

Description

The DFS300HF14I4Q1 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 1400V
- $R_{DS(on)} = 6.6m\Omega @ T_j = 25^\circ C, V_{GS} = 20V$
- Low thermal resistance with Si₃N₄ AMB
- 175°C maximum junction temperature
- Thermistor inside
- Low Switching Losses

Applications

- xEV Applications
- Motor Drives
- Vehicle Fast Chargers
- Smart-Grid/Grid-Tied Distributed Generation

Circuit diagram

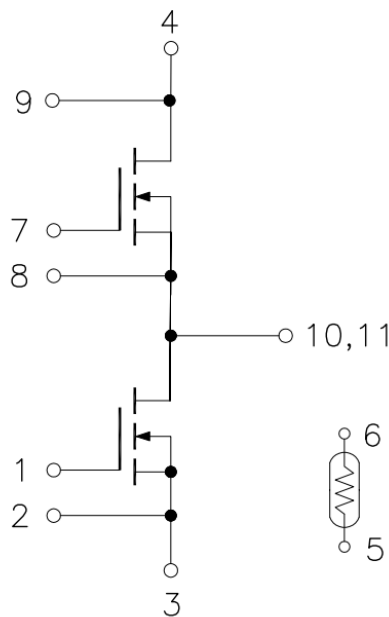


Figure 1. Out drawing & circuit diagram for DFS300HF14I4Q1

Pin Configuration and Marking Information

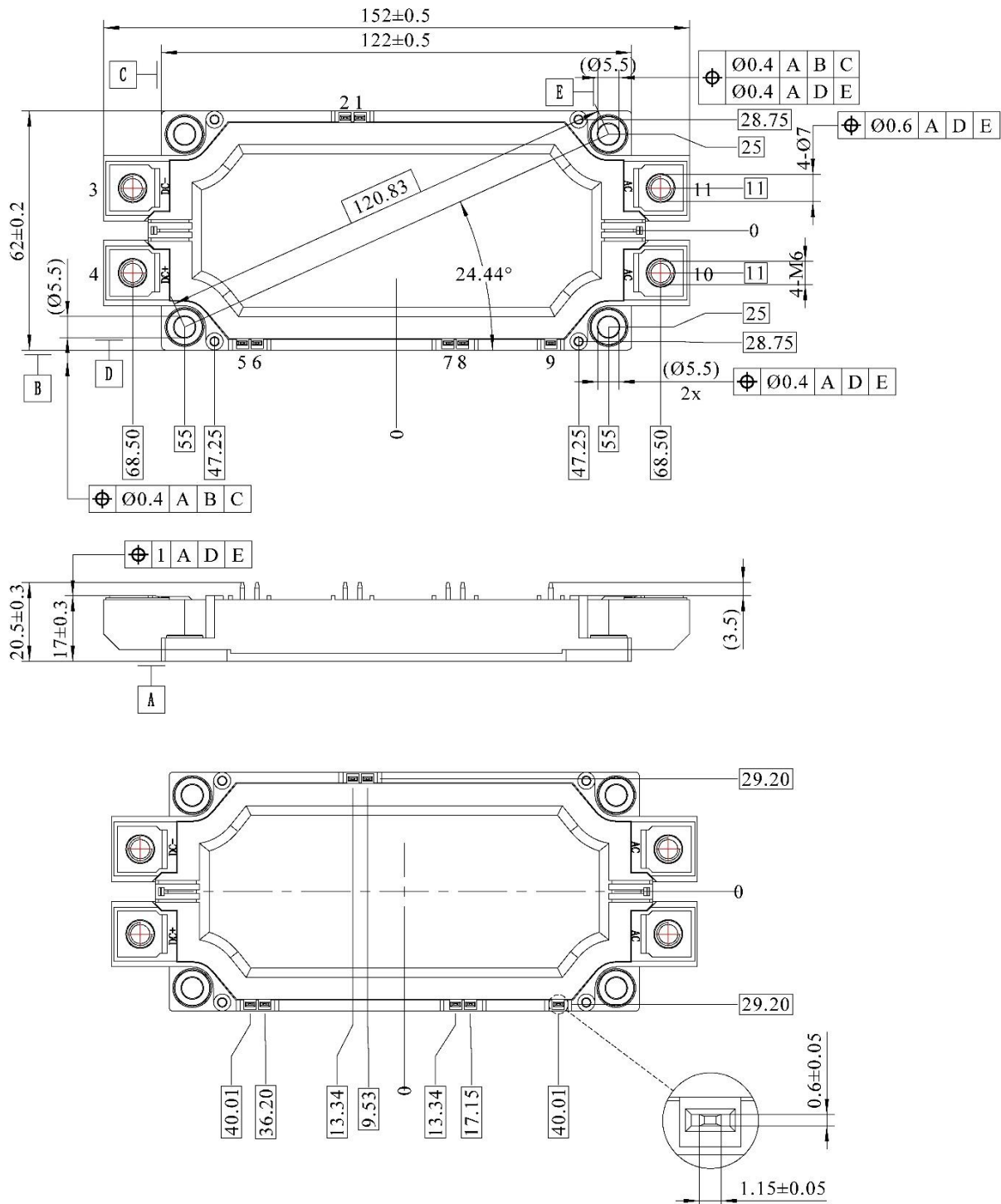


Figure 2. Pin configuration

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 13	mm
Clearance	terminal to heatsink terminal to terminal	12.5 10	mm
CTI	-	>400	-
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	Conditions	Ratings	Unit
V _{DSS}	Drain-Source Voltage	G-S Short	1400	V
V _{DS nom}	Continuous Operating DC Voltage	Not include surge voltage	1100	V
V _{GSS}	Gate-Source Voltage	D-S Short, AC frequency ≥1Hz, Note1	-10 to 25	V
I _{DS}	DC Continuous Drain Current	T _c =60°C, V _{GS} =20V	300	A
I _{DS}	DC Continuous Drain Current	T _c =100°C, V _{GS} =20V	235	A
I _{SD}	Source (Body diode) Current	T _c =60°C, with ON signal	300	A
I _{SD}	Source (Body diode) Current	T _c =100°C, with ON signal	235	A
I _{DSM}	Pulse Forward Current	T _c =25°C, Pulse width =1ms, V _{GS} =20V, Note2	600	A
P _{tot}	Total Power Dissipation	T _c =25°C	1428	W
T _{jmax}	Max Junction Temperature	-	175	°C
T _{stg}	Storage Temperature	-	-40 to 125	°C

Note1: Recommended Operating Value, +20V/-5V, +18V/-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	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 = 3mA	1400	-	-	V	
I _{DSS}	Zero gate voltage drain Current	V _{DS} = 1400V, V _{GS} = 0V	-	3	-	μA	
V _{GS(th)}	Gate-source threshold Voltage	I _D = 60mA V _{DS} = V _{GS}	T _j = 25°C	1.8	2.5	4.0	V
			T _j = 175°C	-	1.6	-	V
I _{GSS}	Gate-Source Leakage Current	V _{GS} = 20V, V _{DS} = 0V, T _j = 25°C	-	100	600	nA	
R _{DS(on)} (Chip)	Static drain-source On-state resistance	I _D = 300A V _{GS} = 20V	T _j = 25°C	-	6.6	-	mΩ
			T _j = 175°C	-	12.4	-	mΩ
		I _D = 300A V _{GS} = 18V	T _j = 25°C	-	7.1	-	mΩ
			T _j = 175°C	-	12.9	-	mΩ
V _{DS(on)} (Chip)	Static drain-source On-state Voltage	I _D = 300A V _{GS} = 20V	T _j = 25°C	-	2.0	-	V
			T _j = 175°C	-	3.7	-	V
		I _D = 300A V _{GS} = 18V	T _j = 25°C	-	2.1	-	V
			T _j = 175°C	-	3.9	-	V
C _{iss}	Input Capacitance	V _D = 1000V, V _{GS} = 0V	-	18.9	-	nF	
C _{oss}	Output Capacitance	f = 200kHz, V _{AC} = 25mV	-	1.08	-	nF	
C _{rss}	Reverse transfer Capacitance		-	0.11	-	nF	
Q _G	Total gate charge	V _{DD} = 800V, I _D = 150A, V _{GS} = +20/-5V	-	650	-	nC	
R _{Gint}	Internal Gate Resistance	T _j = 25°C	-	2.0	-	Ω	
t _{d(on)}	Turn-on delay time	V _{DD} = 600V I _D = 300A V _{GS} = +18/-5V R _{G(on)} = 3.3Ω R _{G(off)} = 3.3Ω Inductive load switching operation	T _j = 25°C	-	45	-	ns
			T _j = 150°C	-	41	-	
t _r	Rise time		T _j = 25°C	-	36	-	ns
			T _j = 150°C	-	32	-	
t _{d(off)}	Turn-off delay time		T _j = 25°C	-	35	-	ns
			T _j = 150°C	-	44	-	
t _f	Fall time		T _j = 25°C	-	17	-	ns
			T _j = 150°C	-	20	-	
E _{on}	Turn-on power dissipation		T _j = 25°C	-	7.5	-	mJ
			T _j = 150°C	-	10.4	-	
E _{off}	Turn-off power dissipation	T _j = 25°C	-	1.8	-	mJ	
		T _j = 150°C	-	3.0	-		
R _{th(j-c)}	FET Thermal Resistance	Junction to Case	-	0.105	-	K/W	
R _{th(c-f)}	Contact thermal Resistance	With thermal conductive grease, Note3	-	0.015	-	K/W	

Note3: 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	-	4.6	-	V
			T _j = 150°C	-	4.0	-	
T _{rr}	Reverse recovery time	V _{RR} = 800V, I _D = 300A MOSFET side:	T _j = 25°C	-	27	-	ns
			T _j = 150°C	-	31	-	
Q _{rr}	Reverse recovery charge	V _{GS} = +18/-5V R _{G(on)} = R _{G(off)} = 3.3Ω	T _j = 25°C	-	1.3	-	uC
			T _j = 150°C	-	3.1	-	
E _{rr}	Diode switching power dissipation	Inductive load switching operation	T _j = 25°C	-	0.3	-	mJ
			T _j = 150°C	-	1.3	-	

Test Conditions

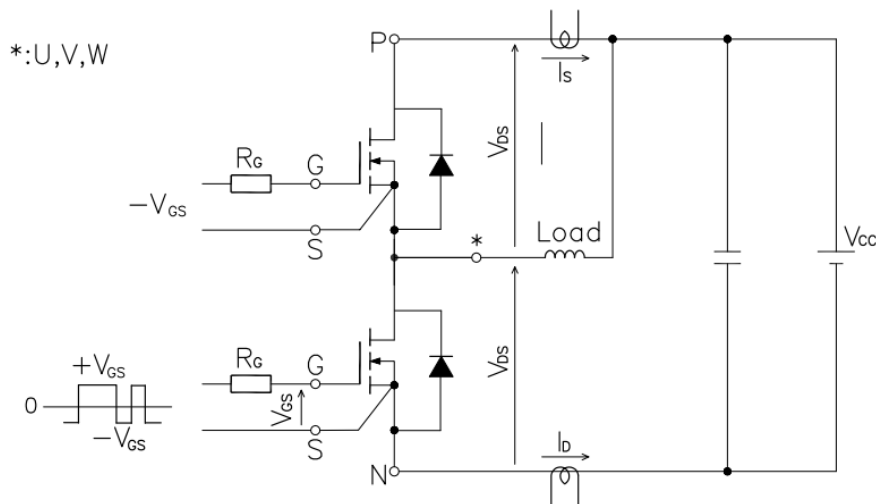


Figure 3. Switching time measure circuit

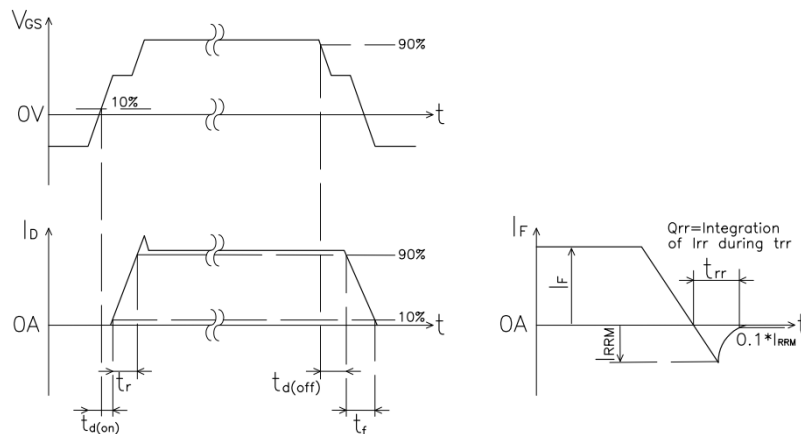


Figure 4. Switching time definition

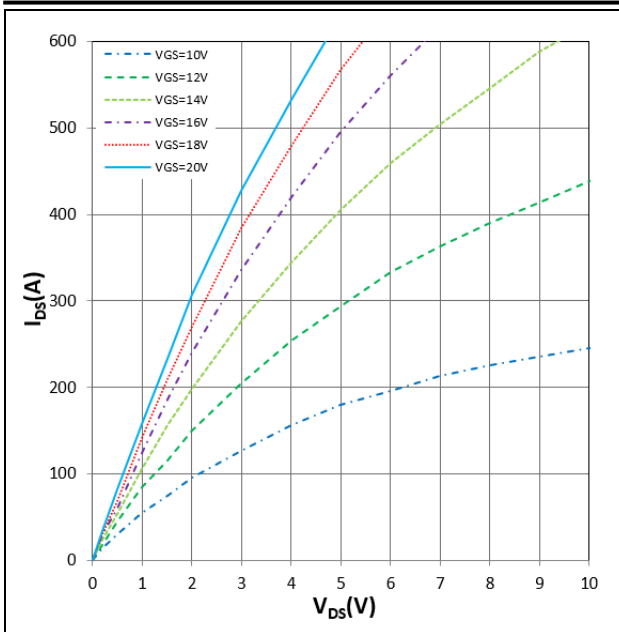


Figure 5. I_{DS} vs V_{DS}
 $T_j = 25^\circ\text{C}$, V_{GS} parameter

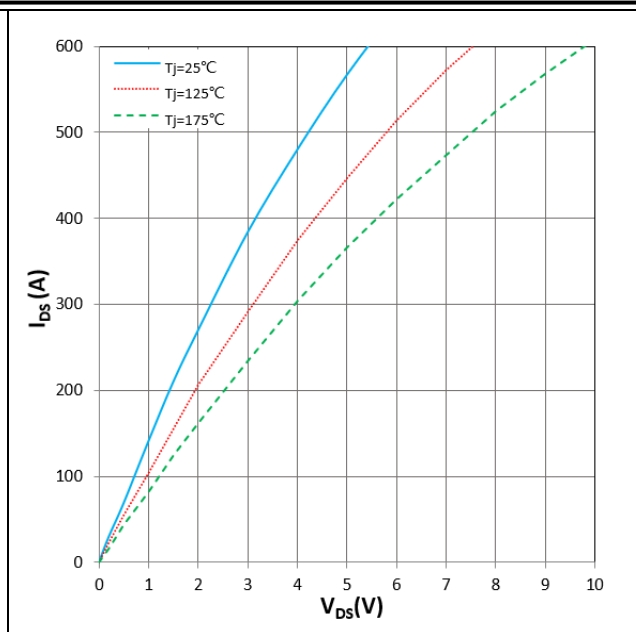


Figure 6. I_{DS} vs V_{DS}
 $V_{GS} = 18\text{V}$, T_j parameter

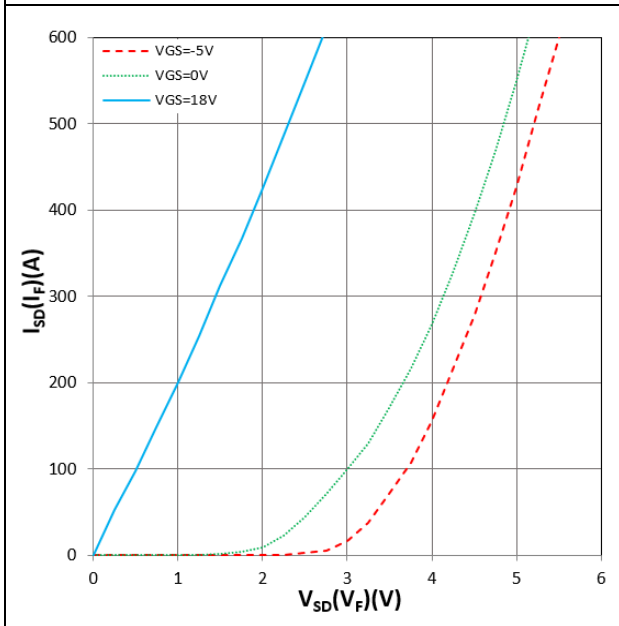


Figure 7. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
 $T_j = 25^\circ\text{C}$, V_{GS} parameter

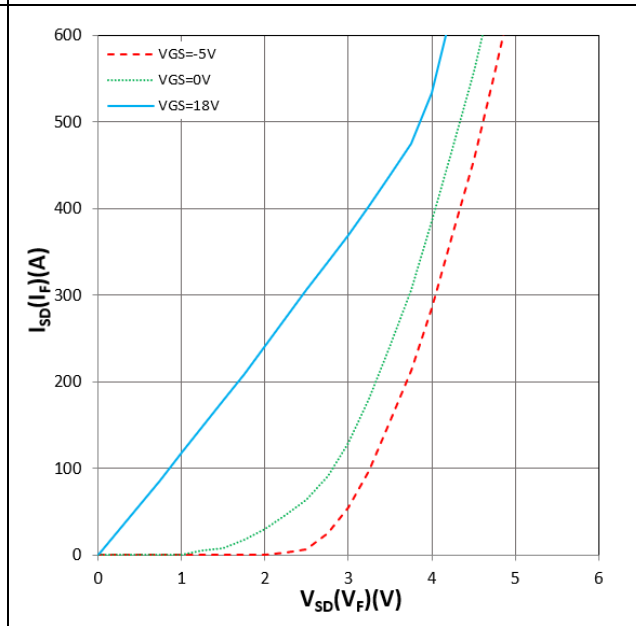


Figure 8. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
 $T_j = 175^\circ\text{C}$, V_{GS} parameter

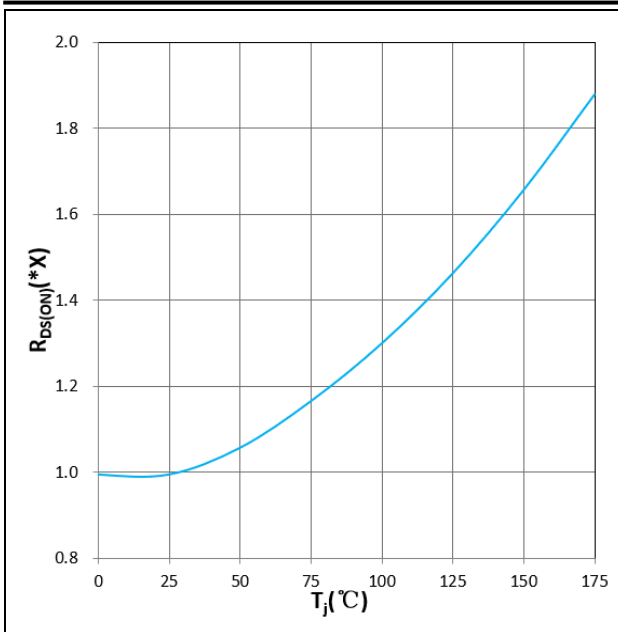


Figure 9. $R_{DS(on)}$ vs T_j
 $V_{GS} = +20V$, $I_D = 300A$, $1.0X = 6.6m\Omega$

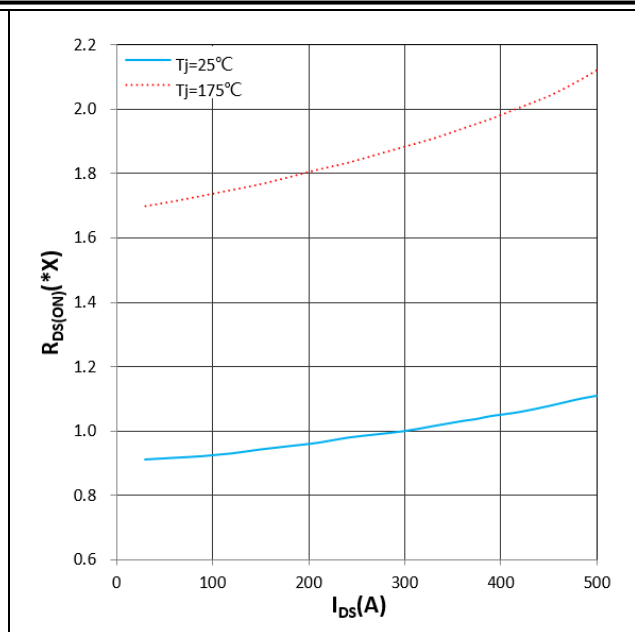


Figure 10. $R_{DS(on)}$ vs I_{DS}
 $T_j = 25^\circ C / 175^\circ C$, $V_{GS} = +20V$, $1.0X = 6.6m\Omega$

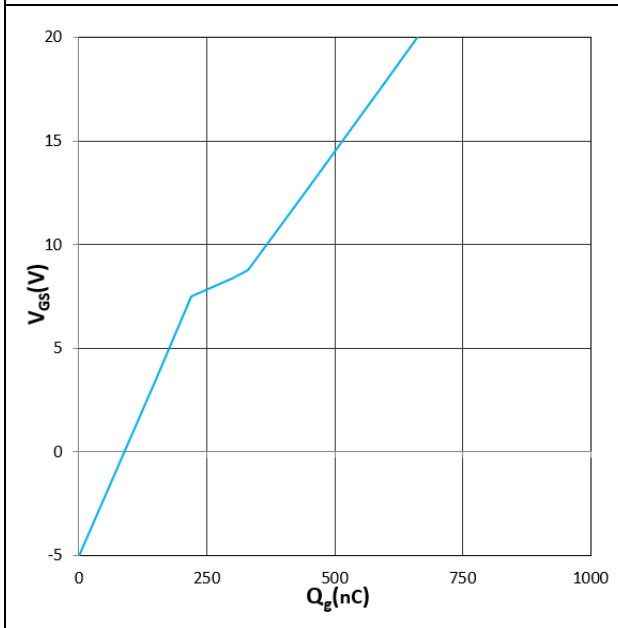


Figure 11. V_{GS} vs Q_g
 $T_j = 25^\circ C$, $V_{DS} = 800V$, $I_D = 150A$

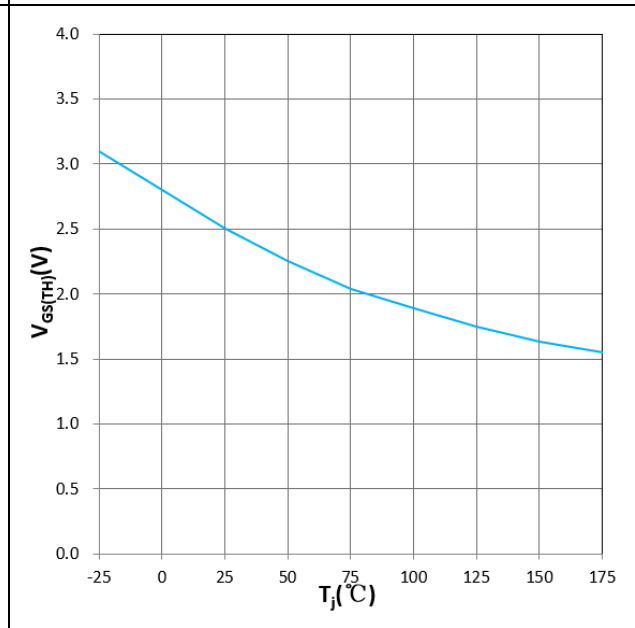


Figure 12. $V_{GS(TH)}$ vs T_j
 $V_{GS} = V_{DS}$, $I_D = 60mA$

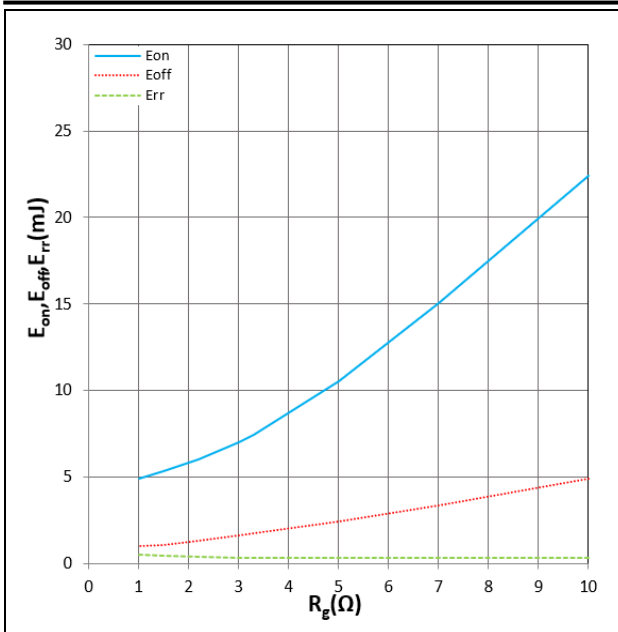


Figure 13. E_{on} , E_{off} , E_{rr} vs R_g
 $T_j=25^\circ\text{C}$, $V_{DD}=600\text{V}$, $V_{GS}=+18\text{V}/-5\text{V}$, $I_D=300\text{A}$
 Inductive Load

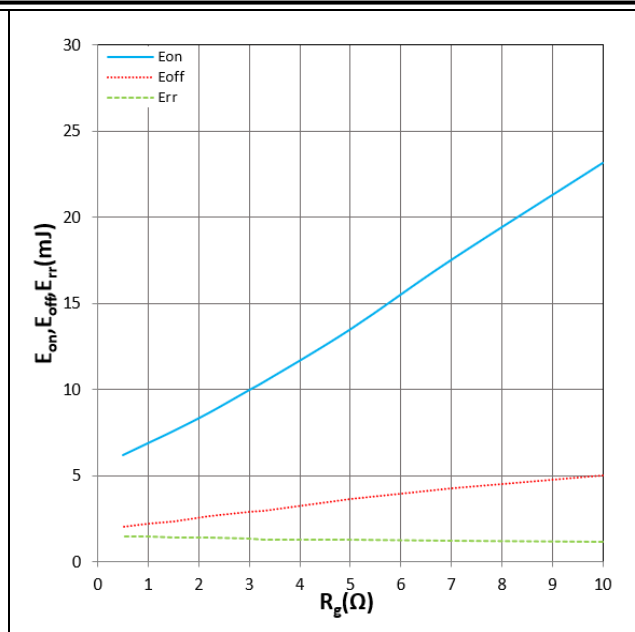


Figure 14. E_{on} , E_{off} , E_{rr} vs R_g
 $T_j=150^\circ\text{C}$, $V_{DD}=600\text{V}$, $V_{GS}=+18\text{V}/-5\text{V}$, $I_D=300\text{A}$
 Inductive Load

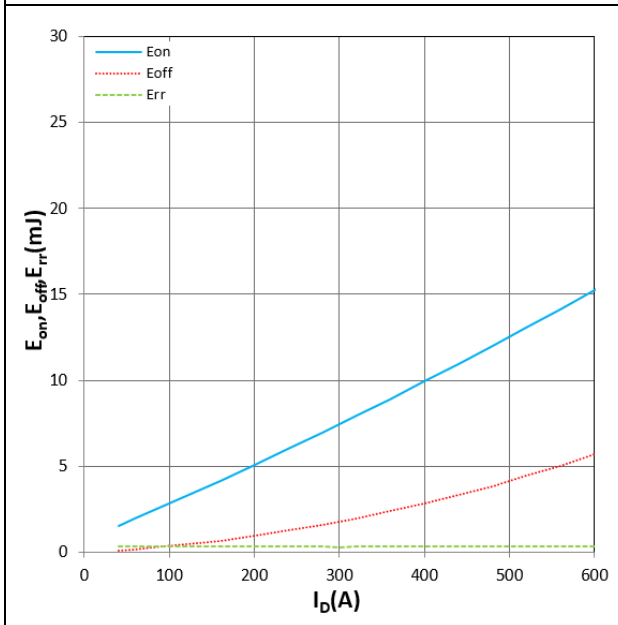


Figure 15. E_{on} , E_{off} , E_{rr} vs I_D
 $T_j=25^\circ\text{C}$, $V_{DD}=600\text{V}$, $V_{GS}=+18\text{V}/-5\text{V}$, $R_g=3.3\Omega$
 Inductive Load

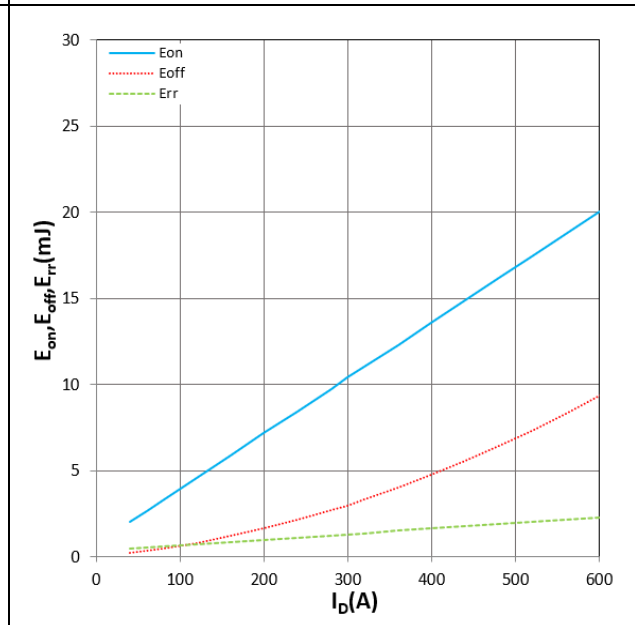


Figure 16. E_{on} , E_{off} , E_{rr} vs I_D
 $T_j=150^\circ\text{C}$, $V_{DD}=600\text{V}$, $V_{GS}=+18\text{V}/-5\text{V}$, $R_g=3.3\Omega$
 Inductive Load

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