N-Channel JFETs

Vishay Siliconix

2N/PN/SST4391 Series

N-Channel JFETs

2N4391  PN4391  SST4391
2N4392  PN4392  SST4392
2N4393  PN4393  SST4393

PRODUCT SUMMARY

<table>
<thead>
<tr>
<th>Part Number</th>
<th>VGS(off) (V)</th>
<th>rDS(on) Max (Ω)</th>
<th>ID(off) Typ (pA)</th>
<th>tON Typ (ns)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2N/PN/SST4391</td>
<td>–4 to –10</td>
<td>30</td>
<td>5</td>
<td>4</td>
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<tr>
<td>2N/PN/SST4392</td>
<td>–2 to –5</td>
<td>60</td>
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<tr>
<td>2N/PN/SST4393</td>
<td>–0.5 to –3</td>
<td>100</td>
<td>5</td>
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</table>

FEATURES

- Low On-Resistance: 4391<30 Ω
- Fast Switching—tON: 4 ns
- High Off-Isolation: ID(off) with Low Leakage
- Low Capacitance: <3.5 pF
- Low Insertion Loss

BENEFITS

- Low Error Voltage
- High-Speed Analog Circuit Performance
- Negligible “Off-Error,” Excellent Accuracy
- Good Frequency Response, Low Glitches
- Eliminates Additional Buffering

APPLICATIONS

- Analog Switches
- Choppers
- Sample-and-Hold
- Normally “On” Switches
- Current Limiters
- Commutators

DESCRIPTION

The 2N/PN/SST4391 series features many of the superior characteristics of JFETs which make it a good choice for demanding analog switching applications and for specialized amplifier circuits.

The 2N series hermetically-sealed TO-206AA (TO-18) can is available with processing per MIL-S-19500 (see Military Information). Both the PN, TO-226AA (TO-92), and SST, TO-236 (SOT-23), series are available in tape-and-reel for automated assembly (see Packaging Information). For similar dual products, see the 2N5564/5565/5566 data sheet.

For applications information see AN104 and AN106.
2N/PN/SST4391 Series
Vishay Siliconix

**ABSOLUTE MAXIMUM RATINGS**

Gate-Drain, Gate-Source Voltage:
(2N/PN Prefixes) ................. –40 V
(SST Prefix) ................. –35 V

Gate Current .......................................................... 50 mA

Lead Temperature .......................................................... 300 °C

Storage Temperature: (2N Prefix) ................. –65 to 200 °C
(PN/SST Prefixes) ................. –55 to 150 °C

**Gate-Drain, Gate-Source Voltage:**
- (2N/PN Prefixes) .................. –40 V
- (SST Prefix) .................. –35 V

**Gate Current** .......................................................... 50 mA

**Lead Temperature** .......................................................... 300 °C

**Storage Temperature:**
- (2N Prefix) ................. –65 to 200 °C
- (PN/SST Prefixes) ................. –55 to 150 °C

**Operating Junction Temperature:**
- (2N Prefix) .................. –55 to 200 °C
- (PN/SST Prefixes) ................. –55 to 150 °C

**Power Dissipation:**
- (2N Prefix) ................. 1800 mW
- (PN/SST Prefixes) ................. 350 mW

**Notes**
- a. Derate 10 mW/°C above 25 °C
- b. Derate 2.8 mW/°C above 25 °C

---

**SPECIFICATIONS (T_A = 25°C UNLESS OTHERWISE NOTED)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Test Conditions</th>
<th>Typ</th>
<th>Limits</th>
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<td>4391</td>
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<td></td>
<td></td>
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<td>Min</td>
<td>Max</td>
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<tr>
<td>Static</td>
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<tr>
<td>Gate-Source Breakdown Voltage</td>
<td>V_(BR)_{GSS}</td>
<td>I_G = –1 μA, V_DS = 0 V</td>
<td>–55</td>
<td>–40</td>
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<tr>
<td>Gate-Source Cutoff Voltage</td>
<td>V_GS(off)</td>
<td>V_DS = 20 V</td>
<td>2N/PN: I_D = 1 nA</td>
<td>–4</td>
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<tr>
<td></td>
<td></td>
<td>V_DS = 15 V</td>
<td>SST: I_D = 10 nA</td>
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<td>Saturation Drain Current</td>
<td>I_DSS</td>
<td>V_DS = 20 V, V GS = 0 V</td>
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<td>PN</td>
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<tr>
<td>Gate Reverse Current</td>
<td>I_GS</td>
<td>V_DS = –20 V</td>
<td>V_DS = 0 V</td>
<td>2N/SST</td>
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<td>PN</td>
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<td>2N: T_A = 150°C</td>
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<td>PN: T_A = 100°C</td>
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<td>SST: T_A = 125°C</td>
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<td>Gate Operating Current</td>
<td>I_G</td>
<td>V_DG = 15 V, I_D = 10 mA</td>
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<tr>
<td>Drain Cutoff Current</td>
<td>I_D(off)</td>
<td>V_DS = 20 V</td>
<td>2N: V_GS = –5 V</td>
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<td>2N: V_GS = –7 V</td>
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<td>2N: V_GS = –12 V</td>
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<td>PN: V_GS = –5 V</td>
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<td>PN: V_GS = –12 V</td>
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<td>SST: V_DS = 10 V</td>
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<td>2N: V_GS = –5 V</td>
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<td>PN: V_GS = –5 V</td>
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<td>PN: V_GS = –12 V</td>
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<td>SST: V_GS = –10 V</td>
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<td>Drain-Source On-Voltage</td>
<td>V_DS(on)</td>
<td>V_GS = 0 V</td>
<td>I_D = 3 mA</td>
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<td>I_D = 6 mA</td>
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<td>I_D = 12 mA</td>
<td>0.35</td>
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<td>Drain-Source On-Resistance</td>
<td>f_DS(on)</td>
<td>V_GS = 0 V, I_D = 1 mA</td>
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<td>60</td>
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<td>Gate-Source Forward Voltage</td>
<td>V_GS(F)</td>
<td>I_G = 1 mA</td>
<td>V_DS = 0 V</td>
<td>2N</td>
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<td>PN/SST</td>
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## SPECIFICATIONS (\(T_A = 25°C\) UNLESS OTHERWISE NOTED)

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<th>Symbol</th>
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<th>Typ(^a)</th>
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<th>Max</th>
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<tr>
<td>Common-Source Forward Transconductance</td>
<td>(g_{fs})</td>
<td>(V_{DS} = 20,V, I_D = 1,mA, f = 1,kHz)</td>
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<tr>
<td>Common-Source Output Conductance</td>
<td>(g_{os})</td>
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<tr>
<td>Drain-Source On-Resistance</td>
<td>(r_{DS(on)})</td>
<td>(V_{GS} = 0,V, I_D = 0,mA, f = 1,kHz)</td>
<td>30, 60, 100</td>
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<tr>
<td>Common-Source Input Capacitance</td>
<td>(C_{iss})</td>
<td>(V_{DS} = 20,V, V_{GS} = 0,V)</td>
<td>2N: 12, 14, 14, 14</td>
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<td>(f = 1,MHz)</td>
<td>PN: 12, 16, 16, 16</td>
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<tr>
<td>Common-Source Reverse Transfer Capacitance</td>
<td>(C_{rss})</td>
<td>(V_{DS} = 0,V)</td>
<td>2N: (V_{GS} = -5,V)</td>
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<td>(f = 1,MHz)</td>
<td>2N: (V_{GS} = -7,V)</td>
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<td>2N: (V_{GS} = -12,V)</td>
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<td>PN: (V_{GS} = -5,V)</td>
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<td>PN: (V_{GS} = -7,V)</td>
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<td>PN: (V_{GS} = -12,V)</td>
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<td>SST: (V_{GS} = -7,V)</td>
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<td>SST: (V_{GS} = -12,V)</td>
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<tr>
<td>Equivalent Input Noise Voltage</td>
<td>(e_n)</td>
<td>(V_{DS} = 10,V, I_D = 10,mA)</td>
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<td>(f = 1,kHz)</td>
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### Switching

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<th>Parameter</th>
<th>Symbol</th>
<th>Test Conditions</th>
<th>2N/PN</th>
<th>SST</th>
<th>2N/PN</th>
<th>SST</th>
<th>2N/PN</th>
<th>SST</th>
<th>2N/PN</th>
<th>SST</th>
<th>2N/PN</th>
<th>SST</th>
</tr>
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<tbody>
<tr>
<td>Turn-On Time</td>
<td>(t_{(on)})</td>
<td>(V_{DS} = 10,V, V_{GS(H)} = 0,V)</td>
<td>2</td>
<td>15</td>
<td>15</td>
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<tr>
<td>Turn-Off Time</td>
<td>(t_{(off)})</td>
<td>(V_{DD} = 10,V, V_{GS(H)} = 0,V)</td>
<td>2N/PN: 6</td>
<td>20</td>
<td>35</td>
<td>50</td>
<td>2N/PN: 6</td>
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<td>(t_{f})</td>
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</tbody>
</table>

Notes:

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

b. Pulse test: \(PW \leq 300\,\mu\text{s} \text{ duty cycle} \leq 3\%.\)
On-Resistance and Drain Current vs. Gate-Source Cutoff Voltage

- $r_{DS} @ I_D = 1 mA, V_{GS} = 0 V$
- $I_{DS} @ V_{DS} = 20 V, V_{GS} = 0 V$

On-Resistance vs. Drain Current

- $T_A = 25^\circ C$
- $V_{GS(off)} = -2 V$
- $V_{GS(off)} = -4 V$
- $V_{GS(off)} = -8 V$

On-Resistance vs. Temperature

- $I_D = 1 mA$
- $r_{DS} \text{ changes } X 0.7\%/^\circ C$
- $V_{GS(on)} = -2 V$
- $V_{GS(on)} = -4 V$
- $V_{GS(on)} = -8 V$

Turn-On Switching

- $t_r$ approximately independent of $I_D$
- $V_{DD} = 5 V, R_G = 50 \Omega$
- $V_{GD(ON)} = -10 V$
- $I_{(ON)} @ I_D = 12 mA$
- $I_{(ON)} @ I_D = 3 mA$

Turn-Off Switching

- $t_{off}$ independent of device $V_{GD(off)}$
- $V_{DD} = 5 V, V_{GD(s)} = -10 V$
- $V_{GD(off)} = -2 V$
- $V_{GD(off)} = -4 V$
- $V_{GD(off)} = -8 V$

Capacitance vs. Gate-Source Voltage

- $t = 1 MHz$
- $V_{DD} = 9 V$
- $C_{ISS}$
- $C_{RSS}$

Capacitance (pF)

- $f = 1 MHz$
- $V_{DS} = 0 V$
- $V_{GS}(off)$
- $V_{GS(off)}$
- $T_A = 25^\circ C$
- $T_{emtperature (_C)}$

Typical Characteristics ($T_A = 25^\circ C$ unless otherwise noted)
TYPICAL CHARACTERISTICS (TA = 25°C UNLESS OTHERWISE NOTED)

**Noise Voltage vs. Frequency**

- $V_{DS} = 10\, V$
- $I_b = 1\, mA$
- $I_b = 10\, mA$

**Forward Transconductance and Output Conductance vs. Gate-Source Cutoff Voltage**

- $g_{fs}$ and $g_{os} @ V_{DS} = 20\, V$
- $V_{GS} = 0\, V$, $f = 1\, kHz$

**Gate Leakage Current**

- $T_A = 125\, ^\circ C$
- $I_{GSS} @ 125\, ^\circ C$
- $I_{GSS} @ 25\, ^\circ C$
- $I_{G(on)} @ I_D$

**Common-Gate Input Admittance**

- $V_{DG} = 10\, V$
- $I_D = 1\, mA$
- $I_D = 10\, mA$

**Common-Gate Forward Admittance**

- $V_{DG} = 10\, V$
- $I_D = 10\, mA$
- $T_A = 25\, ^\circ C$

**Common-Gate Reverse Admittance**

- $V_{DG} = 10\, V$
- $I_D = 10\, mA$
- $T_A = 25\, ^\circ C$

Vishay Siliconix

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

**Common-Gate Output Admittance**

- **VGS = 10 V**
- **ID = 10 mA**
- **TA = 25°C**

**Transconductance vs. Drain Current**

- **VGS(off) = -2 V**
- **VDS = 10 V**
- **f = 1 kHz**
- **TA = -55°C**
- **VGS(off) = -4 V**

**Output Characteristics**

- **VGS(off) = -4 V**
- **VGS = 0 V**
- **VGS = 10 V**
- **VGS = 15 V**
- **VGS = 20 V**

**Transfer Characteristics**

- **VGS(off) = -4 V**
- **VGS = 0 V**
- **VGS = 10 V**
- **VGS = 20 V**
- **TA = -55°C**
- **TA = 25°C**
- **TA = 125°C**

**Switching Time Test Circuit**

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<th>VGS(L)</th>
<th>4391</th>
<th>4392</th>
<th>4393</th>
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<tbody>
<tr>
<td>VGS(H)</td>
<td>-12 V</td>
<td>-7 V</td>
<td>-5 V</td>
</tr>
<tr>
<td>RL*</td>
<td>800 Ω</td>
<td>1600 Ω</td>
<td>3000 Ω</td>
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<tr>
<td>ID(on)</td>
<td>12 mA</td>
<td>6 mA</td>
<td>3 mA</td>
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*Non-inductive

**Input Pulse**

- Rise Time < 1 ns
- Fall Time < 1 ns
- Pulse Width 100 ns
- PRF 1 MHz

**Sampling Scope**

- Rise Time 0.4 ns
- Input Resistance 10 MΩ
- Input Capacitance 1.5 pF

See Typical Characteristics curves for changes.
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