# STARPOWER

SEMICONDUCTOR™

# IGBT

# GD50HFT170C1S

## Molding Type Module

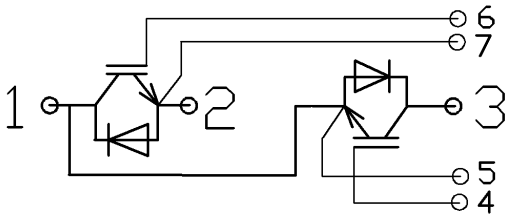
## 1700V/50A 2 in one-package


## 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 | GD50HFT170C1S | Units |
|---|---|---|---|
| $V_{CES}$ | Collector-Emitter Voltage | 1700 | V |

| Symbol | Description | GD50HFT170C1S | Units |
|---|---|---|---|
| $V_{GES}$ | Gate-Emitter Voltage | ±20 | V |
| $I_C$ | Collector Current @ $T_C$=25℃ | 90 | A |
| | @ $T_C$=80℃ | 50 | |
| $I_{CM(1)}$ | Pulsed Collector Current $t_p$=1ms | 100 | A |
| $I_F$ | Diode Continuous Forward Current | 50 | A |
| $I_{FM}$ | Diode Maximum Forward Current | 100 | A |
| $P_D$ | Maximum Power Dissipation @ $T_j$=175℃ | 405 | 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℃ | 425 | $A^2s$ |
| $V_{ISO}$ | Isolation Voltage RMS,f=50Hz,t=1min | 4000 | V |
| Mounting Torque | Power Terminal Screw:M5 | 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, $I_C$=2.5mA, $T_j$=25℃ | 1700 | | | V |
| $I_{CES}$ | Collector Cut-Off Current | $V_{CE}$=$V_{CES}$,$V_{GE}$=0V, $T_j$=25℃ | | | 1.0 | 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 | $I_C$=2.0mA,$V_{CE}$=$V_{GE}$, $T_j$=25℃ | 5.2 | 5.8 | 6.4 | V |
| $V_{CE(sat)}$ | Collector to Emitter Saturation Voltage | $I_C$=50A,$V_{GE}$=15V, $T_j$=25℃ | | 2.0 | | V |
| | | $I_C$=50A,$V_{GE}$=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,$I_C$=50A, | | 370 | | ns |
| $t_r$ | Rise Time | $R_G$=8.0Ω,$V_{GE}$=±15V, | | 40 | | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | $T_j$=25℃ | | 650 | | ns |

| | | | | | | |
|---|---|---|---|---|---|---|
| $t_f$ | Fall Time | $V_{CC}$=900V,$I_C$=50A, $R_G$=8.0Ω,$V_{GE}$=±15V, $T_j$=25℃ | | 180 | | ns |
| $E_{on}$ | Turn-On Switching Loss | | | 11.0 | | mJ |
| $E_{off}$ | Turn-Off Switching Loss | | | 10.5 | | mJ |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{CC}$=900V,$I_C$=50A, $R_G$=8.0Ω,$V_{GE}$=±15V, $T_j$=125℃ | | 400 | | ns |
| $t_r$ | Rise Time | | | 50 | | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 800 | | ns |
| $t_f$ | Fall Time | | | 300 | | ns |
| $E_{on}$ | Turn-On Switching Loss | | | 16.0 | | mJ |
| $E_{off}$ | Turn-Off Switching Loss | | | 15.5 | | mJ |
| $C_{ies}$ | Input Capacitance | $V_{CE}$=25V,f=1MHz, $V_{GE}$=0V | | 4.50 | | nF |
| $C_{oes}$ | Output Capacitance | | | 0.18 | | nF |
| $C_{res}$ | Reverse Transfer Capacitance | | | 0.15 | | nF |
| $I_{SC}$ | SC Data | $t_{SC}$≤10μs,$V_{GE}$=15V, $T_j$=125℃,$V_{CC}$=1000V, $V_{CEM}$≤1700V | | 200 | | A |
| $R_{Gint}$ | Internal Gate Resistance | | | 9.5 | | Ω |
| $L_{CE}$ | Stray Inductance | | | | 30 | nH |
| $R_{CC'+EE'}$ | Module Lead Resistance, Terminal to Chip | $T_C$=25℃ | | 0.75 | | mΩ |

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

| Symbol | Parameter | Test Conditions | | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|---|
| $V_F$ | Diode Forward Voltage | $I_F$=50A | $T_j$=25℃ | | 1.80 | | V |
| | | | $T_j$=125℃ | | 1.90 | | |
| $Q_r$ | Diode Reverse Recovery Charge | $I_F$=50A, $V_R$=900V, di/dt=-1200A/μs, $V_{GE}$=-15V | $T_j$=25℃ | | 14.5 | | μC |
| | | | $T_j$=125℃ | | 24.5 | | |
| $I_{RM}$ | Diode Peak Reverse Recovery Current | | $T_j$=25℃ | | 76.5 | | A |
| | | | $T_j$=125℃ | | 83.5 | | |
| $E_{rec}$ | Reverse Recovery Energy | | $T_j$=25℃ | | 7.6 | | mJ |
| | | | $T_j$=125℃ | | 13.5 | | |

## Thermal Characteristics

| Symbol | Parameter | Typ. | Max. | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ | Junction-to-Case (IGBT Part, per 1/2 Module) | | 0.37 | K/W |
| $R_{\theta JC}$ | Junction-to-Case (DIODE Part, per 1/2 Module) | | 0.54 | K/W |
| $R_{\theta CS}$ | Case-to-Sink (Conductive grease applied) | 0.05 | | K/W |
| Weight | Weight of Module | 150 | | g |

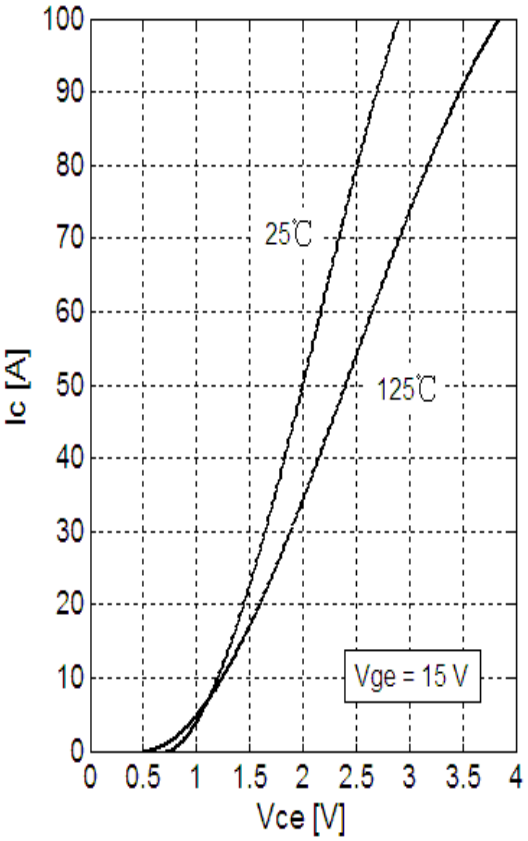



Fig 1. IGBT Typical Output Characteristics

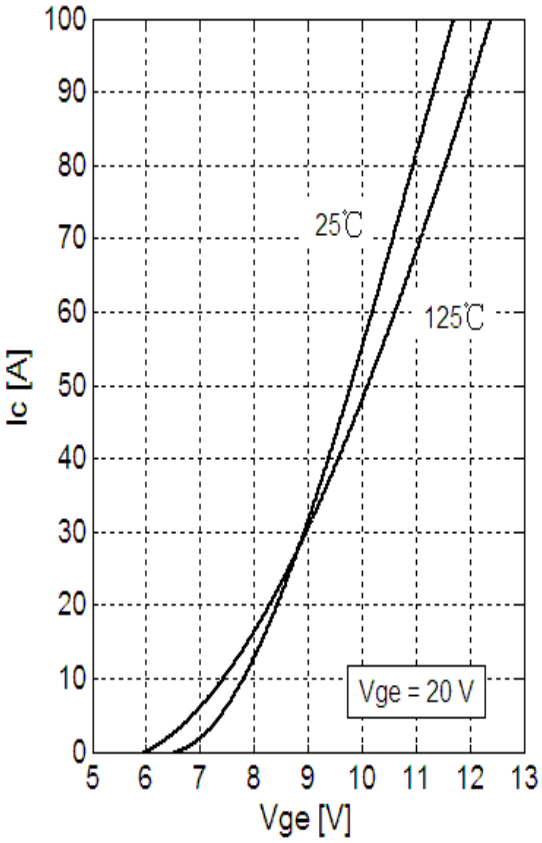



Fig 2. IGBT Typical Transfer Characteristics

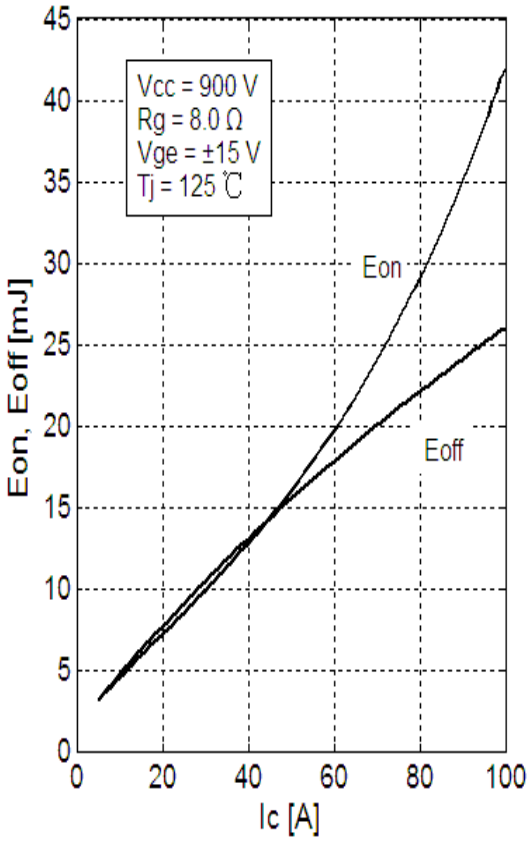



Fig 3. IGBT Switching Loss vs. Collector Current

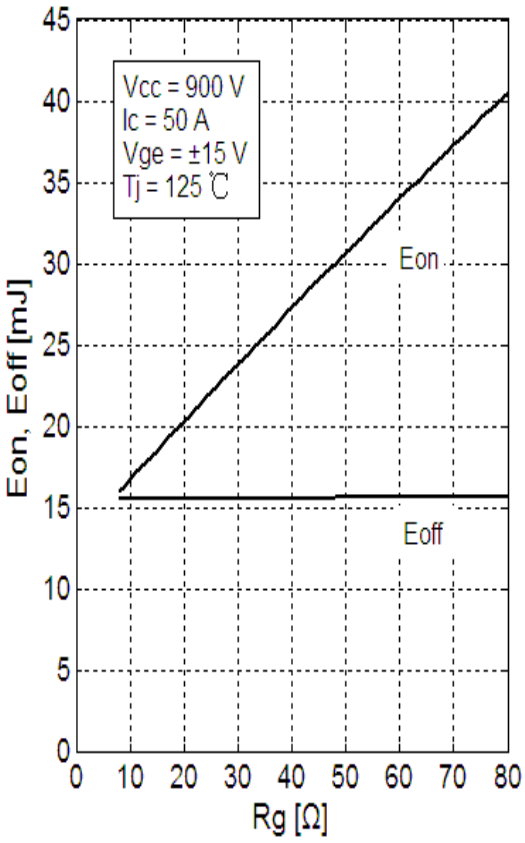



Fig 4. IGBT Switching Loss vs. Gate Resistor

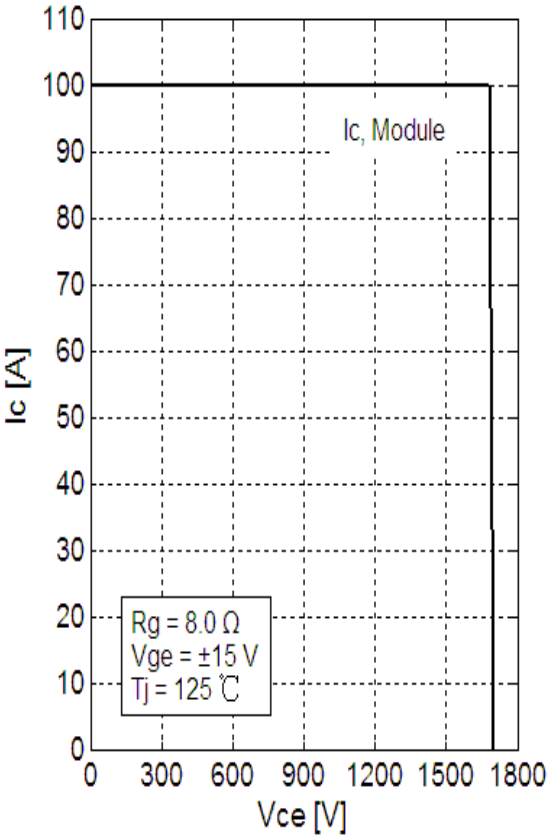



**Fig 5. RBSOA**

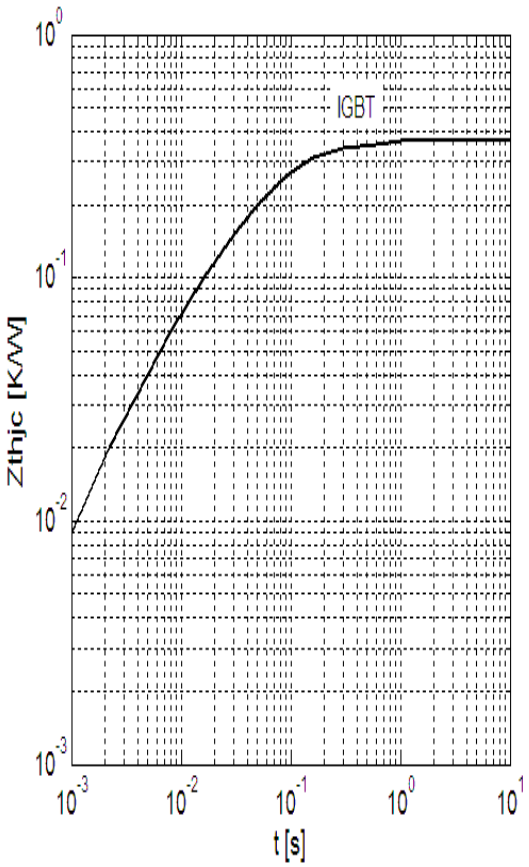



**Fig 6. IGBT Transient Thermal Impedance**

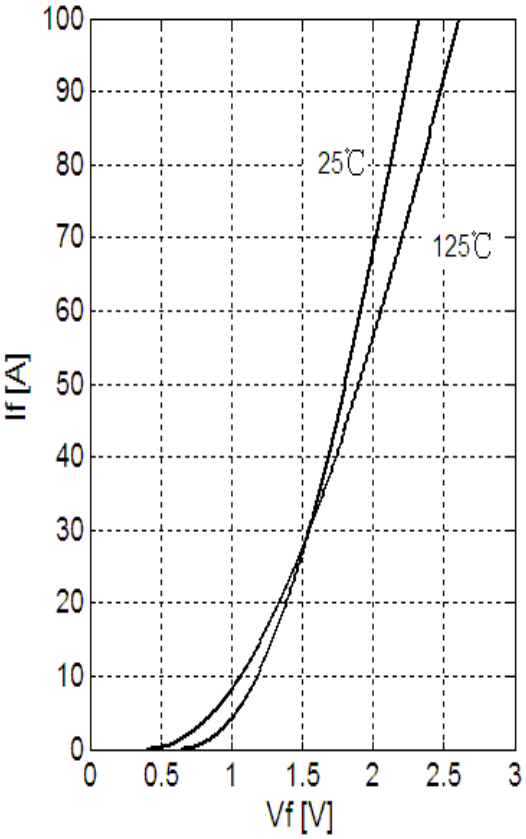



**Fig 7. Forward Characteristics of Diode**

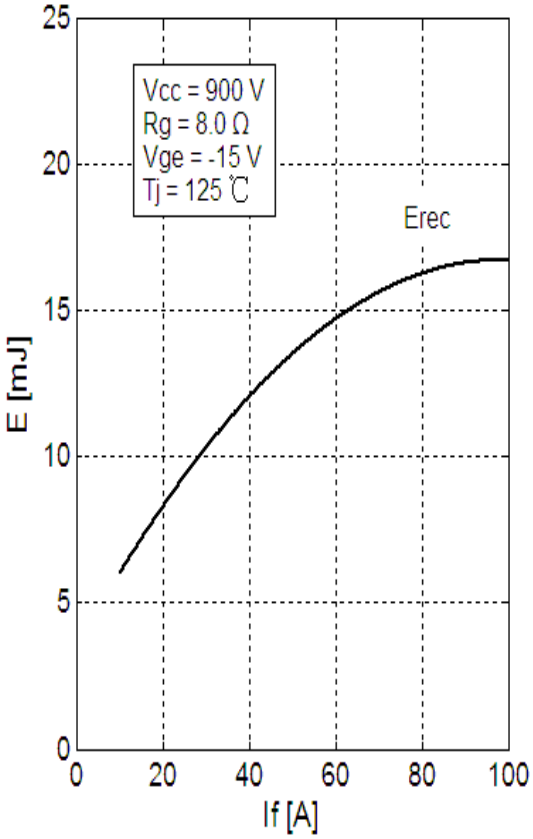



**Fig 8. Diode Switching Loss vs. Collector Current**

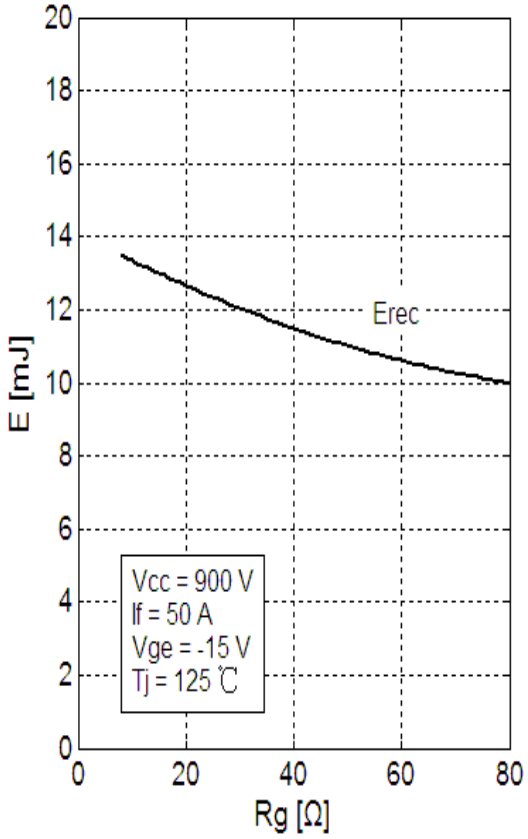



**Fig9. Diode Switching Loss vs. Gate Resistor**

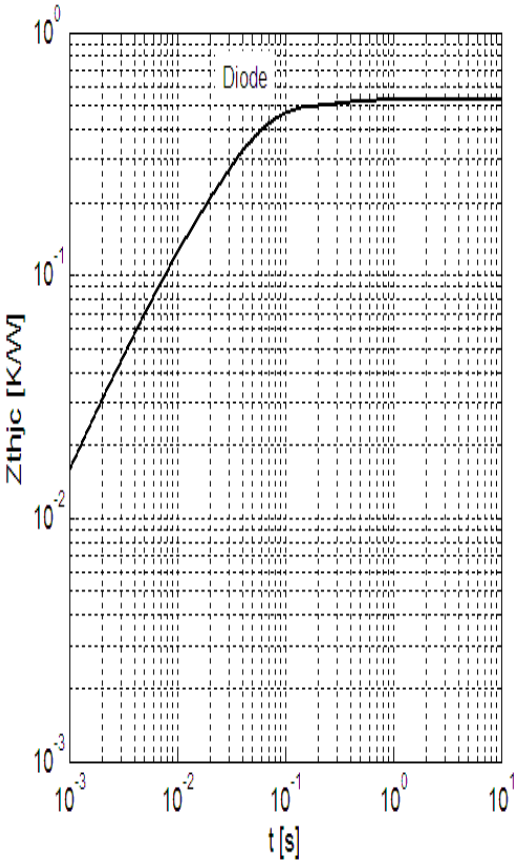
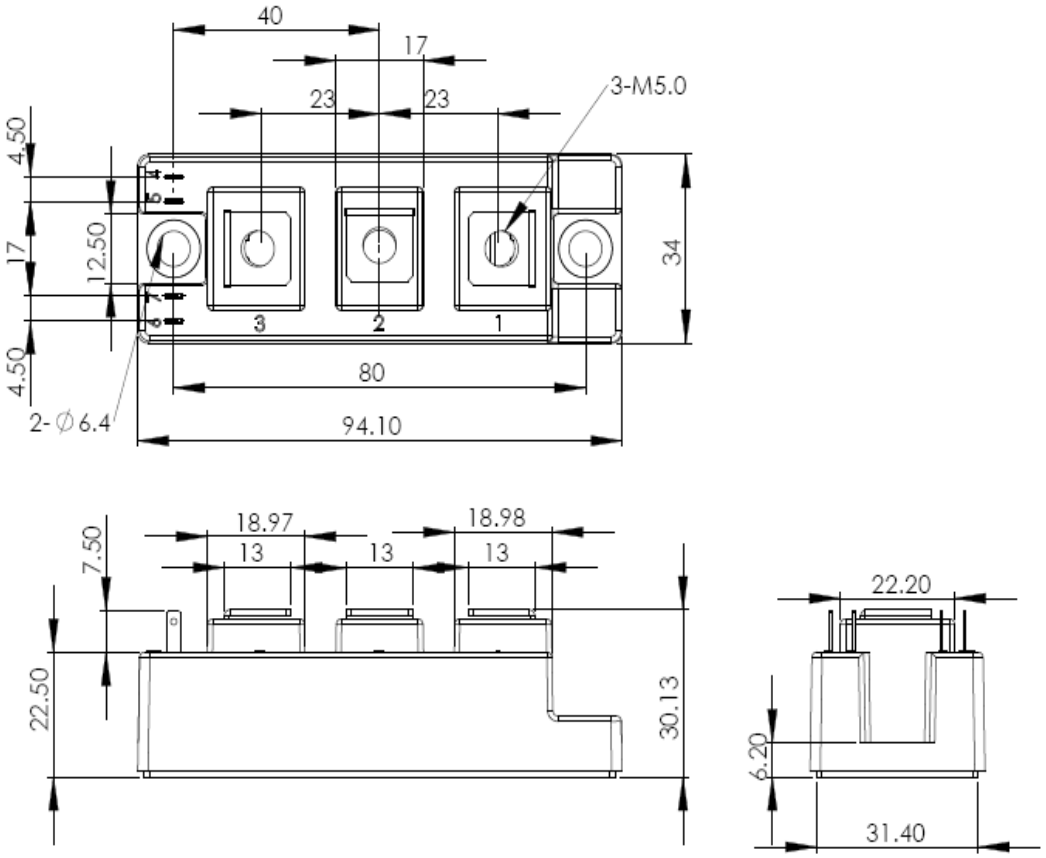



**Fig 10. Diode Transient Thermal Impedance**

# Package Dimension

**Dimensions in Millimeters**



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