

# STARPOWER

SEMICONDUCTOR

# MOSFET

## MD400HFR120C2S

**1200V/400A 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.

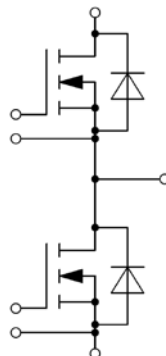
### Features

- SiC power MOSFET
- Low  $R_{DS(on)}$
- Optimized intrinsic reverse diode
- Chip sintering technology
- Low inductance case avoid oscillations
- Isolated copper baseplate using AlN 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 @ $T_C=25^\circ\text{C}$	542	A
	@ $T_C=90^\circ\text{C}$	400	A
$I_{DM}$	Pulsed Drain Current	1644	A

### Inverse Diode

Symbol	Description	Value	Unit
$I_S$	Source Current	400	A
$I_{SM}$	Pulsed Source Current	1644	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	$I_D=240A, V_{GS}=18V, T_j=25^\circ C$		3.3	4.4	m $\Omega$
		$I_D=240A, V_{GS}=18V, T_j=125^\circ C$		5.0		
$V_{GS(th)}$	Gate-Source Threshold Voltage	$I_D=120mA, V_{DS}=V_{GS}, T_j=25^\circ C$	2.7		5.6	V
$g_{fs}$	Forward Transconductance	$V_{DS}=10V, I_D=240A$		99.6		S
$I_{DSS}$	Drain-Source Leakage Current	$V_{DS}=V_{DSS}, V_{GS}=0V, T_j=25^\circ C$			120	$\mu A$
$I_{GSS}$	Gate-Source Leakage Current	$V_{GS}=V_{GSS}, V_{DS}=0V, T_j=25^\circ C$			1.2	$\mu A$
$C_{iss}$	Input Capacitance	$V_{GS}=0V, V_{DS}=800V, f=1MHz$		16.0		nF
$C_{oss}$	Output Capacitance			0.90		nF
$C_{rss}$	Reverse Transfer Capacitance			0.33		nF
$Q_g$	Total Gate Charge	$I_D=240A, V_{DS}=600V, V_{GS}=18V$		1284		nC
$Q_{gs}$	Gate-Source Charge			264		nC
$Q_{gd}$	Gate-Drain ("Miller") Charge			492		nC
$t_{d(on)}$	Turn-On Delay Time	$V_{DS}=400V, I_D=216A, R_G=0\Omega, V_{GS}=18V, T_j=25^\circ C$		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	$V_{DS}=600V, I_D=240A, R_G=0\Omega, V_{GS}=18V, T_j=25^\circ C$		3.39		mJ
$E_{off}$	Turn-Off Switching Loss			1.41		mJ

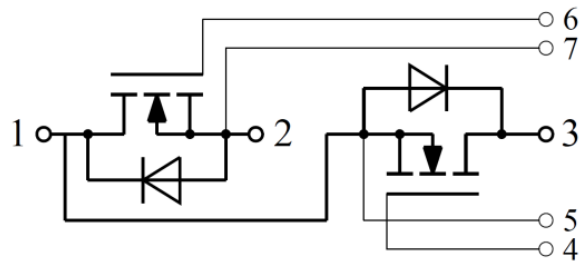
**Inverse Diode Characteristics**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{SD}$	Diode Forward Voltage	$I_S=240A, V_{GS}=0V, T_j=25^\circ C$		3.2		V
$t_{rr}$	Diode Reverse Recovery Time	$V_R=600V, I_S=240A, -di/dt=13200A/\mu s, T_j=25^\circ C$		25		ns
$Q_r$	Diode Reverse Recovery Charge			1.32		$\mu C$
$I_{RM}$	Peak Reverse Recovery Current				108	

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

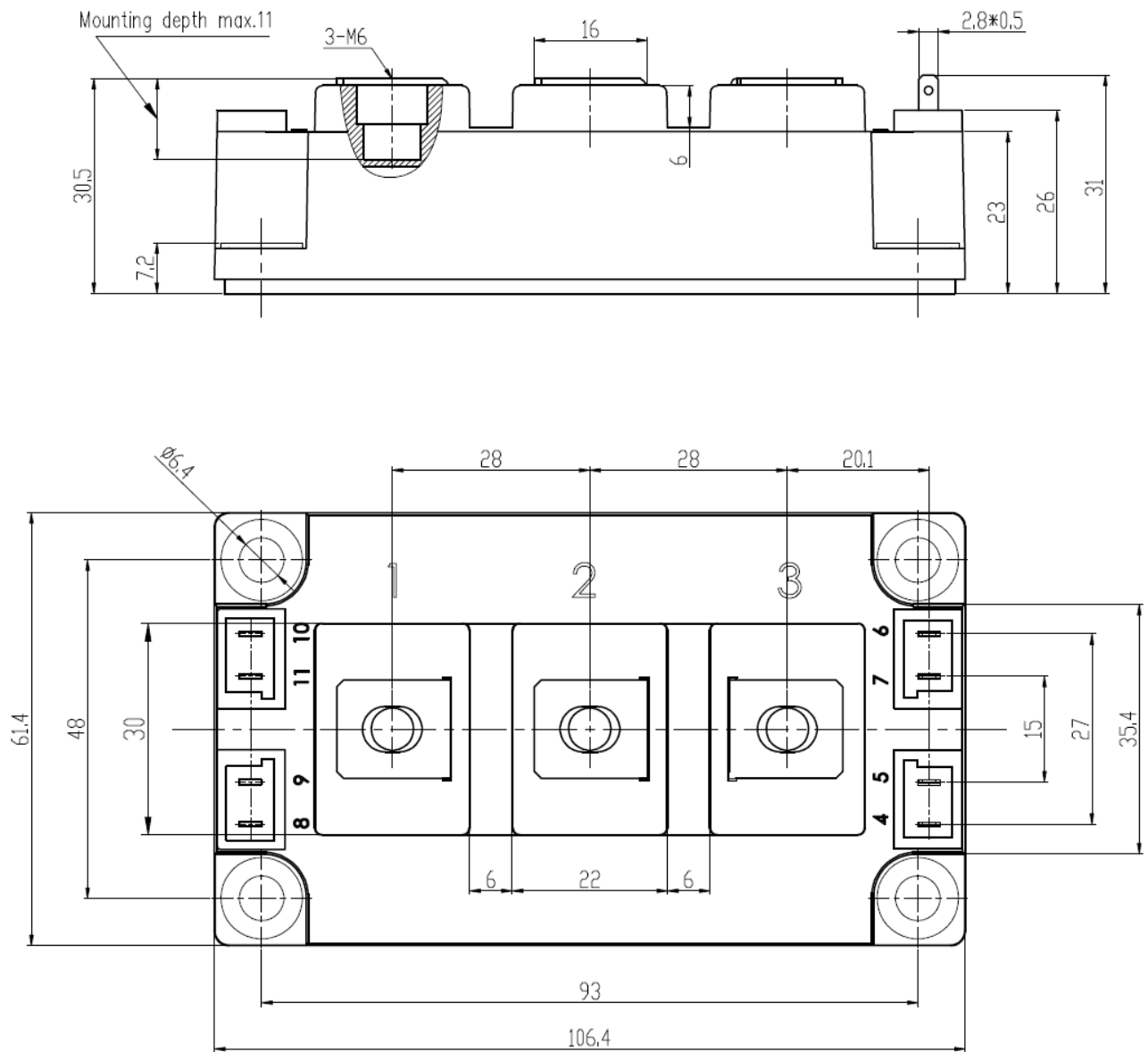
Symbol	Parameter	Min.	Typ.	Max.	Unit
$R_{thJC}$	Junction-to-Case(Mosfet)			0.074	K/W
$R_{thCH}$	Case-to-Heatsink (Mosfet)		0.020		K/W
	Case-to-Heatsink (per Module)		0.010		
M	Terminal Connection Torque, Screw M6	2.5		5.0	N.m
	Mounting Torque, Screw M6	3.0		5.0	
G	Weight of Module		300		g

**Circuit Schematic**



**Package Dimensions**

Dimensions in Millimeters



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