# N-Channel Enhancement Mode Power MOSFET

## Description

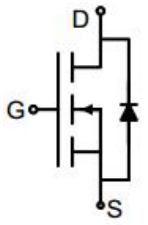
The GC125N65QF uses advanced super junction technology and design to provide excellent Ros(on), low gate charge and operation. This device is suitable for industry's AC-DC SMPS requirement for PFC, AC/DC power conversion, and industrial power application.

## General Features

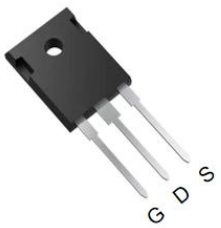
- $V_{DS}$ 650V
- $I_D$ (at $V_{GS}$ = 10V) 27A
- $R_{DS(ON)}$ (at $V_{GS}$ = 10V) < 125mΩ
- 100% Avalanche Tested
- RoHS Compliant
- Ultra-fast body diode

## Application

- Power switch
- DC/DC converters




Schematic diagram




TO-247

## Ordering Information

| Device | Package | Marking | Packaging |
|---|---|---|---|
| GC125N65QF | TO-247 | GC125N65F | 30pcs/Tube |

## Absolute Maximum Ratings $T_C$ = 25ºC, unless otherwise noted

| Parameter | | Symbol | Value | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 650 | V |
| Continuous Drain Current | $T_C$ = 25ºC | $I_D$ | 27 | A |
| | $T_C$ = 100ºC | | 17 | |
| Pulsed Drain Current (note1) | | $I_{DM}$ | 81 | A |
| Gate-Source Voltage | | $V_{GS}$ | ±30 | V |
| Power Dissipation | | $P_D$ | 205 | W |
| Single pulse avalanche energy （note2） | | $E_{AS}$ | 20 | mJ |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | -55 To 150 | ºC |

## Thermal Resistance

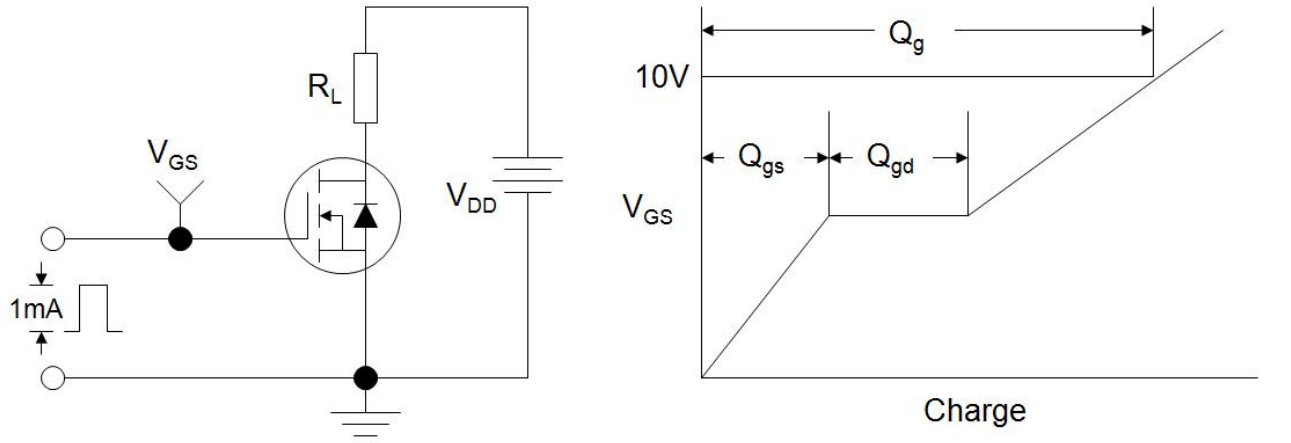
| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Thermal Resistance, Junction-to-Ambient | $R_{thJA}$ | 62 | ºC/W |
| Thermal Resistance, Junction-to-Case | $R_{thJC}$ | 0.6 | ºC/W |

| **Specifications** $T_J$ = 25ºC, unless otherwise noted | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Test Conditions** | **Value** | | | **Unit** |
| | | | **Min.** | **Typ.** | **Max.** | |
| **Static Parameters** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0V, $I_D$ = 250μA | 650 | -- | -- | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 650V, $V_{GS}$ = 0V | -- | -- | 5 | μA |
| Gate-Source Leakage | $I_{GSS}$ | $V_{GS}$ = ±30V | -- | -- | ±100 | nA |
| Gate-Source Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA | 3.2 | 4.0 | 4.6 | V |
| Drain-Source On-Resistance | $R_{DS(on)}$ | $V_{GS}$ = 10V, $I_D$ = 12A | -- | 106 | 125 | mΩ |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$ = 5V, $I_D$ = 12 A | -- | 13 | -- | S |
| **Dynamic Parameters** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0V, $V_{DS}$ = 400V, f = 1.0MHz | -- | 1600 | -- | pF |
| Output Capacitance | $C_{oss}$ | | -- | 70 | -- | |
| Reverse Transfer Capacitance | $C_{rss}$ | | -- | 25 | -- | |
| Total Gate Charge | $Q_g$ | $V_{DD}$ = 400V, $I_D$ = 12A, $V_{GS}$ = 10V | -- | 52 | -- | nC |
| Gate-Source Charge | $Q_{gs}$ | | -- | 14 | -- | |
| Gate-Drain Charge | $Q_{gd}$ | | -- | 30 | -- | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$ = 400V, $I_D$ = 12A, $R_G$ = 2Ω | -- | 25 | -- | ns |
| Turn-on Rise Time | $t_r$ | | -- | 50 | -- | |
| Turn-off Delay Time | $t_{d(off)}$ | | -- | 65 | -- | |
| Turn-off Fall Time | $t_f$ | | -- | 28 | -- | |
| **Drain-Source Body Diode Characteristics** | | | | | | |
| Continuous Body Diode Current | $I_S$ | $T_C$ = 25ºC | -- | -- | 27 | A |
| Body Diode Voltage | $V_{SD}$ | $T_J$ = 25ºC, $I_{SD}$ = 12A, $V_{GS}$ = 0V | -- | -- | 1.2 | V |
| Reverse Recovery Charge | Qrr | $I_F$ = 12A, $V_{GS}$ = 0V di/dt=100A/us | -- | 0.4 | -- | μC |
| Reverse Recovery Time | Trr | | -- | 97 | -- | ns |

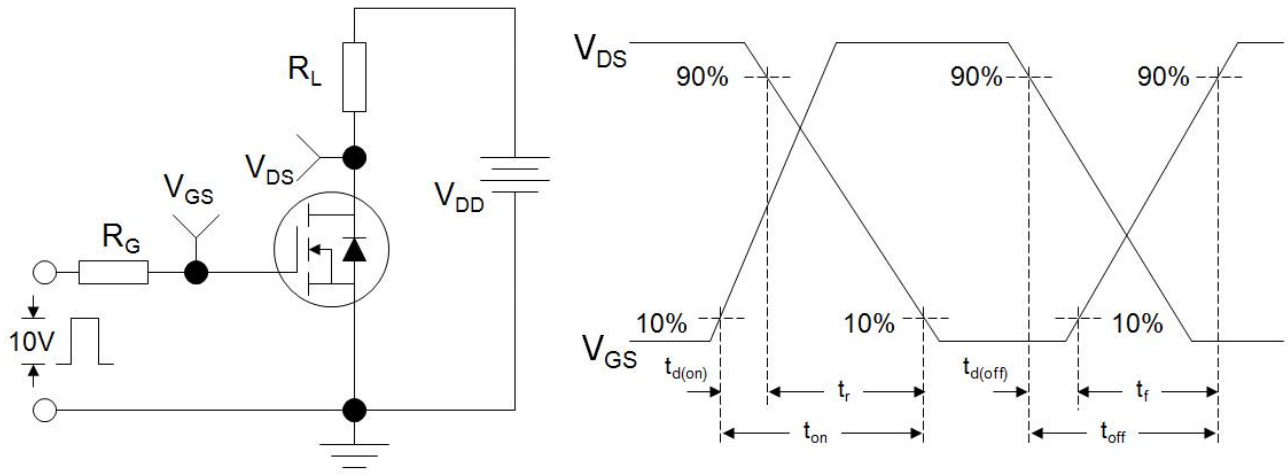
**Notes**

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. EAS condition : Tj=25℃ ,VDD=50V,VGS=10V,L=10mH,Rg=25Ω
   The table shows the minimum avalanche energy, which is 80mJ when the device is tested until failure
3. Identical low side and high side switch with identical $R_G$

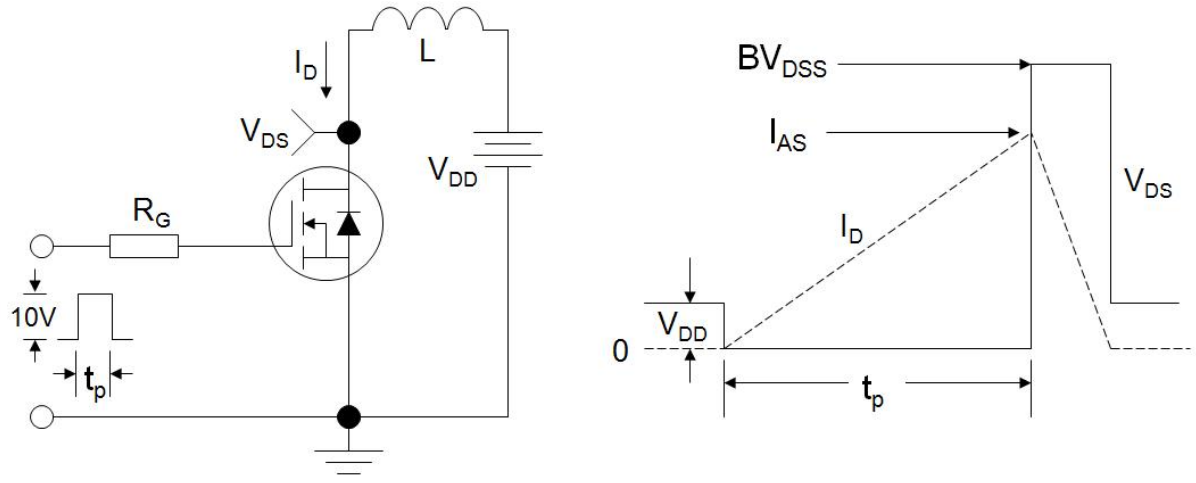
**Gate Charge Test Circuit**




**Switch Time Test Circuit**




**EAS Test Circuit**



## Typical Characteristics $T_J$ = 25ºC, unless otherwise noted

**Figure 1. Output Characteristics**

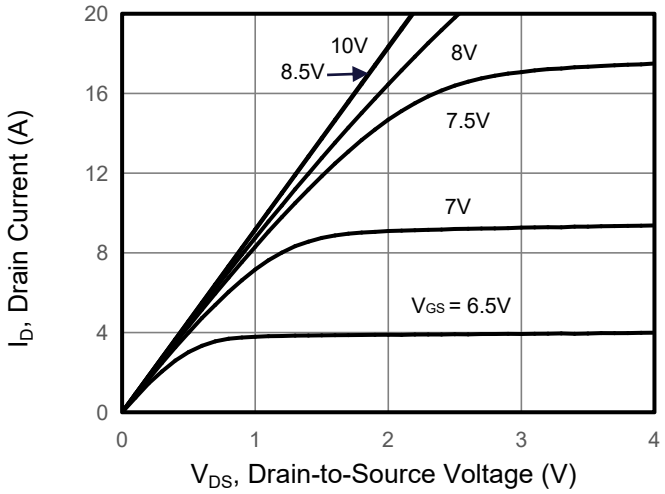



**Figure 2. Transfer Characteristics**

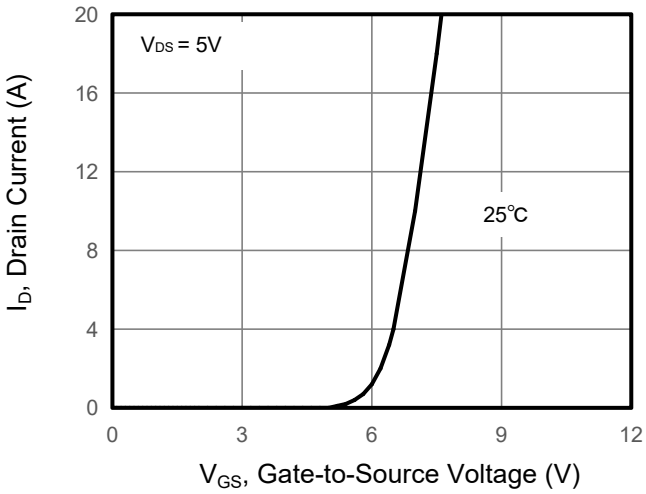



**Figure 3. Drain Source On Resistance**

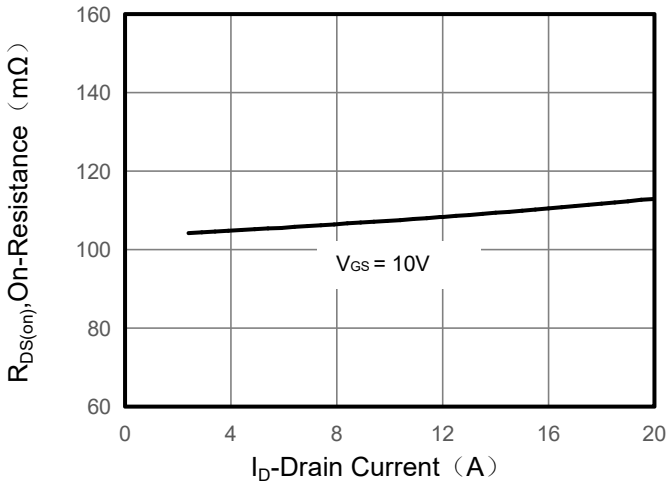



**Figure 4. Gate Charge**

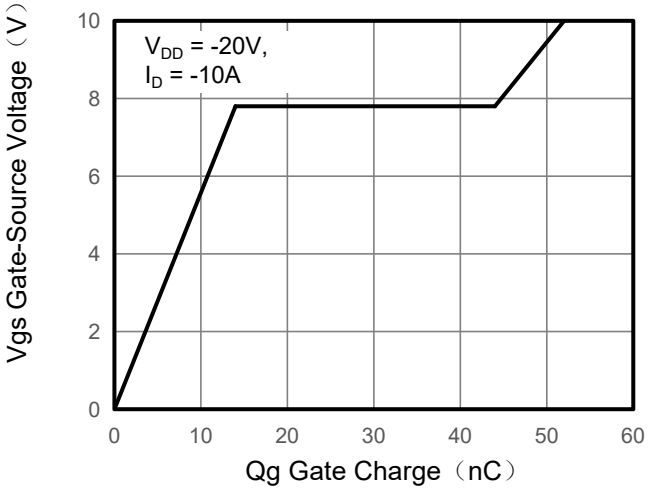



**Figure 5. Capacitance**

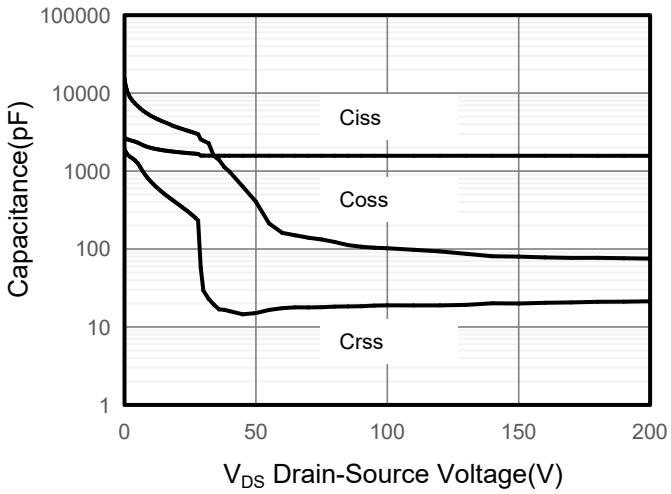
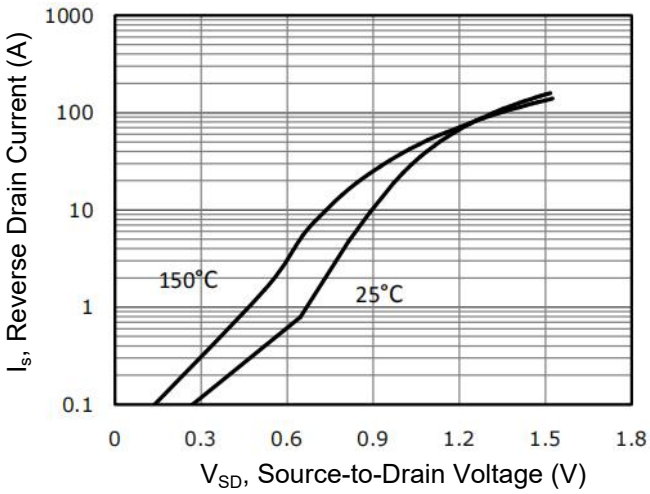



**Figure 6. Source-Drain Diode Forward**



**Typical Characteristics** $T_J$ = 25ºC, unless otherwise noted

**Figure 7. Drain-Source On-Resistance**

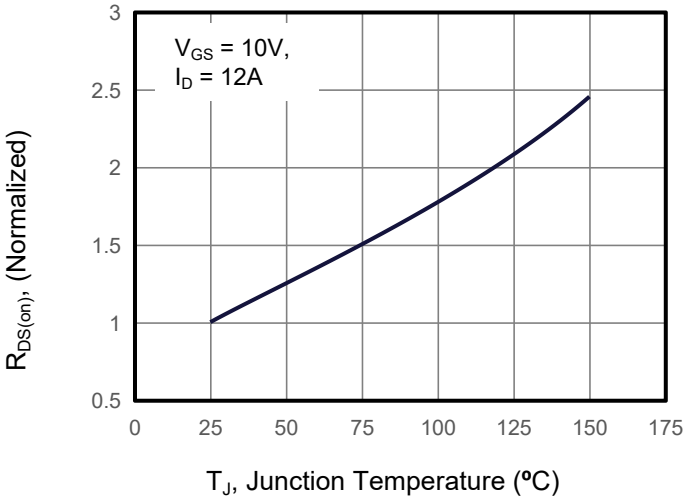



**Figure 8. Safe Operation Area**

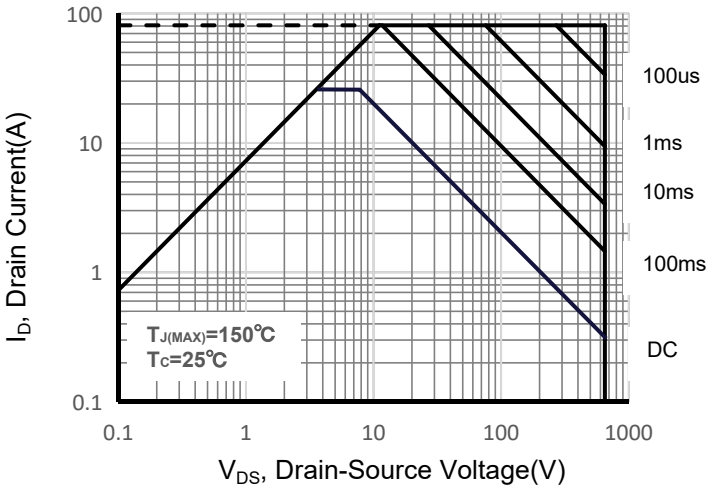



**Figure 9. Maximum Continuous Drain Current vs Case Temperature**

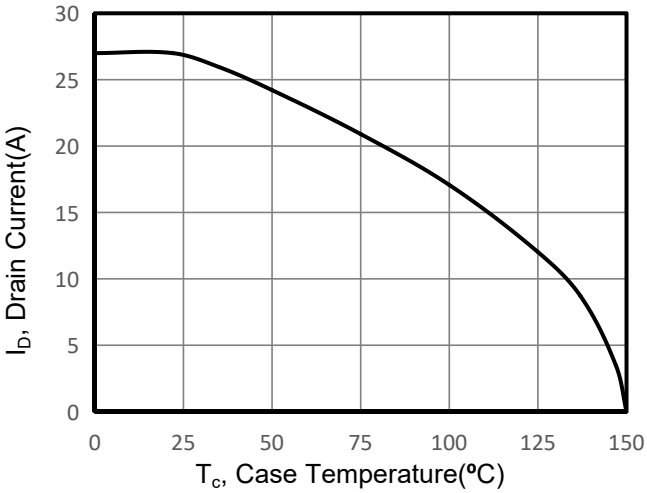
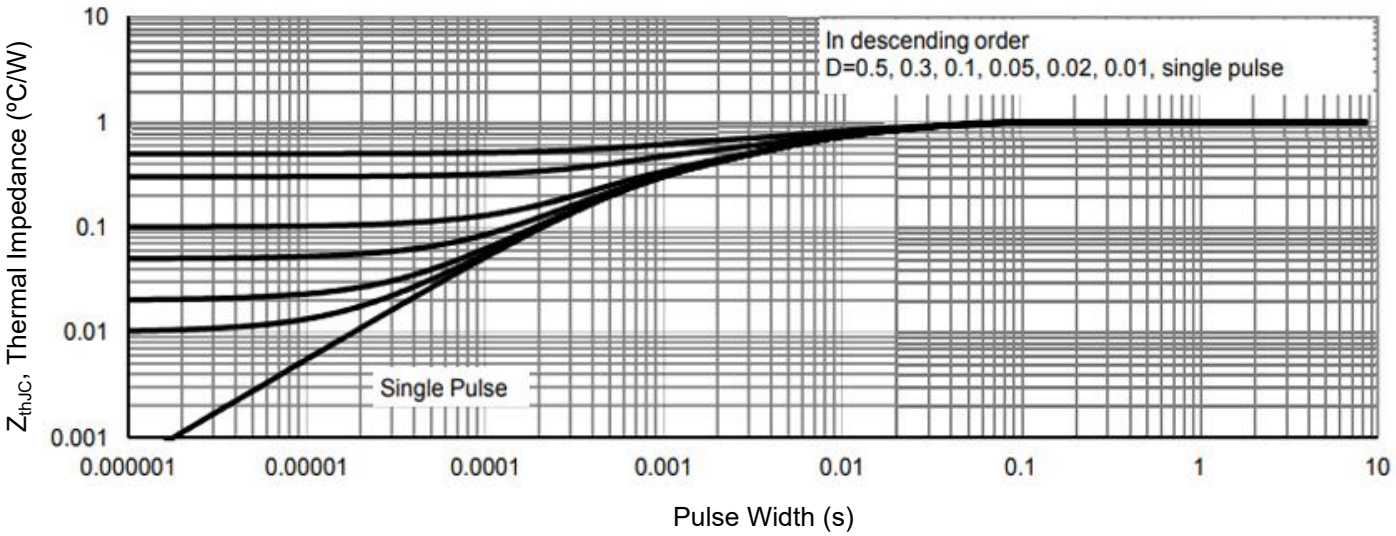
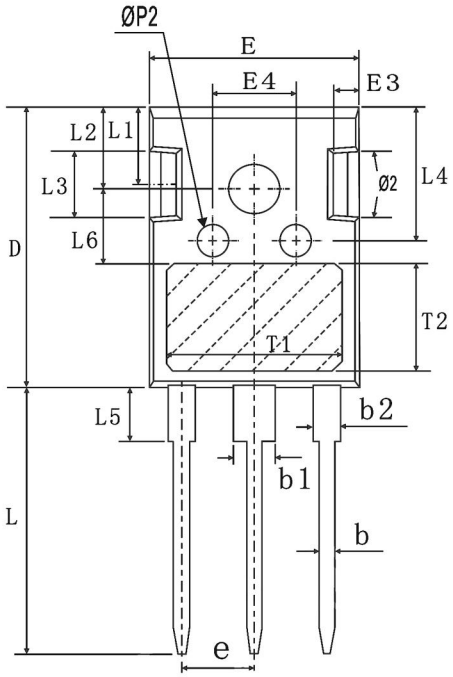


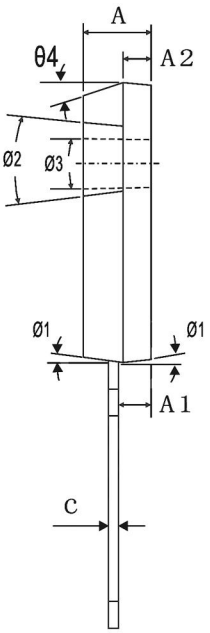

**Figure 10. Normalized Maximum Transient Thermal Impedance**



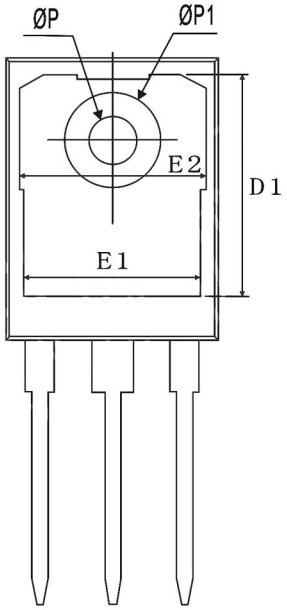
## TO-247 Package Information




TOP VIEW




SIDE VIEW




BOTTOM VIEW


SIDE VIEW

COMMON DIMENSIONS
(UNITS OF MEASURE=mm)

| SYMBOL | MIN | NOM | MAX |
|---|---|---|---|
| A | 4.80 | 5.00 | 5.20 |
| A1 | 2.20 | 2.40 | 2.60 |
| A2 | 1.85 | 2.00 | 2.15 |
| b | 1.10 | 1.20 | 1.30 |
| b1 | 2.80 | 3.00 | 3.20 |
| b2 | 1.80 | 2.00 | 2.20 |
| C | 0.52 | 0.62 | 0.72 |
| D | 20.35 | 20.65 | 20.95 |
| D1 | 16.35 | 16.55 | 16.75 |
| E | 15.50 | 15.80 | 16.10 |
| E1 | 13.10 | 13.30 | 13.50 |
| E2 | 13.80 | 14.00 | 14.20 |
| E3 | 1.45 | 1.60 | 1.75 |
| E4 | 6.00 | 6.20 | 6.40 |
| L | 19.80 | 20.00 | 20.20 |
| L1 | 5.88 | 5.98 | 6.08 |
| L2 | 5.88 | 5.98 | 6.08 |
| L3 | 4.90 | 5.00 | 5.10 |
| L4 | 9.70 | 9.80 | 9.90 |
| L5 | 4.10 | 4.30 | 4.50 |
| Ø1 | 4° | 7° | 10° |
| Ø2 | 11° | 14° | 17° |
| Ø3 | 1° | -- | 2° |
| Ø4 | 10° | 15° | 20° |
| ØP | 3.35 | 3.60 | 3.85 |
| ØP1 | -- | -- | 7.30 |
| ØP2 | 2.25 | 2.50 | 2.75 |
| e | 5.44BSC | | |
| T1 | 12.80REF | | |
| T2 | 7.80REF | | |
| L6 | 5.50REF | | |