3rd. Over Tone Quartz Crystal Oscillator

**GENERAL DESCRIPTION**

The NJU6397 series that is a C-MOS IC for quartz crystal oscillator consists of an oscillation amplifier and 3-state output buffer.

The series has three types of A, B and C. The frequency range of the A type is from 75 to 90MHz, and the B type is from 90 to 110MHz, and the C type is from 110 to 135MHz.

The oscillation amplifier realizes very low oscillation stop current with NAND circuit.

The 3-state output buffer is C-MOS compatible.

**FEATURES**

- Operating Voltage: 2.3 to 3.6V
- Maximum Oscillation Frequency (See Line-up Table)
- High Fan-out: $I_{OH}/I_{OL} = 6mA @V_{DD}=2.5V$
  \[ I_{OH}/I_{OL} = 8mA @V_{DD}=3.3V \]
- Oscillation Stop and Output Stand-by Function
- 3-State Output Buffer
- Oscillation Capacitors $C_g$ and $C_d$ on-Die
- Package Outline: Thin-Die/Wafer
- C-MOS Technology

**LINE-UP TABLE**

<table>
<thead>
<tr>
<th>Type No.</th>
<th>Recommended Oscillation Frequency</th>
<th>Output Frequency</th>
<th>Cg/Cd</th>
</tr>
</thead>
<tbody>
<tr>
<td>NJU6397</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>75 to 90MHz</td>
<td>$f_0$</td>
<td>11/12pF</td>
</tr>
<tr>
<td>B</td>
<td>90 to 110MHz</td>
<td></td>
<td>9/10pF</td>
</tr>
<tr>
<td>C</td>
<td>110 to 135MHz</td>
<td></td>
<td>8/9pF</td>
</tr>
</tbody>
</table>

Note1) The oscillation frequency range has used NJRC's characteristics authentication crystal for measurement. However, it is not guaranteed.

**PAD LOCATION**

<table>
<thead>
<tr>
<th>Thin-Die</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CONT</td>
<td></td>
</tr>
<tr>
<td>XT</td>
<td></td>
</tr>
<tr>
<td>V_{SS}</td>
<td></td>
</tr>
<tr>
<td>F_{OUT}</td>
<td></td>
</tr>
</tbody>
</table>

**COORDINATES**

<table>
<thead>
<tr>
<th>No</th>
<th>Pad Name</th>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CONT</td>
<td>-178</td>
<td>231</td>
</tr>
<tr>
<td>2</td>
<td>XT</td>
<td>-178</td>
<td>77</td>
</tr>
<tr>
<td>3</td>
<td>XT</td>
<td>-178</td>
<td>-77</td>
</tr>
<tr>
<td>4</td>
<td>V_{SS}</td>
<td>-178</td>
<td>-231</td>
</tr>
<tr>
<td>5</td>
<td>F_{OUT}</td>
<td>206</td>
<td>-231</td>
</tr>
<tr>
<td>8</td>
<td>V_{DD}</td>
<td>206</td>
<td>231</td>
</tr>
</tbody>
</table>

Starting Point: Die Center

Die Size: 0.70x0.75mm

Thin-Die Thickness(C-D): 200±20um
Thin-Die Thickness(C-L): 140±10um
Wafer Thickness(W-H): 200±20um
Wafer Thickness(W-L): 140±10um
Pad Size: 90x90um
Die Substrate: V_{DD} Level
## TERMINAL DESCRIPTION

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONT</td>
<td>Oscillation and 3-state Output Buffer Control</td>
</tr>
<tr>
<td>F_OUT</td>
<td>H or OPEN</td>
</tr>
<tr>
<td>L</td>
<td>L Oscillation Stop and High impedance Output</td>
</tr>
<tr>
<td>XT</td>
<td>Quartz Crystal Connecting Terminals</td>
</tr>
<tr>
<td>V_SS</td>
<td>V_SS=0V</td>
</tr>
<tr>
<td>F_OUT</td>
<td>Frequency Output</td>
</tr>
<tr>
<td>V_DD</td>
<td>V_DD=2.5V/3.3V</td>
</tr>
</tbody>
</table>

### ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>RATING</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>V_DD</td>
<td>-0.5 to +7.0</td>
<td>V</td>
</tr>
<tr>
<td>Input Voltage</td>
<td>V_IN</td>
<td>V_SS-0.5 to V_DD+0.5</td>
<td>V</td>
</tr>
<tr>
<td>Output Voltage</td>
<td>V_O</td>
<td>-0.5 to V_DD+0.5</td>
<td>V</td>
</tr>
<tr>
<td>Input Current</td>
<td>I_IN</td>
<td>±10</td>
<td>mA</td>
</tr>
<tr>
<td>Output Current</td>
<td>I_O</td>
<td>±25</td>
<td>mA</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>Topr</td>
<td>-40 to +85</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>Tstg</td>
<td>-55 to +125</td>
<td>°C</td>
</tr>
</tbody>
</table>

Note2) If the supply voltage (V_DD) is less than 7.0V, the input voltage must not over the V_DD level though 7.0V is limit specified.

Note3) Decoupling capacitor should be connected between V_DD and V_SS due to the stabilized operation for the circuit.
## ELECTRICAL CHARACTERISTICS

(Ta=25°C)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Voltage</td>
<td>V_DD</td>
<td></td>
<td>2.3</td>
<td>3.6</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Recommended Oscillation Frequency</td>
<td>f</td>
<td>A type Note4)</td>
<td>75</td>
<td>90</td>
<td></td>
<td>MHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B type Note4)</td>
<td>90</td>
<td>110</td>
<td></td>
<td>MHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C type Note4)</td>
<td>110</td>
<td>135</td>
<td></td>
<td>MHz</td>
</tr>
</tbody>
</table>

Note4) The oscillation frequency range has used NJRC’s characteristics authentication crystal for measurement. However it is not guaranteed.

A,B,C and E type

(V_DD=2.5V,Ta=25°C)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Current</td>
<td>I_DD1</td>
<td>A type, fosc=90MHz, C_L=15pF</td>
<td>10</td>
<td>20</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B type, fosc=110MHz, C_L=15pF</td>
<td>10</td>
<td>20</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C type, fosc=135MHz, C_L=15pF</td>
<td>15</td>
<td>30</td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Oscillation Stopping Current</td>
<td>I_DD2</td>
<td>CONT=V_SS, No load</td>
<td>2</td>
<td>5</td>
<td></td>
<td>uA</td>
</tr>
<tr>
<td>Stand-by Current</td>
<td>I_ST</td>
<td>CONT=XT=V_SS, No load Note5)</td>
<td>1</td>
<td></td>
<td></td>
<td>uA</td>
</tr>
<tr>
<td>Input Voltage</td>
<td>V_IN</td>
<td></td>
<td>2.0</td>
<td>2.5</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>V_IL</td>
<td></td>
<td>0</td>
<td>0.5</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>Output Current</td>
<td>I_OH</td>
<td>V_OH=2.2V</td>
<td>6</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td></td>
<td>I OL</td>
<td>V_OH=0.3V</td>
<td>6</td>
<td></td>
<td></td>
<td>mA</td>
</tr>
<tr>
<td>Input Current</td>
<td>I_IN</td>
<td>CONT=0.8V_DD</td>
<td>7.5</td>
<td>12.0</td>
<td></td>
<td>uA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CONT=0.2V_DD</td>
<td>1.2</td>
<td>2.0</td>
<td></td>
<td>uA</td>
</tr>
<tr>
<td>3-state Off Leakage Current</td>
<td>I_OZ</td>
<td>CONT=V_SS, F_OUT= V_DD or V_SS</td>
<td>±0.1</td>
<td></td>
<td></td>
<td>uA</td>
</tr>
<tr>
<td>Feedback Resistance</td>
<td>Rf</td>
<td>A type</td>
<td>3.8</td>
<td></td>
<td></td>
<td>kΩ</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B type</td>
<td>3.8</td>
<td></td>
<td></td>
<td>kΩ</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C type</td>
<td>2.9</td>
<td></td>
<td></td>
<td>kΩ</td>
</tr>
<tr>
<td>Internal Capacitor</td>
<td>Cg/Cd</td>
<td>A type, fosc=90MHz</td>
<td>11/12</td>
<td></td>
<td></td>
<td>pF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B type, fosc=110MHz</td>
<td>9/10</td>
<td></td>
<td></td>
<td>pF</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C type, fosc=135MHz</td>
<td>8/9</td>
<td></td>
<td></td>
<td>pF</td>
</tr>
<tr>
<td>Oscillation Frequency</td>
<td>f</td>
<td>A type Note6)</td>
<td>90</td>
<td></td>
<td></td>
<td>MHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B type Note6)</td>
<td>110</td>
<td></td>
<td></td>
<td>MHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C type Note6)</td>
<td>135</td>
<td></td>
<td></td>
<td>MHz</td>
</tr>
<tr>
<td>Output Signal Symmetry</td>
<td>SYM</td>
<td>C_L=15pF, @V_DD/2</td>
<td>45</td>
<td>50</td>
<td>55</td>
<td>%</td>
</tr>
<tr>
<td>Output Signal Rise Time</td>
<td>tr</td>
<td>C_L=15pF, 10% to 90%</td>
<td>3</td>
<td>4</td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>Output Signal Fall Time</td>
<td>tf</td>
<td>C_L=15pF, 90% to 10%</td>
<td>3</td>
<td>4</td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>Output Disable time</td>
<td>t_PILZ</td>
<td>C_L=15pF, R_UP=10kΩ</td>
<td>200</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
<tr>
<td>Output Enable time</td>
<td>t_PZL</td>
<td>C_L=15pF, R_UP=10kΩ</td>
<td>200</td>
<td></td>
<td></td>
<td>ns</td>
</tr>
</tbody>
</table>

Note5) Excluding input current on CONT Terminal.

Note6) The oscillation frequency has used NJRC’s characteristics authentication crystal for measurement. However it is not guaranteed.
**NJU6397 Series**

(V_{DD}=3.3V, Ta=25°C)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>CONDITIONS</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Current</td>
<td>I_{DD1}</td>
<td>A type, fosc=90MHz, C_L=15pF</td>
<td>13</td>
<td>25</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>B type, fosc=110MHz, C_L=15pF</td>
<td>13</td>
<td>28</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>C type, fosc=135MHz, C_L=15pF</td>
<td>18</td>
<td>35</td>
<td>mA</td>
<td></td>
</tr>
<tr>
<td>Oscillation Stopping Current</td>
<td>I_{DD2}</td>
<td>CONT=V_{SS}, No load</td>
<td>5</td>
<td>10</td>
<td>uA</td>
<td></td>
</tr>
<tr>
<td>Stand-by Current</td>
<td>I_{ST}</td>
<td>CONT=XT=V_{SS}, No load</td>
<td>5</td>
<td>10</td>
<td>uA</td>
<td></td>
</tr>
<tr>
<td>Input Voltage</td>
<td>V_{IH}</td>
<td>2.3</td>
<td>3.3</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>V_{IL}</td>
<td>0</td>
<td>1.0</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Current</td>
<td>I_{OH}</td>
<td>V_{OH}=2.97V</td>
<td>8</td>
<td>mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I_{OL}</td>
<td>V_{OL}=0.33V</td>
<td>8</td>
<td>mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Current</td>
<td>I_{IN}</td>
<td>CONT=0.8V_{DD}</td>
<td>12.5</td>
<td>18.0</td>
<td>uA</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CONT=0.2V_{DD}</td>
<td>2.5</td>
<td>3.5</td>
<td>uA</td>
<td></td>
</tr>
<tr>
<td>3-state Off Leakage Current</td>
<td>I_{OZ}</td>
<td>CONT=V_{SS}, F_{OUT}=V_{DD} or V_{SS}</td>
<td>±0.1</td>
<td>uA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feedback Resistance</td>
<td>R_{f}</td>
<td>A type</td>
<td>3.8</td>
<td>kΩ</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>B type</td>
<td>3.8</td>
<td>kΩ</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>C type</td>
<td>2.9</td>
<td>kΩ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal Capacitor</td>
<td>C_{g/Cd}</td>
<td>A type, fosc=90MHz</td>
<td>11/12</td>
<td>pF</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>B type, fosc=110MHz</td>
<td>9/10</td>
<td>pF</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>C type, fosc=135MHz</td>
<td>8/9</td>
<td>pF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oscillation Frequency</td>
<td>f</td>
<td>A type Note6)</td>
<td>90</td>
<td>MHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>B type Note6)</td>
<td>110</td>
<td>MHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>C type Note6)</td>
<td>135</td>
<td>MHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Signal Symmetry</td>
<td>SYM</td>
<td>C_L=15pF, @V_{DD}/2</td>
<td>45</td>
<td>50</td>
<td>55</td>
<td>%</td>
</tr>
<tr>
<td>Output Signal Rise Time</td>
<td>tr</td>
<td>C_L=15pF, 10% to 90%</td>
<td>2</td>
<td>3</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>Output Signal Fall Time</td>
<td>tf</td>
<td>C_L=15pF, 90% to 10%</td>
<td>2</td>
<td>3</td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>Output Disable time</td>
<td>I_{PLZ}</td>
<td>C_L=15pF, R_{UP}=10kΩ</td>
<td>150</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Enable Time</td>
<td>I_{PZL}</td>
<td>C_L=15pF, R_{UP}=10kΩ</td>
<td>150</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note5) Excluding input current on CONT Terminal.

Note6) The oscillation frequency has used NJRC's characteristics authentication crystal for measurement. However it is not guaranteed.
MEASUREMENT CIRCUITS

(1) Output Signal Symmetry ($C_L = 15\text{pF}$)

![Circuit Diagram](image)

(2) Output Signal Rise/Fall Time ($C_L = 15\text{pF}$)

![Circuit Diagram](image)

(3) Output Disable/Enable Time ($C_L = 15\text{pF}, R_{UP} = 10\text{k}\Omega$)

![Circuit Diagram](image)

[CAUTION]
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