DFS800HF12I5B3

1200V/800A Half-Bridge SiC MOSFET Module

Description

The DFS800HF12I5B3 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

- 1200V/1.7mΩ @T_j =25°C,V_{GS} =18V
- 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

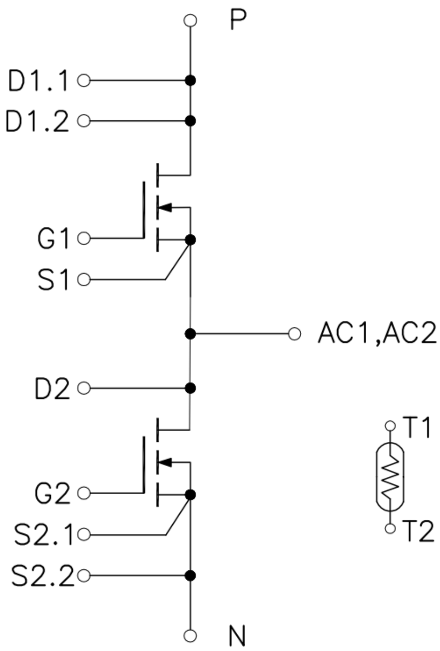

Figure 1. Out drawing & circuit diagram for DFS800HF12I5B3

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

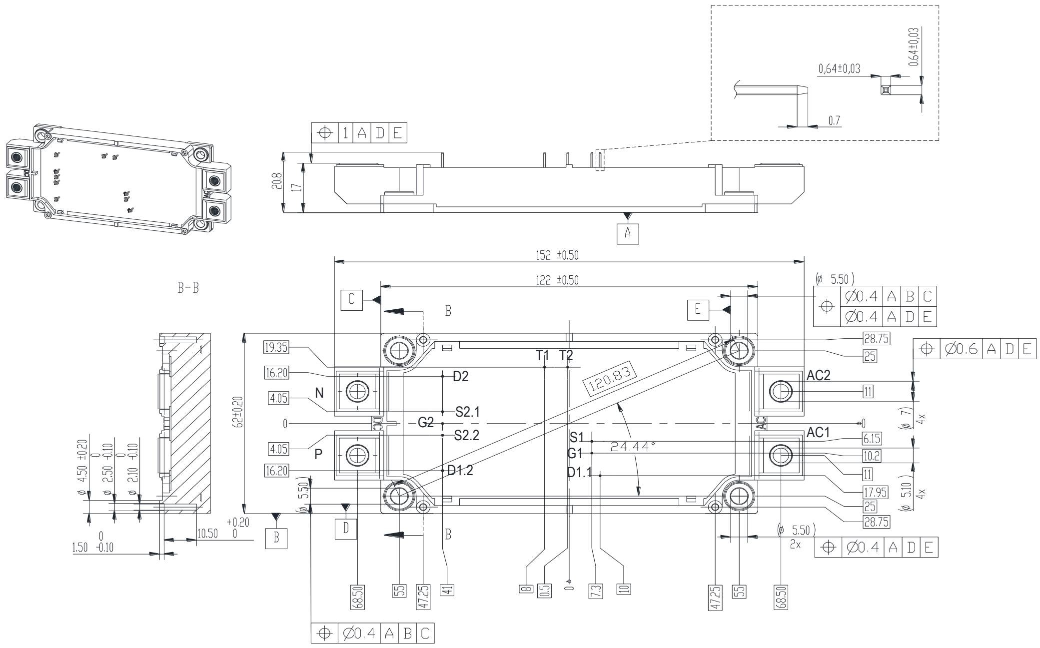

Figure2. Pin configuration

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	-	350	g

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

Symbol	Parameter	Conditions	Ratings	Unit
V_{DSS}	Drain-Source Voltage	G-S Short	1200	V
V_{GSS}	Gate-Source Voltage	D-S Short, AC frequency ≥1Hz, Note1	-11V/+23V	V
I_{DS}	DC Continuous Drain Current	T_f =25°C	720	A
I_{DS}	DC Continuous Drain Current	T_f =65C	620	A
I_{SD}	Source (Body Diode) Current	T_f =25°C, with ON signal	720	A
I_{SD}	Source (Body Diode) Current	T_f =65°C, with ON signal	620	A
I_{DP}	Drain Pulse Current, Peak	Less than 1us, Note2	1600	A
P_{tot}	Maximum Power Dissipation	T_C =25°C	2885	W
T_{jmax}	Max junction temperature	-	175	°C
T_{stg}	Storage temperature	-	-40 to 125	°C

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

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			Unit
				Min.	Typ.	Max	
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS} =0V, I_D =8mA		1200	-	-	V
I_{DSS}	Zero gate voltage drain current	V_{DS} =1200V, V_{GS} =0V		-	-	80	μA
$V_{GS(th)}$	Gate-source threshold voltage	I_D =80mA, V_{DS} =V_{GS}		2.1	-	5.8	V
I_{GSS}	Gate-Source Leakage Current	V_{GS} =20V, V_{DS} =0V, T_j =25°C		-	-	10	μA
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	I_D =800A V_{GS} =18V	T_j =25°C	1.1	1.7	2.3	mΩ
			T_j =175°C	2.6	4.0	5.4	mΩ
$V_{DS(on)}$ (Chip)	Static drain-source On-state voltage	I_D =800A V_{GS} =18V	T_j =25°C	1.1	1.7	2.3	V
			T_j =175°C	2.6	4.0	5.4	V
C_{iss}	Input capacitance	V_{DS} =850V V_{GS} =0V f =1MHz		-	32	-	nF
C_{oss}	Output capacitance			-	1.84	-	nF
C_{rss}	Reverse transfer capacitance			-	0.176	-	nF
Q_G	Total gate charge	V_{DD} =850V, I_D =800A, V_{GS} =-5/+18V		-	1520	-	nC
R_{Gint}	Internal Gate Resistance	f =10MHz, V_{AC} =25		-	0.12	-	Ω
$t_{d(on)}$	Turn-on delay time	V_{DD} =600V I_D =800A V_{GS} =+15/-4V $R_{G(ON)}$ =5Ω $R_{G(OFF)}$ =5Ω Inductive load switching operation	T_j =25°C	-	158	-	ns
			T_j =150°C	-	143	-	
t_r	Rise time		T_j =25°C	-	127	-	ns
			T_j =150°C	-	115	-	
$t_{d(off)}$	Turn-odd delay time		T_j =25°C	-	335	-	ns
			T_j =150°C	-	372	-	
t_f	Fall time		T_j =25°C	-	81	-	ns
			T_j =150°C	-	99	-	
E_{on}	Turn-on power dissipation		T_j =25°C	-	41.1	-	mJ
			T_j =150°C	-	34.5	-	
E_{off}	Turn-off power dissipation		T_j =25°C	-	52.5	-	mJ
			T_j =150°C	-	54.2	-	
$R_{th(j-c)}$	FET Thermal Resistance	Junction to Case/MOSFET		-	0.052	-	K/W
$R_{th(c-f)}$	Contact Thermal Resistance	With thermal conductive grease /MOSFET		-	0.02	-	K/W

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} =800A	T_j=25°C	3.9	4.9	5.6	V
			T_j=175°C	3.1	4.2	5.2	
T_{rr}	Reverse recovery time	V_{DD} =600V I_{SD} =800A V_{GS} =+15/-4V $R_{G(ON)}$ =$R_{G(OFF)}$ =5Ω Inductive load switching operation	T_j=25°C	-	38	-	ns
			T_j=150°C	-	55	-	
Q_{rr}	Reverse recovery charge		T_j=25°C	-	2.72	-	uC
			T_j=150°C	-	7.45	-	
E_{rr}	Diode switching power dissipation		T_j=25°C	-	0.68	-	mJ
			T_j=150°C	-	1.87	-	

Test Conditions

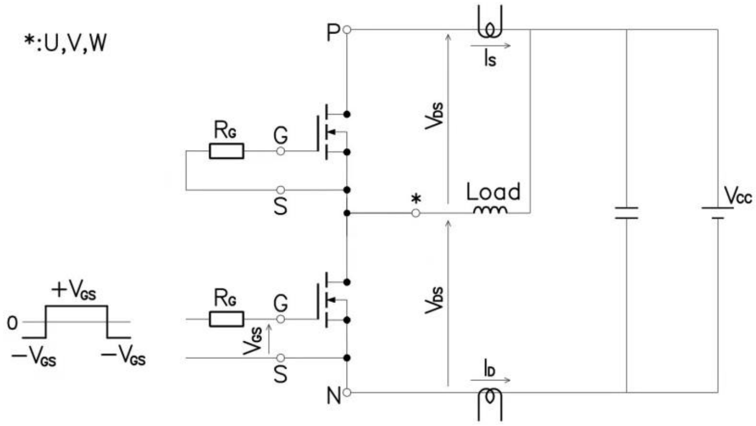

Figure 3. Switching time measure circuit

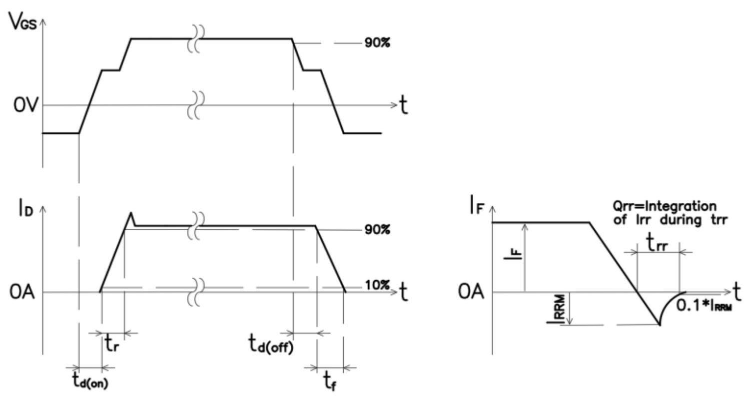

Figure 4. Switching time definition

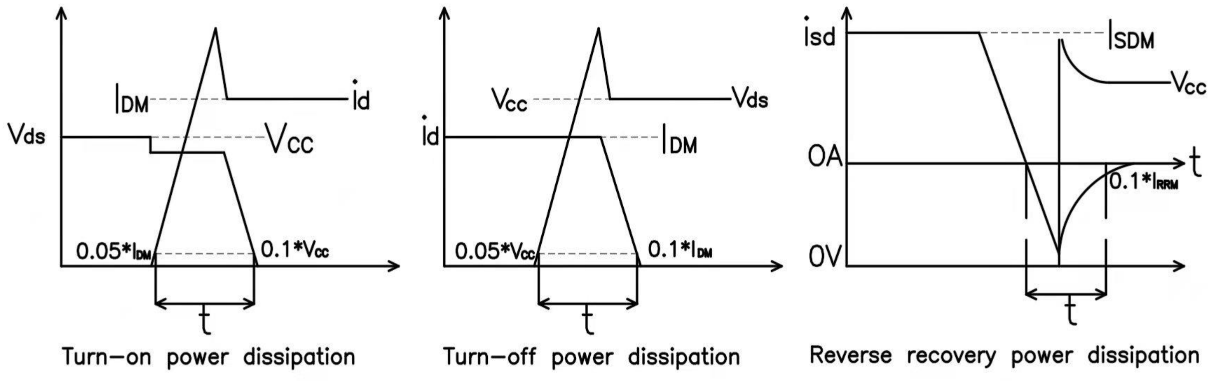

Figure 5. Switching power dissipation definition

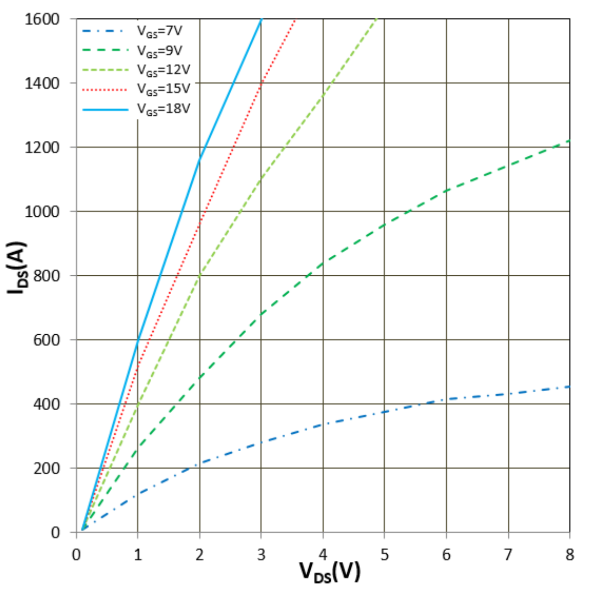

Figure 6. I_{DS} vs V_{DS}

T_j =25°C, V_{GS} parameter

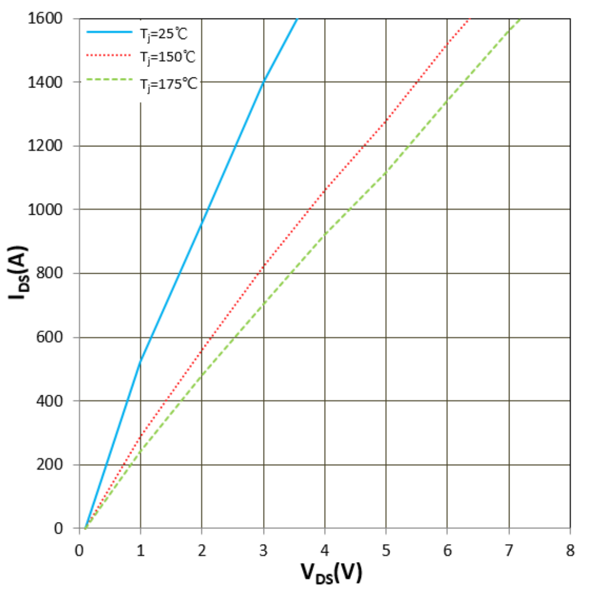

Figure 7. I_{DS} vs V_{DS}

V_{GS} =15V, T_j parameter

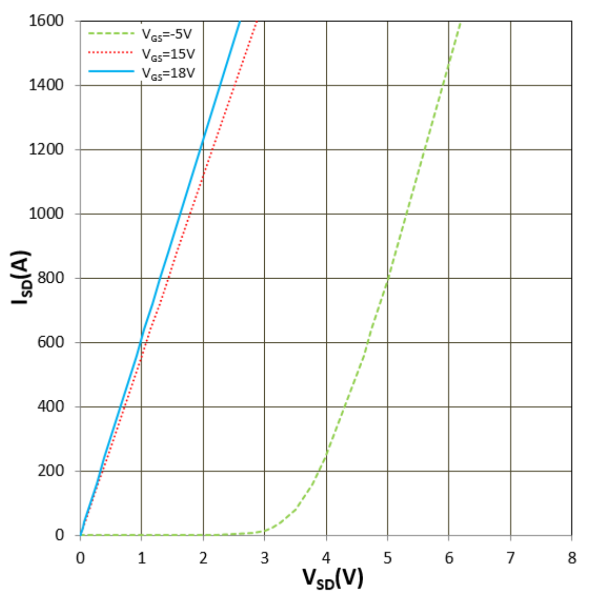

Figure 8. I_{SD} vs V_{SD}
T_j =25℃, V_{GS} parameter

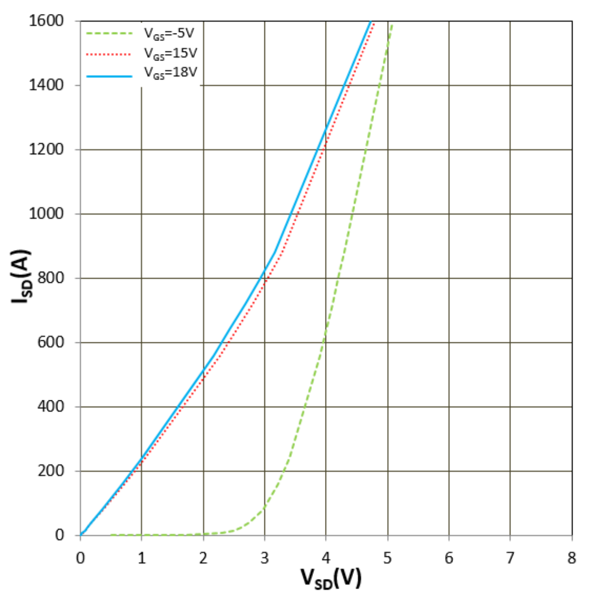

Figure 9. I_{SD} vs V_{SD}
T_j =175℃, V_{GS} parameter

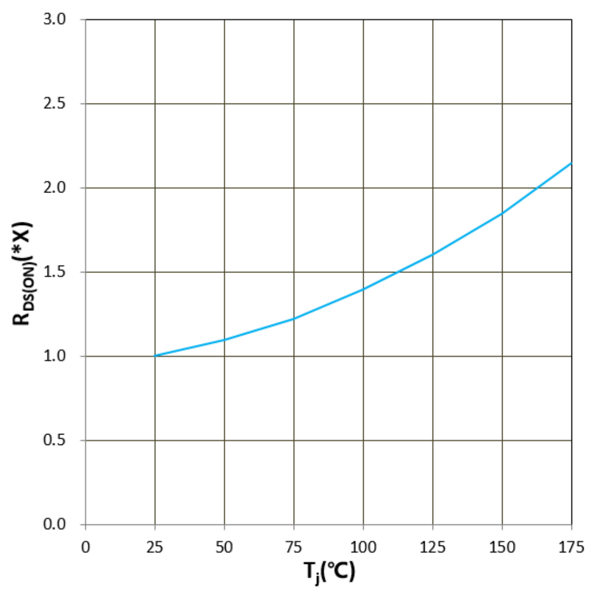

Figure 10. $R_{DS(ON)}$ vs T_j
V_{GS} =+15V, I_D =800A, 1.0x =2.0mΩ

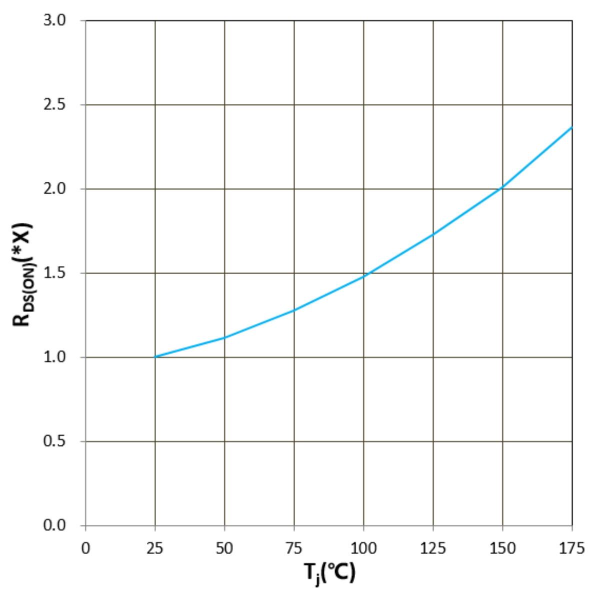

Figure 11. $R_{DS(ON)}$ vs I_{DS}
V_{GS} =+18V, I_D =800A, 1.0x =1.7mΩ

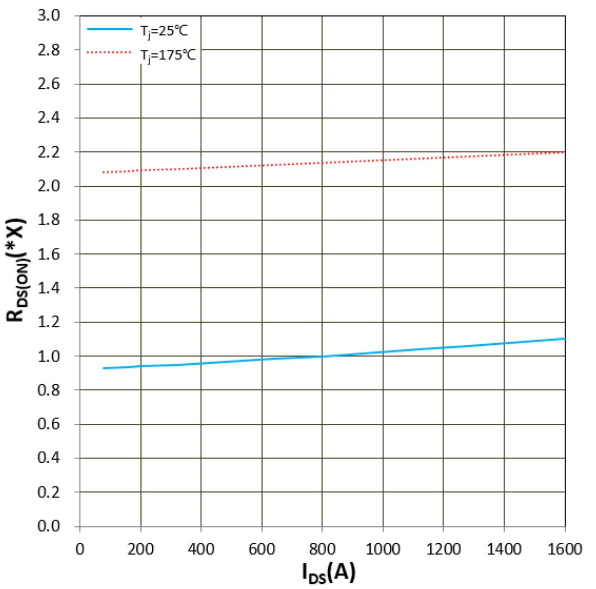

Figure 12. $R_{DS(ON)}$ vs I_{DS}

V_{GS} =+15V, 1.0x =2.0mΩ

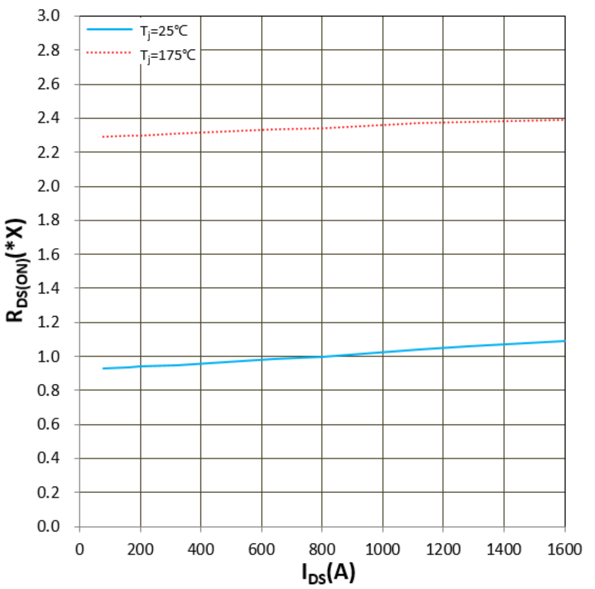

Figure 13. $R_{DS(ON)}$ vs I_{DS}

V_{GS} =+18V, 1.0x =1.7mΩ

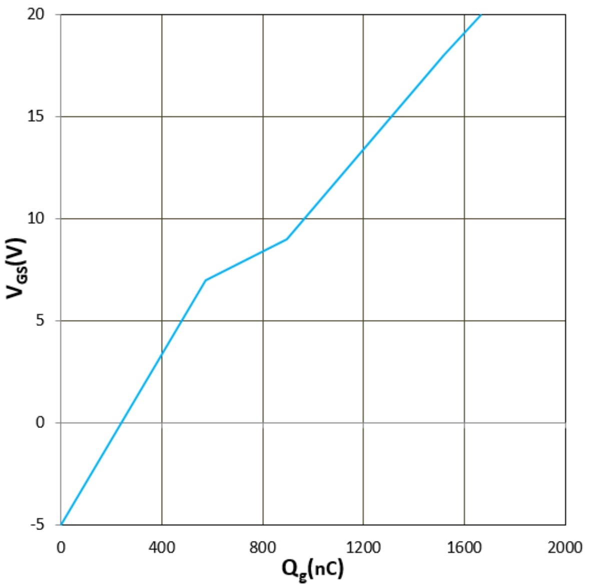

Figure 14. V_{GS} vs Q_g

T_j =25℃, I_{GS} =8mA

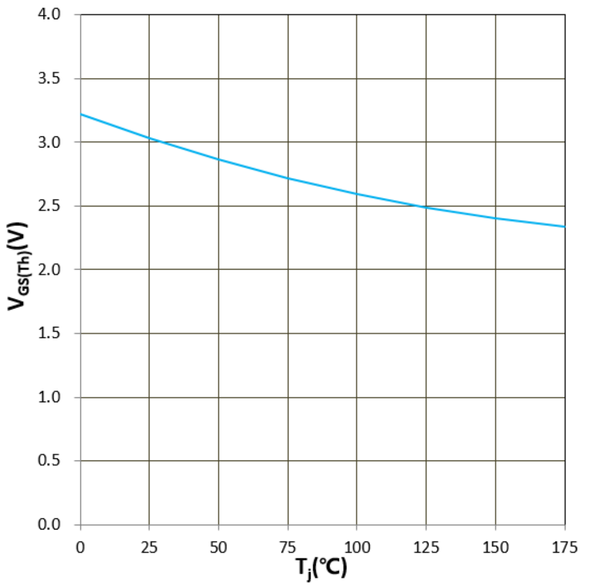

Figure 15. $V_{GS(TH)}$ vs T_j

V_{GS} =V_{DS}, I_D =80mA

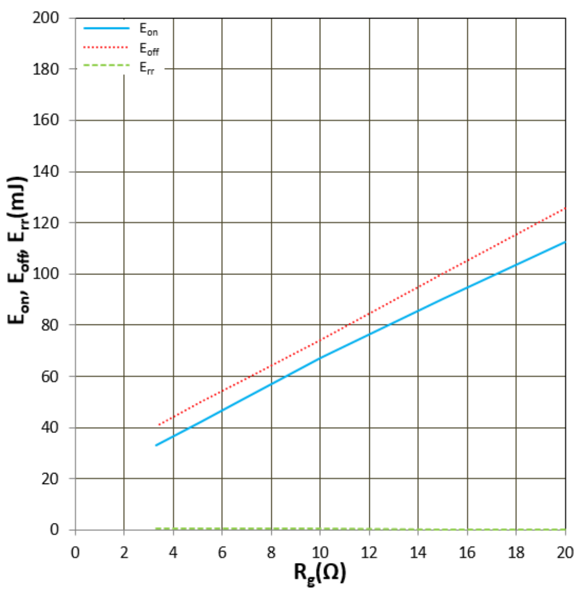

Figure 16. E_{on}, E_{off}, E_{rr} vs R_g

T_j =25°C, V_{CC} =600V, I_D =800A, V_{GS} =+15V/-4V

Inductive Load

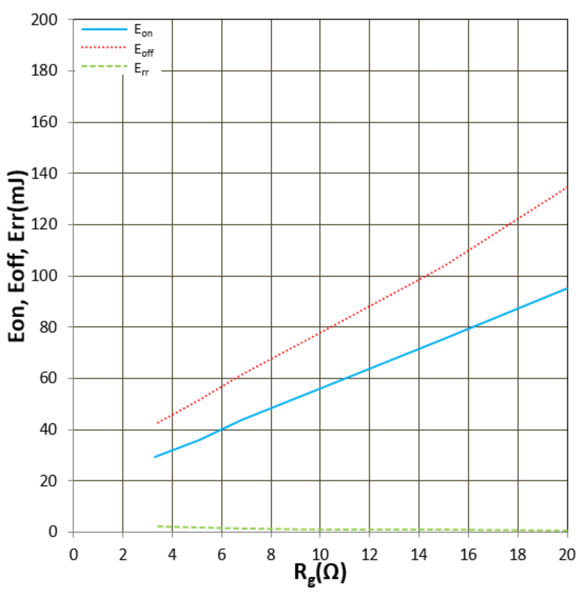

Figure 17. E_{on}, E_{off}, E_{rr} vs R_g

T_j =150°C, V_{CC} =600V, I_D =800A, V_{GS} =+15V/-4V

Inductive Load

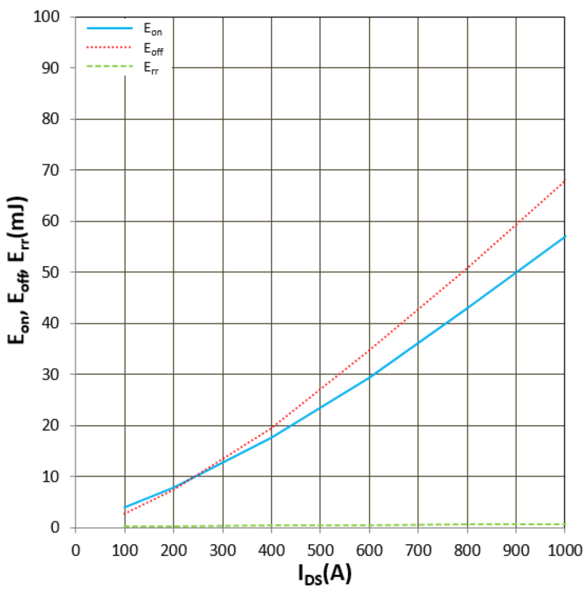

Figure 18. E_{on}, E_{off} , E_{rr} vs I_{DS}

T_j =25°C, V_{CC} =600V, R_G =5Ω, V_{GS} =+15V/-4V

Inductive Load

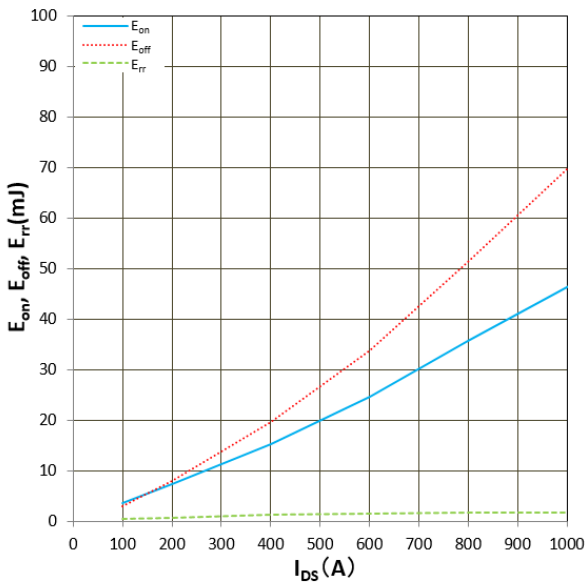

Figure 19. E_{on}, E_{off} , E_{rr} vs I_{DS}

T_j =150°C, V_{CC} =600V, R_G =5Ω, V_{GS} =+15V/-4V

Inductive Load

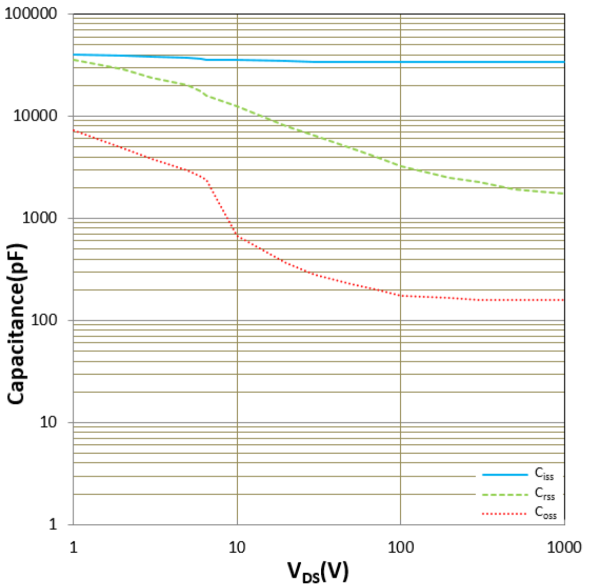

Figure 20. C_{ies},C_{oss},C_{rss} vs V_{DS}
T_j =25℃

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