

Enhancement Mode N-Channel Power MOSFET

Features

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

Applications

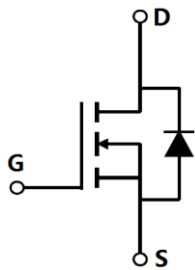

- ◆ Lighting
- ◆ Hard switching PWM
- ◆ Server power supply
- ◆ Charger

■ General Description

OSG60R2K8x use advanced GreenMOS™ technology to provide low $R_{DS(ON)}$, low gate charge, fast switching and excellent avalanche characteristics. This device is suitable for active power factor correction and switching mode power supply applications.

| | |
|--------------------------------|--------------|
| ◆ $V_{DS, min@Tjmax}$ | 650 V |
| ◆ $I_{D, pulse}$ | 4.5 A |
| ◆ $R_{DS(ON), max @ VGS=10 V}$ | 2.8 Ω |
| ◆ Q_g | 4.2 nC |

■ Schematic and Package Information

| | |
|--|---|
| Schematic Diagram  | Pin Assignment Top View  TO251 OSG60R2K8A TO252 OSG60R2K8D |
|--|---|

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

| Parameter | Symbol | Value | Unit |
|--|----------------|------------|------------------|
| Drain source voltage | V_{DS} | 600 | V |
| Gate source voltage | V_{GS} | ± 30 | V |
| Continuous drain current ¹⁾ | I_D | 1.5 | A |
| Continuous drain current ¹⁾ $T_j=100^\circ\text{C}$ | | 0.95 | |
| Pulsed drain current ²⁾ | $I_{D, pulse}$ | 4.5 | A |
| Power dissipation ³⁾ for TO251, TO252 | P_D | 18.1 | W |
| Single pulsed avalanche energy ⁵⁾ | E_{AS} | 10 | mJ |
| MOSFET dv/dt ruggedness, $V_{DS}=0\dots 480\text{ V}$ | dv/dt | 50 | V/ns |
| Reverse diode dv/dt, $V_{DS}=0\dots 480\text{ V}$, $I_{SD}\leq I_D$ | 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 |
|--|-----------------|-------------|-----------------------------|
| | | TO251/TO252 | |
| Thermal resistance, junction-case | $R_{\theta JC}$ | 6.9 | $^{\circ}\text{C}/\text{W}$ |
| Thermal resistance, junction-ambient ⁴⁾ | $R_{\theta JA}$ | 62 | $^{\circ}\text{C}/\text{W}$ |

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

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Test condition |
|----------------------------------|--------------|------|------|------|---------------|--|
| Drain-source breakdown voltage | BV_{DSS} | 600 | | | V | $V_{GS}=0\text{ V}, I_D=250\ \mu\text{A}$ |
| | | 650 | 750 | | | $V_{GS}=0\text{ V}, I_D=250\ \mu\text{A}$ $T_j=150^{\circ}\text{C}$ |
| Gate threshold voltage | $V_{GS(th)}$ | 2.0 | | 4.0 | V | $V_{DS}=V_{GS}, I_D=250\ \mu\text{A}$ |
| Drain-source on-state resistance | $R_{DS(on)}$ | | 2.5 | 2.8 | Ω | $V_{GS}=10\text{ V}, I_D=0.75\text{ A}$ |
| | | | 5.6 | | | $V_{GS}=10\text{ V}, I_D=0.75\text{ A},$ $T_j=150^{\circ}\text{C}$ |
| 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 | $V_{DS}=600\text{ V}, V_{GS}=0\text{ V}$ |

■ Dynamic Characteristics

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Test condition |
|------------------------------|--------------|------|-------|------|------|--|
| Input capacitance | C_{iss} | | 111.9 | | pF | $V_{GS}=0\text{ V},$ $V_{DS}=50\text{ V},$ $f=1\text{ MHz}$ |
| Output capacitance | C_{oss} | | 10.28 | | pF | |
| Reverse transfer capacitance | C_{rss} | | 0.86 | | pF | |
| Turn-on delay time | $t_{d(on)}$ | | 23.9 | | ns | $V_{GS}=10\text{ V},$ $V_{DS}=400\text{ V},$ $R_G=25\ \Omega,$ $I_D=0.8\text{ A}$ |
| Rise time | t_r | | 8.1 | | ns | |
| Turn-off delay time | $t_{d(off)}$ | | 52.7 | | ns | |
| Fall time | t_f | | 14.1 | | ns | |

■ Gate Charge Characteristics

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Test condition |
|----------------------|----------------------|------|------|------|------|---|
| Total gate charge | Q_g | | 4.2 | | nC | $I_D=1\text{ A}$, $V_{DS}=400\text{ V}$, $V_{GS}=10\text{ V}$ |
| Gate-source charge | Q_{gs} | | 1 | | nC | |
| Gate-drain charge | Q_{gd} | | 2.3 | | 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 | | | 1.5 | A | $V_{GS} < V_{th}$ |
| Pulsed source current | I_{SP} | | | 4.5 | | |
| Diode forward voltage | V_{SD} | | | 1.3 | V | $I_S=1.5\text{ A}$, $V_{GS}=0\text{ V}$ |
| Reverse recovery time | t_{rr} | | 81.9 | | ns | $I_S=0.8\text{ A}$, $di/dt=100\text{ A}/\mu\text{s}$ |
| Reverse recovery charge | Q_{rr} | | 0.26 | | μC | |
| Peak reverse recovery current | I_{rrm} | | 6.5 | | 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) $V_{DD}=50\text{ V}$, $R_G=25\text{ }\Omega$, $L=22.5\text{ mH}$, starting $T_j=25\text{ }^\circ\text{C}$.

■ **Electrical Characteristics Diagrams**

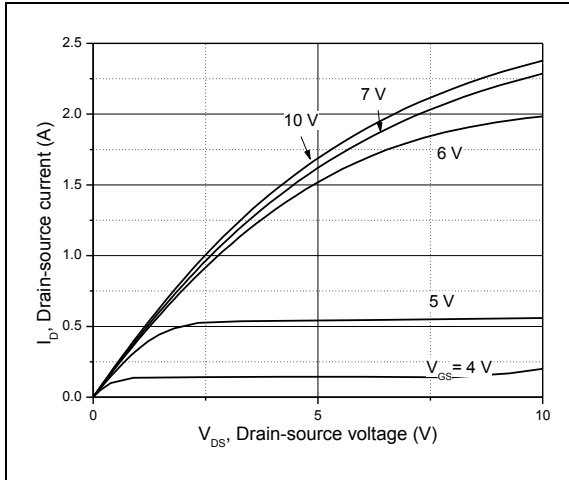


Figure 1, Typ. output characteristics

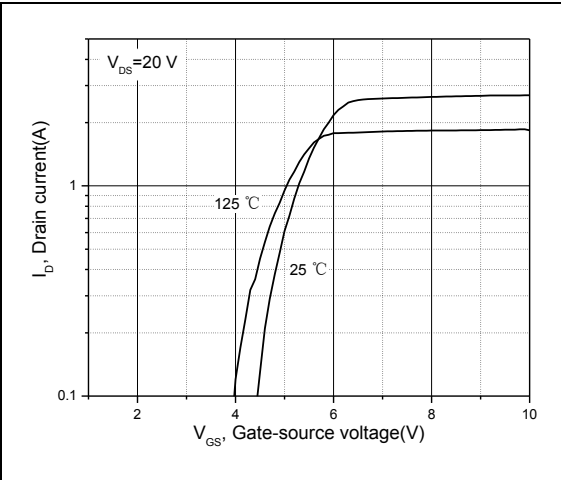


Figure 2, Typ. transfer characteristics

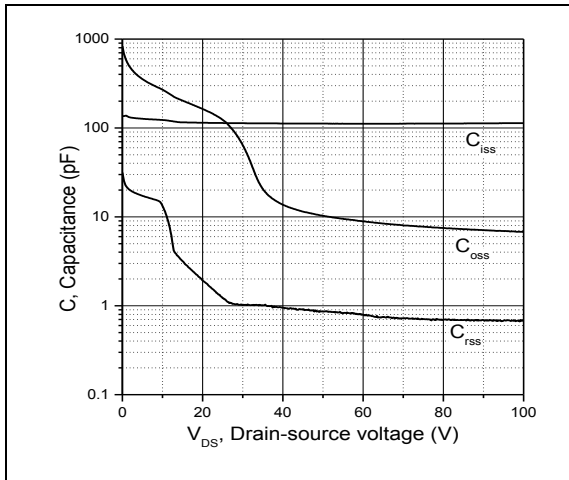


Figure 3, Typ. capacitances

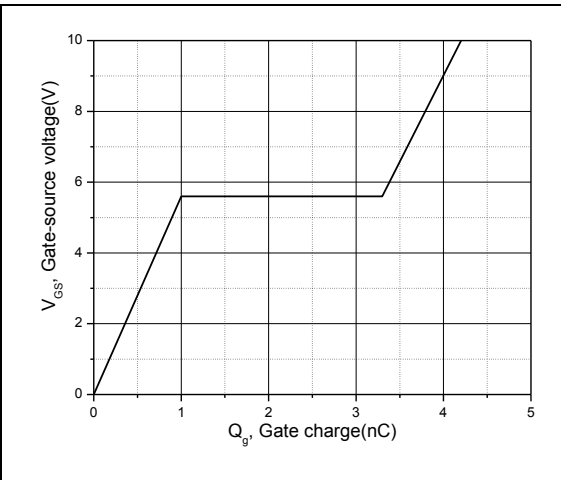


Figure 4, Typ. gate charge

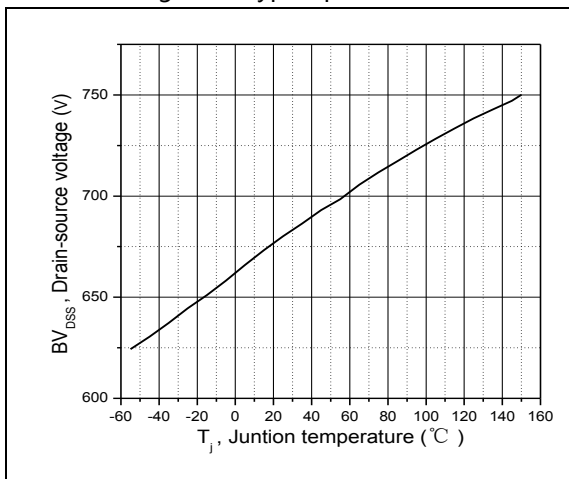


Figure 5, Drain-source breakdown voltage

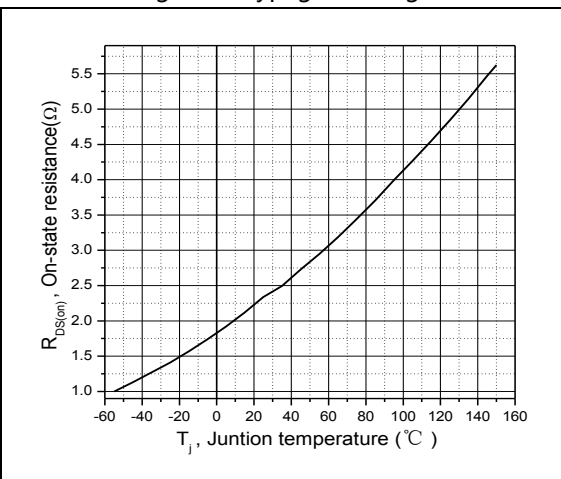


Figure 6, Drain-source on-state resistance

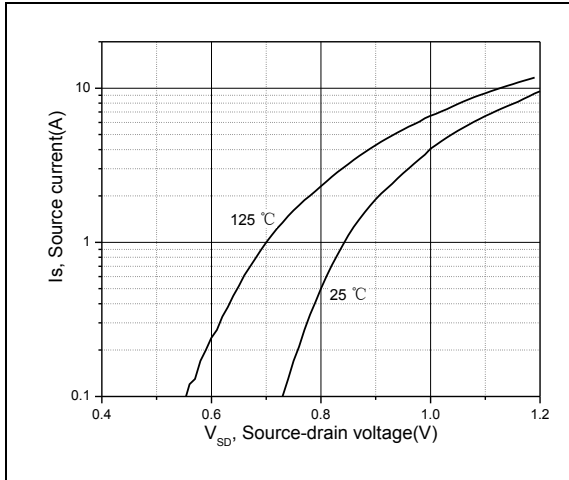


Figure 7, Forward characteristic of body diode

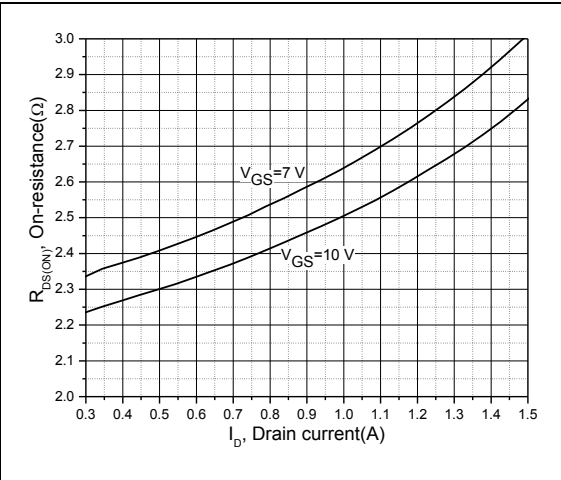


Figure 8, Drain-source on-state resistance

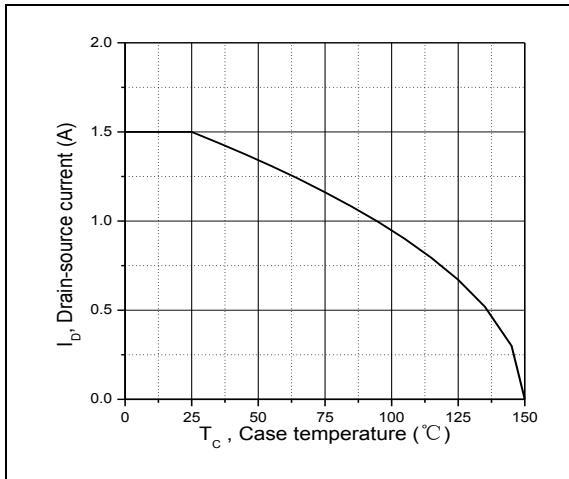


Figure 9, Drain current

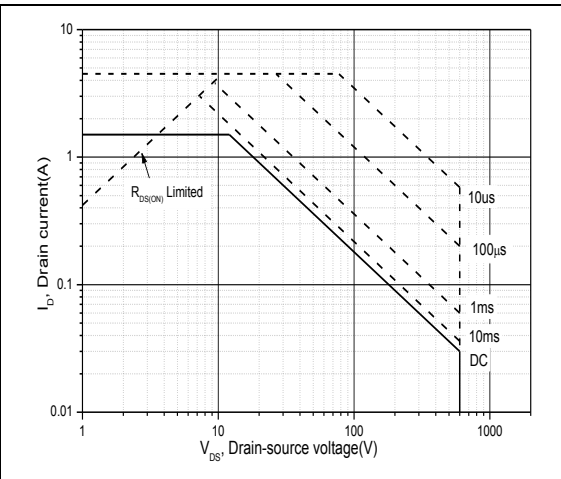


Figure 10, Safe operation area for
TO251/TO252 $T_C=25\text{ }^\circ\text{C}$

■ Test circuits and waveforms

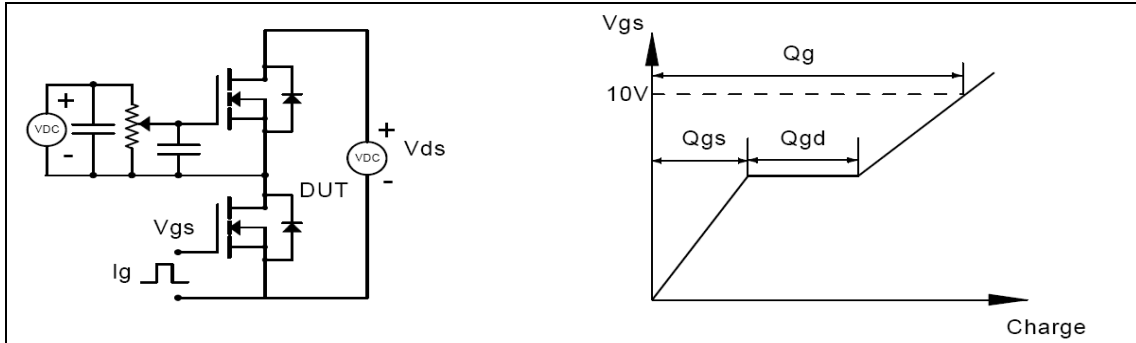


Figure 1, Gate charge test circuit & waveform

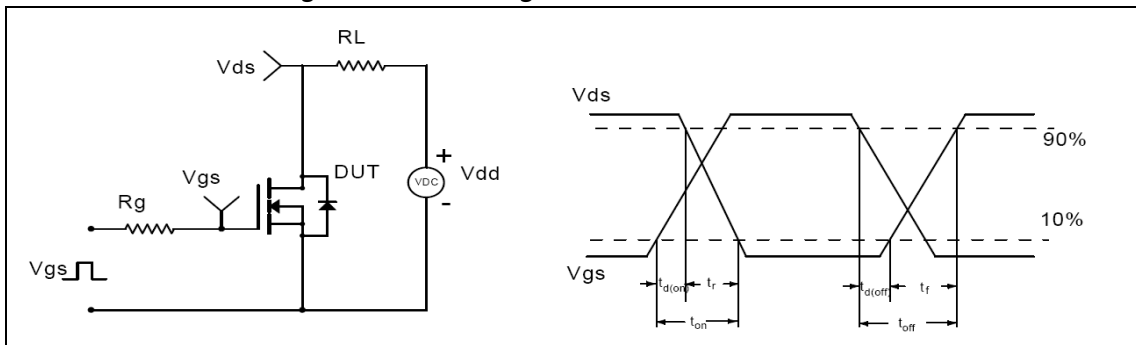


Figure 2, Switching time test circuit & waveforms

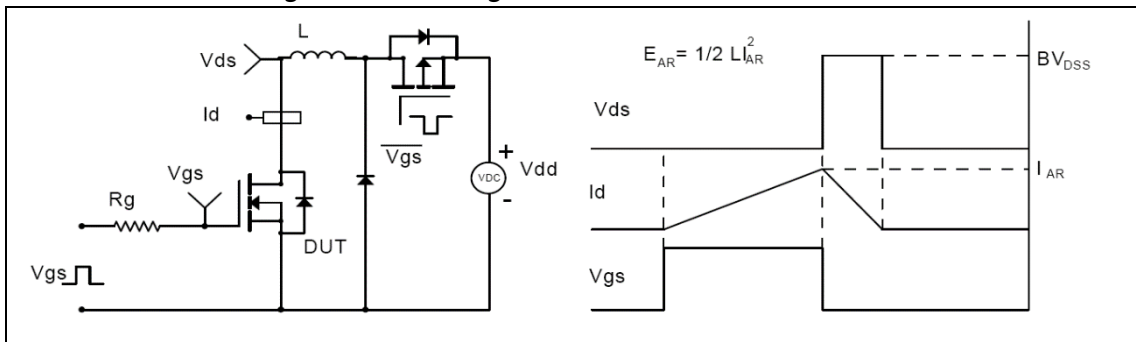


Figure 3, Unclamped inductive switching (UIS) test circuit & waveforms

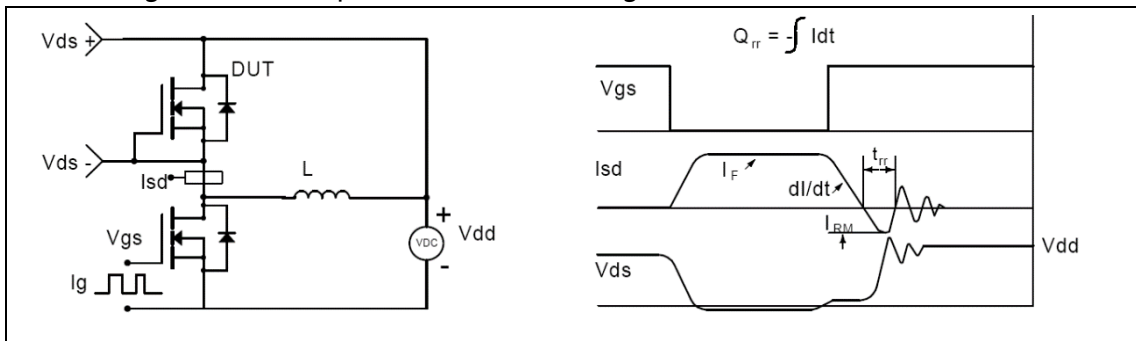
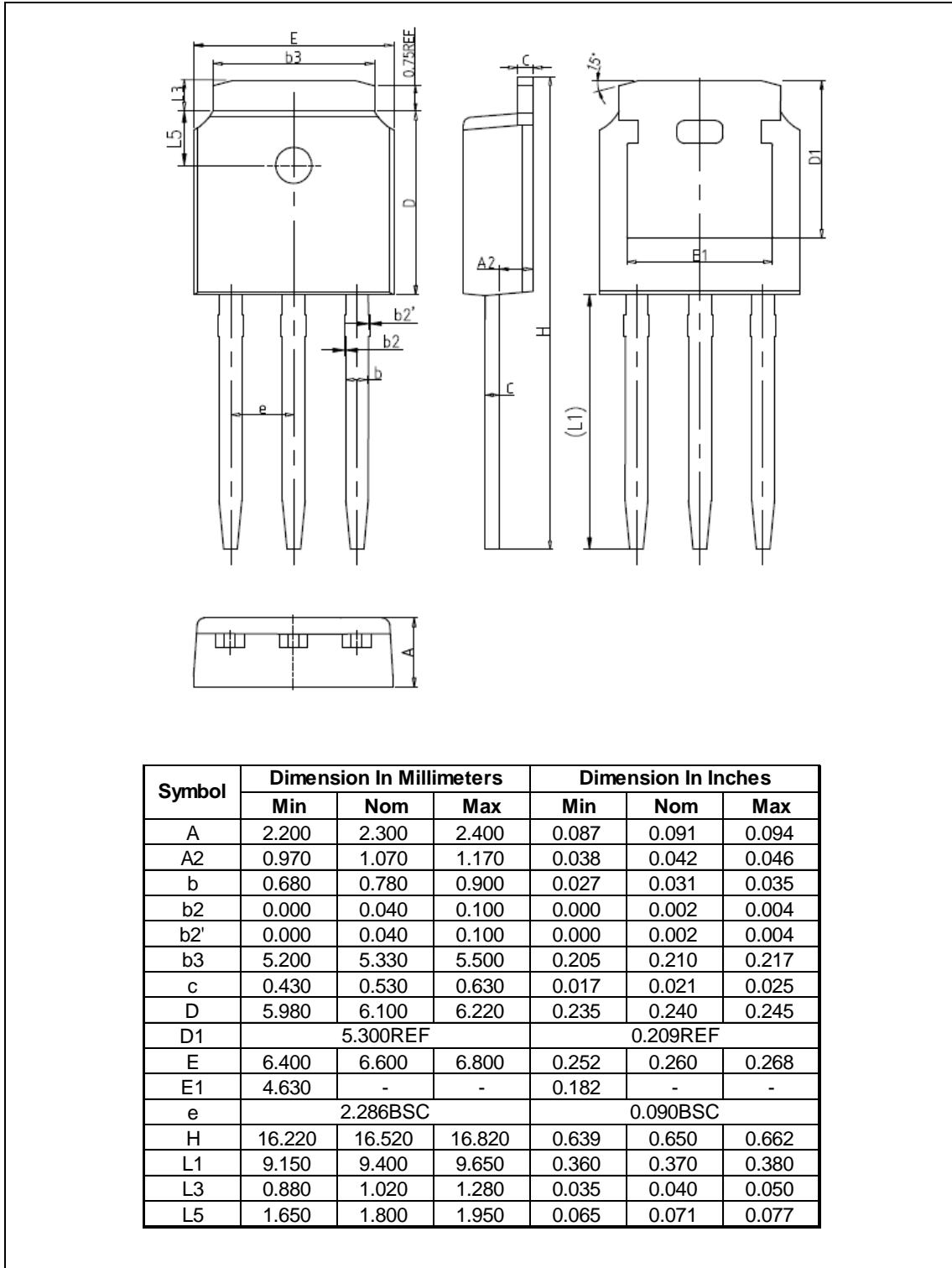


Figure 4, Diode reverse recovery test circuit & waveforms

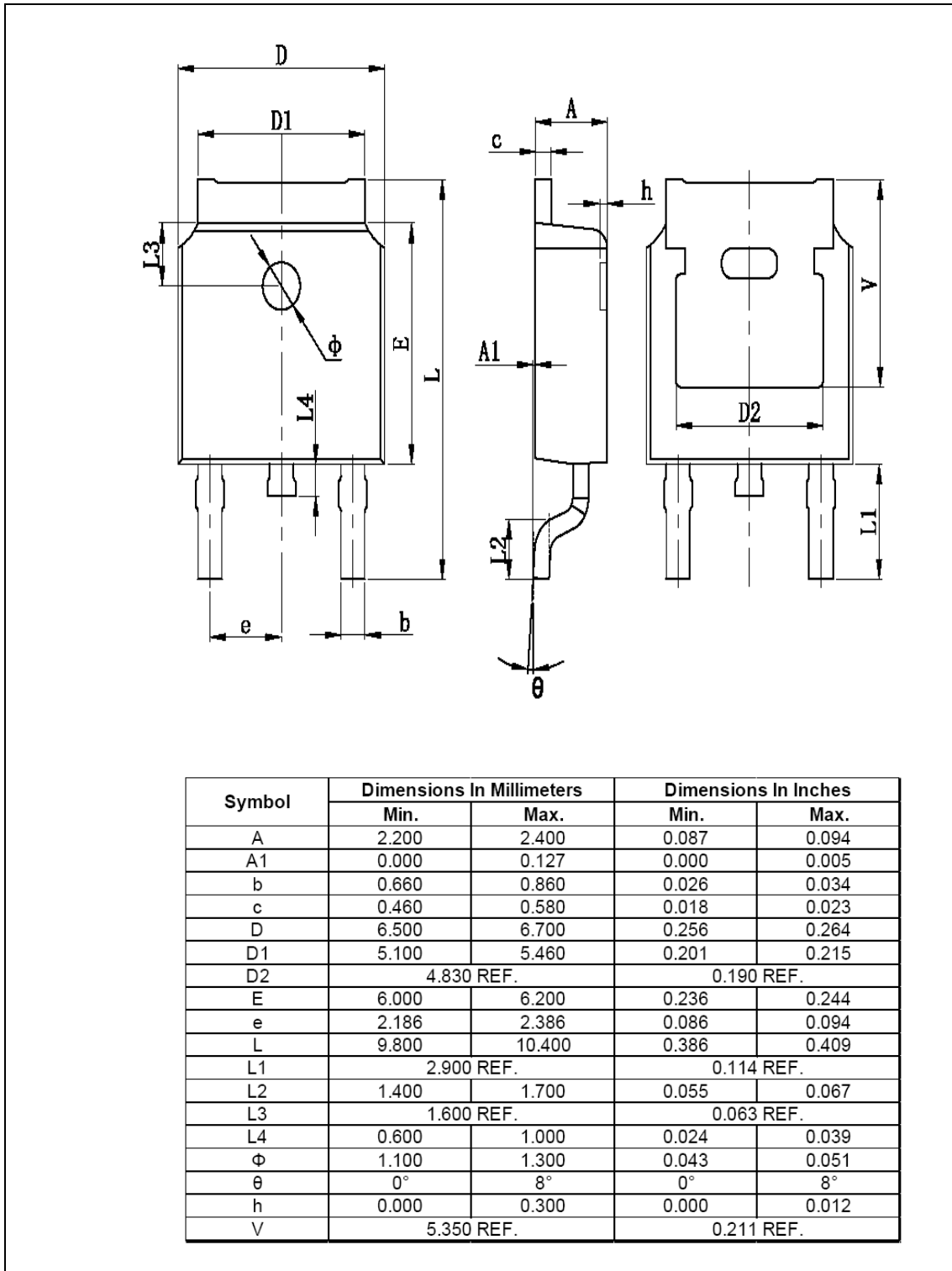
■ Package Information

Figure1, TO251 package outline dimension



■ Package Information

Figure2, TO252 package outline dimension



■ Ordering Information

| Package | Units/Tube | Tubes/Inner Box | Units/Inner Box | Inner Box/Carton Box | Units/Carton Box |
|---------------|------------|-----------------|-----------------|----------------------|------------------|
| TO251 | 75 | 66 | 4950 | 6 | 29700 |
| TO252 Option1 | 75 | 66 | 4950 | 6 | 29700 |

| Package | Units/Tape | Tapes/Inner Box | Units/Inner Box | Inner Box/Carton Box | Units/Carton Box |
|---------------|------------|-----------------|-----------------|----------------------|------------------|
| TO252 Option2 | 2500 | 2 | 5000 | 5 | 25000 |

■ Product Information

| Product | Package | Pb Free | RoHS | Halogen Free |
|-------------|---------|---------|------|--------------|
| OSG60R2K8A | TO251 | yes | yes | no |
| OSG60R2K8AF | TO251 | yes | yes | yes |
| OSG60R2K8D | TO252 | yes | yes | no |
| OSG60R2K8DF | TO252 | yes | yes | yes |