

HCS400FC170D4C2

1700V/400A Chopper SiC MOSFET Module

Description

The HCS400FC170D4C2 is a Chopper SiC MOSFET Power Module. It integrates high performance SiC MOSFET chips designed for the applications such as xEV Application and Renewable energy.



Features

- Blocking Voltage 1700V
- $R_{DS(ON)}=5.2m\Omega$ ($V_{GS}=15V$)
- Low Thermal Resistance with Si_3N_4 AMB
- 175°C Maximum Junction Temperature
- Low Inductive Design
- Thermistor Inside
- Pressfit Terminal
- Copper Base Size: 79mm*62mm

Application

- xEV Applications
- Converter
- Vehicle Fast Chargers
- Renewable Energy

Circuit Diagram

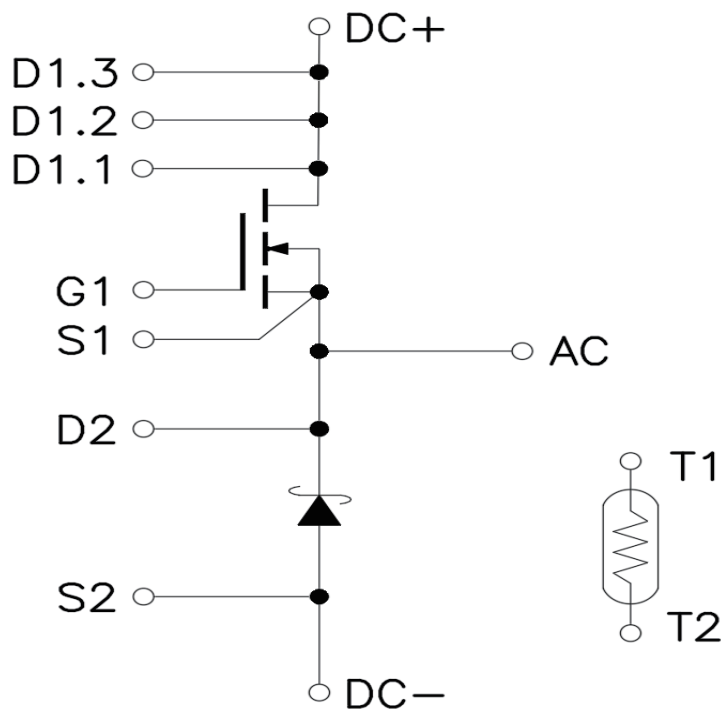


Figure 1. Out Drawing & Circuit Diagram HCS400FC70D4C2

HCS400FC170D4C2

1700V/400A Chopper SiC MOSFET Module

Physical Dimensions

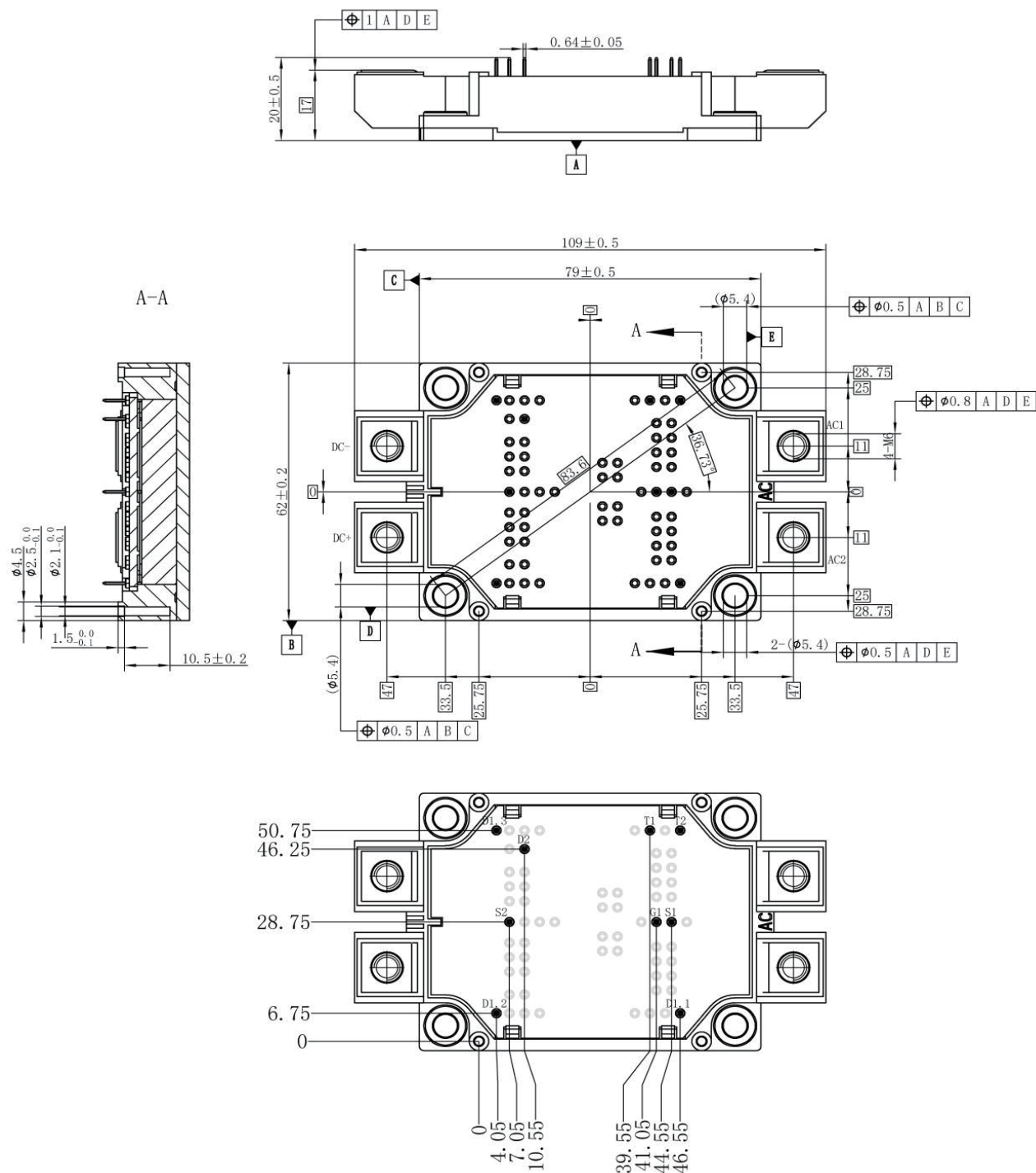


Figure 2. Physical Dimensions

HCS400FC170D4C2

1700V/400A Chopper SiC MOSFET Module

Pin Configuration

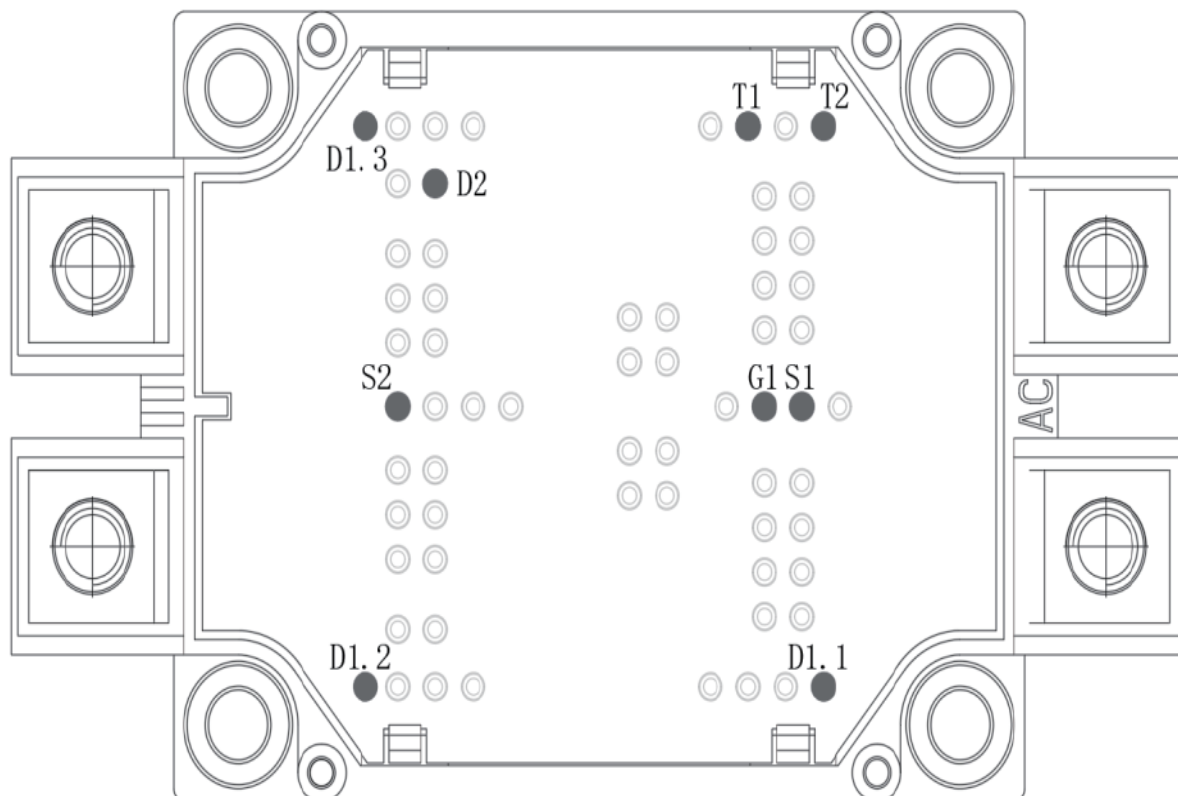


Figure 3. Pin Configuration

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

HCS400FC170D4C2

1700V/400A Chopper SiC MOSFET Module

Maximum Ratings ($T_j=25^{\circ}\text{C}$ Unless Otherwise Specified)

Symbol	Parameter	Conditions	Value	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 (tsurge= 300nsec)	D-S Short, Note1	-10 to 20	V
I_{DS}	DC Continuous Drain Current	$T_j=25^{\circ}\text{C}$, $V_{\text{GS}}=15\text{V}$	420	A
I_{DS}	DC Continuous Drain Current	$T_j=65^{\circ}\text{C}$, $V_{\text{GS}}=15\text{V}$	360	A
I_{DSM}	Pulse Forward Current	$T_c=65^{\circ}\text{C}$, Pulse width =1ms, $V_{\text{GS}}=15\text{V}$ Note2	800	A
I_{F}	Forward Current (Diode)	$T_j=65^{\circ}\text{C}$	430	A
I_{FRM}	Pulse Forward Current (Diode)	Less than 1ms, Note2	800	A
I^2t	$\int I^2 dt$	$T_p=10\text{ms}$, $T_c=25^{\circ}\text{C}$	11248	A^2S
P_{tot}	Total Power Dissipation	$T_c=25^{\circ}\text{C}$	2585	W
T_{jmax}	Max Junction Temperature	-	175	$^{\circ}\text{C}$
T_{stg}	Storage temperature	-	-40 to 125	$^{\circ}\text{C}$

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

Note2: Pulse width limited by maximum junction temperature

NTC Characteristics

Symbol	Parameter	Conditions	Value			Unit
			Min.	Typ.	Max.	
R25	Resistance	$T_c=25^{\circ}\text{C}$	-	5	-	k Ω
$\Delta R/R$	Deviation of R_{100}	$T_c=100^{\circ}\text{C}$, $R_{100}=493\Omega$	5	-	5	%
P_{25}	Power dissipation	$T_c=25^{\circ}\text{C}$	-	-	20	mW
$B_{25/50}$	B-value	$R_2=R_{25} \exp [B_{25/50}(1/T_2 - 1/(298,15 \text{ K}))]$	-	3375	-	K
$B_{25/80}$	B-value	$R_2=R_{25} \exp [B_{25/80}(1/T_2 - 1/(298,15 \text{ K}))]$	-	3411	-	K
$B_{25/100}$	B-value	$R_2=R_{25} \exp [B_{25/100}(1/T_2 - 1/(298,15 \text{ K}))]$	-	3433	-	K

HCS400FC170D4C2

1700V/400A Chopper SiC MOSFET Module

MOSFET Electrical Characteristics ($T_j=25^{\circ}\text{C}$ Unless Otherwise Specified, Chip)

Symbol	Parameter	Conditions		Value			Unit
				Min.	Typ.	Max.	
V _{(BR)DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _D =160μA		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, V _{DS} =V _{GS}	T _J =25°C	1.8	2.7	-	V
			T _J =175°C	-	1.9	-	V
I _{GSS}	Gate-Source Leakage Current	V _{GS} =15V, V _{DS} =0V	T _J =25°C	-	-	1000	nA
R _{DS(on)} (Chip)	Static drain-source On-state resistance	I _D =400A, V _{GS} =15V	T _J =25°C	-	5.2	7.5	mΩ
			T _J =175°C	-	11.6	-	mΩ
V _{DS(on)} (Chip)	Static drain-source On-state resistance	I _D =400A, V _{GS} =15V	T _J =25°C	-	2.08	3.0	V
			T _J =175°C	-	4.64	-	V
V _{SD}	Body Diode Forward Voltage	V _{GS} =0V, I _{SD} =400A	T _J =25°C	-	4.8	-	V
			T _J =175°C	-	4.2	-	V
C _{iss}	Input capacitance	V _{DS} =1000V, V _{GS} =0Vf =100KHz Vac =25mV		-	30.5	-	nF
C _{oss}	Output capacitance			-	0.82	-	nF
C _{rss}	Reverse transfer capacitance			-	0.150	-	nF
Q _g	Total gate charge	V _{DD} =1000V, I _D =300A, V _{GS} =-5/+15V		-	1022	-	nC
t _{d(on)}	Turn-on delay time	V _{DD} =900V I _D =400A V _{GS} =+15/-4V R _{G(ON)} =6.8Ω R _{G(OFF)} =6.8Ω Inductive load Switching operation	T _J =25°C	-	165	-	ns
			T _J =150°C	-	129	-	
t _r	Rise time		T _J =25°C	-	123	-	ns
			T _J =150°C	-	93	-	
t _{d(off)}	Turn-off delay time		T _J =25°C	-	515	-	ns
			T _J =150°C	-	646	-	
t _f	Fall time		T _J =25°C	-	80	-	ns
			T _J =150°C	-	102	-	
E _{on}	Turn-on power dissipation		T _J =25°C	-	48.4	-	mJ
			T _J =150°C	-	40.70	-	
E _{off}	Turn-off power dissipation		T _J =25°C	-	46.1	-	mJ
			T _J =150°C	-	49.6	-	
R _{th(j-c)}	FET Thermal Resistance	Junction to Case		-	0.058	-	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 $\cdot$ K and thickness is 50um.

HCS400FC170D4C2

1700V/400A Chopper SiC MOSFET Module

SiC SBD Electrical Characteristics ($T_j=25^{\circ}\text{C}$ Unless Otherwise Specified, Chip)

Symbol	Parameter	Conditions		Value			Unit
				Min.	Typ.	Max.	
V_{RRM}	Repetitive Peak Reverse Voltage	$T_j=25^{\circ}\text{C}$		-	1700	-	V
V_F	Forward Voltage	$I_F=400$	$T_j=25^{\circ}\text{C}$	-	1.8	-	V
			$T_j=175^{\circ}\text{C}$	-	2.9	-	
I_{RRM}	Reverse Current	$V_{RRM}=1700\text{V}$	$T_j=25^{\circ}\text{C}$	-	8	200	μA
			$T_j=175^{\circ}\text{C}$	-	164	-	
Q_C	Total Capacitive Charge	$I_F \cdot t_{F,MAX}$ $di_F/dt=200\text{A}/\mu\text{S}$	$V_R=600\text{V}$	-	1432	-	nC
			$V_R=1200\text{V}$	-	2096	-	
C	Total Capacitance	$f=1\text{MHz}$	$V_R=1\text{V}$	-	18308	-	pF
			$V_R=1200\text{V}$	-	1008	-	
T_{rr}	Reverse Recovery Time	$V_{RR}=600\text{V}$ $I_F=400\text{A}$ $V_{GS}=+15/-4\text{V}$ $R_G=6.8\Omega$ Inductive load	$T_j=25^{\circ}\text{C}$	-	19	-	μC
			$T_j=150^{\circ}\text{C}$	-	17	-	
E_{rr}	Diode Switching Power Dissipation		$T_j=25^{\circ}\text{C}$	-	0.81	-	mJ
			$T_j=150^{\circ}\text{C}$	-	1.08	-	
$R_{th(j-c)}$	SiC SBD Thermal Resistance	Junction to Case		-	0.063	-	K/W
$R_{th(c-f)}$	Contact thermal Resistance	With thermal conductive grease Note1		-	0.015	-	K/W

HCS400FC170D4C2

1700V/400A Chopper SiC MOSFET Module

Test Conditions

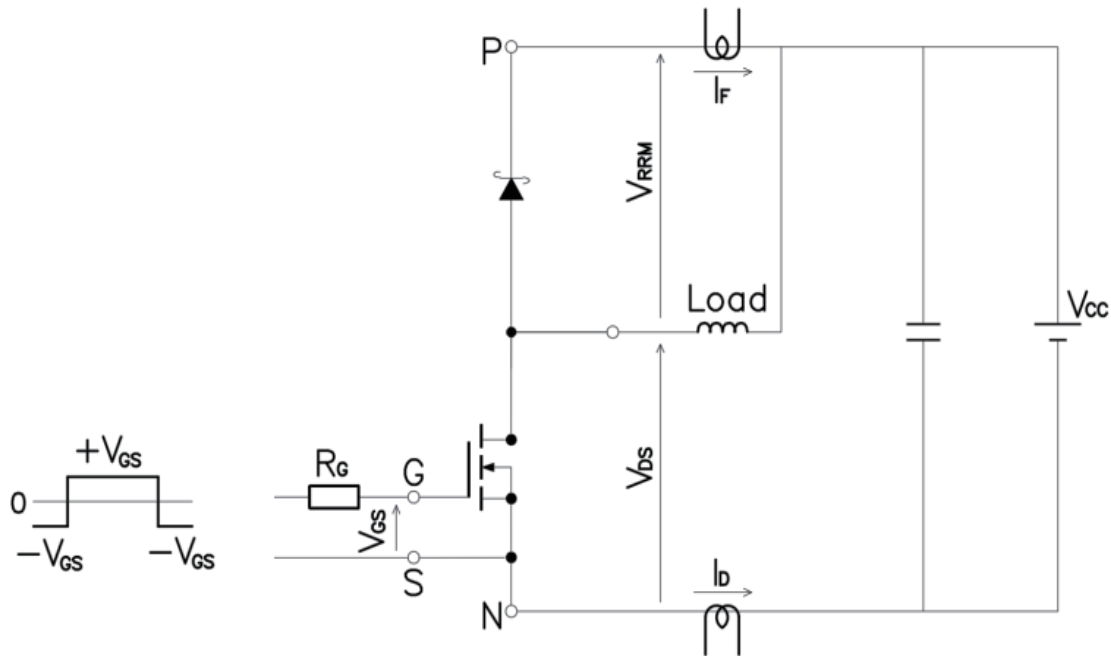


Figure 4. Switching Time Measure Circuit

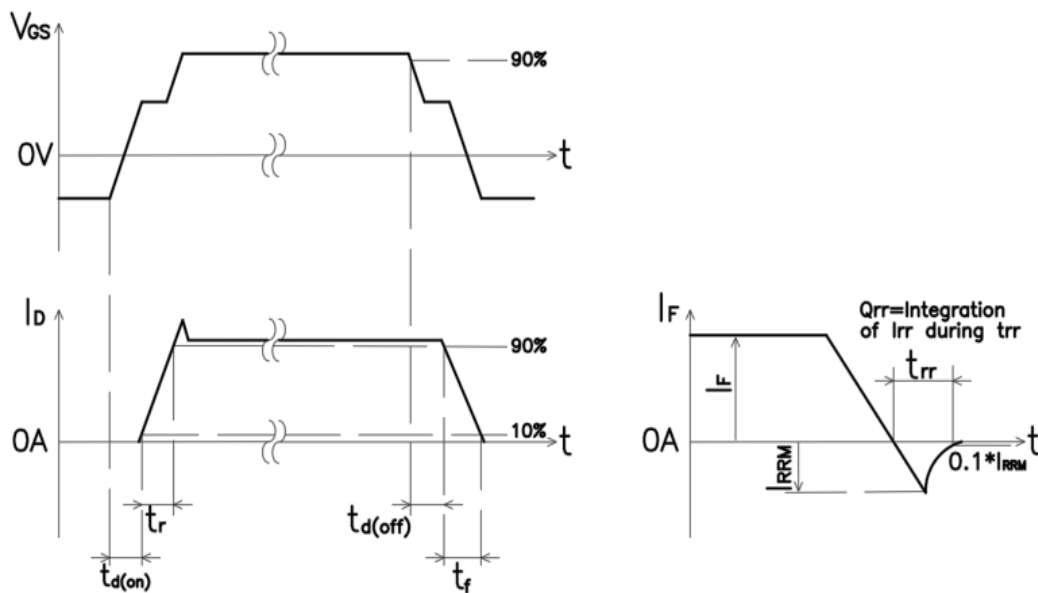


Figure 5. Switching Time Definition

HCS400FC170D4C2

1700V/400A Chopper SiC MOSFET Module

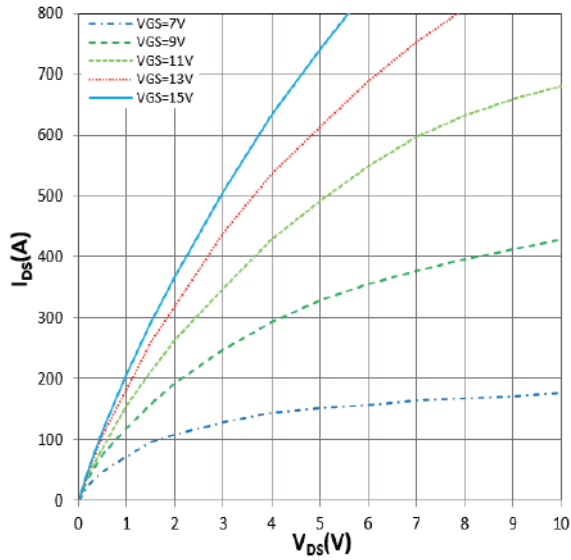


Figure 6. I_{DS} VS V_{DS}
 $T_J = 25^\circ\text{C}$, V_{GS} Parameter

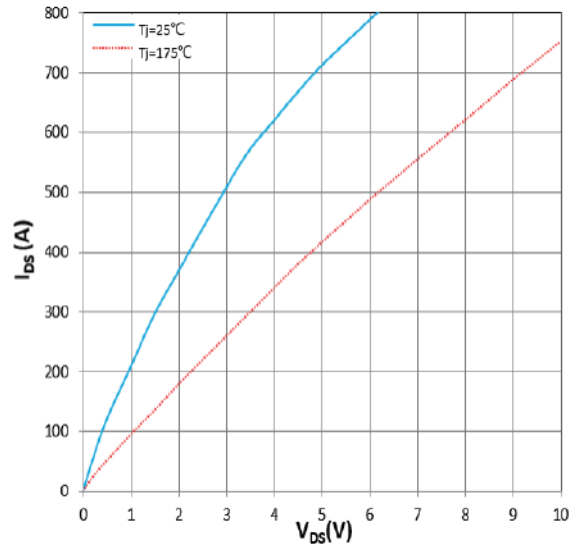


Figure 7. I_{DS} VS V_{DS}
 $V_{GS} = 15\text{V}$, T_J Parameter

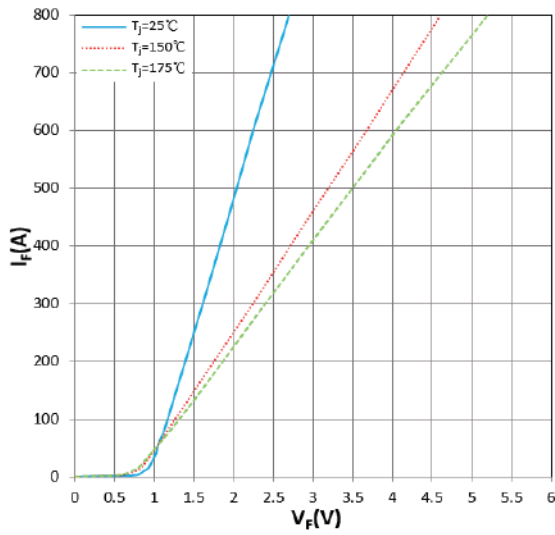


Figure 8. I_{DS} (I_F) VS V_{DS} (V_F)
 T_J Parameter

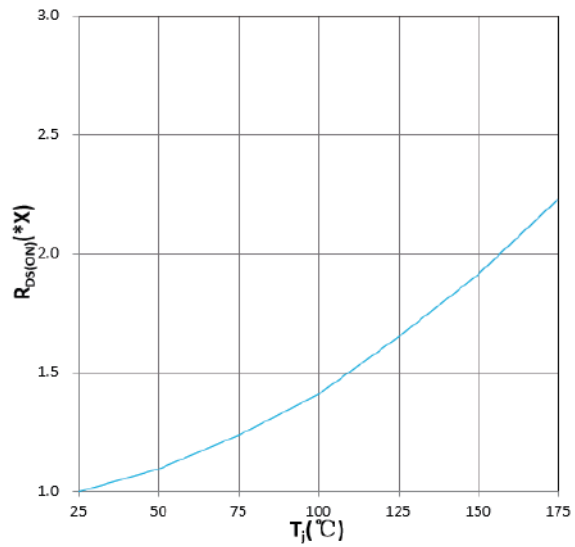


Figure 9. $R_{DS(on)}$ VS T_J
 $V_{GS} = +15\text{V}$, $I_D = 400\text{A}$, $1.0X = 5.2\text{m}\Omega$

HCS400FC170D4C2

1700V/400A Chopper SiC MOSFET Module

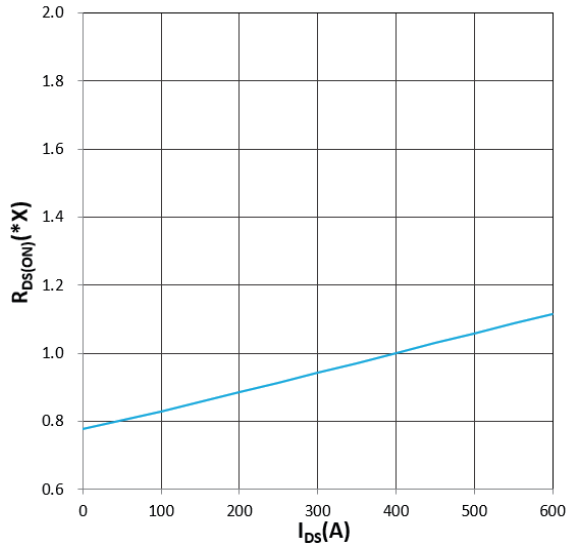


Figure 10. $R_{DS(on)}$ VS I_{DS}
 $V_{GS}=+15V$, $T_J=25^{\circ}C$, $1.0X=5.2m\Omega$

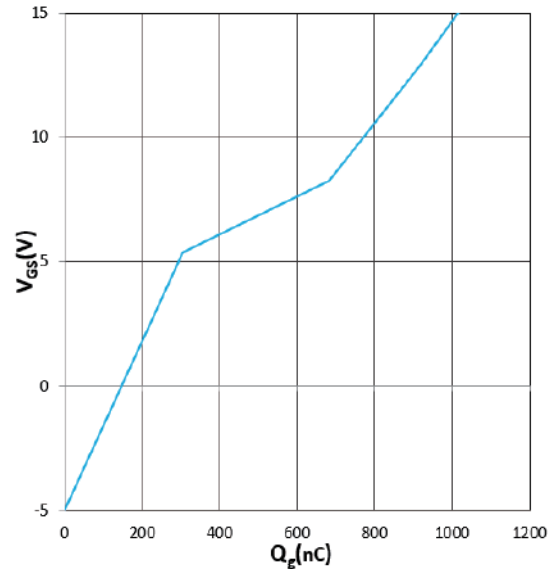


Figure 11. V_{GS} VS Q_g
 $T_J=25^{\circ}C$, $I_D=300A$, $V_{DS}=1000V$

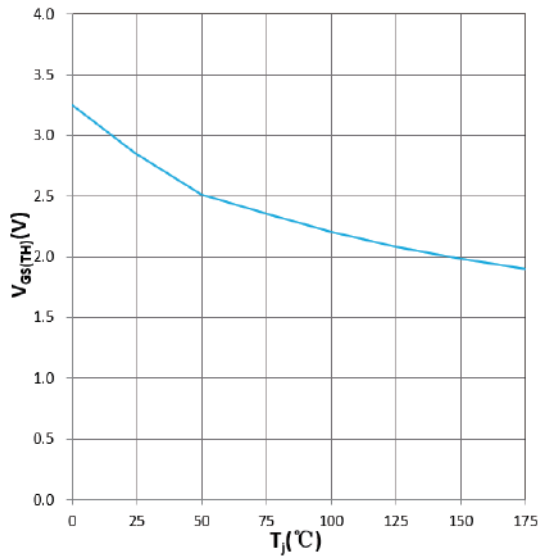


Figure 12. $V_{GS(th)}$ VS T_J
 $V_{GS}=V_{DS}$, $I_D=240mA$

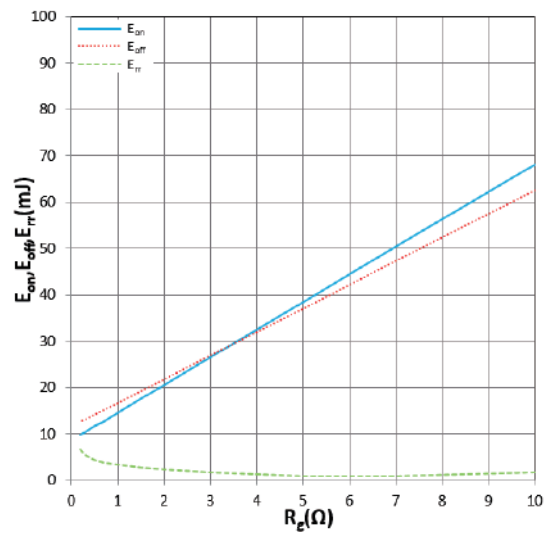


Figure 13. E_{on} , E_{off} , E_{tr} VS R_g
 $T_J=25^{\circ}C$, $V_{CC}=900V$, $I_D=400A$, $V_{GS}=+15V/-4V$
Inductive Load

HCS400FC170D4C2

1700V/400A Chopper SiC MOSFET Module

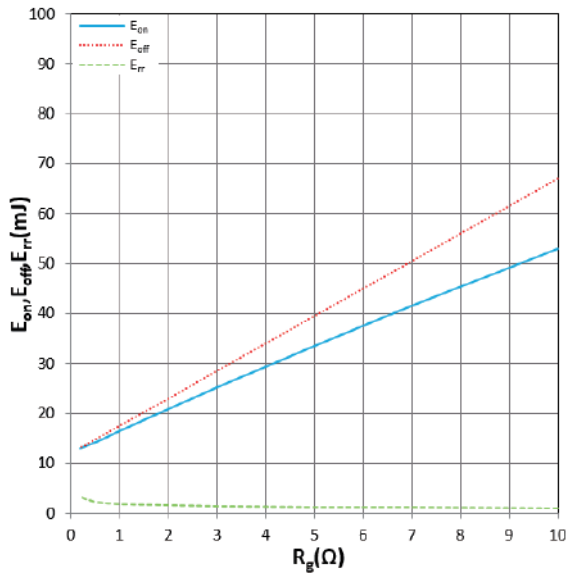


Figure 14. E_{on} , E_{off} , E_{rr} VS R_g
 $T_j=150^{\circ}\text{C}$, $V_{cc}=900\text{V}$, $I_D=400\text{A}$, $V_{GS}=+15\text{V}/-4\text{V}$
 Inductive Load

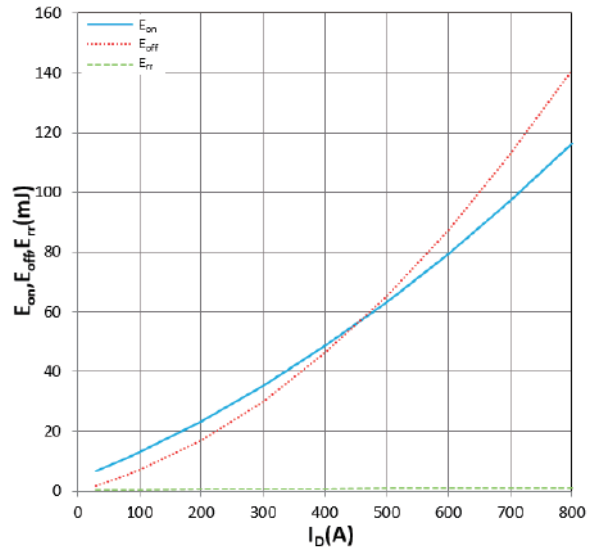


Figure 15. E_{on} , E_{off} , E_{rr} VS I_{DS}
 $T_j=25^{\circ}\text{C}$, $V_{cc}=900\text{V}$, $V_{GS}=+15\text{V}/-4\text{V}$, $R_{G1}=6.8\Omega$
 Inductive Load

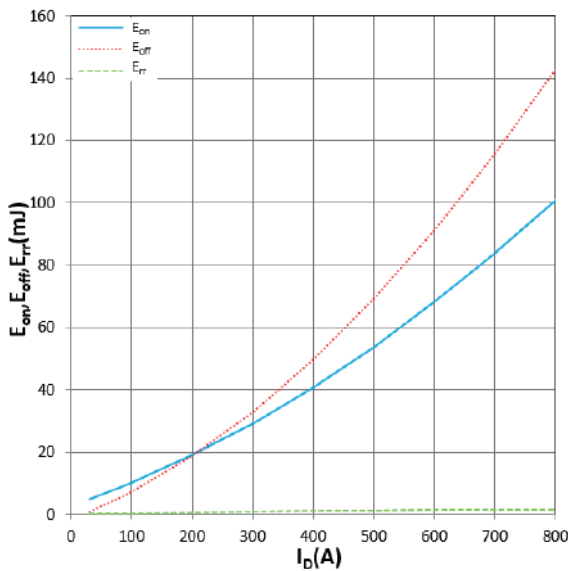


Figure 16. E_{on} , E_{off} , E_{rr} VS I_{DS}
 $T_j=150^{\circ}\text{C}$, $V_{cc}=900\text{V}$, $V_{GS}=+15\text{V}/-4\text{V}$, $R_g=6.8\Omega$
 Inductive Load

HCS400FC170D4C2

1700V/400A Chopper SiC MOSFET Module

IMPORTANT NOTICE

This product data sheet describes the characteristics of this product for which a warranty is granted. Any such warranty is granted exclusively under the terms and conditions of the supply agreement. There will be no guarantee or of any kind for the product and its characteristics.

The data contained in this document is exclusively intended for technically trained staff. You and your technical departments will have to evaluate the product's suitability for the intended application and the completeness of the product data concerning such application.

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.

Please contact the sales staff (sales@hiitio.com) for further information on the product, technology, delivery terms, conditions and prices.

Revision History

Document Version	Description of Changes
RevX.0.1	Released

Zhejiang HIITIO New Energy Co., Ltd

ADD : NO.1125 Zhixing Road,Qiaonan District, Xiaoshan Economic and
Technological Development Zone, Hangzhou, Zhejiang
TEL :400-667-9977

