STARPOWER

SEMICONDUCTOR **SiC MOSFET**

MD29HTC120P6HE

1200V/2.87mΩ 6 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.

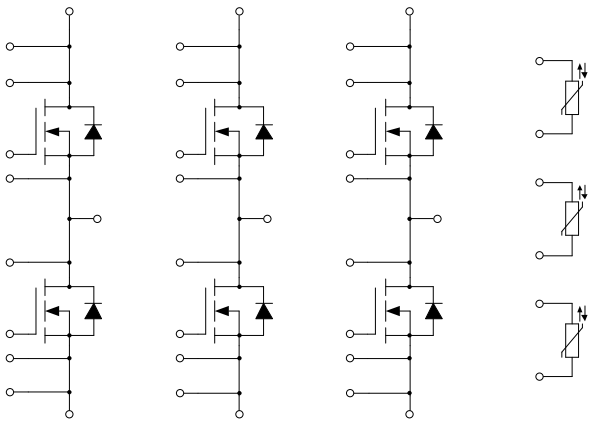
Features

- 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

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	1200	V
V_{GSSmax}	Gate-Source Voltage	-8/+19	V
V_{GSSop}	Gate-Source Voltage	-4/+15	V
I_D	Drain Current @ T_F=60°C	450	A
I_{DM}	Pulsed Drain Current, t_P limited by T_{jmax}	900	A
P_D	Maximum Power Dissipation @ T_F=60°C T_j=175°C	905	W

Body Diode

Symbol	Description	Value	Unit
I_S	Source Current @ T_F=75°C	180	A

Module

Symbol	Description	Value	Unit
T_{jmax}	Maximum Junction Temperature	175	°C
T_{jop}	Operating Junction Temperature	-40 to +175	°C
T_{STG}	Storage Temperature Range	-40 to +125	°C
V_{ISO}	Isolation Voltage RMS,f=50Hz,t=5s	4000	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=450A,V_{GS}=15V, T_j=25°C		2.87		mΩ
		I_D=450A,V_{GS}=15V, T_j=150°C		4.00		
		I_D=450A,V_{GS}=15V, T_j=175°C		4.44		
$V_{GS(th)}$	Gate-Source Threshold Voltage	I_D=118mA,V_{DS}=V_{GS}, T_j=25°C	1.8	2.5	3.6	V
I_{DSS}	Drain-Source Leakage Current	V_{DS}=V_{DSS},V_{GS}=0V, T_j=25°C			500	μA
I_{GSS}	Gate-Source Leakage Current	V_{GS}=19V,V_{DS}=0V, T_j=25°C			600	nA
R_{Gint}	Internal Gate Resistance			1.0		Ω
C_{iss}	Input Capacitance	V_{GS}=0V,V_{DS}=1000V, f=100kHz		38.2		nF
C_{oss}	Output Capacitance			1.45		nF
C_{rss}	Reverse Transfer Capacitance			0.07		nF
Q_g	Total Gate Charge	I_D=450A,V_{DS}=800V, V_{GS}=-4/15V		1320		nC
$t_{d(on)}$	Turn-On Delay Time	V_{DS}=800V,I_D=450A, R_{Gon}=2.35Ω, R_{Goff}=3.3Ω, L_S=26nH, V_{GS}=-4/15V, T_j=25°C		94		ns
t_r	Rise Time			58		ns
$t_{d(off)}$	Turn-Off Delay Time			262		ns
t_f	Fall Time			40		ns
E_{on}	Turn-On Switching Loss			16.7		mJ
E_{off}	Turn-Off Switching Loss			17.3		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{DS}=800V,I_D=450A, R_{Gon}=2.35Ω, R_{Goff}=3.3Ω, L_S=26nH, V_{GS}=-4/15V, T_j=150°C		90		ns
t_r	Rise Time			58		ns
$t_{d(off)}$	Turn-Off Delay Time			306		ns
t_f	Fall Time			42		ns
E_{on}	Turn-On Switching Loss			17.2		mJ
E_{off}	Turn-Off Switching Loss			18.1		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{DS}=800V,I_D=450A, R_{Gon}=2.35Ω, R_{Goff}=3.3Ω, L_S=26nH, V_{GS}=-4/15V, T_j=175°C		90		ns
t_r	Rise Time			56		ns
$t_{d(off)}$	Turn-Off Delay Time			318		ns
t_f	Fall Time			44		ns
E_{on}	Turn-On Switching Loss			17.9		mJ
E_{off}	Turn-Off Switching Loss			18.9		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=450A,V_{GS}=-4V, T_j=25°C		5.10		V
		I_S=450A,V_{GS}=-4V, T_j=150°C		4.60		
		I_S=450A,V_{GS}=-4V, T_j=175°C		4.55		
Q_r	Diode Reverse Recovery Charge	V_R=800V,I_S=450A, -di/dt=10080A/μs, L_S=26nH, V_{GS}=-4V, T_j=25°C		2.67		μC
I_{rrm}	Peak Reverse Recovery Current			168		A
E_{rec}	Reverse Recovery Energy			0.23		mJ
Q_r	Diode Reverse Recovery Charge	V_R=800V,I_S=450A, -di/dt=9660A/μs, L_S=26nH, V_{GS}=-4V, T_j=150°C		5.24		μC
I_{rrm}	Peak Reverse Recovery Current			264		A
E_{rec}	Reverse Recovery Energy			0.85		mJ
Q_r	Diode Reverse Recovery Charge	V_R=800V,I_S=450A, -di/dt=9370A/μs, L_S=26nH, V_{GS}=-4V, T_j=175°C		6.12		μC
I_{rrm}	Peak Reverse Recovery Current			300		A
E_{rec}	Reverse Recovery Energy			0.95		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_j =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
△p	△V/△t=10.0dm^3/min,T_F=60°C		64		mbar
p	Maximum Pressure In Cooling Circuit			2.5	bar
R_{thJF}	Junction-to-Cooling Fluid (per MOSFET) △V/△t=10.0dm^3/min,T_F=60°C			0.127	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

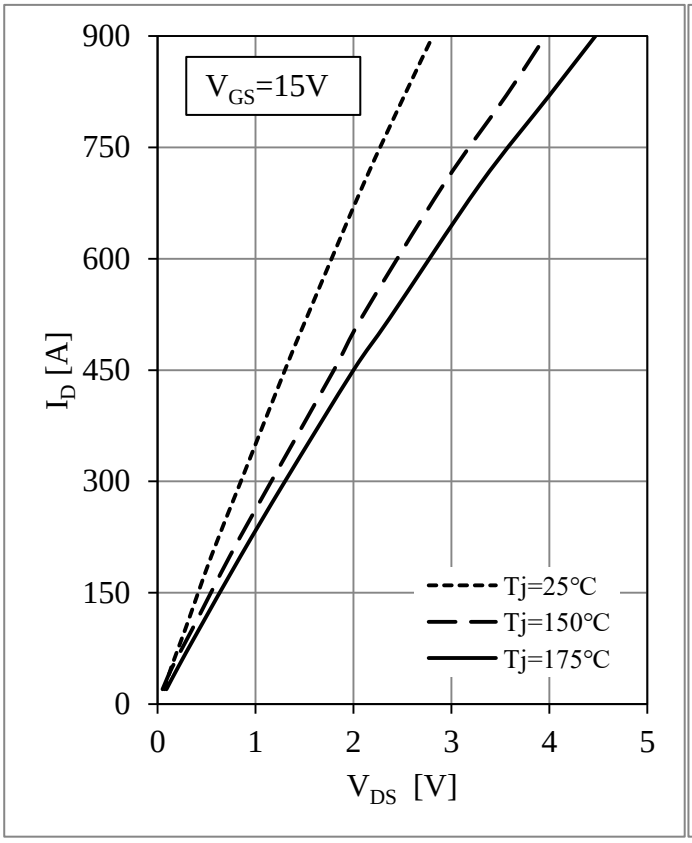


Fig 1. MOSFET Output Characteristics

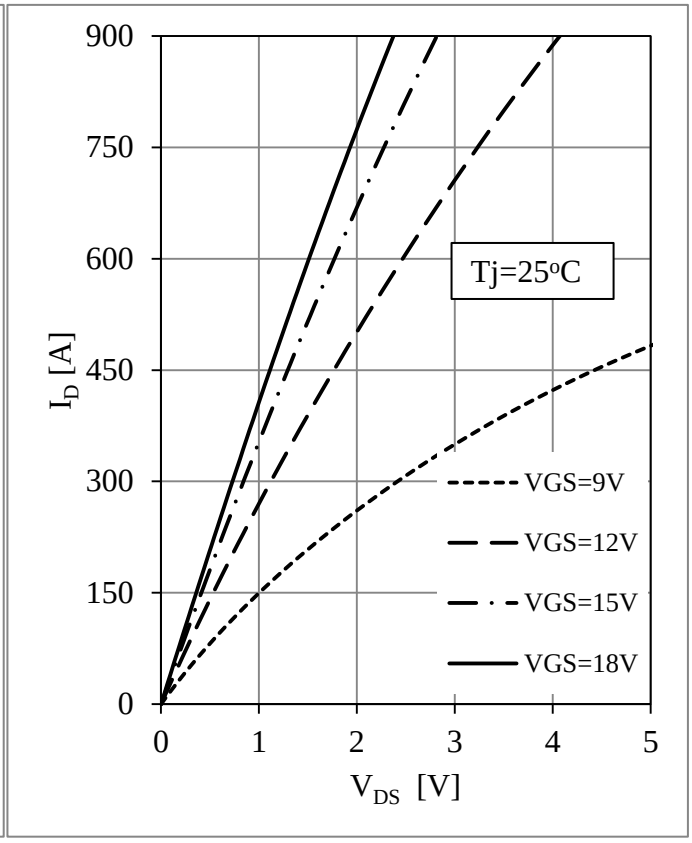


Fig 2. MOSFET Output Characteristics

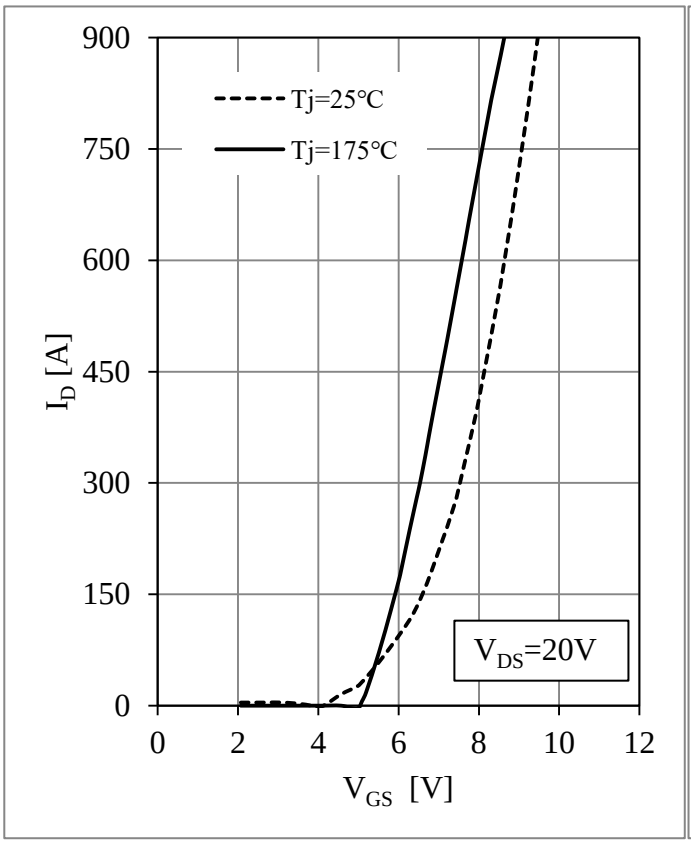


Fig 3. MOSFET Transfer Characteristics

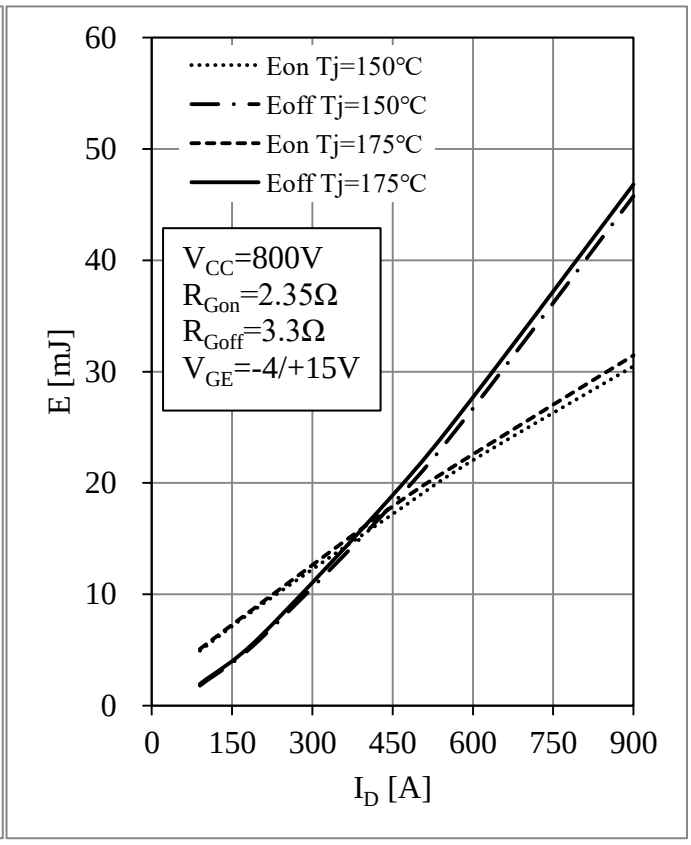


Fig 4. MOSFET Switching Loss vs. I_{DS}

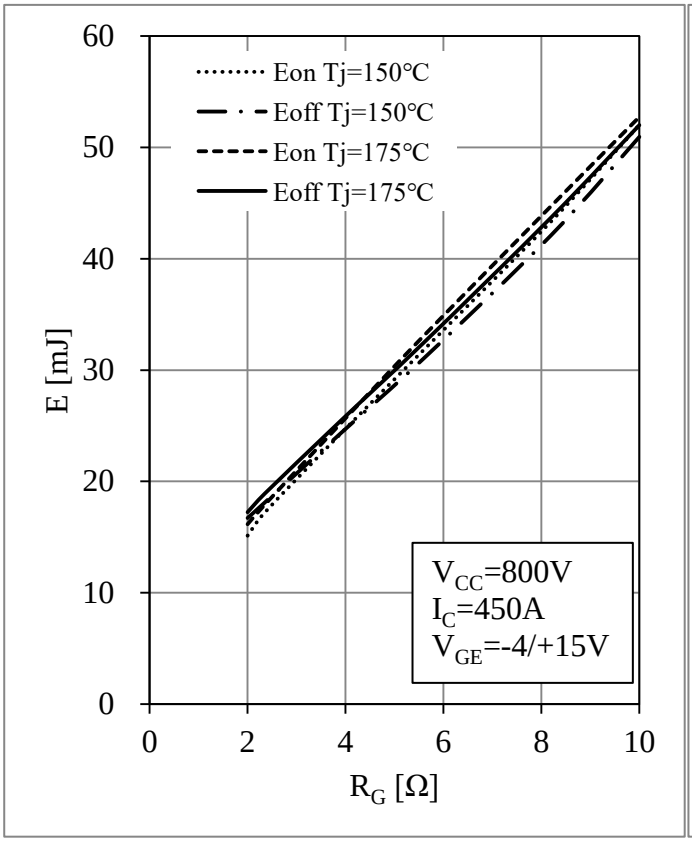


Fig 5. MOSFET Switching Loss vs.R_G

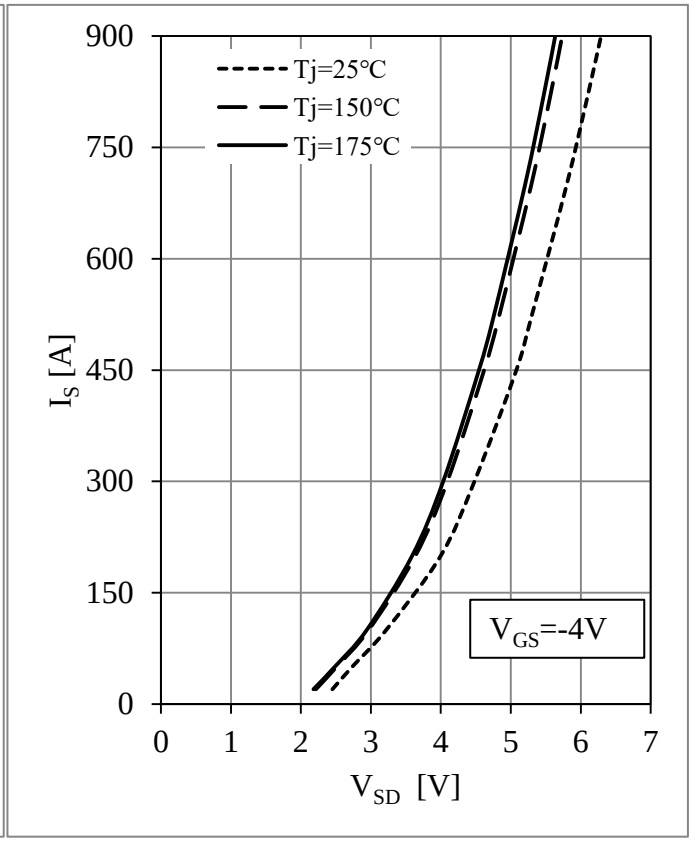


Fig 6. Body Diode Characteristics

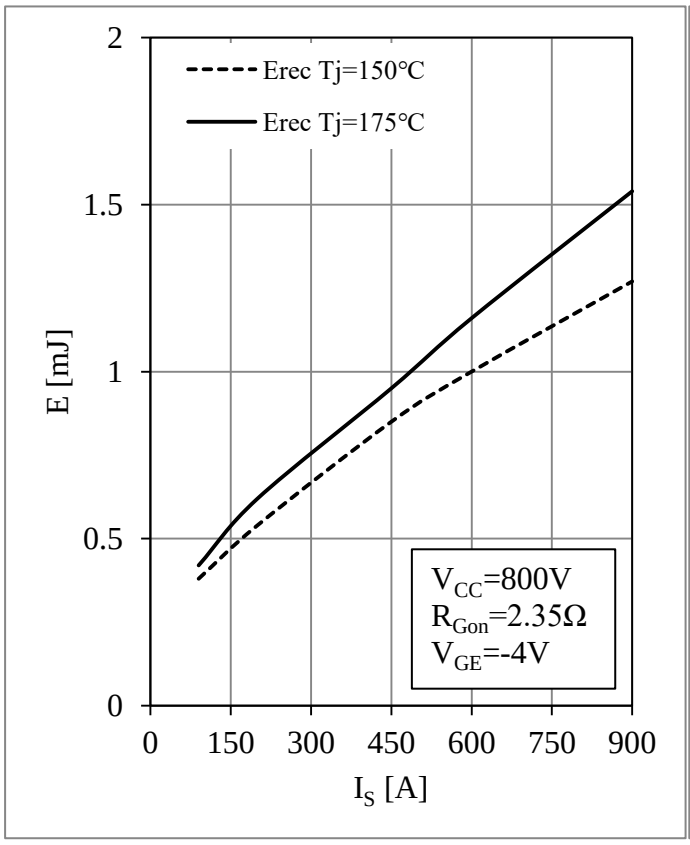


Fig 7. Body Diode Switching Loss vs. I_S

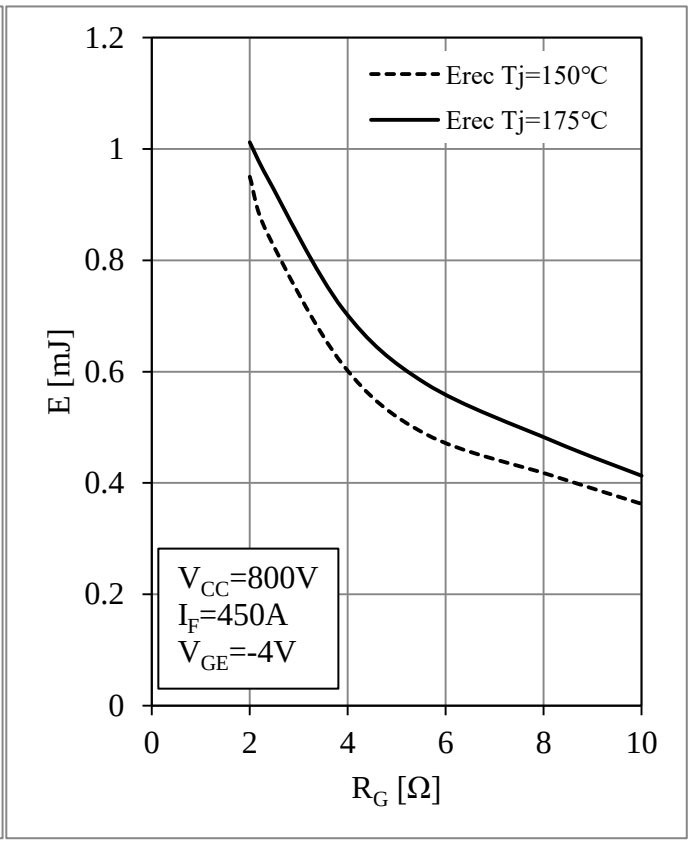


Fig 8. Body Diode Switching Loss vs. R_G

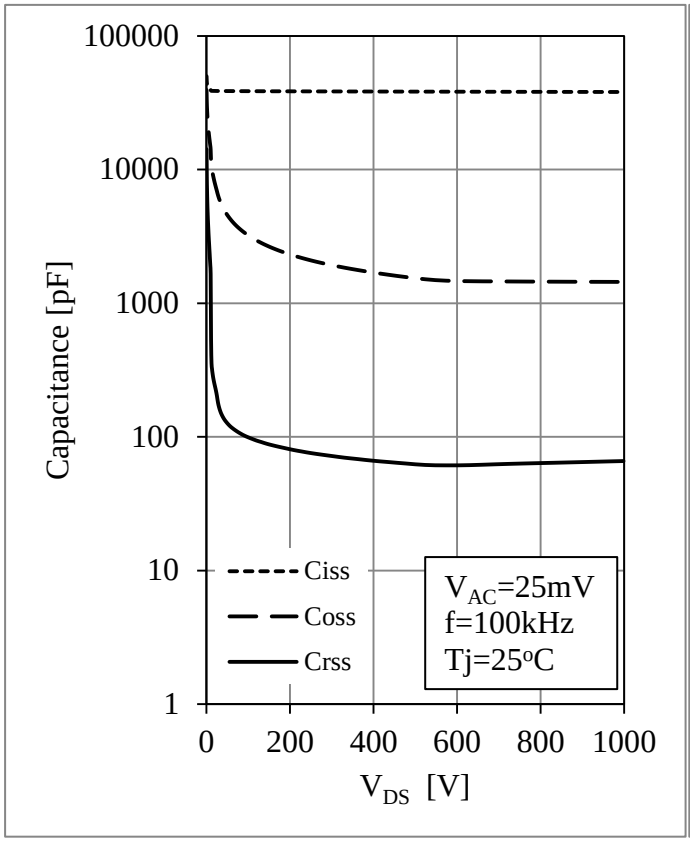


Fig 9. Capacitance vs.V_{DS}

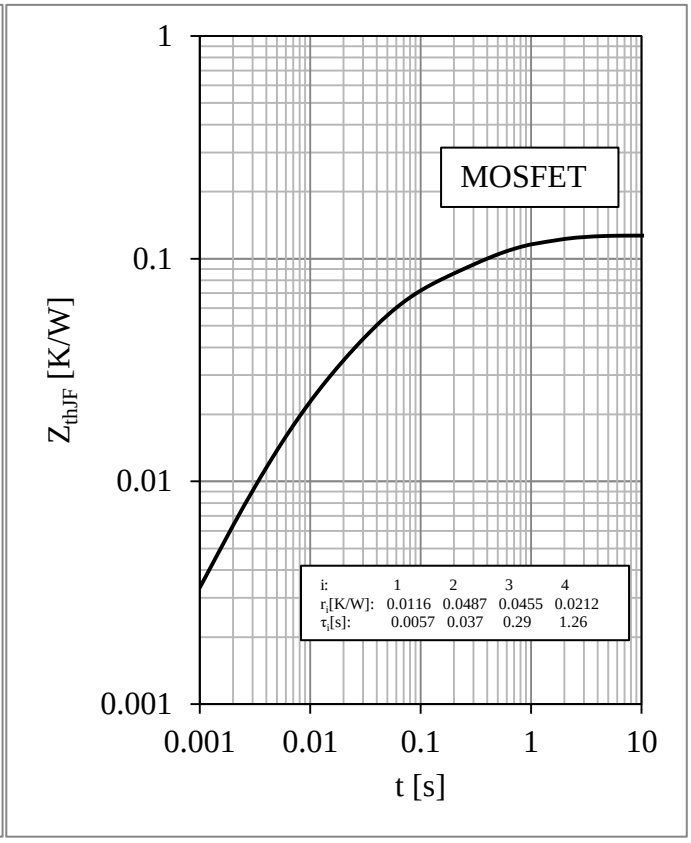


Fig 10. MOSFET Transient Thermal Impedance

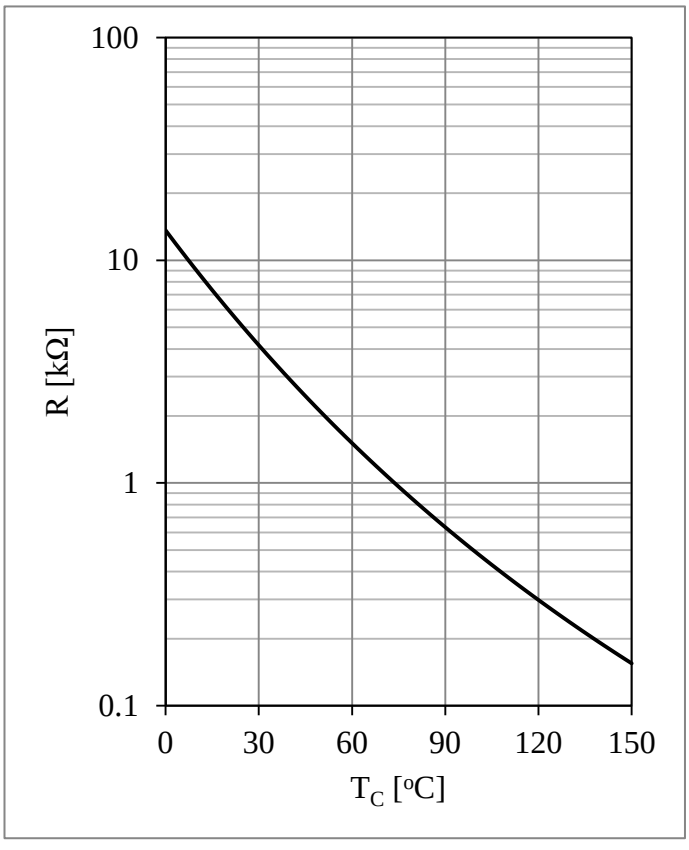
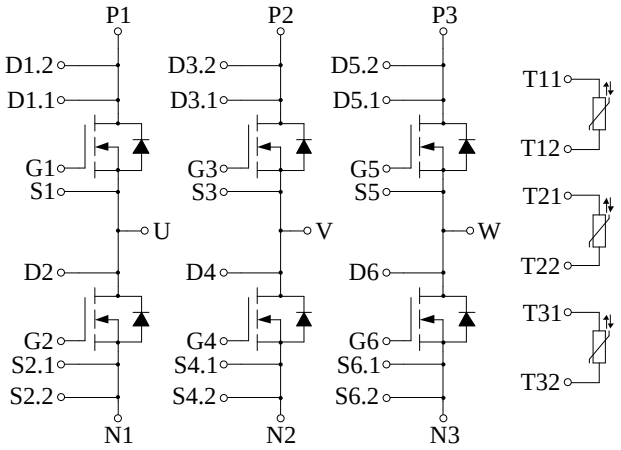


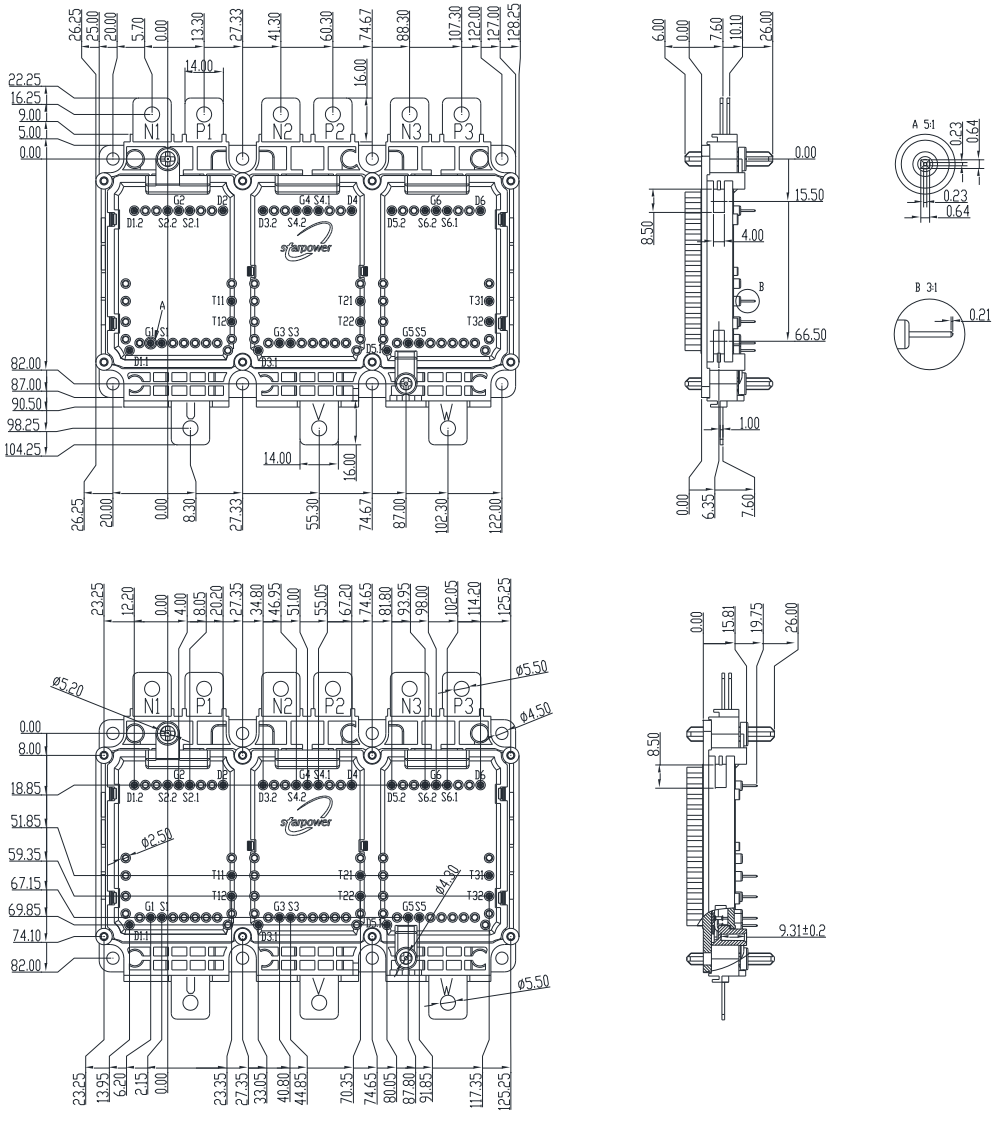
Fig 11. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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