

## Description

The DFI300HF17DFRE1 is a Half Bridge IGBT Power Module. It integrates high performance IGBT chips and offers lower losses and higher energy for the applications such as motor drive、inverter and welding machines.



## Features

- 1700V300A
- $V_{CE(sat)}(typ.)=1.65V@25^{\circ}C$
- Lower losses and higher energy
- High speed switching

## Applications

- Motor drive
- Inverter
- Welding machines
- Power supply
- UPS

## Circuit diagram

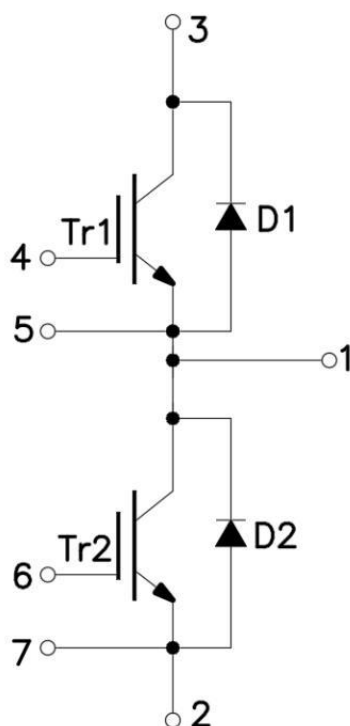


Figure 1. Out drawing & circuit diagram for DFI300HF17DFRE1

## Pin Configuration and Marking Information

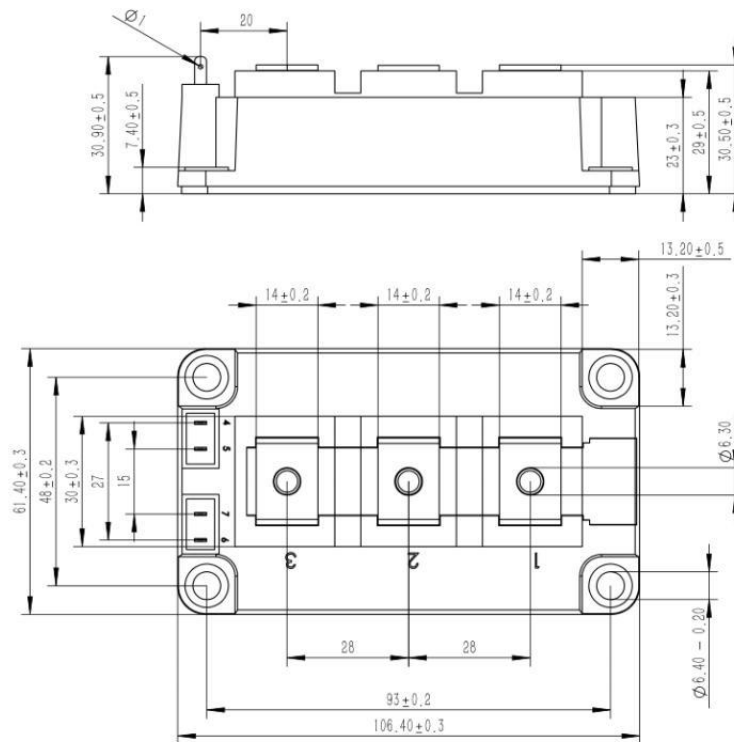


Figure 2. Pin configuration

### Module

| Parameter                                | Condition                                    | 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 | 47<br>26 | mm   |
| Clearance                                | terminal to heatsink<br>terminal to terminal | 29<br>14 | mm   |
| CTI                                      | -                                            | >200     | -    |
| Module lead resistance, terminals - chip | T <sub>C</sub> =25°C                         | 0.8      | mΩ   |
| Mounting torque for module mounting      | M6                                           | 3 to 6   | Nm   |
| Weight                                   | -                                            | 315      | g    |

### Maximum Ratings (T<sub>j</sub>=25°C unless otherwise specified)

| Symbol           | Parameter                       | Conditions                 | Ratings    | Unit |
|------------------|---------------------------------|----------------------------|------------|------|
| V <sub>CES</sub> | Collector-Emitter Voltage       | G-E Short                  | 1700       | V    |
| V <sub>GES</sub> | Gate-Emitter Voltage            | C-E Short                  | ±20        | V    |
| I <sub>C</sub>   | DC Continuous Collector Current | T <sub>C</sub> =125°C      | 300        | A    |
| I <sub>CM</sub>  | Pulse Collector Current         | t <sub>p</sub> =1ms, Note1 | 1200       | A    |
| P <sub>C</sub>   | Maximum Power Dissipation       | T <sub>C</sub> =25°C, IGBT | 2143       | W    |
| I <sub>F</sub>   | Diode Forward Current           | -                          | 300        | A    |
| I <sub>FRM</sub> | Repetitive peak forward Current | t <sub>p</sub> =1ms, Note1 | 600        | A    |
| T <sub>j</sub>   | junction temperature            | -                          | -40 to 175 | °C   |
| T <sub>stg</sub> | 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 <sub>25</sub>     | Resistance                    | T <sub>C</sub> =25°C                                           | -    | 5    | -    | kΩ |
| ΔR/R                | Deviation of R <sub>100</sub> | T <sub>C</sub> =100°C, R <sub>100</sub> =493Ω                  | -5   | -    | 5    | %  |
| P <sub>25</sub>     | Power dissipation             | T <sub>C</sub> =25°C                                           | -    | -    | 20   | mW |
| B <sub>25/50</sub>  | B-value                       | $R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298,15 \text{ K}))]$  | -    | 3375 | -    | K  |
| B <sub>25/80</sub>  | B-value                       | $R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298,15 \text{ K}))]$  | -    | 3411 | -    | K  |
| B <sub>25/100</sub> | B-value                       | $R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298,15 \text{ K}))]$ | -    | 3433 | -    | K  |

### IGBT Electrical characteristics (T<sub>j</sub>=25°C unless otherwise specified, chip)

| Symbol               | Item                                                                 | Condition                                                                                                                                  |                       | Value |       |      | Unit  |  |
|----------------------|----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-------|-------|------|-------|--|
|                      |                                                                      |                                                                                                                                            |                       | Min.  | Typ.  | Max. |       |  |
| V <sub>CE(sat)</sub> | Collector-Emitter Saturation Voltage                                 | I <sub>C</sub> =300A<br>V <sub>GE</sub> =15V                                                                                               | T <sub>j</sub> =25°C  | -     | 1.65  | 1.90 | V     |  |
|                      |                                                                      |                                                                                                                                            | T <sub>j</sub> =125°C | -     | 1.78  | -    | V     |  |
|                      |                                                                      |                                                                                                                                            | T <sub>j</sub> =150°C | -     | 1.87  | -    | V     |  |
|                      |                                                                      |                                                                                                                                            | T <sub>j</sub> =175°C | -     | 1.91  | -    | V     |  |
| V <sub>GE(th)</sub>  | Gate-Emitter threshold Voltage                                       | I <sub>C</sub> =12mA, V <sub>CE</sub> =V <sub>GE</sub>                                                                                     |                       | 5.0   | 6.0   | -    | V     |  |
| Q <sub>G</sub>       | Gate charge                                                          | V <sub>GE</sub> = -15V to +15V, V <sub>CC</sub> =900V                                                                                      |                       | -     | 3.1   | -    | uC    |  |
| R <sub>Gint</sub>    | Internal gate resistor                                               | -                                                                                                                                          | T <sub>j</sub> =25°C  | -     | -     | -    | Ω     |  |
| C <sub>ies</sub>     | Input Capacitance                                                    | V <sub>CE</sub> =25V,<br>V <sub>GE</sub> =0V<br>f=1MHz                                                                                     | T <sub>j</sub> =25°C  | -     | 28.0  | -    | nF    |  |
| C <sub>oes</sub>     | Output Capacitance                                                   |                                                                                                                                            |                       | -     | 1.02  | -    | nF    |  |
| C <sub>res</sub>     | Reverse transfer Capacitance                                         |                                                                                                                                            |                       | -     | 0.38  | -    | nF    |  |
| I <sub>CES</sub>     | Collector- Emitter Cut off Current                                   | V <sub>CE</sub> =1700V, V <sub>GE</sub> =0V                                                                                                | T <sub>j</sub> =25°C  | -     | -     | 1    | mA    |  |
| I <sub>GES</sub>     | Gate-Emitter Leakage Current                                         | V <sub>GE</sub> =20V, V <sub>CE</sub> =0V                                                                                                  | T <sub>j</sub> =25°C  | -     | -     | 1    | uA    |  |
| t <sub>d(on)</sub>   | Turn-on delay time                                                   | V <sub>CC</sub> =900V<br>I <sub>C</sub> =300A<br>V <sub>GE</sub> =+15V/-8V<br>R <sub>Gon</sub> = R <sub>Goff</sub> =1.5Ω<br>Inductive load | T <sub>j</sub> =25°C  | -     | 279   | -    | ns    |  |
|                      |                                                                      |                                                                                                                                            | T <sub>j</sub> =150°C | -     | 304   | -    | ns    |  |
| t <sub>r</sub>       | Rise time                                                            |                                                                                                                                            | T <sub>j</sub> =25°C  | -     | 160   | -    | ns    |  |
|                      |                                                                      |                                                                                                                                            | T <sub>j</sub> =150°C | -     | 192   | -    | ns    |  |
| t <sub>d(off)</sub>  | Turn-off delay time                                                  |                                                                                                                                            | T <sub>j</sub> =25°C  | -     | 630   | -    | ns    |  |
|                      |                                                                      |                                                                                                                                            | T <sub>j</sub> =150°C | -     | 749   | -    | ns    |  |
| t <sub>f</sub>       | Fall time                                                            |                                                                                                                                            | T <sub>j</sub> =25°C  | -     | 380   | -    | ns    |  |
|                      |                                                                      |                                                                                                                                            | T <sub>j</sub> =150°C | -     | 638   | -    | ns    |  |
| E <sub>on</sub>      | Turn-on power dissipation                                            |                                                                                                                                            | T <sub>j</sub> =25°C  | -     | 122.3 | -    | mJ    |  |
|                      |                                                                      |                                                                                                                                            | T <sub>j</sub> =150°C | -     | 202.1 | -    | mJ    |  |
| E <sub>off</sub>     | Turn-offpower dissipation                                            |                                                                                                                                            | T <sub>j</sub> =25°C  | -     | 67.2  | -    | mJ    |  |
|                      |                                                                      |                                                                                                                                            | T <sub>j</sub> =150°C | -     | 99.9  | -    | mJ    |  |
| R <sub>th(j-c)</sub> | Thermal Resistance, Junction to Case (IGBT)                          |                                                                                                                                            |                       | -     | 0.070 | -    | °C /W |  |
| R <sub>th(c-s)</sub> | Thermal Resistance, Case to sink (Conductive Grease applied) , Note1 |                                                                                                                                            |                       | -     | 0.020 | -    | °C /W |  |

Note1: Assumes Thermal Conductivity of grease is  $2.8 \text{ W/m} \cdot \text{K}$  and thickness is  $50\mu\text{m}$ .

### Freewheeling Diode Electrical characteristics ( $T_j=25^{\circ}\text{C}$ unless otherwise specified, chip)

| Symbol               | Item                                                                | Condition                                                                                                       |                       | Value |       |      | Unit |
|----------------------|---------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-----------------------|-------|-------|------|------|
|                      |                                                                     |                                                                                                                 |                       | Min.  | Typ.  | Max. |      |
| V <sub>F</sub>       | Diode Forward Voltage                                               | I <sub>F</sub> =300A, V <sub>GE</sub> =0V                                                                       | T <sub>j</sub> =25°C  | -     | 2.10  | -    | V    |
|                      |                                                                     |                                                                                                                 | T <sub>j</sub> =125°C | -     | 2.12  | -    | V    |
|                      |                                                                     |                                                                                                                 | T <sub>j</sub> =150°C | -     | 2.05  | -    | V    |
|                      |                                                                     |                                                                                                                 | T <sub>j</sub> =175°C | -     | 2.10  | -    | V    |
| t <sub>rr</sub>      | Reverse recovery time                                               | (Switch side)<br>V <sub>CC</sub> =900V, I <sub>C</sub> =300A<br>V <sub>GE</sub> =+15V/-8V, R <sub>G</sub> =1.5Ω | T <sub>j</sub> =25°C  | -     | 730   | -    | ns   |
|                      |                                                                     |                                                                                                                 | T <sub>j</sub> =150°C | -     | 1059  | -    | ns   |
| I <sub>RM</sub>      | Peak reverse recovery Current                                       | (FRD side)<br>V <sub>rr</sub> =900V, I <sub>F</sub> =300A<br>V <sub>GE</sub> =-8V                               | T <sub>j</sub> =25°C  | -     | 134   | -    | A    |
|                      |                                                                     |                                                                                                                 | T <sub>j</sub> =150°C | -     | 168   | -    | A    |
| Q <sub>rr</sub>      | Recovered charge                                                    | Inductive load<br>switching operation                                                                           | T <sub>j</sub> =25°C  | -     | 53    | -    | uC   |
|                      |                                                                     |                                                                                                                 | T <sub>j</sub> =150°C | -     | 124   | -    | uC   |
| E <sub>rr</sub>      | Reverse recovered energy                                            |                                                                                                                 | T <sub>j</sub> =25°C  | -     | 35.9  | -    | mJ   |
|                      |                                                                     |                                                                                                                 | T <sub>j</sub> =150°C | -     | 60.3  | -    | mJ   |
| R <sub>th(j-c)</sub> | Thermal Resistance, Junction to Case (Diode)                        |                                                                                                                 |                       | -     | 0.118 | -    | °C/W |
| R <sub>th(c-s)</sub> | Thermal Resistance, Case to sink (Conductive Grease applied), Note1 |                                                                                                                 |                       | -     | 0.025 | -    | °C/W |

Note1: Assumes Thermal Conductivity of grease is  $2.8 \text{ W/m} \cdot \text{K}$  and thickness is  $50\mu\text{m}$ .

### Test Conditions

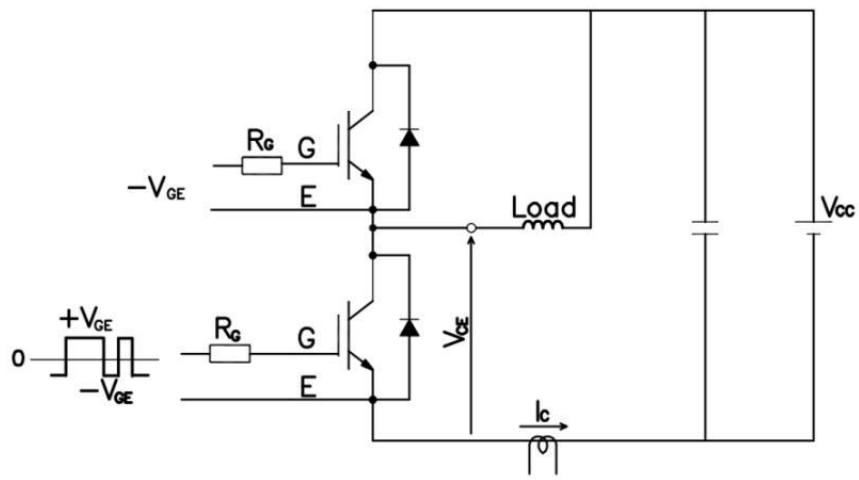


Figure 3. Switching time measure circuit

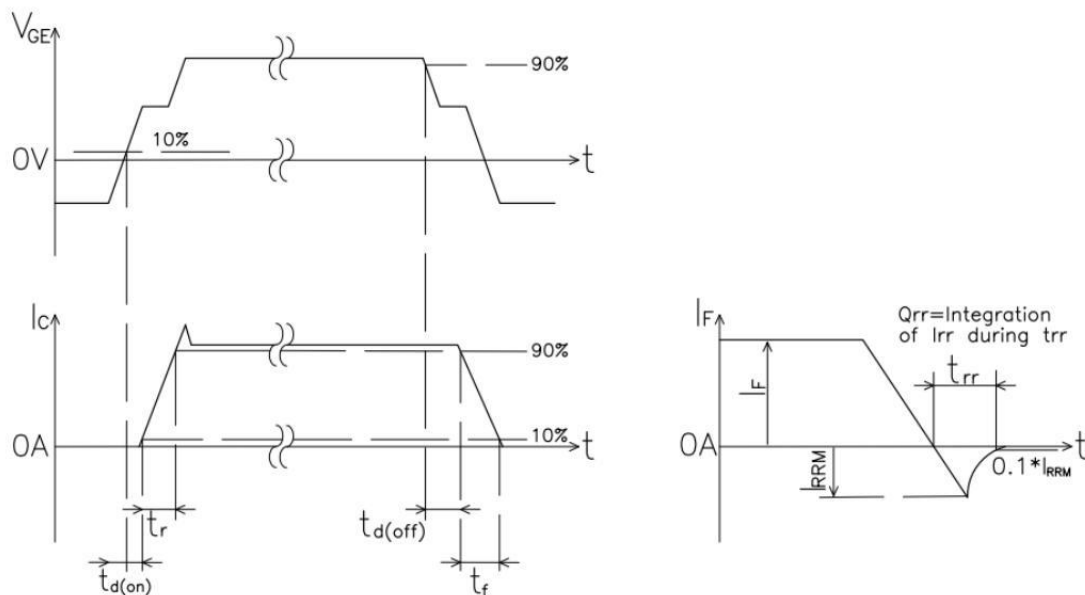


Figure 4. Switching time definition

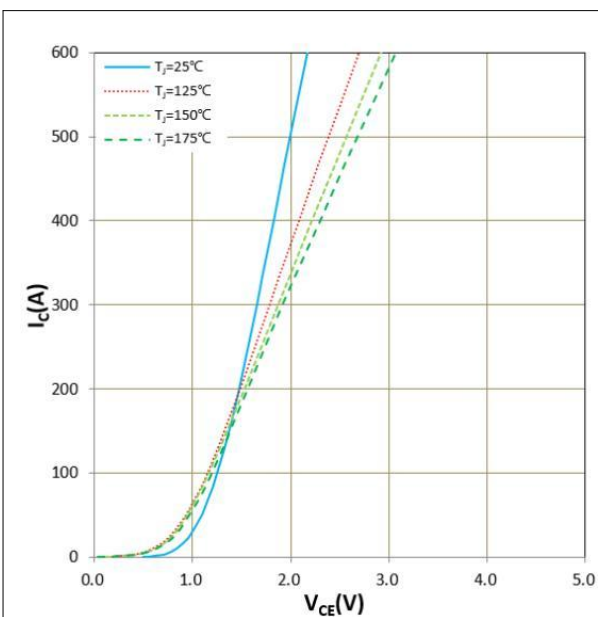


Figure 5.  $I_C$  vs  $V_{CE}$   
 $V_{GE}=15V$

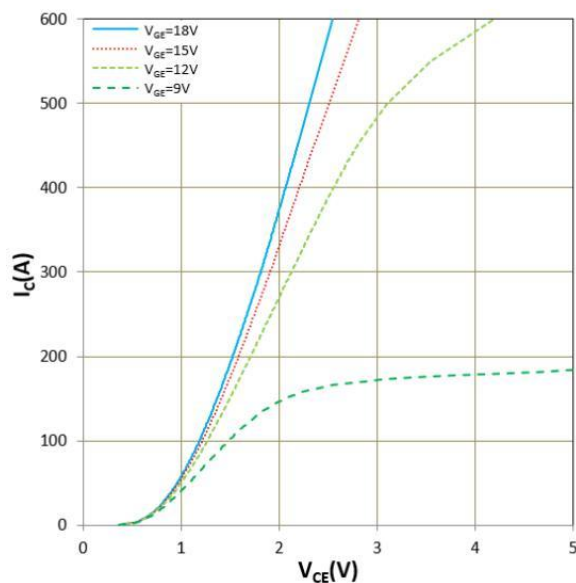


Figure 6.  $I_C$  vs  $V_{CE}$   
 $T_j = 175^\circ C$



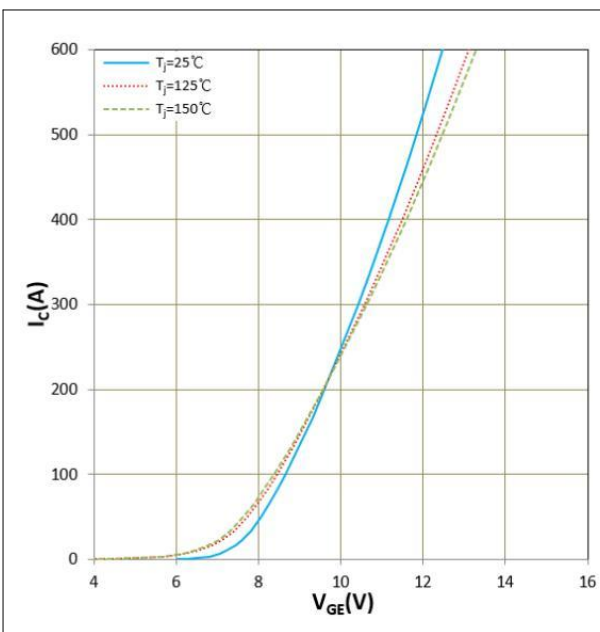


Figure 7.  $I_C$  vs  $V_{GE}$   
 $V_{CE} = 20\text{V}$

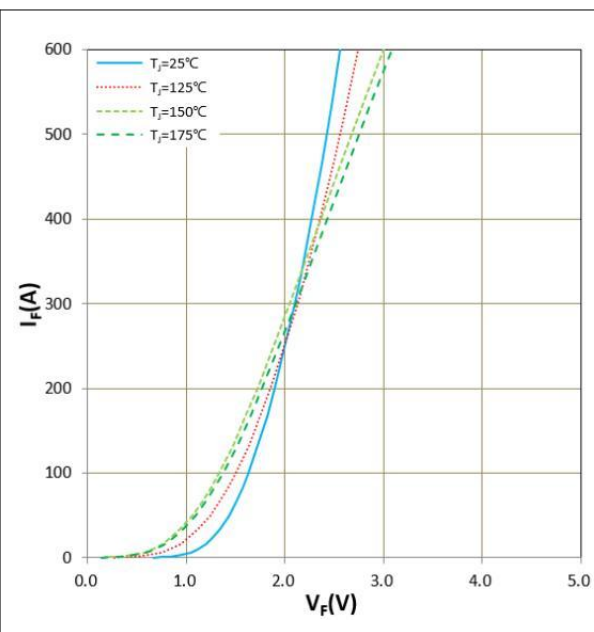


Figure 8.  $I_F$  vs  $V_F$

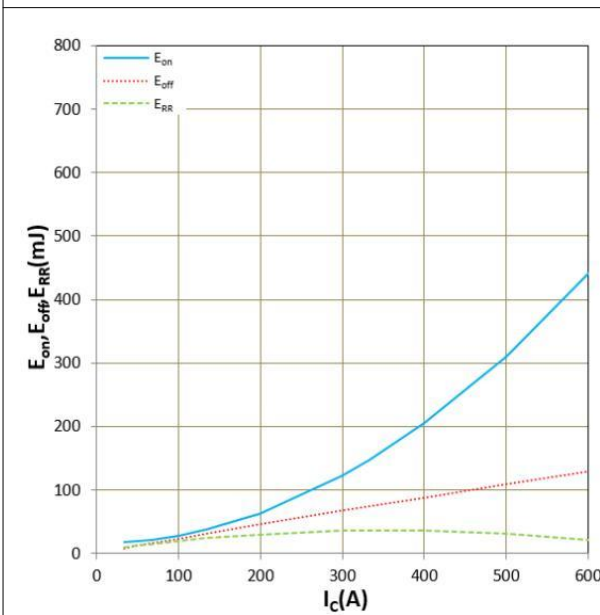


Figure 9.  $E_{on}$ ,  $E_{off}$ ,  $E_{rr}$  vs  $I_C$  (Typ)  
 $V_{CC} = 900\text{V}$ ,  $V_{GE} = +15\text{V}/-8\text{V}$ ,  $R_g = 1.5\Omega$ ,  $T_j = 25^\circ\text{C}$   
Inductive Load

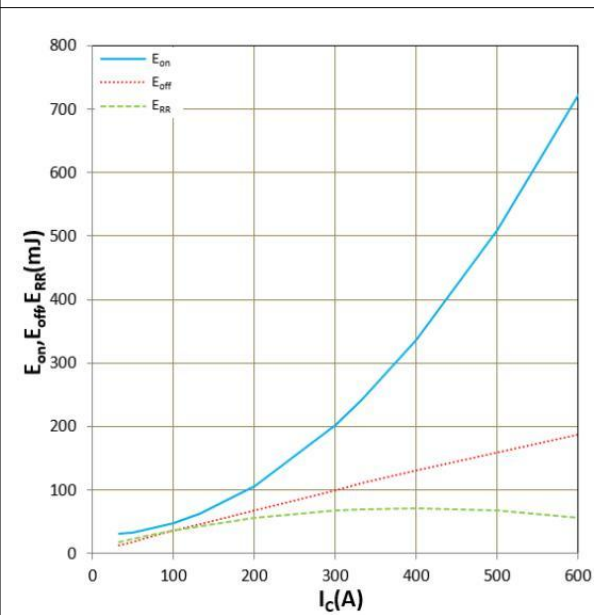


Figure 10.  $E_{on}$ ,  $E_{off}$ ,  $E_{rr}$  vs  $I_C$  (Typ)  
 $V_{CC} = 900\text{V}$ ,  $V_{GE} = +15\text{V}/-8\text{V}$ ,  $R_g = 1.5\Omega$ ,  $T_j = 150^\circ\text{C}$   
Inductive Load



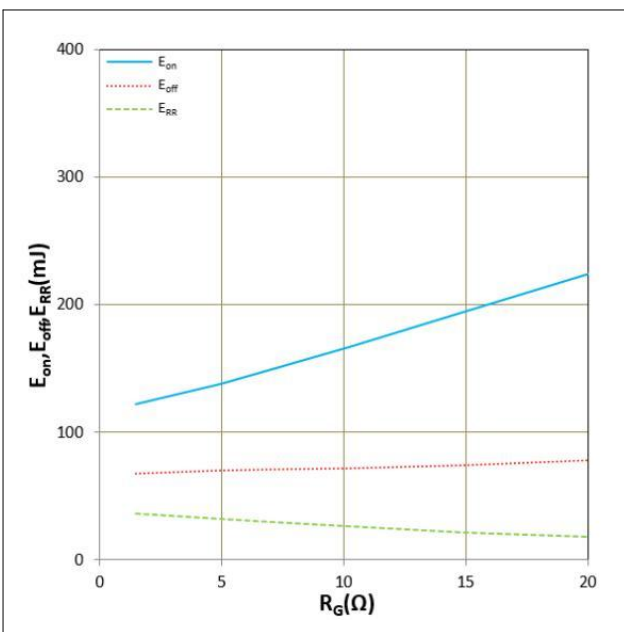


Figure 11. E<sub>on</sub>, E<sub>off</sub>, E<sub>rr</sub> vs R<sub>g</sub>(Typ)  
V<sub>CC</sub>=900V, V<sub>GE</sub>=+15V/-8V, I<sub>C</sub> =300A, T<sub>j</sub> =25°C  
Inductive Load

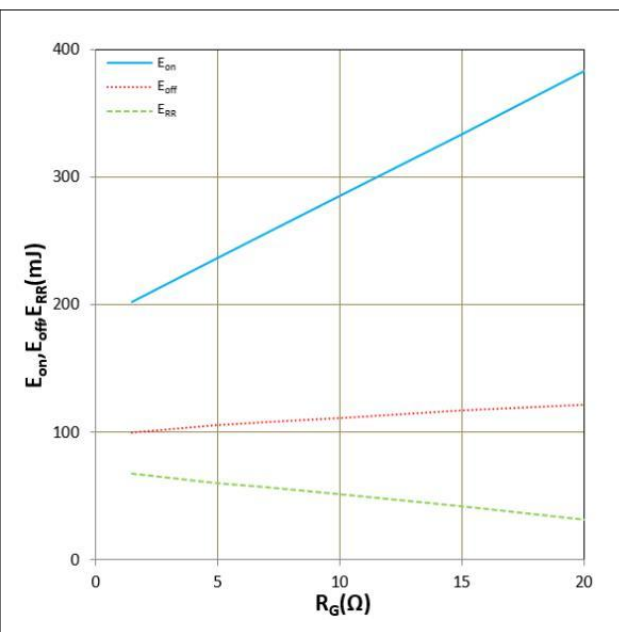


Figure 12. E<sub>on</sub>, E<sub>off</sub>, E<sub>rr</sub> vs R<sub>g</sub>(Typ)  
V<sub>CC</sub>=900V, V<sub>GE</sub>=+15V/-8V, I<sub>C</sub> =300A, T<sub>j</sub> =150°C  
Inductive Load

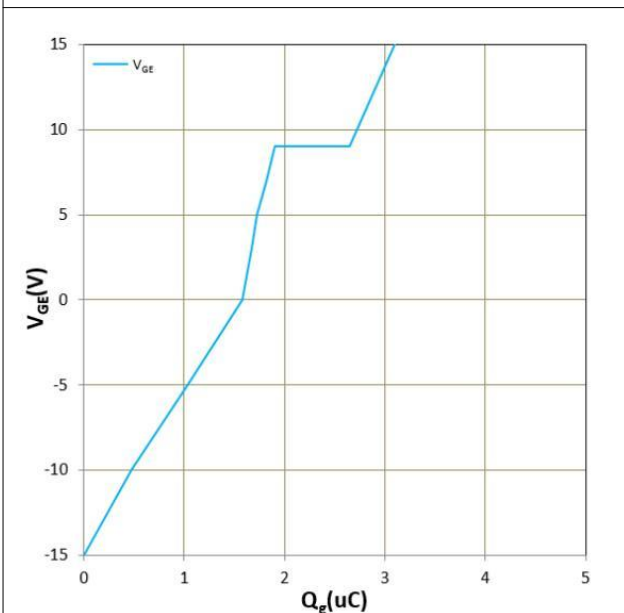


Figure 13. Gate charge

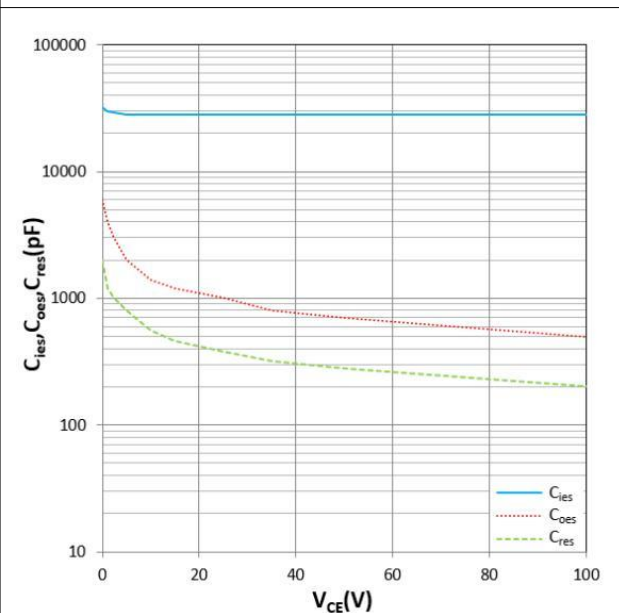


Figure 14. C<sub>ies</sub>, C<sub>oes</sub>, C<sub>res</sub> vs V<sub>CE</sub>  
T<sub>j</sub>=25°C, f=1MHz



### IMPORTANT NOTICE:

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