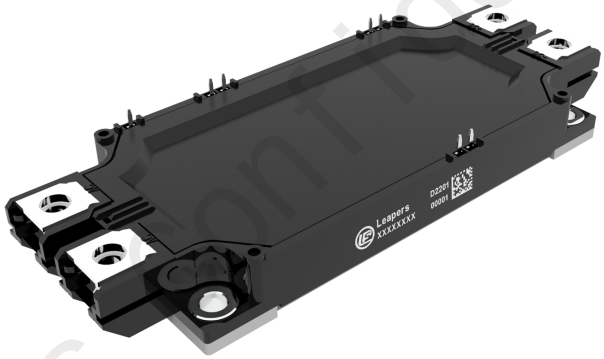
DFS900HF12I4C1

1200V/2.8mΩ Half Bridge SiC MOSFET Module

Description

The DFS900HF12I4C1 is a Half Bridge SiC MOSFET Power Module. It integrates high performance SiC MOSFET chips designed for the applications such as Motor drives and Renewable energy.



Features

- Blocking voltage 1200V
- $R_{DS(on)}$ =2.8mΩ, V_{GS} =+18V
- Low thermal resistance with Si_3N_4 AMB
- 175°C maximum junction temperature
- Thermistor inside
- Low Switching Losses
- RoHS compliant
- REACH compliant

Applications

- xEV Applications
- Motor Drives
- Vehicle Fast Chargers
- Smart-Grid/Grid-Tied Distributed Generation

Circuit diagram

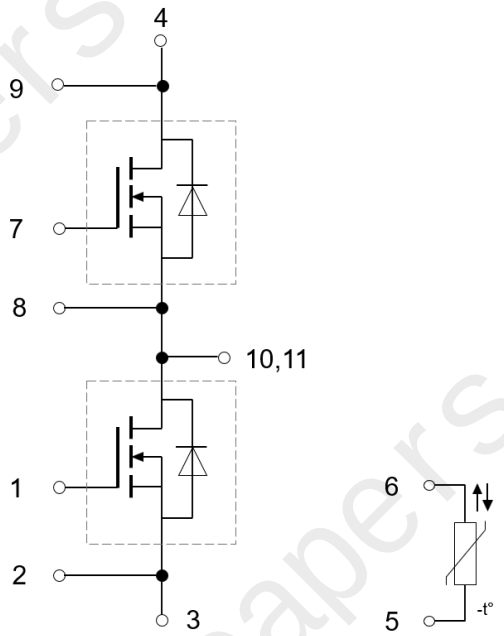


Figure 1. Out drawing & circuit diagram for DFS900HF12I4C1

Pin Configuration and Marking Information (unit :mm)

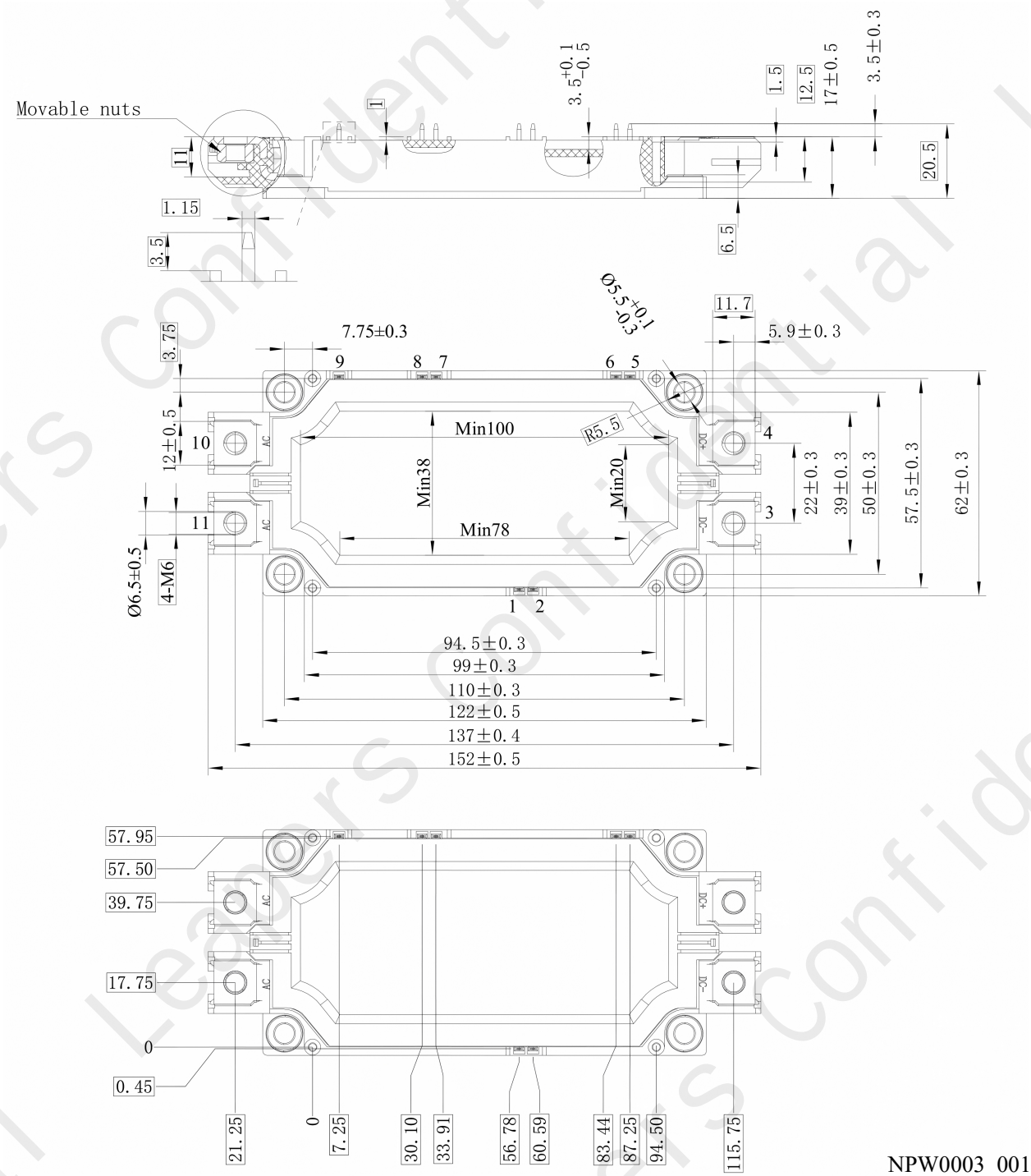


Figure 2. Pin configuration

Module

Parameter	Condition	Value	Unit
Isolation Voltage	RMS, f =50Hz, t =1min	3.4	kV
Material of module baseplate	-	Cu	-
Creepage distance	terminal to heatsink terminal to terminal	14.5 10	mm
Clearance	terminal to heatsink terminal to terminal	12.5 10	mm
CTI	-	>400	-
Module lead resistance, terminals–chip	T_C =25°C	0.5	mΩ
Mounting torque for module mounting	M5, M6	3 to 6	Nm
Weight	-	340	g

Maximum Ratings (T_j =25°C unless otherwise specified)

Symbol	Parameter	Condition	Ratings	Unit
V_{DSS}	Drain-Source Voltage	G-S Short	1200	V
V_{GSS}	Gate-Source Voltage	D-S Short, AC frequency ⩾1Hz, Note1, 2	-10 to 22	V
I_{DS}	DC Continuous Drain Current	T_C =25°C, V_{GS} =18V, Note 2,3	770	A
I_{DSM}	Pulse Forward Current	T_C =25°C, Pulse width =1ms, V_{GS} =20V	1540	A
P_{tot}	Total Power Dissipation	T_C =25°C, Note4	2777	W
T_{jmax}	Max Junction Temperature	-	175	°C
T_{stg}	Storage Temperature	-	-40 to 125	°C

Note1: Recommended Operating Value, +18V/-5V ,+18V/-4V, +15V/-4V

Note2: Pulse width limited by maximum junction temperature

Note3: Current limit calculated by $I_{D(max)}= \sqrt{(P_D/R_{DS(typ)}(T_{vj(max)}))}$

Note4: $P_D= (T_{vj}- T_c)/R_{th(jc,typ)}$

NTC characteristics

Symbol	Parameter	Condition	Value			Unit
			Min.	Typ.	Max.	
R_{25}	Resistance	T_C =25°C	-	5	-	kΩ
ΔR/R	Deviation of R_{100}	T_C =100°C, R_{100} =493Ω	-5	-	5	%
P_{25}	Power dissipation	T_C =25°C	-	-	20	mW
$B_{25/50}$	B-value	R2 =R25 exp [$B_{25/50}$(1/T2 - 1/(298,15 K))]	-	3375	-	K
$B_{25/80}$	B-value	R2 =R25 exp [$B_{25/80}$(1/T2 - 1/(298,15 K))]	-	3411	-	K
$B_{25/100}$	B-value	R2 =R25 exp [$B_{25/100}$(1/T2 - 1/(298,15 K))]	-	3433	-	K

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MOSFET Electrical characteristics (T_j=25°C unless otherwise specified)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS}=0V, I_D=900μA		1200	-	-	V
I_{DSS}	Zero gate voltage drain Current	V_{DS}=1200V, V_{GS}=0V	T_j=25°C	-	1.17	-	μA
			T_j=150°C		36.97	-	
$V_{GS(th)}$	Gate-source threshold Voltage	I_D=315mA, V_{DS}=V_{GS}	T_j=25°C	-	2.89	-	V
			T_j=150°C	-	2.1	-	
I_{GSS}	Gate-Source Leakage Current	V_{GS}=20V, V_{DS}=0V	T_j=25°C	-	2.35	-	nA
			T_j=150°C	-	145.7	-	
$R_{DS(on)}$	Static drain-source On-state resistance	I_D=900A, V_{GS}=+18V	T_j=25°C	-	2.8	-	mΩ
			T_j=175°C	-	4.67	-	
$V_{DS(on)}$	Static drain-source On-state Voltage	I_D=900A, V_{GS}=+18V	T_j=25°C	-	2.53	-	V
			T_j=175°C	-	4.2	-	
C_{iss}	Input Capacitance	V_D=25V, V_{GS}=0V, f=100kHz, V_{AC}=25mV		-	44.8	-	nF
C_{oss}	Output Capacitance			-	8.1	-	
C_{rss}	Reverse transfer Capacitance			-	0.39	-	
R_{Gint}	Internal gate resistor	-		-	0.7	-	Ω
Q_G	Total gate charge	V_{DD}=800V, I_D=900A, V_{GS}=+20/0V		-	1802	-	nC
$t_{d(on)}$	Turn-on delay time	V_{DD}=600V, I_D=900A, V_{GS}=+18/-4V, R_g=5.1Ω, Inductive load switching operation	T_j=25°C	-	0.223	-	μs
			T_j=150°C	-	0.193	-	
t_r	Rise time		T_j=25°C	-	0.162	-	μs
			T_j=150°C	-	0.132	-	
$t_{d(off)}$	Turn-off delay time		T_j=25°C	-	0.441	-	μs
			T_j=150°C	-	0.549	-	
t_f	Fall time		T_j=25°C	-	0.11	-	μs
			T_j=150°C	-	0.136	-	
E_{on}	Turn-on power dissipation		T_j=25°C	-	76.39	-	mJ
			T_j=150°C	-	62.52	-	
E_{off}	Turn-off power dissipation		T_j=25°C	-	70.99	-	mJ
			T_j=150°C	-	73.49	-	
$R_{th(j-c)}$	FET Thermal Resistance	Junction to Case		-	0.054	-	K/W
$R_{th(c-f)}$	Contact thermal Resistance	With thermal conductive grease, Note5		-	0.015	-	K/W

Note5: Assumes Thermal Conductivity of grease is 0.9W/m·K and thickness is 50μm.

Body Diode Electrical characteristics (T_j =25°C unless otherwise specified)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V_{SD}	Body Diode Forward Voltage	V_{GS} = - 4V, I_{SD} =900A	T_j =25°C	-	5.87	-	V
T_{rr}	Reverse recovery time	V_{DD} =600V I_D =900A V_{GS} =+18/-4V R_g =5.1Ω Inductive load switching operation	T_j =25°C	-	0.048	-	μs
			T_j =150°C	-	0.66	-	
Q_{rr}	Reverse recovery charge		T_j =25°C	-	3.64	-	μC
			T_j =150°C	-	8.35	-	
E_{rr}	Diode switching power dissipation		T_j =25°C	-	0.42	-	mJ
			T_j =150°C	-	1.11	-	

Test Conditions

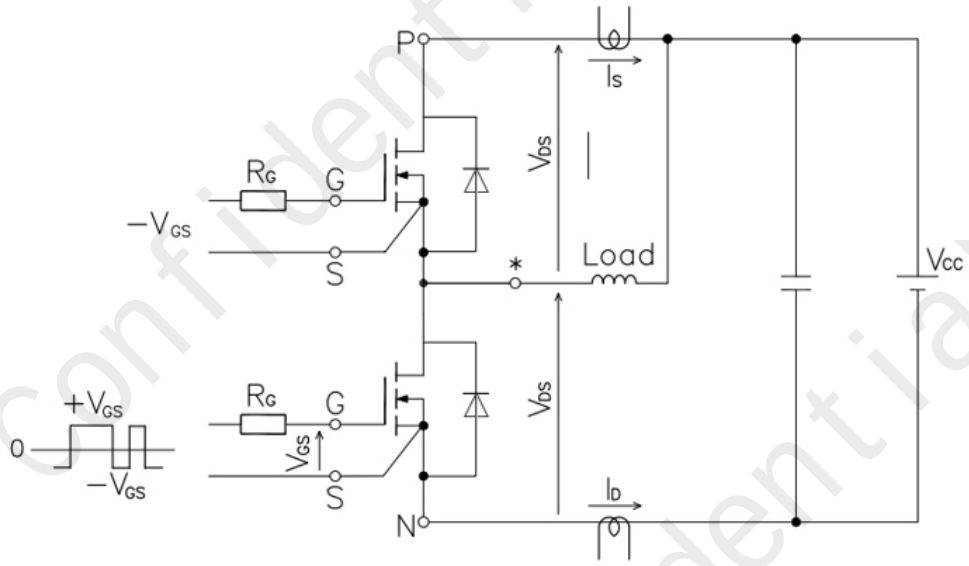


Figure 3. Switching time measure circuit

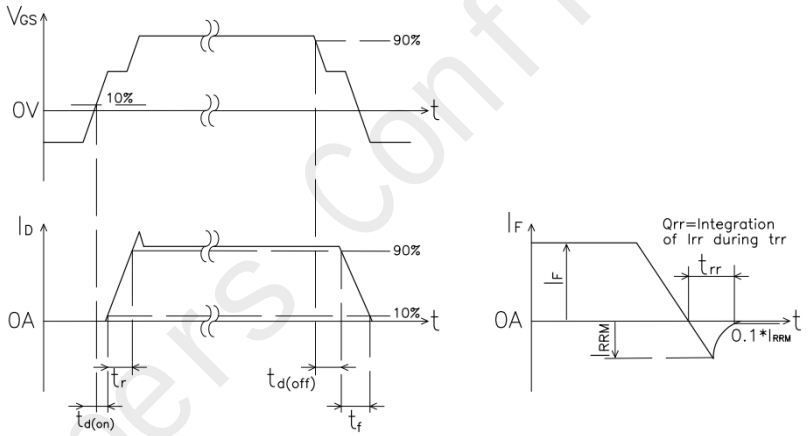


Figure 4. Switching time definition

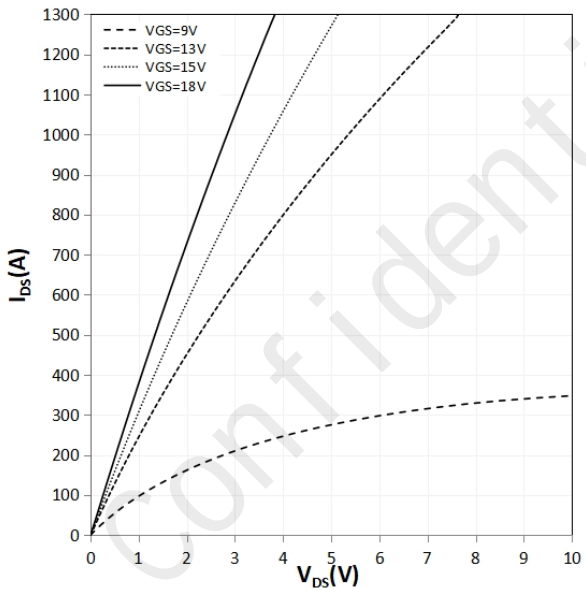


Figure 5. I_{DS} vs V_{DS}
T_j=25°C

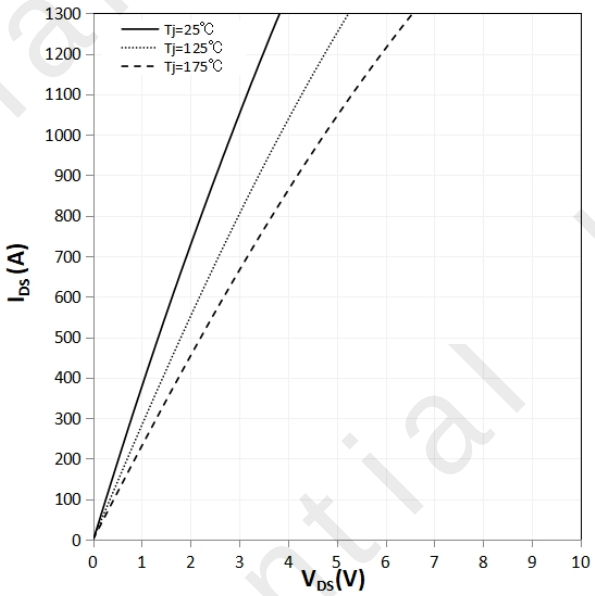


Figure 6. I_{DS} vs V_{DS}
V_{GS}=18V

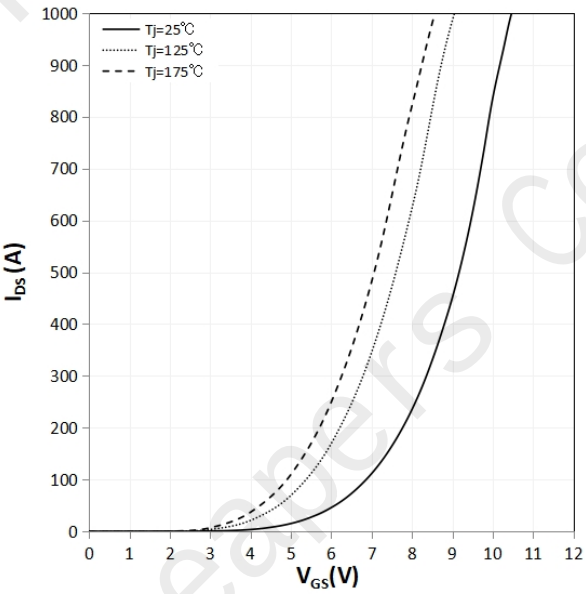


Figure 7. I_{DS} vs V_{GS}
V_{DS}=20V

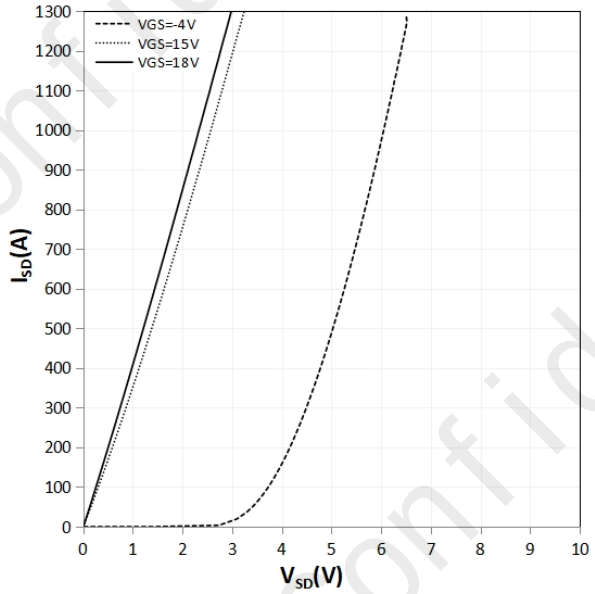


Figure 8. I_{SD} vs V_{SD}
T_j=25°C

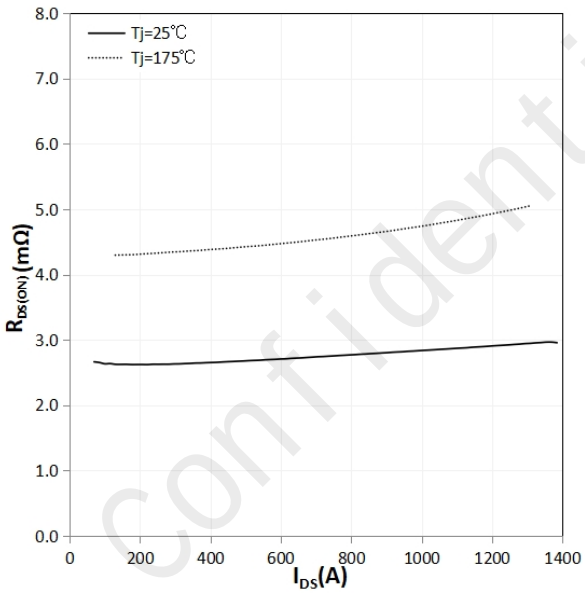


Figure 9. $R_{DS(ON)}$ vs I_{DS}
V_{GS} =+18V

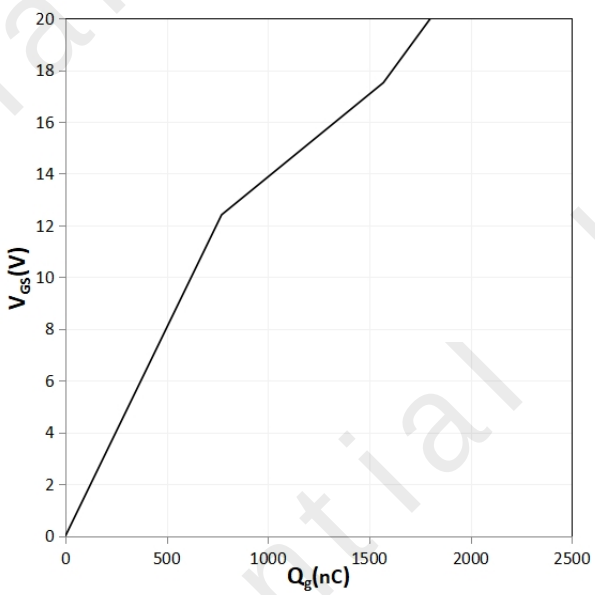


Figure 10. V_{GS} vs Q_g
T_j =25℃, V_{DS} =800V, I_D =900A

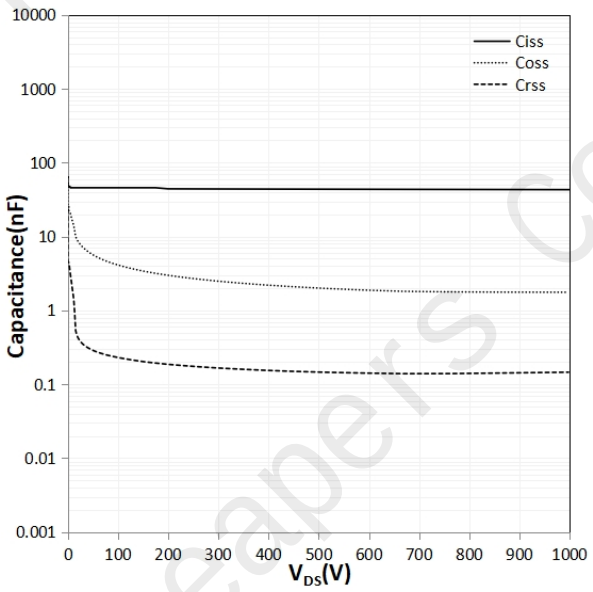


Figure 11. C_{iss},C_{oss},C_{rss} vs V_{DS}
f =100kHz, T_j =25℃

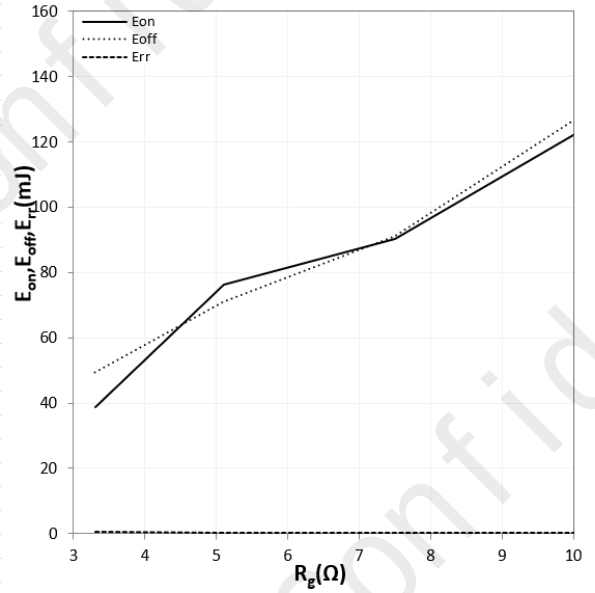


Figure 12. E_{on}, E_{off}, E_{rr} vs R_g
T_j =25°C, V_{DD} =600V, V_{GS} =+18V/-4V, I_D =900A
Inductive Load

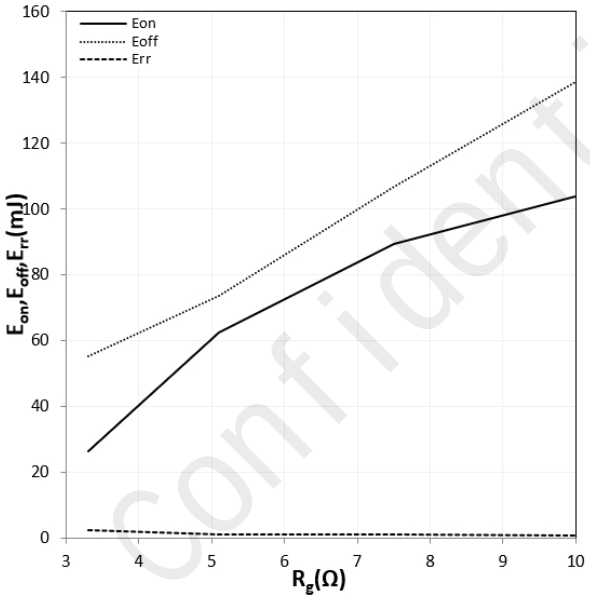


Figure 13. E_{on}, E_{off} , E_{rr} vs R_g
T_j =150°C, V_{DD}=600V, V_{GS} =+18V/-4V, I_D =900A
Inductive Load

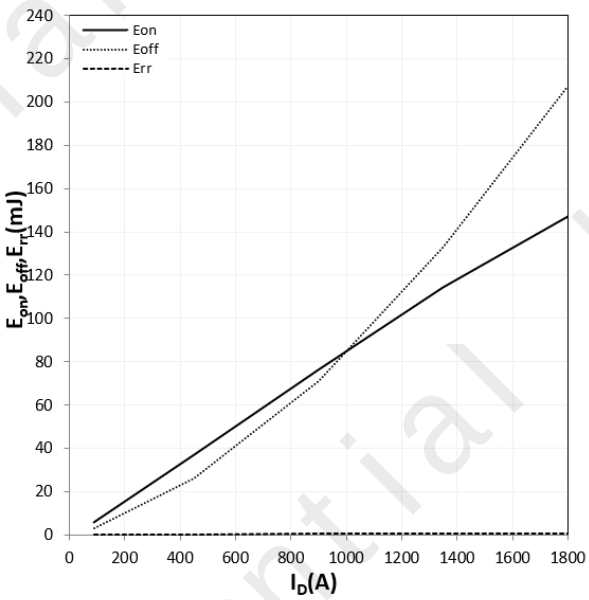


Figure 14. E_{on}, E_{off}, E_{rr} vs I_D
T_j =25°C, V_{DD} =600V, V_{GS} =+18V/-4V,
R_g =5.1Ω, Inductive Load

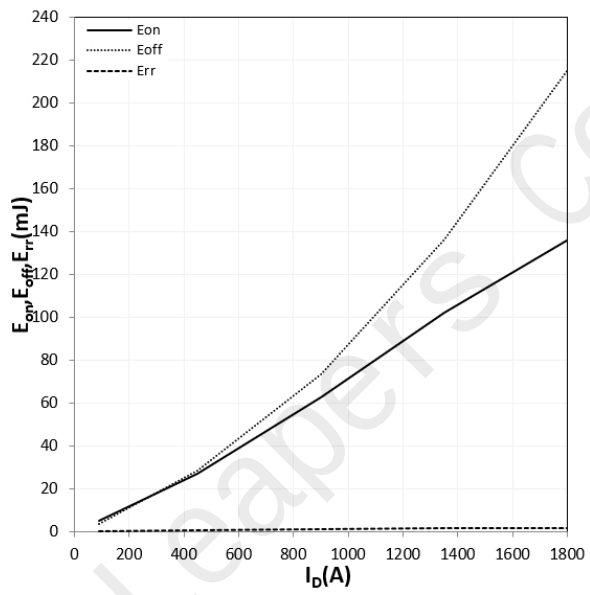


Figure 15. E_{on}, E_{off}, E_{rr} vs I_D
T_j =150°C, V_{DD} =600V, V_{GS} =+18V/-4V,
R_g =5.1Ω, Inductive Load

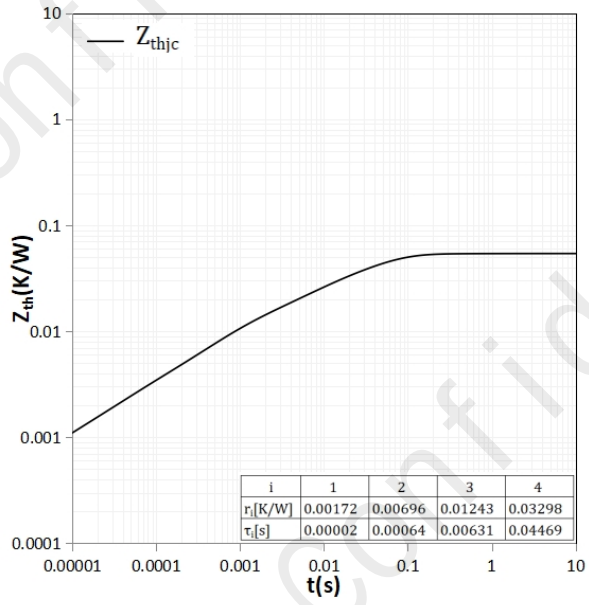


Figure 16. Transient themal impedance
Z_{thjc} for MOSFET

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