

# STARPOWER

SEMICONDUCTOR™

## IGBT

### GD75HFU120C1S

Molding Type Module

1200V/75A 2 in one-package

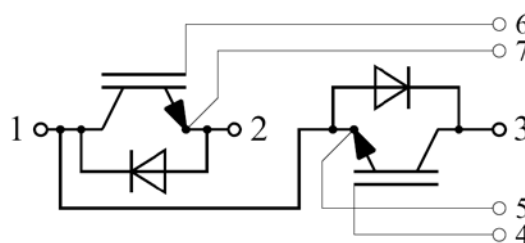
#### General Description

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



#### Features

- Low  $V_{CE(sat)}$  NPT IGBT technology
- Low switching losses
- 10 $\mu$ s 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

- UPS
- Switching mode power supplies
- Electronic welders

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

| Symbol          | Description                                                                | GD75HFU120C1S            | Units              |
|-----------------|----------------------------------------------------------------------------|--------------------------|--------------------|
| $V_{CES}$       | Collector-Emitter Voltage                                                  | 1200                     | V                  |
| $V_{GES}$       | Gate-Emitter Voltage                                                       | $\pm 20$                 | V                  |
| $I_C$           | Collector Current @ $T_C=25^{\circ}\text{C}$<br>@ $T_C=80^{\circ}\text{C}$ | 150                      | A                  |
|                 |                                                                            | 75                       |                    |
| $I_{CM(1)}$     | Pulsed Collector Current $t_p=1\text{ms}$                                  | 150                      | A                  |
| $I_F$           | Diode Continuous Forward Current                                           | 75                       | A                  |
| $I_{FM}$        | Diode Maximum Forward Current                                              | 150                      | A                  |
| $P_D$           | Maximum Power Dissipation @ $T_j=150^{\circ}\text{C}$                      | 658                      | 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:M5<br>Mounting Screw:M6                               | 2.5 to 5.0<br>3.0 to 5.0 | N.m                |

**Notes:**

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

**Electrical Characteristics of IGBT**  $T_C=25^{\circ}\text{C}$  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          | $I_C=750\mu\text{A}$ , $V_{CE}=V_{GE}$ ,<br>$T_j=25^{\circ}\text{C}$  | 4.4  | 5.2  | 6.0  | V     |
| $V_{CE(sat)}$ | Collector to Emitter Saturation Voltage | $I_C=75\text{A}$ , $V_{GE}=15\text{V}$ ,<br>$T_j=25^{\circ}\text{C}$  |      | 3.10 | 3.60 | V     |
|               |                                         | $I_C=75\text{A}$ , $V_{GE}=15\text{V}$ ,<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                       | $V_{CC}=600V, I_C=75A,$<br>$R_G=7.5\Omega, V_{GE}=\pm 15V,$<br>$T_J=25^\circ C$             |      | 286  |      | ns         |
| $t_r$         | Rise Time                                |                                                                                             |      | 53   |      | ns         |
| $t_{d(off)}$  | Turn-Off Delay Time                      |                                                                                             |      | 304  |      | ns         |
| $t_f$         | Fall Time                                |                                                                                             |      | 103  |      | ns         |
| $E_{on}$      | Turn-On Switching Loss                   |                                                                                             |      | 4.16 |      | mJ         |
| $E_{off}$     | Turn-Off Switching Loss                  |                                                                                             |      | 2.17 |      | mJ         |
| $t_{d(on)}$   | Turn-On Delay Time                       | $V_{CC}=600V, I_C=75A,$<br>$R_G=7.5\Omega, V_{GE}=\pm 15V,$<br>$T_J=125^\circ C$            |      | 297  |      | ns         |
| $t_r$         | Rise Time                                |                                                                                             |      | 56   |      | ns         |
| $t_{d(off)}$  | Turn-Off Delay Time                      |                                                                                             |      | 321  |      | ns         |
| $t_f$         | Fall Time                                |                                                                                             |      | 136  |      | ns         |
| $E_{on}$      | Turn-On Switching Loss                   |                                                                                             |      | 5.82 |      | mJ         |
| $E_{off}$     | Turn-Off Switching Loss                  |                                                                                             |      | 3.44 |      | mJ         |
| $C_{ies}$     | Input Capacitance                        | $V_{CE}=30V, f=1MHz,$<br>$V_{GE}=0V$                                                        |      | 6.40 |      | nF         |
| $C_{oes}$     | Output Capacitance                       |                                                                                             |      | 0.57 |      | nF         |
| $C_{res}$     | Reverse Transfer Capacitance             |                                                                                             |      | 0.23 |      | nF         |
| $I_{SC}$      | SC Data                                  | $t_{SC}\leq 10\mu s, V_{GE}=15V,$<br>$T_J=125^\circ C, V_{CC}=600V,$<br>$V_{CEM}\leq 1200V$ |      | 300  |      | A          |
| $L_{CE}$      | Stray Inductance                         |                                                                                             |      |      | 30   | nH         |
| $R_{CC'+EE'}$ | Module Lead Resistance, Terminal to Chip | $T_C=25^\circ C$                                                                            |      | 0.75 |      | m $\Omega$ |

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

| Symbol    | Parameter                     | Test Conditions                      | Min.              | Typ. | Max. | Units   |
|-----------|-------------------------------|--------------------------------------|-------------------|------|------|---------|
| $V_F$     | Diode Forward Voltage         | $I_F=75A$                            | $T_J=25^\circ C$  | 1.78 | 2.18 | V       |
|           |                               |                                      | $T_J=125^\circ C$ | 1.85 |      |         |
| $Q_r$     | Recovered Charge              | $I_F=75A,$                           | $T_J=25^\circ C$  | 3.6  |      | $\mu C$ |
|           |                               |                                      | $T_J=125^\circ C$ | 7.9  |      |         |
| $I_{RM}$  | Peak Reverse Recovery Current | $V_R=600V,$<br>$di/dt=-1550A/\mu s,$ | $T_J=25^\circ C$  | 63   |      | A       |
|           |                               |                                      | $T_J=125^\circ C$ | 73   |      |         |
| $E_{rec}$ | Reverse Recovery Energy       | $V_{GE}=-15V$                        | $T_J=25^\circ C$  | 2.21 |      | mJ      |
|           |                               |                                      | $T_J=125^\circ C$ | 4.48 |      |         |

**Thermal Characteristics**

| Symbol          | Parameter                                | Typ. | Max. | Units |
|-----------------|------------------------------------------|------|------|-------|
| $R_{\theta JC}$ | Junction-to-Case (per IGBT)              |      | 0.19 | K/W   |
| $R_{\theta JC}$ | Junction-to-Case (per DIODE)             |      | 0.49 | K/W   |
| $R_{\theta CS}$ | Case-to-Sink (Conductive grease applied) | 0.05 |      | K/W   |
| Weight          | Weight of Module                         | 150  |      | g     |

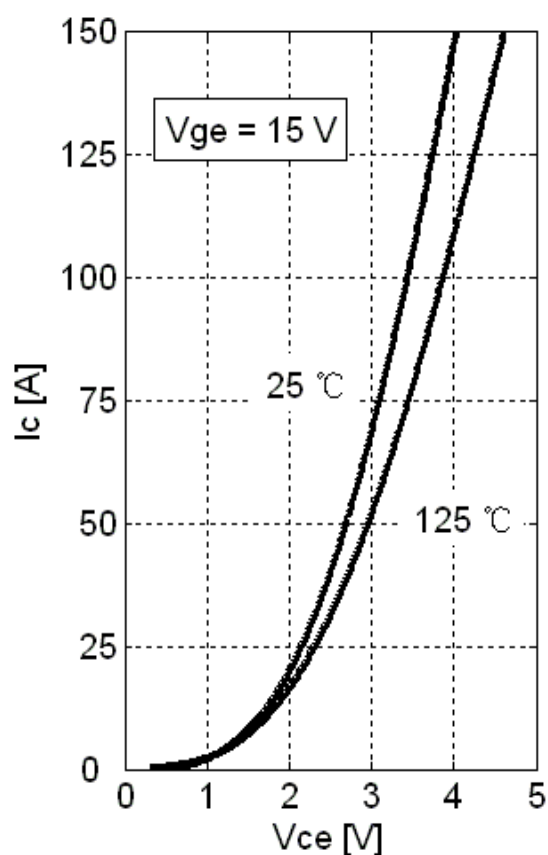


Fig 1. IGBT Typical Output Characteristics

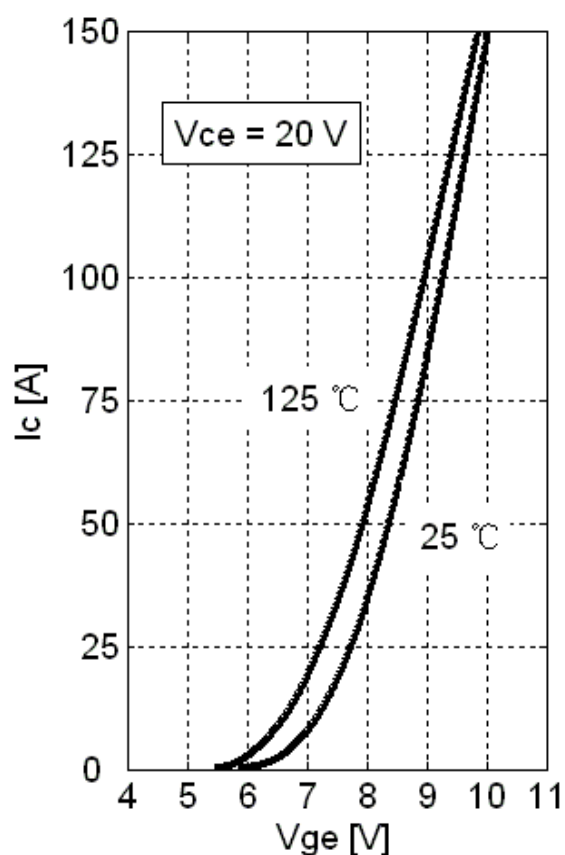
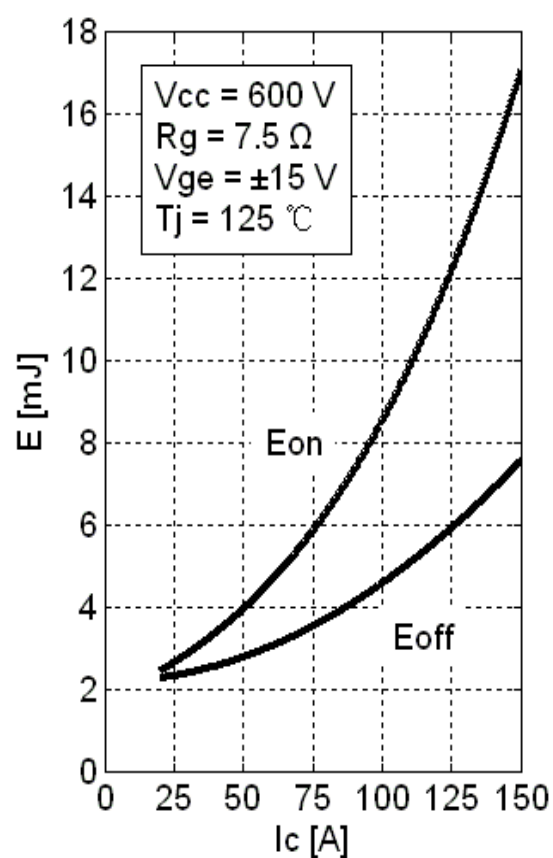
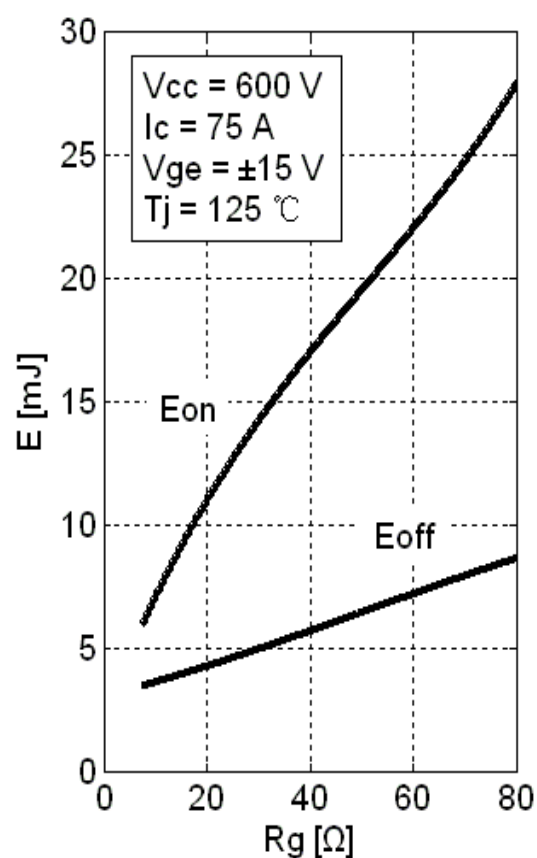


Fig 2. IGBT Typical Transfer Characteristics

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

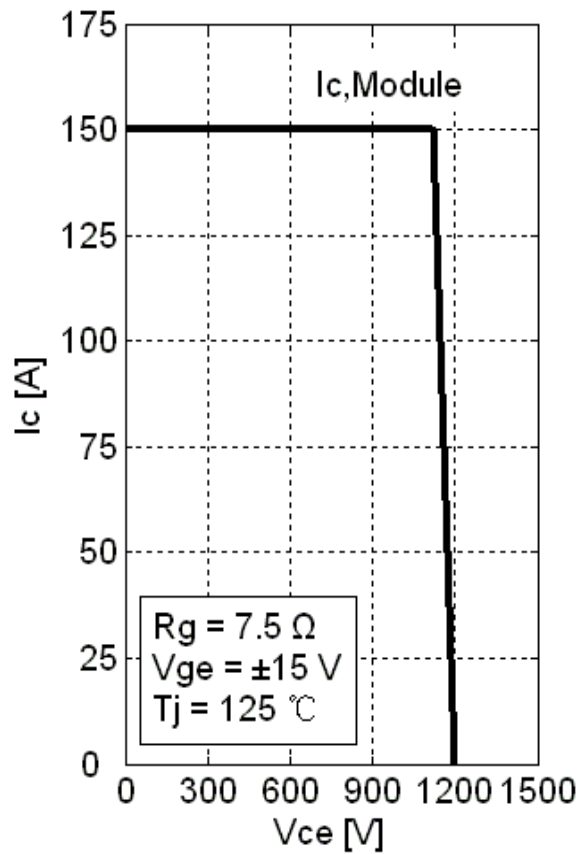


Fig 5. RBSOA

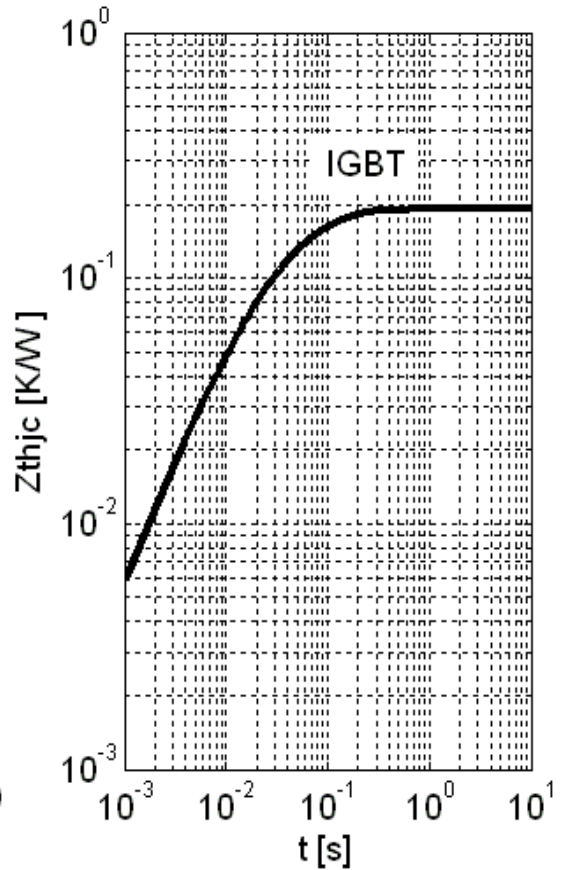


Fig 6. IGBT Transient Thermal Impedance

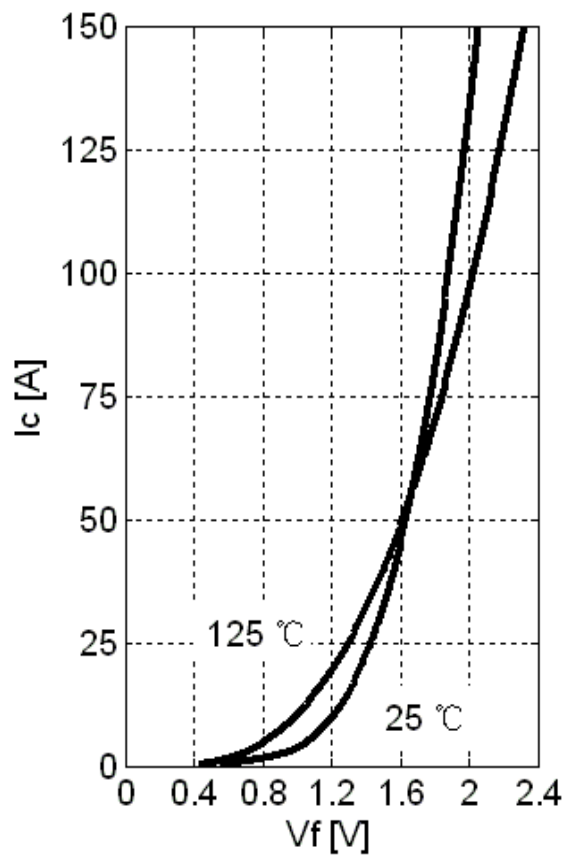
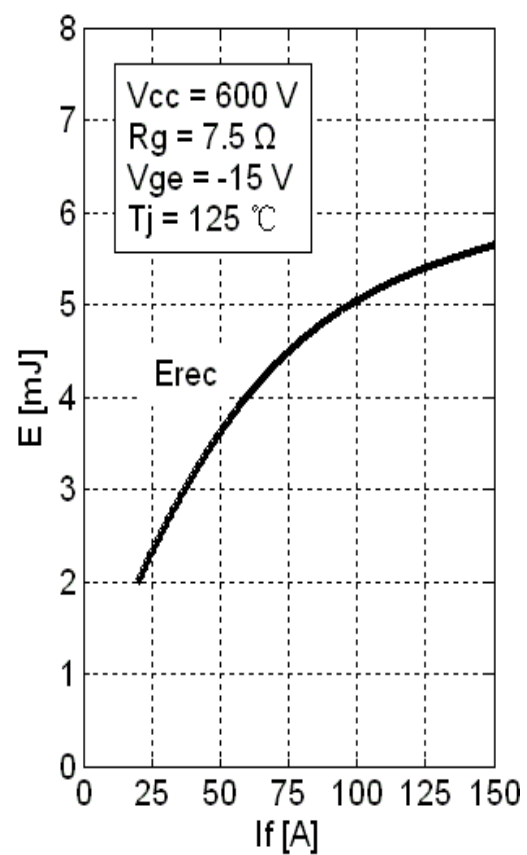


Fig 7. Diode Typical Forward Characteristics

Fig 8. Diode Switching Loss vs.  $I_f$

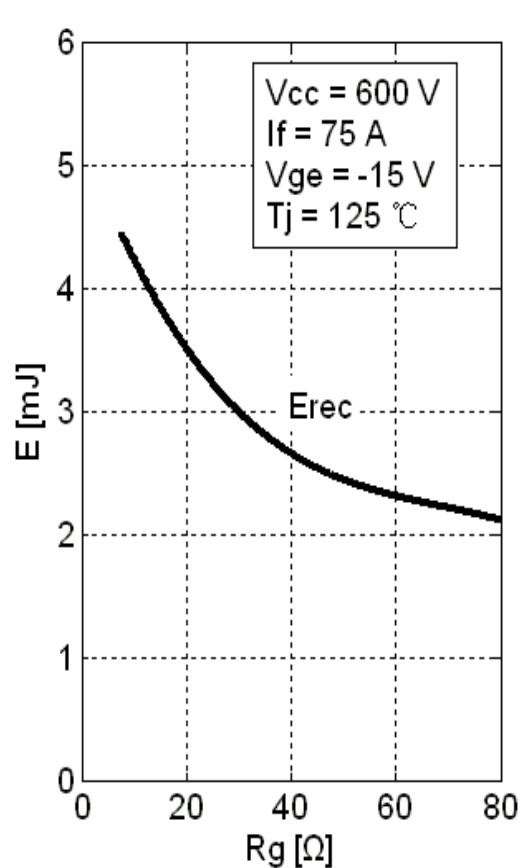
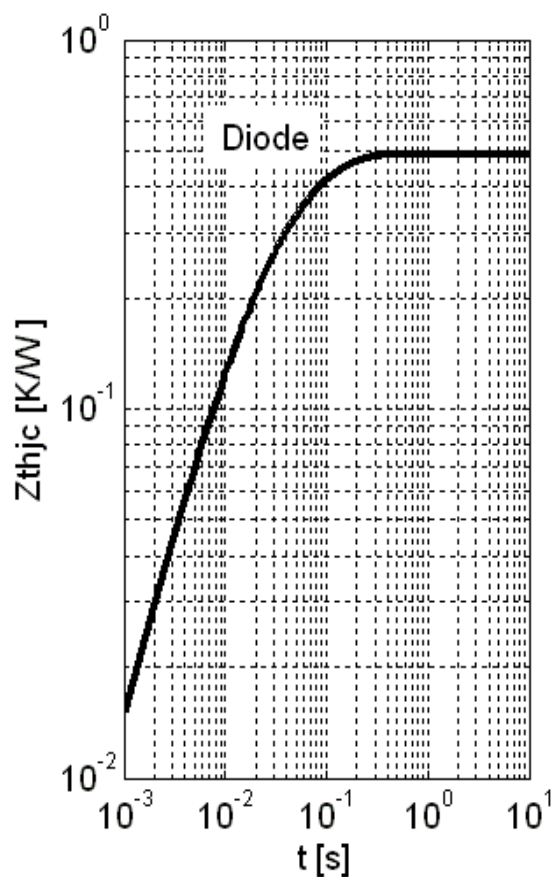
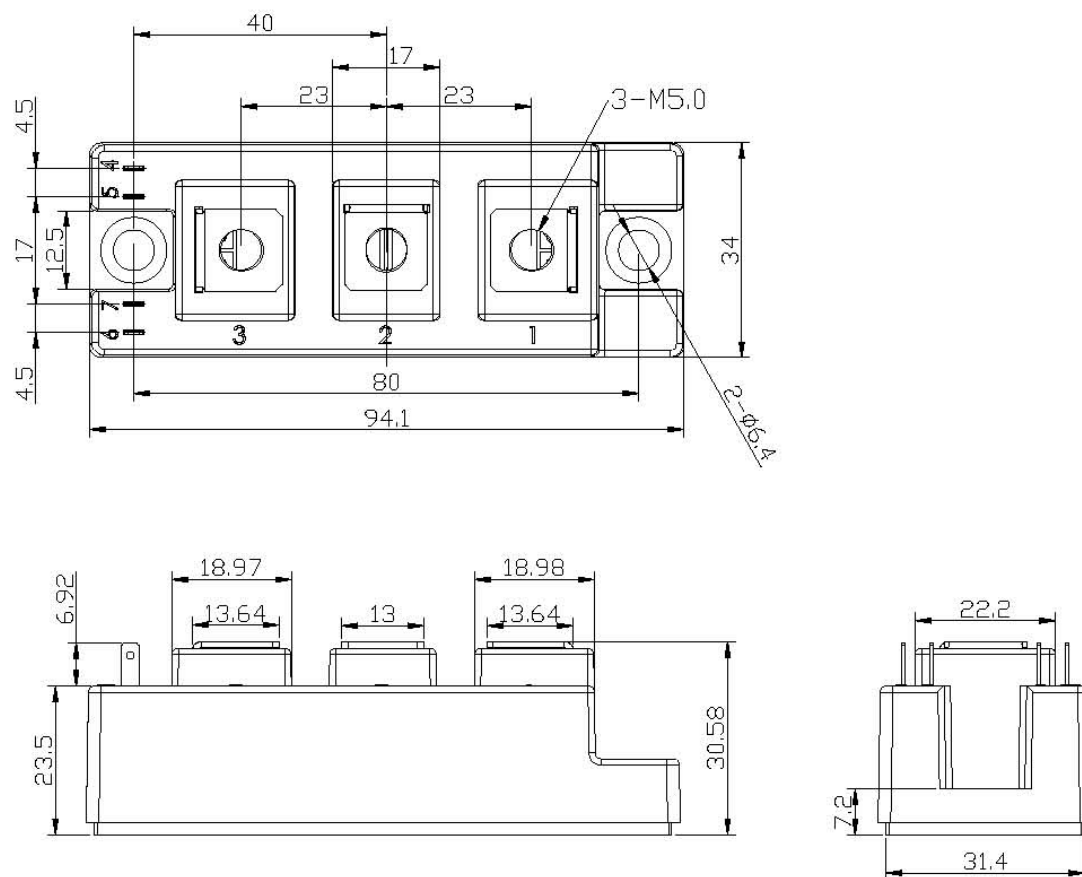
Fig 9. Diode Switching Loss vs.  $R_G$ 

Fig 10. Diode Transient Thermal Impedance

## Package Dimension

Dimensions in Millimeters



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