DFS800HF14I5A1S

1400V/800A Half-Bridge SiC MOSFET Module

Description

The DFS800HF14I5A1S 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

- 1400V/2.45mΩ @T_j =25°C,V_{GS} =20V
- Low thermal resistance with Si3N4 AMB
- 175°C maximum junction temperature
- Low Inductive Design
- Thermistor inside

Applications

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

Circuit diagram

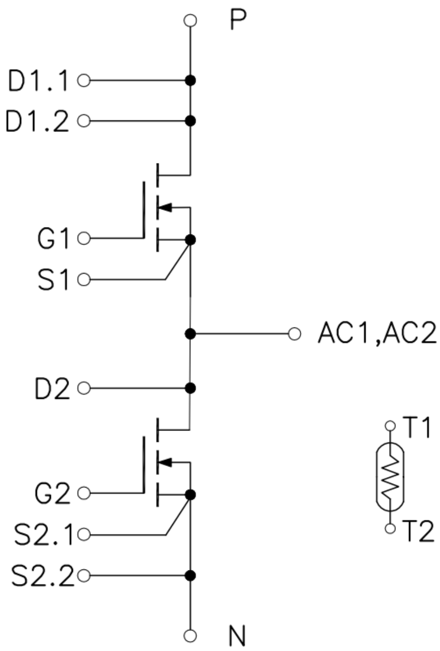

Figure 1. Out drawing & circuit diagram for DFS800HF14I5A1S

Note: Please use **S2.1** for the low side drive signal and do not connect it to **S2.2** which is power terminal

Pin Configuration and Marking Information

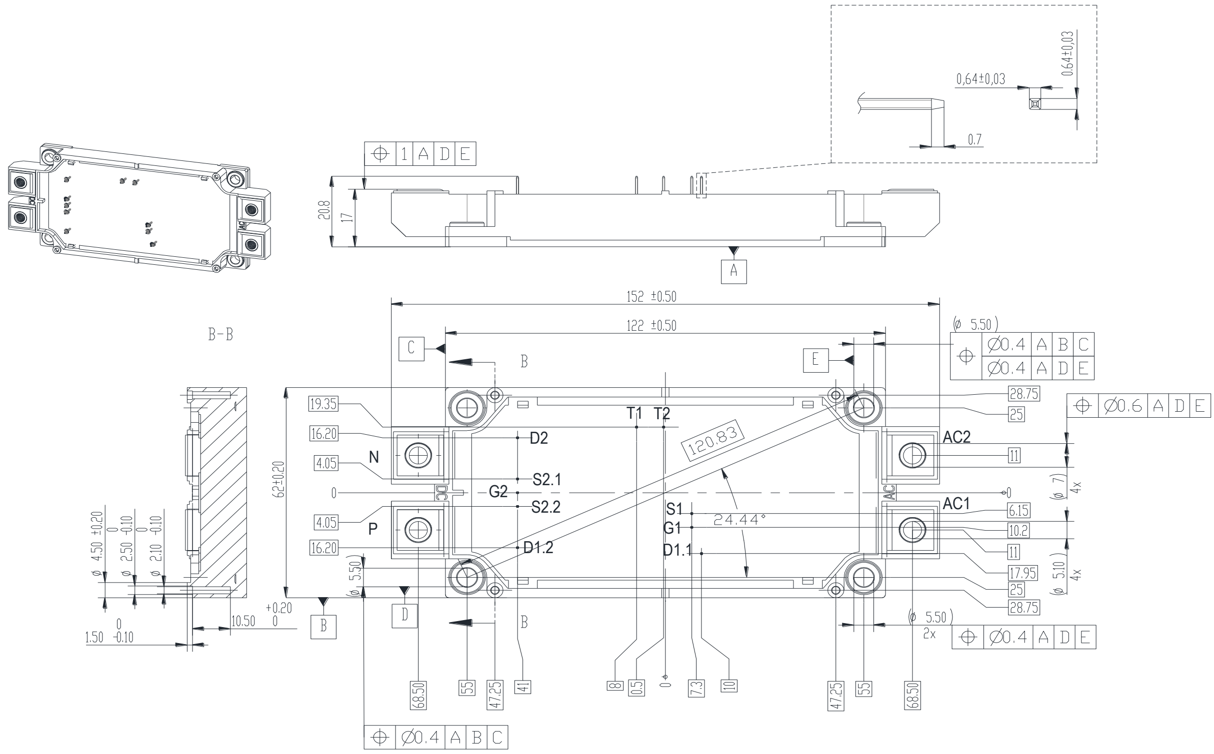

Figure2. Pin configuration

Module

Parameter	Conditions	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
CTI	-	>400	-
Module lead resistance, terminals – chip	T_C = 25°C	0.2	mΩ
Mounting torque for module mounting	M5, M6	3 to 6	Nm
Weight	-	380	g

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

Symbol	Parameter	Conditions	Ratings	Unit
V_{DSS}	Drain-Source Voltage	G-S Short	1400	V
V_{GSS}	Gate-Source Voltage	D-S Short, AC frequency ≥1Hz, Note1	-10V/+25V	V
I_{DS}	DC Continuous Drain Current	T_f=25°C, V_{GS} =20V	705	A
		T_f =65°C, V_{GS} =20V	600	A
I_{DS}	DC Continuous Drain Current	T_f=25°C, V_{GS} =18V	695	A
		T_f =65°C, V_{GS} =18V	595	A
I_{SD}	Source (Body Diode) Current	T_f =25°C, with ON signal	695	A
I_{SD}	Source (Body Diode) Current	T_f =65°C, with ON signal	595	A
I_{DP}	Drain Pulse Current, Peak	Less than 1ms, Note2	1600	A
P_{tot}	Maximum Power Dissipation	T_C =25°C	3333	W
T_{jmax}	Max junction temperature	-	175	°C
T_{stg}	Storage temperature	-	-40 to 125	°C

Note1: Recommended Operating Value: +20V/-5V, +20V/-4V, +18V/-5V, +18V/-4V

Note2: 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 R100	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 Min.	Value Typ.	Value Max.	Unit
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS} =0V, I_D =800μA		1400	-	-	V
I_{DSS}	Zero gate voltage drain current	V_{DS} =1200V, V_{GS} =0V		-	8	400	μA
$V_{GS(Th)}$	Gate-source threshold voltage	I_D=160mA, V_{DS}=V_{GS}	T_j =25°C	1.9	2.45	3.8	V
			T_j =150°C	-	1.70	-	V
			T_j =175°C	-	1.60	-	V
I_{GSS}	Gate-Source Leakage Current	V_{GS} =20V, V_{DS} =0V		-	8	1600	nA
		V_{GS} =-5V, V_{DS} =0V		-1600	-8	0	nA
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	I_D =800A, V_{GS} =20V	T_j =25°C	-	2.45	-	mΩ
			T_j =175°C	-	4.64	-	mΩ
		I_D =800A, V_{GS} =18V	T_j =25°C	-	2.65	-	mΩ
			T_j =175°C	-	4.76	-	mΩ
$V_{DS(on)}$ (Chip)	Static drain-source On-state voltage	I_D =800A, V_{GS} =20V	T_j =25°C	-	1.96	-	V
			T_j =175°C	-	3.71	-	V
		I_D =800A, V_{GS} =18V	T_j =25°C	-	2.12	-	V
			T_j =175°C	-	3.81	-	V
C_{iss}	Input capacitance	V_{DS} =1000V, V_{GS} =0V, f =100kHz		-	38.2	-	nF
C_{oss}	Output capacitance			-	1.73	-	nF
C_{rss}	Reverse transfer capacitance			-	0.13	-	nF
Q_g	Total gate charge	V_{DS} =800V, I_D =400A, V_{GS} =+20/-5V		-	1912	-	nC
Q_{gs}	Gate to source charge			-	496	-	nC
Q_{gd}	Gate to drain charge			-	624	-	nC
R_{gint}	Internal gate resistor	f =1MHz		-	1.1	-	Ω
$t_{d(on)}$	Turn-on delay time	V_{DD} =900V, I_D =800A, V_{GS} =+18/-5V, $R_{G(ON)}$ =5.6Ω, $R_{G(OFF)}$ =5.6Ω, Inductive load switching operation	T_j =25°C	-	162	-	ns
			T_j =150°C	-	144	-	
t_r	Rise time		T_j =25°C	-	113	-	ns
			T_j =150°C	-	105	-	
$t_{d(off)}$	Turn-off delay time		T_j =25°C	-	392	-	ns
			T_j =150°C	-	470	-	
t_f	Fall time		T_j =25°C	-	69	-	ns
			T_j =150°C	-	79	-	
E_{on}	Turn-on power dissipation		T_j =25°C	-	87.9	-	mJ
			T_j =150°C	-	87.5	-	
E_{off}	Turn-off power dissipation		T_j =25°C	-	82.1	-	mJ
			T_j =150°C	-	89.8	-	
$R_{th(j-c)}$	Thermal Resistance, Junction to Case (MOSFET)			-	0.045	-	K/W
$R_{th(c-f)}$	Contact Thermal Resistance, With thermal conductive grease, Note1			-	0.020	-	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, chip)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max.	
V_{SD}	Body Diode Forward Voltage	V_{GS} =-5V I_{SD} =800A	T_j =25°C	-	5.8	-	V
			T_j =175°C	-	5.2	-	
T_{rr}	Reverse recovery time	V_{DD} =900V I_D =800A V_{GS} =+18/-5V $R_{G(ON)}$ =$R_{G(OFF)}$ =5.6Ω Inductive load switching operation	T_j =25°C	-	41	-	ns
			T_j =150°C	-	76	-	
Q_{rr}	Reverse recovery charge		T_j =25°C	-	3.42	-	μC
			T_j =150°C	-	13.2	-	
E_{rr}	Diode switching power dissipation		T_j =25°C	-	0.69	-	mJ
			T_j =150°C	-	3.52	-	

Test Conditions

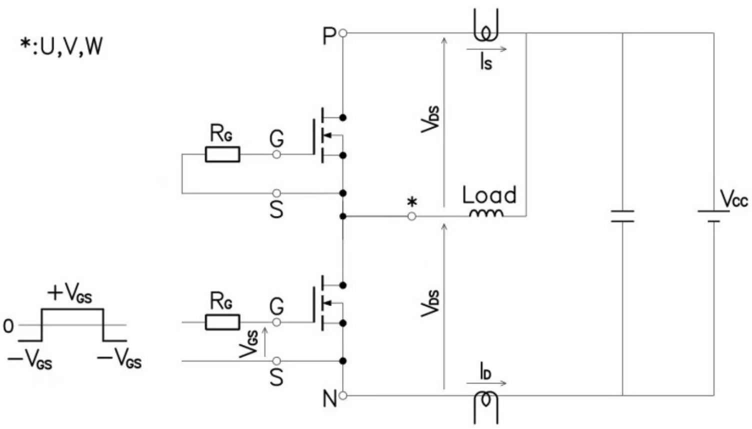

Figure 3. Switching time measure circuit

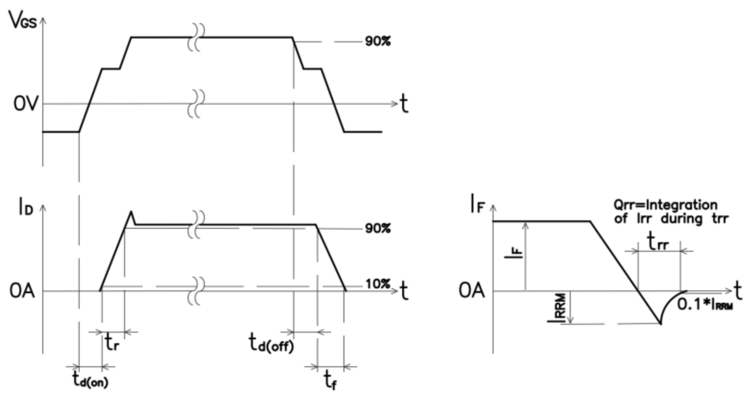

Figure 4. Switching time definition

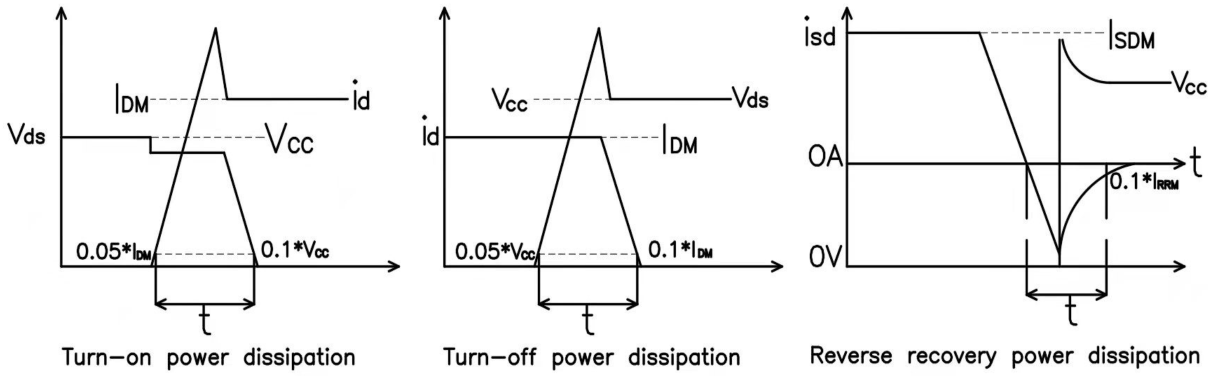

Figure 5. Switching power dissipation definition

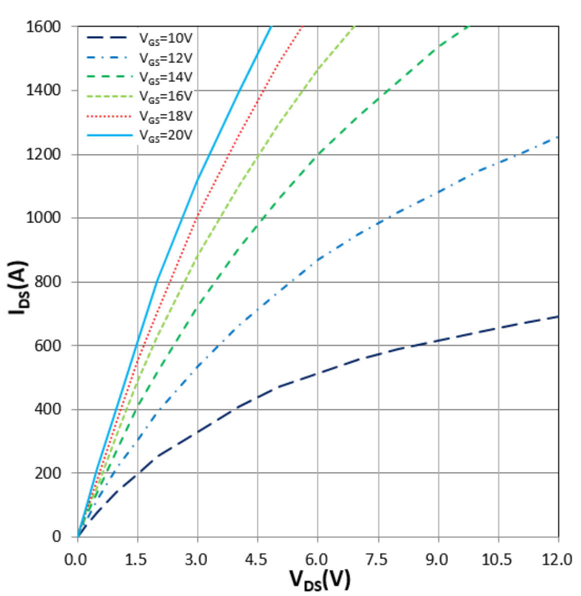

Figure 6. I_{DS} vs V_{DS}

T_j =25°C, V_{GS} parameter

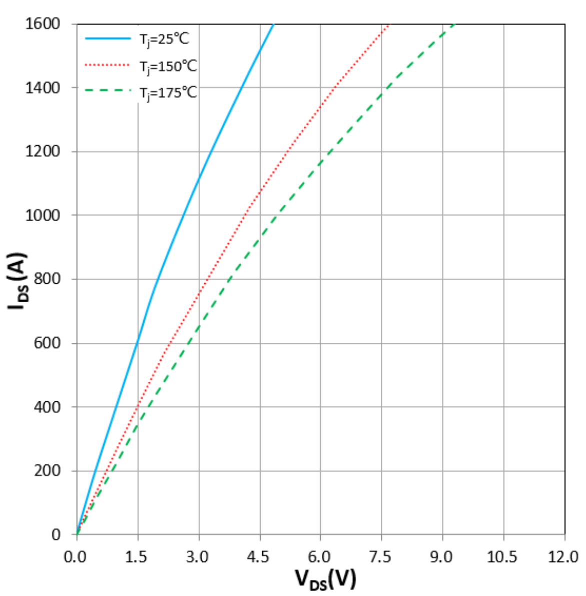

Figure 7. I_{DS} vs V_{DS}

V_{GS} =20V, T_j parameter

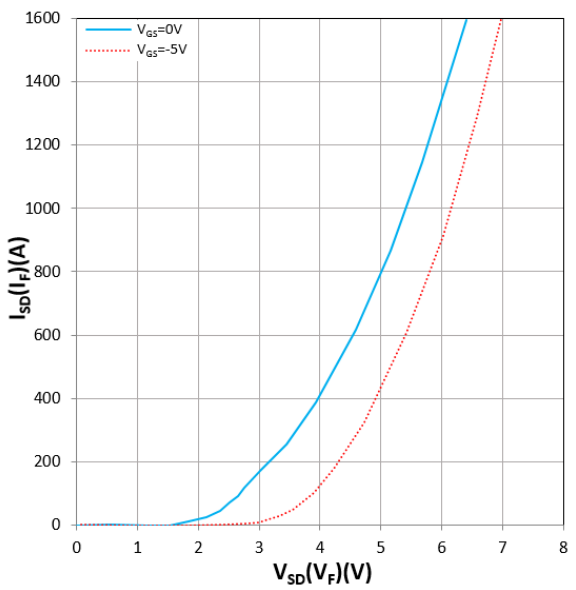

Figure 8. I_{SD} vs V_{SD}

T_j =25°C, V_{GS} parameter

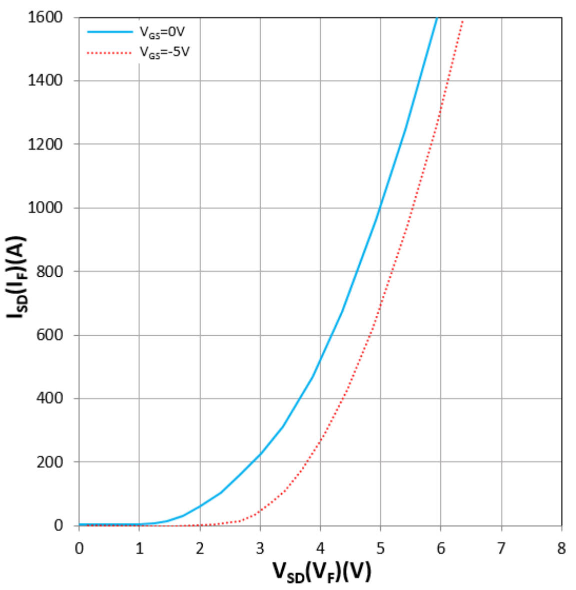

Figure 9. I_{SD} vs V_{SD}

T_j =175°C, V_{GS} parameter

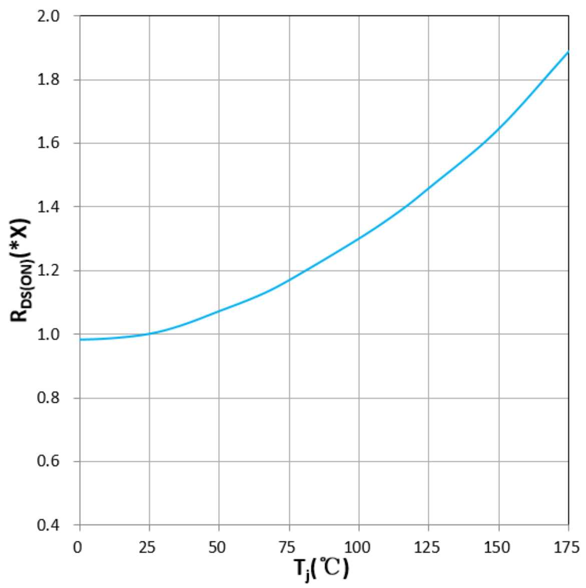

Figure 10. $R_{DS(ON)}$ vs T_j

V_{GS} =+20V, I_D =800A, 1.0X =2.45mΩ

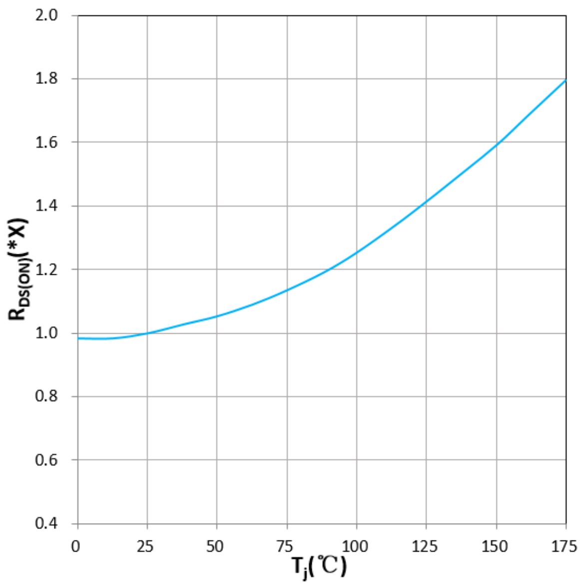

Figure 11. $R_{DS(ON)}$ vs T_j

V_{GS} =+18V, I_D =800A, 1.0X =2.65mΩ

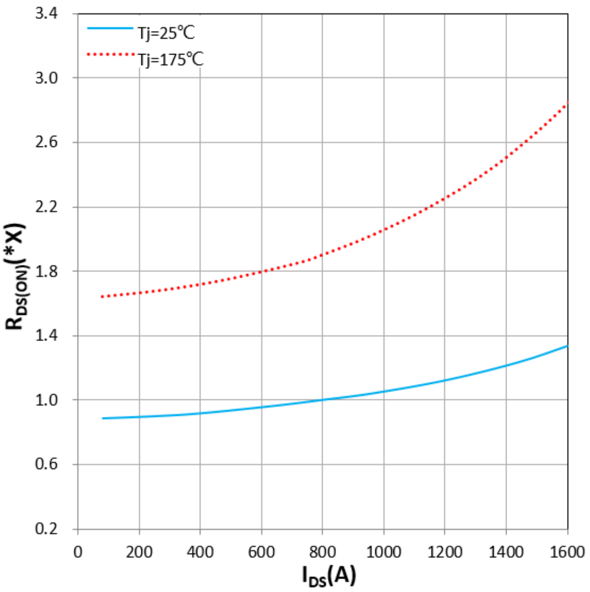

Figure 12. $R_{DS(ON)}$ vs I_{DS}

V_{GS} =+20V, 1.0X =2.45mΩ

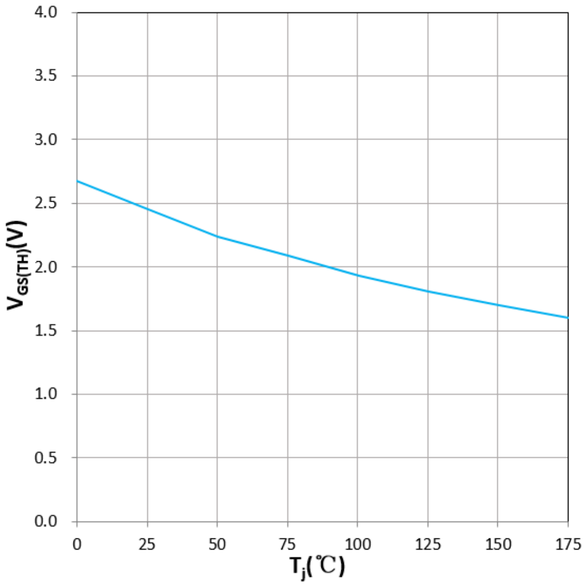

Figure 13. $V_{GS(Th)}$ vs T_j

V_{GS} =V_{DS}, I_D =160mA

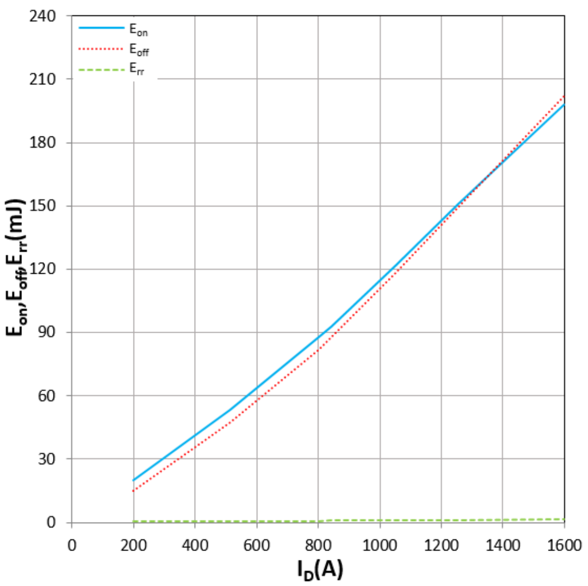

Figure 14. E_{on}, E_{off} , E_{rr} vs I_{DS}

T_j =25°C, V_{DD} =900V, R_G =5.6Ω, V_{GS} =+18V/-5V

Inductive Load

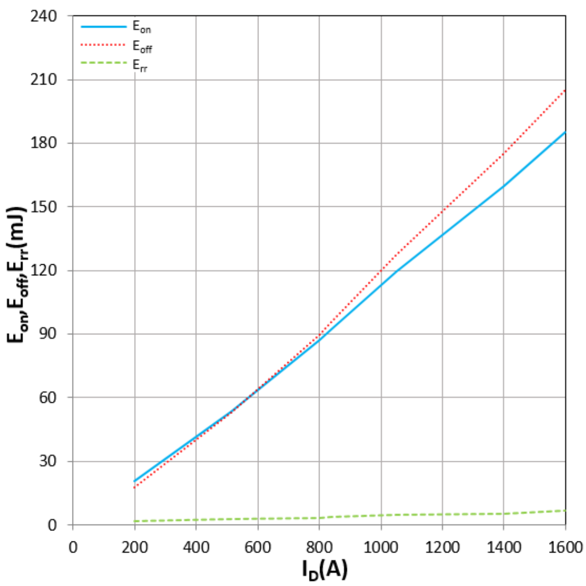

Figure 15. E_{on}, E_{off} , E_{rr} vs I_{DS}

T_j =150°C, V_{DD} =900V, R_G =5.6Ω, V_{GS} =+18V/-5V

Inductive Load

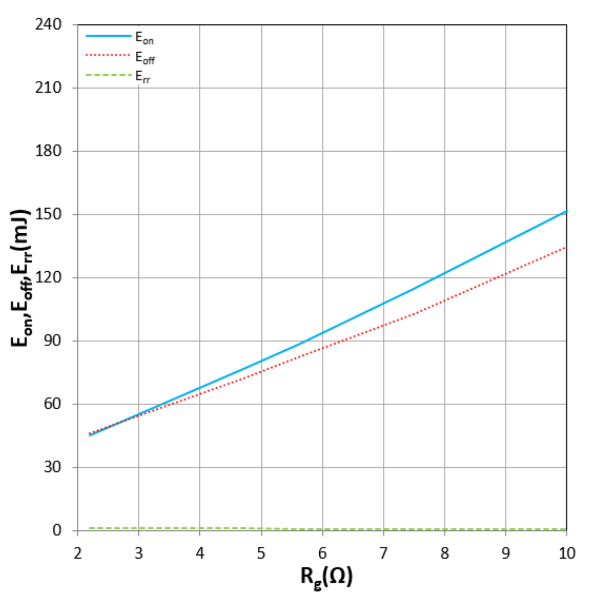

Figure 16. E_{on}, E_{off}, E_{rr} vs R_g

T_j =25°C, V_{DD} =900V, I_D =800A, V_{GS} =+18V/-5V

Inductive Load

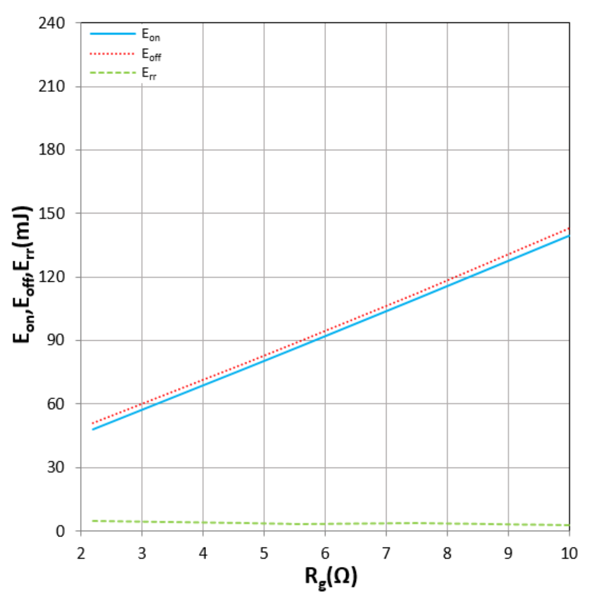

Figure 17. E_{on}, E_{off} , E_{rr} vs R_g

T_j =150°C, V_{DD} =900V, I_D =800A, V_{GS} =+18V/-5V

Inductive Load

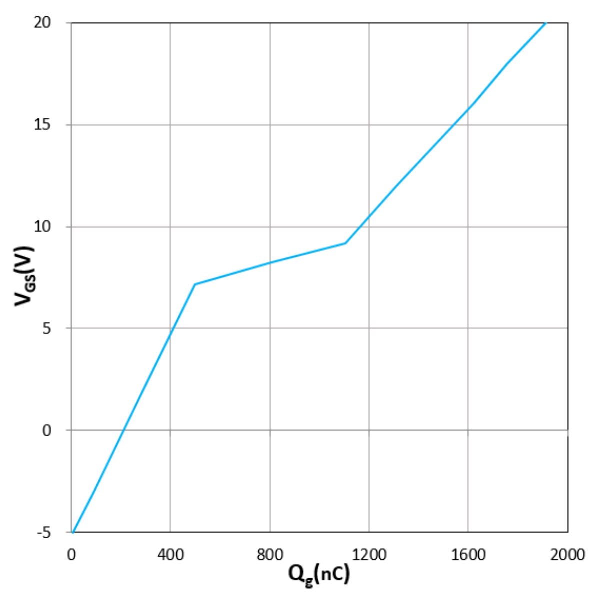

Figure 18. V_{GS} vs Q_g

T_j =25°C, I_D =400A, V_{DS} =800V

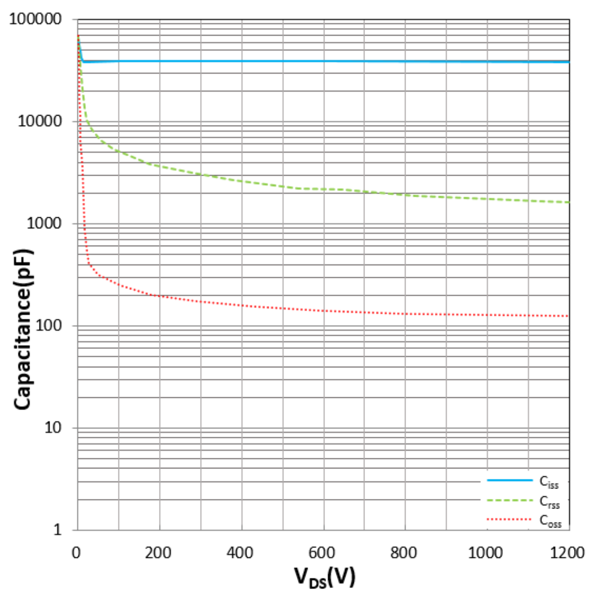

Figure 19. C_{iss},C_{oss},C_{rss} vs V_{DS}

T_j =25°C, f =100kHz

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