# DOSEMI

# IGBT

# DG50X07T2

**650V/50A IGBT with Diode**

## General Description

DOSEMI IGBT Power Discrete provides ultra low conduction loss as well as low switching loss. They are designed for the applications such as general inverters and UPS.

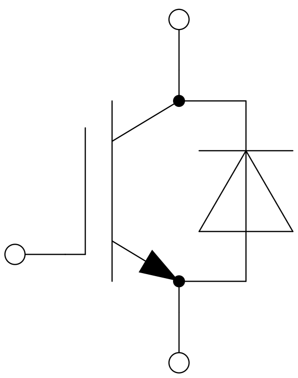
## Features

- Low $V_{CE(sat)}$ Fast IGBT technology
- Low switching loss
- Maximum junction temperature 175°C
- $V_{CE(sat)}$ with positive temperature coefficient
- Fast & soft reverse recovery anti-parallel FWD

## Typical Applications

- Inverter for motor drive
- AC and DC servo drive amplifier
- EV Air Condition

## Equivalent Circuit Schematic



# Absolute Maximum Ratings $T_C$=25°C unless otherwise noted

## IGBT

| Symbol | Description | Value | Unit |
|---|---|---|---|
| $V_{CES}$ | Collector-Emitter Voltage | 650 | V |
| $V_{GES}$ | Gate-Emitter Voltage | ±20 | V |
| $I_C$ | Collector Current @ $T_C$=25°C<br>@ $T_C$=125°C | 100(1)<br>50 | A |
| $I_{CM}$ | Pulsed Collector Current $t_p$ limited by $T_{vjmax}$ | 150 | A |
| $P_D$ | Maximum Power Dissipation @ $T_{vj}$=175°C | 453 | W |

## Diode

| Symbol | Description | Value | Unit |
|---|---|---|---|
| $V_{RRM}$ | Repetitive Peak Reverse Voltage | 650 | V |
| $I_F$ | Diode Continuous Forward Current @ $T_C$=25°C<br>@ $T_C$=90°C | 76(1)<br>50 | A |
| $I_{FM}$ | Diode Maximum Forward Current $t_p$ limited by $T_{vjmax}$ | 150 | A |

## Discrete

| Symbol | Description | Values | Unit |
|---|---|---|---|
| $T_{vjop}$ | Operating Junction Temperature | -40 to +175 | °C |
| $T_{STG}$ | Storage Temperature Range | -55 to +150 | °C |
| $T_S$ | Soldering Temperature,1.6mm from case for 10s | 260 | °C |
| M | Mounting Torque, Screw M3 | 0.6 | N.m |

(1) limited by bondwire

## IGBT Characteristics $T_C$=25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{CE(sat)}$ | Collector to Emitter Saturation Voltage | $I_C$=50A,$V_{GE}$=15V, $T_{vj}$=25°C | | 1.45 | 1.90 | V |
| | | $I_C$=50A,$V_{GE}$=15V, $T_{vj}$=150°C | | 1.70 | | |
| | | $I_C$=50A,$V_{GE}$=15V, $T_{vj}$=175°C | | 1.75 | | |
| $V_{GE(th)}$ | Gate-Emitter Threshold Voltage | $I_C$=0.8mA,$V_{CE}$=$V_{GE}$, $T_{vj}$=25°C | 5.0 | 5.8 | 6.5 | V |
| $I_{CES}$ | Collector Cut-Off Current | $V_{CE}$=$V_{CES}$,$V_{GE}$=0V, $T_{vj}$=25°C | | | 200 | μA |
| $I_{GES}$ | Gate-Emitter Leakage Current | $V_{GE}$=$V_{GES}$,$V_{CE}$=0V, $T_{vj}$=25°C | | | 100 | nA |
| $R_{Gint}$ | Internal Gate Resistance | | | 0 | | Ω |
| $C_{ies}$ | Input Capacitance | $V_{CE}$=25V,f=100kHz, $V_{GE}$=0V | | 5.80 | | nF |
| $C_{res}$ | Reverse Transfer Capacitance | | | 0.26 | | nF |
| $C_{oes}$ | Output Capacitance | | | 0.11 | | nF |
| $Q_G$ | Gate Charge | $V_{GE}$=-15…+15V | | 0.35 | | μC |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{CC}$=300V,$I_C$=50A, $R_G$=6.8Ω,$V_{GE}$=±15V, Ls=40nH,$T_{vj}$=25°C | | 27 | | ns |
| $t_r$ | Rise Time | | | 95 | | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 64 | | ns |
| $t_f$ | Fall Time | | | 164 | | ns |
| $E_{on}$ | Turn-On Switching Loss | | | 1.86 | | mJ |
| $E_{off}$ | Turn-Off Switching Loss | | | 0.89 | | mJ |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{CC}$=300V,$I_C$=50A, $R_G$=6.8Ω,$V_{GE}$=±15V, Ls=40nH,$T_{vj}$=150°C | | 30 | | ns |
| $t_r$ | Rise Time | | | 110 | | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 69 | | ns |
| $t_f$ | Fall Time | | | 215 | | ns |
| $E_{on}$ | Turn-On Switching Loss | | | 2.22 | | mJ |
| $E_{off}$ | Turn-Off Switching Loss | | | 1.19 | | mJ |
| $t_{d(on)}$ | Turn-On Delay Time | $V_{CC}$=300V,$I_C$=50A, $R_G$=6.8Ω,$V_{GE}$=±15V, Ls=40nH,$T_{vj}$=175°C | | 31 | | ns |
| $t_r$ | Rise Time | | | 125 | | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | | 71 | | ns |
| $t_f$ | Fall Time | | | 222 | | ns |
| $E_{on}$ | Turn-On Switching Loss | | | 2.29 | | mJ |
| $E_{off}$ | Turn-Off Switching Loss | | | 1.23 | | mJ |

## Diode Characteristics $T_C$=25°C unless otherwise noted

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_F$ | Diode Forward Voltage | $I_F$=50A,$V_{GE}$=0V,$T_{vj}$=25°C | | 1.65 | 2.10 | V |
| | | $I_F$=50A,$V_{GE}$=0V,$T_{vj}$=150°C | | 1.65 | | |
| | | $I_F$=50A,$V_{GE}$=0V,$T_{vj}$=175°C | | 1.65 | | |
| $Q_r$ | Recovered Charge | $V_R$=300V,$I_F$=50A, -di/dt=390A/µs,$V_{GE}$=-15V Ls=40nH,$T_{vj}$=25°C | | 1.25 | | µC |
| $t_{rr}$ | Recovered Time | | | 139 | | ns |
| $I_{RM}$ | Peak Reverse Recovery Current | | | 15 | | A |
| $E_{rec}$ | Reverse Recovery Energy | | | 0.31 | | mJ |
| $Q_r$ | Recovered Charge | $V_R$=300V,$I_F$=50A, -di/dt=380A/µs,$V_{GE}$=-15V Ls=40nH,$T_{vj}$=150°C | | 2.55 | | µC |
| $t_{rr}$ | Recovered Time | | | 204 | | ns |
| $I_{RM}$ | Peak Reverse Recovery Current | | | 19 | | A |
| $E_{rec}$ | Reverse Recovery Energy | | | 0.62 | | mJ |
| $Q_r$ | Recovered Charge | $V_R$=300V,$I_F$=50A, -di/dt=380A/µs,$V_{GE}$=-15V Ls=40nH,$T_{vj}$=175°C | | 2.96 | | µC |
| $t_{rr}$ | Recovered Time | | | 215 | | ns |
| $I_{RM}$ | Peak Reverse Recovery Current | | | 21 | | A |
| $E_{rec}$ | Reverse Recovery Energy | | | 0.71 | | mJ |

## Discrete Characteristics $T_C$=25°C unless otherwise noted

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| $R_{thJC}$ | Junction-to-Case (per IGBT)<br>Junction-to-Case (per Diode) | | | 0.331<br>0.800 | K/W |
| $R_{thJA}$ | Junction-to-Ambient | | 40 | | K/W |

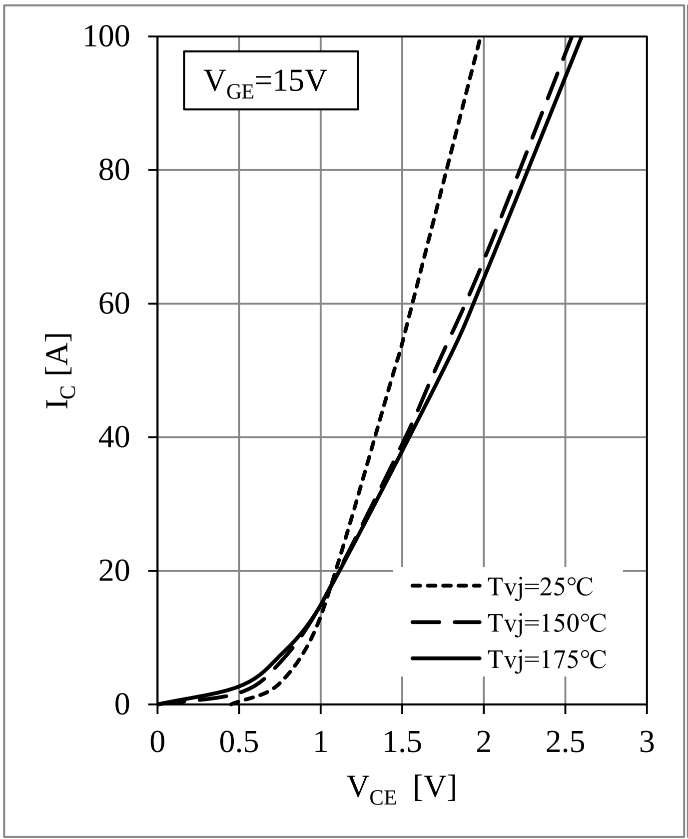



Fig 1. IGBT-inverter Output Characteristics

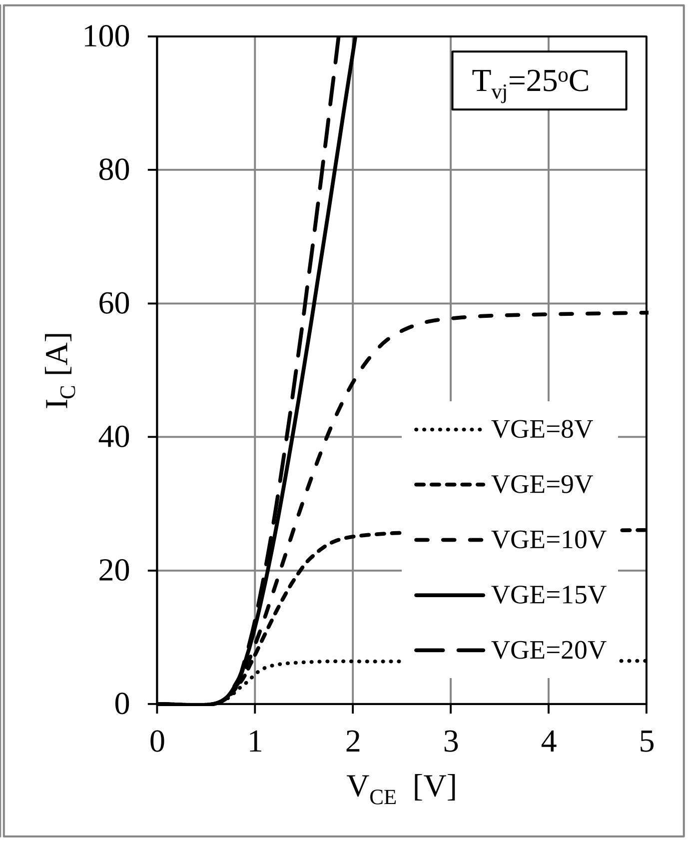



Fig 2. IGBT Output Characteristics

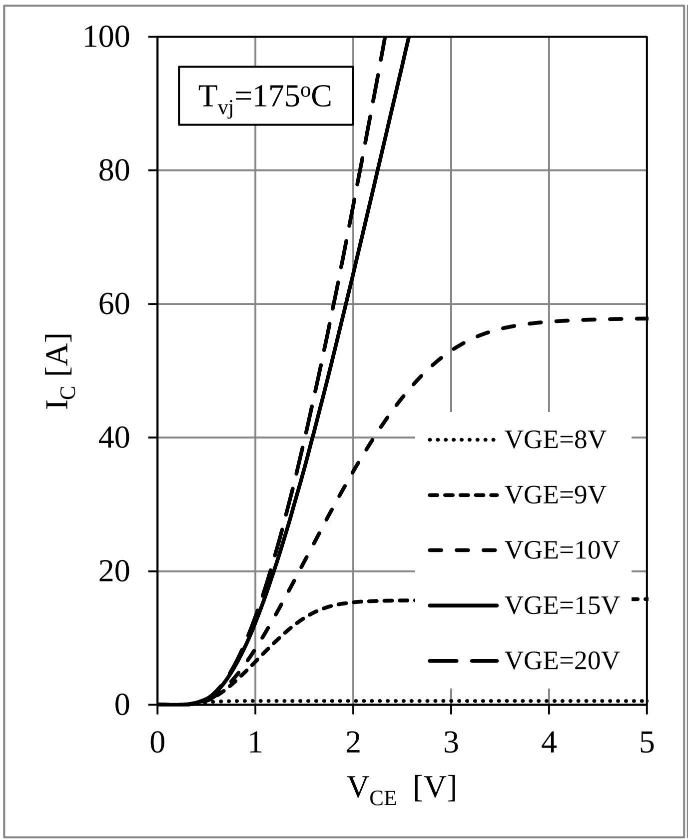



Fig 3. IGBT Output Characteristics

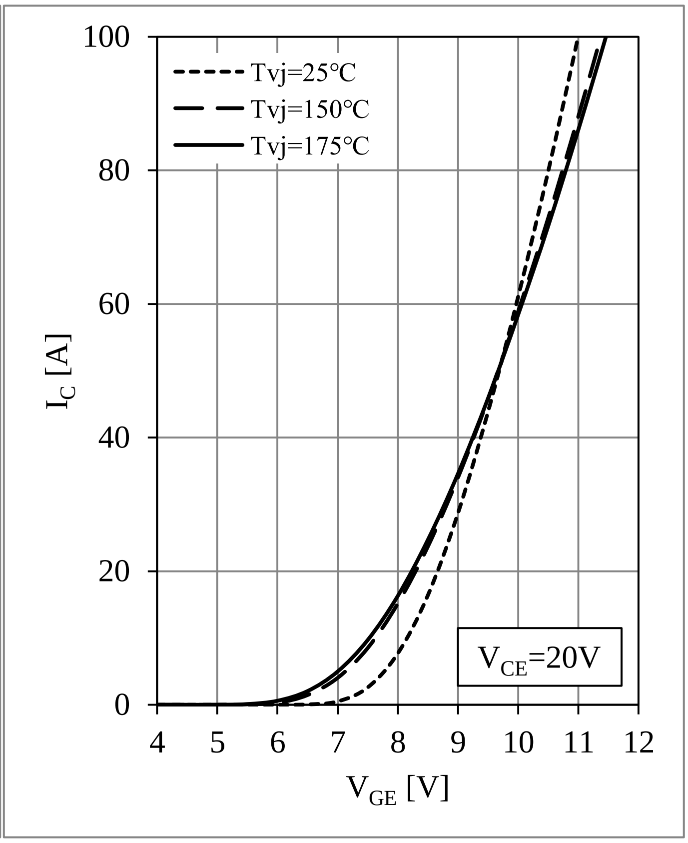



Fig 4. IGBT Transfer Characteristics

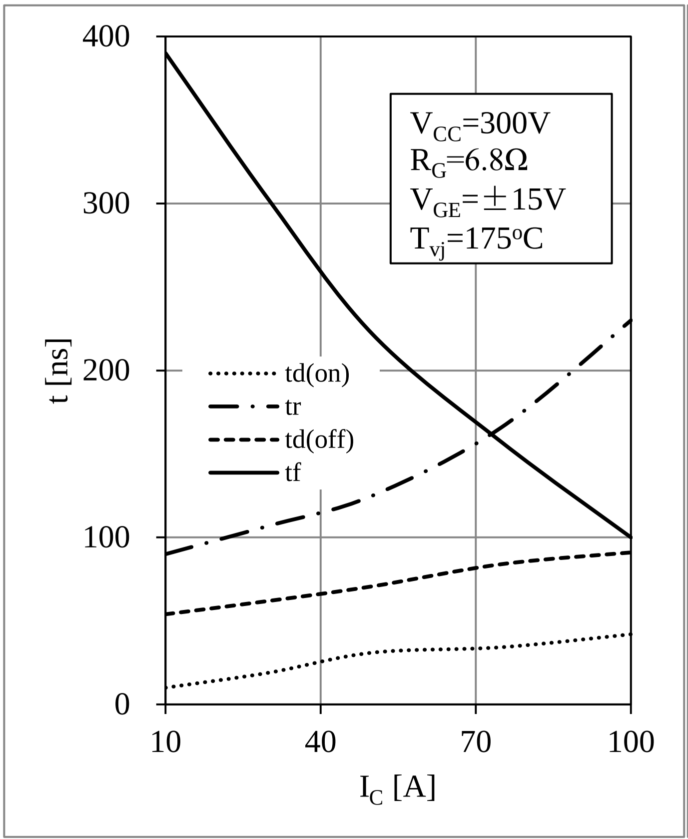



Fig 5. IGBT Switching Times as. $I_C$

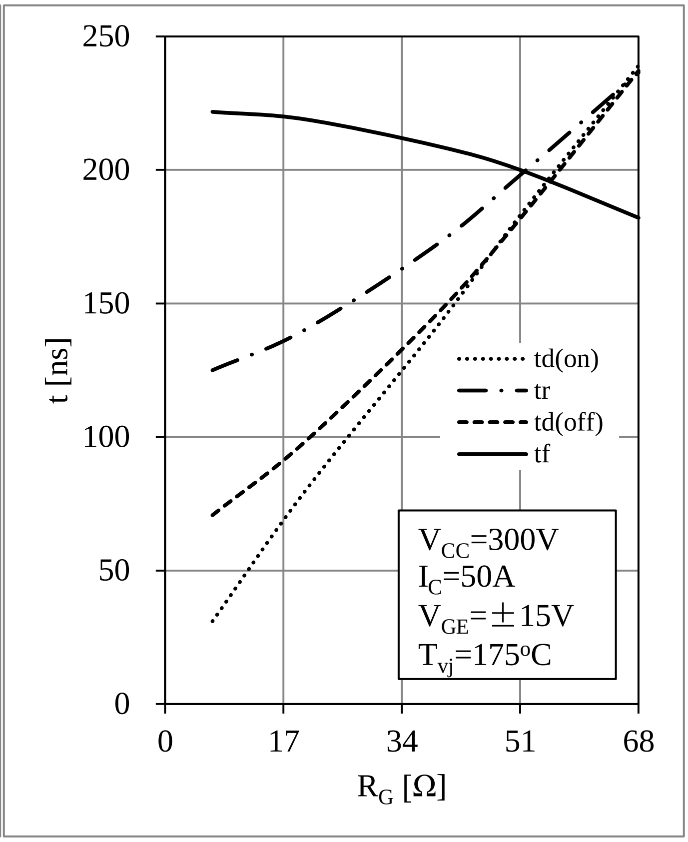



Fig 6. IGBT Switching Times as. $R_G$

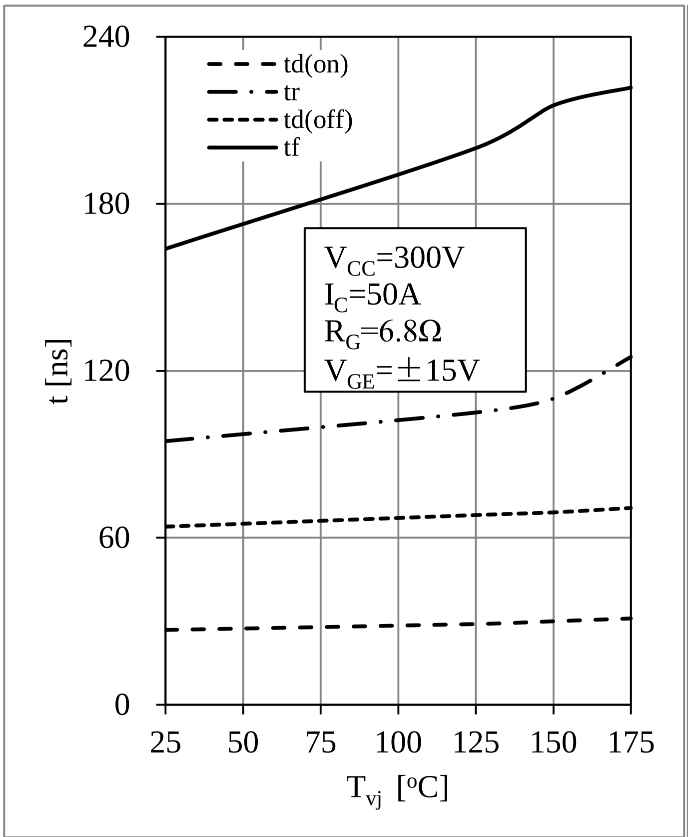



Fig 7. IGBT Switching Times vs. $T_{vj}$

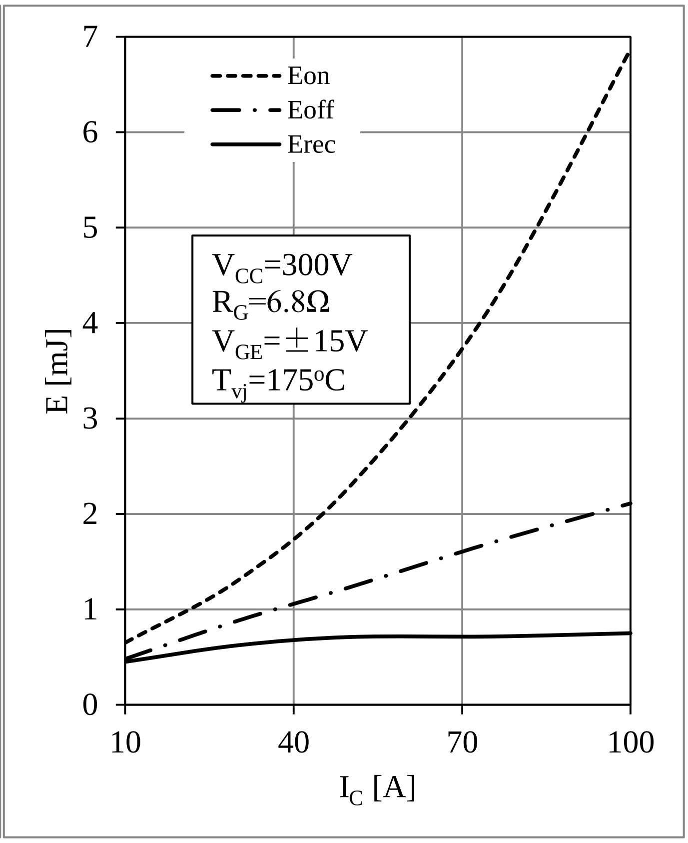



Fig 8. Switching Energy Loss vs. $I_C$

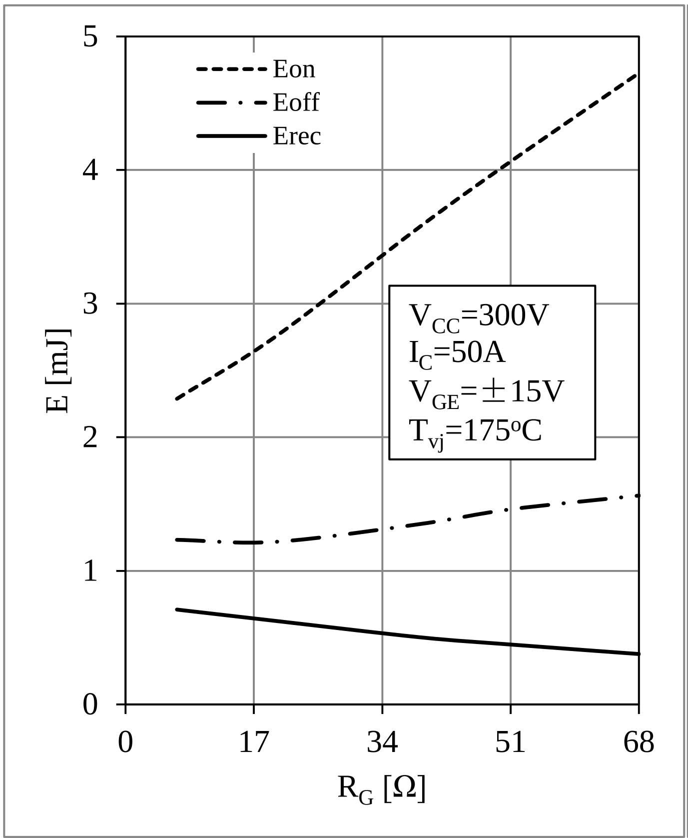



Fig 9. Switching Energy Loss vs. $R_G$

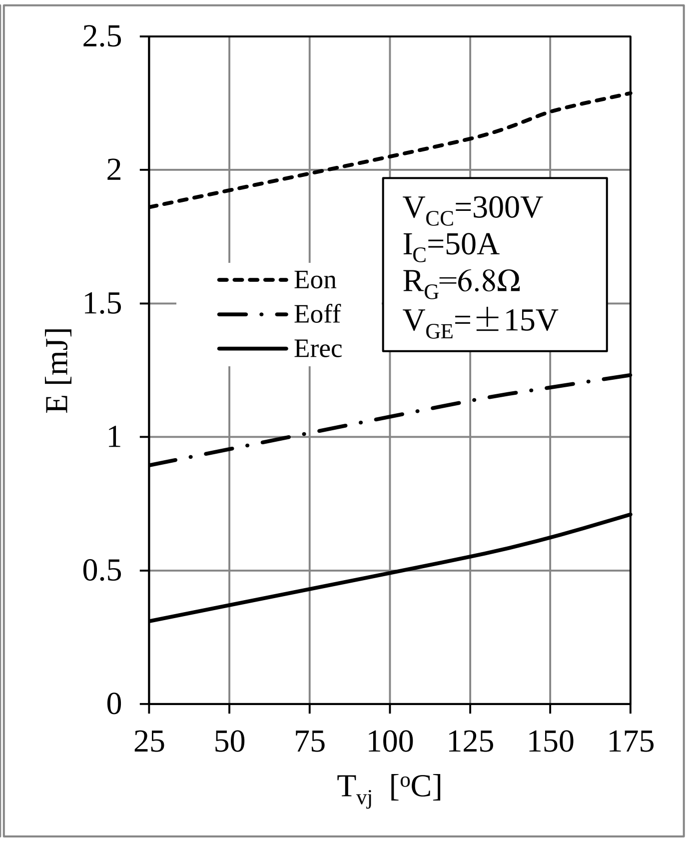



Fig 10. Switching Energy Loss vs. $T_{vj}$

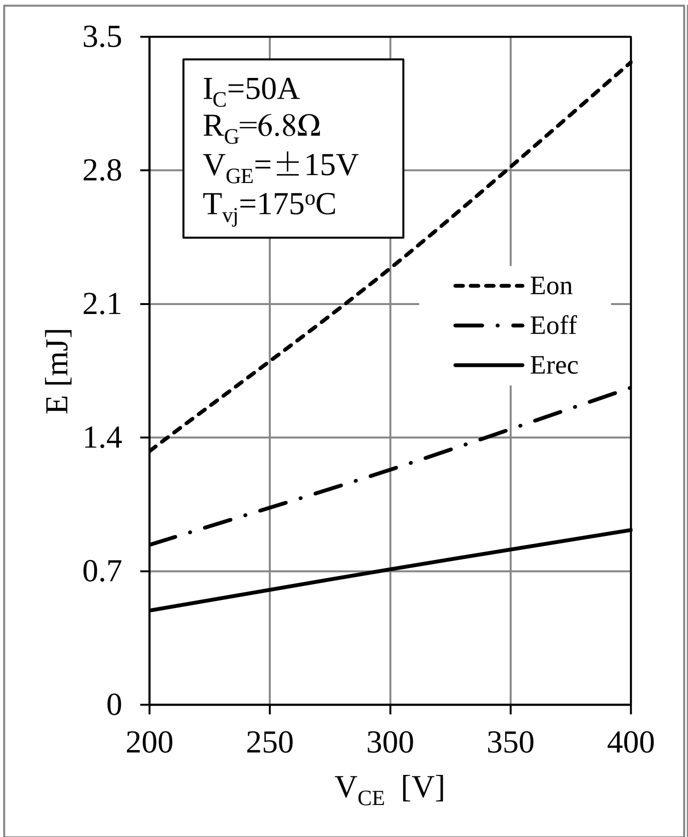



Fig 11. Switching Energy Loss vs. $V_{CE}$

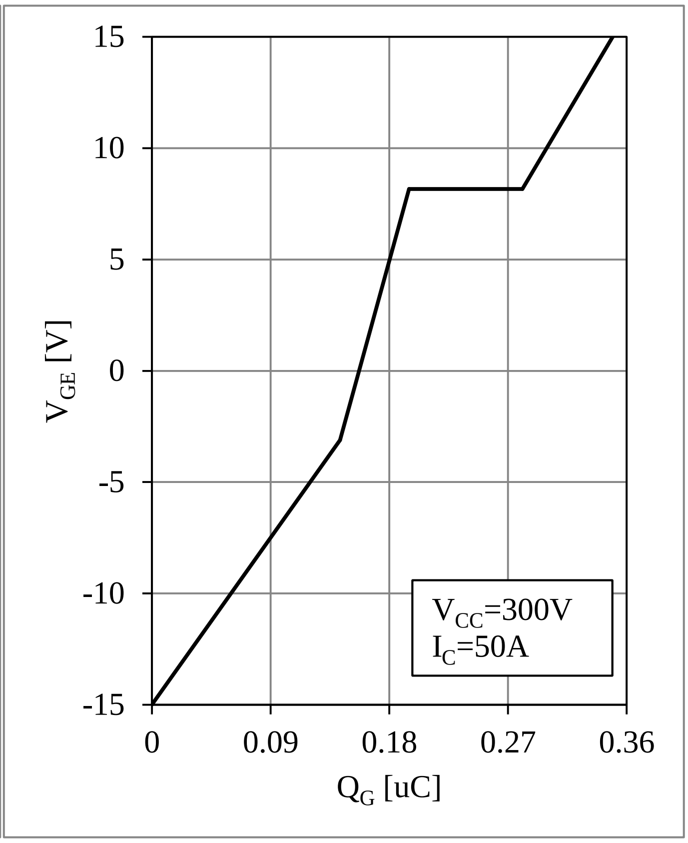



Fig 12 . IGBT Gate Charge vs. $V_{CE}$

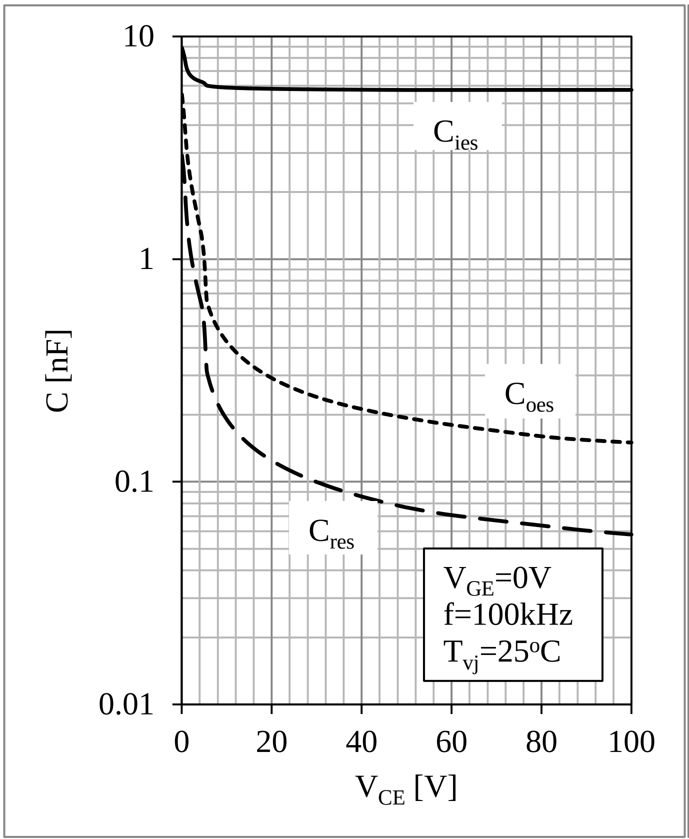



Fig 13. IGBT Capacity Charcteristic

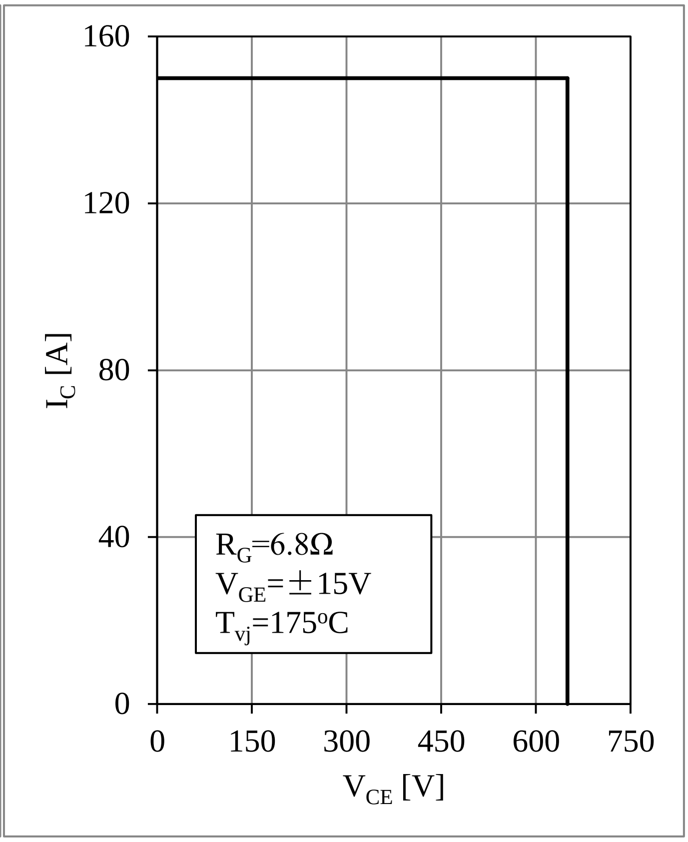



Fig 14 . RBSOA

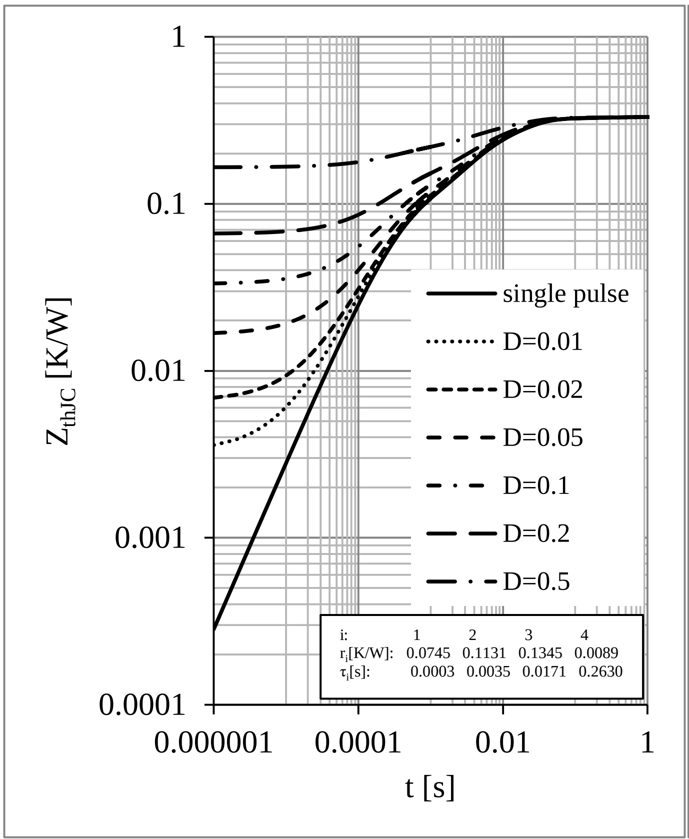



Fig 15. IGBT Transient Thermal Impedance

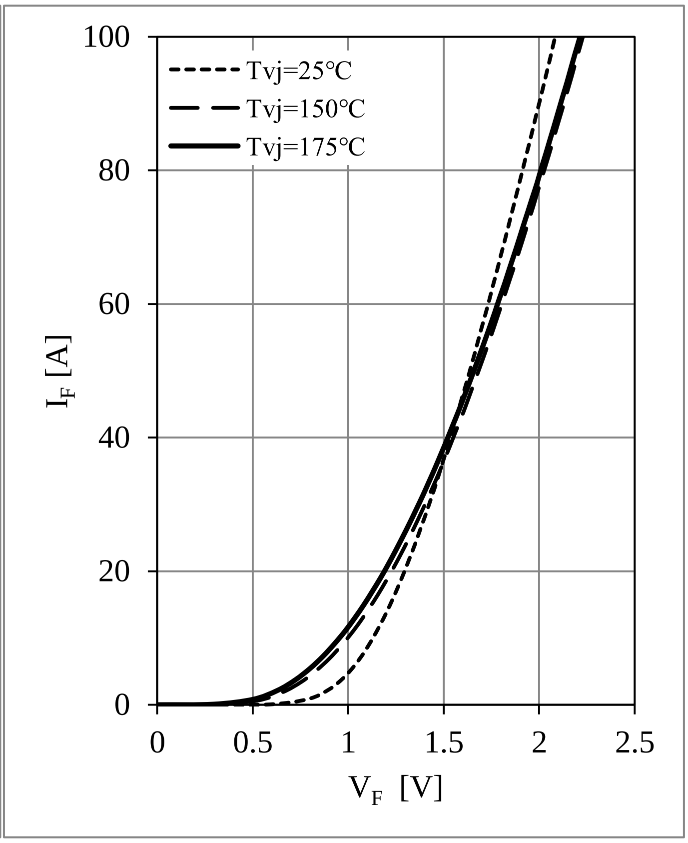



Fig 16. Diode Forward Characteristics

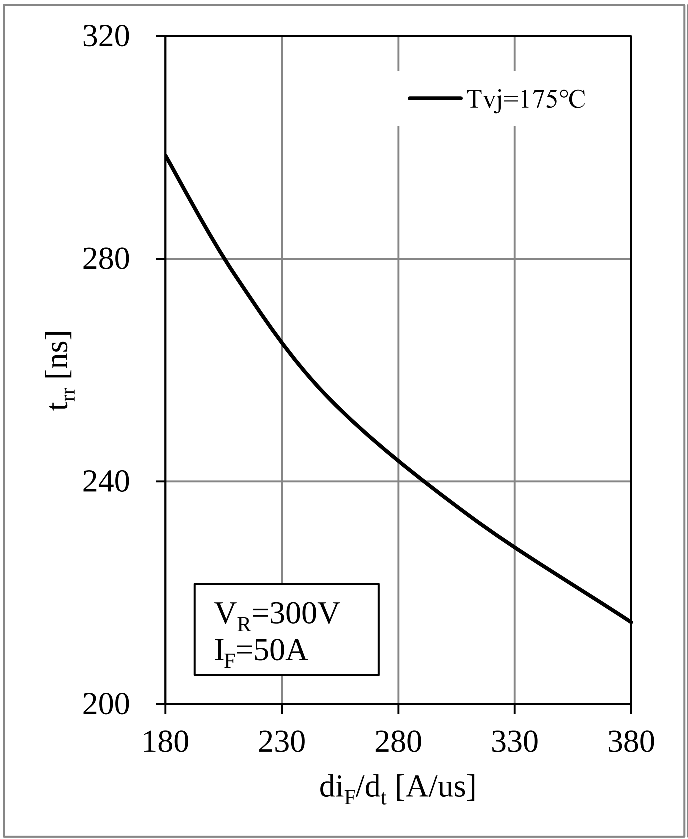



Fig 17. Reverse Recovery Time vs. $di_F/d_t$

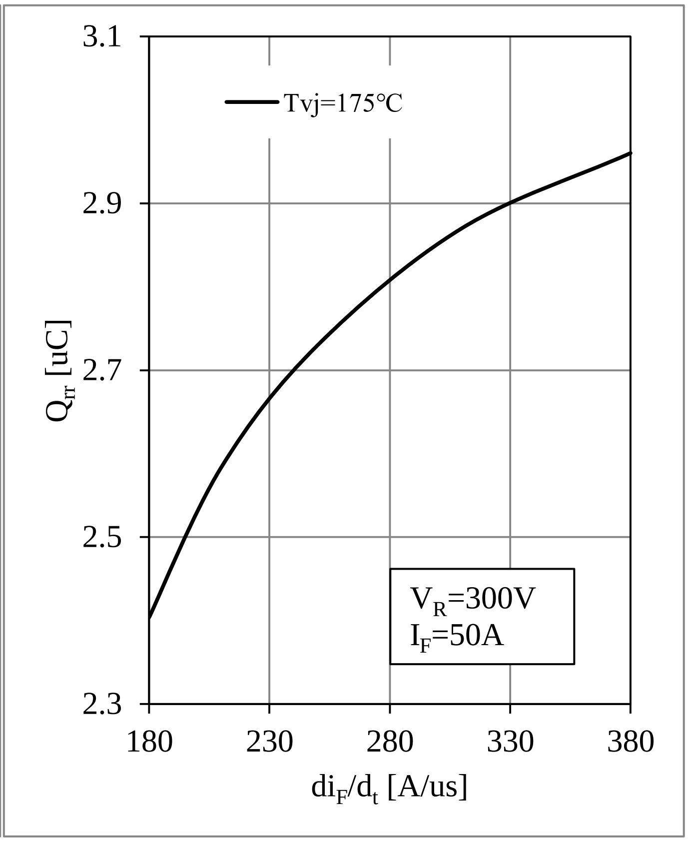



Fig 18. Reverse Recovery Charge vs. $di_F/d_t$

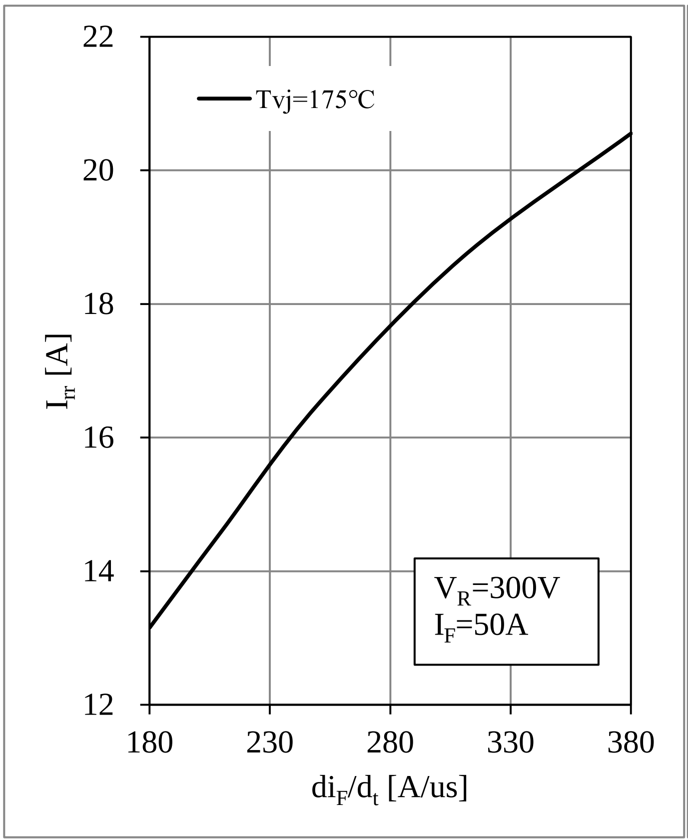



Fig 19. Reverse Recovery Current vs. $di_F/d_t$

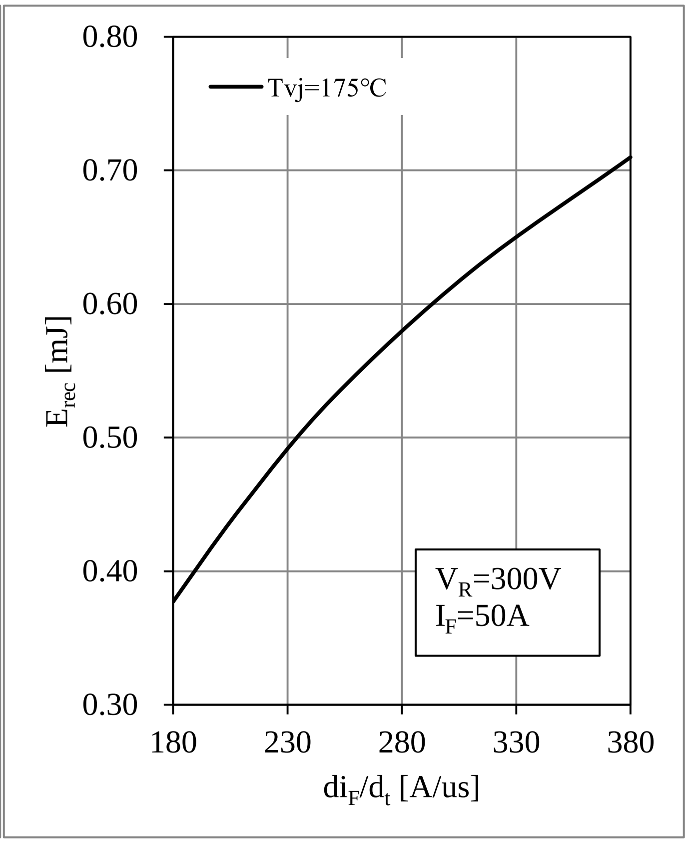



Fig 20. Reverse Energy Losses vs. $di_F/d_t$

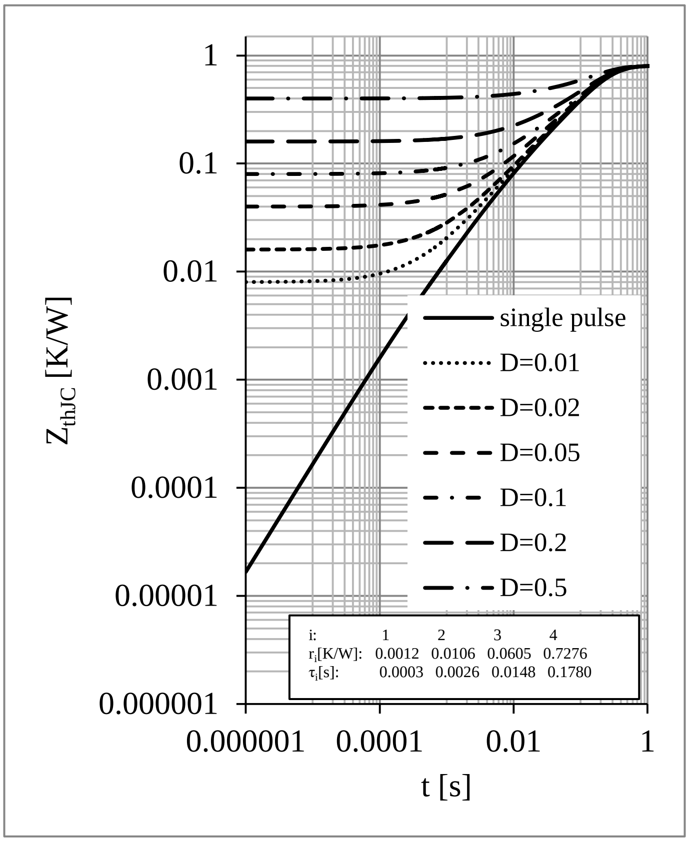
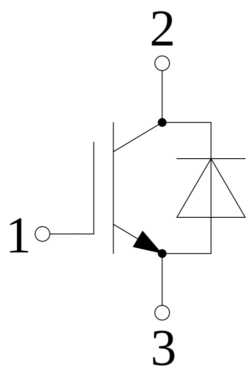


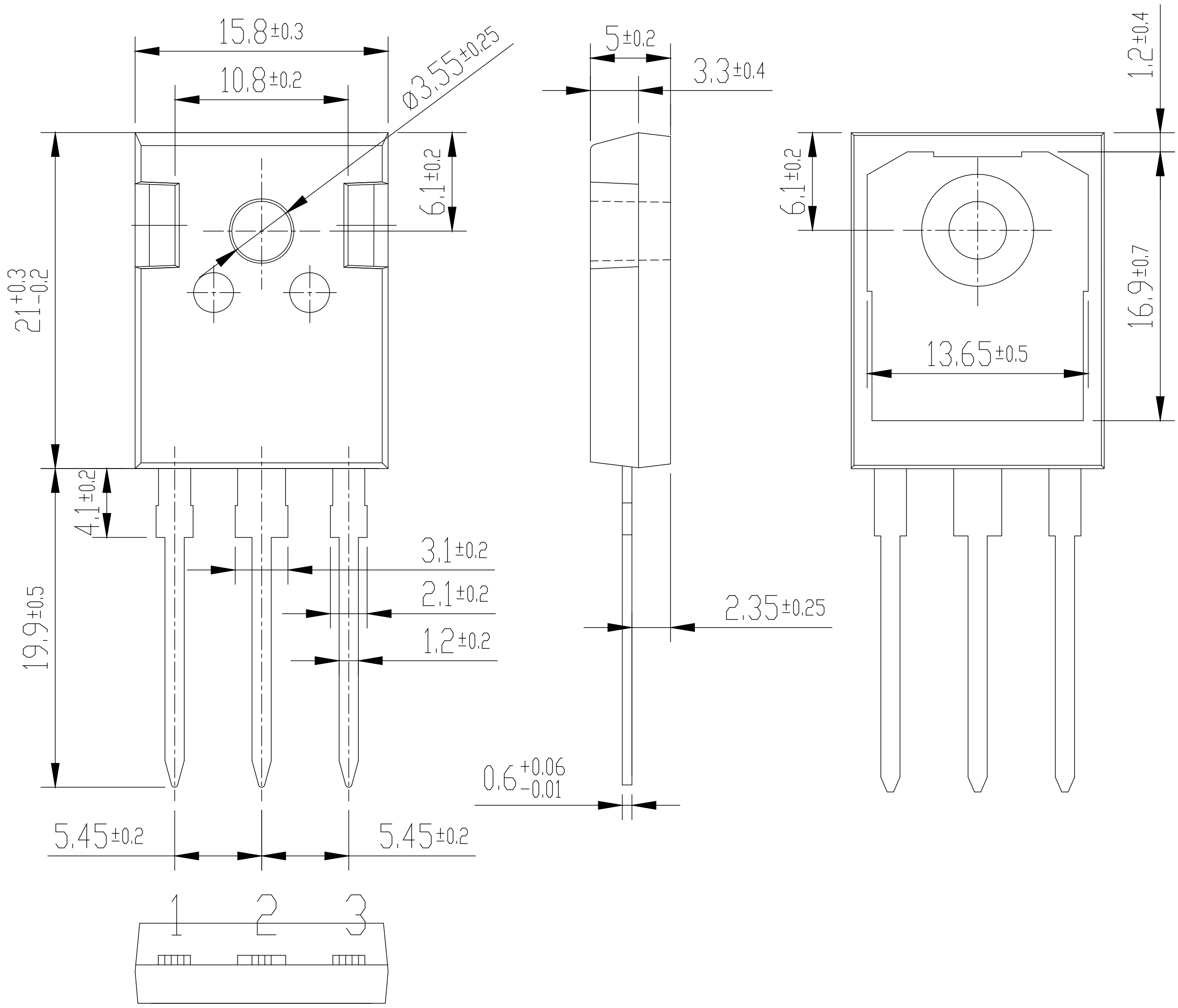

Fig 21. Diode Transient Thermal Impedance

## Circuit Schematic




## Package Dimensions

Dimensions in Millimeters



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