# STARPOWER

**SEMICONDUCTOR** **MOSFET**

# MD50CLR120D6S

**1200V/50A chopper 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.

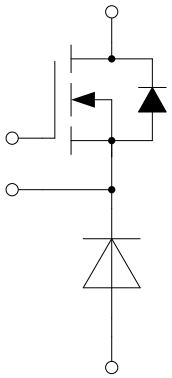
## Features

- SiC power MOSFET
- Low $R_{DS(on)}$
- Optimized intrinsic reverse diode
- Avalanche ruggedness
- 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°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 | 50 | A |
| $I_{DM}$ | Pulsed Drain Current | 154 | A |
| $P_D$ | Maximum Power Dissipation @ $T_j$=175°C | 222 | W |

## Body Diode

| Symbol | Description | Value | Unit |
|---|---|---|---|
| $I_S$ | Source Current | 50 | A |
| $I_{SM}$ | Pulsed Source Current | 154 | A |

## Diode

| Symbol | Description | Value | Unit |
|---|---|---|---|
| $V_{RRM}$ | Repetitive Peak Reverse Voltage | 1200 | V |
| $I_F$ | Diode Continuous Forward Current | 50 | A |
| $I_{FM}$ | Diode Maximum Forward Current $t_p$=1ms | 154 | A |

## Module

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

## MOSFET Characteristics $T_C$=25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $I_D$=20A,$V_{GS}$=18V, $T_j$=25°C | | 40.0 | 50.0 | mΩ |
| | | $I_D$=20A,$V_{GS}$=18V, $T_j$=125°C | | 60.0 | | |
| $V_{GS(th)}$ | Gate-Source Threshold Voltage | $I_D$=10.0mA,$V_{DS}$=10V, $T_j$=25°C | 2.7 | | 5.6 | V |
| $g_{fs}$ | Forward Transconductance | $V_{DS}$=10V,$I_D$=20A, $T_j$=25°C | | 8.8 | | S |
| $I_{DSS}$ | Drain-Source Leakage Current | $V_{DS}$=$V_{DSS}$,$V_{GS}$=0V, $T_j$=25°C | | | 20 | μA |
| $I_{GSS}$ | Gate-Source Leakage Current | $V_{GS}$=$V_{GSS}$,$V_{DS}$=0V, $T_j$=25°C | | | 200 | nA |
| $R_{Gint}$ | Internal Gate Resistance | | | 7.25 | | Ω |
| $C_{iss}$ | Input Capacitance | $V_{GS}$=0V,$V_{DS}$=800V, f=1.0MHz | | 1570 | | pF |
| $C_{oss}$ | Output Capacitance | | | 150 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 70 | | pF |
| $Q_g$ | Total Gate Charge | $I_D$=20A,$V_{DS}$=600V, $V_{GS}$=18V | | 120 | | nC |
| $Q_{gs}$ | Gate-Source Charge | | | 30 | | nC |
| $Q_{gd}$ | Gate-Drain ("Miller") Charge | | | 50 | | nC |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DS}$=400V,$I_D$=20A, $R_G$=0Ω,$V_{GS}$=18V, $T_j$=25°C | | 15 | | ns |
| $t_r$ | Rise Time | | | 22 | | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 29 | | ns |
| $t_f$ | Fall Time | | | 24 | | ns |

## Body Diode Characteristics $T_C$=25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{SD}$ | Diode Forward Voltage | $I_S$=20A,$V_{GS}$=0V,$T_j$=25°C | | 3.20 | 3.65 | V |
| $t_{rr}$ | Diode Reverse Recovery Time | $V_R$=600V,$I_S$=20A, di/dt=2200A/μs,$V_{GS}$=0V, $T_j$=25°C | | 17 | | ns |
| $Q_r$ | Diode Reverse Recovery Charge | | | 100 | | nC |
| $I_{RM}$ | Peak Reverse Recovery Current | | | 12.0 | | A |

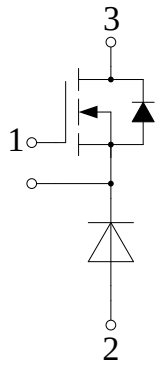
## Diode Characteristics $T_C$=25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{SD}$ | Diode Forward Voltage | $I_S$=40A,$V_{GS}$=0V,$T_j$=25°C | | 1.40 | 1.85 | V |
| $I_{RM}$ | Peak Reverse Recovery Current | $V_R$=1200V,$V_{GS}$=0V, $T_j$=25°C | | 40 | | μA |

## Module Characteristics $T_C$=25°C unless otherwise noted

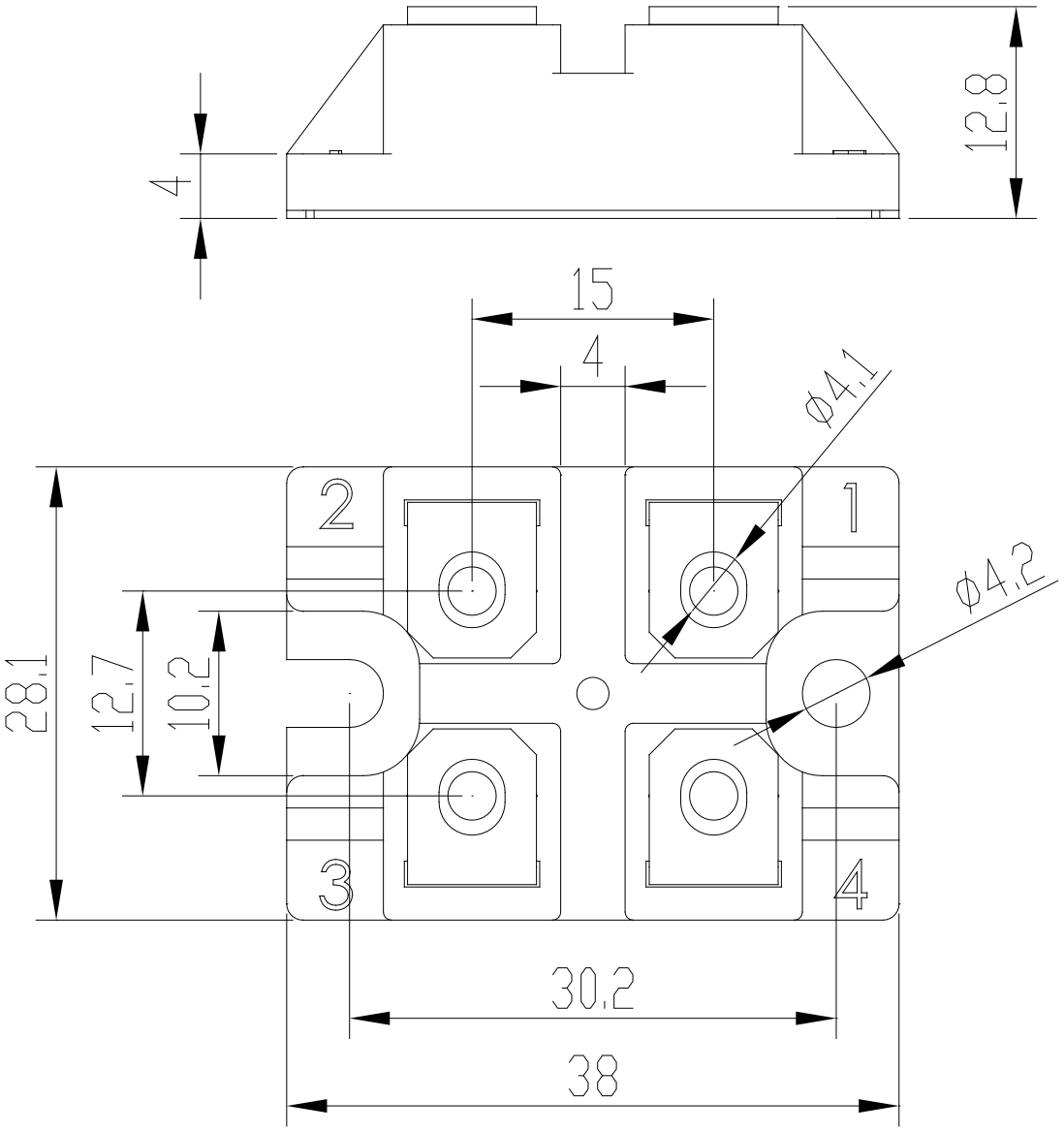
| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| $R_{thJC}$ | Junction-to-Case (per MOSFET)<br>Junction-to-Case (per Diode) | | | 0.674<br>0.524 | K/W |
| $R_{thCH}$ | Case-to-Heatsink (per MOSFET)<br>Case-to-Heatsink (per Diode)<br>Case-to-Heatsink (per module) | | 0.343<br>0.267<br>0.150 | | K/W |
| M | Terminal Connection Torque, Screw M4<br>Mounting Torque, Screw M4 | 1.1<br>1.1 | | 1.5<br>1.5 | N.m |
| G | Weight of Module | | 35 | | g |

## Circuit Schematic




## Package Dimensions

Dimensions in Millimeters



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