

HCS09FC120E1Q1

1200V/9mΩ Chopper SiC MOSFET Module

Description

The HCS09FC120E1Q1 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:1200V
- $9.2\text{m}\Omega$ $R_{ds(on)}$ @ $T_j = 25^\circ\text{C}$
- 150A @ $T_f = 75^\circ\text{C}$
- 175°C maximum junction temperature
- Low thermal resistance with Si₃N₄ AMB
- Low Switching Losses
- Thermistor inside

Applications

- xEV Applications
- Converter
- Vehicle Fast Chargers
- Renewable

Circuit diagram

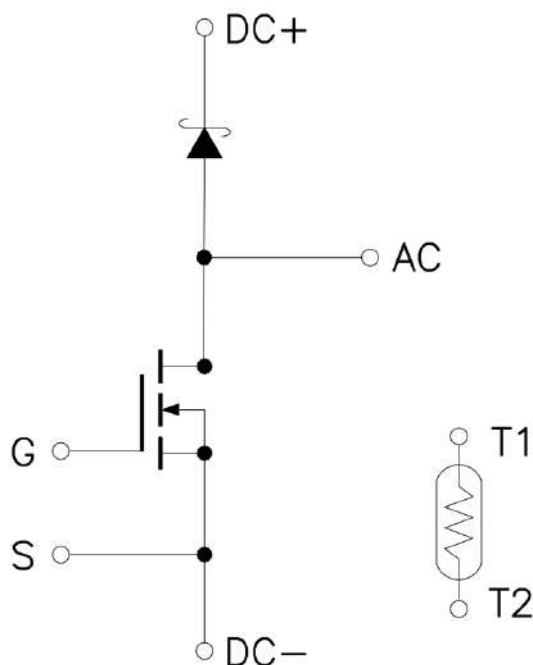


Figure 1. Out drawing & circuit diagram for HCS09FC120E1Q1

HCS09FC120E1Q1

1200V/9mΩ Chopper SiC MOSFET Module

Pin Configuration and Marking Information

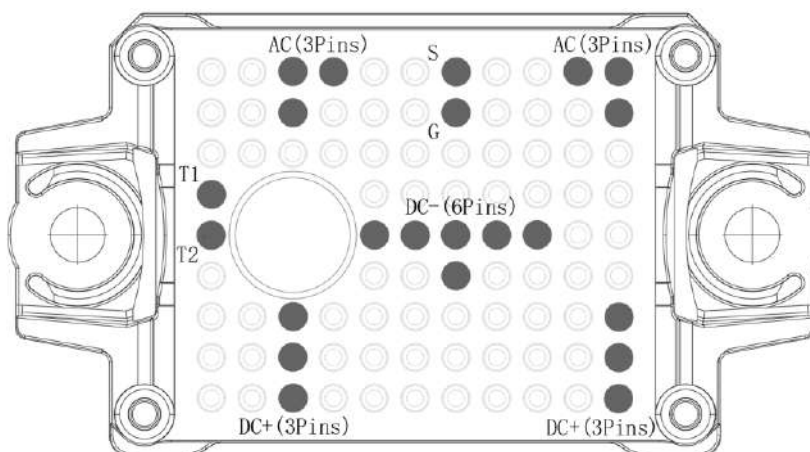


Figure 2. Pin configuration

Symbol	Description
AC	Output terminal of half bridge
S	Source signal terminal
G	Gate signal terminal
DC+	DC+ Bus connection
DC-	DC- Bus connection
T1	Thermistor connection T1
T2	Thermistor connection T2

Module

Parameter	Conditions	Value	Unit
Isolation voltage	RMS, f =50Hz, t =1min	3.4	kV
Clearance	Terminal to Terminal	5	mm
	Terminal to Heatsink	10	mm
Creepage distance	Terminal to Terminal	6.3	mm
	Terminal to Heatsink	12.7	mm
Comparative Tracking Index	-	400	-
Weight	-	26	g

HCS09FC120E1Q1

1200V/9mΩ Chopper SiC MOSFET Module

Maximum Ratings ($T_j=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{DSS}	Drain-Source Voltage	G-S Short	1200	V
V_{GSS}	Gate-Source Voltage(+)	D-S Short	20	V
V_{GSS}	Gate-Source Voltage(-)	D-S Short	-5	V
V_{GSSSurge}	G-S Voltage($t_{\text{surge}} < 300\text{nsec}$)	D-S Short, Note1	-10 to 25	V
I_{DS}	DC Continuous Drain Current	$T_f=75^{\circ}\text{C}$	150	A
I_{DSM}	Pulse Drain Current	Less than 1ms, Note2	300	A
I_{F}	Forward Current (Diode)	$T_f=75^{\circ}\text{C}$	140	A
I_{FRM}	Pulse Forward Current (Diode)	Less than 1ms, Note2	300	A
T_j	junction temperature	-	-40 to 175	$^{\circ}\text{C}$
T_{stg}	Storage temperature	-	-40 to 125	$^{\circ}\text{C}$

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	$T_c=25^{\circ}\text{C}$	-	5	-	$\text{k}\Omega$
$\Delta R/R$	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

HCS09FC120E1Q1

1200V/9mΩ Chopper SiC MOSFET Module

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 =4mA		1200	-	-	V
I _{DSS}	Zero gate voltage drain current	V _{DS} =1200V, V _{GS} =0V		-	0.4	4.0	μA
V _{GS(th)}	Gate-source threshold voltage	I _D =40mA, V _{DS} =V _{GS}		2.0	2.4	4.0	V
I _{GSS+}	Gate-Source Leakage Current	V _{GS} =20V, V _{DS} =0V, T _j =25°C		-	-	400	nA
I _{GSS-}		V _{GS} =-5V, V _{DS} =0V, T _j =25°C		-	-	-400	nA
R _{DS(on)} (Chip)	Static drain-source On-state resistance	I _D =150A, T _j =25°C	V _{GS} =20V	-	9.2	12.8	mΩ
		I _D =150A	V _{GS} =20V	-	18	-	mΩ
		T _j =175°C	V _{GS} =18V	-	18.2	-	mΩ
V _{DS(on)} (Chip)	Static drain-source On-state voltage	I _D =150A, T _j =25°C	V _{GS} =20V	-	1.38	1.92	V
		I _D =150A	V _{GS} =20V	-	2.70	-	V
		T _j =175°C	V _{GS} =18V	-	2.73	-	V
C _{iss}	Input capacitance	V _{DS} =1000V, V _{GS} =0V f =200kHz, V _{AC} =25mV		-	12.77	-	nF
C _{oss}	Output capacitance			-	0.528	-	nF
C _{rss}	Reverse transfer capacitance			-	0.028	-	nF
Q _G	Total gate charge	V _{DD} =800V, I _D =80A, V _{GS} =+20/-5V		-	472	-	nC
R _{Gint}	Internal Gate Resistance	T _j =25°C		-	0.475	-	Ω
t _{d(on)}	Turn-on delay time	V _{DD} =600V I _D =150A V _{GS} =+15/-4V R _G =2.2Ω Inductive load switching operation	T _j =25°C	-	35	-	ns
			T _j =150°C	-	30	-	
t _r	Rise time		T _j =25°C	-	20	-	ns
			T _j =150°C	-	19	-	
t _{d(off)}	Turn-off delay time		T _j =25°C	-	45	-	ns
			T _j =150°C	-	55	-	
t _f	Fall time		T _j =25°C	-	11	-	ns
			T _j =150°C	-	12	-	
E _{on}	Turn-on power dissipation		T _j =25°C	-	1.41	-	mJ
			T _j =150°C	-	1.12	-	
E _{off}	Turn-off power dissipation		T _j =25°C	-	0.51	-	mJ
			T _j =150°C	-	0.47	-	
R _{th(j-c)}	FET Thermal Resistance	Junction to Case/MOSFET		-	0.09	-	K/W
R _{th(c-f)}	Contact thermal resistance	With thermal conductive grease, Note3		-	0.15	-	K/W

Note3: Assumes Thermal Conductivity of grease is 2.8 W/m·K and thickness is 50μm.

HCS09FC120E1Q1

1200V/9mΩ Chopper SiC MOSFET Module

SiC SBD Electrical characteristics($T_j=25^{\circ}\text{C}$ unless otherwise specified, chip)

Symbol	Item	Condition	Value			Unit
			Min.	Typ.	Max	
I_{RRM}	Reverse Current	$V_{RRM}=1200\text{V}$	-	-	200	μA
V_F	Forward Voltage	$I_F=150\text{A}$	$T_j=25^{\circ}\text{C}$	-	1.7	V
			$T_j=175^{\circ}\text{C}$	-	2.7	
T_{rr}	Reverse recovery time	$V_{RR}=600\text{V}$, $I_F=150\text{A}$ MOSFET side:	$T_j=25^{\circ}\text{C}$	-	22	ns
			$T_j=150^{\circ}\text{C}$	-	21	
Q_{rr}	Reverse recovery charge	$V_{GS}=+15/-4\text{V}$ $R_G=2.2\Omega$	$T_j=25^{\circ}\text{C}$	-	1.227	μC
			$T_j=150^{\circ}\text{C}$	-	1.428	
E_{rr}	Diode switching power dissipation	Inductive load switching operation	$T_j=25^{\circ}\text{C}$	-	0.56	mJ
			$T_j=150^{\circ}\text{C}$	-	0.75	
$R_{th(j-c)}$	SiC SBD Thermal Resistance	Junction to Case	-	0.12	-	K/W
$R_{th(c-f)}$	Contact thermal Resistance	With thermal conductive grease, Note4	-	0.15	-	K/W

Note4: Assumes Thermal Conductivity of grease is $2.8\text{W/m}\cdot\text{K}$ and thickness is $50\mu\text{m}$.

Test Conditions

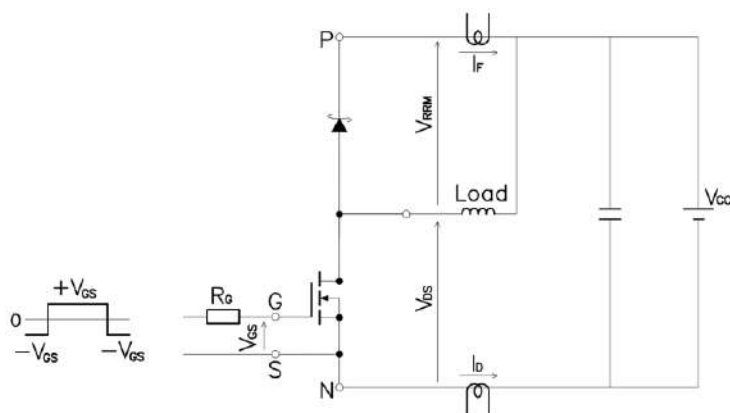


Figure 3. Switching time measure circuit

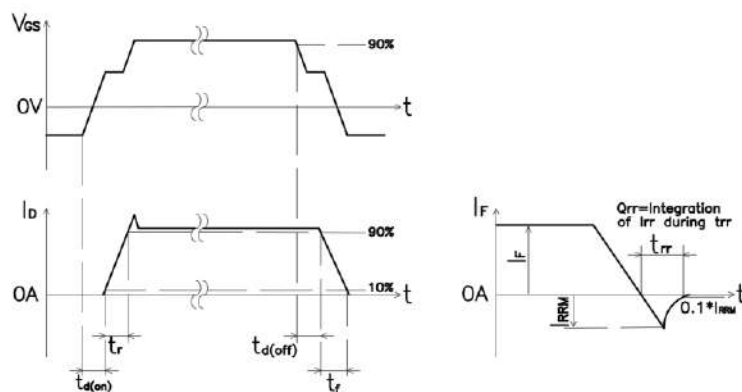


Figure 4. Switching time definition

HCS09FC120E1Q1

1200V/9mΩ Chopper SiC MOSFET Module

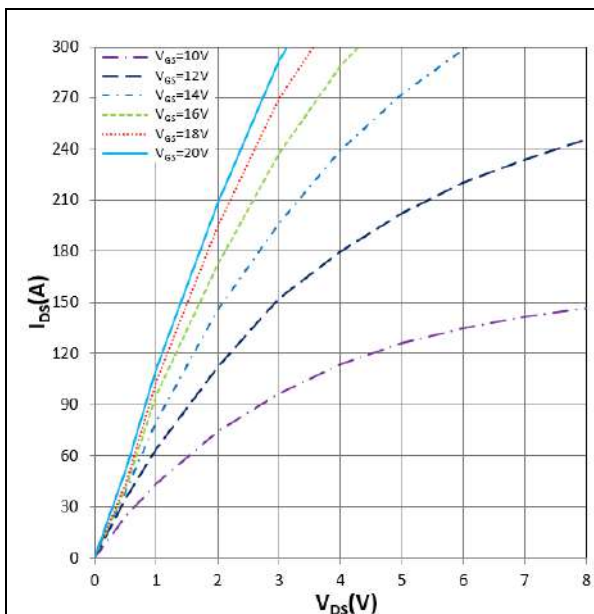


Figure 5. I_{DS} vs V_{DS}
 $T_j = 25^\circ\text{C}$, V_{GS} parameter

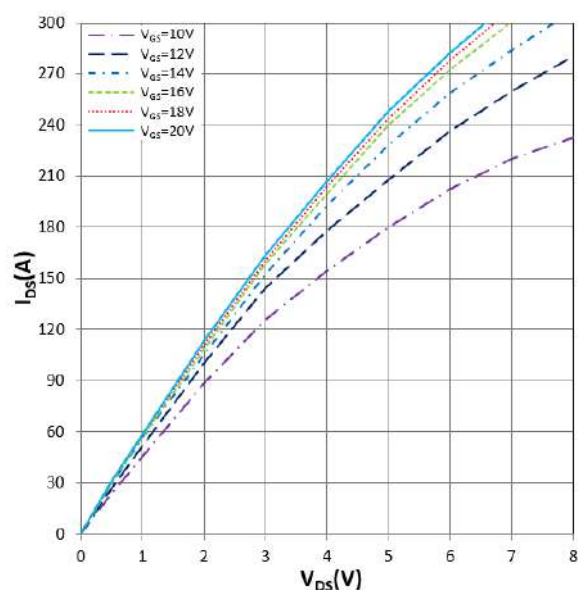


Figure 6. I_{DS} vs V_{DS}
 $T_j = 175^\circ\text{C}$, V_{GS} parameter

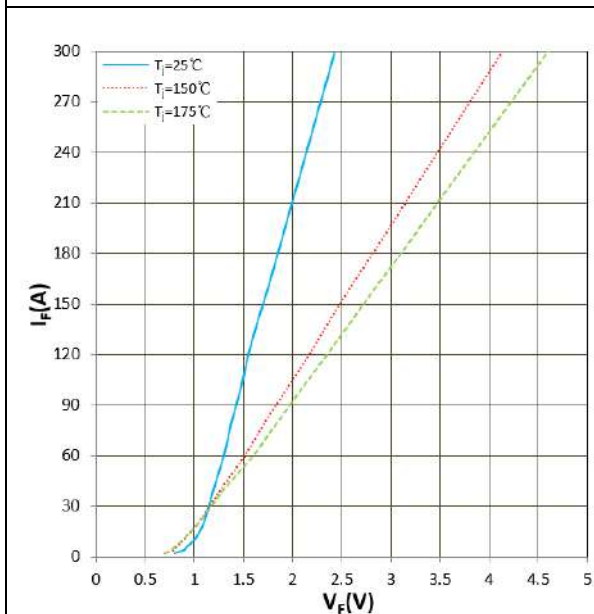


Figure 7. I_F vs V_F

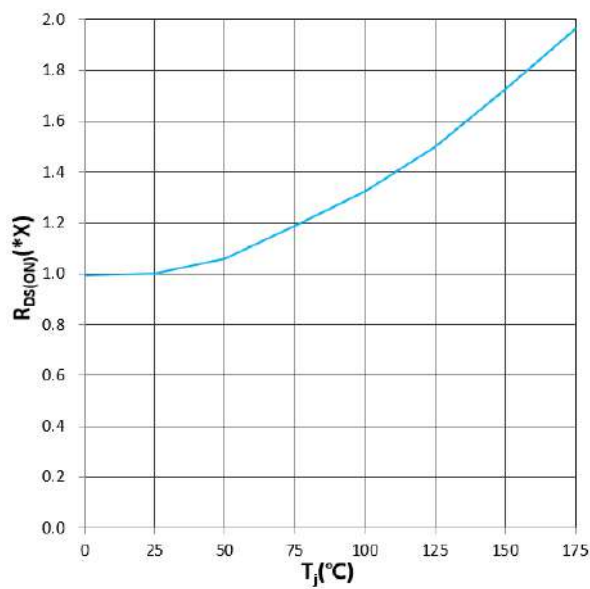


Figure 8. $R_{DS(on)}$ vs T_j
 $V_{GS} = 20\text{V}$, $1.0X = 9.2\text{m}\Omega$

HCS09FC120E1Q1

1200V/9mΩ Chopper SiC MOSFET Module

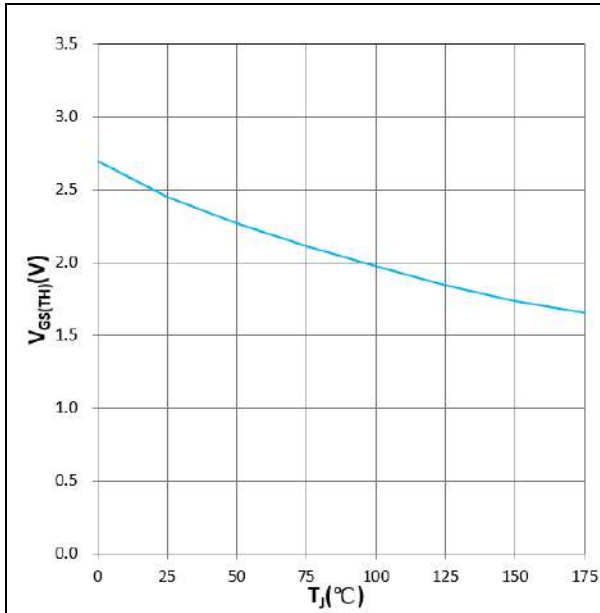


Figure 9. $V_{GS(TH)}$ vs T_J
 $V_{DS} = V_{GS}$, $I_{DS} = 40mA$

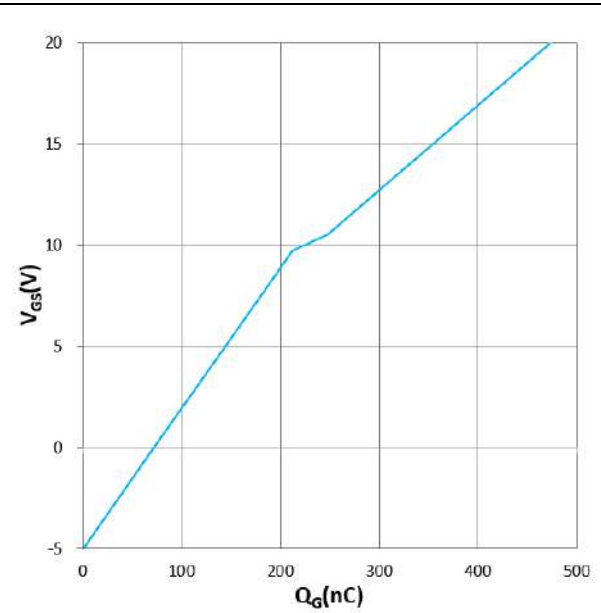


Figure 10. V_{GS} vs Q_G
 $V_{DD} = 800V$, $I_D = 150A$

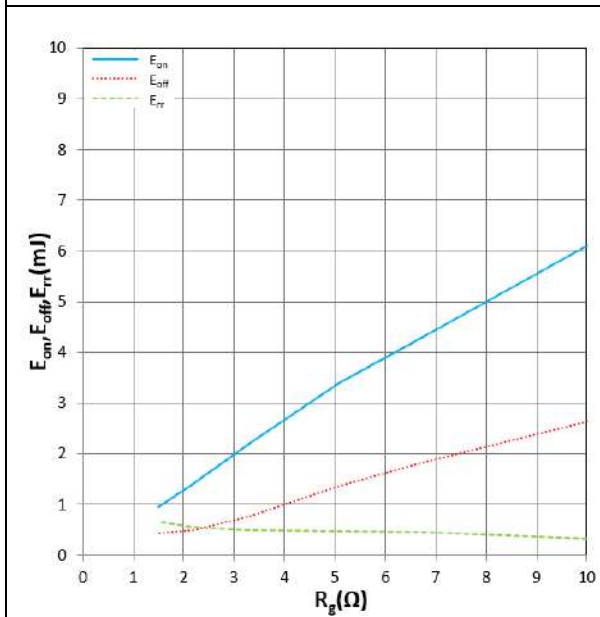


Figure 11. E_{on} , E_{off} , E_{rr} vs R_g
 $T_J = 25^\circ C$, $I_D = 150A$, $V_{GS} = +15/-4V$

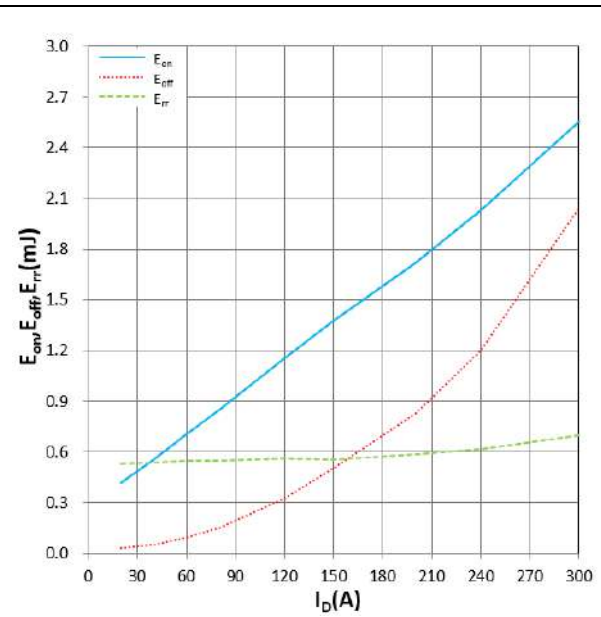


Figure 12. E_{on} , E_{off} , E_{rr} vs I_D
 $T_J = 25^\circ C$, $R_g = 2.2\Omega$, $V_{GS} = +15/-4V$

HCS09FC120E1Q1

1200V/9mΩ Chopper SiC MOSFET Module

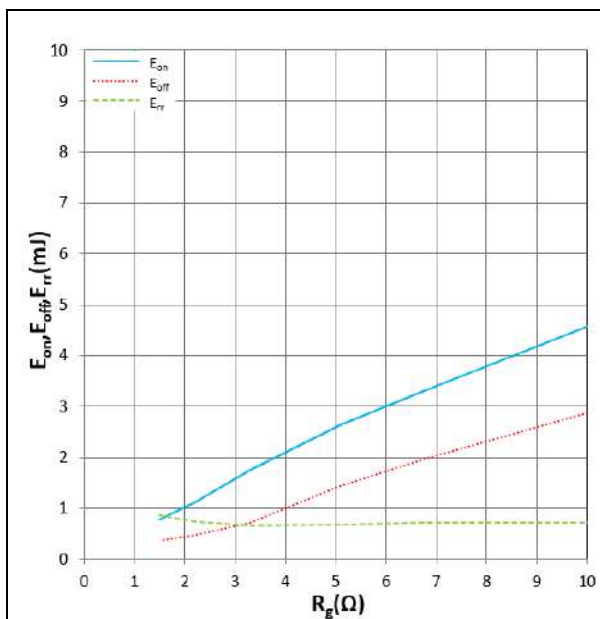


Figure 13. E_{on} , E_{off} , E_{rr} vs R_G
 $T_j = 150^\circ\text{C}$, $I_D = 150\text{A}$, $V_{GS} = +15/-4\text{V}$

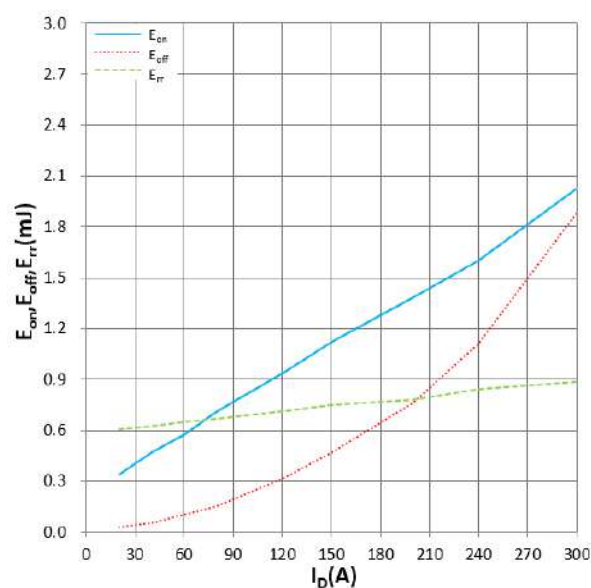


Figure 14. E_{on} , E_{off} , E_{rr} vs I_D
 $T_j = 150^\circ\text{C}$, $R_G = 2.2\Omega$, $V_{GS} = +15/-4\text{V}$

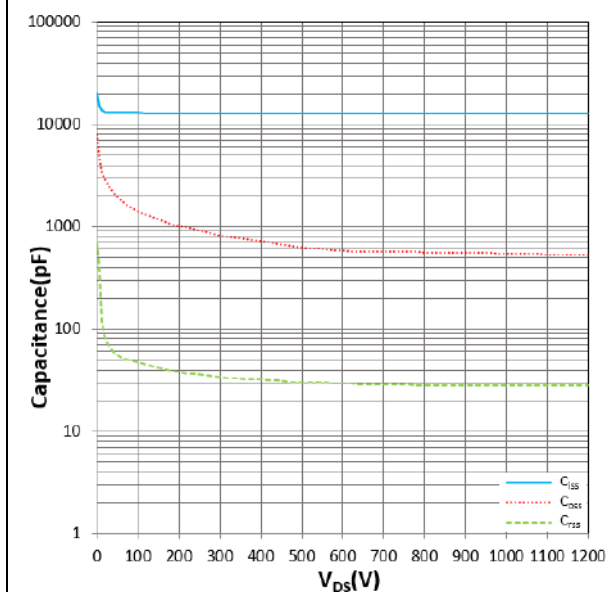
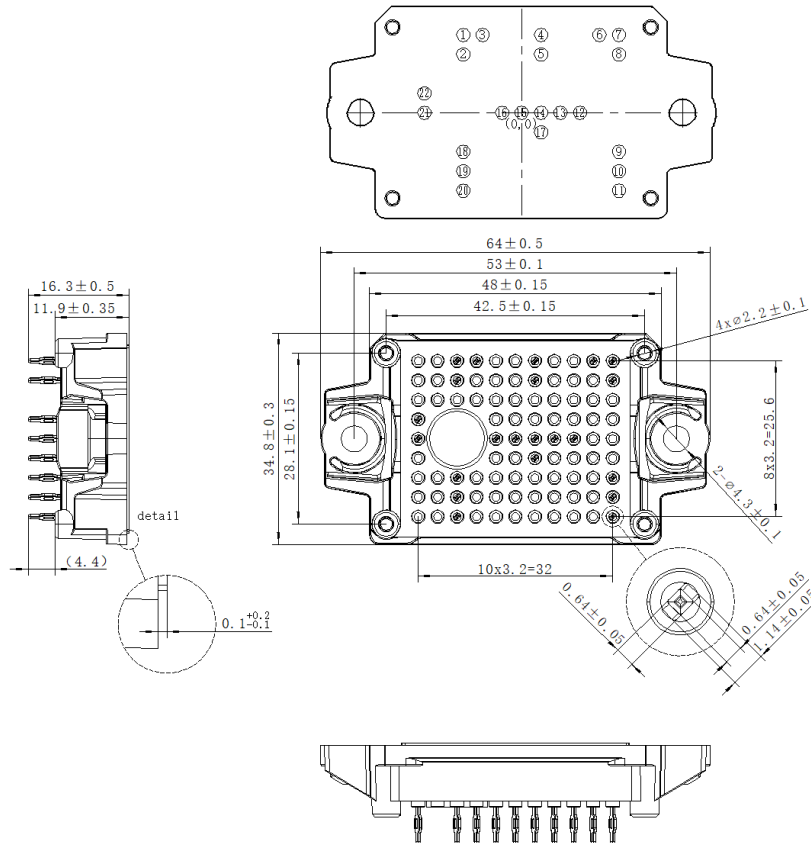


Figure 15. C_{iss} , C_{oss} , C_{rss} vs V_{DS}
 $T_j = 25^\circ\text{C}$

HCS09FC120E1Q1

1200V/9mΩ Chopper SiC MOSFET Module

Package dimensions



Pin table		
Pin	X	Y
1	-9.6	12.8
2	-9.6	9.6
3	-6.4	12.8
4	3.2	12.8
5	3.2	9.6
6	12.8	12.8
7	16	12.8
8	16	9.6
9	16	-6.4
10	16	-9.6
11	16	-12.8
12	9.6	0
13	6.4	0
14	3.2	0
15	0	0
16	-3.2	0
17	3.2	-3.2
18	-9.6	-6.4
19	-9.6	-9.6
20	-9.6	-12.8
21	-16	0
22	-16	3.2

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

