

HCS300FH170D3C1

1700V/300A Half Bridge SiC MOSFET Module

Description

The HCS300FH170D3C1 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
- $R_{DS(on)}=6.1m\Omega @ T_j=25^{\circ}C$
- 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

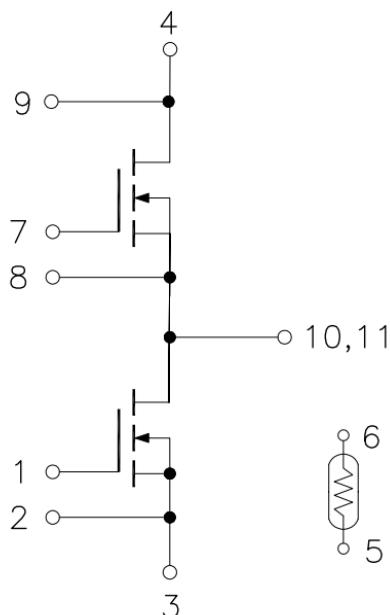


Figure 1. Out drawing & circuit diagram for HCS300FH170D3C1

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Pin Configuration and Marking Information

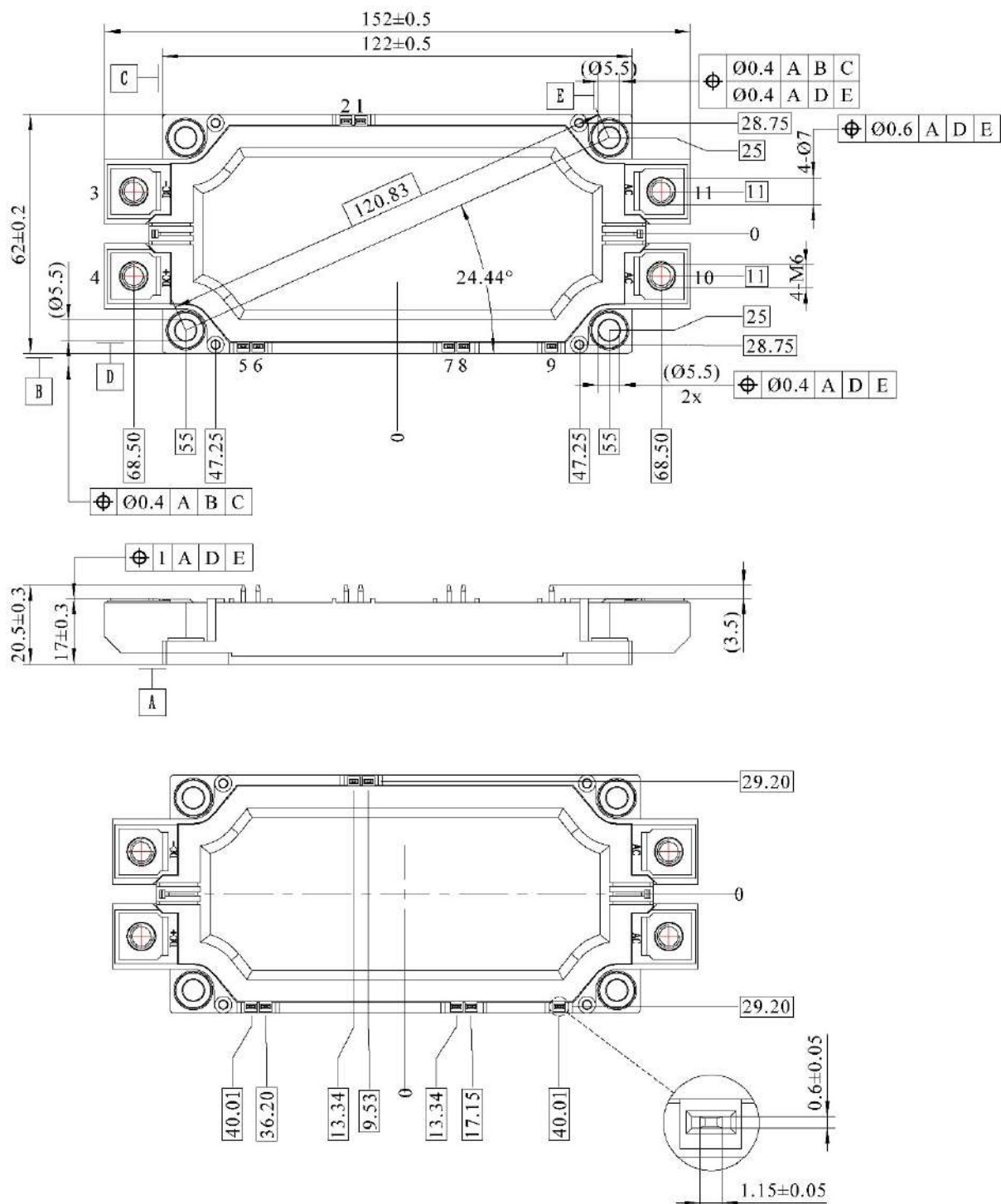


Figure 2. Pin configuration

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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	315	A
I _{DS}	DC Continuous Drain Current	T _c =60°C, V _{GS} =15V	275	A
I _{SD}	Source (Body diode) Current	T _c =25°C, with ON signal	315	A
I _{SD}	Source (Body diode) Current	T _c =60°C, with ON signal	275	A
I _{DSM}	Pulse Forward Current	T _c =25°C, Pulse width =1ms, Note2	600	A
P _{tot}	Total Power Dissipation	T _c =25°C	1579	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 =300μA		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		-	-	300	nA
		V _{GS} =-10V, V _{DS} =0V		-	-	-300	nA
V _{GS(th)}	Gate-source threshold Voltage	I _D =180mA	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	I _D =300A	T _j =25°C	-	6.70	-	m Ω
	On-state resistance	V _{GS} =15V	T _j =175°C	-	15.5	-	m Ω
V _{DS(on)} (Chip)	Static drain-source	I _D =300A	T _j =25°C	-	2.01	-	V
	On-state Voltage	V _{GS} =15V	T _j =175°C	-	4.65	-	V
C _{iss}	Input Capacitance	V _D =1000V, V _{GS} =0V f =1MHz, Vac =25mV		-	22.9	-	nF
C _{oss}	Output Capacitance			-	0.62	-	nF
C _{rss}	Reverse transfer Capacitance			-	0.11	-	nF
Q _g	Total gate charge	V _{DD} =1000V		-	768	-	nC
Q _{gd}	Gate-Drain Charge	I _D =225A		-	270	-	nC
Q _{gs}	Gate-Source Charge	V _{GS} =+15/-5V		-	231	-	nC
R _{Gint}	Internal Gate Resistance	T _j =25°C		-	1.6	-	Ω
t _{d(on)}	Turn-on delay time	V _{DD} =900V I _D =300A V _{GS} =+15/-5V R _{G(on)} =5.1Ω R _{G(off)} =5.1Ω Inductive load switching operation	T _j =25°C	-	137	-	ns
			T _j =150°C	-	106	-	
t _r	Rise time		T _j =25°C	-	101	-	ns
			T _j =150°C	-	85	-	
t _{d(off)}	Turn-off delay time		T _j =25°C	-	497	-	ns
			T _j =150°C	-	596	-	
t _f	Fall time		T _j =25°C	-	71	-	ns
			T _j =150°C	-	93	-	
E _{on}	Turn-on power dissipation		T _j =25°C	-	27.3	-	mJ
			T _j =150°C	-	25.4	-	
E _{off}	Turn-off power dissipation		T _j =25°C	-	30.1	-	mJ
			T _j =150°C	-	33.2	-	
R _{th(j-c)}	FET Thermal Resistance	Junction to Case		-	0.095	-	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} = 300A	T _j = 175°C	-	5.3	-	
T _{rr}	Reverse recovery time	V _{RR} = 900V, I _D = 300A MOSFET side:	T _j = 25°C	-	33	-	ns
			T _j = 150°C	-	112	-	
Q _{rr}	Reverse recovery charge	V _{GS} = +15/-5V R _{G(on)} = R _{G(off)} = 5.1 Ω	T _j = 25°C	-	1.91	-	μC
			T _j = 150°C	-	9.15	-	
E _{rr}	Diode switching power dissipation	Inductive load switching operation	T _j = 25°C	-	0.5	-	mJ
			T _j = 150°C	-	4.2	-	

Test Conditions

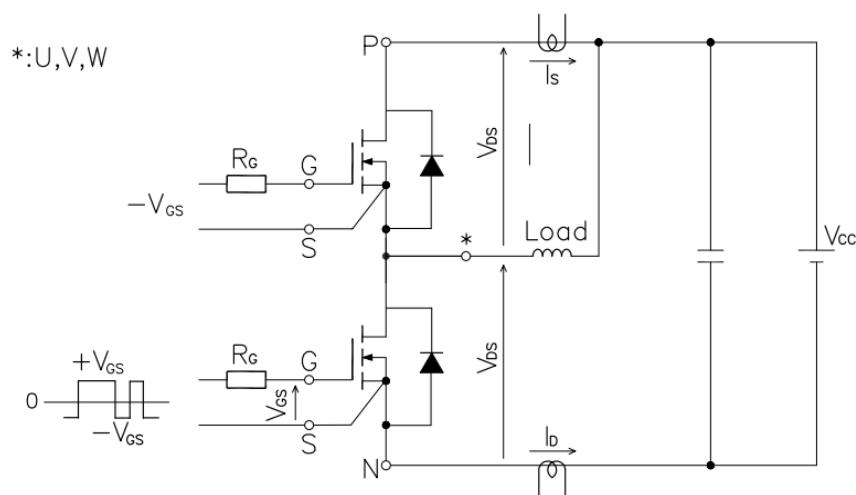


Figure 3. Switching time measure circuit

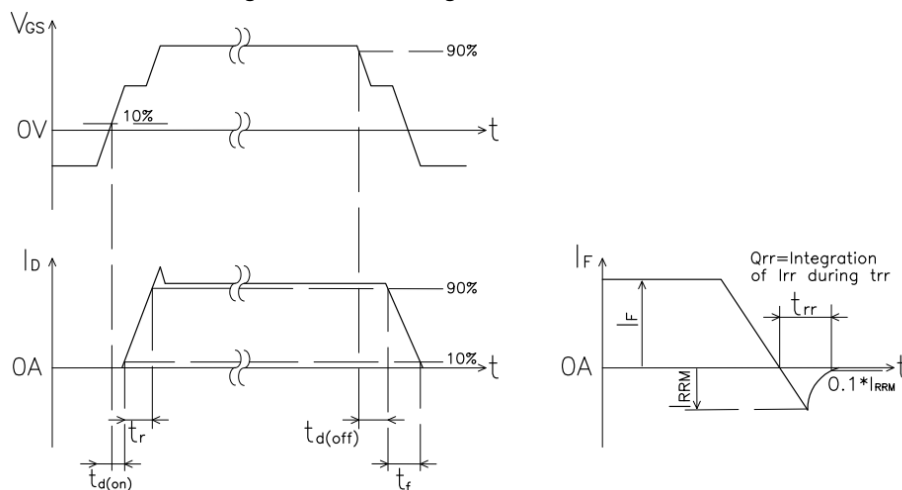


Figure 4. Switching time definition

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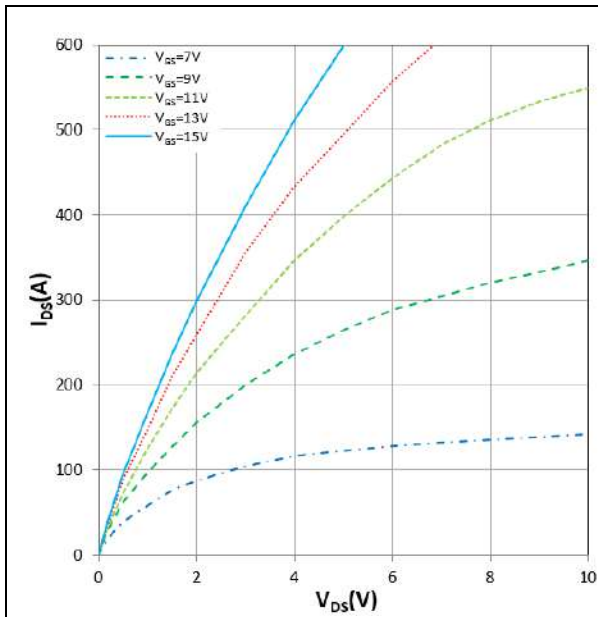


Figure 5. I_{DS} vs V_{DS}
 $T_j = 25^\circ\text{C}$, V_{GS} parameter

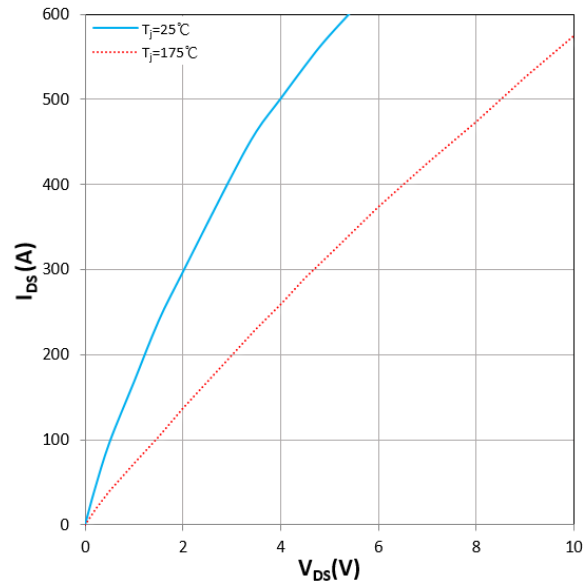


Figure 6. I_{DS} vs V_{DS}
 $V_{GS} = 15\text{V}$, T_j parameter

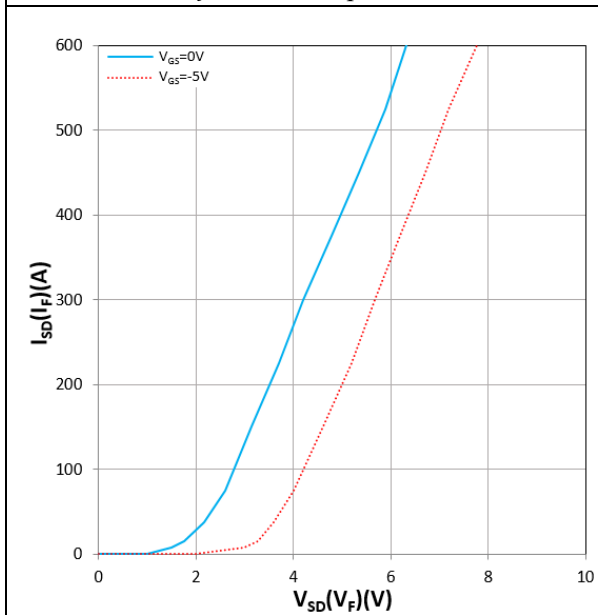


Figure 7. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
 $T_j = 25^\circ\text{C}$, V_{GS} parameter

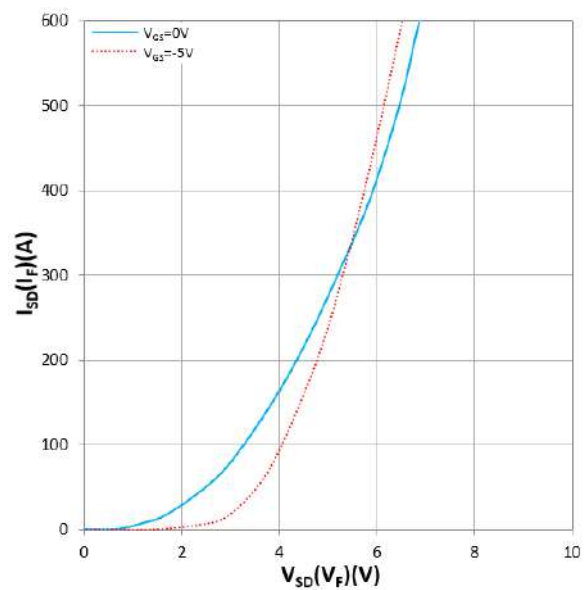


Figure 8. $I_{SD}(I_F)$ vs $V_{SD}(V_F)$
 $T_j = 175^\circ\text{C}$, V_{GS} parameter

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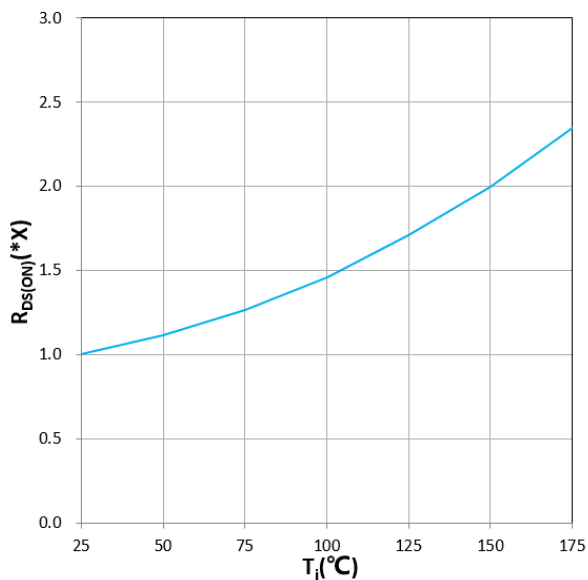


Figure 9. $R_{DS(ON)}$ vs T_j
 $V_{GS}=+15\text{V}$, $I_D=300\text{A}$, $1.0X=6.70\text{m}\Omega$

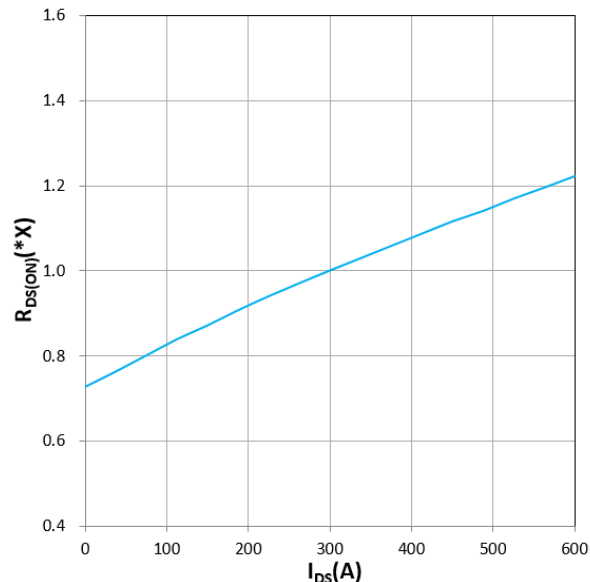


Figure 10. $R_{DS(ON)}$ vs I_{DS}
 $T_j=25^{\circ}\text{C}$, $V_{GS}=+15\text{V}$, $1.0X=6.70\text{m}\Omega$

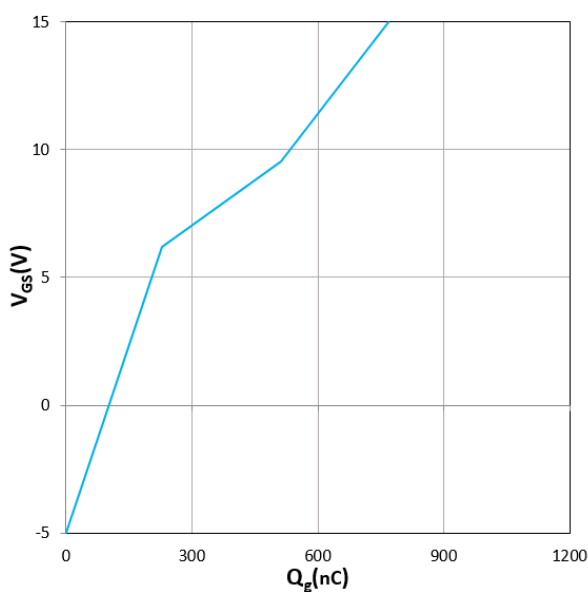


Figure 11. V_{GS} vs Q_g
 $T_j=25^{\circ}\text{C}$, $V_{DS}=1000\text{V}$, $I_D=225\text{A}$

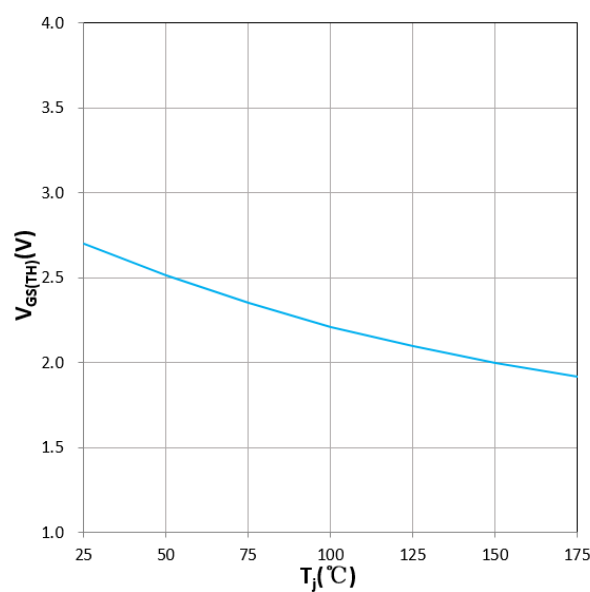


Figure 12. $V_{GS(TH)}$ vs T_j
 $V_{GS}=V_{DS}$, $I_D=180\text{mA}$

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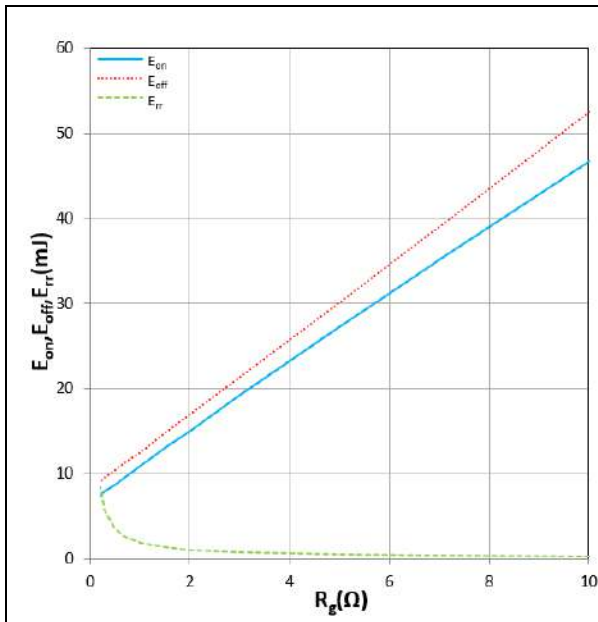


Figure 13. E_{on} , E_{off} , E_{rr} vs R_g
 $T_j = 25^\circ\text{C}$, $V_{DD} = 900\text{V}$, $V_{GS} = +15\text{V}/-5\text{V}$, $I_D = 300\text{A}$
 Inductive Load

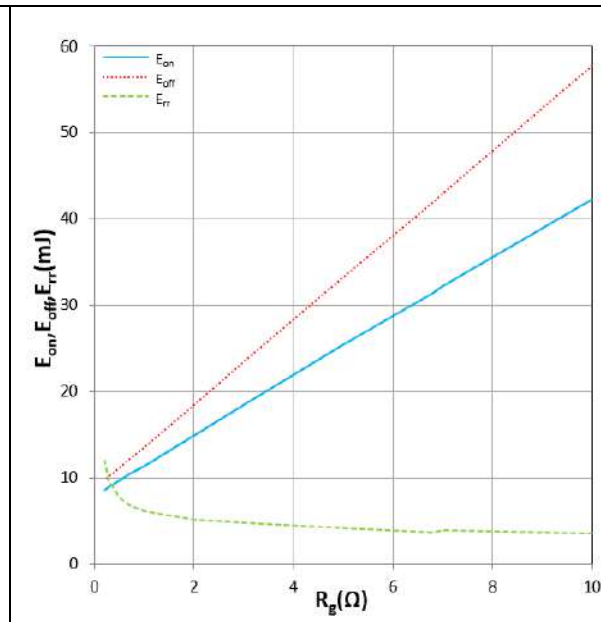


Figure 14. E_{on} , E_{off} , E_{rr} vs R_g
 $T_j = 150^\circ\text{C}$, $V_{DD} = 900\text{V}$, $V_{GS} = +15\text{V}/-5\text{V}$, $I_D = 300\text{A}$
 Inductive Load

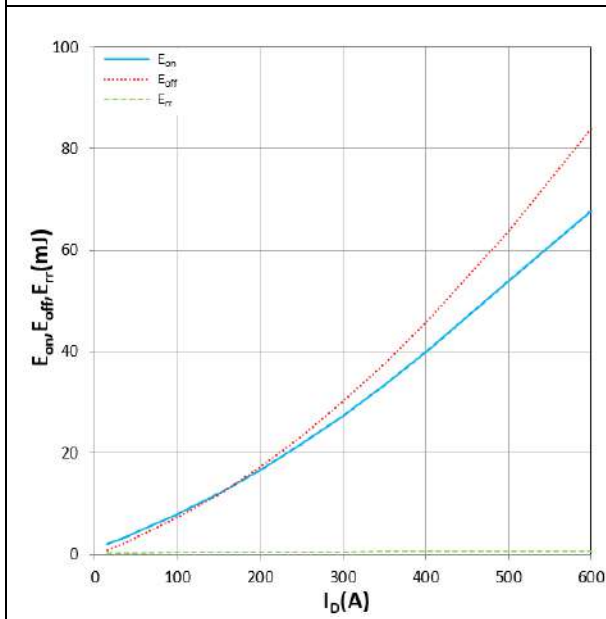


Figure 15. E_{on} , E_{off} , E_{rr} vs I_D
 $T_j = 25^\circ\text{C}$, $V_{DD} = 900\text{V}$, $V_{GS} = +15\text{V}/-5\text{V}$, $R_g = 5.1\Omega$
 Inductive Load

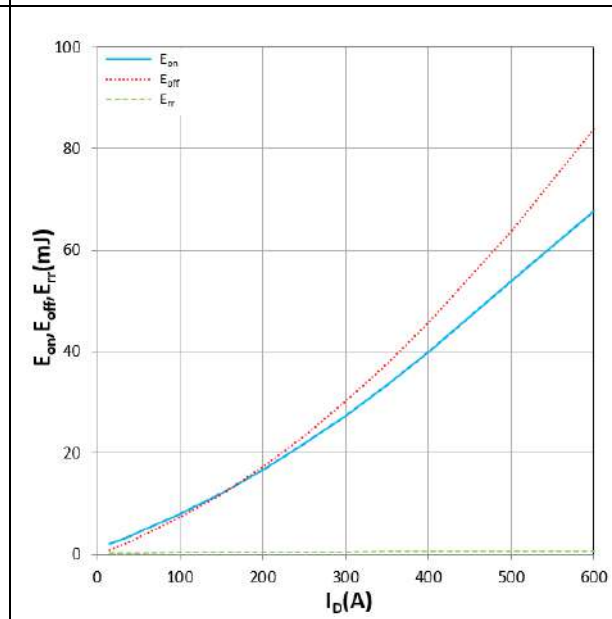


Figure 16. E_{on} , E_{off} , E_{rr} vs I_D
 $T_j = 150^\circ\text{C}$, $V_{DD} = 900\text{V}$, $V_{GS} = +15\text{V}/-5\text{V}$, $R_g = 5.1\Omega$
 Inductive Load

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Due to technical requirements, our product may contain dangerous substances. For information on the types in question, please contact the sales staff responsible for you.

Changes to this product data sheet are reserved.

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Revision History

Document Version	Description of Changes
RevX.0.1	Released

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