



# Thyristor

$V_{RRM} = 2 \times 1200 \text{ V}$

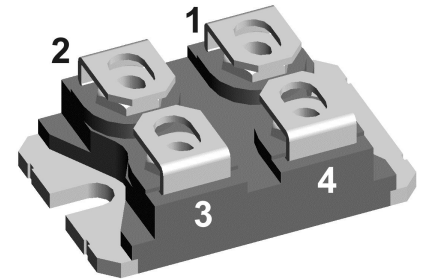
$I_{TAV} = 40 \text{ A}$

$V_T = 1.29 \text{ V}$

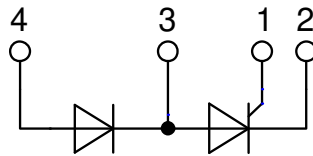
Phase leg

Part number

**MCD40-12io6**



Backside: isolated



### Features / Advantages:

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

### Applications:

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

### Package: SOT-227B (minibloc)

- Isolation Voltage: 3000 V~
- Industry standard outline
- RoHS compliant
- Epoxy meets UL 94V-0
- Base plate: Copper internally DCB isolated
- Advanced power cycling

### Disclaimer Notice

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| Rectifier      |  |   | Ratings                   |      |      |                   |
|----------------|--|---|---------------------------|------|------|-------------------|
| Symbol         | Definition   | Conditions  | min.                      | typ. | max. | Unit              |
| $V_{RSM/DSM}$  | max. non-repetitive reverse/forward blocking voltage | $T_{VJ} = 25^{\circ}C$  |                           |      | 1300 | V                 |
| $V_{RRM/DRM}$  | max. repetitive reverse/forward blocking voltage     | $T_{VJ} = 25^{\circ}C$  |                           |      | 1200 | V                 |
| $I_{RD}$       | reverse current, drain current                       | $V_{R/D} = 1200 V$  | $T_{VJ} = 25^{\circ}C$    |      | 100  | $\mu A$           |
|                |  | $V_{R/D} = 1200 V$  | $T_{VJ} = 125^{\circ}C$   |      | 6    | mA                |
| $V_T$          | forward voltage drop                                 | $I_T = 40 A$  | $T_{VJ} = 25^{\circ}C$    |      | 1.29 | V                 |
|                |  | $I_T = 80 A$  |                           |      | 1.61 | V                 |
|                |  | $I_T = 40 A$  | $T_{VJ} = 125^{\circ}C$   |      | 1.29 | V                 |
|                |  | $I_T = 80 A$  |                           |      | 1.70 | V                 |
| $I_{TAV}$      | average forward current                              | $T_C = 95^{\circ}C$   | $T_{VJ} = 150^{\circ}C$   |      | 40   | A                 |
| $I_{T(RMS)}$   | RMS forward current                                  | 180° sine   |                           |      | 63   | A                 |
| $V_{T0}$       | threshold voltage                                    | } for power loss calculation only   | $T_{VJ} = 150^{\circ}C$   |      | 0.87 | V                 |
| $r_T$          | slope resistance                                     |   |                           |      | 10.5 | m $\Omega$        |
| $R_{thJC}$     | thermal resistance junction to case                  |   |                           |      | 0.7  | K/W               |
| $R_{thCH}$     | thermal resistance case to heatsink                  |   |                           | 0.1  |      | K/W               |
| $P_{tot}$      | total power dissipation                              |   | $T_C = 25^{\circ}C$       |      | 180  | W                 |
| $I_{TSM}$      | max. forward surge current                           | t = 10 ms; (50 Hz), sine  | $T_{VJ} = 45^{\circ}C$    |      | 500  | A                 |
|                |  | t = 8,3 ms; (60 Hz), sine   | $V_R = 0 V$               |      | 540  | A                 |
|                |  | t = 10 ms; (50 Hz), sine  | $T_{VJ} = 150^{\circ}C$   |      | 425  | A                 |
|                |  | t = 8,3 ms; (60 Hz), sine   | $V_R = 0 V$               |      | 460  | A                 |
| $I^2t$         | value for fusing                                     | t = 10 ms; (50 Hz), sine  | $T_{VJ} = 45^{\circ}C$    |      | 1.25 | kA <sup>2</sup> s |
|                |  | t = 8,3 ms; (60 Hz), sine   | $V_R = 0 V$               |      | 1.22 | kA <sup>2</sup> s |
|                |  | t = 10 ms; (50 Hz), sine  | $T_{VJ} = 150^{\circ}C$   |      | 905  | A <sup>2</sup> s  |
|                |  | t = 8,3 ms; (60 Hz), sine   | $V_R = 0 V$               |      | 880  | A <sup>2</sup> s  |
| $C_J$          | junction capacitance                                 | $V_R = 400 V$ f = 1 MHz   | $T_{VJ} = 25^{\circ}C$    |      | 25   | pF                |
| $P_{GM}$       | max. gate power dissipation                          | $t_p = 30 \mu s$  | $T_C = 150^{\circ}C$      |      | 10   | W                 |
|                |  | $t_p = 300 \mu s$   |                           |      | 5    | W                 |
| $P_{GAV}$      | average gate power dissipation                       |   |                           |      | 0.5  | W                 |
| $(di/dt)_{cr}$ | critical rate of rise of current                     | $T_{VJ} = 150^{\circ}C$ ; f = 50 Hz   | repetitive, $I_T = 120 A$ |      | 100  | A/ $\mu s$        |
|                |  | $t_p = 200 \mu s$ ; $di_G/dt = 0.3 A/\mu s$ ;<br>$I_G = 0.3 A$ ; $V = \frac{2}{3} V_{DRM}$                              | non-repet., $I_T = 40 A$  |      | 500  | A/ $\mu s$        |
| $(dv/dt)_{cr}$ | critical rate of rise of voltage                     | $V = \frac{2}{3} V_{DRM}$<br>$R_{GK} = \infty$ ; method 1 (linear voltage rise)   | $T_{VJ} = 150^{\circ}C$   |      | 1000 | V/ $\mu s$        |
| $V_{GT}$       | gate trigger voltage                                 | $V_D = 6 V$   | $T_{VJ} = 25^{\circ}C$    |      | 1.5  | V                 |
|                |  |   | $T_{VJ} = -40^{\circ}C$   |      | 1.6  | V                 |
| $I_{GT}$       | gate trigger current                                 | $V_D = 6 V$   | $T_{VJ} = 25^{\circ}C$    |      | 100  | mA                |
|                |  |   | $T_{VJ} = -40^{\circ}C$   |      | 150  | mA                |
| $V_{GD}$       | gate non-trigger voltage                             | $V_D = \frac{2}{3} V_{DRM}$   | $T_{VJ} = 150^{\circ}C$   |      | 0.2  | V                 |
| $I_{GD}$       | gate non-trigger current                             |   |                           |      | 5    | mA                |
| $I_L$          | latching current                                     | $t_p = 10 \mu s$  | $T_{VJ} = 25^{\circ}C$    |      | 450  | mA                |
|                |  | $I_G = 0.3 A$ ; $di_G/dt = 0.3 A/\mu s$   |                           |      |      |                   |
| $I_H$          | holding current                                      | $V_D = 6 V$ $R_{GK} = \infty$   | $T_{VJ} = 25^{\circ}C$    |      | 100  | mA                |
| $t_{gd}$       | gate controlled delay time                           | $V_D = \frac{1}{2} V_{DRM}$<br>$I_G = 0.3 A$ ; $di_G/dt = 0.3 A/\mu s$  | $T_{VJ} = 25^{\circ}C$    |      | 2    | $\mu s$           |
| $t_q$          | turn-off time  | $V_R = 100 V$ ; $I_T = 40 A$ ; $V = \frac{2}{3} V_{DRM}$<br>$di/dt = 10 A/\mu s$ $dv/dt = 20 V/\mu s$ $t_p = 200 \mu s$ | $T_{VJ} = 125^{\circ}C$   | 150  |      | $\mu s$           |



| Package SOT-227B (minibloc) |  |                      |                                     | Ratings |      |      |  |
|-----------------------------|--|----------------------|-------------------------------------|---------|------|------|--|
| Symbol                      | Definition   | Conditions           | min.                                | typ.    | max. | Unit |  |
| $I_{RMS}$                   | RMS current  | per terminal         |                                     |         | 150  | A    |  |
| $T_{VJ}$                    | virtual junction temperature                                 |                      | -40                                 |         | 150  | °C   |  |
| $T_{op}$                    | operation temperature  |                      | -40                                 |         | 125  | °C   |  |
| $T_{stg}$                   | storage temperature  |                      | -40                                 |         | 150  | °C   |  |
| <b>Weight</b>               |  |                      |                                     |         | 30   | g    |  |
| $M_D$                       | mounting torque  |                      | 1.1                                 |         | 1.5  | Nm   |  |
| $M_T$                       | terminal torque  |                      | 1.1                                 |         | 1.5  | Nm   |  |
| $d_{Spp/App}$               | creepage distance on surface   striking distance through air | terminal to terminal | 10.5                                | 3.2     |      | mm   |  |
| $d_{Spb/Apb}$               |  | terminal to backside | 8.6                                 | 6.8     |      | mm   |  |
| $V_{ISOL}$                  | isolation voltage  | t = 1 second         |                                     | 3000    |      | V    |  |
|                             |  | t = 1 minute         | 50/60 Hz, RMS; $I_{ISOL} \leq 1$ mA | 2500    |      | V    |  |

**Product Marking**



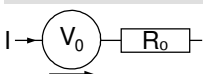
| Ordering | Ordering Number | Marking on Product | Delivery Mode | Quantity | Code No. |
|----------|-----------------|--------------------|---------------|----------|----------|
| Standard | MCD40-12io6     | MCD40-12io6        | Tube          | 10       | 469742   |

| Similar Part   | Package             | Voltage class |
|----------------|---------------------|---------------|
| MCD40-16io6    | SOT-227B (minibloc) | 1600          |
| CLA60PD1200NA  | SOT-227B (minibloc) | 1200          |
| CLA100PD1200NA | SOT-227B (minibloc) | 1200          |

**Equivalent Circuits for Simulation**

\* on die level

$T_{VJ} = 150^{\circ}C$

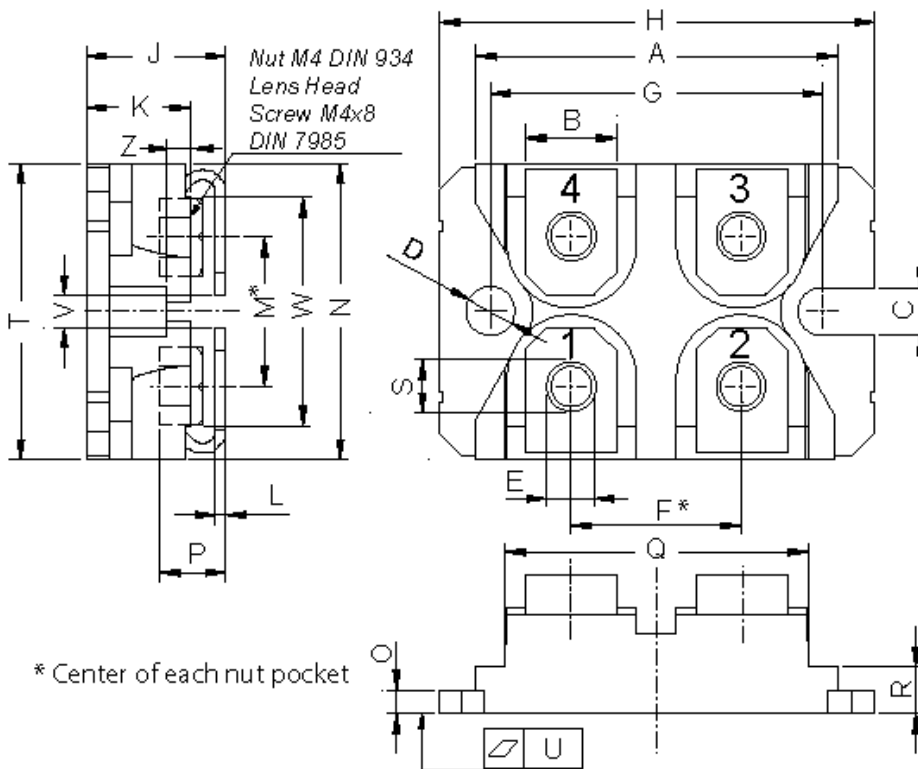


Thyristor

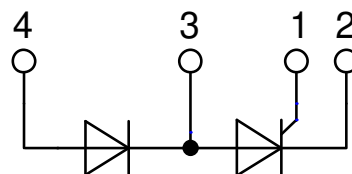
|              |                    |      |    |
|--------------|--------------------|------|----|
| $V_{0\ max}$ | threshold voltage  | 0.87 | V  |
| $R_{0\ max}$ | slope resistance * | 9.7  | mΩ |



**Outlines SOT-227B (minibloc)**



| Dim. | Millimeter |       | Inches |       |
|------|------------|-------|--------|-------|
|      | min        | max   | min    | 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      | 38.23 | 1.488  | 1.505 |
| J    | 11.68      | 12.22 | 0.460  | 0.481 |
| K    | 8.92       | 9.60  | 0.351  | 0.378 |
| L    | 0.74       | 0.84  | 0.029  | 0.033 |
| M    | 12.50      | 13.10 | 0.492  | 0.516 |
| N    | 25.15      | 25.42 | 0.990  | 1.001 |
| O    | 1.95       | 2.13  | 0.077  | 0.084 |
| P    | 4.95       | 6.20  | 0.195  | 0.244 |
| Q    | 26.54      | 26.90 | 1.045  | 1.059 |
| R    | 3.94       | 4.42  | 0.155  | 0.167 |
| S    | 4.55       | 4.85  | 0.179  | 0.191 |
| T    | 24.59      | 25.25 | 0.968  | 0.994 |
| U    | -0.05      | 0.10  | -0.002 | 0.004 |
| V    | 3.20       | 5.50  | 0.126  | 0.217 |
| W    | 19.81      | 21.08 | 0.780  | 0.830 |
| Z    | 2.50       | 2.70  | 0.098  | 0.106 |



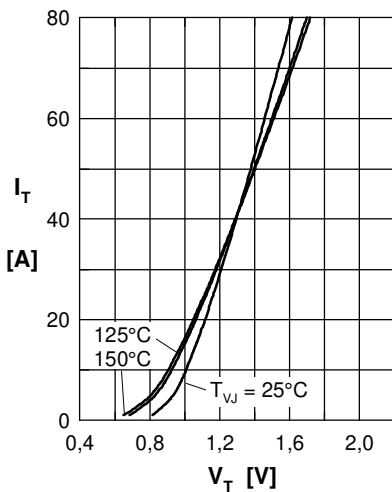
**Thyristor**


Fig. 1 Forward characteristics

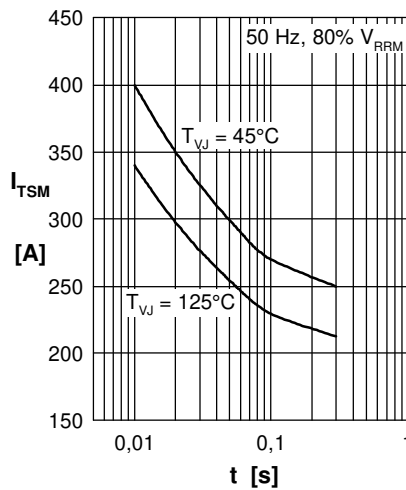


Fig. 2 Surge overload current

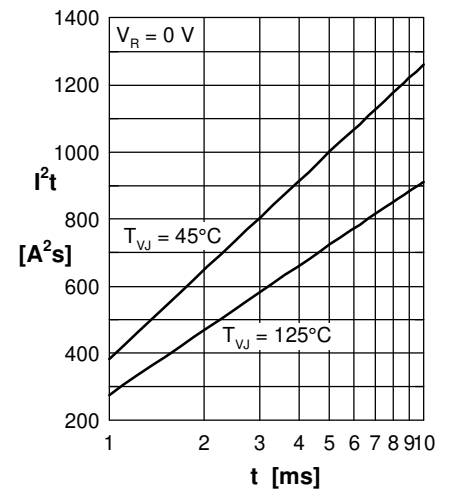
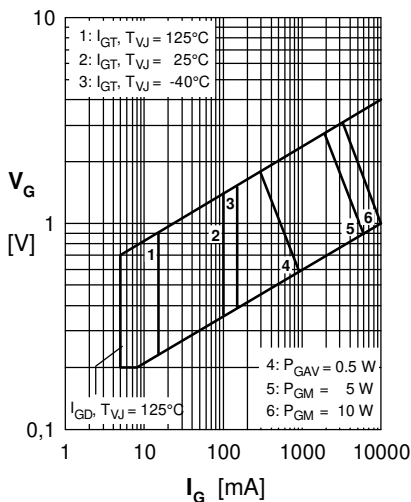

 Fig. 3  $I^2t$  versus time (1-10 ms)


Fig. 4 Gate trigger characteristics

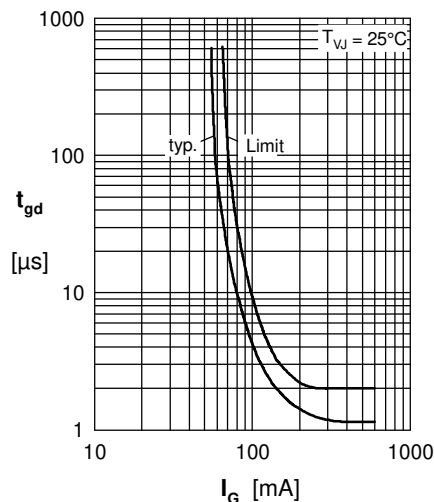


Fig. 5 Gate controlled delay time

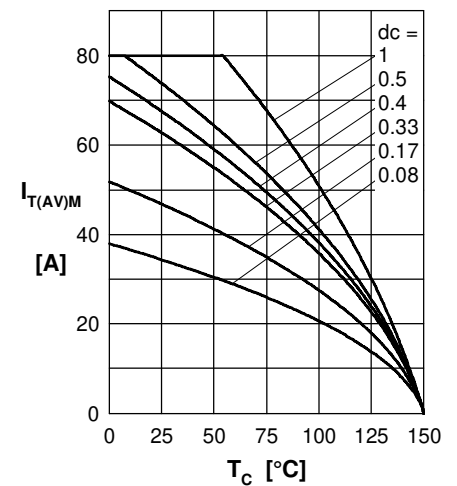


Fig. 6 Max. forward current at case temperature

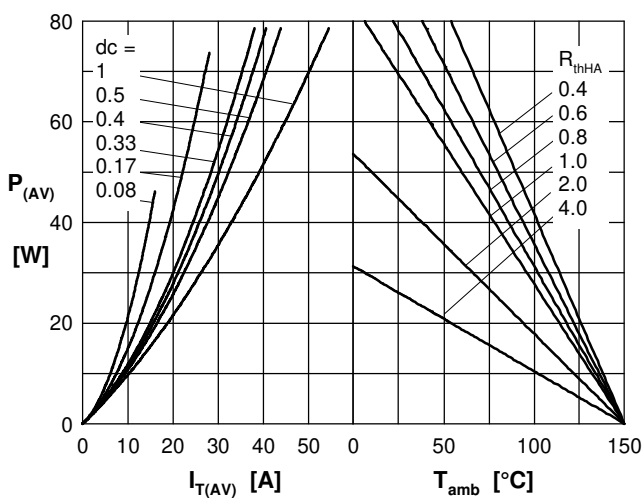
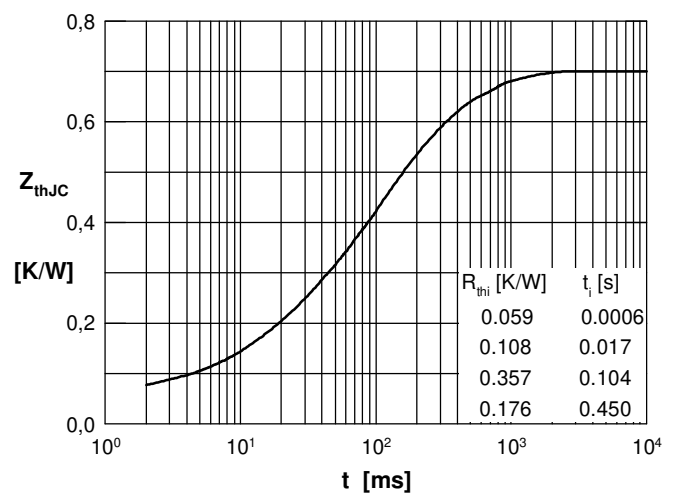

 Fig. 7a Power dissipation versus direct output current  
 Fig. 7b and ambient temperature


Fig. 8 Transient thermal impedance junction to case