P-Channel 60-V (D-S) MOSFET

**Features**
- TrenchFET® Power MOSFET
- ESD Protected: 2000 V

**Applications**
- Drivers: Relays, Solenoids, Lamps, Hammers, Displays, Memories, Transistors, etc.
- Battery Operated Systems
- Power Supply, Converter Circuits
- Motor Control

**Product Summary**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Limit</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain-Source Voltage</td>
<td>( V_{DS} )</td>
<td>−60</td>
<td>V</td>
</tr>
<tr>
<td>Gate-Source Voltage</td>
<td>( V_{GS} )</td>
<td>±20</td>
<td>V</td>
</tr>
<tr>
<td>Continuous Drain Current</td>
<td>( I_D )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( T_A = 25^\circ C )</td>
<td>−0.27</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>( T_A = 70^\circ C )</td>
<td>−0.22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulse Drain Current ( a )</td>
<td>( I_{DM} )</td>
<td>−1.0</td>
<td></td>
</tr>
<tr>
<td>Power Dissipation</td>
<td>( P_D )</td>
<td>0.8</td>
<td>W</td>
</tr>
<tr>
<td>( T_A = 25^\circ C )</td>
<td>0.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( T_A = 70^\circ C )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Junction-to-Ambient</td>
<td>( R_{JJA} )</td>
<td>156</td>
<td>°C/W</td>
</tr>
<tr>
<td>Operating Junction and Storage Temperature Range</td>
<td>( T_J, T_{SAG} )</td>
<td>−55 to 150</td>
<td>°C</td>
</tr>
</tbody>
</table>

Notes
- \( a \) Pulse width limited by maximum junction temperature.
# SPECIFICATIONS (TA = 25°C UNLESS OTHERWISE NOTED)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Static</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drain-Source Breakdown Voltage</td>
<td>V(BR)DSS</td>
<td>VGS = 0 V, ID = −10 µA</td>
<td>−60</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Gate-Threshold Voltage</td>
<td>VGS(th)</td>
<td>VDS = VGS, ID = −250 µA</td>
<td>−1</td>
<td>−2.1</td>
<td>−3.0</td>
<td>µA</td>
</tr>
<tr>
<td>Gate-Body Leakage</td>
<td>IGSS</td>
<td>VDS = 0 V, VGS = ±20 V</td>
<td>±10</td>
<td>±200</td>
<td>±500</td>
<td>nA</td>
</tr>
<tr>
<td>Zero Gate Voltage Drain Current</td>
<td>IDSS</td>
<td>VDS = −60 V, VGS = 0 V</td>
<td>−1</td>
<td></td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>On-State Drain Currenta</td>
<td>ID(on)</td>
<td>VDS = −10 V, VGS = −4.5 V</td>
<td>−50</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Drain-Source On-Resistancea</td>
<td>rDS(on)</td>
<td>VGS = −4.5 V, ID = −50 mA</td>
<td>5.5</td>
<td>10</td>
<td></td>
<td>Ω</td>
</tr>
<tr>
<td>Forward Transconductancea</td>
<td>gfs</td>
<td>VDS = −10 V, ID = −50 mA</td>
<td>4.7</td>
<td>9</td>
<td></td>
<td>mS</td>
</tr>
<tr>
<td>Diode Forward Voltagea</td>
<td>VSD</td>
<td>IS = −10 V, ID = −100 mA</td>
<td>−0.9</td>
<td>−1.4</td>
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<td>V</td>
</tr>
<tr>
<td><strong>Dynamicb</strong></td>
<td></td>
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<tr>
<td>Total Gate Charge</td>
<td>Qg</td>
<td>VDS = −30 V, VGS = −15 V, ID = −500 mA</td>
<td>1.7</td>
<td>3</td>
<td></td>
<td>nC</td>
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<tr>
<td>Gate-Source Charge</td>
<td>Qgs</td>
<td></td>
<td>0.26</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Gate-Drain Charge</td>
<td>Qgd</td>
<td></td>
<td>0.46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate Resistance</td>
<td>Rg</td>
<td></td>
<td>285</td>
<td></td>
<td></td>
<td>Ω</td>
</tr>
<tr>
<td>Turn-On Time</td>
<td>t(on)</td>
<td>VDD = −25 V, RL = 150 Ω, ID = −150 mA</td>
<td>2.4</td>
<td>5</td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>Turn-Off Time</td>
<td>tf</td>
<td>VDD = −25 V, RL = 150 Ω, VSD = −10 V, Rg = 10 Ω</td>
<td>15.5</td>
<td>25</td>
<td></td>
<td>ns</td>
</tr>
</tbody>
</table>

Notes:

a. Pulse test: PW ≤ 300 ms duty cycle ≤ 2%.
b. Guaranteed by design, not subject to production testing.

# TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)

For the following graphs, p-channel negative polarities for all voltage and current values are represented as positive values.
TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)

For the following graphs, p-channel negative polarities for all voltage and current values are represented as positive values.

1. **On-Resistance vs. Drain Current**
   - $V_{GS} = 4.5\, \text{V}$
   - $V_{GS} = 5\, \text{V}$
   - $V_{GS} = 10\, \text{V}$
   - $I_D = 500\, \text{mA}$
   - $V_{DS} = 30\, \text{V}$
   - $V_{DS} = 48\, \text{V}$

2. **Capacitance**
   - $V_{GS} = 0\, \text{V}$
   - $C_{gs}$
   - $C_{oss}$
   - $C_{rss}$

3. **Gate Charge**
   - $I_D = 500\, \text{mA}$
   - $V_{DS} = 30\, \text{V}$
   - $V_{DS} = 48\, \text{V}$

4. **Source-Drain Diode Forward Voltage**
   - $V_{GS} = 0\, \text{V}$
   - $I_S = 125\, \text{°C}$
   - $I_S = 25\, \text{°C}$
   - $I_S = -55\, \text{°C}$

5. **On-Resistance vs. Junction Temperature**
   - $V_{GS} = 10\, \text{V} \oplus 500\, \text{mA}$
   - $V_{GS} = 4.5\, \text{V} \oplus 25\, \text{mA}$

6. **On-Resistance vs. Gate-Source Voltage**
   - $I_D = 500\, \text{mA}$
   - $I_D = 200\, \text{mA}$
TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)

For the following graphs, p-channel negative polarities for all voltage and current values are represented as positive values.

### Threshold Voltage Variance Over Temperature

- $V_{GS(th)}$ (V) vs. $T_J$ - Junction Temperature ($°C$)
- $I_D = 250 \, \mu A$

### Single Pulse Power, Junction-to-Ambient

- Power (W) vs. Time (sec)

### Safe Operating Area

- $V_{DS}$ - Drain-to-Source Voltage (V)
- $I_D$ - Drain Current (A)
- $I_{DS(on)}$ Limited
- $I_{FW}$ Limited
- $T_A = 25°C$
- Single Pulse
- $B V_{DSS}$ Limited

### Normalized Thermal Transient Impedance, Junction-to-Ambient

- Normalized Effective Transient Thermal Impedance
- Normalized Thermal Transient Impedance
- Notes:
  1. Duty Cycle, $D = \frac{t_1}{t_0}$
  2. Per Unit Base - $R_{thJA} = 156°C/W$
  3. $T_{JA} = T_A = P_{DM}Z_{thJA}^{(s)}$
  4. Surface Mounted
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