

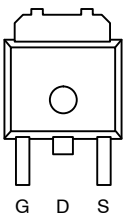


## N-Channel 20-V (D-S) 175°C MOSFET

## PRODUCT SUMMARY

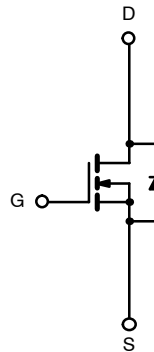
| $V_{DS}$ (V) | $r_{DS(on)}$ ( $\Omega$ ) | $I_D$ (A) <sup>a</sup> |
|--------------|---------------------------|------------------------|
| 20           | 0.0095 @ $V_{GS} = 10$ V  | 20                     |
|              | 0.017 @ $V_{GS} = 4.5$ V  | 15                     |

TO-252



Top View

Drain Connected to Tab



N-Channel MOSFET

## FEATURES

- TrenchFET® Power MOSFET
- 175°C Junction Temperature
- PWM Optimized for High Efficiency
- 100%  $R_g$  Tested

## APPLICATIONS

- High-Side Synchronous Buck DC/DC Conversion
  - Desktop
  - Server

Ordering Information: SUD50N02-09P  
SUD50N02-09P—E3 (Lead Free)

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$  UNLESS OTHERWISE NOTED)

| Parameter                                                 |                           | Symbol         | Limit            | Unit             |
|-----------------------------------------------------------|---------------------------|----------------|------------------|------------------|
| Drain-Source Voltage                                      |                           | $V_{DS}$       | 20               | V                |
| Gate-Source Voltage                                       |                           | $V_{GS}$       | $\pm 20$         |                  |
| Continuous Drain Current <sup>a</sup>                     | $T_A = 25^\circ\text{C}$  | $I_D$          | 20               | A                |
|                                                           | $T_C = 100^\circ\text{C}$ |                | 14               |                  |
| Pulsed Drain Current                                      |                           | $I_{DM}$       | 100              |                  |
| Continuous Source Current (Diode Conduction) <sup>a</sup> |                           | $I_S$          | 4.3              |                  |
| Avalanche Current                                         | $L = 0.1$ mH              | $I_{AS}$       | 29               | mJ               |
| Single Pulse Avalanche Energy                             |                           | $E_{AS}$       | 42               |                  |
| Maximum Power Dissipation                                 | $T_A = 25^\circ\text{C}$  | $P_D$          | 6.5 <sup>a</sup> | W                |
|                                                           | $T_C = 25^\circ\text{C}$  |                | 39.5             |                  |
| Operating Junction and Storage Temperature Range          |                           | $T_J, T_{stg}$ | -55 to 175       | $^\circ\text{C}$ |

## THERMAL RESISTANCE RATINGS

| Parameter                                |                 | Symbol     | Typical | Maximum | Unit               |
|------------------------------------------|-----------------|------------|---------|---------|--------------------|
| Maximum Junction-to-Ambient <sup>a</sup> | $t \leq 10$ sec | $R_{thJA}$ | 19      | 23      | $^\circ\text{C/W}$ |
|                                          | Steady State    |            | 40      | 50      |                    |
| Maximum Junction-to-Case                 |                 | $R_{thJC}$ | 3.1     | 3.8     |                    |

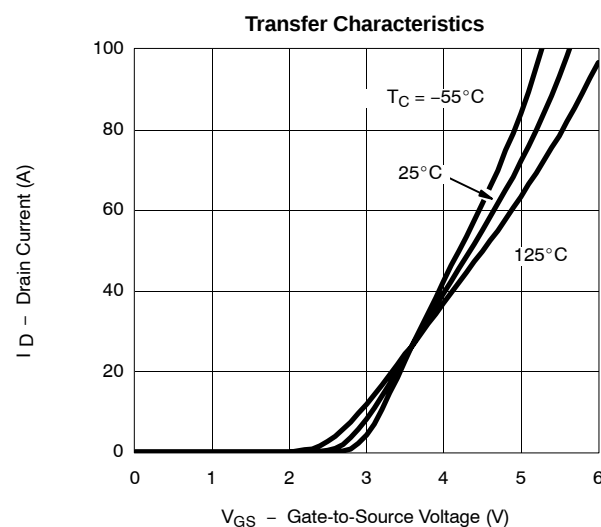
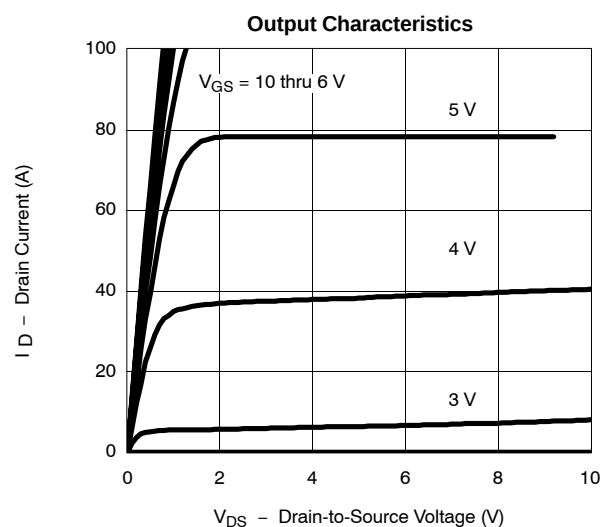
## Notes

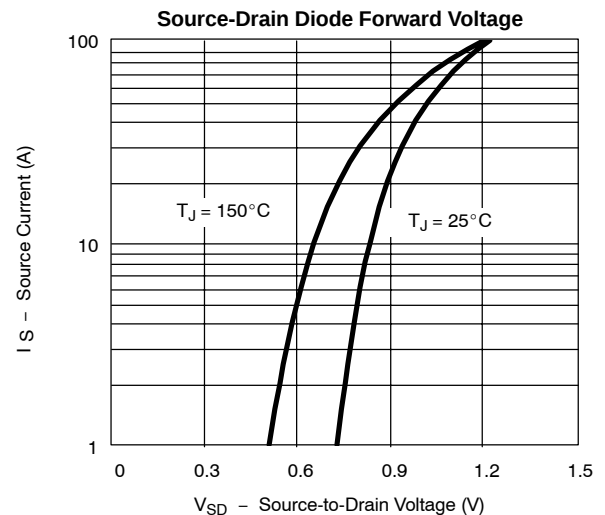
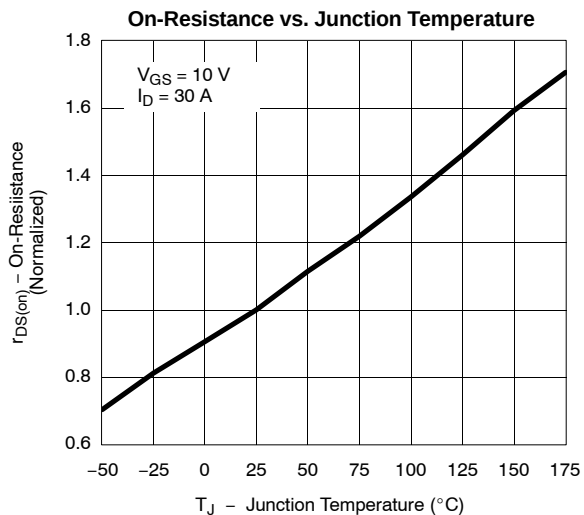
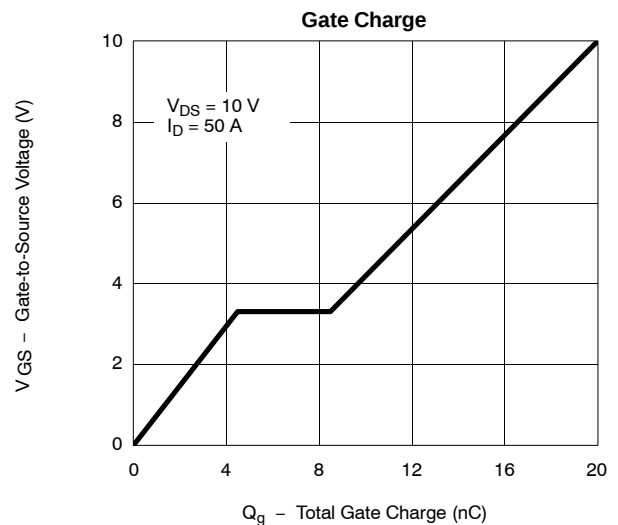
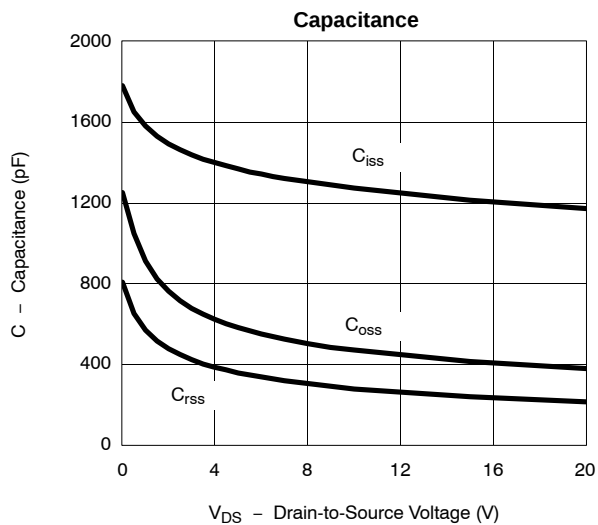
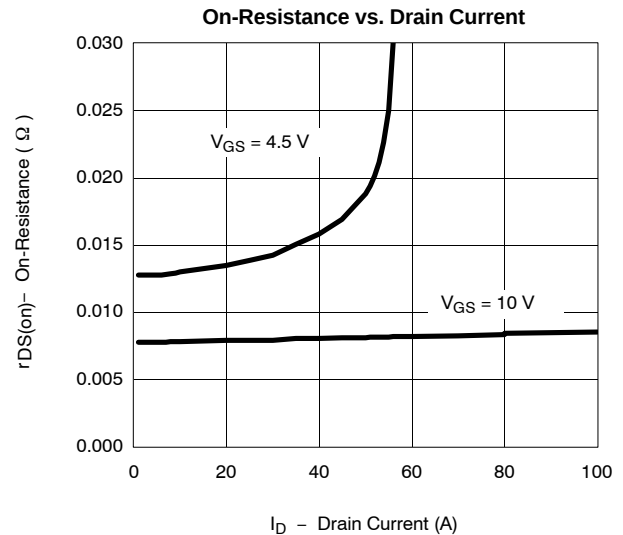
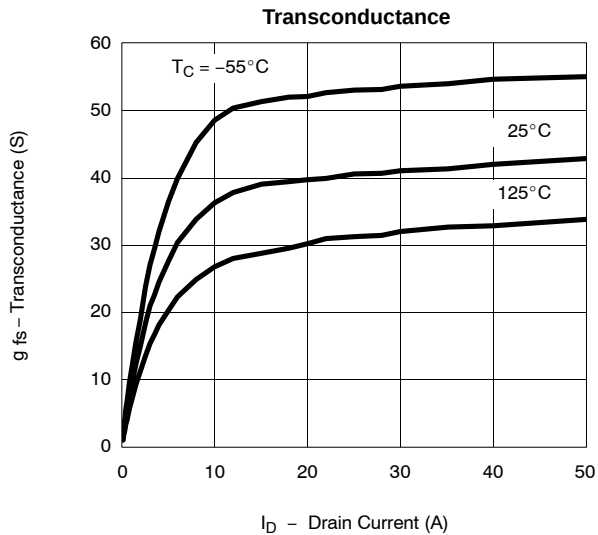
- a. Surface Mounted on FR4 Board,  $t \leq 10$  sec.  
b. Limited by package

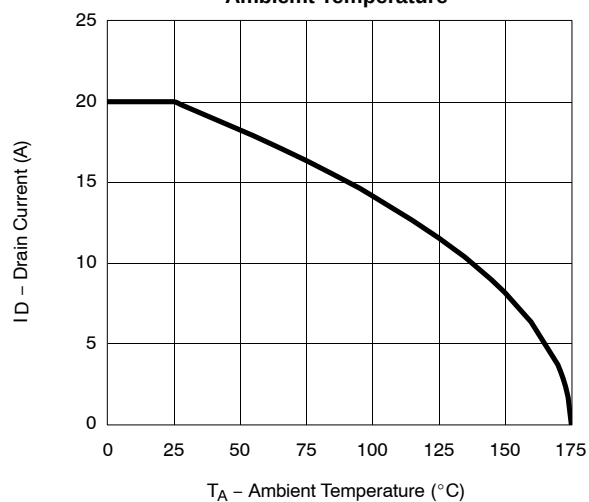
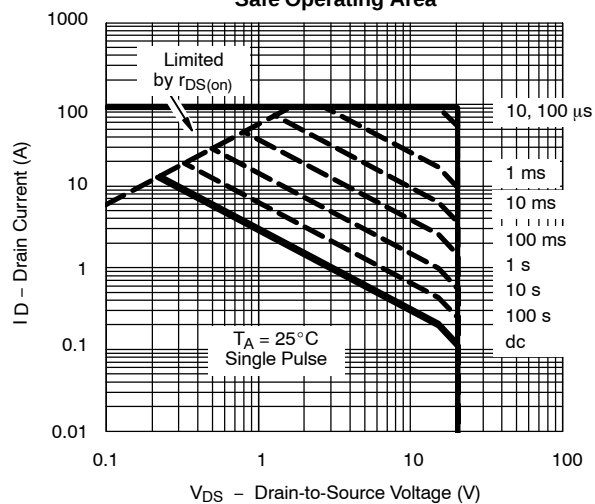
| SPECIFICATIONS (T <sub>J</sub> = 25 °C UNLESS OTHERWISE NOTED)         |                      |                                                                                                                          |     |                  |        |      |
|------------------------------------------------------------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------|-----|------------------|--------|------|
| Parameter                                                              | Symbol               | Test Condition                                                                                                           | Min | Typ <sup>a</sup> | Max    | Unit |
| Static                                                                 |                      |                                                                                                                          |     |                  |        |      |
| Drain-Source Breakdown Voltage                                         | V <sub>(BR)DSS</sub> | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA                                                                           | 20  |                  |        | V    |
| Gate Threshold Voltage                                                 | V <sub>GS(th)</sub>  | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA                                                              | 0.8 |                  | 3.0    |      |
| 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> = 20 V, V <sub>GS</sub> = 0 V                                                                            |     |                  | 1      | μA   |
|                                                                        |                      | V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C                                                   |     |                  | 50     |      |
| On-State Drain Current <sup>b</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>b</sup>                          | r <sub>DS(on)</sub>  | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A                                                                            |     | 0.008            | 0.0095 | Ω    |
|                                                                        |                      | V <sub>GS</sub> = 10 V, I <sub>D</sub> = 20 A, T <sub>J</sub> = 125 °C                                                   |     |                  | 0.014  |      |
|                                                                        |                      | V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 20 A                                                                           |     | 0.0135           | 0.017  |      |
| Forward Transconductance <sup>b</sup>                                  | g <sub>fs</sub>      | V <sub>DS</sub> = 15 V, I <sub>D</sub> = 20 A                                                                            | 15  |                  |        | S    |
| Dynamic <sup>a</sup>                                                   |                      |                                                                                                                          |     |                  |        |      |
| Input Capacitance                                                      | C <sub>iss</sub>     | V <sub>GS</sub> = 0 V, V <sub>DS</sub> = 10 V, f = 1 MHz                                                                 |     | 1300             |        | pF   |
| Output Capacitance                                                     | C <sub>oss</sub>     |                                                                                                                          |     | 470              |        |      |
| Reverse Transfer Capacitance                                           | C <sub>rss</sub>     |                                                                                                                          |     | 275              |        |      |
| Total Gate Charge <sup>c</sup>                                         | Q <sub>g</sub>       | V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 50 A                                                   |     | 10.5             | 16     | nC   |
| Gate-Source Charge <sup>c</sup>                                        | Q <sub>gs</sub>      |                                                                                                                          |     | 4.2              |        |      |
| Gate-Drain Charge <sup>c</sup>                                         | Q <sub>gd</sub>      |                                                                                                                          |     | 4.0              |        |      |
| Gate Resistance                                                        | R <sub>g</sub>       |                                                                                                                          | 1.6 | 4.0              | 6      | Ω    |
| Turn-On Delay Time <sup>c</sup>                                        | t <sub>d(on)</sub>   | V <sub>DD</sub> = 10 V, R <sub>L</sub> = 0.2 Ω<br>I <sub>D</sub> ≅ 50 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 2.5 Ω |     | 8                | 12     | ns   |
| Rise Time <sup>c</sup>                                                 | t <sub>r</sub>       |                                                                                                                          |     | 10               | 15     |      |
| Turn-Off Delay Time <sup>c</sup>                                       | t <sub>d(off)</sub>  |                                                                                                                          |     | 25               | 40     |      |
| Fall Time <sup>c</sup>                                                 | t <sub>f</sub>       |                                                                                                                          |     | 12               | 20     |      |
| Source-Drain Diode Ratings and Characteristic (T <sub>C</sub> = 25 °C) |                      |                                                                                                                          |     |                  |        |      |
| Pulsed Current                                                         | I <sub>SM</sub>      |                                                                                                                          |     |                  | 100    | A    |
| Diode Forward Voltage <sup>b</sup>                                     | V <sub>SD</sub>      | I <sub>F</sub> = 50 A, V <sub>GS</sub> = 0 V                                                                             |     | 1.2              | 1.5    | V    |
| Source-Drain Reverse Recovery Time                                     | t <sub>rr</sub>      | I <sub>F</sub> = 50 A, di/dt = 100 A/μs                                                                                  |     | 35               | 70     | ns   |

## Notes

- a. Guaranteed by design, not subject to production testing.  
b. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
c. Independent of operating temperature.

TYPICAL CHARACTERISTICS ( $25^\circ\text{C}$  UNLESS NOTED)

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

**THERMAL RATINGS****Maximum Drain Current vs.  
Ambient Temperature****Safe Operating Area****Normalized Thermal Transient Impedance, Junction-to-Ambient**