

# STARPOWER

SEMICONDUCTOR™

## IGBT

### GD150HFU120C2S

Molding Type Module

1200V/150A 2 in one-package

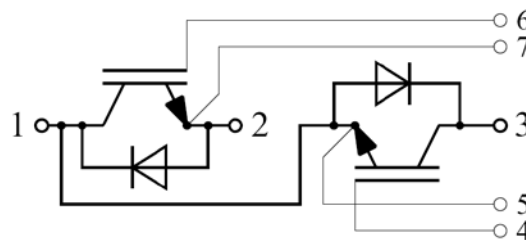
#### General Description

STARPOWER IGBT Power Module provides ultrafast switching speed as well as short circuit ruggedness. It's designed for the applications such as electronic welder and inductive heating.



#### Features

- NPT IGBT technology
- 10 $\mu$ s short circuit capability
- Low switching losses
- Rugged with ultrafast performance
- $V_{CE(sat)}$  with positive temperature coefficient
- Low inductance case
- Fast & soft reverse recovery anti-parallel FWD
- Isolated copper baseplate using DBC technology



Equivalent Circuit Schematic

#### Typical Applications

- Switching mode power supplies
- Inductive heating
- Electronic welder

**Absolute Maximum Ratings**  $T_C=25^{\circ}\text{C}$  unless otherwise noted

| Symbol          | Description                                              | GD150HFU120C2S | Units              |
|-----------------|----------------------------------------------------------|----------------|--------------------|
| $V_{CES}$       | Collector-Emitter Voltage                                | 1200           | V                  |
| $V_{GES}$       | Gate-Emitter Voltage                                     | $\pm 20$       | V                  |
| $I_C$           | Collector Current @ $T_C=25^{\circ}\text{C}$             | 280            | A                  |
|                 | @ $T_C=80^{\circ}\text{C}$                               | 150            |                    |
| $I_{CM(1)}$     | Pulsed Collector Current $t_p=1\text{ms}$                | 300            | A                  |
| $I_F$           | Diode Continuous Forward Current                         | 150            | A                  |
| $I_{FM(1)}$     | Diode Maximum Forward Current                            | 300            | A                  |
| $P_D$           | Maximum power Dissipation @ $T_j=150^{\circ}\text{C}$    | 1147           | W                  |
| $T_j$           | Maximum Junction Temperature                             | 150            | $^{\circ}\text{C}$ |
| $T_{STG}$       | Storage Temperature Range                                | -40 to +125    | $^{\circ}\text{C}$ |
| $V_{ISO}$       | Isolation Voltage RMS, $f=50\text{Hz}$ , $t=1\text{min}$ | 2500           | V                  |
| Mounting Torque | Power Terminal Screw:M6                                  | 2.5 to 5.0     | N.m                |
|                 | Mounting Screw:M6                                        | 3.0 to 6.0     | N.m                |

**Notes:**

(1) Repetitive rating: Pulse width limited by max. junction temperature

**Electrical Characteristics of IGBT**  $T_C=25^{\circ}\text{C}$  unless otherwise noted**Off Characteristics**

| Symbol        | Parameter                           | Test Conditions                                                     | Min. | Typ. | Max. | Units |
|---------------|-------------------------------------|---------------------------------------------------------------------|------|------|------|-------|
| $V_{(BR)CES}$ | Collector-Emitter Breakdown Voltage | $T_j=25^{\circ}\text{C}$                                            | 1200 |      |      | V     |
| $I_{CES}$     | Collector Cut-Off Current           | $V_{CE}=V_{CES}$ , $V_{GE}=0\text{V}$ ,<br>$T_j=25^{\circ}\text{C}$ |      |      | 5.0  | mA    |
| $I_{GES}$     | Gate-Emitter Leakage Current        | $V_{GE}=V_{GES}$ , $V_{CE}=0\text{V}$ ,<br>$T_j=25^{\circ}\text{C}$ |      |      | 400  | nA    |

**On Characteristics**

| Symbol        | Parameter                               | Test Conditions                                                        | Min. | Typ. | Max. | Units |
|---------------|-----------------------------------------|------------------------------------------------------------------------|------|------|------|-------|
| $V_{GE(th)}$  | Gate-Emitter Threshold Voltage          | $I_C=1.5\text{mA}$ , $V_{CE}=V_{GE}$ ,<br>$T_j=25^{\circ}\text{C}$     | 4.4  | 5.2  | 6.0  | V     |
| $V_{CE(sat)}$ | Collector to Emitter Saturation Voltage | $I_C=150\text{A}$ , $V_{GE}=15\text{V}$ ,<br>$T_j=25^{\circ}\text{C}$  |      | 3.10 | 3.60 | V     |
|               |                                         | $I_C=150\text{A}$ , $V_{GE}=15\text{V}$ ,<br>$T_j=125^{\circ}\text{C}$ |      | 3.45 |      |       |

**Switching Characteristics**

| Symbol        | Parameter                                | Test Conditions                                                                            | Min. | Typ. | Max. | Units      |
|---------------|------------------------------------------|--------------------------------------------------------------------------------------------|------|------|------|------------|
| $t_{d(on)}$   | Turn-On Delay Time                       | $V_{CC}=600V, I_C=150A,$<br>$R_G=6.8\Omega, V_{GE}=\pm 15V,$<br>$L=200nH, T_J=25^\circ C$  |      | 612  |      | ns         |
| $t_r$         | Rise Time                                |                                                                                            |      | 116  |      | ns         |
| $t_{d(off)}$  | Turn-Off Delay Time                      |                                                                                            |      | 546  |      | ns         |
| $t_f$         | Fall Time                                |                                                                                            |      | 125  |      | ns         |
| $E_{on}$      | Turn-On Switching Loss                   |                                                                                            |      | 14.7 |      | mJ         |
| $E_{off}$     | Turn-Off Switching Loss                  |                                                                                            |      | 8.9  |      | mJ         |
| $t_{d(on)}$   | Turn-On Delay Time                       | $V_{CC}=600V, I_C=150A,$<br>$R_G=6.8\Omega, V_{GE}=\pm 15V,$<br>$L=200nH, T_J=125^\circ C$ |      | 609  |      | ns         |
| $t_r$         | Rise Time                                |                                                                                            |      | 116  |      | ns         |
| $t_{d(off)}$  | Turn-Off Delay Time                      |                                                                                            |      | 564  |      | ns         |
| $t_f$         | Fall Time                                |                                                                                            |      | 148  |      | ns         |
| $E_{on}$      | Turn-On Switching Loss                   |                                                                                            |      | 17.5 |      | mJ         |
| $E_{off}$     | Turn-Off Switching Loss                  |                                                                                            |      | 11.0 |      | mJ         |
| $C_{ies}$     | Input Capacitance                        | $V_{CE}=30V, f=1MHz,$<br>$V_{GE}=0V$                                                       |      | 12.7 |      | nF         |
| $C_{oes}$     | Output Capacitance                       |                                                                                            |      | 1.14 |      | nF         |
| $C_{res}$     | Reverse Transfer Capacitance             |                                                                                            |      | 0.46 |      | nF         |
| $I_{SC}$      | SC Data                                  | $T_P \leq 10\mu s, V_{GE}=15V,$<br>$T_J=25^\circ C, V_{CC}=600V,$<br>$V_{CEM} \leq 1200V$  |      | 1400 |      | A          |
| $R_{Gint}$    | Internal Gate Resistance                 |                                                                                            |      | 2.4  |      | $\Omega$   |
| $L_{CE}$      | Stray Inductance                         |                                                                                            |      |      | 18   | nH         |
| $R_{CC'+EE'}$ | Module Lead Resistance, Terminal To Chip | $T_C=25^\circ C$                                                                           |      | 0.32 |      | m $\Omega$ |

**Electrical Characteristics of DIODE**  $T_C=25^\circ C$  unless otherwise noted

| Symbol           | Parameter                     | Test Conditions                                                                             |                       | Min. | Typ. | Max. | Units |
|------------------|-------------------------------|---------------------------------------------------------------------------------------------|-----------------------|------|------|------|-------|
| V <sub>F</sub>   | Diode Forward Voltage         | I <sub>F</sub> =150A                                                                        | T <sub>j</sub> =25°C  |      | 1.75 | 2.15 | V     |
|                  |                               |                                                                                             | T <sub>j</sub> =125°C |      | 1.80 |      |       |
| Q <sub>r</sub>   | Recovered Charge              | I <sub>F</sub> =150A,<br>V <sub>R</sub> =600V,<br>di/dt=-1500A/μs,<br>V <sub>GE</sub> =-15V | T <sub>j</sub> =25°C  |      | 8.2  |      | μC    |
|                  |                               |                                                                                             | T <sub>j</sub> =125°C |      | 19.1 |      |       |
| I <sub>RM</sub>  | Peak Reverse Recovery Current |                                                                                             | T <sub>j</sub> =25°C  |      | 85   |      | A     |
|                  |                               |                                                                                             | T <sub>j</sub> =125°C |      | 125  |      |       |
| E <sub>rec</sub> | Reverse Recovery Energy       |                                                                                             | T <sub>j</sub> =25°C  |      | 4.2  |      | mJ    |
|                  |                               |                                                                                             | T <sub>j</sub> =125°C |      | 8.4  |      |       |

**Thermal Characteristics**

| Symbol          | Parameter                                | Typ.  | Max.  | Units |
|-----------------|------------------------------------------|-------|-------|-------|
| $R_{\theta JC}$ | Junction-to-Case (per IGBT)              |       | 0.109 | K/W   |
| $R_{\theta JC}$ | Junction-to-Case (per DIODE)             |       | 0.180 | K/W   |
| $R_{\theta CS}$ | Case-to-Sink (Conductive grease applied) | 0.035 |       | K/W   |
| G               | Weight of Module                         | 300   |       | g     |

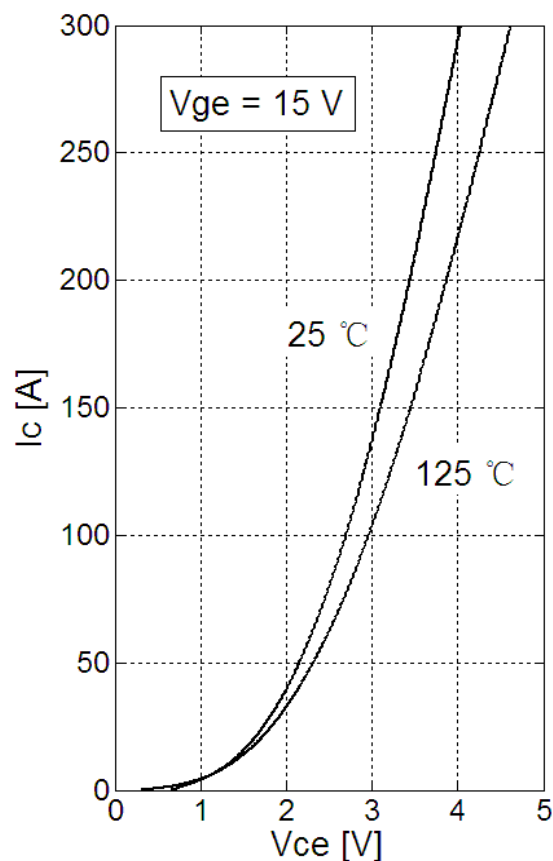


Fig 1. IGBT Typical Output Characteristics

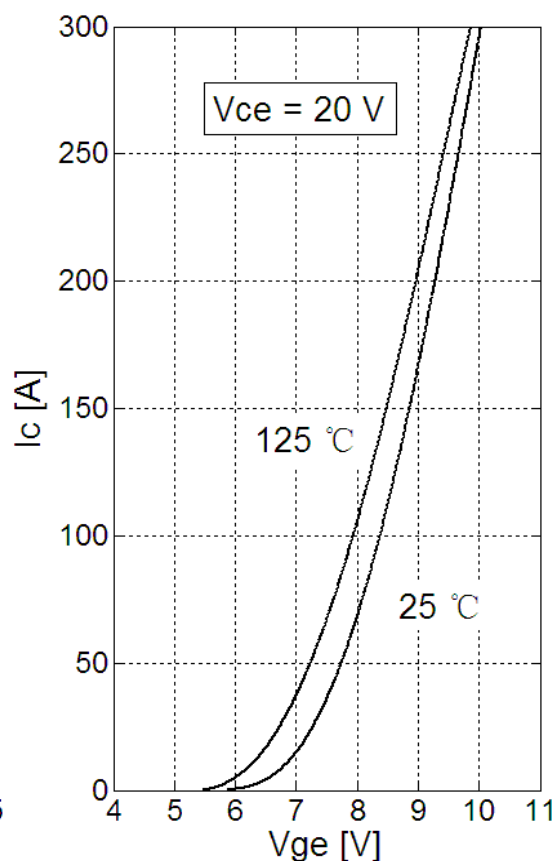
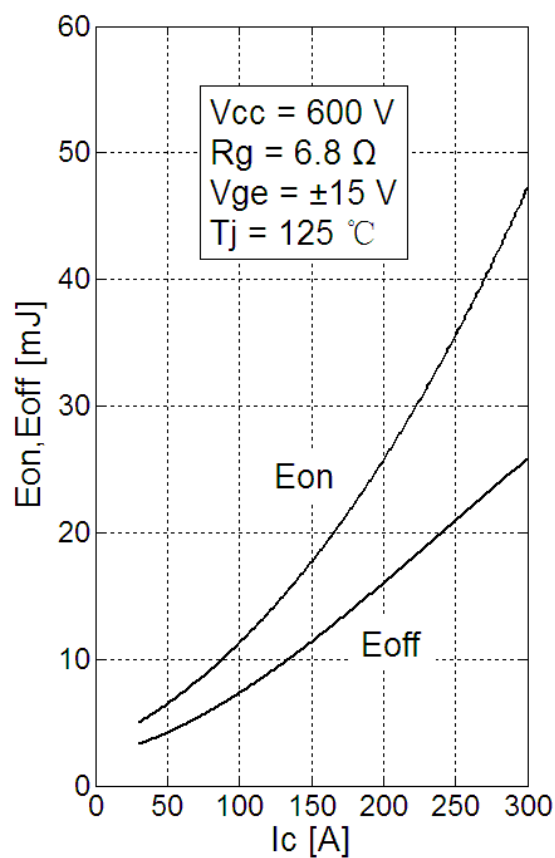
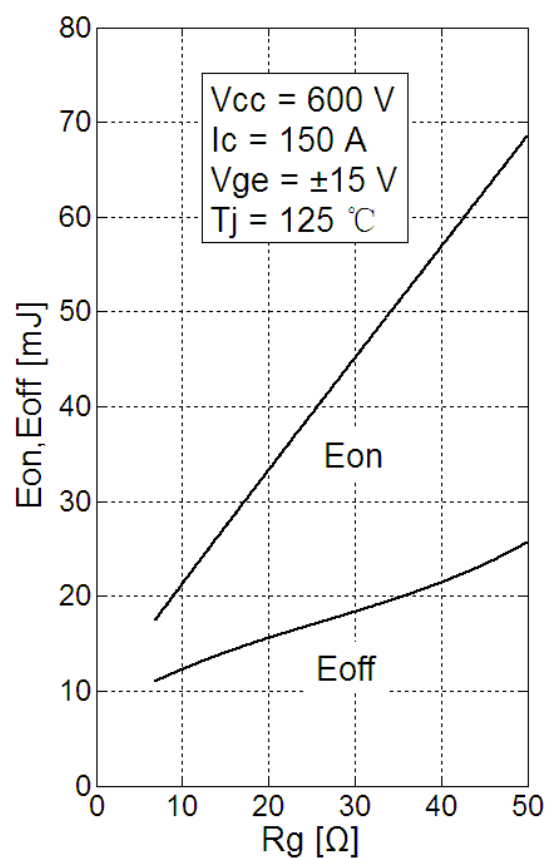


Fig 2. IGBT Typical Transfer Characteristics

Fig 3. IGBT Switching Loss vs.  $I_c$ Fig 4. IGBT Switching Loss vs.  $R_g$

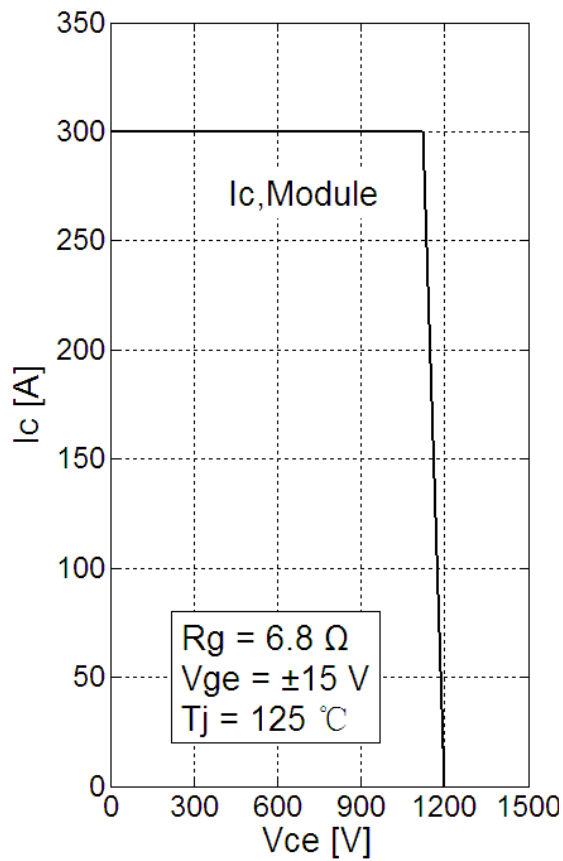


Fig 5. RBSOA

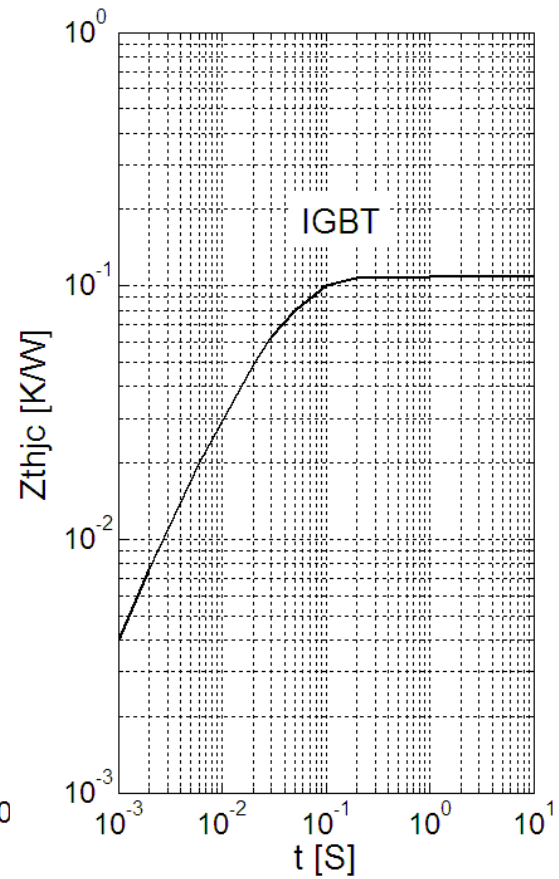


Fig 6. IGBT Transient Thermal Impedance

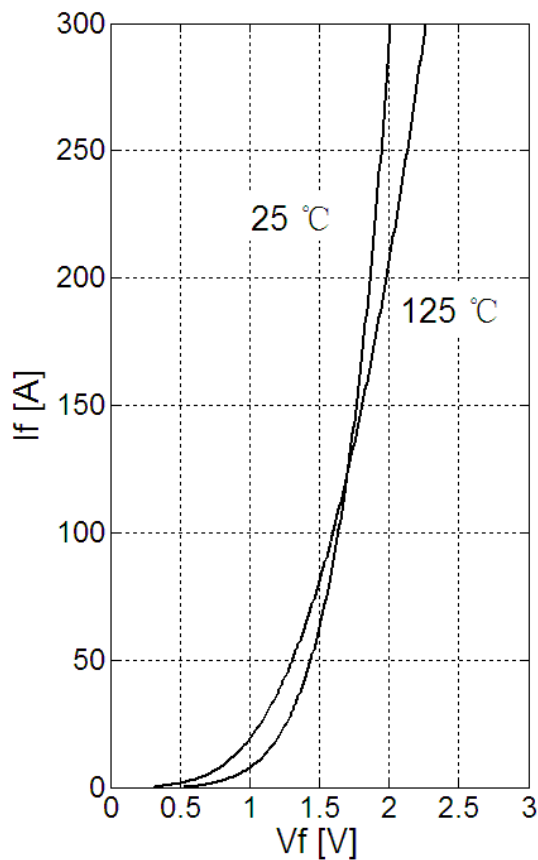
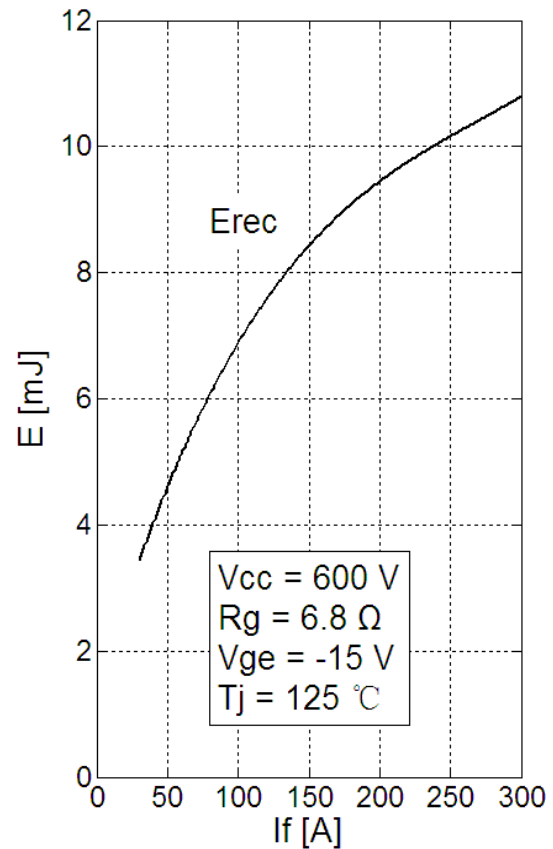


Fig 7. Diode Typical Forward Characteristics

Fig 8. Diode Switching Loss vs.  $I_f$

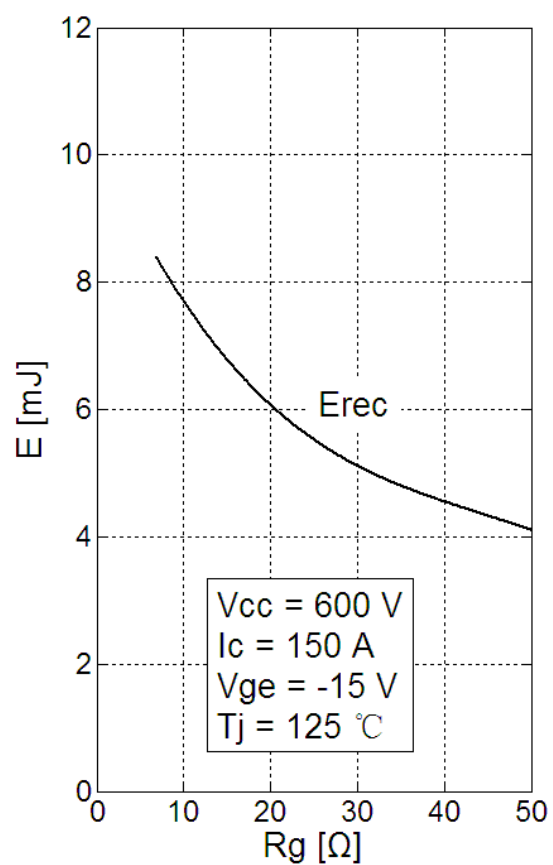
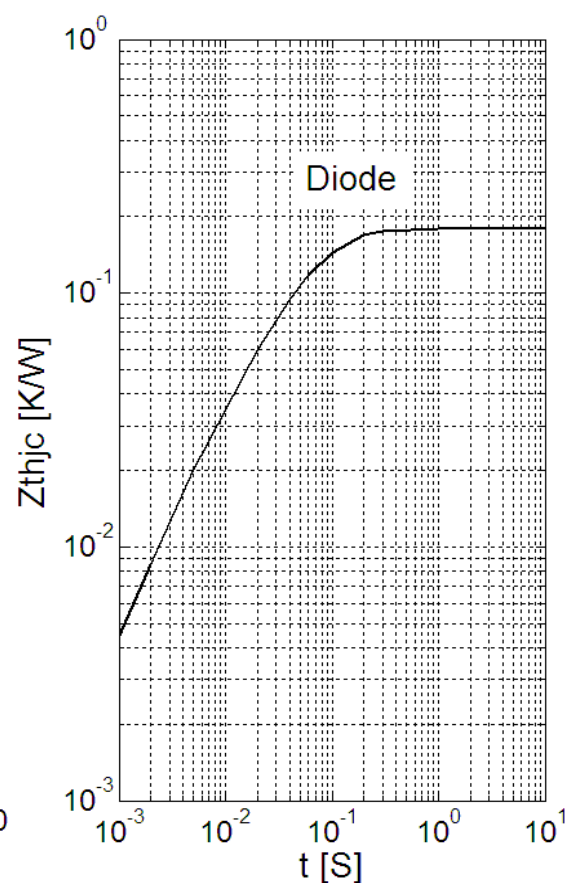
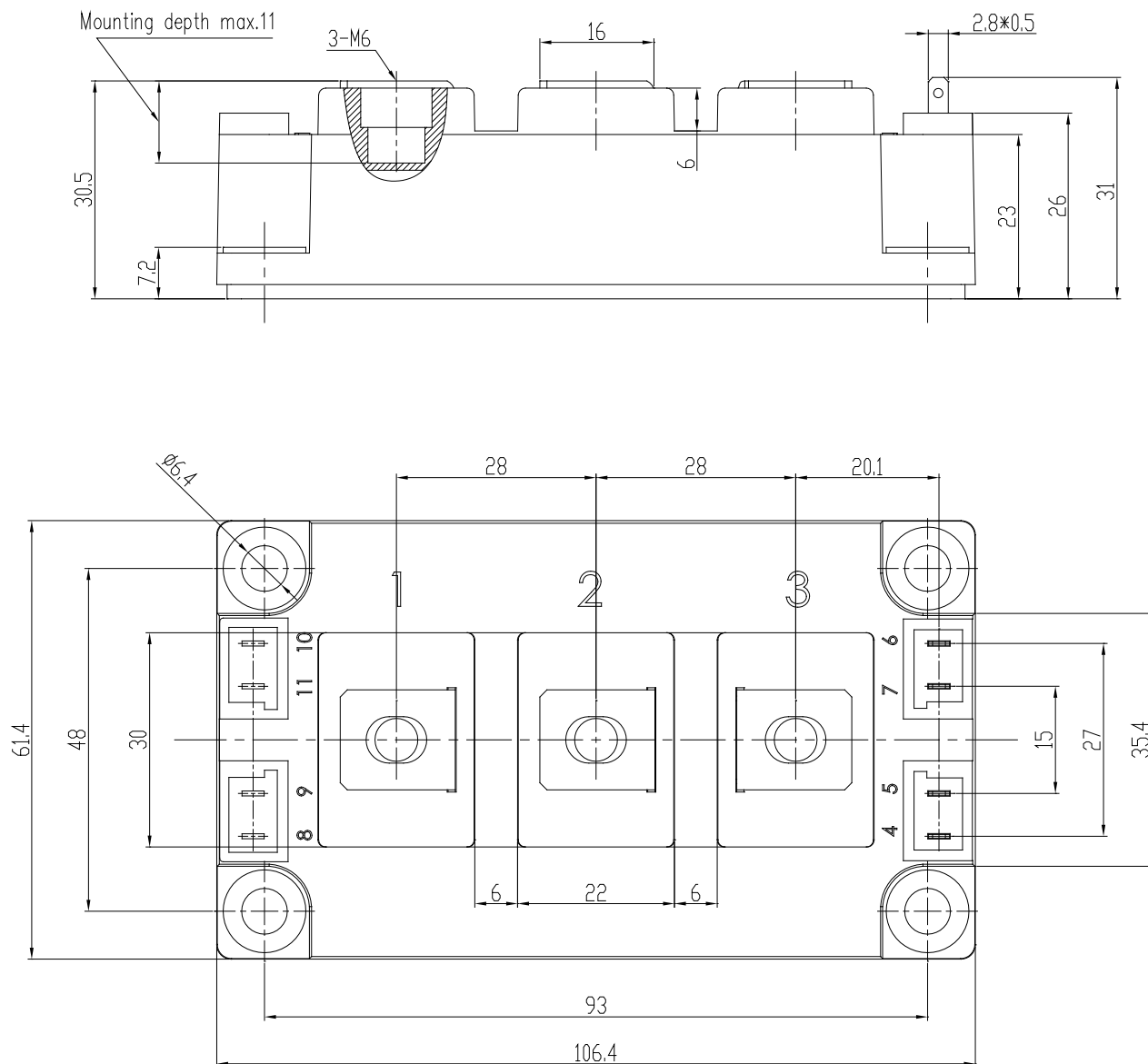
Fig 9. Diode Switching Loss vs.  $R_g$ 

Fig 10. Diode Transient Thermal Impedance

## Package Dimension

Dimensions in Millimeters





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