# N-Channel 20-V (D-S) 175 °C MOSFET

| PRODUCT SUMMARY | | |
|---|---|---|
| $V_{(BR)DSS}$ (V) | $r_{DS(on)}$ ($\Omega$) | $I_D$ (A)[a] |
| 20 | 0.0039 at $V_{GS}$ = 10 V | 60 |
| | 0.0052 at $V_{GS}$ = 4.5 V | 60 |

## FEATURES

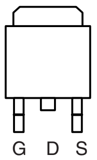
- TrenchFET® Power MOSFET
- 175 °C Junction Temperature
- 100 % $R_g$ Tested
- 100 % UIS Tested

RoHS
COMPLIANT

## APPLICATIONS

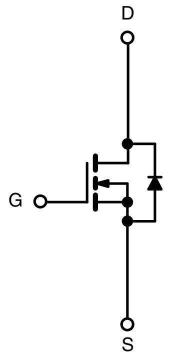
- OR-ing

**TO-263**



Top View

DRAIN connected to TAB



**Ordering Information:** SUM60N02-3m9P-E3 (Lead (Pb)-free)

N-Channel MOSFET

### 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 ($T_J$ = 175 °C) | $T_C$ = 25 °C | $I_D$ | 60[a] | A |
| | $T_C$ = 100 °C | | 60[a] | |
| Pulsed Drain Current | | $I_{DM}$ | 120 | |
| Single Pulse Avalanche Current | L = 0.1 mH | $I_{AS}$ | 50 | |
| Single Pulse Avalanche Energy | | $E_{AS}$ | 125 | mJ |
| Maximum Power Dissipation[b] | $T_C$ = 25 °C | $P_D$ | 120[c] | W |
| | $T_A$ = 25 °C[d] | | 3.75 | |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | - 55 to 175 | °C |

### THERMAL RESISTANCE RATINGS

| Parameter | Symbol | Limit | Unit |
|---|---|---|---|
| Junction-to-Ambient (PCB Mount)[d] | $R_{thJA}$ | 40 | °C/W |
| Junction-to-Case | $R_{thJC}$ | 1.25 | |

Notes:
a. Package limited.
b. Duty cycle ≤ 1 %.
c. See SOA curve for voltage derating.
d. When mounted on 1" square PCB (FR-4 material).

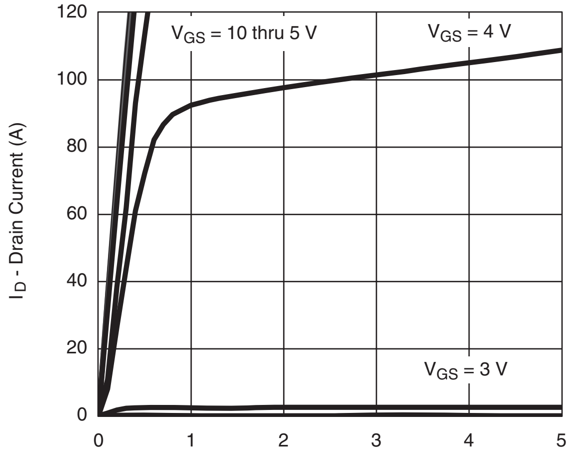
**SPECIFICATIONS** $T_J$ = 25 °C, unless otherwise noted

| Parameter | Symbol | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **Static** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{DS}$ = 0 V, $I_D$ = 250 µA | 20 | | | V |
| Gate-Threshold Voltage | $V_{GS(th)}$ | $V_{DS} = V_{GS}$, $I_D$ = 250 µA | 1.0 | | 3 | |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ± 20 V | | | ± 100 | nA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 20 V, $V_{GS}$ = 0 V | | | 1 | µA |
| | | $V_{DS}$ = 20 V, $V_{GS}$ = 0 V, $T_J$ = 125 °C | | | 50 | |
| | | $V_{DS}$ = 20 V, $V_{GS}$ = 0 V, $T_J$ = 175 °C | | | 250 | |
| On-State Drain Current[a] | $I_{D(on)}$ | $V_{DS} \geq 5$ V, $V_{GS}$ = 10 V | 100 | | | A |
| Drain-Source On-State Resistance[a] | $r_{DS(on)}$ | $V_{GS}$ = 10 V, $I_D$ = 20 A | | 0.0031 | 0.0039 | Ω |
| | | $V_{GS}$ = 10 V, $I_D$ = 20 A, $T_J$ = 125 °C | | | 0.0059 | |
| | | $V_{GS}$ = 10 V, $I_D$ = 20 A, $T_J$ = 175 °C | | | 0.007 | |
| | | $V_{GS}$ = 4.5 V, $I_D$ = 20 A | | 0.0042 | 0.0052 | |
| Forward Transconductance[a] | $g_{fs}$ | $V_{DS}$ = 10 V, $I_D$ = 20 A | | 95 | | S |
| **Dynamic**[b] | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0 V, $V_{DS}$ = 10 V, f = 1 MHz | | 5950 | | pF |
| Output Capacitance | $C_{oss}$ | | | 985 | | |
| Reverse Transfer Capacitance | $C_{rss}$ | | | 365 | | |
| Total Gate Charge[b] | $Q_g$ | $V_{DS}$ = 10 V, $V_{GS}$ = 4.5 V, $I_D$ = 50 A | | 33 | 50 | nC |
| Gate-Source Charge[b] | $Q_{gs}$ | | | 18 | | |
| Gate-Drain Charge[b] | $Q_{gd}$ | | | 7 | | |
| Gate Resistance | $R_g$ | | 0.75 | 1.5 | 2.3 | Ω |
| Turn-On Delay Time[b] | $t_{d(on)}$ | $V_{DD}$ = 10 V, $R_L$ = 0.2 Ω<br>$I_D \cong$ 50 A, $V_{GEN}$ = 10 V, $R_g$ = 1.0 Ω | | 15 | 25 | ns |
| Rise Time[b] | $t_r$ | | | 7 | 11 | |
| Turn-Off Delay Time[b] | $t_{d(off)}$ | | | 35 | 55 | |
| Fall Time[b] | $t_f$ | | | 8 | 12 | |
| **Source-Drain Diode Ratings and Characteristics** $T_C$ = 25 °C[c] | | | | | | |
| Continuous Current | $I_S$ | | | | 60 | A |
| Pulsed Current | $I_{SM}$ | | | | 100 | |
| Forward Voltage[a] | $V_{SD}$ | $I_F$ = 20 A, $V_{GS}$ = 0 V | | 0.85 | 1.5 | V |
| Reverse Recovery Time | $t_{rr}$ | $I_F$ = 20 A, di/dt = 100 A/µs | | 45 | 90 | ns |
| Peak Reverse Recovery Current | $I_{RM}$ | | | 1.7 | 3.4 | A |
| Reverse Recovery Charge | $Q_{rr}$ | | | 0.039 | 0.155 | µC |

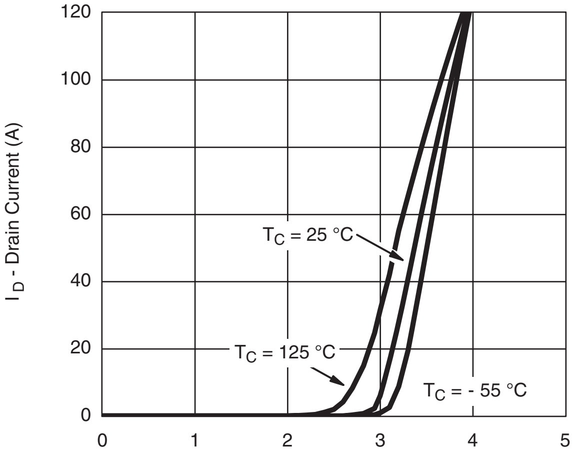
Notes:
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %
b. Independent of operating temperature.
c. Guaranteed by design, not subject to production testing.

*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.*

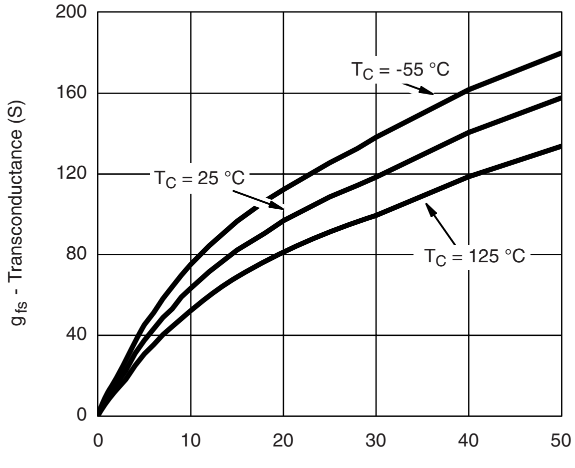
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



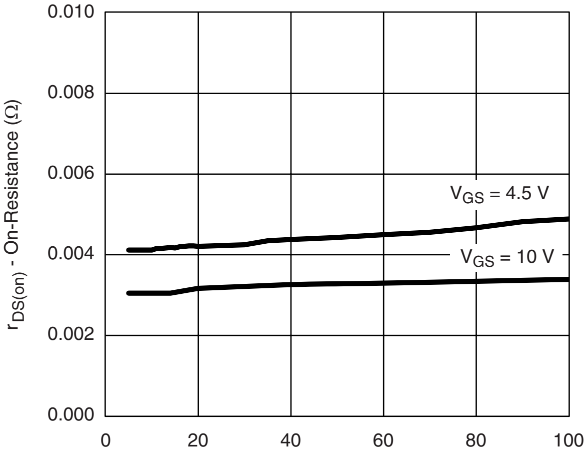
**Output Characteristics**



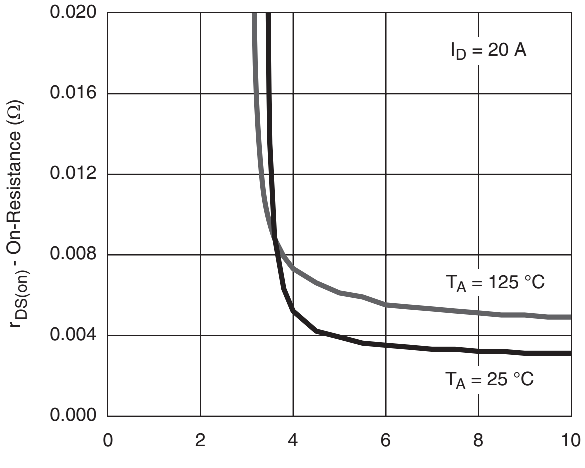
**Transfer Characteristics**



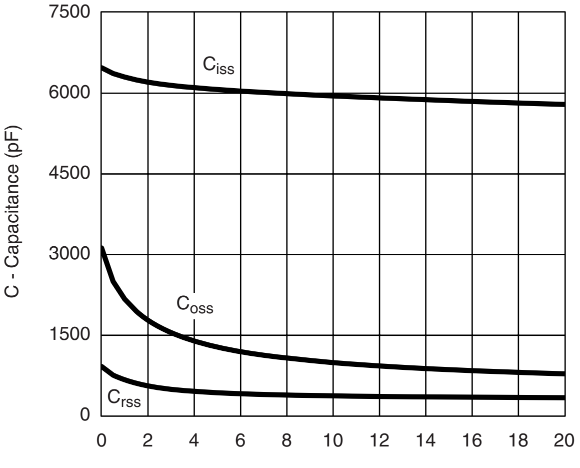
**Transconductance**



**On-Resistance vs. Drain Current**

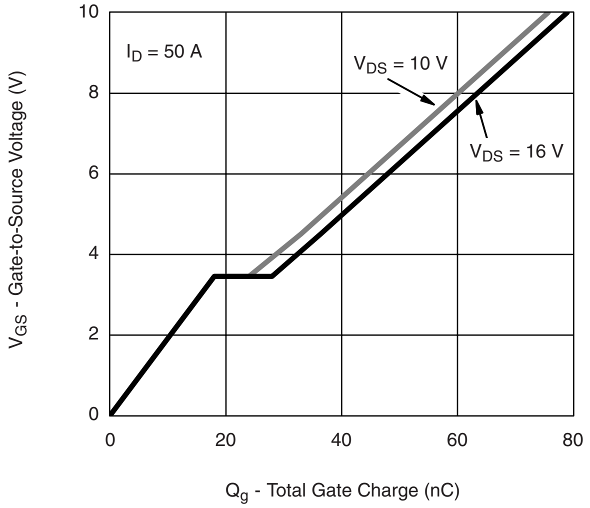


**On-Resistance vs. Gate-to-Source Voltage**

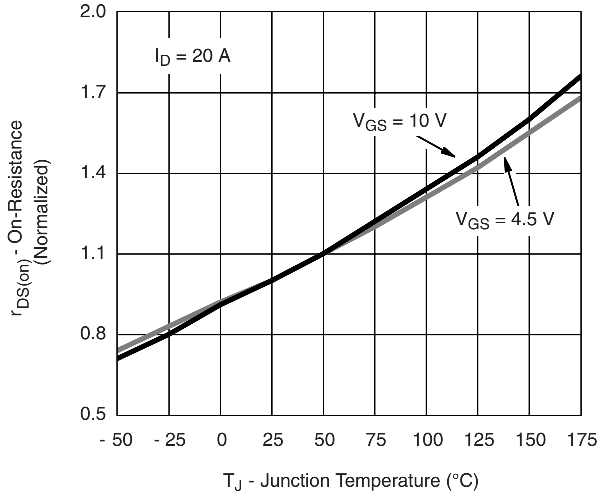


**Capacitance**

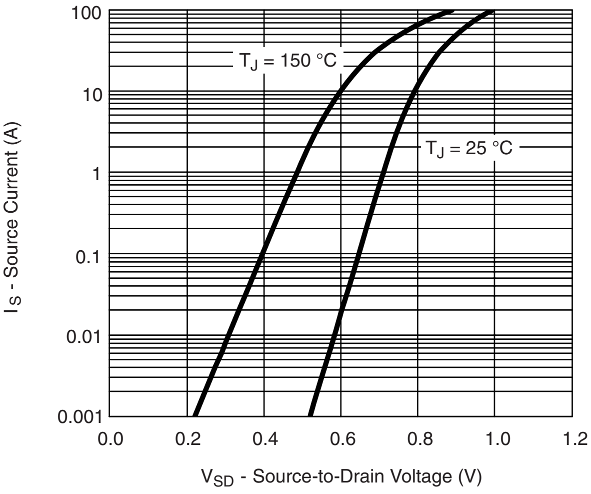
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



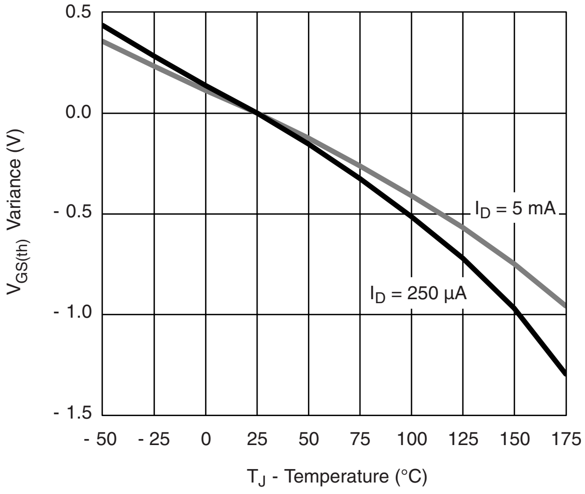
**Gate Charge**



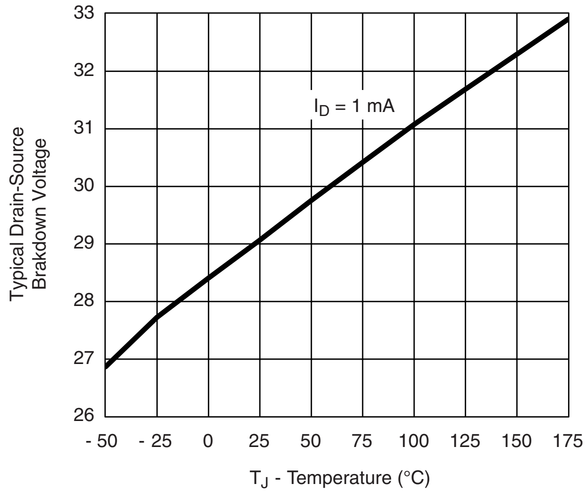
**On-Resistance vs. Junction Temperature**



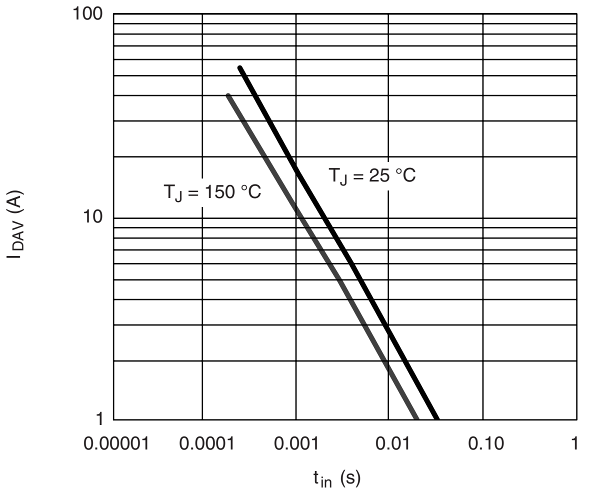
**Source-Drain Diode Forward Voltage**



**Threshold Voltage**

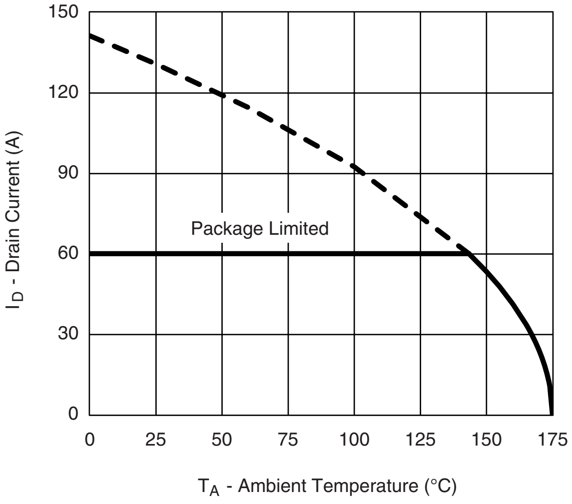


**Typical Drain-Source Brakdown Voltage vs. Junction Temperature**

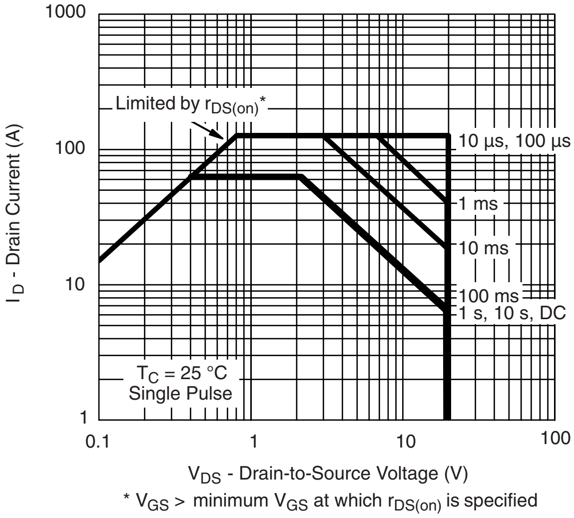


**Single Pulse Avalanche Current vs. Time**

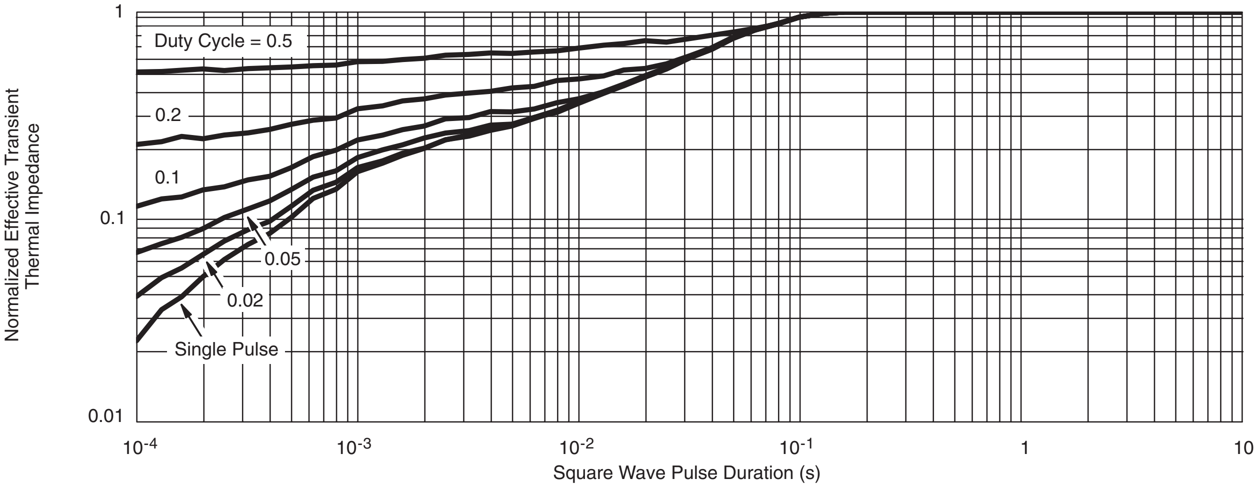
## TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



**Drain Current vs. Ambient Temperature**



**Safe Operating Area**



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

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