

monolithic dual n-channel JFETs designed for . . .



■ Differential Amplifiers

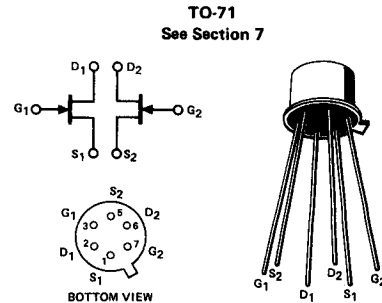
Performance Curves NNP See Section 5

BENEFITS

- Good Matching Characteristics

ABSOLUTE MAXIMUM RATINGS (25°C)

| | |
|---|---------------|
| Gate-Drain or Gate-Source Voltage | -50 V |
| Gate Current | 50 mA |
| Total Device Dissipation at 25°C (Derate 1.7 mW/°C to 200°C) | 300 mW |
| Storage Temperature Range | -65 to +200°C |
| Lead Temperature (1/16" from case for 10 seconds) | 300°C |



ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

| Characteristic | | | Min | Max | Unit | Test Conditions | | |
|----------------|---------------------------------|--|------|------|-----------------|--|------------------------------------|------------|
| 1 | S T A T I C | I_{GSS} Gate Reverse Current | | -100 | pA | $V_{GS} = -30\text{ V}, V_{DS} = 0$ | 150°C | |
| 2 | | | -500 | nA | | | | |
| 3 | | BV_{GSS} Gate-Source Breakdown Voltage | -50 | | | $I_G = -1\text{ }\mu\text{A}, V_{DS} = 0$ $V_{DS} = 20\text{ V}, I_D = 1\text{ nA}$ | | |
| 4 | | $V_{GS(off)}$ Gate-Source Cutoff Voltage | -0.5 | -4.5 | V | | | |
| 5 | | V_{GS} Gate-Source Voltage | -0.3 | -4.0 | | | | |
| 6 | | I_G Gate Operating Current | | -50 | pA | $V_{DG} = 20\text{ V}, I_D = 200\text{ }\mu\text{A}$ | 125°C | |
| | | | -250 | nA | | | | |
| 7 | | I_{DSS} Saturation Drain Current (Note 1) | 0.5 | 5.0 | mA | $V_{DS} = 20\text{ V}, V_{GS} = 0$ | | |
| 8 | D Y N A M I C | g_{fs} Common-Source Forward Transconductance (Note 1) | 1000 | 3000 | μmho | $V_{DS} = 20\text{ V}, V_{GS} = 0$ | f = 1 kHz | |
| | | | 1000 | | | | f = 100 MHz | |
| 9 | | g_{fs} Common-Source Forward Transconductance (Note 1) | 600 | 1600 | | $V_{DG} = 20\text{ V}, I_D = 200\text{ }\mu\text{A}$ | f = 1 kHz | |
| 10 | | g_{os} Common-Source Output Conductance | | 35 | | $V_{DS} = 20\text{ V}, V_{GS} = 0$ | | |
| 11 | | g_{os} Common-Source Output Conductance | | 10 | | $V_{DG} = 20\text{ V}, I_D = 200\text{ }\mu\text{A}$ | | |
| 12 | | C_{iss} Common-Source Input Capacitance | | 6 | | pF | $V_{DS} = 20\text{ V}, V_{GS} = 0$ | f = 1 MHz |
| 13 | | C_{rss} Common-Source Reverse Transfer Capacitance | | 2 | | | | |
| 14 | | \bar{e}_n Equivalent Short Circuit Input Noise Voltage | | 80 | | $\frac{nV}{\sqrt{Hz}}$ | | f = 100 Hz |

| Characteristic | | U231 Max | U232 Max | U233 Max | U234 Max | U235 Max | Unit | Test Conditions | | |
|----------------|---|-------------|-------------|-------------|-------------|-------------|------------------------------|--|--|-----------|
| 15 | $ I_{G1}-I_{G2} $ Differential Gate Current | 10 | 10 | 10 | 10 | 10 | nA | $V_{DG} = 20\text{ V}, I_D = 200\text{ }\mu\text{A}$ | 125°C | |
| 16 | $\frac{ I_{DSS1}-I_{DSS2} }{I_{DSS1}}$ Saturation Drain Current Match (Note 1) | 5 | 5 | 5 | 10 | 15 | % | $V_{DS} = 20\text{ V}, V_{GS} = 0$ | | |
| 17 | $ V_{GS1}-V_{GS2} $ Differential Gate-Source Voltage | 5 | 10 | 15 | 20 | 25 | mV | $V_{DG} = 20\text{ V}, I_D = 200\text{ }\mu\text{A}$ | $T_A = 25^\circ\text{C}$ $T_B = 125^\circ\text{C}$ $T_A = -55^\circ\text{C}$ $T_B = 25^\circ\text{C}$ | |
| 18 | $\frac{ \Delta V_{GS1}-V_{GS2} }{\Delta T}$ Gate-Source Voltage Differential Drift (Note 2) | 10 | 25 | 50 | 75 | 100 | $\mu\text{V}/^\circ\text{C}$ | | | |
| 19 | | 10 | 25 | 50 | 75 | 100 | | | | |
| 20 | $\frac{ g_{fs1}-g_{fs2} }{g_{fs1}}$ Transconductance Match (Note 1) | 3 | 5 | 5 | 10 | 15 | % | | | f = 1 kHz |
| 21 | $ g_{os1}-g_{os2} $ Differential Output Conductance | 5 | 5 | 5 | 5 | 5 | μmho | | | |

NOTES:

- Pulse test required, pulsewidth = 300 μs , duty cycle $\leq 3\%$.
- Measured at end points, T_A and T_B .

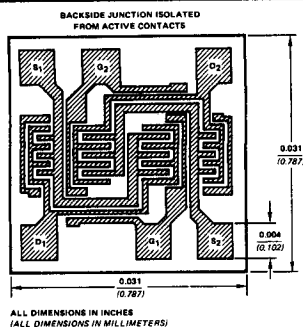
NNP
NP-D

monolithic dual n-channel JFET designed for . . .

- Low and Medium Frequency Amplifiers
- Impedance Converters
- Precision Instrumentation Amplifiers
- Comparators

BENEFITS:

- Minimum System Error and Calibration
5 mV Offset Maximum (2N5196)
- Low Drift With Temperature
5 $\mu\text{V}/^\circ\text{C}$ Maximum (2N5196)



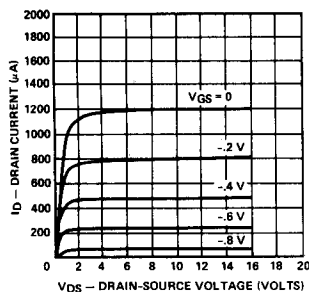
| TYPE | PACKAGE |
|------|---------|
| Dual | TO-71 |
| Dual | Chip |

PRINCIPAL DEVICES

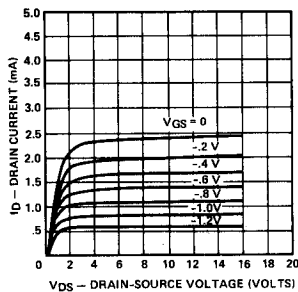
2N5196-9, 2N5545-47, U231-35
2N5199CHP, U232CHP-35CHP
2N5547CHP

PERFORMANCE CURVES (25°C unless otherwise noted)

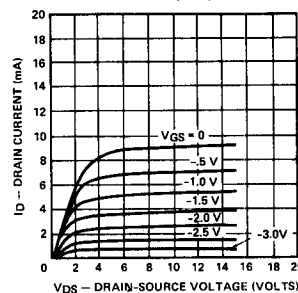
**Output Characteristics
Low $V_{GS(off)}$ Unit**



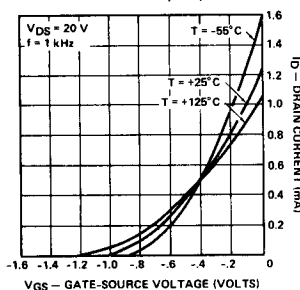
**Output Characteristics
Medium $V_{GS(off)}$ Unit**



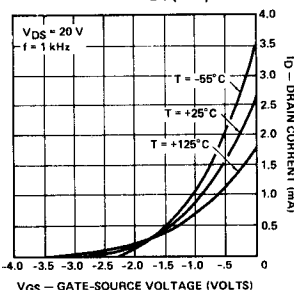
**Output Characteristics
High $V_{GS(off)}$ Unit**



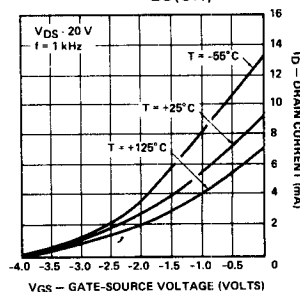
**Transfer Characteristics
Low $V_{GS(off)}$**



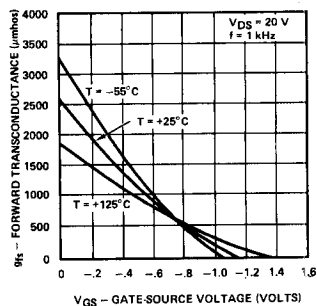
**Transfer Characteristics
Medium $V_{GS(off)}$**



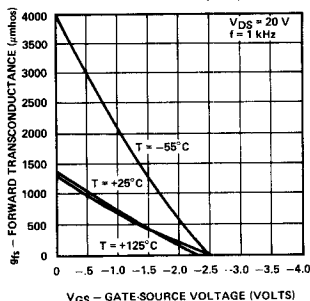
**Transfer Characteristics
High $V_{GS(off)}$**



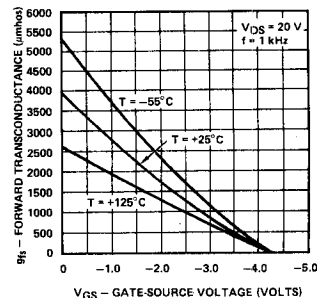
**Transconductance Characteristics
Low $V_{GS(off)}$**



**Transconductance Characteristics
Medium $V_{GS(off)}$**

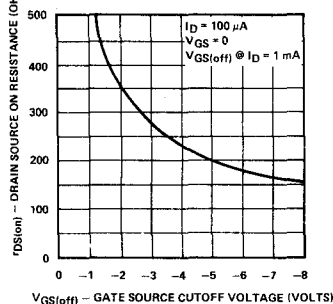


**Transconductance Characteristics
High $V_{GS(off)}$**

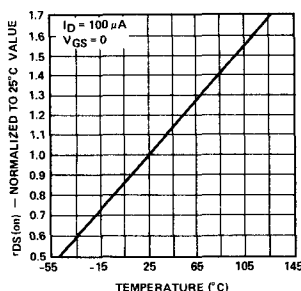


PERFORMANCE CURVES (Cont'd) (25°C unless otherwise noted)

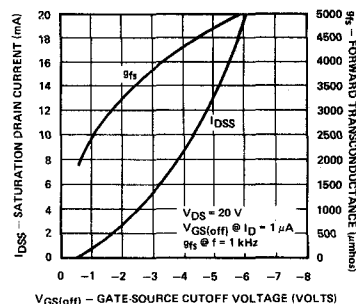
Static Drain-Source ON Resistance
vs Gate-Source Cutoff Voltage



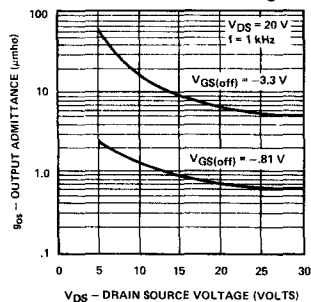
Normalized ON Resistance
vs Ambient Temperature



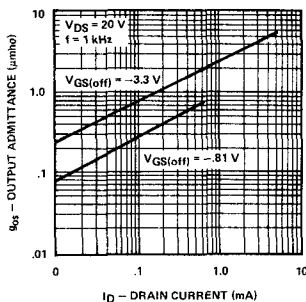
I_{DSS} and g_{fs} vs Gate-Source
Cutoff Voltage



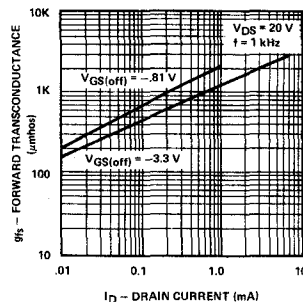
Common-Source Output Conductance
vs Drain-Source Voltage



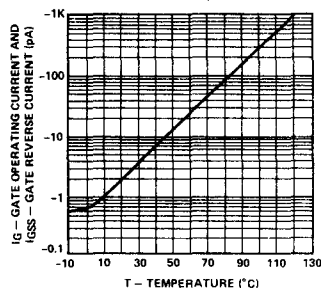
Common-Source Output Conductance
vs Drain Current



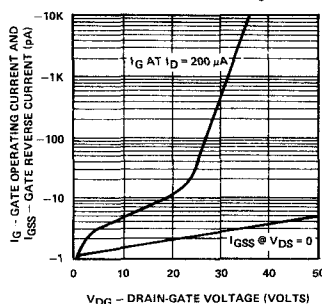
Common Source
Forward Transconductance
vs Drain Current



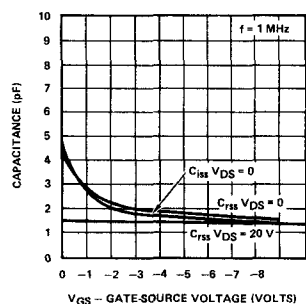
Gate Leakage Currents vs
Ambient Temperature



Gate Leakage Currents vs
Drain-Gate Voltage



Capacitance vs Gate-Source Voltage



Equivalent Input Noise Voltage
vs Frequency

