STARPOWER

SEMICONDUCTOR **SiC MOSFET**

MD16HTS75P6HET

750V/1.60mΩ 6 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 as
hybrid and electric vehicle.

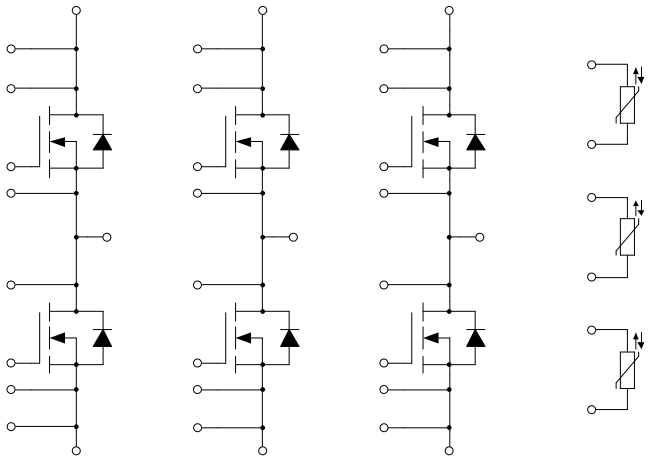
Features

- 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

Typical Applications

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

Equivalent Circuit Schematic



Absolute Maximum Ratings T_F=25°C unless otherwise noted

MOSFET

Symbol	Description	Value	Unit
V_{DSS}	Drain-Source Voltage	750	V
V_{GSSmax}	Gate-Source Voltage	-8/+19	V
V_{GSSop}	Gate-Source Voltage	-4/+15	V
I_D	Drain Curren @ T_F=75°C	660	A
I_{DRM}	Repetitive Peak Drain Current t_p=1ms	1320	A
P_D	Maximum Power Dissipation @ T_F=75°C T_{vj}=175°C	977	W

Body Diode

Symbol	Description	Value	Unit
I_S	Source Current @ T_F=75°C	250	A

Module

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

MOSFET Characteristics T_F=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$R_{DS(on)}$	Static Drain-Source On-Resistance	I_D=628A,V_{GS}=15V, T_{vj}=25°C		1.60	2.25	mΩ
		I_D=628A,V_{GS}=15V, T_{vj}=150°C		1.73	2.56	
		I_D=628A,V_{GS}=15V, T_{vj}=175°C		1.83	2.75	
$V_{GS(th)}$	Gate-Source Threshold Voltage	I_D=176mA,V_{DS}=V_{GS}, T_{vj}=25°C	1.8	2.5	3.2	V
I_{DSS}	Drain-Source Leakage Current	V_{DS}=V_{DSS},V_{GS}=0V, T_{vj}=25°C			500	μA
I_{GSS}	Gate-Source Leakage Current	V_{GS}=15V,V_{DS}=0V, T_{vj}=25°C			600	nA
R_{Gint}	Internal Gate Resistance			0.79		Ω
C_{iss}	Input Capacitance	V_{GS}=0V,V_{DS}=750V, f=100kHz		48.8		nF
C_{oss}	Output Capacitance			1.92		nF
C_{rss}	Reverse Transfer Capacitance			0.13		nF
Q_g	Total Gate Charge	I_D=628A,V_{DS}=470V, V_{GS}=-4/+15V		1.52		μC
$t_{d(on)}$	Turn-On Delay Time	V_{DS}=450V,I_D=680A, R_{Gon}=6.8Ω,L_S=25nH, V_{GS}=-4/+15V, T_{vj}=25°C		225		ns
t_r	Rise Time			122		ns
$t_{d(off)}$	Turn-Off Delay Time			475		ns
t_f	Fall Time			83		ns
E_{on}	Turn-On Switching Loss			21.1		mJ
E_{off}	Turn-Off Switching Loss			33.9		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{DS}=450V,I_D=680A, R_{Gon}=6.8Ω,L_S=25nH, V_{GS}=-4/+15V, T_{vj}=150°C		231		ns
t_r	Rise Time			135		ns
$t_{d(off)}$	Turn-Off Delay Time			592		ns
t_f	Fall Time			99		ns
E_{on}	Turn-On Switching Loss			22.9		mJ
E_{off}	Turn-Off Switching Loss			37.9		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{DS}=450V,I_D=680A, R_{Gon}=6.8Ω,L_S=25nH, V_{GS}=-4/+15V, T_{vj}=175°C		235		ns
t_r	Rise Time			136		ns
$t_{d(off)}$	Turn-Off Delay Time			623		ns
t_f	Fall Time			100		ns
E_{on}	Turn-On Switching Loss			23.1		mJ
E_{off}	Turn-Off Switching Loss			39.4		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=320A,V_{GS}=-4V, T_{vj}=25°C		4.45		V
		I_S=320A,V_{GS}=-4V, T_{vj}=150°C		4.00		
		I_S=320A,V_{GS}=-4V, T_{vj}=175°C		3.95		
t_{rr}	Reverse Recovery Time	V_R=450V,I_F=680A, -di/dt=5590A/μs,L_S=25nH, V_{GE}=-4V,T_{vj}=25°C		43		ns
Q_r	Recovered Charge			3.00		μC
I_{RM}	Peak Reverse Recovery Current			100		A
E_{rec}	Reverse Recovery Energy			0.30		mJ
t_{rr}	Reverse Recovery Time	V_R=450V,I_F=680A, -di/dt=5660A/μs,L_S=25nH, V_{GE}=-4V,T_{vj}=150°C		48		ns
Q_r	Recovered Charge			4.07		μC
I_{RM}	Peak Reverse Recovery Current			126		A
E_{rec}	Reverse Recovery Energy			0.46		mJ
t_{rr}	Reverse Recovery Time	V_R=450V,I_F=680A, -di/dt=5710A/μs,L_S=25nH, V_{GE}=-4V,T_{vj}=175°C		50		ns
Q_r	Recovered Charge			4.57		μC
I_{RM}	Peak Reverse Recovery Current			138		A
E_{rec}	Reverse Recovery Energy			0.55		mJ

NTC Characteristics T_F=25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
R_{25}	Rated Resistance			5.0		kΩ
ΔR/R	Deviation of R_{100}	T_{vj} =100 °C,R_{100}=493.3Ω	-5		5	%
P_{25}	Power Dissipation				20.0	mW
$B_{25/50}$	B-value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$		3375		K
$B_{25/80}$	B-value	$R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15K))]$		3411		K
$B_{25/100}$	B-value	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15K))]$		3433		K

Module Characteristics T_F=25°C unless otherwise noted

Symbol	Parameter	Min.	Typ.	Max.	Unit
L_{CE}	Stray Inductance		8		nH
$R_{CC'+EE'}$	Module Lead Resistance, Terminal to Chip		0.43		mΩ
p	Maximum Pressure In Cooling Circuit			2.5	bar
R_{thJF}	Junction-to-Cooling Fluid (per MOSFET) $\triangle V/\triangle t=10.0dm^3/min, T_F=75°C$		0.093		K/W
M	Terminal Connection Torque, Screw M5 Mounting Torque, Screw M4	3.6 1.8		4.4 2.2	N.m
G	Weight of Module		750		g

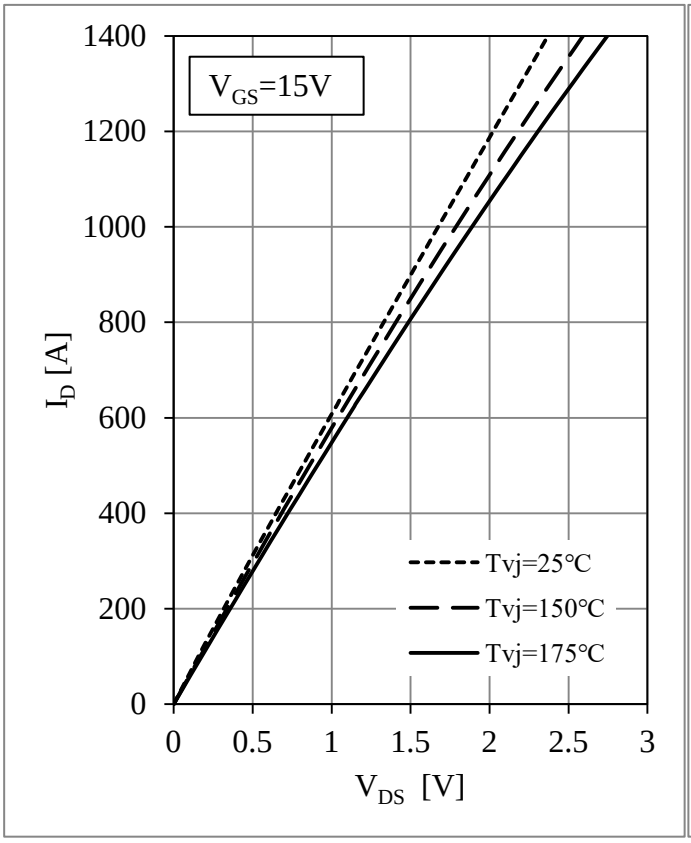


Fig 1. MOSFET Output Characteristics

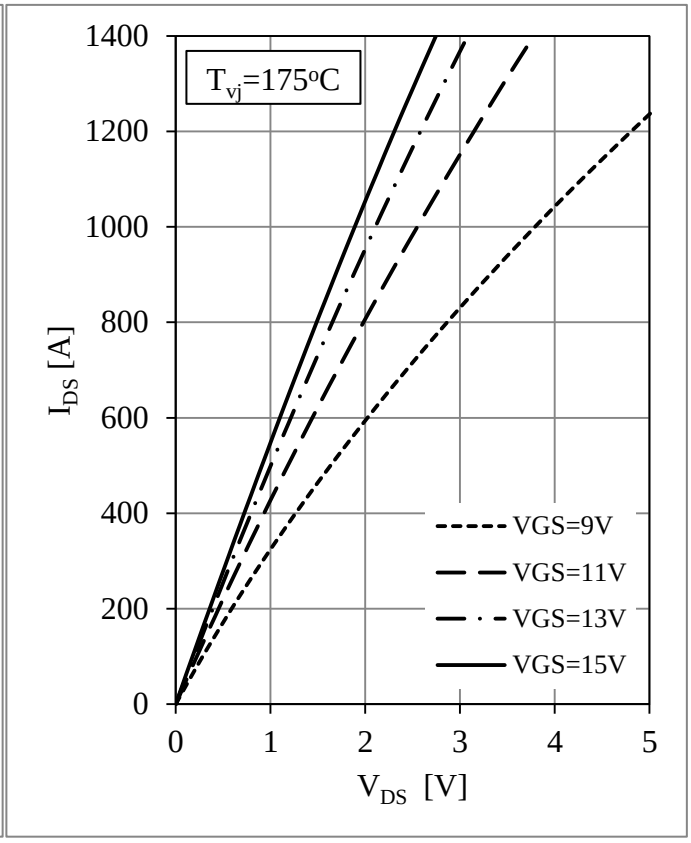


Fig 2. MOSFET Output Characteristics

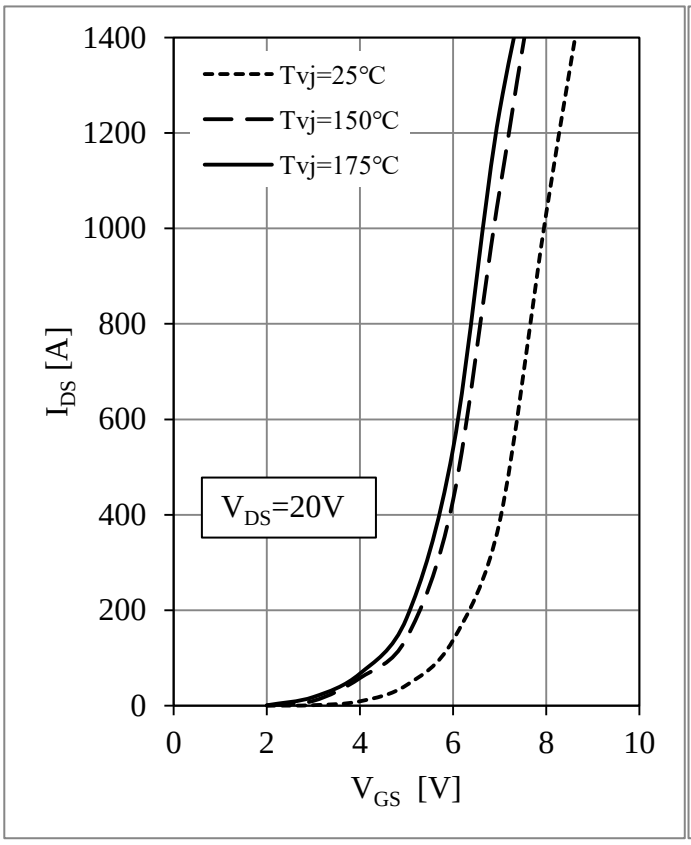


Fig 3. MOSFET Transfer Characteristics

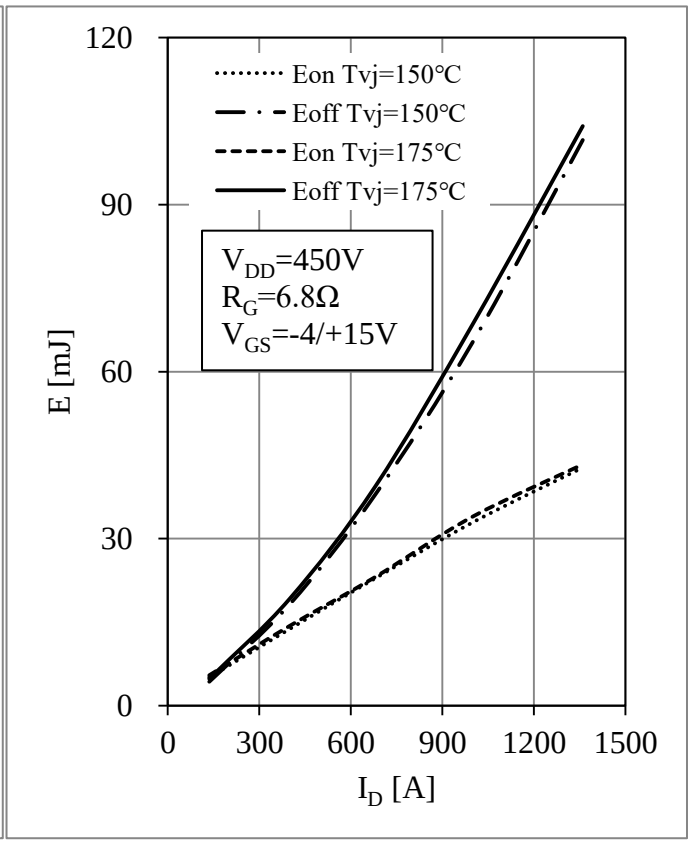


Fig 4. MOSFET Switching Loss vs. I_{DS}

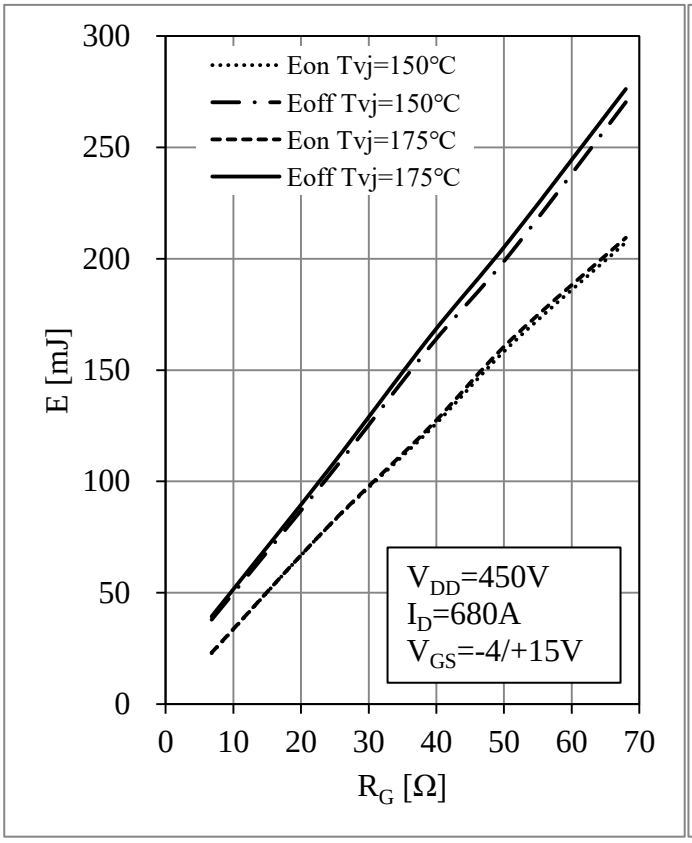


Fig 5. MOSFET Switching Loss vs.R_G

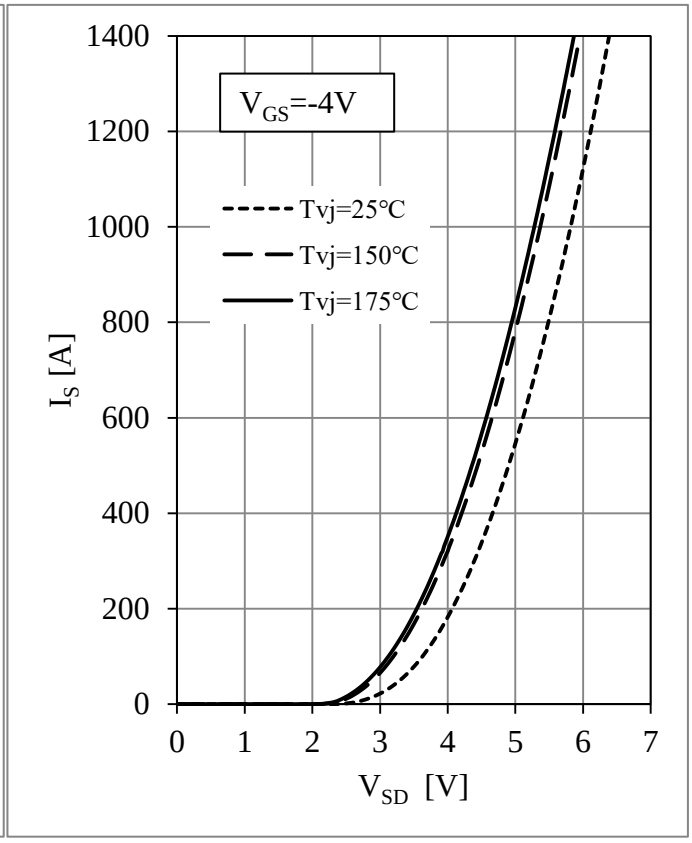


Fig 6. Body Diode Characteristics

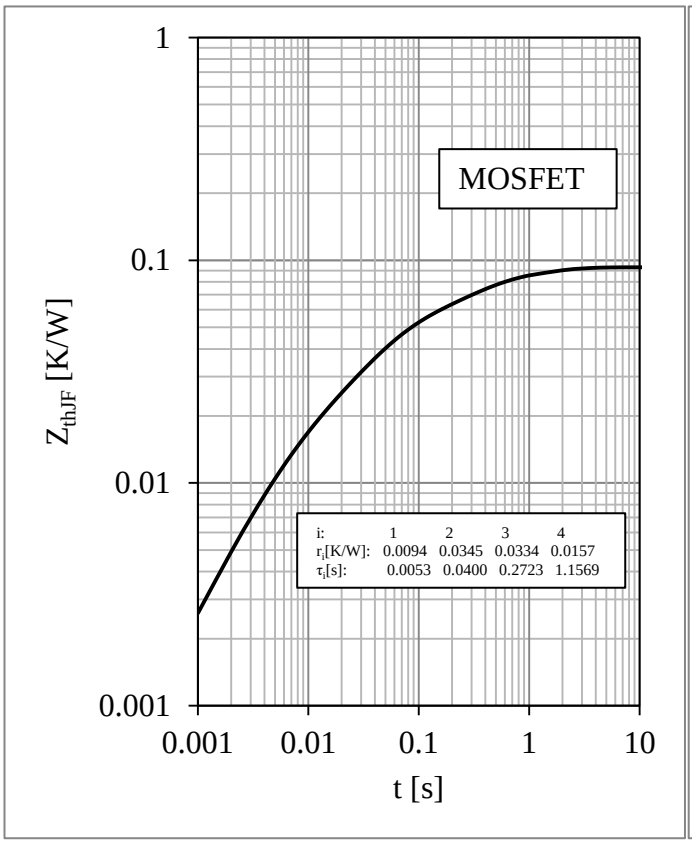


Fig 7. MOSFET Transient Thermal Impedance

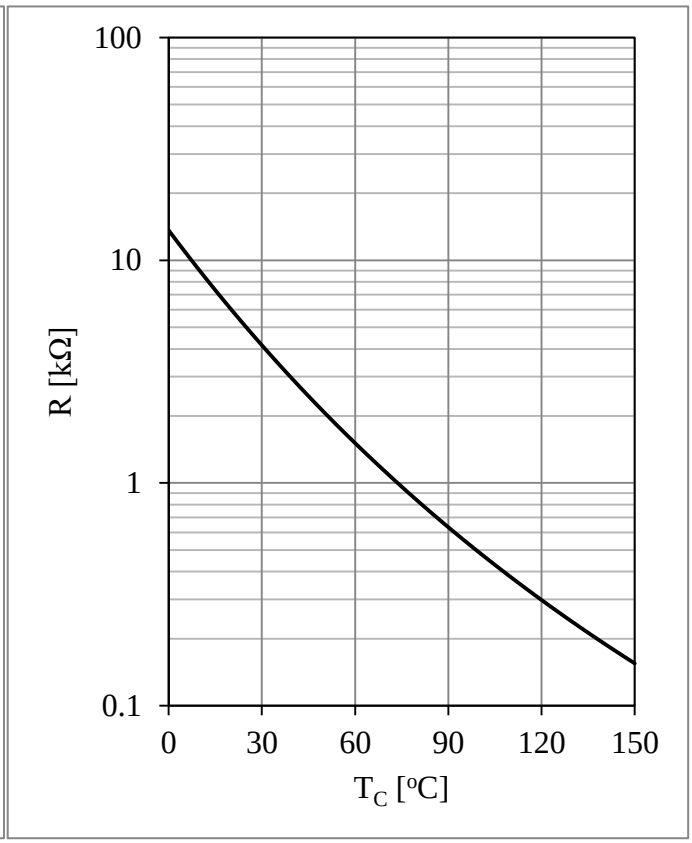
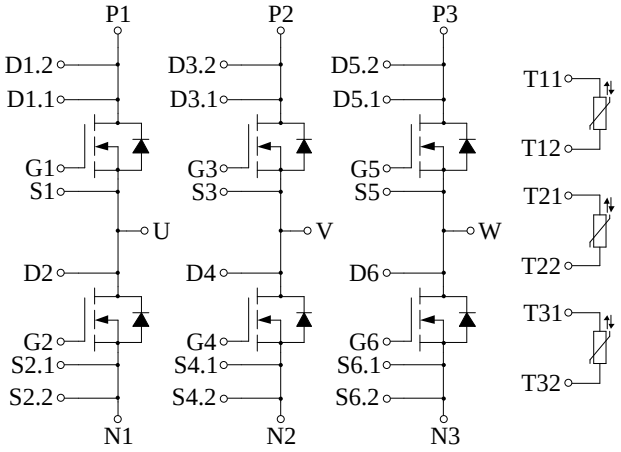


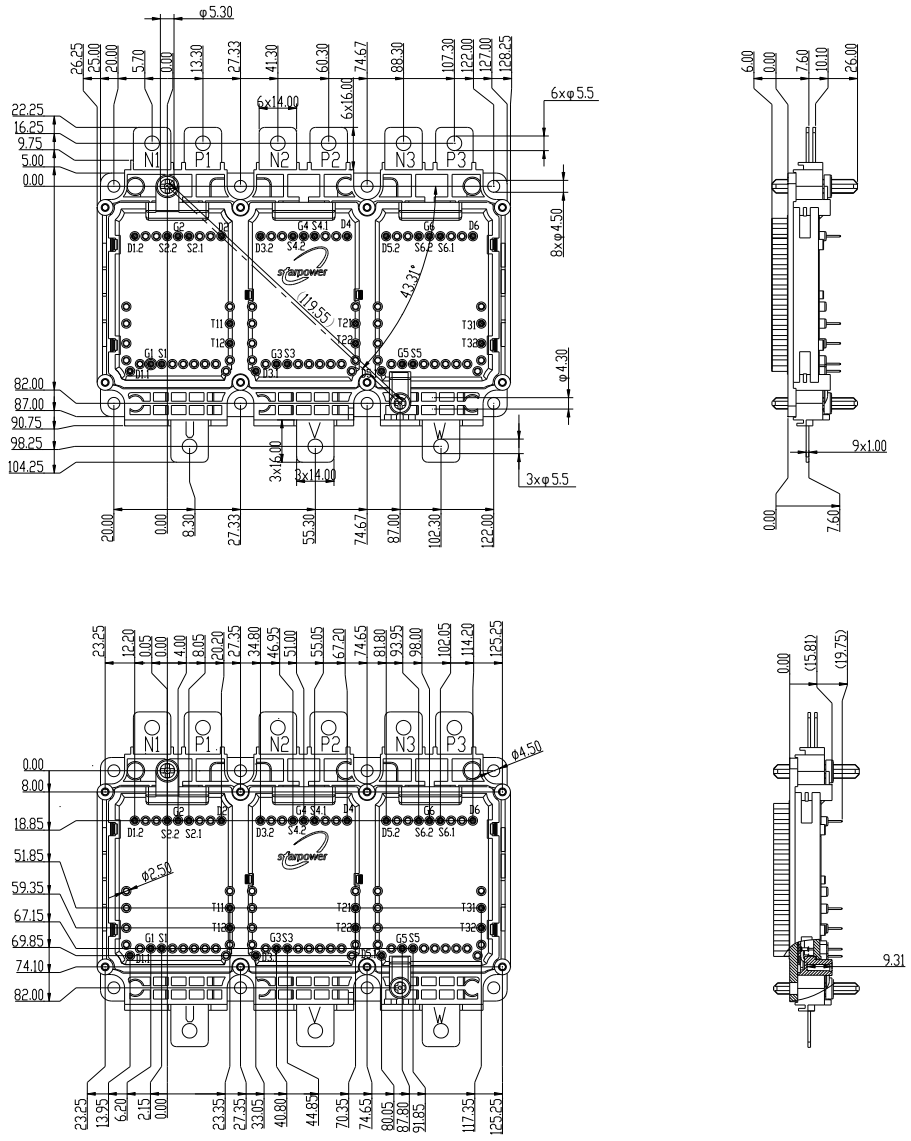
Fig 8. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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