

# STARPOWER

SEMICONDUCTOR

**IGBT**

## GD75CUT120C1S\_G8

**1200V/75A chopper 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 general inverters and UPS.



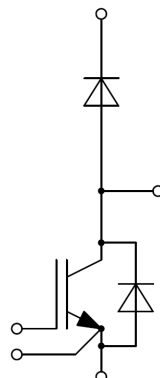
### Features

- Low  $V_{CE(sat)}$  Trench IGBT technology
- 10 $\mu$ s short circuit capability
- $V_{CE(sat)}$  with positive temperature coefficient
- Maximum junction temperature 175°C
- 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

### Equivalent Circuit Schematic



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

| Symbol    | Description   | Value     | Unit |
|-----------|---|-----------|------|
| $V_{CES}$ | Collector-Emitter Voltage   | 1200      | V    |
| $V_{GES}$ | Gate-Emitter Voltage  | $\pm 30$  | V    |
| $I_C$     | Collector Current @ $T_C=25^{\circ}\text{C}$<br>@ $T_C=100^{\circ}\text{C}$ | 125<br>75 | A    |
| $I_{CM}$  | Pulsed Collector Current $t_p=1\text{ms}$                                   | 150       | A    |
| $P_D$     | Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$                       | 441       | W    |

**Diode**

| Symbol    | Description                                    | Value | Unit |
|-----------|--|-------|------|
| $V_{RRM}$ | Repetitive Peak Reverse Voltage                | 1200  | V    |
| $I_F$     | Diode Continuous Forward Current               | 75    | A    |
| $I_{FM}$  | Diode Maximum Forward Current $t_p=1\text{ms}$ | 150   | A    |

**Module**

| Symbol     | Description  | Value       | Unit               |
|------------|--|-------------|--------------------|
| $T_{jmax}$ | Maximum Junction Temperature                             | 175         | $^{\circ}\text{C}$ |
| $T_{jop}$  | Operating Junction Temperature                           | -40 to +150 | $^{\circ}\text{C}$ |
| $T_{STG}$  | Storage Temperature Range                                | -40 to +125 | $^{\circ}\text{C}$ |
| $V_{ISO}$  | Isolation Voltage RMS, $f=50\text{Hz}$ , $t=1\text{min}$ | 4000        | V                  |

**IGBT Characteristics**  $T_c=25^\circ\text{C}$  unless otherwise noted

| Symbol        | Parameter                               | Test Conditions   | Min.  | Typ. | Max. | Unit          |    |
|---------------|---|---|---|------|------|---------------|----|
| $V_{CE(sat)}$ | Collector to Emitter Saturation Voltage | $I_C=75\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$   |   | 1.70 | 2.15 | V             |    |
|               |   | $I_C=75\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$  |   | 1.95 |      |               |    |
|               |   | $I_C=75\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$  |   | 2.00 |      |               |    |
| $V_{GE(th)}$  | Gate-Emitter Threshold Voltage          | $I_C=3.0\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$   | 5.0   | 5.7  | 6.5  | V             |    |
| $I_{CES}$     | Collector Cut-Off Current               | $V_{CE}=V_{CES}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$  |   |      | 5.0  | mA            |    |
| $I_{GES}$     | Gate-Emitter Leakage Current            | $V_{GE}=V_{GES}, V_{CE}=0\text{V}, T_j=25^\circ\text{C}$  |   |      | 400  | nA            |    |
| $R_{Gint}$    | Internal Gate Resistance                |   |   | 2.0  |      | $\Omega$      |    |
| $C_{ies}$     | Input Capacitance                       | $V_{CE}=30\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$  |   | 7.15 |      | nF            |    |
| $C_{res}$     | Reverse Transfer Capacitance            |   |   |      | 0.23 |               | nF |
| $Q_G$         | Gate Charge                             | $V_{GE}=15\text{V}$   |   | 0.48 |      | $\mu\text{C}$ |    |
| $t_{d(on)}$   | Turn-On Delay Time                      | $V_{CC}=600\text{V}, I_C=75\text{A}, R_G=5.1\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$  |   | 219  |      | ns            |    |
| $t_r$         | Rise Time                               |   |   | 42   |      | ns            |    |
| $t_{d(off)}$  | Turn-Off Delay Time                     |   |   | 271  |      | ns            |    |
| $t_f$         | Fall Time                               |   |   | 261  |      | ns            |    |
| $E_{on}$      | Turn-On Switching Loss                  |   |   | 2.95 |      | mJ            |    |
| $E_{off}$     | Turn-Off Switching Loss                 |   |   | 4.70 |      | mJ            |    |
| $t_{d(on)}$   | Turn-On Delay Time                      |   | $V_{CC}=600\text{V}, I_C=75\text{A}, R_G=5.1\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$                 |      | 220  |               | ns |
| $t_r$         | Rise Time                               |   |   |      | 46   |               | ns |
| $t_{d(off)}$  | Turn-Off Delay Time                     |   |   | 289  |      | ns            |    |
| $t_f$         | Fall Time                               |   |   | 397  |      | ns            |    |
| $E_{on}$      | Turn-On Switching Loss                  |   |   | 4.00 |      | mJ            |    |
| $E_{off}$     | Turn-Off Switching Loss                 |   |   | 7.65 |      | mJ            |    |
| $t_{d(on)}$   | Turn-On Delay Time                      | $V_{CC}=600\text{V}, I_C=75\text{A}, R_G=5.1\Omega, V_{GE}=\pm 15\text{V}, T_j=150^\circ\text{C}$ |   |      | 225  |               | ns |
| $t_r$         | Rise Time                               |   |   |      | 47   |               | ns |
| $t_{d(off)}$  | Turn-Off Delay Time                     |   |   | 300  |      | ns            |    |
| $t_f$         | Fall Time                               |   |   | 405  |      | ns            |    |
| $E_{on}$      | Turn-On Switching Loss                  |   |   | 4.40 |      | mJ            |    |
| $E_{off}$     | Turn-Off Switching Loss                 |   |   | 8.80 |      | mJ            |    |
| $I_{SC}$      | SC Data                                 |   | $t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=900\text{V}, V_{CEM} \leq 1200\text{V}$ |      | 300  |               | A  |

**Diode Characteristics**  $T_c=25^\circ\text{C}$  unless otherwise noted

| Symbol    | Parameter                     | Test Conditions  | Min. | Typ. | Max. | Unit          |
|-----------|-------------------------------|--|------|------|------|---------------|
| $V_F$     | Diode Forward Voltage         | $I_F=75\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$   |      | 1.70 | 2.15 | V             |
|           |                               | $I_F=75\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$  |      | 1.65 |      |               |
|           |                               | $I_F=75\text{A}, V_{GE}=0\text{V}, T_j=150^\circ\text{C}$  |      | 1.65 |      |               |
| $Q_r$     | Recovered Charge              |  |      | 5.0  |      | $\mu\text{C}$ |
| $I_{RM}$  | Peak Reverse Recovery Current | $V_R=600\text{V}, I_F=75\text{A},$<br>$-di/dt=1200\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$<br>$T_j=25^\circ\text{C}$  |      | 81   |      | A             |
| $E_{rec}$ | Reverse Recovery Energy       |  |      | 3.40 |      | mJ            |
| $Q_r$     | Recovered Charge              |  |      | 11.0 |      | $\mu\text{C}$ |
| $I_{RM}$  | Peak Reverse Recovery Current | $V_R=600\text{V}, I_F=75\text{A},$<br>$-di/dt=1200\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$<br>$T_j=125^\circ\text{C}$ |      | 97   |      | A             |
| $E_{rec}$ | Reverse Recovery Energy       |  |      | 6.02 |      | mJ            |
| $Q_r$     | Recovered Charge              |  |      | 12.1 |      | $\mu\text{C}$ |
| $I_{RM}$  | Peak Reverse Recovery Current | $V_R=600\text{V}, I_F=75\text{A},$<br>$-di/dt=1200\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$<br>$T_j=150^\circ\text{C}$ |      | 105  |      | A             |
| $E_{rec}$ | Reverse Recovery Energy       |  |      | 7.20 |      | mJ            |

**Module Characteristics**  $T_c=25^\circ\text{C}$  unless otherwise noted

| Symbol          | Parameter                                | Min. | Typ.  | Max.  | Unit       |
|-----------------|--|------|-------|-------|------------|
| $L_{CE}$        | Stray Inductance                         |      |       | 30    | nH         |
| $R_{CC'+EE'}$   | Module Lead Resistance, Terminal to Chip |      | 0.75  |       | m $\Omega$ |
| $R_{\theta JC}$ | Junction-to-Case (per IGBT)              |      |       | 0.340 | K/W        |
|                 | Junction-to-Case (per Diode)             |      |       | 0.559 |            |
| $R_{\theta CS}$ | Case-to-Sink (per IGBT)                  |      | 0.111 |       | K/W        |
|                 | Case-to-Sink (per Diode)                 |      | 0.182 |       |            |
| $R_{\theta CS}$ | Case-to-Sink                             |      | 0.05  |       | K/W        |
| M               | Terminal Connection Torque, Screw M5     | 2.5  |       | 5.0   | N.m        |
|                 | Mounting Torque, Screw M6                | 3.0  |       | 5.0   |            |
| G               | Weight of Module                         |      | 150   |       | g          |

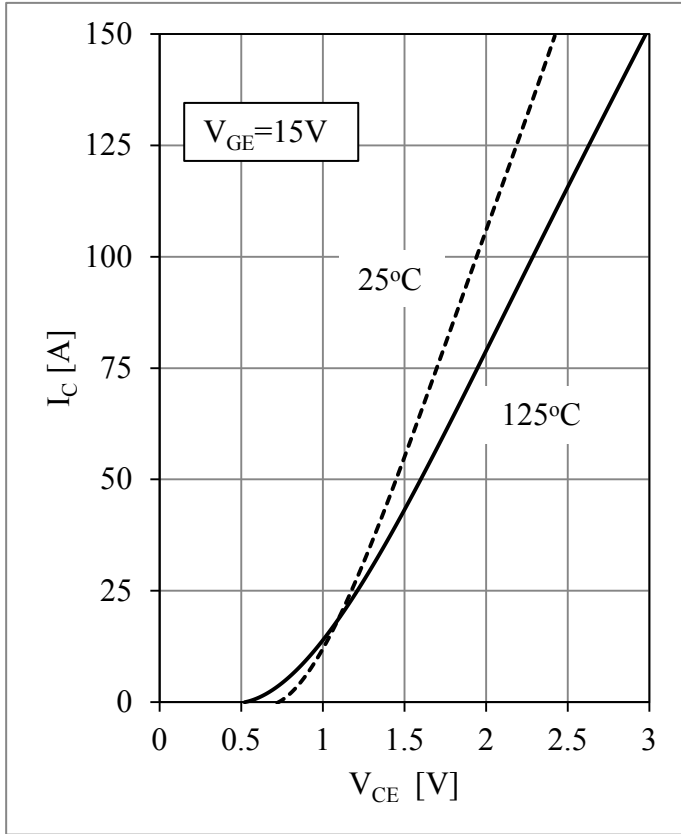


Fig 1. IGBT Output Characteristics

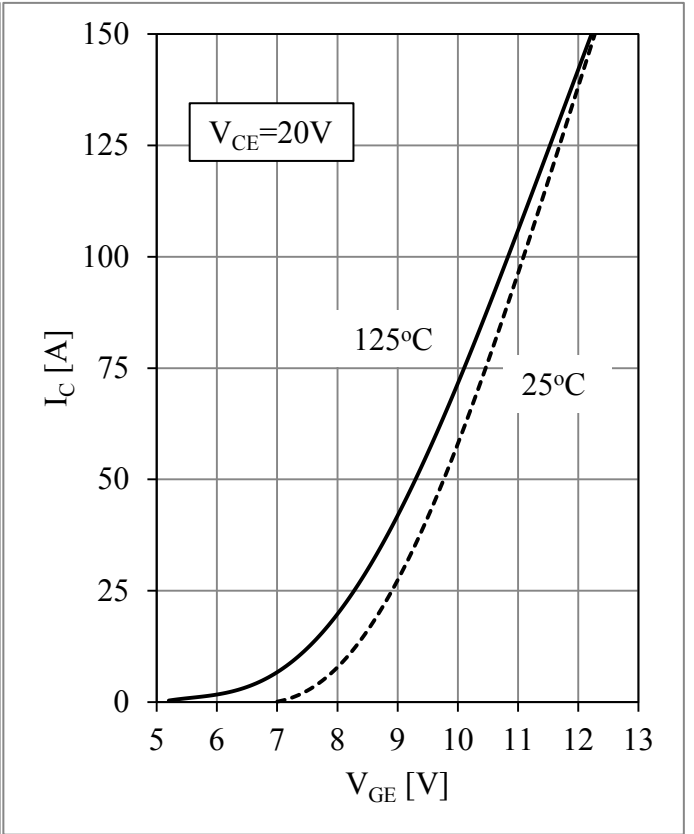


Fig 2. IGBT Transfer Characteristics

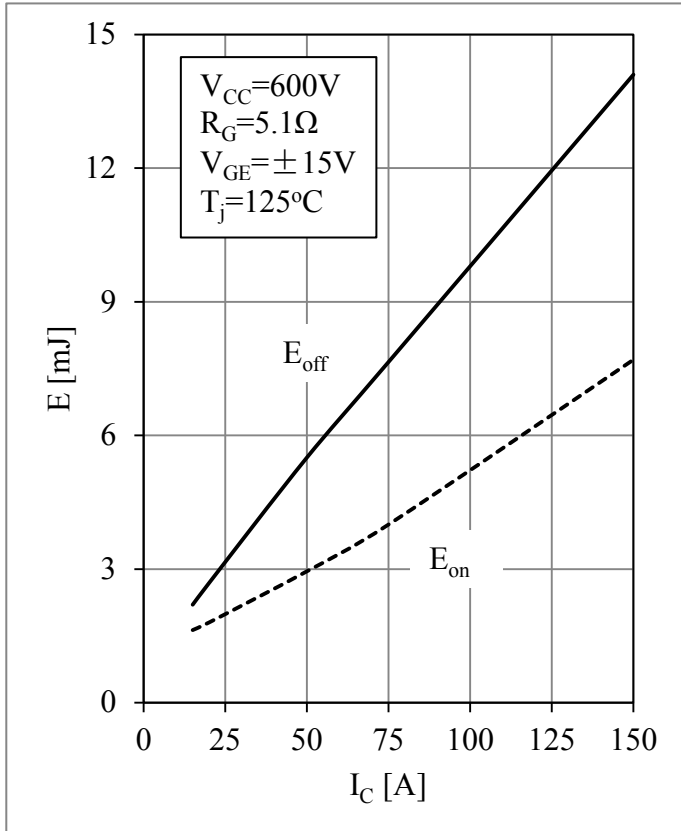


Fig 3. IGBT Switching Loss vs.  $I_c$

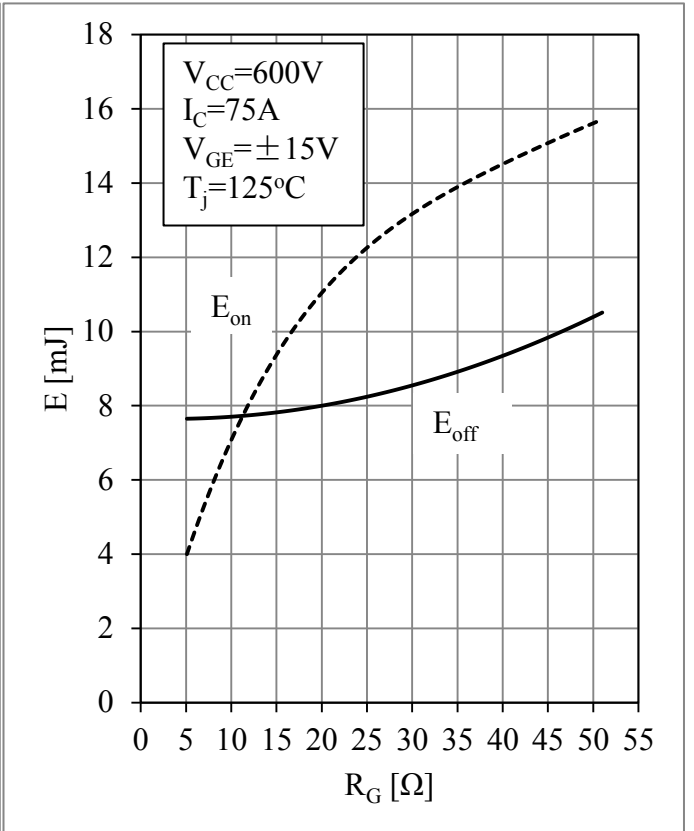


Fig 4. IGBT Switching Loss vs.  $R_G$

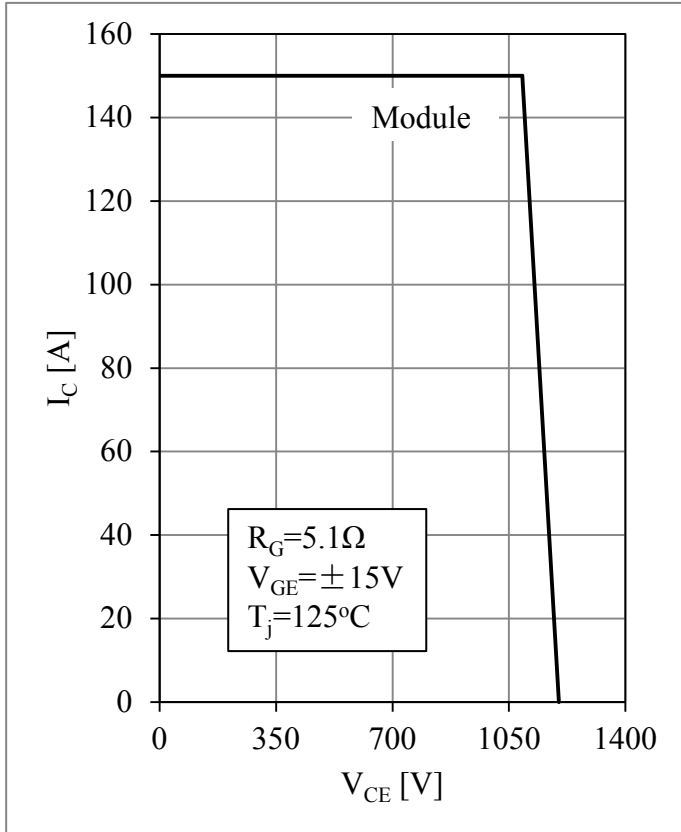


Fig 5. RBSOA

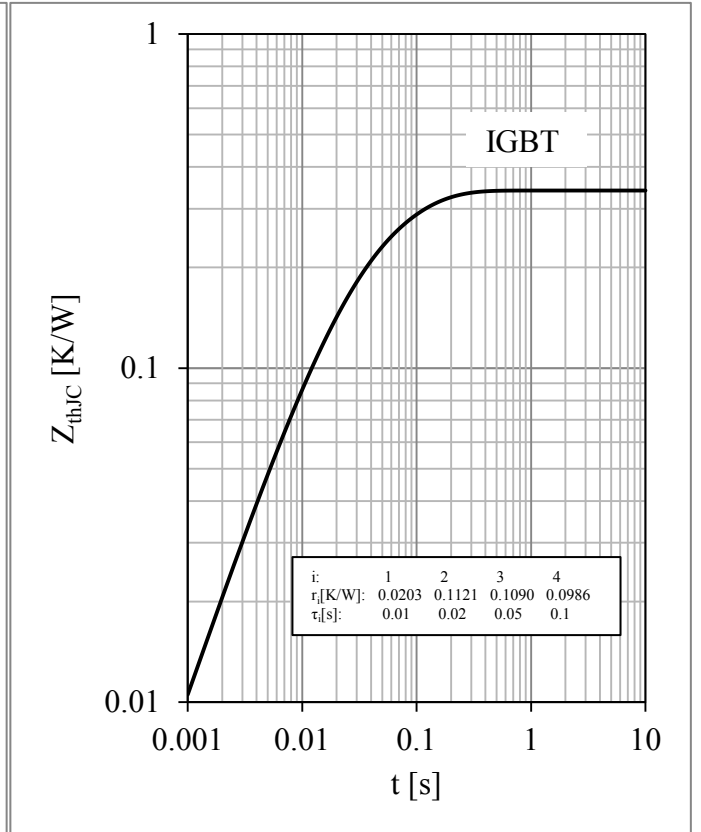


Fig 6. IGBT Transient Thermal Impedance

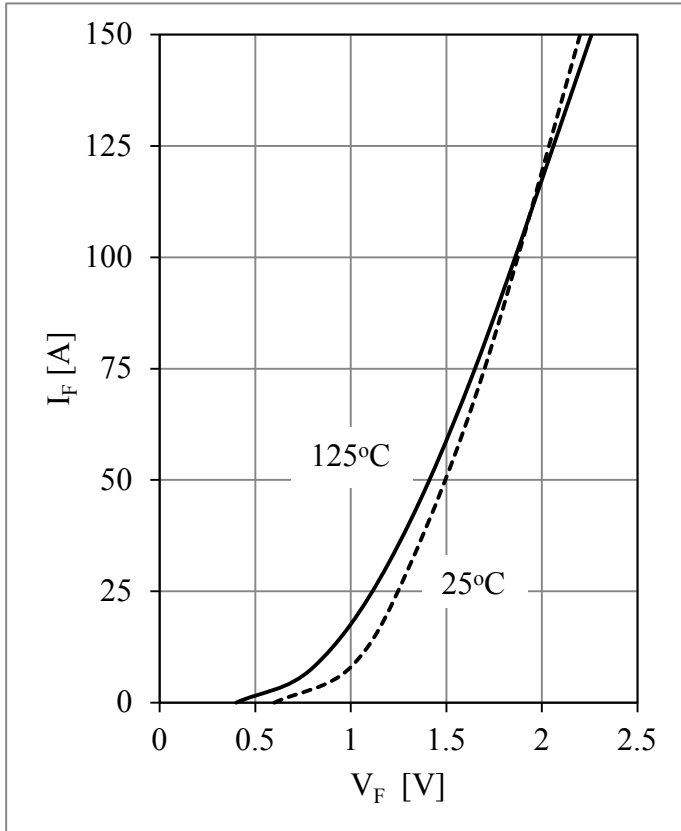


Fig 7. Diode Forward Characteristics

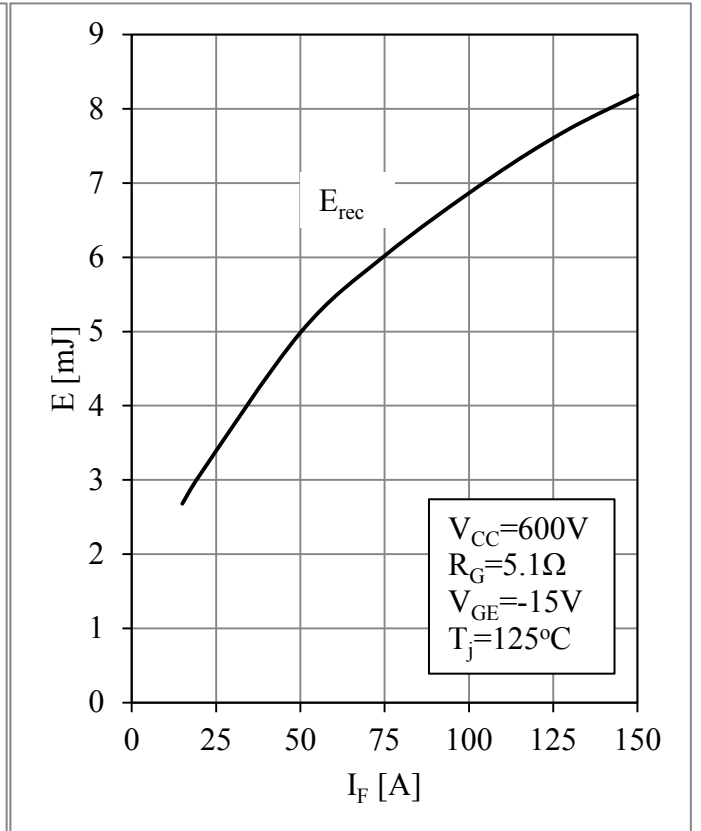


Fig 8. Diode Switching Loss vs.  $I_F$

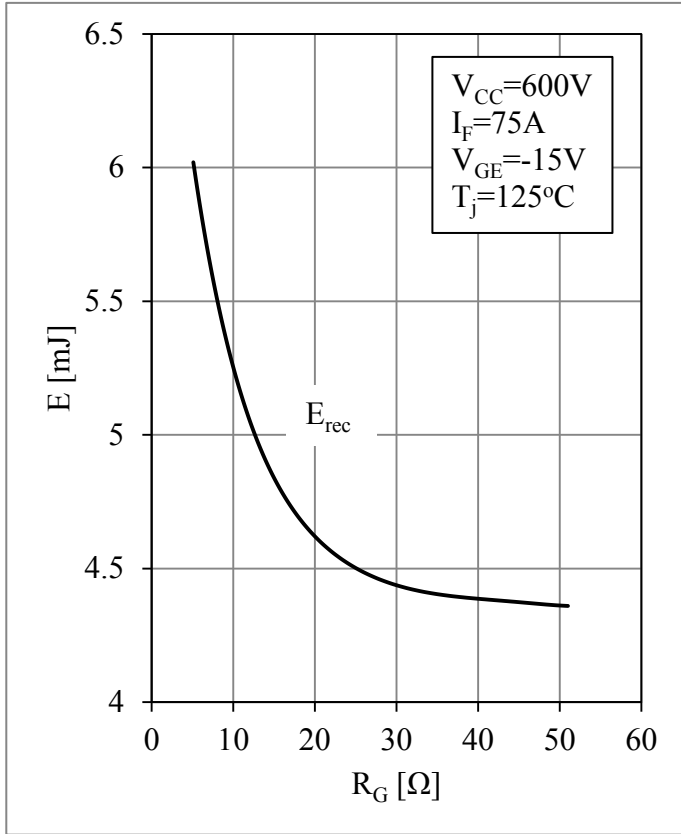


Fig 9. Diode Switching Loss vs.  $R_G$

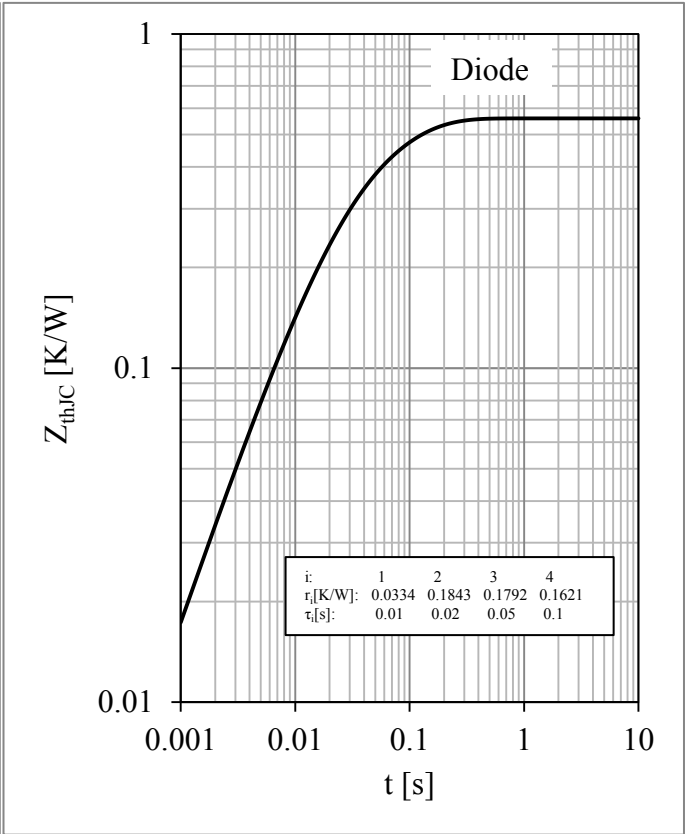


Fig 10. Diode Transient Thermal Impedance





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