HCS04CL120E2C2

1200V/3.9mΩChopperSiC MOSFETModule

Description

The HCS04CL120E2C2 is a Chopper SiC MOSFET Power Module. It integrates high performance SiC MOSFET chips designed for the applications such as xEvApplication and Renewable energy.

Features

- Blocking voltage:1200V
- $R_{ds(on)}$=3.9m Ω
- Low Switching Losses
- 175℃ maximum junction temperature

Applications

- xEV Applications
- Converter
- Vehicle Fast Chargers
- Renewable

Circuit diagram

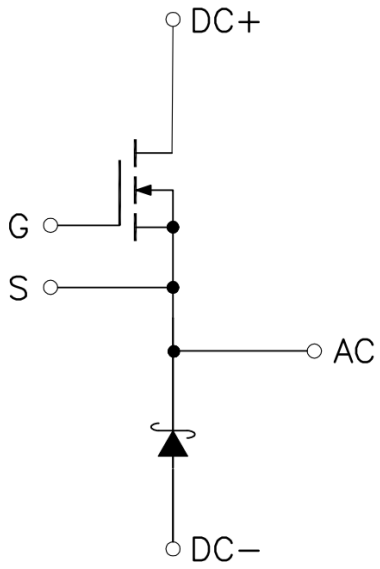

Figure 1. Out drawing & circuit diagramfor HCS04CL120E2C2

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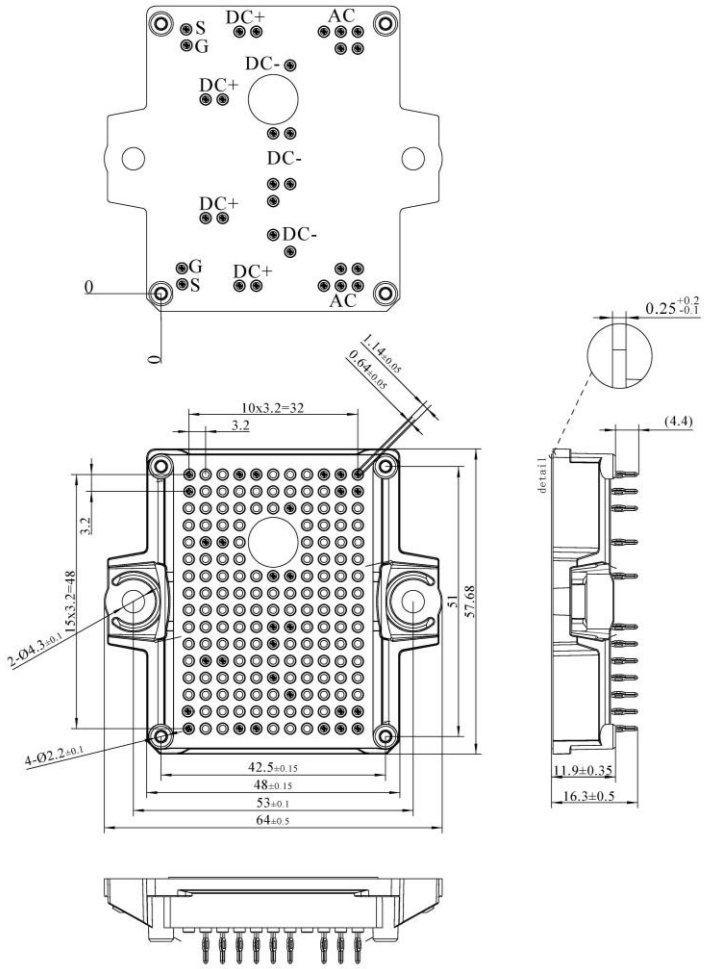
Physical Dimensions



Pin table			
Pin		X	Y
DC+	1	14.85	1.5
	2	18.05	1.5
	3	8.45	14.3
	4	11.65	14.3
	5	8.45	36.7
	6	11.65	36.7
	7	14.85	49.5
	8	18.05	49.5
DC-	1	24.45	7.9
	2	21.25	11.1
	3	21.25	17.5
	4	21.25	20.7
	5	24.45	20.7
	6	21.25	30.3
	7	24.45	30.3
	8	24.45	43.1
AC	1	30.85	1.5
	2	34.05	1.5
	3	37.25	1.5
	4	34.05	4.7
	5	37.25	4.7
	6	34.05	46.3
	7	37.25	46.3
	8	30.85	49.5
	9	34.05	49.5
	10	37.25	49.5
S2	1	34.05	14.3
	2	34.05	36.7
G2	1	37.25	14.3
	2	37.25	36.7

Figure 2. Physical Dimensions

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Module

Parameter	Condition	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	-	40	g

Maximum Ratings (T_j =25°C unless otherwise specified)

Symbol	Parameter	Condition	Ratings	Unit
V_{DSS}	Drain-Source Voltage	G-S Short	1200	V
V_{GSS}	Gate-Source Voltage(+)	D-S Short, Note1	22	V
V_{GSS}	Gate-Source Voltage(-)	D-S Short, Note1	-10	V
I_{DS}	DC Continuous Drain Current	T_f =120°C	200	A
I_{DSM}	Pulse Drain Current	Less than 1ms, Note2	400	A
I_F	Forward Current (Diode)	T_f =120°C	200	A
I_{FRM}	Pulse Forward Current (Diode)	Less than 1ms, Note2	400	A
T_j	Max Junction Temperature	-	-40 to 175	°C
T_{stg}	Storage temperature	-	-40 to 125	°C

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

Note2: Pulse width limited by maximum junction temperature

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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 =400uA		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_D =140mA, V_{DS} =V_{GS}, T_j =175°C		-	2.05	-	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 =200A V_{GS} =15V	T_j =25°C	-	4.7	6.1	m Ω
			T_j 175°C	-	7.1	-	m Ω
		I_D =200A V_{GS} =18V	T_j 25°C	-	3.9	-	m Ω
			T_j 175°C	-	6.3	-	m Ω
$V_{DS(on)}$ (Chip)	Static drain-source On-state Voltage	I_D =200A V_{GS} =15V	T_j 25°C	-	0.94	1.02	V
			T_j 175°C	-	1.42	-	V
		I_D =200A V_{GS} =18V	T_j 25°C	-	0.78	-	V
			T_j 175°C	-	1.26	-	V
C_{iss}	Input Capacitance	V_D =800V, V_{GS} =0V f =1MHz, V_{AC} =25mV		-	23.2	-	nF
C_{oss}	Output Capacitance			-	0.	-	nF
C_{rss}	Reverse transfer Capacitance			-	7040.	-	nF
Q_G	Total gate charge	V_{DD}=800V, I_D=200A, V_{GS}=-5/+18V		-	056	-	nC
R_{Gint}	Internal Gate Resistance	f =1Mhz, V_{AC} =25mV		-	710	-	Ω
$t_{d(on)}$	Turn-on delay time	V_{DD} =600V I_D =200A V_{GS} =-4/+18V R_G =2.5☒ Inductive load switching operation	T_j =25°C	-	0.33	-	ns
			T_j =150°C	-	29	-	
t_r	Rise time		T_j =25°C	-	27	-	ns
			T_j =150°C	-	16	-	
$t_{d(off)}$	Turn-off delay time		T_j =25°C	-	17	-	ns
			T_j =150°C	-	97	-	
t_f	Fall time		T_j =25°C	-	112	-	ns
			T_j =150°C	-	36	-	
E_{on}	Turn-on power dissipation		T_j =25°C	-	41	-	mJ
			T_j =150°C	-	3.98	-	
E_{off}	Turn-off power dissipation		T_j =25°C	-	4.20	-	mJ
			T_j =150°C	-	1.58	-	
$R_{th(j-c)}$	FET Thermal Resistance	Junction to Case/MOSFET		-	1.77	-	K/W
$R_{th(c-f)}$	Contact thermal resistance	With thermal conductive grease /MOSFET		-	0.09 0.12	-	K/W

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

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1200V/3.9mΩChopperSiC MOSFETModule

SiC SBDElectrical characteristics (T_j =25°C unless otherwise specified, chip)

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
I_{RRM}	Reverse Current	V_{RRM} =1200V	-	-	-	200	uA
V_F	Forward Voltage	I_F =200A	T_j =25°C	-	1.45	1.65	V
			T_j =175°C	-	2.05	-	
T_{rr}	Reverse recovery time	V_{RR} =600V, I_F =200A MOSFET side: V_{GS} =+18/-4V R_G =2.5 Ω Inductive load switching operation	T_j =25°C	-	25	-	ns
			T_j =150°C	-	28	-	
Q_{rr}	Reverse recovery charge		T_j =25°C	-	1.35	-	uC
			T_j =150°C	-	1.75	-	
E_{rr}	Diode switching power dissipation		T_j =25°C	-	0.71	-	mJ
			T_j =150°C	-	0.98	-	
$R_{th(j-c)}$	SiC SBD Thermal Resistance	Junction to Case		-	0.08	-	K/W
$R_{th(c-f)}$	Contact thermal Resistance	With thermal conductive grease, Note4		-	0.12	-	K/W

Note4: Assumes Thermal Conductivity of grease is 2.8W/m · K and thickness is 50um.

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

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V_{SD}	Body Diode Forward Voltage	V_{GS} =-5V I_{SD} =200A	T_j =25°C	-	5.17	-	V
			T_j =175°C	-	4.66	-	
T_{rr}	Reverse recovery time	V_{DD} =600V I_D =200A V_{GS} =-4/+18V R_G =2.5 Ω Inductive load switching operation	T_j =25°C	-	55	-	ns
			T_j =150°C	-	45	-	
Q_{rr}	Reverse recovery charge		T_j =25°C	-	4.41	-	μC
			T_j =150°C	-	9.02	-	
E_{rr}	Diode switching power dissipation		T_j =25°C	-	0.92	-	mJ
			T_j =150°C	-	1.60	-	

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Test Conditions

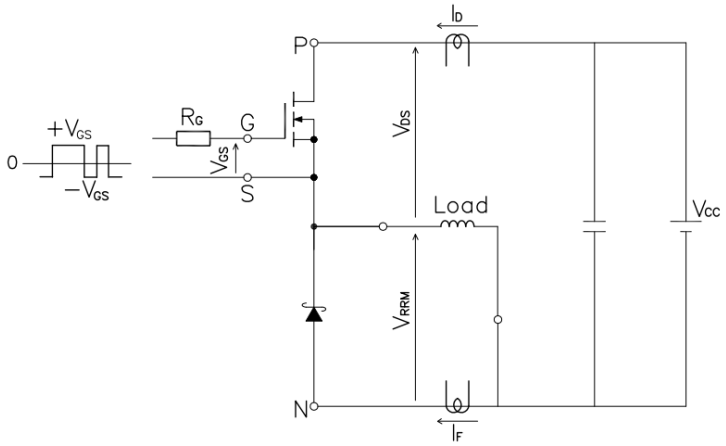

Figure 3. Switching time measure circuit

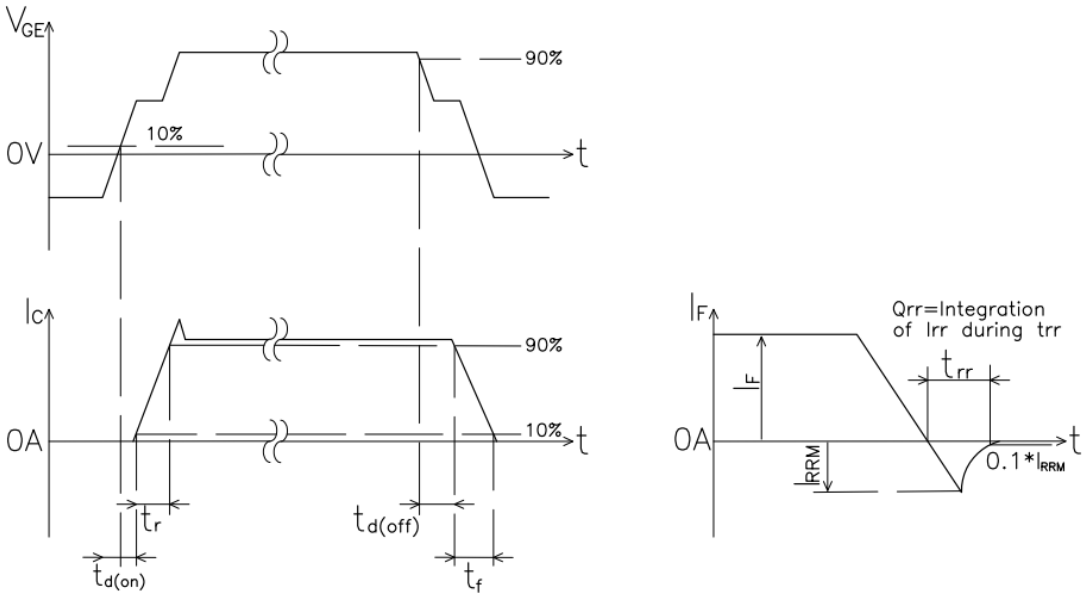

Figure 4. Switching time definition

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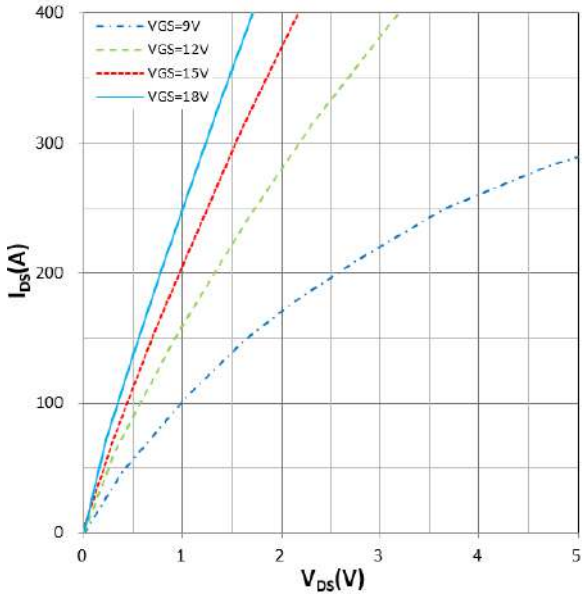

Figure 5. I_{DS} vs V_{DS}
T_j =25°C, V_{GS} parameter

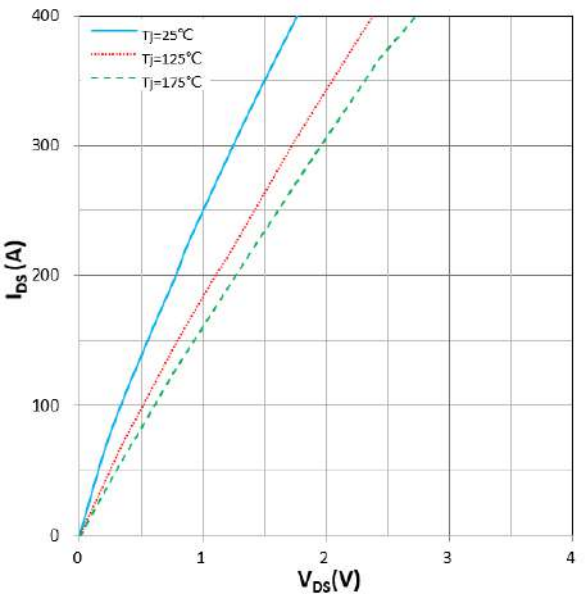

Figure 6. I_{DS} vs V_{DS}
V_{GS} =+18V

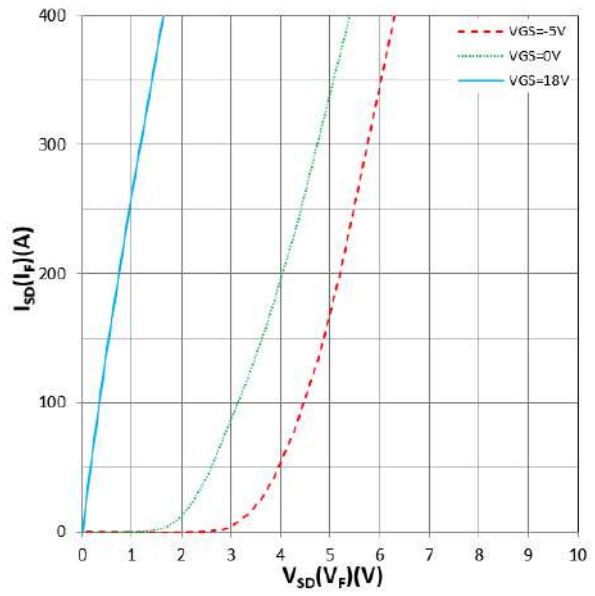

Figure 7. I_{SD} vs V_{SD} (Body Diode)
T_j =25°C, V_{GS} parameter

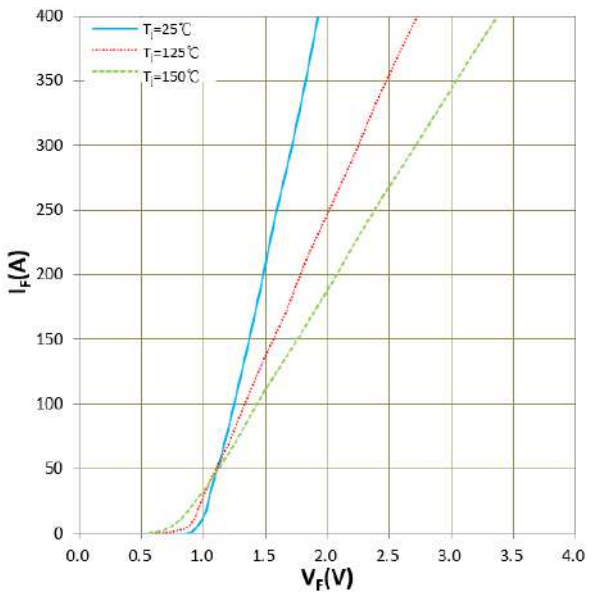

Figure8. I_F vs V_F (SiC SBD)

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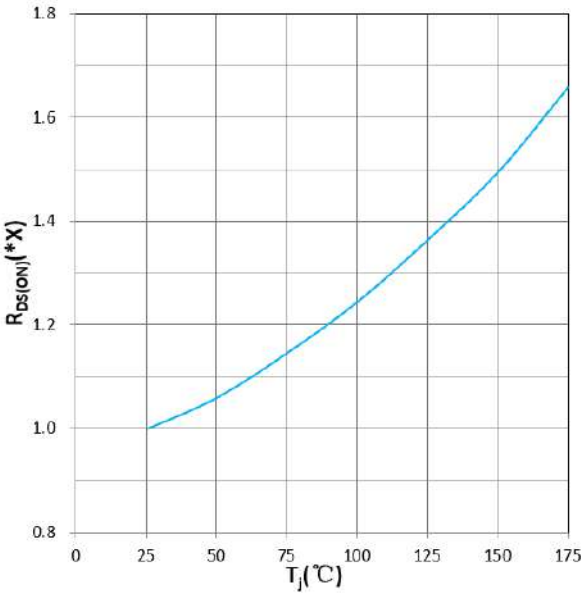

Figure 9. $R_{DS(ON)}$ vs T_j
V_{GS} =+18V, I_D =200A, 1.0X =3.9mΩ

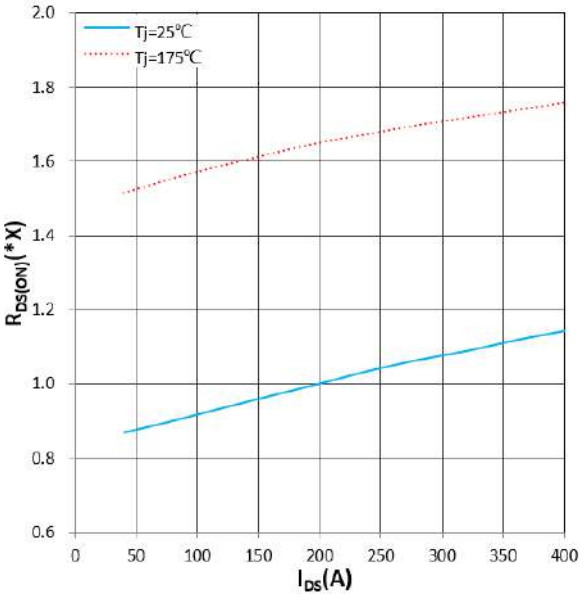

Figure 10. $R_{DS(ON)}$ vs I_{DS}
V_{GS} =+18V, 1.0X =3.9mΩ

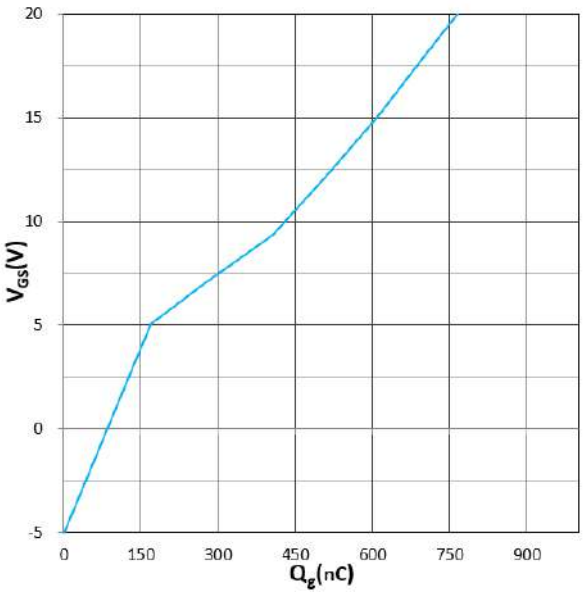

Figure 11. V_{GS} vs Q_g
V_{DS} =800V, I_D =200A , T_j =25°C

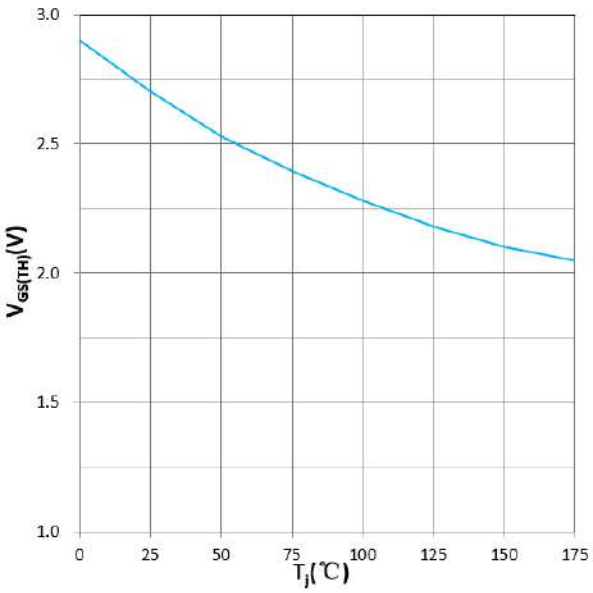

Figure 12. $V_{GS(TH)}$ vs T_j
V_{GS} =V_{DS}, I_D =140mA

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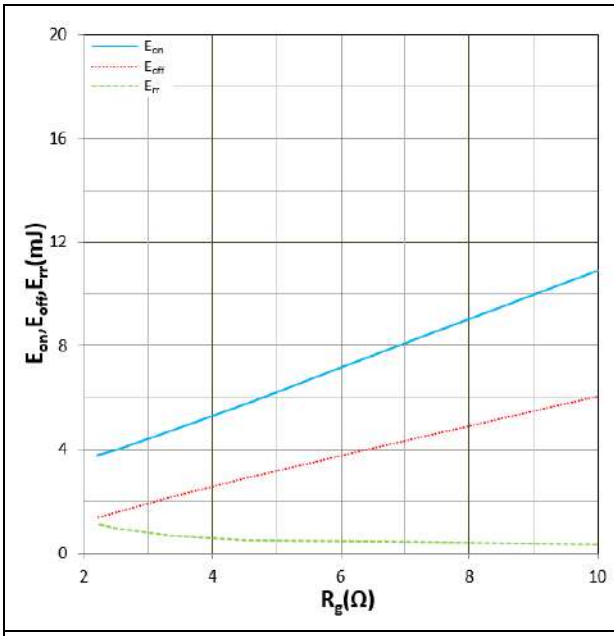

Figure 13. E_{on}, E_{off}, E_{rr} vs R_G
T_j =25°C, V_{DD} =600V, I_D =200A, V_{GS} =-4V/+18V
Inductive Load

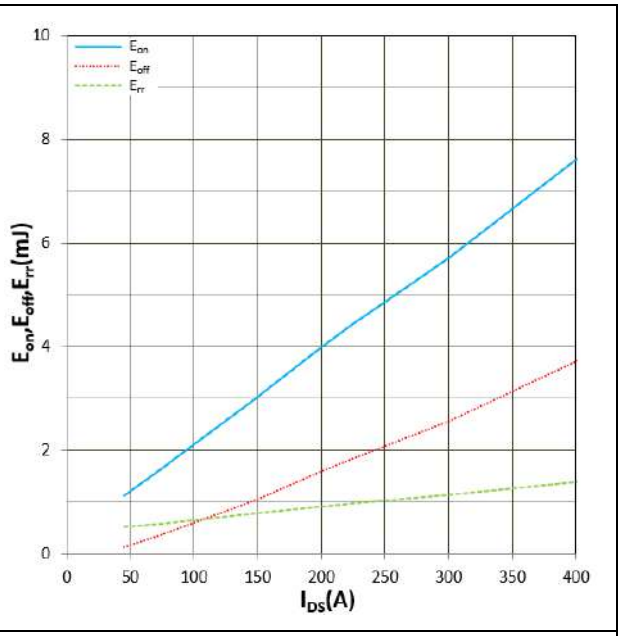

Figure 14. E_{on}, E_{off}, E_{rr} vs I_{DS}
T_j =25°C, V_{DD} =600V, R_G =2.5Ω, V_{GS} =-4V/+18V
Inductive Load

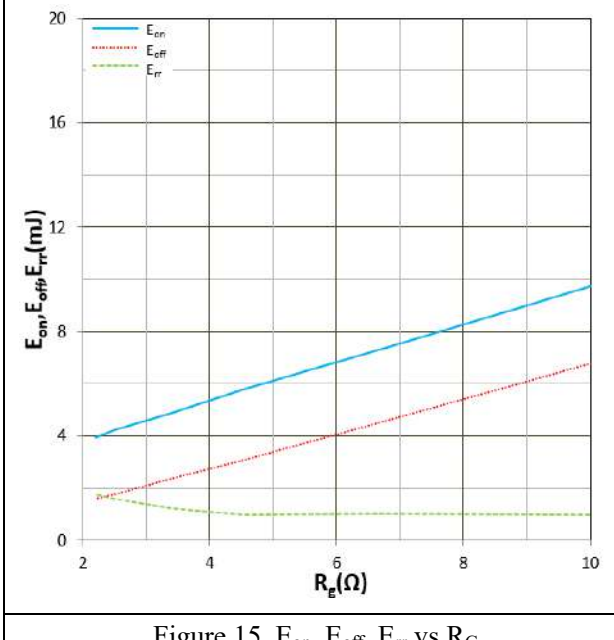

Figure 15. E_{on}, E_{off}, E_{rr} vs R_G
T_j =150°C, V_{DD} =600V, I_D =200A , V_{GS} =-4V/+18V
Inductive Load

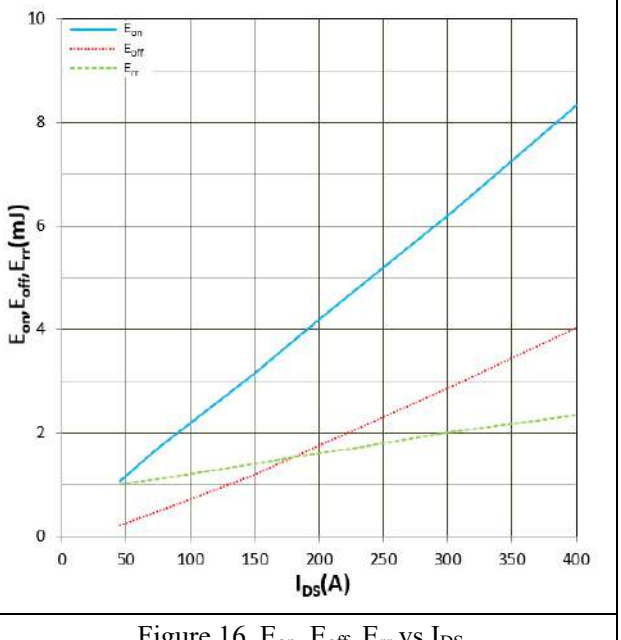

Figure 16. E_{on}, E_{off}, E_{rr} vs I_{DS}
T_j =150°C, V_{DD} =600V, R_G =2.5Ω, V_{GS} =-4V/+18V
Inductive Load

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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.

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	S	04	CL	120	E2	C2

Hecheng Code

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

On-state resistance (mΩ) 01~80

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	
B1： Easy 1B	B1A	B1B…
B2： Easy 2B…	B3： Easy 3B…	
D1： Flow0	D2： Flow1	D3： Flow2
E0 : E0	E1： Econo 2…	E2： E2
E3： ED3	E4 : E4	E5 : ED3S
E6 : EPM2	E7 : EPM3	E8 : EconoPIM3
E9 : ED3H	F0 : F0	P2 : EPM2

Feature :A: Special Code Nil: Standard

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