# HCH900FF120E3ME7

1200V/900A Half Bridge SiC Hybrid Modules

## Description

The HCH900FF120E3ME7 is a Half Bridge SiC Hybrid Power Module. It integrates high performance IGBT chips and SiC SBD designed for the applications such as High Power Switching Application and Motor control.

## Features

- Blocking voltage : 1200V
- Low saturation voltage $V_{CE(sat)}$
- Low Switching Losses
- Low Thermal Resistance
- Thermistor inside


## Applications

- High Power Switching Applications
- Motor Drives
- Solar inverter Systems
- Uninterrupted Power Supply

## Circuit diagram

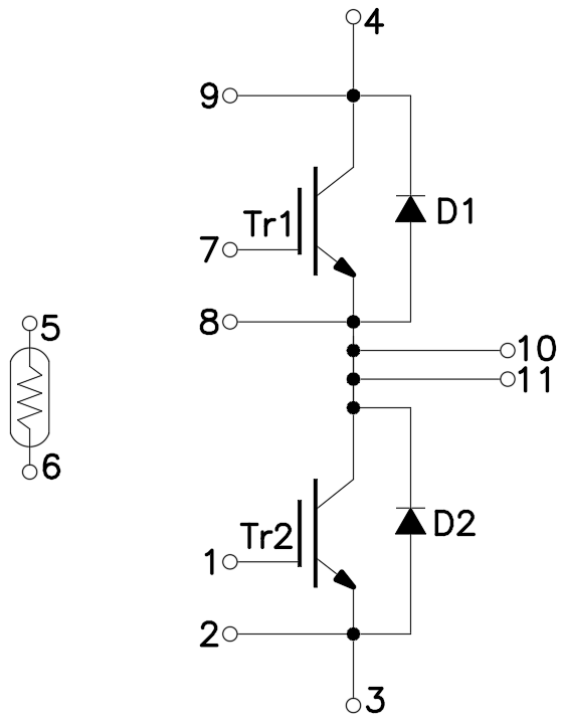


Figure1. Out drawing & circuit diagram for HCH900FF120E3ME7

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## Pin Configuration and Marking Information

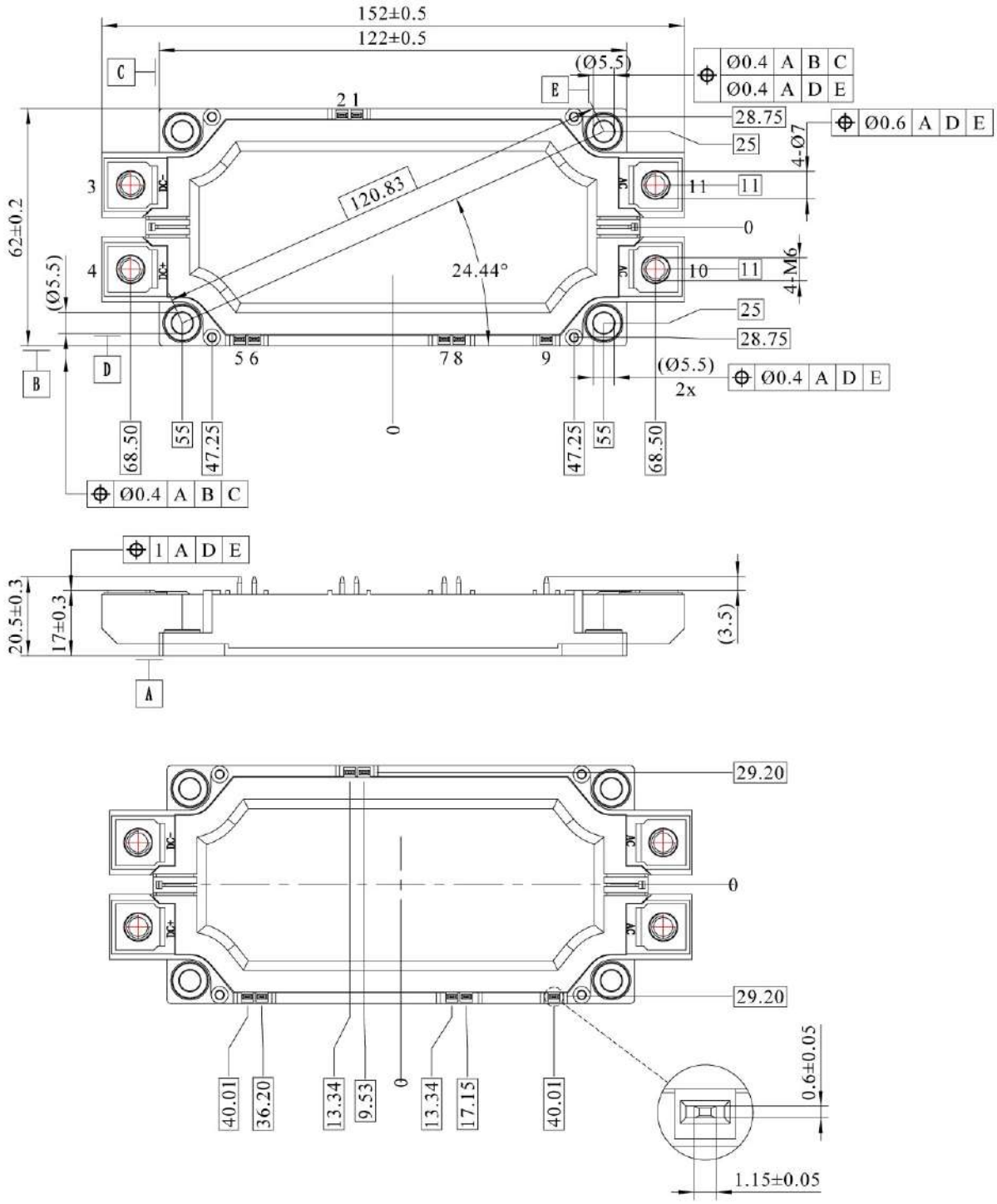


Figure 2. Pin configuration

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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<br>terminal to terminal | 14.5<br>13 | mm |
| Clearance | terminal to heatsink<br>terminal to terminal | 12.5<br>10 | mm |
| CTI | - | >400 | - |
| Module lead resistance, terminals – chip | $T_C$ =25°C | 0.8 | mΩ |
| Mounting torque for module mounting | M5, M6 | 3 to 6 | Nm |
| Weight | - | 350 | g |

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

| Symbol | Parameter | Condition | Ratings | Unit |
|---|---|---|---|---|
| $V_{CES}$ | Collector-Emitter Voltage | G-E Short | 1200 | V |
| $V_{GES}$ | Gate-Emitter Voltage | C-E Short | ±20 | V |
| $I_C$ | DC Continuous Collector Current | $T_C$ =75°C , $T_j$ =150°C | 900 | A |
| $I_{CM}$ | Pulse Collector Current | $t_p$ =1ms, Note1 | 1800 | A |
| $P_C$ | Maximum Power Dissipation | $T_C$ =25°C, $T_j$ =150°C(IGBT) | 3125 | W |
| $I_F$ | Diode Forward Current | - | 900 | A |
| $I_{FRM}$ | Repetitive peak forward Current | $t_p$ =1ms, Note1 | 1800 | A |
| $T_{vjop}$ | Operating junction temperature | Note2 | -40 to 175 | °C |
| $T_{stg}$ | Storage temperature | - | -40 to 125 | °C |

Note1: Pulse width limited by maximum junction temperature

Note2: $T_{vjop}$ > 150°C is only allowed for operation at overload conditions

## 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☒ | -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 |

# HCH900FF120E3ME7

1200V/900A Half Bridge SiC Hybrid Modules

## IGBT Electrical characteristics ($T_j$ =25°C unless otherwise specified, chip)

| Symbol | Item | Condition | | Value | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| $V_{CE(sat)}$ (Chip) | Collector-Emitter Saturation Voltage | $I_C$ =900A, $V_{GE}$ =15V | $T_j$ =25°C | - | 1.72 | 2.06 | V |
| | | | $T_j$ =125°C | - | 2.00 | - | |
| | | | $T_j$ =150°C | - | 2.10 | - | |
| | | | $T_j$ =175°C | - | 2.18 | - | |
| $V_{GE(th)}$ | Gate-Emitter threshold Voltage | $I_C$ =25mA, $V_{CE}$ =$V_{GE}$ | | 5.0 | - | 6.5 | V |
| $Q_G$ | Gate charge | $V_{GE}$ = -15V to +15V | | - | 7.6 | - | uC |
| $R_{Gint}$ | Internal gate resistor | - | $T_j$ =25°C | - | 0.5 | - | Ω |
| $C_{ies}$ | Input Capacitance | $V_{CE}$ =25V, $V_{GE}$ =0V f =1MHz | $T_j$ =25°C | - | 133.8 | - | nF |
| $C_{oes}$ | Output Capacitance | | | - | 4.35 | - | nF |
| $C_{res}$ | Reverse transfer Capacitance | | | - | 1.18 | - | nF |
| $I_{CES}$ | Collector- Emitter Cut off Current | $V_{CE}$ =1200V, $V_{GE}$ =0V | $T_j$ =25°C | - | - | 1 | mA |
| $I_{GES}$ | Gate-Emitter Leakage Current | $V_{GE}$ = 20V, $V_{CE}$ =0V | $T_j$ =25°C | - | - | 1.5 | uA |
| $t_{d(on)}$ | Turn-on delay time | $V_{CC}$ =600V $I_C$ = 900A $V_{GE}$ =+15V/-8V $R_g$ =2.0Ω Inductive load | $T_j$ =25°C | - | 412 | - | ns |
| | | | $T_j$ =150°C | - | 423 | - | |
| $t_r$ | Rise time | | $T_j$ =25°C | - | 112 | - | ns |
| | | | $T_j$ =150°C | - | 126 | - | |
| $t_{d(off)}$ | Turn-off delay time | | $T_j$ =25°C | - | 638 | - | ns |
| | | | $T_j$ =150°C | - | 820 | - | |
| $t_f$ | Fall time | | $T_j$ =25°C | - | 142 | - | ns |
| | | | $T_j$=150°C | - | 146 | - | |
| $E_{on}$ | Turn-on power dissipation | | $T_j$ =25°C | - | 46.1 | - | mJ |
| | | | $T_j$ =150°C | - | 65.4 | - | |
| $E_{off}$ | Turn-off power dissipation | | $T_j$ =25°C | - | 95.1 | - | mJ |
| | | | $T_j$ =150°C | - | 104.6 | - | |
| $R_{th(j-c)}$ | Thermal Resistance, Junction to Case (IGBT) | | | - | 0.040 | - | K/W |
| $R_{th(c-s)}$ | Thermal Resistance, Case to sink (Conductive Grease applied), Note1 | | | - | 0.015 | - | K/W |

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

# HCH900FF120E3ME7

1200V/900A Half Bridge SiC Hybrid Modules

## SiC SBD Electrical characteristics ($T_j$ =25°C unless otherwise specified, chip)

| Symbol | Item | Condition | | Value | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| $V_F$ | Diode Forward Voltage | $I_F$ =900A<br>$V_{GE}$ =0V | $T_j$ =25°C | - | 1.85 | - | V |
| | | | $T_j$ =125°C | - | 2.60 | - | |
| | | | $T_j$ =150°C | - | 2.90 | - | |
| | | | $T_j$ =175°C | - | 3.10 | - | |
| $T_{rr}$ | Reverse recovery time | $V_{CC}$ =600V<br>$I_C$ =900A<br>$V_{GE}$ =+15/-8V<br>$R_g$ =2.0Ω<br>Inductive load<br>switching operation | $T_j$ =25°C | - | 36 | - | ns |
| | | | $T_j$ =150°C | - | 33 | - | |
| $I_{RM}$ | Peak reverse recovery Current | | $T_j$ =25°C | - | 110 | - | A |
| | | | $T_j$ =150°C | - | 73 | - | |
| $Q_{rr}$ | Reverse recovery charge | | $T_j$ =25°C | - | 2.51 | - | uC |
| | | | $T_j$ =150°C | - | 1.44 | - | |
| $E_{rr}$ | Reverse recovered energy | | $T_j$ =25°C | - | 0.62 | - | mJ |
| | | | $T_j$ =150°C | - | 0.27 | - | |
| $R_{th(j-c)}$ | Thermal Resistance, Junction to Case (Diode) | | | - | 0.070 | - | K/W |
| $R_{th(c-s)}$ | Thermal Resistance, Case to sink (Conductive Grease applied) , Note1 | | | - | 0.025 | - | K/W |

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

## Test Conditions

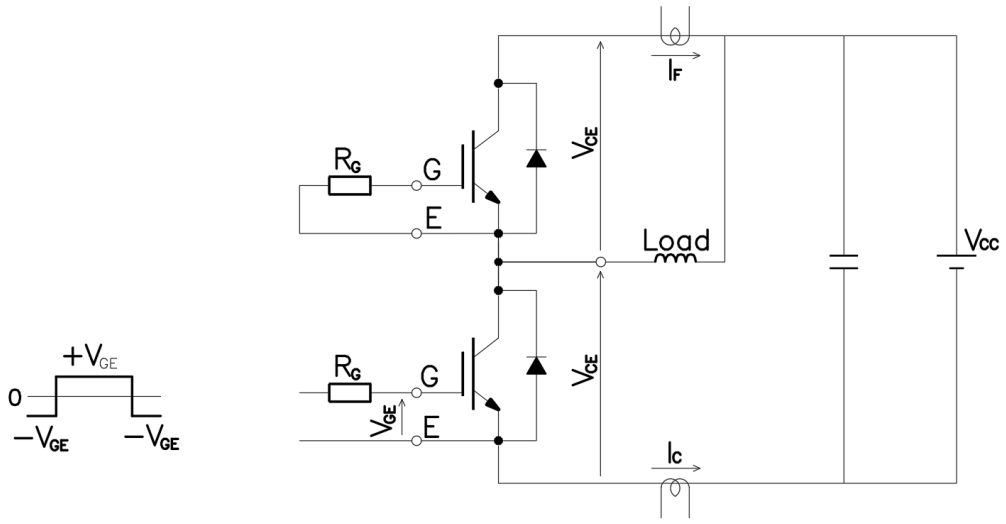


Figure 3. Switching time measure circuit

**HCH900FF120E3ME7**

1200V/900A Half Bridge SiC Hybrid Modules

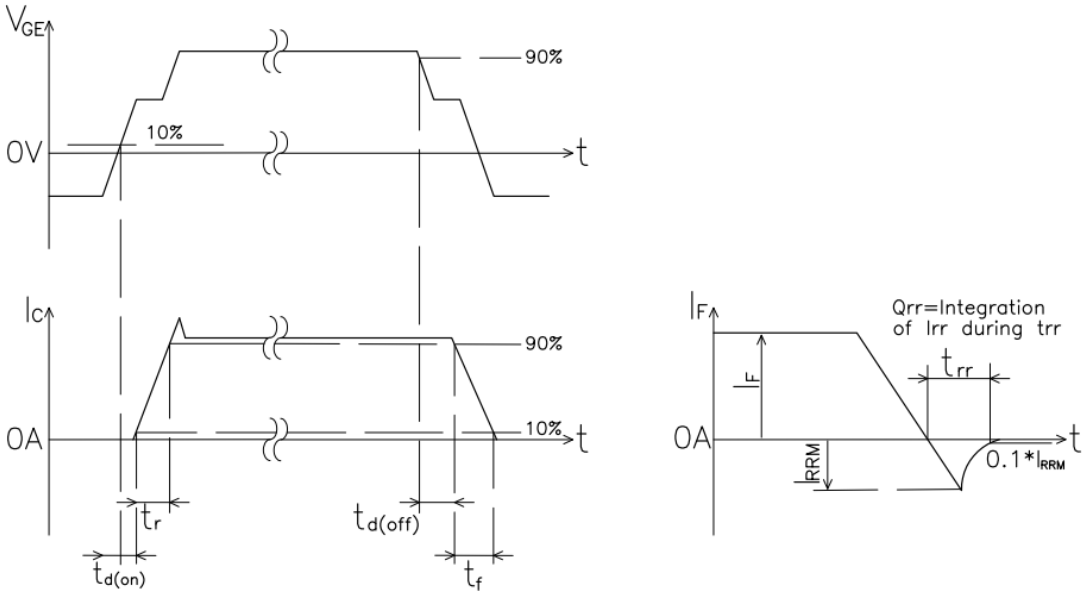


Figure 4. Switching time definition

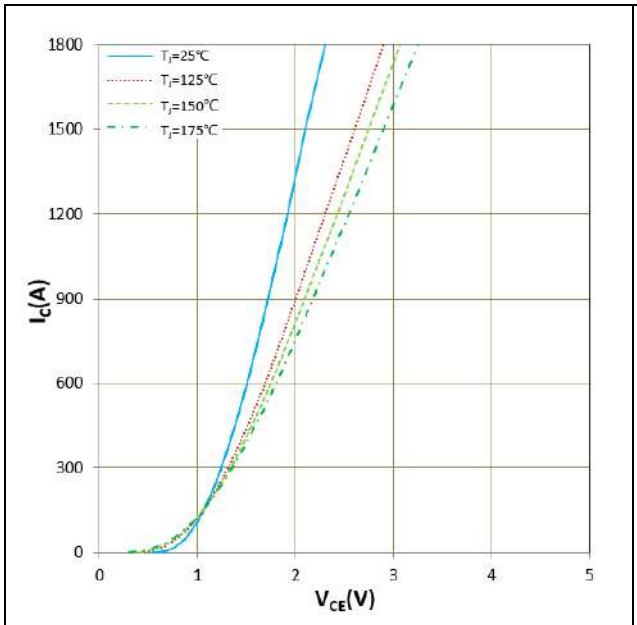


Figure 5. Ic vs $V_{CE}$
$V_{GE}$=15V

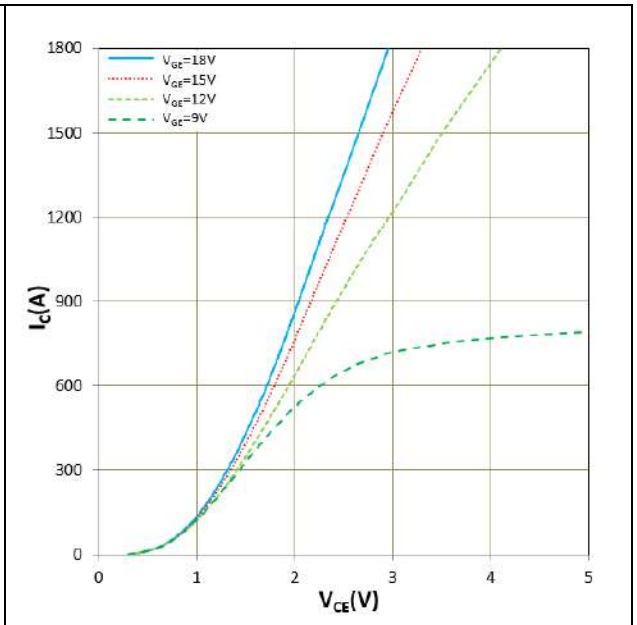


Figure 6. Ic vs $V_{CE}$
$T_j$=175°C

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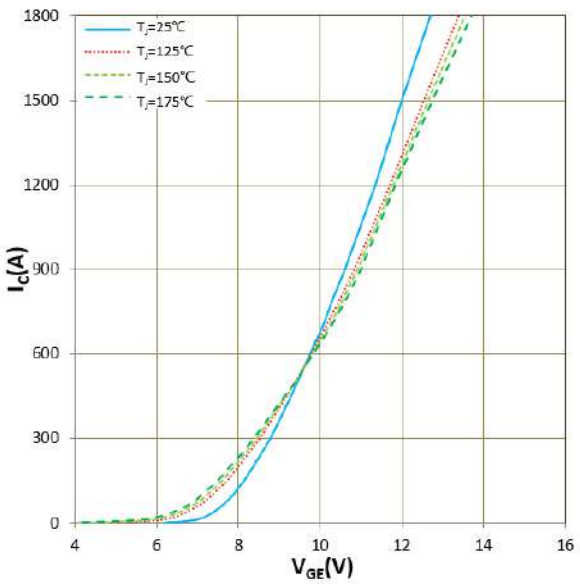


Figure 7. Ic vs $V_{GE}$
$V_{CE}$ =20V

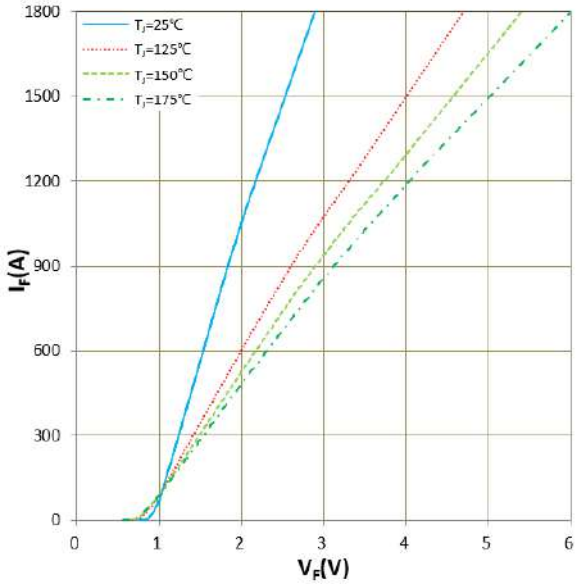


Figure 8. $I_F$ vs $V_F$

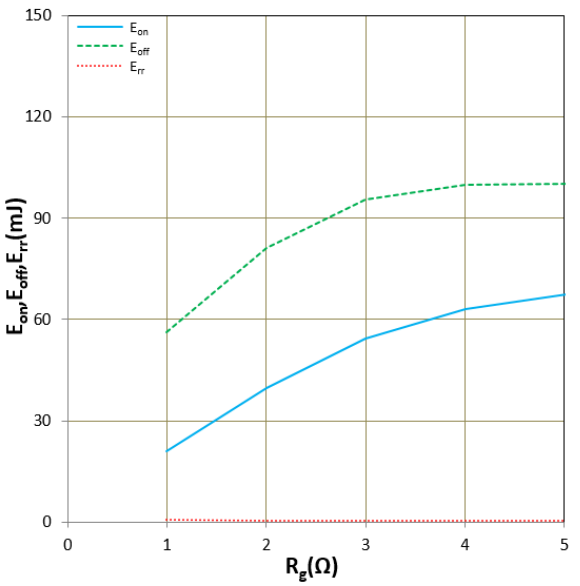


Figure 9. $E_{on}$, $E_{off}$, $E_{rr}$ vs $R_g$ (Typ)
$V_{CC}$ =600V, $V_{GE}$ =+15V/-8V, $I_C$ =900A, $T_j$ =25°C
Inductive Load

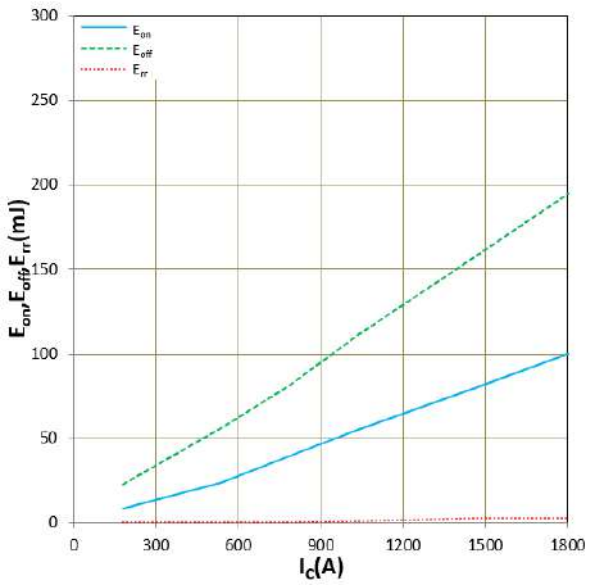


Figure 10. $E_{on}$, $E_{off}$, $E_{rr}$ vs Ic (Typ)
$V_{CC}$ =600V, $V_{GE}$ =+15V/-8V, $R_g$ =2.0Ω, $T_j$ =25°C
Inductive Load

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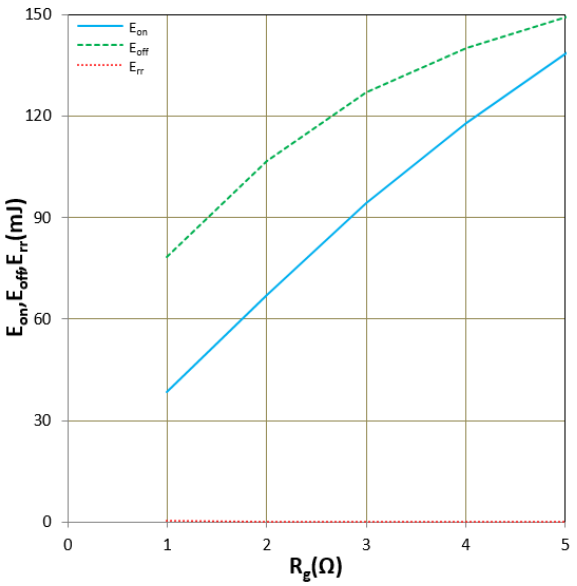


Figure 11. $E_{on}$, $E_{off}$, $E_{rr}$ vs $R_g$ (Typ)
$V_{CC}$ =600V, $V_{GE}$ =+15V/-8V, $I_C$ =900A, $T_j$ =150°C
Inductive Load

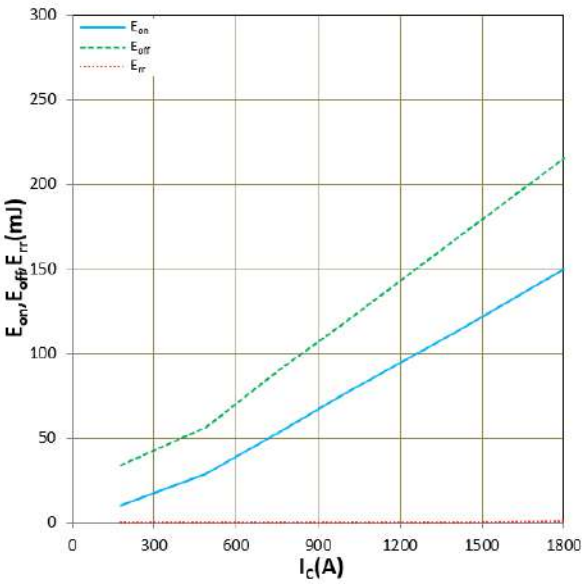


Figure 12. $E_{on}$, $E_{off}$, $E_{rr}$ vs Ic (Typ)
$V_{CC}$ =600V, $V_{GE}$ =+15V/-8V, $R_g$ =2.0Ω, $T_j$ =150°C
Inductive Load

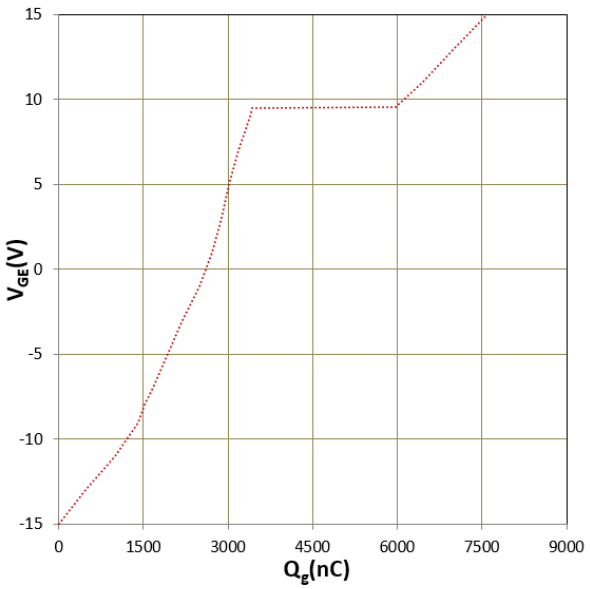


Figure 13. Gate charge
$V_{CC}$ =600V, $I_C$ =900A, $T_j$ =25°C

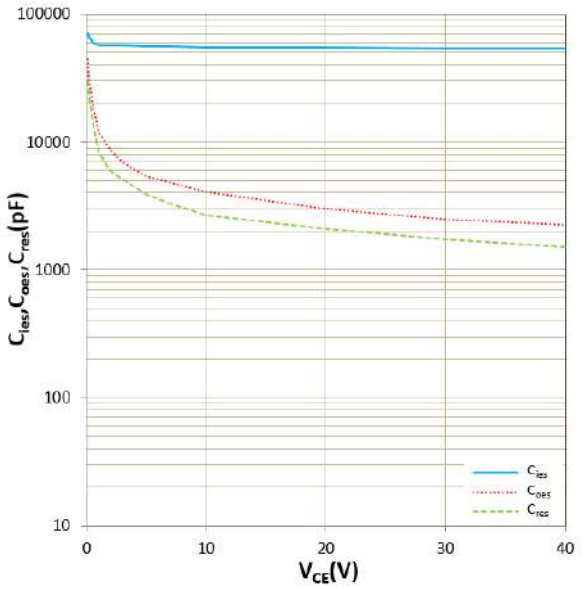


Figure 14. $C_{ies}$, $C_{oes}$, $C_{res}$ vs $V_{CE}$
$T_j$ =25°C, f =1MHz

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## 1200V/900A Half Bridge SiC Hybrid Modules

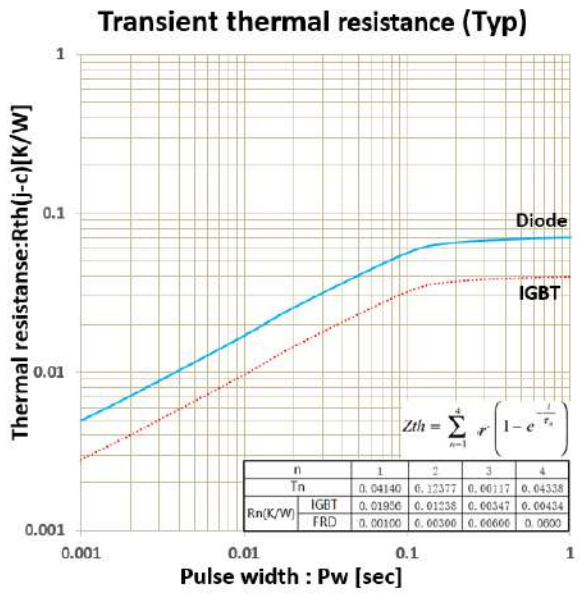


Figure 15. transient thermal impedance IGBT/Diode

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
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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