

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.

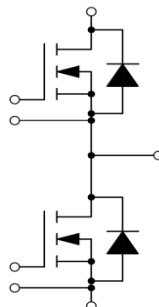
Features

- 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(DC)	-4/+22	V
$V_{GSS\ surge}$	Gate-Source Surge Voltage($t_{surge}<300nsec$)	-4/+26	V
$V_{GS\ op}$	Recommended Drive Voltage	0/+18	V
I_D	Drain Current @ $T_C=25^{\circ}C$	542	A
	@ $T_C=90^{\circ}C$	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	$^{\circ}C$
T_{jop}	Operating Junction Temperature	-40 to +150	$^{\circ}C$
T_{STG}	Storage Temperature Range	-40 to +125	$^{\circ}C$
V_{ISO}	Isolation Voltage RMS, $f=50Hz,t=1min$	2500	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 Ω
		$I_D=240A, V_{GS}=18V, T_j=150^\circ C$		5.8		
$V_{GS(th)}$	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	μA
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=V_{GSS}, V_{DS}=0V, T_j=25^\circ C$			1.2	μA
R_{Gint}	Internal Gate Resistance			0.21		Ω
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	$V_{DS}=900V, I_D=400A, R_G=1.6\Omega, V_{GS}=0/+18V, T_j=25^\circ C$		93		ns
t_r	Rise Time			93		ns
$t_{d(off)}$	Turn-Off Delay Time			296		ns
t_f	Fall Time			78		ns
E_{on}	Turn-On Switching Loss			8.47		mJ
E_{off}	Turn-Off Switching Loss			31.5		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{DS}=900V, I_D=400A, R_G=1.6\Omega, V_{GS}=0/+18V, T_j=125^\circ C$		95		ns
t_r	Rise Time			95		ns
$t_{d(off)}$	Turn-Off Delay Time			336		ns
t_f	Fall Time			78		ns
E_{on}	Turn-On Switching Loss			8.60		mJ
E_{off}	Turn-Off Switching Loss			33.1		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{DS}=900V, I_D=400A, R_G=1.6\Omega, V_{GS}=0/+18V, T_j=150^\circ C$		100		ns
t_r	Rise Time			95		ns
$t_{d(off)}$	Turn-Off Delay Time			343		ns
t_f	Fall Time			82		ns
E_{on}	Turn-On Switching Loss			8.65		mJ
E_{off}	Turn-Off Switching Loss			33.3		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
		$I_S=240A, V_{GS}=0V, T_j=150^\circ C$		3.4		
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		μC
I_{RM}	Peak Reverse Recovery Current			108		A

Module Characteristics $T_C=25^\circ C$ 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

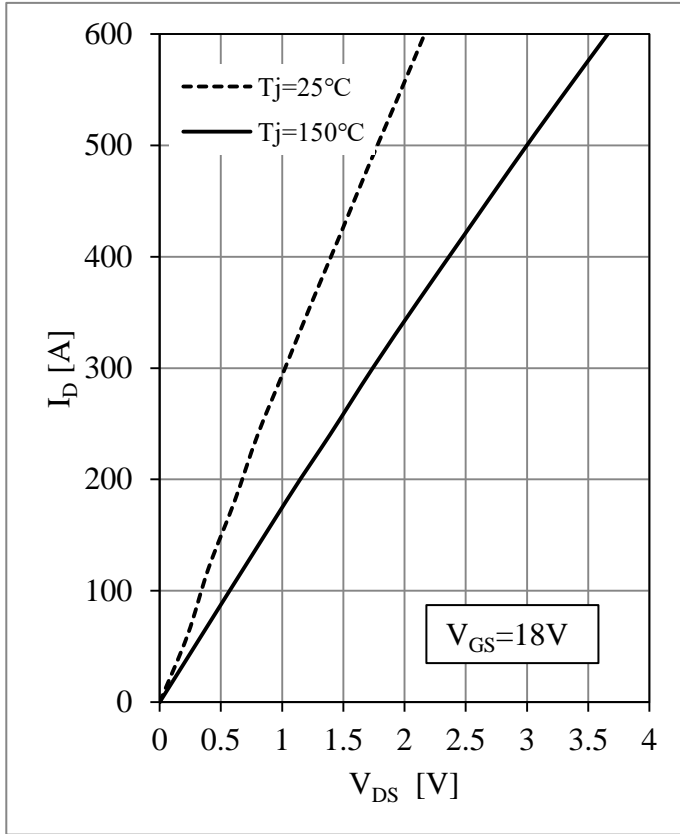


Fig 1. MOSFET Output Characteristics

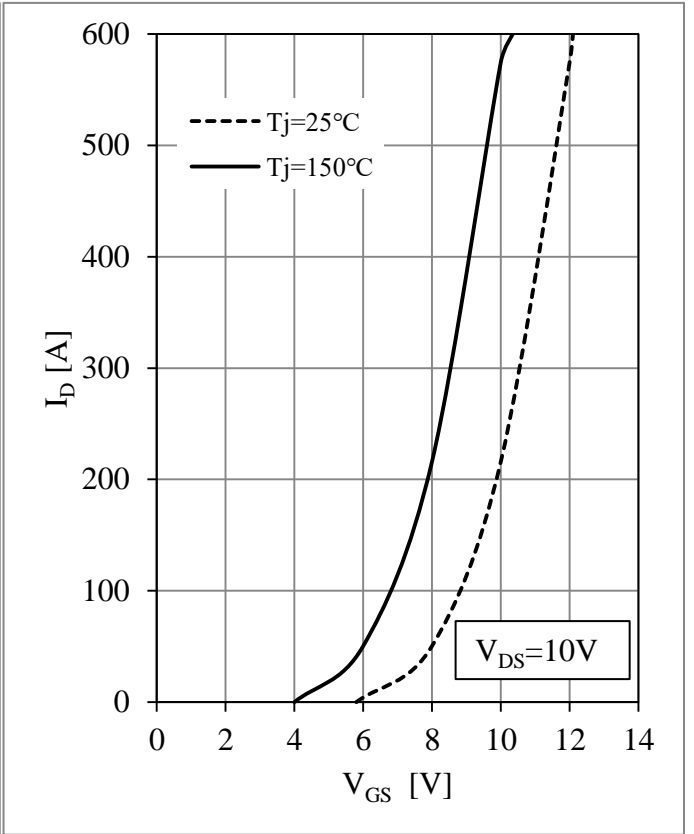


Fig 2. MOSFET Transfer Characteristics

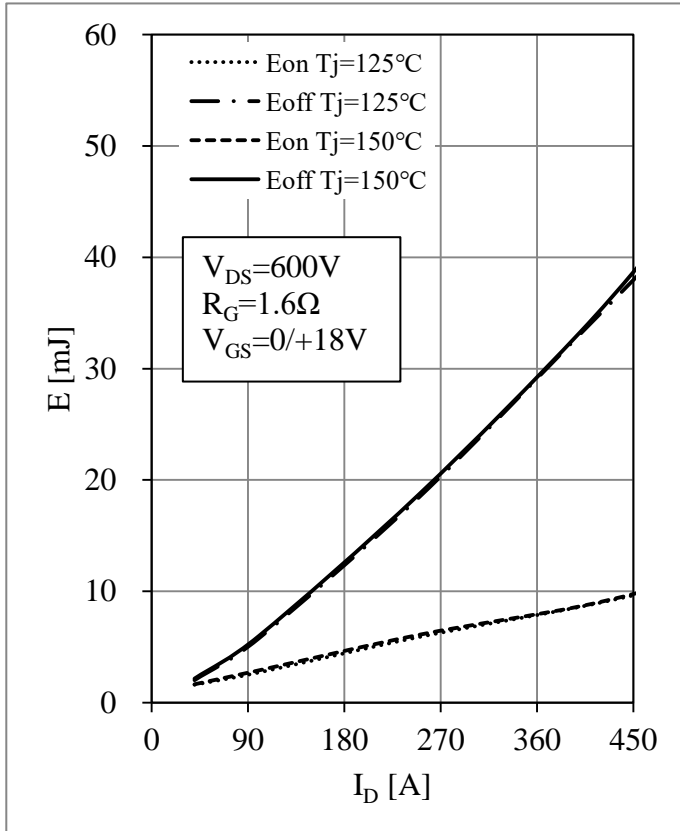


Fig 3. MOSFET Switching Loss vs. I_D

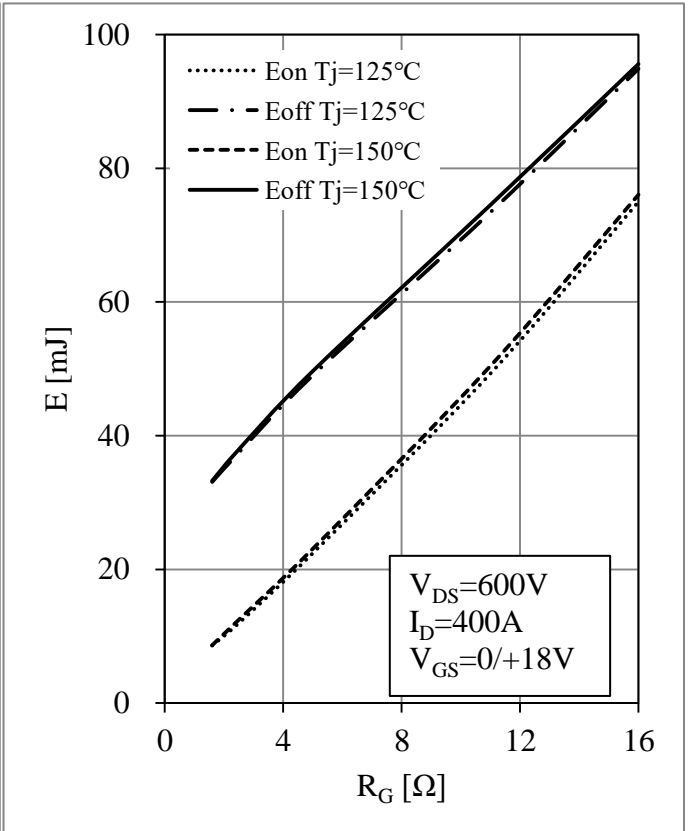


Fig 4. MOSFET Switching Loss vs. R_G

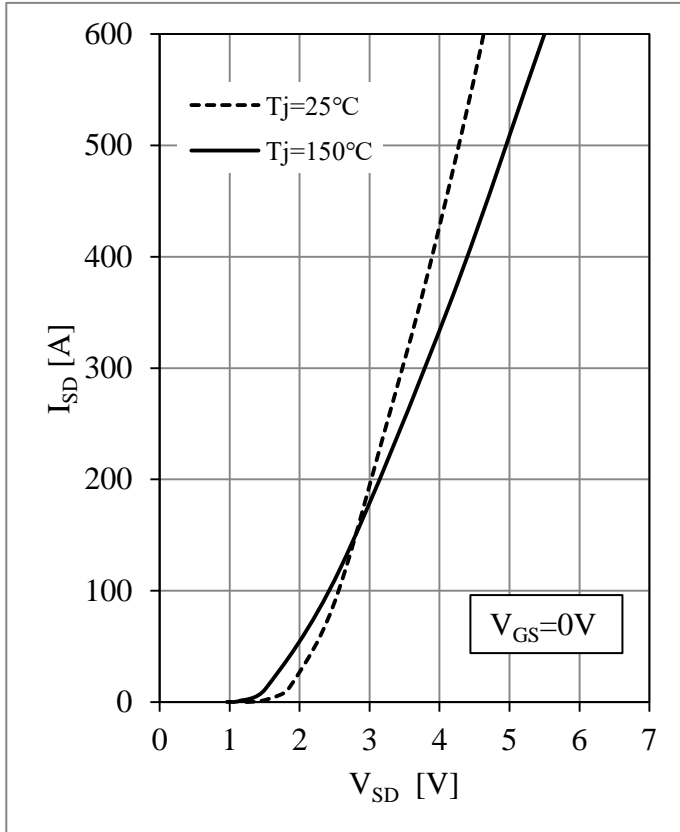


Fig 5. Body Diode Output Characteristics

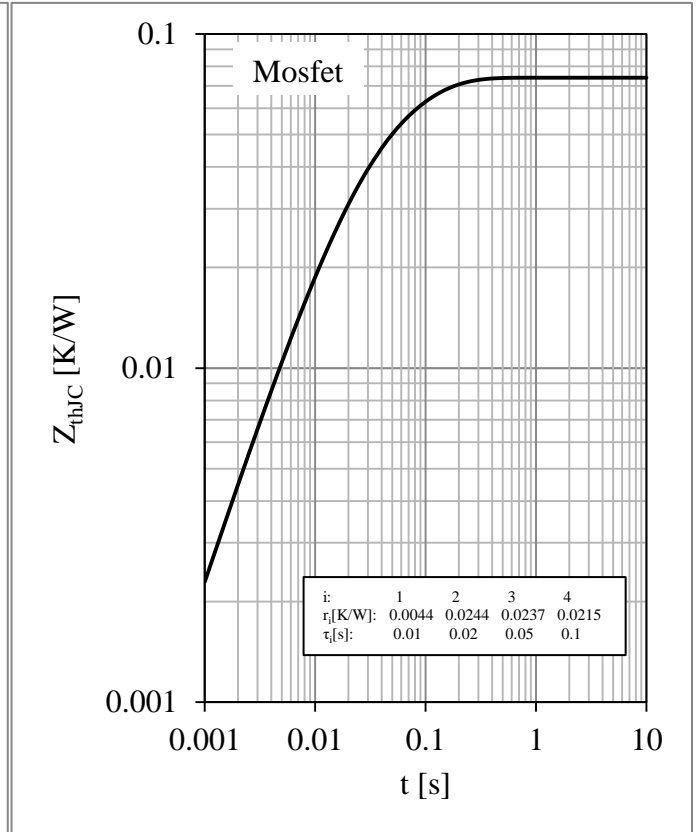
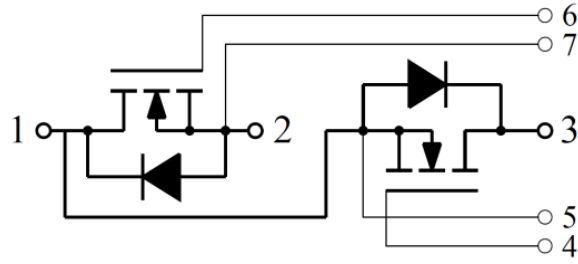


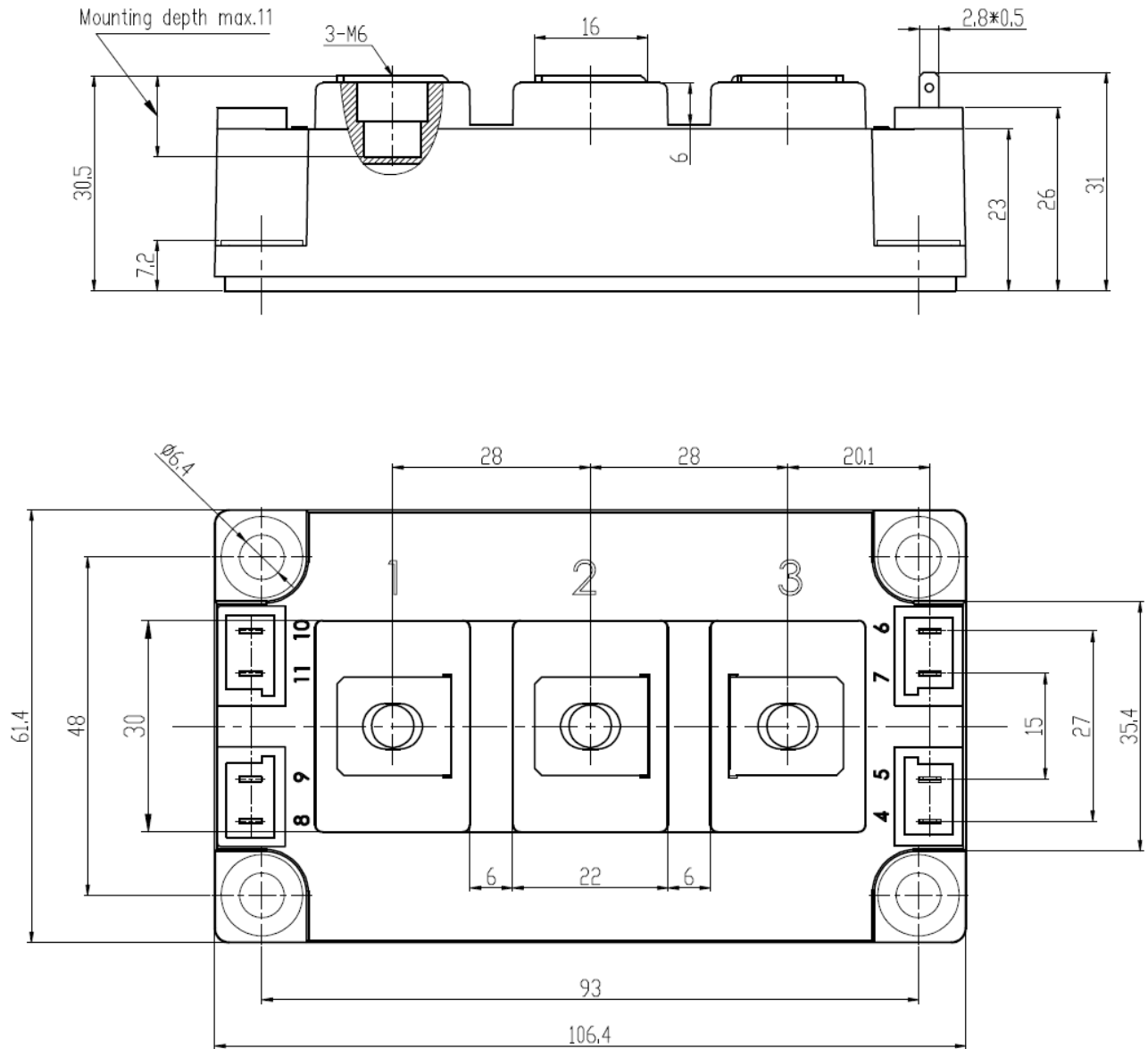
Fig 9. MOSFET Transient Thermal Impedance

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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