

## OVERVIEW

The SM5021 series are crystal oscillator module ICs fabricated in NPC's Molybdenum-gate CMOS, that incorporate high-frequency, low current consumption oscillator and output buffer circuits. Highly

accurate thin-film feedback resistors and high-frequency capacitors are built-in, eliminating the need for external components to make a stable 3rd-harmonic oscillator.

## FEATURES

- 3rd overtone oscillation
- Capacitors CG, CD built-in
- Inverter amplifier feedback resistor built-in (A×, B× series)
- TTL input level
- 4 mA ( $V_{DD} = 2.7\text{ V}$ ) drive capability  
8 mA ( $V_{DD} = 4.5\text{ V}$ ) drive capability
- Output three-state function
- 2.7 to 5.5 V supply voltage (A×, K× series)  
4.5 to 5.5 V supply voltage (B×, L× series)
- Oscillator frequency output
- 6-pin SOT (SM5021××H)
- Chip form (CF5021××)

## SERIES CONFIGURATION

| Version <sup>1</sup> | Supply voltage |            | Recommended operating frequency range (MHz) |          | Built-in capacitance (pF) |                | gm ratio | Rf (kΩ) | Output frequency | Output level | Standby output state |
|----------------------|----------------|------------|---------------------------------------------|----------|---------------------------|----------------|----------|---------|------------------|--------------|----------------------|
|                      | Chip           | SOT        | 3V                                          | 5V       | C <sub>G</sub>            | C <sub>D</sub> |          |         |                  |              |                      |
| SM5021AAH            | 4.5 to 5.5     | 4.5 to 5.5 | ×                                           | 22 to 30 | 8                         | 15             | 1        | 6.0     | f <sub>o</sub>   | CMOS         | High impedance       |
| SM5021ABH            | 2.7 to 5.5     | 2.7 to 5.5 | 22 to 30                                    | 30 to 43 | 8                         | 15             | 1        | 3.3     | f <sub>o</sub>   | CMOS         | High impedance       |
| SM5021ACH            | 2.7 to 5.5     | 2.7 to 5.5 | 30 to 40                                    | 43 to 55 | 8                         | 15             | 2        | 3.9     | f <sub>o</sub>   | CMOS         | High impedance       |
| SM5021ADH            | 2.7 to 5.5     | 2.7 to 5.5 | 40 to 50                                    | 55 to 70 | 8                         | 15             | 3        | 2.7     | f <sub>o</sub>   | CMOS         | High impedance       |
| SM5021AEH            | 2.7 to 3.6     | ×          | 50 to 70                                    | ×        | 8                         | 12             | 4        | 2.7     | f <sub>o</sub>   | CMOS         | High impedance       |
| SM5021BAH            | 4.5 to 5.5     | 4.5 to 5.5 | ×                                           | 22 to 30 | 8                         | 15             | 1        | 6.0     | f <sub>o</sub>   | TTL          | High impedance       |
| SM5021BBH            | 4.5 to 5.5     | 4.5 to 5.5 | ×                                           | 30 to 43 | 8                         | 15             | 1        | 3.3     | f <sub>o</sub>   | TTL          | High impedance       |
| SM5021BCH            | 4.5 to 5.5     | 4.5 to 5.5 | ×                                           | 43 to 55 | 8                         | 15             | 2        | 3.9     | f <sub>o</sub>   | TTL          | High impedance       |
| SM5021BDH            | 4.5 to 5.5     | 4.5 to 5.5 | ×                                           | 55 to 70 | 8                         | 15             | 3        | 2.7     | f <sub>o</sub>   | TTL          | High impedance       |
| SM5021KDH            | 2.7 to 5.5     | 2.7 to 5.5 | 22 to 50                                    | 22 to 70 | 8                         | 15             | 3        | –       | f <sub>o</sub>   | CMOS         | High impedance       |
| SM5021KEH            | 2.7 to 3.6     | 2.7 to 3.6 | 50 to 70                                    | ×        | 8                         | 12             | 4        | –       | f <sub>o</sub>   | CMOS         | High impedance       |
| SM5021LDH            | 4.5 to 5.5     | 4.5 to 5.5 | ×                                           | 22 to 70 | 8                         | 15             | 3        | –       | f <sub>o</sub>   | TTL          | High impedance       |

1. Chip form devices have designation CF5021××.

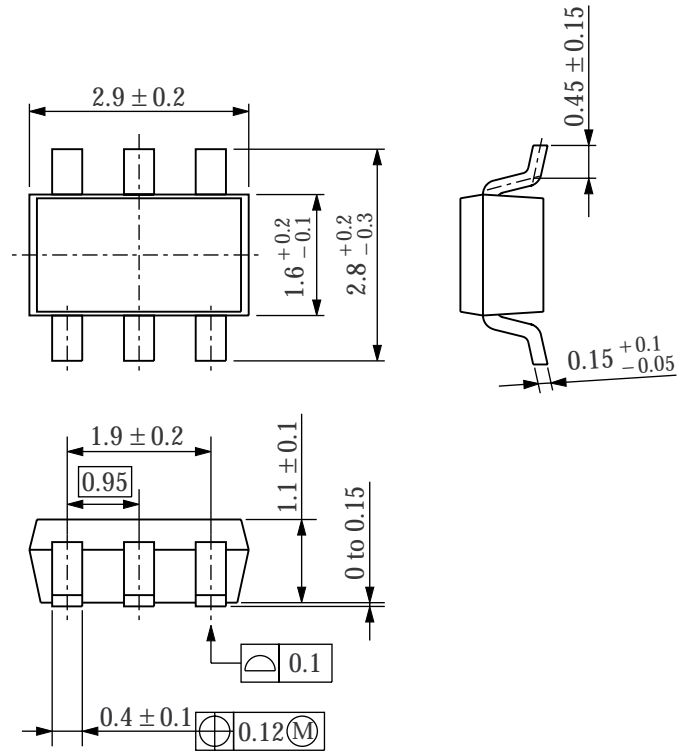
## ORDERING INFORMATION

| Devicez    | Package   |
|------------|-----------|
| SM5021××H  | 6-pin SOT |
| CF5021××-2 | Chip form |

**PACKAGE DIMENSIONS**

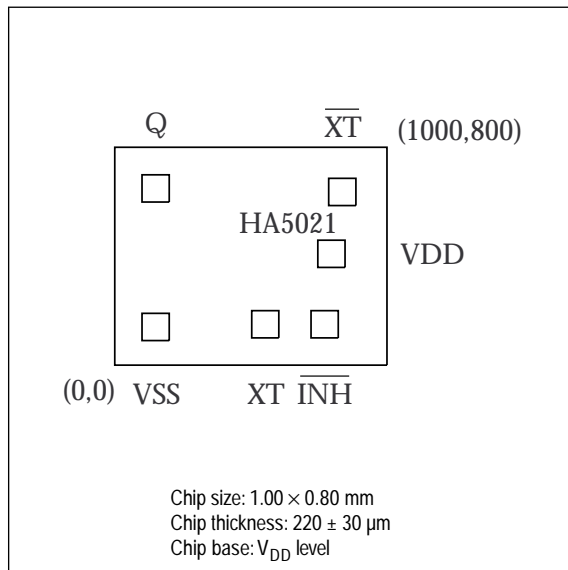
(UNIT : mm)

- 6-pin SOT



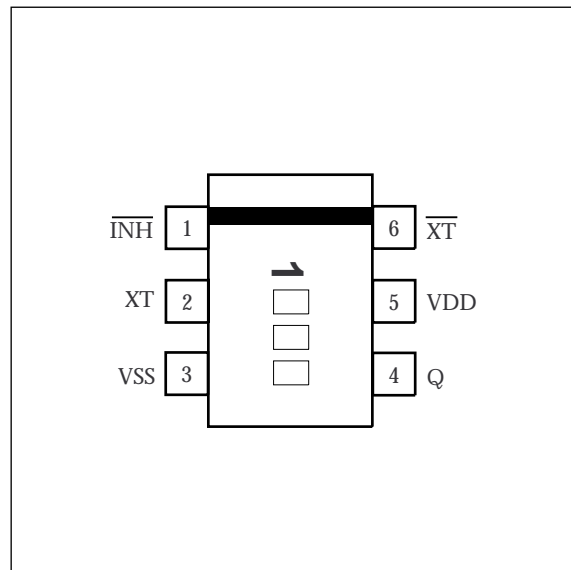
**PAD LAYOUT**

(Unit :  $\mu\text{m}$ )



**PINOUT**

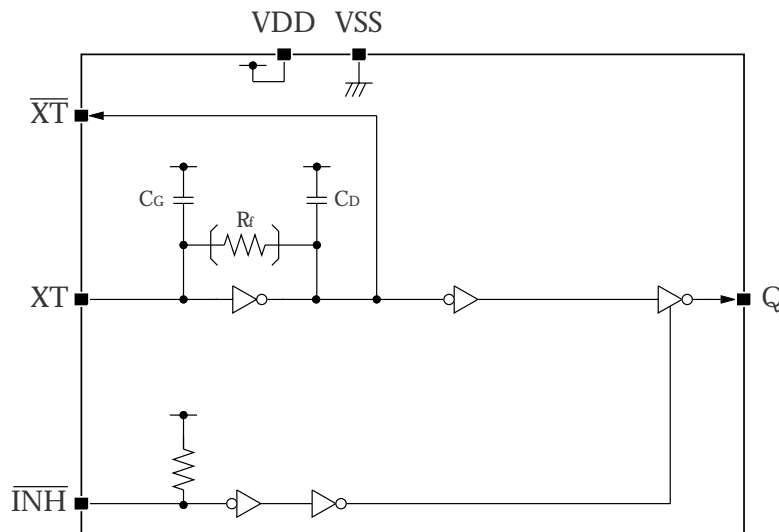
(Top View)



**PIN DESCRIPTION and PAD DIMENSIONS**

| Number | Name                    | I/O | Description                                                                                                              | Pad dimensions [ $\mu\text{m}$ ] |     |
|--------|-------------------------|-----|--------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----|
|        |                         |     |                                                                                                                          | X                                | Y   |
| 1      | $\overline{\text{INH}}$ | I   | Output state control input. High impedance when LOW. Pull-up resistor built in                                           | 771                              | 150 |
| 2      | XT                      | I   | Amplifier input. Crystal oscillator connection pins. Crystal oscillator connected between XT and $\overline{\text{XT}}$  | 553                              | 150 |
| 3      | VSS                     | -   | Ground                                                                                                                   | 150                              | 140 |
| 4      | Q                       | O   | Output. Output frequency ( $f_0$ )                                                                                       | 150                              | 649 |
| 5      | VDD                     | -   | Supply voltage                                                                                                           | 796                              | 409 |
| 6      | $\overline{\text{XT}}$  | O   | Amplifier output. Crystal oscillator connection pins. Crystal oscillator connected between XT and $\overline{\text{XT}}$ | 836                              | 636 |

**BLOCK DIAGRAM**



## SPECIFICATIONS

### Absolute Maximum Ratings

$$V_{SS} = 0 \text{ V}$$

| 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   | $T_{stg}$ | Chip form | -65 to 150             | °C   |
|                             |           | 6-pin SOT | -55 to 125             |      |
| Output current              | $I_{OUT}$ |           | 13                     | mA   |
| Power dissipation           | $P_D$     | 6-pin SOT | 250                    | mW   |

### Recommended Operating Conditions

$$V_{SS} = 0 \text{ V}, f \leq 70\text{MHz}, C_L \leq 15\text{pF}$$

| Parameter             | Symbol    | Condition | Rating   |     |          | Unit |
|-----------------------|-----------|-----------|----------|-----|----------|------|
|                       |           |           | min      | typ | max      |      |
| Supply voltage        | $V_{DD}$  |           | 2.7      | -   | 5.5      | V    |
| Input voltage         | $V_{IN}$  |           | $V_{SS}$ | -   | $V_{DD}$ | V    |
| Operating temperature | $T_{OPR}$ |           | -20      | -   | 80       | °C   |

Note: Recommended operating conditions will change in accordance with operating frequency, load capacitance, or power dissipation.

SM5021 series

**Electrical Characteristics**

3 V operation: AA, AB, AC, AD, AE series/ KD, KE series

$V_{DD} = 2.7$  to  $3.6$  V,  $V_{SS} = 0$  V,  $T_a = -20$  to  $80$  °C unless otherwise noted.

| Parameter                               | Symbol   | Condition                                                                                                      | Rating                                                                                   |       |     | Unit  |               |
|-----------------------------------------|----------|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-------|-----|-------|---------------|
|                                         |          |                                                                                                                | min                                                                                      | typ   | max |       |               |
| HIGH-level output voltage               | $V_{OH}$ | Q: Measurement cct 1, $V_{DD} = 2.7$ V,<br>$I_{OH} = 4$ mA                                                     | SM5021×AH, CF5021×A<br>SM5021×BH, CF5021×B<br>SM5021×CH, CF5021×C<br>SM5021×DH, CF5021×D | 2.1   | 2.4 | –     | V             |
|                                         |          | Q: Measurement cct 1, $V_{DD} = 2.7$ V,<br>$I_{OH} = 8$ mA                                                     | SM5021×EH, CF5021×E                                                                      |       |     |       |               |
| LOW-level output voltage                | $V_{OL}$ | Q: Measurement cct 2, $V_{DD} = 2.7$ V,<br>$I_{OL} = 4$ mA                                                     | SM5021×AH, CF5021×A<br>SM5021×BH, CF5021×B<br>SM5021×CH, CF5021×C<br>SM5021×DH, CF5021×D | –     | 0.3 | 0.4   | V             |
|                                         |          | Q: Measurement cct 2, $V_{DD} = 2.7$ V,<br>$I_{OL} = 8$ mA                                                     | SM5021×EH, CF5021×E                                                                      |       |     |       |               |
| Output leakage current                  | $I_Z$    | Q: Measurement cct 2, $V_{DD} = 3.3$ V, $\overline{INH} = \text{LOW}$ , $V_{OH} = V_{DD}$                      |                                                                                          | –     | –   | 10    | $\mu\text{A}$ |
|                                         |          | Q: Measurement cct 2, $V_{DD} = 3.3$ V, $\overline{INH} = \text{LOW}$ , $V_{OL} = V_{SS}$                      |                                                                                          | –     | –   | 10    |               |
| HIGH-level input voltage                | $V_{IH}$ | $\overline{INH}$                                                                                               |                                                                                          | 2.0   | –   | –     | V             |
| LOW-level input voltage                 | $V_{IL}$ | $\overline{INH}$                                                                                               |                                                                                          | –     | –   | 0.5   | V             |
| Current consumption                     | $I_{DD}$ | $\overline{INH} = \text{open}$ , Measurement cct 3,<br>load cct 1, $C_L = 15$ pF,<br>70 MHz crystal oscillator | SM5021A×H, CF5021A×<br>SM5021K×H, CF5021K×                                               | –     | 13  | 25    | mA            |
| $\overline{INH}$ pull-up resistance     | $R_{UP}$ | Measurement cct 4                                                                                              |                                                                                          | 25    | 100 | 250   | k $\Omega$    |
| Feedback resistance<br>(A× series only) | $R_f$    | Measurement cct 5                                                                                              | SM5021×AH, CF5021×A                                                                      | 5.1   | 6.0 | 6.9   | k $\Omega$    |
|                                         |          |                                                                                                                | SM5021×BH, CF5021×B                                                                      | 2.8   | 3.3 | 3.8   |               |
|                                         |          |                                                                                                                | SM5021×CH, CF5021×C                                                                      | 3.3   | 3.9 | 4.5   |               |
|                                         |          |                                                                                                                | SM5021×DH, CF5021×D<br>SM5021×EH, CF5021×E                                               | 2.3   | 2.7 | 3.1   |               |
| Built-in capacitance                    | $C_G$    | Design value, determined by the internal wafer pattern                                                         |                                                                                          | 7.44  | 8   | 8.56  | pF            |
|                                         | $C_D$    | Design value, determined by the<br>internal wafer pattern                                                      | SM5021×AH, CF5021×A<br>SM5021×BH, CF5021×B<br>SM5021×CH, CF5021×C<br>SM5021×DH, CF5021×D | 13.95 | 15  | 16.05 | pF            |
|                                         |          |                                                                                                                | SM5021×EH, CF5021×E                                                                      | 11.16 | 12  | 12.84 |               |

## SM5021 series

5 V operation: AA, AB, AC, AD series/ BA, BB, BC, BD series/ KD series/ LD series

$V_{DD} = 4.5$  to  $5.5$  V,  $V_{SS} = 0$  V,  $T_a = -20$  to  $80$  °C unless otherwise noted.

| Parameter                                   | Symbol   | Condition                                                                                                                                                                                                                   | Rating                                     |       |     | Unit          |            |
|---------------------------------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|-------|-----|---------------|------------|
|                                             |          |                                                                                                                                                                                                                             | min                                        | typ   | max |               |            |
| HIGH-level output voltage                   | $V_{OH}$ | Q: Measurement cct 1, $V_{DD} = 4.5$ V, $I_{OH} = 8$ mA                                                                                                                                                                     | 3.9                                        | 4.2   | –   | V             |            |
| LOW-level output voltage                    | $V_{OL}$ | Q: Measurement cct 2, $V_{DD} = 4.5$ V, $I_{OL} = 8$ mA                                                                                                                                                                     | –                                          | 0.3   | 0.4 | V             |            |
| Output leakage current                      | $I_Z$    | Q: Measurement cct 2, $V_{DD} = 5.5$ V, $\overline{INH} = \text{LOW}$ , $V_{OH} = V_{DD}$                                                                                                                                   | –                                          | –     | 10  | $\mu\text{A}$ |            |
|                                             |          | Q: Measurement cct 2, $V_{DD} = 5.5$ V, $\overline{INH} = \text{LOW}$ , $V_{OL} = V_{SS}$                                                                                                                                   | –                                          | –     | 10  |               |            |
| HIGH-level input voltage                    | $V_{IH}$ | $\overline{INH}$                                                                                                                                                                                                            | 2.0                                        | –     | –   | V             |            |
| LOW-level input voltage                     | $V_{IL}$ | $\overline{INH}$                                                                                                                                                                                                            | –                                          | –     | 0.8 | V             |            |
| Current consumption                         | $I_{DD}$ | $\overline{INH} = \text{open}$ , Measurement cct 3, load cct 1, $C_L = 15$ pF, 70 MHz crystal oscillator<br>SM5021AAH, CF5021AA<br>SM5021ABH, CF5021AB<br>SM5021ACH, CF5021AC<br>SM5021ADH, CF5021AD<br>SM5021KDH, CF5021KD | –                                          | 18    | 35  | mA            |            |
|                                             |          | $\overline{INH} = \text{open}$ , Measurement cct 3, load cct 2, $C_L = 15$ pF, 70 MHz crystal oscillator<br>SM5021B×H, CF5021B×<br>SM5021L×H, CF5021L×                                                                      | –                                          | 18    | 35  |               |            |
| $\overline{INH}$ pull-up resistance         | $R_{UP}$ | Measurement cct 4                                                                                                                                                                                                           | 25                                         | 100   | 250 | k $\Omega$    |            |
| Feedback resistance<br>(A×, B× series only) | $R_f$    | Measurement cct 5                                                                                                                                                                                                           | SM5021×AH, CF5021×A                        | 5.1   | 6.0 | 6.9           | k $\Omega$ |
|                                             |          |                                                                                                                                                                                                                             | SM5021×BH, CF5021×B                        | 2.8   | 3.3 | 3.8           |            |
|                                             |          |                                                                                                                                                                                                                             | SM5021×CH, CF5021×C                        | 3.3   | 3.9 | 4.5           |            |
|                                             |          |                                                                                                                                                                                                                             | SM5021×DH, CF5021×D                        | 2.3   | 2.7 | 3.1           |            |
| Built-in capacitance                        | $C_G$    | Design value, determined by the internal wafer pattern                                                                                                                                                                      | SM5021×AH, CF5021×A<br>SM5021×BH, CF5021×B | 7.44  | 8   | 8.56          | pF         |
|                                             | $C_D$    |                                                                                                                                                                                                                             | SM5021×CH, CF5021×C<br>SM5021×DH, CF5021×D | 13.95 | 15  | 16.05         | pF         |

## Switching Characteristics

### CMOS

3 V operation: AA, AB, AC, AD, AE series/ KD, KE series

$V_{DD} = 2.7$  to  $3.6$  V,  $V_{SS} = 0$  V,  $T_a = -20$  to  $80$  °C unless otherwise noted.

| Parameter                      | Symbol    | Condition                                                                                    | Rating                                                                                                          |     |     | Unit |    |
|--------------------------------|-----------|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-----|-----|------|----|
|                                |           |                                                                                              | min                                                                                                             | typ | max |      |    |
| Output rise time               | $t_{r1}$  | Measurement cct 6, load cct 1, $0.1V_{DD}$ to $0.9V_{DD}$ , $C_L = 15$ pF                    | SM5021AAH, CF5021AA<br>SM5021ABH, CF5021AB<br>SM5021ACH, CF5021AC<br>SM5021ADH, CF5021AD<br>SM5021KDH, CF5021KD | –   | 5   | 10   | ns |
|                                |           |                                                                                              | SM5021AEH, CF5021AE<br>SM5021KEH, CF5021KE                                                                      | –   | 3.5 | 7    |    |
|                                |           | Measurement cct 6, load cct 1, $0.2V_{DD}$ to $0.8V_{DD}$ , $C_L = 15$ pF                    | SM5021AAH, CF5021AA<br>SM5021ABH, CF5021AB<br>SM5021ACH, CF5021AC<br>SM5021ADH, CF5021AD<br>SM5021KDH, CF5021KD | –   | 3.5 | 7    |    |
| Output fall time               | $t_{f1}$  | Measurement cct 6, load cct 1, $0.9V_{DD}$ to $0.1V_{DD}$ , $C_L = 15$ pF                    | SM5021AAH, CF5021AA<br>SM5021ABH, CF5021AB<br>SM5021ACH, CF5021AC<br>SM5021ADH, CF5021AD<br>SM5021KDH, CF5021KD | –   | 5   | 10   | ns |
|                                |           |                                                                                              | SM5021AEH, CF5021AE<br>SM5021KEH, CF5021KE                                                                      | –   | 3.5 | 7    |    |
|                                |           | Measurement cct 6, load cct 1, $0.8V_{DD}$ to $0.2V_{DD}$ , $C_L = 15$ pF                    | SM5021AAH, CF5021AA<br>SM5021ABH, CF5021AB<br>SM5021ACH, CF5021AC<br>SM5021ADH, CF5021AD<br>SM5021KDH, CF5021KD | –   | 3.5 | 7    |    |
| Output duty cycle <sup>1</sup> | Duty      | Measurement cct 6, load cct 1, $T_a = 25$ °C, $V_{DD} = 3$ V, $C_L = 15$ pF, $f \leq 70$ MHz | 45                                                                                                              | –   | 55  | %    |    |
| Output disable delay time      | $t_{PLZ}$ | Measurement cct 6, load cct 1, $T_a = 25$ °C, $V_{DD} = 3$ V, $C_L = 15$ pF                  | –                                                                                                               | –   | 100 | ns   |    |
| Output enable delay time       | $t_{PZL}$ |                                                                                              | –                                                                                                               | –   | 100 | ns   |    |

1. Determined by the lot monitor.

5 V operation: AA, AB, AC, AD series/ KD series

$V_{DD} = 4.5$  to  $5.5$  V,  $V_{SS} = 0$  V,  $T_a = -20$  to  $80$  °C unless otherwise noted.

| Parameter                      | Symbol    | Condition                                                                                    | Rating |     |     | Unit |
|--------------------------------|-----------|----------------------------------------------------------------------------------------------|--------|-----|-----|------|
|                                |           |                                                                                              | min    | typ | max |      |
| Output rise time               | $t_{r1}$  | Measurement cct 6, load cct 1, $0.1V_{DD}$ to $0.9V_{DD}$ , $C_L = 15$ pF                    | –      | 3.5 | 7   | ns   |
| Output fall time               | $t_{f1}$  | Measurement cct 6, load cct 1, $0.9V_{DD}$ to $0.1V_{DD}$ , $C_L = 15$ pF                    | –      | 3.5 | 7   | ns   |
| Output duty cycle <sup>1</sup> | Duty      | Measurement cct 6, load cct 1, $T_a = 25$ °C, $V_{DD} = 5$ V, $C_L = 15$ pF, $f \leq 70$ MHz | 45     | –   | 55  | %    |
| Output disable delay time      | $t_{PLZ}$ | Measurement cct 6, load cct 1, $T_a = 25$ °C, $V_{DD} = 5$ V, $C_L = 15$ pF                  | –      | –   | 100 | ns   |
| Output enable delay time       | $t_{PZL}$ |                                                                                              | –      | –   | 100 | ns   |

1. Determined by the lot monitor.

**TTL**

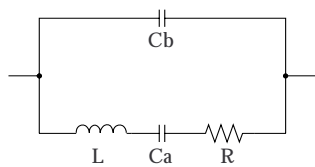
5 V operation: BA, BB, BC, BD series/ LD series

$V_{DD} = 4.5$  to  $5.5$  V,  $V_{SS} = 0$  V,  $T_a = -20$  to  $80$  °C unless otherwise noted.

| Parameter                      | Symbol    | Condition                                                                                       | Rating |     |     | Unit |
|--------------------------------|-----------|-------------------------------------------------------------------------------------------------|--------|-----|-----|------|
|                                |           |                                                                                                 | min    | typ | max |      |
| Output rise time               | $t_{r2}$  | Measurement cct 6, load cct 2, 0.4V to 2.4V, $C_L = 15$ pF                                      | –      | 2.5 | 7   | ns   |
| Output fall time               | $t_{f2}$  | Measurement cct 6, load cct 2, 2.4V to 0.4V, $C_L = 15$ pF                                      | –      | 2.5 | 7   | ns   |
| Output duty cycle <sup>1</sup> | Duty      | Measurement cct 6, load cct 2,<br>$T_a = 25$ °C, $V_{DD} = 5$ V, $C_L = 15$ pF, $f \leq 70$ MHz | 45     | –   | 55  | %    |
| Output disable delay time      | $t_{PLZ}$ | Measurement cct 6, load cct 2, $T_a = 25$ °C, $V_{DD} = 5$ V, $C_L = 15$ pF                     | –      | –   | 100 | ns   |
| Output enable delay time       | $t_{PZL}$ |                                                                                                 | –      | –   | 100 | ns   |

1. Determined by the lot monitor.

**Current consumption and Output waveform with NPC's standard crystal**



| f (MHz) | R (Ω) | L (mH) | Ca (fF) | Cb (pF) |
|---------|-------|--------|---------|---------|
| 30      | 18.62 | 16.24  | 1.733   | 5.337   |
| 40      | 20.53 | 11.34  | 1.396   | 3.989   |
| 50      | 22.17 | 7.40   | 1.370   | 4.105   |
| 60      | 22.20 | 5.05   | 1.388   | 4.226   |
| 70      | 25.42 | 4.18   | 1.254   | 5.170   |

**FUNCTIONAL DESCRIPTION**

**Standby Function**

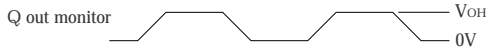
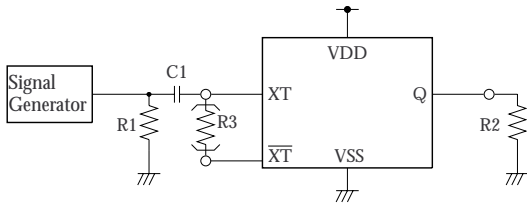
When  $\overline{INH}$  goes LOW, the oscillator output on Q goes high impedance.

| $\overline{INH}$ | Q                      | Oscillator       |
|------------------|------------------------|------------------|
| HIGH (or open)   | $f_0$ output frequency | Normal operation |
| LOW              | High impedance         | Normal operation |



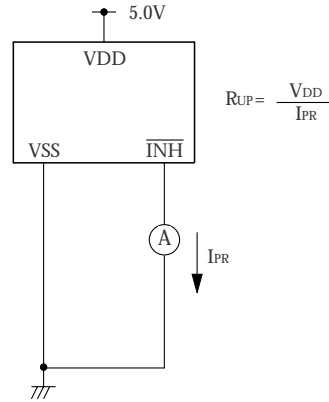
**MEASUREMENT CIRCUITS**

**Measurement cct 1**

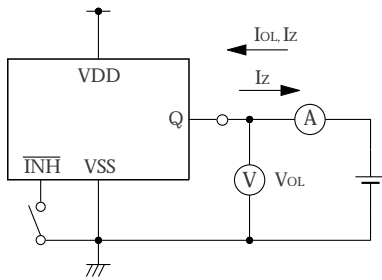


- 2.0V<sub>P-P</sub> , 10MHz sine wave input signal (3V operation)
- 3.5V<sub>P-P</sub> , 10MHz sine wave input signal (5V operation)
- C1 : 0.001μF
- R1 : 50Ω
- R2 : 525Ω (3V operation/ ×A, ×B, ×C, ×D series)  
263Ω (3V operation/ ×E series)  
490Ω (5V operation)
- R3 : 100kΩ (K×, L× series)

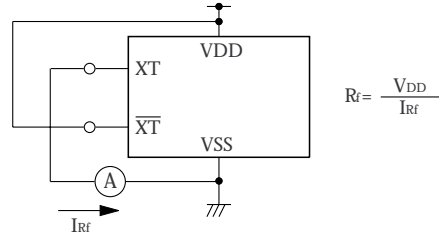
**Measurement cct 4**



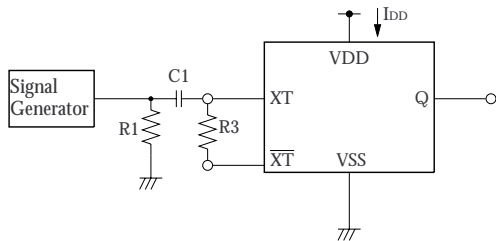
**Measurement cct 2**



**Measurement cct 5**

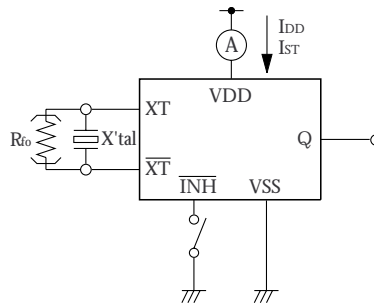


**Measurement cct 3**



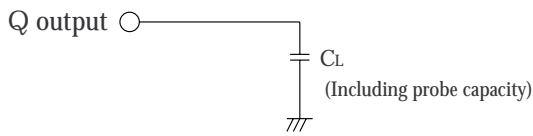
- 2.0V<sub>P-P</sub> , 70MHz sine wave input signal (3V operation)
- 3.5V<sub>P-P</sub> , 70MHz sine wave input signal (5V operation)
- C1 : 0.001μF
- R1 : 50Ω
- R3 : 100kΩ (K×, L× series)

**Measurement cct 6**



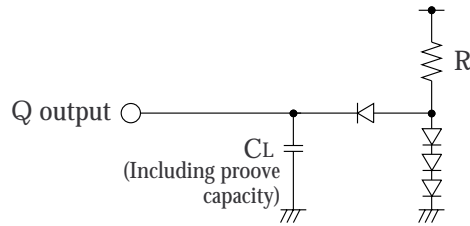
- R<sub>f0</sub> : 2.7kΩ (K×, L× series)

**Load cct 1**



$C_L = 15\text{pF}; t_{11}, t_{f1}$

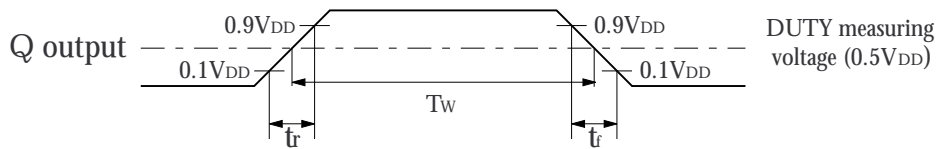
**Load cct 2**



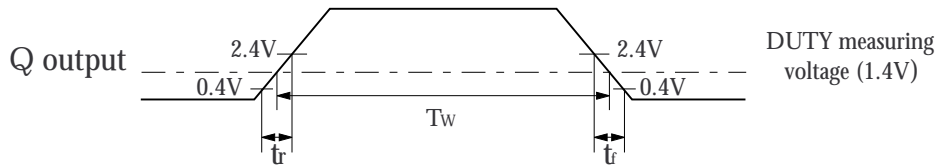
$C_L = 15\text{pF}; t_{12}, t_{f2}$   
 $R = 800\Omega$

**Switching Time Measurement Waveform**

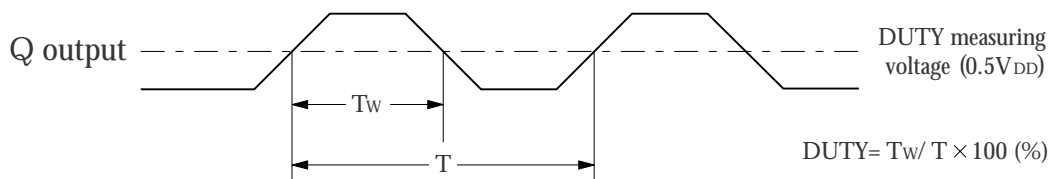
**Output duty level (CMOS)**



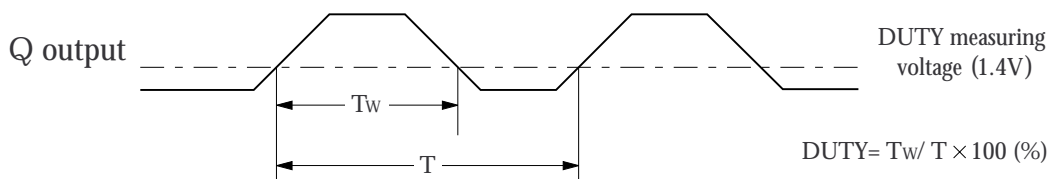
**Output duty level (TTL)**



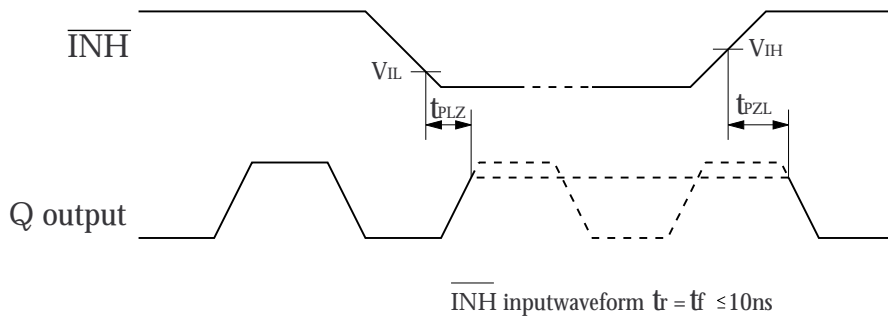
**Output duty cycle (CMOS)**



**Output duty cycle (TTL)**



## Output Enable/Disable Delay



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