B | MCC 19-12io8 B |
| 1500 | 1400 | MCC 19-14io1 B | MCC 19-14io8 B |
| 1700 | 1600 | MCC 19-16io1 B | MCC 19-16io8 B |

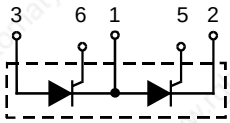
**TO-240 AA**




**Version 1 B**




**Version 8 B**




| Symbol | Test Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$ | $T_{VJ} = T_{VJM}$ | | 40 | A |
| $I_{TAVM}$ | $T_C$ = 58°C; 180° sine | | 25 | A |
| | $T_C$ = 85°C; 180° sine | | 18 | A |
| $I_{TSM}$ | $T_{VJ}$ = 45°C; | t = 10 ms (50 Hz), sine | 400 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 420 | A |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 350 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 370 | A |
| $\int i^2dt$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz), sine | 800 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 730 | $A^2s$ |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 600 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 570 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM}$ | repetitive, $I_T$ = 45 A | 150 | A/µs |
| | f =50 Hz, $t_P$ =200 µs | | | |
| | $V_D$ = 2/3 $V_{DRM}$ | | | |
| | $I_G$ = 0.45 A | non repetitive, $I_T = I_{TAVM}$ | 500 | A/µs |
| | $di_G/dt$ = 0.45 A/µs | | | |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; | $V_{DR}$ = 2/3 $V_{DRM}$ | 1000 | V/µs |
| | $R_{GK} = \infty$; method 1 (linear voltage rise) | | | |
| $P_{GM}$ | $T_{VJ} = T_{VJM}$ | $t_P$ = 30 µs | 10 | W |
| | $I_T = I_{TAVM}$ | $t_P$ = 300 µs | 5 | W |
| $P_{GAV}$ | | | 0.5 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40...+125 | °C |
| $T_{VJM}$ | | | 125 | °C |
| $T_{stg}$ | | | -40...+125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | t = 1 min | 3000 | V~ |
| | $I_{ISOL} \le$ 1 mA | t = 1 s | 3600 | V~ |
| $M_d$ | Mounting torque (M5) | | 2.5-4.0/22-35 | Nm/lb.in. |
| | Terminal connection torque (M5) | | 2.5-4.0/22-35 | Nm/lb.in. |
| Weight | Typical including screws | | 90 | g |

Data according to IEC 60747 and refer to a single thyristor unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions

### Features

- International standard package, JEDEC TO-240 AA
- Direct copper bonded $Al_2O_3$ -ceramic base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered, E 72873
- Gate-cathode twin pins for version 1B

### Applications

- DC motor control
- Softstart AC motor controller
- Light, heat and temperature control

### Advantages

- Space and weight savings
- Simple mounting with two screws
- Improved temperature and power cycling
- Reduced protection circuits

| Symbol | Test Conditions | | Characteristic Values | |
|---|---|---|---|---|
| $I_{RRM}$, $I_{DRM}$ | $T_{VJ} = T_{VJM}$; $V_R = V_{RRM}$; $V_D = V_{DRM}$ | | 3 | mA |
| $V_T$ | $I_T$ = 80 A; $T_{VJ}$ = 25°C | | 2.05 | V |
| $V_{T0}$ | For power-loss calculations only ($T_{VJ}$ = 125°C) | | 0.85 | V |
| $r_T$ | | | 18 | mΩ |
| $V_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 1.5 | V |
| | | $T_{VJ}$ = -40°C | 1.6 | V |
| $I_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 100 | mA |
| | | $T_{VJ}$ = -40°C | 200 | mA |
| $V_{GD}$ | $T_{VJ} = T_{VJM}$; | $V_D$ = 2/3 $V_{DRM}$ | 0.2 | V |
| $I_{GD}$ | | | 10 | mA |
| $I_L$ | $T_{VJ}$ = 25°C; $t_P$ = 10 µs; $V_D$ = 6 V<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 450 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK}$ = ∞ | | 200 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D$ = 1/2 $V_{DRM}$<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 2 | µs |
| $t_q$ | $T_{VJ} = T_{VJM}$; $I_T$ = 20 A, $t_P$ = 200 µs; -di/dt = 10 A/µs<br>$V_R$ = 100 V; dv/dt = 20 V/µs; $V_D$ = 2/3 $V_{DRM}$ | typ. | 150 | µs |
| $Q_S$ | $T_{VJ} = T_{VJM}$; $I_T$ = 25 A, -di/dt = 0.64 A/µs | | 50 | µC |
| $I_{RM}$ | | | 6 | A |
| $R_{thJC}$ | per thyristor; DC current | other values see Fig. 8/9 | 1.3 | K/W |
| | per module | | 0.65 | K/W |
| $R_{thJK}$ | per thyristor; DC current | | 1.5 | K/W |
| | per module | | 0.75 | K/W |
| $d_S$ | Creepage distance on surface | | 12.7 | mm |
| $d_A$ | Strike distance through air | | 9.6 | mm |
| a | Maximum allowable acceleration | | 50 | m/s² |

Optional accessories for module-type MCC 19 version 1 B
Keyed gate/cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red
Type **ZY 200L** (L = Left for pin pair 4/5) } UL 758, style 1385,
Type **ZY 200R** (R = right for pin pair 6/7) } CSA class 5851, guide 460-1-1

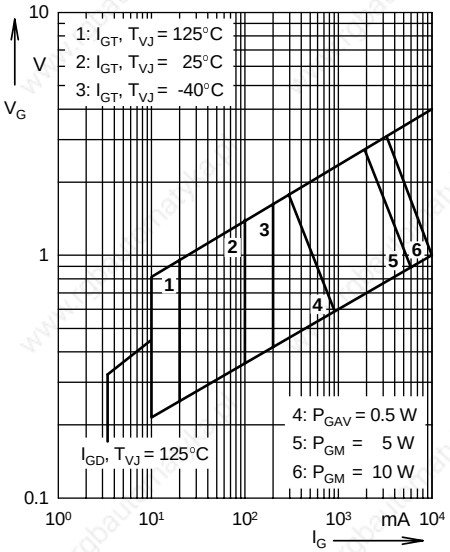



Fig. 1 Gate trigger characteristics

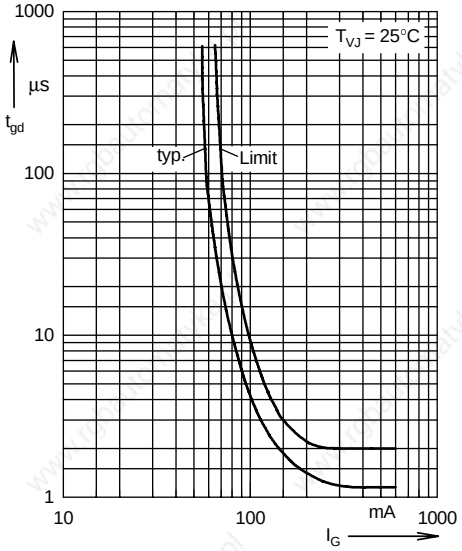
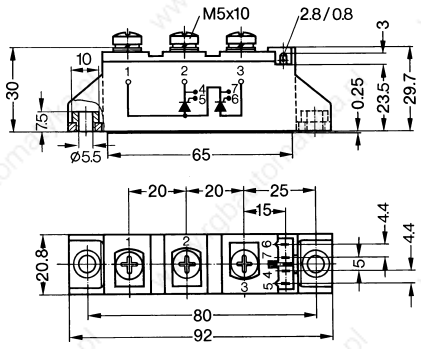



Fig. 2 Gate trigger delay time

**Dimensions in mm (1 mm = 0.0394")**

**Version 1 B**

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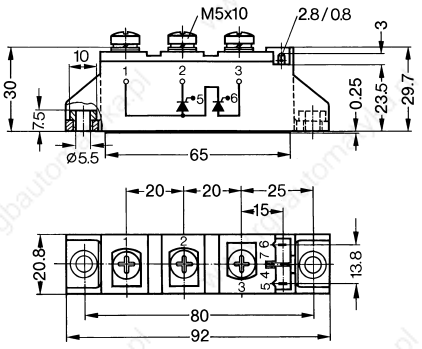


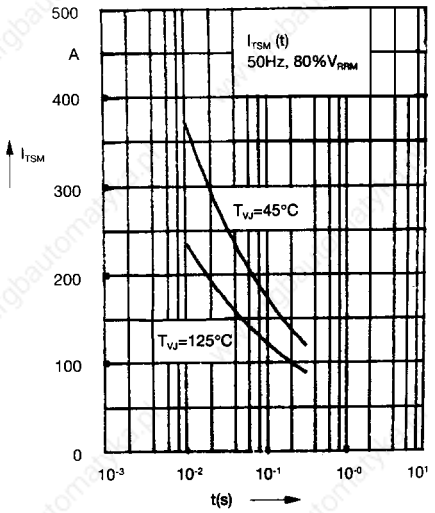



Fig. 3 Surge overload current
$I_{TSM}$: Crest value, t: duration

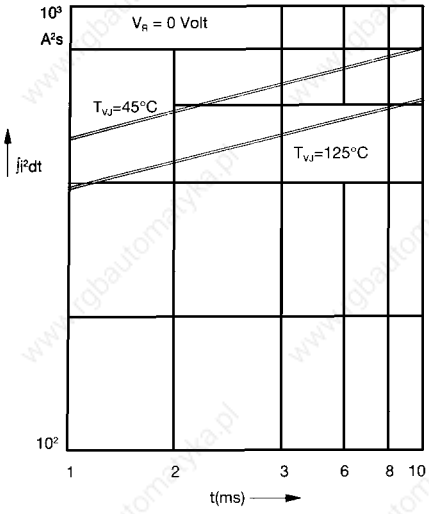



Fig. 4 $\int i^2dt$ versus time (1-10 ms)

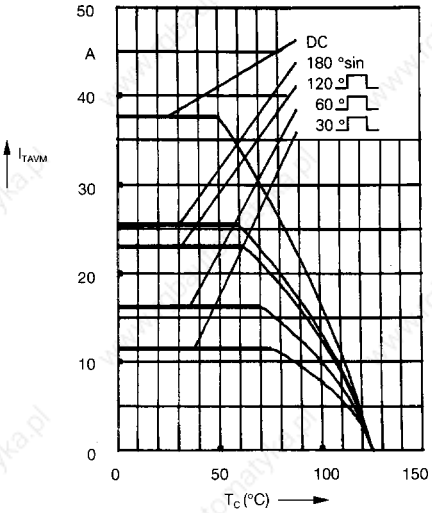



Fig. 4a Maximum forward current at case temperature

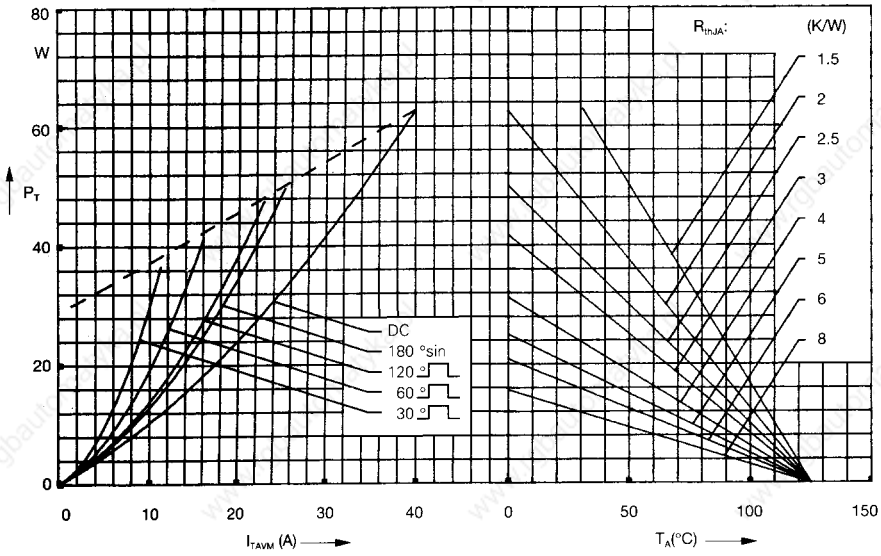



Fig. 5 Power dissipation versus on-state current and ambient temperature (per thyristor)

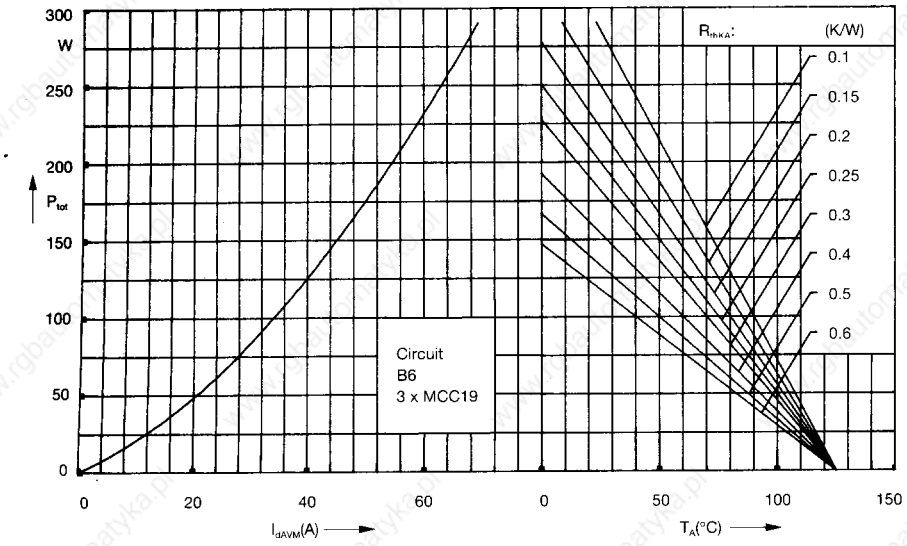



Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

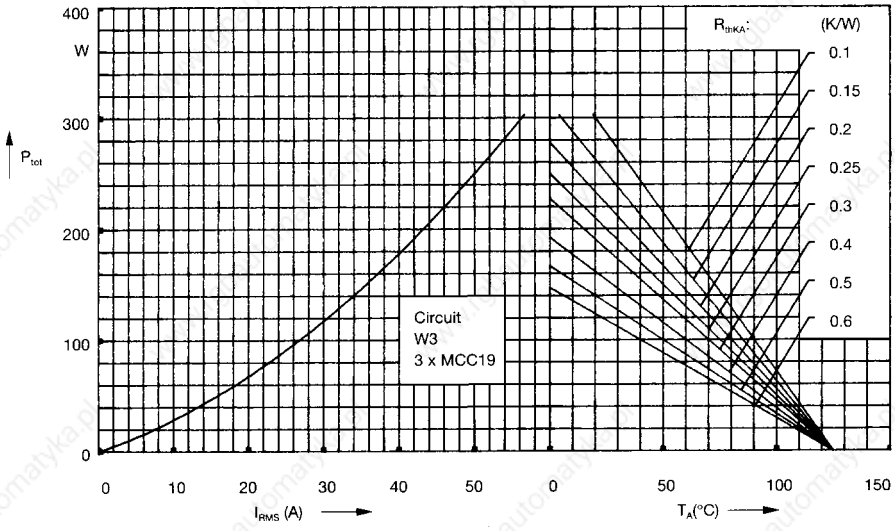



Fig. 7 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

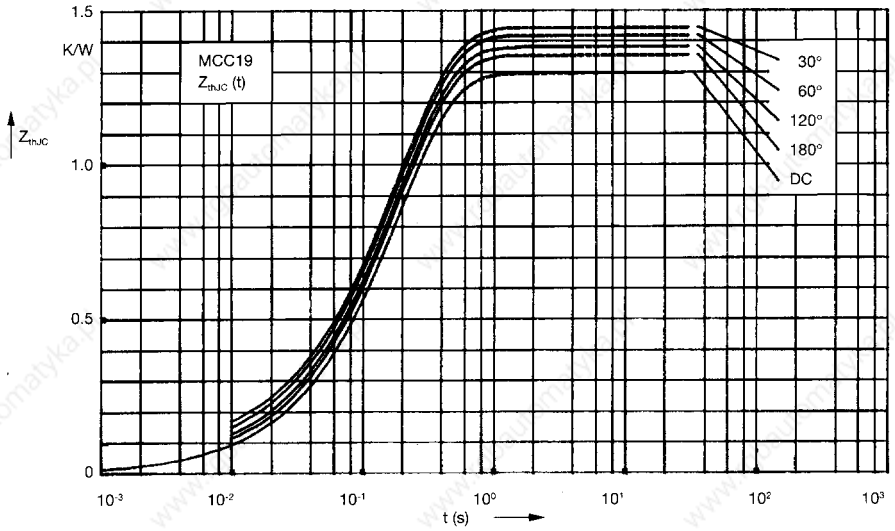



Fig. 8 Transient thermal impedance junction to case (per thyristor)

$R_{thJC}$ for various conduction angles d:

| d | $R_{thJC}$ (K/W) |
|---|---|
| DC | 1.3 |
| 180° | 1.35 |
| 120° | 1.39 |
| 60° | 1.42 |
| 30° | 1.45 |

Constants for $Z_{thJC}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.018 | 0.0033 |
| 2 | 0.041 | 0.0216 |
| 3 | 1.241 | 0.191 |

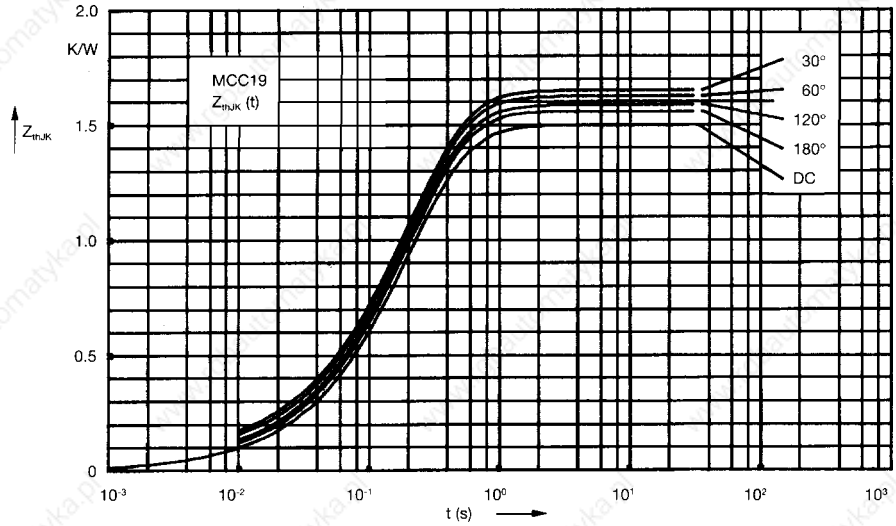



Fig. 9 Transient thermal impedance junction to heatsink (per thyristor)

$R_{thJK}$ for various conduction angles d:

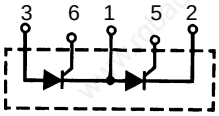
| d | $R_{thJK}$ (K/W) |
|---|---|
| DC | 1.5 |
| 180° | 1.55 |
| 120° | 1.59 |
| 60° | 1.62 |
| 30° | 1.65 |

Constants for $Z_{thJK}$ calculation:

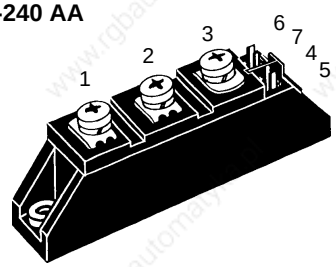
| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.018 | 0.0033 |
| 2 | 0.041 | 0.0216 |
| 3 | 1.241 | 0.191 |
| 4 | 0.2 | 0.46 |

# Thyristor Modules

| $V_{RSM}$ V | $V_{RRM}$ $V_{DRM}$ V | Type |
|---|---|---|
| 900 | 800 | MCC 21-08io8 B |
| 1300 | 1200 | MCC 21-12io8 B |
| 1500 | 1400 | MCC 21-14io8 B |
| 1700 | 1600 | MCC 21-16io8 B |




**TO-240 AA**




| Symbol | Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$ | $T_{VJ} = T_{VJM}$ | | 33 | A |
| $I_{TAVM}$ | $T_C$ = 85°C; 180° sine | | 21 | A |
| $I_{TSM}$ | $T_{VJ}$ = 45°C; | t = 10 ms (50 Hz), sine | 320 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 350 | A |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 280 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 310 | A |
| $I^2dt$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz), sine | 500 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 520 | $A^2s$ |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 390 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 400 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM}$ | repetitive, $I_T$ = 45 A | 150 | A/µs |
| | f = 50Hz, $t_P$ = 200µs | | | |
| | $V_D = {}^2/_3 V_{DRM}$ | | | |
| | $I_G$ = 0.45 A | non repetitive, $I_T = I_{TAVM}$ | 500 | A/µs |
| | $di_G/dt$ = 0.45 A/µs | | | |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; $V_{DR} = {}^2/_3 V_{DRM}$ | | 1000 | V/µs |
| | $R_{GK} = \infty$; method 1 (linear voltage rise) | | | |
| $P_{GM}$ | $T_{VJ} = T_{VJM}$ | $t_P$ = 30 µs | 10 | W |
| | $I_T = I_{TAVM}$ | $t_P$ = 300 µs | 5 | W |
| $P_{GAV}$ | | | 0.5 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40...+125 | °C |
| $T_{VJM}$ | | | 125 | °C |
| $T_{stg}$ | | | -40...+125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | t = 1 min | 3000 | V~ |
| | $I_{ISOL} \leq$ 1 mA | t = 1 s | 3600 | V~ |
| $M_d$ | Mounting torque (M5) | | 2.5-4.0/22-35 | Nm/lb.in. |
| | Terminal connection torque (M5) | | 2.5-4.0/22-35 | Nm/lb.in. |
| Weight | Typical including screws | | 90 | g |

Data according to DIN/IEC 747 and refer to a single thyristor unless otherwise stated.

### Features

- International standard package, JEDEC TO-240 AA
- Direct copper bonded $Al_2O_3$ -ceramic base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered, E 72873
- Gate-cathode twin pins for version 1B

### Applications

- DC motor control
- Softstart AC motor controller
- Light, heat and temperature control

### Advantages

- Space and weight savings
- Simple mounting with two screws
- Improved temperature and power cycling
- Reduced protection circuits

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| Symbol | Conditions | | Characteristic Values | |
|---|---|---|---|---|
| $I_{RRM}$, $I_{DRM}$ | $T_{VJ} = T_{VJM}$; $V_R = V_{RRM}$; $V_D = V_{DRM}$ | | 5 | mA |
| $V_T$ | $I_T$ = 45 A; $T_{VJ}$ = 25°C | | 1.6 | V |
| $V_{T0}$ | For power-loss calculations only ($T_{VJ}$ = 125°C) | | 0.85 | V |
| $r_T$ | | | 15 | mΩ |
| $V_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 1.0 | V |
| | | $T_{VJ}$ = -40°C | 1.2 | V |
| $I_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 65 | mA |
| | | $T_{VJ}$ = -40°C | 80 | mA |
| $V_{GD}$ | $T_{VJ} = T_{VJM}$; | $V_D = {}^2/_3\ V_{DRM}$ | 0.2 | V |
| $I_{GD}$ | | | 5 | mA |
| $I_L$ | $T_{VJ}$ = 25°C; $t_P$ = 10 µs; $V_D$ = 6 V<br>$I_G$ = 0.3 A; $di_G/dt$ = 0.3 A/µs | | 150 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK}$ = ∞ | | 100 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D = ½\ V_{DRM}$<br>$I_G$ = 0.3 A; $di_G/dt$ = 0.3 A/µs | | 2 | µs |
| $t_q$ | $T_{VJ} = T_{VJM}$; $I_T$ = 15 A, $t_P$ = 300 µs; -di/dt = 10 A/µs<br>$V_R$ = 100 V; dv/dt = 20 V/µs; $V_D = {}^2/_3\ V_{DRM}$ | typ. | 150 | µs |
| $I_{RM}$ | $T_{VJ} = T_{VJM}$; $I_T$ = 30 A, -di/dt = 0.3 A/µs | | 4 | A |
| $R_{thJC}$ | per thyristor; DC current | other values see Fig. 8/9 | 1.1 | K/W |
| | per module | | 0.55 | K/W |
| $R_{thJK}$ | per thyristor; DC current | | 1.3 | K/W |
| | per module | | 0.65 | K/W |
| $d_S$ | Creepage distance on surface | | 12.7 | mm |
| $d_A$ | Strike distance through air | | 9.6 | mm |
| a | Maximum allowable acceleration | | 50 | $m/s^2$ |

Optional accessories for module-type MCC 23 version 1 B
Keyed gate/cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red
Type **ZY 200L** (L = Left for pin pair 4/5) } UL 758, style 1385,
Type **ZY 200R** (R = right for pin pair 6/7) } CSA class 5851, guide 460-1-1

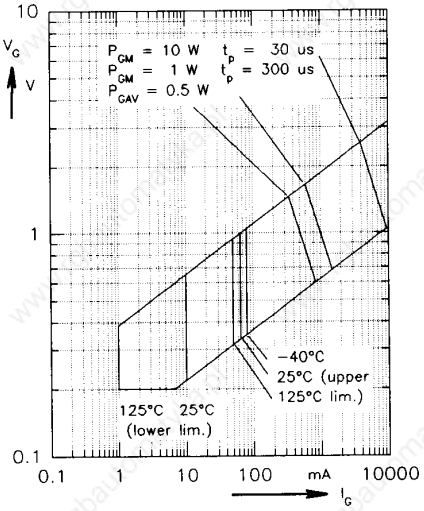



Fig. 1 Gate trigger characteristics

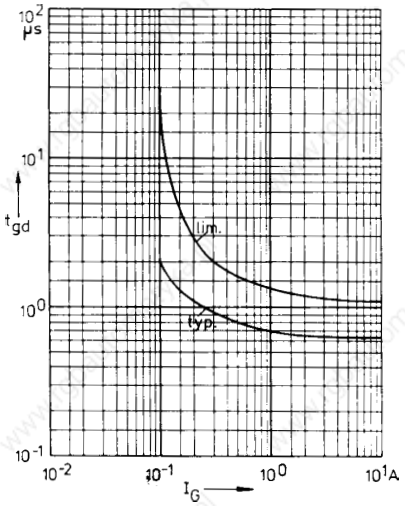
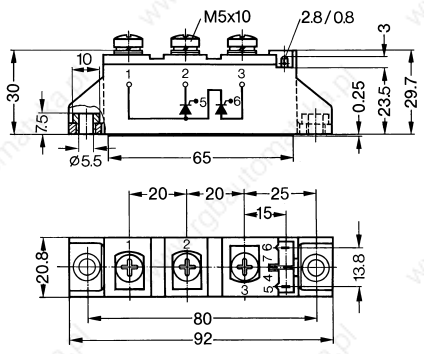



Fig. 2 Gate trigger delay time

**Dimensions in mm (1 mm = 0.0394")**

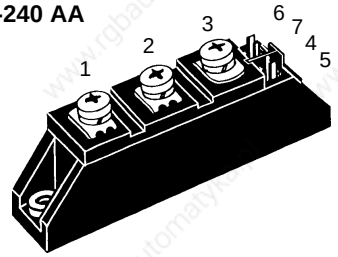


# Thyristor Modules
# Thyristor/Diode Modules

$I_{TRMS}$ = 2x 50 A
$I_{TAVM}$ = 2x 32 A
$V_{RRM}$ = 800-1600 V

| $V_{RSM}$ $V_{DSM}$ V | $V_{RRM}$ $V_{DRM}$ V | Type Version 1 B | Version 8 B | Version 8 B |
|---|---|---|---|---|
| 900 | 800 | MCC 26-08io1 B | MCC 26-08io8 B | MCD 26-08io8 B |
| 1300 | 1200 | MCC 26-12io1 B | MCC 26-12io8 B | MCD 26-12io8 B |
| 1500 | 1400 | MCC 26-14io1 B | MCC 26-14io8 B | MCD 26-14io8 B |
| 1700 | 1600 | MCC 26-16io1 B | MCC 26-16io8 B | MCD 26-16io8 B |

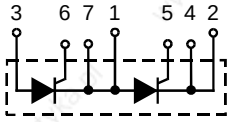
**TO-240 AA**



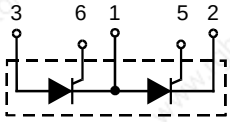

| Symbol | Test Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$, $I_{FRMS}$ | $T_{VJ} = T_{VJM}$ | | 50 | A |
| $I_{TAVM}$, $I_{FAVM}$ | $T_C$ = 75°C; 180° sine | | 32 | A |
| | $T_C$ = 85°C; 180° sine | | 27 | A |
| $I_{TSM}$, $I_{FSM}$ | $T_{VJ}$ = 45°C; | t = 10 ms (50 Hz), sine | 520 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 560 | A |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 460 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 500 | A |
| $\int i^2dt$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz), sine | 1350 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 1300 | $A^2s$ |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 1050 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 1030 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM}$ | repetitive, $I_T$ = 45 A | 150 | A/µs |
| | f =50 Hz, $t_P$ =200 µs | | | |
| | $V_D$ = 2/3 $V_{DRM}$ | | | |
| | $I_G$ = 0.45 A | non repetitive, $I_T = I_{TAVM}$ | 500 | A/µs |
| | $di_G/dt$ = 0.45 A/µs | | | |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; | $V_{DR}$ = 2/3 $V_{DRM}$ | 1000 | V/µs |
| | $R_{GK}$ = ∞; method 1 (linear voltage rise) | | | |
| $P_{GM}$ | $T_{VJ} = T_{VJM}$ | $t_P$ = 30 µs | 10 | W |
| | $I_T = I_{TAVM}$ | $t_P$ = 300 µs | 5 | W |
| $P_{GAV}$ | | | 0.5 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40...+125 | °C |
| $T_{VJM}$ | | | 125 | °C |
| $T_{stg}$ | | | -40...+125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | t = 1 min | 3000 | V~ |
| | $I_{ISOL} \le$ 1 mA | t = 1 s | 3600 | V~ |
| $M_d$ | Mounting torque (M5) | | 2.5-4.0/22-35 | Nm/lb.in. |
| | Terminal connection torque (M5) | | 2.5-4.0/22-35 | Nm/lb.in. |
| Weight | Typical including screws | | 90 | g |

Data according to IEC 60747 and refer to a single thyristor/diode unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions

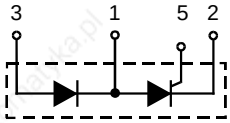
**MCC Version 1 B**




**MCC Version 8 B**




**MCD Version 8 B**




### Features

- International standard package, JEDEC TO-240 AA
- Direct copper bonded $Al_2O_3$ -ceramic base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered, E 72873
- Gate-cathode twin pins for version 1B

### Applications

- DC motor control
- Softstart AC motor controller
- Light, heat and temperature control

### Advantages

- Space and weight savings
- Simple mounting with two screws
- Improved temperature and power cycling
- Reduced protection circuits

| Symbol | Test Conditions | | Characteristic Values | |
|---|---|---|---|---|
| $I_{RRM}$, $I_{DRM}$ | $T_{VJ} = T_{VJM}$; $V_R = V_{RRM}$; $V_D = V_{DRM}$ | | 3 | mA |
| $V_T$, $V_F$ | $I_T$, $I_F$ = 80 A; $T_{VJ}$ = 25°C | | 1.64 | V |
| $V_{T0}$ | For power-loss calculations only ($T_{VJ}$ = 125°C) | | 0.85 | V |
| $r_T$ | | | 11.0 | mΩ |
| $V_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 1.5 | V |
| | | $T_{VJ}$ = -40°C | 1.6 | V |
| $I_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 100 | mA |
| | | $T_{VJ}$ = -40°C | 200 | mA |
| $V_{GD}$ | $T_{VJ} = T_{VJM}$; | $V_D$ = 2/3 $V_{DRM}$ | 0.2 | V |
| $I_{GD}$ | | | 10 | mA |
| $I_L$ | $T_{VJ}$ = 25°C; $t_P$ = 10 µs; $V_D$ = 6 V<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 450 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK}$ = ∞ | | 200 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D$ = 1/2 $V_{DRM}$<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 2 | µs |
| $t_q$ | $T_{VJ} = T_{VJM}$; $I_T$ = 20 A, $t_P$ = 200 µs; -di/dt = 10 A/µs<br>$V_R$ = 100 V; dv/dt = 20 V/µs; $V_D$ = 2/3 $V_{DRM}$ | typ. | 150 | µs |
| $Q_S$ | $T_{VJ} = T_{VJM}$; $I_T$, $I_F$ = 25 A, -di/dt = 0.64 A/µs | | 50 | µC |
| $I_{RM}$ | | | 6 | A |
| $R_{thJC}$ | per thyristor/diode; DC current | other values see Fig. 8/9 | 0.88 | K/W |
| | per module | | 0.44 | K/W |
| $R_{thJK}$ | per thyristor/diode; DC current | | 1.08 | K/W |
| | per module | | 0.54 | K/W |
| $d_S$ | Creepage distance on surface | | 12.7 | mm |
| $d_A$ | Strike distance through air | | 9.6 | mm |
| a | Maximum allowable acceleration | | 50 | $m/s^2$ |

Optional accessories for module-type MCC 26 version 1 B
Keyed gate/cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red
Type **ZY 200L** (L = Left for pin pair 4/5) } UL 758, style 1385,
Type **ZY 200R** (R = right for pin pair 6/7) } CSA class 5851, guide 460-1-1

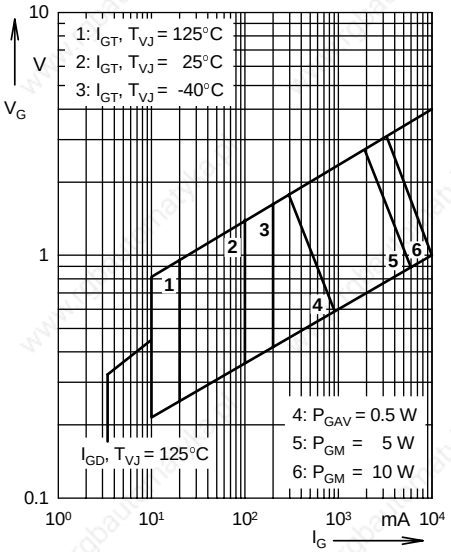



Fig. 1 Gate trigger characteristics

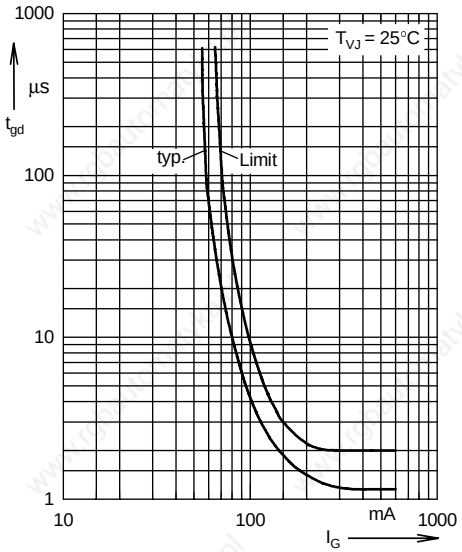
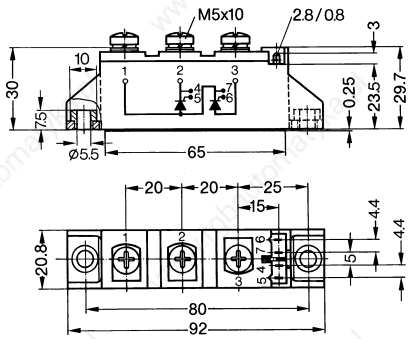


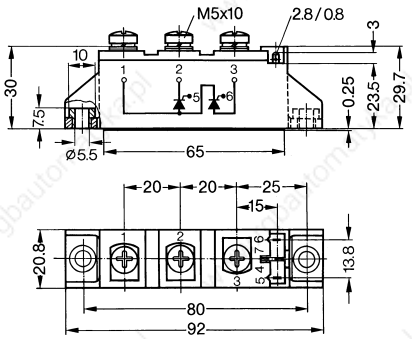

Fig. 2 Gate trigger delay time

**Dimensions in mm (1 mm = 0.0394")**

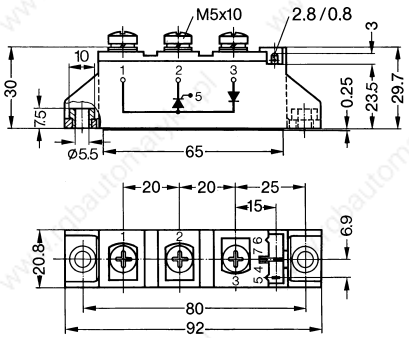
**MCC Version 1 B**




**MCC Version 8 B**




**MCD Version 8 B**



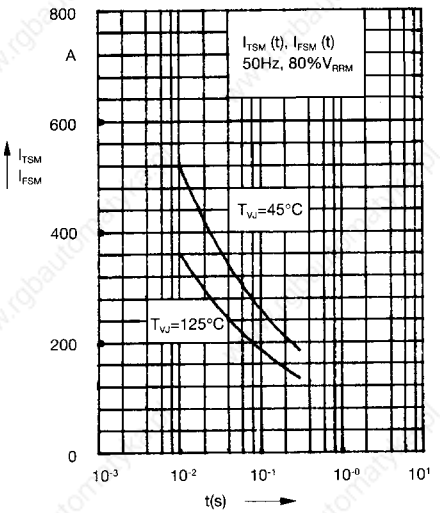



Fig. 3 Surge overload current
$I_{TSM}$, $I_{FSM}$: Crest value, t: duration

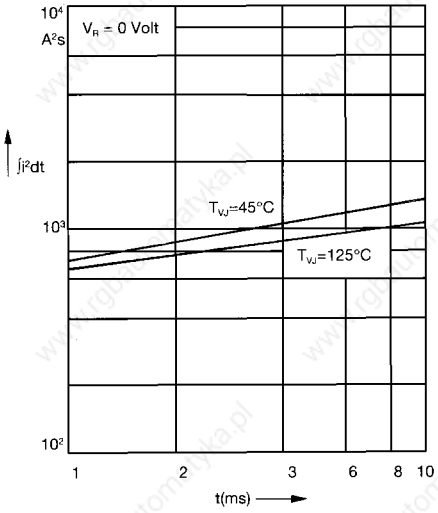



Fig. 4 $\int i^2dt$ versus time (1-10 ms)

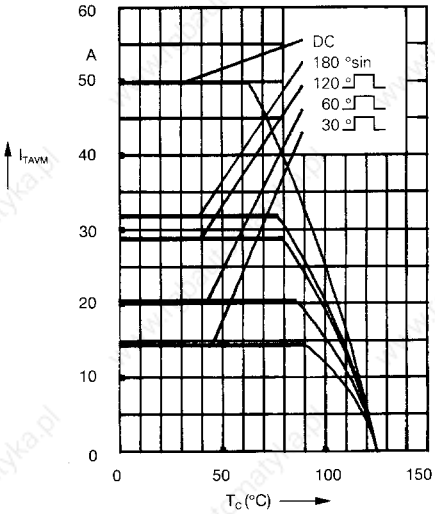



Fig. 4a Maximum forward current at case temperature

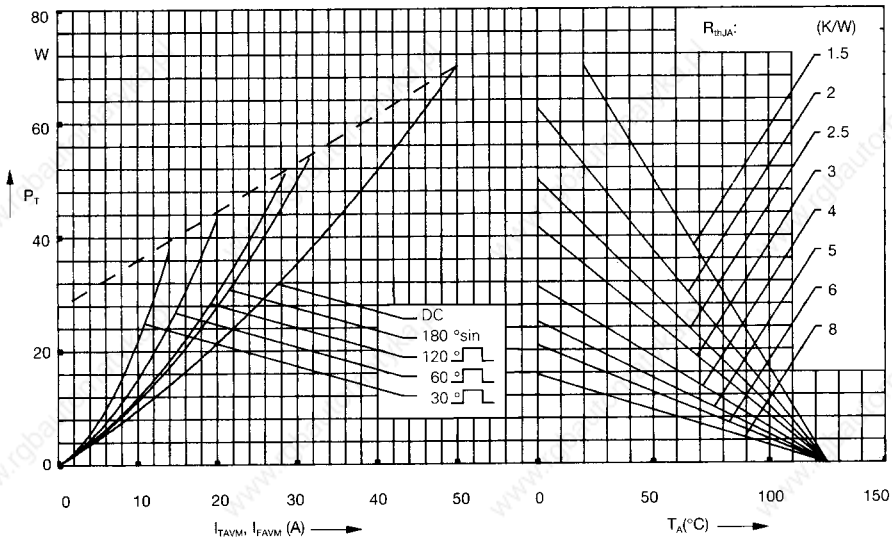



Fig. 5 Power dissipation versus on-state current and ambient temperature (per thyristor or diode)

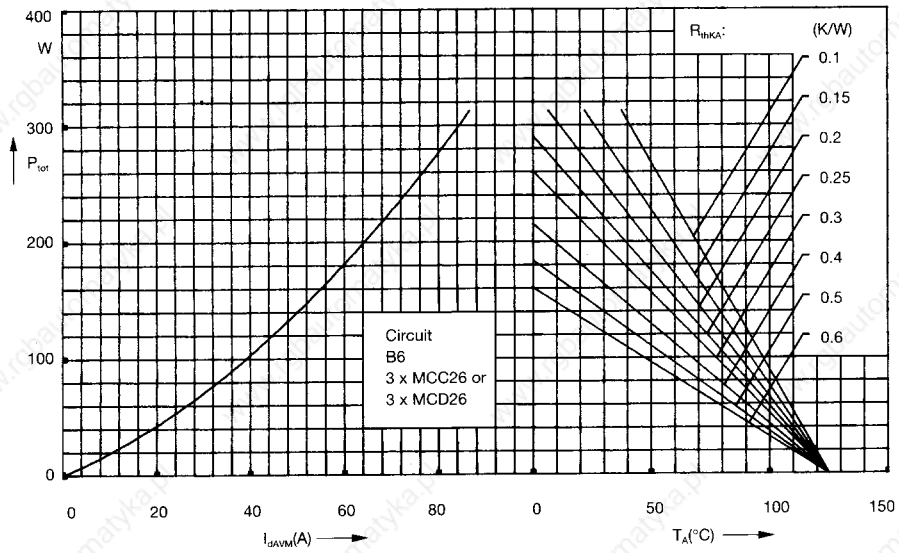



Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

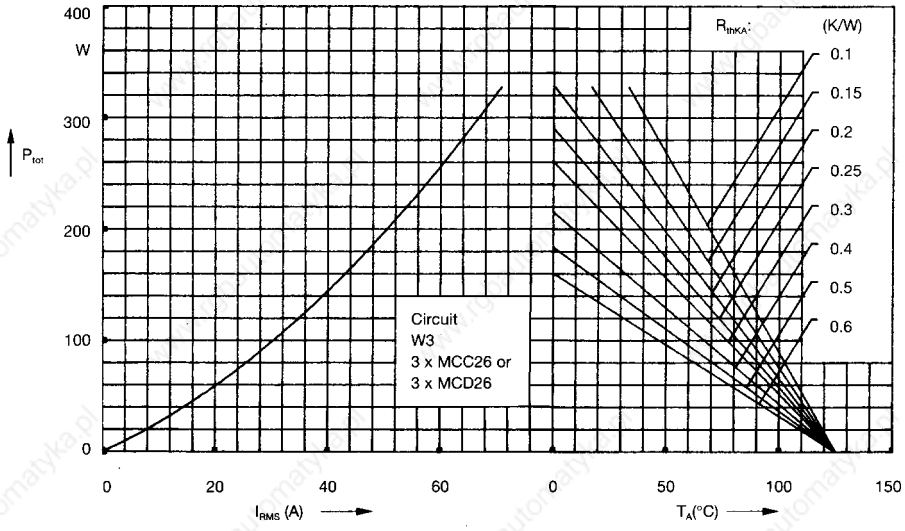



Fig. 7 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

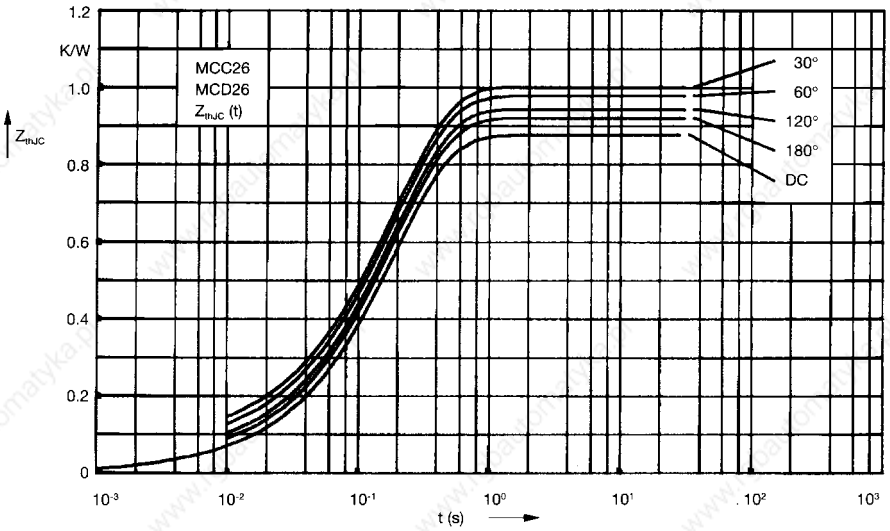



Fig. 8 Transient thermal impedance junction to case (per thyristor or diode)

$R_{thJC}$ for various conduction angles d:

| d | $R_{thJC}$ (K/W) |
|---|---|
| DC | 0.88 |
| 180° | 0.92 |
| 120° | 0.95 |
| 60° | 0.98 |
| 30° | 1.01 |

Constants for $Z_{thJC}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.019 | 0.0031 |
| 2 | 0.029 | 0.0216 |
| 3 | 0.832 | 0.191 |

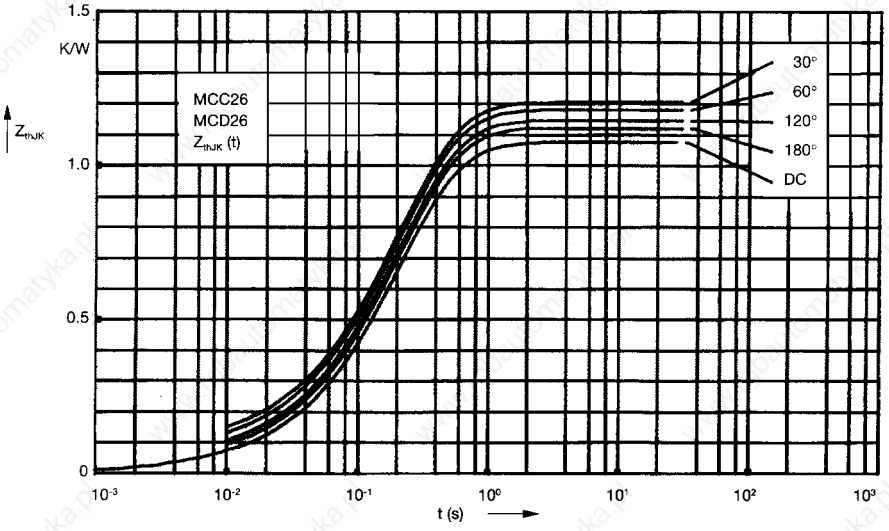



Fig. 9 Transient thermal impedance junction to heatsink (per thyristor or diode)

$R_{thJK}$ for various conduction angles d:

| d | $R_{thJK}$ (K/W) |
|---|---|
| DC | 1.08 |
| 180° | 1.12 |
| 120° | 1.15 |
| 60° | 1.18 |
| 30° | 1.21 |

Constants for $Z_{thJK}$ calculation:

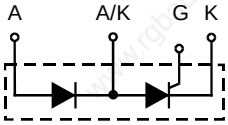
| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.019 | 0.0031 |
| 2 | 0.029 | 0.0216 |
| 3 | 0.832 | 0.191 |
| 4 | 0.2 | 0.45 |

# Thyristor/Diode Module

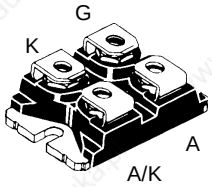
$I_{TRMS}$ = 2x 60 A
$I_{TAVM}$ = 2x 38 A
$V_{RRM}$ = 1200-1600 V

Preliminary data

| $V_{RSM}$ $V_{DSM}$ V | $V_{RRM}$ $V_{DRM}$ V | Type |
|---|---|---|
| 1300 | 1200 | MCD 40-12io6 |
| 1700 | 1600 | MCD 40-16io6 |




**SOT-227 B, miniBLOC**




K = Cathode, A = Anode, G = Gate,
A/K = Common output

| Symbol | Test Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$, $I_{FRMS}$ | $T_{VJ} = T_{VJM}$; $T_C$ = 85°C | | 60 | A |
| $I_{TAVM}$, $I_{FAVM}$ | $T_{VJ} = T_{VJM}$; $T_C$ = 85°C; 180° sine | | 38 | A |
| $I_{TSM}$, $I_{FSM}$ | $T_{VJ}$ = 45°C; | t = 10 ms (50 Hz), sine | 500 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 440 | A |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 450 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 490 | A |
| ∫i²dt | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz), sine | 1250 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 1220 | $A^2s$ |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 1010 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 1010 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM}$ | repetitive, $I_T$ = 45 A | 100 | A/µs |
| | f = 50 Hz, $t_P$ =200 µs | | | |
| | $V_D$ = 2/3 $V_{DRM}$ | | | |
| | $I_G$ = 0.45 A | non repetitive, $I_T = I_{TAVM}$ | 500 | A/µs |
| | $di_G/dt$ = 0.45 A/µs | | | |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; | $V_{DR}$ = 2/3 $V_{DRM}$ | 1000 | V/µs |
| | $R_{GK}$ = ∞; method 1 (linear voltage rise) | | | |
| $P_{GM}$ | $T_{VJ} = T_{VJM}$ | $t_P$ = 30 µs | 10 | W |
| | $I_T = I_{TAVM}$ | $t_P$ = 300 µs | 5 | W |
| $P_{GAV}$ | | | 0.5 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40...+125 | °C |
| $T_{VJM}$ | | | 125 | °C |
| $T_{stg}$ | | | -40...+125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | $I_{ISOL} \leq$ 1 mA | 2500 | V~ |
| $M_d$ | Mounting torque (M4) | | 1.5/13 | Nm/lb.in. |
| | Terminal connection torque (M4) | | 1.5/13 | Nm/lb.in. |
| Weight | Typical including screws | | 30 | g |

### Features

- International standard package miniBLOC, SOT-227 B
- Planar passivated chips

### Applications

- DC motor control
- Softstart AC motor controller
- Light, heat and temperature control
- Half controlled rectifier bridge

### Advantages

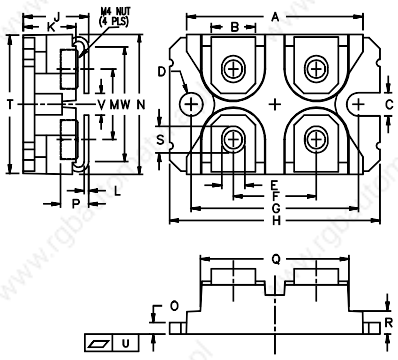
- Space and weight savings
- Simple mounting with two screws
- Improved temperature and power cycling
- Reduced protection circuits

Data according to IEC 60747 refer to a single thyristor/diode unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions

031

| Symbol | Test Conditions | | Characteristic Values | |
|---|---|---|---|---|
| $I_{RRM}$, $I_{DRM}$ | $T_{VJ} = T_{VJM}$; $V_R = V_{RRM}$; $V_D = V_{DRM}$ | | 5 | mA |
| $V_T$, $V_F$ | $I_T$, $I_F$ = 80 A; $T_{VJ}$ = 25°C | | 1.68 | V |
| $V_{T0}$ | For power-loss calculations only ($T_{VJ}$ = 125°C) | | 0.85 | V |
| $r_T$ | | | 9.5 | mΩ |
| $V_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 1.5 | V |
| | | $T_{VJ}$ = -40°C | 1.6 | V |
| $I_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 100 | mA |
| | | $T_{VJ}$ = -40°C | 200 | mA |
| $V_{GD}$ | $T_{VJ} = T_{VJM}$; | $V_D$ = 2/3 $V_{DRM}$ | 0.2 | V |
| $I_{GD}$ | | | 5 | mA |
| $I_L$ | $T_{VJ}$ = 25°C; $t_P$ = 10 µs, $V_D$ = 6 V<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 450 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK}$ = ∞ | | 200 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D$ = 1/2 $V_{DRM}$<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 2 | µs |
| $t_q$ | $T_{VJ} = T_{VJM}$; $I_T$ = 120 A, $t_P$ = 200 µs; -di/dt = 10 A/µs<br>$V_R$ = 100 V; dv/dt = 20 V/µs; $V_D$ = 2/3 $V_{DRM}$ | | typ.150 | µs |
| $R_{thJC}$ | per thyristor/diode; DC current | | 0.6 | K/W |
| $R_{thCH}$ | | | 0.1 | K/W |
| $d_S$ | Creepage distance on surface | | 8 | mm |
| $d_A$ | Strike distance through air | | 4 | mm |
| a | Maximum allowable acceleration | | 50 | $m/s^2$ |

**miniBLOC, SOT-227 B**




M4 screws (4x) supplied

| Dim. | Millimeter Min. | Millimeter Max. | Inches Min. | Inches Max. |
|---|---|---|---|---|
| A | 31.50 | 31.88 | 1.240 | 1.255 |
| B | 7.80 | 8.20 | 0.307 | 0.323 |
| C | 4.09 | 4.29 | 0.161 | 0.169 |
| D | 4.09 | 4.29 | 0.161 | 0.169 |
| E | 4.09 | 4.29 | 0.161 | 0.169 |
| F | 14.91 | 15.11 | 0.587 | 0.595 |
| G | 30.12 | 30.30 | 1.186 | 1.193 |
| H | 37.80 | 38.20 | 1.489 | 1.505 |
| J | 11.68 | 12.22 | 0.460 | 0.481 |
| K | 8.92 | 9.60 | 0.351 | 0.378 |
| L | 0.76 | 0.84 | 0.030 | 0.033 |
| M | 12.60 | 12.85 | 0.496 | 0.506 |
| N | 25.15 | 25.42 | 0.990 | 1.001 |
| O | 1.98 | 2.13 | 0.078 | 0.084 |
| P | 4.95 | 5.97 | 0.195 | 0.235 |
| Q | 26.54 | 26.90 | 1.045 | 1.059 |
| R | 3.94 | 4.42 | 0.155 | 0.174 |
| S | 4.72 | 4.85 | 0.186 | 0.191 |
| T | 24.59 | 25.07 | 0.968 | 0.987 |
| U | -0.05 | 0.1 | -0.002 | 0.004 |
| V | 3.30 | 4.57 | 0.130 | 0.180 |
| W | 0.780 | 0.830 | 19.81 | 21.08 |

# Thyristor Modules
# Thyristor/Diode Modules

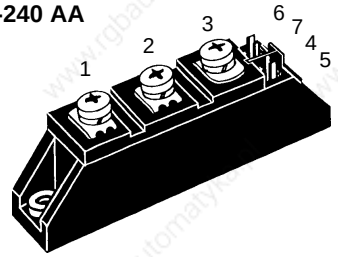
$I_{TRMS}$ = 2x 80 A
$I_{TAVM}$ = 2x 51 A
$V_{RRM}$ = 800-1800 V

| $V_{RSM}$ $V_{DSM}$ V | $V_{RRM}$ $V_{DRM}$ V | Type Version 1 B | Version 8 B | Version 8 B |
|---|---|---|---|---|
| 900 | 800 | MCC 44-08io1 B | MCC 44-08io8 B | MCD 44-08io8 B |
| 1300 | 1200 | MCC 44-12io1 B | MCC 44-12io8 B | MCD 44-12io8 B |
| 1500 | 1400 | MCC 44-14io1 B | MCC 44-14io8 B | MCD 44-14io8 B |
| 1700 | 1600 | MCC 44-16io1 B | MCC 44-16io8 B | MCD 44-16io8 B |
| 1900 | 1800 | MCC 44-18io1 B | MCC 44-18io8 B | MCD 44-18io8 B |

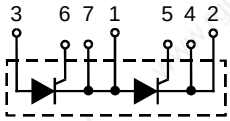
| Symbol | Test Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$, $I_{FRMS}$ | $T_{VJ} = T_{VJM}$ | | 80 | A |
| $I_{TAVM}$, $I_{FAVM}$ | $T_C$ = 83°C; 180° sine | | 51 | A |
| | $T_C$ = 85°C; 180° sine | | 49 | A |
| $I_{TSM}$, $I_{FSM}$ | $T_{VJ}$ = 45°C; | t = 10 ms (50 Hz), sine | 1150 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 1230 | A |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 1000 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 1070 | A |
| $\int i^2dt$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz), sine | 6600 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 6280 | $A^2s$ |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 5000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 4750 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM}$ f =50 Hz, $t_P$ =200 µs $V_D$ = 2/3 $V_{DRM}$ | repetitive, $I_T$ = 150 A | 150 | A/µs |
| | $I_G$ = 0.45 A $di_G/dt$ = 0.45 A/µs | non repetitive, $I_T = I_{TAVM}$ | 500 | A/µs |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; $R_{GK}$ = ∞; method 1 (linear voltage rise) | $V_{DR}$ = 2/3 $V_{DRM}$ | 1000 | V/µs |
| $P_{GM}$ | $T_{VJ} = T_{VJM}$ | $t_P$ = 30 µs | 10 | W |
| | $I_T = I_{TAVM}$ | $t_P$ = 300 µs | 5 | W |
| $P_{GAV}$ | | | 0.5 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40...+125 | °C |
| $T_{VJM}$ | | | 125 | °C |
| $T_{stg}$ | | | -40...+125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | t = 1 min | 3000 | V~ |
| | $I_{ISOL} \leq$ 1 mA | t = 1 s | 3600 | V~ |
| $M_d$ | Mounting torque (M5) | | 2.5-4.0/22-35 | Nm/lb.in. |
| | Terminal connection torque (M5) | | 2.5-4.0/22-35 | Nm/lb.in. |
| Weight | Typical including screws | | 90 | g |

Data according to IEC 60747 and refer to a single thyristor/diode unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions

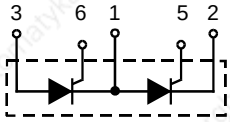
**TO-240 AA**



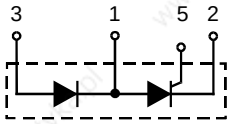

**MCC Version 1 B**




**MCC Version 8 B**




**MCD Version 8 B**




### Features

- International standard package, JEDEC TO-240 AA
- Direct copper bonded $Al_2O_3$ -ceramic base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered, E 72873
- Gate-cathode twin pins for version 1B

### Applications

- DC motor control
- Softstart AC motor controller
- Light, heat and temperature control

### Advantages

- Space and weight savings
- Simple mounting with two screws
- Improved temperature and power cycling
- Reduced protection circuits

| Symbol | Test Conditions | | Characteristic Values | |
|---|---|---|---|---|
| $I_{RRM}$, $I_{DRM}$ | $T_{VJ} = T_{VJM}$; $V_R = V_{RRM}$; $V_D = V_{DRM}$ | | 5 | mA |
| $V_T$, $V_F$ | $I_T$, $I_F$ = 200 A; $T_{VJ}$ = 25°C | | 1.75 | V |
| $V_{T0}$ | For power-loss calculations only ($T_{VJ}$ = 125°C) | | 0.85 | V |
| $r_T$ | | | 5.3 | mΩ |
| $V_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 1.5 | V |
| | | $T_{VJ}$ = -40°C | 1.6 | V |
| $I_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 100 | mA |
| | | $T_{VJ}$ = -40°C | 200 | mA |
| $V_{GD}$ | $T_{VJ} = T_{VJM}$; | $V_D$ = 2/3 $V_{DRM}$ | 0.2 | V |
| $I_{GD}$ | | | 10 | mA |
| $I_L$ | $T_{VJ}$ = 25°C; $t_P$ = 10 µs, $V_D$ = 6 V<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 450 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK}$ = ∞ | | 200 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D$ = 1/2 $V_{DRM}$<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 2 | µs |
| $t_q$ | $T_{VJ} = T_{VJM}$; $I_T$ = 120 A, $t_P$ = 200 µs; -di/dt = 10 A/µs typ.<br>$V_R$ = 100 V; dv/dt = 20 V/µs; $V_D$ = 2/3 $V_{DRM}$ | | 150 | µs |
| $Q_S$ | $T_{VJ} = T_{VJM}$; $I_T$, $I_F$ = 50 A, -di/dt = 0.64 A/µs | | 90 | µC |
| $I_{RM}$ | | | 11 | A |
| $R_{thJC}$ | per thyristor/diode; DC current | other values see Fig. 8/9 | 0.53 | K/W |
| | per module | | 0.265 | K/W |
| $R_{thJK}$ | per thyristor/diode; DC current | | 0.73 | K/W |
| | per module | | 0.365 | K/W |
| $d_S$ | Creepage distance on surface | | 12.7 | mm |
| $d_A$ | Strike distance through air | | 9.6 | mm |
| a | Maximum allowable acceleration | | 50 | $m/s^2$ |

Optional accessories for module-type MCC 44 version 1 B
Keyed gate/cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red
Type **ZY 200L** (L = Left for pin pair 4/5) } UL 758, style 1385,
Type **ZY 200R** (R = right for pin pair 6/7) } CSA class 5851, guide 460-1-1

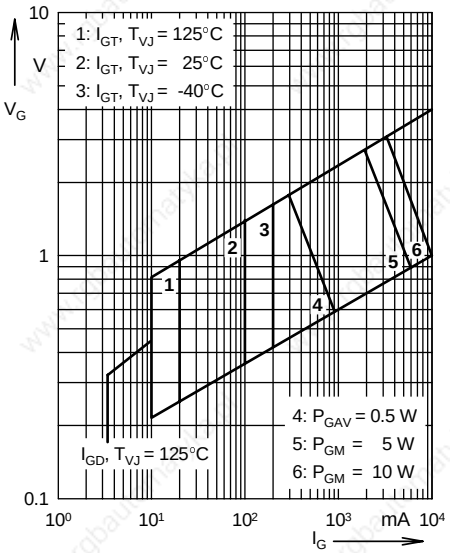



Fig. 1 Gate trigger characteristics

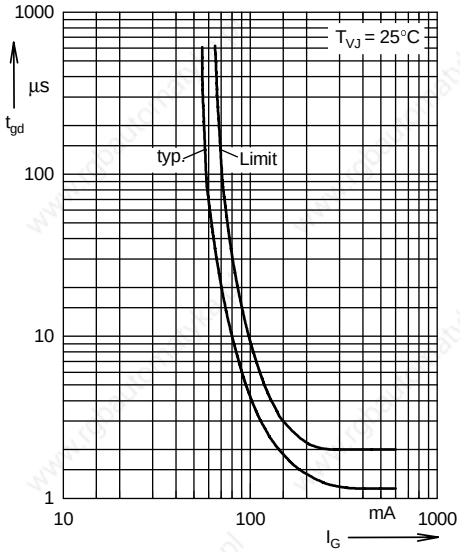
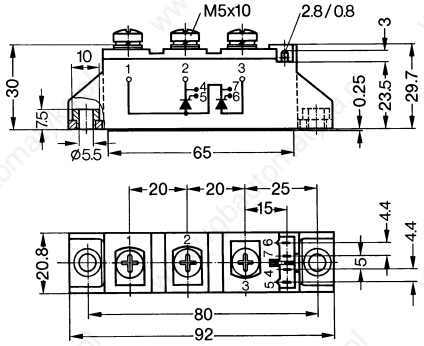


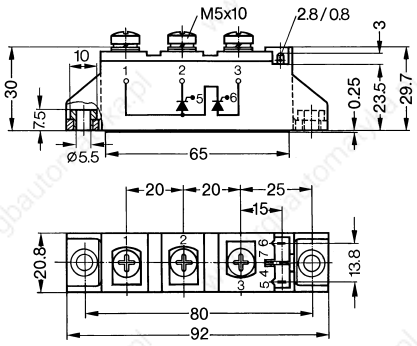

Fig. 2 Gate trigger delay time

**Dimensions in mm (1 mm = 0.0394")**

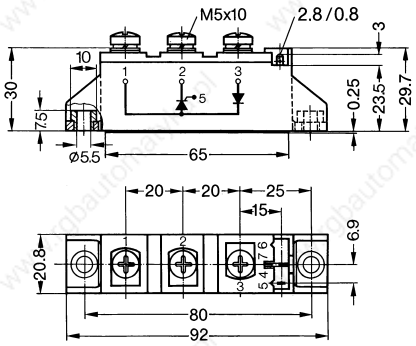
**MCC Version 1 B**




**MCC Version 8 B**




**MCD Version 8 B**



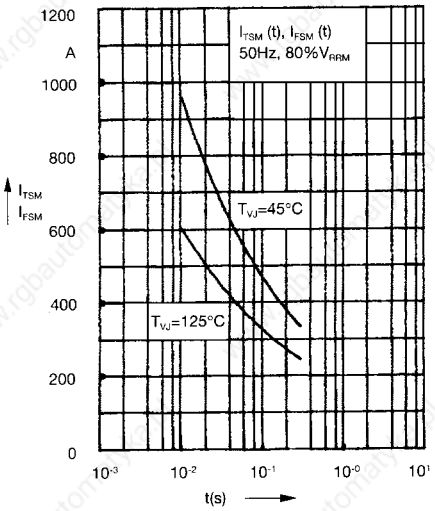



Fig. 3 Surge overload current
$I_{TSM}$, $I_{FSM}$: Crest value, t: duration

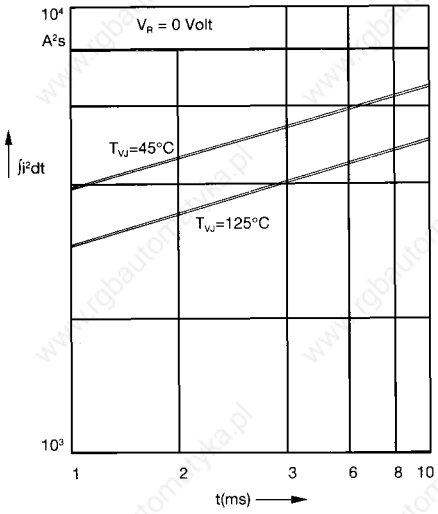



Fig. 4 $\int i^2dt$ versus time (1-10 ms)

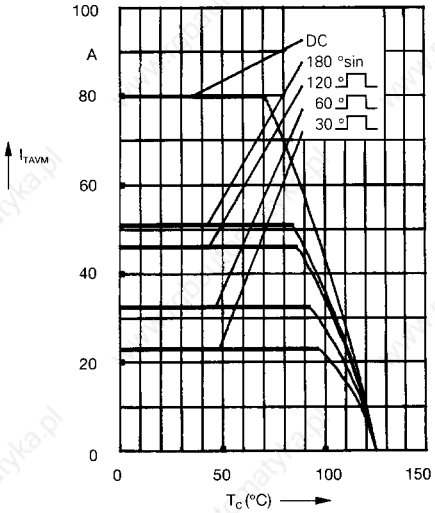



Fig. 4a Maximum forward current at case temperature

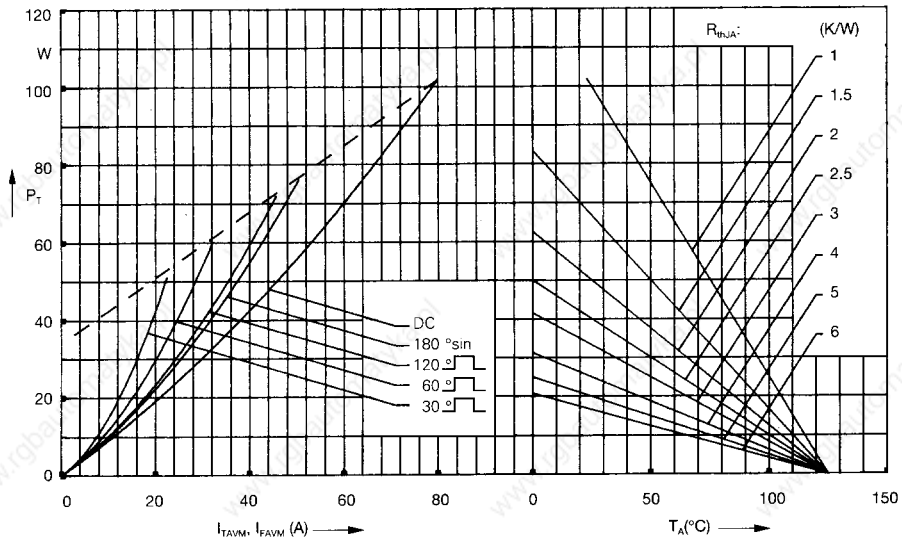



Fig. 5 Power dissipation versus on-state current and ambient temperature (per thyristor or diode)

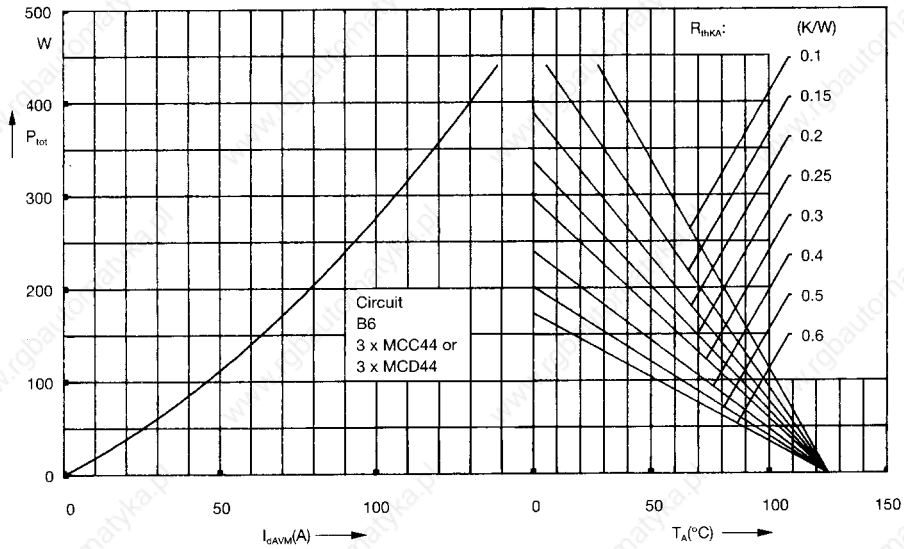



Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

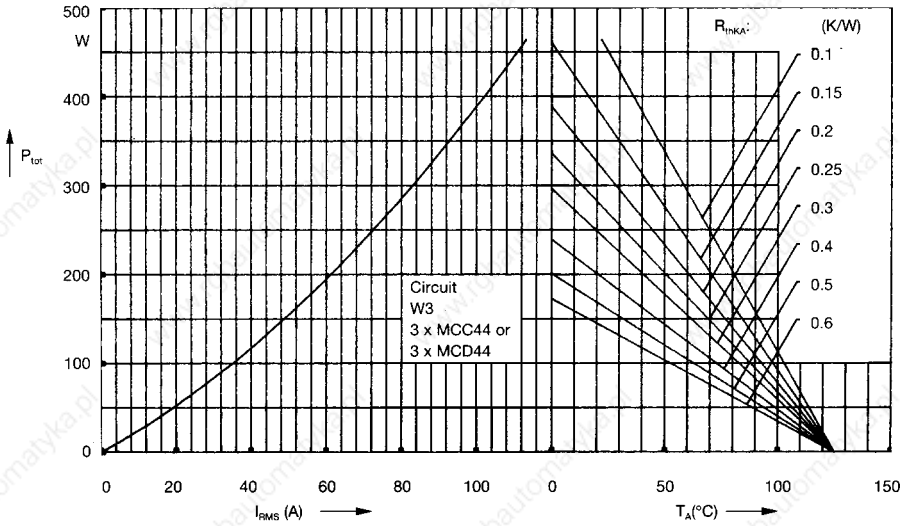



Fig. 7 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

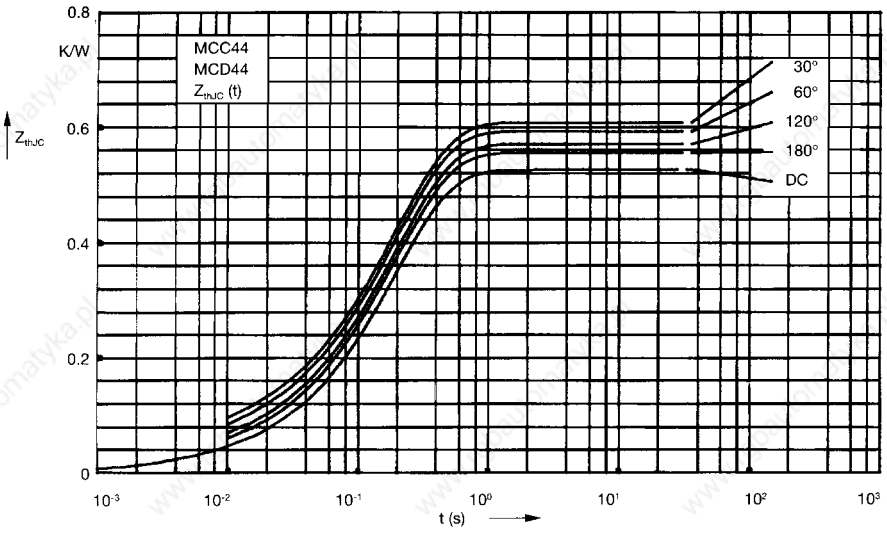



Fig. 8 Transient thermal impedance junction to case (per thyristor or diode)

$R_{thJC}$ for various conduction angles d:

| d | $R_{thJC}$ (K/W) |
|---|---|
| DC | 0.53 |
| 180° | 0.55 |
| 120° | 0.58 |
| 60° | 0.6 |
| 30° | 0.62 |

Constants for $Z_{thJC}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.015 | 0.0035 |
| 2 | 0.026 | 0.02 |
| 3 | 0.489 | 0.195 |

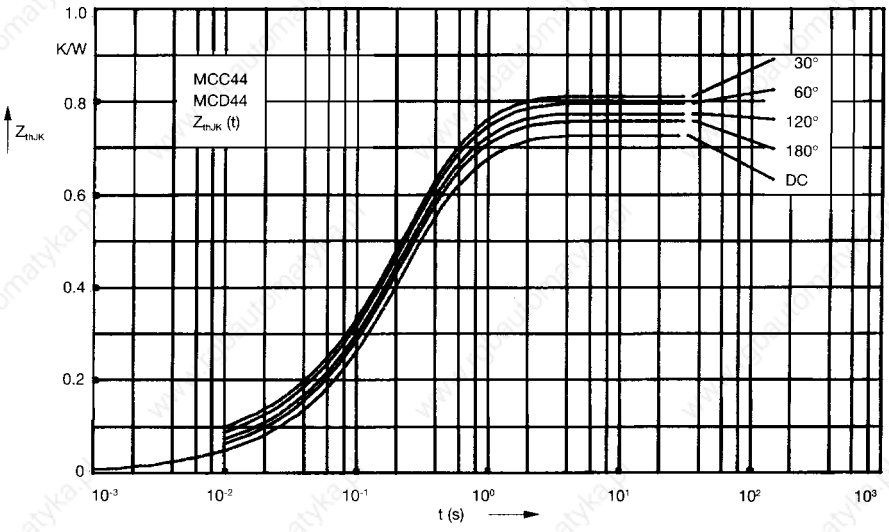



Fig. 9 Transient thermal impedance junction to heatsink (per thyristor or diode)

$R_{thJK}$ for various conduction angles d:

| d | $R_{thJK}$ (K/W) |
|---|---|
| DC | 0.73 |
| 180° | 0.75 |
| 120° | 0.78 |
| 60° | 0.8 |
| 30° | 0.82 |

Constants for $Z_{thJK}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.015 | 0.0035 |
| 2 | 0.026 | 0.02 |
| 3 | 0.489 | 0.195 |
| 4 | 0.2 | 0.68 |

# Thyristor Modules
# Thyristor/Diode Modules

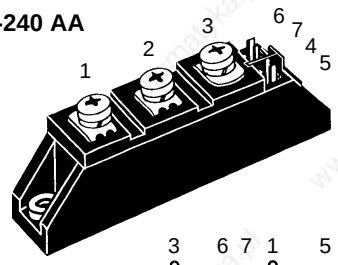
$I_{TRMS}$ = 2x 100 A
$I_{TAVM}$ = 2x 64 A
$V_{RRM}$ = 800-1800 V

| $V_{RSM}$ $V_{DSM}$ | $V_{RRM}$ $V_{DRM}$ | Type | | | |
|---|---|---|---|---|---|
| V | V | Version 1 | | Version 8 | |
| 900 | 800 | MCC 56-08io1 B | MCD 56-08io1 B | MCC 56-08io8 B | MCD 56-08io8 B |
| 1300 | 1200 | MCC 56-12io1 B | MCD 56-12io1 B | MCC 56-12io8 B | MCD 56-12io8 B |
| 1500 | 1400 | MCC 56-14io1 B | -- | MCC 56-14io8 B | MCD 56-14io8 B |
| 1700 | 1600 | MCC 56-16io1 B | MCD 56-16io1 B | MCC 56-16io8 B | MCD 56-16io8 B |
| 1900 | 1800 | MCC 56-18io1 B | -- | MCC 56-18io8 B | MCD 56-18io8 B |
| 1500 | 1400 | MCC 56-14io1 | | | |
| 1700 | 1600 | MCC 56-16io1 | | | |
| 700 | 600 | MDC 56-06io1 B | | | |

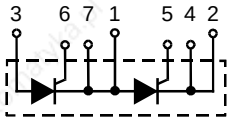
| Symbol | Test Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$, $I_{FRMS}$ | $T_{VJ} = T_{VJM}$ | | 100 | A |
| $I_{TAVM}$, $I_{FAVM}$ | $T_C$ = 83°C; 180° sine | | 64 | A |
| | $T_C$ = 85°C; 180° sine | | 60 | A |
| $I_{TSM}$, $I_{FSM}$ | $T_{VJ}$ = 45°C; | t = 10 ms (50 Hz), sine | 1500 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 1600 | A |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 1350 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 1450 | A |
| $\int i^2dt$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz), sine | 11 200 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 10 750 | $A^2s$ |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 9100 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 8830 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM}$ | repetitive, $I_T$ = 150 A | 150 | A/µs |
| | f =50 Hz, $t_P$ =200 µs | | | |
| | $V_D$ = 2/3 $V_{DRM}$ | | | |
| | $I_G$ = 0.45 A | non repetitive, $I_T = I_{TAVM}$ | 500 | A/µs |
| | $di_G/dt$ = 0.45 A/µs | | | |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; | $V_{DR}$ = 2/3 $V_{DRM}$ | 1000 | V/µs |
| | $R_{GK}$ = ∞; method 1 (linear voltage rise) | | | |
| $P_{GM}$ | $T_{VJ} = T_{VJM}$ | $t_P$ = 30 µs | 10 | W |
| | $I_T = I_{TAVM}$ | $t_P$ = 300 µs | 5 | W |
| $P_{GAV}$ | | | 0.5 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40...+125 | °C |
| $T_{VJM}$ | | | 125 | °C |
| $T_{stg}$ | | | -40...+125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | t = 1 min | 3000 | V~ |
| | $I_{ISOL} \leq$ 1 mA | t = 1 s | 3600 | V~ |
| $M_d$ | Mounting torque (M5) | | 2.5-4.0/22-35 | Nm/lb.in. |
| | Terminal connection torque (M5) | | 2.5-4.0/22-35 | Nm/lb.in. |
| Weight | Typical including screws | | 90 | g |

Data according to IEC 60747 and refer to a single thyristor/diode unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions

**TO-240 AA**




**MCC Version 1**

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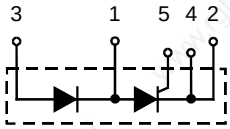
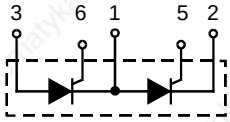
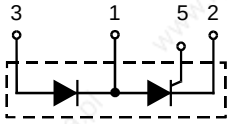


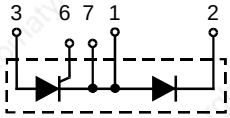

**MCC Version 8**




**MCD Version 8**




**MDC Version 1**




### Features

- International standard package, JEDEC TO-240 AA
- Direct copper bonded $Al_2O_3$ -ceramic base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered, E 72873
- Gate-cathode twin pins for version 1B

### Applications

- DC motor control
- Softstart AC motor controller
- Light, heat and temperature control

### Advantages

- Space and weight savings
- Simple mounting with two screws
- Improved temperature and power cycling
- Reduced protection circuits

031

| Symbol | Test Conditions | | Characteristic Values | |
|---|---|---|---|---|
| $I_{RRM}$, $I_{DRM}$ | $T_{VJ} = T_{VJM}$; $V_R = V_{RRM}$; $V_D = V_{DRM}$ | | 5 | mA |
| $V_T$, $V_F$ | $I_T$, $I_F$ = 200 A; $T_{VJ}$ = 25°C | | 1.57 | V |
| $V_{T0}$ | For power-loss calculations only ($T_{VJ}$ = 125°C) | | 0.85 | V |
| $r_T$ | | | 3.7 | mΩ |
| $V_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 1.5 | V |
| | | $T_{VJ}$ = -40°C | 1.6 | V |
| $I_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 100 | mA |
| | | $T_{VJ}$ = -40°C | 200 | mA |
| $V_{GD}$ | $T_{VJ} = T_{VJM}$; | $V_D$ = 2/3 $V_{DRM}$ | 0.2 | V |
| $I_{GD}$ | | | 10 | mA |
| $I_L$ | $T_{VJ}$ = 25°C; $t_P$ = 10 µs; $V_D$ = 6 V<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 450 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK}$ = ∞ | | 200 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D$ = 1/2 $V_{DRM}$<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 2 | µs |
| $t_q$ | $T_{VJ} = T_{VJM}$; $I_T$ = 150 A, $t_P$ = 200 µs; -di/dt = 10 A/µs typ.<br>$V_R$ = 100 V; dv/dt = 20 V/µs; $V_D$ = 2/3 $V_{DRM}$ | | 150 | µs |
| $Q_S$ | $T_{VJ} = T_{VJM}$; $I_T$, $I_F$ = 50 A, -di/dt = 3 A/µs | | 100 | µC |
| $I_{RM}$ | | | 24 | A |
| $R_{thJC}$ | per thyristor/diode; DC current | other values see Fig. 8/9 | 0.45 | K/W |
| | per module | | 0.225 | K/W |
| $R_{thJK}$ | per thyristor/diode; DC current | | 0.65 | K/W |
| | per module | | 0.325 | K/W |
| $d_S$ | Creepage distance on surface | | 12.7 | mm |
| $d_A$ | Strike distance through air | | 9.6 | mm |
| a | Maximum allowable acceleration | | 50 | m/s² |

Optional accessories for module-type MCC 56 version 1 B
Keyed gate/cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red
Type **ZY 200L** (L = Left for pin pair 4/5) } UL 758, style 1385,
Type **ZY 200R** (R = right for pin pair 6/7) } CSA class 5851, guide 460-1-1

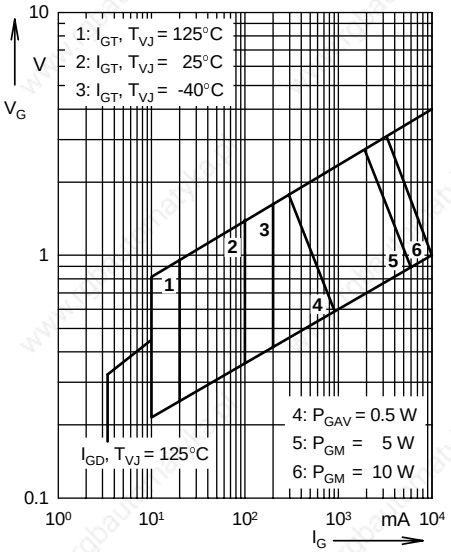



Fig. 1 Gate trigger characteristics

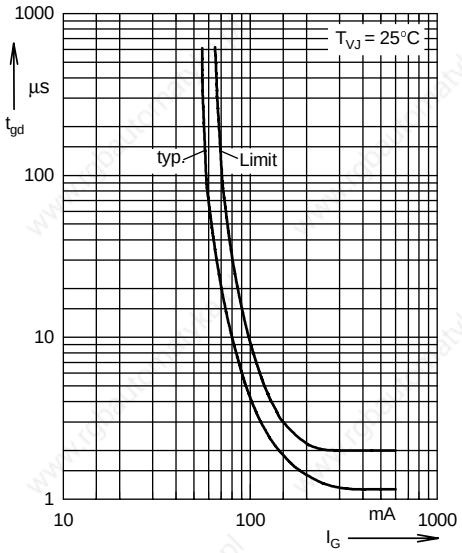
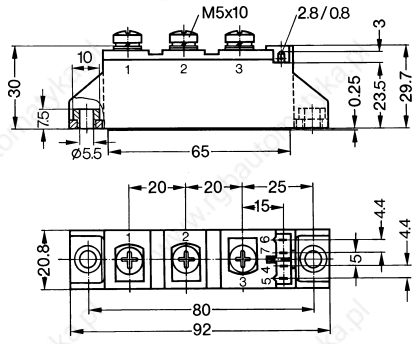


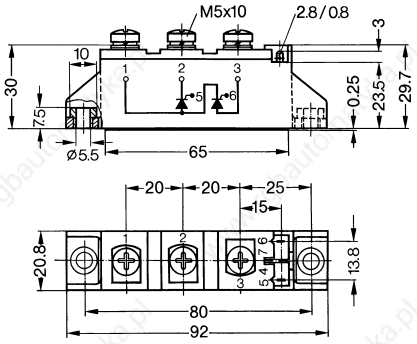

Fig. 2 Gate trigger delay time

**Dimensions in mm (1 mm = 0.0394")**

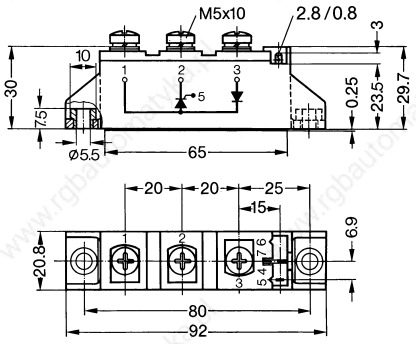
**MCC / MCD / MDC Version 1 B**




**MCC Version 8 B**




**MCD Version 8 B**




**Version 1 or 8 without B in typ designation = without insert in mountig holes**

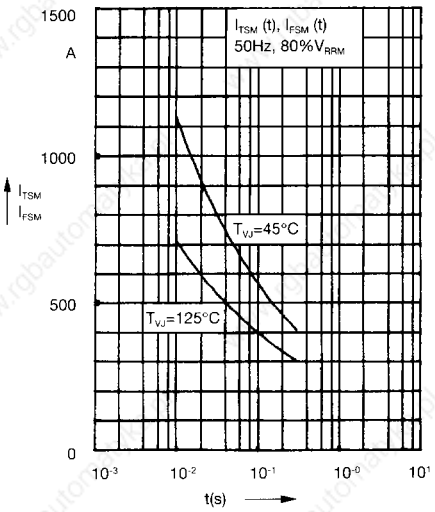



Fig. 3 Surge overload current
$I_{TSM}$, $I_{FSM}$: Crest value, t: duration

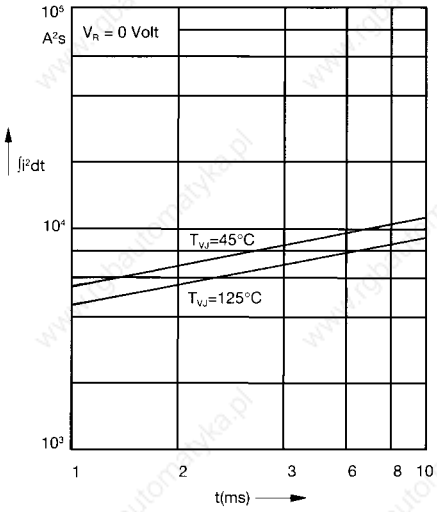



Fig. 4 $\int i^2dt$ versus time (1-10 ms)

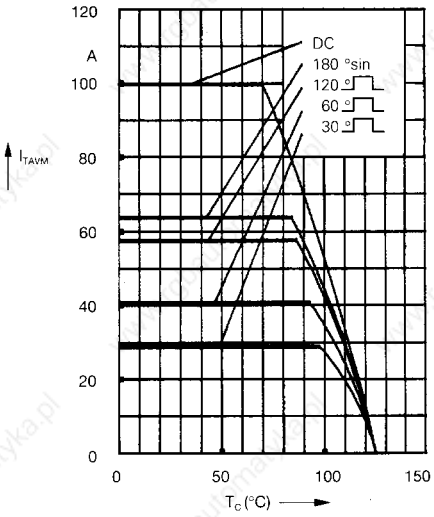



Fig. 4a Maximum forward current at case temperature

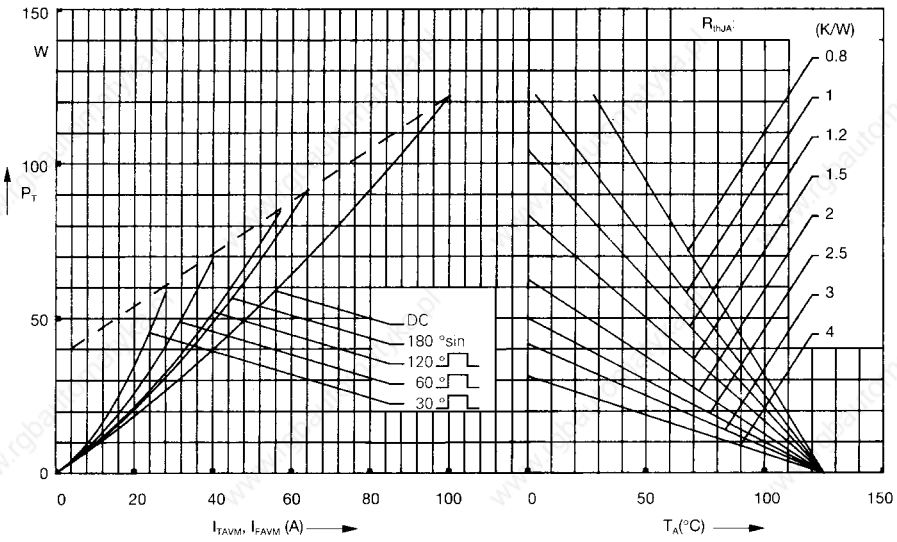



Fig. 5 Power dissipation versus on-state current and ambient temperature (per thyristor or diode)

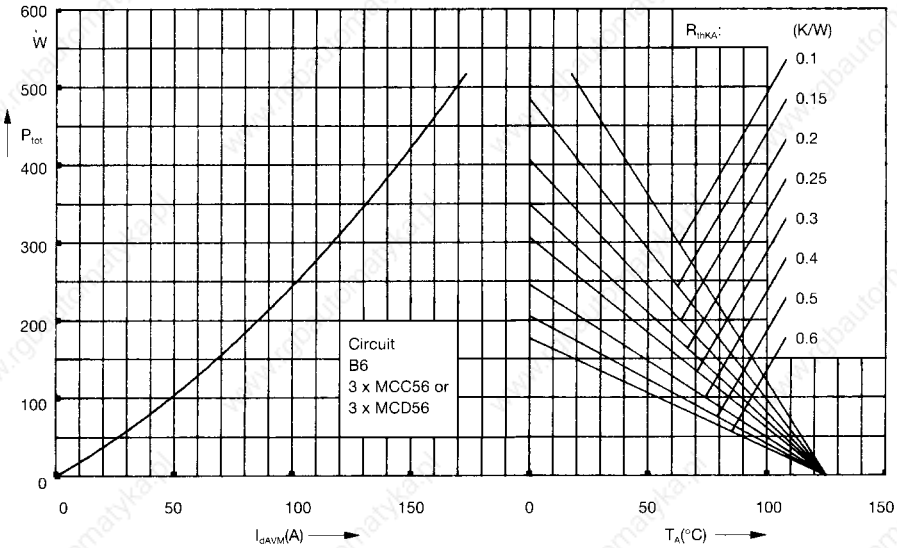



Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

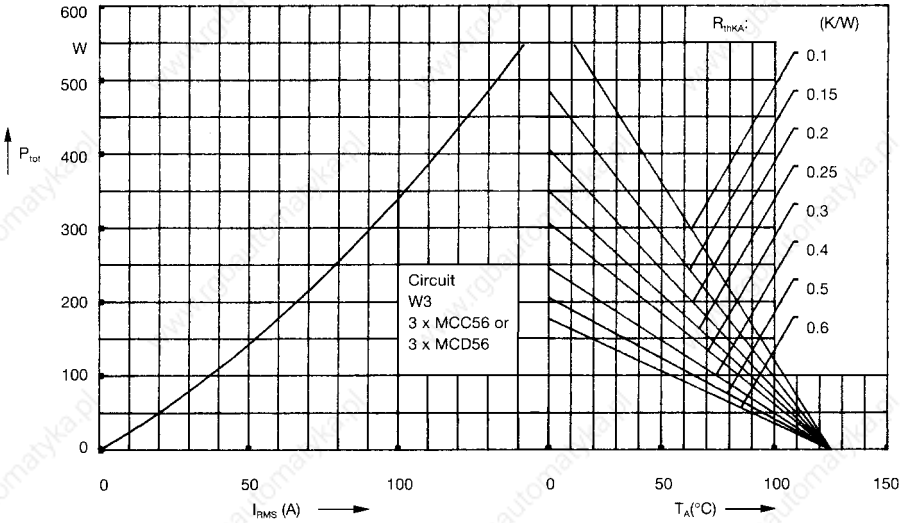



Fig. 7 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

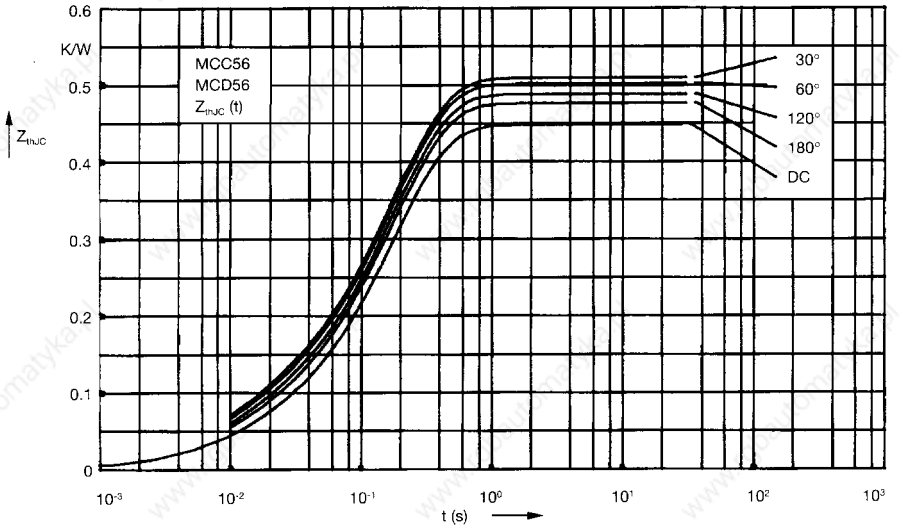



Fig. 8 Transient thermal impedance junction to case (per thyristor or diode)

$R_{thJC}$ for various conduction angles d:

| d | $R_{thJC}$ (K/W) |
|---|---|
| DC | 0.45 |
| 180° | 0.47 |
| 120° | 0.49 |
| 60° | 0.505 |
| 30° | 0.52 |

Constants for $Z_{thJC}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.014 | 0.015 |
| 2 | 0.026 | 0.0095 |
| 3 | 0.41 | 0.175 |

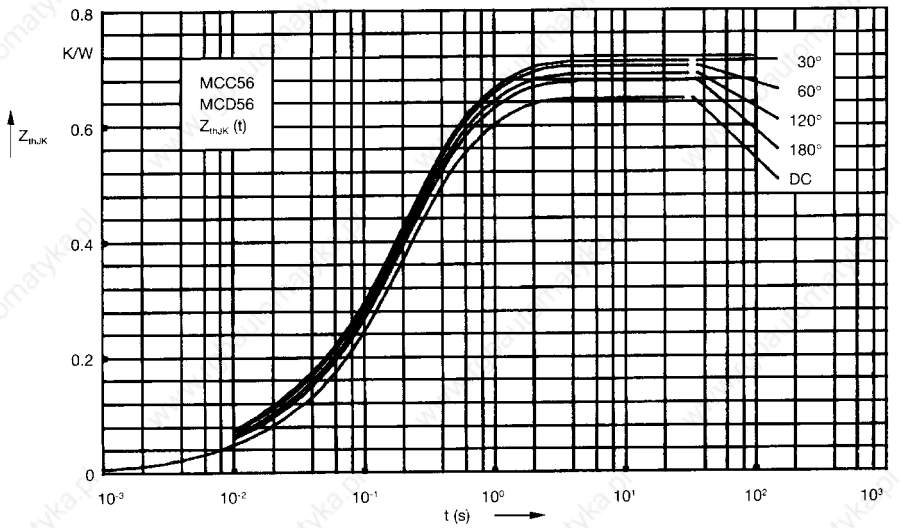



Fig. 9 Transient thermal impedance junction to heatsink (per thyristor or diode)

$R_{thJK}$ for various conduction angles d:

| d | $R_{thJK}$ (K/W) |
|---|---|
| DC | 0.65 |
| 180° | 0.67 |
| 120° | 0.69 |
| 60° | 0.705 |
| 30° | 0.72 |

Constants for $Z_{thJK}$ calculation:

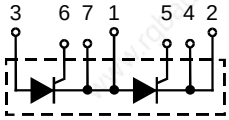
| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.014 | 0.015 |
| 2 | 0.026 | 0.0095 |
| 3 | 0.41 | 0.175 |
| 4 | 0.2 | 0.67 |

# Thyristor Module

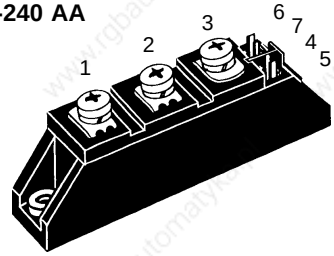
Preliminary data

$I_{TRMS}$ = 2x 100 A
$I_{TAVM}$ = 2x 64 A
$V_{RRM, DRM}$ = 1600 V

| $V_{RSM}$ V | $V_{RRM}$ $V_{DRM}$ V | Type |
|---|---|---|
| 1700 | 1600 | MCC 60-16io1 B |




**TO-240 AA**




| Symbol | Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$, $I_{FRMS}$ | $T_{VJ} = T_{VJM}$ | | 100 | A |
| $I_{TAVM}$ | $T_C$ = 85°C; 180° sine | | 64 | A |
| $I_{TSM}$, $I_{FSM}$ | $T_{VJ}$ = 45°C; | t = 10 ms (50 Hz), sine | 1150 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 1230 | A |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 1000 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 1070 | A |
| $I^2dt$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz), sine | 6610 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 6350 | $A^2s$ |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 5000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 4810 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM}$ f = 50Hz, $t_P$ = 200µs | repetitive, $I_T$ = 150 A | 150 | A/µs |
| | $V_D = {}^2/_3 V_{DRM}$ $I_G$ = 0.45 A $di_G/dt$ = 0.45 A/µs | non repetitive, $I_T = I_{TAVM}$ | 500 | A/µs |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; $R_{GK} = \infty$; method 1 (linear voltage rise) | $V_{DR} = {}^2/_3 V_{DRM}$ | 1000 | V/µs |
| $P_{GM}$ | $T_{VJ} = T_{VJM}$ | $t_P$ = 30 µs | 10 | W |
| | $I_T = I_{TAVM}$ | $t_P$ = 300 µs | 5 | W |
| $P_{GAV}$ | | | 0.5 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40...+140 | °C |
| $T_{VJM}$ | | | 140 | °C |
| $T_{stg}$ | | | -40...+125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | t = 1 min | 3000 | V~ |
| | $I_{ISOL} \le$ 1 mA | t = 1 s | 3600 | V~ |
| $M_d$ | Mounting torque (M5) | | 2.5-4.0/22-35 | Nm/lb.in. |
| | Terminal connection torque (M5) | | 2.5-4.0/22-35 | Nm/lb.in. |
| Weight | Typical including screws | | 90 | g |

### Features

- International standard package
- Direct copper bonded $Al_2O_3$-ceramic base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- Gate-cathode twin pins

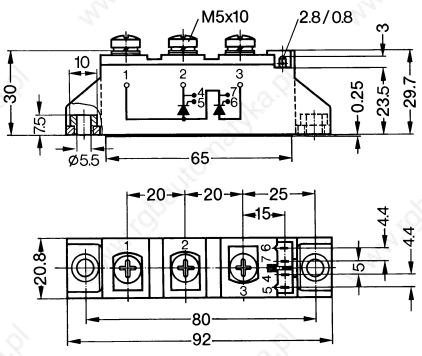
### Applications

- DC motor control
- Softstart AC motor controller
- Light, heat and temperature control

### Advantages

- Space and weight savings
- Simple mounting with two screws
- Improved temperature and power cycling
- Reduced protection circuits

**Dimensions in mm (1 mm = 0.0394")**




Data according to IEC 60747 and refer to a single thyristor/diode unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions

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| Symbol | Conditions | | Characteristic Values | |
|---|---|---|---|---|
| $I_{RRM}$, $I_{DRM}$ | $T_{VJ} = T_{VJM}$; $V_R = V_{RRM}$; $V_D = V_{DRM}$ | | 20 | mA |
| $V_T$, $V_F$ | $I_T$, $I_F$ = 200 A; $T_{VJ}$ = 25°C | | 1.70 | V |
| $V_{T0}$ | $T_{VJ}$ = 125°C; For power-loss calculations only | | 0.85 | V |
| $r_T$ | $T_{VJ} = T_{VJM}$ | | 4.8 | mΩ |
| $V_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 1.4 | V |
| | | $T_{VJ}$ = -40°C | 1.6 | V |
| $I_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 100 | mA |
| | | $T_{VJ}$ = -40°C | 200 | mA |
| $V_{GD}$ | $T_{VJ} = T_{VJM}$; | $V_D = {}^2/_3\ V_{DRM}$ | 0.2 | V |
| $I_{GD}$ | | | 10 | mA |
| $I_L$ | $T_{VJ}$ = 25°C; $t_P$ = 10 µs, $V_D$ = 6 V<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 450 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK} = \infty$ | | 200 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D = {}^1/_2\ V_{DRM}$<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 2 | µs |
| $t_q$ | $T_{VJ} = T_{VJM}$; $I_T$ = 120 A, $t_P$ = 200 µs; -di/dt = 10 A/µs<br>$V_R$ = 100 V; dv/dt = 20 V/µs; $V_D = {}^2/_3\ V_{DRM}$ | typ. | 150 | µs |
| $Q_S$ | $T_{VJ} = T_{VJM}$; $I_T$, $I_F$ = 50 A, -di/dt = 0.64 A/µs | | 110 | µC |
| $I_{RM}$ | | | 12 | A |
| $R_{thJC}$ | per thyristor/diode; DC current | | 0.5 | K/W |
| | per module | | 0.25 | K/W |
| $R_{thCH}$ | per thyristor/diode; DC current | typ. | 0.1 | K/W |
| $d_S$ | Creepage distance on surface | | 12.7 | mm |
| $d_A$ | Strike distance through air | | 9.6 | mm |
| a | Maximum allowable acceleration | | 50 | $m/s^2$ |

Optional accessories for module-type MCC 60 version 1 B
Keyed gate/cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red
Type **ZY 200L** (L = Left for pin pair 4/5) } UL 758, style 1385,
Type **ZY 200R** (R = right for pin pair 6/7) } CSA class 5851, guide 460-1-1

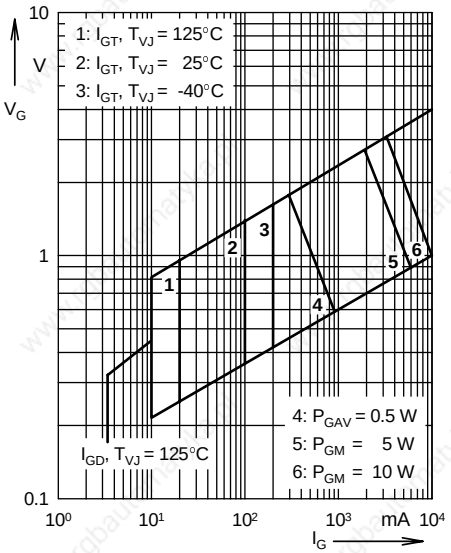



Fig. 1 Gate trigger characteristics

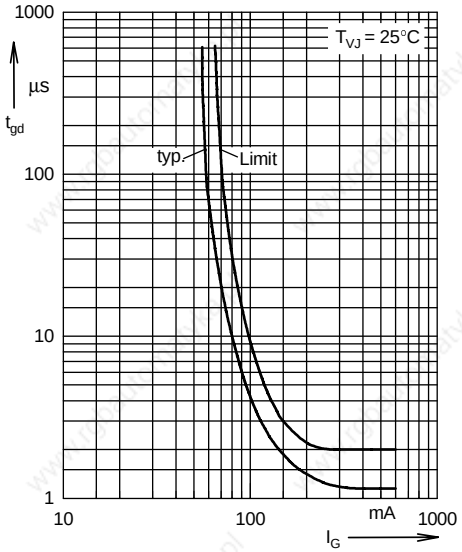


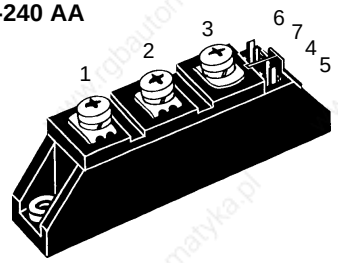

Fig. 2 Gate trigger delay time

# Thyristor Modules
# Thyristor/Diode Modules

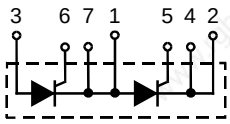
$I_{TRMS}$ = 2x 180 A
$I_{TAVM}$ = 2x 115 A
$V_{RRM}$ = 800-1800 V

| $V_{RSM}$ $V_{DSM}$ | $V_{RRM}$ $V_{DRM}$ | Type | | | |
|---|---|---|---|---|---|
| V | V | Version 1 B | | Version 8 B | |
| 900 | 800 | MCC 72-08io1 B | -- | MCC 72-08io8 B | MCD 72-08io8 B |
| 1300 | 1200 | MCC 72-12io1 B | MCD 72-12io1B | MCC 72-12io8 B | MCD 72-12io8 B |
| 1500 | 1400 | MCC 72-14io1 B | -- | MCC 72-14io8 B | MCD 72-14io8 B |
| 1700 | 1600 | MCC 72-16io1 B | MCD 72-16io1B | MCC 72-16io8 B | MCD 72-16io8 B |
| 1900 | 1800 | MCC 72-18io1 B | -- | MCC 72-18io8 B | MCD 72-18io8 B |

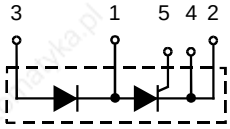
**TO-240 AA**



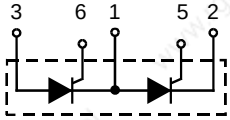

**MCC Version 1 B**



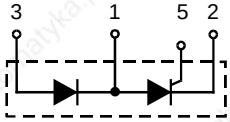

**MCD Version 1 B**




**MCC Version 8 B**




**MCD Version 8 B**




| Symbol | Test Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$, $I_{FRMS}$ | $T_{VJ} = T_{VJM}$ | | 180 | A |
| $I_{TAVM}$, $I_{FAVM}$ | $T_C$ = 63°C; 180° sine | | 115 | A |
| | $T_C$ = 85°C; 180° sine | | 85 | A |
| $I_{TSM}$, $I_{FSM}$ | $T_{VJ}$ = 45°C; | t = 10 ms (50 Hz), sine | 1700 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 1800 | A |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 1540 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 1640 | A |
| $\int i^2dt$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz), sine | 14 450 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 13 500 | $A^2s$ |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 11 850 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 11 300 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM}$ | repetitive, $I_T$ = 250 A | 150 | A/µs |
| | f =50 Hz, $t_P$ =200 µs | | | |
| | $V_D$ = 2/3 $V_{DRM}$ | | | |
| | $I_G$ = 0.45 A | non repetitive, $I_T = I_{TAVM}$ | 500 | A/µs |
| | $di_G/dt$ = 0.45 A/µs | | | |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; | $V_{DR}$ = 2/3 $V_{DRM}$ | 1000 | V/µs |
| | $R_{GK}$ = ∞; method 1 (linear voltage rise) | | | |
| $P_{GM}$ | $T_{VJ} = T_{VJM}$ | $t_P$ = 30 µs | 10 | W |
| | $I_T = I_{TAVM}$ | $t_P$ = 300 µs | 5 | W |
| $P_{GAV}$ | | | 0.5 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40...+125 | °C |
| $T_{VJM}$ | | | 125 | °C |
| $T_{stg}$ | | | -40...+125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | t = 1 min | 3000 | V~ |
| | $I_{ISOL} \leq$ 1 mA | t = 1 s | 3600 | V~ |
| $M_d$ | Mounting torque (M5) | | 2.5-4.0/22-35 | Nm/lb.in. |
| | Terminal connection torque (M5) | | 2.5-4.0/22-35 | Nm/lb.in. |
| Weight | Typical including screws | | 90 | g |

Data according to IEC 60747 and refer to a single thyristor/diode unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions

### Features

- International standard package, JEDEC TO-240 AA
- Direct copper bonded $Al_2O_3$ -ceramic base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered, E 72873
- Gate-cathode twin pins for version 1B

### Applications

- DC motor control
- Softstart AC motor controller
- Light, heat and temperature control

### Advantages

- Space and weight savings
- Simple mounting with two screws
- Improved temperature and power cycling
- Reduced protection circuits

032

| Symbol | Test Conditions | | Characteristic Values | |
|---|---|---|---|---|
| $I_{RRM}$, $I_{DRM}$ | $T_{VJ} = T_{VJM}$; $V_R = V_{RRM}$; $V_D = V_{DRM}$ | | 5 | mA |
| $V_T$, $V_F$ | $I_T$, $I_F$ = 300 A; $T_{VJ}$ = 25°C | | 1.74 | V |
| $V_{T0}$ | For power-loss calculations only ($T_{VJ}$ = 125°C) | | 0.85 | V |
| $r_T$ | | | 3.2 | mΩ |
| $V_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 2.5 | V |
| | | $T_{VJ}$ = -40°C | 2.6 | V |
| $I_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 150 | mA |
| | | $T_{VJ}$ = -40°C | 200 | mA |
| $V_{GD}$ | $T_{VJ} = T_{VJM}$; | $V_D$ = 2/3 $V_{DRM}$ | 0.2 | V |
| $I_{GD}$ | | | 10 | mA |
| $I_L$ | $T_{VJ}$ = 25°C; $t_P$ = 10 µs; $V_D$ = 6 V<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 450 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK}$ = ∞ | | 200 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D$ = 1/2 $V_{DRM}$<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 2 | µs |
| $t_q$ | $T_{VJ} = T_{VJM}$; $I_T$ = 150 A, $t_P$ = 200 µs; -di/dt = 10 A/µs typ.<br>$V_R$ = 100 V; dv/dt = 20 V/µs; $V_D$ = 2/3 $V_{DRM}$ | | 185 | µs |
| $Q_S$ | $T_{VJ} = T_{VJM}$; $I_T$, $I_F$ = 50 A, -di/dt = 6 A/µs | | 170 | µC |
| $I_{RM}$ | | | 45 | A |
| $R_{thJC}$ | per thyristor/diode; DC current | other values see Fig. 8/9 | 0.3 | K/W |
| | per module | | 0.15 | K/W |
| $R_{thJK}$ | per thyristor/diode; DC current | | 0.5 | K/W |
| | per module | | 0.25 | K/W |
| $d_S$ | Creepage distance on surface | | 12.7 | mm |
| $d_A$ | Strike distance through air | | 9.6 | mm |
| a | Maximum allowable acceleration | | 50 | $m/s^2$ |

Optional accessories for module-type MCC 72 version 1 B
Keyed gate/cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red
Type **ZY 200L** (L = Left for pin pair 4/5) } UL 758, style 1385,
Type **ZY 200R** (R = right for pin pair 6/7) } CSA class 5851, guide 460-1-1

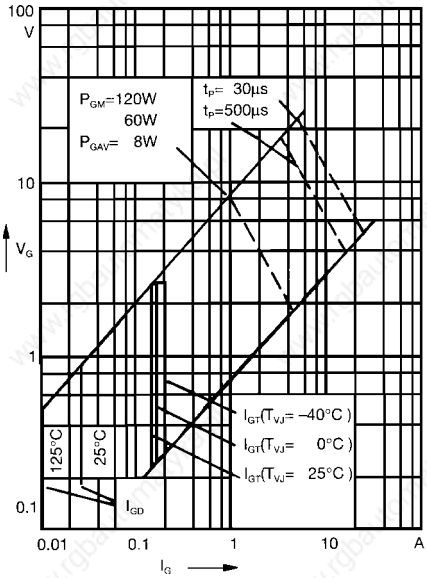



Fig. 1 Gate trigger characteristics

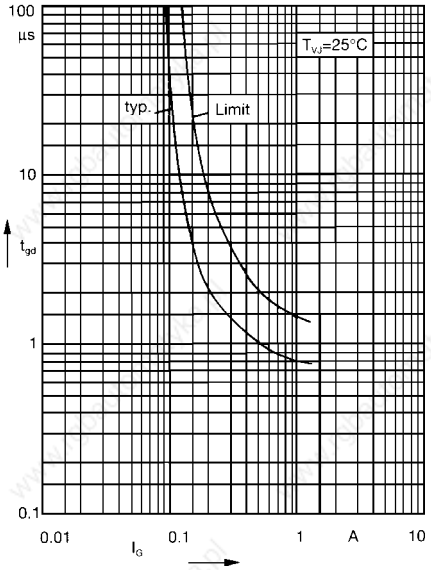
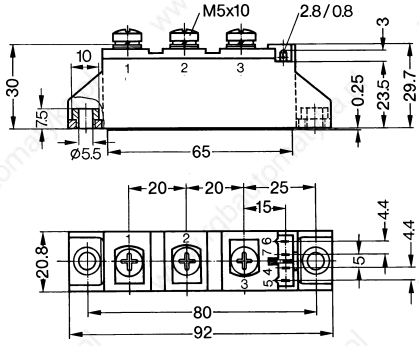


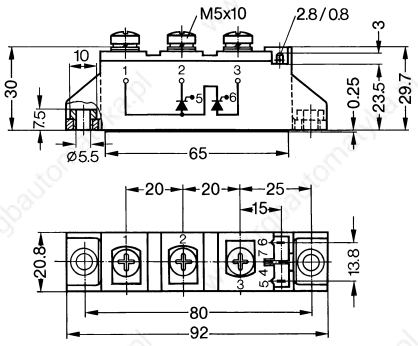

Fig. 2 Gate trigger delay time

**Dimensions in mm (1 mm = 0.0394")**

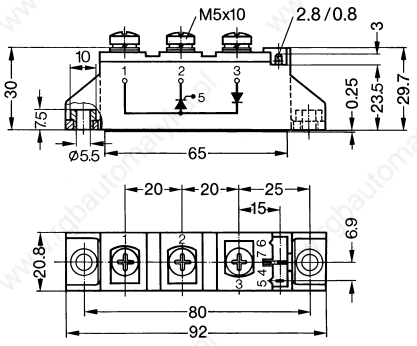
**MCC / MCD Version 1 B**




**MCC Version 8 B**




**MCD Version 8 B**



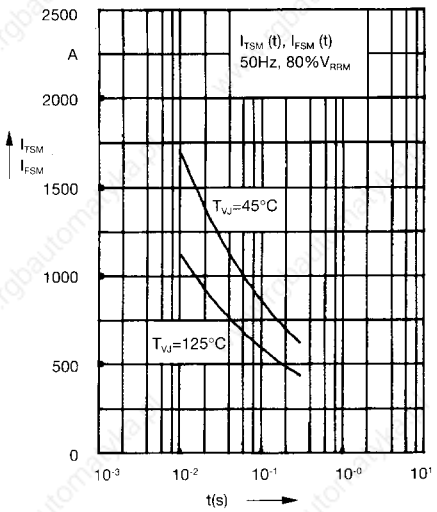



Fig. 3 Surge overload current
$I_{TSM}$, $I_{FSM}$: Crest value, t: duration

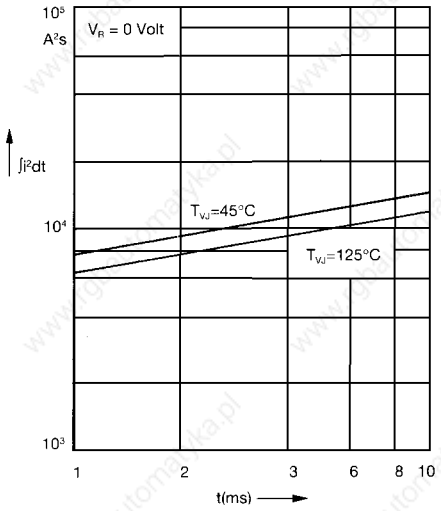



Fig. 4 $\int i^2dt$ versus time (1-10 ms)

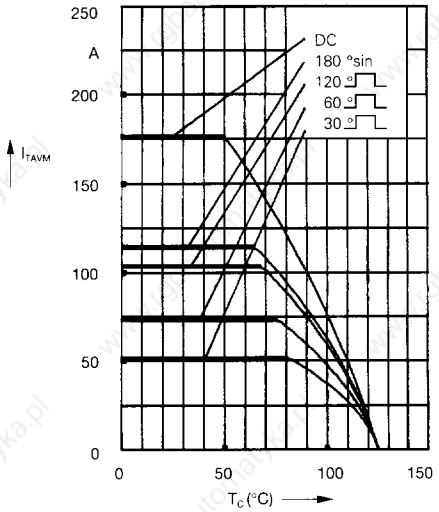



Fig. 4a Maximum forward current at case temperature

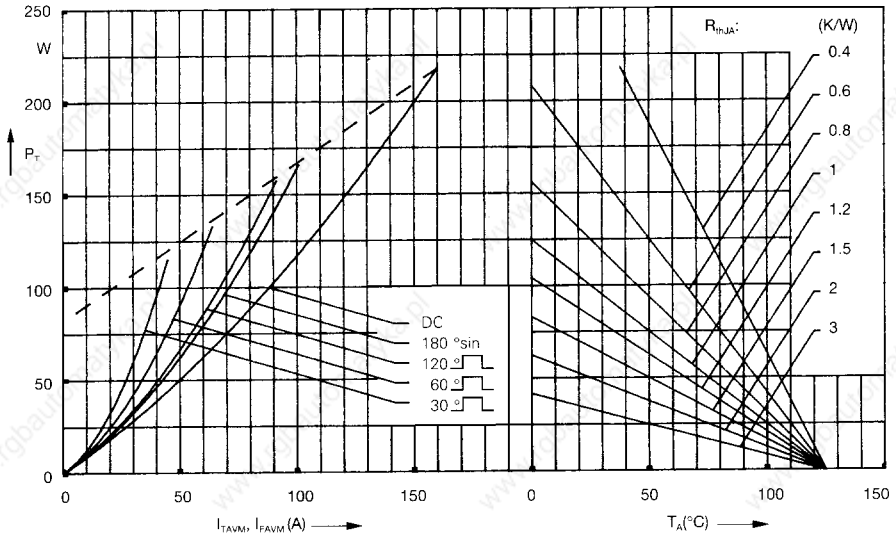



Fig. 5 Power dissipation versus on-state current and ambient temperature (per thyristor or diode)

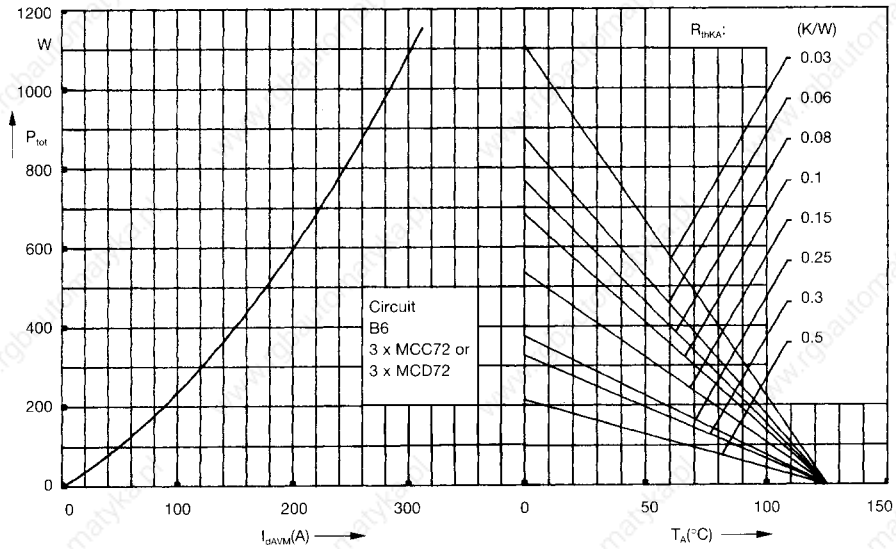



Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

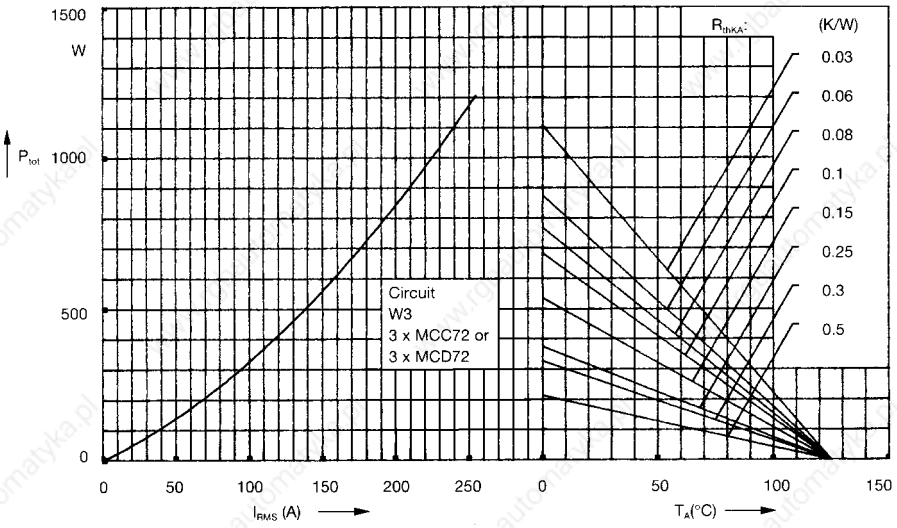



Fig. 7 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

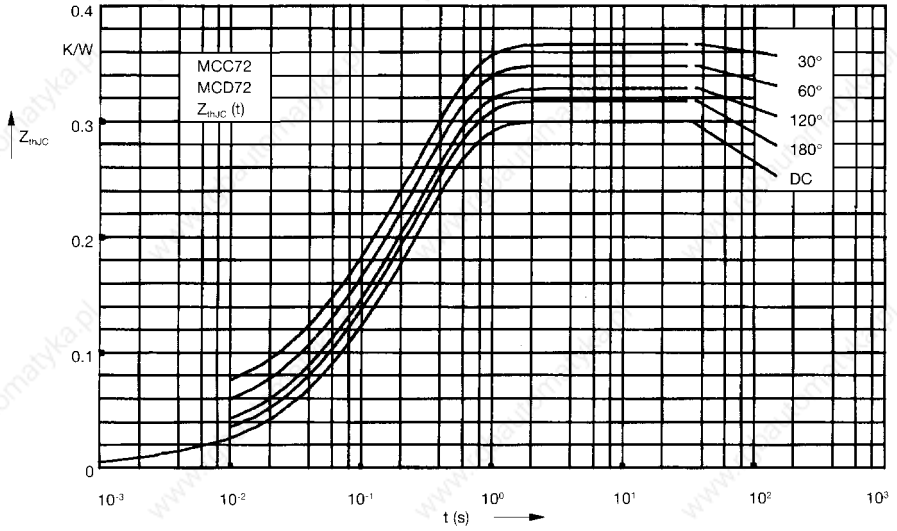



Fig. 8 Transient thermal impedance junction to case (per thyristor or diode)

$R_{thJC}$ for various conduction angles d:

| d | $R_{thJC}$ (K/W) |
|---|---|
| DC | 0.3 |
| 180° | 0.31 |
| 120° | 0.33 |
| 60° | 0.35 |
| 30° | 0.37 |

Constants for $Z_{thJC}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.008 | 0.0019 |
| 2 | 0.054 | 0.047 |
| 3 | 0.238 | 0.3 |

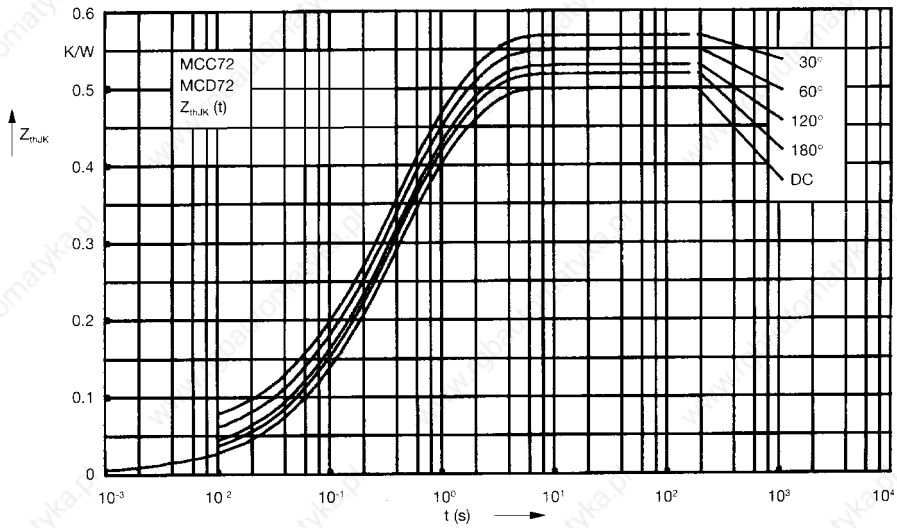



Fig. 9 Transient thermal impedance junction to heatsink (per thyristor or diode)

$R_{thJK}$ for various conduction angles d:

| d | $R_{thJK}$ (K/W) |
|---|---|
| DC | 0.5 |
| 180° | 0.51 |
| 120° | 0.53 |
| 60° | 0.55 |
| 30° | 0.57 |

Constants for $Z_{thJK}$ calculation:

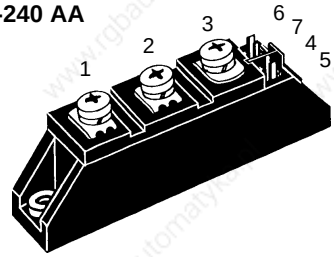
| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.008 | 0.0019 |
| 2 | 0.054 | 0.047 |
| 3 | 0.238 | 0.3 |
| 4 | 0.2 | 1.25 |

# High Voltage Thyristor Module
# High Voltage Thyristor/Diode Modules

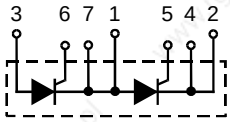
$I_{TRMS}$ = 2x 180 A
$I_{TAVM}$ = 2x 104 A
$V_{RRM}$ = 2000-2200 V

| $V_{RSM}$ $V_{DSM}$ V | $V_{RRM}$ $V_{DRM}$ V | Type | |
|---|---|---|---|
| 2100 | 2000 | MCC 94-20io1 B | MCD 94-20io1 B |
| 2300 | 2200 | MCC 94-22io1 B | MCD 94-22io1 B |

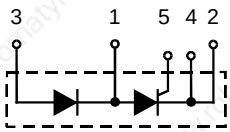
**TO-240 AA**




**MCC**




**MCD**




| Symbol | Test Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$ | $T_{VJ} = T_{VJM}$ | | 180 | A |
| $I_{TAVM}$ | $T_C$ = 85°C; 180° sine | | 104 | A |
| $I_{TSM}$ | $T_{VJ}$ = 45°C; | t = 10 ms (50 Hz) | 1700 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 1800 | A |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz) | 1540 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 1640 | A |
| $\int i^2dt$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz) | 14450 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 13500 | $A^2s$ |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz) | 11850 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 11300 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; f = 50 Hz, $t_P$ = 200 µs | repetitive, $I_T$ = 250 A | 150 | A/µs |
| | $V_D$ = 2/3 $V_{DRM}$ | | | |
| | $I_G$ = 0.45 A, $di_G/dt$ = 0.45 A/µs | non repetitive, $I_T = I_{TAVM}$ | 500 | A/µs |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; $V_{DR}$ = 2/3 $V_{DRM}$; $R_{GK}$ = ∞; method 1 (linear voltage rise) | | 1000 | V/µs |
| $P_{GM}$ | $T_{VJ} = T_{VJM}$ | $t_P$ = 30 µs | 10 | W |
| | $I_T = I_{TAVM}$ | $t_P$ = 300 µs | 5 | W |
| $P_{GAV}$ | | | 0.5 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40 ...125 | °C |
| $T_{VJM}$ | | | 125 | °C |
| $T_{stg}$ | | | -40 ...125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | t = 1 min | 3000 | V~ |
| | $I_{ISOL} \leq$ 1 mA | t = 1 s | 3600 | V~ |
| $M_d$ | Mounting torque (M5) | | 2.5-4.0/22-35 | Nm/lb.in. |
| | Terminal connection torque (M5) | | 2.5-4.0/22-35 | Nm/lb.in. |
| Weight | Typical including screws | | 90 | g |

### Features

- International standard package, JEDEC TO-240 AA
- **D**irect **C**opper **B**onded $Al_2O_3$ -ceramic base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered, E 72873
- Gate-cathode twin pins for version 1B

### Applications

- DC motor control
- Softstart AC motor controller
- Light, heat and temperature control

### Advantages

- Space and weight savings
- Simple mounting with two screws
- Improved temperature and power cycling
- Reduced protection circuits

Data according to IEC 60747 and refer to a single thyristor/diode unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions

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| Symbol | Test Conditions | Characteristic Values | |
|---|---|---|---|
| $I_{RRM}$, $I_{DRM}$ | $T_{VJ}$ = $T_{VJM}$; $V_R$ = $V_{RRM}$ | 15 | mA |
| $V_T$ | $I_T$ = 300 A; $T_{VJ}$ = 25°C | 1.74 | V |
| $V_{T0}$ | For power-loss calculations only ($T_{VJ}$ = $T_{VJM}$) | 0.85 | V |
| $r_T$ | | 3.2 | mΩ |
| $V_{GT}$ | $V_D$ = 6 V; $T_{VJ}$ = 25°C | 1.5 | V |
| | $T_{VJ}$ = -40°C | 1.6 | V |
| $I_{GT}$ | $V_D$ = 6 V; $T_{VJ}$ = 25°C | 100 | mA |
| | $T_{VJ}$ = -40°C | 200 | mA |
| $V_{GD}$ | $T_{VJ}$ = $T_{VJM}$; $V_D$ = 2/3 $V_{DRM}$ | 0.25 | V |
| $I_{GD}$ | $T_{VJ}$ = $T_{VJM}$; $V_D$ = 2/3 $V_{DRM}$ | 10 | mA |
| $I_L$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $t_P$ = 30 µs<br>$di_G/dt$ = 0.45 A/µs; $I_G$ = 0.45 A | 200 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK}$ = ∞ | 150 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D$ = 1/2 $V_{DRM}$<br>$di_G/dt$ = 0.45 A/µs; $I_G$ = 0.45 A | 2 | µs |
| $t_q$ | $T_{VJ}$ = $T_{VJM}$; $V_R$ = 100 V; $V_D$ = 2/3 $V_{DRM}$; $t_P$ = 200 µs<br>dv/dt = 20 V/µs; $I_T$ = 150 A; -di/dt = 10 A/µs | typ. 185 | µs |
| $Q_S$ | $T_{VJ}$ = $T_{VJM}$ | 170 | µC |
| $I_{RM}$ | -di/dt = 6 A/µs; $I_T$ = 50 A | 45 | A |
| $R_{thJC}$ | per thyristor; DC current | 0.22 | K/W |
| | per module | 0.11 | K/W |
| $R_{thJK}$ | per thyristor; DC current | 0.42 | K/W |
| | per module | 0.21 | K/W |
| $d_S$ | Creeping distance on surface | 12.7 | mm |
| $d_A$ | Creepage distance in air | 9.6 | mm |
| a | Maximum allowable acceleration | 50 | $m/s^2$ |

Optional accessories for module-type MCC 94 version 1 B
Keyed gate/cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red
Type **ZY 200L** (L = Left for pin pair 4/5) } UL 758, style 1385,
Type **ZY 200R** (R = right for pin pair 6/7) } CSA class 5851, guide 460-1-1

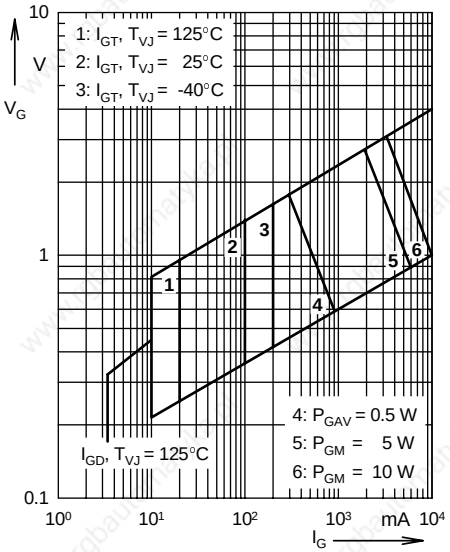



Fig. 1 Gate trigger characteristics

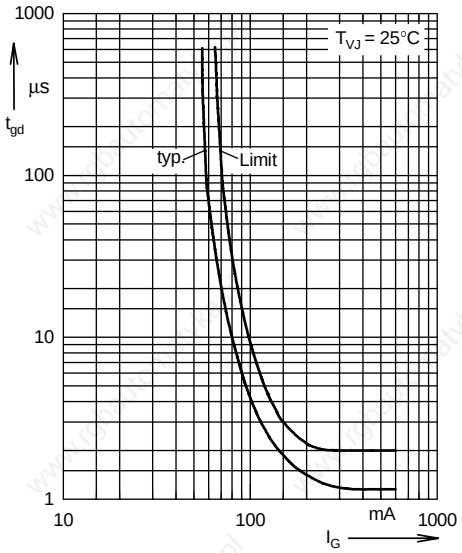
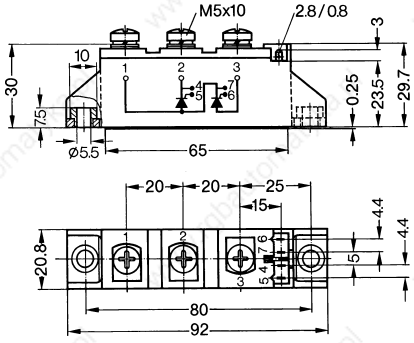



Fig. 2 Gate trigger delay time

**Dimensions in mm (1 mm = 0.0394")**




$R_{thJC}$ for various conduction angles d:

| d | $R_{thJC}$ (K/W) |
|---|---|
| DC | 0.22 |
| 180° | 0.23 |
| 120° | 0.25 |
| 60° | 0.27 |
| 30° | 0.28 |

Constants for $Z_{thJC}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0066 | 0.0019 |
| 2 | 0.0678 | 0.0477 |
| 3 | 0.1456 | 0.344 |

$R_{thJK}$ for various conduction angles d:

| d | $R_{thJK}$ (K/W) |
|---|---|
| DC | 0.42 |
| 180° | 0.43 |
| 120° | 0.45 |
| 60° | 0.47 |
| 30° | 0.48 |

Constants for $Z_{thJK}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0066 | 0.0019 |
| 2 | 0.0678 | 0.0477 |
| 3 | 0.1456 | 0.344 |
| 4 | 0.2 | 1.32 |

# Thyristor Modules
# Thyristor/Diode Modules

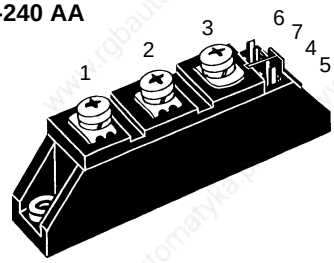
$I_{TRMS}$ = 2x 180 A
$I_{TAVM}$ = 2x 116 A
$V_{RRM}$ = 800-1800 V

| $V_{RSM}$ $V_{DSM}$ | $V_{RRM}$ $V_{DRM}$ | Type | | | |
|---|---|---|---|---|---|
| V | V | Version 1 | | Version 8 | |
| 900 | 800 | MCC 95-08io1 B | -- | MCC 95-08io8 B | MCD 95-08io8 B |
| 1300 | 1200 | MCC 95-12io1 B | MCD 95-12io1 B | MCC 95-12io8 B | MCD 95-12io8 B |
| 1500 | 1400 | MCC 95-14io1 B | -- | MCC 95-14io8 B | MCD 95-14io8 B |
| 1700 | 1600 | MCC 95-16io1 B | MCD 95-16io1 B | MCC 95-16io8 B | MCD 95-16io8 B |
| 1900 | 1800 | MCC 95-18io1 B | -- | MCC 95-18io8 B | MCD 95-18io8 B |
| 1500 | 1400 | MCC 95-16io1 | | | |
| 1700 | 1600 | MCC 95-18io1 | | | |

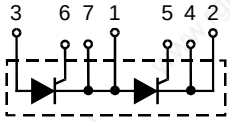
| Symbol | Test Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$, $I_{FRMS}$ | $T_{VJ} = T_{VJM}$ | | 180 | A |
| $I_{TAVM}$, $I_{FAVM}$ | $T_C$ = 85°C; 180° sine | | 116 | A |
| $I_{TSM}$, $I_{FSM}$ | $T_{VJ}$ = 45°C; | t = 10 ms (50 Hz), sine | 2250 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 2400 | A |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 2000 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 2150 | A |
| $\int i^2dt$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz), sine | 25 300 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 23 900 | $A^2s$ |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 20 000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 19 100 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM}$ | repetitive, $I_T$ = 250 A | 150 | A/µs |
| | f =50 Hz, $t_P$ =200 µs | | | |
| | $V_D$ = 2/3 $V_{DRM}$ | | | |
| | $I_G$ = 0.45 A | non repetitive, $I_T = I_{TAVM}$ | 500 | A/µs |
| | $di_G/dt$ = 0.45 A/µs | | | |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; | $V_{DR}$ = 2/3 $V_{DRM}$ | 1000 | V/µs |
| | $R_{GK}$ = ∞; method 1 (linear voltage rise) | | | |
| $P_{GM}$ | $T_{VJ} = T_{VJM}$ | $t_P$ = 30 µs | 10 | W |
| | $I_T = I_{TAVM}$ | $t_P$ = 300 µs | 5 | W |
| $P_{GAV}$ | | | 0.5 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40...+125 | °C |
| $T_{VJM}$ | | | 125 | °C |
| $T_{stg}$ | | | -40...+125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | t = 1 min | 3000 | V~ |
| | $I_{ISOL} \leq$ 1 mA | t = 1 s | 3600 | V~ |
| $M_d$ | Mounting torque (M5) | | 2.5-4.0/22-35 | Nm/lb.in. |
| | Terminal connection torque (M5) | | 2.5-4.0/22-35 | Nm/lb.in. |
| Weight | Typical including screws | | 90 | g |

Data according to IEC 60747 and refer to a single thyristor/diode unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions

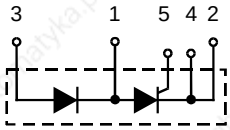
**TO-240 AA**



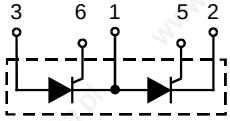

**MCC Version 1**



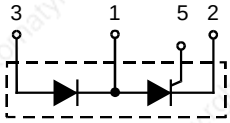

**MCD Version 1**




**MCC Version 8**




**MCD Version 8**




### Features

- International standard package, JEDEC TO-240 AA
- Direct copper bonded $Al_2O_3$ -ceramic base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered, E 72873
- Gate-cathode twin pins for version 1

### Applications

- DC motor control
- Softstart AC motor controller
- Light, heat and temperature control

### Advantages

- Space and weight savings
- Simple mounting with two screws
- Improved temperature and power cycling
- Reduced protection circuits

032

| Symbol | Test Conditions | | Characteristic Values | |
|---|---|---|---|---|
| $I_{RRM}$, $I_{DRM}$ | $T_{VJ} = T_{VJM}$; $V_R = V_{RRM}$; $V_D = V_{DRM}$ | | 5 | mA |
| $V_T$, $V_F$ | $I_T$, $I_F$ = 300 A; $T_{VJ}$ = 25°C | | 1.5 | V |
| $V_{T0}$ | For power-loss calculations only ($T_{VJ}$ = 125°C) | | 0.8 | V |
| $r_T$ | | | 2.4 | mΩ |
| $V_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 2.5 | V |
| | | $T_{VJ}$ = -40°C | 2.6 | V |
| $I_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 150 | mA |
| | | $T_{VJ}$ = -40°C | 200 | mA |
| $V_{GD}$ | $T_{VJ} = T_{VJM}$; | $V_D$ = 2/3 $V_{DRM}$ | 0.2 | V |
| $I_{GD}$ | | | 10 | mA |
| $I_L$ | $T_{VJ}$ = 25°C; $t_P$ = 10 µs; $V_D$ = 6 V<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 450 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK}$ = ∞ | | 200 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D$ = 1/2 $V_{DRM}$<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 2 | µs |
| $t_q$ | $T_{VJ} = T_{VJM}$; $I_T$ = 150 A, $t_P$ = 200 µs; -di/dt = 10 A/µs typ.<br>$V_R$ = 100 V; dv/dt = 20 V/µs; $V_D$ = 2/3 $V_{DRM}$ | | 185 | µs |
| $Q_S$ | $T_{VJ} = T_{VJM}$; $I_T$, $I_F$ = 50 A, -di/dt = 6 A/µs | | 170 | µC |
| $I_{RM}$ | | | 45 | A |
| $R_{thJC}$ | per thyristor/diode; DC current | other values see Fig. 8/9 | 0.22 | K/W |
| | per module | | 0.11 | K/W |
| $R_{thJK}$ | per thyristor/diode; DC current | | 0.42 | K/W |
| | per module | | 0.21 | K/W |
| $d_S$ | Creepage distance on surface | | 12.7 | mm |
| $d_A$ | Strike distance through air | | 9.6 | mm |
| a | Maximum allowable acceleration | | 50 | $m/s^2$ |

Optional accessories for module-type MCC 95 version 1 B
Keyed gate/cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red
Type **ZY 200L** (L = Left for pin pair 4/5) } UL 758, style 1385,
Type **ZY 200R** (R = right for pin pair 6/7) } CSA class 5851, guide 460-1-1

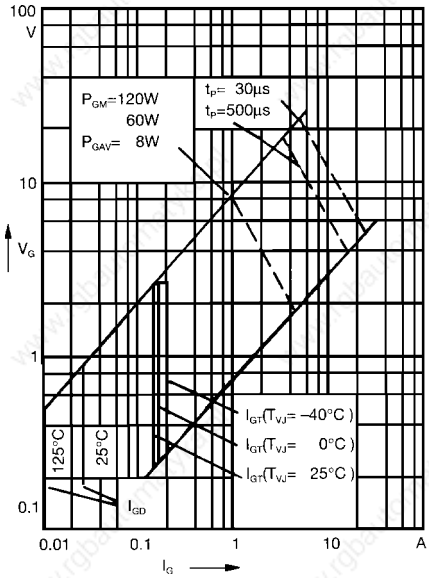



Fig. 1 Gate trigger characteristics

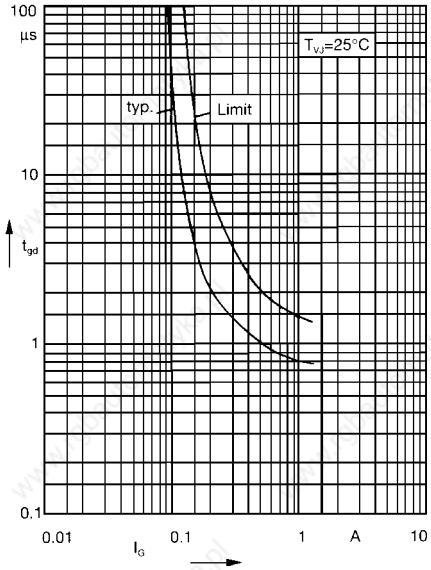
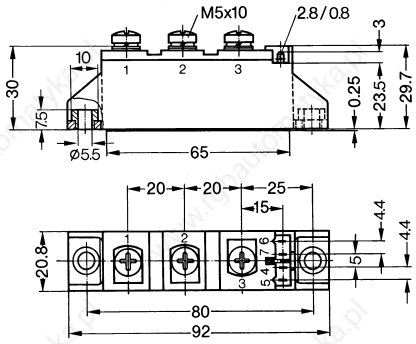


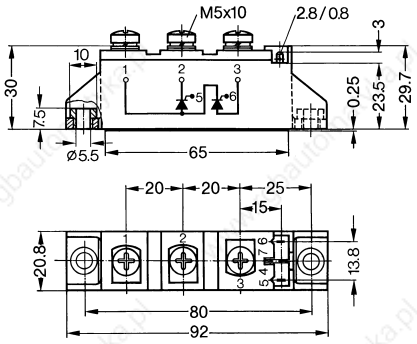

Fig. 2 Gate trigger delay time

**Dimensions in mm (1 mm = 0.0394")**

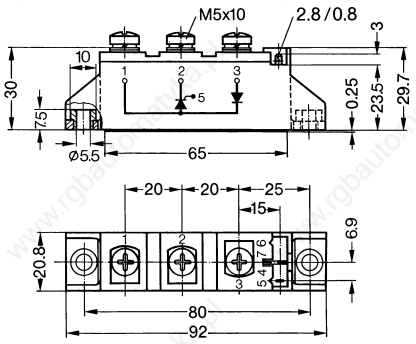
**MCC / MCD Version 1 B**




**MCC Version 8 B**




**MCD Version 8 B**




**Version 1 or 8 without B in typ designation = without insert in mountig holes**

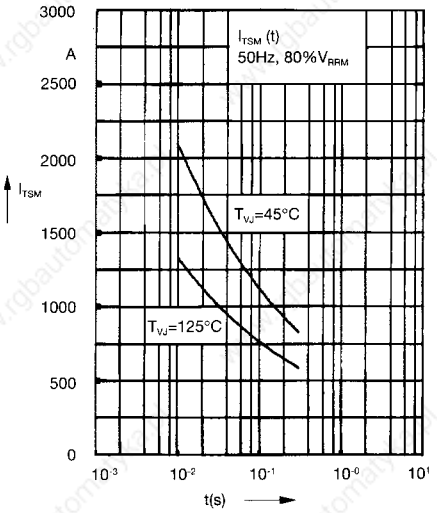



Fig. 3 Surge overload current
$I_{TSM}$, $I_{FSM}$: Crest value, t: duration

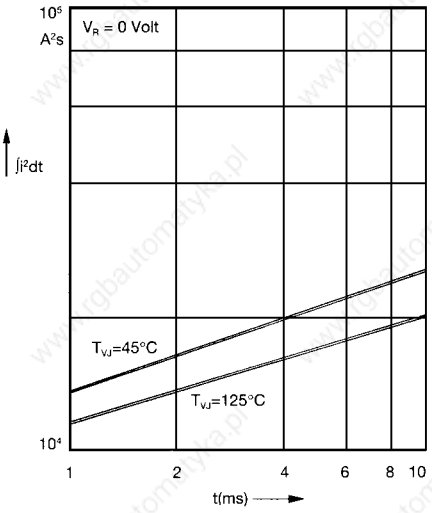



Fig. 4 $\int i^2dt$ versus time (1-10 ms)

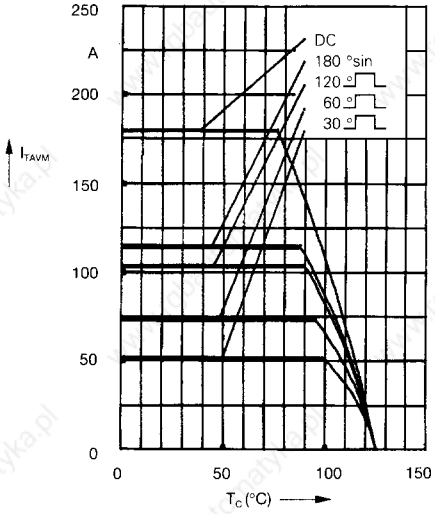



Fig. 4a Maximum forward current at case temperature

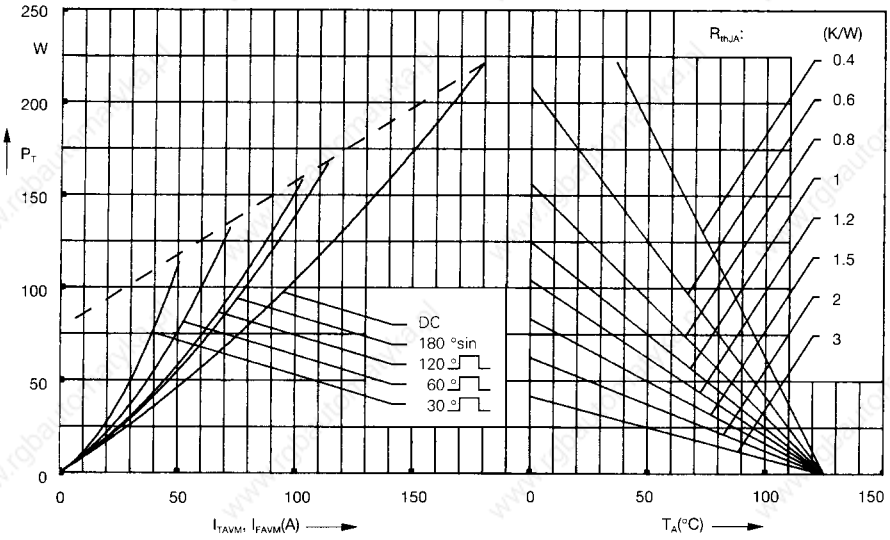



Fig. 5 Power dissipation versus on-state current and ambient temperature (per thyristor or diode)

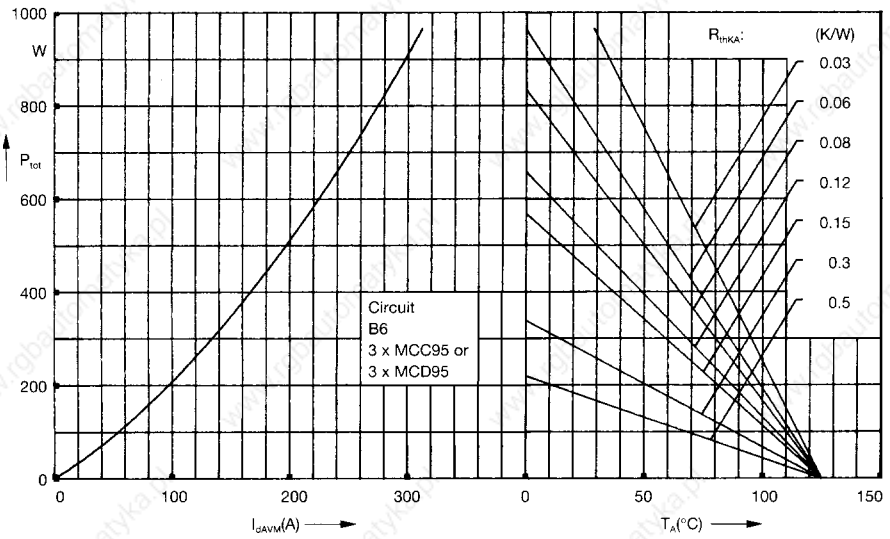



Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

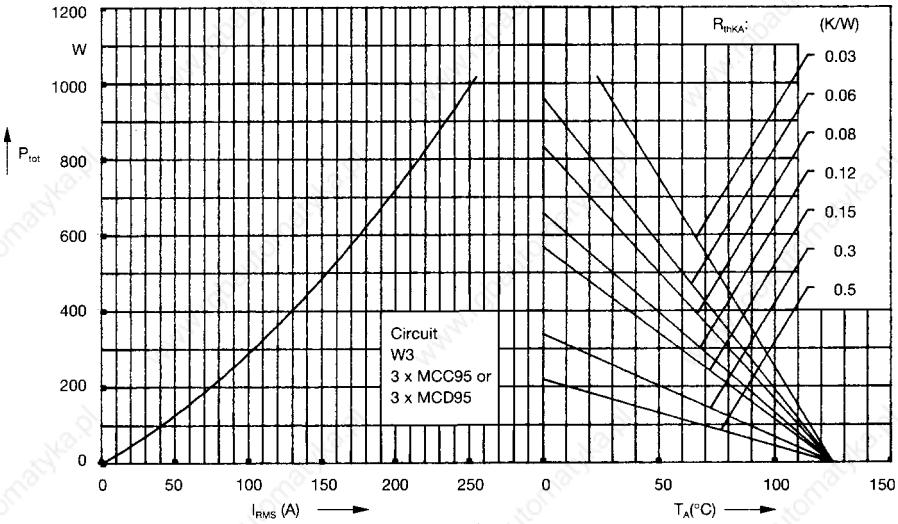



Fig. 7 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

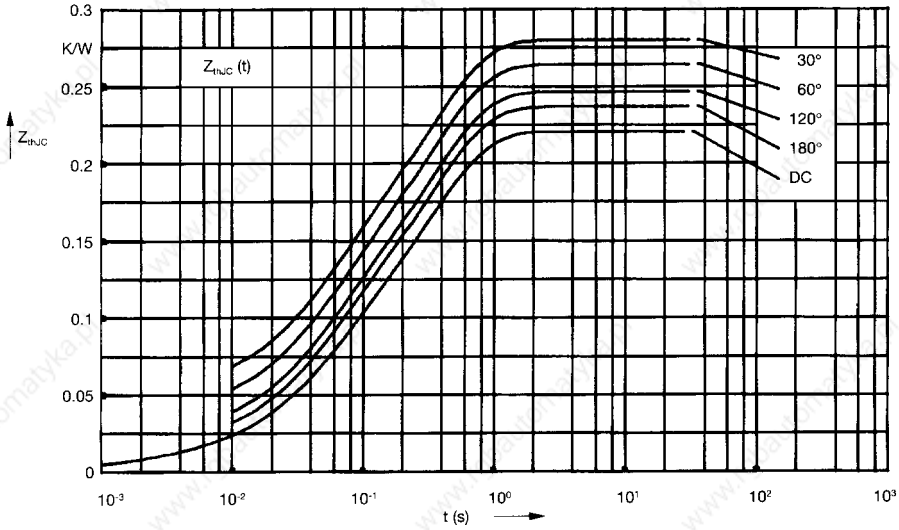



Fig. 8 Transient thermal impedance junction to case (per thyristor or diode)

$R_{thJC}$ for various conduction angles d:

| d | $R_{thJC}$ (K/W) |
|---|---|
| DC | 0.22 |
| 180° | 0.23 |
| 120° | 0.25 |
| 60° | 0.27 |
| 30° | 0.28 |

Constants for $Z_{thJC}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0066 | 0.0019 |
| 2 | 0.0678 | 0.0477 |
| 3 | 0.1456 | 0.344 |

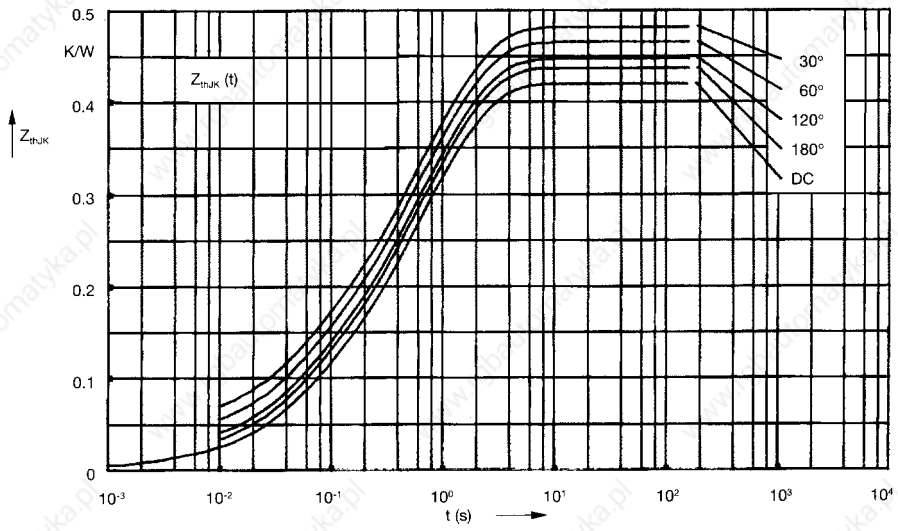



Fig. 9 Transient thermal impedance junction to heatsink (per thyristor or diode)

$R_{thJK}$ for various conduction angles d:

| d | $R_{thJK}$ (K/W) |
|---|---|
| DC | 0.42 |
| 180° | 0.43 |
| 120° | 0.45 |
| 60° | 0.47 |
| 30° | 0.48 |

Constants for $Z_{thJK}$ calculation:

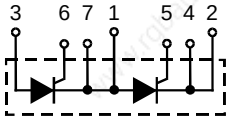
| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0066 | 0.0019 |
| 2 | 0.0678 | 0.0477 |
| 3 | 0.1456 | 0.344 |
| 4 | 0.2 | 1.32 |

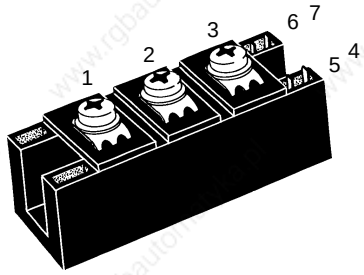
# Thyristor Module

Preliminary data

$I_{TRMS}$ = 2x300 A
$I_{TAVM}$ = 2x128 A
$V_{RRM, DRM}$ = 800-1800 V

| $V_{RSM}$ V | $V_{RRM}$ $V_{DRM}$ V | Type |
|---|---|---|
| 900 | 800 | MCC 122-08io1 |
| 1300 | 1200 | MCC 122-12io1 |
| 1500 | 1400 | MCC 122-14io1 |
| 1700 | 1600 | MCC 122-16io1 |
| 1900 | 1800 | MCC 122-18io1 |




| Symbol | Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$ | | | 300 | A |
| $I_{TAVM}$ | $T_C$ = 85°C; 180° sine | | 128 | A |
| $I_{TSM}$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz), sine | 3600 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 3850 | A |
| | $T_{VJ}$ = $T_{VJM}$ | t = 10 ms (50 Hz), sine | 3200 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 3420 | A |
| $I^2dt$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz), sine | 64800 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 62300 | $A^2s$ |
| | $T_{VJ}$ = $T_{VJM}$ | t = 10 ms (50 Hz), sine | 51200 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 49100 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ}$ = $T_{VJM}$; f = 50Hz, $t_P$ = 200µs; $V_D$ = $^2/_3$ $V_{DRM}$; $I_G$ = 0.5 A; $di_G/dt$ = 0.5 A/µs | repetitive, $I_T$ = 500 A | 150 | A/µs |
| | | non repetitive, $I_T$ = 500 A | 500 | A/µs |
| $(dv/dt)_{cr}$ | $T_{VJ}$ = $T_{VJM}$; $R_{GK}$ = ∞; method 1 (linear voltage rise) | $V_{DR}$ = $^2/_3$ $V_{DRM}$ | 1000 | V/µs |
| $P_{GM}$ | $T_{VJ}$ = $T_{VJM}$ | $t_P$ = 30 µs | 120 | W |
| | $I_T$ = $I_{TAVM}$ | $t_P$ = 500 µs | 60 | W |
| $P_{GAV}$ | | | 8 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40...+125 | °C |
| $T_{VJM}$ | | | 125 | °C |
| $T_{stg}$ | | | -40...+125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | t = 1 min | 3000 | V~ |
| | $I_{ISOL}$ ≤ 1 mA | t = 1 s | 3600 | V~ |
| $M_d$ | Mounting torque (M6) | | 2.25-2.75/20-25 | Nm/lb.in. |
| | Terminal connection torque (M6) | | 4.5-5.5/40-48 | Nm/lb.in. |
| Weight | Typical including screws | | 125 | g |

Data according to IEC 60747 and refer to a single thyristor/diode unless otherwise stated.

### Features

- International standard package
- Direct copper bonded $Al_2O_3$-ceramic base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered, E 72873
- Keyed gate/cathode twin pins

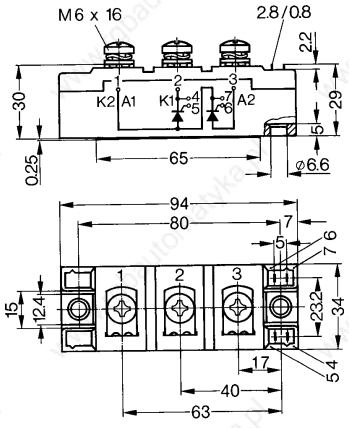
### Applications

- Motor control
- Power converter
- Heat and temperature control for industrial furnaces and chemical processes
- Lighting control
- Contactless switches

### Advantages

- Space and weight savings
- Simple mounting
- Improved temperature and power cycling
- Reduced protection circuits

### Dimensions in mm (1 mm = 0.0394")




948

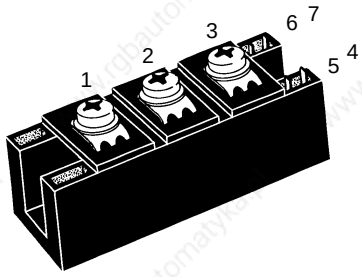
| Symbol | Conditions | | Characteristic Values | |
|---|---|---|---|---|
| $I_{RRM}$, $I_{DRM}$ | $T_{VJ} = T_{VJM}$; $V_R = V_{RRM}$; $V_D = V_{DRM}$ | | 10 | mA |
| $V_T$, $V_F$ | $I_T$, $I_F$ = 120 A; $T_{VJ}$ = 25°C | | 1.13 | V |
| $V_{T0}$ | $T_{VJ}$ = 125°C; For power-loss calculations only | | 0.85 | V |
| $r_T$ | $T_{VJ} = T_{VJM}$ | | 2 | mΩ |
| $V_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 1.4 | V |
| | | $T_{VJ}$ = -40°C | 1.6 | V |
| $I_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 150 | mA |
| | | $T_{VJ}$ = -40°C | 200 | mA |
| $V_{GD}$ | $T_{VJ} = T_{VJM}$; $V_D = {}^2/_3 V_{DRM}$ | | 0.2 | V |
| $I_{GD}$ | | | 10 | mA |
| $I_L$ | $T_{VJ}$ = 25°C; $t_P$ = 10 µs, $V_D$ = 6 V<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 300 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK} = \infty$ | | 200 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D$ = ½ $V_{DRM}$<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 2 | µs |
| $t_q$ | $T_{VJ} = T_{VJM}$; $I_T$ = 120 A, $t_P$ = 200 µs; -di/dt = 10 A/µs<br>$V_R$ = 100 V; dv/dt = 20 V/µs; $V_D = {}^2/_3 V_{DRM}$ | typ. | 150 | µs |
| $Q_S$ | $T_{VJ} = T_{VJM}$; $I_T$, $I_F$ = 200 A, -di/dt = 50 A/µs | | 330 | µC |
| $I_{RM}$ | | | 180 | A |
| $R_{thJC}$ | per thyristor/diode; DC current | | 0.2 | K/W |
| | per module | | 0.1 | K/W |
| $R_{thCH}$ | per thyristor/diode; DC current | typ. | 0.1 | K/W |
| $d_S$ | Creepage distance on surface | | 12.7 | mm |
| $d_A$ | Strike distance through air | | 9.6 | mm |
| a | Maximum allowable acceleration | | 50 | $m/s^2$ |

Optional accessories for modules
Keyed gate/cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red
Type **ZY 180L** (L = Left for pin pair 4/5) } UL Styles 1385,
Type **ZY 180R** (R = right for pin pair 6/7) } CSA Class 5851, File 41234

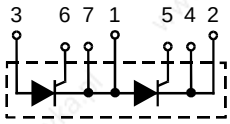
# Thyristor Modules
# Thyristor/Diode Modules

$I_{TRMS}$ = 2x 300 A
$I_{TAVM}$ = 2x 130 A
$V_{RRM}$ = 800-1800 V

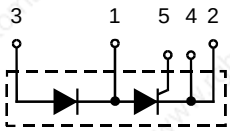
| $V_{RSM}$ $V_{DSM}$ V | $V_{RRM}$ $V_{DRM}$ V | Type Version 1 | Version 1 |
|---|---|---|---|
| 900 | 800 | MCC 132-08io1 | MCD 132-08io1 |
| 1300 | 1200 | MCC 132-12io1 | MCD 132-12io1 |
| 1500 | 1400 | MCC 132-14io1 | MCD 132-14io1 |
| 1700 | 1600 | MCC 132-16io1 | MCD 132-16io1 |
| 1900 | 1800 | MCC 132-18io1 | MCD 132-18io1 |




MCC




MCD




| Symbol | Test Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$, $I_{FRMS}$ | $T_{VJ} = T_{VJM}$ | | 300 | A |
| $I_{TAVM}$, $I_{FAVM}$ | $T_C$ = 85°C; 180° sine | | 130 | A |
| $I_{TSM}$, $I_{FSM}$ | $T_{VJ}$ = 45°C; | t = 10 ms (50 Hz), sine | 4750 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 5080 | A |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 4230 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 4530 | A |
| $\int i^2dt$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz), sine | 113 000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 108 000 | $A^2s$ |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 89 500 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 86 200 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM}$ | repetitive, $I_T$ = 500 A | 150 | A/µs |
| | f =50 Hz, $t_P$ =200 µs | | | |
| | $V_D$ = 2/3 $V_{DRM}$ | | | |
| | $I_G$ = 0.5 A | non repetitive, $I_T$ = 500 A | 500 | A/µs |
| | $di_G/dt$ = 0.5 A/µs | | | |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; | $V_{DR}$ = 2/3 $V_{DRM}$ | 1000 | V/µs |
| | $R_{GK}$ = ∞; method 1 (linear voltage rise) | | | |
| $P_{GM}$ | $T_{VJ} = T_{VJM}$ | $t_P$ = 30 µs | 120 | W |
| | $I_T = I_{TAVM}$ | $t_P$ = 500 µs | 60 | W |
| $P_{GAV}$ | | | 8 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40...+125 | °C |
| $T_{VJM}$ | | | 125 | °C |
| $T_{stg}$ | | | -40...+125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | t = 1 min | 3000 | V~ |
| | $I_{ISOL} \le$ 1 mA | t = 1 s | 3600 | V~ |
| $M_d$ | Mounting torque (M6) | | 2.25-2.75/20-25 | Nm/lb.in. |
| | Terminal connection torque (M6) | | 4.5-5.5/40-48 | Nm/lb.in. |
| Weight | Typical including screws | | 125 | g |

Data according to IEC 60747 and refer to a single thyristor/diode unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions

**Features**
- International standard package
- Direct copper bonded $Al_2O_3$ -ceramic base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered, E 72873
- Keyed gate/cathode twin pins

**Applications**
- Motor control
- Power converter
- Heat and temperature control for industrial furnaces and chemical processes
- Lighting control
- Contactless switches

**Advantages**
- Space and weight savings
- Simple mounting
- Improved temperature and power cycling
- Reduced protection circuits

032

| Symbol | Test Conditions | | Characteristic Values | |
|---|---|---|---|---|
| $I_{RRM}$, $I_{DRM}$ | $T_{VJ} = T_{VJM}$; $V_R = V_{RRM}$; $V_D = V_{DRM}$ | | 10 | mA |
| $V_T$, $V_F$ | $I_T$, $I_F$ = 300 A; $T_{VJ}$ = 25°C | | 1.36 | V |
| $V_{T0}$ | For power-loss calculations only ($T_{VJ}$ = 125°C) | | 0.8 | V |
| $r_T$ | | | 1.5 | mΩ |
| $V_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 2.5 | V |
| | | $T_{VJ}$ = -40°C | 2.6 | V |
| $I_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 150 | mA |
| | | $T_{VJ}$ = -40°C | 200 | mA |
| $V_{GD}$ | $T_{VJ} = T_{VJM}$; | $V_D$ = 2/3 $V_{DRM}$ | 0.2 | V |
| $I_{GD}$ | | | 10 | mA |
| $I_L$ | $T_{VJ}$ = 25°C; $t_P$ = 30 µs; $V_D$ = 6 V<br>$I_G$ = 0.5 A; $di_G/dt$ = 0.5 A/µs | | 300 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK}$ = ∞ | | 200 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D$ = 1/2 $V_{DRM}$<br>$I_G$ = 0.5 A; $di_G/dt$ = 0.5 A/µs | | 2 | µs |
| $t_q$ | $T_{VJ} = T_{VJM}$; $I_T$ = 160 A, $t_P$ = 200 µs; -di/dt = 10 A/µs typ.<br>$V_R$ = 100 V; dv/dt = 20 V/µs; $V_D$ = 2/3 $V_{DRM}$ | | 150 | µs |
| $Q_S$ | $T_{VJ} = T_{VJM}$; $I_T$, $I_F$ = 300 A, -di/dt = 50 A/µs | | 550 | µC |
| $I_{RM}$ | | | 235 | A |
| $R_{thJC}$ | per thyristor/diode; DC current | other values see Fig. 8/9 | 0.23 | K/W |
| | per module | | 0.115 | K/W |
| $R_{thJK}$ | per thyristor/diode; DC current | | 0.33 | K/W |
| | per module | | 0.165 | K/W |
| $d_S$ | Creepage distance on surface | | 12.7 | mm |
| $d_A$ | Strike distance through air | | 9.6 | mm |
| a | Maximum allowable acceleration | | 50 | $m/s^2$ |

Optional accessories for modules
Keyed gate/cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red
Type **ZY 180L** (L = Left for pin pair 4/5) } UL 758, style 1385,
Type **ZY 180R** (R = right for pin pair 6/7) } CSA class 5851, guide 460-1-1

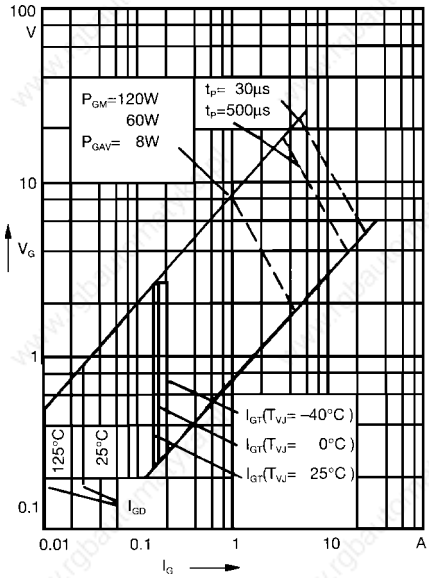



Fig. 1 Gate trigger characteristics

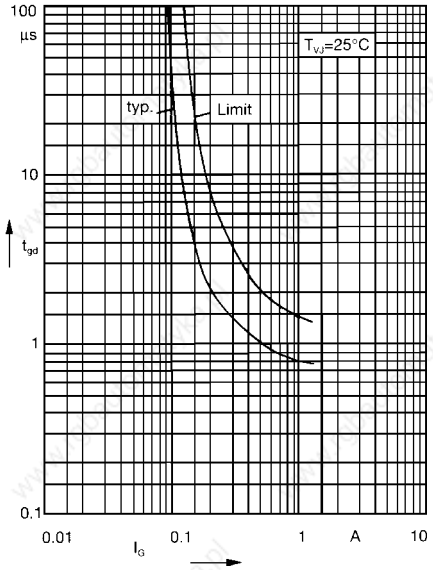
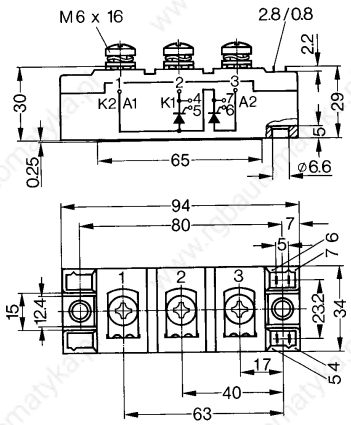



Fig. 2 Gate trigger delay time

**Dimensions in mm (1 mm = 0.0394")**

**MCC**

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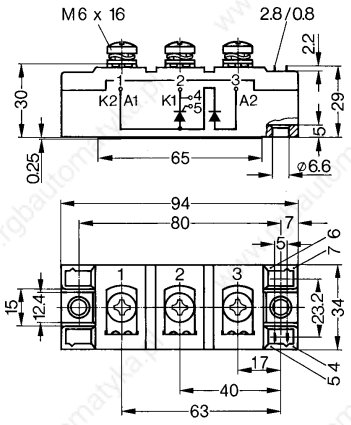


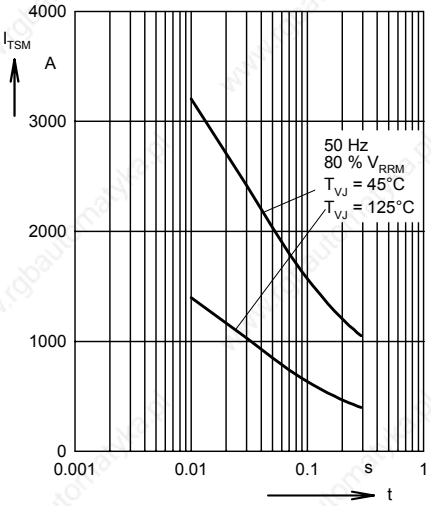



Fig. 3 Surge overload current
$I_{TSM}$, $I_{FSM}$: Crest value, t: duration

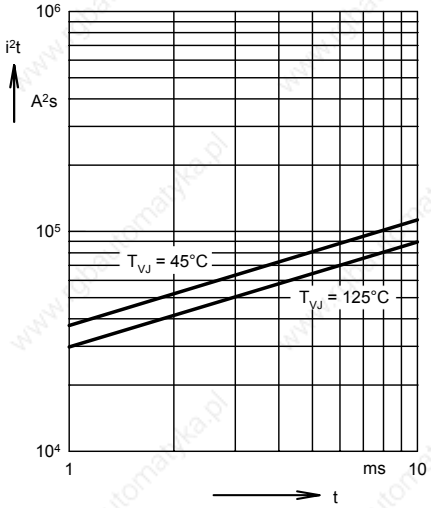



Fig. 4 $i^2t$ versus time (1-10 ms)

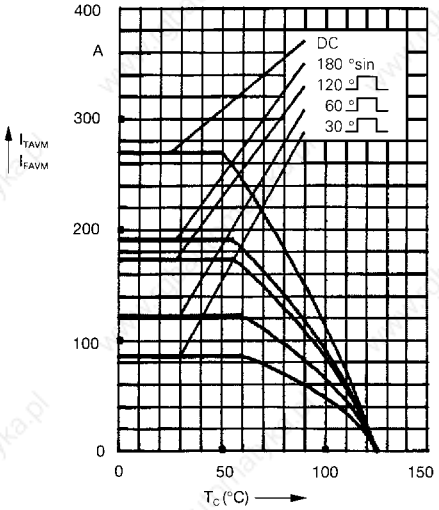



Fig. 4a Maximum forward current at case temperature

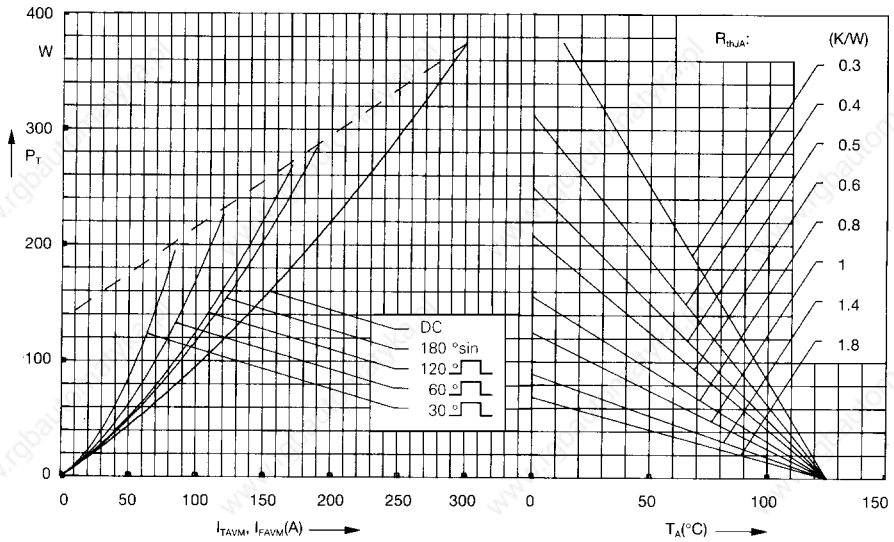



Fig. 5 Power dissipation versus on-state current and ambient temperature (per thyristor or diode)

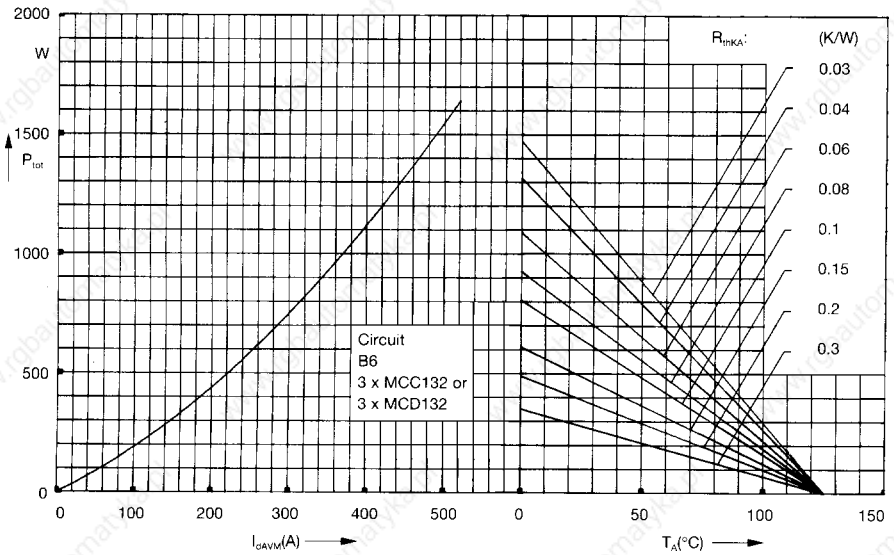



Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

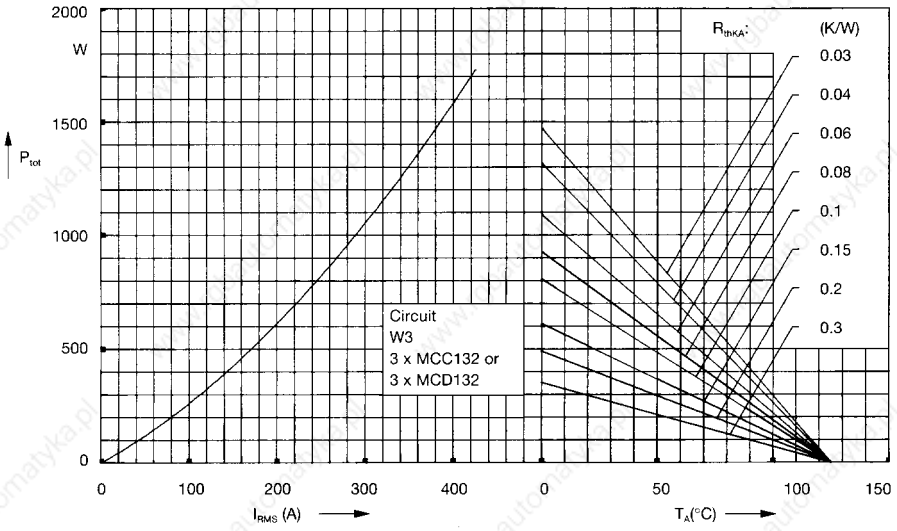



Fig. 7 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

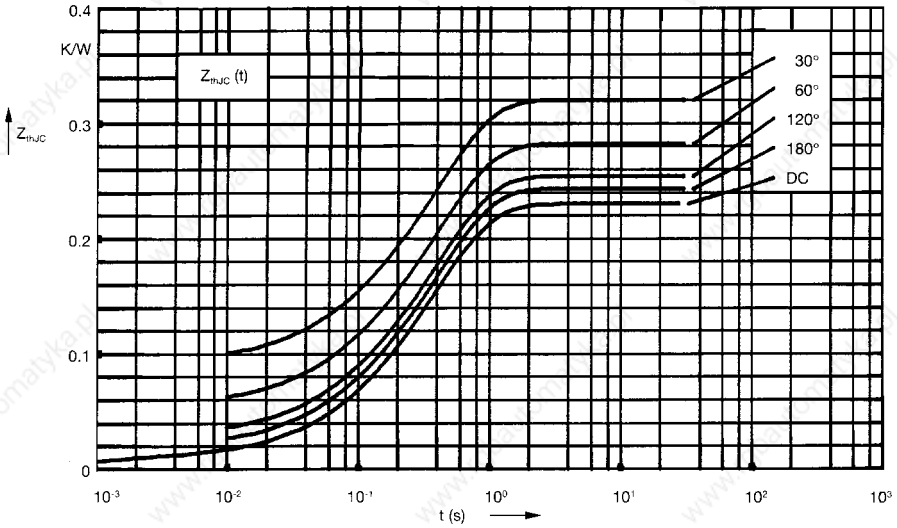



Fig. 8 Transient thermal impedance junction to case (per thyristor or diode)

$R_{thJC}$ for various conduction angles d:

| d | $R_{thJC}$ (K/W) |
|---|---|
| DC | 0.230 |
| 180° | 0.244 |
| 120° | 0.255 |
| 60° | 0.283 |
| 30° | 0.321 |

Constants for $Z_{thJC}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0095 | 0.001 |
| 2 | 0.0175 | 0.065 |
| 3 | 0.203 | 0.4 |

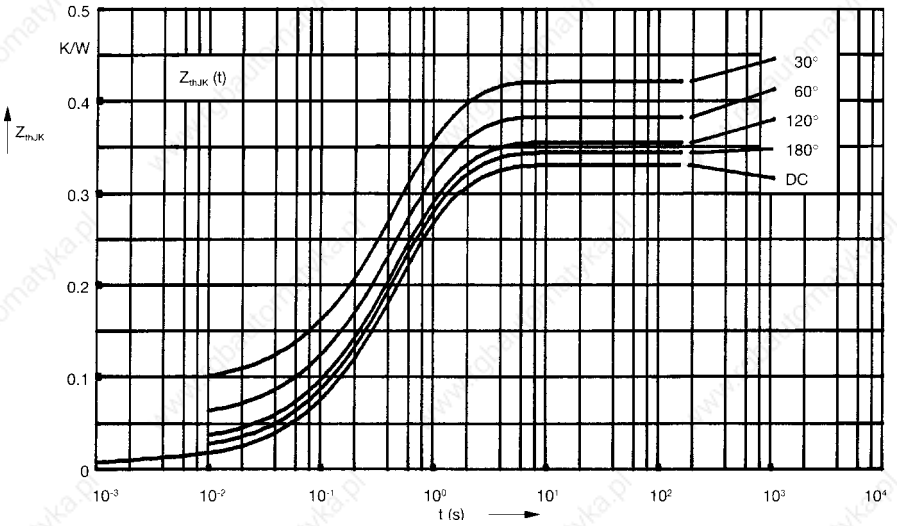



Fig. 9 Transient thermal impedance junction to heatsink (per thyristor or diode)

$R_{thJK}$ for various conduction angles d:

| d | $R_{thJK}$ (K/W) |
|---|---|
| DC | 0.330 |
| 180° | 0.344 |
| 120° | 0.355 |
| 60° | 0.383 |
| 30° | 0.421 |

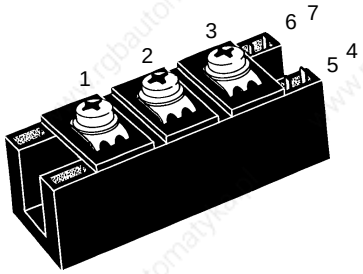
Constants for $Z_{thJK}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0095 | 0.001 |
| 2 | 0.0175 | 0.065 |
| 3 | 0.203 | 0.4 |
| 4 | 0.1 | 1.29 |

# High Voltage Thyristor Module
# High Voltage High Voltage

$I_{TRMS}$ = 2x 300 A
$I_{TAVM}$ = 2x 165 A
$V_{RRM}$ = 2000-2200 V

| $V_{RSM}$ $V_{DSM}$ V | $V_{RRM}$ $V_{DRM}$ V | Type | |
|---|---|---|---|
| 2100 | 2000 | MCC 161-20io1 | MCD 161-20io1 |
| 2300 | 2200 | MCC 161-22io1 | MCD 161-22io1 |

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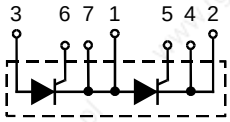


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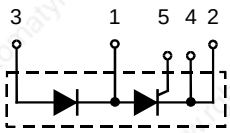



| Symbol | Test Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$ | $T_{VJ} = T_{VJM}$ | | 300 | A |
| $I_{TAVM}$ | $T_C$ = 85°C; 180° sine | | 165 | A |
| $I_{TSM}$ | $T_{VJ}$ = 45°C; | t = 10 ms (50 Hz) | 6000 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 6400 | A |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz) | 5250 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 5600 | A |
| $\int i^2dt$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz) | 180000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 170000 | $A^2s$ |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz) | 137000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 128000 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; f = 50 Hz, $t_P$ = 200 µs; $V_D$ = 2/3 $V_{DRM}$; $I_G$ = 0.5 A, $di_G/dt$ = 0.5 A/µs | repetitive, $I_T$ = 500 A | 150 | A/µs |
| | | non repetitive, $I_T = I_{TAVM}$ | 500 | A/µs |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; $V_{DR}$ = 2/3 $V_{DRM}$; $R_{GK}$ = ∞; method 1 (linear voltage rise) | | 1000 | V/µs |
| $P_{GM}$ | $T_{VJ} = T_{VJM}$ | $t_P$ = 30 µs | 120 | W |
| | $I_T = I_{TAVM}$ | $t_P$ = 500 µs | 60 | W |
| $P_{GAV}$ | | | 8 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40 ...125 | °C |
| $T_{VJM}$ | | | 125 | °C |
| $T_{stg}$ | | | -40 ...125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | t = 1 min | 3000 | V~ |
| | $I_{ISOL} \leq$ 1 mA | t = 1 s | 3600 | V~ |
| $M_d$ | Mounting torque (M6) | | 2.25-2.75/20-25 | Nm/lb.in. |
| | Terminal connection torque (M6) | | 4.5-5.5/40-48 | Nm/lb.in. |
| Weight | Typical including screws | | 125 | g |

### Features

- International standard package
- **D**irect **C**opper **B**onded $Al_2O_3$ -ceramic base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered, E 72873
- Keyed gate/cathode twin pins

### Applications

- Motor control
- Power converter
- Heat and temperature control for industrial furnaces and chemical processes
- Lighting control
- Contactless switches

### Advantages

- Space and weight savings
- Simple mounting
- Improved temperature and power cycling
- Reduced protection circuits

Data according to IEC 60747 and refer to a single thyristor/diode unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions

| Symbol | Test Conditions | Characteristic Values | |
|---|---|---|---|
| $I_{RRM}$, $I_{DRM}$ | $T_{VJ}$ = $T_{VJM}$; $V_R$ = $V_{RRM}$ | 40 | mA |
| $V_T$ | $I_T$ = 300 A; $T_{VJ}$ = 25°C | 1.36 | V |
| $V_{T0}$ | For power-loss calculations only ($T_{VJ}$ = $T_{VJM}$) | 0.8 | V |
| $r_T$ | | 1.6 | mΩ |
| $V_{GT}$ | $V_D$ = 6 V; $T_{VJ}$ = 25°C | 2 | V |
| | $T_{VJ}$ = -40°C | 2.6 | V |
| $I_{GT}$ | $V_D$ = 6 V; $T_{VJ}$ = 25°C | 150 | mA |
| | $T_{VJ}$ = -40°C | 200 | mA |
| $V_{GD}$ | $T_{VJ}$ = $T_{VJM}$; $V_D$ = 2/3 $V_{DRM}$ | 0.25 | V |
| $I_{GD}$ | $T_{VJ}$ = $T_{VJM}$; $V_D$ = 2/3 $V_{DRM}$ | 10 | mA |
| $I_L$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $t_P$ = 30 µs<br>$di_G/dt$ = 0.45A/µs; $I_G$ = 0.45 A | 200 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK}$ = ∞ | 150 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D$ = 1/2 $V_{DRM}$<br>$di_G/dt$ = 0.5 A/µs; $I_G$ = 0.5 A | 2 | µs |
| $t_q$ | $T_{VJ}$ = $T_{VJM}$; $V_R$ = 100 V; $V_D$ = 2/3 $V_{DRM}$; $t_P$ = 200 µs<br>dv/dt = 20 V/µs; $I_T$ = 160 A; -di/dt = 10A/µs | typ. 150 | µs |
| $Q_S$ | $T_{VJ}$ = $T_{VJM}$ | 550 | µC |
| $I_{RM}$ | -di/dt = 50 A/µs; $I_T$ = 300 A | 235 | A |
| $R_{thJC}$ | per thyristor; DC current | 0.155 | K/W |
| | per module | 0.078 | K/W |
| $R_{thJK}$ | per thyristor; DC current | 0.225 | K/W |
| | per module | 0.113 | K/W |
| $d_S$ | Creeping distance on surface | 12.7 | mm |
| $d_A$ | Creepage distance in air | 9.6 | mm |
| a | Maximum allowable acceleration | 50 | $m/s^2$ |

Optional accessories for modules
Keyed gate/cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red
Type **ZY 180L** (L = Left for pin pair 4/5) } UL 758, style 1385,
Type **ZY 180R** (R = right for pin pair 6/7) } CSA class 5851, guide 460-1-1

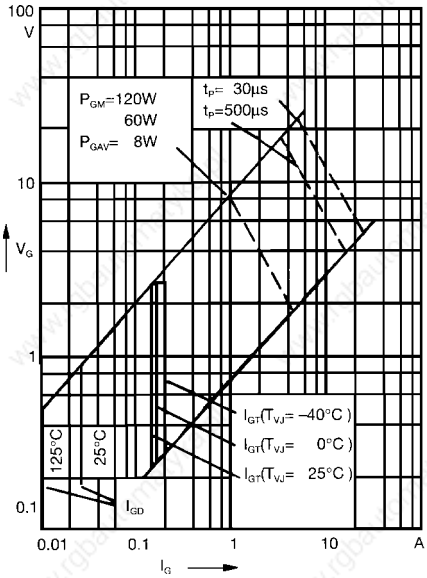



Fig. 1 Gate trigger characteristics

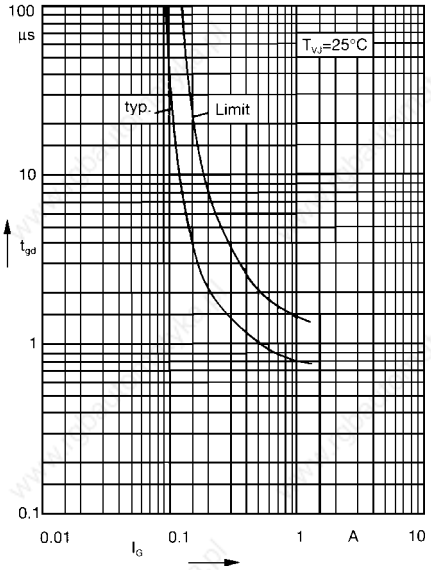
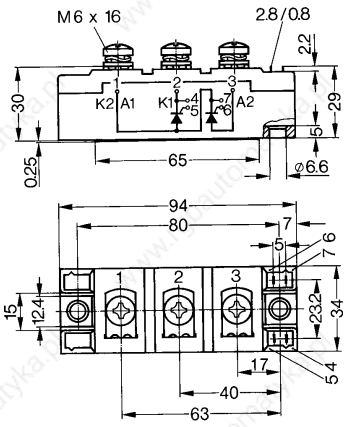



Fig. 2 Gate trigger delay time

**Dimensions in mm (1 mm = 0.0394")**




$R_{thJC}$ for various conduction angles d:

| d | $R_{thJC}$ (K/W) |
|---|---|
| DC | 0.155 |
| 180° | 0.167 |
| 120° | 0.175 |
| 60° | 0.197 |
| 30° | 0.226 |

Constants for $Z_{thJC}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0072 | 0.001 |
| 2 | 0.0188 | 0.08 |
| 3 | 0.129 | 0.2 |

$R_{thJK}$ for various conduction angles d:

| d | $R_{thJK}$ (K/W) |
|---|---|
| DC | 0.225 |
| 180° | 0.237 |
| 120° | 0.245 |
| 60° | 0.262 |
| 30° | 0.296 |

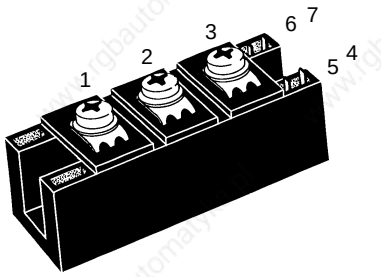
Constants for $Z_{thJK}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0072 | 0.001 |
| 2 | 0.0188 | 0.08 |
| 3 | 0.129 | 0.2 |
| 4 | 0.07 | 1.0 |

# Thyristor Modules
# Thyristor/Diode Modules

$I_{TRMS}$ = 2x 300 A
$I_{TAVM}$ = 2x 190 A
$V_{RRM}$ = 800-1800 V

| $V_{RSM}$ $V_{DSM}$ V | $V_{RRM}$ $V_{DRM}$ V | Type Version 1 | Type Version 1 |
|---|---|---|---|
| 900 | 800 | MCC 162-08io1 | MCD 162-08io1 |
| 1300 | 1200 | MCC 162-12io1 | MCD 162-12io1 |
| 1500 | 1400 | MCC 162-14io1 | MCD 162-14io1 |
| 1700 | 1600 | MCC 162-16io1 | MCD 162-16io1 |
| 1900 | 1800 | MCC 162-18io1 | MCD 162-18io1 |

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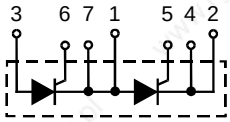


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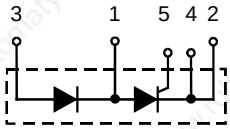



| Symbol | Test Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$, $I_{FRMS}$ | $T_{VJ} = T_{VJM}$ | | 300 | A |
| $I_{TAVM}$, $I_{FAVM}$ | $T_C$ = 80°C; 180° sine | | 190 | A |
| | $T_C$ = 85°C; 180° sine | | 181 | A |
| $I_{TSM}$, $I_{FSM}$ | $T_{VJ}$ = 45°C; | t = 10 ms (50 Hz), sine | 6000 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 6400 | A |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 5250 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 5600 | A |
| $\int i^2dt$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz), sine | 180 000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 170 000 | $A^2s$ |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 137 000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 128 000 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM}$ | repetitive, $I_T$ = 500 A | 150 | A/µs |
| | f =50 Hz, $t_P$ =200 µs | | | |
| | $V_D$ = 2/3 $V_{DRM}$ | | | |
| | $I_G$ = 0.5 A | non repetitive, $I_T$ = 500 A | 500 | A/µs |
| | $di_G/dt$ = 0.5 A/µs | | | |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; | $V_{DR}$ = 2/3 $V_{DRM}$ | 1000 | V/µs |
| | $R_{GK}$ = ∞; method 1 (linear voltage rise) | | | |
| $P_{GM}$ | $T_{VJ} = T_{VJM}$ | $t_P$ = 30 µs | 120 | W |
| | $I_T = I_{TAVM}$ | $t_P$ = 500 µs | 60 | W |
| $P_{GAV}$ | | | 8 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40...+125 | °C |
| $T_{VJM}$ | | | 125 | °C |
| $T_{stg}$ | | | -40...+125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | t = 1 min | 3000 | V~ |
| | $I_{ISOL} \leq$ 1 mA | t = 1 s | 3600 | V~ |
| $M_d$ | Mounting torque (M6) | | 2.25-2.75/20-25 | Nm/lb.in. |
| | Terminal connection torque (M6) | | 4.5-5.5/40-48 | Nm/lb.in. |
| Weight | Typical including screws | | 125 | g |

Data according to IEC 60747 and refer to a single thyristor/diode unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions

**Features**
- International standard package
- Direct copper bonded $Al_2O_3$ -ceramic base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered, E 72873
- Keyed gate/cathode twin pins

**Applications**
- Motor control
- Power converter
- Heat and temperature control for industrial furnaces and chemical processes
- Lighting control
- Contactless switches

**Advantages**
- Space and weight savings
- Simple mounting
- Improved temperature and power cycling
- Reduced protection circuits

| Symbol | Test Conditions | | Characteristic Values | |
|---|---|---|---|---|
| $I_{RRM}$, $I_{DRM}$ | $T_{VJ} = T_{VJM}$; $V_R = V_{RRM}$; $V_D = V_{DRM}$ | | 10 | mA |
| $V_T$, $V_F$ | $I_T$, $I_F$ = 300 A; $T_{VJ}$ = 25°C | | 1.25 | V |
| $V_{T0}$ | For power-loss calculations only ($T_{VJ}$ = 125°C) | | 0.88 | V |
| $r_T$ | | | 1.15 | mΩ |
| $V_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 2.5 | V |
| | | $T_{VJ}$ = -40°C | 2.6 | V |
| $I_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 150 | mA |
| | | $T_{VJ}$ = -40°C | 200 | mA |
| $V_{GD}$ | $T_{VJ} = T_{VJM}$; | $V_D$ = 2/3 $V_{DRM}$ | 0.2 | V |
| $I_{GD}$ | | | 10 | mA |
| $I_L$ | $T_{VJ}$ = 25°C; $t_P$ = 30 µs; $V_D$ = 6 V<br>$I_G$ = 0.5 A; $di_G/dt$ = 0.5 A/µs | | 300 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK}$ = ∞ | | 200 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D$ = 1/2 $V_{DRM}$<br>$I_G$ = 0.5 A; $di_G/dt$ = 0.5 A/µs | | 2 | µs |
| $t_q$ | $T_{VJ} = T_{VJM}$; $I_T$ = 300 A, $t_P$ = 200 µs; -di/dt = 10 A/µs typ.<br>$V_R$ = 100 V; dv/dt = 20 V/µs; $V_D$ = 2/3 $V_{DRM}$ | | 150 | µs |
| $Q_S$ | $T_{VJ} = T_{VJM}$; $I_T$, $I_F$ = 300 A, -di/dt = 50 A/µs | | 550 | µC |
| $I_{RM}$ | | | 235 | A |
| $R_{thJC}$ | per thyristor/diode; DC current | other values see Fig. 8/9 | 0.155 | K/W |
| | per module | | 0.0775 | K/W |
| $R_{thJK}$ | per thyristor/diode; DC current | | 0.225 | K/W |
| | per module | | 0.1125 | K/W |
| $d_S$ | Creepage distance on surface | | 12.7 | mm |
| $d_A$ | Strike distance through air | | 9.6 | mm |
| a | Maximum allowable acceleration | | 50 | $m/s^2$ |

Optional accessories for modules
Keyed gate/cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red
Type **ZY 180L** (L = Left for pin pair 4/5) } UL 758, style 1385,
Type **ZY 180R** (R = right for pin pair 6/7) } CSA class 5851, guide 460-1-1

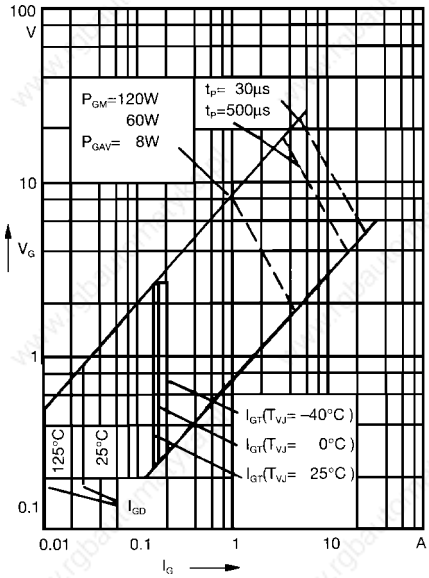



Fig. 1 Gate trigger characteristics

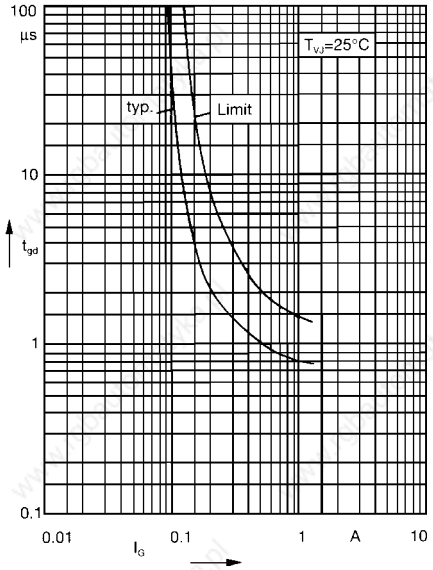
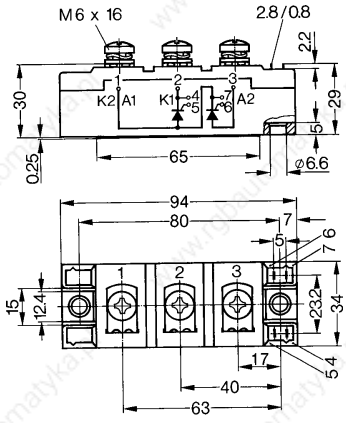


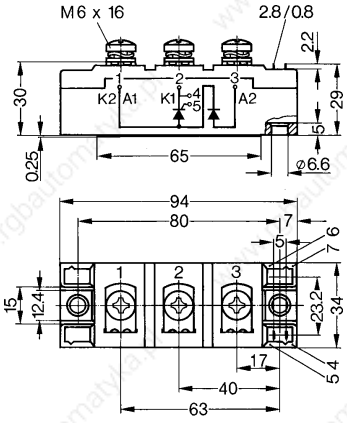

Fig. 2 Gate trigger delay time

**Dimensions in mm (1 mm = 0.0394")**

**MCC Version 1**




**MCD Version 1**



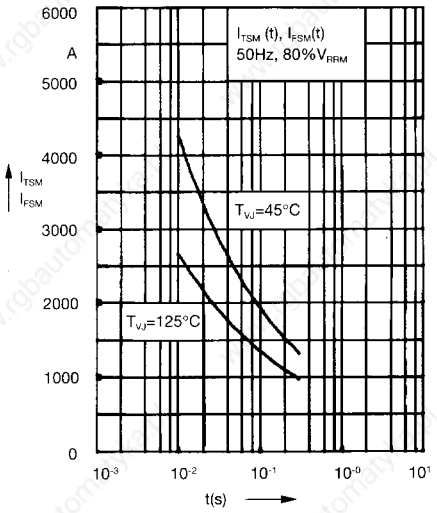



Fig. 3 Surge overload current
$I_{TSM}$, $I_{FSM}$: Crest value, t: duration

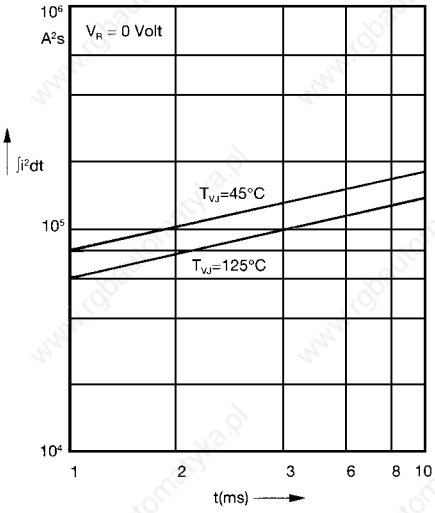



Fig. 4 $\int i^2dt$ versus time (1-10 ms)

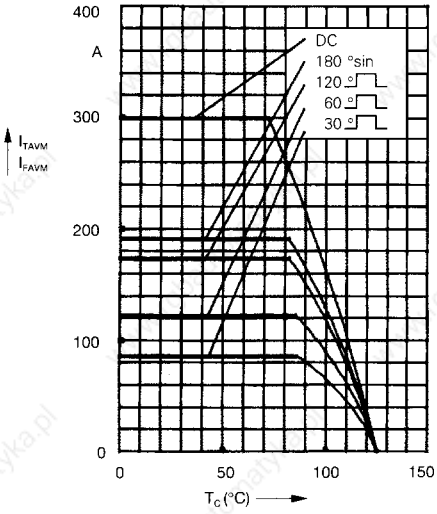



Fig. 4a Maximum forward current at case temperature

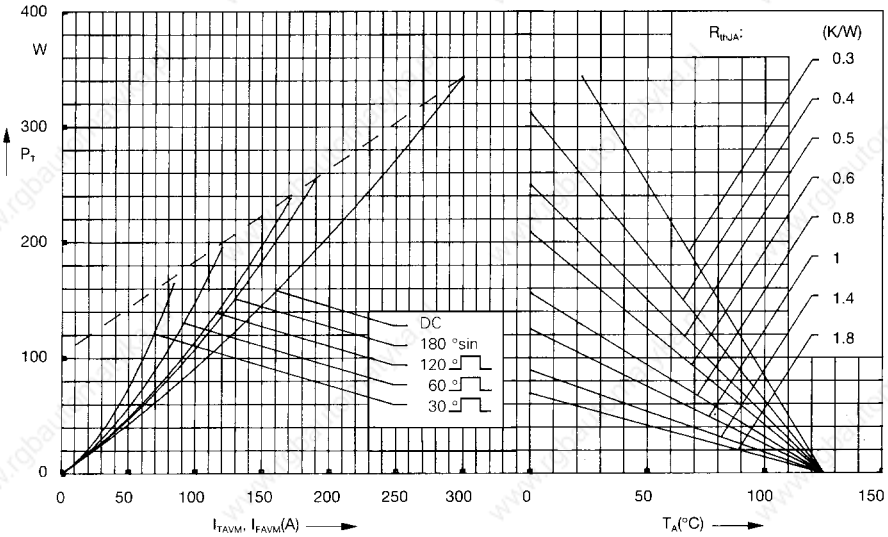



Fig. 5 Power dissipation versus on-state current and ambient temperature (per thyristor or diode)

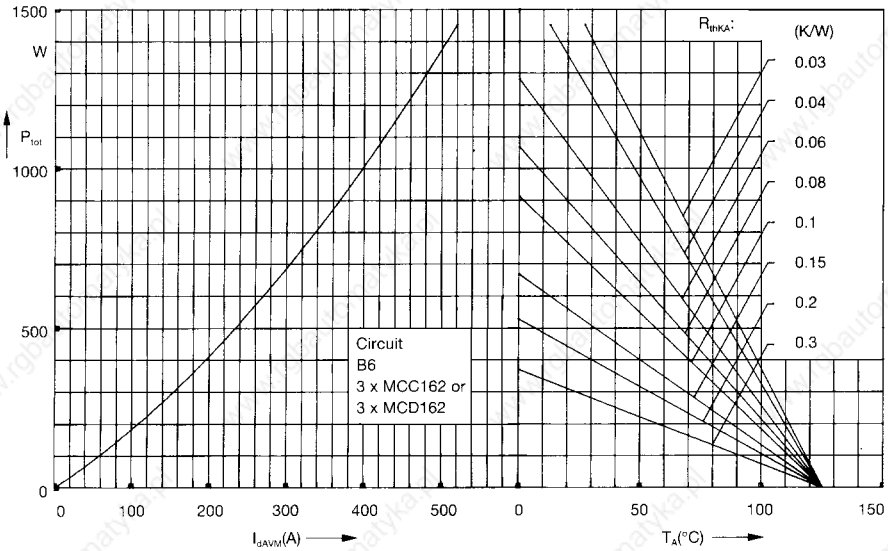



Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

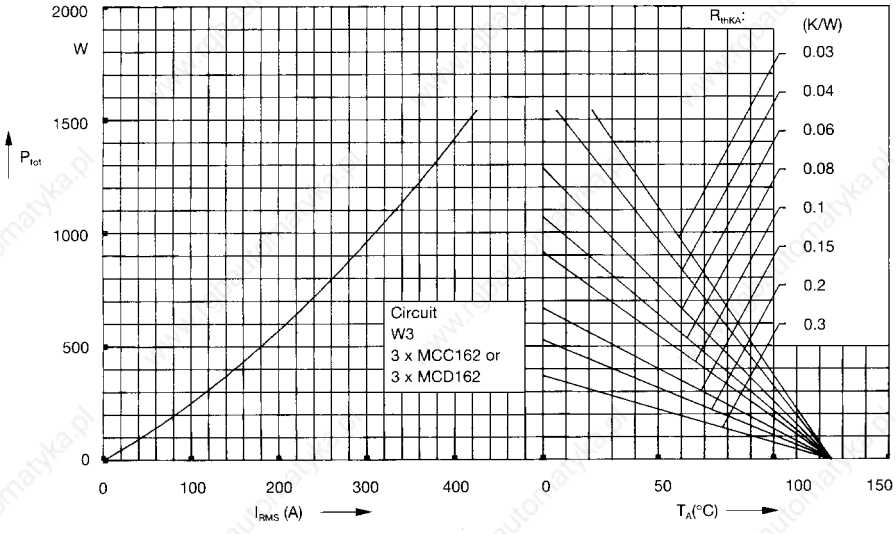



Fig. 7 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

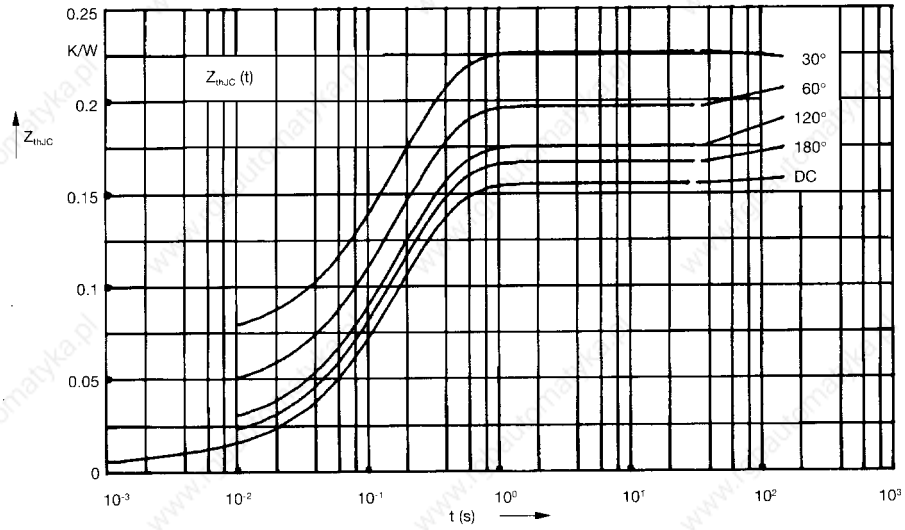



Fig. 8 Transient thermal impedance junction to case (per thyristor or diode)

$R_{thJC}$ for various conduction angles d:

| d | $R_{thJC}$ (K/W) |
|---|---|
| DC | 0.155 |
| 180° | 0.167 |
| 120° | 0.176 |
| 60° | 0.197 |
| 30° | 0.227 |

Constants for $Z_{thJC}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0072 | 0.001 |
| 2 | 0.0188 | 0.08 |
| 3 | 0.129 | 0.2 |

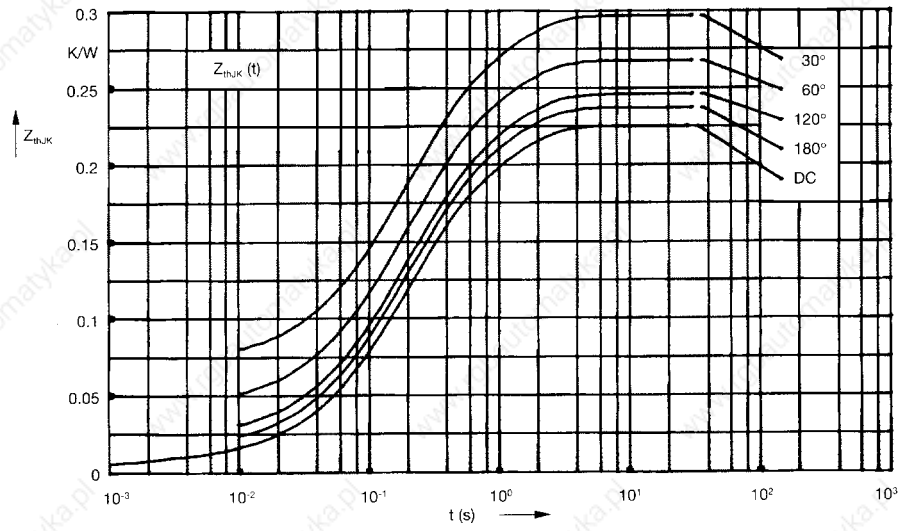



Fig. 9 Transient thermal impedance junction to heatsink (per thyristor or diode)

$R_{thJK}$ for various conduction angles d:

| d | $R_{thJK}$ (K/W) |
|---|---|
| DC | 0.225 |
| 180° | 0.237 |
| 120° | 0.246 |
| 60° | 0.267 |
| 30° | 0.297 |

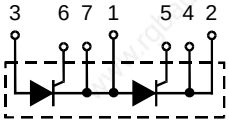
Constants for $Z_{thJK}$ calculation:

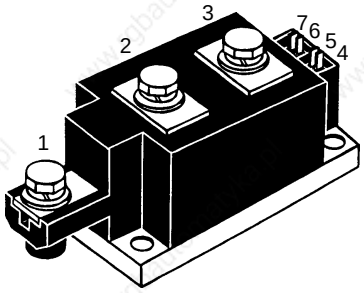
| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0072 | 0.001 |
| 2 | 0.0188 | 0.08 |
| 3 | 0.129 | 0.2 |
| 4 | 0.07 | 1.0 |

# Thyristor Modules
# Thyristor/Diode Modules

$I_{TRMS}$ = 2x 350 A
$I_{TAVM}$ = 2x 203 A
$V_{RRM}$ = 1200-1800 V

| $V_{RSM}$ $V_{DSM}$ V | $V_{RRM}$ $V_{DRM}$ V | Type |
|---|---|---|
| 1300 | 1200 | MCC 170-12io1 |
| 1500 | 1400 | MCC 170-14io1 |
| 1700 | 1600 | MCC 170-16io1 |
| 1900 | 1800 | MCC 170-18io1 |




| Symbol | Test Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$ | $T_{VJ} = T_{VJM}$ | | 350 | A |
| $I_{TAVM}$ | $T_C$ = 85°C; 180° sine | | 203 | A |
| $I_{TSM}$, $I_{FSM}$ | $T_{VJ}$ = 45°C; | t = 10 ms (50 Hz) | 5400 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 5800 | A |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz) | 5000 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 5500 | A |
| $\int i^2dt$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz) | 146 000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 140 000 | $A^2s$ |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz) | 125 000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 126 000 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM}$ | repetitive, $I_T$ = 660 A | 100 | A/µs |
| | f =50 Hz, $t_P$ =200 µs | | | |
| | $V_D$ = 2/3 $V_{DRM}$ | | | |
| | $I_G$ = 1 A, | non repetitive, $I_T = I_{TAVM}$ | 500 | A/µs |
| | $di_G/dt$ = 1 A/µs | | | |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; $V_{DR}$ = 2/3 $V_{DRM}$ | | 1000 | V/µs |
| | $R_{GK}$ = ∞; method 1 (linear voltage rise) | | | |
| $P_{GM}$ | $T_{VJ} = T_{VJM}$ | $t_P$ = 30 µs | 120 | W |
| | $I_T = I_{TAVM}$ | $t_P$ = 500 µs | 60 | W |
| $P_{GAV}$ | | | 20 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40...+130 | °C |
| $T_{VJM}$ | | | 130 | °C |
| $T_{stg}$ | | | -40...+125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | t = 1 min | 3000 | V~ |
| | $I_{ISOL}$ ≤ 1 mA | t = 1 s | 3600 | V~ |
| $M_d$ | Mounting torque (M6) | | 4.5-7/40-62 | Nm/lb.in. |
| | Terminal connection torque (M8) | | 11-13/97-115 | Nm/lb.in. |
| Weight | Typical including screws | | 750 | g |

Data according to IEC 60747 and refer to a single thyristor/diode unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions

**Features**
- International standard package
- Direct copper bonded $Al_2O_3$-ceramic with copper base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered E 72873
- Keyed gate/cathode twin pins

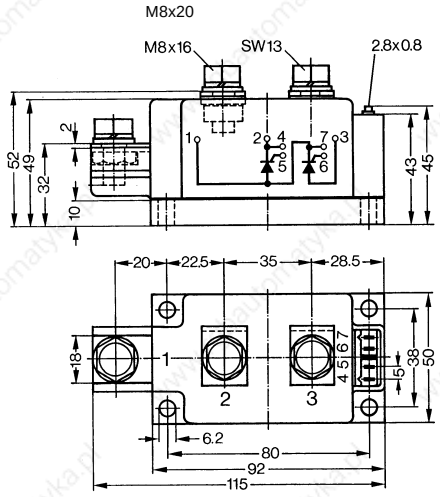
**Applications**
- Motor control, softstarter
- Power converter
- Heat and temperature control for industrial furnaces and chemical processes
- Lighting control
- Solid state switches

**Advantages**
- Simple mounting
- Improved temperature and power cycling
- Reduced protection circuits

| Symbol | Test Conditions | | Characteristic Values | |
|---|---|---|---|---|
| $I_{RRM}$, $I_{DRM}$ | $T_{VJ} = T_{VJM}$; $V_R = V_{RRM}$; $V_D = V_{DRM}$ | | 40 | mA |
| $V_T$, $V_F$ | $I_T$, $I_F$ = 600 A; $T_{VJ}$ = 25°C | | 1.65 | V |
| $V_{T0}$ | For power-loss calculations only ($T_{VJ}$ = 130°C) | | 0.8 | V |
| $r_T$ | | | 1 | mΩ |
| $V_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 2 | V |
| | | $T_{VJ}$ = -40°C | 3 | V |
| $I_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 150 | mA |
| | | $T_{VJ}$ = -40°C | 220 | mA |
| $V_{GD}$ | $T_{VJ} = T_{VJM}$; | $V_D$ = 2/3 $V_{DRM}$ | 0.25 | V |
| $I_{GD}$ | $T_{VJ} = T_{VJM}$; | $V_D$ = 2/3 $V_{DRM}$ | 10 | mA |
| $I_L$ | $T_{VJ}$ = 25°C; $t_P$ = 30 µs; $V_D$ = 6 V<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 200 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK}$ = ∞ | | 150 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D$ = 1/2 $V_{DRM}$<br>$I_G$ = 1 A; $di_G/dt$ = 1 A/µs | | 2 | µs |
| $t_q$ | $T_{VJ} = T_{VJM}$; $I_T$ = 300 A, $t_P$ = 200 µs; -di/dt = 10 A/µs<br>$V_R$ = 100 V; dv/dt = 50 V/µs; $V_D$ = 2/3 $V_{DRM}$ | typ. | 200 | µs |
| $Q_S$ | $T_{VJ}$ = 125°C; $I_T$, $I_F$ = 300 A; -di/dt = 50 A/µs | | 550 | µC |
| $I_{RM}$ | | | 235 | A |
| $R_{thJC}$ | per thyristor (diode); DC current | other values see Fig. 8/9 | 0.164 | K/W |
| | per module | | 0.082 | K/W |
| $R_{thJK}$ | per thyristor (diode); DC current | | 0.204 | K/W |
| | per module | | 0.102 | K/W |
| $d_S$ | Creeping distance on surface | | 12.7 | mm |
| $d_A$ | Creepage distance in air | | 9.6 | mm |
| a | Maximum allowable acceleration | | 50 | $m/s^2$ |

Optional accessories for modules
Keyed Gate/Cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red
Type **ZY 180 L** (L = Left for pin pair 4/5) } UL 758, style 1385,
Type **ZY 180 R** (R = Right for pin pair 6/7) } CSA class 5851, guide 460-1-1

**Dimensions in mm (1 mm = 0.0394")**



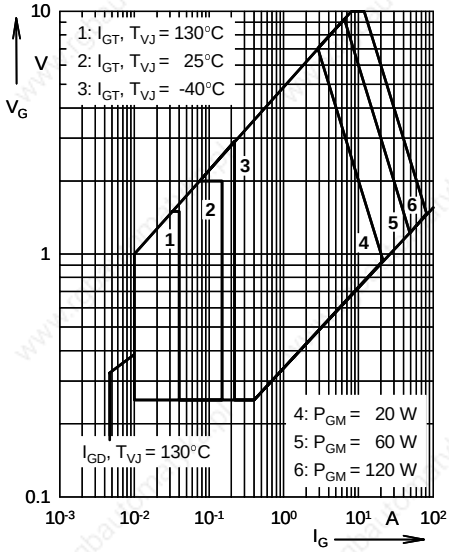




Fig. 1 Gate trigger characteristics

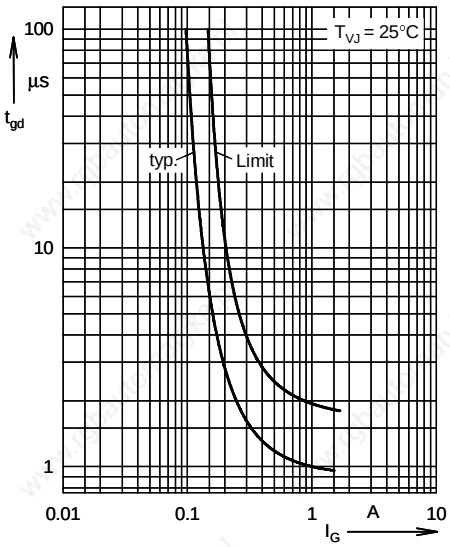



Fig. 2 Gate trigger delay time

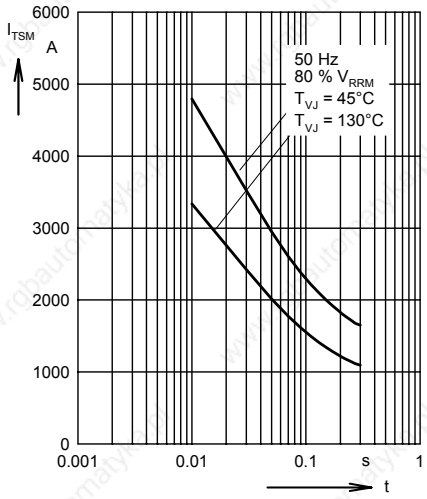



Fig. 3 Surge overload current
$I_{TSM}$, $I_{FSM}$: Crest value, t: duration

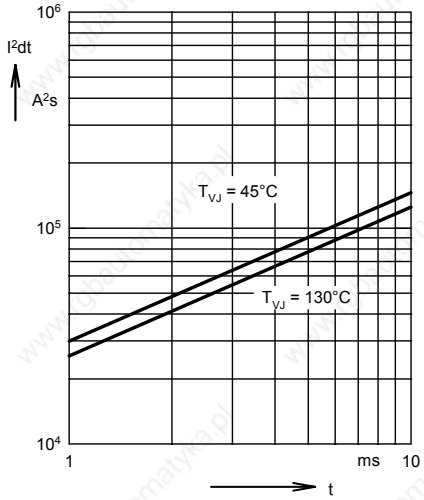



Fig. 4 $\int i^2dt$ versus time (1-10 ms)

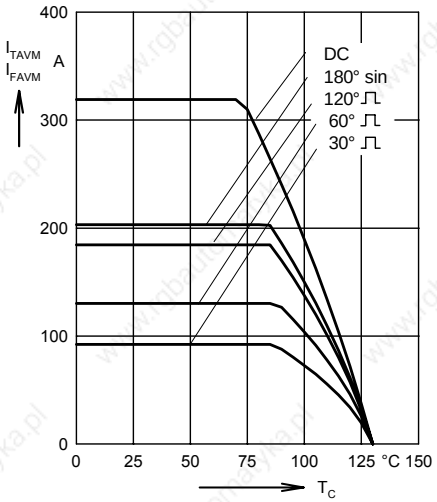



Fig. 4a Maximum forward current at case temperature

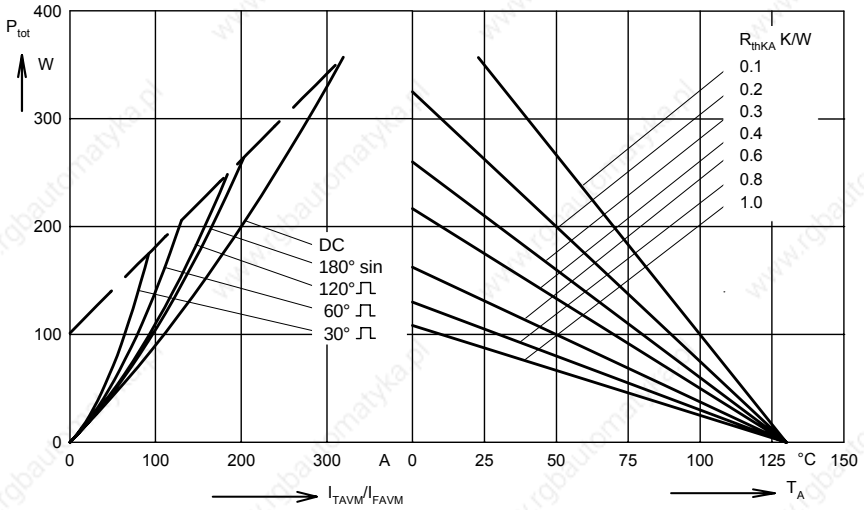



Fig. 5 Power dissipation versus on-state current and ambient temperature (per thyristor or diode)

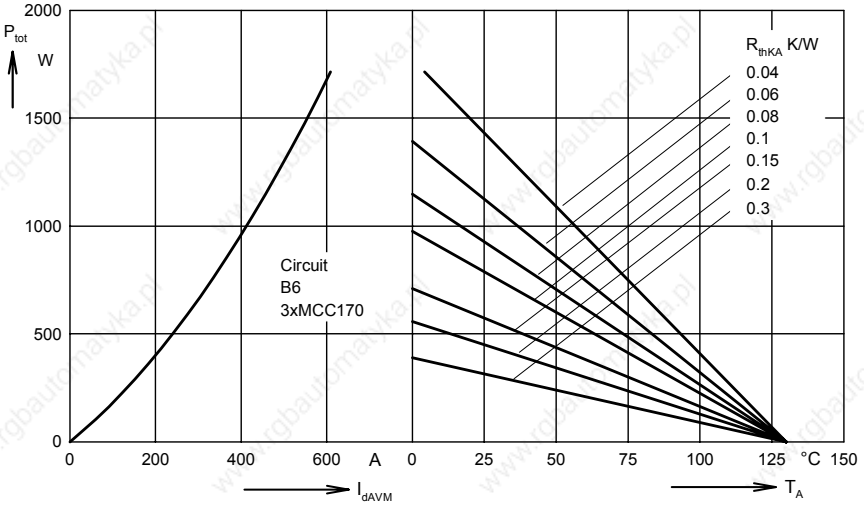



Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

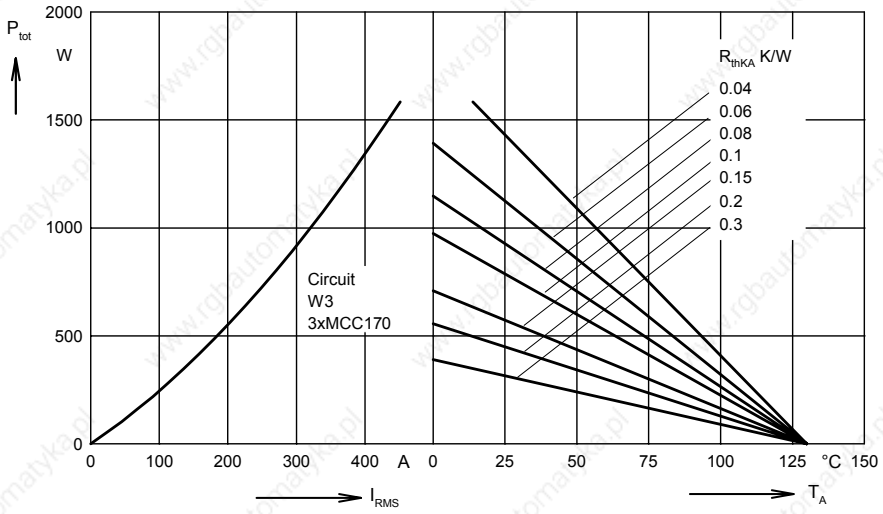



Fig. 7 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

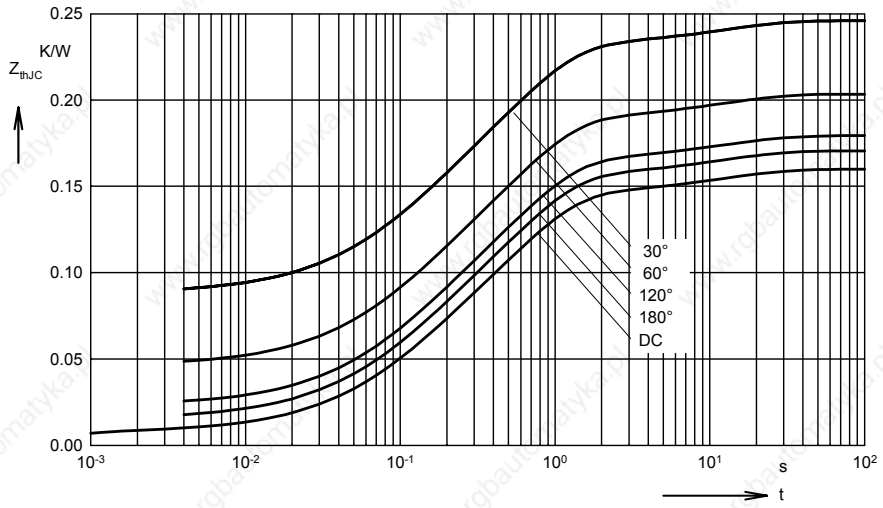



Fig. 8 Transient thermal impedance junction to case (per thyristor or diode)

$R_{thJC}$ for various conduction angles d:

| d | $R_{thJC}$ (K/W) |
|---|---|
| DC | 0.160 |
| 180° | 0.171 |
| 120° | 0.180 |
| 60° | 0.203 |
| 30° | 0.247 |

Constants for $Z_{thJC}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0077 | 0.00054 |
| 2 | 0.0413 | 0.098 |
| 3 | 0.096 | 0.54 |
| 4 | 0.0149 | 12 |

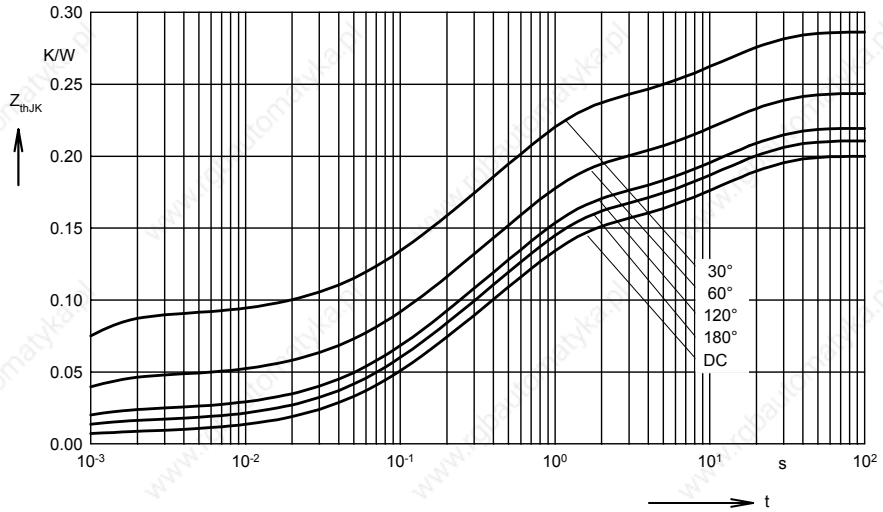



Fig. 9 Transient thermal impedance junction to heatsink (per thyristor or diode)

$R_{thJK}$ for various conduction angles d:

| d | $R_{thJK}$ (K/W) |
|---|---|
| DC | 0.200 |
| 180° | 0.211 |
| 120° | 0.220 |
| 60° | 0.243 |
| 30° | 0.287 |

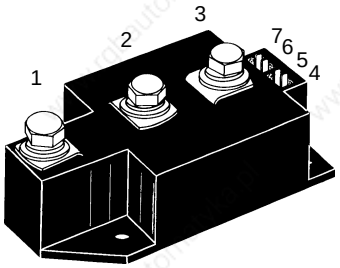
Constants for $Z_{thJK}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0077 | 0.00054 |
| 2 | 0.0413 | 0.098 |
| 3 | 0.096 | 0.54 |
| 4 | 0.0149 | 12 |
| 5 | 0.04 | 12 |

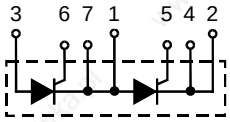
# Thyristor Modules
# Thyristor/Diode Modules

$I_{TRMS}$ = 2x 400 A
$I_{TAVM}$ = 2x 250 A
$V_{RRM}$ = 800-1600 V

| $V_{RSM}$ $V_{DSM}$ V | $V_{RRM}$ $V_{DRM}$ V | Type Version 1 | Version 1 |
|---|---|---|---|
| 900 | 800 | MCC 220-08io1 | MCD 220-08io1 |
| 1300 | 1200 | MCC 220-12io1 | MCD 220-12io1 |
| 1500 | 1400 | MCC 220-14io1 | MCD 220-14io1 |
| 1700 | 1600 | MCC 220-16io1 | MCD 220-16io1 |




MCC

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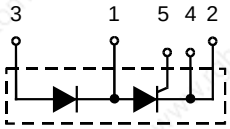



| Symbol | Test Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$, $I_{FRMS}$ | $T_{VJ} = T_{VJM}$ | | 400 | A |
| $I_{TAVM}$, $I_{FAVM}$ | $T_C$ = 85°C; 180° sine | | 250 | A |
| $I_{TSM}$, $I_{FSM}$ | $T_{VJ}$ = 45°C; | t = 10 ms (50 Hz), sine | 8500 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 9000 | A |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 7000 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 7600 | A |
| $\int i^2dt$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz), sine | 360 000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 336 000 | $A^2s$ |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 245 000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 240 000 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM}$ | repetitive, $I_T$ = 750 A | 100 | A/µs |
| | f =50 Hz, $t_P$ =200 µs | | | |
| | $V_D$ = 2/3 $V_{DRM}$ | | | |
| | $I_G$ = 1 A | non repetitive, $I_T$ = 250 A | 800 | A/µs |
| | $di_G/dt$ = 1 A/µs | | | |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; | $V_{DR}$ = 2/3 $V_{DRM}$ | 1000 | V/µs |
| | $R_{GK}$ = ∞; method 1 (linear voltage rise) | | | |
| $P_{GM}$ | $T_{VJ} = T_{VJM}$ | $t_P$ = 30 µs | 120 | W |
| | $I_T = I_{TAVM}$ | $t_P$ = 500 µs | 60 | W |
| $P_{GAV}$ | | | 20 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40...+140 | °C |
| $T_{VJM}$ | | | 140 | °C |
| $T_{stg}$ | | | -40...+125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | t = 1 min | 3000 | V~ |
| | $I_{ISOL} \le$ 1 mA | t = 1 s | 3600 | V~ |
| $M_d$ | Mounting torque (M5) | | 2.5-5/22-44 | Nm/lb.in. |
| | Terminal connection torque (M8) | | 12-15/106-132 | Nm/lb.in. |
| Weight | Typical including screws | | 320 | g |

Data according to IEC 60747 and refer to a single thyristor/diode unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions

**Features**
- International standard package
- Direct copper bonded $Al_2O_3$ -ceramic base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered, E 72873
- Keyed gate/cathode twin pins

**Applications**
- Motor control
- Power converter
- Heat and temperature control for industrial furnaces and chemical processes
- Lighting control
- Contactless switches

**Advantages**
- Space and weight savings
- Simple mounting
- Improved temperature and power cycling
- Reduced protection circuits

| Symbol | Test Conditions | | Characteristic Values | |
|---|---|---|---|---|
| $I_{RRM}$ | $T_{VJ} = T_{VJM}$; $V_R = V_{RRM}$; $V_D = V_{DRM}$ | | 70 | mA |
| $I_{DRM}$ | | | 40 | mA |
| $V_T$, $V_F$ | $I_T$, $I_F$ = 600 A; $T_{VJ}$ = 25°C | | 1.53 | V |
| $V_{T0}$ | For power-loss calculations only ($T_{VJ}$ = 140°C) | | 0.9 | V |
| $r_T$ | | | 1.0 | mΩ |
| $V_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 2 | V |
| | | $T_{VJ}$ = -40°C | 3 | V |
| $I_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 150 | mA |
| | | $T_{VJ}$ = -40°C | 200 | mA |
| $V_{GD}$ | $T_{VJ} = T_{VJM}$; | $V_D$ = 2/3 $V_{DRM}$ | 0.25 | V |
| $I_{GD}$ | | | 10 | mA |
| $I_L$ | $T_{VJ}$ = 25°C; $t_P$ = 30 µs; $V_D$ = 6 V<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 200 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK}$ = ∞ | | 150 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D$ = 1/2 $V_{DRM}$<br>$I_G$ = 1 A; $di_G/dt$ = 1 A/µs | | 2 | µs |
| $t_q$ | $T_{VJ} = T_{VJM}$; $I_T$ = 300 A, $t_P$ = 200 µs; -di/dt = 10 A/µs typ.<br>$V_R$ = 100 V; dv/dt = 50 V/µs; $V_D$ = 2/3 $V_{DRM}$ | | 200 | µs |
| $Q_S$ | $T_{VJ}$ = 125°C; $I_T$, $I_F$ = 400 A, -di/dt = 50 A/µs | | 760 | µC |
| $I_{RM}$ | | | 275 | A |
| $R_{thJC}$ | per thyristor/diode; DC current | other values see Fig. 8/9 | 0.139 | K/W |
| | per module | | 0.0695 | K/W |
| $R_{thJK}$ | per thyristor/diode; DC current | | 0.179 | K/W |
| | per module | | 0.0895 | K/W |
| $d_S$ | Creepage distance on surface | | 12.7 | mm |
| $d_A$ | Strike distance through air | | 9.6 | mm |
| a | Maximum allowable acceleration | | 50 | $m/s^2$ |

Optional accessories for modules
Keyed gate/cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red
Type **ZY 180L** (L = Left for pin pair 4/5) } UL 758, style 1385,
Type **ZY 180R** (R = right for pin pair 6/7) } CSA class 5851, guide 460-1-1

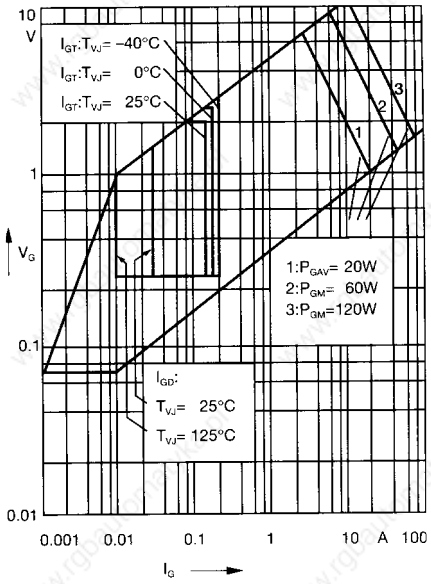



Fig. 1 Gate trigger characteristics

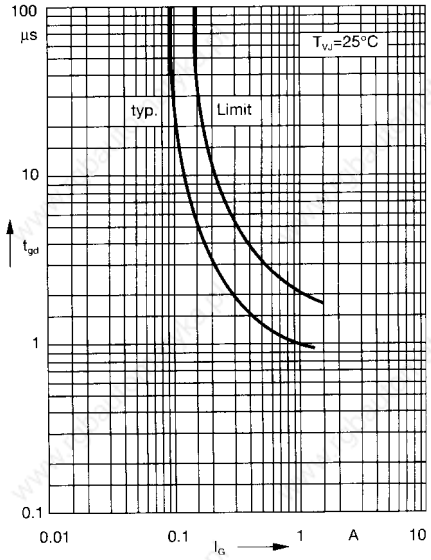
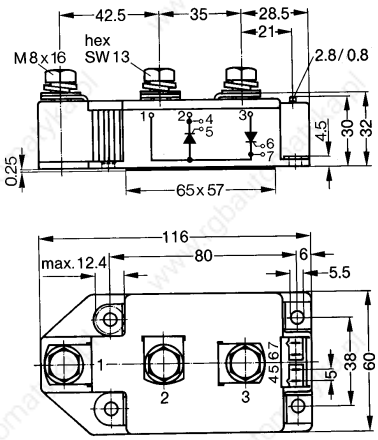



Fig. 2 Gate trigger delay time

**Dimensions in mm (1 mm = 0.0394")**

**MCC**

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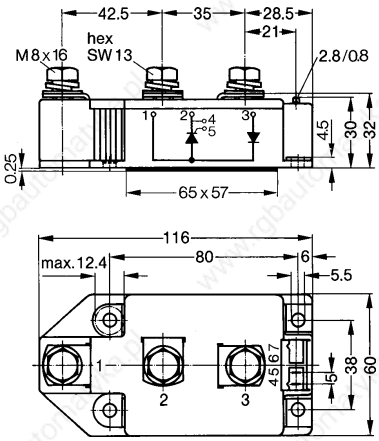
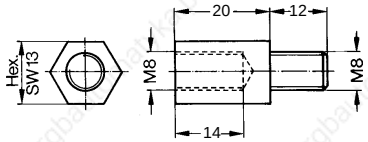



Threaded spacer for higher Anode/ Cathode construction:
Type **ZY 250**, material brass



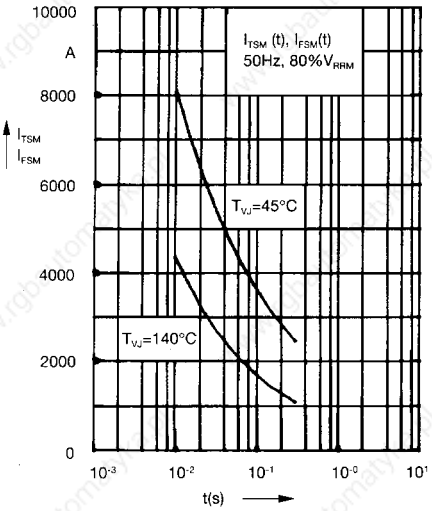



Fig. 3 Surge overload current
$I_{TSM}$, $I_{FSM}$: Crest value, t: duration

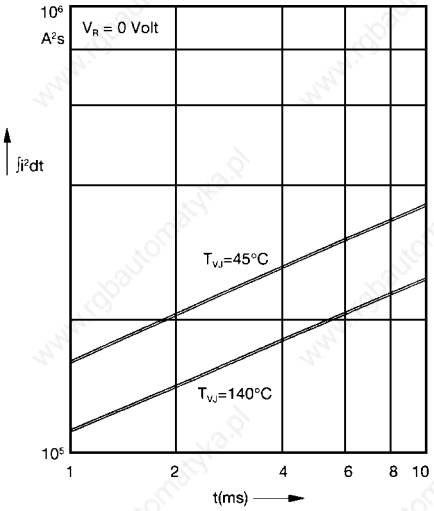



Fig. 4 $\int i^2dt$ versus time (1-10 ms)

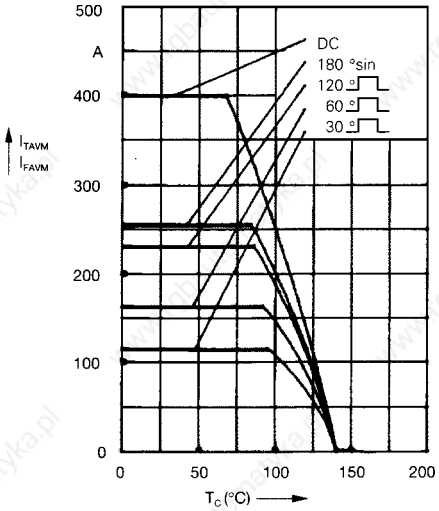



Fig. 4a Maximum forward current at case temperature

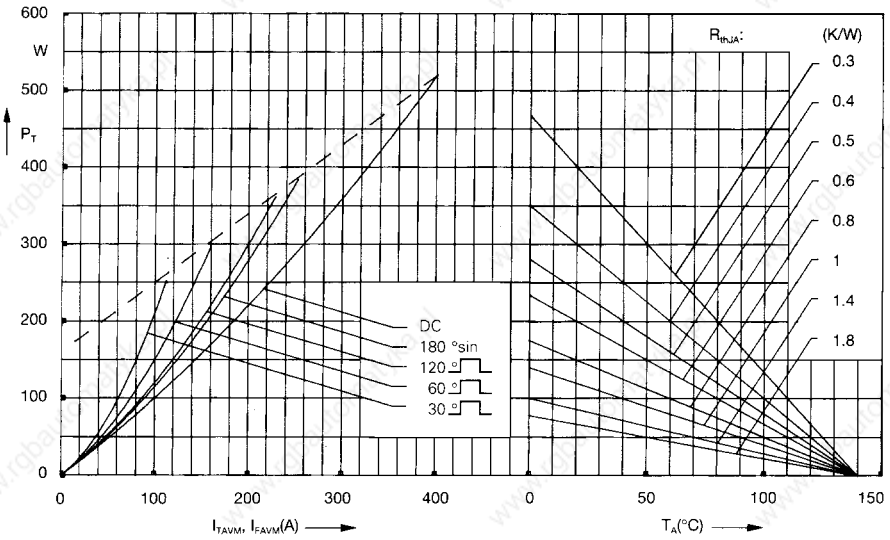



Fig. 5 Power dissipation versus on-state current and ambient temperature (per thyristor or diode)

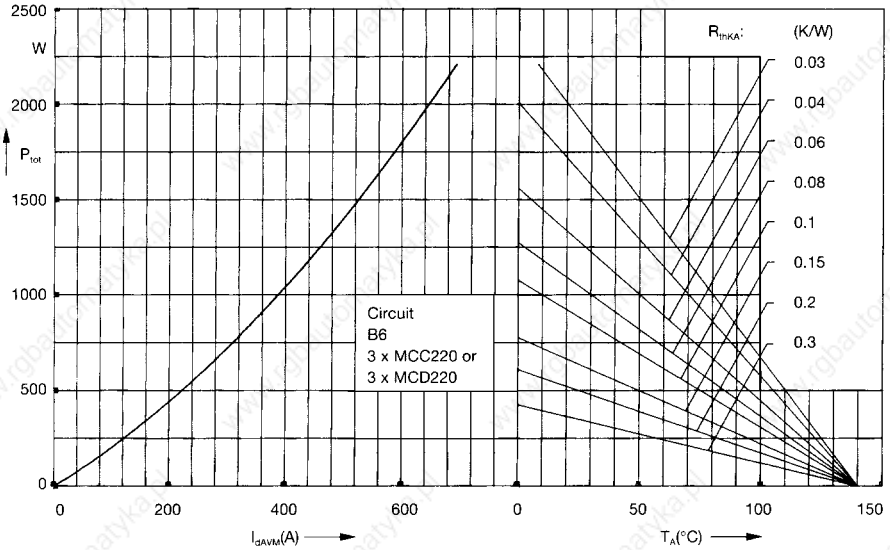



Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

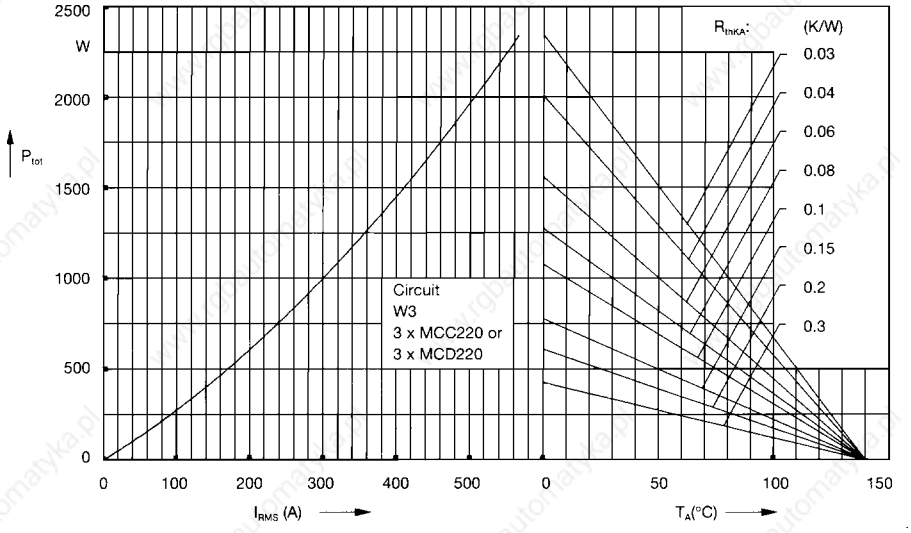



Fig. 7 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

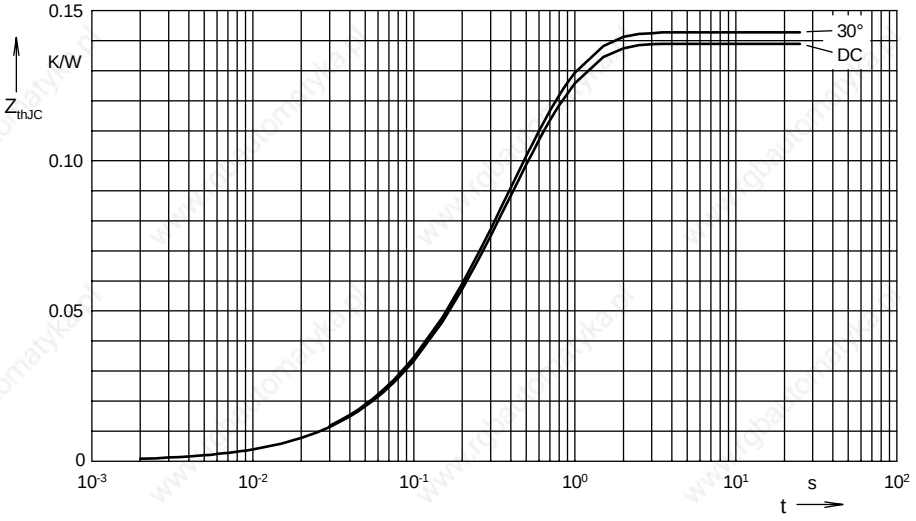



Fig. 8 Transient thermal impedance junction to case (per thyristor or diode)

$R_{thJC}$ for various conduction angles d:

| d | $R_{thJC}$ (K/W) |
|---|---|
| DC | 0.139 |
| 180°C | 0.141 |
| 120°C | 0.142 |
| 60°C | 0.142 |
| 30°C | 0.143 |

Constants for $Z_{thJC}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0037 | 0.0099 |
| 2 | 0.0177 | 0.168 |
| 3 | 0.1175 | 0.456 |

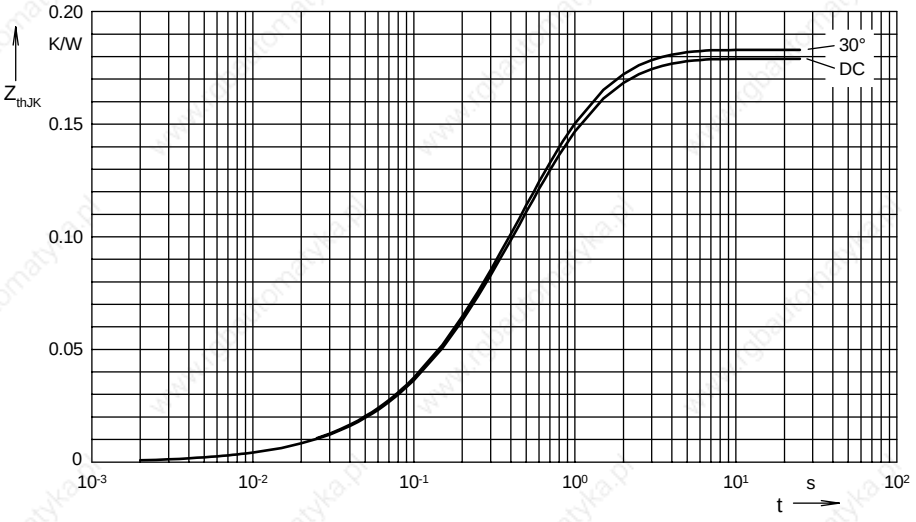



Fig. 9 Transient thermal impedance junction to heatsink (per thyristor or diode)

$R_{thJK}$ for various conduction angles d:

| d | $R_{thJK}$ (K/W) |
|---|---|
| DC | 0.179 |
| 180°C | 0.181 |
| 120°C | 0.182 |
| 60°C | 0.183 |
| 30°C | 0.183 |

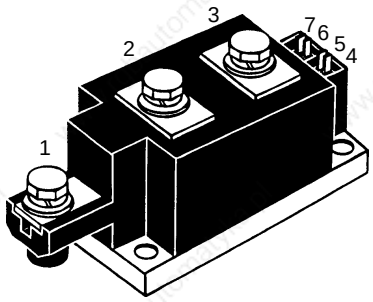
Constants for $Z_{thJK}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0037 | 0.0099 |
| 2 | 0.0177 | 0.168 |
| 3 | 0.1175 | 0.456 |
| 4 | 0.04 | 1.36 |

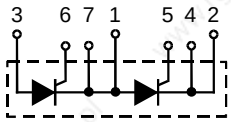
# Thyristor Modules
# Thyristor/Diode Modules

$I_{TRMS}$ = 2x 400 A
$I_{TAVM}$ = 2x 240 A
$V_{RRM}$ = 2000-2200 V

| $V_{RSM}$ $V_{DSM}$ V | $V_{RRM}$ $V_{DRM}$ V | Type | |
|---|---|---|---|
| **2100** | **2000** | **MCC 224-20io1** | **MCD 224-20io1** |
| **2300** | **2200** | **MCC 224-22io1** | **MCD 224-22io1** |




MCC

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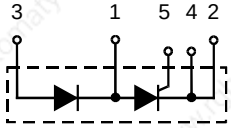


| Symbol | Test Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$ | $T_{VJ} = T_{VJM}$ | | 400 | A |
| $I_{TAVM}$ | $T_C$ = 85°C; 180° sine | | 240 | A |
| $I_{TSM}$ | $T_{VJ}$ = 45°C; | t = 10 ms (50 Hz) | 8000 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 8500 | A |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz) | 7000 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 7500 | A |
| $\int i^2dt$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz) | 320000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 303000 | $A^2s$ |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz) | 245000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 240000 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; f = 50 Hz, $t_P$ = 200 µs | repetitive, $I_T$ = 750 A | 100 | A/µs |
| | $V_D$ = 2/3 $V_{DRM}$; $I_G$ = 1 A; $di_G/dt$ = 1 A/µs | non repetitive, $I_T = I_{TAVM}$ | 500 | A/µs |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; $V_{DR}$ = 2/3 $V_{DRM}$; $R_{GK}$ = ∞; method 1 (linear voltage rise) | | 1000 | V/µs |
| $P_{GM}$ | $T_{VJ} = T_{VJM}$ | $t_P$ = 30 µs | 120 | W |
| | $I_T = I_{TAVM}$ | $t_P$ = 500 µs | 60 | W |
| $P_{GAV}$ | | | 20 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40 ...130 | °C |
| $T_{VJM}$ | | | 130 | °C |
| $T_{stg}$ | | | -40 ...125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | t = 1 min | 3000 | V~ |
| | $I_{ISOL} \leq$ 1 mA | t = 1 s | 3600 | V~ |
| $M_d$ | Mounting torque (M6) | | 4.5-7/40-62 | Nm/lb.in. |
| | Terminal connection torque (M8) | | 11-13/97-115 | Nm/lb.in. |
| **Weight** | Typical including screws | | 750 | g |

Data according to IEC 60747 and refer to a single thyristor/diode unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions

### Features

- International standard package
- **D**irect **C**opper **B**onded $Al_2O_3$-ceramic with copper base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered E 72873
- Keyed gate/cathode twin pins

### Applications

- Motor control, softstarter
- Power converter
- Heat and temperature control for industrial furnaces and chemical processes
- Lighting control
- Solid state switches

### Advantages

- Simple mounting
- Improved temperature and power cycling
- Reduced protection circuits

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| Symbol | Test Conditions | Characteristic Values | |
|---|---|---|---|
| $I_{RRM}$, $I_{DRM}$ | $T_{VJ}$ = $T_{VJM}$; $V_R$ = $V_{RRM}$ | 40 | mA |
| $V_T$ | $I_T$ = 600 A; $T_{VJ}$ = 25°C | 1.4 | V |
| $V_{T0}$ | For power-loss calculations only ($T_{VJ}$ = $T_{VJM}$) | 0.8 | V |
| $r_T$ | | 0.76 | mΩ |
| $V_{GT}$ | $V_D$ = 6 V; $T_{VJ}$ = 25°C | 2 | V |
| | $T_{VJ}$ = -40°C | 3 | V |
| $I_{GT}$ | $V_D$ = 6 V; $T_{VJ}$ = 25°C | 150 | mA |
| | $T_{VJ}$ = -40°C | 220 | mA |
| $V_{GD}$ | $T_{VJ}$ = $T_{VJM}$; $V_D$ = 2/3 $V_{DRM}$ | 0.25 | V |
| $I_{GD}$ | $T_{VJ}$ = $T_{VJM}$; $V_D$ = 2/3 $V_{DRM}$ | 10 | mA |
| $I_L$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $t_P$ = 30 µs<br>$di_G/dt$ = 0.45 A/µs; $I_G$ = 0.45 A | 200 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK}$ = ∞ | 150 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D$ = 1/2 $V_{DRM}$<br>$di_G/dt$ = 1 A/µs; $I_G$ = 1 A | 2 | µs |
| $t_q$ | $T_{VJ}$ = $T_{VJM}$; $V_R$ = 100 V; $V_D$ = 2/3 $V_{DRM}$; $t_P$ = 200 µs<br>dv/dt = 50 V/µs; $I_T$ = 300 A; -di/dt = 10 A/µs | typ. 200 | µs |
| $Q_S$ | $T_{VJ}$ = $T_{VJM}$ | 760 | µC |
| $I_{RM}$ | -di/dt = 50 A/µs; $I_T$ = 400 A | 275 | A |
| $R_{thJC}$ | per thyristor; DC current | 0.139 | K/W |
| | per module | 0.069 | K/W |
| $R_{thJK}$ | per thyristor; DC current | 0.179 | K/W |
| | per module | 0.089 | K/W |
| $d_S$ | Creeping distance on surface | 12.7 | mm |
| $d_A$ | Creepage distance in air | 9.6 | mm |
| a | Maximum allowable acceleration | 50 | $m/s^2$ |

Optional accessories for modules
Keyed Gate/Cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red
Type **ZY 180 L** (L = Left for pin pair 4/5) } UL 758, style 1385,
Type **ZY 180 R** (R = Right for pin pair 6/7) } CSA class 5851, guide 460-1-1

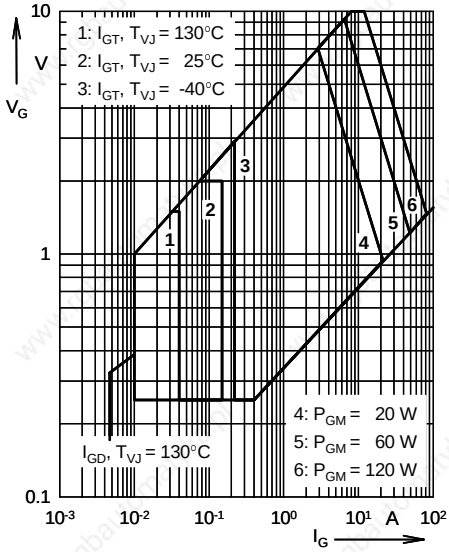



Fig. 1 Gate trigger characteristics

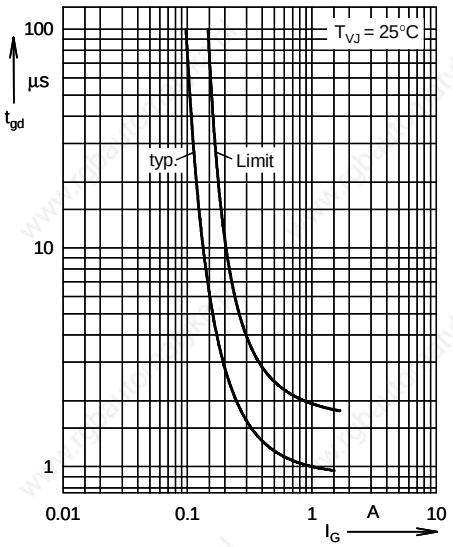
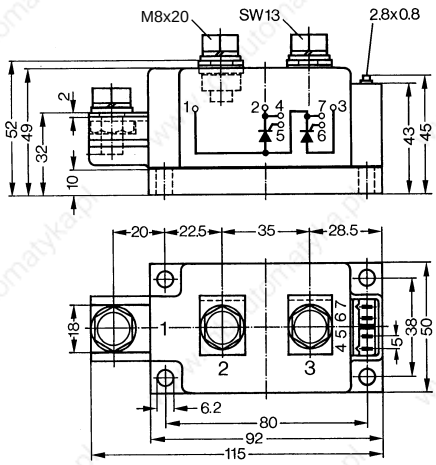



Fig. 2 Gate trigger delay time

**Dimensions in mm (1 mm = 0.0394")**

**MCC**

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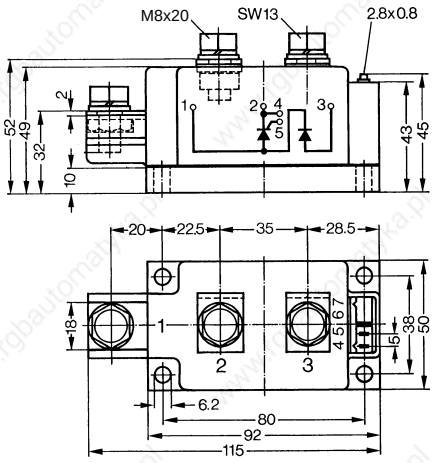


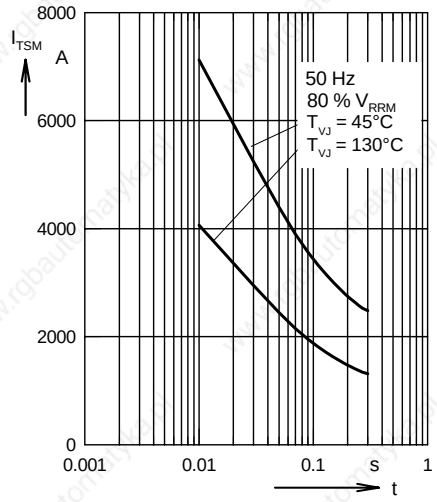



Fig. 3 Surge overload current
$I_{TSM}$: Crest value, t: duration

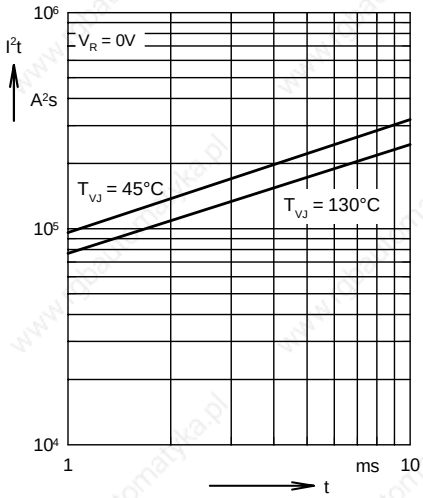



Fig. 4 $I^2t$ versus time (1-10 ms)

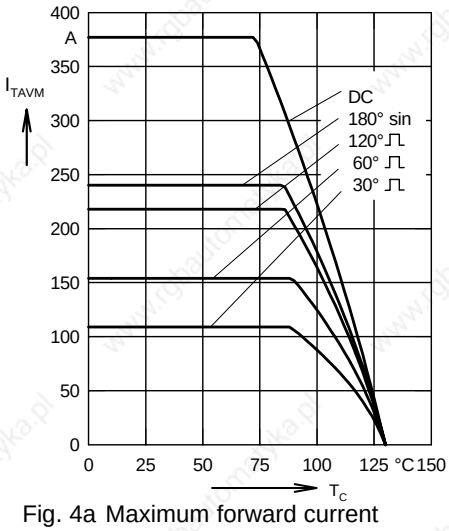



Fig. 4a Maximum forward current at case temperature

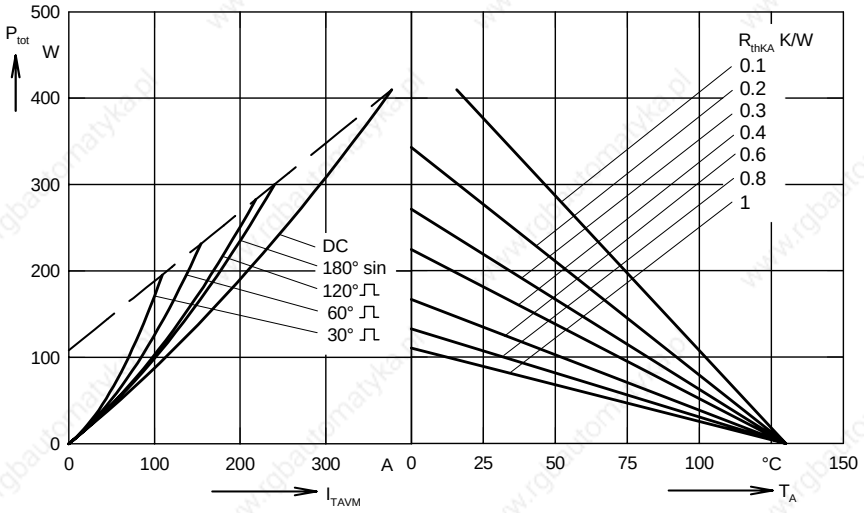



Fig. 5 Power dissipation versus on-state current and ambient temperature (per thyristor or diode)

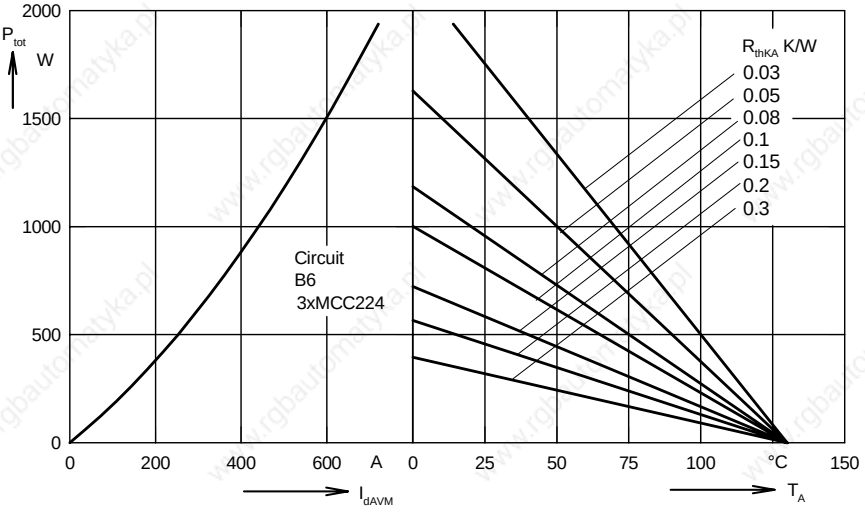



Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

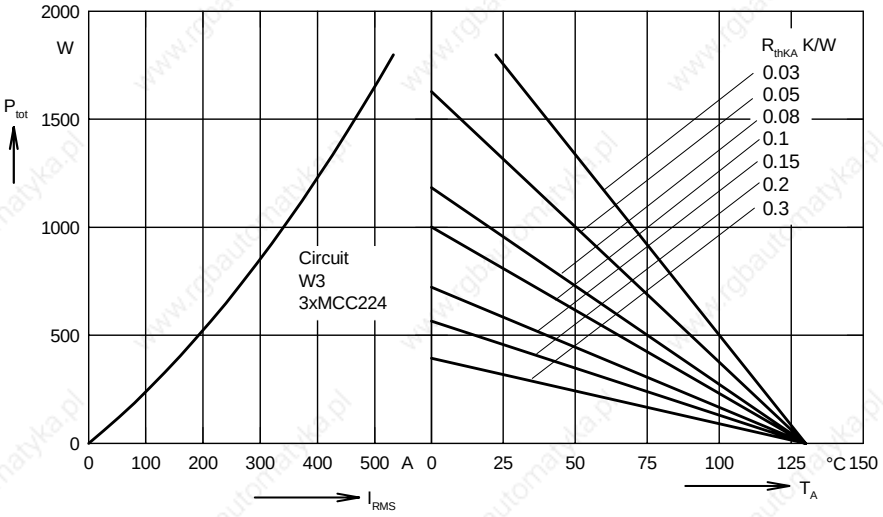



Fig. 7 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

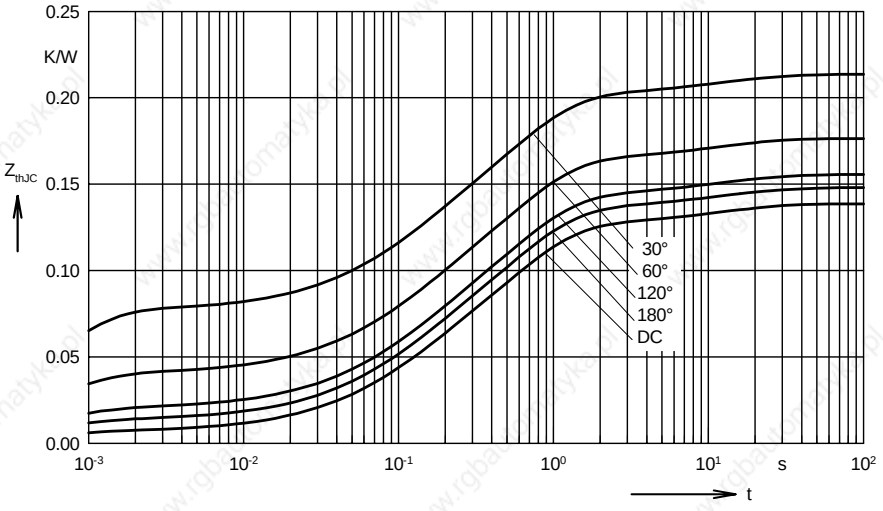



Fig. 8 Transient thermal impedance junction to case (per thyristor or diode)

$R_{thJC}$ for various conduction angles d:

| d | $R_{thJC}$ (K/W) |
|---|---|
| DC | 0.139 |
| 180° | 0.148 |
| 120° | 0.156 |
| 60° | 0.176 |
| 30° | 0.214 |

Constants for $Z_{thJC}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0067 | 0.00054 |
| 2 | 0.0358 | 0.098 |
| 3 | 0.0832 | 0.54 |
| 4 | 0.0129 | 12 |

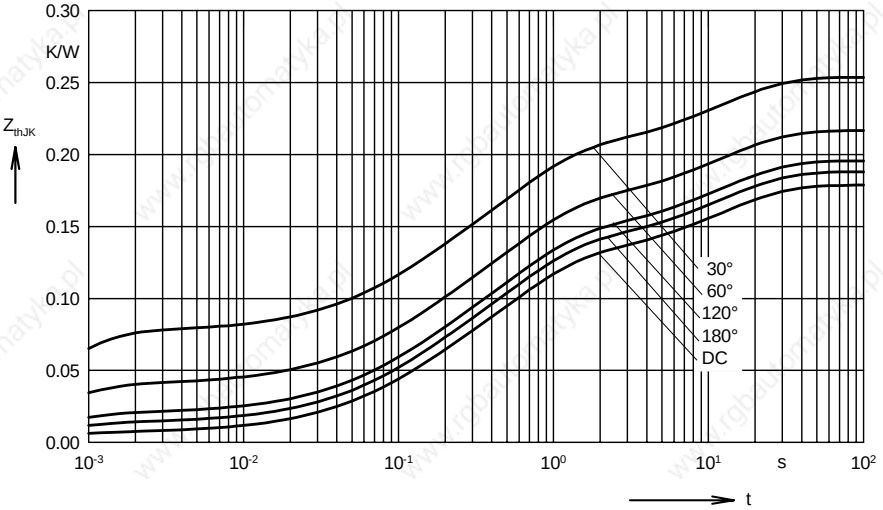



Fig. 9 Transient thermal impedance junction to heatsink (per thyristor or diode)

$R_{thJK}$ for various conduction angles d:

| d | $R_{thJK}$ (K/W) |
|---|---|
| DC | 0.179 |
| 180° | 0.188 |
| 120° | 0.196 |
| 60° | 0.216 |
| 30° | 0.256 |

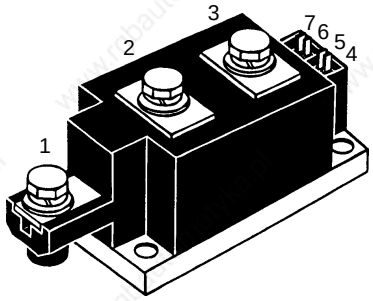
Constants for $Z_{thJK}$ calculation:

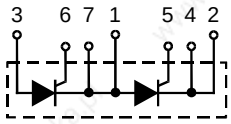
| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0067 | 0.00054 |
| 2 | 0.0358 | 0.098 |
| 3 | 0.0832 | 0.54 |
| 4 | 0.0129 | 12 |
| 5 | 0.04 | 12 |

# Thyristor Modules
# Thyristor/Diode Modules

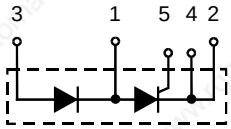
$I_{TRMS}$ = 2x 400 A
$I_{TAVM}$ = 2x 221 A
$V_{RRM}$ = 1200-1800 V

| $V_{RSM}$ $V_{DSM}$ V | $V_{RRM}$ $V_{DRM}$ V | Type | |
|---|---|---|---|
| **1300** | **1200** | **MCC 225-12io1** | **MCD 225-12io1** |
| **1500** | **1400** | **MCC 225-14io1** | **MCD 225-14io1** |
| **1700** | **1600** | **MCC 225-16io1** | **MCD 225-16io1** |
| **1900** | **1800** | **MCC 225-18io1** | **MCD 225-18io1** |




**MCC**




**MCD**

| Symbol | Test Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$ | $T_{VJ} = T_{VJM}$ | | 400 | A |
| $I_{TAVM}$ | $T_C$ = 85°C; 180° sine | | 221 | A |
| $I_{TSM}$, $I_{FSM}$ | $T_{VJ}$ = 45°C; | t = 10 ms (50 Hz) | 8000 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 8500 | A |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz) | 7000 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 7700 | A |
| $\int i^2dt$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz) | 320 000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 300 000 | $A^2s$ |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz) | 245 000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 246 000 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; f =50 Hz, $t_P$ =200 µs; $V_D$ = 2/3 $V_{DRM}$; $I_G$ = 1 A, $di_G/dt$ = 1 A/µs | repetitive, $I_T$ = 750 A | 100 | A/µs |
| | | non repetitive, $I_T = I_{TAVM}$ | 500 | A/µs |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; $V_{DR}$ = 2/3 $V_{DRM}$; $R_{GK}$ = ∞; method 1 (linear voltage rise) | | 1000 | V/µs |
| $P_{GM}$ | $T_{VJ} = T_{VJM}$ | $t_P$ = 30 µs | 120 | W |
| | $I_T = I_{TAVM}$ | $t_P$ = 500 µs | 60 | W |
| $P_{GAV}$ | | | 20 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40...+130 | °C |
| $T_{VJM}$ | | | 130 | °C |
| $T_{stg}$ | | | -40...+125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | t = 1 min | 3000 | V~ |
| | $I_{ISOL} \leq$ 1 mA | t = 1 s | 3600 | V~ |
| $M_d$ | Mounting torque (M6) | | 4.5-7/40-62 | Nm/lb.in. |
| | Terminal connection torque (M8) | | 11-13/97-115 | Nm/lb.in. |
| **Weight** | Typical including screws | | 750 | g |

Data according to IEC 60747 and refer to a single thyristor/diode unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions

**Features**
- International standard package
- Direct copper bonded $Al_2O_3$-ceramic with copper base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered E 72873
- Keyed gate/cathode twin pins

**Applications**
- Motor control, softstarter
- Power converter
- Heat and temperature control for industrial furnaces and chemical processes
- Lighting control
- Solid state switches

**Advantages**
- Simple mounting
- Improved temperature and power cycling
- Reduced protection circuits

| Symbol | Test Conditions | | Characteristic Values | |
|---|---|---|---|---|
| $I_{RRM}$, $I_{DRM}$ | $T_{VJ} = T_{VJM}$; $V_R = V_{RRM}$; $V_D = V_{DRM}$ | | 40 | mA |
| $V_T$, $V_F$ | $I_T$, $I_F$ = 600 A; $T_{VJ}$ = 25°C | | 1.40 | V |
| $V_{T0}$ | For power-loss calculations only ($T_{VJ}$ = 130°C) | | 0.8 | V |
| $r_T$ | | | 0.76 | mΩ |
| $V_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 2 | V |
| | | $T_{VJ}$ = -40°C | 3 | V |
| $I_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 150 | mA |
| | | $T_{VJ}$ = -40°C | 220 | mA |
| $V_{GD}$ | $T_{VJ} = T_{VJM}$; | $V_D$ = 2/3 $V_{DRM}$ | 0.25 | V |
| $I_{GD}$ | $T_{VJ} = T_{VJM}$; | $V_D$ = 2/3 $V_{DRM}$ | 10 | mA |
| $I_L$ | $T_{VJ}$ = 25°C; $t_P$ = 30 µs; $V_D$ = 6 V<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 200 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK}$ = ∞ | | 150 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D$ = 1/2 $V_{DRM}$<br>$I_G$ = 1 A; $di_G/dt$ = 1 A/µs | | 2 | µs |
| $t_q$ | $T_{VJ} = T_{VJM}$; $I_T$ = 300 A, $t_P$ = 200 µs; -di/dt = 10 A/µs<br>$V_R$ = 100 V; dv/dt = 50 V/µs; $V_D$ = 2/3 $V_{DRM}$ | typ. | 200 | µs |
| $Q_S$ | $T_{VJ}$ = 125°C; $I_T$, $I_F$ = 300 A; -di/dt = 50 A/µs | | 550 | µC |
| $I_{RM}$ | | | 235 | A |
| $R_{thJC}$ | per thyristor (diode); DC current | other values see Fig. 8/9 | 0.157 | K/W |
| | per module | | 0.08 | K/W |
| $R_{thJK}$ | per thyristor (diode); DC current | | 0.197 | K/W |
| | per module | | 0.1 | K/W |
| $d_S$ | Creeping distance on surface | | 12.7 | mm |
| $d_A$ | Creepage distance in air | | 9.6 | mm |
| a | Maximum allowable acceleration | | 50 | m/s² |

Optional accessories for modules
Keyed Gate/Cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red
Type **ZY 180 L** (L = Left for pin pair 4/5) } UL 758, style 1385,
Type **ZY 180 R** (R = Right for pin pair 6/7) } CSA class 5851, guide 460-1-1

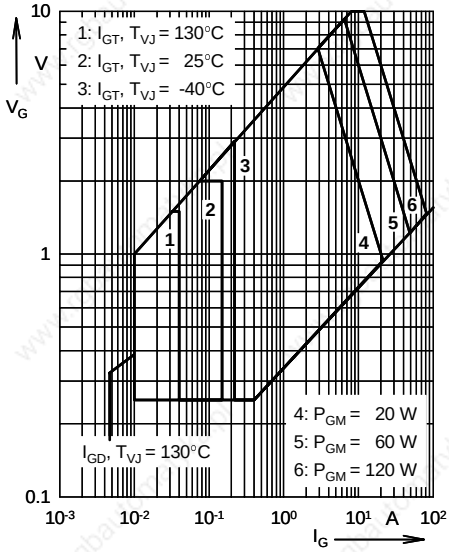



Fig. 1 Gate trigger characteristics

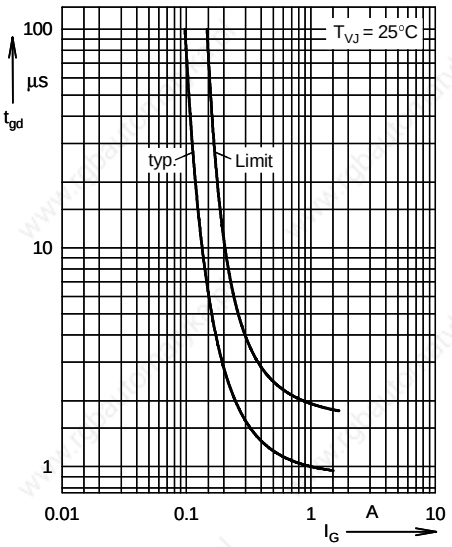
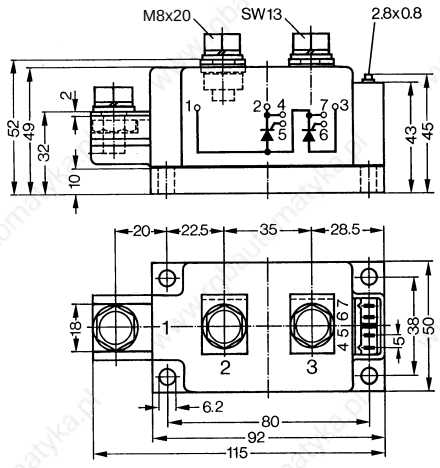



Fig. 2 Gate trigger delay time

**Dimensions in mm (1 mm = 0.0394")**

**MCC**

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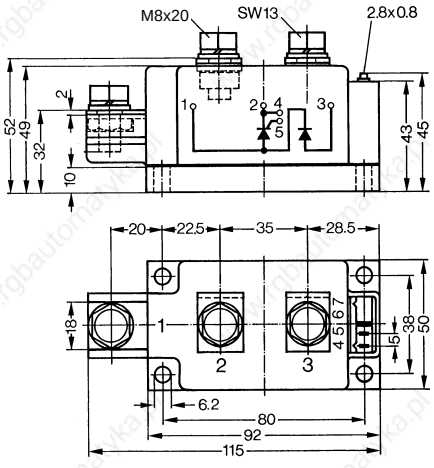


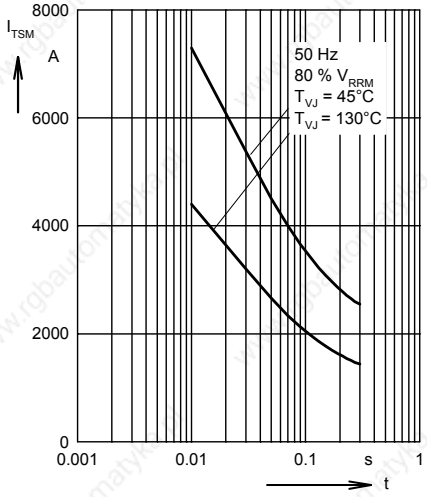



Fig. 3 Surge overload current
$I_{TSM}$, $I_{FSM}$: Crest value, t: duration

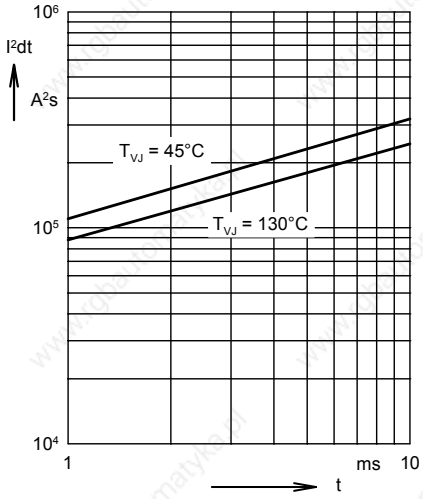



Fig. 4 $\int i^2dt$ versus time (1-10 ms)

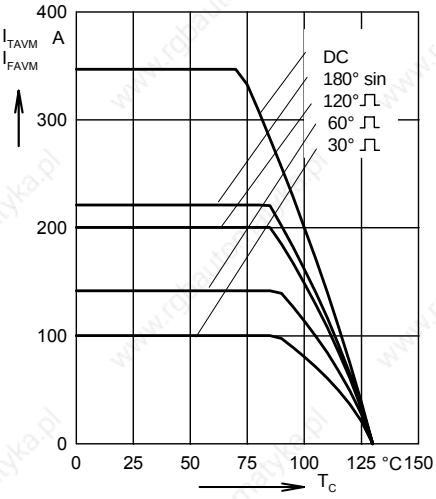



Fig. 4a Maximum forward current at case temperature

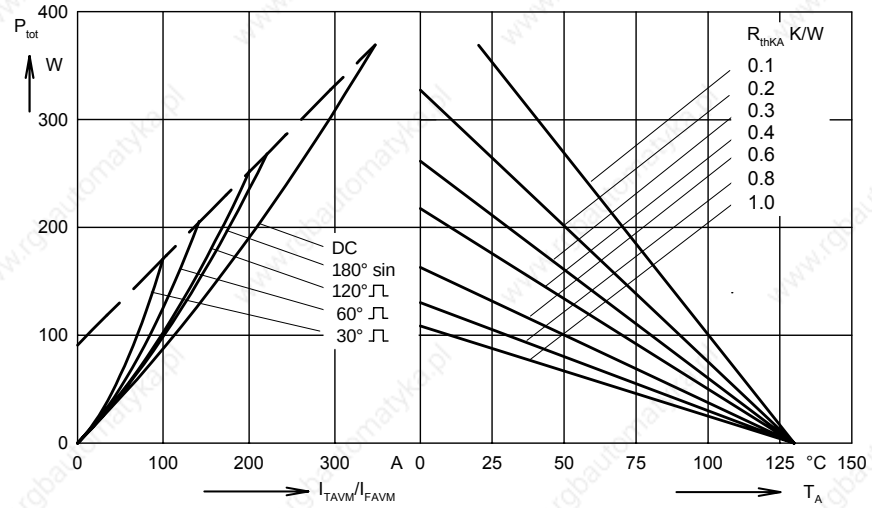



Fig. 5 Power dissipation versus on-state current and ambient temperature (per thyristor or diode)

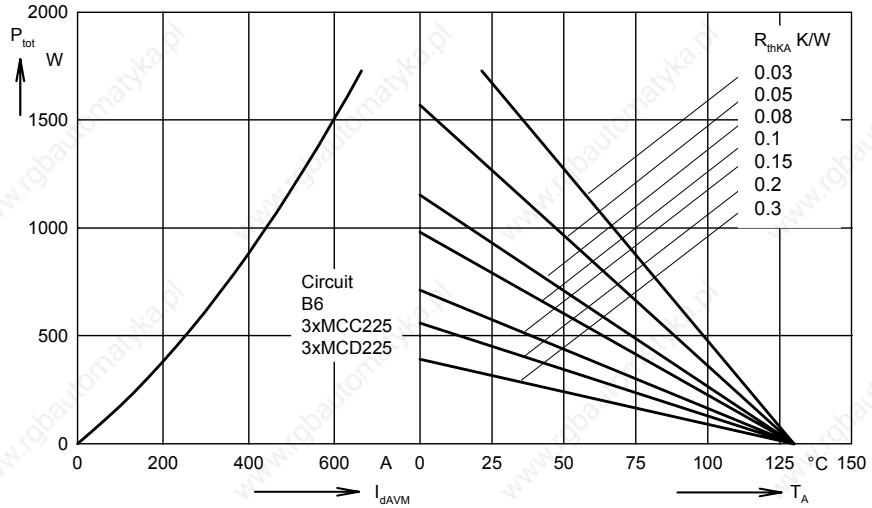



Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

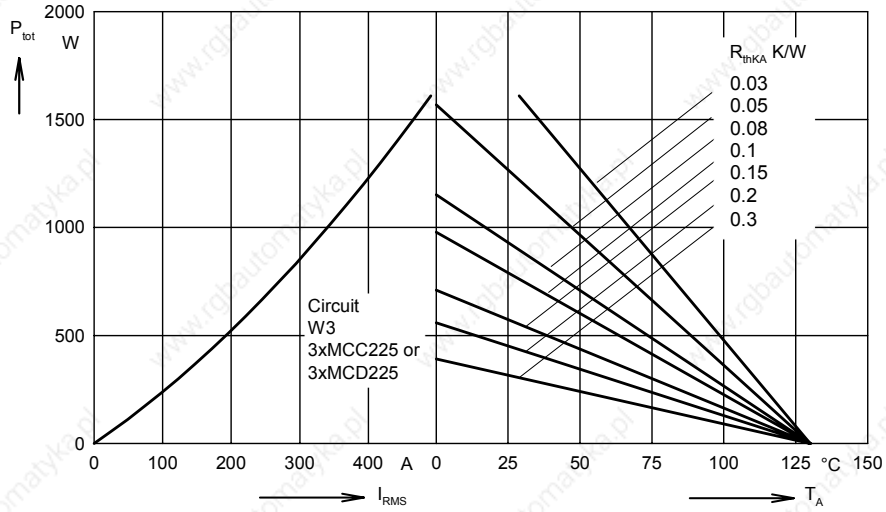



Fig. 7 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

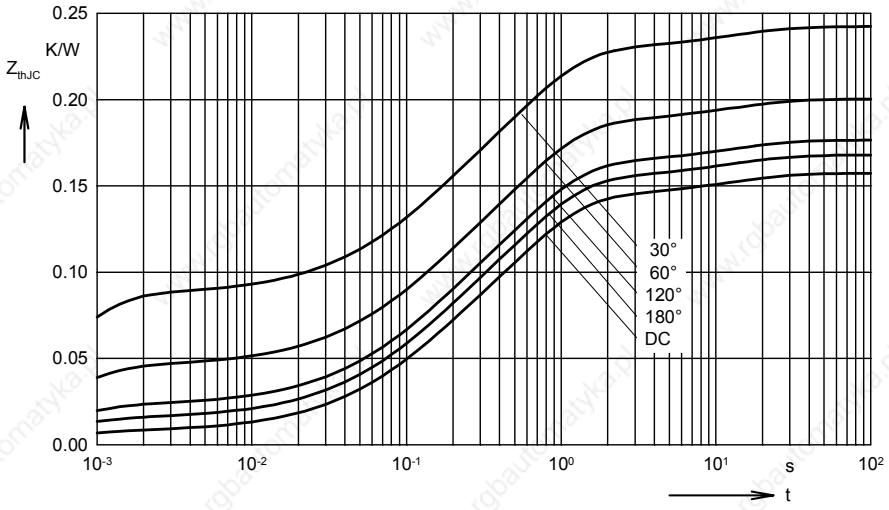



Fig. 8 Transient thermal impedance junction to case (per thyristor or diode)

$R_{thJC}$ for various conduction angles d:

| d | $R_{thJC}$ (K/W) |
|---|---|
| DC | 0.157 |
| 180° | 0.168 |
| 120° | 0.177 |
| 60° | 0.200 |
| 30° | 0.243 |

Constants for $Z_{thJC}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0076 | 0.00054 |
| 2 | 0.0406 | 0.098 |
| 3 | 0.0944 | 0.54 |
| 4 | 0.0147 | 12 |

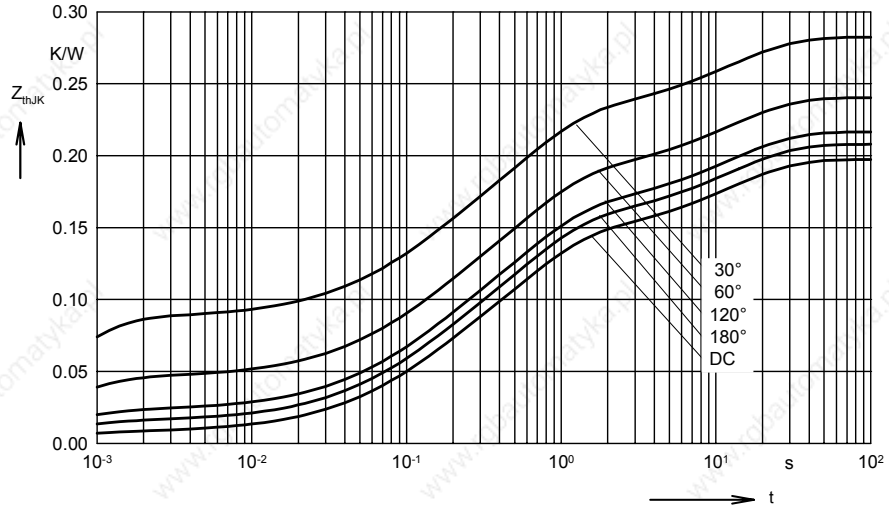



Fig. 9 Transient thermal impedance junction to heatsink (per thyristor or diode)

$R_{thJK}$ for various conduction angles d:

| d | $R_{thJK}$ (K/W) |
|---|---|
| DC | 0.197 |
| 180° | 0.208 |
| 120° | 0.217 |
| 60° | 0.240 |
| 30° | 0.283 |

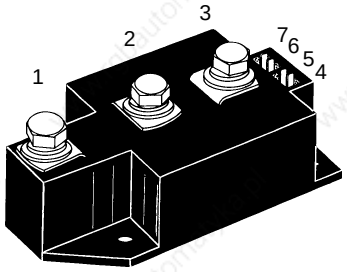
Constants for $Z_{thJK}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0076 | 0.00054 |
| 2 | 0.0406 | 0.098 |
| 3 | 0.0944 | 0.54 |
| 4 | 0.0147 | 12 |
| 5 | 0.04 | 12 |

# Thyristor Modules
# Thyristor/Diode Modules

$I_{TRMS}$ = 2x 450 A
$I_{TAVM}$ = 2x 287 A
$V_{RRM}$ = 800-1800 V

| $V_{RSM}$ $V_{DSM}$ V | $V_{RRM}$ $V_{DRM}$ V | Type Version 1 | Version 1 |
|---|---|---|---|
| 900 | 800 | MCC 250-08io1 | MCD 250-08io1 |
| 1300 | 1200 | MCC 250-12io1 | MCD 250-12io1 |
| 1500 | 1400 | MCC 250-14io1 | MCD 250-14io1 |
| 1700 | 1600 | MCC 250-16io1 | MCD 250-16io1 |
| 1900 | 1800 | MCC 250-18io1 | |

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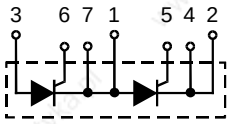
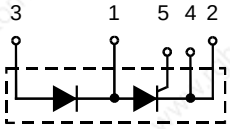



MCD




| Symbol | Test Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$, $I_{FRMS}$ | $T_{VJ} = T_{VJM}$ | | 450 | A |
| $I_{TAVM}$, $I_{FAVM}$ | $T_C$ = 85°C; 180° sine | | 287 | A |
| $I_{TSM}$, $I_{FSM}$ | $T_{VJ}$ = 45°C; | t = 10 ms (50 Hz), sine | 9000 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 9600 | A |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 7800 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 8500 | A |
| $\int i^2dt$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz), sine | 405 000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 380 000 | $A^2s$ |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 304 000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 300 000 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM}$ f =50 Hz, $t_P$ =200 µs $V_D$ = 2/3 $V_{DRM}$ | repetitive, $I_T$ = 860 A | 100 | A/µs |
| | $I_G$ = 1 A $di_G/dt$ = 1 A/µs | non repetitive, $I_T$ = 290 A | 800 | A/µs |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; $R_{GK} = \infty$; method 1 (linear voltage rise) | $V_{DR}$ = 2/3 $V_{DRM}$ | 1000 | V/µs |
| $P_{GM}$ | $T_{VJ} = T_{VJM}$ | $t_P$ = 30 µs | 120 | W |
| | $I_T = I_{TAVM}$ | $t_P$ = 500 µs | 60 | W |
| $P_{GAV}$ | | | 20 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40...+140 | °C |
| $T_{VJM}$ | | | 140 | °C |
| $T_{stg}$ | | | -40...+125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | t = 1 min | 3000 | V~ |
| | $I_{ISOL} \le$ 1 mA | t = 1 s | 3600 | V~ |
| $M_d$ | Mounting torque (M5) | | 2.5-5/22-44 | Nm/lb.in. |
| | Terminal connection torque (M8) | | 12-15/106-132 | Nm/lb.in. |
| Weight | Typical including screws | | 320 | g |

Data according to IEC 60747 and refer to a single thyristor/diode unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions

**Features**
- International standard package
- Direct copper bonded $Al_2O_3$ -ceramic base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered, E 72873
- Keyed gate/cathode twin pins

**Applications**
- Motor control
- Power converter
- Heat and temperature control for industrial furnaces and chemical processes
- Lighting control
- Contactless switches

**Advantages**
- Space and weight savings
- Simple mounting
- Improved temperature and power cycling
- Reduced protection circuits

| Symbol | Test Conditions | | Characteristic Values | |
|---|---|---|---|---|
| $I_{RRM}$<br>$I_{DRM}$ | $T_{VJ} = T_{VJM}$; $V_R = V_{RRM}$; $V_D = V_{DRM}$ | | 70<br>40 | mA<br>mA |
| $V_T$, $V_F$ | $I_T$, $I_F$ = 600 A; $T_{VJ}$ = 25°C | | 1.36 | V |
| $V_{T0}$<br>$r_T$ | For power-loss calculations only ($T_{VJ}$ = 140°C) | | 0.85<br>0.82 | V<br>mΩ |
| $V_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C<br>$T_{VJ}$ = -40°C | 2<br>3 | V<br>V |
| $I_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C<br>$T_{VJ}$ = -40°C | 150<br>200 | mA<br>mA |
| $V_{GD}$<br>$I_{GD}$ | $T_{VJ} = T_{VJM}$; | $V_D$ = 2/3 $V_{DRM}$ | 0.25<br>10 | V<br>mA |
| $I_L$ | $T_{VJ}$ = 25°C; $t_P$ = 30 µs; $V_D$ = 6 V<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 200 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK}$ = ∞ | | 150 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D$ = 1/2 $V_{DRM}$<br>$I_G$ = 1 A; $di_G/dt$ = 1 A/µs | | 2 | µs |
| $t_q$ | $T_{VJ} = T_{VJM}$; $I_T$ = 300 A, $t_P$ = 200 µs; -di/dt = 10 A/µs typ.<br>$V_R$ = 100 V; dv/dt = 50 V/µs; $V_D$ = 2/3 $V_{DRM}$ | | 200 | µs |
| $Q_S$<br>$I_{RM}$ | $T_{VJ}$ = 125°C; $I_T$, $I_F$ = 400 A, -di/dt = 50 A/µs | | 760<br>275 | µC<br>A |
| $R_{thJC}$<br><br>$R_{thJK}$<br> | per thyristor/diode; DC current<br>per module<br>per thyristor/diode; DC current<br>per module | other values see Fig. 8/9 | 0.129<br>0.0645<br>0.169<br>0.0845 | K/W<br>K/W<br>K/W<br>K/W |
| $d_S$<br>$d_A$<br>a | Creepage distance on surface<br>Strike distance through air<br>Maximum allowable acceleration | | 12.7<br>9.6<br>50 | mm<br>mm<br>$m/s^2$ |

Optional accessories for modules
Keyed gate/cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red
Type **ZY 180L** (L = Left for pin pair 4/5) } UL 758, style 1385,
Type **ZY 180R** (R = right for pin pair 6/7) } CSA class 5851, guide 460-1-1

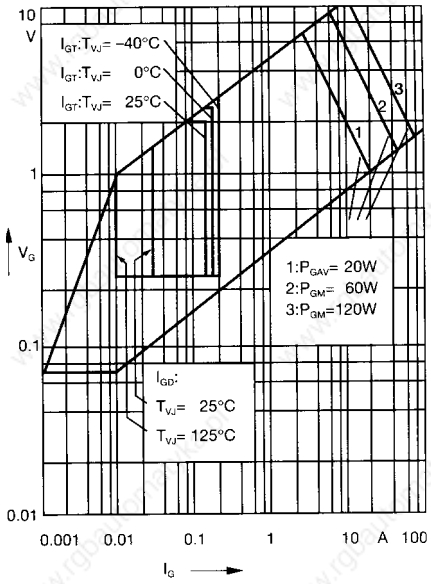


Fig. 1 Gate trigger characteristics

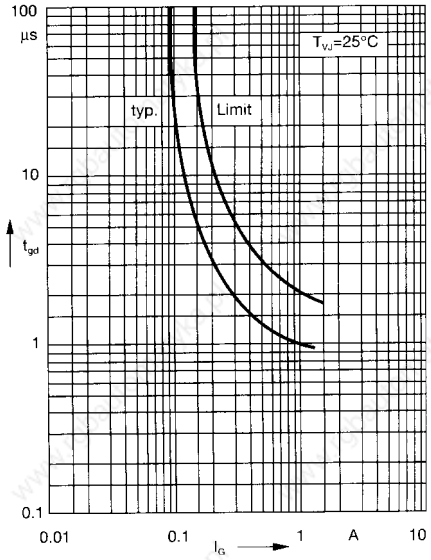
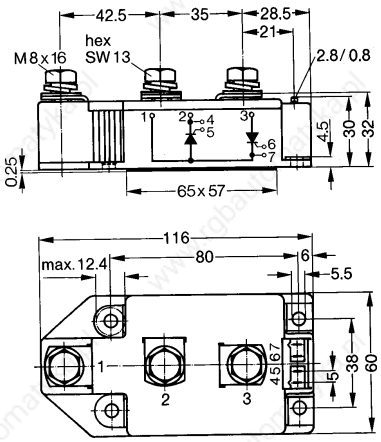


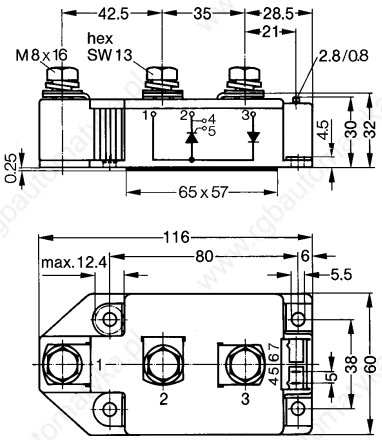
Fig. 2 Gate trigger delay time

**Dimensions in mm (1 mm = 0.0394")**

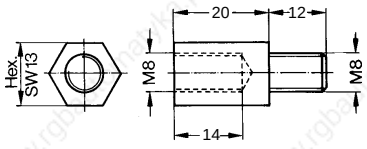
**MCC**




**MCD**




Threaded spacer for higher Anode/ Cathode construction:
Type **ZY 250**, material brass



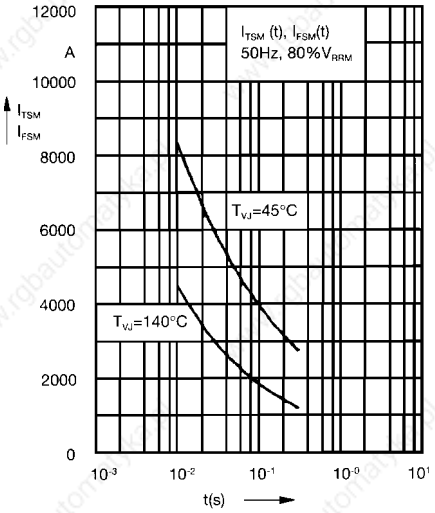



Fig. 3 Surge overload current
$I_{TSM}$, $I_{FSM}$: Crest value, t: duration

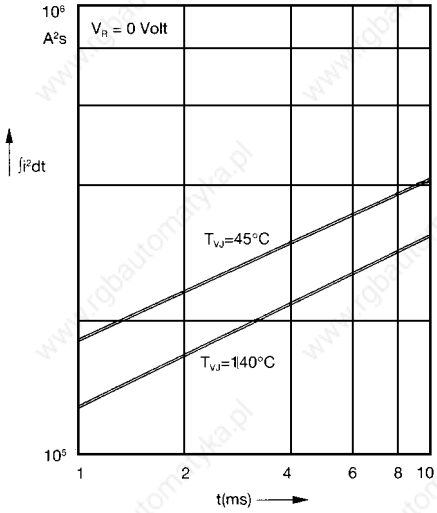



Fig. 4 $\int i^2dt$ versus time (1-10 ms)

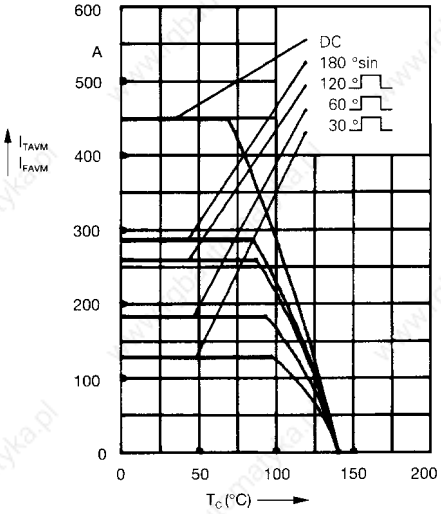



Fig. 4a Maximum forward current at case temperature

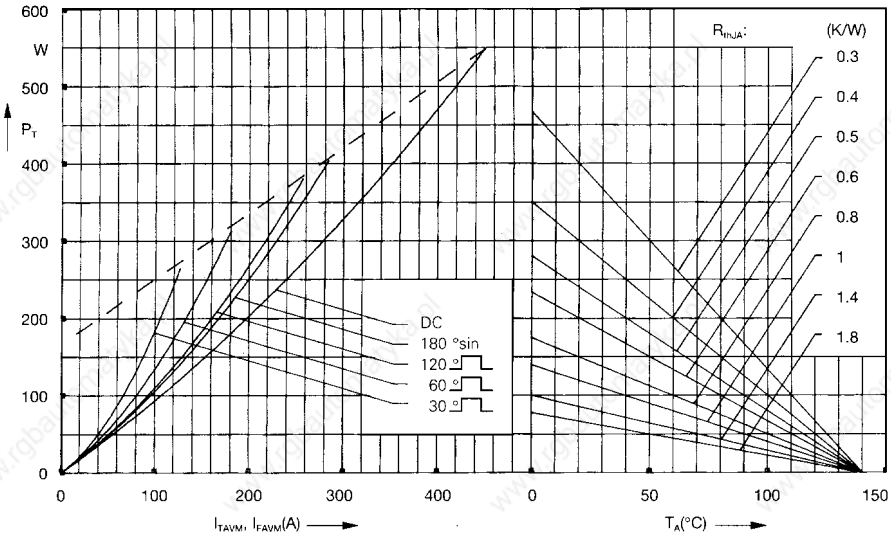



Fig. 5 Power dissipation versus on-state current and ambient temperature (per thyristor or diode)

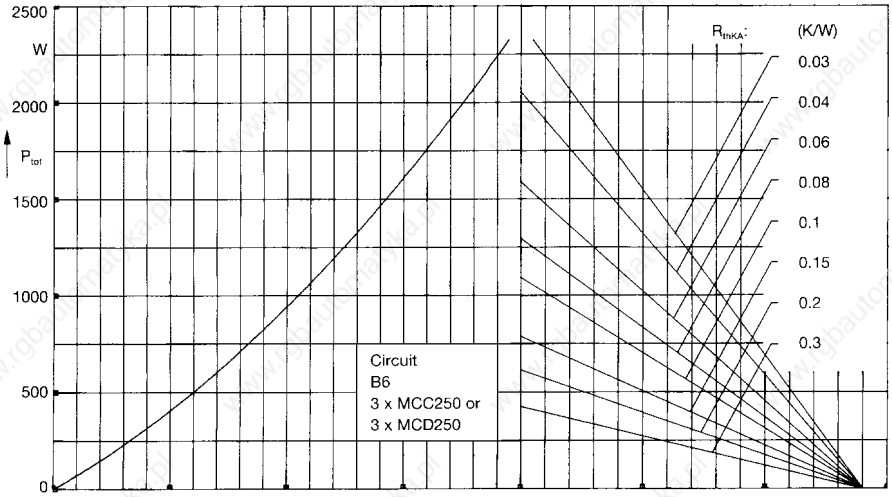



Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

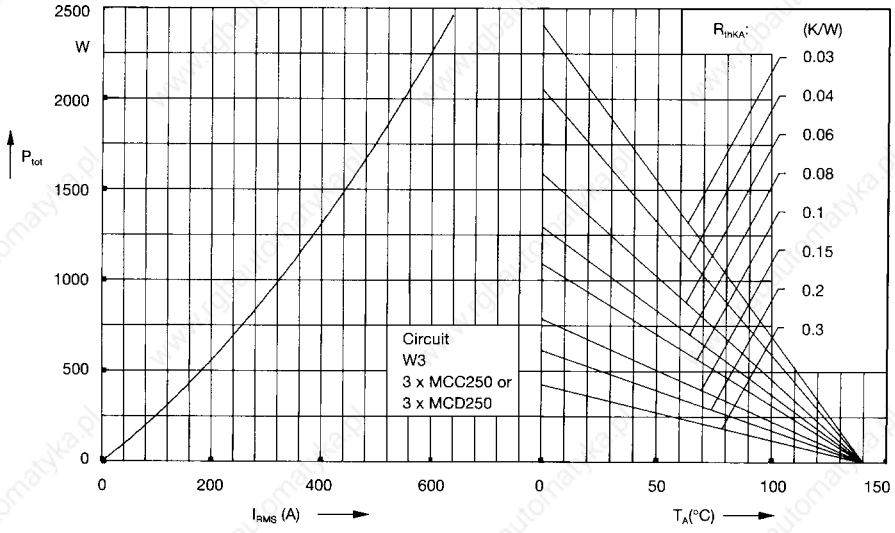



Fig. 7 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

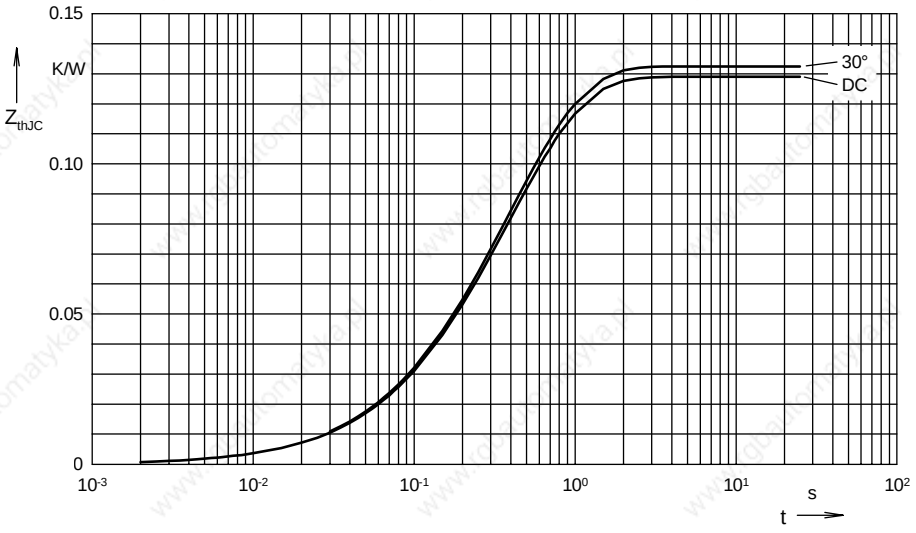



Fig. 8 Transient thermal impedance junction to case (per thyristor or diode)

$R_{thJC}$ for various conduction angles d:

| d | $R_{thJC}$ (K/W) |
|---|---|
| DC | 0.129 |
| 180°C | 0.131 |
| 120°C | 0.131 |
| 60°C | 0.132 |
| 30°C | 0.132 |

Constants for $Z_{thJC}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0035 | 0.099 |
| 2 | 0.0165 | 0.168 |
| 3 | 0.1091 | 0.456 |

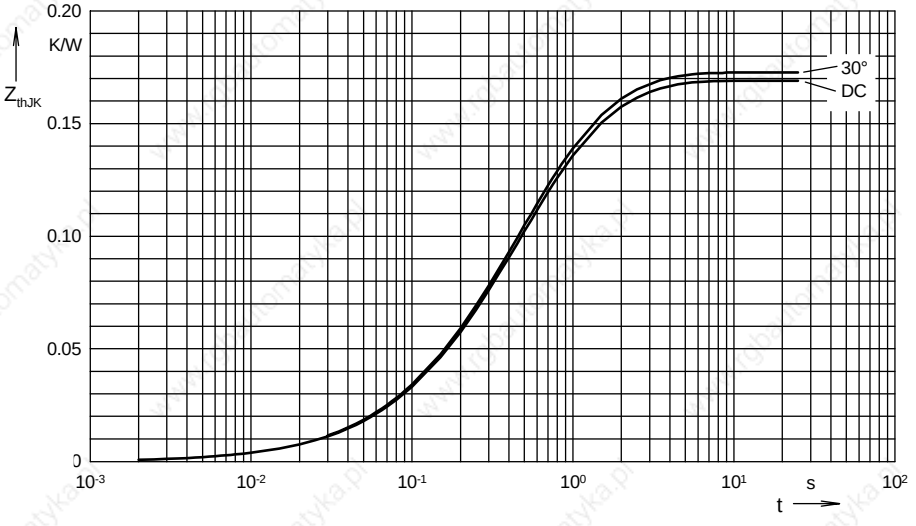



Fig. 9 Transient thermal impedance junction to heatsink (per thyristor or diode)

$R_{thJK}$ for various conduction angles d:

| d | $R_{thJK}$ (K/W) |
|---|---|
| DC | 0.169 |
| 180°C | 0.171 |
| 120°C | 0.172 |
| 60°C | 0.172 |
| 30°C | 0.173 |

Constants for $Z_{thJK}$ calculation:

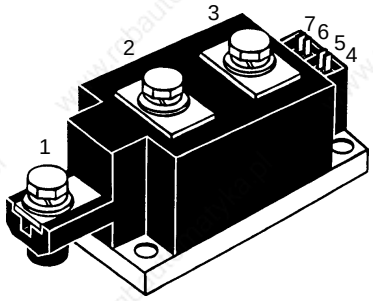
| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0033 | 0.099 |
| 2 | 0.0159 | 0.168 |
| 3 | 0.1053 | 0.456 |
| 4 | 0.04 | 1.36 |

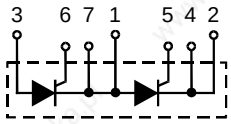
835

# Thyristor Modules
# Thyristor/Diode Modules

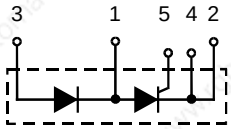
$I_{TRMS}$ = 2x 450 A
$I_{TAVM}$ = 2x 250 A
$V_{RRM}$ = 1200-1800 V

| $V_{RSM}$ $V_{DSM}$ V | $V_{RRM}$ $V_{DRM}$ V | Type | |
|---|---|---|---|
| **1300** | **1200** | **MCC 255-12io1** | **MCD 255-12io1** |
| **1500** | **1400** | **MCC 255-14io1** | **MCD 255-14io1** |
| **1700** | **1600** | **MCC 255-16io1** | **MCD 255-16io1** |
| **1900** | **1800** | **MCC 255-18io1** | **MCD 255-18io1** |




**MCC**




**MCD**

| Symbol | Test Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$, $I_{FRMS}$ | $T_{VJ} = T_{VJM}$ | | 450 | A |
| $I_{TAVM}$, $I_{FAVM}$ | $T_C$ = 85°C; 180° sine | | 250 | A |
| $I_{TSM}$, $I_{FSM}$ | $T_{VJ}$ = 45°C; | t = 10 ms (50 Hz) | 9000 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 9600 | A |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz) | 7800 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 8600 | A |
| $\int i^2dt$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz) | 405 000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 382 000 | $A^2s$ |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz) | 304 000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 307 000 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM}$ f =50 Hz, $t_P$ =200 µs $V_D$ = 2/3 $V_{DRM}$ $I_G$ = 1 A, $di_G/dt$ = 1 A/µs | repetitive, $I_T$ = 860 A | 100 | A/µs |
| | | non repetitive, $I_T = I_{TAVM}$ | 500 | A/µs |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; $V_{DR}$ = 2/3 $V_{DRM}$ $R_{GK}$ = ∞; method 1 (linear voltage rise) | | 1000 | V/µs |
| $P_{GM}$ | $T_{VJ} = T_{VJM}$ | $t_P$ = 30 µs | 120 | W |
| | $I_T = I_{TAVM}$ | $t_P$ = 500 µs | 60 | W |
| $P_{GAV}$ | | | 20 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40...+130 | °C |
| $T_{VJM}$ | | | 130 | °C |
| $T_{stg}$ | | | -40...+125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | t = 1 min | 3000 | V~ |
| | $I_{ISOL} \leq$ 1 mA | t = 1 s | 3600 | V~ |
| $M_d$ | Mounting torque (M6) | | 4.5-7/40-62 | Nm/lb.in. |
| | Terminal connection torque (M8) | | 11-13/97-115 | Nm/lb.in. |
| **Weight** | Typical including screws | | 750 | g |

Data according to IEC 60747 and refer to a single thyristor/diode unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions

**Features**
- International standard package
- Direct copper bonded $Al_2O_3$-ceramic with copper base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered E 72873
- Keyed gate/cathode twin pins

**Applications**
- Motor control, softstarter
- Power converter
- Heat and temperature control for industrial furnaces and chemical processes
- Lighting control
- Solid state switches

**Advantages**
- Simple mounting
- Improved temperature and power cycling
- Reduced protection circuits

| Symbol | Test Conditions | | Characteristic Values | |
|---|---|---|---|---|
| $I_{RRM}$, $I_{DRM}$ | $T_{VJ} = T_{VJM}$; $V_R = V_{RRM}$; $V_D = V_{DRM}$ | | 40 | mA |
| $V_T$, $V_F$ | $I_T$, $I_F$ = 600 A; $T_{VJ}$ = 25°C | | 1.36 | V |
| $V_{T0}$ | For power-loss calculations only ($T_{VJ}$ = 130°C) | | 0.8 | V |
| $r_T$ | | | 0.68 | mΩ |
| $V_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 2 | V |
| | | $T_{VJ}$ = -40°C | 3 | V |
| $I_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 150 | mA |
| | | $T_{VJ}$ = -40°C | 220 | mA |
| $V_{GD}$ | $T_{VJ} = T_{VJM}$; | $V_D$ = 2/3 $V_{DRM}$ | 0.25 | V |
| $I_{GD}$ | $T_{VJ} = T_{VJM}$; | $V_D$ = 2/3 $V_{DRM}$ | 10 | mA |
| $I_L$ | $T_{VJ}$ = 25°C; $t_P$ = 30 µs; $V_D$ = 6 V<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 200 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK}$ = ∞ | | 150 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D$ = 1/2 $V_{DRM}$<br>$I_G$ = 1 A; $di_G/dt$ = 1 A/µs | | 2 | µs |
| $t_q$ | $T_{VJ} = T_{VJM}$; $I_T$ = 300 A, $t_P$ = 200 µs; -di/dt = 10 A/µs<br>$V_R$ = 100 V; dv/dt = 50 V/µs; $V_D$ = 2/3 $V_{DRM}$ | typ. | 200 | µs |
| $Q_S$ | $T_{VJ}$ = 125°C; $I_T$, $I_F$ = 300 A; -di/dt = 50 A/µs | | 760 | µC |
| $I_{RM}$ | | | 275 | A |
| $R_{thJC}$ | per thyristor (diode); DC current | other values see Fig. 8/9 | 0.140 | K/W |
| | per module | | 0.07 | K/W |
| $R_{thJK}$ | per thyristor (diode); DC current | | 0.18 | K/W |
| | per module | | 0.09 | K/W |
| $d_S$ | Creeping distance on surface | | 12.7 | mm |
| $d_A$ | Creepage distance in air | | 9.6 | mm |
| a | Maximum allowable acceleration | | 50 | m/s² |

Optional accessories for modules
Keyed Gate/Cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red
Type **ZY 180 L** (L = Left for pin pair 4/5) } UL 758, style 1385,
Type **ZY 180 R** (R = Right for pin pair 6/7) } CSA class 5851, guide 460-1-1

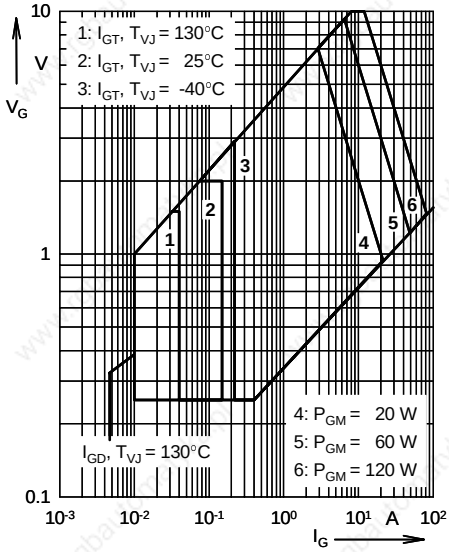



Fig. 1 Gate trigger characteristics

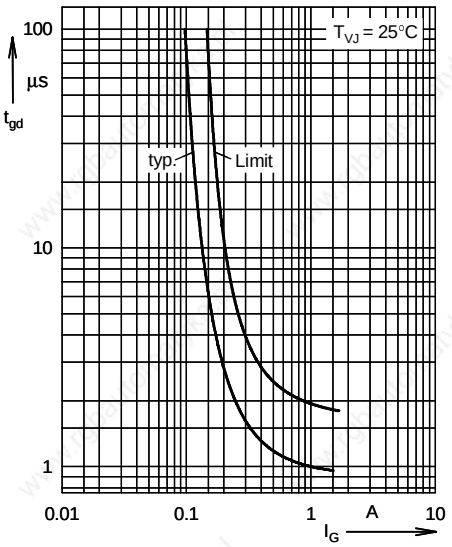
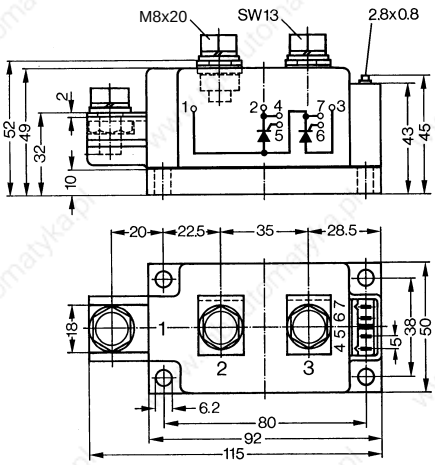


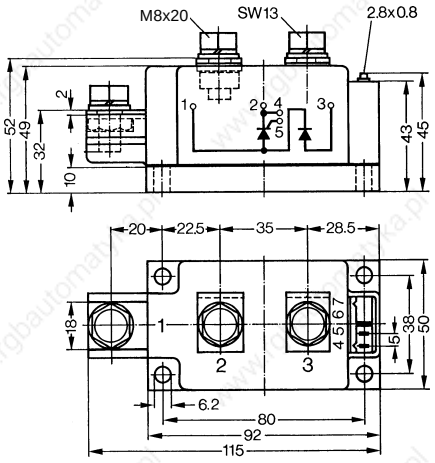

Fig. 2 Gate trigger delay time

**Dimensions in mm (1 mm = 0.0394")**

**MCC 255**




**MCD 255**



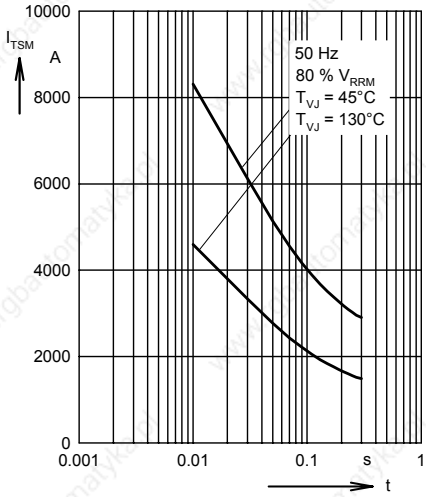



Fig. 3 Surge overload current
$I_{TSM}$, $I_{FSM}$: Crest value, t: duration

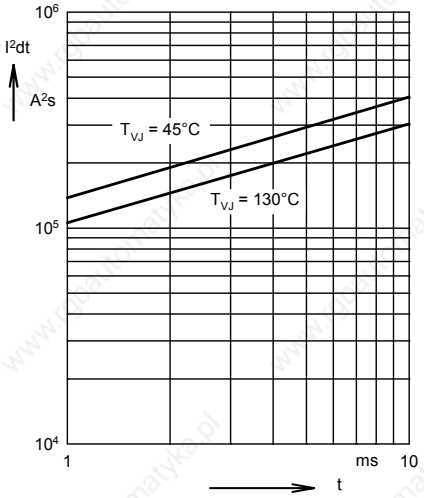



Fig. 4 $\int i^2dt$ versus time (1-10 ms)

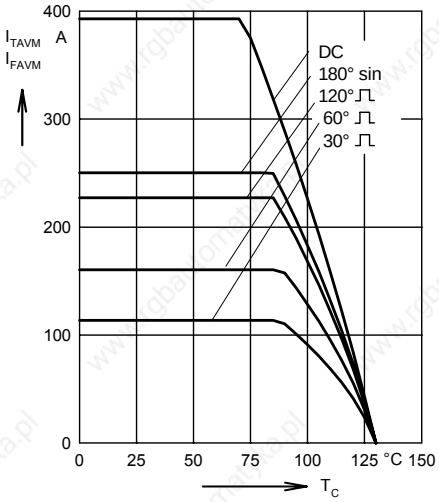



Fig. 4a Maximum forward current at case temperature

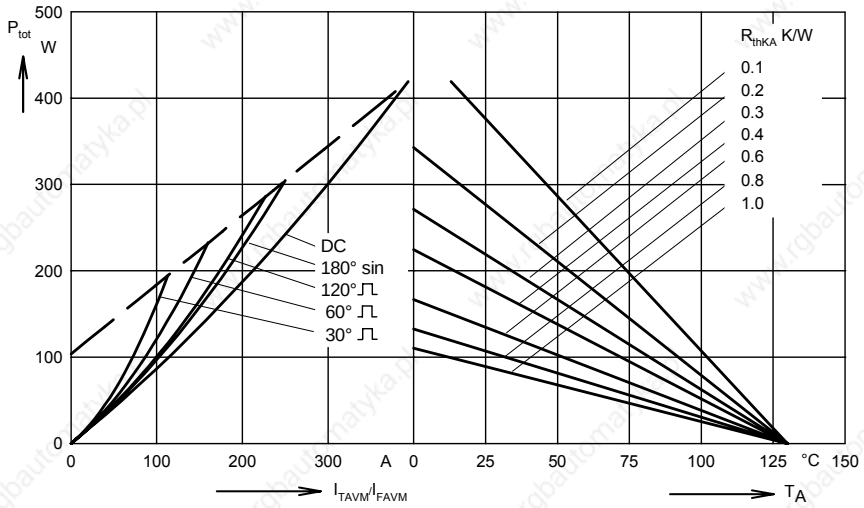



Fig. 5 Power dissipation versus on-state current and ambient temperature (per thyristor or diode)

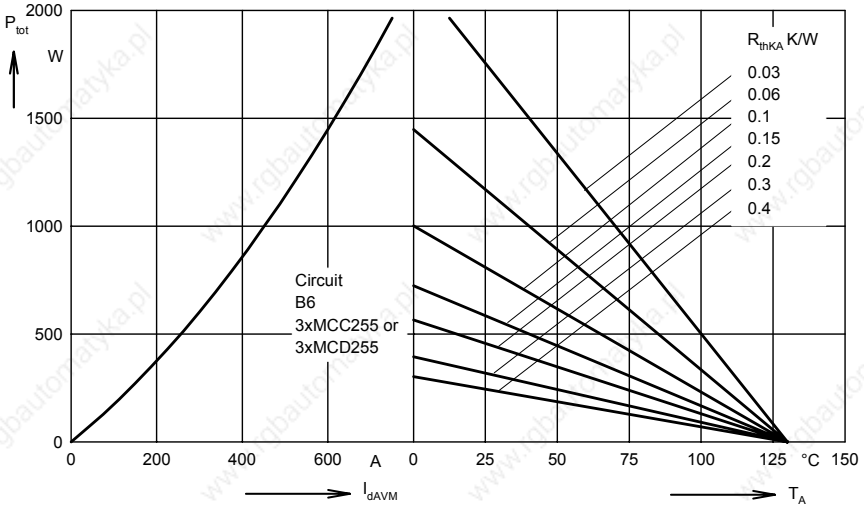



Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

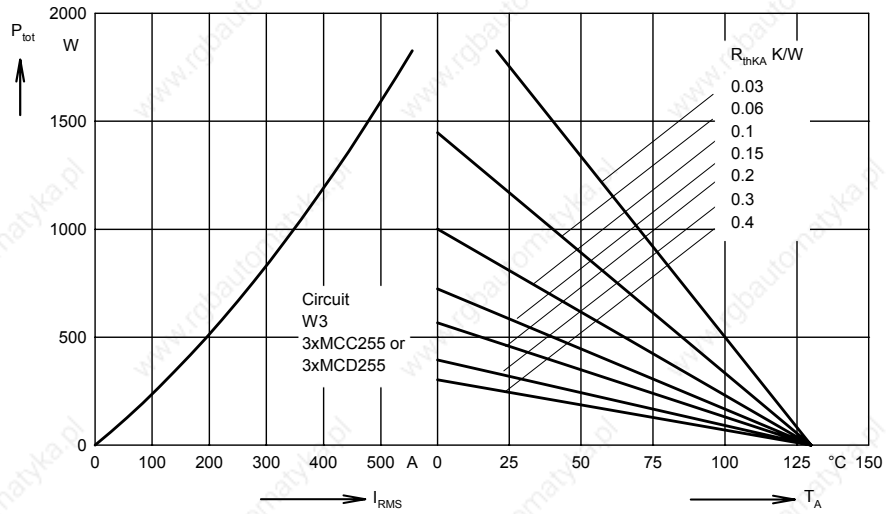



Fig. 7 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

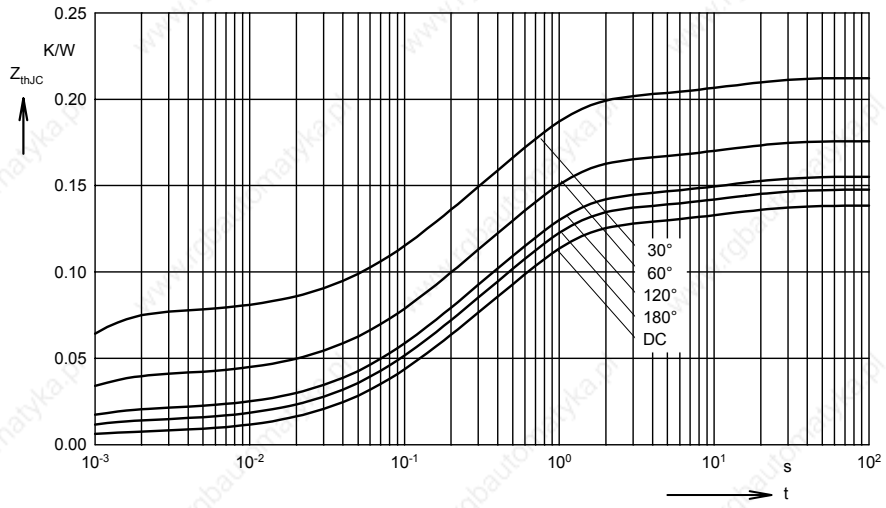



Fig. 8 Transient thermal impedance junction to case (per thyristor or diode)

$R_{thJC}$ for various conduction angles d:

| d | $R_{thJC}$ (K/W) |
|---|---|
| DC | 0.139 |
| 180° | 0.148 |
| 120° | 0.156 |
| 60° | 0.176 |
| 30° | 0.214 |

Constants for $Z_{thJC}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0066 | 0.00054 |
| 2 | 0.0358 | 0.098 |
| 3 | 0.0831 | 0.54 |
| 4 | 0.0129 | 12 |

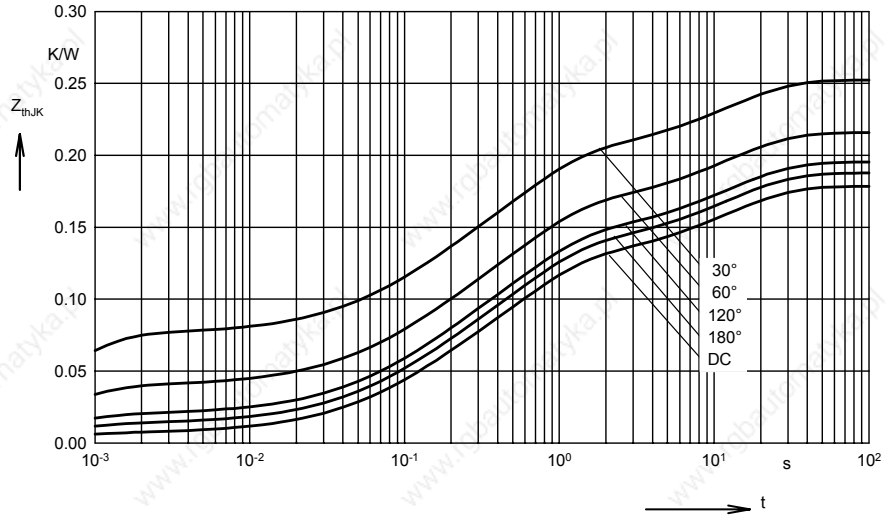



Fig. 9 Transient thermal impedance junction to heatsink (per thyristor or diode)

$R_{thJK}$ for various conduction angles d:

| d | $R_{thJK}$ (K/W) |
|---|---|
| DC | 0.179 |
| 180° | 0.188 |
| 120° | 0.196 |
| 60° | 0.216 |
| 30° | 0.254 |

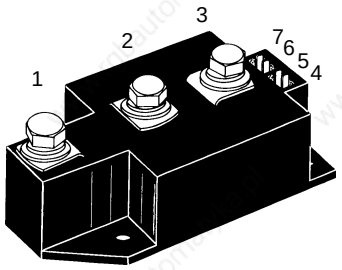
Constants for $Z_{thJK}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0066 | 0.00054 |
| 2 | 0.0358 | 0.098 |
| 3 | 0.0831 | 0.54 |
| 4 | 0.0129 | 12 |
| 5 | 0.04 | 12 |

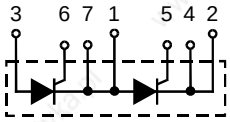
# Thyristor Modules
# Thyristor/Diode Modules

$I_{TRMS}$ = 2x 500 A
$I_{TAVM}$ = 2x 320 A
$V_{RRM}$ = 800-2200 V

| $V_{RSM}$ $V_{DSM}$ V | $V_{RRM}$ $V_{DRM}$ V | Type Version 1 | Version 1 |
|---|---|---|---|
| 900 | 800 | MCC 310-08io1 | MCD 310-08io1 |
| 1300 | 1200 | MCC 310-12io1 | MCD 310-12io1 |
| 1500 | 1400 | MCC 310-14io1 | MCD 310-14io1 |
| 1700 | 1600 | MCC 310-16io1 | MCD 310-16io1 |
| 1900 | 1800 | MCC 310-18io1 | MCD 310-18io1 |




MCC

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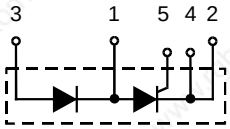



| Symbol | Test Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$, $I_{FRMS}$ | $T_{VJ} = T_{VJM}$ | | 500 | A |
| $I_{TAVM}$, $I_{FAVM}$ | $T_C$ = 85°C; 180° sine | | 320 | A |
| $I_{TSM}$, $I_{FSM}$ | $T_{VJ}$ = 45°C; | t = 10 ms (50 Hz), sine | 9200 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 9800 | A |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 8000 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 8600 | A |
| $\int i^2dt$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz), sine | 420 000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 400 000 | $A^2s$ |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz), sine | 320 000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz), sine | 306 000 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM}$ | repetitive, $I_T$ = 960 A | 100 | A/µs |
| | f =50 Hz, $t_P$ =200 µs | | | |
| | $V_D$ = 2/3 $V_{DRM}$ | | | |
| | $I_G$ = 1 A | non repetitive, $I_T$ = 320 A | 500 | A/µs |
| | $di_G/dt$ = 1 A/µs | | | |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; | $V_{DR}$ = 2/3 $V_{DRM}$ | 1000 | V/µs |
| | $R_{GK}$ = ∞; method 1 (linear voltage rise) | | | |
| $P_{GM}$ | $T_{VJ} = T_{VJM}$ | $t_P$ = 30 µs | 120 | W |
| | $I_T = I_{TAVM}$ | $t_P$ = 500 µs | 60 | W |
| $P_{GAV}$ | | | 20 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40...+140 | °C |
| $T_{VJM}$ | | | 140 | °C |
| $T_{stg}$ | | | -40...+125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | t = 1 min | 3000 | V~ |
| | $I_{ISOL} \le$ 1 mA | t = 1 s | 3600 | V~ |
| $M_d$ | Mounting torque (M5) | | 2.5-5/22-44 | Nm/lb.in. |
| | Terminal connection torque (M8) | | 12-15/106-132 | Nm/lb.in. |
| Weight | Typical including screws | | 320 | g |

Data according to IEC 60747 and refer to a single thyristor/diode unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions

**Features**
- International standard package
- Direct copper bonded $Al_2O_3$ -ceramic base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered, E 72873
- Keyed gate/cathode twin pins

**Applications**
- Motor control
- Power converter
- Heat and temperature control for industrial furnaces and chemical processes
- Lighting control
- Contactless switches

**Advantages**
- Space and weight savings
- Simple mounting
- Improved temperature and power cycling
- Reduced protection circuits

030

| Symbol | Test Conditions | | Characteristic Values | |
|---|---|---|---|---|
| $I_{RRM}$ | $T_{VJ} = T_{VJM}$; $V_R = V_{RRM}$; $V_D = V_{DRM}$ | | 70 | mA |
| $I_{DRM}$ | | | 40 | mA |
| $V_T$, $V_F$ | $I_T$, $I_F$ = 600 A; $T_{VJ}$ = 25°C | | 1.32 | V |
| $V_{T0}$ | For power-loss calculations only ($T_{VJ}$ = 140°C) | | 0.8 | V |
| $r_T$ | | | 0.82 | mΩ |
| $V_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 2 | V |
| | | $T_{VJ}$ = -40°C | 3 | V |
| $I_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 150 | mA |
| | | $T_{VJ}$ = -40°C | 200 | mA |
| $V_{GD}$ | $T_{VJ} = T_{VJM}$; | $V_D$ = 2/3 $V_{DRM}$ | 0.25 | V |
| $I_{GD}$ | | | 10 | mA |
| $I_L$ | $T_{VJ}$ = 25°C; $t_P$ = 30 µs; $V_D$ = 6 V<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 200 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK}$ = ∞ | | 150 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D$ = 1/2 $V_{DRM}$<br>$I_G$ = 1 A; $di_G/dt$ = 1 A/µs | | 2 | µs |
| $t_q$ | $T_{VJ} = T_{VJM}$; $I_T$ = 300 A, $t_P$ = 200 µs; -di/dt = 10 A/µs<br>$V_R$ = 100 V; dv/dt = 50 V/µs; $V_D$ = 2/3 $V_{DRM}$ | typ. | 200 | µs |
| $Q_S$ | $T_{VJ}$ = 125°C; $I_T$, $I_F$ = 400 A, -di/dt = 50 A/µs | | 760 | µC |
| $I_{RM}$ | | | 275 | A |
| $R_{thJC}$ | per thyristor/diode; DC current | other values see Fig. 8/9 | 0.112 | K/W |
| | per module | | 0.056 | K/W |
| $R_{thJK}$ | per thyristor/diode; DC current | | 0.152 | K/W |
| | per module | | 0.076 | K/W |
| $d_S$ | Creepage distance on surface | | 12.7 | mm |
| $d_A$ | Strike distance through air | | 9.6 | mm |
| a | Maximum allowable acceleration | | 50 | $m/s^2$ |

Optional accessories for modules
Keyed gate/cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red
Type **ZY 180L** (L = Left for pin pair 4/5) } UL 758, style 1385,
Type **ZY 180R** (R = right for pin pair 6/7) } CSA class 5851, guide 460-1-1

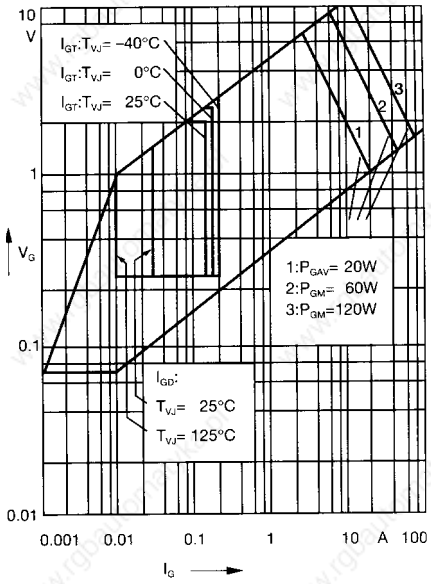


Fig. 1 Gate trigger characteristics

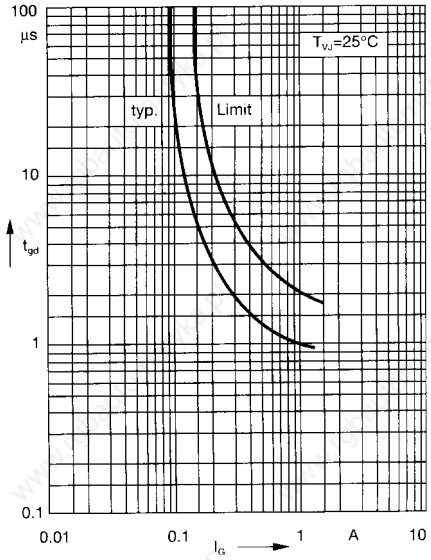
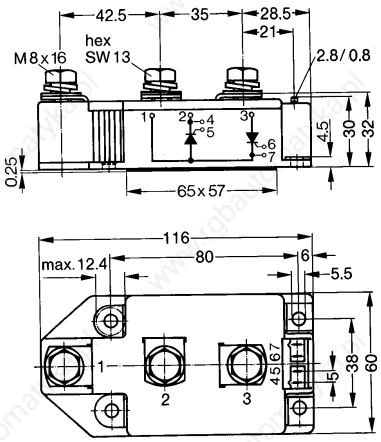


Fig. 2 Gate trigger delay time

**Dimensions in mm (1 mm = 0.0394")**

**MCC**

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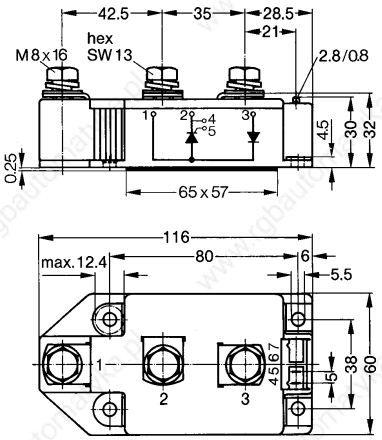
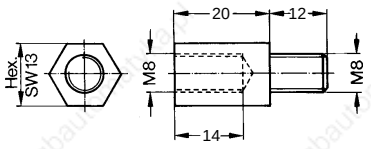



Threaded spacer for higher Anode/ Cathode construction:
Type **ZY 250**, material brass



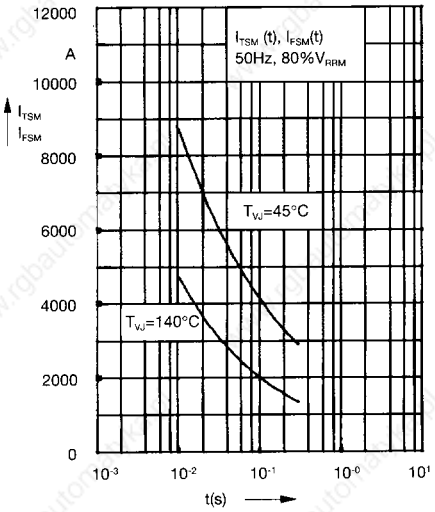



Fig. 3 Surge overload current
$I_{TSM}$, $I_{FSM}$: Crest value, t: duration

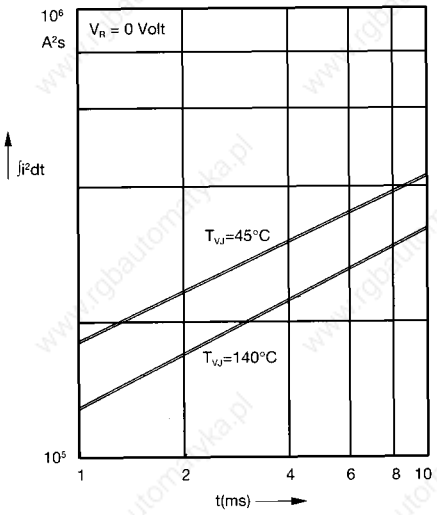



Fig. 4 $\int i^2dt$ versus time (1-10 ms)

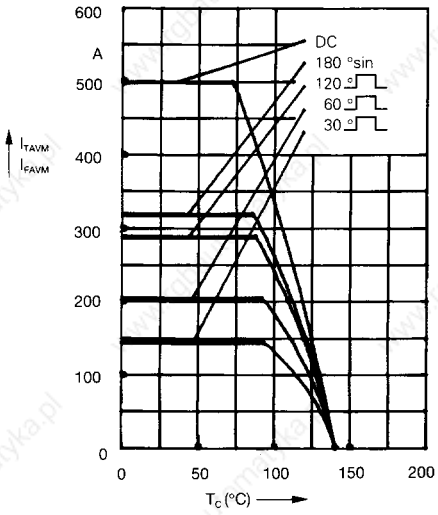



Fig. 4a Maximum forward current at case temperature

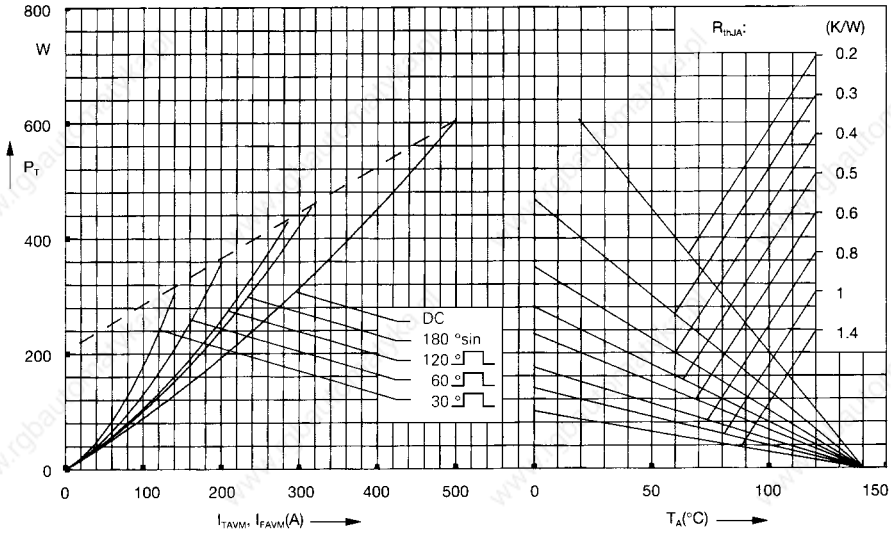



Fig. 5 Power dissipation versus on-state current and ambient temperature (per thyristor or diode)

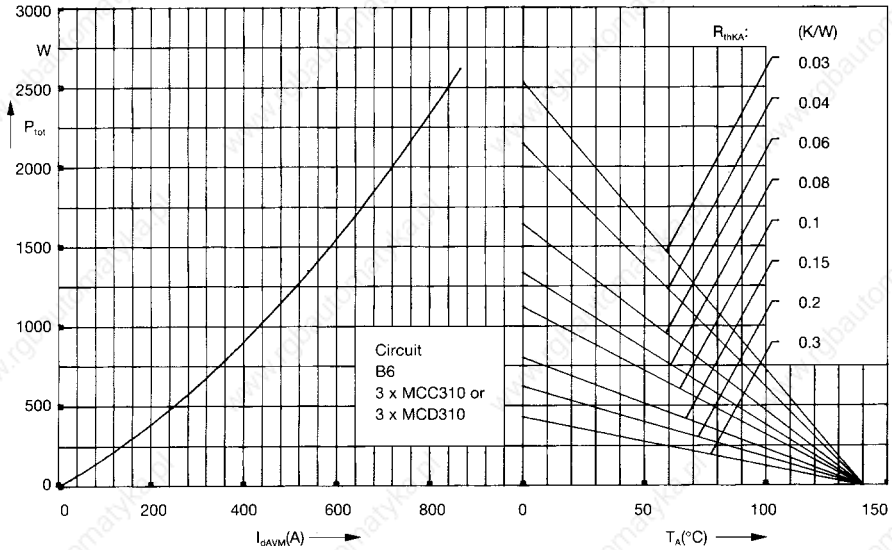



Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

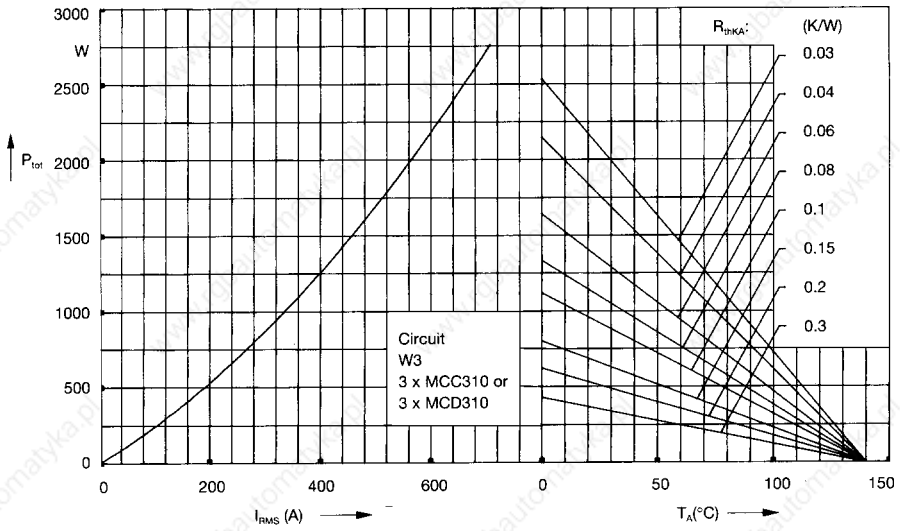



Fig. 7 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

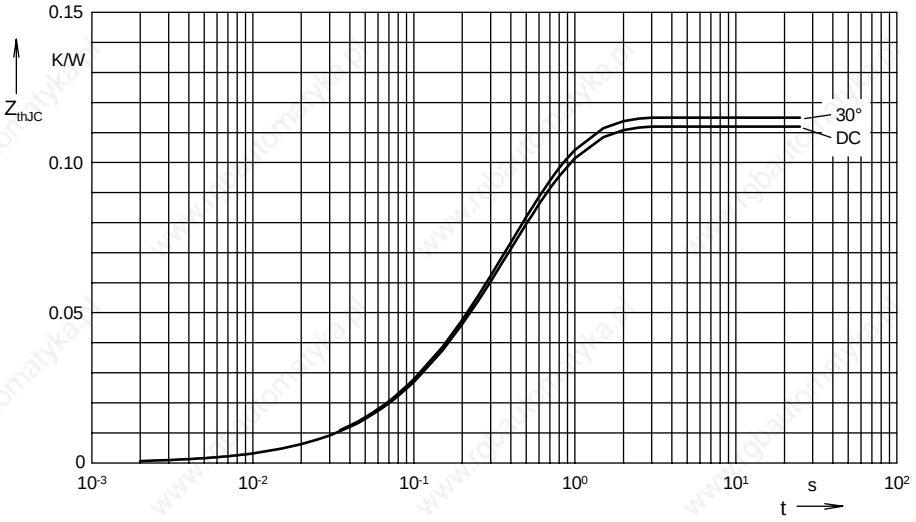



Fig. 8 Transient thermal impedance junction to case (per thyristor or diode)

$R_{thJC}$ for various conduction angles d:

| d | $R_{thJC}$ (K/W) |
|---|---|
| DC | 0.112 |
| 180°C | 0.113 |
| 120°C | 0.114 |
| 60°C | 0.115 |
| 30°C | 0.115 |

Constants for $Z_{thJC}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.003 | 0.099 |
| 2 | 0.0143 | 0.168 |
| 3 | 0.0947 | 0.456 |

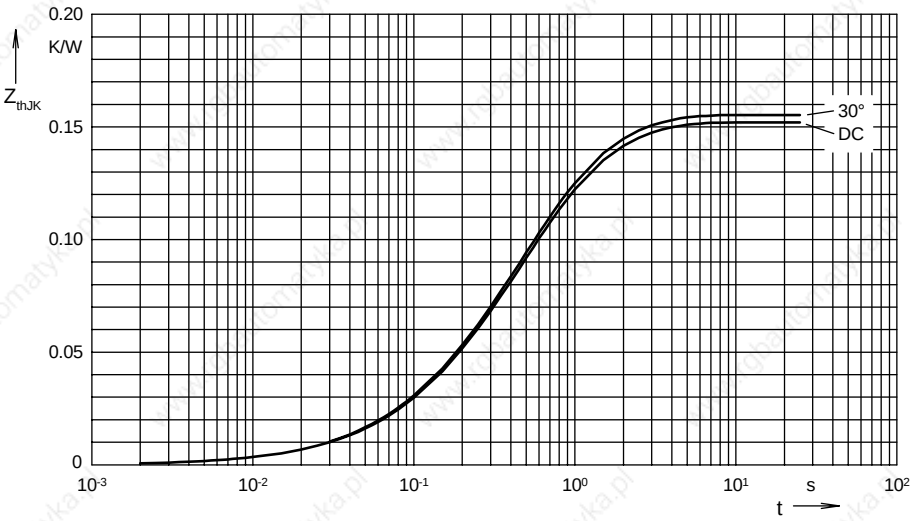



Fig. 9 Transient thermal impedance junction to heatsink (per thyristor or diode)

$R_{thJK}$ for various conduction angles d:

| d | $R_{thJK}$ (K/W) |
|---|---|
| DC | 0.152 |
| 180°C | 0.154 |
| 120°C | 0.154 |
| 60°C | 0.155 |
| 30°C | 0.155 |

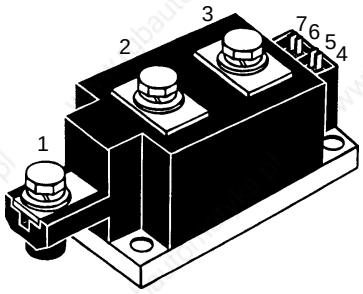
Constants for $Z_{thJK}$ calculation:

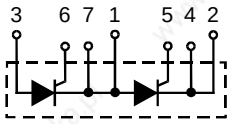
| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.003 | 0.099 |
| 2 | 0.0143 | 0.168 |
| 3 | 0.0947 | 0.456 |
| 4 | 0.04 | 1.36 |

# Thyristor Modules
# Thyristor/Diode Modules

$I_{TRMS}$ = 2x 520 A
$I_{TAVM}$ = 2x 320 A
$V_{RRM}$ = 1200-1800 V

| $V_{RSM}$ $V_{DSM}$ V | $V_{RRM}$ $V_{DRM}$ V | Type | |
|---|---|---|---|
| **1300** | **1200** | **MCC 312-12io1** | **MCD 312-12io1** |
| **1500** | **1400** | **MCC 312-14io1** | **MCD 312-14io1** |
| **1700** | **1600** | **MCC 312-16io1** | **MCD 312-16io1** |
| **1900** | **1800** | **MCC 312-18io1** | **MCD 312-18io1** |

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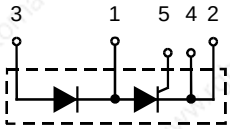



**MCD**

| Symbol | Test Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$, $I_{FRMS}$ | $T_{VJ} = T_{VJM}$ | | 520 | A |
| $I_{TAVM}$, $I_{FAVM}$ | $T_C$ = 85°C; 180° sine | | 320 | A |
| $I_{TSM}$, $I_{FSM}$ | $T_{VJ}$ = 45°C; | t = 10 ms (50 Hz) | 9200 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 10100 | A |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz) | 8000 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 8800 | A |
| $\int i^2dt$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz) | 423 000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 423 000 | $A^2s$ |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz) | 320 000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 321 000 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM}$ | repetitive, $I_T$ = 960 A | 100 | A/µs |
| | f =50 Hz, $t_P$ =200 µs | | | |
| | $V_D$ = 2/3 $V_{DRM}$ | | | |
| | $I_G$ = 1 A, | non repetitive, $I_T = I_{TAVM}$ | 500 | A/µs |
| | $di_G/dt$ = 1 A/µs | | | |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; $V_{DR}$ = 2/3 $V_{DRM}$ | | 1000 | V/µs |
| | $R_{GK}$ = ∞; method 1 (linear voltage rise) | | | |
| $P_{GM}$ | $T_{VJ} = T_{VJM}$ | $t_P$ = 30 µs | 120 | W |
| | $I_T = I_{TAVM}$ | $t_P$ = 500 µs | 60 | W |
| $P_{GAV}$ | | | 20 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40...+140 | °C |
| $T_{VJM}$ | | | 140 | °C |
| $T_{stg}$ | | | -40...+125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | t = 1 min | 3000 | V~ |
| | $I_{ISOL} \leq$ 1 mA | t = 1 s | 3600 | V~ |
| $M_d$ | Mounting torque (M6) | | 4.5-7/40-62 | Nm/lb.in. |
| | Terminal connection torque (M8) | | 11-13/97-115 | Nm/lb.in. |
| **Weight** | Typical including screws | | 750 | g |

Data according to IEC 60747 and refer to a single thyristor/diode unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions

**Features**
- International standard package
- Direct copper bonded $Al_2O_3$-ceramic with copper base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered E 72873
- Keyed gate/cathode twin pins

**Applications**
- Motor control, softstarter
- Power converter
- Heat and temperature control for industrial furnaces and chemical processes
- Lighting control
- Solid state switches

**Advantages**
- Simple mounting
- Improved temperature and power cycling
- Reduced protection circuits

| Symbol | Test Conditions | | Characteristic Values | |
|---|---|---|---|---|
| $I_{RRM}$, $I_{DRM}$ | $T_{VJ} = T_{VJM}$; $V_R = V_{RRM}$; $V_D = V_{DRM}$ | | 40 | mA |
| $V_T$, $V_F$ | $I_T$, $I_F$ = 600 A; $T_{VJ}$ = 25°C | | 1.32 | V |
| $V_{T0}$ | For power-loss calculations only ($T_{VJ}$ = 140°C) | | 0.8 | V |
| $r_T$ | | | 0.68 | mΩ |
| $V_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 2 | V |
| | | $T_{VJ}$ = -40°C | 3 | V |
| $I_{GT}$ | $V_D$ = 6 V; | $T_{VJ}$ = 25°C | 150 | mA |
| | | $T_{VJ}$ = -40°C | 220 | mA |
| $V_{GD}$ | $T_{VJ} = T_{VJM}$; | $V_D$ = 2/3 $V_{DRM}$ | 0.25 | V |
| $I_{GD}$ | $T_{VJ} = T_{VJM}$; | $V_D$ = 2/3 $V_{DRM}$ | 10 | mA |
| $I_L$ | $T_{VJ}$ = 25°C; $t_P$ = 30 µs; $V_D$ = 6 V<br>$I_G$ = 0.45 A; $di_G/dt$ = 0.45 A/µs | | 200 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK}$ = ∞ | | 150 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D$ = 1/2 $V_{DRM}$<br>$I_G$ = 1 A; $di_G/dt$ = 1 A/µs | | 2 | µs |
| $t_q$ | $T_{VJ} = T_{VJM}$; $I_T$ = 300 A, $t_P$ = 200 µs; -di/dt = 10 A/µs typ.<br>$V_R$ = 100 V; dv/dt = 50 V/µs; $V_D$ = 2/3 $V_{DRM}$ | | 200 | µs |
| $Q_S$ | $T_{VJ}$ = 125°C; $I_T$, $I_F$ = 300 A; -di/dt = 50 A/µs | | 760 | µC |
| $I_{RM}$ | | | 275 | A |
| $R_{thJC}$ | per thyristor (diode); DC current | other values see Fig. 8/9 | 0.12 | K/W |
| | per module | | 0.06 | K/W |
| $R_{thJK}$ | per thyristor (diode); DC current | | 0.16 | K/W |
| | per module | | 0.08 | K/W |
| $d_S$ | Creeping distance on surface | | 12.7 | mm |
| $d_A$ | Creepage distance in air | | 9.6 | mm |
| a | Maximum allowable acceleration | | 50 | m/s² |

Optional accessories for modules
Keyed Gate/Cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red
Type **ZY 180 L** (L = Left for pin pair 4/5) } UL 758, style 1385,
Type **ZY 180 R** (R = Right for pin pair 6/7) } CSA class 5851, guide 460-1-1

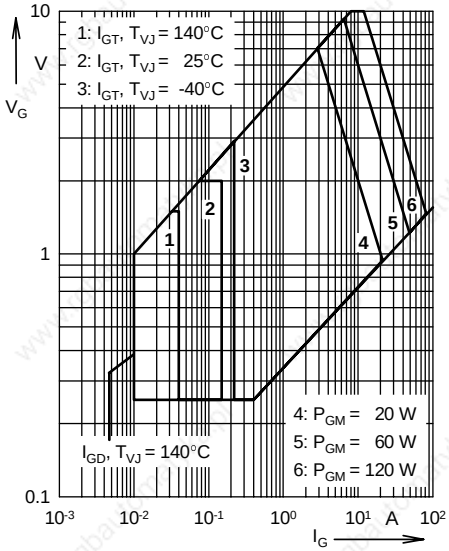



Fig. 1 Gate trigger characteristics

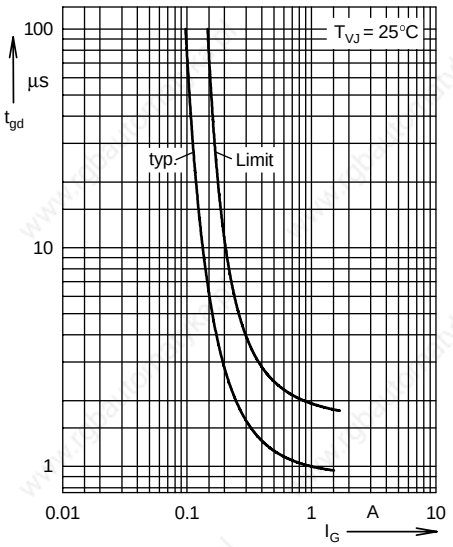
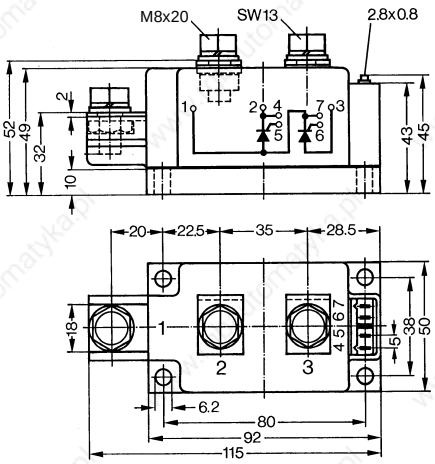



Fig. 2 Gate trigger delay time

**Dimensions in mm (1 mm = 0.0394")**

**MCC**

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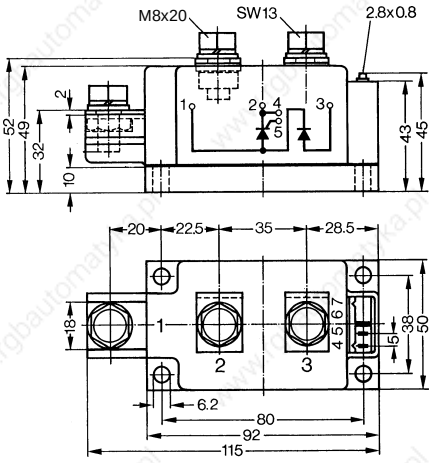


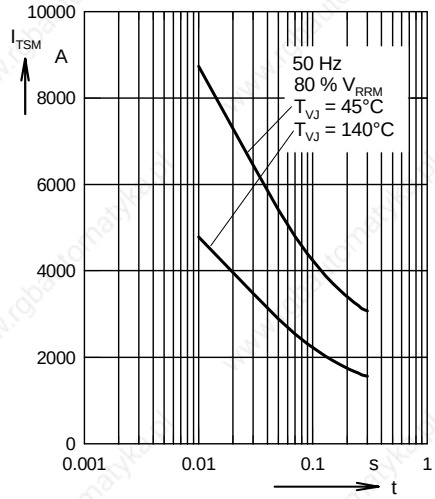



Fig. 3 Surge overload current
$I_{TSM}$, $I_{FSM}$: Crest value, t: duration

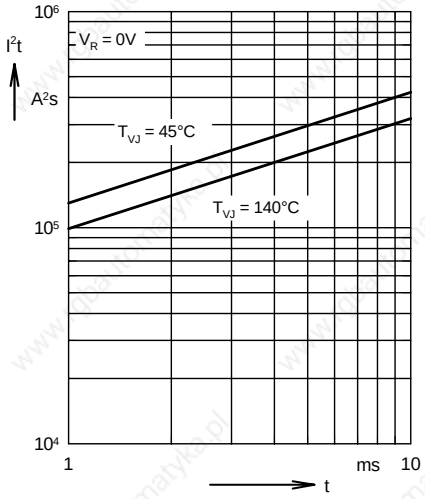



Fig. 4 $I^2t$ versus time (1-10 ms)

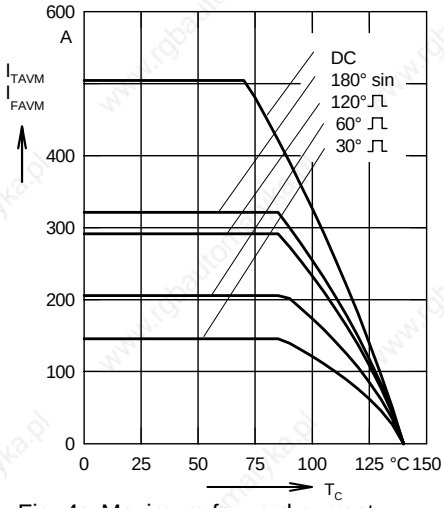



Fig. 4a Maximum forward current at case temperature

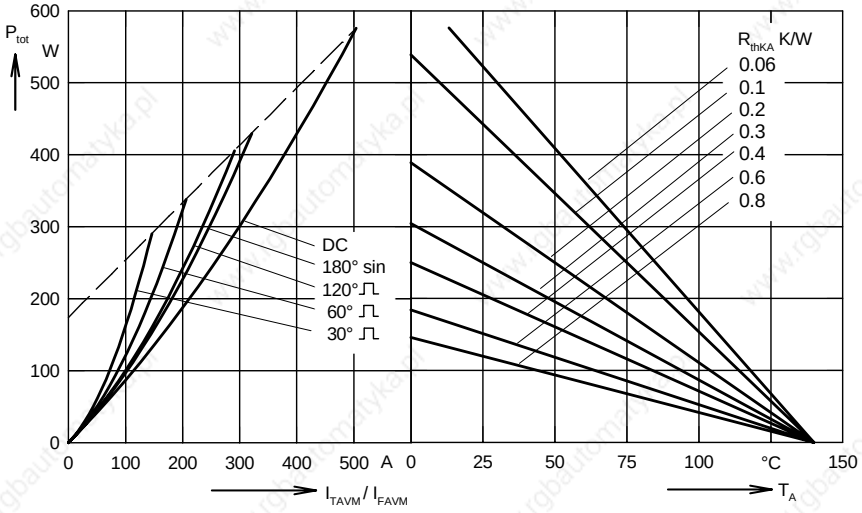



Fig. 5 Power dissipation versus on-state current and ambient temperature (per thyristor or diode)

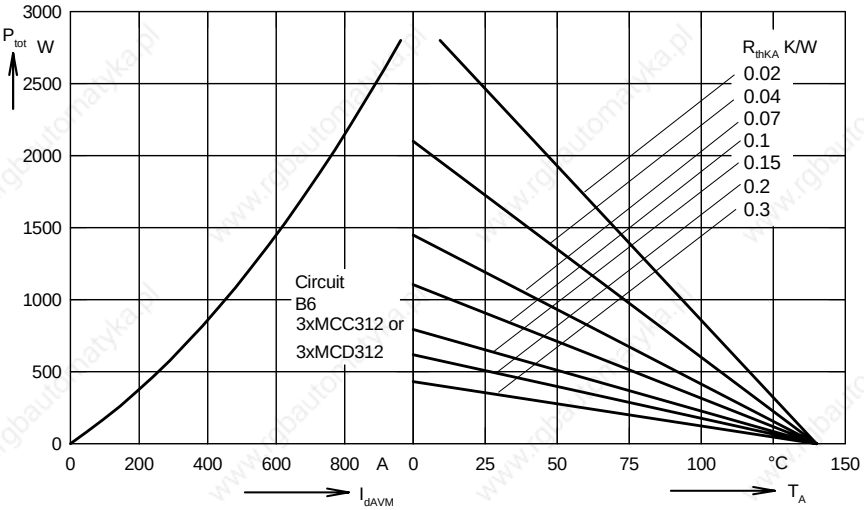



Fig. 6 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

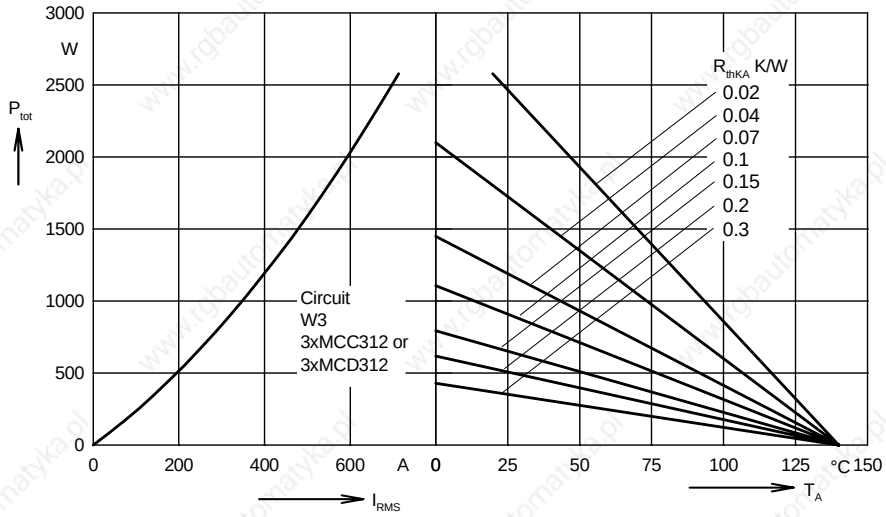



Fig. 7 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

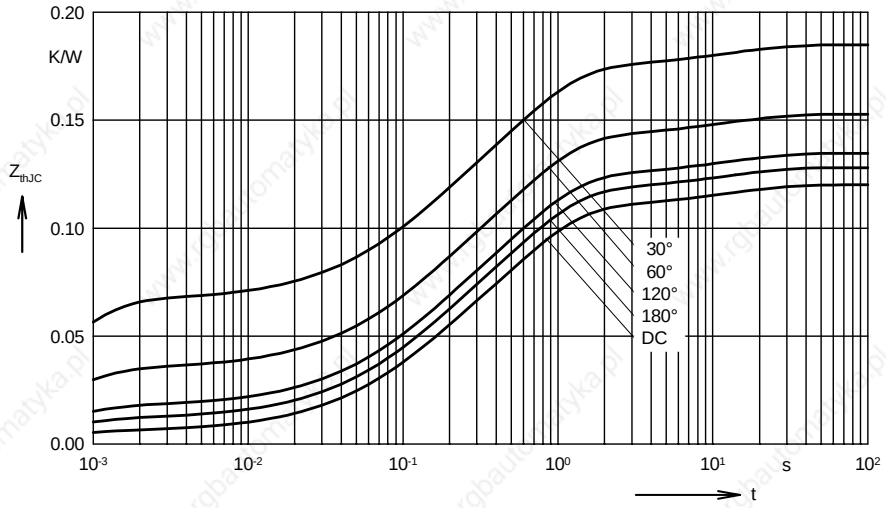



Fig. 8 Transient thermal impedance junction to case (per thyristor or diode)

$R_{thJC}$ for various conduction angles d:

| d | $R_{thJC}$ (K/W) |
|---|---|
| DC | 0.120 |
| 180° | 0.128 |
| 120° | 0.135 |
| 60° | 0.153 |
| 30° | 0.185 |

Constants for $Z_{thJC}$ calculation:

| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0058 | 0.00054 |
| 2 | 0.031 | 0.098 |
| 3 | 0.072 | 0.54 |
| 4 | 0.0112 | 12 |

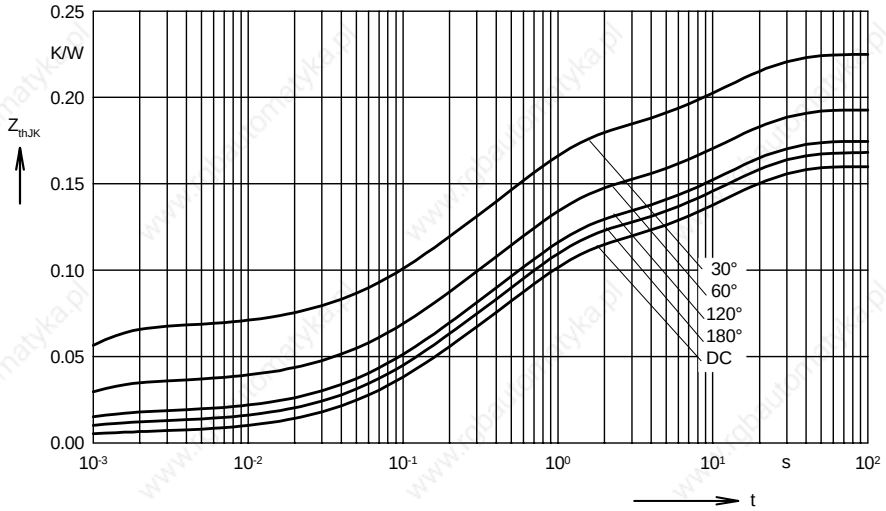



Fig. 9 Transient thermal impedance junction to heatsink (per thyristor or diode)

$R_{thJK}$ for various conduction angles d:

| d | $R_{thJK}$ (K/W) |
|---|---|
| DC | 0.160 |
| 180° | 0.168 |
| 120° | 0.175 |
| 60° | 0.193 |
| 30° | 0.225 |

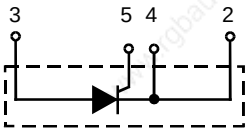
Constants for $Z_{thJK}$ calculation:

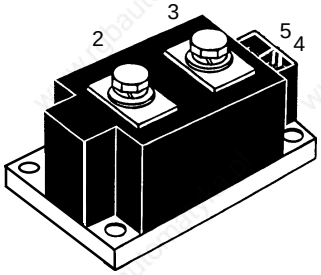
| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0058 | 0.00054 |
| 2 | 0.031 | 0.098 |
| 3 | 0.072 | 0.54 |
| 4 | 0.0112 | 12 |
| 5 | 0.04 | 12 |

# High Power Single Thyristor Module

$I_{TRMS}$ = 750 A
$I_{TAV}$ = 464 A
$V_{RRM}$ = 2000-2200 V

| $V_{RSM}$ $V_{DSM}$ V | $V_{RRM}$ $V_{DRM}$ V | Type |
|---|---|---|
| 2100 | 2000 | MCO 450-20io1 |
| 2300 | 2200 | MCO 450-22io1 |




| Symbol | Test Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$ | $T_{VJ} = T_{VJM}$ | | 750 | A |
| $I_{TAV}$ | $T_C$ = 85°C; 180° sine | | 464 | A |
| $I_{TSM}$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz) | 15000 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 16000 | A |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz) | 13000 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 14400 | A |
| $I^2t$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz) | 1125000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 1062000 | $A^2s$ |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz) | 845000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 813000 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; f = 50 Hz, $t_P$ = 200 µs; $V_D$ = 2/3 $V_{DRM}$ | repetitive, $I_T$ = 960 A | 100 | A/µs |
| | $I_G$ = 1 A, $di_G/dt$ = 1 A/µs | non repetitive, $I_T = I_{TAVM}$ | 500 | A/µs |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; $V_{DR}$ = 2/3 $V_{DRM}$; $R_{GK}$ = ∞; method 1 (linear voltage rise) | | 1000 | V/µs |
| $P_{GM}$ | $T_{VJ} = T_{VJM}$ | $t_P$ = 30 µs | 120 | W |
| | $I_T = I_{TAVM}$ | $t_P$ = 500 µs | 60 | W |
| $P_{GAV}$ | | | 30 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40...130 | °C |
| $T_{VJM}$ | | | 130 | °C |
| $T_{stg}$ | | | -40...125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | t = 1 min | 3000 | V~ |
| | $I_{ISOL} \leq$ 1 mA | t = 1 s | 3600 | V~ |
| $M_d$ | Mounting torque (M6) | | 4.5-7/40-62 | Nm/lb.in. |
| | Terminal connection torque (M8) | | 11-13/97-115 | Nm/lb.in. |
| Weight | Typical including screws | | 650 | g |

### Features

- Direct copper bonded $Al_2O_3$ -ceramic with copper base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL applied
- Keyed gate/cathode twin pins

### Applications

- Motor control, soft starter
- Power converter
- Heat and temperature control for industrial furnaces and chemical processes
- Lighting control
- Solid state switches

### Advantages

- Improved temperature and power cycling
- Reduced protection circuits

Data according to IEC 60747 refer to a single thyristor/diode unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions

030

| Symbol | Test Conditions | Characteristic Values | |
|---|---|---|---|
| $I_{RRM}$ | $T_{VJ}$ = $T_{VJM}$; $V_R$ = $V_{RRM}$ | 40 | mA |
| $V_T$ | $I_T$ = 600 A; $T_{VJ}$ = 25°C | 1.15 | V |
| $V_{T0}$ | For power-loss calculations only ($T_{VJ}$ = $T_{VJM}$) | 0.77 | V |
| $r_T$ | | 0.42 | mΩ |
| $V_{GT}$ | $V_D$ = 6 V; $T_{VJ}$ = 25°C | 2 | V |
| | $T_{VJ}$ = -40°C | 3 | V |
| $I_{GT}$ | $V_D$ = 6 V; $T_{VJ}$ = 25°C | 300 | mA |
| | $T_{VJ}$ = -40°C | 400 | mA |
| $V_{GD}$ | $T_{VJ}$ = $T_{VJM}$; $V_D$ = 2/3 $V_{DRM}$ | 0.25 | V |
| $I_{GD}$ | $T_{VJ}$ = $T_{VJM}$; $V_D$ = 2/3 $V_{DRM}$ | 10 | mA |
| $I_L$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $t_P$ = 30 µs<br>$di_G/dt$ = 1 A/µs; $I_G$ = 1 A | 400 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK}$ = ∞ | 300 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D$ = 1/2 $V_{DRM}$<br>$di_G/dt$ = 1 A/µs; $I_G$ = 1 A | 2 | µs |
| $t_q$ | $T_{VJ}$ = $T_{VJM}$; $V_R$ = 100 V; $V_D$ = 2/3 $V_{DRM}$; $t_P$ = 200 µs<br>dv/dt = 50 V/µs; $I_T$ = 500 A; -di/dt = 10 A/µs | typ. 350 | µs |
| $R_{thJC}$ | DC current | 0.072 | K/W |
| $R_{thJK}$ | DC current | 0.096 | K/W |
| $d_S$ | Creep distance on surface | 12.7 | mm |
| $d_A$ | Strike distance in air | 9.6 | mm |
| a | Maximum allowable acceleration | 50 | $m/s^2$ |

Optional accessories for modules
Keyed Gate/Cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red
Type **ZY 180 L** (L = Left for pin pair 4/5) { UL 758, style 1385, File E 38136, CSA class 5851, guide 460-1-1, appl. 41234

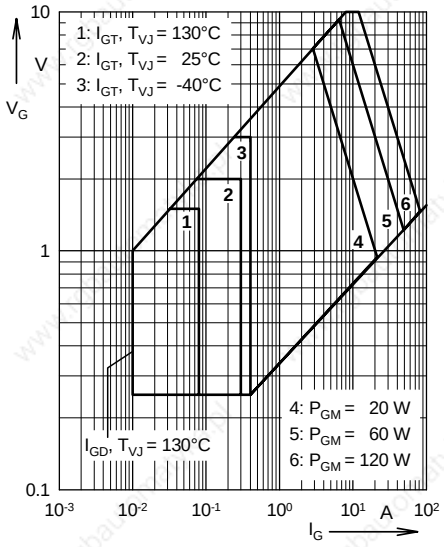



Fig. 1 Gate trigger characteristics

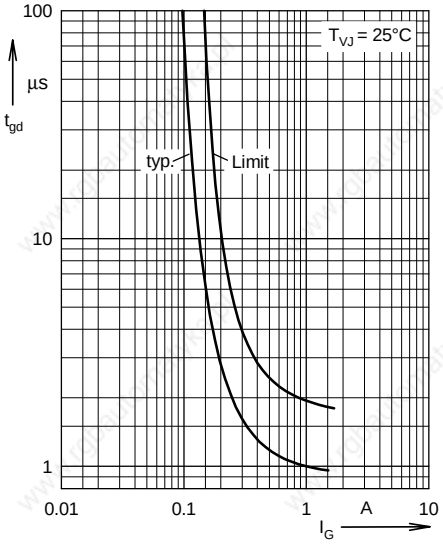
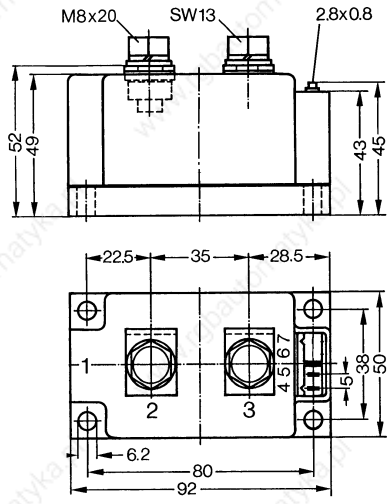



Fig. 2 Gate trigger delay time

**Dimensions in mm (1 mm = 0.0394")**



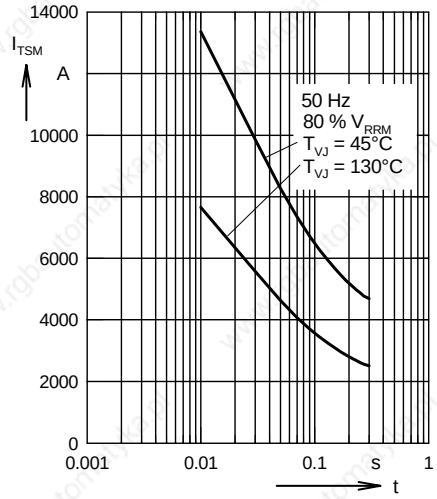



Fig. 3 Surge overload current
$I_{TSM}$: Crest value, t: duration

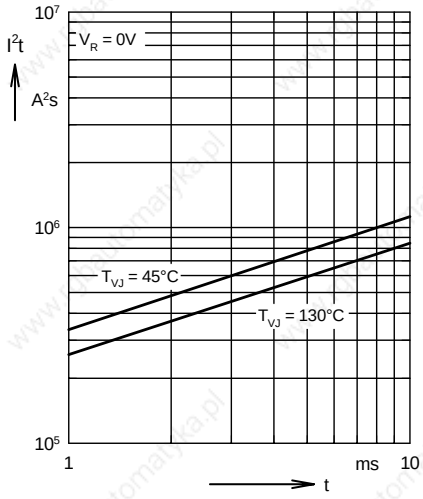



Fig. 4 $I^2t$ versus time (1-10 ms)

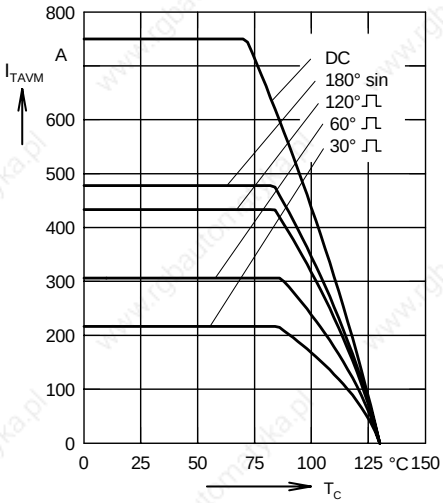



Fig. 5 Maximum forward current at case temperature

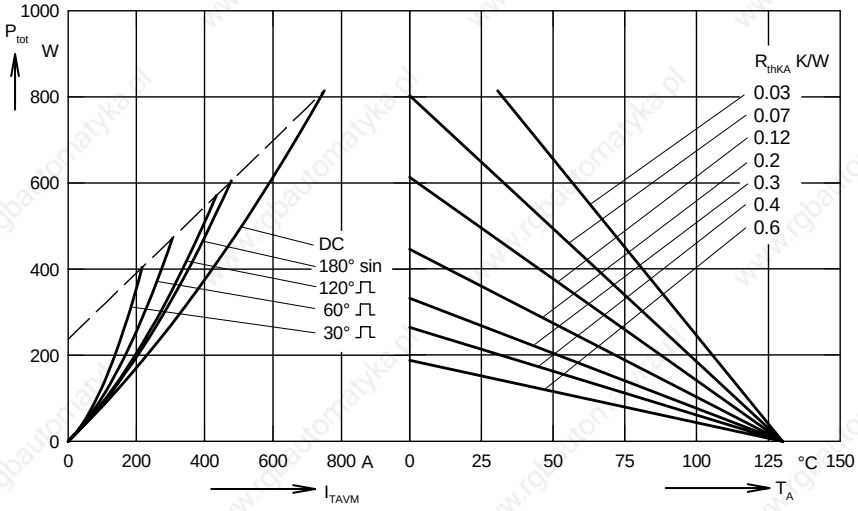



Fig. 6 Power dissipation versus on-state current and ambient temperature

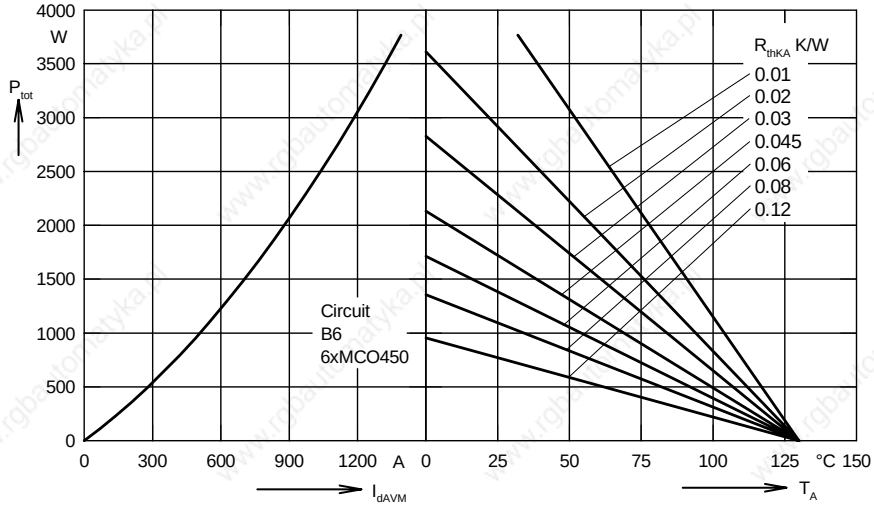



Fig. 7 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

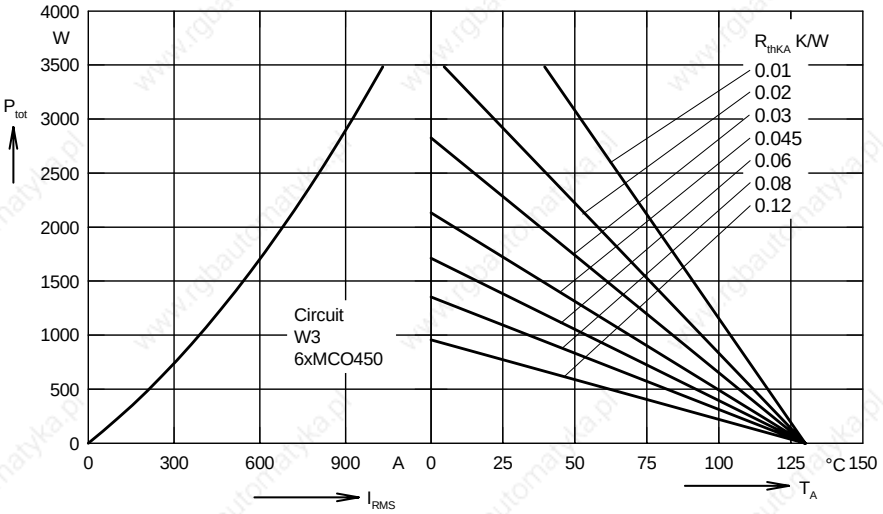



Fig. 8 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

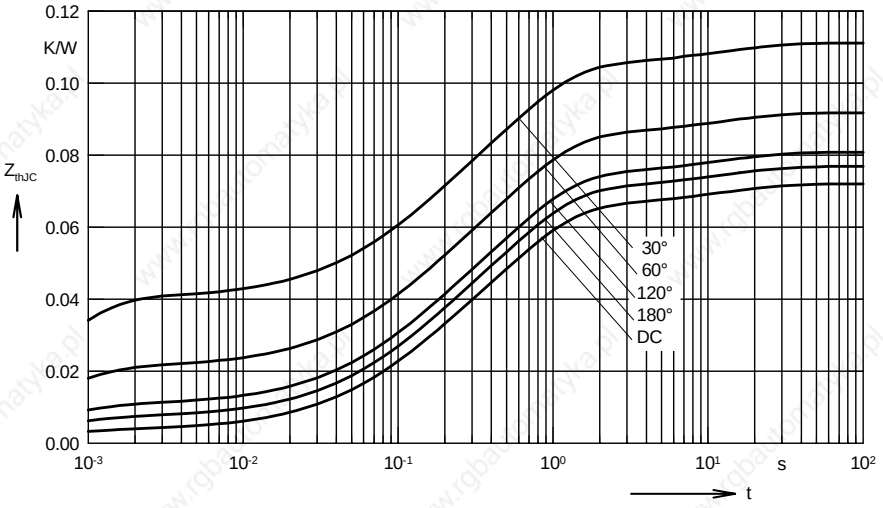



Fig. 9 Transient thermal impedance junction to case

$R_{thJC}$ 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 |

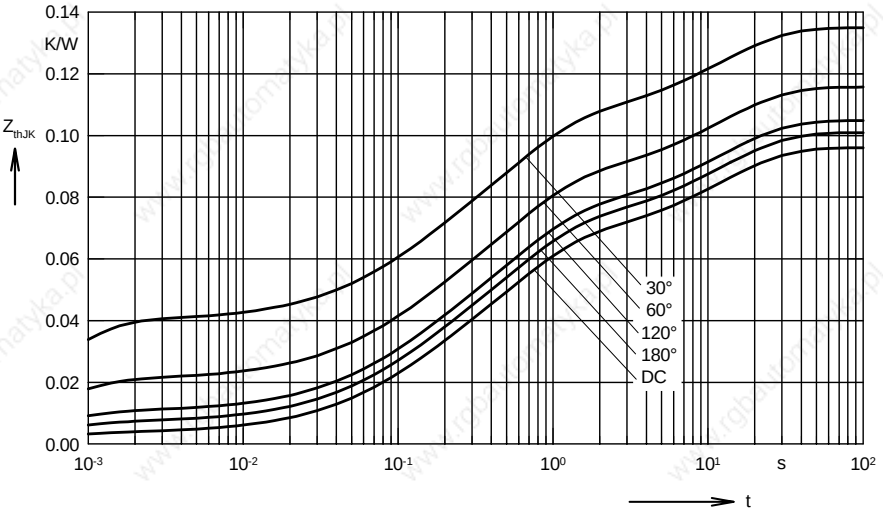



Fig.10 Transient thermal impedance junction to heatsink

$R_{thJK}$ 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 |

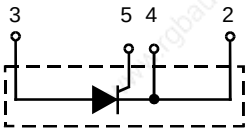
Constants for $Z_{thJK}$ calculation:

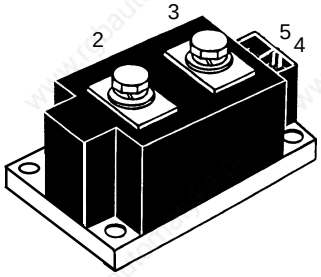
| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0035 | 0.0054 |
| 2 | 0.0186 | 0.098 |
| 3 | 0.0432 | 0.54 |
| 4 | 0.0067 | 12 |
| 5 | 0.024 | 12 |

# High Power Thyristor Modules

$I_{TRMS}$ = 880 A
$I_{T(AV)M}$ = 560 A
$V_{RRM}$ = 1200-1800 V

| $V_{RSM}$ $V_{DSM}$ V | $V_{RRM}$ $V_{DRM}$ V | Type |
|---|---|---|
| 1300 | 1200 | MCO 500-12io1 |
| 1500 | 1400 | MCO 500-14io1 |
| 1700 | 1600 | MCO 500-16io1 |
| 1900 | 1800 | MCO 500-18io1 |




| Symbol | Test Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$ | $T_{VJ} = T_{VJM}$ | | 880 | A |
| $I_{T(AV)M}$ | $T_C$ = 85°C; 180° sine | | 560 | A |
| $I_{TSM}$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz) | 17000 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 16000 | A |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz) | 13000 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 14400 | A |
| $I^2t$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz) | 1445000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 1062000 | $A^2s$ |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz) | 845000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 813000 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; $f$ = 50 Hz, $t_P$ = 200 µs; $V_D$ = 2/3 $V_{DRM}$ | repetitive, $I_T$ = 960 A | 100 | A/µs |
| | $I_G$ = 1 A, $di_G/dt$ = 1 A/µs | non repetitive, $I_T = I_{T(AV)M}$ | 500 | A/µs |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; $V_{DR}$ = 2/3 $V_{DRM}$; $R_{GK}$ = ∞; method 1 (linear voltage rise) | | 1000 | V/µs |
| $P_{GM}$ | $T_{VJ} = T_{VJM}$ | $t_P$ = 30 µs | 120 | W |
| | $I_T = I_{T(AV)M}$ | $t_P$ = 500 µs | 60 | W |
| $P_{GAV}$ | | | 30 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40...140 | °C |
| $T_{VJM}$ | | | 140 | °C |
| $T_{stg}$ | | | -40...125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | t = 1 min | 3000 | V~ |
| | $I_{ISOL} \le$ 1 mA | t = 1 s | 3600 | V~ |
| $M_d$ | Mounting torque (M6) | | 4.5-7/40-62 | Nm/lb.in. |
| | Terminal connection torque (M8) | | 11-13/97-115 | Nm/lb.in. |
| Weight | Typical including screws | | 650 | g |

**Features**
- International standard package
- Direct copper bonded $Al_2O_3$-ceramic with copper base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL registered E 72873
- Keyed gate/cathode twin pins

**Applications**
- Motor control, softstarter
- Power converter
- Heat and temperature control for industrial furnaces and chemical processes
- Lighting control
- Solid state switches

**Advantages**
- Simple mounting
- Improved temperature and power cycling
- Reduced protection circuits

Data according to IEC 60747 refer to a single thyristor/diode unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions

030

| Symbol | Test Conditions | Characteristic Values | |
|---|---|---|---|
| $I_{RRM}$ | $T_{VJ}$ = $T_{VJM}$; $V_R$ = $V_{RRM}$ | 40 | mA |
| $V_T$ | $I_T$ = 1200 A; $T_{VJ}$ = 25°C | 1.3 | V |
| $V_{T0}$ | For power-loss calculations only ($T_{VJ}$ = $T_{VJM}$) | 0.8 | V |
| $r_T$ | | 0.38 | mΩ |
| $V_{GT}$ | $V_D$ = 6 V; $T_{VJ}$ = 25°C | 2 | V |
| | $T_{VJ}$ = -40°C | 3 | V |
| $I_{GT}$ | $V_D$ = 6 V; $T_{VJ}$ = 25°C | 300 | mA |
| | $T_{VJ}$ = -40°C | 400 | mA |
| $V_{GD}$ | $T_{VJ}$ = $T_{VJM}$; $V_D$ = 2/3 $V_{DRM}$ | 0.25 | V |
| $I_{GD}$ | $T_{VJ}$ = $T_{VJM}$; $V_D$ = 2/3 $V_{DRM}$ | 10 | mA |
| $I_L$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $t_P$ = 30 µs<br>$di_G/dt$ = 1 A/µs; $I_G$ = 1 A | 400 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK}$ = ∞ | 300 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D$ = 1/2 $V_{DRM}$<br>$di_G/dt$ = 1 A/µs; $I_G$ = 1 A | 2 | µs |
| $t_q$ | $T_{VJ}$ = $T_{VJM}$; $V_R$ = 100 V; $V_D$ = 2/3 $V_{DRM}$; $t_P$ = 200 µs<br>dv/dt = 50 V/µs; $I_T$ = 500 A; -di/dt = 10 A/µs | typ. 350 | µs |
| $R_{thJC}$ | DC current | 0.072 | K/W |
| $R_{thJK}$ | DC current | 0.096 | K/W |
| $d_S$ | Creeping distance on surface | 12.7 | mm |
| $d_A$ | Creepage distance in air | 9.6 | mm |
| a | Maximum allowable acceleration | 50 | $m/s^2$ |

Optional accessories for modules
Keyed Gate/Cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red
Type **ZY 180 L** (L = Left for pin pair 4/5) { UL 758, style 1385, CSA class 5851, guide 460-1-1

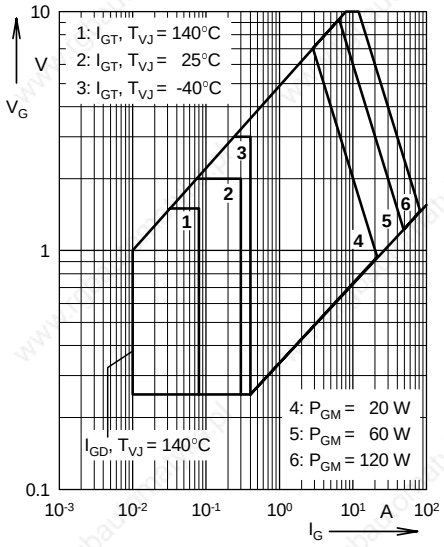



Fig. 1 Gate trigger characteristics

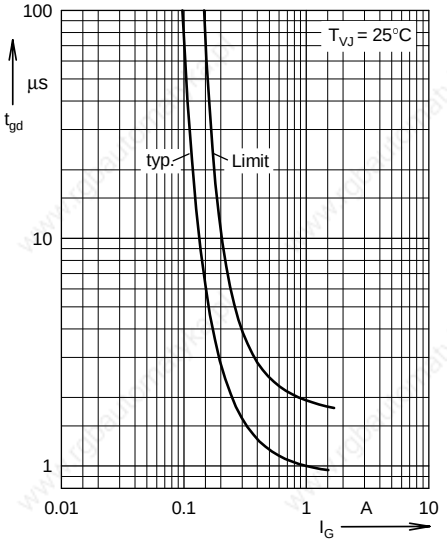
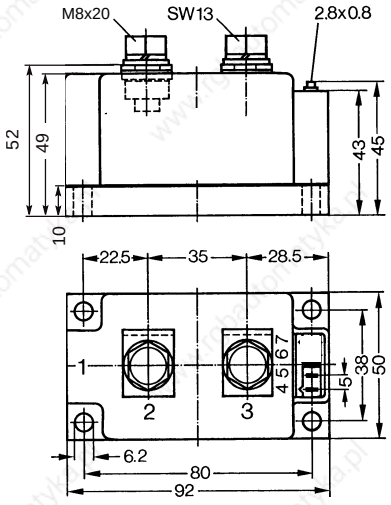



Fig. 2 Gate trigger delay time

**Dimensions in mm (1 mm = 0.0394")**



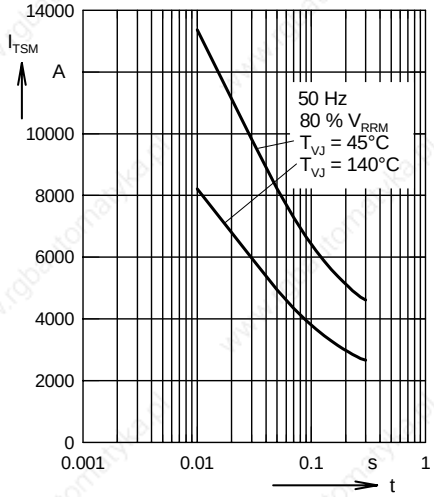



Fig. 3 Surge overload current
$I_{TSM}$, $I_{FSM}$: Crest value, t: duration

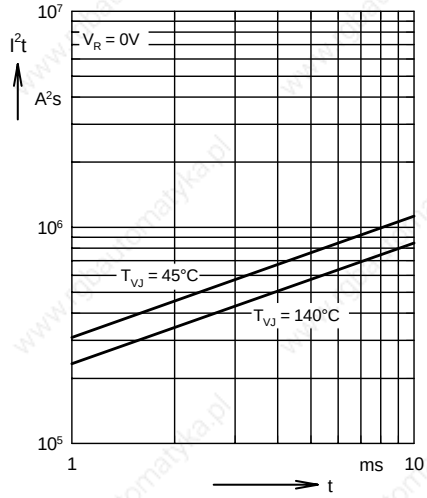



Fig. 4 $\int i^2dt$ versus time (1-10 ms)

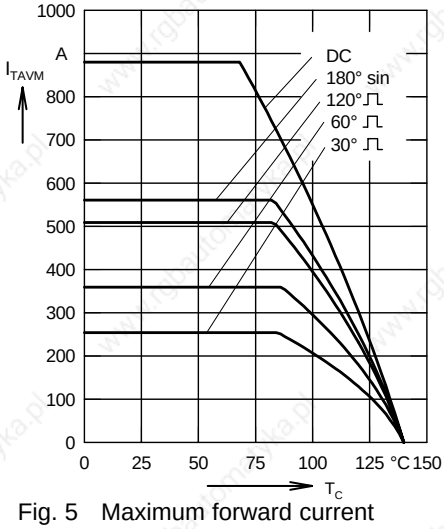



Fig. 5 Maximum forward current at case temperature

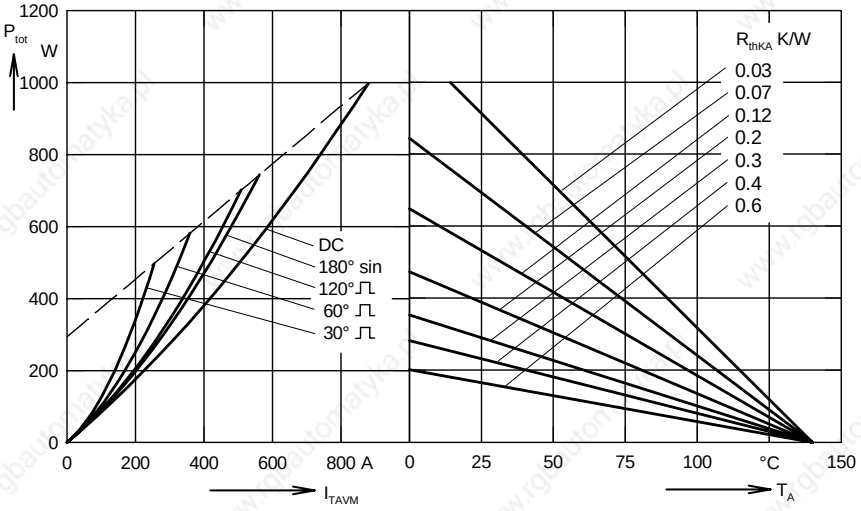



Fig. 6 Power dissipation versus on-state current and ambient temperature

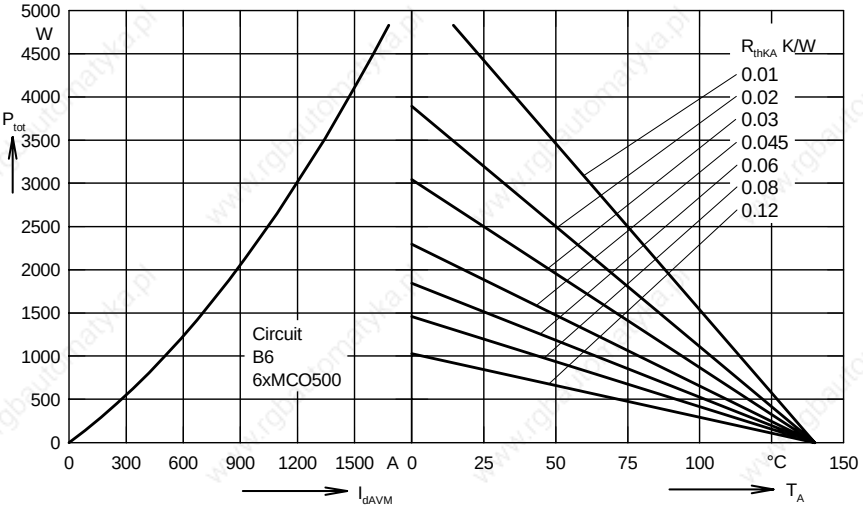



Fig. 7 Three phase rectifier bridge: Power dissipation versus direct output current and ambient temperature

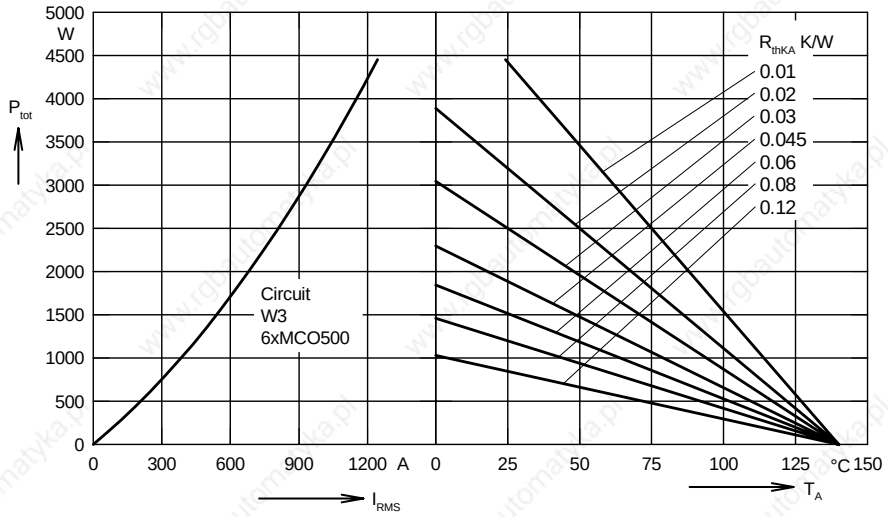



Fig. 8 Three phase AC-controller: Power dissipation versus RMS output current and ambient temperature

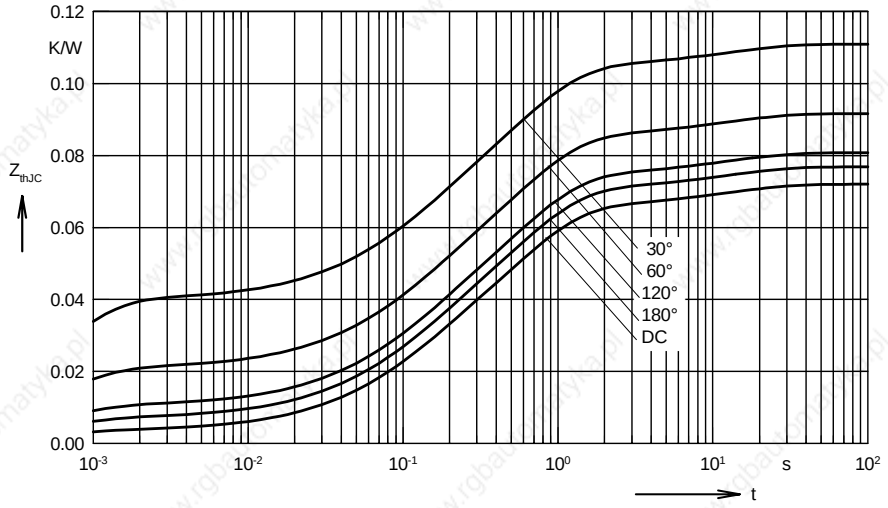



Fig. 9 Transient thermal impedance junction to case (per thyristor)

$R_{thJC}$ 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 |

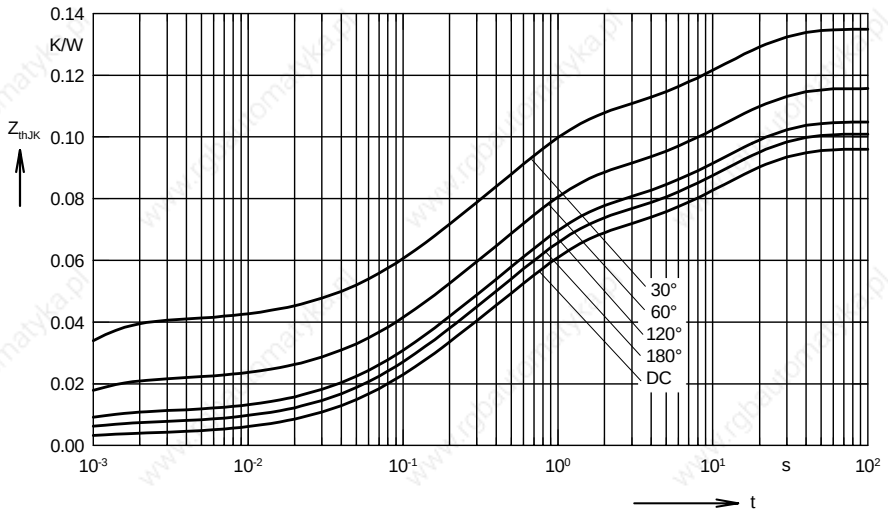



Fig.10 Transient thermal impedance junction to heatsink (per thyristor)

$R_{thJK}$ 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:

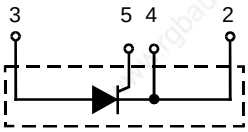
| i | $R_{thi}$ (K/W) | $t_i$ (s) |
|---|---|---|
| 1 | 0.0035 | 0.0054 |
| 2 | 0.0186 | 0.098 |
| 3 | 0.0432 | 0.54 |
| 4 | 0.0067 | 12 |
| 5 | 0.024 | 12 |

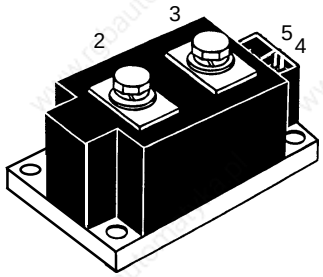
# High Power Single Thyristor Module

$I_{TRMS}$ = 928 A
$I_{TAV}$ = 600 A
$V_{RRM}$ = 2000-2200 V

Preliminary data

| $V_{RSM}$ $V_{DSM}$ V | $V_{RRM}$ $V_{DRM}$ V | Type |
|---|---|---|
| 2100 | 2000 | MCO 600-20io1 |
| 2300 | 2200 | MCO 600-22io1 |




| Symbol | Test Conditions | | Maximum Ratings | |
|---|---|---|---|---|
| $I_{TRMS}$ | $T_{VJ} = T_{VJM}$ | | 928 | A |
| $I_{TAV}$ | $T_C$ = 85°C; 180° sine | | 600 | A |
| $I_{TSM}$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz) | 15000 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 16000 | A |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz) | 13000 | A |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 14400 | A |
| $I^2t$ | $T_{VJ}$ = 45°C | t = 10 ms (50 Hz) | 1125000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 1062000 | $A^2s$ |
| | $T_{VJ} = T_{VJM}$ | t = 10 ms (50 Hz) | 845000 | $A^2s$ |
| | $V_R$ = 0 | t = 8.3 ms (60 Hz) | 813000 | $A^2s$ |
| $(di/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; $V_D$ = 2/3 $V_{DRM}$ | repetitive, $I_T$ = 960 A | 100 | A/µs |
| | f = 50 Hz, $t_P$ = 200 µs | | | |
| | $I_G$ = 1 A, $di_G/dt$ = 1 A/µs | non repetitive, $I_T = I_{TAVM}$ | 500 | A/µs |
| $(dv/dt)_{cr}$ | $T_{VJ} = T_{VJM}$; $V_{DR}$ = 2/3 $V_{DRM}$ | | 1000 | V/µs |
| | $R_{GK}$ = ∞; method 1 (linear voltage rise) | | | |
| $P_{GM}$ | $T_{VJ} = T_{VJM}$ | $t_P$ = 30 µs | 120 | W |
| | $I_T = I_{TAVM}$ | $t_P$ = 500 µs | 60 | W |
| $P_{GAV}$ | | | 30 | W |
| $V_{RGM}$ | | | 10 | V |
| $T_{VJ}$ | | | -40...140 | °C |
| $T_{VJM}$ | | | 140 | °C |
| $T_{stg}$ | | | -40...125 | °C |
| $V_{ISOL}$ | 50/60 Hz, RMS | t = 1 min | 3000 | V~ |
| | $I_{ISOL} \leq$ 1 mA | t = 1 s | 3600 | V~ |
| $M_d$ | Mounting torque (M6) | | 4.5-7/40-62 | Nm/lb.in. |
| | Terminal connection torque (M8) | | 11-13/97-115 | Nm/lb.in. |
| Weight | Typical including screws | | 650 | g |

### Features

- Direct copper bonded $Al_2O_3$ -ceramic with copper base plate
- Planar passivated chips
- Isolation voltage 3600 V~
- UL applied
- Keyed gate/cathode twin pins

### Applications

- Motor control, softstarter
- Power converter
- Heat and temperature control for industrial furnaces and chemical processes
- Lighting control
- Solid state switches

### Advantages

- Improved temperature and power cycling
- Reduced protection circuits

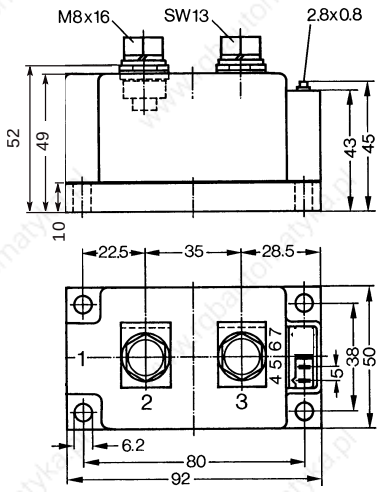
Data according to IEC 60747 and refer to a single thyristor/diode unless otherwise stated.
IXYS reserves the right to change limits, test conditions and dimensions

748

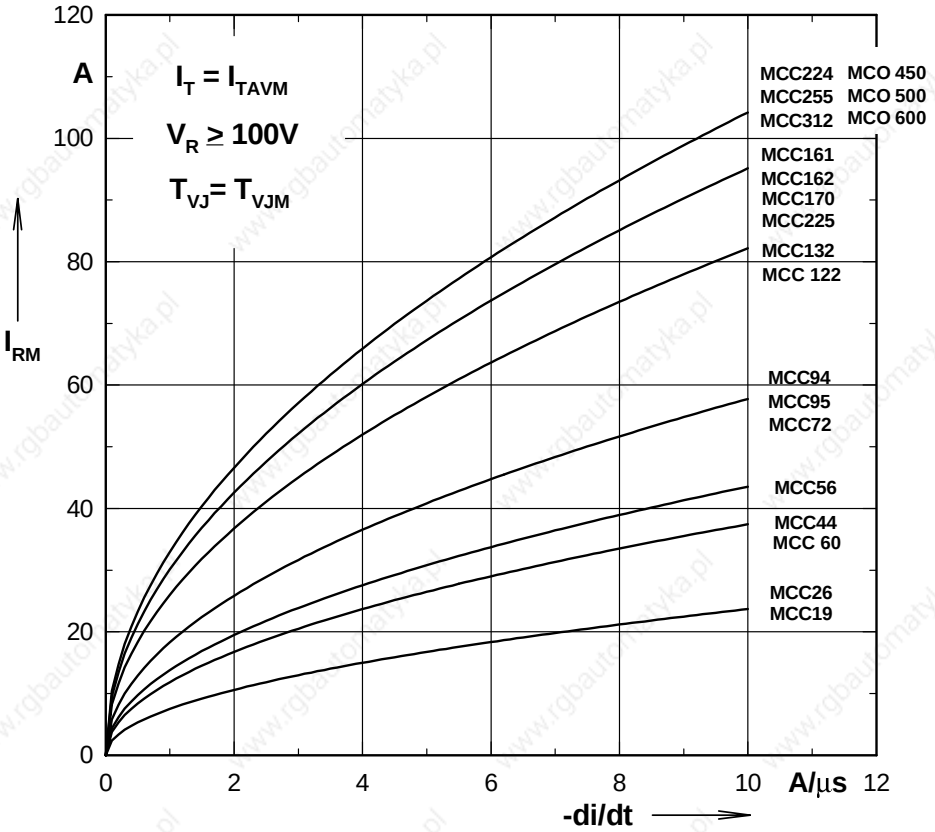
| Symbol | Test Conditions | Characteristic Values | |
|---|---|---|---|
| $I_{RRM}$ | $T_{VJ}$ = $T_{VJM}$; $V_R$ = $V_{RRM}$ | 60 | mA |
| $V_T$ | $I_T$ = 600 A; $T_{VJ}$ = 25°C | 1.15 | V |
| $V_{T0}$ | For power-loss calculations only ($T_{VJ}$ = $T_{VJM}$) | 0.77 | V |
| $r_T$ | | 0.42 | mΩ |
| $V_{GT}$ | $V_D$ = 6 V; $T_{VJ}$ = 25°C | 2 | V |
| | $T_{VJ}$ = -40°C | 3 | V |
| $I_{GT}$ | $V_D$ = 6 V; $T_{VJ}$ = 25°C | 300 | mA |
| | $T_{VJ}$ = -40°C | 400 | mA |
| $V_{GD}$ | $T_{VJ}$ = $T_{VJM}$; $V_D$ = 2/3 $V_{DRM}$ | 0.25 | V |
| $I_{GD}$ | $T_{VJ}$ = $T_{VJM}$; $V_D$ = 2/3 $V_{DRM}$ | 10 | mA |
| $I_L$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $t_P$ = 30 µs<br>$di_G/dt$ = 1 A/µs; $I_G$ = 1 A | 400 | mA |
| $I_H$ | $T_{VJ}$ = 25°C; $V_D$ = 6 V; $R_{GK}$ = ∞ | 300 | mA |
| $t_{gd}$ | $T_{VJ}$ = 25°C; $V_D$ = 1/2 $V_{DRM}$<br>$di_G/dt$ = 1 A/µs; $I_G$ = 1 A | 2 | µs |
| $t_q$ | $T_{VJ}$ = $T_{VJM}$; $V_R$ = 100 V; $V_D$ = 2/3 $V_{DRM}$; $t_P$ = 200 µs<br>dv/dt = 50 V/µs; $I_T$ = 500 A; -di/dt = 10 A/µs | typ. 350 | µs |
| $R_{thJC}$ | DC current | 0.065 | K/W |
| $R_{thJK}$ | DC current | 0.085 | K/W |
| $d_S$ | Creep distance on surface | 12.7 | mm |
| $d_A$ | Strike distance in air | 9.6 | mm |
| a | Maximum allowable acceleration | 50 | $m/s^2$ |

Optional accessories for modules
Keyed Gate/Cathode twin plugs with wire length = 350 mm, gate = yellow, cathode = red
Type **ZY 180 L** (L = Left for pin pair 4/5) { UL 758, style 1385, File E 38136, CSA class 5851, guide 460-1-1, appl. 41234

**Dimensions in mm (1 mm = 0.0394")**



## Peak reverse recovery current versus -di/dt




## Recommended RC snubber network against hole storage effect overvoltage

| Type | Supply Voltage $V_{vRMS}$ | | |
|---|---|---|---|
| | ≤ 250 V | ≤ 400 V | ≤ 575 V |
| MCC/MCD/MDD 19/26 | R = 68 Ω/6 W<br>C = 0.22 µF | R = 68 Ω/6 W<br>C = 0.22 µF | R = 100 Ω/10 W<br>C = 0.1 µF |
| MCC/MCD/MDD 44/56/60/72/94/95 | R = 33 Ω/10 W<br>C = 0.22 µF | R = 47 Ω/10 W<br>C = 0.22 µF | R = 68 Ω/10 W<br>C = 0.1 µF |
| MCC/MCD/MDD/MCO/MDO 122/132/142/161/162/170/ 172/220/225/250/255/310/ 312/450/500/600 | R = 33 Ω/25 W<br>C = 0.47 µF | R = 33 Ω/25 W<br>C = 0.47 µF | R = 47 Ω/25 W<br>C = 0.1 µF |

**Conditions**

f = 40 - 60 Hz
Short circuit voltage 4-6 %
Voltage safety factor 2.5