N-Channel JFETs

**PRODUCT SUMMARY**

<table>
<thead>
<tr>
<th>Part Number</th>
<th>( V_{GS(\text{off})} ) (V)</th>
<th>( V_{(BR)\text{GSS}} ) Min (V)</th>
<th>( g_{fs} ) Min (mS)</th>
<th>( I_{DSS} ) Max (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2N4338</td>
<td>-0.3 to -1</td>
<td>-50</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>2N4339</td>
<td>-0.6 to -1.8</td>
<td>-50</td>
<td>0.8</td>
<td>1.5</td>
</tr>
<tr>
<td>2N4340</td>
<td>-1 to -3</td>
<td>-50</td>
<td>1.3</td>
<td>3.6</td>
</tr>
<tr>
<td>2N4341</td>
<td>-2 to -6</td>
<td>-50</td>
<td>2</td>
<td>9</td>
</tr>
</tbody>
</table>

**FEATURES**

- Low Cutoff Voltage: 2N4338 <1 V
- High Input Impedance
- Very Low Noise
- High Gain: \( A_{V} = 80 \) @ 20 \( \mu \text{A} \)

**BENEFITS**

- Full Performance from Low-Voltage Power Supply: Down to 1 V
- Low Signal Loss/System Error
- High System Sensitivity
- High-Quality Low-Level Signal Amplification
- High-Gain, Low-Noise Amplifiers
- Low-Current, Low-Voltage Battery-Powered Amplifiers
- Infrared Detector Amplifiers
- Ultrahigh Input Impedance Pre-Amplifiers

**APPLICATIONS**

- High-Gain, Low-Noise Amplifiers
- Low-Current, Low-Voltage Battery-Powered Amplifiers
- Infrared Detector Amplifiers
- Ultrahigh Input Impedance Pre-Amplifiers

**DESCRIPTION**

The 2N4338/4339/4340/4341 n-channel JFETs are designed for sensitive amplifier stages at low- to mid-frequencies. Low cut-off voltages accommodate low-level power supplies and low leakage for improved system accuracy.

The TO-206AA (TO-18) package is hermetically sealed and suitable for military processing (see Military Information). For similar products in TO-226AA (TO-92) and TO-236 (SOT-23) packages, see the J/SST201 series data sheet.

**ABSOLUTE MAXIMUM RATINGS**

- Gate-Source/Gate-Drain Voltage: \(-50 \text{ V}\)
- Forward Gate Current: \(50 \text{ mA}\)
- Storage Temperature: \(-65 \text{ to } 200^\circ \text{C}\)
- Operating Junction Temperature: \(-55 \text{ to } 175^\circ \text{C}\)
- Lead Temperature (\(1/16^\circ \text{in} \) from case for 10 sec.): \(300^\circ \text{C}\)
- Power Dissipation: \(300 \text{ mW}\)

Notes:
- Derate 2 mW/\(^\circ \text{C}\) above 25\(^\circ \text{C}\)

For applications information see AN102 and AN106.
### SPECIFICATIONS FOR 2N4338 AND 2N4339 (TA = 25°C UNLESS OTHERWISE NOTED)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Conditions</th>
<th>Typa</th>
<th>Min</th>
<th>Max</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Static</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate-Source Breakdown Voltage</td>
<td>$V_{BR(GS)}$</td>
<td>$I_G = -1 \mu A$, $V_{DS} = 0 , V$</td>
<td>$-57$</td>
<td>$-50$</td>
<td>$-50$</td>
<td>$-50$</td>
<td>$-50$</td>
<td>$V$</td>
</tr>
<tr>
<td>Gate-Source Cutoff Voltage</td>
<td>$V_{GS(0)}$</td>
<td>$V_{DS} = 15 , V$, $I_G = 0.1 \mu A$</td>
<td>$-0.3$</td>
<td>$-1$</td>
<td>$-0.6$</td>
<td>$1.8$</td>
<td>$1.8$</td>
<td>$V$</td>
</tr>
<tr>
<td>Saturation Drain Current$^c$</td>
<td>$I_{DS}$</td>
<td>$V_{DS} = 15 , V$, $V_{GS} = 0 , V$</td>
<td>$0.2$</td>
<td>$0.6$</td>
<td>$0.5$</td>
<td>$1.5$</td>
<td>$1.5$</td>
<td>$mA$</td>
</tr>
<tr>
<td>Gate Reverse Current</td>
<td>$I_{GS}$</td>
<td>$V_{GS} = -30 , V$, $V_{DS} = 0 , V$, $T_A = 150^\circ C$</td>
<td>$-4$</td>
<td>$-100$</td>
<td>$-100$</td>
<td>$-100$</td>
<td>$-100$</td>
<td>$nA$</td>
</tr>
<tr>
<td>Gate Operating Current$^b$</td>
<td>$I_G$</td>
<td>$V_{DG} = 15 , V$, $I_G = 0.1 , mA$</td>
<td>$-2$</td>
<td>$-100$</td>
<td>$-100$</td>
<td>$-100$</td>
<td>$-100$</td>
<td>$pA$</td>
</tr>
<tr>
<td>Drain Cutoff Current</td>
<td>$I_{(off)}$</td>
<td>$V_{DS} = 15 , V$, $V_{GS} = -5 , V$</td>
<td>$2$</td>
<td>$50$</td>
<td>$50$</td>
<td>$50$</td>
<td>$50$</td>
<td>$V$</td>
</tr>
<tr>
<td>Gate-Source Forward Voltage</td>
<td>$V_{GS(F)}$</td>
<td>$I_G = 1 , mA$, $V_{DS} = 0 , V$</td>
<td>$0.7$</td>
<td>$-100$</td>
<td>$-100$</td>
<td>$-100$</td>
<td>$-100$</td>
<td>$pA$</td>
</tr>
<tr>
<td><strong>Dynamic</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common-Source Forward Transconductance</td>
<td>$g_{fs}$</td>
<td>$V_{DS} = 15 , V$, $V_{GS} = 0 , V$, $f = 1 , kHz$</td>
<td>$0.6$</td>
<td>$1.8$</td>
<td>$0.8$</td>
<td>$2.4$</td>
<td>$2.4$</td>
<td>$mS$</td>
</tr>
<tr>
<td>Common-Source Output Conductance</td>
<td>$g_{ds}$</td>
<td>$V_{DS} = 0 , V$, $V_{GS} = 0 , V$, $f = 1 , kHz$</td>
<td>$5$</td>
<td>$15$</td>
<td>$15$</td>
<td>$15$</td>
<td>$15$</td>
<td>$\mu S$</td>
</tr>
<tr>
<td>Drain-Source On-Resistance</td>
<td>$r_{ds(on)}$</td>
<td>$V_{DS} = 0 , V$, $V_{GS} = 0 , V$, $f = 1 , kHz$</td>
<td>$2500$</td>
<td>$1700$</td>
<td>$1700$</td>
<td>$1700$</td>
<td>$1700$</td>
<td>$\Omega$</td>
</tr>
<tr>
<td>Common-Source Input Capacitance</td>
<td>$C_{iss}$</td>
<td>$V_{DS} = 15 , V$, $V_{GS} = 0 , V$, $f = 1 , MHz$</td>
<td>$5$</td>
<td>$7$</td>
<td>$7$</td>
<td>$7$</td>
<td>$7$</td>
<td>$pF$</td>
</tr>
<tr>
<td>Common-Source Reverse Transfer Capacitance</td>
<td>$C_{rss}$</td>
<td>$V_{DS} = 10 , V$, $V_{GS} = 0 , V$, $f = 1 , kHz$</td>
<td>$1.5$</td>
<td>$3$</td>
<td>$3$</td>
<td>$3$</td>
<td>$3$</td>
<td>$pF$</td>
</tr>
<tr>
<td>Equivalent Input Noise Voltage$^c$</td>
<td>$\xi_{in}$</td>
<td>$V_{DS} = 15 , V$, $V_{GS} = 0 , V$, $f = 1 , kHz$</td>
<td>$6$</td>
<td>$1$</td>
<td>$1$</td>
<td>$1$</td>
<td>$1$</td>
<td>$dB$</td>
</tr>
<tr>
<td>Noise Figure</td>
<td>$NF$</td>
<td>$V_{DS} = 10 , V$, $V_{GS} = 0 , V$, $f = 1 , kHz$, $R_G = 1 , M\Omega$</td>
<td>$1$</td>
<td>$1$</td>
<td>$1$</td>
<td>$1$</td>
<td>$1$</td>
<td>$dB$</td>
</tr>
</tbody>
</table>

### SPECIFICATIONS FOR 2N4340 AND 2N4341 (TA = 25°C UNLESS OTHERWISE NOTED)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Conditions</th>
<th>Typa</th>
<th>Min</th>
<th>Max</th>
<th>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Static</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate-Source Breakdown Voltage</td>
<td>$V_{BR(GS)}$</td>
<td>$I_G = -1 \mu A$, $V_{DS} = 0 , V$</td>
<td>$-57$</td>
<td>$-50$</td>
<td>$-50$</td>
<td>$-50$</td>
<td>$-50$</td>
<td>$V$</td>
</tr>
<tr>
<td>Gate-Source Cutoff Voltage</td>
<td>$V_{GS(0)}$</td>
<td>$V_{DS} = 15 , V$, $I_G = 0.1 \mu A$</td>
<td>$-1$</td>
<td>$-3$</td>
<td>$-2$</td>
<td>$-6$</td>
<td>$-6$</td>
<td>$mA$</td>
</tr>
<tr>
<td>Saturation Drain Current$^c$</td>
<td>$I_{DS}$</td>
<td>$V_{DS} = 15 , V$, $V_{GS} = 0 , V$</td>
<td>$1.2$</td>
<td>$3.6$</td>
<td>$3$</td>
<td>$9$</td>
<td>$9$</td>
<td>$mA$</td>
</tr>
<tr>
<td>Gate Reverse Current</td>
<td>$I_{GS}$</td>
<td>$V_{GS} = -30 , V$, $V_{DS} = 0 , V$, $T_A = 150^\circ C$</td>
<td>$-4$</td>
<td>$-100$</td>
<td>$-100$</td>
<td>$-100$</td>
<td>$-100$</td>
<td>$nA$</td>
</tr>
<tr>
<td>Gate Operating Current$^b$</td>
<td>$I_G$</td>
<td>$V_{DG} = 15 , V$, $I_G = 0.1 , mA$</td>
<td>$-2$</td>
<td>$-100$</td>
<td>$-100$</td>
<td>$-100$</td>
<td>$-100$</td>
<td>$pA$</td>
</tr>
<tr>
<td>Drain Cutoff Current</td>
<td>$I_{(off)}$</td>
<td>$V_{DS} = 15 , V$, $V_{GS} = -5 , V$</td>
<td>$2$</td>
<td>$50$</td>
<td>$50$</td>
<td>$50$</td>
<td>$50$</td>
<td>$V$</td>
</tr>
<tr>
<td>Gate-Source Forward Voltage</td>
<td>$V_{GS(F)}$</td>
<td>$I_G = 1 , mA$, $V_{DS} = 0 , V$</td>
<td>$0.7$</td>
<td>$-100$</td>
<td>$-100$</td>
<td>$-100$</td>
<td>$-100$</td>
<td>$pA$</td>
</tr>
</tbody>
</table>
## SPECIFICATIONS FOR 2N4340 AND 2N4341 (TA = 25°C UNLESS OTHERWISE NOTED)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Conditions</th>
<th>Typ&lt;sup&gt;a&lt;/sup&gt;</th>
<th>2N4340 Min</th>
<th>2N4340 Max</th>
<th>2N4341 Min</th>
<th>2N4341 Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dynamic</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Common-Source Forward Transconductance</td>
<td>g&lt;sub&gt;f&lt;/sub&gt;&lt;sup&gt;s&lt;/sup&gt;</td>
<td>V&lt;sub&gt;DS&lt;/sub&gt; = 15 V, V&lt;sub&gt;GS&lt;/sub&gt; = 0 V, f = 1 kHz</td>
<td>1.3</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>mS</td>
<td></td>
</tr>
<tr>
<td>Common-Source Output Conductance</td>
<td>g&lt;sub&gt;os&lt;/sub&gt;</td>
<td>V&lt;sub&gt;DS&lt;/sub&gt; = 15 V, V&lt;sub&gt;GS&lt;/sub&gt; = 0 V</td>
<td>30</td>
<td>60</td>
<td></td>
<td></td>
<td>pS</td>
<td></td>
</tr>
<tr>
<td>Drain-Source On-Resistance</td>
<td>r&lt;sub&gt;ds(on)&lt;/sub&gt;</td>
<td>V&lt;sub&gt;DS&lt;/sub&gt; = 0 V, V&lt;sub&gt;GS&lt;/sub&gt; = 0 V, f = 1 kHz</td>
<td>1500</td>
<td>800</td>
<td></td>
<td></td>
<td>Ω</td>
<td></td>
</tr>
<tr>
<td>Common-Source Input Capacitance</td>
<td>C&lt;sub&gt;iss&lt;/sub&gt;</td>
<td>V&lt;sub&gt;DS&lt;/sub&gt; = 15 V, V&lt;sub&gt;GS&lt;/sub&gt; = 0 V, f = 1 MHz</td>
<td>5</td>
<td>7</td>
<td>7</td>
<td></td>
<td>pF</td>
<td></td>
</tr>
<tr>
<td>Common-Source Reverse Transfer Capacitance</td>
<td>C&lt;sub&gt;rss&lt;/sub&gt;</td>
<td>V&lt;sub&gt;DS&lt;/sub&gt; = 15 V, V&lt;sub&gt;GS&lt;/sub&gt; = 0 V, f = 1 MHz</td>
<td>1.5</td>
<td>3</td>
<td>3</td>
<td></td>
<td>pF</td>
<td></td>
</tr>
<tr>
<td>Equivalent Input Noise Voltage</td>
<td>e&lt;sub&gt;n&lt;/sub&gt;</td>
<td>V&lt;sub&gt;DS&lt;/sub&gt; = 10 V, V&lt;sub&gt;GS&lt;/sub&gt; = 0 V, f = 1 kHz</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td>nV/√Hz</td>
<td></td>
</tr>
<tr>
<td>Noise Figure</td>
<td>NF</td>
<td>V&lt;sub&gt;DS&lt;/sub&gt; = 15 V, V&lt;sub&gt;GS&lt;/sub&gt; = 0 V, f = 1 kHz, R&lt;sub&gt;G&lt;/sub&gt; = 1 MΩ</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>dB</td>
<td></td>
</tr>
</tbody>
</table>

Notes:

a. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.

b. Pulse test: PW ≤ 300 μs, duty cycle ≤ 3%.

c. This parameter not registered with JEDEC.

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

### Drain Current and Transconductance vs. Gate-Source Cutoff Voltage

- I<sub>DSS</sub> @ V<sub>DS</sub> = 10 V, V<sub>GS</sub> = 0 V
- g<sub>f</sub><sup>s</sup> @ V<sub>DS</sub> = 10 V, V<sub>GS</sub> = 0 V, f = 1 kHz

### Gate Leakage Current

- I<sub>GSS</sub> @ 125°C
- I<sub>GSS</sub> @ 25°C

Document Number: 70240
S-40990—Rev. F, 24-May-04
www.vishay.com
TYPICAL CHARACTERISTICS (TA = 25°C UNLESS OTHERWISE NOTED)

On-Resistance and Output Conductance vs. Gate-Source Cutoff Voltage

Common-Source Forward Transconductance vs. Drain Current

Output Characteristics

Output Characteristics

Output Characteristics

Output Characteristics

www.vishay.com
TYPICAL CHARACTERISTICS (TA = 25°C UNLESS OTHERWISE NOTED)

Transfer Characteristics

- VGS(on) = -0.7 V
- VDS = 10 V
- TA = -55°C
- 25°C
- 125°C

- VGS(on) = -1.5 V
- VDS = 10 V
- TA = -55°C
- 25°C
- 125°C

Transconductance vs. Gate-Source Voltage

- VGS(on) = -0.7 V
- VDS = 10 V
- f = 1 kHz
- TA = -55°C
- 25°C
- 125°C

- VGS(on) = -1.5 V
- VDS = 10 V
- f = 1 kHz
- TA = -55°C
- 25°C
- 125°C

Circuit Voltage Gain vs. Drain Current

- $A_V = \frac{g_{fs} R_L}{T + RLg_{mos}}$
- Assume VDD = 15 V, VDS = 5 V
- $R_L = \frac{10\, \text{V}}{I_D}$
- $V_{GS(on)} = -0.7\, \text{V}$
- $V_{GS(on)} = -1.5\, \text{V}$

On-Resistance vs. Drain Current

- $r_{DS(on)}$
- $V_{GS(on)} = -0.7\, \text{V}$
- $V_{GS(on)} = -1.5\, \text{V}$

Drain Current (mA)
TYPICAL CHARACTERISTICS (TA = 25°C UNLESS OTHERWISE NOTED)

Common-Source Input Capacitance vs. Gate-Source Voltage

Common-Source Reverse Feedback Capacitance vs. Gate-Source Voltage

Output Conductance vs. Drain Current

Equivalent Input Noise Voltage vs. Frequency

\[ V_{GS} \text{ (Gate-Source Voltage)} \]

\[ V_{DS} = 0 \text{ V} \]

\[ V_{DS} = 10 \text{ V} \]

\[ f = 1 \text{ MHz} \]

\[ I_D = 100 \mu A \]

\[ I_D = I_{DS} \]

\[ V_{DS} = 10 \text{ V} \]

\[ f = 1 \text{ kHz} \]

\[ T_A = -55^\circ \text{C} \]

\[ 25^\circ \text{C} \]

\[ 125^\circ \text{C} \]

\[ I_D \text{ (Drain Current)} \]

\[ f \text{ (Frequency)} \]

\[ V_{GS(off)} = -1.5 \text{ V} \]

\[ \beta_{os} \text{ (Output Conductance)} \]

\[ C_{iss} \text{ (Input Capacitance)} \]

\[ C_{rss} \text{ (Reverse Feedback Capacitance)} \]

\[ \sim \text{ Noise Voltage (nV/\sqrt{Hz})} \]
Disclaimer

All product specifications and data are subject to change without notice.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained herein or in any other disclosure relating to any product.

Vishay disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications unless otherwise expressly indicated. Customers using or selling Vishay products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Vishay for any damages arising or resulting from such use or sale. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.