# HCS06FF120E0C1

1200V/6.2mΩ Half Bridge SiC MOSFET Module

## Description

The HCS06FF120E0C1 is a half bridge SiC MOSFET Power Module. It integrates high performance SiC MOSFET chips designed for the applications such as Solar Inverter Systems,Fuel cell-DC/DC converter, Uninterruptible Power Supplier, Energy Storage Systems.

## Features

- Blocking voltage:1200V
- $R_{ds(on)}$:6.2mΩ@25℃;10.3mΩ@175℃
- Low Switching Losses
- 175℃maximum junction temperature
- $Si_3N_4$AMB
- Thermistor inside

## Applications

- Solar inverterSystems
- Fuel cell-DC/DC converter
- Uninterruptible Power Supplier
- Energy Storage Systems
- Solid State Relay

## Circuit diagram

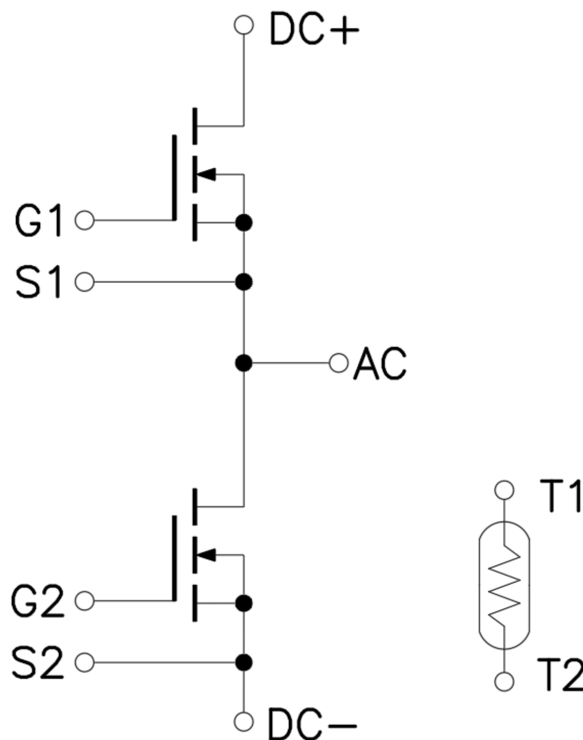


Figure 1. Out drawing & circuit diagram for HCS06FF120E0C1

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## Pin Configuration and Marking Information

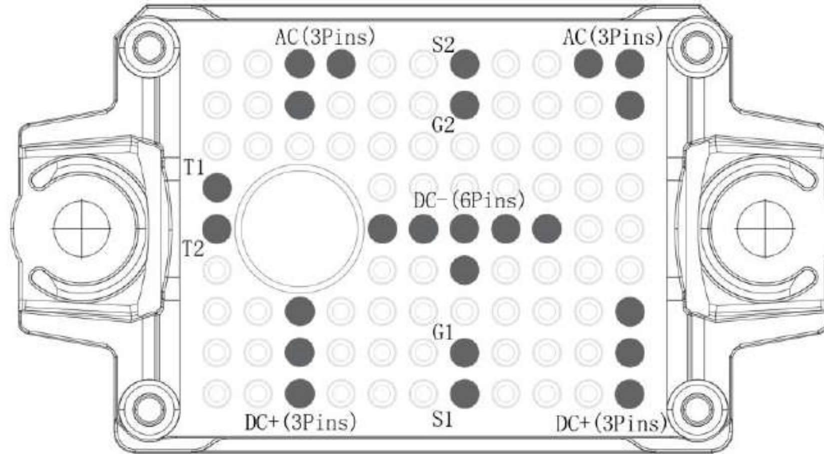


Figure 2. Pin configuration

| Symbol | Description |
|---|---|
| AC | Output terminal of half bridge |
| S2 | Low side source signal terminal |
| G2 | Low side gate signal terminal |
| DC+ | DC+ Bus connection |
| DC– | DC– Bus connection |
| S1 | High side source signal terminal |
| G1 | High side gate signal terminal |
| T1 | Thermistor connection 1 |
| T2 | Thermistor connection 2 |

## 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 | - | 600 | - |
| Weight | - | 26 | g |

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## 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-Sourse Voltage | D-S Short, Note1 | -10 to 22 | V |
| $I_{DS}$ | DC Continuous Drain Current | $T_f$ =95°C, Note2 | 150 | A |
| $I_{SD}$ | Source (Body diode) Current | $T_f$ =95°C, with ON signal | 150 | A |
| $I_{DP}$ | Drain Pulse Current, Peak | Less than 1ms, Note3 | 300 | A |
| $T_{jop}$ | Operation junction temperature | - | -40 to 175 | °C |
| $T_{stg}$ | Storage temperature | - | -40 to 125 | °C |

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

Note2: Case temperature(Tc) is defined on the surface of base plate just under the chips.

Note3: 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, $R_{100}$ =493 Ω | -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 |

# HCS06FF120E0C1

1200V/6.2mΩ Half Bridge SiC MOSFET Module

## 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, $I_D$=200μA | | 1200 | - | - | V |
| $I_{DSS}$ | Zero gate voltage drain current | $V_{DS}$=1200V, $V_{GS}$=0V | | - | 5 | - | μA |
| $V_{GS(th)}$ | Gate-source threshold voltage | $I_D$=40mA, $V_{DS}$=$V_{GS}$ | | 2.1 | 2.7 | - | V |
| $I_{GSS+}$ | Gate-Source Leakage Current | $V_{GS}$=22V, $V_{DS}$=0V, $T_j$=25°C | | - | - | 200 | nA |
| $I_{GSS-}$ | | $V_{GS}$=-10V, $V_{DS}$=0V, $T_j$=25°C | | - | - | -200 | nA |
| $R_{DS(on)}$ (Chip) | Static drain-source On-state resistance | $I_D$=150A $V_{GS}$=+18V | $T_j$=25°C | - | 6.2 | - | mΩ |
| | | | $T_j$=175°C | - | 10.3 | - | mΩ |
| $V_{DS(on)}$ (Chip) | Static drain-source On-state voltage | $I_D$=150A $V_{GS}$=+18V | $T_j$=25°C | - | 0.93 | - | V |
| | | | $T_j$=175°C | - | 1.55 | - | V |
| $C_{iss}$ | Input capacitance | $V_D$=800V, $V_{GS}$=0V, f=100kHz, $V_{AC}$=25mV | | - | 14.4 | - | nF |
| $C_{oss}$ | Output capacitance | | | - | 0.4 | - | nF |
| $C_{rss}$ | Reverse transfer capacitance | | | - | 0.03 | - | nF |
| $Q_G$ | Total gate charge | $V_{DS}$=800V, $I_D$=150A, $V_{GS}$=+18/-5V | | - | 400 | - | nC |
| $R_{Gint}$ | Internal Gate Resistance | $T_j$=25°C | | - | 0.25 | - | Ω |
| $t_{d(on)}$ | Turn-on delay time | $V_{DD}$=600V $I_D$=150A $V_{GS}$=+18/-4V $R_G$=3.3Ω Inductive load switching operation | $T_j$=25°C | - | 48 | - | ns |
| | | | $T_j$=150°C | - | 45 | - | |
| $t_r$ | Rise time | | $T_j$=25°C | - | 32 | - | ns |
| | | | $T_j$=150°C | - | 30 | - | |
| $t_{d(off)}$ | Turn-off delay time | | $T_j$=25°C | - | 39 | - | ns |
| | | | $T_j$=150°C | - | 45 | - | |
| $t_f$ | Fall time | | $T_j$=25°C | - | 22 | - | ns |
| | | | $T_j$=150°C | - | 26 | - | |
| $E_{on}$ | Turn-on power dissipation | | $T_j$=25°C | - | 1.52 | - | mJ |
| | | | $T_j$=150°C | - | 1.99 | - | |
| $E_{off}$ | Turn-off power dissipation | | $T_j$=25°C | - | 0.93 | - | mJ |
| | | | $T_j$=150°C | - | 1.12 | - | |
| $R_{th(j-c)}$ | FET Thermal Resistance | Junction to Case/MOSFET | | - | 0.12 | - | K/W |
| $R_{th(c-f)}$ | Contact thermal resistance | With thermal conductive grease/MOSFET | | - | 0.15 | - | K/W |

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

# HCS06FF120E0C1

1200V/6.2mΩ Half Bridge SiC MOSFET Module

## 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<br>$I_{SD}$ =150A | $T_j$=25°C | - | 5.0 | - | V |
| | | | $T_j$=150°C | - | 4.5 | - | |
| $T_{rr}$ | Reverse recovery time | $V_{DD}$ =600V<br>$I_D$ =150A<br>$V_{GS}$ =+18/-4V<br>$R_G$ =3.3 Ω | $T_j$=25°C | - | 41 | - | ns |
| | | | $T_j$=150°C | - | 45 | - | |
| $Q_{rr}$ | Reverse recovery charge | | $T_j$=25°C | - | 1.05 | - | μC |
| | | | $T_j$=150°C | - | 1.93 | - | |

## Test Conditions

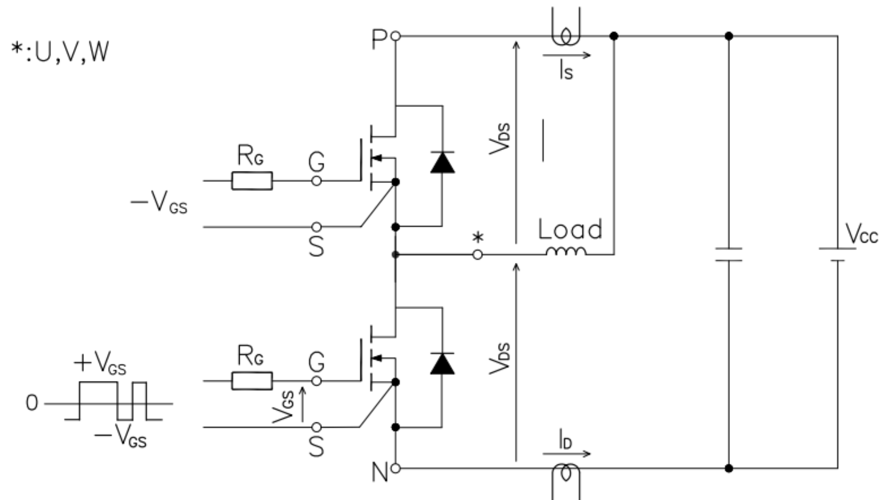


Figure 3. Switching time measure circuit

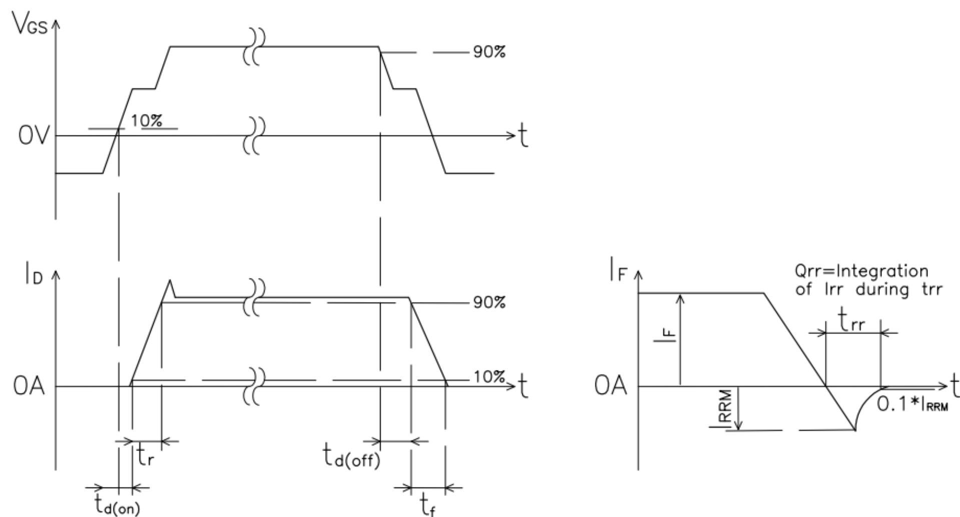


Figure 4. Switching time definition

# HCS06FF120E0C1

1200V/6.2mΩ Half Bridge SiC MOSFET Module

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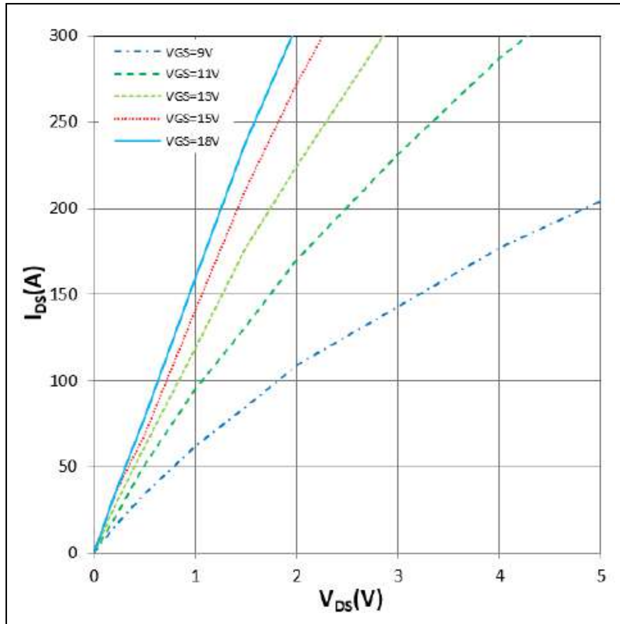
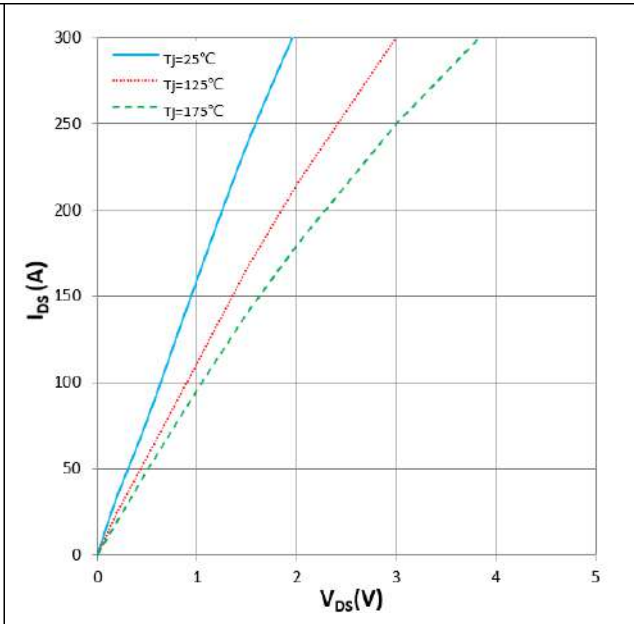
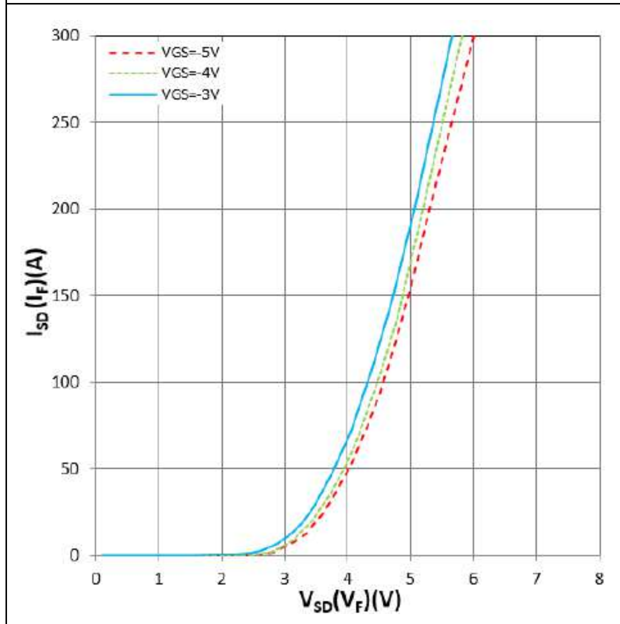
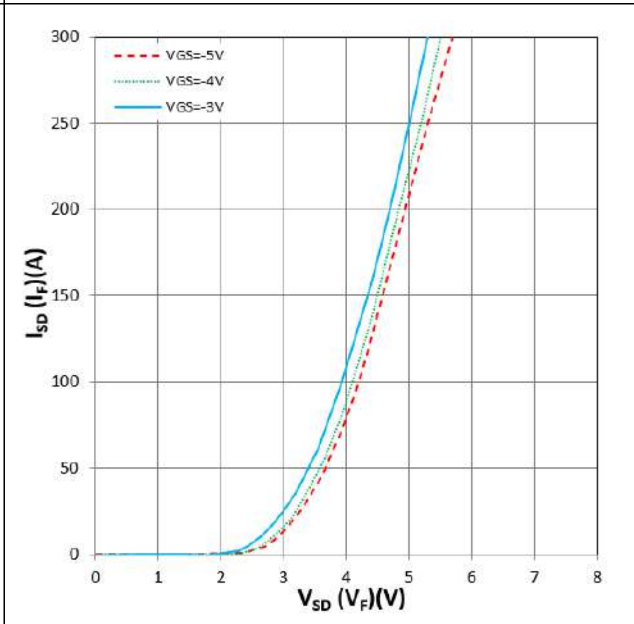
<tr><td>
</td><td>
</td></tr>
<tr><td>Figure 5. $I_{DS}$ vs $V_{DS}$<br>$T_j$ =25°C, $V_{GS}$ parameter</td><td>Figure 6. $I_{DS}$ vs $V_{DS}$<br>$V_{GS}$ =+18V</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>Figure 7. $I_{SD}$ vs $V_{SD}$ ($V_F$)<br>$T_j$ =25°C, $V_{GS}$ parameter</td><td>Figure 8. $I_{SD}$ vs $V_{SD}$ ($V_F$)<br>$T_j$ =150°C, $V_{GS}$ parameter</td></tr>
</table>

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1200V/6.2mΩ Half Bridge SiC MOSFET Module

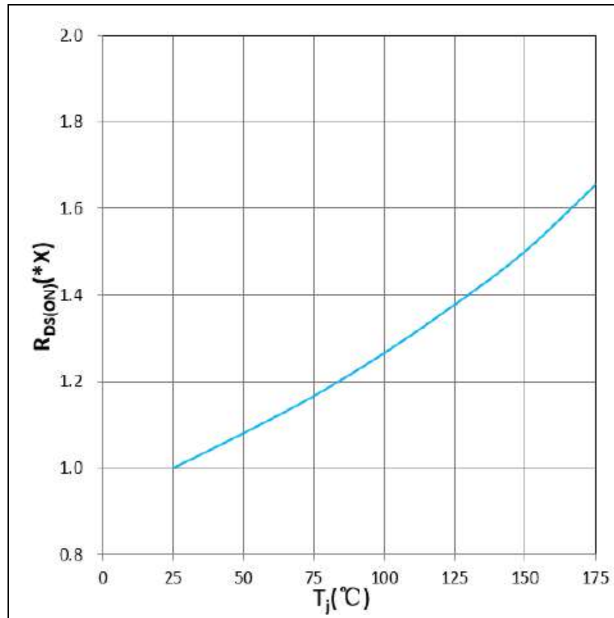


Figure 9. $R_{DS(ON)}$ vs $T_j$

$V_{GS}$ =+18V, $I_D$ =150A, 1.0X =6.2m⊠

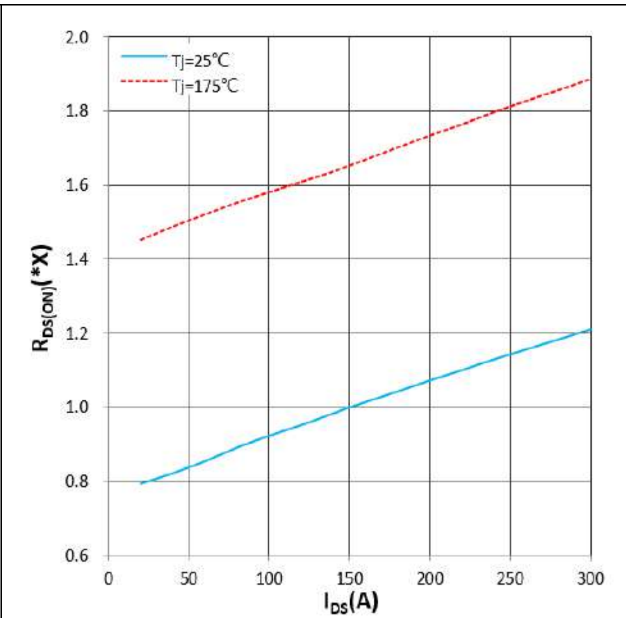


Figure 10. $R_{DS(ON)}$ vs $I_{DS}$

$V_{GS}$ =+18V, $I_D$ =150A, 1.0X =6.2m⊠

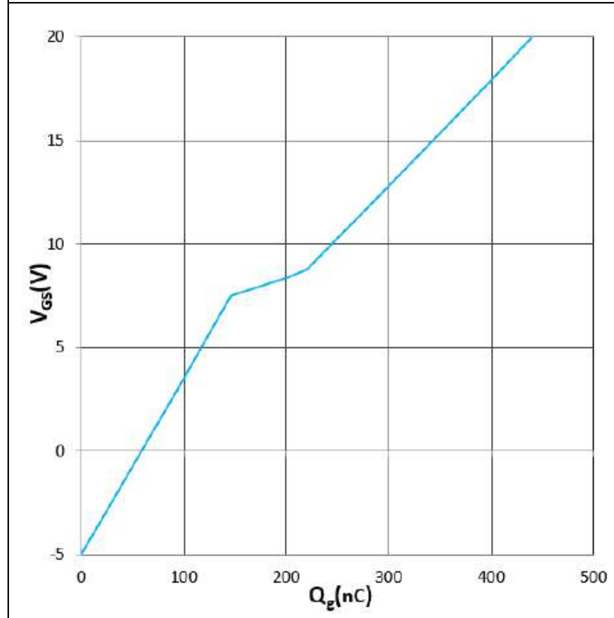


Figure 11. $V_{GS}$ vs $Q_g$

$V_{DS}$ =800V, $I_D$ =150A, $T_j$ =25℃

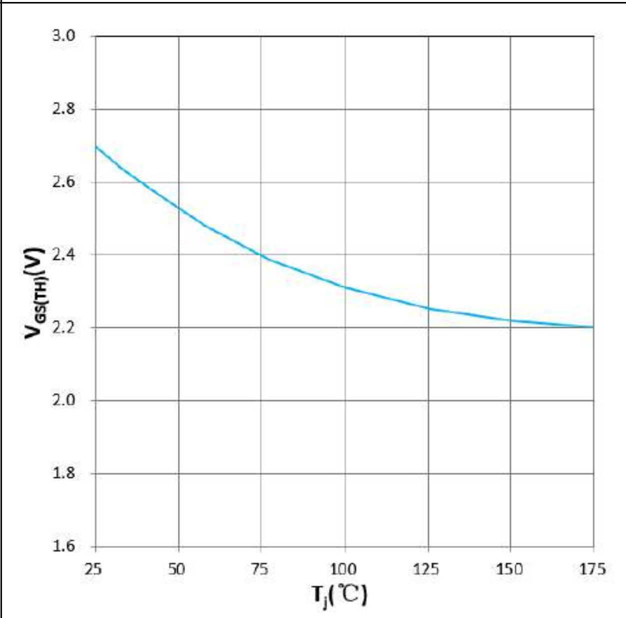


Figure 12. $V_{GS(TH)}$ vs $T_j$

$V_{GS}$ =$V_{DS}$, $I_D$ =40mA

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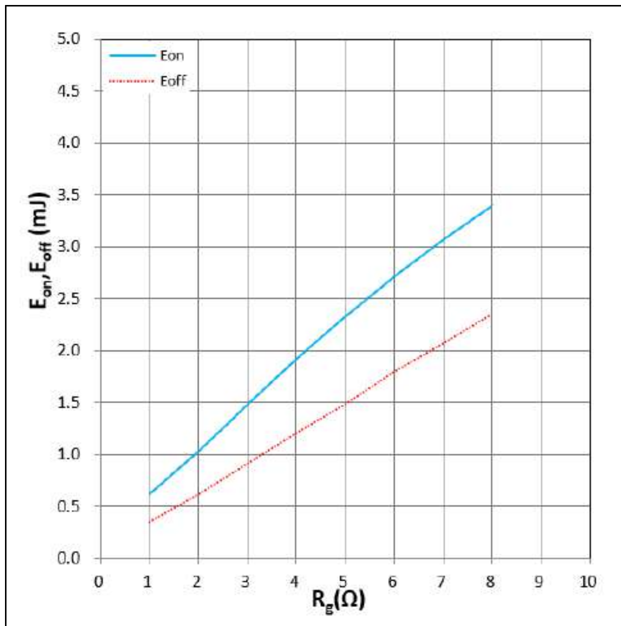


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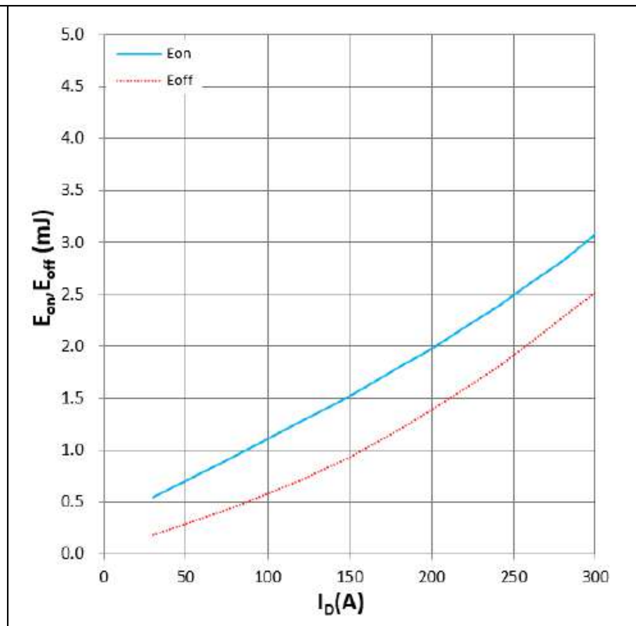


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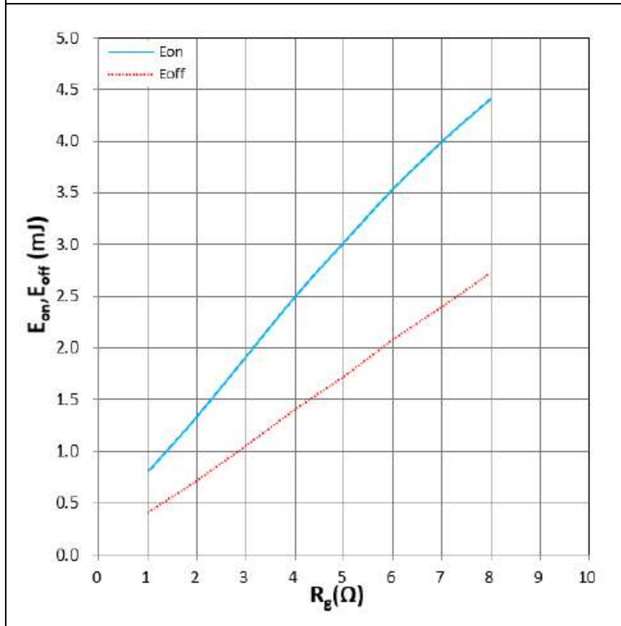
<tr><td>Figure 13. $E_{on}$, $E_{off}$ vs $R_G$<br>$T_j$ =25°C, $I_D$ =150A, $V_{GS}$ =+18V/-4V</td><td>Figure 14. $E_{on}$, $E_{off}$ vs $I_{DS}$<br>$T_j$ =25°C, $R_G$ =3.3⊠ $V_{GS}$ =+18V/-4V</td></tr>
<tr><td>

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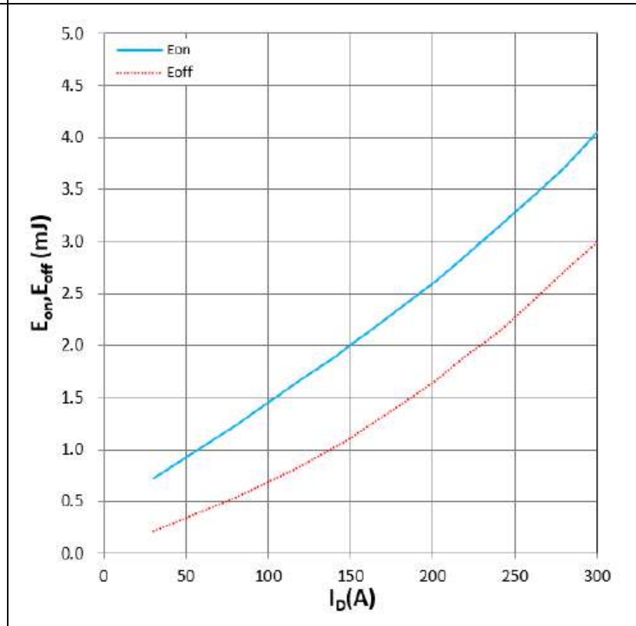


</td></tr>
<tr><td>Figure 15. $E_{on}$, $E_{off}$ vs $R_G$<br>$T_j$ =150°C, $I_D$ =150A, $V_{GS}$ =+18V/-4V</td><td>Figure 16. $E_{on}$, $E_{off}$ vs $I_{DS}$<br>$T_j$ =150°C, $R_G$ =3.3⊠ $V_{GS}$ =+18V/-4V</td></tr>
</table>

# HCS06FF120E0C1

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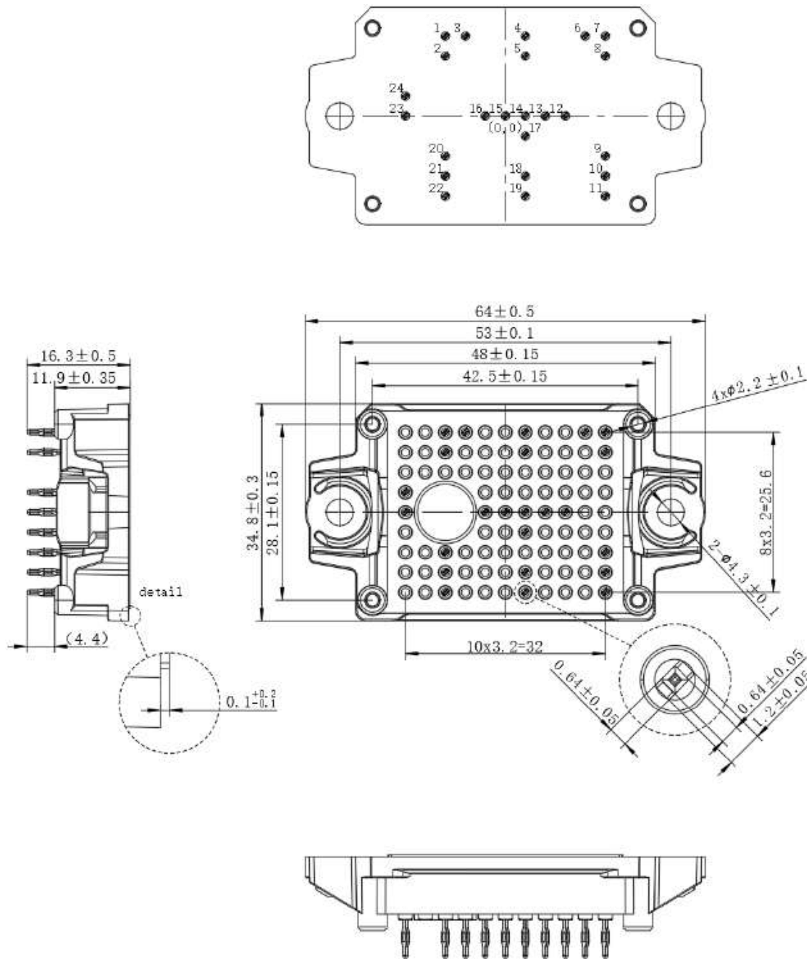
## Package dimensions




| Pin table | | |
|---|---|---|
| Pin | X | Y |
| 1 | -9.6 | 12.8 |
| 2 | -9.6 | 9.6 |
| 3 | -6.4 | 12.8 |
| 4 | 3.2 | 12.8 |
| 5 | 3.2 | 9.6 |
| 6 | 12.8 | 12.8 |
| 7 | 16 | 12.8 |
| 8 | 16 | 9.6 |
| 9 | 16 | -6.4 |
| 10 | 16 | -9.6 |
| 11 | 16 | -12.8 |
| 12 | 9.6 | 0 |
| 13 | 6.4 | 0 |
| 14 | 3.2 | 0 |
| 15 | 0 | 0 |
| 16 | -3.2 | 0 |
| 17 | 3.2 | -3.2 |
| 18 | 3.2 | -9.6 |
| 19 | 3.2 | -12.8 |
| 20 | -9.6 | -6.4 |
| 21 | -9.6 | -9.6 |
| 22 | -9.6 | -12.8 |
| 23 | -16 | 0 |
| 24 | -16 | 3.2 |

**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 | 06 | FF | 120 | E0 | C1 |
|---|---|---|---|---|---|---|

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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