DFS400HF17I4I1

1700V/5.78mΩ Half Bridge SiC Module

Description

The DFS400HF17I4I1 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 1700V
- $R_{DS(on)}$ =5.78mΩ@V_{GS} =18V
- 175°C maximum junction temperature
- Thermistor inside
- Low Switching Losses
- RoHS compliant
- REACH compliant

RoHS Compliant

REACH Compliant

Applications

- High Power Switching Applications
- Motor Drives
- Solar inverter Systems
- Uninterrupted Power Supply

Circuit diagram

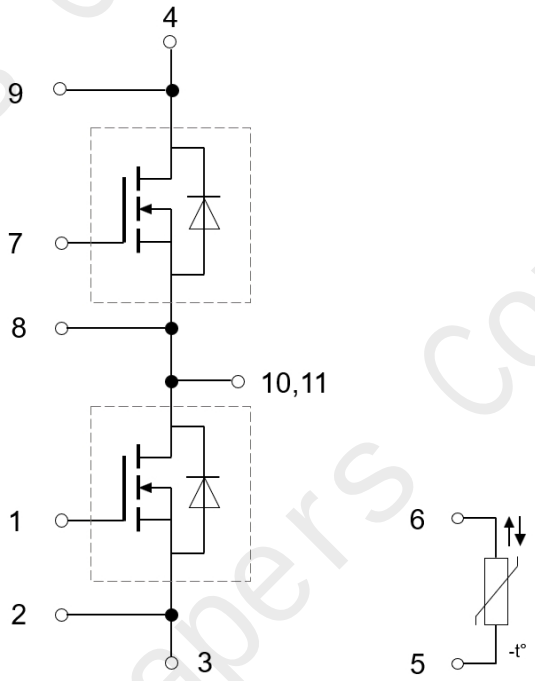


Figure 1. Out drawing & circuit diagram for DFS400HF17I4I1

Outline drawing (Unit : mm)

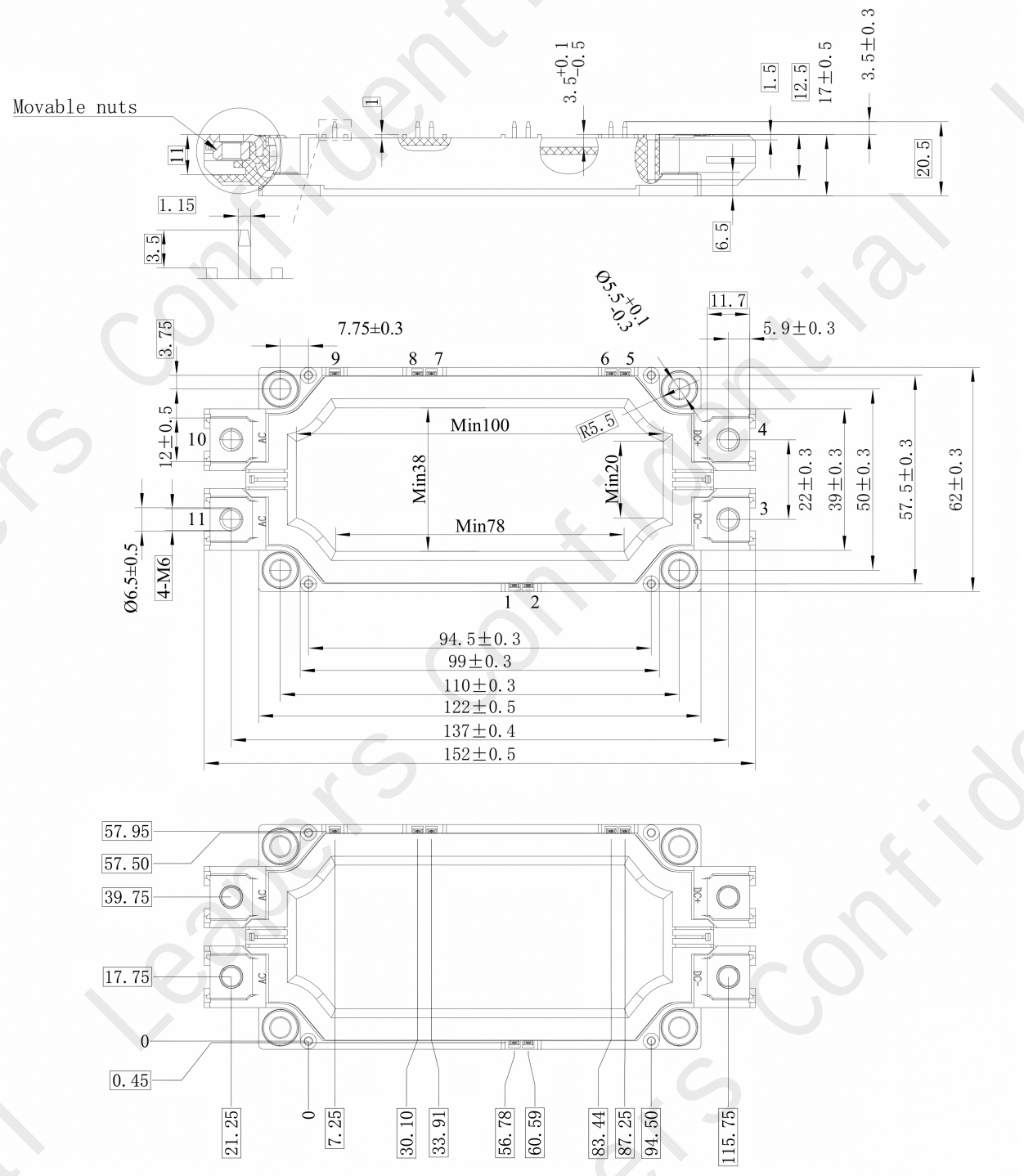


Figure 2. Pin configuration

Module

Parameter	Condition	Value	Unit
Isolation Voltage	RMS, f =50Hz, t =1min	3.4	kV
Material of module baseplate	-	AMB	-
Creepage distance	terminal to heatsink terminal to terminal	14.5 10	mm
Clearance	terminal to heatsink terminal to terminal	12.5 10	mm
Stray inductance	-	20	nH
CTI	-	600	-
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		1700	V
V_{GSS}	Gate-Source Voltage	D-S Short, Note1		-10/23	V
V_{GSOP}				-4/18	
I_{DS}	DC Continuous Drain Current	V_{GS} =18V, Note2	T_C =25°C	335	A
			T_C =100°C	237	
I_{DSM}	Pulse Forward Current	Pulse width =1ms, Note3		670	A
P_{tot}	Total Power Dissipation	T_C =25°C, Note4		1476	W
T_{jmax}	Max Junction Temperature	Note5		175	°C
T_{jop}	Operating junction temperature	-		-40 to 175	°C
T_{stg}	Storage Temperature	-		-40 to 125	°C

Note1: Pulse width limited by maximum junction temperature

Note2: Current limit calculated by $I_{D(max)}= \sqrt{(P_D/R_{DS(typ)}(T_{vj(max)}))}$

Note3：Under Pw≤10us, Duty cycle≤1%，$I_{DS(pulse)}$=670A

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

Note5: T_{jmax}=175°C verified by chip

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	-	-	60	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))]	-	3425	-	K
$B_{25/100}$	B-value	R2 =R25 exp [$B_{25/100}$(1/T2 - 1/(298,15 K))]	-	3443	-	K

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

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max.	
I_{DSS}	Zero gate voltage drain Current	V_{DS}=1700V, V_{GS}=0V		-	8	-	μA
$V_{GS(th)}$	Gate-source threshold Voltage	I_D=80mA, V_{DS}=V_{GS}	T_j=25°C	-	3.19	-	V
I_{GSS+}	Gate-Source Leakage Current	V_{GS}=20V, V_{DS}=0V		-	-	400	nA
I_{GSS-}		V_{GS}=-5V, V_{DS}=0V		-400	-	-	
$R_{DS(on)}$	Static drain-source On-state resistance	I_D=400A, V_{GS}=+18V	T_j=25°C	-	5.78	-	mΩ
			T_j=175°C	-	13.12	-	
		I_D=400A, V_{GS}=+15V	T_j=25°C	-	7.43	-	
			T_j=175°C	-	13.92	-	
C_{iss}	Input Capacitance	V_D=25V, V_{GS}=0V, f=100kHz, V_{AC}=25mV		-	25.08	-	nF
C_{oss}	Output Capacitance			-	1.66	-	
C_{rss}	Reverse transfer Capacitance			-	0.11	-	
R_{Gint}	Internal gate resistor	-		-	1.57	-	Ω
Q_G	Total gate charge	V_{DD}=900V, I_D=400A, V_{GS}=+18/-4V		-	1091	-	nC
Q_{GS}	Gate-source charge			-	367	-	
Q_{GD}	Gate-drain charge			-	355	-	
$t_{d(on)}$	Turn-on delay time	V_{DD}=800V, I_D=400A, V_{GS}=+18/-4V, R_G=12Ω, Inductive load switching operation	T_j=25°C	-	221.2	-	ns
			T_j=150°C	-	182	-	
t_r	Rise time		T_j=25°C	-	145.6	-	
			T_j=150°C	-	131.6	-	
$t_{d(off)}$	Turn-off delay time		T_j=25°C	-	600	-	
			T_j=150°C	-	676.8	-	
t_f	Fall time		T_j=25°C	-	88.8	-	
			T_j=150°C	-	127.2	-	
E_{on}	Turn-on power dissipation		T_j=25°C	-	49.5	-	mJ
			T_j=150°C	-	47.19	-	
E_{off}	Turn-off power dissipation		T_j=25°C	-	34.78	-	
			T_j=150°C	-	37.54	-	
$R_{th(j-c)}$	Thermal Resistance	Junction to case		-	0.1016	-	K/W

Note1: Assumes Thermal Conductivity of grease is 2.8 W/m・K and thickness is 50um.

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} =400A	T_j =25°C	-	6.68	-	V
			T_j =175°C	-	5.97	-	
T_{rr}	Reverse recovery time	V_{DD} =800V I_{SD} =400A V_{GS} =+18/-4V R_G =12Ω Inductive load switching operation	T_j =25°C	-	286.4	-	ns
			T_j =175°C	-	162	-	
E_{rr}	Diode switching power dissipation		T_j =25°C	-	1.7	-	mJ
			T_j =175°C	-	3.2	-	
Q_{rr}	Reverse recovery charge		T_j =25°C	-	7.9	-	μC
			T_j =175°C	-	11.8	-	
I_{rrm}	Peak reverse recovery current		T_j =25°C	-	64.8	-	A
			T_j =175°C	-	142	-	

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Test Conditions

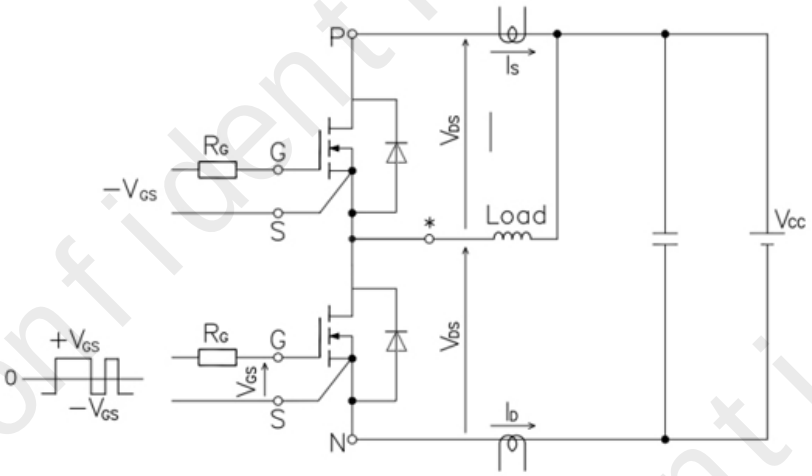


Figure 3. Switching time measure circuit

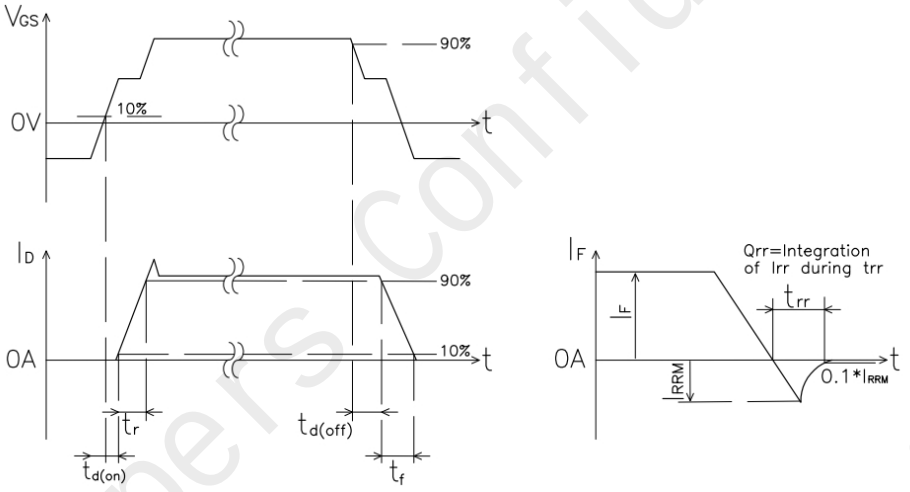


Figure 4. Switching time definition

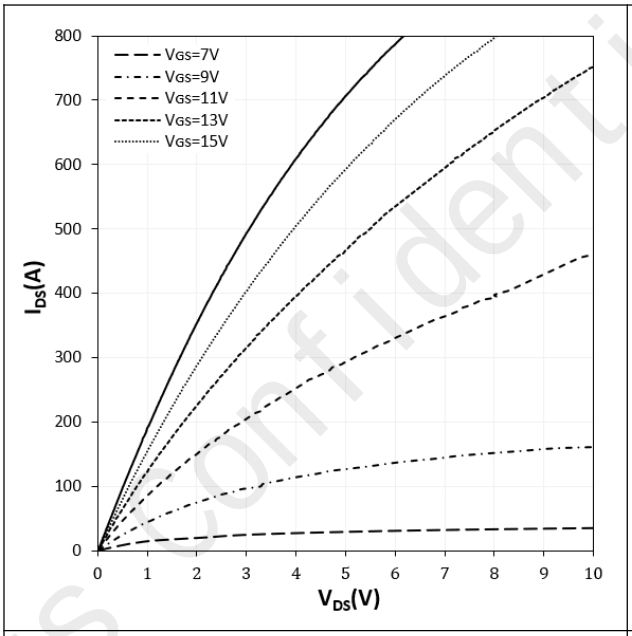


Figure 5. I_{DS} vs V_{DS}
T_j =25°C, Typical Output characteristic

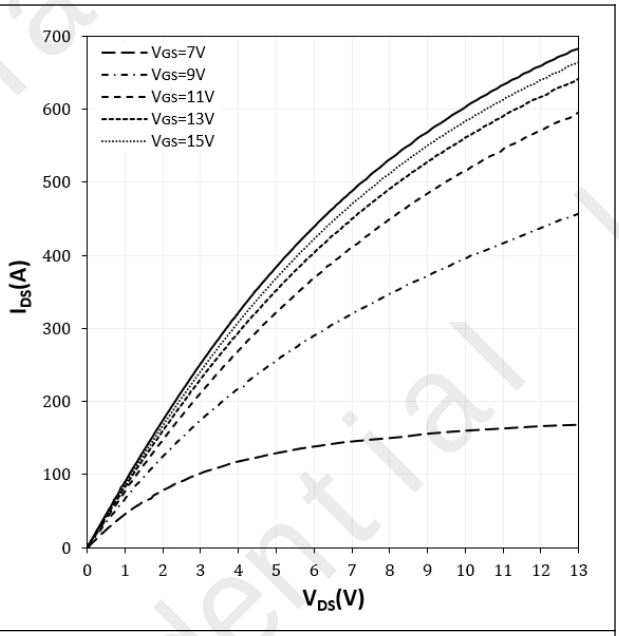


Figure 6. I_{DS} vs V_{DS}
T_j =175°C, Typical Output characteristic

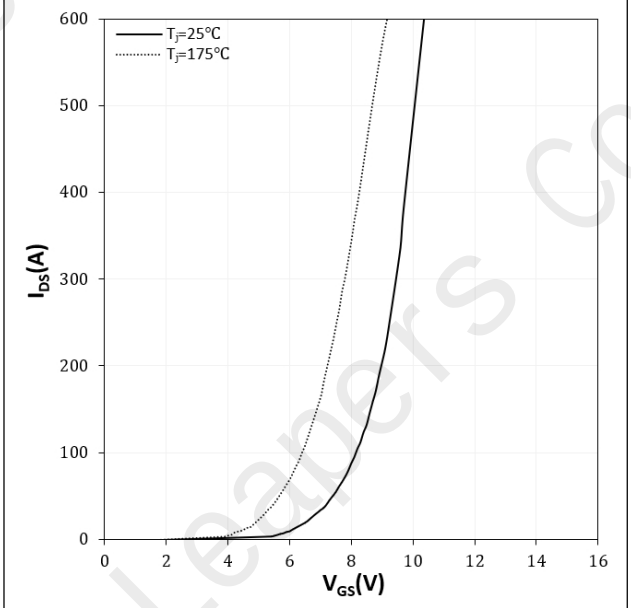


Figure 7. I_{DS} vs V_{GS}
V_{DS} =20V,Typical Output characteristic

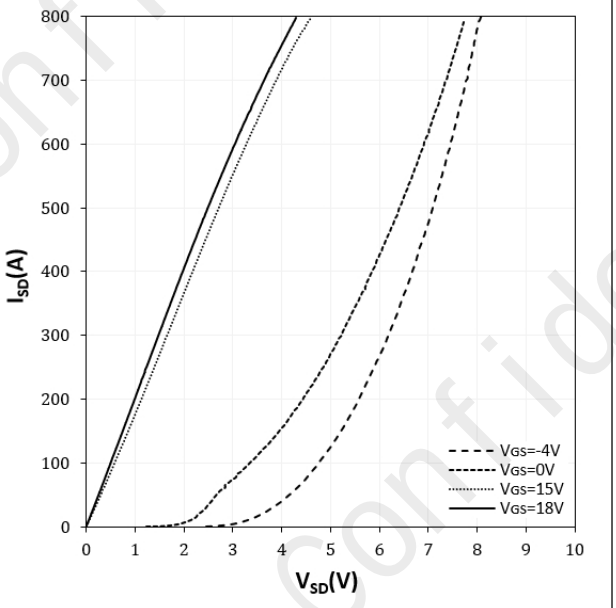


Figure 8. I_{SD} vs V_{SD}
T_j =25°C, Typical Output characteristic

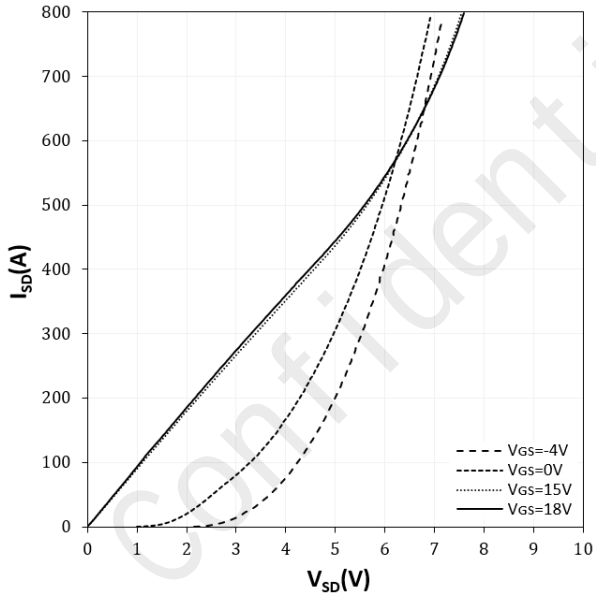


Figure 9. I_{SD} vs V_{SD}
T_j =175°C, Typical Output characteristic

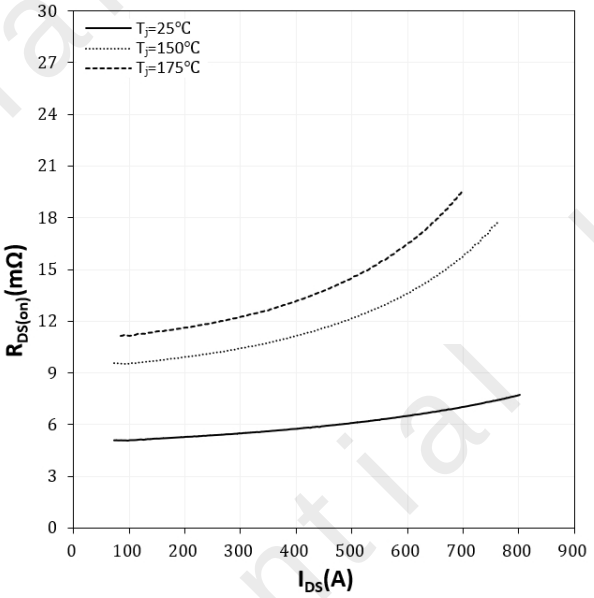


Figure 10. $R_{DS(ON)}$ vs I_{DS}
V_{GS} =+18V

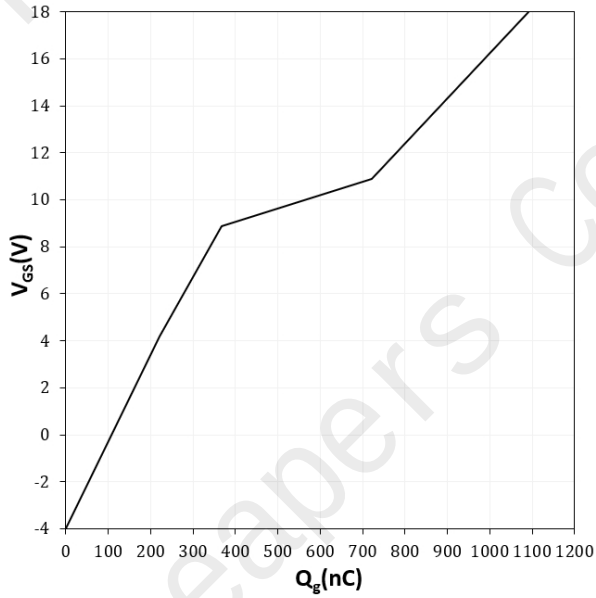


Figure 11. V_{GS} vs Q_g
V_{DS} =900V, I_D =400A , T_j =25°C

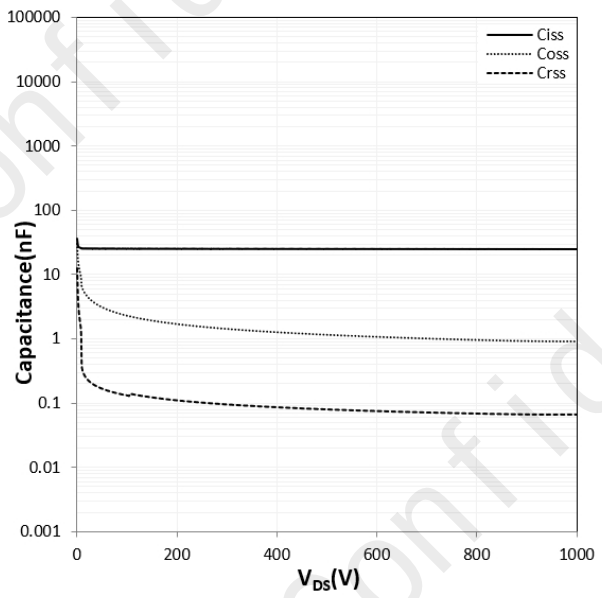


Figure 12. C_{iss}, C_{oss}, C_{rss} vs V_{DS}
f =100kHz, T_j =25°C

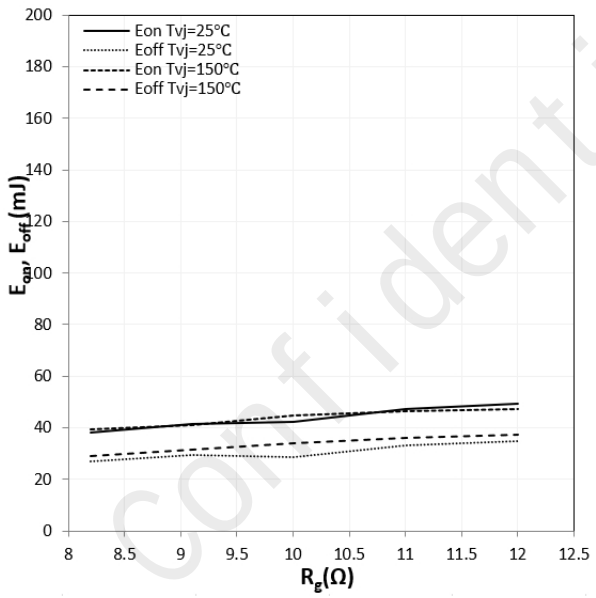


Figure 13. E_{on}, E_{off} vs R_g
V_{DS} =800V, I_D =400A, V_{GS} = -4V/+18V
Inductive Load

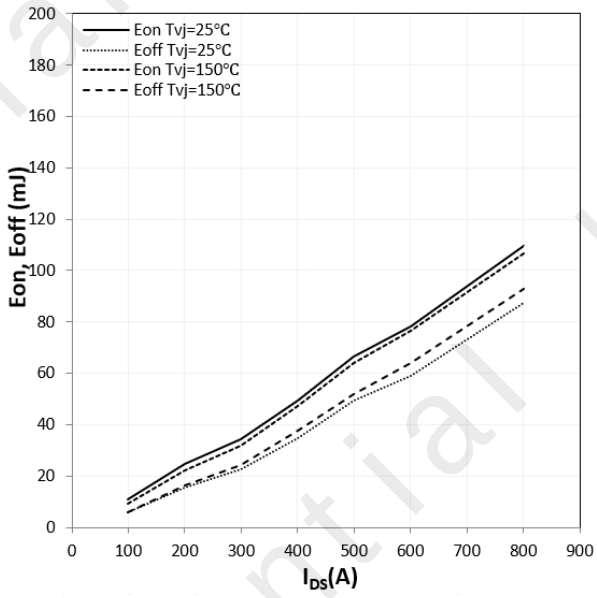


Figure 14. E_{on}, E_{off} vs I_{DS}
V_{DS} =800V, R_g=12Ω,V_{GS} = -4V/+18V
Inductive Load

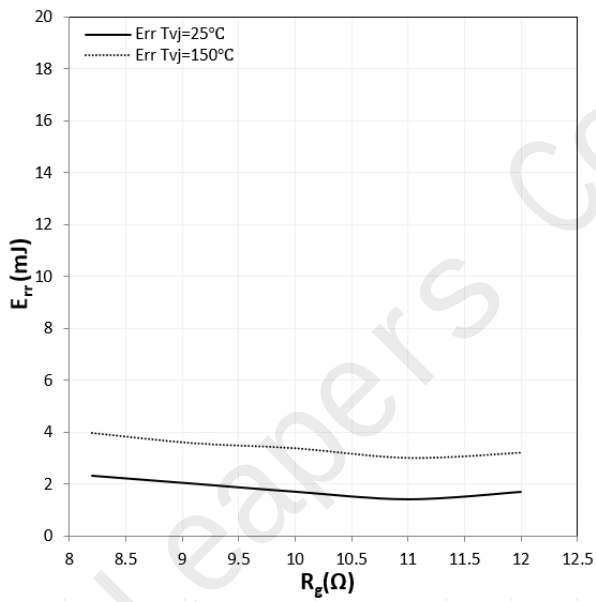


Figure 15. E_{rr} vs R_g
V_{DS} =800V, I_D =400A, V_{GS} = -4V/+18V
Inductive Load

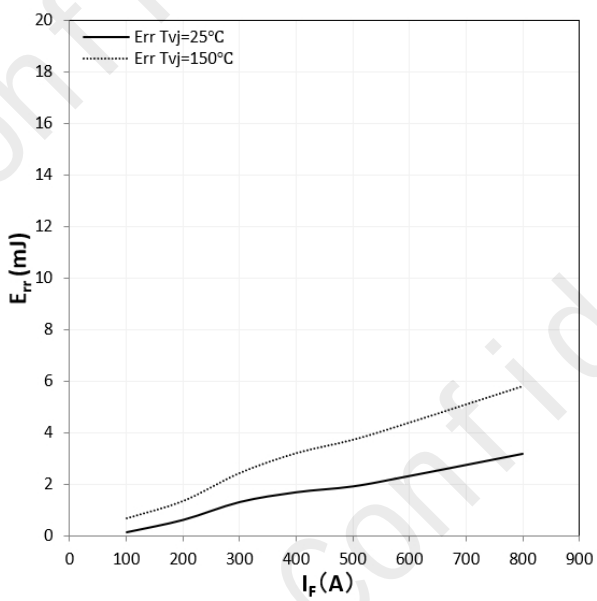


Figure 16. E_{rr} vs I_F
V_{DS} =800V, R_g = 12Ω, V_{GS} = -4V/+18V
Inductive Load

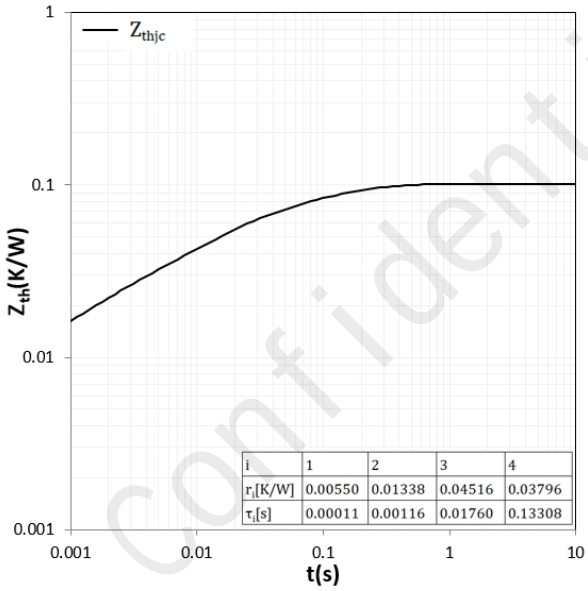


Figure 17. Transient themal impedance Z_{thjc} for MOSFET

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