# N-Channel 40-V (D-S), 175°C MOSFET

| PRODUCT SUMMARY | | |
|---|---|---|
| $V_{(BR)DSS}$ (V) | $r_{DS(on)}$ (Ω) | $I_D$ (A)[c] |
| 40 | 0.0074 @ $V_{GS}$ = 10 V | 65 |
| | 0.011 @ $V_{GS}$ = 4.5 V | 54 |

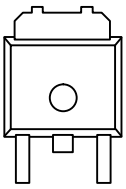
## FEATURES

- TrenchFET® Power MOSFETS
- 175°C Junction Temperature
- Low Threshold

## APPLICATIONS

- Motor Control
- Automotive
  - 12-V Boardnet

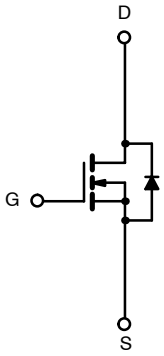
TO-252




Top View

Drain Connected to Tab

Ordering Information: SUD50N04-07L




N-Channel MOSFET

| ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25°C UNLESS OTHERWISE NOTED) | | | | |
|---|---|---|---|---|
| Parameter | | Symbol | Limit | Unit |
| Drain-Source Voltage | | $V_{DS}$ | 40 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | |
| Continuous Drain Current ($T_J$ = 175°C) | $T_C$ = 25°C | $I_D$ | 65[c] | A |
| | $T_C$ = 100°C | | 46[c] | |
| Pulsed Drain Current | | $I_{DM}$ | 100 | |
| Avalanche Current | | $I_{AR}$ | 40 | |
| Repetitive Avalanche Energy[a] | L = 0.1 mH | $E_{AR}$ | 80 | mJ |
| Power Dissipation | $T_C$ = 25°C | $P_D$ | 65 | W |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | -55 to 175 | °C |

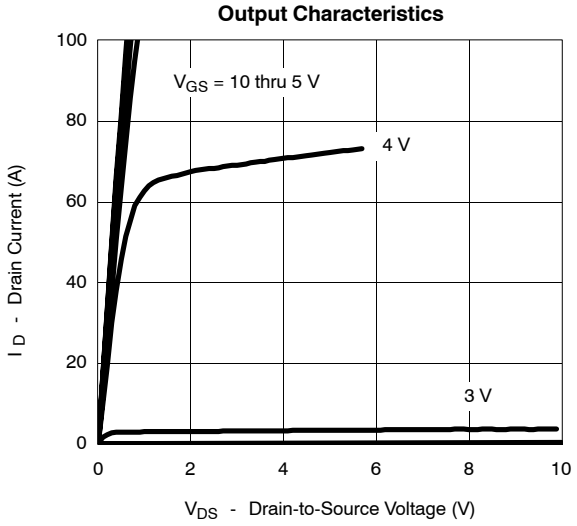
| THERMAL RESISTANCE RATINGS | | | | | |
|---|---|---|---|---|---|
| Parameter | | Symbol | Typical | Maximum | Unit |
| Junction-to-Ambient[b] | t ≤ 10 sec | $R_{thJA}$ | 18 | 22 | °C/W |
| | Steady State | | 40 | 50 | |
| Junction-to-Case | | $R_{thJC}$ | 1.9 | 2.3 | |

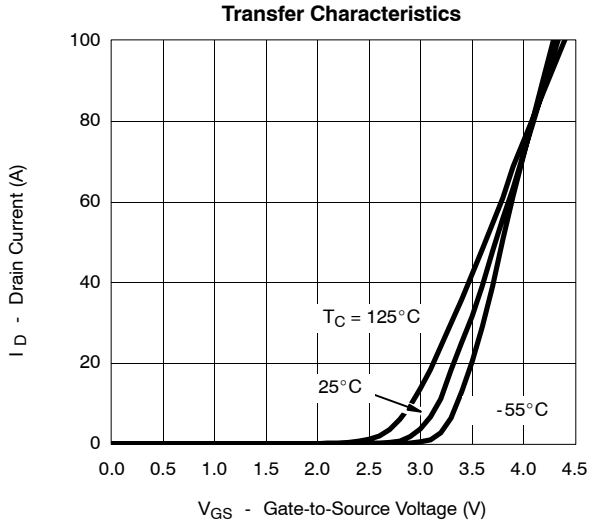
Notes:
a. Duty cycle ≤ 1%.
b. Surface mounted on 1" FR4 board.
c. Based on maximum allowable Junction Temperature. Package limitation current is 50 A.

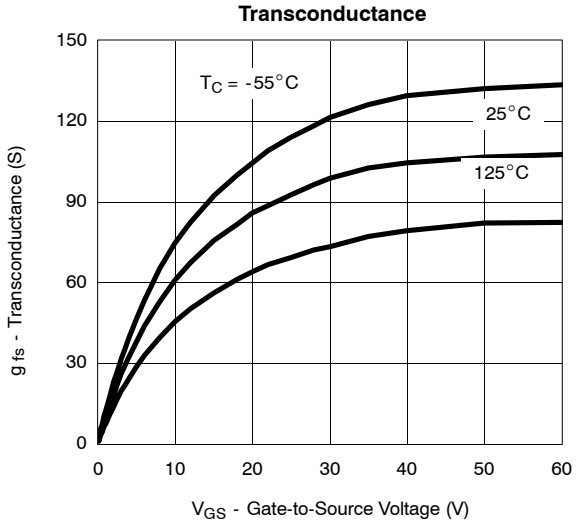
| SPECIFICATIONS ($T_J$ = 25°C UNLESS OTHERWISE NOTED) | | | | | | |
|---|---|---|---|---|---|---|
| **Parameter** | **Symbol** | **Test Condition** | **Min** | **Typ** | **Max** | **Unit** |
| **Static** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0 V, $I_D$ = 250 μA | 40 | | | V |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_{DS}$ = 250 μA | 1 | | 3 | |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ±20 V | | | ±100 | nA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 32 V, $V_{GS}$ = 0 V | | | 1 | μA |
| | | $V_{DS}$ = 32 V, $V_{GS}$ = 0 V, $T_J$ = 125°C | | | 50 | |
| | | $V_{DS}$ = 32 V, $V_{GS}$ = 0 V, $T_J$ = 175°C | | | 150 | |
| On-State Drain Current[a] | $I_{D(on)}$ | $V_{DS}$ = 5 V, $V_{GS}$ = 10 V | 65 | | | A |
| Drain-Source On-State Resistance[a] | $r_{DS(on)}$ | $V_{GS}$ = 10 V, $I_D$ = 20 A | | 0.006 | 0.0074 | Ω |
| | | $V_{GS}$ = 10 V, $I_D$ = 20 A, $T_J$ = 125°C | | | 0.012 | |
| | | $V_{GS}$ = 10 V, $I_D$ = 20 A, $T_J$ = 175°C | | | 0.015 | |
| | | $V_{GS}$ = 4.5 V, $I_D$ = 10 A | | 0.0085 | 0.011 | |
| Forward Transconductance[a] | $g_{fs}$ | $V_{DS}$ = 15 V, $I_D$ = 15 A | 20 | 57 | | S |
| **Dynamic[b]** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 25 V, f = 1 MHz | | 2800 | | pF |
| Output Capacitance | $C_{oss}$ | | | 320 | | |
| Reversen Transfer Capacitance | $C_{rss}$ | | | 190 | | |
| Total Gate Charge[c] | $Q_g$ | $V_{DS}$ = 20 V, $V_{GS}$ = 10 V, $I_D$ = 50 A | | 50 | 75 | nC |
| Gate-Source Charge[c] | $Q_{gs}$ | | | 10 | | |
| Gate-Drain Charge[c] | $Q_{gd}$ | | | 10 | | |
| Gate Resistance | $R_g$ | | | 2.0 | | Ω |
| Turn-On Delay Time[c] | $t_{d(on)}$ | $V_{DD}$ = 20 V, $R_L$ = 0.4 Ω<br>$I_D$ ≃ 50 A, $V_{GEN}$ = 10 V, $R_G$ = 2.5 Ω | | 11 | 20 | ns |
| Rise Time[c] | $t_r$ | | | 20 | 30 | |
| Turn-Off Delay Time[c] | $t_{d(off)}$ | | | 40 | 60 | |
| Fall Time[c] | $t_f$ | | | 15 | 25 | |
| **Source-Drain Ciode Ratings and Characteristics ($T_C$ = 25°C)[b]** | | | | | | |
| Continuous Current | $I_s$ | | | | 43 | A |
| Pulsed Current | $I_{SM}$ | | | | 100 | |
| Forward Voltage[a] | $V_{SD}$ | $I_F$ = 30 A, $V_{GS}$ = 0 V | | 0.90 | 1.50 | V |
| Reverse Recovery Time | $t_{rr}$ | $I_F$ = 30 A, di/dt = 100 A/μs | | 30 | 45 | ns |

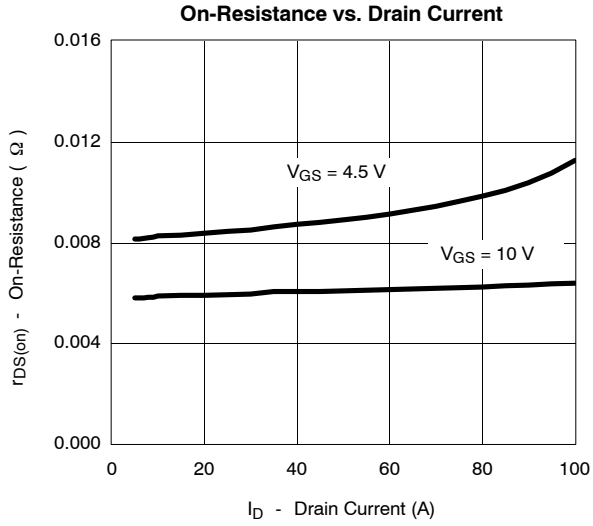
Notes:
a. Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2%.
b. Guaranteed by design, not subject to production testing.
c. Independent of operating temperature.

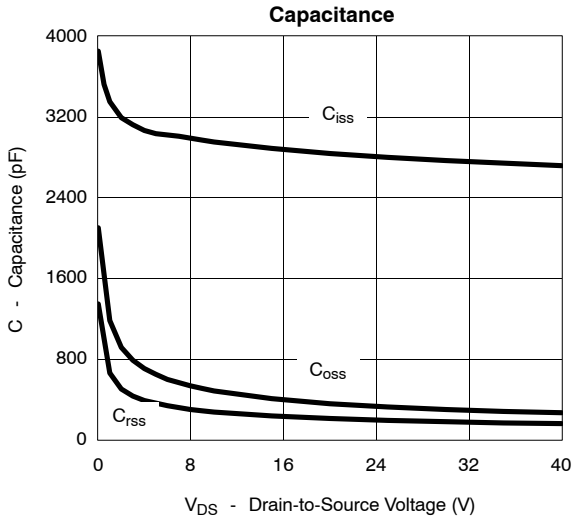
## TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)

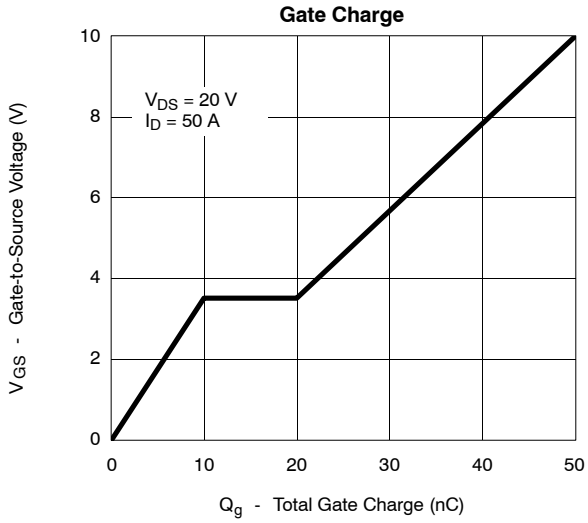


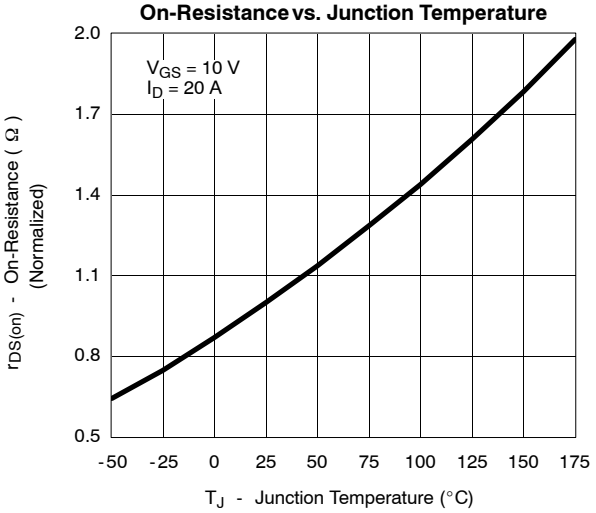



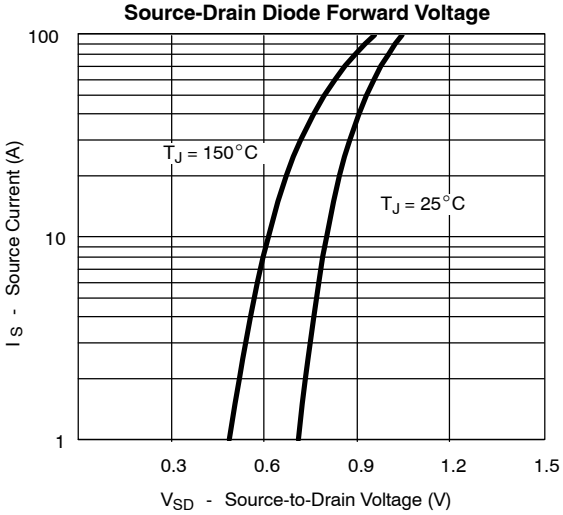



## TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)

**On-Resistance vs. Junction Temperature**

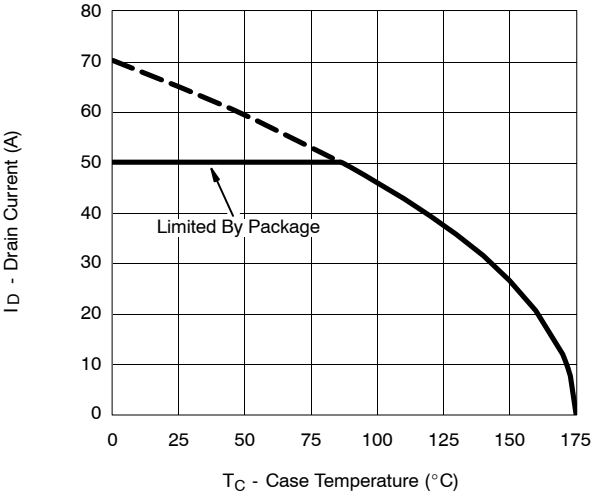



**Source-Drain Diode Forward Voltage**

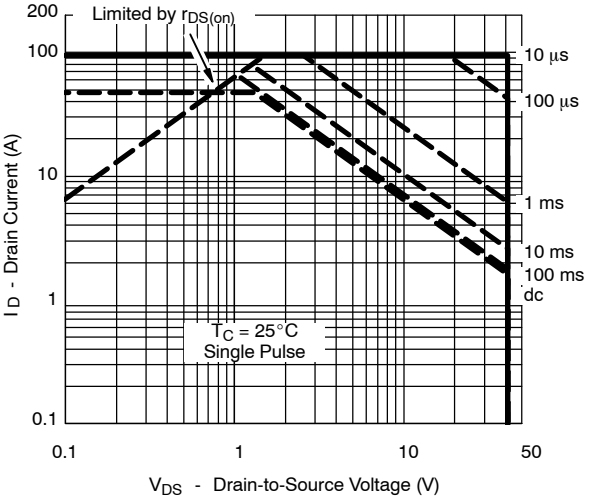



## THERMAL RATINGS

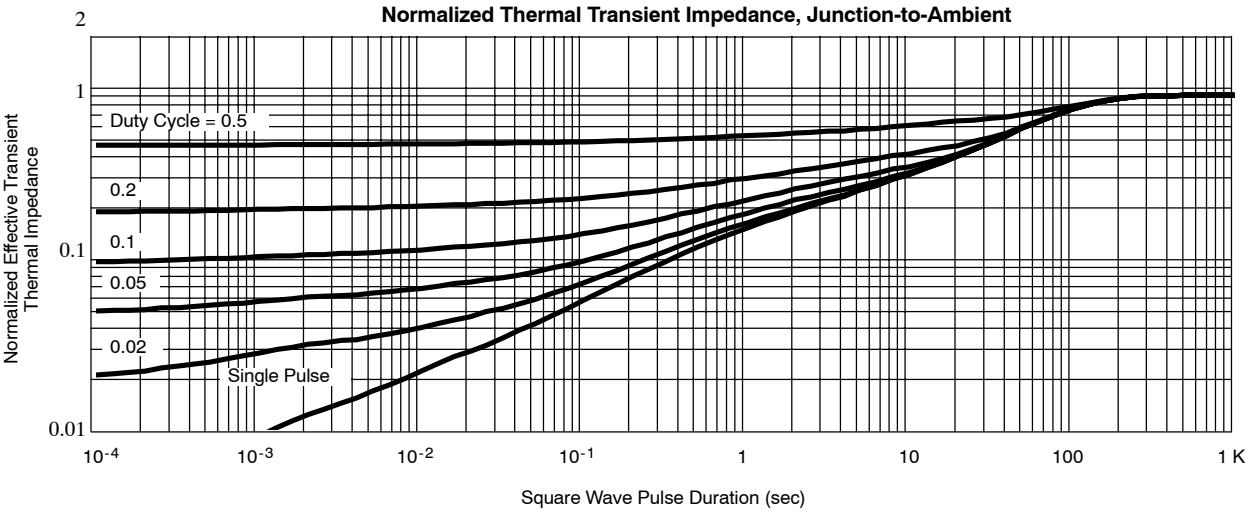
**Maximum Avalanche and Drain Current vs. Case Temperature**




**Safe Operating Area**




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



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