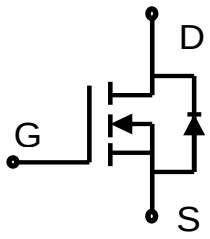
# WLP099R650GF

## N-Channel 650V 40A 0.099Ω Power MOSFET

### Description

WENLAI Power MOSFET is fabricated using advanced super junction technology. The resulting device has extremely low on resistance, making it especially suitable for applications which require superior power density and outstanding efficiency.




N-Channel MOSFET

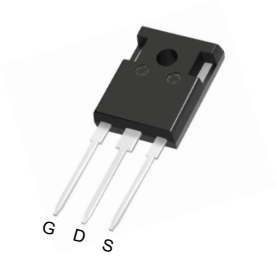
### Features

- Ultra low $R_{DS(on)}$
- Ultra low gate charge (typ. $Q_g$ = 70.5nC)
- 100% UIS tested
- RoHS compliant

### Applications

- Power factor correction (PFC).
- Switched mode power supplies (SMPS).
- Uninterruptible power supply (UPS).

### Pin Configuration




**TO-247**

### Product Summary

| | |
|---|---|
| $V_{DS}$ @ $T_{j,max}$ | 700V |
| $R_{DS(on),max}$ | 0.099Ω |
| $I_{DM}$ | 120A |
| $Q_{g,typ}$ | 70.5nC |

### Absolute Maximum Ratings

| Parameter | Symbol | Value | Unit |
|---|---|---|---|
| Drain-Source Voltage | $V_{DSS}$ | 650 | V |
| Continuous drain current ( $T_C$ = 25°C ) | $I_D$ | 40 | A |
| ( $T_C$ = 100°C ) | | 25.3 | A |
| Pulsed drain current [1] | $I_{DM}$ | 120 | A |
| Gate-Source voltage | $V_{GSS}$ | ±30 | V |
| Avalanche energy, single pulse [2] | $E_{AS}$ | 992 | mJ |
| Power Dissipation | $P_D$ | 357 | W |
| Operating and Storage Temperature Range | $T_J$, $T_{STG}$ | -55 to +150 | °C |
| Continuous diode forward current | $I_S$ | 40 | A |
| Diode pulse current | $I_{S,pulse}$ | 120 | A |
| **Thermal Characteristics** | | | |
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 0.35 | °C/W |
| Thermal Resistance, Junction-to-Ambient [3] | $R_{\theta JA}$ | 65 | °C/W |
| Soldering temperature, wavesoldering only allowed at leads. (1.6mm from case for 10s) | $T_{sold}$ | 260 | °C |

### Package Marking and Ordering Information

| Device | Device Package | Marking | Units/Tube |
|---|---|---|---|
| WLP099R650GF | TO-247 | WLP099R650GF | 30 |

## Electrical Characteristics

$T_c$ = 25°C unless otherwise noted

| Parameter | Symbol | Test Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **Static characteristics** | | | | | | |
| Drain-source breakdown voltage | $BV_{DSS}$ | $V_{GS}$=0 V, $I_D$=0.25mA | 650 | - | - | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$, $I_D$=0.25mA | 2.5 | 3.0 | 5.0 | V |
| Drain cut-off current | $I_{DSS}$ | $V_{DS}$=650 V, $V_{GS}$=0 V,$T_j$ = 25°C | - | - | 5 | μA |
| Gate leakage current, Forward | $I_{GSSF}$ | $V_{GS}$=30 V, $V_{DS}$=0 V | - | - | 100 | nA |
| Gate leakage current, Reverse | $I_{GSSR}$ | $V_{GS}$=-30 V, $V_{DS}$=0 V | - | - | -100 | nA |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS}$=10 V, $I_D$=20 A | - | | | |
| | | $T_j$ = 25°C | - | 0.092 | 0.099 | Ω |
| | | $T_j$ = 150°C | - | 0.2 | - | |
| Gate resistance | $R_G$ | f=1 MHz, open drain | - | 1.9 | - | Ω |
| **Dynamic characteristics** | | | | | | |
| Input capacitance | $C_{iss}$ | $V_{DS}$ = 100 V, $V_{GS}$ = 0 V, | - | 3580 | - | pF |
| Output capacitance | $C_{oss}$ | f = 250kHz | - | 110 | - | |
| Reverse transfer capacitance | $C_{rss}$ | | - | 3.2 | - | |
| Turn-on delay time | $t_{d(on)}$ | $V_{DD}$ = 400V, $I_D$ = 20A | - | 136.2 | - | ns |
| Rise time | $t_r$ | $R_G$ = 10Ω, $V_{GS}$=10V | - | 21.9 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 81.1 | - | |
| Fall time | $t_f$ | | - | 7.1 | - | |
| **Gate charge characteristics** | | | | | | |
| Gate to source charge | $Q_{gs}$ | $V_{DD}$=520V, $I_D$=20A, | - | 18.9 | - | nC |
| Gate to drain charge | $Q_{gd}$ | $V_{GS}$=0 to 10 V | - | 25.1 | - | |
| Gate charge total | $Q_g$ | | - | 70.5 | - | |
| Gate plateau voltage | $V_{plateau}$ | | - | 6 | - | V |
| **Reverse diode characteristics** | | | | | | |
| Diode forward voltage | $V_{SD}$ | $V_{GS}$=0 V, $I_F$=40A | - | - | 1.1 | V |
| Reverse recovery time | $t_{rr}$ | $V_R$=400V, $I_F$=20A, | - | 170.1 | - | ns |
| Reverse recovery charge | $Q_{rr}$ | $dI_F/dt$=100 A/μs | - | 1.3 | - | μC |
| Peak reverse recovery current | $I_{rrm}$ | | - | 15.4 | - | A |

Notes:

1. Limited by maximum junction temperature, maximum duty cycle is 0.75.

2. $I_{AS}$ = 8A, L=31mH,$V_{DD}$ = 60V, Starting $T_j$= 25°C.

3: The value of $R_{thJA}$ is measured by placing the device in a still air box which is one cubic foot.

## Electrical Characteristics Diagrams

Figure 1. Typ. Output Characteristics

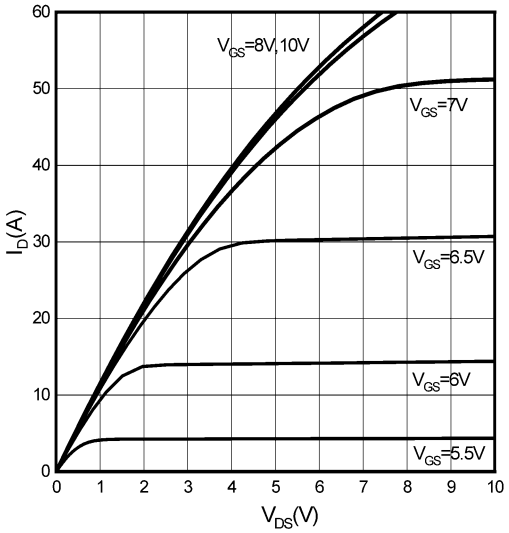



Figure 2. Transfer Characteristics

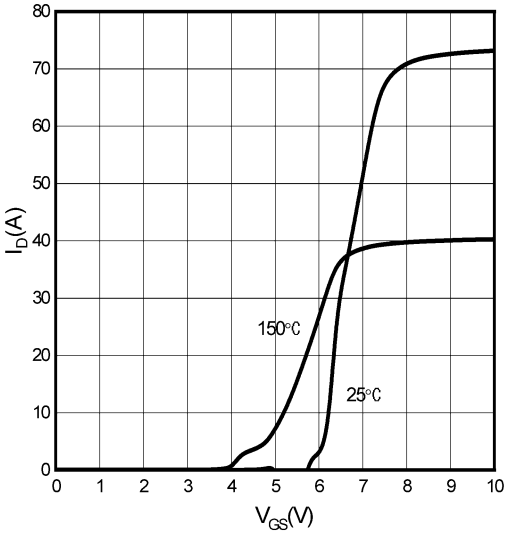



Figure 3. On-Resistance vs. Drain Current

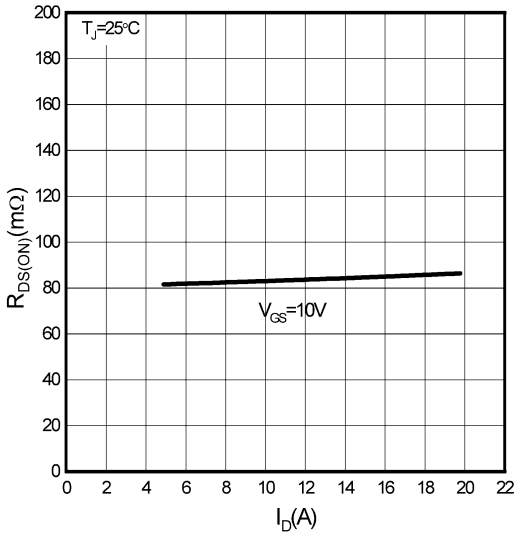



Figure 4.On-Resistance vs.Temperature

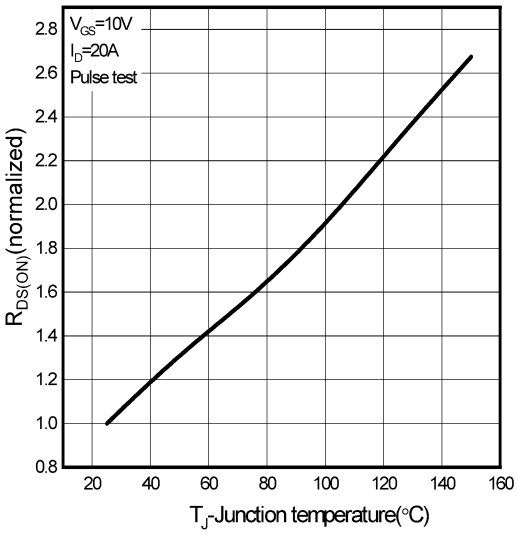



Figure 5.Breakdown Voltage vs.Temperature

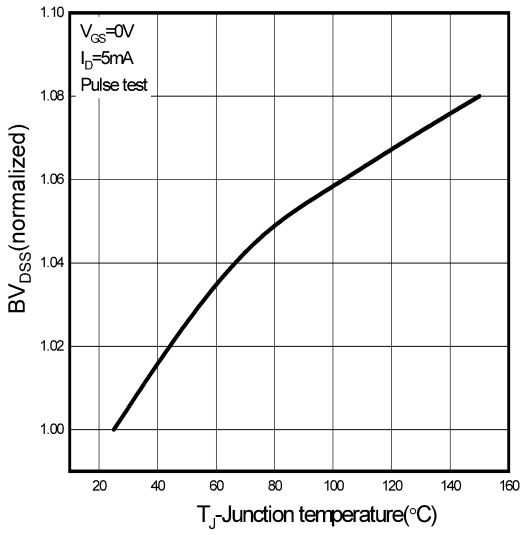



Figure 6.Threshold Voltage vs.Temperature

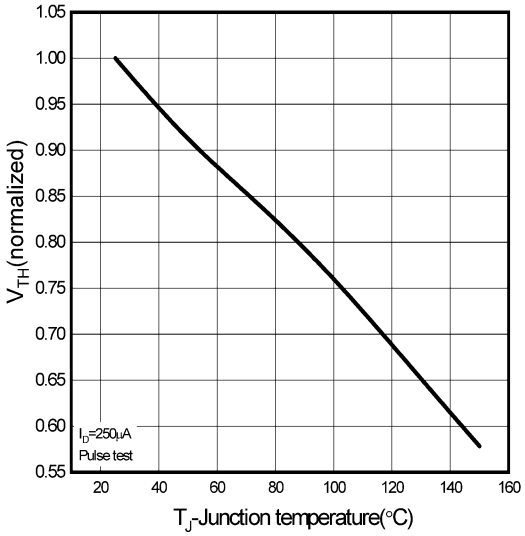


Figure 7.Body-Diode Characteristics

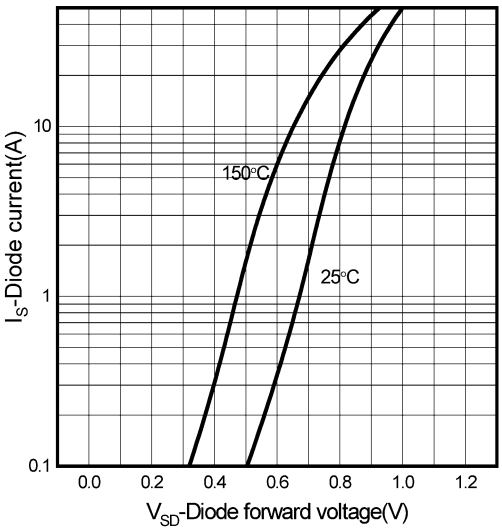



Figure 8.Capacitance Characteristics

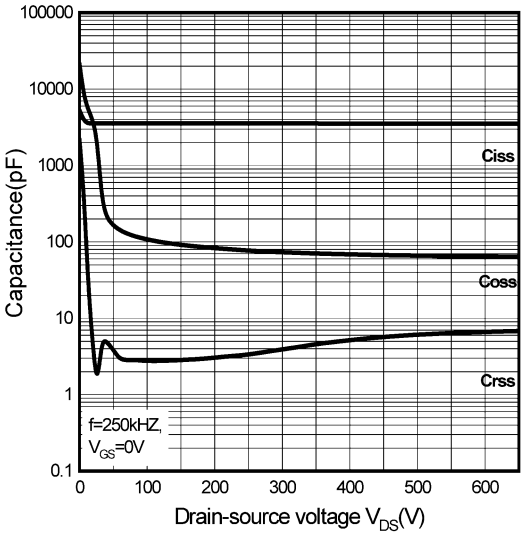



Figure 9.Gate Charge Characteristics

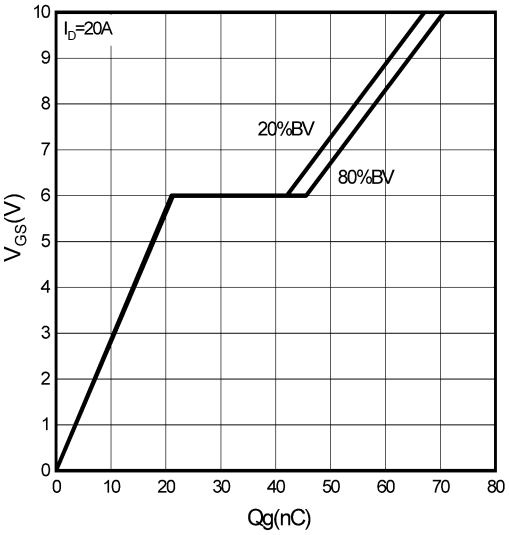



Figure 10.Drain Current Derating

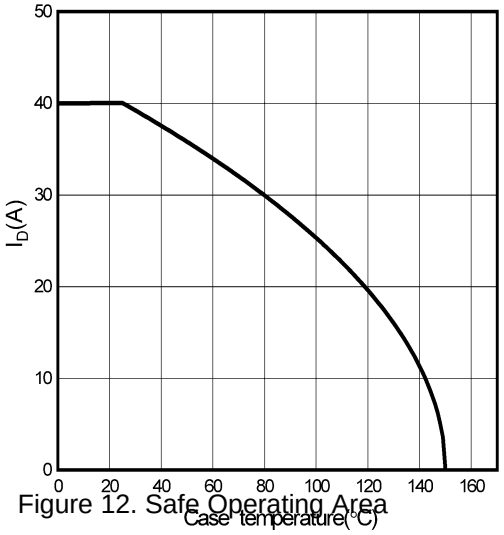



Figure 11.Power Dissipation vs.Temperature

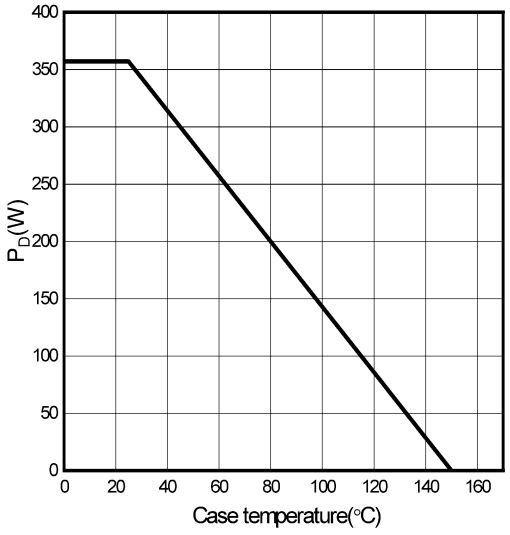



Figure 12. Safe Operating Area

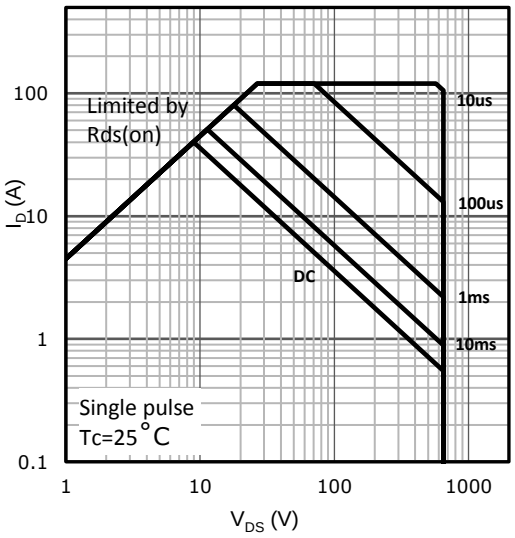
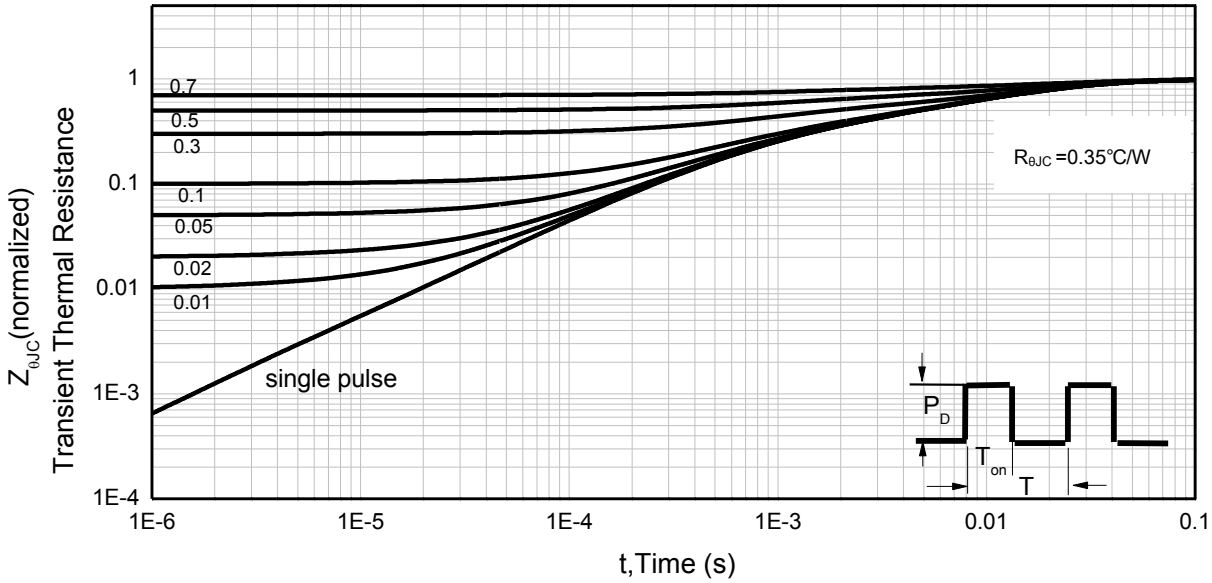
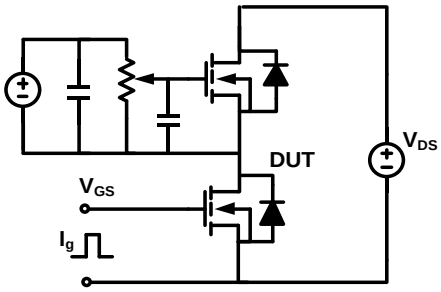


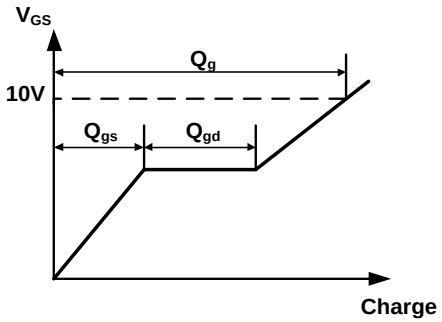
Figure 13. Normalized Maximum Transient Thermal Impedance (RthJC)



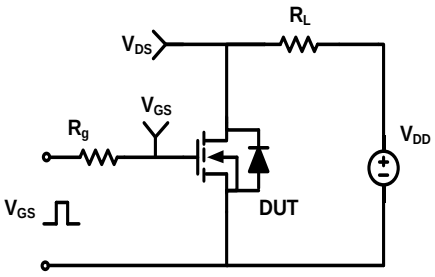
## Test Circuit & Waveforms

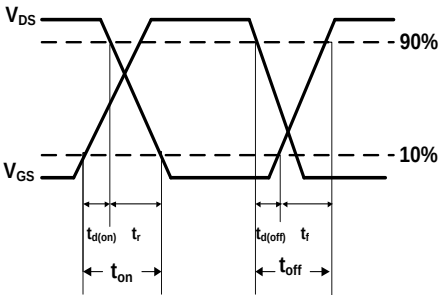
Gate Charge Test Circuit & Waveform



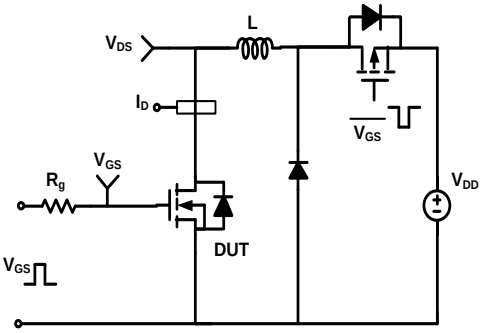



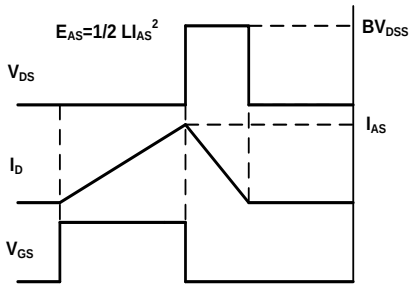

Resistive Switching Test Circuit & Waveform



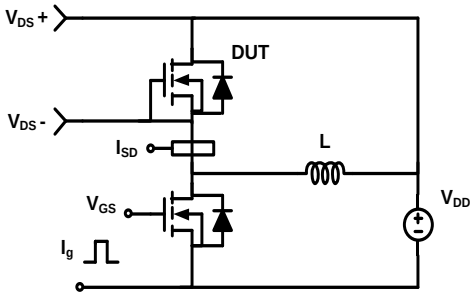



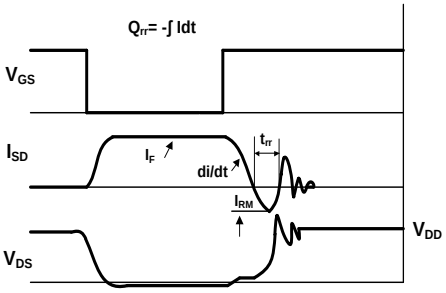

Unclamped Inductive Switching (UIS) Test Circuit & Waveform



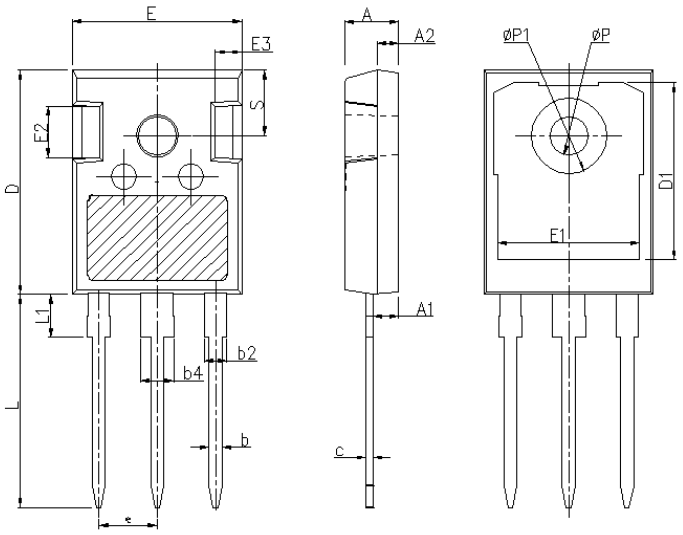




Diode Recovery Test Circuit & Waveform



## Mechanical Dimensions for TO-247




| DIMENSIONS IN MILLITMETERS | | |
|---|---|---|
| SYMBOL | MIN | MAX |
| A | 4.8 | 5.21 |
| A1 | 2.21 | 2.61 |
| A2 | 1.85 | 2.16 |
| b | 1.07 | 1.36 |
| b2 | 1.91 | 2.41 |
| b4 | 2.87 | 3.38 |
| c | 0.51 | 0.75 |
| D | 20.7 | 21.3 |
| D1 | 16.25 | 17.65 |
| E | 15.5 | 16.13 |
| E1 | 13 | 13.6 |
| E2 | 3.68 | 5.2 |
| E3 | 1 | 2.7 |
| e | 5.44BSC | |
| L | 19.62 | 20.32 |
| L1 | - | 4.4 |
| ΦP | 3.4 | 3.8 |
| ΦP1 | - | 7.4 |
| S | 6.04 | 6.3 |

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