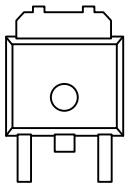
# N-Channel 20 V (D-S) 175 °C MOSFET

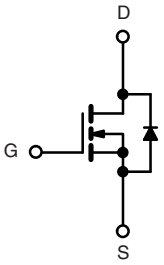
| PRODUCT SUMMARY | | |
|---|---|---|
| $V_{DS}$ (V) | $R_{DS(on)}$ (Ω) | $I_D$ (A)[a] |
| 20 | 0.0043 at $V_{GS}$ = 10 V | 34 |
| | 0.006 at $V_{GS}$ = 4.5 V | 28 |

**TO-252**




Drain Connected to Tab

Top View




N-Channel MOSFET

**Ordering Information:**
SUD50N02-04P-E3 (Lead (Pb)-free)

## FEATURES

- TrenchFET® Power MOSFET
- 175 °C Junction Temperature
- PWM Optimized for High Efficiency
- Material categorization:
  For definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

## APPLICATIONS

- Synchronous Buck Converter
  - Low-Side
  - Desktop, Servers, Desknote
- Synchronous Rectification
  - POL

| ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25 °C, unless otherwise noted) | | | | |
|---|---|---|---|---|
| **Parameter** | | **Symbol** | **Limit** | **Unit** |
| Drain-Source Voltage | | $V_{DS}$ | 20 | V |
| Gate-Source Voltage | | $V_{GS}$ | ± 20 | |
| Continuous Drain Current[a] | $T_A$ = 25 °C | $I_D$ | 34[a] | A |
| | $T_C$ = 25 °C | | 50[b] | |
| Pulsed Drain Current | | $I_{DM}$ | 100 | |
| Continuous Source Current (Diode Conduction)[a] | | $I_S$ | 8.3[a] | |
| Avalanche Current[c] | L = 0.1 mH | $I_{AS}$ | 50 | |
| Avalanche Energy[c] | | $E_{AS}$ | 125 | mJ |
| Maximum Power Dissipation | $T_A$ = 25 °C | $P_D$ | 8.3[a] | W |
| | $T_C$ = 25 °C | | 136 | |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | - 55 to 175 | °C |

| THERMAL RESISTANCE RATINGS | | | | | |
|---|---|---|---|---|---|
| **Parameter** | | **Symbol** | **Typical** | **Maximum** | **Unit** |
| Maximum Junction-to-Ambient[a] | t ≤ 10 s | $R_{thJA}$ | 15 | 18 | °C/W |
| | Steady State | | 40 | 50 | |
| Maximum Junction-to-Case | | $R_{thJC}$ | 0.85 | 1.1 | |

Notes:
a. Surface mounted on FR4 board, t ≤ 10 s.
b. Limited by package.
c. Single pulse.

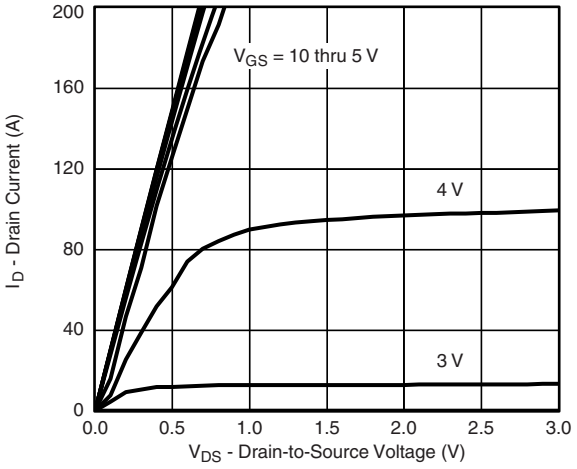
## SPECIFICATIONS ($T_J$ = 25 °C, unless otherwise noted)

| Parameter | Symbol | Test Conditions | Min. | Typ.[a] | Max. | Unit |
|---|---|---|---|---|---|---|
| **Static** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0 V, $I_D$ = 250 µA | 20 | | | V |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 250 µA | 0.8 | | 3.0 | |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ± 20 V | | | ± 100 | nA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 20 V, $V_{GS}$ = 0 V | | | 1 | µA |
| | | $V_{DS}$ = 20 V, $V_{GS}$ = 0 V, $T_J$ = 125 °C | | | 50 | |
| On-State Drain Current[b] | $I_{D(on)}$ | $V_{DS}$ = 5 V, $V_{GS}$ = 10 V | 50 | | | A |
| Drain-Source On-State Resistance[b] | $R_{DS(on)}$ | $V_{GS}$ = 10 V, $I_D$ = 20 A | | 0.0035 | 0.0043 | Ω |
| | | $V_{GS}$ = 10 V, $I_D$ = 20 A, $T_J$ = 125 °C | | | 0.0061 | |
| | | $V_{GS}$ = 4.5 V, $I_D$ = 20 A | | 0.0048 | 0.006 | |
| Forward Transconductance[b] | $g_{fs}$ | $V_{DS}$ = 15 V, $I_D$ = 20 A | 15 | | | S |
| **Dynamic[a]** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 10 V, f = 1 MHz | | 5000 | | pF |
| Output Capacitance | $C_{oss}$ | | | 1650 | | |
| Reverse Transfer Capacitance | $C_{rss}$ | | | 770 | | |
| Gate Resistance | $R_g$ | f = 1 MHz | | 1.6 | | Ω |
| Total Gate Charge[c] | $Q_g$ | $V_{DS}$ = 10 V, $V_{GS}$ = 4.5 V, $I_D$ = 50 A | | 40 | 60 | nC |
| Gate-Source Charge[c] | $Q_{gs}$ | | | 14 | | |
| Gate-Drain Charge[c] | $Q_{gd}$ | | | 13 | | |
| Turn-On Delay Time[c] | $t_{d(on)}$ | $V_{DD}$ = 10 V, $R_L$ = 0.2 Ω, $I_D$ ≅ 50 A, $V_{GEN}$ = 10 V, $R_g$ = 2.5 Ω | | 20 | 30 | ns |
| Rise Time[c] | $t_r$ | | | 20 | 30 | |
| Turn-Off Delay Time[c] | $t_{d(off)}$ | | | 50 | 75 | |
| Fall Time[c] | $t_f$ | | | 15 | 25 | |
| **Source-Drain Diode Ratings and Characteristics** $T_C$ = 25 °C | | | | | | |
| Pulsed Current | $I_{SM}$ | | | | 100 | A |
| Diode Forward Voltage[b] | $V_{SD}$ | $I_F$ = 50 A, $V_{GS}$ = 0 V | | 0.9 | 1.5 | V |
| Source-Drain Reverse Recovery Time | $t_{rr}$ | $I_F$ = 50 A, dI/dt = 100 A/µs | | 45 | 70 | ns |

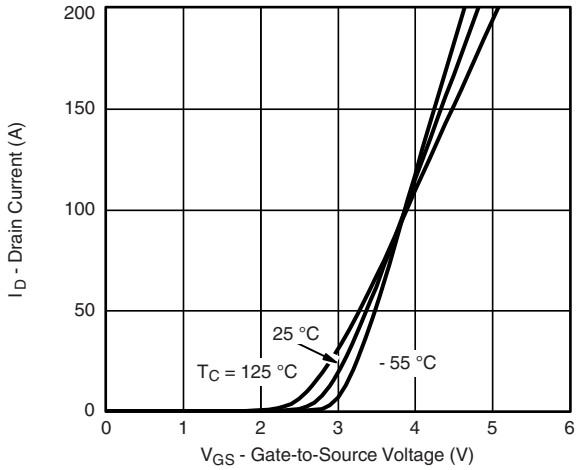
Notes:
a. Guaranteed by design, not subject to production testing.
b. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
c. Independent of operating temperature.

*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 (25 °C, unless otherwise noted)

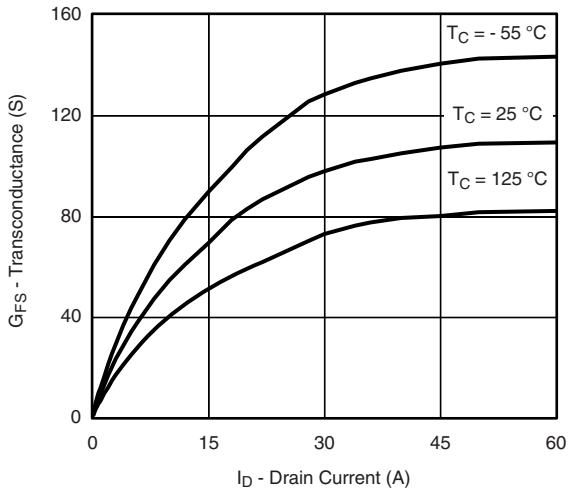



**Output Characteristics**

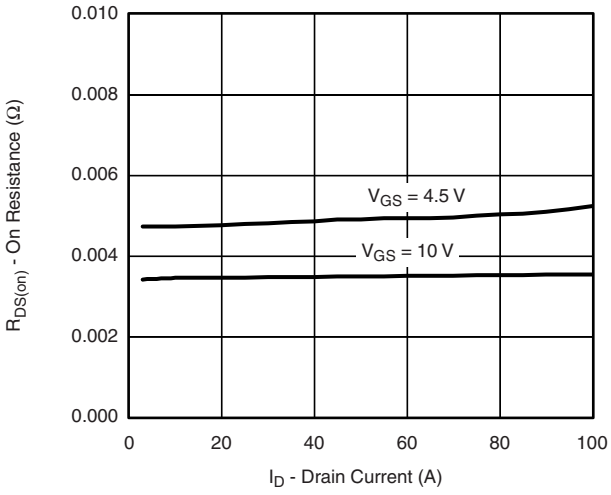



**Transfer Characteristics**

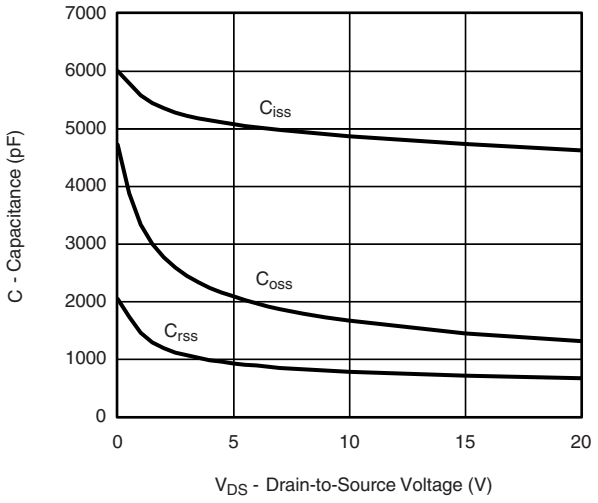
## TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



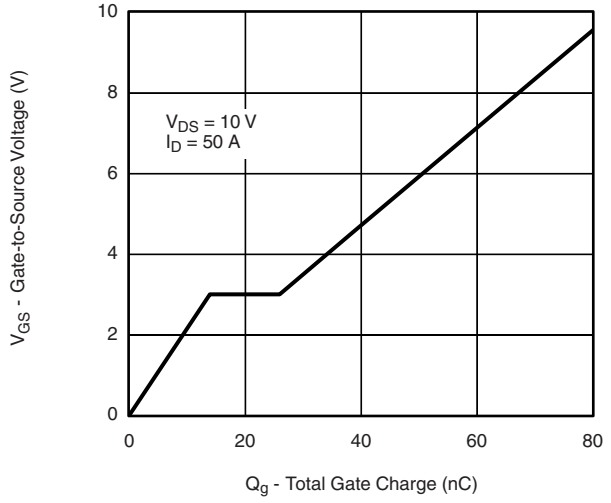

**Transconductance**



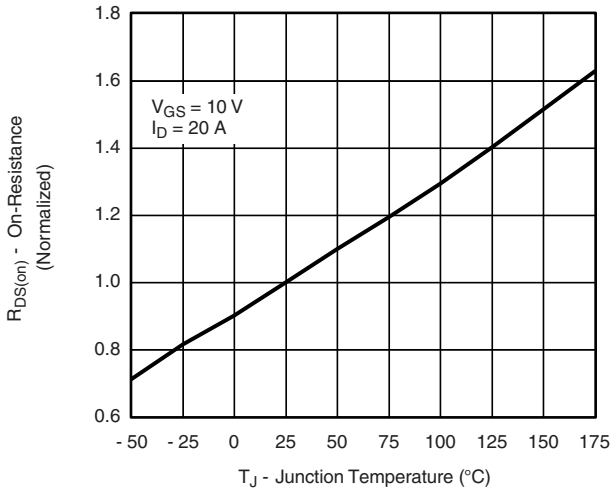

**On-Resistance vs. Drain Current**



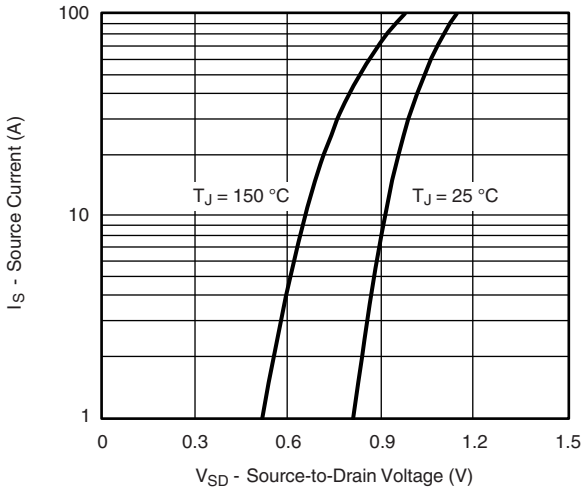

**Capacitance**




**Gate Charge**

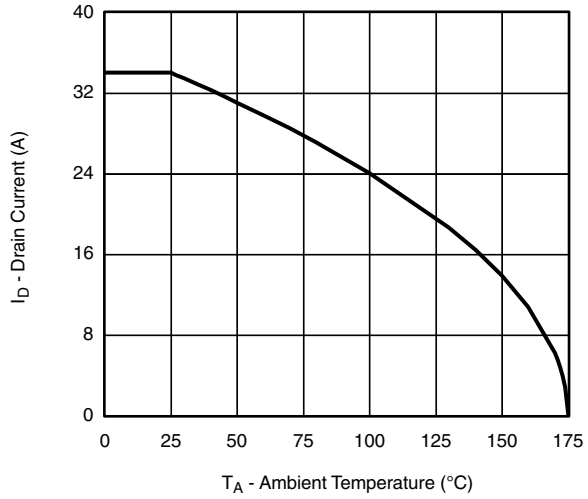



**On-Resistance vs. Junction Temperature**

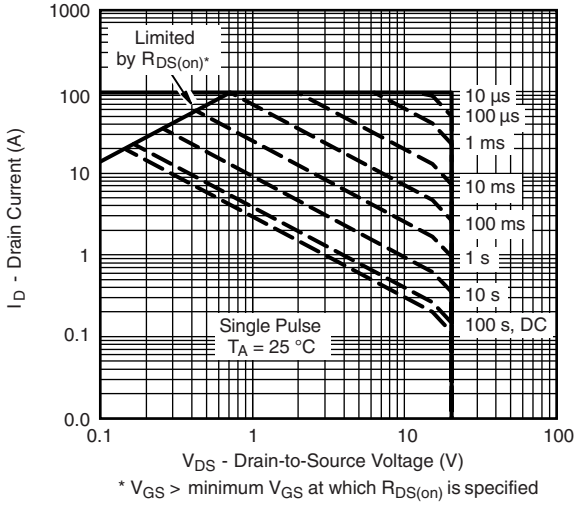



**Source-Drain Diode Forward Voltage**

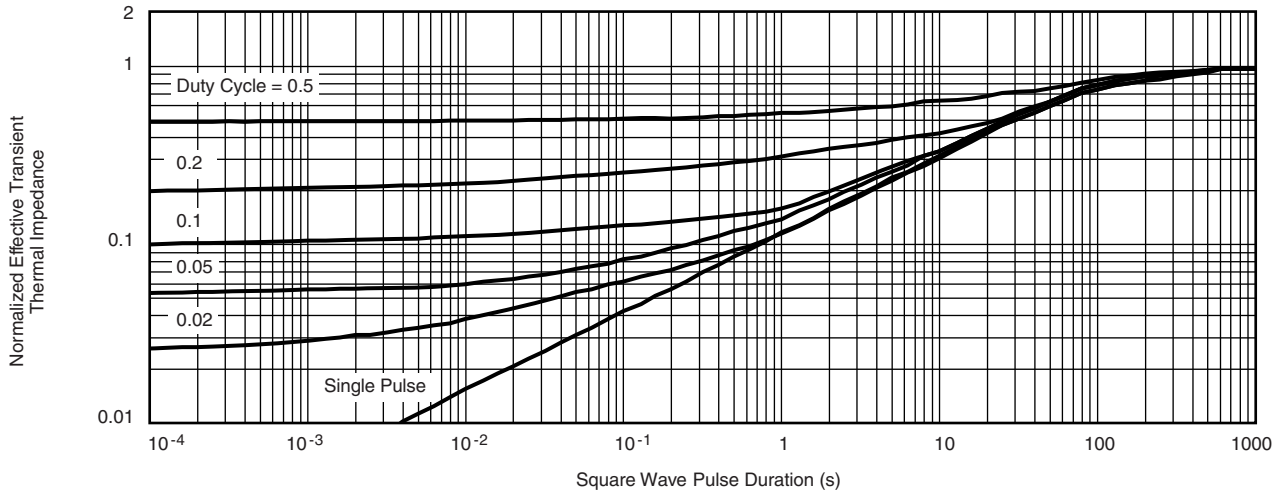
## THERMAL RATINGS




**Max. Avalanche and Drain Current vs. Ambient Temperature**




**Safe Operating Area**




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

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