DFS200HF12DFC2

1200V/200A Half Bridge SiC MOSFET Module

Description

The DFS200HF12DFC1 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:1200V
- $R_{ds(on)}$ =9.1mΩ
- Low thermal resistance with Si_3N_4 AMB
- 175°C maximum junction temperature
- 62mm half bridge module

Applications

- Motor Drives
- Vehicle Fast Chargers
- Renewable energy
- UPS

Circuit diagram

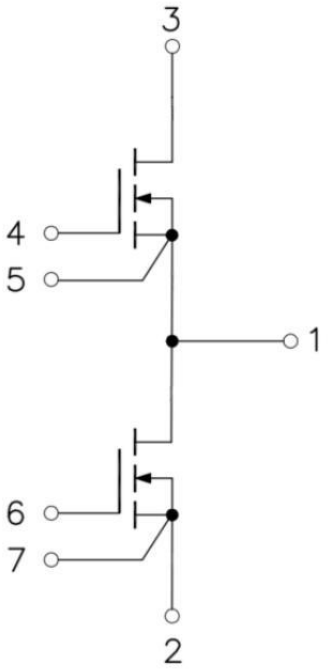

Figure 1. Out drawing & circuit diagram for DFS200HF12DFC2

Pin Configuration and Marking Information

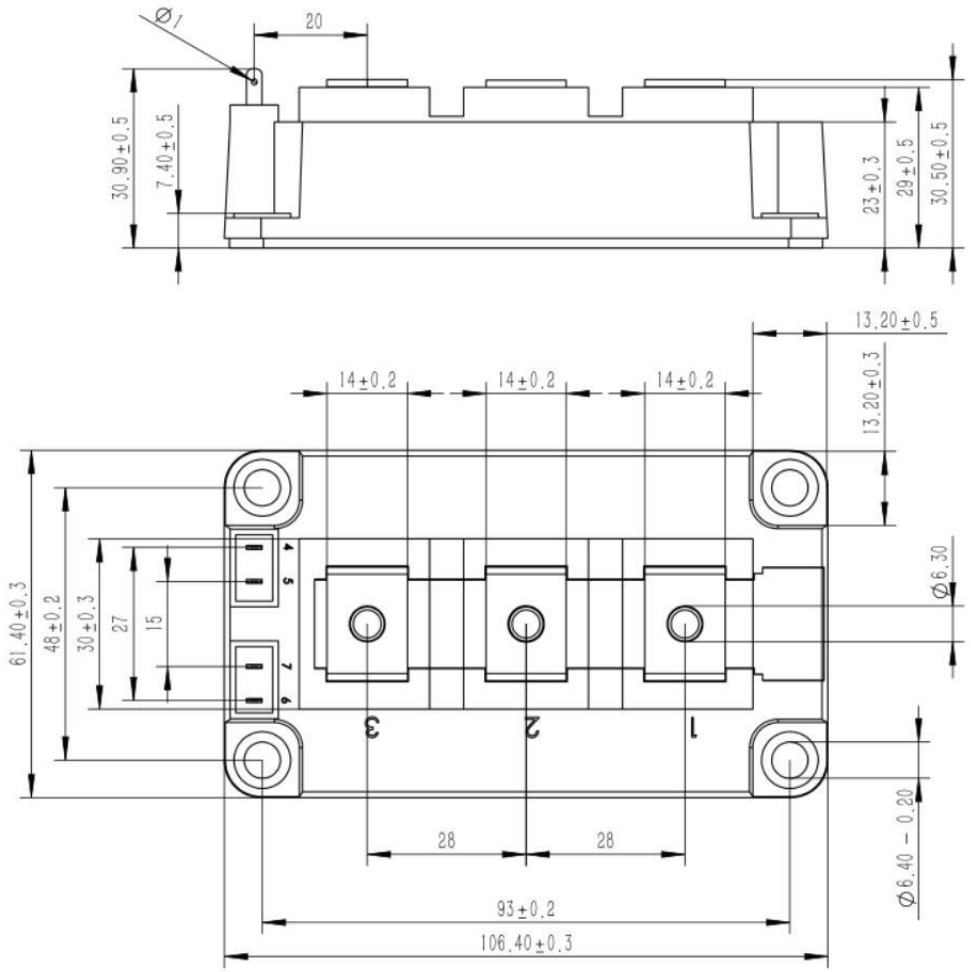

Figure 2. Pin configuration

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 10	mm
Clearance	terminal to heatsink terminal to terminal	12.5 10	mm
CTI	-	200	-
Module lead resistance, terminals – chip	T_C =25 °C	0.6	mΩ
Mounting torque for module mounting	M6	4 to 6	Nm
Weight	-	320	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-Sourse Voltage	D-S Short, AC frequency ⩾1Hz, Note1	-10 to 22	V
I_{DS}	DC Continuous Drain Current	T_C =25°C , V_{GS} =18V	245	A
I_{DS}	DC Continuous Drain Current	T_C =80°C , V_{GS} =18V	200	A
I_{SD}	Source-Drain Current(diode)	T_C =25°C, with ON signal	245	A
I_{SD}	Source-Drain Current(diode)	T_C =80°C, with ON signal	200	A
I_{DSM}	Pulse Drain Current	T_C =25°C, Pulse width =1ms, V_{GS} =18V, Note2	400	A
P_{tot}	Total Power Dissipation	T_C =25°C	785	W
T_{jmax}	Max Junction Temperature	-	175	°C
T_{stg}	Storage Temperature	-	-40 to 125	°C

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

Note2: Pulse width limited by maximum junction temperature

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 =200uA		1200	-	-	V
I_{DSS}	Zero gate voltage drain Current	V_{DS}=1200V, V_{GS}=0V		-	2	-	μA
$V_{GS(th)}$	Gate-source threshold Voltage	I_D=70mA, V_{DS}=V_{GS}	T_j =25°C	1.8	2.7	-	V
			T_j=175°C	-	2.05	-	V
I_{GSS}	Gate-Source Leakage Current	V_{GS}=20V, V_{DS}=0V	T_j =25°C	-	-	200	nA
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	I_D=200A V_{GS}=+15V	T_j=25°C	-	10.4	-	mΩ
			T_j=175°C	-	14.4	-	mΩ
		I_D=200A V_{GS}=+18V	T_j=25°C	-	9.1	-	mΩ
			T_j=175°C	-	12.7	-	mΩ
$V_{DS(on)}$ (Chip)	Static drain-source On-state Voltage	I_D=200A V_{GS}=+15V	T_j=25°C	-	2.08	-	V
			T_j=175°C	-	2.88	-	V
		I_D=200A V_{GS}=+18V	T_j=25°C	-	1.82	-	V
			T_j=175°C	-	2.54	-	V
C_{iss}	Input Capacitance	V_D=800V, V_{GS}=0V f=100kHz, V_{AC}=25mV		-	11628	-	pF
C_{oss}	Output Capacitance			-	354	-	pF
C_{rss}	Reverse transfer Capacitance			-	29	-	pF
R_{Gint}	Internal gate resistor	f=100kHz, V_{AC}=25mV		-	3.2	-	Ω
Q_g	Total gate charge	V_{DD}=800V, I_D=120A, V_{GS}=+18/-4V		-	420	-	nC
$t_{d(on)}$	Turn-on delay time	V_{DD}=600V I_D=200A V_{GS}=+18/-4V R_{gon}/R_{goff}=5.0Ω/5.0Ω	T_j =25°C	-	79	-	ns
			T_j =150°C	-	74	-	
t_r	Rise time		T_j =25°C	-	52	-	ns
			T_j =150°C	-	49	-	
$t_{d(off)}$	Turn-off delay time		T_j =25°C	-	180	-	ns
			T_j =150°C	-	192	-	
t_f	Fall time		T_j=25°C	-	46	-	ns

		Inductive load switching operation	T_j =150°C	-	53	-	
E_{on}	Turn-on power dissipation		T_j =25°C	-	3.20	-	mJ
			T_j =150°C	-	3.64	-	
E_{off}	Turn-off power dissipation		T_j =25°C	-	4.93	-	mJ
			T_j =150°C	-	5.16	-	
$R_{th(j-c)}$	FET Thermal Resistance	Junction to Case		-	0.19	-	°C /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} =-5V I_{SD} =200A	T_j=25°C	-	6.3	-	V
			T_j=175°C	-	5.6	-	
T_{rr}	Reverse recovery time	V_{DD}=600V I_D=200A V_{GS}=+18/-4V R_{gon}/R_{goff}=5.0Ω/5.0Ω Inductive load switching operation	T_j=25°C	-	26	-	ns
			T_j=150°C	-	52	-	
Q_{rr}	Reverse recovery charge		T_j=25°C	-	1.2	-	uC
			T_j=150°C	-	4.6	-	
E_{rr}	Diode switching power dissipation		T_j=25°C	-	0.40	-	mJ
			T_j=150°C	-	1.03	-	

Test Conditions

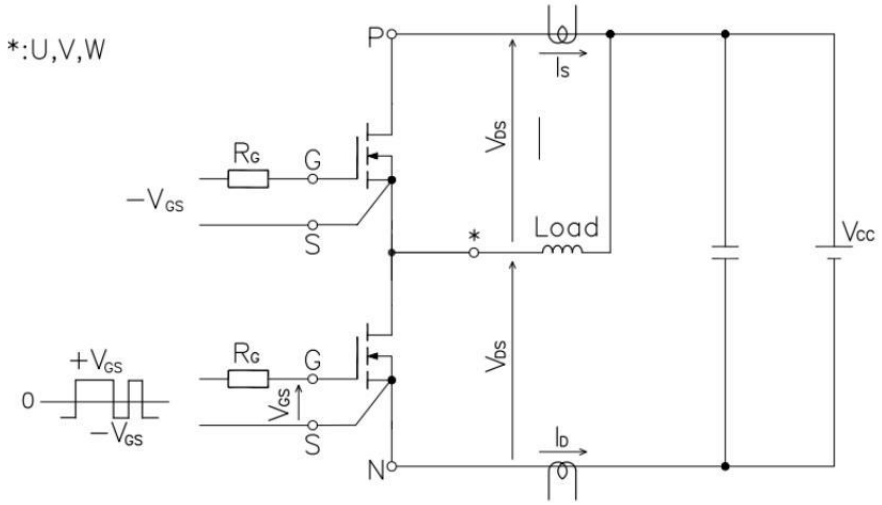

Figure 3. Switching time measure circuit

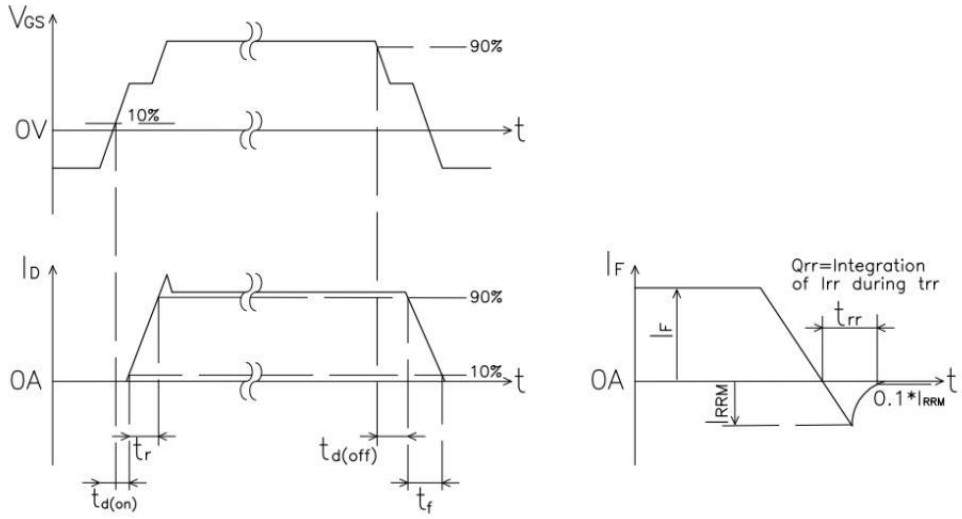

Figure 4. Switching time definition

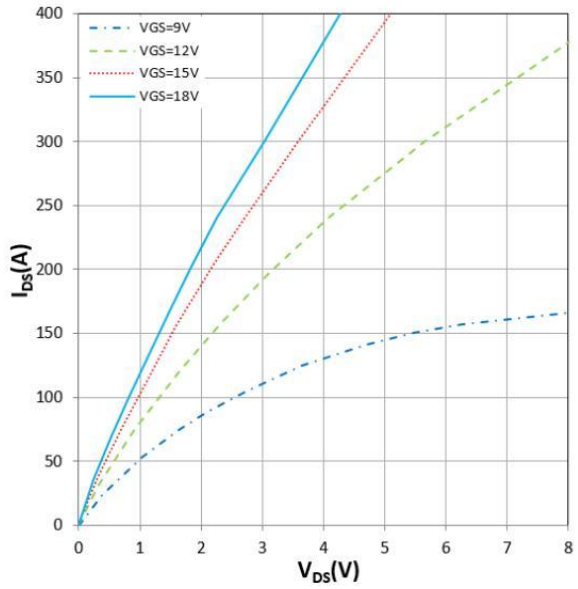

Figure 5. I_{DS} vs V_{DS}

T_j =25°C

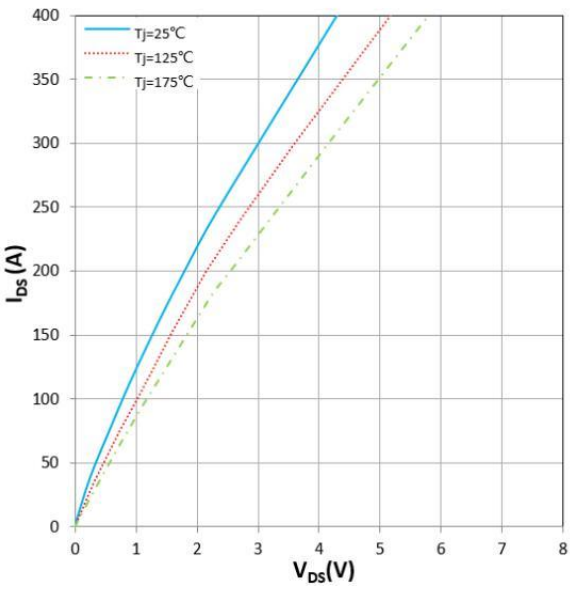

Figure 6. I_{DS} vs V_{DS}

V_{GS} =+18V

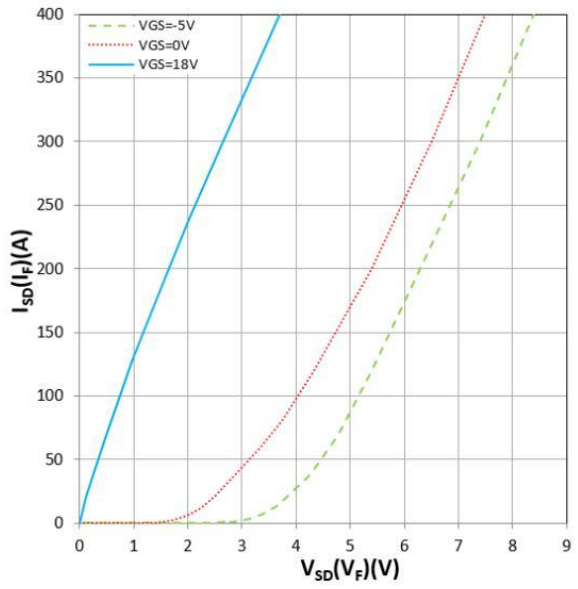

Figure 7. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$

T_j =25°C, V_{GS} parameter

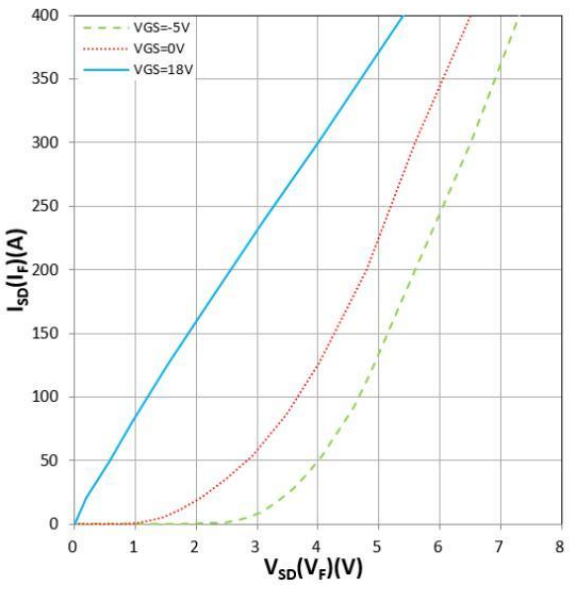

Figure 8. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$

T_j =175°C, V_{GS} parameter

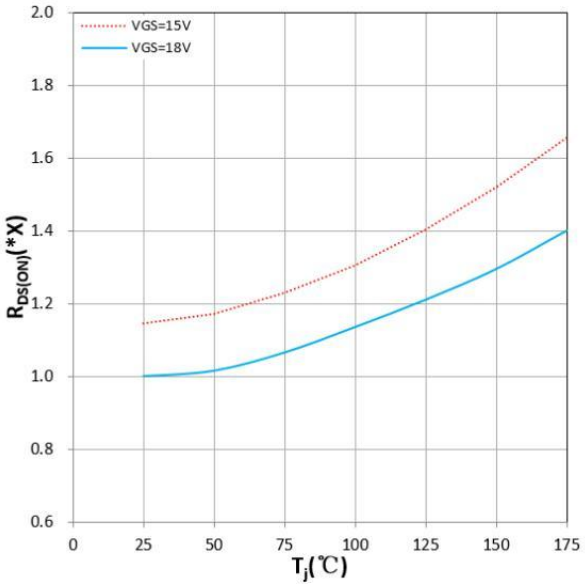

Figure 9. $R_{DS(ON)}$ vs T_j

V_{GS} =+15V/+18V, I_D =200A, 1.0X =9.1mΩ

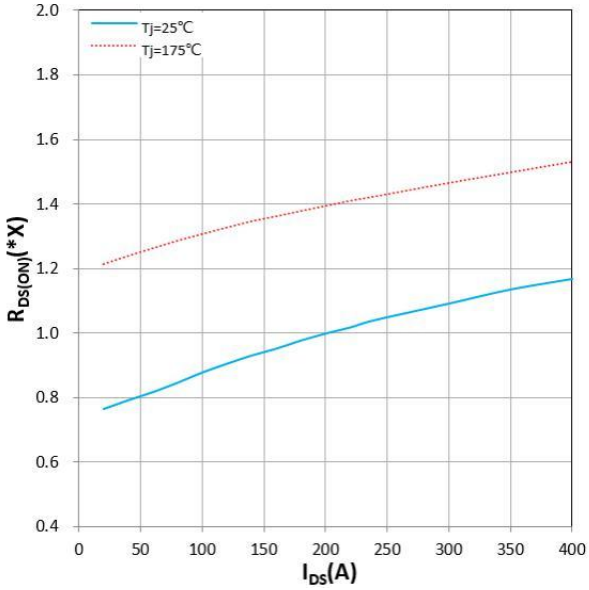

Figure 10. $R_{DS(ON)}$ vs I_{DS}

V_{GS} =+18V , 1.0X =9.1mΩ

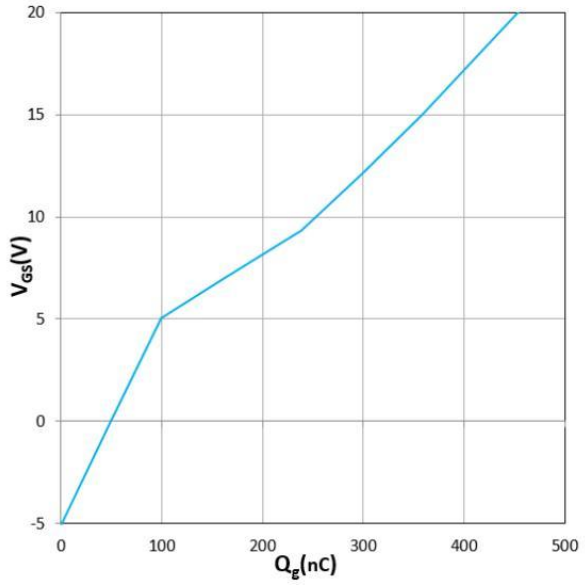

Figure 11. V_{GS} vs Q_g

V_{DS} =800V, I_D =120A, T_j =25°C

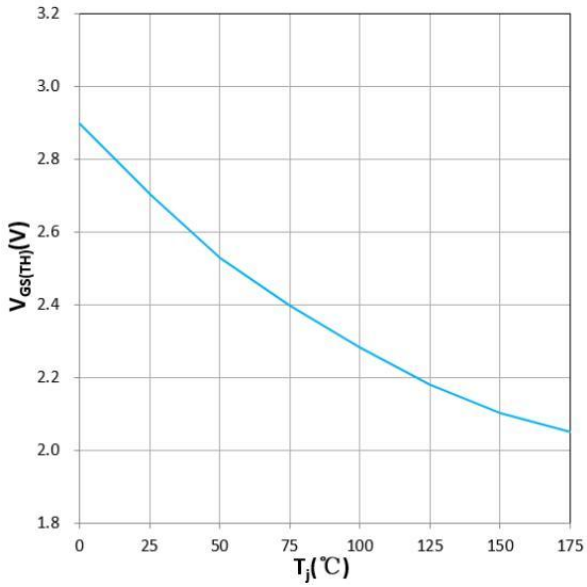

Figure 12. $V_{GS(TH)}$ vs T_j

V_{GS} =V_{DS}, I_D =70mA

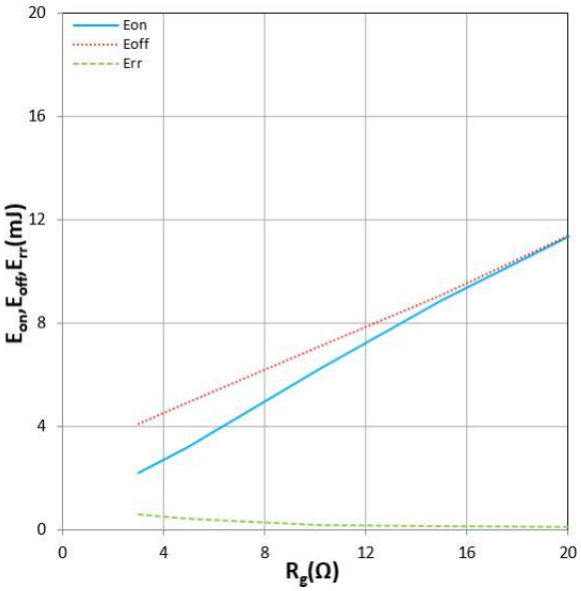

Figure 13. E_{on}, E_{off}, E_{rr} vs R_g
T_j=25°C, V_{DD} =600V, V_{GS} =+18V/-4V, I_D =200A
Inductive Load

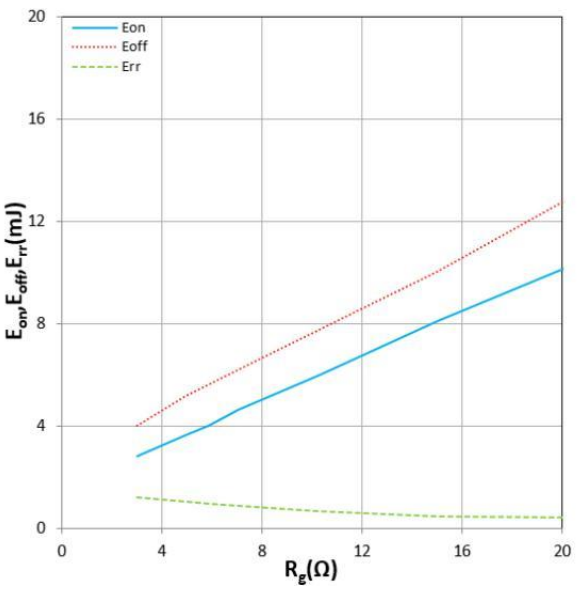

Figure 14. E_{on}, E_{off}, E_{rr} vs R_g
T_j=150°C, V_{DD} =600V, V_{GS} =+18V/-4V, I_D =200A
Inductive Load

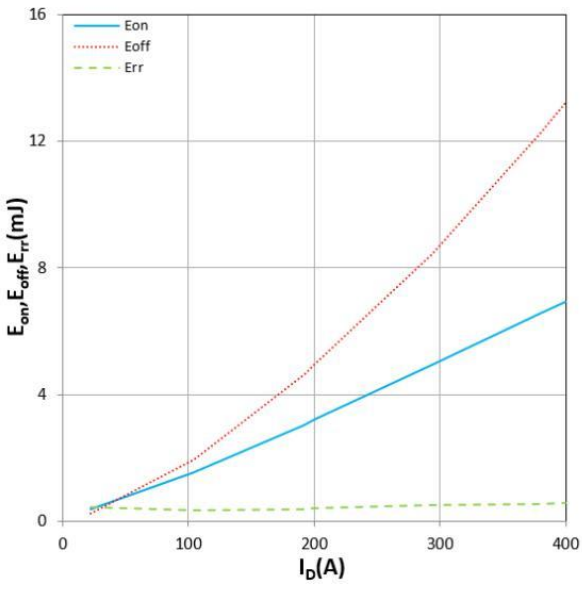

Figure 15. E_{on}, E_{off}, E_{rr} vs I_{DS}
T_j=25°C, V_{DD} =600V, V_{GS} =+18V/-4V
R_{gon}/R_{goff} =5.0Ω/5.0Ω, Inductive Load

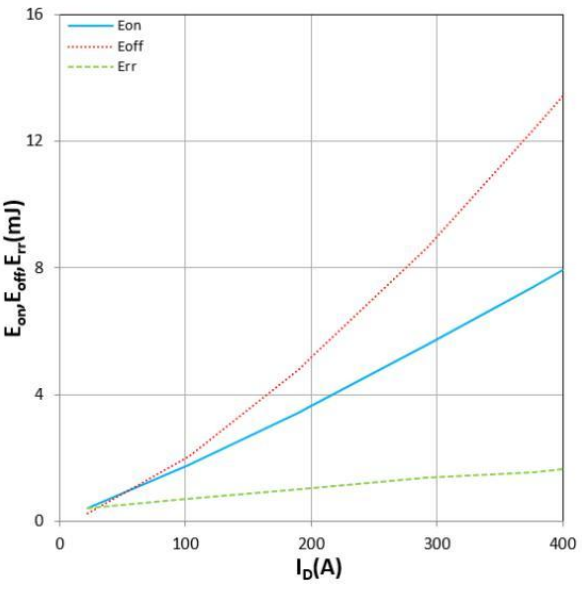

Figure 16. E_{on}, E_{off}, E_{rr} vs I_{DS}
T_j=150°C, V_{DD} =600V, V_{GS} =+18V/-4V
R_{gon}/R_{goff} =5.0Ω/5.0Ω, Inductive Load

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