# DFI450HF17I4RE1

**1700V/450A Half Bridge IGBT Module**

## Description

The DFI450HF17I4RE1 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
- 150°C maximum junction temperature
- Thermistor inside

## Applications

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

## Circuit diagram

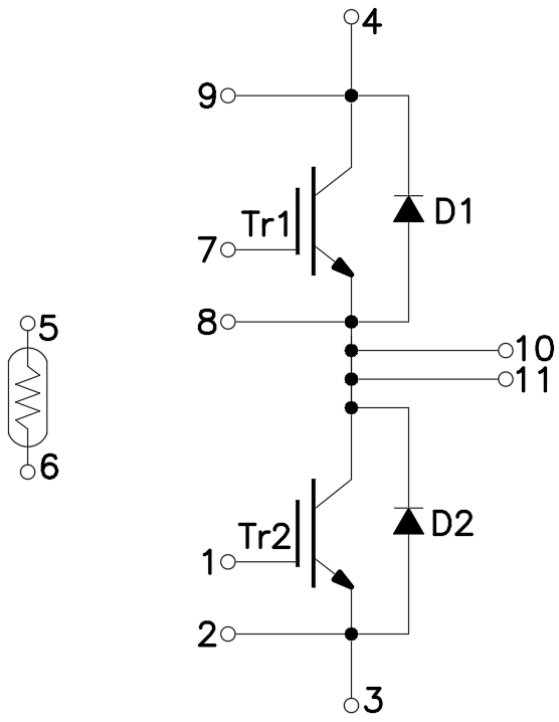


Figure 1. Out drawing & circuit diagram for DFI450HF17I4RE1

## Pin Configuration and Marking Information

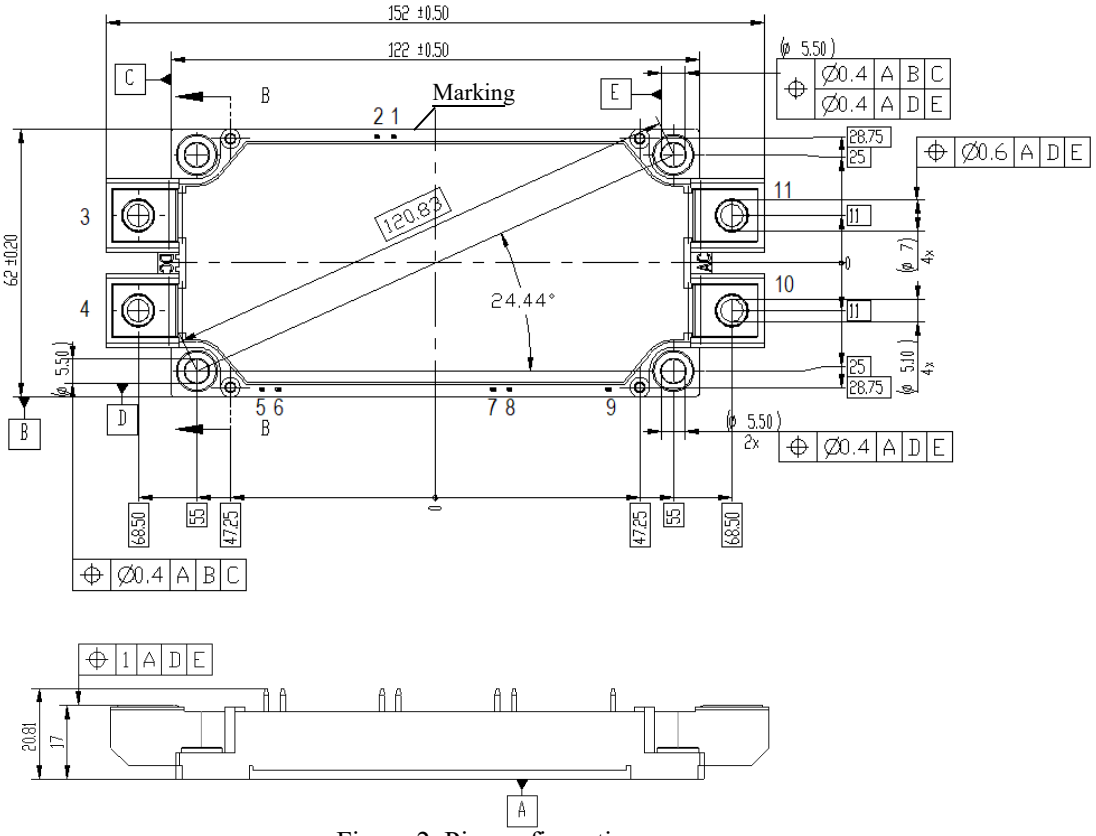


Figure 2. Pin configuration

## Module

| Parameter | Conditions | 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 | - | >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°C 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 | $T_C$=100°C | 500 | A |
| $I_{CM}$ | Pulse Collector Current | $t_p$=1ms, Note1 | 1000 | A |
| $P_C$ | Maximum Power Dissipation | $T_C$=25°C, $T_j$=150°C(IGBT) | 3125 | W |
| $I_F$ | Diode Forward Current | - | 500 | A |
| $I_{FRM}$ | Repetitive peak forward current | $t_p$=1ms, Note1 | 1000 | A |
| $I^2t$ | $I^2t$-value | $V_R$=0V, $t_p$=10ms, $T_j$=125°C(Diode) | 20000 | $A^2s$ |
| $T_j$ | junction temperature | - | -40 to 150 | °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 |
| ΔR/R | Deviation of R100 | $T_C$=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 |

## IGBT Electrical characteristics ($T_j$=25°C 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 | - | 1.6 | 1.9 | V |
| | | | $T_j$=125°C | - | 1.95 | - | V |
| | | | $T_j$=150°C | - | 2.03 | - | V |
| $V_{GE(th)}$ | 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, $R_G$=3.3Ω, 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 | - | |
| $I_{SC}$ | SC data | $V_{GE}$<15V, $V_{CC}$=1000V | $T_j$=150°C, $t_p$<10us | - | 2300 | - | A |
| $R_{th(j-c)}$ | Thermal Resistance, Junction to Case(IGBT) | | | - | 0.04 | - | °C/W |
| $R_{th(c-s)}$ | Thermal Resistance, Case to sink(Conductive Grease applied) | | | - | 0.015 | - | °C/W |

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

| Symbol | Item | Condition | | Value | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max | |
| $V_F$ | Diode Forward Voltage | $I_F$=450A<br>$V_{GE}$=0V | $T_j$=25°C | - | 1.76 | 2.0 | V |
| | | | $T_j$=150°C | - | 1.74 | - | |
| $t_{rr}$ | Reverse recovery time | (Switch side)<br>$V_{CC}$=900V, $I_C$=450A<br>$V_{GE}$=+15V/-8V<br>$R_G$=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) | | | - | 0.06 | - | °C/W |
| $R_{th(c-s)}$ | Thermal Resistance, Case to sink (Conductive Grease applied) | | | - | 0.015 | - | °C/W |

## Test Conditions

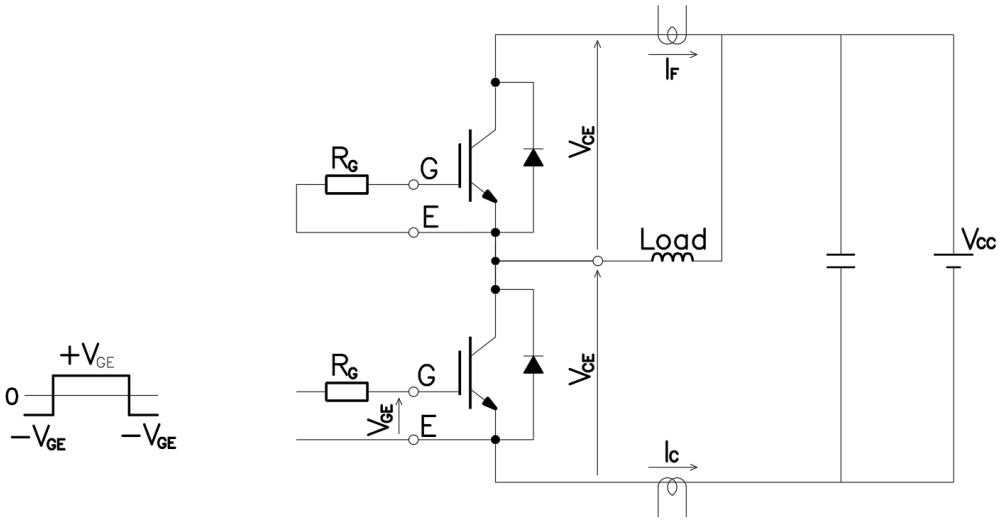


Figure 3. Switching time measure circuit

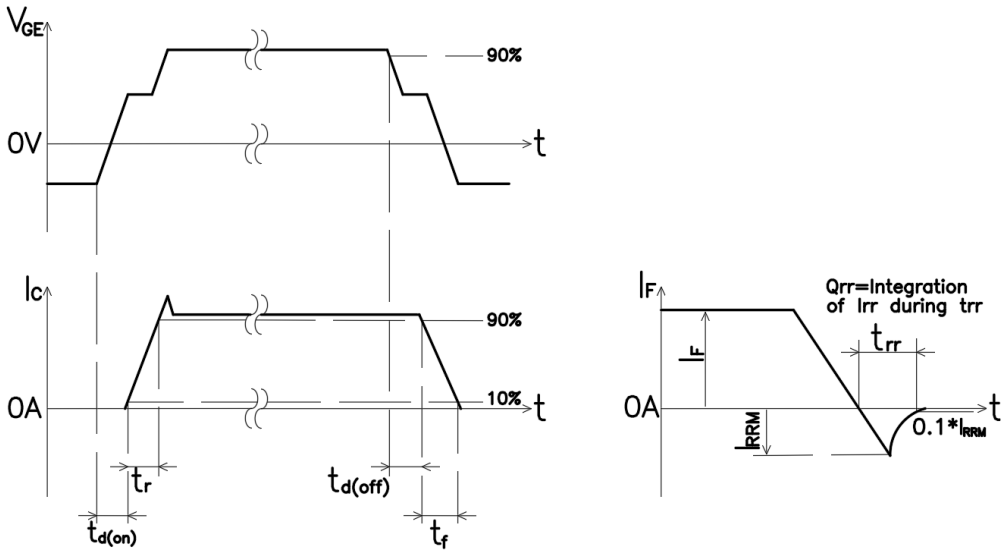


Figure 4. Switching time definition

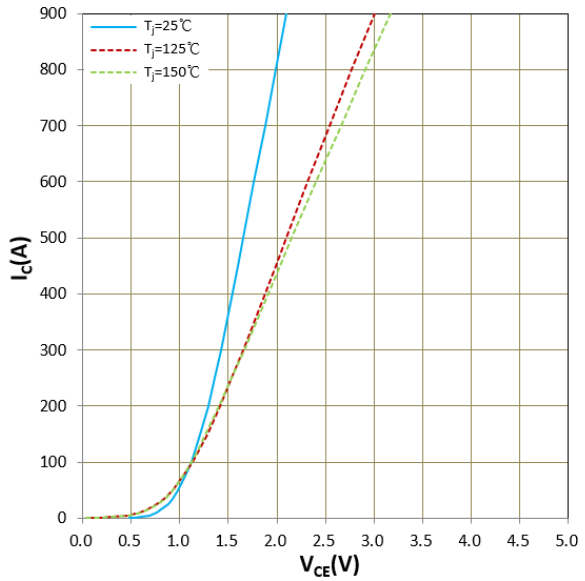


Figure 5. Ic vs $V_{CE}$
$V_{GE}$=15V

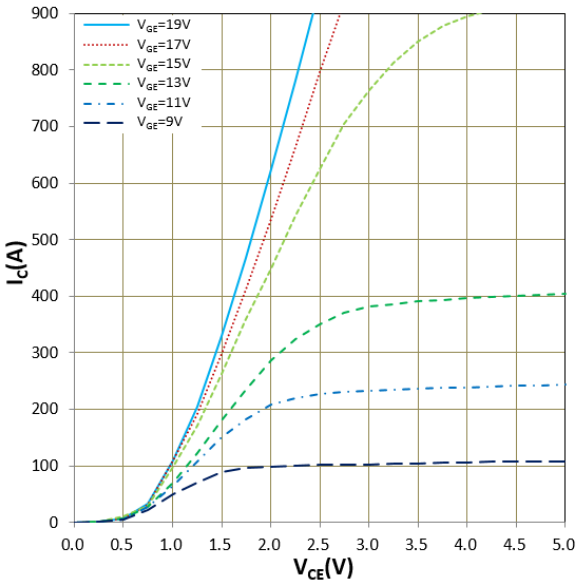


Figure 6. Ic vs $V_{CE}$
$T_j$=150°C

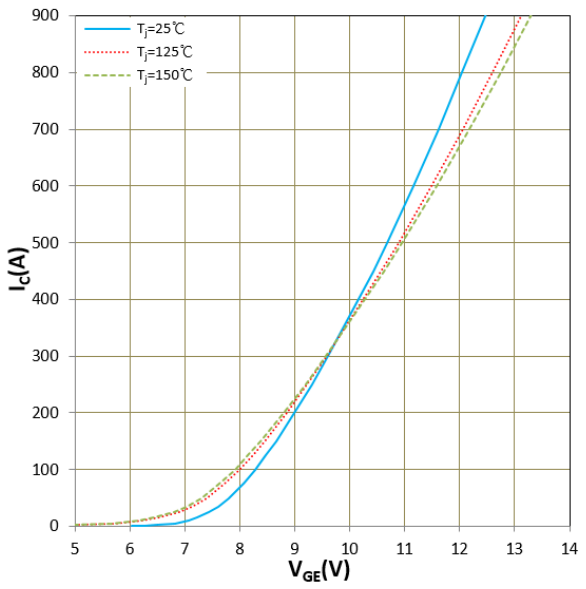


Figure 7. Ic vs $V_{GE}$
$V_{CE}$ =20V

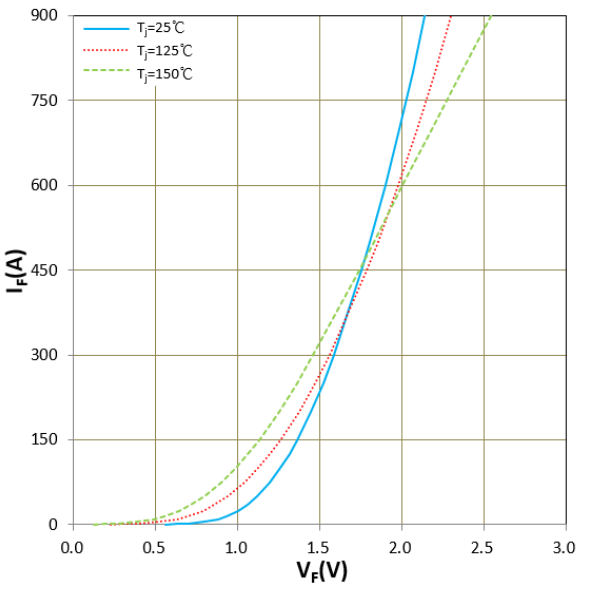


Figure 8. $I_F$ vs $V_F$

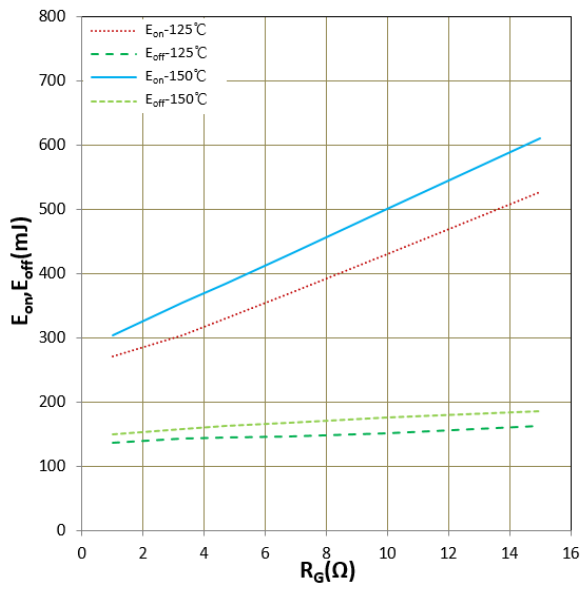


Figure 9. $E_{on}$, $E_{off}$ vs $R_G$(Typ)
$V_{CC}$ =900V, $V_{GE}$ =+15V/-8V, $I_C$ =450A
Inductive Load

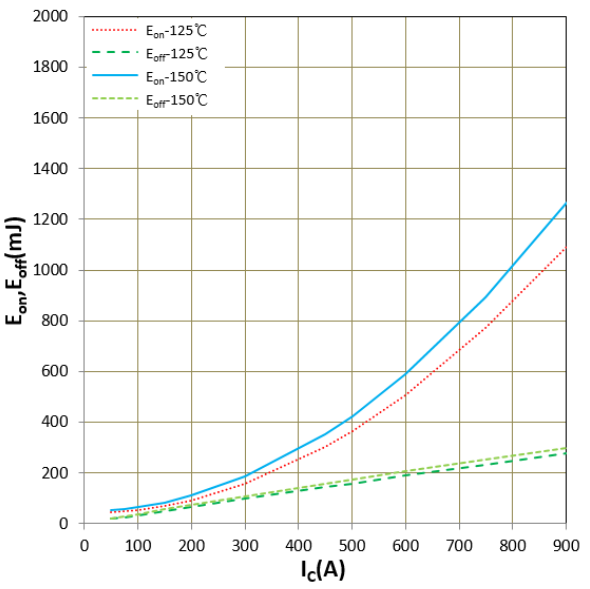


Figure 10. $E_{on}$, $E_{off}$ vs Ic(Typ)
$V_{CC}$=900V, $V_{GE}$ =+15V/-8V, $R_G$ =3.3Ω
Inductive Load

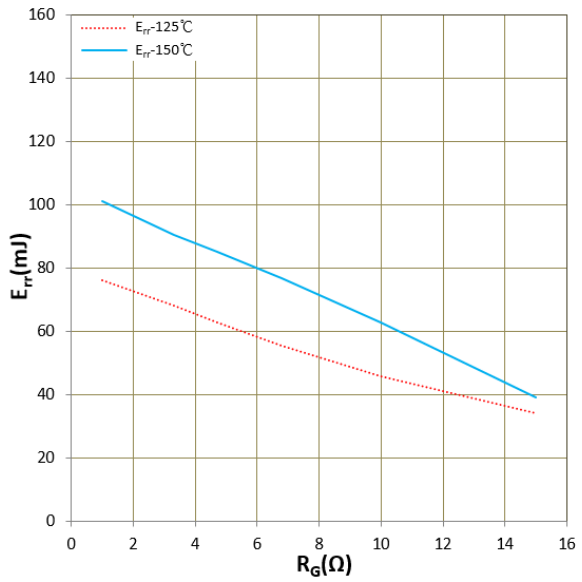


Figure 11. Err vs $R_G$(Typ)
$V_{CC}$ =900V, $V_{GE}$ =+15V/-8V, $I_F$ =450A
Inductive Load

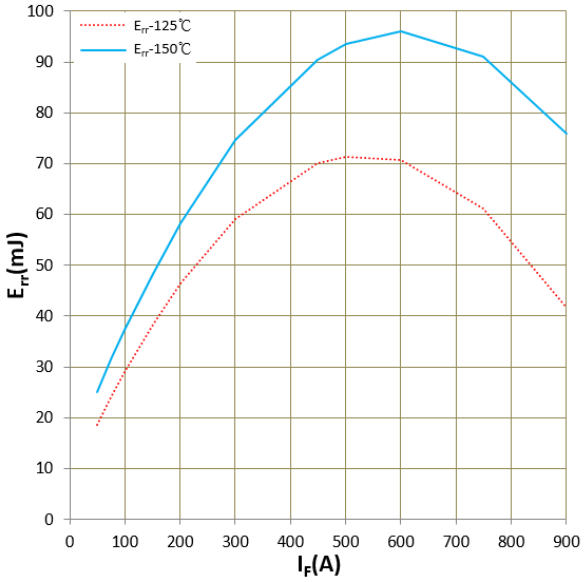


Figure 12. $E_{rr}$ vs $I_F$(Typ)
$V_{CC}$ =900V, $V_{GE}$ =+15V/-8V, $R_G$ =3.3Ω
Inductive Load

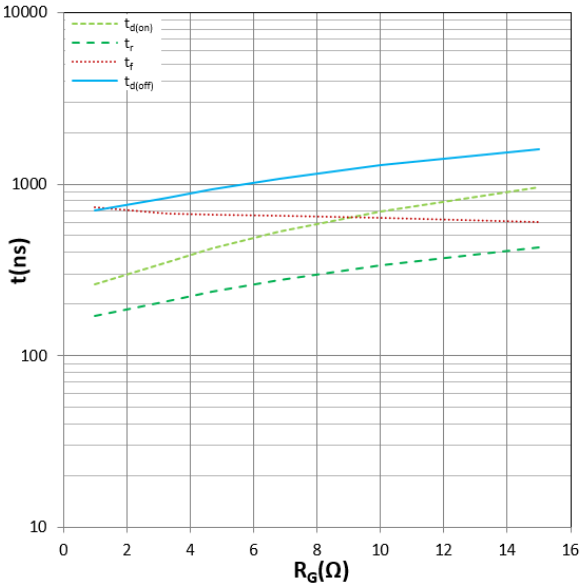


Figure 13. Switching time vs $R_G$(Typ)
$V_{CC}$ =900V, $V_{GE}$ =+15V/-8V, $I_C$ =450A,
$T_j$ =150°C, Inductive Load

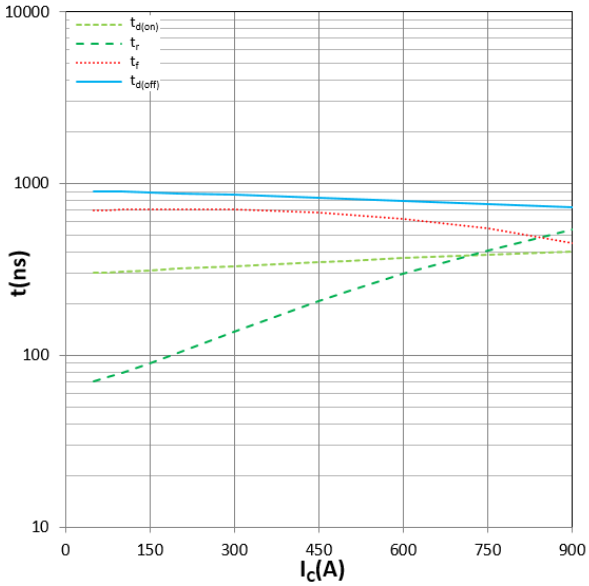


Figure 14. Switching time vs Ic(Typ)
$V_{CC}$ =900V, $V_{GE}$ =+15V/-8V, $R_G$ =3.3Ω
$T_j$ =150°C, Inductive Load

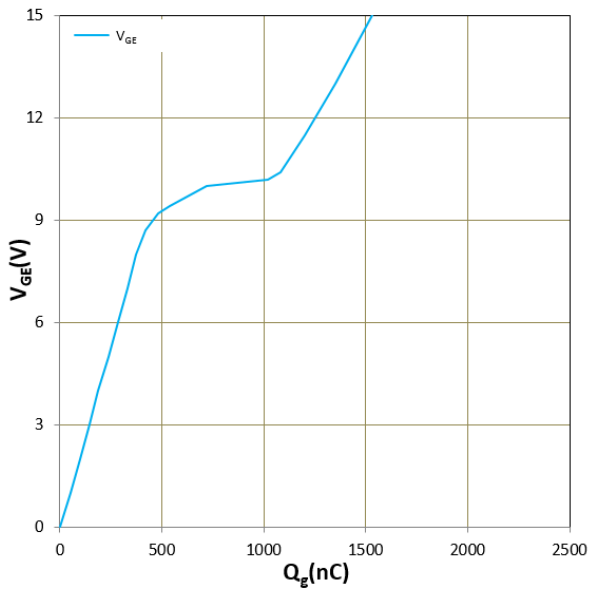


Figure 15. Gate charge

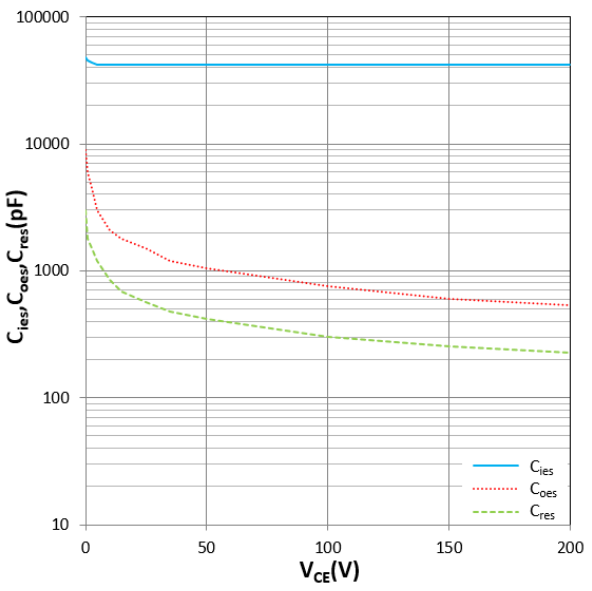


Figure 16. $C_{ies}$, $C_{oes}$, $C_{res}$ vs $V_{CE}$
$T_j$ =25°C, f =1MHz

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