

Description

The DFS600HF17I4C1 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 Si₃N₄ AMB
- Low Inductive Design
- Thermistor inside

Applications

- xEV Applications
- Motor Drives
- Servo Drives
- Smart-Grid/Grid-Tied Distributed Generation

Circuit diagram

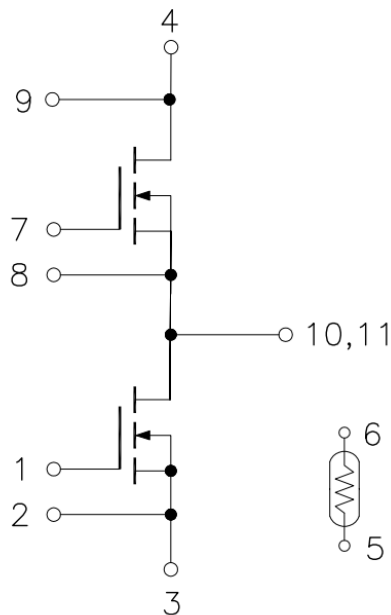


Figure 1. Out drawing & circuit diagram for DFS600HF17I4C1

Pin Configuration and Marking Information

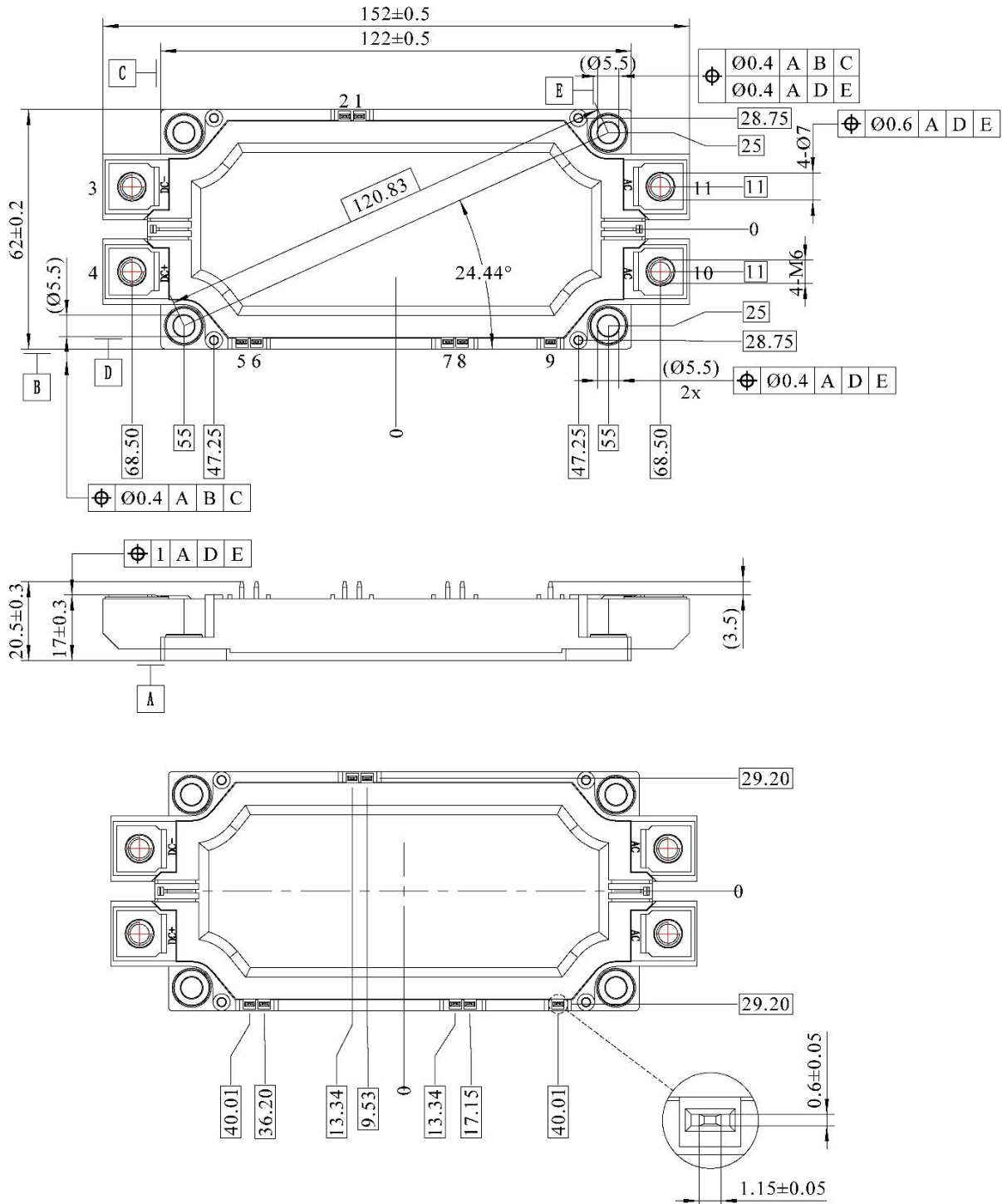


Figure 2. Pin configuration

Module

Parameter	Condition	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	-	340	g

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

Symbol	Parameter	Condition	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	620	A
I _{DS}	DC Continuous Drain Current	T _c =60°C, V _{GS} =15V	540	A
I _{SD}	Source (Body diode) Current	T _c =25°C, with ON signal	620	A
I _{SD}	Source (Body diode) Current	T _c =60°C, with ON signal	540	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	3000	W
T _{jmax}	Max Junction Temperature	-	-55 to 200	°C
T _{stg}	Storage Temperature	-	-55 to 150	°C

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

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	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 =600μA	1700	-	-	V	
I _{DSS}	Zero gate voltage drain Current	V _{DS} =1700V, V _{GS} =0V	-	6	600	μA	
V _{GS(th)}	Gate-source threshold Voltage	I _D =360mA	T _j =25°C	1.8	2.7	-	V
		V _{DS} =V _{GS}	T _j =175°C	-	1.9	-	V
I _{GSS}	Gate-Source Leakage Current	V _{GS} =15V, V _{DS} =0V	-	-	600	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 f =1MHz, V _{ac} =25mV	-	45.7	-	nF	
C _{oss}	Output Capacitance		-	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	-	1560	-	nC	
R _{Gint}	Internal Gate Resistance	T _j =25°C	-	0.3	-	Ω	
t _{d(on)}	Turn-on delay time	V _{DD} =900V I _D =600A V _{GS} =+15/-5V R _{G(on)} =4.7Ω R _{G(off)} =4.7Ω Inductive load switching operation	T _j =25°C	-	162	-	ns
			T _j =150°C	-	123	-	
t _r	Rise time		T _j =25°C	-	112	-	ns
			T _j =150°C	-	93	-	
t _{d(off)}	Turn-off delay time		T _j =25°C	-	556	-	ns
			T _j =150°C	-	621	-	
t _f	Fall time		T _j =25°C	-	98	-	ns
			T _j =150°C	-	113	-	
E _{on}	Turn-on power dissipation		T _j =25°C	-	50.7	-	mJ
			T _j =150°C	-	46.8	-	
E _{off}	Turn-off power dissipation	T _j =25°C	-	57.4	-	mJ	
		T _j =150°C	-	62.3	-		
R _{th(j-c)}	FET Thermal Resistance	Junction to Case	-	0.05	-	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} = 600A	T _j = 25°C	-	5.7	-	V
			T _j = 175°C	-	5.3	-	
T _{rr}	Reverse recovery time	V _{RR} = 900V, I _D = 600A MOSFET side:	T _j = 25°C	-	36	-	ns
			T _j = 150°C	-	125	-	
Q _{rr}	Reverse recovery charge	V _{GS} = +15/-5V R _{G(on)} = R _{G(off)} = 4.7Ω	T _j = 25°C	-	2.56	-	uC
			T _j = 150°C	-	13.95	-	
E _{rr}	Diode switching power dissipation	Inductive load switching operation	T _j = 25°C	-	1.0	-	mJ
			T _j = 150°C	-	8.1	-	

Test Conditions

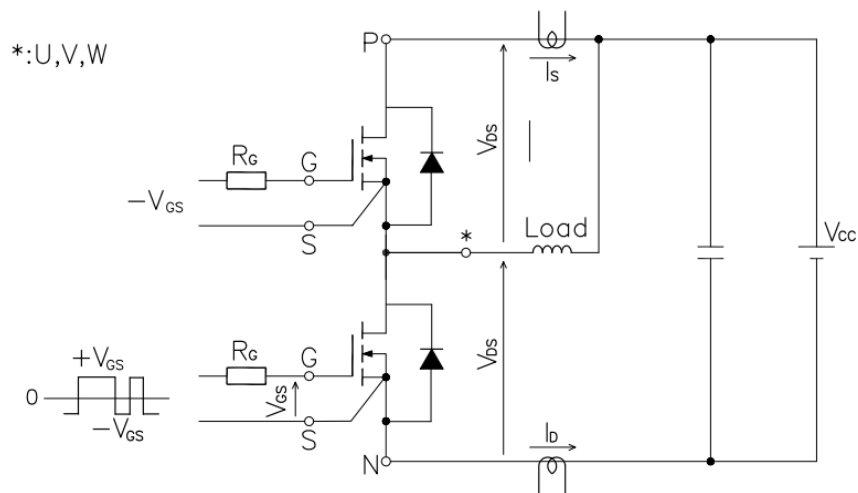


Figure 3. Switching time measure circuit

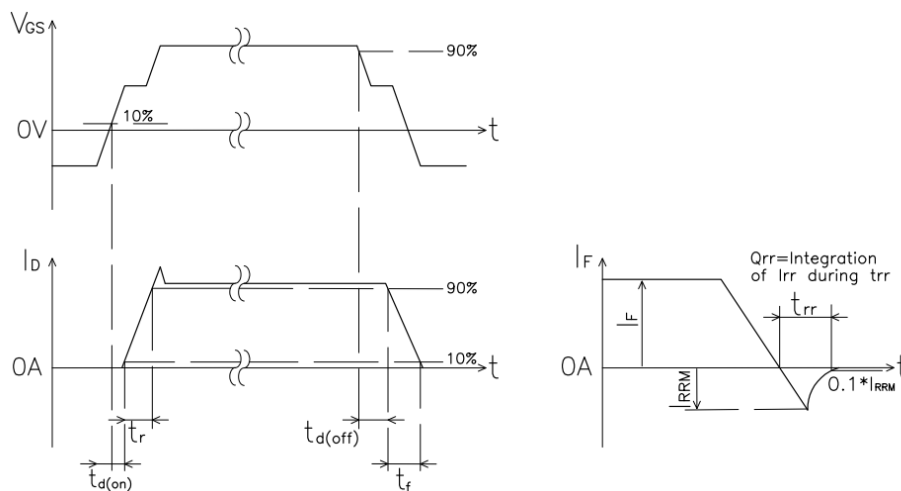


Figure 4. Switching time definition

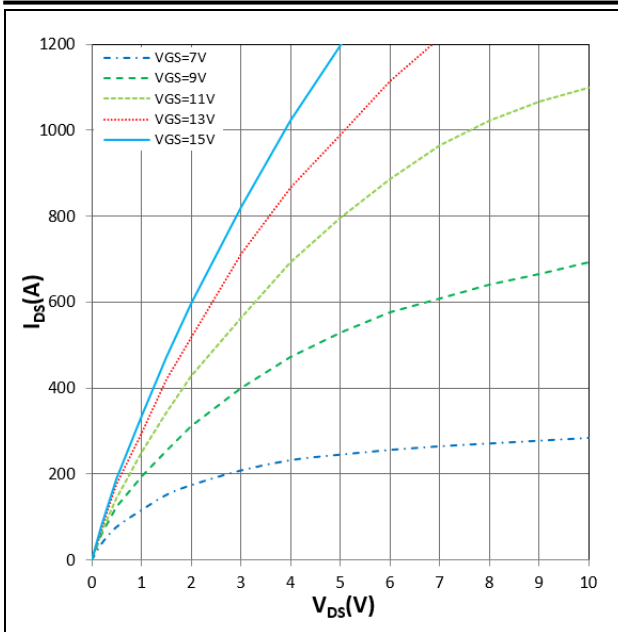


Figure 5. I_{DS} vs V_{DS}
 $T_j=25^\circ\text{C}$, V_{GS} parameter

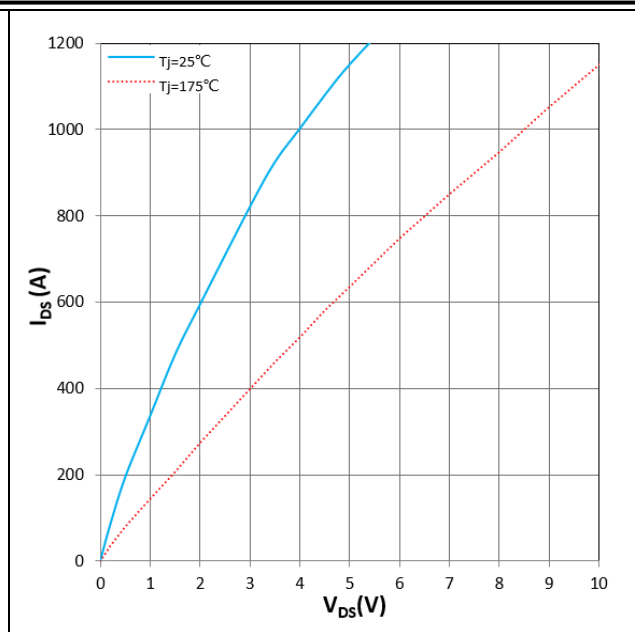


Figure 6. I_{DS} vs V_{DS}
 $V_{GS} = 15\text{V}$, T_j parameter

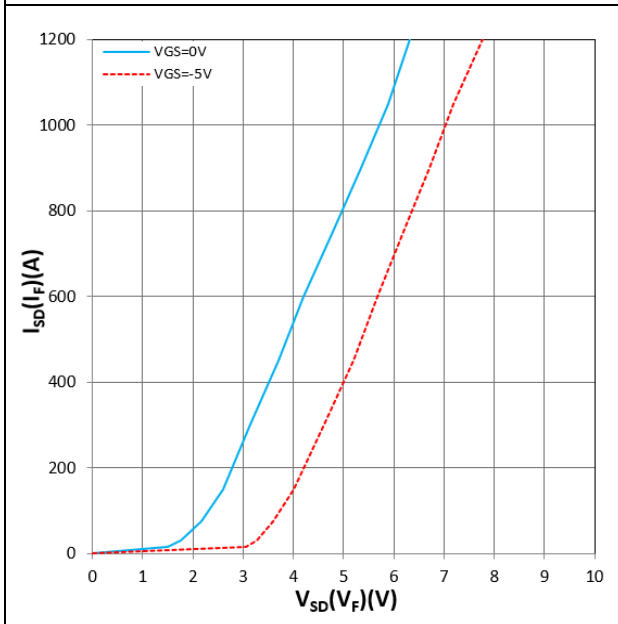


Figure 7. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
 $T_j=25^\circ\text{C}$, V_{GS} parameter

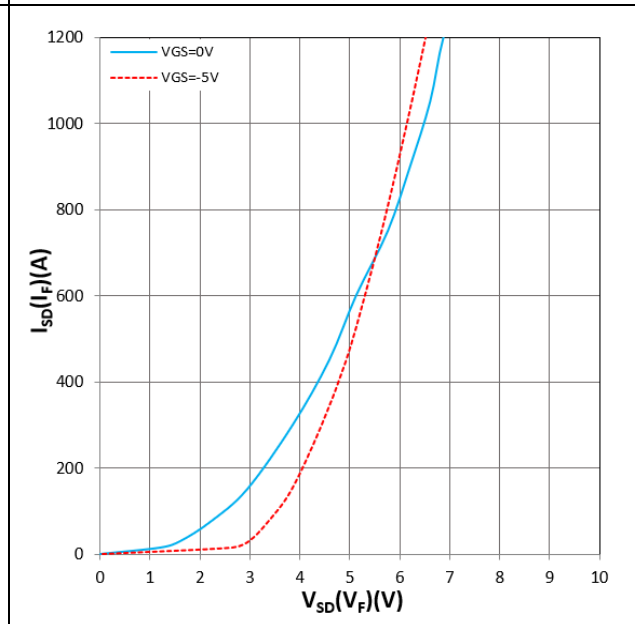


Figure 8. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
 $T_j=175^\circ\text{C}$, V_{GS} parameter

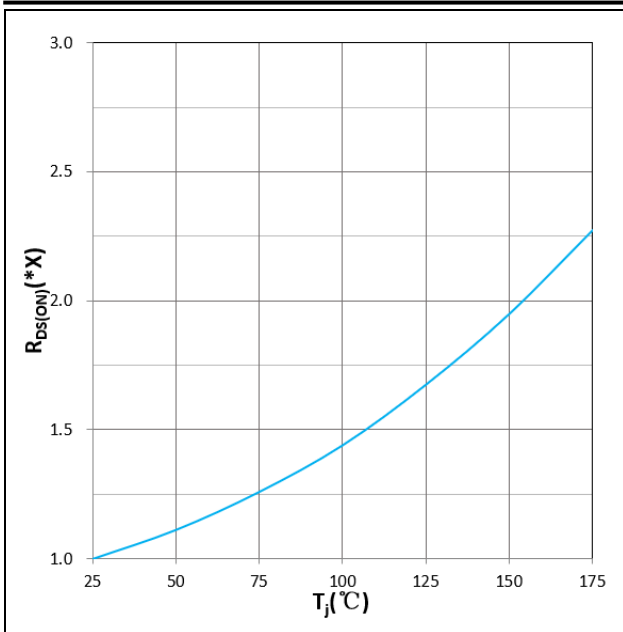


Figure 9. $R_{DS(ON)}$ vs T_j
 $V_{GS}=+15V, I_D=600A, 1.0X=3.4m\Omega$

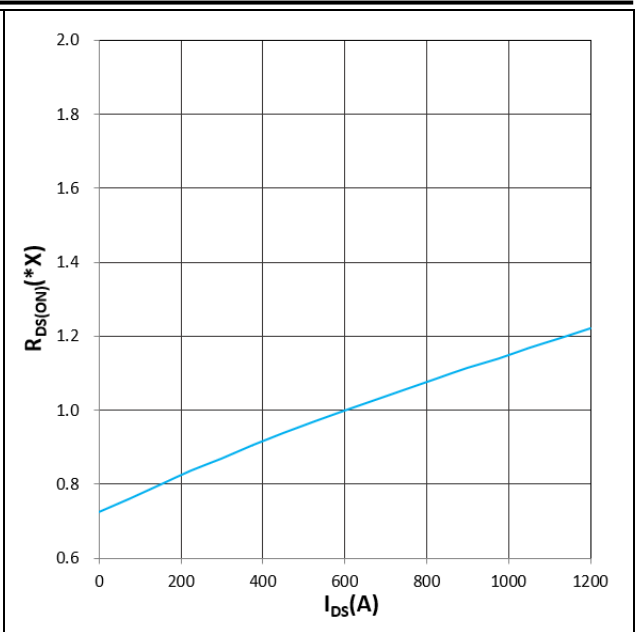


Figure 10. $R_{DS(ON)}$ vs I_{DS}
 $T_j=25^\circ C, V_{GS}=+15V, 1.0X=3.4m\Omega$

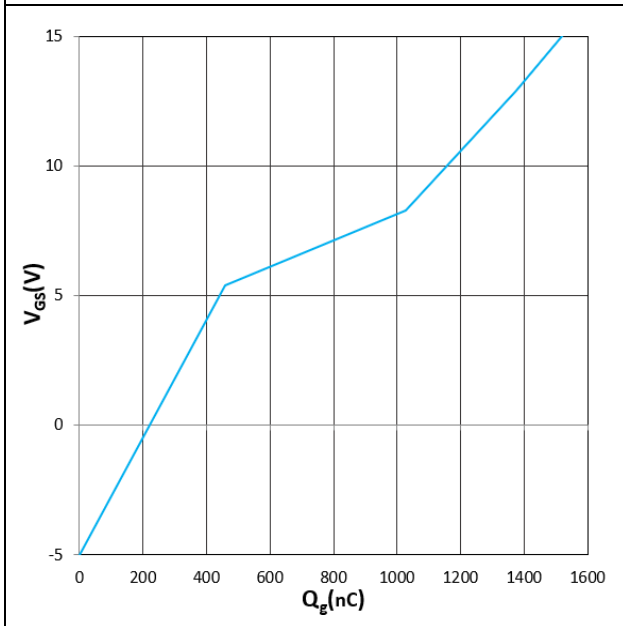


Figure 11. V_{GS} vs Q_g
 $T_j=25^\circ C, V_{DS}=1000V, I_D=450A$

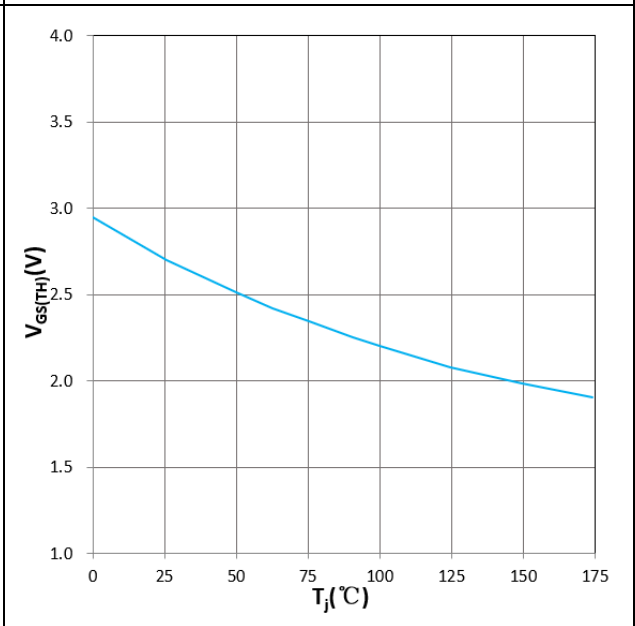


Figure 12. $V_{GS(TH)}$ vs T_j
 $V_{GS}=V_{DS}, I_D=360mA$

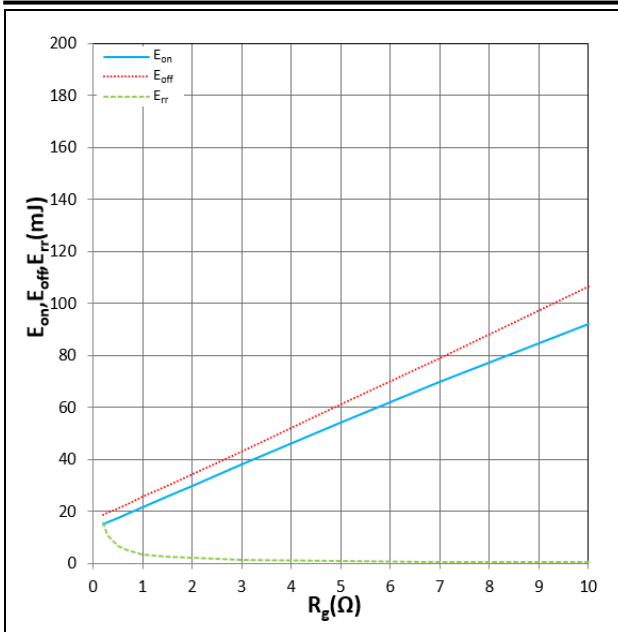


Figure 13. E_{on} , E_{off} , E_{rr} vs R_g
 $T_j=25^{\circ}\text{C}$, $V_{DD}=900\text{V}$, $V_{GS}=+15\text{V}/-5\text{V}$, $I_D=600\text{A}$
 Inductive Load

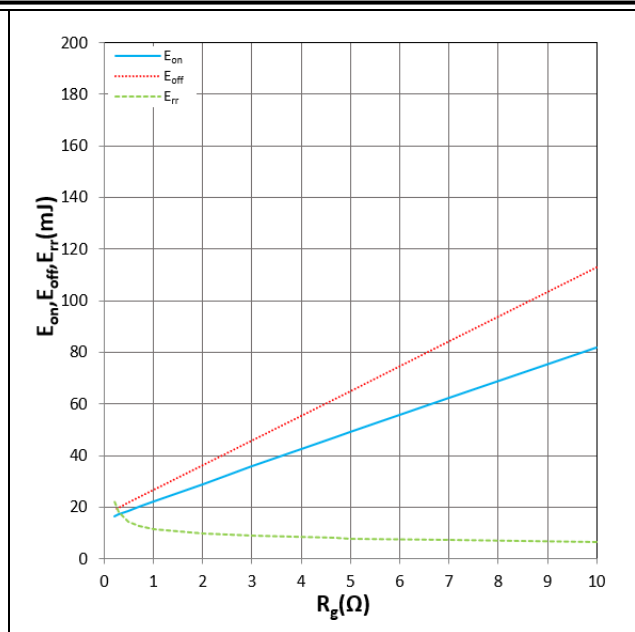


Figure 14. E_{on} , E_{off} , E_{rr} vs R_g
 $T_j=150^{\circ}\text{C}$, $V_{DD}=900\text{V}$, $V_{GS}=+15\text{V}/-5\text{V}$, $I_D=600\text{A}$
 Inductive Load

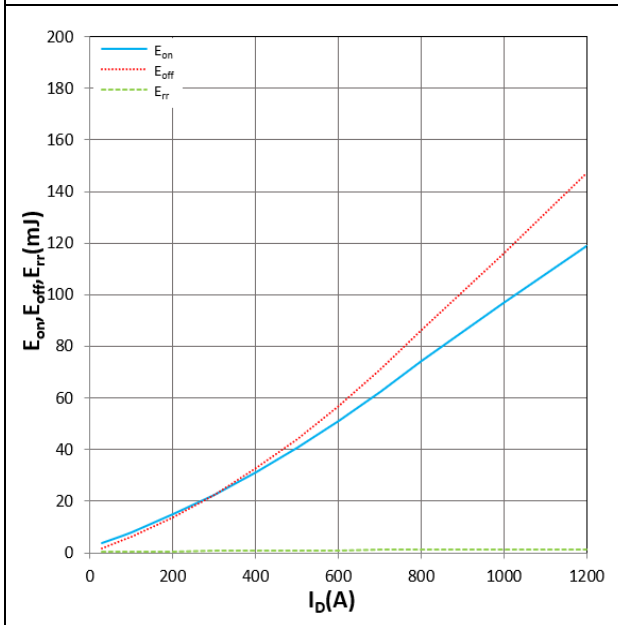


Figure 15. E_{on} , E_{off} , E_{rr} vs I_D
 $T_j=25^{\circ}\text{C}$, $V_{DD}=900\text{V}$, $V_{GS}=+15\text{V}/-5\text{V}$, $R_g=4.7\Omega$
 Inductive Load

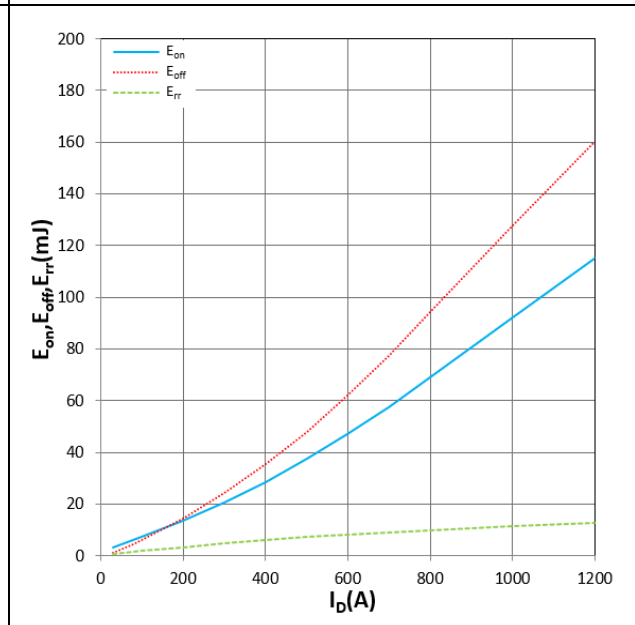


Figure 16. E_{on} , E_{off} , E_{rr} vs I_D
 $T_j=150^{\circ}\text{C}$, $V_{DD}=900\text{V}$, $V_{GS}=+15\text{V}/-5\text{V}$, $R_g=4.7\Omega$
 Inductive Load

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