

# STARPOWER

SEMICONDUCTOR

**SiC MOSFET**

## MD29HFS120C2S\_B20

**1200V/2.9mΩ 2 in one-package**

### General Description

STARPOWER MOSFET Power Module provides very low  $R_{DS(on)}$  as well as optimized intrinsic diode. They are designed for the applications such as SMPS and DC drives.

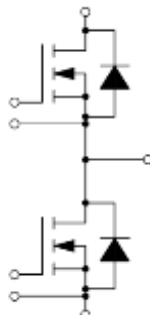
### Features

- SiC power MOSFET
- Low  $R_{DS(on)}$
- Optimized intrinsic reverse diode
- Chip sintering technology
- Low inductance case avoid oscillations
- Isolated copper baseplate using 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**  $T_C=25^{\circ}\text{C}$  unless otherwise noted**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 $T_{vjmax}=175^{\circ}\text{C}$	440	A
$P_D$	Maximum Power Dissipation $T_{vjmax}=175^{\circ}\text{C}$	1119	W

**Body Diode**

Symbol	Description	Value	Unit
$I_S$	Source Current $T_{vjmax}=175^{\circ}\text{C}$	285	A

**Module**

Symbol	Description	Value	Unit
$T_{vjmax}$	Maximum Junction Temperature	175	$^{\circ}\text{C}$
$T_{viop}$	Operating Junction Temperature	-40 to +175	$^{\circ}\text{C}$
$T_{STG}$	Storage Temperature Range	-40 to +125	$^{\circ}\text{C}$
$V_{ISO}$	Isolation Voltage RMS, $f=50\text{Hz}, t=1\text{min}$	2500	V

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	
$R_{DS(on)}$	Static Drain-Source On-Resistance	$I_D=450\text{A}, V_{GS}=15\text{V}, T_{vj}=25^\circ\text{C}$		2.90		m $\Omega$	
		$I_D=450\text{A}, V_{GS}=15\text{V}, T_{vj}=150^\circ\text{C}$		4.53			
		$I_D=450\text{A}, V_{GS}=15\text{V}, T_{vj}=175^\circ\text{C}$		4.77			
$V_{GS(th)}$	Gate-Source Threshold Voltage	$I_D=125\text{mA}, V_{DS}=V_{GS}, T_{vj}=25^\circ\text{C}$		2.6		V	
$I_{DSS}$	Drain-Source Leakage Current	$V_{DS}=V_{DSS}, V_{GS}=0\text{V}, T_{vj}=25^\circ\text{C}$			500	mA	
$I_{GSS}$	Gate-Source Leakage Current	$V_{GS}=19\text{V}, V_{DS}=0\text{V}, T_{vj}=25^\circ\text{C}$			600	nA	
$R_{Gint}$	Internal Gate Resistance			1.8		$\Omega$	
$C_{iss}$	Input Capacitance	$V_{GS}=0\text{V}, V_{DS}=800\text{V}, f=100\text{kHz}$		39.3		nF	
$C_{oss}$	Output Capacitance			1.32		nF	
$C_{rss}$	Reverse Transfer Capacitance			0.06		nF	
$Q_g$	Total Gate Charge	$I_D=450\text{A}, V_{DS}=800\text{V}, V_{GS}=-4/+15\text{V}$		1.14		$\mu\text{C}$	
$t_{d(on)}$	Turn-On Delay Time	$V_{DS}=600\text{V}, I_D=600\text{A}, R_{Gon}=6.0\Omega, R_{Goff}=2.7\Omega, L_S=42\text{nH}, V_{GS}=-4/+15\text{V}, T_{vj}=25^\circ\text{C}$		208		ns	
$t_r$	Rise Time			128		ns	
$t_{d(off)}$	Turn-Off Delay Time			206		ns	
$t_f$	Fall Time			49		ns	
$E_{on}$	Turn-On Switching Loss			26.4		mJ	
$E_{off}$	Turn-Off Switching Loss			22.8		mJ	
$t_{d(on)}$	Turn-On Delay Time		$V_{DS}=600\text{V}, I_D=600\text{A}, R_{Gon}=6.0\Omega, R_{Goff}=2.7\Omega, L_S=42\text{nH}, V_{GS}=-4/+15\text{V}, T_{vj}=150^\circ\text{C}$		209		ns
$t_r$	Rise Time				132		ns
$t_{d(off)}$	Turn-Off Delay Time				314		ns
$t_f$	Fall Time				60		ns
$E_{on}$	Turn-On Switching Loss			29.9		mJ	
$E_{off}$	Turn-Off Switching Loss			27.9		mJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{DS}=600\text{V}, I_D=600\text{A}, R_{Gon}=6.0\Omega, R_{Goff}=2.7\Omega, L_S=42\text{nH}, V_{GS}=-4/+15\text{V}, T_{vj}=175^\circ\text{C}$			210		ns
$t_r$	Rise Time				133		ns
$t_{d(off)}$	Turn-Off Delay Time				334		ns
$t_f$	Fall Time				68		ns
$E_{on}$	Turn-On Switching Loss			30.7		mJ	
$E_{off}$	Turn-Off Switching Loss			28.5		mJ	

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{SD}$	Diode Forward Voltage	$I_{SD}=228\text{A}, V_{GS}=-4\text{V}, T_{vj}=25^\circ\text{C}$		4.35		V
		$I_{SD}=228\text{A}, V_{GS}=-4\text{V}, T_{vj}=175^\circ\text{C}$		3.80		

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

Symbol	Parameter	Min.	Typ.	Max.	Unit
$R_{thJC}$	Junction-to-Case (per MOSFET)			0.134	K/W
$R_{thCH}$	Case-to-Heatsink (per MOSFET)		0.041		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		320		g

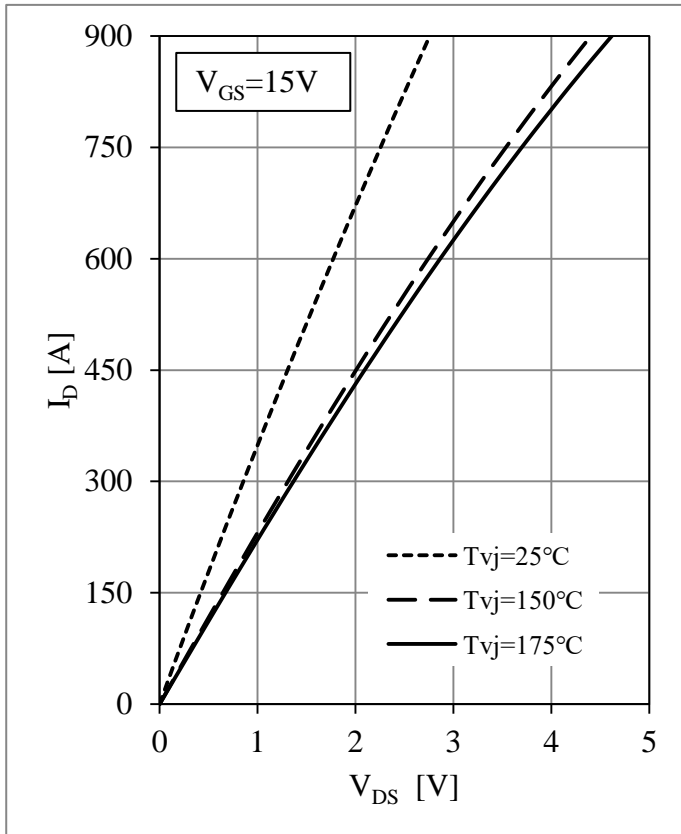


Fig 1. MOSFET Output Characteristics

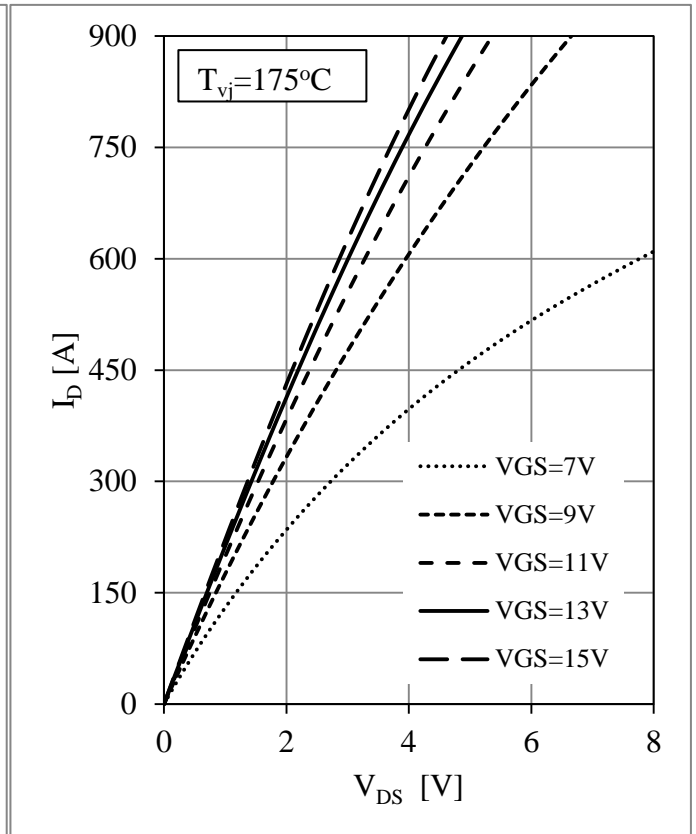


Fig 2. MOSFET Output Characteristics

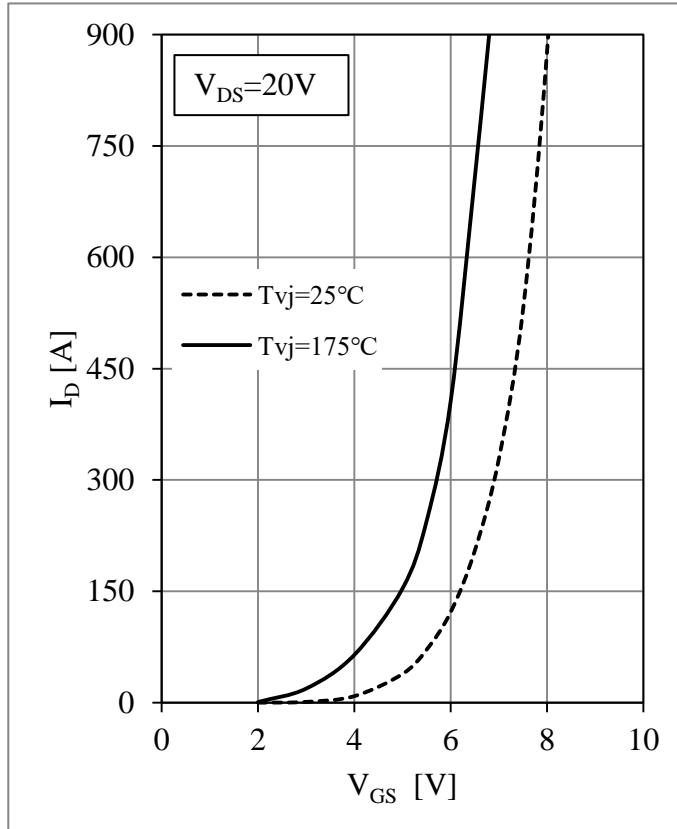


Fig 3. MOSFET Transfer Characteristics

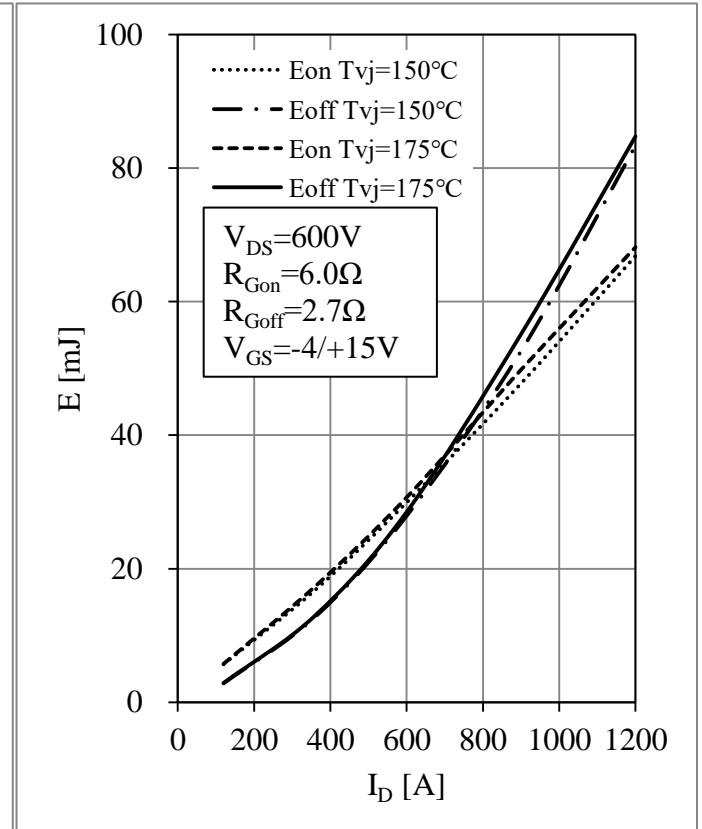


Fig 4. MOSFET Switching Loss vs.  $I_{DS}$

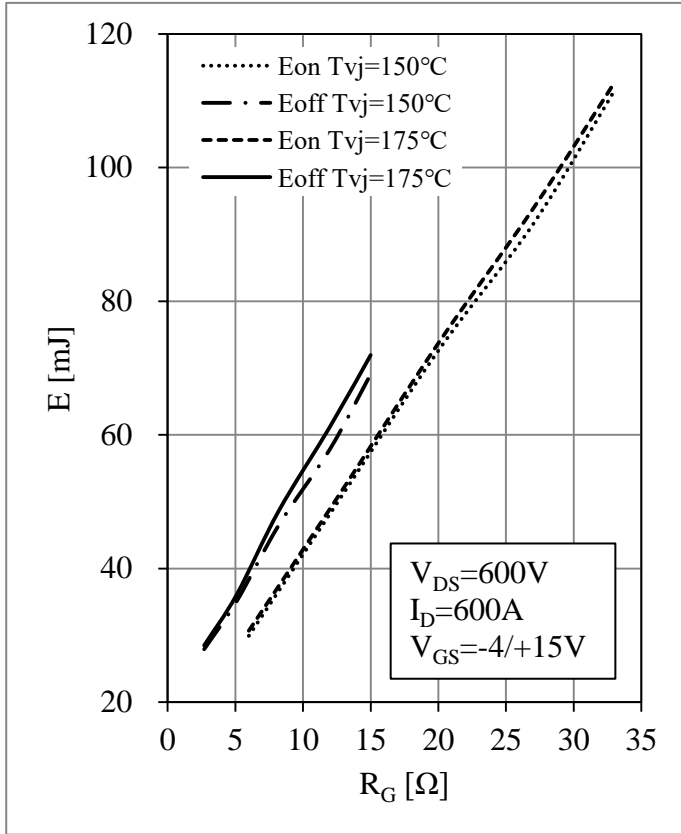


Fig 5. MOSFET Switching Loss vs.  $R_G$

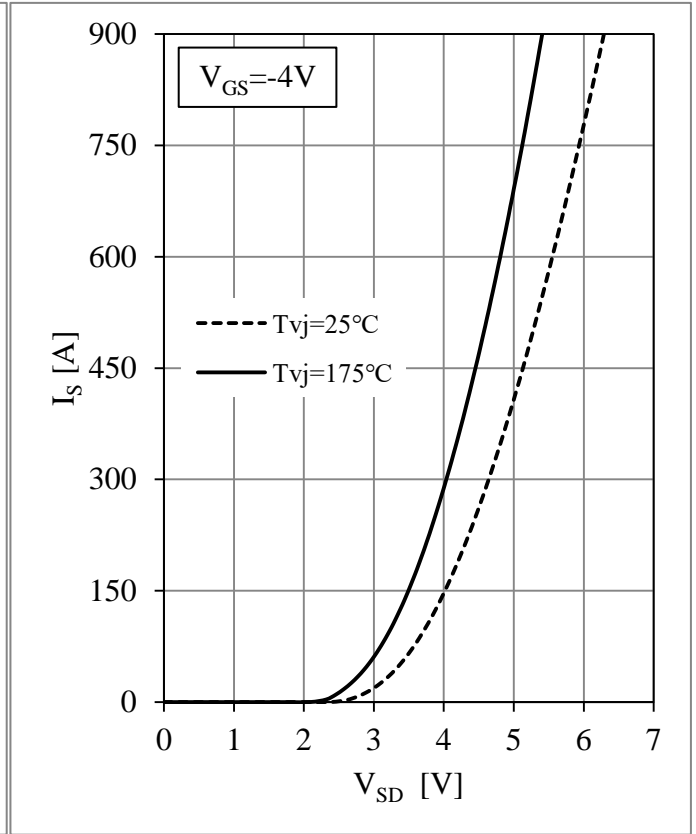


Fig 6. Body Diode Characteristics

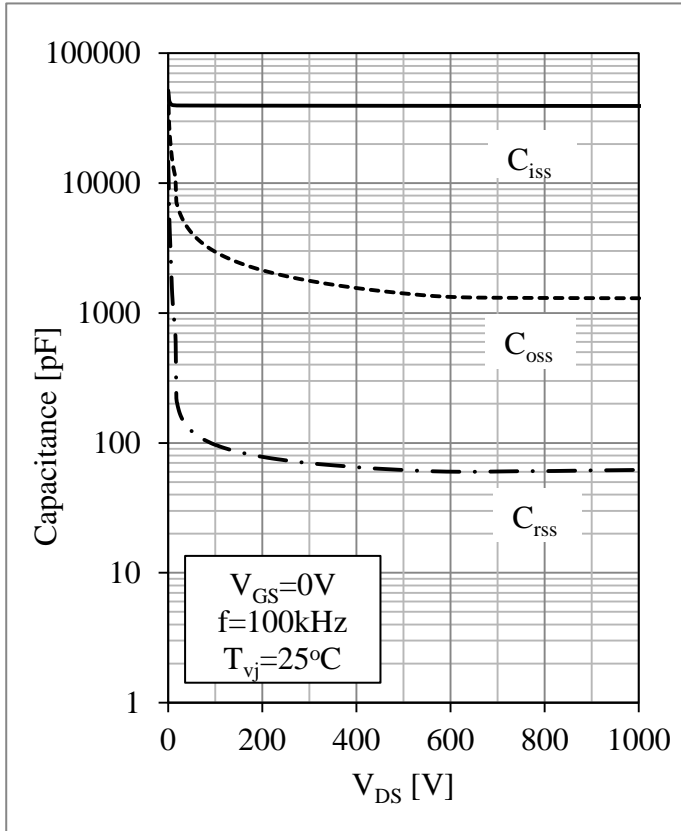


Fig 7. Capacitance vs.  $V_{DS}$

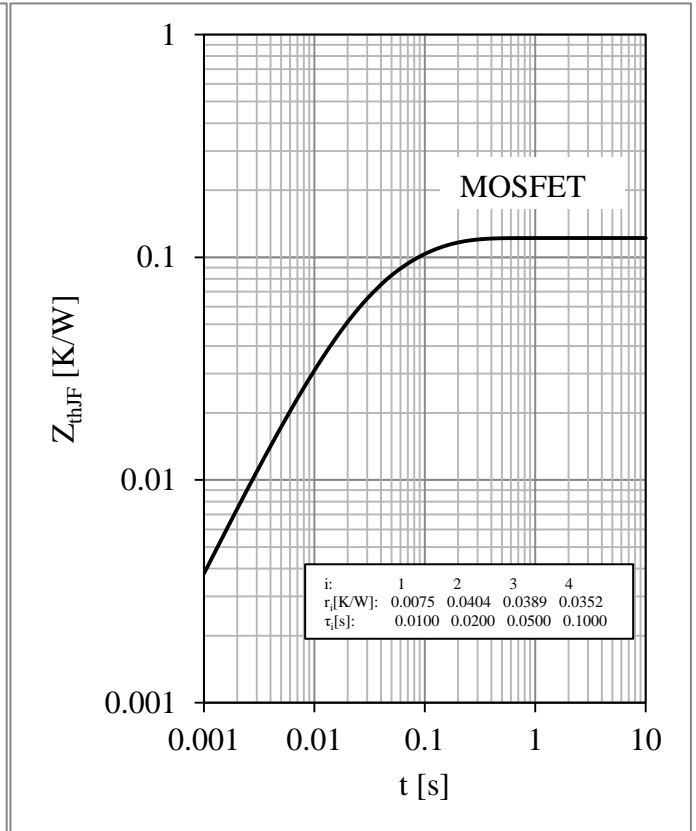
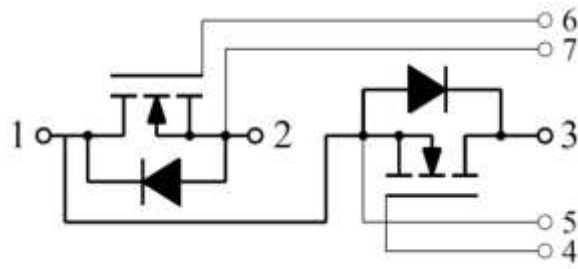


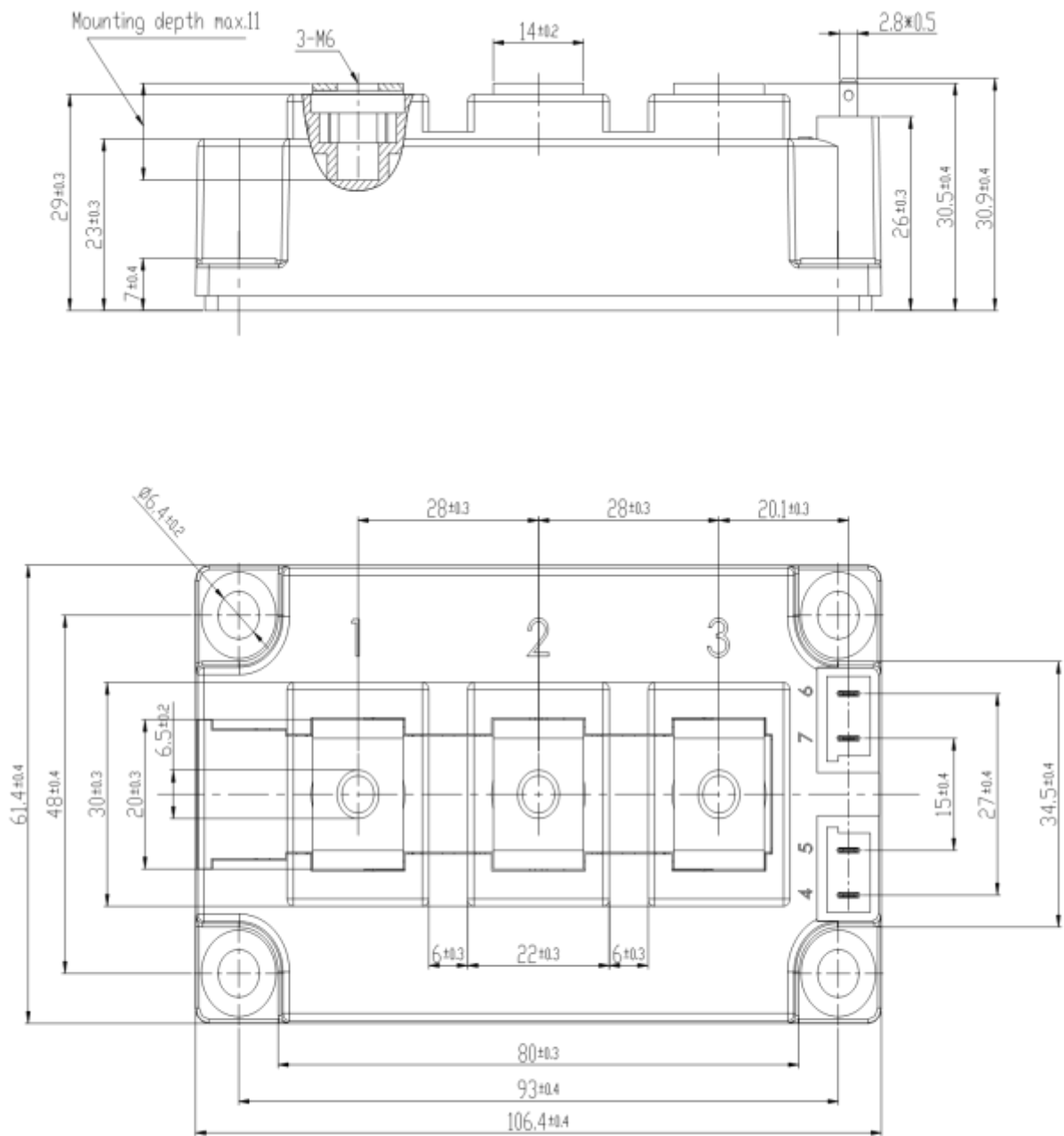
Fig 8. MOSFET Transient Thermal Impedance

**Circuit Schematic**



**Package Dimensions**

Dimensions in Millimeters



## Terms and Conditions of Usage

The data contained in this product datasheet is exclusively intended for technically trained staff. you and your technical departments will have to evaluate the suitability of the product for the intended application and the completeness of the product data with respect to such application.

This product data sheet is describing the characteristics of this product for which a warranty is granted. Any such warranty is granted exclusively pursuant the terms and conditions of the supply agreement. There will be no guarantee of any kind for the product and its characteristics.

Should you require product information in excess of the data given in this product data sheet or which concerns the specific application of our product, please contact the sales office, which is responsible for you (see [www.powersemi.cc](http://www.powersemi.cc)), For those that are specifically interested we may provide application notes.

Due to technical requirements our product may contain dangerous substances. For information on the types in question please contact the sales office, which is responsible for you.

Should you intend to use the Product in aviation applications, in health or live endangering or life support applications, please notify.

If and to the extent necessary, please forward equivalent notices to your customers.  
Changes of this product data sheet are reserved.