

Description

The DFS600HF17I3C2 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
- $R_{DS(on)} = 3.4m\Omega$
- Low thermal resistance with Si_3N_4 AMB
- 175°C maximum junction temperature
- Low Inductive Design
- Thermistor inside
- Pressfit terminal
- Copper base size: 79mmx62mm

Applications

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

Circuit diagram

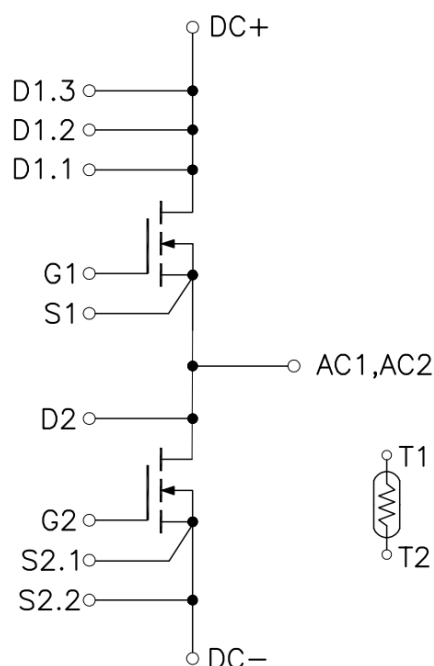


Figure 1. Out drawing & circuit diagram for DFS600HF17I3C2

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

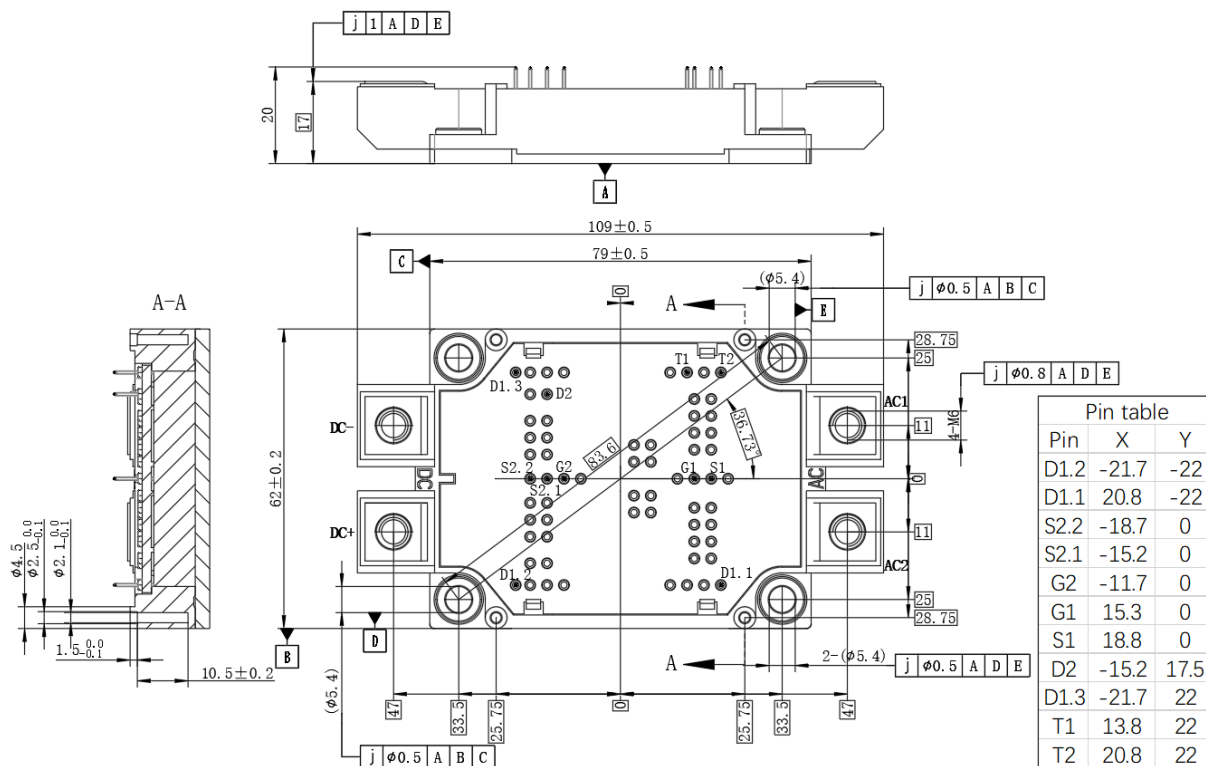


Figure 2. Pin configuration

Module

Parameter	Conditions	Value	Unit
Isolation Voltage	RMS, f =50Hz, t =1min	4	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	-	250	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 _C = 25°C, V _{GS} = 15V	585	A
I _{DS}	DC Continuous Drain Current	T _C = 80°C, V _{GS} = 15V	465	A
I _{SD}	Source (Body diode) Current	T _C = 25°C, with ON signal	585	A
I _{SD}	Source (Body diode) Current	T _C = 80°C, with ON signal	465	A
I _{DSM}	Pulse Forward Current	T _C = 25°C, Pulse width = 1ms, V _{GS} = 15V, Note2	1200	A
P _{tot}	Total Power Dissipation	T _C = 25°C	2630	W
T _{jmax}	Max Junction Temperature	-	175	°C
T _{jop}	Operating junction Temperature	-	-40 to 150	°C
T _{stg}	Storage Temperature	-	-40 to 125	°C

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

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	R ₂ = R ₂₅ exp [B _{25/50} (1/T ₂ - 1/(298,15 K))]	-	3375	-	K
B _{25/80}	B-value	R ₂ = R ₂₅ exp [B _{25/80} (1/T ₂ - 1/(298,15 K))]	-	3411	-	K
B _{25/100}	B-value	R ₂ = R ₂₅ exp [B _{25/100} (1/T ₂ - 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 =160uA		1700	-	-	V
I _{DSS}	Zero gate voltage drain Current	V _{DS} =1700V, V _{GS} =0V		-	4	160	μA
V _{GS(th)}	Gate-source threshold Voltage	I _D =240mA	T _j =25°C	1.8	2.70	-	V
		V _{DS} =V _{GS}	T _j =175°C	-	1.90	-	V
I _{GSS}	Gate-Source Leakage Current	V _{GS} =15V, V _{DS} =0V, T _j =25°C		-	-	1200	nA
R _{DS(on)} (Chip)	Static drain-source	I _D =600A	T _j =25°C	-	3.4	5.2	mΩ
	On-state resistance	V _{GS} =15V	T _j =175°C	-	7.7	-	mΩ
V _{DS(on)} (Chip)	Static drain-source	I _D =600A	T _j =25°C	-	2.04	3.12	V
	On-state Voltage	V _{GS} =15V	T _j =175°C	-	4.62	-	V
C _{iss}	Input Capacitance	V _D =1000V, V _{GS} =0V		-	45.7	-	nF
C _{Oss}	Output Capacitance	f =1MHz, Vac =25mV		-	1.23	-	nF
C _{Rss}	Reverse transfer Capacitance			-	0.22	-	nF
Q _G	Total gate charge	V _{DD} =1000V, I _D =450A, V _{GS} =-5/+15V		-	1536	-	nC
R _{Gint}	Internal Gate Resistance	T _j =25°C		-	0.32	-	Ω
t _{d(on)}	Turn-on delay time	V _{DD} =900V I _D =600A V _{GS} =+15/-4V R _{G(on)} =6.8Ω R _{G(off)} =6.8Ω Inductive load switching operation	T _j =25°C	-	229	-	ns
			T _j =150°C	-	183	-	
t _r	Rise time		T _j =25°C	-	169	-	ns
			T _j =150°C	-	138	-	
t _{d(off)}	Turn-off delay time		T _j =25°C	-	766	-	ns
			T _j =150°C	-	922	-	
t _f	Fall time		T _j =25°C	-	125	-	ns
			T _j =150°C	-	156	-	
E _{on}	Turn-on power dissipation		T _j =25°C	-	92.4	-	mJ
			T _j =150°C	-	84.2	-	
E _{off}	Turn-off power dissipation		T _j =25°C	-	99.8	-	mJ
			T _j =150°C	-	107.9	-	
R _{th(j-c)}	FET Thermal Resistance	Junction to Case		-	0.057	-	K/W
R _{th(c-f)}	Contact thermal Resistance	With thermal conductive grease, Note4		-	0.015	-	K/W

Note4: Assumes Thermal Conductivity of grease is 0.9W/m · K and thickness is 50μm.

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	T _j = 25°C	-	5.6	-	V
		I _{SD} = 600A	T _j = 150°C	-	5.1	-	
T _{rr}	Reverse recovery time	V _{RR} = 900V, I _D = 600A	T _j = 25°C	-	58	-	ns
		MOSFET side:	T _j = 150°C	-	191	-	
Q _{rr}	Reverse recovery charge	V _{GS} = +15/-4V	T _j = 25°C	-	3.37	-	uC
		R _{G(on)} = R _{G(off)} = 6.8Ω	T _j = 150°C	-	19.38	-	
E _{rr}	Diode switching power dissipation	Inductive load	T _j = 25°C	-	0.68	-	mJ
		switching operation	T _j = 150°C	-	7.96	-	

Test Conditions

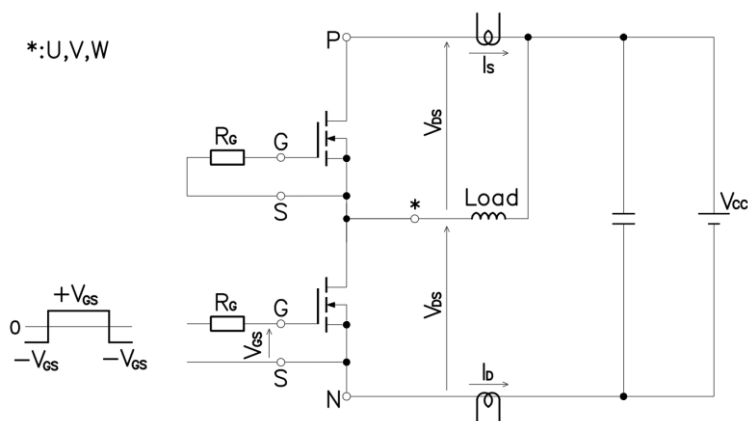


Figure 3. Switching time measure circuit

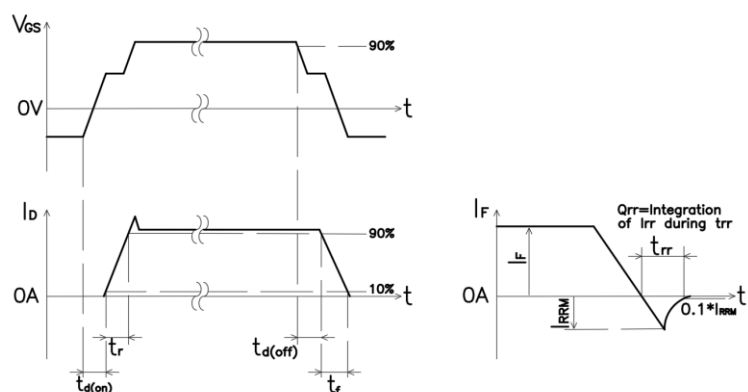


Figure 4. Switching time definition

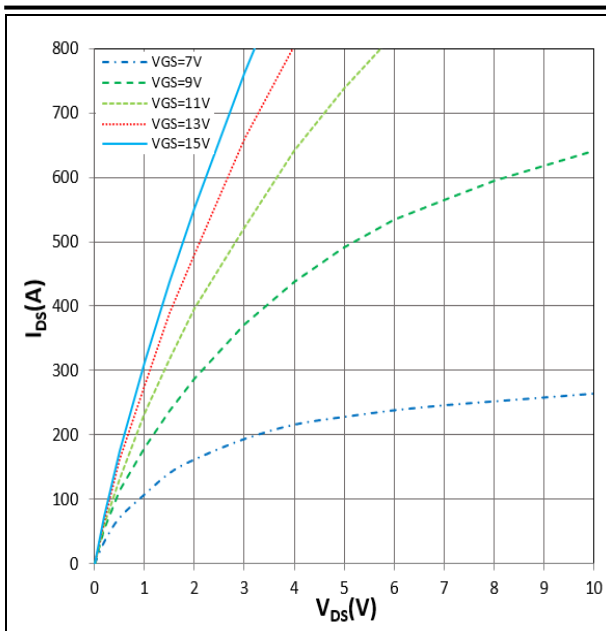


Figure 5. I_{DS} vs V_{DS}
 $T_j = 25^\circ\text{C}$, V_{GS} parameter

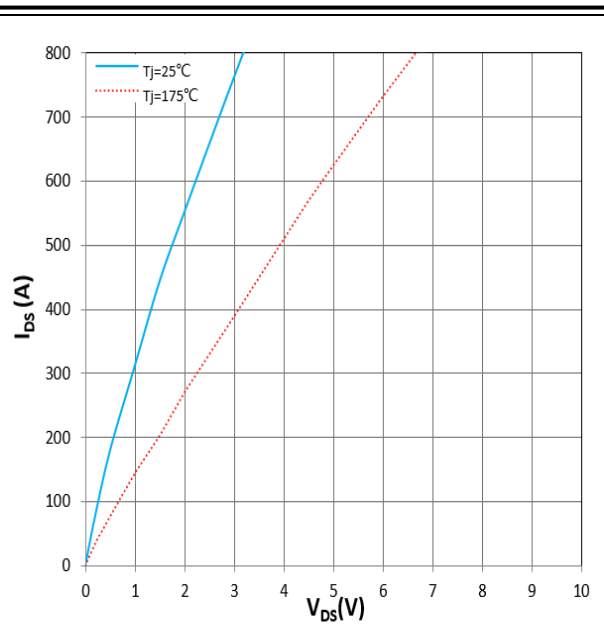


Figure 6. I_{DS} vs V_{DS}
 $V_{GS} = 15\text{V}$, T_j parameter

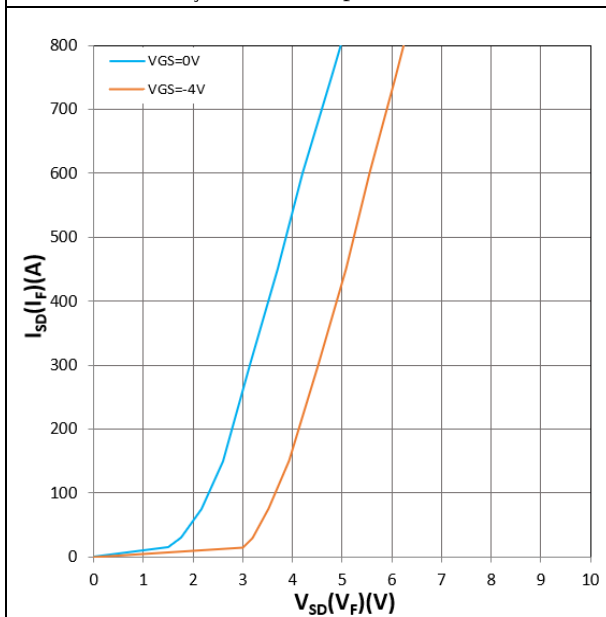


Figure 7. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
 $T_j = 25^\circ\text{C}$, V_{GS} parameter

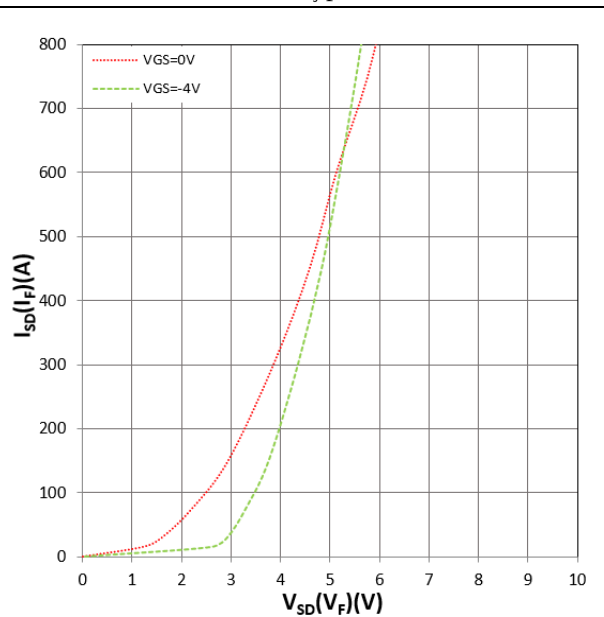


Figure 8. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
 $T_j = 175^\circ\text{C}$, V_{GS} parameter

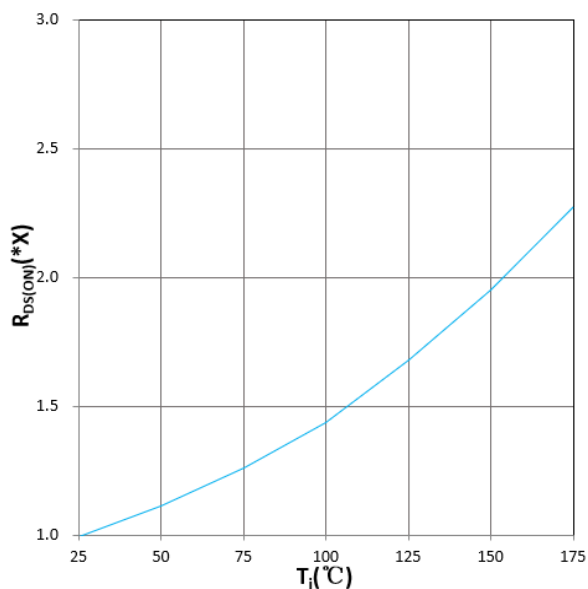


Figure 9. $R_{DS(on)}$ vs T_j
 $V_{GS}=+15V$, $I_D=600A$, $1.0X=3.4m\Omega$

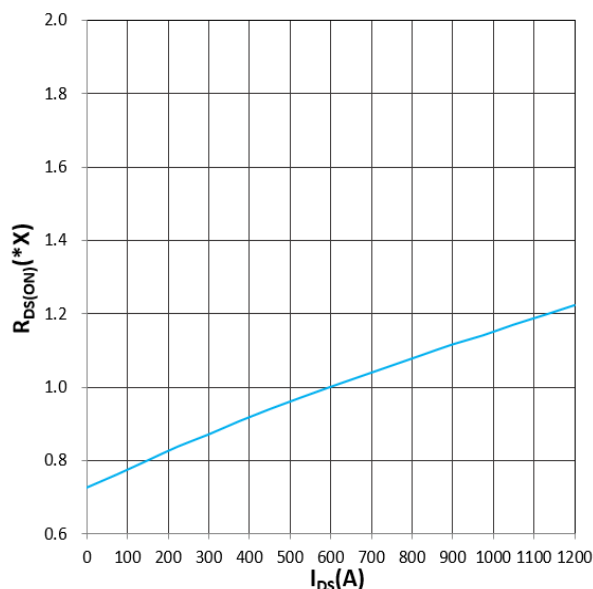


Figure 10. $R_{DS(on)}$ vs I_{DS}
 $T_j=25^\circ C$, $V_{GS}=+15V$, $1.0X=3.4m\Omega$

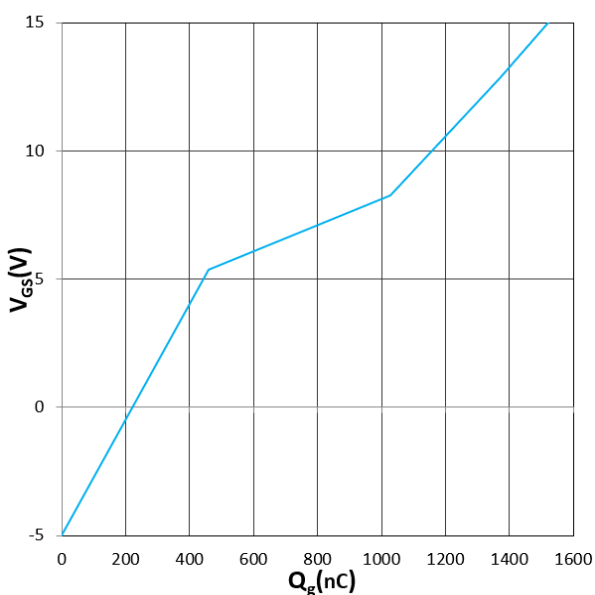


Figure 11. V_{GS} vs Q_g
 $T_j=25^\circ C$, $V_{DS}=1000V$, $I_D=450A$

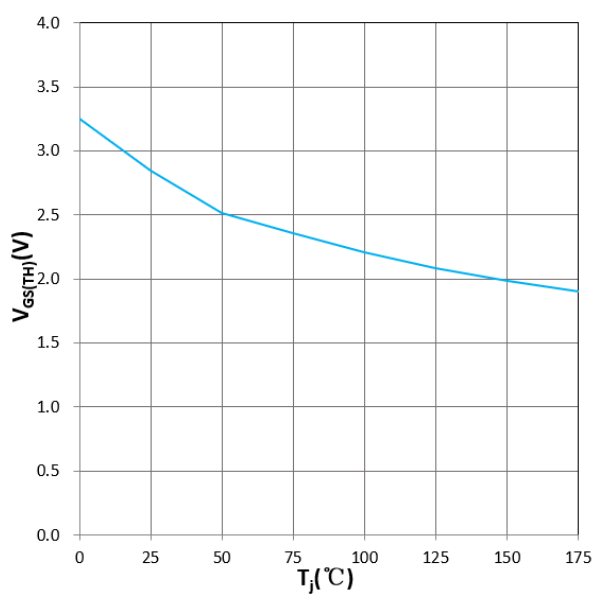


Figure 12. $V_{GS(TH)}$ vs T_j
 $V_{GS}=V_{DS}$, $I_D=240mA$

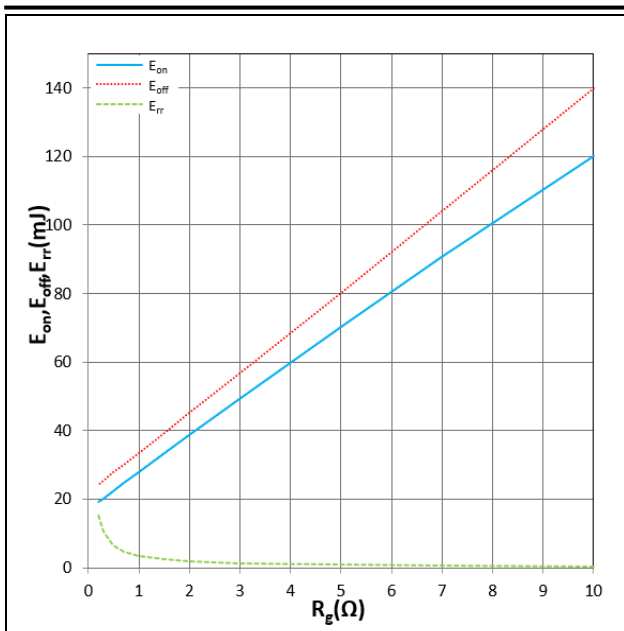


Figure 13. E_{on} , E_{off} , E_{rr} vs R_g
 $T_j=25^\circ\text{C}$, $V_{CC}=900\text{V}$, $V_{GS}=+15\text{V}/-4\text{V}$, $I_D=600\text{A}$
 Inductive Load

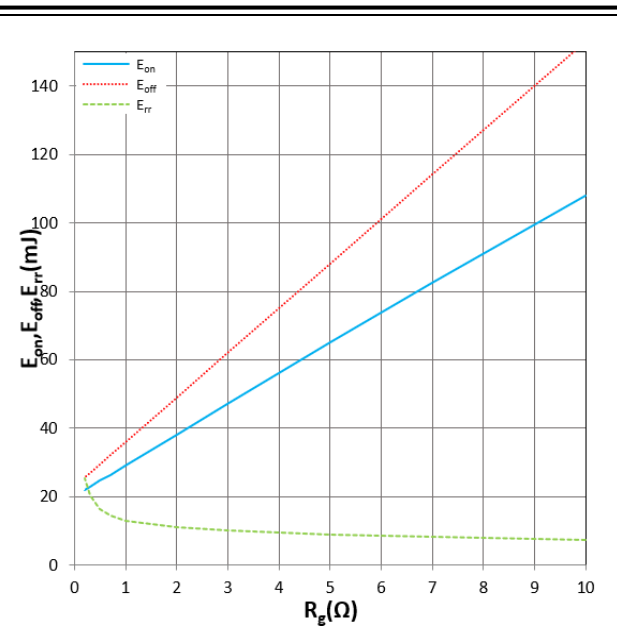


Figure 14. E_{on} , E_{off} , E_{rr} vs R_g
 $T_j=150^\circ\text{C}$, $V_{CC}=900\text{V}$, $V_{GS}=+15\text{V}/-4\text{V}$, $I_D=600\text{A}$
 Inductive Load

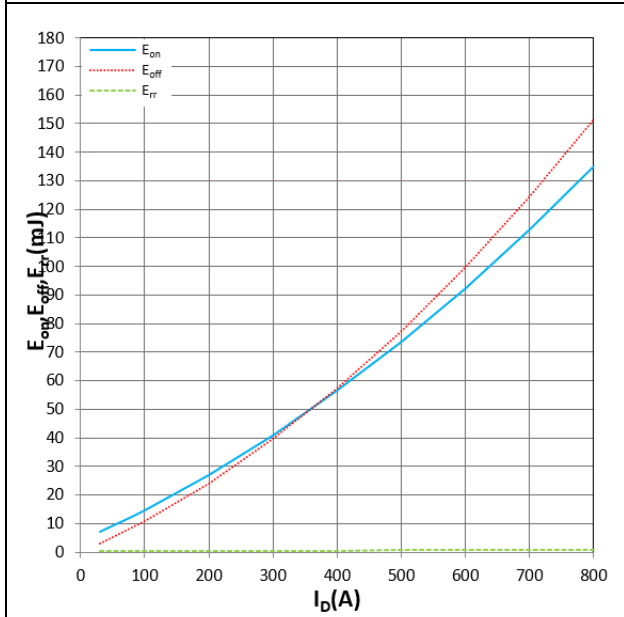


Figure 15. E_{on} , E_{off} , E_{rr} vs I_D
 $T_j=25^\circ\text{C}$, $V_{CC}=900\text{V}$, $V_{GS}=+15\text{V}/-4\text{V}$, $R_g=6.8\Omega$
 Inductive Load

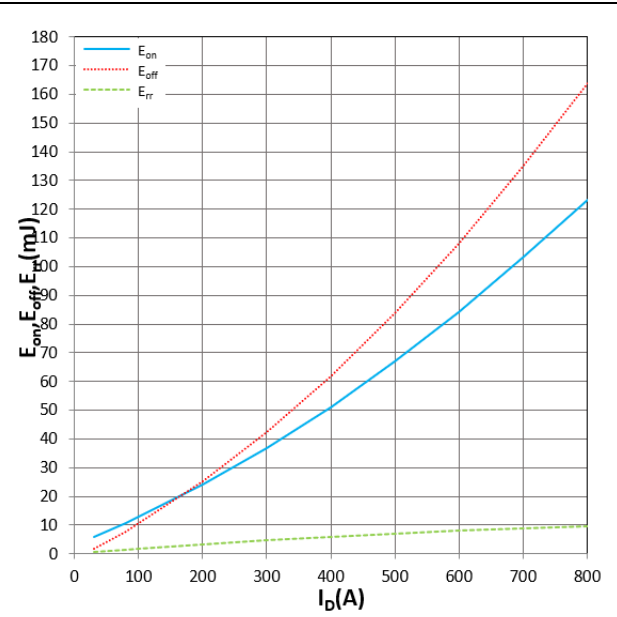


Figure 16. E_{on} , E_{off} , E_{rr} vs I_D
 $T_j=150^\circ\text{C}$, $V_{CC}=900\text{V}$, $V_{GS}=+15\text{V}/-4\text{V}$, $R_g=6.8\Omega$
 Inductive Load

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