

## 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> Z series is integrated with fast recovery diode (FRD) to minimize reverse recovery time. It is suitable for resonant switching topologies to reach higher efficiency, higher reliability and smaller form factor.

## Features

- Low  $R_{DS(on)}$  & FOM
- Extremely low switching loss
- Excellent stability and uniformity
- Ultra-fast and robust body diode

GreenMOS<sup>®</sup>



## Applications

- PC power
- Telecom power
- Server power
- EV Charger
- Motor driver

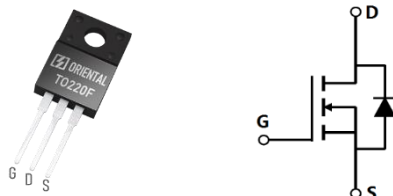
## Key Performance Parameters

| Parameter                         | Value | Unit       |
|-----------------------------------|-------|------------|
| $V_{DS}$                          | 650   | V          |
| $I_D$ , pulse                     | 75    | A          |
| $R_{DS(on)}$ , max @ $V_{GS}=10V$ | 125   | m $\Omega$ |
| $Q_g$                             | 40.3  | nC         |

## Marking Information

| Product Name | Package | Marking     |
|--------------|---------|-------------|
| OSG65R125FZF | TO220F  | OSG65R125FZ |

## 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                                                       | $V_{GS}$              | $\pm 30$   | V                  |
| Continuous drain current <sup>1)</sup> , $T_C=25^{\circ}\text{C}$         | $I_D$                 | 25         | A                  |
| Continuous drain current <sup>1)</sup> , $T_C=100^{\circ}\text{C}$        |                       | 16         |                    |
| Pulsed drain current <sup>2)</sup> , $T_C=25^{\circ}\text{C}$             | $I_{D, \text{pulse}}$ | 75         | A                  |
| Continuous diode forward current <sup>1)</sup> , $T_C=25^{\circ}\text{C}$ | $I_S$                 | 25         | A                  |
| Diode pulsed current <sup>2)</sup> , $T_C=25^{\circ}\text{C}$             | $I_{S, \text{pulse}}$ | 75         | A                  |
| Power dissipation <sup>3)</sup> , $T_C=25^{\circ}\text{C}$                | $P_D$                 | 34         | W                  |
| Single pulsed avalanche energy <sup>4)</sup>                              | $E_{AS}$              | 1000       | mJ                 |
| MOSFET dv/dt ruggedness, $V_{DS}=0\ldots 480\text{ V}$                    | dv/dt                 | 50         | V/ns               |
| Reverse diode dv/dt, $V_{DS}=0\ldots 480\text{ V}$ , $I_{SD}\leq I_D$     | dv/dt                 | 50         | 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    | $R_{\theta JC}$ | 3.68  | $^{\circ}\text{C/W}$ |
| Thermal resistance, junction-ambient | $R_{\theta JA}$ | 62.5  | $^{\circ}\text{C/W}$ |

**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             | $V_{GS}=0\text{ V}$ , $I_D=1\text{ mA}$                                |
| Gate threshold voltage           | $V_{GS(th)}$ | 3.0  |       | 4.5   | V             | $V_{DS}=V_{GS}$ , $I_D=1\text{ mA}$                                    |
| Drain-source on-state resistance | $R_{DS(on)}$ |      | 0.115 | 0.125 | $\Omega$      | $V_{GS}=10\text{ V}$ , $I_D=12.5\text{ A}$                             |
|                                  |              |      | 0.2   |       |               | $V_{GS}=10\text{ V}$ , $I_D=12.5\text{ A}$ , $T_j=150^{\circ}\text{C}$ |
| Gate-source leakage current      | $I_{GSS}$    |      |       | 100   | nA            | $V_{GS}=30\text{ V}$                                                   |
|                                  |              |      |       | -100  |               | $V_{GS}=-30\text{ V}$                                                  |
| Drain-source leakage current     | $I_{DSS}$    |      |       | 10    | $\mu\text{A}$ | $V_{DS}=650\text{ V}$ , $V_{GS}=0\text{ V}$                            |

### Dynamic Characteristics

| Parameter                    | Symbol       | Min. | Typ.   | Max. | Unit | Test condition                                                                              |
|------------------------------|--------------|------|--------|------|------|---------------------------------------------------------------------------------------------|
| Input capacitance            | $C_{iss}$    |      | 2681.3 |      | pF   | $V_{GS}=0\text{ V}$ ,<br>$V_{DS}=50\text{ V}$ ,<br>$f=100\text{ kHz}$                       |
| Output capacitance           | $C_{oss}$    |      | 165.3  |      | pF   |                                                                                             |
| Reverse transfer capacitance | $C_{rss}$    |      | 7.4    |      | pF   |                                                                                             |
| Turn-on delay time           | $t_{d(on)}$  |      | 73.0   |      | ns   | $V_{GS}=10\text{ V}$ ,<br>$V_{DS}=400\text{ V}$ ,<br>$R_G=2\ \Omega$ ,<br>$I_D=20\text{ A}$ |
| Rise time                    | $t_r$        |      | 91.4   |      | ns   |                                                                                             |
| Turn-off delay time          | $t_{d(off)}$ |      | 87.3   |      | ns   |                                                                                             |
| Fall time                    | $t_f$        |      | 38.4   |      | ns   |                                                                                             |

### Gate Charge Characteristics

| Parameter            | Symbol        | Min. | Typ. | Max. | Unit | Test condition                                                         |
|----------------------|---------------|------|------|------|------|------------------------------------------------------------------------|
| Total gate charge    | $Q_g$         |      | 40.3 |      | nC   | $V_{GS}=10\text{ V}$ ,<br>$V_{DS}=400\text{ V}$ ,<br>$I_D=20\text{ A}$ |
| Gate-source charge   | $Q_{gs}$      |      | 13.5 |      | nC   |                                                                        |
| Gate-drain charge    | $Q_{gd}$      |      | 14.7 |      | nC   |                                                                        |
| Gate plateau voltage | $V_{plateau}$ |      | 7.1  |      | V    |                                                                        |

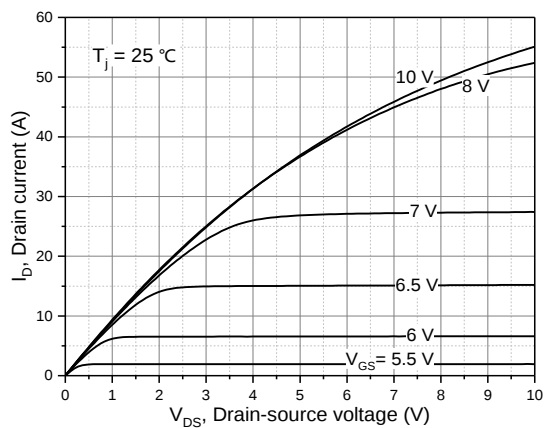
### Body Diode Characteristics

| Parameter                     | Symbol    | Min. | Typ. | Max. | Unit | Test condition                                          |
|-------------------------------|-----------|------|------|------|------|---------------------------------------------------------|
| Diode forward voltage         | $V_{SD}$  |      |      | 1.3  | V    | $I_S=25\text{ A}$ ,<br>$V_{GS}=0\text{ V}$              |
| Reverse recovery time         | $t_{rr}$  |      | 131  |      | ns   | $I_S=20\text{ A}$ ,<br>$di/dt=100\text{ A}/\mu\text{s}$ |
| Reverse recovery charge       | $Q_{rr}$  |      | 0.8  |      | uC   |                                                         |
| Peak reverse recovery current | $I_{rrm}$ |      | 11.9 |      | A    |                                                         |

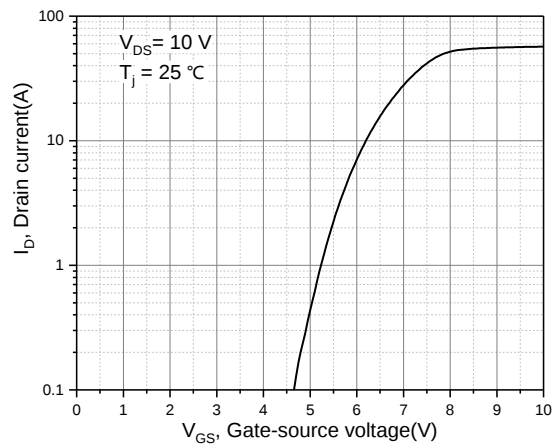
### Note

- 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)  $V_{DD}=100\text{ V}$ ,  $V_{GS}=10\text{ V}$ ,  $L=60\text{ mH}$ , starting  $T_j=25\text{ }^\circ\text{C}$ .

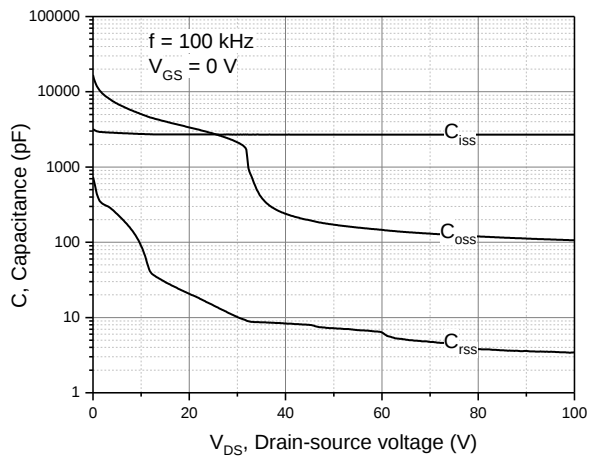
## Electrical Characteristics Diagrams



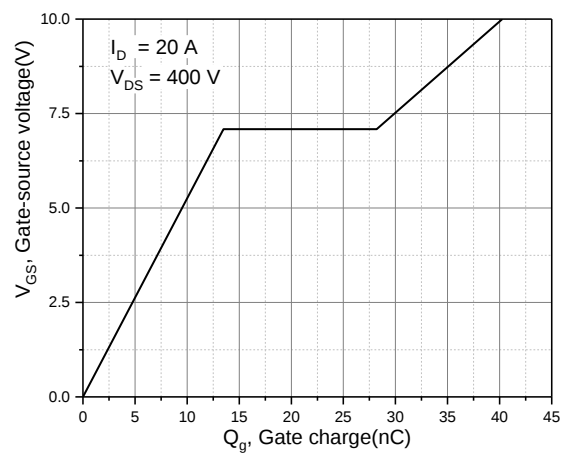
**Figure 1. Typ. output characteristics**



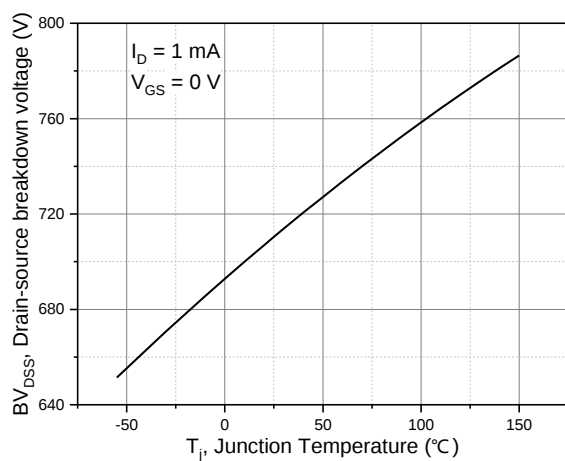
**Figure 2. Typ. transfer characteristics**



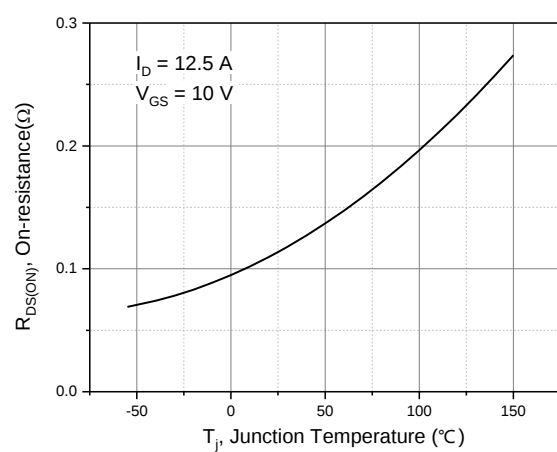
**Figure 3. Typ. capacitances**



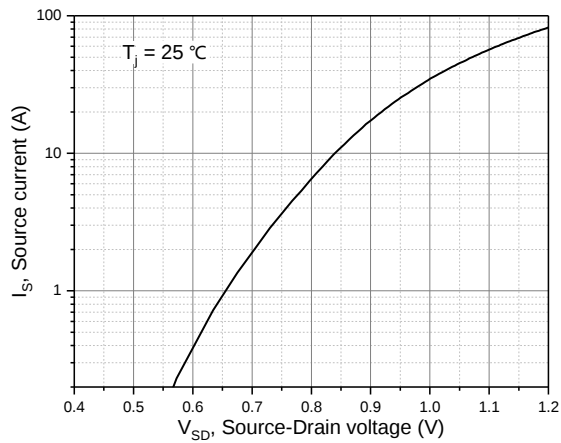
**Figure 4. Typ. gate charge**



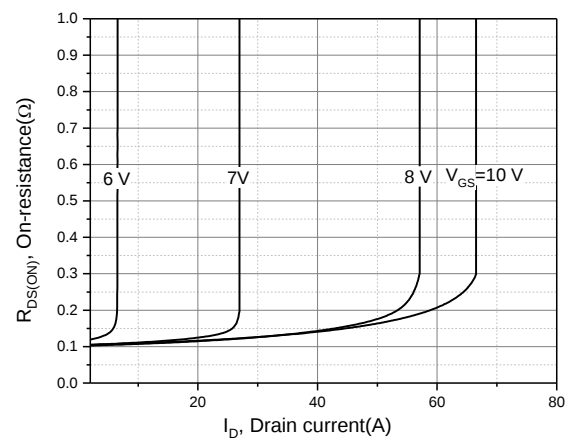
**Figure 5. Drain-source breakdown voltage**



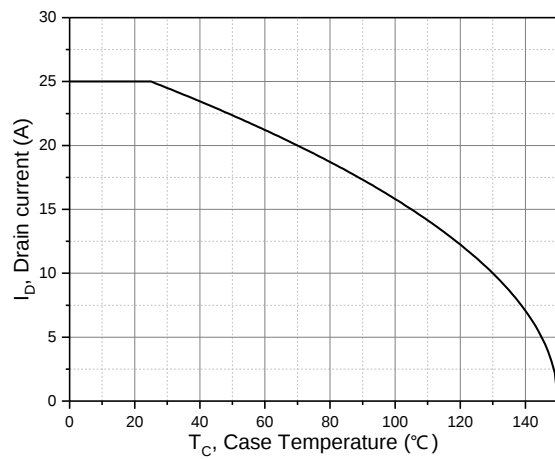
**Figure 6. Drain-source on-state resistance**



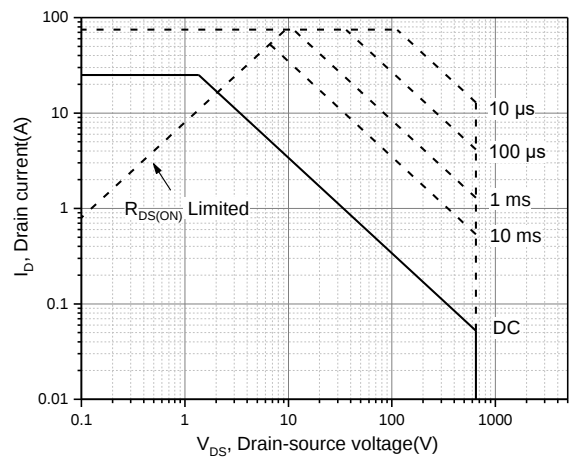
**Figure 7. Forward characteristic of body diode**



**Figure 8. Drain-source on-state resistance**



**Figure 9. Drain current**

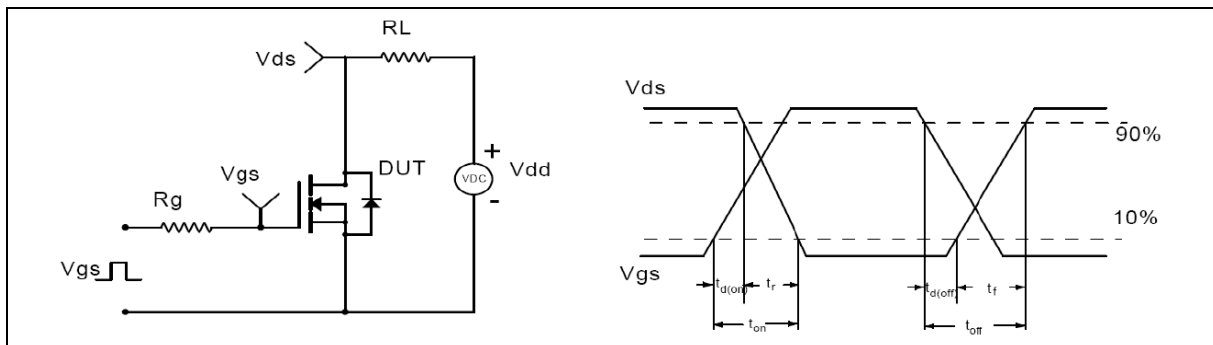


**Figure 10. Safe operation area  $T_C=25\text{ °C}$**

## Test circuits and waveforms



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



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

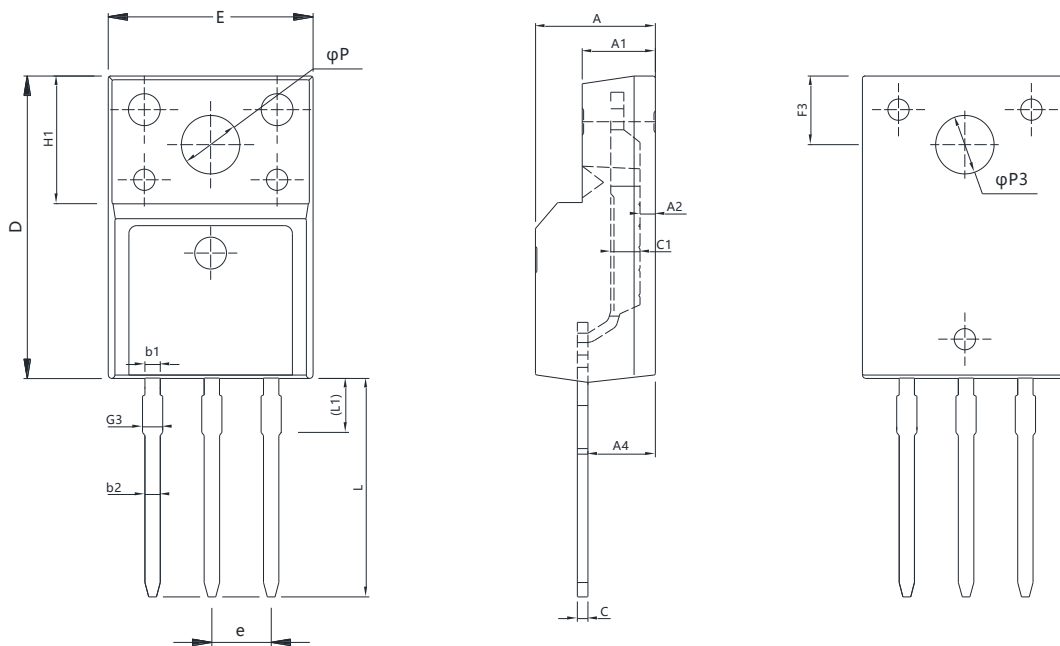


**Figure 3. Unclamped inductive switching (UIS) test circuit & waveforms**



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

## Package Information



| 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  |
| A2     | 0.30    | 0.45  | 0.60  |
| A4     | 2.56    | 2.76  | 2.96  |
| c      | 0.40    | 0.50  | 0.65  |
| C1     | 1.20    | 1.30  | 1.35  |
| 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  |

Version1: TO220F-P package outline dimension

### Ordering Information

| Package Type | Units/ Tube | Tubes/ Inner Box | Units/ Inner Box | Inner Boxes/ Carton Box | Units/ Carton Box |
|--------------|-------------|------------------|------------------|-------------------------|-------------------|
| TO220F-P     | 50          | 20               | 1000             | 6                       | 6000              |

### Product Information

| Product      | Package | Pb Free | RoHS | Halogen Free |
|--------------|---------|---------|------|--------------|
| OSG65R125FZF | TO220F  | yes     | yes  | yes          |

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