**HCG450FF170E3RE1**

1700V/450A Half Bridge IGBT Module

**Description**

The HCG450FF170E3RE1 is a Half Bridge IGBT Power Module. It integrates high performance IGBT chips designed for the applications such as High Power supply and Motor control.

## Features

- Blocking voltage 1700V
- Low saturation voltage $V_{CE(sat)}$
- Low Switching Losses
- 175℃ maximum junction temperature
- Thermistor inside

## Applications

- High Power Switching Applications
- Motor Drives
- Solar inverter Systems
- Wind Turbines

## Circuit diagram

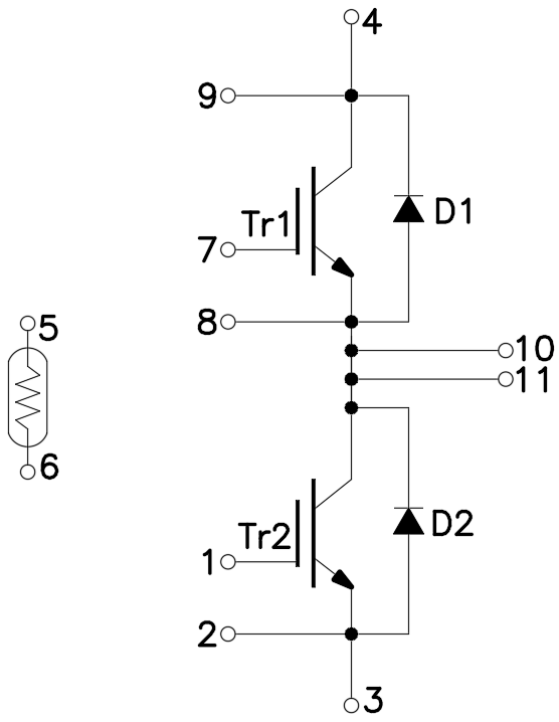


Figure 1. Out drawing & circuit diagram for HCG450FF170E3RE1

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## Pin Configuration and Marking Information

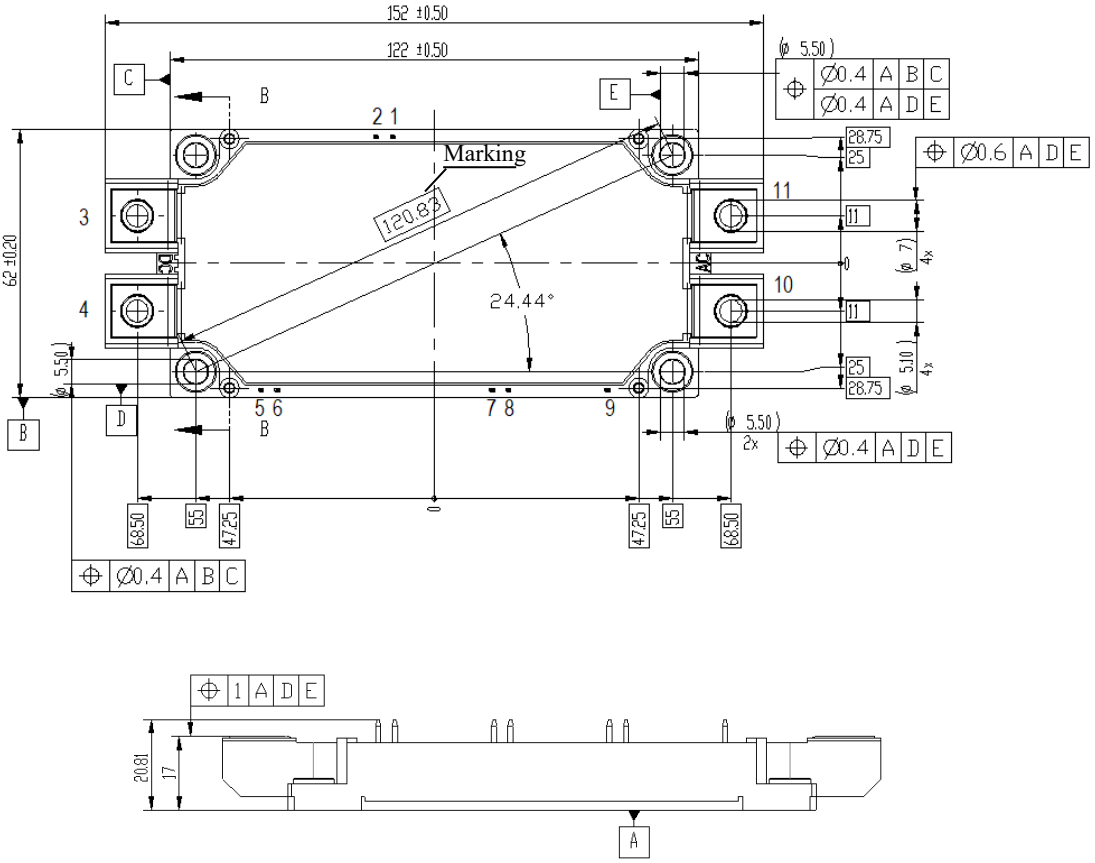


Figure 2. Pin configuration

# HCG450FF170E3RE1

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## Module

| Parameter | Conditions | Value | Unit |
|---|---|---|---|
| Isolation voltage | RMS, f =50Hz, t =1min | 4.0 | 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 | - | >225 | - |
| Module lead resistance, terminals – chip | $T_C$ =25°C | 0.8 | mΩ |
| Mounting torque for module mounting | M5, M6 | 3 to 6 | Nm |
| Weight | - | 420 | g |

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

| Symbol | Parameter | Conditions | Ratings | Unit |
|---|---|---|---|---|
| $V_{CES}$ | Collector-Emitter Voltage | G-E Short | 1700 | V |
| $V_{GES}$ | Gate-Emitter Voltage | C-E Short | ±20 | V |
| $I_C$ | DC Continuous Collector Current | $T_C$ =95°C | 450 | A |
| $I_{CM}$ | Pulse Collector Current | $t_p$ =1ms, Note1 | 900 | A |
| $P_C$ | Maximum Power Dissipation | $T_C$ =25°C | 2632 | W |
| $I_F$ | Diode Forward Current | - | 450 | A |
| $I_{FRM}$ | Repetitive peak forward current | $t_p$ =1ms, Note1 | 900 | A |
| $I^2t$ | $I^2t$-value | $V_R$ =0V, $t_p$ =10ms, $T_j$ =125°C(Diode) | 20000 | $A^2s$ |
| $T_{jmax}$ | Max junction temperature | - | 175 | °C |
| $T_{vjop}$ | Operating junction temperature | - | -40 to 175 | °C |
| $T_{stg}$ | Storage temperature | - | -40 to 125 | °C |

Note1: 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 R100 | $T_C$ =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 |

# HCG450FF170E3RE1

1700V/450A Half Bridge IGBT Module

## IGBT Electrical characteristics ($T_j$ =25℃ unless otherwise specified, chip: Target)

| Symbol | Item | Condition | | Value | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max | |
| $V_{CE(sat)}$ (Chip) | Collector-Emitter Saturation Voltage | $I_C$ =450A, $V_{GE}$ =15V | $T_j$ =25°C | - | 1.60 | 1.90 | V |
| | | | $T_j$ =150°C | - | 2.03 | - | |
| | | | $T_j$ =175°C | - | 2.08 | - | |
| $V_{GE(th)}$ | Gate-Emitter threshold Voltage | $I_C$ =18mA, $V_{CE}$ =$V_{GE}$ | | 5.2 | 5.8 | 6.4 | V |
| $Q_G$ | Gate charge | $V_{GE}$ =-15V to +15V | | - | 4.6 | - | uC |
| $R_{Gint}$ | Internal gate resistor | - | $T_j$ =25°C | - | 2.2 | - | Ω |
| $C_{ies}$ | Input Capacitance | $V_{CE}$ =25V, $V_{GE}$ =0V, f =1MHz | $T_j$ =25°C | - | 36 | - | nF |
| $C_{res}$ | Reverse transfer Capacitance | | | - | 1.15 | - | nF |
| $I_{CES}$ | Collector- Emitter Cut off Current | $V_{CE}$ =1700V, $V_{GE}$ =0V | $T_j$ =25°C | - | - | 1 | mA |
| $I_{GES}$ | Gate-Emitter Leakage Current | $V_{GE}$ =20V, $V_{CE}$ =0V | $T_j$ =25°C | - | - | 1.35 | uA |
| $t_{d(on)}$ | Turn-on delay time | $V_{CC}$ =900V, $I_C$ =450A, $V_{GE}$ =+15V/-8V, $R_G$ =3.3 Ω, Inductive load | $T_j$ =25°C | - | 335 | - | ns |
| | | | $T_j$ =150°C | - | 360 | - | |
| $t_r$ | Rise time | | $T_j$ =25°C | - | 170 | - | ns |
| | | | $T_j$ =150°C | - | 210 | - | |
| $t_{d(off)}$ | Turn-off delay time | | $T_j$ =25°C | - | 655 | - | ns |
| | | | $T_j$ =150°C | - | 800 | - | |
| $t_f$ | Fall time | | $T_j$ =25°C | - | 405 | - | ns |
| | | | $T_j$=150°C | - | 680 | - | |
| $E_{on}$ | Turn-on power dissipation | | $T_j$ =25°C | - | 205 | - | mJ |
| | | | $T_j$ =150°C | - | 320 | - | |
| $E_{off}$ | Turn-off power dissipation | | $T_j$ =25°C | - | 105 | - | mJ |
| | | | $T_j$ =150°C | - | 153 | - | |
| $R_{th(j-c)}$ | Thermal Resistance, Junction to Case(IGBT) | | | - | 0.057 | - | °C/W |
| $R_{th(c-s)}$ | Thermal Resistance, Case to sink(Conductive Grease applied) | | | - | 0.015 | - | °C/W |

# HCG450FF170E3RE1

1700V/450A Half Bridge IGBT Module

## Freewheeling Diode Electrical characteristics (Tj=25℃ unless otherwise specified, chip)

| Symbol | Item | Condition | | Value | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max | |
| $V_F$ | Diode Forward Voltage | $I_F$=450A, $V_{GE}$=0V | $T_j$=25°C | - | 1.95 | - | V |
| | | | $T_j$=150°C | - | 2.21 | - | |
| | | | $T_j$=175°C | - | 2.23 | - | |
| $t_{rr}$ | Reverse recovery time | (Switch side)<br>$V_{CC}$=900V, $I_C$=450A<br>$V_{GE}$=+15V/-8V, $R_G$=3.3Ω<br>(FRD side)<br>$V_{rr}$=900V, $I_F$=450A<br>$V_{GE}$=+15V/-8V<br>Inductive load<br>switching operation | $T_j$=25°C | - | 1.09 | - | us |
| | | | $T_j$=150°C | - | 1.58 | - | |
| $I_{RM}$ | Peak reverse recovery Current | | $T_j$=25°C | - | 199 | - | A |
| | | | $T_j$=150°C | - | 250 | - | |
| $Q_{rr}$ | Recovered charge | | $T_j$=25°C | - | 79 | - | uC |
| | | | $T_j$=150°C | - | 184 | - | |
| $E_{rr}$ | Reverse recovered energy | | $T_j$=25°C | - | 35 | - | mJ |
| | | | $T_j$=150°C | - | 90 | - | |
| $R_{th(j-c)}$ | Thermal Resistance, Junction to Case (Diode) | | | - | 0.075 | - | °C/W |
| $R_{th(c-s)}$ | Thermal Resistance, Case to sink (Conductive Grease applied) | | | - | 0.020 | - | °C/W |

## Test Conditions

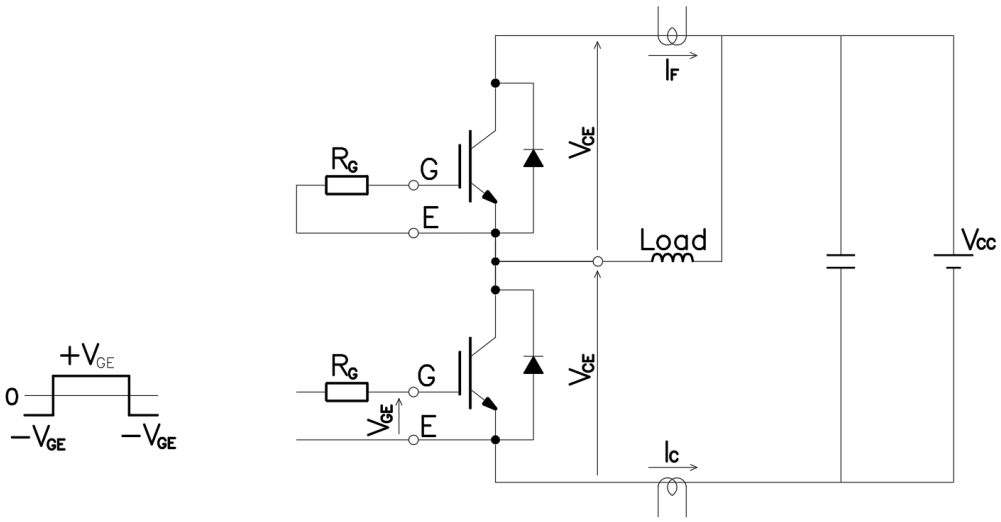


Figure 3. Switching time measure circuit

**HCG450FF170E3RE1**

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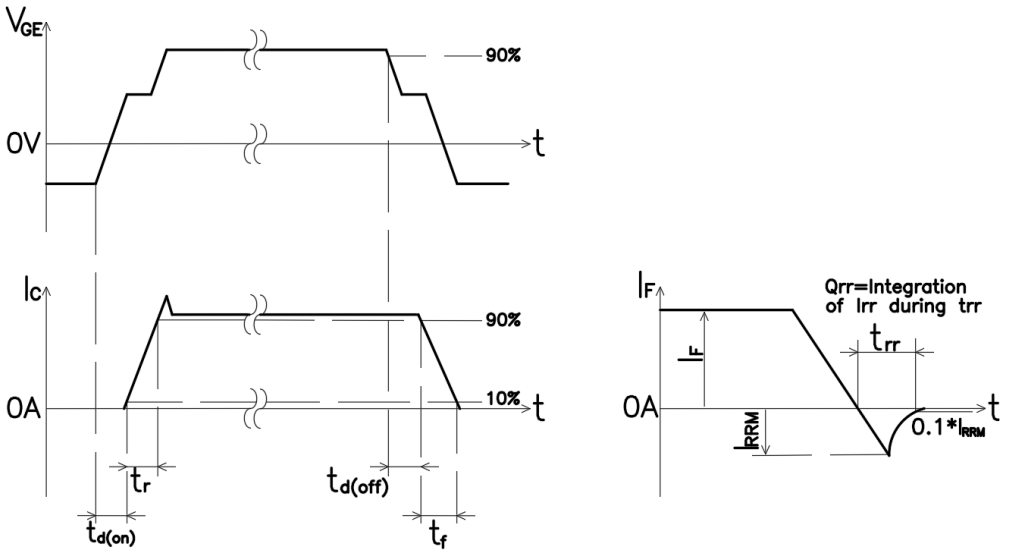


Figure 4. Switching time definition

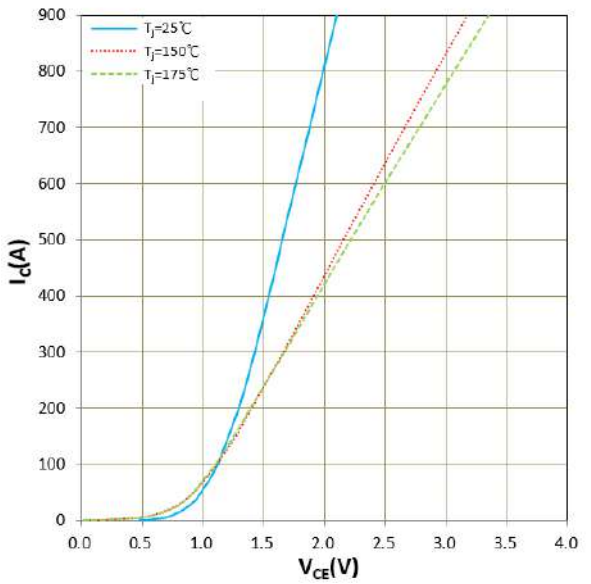


Figure 5. Ic vs $V_{CE}$

$V_{GE}$=15V

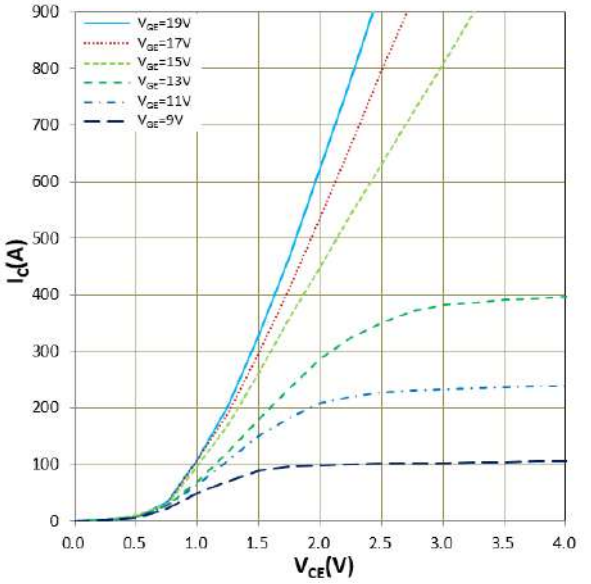


Figure 6. Ic vs $V_{CE}$

$T_j$=150°C

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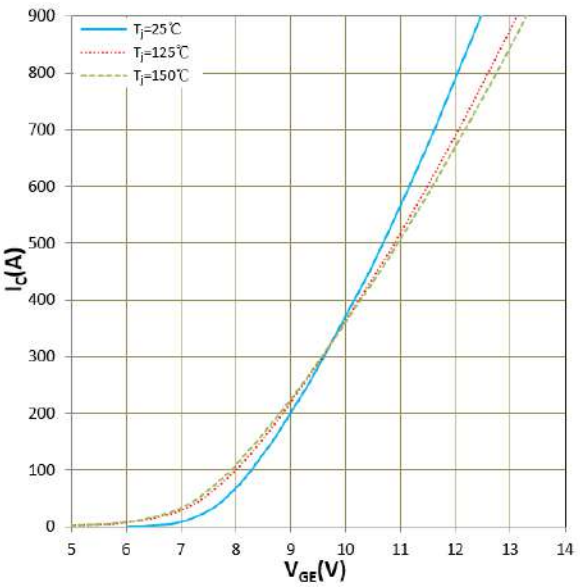


Figure 7. Ic vs $V_{GE}$
$V_{CE}$ =20V

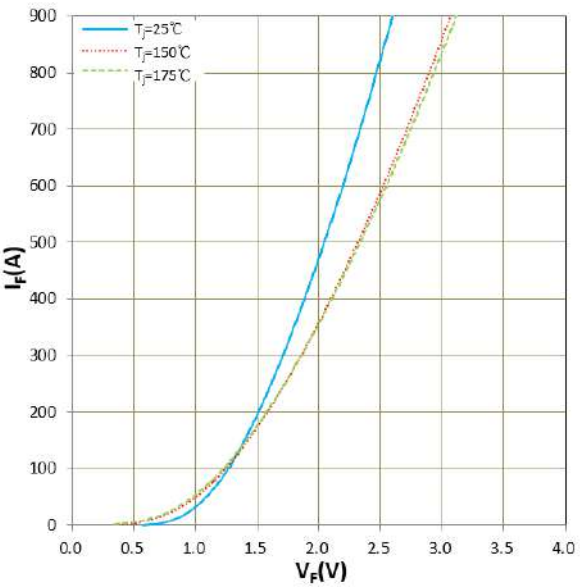


Figure 8. $I_F$ vs $V_F$

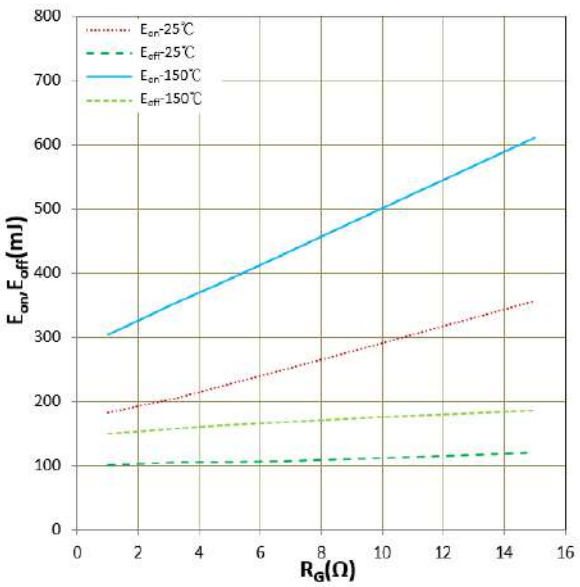


Figure 9. $E_{on}$, $E_{off}$ vs $R_G$(Typ)
$V_{CC}$ =900V, $V_{GE}$ =+15V/-8V, $I_C$ =450A
Inductive Load

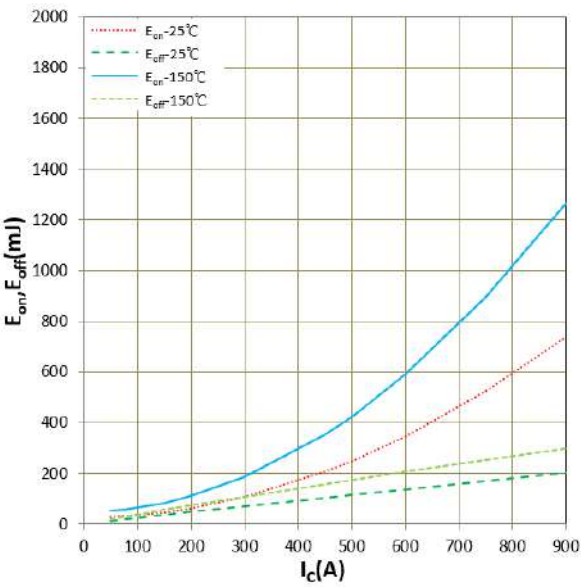


Figure 10. $E_{on}$, $E_{off}$ vs Ic(Typ)
$V_{CC}$=900V, $V_{GE}$ =+15V/-8V, $R_G$ =3.3Ω
Inductive Load

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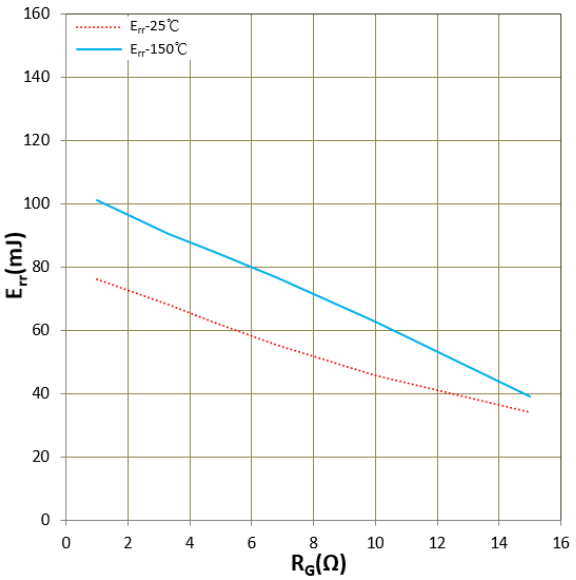


Figure 11. Err vs $R_G$(Typ)
$V_{CC}$ =900V, $V_{GE}$ =+15V/-8V, $I_F$ =450A
Inductive Load

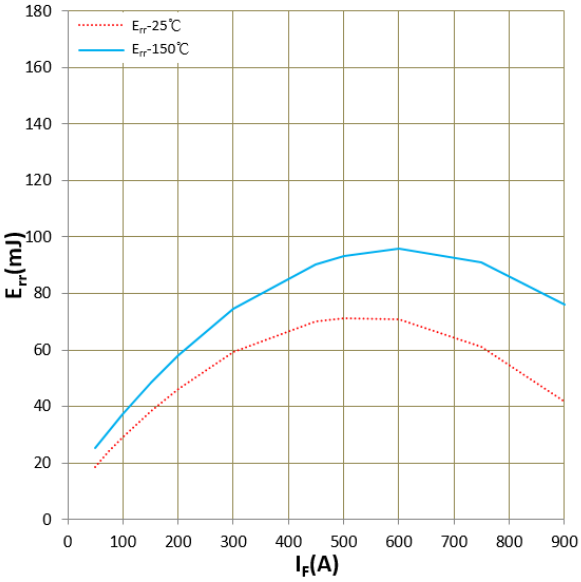


Figure 12. $E_{rr}$ vs $I_F$(Typ)
$V_{CC}$ =900V, $V_{GE}$ =+15V/-8V, $R_G$ =3.3Ω
Inductive Load

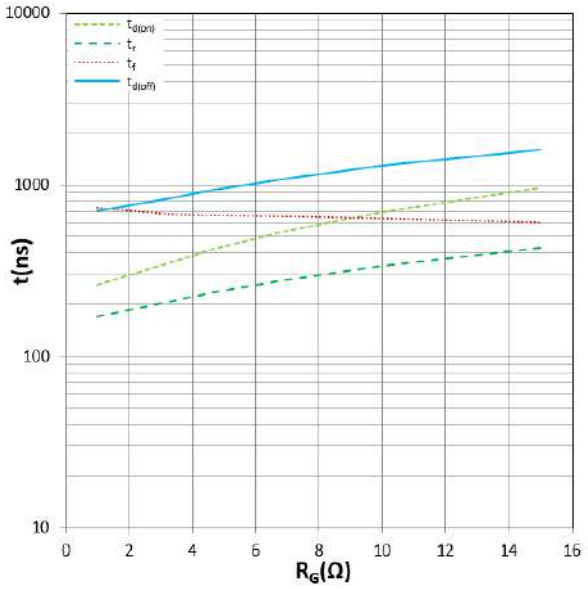


Figure 13. Switching time vs $R_G$(Typ)
$V_{CC}$ =900V, $V_{GE}$ =+15V/-8V, $I_C$ =450A,
$T_j$ =150°C, Inductive Load

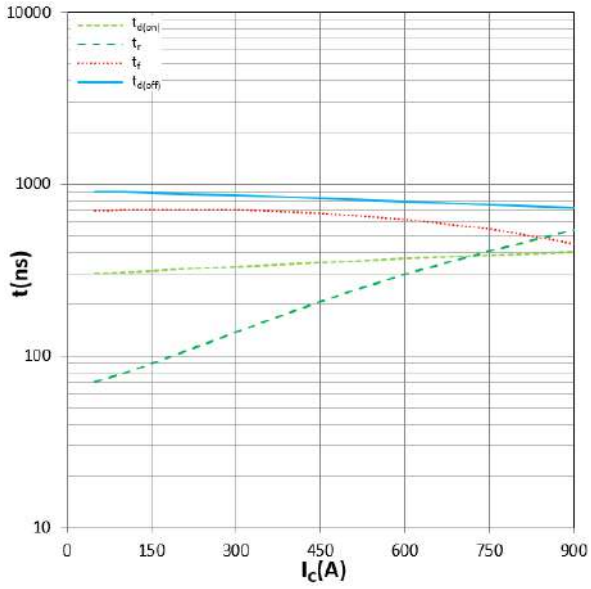


Figure 14. Switching time vs Ic(Typ)
$V_{CC}$ =900V, $V_{GE}$ =+15V/-8V, $R_G$ =3.3Ω
$T_j$ =150°C, Inductive Load

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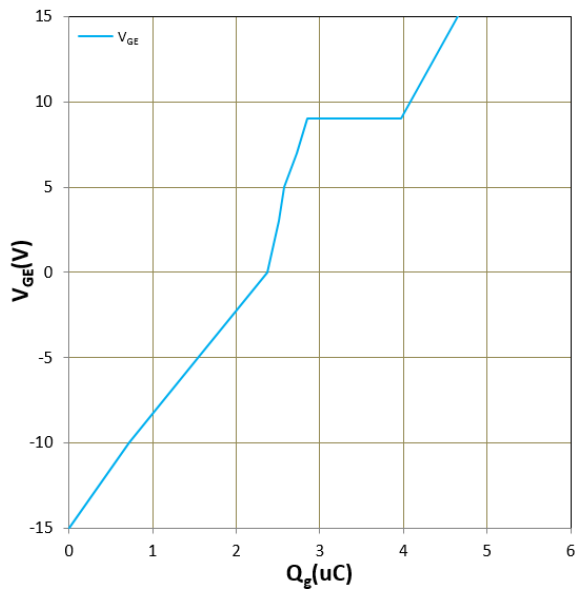


Figure 15. Gate charge

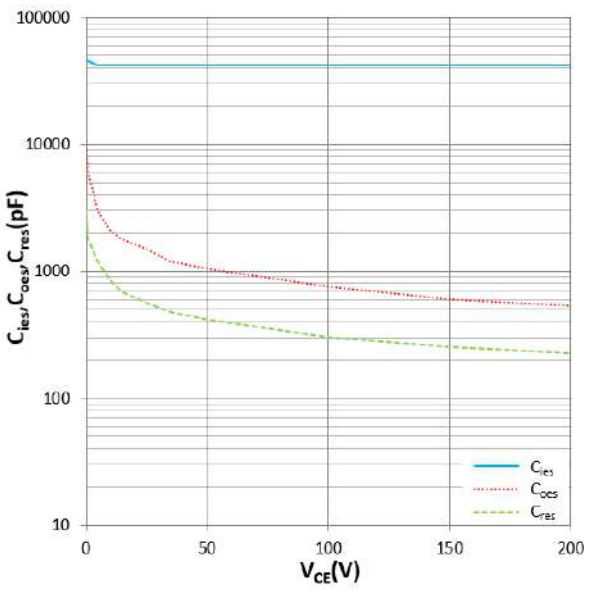


Figure 16. $C_{ies}$, $C_{oes}$, $C_{res}$ vs $V_{CE}$
$T_j$ =25°C, f =1MHz

**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 | 450 | FF | 1200 | 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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