

HCS400FH120D4C2

1200V/400A Half Bridge SiC MOSFET Module

Description

The HCS400FH120D4C2 is a Half Bridge SiC MOSFET Power Module. It integrates high performance SiC MOSFET chips designed for applications such as the Motor drives and Renewable energy.



Features

- 1200V/5.4mΩ($V_{GS}=15V$), 4.5mΩ($V_{GS}=18V$)
- Low Thermal Resistance with Si₃N₄ AMB
- 175°C Maximum Junction Temperature
- Low Inductive Design
- Thermistor Inside
- Pressfit Terminal
- Copper Base Size: 79mm*62mm

Application

- xEV Applications
- Motor Drives
- Vehicle Fast Chargers
- Renewable Energy

Circuit Diagram

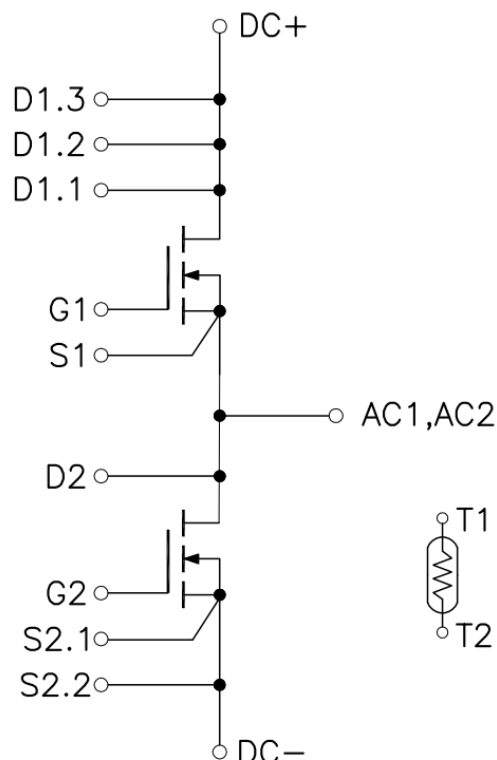


Figure 1. Out Drawing & Circuit Diagram HCS400FH120D4C2

Note: Please use **S2.1** for the low side drive signal and do not connect it to **S2.2** which is power terminal

HCS400FH12D4C2

1200V/400A Half Bridge SiC MOSFET Module

Physical Dimensions

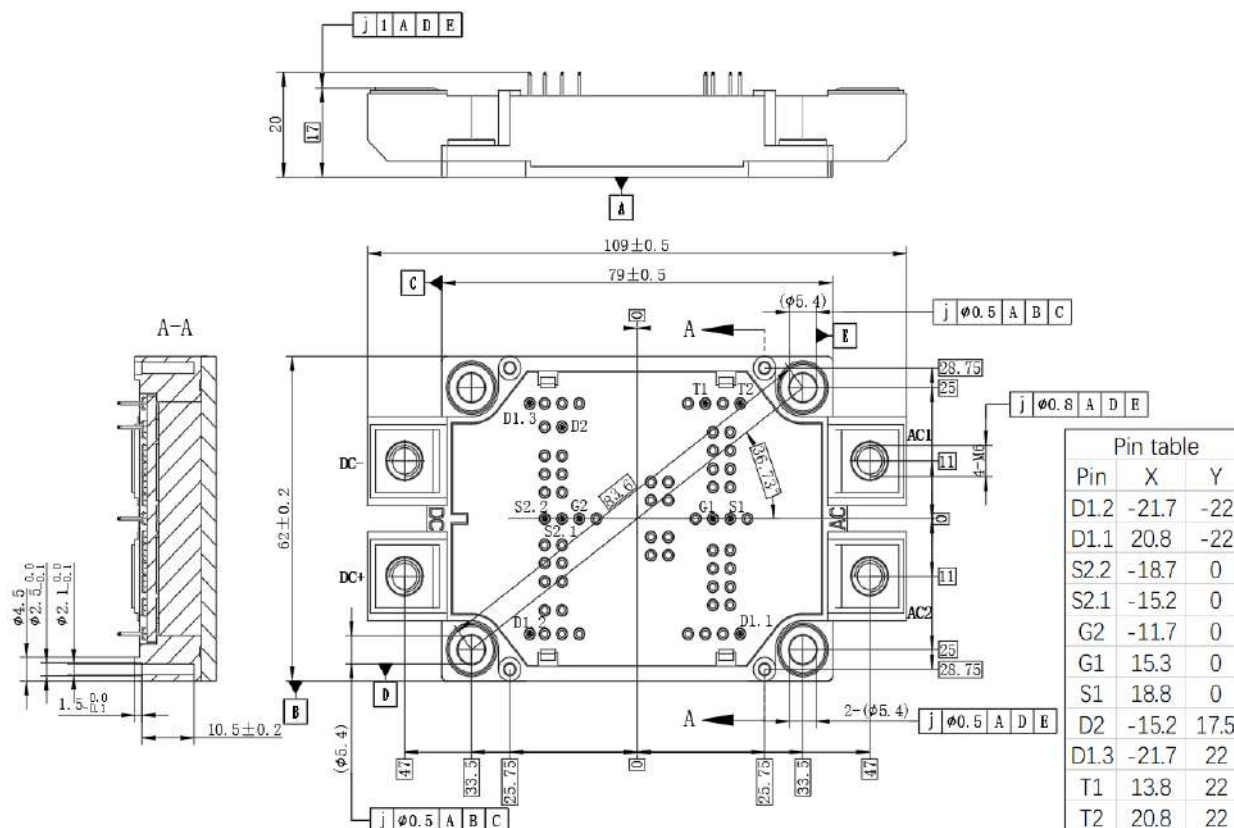


Figure 2. Physical Dimensions

Module

Parameter	Conditions	Value	Unit
Isolation voltage	RMS, f =0Hz, t =1min	3.4	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	-	>400	-
Module lead resistance, terminals – chip	T _c =25°C	0.3	mΩ
Mounting torque for module mounting	M5, M6	3 to 6	Nm
Weight	-	250	g

HCS400FH120D4C2

1200V/400A Half Bridge SiC MOSFET Module

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

Symbol	Parameter	Conditions	Value	Unit
V_{DS}	Drain-Source Voltage	G-S Short	1200	V
V_{GS}	Gate-Source Voltage	D-S Short, AC frequency • 4Hz, Note1	-10 to 22	V
I_{DS}	DC Continuous Drain Current	$T_f=25^{\circ}\text{C}$, $V_{\text{GS}}=+15\text{V}$	430	A
I_{DS}	DC Continuous Drain Current	$T_f=65^{\circ}\text{C}$, $V_{\text{GS}}=+15\text{V}$	370	A
I_{SD}	Source (Body Diode) Current	$T_f=25^{\circ}\text{C}$, with ON signal	430	A
I_{SD}	Source (Body Diode) Current	$T_f=65^{\circ}\text{C}$, with ON signal	370	A
I_{DSM}	Pulse Drain Current	$T_c=65^{\circ}\text{C}$, Pulse Width=1ms, $V_{\text{GS}}=+15\text{V}$, Note 2	800	A
P_{tot}	Total Power Dissipation	$T_c=25^{\circ}\text{C}$	1720	W
T_{jmax}	Max Junction temperature	-	175	$^{\circ}\text{C}$
T_{stg}	Storage temperature	-	-40 to 125	$^{\circ}\text{C}$

Note1: Recommended Operating Value: +18V/-5V, +15V/-4V

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

HCS400FH120D4C2

1200V/400A Half Bridge 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 =400μA		1200	-	-	V
I _{DSS}	Zero gate voltage drain current	V _{DS} =1200V, V _{GS} =0V		-	4	-	μA
V _{GS(Th)}	Gate-source threshold voltage	I _D =140mA, V _{DS} =V _{GS}	T _J =25°C	1.8	2.7	-	V
I _{GSS}	Gate-Source Leakage Current	V _{GS} =20V, V _{DS} =0V	T _J =25°C	-	-	400	nA
R _{DS(on)} (Chip)	Static drain-source On-state resistance	I _D =400A, V _{GS} =+15V	T _J =25°C	-	5.4	-	mΩ
			T _J =175°C	-	7.7	-	mΩ
		I _D =400A, V _{GS} =+18V	T _J =25°C	-	4.5	-	mΩ
			T _J =175°C	-	6.4	-	mΩ
V _{DS(on)} (Chip)	Static drain-source On-state resistance	I _D =400A, V _{GS} =+15V	T _J =25°C	-	2.16	3.2	V
			T _J =175°C	-	3.08	-	V
		I _D =400A, V _{GS} =+18V	T _J =25°C	-	1.80	-	V
			T _J =175°C	-	2.56	-	V
C _{iss}	Input capacitance	V _{DS} =800V, V _{GS} =0V, f=100kHz		-	17.4	-	nF
C _{oss}	Output capacitance			-	0.53	-	nF
C _{rss}	Reverse transfer capacitance			-	0.043	-	nF
Q _g	Total gate charge	V _{DS} =800V, I _D =300A, V _{GS} =+15/-5V		-	720	-	nC
t _{d(on)}	Turn-on delay tim	V _{DD} =600V I _D =400A V _{GS} =+15/-4V R _{G(ON)} =5.1Ω R _{G(OFF)} =3.3Ω Inductive load Switching operation	T _J =25°C	-	56	-	ns
			T _J =150°C	-	49	-	
t _r	Rise time		T _J =25°C	-	33	-	ns
			T _J =150°C	-	27	-	
t _{d(off)}	Turn-off delay time		T _J =25°C	-	119	-	ns
			T _J =150°C	-	131	-	
t _f	Fall time		T _J =25°C	-	19	-	ns
			T _J =150°C	-	48	-	
E _{on}	Turn-on power dissipation		T _J =25°C	-	13.64	-	mJ
			T _J =150°C	-	13.42	-	
E _{off}	Turn-off power dissipation		T _J =25°C	-	5.64	-	mJ
			T _J =150°C	-	6.11	-	
R _{th(j-c)}	FET Thermal Resistance	Junction to Case		-	0.087	-	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 $\cdot$ K and thickness is 50um.

HCS400FH120D4C2

1200V/400A Half Bridge SiC MOSFET Module

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

Symbol	Parameter	Conditions		Value			Unit
				Min.	Typ.	Max.	
V _{SD}	Body Diode Forward Voltage	V _{GS} =-5V I _{SD} =400A	T _J =25°C	-	5.2	-	V
			T _J =175°C	-	4.3	-	
T _{rr}	Reverse Recovery Time	V _{DD} =600V I _D =400A V _{GS} =+15/-4V R _{G(ON)} /R _{G(OFF)} =5.1Ω/3.3Ω Inductive loads Switching operation	T _J =25°C	-	31	-	ns
			T _J =150°C	-	63	-	
Q _{rr}	Reverse Recovery Charge		T _J =25°C	-	1.5	-	μC
			T _J =150°C	-	6.4	-	
E _{rr}	Diode Switching Power Dissipation		T _J =25°C	-	0.96	-	mJ
			T _J =150°C	-	2.37	-	

Test Conditions

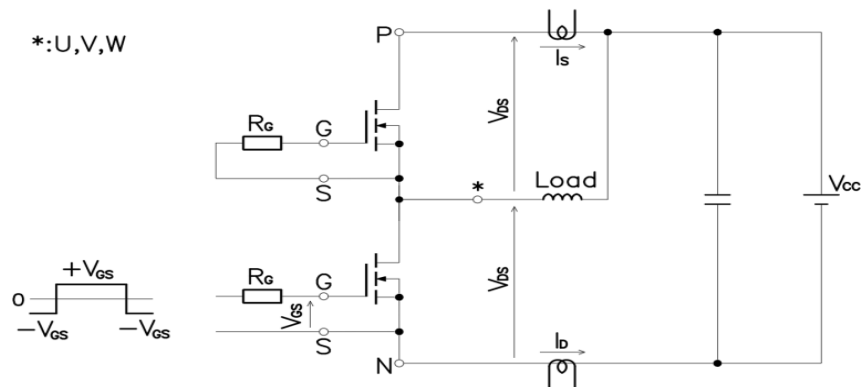


Figure 3. Switching Time Measure Circuit

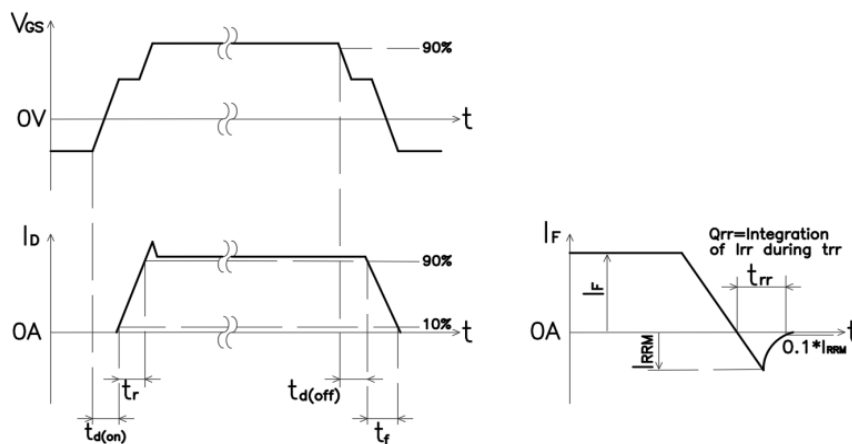


Figure 4. Switching Time Definition

HCS400FH120D4C2

1200V/400A Half Bridge SiC MOSFET Module

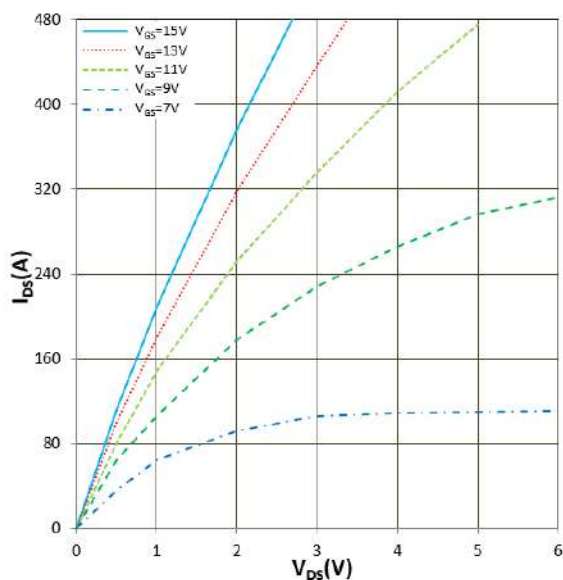


Figure 5. I_{DS} VS V_{DS}
 $T_J = 25^\circ\text{C}$

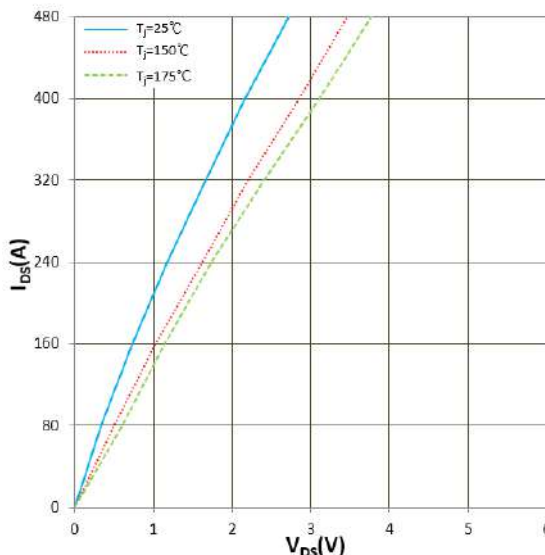


Figure 6. I_{DS} VS V_{DS}
 $V_{GS} = +15\text{V}$

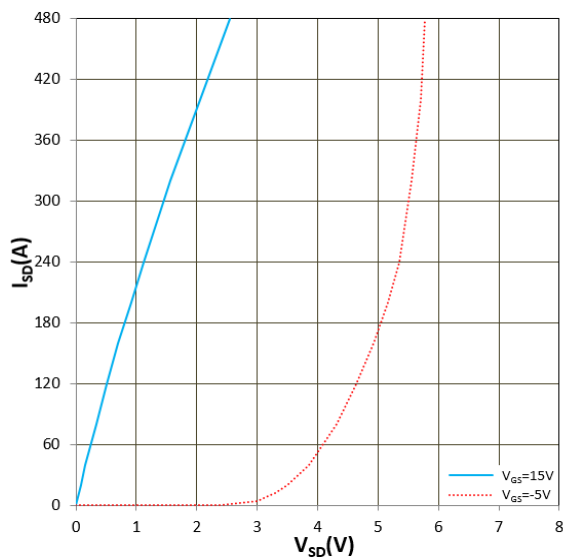


Figure 7. I_{SD} VS $V_{SD}(V_F)$
 $T_J = 25^\circ\text{C}$

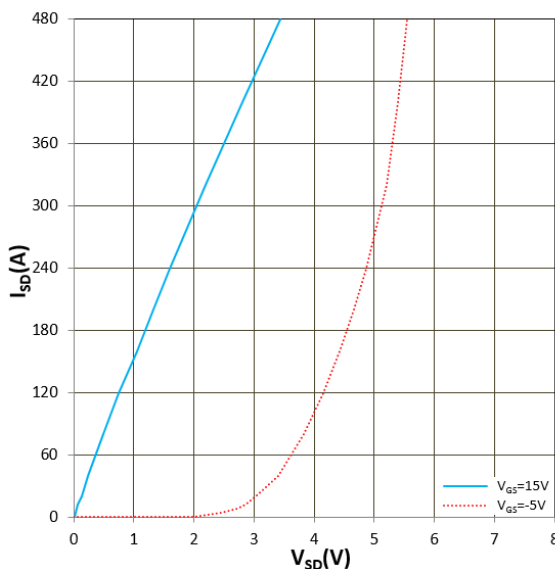
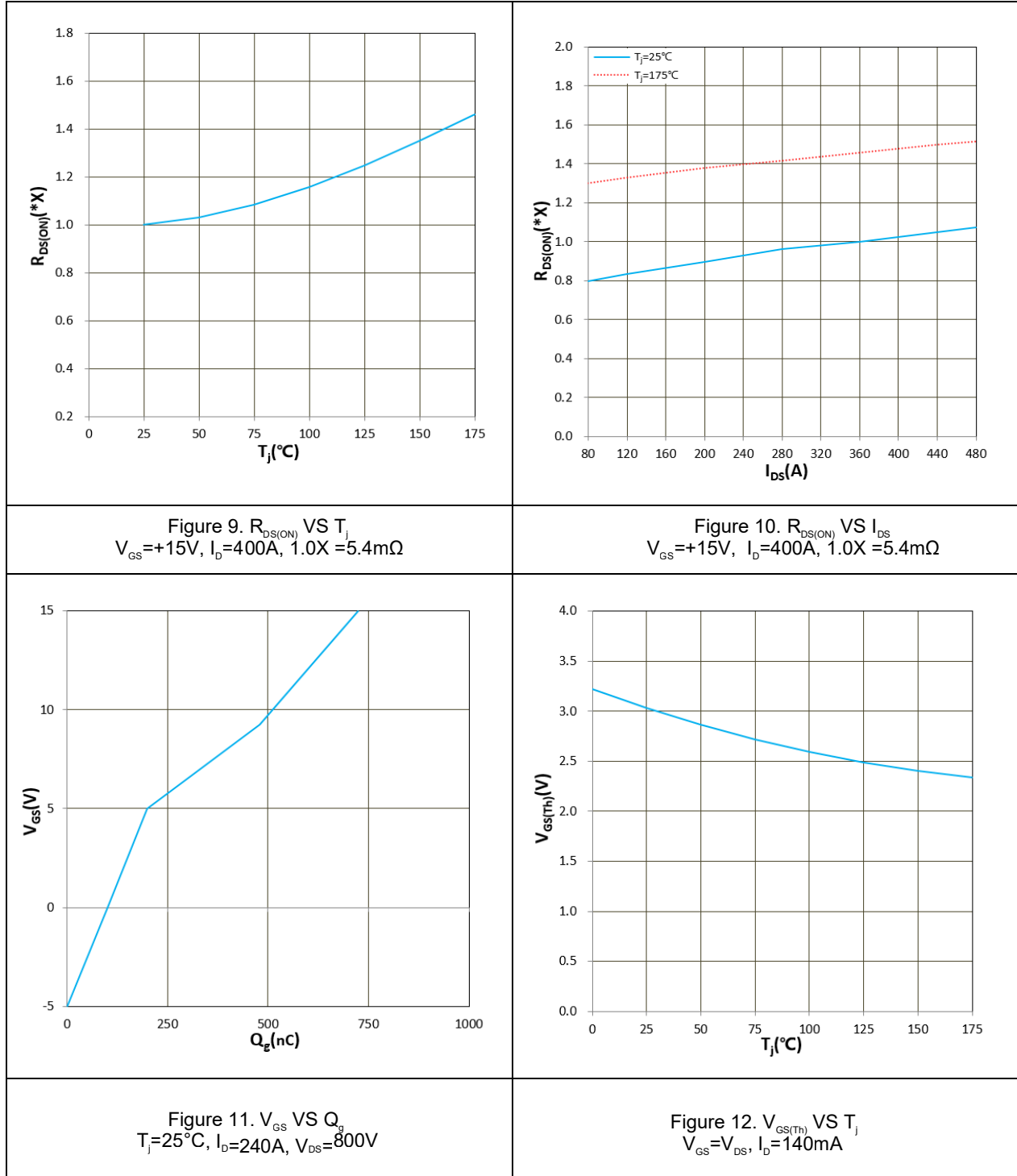


Figure 8. I_{SD} VS $V_{SD}(V_F)$
 $T_J = 175^\circ\text{C}$

HCS400FH120D4C2

1200V/400A Half Bridge SiC MOSFET Module



HCS400FH120D4C2

1200V/400A Half Bridge SiC MOSFET Module

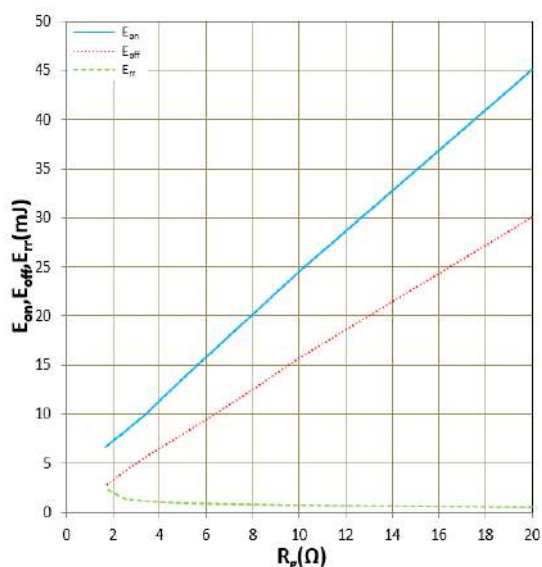


Figure 13. E_{on} , E_{off} , E_{rr} VS R_g
 $T_j=25^{\circ}\text{C}$, $V_{CC}=600\text{V}$, $I_D=400\text{A}$, $V_{GS}=+15\text{V}/-4\text{V}$
 Inductive Load

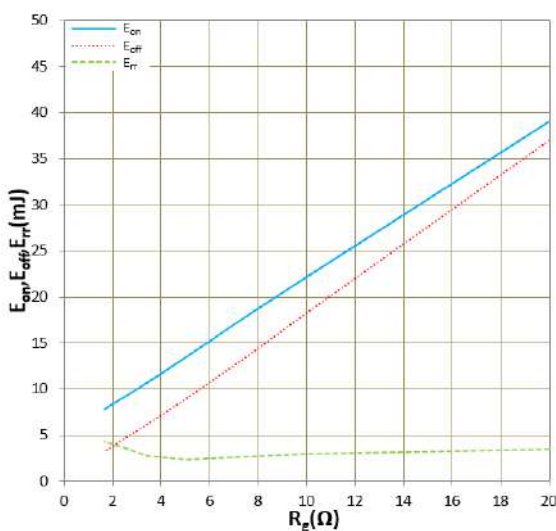


Figure14. E_{on} , E_{off} , E_{rr} VS R_g
 $T_j=150^{\circ}\text{C}$, $V_{CC}=600\text{V}$, $I_D=400\text{A}$, $V_{GS}=+15\text{V}/-4\text{V}$
 Inductive Load

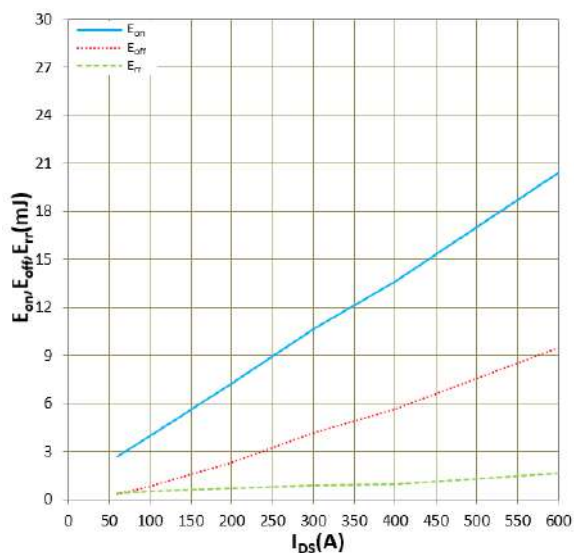


Figure 15. E_{on} , E_{off} , E_{rr} VS I_{DS}
 $T_j=25^{\circ}\text{C}$, $V_{CC}=600\text{V}$, $V_{GS}=+15\text{V}/-4\text{V}$
 $R_{G(ON)}R_{G(OFF)}=5.1/3.3\Omega$, Inductive Load

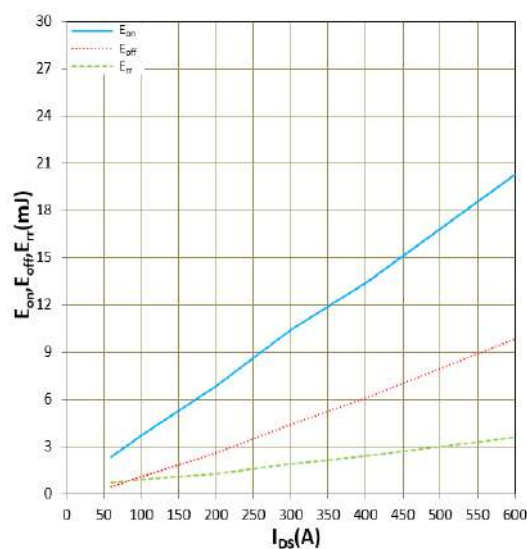


Figure 16. E_{on} , E_{off} , E_{rr} VS I_{DS}
 $T_j=150^{\circ}\text{C}$, $V_{CC}=600\text{V}$, $V_{GS}=+15\text{V}/-4\text{V}$
 $R_{G(ON)}R_{G(OFF)}=5.1/3.3\Omega$, Inductive Load

HCS400FH120D4C2

1200V/400A Half Bridge 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

