Automotive P-Channel 60 V (D-S) 175 °C MOSFET

**FEATURES**
- TrenchFET® power MOSFET
- 100 % Rg and UIS tested
- AEC-Q101 qualified

**PRODUCT SUMMARY**
- VDS (V): -60
- \( R_{DS(ON)} \) at \( V_{GS} = -10 \) V: 0.018
- \( R_{DS(ON)} \) at \( V_{GS} = -4.5 \) V: 0.024
- \( I_D \) (A): -52
- Configuration: Single
- Package: PowerPAK SO-8L

**ABSOLUTE MAXIMUM RATINGS** (\( T_C = 25 ^\circ C \), unless otherwise noted)

<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></td>
</tr>
<tr>
<td>Continuous Drain Current (( T_C = 25 ^\circ C ))</td>
<td>( I_D )</td>
<td>-52</td>
<td>A</td>
</tr>
<tr>
<td>Continuous Drain Current (( T_C = 125 ^\circ C ))</td>
<td>( I_D )</td>
<td>-30</td>
<td></td>
</tr>
<tr>
<td>Continuous Source Current (Diode Conduction)</td>
<td></td>
<td>-75</td>
<td></td>
</tr>
<tr>
<td>Pulsed Drain Current</td>
<td>( I_{DM} )</td>
<td>-200</td>
<td></td>
</tr>
<tr>
<td>Single Pulse Avalanche Current</td>
<td>( I_{AS} )</td>
<td>-40</td>
<td></td>
</tr>
<tr>
<td>Single Pulse Avalanche Energy</td>
<td>( E_{AS} )</td>
<td>80</td>
<td>mJ</td>
</tr>
<tr>
<td>Maximum Power Dissipation</td>
<td>( P_D )</td>
<td>83</td>
<td>W</td>
</tr>
<tr>
<td>Operating Junction and Storage Temperature Range</td>
<td>( T_J, T_{stg} )</td>
<td>-55 to +175</td>
<td>°C</td>
</tr>
<tr>
<td>Soldering Recommendations (Peak Temperature)</td>
<td></td>
<td>260</td>
<td></td>
</tr>
</tbody>
</table>

**THERMAL RESISTANCE RATINGS**

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>LIMIT</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Junction-to-Ambient (PCB Mount)</td>
<td>( R_{JA} )</td>
<td>65</td>
<td>°C/W</td>
</tr>
<tr>
<td>Junction-to-Case (Drain)</td>
<td>( R_{JC} )</td>
<td>1.8</td>
<td></td>
</tr>
</tbody>
</table>

**NOTES**
- Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
- When mounted on 1" square PCB (FR4 material).
- Parametric verification ongoing.
- See solder profile ([www.vishay.com/doc?73257](http://www.vishay.com/doc?73257)). The PowerPAK SO-8L is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper tip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection.
- Rework conditions: manual soldering with a soldering iron is not recommended for leadless components.
### SPECIFICATIONS (TC = 25 °C, unless otherwise noted)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>TEST CONDITIONS</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_{DS}</td>
<td>V_{GS} = 0, I_{D} = -250 μA</td>
<td>-60</td>
<td>-</td>
<td>-</td>
<td>V</td>
</tr>
<tr>
<td>Gate-Source Threshold Voltage</td>
<td>V_{GS(th)}</td>
<td>V_{DS} = V_{GS}, I_{D} = -250 μA</td>
<td>-1.5</td>
<td>-2.0</td>
<td>-2.5</td>
<td></td>
</tr>
<tr>
<td>Gate-Source Leakage</td>
<td>I_{GS}</td>
<td>V_{DS} = 0 V, V_{GS} = ± 20 V</td>
<td>-</td>
<td>-</td>
<td>± 100</td>
<td>nA</td>
</tr>
<tr>
<td>Zero Gate Voltage Drain Current</td>
<td>I_{DSS}</td>
<td>V_{GS} = 0 V</td>
<td>-</td>
<td>-</td>
<td>-1</td>
<td>μA</td>
</tr>
<tr>
<td>On-State Drain Current</td>
<td>I_{D(on)}</td>
<td>V_{DS} = -10 V</td>
<td>-30</td>
<td>-</td>
<td>-</td>
<td>A</td>
</tr>
<tr>
<td>Drain-Sourced On-State Resistance</td>
<td>R_{DS(on)}</td>
<td>V_{GS} = -10 V</td>
<td>-0.0155 to 0.0180</td>
<td></td>
<td></td>
<td>Ω</td>
</tr>
<tr>
<td>Forward Transconductance</td>
<td>g_{fs}</td>
<td>V_{DS} = -30 V, I_{D} = -15 A</td>
<td>-40</td>
<td>-</td>
<td>-</td>
<td>S</td>
</tr>
<tr>
<td><strong>Dynamic</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Capacitance</td>
<td>C_{iss}</td>
<td>V_{GS} = 0 V</td>
<td>-</td>
<td>3448</td>
<td>4586</td>
<td>pF</td>
</tr>
<tr>
<td>Output Capacitance</td>
<td>C_{oss}</td>
<td>V_{DS} = -30 V, f = 1 MHz</td>
<td>-374</td>
<td>497</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reverse Transfer Capacitance</td>
<td>C_{rss}</td>
<td>V_{GS} = -10 V</td>
<td>-234</td>
<td>312</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Gate Charge c</td>
<td>Q_{g}</td>
<td>V_{DS} = -40 V, I_{D} = -15 A</td>
<td>-73</td>
<td>108</td>
<td></td>
<td>nC</td>
</tr>
<tr>
<td>Gate-Source Charge c</td>
<td>Q_{gs}</td>
<td>V_{DS} = -10 V</td>
<td>-10</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate-Drain Charge c</td>
<td>Q_{gd}</td>
<td>V_{DS} = -10 V</td>
<td>-20</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate Resistance</td>
<td>R_{g}</td>
<td>f = 1 MHz</td>
<td>0.5</td>
<td>1.1</td>
<td>2</td>
<td>Ω</td>
</tr>
<tr>
<td>Turn-On Delay Time c</td>
<td>t_{d(on)}</td>
<td>V_{DD} = -30 V, R_{L} = 30 Ω</td>
<td>-12</td>
<td>17</td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>Rise Time c</td>
<td>t_{r}</td>
<td>I_{D} = -1 A, V_{GEN} = -10 V, R_{g} = 6 Ω</td>
<td>-19</td>
<td>26</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turn-Off Delay Time c</td>
<td>t_{d(off)}</td>
<td>V_{DD} = -30 V, R_{L} = 30 Ω</td>
<td>-88</td>
<td>117</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fall Time c</td>
<td>t_{f}</td>
<td>I_{D} = -1 A, V_{GEN} = -10 V, R_{g} = 6 Ω</td>
<td>-45</td>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Source-Drain Diode Ratings and Characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulsed Current a</td>
<td>I_{SM}</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-200</td>
<td>A</td>
</tr>
<tr>
<td>Forward Voltage</td>
<td>V_{SD}</td>
<td>I_{F} = -2.5 A, V_{GS} = 0</td>
<td>-0.8</td>
<td>1.2</td>
<td></td>
<td>V</td>
</tr>
</tbody>
</table>

**Notes**

a. Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2 %.

b. Guaranteed by design, not subject to production testing.

c. Independent of operating temperature.

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
TYPICAL CHARACTERISTICS (T_A = 25 °C, unless otherwise noted)

Output Characteristics

Transfer Characteristics

Capacitance

Transfer Characteristics

Transconductance

On-Resistance vs. Drain Current
TYPICAL CHARACTERISTICS \((T_A = 25 \, ^\circ C, \text{ unless otherwise noted})\)

**Gate Charge**

\[
Q_g - \text{Total Gate Charge (nC)}
\]

\[
0 \quad 2 \quad 4 \quad 6 \quad 8 \quad 10
\]

\[
0 \quad 20 \quad 40 \quad 60 \quad 80
\]

\[
V_{GS} - \text{Gate-to-Source Voltage (V)}
\]

**Source Drain Diode Forward Voltage**

\[
I_s - \text{Source Current (A)}
\]

\[
0 \quad 0.01 \quad 0.1 \quad 1 \quad 10
\]

\[
V_{DS} - \text{Source-to-Drain Voltage (V)}
\]

\[
0.001 \quad 0.01 \quad 0.1 \quad 1 \quad 10
\]

**On-Resistance vs. Junction Temperature**

\[
R_{DS(on)} - \text{On-Resistance (normalized)}
\]

\[
0.5 \quad 0.8 \quad 1.1 \quad 1.4 \quad 1.7
\]

\[
-50 \quad -25 \quad 0 \quad 25 \quad 50 \quad 75 \quad 100 \quad 125 \quad 150 \quad 175
\]

\[
V_{GS} - \text{Gate-to-Source Voltage (V)}
\]

**Threshold Voltage**

\[
V_{GS(th)} - \text{Variance (V)}
\]

\[
-0.5 \quad -0.2 \quad 0.1 \quad 0.4 \quad 0.7 \quad 1.0
\]

\[
-50 \quad -25 \quad 0 \quad 25 \quad 50 \quad 75 \quad 100 \quad 125 \quad 150 \quad 175
\]

**Drain Source Breakdown vs. Junction Temperature**

\[
V_{DS} - \text{Drain-to-Source Voltage (V)}
\]

\[
-75 \quad -72 \quad -69 \quad -66 \quad -63 \quad -60
\]

\[
T_J - \text{Temperature (°C)}
\]

\[
T_J = 150 \, ^\circ C
\]

\[
T_J = 25 \, ^\circ C
\]

**On-Resistance vs. Gate-to-Source Voltage**

\[
R_{DS(on)} - \text{On-Resistance (Ω)}
\]

\[
0.02 \quad 0.04 \quad 0.06 \quad 0.08 \quad 0.10
\]

\[
0 \quad 2 \quad 4 \quad 6 \quad 8 \quad 10
\]

\[
V_{DS} - \text{Gate-to-Source Voltage (V)}
\]

\[
T_J = 150 \, ^\circ C
\]

\[
T_J = 25 \, ^\circ C
\]

**Drain Source Breakdown vs. Junction Temperature**

\[
V_{DS} - \text{Drain-to-Source Voltage (V)}
\]

\[
-75 \quad -72 \quad -69 \quad -66 \quad -63 \quad -60
\]

\[
T_J - \text{Temperature (°C)}
\]

\[
T_J = 150 \, ^\circ C
\]

\[
T_J = 25 \, ^\circ C
\]
THERMAL RATINGS \( (T_A = 25 \, ^\circ\text{C}, \text{unless otherwise noted}) \)

![Graph showing Thermal Ratings]

Normalized Effective Transient Thermal Impedance

- Duty Cycle, \( D = \frac{t_1}{t_2} \)
- Per Unit Base = \( R_{\text{thJA}} = 68 \, ^\circ\text{C/W} \)
- \( T_{\text{JA}} - T_A = P_{\text{D}}/R_{\text{thJA}} \)
- Surface Mounted

Notes:
1. Duty Cycle: \( D = \frac{t_1}{t_2} \)
2. Per Unit Base: \( R_{\text{thJA}} = 68 \, ^\circ\text{C/W} \)
3. \( T_{\text{JA}} - T_A = P_{\text{D}}/R_{\text{thJA}} \)
4. Surface Mounted
**THERMAL RATINGS**  ($T_A = 25 \, ^\circ\text{C}$, unless otherwise noted)

![Graph showing normalized thermal transient impedance]

**Note**
- The characteristics shown in the two graphs:
  - Normalized Transient Thermal Impedance Junction-to-Ambient ($25 \, ^\circ\text{C}$)
  - Normalized Transient Thermal Impedance Junction-to-Case ($25 \, ^\circ\text{C}$)
are given for general guidelines only to enable the user to get a “ball park” indication of part capabilities. The data are extracted from single pulse transient thermal impedance characteristics which are developed from empirical measurements. The latter is valid for the part mounted on printed circuit board - FR4, size 1” x 1” x 0.062”, double sided with 2 oz. copper, 100 % on both sides. The part capabilities can widely vary depending on actual application parameters and operating conditions.

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PowerPAK® SO-8L Case Outline for Al Parts

TOPSIDE VIEW

BACKSIDE VIEW(SINGLE)

BACKSIDE VIEW(DUAL)
<table>
<thead>
<tr>
<th>DIM.</th>
<th>MILLIMETERS</th>
<th>INCHES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MIN.</td>
<td>NOM.</td>
</tr>
<tr>
<td>A</td>
<td>1.00</td>
<td>1.07</td>
</tr>
<tr>
<td>A1</td>
<td>0.00</td>
<td>-</td>
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<tr>
<td>b</td>
<td>0.33</td>
<td>0.41</td>
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<tr>
<td>b1</td>
<td>0.44</td>
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<td>b2</td>
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<td>b3</td>
<td>0.094</td>
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<td>5.13</td>
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<tr>
<td>D1</td>
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<td>4.90</td>
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<tr>
<td>D2</td>
<td>3.86</td>
<td>3.96</td>
</tr>
<tr>
<td>D3</td>
<td>1.63</td>
<td>1.73</td>
</tr>
<tr>
<td>e</td>
<td>1.27 BSC</td>
<td>0.050 BSC</td>
</tr>
<tr>
<td>E</td>
<td>6.05</td>
<td>6.15</td>
</tr>
<tr>
<td>E1</td>
<td>4.27</td>
<td>4.37</td>
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<td>E2</td>
<td>2.75</td>
<td>2.85</td>
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<tr>
<td>F</td>
<td>-</td>
<td>-</td>
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<tr>
<td>L</td>
<td>0.62</td>
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<tr>
<td>L1</td>
<td>0.92</td>
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<tr>
<td>K</td>
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<tr>
<td>W</td>
<td>0.23</td>
<td>0.23</td>
</tr>
<tr>
<td>W1</td>
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<tr>
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<tr>
<td>W3</td>
<td>2.96</td>
<td>2.96</td>
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<tr>
<td>q</td>
<td>0°</td>
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</tr>
</tbody>
</table>

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DWG: 6044

Note
- Millimeters will govern
RECOMMENDED MINIMUM PAD FOR PowerPAK® SO-8L SINGLE

Recommended Minimum Pads
Dimensions in mm (inches)
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