

Description

The DFS400HF17I3C2 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
- $R_{DS(on)} = 5.2m\Omega @ T_j = 25^\circ C$
- Low thermal resistance with Si_3N_4 AMB
- $175^\circ C$ 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

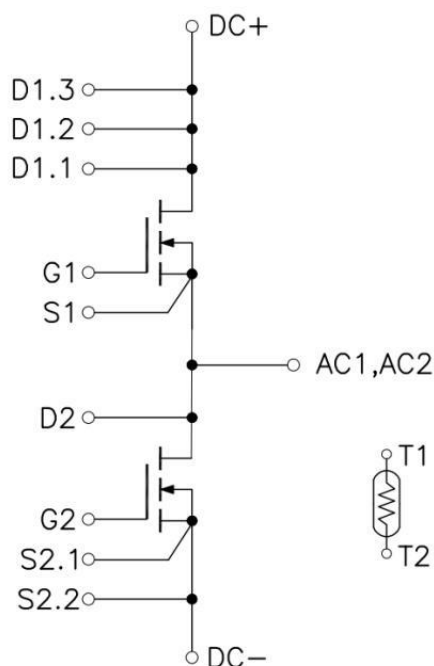


Figure 1. Out drawing & circuit diagram for DFS400HF17I3C2

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

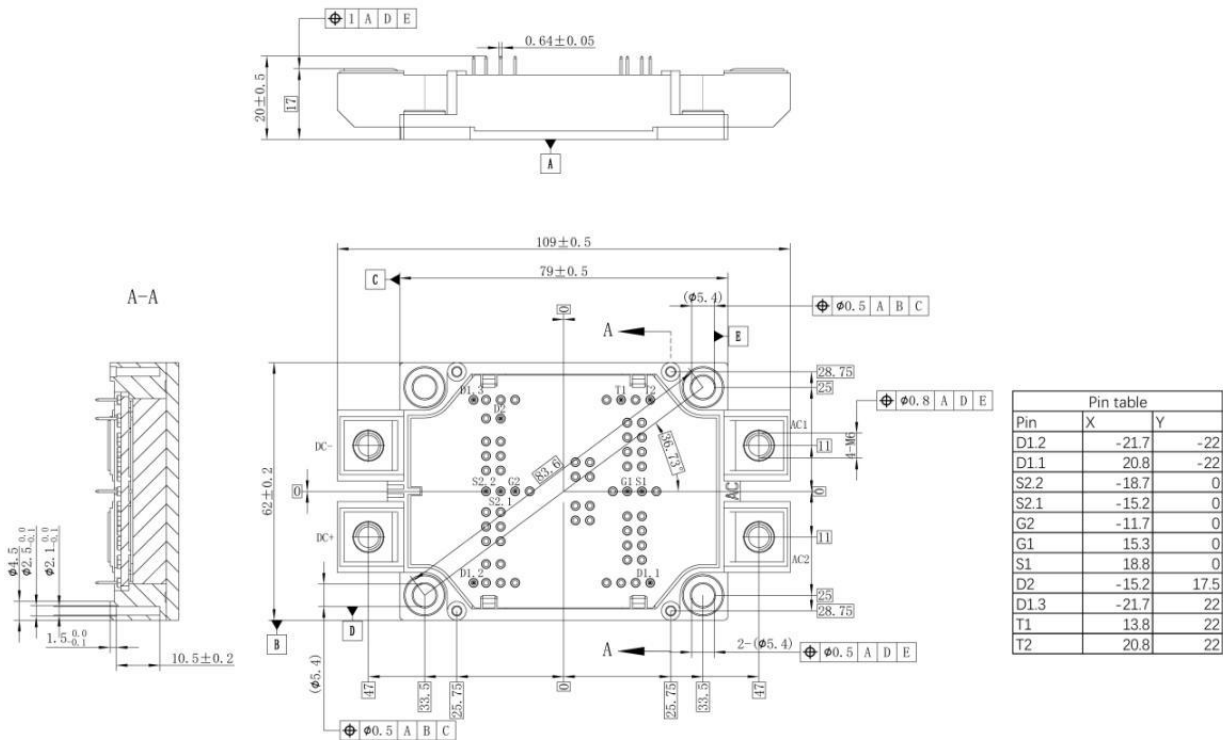


Figure 2. Pin configuration

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	mm

		10	
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 ($T_j = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{DS}	Drain-Source Voltage	G-S Short	1700	V
V_{GS}	Gate-Source Voltage (+)	D-S Short	20	V
V_{GS}	Gate-Source Voltage (-)	D-S Short	-10	V
$V_{GSSurge}$	G-S Voltage($t_{surge} < 300\text{nsec}$)	D-S Short, Note1	-10 to 20	V
I_{DS}	DC Continuous Drain Current	$T_f = 25^\circ\text{C}$, $V_{GS} = 15\text{V}$	420	A
I_{DS}	DC Continuous Drain Current	$T_f = 60^\circ\text{C}$, $V_{GS} = 15\text{V}$	365	A
I_{SD}	Source (Body diode) Current	$T_f = 25^\circ\text{C}$, with ON signal	420	A
I_{SD}	Source (Body diode) Current	$T_f = 60^\circ\text{C}$, with ON signal	365	A
I_{DSM}	Pulse Forward Current	$T_c = 25^\circ\text{C}$, Pulse width = 1ms, Note2	800	A
P_{tot}	Total Power Dissipation	$T_c = 25^\circ\text{C}$	2586	W
T_{jmax}	Max Junction Temperature	-	175	$^\circ\text{C}$
T_{stg}	Storage Temperature	-	-40 to 125	$^\circ\text{C}$

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	$T_c = 25^\circ\text{C}$	-	5	-	k Ω
$\Delta R/R$	Deviation of R_{100}	$T_c = 100^\circ\text{C}$, $R_{100} = 493\Omega$	-5	-	5	%
P_{25}	Power dissipation	$T_c = 25^\circ\text{C}$	-	-	20	mW
$B_{25/50}$	B-value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298,15 \text{ K}))]$	-	3375	-	K
$B_{25/80}$	B-value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298,15 \text{ K}))]$	-	3411	-	K
$B_{25/100}$	B-value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298,15 \text{ K}))]$	-	3433	-	K

Preliminary datasheet_Ver.F EN

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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 =400μA		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} =15V, V _{DS} =0V		-	-	400	nA
		V _{GS} =-10V, V _{DS} =0V		-	-	-400	nA
V _{GS(th)}	Gate-source threshold Voltage	I _D =240mA 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	I _D =400A	T _j =25°C	-	5.20	-	mΩ
	On-state resistance	V _{GS} =15V	T _j =175°C	-	11.6	-	mΩ
V _{DS(on)} (Chip)	Static drain-source	I _D =400A	T _j =25°C	-	2.08	-	V
	On-state Voltage	V _{GS} =15V	T _j =175°C	-	4.64	-	V
C _{iss}	Input Capacitance	V _D =1000V, V _{GS} =0V f =1MHz, V _{AC} =25mV		-	30.5	-	nF
C _{oss}	Output Capacitance			-	0.82	-	nF
C _{rss}	Reverse transfer Capacitance			-	0.15	-	nF
Q _g	Total gate charge	V _{DD} =1000V		-	1024	-	nC
Q _{gd}	Gate-Drain Charge	I _D =300A		-	360	-	nC
Q _{gs}	Gate-Source Charge	V _{GS} =+15/-5V		-	308	-	nC
R _{Gint}	Internal Gate Resistance	T _j =25°C		-	1.2	-	Ω
t _{d(on)}	Turn-on delay time	V _{DD} =900V I _D =400A V _{GS} =+15/-5V R _{G(on)} =6.8Ω R _{G(off)} =6.8Ω	T _j =25°C	-	165	-	ns
			T _j =150°C	-	129	-	
t _r	Rise time		T _j =25°C	-	123	-	ns
			T _j =150°C	-	93	-	
t _{d(off)}	Turn-off delay time		T _j =25°C	-	515	-	ns
			T _j =150°C	-	646	-	
t _f	Fall time		T _j =25°C	-	80	-	ns
			T _j =150°C	-	102	-	

E _{on}	Turn-on power dissipation	Inductive load switching operation	T _j =25°C	-	48.4	-	mJ
			T _j =150°C	-	40.7	-	
E _{off}	Turn-off power dissipation		T _j =25°C	-	46.1	-	mJ
			T _j =150°C	-	49.6	-	
R _{th(j-c)}	FET Thermal Resistance	Junction to Case		-	0.058	-	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 ($T_j=25^\circ\text{C}$ unless otherwise specified, chip)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V_{SD}	Body Diode Forward Voltage	$V_{GS} = -4\text{V}$ $I_{SD} = 400\text{A}$	$T_j = 25^\circ\text{C}$	-	5.5	-	V
			$T_j = 175^\circ\text{C}$	-	5.2	-	
T_{rr}	Reverse recovery time	$V_{RR} = 900\text{V}$, $I_D = 400\text{A}$ MOSFET side: $V_{GS} = +15/-5\text{V}$	$T_j = 25^\circ\text{C}$	-	46	-	ns
			$T_j = 150^\circ\text{C}$	-	147	-	
Q_{rr}	Reverse recovery charge	$R_{G(on)} = R_{G(off)} = 6.8\Omega$ Inductive load switching operation	$T_j = 25^\circ\text{C}$	-	2.2	-	μC
			$T_j = 150^\circ\text{C}$	-	11.1	-	
E_{rr}	Diode switching power dissipation	switching operation	$T_j = 25^\circ\text{C}$	-	0.5	-	mJ
			$T_j = 150^\circ\text{C}$	-	4.6	-	

Test Conditions

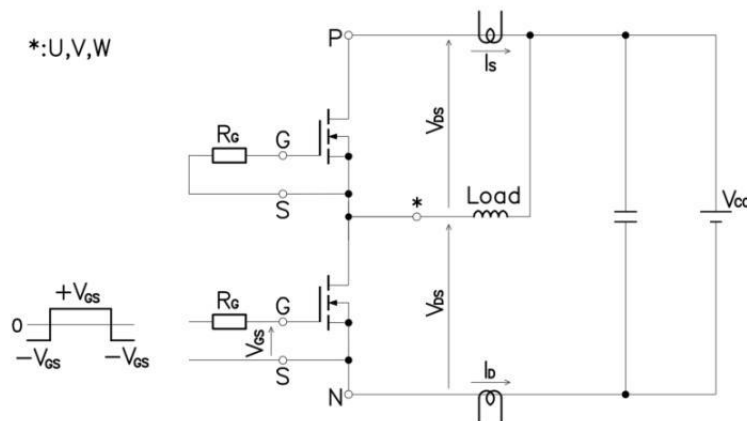


Figure 3. Switching time measure circuit

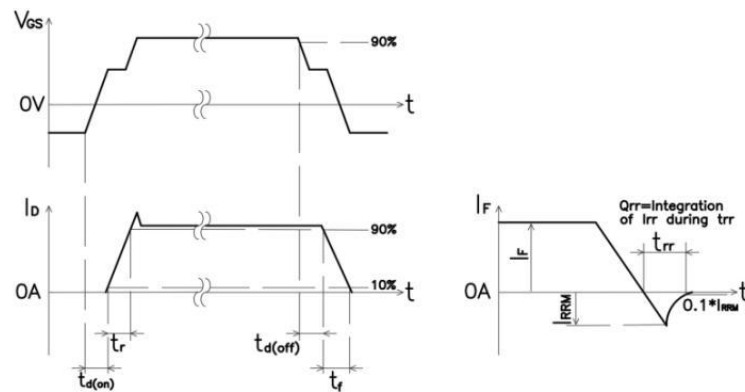


Figure 4. Switching time definition

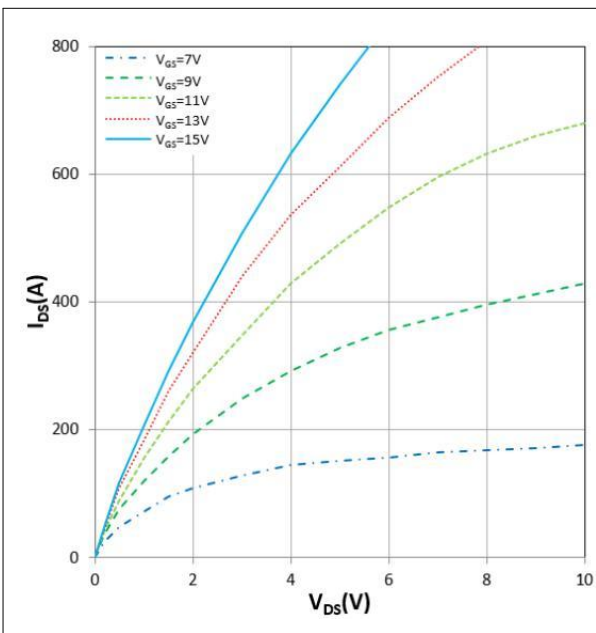


Figure 5. I_{DS} vs V_{DS}
 $T_j = 25^\circ\text{C}$, V_{GS} parameter

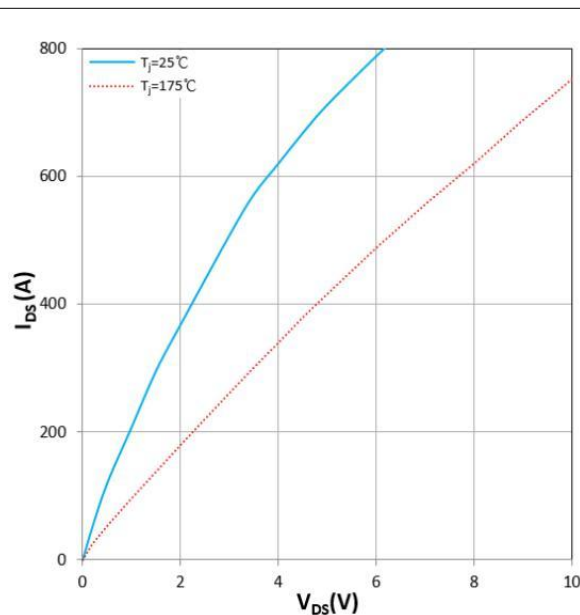


Figure 6. I_{DS} vs V_{DS}
 $V_{GS} = 15\text{V}$, T_j parameter

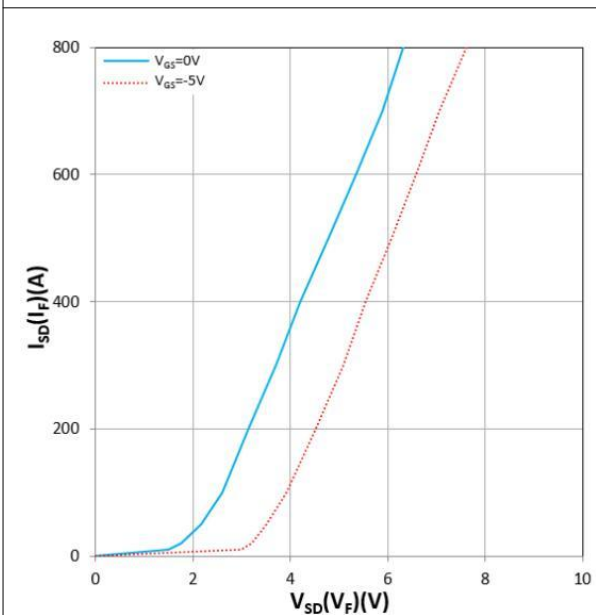


Figure 7. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
 $T_j = 25^\circ\text{C}$, V_{GS} parameter

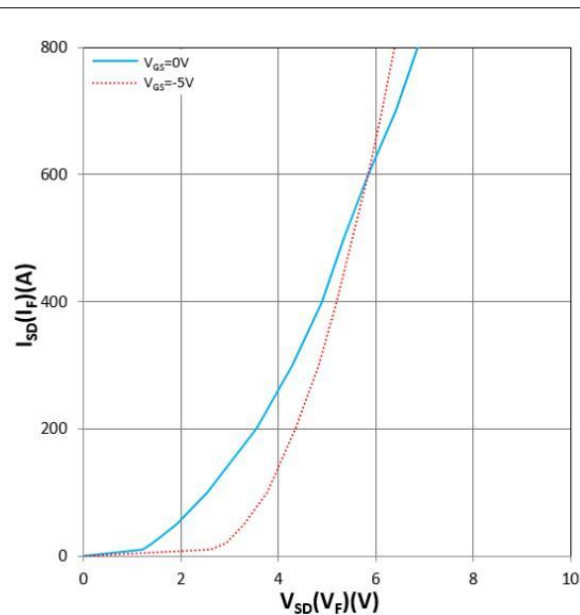


Figure 8. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
 $T_j = 175^\circ\text{C}$, V_{GS} parameter

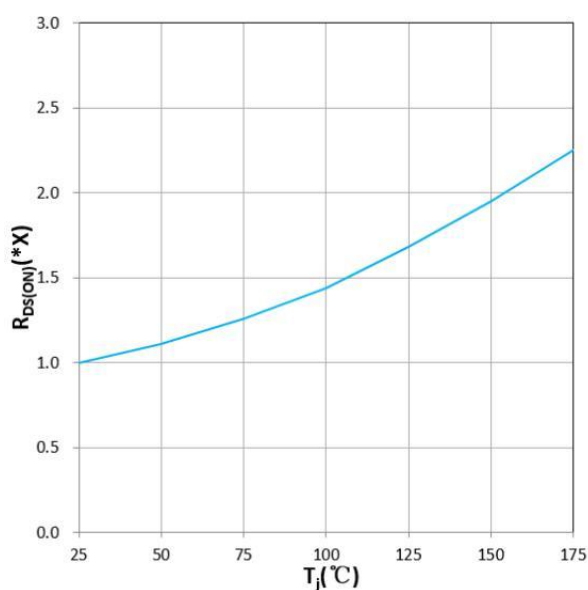


Figure 9. $R_{DS(ON)}$ vs T_j

$V_{GS}=+15\text{V}$, $I_D=400\text{A}$, $1.0X=5.2\text{m}\Omega$

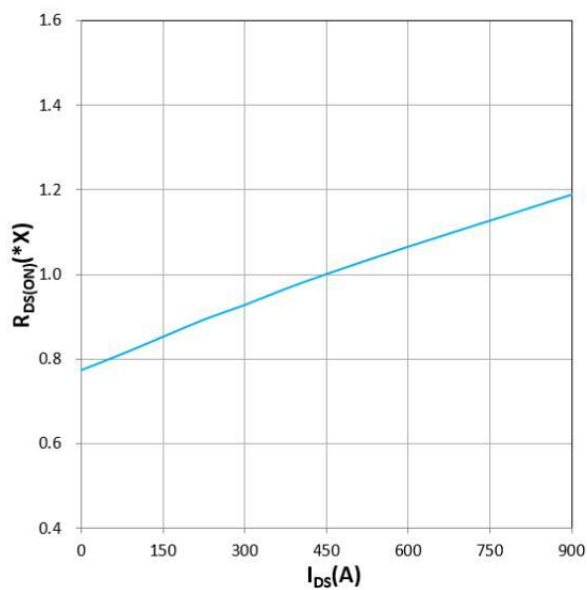


Figure 10. $R_{DS(ON)}$ vs I_{DS}

$T_j=25^{\circ}\text{C}$, $V_{GS}=+15\text{V}$, $1.0X=5.2\text{m}\Omega$

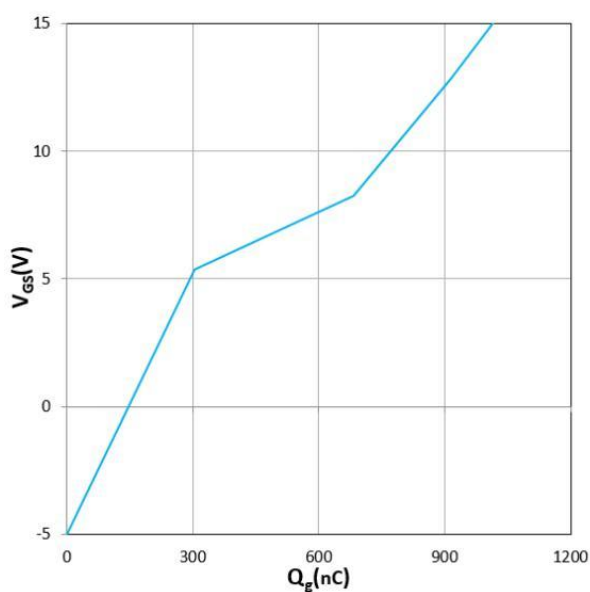


Figure 11. V_{GS} vs Q_g

$T_j=25^{\circ}\text{C}$, $V_{DS}=1000\text{V}$, $I_D=300\text{A}$

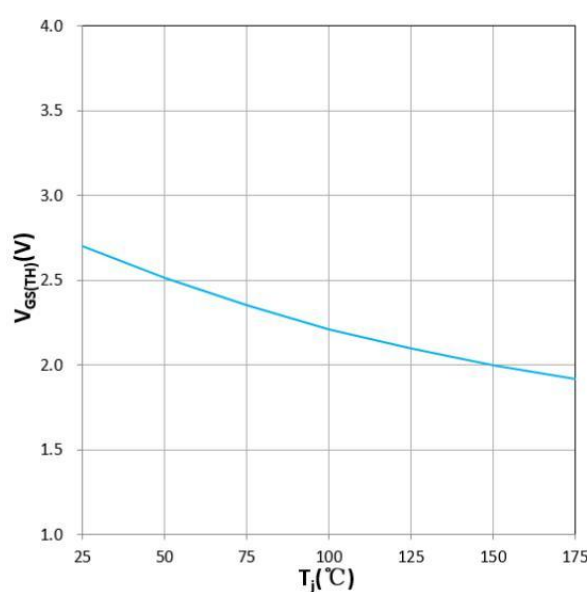


Figure 12. $V_{GS(TH)}$ vs T_j

$V_{GS}=V_{DS}$, $I_D=240\text{mA}$

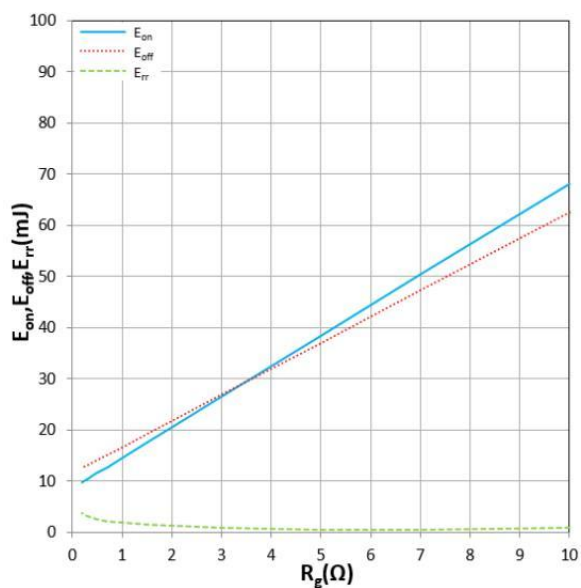


Figure 13. E_{on} , E_{off} , E_{rr} vs R_g

$T_j=25^{\circ}\text{C}$, $V_{DD}=900\text{V}$, $V_{GS}=+15\text{V}/-5\text{V}$, $I_D=400\text{A}$
Inductive Load

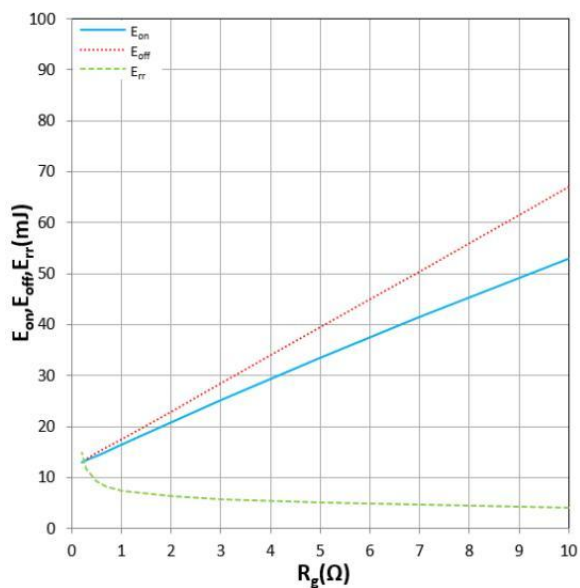


Figure 14. E_{on} , E_{off} , E_{rr} vs R_g

$T_j=150^{\circ}\text{C}$, $V_{DD}=900\text{V}$, $V_{GS}=+15\text{V}/-5\text{V}$, $I_D=400\text{A}$
Inductive Load

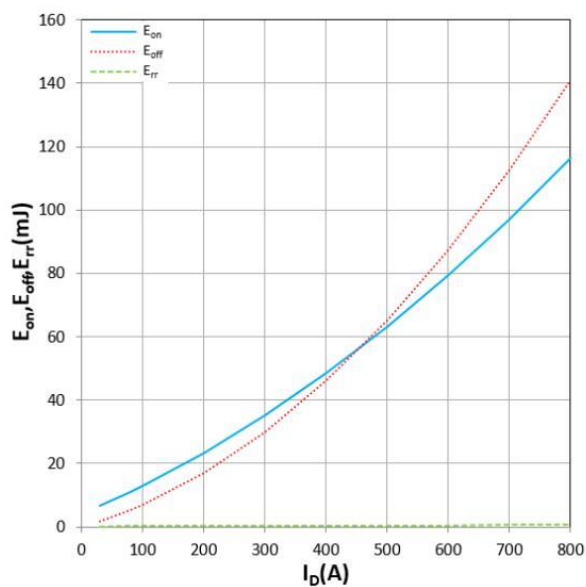


Figure 15. E_{on} , E_{off} , E_{rr} vs I_D

$T_j=25^{\circ}\text{C}$, $V_{DD}=900\text{V}$, $V_{GS}=+15\text{V}/-5\text{V}$, $R_g=6.8\Omega$
Inductive Load

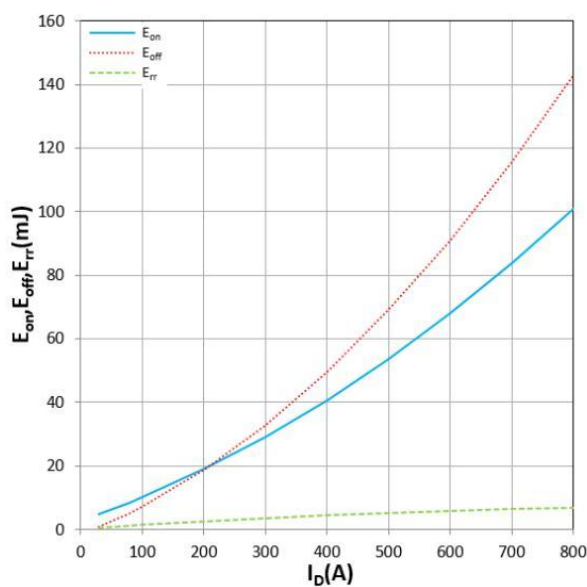


Figure 16. E_{on} , E_{off} , E_{rr} vs I_D

$T_j=150^{\circ}\text{C}$, $V_{DD}=900\text{V}$, $V_{GS}=+15\text{V}/-5\text{V}$, $R_g=6.8\Omega$
Inductive Load

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