

## 1. General description

Pressure contact thyristor / diode module in industrial standard 60mm package for use in applications requiring high blocking voltage capability, high inrush current capability and high thermal cycling performance.

## 2. Features and benefits

- High blocking voltage capability
- High surge current capability
- High thermal cycling performance
- Pressure contact module with high reliability
- Easy mounting

## 3. Applications

- Heat and Temperature Control
- Power Converter
- Industrial Motor Drive & Soft Starter
- Lighting Control
- UPS

## 4. Quick reference data

Table 1. Quick reference data

| Symbol                                 | Parameter                            | Conditions                                                             | Notes | Values |     |     | Unit |
|----------------------------------------|--------------------------------------|------------------------------------------------------------------------|-------|--------|-----|-----|------|
| Absolute maximum rating                |                                      |                                                                        |       |        |     |     |      |
| V <sub>DRM</sub>                       | repetitive peak forward voltage      |                                                                        |       | 1600   |     |     | V    |
| V <sub>RRM</sub>                       | repetitive peak reverse voltage      |                                                                        |       | 1600   |     |     | V    |
| I <sub>T(AV)</sub> /I <sub>F(AV)</sub> | average on-state current             | half sine wave; T <sub>c</sub> = 85 °C                                 |       | 600    |     |     | A    |
| I <sub>TSM</sub> /I <sub>FSM</sub>     | non-repetitive peak on-state current | half sine wave; T <sub>j(init)</sub> = 25 °C; t <sub>p</sub> = 10 ms   |       | 19000  |     |     | A    |
|                                        |                                      | half sine wave; T <sub>j(init)</sub> = 135 °C; t <sub>p</sub> = 10 ms  |       | 16000  |     |     | A    |
|                                        |                                      | half sine wave; T <sub>j(init)</sub> = 25 °C; t <sub>p</sub> = 8.3 ms  |       | 20900  |     |     | A    |
|                                        |                                      | half sine wave; T <sub>j(init)</sub> = 135 °C; t <sub>p</sub> = 8.3 ms |       | 17600  |     |     | A    |
| Symbol                                 | Parameter                            | Conditions                                                             |       | Min    | Typ | Max | Unit |
| Static characteristics                 |                                      |                                                                        |       |        |     |     |      |
| I <sub>GT</sub>                        | gate trigger current                 | V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T <sub>J</sub> = 25 °C  |       | 30     | -   | 150 | mA   |
| V <sub>GT</sub>                        | gate trigger voltage                 | V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T <sub>J</sub> = 25 °C  |       | -      | -   | 2.5 | V    |
| V <sub>T</sub>                         | on-state voltage                     | I <sub>T</sub> = 1500 A; T <sub>J</sub> = 25 °C                        |       | -      | -   | 1.5 | V    |
| V <sub>F</sub>                         | forward voltage                      | I <sub>F</sub> = 1500 A; T <sub>J</sub> = 25 °C                        |       | -      | -   | 1.5 | V    |

5. Pinning information

Table 2. Pinning information

| Simplified outline | Graphic symbol |
|--------------------|----------------|
|                    |                |

6. Ordering information

Table 3. Ordering information

| Type number | Orderable part number | Packing method | Small packing quantity |
|-------------|-----------------------|----------------|------------------------|
| WHMH600F16  | WHMH600F16T           | Tray           | 9                      |

7. Marking

Table 4. Marking codes

| Type number | Marking codes |
|-------------|---------------|
| WHMH600F16  | WHMH600F16    |

## 8. Limiting values

**Table 5. Limiting values**

*In accordance with the Absolute Maximum Rating System (IEC 60134).*

| Symbol       | Parameter                            | Conditions                                                                   | Notes | Values     | Unit                   |
|--------------|--------------------------------------|------------------------------------------------------------------------------|-------|------------|------------------------|
| $V_{DRM}$    | repetitive peak forward voltage      |                                                                              |       | 1600       | V                      |
| $V_{RRM}$    | repetitive peak reverse voltage      |                                                                              |       | 1600       | V                      |
| $I_{T(AV)}$  | average on-state current             | half sine wave; $T_c = 85\text{ °C}$                                         |       | 600        | A                      |
| $I_{T(RMS)}$ | RMS on-state current                 | half sine wave; $T_c = 85\text{ °C}$                                         |       | 1000       | A                      |
| $I_{TSM}$    | non-repetitive peak on-state current | half sine wave; $T_{J(\text{init})} = 25\text{ °C}$ ; $t_p = 10\text{ ms}$   |       | 19000      | A                      |
|              |                                      | half sine wave; $T_{J(\text{init})} = 135\text{ °C}$ ; $t_p = 10\text{ ms}$  |       | 16000      | A                      |
|              |                                      | half sine wave; $T_{J(\text{init})} = 25\text{ °C}$ ; $t_p = 8.3\text{ ms}$  |       | 20900      | A                      |
|              |                                      | half sine wave; $T_{J(\text{init})} = 135\text{ °C}$ ; $t_p = 8.3\text{ ms}$ |       | 17600      | A                      |
| $I^2t$       | $I^2t$ for fusing                    | $t_p = 10\text{ ms}$ ; SIN; $T_{vj} = 25\text{ °C}$                          |       | 1805       | $\text{kA}^2\text{s}$  |
|              |                                      | $t_p = 10\text{ ms}$ ; SIN; $T_{vj} = 125\text{ °C}$                         |       | 1280       | $\text{kA}^2\text{s}$  |
| $di_T/dt$    | rate of rise of on-state current     | $I_G = 300\text{ mA}$ ; $T_j = 135\text{ °C}$                                |       | 250        | $\text{A}/\mu\text{s}$ |
| $I_{GM}$     | peak gate current                    |                                                                              |       | 10         | A                      |
| $V_{RGM}$    | peak reverse gate voltage            |                                                                              |       | 5          | V                      |
| $P_{GM}$     | peak gate power                      |                                                                              |       | 20         | W                      |
| $P_{G(AV)}$  | average gate power                   | over any 20 ms period                                                        |       | 0.5        | W                      |
| $T_{vj}$     | virtual junction temperature         |                                                                              |       | -40 to 135 | $^{\circ}\text{C}$     |
| $T_{op}$     | operation temperature                |                                                                              |       | -40 to 125 | $^{\circ}\text{C}$     |
| $T_{stg}$    | storage temperature                  |                                                                              |       | -40 to 125 | $^{\circ}\text{C}$     |

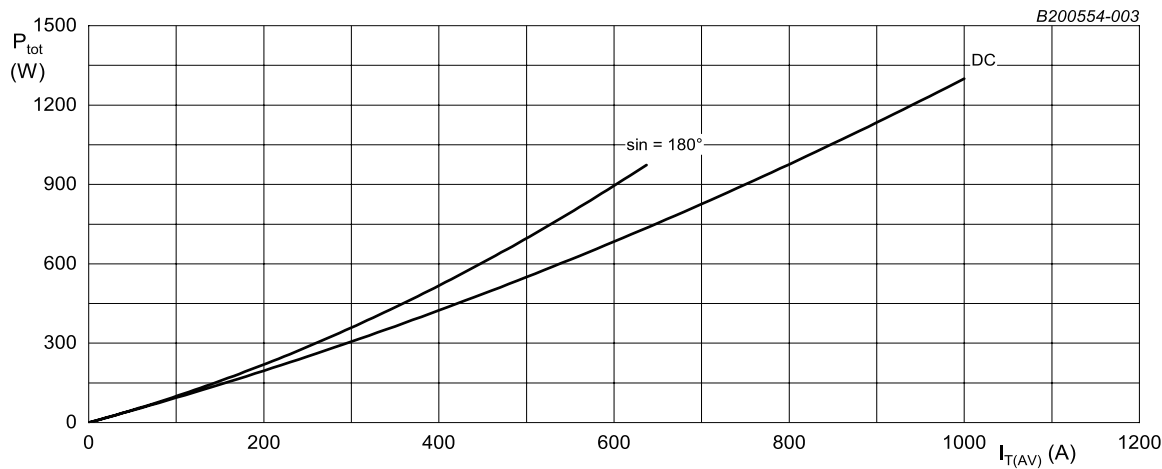
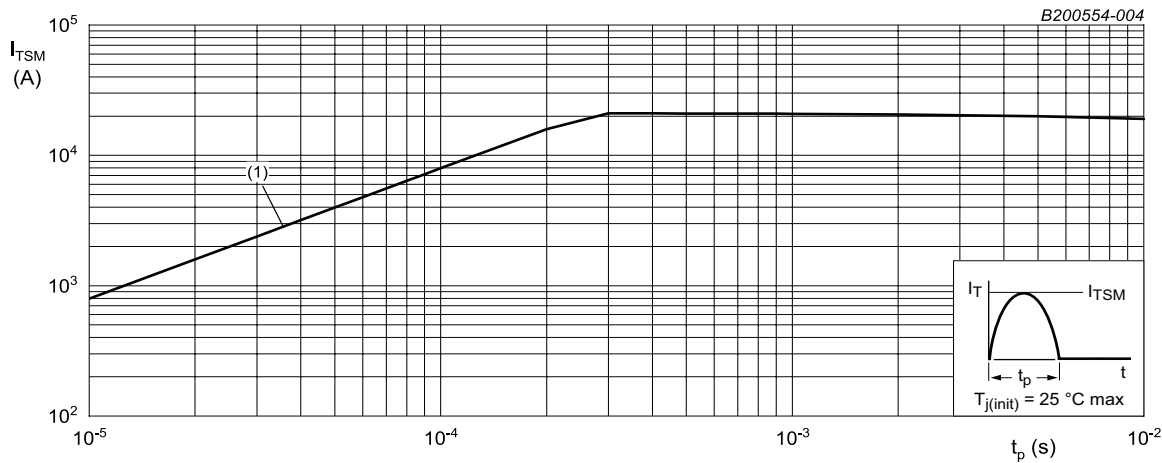


Fig. 1. Total power dissipation as a function of average on-state current; maximum values; per thyristor



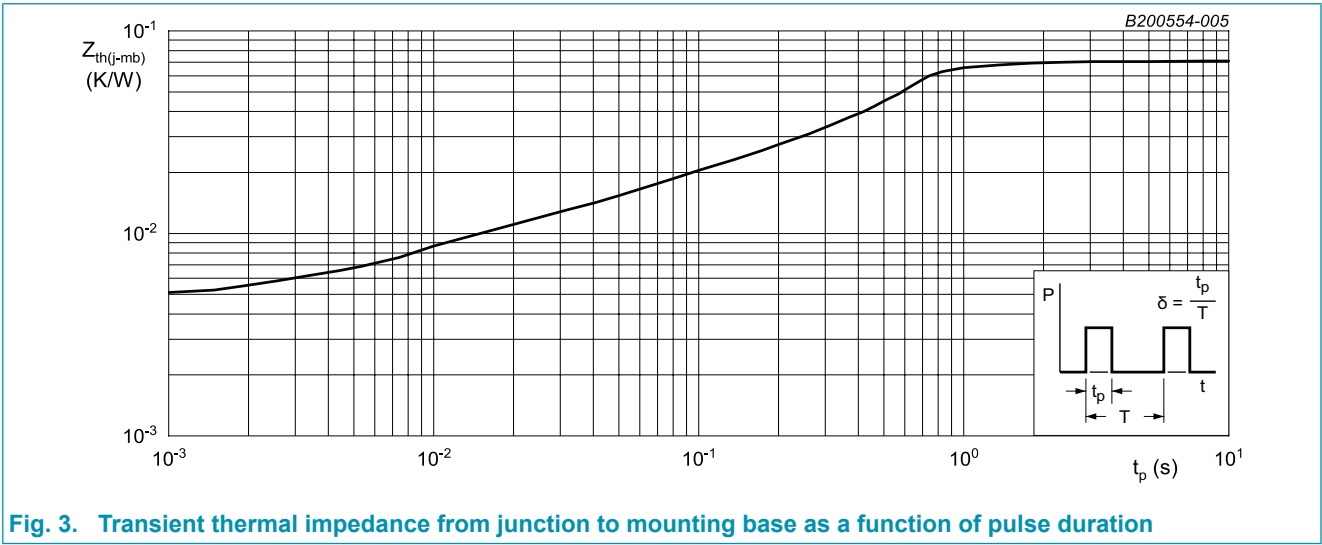
$t_p \leq 10\text{ ms}$   
(1)  $di_T/dt$  limit

Fig. 2. Non-repetitive peak on-state current as a function of pulse width; maximum values

9. Thermal characteristics

Table 6. Thermal characteristics

| Symbol        | Parameter                                    | Conditions    | Min | Typ | Max   | Unit |
|---------------|----------------------------------------------|---------------|-----|-----|-------|------|
| $R_{th(j-c)}$ | thermal resistance from junction to case     | per thyristor | -   | -   | 0.071 | K/W  |
| $R_{th(j-h)}$ | thermal resistance from junction to heatsink | per thyristor | -   | -   | 0.024 | K/W  |



10. Package characteristics

Table 7. Isolation characteristics

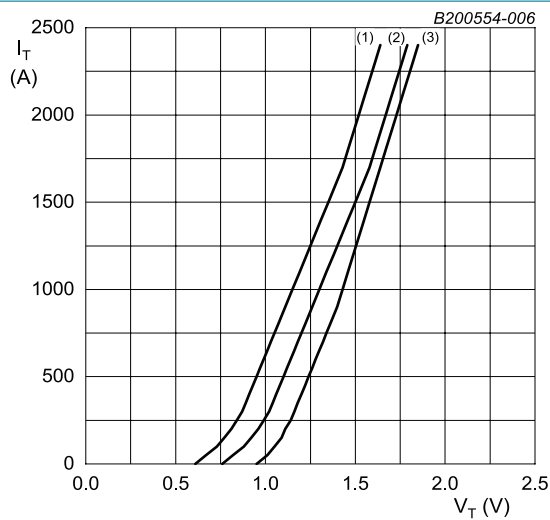
| Symbol     | Parameter         | Conditions                      | Min | Typ | Max  | Unit |
|------------|-------------------|---------------------------------|-----|-----|------|------|
| $V_{isol}$ | isolation voltage | 50/60 Hz; RMS; t = 1 minute; AC | -   | -   | 2500 | V    |

## 11. Characteristics

Table 8. Characteristics

| Symbol                  | Parameter                         | Conditions                                                                                                                               |  | Min  | Typ | Max  | Unit |
|-------------------------|-----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|--|------|-----|------|------|
| Static characteristics  |                                   |                                                                                                                                          |  |      |     |      |      |
| I <sub>GT</sub>         | gate trigger current              | V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T <sub>j</sub> = 25 °C                                                                    |  | 30   | -   | 150  | mA   |
| V <sub>GT</sub>         | gate trigger voltage              | V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T <sub>j</sub> = 25 °C                                                                    |  | -    | -   | 2.5  | V    |
| I <sub>GD</sub>         | gate non-trigger current          | T <sub>j</sub> = 135 °C                                                                                                                  |  | -    | -   | 10   | mA   |
| V <sub>GD</sub>         | gate non-trigger voltage          | T <sub>j</sub> = 135 °C                                                                                                                  |  | -    | -   | 0.25 | V    |
| I <sub>L</sub>          | latching current                  | V <sub>D</sub> = 12 V; I <sub>T</sub> = 0.1 A; T <sub>j</sub> = 25 °C                                                                    |  | -    | -   | 500  | mA   |
| I <sub>H</sub>          | holding current                   | V <sub>D</sub> = 12 V; T <sub>j</sub> = 25 °C                                                                                            |  | -    | -   | 150  | mA   |
| V <sub>T</sub>          | on-state voltage                  | I <sub>T</sub> = 1500 A; T <sub>j</sub> = 25 °C                                                                                          |  | -    | -   | 1.5  | V    |
| V <sub>TO</sub>         | threshold voltage                 | T <sub>j</sub> = 135 °C                                                                                                                  |  | -    | -   | 0.9  | V    |
| r <sub>T</sub>          | slope resistance                  | T <sub>j</sub> = 135 °C                                                                                                                  |  | -    | -   | 0.4  | mΩ   |
| I <sub>D</sub>          | off-state current                 | V <sub>D</sub> = 1600 V; T <sub>j</sub> = 25 °C                                                                                          |  | -    | -   | 1    | mA   |
|                         |                                   | V <sub>D</sub> = 1600 V; T <sub>j</sub> = 135 °C                                                                                         |  | -    | -   | 100  | mA   |
| I <sub>R</sub>          | reverse current                   | V <sub>R</sub> = 1600 V; T <sub>j</sub> = 25 °C                                                                                          |  | -    | -   | 1    | mA   |
|                         |                                   | V <sub>R</sub> = 1600 V; T <sub>j</sub> = 135 °C                                                                                         |  | -    | -   | 100  | mA   |
| Dynamic characteristics |                                   |                                                                                                                                          |  |      |     |      |      |
| dV <sub>D</sub> /dt     | rate of rise of off-state voltage | V <sub>DM</sub> = 1072 V; T <sub>j</sub> = 125 °C; (V <sub>DM</sub> = 67% of V <sub>DRM</sub> ); exponential waveform; gate open circuit |  | 1500 | -   | -    | V/μs |
| t <sub>gt</sub>         | gate-controlled turn-on time      | V <sub>D</sub> = 800 V; I <sub>G</sub> = 300 mA; (dI <sub>G</sub> /dt) <sub>M</sub> = 1 A/μs; T <sub>j</sub> = 25 °C                     |  | -    | 5   | -    | μs   |
| t <sub>q</sub>          | commutated turn-off time          | I <sub>TM</sub> = 2 A; t <sub>p</sub> = 50 μs; dV <sub>D</sub> /dt = 5 V/μs; dI/dt = 30 A/μs; T <sub>j</sub> = 25 °C                     |  | -    | 150 | -    | μs   |

| <b>Diode</b>                  |                 |                                                        |       |     |     |     |      |
|-------------------------------|-----------------|--------------------------------------------------------|-------|-----|-----|-----|------|
| Symbol                        | Parameter       | Conditions                                             | Notes | Min | Typ | Max | Unit |
| <b>Static characteristics</b> |                 |                                                        |       |     |     |     |      |
| $V_F$                         | forward voltage | $I_F = 1500\text{ A}; T_j = 25\text{ }^\circ\text{C}$  |       | -   | -   | 1.5 | V    |
| $I_R$                         | reverse current | $V_R = 1600\text{ V}; T_j = 25\text{ }^\circ\text{C}$  |       | -   | -   | 1   | mA   |
|                               |                 | $V_R = 1600\text{ V}; T_j = 135\text{ }^\circ\text{C}$ |       | -   | -   | 100 | mA   |



$V_{TO} = 0.900 \text{ V}$ ;  $r_T = 0.0004 \text{ } \Omega$   
(1)  $T_J = 135 \text{ } ^\circ\text{C}$ ; typical values  
(2)  $T_J = 135 \text{ } ^\circ\text{C}$ ; maximum values  
(3)  $T_J = 25 \text{ } ^\circ\text{C}$ ; maximum values

Fig. 4. On-state current as a function of on-state voltage

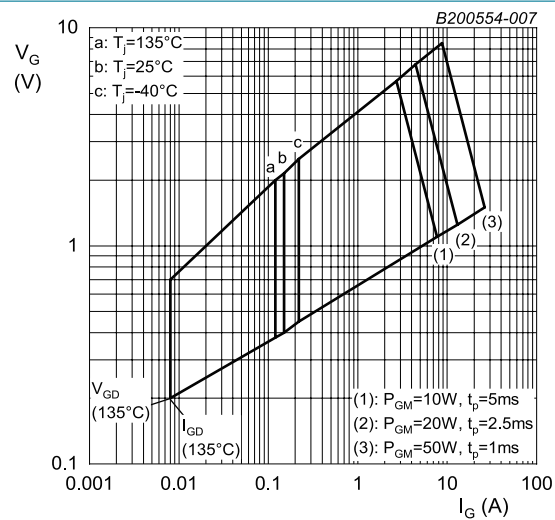
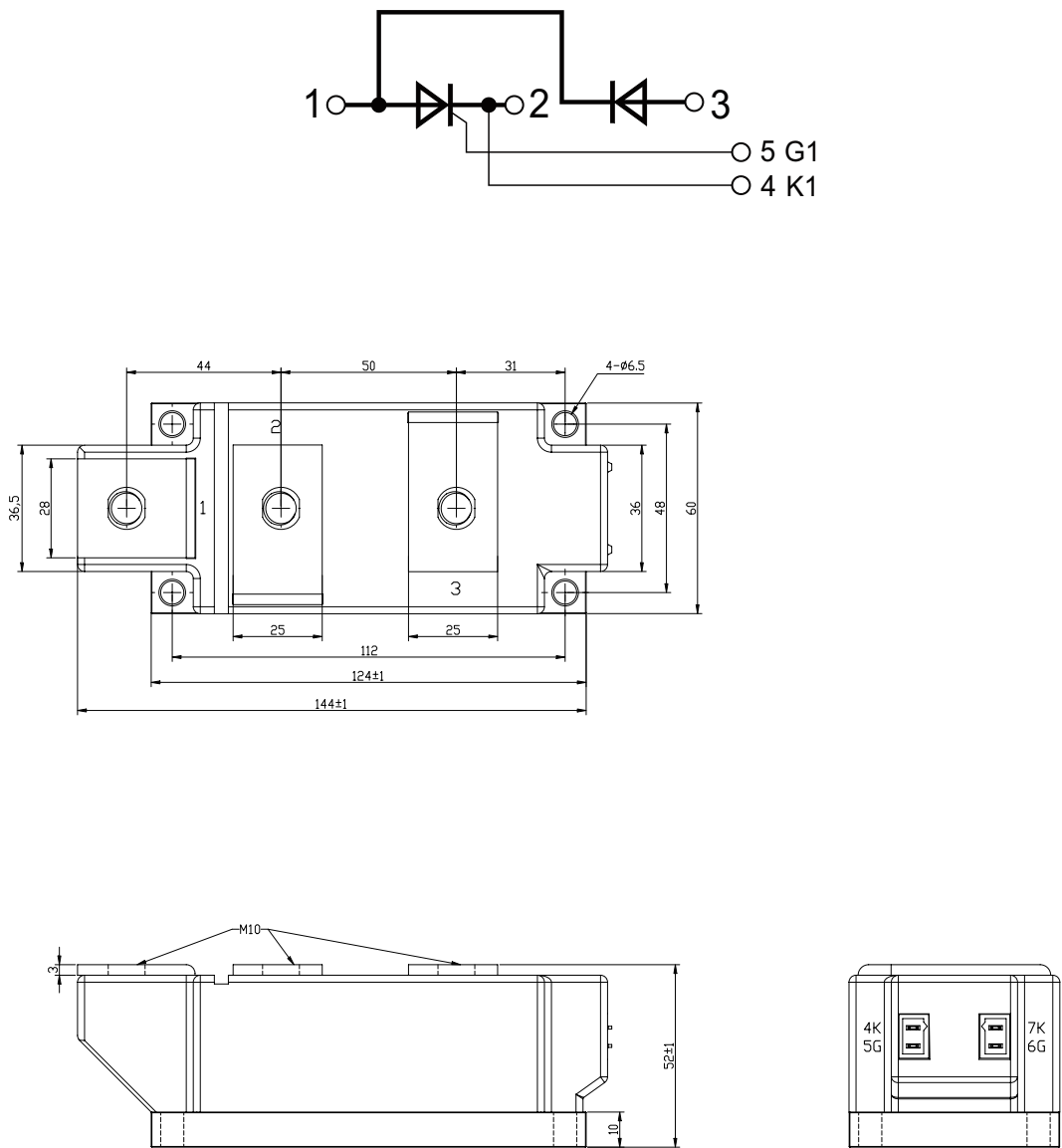


Fig. 5. Gate voltage as a function of gate current

12. Package outline

Package Outline

Dimensions in mm



General tolerance ±0.5mm

## 13. Legal information

### Data sheet status

| Document status [1][2]         | Product status [3] | Definition                                                                            |
|--------------------------------|--------------------|---------------------------------------------------------------------------------------|
| Objective [short] data sheet   | Development        | This document contains data from the objective specification for product development. |
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