

## General Description

The GreenMOS<sup>®</sup> high voltage MOSFET utilizes charge balance technology to achieve outstanding low on-resistance and lower gate charge. It is engineered to minimize conduction loss, provide superior switching performance and robust avalanche capability.

The GreenMOS<sup>®</sup> Generic series is optimized for extreme switching performance to minimize switching loss. It is tailored for high power density applications to meet the highest efficiency standards.

## Features

- Low  $R_{DS(ON)}$  & FOM
- Extremely low switching loss
- Excellent stability and uniformity




## Applications

- LED lighting
- Telecom
- Adapter
- Sever
- Solar/UPS

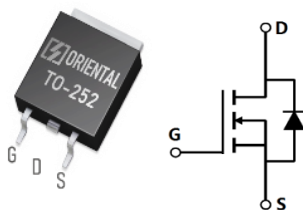
## Key Performance Parameters

| Parameter                      | Value | Unit       |
|--------------------------------|-------|------------|
| $V_{DS}$                       | 650   | V          |
| $I_{D, pulse}$                 | 54    | A          |
| $R_{DS(ON), max} @ V_{GS}=10V$ | 180   | m $\Omega$ |
| $Q_g$                          | 23    | nC         |
| PD                             | 140   | W          |

## Marking Information

| Product Name  | Package | Marking      |
|---------------|---------|--------------|
| OSG65R180DT3F | TO252   | OSG65R180DT3 |

## Package & Pin Information



**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 (static)  | $V_{GS}$       | $\pm 20$   | V                  |
| Gate-source voltage (dynamic)   |                | $\pm 30$   | V                  |
| Continuous drain current <sup>1)</sup> , $T_C=25^{\circ}\text{C}$         | $I_D$          | 18         | A                  |
| Continuous drain current <sup>1)</sup> , $T_C=100^{\circ}\text{C}$        |                | 11         |                    |
| Pulsed drain current <sup>2)</sup> , $T_C=25^{\circ}\text{C}$             | $I_{D, pulse}$ | 54         | A                  |
| Continuous diode forward current <sup>1)</sup> , $T_C=25^{\circ}\text{C}$ | $I_S$          | 18         | A                  |
| Diode pulsed current <sup>2)</sup> , $T_C=25^{\circ}\text{C}$             | $I_{S, pulse}$ | 54         | A                  |
| Power dissipation <sup>3)</sup> , $T_C=25^{\circ}\text{C}$                | $P_D$          | 140        | W                  |
| Single pulsed avalanche energy <sup>5)</sup>                              | $E_{AS}$       | 210        | mJ                 |
| MOSFET dv/dt ruggedness, $V_{DS}=0\dots 400\text{ V}$                     | dv/dt          | 100        | V/ns               |
| Reverse diode dv/dt, $V_{DS}=0\dots 400\text{ V}$ , $I_{SD}\leq I_D$      | 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                 |
|--|-----------------|-------|----------------------|
| Thermal resistance, junction-case                  | $R_{\theta JC}$ | 0.89  | $^{\circ}\text{C/W}$ |
| Thermal resistance, junction-ambient <sup>4)</sup> | $R_{\theta JA}$ | 62    | $^{\circ}\text{C/W}$ |

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

| PARAMETER                        | SYMBOL       | MIN. | TYP. | MAX. | UNIT          | TEST CONDITION  |
|----------------------------------|--------------|------|------|------|---------------|---|
| Drain-source breakdown voltage   | $BV_{DSS}$   | 650  |      |      | V             | $V_{GS}=0\text{ V}$ , $I_D=250\ \mu\text{A}$                            |
| Gate threshold voltage           | $V_{GS(th)}$ | 2.9  |      | 3.9  | V             | $V_{DS}=V_{GS}$ , $I_D=250\ \mu\text{A}$                                |
| Drain-source on-state resistance | $R_{DS(ON)}$ |      | 148  | 180  | m $\Omega$    | $V_{GS}=10\text{ V}$ , $I_D=10\text{ A}$                                |
|                                  |              |      | 339  |      |               | $V_{GS}=10\text{ V}$ , $I_D=10\text{ A}$ ,<br>$T_j=150^{\circ}\text{C}$ |
| Gate-source leakage current      | $I_{GSS}$    |      |      | 100  | nA            | $V_{GS}=20\text{ V}$  |
|                                  |              |      |      | -100 |               | $V_{GS}=-20\text{ V}$   |
| Drain-source leakage current     | $I_{DSS}$    |      |      | 1    | $\mu\text{A}$ | $V_{DS}=650\text{ V}$ , $V_{GS}=0\text{ V}$                             |
| Gate resistance                  | $R_G$        |      | 22   |      | $\Omega$      | $f=1\text{ MHz}$ , Open drain   |

### Dynamic Characteristics

| PARAMETER                                    | SYMBOL       | MIN. | TYP. | MAX. | UNIT | TEST CONDITION  |
|--|--------------|------|------|------|------|---|
| Input capacitance                            | $C_{iss}$    |      | 1058 |      | pF   | $V_{GS}=0\text{ V}$ ,<br>$V_{DS}=50\text{ V}$ ,<br>$f=100\text{ kHz}$                       |
| Output capacitance                           | $C_{oss}$    |      | 76   |      | pF   |   |
| Reverse transfer capacitance                 | $C_{rss}$    |      | 1.7  |      | pF   |   |
| Effective output capacitance, energy related | $C_{o(er)}$  |      | 50   |      | pF   | $V_{GS}=0\text{ V}$ ,<br>$V_{DS}=0\text{ V}-400\text{ V}$                                   |
| Effective output capacitance, time related   | $C_{o(tr)}$  |      | 290  |      | pF   |   |
| Turn-on delay time                           | $t_{d(on)}$  |      | 16   |      | ns   | $V_{GS}=10\text{ V}$ ,<br>$V_{DS}=400\text{ V}$ ,<br>$R_G=2\ \Omega$ ,<br>$I_D=10\text{ A}$ |
| Rise time                                    | $t_r$        |      | 30   |      | ns   |   |
| Turn-off delay time                          | $t_{d(off)}$ |      | 68   |      | ns   |   |
| Fall time                                    | $t_f$        |      | 26   |      | ns   |   |

### Gate Charge Characteristics

| PARAMETER            | SYMBOL        | MIN. | TYP. | MAX. | UNIT | TEST CONDITION   |
|----------------------|---------------|------|------|------|------|--|
| Total gate charge    | $Q_g$         |      | 23   |      | nC   | $V_{GS}=10\text{ V}$ ,<br>$V_{DS}=400\text{ V}$ ,<br>$I_D=10\text{ A}$ |
| Gate-source charge   | $Q_{gs}$      |      | 5    |      | nC   |  |
| Gate-drain charge    | $Q_{gd}$      |      | 8.4  |      | nC   |  |
| Gate plateau voltage | $V_{plateau}$ |      | 5.4  |      | V    |  |

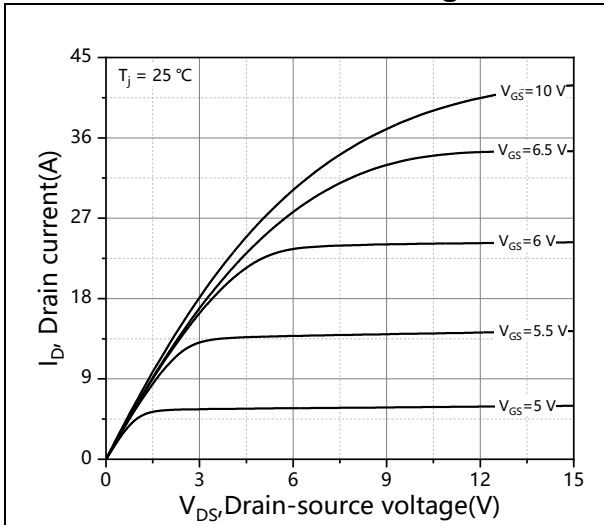
### Body Diode Characteristics

| PARAMETER                     | SYMBOL    | MIN. | TYP. | MAX. | UNIT          | TEST CONDITION  |
|-------------------------------|-----------|------|------|------|---------------|---|
| Diode forward voltage         | $V_{SD}$  |      |      | 1.3  | V             | $I_S=20\text{ A}$ ,<br>$V_{GS}=0\text{ V}$                                      |
| Reverse recovery time         | $t_{rr}$  |      | 255  |      | ns            | $V_R=400\text{ V}$ ,<br>$I_S=10\text{ A}$ ,<br>$di/dt=100\text{ A}/\mu\text{s}$ |
| Reverse recovery charge       | $Q_{rr}$  |      | 2.7  |      | $\mu\text{C}$ |   |
| Peak reverse recovery current | $I_{rrm}$ |      | 19   |      | A             |   |

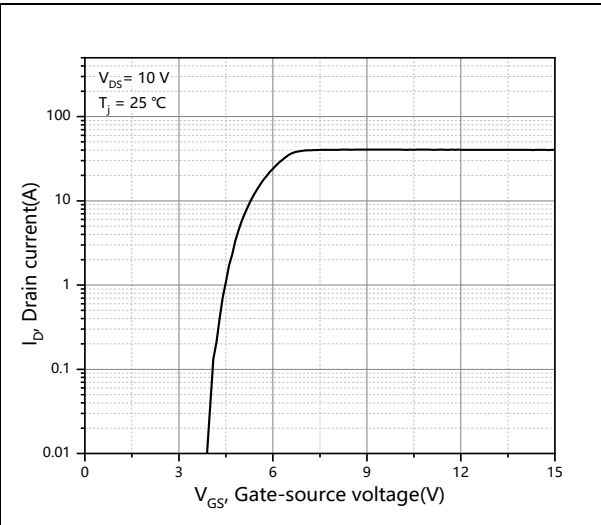
### Note

- 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<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_a=25\text{ }^\circ\text{C}$ .
- 5)  $V_{DD}=100\text{ V}$ ,  $V_{GS}=10\text{ V}$ ,  $L=80\text{ mH}$ , starting  $T_j=25\text{ }^\circ\text{C}$ .

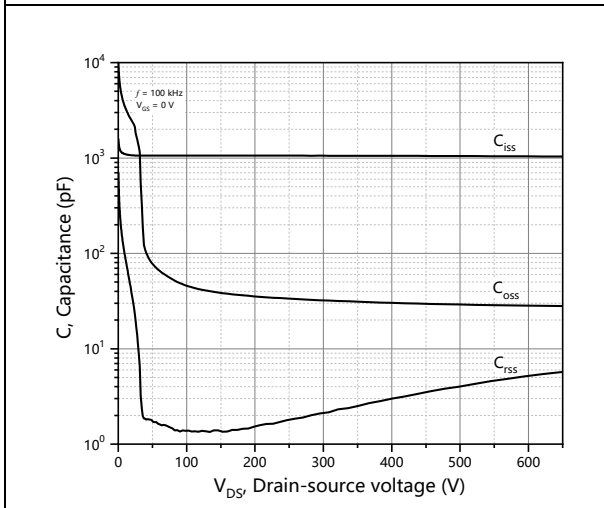
**Electrical Characteristics Diagrams**



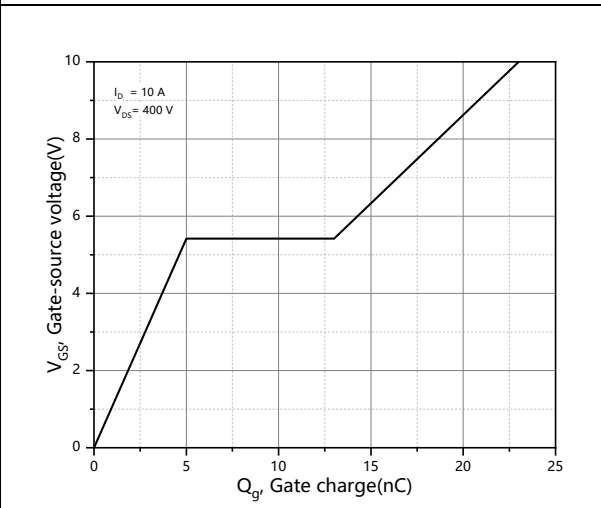
**Figure 1. Typ. output characteristics  $T_j=25^\circ\text{C}$**



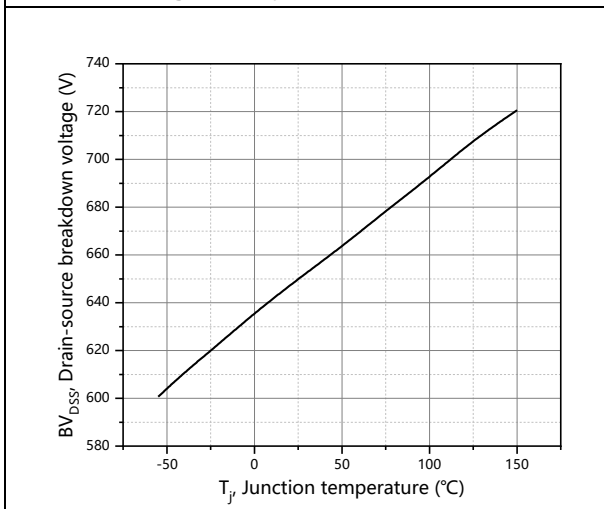
**Figure 2. Typ. transfer characteristics**



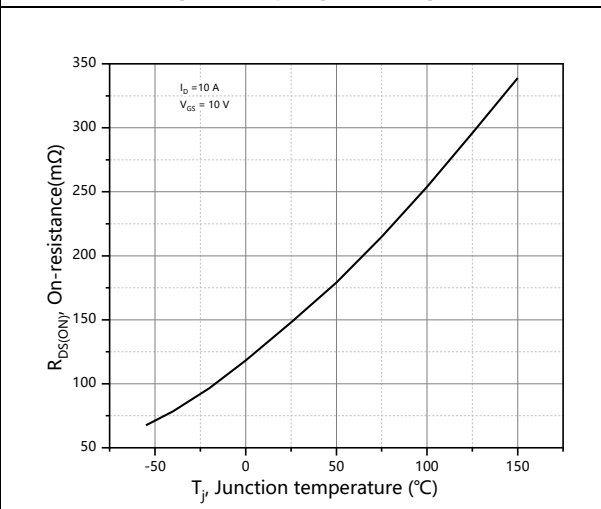
**Figure 3. Typ. capacitances**



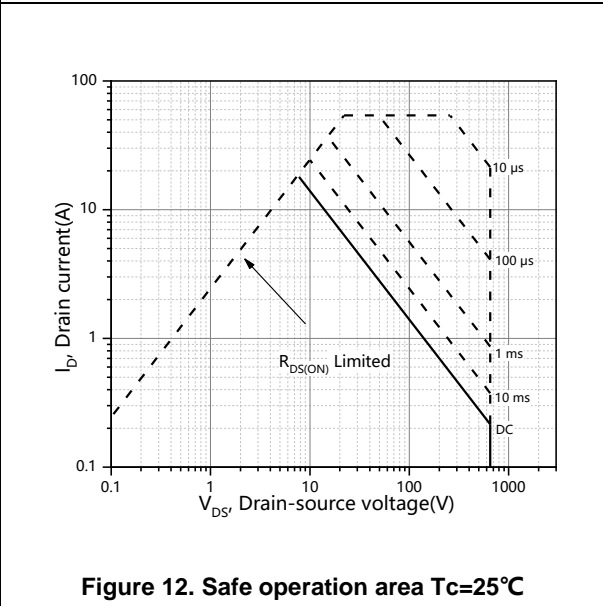
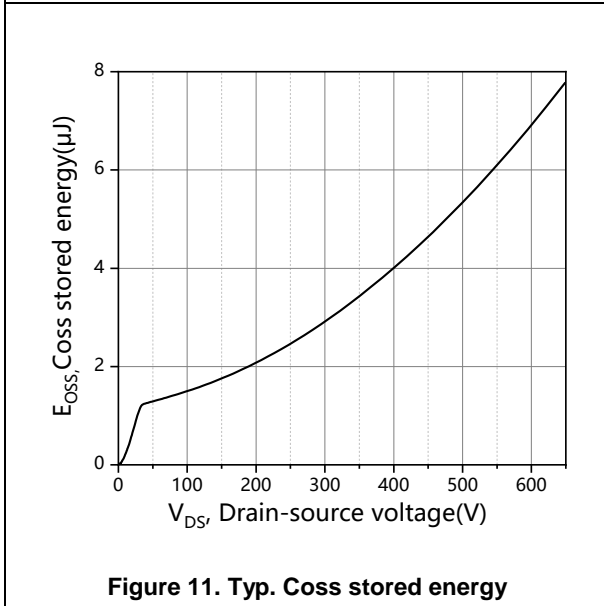
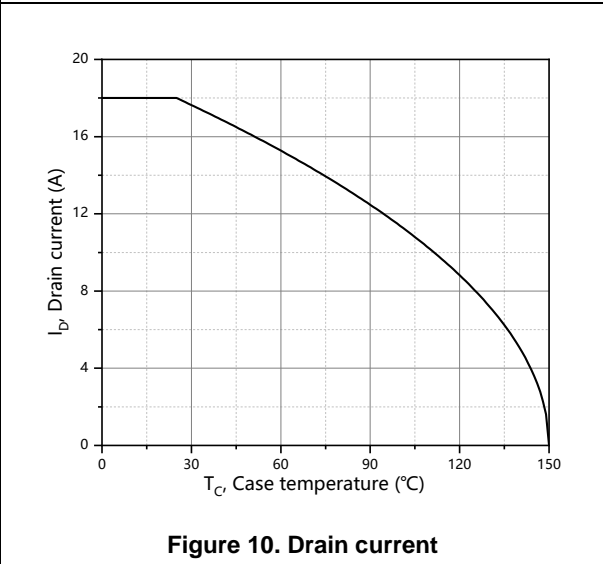
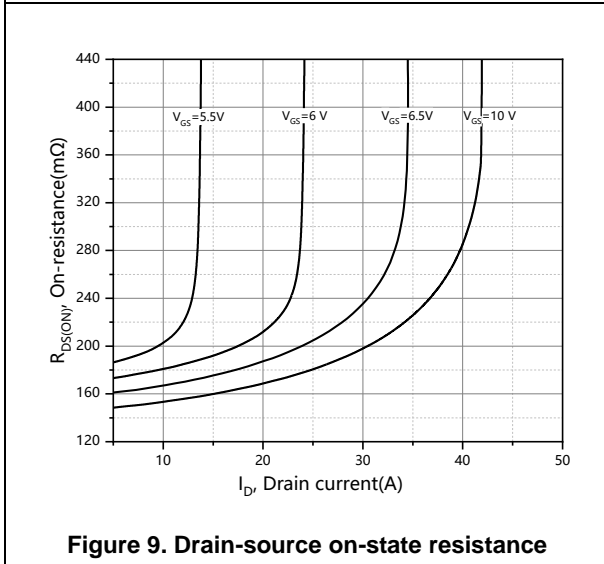
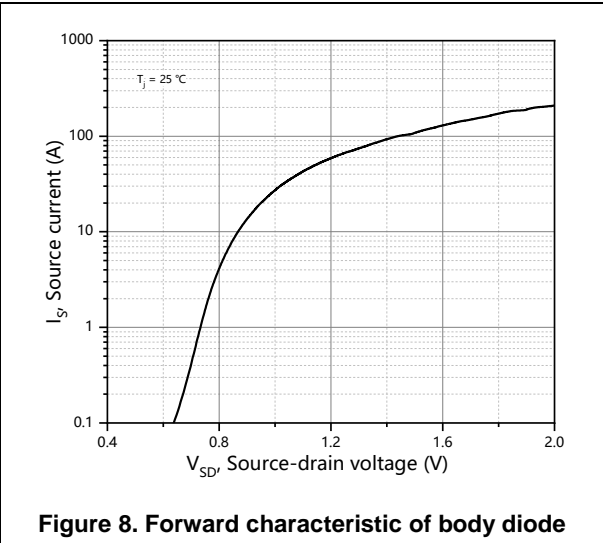
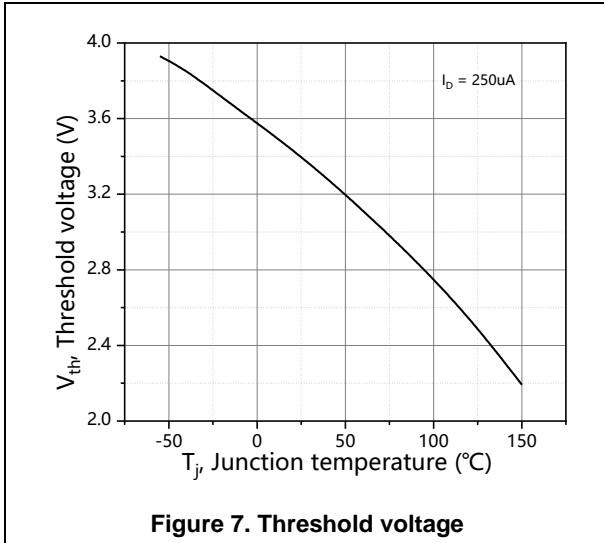
**Figure 4. Typ. gate charge**

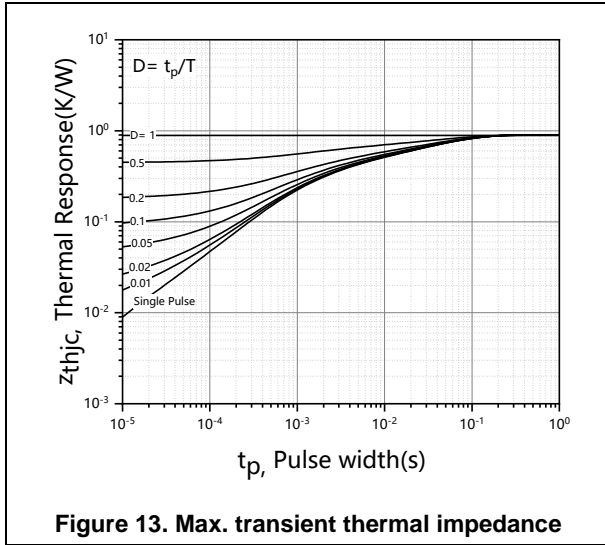


**Figure 5. Drain-source breakdown voltage**



**Figure 6. Drain-source on-state resistance**





**Test circuits and waveforms**



**Figure 1. Gate charge test circuit & waveform**



**Figure 2. Switching time test circuit & waveforms**

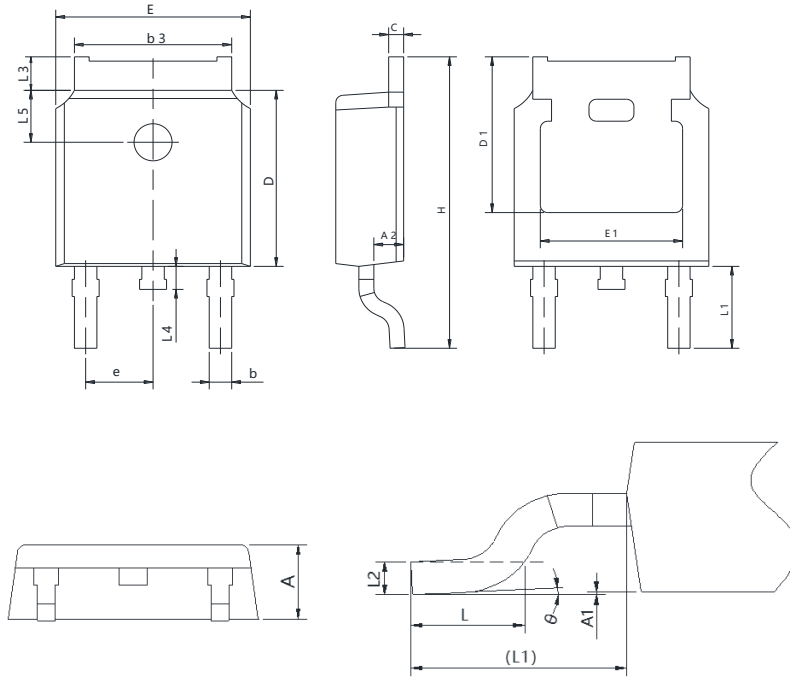


**Figure 3. Unclamped inductive switching (UIS) test circuit & waveforms**



**Figure 4. Diode reverse recovery test circuit & waveforms**

**Package Information**



| Symbol | mm        |       |       |
|--------|-----------|-------|-------|
|        | Min       | Nom   | Max   |
| A      | 2.20      | 2.30  | 2.38  |
| A1     | 0.00      | -     | 0.20  |
| A2     | 0.97      | 1.07  | 1.17  |
| b      | 0.68      | 0.78  | 0.90  |
| b3     | 5.20      | 5.33  | 5.46  |
| c      | 0.43      | 0.53  | 0.61  |
| D      | 5.98      | 6.10  | 6.22  |
| D1     | 5.30 REF  |       |       |
| E      | 6.40      | 6.60  | 6.73  |
| E1     | 4.63      | -     | -     |
| e      | 2.286 BSC |       |       |
| H      | 9.40      | 10.10 | 10.50 |
| L      | 1.38      | 1.50  | 1.75  |
| L1     | 2.90 REF  |       |       |
| L2     | 0.51 BSC  |       |       |
| L3     | 0.88      | -     | 1.28  |
| L4     | 0.50      | -     | 1.00  |
| L5     | 1.65      | 1.80  | 1.95  |
| θ      | 0°        | -     | 8°    |

Version: TO252-P package outline dimension

## Ordering Information

| Package Type | Units/ Reel | Reels/ Inner Box | Units/ Inner Box | Inner Boxes/ Carton Box | Units/ Carton Box |
|--------------|-------------|------------------|------------------|-------------------------|-------------------|
| TO252-P      | 2500        | 2                | 5000             | 5                       | 25000             |

## Product Information

| Product       | Package | Pb Free | RoHS | Halogen Free |
|---------------|---------|---------|------|--------------|
| OSG65R180DT3F | TO252   | yes     | yes  | yes          |

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