

STARPOWER**SEMICONDUCTOR****SiC MOSFET****MD29HFC120N4HFY****630-23357-00****1200V/2.83mΩ 2 in one-package**

General Description

STARPOWER SiC MOSFET Power Module provides very low $R_{DS(on)}$ as well as high blocking voltage. It's designed for the applications such as hybrid and electric vehicle.

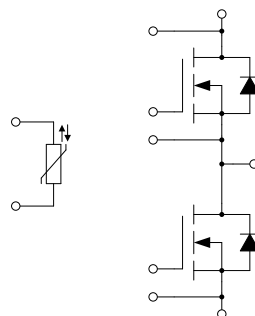
Features

- SiC power MOSFET
- High blocking voltage with low $R_{DS(on)}$
- Easy to parallel and simple to drive
- Low inductance case avoid oscillations
- Isolated copper pinfin baseplate using Si_3N_4 AMB technology
- PressFIT contact technology

Typical Applications

- Automotive application
- Hybrid and electric vehicle
- Inverter for motor drive

Equivalent Circuit Schematic



Absolute Maximum Ratings $T_F=25^{\circ}\text{C}$ 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 $T_{\text{vjmax}}=175^{\circ}\text{C}$	518	A
P_{D}	Maximum Power Dissipation @ $T_F=65^{\circ}\text{C}$ $T_{\text{vjmax}}=175^{\circ}\text{C}$	1250	W

Body Diode

Symbol	Description	Value	Unit
I_{S}	Source Current $T_{\text{vjmax}}=175^{\circ}\text{C}$	337	A

Module

Symbol	Description	Value	Unit
T_{vjmax}	Maximum Junction Temperature	175	$^{\circ}\text{C}$
T_{vjop}	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, $f=50\text{Hz}$, $t=5\text{s}$	3500	V
D_{Clear}	Terminal to Heatsink	7.3	mm
	Terminal to Terminal	7.0	
D_{Creep}	Terminal to Heatsink	7.3	mm
	Terminal to Terminal	7.3	

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$R_{DS(on)}$	Static Drain-Source On-Resistance	$I_D=450\text{A}, V_{GS}=15\text{V}, T_{vj}=25^{\circ}\text{C}$	2.00	2.83	3.67	$\text{m}\Omega$
		$I_D=450\text{A}, V_{GS}=15\text{V}, T_{vj}=150^{\circ}\text{C}$		4.45		
		$I_D=450\text{A}, V_{GS}=15\text{V}, T_{vj}=175^{\circ}\text{C}$		4.95	6.30	
$V_{GS(th)}$	Gate-Source Threshold Voltage	$I_D=126\text{mA}, V_{DS}=V_{GS}, T_{vj}=25^{\circ}\text{C}$	1.8	2.5	3.6	V
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=V_{DSS}, V_{GS}=0\text{V}, T_{vj}=25^{\circ}\text{C}$			500	μA
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			1.43		Ω
C_{iss}	Input Capacitance	$V_{GS}=0\text{V}, V_{DS}=800\text{V}, f=100\text{kHz}$		39.2		nF
C_{oss}	Output Capacitance			1.98		nF
C_{rss}	Reverse Transfer Capacitance			0.09		nF
Q_g	Total Gate Charge	$I_D=495\text{A}, V_{DS}=800\text{V}, V_{GS}=-4\text{V}/+15\text{V}$		1.33		μC
$t_{d(on)}$	Turn-On Delay Time	$V_{DS}=800\text{V}, I_D=495\text{A}, R_{Gon}=1.5\Omega, R_{Goff}=2.7\Omega, L_S=16\text{nH}, V_{GS}=-4\text{V}/+15\text{V}, di/dt_{on}=14.4\text{A/ns}, dv/dt_{off}=16.5\text{V/ns}, T_{vj}=25^{\circ}\text{C}$		68		ns
t_r	Rise Time			43		ns
$t_{d(off)}$	Turn-Off Delay Time			220		ns
t_f	Fall Time			40		ns
E_{on}	Turn-On Switching Loss			20.5		mJ
E_{off}	Turn-Off Switching Loss			20.6		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{DS}=800\text{V}, I_D=495\text{A}, R_{Gon}=1.5\Omega, R_{Goff}=2.7\Omega, L_S=16\text{nH}, V_{GS}=-4\text{V}/+15\text{V}, di/dt_{on}=13.3\text{A/ns}, dv/dt_{off}=14.9\text{V/ns}, T_{vj}=150^{\circ}\text{C}$		69		ns
t_r	Rise Time			49		ns
$t_{d(off)}$	Turn-Off Delay Time			260		ns
t_f	Fall Time			47		ns
E_{on}	Turn-On Switching Loss			25.8		mJ
E_{off}	Turn-Off Switching Loss			23.0		mJ
$t_{d(on)}$	Turn-On Delay Time	$V_{DS}=800\text{V}, I_D=495\text{A}, R_{Gon}=1.5\Omega, R_{Goff}=2.7\Omega, L_S=16\text{nH}, V_{GS}=-4\text{V}/+15\text{V}, di/dt_{on}=13.1\text{A/ns}, dv/dt_{off}=14.6\text{V/ns}, T_{vj}=175^{\circ}\text{C}$		70		ns
t_r	Rise Time			51		ns
$t_{d(off)}$	Turn-Off Delay Time			275		ns
t_f	Fall Time			48		ns
E_{on}	Turn-On Switching Loss			27.9		mJ
E_{off}	Turn-Off Switching Loss			24.9		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	$I_S=228\text{A}, V_{GS}=-4\text{V}, T_{vj}=25^{\circ}\text{C}$		4.90		V
		$I_S=228\text{A}, V_{GS}=-4\text{V}, T_{vj}=175^{\circ}\text{C}$		4.20		

PTC Characteristics $T_F=25^{\circ}\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R	Nominal Resistance	$T_C=0^{\circ}\text{C}$	997.7	1000.0	1002.3	Ω
		$T_C=150^{\circ}\text{C}$	1565.4	1573.3	1581.1	Ω
T_{CR}	Temperature Coefficient			0.385		%/K
T_{SH}	Self Heating	$T_C=0^{\circ}\text{C}$ $I_m=0.1\ldots 0.3\text{mA}$		0.4		K/mW

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

Symbol	Parameter	Min.	Typ.	Max.	Unit
L_{CE}	Stray Inductance		6.5		nH
R_{module}	Terminal to chip module lead resistance		0.25		m Ω
p	Maximum Pressure In Cooling Circuit			3.5	bar
R_{thJF}	Test Value Junction-to-Cooling Fluid (per MOSFET) $\Delta V/\Delta t=3.3\text{ L/min}, T_F=25^{\circ}\text{C}$		0.092	0.101	K/W
R_{thJF}	Test Value Junction-to-Cooling Fluid (per MOSFET) $\Delta V/\Delta t=3.3\text{ L/min}, T_F=65^{\circ}\text{C}$		0.088	0.097	K/W
G	Weight of Module		222		g
CTI	Comparative tracking index	600			

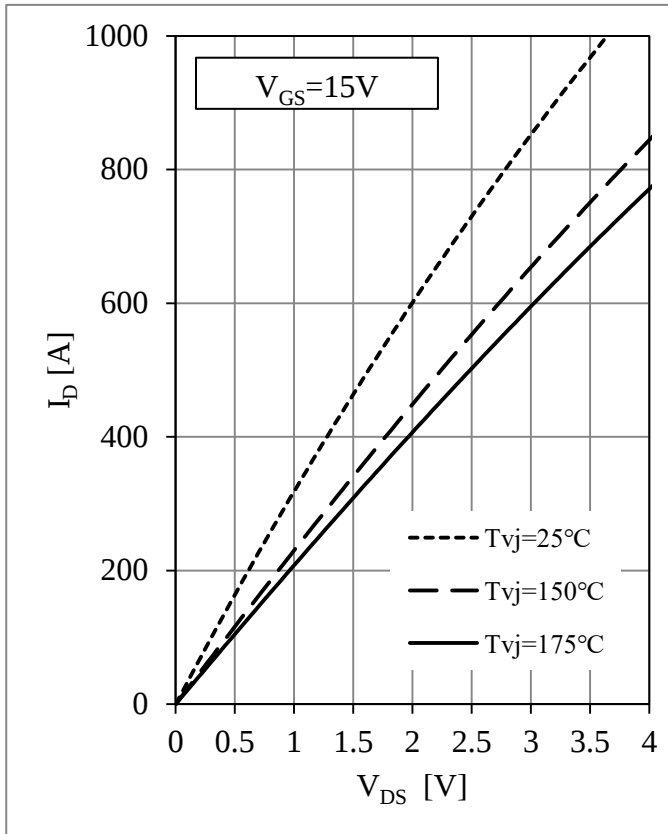


Fig 1. MOSFET Output Characteristics

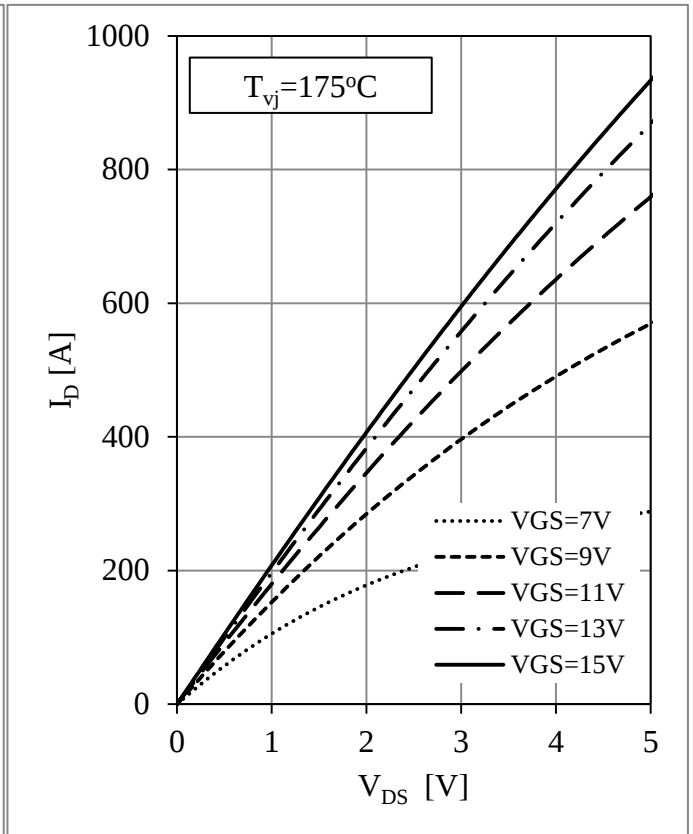


Fig 2. MOSFET Output Characteristics

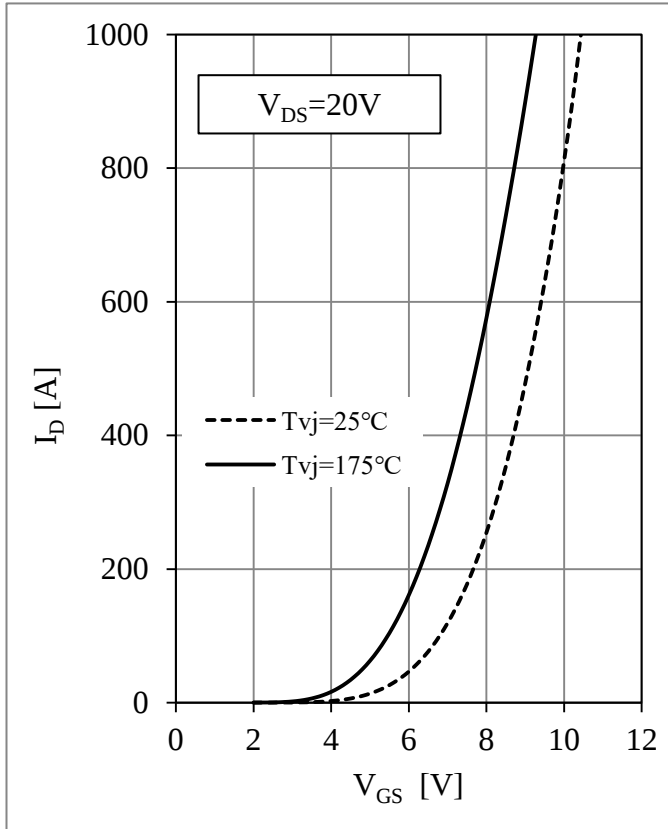
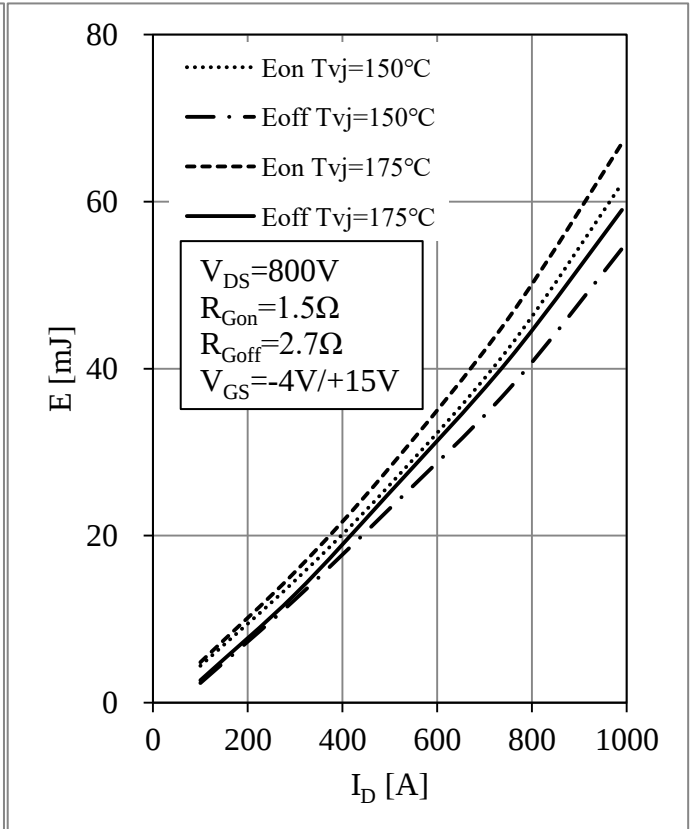


Fig 3. MOSFET Transfer Characteristics

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

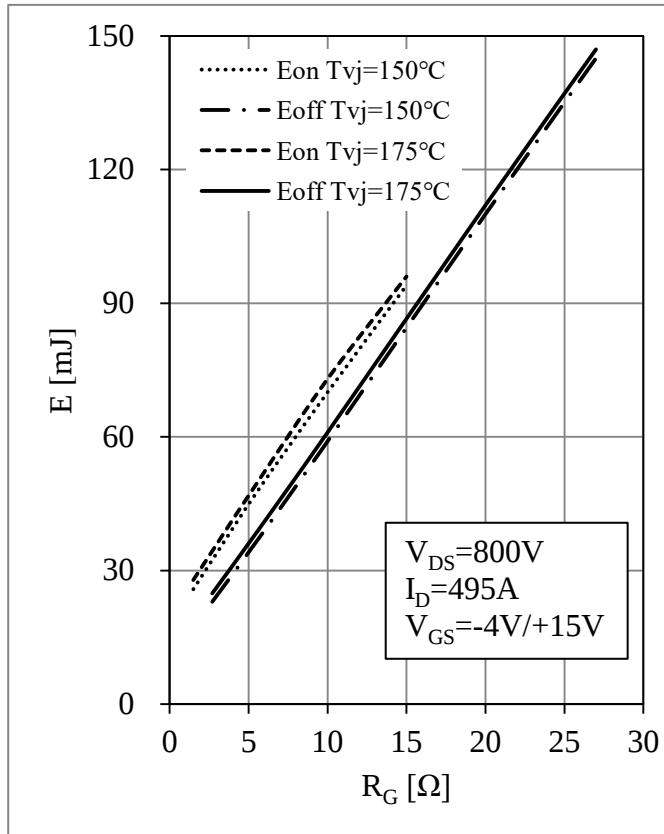
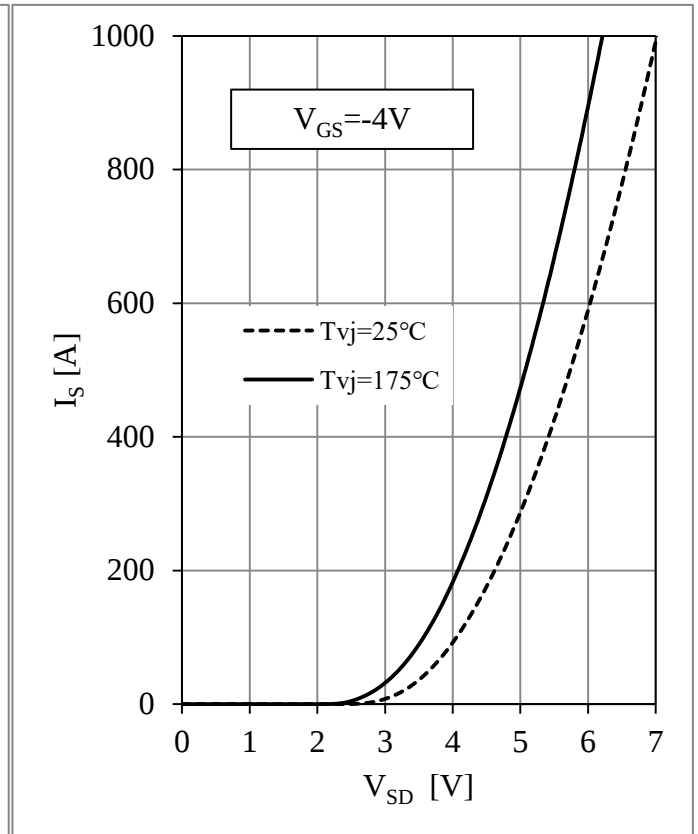
Fig 5. MOSFET Switching Loss vs. R_G 

Fig 6. Body Diode Characteristics

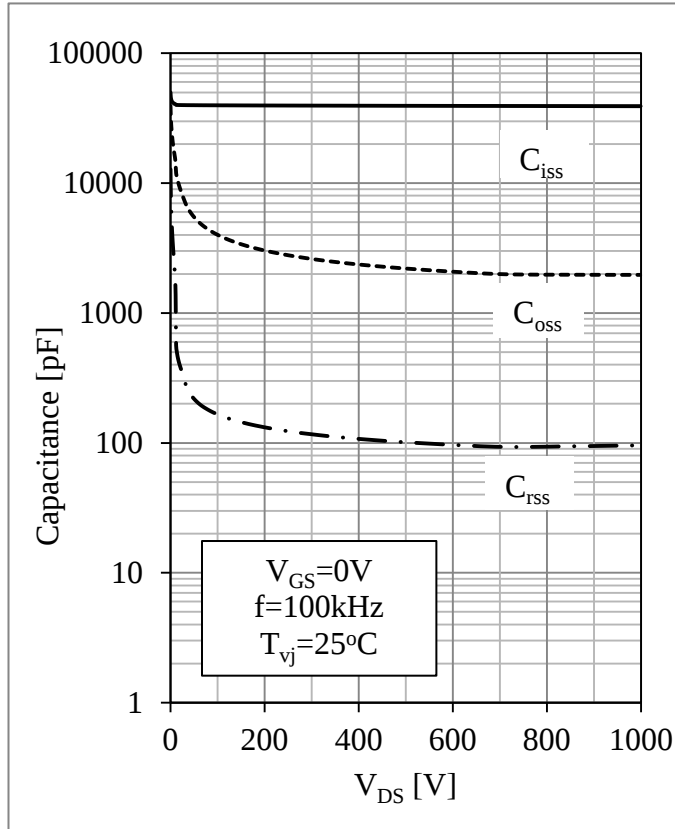
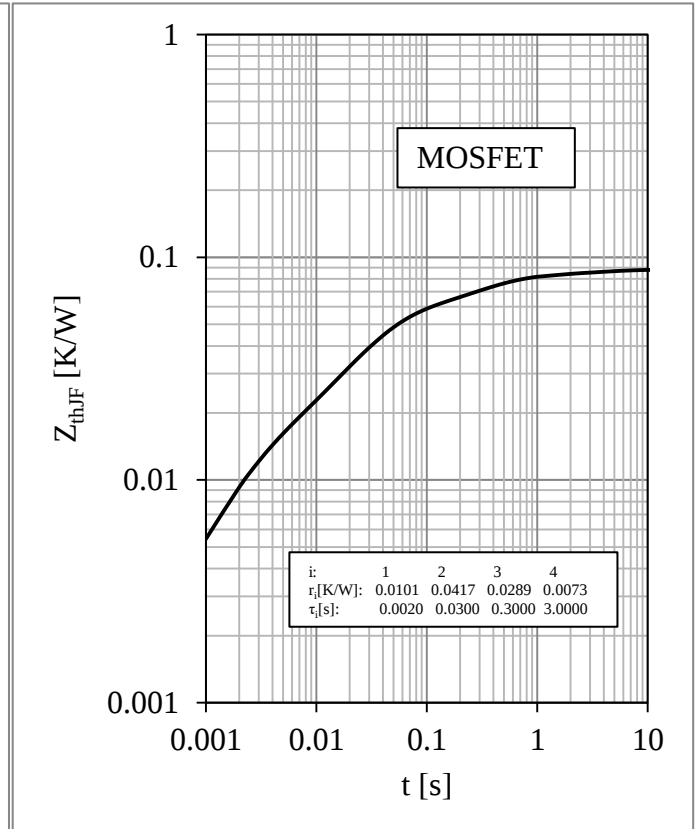
Fig 7. Capacitance vs. V_{DS} 

Fig 8. MOSFET Transient Thermal Impedance

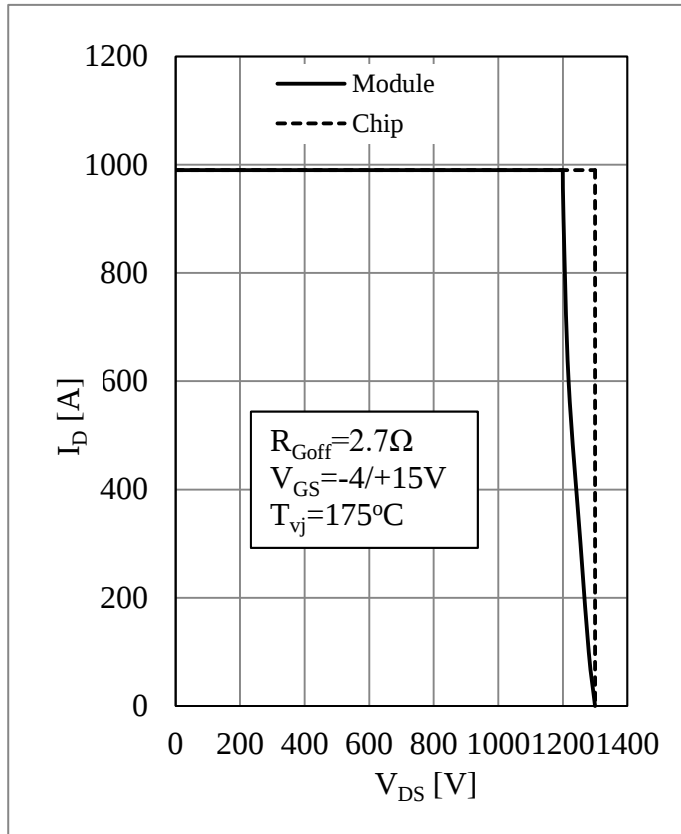
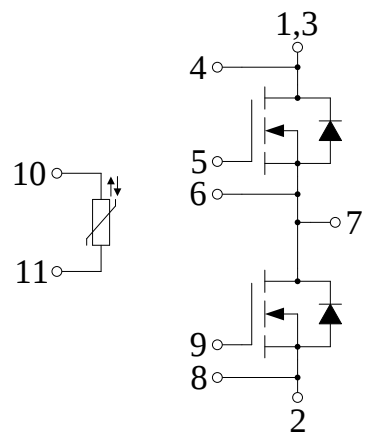


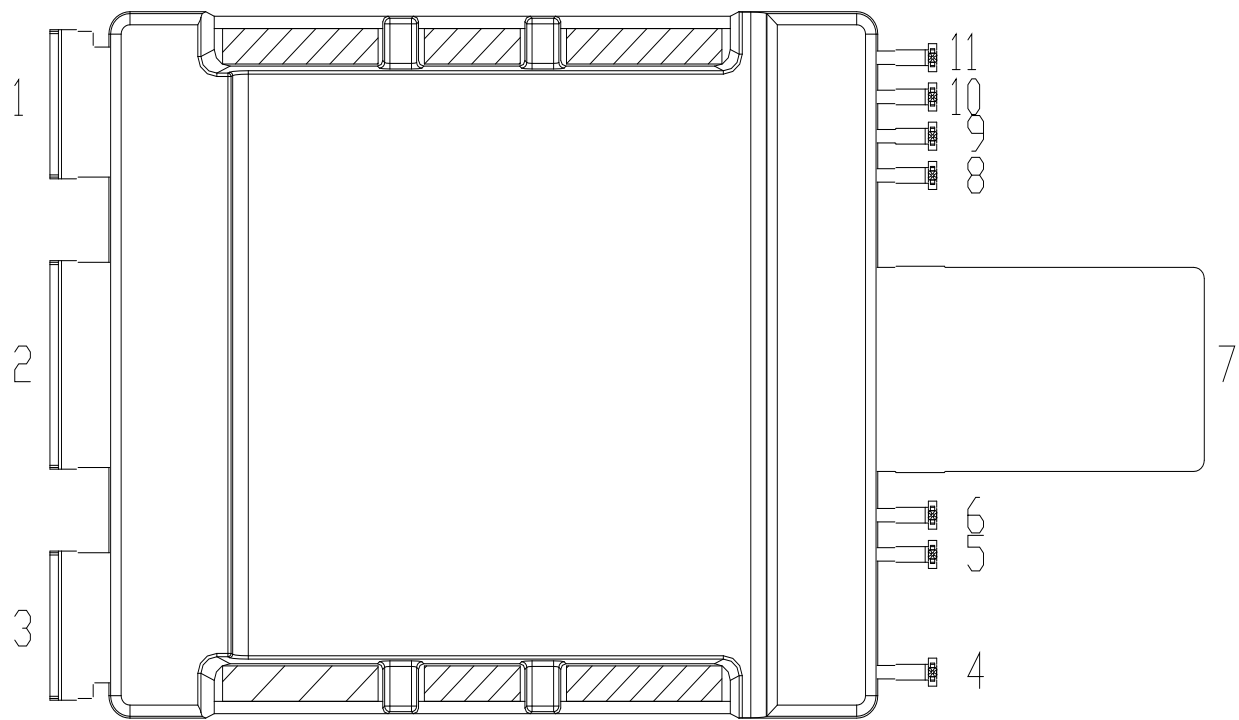
Fig 9. RBSOA

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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