

STARPOWER

SEMICONDUCTOR

MOSFET

MD300HFC120C2S

1200V/300A 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.

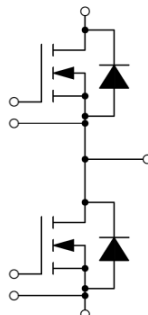
Features

- 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_{GSSmax}	Gate-Source Voltage	-8/+19	V
V_{GSSop}	Gate-Source Voltage	-4/+15	V
I_D	Drain Current @ $T_C=25^{\circ}C$	499	A
	@ $T_C=100^{\circ}C$	300	A
I_{DM}	Pulsed Drain Current	960	A
P_D	Maximum Power Dissipation @ $T_j=175^{\circ}C$	1923	W

Body Diode

Symbol	Description	Value	Unit
I_S	Source Current @ $T_C=100^{\circ}C$	TBD	A
I_{SM}	Pulsed Source Current	960	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, $f=50Hz, t=1min$	4000	V

MOSFET Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	
$R_{DS(on)}$	Static Drain-Source On-Resistance	$I_D=320A, V_{GS}=15V, T_j=25^\circ C$		4.00	5.20	m Ω	
		$I_D=320A, V_{GS}=15V, T_j=175^\circ C$		7.20			
$V_{GS(th)}$	Gate-Source Threshold Voltage	$I_D=92mA, V_{DS}=V_{GS}, T_j=25^\circ C$	1.8	2.5	3.6	V	
g_{fs}	Forward Transconductance	$V_{DS}=20V, I_D=320A$		216		S	
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=V_{DSS}, V_{GS}=0V, T_j=25^\circ C$			152	μA	
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=V_{GSS}, V_{DS}=0V, T_j=25^\circ C$			2000	nA	
R_{Gint}	Internal Gate Resistance			0.53		Ω	
C_{iss}	Input Capacitance			26.9		nF	
C_{oss}	Output Capacitance	$V_{GS}=0V, V_{DS}=1000V, f=100kHz$		1.03		nF	
C_{rss}	Reverse Transfer Capacitance			0.06		nF	
Q_g	Total Gate Charge			944		nC	
Q_{gs}	Gate-Source Charge	$I_D=320A, V_{DS}=800V, V_{GS}=-4/+15V$		320		nC	
Q_{gd}	Gate-Drain ("Miller") Charge			272		nC	
$t_{d(on)}$	Turn-On Delay Time	$V_{DS}=600V, I_D=300A, R_G=3.0\Omega, V_{GS}=-4/15V, T_j=25^\circ C$		88		ns	
t_r	Rise Time			63		ns	
$t_{d(off)}$	Turn-Off Delay Time			187		ns	
t_f	Fall Time			58		ns	
E_{on}	Turn-On Switching Loss				6.5		mJ
E_{off}	Turn-Off Switching Loss				11.5		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{DS}=600V, I_D=300A, R_G=3.0\Omega, V_{GS}=-4/15V, T_j=125^\circ C$		88		ns	
t_r	Rise Time			63		ns	
$t_{d(off)}$	Turn-Off Delay Time			215		ns	
t_f	Fall Time			62		ns	
E_{on}	Turn-On Switching Loss				6.8		mJ
E_{off}	Turn-Off Switching Loss				12.2		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{DS}=600V, I_D=300A, R_G=3.0\Omega, V_{GS}=-4/15V, T_j=150^\circ C$		93		ns	
t_r	Rise Time			64		ns	
$t_{d(off)}$	Turn-Off Delay Time			227		ns	
t_f	Fall Time			62		ns	
E_{on}	Turn-On Switching Loss				7.0		mJ
E_{off}	Turn-Off Switching Loss				12.5		mJ

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{SD}	Diode Forward Voltage	$I_S=160\text{A}, V_{GS}=-4\text{V}, T_j=25^{\circ}\text{C}$		4.60		V
		$I_S=180\text{A}, V_{GS}=-4\text{V}, T_j=175^{\circ}\text{C}$		4.00		
t_{rr}	Diode Reverse Recovery Time	$V_R=600\text{V}, I_S=300\text{A}, -di/dt=4180\text{A}/\mu\text{s}, V_{GS}=-4\text{V}, T_j=25^{\circ}\text{C}$		29.3		ns
I_{rrm}	Peak Reverse Recovery Current			80		A
E_{rec}	Reverse Recovery Energy			0.43		mJ
t_{rr}	Diode Reverse Recovery Time	$V_R=600\text{V}, I_S=300\text{A}, -di/dt=4400\text{A}/\mu\text{s}, V_{GS}=-4\text{V}, T_j=125^{\circ}\text{C}$		37.3		ns
I_{rrm}	Peak Reverse Recovery Current			128		A
E_{rec}	Reverse Recovery Energy			1.01		mJ
t_{rr}	Diode Reverse Recovery Time	$V_R=600\text{V}, I_S=300\text{A}, -di/dt=4400\text{A}/\mu\text{s}, V_{GS}=-4\text{V}, T_j=150^{\circ}\text{C}$		39.0		ns
I_{rrm}	Peak Reverse Recovery Current			148		A
E_{rec}	Reverse Recovery Energy			1.32		mJ

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

Symbol	Parameter	Min.	Typ.	Max.	Unit
R_{thJC}	Junction-to-Case(Mosfet)			0.078	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

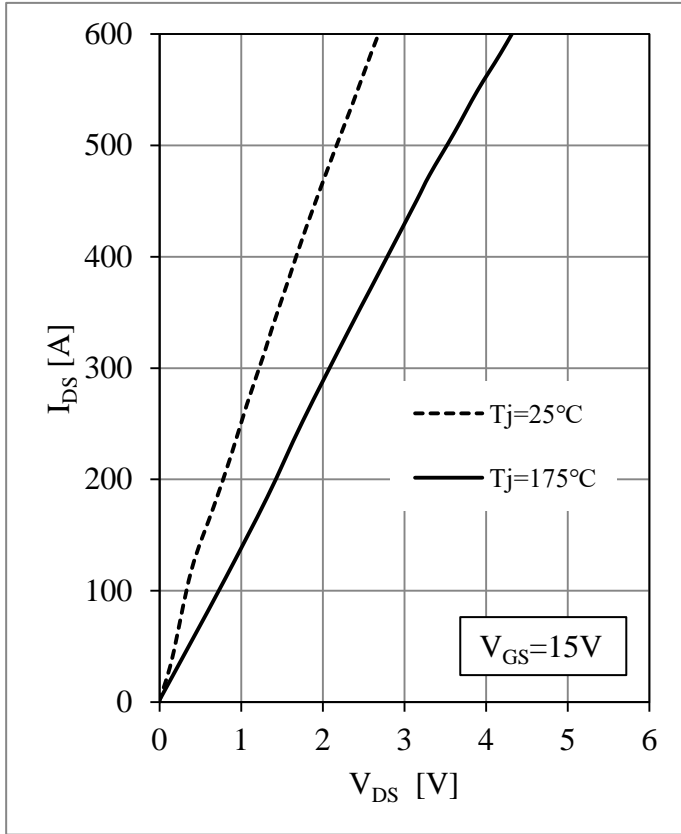


Fig 1. MOSFET Output Characteristics

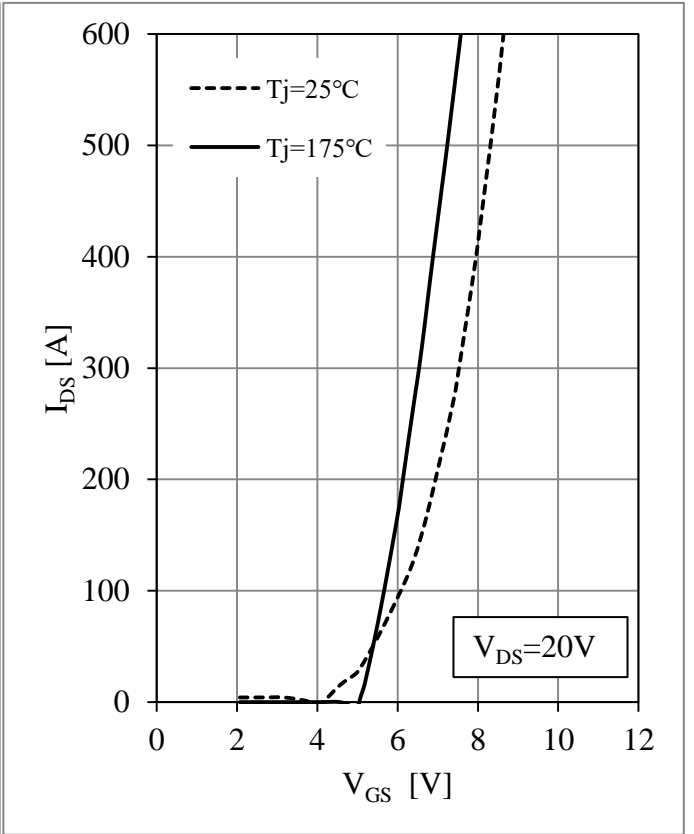


Fig 2. MOSFET Transfer Characteristics

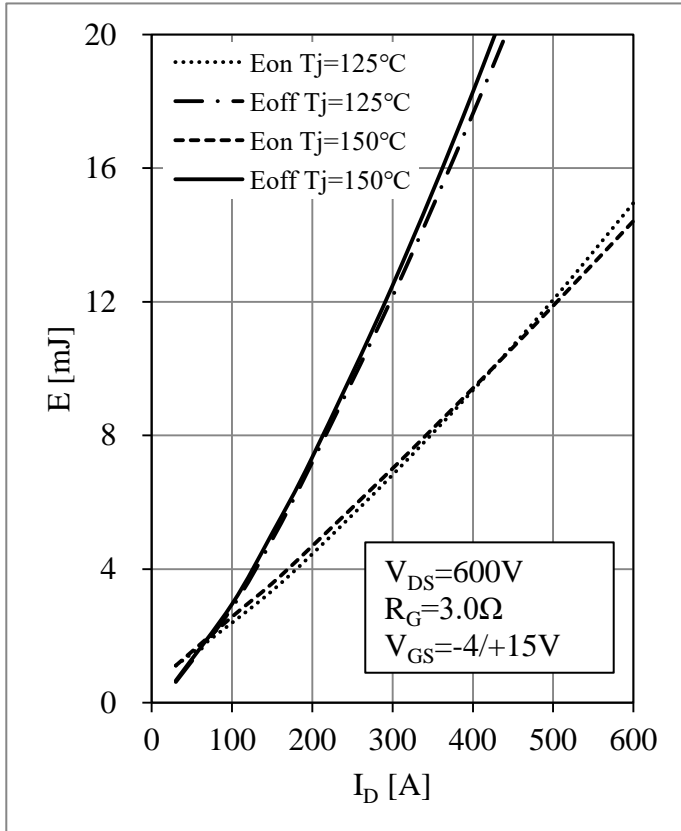


Fig 3. MOSFET Switching Loss vs. I_{DS}

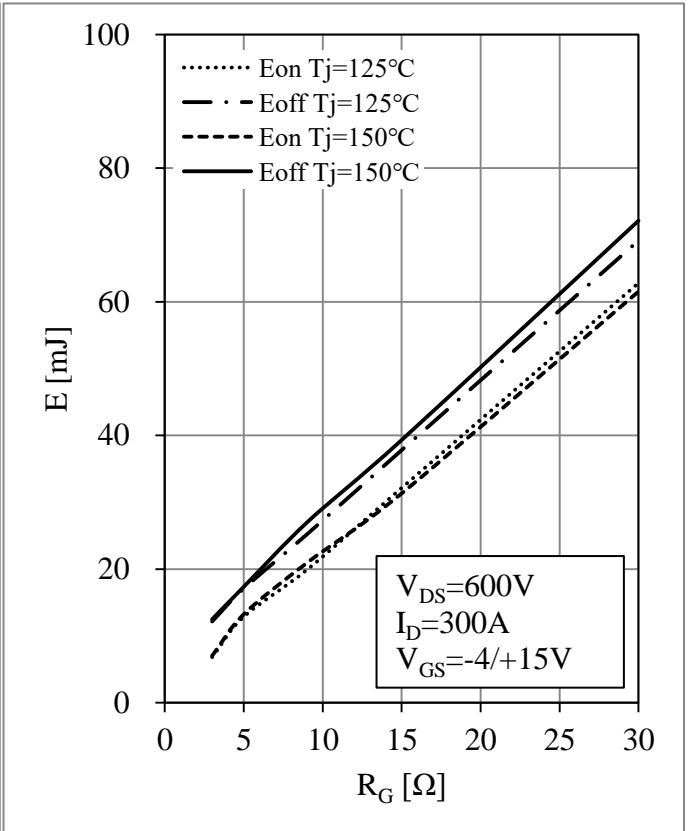


Fig 4. MOSFET Switching Loss vs. R_G

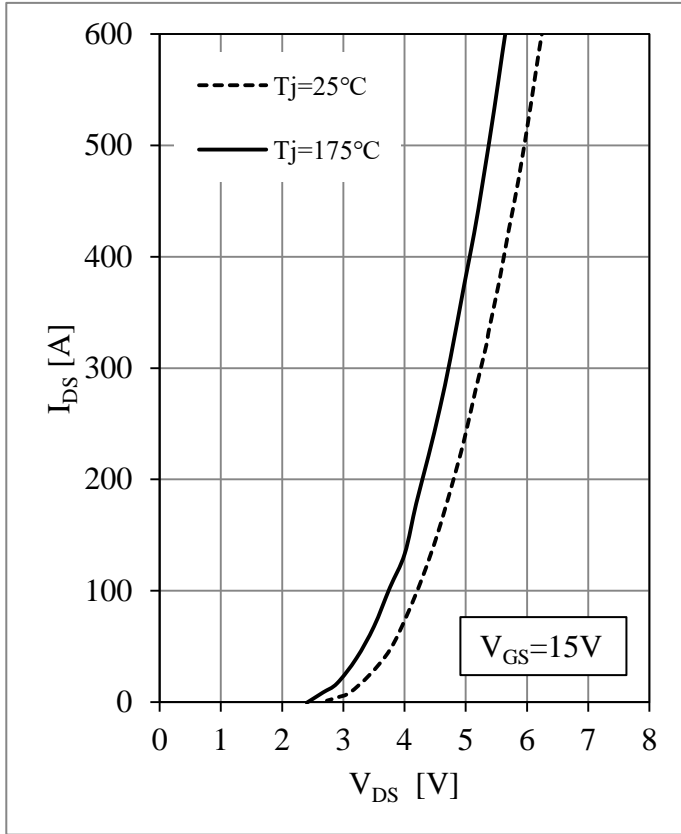


Fig 5. Body Diode Characteristics

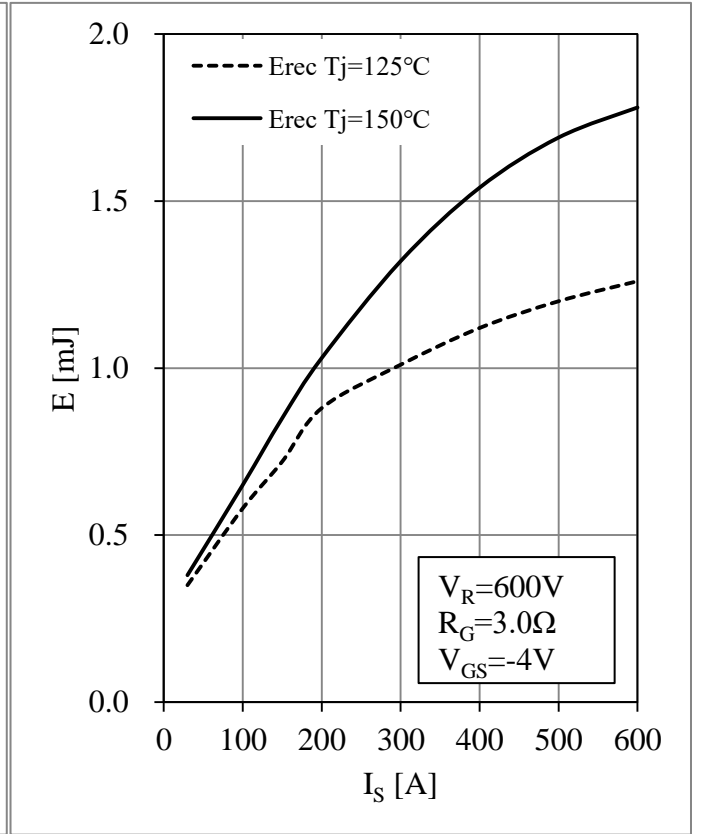


Fig 6. Body Diode Switching Loss vs. I_S

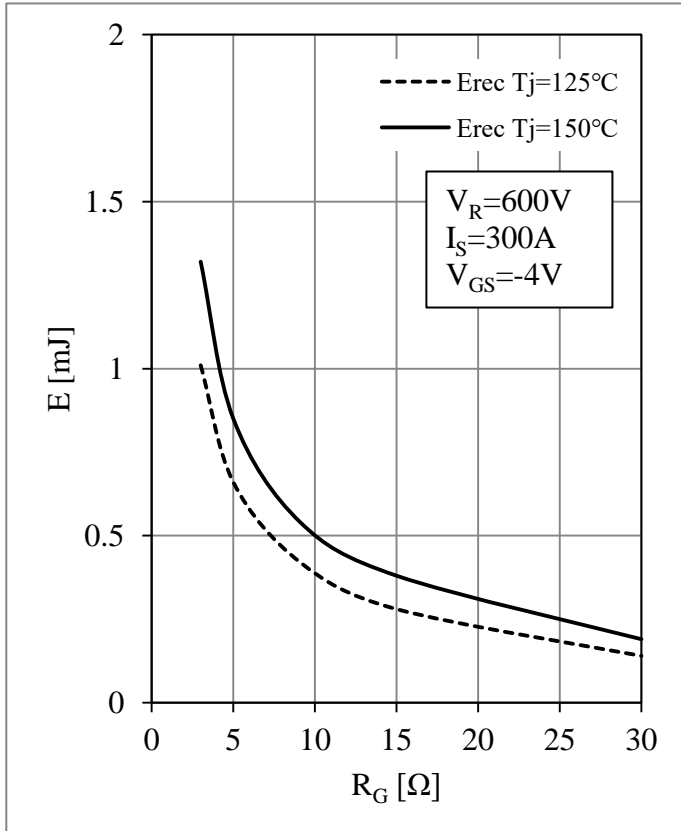


Fig 7. Body Diode Switching Loss vs. R_G

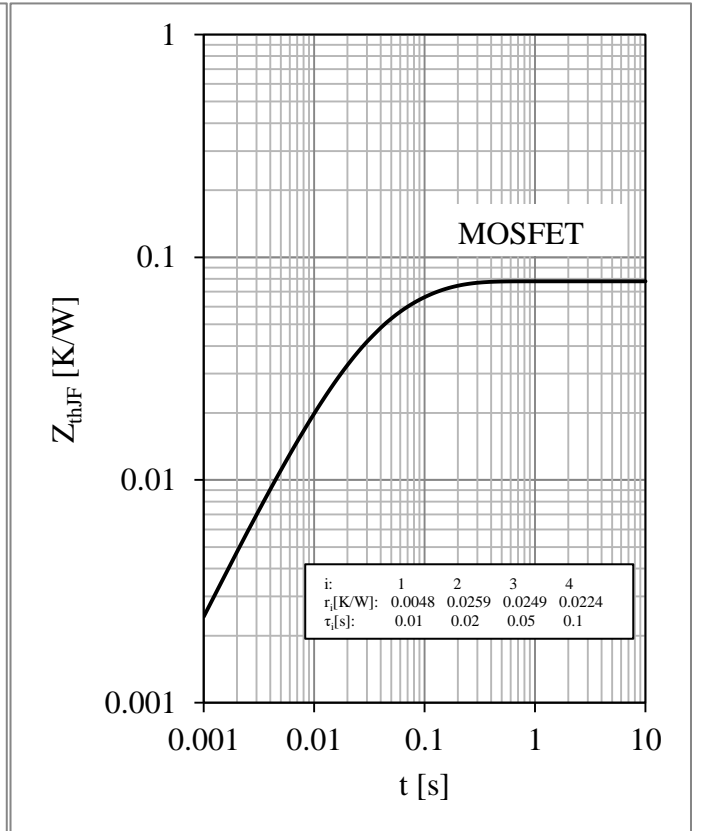
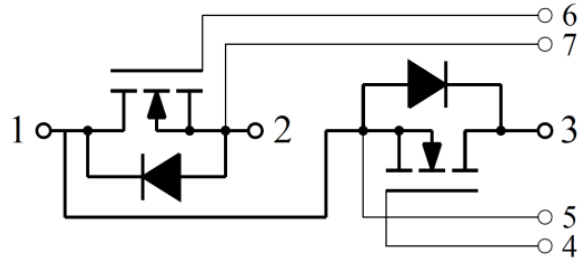


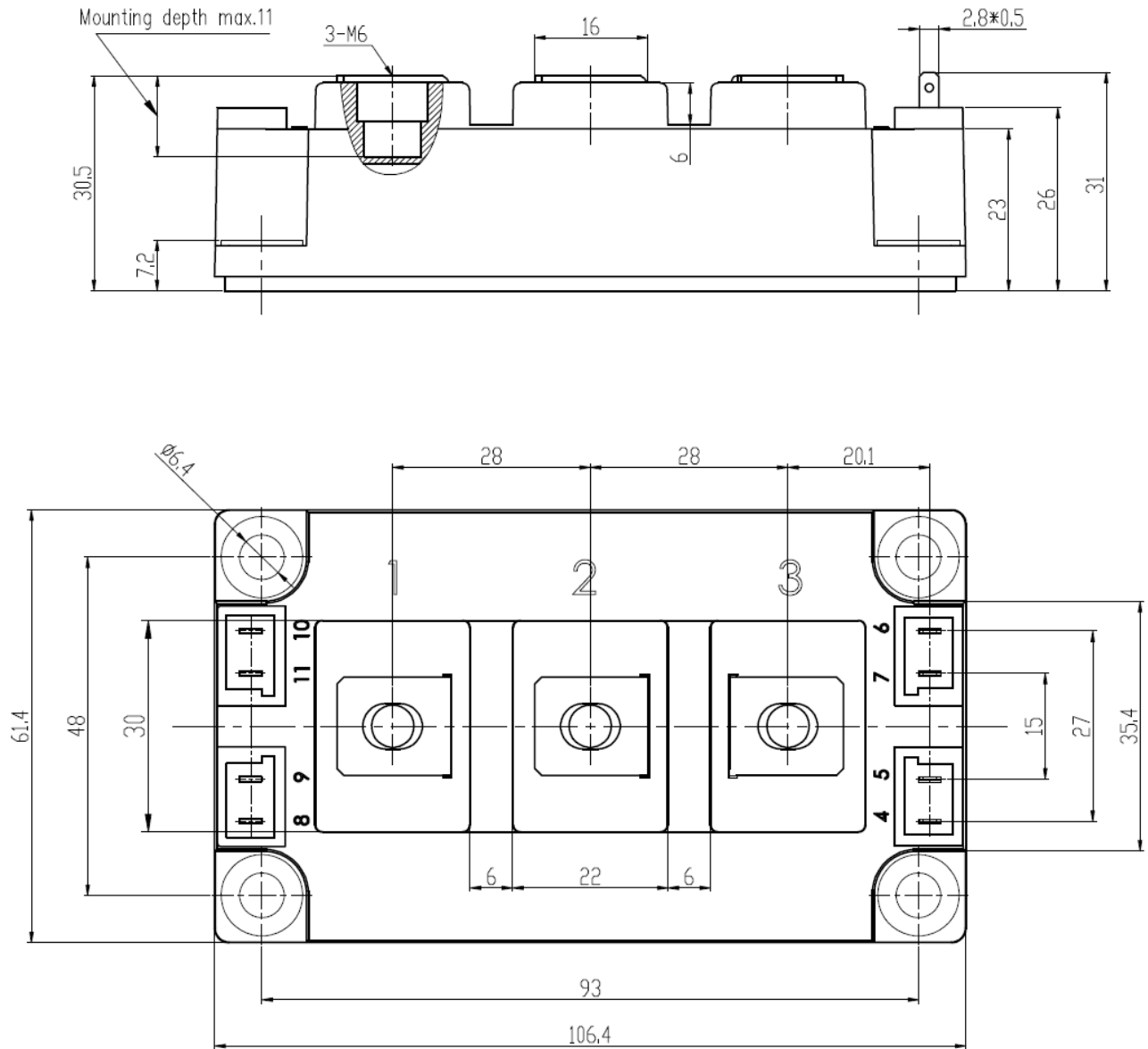
Fig 8. MOSFET Transient Thermal Impedance

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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