DFS800HF17I4I1

1700V/800A Half Bridge SiC Module

Description

The DFS800HF17I4I1 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
- $R_{DS(on)}$ =2.5mΩ@V_{GS} =18V
- 175°C maximum junction temperature
- Thermistor inside
- Low Switching Losses

Applications

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

Circuit diagram

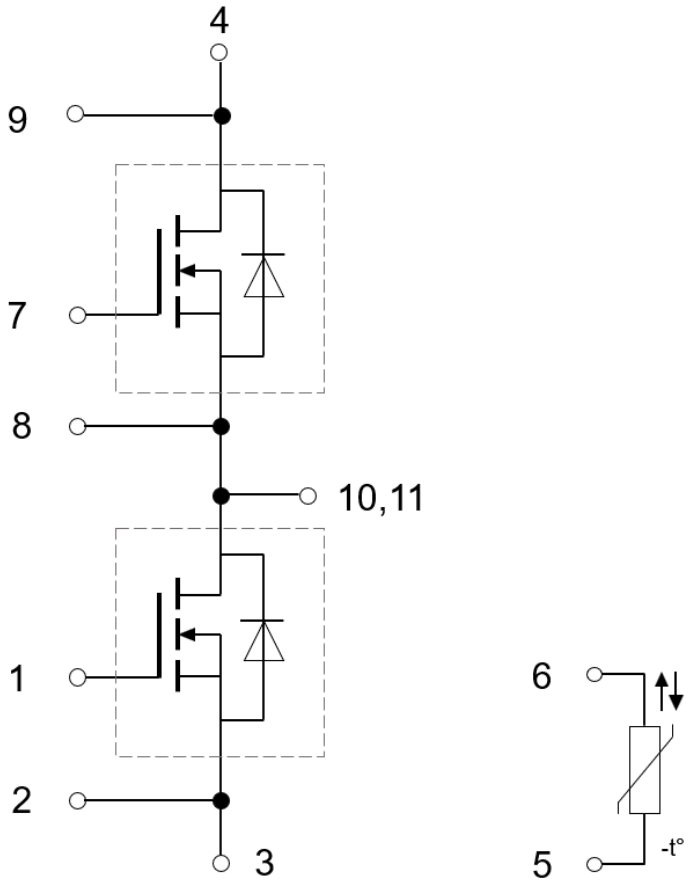


Figure 1. Out drawing & circuit diagram for DFS800HF17I4I1

Outline drawing (Unit : mm)

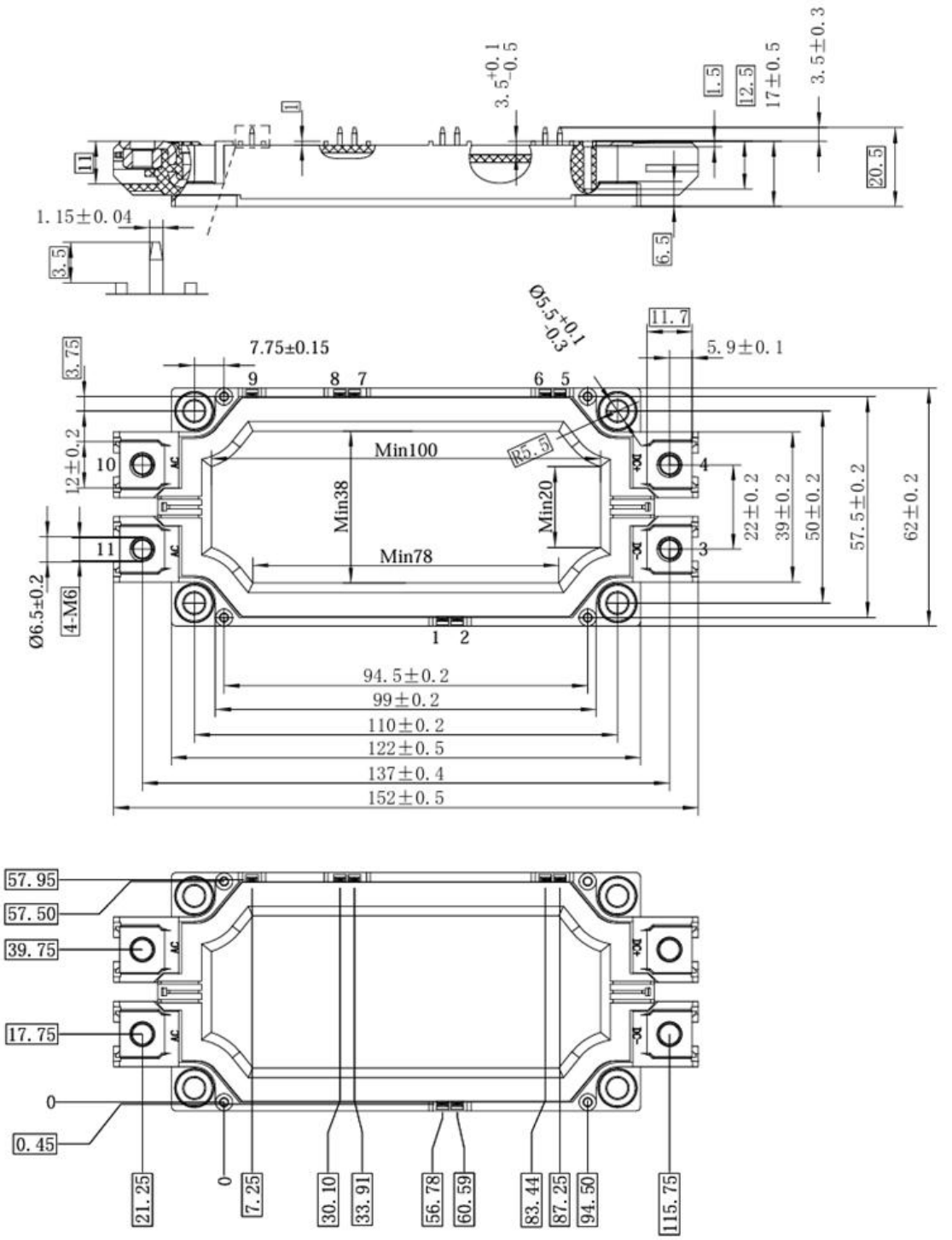


Figure 2. Pin configuration

Module

Parameter	Condition	Value	Unit
Isolation Voltage	RMS, f =50Hz, t =1min	3.4	kV
Material of module baseplate	-	Cu	-
Creepage distance	terminal to heatsink terminal to terminal	14.5 13	mm
Clearance	terminal to heatsink terminal to terminal	12.5 10	mm
Stray inductance	-	20	nH
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		1700	V
V_{GSS}	Gate-Source Voltage	D-S Short, AC frequency ⩾1Hz, Note1		-10/23	V
V_{GSOP}				-4/18	
I_{DS}	DC Continuous Drain Current	V_{GS} =18V	T_C =25°C	752	A
			T_C =100°C	544	
I_{SD}	Source (Body diode) Current	with ON signal	T_C =25°C	752	A
			T_C =100°C	544	
I_{DSM}	Pulse Forward Current	Pulse width =1ms, Note1		1080	A
P_{tot}	Total Power Dissipation	T_C =25°C		3400	W
T_{jmax}	Max Junction Temperature	-		175	°C
T_{jop}	Operating junction temperature	-		-55 to 175	°C
T_{stg}	Storage Temperature	-		-55 to 150	°C

Note1: Pulse width limited by maximum junction temperature

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

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

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max.	
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS}=0V, I_D=800μA		1700	-	-	V
I_{DSS}	Zero gate voltage drain Current	V_{DS}=1700V, V_{GS}=0V		-	16	80	μA
$V_{GS(th)}$	Gate-source threshold Voltage	I_D=160mA	T_j=25°C	1.8	3.0	5.0	V
		V_{DS}=V_{GS}	T_j=175°C	-	2.2	-	
I_{GSS+}	Gate-Source Leakage Current	V_{GS}=20V, V_{DS}=0V		-	-	800	nA
I_{GSS-}		V_{GS}=-5V, V_{DS}=0V		-800	-	-	
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	I_D=240A	T_j=25°C	-	2.5	3.25	mΩ
		V_{GS}=+18V	T_j=175°C	-	5.5	-	
C_{iss}	Input Capacitance	V_D=1200V, V_{GS}=0V f=100kHz, V_{AC}=25mV		-	51.76	-	nF
C_{oss}	Output Capacitance			-	1.456	-	
C_{rss}	Reverse transfer Capacitance			-	0.12	-	
R_{Gint}	Internal gate resistor	-		-	0.325	-	Ω
Q_G	Total gate charge	V_{DD}=1200V, I_D=240A, V_{GS}=+18/-4V		-	1872	-	nC
Q_{GS}	Gate-source charge			-	560	-	
Q_{GD}	Gate-drain charge			-	600	-	
$t_{d(on)}$	Turn-on delay time	V_{DD}=900V I_D=800A V_{GS}=+18/-3V R_G=5Ω Inductive load switching operation	T_j=25°C	-	216	-	ns
			T_j=175°C	-	161	-	
t_r	Rise time		T_j=25°C	-	260	-	
			T_j=175°C	-	216	-	
$t_{d(off)}$	Turn-off delay time		T_j=25°C	-	385	-	
			T_j=175°C	-	493	-	
t_f	Fall time		T_j=25°C	-	117	-	
			T_j=175°C	-	108	-	
E_{on}	Turn-on power dissipation		T_j=25°C	-	82.4	-	mJ
			T_j=175°C	-	83	-	
E_{off}	Turn-off power dissipation		T_j=25°C	-	86.6	-	
			T_j=175°C	-	93.3	-	
$R_{th(j-c)}$	Thermal Resistance	Junction to case		-	0.044	-	K/W

Note1: Assumes Thermal Conductivity of grease is 0.9W/m・K and thickness is 50um.

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

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max.	
V_{SD}	Body Diode Forward Voltage	V_{GS} = -4V I_{SD} =240A	T_j=25°C	-	3.5	-	V
			T_j=175°C	-	3.3	-	
T_{rr}	Reverse recovery time	V_{DD}=900V I_{SD}=800A V_{GS}=+18/-3V R_G=5Ω Inductive load switching operation	T_j=25°C	-	77.4	-	ns
			T_j=175°C	-	113	-	
E_{rr}	Diode switching power dissipation		T_j=25°C	-	3.55	-	mJ
			T_j=175°C	-	16	-	
Q_{rr}	Reverse recovery charge		T_j=25°C	-	9.49	-	uC
			T_j=175°C	-	32.9	-	
I_{rrm}	Reverse recovery current		T_j=25°C	-	206	-	A
			T_j=175°C	-	476	-	

Test Conditions

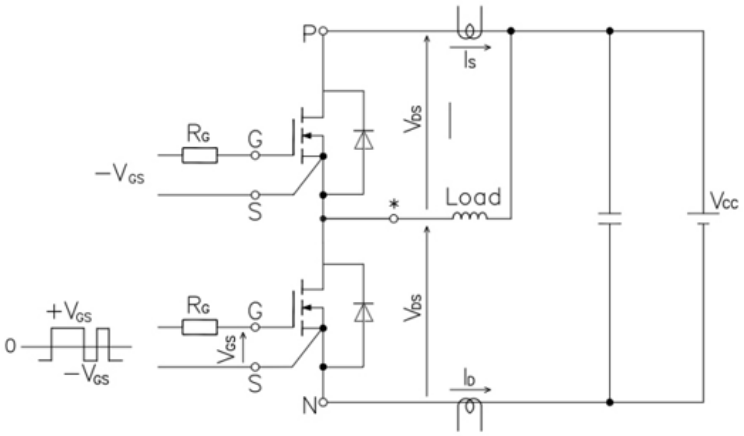


Figure 3. Switching time measure circuit

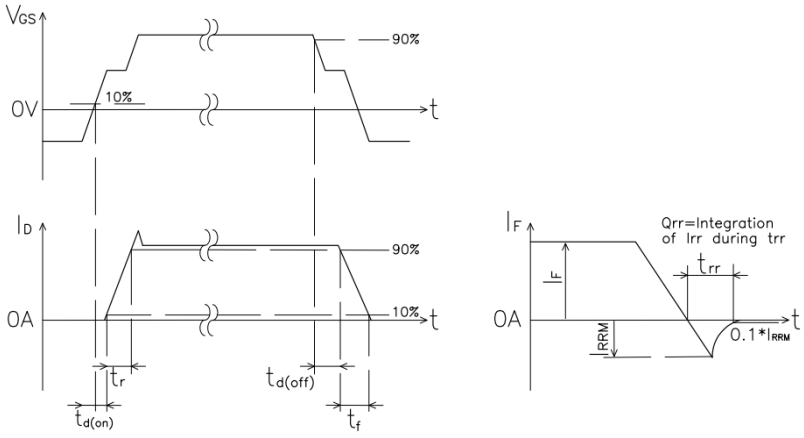


Figure 4. Switching time definition

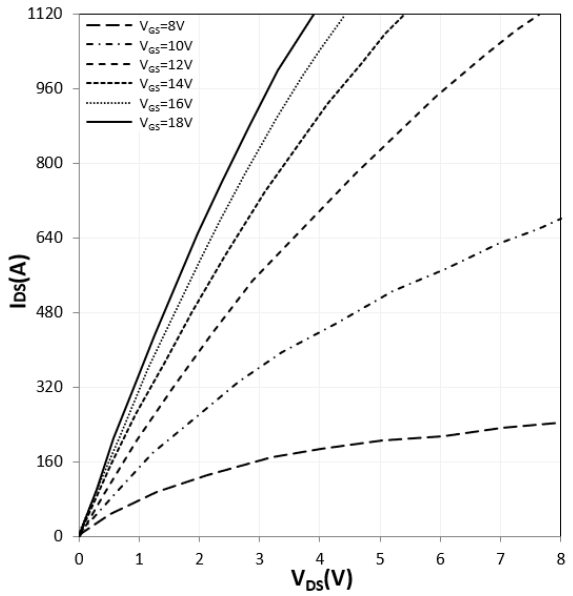


Figure 5. I_{DS} vs V_{DS}
T_j=25°C

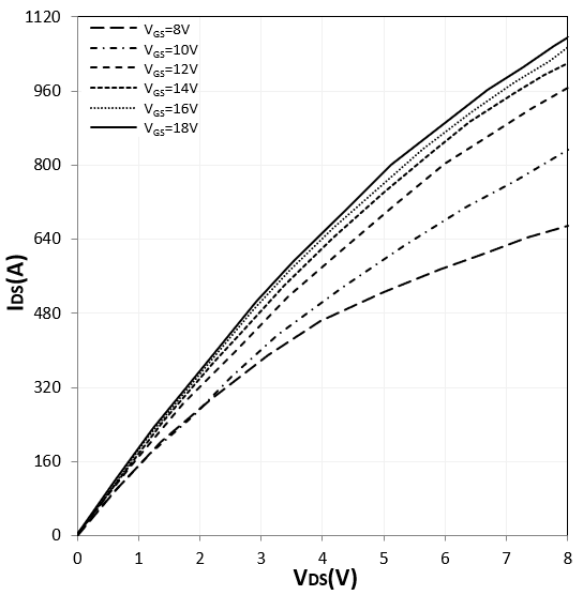


Figure 6. I_{DS} vs V_{DS}
T_j=175°C

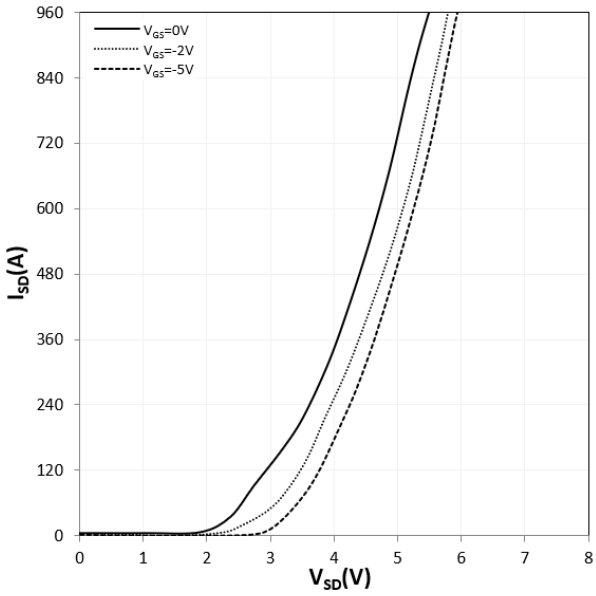


Figure 7. I_{SD} vs V_{SD}
T_j=25°C, V_{GS}=0V

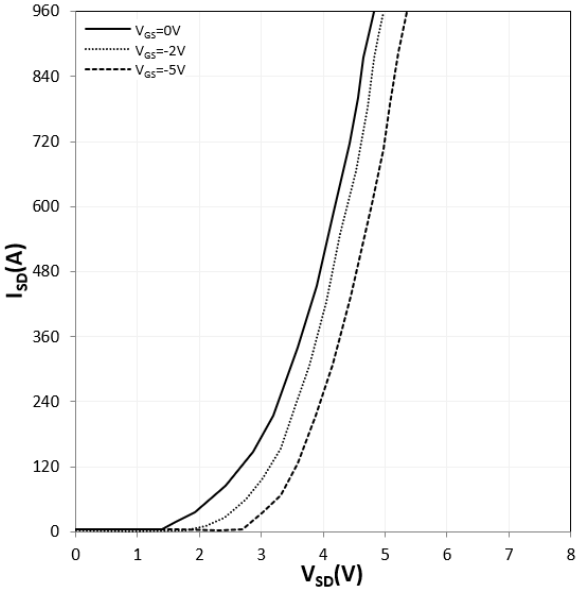


Figure 8. I_{SD} vs V_{SD}
T_j=175°C, V_{GS}=0V

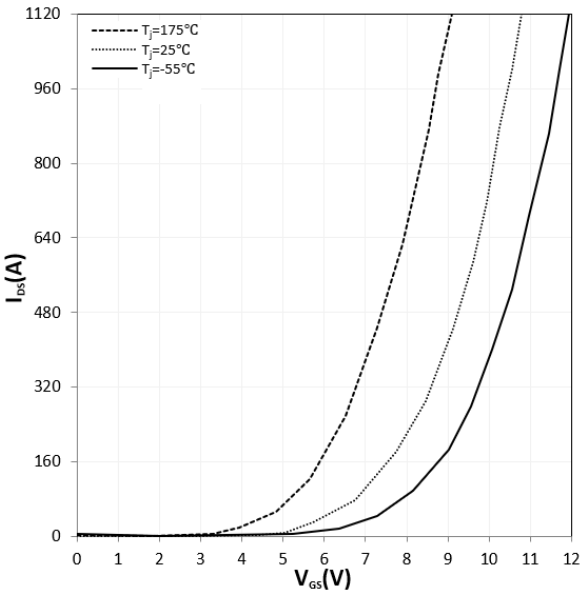


Figure 9. I_{DS} vs V_{GS}
T_j =25°C, V_{DS} =20V

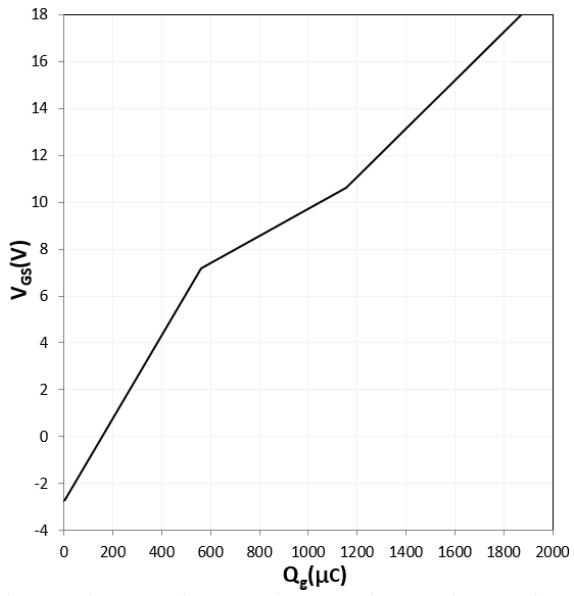


Figure 10. V_{GS} vs Q_g
T_j =25°C, V_{DS} =1200V, I_{DS}=240A

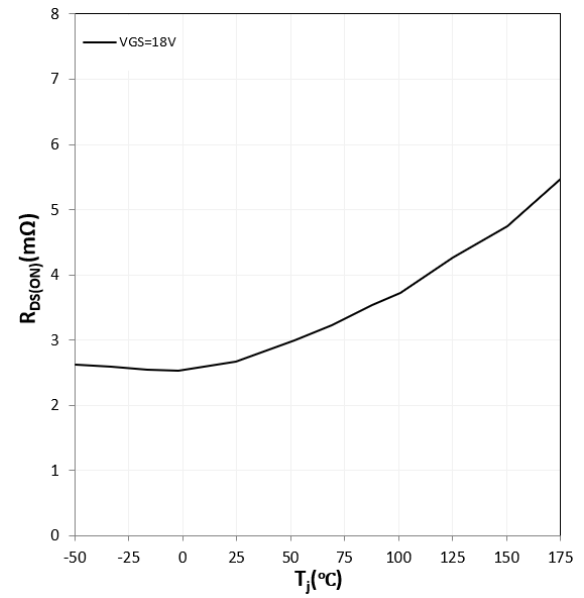


Figure 11. $R_{DS(ON)}$ vs T_j
V_{GS} =+18V, I_D =240A

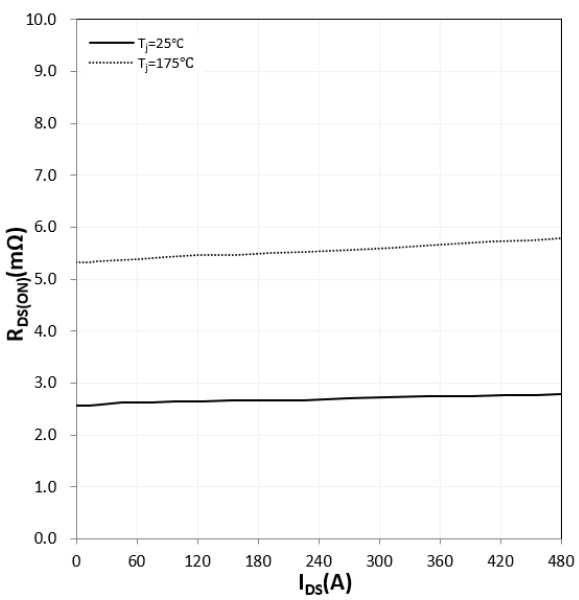


Figure 12. $R_{DS(ON)}$ vs I_{DS}
V_{GS} =+18V

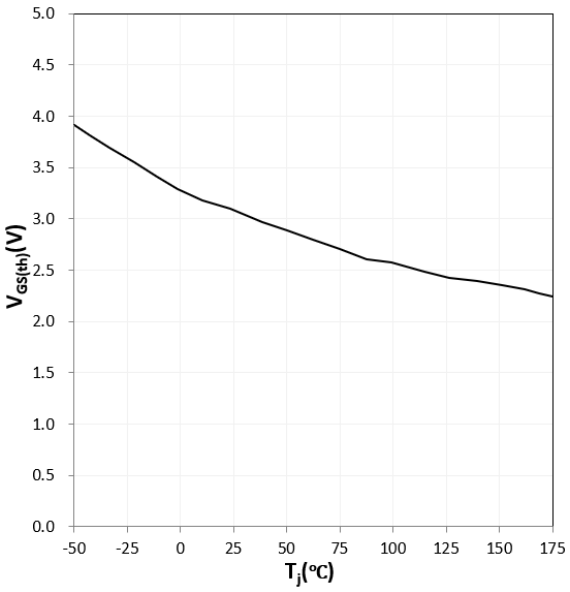


Figure 13. $V_{GS(th)}$ vs T_j
V_{GS} =V_{DS}, I_{DS} =160mA, Inductive Load

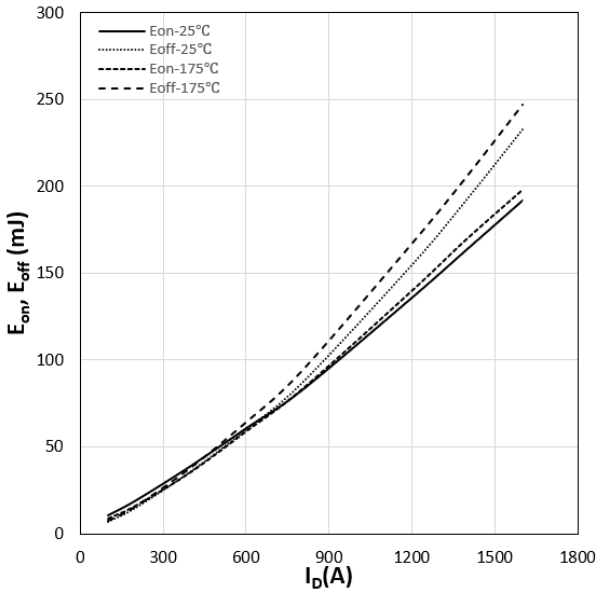


Figure 14. E_{on}, E_{off} vs I_{DS}
V_{DS} =900V, R_G =5Ω, V_{GS} =-3V/+18V
Inductive Load

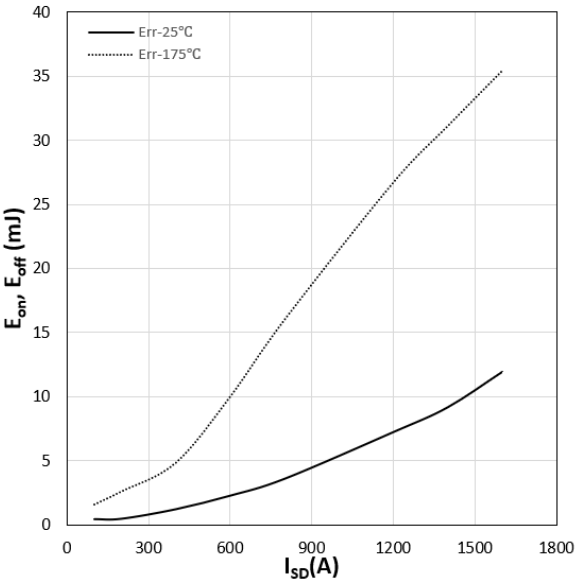


Figure 15. E_{rr} vs I_{SD}
V_{DS} =900V, R_G =5Ω, V_{GS} =-3V/+18V
Inductive Load

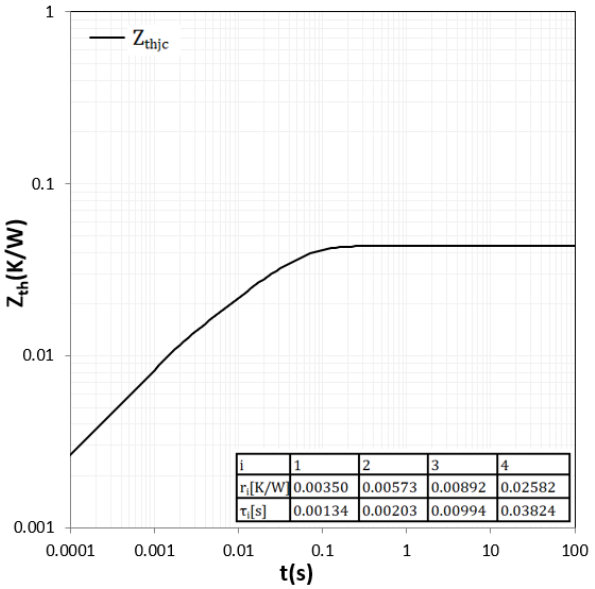


Figure 16. Transient themal impedance
Z_{thjc} for MOSFET

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