

General Description

The GreenMOS[®] 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[®] S series is optimized for its switching characteristics to achieve aggressive EMI standards. It is easy to use for smaller power supply systems to meet the both efficiency and EMI standards.

Features

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




Applications

- LED lighting
- Charger
- Adapter
- Telecom power
- Server power
- Solar/UPS

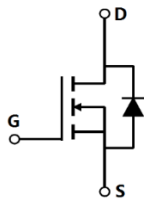
Key Performance Parameters

| Parameter | Value | Unit |
|--------------------------------|-------|------------|
| $V_{DS, min} @ T_{j(max)}$ | 650 | V |
| $I_D, pulse$ | 120 | A |
| $R_{DS(ON), max} @ V_{GS}=10V$ | 96 | m Ω |
| Q_g | 56.6 | nC |

Marking Information

| Product Name | Package | Marking |
|--------------|---------|-------------|
| OSG60R096FSF | TO220F | OSG60R096FS |

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} | 600 | 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 |
| Continuous diode forward current ¹⁾ , $T_C=25^{\circ}\text{C}$ | I_S | 40 | A |
| Diode pulsed current ²⁾ , $T_C=25^{\circ}\text{C}$ | $I_{S, pulse}$ | 120 | A |
| Power dissipation ³⁾ , $T_C=25^{\circ}\text{C}$ | P_D | 35 | W |
| Single pulsed avalanche energy ⁵⁾ | E_{AS} | 793.6 | 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 |
|--|-----------------|-------|----------------------|
| Thermal resistance, junction-case | $R_{\theta JC}$ | 3.6 | $^{\circ}\text{C/W}$ |
| Thermal resistance, junction-ambient ⁴⁾ | $R_{\theta JA}$ | 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} | 600 | | | V | $V_{GS}=0\text{ V}$, $I_D=1\text{ mA}$ |
| | | 650 | | | | $V_{GS}=0\text{ V}$, $I_D=1\text{ mA}$, $T_j=150^{\circ}\text{C}$ |
| 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 | $R_{DS(ON)}$ | | 0.085 | 0.096 | Ω | $V_{GS}=10\text{ V}$, $I_D=20\text{ A}$ |
| | | | 0.2 | | | $V_{GS}=10\text{ V}$, $I_D=20\text{ A}$, $T_j=150^{\circ}\text{C}$ |
| 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 | $V_{DS}=600\text{ V}$, $V_{GS}=0\text{ V}$ |
| Gate resistance | R_G | | 7.4 | | Ω | $f=1\text{ MHz}$, Open drain |

Dynamic Characteristics

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Test condition |
|------------------------------|--------------|------|--------|------|------|---|
| Input capacitance | C_{iss} | | 3190.3 | | pF | $V_{GS}=0\text{ V}$, $V_{DS}=50\text{ V}$, $f=100\text{ KHz}$ |
| Output capacitance | C_{oss} | | 280.1 | | pF | |
| Reverse transfer capacitance | C_{rss} | | 1.69 | | pF | |
| Turn-on delay time | $t_{d(on)}$ | | 36.8 | | ns | $V_{GS}=10\text{ V}$, $V_{DS}=400\text{ V}$, $R_G=2\ \Omega$, $I_D=20\text{ A}$ |
| Rise time | t_r | | 34.7 | | ns | |
| Turn-off delay time | $t_{d(off)}$ | | 104.7 | | ns | |
| Fall time | t_f | | 7.7 | | ns | |

Gate Charge Characteristics

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Test condition |
|----------------------|---------------|------|------|------|------|--|
| Total gate charge | Q_g | | 56.6 | | nC | $V_{GS}=10\text{ V}$, $V_{DS}=400\text{ V}$, $I_D=20\text{ A}$ |
| Gate-source charge | Q_{gs} | | 16.2 | | nC | |
| Gate-drain charge | Q_{gd} | | 16.6 | | nC | |
| Gate plateau voltage | $V_{plateau}$ | | 5.5 | | V | |

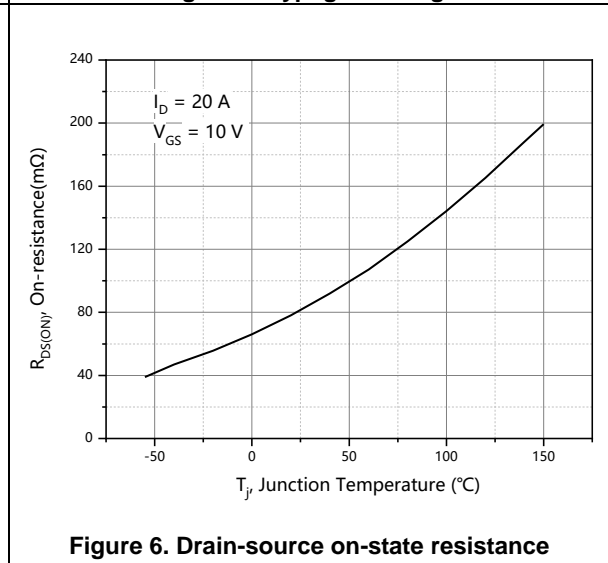
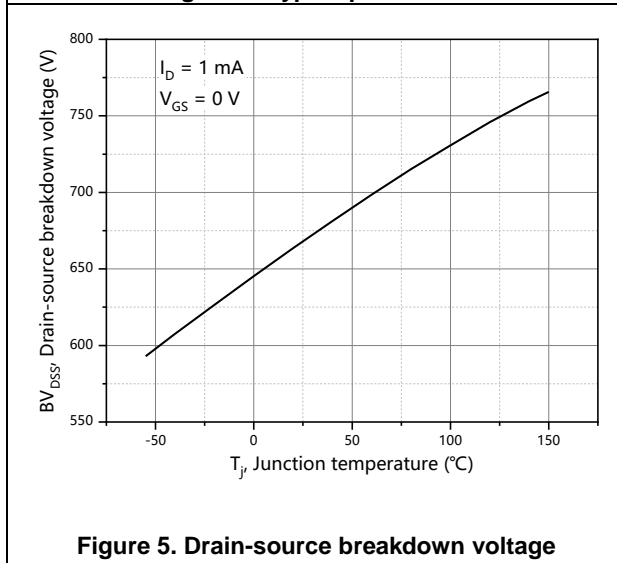
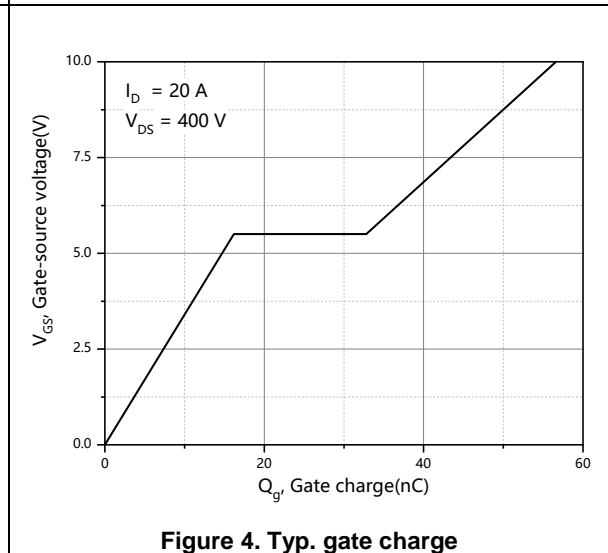
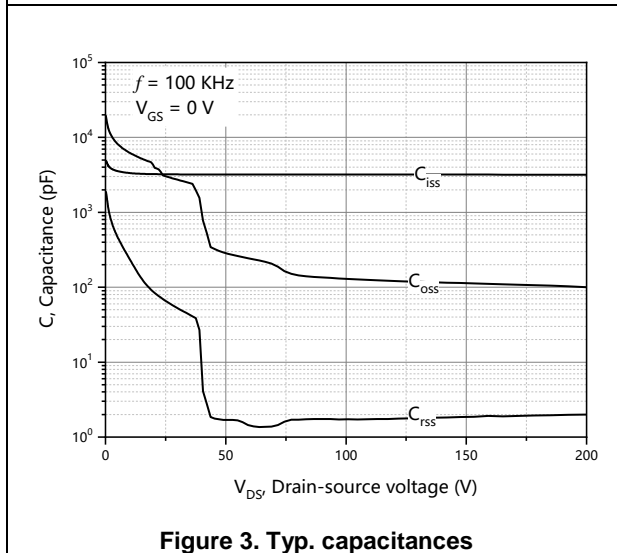
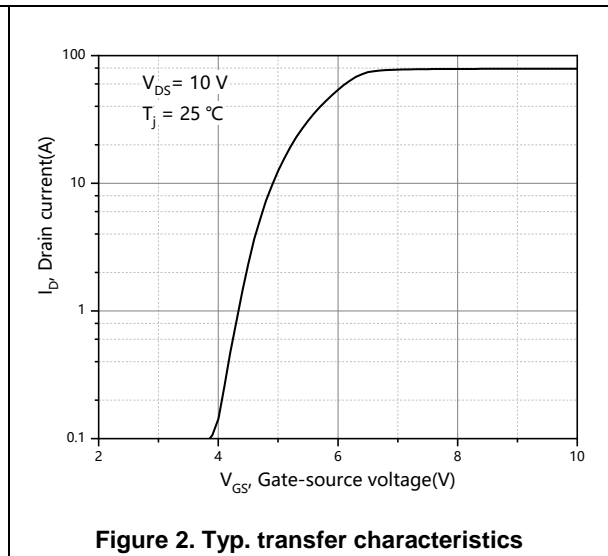
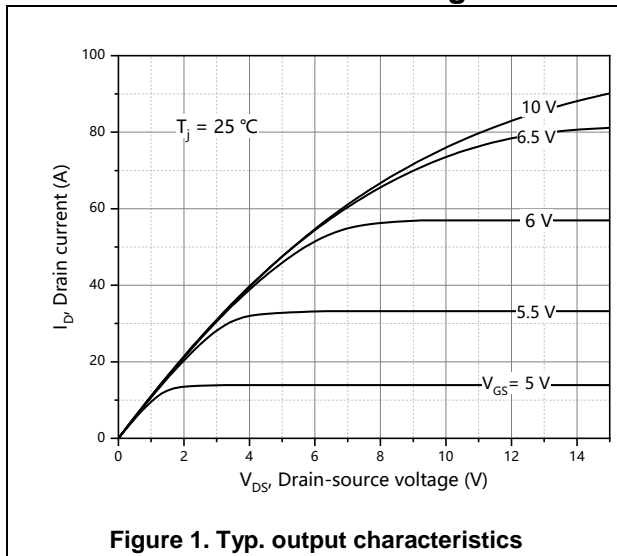
Body Diode Characteristics

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Test condition |
|-------------------------------|-----------|------|-------|------|---------------|---|
| Diode forward voltage | V_{SD} | | | 1.4 | V | $I_S=40\text{ A}$, $V_{GS}=0\text{ V}$ |
| Reverse recovery time | t_{rr} | | 506.0 | | ns | $V_R=400\text{ V}$, $I_S=20\text{ A}$, $di/dt=100\text{ A}/\mu\text{s}$ |
| Reverse recovery charge | Q_{rr} | | 4.2 | | μC | |
| Peak reverse recovery current | I_{rrm} | | 27.7 | | 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) $V_{DD}=100\text{ V}$, $V_{GS}=10\text{ V}$, $L=60\text{ mH}$, starting $T_j=25\text{ }^\circ\text{C}$.

Electrical Characteristics Diagrams



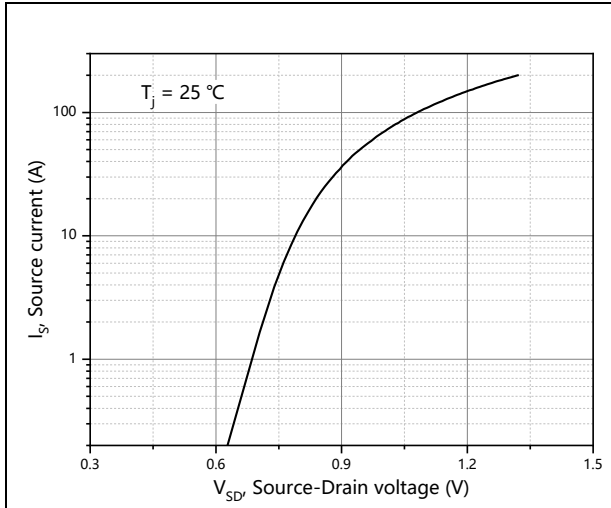


Figure 7. Forward characteristic of body diode

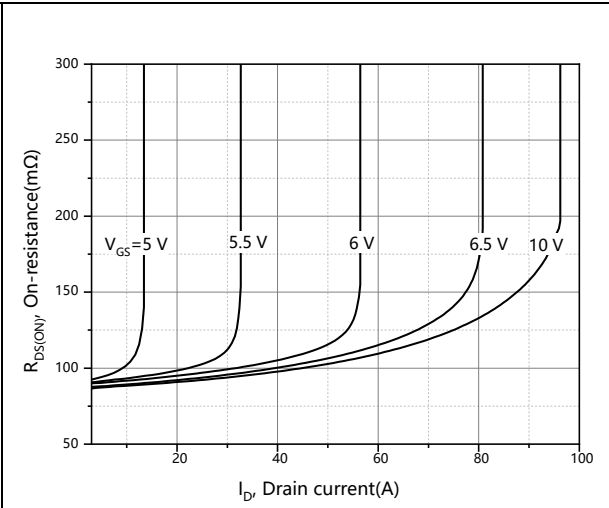


Figure 8. Drain-source on-state resistance

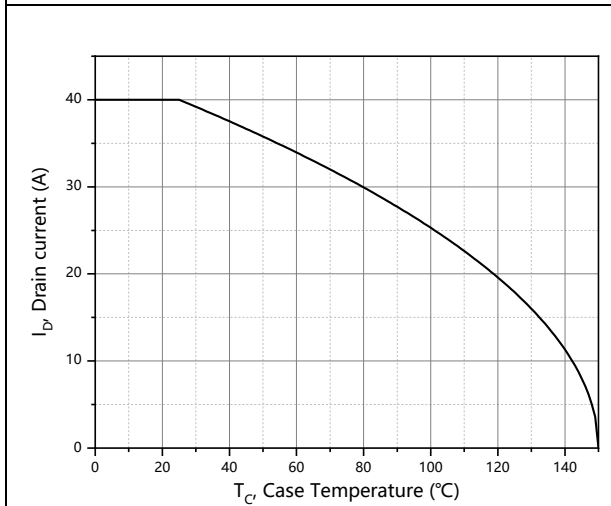


Figure 9. Drain current

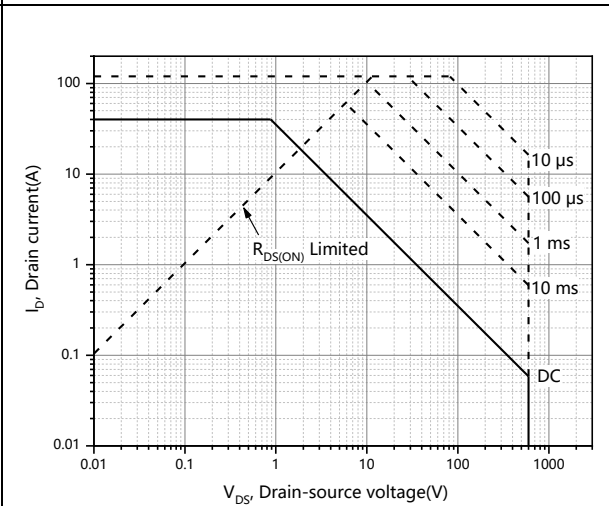


Figure 10. Safe operation area T_C=25 °C

Test circuits and waveforms



Figure 1. Gate charge test circuit & waveform



Figure 2. Switching time test circuit & waveforms

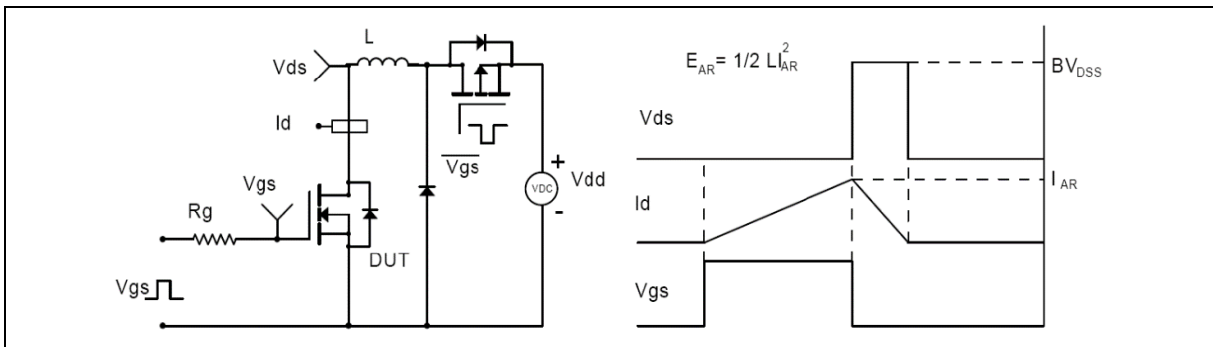


Figure 3. Unclamped inductive switching (UIS) test circuit & waveforms

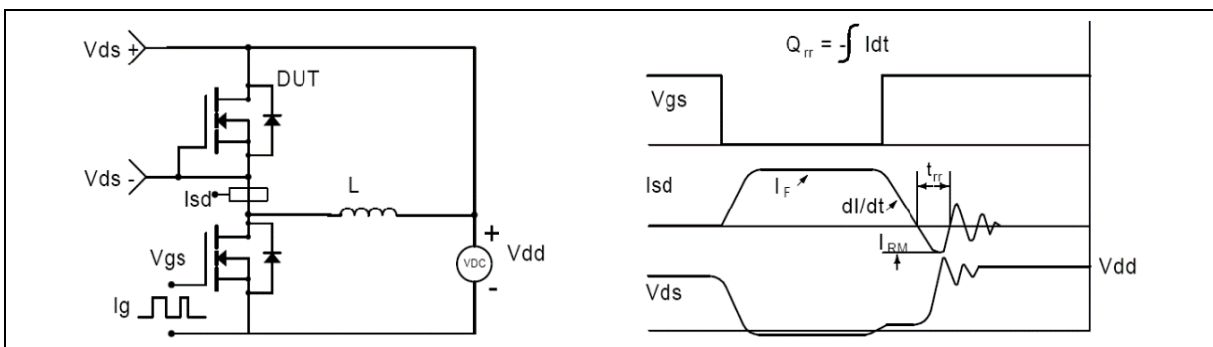
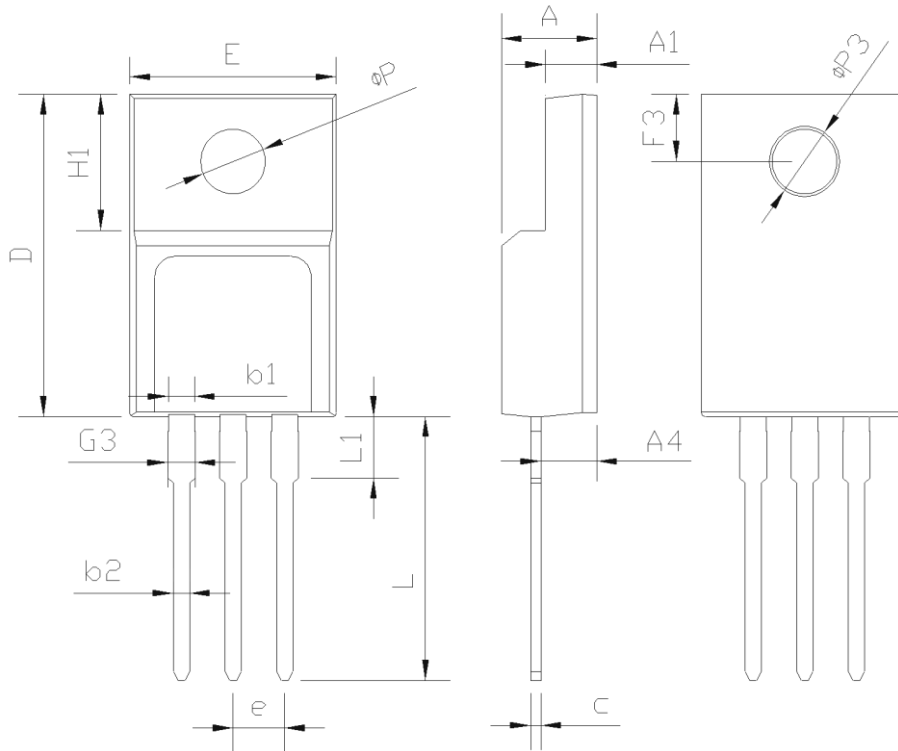


Figure 4. Diode reverse recovery test circuit & waveforms

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 |
| A4 | 2.56 | 2.76 | 2.96 |
| c | 0.40 | 0.50 | 0.65 |
| D | 15.57 | 15.87 | 16.17 |
| H1 | 6.70 REF | | |
| e | 2.54 BSC | | |
| L | 12.68 | 12.98 | 13.28 |
| L1 | 2.88 | 3.03 | 3.18 |
| ΦP | 3.03 | 3.18 | 3.38 |
| $\Phi P3$ | 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 |

Version 1: TO220F-P 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 |
|--------------|---------|---------|------|--------------|
| OSG60R096FSF | TO220F | yes | yes | yes |

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