STARPOWER

SEMICONDUCTOR **MOSFET**

MD250HFR170C2S

1700V/250A 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.

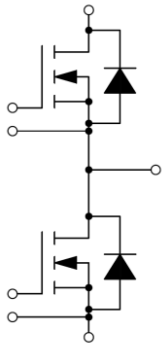
Features

- SiC power MOSFET
- Low $R_{DS(on)}$
- Optimized intrinsic reverse diode
- Low inductance case avoid oscillations
- Isolated heatsink 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

MOSFET

Symbol	Description	Value	Unit
V_{DSS}	Drain-Source Voltage	1700	V
V_{GSS}	Gate-Source Voltage	-6/+22	V
I_D	Drain Current @ T_C=25°C @ T_C=90°C	340 250	A
I_{DM}	Pulsed Drain Current	960	A

Inverse Diode

Symbol	Description	Value	Unit
I_S	Source Current	250	A
I_{SM}	Pulsed Source Current	960	A

Module

Symbol	Description	Value	Unit
T_{jmax}	Maximum Junction Temperature	175	°C
T_{jop}	Operating Junction Temperature	-40 to +150	°C
T_{STG}	Storage Temperature Range	-40 to +125	°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=156A,V_{GS}=18V, T_j=25°C		8.3	10.4	mΩ
		I_D=156A,V_{GS}=18V, T_j=125°C		12.1		
$V_{GS(th)}$	Gate-Source Threshold Voltage	I_D=56.4mA,V_{DS}=V_{GS}, T_j=25°C	1.6	2.8	4.0	V
g_{fs}	Forward Transconductance	V_{DS}=10V,I_D=156A		50.4		S
I_{DSS}	Drain-Source Leakage Current	V_{DS}=V_{DSS},V_{GS}=0V, T_j=25°C			120	μA
I_{GSS}	Gate-Source Leakage Current	V_{GS}=V_{GSS},V_{DS}=0V, T_j=25°C			1.2	μA
R_{Gint}	Internal Gate Resistance			0.92		Ω
C_{iss}	Input Capacitance	V_{GS}=0V,V_{DS}=800V, f=1MHz		27		nF
C_{oss}	Output Capacitance			0.86		nF
C_{rss}	Reverse Transfer Capacitance			0.16		nF
Q_g	Total Gate Charge	I_D=156A,V_{DS}=500V, V_{GS}=18V		1272		nC
Q_{gs}	Gate-Source Charge			360		nC
Q_{gd}	Gate-Drain ("Miller") Charge			396		nC
$t_{d(on)}$	Turn-On Delay Time	V_{DS}=900V,I_D=250A, R_G=2.4Ω, V_{GS}=0/+18V, T_j=25°C		123		ns
t_r	Rise Time			94		ns
$t_{d(off)}$	Turn-Off Delay Time			340		ns
t_f	Fall Time			55		ns
E_{on}	Turn-On Switching Loss			28.4		mJ
E_{off}	Turn-Off Switching Loss			19.2		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{DS}=900V,I_D=250A, R_G=2.4Ω, V_{GS}=0/+18V, T_j=125°C		108		ns
t_r	Rise Time			83		ns
$t_{d(off)}$	Turn-Off Delay Time			400		ns
t_f	Fall Time			73		ns
E_{on}	Turn-On Switching Loss			28.8		mJ
E_{off}	Turn-Off Switching Loss			21.5		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{DS}=900V,I_D=250A, R_G=2.4Ω, V_{GS}=0/+18V, T_j=150°C		108		ns
t_r	Rise Time			83		ns
$t_{d(off)}$	Turn-Off Delay Time			412		ns
t_f	Fall Time			78		ns
E_{on}	Turn-On Switching Loss			30.3		mJ
E_{off}	Turn-Off Switching Loss			22.2		mJ

Inverse Diode Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{SD}	Diode Forward Voltage	I_S=156A,V_{GS}=0V,T_j=25°C		4.5		V
t_{rr}	Diode Reverse Recovery Time	V_R=900V,I_S=250A, -di/dt=2600A/μs, V_{GS}=0V, T_j=25°C		118		ns
Q_r	Diode Reverse Recovery Charge			4.1		μC
I_{rrm}	Peak Reverse Recovery Current			70		A
E_{rec}	Reverse Recovery Energy			11.1		mJ
t_{rr}	Diode Reverse Recovery Time	V_R=900V,I_S=250A, -di/dt=3100A/μs, V_{GS}=0V, T_j=125°C		175		ns
Q_r	Diode Reverse Recovery Charge			12.2		μC
I_{rrm}	Peak Reverse Recovery Current			139		A
E_{rec}	Reverse Recovery Energy			24.5		mJ
t_{rr}	Diode Reverse Recovery Time	V_R=900V,I_S=250A, -di/dt=3200A/μs, V_{GS}=0V, T_j=150°C		188		ns
Q_r	Diode Reverse Recovery Charge			15.7		μC
I_{rrm}	Peak Reverse Recovery Current			167		A
E_{rec}	Reverse Recovery Energy			28.0		mJ

Module Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
R_{thJC}	Junction-to-Case(Mosfet)			0.069	K/W
R_{thCH}	Case-to-Heatsink (Mosfet) Case-to-Heatsink (per Module)		0.020 0.010		K/W
M	Terminal Connection Torque, Screw M6 Mounting Torque, Screw M6	2.5 3.0		5.0 5.0	N.m
G	Weight of Module		300		g

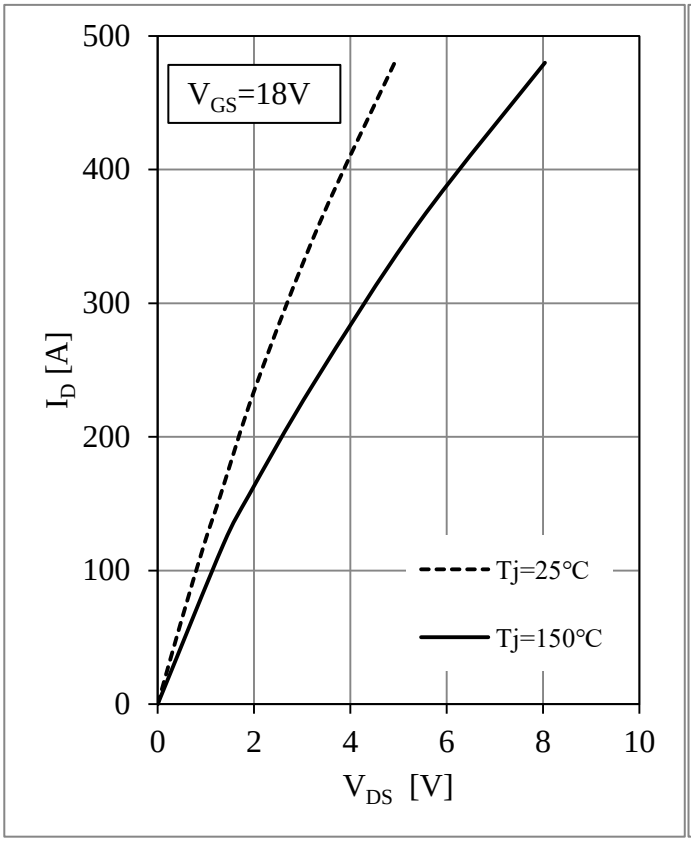


Fig 1. MOSFET Output Characteristics

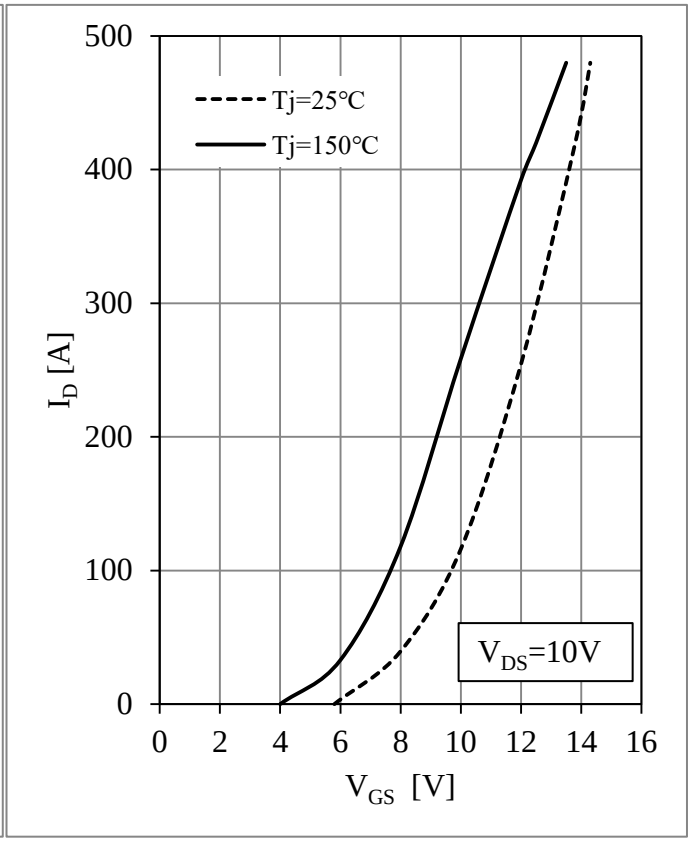


Fig 2. MOSFET Transfer Characteristics

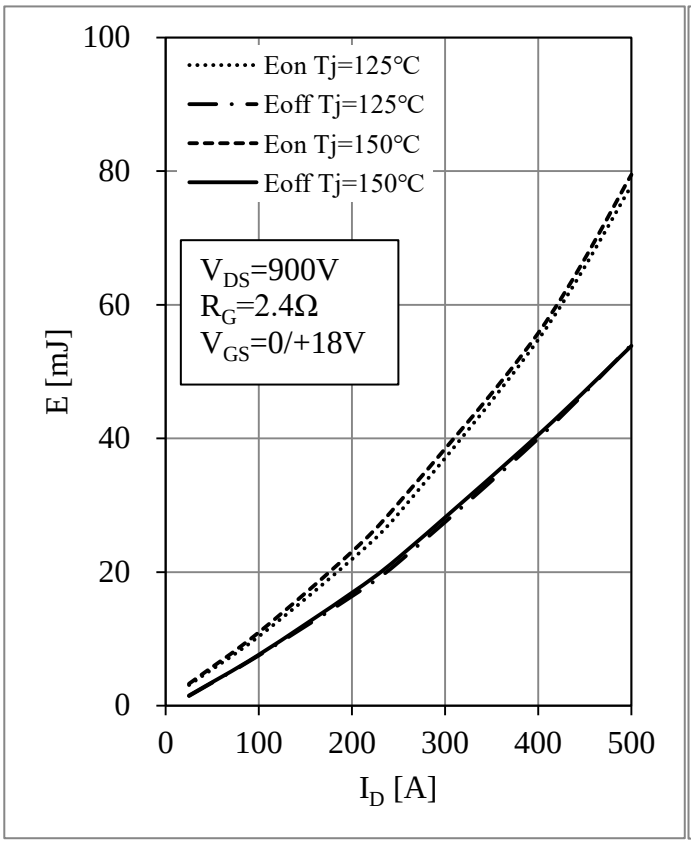


Fig 3. MOSFET Switching Loss vs. I_D

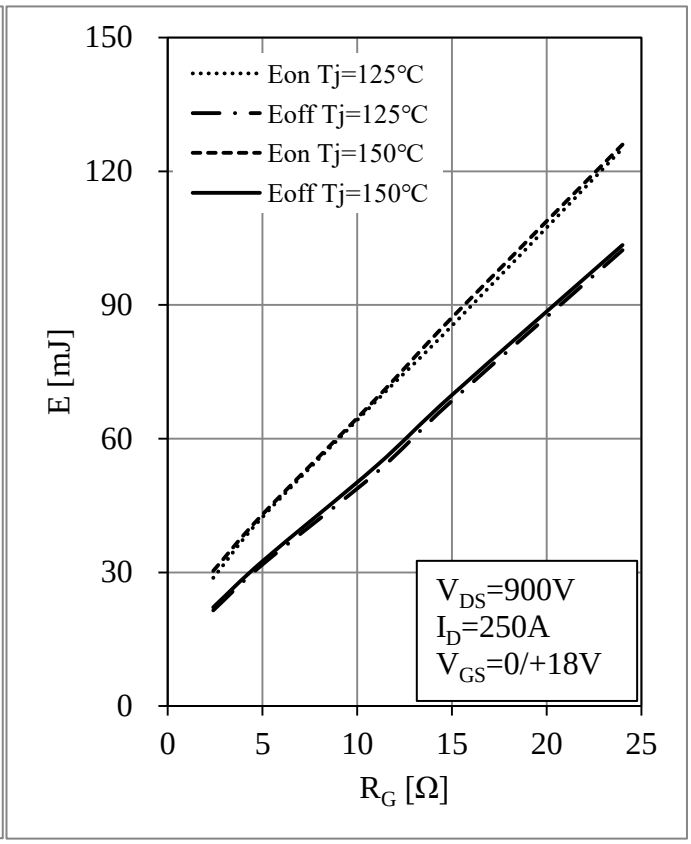


Fig 4. MOSFET Switching Loss vs. R_G

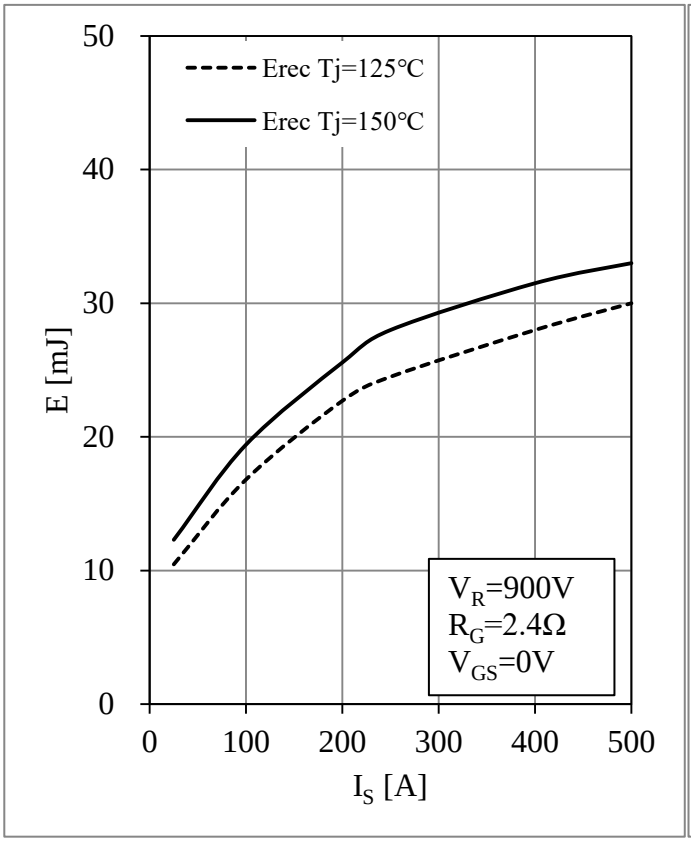


Fig 5. Body Diode Switching Loss vs. I_S

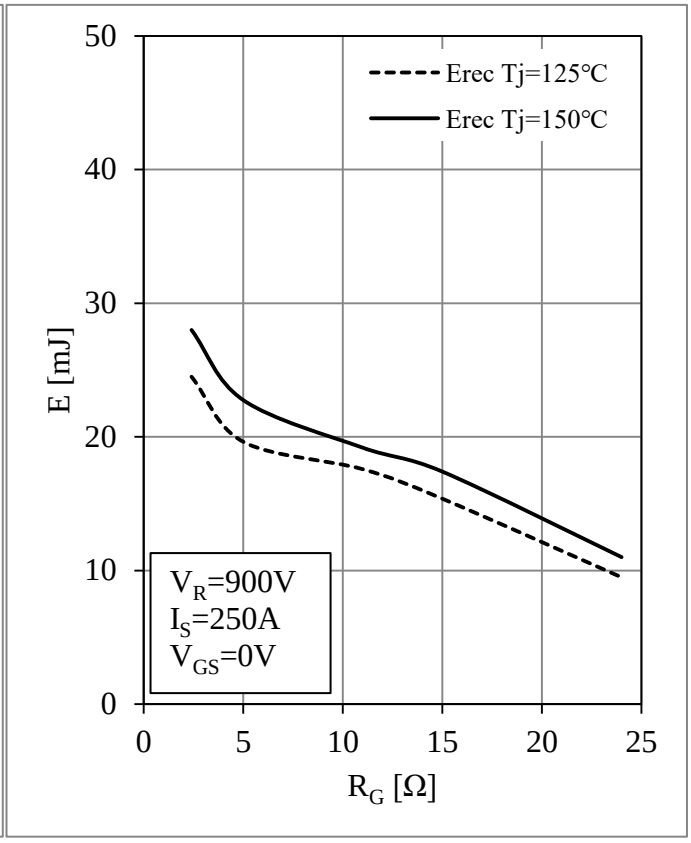


Fig 6. Body Diode Switching Loss vs. R_G

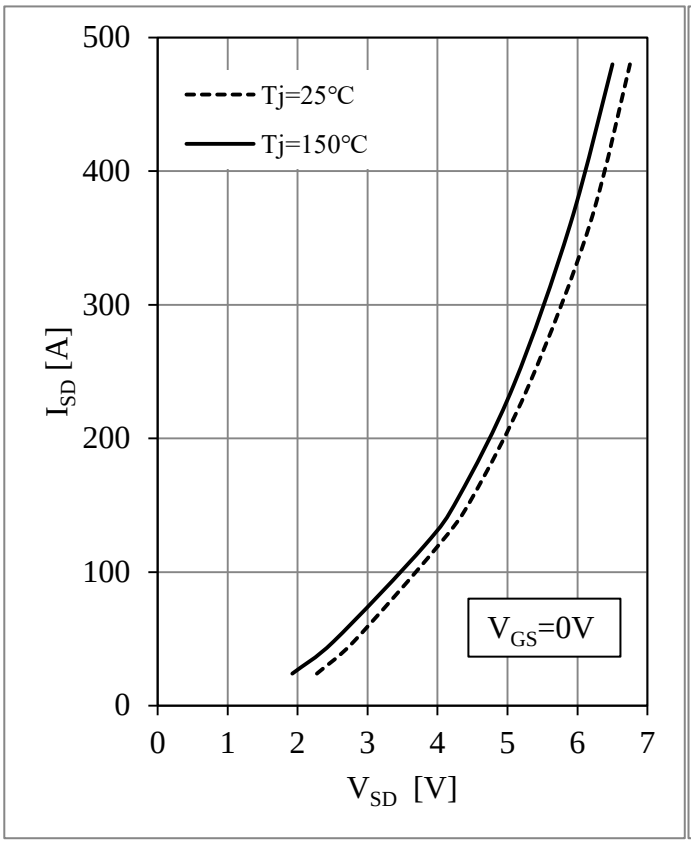


Fig 7. Body Diode Output Characteristics

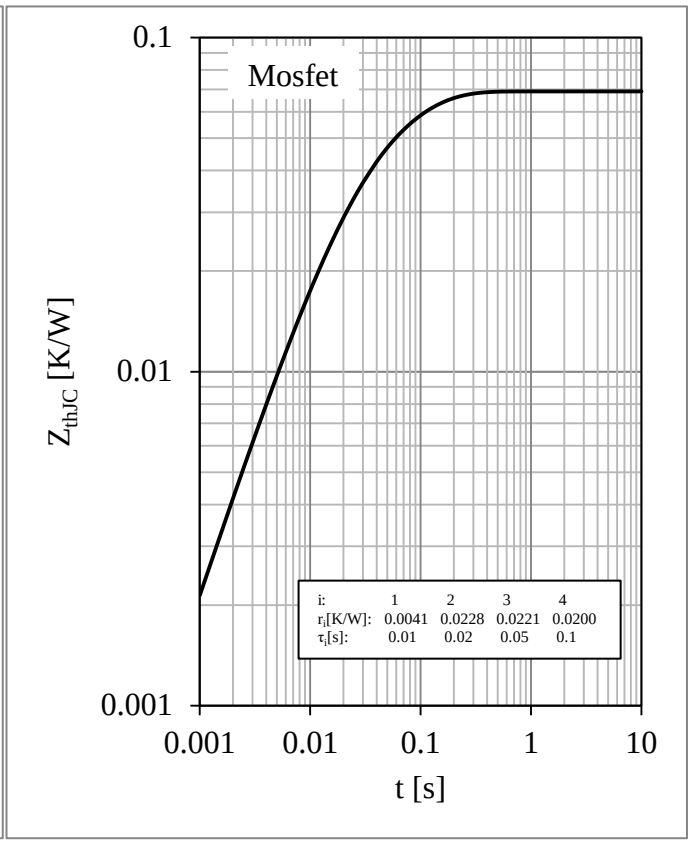
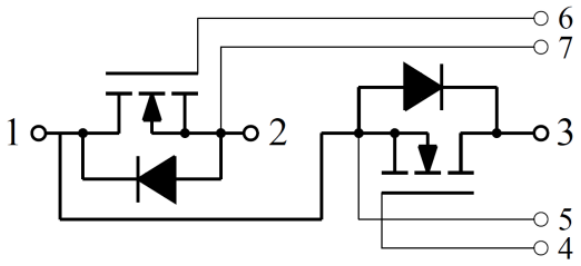


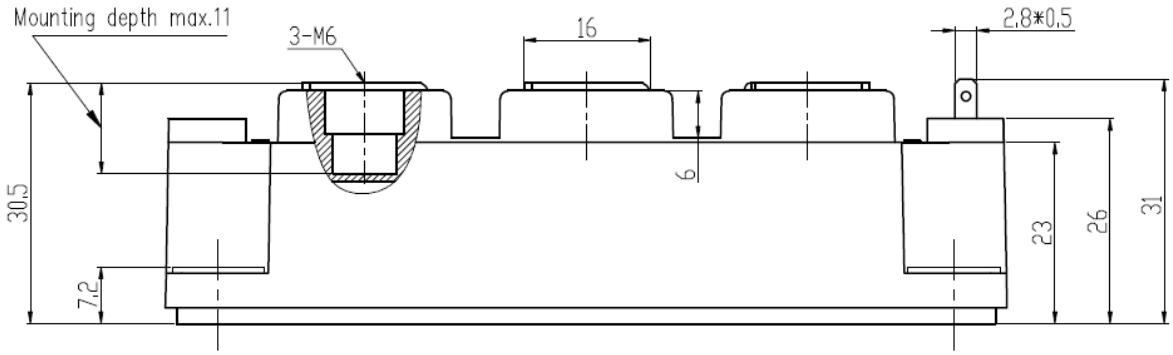
Fig 8. MOSFET Transient Thermal Impedance

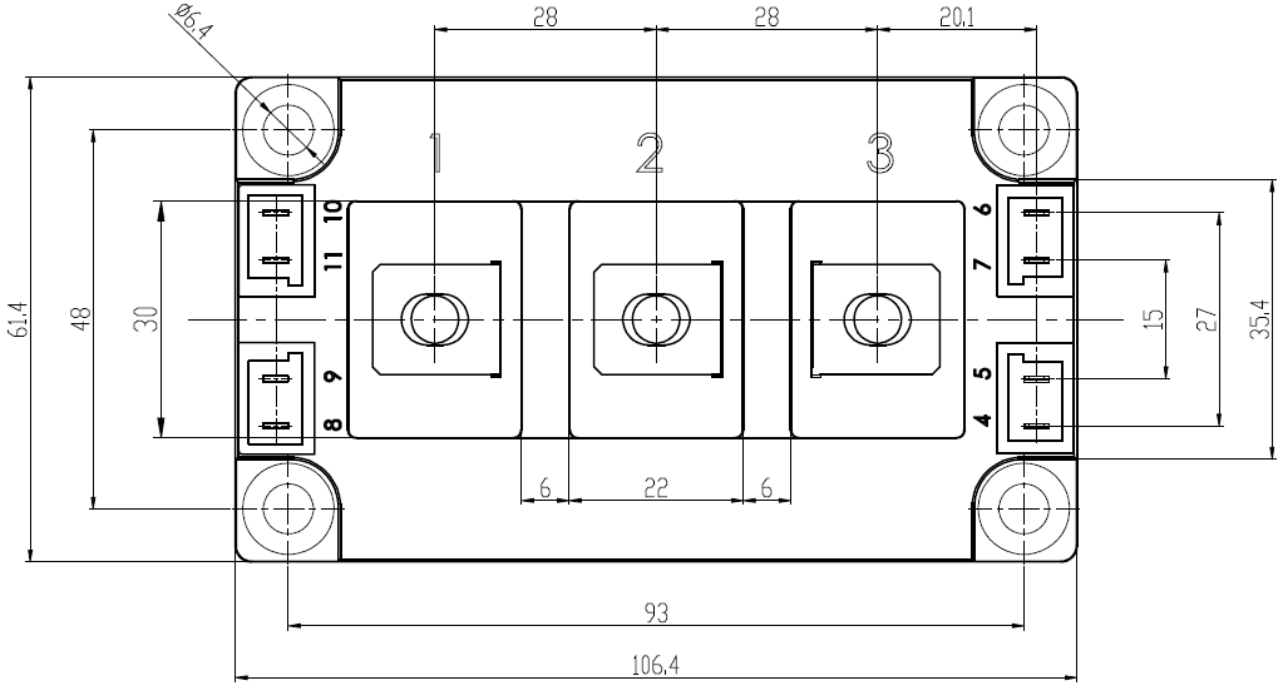
Circuit Schematic



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), 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.