# N-Channel 20-, 30-, 40-V (D-S) MOSFETs

| PRODUCT SUMMARY | | | | |
|---|---|---|---|---|
| **Part Number** | **$V_{(BR)DSS}$ Min (V)** | **$r_{DS(on)}$ Max (Ω)** | **$V_{GS(th)}$ (V)** | **$I_D$ (A)** |
| TN0201L | 20 | 1.2 @ $V_{GS}$ = 10 V | 0.5 to 2 | 0.64 |
| TN0401L | 40 | 1.2 @ $V_{GS}$ = 10 V | 0.5 to 2 | 0.64 |
| VN0300L | 30 | 1.2 @ $V_{GS}$ = 10 V | 0.8 to 2.5 | 0.64 |
| VN0300LS | 30 | 1.2 @ $V_{GS}$ = 10 V | 0.8 to 2.5 | 0.67 |

## FEATURES

- Low On-Resistance: 0.85 Ω
- Low Threshold: 1.4 V
- Low Input Capacitance: 38 pF
- Fast Switching Speed: 9 ns
- Low Input and Output Leakage

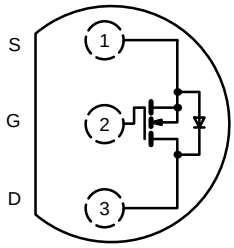
## BENEFITS

- Low Offset Voltage
- Low-Voltage Operation
- Easily Driven Without Buffer
- High-Speed Circuits
- Low Error Voltage

## APPLICATIONS

- Direct Logic-Level Interface: TTL/CMOS
- Drivers: Relays, Solenoids, Lamps, Hammers, Displays, Memories, Transistors, etc.
- Battery Operated Systems
- Solid-State Relays

**TO-226AA (TO-92)**




Top View

TN0201L
TN0401L
VN0300L

Device Marking
Front View

**TN0201L**

"S" TN
0201L
*xxyy*

**TN0401L**

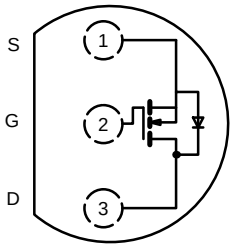
"S" TN
0401L
*xxyy*

**VN0300L**

"S" VN
0300L
*xxyy*

"S" = Siliconix Logo
*xxyy* = Date Code

**TO-92S (Copper Lead Frame)**




Top View

VN0300LS

Device Marking
Front View

**VN0300LS**

"S" VN
0300LS
*xxyy*

"S" = Siliconix Logo
*xxyy* = Date Code

| ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25°C UNLESS OTHERWISE NOTED) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | | **Symbol** | **TN0201L** | **TN0401L** | **VN0300L** | **VN0300LS** | **Unit** |
| Drain-Source Voltage | | $V_{DS}$ | 20 | 40 | 30 | 30 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | ±20 | ±30 | ±30 | |
| Continuous Drain Current ($T_J$ = 150°C) | $T_A$= 25°C | $I_D$ | 0.64 | 0.64 | 0.64 | 0.67 | A |
| | $T_A$= 100°C | | 0.38 | 0.38 | 0.38 | 0.43 | |
| Pulsed Drain Current[a] | | $I_{DM}$ | 1.5 | 1.5 | 3 | 3 | |
| Power Dissipation | $T_A$= 25°C | $P_D$ | 0.8 | 0.8 | 0.8 | 0.9 | W |
| | $T_A$= 100°C | | 0.32 | 0.32 | 0.32 | 0.4 | |
| Thermal Resistance, Junction-to-Ambient | | $R_{thJA}$ | 156 | 156 | 156 | 156 | °C/W |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | –55 to 150 | | | | °C |

Notes
a. Pulse width limited by maximum junction temperature.

## SPECIFICATIONS ($T_A$ = 25°C UNLESS OTHERWISE NOTED)

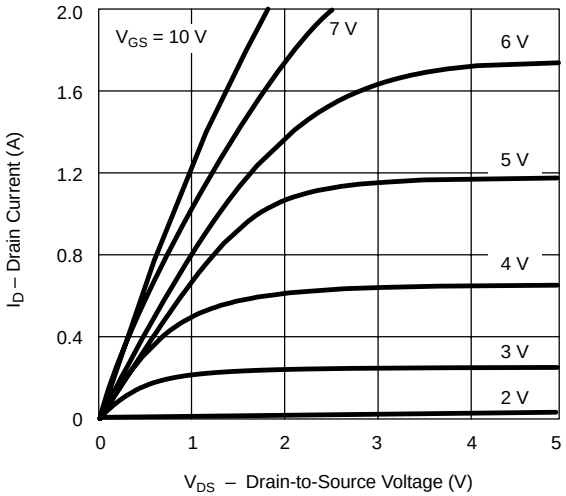
| Parameter | Symbol | Test Conditions | | Typ[a] | Limits TN0201L TN0401L Min | Limits TN0201L TN0401L Max | Limits VN0300L VN0300LS Min | Limits VN0300L VN0300LS Max | Unit |
|---|---|---|---|---|---|---|---|---|---|
| **Static** | | | | | | | | | |
| Drain-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0 V, $I_D$ = 10 μA | TN0201L | 55 | 20 | | | | V |
| | | | TN0401L | 55 | 40 | | | | |
| | | | | | | | 30 | | |
| Gate-Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = 0.25 mA | | 1.4 | 0.5 | 2 | | | |
| | | $V_{DS}$ = $V_{GS}$, $I_D$ = 1 mA | | 1.5 | | | 0.8 | 2.5 | |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ±20 V | | | | ±10 | | | nA |
| | | $V_{DS}$ = 0 V, $V_{GS}$ = ±30 V | | | | | | ±100 | |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = 30 V, $V_{GS}$ = 0 V | | | | | | 10 | μA |
| | | | $T_J$ = 125°C | | | | | 500 | |
| | | $V_{DS}$ = 0.8 x $V_{(BR)DSS}$, $V_{GS}$ = 0 V | | | | 1 | | | |
| | | | $T_J$ = 125°C | | | 100 | | | |
| On-State Drain Current[b] | $I_{D(on)}$ | $V_{DS}$ = 10 V, $V_{GS}$ = 4.5 V | | 0.9 | 0.25 | | | | A |
| | | $V_{DS}$ = 10 V, $V_{GS}$ = 10 V | | 3.5 | 1 | | 1 | | |
| Drain-Source On-Resistance[b] | $r_{DS(on)}$ | $V_{GS}$ = 3.5 V, $I_D$ = 0.05 A | | 1.8 | | 4 | | | Ω |
| | | $V_{GS}$ = 5 V, $I_D$ = 0.3 A | | 1.2 | | | | 3.3 | |
| | | $V_{GS}$ = 4.5 V, $I_D$ = 0.25 A | | 1.4 | | 2 | | | |
| | | | $T_J$ = 125°C | 2.6 | | 4 | | | |
| | | $V_{GS}$ = 10 V, $I_D$ = 1 A | | 0.85 | | 1.2 | | 1.2 | |
| | | | $T_J$ = 125°C | 1.6 | | | | 2.4 | |
| Forward Transconductance[b] | $g_{fs}$ | $V_{DS}$ = 10 V, $I_D$ = 0.5 A | | 500 | 200 | | 200 | | mS |
| **Dynamic** | | | | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{DS}$ = 15 V, $V_{GS}$ = 0 V, f = 1 MHz | | 38 | | 60 | | 100 | pF |
| Output Capacitance | $C_{oss}$ | | | 33 | | 50 | | 95 | |
| Reverse Transfer Capacitance | $C_{rss}$ | | | 8 | | 15 | | 25 | |
| **Switching[c]** | | | | | | | | | |
| Turn-On Time | $t_{ON}$ | $V_{DD}$ = 15 V, $R_L$ = 14 Ω, $I_D$ ≅ 1 A, $V_{GEN}$ = 10 V, $R_G$ = 25 Ω | | 10 | | 30 | | 30 | ns |
| Turn-Off Time | $t_{OFF}$ | | | 13 | | 30 | | 30 | |

Notes
a. For DESIGN AID ONLY, not subject to production testing..
b. Pulse test: PW ≤300 μs duty cycle ≤2%.
c. Switching time is essentially independent of operating temperature.

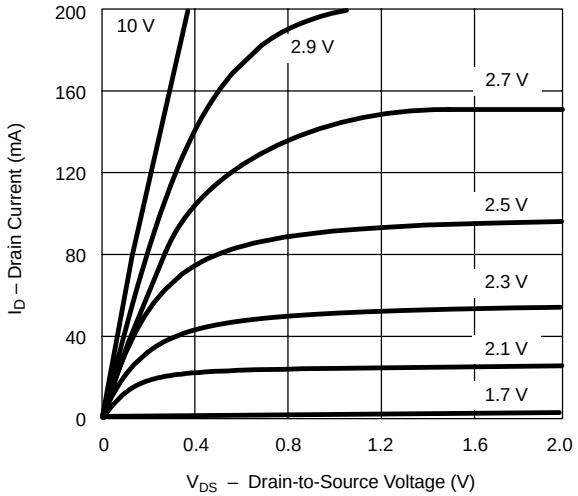
VNDQ03

## TYPICAL CHARACTERISTICS ($T_A$ = 25°C UNLESS OTHERWISE NOTED)

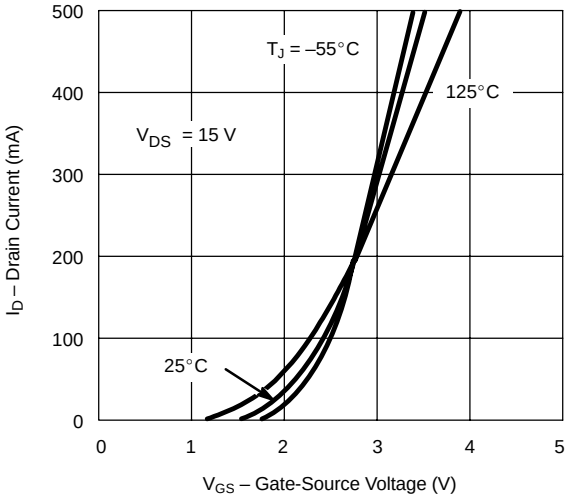
**Ohmic Region Characteristics**



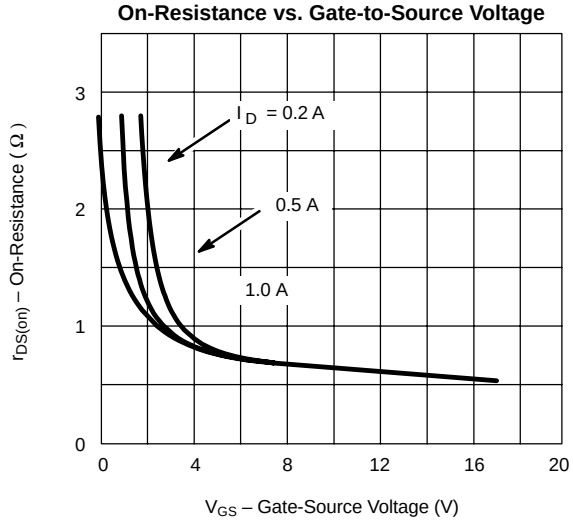

**Output Characteristics for Low Gate Drive**



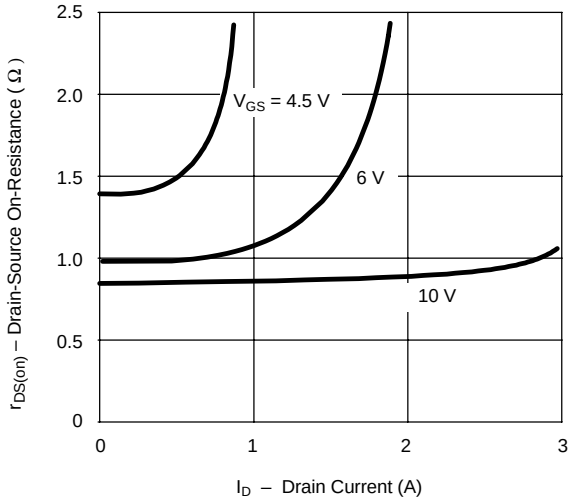

**Transfer Characteristics**



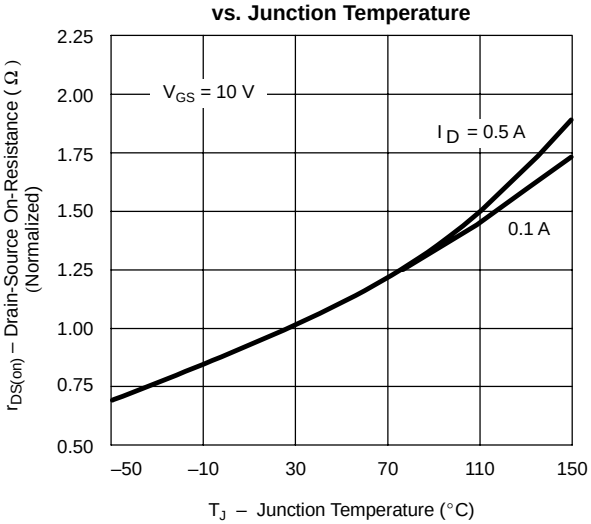

**On-Resistance vs. Gate-to-Source Voltage**




**On-Resistance vs. Drain Current**

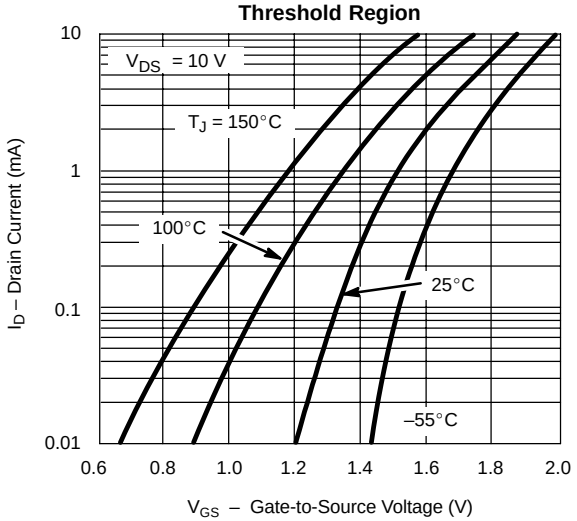



**Normalized On-Resistance vs. Junction Temperature**

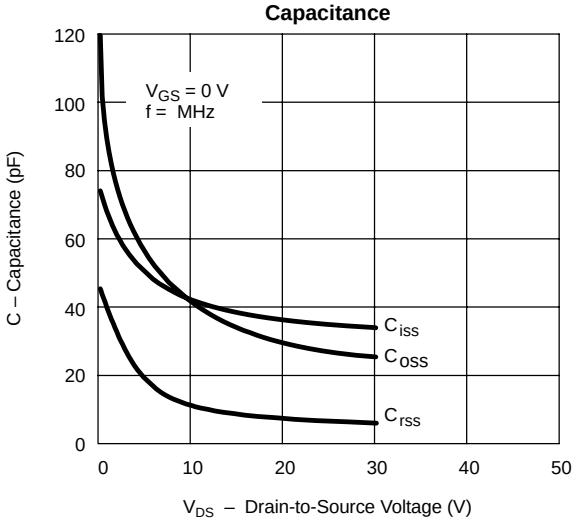


## TYPICAL CHARACTERISTICS ($T_A$ = 25°C UNLESS OTHERWISE NOTED)

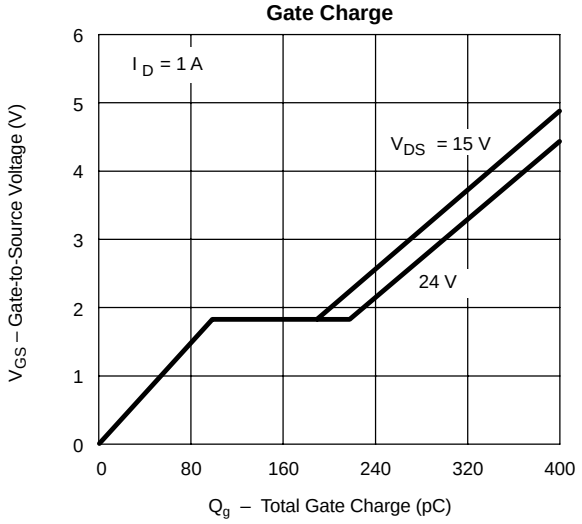
**Threshold Region**



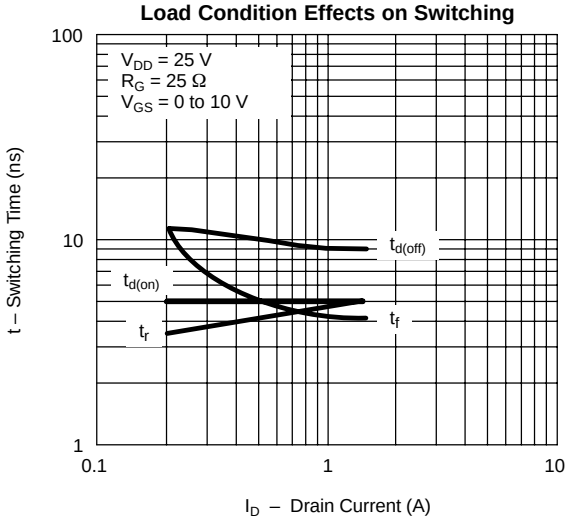

**Capacitance**



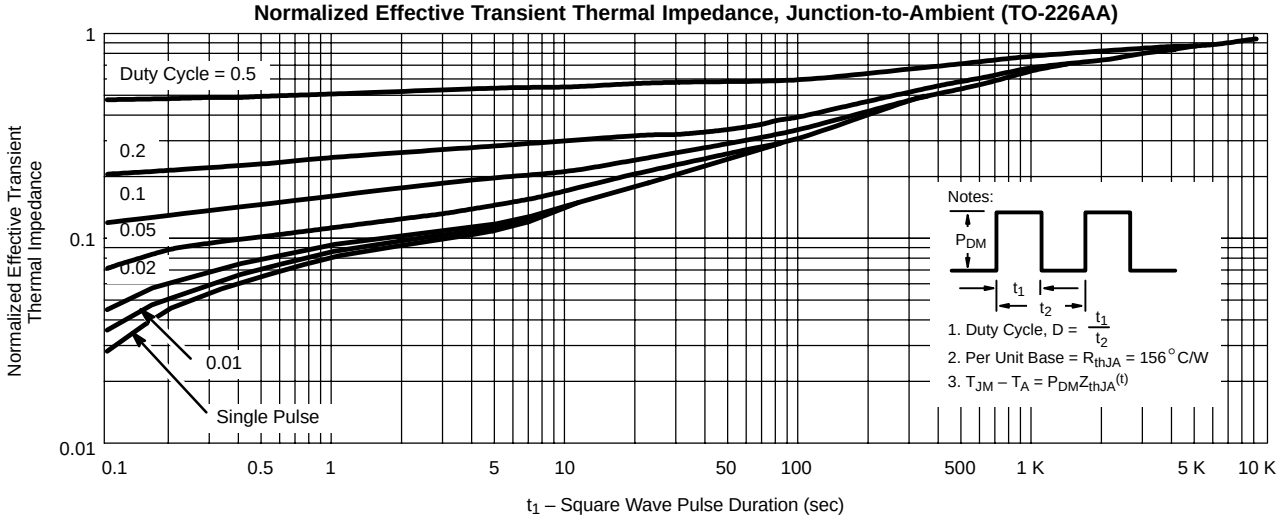

**Gate Charge**




**Load Condition Effects on Switching**




**Normalized Effective Transient Thermal Impedance, Junction-to-Ambient (TO-226AA)**



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