**SEMICONDUCTOR**
**TECHNICAL DATA**

# 2N4416A

## N-Channel, Small-Signal Field Effect Transistor

| MAXIMUM RATINGS | | | |
|---|---|---|---|
| **Rating** | **Symbol** | **Value** | **Unit** |
| Drain-Source Voltage | $V_{DS}$ | 35 | Vdc |
| Drain-Gate Voltage | $V_{DG}$ | 35 | Vdc |
| Gate-Source Voltage | $V_{GS}$ | –35 | Vdc |
| Gate Current | $I_G$ | 10 | mAdc |
| Storage Temperature Range | $T_{stg}$ | –65 to +200 | °C |
| Power Dissipation @ $T_A$ = 25°C<br>Derate above 25°C | $P_T$ | 300<br>1.7 | mW<br>mW/°C |

CASE 20-03, STYLE 1
TO-206AF (TO-72)

| ELECTRICAL CHARACTERISTICS ($T_A$ = 25°C unless otherwise noted.) | | | | |
|---|---|---|---|---|
| **Characteristic** | **Symbol** | **Min** | **Max** | **Unit** |
| **OFF CHARACTERISTICS** | | | | |
| Gate-Source Breakdown Voltage ($I_G$ = 1.0 µAdc, $V_{DS}$ = 0) | $V_{(BR)GSS}$ | 35 | — | Vdc |
| Gate Reverse Current ($V_{GS}$ = –20 Vdc, $V_{DS}$ = 0)<br>($V_{GS}$ = –20 Vdc, $V_{DS}$ = 0, $T_A$ = 150°C | $I_{GSS}$ | —<br>— | –0.1<br>–0.1 | nAdc<br>µAdc |
| Gate Source Cutoff Voltage ($I_D$ = 1.0 nAdc, $V_{DS}$ = 15 Vdc) | $V_{GS(off)}$ | –2.5 | –6.0 | Vdc |
| Gate Source Voltage ($I_D$ = 0.5 mAdc, $V_{DS}$ = 15 Vdc) | $V_{GS}$ | –1.0 | –5.5 | Vdc |
| Gate-Source Forward Voltage ($I_G$ = 1.0 mAdc, $V_{DS}$ = 0) | $V_{GSF}$ | — | 1.0 | Vdc |

(continued)

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| **ELECTRICAL CHARACTERISTICS — continued** ($T_A$ = 25°C unless otherwise noted.) | | | | |
|---|---|---|---|---|
| **Characteristic** | **Symbol** | **Min** | **Max** | **Unit** |
| **ON CHARACTERISTICS** | | | | |
| Zero-Gate Voltage Drain Current(1)<br>($V_{DS}$ = 15 Vdc, $V_{GS}$ = 0) | $I_{DSS}$ | 5.0 | 15 | mAdc |
| **SMALL-SIGNAL CHARACTERISTICS** | | | | |
| Forward Transfer Admittance<br>($V_{DS}$ = 15 Vdc, $V_{GS}$ = 0, f = 1.0 kHz, PW = 100 ms, DC = 10%)<br>($V_{DS}$ = 15 Vdc, $V_{GS}$ = 0, f = 1.0 kHz, $T_A$ = −55°C) | $\|h_{fe}\|$ | <br>4.5<br>— | <br>7.5<br>11.25 | mmhos |
| Output Admittance<br>($V_{DS}$ = 15 Vdc, $V_{GS}$ = 0, f = 1.0 kHz, PW = 100 µA, DC = 10%) | $\|Y_{oe}\|$ | — | 0.05 | µs |
| Input Capacitance<br>($V_{DS}$ = 15 Vdc, $V_{GS}$ = 0, f = 1.0 MHz) | Ciss | — | 4.0 | pF |
| Reverse Transfer Capacitance<br>($V_{DS}$ = 15 Vdc, $V_{GS}$ = 0, f = 0.1 to 1.0 MHz) | $C_{rss}$ | — | 0.8 | pF |
| Common Source Output Capacitance<br>($V_{DS}$ = 15 Vdc, $V_{GS}$ = 0, f = 0.1 to 1.0 MHz) | $C_{oss}$ | — | 2.0 | pF |
| Common-Source Input Susceptance<br>($V_{DS}$ = 15 Vdc, $V_{GS}$ = 0, f = 100 MHz)<br>($V_{DS}$ = 15 Vdc, $V_{GS}$ = 0, f = 400 MHz) | $b_{is}$ | <br>—<br>— | <br>2.5<br>10 | mA |
| Common-Source Output Susceptance<br>($V_{DS}$ = 15 Vdc, $V_{GS}$ = 0, f = 100 MHz)<br>($V_{DS}$ = 15 Vdc, $V_{GS}$ = 0, f = 400 MHz) | $b_{oe}$ | <br>—<br>— | <br>1.0<br>4.0 | mA |
| Common-Source Input Conductance<br>($V_{DS}$ = 15 Vdc, $V_{GS}$ = 0, f = 100 MHz)<br>($V_{DS}$ = 15 Vdc, $V_{GS}$ = 0, f = 400 MHz) | $g_{is}$ | <br>—<br>— | <br>0.3<br>3.0 | mA |
| Common-Source Output Conductance<br>($V_{DS}$ = 15 Vdc, $V_{GS}$ = 0, f = 100 MHz)<br>($V_{DS}$ = 15 Vdc, $V_{GS}$ = 0, f = 400 MHz) | $g_{oe}$ | <br>—<br>— | <br>0.075<br>0.4 | mA |
| Common-Source Forward Transfer Conductance<br>($V_{DS}$ = 15 Vdc, $V_{GS}$ = 0, f = 400 MHz) | $g_{fs}$ | 4.0 | — | mA |
| **FUNCTIONAL CHARACTERISTICS** (See Figure 6) | | | | |
| Noise Figure<br>($V_{DS}$ = 15 Vdc, $I_D$ = 5.0 mAdc, $R_G$ = 1.0 kohm, f = 100 MHz)<br>($V_{DS}$ = 15 Vdc, $I_D$ = 5.0 mAdc, $R_G$ = 1.0 kohm, f = 400 MHz) | NF | <br>—<br>— | <br>2.0<br>4.0 | dB |
| Common-Source Insertion Power Gain<br>($V_{DS}$ = 15 Vdc, $I_D$ = 5.0 mAdc, $R_G$ = 1.0 kohm, f = 100 MHz)<br>($V_{DS}$ = 15 Vdc, $I_D$ = 5.0 mAdc, $R_G$ = 1.0 kohm, f = 400 MHz) | $G_{pe}$ | <br>18<br>10 | <br>—<br>— | dB |

| **ASSURANCE TESTING (Pre/Post Burn-In)**<br>**Burn-In Conditions: $T_A$ = 175°C, $V_{GS}$ = −24 Vdc, $V_{DS}$ = 0** | | | | |
|---|---|---|---|---|
| | | **Initial and End Point Limits** | | |
| **Characteristics Tested** | **Symbol** | **Min** | **Max** | **Unit** |
| Gate Reverse Current<br>($V_{GS}$ = −20 Vdc) | $I_{GSS}$ | — | 0.1 | nAdc |
| Zero-Gate Voltage Drain Current(1)<br>($V_{DS}$ = 15 Vdc, $V_{GS}$ = 0) | $I_{Dss}$ | 5.0 | 15 | mAdc |
| Forward Transfer Admittance<br>($V_{DS}$ = 15 Vdc, $V_{GS}$ = 0, f = 1.0 kHz) | $\|Y_{fs}\|$ | 4.5 | 7.5 | mmho |

| **Delta from Pre-Burn-In Measured Values** | | **Min** | **Max** | |
|---|---|---|---|---|
| Delta Forward Transfer Admittance | $\Delta\|Y_{fs}\|$ | — | ±20 | % of Initial Value |
| Delta Zero-Gate Voltage Drain Current(1) | $\Delta I_{DSS}$ | — | ±10 | % of Initial Value |

(1) Pulsed: Pulse Width 250 to 350 us. Duty Cycle 1.0 to 2.0%

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