

HCS600FH170D3C1

1700V/600A Half Bridge SiC MOSFET Module

Description

The HCS600FH170D3C1 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
- $R_{DS(on)}=3.4m\Omega @ T_j=25^{\circ}C$
- Low thermal resistance with Si_3N_4 AMB
- Low Inductive Design
- Thermistor inside

Applications

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

Circuit diagram

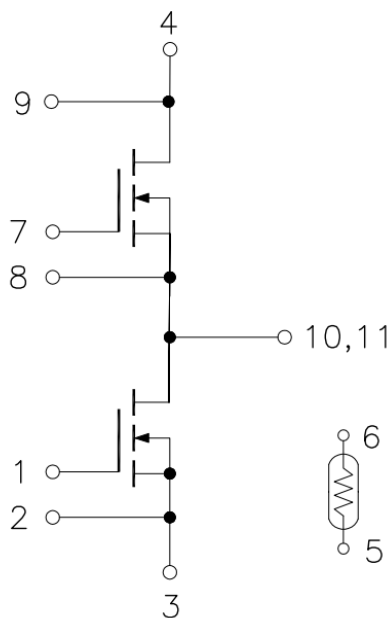


Figure 1. Out drawing & circuit diagram for HCS600FH170D3C1

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Pin Configuration and Marking Information

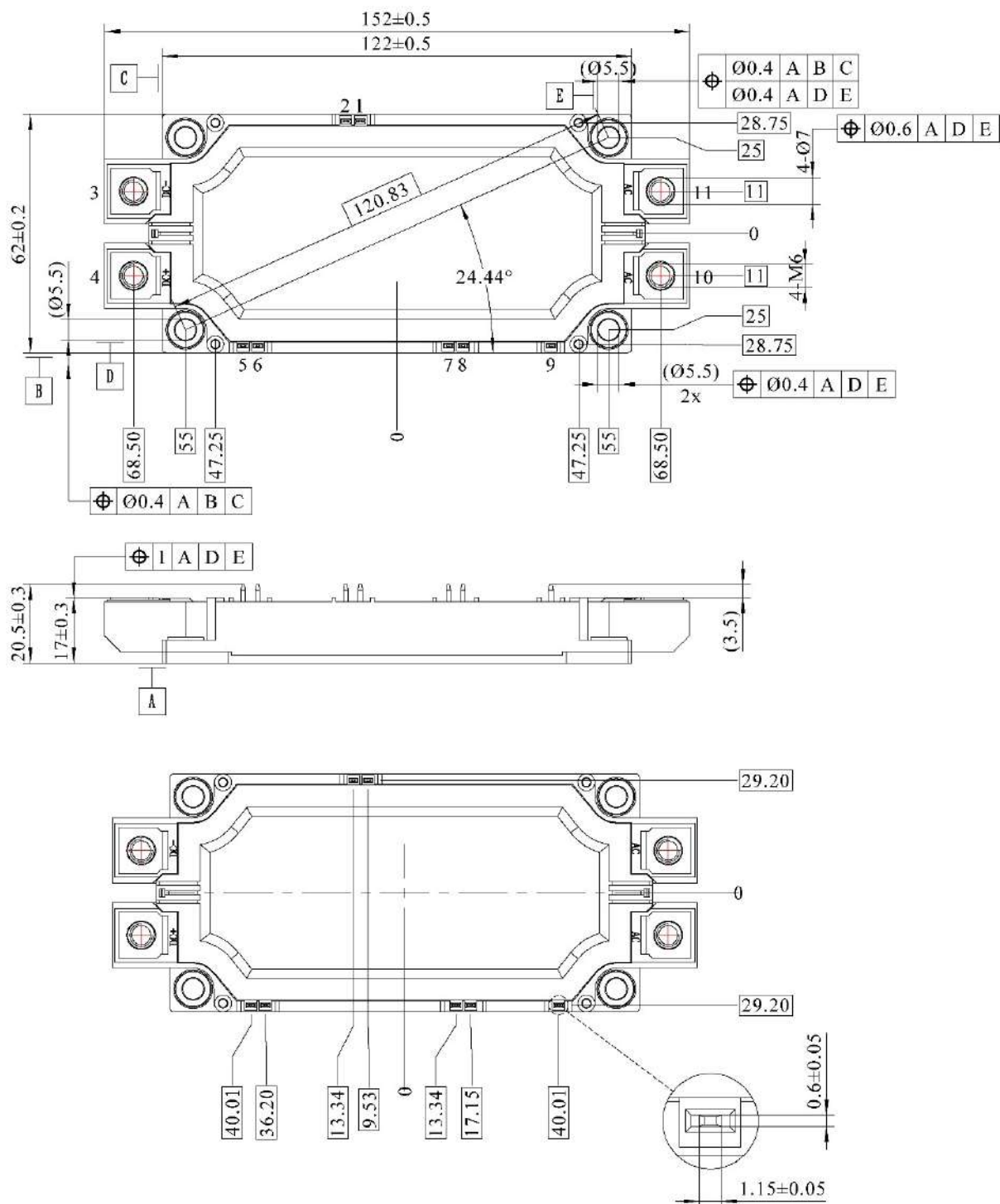


Figure 2. Pin configuration

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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	-	385	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	545	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	545	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 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 =493 Ω	-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

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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 =600μA		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		-	-	600	nA
		V _{GS} =-10V, V _{DS} =0V		-	-	-600	nA
V _{GS(th)}	Gate-source threshold Voltage	I _D =360mA	T _j =25°C	1.80	2.70	-	V
		V _{DS} =V _{GS}	T _j =175°C	-	1.90	-	V
R _{DS(on)} (Chip)	Static drain-source On-state resistance	I _D =600A	T _j =25°C	-	3.4	-	mΩ
		V _{GS} =15V	T _j =175°C	-	7.7	-	mΩ
V _{DS(on)} (Chip)	Static drain-source On-state Voltage	I _D =600A	T _j =25°C	-	2.04	-	V
		V _{GS} =15V	T _j =175°C	-	4.62	-	V
C _{iss}	Input Capacitance	V _D =1000V, V _{GS} =0V f =1MHz, Vac =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} =+15/-5V		-	1536	-	nC
Q _{gd}	Gate-Drain Charge			-	540	-	nC
Q _{gs}	Gate-Source Charge			-	462	-	nC
R _{Gint}	Internal Gate Resistance	T _j =25°C		-	0.8	-	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.

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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} = -5V	T _j =25°C	-	5.6	-	V
		I _{SD} =600A	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)} =4.7 Ω	T _j =25°C	-	2.56	-	μC
			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

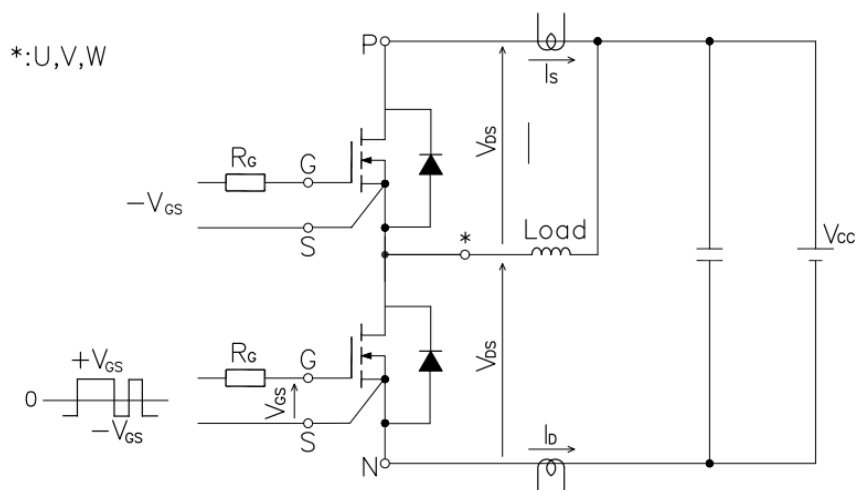


Figure 3. Switching time measure circuit

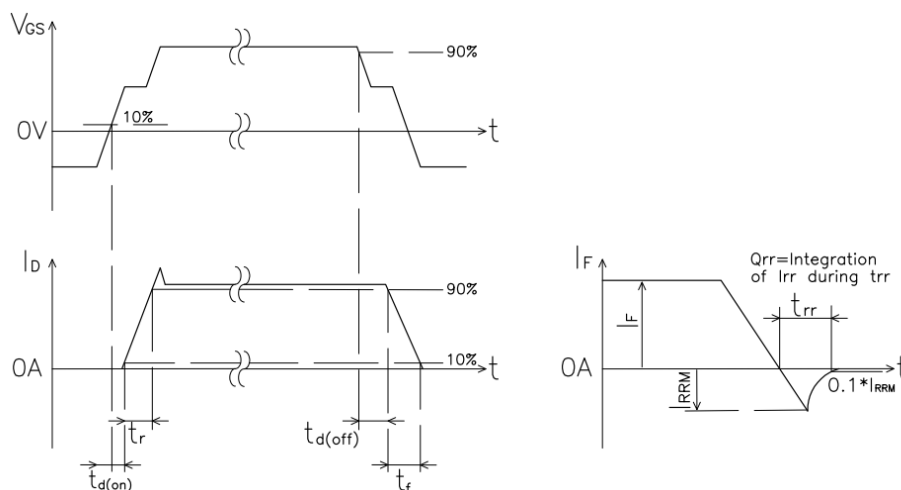


Figure 4. Switching time definition

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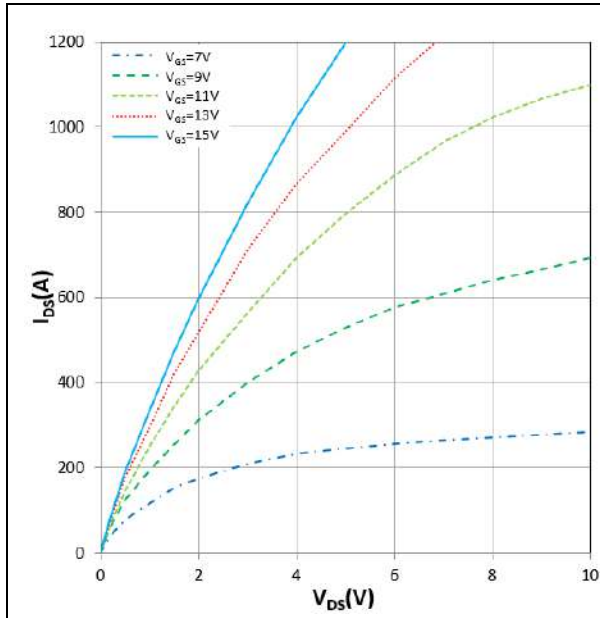


Figure 5. I_{DS} vs V_{DS}
 $T_j = 25^\circ\text{C}$, V_{GS} parameter

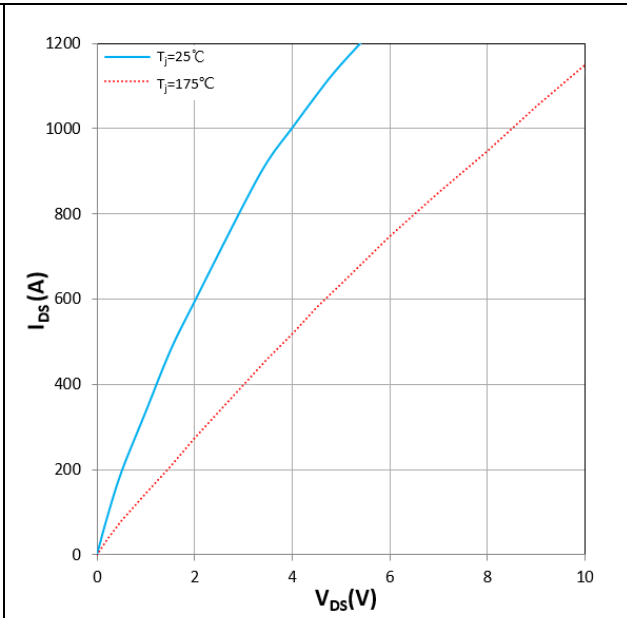


Figure 6. I_{DS} vs V_{DS}
 $V_{GS} = 15\text{V}$, T_j parameter

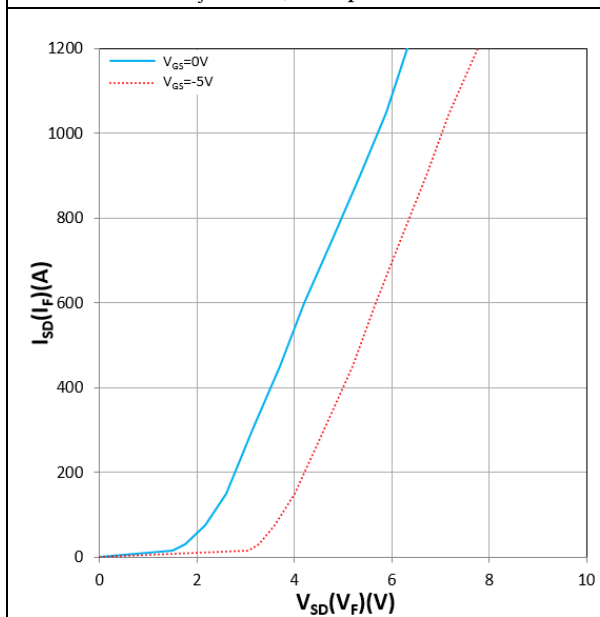


Figure 7. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
 $T_j = 25^\circ\text{C}$, V_{GS} parameter

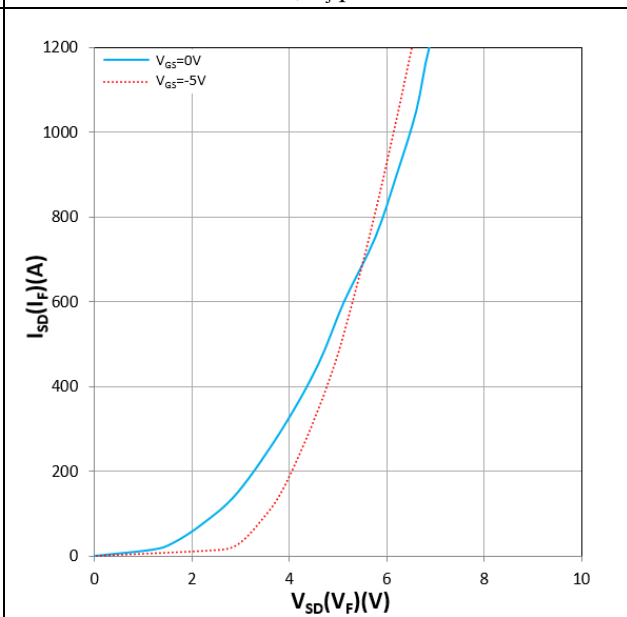
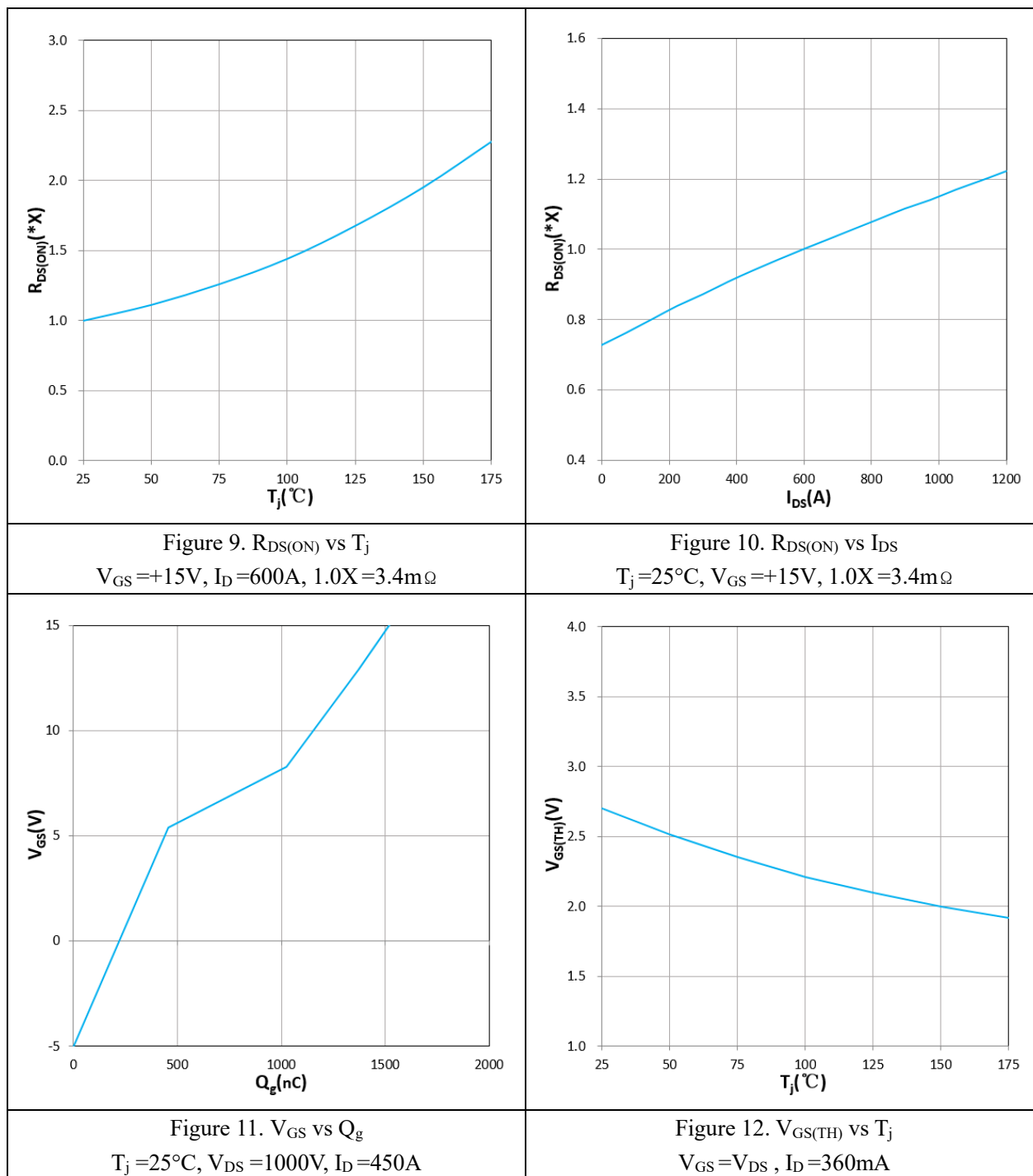


Figure 8. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
 $T_j = 175^\circ\text{C}$, V_{GS} parameter

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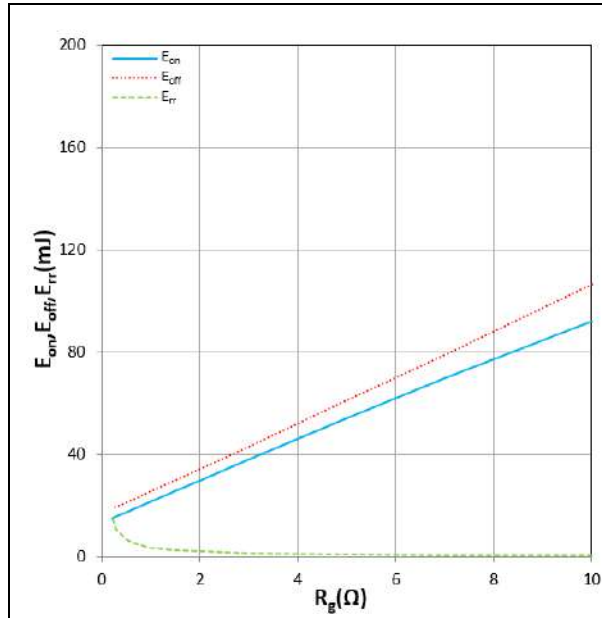


Figure 13. E_{on} , E_{off} , E_{rr} vs R_g
 $T_j=25^\circ\text{C}$, $V_{DD}=900\text{V}$, $V_{GS}=+15\text{V}/-5\text{V}$, $I_D=600\text{A}$
 Inductive Load

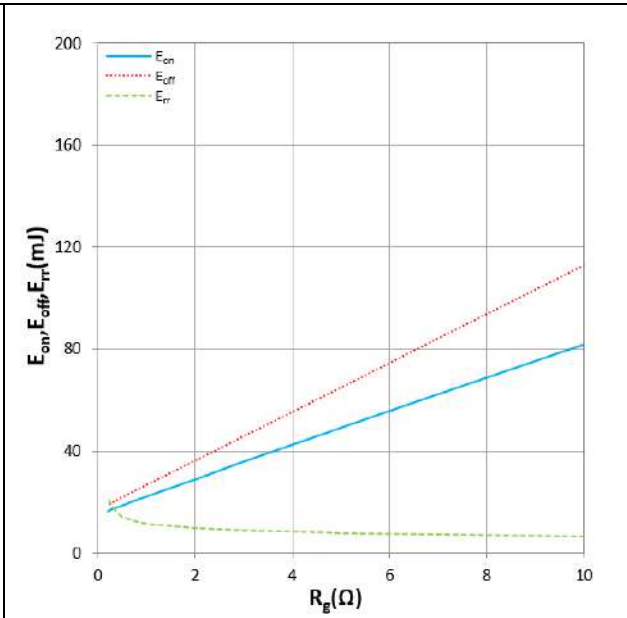


Figure 14. E_{on} , E_{off} , E_{rr} vs R_g
 $T_j=150^\circ\text{C}$, $V_{DD}=900\text{V}$, $V_{GS}=+15\text{V}/-5\text{V}$, $I_D=600\text{A}$
 Inductive Load

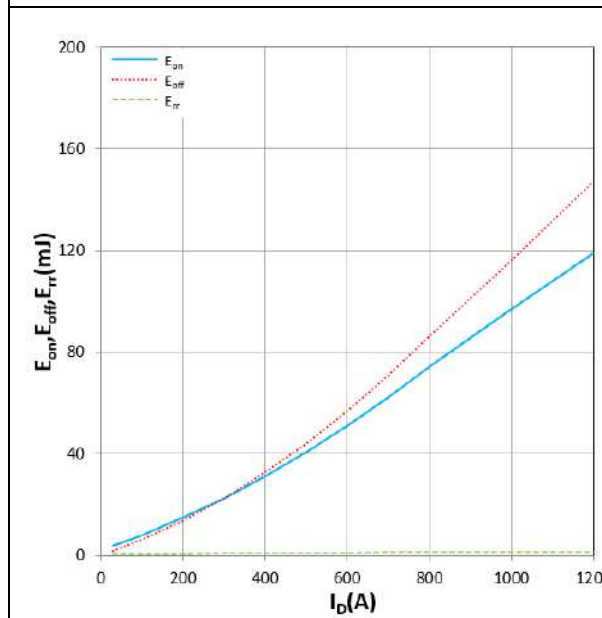


Figure 15. E_{on} , E_{off} , E_{rr} vs I_D
 $T_j=25^\circ\text{C}$, $V_{DD}=900\text{V}$, $V_{GS}=+15\text{V}/-5\text{V}$, $R_g=4.7\Omega$
 Inductive Load

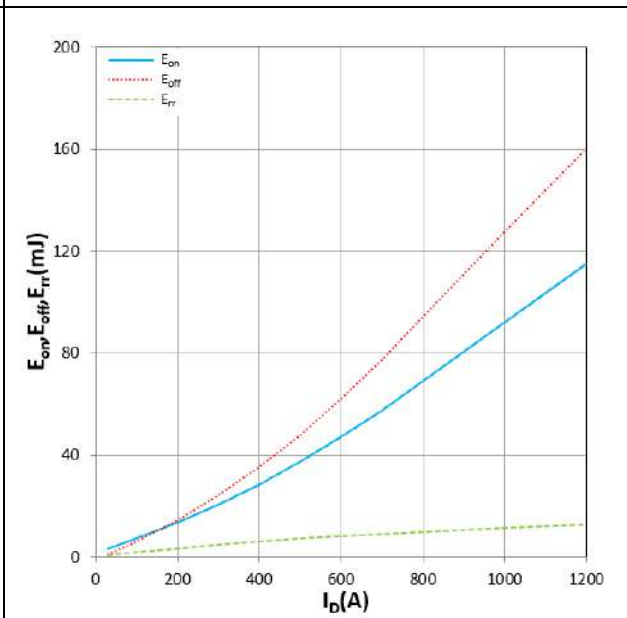


Figure 16. E_{on} , E_{off} , E_{rr} vs I_D
 $T_j=150^\circ\text{C}$, $V_{DD}=900\text{V}$, $V_{GS}=+15\text{V}/-5\text{V}$, $R_g=4.7\Omega$
 Inductive Load

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Revision History

Document Version	Description of Changes
RevX.0.1	Released

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