N-Channel JFETs

2N4117A  PN4117A  SST4117
2N4118A  PN4118A  SST4118
2N4119A  PN4119A  SST4119

PRODUCT SUMMARY

<table>
<thead>
<tr>
<th>Part Number</th>
<th>V_{GS(off)} (V)</th>
<th>V_{(BR)GSS} Min (V)</th>
<th>g_{fs} Min (\mu S)</th>
<th>I_{DSS} Min (\mu A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4117</td>
<td>-0.6 to -1.8</td>
<td>-40</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>4118</td>
<td>-1 to -3</td>
<td>-40</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>4119</td>
<td>-2 to -6</td>
<td>-40</td>
<td>100</td>
<td>200</td>
</tr>
</tbody>
</table>

FEATURES

- Ultra-Low Leakage: 0.2 pA
- Very Low Current/Voltage Operation
- Ultrahigh Input Impedance
- Low Noise

DESCRIPTION

The 2N/PN/SST4117A series of n-channel JFETs provide ultra-high input impedance. These devices are specified with a 1-pA limit and typically operate at 0.2 pA. This makes them perfect choices for use as high-impedance sensitive front-end amplifiers.

The hermetically sealed TO-206AF package allows full military processing per MIL-S-19500 (see Military Information). The TO-226A (TO-92) plastic package provides a low-cost option. The TO-236 (SOT-23) package provides surface-mount capability. Both the PN and SST series are available in tape-and-reel for automated assembly (see Packaging Information).

For applications information see AN105.
# 2N/PN/SST4117A Series

Vishay Siliconix

## ABSOLUTE MAXIMUM RATINGS

<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>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gate-Source/Gate-Drain Voltage</td>
<td>V(BR)GSS</td>
<td>I_G = -1 ( \mu )A, V_DS = 0 V</td>
<td></td>
<td>-70</td>
<td>-40</td>
<td>-40</td>
<td>-40</td>
<td></td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Forward Gate Current</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage Temperature : (2N Prefix)</td>
<td></td>
<td>-65 to 175°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(PN, SST Prefix)</td>
<td></td>
<td>-55 to 150°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating Junction Temperature : (2N Prefix)</td>
<td></td>
<td>-55 to 175°C</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>(PN, SST Prefix)</td>
<td></td>
<td>-55 to 150°C</td>
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<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Lead Temperature (( ^1/16 ) from case for 10 sec.)</td>
<td></td>
<td>300°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power Dissipation (case 25°C)</td>
<td></td>
<td>300 mW</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notes a. Derate 2 mW/°C above 25°C</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notes b. Derate 2.8 mW/°C above 25°C</td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

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

### Static

<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>Min</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gate-Source Breakdown Voltage</td>
<td>V(BR)GSS</td>
<td>I_G = -1 ( \mu )A, V_DS = 0 V</td>
<td></td>
<td>-70</td>
<td>-40</td>
<td>-40</td>
<td>-40</td>
<td></td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Gate-Source Cutoff Voltage</td>
<td>V_GS(off)</td>
<td>V_DS = 10 V, I_G = 1 nA</td>
<td></td>
<td>-0.6</td>
<td>-1.8</td>
<td>-1</td>
<td>-2</td>
<td>-6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saturation Drain Current</td>
<td>I_DSS</td>
<td>V_DS = 10 V, V_GS = 0 V</td>
<td></td>
<td>30</td>
<td>90</td>
<td>80</td>
<td>240</td>
<td>200</td>
<td>600</td>
<td>( \mu )A</td>
</tr>
<tr>
<td>Gate Reverse Current</td>
<td>I_GSS</td>
<td>V_GS = -20 V, V_DS = 0 V</td>
<td></td>
<td>-0.2</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
<td></td>
<td></td>
<td>pA</td>
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<tr>
<td>Gate Reverse Current</td>
<td>I_GSS</td>
<td>V_GS = -20 V, V_DS = 0 V, TA = 150°C</td>
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<td>-0.4</td>
<td>-2.5</td>
<td>-2.5</td>
<td>-2.5</td>
<td></td>
<td></td>
<td>nA</td>
</tr>
<tr>
<td>Gate Reverse Current</td>
<td>I_GSS</td>
<td>V_GS = -10 V, V_DS = 0 V, PN</td>
<td></td>
<td>-0.2</td>
<td>-1</td>
<td>-1</td>
<td>-1</td>
<td></td>
<td></td>
<td>pA</td>
</tr>
<tr>
<td>Gate Reverse Current</td>
<td>I_GSS</td>
<td>V_GS = -10 V, V_DS = 0 V, SST</td>
<td></td>
<td>-0.2</td>
<td>-10</td>
<td>-10</td>
<td>-10</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Gate Reverse Current</td>
<td>I_GSS</td>
<td>V_GS = -10 V, V_DS = 0 V, PN/SST</td>
<td></td>
<td>-0.03</td>
<td>-2.5</td>
<td>-2.5</td>
<td>-2.5</td>
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<td></td>
<td>nA</td>
</tr>
<tr>
<td>Gate Operating Currentb</td>
<td>I_G</td>
<td>V_DG = 15 V, I_G = 30 ( \mu )A</td>
<td></td>
<td>-0.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>pA</td>
</tr>
<tr>
<td>Drain Cutoff Currentb</td>
<td>I_D(off)</td>
<td>V_DS = 10 V, V_GS = -8 V</td>
<td></td>
<td>0.2</td>
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</tr>
<tr>
<td>Gate-Source Forward Voltageb</td>
<td>V_GS(F)</td>
<td>I_G = 1 mA, V_DS = 0 V</td>
<td></td>
<td>0.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>V</td>
</tr>
</tbody>
</table>

### Dynamic

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Conditions</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common-Source Forward Transconductance</td>
<td>gfs</td>
<td>V_DS = 10 V, V_GS = 0 V, f = 1 kHz</td>
<td>( \mu )S</td>
</tr>
<tr>
<td>Common-Source Output Conductance</td>
<td>gos</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Common-Source Input Capacitance</td>
<td>ciss</td>
<td>V_DS = 10 V, V_GS = 0 V, f = 1 MHz</td>
<td>( pF )</td>
</tr>
<tr>
<td>Common-Source Reverse Transfer Capacitance</td>
<td>crss</td>
<td>V_DS = 10 V, V_GS = 0 V, f = 1 kHz</td>
<td>( pF )</td>
</tr>
<tr>
<td>Equivalent Input Noise Voltageb</td>
<td>( \xi_n )</td>
<td>V_DS = 10 V, V_GS = 0 V, f = 1 kHz</td>
<td>( nV/\sqrt{Hz} )</td>
</tr>
</tbody>
</table>

Notes
a. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
b. This parameter not registered with JEDEC.

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

- **Gate Leakage Current**
  - $I_{GSS} @ V_{DS} = 10\,\text{V}, V_{GS} = 0\,\text{V}$
  - $I_{GSS} @ V_{DS} = 10\,\text{V}, V_{GS} = 0\,\text{V}$
  - $I_{GSS} @ V_{DS} = 125\,\text{V}, V_{GS} = 0\,\text{V}$

- **Drain Current and Transconductance vs. Gate-Source Cutoff Voltage**
  - $I_{DSS} @ V_{DS} = 10\,\text{V}, V_{GS} = 0\,\text{V}$
  - $g_{ss} @ V_{DS} = 10\,\text{V}, V_{GS} = 0\,\text{V}$
  - $f = 1\,\text{kHz}$

- **On-Resistance and Output Conductance vs. Gate-Source Cutoff Voltage**
  - $r_{DS(on)} @ I_D = 10\,\text{mA}, V_{GS} = 0\,\text{V}$
  - $g_{os} @ V_{DS} = 10\,\text{V}, V_{GS} = 0\,\text{V}$
  - $f = 1\,\text{kHz}$

- **Common-Source Forward Transconductance vs. Drain Current**
  - $g_{fs} @ V_{DS} = 10\,\text{V}, V_{GS} = 0\,\text{V}$
  - $T_A = 125\,\text{°C}$
  - $V_{DS} = 10\,\text{V}$
  - $f = 1\,\text{kHz}$

- **Output Characteristics**
  - $V_{GS} = 0\,\text{V}$
  - $V_{GS} = -0.7\,\text{V}$
  - $V_{GS} = -1.0\,\text{V}$
  - $V_{GS} = -1.5\,\text{V}$
  - $V_{GS} = -2.0\,\text{V}$

- **Output Characteristics**
  - $V_{GS} = 0\,\text{V}$
  - $V_{GS} = -0.5\,\text{V}$
  - $V_{GS} = -1.0\,\text{V}$
  - $V_{GS} = -1.5\,\text{V}$
  - $V_{GS} = -2.0\,\text{V}$
TYPICAL CHARACTERISTICS \((T_A = 25^\circ C\) UNLESS OTHERWISE NOTED\)

**Transfer Characteristics**

- **Transconductance vs. Gate-Source Voltage**
  - \(V_{GS} = -0.7 \text{ V}\)
  - \(V_{DS} = 10 \text{ V}\)
  - \(T_A = 125^\circ C\)
  - \(25^\circ C\)
  - \(-55^\circ C\)

- **Transconductance vs. Gate-Source Voltage**
  - \(V_{GS} = -2.5 \text{ V}\)
  - \(V_{DS} = 10 \text{ V}\)
  - \(T_A = -55^\circ C\)
  - \(25^\circ C\)
  - \(125^\circ C\)

**Common-Source Input Capacitance**

- **Circuit Voltage Gain vs. Drain Current**
  - \(A_V = \frac{g_{fs} R_L}{1 + R_L R_{GS}}\)
  - Assume \(V_{DD} = 15 \text{ V}, V_{DS} = 5 \text{ V}\)
  - \(R_L = 10 \text{ V}\)
  - \(V_{GS} = -0.7 \text{ V}\)
  - \(-2.5 \text{ V}\)

- **Common-Source Input Capacitance vs. Gate-Source Voltage**
  - \(f = 1 \text{ MHz}\)
  - \(V_{GS} = 0 \text{ V}\)
  - \(10 \text{ V}\)
TYPICAL CHARACTERISTICS (TA = 25°C UNLESS OTHERWISE NOTED)

- Common-Source Reverse Feedback Capacitance vs. Gate-Source Voltage
  - $C_{rss}$ vs. $V_{GS}$ graph
  - $f = 1$ MHz
  - $V_{DS} = 0$ V, 10 V

- Equivalent Input Noise Voltage vs. Frequency
  - $f = 1$ MHz
  - $V_{DS} = 0$ V, 10 V
  - Incremental $f$ values

- Output Conductance vs. Drain Current
  - $g_{os}$ vs. $I_D$ graph
  - $V_{GS(off)} = -2.5$ V
  - $T_A = -55^\circ C$, 25$^\circ C$, 125$^\circ C$
  - $V_{DS} = 10$ V
  - $f = 1$ kHz

- On-Resistance vs. Drain Current
  - $r_{DS(on)}$ vs. $I_D$ graph
  - $V_{GS(off)} = -0.7$ V
  - $-2.5$ V
  - $T_A = 25^\circ C$
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