STARPOWER

SEMICONDUCTOR **MOSFET**

MD300HFR120C2S

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.

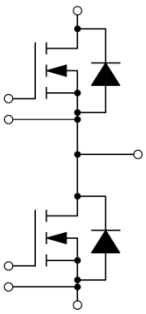
Features

- 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_{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°C @ T_C=80°C	381 300	A
I_{DM}	Pulsed Drain Current	1096	A

Inverse Diode

Symbol	Description	Value	Unit
I_S	Source Current	300	A
I_{SM}	Pulsed Source Current	1096	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	2500	V

MOSFET Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$R_{DS(on)}$	Static Drain-Source On-Resistance	I_D=160A,V_{GS}=18V, T_j=25°C		5.0	6.5	mΩ
		I_D=160A,V_{GS}=18V, T_j=125°C		7.5		
$V_{GS(th)}$	Gate-Source Threshold Voltage	I_D=80mA,V_{DS}=V_{GS}, T_j=25°C	2.7		5.6	V
g_{fs}	Forward Transconductance	V_{DS}=10V,I_D=160A		66.4		S
I_{DSS}	Drain-Source Leakage Current	V_{DS}=V_{DSS},V_{GS}=0V, T_j=25°C			80	μA
I_{GSS}	Gate-Source Leakage Current	V_{GS}=V_{GSS},V_{DS}=0V, T_j=25°C			0.8	μA
R_{Gint}	Internal Gate Resistance			1.13		Ω
C_{iss}	Input Capacitance	V_{GS}=0V,V_{DS}=800V, f=1MHz		10.7		nF
C_{oss}	Output Capacitance			0.60		nF
C_{rss}	Reverse Transfer Capacitance			0.22		nF
Q_g	Total Gate Charge	I_D=160A,V_{DS}=600V, V_{GS}=18V		856		nC
Q_{gs}	Gate-Source Charge			176		nC
Q_{gd}	Gate-Drain ("Miller") Charge			328		nC
$t_{d(on)}$	Turn-On Delay Time	V_{DS}=600V,I_D=300A, R_G=1.6Ω, V_{GS}=0/+18V, T_j=25°C		58		ns
t_r	Rise Time			66		ns
$t_{d(off)}$	Turn-Off Delay Time			170		ns
t_f	Fall Time			64		ns
E_{on}	Turn-On Switching Loss			13.6		mJ
E_{off}	Turn-Off Switching Loss			10.7		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{DS}=600V,I_D=300A, R_G=1.6Ω, V_{GS}=0/+18V, T_j=125°C		59		ns
t_r	Rise Time			68		ns
$t_{d(off)}$	Turn-Off Delay Time			191		ns
t_f	Fall Time			73		ns
E_{on}	Turn-On Switching Loss			13.8		mJ
E_{off}	Turn-Off Switching Loss			11.7		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{DS}=600V,I_D=300A, R_G=1.6Ω, V_{GS}=0/+18V, T_j=150°C		59		ns
t_r	Rise Time			68		ns
$t_{d(off)}$	Turn-Off Delay Time			197		ns
t_f	Fall Time			75		ns
E_{on}	Turn-On Switching Loss			14.0		mJ
E_{off}	Turn-Off Switching Loss			12.1		mJ

Inverse Diode Characteristics

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{SD}	Diode Forward Voltage	I_S=160A,V_{GS}=0V,T_j=25°C		3.2		V
t_{rr}	Diode Reverse Recovery Time	V_R=600V,I_S=300, -di/dt=4500A/μs, V_{GS}=0V, T_j=25°C		296		ns
Q_r	Diode Reverse Recovery Charge			68		μC
I_{rrm}	Peak Reverse Recovery Current			402		A
E_{rec}	Reverse Recovery Energy			38.2		mJ
t_{rr}	Diode Reverse Recovery Time	V_R=600V,I_S=300A, -di/dt=4500A/μs, V_{GS}=0V, T_j=125°C		297		ns
Q_r	Diode Reverse Recovery Charge			69		μC
I_{rrm}	Peak Reverse Recovery Current			407		A
E_{rec}	Reverse Recovery Energy			39.0		mJ
t_{rr}	Diode Reverse Recovery Time	V_R=600V,I_S=300A, -di/dt=4500A/μs, V_{GS}=0V, T_j=150°C		298		ns
Q_r	Diode Reverse Recovery Charge			69		μC
I_{rrm}	Peak Reverse Recovery Current			409		A
E_{rec}	Reverse Recovery Energy			39.7		mJ

Module Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
R_{thJC}	Junction-to-Case(Mosfet)			0.100	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

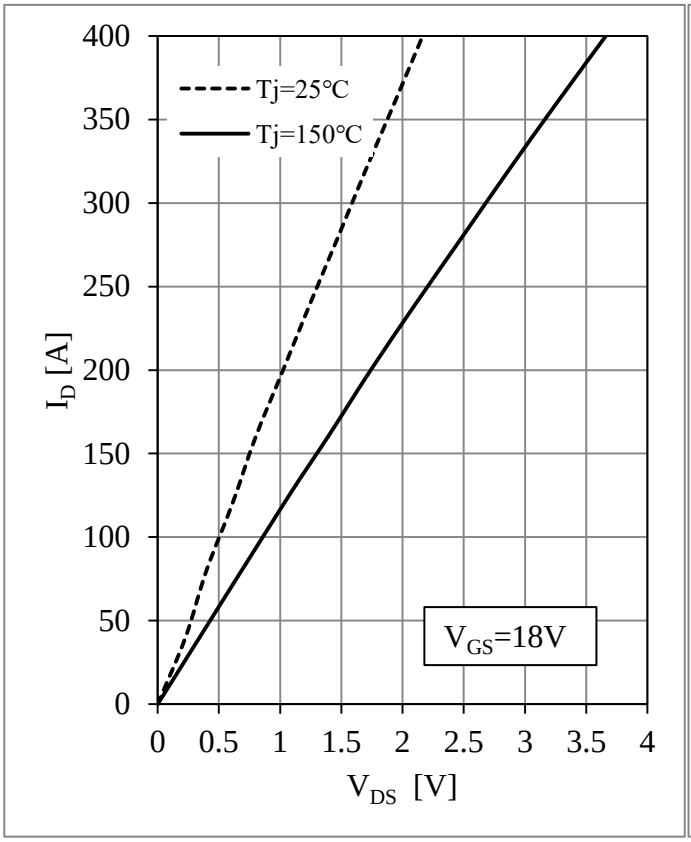


Fig 1. MOSFET Output Characteristics

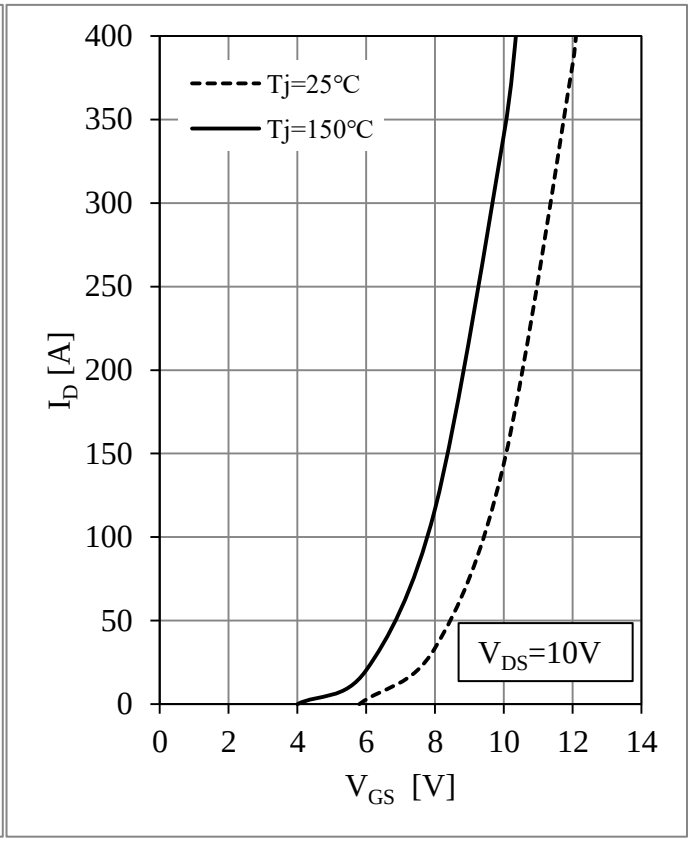


Fig 2. MOSFET Transfer Characteristics

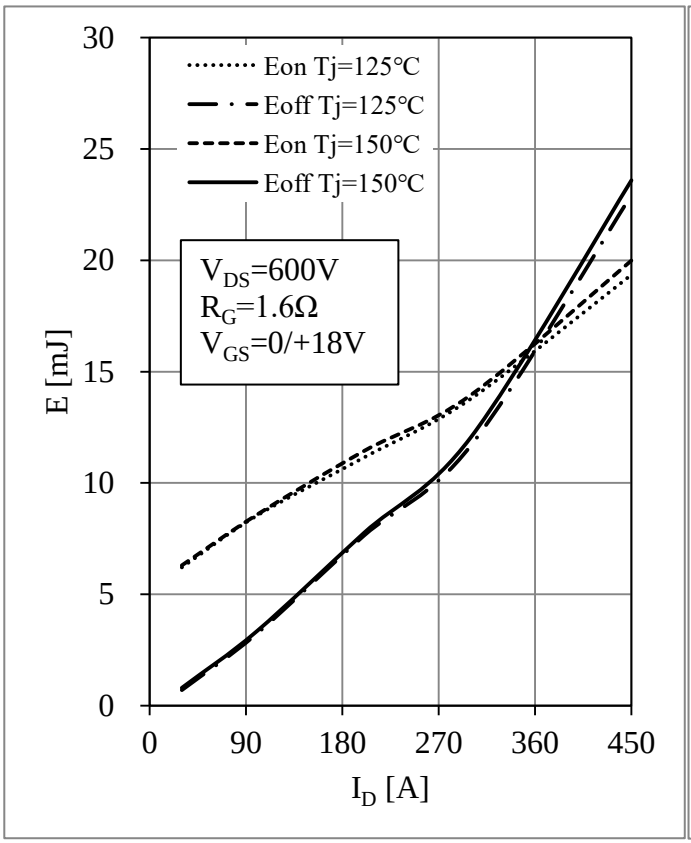


Fig 3. MOSFET Switching Loss vs. I_D

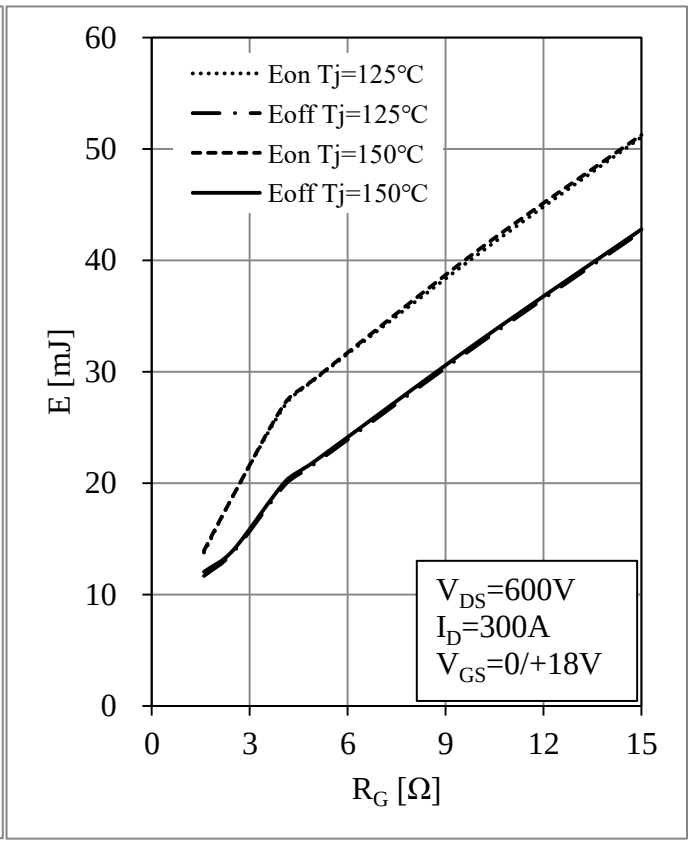


Fig 4. MOSFET Switching Loss vs. R_G

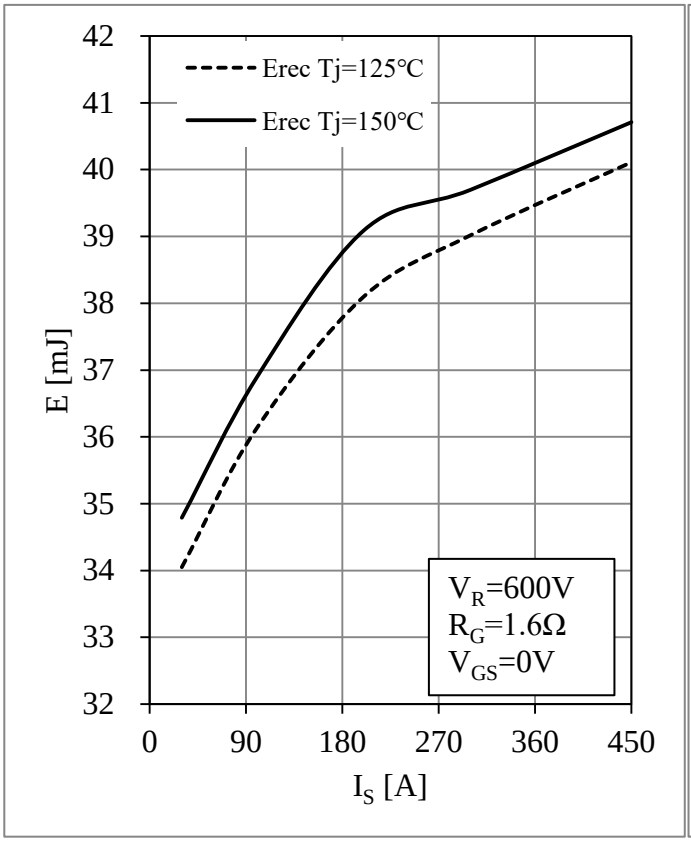


Fig 5. Body Diode Switching Loss vs. I_S

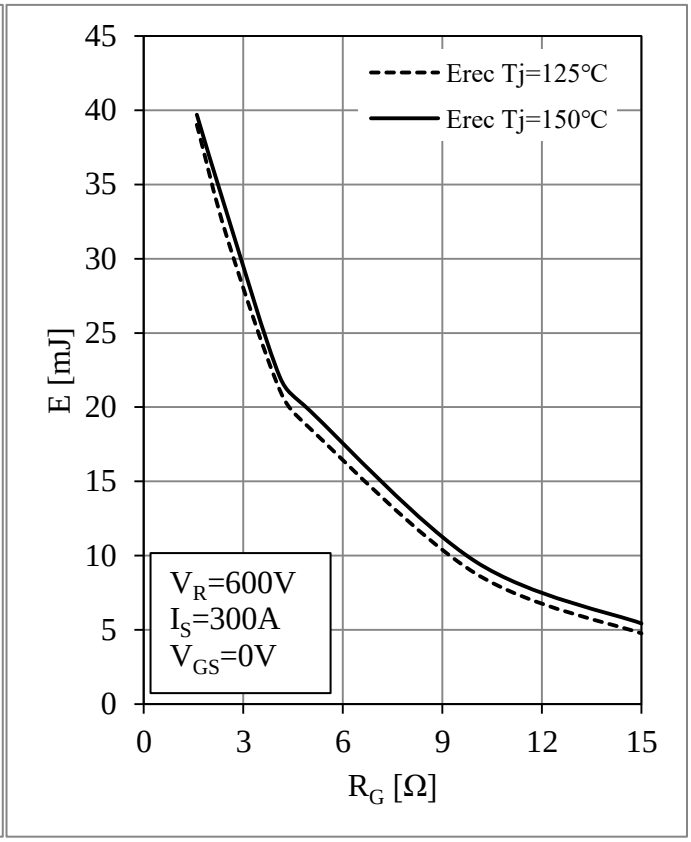


Fig 6. Body Diode Switching Loss vs. R_G

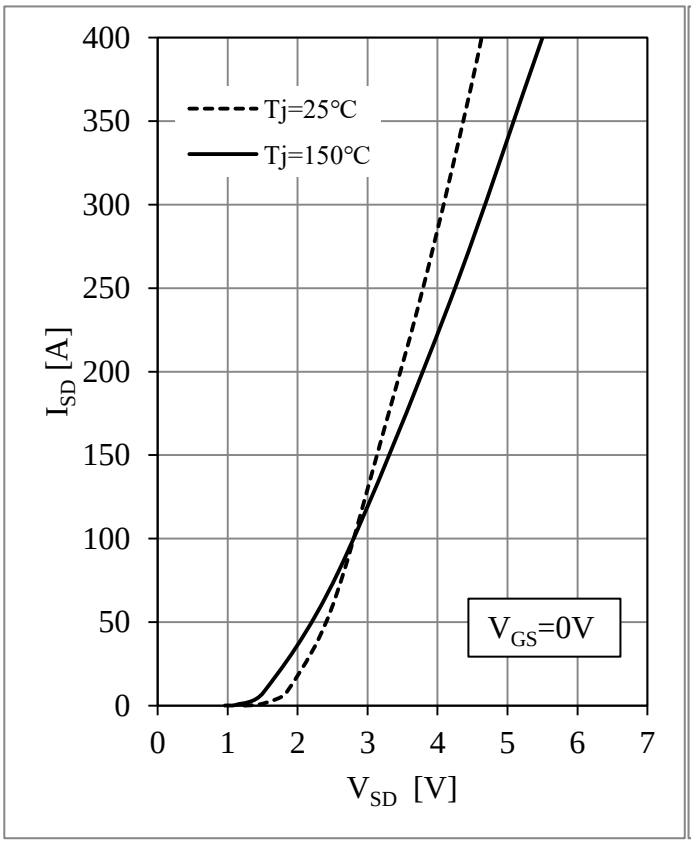


Fig 7. Body Diode Output Characteristics

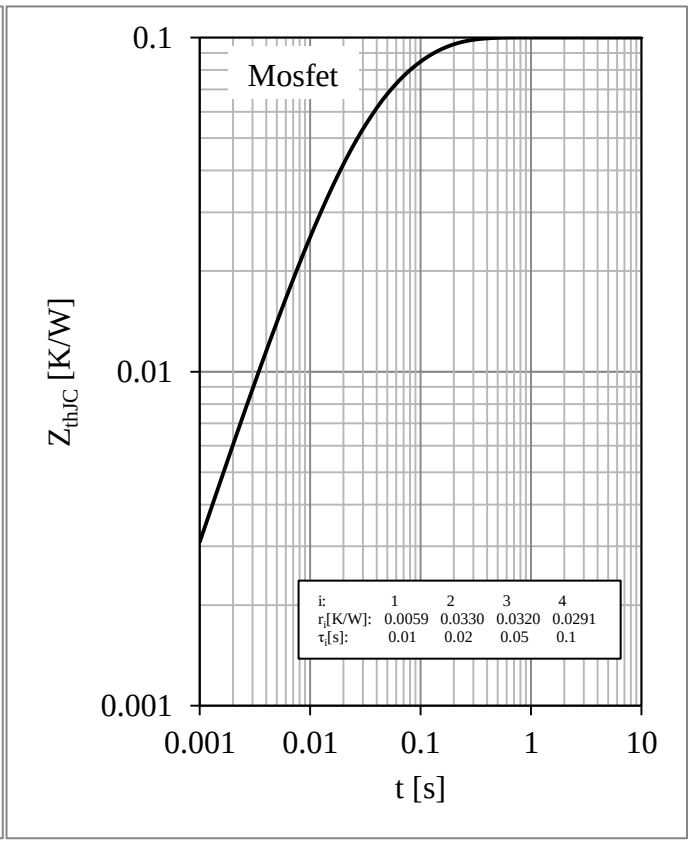
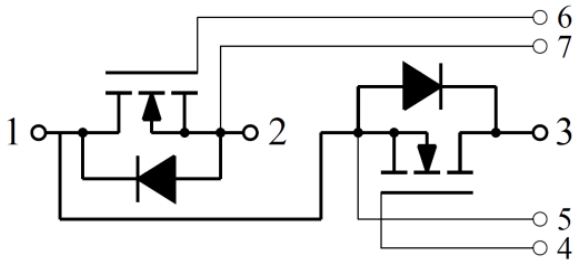


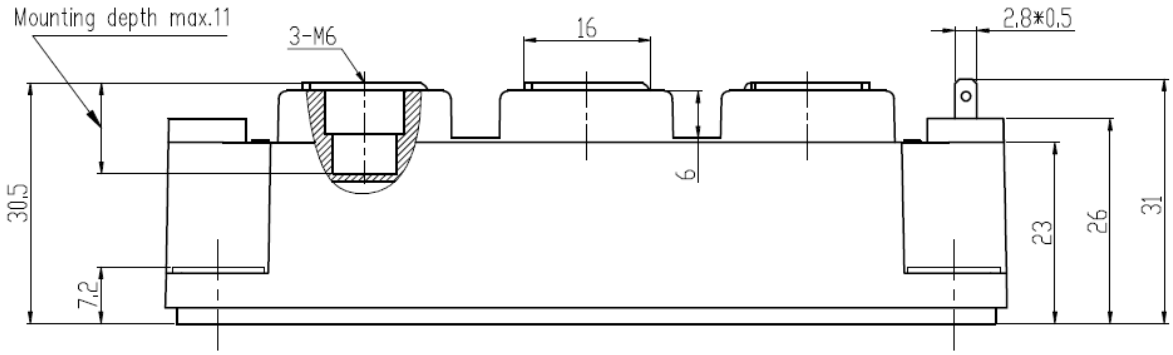
Fig 8. MOSFET Transient Thermal Impedance

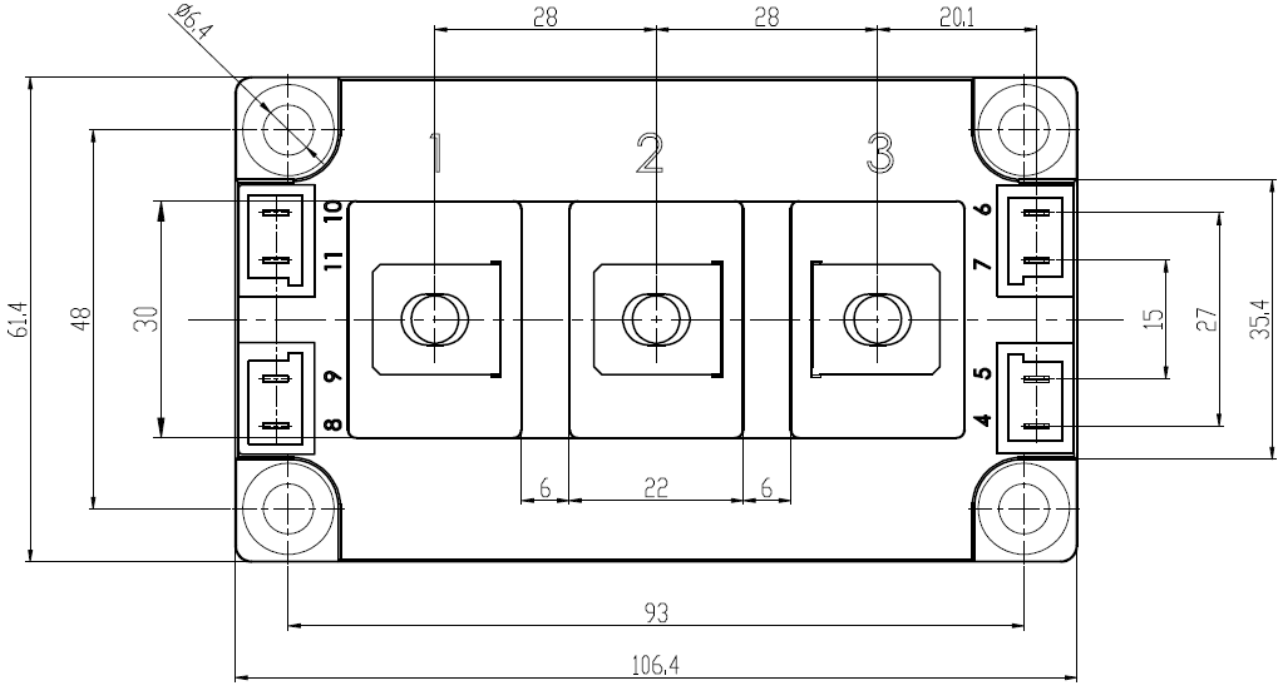
Circuit Schematic



Package Dimensions

Dimensions in Millimeters





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