

STARPOWER

SEMICONDUCTOR

MOSFET

MD300HFC170C2S

1700V/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.

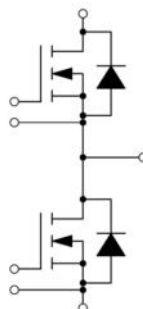
Features

- 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	1700	V
V_{GSSmax}	Gate-Source Voltage	-8/+19	V
V_{GSSop}	Gate-Source Voltage	-4/+15	V
I_D	Drain Current @ $T_C=25^{\circ}C$ @ $T_C=100^{\circ}C$	553 300	A

Body Diode

Symbol	Description	Value	Unit
I_S	Source Current @ $T_C=100^{\circ}C$	296	A

Module

Symbol	Description	Value	Unit
T_{vjmax}	Maximum Junction Temperature	175	$^{\circ}C$
T_{vjop}	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	$I_D=600A, V_{GS}=15V, T_{vj}=25^{\circ}C$		3.33	4.33	$m\Omega$
		$I_D=600A, V_{GS}=15V, T_{vj}=125^{\circ}C$		5.97		
		$I_D=600A, V_{GS}=15V, T_{vj}=150^{\circ}C$		7.05		
$V_{GS(th)}$	Gate-Source Threshold Voltage	$I_D=159mA, V_{DS}=V_{GS}, T_{vj}=25^{\circ}C$	1.8	2.5	3.6	V
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=V_{DSS}, V_{GS}=0V, T_{vj}=25^{\circ}C$			240	μA
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=V_{GSS}, V_{DS}=0V, T_{vj}=25^{\circ}C$			600	nA
R_{Gint}	Internal Gate Resistance			0.4		Ω
C_{iss}	Input Capacitance	$V_{GS}=0V, V_{DS}=1000V, f=100kHz$		42.4		nF
C_{oss}	Output Capacitance			1.11		nF
C_{rss}	Reverse Transfer Capacitance			0.04		nF
Q_g	Total Gate Charge	$I_D=600A, V_{DS}=1200V, V_{GS}=-4/+15V$		1170		nC
$t_{d(on)}$	Turn-On Delay Time	$V_{DS}=900V, I_D=300A, R_G=8.2\Omega, L_S=60nH, V_{GS}=-4/+15V, T_{vj}=25^{\circ}C$		214		ns
t_r	Rise Time			98		ns
$t_{d(off)}$	Turn-Off Delay Time			792		ns
t_f	Fall Time			82		ns
E_{on}	Turn-On Switching Loss			36.7		mJ
E_{off}	Turn-Off Switching Loss			21.8		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{DS}=900V, I_D=300A, R_G=8.2\Omega, L_S=60nH, V_{GS}=-4/+15V, T_{vj}=125^{\circ}C$		210		ns
t_r	Rise Time			93		ns
$t_{d(off)}$	Turn-Off Delay Time			807		ns
t_f	Fall Time			85		ns
E_{on}	Turn-On Switching Loss			36.8		mJ
E_{off}	Turn-Off Switching Loss			21.8		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{DS}=900V, I_D=300A, R_G=8.2\Omega, L_S=60nH, V_{GS}=-4/+15V, T_{vj}=150^{\circ}C$		245		ns
t_r	Rise Time			111		ns
$t_{d(off)}$	Turn-Off Delay Time			711		ns
t_f	Fall Time			86		ns
E_{on}	Turn-On Switching Loss			36.7		mJ
E_{off}	Turn-Off Switching Loss			21.3		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	$I_{SD}=300\text{A}, V_{GS}=-4\text{V}, T_{vj}=25^{\circ}\text{C}$		4.60	5.60	V
		$I_{SD}=300\text{A}, V_{GS}=-4\text{V}, T_{vj}=125^{\circ}\text{C}$		4.60		
		$I_{SD}=300\text{A}, V_{GS}=-4\text{V}, T_{vj}=150^{\circ}\text{C}$		4.60		
Q_r	Recovered Charge	$V_R=900\text{V}, I_{SD}=300\text{A}, -di/dt=3900\text{A}/\mu\text{s}, V_{GS}=-4\text{V}, L_S=60\text{nH}, T_{vj}=25^{\circ}\text{C}$		5.94		μC
I_{RM}	Peak Reverse Recovery Current			130		A
E_{rec}	Reverse Recovery Energy			0.92		mJ
Q_r	Recovered Charge	$V_R=900\text{V}, I_{SD}=300\text{A}, -di/dt=3800\text{A}/\mu\text{s}, V_{GS}=-4\text{V}, L_S=60\text{nH}, T_{vj}=125^{\circ}\text{C}$		7.71		μC
I_{RM}	Peak Reverse Recovery Current			148		A
E_{rec}	Reverse Recovery Energy			0.70		mJ
Q_r	Recovered Charge	$V_R=900\text{V}, I_{SD}=300\text{A}, -di/dt=3600\text{A}/\mu\text{s}, V_{GS}=-4\text{V}, L_S=60\text{nH}, T_{vj}=150^{\circ}\text{C}$		2.3		μC
I_{RM}	Peak Reverse Recovery Current			87		A
E_{rec}	Reverse Recovery Energy			0.75		mJ

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

Symbol	Parameter	Min.	Typ.	Max.	Unit
R_{thJC}	Junction-to-Case(Mosfet)			0.055	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

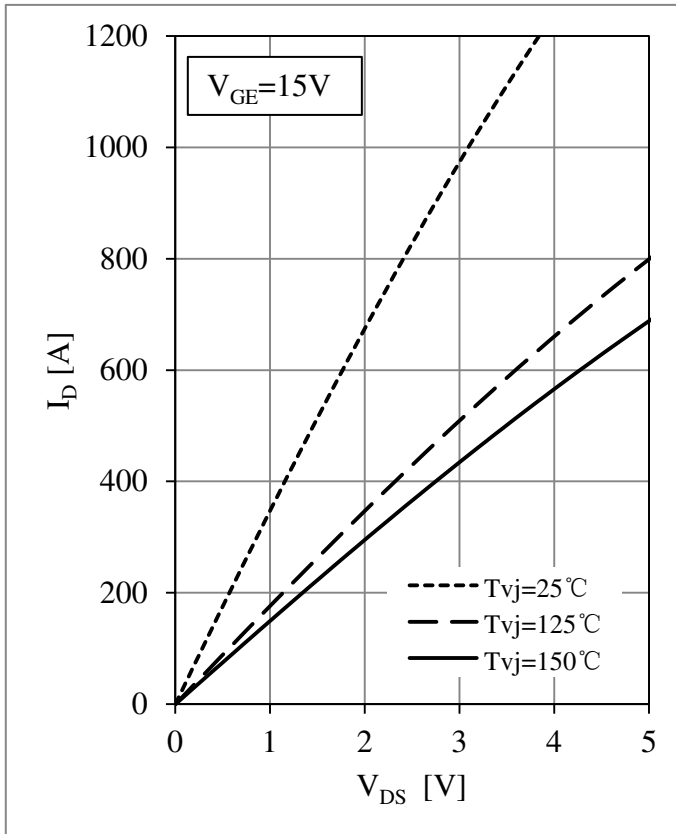


Fig 1. MOSFET Output Characteristics

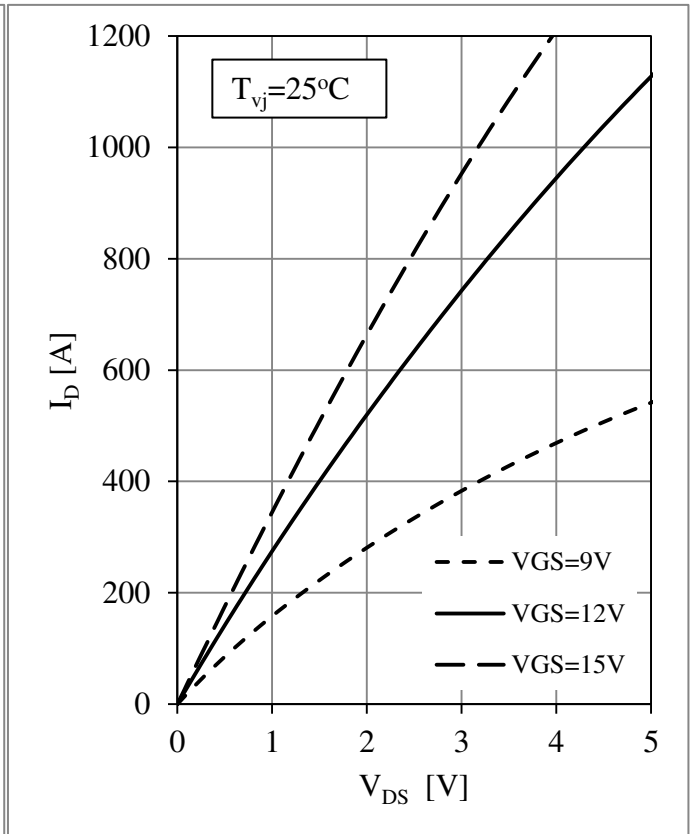


Fig 2. MOSFET Output Characteristics

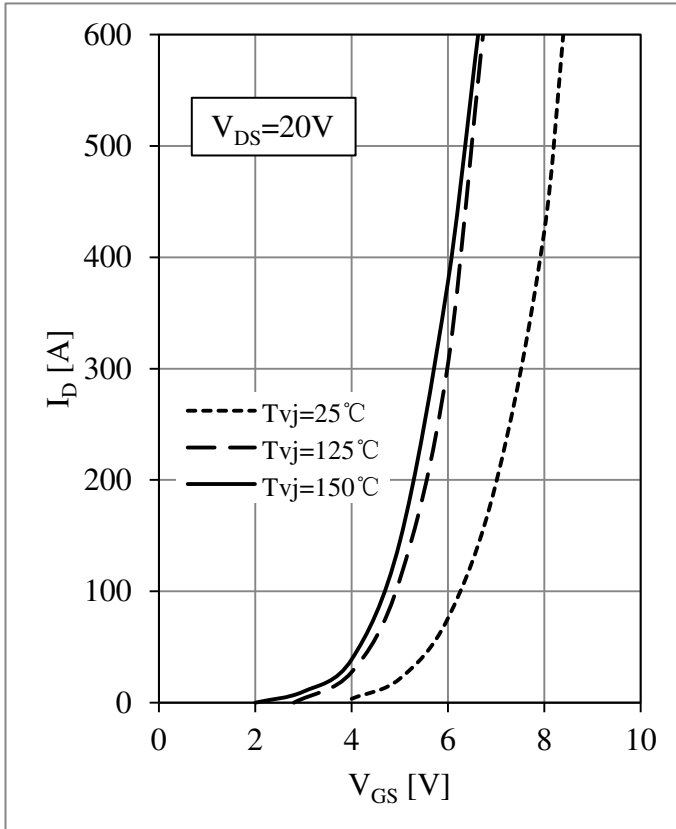
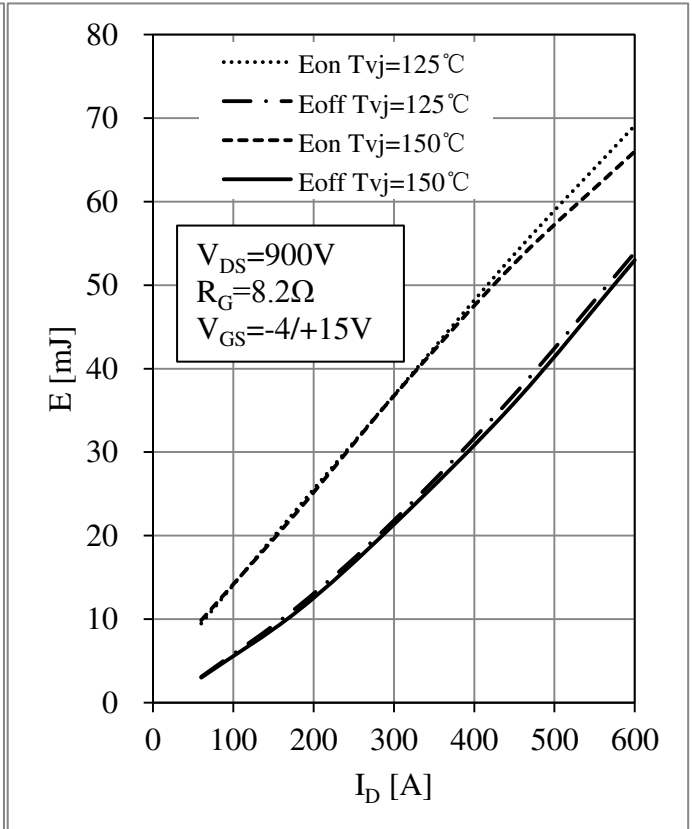


Fig 3. MOSFET Transfer Characteristics

Fig 4. MOSFET Switching Loss vs. I_{DS}

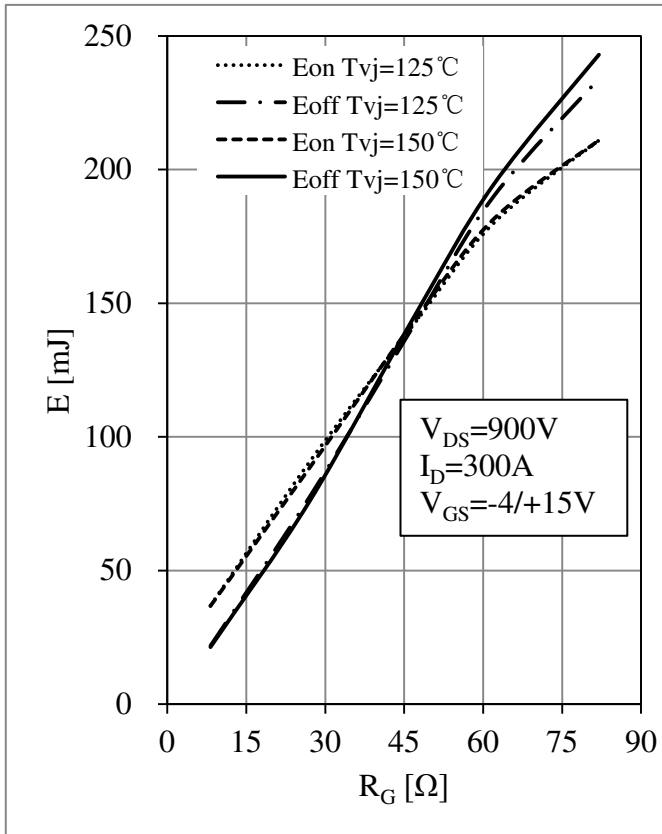
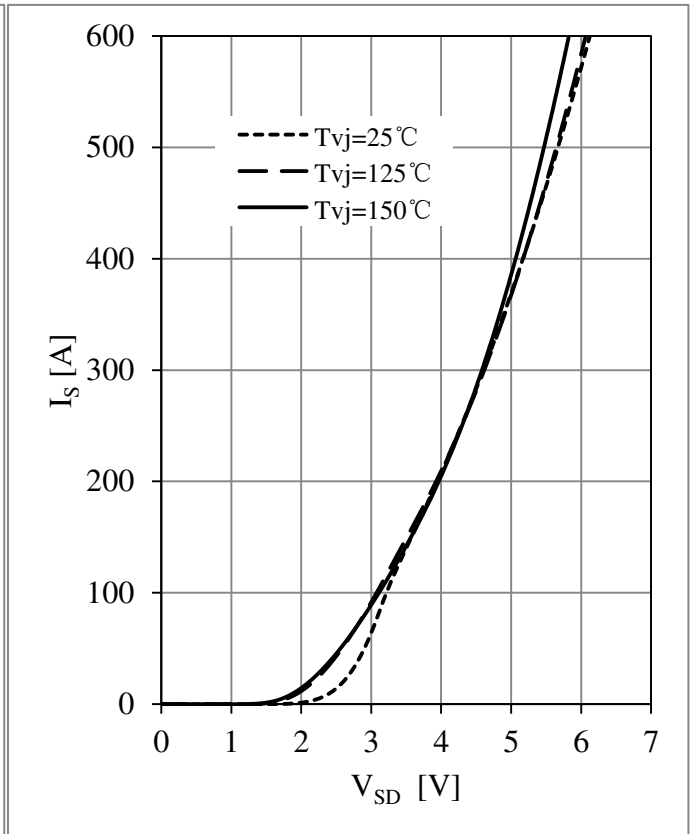
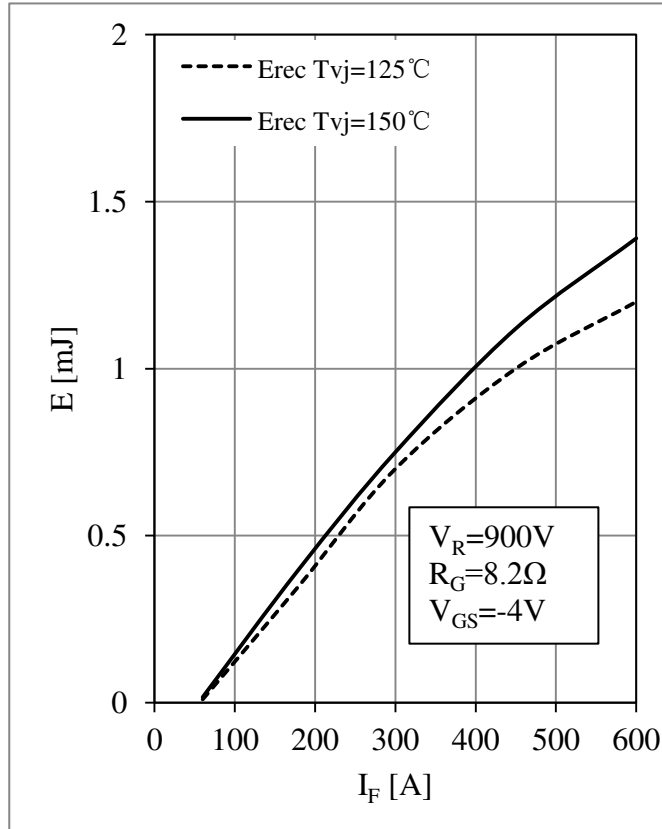
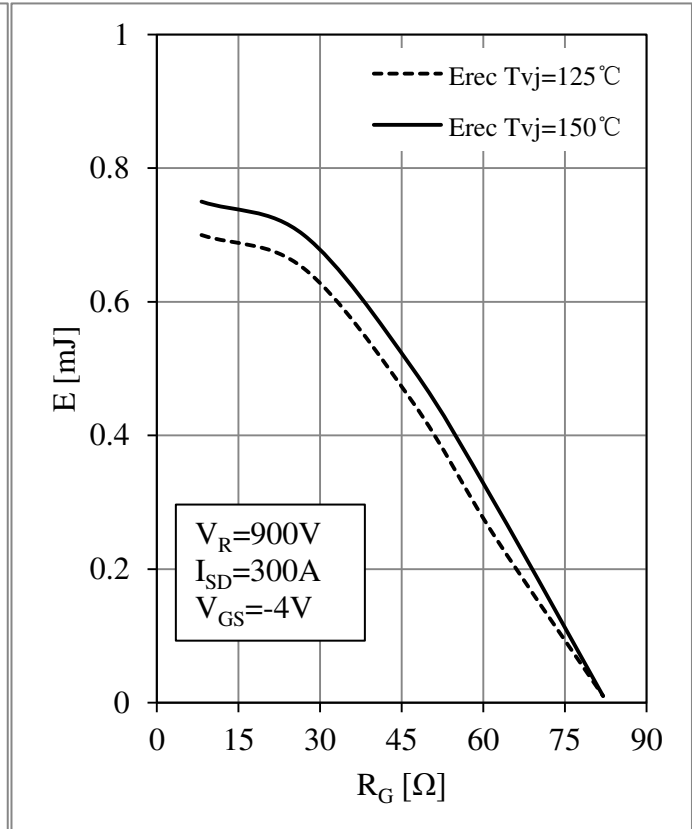
Fig 5. MOSFET Switching Loss vs. R_G 

Fig 6. Body Diode Characteristics

Fig 7. Body Diode Switching Loss vs. I_S Fig 8. Body Diode Switching Loss vs. R_G

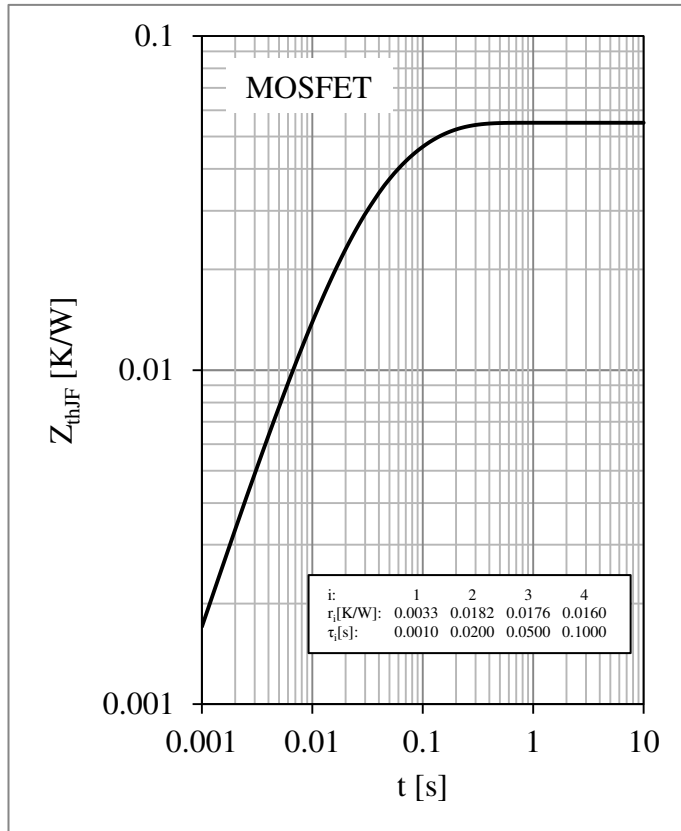
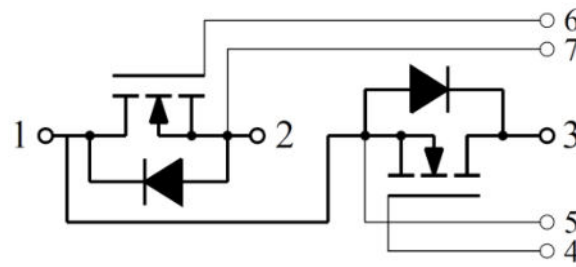


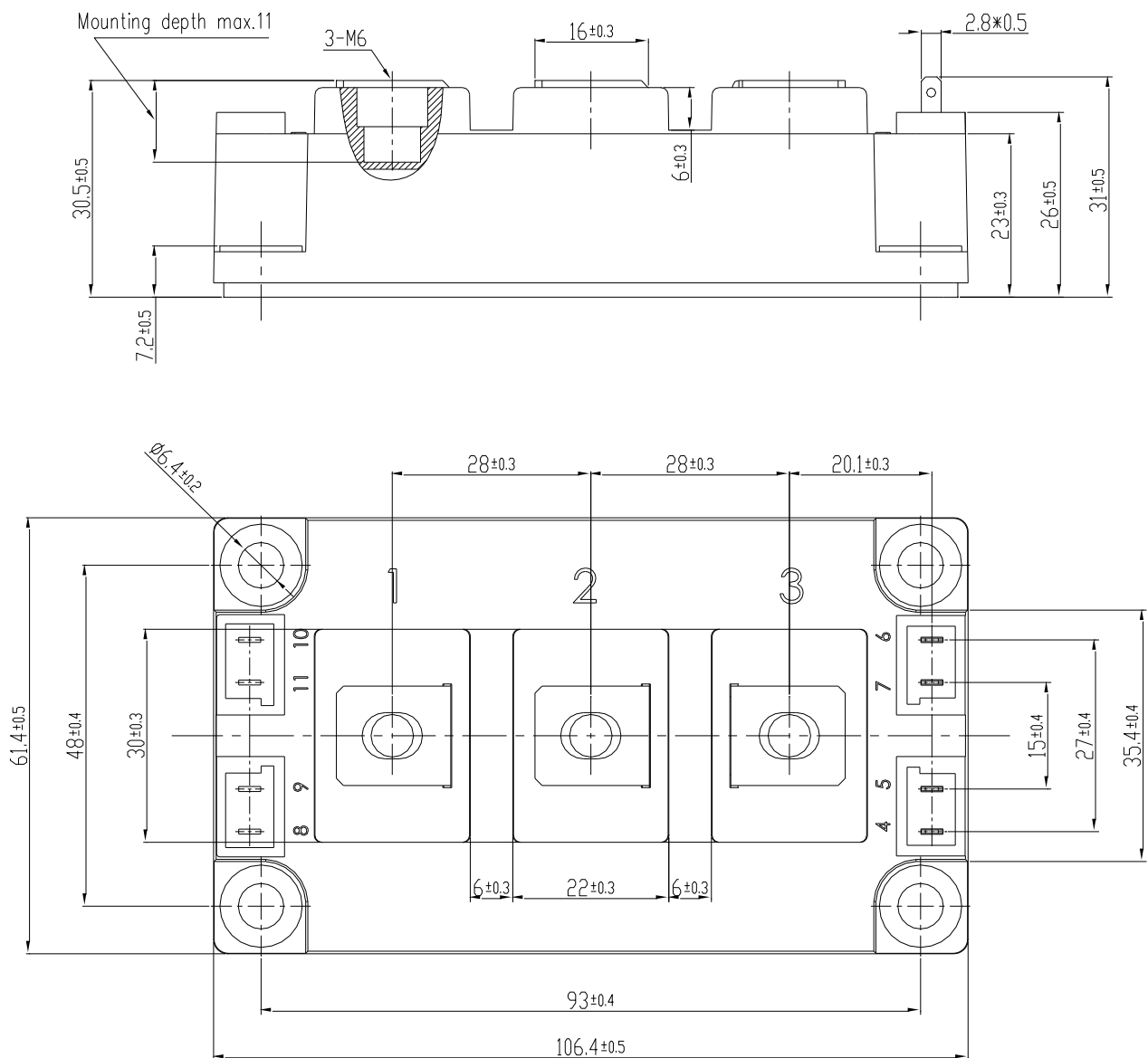
Fig 9. MOSFET Transient Thermal Impedance

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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