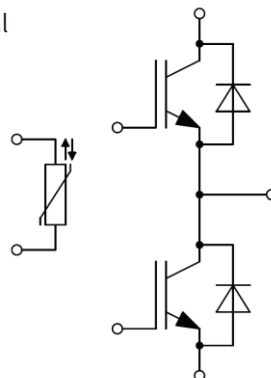


## General Description

GD300HFX120C6SA IGBT Power Module provides ultra low conduction loss as well as short circuit ruggedness. They are designed for the applications such as general inverter 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



Equivalent Circuit Schematic

## 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

| IGBT       |                                                          |             |                  |
|------------|----------------------------------------------------------|-------------|------------------|
| Symbol     | Description                                              | Value       | Unit             |
| $V_{CES}$  | Collector-Emitter Voltage                                | 1200        | V                |
| $V_{GES}$  | Gate-Emitter Voltage                                     | $\pm 20$    | V                |
| $I_C$      | Collector Current @ $T_c=25^\circ\text{C}$               | 496         | A                |
|            | Collector Current @ $T_c=100^\circ\text{C}$              | 300         | A                |
| $I_{CM}$   | Pulsed Collector Current $t_p=1\text{ms}$                | 600         | A                |
| $P_D$      | Maximum Power Dissipation @ $T_j=175^\circ\text{C}$      | 1685        | W                |
| Diode      |                                                          |             |                  |
| Symbol     | Description                                              | Value       | Unit             |
| $V_{RRM}$  | Repetitive Peak Reverse Voltage                          | 1200        | V                |
| $I_F$      | Diode Continuous Forward Current                         | 300         | A                |
| $I_{FM}$   | Diode Maximum Forward Current $t_p=1\text{ms}$           | 600         | 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, $f=50\text{Hz}$ , $t=1\text{min}$ | 2500        | V                |

**IGBT Characteristics**

Tc=25°C, unless otherwise specified

| Symbol        | Parameter                               | Test Conditions                                                                            | Min. | Typ. | Max. | Unit     |
|---------------|-----------------------------------------|--------------------------------------------------------------------------------------------|------|------|------|----------|
| $V_{CE(sat)}$ | Collector to Emitter Saturation Voltage | $I_C=300A, V_{GE}=15V, T_J=25^\circ C$                                                     |      | 1.70 | 2.15 | V        |
|               |                                         | $I_C=300A, V_{GE}=15V, T_J=125^\circ C$                                                    |      | 1.95 |      |          |
|               |                                         | $I_C=300A, V_{GE}=15V, T_J=150^\circ C$                                                    |      | 2.00 |      |          |
| $V_{GE(th)}$  | Gate-Emitter Threshold Voltage          | $I_C=12.0mA, V_{CE}=V_{GE}, T_J=25^\circ C$                                                | 5.6  | 6.2  | 6.8  | V        |
| $I_{CES}$     | Collector Cut-Off Current               | $V_{CE}=V_{CES}, V_{GE}=0V, T_J=25^\circ C$                                                |      |      | 1.0  | mA       |
| $I_{GES}$     | Gate-Emitter Leakage Current            | $V_{CE}=V_{CES}, V_{GE}=0V, T_J=25^\circ C$                                                |      |      | 400  | nA       |
| $R_{Gint}$    | Internal Gate Resistance                |                                                                                            |      | 2.5  |      | $\Omega$ |
| $C_{ies}$     | Input Capacitance                       | $V_{CE}=25V, f=1MHz$                                                                       |      | 31.1 |      | nF       |
| $C_{res}$     | Reverse Transfer Capacitance            | $V_{GE}=0V$                                                                                |      | 0.87 |      | nF       |
| $Q_G$         | Gate Charge                             | $V_{GE}=-15...+15V$                                                                        |      | 2.33 |      | $\mu C$  |
| $t_{d(on)}$   | Turn-On Delay Time                      | $V_{CC}=600V, I_C=300A,$<br>$R_G=1.5\Omega, V_{GE}=\pm 15V,$<br>$T_J=25^\circ C$           |      | 313  |      | ns       |
| $t_r$         | Rise Time                               |                                                                                            |      | 57   |      | ns       |
| $t_{d(off)}$  | Turn-Off Delay Time                     |                                                                                            |      | 464  |      | ns       |
| $t_f$         | Fall Time                               |                                                                                            |      | 206  |      | ns       |
| $E_{on}$      | Turn-On Switching Loss                  |                                                                                            |      | 9.97 |      | mJ       |
| $E_{off}$     | Turn-Off Switching Loss                 |                                                                                            |      | 28.6 |      | mJ       |
| $t_{d(on)}$   | Turn-On Delay Time                      | $V_{CC}=600V, I_C=300A,$<br>$R_G=1.5\Omega, V_{GE}=\pm 15V,$<br>$T_J=125^\circ C$          |      | 336  |      | ns       |
| $t_r$         | Rise Time                               |                                                                                            |      | 66   |      | ns       |
| $t_{d(off)}$  | Turn-Off Delay Time                     |                                                                                            |      | 528  |      | ns       |
| $t_f$         | Fall Time                               |                                                                                            |      | 299  |      | ns       |
| $E_{on}$      | Turn-On Switching Loss                  |                                                                                            |      | 21.1 |      | mJ       |
| $E_{off}$     | Turn-Off Switching Loss                 |                                                                                            |      | 36.6 |      | mJ       |
| $t_{d(on)}$   | Turn-On Delay Time                      | $V_{CC}=600V, I_C=300A,$<br>$R_G=1.5\Omega, V_{GE}=\pm 15V,$<br>$T_J=150^\circ C$          |      | 345  |      | ns       |
| $t_r$         | Rise Time                               |                                                                                            |      | 68   |      | ns       |
| $t_{d(off)}$  | Turn-Off Delay Time                     |                                                                                            |      | 539  |      | ns       |
| $t_f$         | Fall Time                               |                                                                                            |      | 309  |      | ns       |
| $E_{on}$      | Turn-On Switching Loss                  |                                                                                            |      | 25.6 |      | mJ       |
| $E_{off}$     | Turn-Off Switching Loss                 |                                                                                            |      | 37.8 |      | mJ       |
| $I_{SC}$      | SC Data                                 | $t_p \leq 10\mu s, V_{GE}=15V,$<br>$T_J=150^\circ C, V_{CC}=900V,$<br>$V_{CEM} \leq 1200V$ |      | 1200 |      | A        |

### Diode Characteristics

Tc=25°C, unless otherwise specified

| Parameter                     | Test Conditions                        | Min. | Typ. | Max. | Unit    |
|-------------------------------|----------------------------------------|------|------|------|---------|
| Diode Forward Voltage         | $I_F=300A, V_{GE}=0V, T_J=25^\circ C$  |      | 1.85 | 2.30 | V       |
|                               | $I_F=300A, V_{GE}=0V, T_J=125^\circ C$ |      | 1.90 |      |         |
|                               | $I_F=300A, V_{GE}=0V, T_J=150^\circ C$ |      | 1.95 |      |         |
| Recovered Charge              | $V_{CC}=600V, I_F=300A,$               |      | 10.8 |      | $\mu C$ |
| Peak Reverse Recovery Current | $-di/dt=6950A/\mu s, V_{GE}=-15V,$     |      | 272  |      | A       |
| Reverse Recovery Energy       | $T_J=25^\circ C$                       |      | 9.53 |      | mJ      |
| Recovered Charge              | $V_{CC}=600V, I_F=300A,$               |      | 24.2 |      | $\mu C$ |
| Peak Reverse Recovery Current | $-di/dt=6090A/\mu s, V_{GE}=-15V,$     |      | 276  |      | A       |
| Reverse Recovery Energy       | $T_J=125^\circ C$                      |      | 18.4 |      | mJ      |
| Recovered Charge              | $V_{CC}=600V, I_F=300A,$               |      | 33.6 |      | $\mu C$ |
| Peak Reverse Recovery Current | $-di/dt=5440A/\mu s, V_{GE}=-15V,$     |      | 278  |      | A       |
| Reverse Recovery Energy       | $T_J=150^\circ C$                      |      | 20.6 |      | mJ      |

### NTC Characteristics

Tc=25°C, unless otherwise specified

| Symbol       | Parameter              | Test Conditions                               | Min. | Typ. | Max. | Unit       |
|--------------|------------------------|-----------------------------------------------|------|------|------|------------|
| $R_{25}$     | Rated Resistance       |                                               |      | 5.0  |      | k $\Omega$ |
| $\Delta R/R$ | Deviation of $R_{100}$ | $T_C=100^\circ C, R_{100}=493.3\Omega$        | -5   |      | 5    | %          |
| $P_{25}$     | Power Dissipation      |                                               |      |      | 20.0 | mW         |
| $B_{25/50}$  | B-value                | $R_2=R_{25}\exp[B_{25/50}(1/T_2-1/298.15K)]$  |      | 3375 |      | K          |
| $B_{25/80}$  | B-value                | $R_2=R_{25}\exp[B_{25/80}(1/T_2-1/298.15K)]$  |      | 3411 |      | K          |
| $B_{25/100}$ | B-value                | $R_2=R_{25}\exp[B_{25/100}(1/T_2-1/298.15K)]$ |      | 3433 |      | K          |

### Module Characteristics

Tc=25°C, unless otherwise specified

| Symbol        | Parameter                                | Min. | Typ.  | Max.  | Unit       |
|---------------|------------------------------------------|------|-------|-------|------------|
| $L_{CE}$      | Stray Inductance                         |      | 20    |       | nH         |
| $R_{CC'+EE'}$ | Module Lead Resistance, Terminal to Chip |      | 1.10  |       | m $\Omega$ |
| $R_{thJC}$    | Junction-to-Case (per IGBT)              |      |       | 0.089 | K/W        |
|               | Junction-to-Case (per Diode)             |      |       | 0.150 |            |
| $R_{thCH}$    | Case-to-Heatsink (per IGBT)              |      | 0.029 |       | K/W        |
|               | Case-to-Heatsink (per Diode)             |      | 0.048 |       |            |
|               | Case-to-Heatsink (per Module)            |      | 0.009 |       |            |
| M             | Terminal Connection Torque, Screw M6     | 3.0  |       | 6.0   | N · m      |
|               | Mounting Torque, Screw M5                | 3.0  |       | 6.0   |            |
| G             | Weight of Module                         |      | 350   |       | g          |

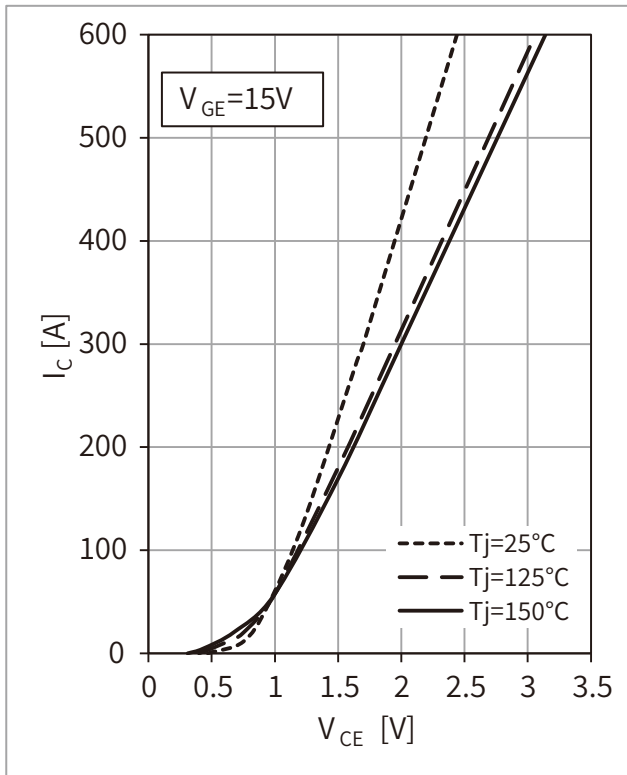


Fig 1. IGBT Output Characteristics

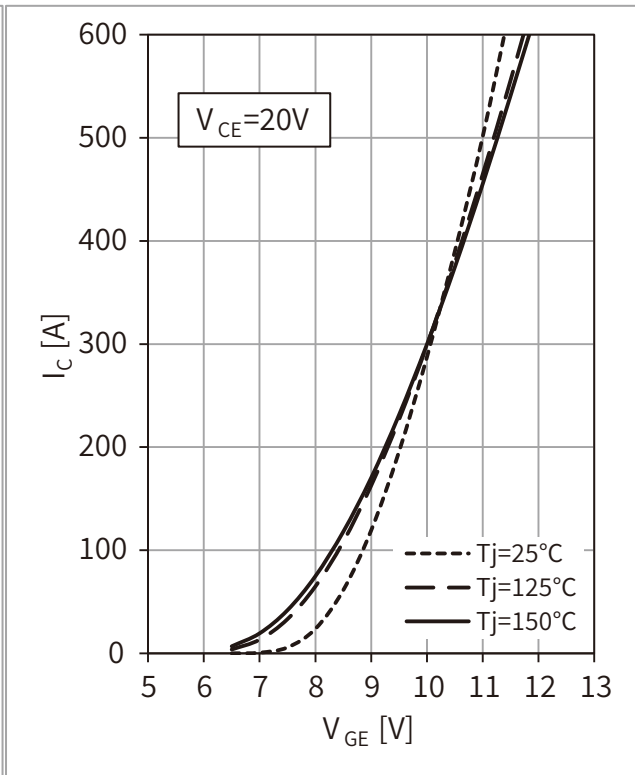


Fig 2. IGBT Transfer Characteristics

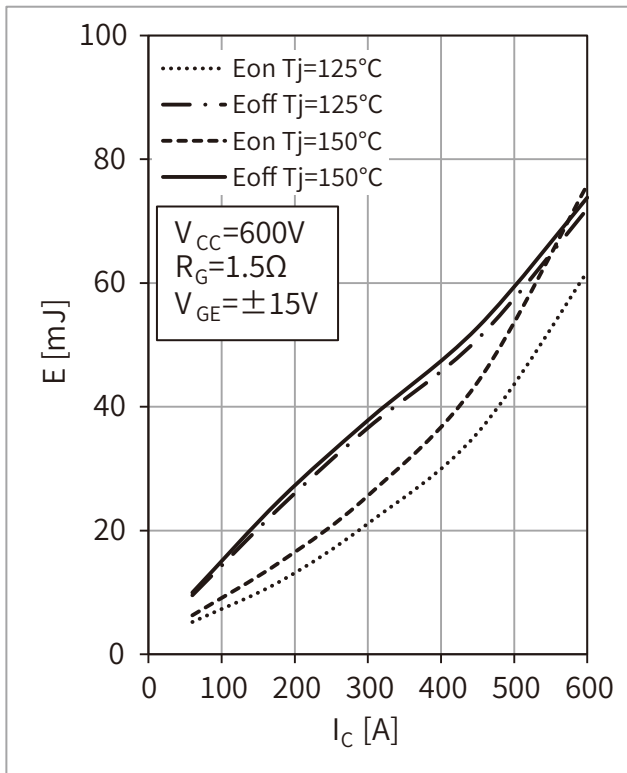


Fig 3. IGBT Switching Loss vs.  $I_C$

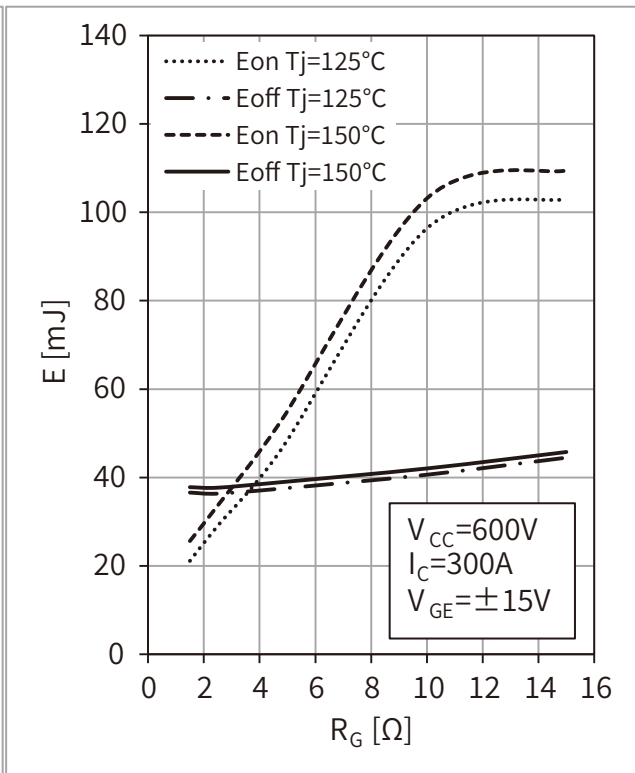


Fig 4. IGBT Switching Loss vs.  $R_G$

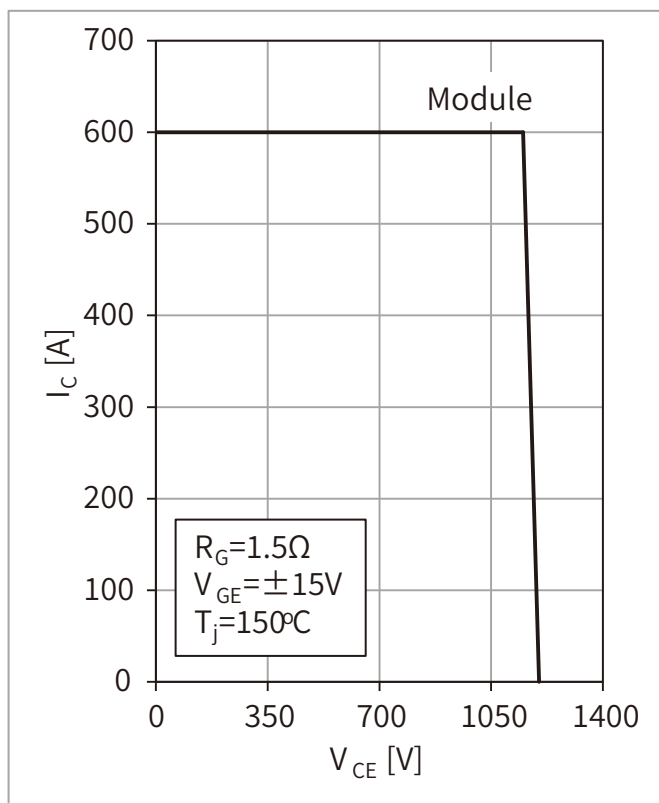


Fig 5. RBSOA

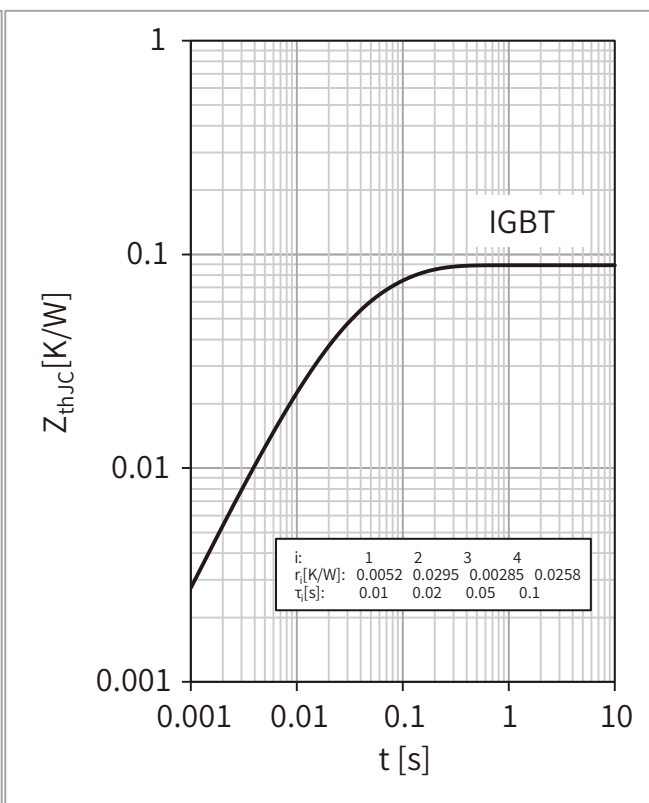


Fig 6. IGBT Transient Thermal Impedance

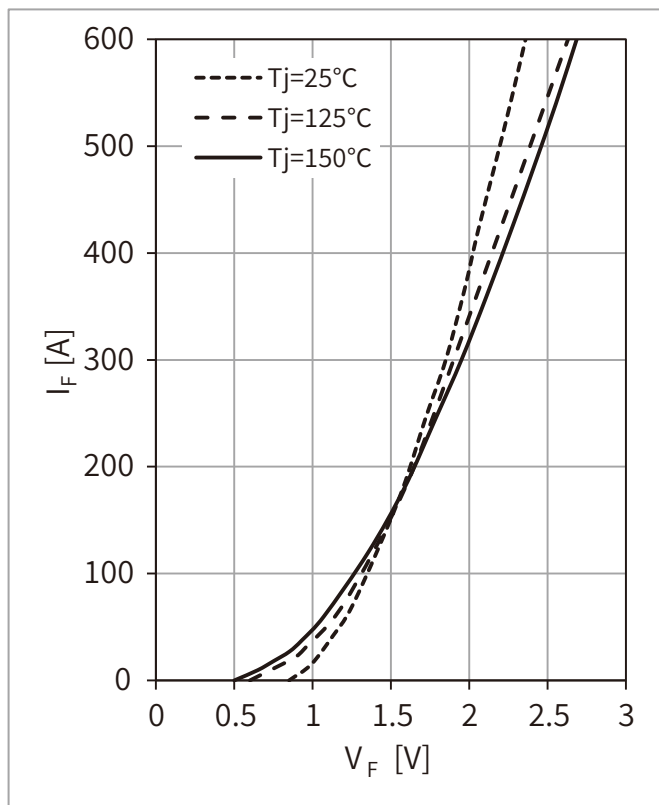


Fig 7. Diode Forward Characteristics

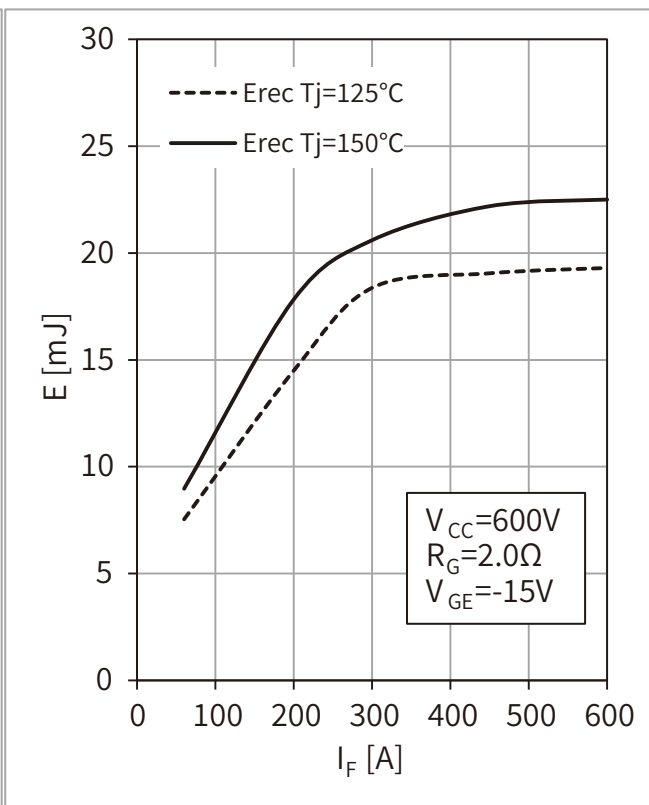


Fig 8. Diode Switching Loss vs.  $I_F$

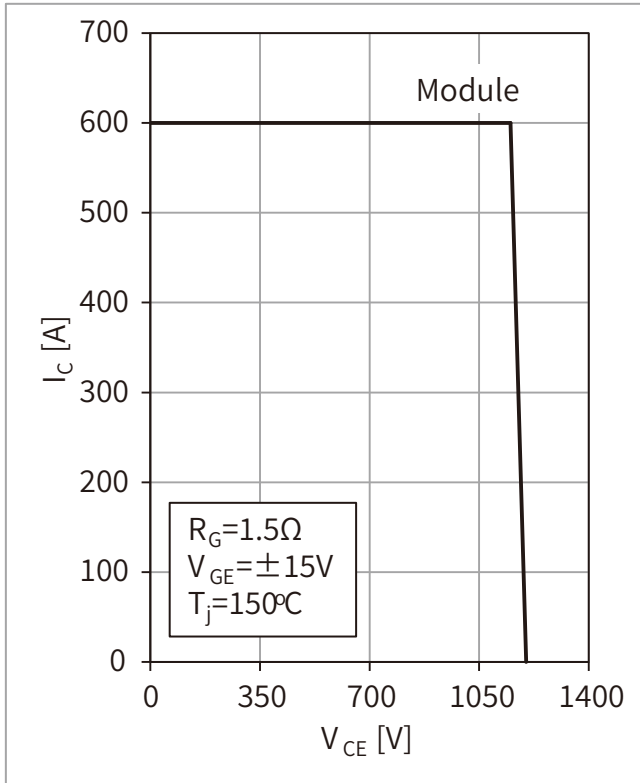


Fig 5. RBSOA

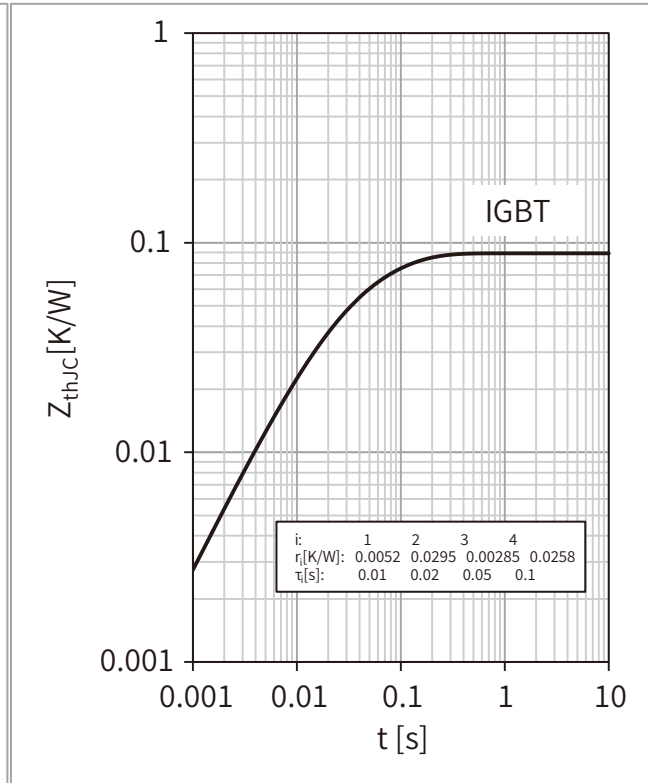


Fig 6. IGBT Transient Thermal Impedance

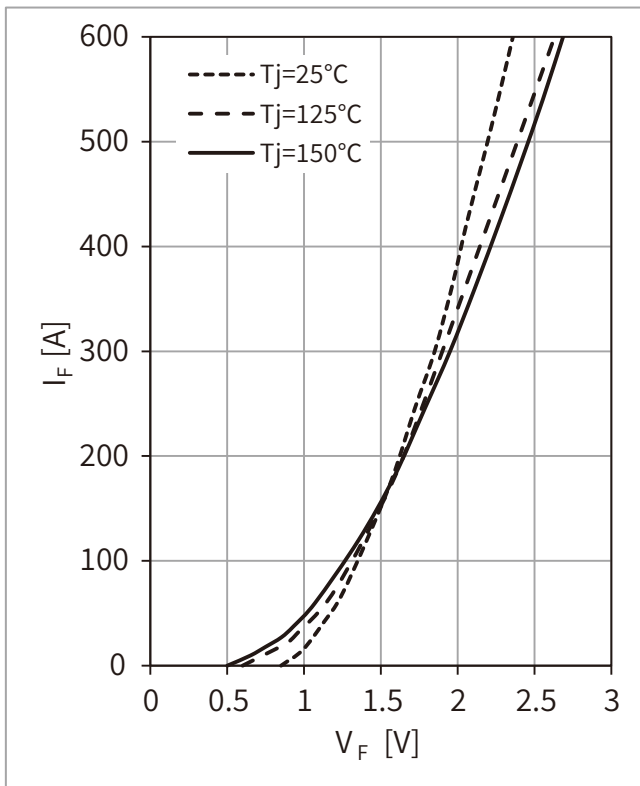


Fig 7. Diode Forward Characteristics

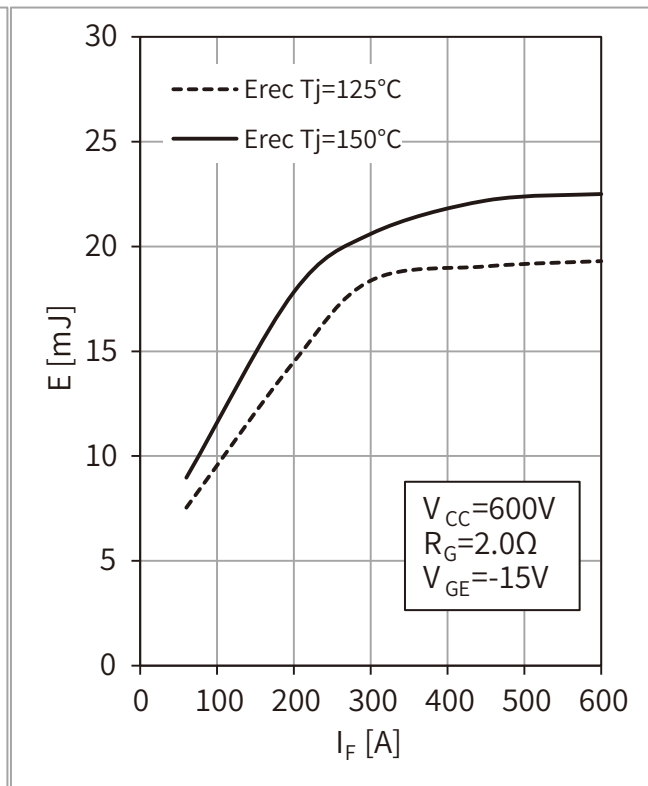
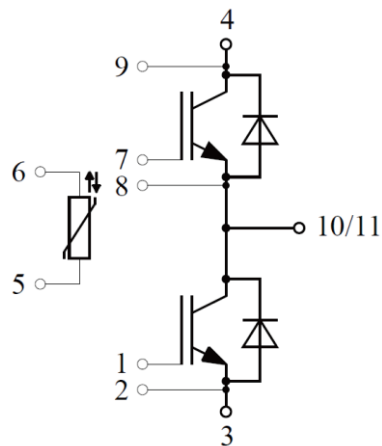


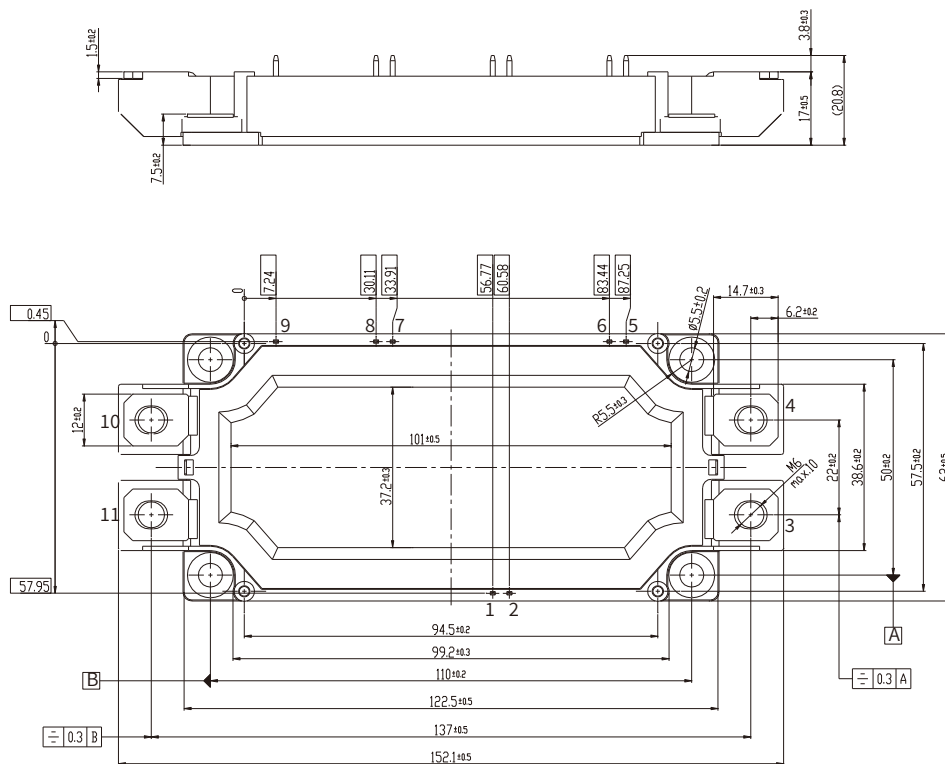
Fig 8. Diode Switching Loss vs.  $I_F$

**Circuit Schematic**



**Package Dimension**

Dimensions in Millimeters



$\square$  = all dimension with tolerance of  $\pm 0.5$