

## 1.8V 125MHz 3rd Over Tone Quartz Crystal Oscillator

### ■GENERAL DESCRIPTION

The NJU6394 series is a C-MOS, 1.8V, 125MHz, 3rd overtone quartz crystal oscillator that consists of an oscillation amplifier (low oscillation-stop current based on NAND circuit) and 3-state output buffer (C-MOS compatible, 15pF load).

The operating voltage is from 1.6V to 3.0V, and frequency range is from 75MHz to 125MHz divided by 3 version, A-type: 75MHz to 90MHz, B-type: 90MHz to 105MHz, C-type: 105MHz to 125MHz.

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

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

### ■PACKAGE OUTLINE

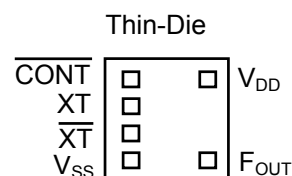


NJU6394XC-X

### ■FEATURES

- Operating Voltage 1.6 to 3.0V
- Maximum Oscillation Frequency (See Line-up Table)
- 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

### ■PAD LOCATION



### ■LINE-UP TABLE

| Type No. |   | Recommended Oscillation Frequency | Output Frequency | Rf             | Cg/Cd  |
|----------|---|-----------------------------------|------------------|----------------|--------|
| NJU6394  | A | 75 to 90MHz                       | $f_0$            | 2.2 k $\Omega$ | 8/12pF |
|          | B | 90 to 105MHz                      |                  |                | 7/10pF |
|          | C | 105 to 125MHz                     |                  |                | 6/7pF  |

### ■COORDINATES

| No | Pad Name         | X    | Y    |
|----|------------------|------|------|
| 1  | CONT             | -178 | 231  |
| 2  | XT               | -178 | 77   |
| 3  | XT               | -178 | -77  |
| 4  | V <sub>SS</sub>  | -178 | -231 |
| 5  | F <sub>OUT</sub> | 206  | -231 |
| 6  | V <sub>DD</sub>  | 206  | 231  |

Starting Point: Die Center Unit[ $\mu$ m]

Die Size: 0.7x0.75mm

Thin-Die Thickness(C-D): 200 $\pm$ 20 $\mu$ m

Thin-Die Thickness(C-L): 140 $\pm$ 10 $\mu$ m

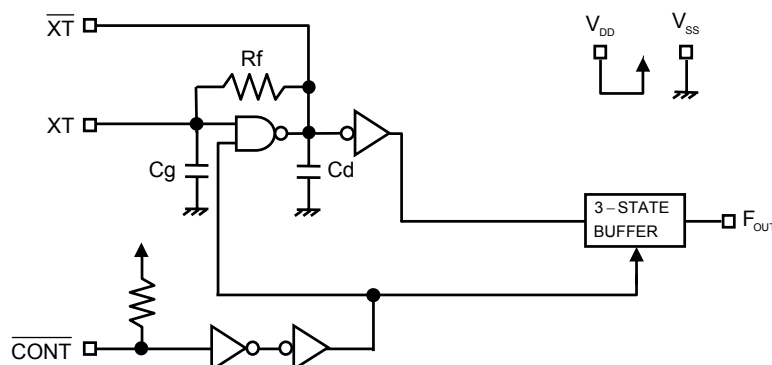
Wafer Thickness(W-H): 200 $\pm$ 20 $\mu$ m

Wafer Thickness(W-L): 140 $\pm$ 10 $\mu$ m

Pad Size: 90x90 $\mu$ m

Die Substrate: V<sub>DD</sub> Level

### ■BLOCK DIAGRAM



## ■ TERMINAL DESCRIPTION

| SYMBOL                   | FUNCTION                                      |                                            |
|--------------------------|-----------------------------------------------|--------------------------------------------|
| $\overline{\text{CONT}}$ | Oscillation and 3-state Output Buffer Control |                                            |
|                          | $\overline{\text{CONT}}$                      | $F_{\text{OUT}}$                           |
|                          | H or OPEN                                     | Output frequency $f_0$                     |
|                          | L                                             | Oscillation Stop and High impedance Output |
| $\text{XT}$              | Quartz Crystal Connecting Terminals           |                                            |
| $\overline{\text{XT}}$   |                                               |                                            |
| $V_{\text{SS}}$          | $V_{\text{SS}}=0\text{V}$                     |                                            |
| $F_{\text{OUT}}$         | Frequency Output                              |                                            |
| $V_{\text{DD}}$          | $V_{\text{DD}}=1.8\text{V}$                   |                                            |

## ■ ABSOLUTE MAXIMUM RATINGS

( $T_a=25^\circ\text{C}$ )

| PARAMETER                   | SYMBOL           | RATING                                     | UNIT             |
|-----------------------------|------------------|--------------------------------------------|------------------|
| Supply Voltage              | $V_{\text{DD}}$  | -0.5 to +7.0                               | V                |
| Input Voltage               | $V_{\text{IN}}$  | $V_{\text{SS}}-0.5$ to $V_{\text{DD}}+0.5$ | V                |
| Output Voltage              | $V_{\text{O}}$   | -0.5 to $V_{\text{DD}}+0.5$                | V                |
| Input Current               | $I_{\text{IN}}$  | $\pm 10$                                   | mA               |
| Output Current              | $I_{\text{O}}$   | $\pm 25$                                   | mA               |
| Operating Temperature Range | $T_{\text{opr}}$ | -40 to +85                                 | $^\circ\text{C}$ |
| Storage Temperature Range   | $T_{\text{stg}}$ | -55 to +125                                | $^\circ\text{C}$ |

Note1) If the supply voltage( $V_{\text{DD}}$ ) is less than 7.0V, the input voltage must not over the  $V_{\text{DD}}$  level though 7.0V is limit specified.

Note2) Decoupling capacitor should be connected between  $V_{\text{DD}}$  and  $V_{\text{SS}}$  due to the stabilized operation for the circuit.

## ■ ELECTRICAL CHARACTERISTICS

(Ta=25°C)

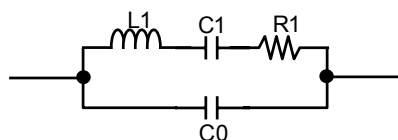
| PARAMETER         | SYMBOL   | CONDITIONS | MIN | TYP | MAX | UNIT |
|-------------------|----------|------------|-----|-----|-----|------|
| Operating Voltage | $V_{DD}$ |            | 1.6 |     | 3.0 | V    |

(V<sub>DD</sub>=1.8V, Ta=25°C)

| PARAMETER                     | SYMBOL                         | CONDITIONS                                                                   | MIN  | TYP  | MAX  | UNIT |
|-------------------------------|--------------------------------|------------------------------------------------------------------------------|------|------|------|------|
| Operating Current             | $I_{DD1}$                      | A type, fosc=90MHz, C <sub>L</sub> =15pF                                     |      | 6    | 10   | mA   |
|                               |                                | B type, fosc=105MHz, C <sub>L</sub> =15pF                                    |      | 7    | 12   |      |
|                               |                                | C type, fosc=125MHz, C <sub>L</sub> =15pF                                    |      | 8    | 12   |      |
| Oscillation Stopping Current  | $I_{DD2}$                      | CONT=V <sub>SS</sub> , No load                                               |      | 2    | 6    | uA   |
| Stand-by Current              | I <sub>st</sub>                | CONT=XT=V <sub>SS</sub> , No load Note3)                                     |      |      | 2    | uA   |
| Input Voltage                 | V <sub>IH</sub>                |                                                                              | 1.26 |      | 1.8  | V    |
|                               | V <sub>IL</sub>                |                                                                              | 0    |      | 0.54 | V    |
| Output Current                | I <sub>OH</sub>                | V <sub>OH</sub> =1.62V                                                       | 2    |      |      | mA   |
|                               | I <sub>OL</sub>                | V <sub>OL</sub> =0.18V                                                       | 2    |      |      | mA   |
| Input Current                 | I <sub>IN</sub>                | CONT=0.8V <sub>DD</sub>                                                      |      | 3.0  | 4.5  | uA   |
|                               |                                | CONT=0.2V <sub>DD</sub>                                                      |      | 0.5  | 0.7  | uA   |
| 3-state Off Leakage Current   | I <sub>OZ</sub>                | CONT=V <sub>SS</sub> , F <sub>OUT</sub> = V <sub>DD</sub> or V <sub>SS</sub> |      |      | ±0.2 | uA   |
| Feedback Resistance           | R <sub>f</sub>                 | A type                                                                       |      | 2.2  |      | kΩ   |
| Internal Capacitor            | C <sub>g</sub> /C <sub>d</sub> | A type, fosc=90MHz                                                           |      | 8/12 |      | pF   |
|                               |                                | B type, fosc=105MHz                                                          |      | 7/10 |      |      |
|                               |                                | C type, fosc=125MHz                                                          |      | 6/7  |      |      |
| Maximum Oscillation Frequency | F <sub>MAX</sub>               | A type                                                                       | 90   |      |      | MHz  |
|                               |                                | B type                                                                       | 105  |      |      |      |
|                               |                                | C type                                                                       | 125  |      |      |      |
| Output Signal Symmetry        | SYM                            | C <sub>L</sub> =15pF, @V <sub>DD</sub> /2                                    | 45   | 50   | 55   | %    |
| Output Signal Rise Time       | t <sub>r</sub>                 | C <sub>L</sub> =15pF, 10% to 90%                                             |      | 2.2  | 3    | ns   |
| Output Signal Fall Time       | t <sub>f</sub>                 | C <sub>L</sub> =15pF, 90% to 10%                                             |      | 2.2  | 3    | ns   |
| Output Disable time           | t <sub>PLZ</sub>               | C <sub>L</sub> =15pF, R <sub>UP</sub> =10kΩ                                  |      |      | 250  | ns   |
| Output Enable Time            | t <sub>PZL</sub>               | C <sub>L</sub> =15pF, R <sub>UP</sub> =10kΩ                                  |      |      | 250  | ns   |

Note3) Excluding input current on CONT Terminal.

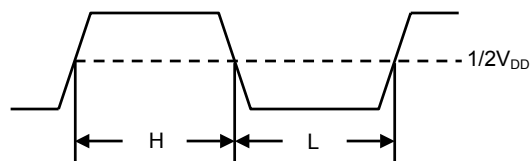
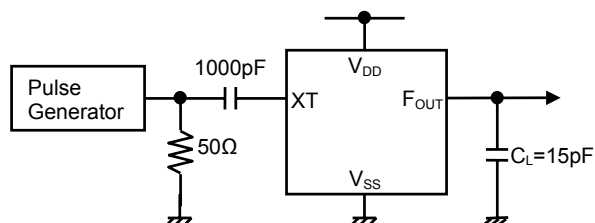
## ■ STANDARD CRYSTAL PARAMETERS FOR MEASUREMENT CIRCUITS



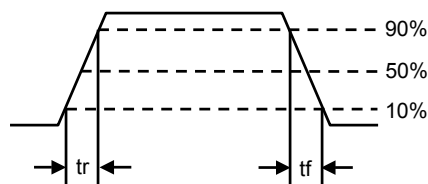
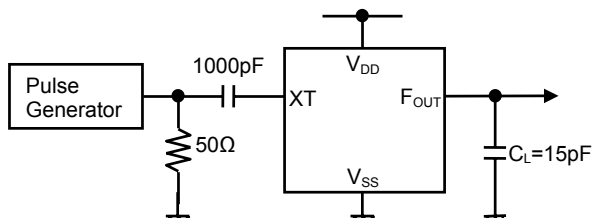
| f[MHz] | R1[Ω] | L1[mH] | C1[fF] | C0[pF] |
|--------|-------|--------|--------|--------|
| 90     | 27.6  | 3.12   | 1.00   | 3.29   |
| 105    | 17.1  | 1.99   | 1.16   | 3.27   |
| 125    | 14.9  | 1.20   | 1.36   | 4.83   |

## MEASUREMENT CIRCUITS

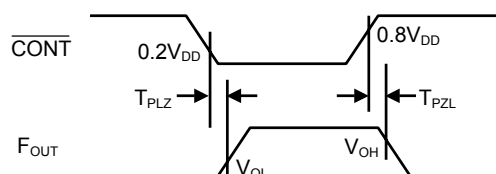
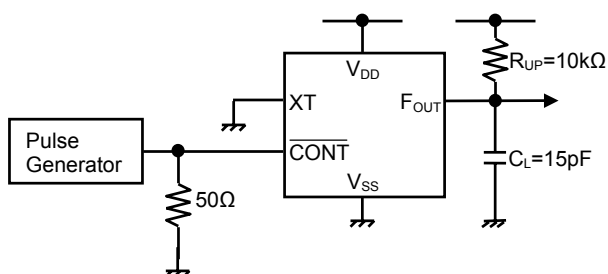
### (1) Output Signal Symmetry ( $C_L=15\text{pF}$ )



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



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



#### [CAUTION]

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