STARPOWER

SEMICONDUCTOR **SiC MOSFET**

MD13HTC75P6HE

750V/1.25mΩ 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.

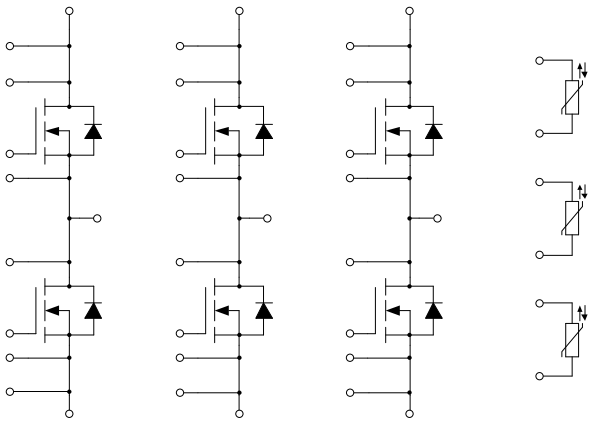
Features

- SiC power MOSFET
- Low $R_{DS(on)}$
- Optimized intrinsic reverse diode
- 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 Current @ T_F=75°C	630	A
I_{DM}	Pulsed Drain Current, t_P limited by T_{jmax}	1260	A
P_D	Maximum Power Dissipation @ T_F=75°C T_j=175°C	900	W

Body Diode

Symbol	Description	Value	Unit
I_S	Source Current @ T_F=75°C	222	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=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=660A,V_{GS}=15V, T_j=25°C		1.25	1.70	mΩ
		I_D=660A,V_{GS}=15V, T_j=175°C		1.85		
$V_{GS(th)}$	Gate-Source Threshold Voltage	I_D=180mA,V_{DS}=V_{GS}, T_j=25°C	1.8	2.4	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			800	nA
R_{Gint}	Internal Gate Resistance			0.40		Ω
C_{iss}	Input Capacitance	V_{GS}=0V,V_{DS}=470V, f=100kHz		57.5		nF
C_{oss}	Output Capacitance			3.71		nF
C_{rss}	Reverse Transfer Capacitance			0.31		nF
Q_g	Total Gate Charge	I_D=660A,V_{DS}=470V, V_{GS}=-4/+15V		1.19		μC
$t_{d(on)}$	Turn-On Delay Time	V_{DS}=470V,I_D=660A, R_{Gon}=1.5Ω, R_{Goff}=4.7Ω, L_S=25nH, V_{GS}=-4/+15V, T_j=25°C		92		ns
t_r	Rise Time			64		ns
$t_{d(off)}$	Turn-Off Delay Time			628		ns
t_f	Fall Time			89		ns
E_{on}	Turn-On Switching Loss			5.56		mJ
E_{off}	Turn-Off Switching Loss			41.6		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{DS}=470V,I_D=660A, R_{Gon}=1.5Ω, R_{Goff}=4.7Ω, L_S=25nH, V_{GS}=-4/+15V, T_j=150°C		85		ns
t_r	Rise Time			59		ns
$t_{d(off)}$	Turn-Off Delay Time			688		ns
t_f	Fall Time			98		ns
E_{on}	Turn-On Switching Loss			4.49		mJ
E_{off}	Turn-Off Switching Loss			41.9		mJ
$t_{d(on)}$	Turn-On Delay Time	V_{DS}=470V,I_D=660A, R_{Gon}=1.5Ω, R_{Goff}=4.7Ω, L_S=25nH, V_{GS}=-4/+15V, T_j=175°C		84		ns
t_r	Rise Time			58		ns
$t_{d(off)}$	Turn-Off Delay Time			720		ns
t_f	Fall Time			104		ns
E_{on}	Turn-On Switching Loss			4.40		mJ
E_{off}	Turn-Off Switching Loss			42.1		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=325A,V_{GS}=-4V, T_j=25°C		4.20		V
		I_S=325A,V_{GS}=-4V, T_j=175°C		3.80		
Q_r	Diode Reverse Recovery Charge	V_R=470V,I_S=660A, -di/dt=11690A/μs, L_S=25nH, V_{GS}=-4V, T_j=25°C		4.50		μC
I_{rrm}	Peak Reverse Recovery Current			172		A
E_{rec}	Reverse Recovery Energy			2.57		mJ
Q_r	Diode Reverse Recovery Charge	V_R=470V,I_S=660A, -di/dt=12560A/μs, L_S=25nH, V_{GS}=-4V, T_j=150°C		6.75		μC
I_{rrm}	Peak Reverse Recovery Current			238		A
E_{rec}	Reverse Recovery Energy			3.84		mJ
Q_r	Diode Reverse Recovery Charge	V_R=470V,I_S=660A, -di/dt=12700A/μs, L_S=25nH, V_{GS}=-4V, T_j=175°C		6.99		μC
I_{rrm}	Peak Reverse Recovery Current			244		A
E_{rec}	Reverse Recovery Energy			4.20		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=75°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=75°C		0.101	0.111	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

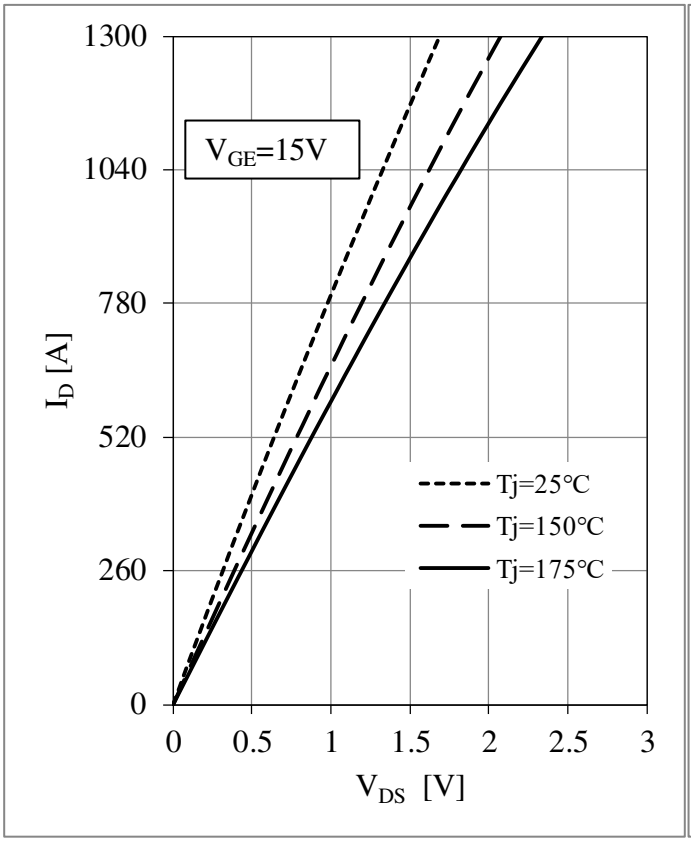


Fig 1. MOSFET Output Characteristics

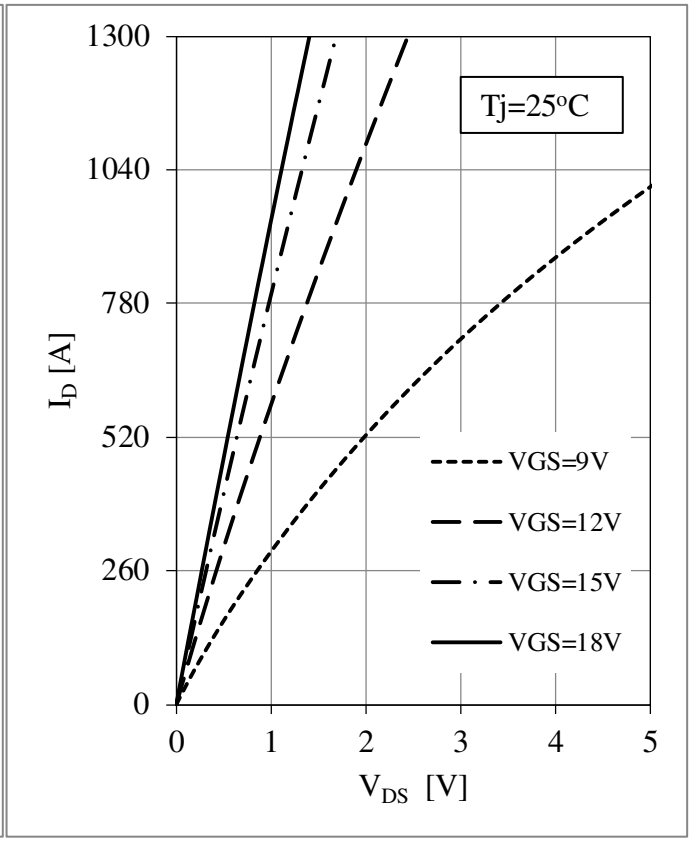


Fig 2. MOSFET Output Characteristics

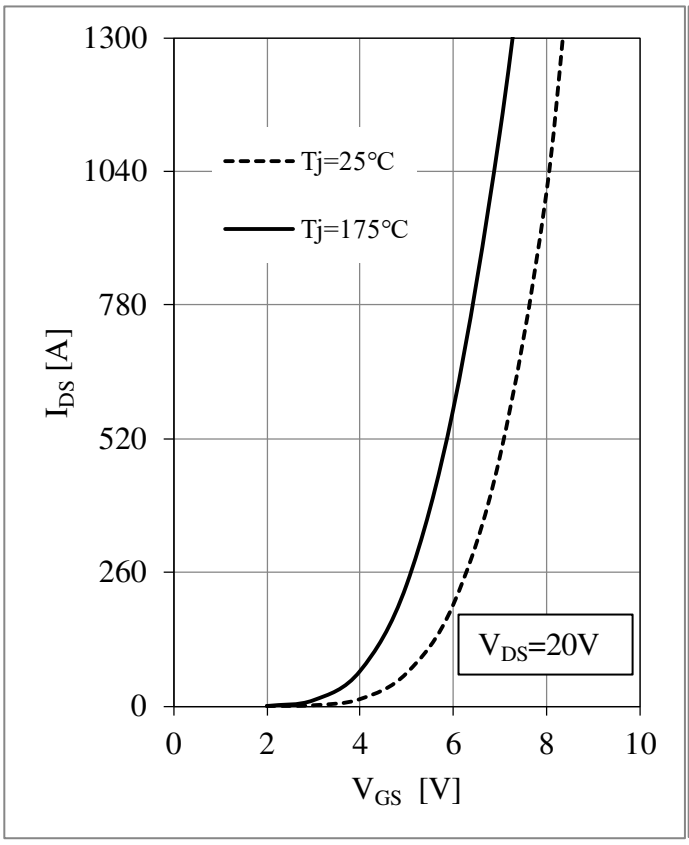


Fig 3. MOSFET Transfer Characteristics

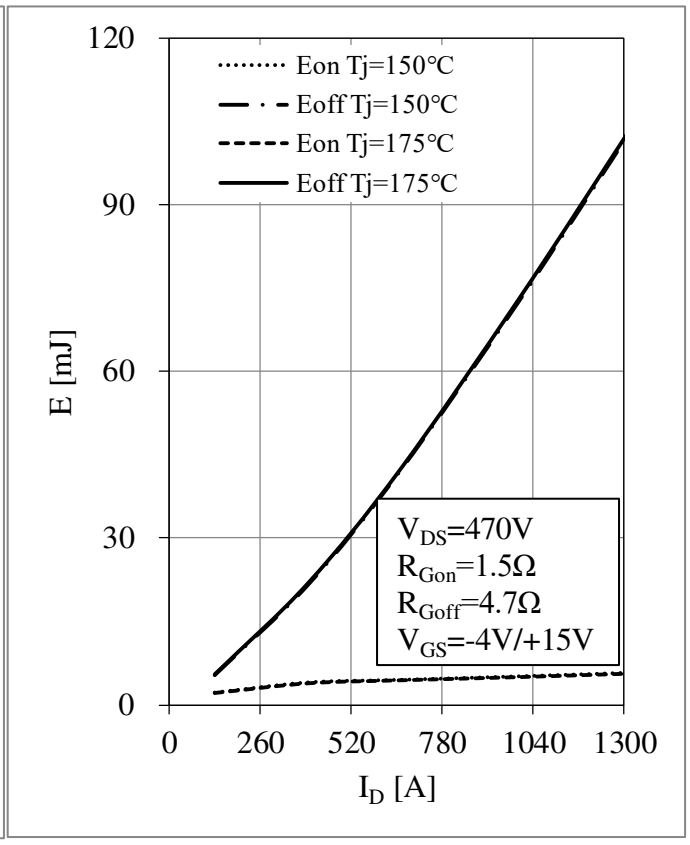


Fig 4. MOSFET Switching Loss vs. I_{DS}

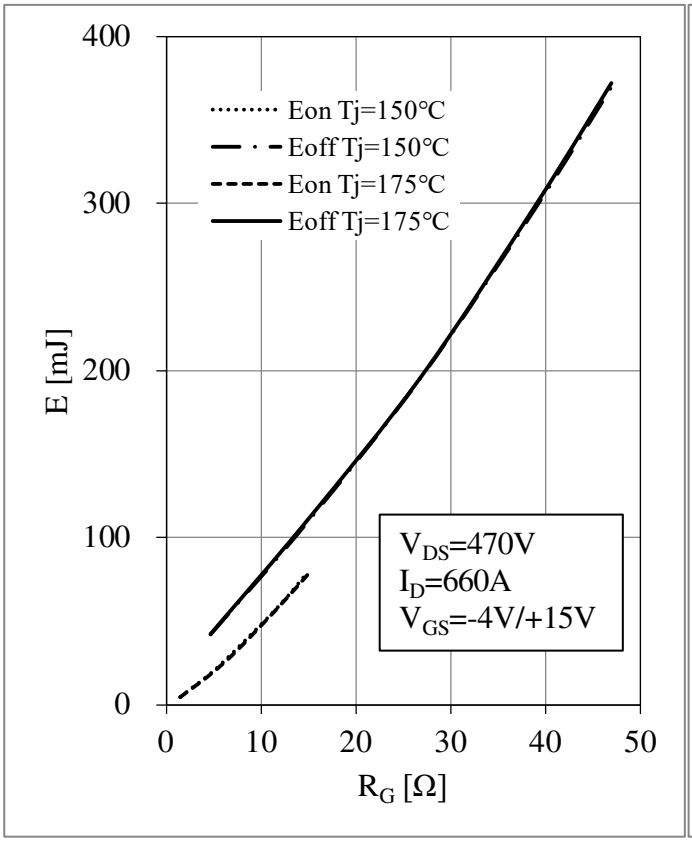


Fig 5. MOSFET Switching Loss vs.R_G

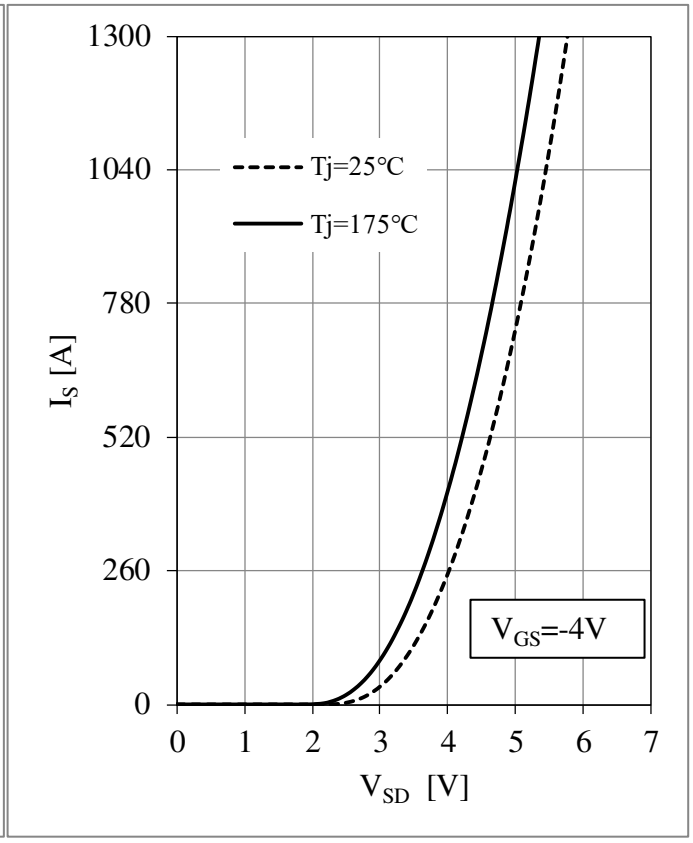


Fig 6. Body Diode Characteristics

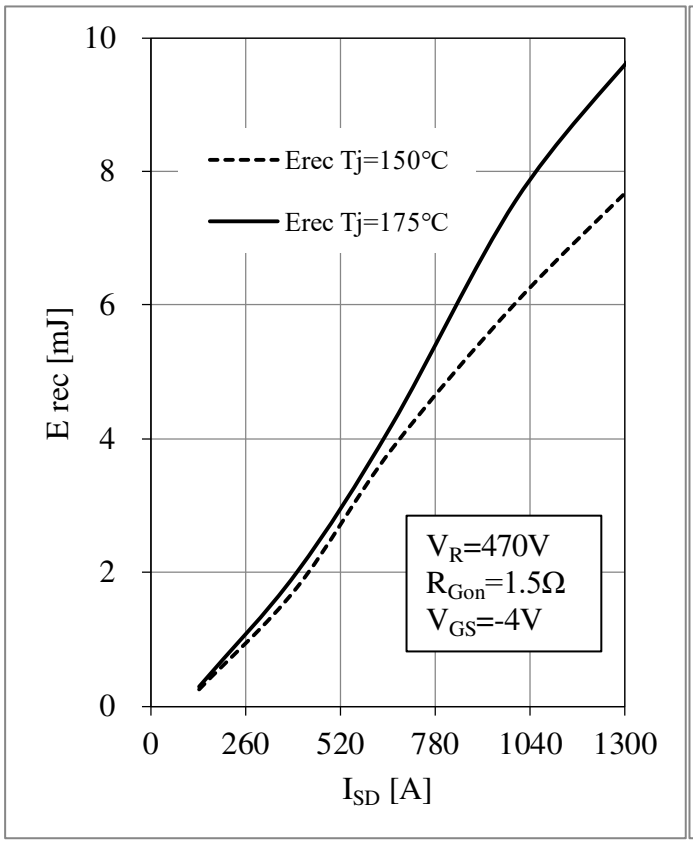


Fig 7. Body Diode Switching Loss vs. I_S

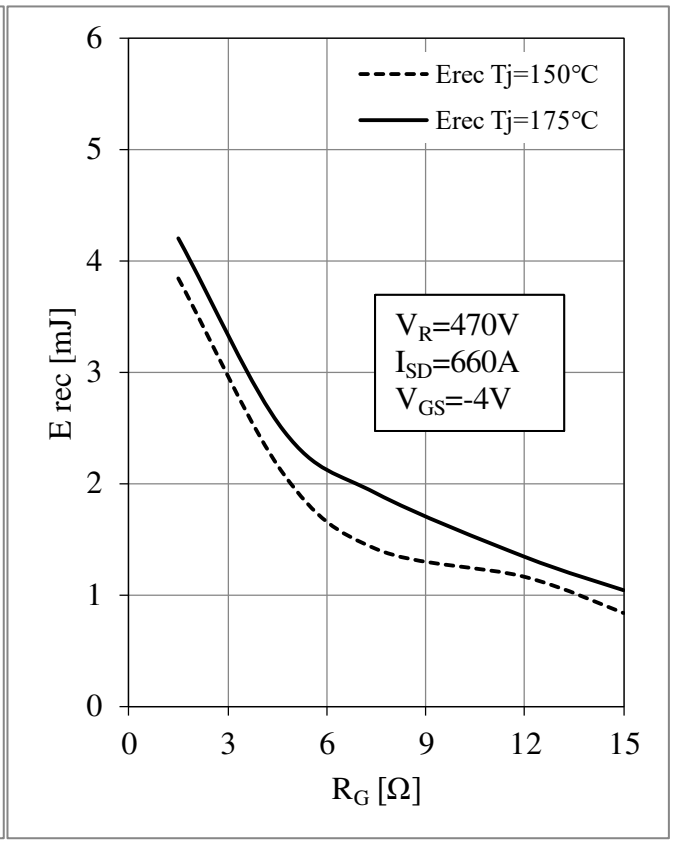


Fig 8. Body Diode Switching Loss vs. R_G

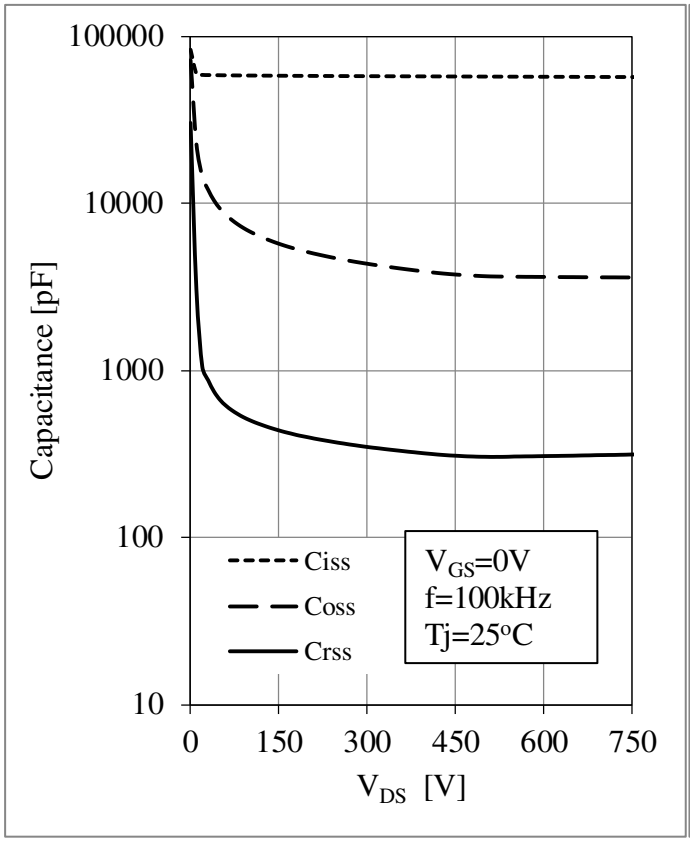


Fig 9. Capacitance vs.V_{DS}

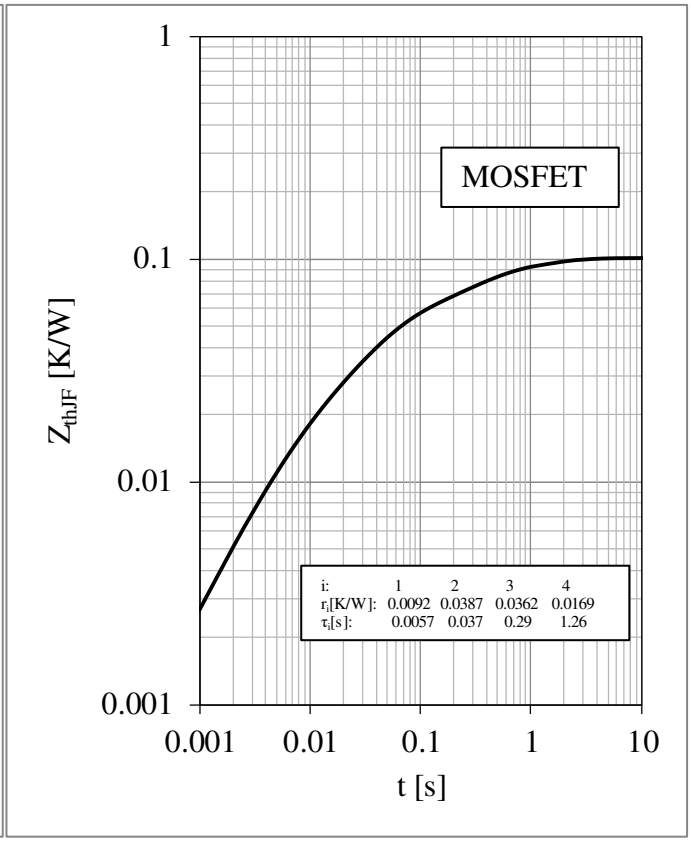


Fig 10. MOSFET Transient Thermal Impedance

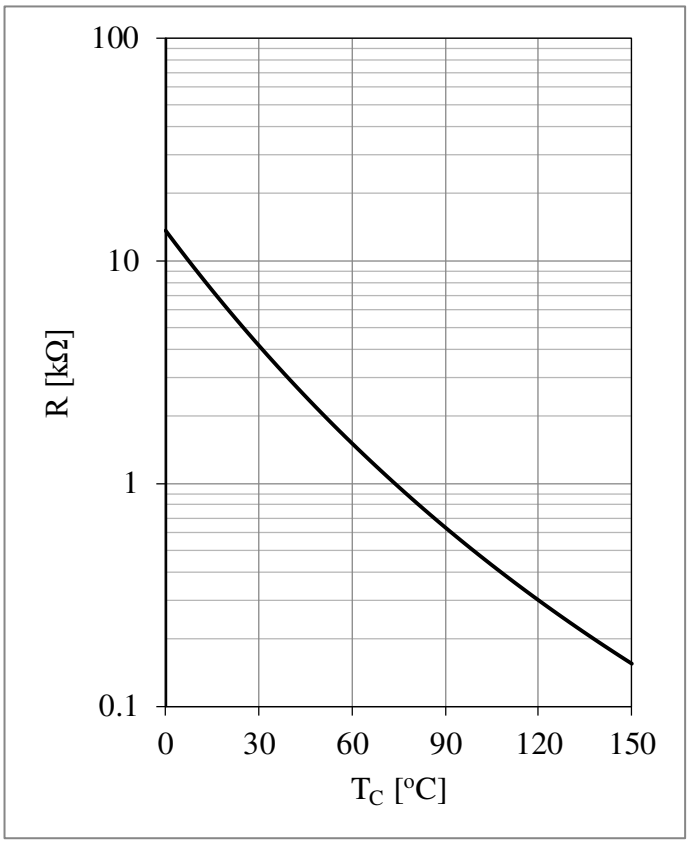
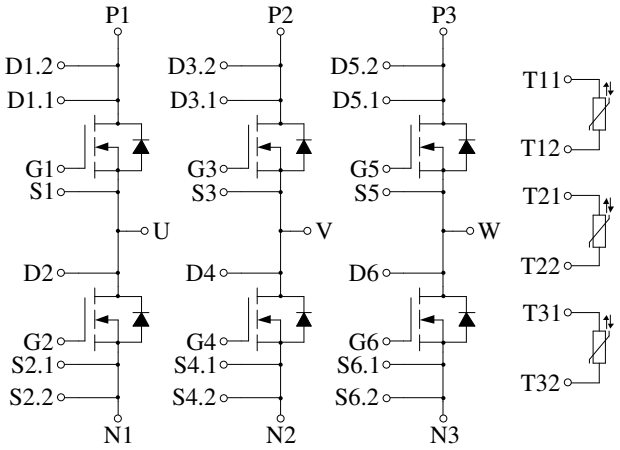


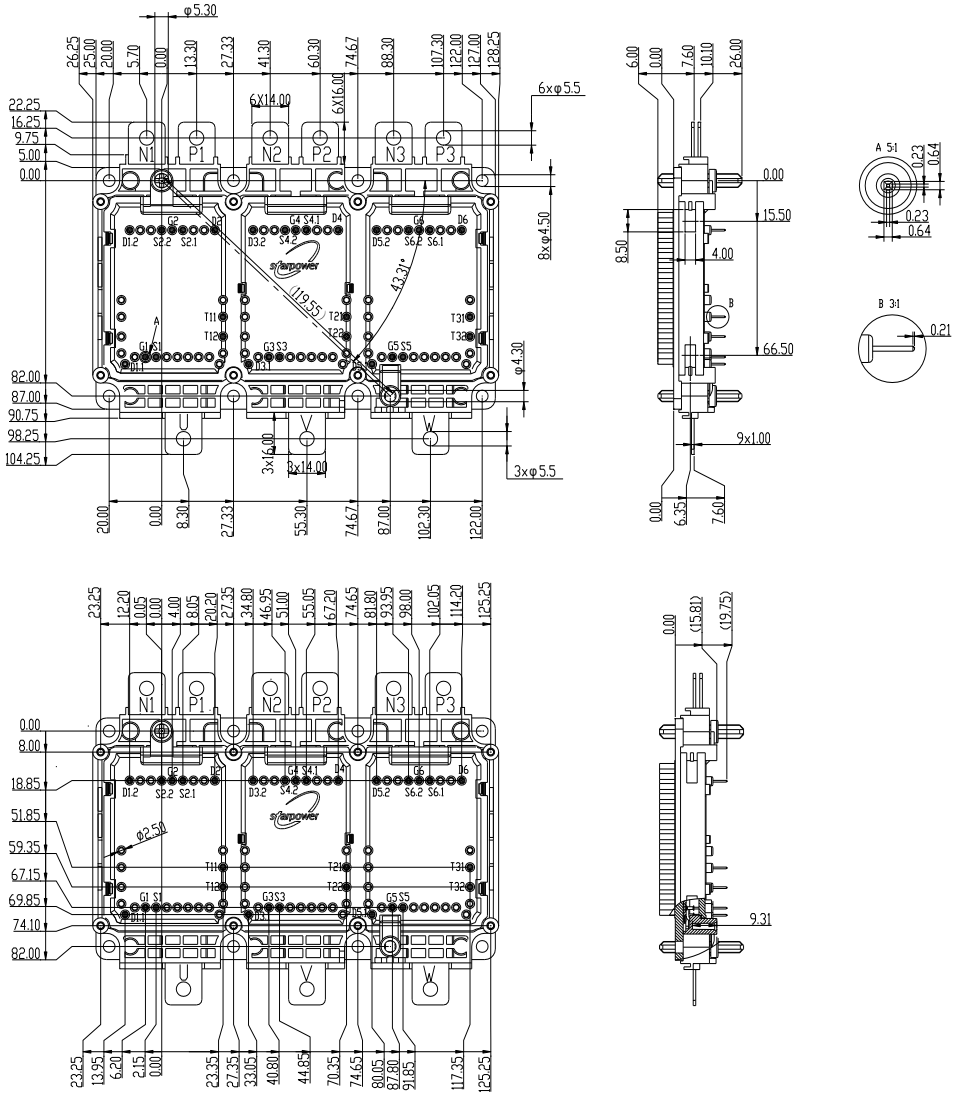
Fig 11. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



Terms and Conditions of Usage

The data contained in this product datasheet is exclusively intended for technically trained staff. you and your technical departments will have to evaluate the suitability of the product for the intended application and the completeness of the product data with respect to such application.

This product data sheet is describing the characteristics of this product for which a warranty is granted. Any such warranty is granted exclusively pursuant the terms and conditions of the supply agreement. There will be no guarantee of any kind for the product and its characteristics.

Should you require product information in excess of the data given in this product data sheet or which concerns the specific application of our product, please contact the sales office, which is responsible for you (see www.powersemi.cc), For those that are specifically interested we may provide application notes.

Due to technical requirements our product may contain dangerous substances. For information on the types in question please contact the sales office, which is responsible for you.

Should you intend to use the Product in aviation applications, in health or live endangering or life support applications, please notify.

If and to the extent necessary, please forward equivalent notices to your customers.
Changes of this product data sheet are reserved.