



## P-Channel 40-V (D-S), 175°C MOSFET

| PRODUCT SUMMARY |                            |                        |
|-----------------|----------------------------|------------------------|
| $V_{DS}$ (V)    | $r_{DS(on)}$ ( $\Omega$ )  | $I_D$ (A) <sup>d</sup> |
| -40             | 0.0094 @ $V_{GS} = -10$ V  | -50                    |
|                 | 0.0145 @ $V_{GS} = -4.5$ V | -50                    |

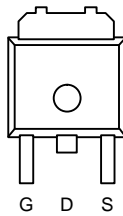
## FEATURES

- TrenchFET® Power MOSFET
- 175°C Junction Temperature

## APPLICATIONS

- Automotive 12-V Boardnet

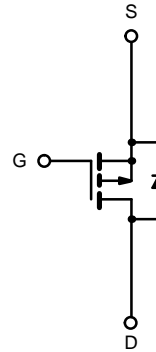
TO-252



Drain Connected to Tab

Top View

Ordering Information: SUD50P04-09L



P-Channel MOSFET

| ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ UNLESS OTHERWISE NOTED) |                           |                |                   |                  |
|---|---------------------------|----------------|-------------------|------------------|
| Parameter   |                           | Symbol         | Limit             | Unit             |
| Drain-Source Voltage  |                           | $V_{DS}$       | -40               | V                |
| Gate-Source Voltage   |                           | $V_{GS}$       | $\pm 20$          |                  |
| Continuous Drain Current<br>( $T_J = 175^\circ\text{C}$ )                   | $T_C = 25^\circ\text{C}$  | $I_D$          | -50 <sup>d</sup>  | A                |
|   | $T_C = 125^\circ\text{C}$ |                | -50 <sup>d</sup>  |                  |
| Pulsed Drain Current  |                           | $I_{DM}$       | -100              |                  |
| Avalanche Current   |                           | $I_{AR}$       | -50               |                  |
| Repetitive Avalanche Energy <sup>a</sup>                                    | $L = 0.1$ mH              | $E_{AR}$       | 125               | mJ               |
|   |                           |                |                   |                  |
| Power Dissipation   | $T_C = 25^\circ\text{C}$  | $P_D$          | 136 <sup>c</sup>  | W                |
|   | $T_A = 25^\circ\text{C}$  |                | 3 <sup>b, c</sup> |                  |
| Operating Junction and Storage Temperature Range                            |                           | $T_J, T_{stg}$ | -55 to 175        | $^\circ\text{C}$ |

| THERMAL RESISTANCE RATINGS       |              |                   |         |         |      |
|----------------------------------|--------------|-------------------|---------|---------|------|
| Parameter                        |              | Symbol            | Typical | Maximum | Unit |
| Junction-to-Ambient <sup>b</sup> | t ≤ 10 sec   | R <sub>thJA</sub> | 15      | 18      | °C/W |
|                                  | Steady State |                   | 40      | 50      |      |
| Junction-to-Case                 |              | R <sub>thJC</sub> | 0.82    | 1.1     |      |

## Notes:

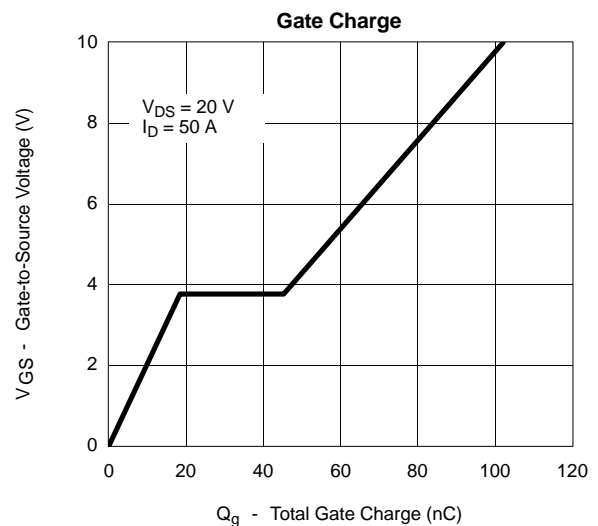
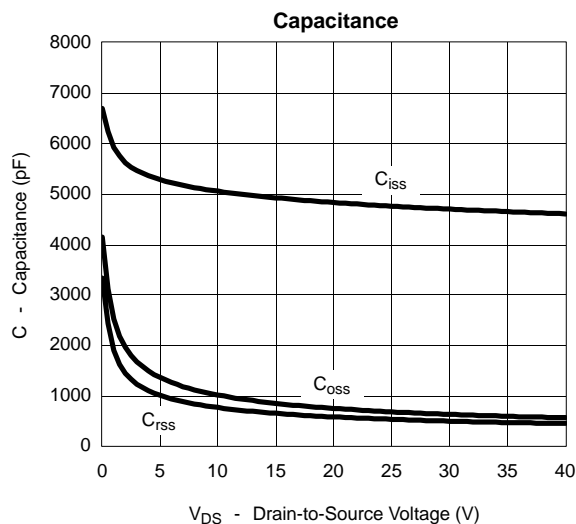
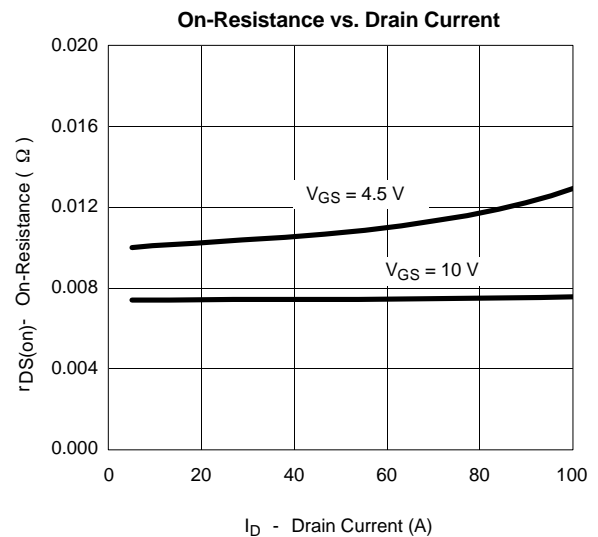
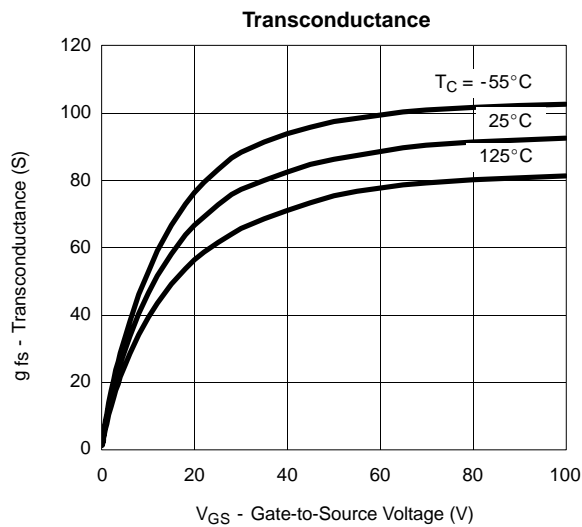
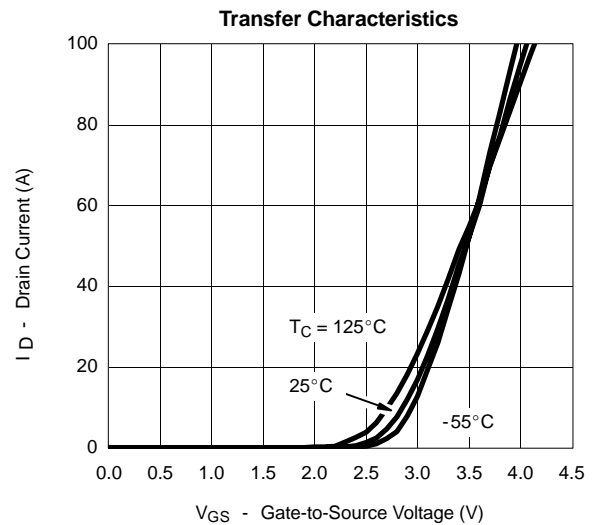
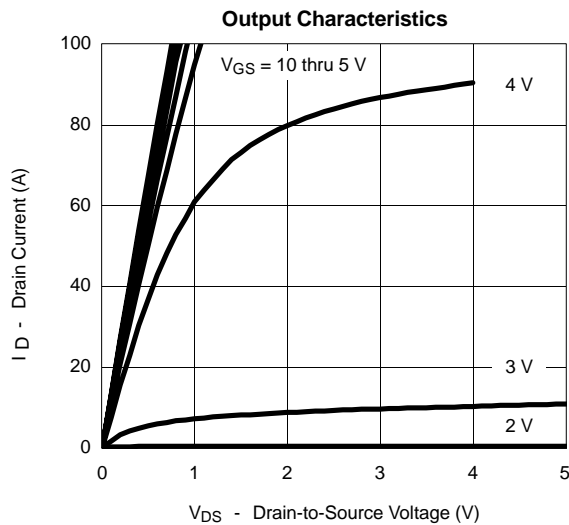
- Duty cycle  $\leq 1\%$ .
- When mounted on 1" square PCB (FR-4 material).
- See SOA curve for voltage derating.
- Package limited.

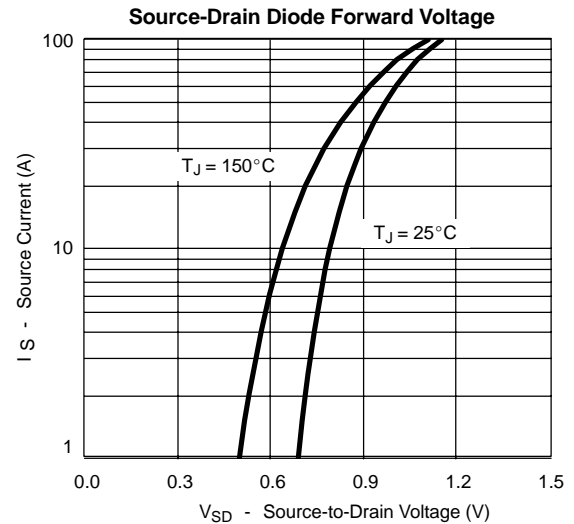
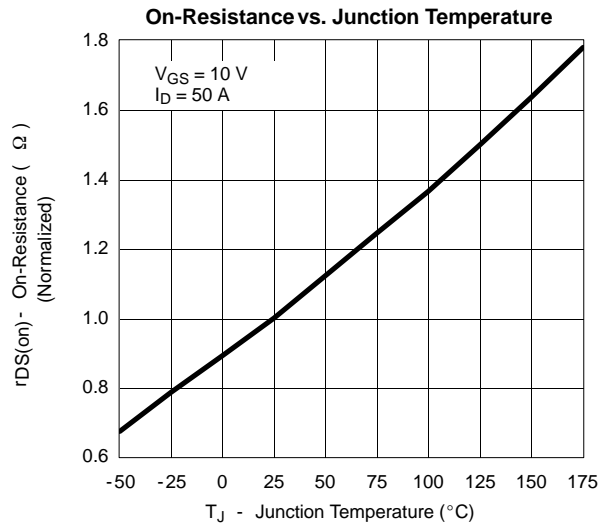
**SPECIFICATIONS (T<sub>J</sub> = 25 °C UNLESS OTHERWISE NOTED)**

| Parameter   | Symbol               | Test Condition  | Min | Typ    | Max    | Unit |
|---|----------------------|---|-----|--------|--------|------|
| Static  |                      |   |     |        |        |      |
| Drain-Source Breakdown Voltage  | V <sub>(BR)DSS</sub> | V <sub>GS</sub> = 0 V, I <sub>D</sub> = -250 μA   | -40 |        |        | V    |
| Gate Threshold Voltage  | V <sub>GS(th)</sub>  | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250 μA  | -1  |        | -3     |      |
| Gate-Body Leakage   | I <sub>GSS</sub>     | V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ±20 V  |     |        | ±100   | nA   |
| Zero Gate Voltage Drain Current   | I <sub>DSS</sub>     | V <sub>DS</sub> = -32 V, V <sub>GS</sub> = 0 V  |     |        | -1     | μA   |
|   |                      | V <sub>DS</sub> = -32 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125°C  |     |        | -50    |      |
|   |                      | V <sub>DS</sub> = -32 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 175°C  |     |        | -150   |      |
| On-State Drain Current <sup>a</sup>   | I <sub>D(on)</sub>   | V <sub>DS</sub> = -5 V, V <sub>GS</sub> = -10 V   | -50 |        |        | A    |
| Drain-Source On-State Resistance <sup>a</sup>                                       | r <sub>DS(on)</sub>  | V <sub>GS</sub> = -10 V, I <sub>D</sub> = -24 A   |     | 0.0075 | 0.0094 | Ω    |
|   |                      | V <sub>GS</sub> = -10 V, I <sub>D</sub> = -50 A, T <sub>J</sub> = 125°C   |     |        | 0.014  |      |
|   |                      | V <sub>GS</sub> = -10 V, I <sub>D</sub> = -50 A, T <sub>J</sub> = 175°C   |     |        | 0.017  |      |
|   |                      | V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -18 A  |     | 0.0115 | 0.0145 |      |
| Forward Transconductance <sup>a</sup>   | g <sub>fs</sub>      | V <sub>DS</sub> = -5 V, I <sub>D</sub> = -24 A  |     | 73     |        | S    |
| Dynamic <sup>b</sup>  |                      |   |     |        |        |      |
| Input Capacitance   | C <sub>iss</sub>     | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = -25 V, f = 1 MHz   |     | 4800   |        | pF   |
| Output Capacitance  | C <sub>oss</sub>     |   |     | 700    |        |      |
| Reverse Transfer Capacitance  | C <sub>rss</sub>     |   |     | 550    |        |      |
| Total Gate Charge <sup>c</sup>  | Q <sub>g</sub>       | V <sub>DS</sub> = -20 V, V <sub>GS</sub> = -10 V, I <sub>D</sub> = -50 A  |     | 102    | 150    | nC   |
| Gate-Source Charge <sup>c</sup>   | Q <sub>gs</sub>      |   |     | 18.5   |        |      |
| Gate-Drain Charge <sup>c</sup>  | Q <sub>gd</sub>      |   |     | 27     |        |      |
| Turn-On Delay Time <sup>c</sup>   | t <sub>d(on)</sub>   | V <sub>DD</sub> = -20 V, R <sub>L</sub> = 0.4 Ω<br>I <sub>D</sub> ≈ -50 A, V <sub>GEN</sub> = -10 V, R <sub>G</sub> = 6 Ω |     | 10     | 15     | ns   |
| Rise Time <sup>c</sup>  | t <sub>r</sub>       |   |     | 60     | 90     |      |
| Turn-Off Delay Time <sup>c</sup>  | t <sub>d(off)</sub>  |   |     | 145    | 220    |      |
| Fall Time <sup>c</sup>  | t <sub>f</sub>       |   |     | 140    | 220    |      |
| Source-Drain Diode Ratings and Characteristics (T <sub>C</sub> = 25°C) <sup>b</sup> |                      |   |     |        |        |      |
| Continuous Current  | I <sub>s</sub>       |   |     |        | -50    | A    |
| Pulsed Current  | I <sub>SM</sub>      |   |     |        | -100   |      |
| Forward Voltage <sup>a</sup>  | V <sub>SD</sub>      | I <sub>F</sub> = -50 A, V <sub>GS</sub> = 0 V   |     | -1.0   | -1.5   | V    |
| Reverse Recovery Time   | t <sub>rr</sub>      | I <sub>F</sub> = -50 A, di/dt = 100 A/μs  |     | 55     | 85     | ns   |

## Notes:

- Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2%.
- Guaranteed by design, not subject to production testing.
- Independent of operating temperature.

**TYPICAL CHARACTERISTICS (25 °C UNLESS NOTED)**

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