DFS300HF17I3C2

1700V/300A Half Bridge SiC MOSFET Module

Description

The DFS300HF17I3C2 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
- $R_{DS(on)}$ =6.7mΩ @ T_j =25°C
- Low thermal resistance with Si_3N_4 AMB
- 175°C maximum junction temperature
- Low Inductive Design
- Thermistor inside
- Copper base size: 79mmx62mm

Applications

- Motor Drives
- Servo Drives
- UPS Systems
- Smart-Grid/Grid-Tied Distributed Generation

Circuit diagram

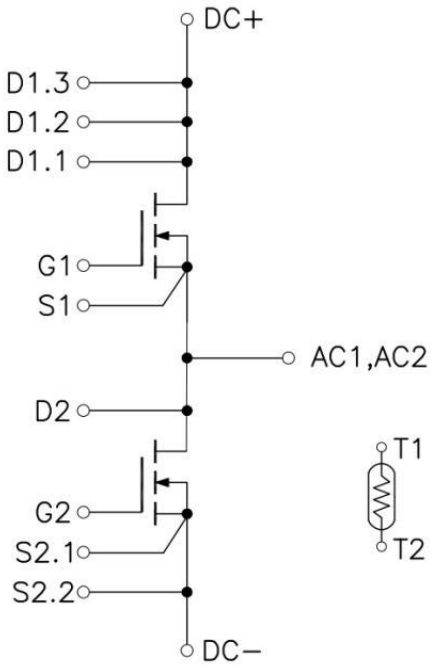

Figure 1. Out drawing & circuit diagram for DFS300HF17I3C2

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

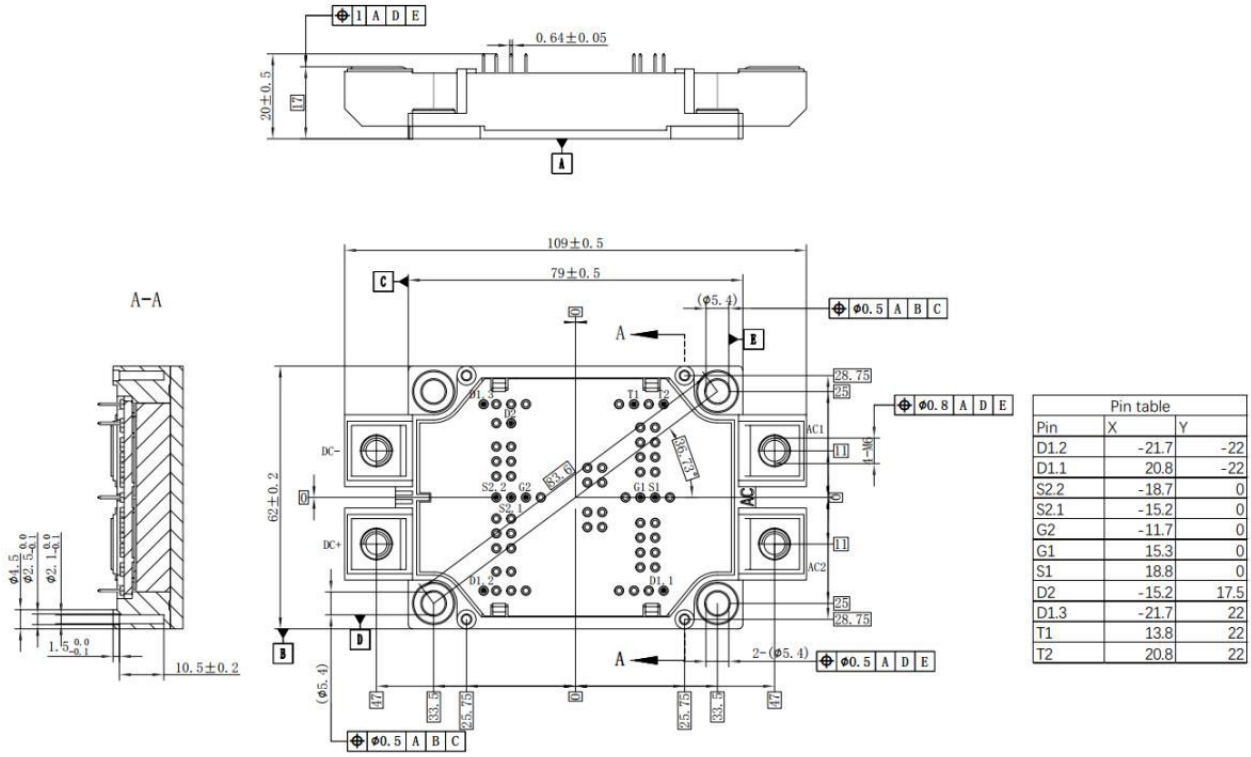

Figure 2. Pin configuration

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 10	mm
Clearance	terminal to heatsink terminal to terminal	12.5 10	mm
CTI	-	600	-
Module lead resistance, terminals-chip	T_C =25°C	0.5	mΩ

Mounting torque for module mounting	M5, M6	3 to 6	Nm
Weight	-	260	g

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

Symbol	Parameter	Conditions	Ratings	Unit
V_{DSS}	Drain-Source Voltage	G-S Short	1700	V
V_{GSS}	Gate-Source Voltage (+)	D-S Short	20	V
V_{GSS}	Gate-Source Voltage (-)	D-S Short	-10	V
$V_{GSSSurge}$	G-S Voltage(t_{surge} <300nsec)	D-S Short, Note1	-10 to 20	V
I_{DS}	DC Continuous Drain Current	T_f=25°C, V_{GS} =15V	320	A
I_{DS}	DC Continuous Drain Current	T_f=60°C, V_{GS} =15V	280	A
I_{SD}	Source (Body diode) Current	T_f=25°C, with ON signal	320	A
I_{SD}	Source (Body diode) Current	T_f=80°C, with ON signal	280	A
I_{DSM}	Pulse Forward Current	T_C =25°C, Pulse width =1ms, Note2	600	A
P_{tot}	Total Power Dissipation	T_C =25°C	1923	W
T_{jmax}	Max Junction Temperature	-	175	°C
T_{stg}	Storage Temperature	-	-55 to 125	°C

Note1: Recommended Operating Value, +15V/-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			Unit
				Min.	Typ.	Max.	
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS} =0V, I_D =300μA		1700	-	-	V
I_{DSS}	Zero gate voltage drain Current	V_{DS}=1700V, V_{GS}=0V		-	-	1	mA
I_{GSS}	Gate-Source Leakage Current	V_{GS} =20V, V_{DS} =0V		-	-	300	nA
		V_{GS} =-10V, V_{DS} =0V		-	-	-300	nA
$V_{GS(th)}$	Gate-source threshold Voltage	I_D=180mA V_{DS}=V_{GS}	T_j =25°C	1.80	2.70	-	V
			T_j=175°C	-	1.90	-	V
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	I_D=300A V_{GS}=15V	T_j=25°C	-	6.70	-	mΩ
			T_j=175°C	-	15.5	-	mΩ
$V_{DS(on)}$ (Chip)	Static drain-source On-state Voltage	I_D=300A V_{GS}=15V	T_j=25°C	-	2.01	-	V
			T_j=175°C	-	4.65	-	V
C_{iss}	Input Capacitance	V_D=1000V, V_{GS}=0V f=1MHz, V_{AC}=25mV		-	22.9	-	nF
C_{oss}	Output Capacitance			-	0.62	-	nF
C_{rss}	Reverse transfer Capacitance			-	0.11	-	nF
Q_g	Total gate charge	V_{DD}=1000V I_D=225A V_{GS}=+15/-5V		-	768	-	nC
Q_{gd}	Gate-Drain Charge			-	270	-	nC
Q_{gs}	Gate-Source Charge			-	231	-	nC
R_{Gint}	Internal Gate Resistance	T_j =25°C		-	1.6	-	Ω
$t_{d(on)}$	Turn-on delay time	V_{DD}=900V I_D=300A V_{GS}=+15/-5V $R_{G(on)}$=6.8Ω $R_{G(off)}$=6.8Ω	T_j=25°C	-	157	-	ns
			T_j=150°C	-	119	-	
t_r	Rise time		T_j=25°C	-	116	-	ns
			T_j=150°C	-	97	-	
$t_{d(off)}$	Turn-off delay time		T_j=25°C	-	497	-	ns
			T_j=150°C	-	596	-	
t_f	Fall time		T_j=25°C	-	71	-	ns
			T_j=150°C	-	93	-	

E_{on}	Turn-on power dissipation	Inductive load switching operation	T_j =25°C	-	45.1	-	mJ
			T_j =150°C	-	38.5	-	
E_{off}	Turn-off power dissipation		T_j =25°C	-	40.2	-	mJ
			T_j =150°C	-	43.6	-	
$R_{th(j-c)}$	FET Thermal Resistance	Junction to Case		-	0.078	-	K/W
$R_{th(c-f)}$	Contact thermal Resistance	With thermal conductive grease, Note1		-	0.015	-	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} = -5V I_{SD} =300A	T_j =25°C	-	5.6	-	V
			T_j =175°C	-	5.3	-	
T_{rr}	Reverse recovery time	V_{RR} =900V, I_D =300A MOSFET side: V_{GS} =+15/-5V $R_{G(on)}$ = $R_{G(off)}$ =6.8Ω Inductive load switching operation	T_j =25°C	-	41	-	ns
			T_j =150°C	-	138	-	
Q_{rr}	Reverse recovery charge		T_j =25°C	-	2.11	-	μC
			T_j =150°C	-	9.25	-	
E_{rr}	Diode switching power dissipation		T_j =25°C	-	0.45	-	mJ
			T_j =150°C	-	3.52	-	

Test Conditions

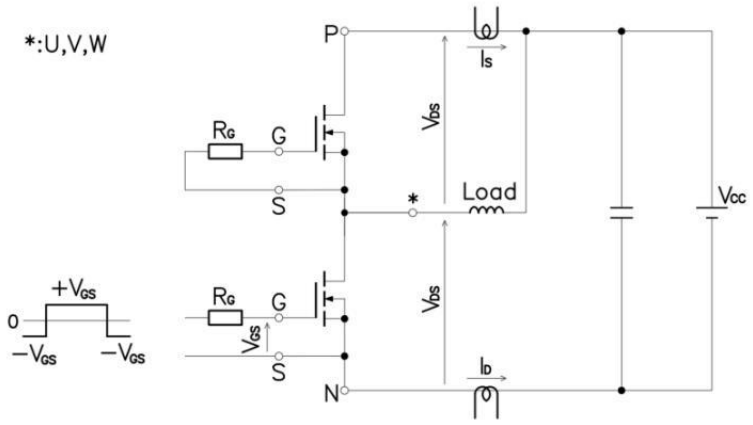

Figure 3. Switching time measure circuit

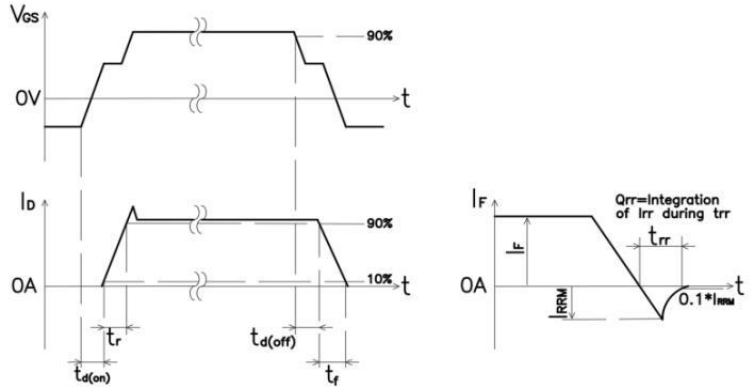

Figure 4. Switching time definition

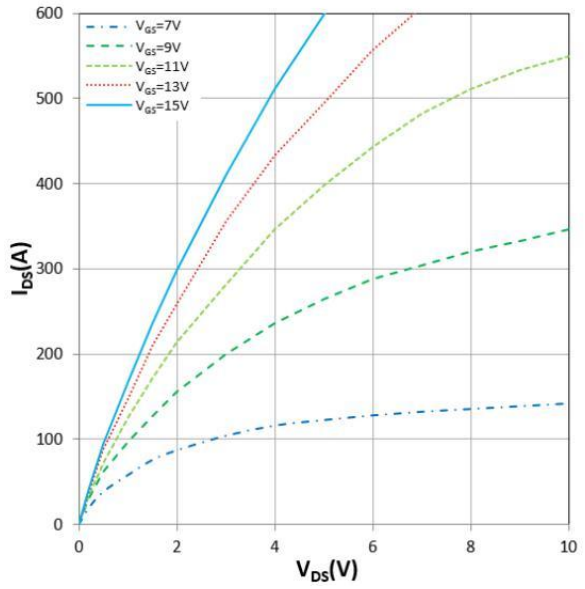

Figure 5. I_{DS} vs V_{DS}
T_j=25°C, V_{GS} parameter

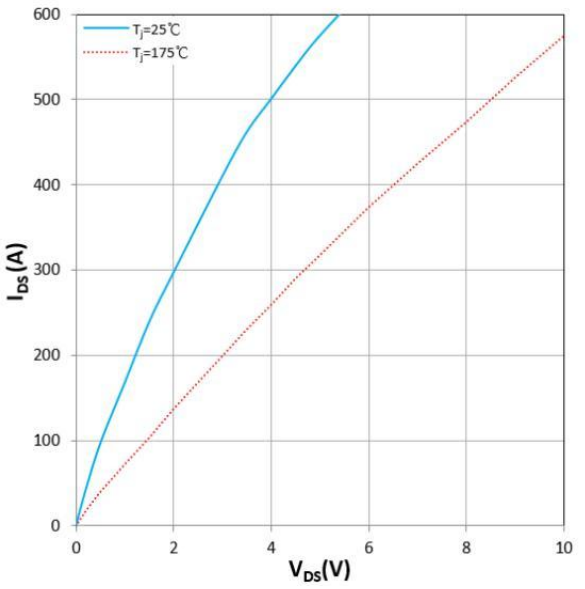

Figure 6. I_{DS} vs V_{DS}
V_{GS}=15V, T_j parameter

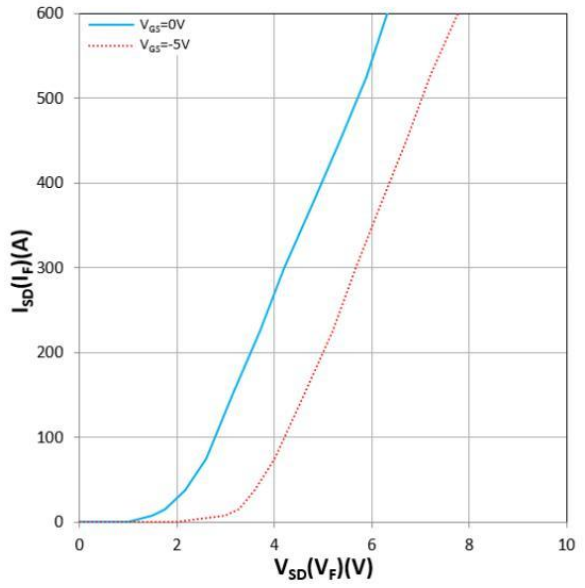

Figure 7. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
T_j=25°C, V_{GS} parameter

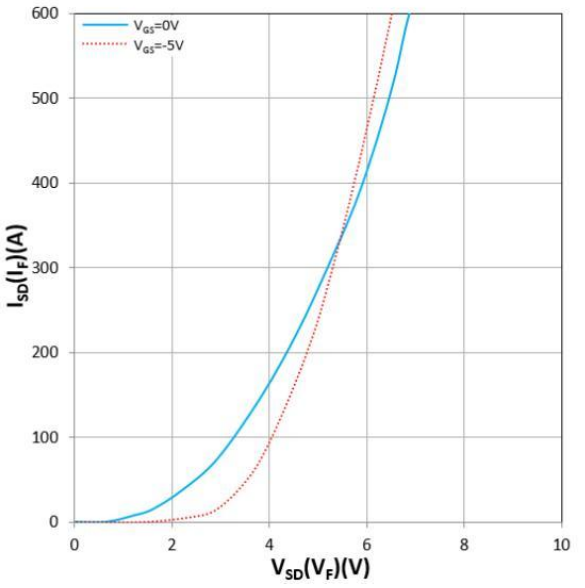

Figure 8. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
T_j=175°C, V_{GS} parameter

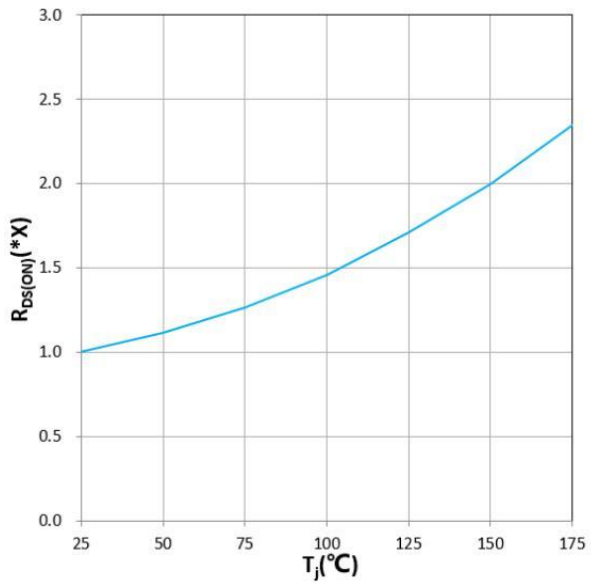

Figure 9. $R_{DS(ON)}$ vs T_j

V_{GS} =+15V, I_D =300A, 1.0X =6.70mΩ

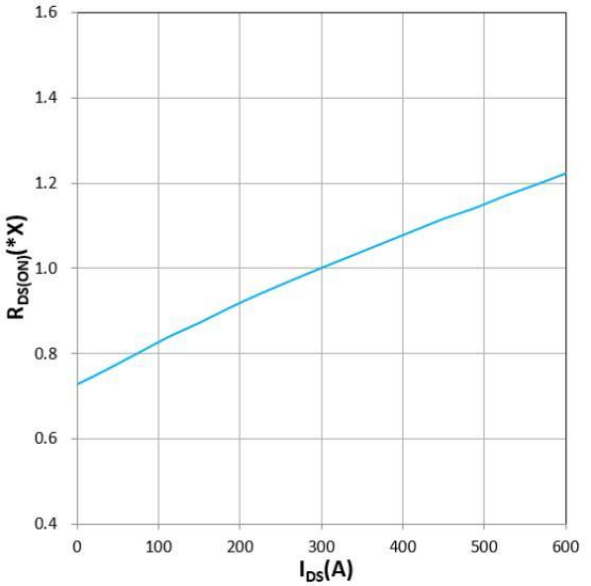

Figure 10. $R_{DS(ON)}$ vs I_{DS}

T_j =25°C,V_{GS} =+15V, 1.0X =6.70mΩ

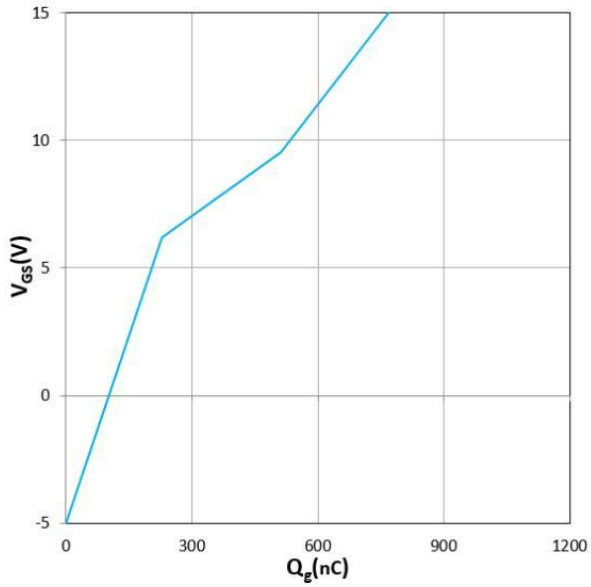

Figure 11. V_{GS} vs Q_g

T_j =25°C, V_{DS} =1000V, I_D =225A

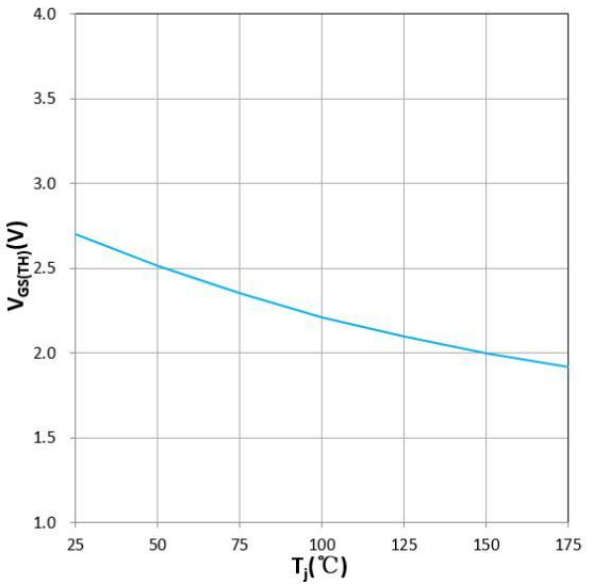

Figure 12. $V_{GS(TH)}$ vs T_j

V_{GS} =V_{DS} , I_D =180mA

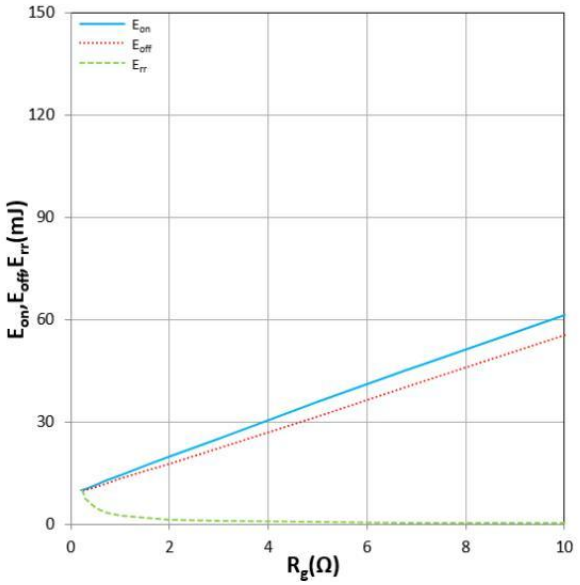

Figure 13. E_{on}, E_{off}, E_{rr} vs R_g

T_j=25°C, V_{DD}=900V, V_{GS}=+15V/-5V, I_D=300A

Inductive Load

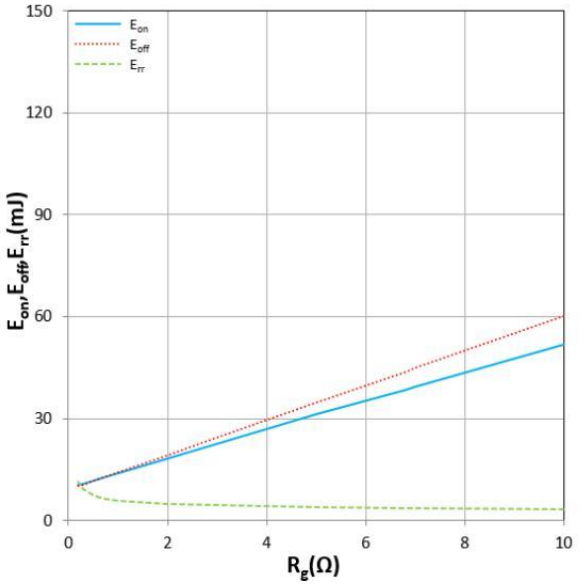

Figure 14. E_{on}, E_{off}, E_{rr} vs R_g

T_j=150°C, V_{DD}=900V, V_{GS}=+15V/-5V, I_D=300A

Inductive Load

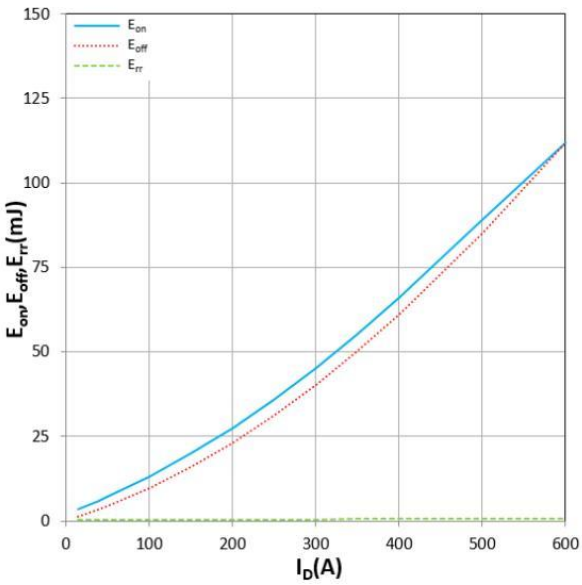

Figure 15. E_{on}, E_{off}, E_{rr} vs I_D

T_j=25°C, V_{DD}=900V, V_{GS}=+15V/-5V, R_g=6.8Ω

Inductive Load

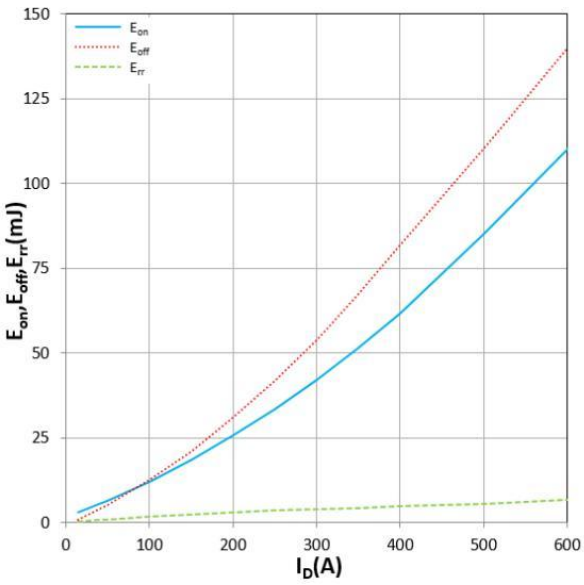

Figure 16. E_{on}, E_{off}, E_{rr} vs I_D

T_j=150°C, V_{DD}=900V, V_{GS}=+15V/-5V, R_g=6.8Ω

Inductive Load

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