DFS800HF14I4Q1

1400V/800A Half Bridge SiC MOSFET Module

Description

The DFS800HF14I4Q1 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 1400V
- $R_{DS(on)}$ =2.5mΩ@T_j =25°C,V_{GS} =20V
- Low thermal resistance with Si_3N_4 AMB
- 175°C maximum junction temperature
- Thermistor inside
- Low Switching Losses

Applications

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

Circuit diagram

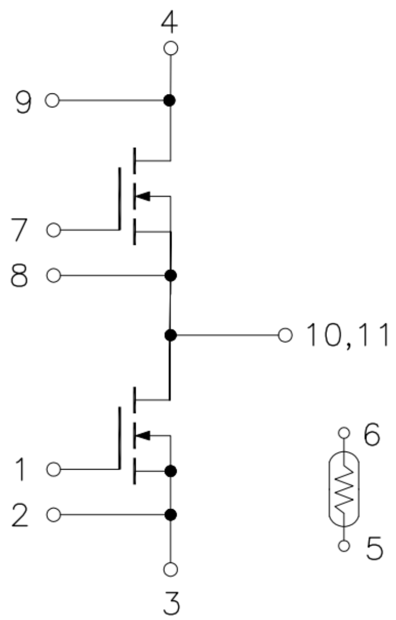

Figure 1. Out drawing & circuit diagram for DFS800HF14I4Q1

Pin Configuration and Marking Information

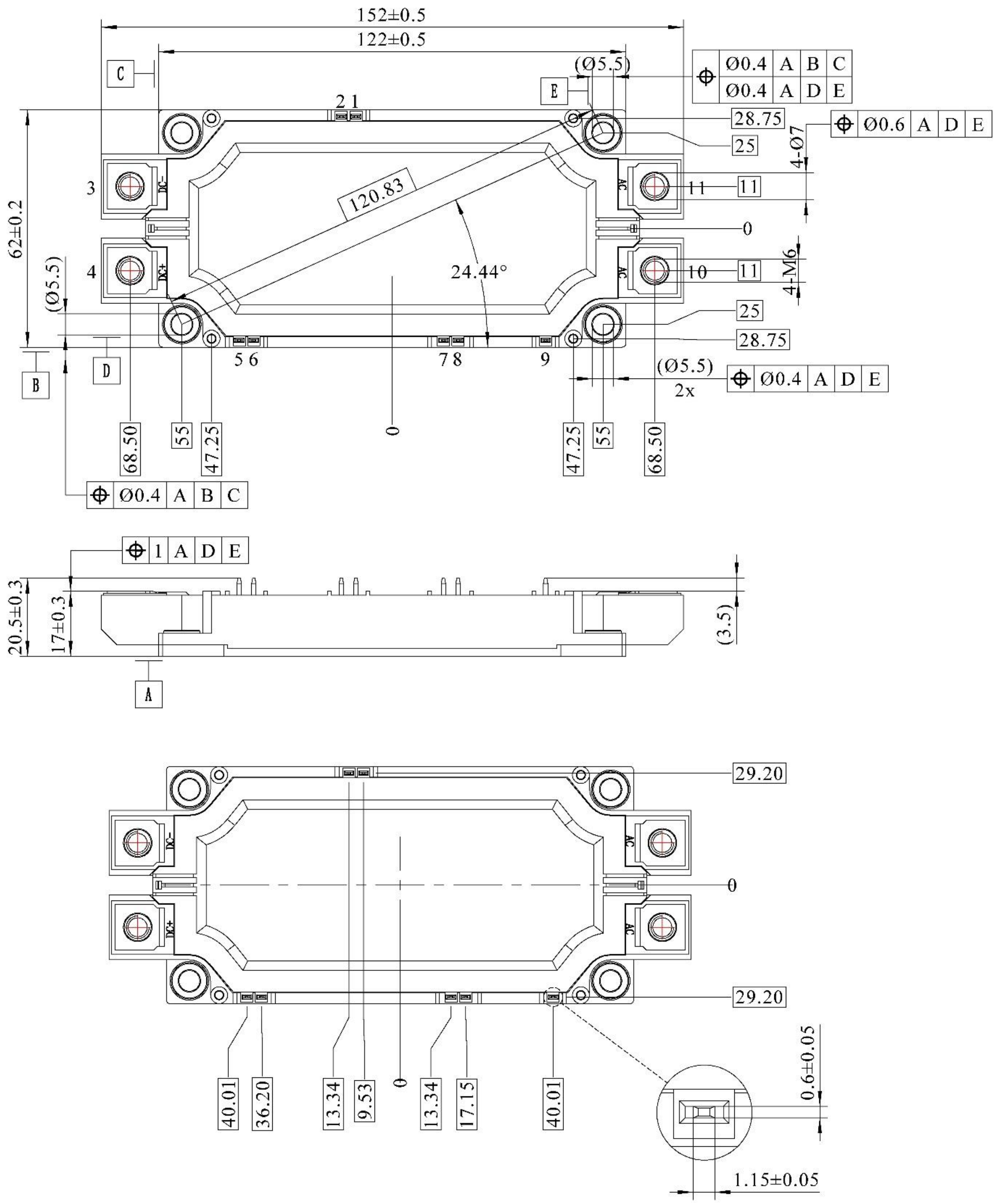

Figure 2. Pin configuration

Module

Parameter	Conditions	Value	Unit
Isolation Voltage	RMS, f =50Hz, t =1min	4.0	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	0.5	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	Conditions	Ratings	Unit
V_{DSS}	Drain-Source Voltage	G-S Short	1400	V
$V_{DS\ nom}$	Continuous Operating DC Voltage	Not include surge voltage	1100	V
V_{GSS}	Gate-Source Voltage	D-S Short, AC frequency ≥1Hz, Note1	-10 to 25	V
I_{DS}	DC Continuous Drain Current	T_C =50°C, V_{GS} =20V	800	A
I_{DS}	DC Continuous Drain Current	T_C =100°C, V_{GS} =20V	600	A
I_{SD}	Source (Body diode) Current	T_C =50°C, with ON signal	800	A
I_{SD}	Source (Body diode) Current	T_C =100℃, with ON signal	600	A
I_{DSM}	Pulse Forward Current	T_C =25°C, Pulse width =1ms, V_{GS} =20V, Note2	1600	A
P_{tot}	Total Power Dissipation	T_C =25°C	3750	W
T_{jmax}	Max Junction Temperature	-	175	°C
T_{stg}	Storage Temperature	-	-40 to 125	°C

Note1: Recommended Operating Value, +20V/-5V ,+18V/-5V, +15V/-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 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 Min.	Value Typ.	Value Max	Unit
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS} =0V, I_D =8mA		1400	-	-	V
I_{DSS}	Zero gate voltage drain Current	V_{DS} =1400V, V_{GS} =0V		-	10	-	μA
$V_{GS(th)}$	Gate-source threshold Voltage	I_D =160mA, V_{DS} =V_{GS}	T_j =25°C	1.8	2.5	4.0	V
			T_j =175°C	-	1.6	-	V
I_{GSS}	Gate-Source Leakage Current	V_{GS} =20V, V_{DS} =0V, T_j =25°C		-	200	1600	nA
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	I_D =800A, V_{GS} =20V	T_j =25°C	-	2.5	-	mΩ
			T_j =175°C	-	4.7	-	mΩ
		I_D =800A, V_{GS} =18V	T_j =25°C	-	2.9	-	mΩ
			T_j =175°C	-	5.0	-	mΩ
$V_{DS(on)}$ (Chip)	Static drain-source On-state Voltage	I_D =800A, V_{GS} =20V	T_j =25°C	-	2.0	-	V
			T_j =175°C	-	3.8	-	V
		I_D =800A, V_{GS} =18V	T_j =25°C	-	2.3	-	V
			T_j =175°C	-	4.0	-	V
C_{iss}	Input Capacitance	V_D =1000V, V_{GS} =0V, f =200kHz, V_{AC} =25mV		-	50.6	-	nF
C_{oss}	Output Capacitance			-	2.88	-	nF
C_{rss}	Reverse transfer Capacitance			-	0.3	-	nF
Q_G	Total gate charge	V_{DD} =800V, I_D =400A, V_{GS} =+20/-5V		-	1730	-	nC
R_{Gint}	Internal Gate Resistance	T_j =25°C		-	0.8	-	Ω
$t_{d(on)}$	Turn-on delay time	V_{DD} =600V, I_D =800A, V_{GS} =+18/-5V, $R_{G(on)}$ =3.3Ω, $R_{G(off)}$ =3.3Ω, Inductive load switching operation	T_j =25°C	-	67	-	ns
			T_j =150°C	-	55	-	ns
t_r	Rise time		T_j =25°C	-	53	-	ns
			T_j =150°C	-	41	-	ns
$t_{d(off)}$	Turn-off delay time		T_j =25°C	-	43	-	ns
			T_j =150°C	-	56	-	ns
t_f	Fall time		T_j =25°C	-	24	-	ns
			T_j =150°C	-	29	-	ns
E_{on}	Turn-on power dissipation		T_j =25°C	-	19.1	-	mJ
			T_j =150°C	-	27.2	-	mJ
E_{off}	Turn-off power dissipation		T_j =25°C	-	4.3	-	mJ
			T_j =150°C	-	7.8	-	mJ
$R_{th(j-c)}$	FET Thermal Resistance	Junction to Case		-	0.04	-	K/W
$R_{th(c-f)}$	Contact thermal Resistance	With thermal conductive grease, Note3		-	0.015	-	K/W

Note3: 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} = -5V I_{SD} =800A	T_j =25°C	-	4.6	-	V
			T_j =150°C	-	4.0	-	
T_{rr}	Reverse recovery time	V_{RR} =800V, I_D =800A MOSFET side: V_{GS} =+18/-5V $R_{G(on)}$ = $R_{G(off)}$ =3.3Ω Inductive load switching operation	T_j =25°C	-	41	-	ns
			T_j =150°C	-	45	-	
Q_{rr}	Reverse recovery charge		T_j =25°C	-	3.2	-	uC
			T_j =150°C	-	7.1	-	
E_{rr}	Diode switching power dissipation		T_j =25°C	-	1.1	-	mJ
			T_j =150°C	-	2.9	-	

Test Conditions

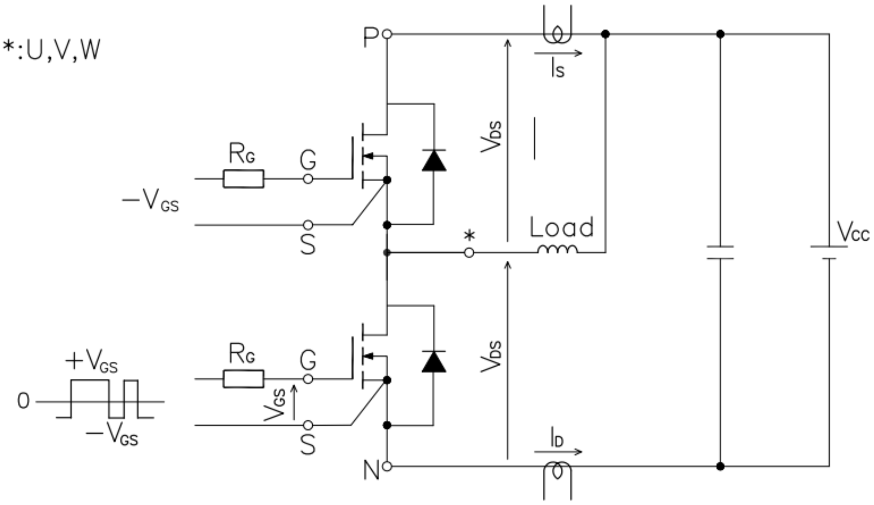

Figure 3. Switching time measure circuit

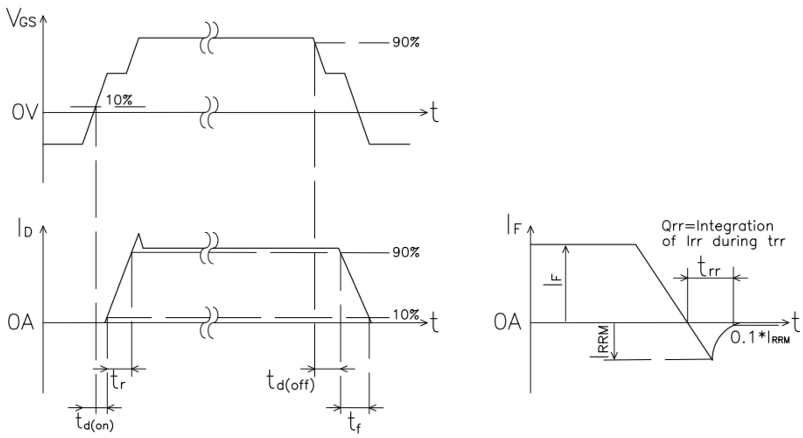

Figure 4. Switching time definition

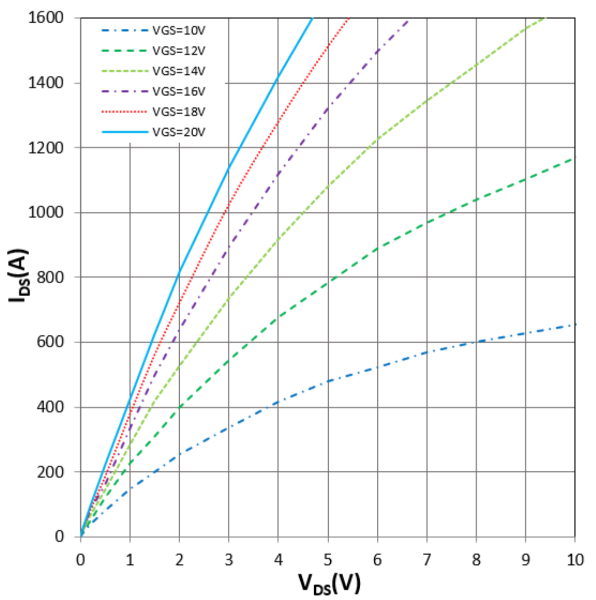

Figure 5. I_{DS} vs V_{DS}
T_j =25°C, V_{GS} parameter

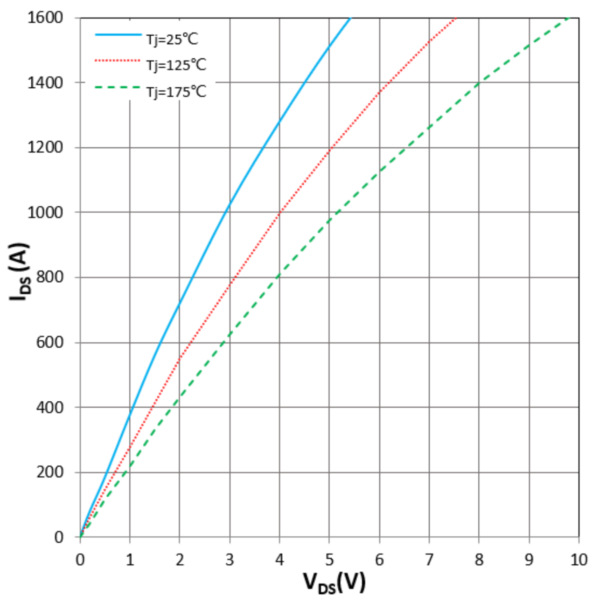

Figure 6. I_{DS} vs V_{DS}
V_{GS} =18V, T_j parameter

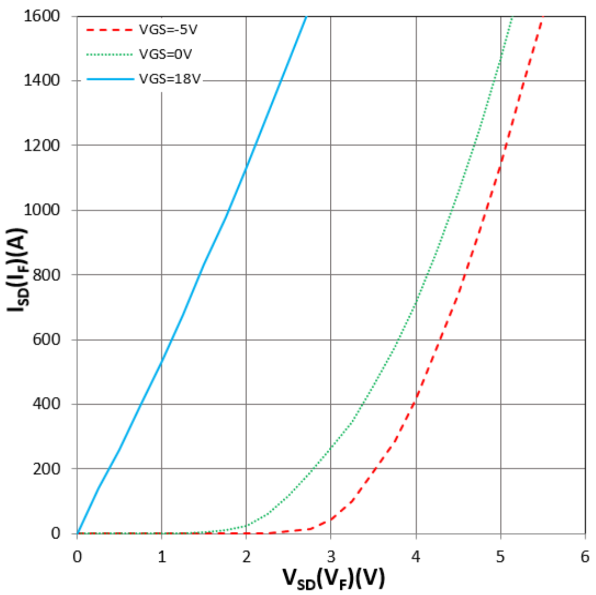

Figure 7. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
T_j =25°C, V_{GS} parameter

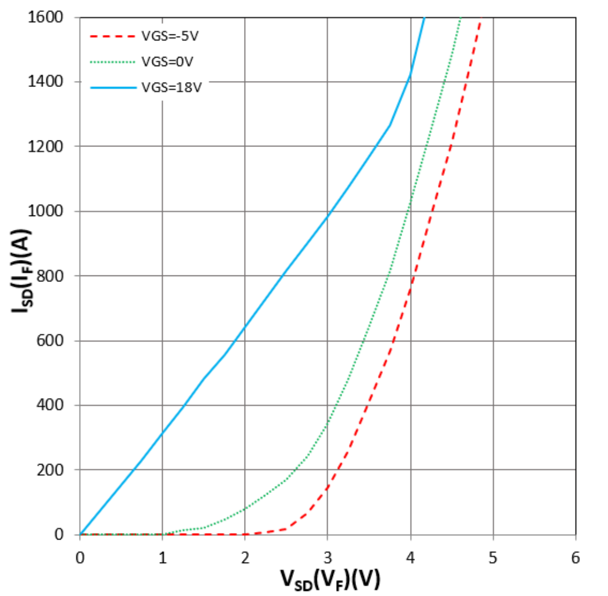

Figure8. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
T_j =175°C, V_{GS} parameter

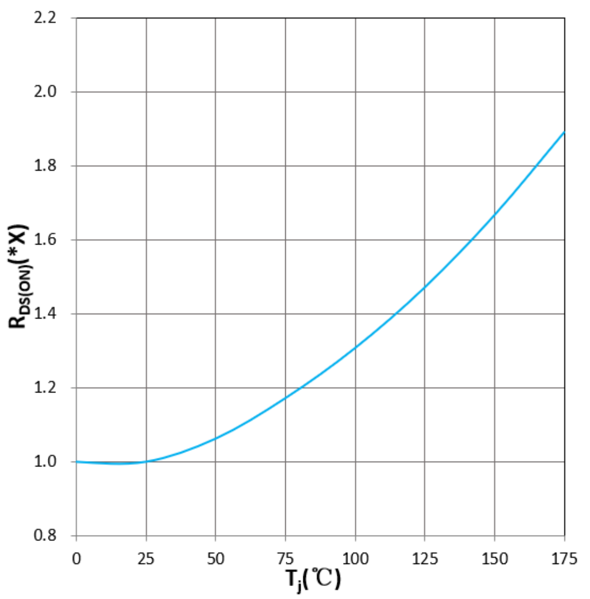

Figure 9. $R_{DS(ON)}$ vs T_j

V_{GS} =+20V, I_D =800A, 1.0X =2.5mΩ

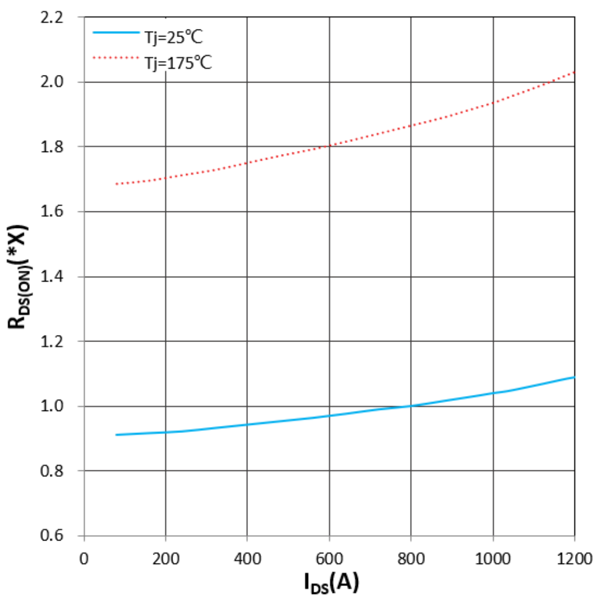

Figure 10. $R_{DS(ON)}$ vs I_{DS}

T_j =25℃/175℃,V_{GS} =+20V, 1.0X =2.5mΩ

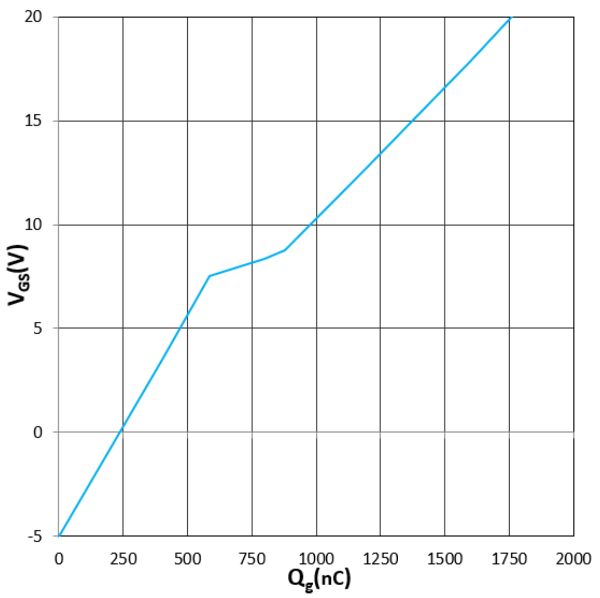

Figure 11. V_{GS} vs Q_g

T_j =25℃, V_{DS} =800V, I_D =400A

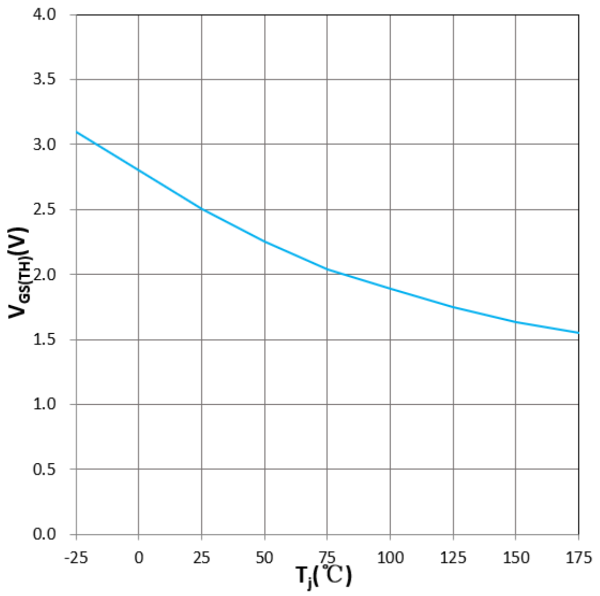

Figure 12. $V_{GS(TH)}$ vs T_j

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

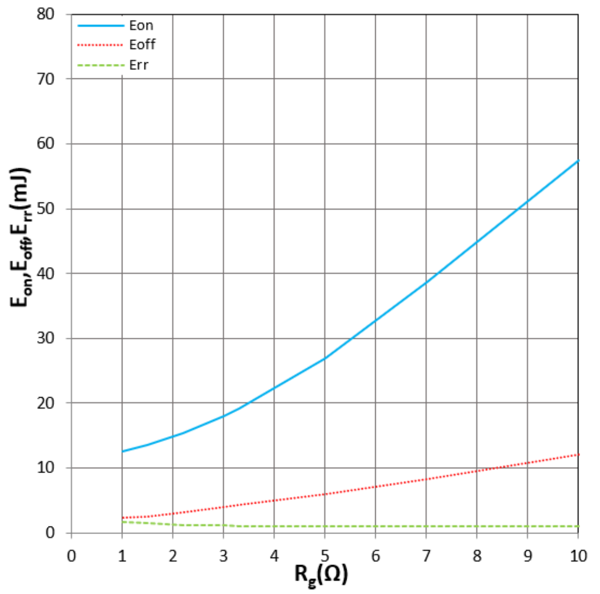

Figure 13. E_{on}, E_{off}, E_{rr} vs R_g

T_j =25°C, V_{DD} =600V, V_{GS} =+18V/-5V, I_D =800A

Inductive Load

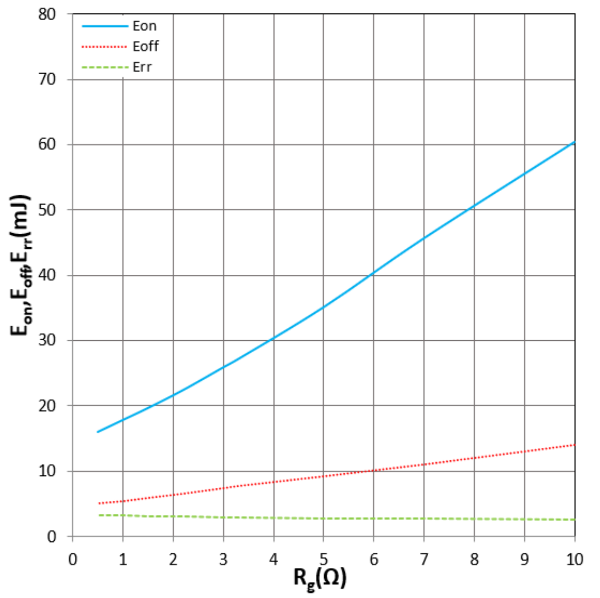

Figure 14. E_{on}, E_{off} , E_{rr} vs R_g

T_j =150°C, V_{DD}=600V, V_{GS} =+18V/-5V, I_D =800A

Inductive Load

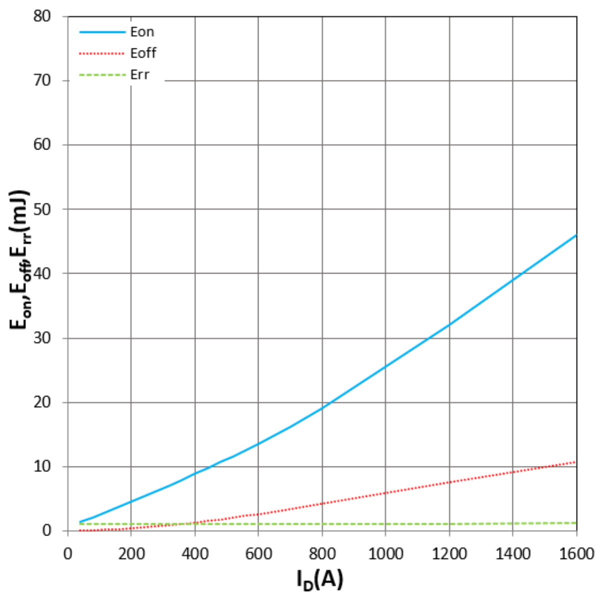

Figure 15. E_{on}, E_{off}, E_{rr} vs I_D

T_j =25°C, V_{DD} =600V, V_{GS} =+18V/-5V, R_g =3.3Ω

Inductive Load

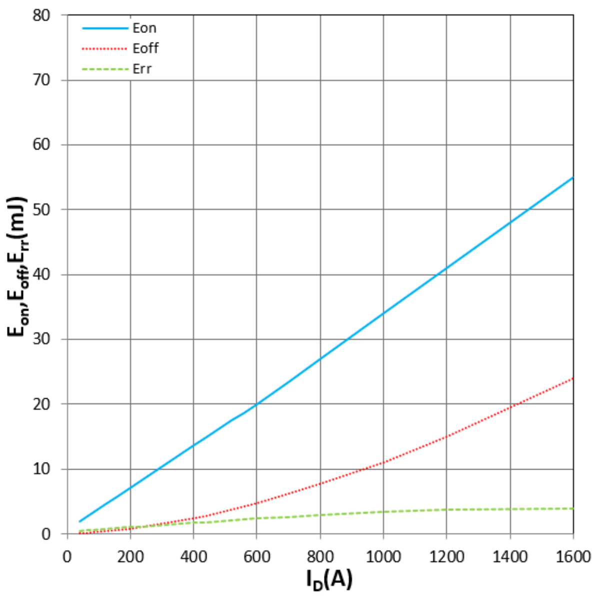

Figure 16. E_{on}, E_{off}, E_{rr} vs I_D

T_j =150°C, V_{DD} =600V, V_{GS} =+18V/-5V, R_g =3.3Ω

Inductive Load

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