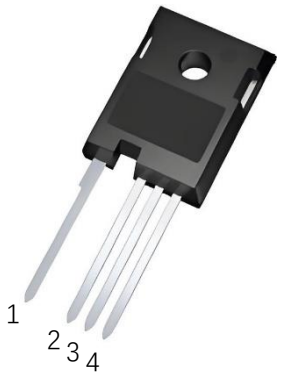
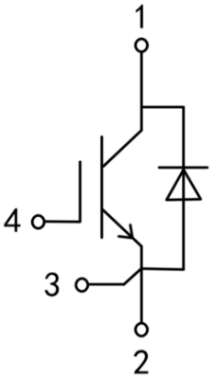
IGBT with Trench and Field-Stop technology, and SiC Schottky Barrier Diode (SBD)

# WGH75R65FFC4




## Features

- $V_{CES}$=650V
- $I_C$=75A@ $T_C$=100℃
- Very low $V_{CEsat}$
- High speed switching
- Lower recovery losses SiC SBD
- High ruggedness
- RoHS compliant
- Halogen free




## Applications

- Inverter
- Power factor correction(PFC)

| Package pin definition | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| | Collector | Emitter | Kelvin emitter | Gate |

| Part | Package | Marking | Packing method | MPQ |
|---|---|---|---|---|
| WGH75R65FFC4 | TO-247-4L | 75R65FFC4 | Tube | 30/Tube |

# 1 Maximum Ratings

**Table 1 Maximum rated Values($T_C$=25℃ unless otherwise specified)**

| Parameter | Symbol | Condition | Values | Unit |
|---|---|---|---|---|
| Collector to Emitter Voltage | $V_{CES}$ | | 650 | V |
| Gate to Emitter Voltage | $V_{GES}$ | | ±20 | V |
| Continuous Collector Current [1] | $I_C$ | | 120 | A |
| | | $T_C$ =100℃ | 75 | A |
| Pulsed Collector Current [2] | $I_{CM}$ | | 300 | A |
| Diode Continuous Forward Current [1] | $I_F$ | | 70 | A |
| | | $T_C$ =100℃ | 40 | A |
| Diode Maximum Forward Current [2] | $I_{FM}$ | | 160 | A |
| Maximum Power Dissipation | $P_{tot}$ | | 375 | W |
| | | $T_C$ =100℃ | 188 | W |
| Operating Junction Temperature Range | $T_J$ | | -55~+175 | ℃ |
| Storage Temperature Range | $T_{STG}$ | | -55~+150 | ℃ |
| Thermal Resistance, Junction to case for IGBT | $R_{th(J-C)}$ | | 0.40 | K/W |
| Thermal Resistance, Junction to case for Diode | $R_{th(J-C)}$ | | 0.95 | K/W |

Notes:

1. Calculated continuous current limited by package.
2. Pulse width limited by maximum junction temperature.

## 2 Electrical Characteristics, IGBT

**Table 2 Characteristics Values($T_C$=25℃ unless otherwise specified)**

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Collector to Emitter Breakdown Voltage | $BV_{CES}$ | $I_C$=250μA, $V_{GE}$=0V | 650 | - | - | V |
| Collector to Emitter Saturation Voltage | $V_{CE(sat)}$ | $I_C$=75A, $V_{GE}$=15V | - | 1.7 | 2.2 | V |
| | | $I_C$=75A, $V_{GE}$=15V, $T_J$=150℃ | - | 2.1 | - | V |
| Gate Threshold Voltage | $V_{GE(th)}$ | $I_C$=1mA, $V_{GE}$= $V_{CE}$ | 4.0 | 4.8 | 5.6 | V |
| Zero Gate Voltage Collector current | $I_{CES}$ | $V_{CE}$=650V, $V_{GE}$=0V | - | - | 12 | μA |
| Gate to Emitter Leakage Current | $I_{GES}$ | $V_{GE}$=±20V, $V_{CE}$=0V | - | - | ±250 | nA |
| Interal Gate Resistor | $R_{Gint}$ | f=1MHz, $V_{AC}$=25mV | - | 0.7 | - | Ω |
| Input Capacitance | $C_{ies}$ | f=1MHz, $V_{CE}$=30V, $V_{GE}$=0V | - | 3769 | - | pF |
| Output Capacitance | $C_{oes}$ | | - | 157 | - | pF |
| Reverse Transfer Capacitance | $C_{res}$ | | - | 46 | - | pF |
| Total Gate charge | $Q_G$ | $V_{CC}$=520V, $I_C$=75A, $V_{GE}$=15V | - | 128 | - | nc |
| Gate to Emiter charge | $Q_{GE}$ | | - | 47 | - | nc |
| Gate to Collector charge | $Q_{GC}$ | | - | 65 | - | nc |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{CC}$=400V, $I_C$=75A, $V_{GE}$=0/15V, $R_G$=10Ω, $T_J$=25℃ Inductive load | - | 40 | - | ns |
| Rising Time | $t_r$ | | - | 44 | - | ns |
| Turn-off Delay Time | $t_{d(off)}$ | | - | 90 | - | ns |
| Falling Time | $t_f$ | | - | 82 | - | ns |
| Turn-on Switching Loss | $E_{on}$ | | - | 1.0 | - | mJ |
| Turn-off Switching Loss | $E_{off}$ | | - | 1.2 | - | mJ |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{CC}$=400V, $I_C$=75A, $V_{GE}$=0/15V, $R_G$=10Ω, $T_J$=150℃ Inductive load | - | 38 | - | ns |
| Rising Time | $t_r$ | | - | 48 | - | ns |
| Turn-off Delay Time | $t_{d(off)}$ | | - | 98 | - | ns |
| Falling Time | $t_f$ | | - | 94 | - | ns |
| Turn-on Switching Loss | $E_{on}$ | | - | 1.3 | - | mJ |
| Turn-off Switching Loss | $E_{off}$ | | - | 1.5 | - | mJ |

# 3 Electrical Characteristics, Diode

**Table 3 Characteristics Values($T_C$=25℃ unless otherwise specified)**

| Parameter | Symbol | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Diode Forward Voltage | $V_F$ | $I_F$=40A, $T_J$=25℃ | - | 1.4 | 1.9 | V |
| | | $I_F$=40A, $T_J$=150℃ | - | 1.7 | - | V |
| Diode Peak Reverse Recovery Current | $I_{rr}$ | $I_F$=40A<br>di/dt=-1300A/μs<br>$V_{CC}$=400V<br>$T_J$=25℃ | - | 12 | - | A |
| Diode Reverse Recovery Time | $t_{rr}$ | | - | 20 | - | ns |
| Diode Reverse Recovery Charge | $Q_{rr}$ | | - | 134 | - | nC |
| Reverse Recovery Energy | $E_{rec}$ | | - | 25 | - | μJ |
| Diode Peak Reverse Recovery Current | $I_{rr}$ | $I_F$=40A<br>di/dt=-1300A/μs<br>$V_{CC}$=400V<br>$T_J$=150℃ | - | 12 | - | A |
| Diode Reverse Recovery Time | $t_{rr}$ | | - | 20 | - | ns |
| Diode Reverse Recovery Charge | $Q_{rr}$ | | - | 135 | - | nC |
| Reverse Recovery Energy | $E_{rec}$ | | - | 24 | - | μJ |

# 4 Typical Characteristics diagrams

Fig.1 Typical output characteristic
$I_C=f(V_{CE})$, $T_{vj}=25℃$

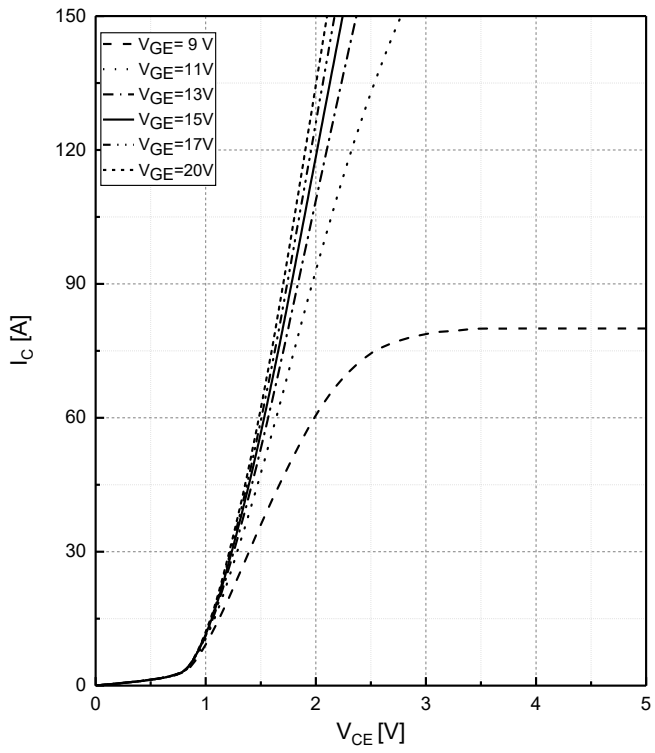



Fig.2 Typical output characteristic
$I_C=f(V_{CE})$, $T_{vj}=150℃$

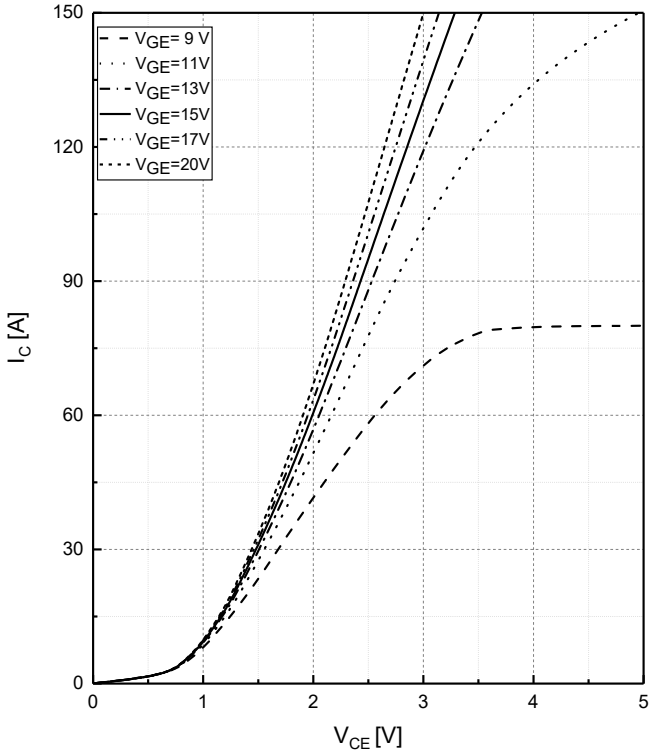



Fig.3 Typical transfer characteristic
$I_C=f(V_{GE})$, $V_{CE}=20V$

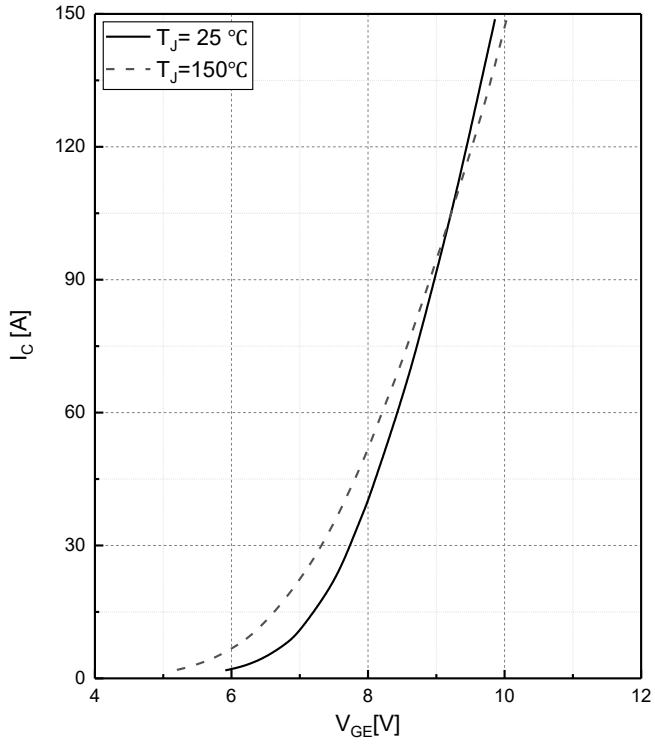



Fig.4 Typical $I_F$ as a function of $V_F$
$I_F=f(V_F)$

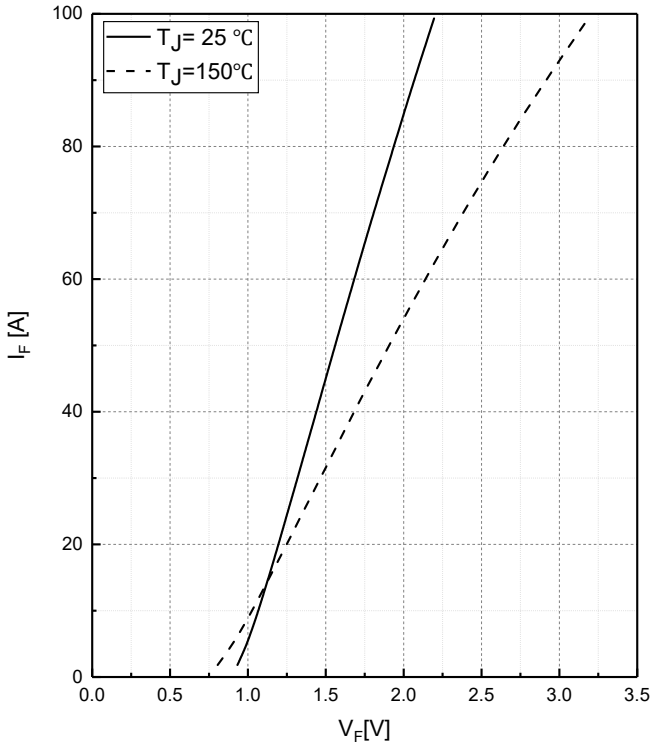


Fig.5 Typical $V_{GE(th)}$ as a function of $T_{vj}$
$V_{GEth}=f(T_{vj})$, $I_C$=1mA

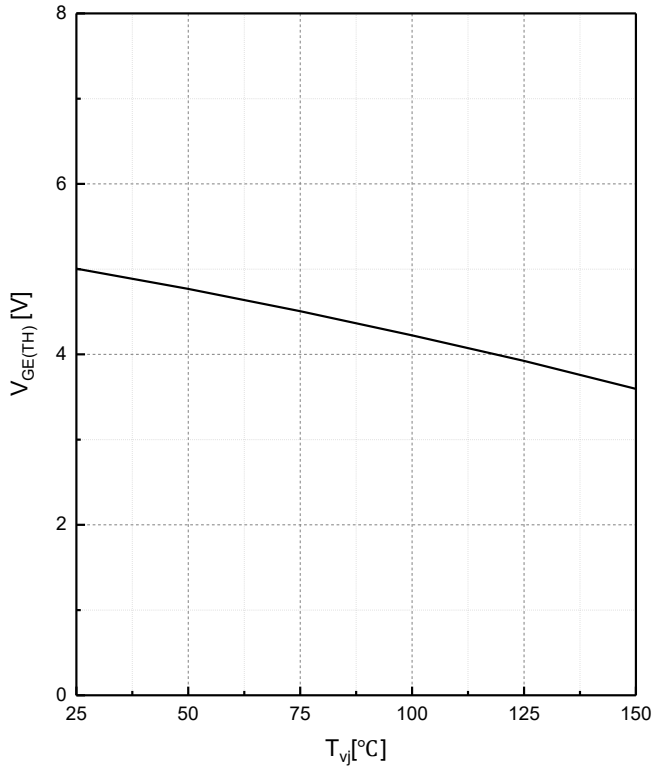



Fig.6 Typical $V_{CEsat}$ as a function of $T_{vj}$
$V_{CEsat}=f(T_{vj})$, $V_{GE}$=15V

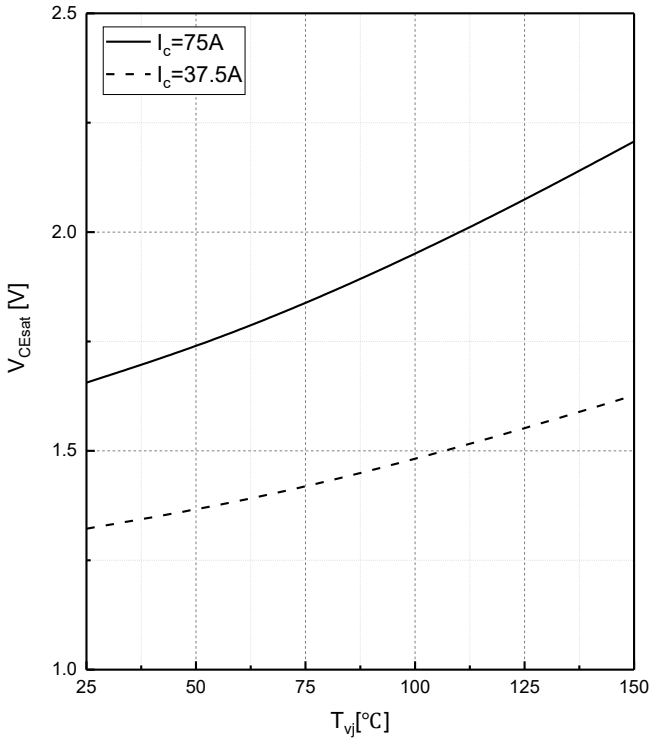



Fig.7 Typical $V_F$ as a function of $T_{vj}$
$V_F=f(T_{vj})$

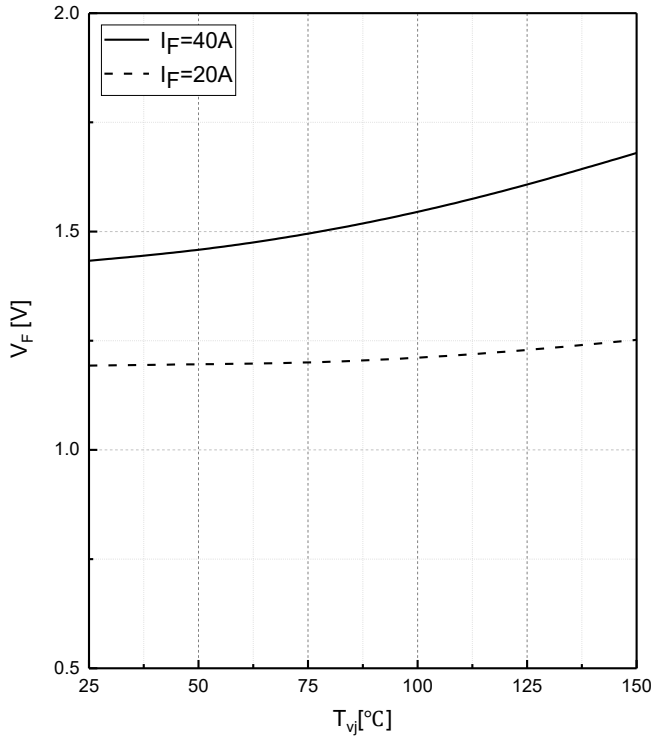



Fig.8 Typical Gate charge
$V_{GE}=f(Q_G)$, $I_C$=75A

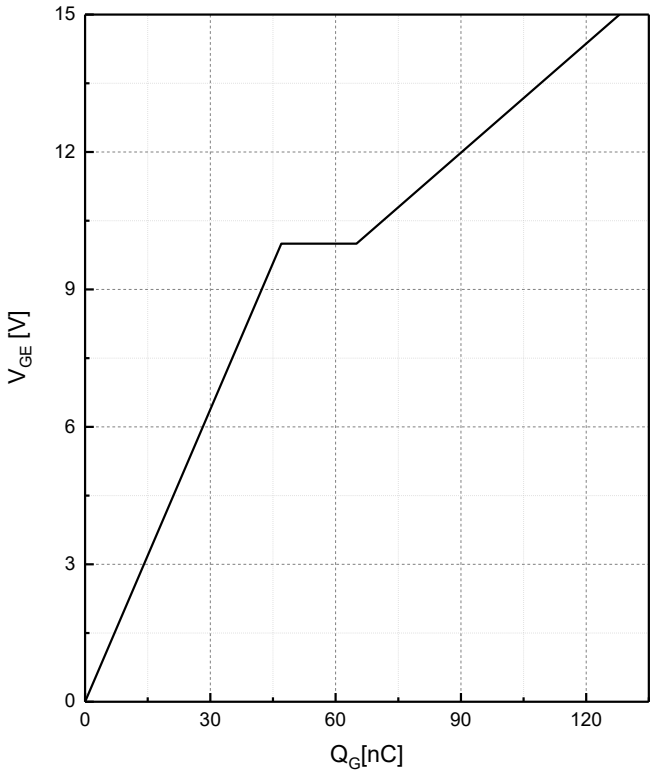


Fig.9 Typical switching energy losses as a function of $R_G$

$E=f(R_G)$, $V_{CC}$=400V, $I_C$=75A, $V_{GE}$=0/15V, $T_J$=150℃

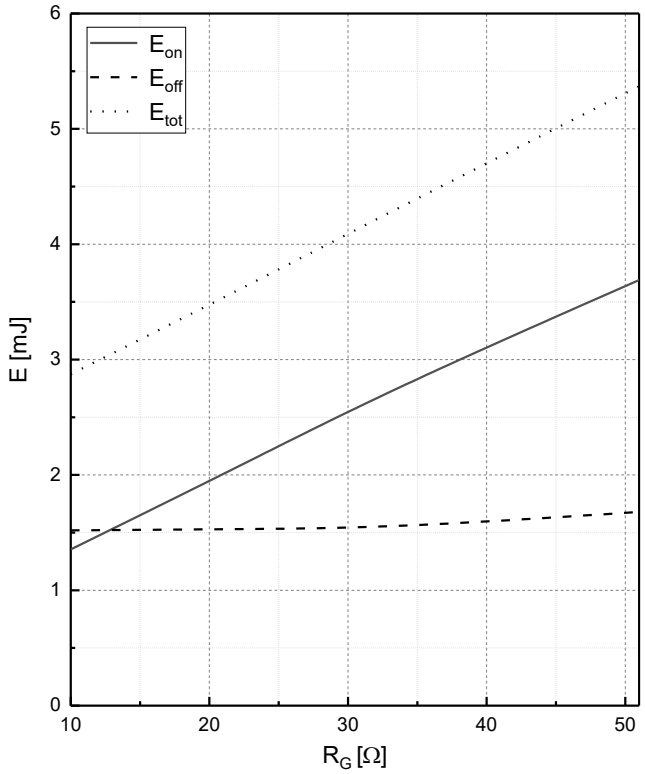



Fig.10 Typical switching energy losses as a function of $I_C$

$E=f(I_C)$, $V_{CC}$=400V, $R_G$=10Ω, $V_{GE}$=0/15V, $T_J$=150℃

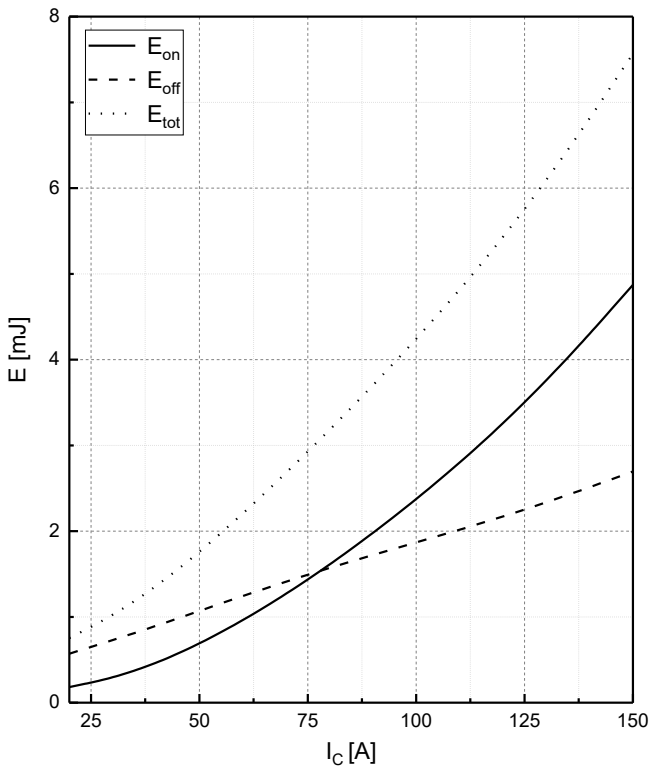



Fig.11 Typical capacitance as a function of $V_{CE}$

$C=f(V_{CE})$, f=1MHz, $V_{GE}$=0V

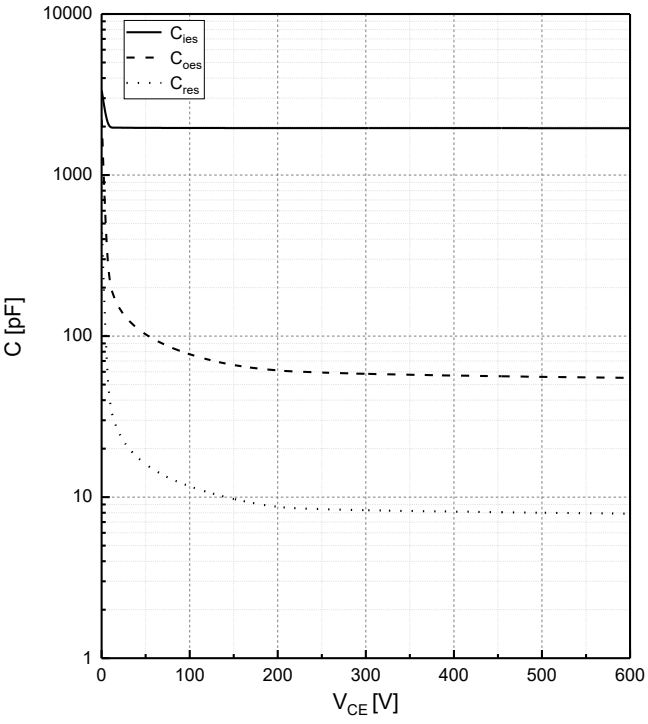



Fig.12 Power dissipation as a function of $T_C$

$P_{tot}=f(T_C)$, $T_{vj}$≤175℃

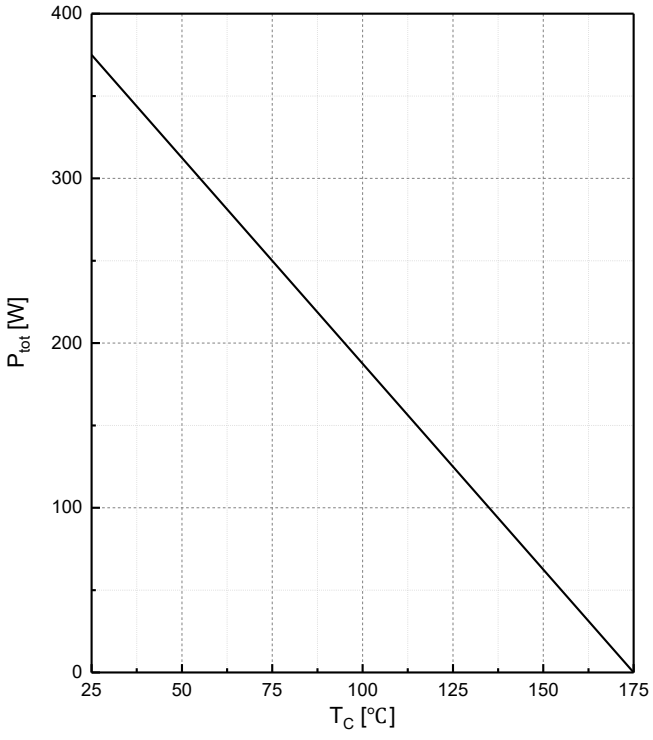


Fig.13 Transient thermal impedance of IGBT
$Z_{th(j-c)}=f(t_p)$, $D=t_p/T$

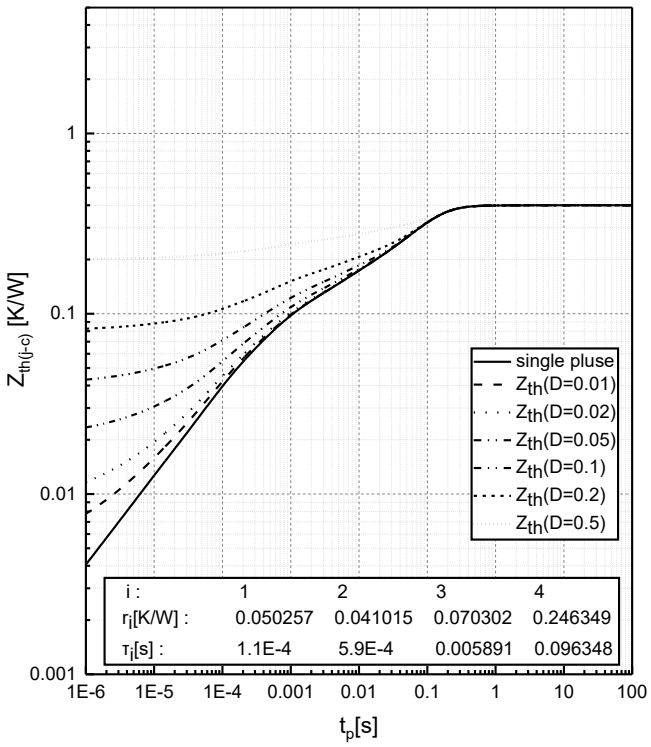
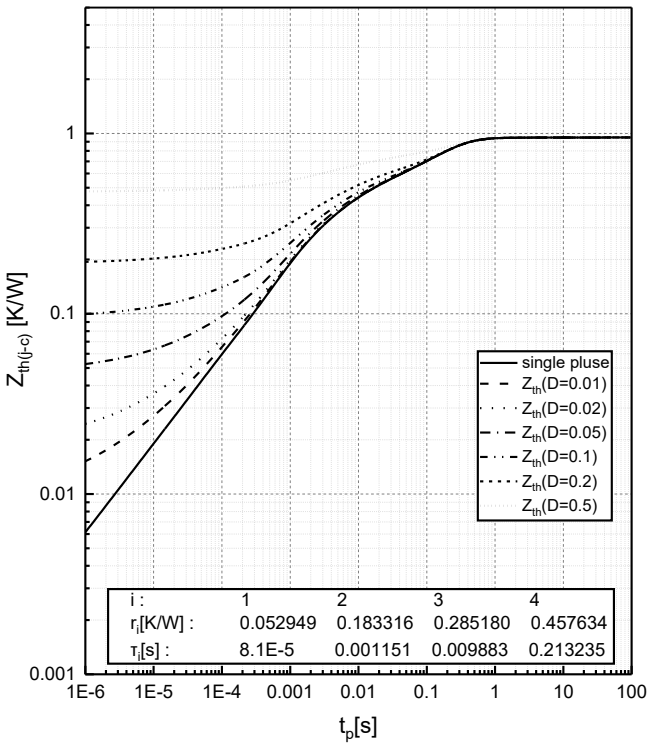
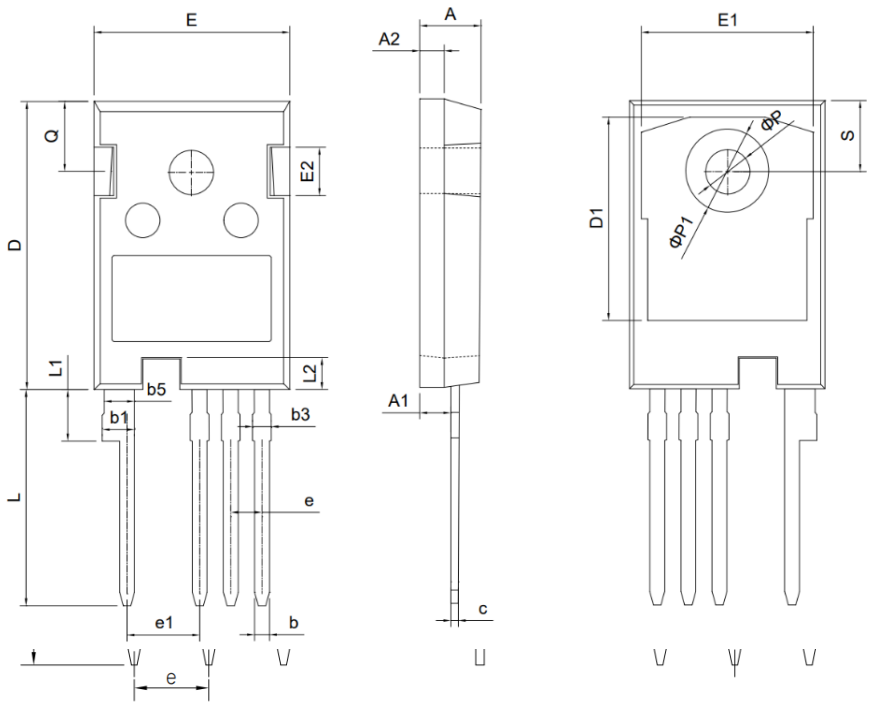



Fig.14 Transient thermal impedance of Diode
$Z_{th(j-c)}=f(t_p)$, $D=t_p/T$



# 5 Package Outlines




| SYMBOL | mm | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 4.80 | 5.00 | 5.21 |
| A1 | 2.21 | 2.41 | 2.61 |
| A2 | 1.80 | 2.00 | 2.20 |
| b | 1.06 | 1.21 | 1.36 |
| b1 | 2.33 | 2.63 | 2.93 |
| b3 | 1.07 | 1.30 | 1.60 |
| b5 | 2.30 | 2.53 | 2.72 |
| c | 0.51 | 0.61 | 0.75 |
| D | 23.30 | 23.45 | 23.60 |
| D1 | 16.25 | 16.55 | 17.65 |
| E | 15.74 | 15.94 | 16.14 |
| E1 | 13.72 | 14.02 | 14.32 |
| E2 | 3.68 | 5.00 | 5.20 |
| e | 2.54BSC | | |
| e1 | 5.44BSC | | |
| L | 17.27 | 17.57 | 17.87 |
| L1 | 3.97 | 4.19 | 4.39 |
| L2 | 2.35 | 2.50 | 2.60 |
| ΦP | 3.40 | 3.60 | 3.80 |
| ΦP1 | 7.19REF | | |
| Q | 5.49 | 5.79 | 6.09 |
| S | 6.00 | 6.17 | 6.40 |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1.The product specification aims to provide users with a reference regarding various product parameters, performance, and usage. It presents certain aspects of the product's performance in graphical form and is intended solely for users to select product and make product comparisons, enabling users to better understand and evaluate the characteristics and advantages of the product. It does not constitute any commitment, warranty, or guarantee.

2.The product parameters described in the product specification are numerical values, characteristics, and functions obtained through actual testing or theoretical calculations of the product in an independent or ideal state. Due to the complexity of product applications and variations in test conditions and equipment, there may be slight fluctuations in parameter test values. WAYON shall not guarantee that the actual performance of the product when installed in the customer's system or equipment will be entirely consistent with the product specification, especially concerning dynamic parameters. It is recommended that users consult with professionals for product selection and system design. Users should also thoroughly validate and assess whether the actual parameters and performance when installed in their respective systems or equipment meet their requirements or expectations. Additionally, users should exercise caution in verifying product compatibility issues, and WAYON assumes no responsibility for the application of the product.

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