HCS800FF140E9A1S

1400V/800A Half Bridge SiC MOSFET Module

Description

The HCS800FF140E9A1S 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.

Features

- 1400V/2.45mΩ @T_j =25℃ ,V_{GS} =20V
- Low thermal resistance with Si3N4 AMB
- 175°C maximum junction temperature
- Low Inductive Design
- Thermistor inside

Applications

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

Circuit diagram

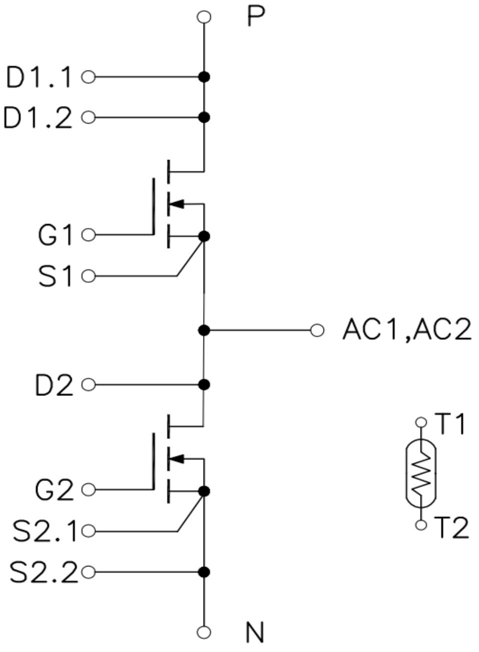

Figure 1. Out drawing & circuit diagram forHCS800FF140E9A

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

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Pin Configuration and Marking Information

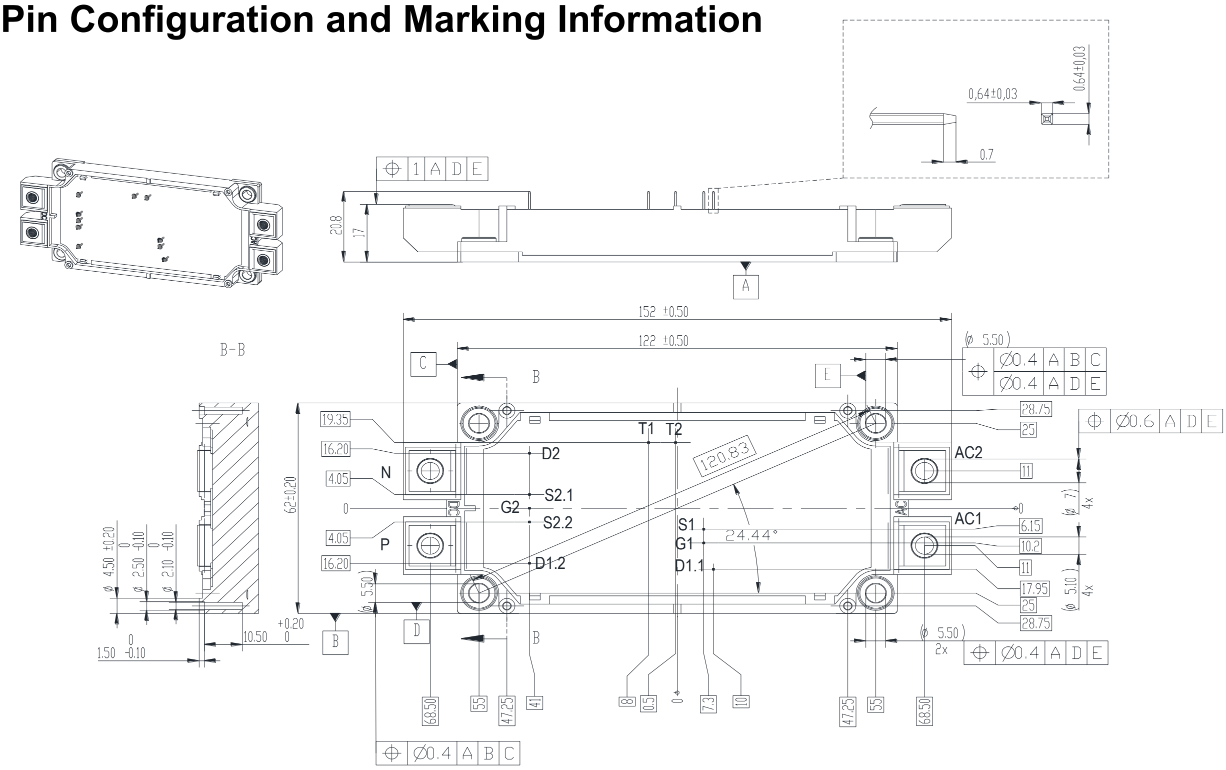

Figure2. Pin configuration

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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	-	380	g

Maximum Ratings (T$_j$ =25℃unless otherwise specified)

Symbol	Parameter	Conditions	Ratings	Unit
V_{DSS}	Drain-Source Voltage	G-S Short	1400	V
V_{GSS}	Gate-Source Voltage	D-S Short, AC frequency ≥1Hz, Note1	-10V/+25V	V
I_{DS}	DC Continuous Drain Current	T_f=25°C, V_{GS} =20V	705	A
		T_f =65°C, V_{GS} =20V	600	A
I_{DS}	DC Continuous Drain Current	T_f=25°C, V_{GS} =18V	695	A
		T_f =65°C, V_{GS} =18V	595	A
I_{SD}	Source (Body Diode) Current	T_f =25°C, with ON signal	695	A
I_{SD}	Source (Body Diode) Current	T_f =65°C, with ON signal	595	A
I_{DP}	Drain Pulse Current, Peak	Less than 1ms, Note2	1600	A
P_{tot}	Maximum Power Dissipation	T_C =25°C	3333	W
T_{jmax}	Max junction temperature	-	175	°C
T_{stg}	Storage temperature	-	-40 to 125	°C

Note1: Recommended Operating Value: +20V/-5V, +20V/-4V, +18V/-5V, +18V/-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
⊠R/R	Deviation of R100	T_C =100°C, R_{100} =493Ω	-5	-	5	%
P_{25}	Power dissipation	T_C =25°C	-	-	20	mW
$B_{25/50}$	B-value	R2 =R25 exp [$B_{25/50}$(1/T2 - 1/(298,15 K))]	-	3375	-	K
$B_{25/80}$	B-value	R2 =R25 exp [$B_{25/80}$(1/T2 - 1/(298,15 K))]	-	3411	-	K
$B_{25/100}$	B-value	R2 =R25 exp [$B_{25/100}$(1/T2 - 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 =800μA		1400	-	-	V
I_{DSS}	Zero gate voltage drain current	V_{DS} =1200V, V_{GS} =0V		-	8	400	μA
$V_{GS(Th)}$	Gate-source threshold voltage	I_D=160mA V_{DS}=V_{GS}	T_j =25°C	1.9	2.45	3.8	V
			T_j =150°C	-	1.70	-	V
			T_j =175°C	-	1.60	-	V
I_{GSS}	Gate-Source Leakage Current	V_{GS} =20V, V_{DS} =0V		-	8	1600	nA
		V_{GS} =-5V, V_{DS} =0V		-1600	-8	0	nA
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	I_D =800A V_{GS} =20V	T_j =25°C	-	2.45	-	mΩ
			T_j =175°C	-	4.64	-	mΩ
		I_D =800A V_{GS} =18V	T_j =25°C	-	2.65	-	mΩ
			T_j =175°C	-	4.76	-	mΩ
$V_{DS(on)}$ (Chip)	Static drain-source On-state voltage	I_D =800A V_{GS} =20V	T_j =25°C	-	1.96	-	V
			T_j =175°C	-	3.71	-	V
		I_D =800A V_{GS} =18V	T_j =25°C	-	2.12	-	V
			T_j =175°C	-	3.81	-	V
C_{iss}	Input capacitance	V_{DS} =1000V V_{GS} =0V f =100kHz		-	38.2	-	nF
C_{oss}	Output capacitance			-	1.73	-	nF
C_{rss}	Reverse transfer capacitance			-	0.13	-	nF
Q_g	Total gate charge	V_{DS} =800V I_D =400A V_{GS} =+20/-5V		-	1912	-	nC
Q_{gs}	Gate to source charge			-	496	-	nC
Q_{gd}	Gate to drain charge			-	624	-	nC
R_{gint}	Internal gate resistor	f =1MHz		-	1.1	-	Ω
$t_{d(on)}$	Turn-on delay time	V_{DD} =900V I_D =800A V_{GS} =+18/-5V $R_{G(ON)}$ =5.6Ω $R_{G(OFF)}$ =5.6Ω Inductive load switching operation	T_j =25°C	-	162	-	ns
			T_j =150°C	-	144	-	
t_r	Rise time		T_j =25°C	-	113	-	ns
			T_j =150°C	-	105	-	
$t_{d(off)}$	Turn-off delay time		T_j =25°C	-	392	-	ns
			T_j =150°C	-	470	-	
t_f	Fall time		T_j =25°C	-	69	-	ns
			T_j =150°C	-	79	-	
E_{on}	Turn-on power dissipation		T_j =25°C	-	87.9	-	mJ
			T_j =150°C	-	87.5	-	
E_{off}	Turn-off power dissipation		T_j =25°C	-	82.1	-	mJ
			T_j =150°C	-	89.8	-	
$R_{th(j-c)}$	Thermal Resistance, Junction to Case (MOSFET)			-	0.045	-	K/W
$R_{th(c-f)}$	Contact Thermal Resistance, With thermal conductive grease, Note1			-	0.020	-	K/W

Note1: Assumes Thermal Conductivity of grease is 2.8 W/m・K and thickness is 50um

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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} =-5V I_{SD} =800A	T_j =25°C	-	5.8	-	V
			T_j =175°C	-	5.2	-	
T_{rr}	Reverse recovery time	V_{DD} =900V I_D =800A V_{GS} =+18/-5V $R_{G(ON)}$ =$R_{G(OFF)}$ =5.6 Ω Inductive load switching operation	T_j =25°C	-	41	-	ns
			T_j =150°C	-	76	-	
Q_{rr}	Reverse recovery charge		T_j=25°C	-	3.42	-	μC
			T_j =150°C	-	13.2	-	
E_{rr}	Diode switching power dissipation		T_j =25°C	-	0.69	-	mJ
			T_j =150°C	-	3.52	-	

Test Conditions

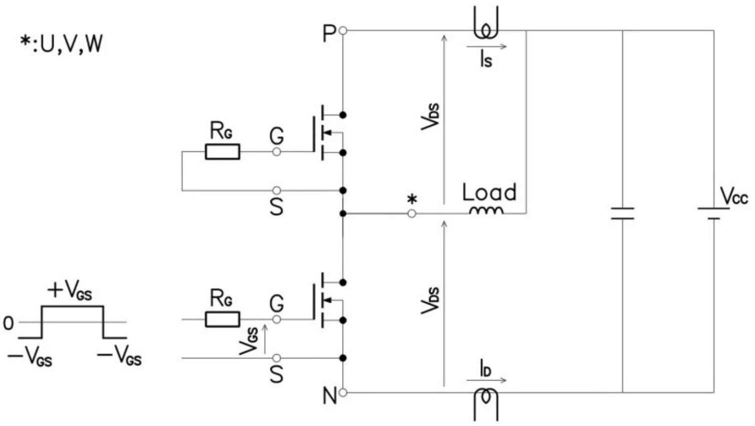

Figure 3. Switching time measure circuit

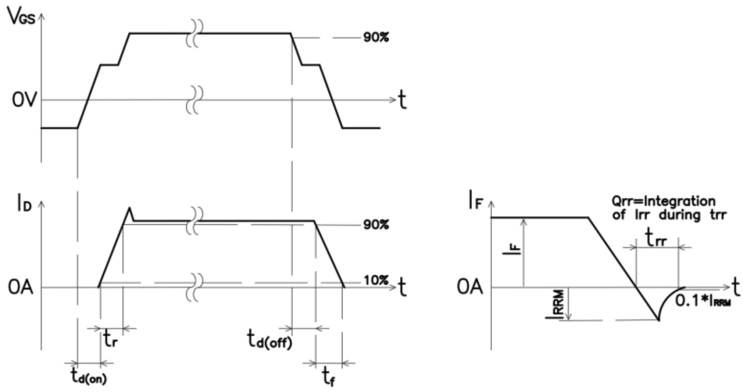

Figure 4. Switching time definition

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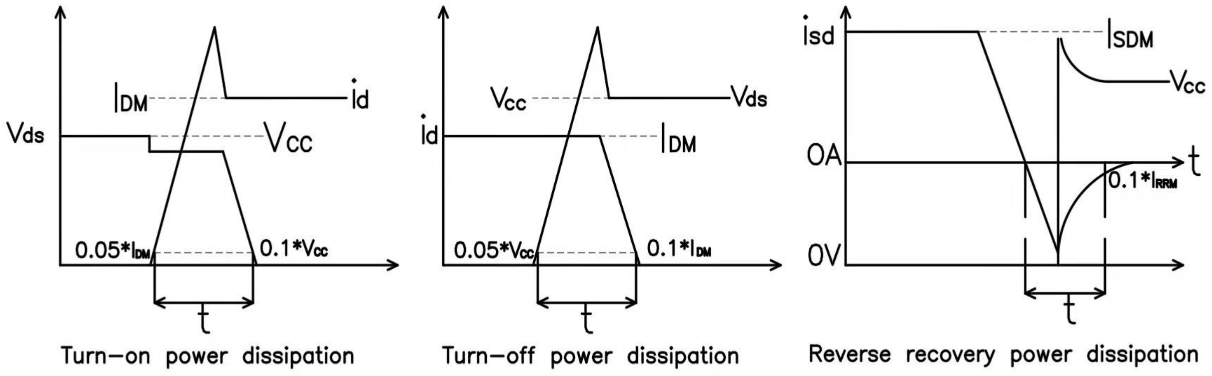

Figure 5. Switching power dissipation definition

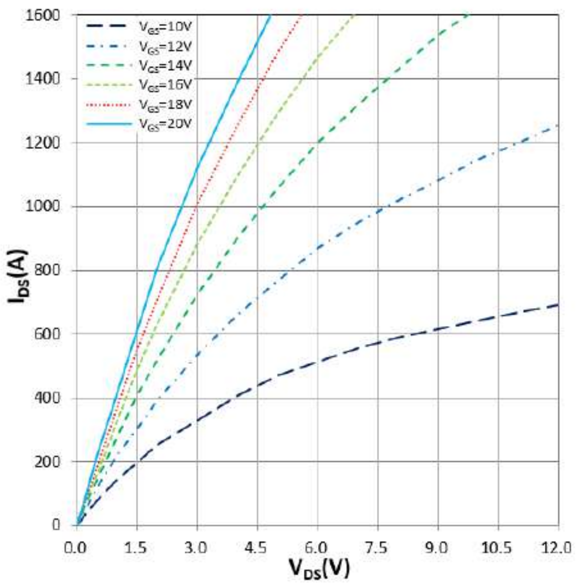	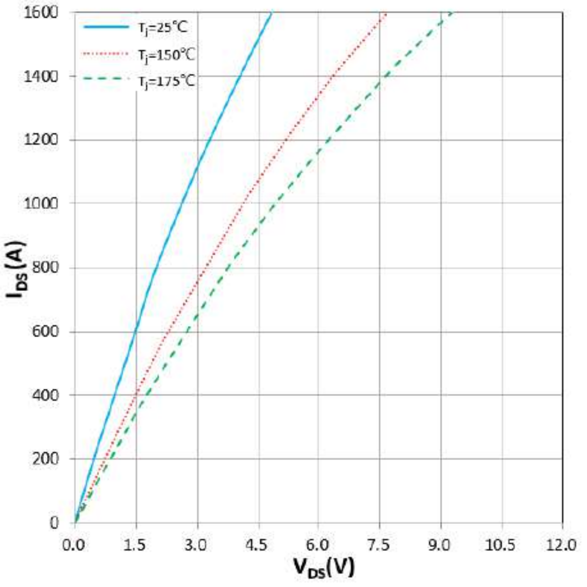
Figure 6. I_{DS} vs V_{DS} T_j =25℃, V_{GS} parameter	Figure 7. I_{DS} vs V_{DS} V_{GS} =20V, T_j parameter

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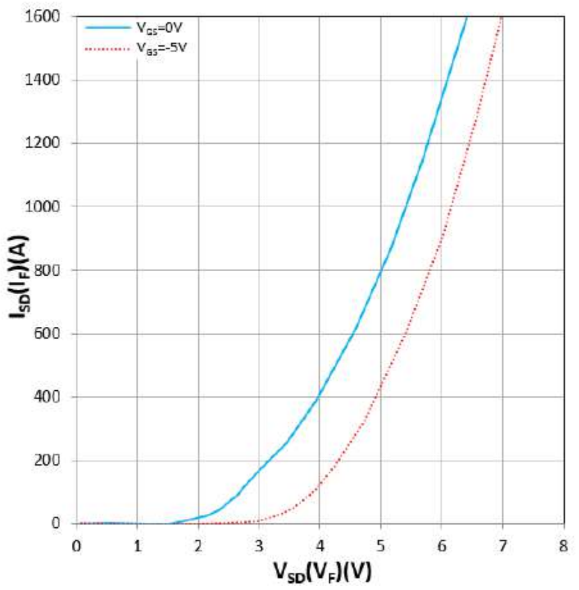

Figure 8. I_{SD} vs V_{SD}

T_j =25°C, V_{GS} parameter

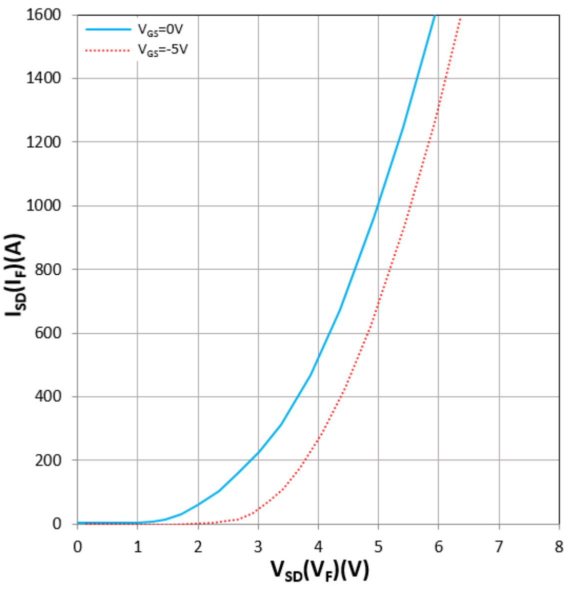

Figure 9. I_{SD} vs V_{SD}

T_j =175°C, V_{GS} parameter

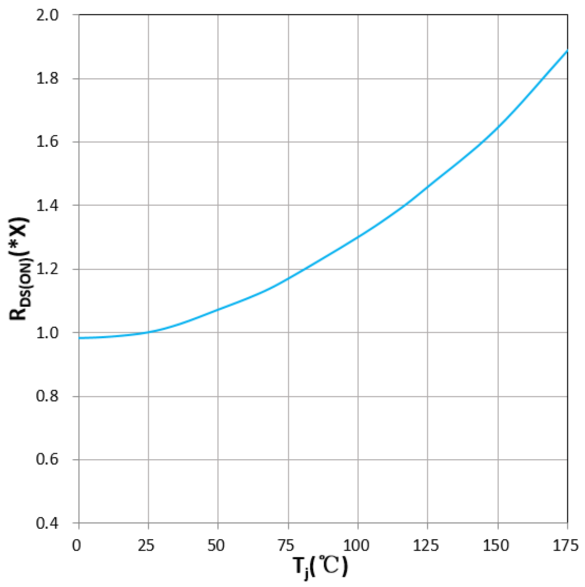

Figure 10. $R_{DS(ON)}$ vs T_j

V_{GS} =+20V, I_D =800A, 1.0X =2.45mΩ

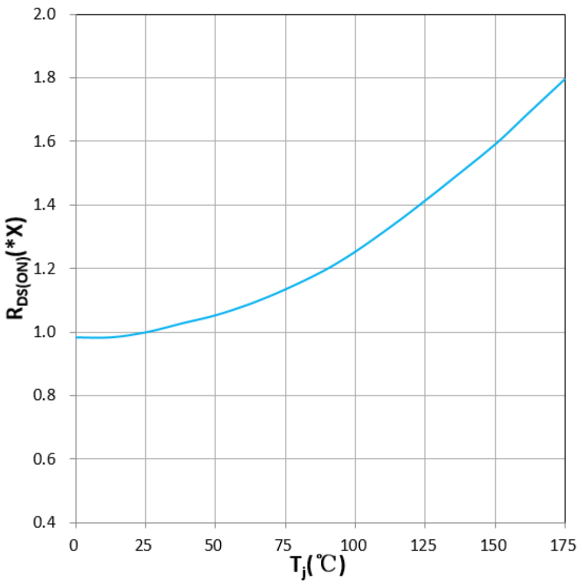

Figure 11. $R_{DS(ON)}$ vs T_j

V_{GS} =+18V, I_D =800A, 1.0X =2.65mΩ

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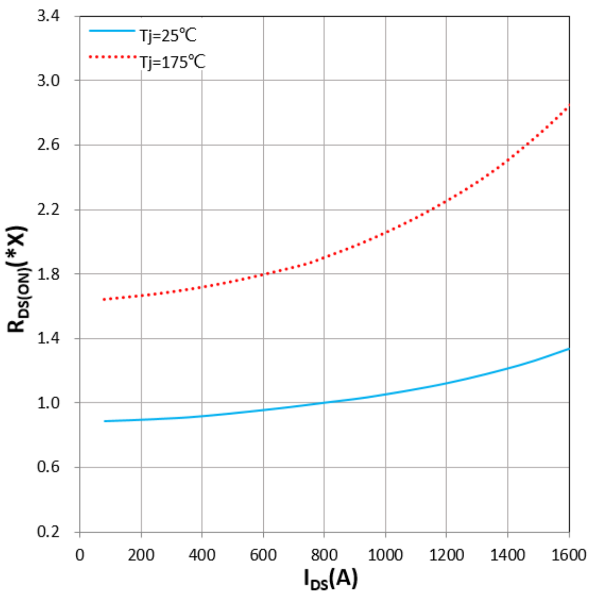

Figure 12. $R_{DS(ON)}$ vs I_{DS}

V_{GS} =+20V, 1.0X =2.45m⊠

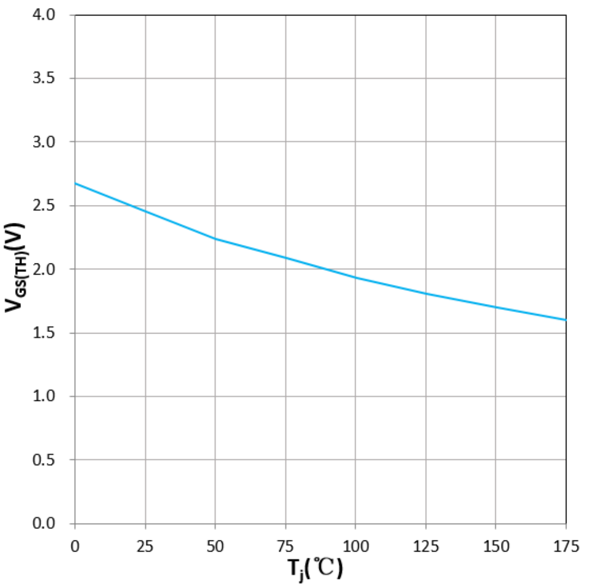

Figure 13. $V_{GS(Th)}$ vs T_j

V_{GS} =V_{DS}, I_D =160mA

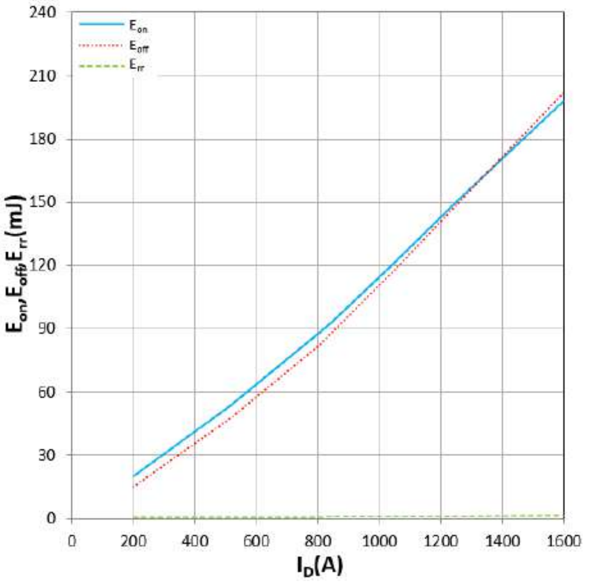

Figure 14. E_{on}, E_{off} , E_{rr} vs I_{DS}

T_j =25°C, V_{DD} =900V, R_G =5.6⊠, V_{GS} =+18V/-5V

Inductive Load

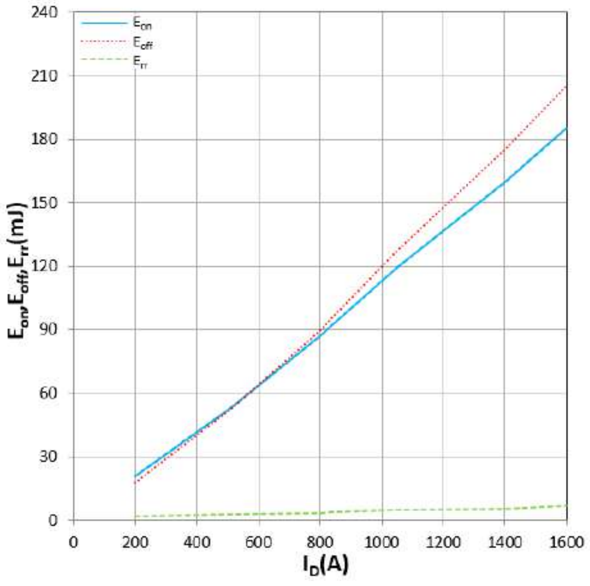

Figure 15. E_{on}, E_{off} , E_{rr} vs I_{DS}

T_j =150°C, V_{DD} =900V, R_G =5.6⊠, V_{GS} =+18V/-5V

Inductive Load

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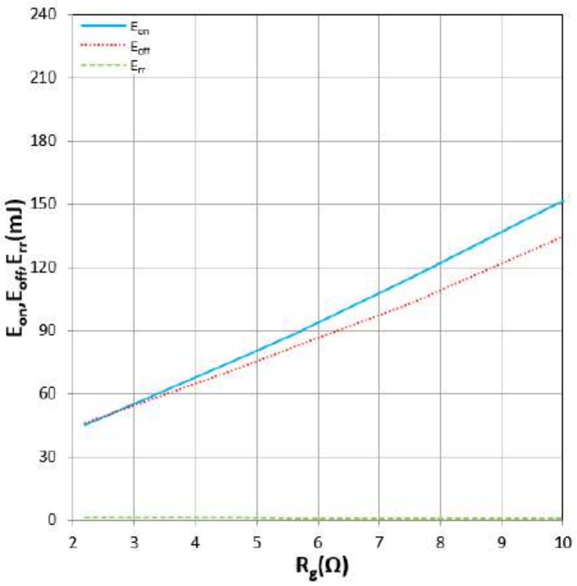

Figure 16. E_{on}, E_{off}, E_{rr} vs R_g
T_j =25°C, V_{DD} =900V, I_D =800A, V_{GS} =+18V/-5V
Inductive Load

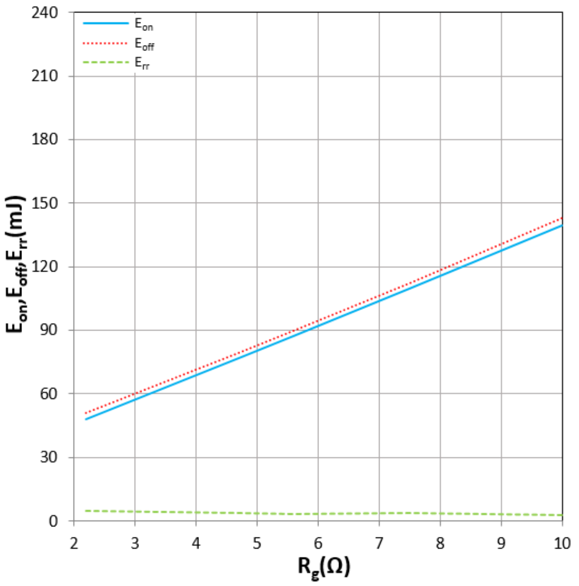

Figure 17. E_{on}, E_{off} , E_{rr} vs R_g
T_j =150°C, V_{DD} =900V, I_D =800A, V_{GS} =+18V/-5V
Inductive Load

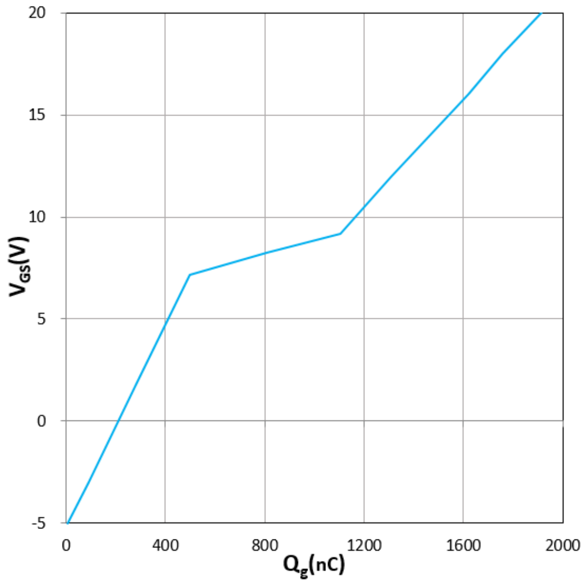

Figure 18. V_{GS} vs Q_g
T_j =25°C, I_D =400A, V_{DS} =800V

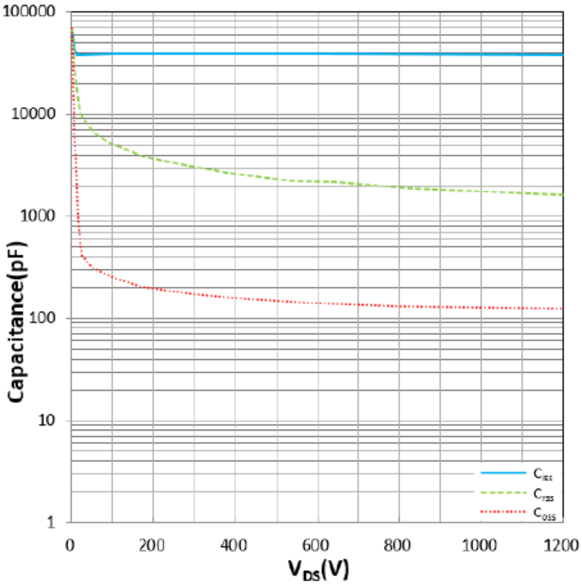

Figure 19. C_{iss},C_{oss},C_{rss} vs V_{DS}
T_j =25°C, f =100kHz

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IMPORTANT NOTICE：

This product data sheet is describing the characteristics of this product for which a warranty is granted. Any such warranty is granted exclusively pursuant the terms and conditions of the supply agreement. There will be no guarantee 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 suitability of the product for the intended application and the completeness of the product data with respect to such application.

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

Instruction note

Naming rules for power module product models（Industrial module）

Product Model

HC	G	100	FF	120	E3	A

Hecheng Code

Module type G : IGBT module
D : FRD module
S : SiC module
H : Si/SiC hybrid

Current level (A) 50~900

Topology structure FZ : A switch unit FF : Half bridge
FS : Three phase F4 : H Bridge
F3L : Three level DF : Boost Circuit
FD : Braking Circuit
FP : Rectification+Inverter+Control move
AL : ANPC CL : Chopper

Voltage level (x10)（V） 650~2200

Packaging form+features（A…Z） A1： 34 mm A2： 62 mm
D0： Flow0 D1： Flow1 D2： Flow2
E1： Easy 1B E2： Easy 2B
E3： Econo Dual E4 : E4 E5 : ED3S
E6 : EconoPIM2 E7 : EconoPIM3
E9 : ED3H
F0 : F0

Feature :A: Special Code Nil: Standard

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