# CF5019 series

## High-Frequency, 3rd Overtone Crystal Oscillator Module ICs



## OVERVIEW

The CF5019 series are high-frequency, 3rd overtone crystal oscillator module ICs. They incorporate an oscillator circuit and an output buffer that operate at high frequency on a single chip. The oscillator circuit employs CMOS inverters and a built-in damping resistor $R_D$, reducing the crystal current compared with existing devices. The damping resistor $R_D$ is fabricated using NPC's unique high-precision thin-film resistor technology, which suppresses oscillator characteristic variations due to changes in temperature and voltage to a minimum. The CF5019 series can be utilized to construct stable, high-frequency, 3rd overtone crystal oscillators.

## FEATURES

- $R_D$ built-in to reduce crystal current in the oscillator circuit
- 2.25 to 3.6V operating supply voltage range
- Recommended operating frequency range (varies with version)
  - 2.5V operation: 60 to 155MHz
  - 3.0V operation: 60 to 170MHz
- – 40 to 85°C operating temperature range
- Oscillator capacitors with excellent frequency response built-in
- Feedback resistors with good temperature characteristics built-in
- Standby function
  - High impedance in standby mode, oscillator stops
- Low standby current
  - Power-saving pull-up resistor built-in
- Oscillation detector function
- CMOS output duty level (1/2VDD)
- 50 ± 5% output duty (at 1/2VDD)
- 30pF output load (3.3V operation)
- Molybdenum-gate CMOS process
- Chip form (CF5019AL×)

## APPLICATIONS

- Crystal oscillator modules (3rd overtone oscillation)

## SERIES CONFIGURATION

| Version | Recommended operating frequency range*1 [MHz] | | Oscillator circuit constants | | | | | INHN input level | Standby mode | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | gm ratio | Built-in capacitance | | Feedback resistance | Damping resistance | | Oscillator stop function | Output state |
| | 2.5V operation | 3.0V operation | | $C_G$ [pF] | $C_D$ [pF] | Rf [kΩ] | $R_D$ [Ω] | | | |
| CF5019ALA | 60 to 80 | 60 to 90 | 0.6 | 4 | 7 | 2.5 | 200 | CMOS | Yes | High impedance |
| CF5019ALB | 70 to 115 | 80 to 125 | 0.8 | 3 | 3 | 4.5 | 57 | | | |
| CF5019ALC | 105 to 135 | 115 to 145 | 1.0 | 1 | 3 | 3.3 | 57 | | | |
| CF5019ALD | 110 to 155 | 135 to 170 | 1.0 | 1 | 5 | 2.2 | 57 | | | |
| CF5019ALE | 90 to 125 | 95 to 135 | 0.8 | 2 | 7 | 3.3 | 57 | | | |

***1. The recommended operating frequency is a yardstick value derived from the crystal used for NPC characteristics authentication. However, the oscillator frequency band is not guaranteed. Specifically, the characteristics can vary greatly due to crystal characteristics and mounting conditions, so the oscillation characteristics of components must be carefully evaluated.**

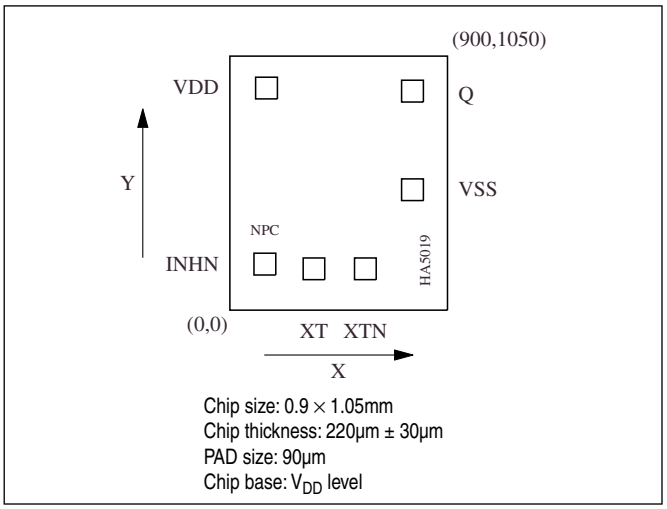
## ORDERING INFORMATION

| Device | Package |
|---|---|
| CF5019AL×–2 | Chip form |

## PAD LAYOUT

(Unit: µm)

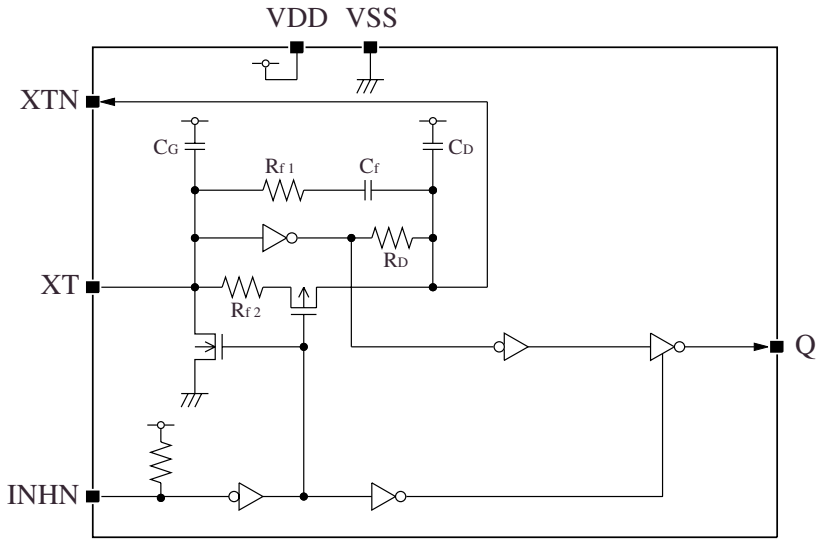





## PIN DESCRIPTION and PAD DIMENSIONS

| Name | I/O | Description | | Pad dimensions [µm] | |
|---|---|---|---|---|---|
| | | | | X | Y |
| INHN | I | Output state control input. High impedance when LOW (oscillator stops). Power-saving pull-up resistor built-in. | | 144.6 | 190.6 |
| XT | I | Amplifier input | Crystal connection pins. Crystal is connected between XT and XTN. | 347.8 | 171 |
| XTN | O | Amplifier output | | 560.6 | 171 |
| VSS | – | (–) ground | | 755.4 | 497.8 |
| Q | O | Output | | 755.4 | 905.4 |
| VDD | – | (+) supply voltage | | 151.4 | 918.2 |

## BLOCK DIAGRAM




INHN = LOW active

# SPECIFICATIONS

## Absolute Maximum Ratings

$V_{SS}$ = 0V



| Parameter | Symbol | Condition | Rating | Unit |
|---|---|---|---|---|
| Supply voltage range | $V_{DD}$ | | –0.5 to +7.0 | V |
| Input voltage range | $V_{IN}$ | | –0.5 to $V_{DD}$ + 0.5 | V |
| Output voltage range | $V_{OUT}$ | | –0.5 to $V_{DD}$ + 0.5 | V |
| Operating temperature range | $T_{opr}$ | | –40 to +85 | °C |
| Storage temperature range | $T_{STG}$ | | –65 to +150 | °C |
| Output current | $I_{OUT}$ | | 25 | mA |

## Recommended Operating Conditions

### CF5019ALA, CF5019ALB

#### 3V Operation

$V_{SS}$ = 0V

| Parameter | Symbol | Condition | | Rating | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | min | typ | max | |
| Operating supply voltage | $V_{DD}$ | f ≤ 125MHz | $C_L$ ≤ 15pF | 2.7 | – | 3.6 | V |
| | | | $C_L$ ≤ 30pF | 3.0 | – | 3.6 | V |
| | | | | 2.7*1 | – | 3.6*1 | V |
| Input voltage | $V_{IN}$ | | | $V_{SS}$ | – | $V_{DD}$ | V |
| Operating temperature | $T_{OPR}$ | | | –40 | – | +85 | °C |

*1. The output duty cycle variability increases than other conditions.

#### 2.5V Operation

$V_{SS}$ = 0V

| Parameter | Symbol | Condition | | Rating | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | min | typ | max | |
| Operating supply voltage | $V_{DD}$ | f ≤ 106MHz | $C_L$ ≤ 15pF | 2.25 | – | 2.75 | V |
| | | f ≤ 70MHz | $C_L$ ≤ 30pF | 2.25 | – | 2.75 | V |
| | | f ≤ 125MHz | $C_L$ ≤ 15pF | 2.25*1 | – | 2.75*1 | V |
| Input voltage | $V_{IN}$ | | | $V_{SS}$ | – | $V_{DD}$ | V |
| Operating temperature | $T_{OPR}$ | | | –40 | – | +85 | °C |

*1. The output duty cycle variability increases than other conditions.

## CF5019ALC, CF5019ALD, CF5019ALE

### 3V Operation

$V_{SS}$ = 0V



| Parameter | Symbol | Condition | | Rating | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | min | typ | max | |
| Operating supply voltage | $V_{DD}$ | f ≤ 170MHz | $C_L$ ≤ 15pF | 2.7 | – | 3.6 | V |
| | | f ≤ 125MHz | $C_L$ ≤ 30pF | 2.7 | – | 3.6 | V |
| Input voltage | $V_{IN}$ | | | $V_{SS}$ | – | $V_{DD}$ | V |
| Operating temperature | $T_{OPR}$ | | | –40 | – | +85 | °C |

### 2.5V Operation

$V_{SS}$ = 0V

| Parameter | Symbol | Condition | | Rating | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | min | typ | max | |
| Operating supply voltage | $V_{DD}$ | f ≤ 155MHz | $C_L$ ≤ 15pF | 2.25 | – | 2.75 | V |
| Input voltage | $V_{IN}$ | | | $V_{SS}$ | – | $V_{DD}$ | V |
| Operating temperature | $T_{OPR}$ | | | –40 | – | +85 | °C |

## Electrical Characteristics

### 2.5V operation

$V_{DD}$ = 2.25 to 2.75V, $V_{SS}$ = 0V, Ta = −40 to +85°C unless otherwise noted.



| Parameter | Symbol | Condition | | | Rating min | Rating typ | Rating max | Unit |
|---|---|---|---|---|---|---|---|---|
| HIGH-level output voltage | $V_{OH}$ | Q: Measurement cct 1, $V_{DD}$ = 2.25V, $I_{OH}$ = 8mA | | | 1.75 | 1.95 | – | V |
| LOW-level output voltage | $V_{OL}$ | Q: Measurement cct 2, $V_{DD}$ = 2.25V, $I_{OL}$ = 8mA | | | – | 0.3 | 0.4 | V |
| HIGH-level input voltage | $V_{IH}$ | INHN | | | 0.7$V_{DD}$ | – | – | V |
| LOW-level input voltage | $V_{IL}$ | INHN | | | – | – | 0.3$V_{DD}$ | V |
| Output leakage current | $I_Z$ | Q: Measurement cct 2, INHN = LOW | | $V_{OH}$ = $V_{DD}$ | – | – | 10 | µA |
| | | | | $V_{OL}$ = $V_{SS}$ | – | – | 10 | µA |
| Current consumption | $I_{DD}$ | Measurement cct 3, load cct 1, INHN = open | CF5019ALA | $C_L$ = 15pF f = 80MHz | – | 15 | 40 | mA |
| | | | | $C_L$ = 30pF f = 70MHz | – | 20 | 50 | mA |
| | | | CF5019ALB | $C_L$ = 15pF f = 106MHz | – | 20 | 50 | mA |
| | | | | $C_L$ = 30pF f = 70MHz | – | 20 | 50 | mA |
| | | | CF5019ALC | $C_L$ = 15pF f = 135MHz | – | 25 | 60 | mA |
| | | | CF5019ALD | $C_L$ = 15pF f = 155MHz | – | 30 | 70 | mA |
| | | | CF5019ALE | $C_L$ = 15pF f = 125MHz | – | 22 | 55 | mA |
| Standby current | $I_{ST}$ | Measurement cct 3, INHN = LOW | | | – | – | 3 | µA |
| INHN pull-up resistance | $R_{UP1}$ | Measurement cct 4 | | | 2 | 6 | 12 | MΩ |
| | $R_{UP2}$ | | | | 50 | 100 | 150 | kΩ |
| AC feedback resistance | $R_{f1}$ | Design value. A monitor pattern on a wafer is tested. | | CF5019ALA | 2.12 | 2.5 | 2.88 | kΩ |
| | | | | CF5019ALB | 3.82 | 4.5 | 5.18 | kΩ |
| | | | | CF5019ALC | 2.80 | 3.3 | 3.80 | kΩ |
| | | | | CF5019ALD | 1.87 | 2.2 | 2.53 | kΩ |
| | | | | CF5019ALE | 2.80 | 3.3 | 3.80 | kΩ |
| DC feedback resistance | $R_{f2}$ | Measurement cct 5 | | | 50 | 100 | 150 | kΩ |
| Oscillator amplifier output resistance | $R_D$ | Design value. A monitor pattern on a wafer is tested. | | CF5019ALA | 170 | 200 | 230 | Ω |
| | | | | CF5019ALB | 48.4 | 57 | 65.6 | Ω |
| | | | | CF5019ALC | 48.4 | 57 | 65.6 | Ω |
| | | | | CF5019ALD | 48.4 | 57 | 65.6 | Ω |
| | | | | CF5019ALE | 48.4 | 57 | 65.6 | Ω |
| AC feedback capacitance | $C_f$ | Design value. A monitor pattern on a wafer is tested. | | | 8.5 | 10 | 11.5 | pF |
| Built-in capacitance | $C_G$ | Design value. A monitor pattern on a wafer is tested. | | CF5019ALA | 3.40 | 4 | 4.60 | pF |
| | | | | CF5019ALB | 2.55 | 3 | 3.45 | pF |
| | | | | CF5019ALC | 0.85 | 1 | 1.15 | pF |
| | | | | CF5019ALD | 0.85 | 1 | 1.15 | pF |
| | | | | CF5019ALE | 1.70 | 2 | 2.30 | pF |
| | $C_D$ | Design value. A monitor pattern on a wafer is tested. | | CF5019ALA | 5.95 | 7 | 8.05 | pF |
| | | | | CF5019ALB | 2.55 | 3 | 3.45 | pF |
| | | | | CF5019ALC | 2.55 | 3 | 3.45 | pF |
| | | | | CF5019ALD | 4.25 | 5 | 5.75 | pF |
| | | | | CF5019ALE | 5.95 | 7 | 8.05 | pF |

## 3V operation

$V_{DD}$ = 2.7 to 3.6V, $V_{SS}$ = 0V, Ta = −40 to +85°C unless otherwise noted.



| Parameter | Symbol | Condition | | | Rating min | Rating typ | Rating max | Unit |
|---|---|---|---|---|---|---|---|---|
| HIGH-level output voltage | $V_{OH}$ | Q: Measurement cct 1, $V_{DD}$ = 2.7V, $I_{OH}$ = 8mA | | | 2.2 | 2.4 | – | V |
| LOW-level output voltage | $V_{OL}$ | Q: Measurement cct 2, $V_{DD}$ = 2.7V, $I_{OL}$ = 8mA | | | – | 0.3 | 0.4 | V |
| HIGH-level input voltage | $V_{IH}$ | INHN | | | 0.7$V_{DD}$ | – | – | V |
| LOW-level input voltage | $V_{IL}$ | INHN | | | – | – | 0.3$V_{DD}$ | V |
| Output leakage current | $I_Z$ | Q: Measurement cct 2, INHN = LOW | | $V_{OH}$ = $V_{DD}$ | – | – | 10 | µA |
| | | | | $V_{OL}$ = $V_{SS}$ | – | – | 10 | µA |
| Current consumption | $I_{DD}$ | Measurement cct 3, load cct 1, INHN = open | CF5019ALA | $C_L$ = 15pF f = 90MHz | – | 20 | 50 | mA |
| | | | | $C_L$ = 30pF f = 90MHz | – | 25 | 60 | mA |
| | | | CF5019ALB | $C_L$ = 15pF f = 125MHz | – | 25 | 60 | mA |
| | | | | $C_L$ = 30pF f = 125MHz | – | 40 | 100 | mA |
| | | | CF5019ALC | $C_L$ = 15pF f = 135MHz | – | 30 | 70 | mA |
| | | | | $C_L$ = 30pF f = 125MHz | – | 40 | 100 | mA |
| | | | CF5019ALD | $C_L$ = 15pF f = 170MHz | – | 40 | 100 | mA |
| | | | CF5019ALE | $C_L$ = 15pF f = 135MHz | – | 30 | 70 | mA |
| Standby current | $I_{ST}$ | Measurement cct 3, INHN = LOW | | | – | – | 5 | µA |
| INHN pull-up resistance | $R_{UP1}$ | Measurement cct 4 | | | 2 | 4 | 8 | MΩ |
| | $R_{UP2}$ | | | | 50 | 100 | 150 | kΩ |
| AC feedback resistance | $R_{f1}$ | Design value. A monitor pattern on a wafer is tested. | | CF5019ALA | 2.12 | 2.5 | 2.88 | kΩ |
| | | | | CF5019ALB | 3.82 | 4.5 | 5.18 | kΩ |
| | | | | CF5019ALC | 2.80 | 3.3 | 3.80 | kΩ |
| | | | | CF5019ALD | 1.87 | 2.2 | 2.53 | kΩ |
| | | | | CF5019ALE | 2.80 | 3.3 | 3.80 | kΩ |
| DC feedback resistance | $R_{f2}$ | Measurement cct 5 | | | 50 | 100 | 150 | kΩ |
| Oscillator amplifier output resistance | $R_D$ | Design value. A monitor pattern on a wafer is tested. | | CF5019ALA | 170 | 200 | 230 | Ω |
| | | | | CF5019ALB | 48.4 | 57 | 65.6 | Ω |
| | | | | CF5019ALC | 48.4 | 57 | 65.6 | Ω |
| | | | | CF5019ALD | 48.4 | 57 | 65.6 | Ω |
| | | | | CF5019ALE | 48.4 | 57 | 65.6 | Ω |
| AC feedback capacitance | $C_f$ | Design value. A monitor pattern on a wafer is tested. | | | 8.5 | 10 | 11.5 | pF |
| Built-in capacitance | $C_G$ | Design value. A monitor pattern on a wafer is tested. | | CF5019ALA | 3.40 | 4 | 4.60 | pF |
| | | | | CF5019ALB | 2.55 | 3 | 3.45 | pF |
| | | | | CF5019ALC | 0.85 | 1 | 1.15 | pF |
| | | | | CF5019ALD | 0.85 | 1 | 1.15 | pF |
| | | | | CF5019ALE | 1.70 | 2 | 2.30 | pF |
| | $C_D$ | Design value. A monitor pattern on a wafer is tested. | | CF5019ALA | 5.95 | 7 | 8.05 | pF |
| | | | | CF5019ALB | 2.55 | 3 | 3.45 | pF |
| | | | | CF5019ALC | 2.55 | 3 | 3.45 | pF |
| | | | | CF5019ALD | 4.25 | 5 | 5.75 | pF |
| | | | | CF5019ALE | 5.95 | 7 | 8.05 | pF |

## Switching Characteristics

### CF5019ALA, CF5019ALB

#### 2.5V operation



$V_{DD}$ = 2.25 to 2.75V, $V_{SS}$ = 0V, Ta = −40 to +85°C unless otherwise noted.

| Parameter | Symbol | Condition | | Rating min | Rating typ | Rating max | Unit |
|---|---|---|---|---|---|---|---|
| Output rise time | $t_{r1}$ | Measurement cct 3, load cct 1, 0.1$V_{DD}$ to 0.9$V_{DD}$ | $C_L$ = 15pF | – | 1 | 3 | ns |
| | $t_{r2}$ | | $C_L$ = 30pF | – | 2 | 5.5 | ns |
| Output fall time | $t_{f1}$ | Measurement cct 3, load cct 1, 0.9$V_{DD}$ to 0.1$V_{DD}$ | $C_L$ = 15pF | – | 1 | 3 | ns |
| | $t_{f2}$ | | $C_L$ = 30pF | – | 2 | 5.5 | ns |
| Output duty cycle*1 | Duty1 | Measurement cct 3, load cct 1, $V_{DD}$ = 2.5V, Ta = 25°C | $C_L$ = 15pF, f = 106MHz | 45 | – | 55 | % |
| | | | $C_L$ = 15pF, f = 125MHz | 40 | – | 60 | % |
| | Duty2 | | $C_L$ = 30pF, f = 70MHz | 45 | – | 55 | % |
| Output disable delay time*2 | $t_{PLZ}$ | Measurement cct 6, load cct 1, $V_{DD}$ = 2.5V, Ta = 25°C, $C_L$ = 15pF | | – | – | 100 | ns |
| Output enable delay time*2 | $t_{PZL}$ | | | – | – | 100 | ns |

*1. The duty cycle characteristic is checked the sample chips of each production lot.
*2. Oscillator stop function is built-in. When INHN goes LOW, normal output stops. When INHN goes HIGH, normal output is not resumed until after the oscillator start-up time has elapsed.

#### 3V operation

$V_{DD}$ = 2.7 to 3.6V, $V_{SS}$ = 0V, Ta = −40 to +85°C unless otherwise noted.

| Parameter | Symbol | Condition | | Rating min | Rating typ | Rating max | Unit |
|---|---|---|---|---|---|---|---|
| Output rise time | $t_{r1}$ | Measurement cct 3, load cct 1, 0.1$V_{DD}$ to 0.9$V_{DD}$ | $C_L$ = 15pF | – | 1 | 2.5 | ns |
| | $t_{r2}$ | | $V_{DD}$ = 3.0 to 3.6V, $C_L$ = 30pF | – | 1.5 | 3 | ns |
| Output fall time | $t_{f1}$ | Measurement cct 3, load cct 1, 0.9$V_{DD}$ to 0.1$V_{DD}$ | $C_L$ = 15pF | – | 1 | 2.5 | ns |
| | $t_{f2}$ | | $V_{DD}$ = 3.0 to 3.6V, $C_L$ = 30pF | – | 1.5 | 3 | ns |
| Output duty cycle*1 | Duty2 | Measurement cct 3, load cct 1, $V_{DD}$ = 3.0V, Ta = 25°C, $C_L$ = 30pF, f = 125MHz | | 45 | – | 55 | % |
| Output disable delay time*2 | $t_{PLZ}$ | Measurement cct 6, load cct 1, $V_{DD}$ = 3.0V, Ta = 25°C, $C_L$ = 15pF | | – | – | 100 | ns |
| Output enable delay time*2 | $t_{PZL}$ | | | – | – | 100 | ns |

*1. The duty cycle characteristic is checked the sample chips of each production lot.
*2. Oscillator stop function is built-in. When INHN goes LOW, normal output stops. When INHN goes HIGH, normal output is not resumed until after the oscillator start-up time has elapsed.

## CF5019ALC, CF5019ALD, CF5019ALE

### 2.5V operation

$V_{DD}$ = 2.25 to 2.75V, $V_{SS}$ = 0V, Ta = –40 to +85°C unless otherwise noted.



| Parameter | Symbol | Condition | Rating | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| Output rise time | $t_{r1}$ | Measurement cct 3, load cct 1, 0.1$V_{DD}$ to 0.9$V_{DD}$, $C_L$ = 15pF | – | 1 | 3 | ns |
| Output fall time | $t_{f1}$ | Measurement cct 3, load cct 1, 0.9$V_{DD}$ to 0.1$V_{DD}$, $C_L$ = 15pF | – | 1 | 3 | ns |
| Output duty cycle*1 | Duty1 | Measurement cct 3, load cct 1, $V_{DD}$ = 2.5V, Ta = 25°C, $C_L$ = 15pF, f = 155MHz | 45 | – | 55 | % |
| Output disable delay time*2 | $t_{PLZ}$ | Measurement cct 6, load cct 1, $V_{DD}$ = 2.5V, Ta = 25°C, $C_L$ = 15pF | – | – | 100 | ns |
| Output enable delay time*2 | $t_{PZL}$ | | – | – | 100 | ns |

*1. The duty cycle characteristic is checked the sample chips of each production lot.
*2. Oscillator stop function is built-in. When INHN goes LOW, normal output stops. When INHN goes HIGH, normal output is not resumed until after the oscillator start-up time has elapsed.

### 3V operation

$V_{DD}$ = 2.7 to 3.6V, $V_{SS}$ = 0V, Ta = –40 to +85°C unless otherwise noted.

| Parameter | Symbol | Condition | | Rating | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | min | typ | max | |
| Output rise time | $t_{r1}$ | Measurement cct 3, load cct 1, 0.1$V_{DD}$ to 0.9$V_{DD}$ | $C_L$ = 15pF | – | 1 | 2.5 | ns |
| | $t_{r2}$ | | $C_L$ = 30pF | – | 1.5 | 4 | ns |
| Output fall time | $t_{f1}$ | Measurement cct 3, load cct 1, 0.9$V_{DD}$ to 0.1$V_{DD}$ | $C_L$ = 15pF | – | 1 | 2.5 | ns |
| | $t_{f2}$ | | $C_L$ = 30pF | – | 1.5 | 4 | ns |
| Output duty cycle*1 | Duty1 | Measurement cct 3, load cct 1, $V_{DD}$ = 3.0V, Ta = 25°C | $C_L$ = 15pF, f = 170MHz | 45 | – | 55 | % |
| | Duty2 | | $C_L$ = 30pF, f = 125MHz | 45 | – | 55 | % |
| Output disable delay time*2 | $t_{PLZ}$ | Measurement cct 6, load cct 1, $V_{DD}$ = 3.0V, Ta = 25°C, $C_L$ = 15pF | | – | – | 100 | ns |
| Output enable delay time*2 | $t_{PZL}$ | | | – | – | 100 | ns |

*1. The duty cycle characteristic is checked the sample chips of each production lot.
*2. Oscillator stop function is built-in. When INHN goes LOW, normal output stops. When INHN goes HIGH, normal output is not resumed until after the oscillator start-up time has elapsed.

# FUNCTIONAL DESCRIPTION

## Standby Function

When INHN goes LOW, the oscillator stops and the oscillator output on Q becomes high impedance.



| INHN | Q | Oscillator |
|---|---|---|
| HIGH (or open) | $f_O$ output frequency | Normal operation |
| LOW | High impedance | Stopped |

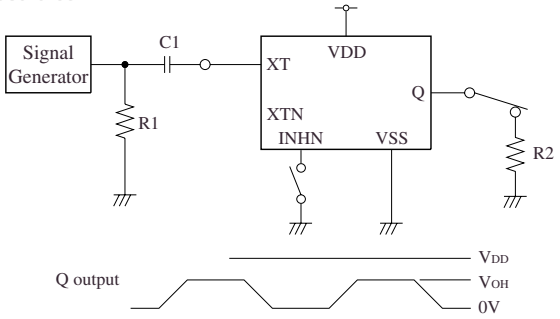
## Power-saving Pull-up Resistor

The INHN pull-up resistance changes in response to the input level (HIGH or LOW). When INHN goes LOW (standby state), the pull-up resistance becomes large to reduce the current consumption during standby.

# MEASUREMENT CIRCUITS

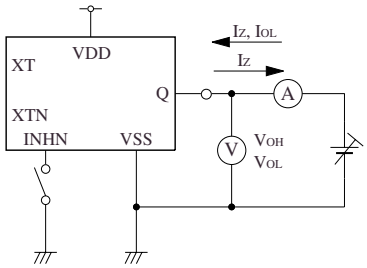
## Measurement cct 1



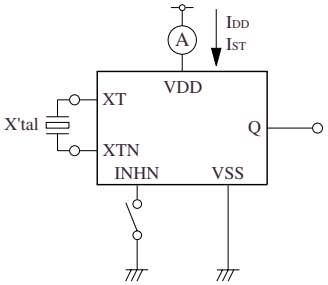



2Vp-p, 10MHz sine wave input signal
C1: 0.001µF
R1: 50Ω
R2: 219Ω (2.5V operation)
275Ω (3.0V operation)

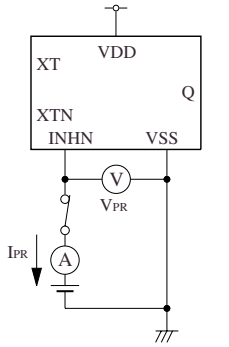
## Measurement cct 2




## Measurement cct 3



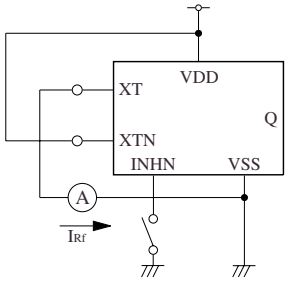

## Measurement cct 4




$$R_{UP1} = \frac{V_{DD}}{I_{PR}} \quad (V_{PR} = V_{SS})$$

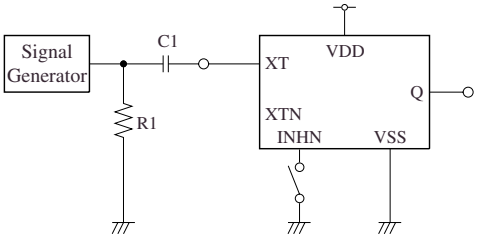
$$R_{UP2} = \frac{V_{DD} - V_{PR}}{I_{PR}} \quad (V_{PR} = 0.7V_{DD})$$

## Measurement cct 5



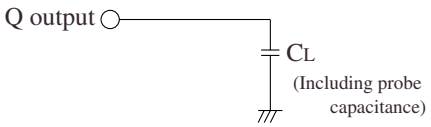

$$R_f = \frac{V_{DD}}{I_{Rf}}$$

## Measurement cct 6




2Vp-p, 10MHz sine wave input signal
C1: 0.001µF
R1: 50Ω

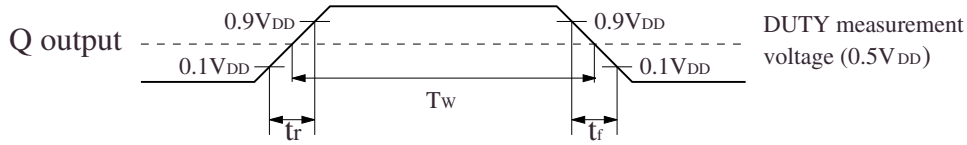
## Load cct 1



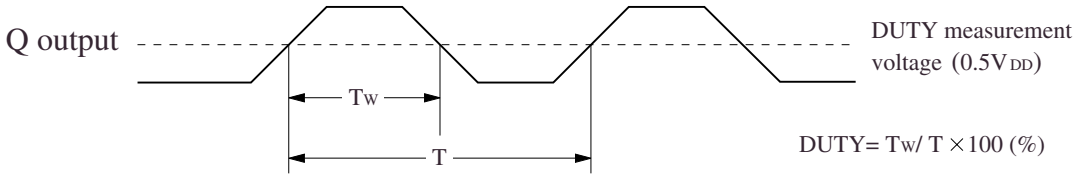
## Switching Time Measurement Waveform

### Output duty level, $t_r$, $t_f$



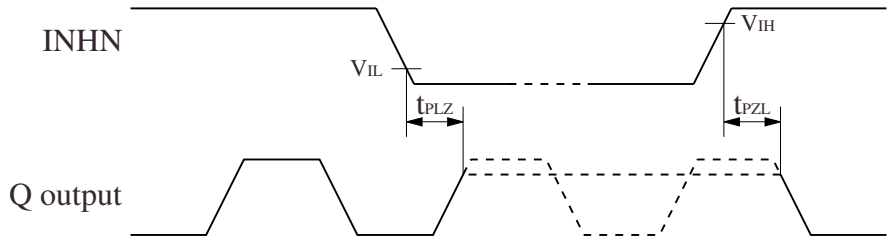



### Output duty cycle




## Output Enable/Disable Delay

when the device is in standby, the oscillator stops. When standby is released, the oscillator starts and stable oscillator output occurs after a short delay.




INHN input waveform $t_r = t_f \leq 10ns$

Please pay your attention to the following points at time of using the products shown in this document.

The products shown in this document (hereinafter "Products") are not intended to be used for the apparatus that exerts harmful influence on human lives due to the defects, failure or malfunction of the Products. Customers are requested to obtain prior written agreement for such use from SEIKO NPC CORPORATION (hereinafter "NPC"). Customers shall be solely responsible for, and indemnify and hold NPC free and harmless from, any and all claims, damages, losses, expenses or lawsuits, due to such use without such agreement. NPC reserves the right to change the specifications of the Products in order to improve the characteristic or reliability thereof. NPC makes no claim or warranty that the contents described in this document dose not infringe any intellectual property right or other similar right owned by third parties. Therefore, NPC shall not be responsible for such problems, even if the use is in accordance with the descriptions provided in this document. Any descriptions including applications, circuits, and the parameters of the Products in this document are for reference to use the Products, and shall not be guaranteed free from defect, inapplicability to the design for the mass-production products without further testing or modification. Customers are requested not to export or re-export, directly or indirectly, the Products to any country or any entity not in compliance with or in violation of the national export administration laws, treaties, orders and regulations. Customers are requested appropriately take steps to obtain required permissions or approvals from appropriate government agencies.

NPC

SEIKO NPC CORPORATION

15-6, Nihombashi-kabutocho, Chuo-ku,
Tokyo 103-0026, Japan
Telephone: +81-3-6667-6601
Facsimile: +81-3-6667-6611
http://www.npc.co.jp/
Email: sales@npc.co.jp

NC0601AE 2006.05