

STARPOWER

SEMICONDUCTOR

MOSFET

MD50SGR120D6S_B20

1200V/50A 1 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 solar power.

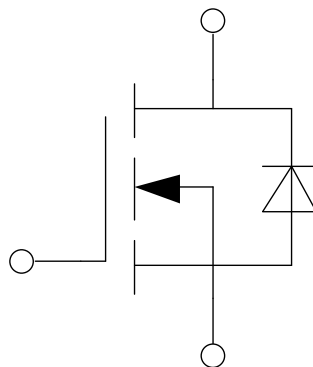
Features

- SiC power MOSFET
- Low $R_{DS(on)}$
- Optimized intrinsic reverse diode
- Low inductance case
- AlN substrate for low thermal resistance
- Isolated copper baseplate using DBC technology

Typical Applications

- Electric vehicle
- Solar Power
- Switching mode power supply

Equivalent Circuit Schematic



Absolute Maximum Ratings $T_C=25^{\circ}\text{C}$ unless otherwise noted**MOSFET**

| Symbol | Description | Value | Unit |
|-----------|---|--------|------|
| V_{DSS} | Drain-Source Voltage | 1200 | V |
| V_{GSS} | Gate-Source Voltage | -4/+22 | V |
| I_D | Drain Current @ $T_C=25^{\circ}\text{C}$ @ $T_C=100^{\circ}\text{C}$ | 100 | A |
| | | 50 | A |
| I_{DM} | Pulsed Drain Current | 274 | A |
| P_D | Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$ | 416 | W |

Diode

| Symbol | Description | Value | Unit |
|----------|-----------------------|-------|------|
| I_S | Source Current | 50 | A |
| I_{SM} | Pulsed Source Current | 274 | 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 +150 | $^{\circ}\text{C}$ |
| V_{ISO} | Isolation Voltage RMS, $f=50\text{Hz}$, $t=1\text{min}$ | 4000 | V |

MOSFET Characteristics $T_C=25^\circ\text{C}$ unless otherwise noted

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--------------|-----------------------------------|--|------|------|------|------------------|
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $I_D=40\text{A}, V_{GS}=18\text{V}, T_j=25^\circ\text{C}$ | | 20.0 | 25.0 | $\text{m}\Omega$ |
| | | $I_D=40\text{A}, V_{GS}=20\text{V}, T_j=125^\circ\text{C}$ | | 30.0 | | |
| $V_{GS(th)}$ | Gate-Source Threshold Voltage | $I_D=20.0\text{mA}, V_{DS}=10\text{V}, T_j=25^\circ\text{C}$ | 2.7 | | 5.6 | V |
| g_{fs} | Forward Transconductance | $V_{DS}=10\text{V}, I_D=40\text{A}, T_j=25^\circ\text{C}$ | | 16.6 | | S |
| I_{DSS} | Drain-Source Leakage Current | $V_{DS}=V_{DSS}, V_{GS}=0\text{V}, T_j=25^\circ\text{C}$ | | | 20 | μA |
| I_{GSS} | Gate-Source Leakage Current | $V_{GS}=V_{GSS}, V_{DS}=0\text{V}, T_j=25^\circ\text{C}$ | | | 200 | μA |
| R_{Gint} | Internal Gate Resistance | | | 3.5 | | Ω |
| C_{iss} | Input Capacitance | $V_{GS}=0\text{V}, V_{DS}=800\text{V}, f=1.0\text{MHz}$ | | 2674 | | pF |
| C_{oss} | Output Capacitance | | | 152 | | pF |
| C_{rss} | Reverse Transfer Capacitance | | | 54 | | pF |
| Q_g | Total Gate Charge | $I_D=40\text{A}, V_{DS}=600\text{V}, V_{GS}=18\text{V}$ | | 214 | | nC |
| Q_{gs} | Gate-Source Charge | | | 44 | | nC |
| Q_{gd} | Gate-Drain ("Miller") Charge | | | 82 | | nC |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DS}=400\text{V}, I_D=36\text{A}, R_G=0\Omega, V_{GS}=0/18\text{V}, T_j=25^\circ\text{C}$ | | 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 | $V_{DS}=600\text{V}, I_D=40\text{A}, R_G=0\Omega, V_{GS}=0/18\text{V}$ | | 0.56 | | mJ |
| E_{off} | Turn-Off Switching Loss | | | 0.24 | | mJ |

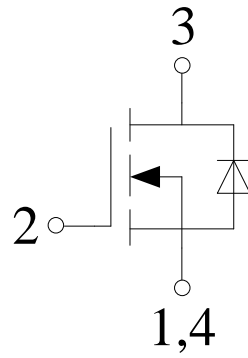
Diode Characteristics $T_C=25^\circ\text{C}$ unless otherwise noted

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--------|-------------------------|---|------|------|------|---------------|
| V_F | Diode Forward Voltage | $I_F=40\text{A}, T_j=25^\circ\text{C}$ | | 1.50 | 1.70 | V |
| | | $I_F=40\text{A}, T_j=150^\circ\text{C}$ | | 1.80 | | |
| | | $I_F=40\text{A}, T_j=175^\circ\text{C}$ | | 1.90 | | |
| I_R | Diode Reverse Current | $V_R=V_{RRM}, T_j=25^\circ\text{C}$ | | 40 | 800 | μA |
| | | $V_R=V_{RRM}, T_j=150^\circ\text{C}$ | | 320 | | |
| | | $V_R=V_{RRM}, T_j=175^\circ\text{C}$ | | 520 | | |
| Q_C | Total Capacitive Charge | $V_R=800\text{V}, di/dt=1000\text{A}/\mu\text{s}$ | | 132 | | nC |

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

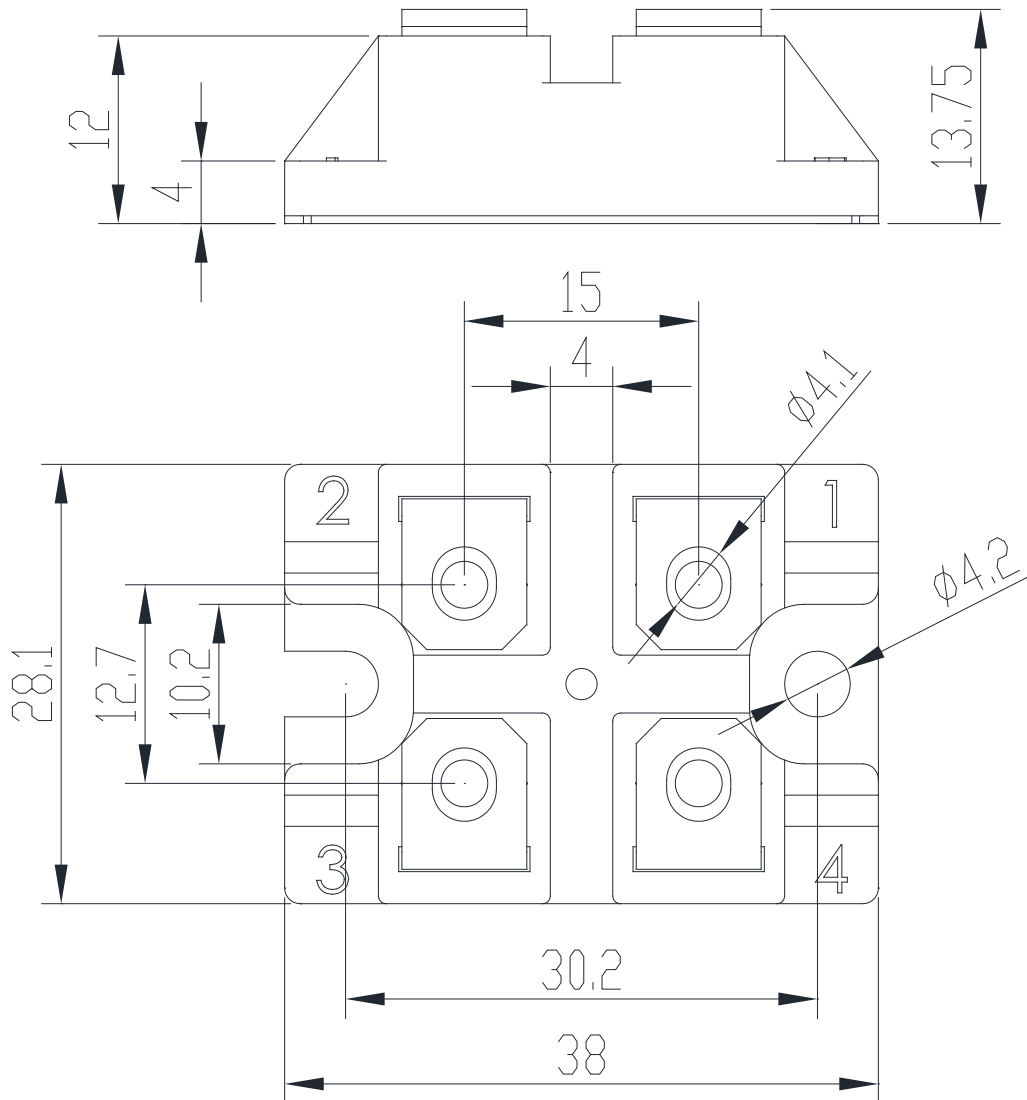
| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|------------|--------------------------------------|------|------|-------|------|
| R_{thJC} | Junction-to-Case (per MOSFET) | | | 0.360 | K/W |
| | Junction-to-Case (per Diode) | | | 0.550 | |
| R_{thCH} | Case-to-Heatsink (per Module) | | 0.15 | | K/W |
| M | Terminal Connection Torque, Screw M4 | 1.1 | | 1.5 | N.m |
| | Mounting Torque, Screw M4 | 1.1 | | 1.5 | |
| G | Weight of Module | | 35 | | g |

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



Terms and Conditions of Usage

The data contained in this product datasheet is exclusively intended for technically trained staff. you and your technical departments will have to evaluate the suitability of the product for the intended application and the completeness of the product data with respect to such application.

This product data sheet is describing the characteristics of this product for which a warranty is granted. Any such warranty is granted exclusively pursuant the terms and conditions of the supply agreement. There will be no guarantee of any kind for the product and its characteristics.

Should you require product information in excess of the data given in this product data sheet or which concerns the specific application of our product, please contact the sales office, which is responsible for you (see www.powersemi.cc), For those that are specifically interested we may provide application notes.

Due to technical requirements our product may contain dangerous substances. For information on the types in question please contact the sales office, which is responsible for you.

Should you intend to use the Product in aviation applications, in health or live endangering or life support applications, please notify.

If and to the extent necessary, please forward equivalent notices to your customers.
Changes of this product data sheet are reserved.