# STARPOWER

SEMICONDUCTOR

# IGBT

# GD300HFT170C2S

## Molding Type Module

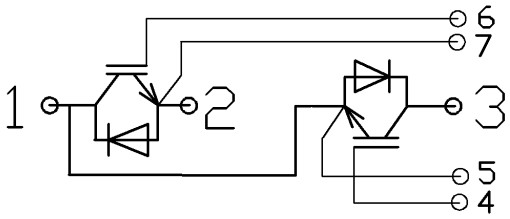
## 1700V/300A 2 in one-package

## General Description

STARPOWER IGBT Power Module provides ultra low conduction loss as well as short circuit ruggedness. They are designed for the applications such as AC inverters.

## Features

- Low $V_{CE(sat)}$ trench IGBT technology
- Low switching losses
- 10μs short circuit capability
- $V_{CE(sat)}$ 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

- AC inverter drives mains 575-750V AC
- Public transport (auxiliary syst.)

## Absolute Maximum Ratings $T_C$=25℃ unless otherwise noted

| Symbol | Description | GD300HFT170C2S | Units |
|---|---|---|---|
| $V_{CES}$ | Collector-Emitter Voltage | 1700 | V |

| Symbol | Description | GD300HFT170C2S | Units |
|---|---|---|---|
| $V_{GES}$ | Gate-Emitter Voltage | ±20 | V |
| $I_C$ | Collector Current @ $T_C$=25℃ | 550 | A |
| | @ $T_C$=80℃ | 300 | |
| $I_{CM(1)}$ | Pulsed Collector Current $t_p$=1ms | 600 | A |
| $I_F$ | Diode Continuous Forward Current | 300 | A |
| $I_{FM}$ | Diode Maximum Forward Current | 600 | A |
| $P_D$ | Maximum Power Dissipation @ $T_j$=175℃ | 2083 | W |
| $T_{SC}$ | Short Circuit Withstand Time @ $T_j$=125℃ | 10 | μs |
| $T_{jmax}$ | Maximum Junction Temperature | 175 | ℃ |
| $T_{STG}$ | Storage Temperature Range | -40 to +125 | ℃ |
| $I^2t$-value,Diode | $V_R$=0V,t=10ms,$T_j$=125℃ | 14500 | $A^2s$ |
| $V_{ISO}$ | Isolation Voltage RMS,f=50Hz,t=1min | 4000 | V |
| Mounting Torque | Power Terminal Screw:M6 | 2.5 to 5.0 | N.m |
| | Mounting Screw:M6 | 3.0 to 5.0 | N.m |

**Notes:**

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

# Electrical Characteristics of IGBT $T_C$=25℃ unless otherwise noted

## Off Characteristics

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $BV_{CES}$ | Collector-Emitter Breakdown Voltage | $V_{GE}$=0V, $I_C$=4.0mA, $T_j$=25℃ | 1700 | | | V |
| $I_{CES}$ | Collector Cut-Off Current | $V_{CE}$=$V_{CES}$,$V_{GE}$=0V, $T_j$=25℃ | | | 3.0 | mA |
| $I_{GES}$ | Gate-Emitter Leakage Current | $V_{GE}$=$V_{GES}$,$V_{CE}$=0V, $T_j$=25℃ | | | 400 | nA |

## On Characteristics

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $V_{GE(th)}$ | Gate-Emitter Threshold Voltage | $I_C$=12.0mA,$V_{CE}$=$V_{GE}$, $T_j$=25℃ | 5.2 | 5.8 | 6.4 | V |
| $V_{CE(sat)}$ | Collector to Emitter Saturation Voltage | $I_C$=300A,$V_{GE}$=15V, $T_j$=25℃ | | 2.0 | | V |
| | | $I_C$=300A,$V_{GE}$=15V, $T_j$=125℃ | | 2.4 | | |

## Switching Characteristics

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-On Delay Time | $V_{CC}$=900V,$I_C$=300A, | | 281 | | ns |
| $t_r$ | Rise Time | $R_G$=4.7Ω,$V_{GE}$=±15V, | | 82 | | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | $T_j$=25℃ | | 801 | | ns |

| | | | | | | |
|---|---|---|---|---|---|---|
| $t_f$ | Fall Time | $V_{CC}$=900V,$I_C$=300A, $R_G$=4.7Ω,$V_{GE}$=±15V, $T_j$=25℃ | | 121 | | ns |
| $E_{on}$ | Turn-On Switching Loss | | | 70 | | mJ |
| $E_{off}$ | Turn-Off Switching Loss | | | 65 | | mJ |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{CC}$=900V,$I_C$=300A, $R_G$=4.7Ω,$V_{GE}$=±15V, $T_j$=125℃ | | 303 | | ns |
| $t_r$ | Rise Time | | | 103 | | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 1002 | | ns |
| $t_f$ | Fall Time | | | 203 | | ns |
| $E_{on}$ | Turn-On Switching Loss | | | 105 | | mJ |
| $E_{off}$ | Turn-Off Switching Loss | | | 94 | | mJ |
| $C_{ies}$ | Input Capacitance | $V_{CE}$=25V,f=1MHz, $V_{GE}$=0V | | 27.0 | | nF |
| $C_{oes}$ | Output Capacitance | | | 1.1 | | nF |
| $C_{res}$ | Reverse Transfer Capacitance | | | 0.9 | | nF |
| $I_{SC}$ | SC Data | $t_{SC}$≤10μs,$V_{GE}$=15V, $T_j$=125℃,$V_{CC}$=1000V, $V_{CEM}$≤1700V | | 1200 | | A |
| $R_{Gint}$ | Internal Gate Resistance | | | 2.5 | | Ω |
| $L_{CE}$ | Stray Inductance | | | | 20 | nH |
| $R_{CC'+EE'}$ | Module Lead Resistance, Terminal to Chip | $T_C$=25℃ | | 0.35 | | mΩ |

## Electrical Characteristics of DIODE $T_C$=25℃ unless otherwise noted

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| $V_F$ | Diode Forward Voltage | $I_F$=300A | $T_j$=25℃ | | 1.8 | | V |
| | | | $T_j$=125℃ | | 1.9 | | |
| $Q_r$ | Diode Reverse Recovery Charge | $I_F$=300A, $V_R$=900V, di/dt=-3600A/μs, $V_{GE}$=-15V | $T_j$=25℃ | | 77 | | μC |
| | | | $T_j$=125℃ | | 131 | | |
| $I_{RM}$ | Diode Peak Reverse Recovery Current | | $T_j$=25℃ | | 351 | | A |
| | | | $T_j$=125℃ | | 383 | | |
| $E_{rec}$ | Reverse Recovery Energy | | $T_j$=25℃ | | 40 | | mJ |
| | | | $T_j$=125℃ | | 72 | | |

## Thermal Characteristics

| Symbol | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case (IGBT Part, per 1/2 Module) | | 0.072 | K/W |
| $R_{\theta JC}$ | Junction-to-Case (DIODE Part, per 1/2 Module) | | 0.13 | K/W |
| $R_{\theta JC}$ | Case-to-Sink (Conductive grease applied) | 0.035 | | K/W |
| Weight | Weight of Module | 300 | | g |

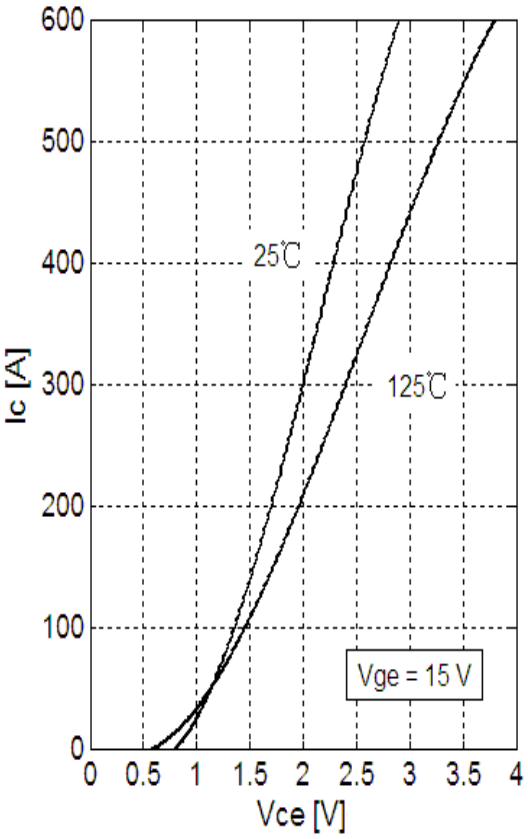



Fig 1. IGBT Typical Output Characteristics

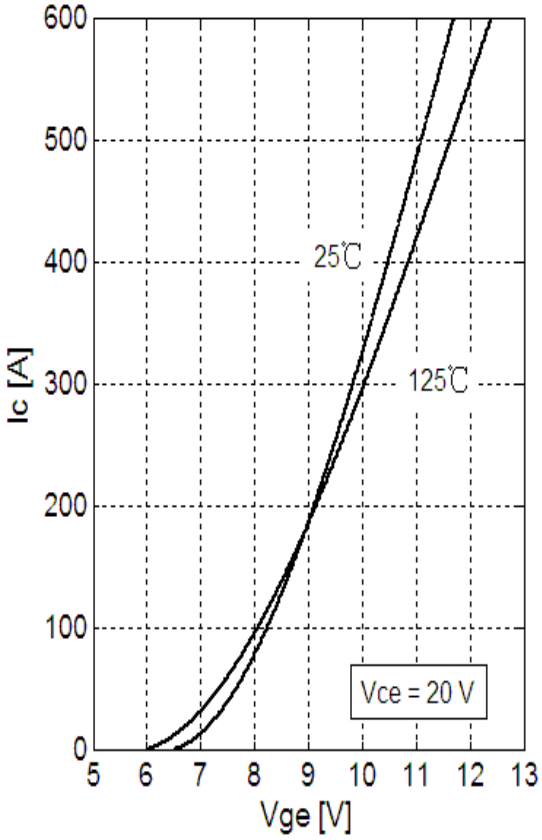



Fig 2. IGBT Typical Transfer Characteristics

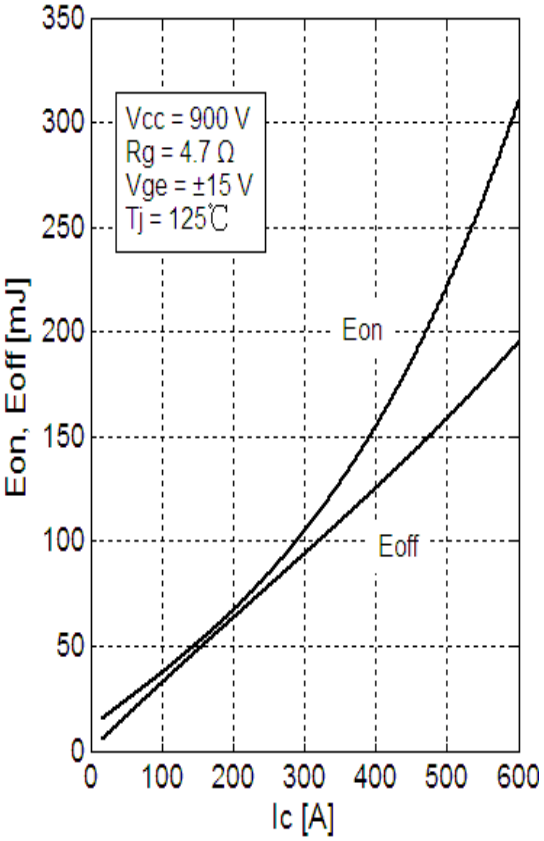



Fig 3. IGBT Switching Loss vs. Collector Current

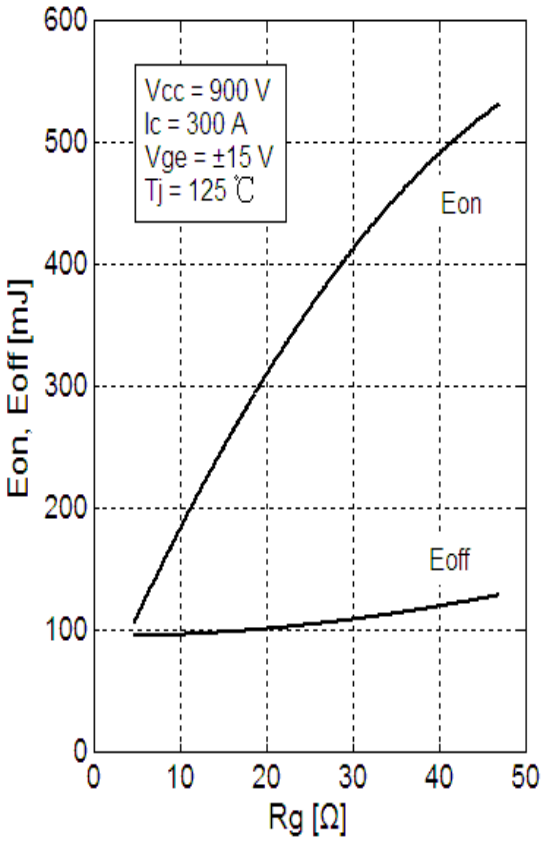



Fig 4. IGBT Switching Loss vs. Gate Resistor

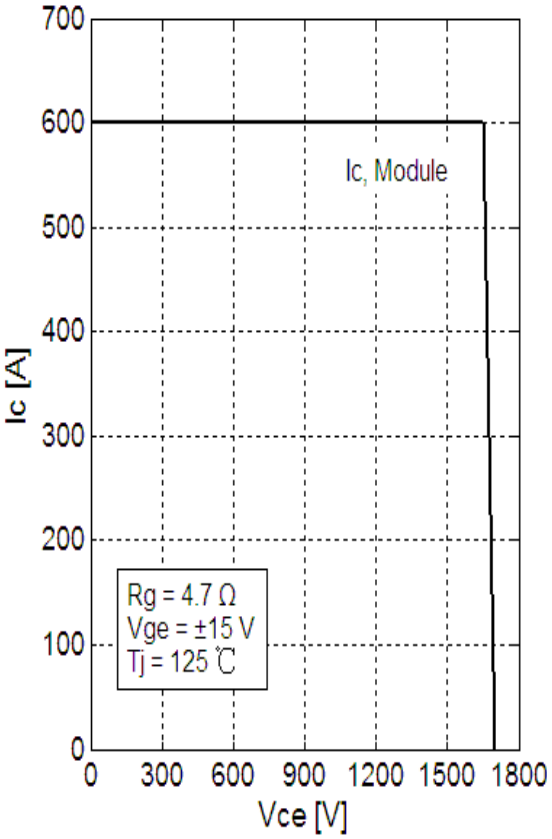



Fig 5. RBSOA

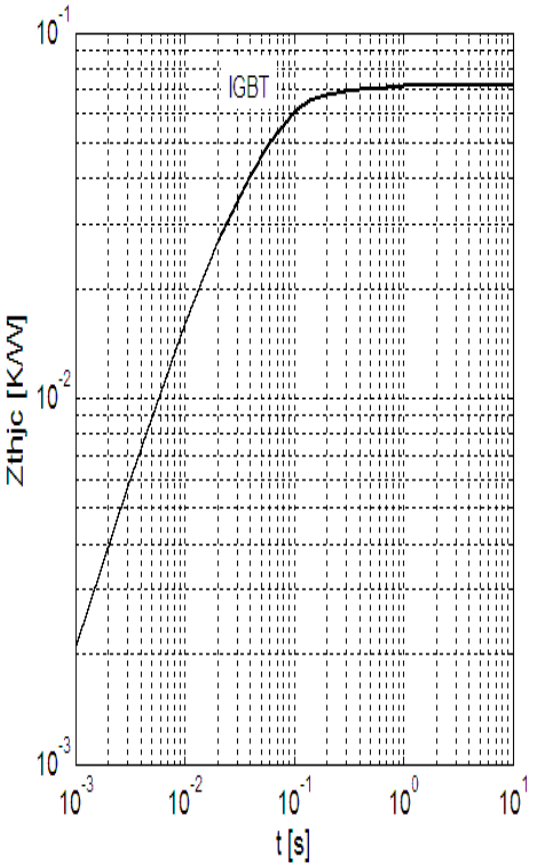



Fig 6. IGBT Transient Thermal Impedance

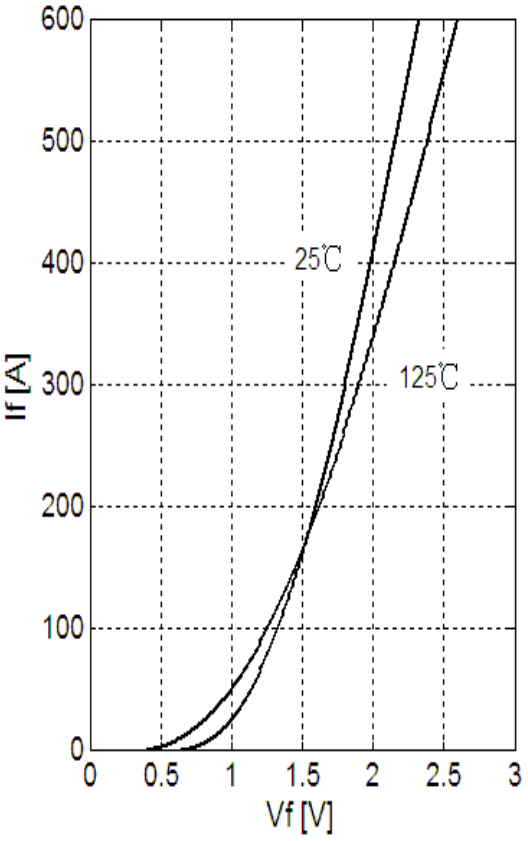



Fig 7. Forward Characteristics of Diode

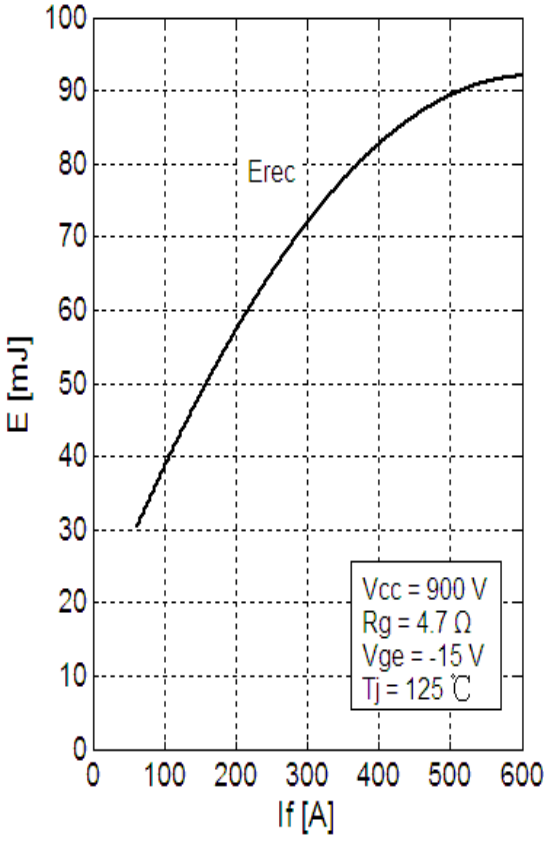



Fig 8. Diode Switching Loss vs. Collector Current

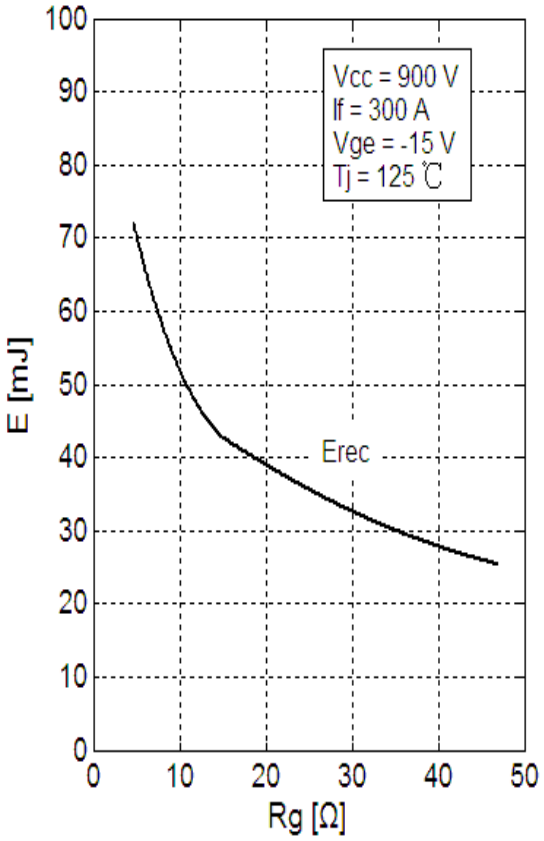



**Fig9. Diode Switching Loss vs. Gate Resistor**

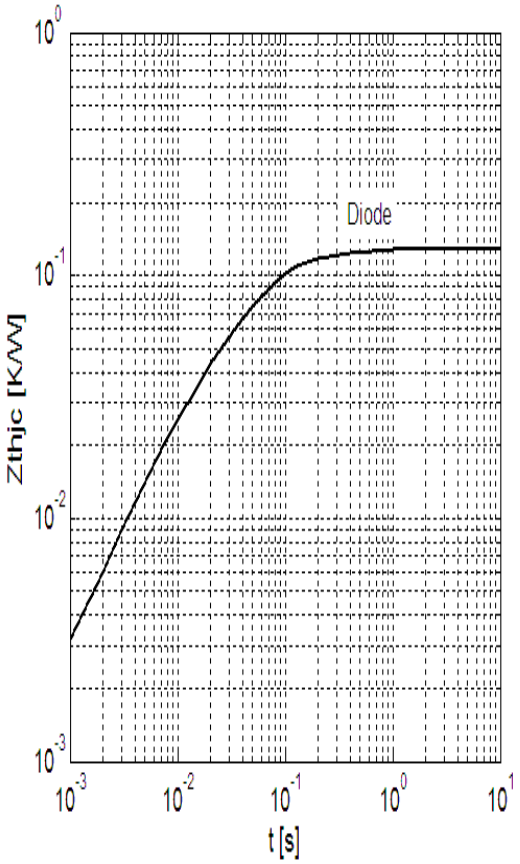
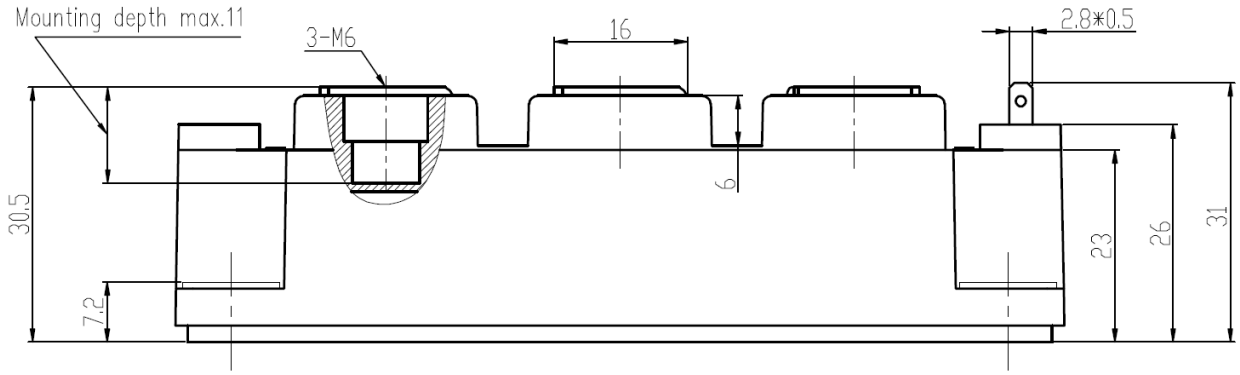
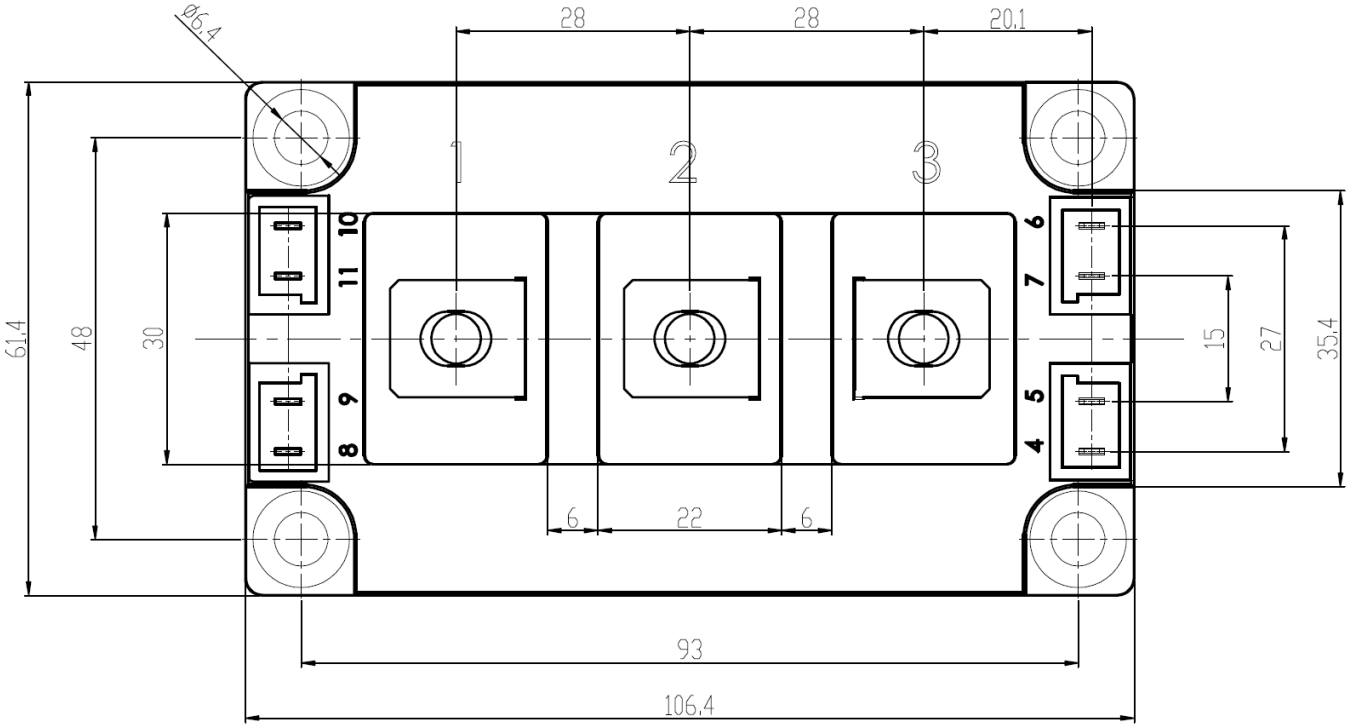



**Fig 10. Diode Transient Thermal Impedance**

# Package Dimension

**Dimensions in Millimeters**



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