HCS400FF170A2C1

1700V/400A Half Bridge SiC MOSFET Module

Description

The HCS400FF170A2C1 is a Half Bridge SiC MOSFET Power Module. It integrates high performance SiC MOSFET chips and SiC Diode designed for applications such as the Motor drives and Renewable energy.

Fetures

- Blocking Voltage: 1700V
- Rds(on)= 4.3mΩ
- Low Ther mal Resistance with Si_3N_4 AMB
- 175°C Maximum Junction Temperature
- 62mm Half Bridge Module

Applications

- Motor Drives
- Solar and Wind Inverter Systems
- Vehicle Fast Chargers
- UPS

Circuit Diagram

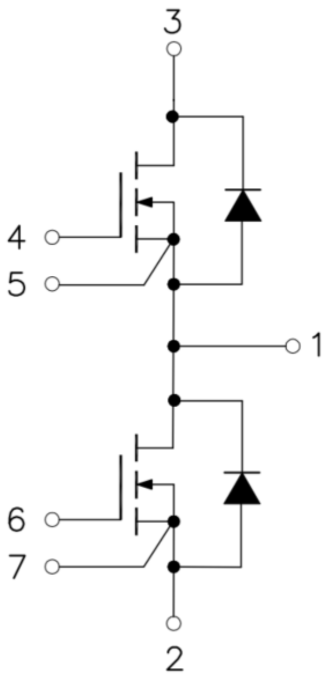

Figure 1. Out Drawing & Circuit Diagram HCS400FF170A2C1

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Pin Configuration and Marking Information

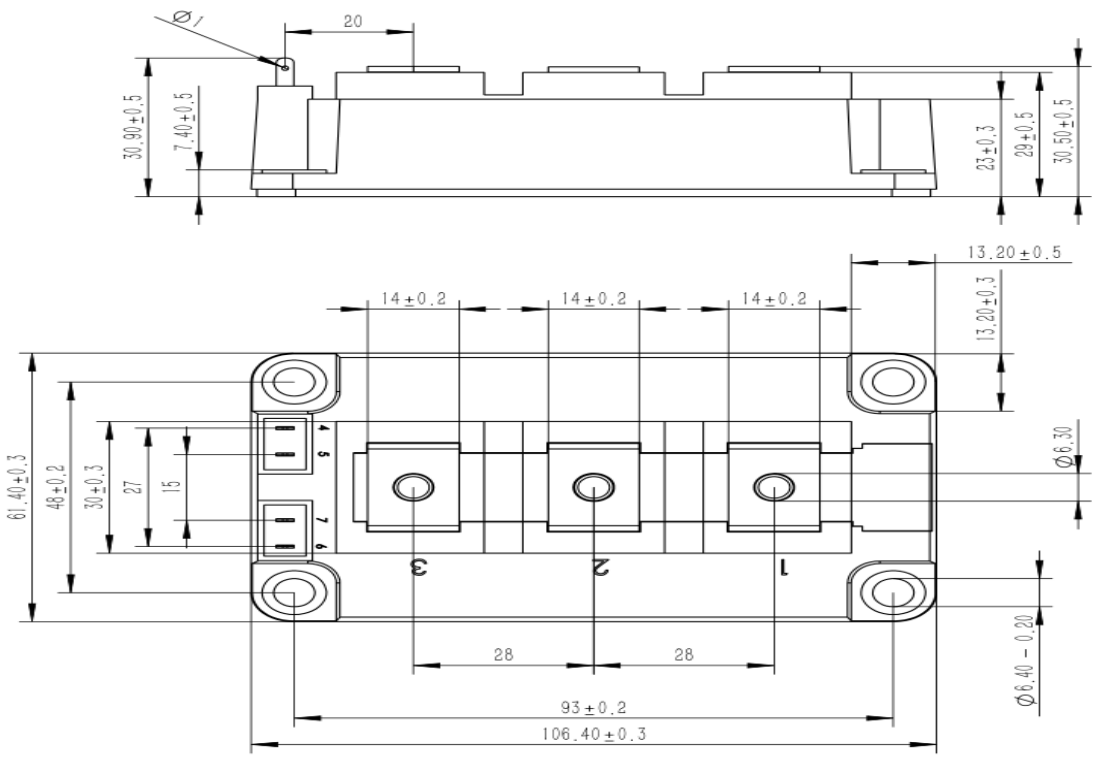

Figure 2. Pin Configuration

Module

Parameter	Conditions	Value	Unit
Isolation voltage	RMS, f =0Hz, t =1min	4.0	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	Tc=25°C	0.6	mΩ
Mounting torque for module mounting	M6	4 to 6	Nm
Weight	-	320	g

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Maximum Ratings (T_j=25°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, AC frequency 1Hz, Note1	-10 to 22	V
I_{DS}	DC Continuous Drain Current	T_c=25°C, V_{GS}=+15V	500	A
I_{DS}	DC Continuous Drain Current	T_c=80°C, V_{GS}=+15V	400	A
I_{SD}	Source-Drain Current (Diode)	T_c=25°C,with ON signal	500	A
I_{SD}	Source-Drain Current (Diode)	T_c=80°C,with ON signal	400	A
I_{DSM}	Pulse Drain Current	T_c=65°C, Pulse Width=1ms, V_{GS}=+15V, Note 2	800	A
P_{tot}	Total Power Dissipation	T_c=25°C	2020	W
T_{jmax}	Max Junction temperature	-	175	°C
T_{stg}	Storage temperature	-	-40 to 125	°C

Note1: Recommended Operating Value: -4V/+15V, -5V/+15V
Note2: Pulse width limited by maximum junction temperature

Diode Electrical Characteristics T_j=25°C Unless Otherwise Specified, Chip)

Symbol	Item	Conditions		Value			Unit
				Min.	Typ.	Max.	
V_F	Diode Forward Voltage	I_F=400A, V_{GS}=0V	T_j=25°C	-	1.65	-	V
			T_j=175°C	-	2.55	-	
T_{rr}	Diode Reverse Recovery Time	(Switch Side) V_{DD}=900V, I_D=400A V_{GS}=+15V/-4V $R_{G(ON)}$=$R_{G (OFF)}$=2.2Ω (FRD Side) V_{RR}=900V, I_F=400A V_{GE}=+15V/-4V Inductive load Switching operation	T_j=25°C	-	27	-	ns
			T_j=150°C	-	38	-	
I_{RM}	Peak Reverse Recovery Current		T_j=25°C	-	77	-	A
			T_j=150°C	-	165	-	
Q_{rr}	Recovered Charge		T_j=25°C	-	1.18	-	μC
			T_j=150°C	-	3.12	-	
E_{rr}	Reverse Recovered Energy		T_j=25°C	-	0.4	-	mJ
			T_j=150°C	-	0.6	-	
$R_{th(j-c)}$	Thermal Resustance, Junction to Case(Diode)			-	0.056	-	°C/W

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MOSFET Electrical Charateristics (T_j=25°C Unless Otherwise Specified, Chip)

Symbol	Item	Conditions		Value Min.	Value Typ.	Value Max.	Unit
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS}=0V, I_D =400μA		1700	-	-	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=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}=20V, V_{DS}=0V	T_j=25°C	-	25	-	nA
$R_{DS(on)}$ (Chip)	Static drain-source On-state resistance	I_D=400A, V_{GS}=15V	T_j=25°C	-	4.3	-	mΩ
			T_j=175°C	-	7.1	-	mΩ
$V_{DS(on)}$ (Chip)	Static drain-source On-state resistance	I_D=400A, V_{GS}=15V	T_j=25°C	-	1.72	-	V
			T_j=175°C	-	2.84	-	V
C_{iss}	Input capacitance	V_D=1000V, V_{GS}=0V, f=1mHz, V_{AC}=25mV		-	30480	-	pF
C_{oss}	Output capacitance			-	820	-	pF
C_{rss}	Reverse transfer capacitance			-	151	-	pF
R_{Gint}	Internal ate resistor	f=1MHZ, V_{AC}=25mV		-	1.7	-	Ω
Q_g	Total gate charge	V_{DD}=1000V, I_D=300A, V_{GS}=+15/-4V		-	1030	-	nC
$t_{d(on)}$	Turn-on delay time	V_{DD}=900V I_D=400A V_{GS}=+15/-4V $R_{G(ON)}$=2.2Ω $R_{G(OFF)}$=2.2Ω Inductive load Switching operation	T_j=25°C	-	118	-	ns
			T_j=150°C	-	108	-	
t_r	Rise time		T_j=25°C	-	68	-	ns
			T_j=150°C	-	58	-	
$t_{d(off)}$	Turn-off delay time		T_j=25°C	-	232	-	ns
			T_j=150°C	-	261	-	
t_f	Fall time		T_j=25°C	-	60	-	ns
			T_j=150°C	-	64	-	
E_{on}	Turn-on power dissipation		T_j=25°C	-	27.9	-	mJ
			T_j=150°C	-	23.7	-	
E_{off}	Turn-off power dissipation		T_j=25°C	-	12.9	-	mJ
			T_j=150°C	-	13.6	-	
$R_{th(j-c)}$	FET Thermal Resistance	Junction to Case		-	0.074	-	K/W

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Test Conditions

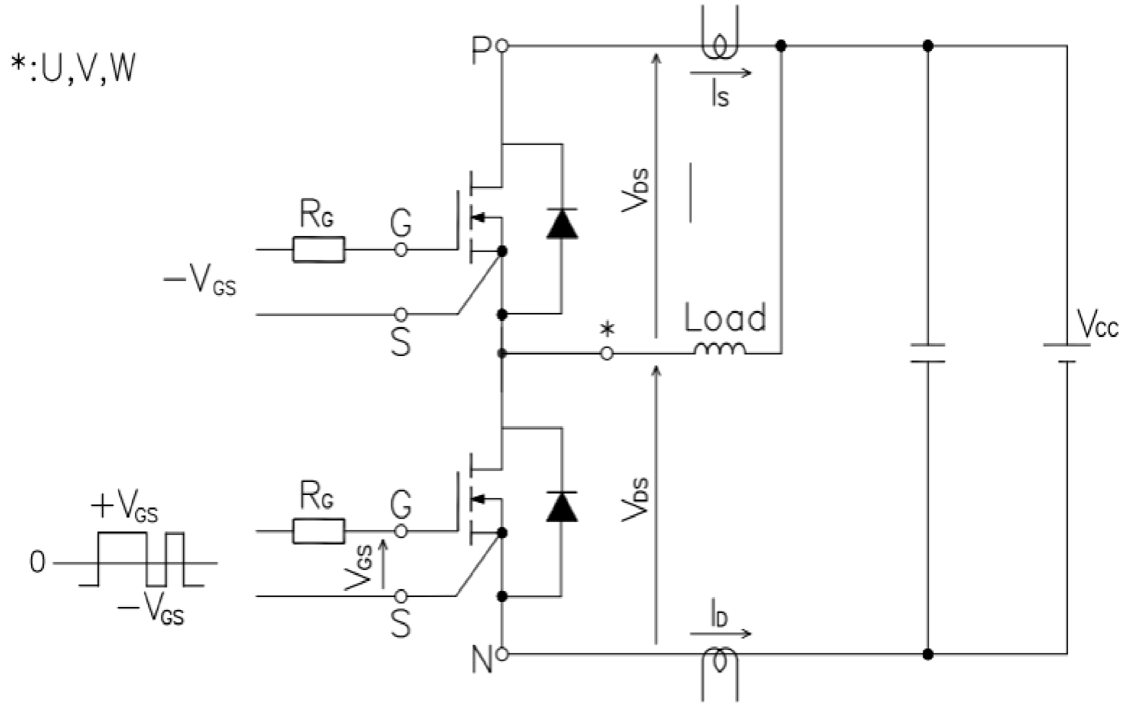

Figure 3. Switching Time Measure Circuit

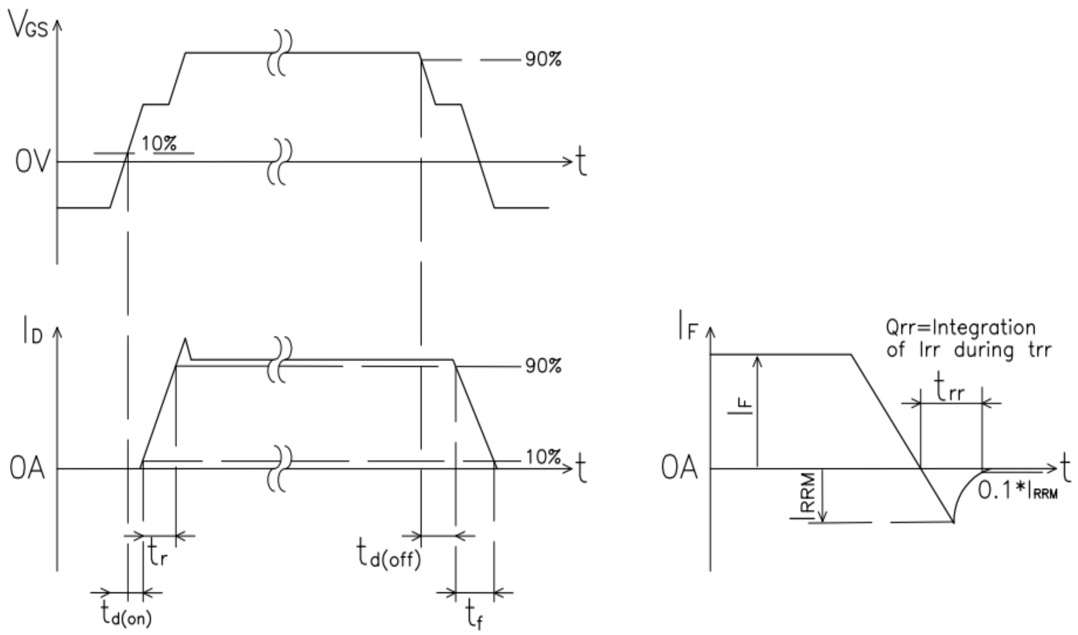

Figure 4. Switching Time Definition

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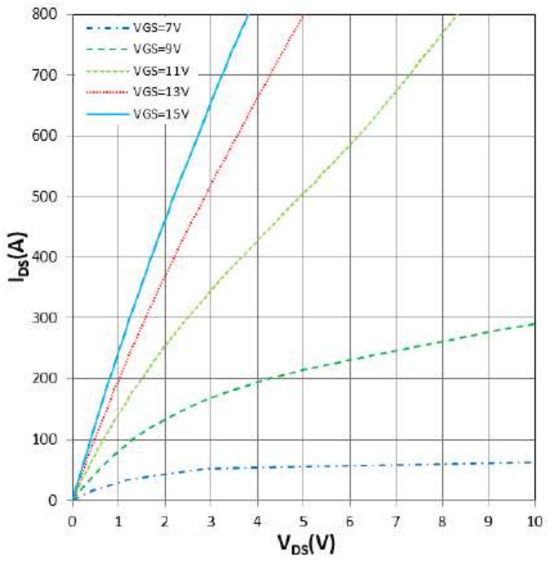

Figure 5. I_{DS} VS V_{DS}
T_j=25°C

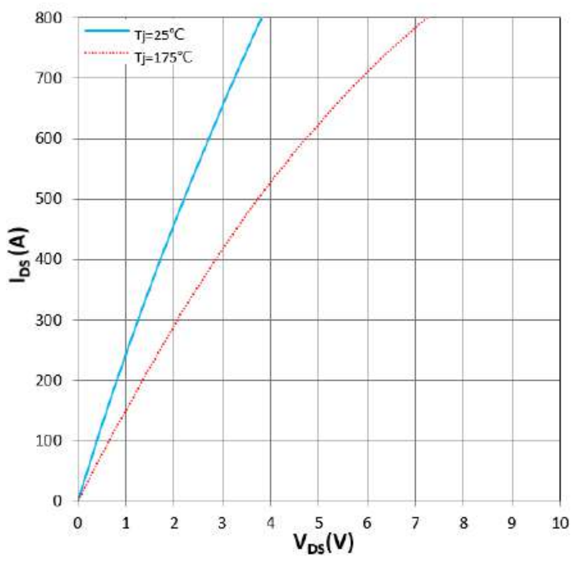

Figure 6. I_{DS} VS V_{DS}
V_{GS} =+15V

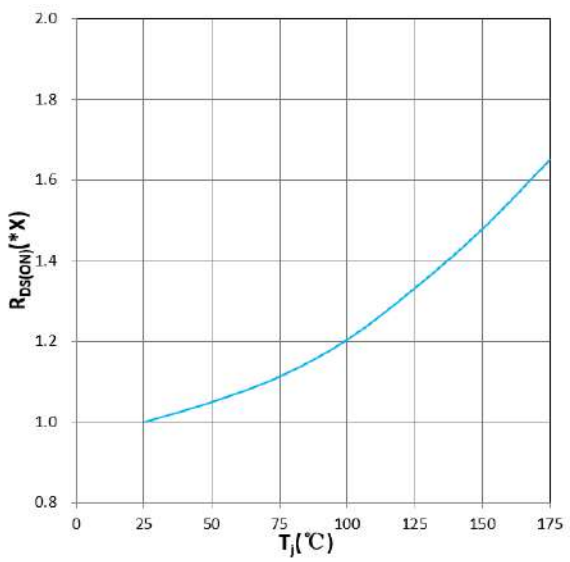

Figure 7. $R_{DS(ON)}$ VS T_j
V_{GS}=+15V, I_D=400A, 1.0X =4.3mΩ

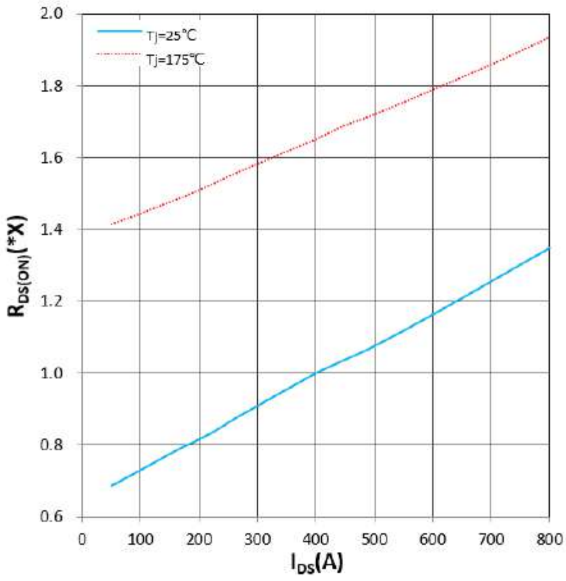

Figure 8. $R_{DS(ON)}$ VS T_j
V_{GS}=+15V, 1.0X =4.3mΩ

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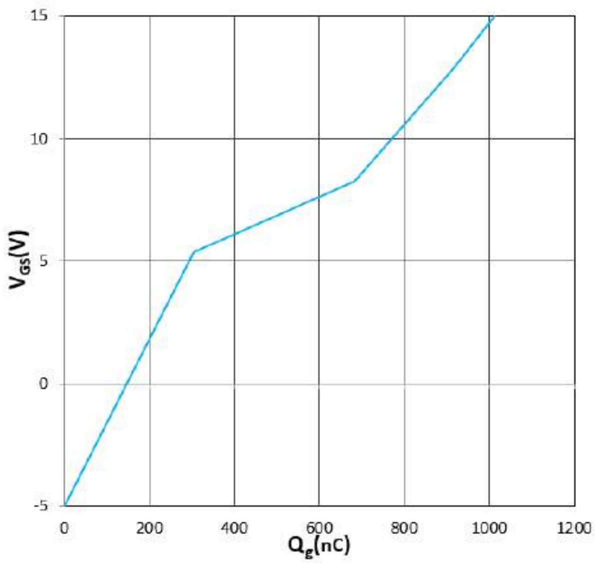

Figure 9. V_{GS} VS Q_g
V_{DS}=1000V, I_D=300A, T_j=25°C

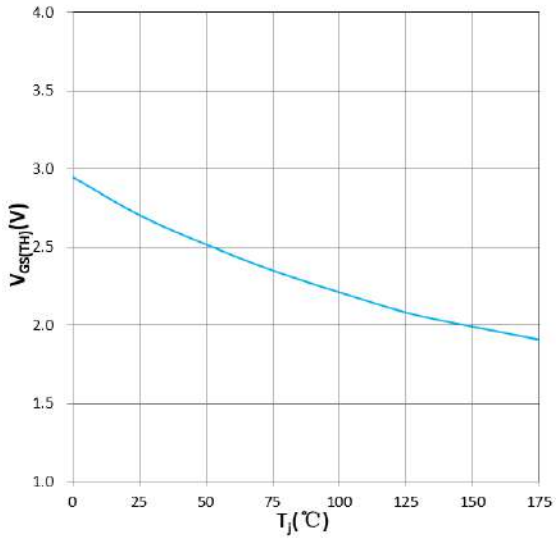

Figure 10. $V_{GS(TH)}$ VS T_j
V_{GS}=V_{DS}, I_D=240mA

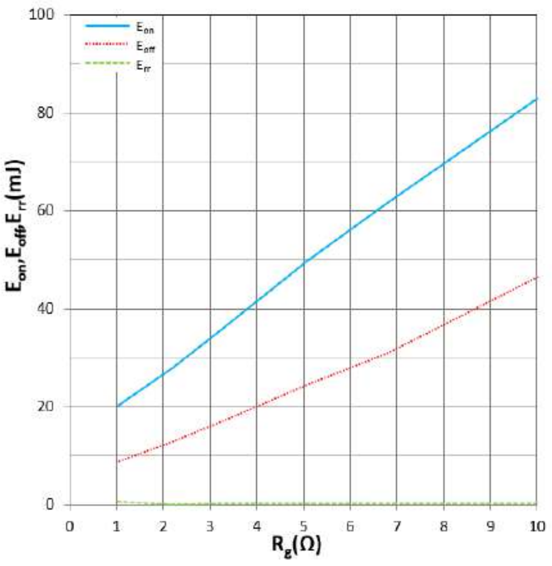

Figure 11. E_{on}, E_{off}, E_{rr} VS R_g
T_j=25°C, V_{DD}=900V, V_{GS}=+15V/-4V, I_D=400A
Inductive Load

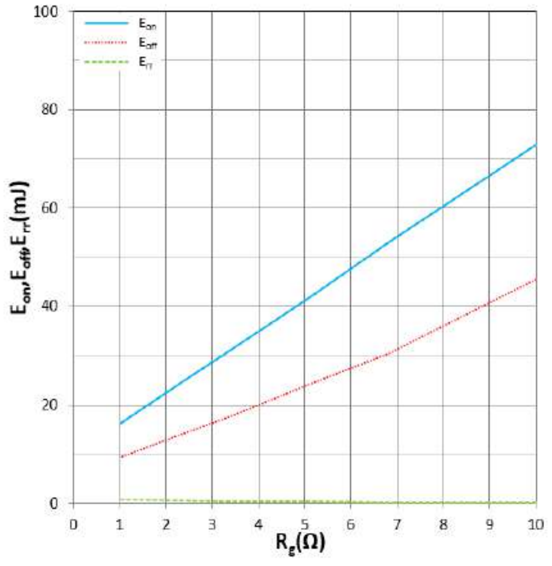

Figure 12. E_{on}, E_{off}, E_{rr} VS R_g
T_j=150°C, V_{DD}=900V, V_{GS}=+15V/-4V, I_D=400A
Inductive Load

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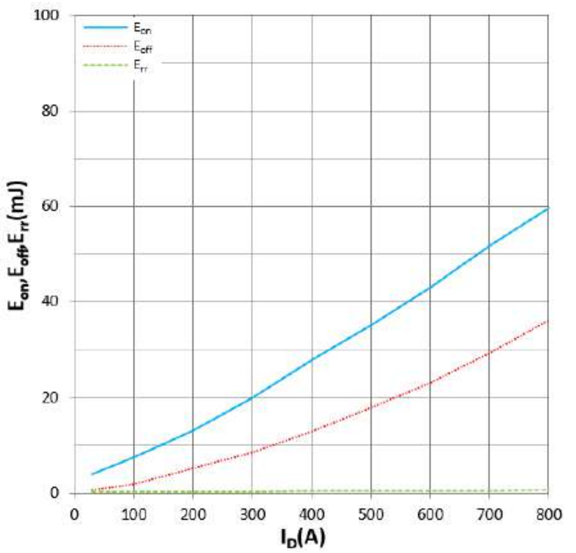

Figure 13. E_{on}, E_{off}, E_{rr} VS I_{DS}
T_j=25°C, V_{DD}=900V, V_{GS}=+15V/-4V
$R_{G(ON)}/R_{G(OFF)}$=2.2/2.2Ω, Inductive Load

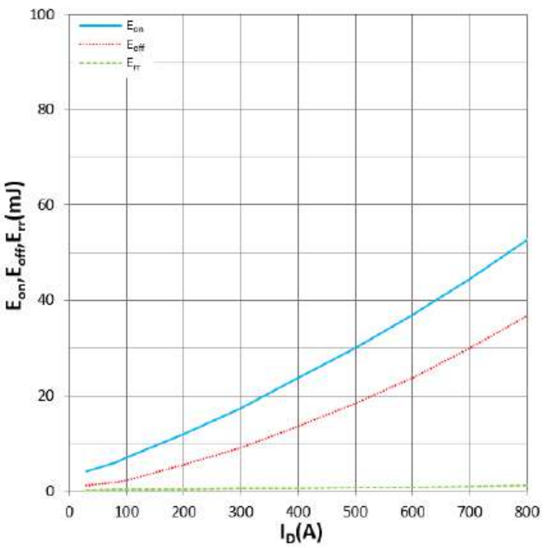

Figure 14. E_{on}, E_{off}, E_{rr} VS I_{DS}
T_j=150°C, V_{DD}=900V, V_{GS}=+15V/-4V
$R_{G(ON)}/R_{G(OFF)}$=2.2/2.2Ω, Inductive Load

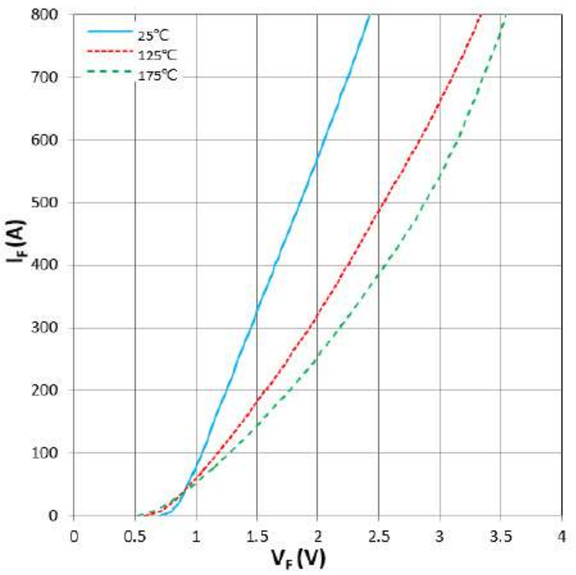

Figure 15. I_F VS V_F
V_{GS}=0V

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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.

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.

Instruction note

Naming rules for power module product models（Industrial module）

Product Model

HC G 100 FF 120 E3 A

- HC — Hecheng Code
- G — Module type
  - G : IGBT module
  - D : FRD module
  - S : SiC module
  - H : Si/SiC hybrid
- 100 — Current level (A) 50~900
- FF — 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
- 120 — Voltage level (x10)（V） 650~2200
- E3 — 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
- A — Feature :A: Special Code Nil: Standard

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