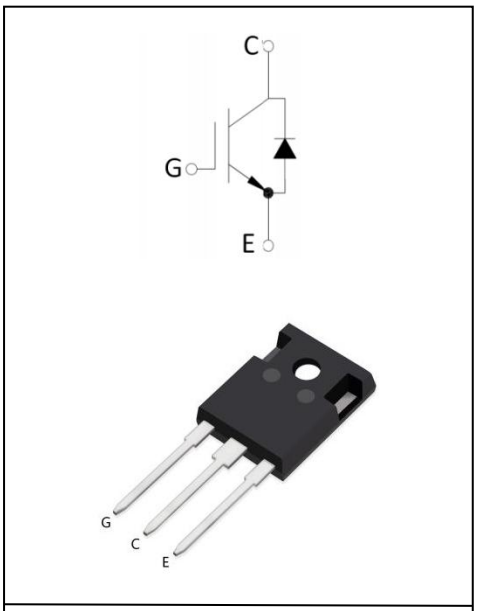
Thunder High Power Products

# Silicon Trench NPT IGBT

## Description

The THG20T65NQK is use advanced trench NPT technology.
The 650V NPT Trench IGBT offers superior conduction and switching performances.




THUNDER TO-247

## General Features

- High Speed Switching & Low Power Loss
- Low saturation voltage: $V_{CE(sat)}$ = 1.95V @ $I_C$ = 20A
- $E_{off}$ = 0.6mJ @ $T_C$ = 25°C
- Maximum junction temperature 175°C

## Application

- Solar Converters
- Welding Converters
- UPS
- PFC
- PV Inverter

## Absolute Maximum Ratings @ Tc=25°C (unless otherwise specified)

| Symbol | Parameter | Value | Units |
|---|---|---|---|
| $V_{CES}$ | Collector-Emitter Voltage | 650 | V |
| $V_{GES}$ | Gate-Emitter Voltage | ±20 | V |
| $I_C$ | Collector Current | 40 | A |
| | Collector Current @Tc=100°C | 20 | A |
| $I_{CM}$ | Pulsed Collector Current | 60 | A |
| $I_F$ | Diode Continuous Forward Current @Tc=100°C | 20 | A |
| $I_{FM}$ | Pulsed Diode Forward Current | 60 | A |
| $P_D$ | Total Dissipation at @Tc = 25°C | 125 | W |
| | Total Dissipation at @Tc = 100°C | 62.5 | |
| $T_j$ | Operating Junction and Storage Temperature Range | -55 to +175 | °C |
| $T_L$ | Max Temperature For Soldering | 260 | °C |
| $T_{SC}$ | Short circuit withstand time VGE=15V, VCC≤400V, Allowed number of short circuits<1000Time between short circuits:≥1.0s,Tj≤150°C | 5 | us |

## Electrical Characteristics @ Tc=25°C (unless otherwise specified)

| Symbol | Parameter | Test Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **Static Characteristics** | | | | | | | |
| $V_{CES}$ | Collector-Emitter Voltage | $V_{GE}$=0V, $I_{CE}$=250μA | | 650 | — | — | V |
| $V_{CE(sat)}$ | Collector-Emitter Saturation Voltage | $V_{GE}$=15V, $I_C$=20A | $T_j$ = 25°C | — | 1.95 | 2.50 | V |
| | | | $T_j$ = 175°C | — | 2.15 | — | V |
| $V_{GE(th)}$ | Gated Threshold Voltage | $V_{CE}$= $V_{GE}$, $I_C$=0.5mA | | 4.8 | 5.7 | 6.6 | V |
| $I_{CES}$ | Collector-Emitter Leakage Current | $V_{GE}$=0V, $V_{CE}$ =650V | | — | — | 10 | uA |
| $I_{GES(F)}$ | Gate to Emitter Forward Leakage | $V_{GE}$ = +20V, $V_{CE}$ = 0V | | — | — | 200 | nA |
| $I_{GES(R)}$ | Gate to Emitter Reverse Leakage | $V_{GE}$ = -20V, $V_{CE}$ = 0V | | — | — | -200 | nA |
| **Dynamic Characteristics** | | | | | | | |
| $C_{ies}$ | Input Capacitance | $V_{GE}$ =0V, $V_{CE}$=25V, f=1.0MHZ | | — | 1200 | — | pF |
| $C_{oes}$ | Output Capacitance | | | — | 90 | — | pF |
| $C_{res}$ | Reverse Transfer Capacitance | | | — | 15.1 | — | pF |
| $Q_g$ | Total Gate Charge | $V_{CE}$=480V,$I_C$=20A,$V_{GE}$=15V | | — | 72 | — | nC |
| $Q_{ge}$ | | | | — | 12 | — | |
| $Q_{gc}$ | | | | — | 37 | — | |
| **Switching Characteristics** | | | | | | | |
| $t_{d(on)}$ | Turn-on Delay Time | $V_{CE}$=400V,$I_C$=20A $V_{GE}$=15V,$R_G$=10 Ω | | — | 30 | — | nS |
| $t_r$ | Rise Time | | | — | 24 | — | |
| $t_{d(off)}$ | Turn-off Delay Time | | | — | 170 | — | |
| $t_f$ | Fall Time | | | — | 22 | — | |
| $E_{on}$ | Turn-on Switching Loss | | | | 0.221 | | mJ |
| $E_{off}$ | Turn-off Switching Loss | | | | 0.586 | | |

## Electrical Characteristics of the Diode @$T_C$= 25°C unless otherwise specified

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $I_F$ | Diode Continuous Forward Current | $T_C$ = 100°C | 20 | — | — | A |
| $I_{FM}$ | Pulsed Diode Forward Current | $T_C$ = 25°C | 60 | — | — | A |
| $V_F$ | Diode Forward Voltage | $I_F$ =20A | — | 1.6 | 2.4 | V |
| $t_{rr}$ | Reverse Recovery Time | $T_J$=25°C, $I_F$=20A di/dt=200A/us | — | 80 | — | nS |
| $Q_{rr}$ | Reverse Recovery Charge | | — | 4.9 | — | nC |
| *Pulse Test: Pulse Width <= 300μs, Duty Cycle< =2% | | | | | | |

## Thermal Characteristic

| Symbol | Paramter | Typ | MAX | Units |
|---|---|---|---|---|
| $R_{\theta JC}$ | Themal Resistance,Junction to case for IGBT | -- | 1.2 | °C/W |
| $R_{\theta JA}$ | Themal Resistance,Junction to Ambient | -- | 59.5 | °C/W |

## Typical Performance Characteristics

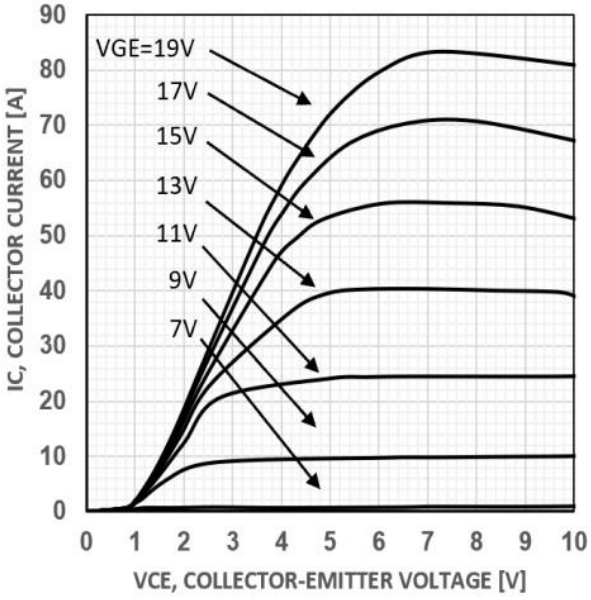



Figure1:typical IGBT output characteristics, TC=25℃

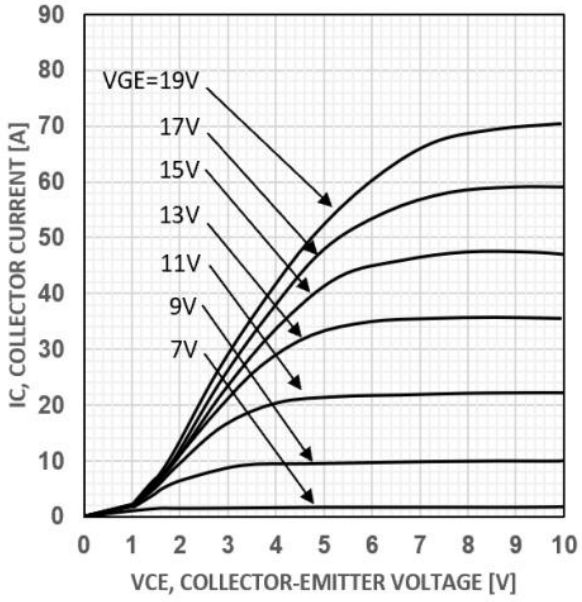



Figure2: typical IGBT output characteristics TC=125℃

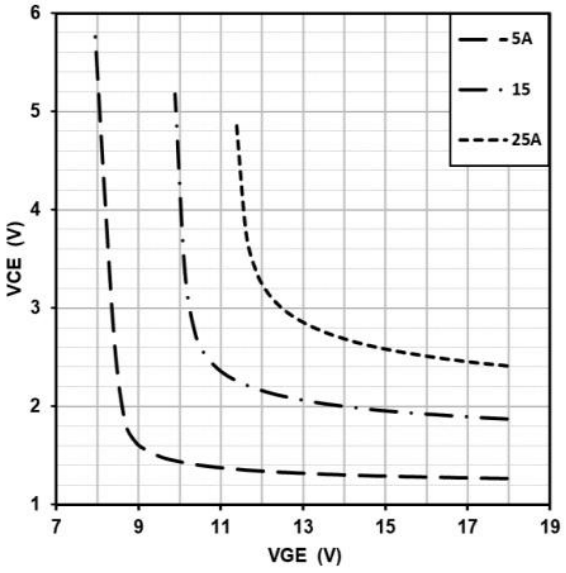



Figure3: typical VCE VS. VGE,TJ=25℃

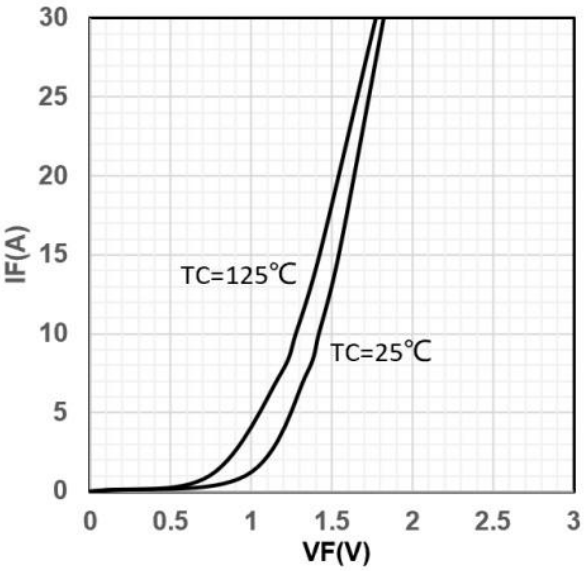



Figure4:typical diode forward characteristic

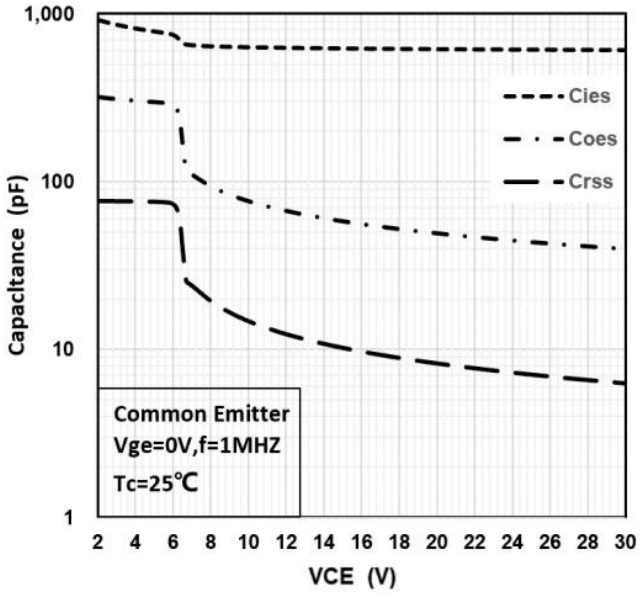



Figure5:typical capacitance VS. VCE,VGE=0V,f=100kHz

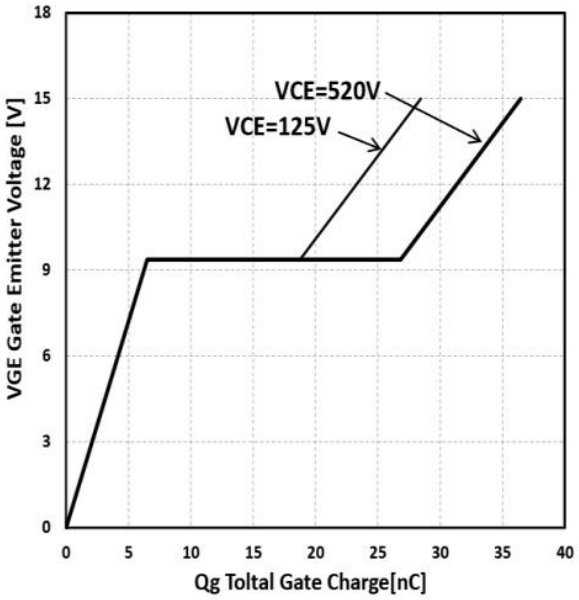



Figure 6 :typical gate charge VS. VGE,IC=15A

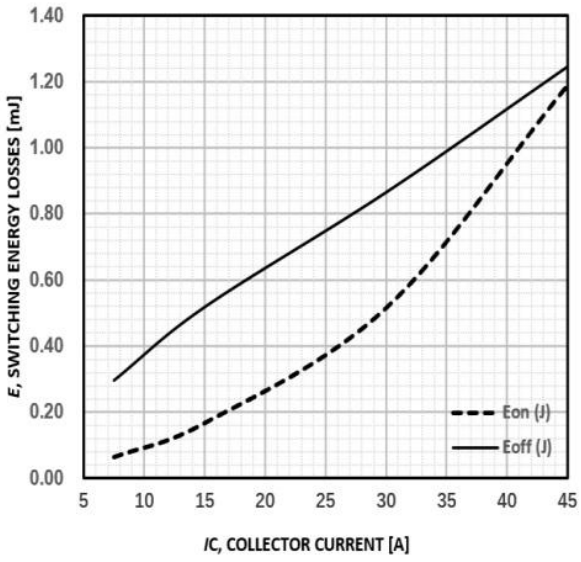



Figure 7 : typical energy loss VS. IC, TC=25℃,

L=500uH， VCE=400V,VGE=15V,Rg=10Ω

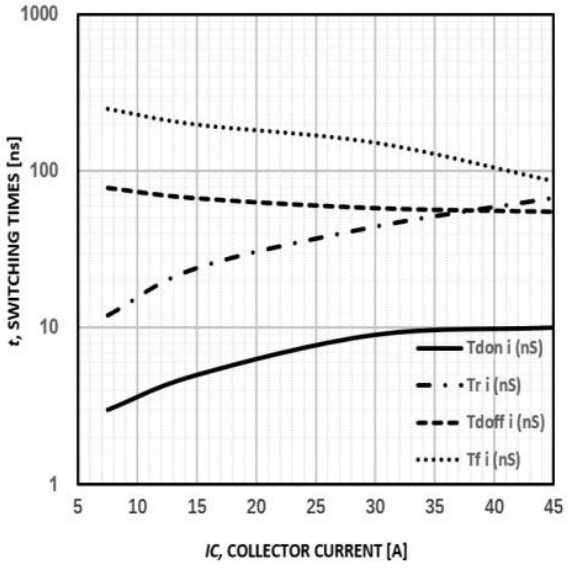



Figure 8 : typical switching time VS. IC, TC=25℃,

L=500uH, VCE=400V,VGE=15V,Rg=10Ω

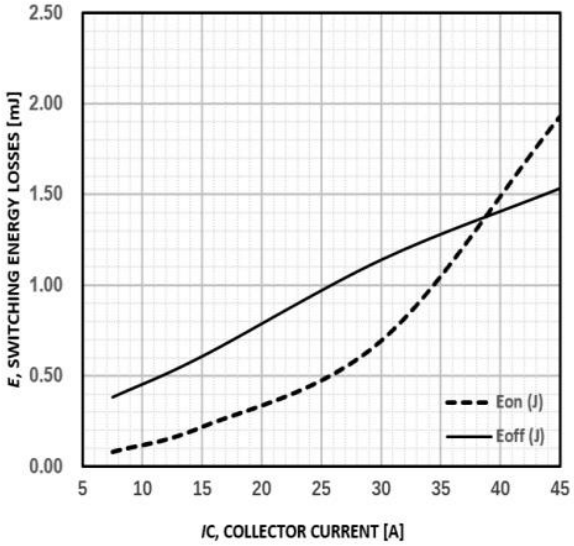



Figure 9 : typical energy loss VS. IC, TC=125℃,

L=500uH， VCE=400V,VGE=15V,Rg=10Ω

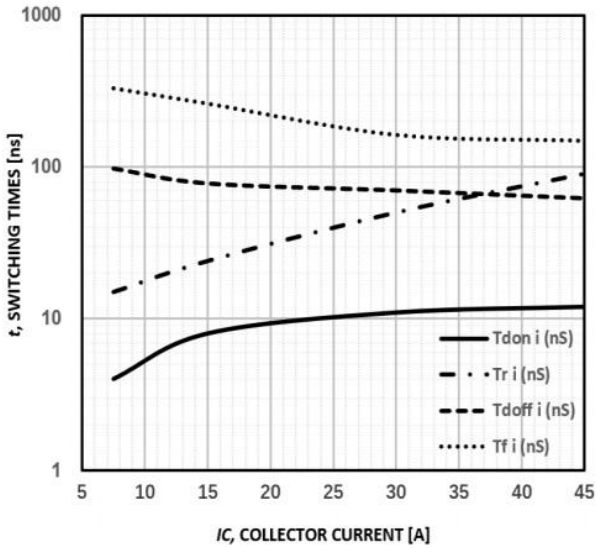



Figure10: typical switching time VS. IC, TC=125℃,

L=500uH, VCE=400V,VGE=15V,Rg=10Ω

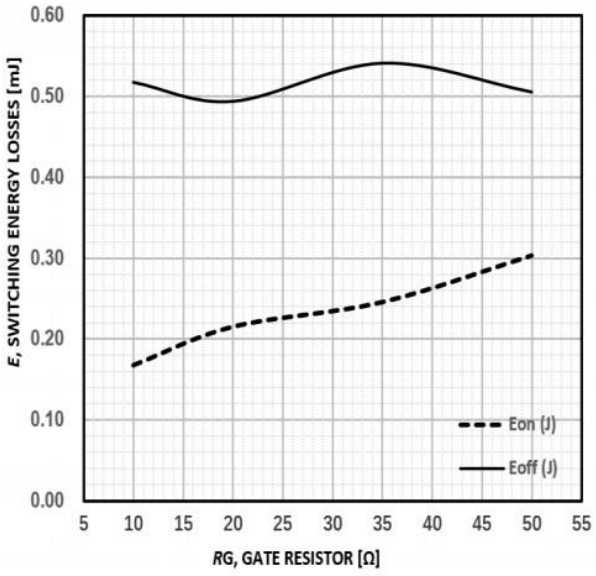



Figure11: typical energy loss VS. Rg,TC=25℃,

L=500uH, VCE=400V, VGE=15V ,IC=15A

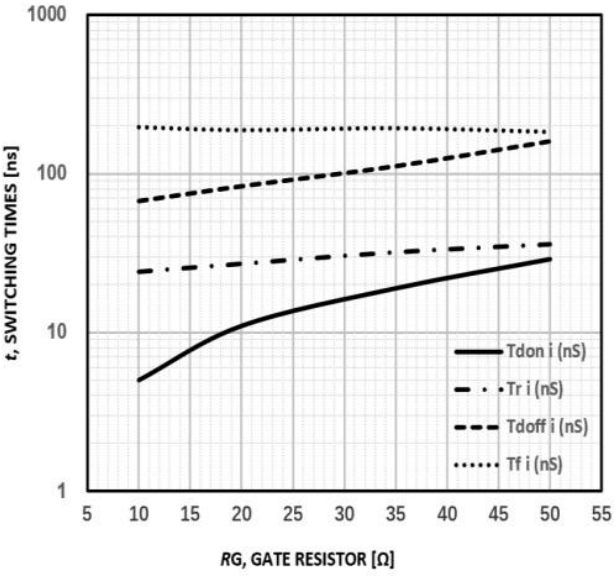



Figure12: typical switching time VS. Rg,TC=25℃,

L=500uH,VCE=400V,VGE=15V,IC=15A

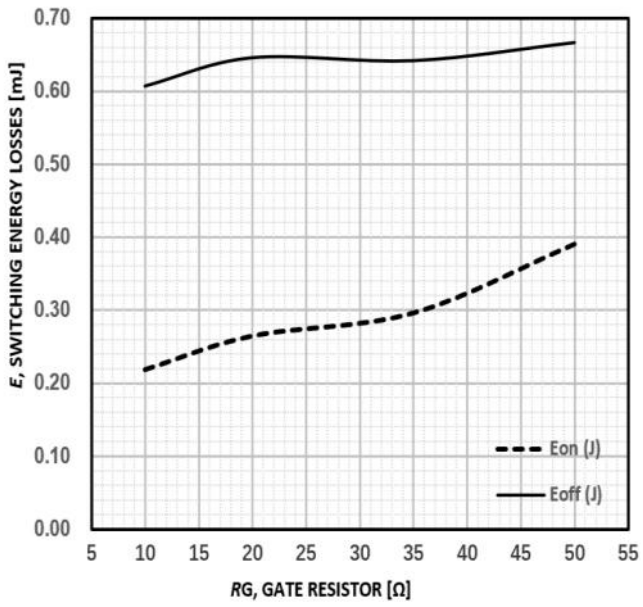



Figure13: typical energy loss VS. Rg,TC=125℃,
L=500uH, VCE=400V, VGE=15V ,IC=15A

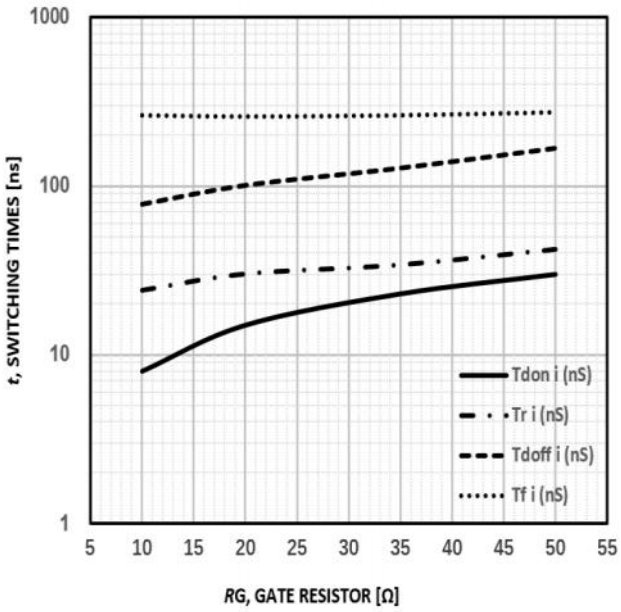



Figure14: typical switching time VS. Rg,TC=125℃,
L=500uH,VCE=400V,VGE=15V,IC=15A

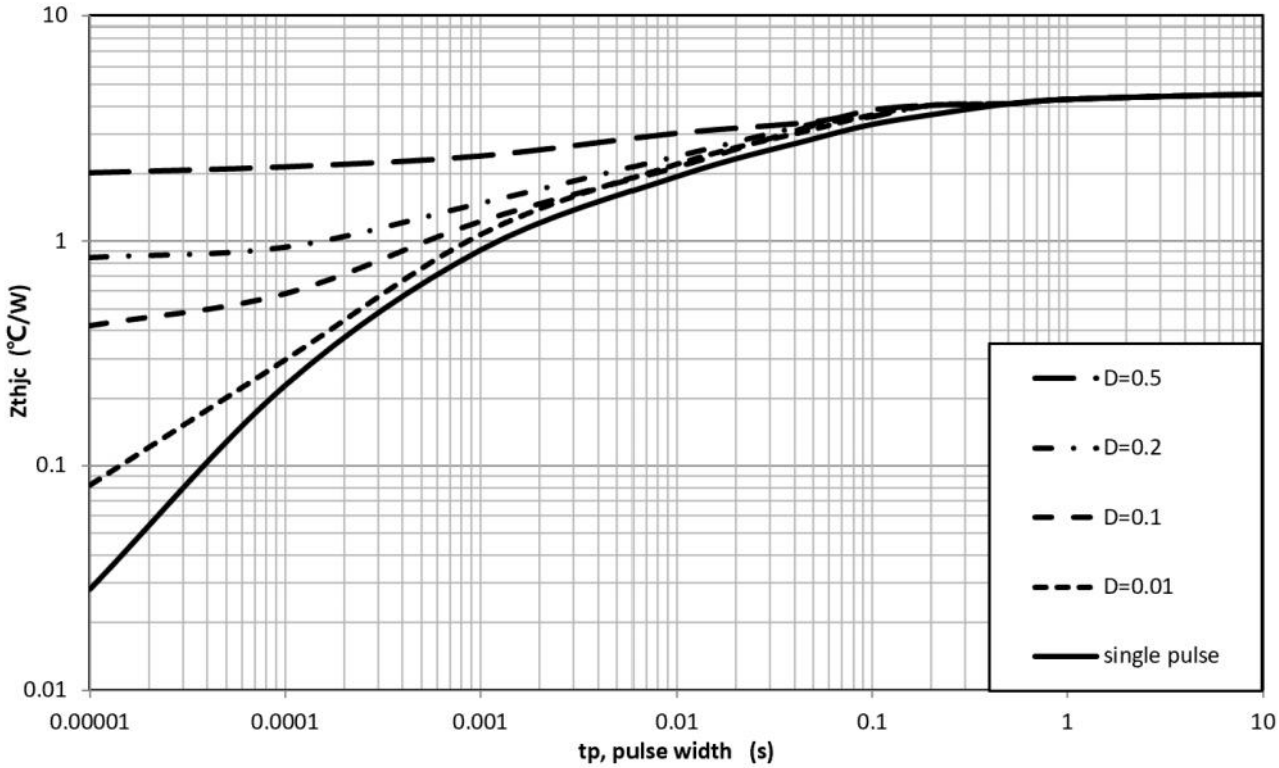
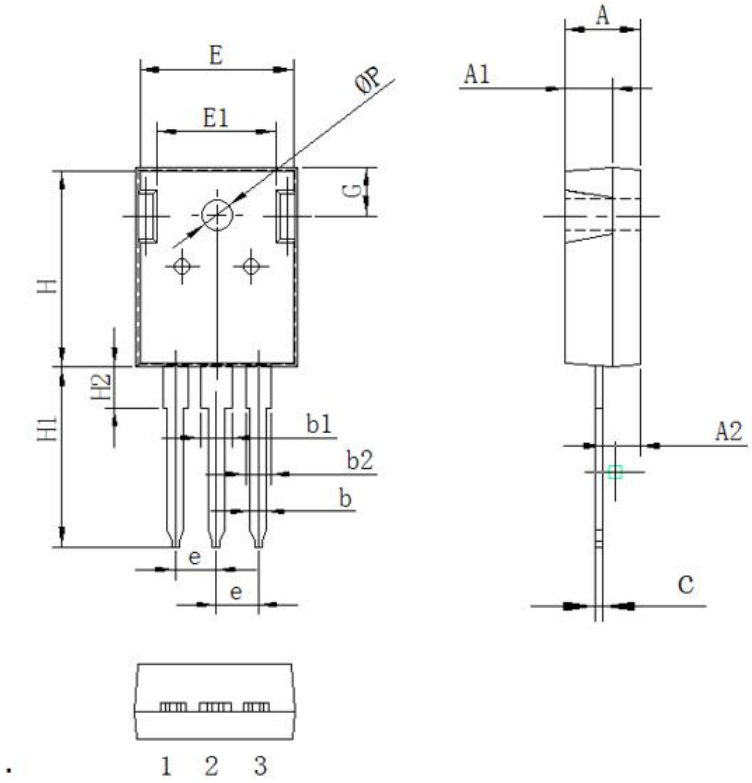



Figure15:normalized transient thermal impedance, junction-to-case

## Package Information

**TO-247 PACKAGE**




基本尺寸

| Symbol | 单位 mm | | |
|---|---|---|---|
| | Min | Nom | Max |
| A | 4.8 | 5.00 | 5.20 |
| A1 | 3.3 | 3.5 | 3.7 |
| A2 | 2.20 | 2.40 | 2.60 |
| b | 1.00 | 1.2 | 1.40 |
| b1 | 2.90 | 3.10 | 3.30 |
| b2 | 1.90 | 2.10 | 2.30 |
| c | 0.50 | 0.60 | 0.70 |
| e | 5.25 | 5.45 | 5.65 |
| E | 15.2 | 15.7 | 16.2 |
| E1 | 10.2 | 10.7 | 11.2 |
| H | 20.8 | 21 | 21.2 |
| H1 | 19.5 | 20.0 | 20.5 |
| H2 | 4.00 | 4.20 | 4.40 |
| G | 5.60 | 5.80 | 600 |
| ΦP | 3.50 | 3.70 | 3.90 |

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