

STARPOWER

SEMICONDUCTOR

IGBT

GD100FFX170C6S

1200V/100A 6 in one-package

General Description

STARPOWER IGBT Power Module provides ultrafast switching speed as well as short circuit ruggedness. It's designed for the applications such as welding machine and UPS.

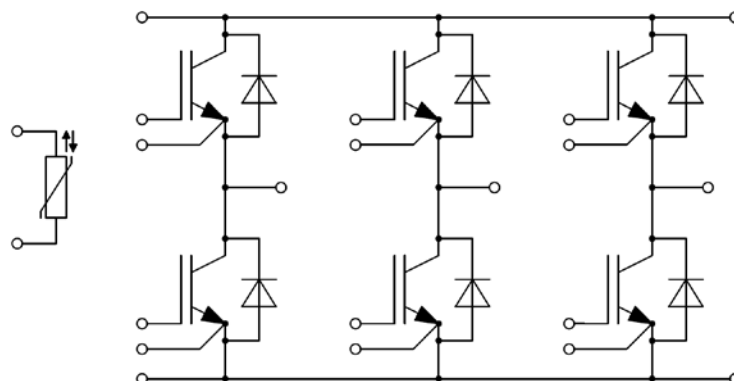
Features

- Low $V_{CE(sat)}$ Trench IGBT technology
- 10 μ 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

- Uninterruptible power supply
- Inductive heating
- Welding machine

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 | 1700 | V |
| V_{GES} | Gate-Emitter Voltage | ± 20 | V |
| I_C | Collector Current @ $T_C=25^{\circ}\text{C}$ | 168 | A |
| | @ $T_C=100^{\circ}\text{C}$ | 100 | |
| I_{CM} | Pulsed Collector Current $t_p=1\text{ms}$ | 200 | A |
| P_D | Maximum Power Dissipation @ $T_j=175^{\circ}\text{C}$ | 632 | W |

Diode

| Symbol | Description | Value | Unit |
|-----------|--|-------|------|
| V_{RRM} | Repetitive Peak Reverse Voltage | 1700 | V |
| I_F | Diode Continuous Forward Current | 100 | A |
| I_{FM} | Diode Maximum Forward Current $t_p=1\text{ms}$ | 200 | 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 | $I_C=100\text{A}, V_{GE}=15\text{V}, T_j=25^\circ\text{C}$ | | 1.85 | 2.20 | V | |
| | | $I_C=100\text{A}, V_{GE}=15\text{V}, T_j=125^\circ\text{C}$ | | 2.25 | | | |
| | | $I_C=100\text{A}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}$ | | 2.35 | | | |
| $V_{GE(th)}$ | Gate-Emitter Threshold Voltage | $I_C=4.0\text{mA}, V_{CE}=V_{GE}, T_j=25^\circ\text{C}$ | 5.6 | 6.2 | 6.8 | 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 | | | 7.5 | | Ω | |
| C_{ies} | Input Capacitance | $V_{CE}=25\text{V}, f=1\text{MHz}, V_{GE}=0\text{V}$ | | 12.0 | | nF | |
| C_{res} | Reverse Transfer Capacitance | | | 0.29 | | nF | |
| Q_G | Gate Charge | $V_{GE}=-15\dots+15\text{V}$ | | 0.94 | | μC | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{CC}=900\text{V}, I_C=100\text{A}, R_G=4.8\Omega, V_{GE}=\pm 15\text{V}, T_j=25^\circ\text{C}$ | | 187 | | ns | |
| t_r | Rise Time | | | 31 | | ns | |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 434 | | ns | |
| t_f | Fall Time | | | 363 | | ns | |
| E_{on} | Turn-On Switching Loss | | | 18.5 | | mJ | |
| E_{off} | Turn-Off Switching Loss | | | 20.8 | | mJ | |
| $t_{d(on)}$ | Turn-On Delay Time | | $V_{CC}=900\text{V}, I_C=100\text{A}, R_G=4.8\Omega, V_{GE}=\pm 15\text{V}, T_j=125^\circ\text{C}$ | | 194 | | ns |
| t_r | Rise Time | | | | 44 | | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 503 | | ns | |
| t_f | Fall Time | | | 637 | | ns | |
| E_{on} | Turn-On Switching Loss | | | 30.3 | | mJ | |
| E_{off} | Turn-Off Switching Loss | | | 32.1 | | mJ | |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{CC}=900\text{V}, I_C=100\text{A}, R_G=4.8\Omega, V_{GE}=\pm 15\text{V}, T_j=150^\circ\text{C}$ | | | 202 | | ns |
| t_r | Rise Time | | | | 55 | | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 512 | | ns | |
| t_f | Fall Time | | | 720 | | ns | |
| E_{on} | Turn-On Switching Loss | | | 33.0 | | mJ | |
| E_{off} | Turn-Off Switching Loss | | | 34.8 | | mJ | |
| I_{SC} | SC Data | | $t_p \leq 10\mu\text{s}, V_{GE}=15\text{V}, T_j=150^\circ\text{C}, V_{CC}=1000\text{V}, V_{CEM} \leq 1700\text{V}$ | | 400 | | 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 | $I_F=100\text{A}, V_{GE}=0\text{V}, T_j=25^\circ\text{C}$ | | 1.80 | 2.25 | V |
| | | $I_F=100\text{A}, V_{GE}=0\text{V}, T_j=125^\circ\text{C}$ | | 1.90 | | |
| | | $I_F=100\text{A}, V_{GE}=0\text{V}, T_j=150^\circ\text{C}$ | | 1.95 | | |
| Q_r | Recovered Charge | $V_R=900\text{V}, I_F=100\text{A},$ $-di/dt=3550\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=25^\circ\text{C}$ | | 17.8 | | μC |
| I_{RM} | Peak Reverse Recovery Current | | | 103 | | A |
| E_{rec} | Reverse Recovery Energy | | | 9.78 | | mJ |
| Q_r | Recovered Charge | $V_R=900\text{V}, I_F=100\text{A},$ $-di/dt=3550\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=125^\circ\text{C}$ | | 33.7 | | μC |
| I_{RM} | Peak Reverse Recovery Current | | | 107 | | A |
| E_{rec} | Reverse Recovery Energy | | | 19.4 | | mJ |
| Q_r | Recovered Charge | $V_R=900\text{V}, I_F=100\text{A},$ $-di/dt=3550\text{A}/\mu\text{s}, V_{GE}=-15\text{V}$ $T_j=150^\circ\text{C}$ | | 37.4 | | μC |
| I_{RM} | Peak Reverse Recovery Current | | | 106 | | A |
| E_{rec} | Reverse Recovery Energy | | | 23.8 | | mJ |

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

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--------------|------------------------|--|------|------|------|------------|
| R_{25} | Rated Resistance | | | 5.0 | | k Ω |
| $\Delta R/R$ | Deviation of R_{100} | $T_C=100^\circ\text{C}, R_{100}=493.3\Omega$ | -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 |
| $B_{25/80}$ | B-value | $R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15\text{K}))]$ | | 3411 | | K |
| $B_{25/100}$ | B-value | $R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15\text{K}))]$ | | 3433 | | K |

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

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|---------------|--|------|-------|-------|------------|
| L_{CE} | Stray Inductance | | 21 | | nH |
| $R_{CC'+EE'}$ | Module Lead Resistance, Terminal to Chip | | 1.80 | | m Ω |
| R_{thJC} | Junction-to-Case (per IGBT) | | | 0.237 | K/W |
| | Junction-to-Case (per Diode) | | | 0.397 | |
| R_{thCH} | Case-to-Heatsink (per IGBT) | | 0.086 | | K/W |
| | Case-to-Heatsink (per Diode) | | 0.144 | | |
| | Case-to-Heatsink (per Module) | | 0.009 | | |
| M | Mounting Screw:M5 | 3.0 | | 6.0 | N.m |
| G | Weight of Module | | 300 | | g |

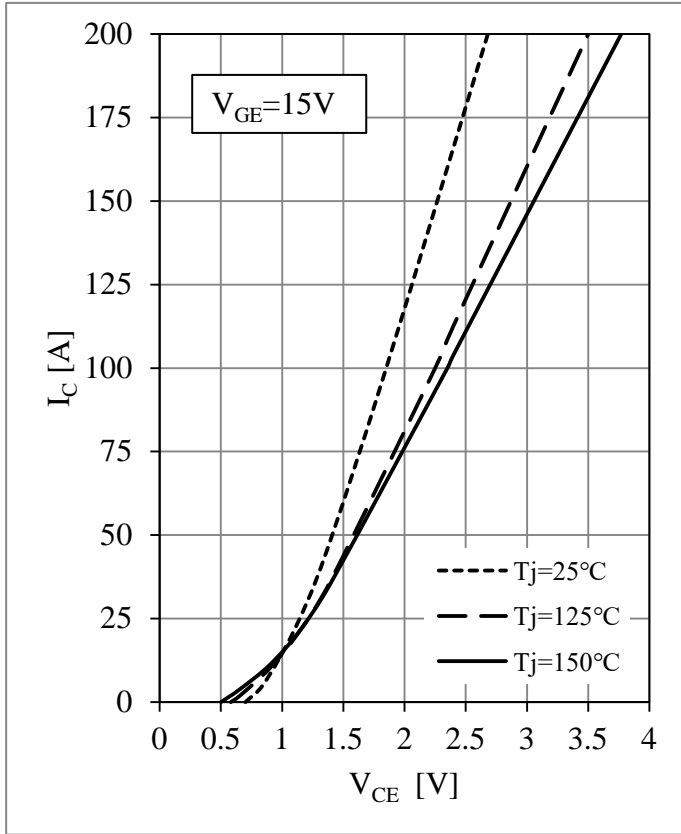


Fig 1. IGBT Output Characteristics

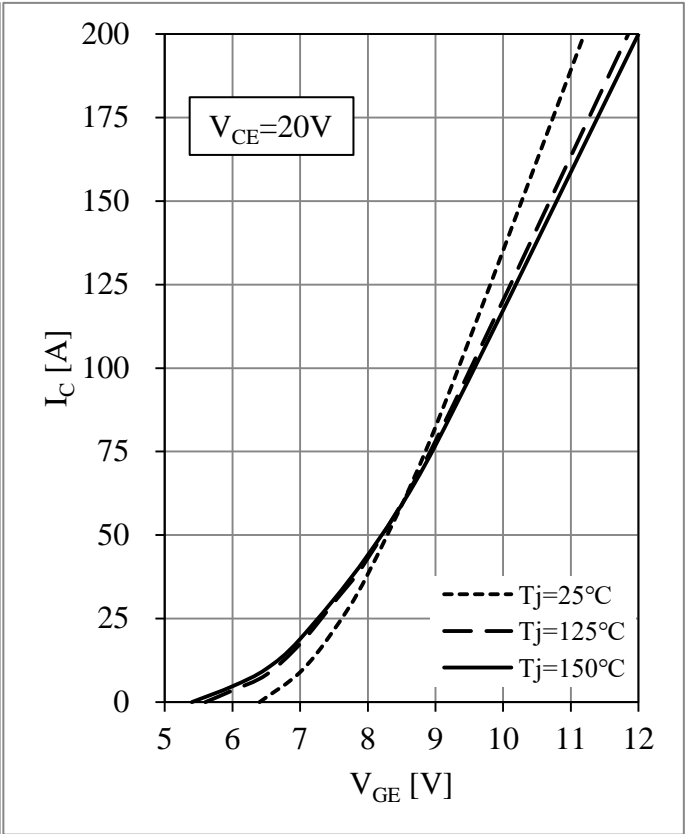


Fig 2. IGBT Transfer Characteristics

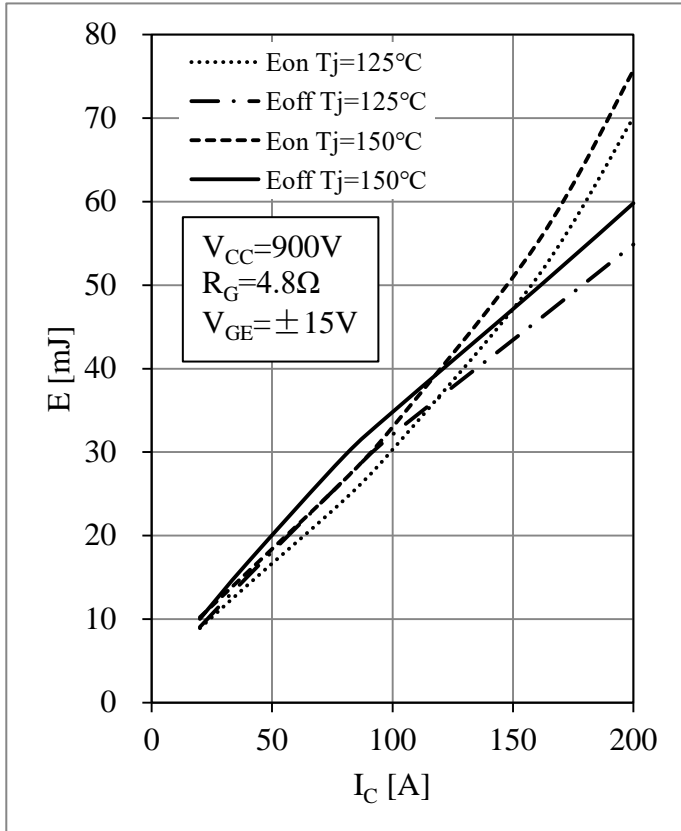


Fig 3. IGBT Switching Loss vs. I_C

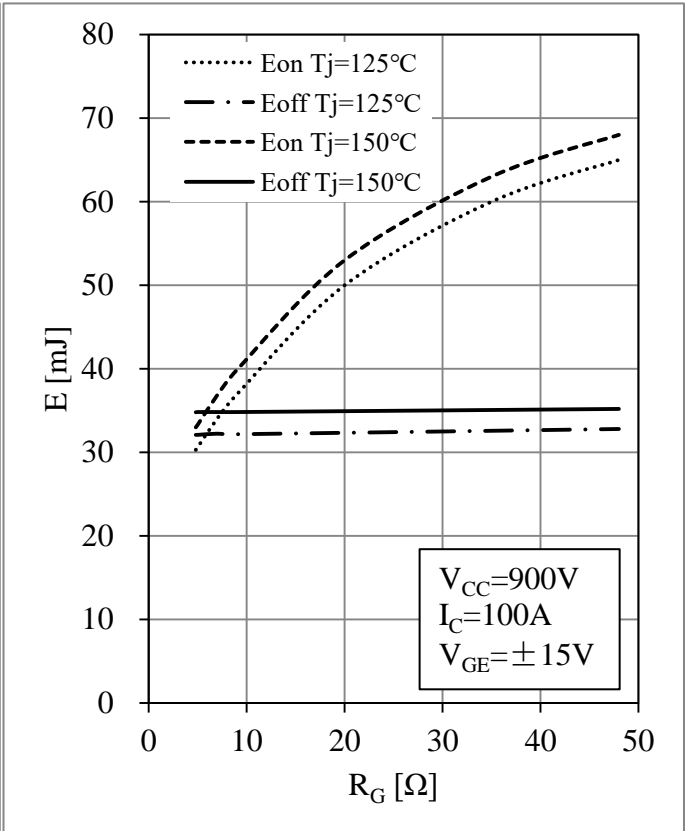


Fig 4. IGBT Switching Loss vs. R_G

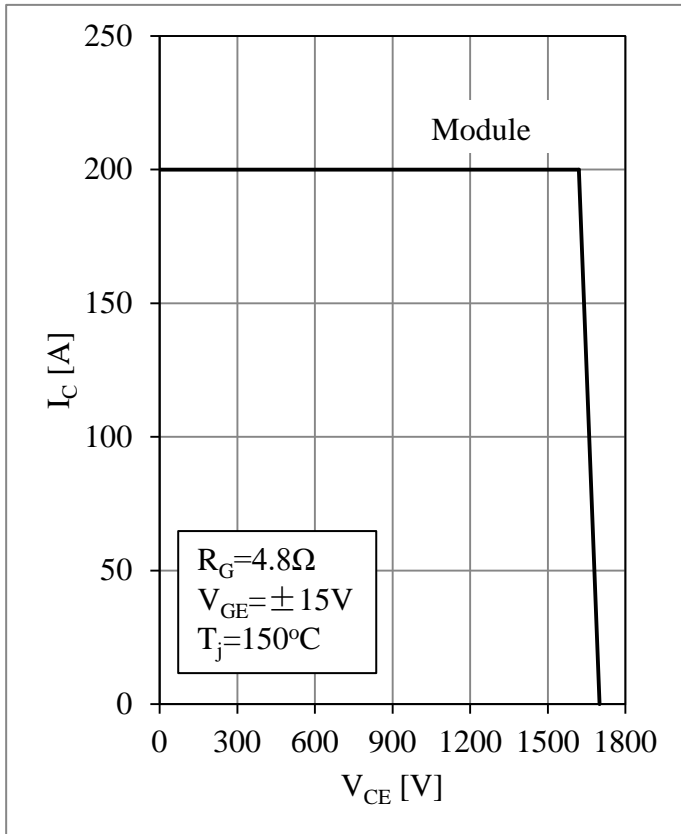


Fig 5. IGBT RBSOA

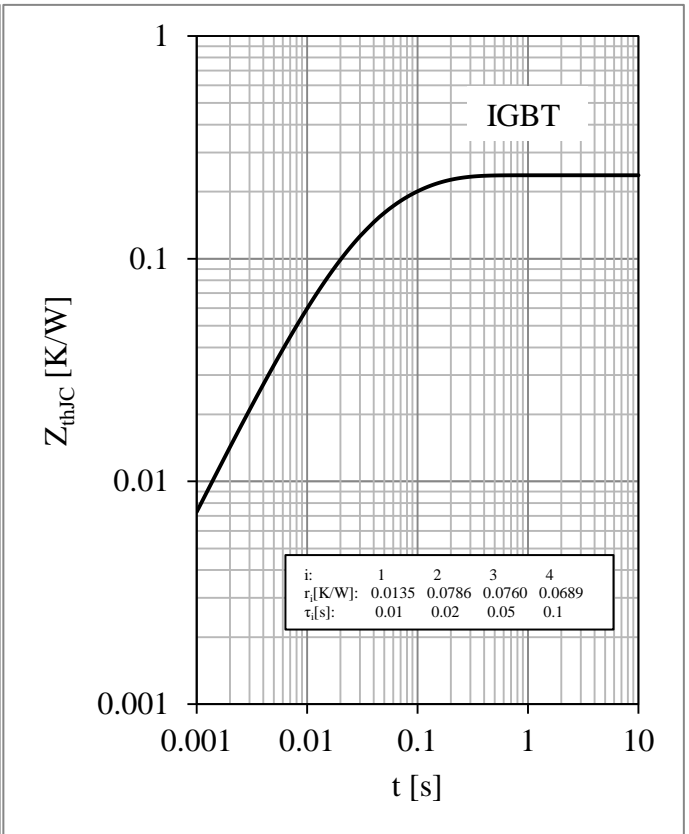


Fig 6. IGBT Transient Thermal Impedance

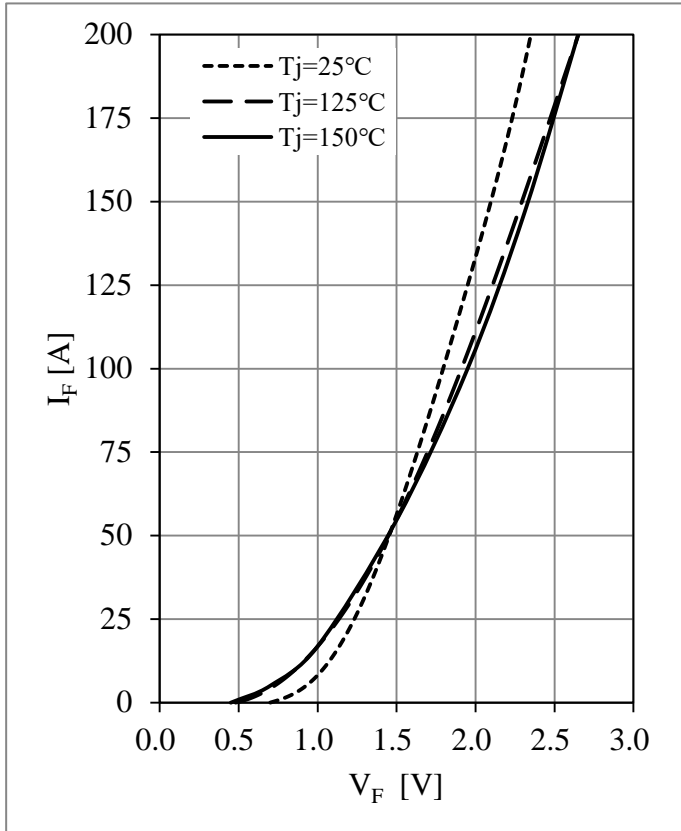


Fig 7. Diode Forward Characteristics

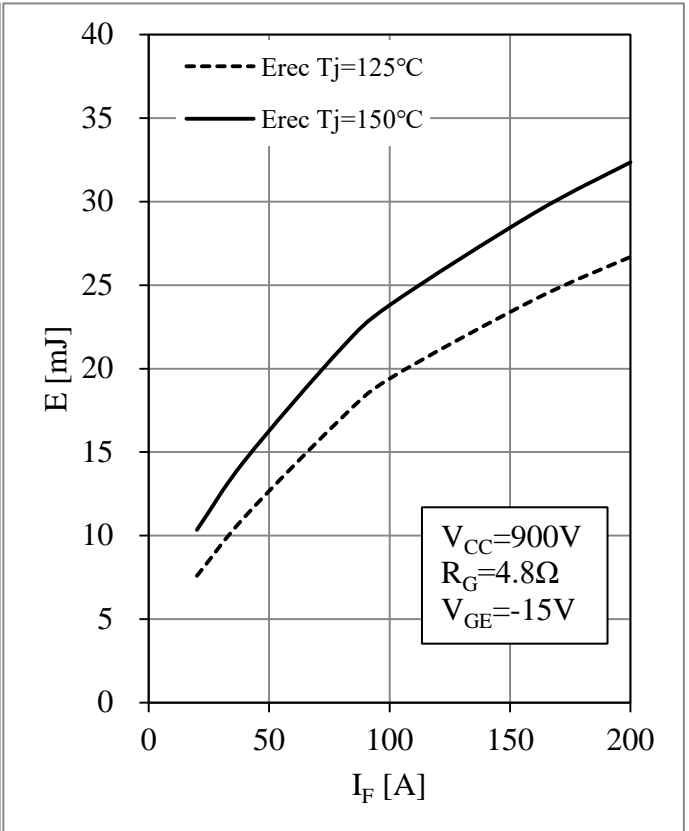


Fig 8. Diode Switching Loss vs. I_F

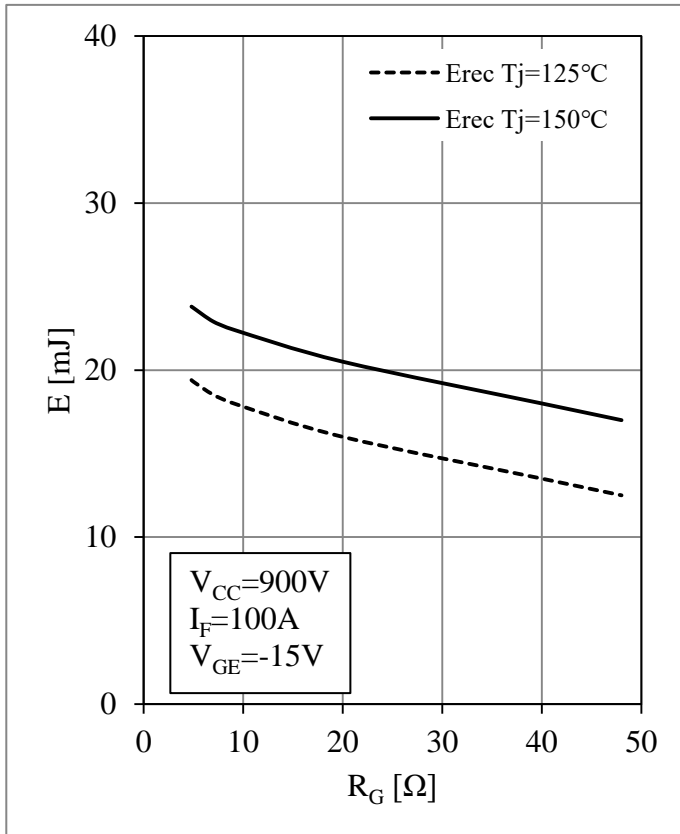


Fig 9. Diode Switching Loss vs. R_G

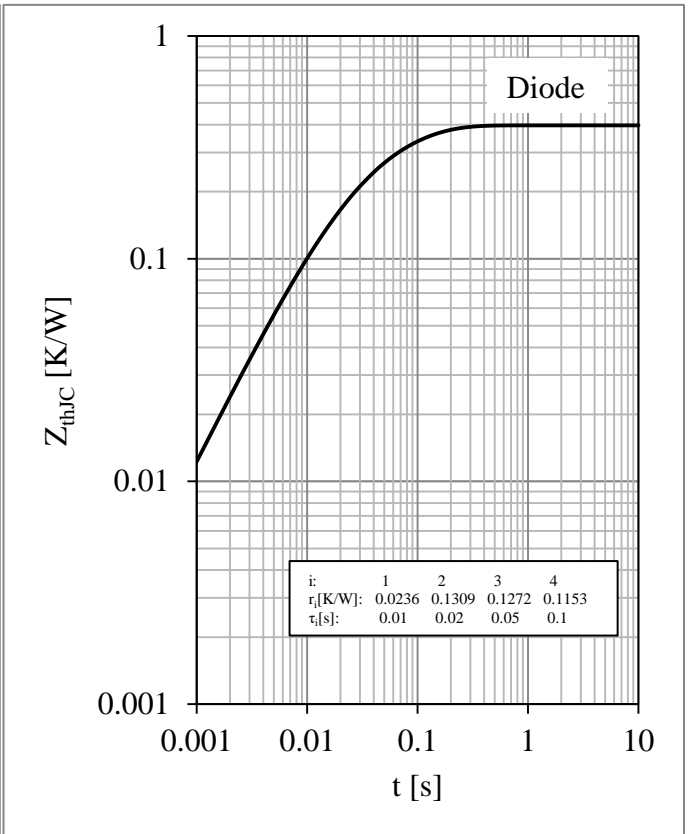


Fig 10. Diode Transient Thermal Impedance

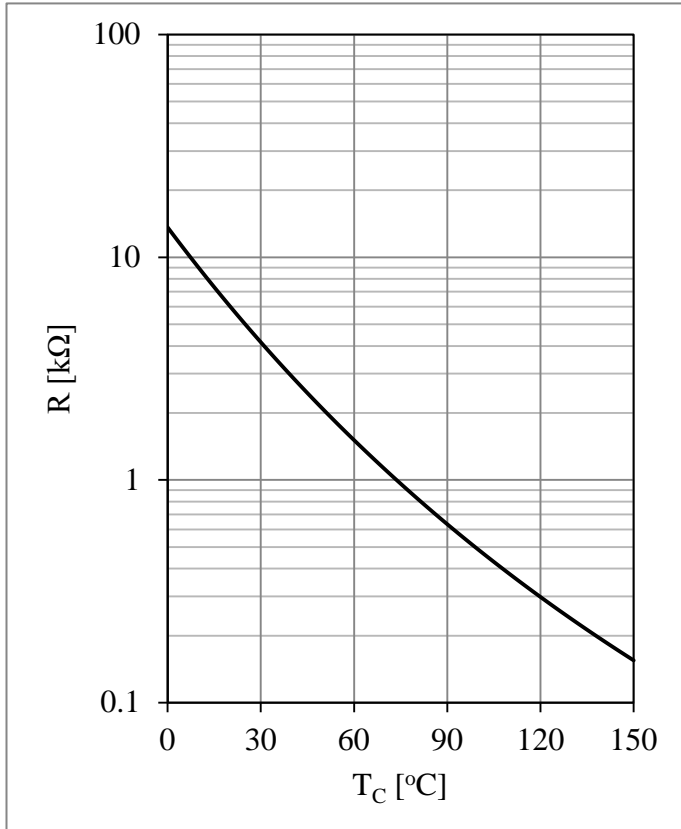
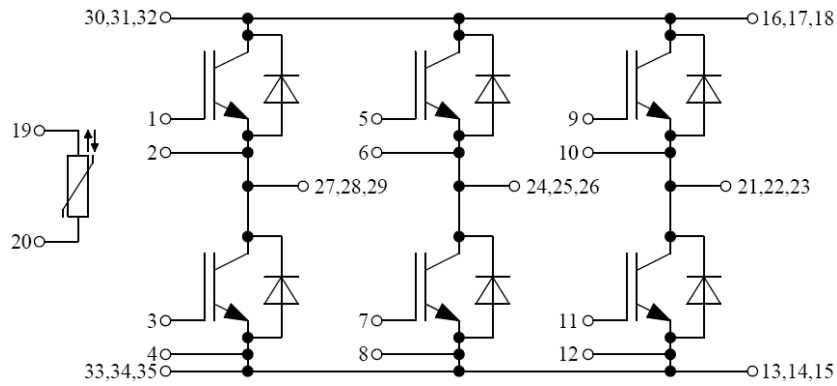


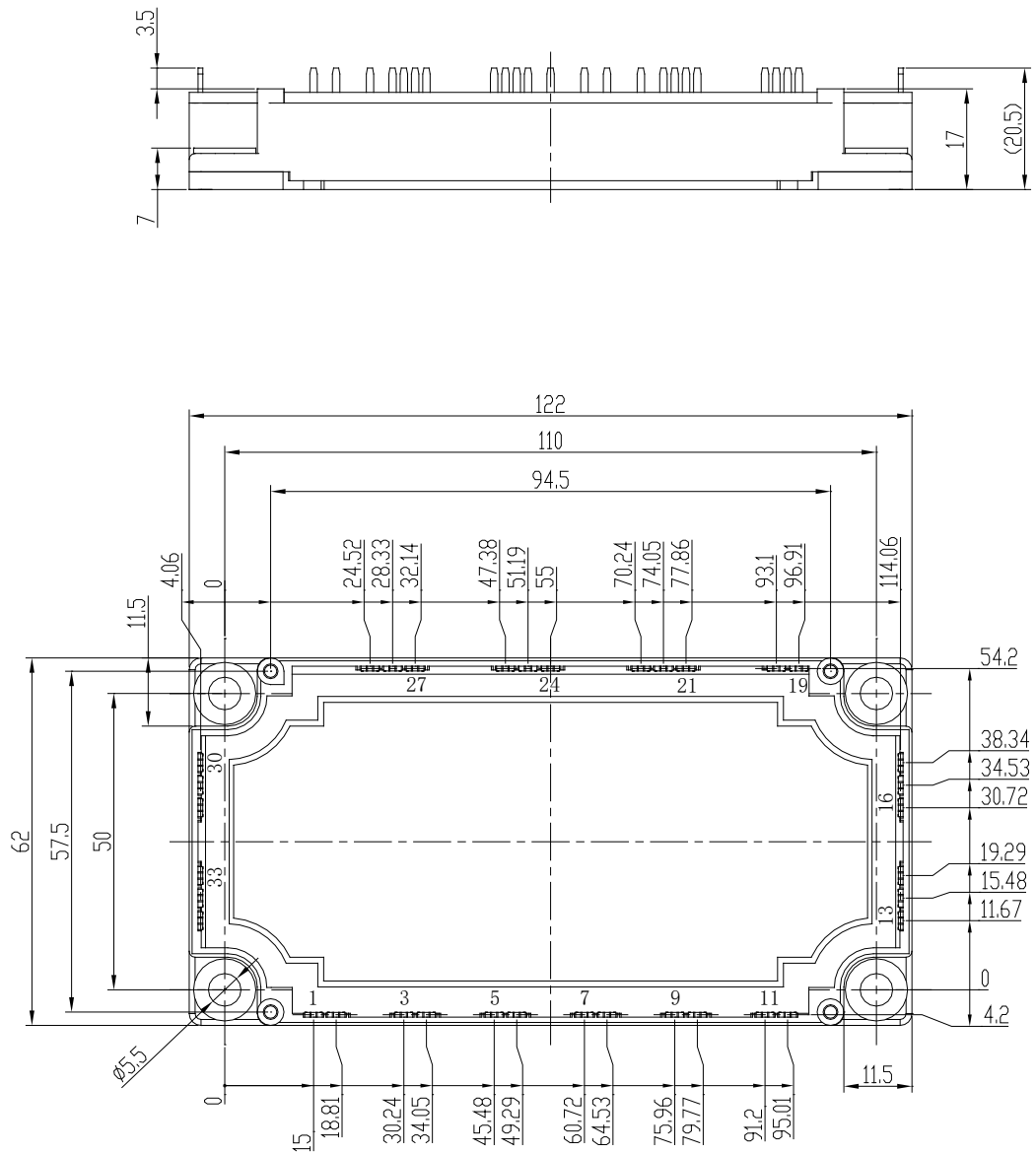
Fig 11. NTC Temperature Characteristic

Circuit Schematic



Package Dimensions

Dimensions in Millimeters



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