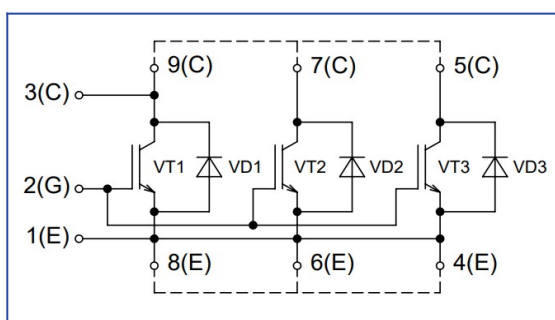
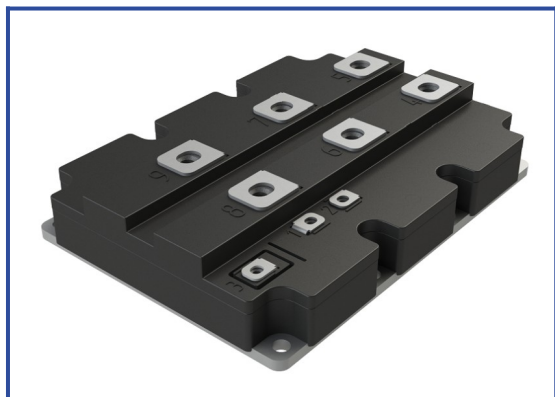


**IGBT high-power module**
**3300 V 1500 A**

**Chip features**

- IGBT chip
  - low  $V_{CE(sat)}$  value
  - 10  $\mu s$  short circuit of 150°C
  - square RBSOA of 2xIC
  - low EMI
- FRD chip
  - fast and soft reverse recovery
  - low voltage drop

**Design features**

- AlSiC baseplate
- AlN DBC substrate

**Typical application**

- AC and DC motor drives
- high-power converters
- wind-powered generator inverters
- industrial equipment

**Maximum rated values**

| Definition                                       | Symbol        | Conditions                                                                      | Value      | Unit        |
|--------------------------------------------------|---------------|---------------------------------------------------------------------------------|------------|-------------|
| <b>IGBT</b>                                      |               |                                                                                 |            |             |
| Collector-Emitter voltage                        | $V_{CES}$     | $V_{GE} = 0$                                                                    | 3300       | V           |
| Maximum allowable collector current (continuous) | $I_{C 25}$    | $T_{vj(max)} = 175^{\circ}C; T_c = 25^{\circ}C$                                 | 2911       | A           |
|                                                  | $I_{C 80}$    | $T_{vj(max)} = 175^{\circ}C; T_c = 80^{\circ}C$                                 | 1500       | A           |
| Repetitive peak collector current*1              | $I_{CRM}$     | $I_{CRM} = 2 \times I_{C nom}; t_p = 1 ms$                                      | 3000       | A           |
| Short-circuit duration                           | $t_{psc}$     | $T_{vj} = 25^{\circ}C; V_{GE} = \pm 15 V; V_{CE} = 2500 V; I_{C max} < 5800 A$  | 10         | $\mu s$     |
|                                                  |               | $T_{vj} = 150^{\circ}C; V_{GE} = \pm 15 V; V_{CE} = 2500 V; I_{C max} < 5800 A$ | 10         |             |
| Gate-Emitter voltage                             | $V_{GES}$     |                                                                                 | $\pm 20$   | V           |
| Junction operating temperature                   | $T_{vj (op)}$ |                                                                                 | -40...+150 | $^{\circ}C$ |
| <b>Inverse diode \ Freewheeling diode</b>        |               |                                                                                 |            |             |
| Repetitive peak reverse voltage                  | $V_{RRM}$     | $V_{GE} = 0 V$                                                                  | 3300       | V           |
| Maximum allowable forward current (continuous)   | $I_{F 25}$    | $T_{vj(max)} = 175^{\circ}C; T_c = 25^{\circ}C$                                 | 2331       | A           |
|                                                  | $I_{F 80}$    | $T_{vj(max)} = 175^{\circ}C; T_c = 80^{\circ}C$                                 | 1500       | A           |
| Repetitive peak forward current*1                | $I_{FRM}$     | $I_{FRM} = 2 \times I_{F nom}; t_p = 1 ms$                                      | 3000       | A           |
| Junction operating temperature                   | $T_{vj (op)}$ |                                                                                 | -40...+150 | $^{\circ}C$ |
| <b>Module</b>                                    |               |                                                                                 |            |             |
| Storage temperature                              | $T_{stg}$     |                                                                                 | -40...+50  | $^{\circ}C$ |
| Isolation voltage                                | $V_{isol}$    | AC sin 50 Hz; $t = 1 min$                                                       | 6000       | V           |

\*1 Pulse width and repetition rate should be such that device junction temperature does not exceed maximum  $T_{vj}$  rating.

## Characteristics

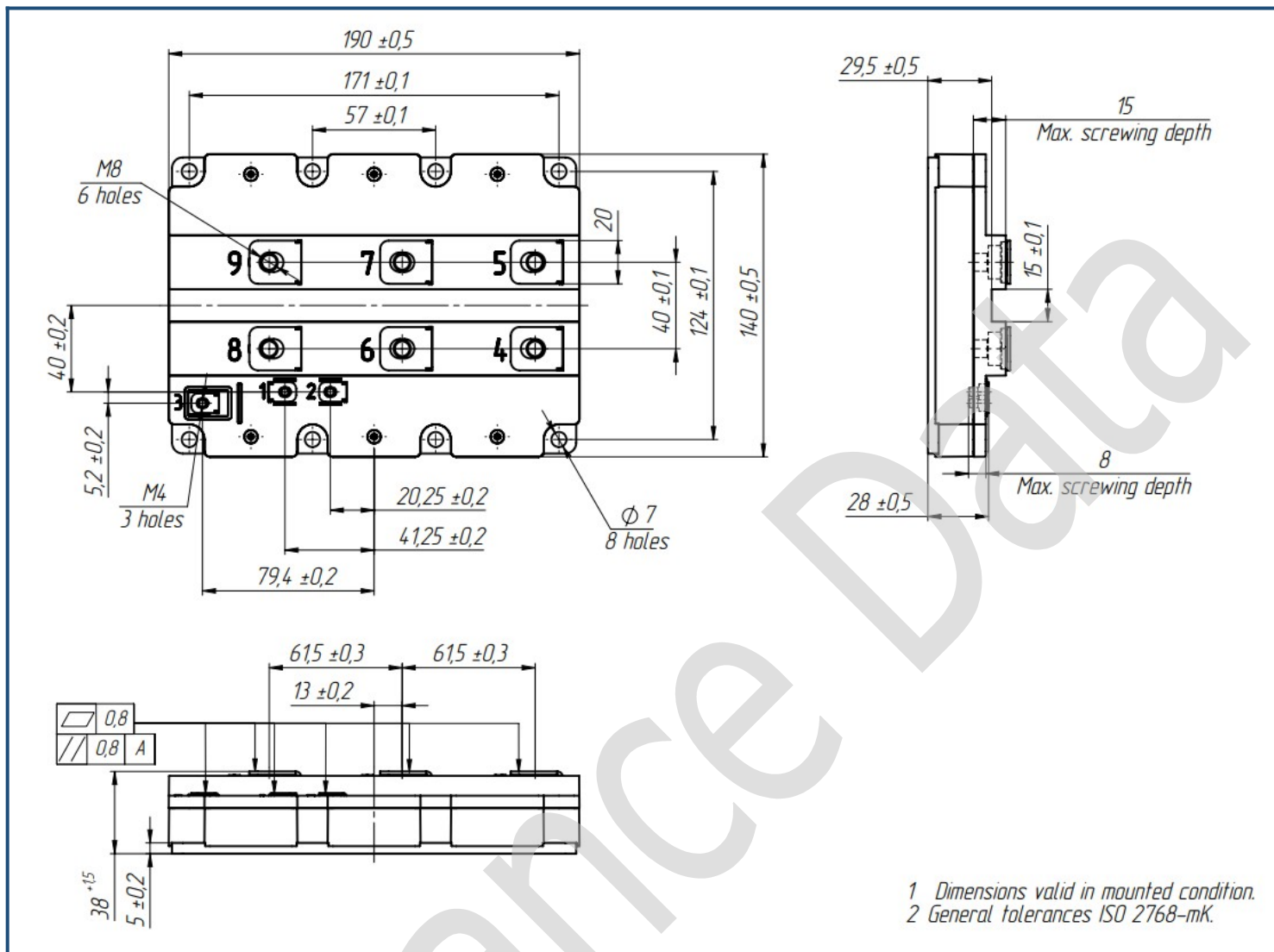
| Definition                           | Symbol                | Conditions                                                                                                       | Value                   |        |       | Unit. |     |  |
|--------------------------------------|-----------------------|------------------------------------------------------------------------------------------------------------------|-------------------------|--------|-------|-------|-----|--|
|                                      |                       |                                                                                                                  | min.                    | typ.   | max.  |       |     |  |
| IGBT                                 |                       |                                                                                                                  |                         |        |       |       |     |  |
| Collector-Emitter saturation voltage | V <sub>CEsat</sub>    | V <sub>GE</sub> = +15 V; I <sub>C</sub> = 1500 A;<br>t <sub>u</sub> = 1000 μs.                                   | T <sub>vj</sub> = 25°C  | -      | 2.72  | -     | V   |  |
|                                      |                       |                                                                                                                  | T <sub>vj</sub> = 150°C | -      | 3.50  | -     | V   |  |
| Gate-Emitter threshold voltage       | V <sub>GE(th)</sub>   | I <sub>C</sub> = 240 mA; U <sub>CE</sub> = U <sub>GE</sub> ; T <sub>vj</sub> = 25°C;<br>t <sub>u</sub> = 2 ms.   | 5.80                    | 6.80   | 7.80  |       | V   |  |
| Collector-Emitter cut-off current    | I <sub>CES</sub>      | V <sub>CE</sub> = 3300 V;<br>t <sub>u</sub> = 50 ms; V <sub>GE</sub> = 0.                                        | T <sub>vj</sub> = 25°C  | -      | -     | 1.00  | mA  |  |
|                                      |                       |                                                                                                                  | T <sub>vj</sub> = 150°C | -      | -     | 48.00 |     |  |
| Gate-Emitter leakage current         | I <sub>GES</sub>      | V <sub>CE</sub> = 0; V <sub>GE</sub> = ±20 V; T <sub>vj</sub> = 25°C;<br>t <sub>u</sub> = 30 ms.                 | -                       | -      | 500   |       | nA  |  |
| Input capacitance                    | C <sub>ies</sub>      | V <sub>CE</sub> = 25 V; V <sub>GE</sub> = 0 V;<br>f = 1 MHz; T <sub>vj</sub> = 25°C.                             | -                       | 153.12 | -     |       | nF  |  |
| Output capacitance                   | C <sub>oes</sub>      |                                                                                                                  | -                       | 12.00  | -     |       | nF  |  |
| Reverse transfer capacitance         | C <sub>res</sub>      |                                                                                                                  | -                       | 3.12   | -     |       | nF  |  |
| Total gate charge                    | Q <sub>G</sub>        | V <sub>CE</sub> = 1800 V; V <sub>GE</sub> = -8...+15 V.                                                          | -                       | 12.00  | -     |       | μC  |  |
| Internal gate resistance             | R <sub>Gint</sub>     | T <sub>vj</sub> = 25°C.                                                                                          | -                       | 0.21   | -     |       | Ω   |  |
| Turn-on delay time                   | t <sub>d(on)</sub>    | V <sub>CE</sub> = 1800 V;<br>V <sub>GE</sub> = ±15 V;<br>I <sub>C max</sub> = 1500 A;<br>L <sub>s</sub> = 20 μH. | T <sub>vj</sub> = 25°C  | -      | -     | -     | ns  |  |
|                                      |                       |                                                                                                                  | T <sub>vj</sub> = 150°C | -      | -     | -     |     |  |
| Rise time                            | t <sub>ri</sub>       |                                                                                                                  | T <sub>vj</sub> = 25°C  | -      | -     | -     | ns  |  |
|                                      |                       |                                                                                                                  | T <sub>vj</sub> = 150°C | -      | -     | -     |     |  |
| Turn-on energy                       | E <sub>on</sub>       |                                                                                                                  | T <sub>vj</sub> = 25°C  | -      | 1608  | -     | mJ  |  |
|                                      |                       |                                                                                                                  | T <sub>vj</sub> = 150°C | -      | 2184  | -     |     |  |
| Turn-off delay time                  | t <sub>d(off)</sub>   |                                                                                                                  | T <sub>vj</sub> = 25°C  | -      | -     | -     | ns  |  |
|                                      |                       |                                                                                                                  | T <sub>vj</sub> = 150°C | -      | -     | -     |     |  |
| Fall time                            | t <sub>fi</sub>       |                                                                                                                  | T <sub>vj</sub> = 25°C  | -      | -     | -     | ns  |  |
|                                      |                       |                                                                                                                  | T <sub>vj</sub> = 150°C | -      | -     | -     |     |  |
| Turn-off energy                      | E <sub>off</sub>      |                                                                                                                  | T <sub>vj</sub> = 25°C  | -      | 2112  | -     | mJ  |  |
|                                      |                       |                                                                                                                  | T <sub>vj</sub> = 150°C | -      | 2640  | -     |     |  |
| Collector-emitter threshold voltage  | V <sub>CE0</sub>      | V <sub>GE</sub> = +15 V; T <sub>vj</sub> = 150°C; I <sub>CE1</sub> = 375 A;                                      | -                       | -      | 1.15  |       | V   |  |
| On-State slope resistance (IGBT)     | r <sub>CE0</sub>      | I <sub>CE2</sub> = 1500 A; t <sub>u</sub> = 1000 μs.                                                             | -                       | -      | 1.58  |       | mΩ  |  |
| Thermal resistance junction to case  | R <sub>th(j-c)</sub>  | DC; V <sub>GE</sub> = +15 V.                                                                                     | -                       | -      | 0.009 |       | K/W |  |
| Inverse diode \ Freewheeling diode   |                       |                                                                                                                  |                         |        |       |       |     |  |
| Forward voltage drop                 | V <sub>F</sub>        | I <sub>F</sub> = 1500 A;<br>V <sub>GE</sub> = 0; t <sub>u</sub> = 1000 μs.                                       | T <sub>vj</sub> = 25°C  | -      | 2.42  | -     | V   |  |
|                                      |                       |                                                                                                                  | T <sub>vj</sub> = 150°C | -      | 2.65  | -     | V   |  |
| Reverse recovery time                | t <sub>rr</sub>       | V <sub>GE</sub> = ±15 V;<br>V <sub>CE</sub> = 1800 V;<br>I <sub>C max</sub> = 1500 A;<br>L <sub>s</sub> = 20 μH. | T <sub>vj</sub> = 25°C  | -      | -     | -     | ns  |  |
|                                      |                       |                                                                                                                  | T <sub>vj</sub> = 150°C | -      | -     | -     | ns  |  |
| Peak reverse current                 | I <sub>RM</sub>       |                                                                                                                  | T <sub>vj</sub> = 25°C  | -      | 1000  | -     | A   |  |
|                                      |                       |                                                                                                                  | T <sub>vj</sub> = 150°C | -      | 1150  | -     | A   |  |
| Recovered charge                     | Q <sub>r</sub>        |                                                                                                                  | T <sub>vj</sub> = 25°C  | -      | 960   | -     | μC  |  |
|                                      |                       |                                                                                                                  | T <sub>vj</sub> = 150°C | -      | 1500  | -     | μC  |  |
| Reverse recovery energy              | E <sub>rec</sub>      |                                                                                                                  | T <sub>vj</sub> = 25°C  | -      | 1140  | -     | mJ  |  |
|                                      |                       |                                                                                                                  | T <sub>vj</sub> = 150°C | -      | 1860  | -     | mJ  |  |
| Threshold voltage                    | V <sub>(T0)</sub>     | T <sub>vj</sub> = 150°C; V <sub>GE</sub> = 0; I <sub>F1</sub> = 375 A;                                           | -                       | -      | 0.97  |       | V   |  |
| Forward slope resistance             | r <sub>T</sub>        | I <sub>F2</sub> = 1500 A; t <sub>u</sub> = 1000 μs                                                               | -                       | -      | 1.12  |       | mΩ  |  |
| Thermal resistance junction to case  | R <sub>th(JC-D)</sub> | DC; U <sub>GE</sub> = +15 V.                                                                                     | -                       | -      | 0.018 |       | K/W |  |

| Module                                         |            |                               |                    |     |       |       |      |
|------------------------------------------------|------------|-------------------------------|--------------------|-----|-------|-------|------|
| Pin resistance                                 | $R_{Pxy}$  | $T_{vj} = 25^{\circ}\text{C}$ | $R_{P5-7-9/4-6-8}$ | -   | 0.10  | -     | mΩ   |
| Parasitic inductance between terminals         | $L_{Pxy}$  |                               | $L_{P5-7-9/4-6-8}$ | -   | 11.00 | -     | nH   |
| Thermal resistance case to heatsink            | $R_{thCH}$ | per module                    |                    | -   | -     | 6.00  | K/kW |
| Mounting torque for screws to heatsink         | $M_s$      | to heatsink M6                |                    | -   | 5.00  | -     | N*m  |
| Mounting torque for screws to control terminal | $M_t$      | to terminals M4               |                    | -   | 2.00  | -     | N*m  |
| Mounting torque for screws to power terminal   | $M_t$      | to terminals M8               |                    | -   | 9.00  | -     | N*m  |
| Creepage distance                              | $d_s$      |                               |                    | -   | -     | 33.00 | mm   |
| Clearance                                      | $d_a$      |                               |                    | -   | -     | 20.00 | mm   |
| Comparative Tracking Index                     | CTI        |                               |                    | 600 | -     | -     |      |
| Weight                                         | W          |                               |                    | -   | -     | 1400  | g    |

“ - ” Data will be refined as additional tests are conducted and statistics are collected.

### Notes:

- Insulating material operating temperature 125°C max;
- Case temperature 125°C max;
- The recommended operating junction temperature  $T_{vj\text{ op}} = -40 \div +150^{\circ}\text{C}$ .

**Overall dimensions: Package type – HM**

**Part numbering guide**

| MIHM | - | SS | 33 | SG | -    | 1500 | N |                                  |
|------|---|----|----|----|------|------|---|----------------------------------|
| MIHM |   |    |    |    |      |      |   | IGBT module package type: HM     |
|      |   | SS |    |    |      |      |   | Single switch                    |
|      |   |    | 33 |    |      |      |   | Voltage rating ( $V_{CES}/100$ ) |
|      |   |    |    | SG |      |      |   | IGBT+FRD chipset modification    |
|      |   |    |    |    | 1500 |      |   | Current Rating                   |
|      |   |    |    |    |      | N    |   | Climatic version: normal climate |

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