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.

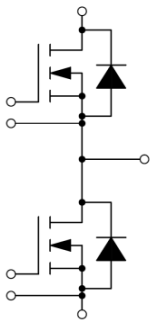
Features

- 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°C @ T_C=90°C	409 300	A
I_{DM}	Pulsed Drain Current	720	A
P_D	Maximum Power Dissipation @ T_j=175°C	1724	W

Body Diode

Symbol	Description	Value	Unit
I_S	Source Current @ T_C=100°C	TBD	A
I_{SM}	Pulsed Source Current	720	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=240A,V_{GS}=15V, T_j=25°C		5.33	6.93	mΩ
		I_D=240A,V_{GS}=15V, T_j=175°C		9.60		
$V_{GS(th)}$	Gate-Source Threshold Voltage	I_D=69mA,V_{DS}=V_{GS}, T_j=25°C	1.8	2.5	3.6	V
g_{fs}	Forward Transconductance	V_{DS}=20V,I_D=240A		162		S
I_{DSS}	Drain-Source Leakage Current	V_{DS}=V_{DSS},V_{GS}=0V, T_j=25°C			114	μA
I_{GSS}	Gate-Source Leakage Current	V_{GS}=V_{GSS},V_{DS}=0V, T_j=25°C			1500	nA
R_{Gint}	Internal Gate Resistance			0.70		Ω
C_{iss}	Input Capacitance	V_{GS}=0V,V_{DS}=1000V, f=100kHz		20.1		nF
C_{oss}	Output Capacitance			0.77		nF
C_{rss}	Reverse Transfer Capacitance			48		pF
Q_g	Total Gate Charge	I_D=240A,V_{DS}=800V, V_{GS}=-4/+15V		708		nC
Q_{gs}	Gate-Source Charge			240		nC
Q_{gd}	Gate-Drain ("Miller") Charge			204		nC
$t_{d(on)}$	Turn-On Delay Time	V_{DS}=600V,I_D=300A, R_G=3.0Ω,V_{GS}=-4/15V, T_j=25°C		85		ns
t_r	Rise Time			40		ns
$t_{d(off)}$	Turn-Off Delay Time			148		ns
t_f	Fall Time			27		ns
E_{on}	Turn-On Switching Loss			7.67		mJ
E_{off}	Turn-Off Switching Loss			5.13		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{DS}=600V,I_D=300A, R_G=3.0Ω,V_{GS}=-4/15V, T_j=125°C		89		ns
t_r	Rise Time			44		ns
$t_{d(off)}$	Turn-Off Delay Time			174		ns
t_f	Fall Time			29		ns
E_{on}	Turn-On Switching Loss			4.59		mJ
E_{off}	Turn-Off Switching Loss			7.87		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{DS}=600V,I_D=300A, R_G=3.0Ω,V_{GS}=-4/15V, T_j=150°C		90		ns
t_r	Rise Time			45		ns
$t_{d(off)}$	Turn-Off Delay Time			179		ns
t_f	Fall Time			32		ns
E_{on}	Turn-On Switching Loss			4.46		mJ
E_{off}	Turn-Off Switching Loss			7.69		mJ

Body Diode Characteristics T_F=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{SD}	Diode Forward Voltage	I_S=120A,V_{GS}=-4V, T_j=25°C		4.60		V
		I_S=120A,V_{GS}=-4V, T_j=175°C		4.00		
t_{rr}	Diode Reverse Recovery Time	V_R=600V,I_S=300A, -di/dt=7830A/μs, V_{GS}=-4V, T_j=25°C		24		ns
Q_r	Recovered Charge			1.0		μC
I_{rrm}	Peak Reverse Recovery Current			64		A
E_{rec}	Reverse Recovery Energy			0.22		mJ
t_{rr}	Diode Reverse Recovery Time	V_R=600V,I_S=300A, -di/dt=6870A/μs, V_{GS}=-4V, T_j=125°C		44		ns
Q_r	Recovered Charge			3.6		μC
I_{rrm}	Peak Reverse Recovery Current			145		A
E_{rec}	Reverse Recovery Energy			1.20		mJ
t_{rr}	Diode Reverse Recovery Time	V_R=600V,I_S=300A, -di/dt=6600A/μs, V_{GS}=-4V, T_j=150°C		47		ns
Q_r	Recovered Charge			4.4		μC
I_{rrm}	Peak Reverse Recovery Current			165		A
E_{rec}	Reverse Recovery Energy			1.75		mJ

Module Characteristics T_C=25°C unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
R_{thJC}	Junction-to-Case(Mosfet)			0.087	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

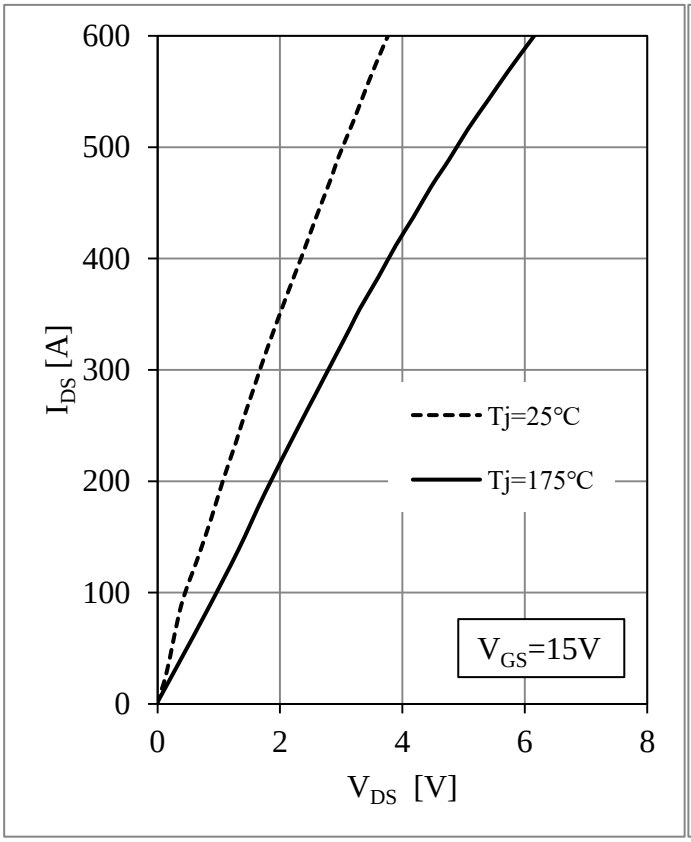


Fig 1. MOSFET Output Characteristics

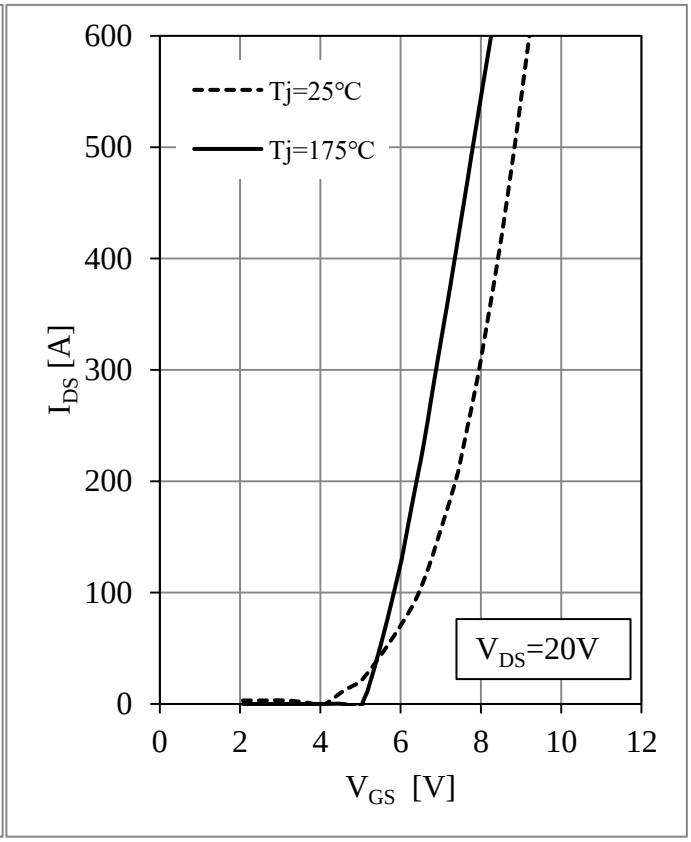


Fig 2. MOSFET Transfer Characteristics

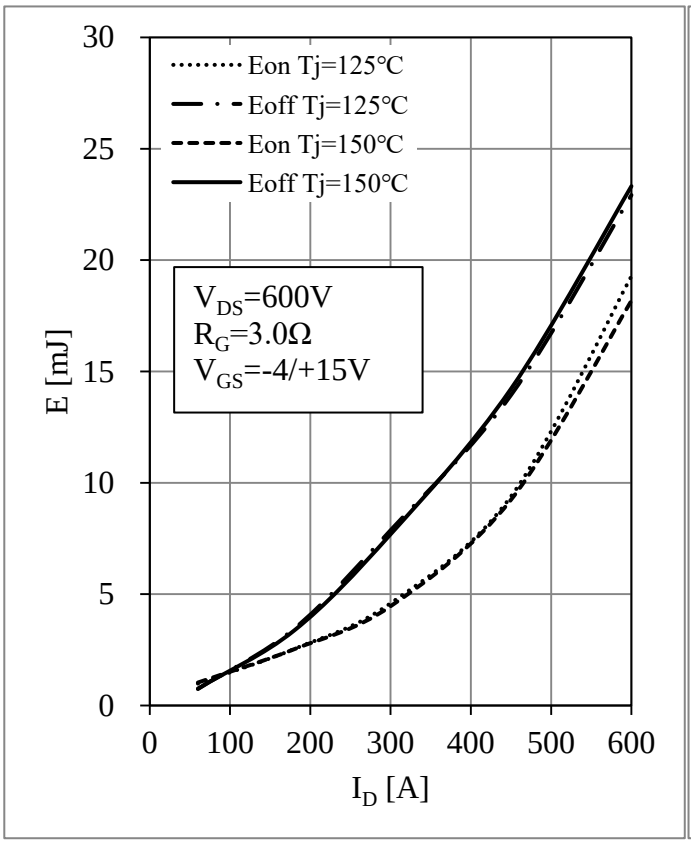


Fig 3. MOSFET Switching Loss vs. I_{DS}

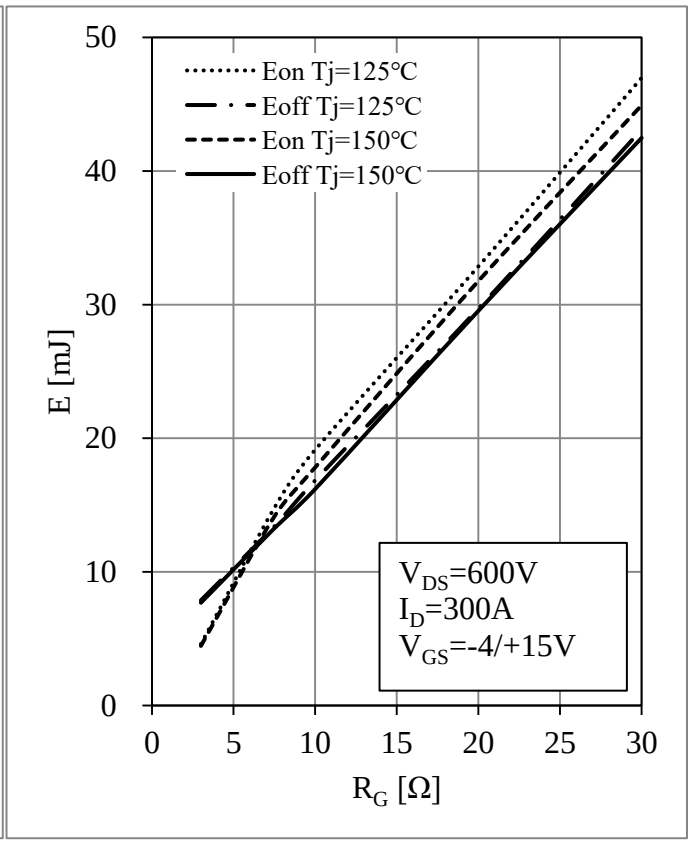


Fig 4. MOSFET Switching Loss vs.R_G

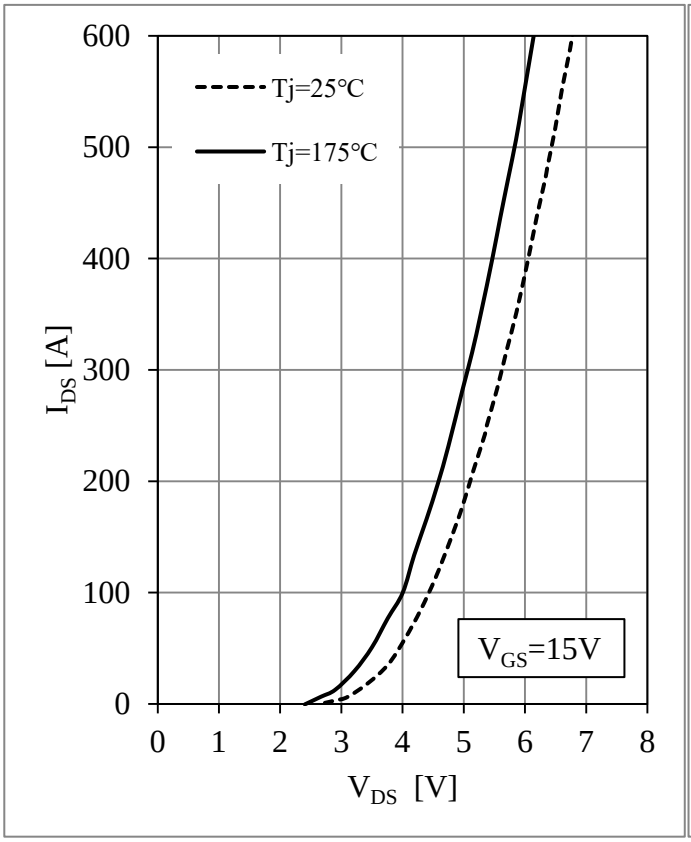


Fig 5. Body Diode Characteristics

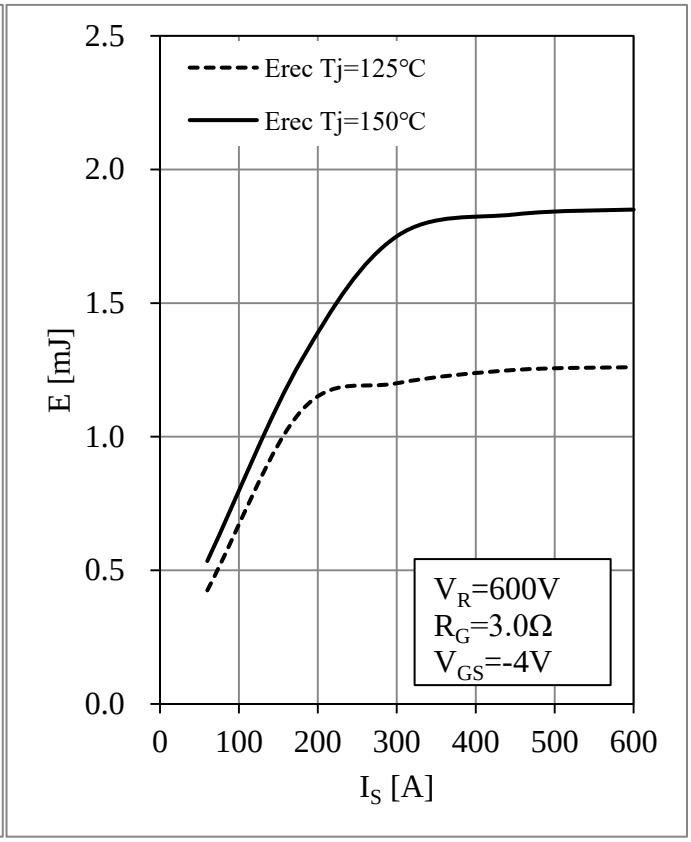


Fig 6. Body Diode Switching Loss vs. I_S

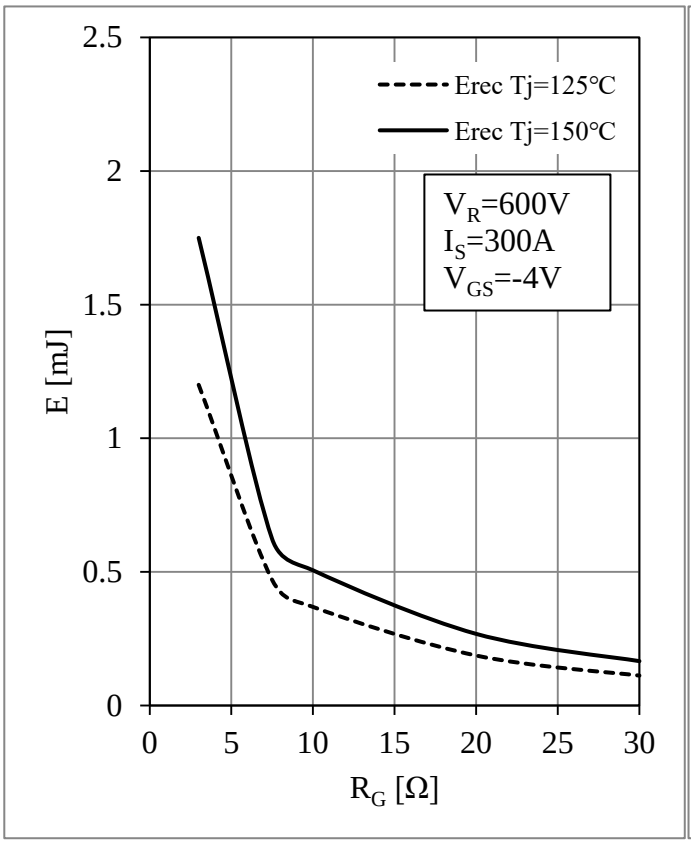


Fig 7. Body Diode Switching Loss vs. R_G Fig

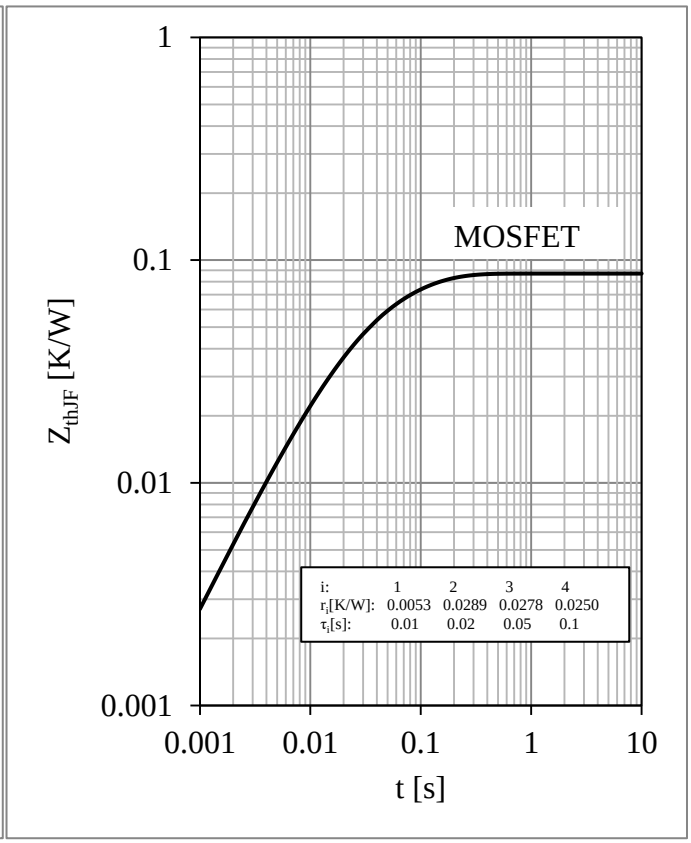
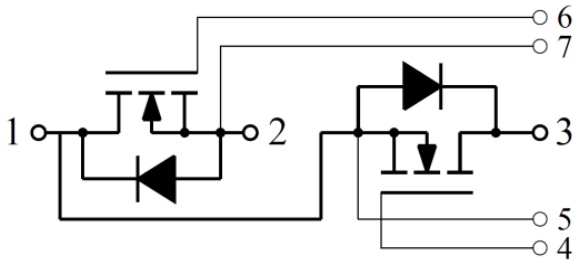


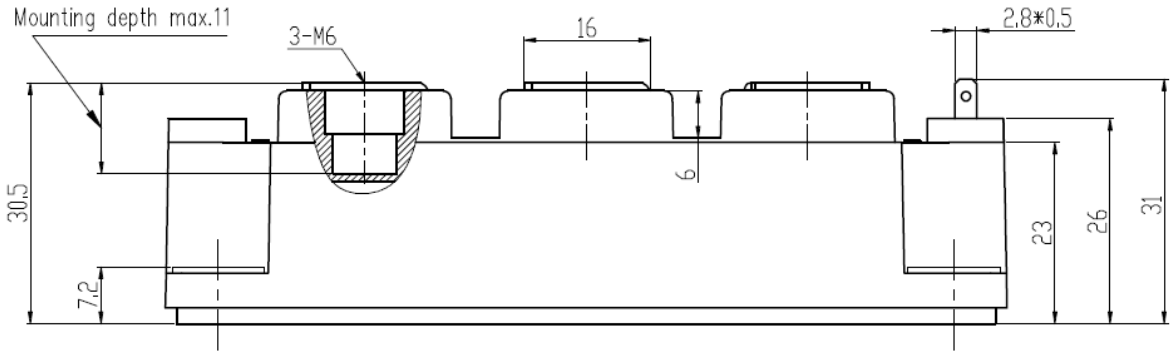
Fig 8. MOSFET Transient Thermal Impedance

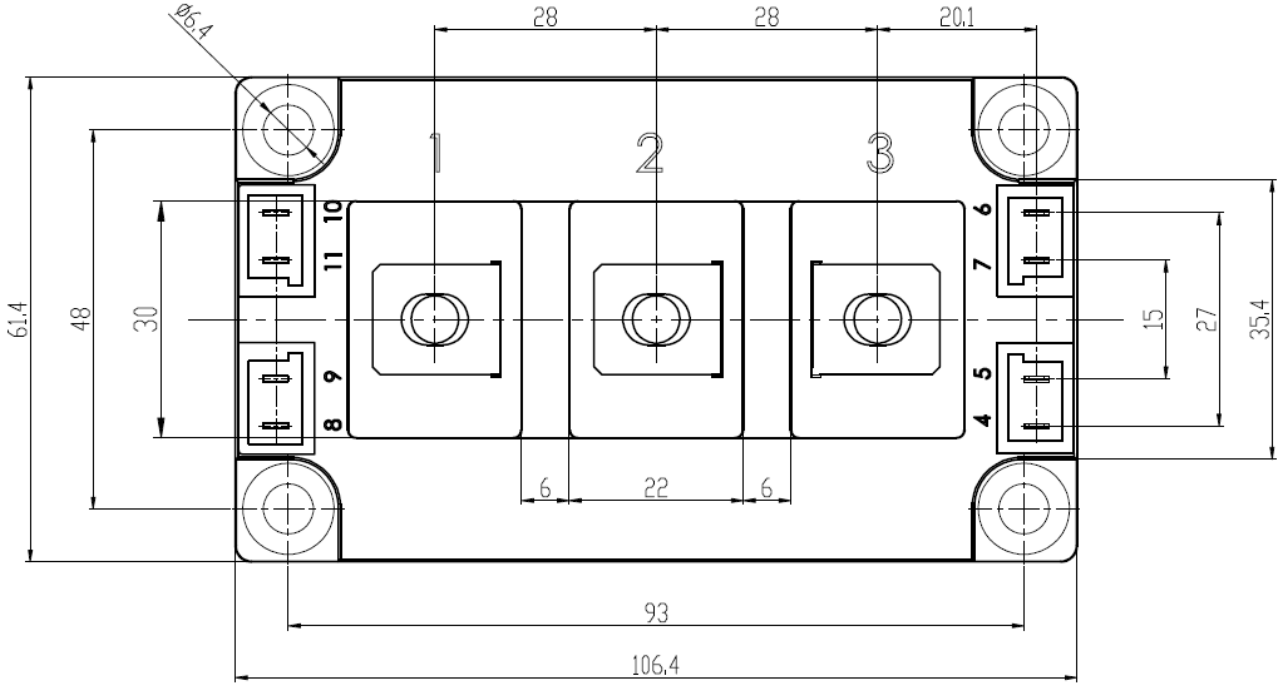
Circuit Schematic



Package Dimensions

Dimensions in Millimeters





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