

## High Drive Fundamental Quartz Crystal Oscillator

### ■GENERAL DESCRIPTION

The NJU6368 series is a C-MOS fundamental quartz crystal oscillator that consists of an oscillation amplifier, 3-stage divider and 3-state output buffer.

The 3-stage divider generates only one frequency selected of  $f_0$ ,  $f_0/2$ ,  $f_0/4$  and  $f_0/8$  by internal circuits is output.

The oscillation amplifier is realized very low stand-by current using NAND circuit.

The 3-state output buffer is C-MOS compatible and can drive 50pF(@5V) C-MOS load.

Furthermore, the package is small-sized SOT-23-6-1.

### ■PACKAGE OUTLINE

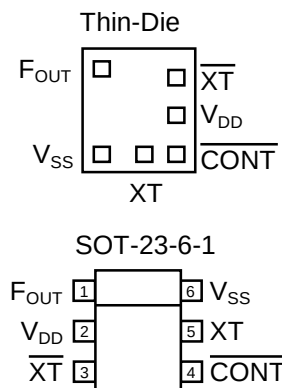


NJU6368XC-C NJU6368XF1

### ■FEATURES

- Operating Voltage 2.7 to 5.5V
- Maximum Oscillation Frequency 50MHz
- Low Operating Current
- High Fan-out  $I_{OH}/I_{OL}=8mA@3.3V$   
 $I_{OH}/I_{OL}=16mA@5.0V$
- 3-Stage Divider Maximum Divider  $f_0/8$
- Oscillation Stop and Output Stand-by Function
- 3-State Output Buffer
- Oscillation Capacitors  $C_g$  and  $C_d$  on-Die
- Package Outline Thin-Die/SOT-23-6-1
- C-MOS Technology

### ■PAD LOCATION



### ■LINE-UP TABLE

| Type No. | $F_{OUT}$ | Internal Connect | $C_g/C_d$ |
|----------|-----------|------------------|-----------|
| NJU6368  | A $f_0$   | Connected A Line | 15/15pF   |
|          | B $f_0/2$ | Connected B Line | 15/15pF   |
|          | C $f_0/4$ | Connected C Line | 15/15pF   |
|          | D $f_0/8$ | Connected D Line | 15/15pF   |
|          | P $f_0$   | Connected A Line | Non       |

### ■COORDINATES

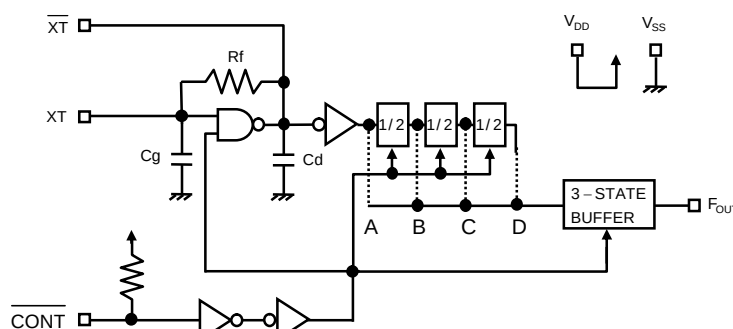
| No | Pad Name          | X    | Y    |
|----|-------------------|------|------|
| 1  | $F_{OUT}$         | -207 | 247  |
| 2  | $V_{SS}$          | -207 | -247 |
| 3  | XT                | 33   | -247 |
| 4  | $\overline{CONT}$ | 207  | -247 |
| 5  | $V_{DD}$          | 207  | -17  |
| 8  | $\overline{XT}$   | 207  | 172  |

### ■EXAMPLE OF PART NUMBER

- 1)NJU6368AC-C  
 $F_{OUT}=f_0$ , Die Thickness=260um
- 2)NJU6368CF1  
 $F_{OUT}=f_0/4$ , Mold package, SOT-23-6-1

Starting Point: Die Center Unit[um]  
 Die Size: 0.67x0.75mm  
 Thin-Die Thickness: 260±20um  
 Pad Size: 90x90um  
 Die Substrate:  $V_{DD}$  Level

### ■BLOCK DIAGRAM



New Japan Radio Co., Ltd.

## ■ TERMINAL DESCRIPTION

| SYMBOL                   | FUNCTION                                      |                                                                                      |
|--------------------------|-----------------------------------------------|--------------------------------------------------------------------------------------|
| $\overline{\text{CONT}}$ | Oscillation and 3-state Output Buffer Control |                                                                                      |
|                          | $\overline{\text{CONT}}$                      | $F_{\text{OUT}}$                                                                     |
|                          | H or OPEN                                     | Output either one frequency selected of $f_0$ , $f_0/2$ , $f_0/4$ and $f_0/8$ Note1) |
|                          | 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                              |                                                                                      |
| $V_{\text{DD}}$          | $V_{\text{DD}}=3.3\text{V}/5.0\text{V}$       |                                                                                      |

Note1) Refer to the line-up table.

## ■ ABSOLUTE MAXIMUM RATINGS

(Ta=25°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   |
| Power Dissipation Note 4)   | $P_{\text{D}}$   | 200(SOT-23-6-1)                            | mW   |
| Operating Temperature Range | $T_{\text{opr}}$ | -40 to +85                                 | °C   |
| Storage Temperature Range   | $T_{\text{stg}}$ | -55 to +125                                | °C   |

Note2) 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.

Note3) Decoupling capacitor should be connected between  $V_{\text{DD}}$  and  $V_{\text{SS}}$  due to the stabilized operation for the circuit.

Note4) Power Dissipation is the maximum value of a package simple substance.

## ■ ELECTRICAL CHARACTERISTICS

(Ta=25°C)

| PARAMETER         | SYMBOL   | CONDITIONS | MIN | TYP | MAX | UNIT |
|-------------------|----------|------------|-----|-----|-----|------|
| Operating Voltage | $V_{DD}$ |            | 2.7 |     | 5.5 | V    |

(V<sub>DD</sub>=3.3V, Ta=25°C)

| PARAMETER                     | SYMBOL                         | CONDITIONS                                                                         | MIN  | TYP   | MAX  | UNIT |
|-------------------------------|--------------------------------|------------------------------------------------------------------------------------|------|-------|------|------|
| Operating Current             | $I_{DD}$                       | A version, fosc=16MHz, C <sub>L</sub> =30pF                                        |      |       | 8    | mA   |
|                               |                                | B version, fosc=16MHz, C <sub>L</sub> =30pF                                        |      |       | 6    |      |
|                               |                                | C version, fosc=16MHz, C <sub>L</sub> =30pF                                        |      |       | 4    |      |
|                               |                                | D version, fosc=16MHz, C <sub>L</sub> =30pF                                        |      |       | 3    |      |
|                               |                                | P version, fosc=16MHz, C <sub>L</sub> =30pF<br>Note5)                              |      |       | 8    |      |
| Oscillation Stopping Current  | $I_{STB}$                      | $\overline{CONT} = V_{SS}$ , No load                                               |      | 2     | 5    | uA   |
| Stand-by Current              | $I_{st}$                       | $\overline{CONT} = XT = V_{SS}$ , No load Note6)                                   |      |       | 1    | uA   |
| Input Voltage                 | $V_{IH}$                       |                                                                                    | 2.31 |       | 3.3  | V    |
|                               | $V_{IL}$                       |                                                                                    | 0    |       | 0.99 | V    |
| Output Current                | $I_{OH}$                       | $V_{OH}=2.97V$                                                                     | 8    |       |      | mA   |
|                               | $I_{OL}$                       | $V_{OL}=0.33V$                                                                     | 8    |       |      | mA   |
| Input Current                 | $I_{IN}$                       | $\overline{CONT} = 0.8V_{DD}$                                                      |      | 10.0  | 15.0 | uA   |
|                               |                                | $\overline{CONT} = 0.2V_{DD}$                                                      |      | 1.8   | 3.0  | uA   |
| 3-state Off Leakage Current   | $I_{OZ}$                       | $\overline{CONT} = V_{SS}$ , F <sub>OUT</sub> = V <sub>DD</sub> or V <sub>SS</sub> |      |       | ±0.1 | uA   |
| Feedback Resistance           | R <sub>f</sub>                 |                                                                                    |      | 255   |      | kΩ   |
| Internal Capacitor            | C <sub>g</sub> /C <sub>d</sub> | fosc=16MHz, A/B/C/D version                                                        |      | 15/15 |      | pF   |
|                               |                                | P version                                                                          |      | -     |      |      |
| Maximum Oscillation Frequency | F <sub>MAX</sub>               |                                                                                    | 50   |       |      | MHz  |
| Output Signal Symmetry        | SYM                            | C <sub>L</sub> =15pF, @V <sub>DD</sub> /2                                          | 45   | 50    | 55   | %    |
|                               |                                | C <sub>L</sub> =30pF, @V <sub>DD</sub> /2                                          | 45   | 50    | 55   |      |
| Output Signal Rise Time       | tr                             | C <sub>L</sub> =15pF, 10% to 90%                                                   |      | 2     | 4    | ns   |
|                               |                                | C <sub>L</sub> =30pF, 10% to 90%                                                   |      | 4     | 8    |      |
| Output Signal Fall Time       | tf                             | C <sub>L</sub> =15pF, 90% to 10%                                                   |      | 2     | 4    | ns   |
|                               |                                | C <sub>L</sub> =30pF, 90% to 10%                                                   |      | 4     | 8    |      |
| Output Disable time           | t <sub>PLZ</sub>               | C <sub>L</sub> =15pF, R <sub>UP</sub> =10kΩ                                        |      |       | 150  | ns   |
| Output Enable Time            | t <sub>PZL</sub>               | C <sub>L</sub> =15pF, R <sub>UP</sub> =10kΩ                                        |      |       | 150  | ns   |

Note5) P version is measured with external capacitors contained 13pF for C<sub>g</sub> and 13pF for C<sub>d</sub>.Note6) Excluding input current on  $\overline{CONT}$  Terminal.

(V<sub>DD</sub>=5.0V, Ta=25°C)

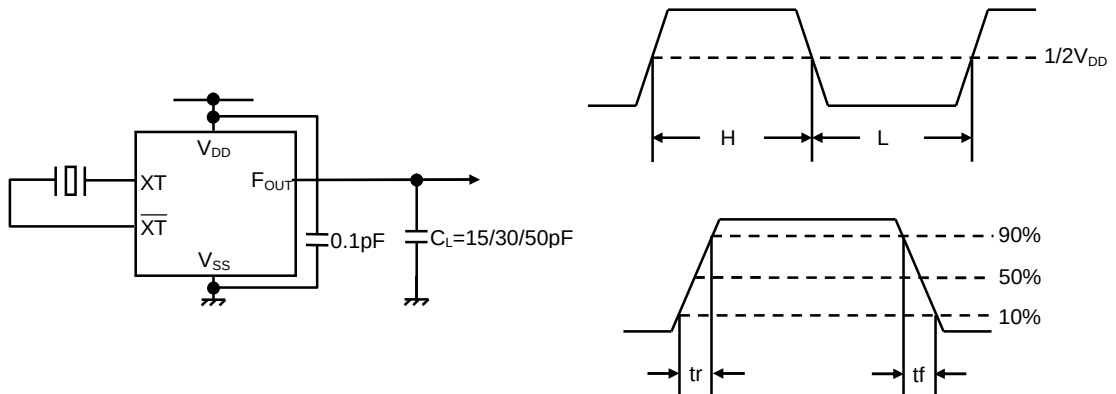
| PARAMETER                     | SYMBOL                         | CONDITIONS                                                                     | MIN | TYP   | MAX  | UNIT |
|-------------------------------|--------------------------------|--------------------------------------------------------------------------------|-----|-------|------|------|
| Operating Current             | I <sub>DD</sub>                | A version, fosc=16MHz, C <sub>L</sub> =50pF                                    |     |       | 15   | mA   |
|                               |                                | B version, fosc=16MHz, C <sub>L</sub> =50pF                                    |     |       | 11   |      |
|                               |                                | C version, fosc=16MHz, C <sub>L</sub> =50pF                                    |     |       | 9    |      |
|                               |                                | D version, fosc=16MHz, C <sub>L</sub> =50pF                                    |     |       | 7    |      |
|                               |                                | P version, fosc=16MHz, C <sub>L</sub> =50pF<br>Note5)                          |     |       | 15   |      |
| Oscillation Stopping Current  | I <sub>STB</sub>               | CONT = V <sub>SS</sub> , No load                                               |     | 5     | 10   | uA   |
| Stand-by Current              | I <sub>st</sub>                | CONT = XT = V <sub>SS</sub> , No load Note6)                                   |     |       | 1    | uA   |
| Input Voltage                 | V <sub>IH</sub>                |                                                                                | 3.5 |       | 5.0  | V    |
|                               | V <sub>IL</sub>                |                                                                                | 0   |       | 1.5  | V    |
| Output Current                | I <sub>OH</sub>                | V <sub>OH</sub> =4.5V                                                          | 16  |       |      | mA   |
|                               | I <sub>OL</sub>                | V <sub>OL</sub> =0.5V                                                          | 16  |       |      | mA   |
| Input Current                 | I <sub>IN</sub>                | CONT = 0.8V <sub>DD</sub>                                                      |     | 27.0  | 40.0 | uA   |
|                               |                                | CONT = 0.2V <sub>DD</sub>                                                      |     | 5.5   | 8.0  | 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> |     |       | ±0.1 | uA   |
| Feedback Resistance           | R <sub>f</sub>                 |                                                                                |     | 255   |      | kΩ   |
| Internal Capacitor            | C <sub>g</sub> /C <sub>d</sub> | fosc=16MHz, A/B/C/D version                                                    |     | 15/15 |      | pF   |
|                               |                                | P version                                                                      |     | -     |      |      |
| Maximum Oscillation Frequency | F <sub>MAX</sub>               |                                                                                | 50  |       |      | MHz  |
| Output Signal Symmetry        | SYM                            | C <sub>L</sub> =15pF, @V <sub>DD</sub> /2                                      | 45  | 50    | 55   | %    |
|                               |                                | C <sub>L</sub> =50pF, @V <sub>DD</sub> /2                                      | 45  | 50    | 55   |      |
| Output Signal Rise Time       | tr                             | C <sub>L</sub> =15pF, 10% to 90%                                               |     | 2     | 4    | ns   |
|                               |                                | C <sub>L</sub> =50pF, 10% to 90%                                               |     | 4     | 8    |      |
| Output Signal Fall Time       | tf                             | C <sub>L</sub> =15pF, 90% to 10%                                               |     | 2     | 4    | ns   |
|                               |                                | C <sub>L</sub> =50pF, 90% to 10%                                               |     | 4     | 8    |      |
| Output Disable time           | t <sub>PLZ</sub>               | C <sub>L</sub> =15pF, R <sub>Up</sub> =10kΩ                                    |     |       | 100  | ns   |
| Output Enable Time            | t <sub>PZL</sub>               | C <sub>L</sub> =15pF, R <sub>Up</sub> =10kΩ                                    |     |       | 100  | ns   |

Note5) P version is measured with external capacitors contained 13pF for C<sub>g</sub> and 13pF for C<sub>d</sub>.

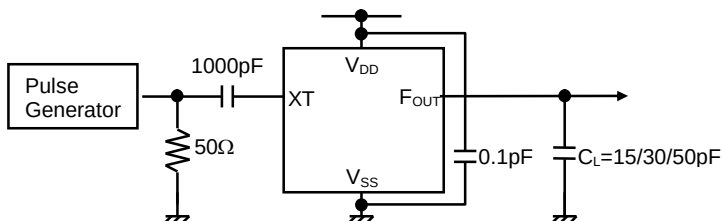
Note6) Excluding input current on CONT Terminal.

## MEASUREMENT CIRCUITS

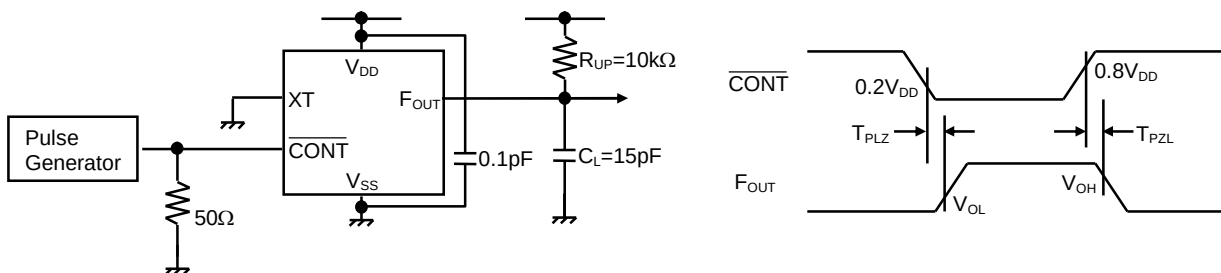
### (1) Operating Current, Output Signal Symmetry, Output Signal Rise/Fall Time



### (2) Check of Operation



### (3) Output Disable/Enable Time



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