

# IGBT

## GD150FFL120C6S

**Molding Type Module**

**1200V/150A 6 in one-package**



### Features

- Low  $V_{CE(sat)}$  SPT+ IGBT technology
- 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

### Typical Applications

- Inverter for motor drive
- AC and DC servo drive amplifier
- Uninterruptible power supply

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

| Symbol          | Description                                                                | GD150FFL120C6S | 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>@ $T_C=80^{\circ}\text{C}$ | 230<br>150     | A                  |
| $I_{CM(1)}$     | Pulsed Collector Current @ $T_C=80^{\circ}\text{C}$                        | 300            | A                  |
| $I_F$           | Diode Continuous Forward Current                                           | 150            | A                  |
| $I_{FM}$        | Diode Maximum Forward Current                                              | 300            | A                  |
| $P_D$           | Maximum power Dissipation @ $T_j=150^{\circ}\text{C}$                      | 749            | W                  |
| $T_{SC}$        | Short Circuit Withstand Time @ $T_j=125^{\circ}\text{C}$                   | 10             | $\mu\text{s}$      |
| $T_j$           | 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 | Mounting Screw:M5                                                          | 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          | $I_C=6.0\text{mA}$ , $V_{CE}=V_{GE}$ ,<br>$T_j=25^{\circ}\text{C}$     | 5.0  | 6.3  | 7.0  | V     |
| $V_{CE(sat)}$ | Collector to Emitter Saturation Voltage | $I_C=150\text{A}$ , $V_{GE}=15\text{V}$ ,<br>$T_j=25^{\circ}\text{C}$  |      | 2.00 | 2.45 | V     |
|               |                                         | $I_C=150\text{A}$ , $V_{GE}=15\text{V}$ ,<br>$T_j=150^{\circ}\text{C}$ |      | 2.20 |      |       |

## Switching Characteristics

| Symbol        | Parameter                                | Test Conditions                                                                            | Min. | Typ. | Max. | Units      |
|---------------|------------------------------------------|--------------------------------------------------------------------------------------------|------|------|------|------------|
| $t_{d(on)}$   | Turn-On Delay Time                       | $V_{CC}=600V, I_C=150A,$<br>$R_G=5.1\Omega, V_{GE}=\pm 15V,$<br>$T_J=25^\circ C$           |      | 200  |      | ns         |
| $t_r$         | Rise Time                                |                                                                                            |      | 71   |      | ns         |
| $t_{d(off)}$  | Turn-Off Delay Time                      |                                                                                            |      | 442  |      | ns         |
| $t_f$         | Fall Time                                |                                                                                            |      | 165  |      | ns         |
| $E_{on}$      | Turn-On Switching Loss                   |                                                                                            |      | 8.0  |      | mJ         |
| $E_{off}$     | Turn-Off Switching Loss                  |                                                                                            |      | 10.0 |      | mJ         |
| $t_{d(on)}$   | Turn-On Delay Time                       | $V_{CC}=600V, I_C=150A,$<br>$R_G=5.1\Omega, V_{GE}=\pm 15V,$<br>$T_J=125^\circ C$          |      | 230  |      | ns         |
| $t_r$         | Rise Time                                |                                                                                            |      | 71   |      | ns         |
| $t_{d(off)}$  | Turn-Off Delay Time                      |                                                                                            |      | 481  |      | ns         |
| $t_f$         | Fall Time                                |                                                                                            |      | 311  |      | ns         |
| $E_{on}$      | Turn-On Switching Loss                   |                                                                                            |      | 12.5 |      | mJ         |
| $E_{off}$     | Turn-Off Switching Loss                  |                                                                                            |      | 15.3 |      | mJ         |
| $C_{ies}$     | Input Capacitance                        | $V_{CE}=25V, f=1MHz,$<br>$V_{GE}=0V$                                                       |      | 10.6 |      | nF         |
| $C_{oes}$     | Output Capacitance                       |                                                                                            |      | 0.71 |      | nF         |
| $C_{res}$     | Reverse Transfer Capacitance             |                                                                                            |      | 0.47 |      | nF         |
| $I_{SC}$      | SC Data                                  | $T_P \leq 10\mu s, V_{GE}=15V,$<br>$T_J=125^\circ C, V_{CC}=900V,$<br>$V_{CEM} \leq 1200V$ |      | 900  |      | A          |
| $L_{CE}$      | Stray Inductance                         |                                                                                            |      | 21   |      | nH         |
| $R_{CC'+EE'}$ | Module Lead Resistance, Terminal To Chip |                                                                                            |      | 1.80 |      | 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         | $I_F=150A$                           | $T_J=25^\circ C$  | 1.80 | 2.25 | V       |
|           |                               |                                      | $T_J=125^\circ C$ | 1.85 |      |         |
| $Q_r$     | Recovered charge              | $I_F=150A,$                          | $T_J=25^\circ C$  | 13.4 |      | $\mu C$ |
|           |                               |                                      | $T_J=125^\circ C$ | 26.1 |      |         |
| $I_{RM}$  | Peak Reverse Recovery Current | $V_R=600V,$<br>$di/dt=-2556A/\mu s,$ | $T_J=25^\circ C$  | 143  |      | A       |
|           |                               |                                      | $T_J=125^\circ C$ | 178  |      |         |
| $E_{rec}$ | Reverse Recovery Energy       | $V_{GE}=-15V$                        | $T_J=25^\circ C$  | 9.1  |      | mJ      |
|           |                               |                                      | $T_J=125^\circ C$ | 15.4 |      |         |

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

| Symbol       | Parameter              | Test Conditions                                       | Min. | Typ. | Max. | Units            |
|--------------|------------------------|-------------------------------------------------------|------|------|------|------------------|
| $R_{25}$     | Rated Resistance       |                                                       |      | 5.0  |      | $\text{k}\Omega$ |
| $\Delta R/R$ | Deviation of $R_{100}$ | $R_{100}=493.3\Omega$                                 | -5   |      | 5    | %                |
| $P_{25}$     | Power Dissipation      |                                                       |      |      | 20.0 | mW               |
| $B_{25/50}$  | B-value                | $R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$ |      | 3375 |      | K                |

**Thermal Characteristics**

| Symbol          | Parameter                                | Typ.  | Max.  | Units |
|-----------------|------------------------------------------|-------|-------|-------|
| $R_{\theta JC}$ | Junction-to-Case (per IGBT)              |       | 0.167 | K/W   |
| $R_{\theta JC}$ | Junction-to-Case (per DIODE)             |       | 0.268 | K/W   |
| $R_{\theta CS}$ | Case-to-Sink (Conductive grease applied) | 0.009 |       | K/W   |
| Weight          | Weight of Module                         | 300   |       | g     |

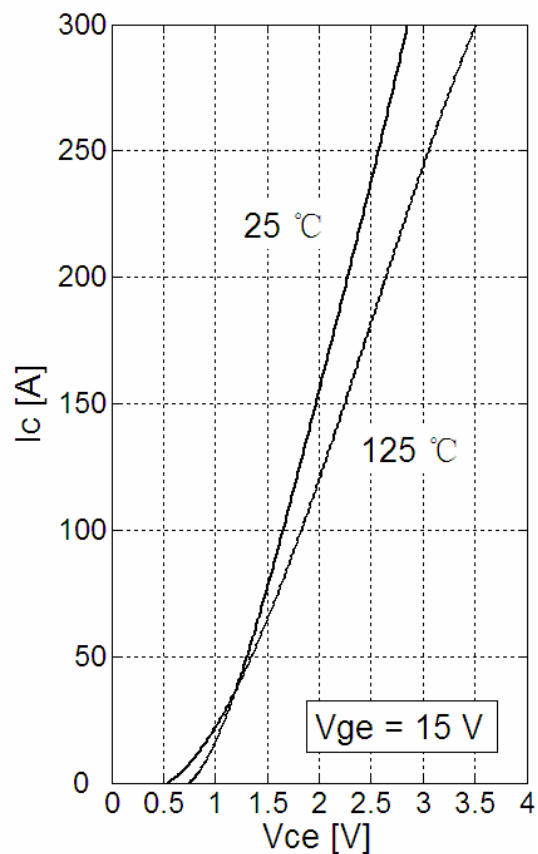


Fig 1. IGBT Output Characteristics

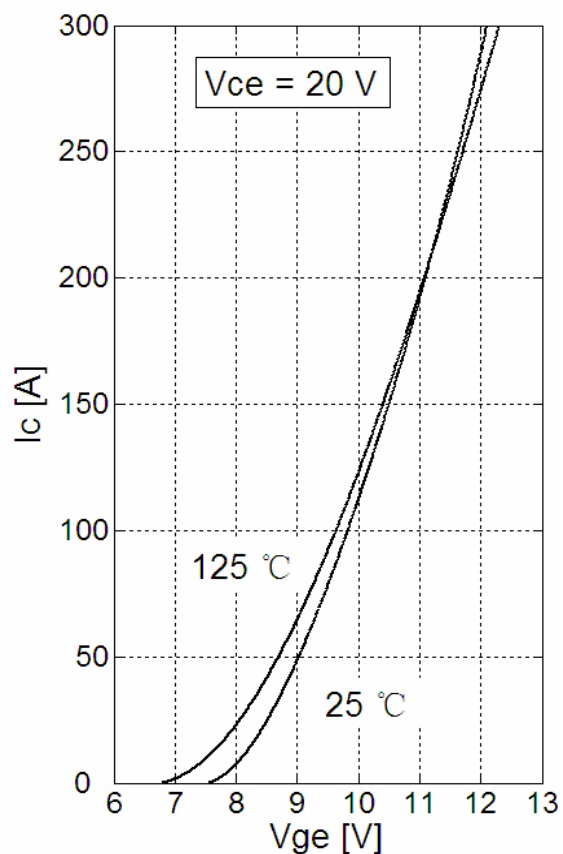
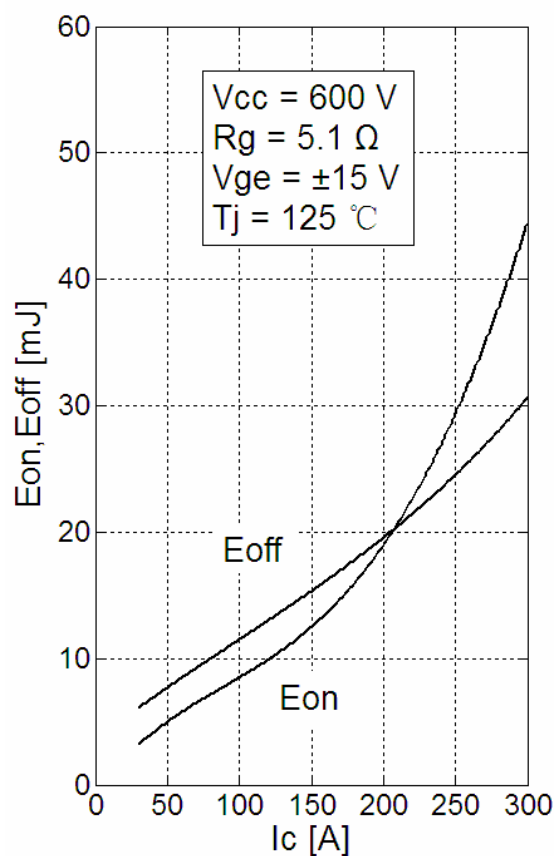
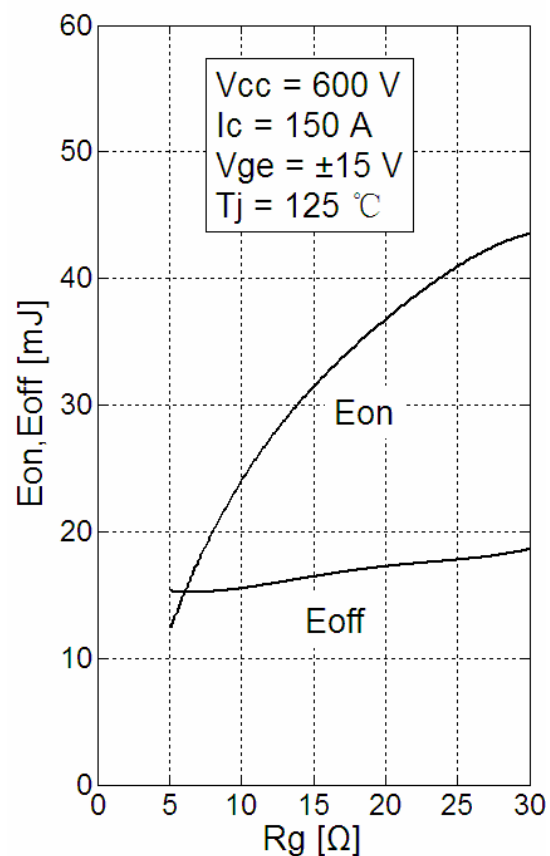


Fig 2. IGBT Transfer Characteristics

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

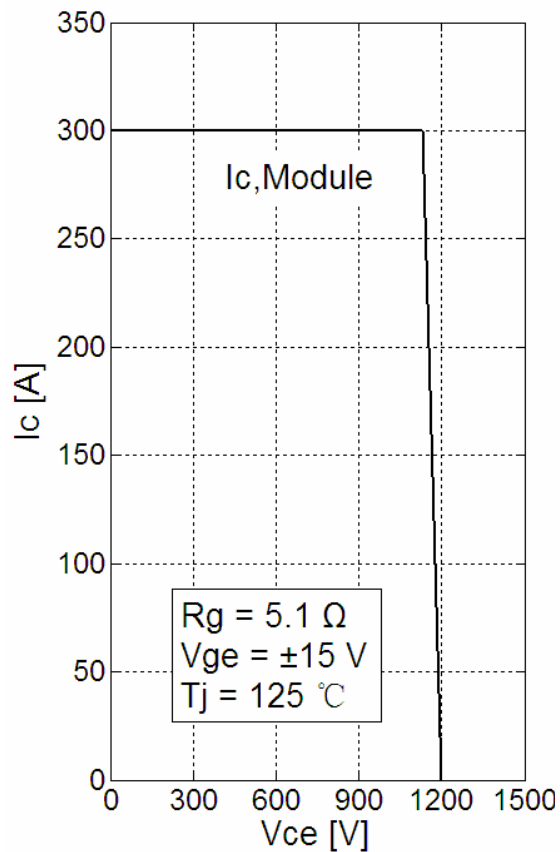


Fig 5. RBSOA

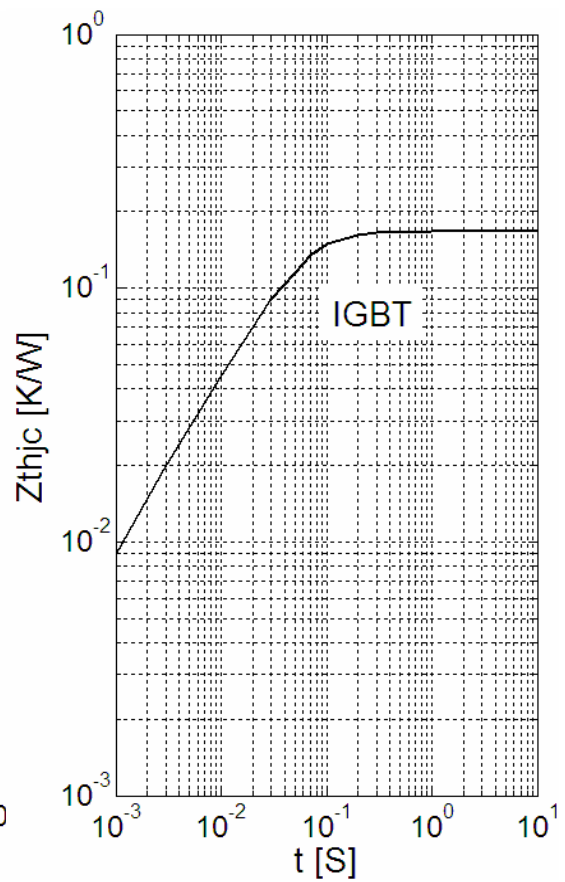


Fig 6. IGBT Transient Thermal Impedance

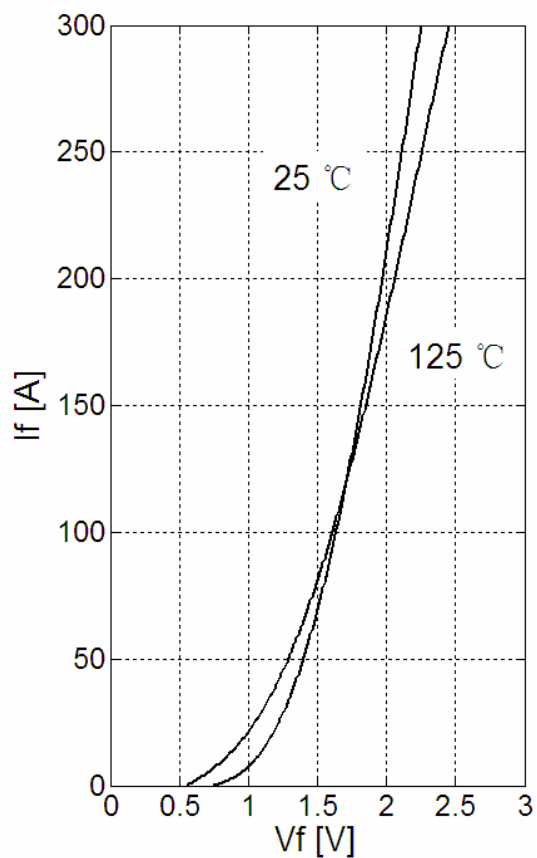
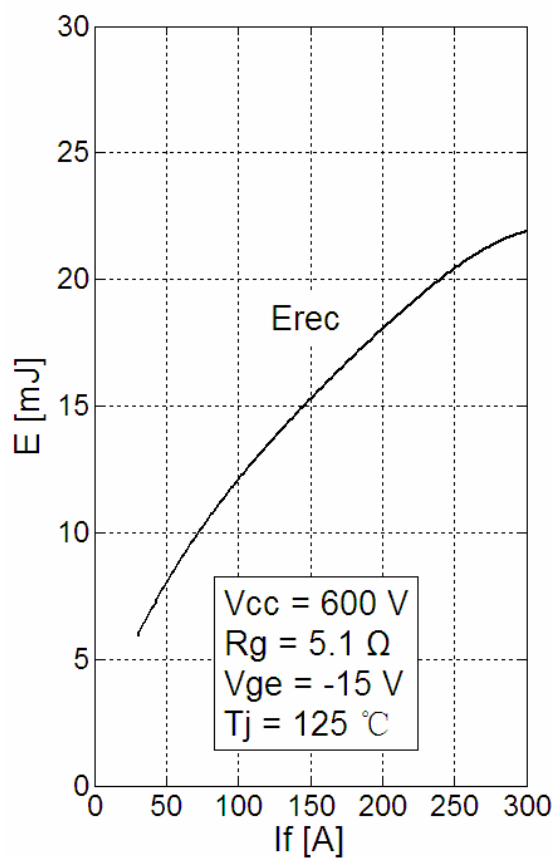
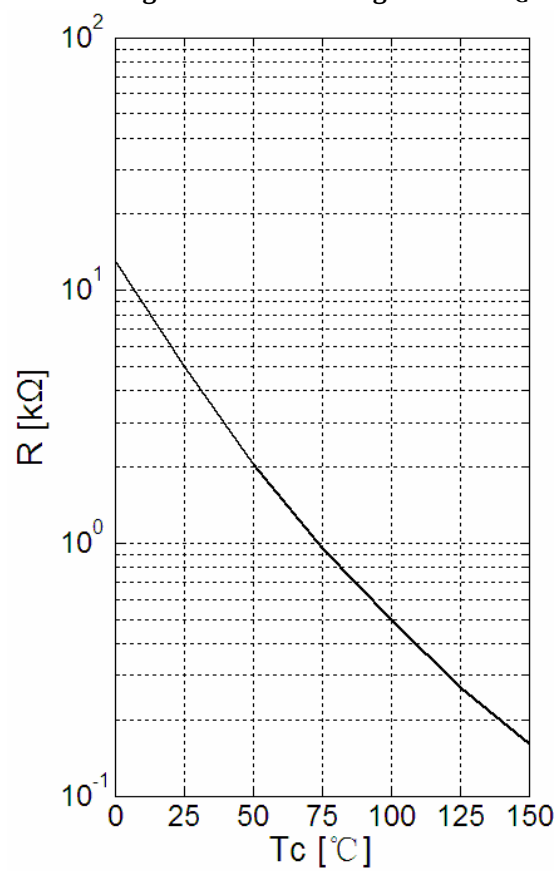
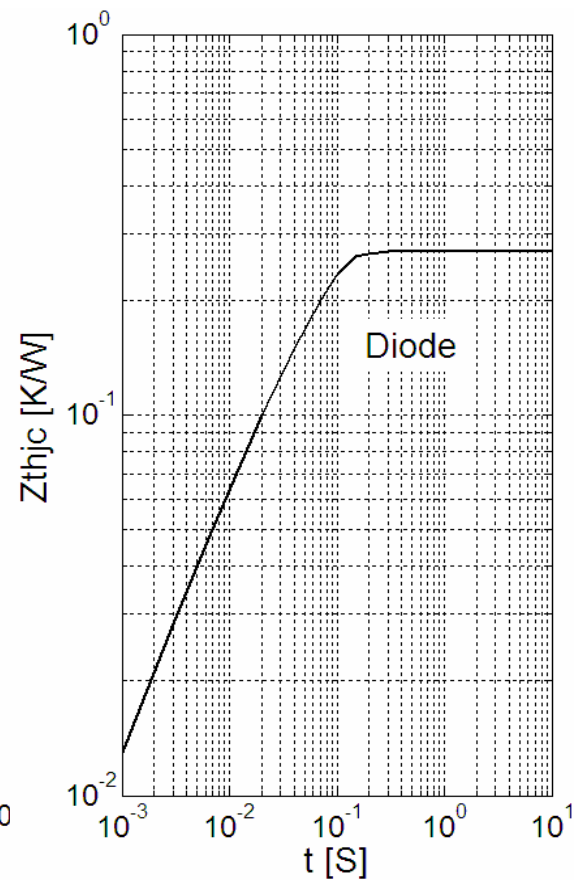
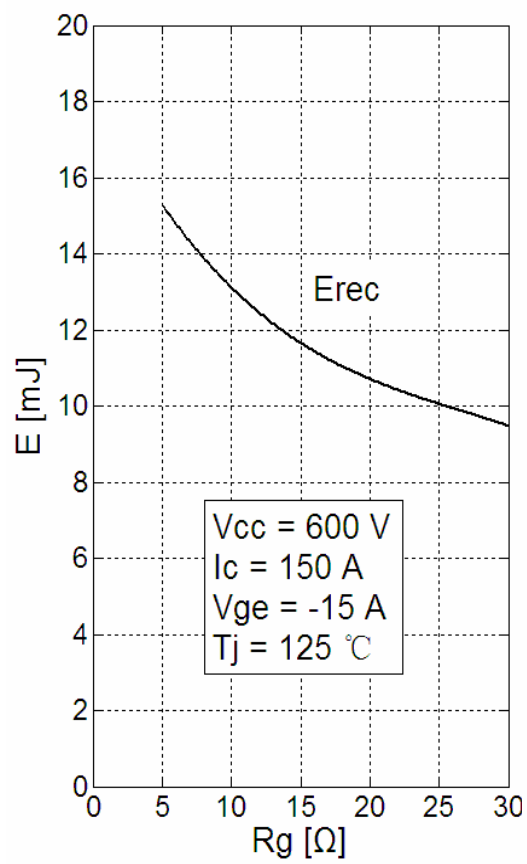
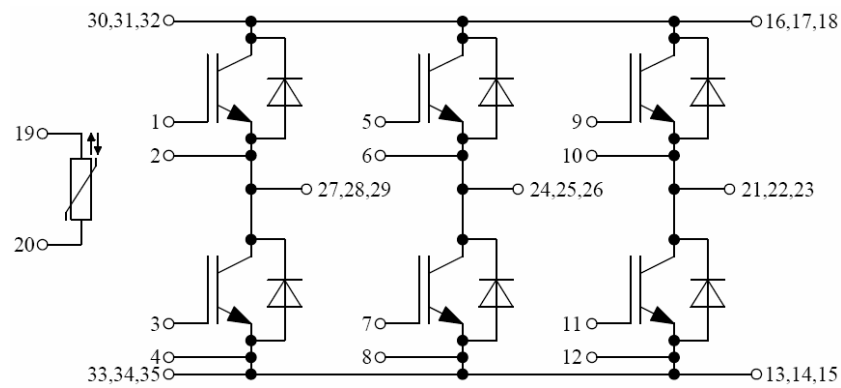


Fig 7. Diode Forward Characteristics

Fig 8. Diode Switching Loss vs.  $I_f$



## Equivalent Circuit Schematic



## Package Dimension

Dimensions in Millimeters

