

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)
- $50 \pm 5\%$ output duty (at 1/2VDD)
- 30pF output load (3.3V operation)
- Molybdenum-gate CMOS process
- Chip form (CF5019ALx)

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 Rf [kΩ] | Damping resistance R _D [Ω] | | Oscillator stop function | Output state |
| | 2.5V operation | 3.0V operation | | C _G [pF] | C _D [pF] | | | | | |
| 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 | | | |

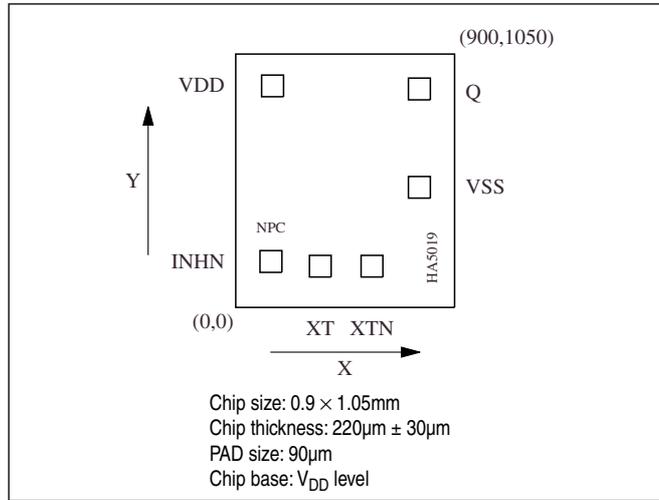
*1. The recommended operating frequency is a yardstick value derived from the crystal used for NPC characteristics authentication. However, the oscillator frequency band is not guaranteed. Specifically, the characteristics can vary greatly due to crystal characteristics and mounting conditions, so the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

ORDERING INFORMATION

| Device | Package |
|-------------|-----------|
| CF5019ALx-2 | Chip form |

PAD LAYOUT

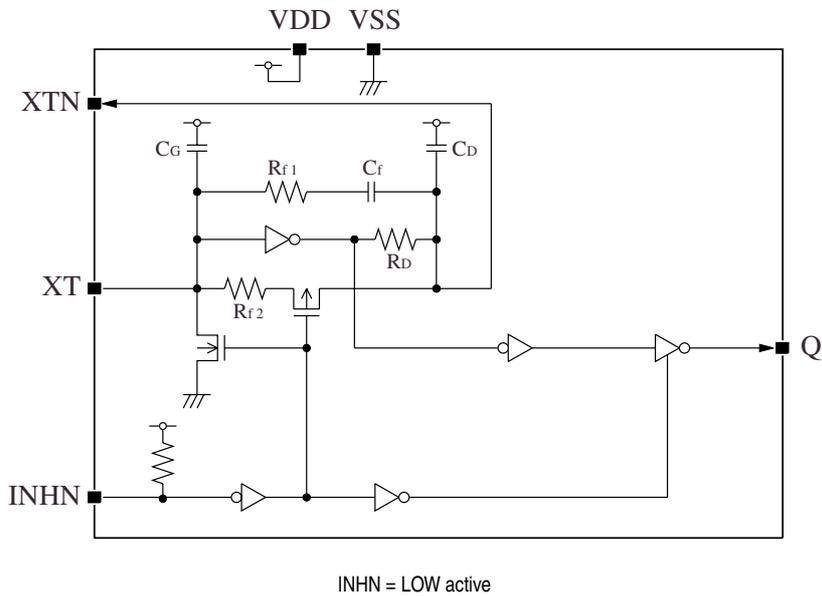
(Unit: μm)



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 | 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



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} | $f \leq 125\text{MHz}$ | $C_L \leq 15\text{pF}$ | 2.7 | - | 3.6 | V |
| | | | $C_L \leq 30\text{pF}$ | 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} | $f \leq 106\text{MHz}$ | $C_L \leq 15\text{pF}$ | 2.25 | - | 2.75 | V |
| | | $f \leq 70\text{MHz}$ | $C_L \leq 30\text{pF}$ | 2.25 | - | 2.75 | V |
| | | $f \leq 125\text{MHz}$ | $C_L \leq 15\text{pF}$ | 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} | $f \leq 170\text{MHz}$ | $C_L \leq 15\text{pF}$ | 2.7 | – | 3.6 | V |
| | | $f \leq 125\text{MHz}$ | $C_L \leq 30\text{pF}$ | 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} | $f \leq 155\text{MHz}$ | $C_L \leq 15\text{pF}$ | 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 2.75 V, $V_{SS} = 0$ V, $T_a = -40$ to $+85$ °C unless otherwise noted.

| Parameter | Symbol | Condition | | Rating | | | Unit | |
|--|-----------|--|-------------------|--------------------------------|------|-------------|------------|----|
| | | | | min | typ | max | | |
| HIGH-level output voltage | V_{OH} | Q: Measurement cct 1, $V_{DD} = 2.25$ V, $I_{OH} = 8$ mA | | 1.75 | 1.95 | – | V | |
| LOW-level output voltage | V_{OL} | Q: Measurement cct 2, $V_{DD} = 2.25$ V, $I_{OL} = 8$ mA | | – | 0.3 | 0.4 | V | |
| HIGH-level input voltage | V_{IH} | INH N | | $0.7V_{DD}$ | – | – | V | |
| LOW-level input voltage | V_{IL} | INH N | | – | – | $0.3V_{DD}$ | V | |
| Output leakage current | I_Z | Q: Measurement cct 2, INH N = LOW | $V_{OH} = V_{DD}$ | – | – | 10 | μ A | |
| | | | $V_{OL} = V_{SS}$ | – | – | 10 | μ A | |
| Current consumption | I_{DD} | Measurement cct 3, load cct 1, INH N = open | CF5019ALA | $C_L = 15$ pF $f = 80$ MHz | – | 15 | 40 | mA |
| | | | | $C_L = 30$ pF $f = 70$ MHz | – | 20 | 50 | mA |
| | | | CF5019ALB | $C_L = 15$ pF $f = 106$ MHz | – | 20 | 50 | mA |
| | | | | $C_L = 30$ pF $f = 70$ MHz | – | 20 | 50 | mA |
| | | | CF5019ALC | $C_L = 15$ pF $f = 135$ MHz | – | 25 | 60 | mA |
| | | | CF5019ALE | $C_L = 15$ pF $f = 125$ MHz | – | 22 | 55 | mA |
| Standby current | I_{ST} | Measurement cct 3, INH N = LOW | | – | – | 3 | μ A | |
| INH N pull-up resistance | R_{UP1} | Measurement cct 4 | | 2 | 6 | 12 | M Ω | |
| | R_{UP2} | | | 50 | 100 | 150 | k Ω | |
| AC feedback resistance | R_{f1} | Design value. A monitor pattern on a wafer is tested. | CF5019ALA | 2.12 | 2.5 | 2.88 | k Ω | |
| | | | CF5019ALB | 3.82 | 4.5 | 5.18 | k Ω | |
| | | | CF5019ALC | 2.80 | 3.3 | 3.80 | k Ω | |
| | | | CF5019ALD | 1.87 | 2.2 | 2.53 | k Ω | |
| | | | CF5019ALE | 2.80 | 3.3 | 3.80 | k Ω | |
| DC feedback resistance | R_{f2} | Measurement cct 5 | | 50 | 100 | 150 | k Ω | |
| 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 | |

CF5019 series

3V operation

$V_{DD} = 2.7$ to $3.6V$, $V_{SS} = 0V$, $T_a = -40$ to $+85^{\circ}C$ unless otherwise noted.

| Parameter | Symbol | Condition | | Rating | | | Unit | |
|--|------------------------------|--|-------------------|------------------------------|-----|-------------|-----------|----|
| | | | | min | typ | max | | |
| 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} | INH N | | $0.7V_{DD}$ | – | – | V | |
| LOW-level input voltage | V_{IL} | INH N | | – | – | $0.3V_{DD}$ | V | |
| Output leakage current | I_Z | Q: Measurement cct 2, INH N = LOW | $V_{OH} = V_{DD}$ | – | – | 10 | μA | |
| | | | $V_{OL} = V_{SS}$ | – | – | 10 | μA | |
| Current consumption | I_{DD} | Measurement cct 3, load cct 1, INH N = 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, INH N = LOW | | – | – | 5 | μA | |
| INH N pull-up resistance | R_{UP1} | Measurement cct 4 | | 2 | 4 | 8 | $M\Omega$ | |
| | R_{UP2} | | | 50 | 100 | 150 | $k\Omega$ | |
| AC feedback resistance | R_{f1} | Design value. A monitor pattern on a wafer is tested. | CF5019ALA | 2.12 | 2.5 | 2.88 | $k\Omega$ | |
| | | | CF5019ALB | 3.82 | 4.5 | 5.18 | $k\Omega$ | |
| | | | CF5019ALC | 2.80 | 3.3 | 3.80 | $k\Omega$ | |
| | | | CF5019ALD | 1.87 | 2.2 | 2.53 | $k\Omega$ | |
| | | | CF5019ALE | 2.80 | 3.3 | 3.80 | $k\Omega$ | |
| DC feedback resistance | R_{f2} | Measurement cct 5 | | 50 | 100 | 150 | $k\Omega$ | |
| 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 $2.75V$, $V_{SS} = 0V$, $T_a = -40$ to $+85^\circ C$ unless otherwise noted.

| Parameter | Symbol | Condition | Rating | | | Unit | |
|---|-----------|--|-----------------------------|-----|-----|------|----|
| | | | min | typ | max | | |
| Output rise time | t_{r1} | Measurement cct 3, load cct 1, $0.1V_{DD}$ to $0.9V_{DD}$ | $C_L = 15pF$ | – | 1 | 3 | ns |
| | t_{r2} | | $C_L = 30pF$ | – | 2 | 5.5 | ns |
| Output fall time | t_{f1} | Measurement cct 3, load cct 1, $0.9V_{DD}$ to $0.1V_{DD}$ | $C_L = 15pF$ | – | 1 | 3 | ns |
| | t_{f2} | | $C_L = 30pF$ | – | 2 | 5.5 | ns |
| Output duty cycle ^{*1} | Duty1 | Measurement cct 3, load cct 1, $V_{DD} = 2.5V$, $T_a = 25^\circ C$ | $C_L = 15pF$, $f = 106MHz$ | 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, $V_{DD} = 2.5V$, $T_a = 25^\circ C$, | | – | – | 100 | ns |
| Output enable delay time ^{*2} | t_{PZL} | $C_L = 15pF$ | | – | – | 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 $3.6V$, $V_{SS} = 0V$, $T_a = -40$ to $+85^\circ C$ unless otherwise noted.

| Parameter | Symbol | Condition | Rating | | | Unit | |
|---|-----------|--|--|-----|-----|------|----|
| | | | min | typ | max | | |
| Output rise time | t_{r1} | Measurement cct 3, load cct 1, $0.1V_{DD}$ to $0.9V_{DD}$ | $C_L = 15pF$ | – | 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, $0.9V_{DD}$ to $0.1V_{DD}$ | $C_L = 15pF$ | – | 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, $V_{DD} = 3.0V$, $T_a = 25^\circ C$, $C_L = 30pF$, $f = 125MHz$ | | 45 | – | 55 | % |
| Output disable delay time ^{*2} | t_{PLZ} | Measurement cct 6, load cct 1, $V_{DD} = 3.0V$, $T_a = 25^\circ C$, | | – | – | 100 | ns |
| Output enable delay time ^{*2} | t_{PZL} | $C_L = 15pF$ | | – | – | 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 $2.75V$, $V_{SS} = 0V$, $T_a = -40$ to $+85^\circ C$ unless otherwise noted.

| Parameter | Symbol | Condition | Rating | | | Unit |
|---|-----------|---|--------|-----|-----|------|
| | | | min | typ | max | |
| Output rise time | t_{r1} | Measurement cct 3, load cct 1, $0.1V_{DD}$ to $0.9V_{DD}$, $C_L = 15pF$ | – | 1 | 3 | ns |
| Output fall time | t_{f1} | Measurement cct 3, load cct 1, $0.9V_{DD}$ to $0.1V_{DD}$, $C_L = 15pF$ | – | 1 | 3 | ns |
| Output duty cycle ^{*1} | Duty1 | Measurement cct 3, load cct 1, $V_{DD} = 2.5V$, $T_a = 25^\circ C$, $C_L = 15pF$, $f = 155MHz$ | 45 | – | 55 | % |
| Output disable delay time ^{*2} | t_{PLZ} | Measurement cct 6, load cct 1, $V_{DD} = 2.5V$, $T_a = 25^\circ C$, $C_L = 15pF$ | – | – | 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 $3.6V$, $V_{SS} = 0V$, $T_a = -40$ to $+85^\circ C$ unless otherwise noted.

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

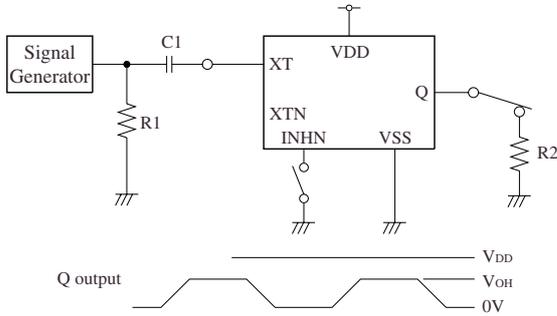
| INHN | Q | Oscillator |
|----------------|------------------------|------------------|
| HIGH (or open) | f_O output frequency | Normal operation |
| LOW | High impedance | Stopped |

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.

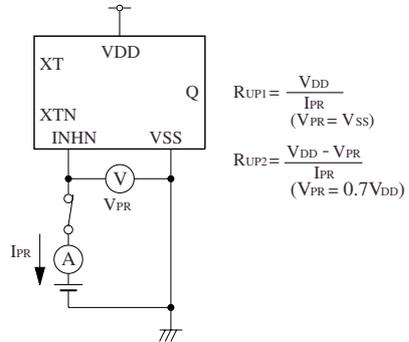
MEASUREMENT CIRCUITS

Measurement cct 1



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

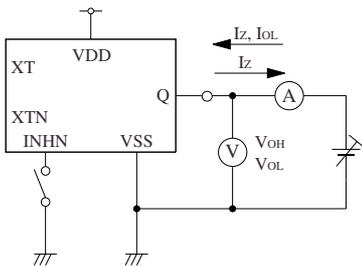
Measurement cct 4



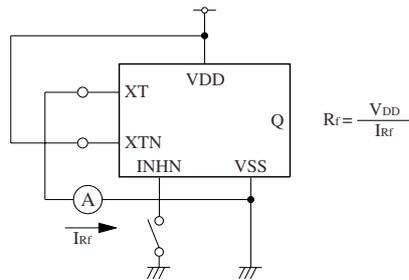
$$R_{UP1} = \frac{V_{DD}}{I_{PR}} \quad (V_{PR} = V_{SS})$$

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

Measurement cct 2

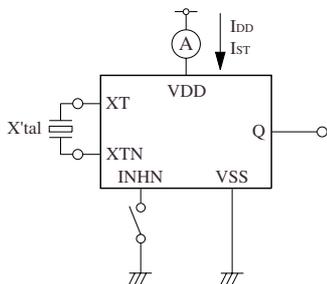


Measurement cct 5

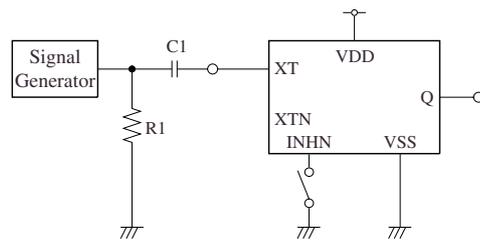


$$R_f = \frac{V_{DD}}{I_{rf}}$$

Measurement cct 3

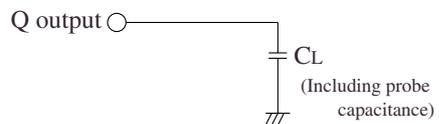


Measurement cct 6



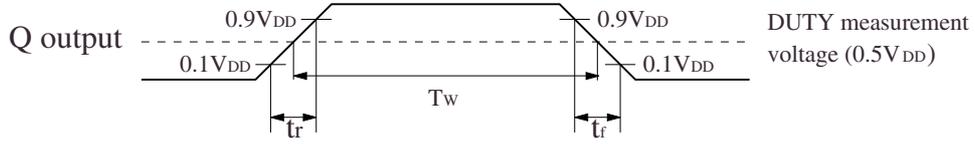
2Vp-p, 10MHz sine wave input signal
 C1: 0.001μF
 R1: 50Ω

Load cct 1

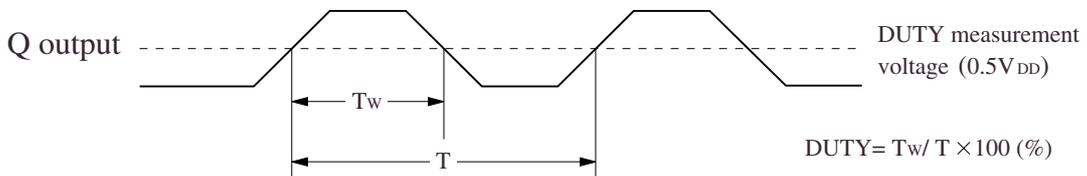


Switching Time Measurement Waveform

Output duty level, t_r , t_f

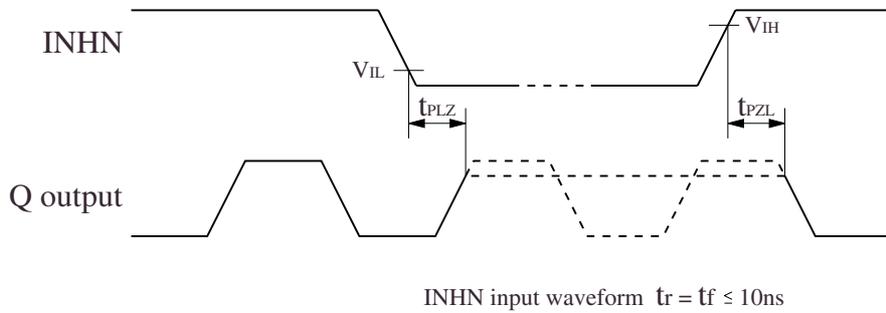


Output duty cycle



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.



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

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The logo for SEIKO NPC CORPORATION, consisting of the letters 'NPC' in a bold, black, sans-serif font.

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