# XC2164 Series

## ICs for use with Crystal Oscillators

## ■GENERAL DESCRIPTION

The XC2164 series are high frequency, low current consumption CMOS ICs with built-in crystal oscillator and divider circuits. For fundamental oscillation, output is selectable from any one of the following values for f0: f0/1, f0/2, f0/4, and f0/8. With oscillation capacitors and a feedback resistor built-in, it is possible to configure a stable fundamental oscillator or 3rd overtone oscillator using only an external crystal. Also the series has stand-by function built-in and the type, which suspends the oscillation completely (XC2164A~D type) or the type suspends only an output (XC2164K~N type) are available. The XC2164 series are integrated into SOT-26 packages. The series is also available in chip form.

## ■APPLICATIONS

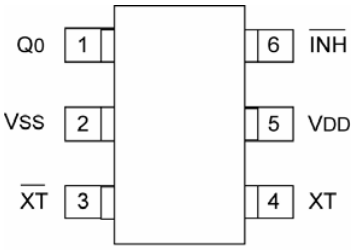
- ●Crystal oscillation modules
- ●Clocks for micro computer, DSPs
- ●Communication equipment
- ●Various system clocks

## ■FEATURES

**Oscillation Frequency** : 4MHz ~ 30MHz (Fundamental)
20MHz ~ 125MHz (3rd Overtone)
**Divider Ratio** : Selectable from f0/1, f0/2, f0/4, f0/8 (f0/2, f0/4, f0/8 are fundamental only)
**Output** : 3-State
**Operating Voltage Range** : 3.3V±10%, 5.0V±10%
**Low Power Consumption** : Stand-by function included
Selectable from Chip Enable type and Output Enable type

**CMOS**
**Built-in Oscillation Feedback Resistor**
**Built- in Oscillation Capacitors Cg, Cd**
**Packages** : SOT-26, Chip Form (1.3x0.8mm)

## ■PIN CONFIGURATION




SOT-26
(TOP VIEW)

## ■PIN ASSIGNMENT

| PIN NUMBER | PIN NAME | FUNCTION |
|---|---|---|
| 1 | $Q_0$ | Clock Output |
| 2 | $V_{SS}$ | Ground |
| 3 | /XT | Crystal Oscillator Connection (Output) |
| 4 | XT | Crystal Oscillator Connection (Input) |
| 5 | $V_{DD}$ | Power Supply |
| 6 | /INH | Stand-by Control* |

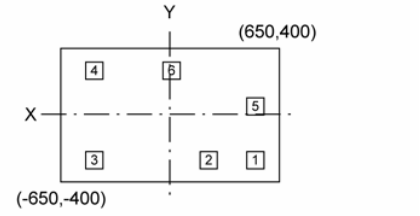
*Stand-by control pin has a pull-up resistor built-in. unit [μm]

## ■/INH, $Q_0$ PIN FUNCTION

| $/I_{NH}$ | $Q_0$ |
|---|---|
| “H” or OPEN | Clock Output |
| “L” | High impedance |

H = High level
L = Low level

## ■PAD LAYOUT FOR CHIP FORM




Size (Chip) : 1.3×0.8mm
Thickness (Chip) : XC2164xx1xxT : 280±20μm
: XC2164xx1xxF : 200±20μm
Backside (Chip) : $V_{DD}$ Level
Aperture (Pad) : 100×100μm

## ■PAD DIMENSIONS

| PIN NUMBER | PIN NAME | PAD DIMENSIONS | |
|---|---|---|---|
| | | X | Y |
| 1 | $Q_0$ | 514 | - 264 |
| 2 | $V_{SS}$ | 222 | - 264 |
| 3 | / XT | - 450 | - 264 |
| 4 | XT | - 450 | 264 |
| 5 | $V_{DD}$ | 514 | 27 |
| 6 | / INH | 47 | 264 |

unit [μm]

## ■ PRODUCT CLASSIFICATION

●Ordering Information

XC2164 ①②③④⑤⑥

| DESIGNATOR | DESCRIPTION | SYMBOL | DESCRIPTION |
|---|---|---|---|
| ① | Divider Ratio & /INH Pin Function | A | : Chip Enable: f0/1 |
| | | B | : Chip Enable: f0/2 (Fundamental only) |
| | | C | : Chip Enable: f0/4 (Fundamental only) |
| | | D | : Chip Enable: f0/8 (Fundamental only) |
| | | K | : Output Enable: f0/1 |
| | | L | : Output Enable: f0/2 (Fundamental only) |
| | | M | : Output Enable: f0/4 (Fundamental only) |
| | | N | : Output Enable: f0/8 (Fundamental only) |
| ② | Chip Surface Treatment | 5 | : Not polyimide coating on the chip surface (SOT-26 only) |
| | | 6 | : Polyimide coating on the chip surface (Chip form only) |
| ③ | Duty Level | 1 | : CMOS ($V_{DD}$/2) *TTL: Fundamental 4MHz to 30MHz |
| ④ | Frequency Range & Rf, Cg, Cd Values | (Table 1) | : 3rd Overtone, built-in type |
| | | (Table 2) | : Fundamental, built-in type |
| ⑤ | Packages | C | : Chip form |
| | | M | : SOT-26 |
| ⑥ | Device Orientation | R | : Embossed tape, standard feed |
| | | L | : Embossed tape, reverse feed |
| | | T | : Chip tray (Wafer thickness : 280±20μm) |
| | | F | : Chip tray (Wafer thickness : 200±20μm) |

Table 1: 3rd Overtone, Built-In Type

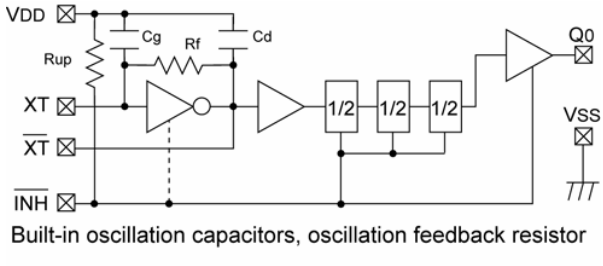
| SYMBOL | FREQUENCY RANGE | | Rf (kΩ) | Cg (pF) | Cd (pF) |
|---|---|---|---|---|---|
| | 3.3V ±10% | 5.0V ±10% | | | |
| A | – | 20MHz to 30MHz | 9.0 | 21.5 | 21.5 |
| B | 20MHz to 30MHz | 30MHz to 40MHz | 6.5 | 20.0 | 20.0 |
| C | 30MHz to 40MHz | 40MHz to 50MHz | 5.0 | 16.0 | 16.0 |
| D | 40MHz to 50MHz | 50MHz to 65MHz | 3.5 | 14.0 | 14.0 |
| E | 50MHz to 65MHz | 65MHz to 80MHz | 2.8 | 12.5 | 12.5 |
| F | 65MHz to 80MHz | 80MHz to 95MHz | 2.5 | 10.0 | 10.0 |
| H | 80MHz to 95MHz | 95MHz to 110MHz | 2.2 | 8.0 | 8.0 |
| K | 95MHz to 110MHz | 110MHz to 125MHz | 2.0 | 7.0 | 7.0 |
| L | 110MHz to 125MHz | – | 2.3 | 5.5 | 5.5 |

Table 2: Fundamental, Built-In Type

| SYMBOL | FREQUENCY RANGE | | Rf (kΩ) | Cg (pF) | Cd (pF) |
|---|---|---|---|---|---|
| | 3.3V ±10% | 5.0V ±10% | | | |
| M, V | 4MHz to 30MHz | 4MHz to 30MHz | 3.5/7.0 | 20.0 | 20.0 |
| T | 4MHz to 30MHz | 4MHz to 30MHz | 3.5/7.0 | 35.0 | 35.0 |

(*)Rf = 3.5MΩ@$V_{DD}$ = 5.0V Operation
Rf = 7.0 MΩ@$V_{DD}$ =3.3V Operation

## ■BLOCK DIAGRAM




Built-in oscillation capacitors, oscillation feedback resistor

## ■ABSOLUTE MAXIMUM RATINGS

Ta=25℃

| PARAMETER | SYMBOL | CONDITIONS | UNITS |
|---|---|---|---|
| Supply Voltage | $V_{DD}$ | $V_{SS}$ - 0.3 ~ $V_{SS}$ + 7.0 | V |
| Input Voltage | $V_{IN}$ | $V_{SS}$ - 0.3 ~ $V_{DD}$ + 0.3 | V |
| Power Dissipation | Pd | 250* | mW |
| Operating Temperature Range | Topr | - 40 ~ + 85 | ℃ |
| Storage Temperature Range | Tstg | - 65 ~ + 150 (Chip Form) | ℃ |
| | | - 55 ~ + 125 (SOT-26) | ℃ |

** When implemented on a glass epoxy PCB. (SOT-26 package)

# ■ELECTRICAL CHARACTERISTICS

## ●DC Electrical Characteristics

XC2164Ax1M, T, V / XC2164Kx1M, T, V (Fundamental)

5.0V operation (unless otherwise stated, $V_{DD}$=5.0V, No Load, Ta= -30~+80℃)

| PARAMETER | SYMBOL | CONDITIONS | | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|---|
| Operating Voltage | $V_{DD}$ | | | 4.5 | 5.0 | 5.5 | V |
| "H" Level Input Voltage | $V_{IH}$ | | | 2.4 | - | - | V |
| "L" Level Input Voltage | $V_{IL}$ | | | - | - | 0.4 | V |
| "H" Level Output Voltage | $V_{OH}$ | CMOS: $V_{DD}$=4.5V, $I_{OH}$= - 16mA | | 3.9 | 4.2 | - | V |
| "L" Level Output Voltage | $V_{OL}$ | CMOS: $V_{DD}$=4.5V, $I_{OH}$=16mA | | - | 0.3 | 0.4 | V |
| Supply Current 1 | $I_{DD1}$ | /INH=Open, $Q_0$=Open f=30MHz | XC2164Ax1M, V | - | 11 | (15) | mA |
| | | | XC2164Ax1T | - | 11 | (15) | |
| | | | XC2164Kx1M, V | - | 11 | (15) | |
| | | | XC2164Kx1T | - | 11 | (15) | |
| Supply Current 2 | $I_{DD2}$ | /INH="L", $Q_0$=Open f=30MHz | XC2164Ax1M, V | - | 5 | (8) | μA |
| | | | XC2164Ax1T | - | 5 | (8) | |
| | | | XC2164Kx1M, V | - | (T.B.D.*) | (T.B.D.*) | mA |
| | | | XC2164Kx1T | - | 9 | (14) | |
| Input Pull-Up Resistance 1 | $R_{UP1}$ | /INH="L" | | 0.5 | 1.0 | 2.0 | MΩ |
| Input Pull-Up Resistance 2 | $R_{UP2}$ | /INH=0.7 $V_{DD}$ | | 25 | 50 | 100 | kΩ |
| Internal Oscillation Feedback Resistance | Rf | | | - | 3.5 | - | MΩ |
| Output Disable Leak Current | $I_{OZ}$ | /INH="L" | | - | - | 10 | μA |

* T.B.D.: To be determined

XC2164Ax1M, XC2164Kx1M (Fundamental)

3.3V operation (unless otherwise stated, $V_{DD}$=3.3V, No Load, Ta= -30~+80℃)

| PARAMETER | SYMBOL | CONDITIONS | | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|---|
| Operating Voltage | $V_{DD}$ | | | 2.97 | 3.30 | 3.63 | V |
| "H" Level Input Voltage | $V_{IH}$ | | | 2.4 | - | - | V |
| "L" Level Input Voltage | $V_{IL}$ | | | - | - | 0.4 | V |
| "H" Level Output Voltage | $V_{OH}$ | CMOS: $V_{DD}$=2.97V, $I_{OH}$= - 8mA | | 2.5 | - | - | V |
| "L" Level Output Voltage | $V_{OL}$ | CMOS: $V_{DD}$=2.97V, $I_{OH}$=8mA | | - | - | 0.4 | V |
| Supply Current 1 | $I_{DD1}$ | /INH=Open, $Q_0$=Open, f=30MHz | XC2164Ax1M | - | 5 | (8) | mA |
| | | | XC2164Kx1M | - | 5 | (8) | |
| Supply Current 2 | $I_{DD2}$ | /INH="L", $Q_0$=Open, f=30MHz | XC2164Ax1M | - | 2 | (4) | μA |
| | | | XC2164Kx1M | - | (T.B.D.*) | (T.B.D.*) | mA |
| Input Pull-Up Resistance 1 | $R_{UP1}$ | /INH="L" | | 1.0 | 2.0 | 4.0 | MΩ |
| Input Pull-Up Resistance 2 | $R_{UP2}$ | /INH=0.7 $V_{DD}$ | | 35 | 70 | 140 | kΩ |
| Internal Oscillation Feedback Resistance | Rf | | | - | 7.0 | - | MΩ |
| Output Disable Leak Current | Id | /INH="L" | | - | - | 10 | μA |

* T.B.D.: To be determined

# ■ ELECTRICAL CHARACTERISTICS (Continued)

●DC Electrical Characteristics (Continued)

XC2164Ax1T, V / XC2164Kx1T, V (Fundamental)

3.3V operation (unless otherwise stated, $V_{DD}$=3.3V, No Load, Ta= -30~+80℃)

| PARAMETER | SYMBOL | CONDITIONS | | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|---|
| Operating Voltage | $V_{DD}$ | | | 2.50 | 3.30 | 3.63 | V |
| "H" Level Input Voltage | $V_{IH}$ | | | 2.4 | - | - | V |
| "L" Level Input Voltage | $V_{IL}$ | | | - | - | 0.4 | V |
| "H" Level Output Voltage | $V_{OH}$ | CMOS: 2.97V, $I_{OH}$= - 8mA | | 2.5 | - | - | V |
| "L" Level Output Voltage | $V_{OL}$ | CMOS: 2.97V, $I_{OH}$=8mA | | - | - | 0.4 | V |
| Supply Current 1 | $I_{DD1}$ | /INH=Open, $Q_0$=Open, f=30MHz | XC2164Ax1T | - | 4 | (6.5) | mA |
| | | | XC2164Ax1V | - | 5 | (8) | |
| | | | XC2164Kx1T | - | 4 | (6.5) | |
| | | | XC2164Kx1V | - | 5 | (8) | |
| Supply Current 2 | $I_{DD2}$ | /INH="L", $Q_0$=Open, f=30MHz | XC2164Ax1T | - | 2 | (4) | μA |
| | | | XC2164Ax1V | - | 2 | (4) | |
| | | | XC2164Kx1T | - | (T.B.D.*) | (T.B.D.*) | mA |
| | | | XC2164Kx1V | - | (T.B.D.*) | (T.B.D.*) | |
| Input Pull-Up Resistance 1 | $R_{UP1}$ | /INH="L" | | 1.0 | 2.0 | 4.0 | MΩ |
| Input Pull-Up Resistance 2 | $R_{UP2}$ | /INH=0.7 $V_{DD}$ | | 35 | 70 | 140 | kΩ |
| Internal Oscillation Feedback Resistance | Rf | | | - | 7.0 | - | MΩ |
| Output Disable Leakage Current | $I_{OZ}$ | /INH="L" | | - | - | 10 | μA |

* T.B.D.: To be determined

Comparative Chart of Oscillation Frequency vs. Supply Voltage, and Negative Resistance Value

| SYMBOL | OSCILLATION FREQUENCY vs. SUPPLY VOLTAGE | | NEGATIVE RESISTANCE VALUE | |
|---|---|---|---|---|
| | $V_{DD}$=3.3V±10% | $V_{DD}$=5.0V±10% | $V_{DD}$=3.3V | $V_{DD}$=5.0V |
| M | ±4.3ppm | ±4.5ppm | - 130Ω | - 220Ω |
| V | ±1.2ppm | ±2.1ppm | - 150Ω | - 250Ω |
| T | ±9.4ppm | ±7.0ppm | - 660Ω | - 760Ω |

(The designed value when 30MHz crystal is used.)

## ■ ELECTRICAL CHARACTERISTICS (Continued)

●DC Electrical Characteristics (Continued)

XC2164Ax1A ~ XC2164Ax1K (3rd Overtone)

5.0V Operation (Unless otherwise stated, $V_{DD}$=5.0V, No Load, Ta= -30~+80℃)

| PARAMETER | SYMBOL | CONDITIONS | | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|---|
| Operating Voltage | $V_{DD}$ | | | 4.5 | 5.0 | 5.5 | V |
| "H" Level Input Voltage | $V_{IH}$ | | | 2.4 | - | - | V |
| "L" Level Input Voltage | $V_{IL}$ | | | - | - | 0.4 | V |
| "H" Level Output Voltage | $V_{OH}$ | CMOS: 4.5V, $I_{OH}$= -16mA | | 3.9 | 4.2 | - | V |
| "L" Level Output Voltage | $V_{OL}$ | CMOS: 4.5V, $I_{OH}$=16mA | | - | 0.3 | 0.4 | V |
| Supply Current 1 | $I_{DD1}$ | /INH=Open, $Q_0$=Open | XC2164Ax1A, f0=30MHz | - | 17.0 | (23) | mA |
| | | | XC2164Ax1B, f0=40MHz | - | 17.0 | (23) | |
| | | | XC2164Ax1C, f0=55MHz | - | 19.0 | (26) | |
| | | | XC2164Ax1D, f0=70MHz | - | 23.0 | (32) | |
| | | | XC2164Ax1E, f0=85MHz | - | 24.0 | (32) | |
| | | | XC2164Ax1F, f0=100MHz | - | 30.0 | (40) | |
| | | | XC2164Ax1H, f0=110MHz | - | 30.0 | (40) | |
| | | | XC2164Ax1K, f0=125MHz | - | 30.0 | (40) | |
| Supply Current 2 | $I_{DD2}$ | /INH="L", $Q_0$=Open | | - | 5.0 | ( 8 ) | μA |
| Input Pull-Up Resistance 1 | $R_{UP1}$ | /INH="L" | | 0.5 | 1.0 | 2.0 | MΩ |
| Input Pull-Up Resistance 2 | $R_{UP2}$ | /INH=0.7 $V_{DD}$ | | 25 | 50 | 100 | kΩ |
| Internal Oscillation Feedback Resistance | Rf | XC2164Ax1A | | - | 9.0 | - | kΩ |
| | | XC2164Ax1B | | - | 6.5 | - | |
| | | XC2164Ax1C | | - | 5.0 | - | |
| | | XC2164Ax1D | | - | 3.5 | - | |
| | | XC2164Ax1E | | - | 2.8 | - | |
| | | XC2164Ax1F | | - | 2.5 | - | |
| | | XC2164Ax1H | | - | 2.2 | - | |
| | | XC2164Ax1K | | - | 2.0 | - | |
| Output Disable Leak Current | $I_{OZ}$ | /INH="L" | | - | - | 10 | μA |

# ■ ELECTRICAL CHARACTERISTICS (Continued)

●DC Electrical Characteristics (Continued)

XC2164Ax1B, C, E, F, H, K, L (3rd Overtone)

3.3V Operation (unless otherwise stated, $V_{DD}$=3.3V, No Load, Ta= -30~+80℃)

| PARAMETER | SYMBOL | CONDITIONS | | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|---|
| Operating Voltage | $V_{DD}$ | | | 2.97 | 3.30 | 3.63 | V |
| "H" Level Input Voltage | $V_{IH}$ | | | 2.4 | - | - | V |
| "L" Level Input Voltage | $V_{IL}$ | | | - | - | 0.4 | V |
| "H" Level Output Voltage | $V_{OH}$ | CMOS: 2.97V, $I_{OH}$= - 8mA | | 2.5 | - | - | V |
| "L" Level Output Voltage | $V_{OL}$ | CMOS: 2.97V, $I_{OH}$=8mA | | - | - | 0.4 | V |
| Supply Current 1 | $I_{DD1}$ | /INH=Open, $Q_0$=Open | XC2164Ax1B, f0=30MHz | - | 4.5 | (7) | mA |
| | | | XC2164Ax1C, f0=40MHz | - | 5.0 | (8) | |
| | | | XC2164Ax1E, f0=70MHz | - | 8.0 | (13) | |
| | | | XC2164Ax1F, f0=85MHz | - | 8.5 | (13) | |
| | | | XC2164Ax1H, f0=100MHz | - | 9.5 | (15) | |
| | | | XC2164Ax1K, f0=110MHz | - | 10.0 | (15) | |
| | | | XC2164Ax1L, f0=125MHz | - | 10.5 | (15) | |
| Supply Current 2 | $I_{DD2}$ | /INH="L", $Q_0$=Open | | - | 2.0 | - | μA |
| Input Pull-Up Resistance 1 | $R_{UP1}$ | /INH="L" | | 1.0 | 2.0 | 4.0 | MΩ |
| Input Pull-Up Resistance 2 | $R_{UP2}$ | /INH=0.7 $V_{DD}$ | | 35 | 70 | 140 | kΩ |
| Internal Oscillation Feedback Resistance | Rf | XC2164Ax1B | | - | 6.5 | - | kΩ |
| | | XC2164Ax1C | | - | 5.0 | - | |
| | | XC2164Ax1E | | - | 2.8 | - | |
| | | XC2164Ax1F | | - | 2.5 | - | |
| | | XC2164Ax1H | | - | 2.2 | - | |
| | | XC2164Ax1K | | - | 2.0 | - | |
| | | XC2164Ax1L | | - | 2.3 | - | |
| Output Disable Leak Current | $I_{OZ}$ | /INH="L" | | - | - | 10 | μA |

XC2164Ax1D (3rd Overtone)

3.3V Operation (Unless otherwise stated, $V_{DD}$=3.3V, Oscillation Frequency f0=48MHz, Ta= -30~+80℃)

| PARAMETER | SYMBOL | CONDITIONS | | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|---|
| Operating Voltage | $V_{DD}$ | | | 2.70 | 3.30 | 3.63 | V |
| 'H' Level Input Voltage | $V_{IH}$ | | | 2.4 | - | - | V |
| 'L' Level Input Voltage | $V_{IL}$ | | | - | - | 0.4 | V |
| 'H' Level Output Voltage | $V_{OH}$ | CMOS: 2.97V, $I_{OH}$= - 8mA | | 2.5 | - | - | V |
| 'L' Level Output Voltage | $V_{OL}$ | CMOS: 2.97V, $I_{OH}$=8mA | | - | - | 0.4 | V |
| Supply Current 1 | $I_{DD1}$ | /INH=Open, $Q_0$=Open | XC2164Ax1D, f0=55MHz | - | 6.5 | (10) | mA |
| Supply Current 2 | $I_{DD2}$ | /INH = 'L', Q0=Open | | - | 2.0 | - | μA |
| Input Pull-Up Resistance 1 | $R_{UP1}$ | /INH = 'L' | | 1.0 | 2.0 | 4.0 | MΩ |
| Input Pull-Up Resistance 2 | $R_{UP2}$ | /INH = 0.7$V_{DD}$ | | 35 | 70 | 140 | kΩ |
| Internal Oscillation Feedback Resistance | Rf | XC2164Ax1D | | - | 3.5 | - | kΩ |
| Output Disable Leak Current | $I_{OZ}$ | /INH = 'L' | | - | - | 10 | μA |

## ■SWITCHING CHARACTERISTICS

XC2164Ax1M, T, V (Fundamental) <Chip Enable>

(unless otherwise stated, $V_{DD}$=3.3V or 5.0V, Ta= -30~+80℃)

| PARAMETER | SYMBOL | CONDITIONS | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|
| Output Rise Time (*1) | tr | CMOS: $C_L$=15pF, 0.1$V_{DD}$→0.9$V_{DD}$ | - | 1.5 | - | ns |
| | | TTL: Load=10TTL, 0.4V →2.4V | - | 1.5 | - | ns |
| Output Fall Time (*1) | tf | CMOS: $C_L$=15pF, 0.9$V_{DD}$→0.1$V_{DD}$ | - | 1.5 | - | ns |
| | | TTL: Load=10TTL, 2.4V →0.4V | - | 1.5 | - | ns |
| Output Duty Cycle | DUTY | CMOS: $C_L$=15pF @ 0.5$V_{DD}$ | 45 | - | 55 | % |
| | | TTL: Load=10TTL @ 1.4V | 45 | - | 55 | % |
| Output Disable Delay Time (*1) | tplz | f0=4MHz, $C_L$=15pF | - | - | 100 | ns |
| Output Enable Delay Time (*1) | tplz | f0=4MHz, $C_L$=15pF | - | - | 6 | ms |
| Oscillation Start Time (*1) | tosc_on | f0=4MHz, $C_L$=15pF | - | - | 6 | ms |

*1: the values are the designed values.

XC2164Ax1A to L (3rd Overtone) <Chip Enable>

(unless otherwise stated, $V_{DD}$=3.3V or 5.0V, Ta= -30~+80℃)

| PARAMETER | SYMBOL | CONDITIONS | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|
| Output Rise Time (*1) | tr | CMOS: $C_L$=15pF, 0.1$V_{DD}$→0.9$V_{DD}$ | - | 1.5 | - | ns |
| | | TTL: Load=10TTL, 0.4V →2.4V | - | 1.5 | - | ns |
| Output Fall Time (*1) | tf | CMOS: $C_L$=15pF, 0.9$V_{DD}$→0.1$V_{DD}$ | - | 1.5 | - | ns |
| | | TTL: Load=10TTL, 2.4V →0.4V | - | 1.5 | - | ns |
| Output Duty Cycle | DUTY | CMOS: $C_L$=15pF @ 0.5$V_{DD}$ | 45 | - | 55 | % |
| | | TTL: Load=10TTL @ 1.4V | 45 | - | 55 | % |
| Output Disable Delay Time (*1) | tplz | f0=20MHz, $C_L$=15pF | - | - | 100 | ns |
| Output Enable Delay Time (*1) | tplz | f0=20MHz, $C_L$=15pF | - | - | 6 | ms |
| Oscillation Start Time (*1) | tosc_on | f0=20MHz, $C_L$=15pF | - | - | 6 | ms |

*1: the values are the designed values.

XC2164Kx1M, T, V (Fundamental) <Output Enable>

(unless otherwise stated, $V_{DD}$=3.3V or 5.0V, Ta= -30~+80℃)

| PARAMETER | SYMBOL | CONDITIONS | MIN. | TYP. | MAX. | UNITS |
|---|---|---|---|---|---|---|
| Output Rise Time (*1) | tr | CMOS: $C_L$=15pF, 0.1$V_{DD}$→0.9$V_{DD}$ | - | 1.5 | - | ns |
| | | TTL: Load=10TTL, 0.4V →2.4V | - | 1.5 | - | ns |
| Output Fall Time (*1) | tf | CMOS: $C_L$=15pF, 0.9$V_{DD}$→0.1$V_{DD}$ | - | 1.5 | - | ns |
| | | TTL: Load=10TTL, 2.4V →0.4V | - | 1.5 | - | ns |
| Output Duty Cycle | DUTY | CMOS: $C_L$=15pF @ 0.5$V_{DD}$ | 45 | - | 55 | % |
| | | TTL: Load=10TTL @ 1.4V | 45 | - | 55 | % |
| Output Disable Delay Time (*1) | tplz | f0=4MHz, $C_L$=15pF | - | - | 100 | ns |
| Output Enable Delay Time (*1) | tplz | f0=4MHz, $C_L$=15pF | - | - | 10 | μs |
| Oscillation Start Time (*1) | tosc_on | f0=4MHz, $C_L$=15pF | - | - | 6 | ms |

*1: the values are the designed values.

* The values shown are preliminary so that the values may be changed without a prior announcement.

# ■SWITCHING WAVEFORMS

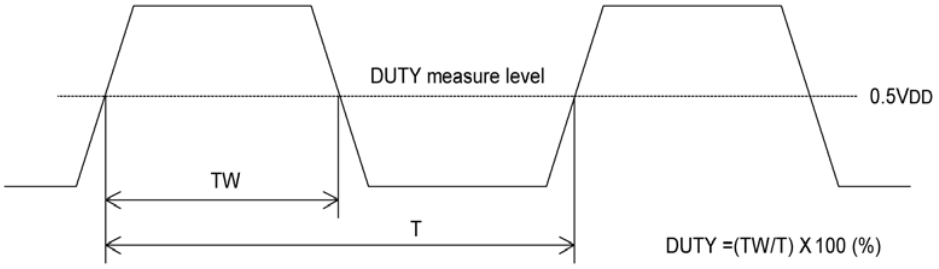
● Switching Time

(1) CMOS Output

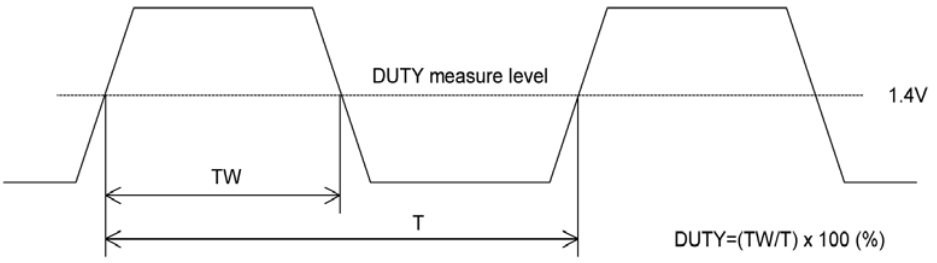

(2) TTL Output


● Duty Cycle

(1) CMOS Output

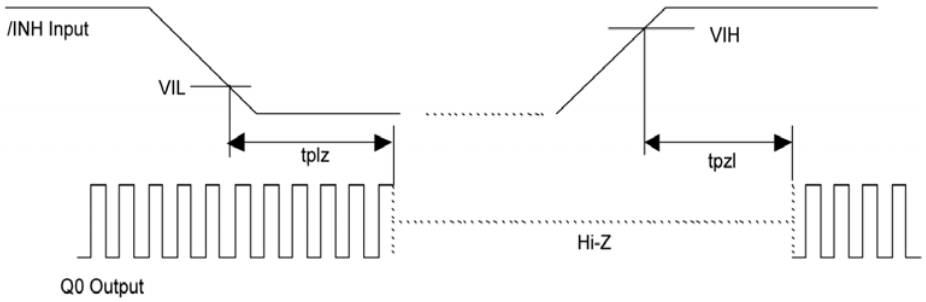



(2) TTL Output

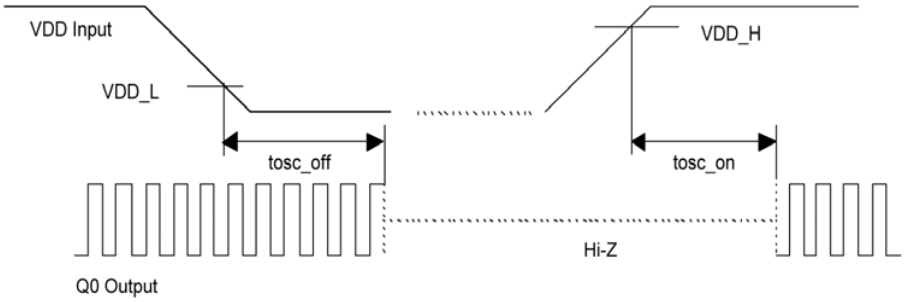


## ■SWITCHING WAVEFORMS (Continued)

(3) Output Disable Delay Time, Output Enable Delay Time *)The /INH pin input waveform: less than tr=tf=10ns, VDD input

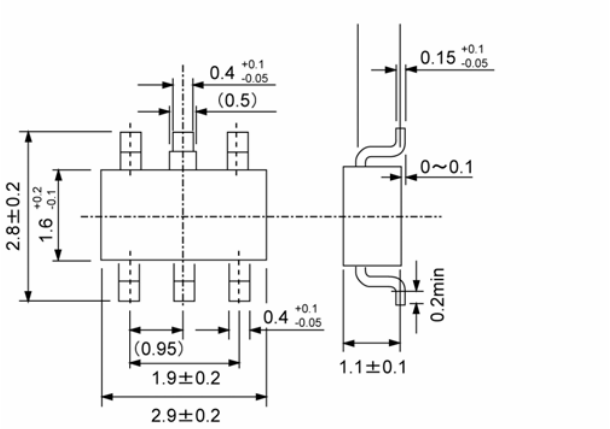



(4) Oscillation Start Time: tosc_on *)The VDD pin input waveform : less than tr=tf=10ns，/INH=Open



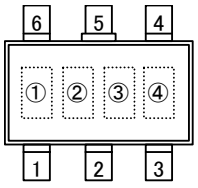
## ■ PACKAGING INFORMATION

●SOT-26




## ■ MARKING RULE

●SOT-26




SOT-26
(TOP VIEW)

①Represents product series

| MARK |
|---|
| 4 |

②Represents divider ratio

<Chip Enable>

| MARK | RATIO | MARK | RATIO |
|---|---|---|---|
| A | f0/1 | C | f0/4 |
| B | f0/2 | D | f0/8 |

*B, C, D: fundamental only

<Output Enable>

| MARK | RATIO | MARK | RATIO |
|---|---|---|---|
| K | f0/1 | M | f0/4 |
| L | f0/2 | N | f0/8 |

*L, M, N: fundamental only

③Represents recommended frequency & Rf, Cg &Cd values
* Please refer to the ordering information, SYMBOL ① to ④

④Represents assembly lot number
(Based on internal standards)

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