

# STARPOWER

SEMICONDUCTOR

# MOSFET

## MD350HFR120B3S

**1200V/350A 2 in one-package**

### General Description

STARPOWER MOSFET Power Module provides very low  $R_{DS(on)}$  as well as optimized intrinsic diode. It's designed for the applications such SMPS and DC drives.

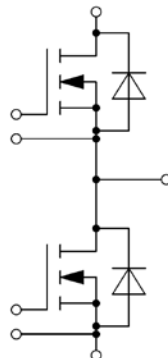
### Features

- SiC power MOSFET
- Low  $R_{DS(on)}$
- Optimized intrinsic reverse diode
- Chip sintering technology
- Low inductance case avoid oscillations
- Isolated copper baseplate using DBC technology

### Typical Applications

- Main and auxiliary AC drives of electric vehicles
- DC servo and robot drives
- Battery vehicles
- UPS equipment
- Plasma cutting

### Equivalent Circuit Schematic



**Absolute Maximum Ratings****MOSFET**

| Symbol    | Description                            | Value    | Unit |
|-----------|--|----------|------|
| $V_{DSS}$ | Drain-Source Voltage                   | 1200     | V    |
| $V_{GSS}$ | Gate-Source Voltage                    | $\pm 20$ | V    |
| $I_D$     | Drain Current @ $T_C=25^\circ\text{C}$ | 473      | A    |
|           | @ $T_C=90^\circ\text{C}$               | 350      | A    |
| $I_{DM}$  | Pulsed Drain Current                   | 1370     | A    |

**Inverse Diode**

| Symbol   | Description           | Value | Unit |
|----------|-----------------------|-------|------|
| $I_S$    | Source Current        | 350   | A    |
| $I_{SM}$ | Pulsed Source Current | 1370  | A    |

**Module**

| Symbol     | Description   | Value       | Unit             |
|------------|---|-------------|------------------|
| $T_{jmax}$ | Maximum Junction Temperature                          | 175         | $^\circ\text{C}$ |
| $T_{jop}$  | Operating Junction Temperature                        | -40 to +150 | $^\circ\text{C}$ |
| $T_{STG}$  | Storage Temperature Range                             | -40 to +125 | $^\circ\text{C}$ |
| $V_{ISO}$  | Isolation Voltage RMS, $f=50\text{Hz}, t=1\text{min}$ | 4000        | V                |

**MOSFET Characteristics**

| Symbol       | Parameter                         | Test Conditions  | Min. | Typ. | Max. | Unit       |
|--------------|-----------------------------------|--|------|------|------|------------|
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $I_D=200A, V_{GS}=18V, T_j=25^\circ C$                           |      | 4.0  | 5.2  | m $\Omega$ |
|              |                                   | $I_D=200A, V_{GS}=18V, T_j=125^\circ C$                          |      | 6.0  |      |            |
| $V_{GS(th)}$ | Gate-Source Threshold Voltage     | $I_D=100mA, V_{DS}=V_{GS}, T_j=25^\circ C$                       | 2.7  |      | 5.6  | V          |
| $g_{fs}$     | Forward Transconductance          | $V_{DS}=10V, I_D=200A$   |      | 83   |      | S          |
| $I_{DSS}$    | Drain-Source Leakage Current      | $V_{DS}=V_{DSS}, V_{GS}=0V, T_j=25^\circ C$                      |      |      | 100  | $\mu A$    |
| $I_{GSS}$    | Gate-Source Leakage Current       | $V_{GS}=V_{GSS}, V_{DS}=0V, T_j=25^\circ C$                      |      |      | 1    | $\mu A$    |
| $C_{iss}$    | Input Capacitance                 | $V_{GS}=0V, V_{DS}=800V, f=1MHz$                                 |      | 13.4 |      | nF         |
| $C_{oss}$    | Output Capacitance                |  |      | 0.75 |      | nF         |
| $C_{rss}$    | Reverse Transfer Capacitance      |  |      | 0.28 |      | nF         |
| $Q_g$        | Total Gate Charge                 | $I_D=200A, V_{DS}=600V, V_{GS}=18V$                              |      | 1070 |      | nC         |
| $Q_{gs}$     | Gate-Source Charge                |  |      | 220  |      | nC         |
| $Q_{gd}$     | Gate-Drain ("Miller") Charge      |  |      | 410  |      | nC         |
| $t_{d(on)}$  | Turn-On Delay Time                | $V_{DS}=400V, I_D=180A, R_G=0\Omega, V_{GS}=18V, T_j=25^\circ C$ |      | 21   |      | ns         |
| $t_r$        | Rise Time                         |  |      | 39   |      | ns         |
| $t_{d(off)}$ | Turn-Off Delay Time               |  |      | 49   |      | ns         |
| $t_f$        | Fall Time                         |  |      | 24   |      | ns         |
| $E_{on}$     | Turn-On Switching Loss            | $V_{DS}=600V, I_D=200A, R_G=0\Omega, V_{GS}=18V, T_j=25^\circ C$ |      | 2.83 |      | mJ         |
| $E_{off}$    | Turn-Off Switching Loss           |  |      | 1.18 |      | mJ         |

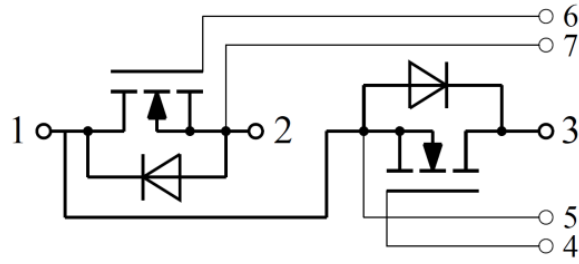
**Inverse Diode Characteristics**

| Symbol   | Parameter                     | Test Conditions   | Min. | Typ. | Max. | Unit    |
|----------|-------------------------------|---|------|------|------|---------|
| $V_{SD}$ | Diode Forward Voltage         | $I_S=200A, V_{GS}=0V, T_j=25^\circ C$                     |      | 3.2  |      | V       |
| $t_{rr}$ | Diode Reverse Recovery Time   | $V_R=600V, I_S=200A, -di/dt=22000A/\mu s, T_j=25^\circ C$ |      | 25   |      | ns      |
| $Q_r$    | Diode Reverse Recovery Charge |   |      | 1.15 |      | $\mu C$ |
| $I_{RM}$ | Peak Reverse Recovery Current |   |      |      | 90   |         |

**Module Characteristics**  $T_c=25^{\circ}\text{C}$  unless otherwise noted

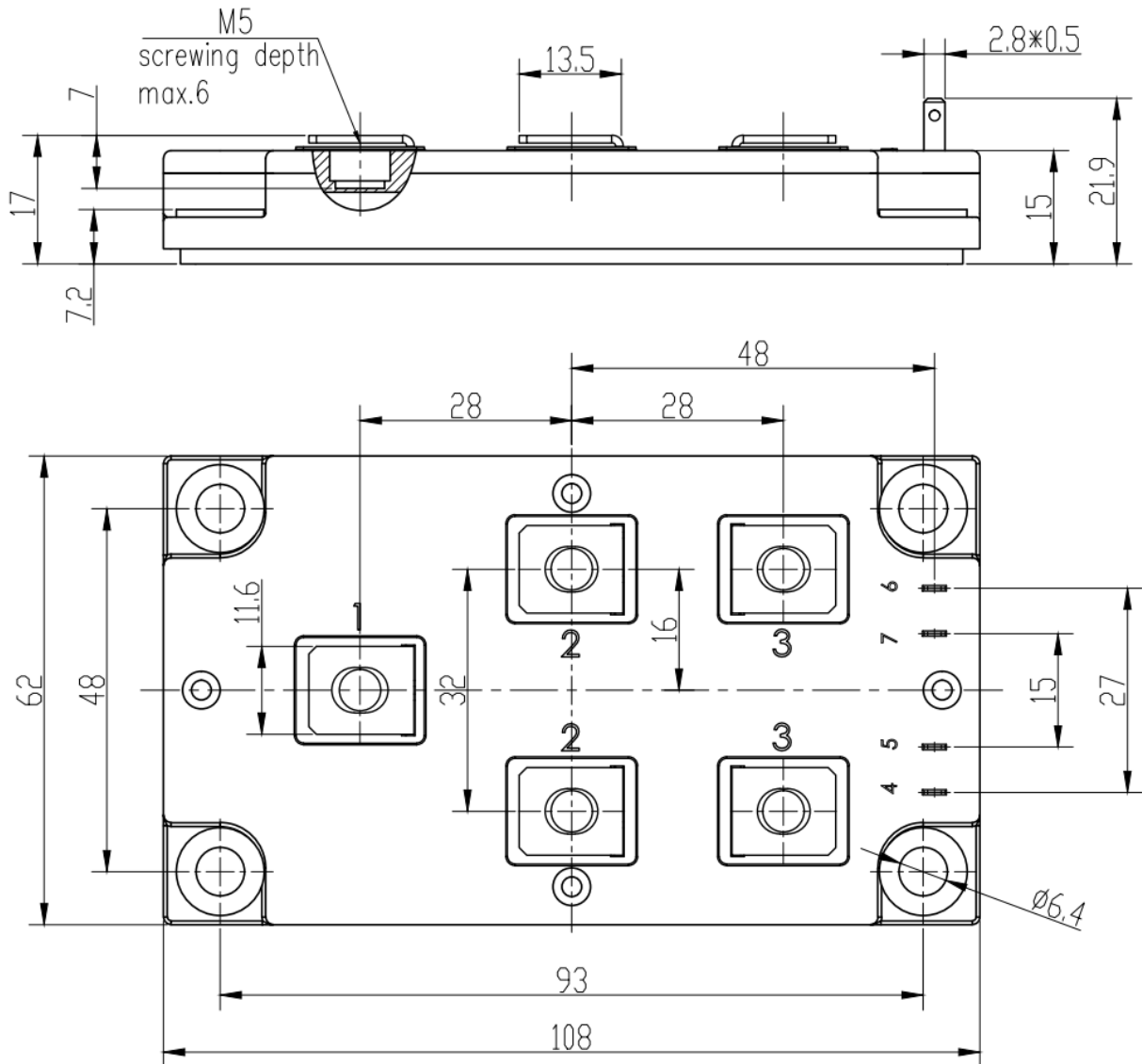
| Symbol     | Parameter                            | Min. | Typ.  | Max.  | Unit |
|------------|--------------------------------------|------|-------|-------|------|
| $R_{thJC}$ | Junction-to-Case(Mosfet)             |      |       | 0.081 | K/W  |
| $R_{thCH}$ | Case-to-Heatsink (Mosfet)            |      | 0.020 |       | K/W  |
|            | Case-to-Heatsink (per Module)        |      | 0.010 |       |      |
| M          | Terminal Connection Torque, Screw M5 | 2.5  |       | 5.0   | N.m  |
|            | Mounting Torque, Screw M6            | 3.0  |       | 5.0   |      |
| G          | Weight of Module                     |      | 300   |       | g    |

### Circuit Schematic



### Package Dimensions

Dimensions in Millimeters



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