

HCS600FH120D4B3

1200V/600A Half Bridge SiC MOSFET Module

Description

The HCS600FH120D4B3 is a Half Bridge IGBT Power Module. It integrates high performance IGBT chips designed for the applications such as High Power supply and Motor control.



Circuit diagram

Features

- 1200V/2.2mΩ
- Low thermal resistance with Si₃N₄ AMB
- 175°C maximum junction temperature
- Low Inductive Design
- Thermistor inside
- Pressfit terminal

Applications

- xEV Applications
- Motor Drives
- Vehicle Fast Chargers
- Smart-Grid / Grid-Tied Distributed Generation

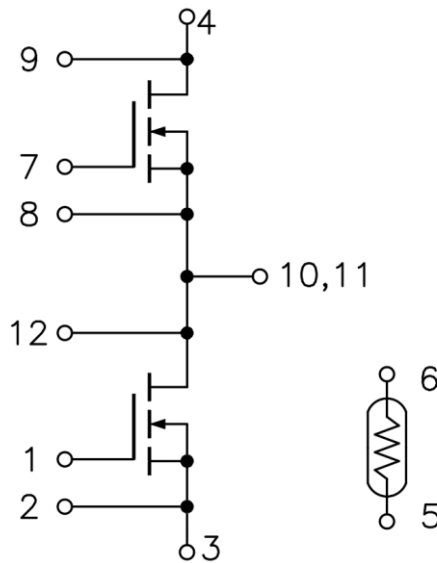


Figure 1 Out drawing & circuit diagram for HCS600FH120D4B3

HCS600FH120D4B3

1200V/600A Half Bridge SiC MOSFET Module

Pin Configuration and Marking Information

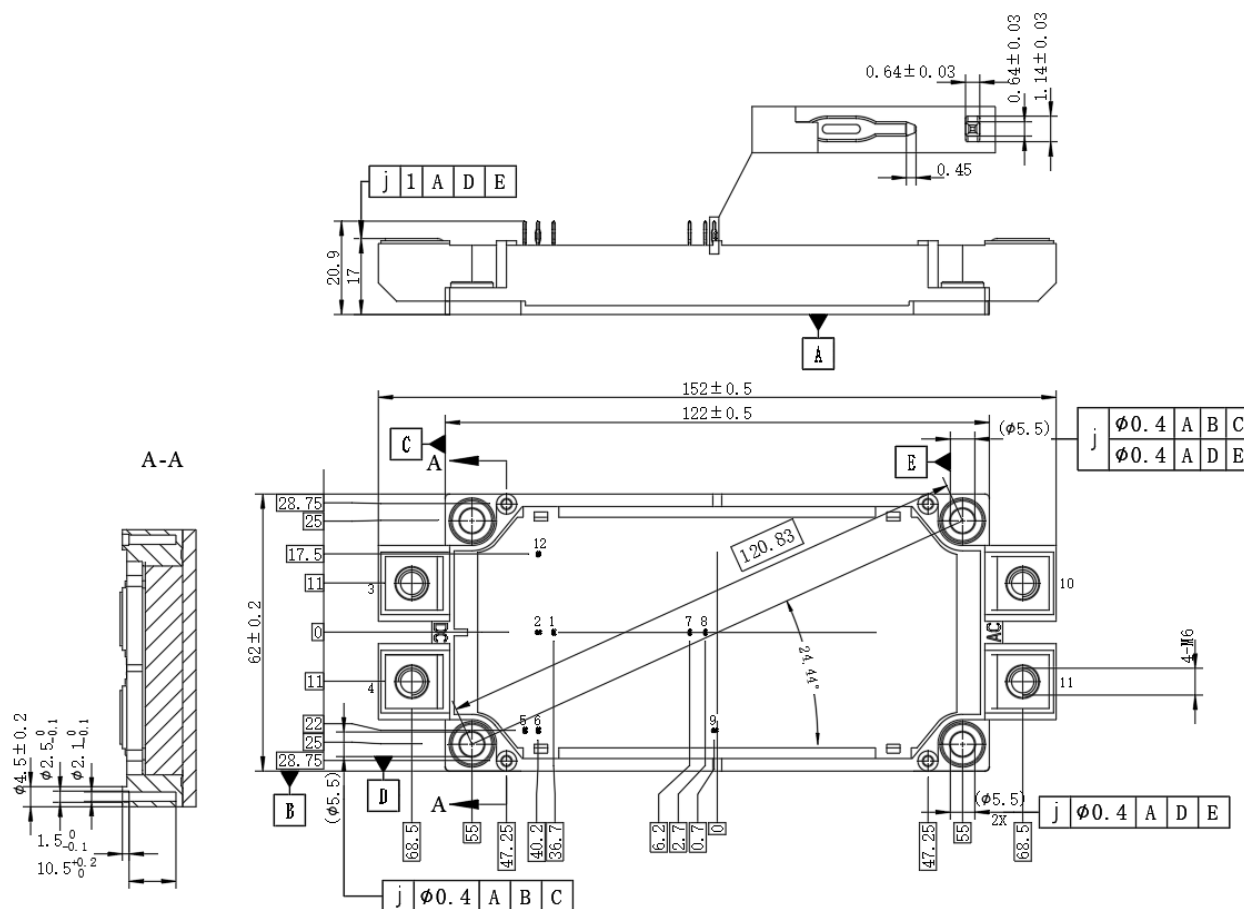


Figure2. Pin configuration

HCS600FH120D4B3

1200V/600A Half Bridge SiC MOSFET Module

Module

Parameter	Conditions	Value	Unit
Isolation voltage	RMS, f=50Hz, t=1min	3.4	kV
Material of module baseplate	-	Cu	-
Creepage distance	terminal to heatsink terminal to terminal	14.5 13	mm
Clearance	terminal to heatsink terminal to terminal	12.5 10	mm
CTI	-	>400	-
Module lead resistance, terminals – chip	T _C =25°C	0.2	mΩ
Mounting torque for module mounting	M5, M6	3 to 6	Nm
Weight	-	350	g

Maximum Ratings (T_j =25 °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, AC frequency ≥1Hz, Note1	-11 to 23	V
I _{DS}	DC Continuous Drain Current	T _C =25°C , V _{GS} =18V	680	A
I _{DS}	DC Continuous Drain Current	T _C =85°C , V _{GS} =18V	525	A
I _{SD}	Source (Body diode) Current	T _C =25°C, with ON signal	680	A
I _{SD}	Source (Body diode) Current	T _C =85°C, with ON signal	525	A
I _{DSM}	Pulse Drain Current	T _C =85°C, Pulse width =1ms, V _{GS} =18V, Note2	1200	A
P _{tot}	Total Power Dissipation	T _C =25°C	2500	W
T _{jmax}	Max Junction Temperature	-	175	°C
T _{stg}	Storage Temperature	-	-40 to 125	°C

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

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 =493Ω	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

HCS600FH120D4B3

1200V/600A Half Bridge SiC MOSFET Module

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

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V _{(BR)DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _D =6mA		1200	-	-	V
I _{DSS}	Zero gate voltage drain Current	V _{DS} =1200V, V _{GS} =0V		-	-	60	μA
V _{GS(th)}	Gate-source threshold Voltage	I _D =60mA, V _{DS} =V _{GS}	T _j =25°C	2.1	3.2	5.8	V
I _{GSS}	Gate-Source Leakage Current	V _{GS} =20V, V _{DS} =0V	T _j =25°C	-	-	600	nA
R _{DS(on)} (Chip)	Static drain-source	I _D =600A	T _j =25°C	1.5	2.2	3.1	mΩ
	On-state resistance	V _{GS} =18V	T _j =175°C	3.5	5.4	7.2	mΩ
V _{DS(on)} (Chip)	Static drain-source	I _D =600A	T _j =25°C	9.0	1.32	1.86	V
	On-state Voltage	V _{GS} =18V	T _j =175°C	2.1	3.24	4.32	V
C _{iss}	Input Capacitance	V _D =850V, V _{GS} =0V, f =1MHz		-	24	-	nF
C _{oss}	Output Capacitance			-	1.84	-	nF
C _{rss}	Reverse transfer Capacitance			-	0.132	-	nF
Q _g	Total gate charge	V _{DD} =850V, I _D =600A, V _{GS} =-5/+18V		-	1140	-	nC
t _{d(on)}	Turn-on delay time	V _{DD} =600V I _D =600A V _{GS} =+15/-4V R _{G(on)} =5.1Ω R _{G(off)} =3.3Ω Inductive load switching operation	T _j =25°C	-	140	-	ns
			T _j =150°C	-	119	-	
t _r	Rise time		T _j =25°C	-	104	-	ns
			T _j =150°C	-	89	-	
t _{d(off)}	Turn-off delay time		T _j =25°C	-	278	-	ns
			T _j =150°C	-	302	-	
t _f	Fall time		T _j =25°C	-	67	-	ns
			T _j =150°C	-	89	-	
E _{on}	Turn-on power dissipation		T _j =25°C	-	29.6	-	mJ
			T _j =150°C	-	24.2	-	
E _{off}	Turn-off power dissipation		T _j =25°C	-	27.2	-	mJ
			T _j =150°C	-	28.9	-	
R _{th(j-c)}	FET Thermal Resistance	Junction to Case		-	0.06	-	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.

HCS600FH120D4B3

1200V/600A Half Bridge SiC MOSFET Module

Body Diode Electrical characteristics (T_j=25 °C unless otherwise specified, chip)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V _{SD}	Body Diode Forward Voltage	V _{GS} =-4V I _{SD} =600A	T _j =25°C	3.9	4.9	5.6	V
			T _j =175°C	3.1	4.2	5.2	
T _{rr}	Reverse recovery time	V _{DD} =600V, I _D =400A V _{GS} =-4/+15V	T _j =25°C	-	39	-	ns
			T _j =150°C	-	56	-	
Q _{rr}	Reverse recovery charge	R _{g(on)} =5.1Ω R _{g(off)} =3.3Ω	T _j =25°C	-	2.12	-	μC
			T _j =150°C	-	5.48	-	
E _{rr}	Diode switching power dissipation	Inductive load switching operation	T _j =25°C	-	0.55	-	mJ
			T _j =150°C	-	1.72	-	

Test Conditions

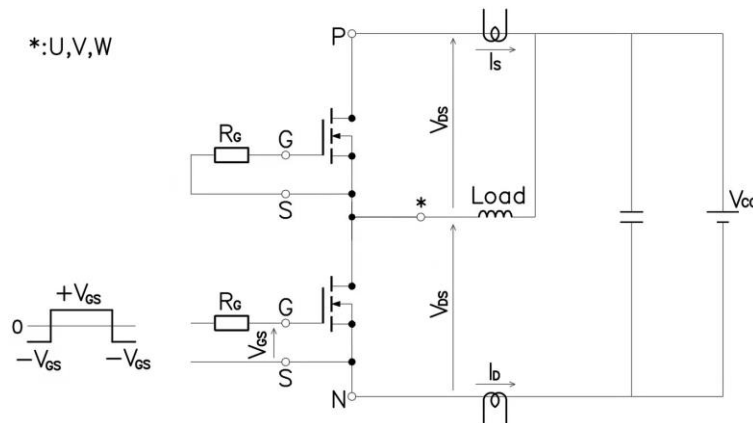


Figure 3. Switching time measure circuit

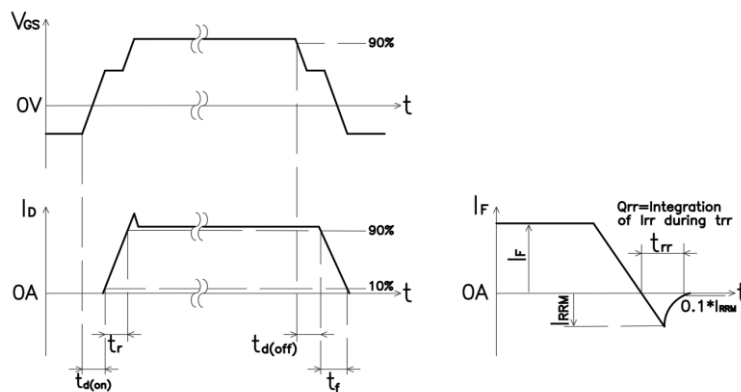


Figure 4. Switching time definition

HCS600FH120D4B3

1200V/600A Half Bridge SiC MOSFET Module

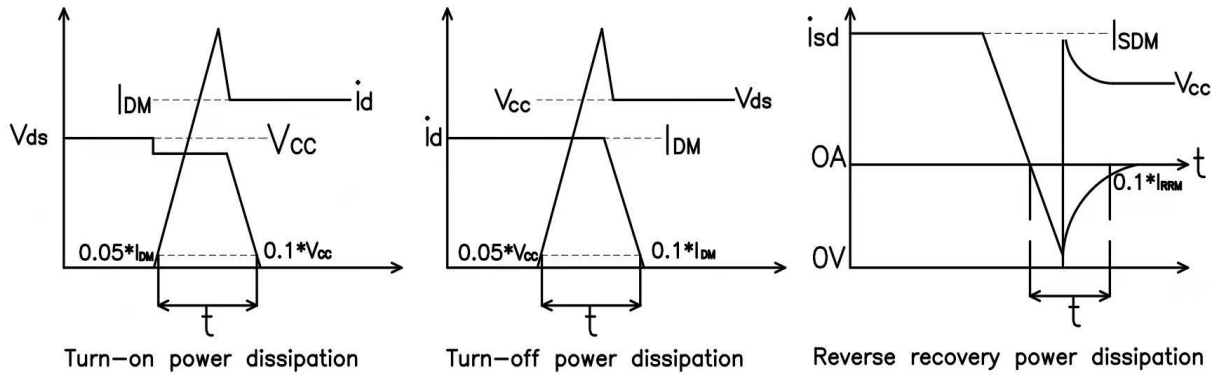


Figure 5. Switching power dissipation definition

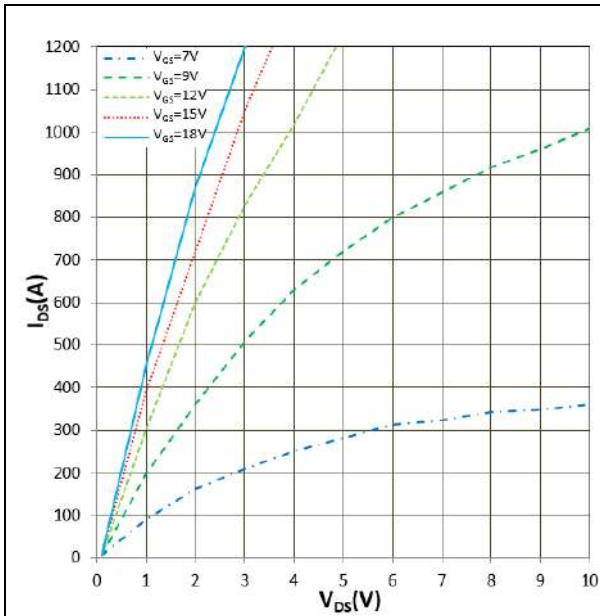


Figure 6. I_{DS} vs V_{DS}
 $T_J = 25^\circ\text{C}$

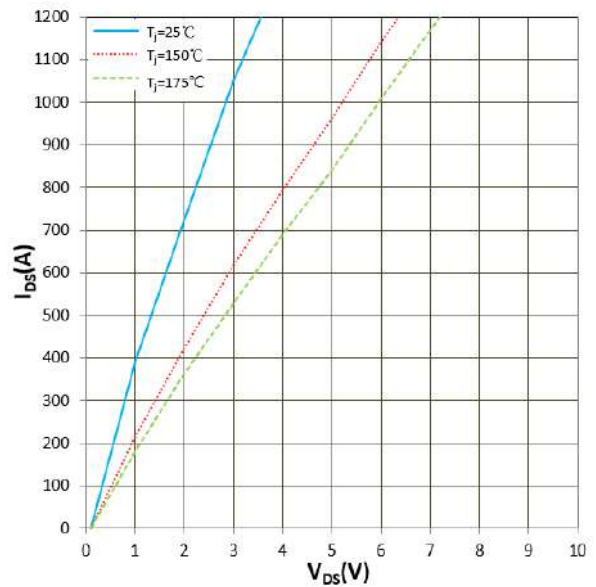


Figure 7. I_{DS} vs V_{DS}
 $V_{GS} = 15\text{V}$

HCS600FH120D4B3

1200V/600A Half Bridge SiC MOSFET Module

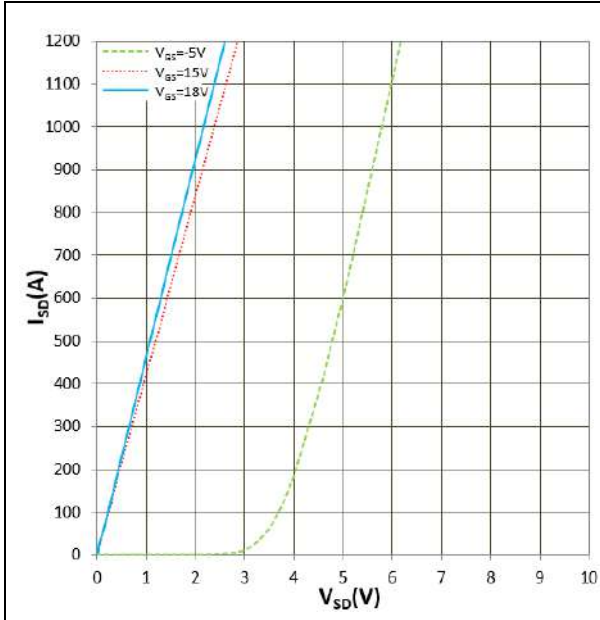


Figure 8. I_{SD} vs V_{SD}
 $T_j = 25^\circ\text{C}$

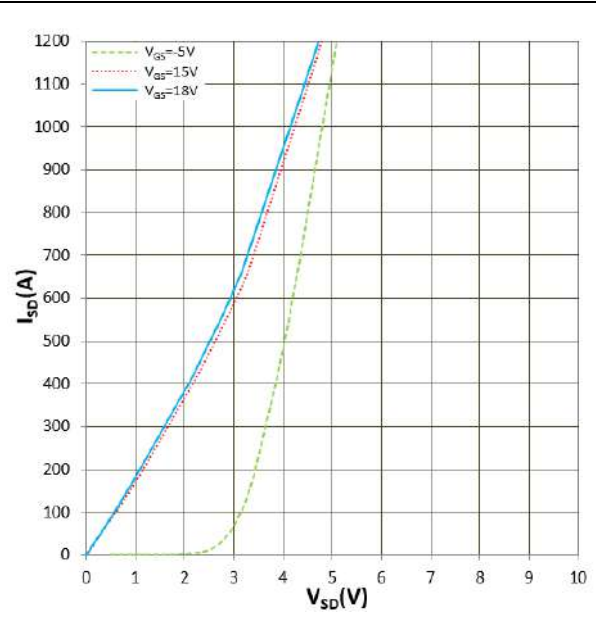


Figure 9. I_{SD} vs V_{SD}
 $T_j = 150^\circ\text{C}$

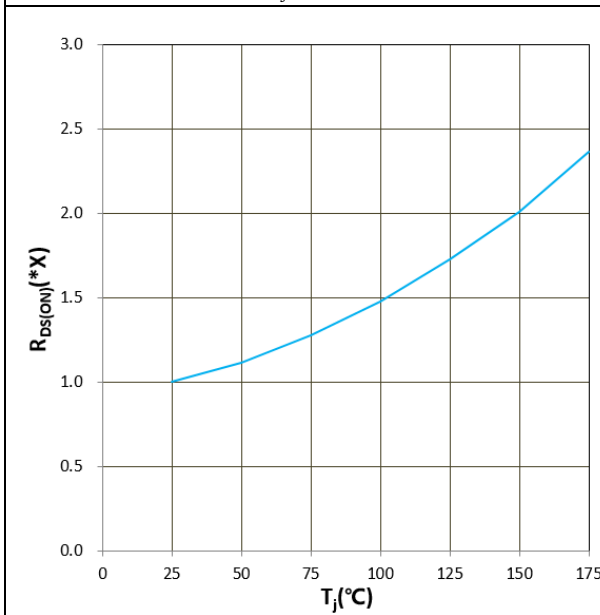


Figure 10. $R_{DS(ON)}$ vs T_j
 $V_{GS} = +18\text{V}$, $I_D = 600\text{A}$, $1.0X = 2.2\text{m}\Omega$

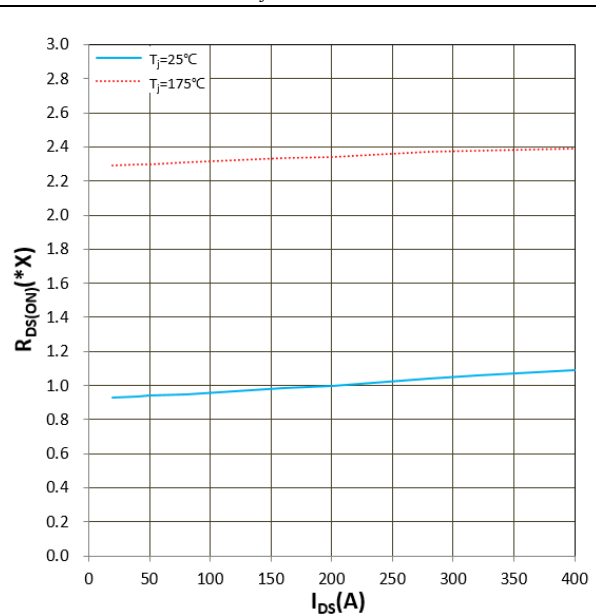


Figure 11. $R_{DS(ON)}$ vs I_{DS}
 $V_{GS} = +18\text{V}$, $I_D = 600\text{A}$, $1.0X = 2.2\text{m}\Omega$

HCS600FH120D4B3

1200V/600A Half Bridge SiC MOSFET Module

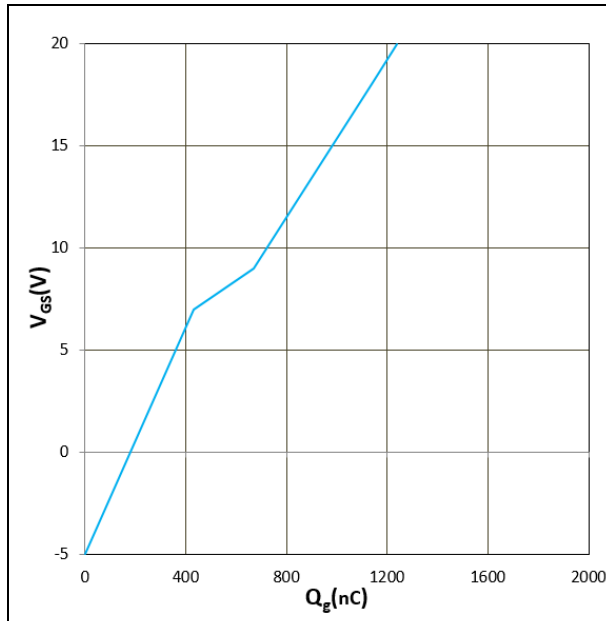


Figure 12. V_{GS} vs Q_g
 $T_j = 25^\circ\text{C}$, $I_{GS} = 6\text{mA}$

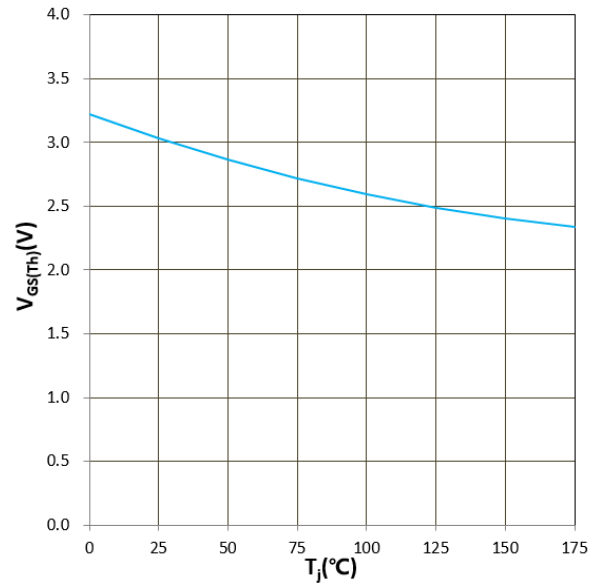


Figure 13. $V_{GS(TH)}$ vs T_j
 $V_{GS} = V_{DS}$, $I_D = 60\text{mA}$

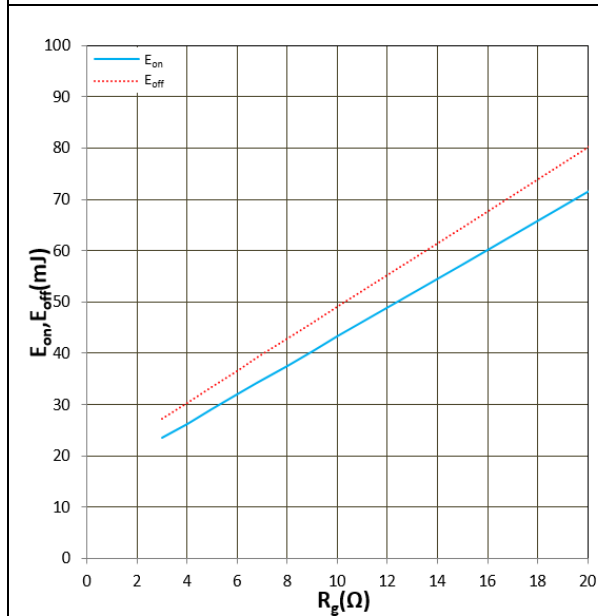


Figure 14. E_{on}, E_{off} vs R_g
 $T_j = 25^\circ\text{C}$, $V_{CC} = 600\text{V}$, $V_{GS} = +15\text{V}/-4\text{V}$, $I_D = 600\text{A}$
 Inductive Load

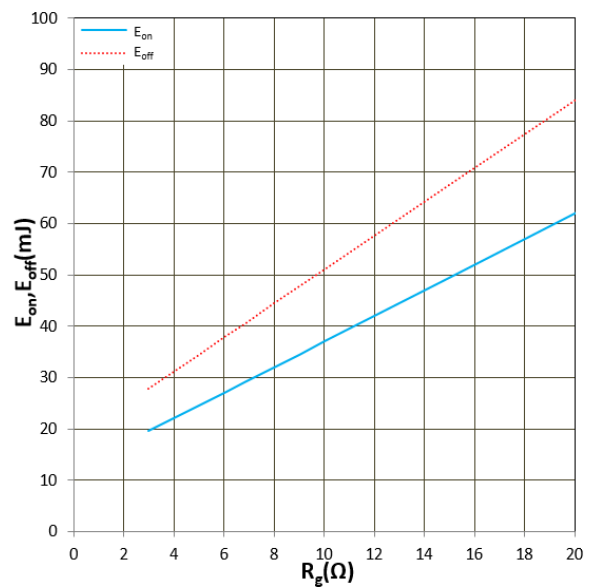


Figure 15. E_{on}, E_{off} vs R_g
 $T_j = 150^\circ\text{C}$, $V_{CC} = 600\text{V}$, $V_{GS} = +15\text{V}/-4\text{V}$, $I_D = 600\text{A}$
 Inductive Load

HCS600FH120D4B3

1200V/600A Half Bridge SiC MOSFET Module

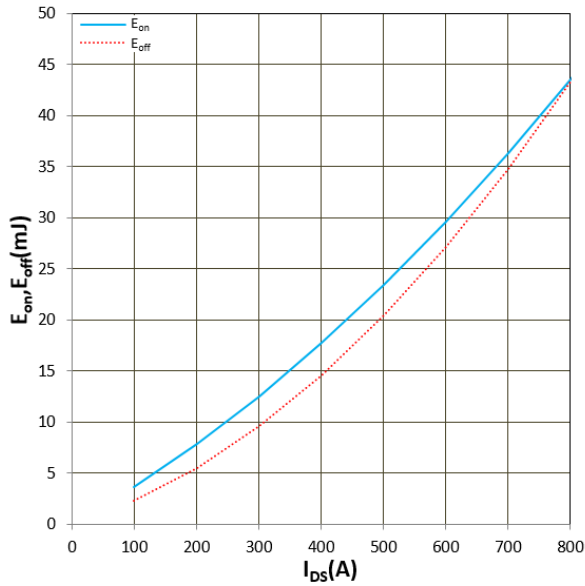


Figure 16. E_{on} , E_{off} vs I_{DS}
 $T_j = 25^\circ\text{C}$, $V_{CC} = 600\text{V}$, $V_{GS} = +15\text{V}/-4\text{V}$
 $R_{g(on)} = 5.1\Omega$, $R_{g(off)} = 3.3\Omega$, Inductive Load

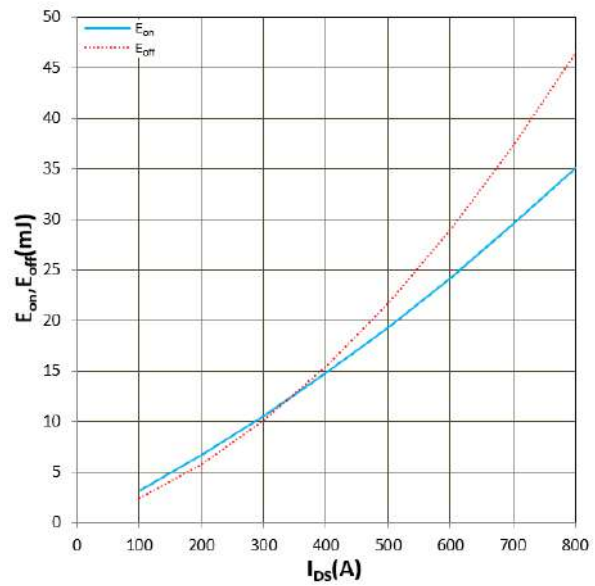


Figure 17. E_{on} , E_{off} vs I_{DS}
 $T_j = 150^\circ\text{C}$, $V_{CC} = 600\text{V}$, $V_{GS} = +15\text{V}/-4\text{V}$
 $R_{g(on)} = 5.1\Omega$, $R_{g(off)} = 3.3\Omega$, Inductive Load

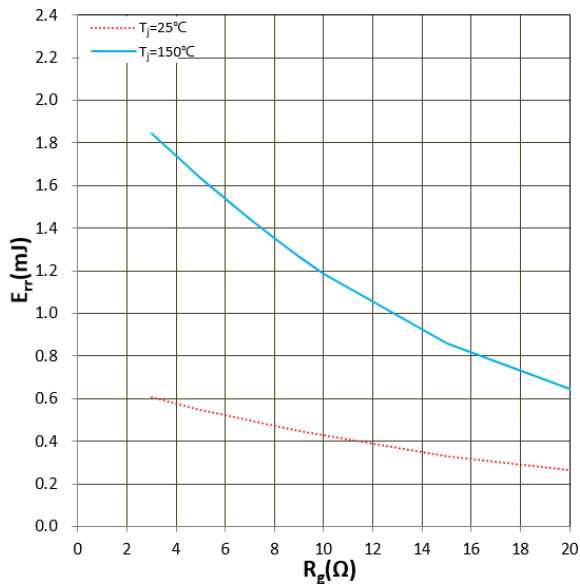


Figure 18. E_{rr} vs R_g
 $V_{DD} = 600\text{V}$, $I_F = 600\text{A}$, $V_{GS} = +15\text{V}/-4\text{V}$
Inductive Load

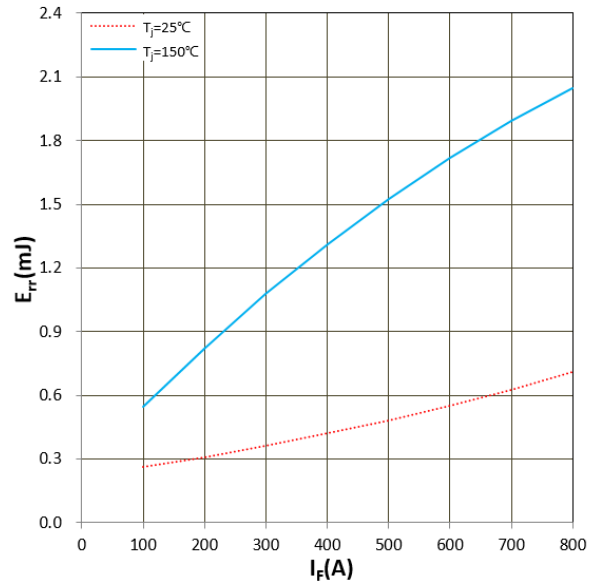
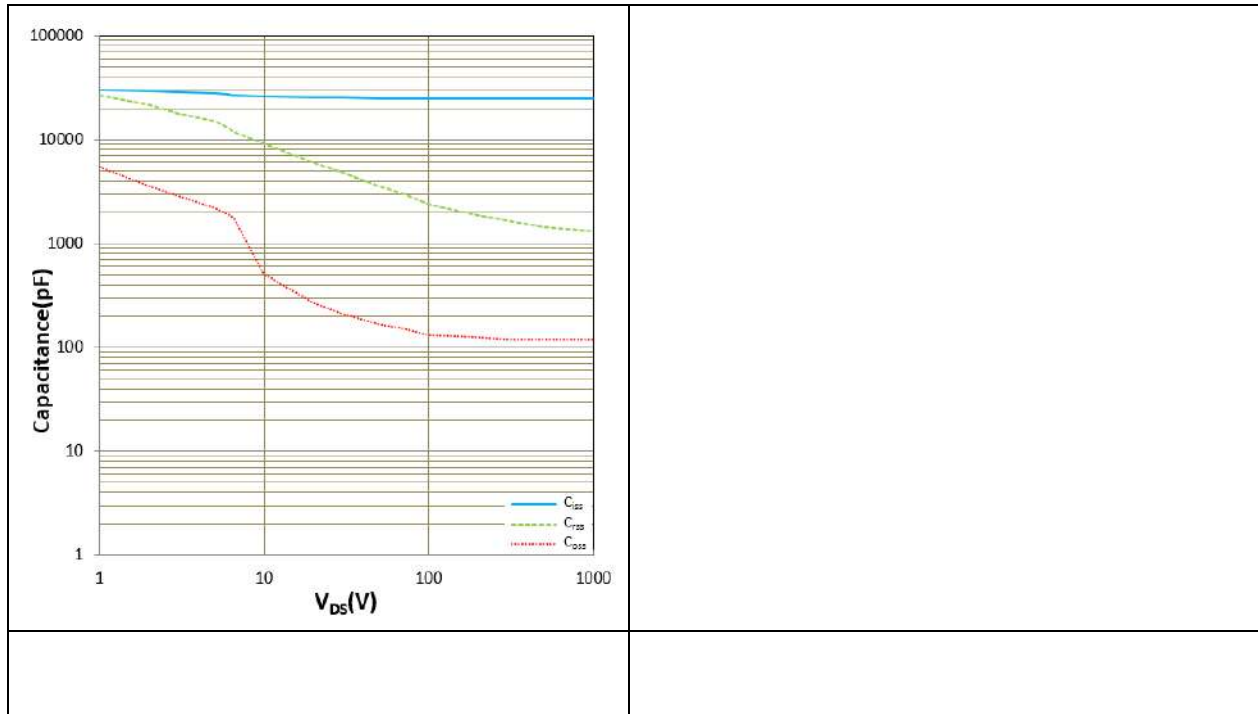


Figure 19. E_{rr} vs I_F
 $V_{DD} = 600\text{V}$, $R_{g(on)} = 5.1\Omega$, $R_{g(off)} = 3.3\Omega$
 $V_{GS} = +15\text{V}/-4\text{V}$, Inductive Load

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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.

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

Changes of this product data sheet are reserved.

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

