

## LVDS-output Quartz Crystal Oscillator IC

### ■GENERAL DESCRIPTION

The NJU6398 is a quartz crystal oscillator IC with LVDS output, from 110MHz to 160MHz frequency output, which consists of an oscillation amplifier, LVDS output, and 3-state output buffer for each LVDS. The oscillation amplifier realizes very low oscillation stop current with NAND circuit. The NJU6398 is suitable for mobile, optical communications (including WDM system), PC & Peripherals, telecommunications, LAN/WAN, and wireless systems

### ■FEATURES

- Operating Voltage 2.7 to 3.6V
- Oscillation Frequency 110MHz to 160MHz
- Output Level LVDS
- Oscillation Stop and Output Stand-by Function
- 3-State Output Buffer
- Oscillation Capacitors Cg and Cd on-Die
- Package Outline Thin-Die
- C-MOS Technology

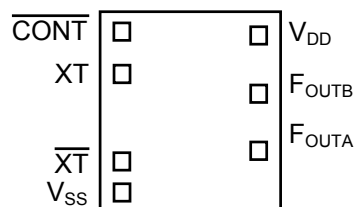
### ■PACKAGE OUTLINE



NJU6398C-D

### ■PAD LOCATION

Thin-Chip

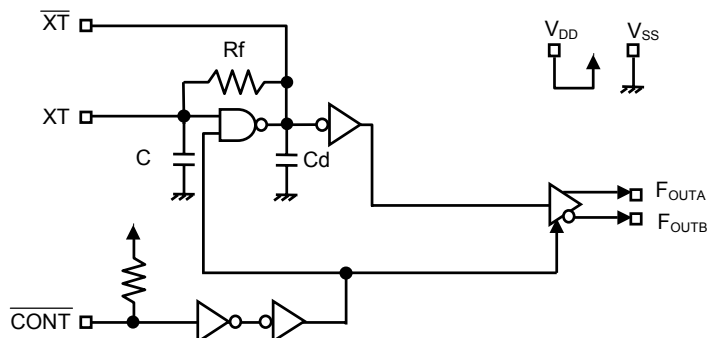


### ■COORDINATES

| No | Pad Name | X      | Y      |
|----|----------|--------|--------|
| 1  | CONT     | -578.2 | 688    |
| 2  | XT       | -578.2 | 405    |
| 3  | XT       | -578.2 | -535.7 |
| 4  | VSS      | -578.2 | -689.7 |
| 5  | FOUTA    | 609    | -476.7 |
| 6  | FOUTB    | 609    | 105.6  |
| 7  | VDD      | 609    | 706    |

Starting Point: Die Center Unit[um]  
 Die Size: 1.55x1.70mm  
 Die Thickness(-D): 200±20um  
 Pad Size: 90x90um  
 Note1) Substrate: V<sub>SS</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           |                                            |
| $\overline{\text{XT}}$   |                                               |                                            |
| $V_{\text{SS}}$          | $V_{\text{SS}}=0\text{V}$                     |                                            |
| $F_{\text{OUTA}}$        | LVDS Output, Differential output pair         |                                            |
| $F_{\text{OUTB}}$        |                                               |                                            |
| $V_{\text{DD}}$          | $V_{\text{DD}}=3.3\text{V}$                   |                                            |

## ■ 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   |
| Operating Temperature Range | Topr            | -40 to +85                                 | °C   |
| Storage Temperature Range   | Tstg            | -55 to +125                                | °C   |

Note2) If the supply voltage( $V_{\text{DD}}$ ) is less than 7.0V, the input voltage do not over the  $V_{\text{DD}}$  level.

Note3) 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 <sub>DD</sub> |            | 2.7 |     | 3.6 | V    |

(V<sub>DD</sub>=3.3V, Ta=25°C)

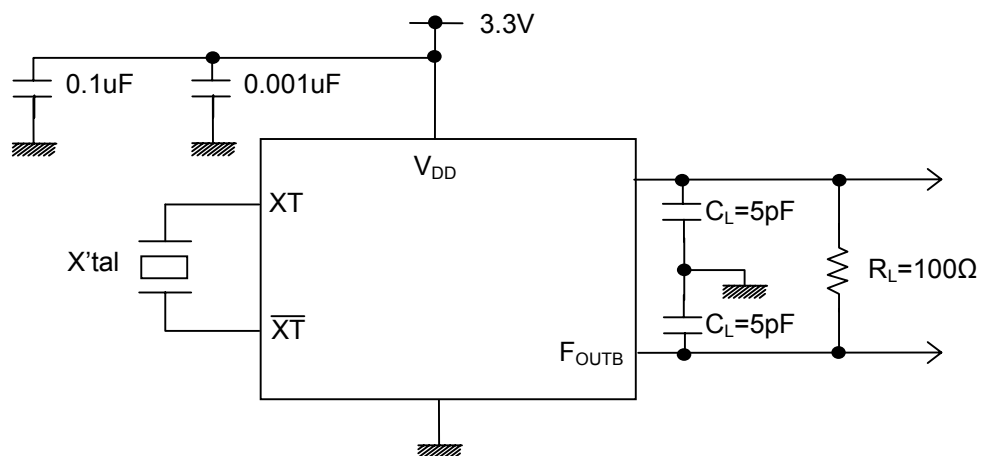
| PARAMETER                     | SYMBOL                         | CONDITIONS                                                                                                                                                         | MIN   | TYP  | MAX   | UNIT  | CIR-<br>CUIT |
|-------------------------------|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------|-------|-------|--------------|
| Operating Current             | I <sub>DD1</sub>               | fosc=155MHz, C <sub>L</sub> =5pF                                                                                                                                   |       | 27   | 40    | mA    | 1            |
| Oscillation Stopping Current  | I <sub>DD2</sub>               | CONT=V <sub>SS</sub> , No load                                                                                                                                     |       | 2.5  | 5     | uA    |              |
| Stand-by Current              | I <sub>st</sub>                | CONT=XT=V <sub>SS</sub> , No load Note4)                                                                                                                           |       |      | 1     | uA    |              |
| Input Voltage                 | V <sub>IH</sub>                |                                                                                                                                                                    | 2.31  |      | 3.3   | V     |              |
|                               | V <sub>IL</sub>                |                                                                                                                                                                    | 0     |      | 0.99  | V     |              |
| Input Current                 | I <sub>IN</sub>                | CONT=0.8V <sub>DD</sub>                                                                                                                                            |       | 15.0 | 20.0  | uA    |              |
|                               |                                | CONT=0.2V <sub>DD</sub>                                                                                                                                            |       | 2.3  | 3.5   | uA    |              |
| Output Off Leakage Current    | I <sub>oz</sub>                | CONT=V <sub>SS</sub> , F <sub>OUTA</sub> and F <sub>OUTB</sub> =V <sub>DD</sub><br>CONT=V <sub>SS</sub> , F <sub>OUTA</sub> and F <sub>OUTB</sub> =V <sub>SS</sub> |       |      | ±1    | uA    |              |
| Feedback Resistance           | R <sub>f</sub>                 |                                                                                                                                                                    |       | 1.93 |       | kΩ    |              |
| Internal Capacitor            | C <sub>g</sub> /C <sub>d</sub> | fosc=155MHz                                                                                                                                                        |       | 9/14 |       | pF    |              |
| Maximum Oscillation Frequency | f <sub>MAX</sub>               |                                                                                                                                                                    | 160   |      |       | MHz   |              |
| Output Signal Symmetry        | SYM                            | F <sub>OUTA</sub> - F <sub>OUTB</sub> , C <sub>L</sub> =5pF, R <sub>L</sub> =100Ω<br>@1/2V <sub>OD</sub> , Hi side                                                 | 45    | 50   | 55    | %     | 1            |
| Differential Output Voltage   | V <sub>OD</sub>                |                                                                                                                                                                    | 250   | 350  | 450   | mV    | 2            |
| Δ Differential Output Voltage | ΔV <sub>OD</sub>               |                                                                                                                                                                    |       | 2    | 35    | mV    | 2            |
| Offset Voltage                | V <sub>OS</sub>                |                                                                                                                                                                    | 1.125 | 1.25 | 1.375 | V     | 3            |
| Δ Offset Voltage              | ΔV <sub>OS</sub>               |                                                                                                                                                                    |       | 2    | 25    | mV    | 3            |
| Output Short Current 1        | I <sub>OS</sub><br>(SHORT)     |                                                                                                                                                                    |       |      | 24    | mA    | 4            |
| Output Short Current 2        | I <sub>OSD</sub><br>(SHORT)    |                                                                                                                                                                    |       |      | 12    | mA    | 5            |
| Differential Output Ripple    | V <sub>OR</sub>                | Note5)                                                                                                                                                             |       |      | ±150  | mVp-p | 6            |
| Output Signal Rise Time       | t <sub>r</sub>                 | R <sub>L</sub> =100Ω, C <sub>L</sub> =5pF<br>0.2V <sub>OD</sub> to 0.8V <sub>OD</sub>                                                                              | 0.3   |      | 1.5   | ns    | 1            |
| Output Signal Fall Time       | t <sub>f</sub>                 | R <sub>L</sub> =100Ω, C <sub>L</sub> =5pF<br>0.8V <sub>OD</sub> to 0.2V <sub>OD</sub>                                                                              | 0.3   |      | 1.5   | ns    | 1            |
| Output Disable Time           | t <sub>PLZ</sub>               | C <sub>L</sub> =5pF, R <sub>UP</sub> =10kΩ                                                                                                                         |       |      | 100   | ns    | 8            |
| Output Enable Time            | t <sub>PZL</sub>               | C <sub>L</sub> =5pF, R <sub>UP</sub> =10kΩ                                                                                                                         |       |      | 100   | ns    | 8            |

Note4) Excluding input current on CONT Terminal.

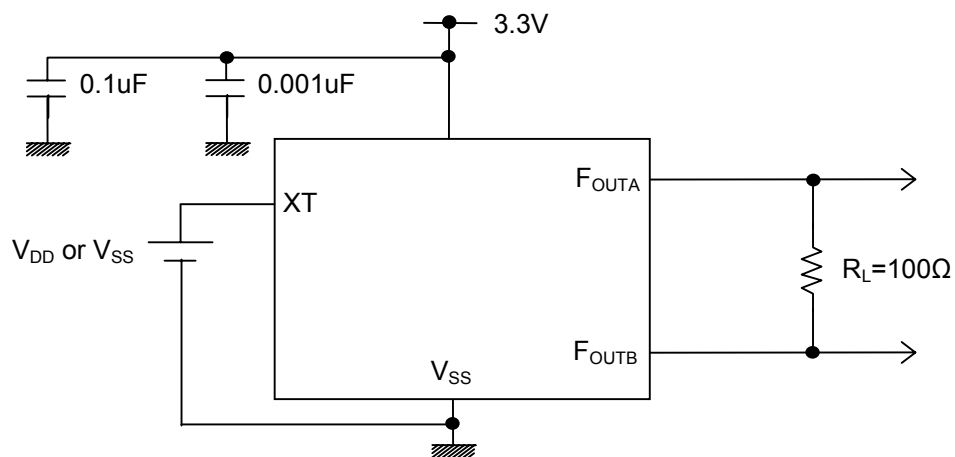
Note5) Design guarantee.

# MEASUREMENT CIRCUITS

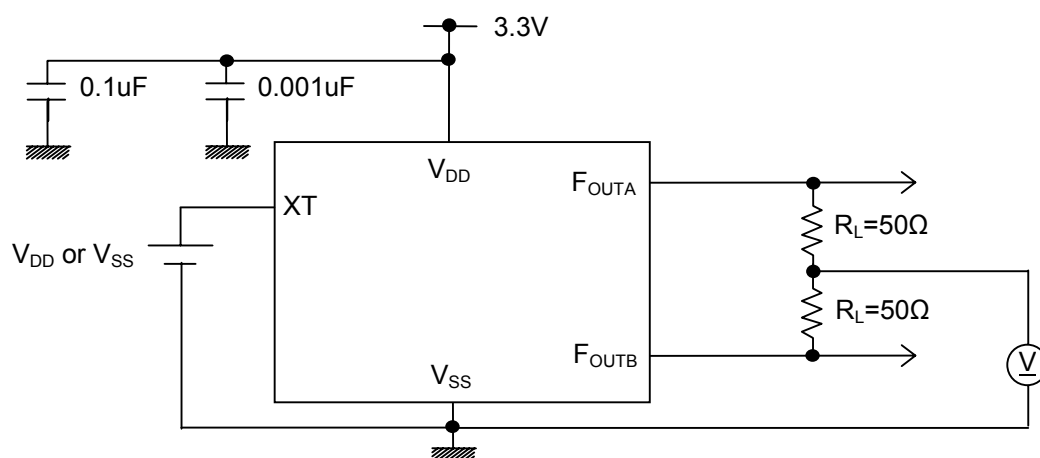
(1) Operating Current / Output Signal Symmetry / Output Signal Rise / Fall Time



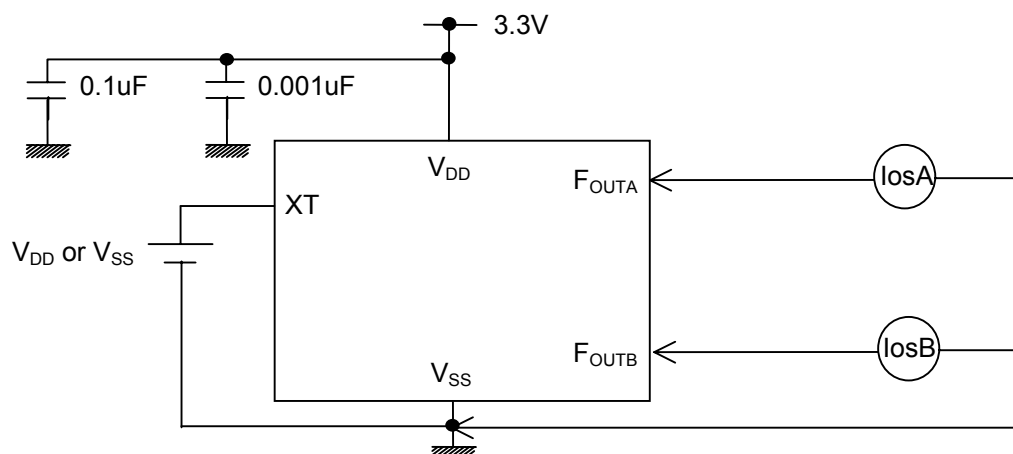
(2) Differential Output Voltage



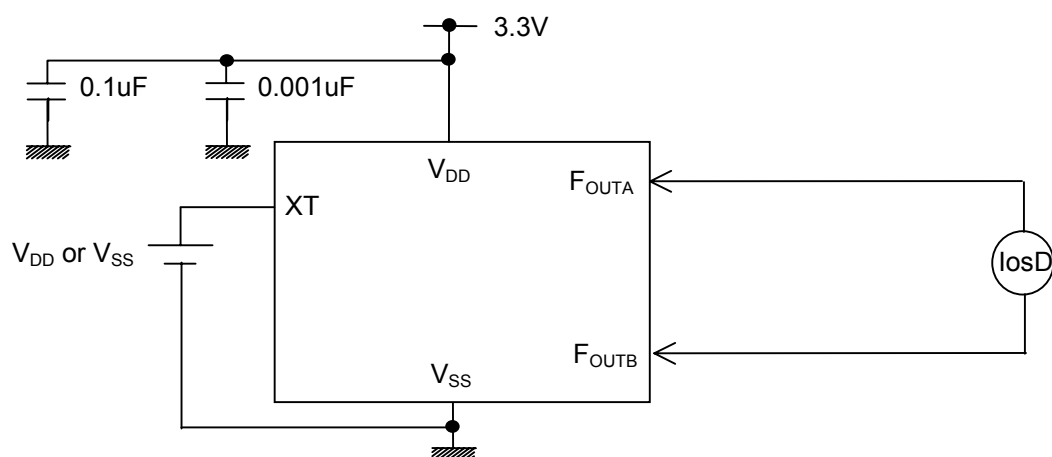
(3) Offset Voltage



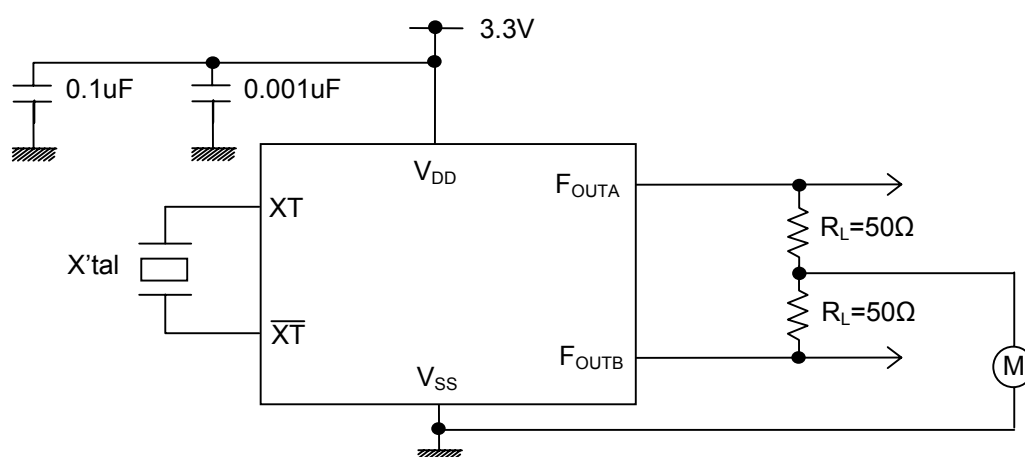
(4) Output Short Current 1



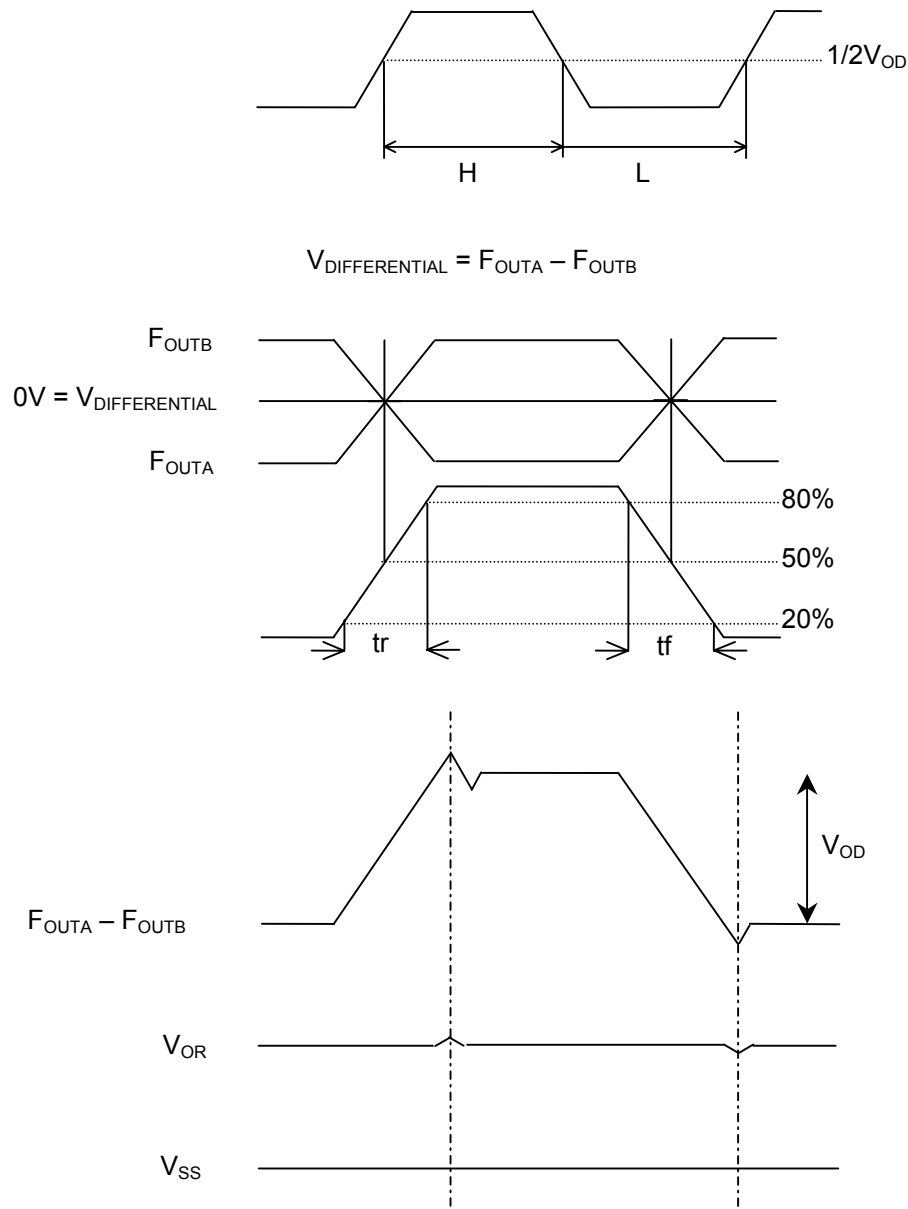
(5) Output Short Current 2



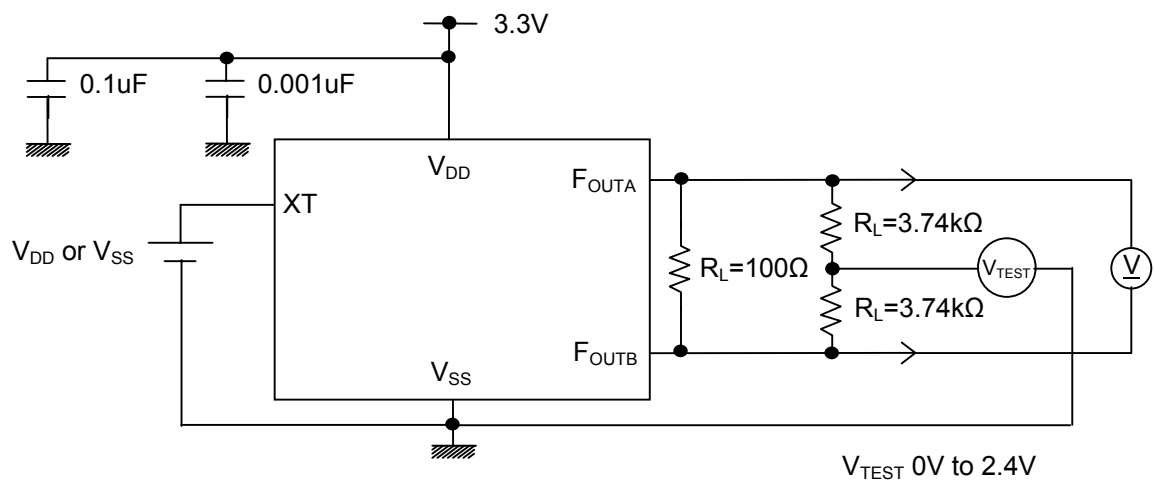
(6) Differential Output Ripple



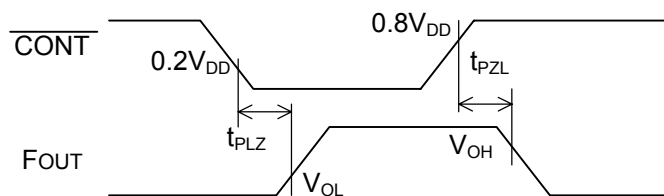
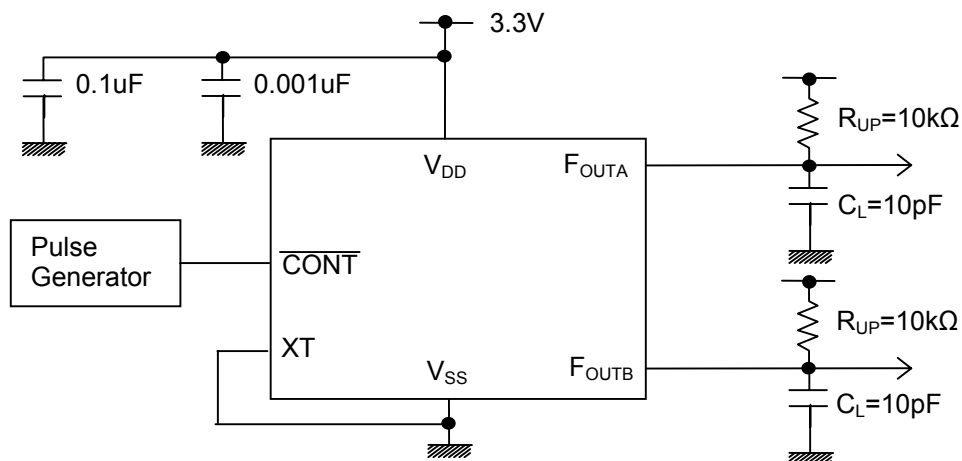
# Output Signal Symmetry



## (7) FULL LOAD DC Test



## (8) Output Disable Time / Output Enable Time



## [CAUTION]

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