HCS900CL120E3A1

1200V/900A Half Bridge SiC MOSFET Module

Description

The HCS900CL120E3A1 is a Half Bridge SiC MOSFET Power Module. It integrates high performance SiC MOSFET chips designed for the applications such as Motor drives and Renewable energy.

Features

- Blocking voltage:1200V
- $R_{DS(on)}$=2.1mΩ (T_j =25°C,V_{GS}=18V)
- Low thermal resistance with Si_3N_4 AMB
- 175°Cmaximum junction temperature
- Thermistor inside
- Low Switching Losses

Applications

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

Circuit diagram

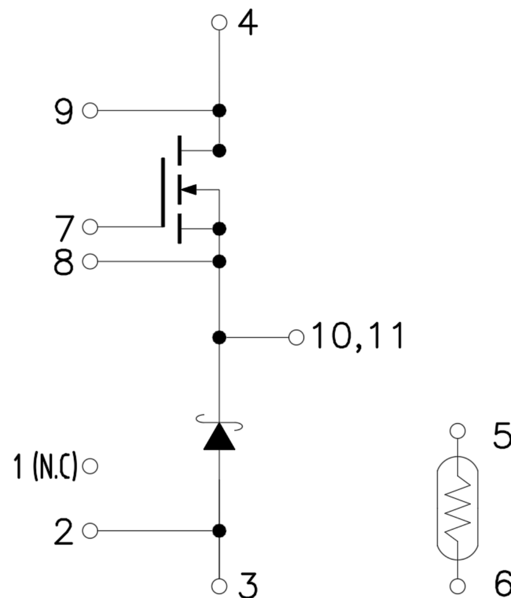

Figure 1. Out drawing & circuit diagram for HCS900CL120E3A1

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Pin Configuration and Marking Information

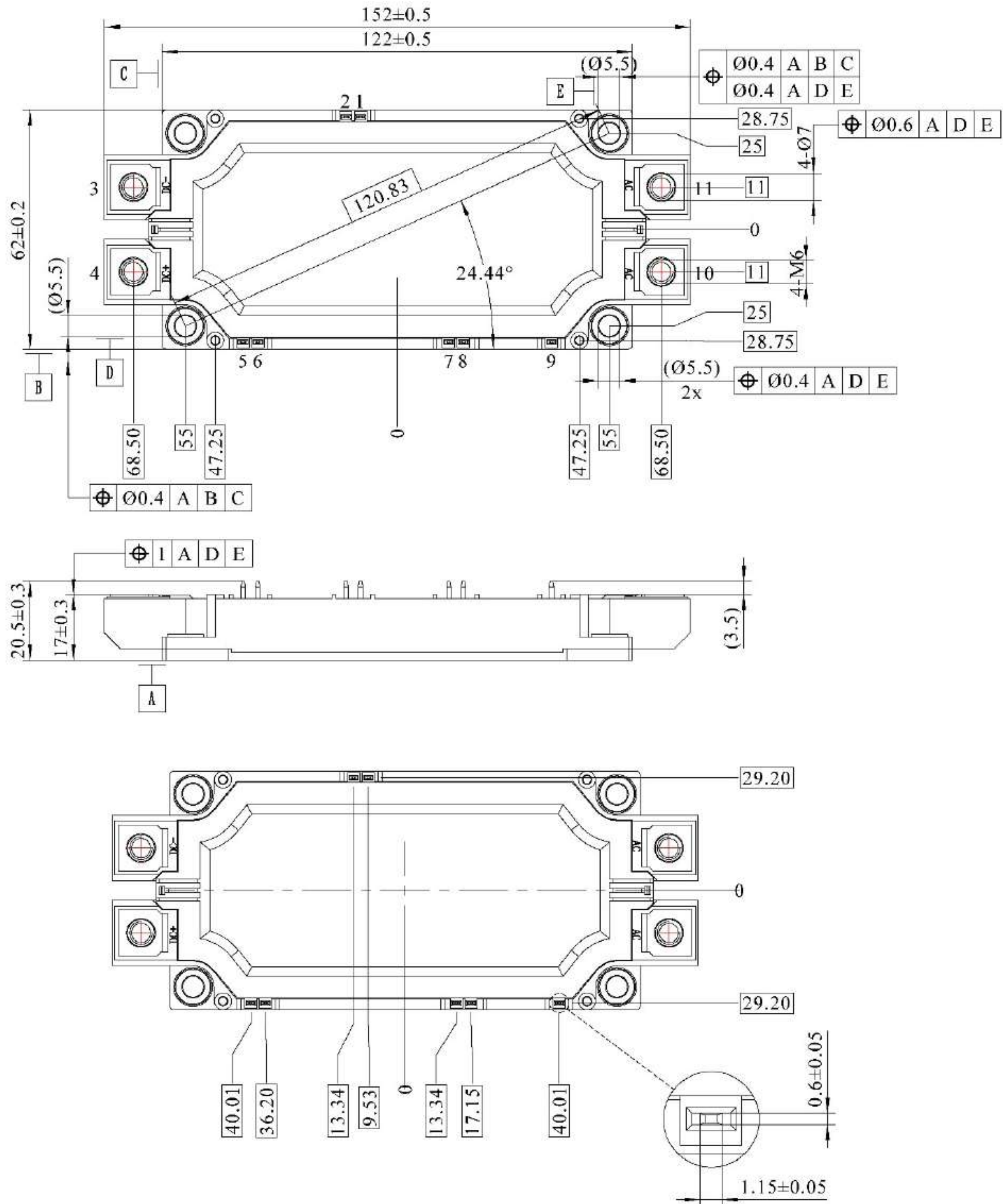

Figure 2. Pin configuration

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Module

Parameter	Condition	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	0.5	mΩ
Mounting torque for module mounting	M5, M6	3 to 6	Nm
Weight	-	340	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, AC frequency ≥1Hz, Note1	-10 to 25	V
I_{DS}	DC Continuous Drain Current	T_C =25°C, V_{GS} =+18V	930	A
I_{DS}	DC Continuous Drain Current	T_C =80°C, V_{GS} =+18V	745	A
I_{DSM}	Pulse Drain Current	T_C =25°C, Pulse width =1ms, V_{GS} =+18V, Note2	1800	A
I_F	Forward Current (Diode)	-	900	A
I_{FRM}	Pulse Forward Current (Diode)	Less than 1ms, Note2	1800	A
P_{tot}	Total Power Dissipation	T_C =25°C	3330	W
T_{jmax}	Max Junction Temperature	-	175	°C
T_{stg}	Storage Temperature	-	-40 to 125	°C

Note1: Recommended Operating Value, +18V/-5V ,+18V/-4V, +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°C	-	5	-	kΩ
△R/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	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)

<table>
<tr><th rowspan="2">Symbol</th><th rowspan="2">Item</th><th rowspan="2" colspan="2">Condition</th><th colspan="3">Value</th><th rowspan="2">Unit</th></tr>
<tr><th>Min.</th><th>Typ.</th><th>Max</th></tr>
<tr><td>$V_{(BR)DSS}$</td><td>Drain-Source Breakdown Voltage</td><td colspan="2">V_{GS} =0V, I_D =800μA</td><td>1200</td><td>-</td><td>-</td><td>V</td></tr>
<tr><td>I_{DSS}</td><td>Zero gate voltage drain Current</td><td colspan="2">V_{DS} =1200V, V_{GS} =0V</td><td>-</td><td>10</td><td>-</td><td>μA</td></tr>
<tr><td rowspan="2">$V_{GS(th)}$</td><td rowspan="2">Gate-source threshold Voltage</td><td rowspan="2">I_D =160mA
V_{DS} =V_{GS}</td><td>T_j =25°C</td><td>1.9</td><td>2.5</td><td>4.0</td><td>V</td></tr>
<tr><td>T_j =175°C</td><td>-</td><td>1.6</td><td>-</td><td>V</td></tr>
<tr><td>I_{GSS}</td><td>Gate-Source Leakage Current</td><td colspan="2">V_{GS} =18V, V_{DS} =0V, T_j =25°C</td><td>-</td><td>20</td><td>2000</td><td>nA</td></tr>
<tr><td rowspan="2">$R_{DS(on)}$
(Chip)</td><td rowspan="2">Static drain-source
On-state resistance</td><td rowspan="2">I_D =900A
V_{GS} =18V</td><td>T_j =25°C</td><td>-</td><td>2.1</td><td>-</td><td>mΩ</td></tr>
<tr><td>T_j =175°C</td><td>-</td><td>3.8</td><td>-</td><td>mΩ</td></tr>
<tr><td rowspan="2">$V_{DS(on)}$
(Chip)</td><td rowspan="2">Static drain-source
On-state Voltage</td><td rowspan="2">I_D =900A
V_{GS} =18V</td><td>T_j =25°C</td><td>-</td><td>1.89</td><td>-</td><td>V</td></tr>
<tr><td>T_j =175°C</td><td>-</td><td>3.42</td><td>-</td><td>V</td></tr>
<tr><td>C_{iss}</td><td>Input Capacitance</td><td rowspan="3" colspan="2">V_D =1000V, V_{GS} =0V
f =100kHz, V_{AC} =25mV</td><td>-</td><td>38.2</td><td>-</td><td>nF</td></tr>
<tr><td>C_{oss}</td><td>Output Capacitance</td><td>-</td><td>1.74</td><td>-</td><td>nF</td></tr>
<tr><td>C_{rss}</td><td>Reverse transfer Capacitance</td><td>-</td><td>0.14</td><td>-</td><td>nF</td></tr>
<tr><td>Q_G</td><td>Total gate charge</td><td colspan="2">V_{DD} =800V, I_D =400A, V_{GS} =+20/-5V</td><td>-</td><td>1895</td><td>-</td><td>nC</td></tr>
<tr><td>R_{Gint}</td><td>Internal Gate Resistance</td><td colspan="2">T_j =25°C</td><td>-</td><td>0.9</td><td>-</td><td>Ω</td></tr>
<tr><td rowspan="2">$t_{d(on)}$</td><td rowspan="2">Turn-on delay time</td><td rowspan="12">V_{DD} =600V
I_D =900A
V_{GS} =+18/-4V
$R_{g(on)}$ =1.5Ω
$R_{g(off)}$ =1.5Ω
Inductive load
switching operation</td><td>T_j =25°C</td><td>-</td><td>51</td><td>-</td><td rowspan="2">ns</td></tr>
<tr><td>T_j =150°C</td><td>-</td><td>42</td><td>-</td></tr>
<tr><td rowspan="2">t_r</td><td rowspan="2">Rise time</td><td>T_j =25°C</td><td>-</td><td>41</td><td>-</td><td rowspan="2">ns</td></tr>
<tr><td>T_j =150°C</td><td>-</td><td>39</td><td>-</td></tr>
<tr><td rowspan="2">$t_{d(off)}$</td><td rowspan="2">Turn-off delay time</td><td>T_j =25°C</td><td>-</td><td>35</td><td>-</td><td rowspan="2">ns</td></tr>
<tr><td>T_j =150°C</td><td>-</td><td>47</td><td>-</td></tr>
<tr><td rowspan="2">t_f</td><td rowspan="2">Fall time</td><td>T_j =25°C</td><td>-</td><td>23</td><td>-</td><td rowspan="2">ns</td></tr>
<tr><td>T_j =150°C</td><td>-</td><td>29</td><td>-</td></tr>
<tr><td rowspan="2">E_{on}</td><td rowspan="2">Turn-on power dissipation</td><td>T_j =25°C</td><td>-</td><td>22.5</td><td>-</td><td rowspan="2">mJ</td></tr>
<tr><td>T_j =150°C</td><td>-</td><td>31.6</td><td>-</td></tr>
<tr><td rowspan="2">E_{off}</td><td rowspan="2">Turn-off power dissipation</td><td>T_j =25°C</td><td>-</td><td>6.6</td><td>-</td><td rowspan="2">mJ</td></tr>
<tr><td>T_j =150°C</td><td>-</td><td>10.9</td><td>-</td></tr>
<tr><td>$R_{th(j-c)}$</td><td>FET Thermal Resistance</td><td colspan="2">Junction to Case</td><td>-</td><td>0.045</td><td>-</td><td>K/W</td></tr>
<tr><td>$R_{th(c-f)}$</td><td>Contact thermal Resistance</td><td colspan="2">With thermal conductive grease, Note3</td><td>-</td><td>0.015</td><td>-</td><td>K/W</td></tr>
</table>

Note3: Assumes Thermal Conductivity of grease is 0.9W/m・K and thickness is 50um.

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

Symbol	Item	Condition		Value			Unit
				Min.	Typ.	Max	
V_{DC}	DC blocking Voltage	T_j =25°C		1200	-	-	V
V_{BR}	Breakdown Voltage	I_R =16mA, T_j =25°C		1200	-	-	V
V_F	Diode forward Voltage	I_F =900A	T_j =25°C	-	2.00	2.20	V
			T_j =125°C	-	2.90	-	
			T_j =175°C	-	3.70	-	
I_R	Reverse Current	V_R =1200V	T_j =25°C	-	48	800	μA
			T_j =125°C	-	392	-	
			T_j =175°C	-	1544	-	
Q_C	Total capacitive charge	V_R =800V	T_j =25°C	-	2152	-	nC
C	Total capacitance	V_R =800V	f =1MHz		1448		pF
$R_{th(j-c)}$	SiC SBD Thermal Resistance	Junction to Case		-	0.054	-	K/W
$R_{th(c-f)}$	Contact thermal Resistance	With thermal conductive grease, Note1		-	0.020	-	K/W

Test Conditions

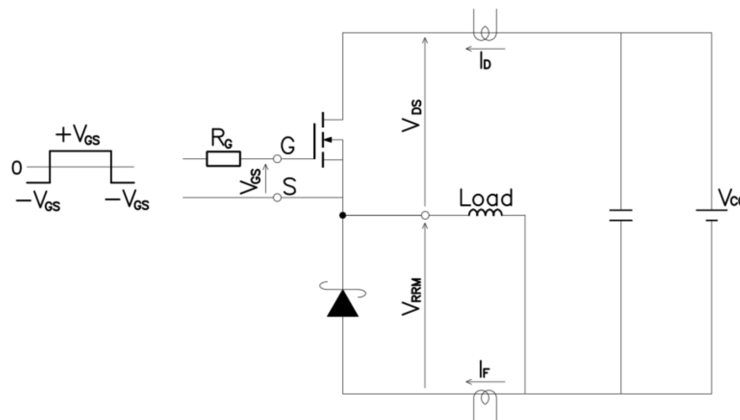

Figure 3. Switching time measure circuit

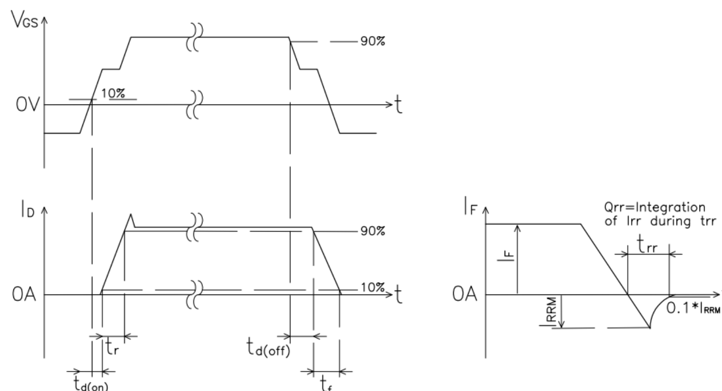

Figure 4. Switching time definition

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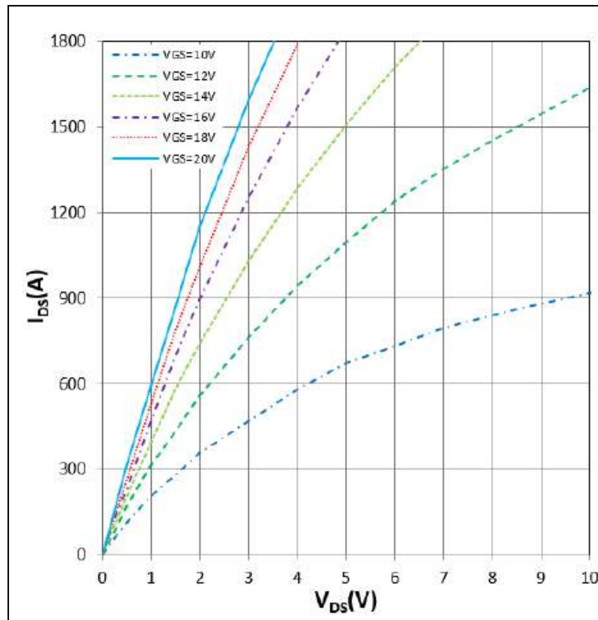

Figure 5. I_{DS} vs V_{DS}
T_j =25°C, V_{GS} parameter

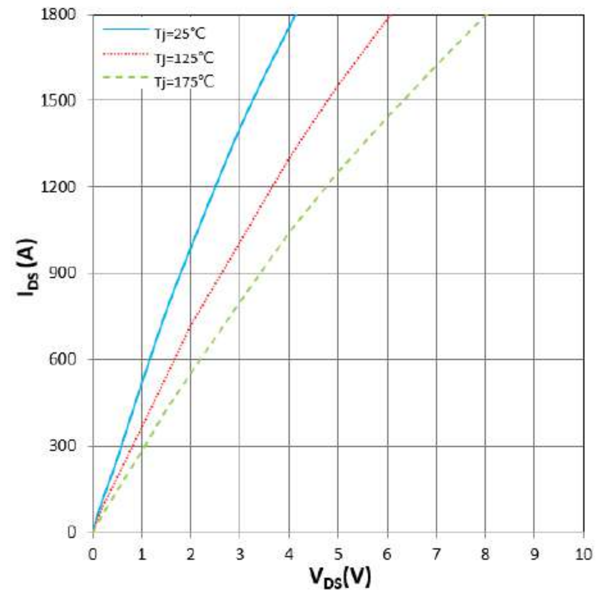

Figure 6. I_{DS} vs V_{DS}
V_{GS} =18V, T_j parameter

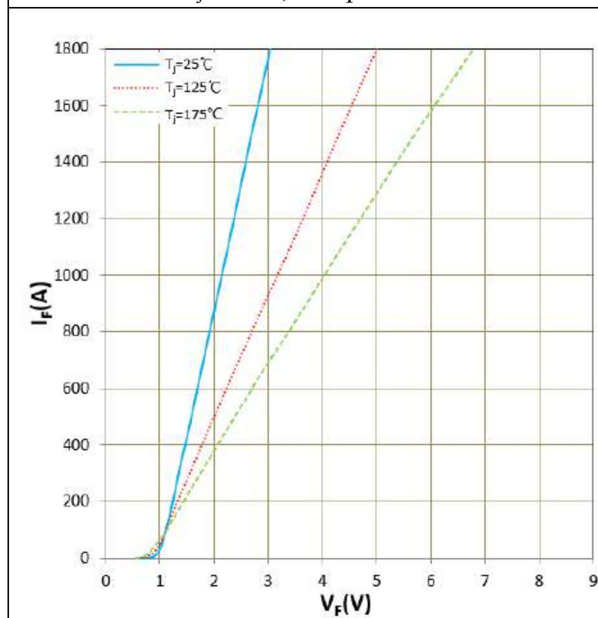

Figure 7. I_F vs V_F
T_j parameter

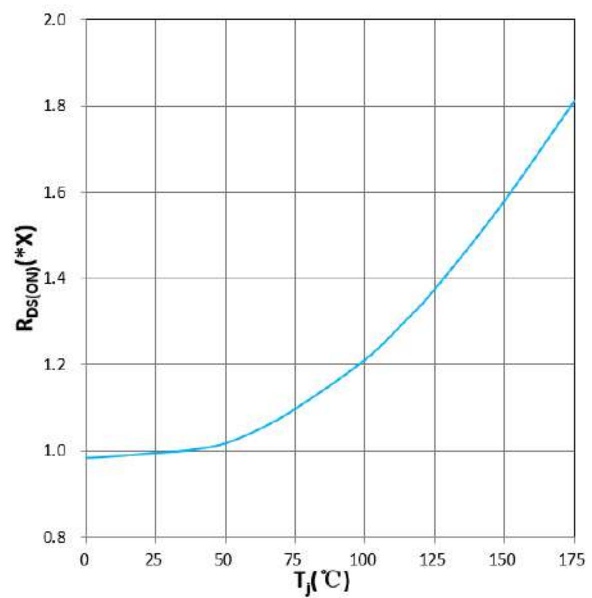

Figure 8. $R_{DS(ON)}$ vs T_j
V_{GS} =+18V, I_D =900A, 1.0X =2.1m⊠

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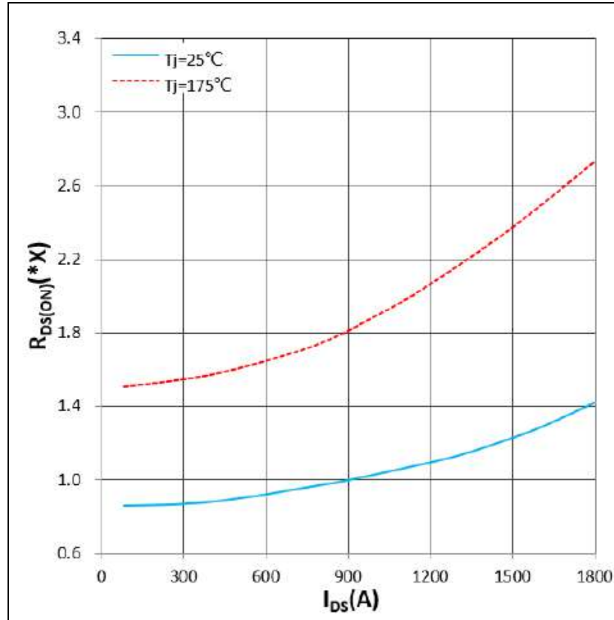	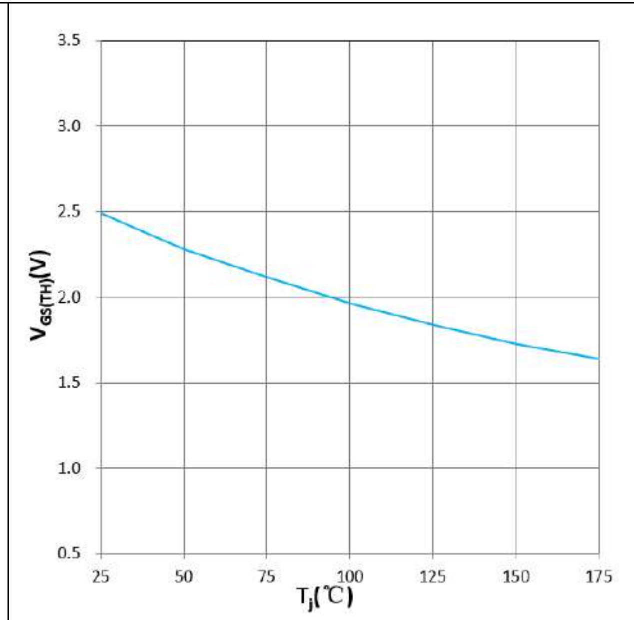
Figure 9. $R_{DS(ON)}$ vs I_{DS} V_{GS} =+18V, 1.0X =2.1mΩ	Figure 10. $V_{GS(TH)}$ vs T_j V_{GS} =V_{DS} , I_D =160mA
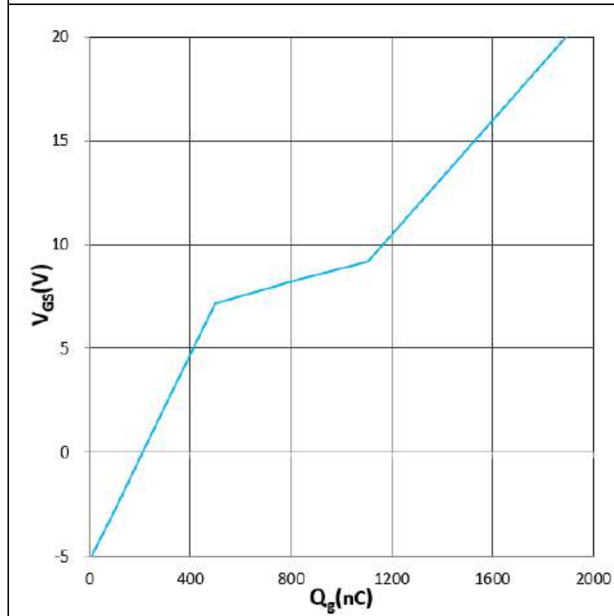	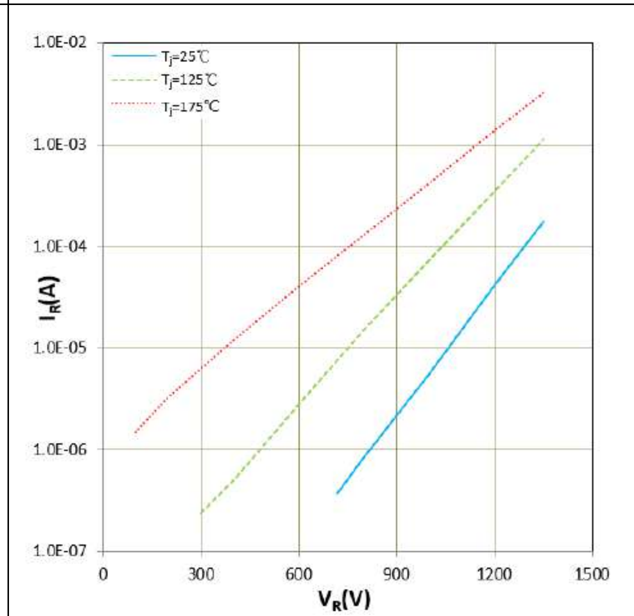
Figure 11. V_{GS} vs Q_g T_j =25°C, V_{DS} =800V, I_D =400A	Figure 12. I_R vs V_R T_j parameter

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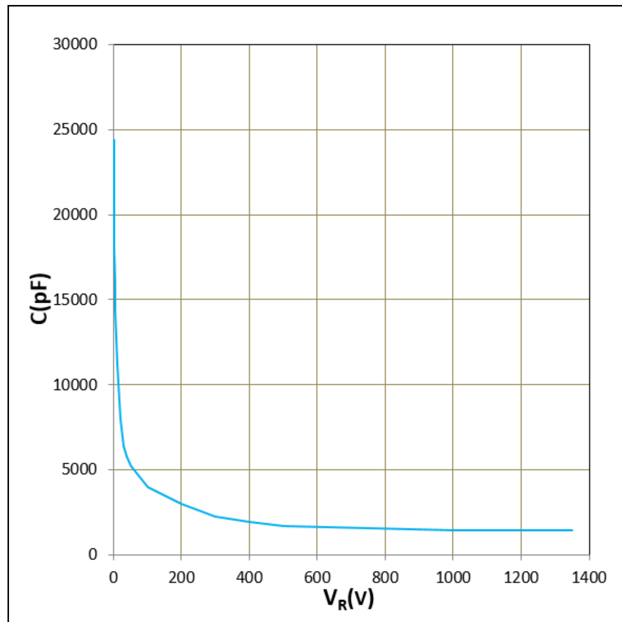
<td>
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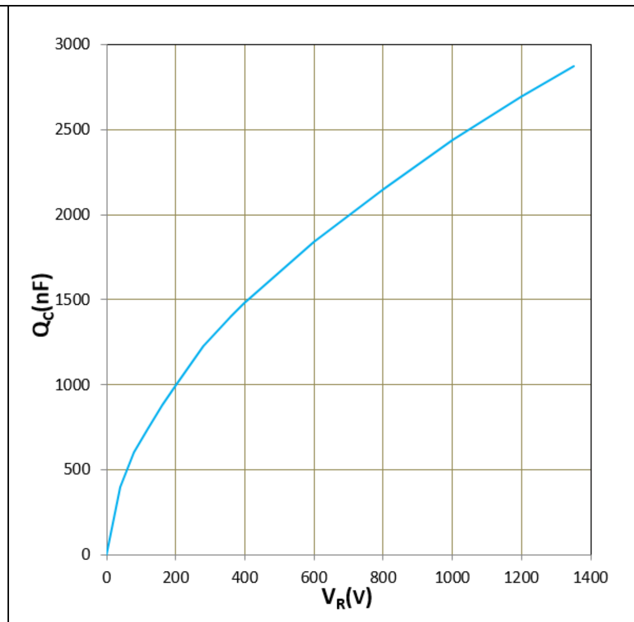
<td>
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<tr>
<td>Figure 13. C vs V_R
T_j =25°C</td>
<td>Figure 14. Q_C vs V_R
T_j =25°C</td>
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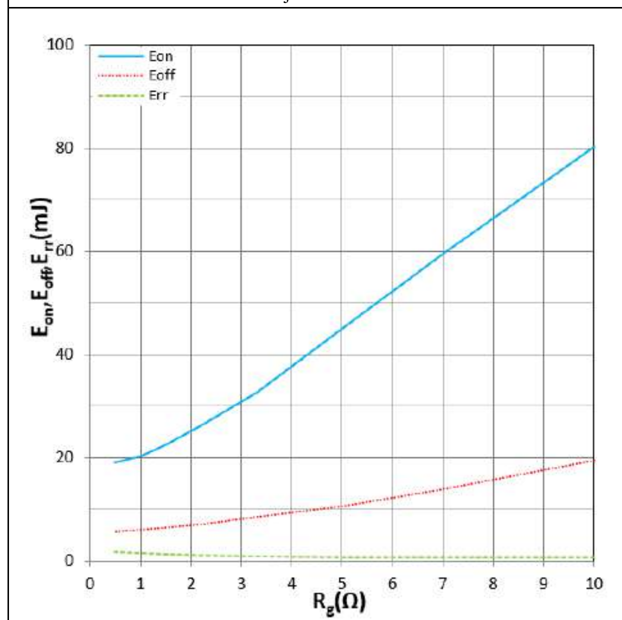
<td>
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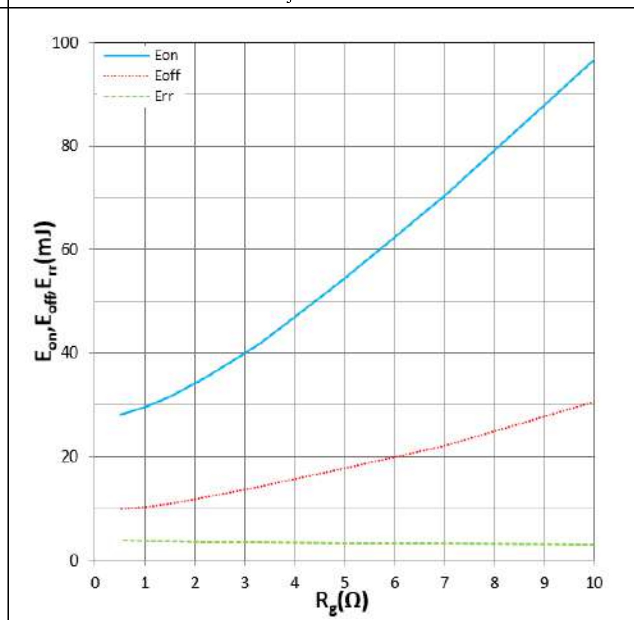
<td>
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</tr>
<tr>
<td>Figure 15. E_{on}, E_{off}, E_{rr} vs R_g
T_j =25°C, V_{DD} =600V, V_{GS} =+18V/-4V, I_D =900A
Inductive Load</td>
<td>Figure 16. E_{on}, E_{off} , E_{rr} vs R_g
T_j =150°C, V_{DD}=600V, V_{GS} =+18V/-4V, I_D =900A
Inductive Load</td>
</tr>
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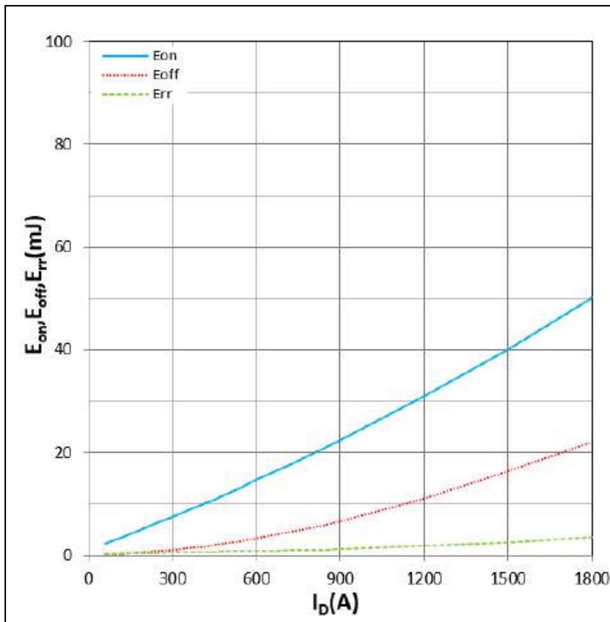

Figure 17. E_{on}, E_{off}, E_{rr} vs I_D
T_j =25°C, V_{DD} =600V, V_{GS} =+18V/-4V, R_g =1.5Ω
Inductive Load

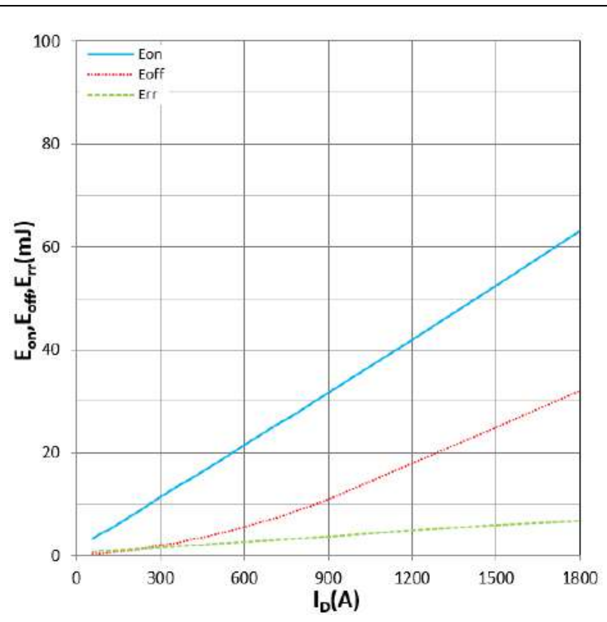

Figure 18. E_{on}, E_{off}, E_{rr} vs I_D
T_j =150°C, V_{DD} =600V, V_{GS} =+18V/-4V, R_g =1.5Ω
Inductive Load

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

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	
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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