

Enhancement Mode N-Channel Power MOSFET

Features

- ◆ Low $R_{DS(on)}$ & FOM
- ◆ Excellent low switching loss
- ◆ Excellent stability and uniformity
- ◆ Easy to drive

Applications

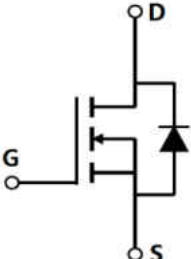


- ◆ PC power
- ◆ Server power supply
- ◆ Telecom
- ◆ Solar inverter
- ◆ Super charger for automobiles

■ General Description

OSG65R099xF use advanced GreenMOS™ technology to provide low $R_{DS(ON)}$, low gate charge, fast switching and excellent avalanche characteristics. This device is suitable for telecom and super charger applications.

| | |
|-----------------------------------|---------|
| ◆ $V_{DS, min@T_{jmax}}$ | 700 V |
| ◆ $I_{D, pulse}$ | 120 A |
| ◆ $R_{DS(ON), max @ V_{GS}=10 V}$ | 99 mΩ |
| ◆ Q_g | 43.6 nC |

■ Schematic and Package Information

| SCHEMATIC DIAGRAM | PIN ASSIGNMENT-TOP VIEW | |
|--|--|--|
|  |  TO247 OSG65R099HF |  TO220F OSG65R099FF |

■ Absolute Maximum Ratings at $T_j=25^\circ\text{C}$ unless otherwise noted

| Parameter | Symbol | Value | Unit |
|--|----------------|------------|------------------|
| Drain source voltage | V_{DS} | 650 | V |
| Gate source voltage | V_{GS} | ± 30 | V |
| Continuous drain current ¹⁾ , $T_C=25^\circ\text{C}$ | I_D | 40 | A |
| Continuous drain current ¹⁾ , $T_C=100^\circ\text{C}$ | | 25 | |
| Pulsed drain current ²⁾ , $T_C=25^\circ\text{C}$ | $I_{D, pulse}$ | 120 | A |
| Power dissipation ³⁾ for TO247, $T_C=25^\circ\text{C}$ | P_D | 278 | W |
| Power dissipation ³⁾ for TO220F, $T_C=25^\circ\text{C}$ | | 35 | |
| Single pulsed avalanche energy ⁵⁾ | E_{AS} | 1000 | mJ |
| MOSFET dv/dt ruggedness, $V_{DS}=0\text{...}480\text{ V}$ | dv/dt | 50 | V/ns |
| Reverse diode dv/dt, $V_{DS}=0\text{...}480\text{ V}$, $I_{SD}\leq I_D$ | dv/dt | 15 | V/ns |
| Operation and storage temperature | T_{stg}, T_j | -55 to 150 | $^\circ\text{C}$ |

■ Thermal Characteristics

| Parameter | Symbol | Value | | Unit |
|--|-----------------|-------|--------|------|
| | | TO247 | TO220F | |
| Thermal resistance, junction-case | $R_{\theta JC}$ | 0.45 | 3.6 | °C/W |
| Thermal resistance, junction-ambient ⁴⁾ | $R_{\theta JA}$ | 62 | 62.5 | °C/W |

■ Electrical Characteristics at $T_j=25\text{ }^{\circ}\text{C}$ unless otherwise specified

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Test condition |
|----------------------------------|--------------|------|-------|-------|---------------|---|
| Drain-source breakdown voltage | BV_{DSS} | 650 | | | V | $V_{GS}=0\text{ V}$, $I_D=1\text{ mA}$ |
| | | 700 | 770 | | | $V_{GS}=0\text{ V}$, $I_D=1\text{ mA}$, $T_j=150\text{ }^{\circ}\text{C}$ |
| Gate threshold voltage | $V_{GS(th)}$ | 3.0 | | 4.0 | V | $V_{DS}=V_{GS}$, $I_D=1\text{ mA}$ |
| Drain-source on-state resistance | $R_{DS(on)}$ | | 0.08 | 0.099 | Ω | $V_{GS}=10\text{ V}$, $I_D=20\text{ A}$ |
| | | | 0.205 | | | $V_{GS}=10\text{ V}$, $I_D=20\text{ A}$, $T_j=150\text{ }^{\circ}\text{C}$ |
| Gate-source leakage current | I_{GSS} | | | 100 | nA | $V_{GS}=30\text{ V}$ |
| | | | | -100 | | $V_{GS}=-30\text{ V}$ |
| Drain-source leakage current | I_{DSS} | | | 1 | μA | $V_{DS}=650\text{ V}$, $V_{GS}=0\text{ V}$ |

■ Dynamic Characteristics

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Test condition |
|------------------------------|--------------|------|--------|------|------|--|
| Input capacitance | C_{iss} | | 3042.6 | | pF | $V_{GS}=0\text{ V}$, $V_{DS}=50\text{ V}$, $f=200\text{ kHz}$ |
| Output capacitance | C_{oss} | | 200.6 | | pF | |
| Reverse transfer capacitance | C_{rss} | | 3.9 | | pF | |
| Turn-on delay time | $t_{d(on)}$ | | 68.1 | | ns | $I_D=20\text{ A}$, $V_{GS}=10\text{ V}$, $V_{DS}=400\text{ V}$, $R_G=25\text{ }\Omega$, |
| Rise time | t_r | | 53.7 | | ns | |
| Turn-off delay time | $t_{d(off)}$ | | 109.6 | | ns | |
| Fall time | t_f | | 56.4 | | ns | |

■ Gate Charge Characteristics

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Test condition |
|----------------------|----------------------|------|------|------|------|--|
| Total gate charge | Q_g | | 43.6 | | nC | $I_D=20\text{ A}$, $V_{DS}=400\text{ V}$, $V_{GS}=10\text{ V}$ |
| Gate-source charge | Q_{gs} | | 13 | | nC | |
| Gate-drain charge | Q_{gd} | | 13.4 | | nC | |
| Gate plateau voltage | V_{plateau} | | 5.6 | | V | |

■ Body Diode Characteristics

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Test condition |
|-------------------------------|-----------|------|-------|------|---------------|---|
| Diode forward current | I_S | | | 40 | A | $V_{GS} < V_{th}$ |
| Pulsed source current | I_{SP} | | | 120 | | |
| Diode forward voltage | V_{SD} | | | 1.4 | V | $I_S=40\text{ A}$, $V_{GS}=0\text{ V}$ |
| Reverse recovery time | t_{rr} | | 441.5 | | ns | $I_S=20\text{ A}$, $di/dt=100\text{ A}/\mu\text{s}$ |
| Reverse recovery charge | Q_{rr} | | 7.5 | | μC | |
| Peak reverse recovery current | I_{rrm} | | 31.2 | | A | |

■ Note

- 1) Calculated continuous current based on maximum allowable junction temperature.
- 2) Repetitive rating; pulse width limited by max. junction temperature.
- 3) P_d is based on max. junction temperature, using junction-case thermal resistance.
- 4) The value of $R_{\theta JA}$ is measured with the device mounted on 1 in 2 FR-4 board with 2oz. Copper, in a still air environment with $T_a=25\text{ }^\circ\text{C}$.
- 5) $V_{DD}=100\text{ V}$, $R_G=25\text{ }\Omega$, $L=20\text{ mH}$, starting $T_j=25\text{ }^\circ\text{C}$.

■ **Electrical Characteristics Diagrams**

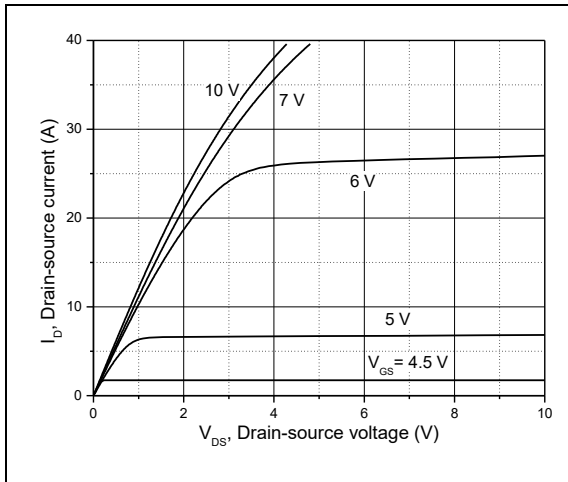


Figure 1, Typ. output characteristics

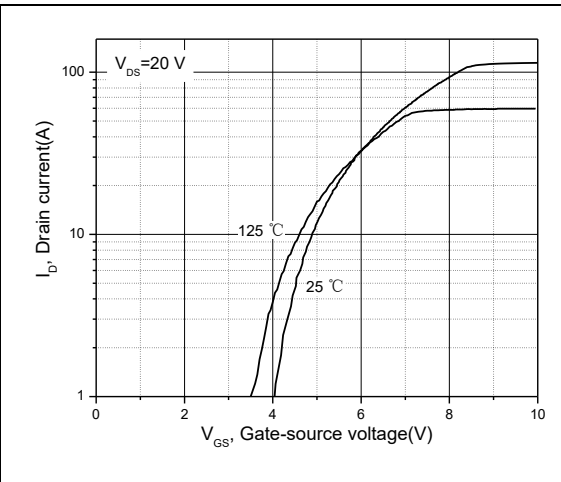


Figure 2, Typ. transfer characteristics

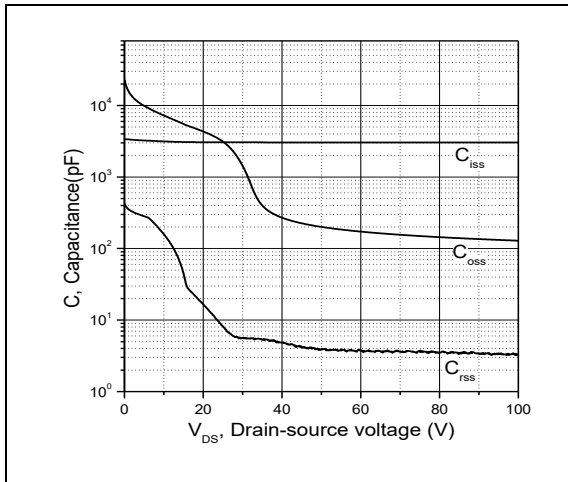


Figure 3, Typ. capacitances

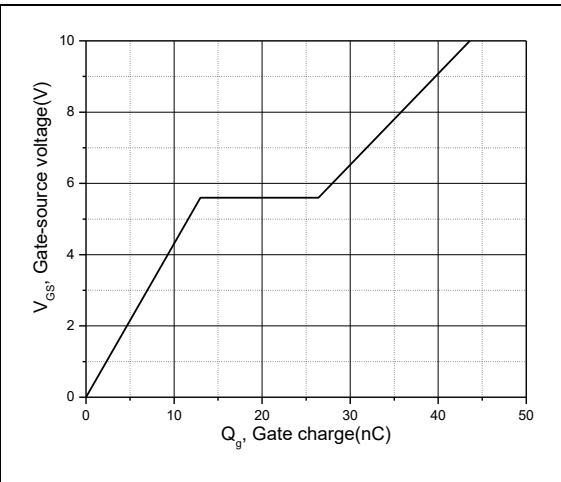


Figure 4, Typ. gate charge

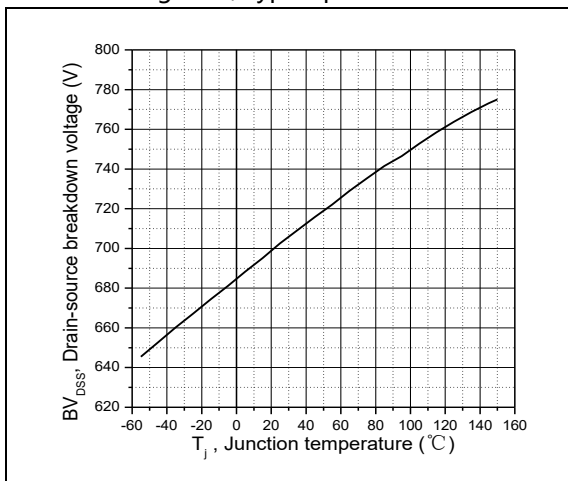


Figure 5, Drain-source breakdown voltage

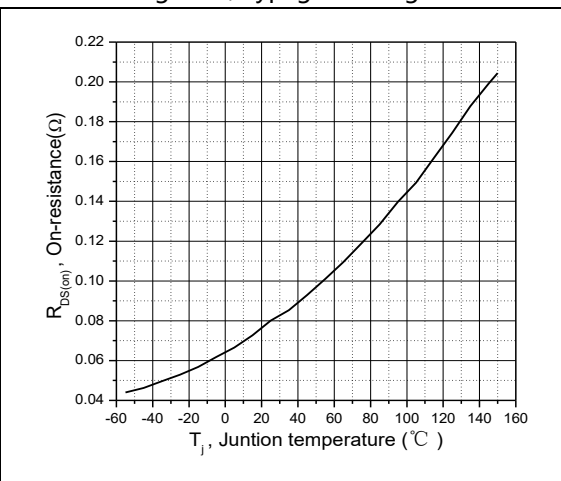


Figure 6, Drain-source on-state resistance

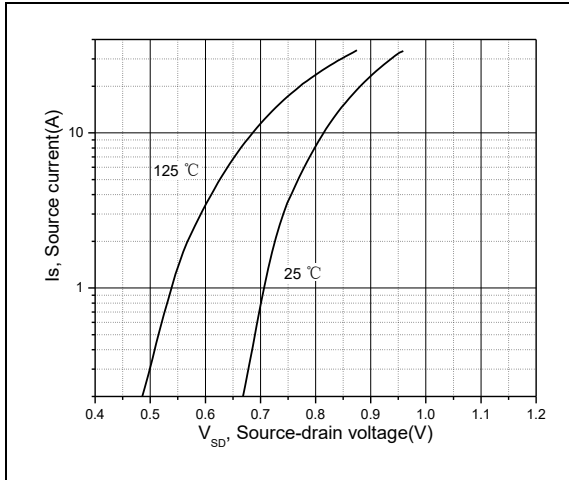


Figure 7, Forward characteristic of body diode

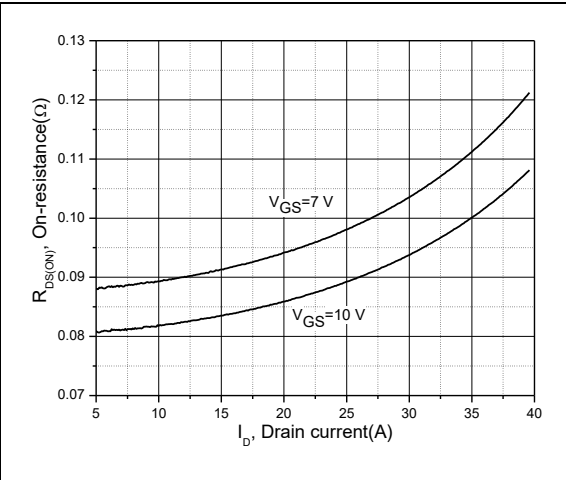


Figure 8, Drain-source on-state resistance

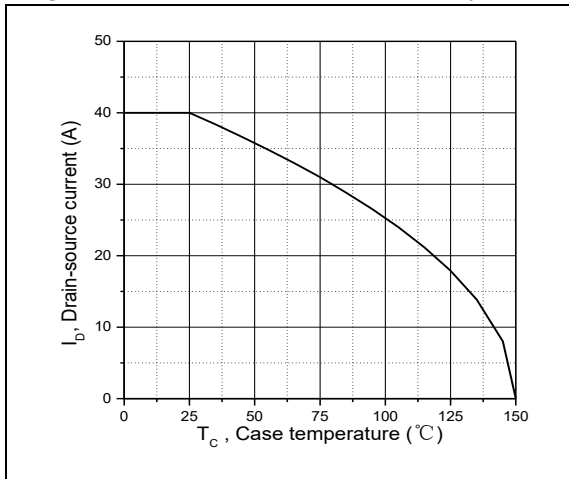


Figure 9, Drain current

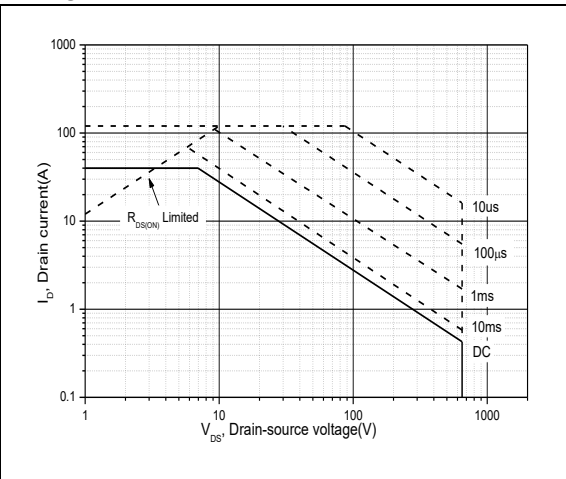


Figure 10, Safe operation area for TO247
 $T_C = 25\text{ °C}$

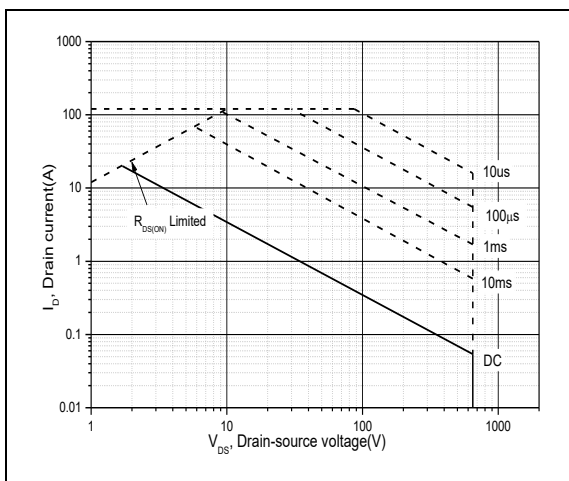


Figure 11, Safe operation area for TO220F
 $T_C = 25\text{ °C}$

■ Test circuits and waveforms

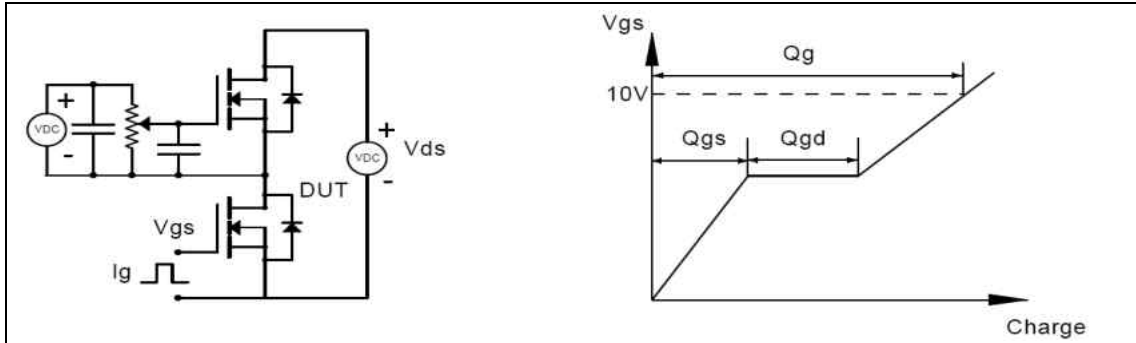


Figure 1, Gate charge test circuit & waveform

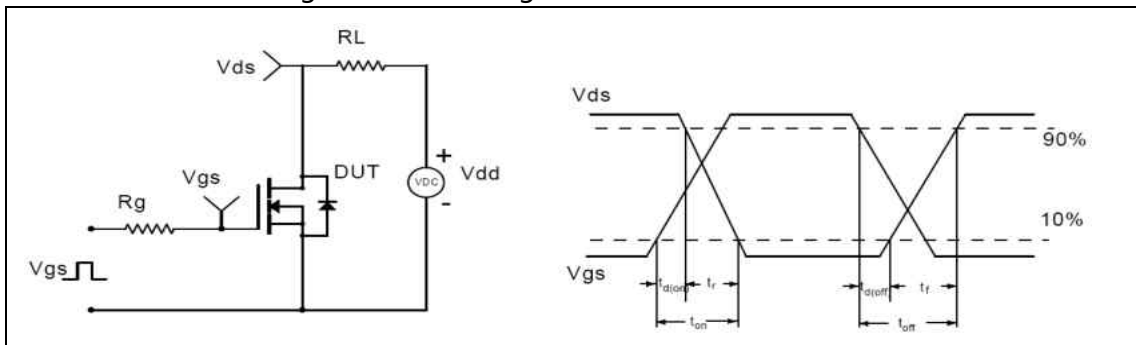


Figure 2, Switching time test circuit & waveforms

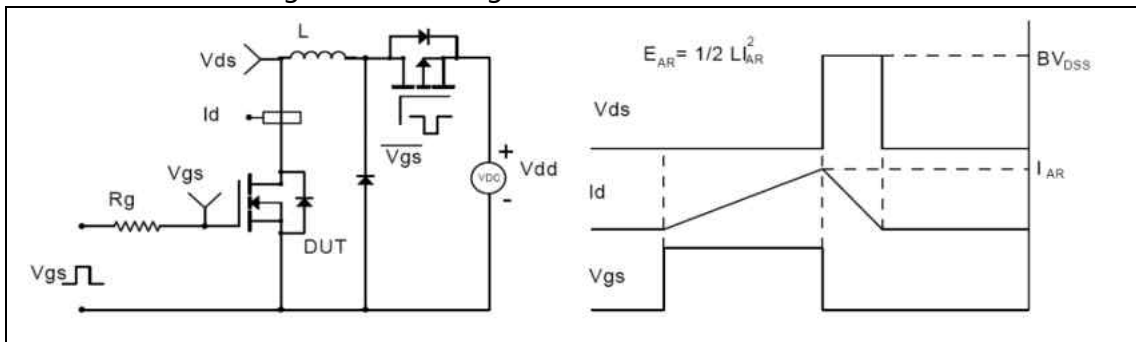


Figure 3, Unclamped inductive switching (UIS) test circuit & waveforms

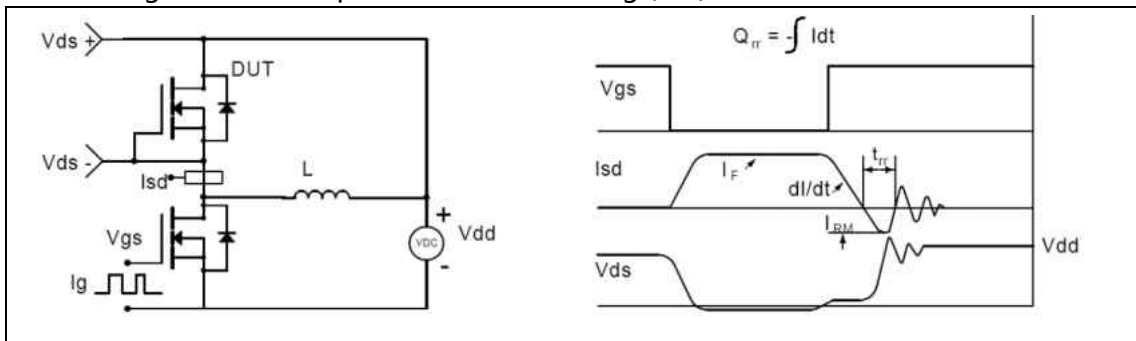
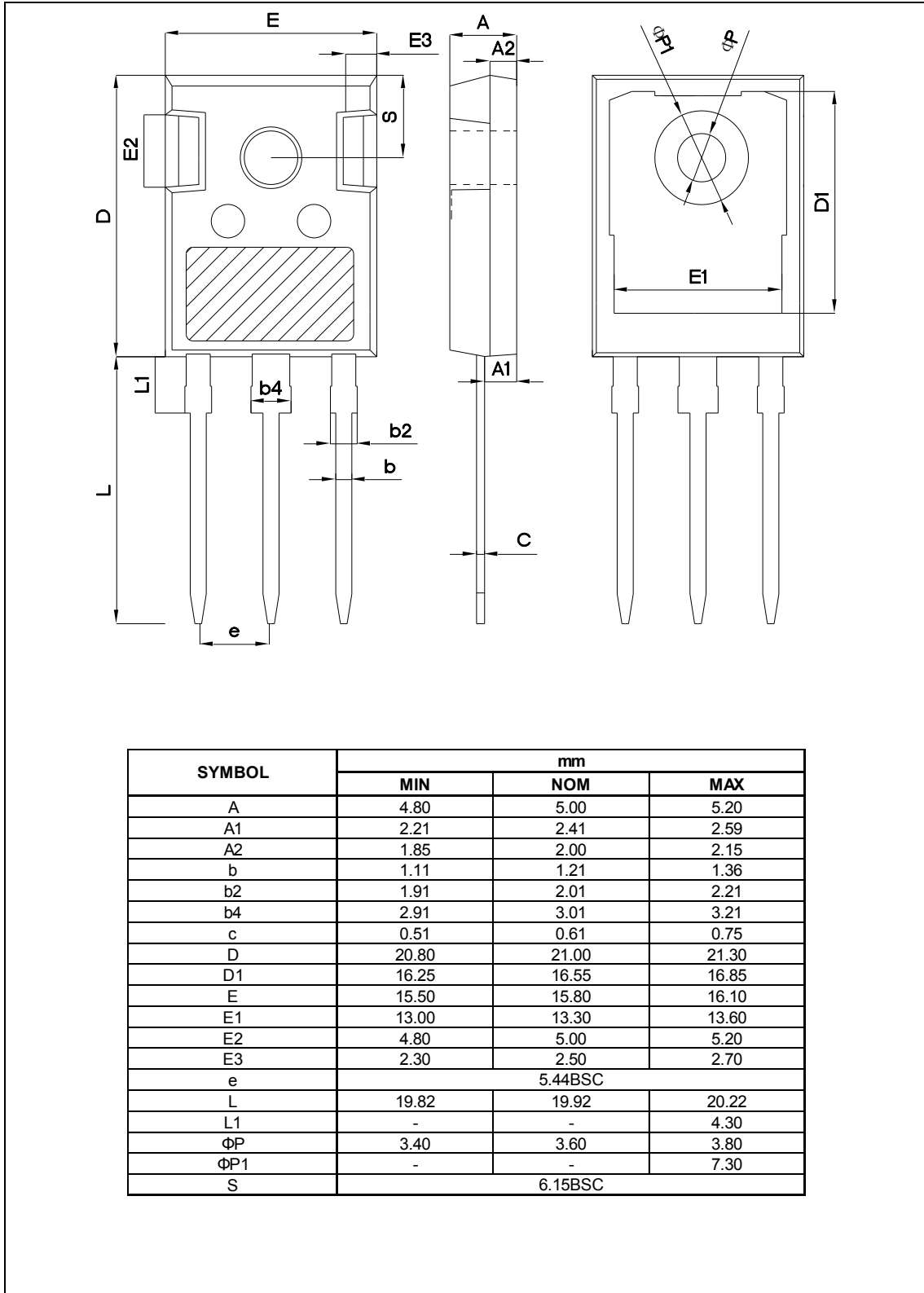


Figure 4, Diode reverse recovery test circuit & waveforms

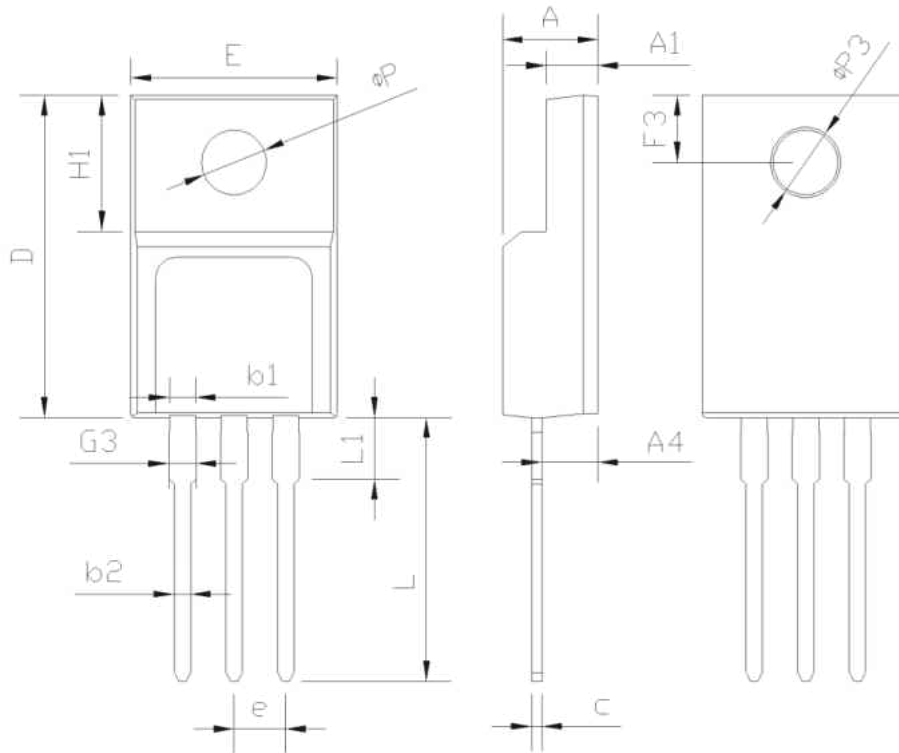
■ Package Information

Figure1, TO247 package outline dimension



■ Package Information

Figure2, TO220F package outline dimension



| SYMBOL | mm | | |
|--------|---------|-------|-------|
| | MIN | NOM | MAX |
| E | 9.96 | 10.16 | 10.36 |
| A | 4.50 | 4.70 | 4.90 |
| A1 | 2.34 | 2.54 | 2.74 |
| A4 | 2.56 | 2.76 | 2.96 |
| c | 0.40 | 0.50 | 0.65 |
| D | 15.57 | 15.87 | 16.17 |
| H1 | 6.70REF | | |
| e | 2.54BSC | | |
| L | 12.68 | 12.98 | 13.28 |
| L1 | 2.88 | 3.03 | 3.18 |
| ΦP | 3.03 | 3.18 | 3.38 |
| ΦP3 | 3.15 | 3.45 | 3.65 |
| F3 | 3.15 | 3.30 | 3.45 |
| G3 | 1.25 | 1.35 | 1.55 |
| b1 | 1.18 | 1.28 | 1.43 |
| b2 | 0.70 | 0.80 | 0.95 |

■ Ordering Information

| Package | Units/Tube | Tubes/Inner Box | Units/Inner Box | Inner Box/Carton Box | Units/Carton Box |
|---------|------------|-----------------|-----------------|----------------------|------------------|
| TO220F | 50 | 20 | 1000 | 6 | 6000 |
| TO247 | 30 | 11 | 330 | 6 | 1980 |

■ Product Information

| Product | Package | Pb Free | RoHS | Halogen Free |
|-------------|---------|---------|------|--------------|
| OSG65R099FF | TO220F | yes | yes | yes |
| OSG65R099HF | TO247 | yes | yes | yes |