# P-Channel Enhancement-Mode MOSFET Transistors

## Product Summary

| Part Number | $V_{(BR)DSS}$ Min (V) | $r_{DS(on)}$ Max (Ω) | $V_{GS(th)}$ (V) | $I_D$ (A) |
|---|---|---|---|---|
| VP0300B | –30 | 2.5 @ $V_{GS}$ = –12 V | –2 to –4.5 | –1.25 |
| VP0300L | | 2.5 @ $V_{GS}$ = –12 V | –2 to –4.5 | –0.32 |
| VP0300M | | 2.5 @ $V_{GS}$ = –12 V | –2 to –4.5 | –0.5 |
| VQ2001J | | 2 @ $V_{GS}$ = –12 V | –2 to –4.5 | –0.6 |
| VQ2001P | | 2 @ $V_{GS}$ = –12 V | –2 to –4.5 | –0.6 |

## Features

- High-Side Switching
- Low On-Resistance: 1.5 Ω
- Moderate Threshold: –3.1 V
- Fast Switching Speed: 17 ns
- Low Input Capacitance: 60 pF

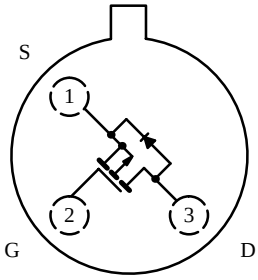
## Benefits

- Ease in Driving Switches
- Low Offset (Error) Voltage
- Low-Voltage Operation
- High-Speed Switching
- Easily Driven Without Buffer

## Applications

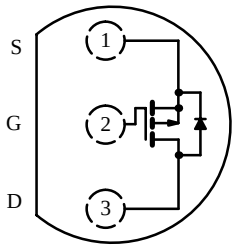
- Drivers: Relays, Solenoids, Lamps, Hammers, Displays, Memories, Transistors, etc.
- Battery Operated Systems
- Power Supply, Converter Circuits
- Motor Control

TO-205AD (TO-39)
(Case Drain)



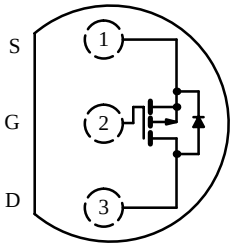

Top View
VP0300B

TO-226AA
(TO-92)



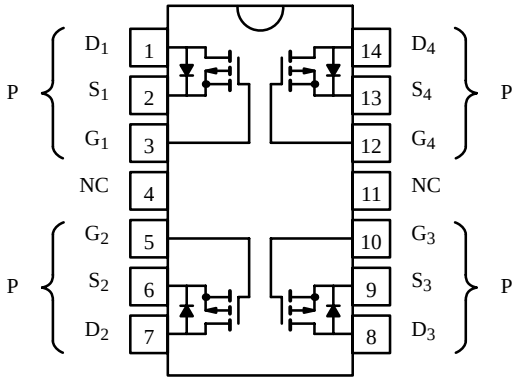

Top View
VP0300L

TO-237
(Tab Drain)




Top View
VP0300M

Dual-In-Line




Top View
Plastic: VQ2001J
Sidebraze: VQ2001P

Updates to this data sheet may be obtained via facsimile by calling Siliconix FaxBack, 1-408-970-5600. Please request FaxBack document #70217. Applications information may also be obtained via FaxBack, request document #70611.

## Absolute Maximum Ratings ($T_A$ = 25°C Unless Otherwise Noted)

| Parameter | | Symbol | VP0300B | VP0300L | VP0300M | VQ2001J/P Single | VQ2001J/P Total Quad | Unit |
|---|---|---|---|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | –30 | –30 | –30 | –30 | –30 | V |
| Gate-Source Voltage | | $V_{GS}$ | ± 20 | ± 20 | ± 20 | ± 20 | ± 20 | V |
| Continuous Drain Current ($T_J$ = 150°C) | $T_A$= 25°C | $I_D$ | –1.25[b] | –0.32 | –0.5 | –0.6 | –0.6 | A |
| | $T_A$= 100°C | | –0.79[b] | –0.2 | –0.32 | –0.37 | –0.37 | A |
| Pulsed Drain Current[a] | | $I_{DM}$ | –3 | –2.4 | –3 | –2 | –2 | A |
| Power Dissipation | $T_A$= 25°C | $P_D$ | 6.25[b] | 0.8 | 1 | 1.3 | 2 | W |
| | $T_A$= 100°C | | 2.5[b] | 0.32 | 0.4 | 0.52 | 0.8 | W |
| Maximum Junction-to-Ambient | | $R_{thJA}$ | 20[b] | 156 | 125 | 96 | 62.5 | °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.
b. Power dissipation and continuous drain current at $T_C$ = 25°C; $R_{thJC}$ = 20°C/W.

## Specifications[a]

| Parameter | Symbol | Test Conditions | Typ[b] | Limits VP0300B/L/M Min | Limits VP0300B/L/M Max | Limits VQ2001J/P Min | Limits VQ2001J/P Max | Unit |
|---|---|---|---|---|---|---|---|---|
| **Static** | | | | | | | | |
| Drain-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0 V, $I_D$ = –10 µA | –55 | –30 | | –30 | | V |
| Gate-Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = –1 mA | –3.1 | –2 | –4.5 | –2 | –4.5 | V |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = ± 16 V | | | | | ± 100 | nA |
| | | $T_J$ = 125°C | | | | | ± 500 | nA |
| | | $V_{DS}$ = 0 V, $V_{GS}$ = ± 20 V | | | ± 100 | | | nA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = –24 V, $V_{GS}$ = 0 V | | | –10 | | | µA |
| | | $T_J$ = 125°C | | | –500 | | –500 | µA |
| | | $V_{DS}$ = –30 V, $V_{GS}$ = 0 V | | | | | –10 | µA |
| On-State Drain Current[c] | $I_{D(on)}$ | $V_{DS}$ = –10 V, $V_{GS}$ = –12 V | –2.8 | –1.5 | | –1.5 | | A |
| Drain-Source On-Resistance[c] | $r_{DS(on)}$ | $V_{GS}$ = –12 V, $I_D$ = –1 A | 1.5 | | 2.5 | | 2 | Ω |
| | | $T_J$ = 125°C | 2.6 | | 3.6 | | 3.6 | Ω |
| Forward Transconductance[c] | $g_{fs}$ | $V_{DS}$ = –10 V, $I_D$ = –0.5 A | 370 | 200 | | 200 | | mS |
| Common Source Output Conductance[c] | $g_{os}$ | $V_{DS}$ = –7.5 V, $I_D$ = –0.05 A | 0.25 | | | | | mS |
| **Dynamic** | | | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{DS}$ = –15 V, $V_{GS}$ = 0 V f = 1 MHz | 60 | | 150 | | 150 | pF |
| Output Capacitance | $C_{oss}$ | | 40 | | 100 | | 100 | pF |
| Reverse Transfer Capacitance | $C_{rss}$ | | 10 | | 60 | | 60 | pF |

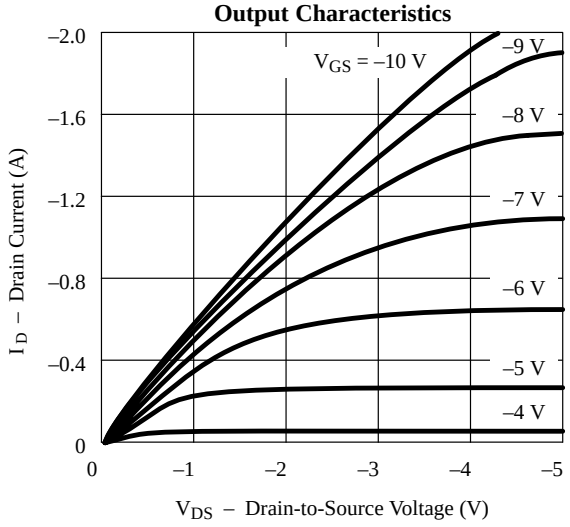
## Specifications[a]

| Parameter | Symbol | Test Conditions | Typ[b] | Limits | | | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | | | VP0300B/L/M | | VQ2001J/P | | |
| | | | | Min | Max | Min | Max | |
| **Switching[d]** | | | | | | | | |
| Turn-On Time | $t_{ON}$ | $V_{DD}$ = –25 V, $R_L$ = 23 Ω<br>$I_D \cong -1$ A, $V_{GEN}$ = –10 V<br>$R_G$ = 25 Ω | 19 | | 30 | | | ns |
| Turn-Off Time | $t_{OFF}$ | | 17 | | 30 | | | |
| Turn-On Time | $t_{ON}$ | $V_{DD}$ = –15 V, $R_L$ = 23 Ω<br>$I_D \cong -0.6$ A, $V_{GEN}$ = –10 V<br>$R_G$ = 25 Ω | 19 | | | | 30 | |
| Turn-Off Time | $t_{OFF}$ | | 16 | | | | 30 | |

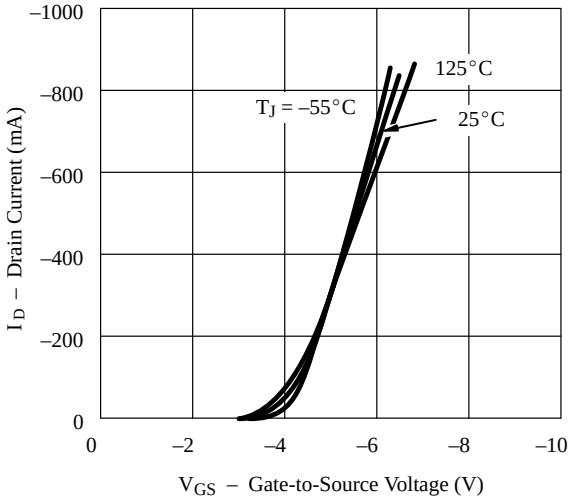
Notes
a. $T_A$ = 25°C unless otherwise noted. VPEA03
b. For DESIGN AID ONLY, not subject to production testing.
c. Pulse test: PW ≤ 300 µs duty cycle ≤ 2%.
d. Switching time is essentially independent of operating temperature.

## Typical Characteristics (25°C Unless Otherwise Noted)

**Output Characteristics**

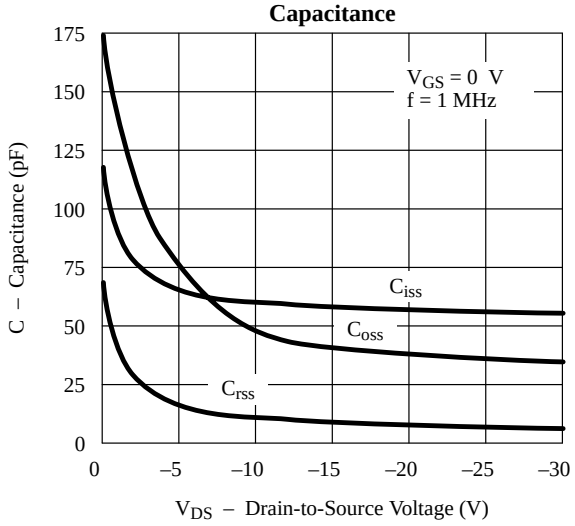



**Transfer Characteristics**

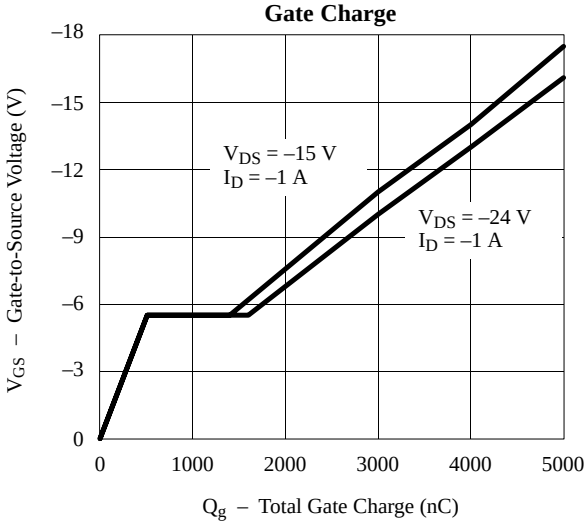


## Typical Characteristics (25°C Unless Otherwise Noted)

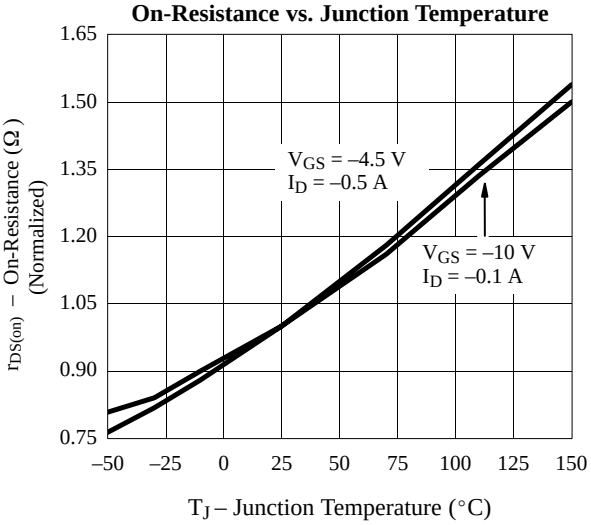
**Capacitance**



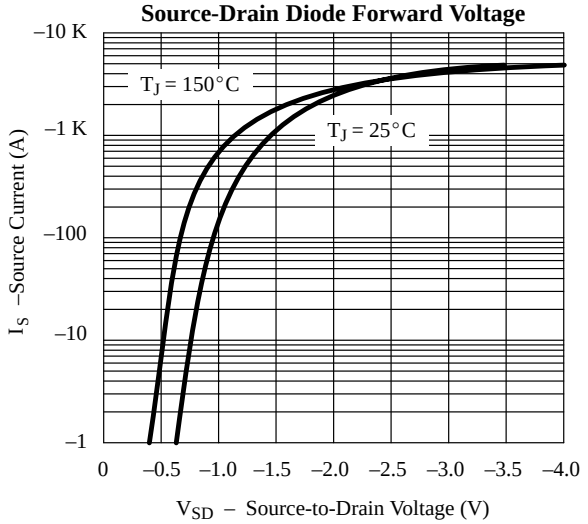

**Gate Charge**



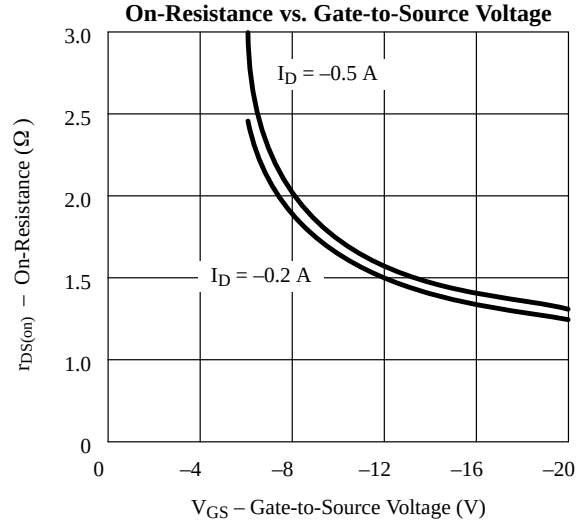

**On-Resistance vs. Junction Temperature**



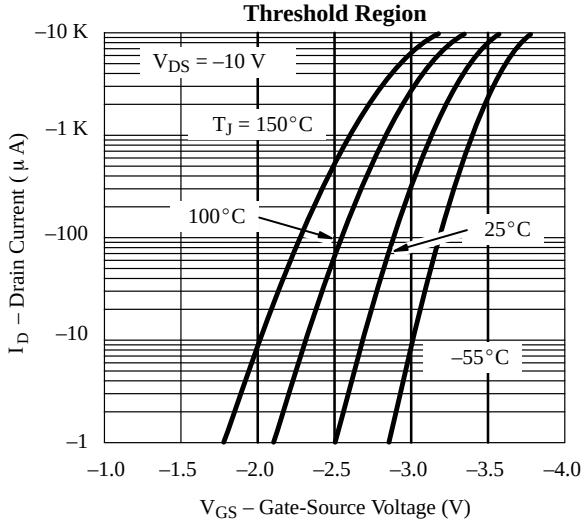

**Source-Drain Diode Forward Voltage**




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

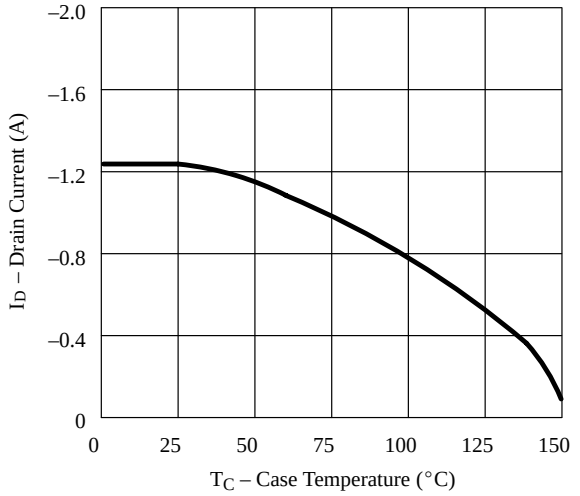



**Threshold Region**

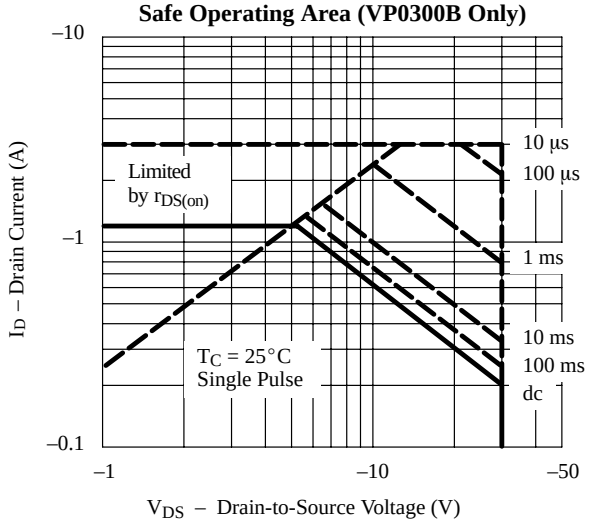


# Thermal Ratings

**Maximum Drain Current vs. Case Temperature (VP0300B Only)**




**Safe Operating Area (VP0300B Only)**




**Normalized Effective Transient Thermal Impedance, Junction-to-Ambient (TO-226AA, VP0300L Only)**