

# XC2165 Series



ICs for use with low voltage Crystal Oscillators

## Preliminary

- ◆ Low Voltage Operation, CMOS Low Power Consumption
  - C2xA series : 1.5V (MIN.) ~ 3.6V (MAX.)
  - C2xB series : 1.8V (MIN.) ~ 3.6V (MAX.)
- ◆ Oscillation Frequency Range
  - 8MHz ~ 70MHz C2xA: Fundamental Oscillation
  - 16MHz ~ 120MHz C2xB: Fundamental Oscillation
- ◆ 3-State Output
- ◆ Built-in Capacitors Cg, Cd
- ◆ Built-in Feedback Resistor
- ◆ Chip form
- ◆ Mini Mold SOT-26 Package

## APPLICATIONS

- Crystal oscillation modules
- Micro computers, DSP clocks
- Communication equipment
- Various system clocks

## GENERAL DESCRIPTION

The XC2165 series are CMOS ICs operates from supply voltage range from 1.5V to 3.6V with built-in crystal oscillator and divider circuits.

Output is selectable from any one of the following values for  $f_0$  :  $f_0/1$ ,  $f_0/2$ ,  $f_0/4$ ,  $f_0/8$ .

With oscillation capacitors and a feedback resistor built-in, it is possible to configure a stable fundamental oscillator using only an external crystal.

In stand-by mode, oscillation stops completely and output pin Q0 becomes in the state of high impedance.

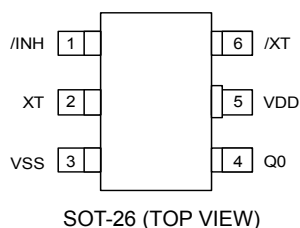
The XC2165 series are integrated into SOT-26 packages.

The series is also available in chip form.

## FEATURES

- Oscillation Frequency** : C2xA series  
8MHz ~ 70MHz (Fundamental)  
: C2xB series  
16MHz ~ 120MHz (Fundamental)
- Divider Ratio** : Selectable from  $f_0/1$ ,  $f_0/2$ ,  $f_0/4$ ,  $f_0/8$
- Output** : 3-State
- Operating Voltage Range** : 1.5V ~ 3.6V  
(C21B series: 1.8V ~ 3.6V)
- Low Current Consumption**: Stand-by function included  
30  $\mu$  A (MAX.) when stand-by
- Chip Form (size)** : 800 × 1200  $\mu$  m
- Ultra Small Package** : SOT-26 mini mold

## PIN CONFIGURATION



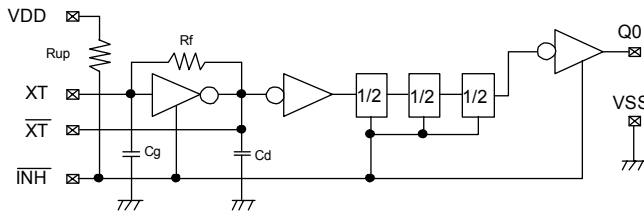
## PIN ASSIGNMENT

| PIN NUMBER | PIN NAME | FUNCTION                               |
|------------|----------|--|
| 1          | / INH    | Stand-by Control *                     |
| 2          | XT       | Crystal Oscillator Connection (Input)  |
| 3          | VSS      | Ground                                 |
| 4          | Q0       | Clock Output                           |
| 5          | VDD      | Power Supply                           |
| 6          | /XT      | Crystal Oscillator Connection (Output) |

\* Pull-up resistor is built-in to the stand-by control pin.

# XC2165 Series

## ■ BLOCK DIAGRAM



## ■ / INH, Q0 PIN FUNCTION

| / INH       | Q0             |
|-------------|----------------|
| 'H' or Open | Clock Output   |
| 'L'         | High Impedance |

## ■ PRODUCT CLASSIFICATION

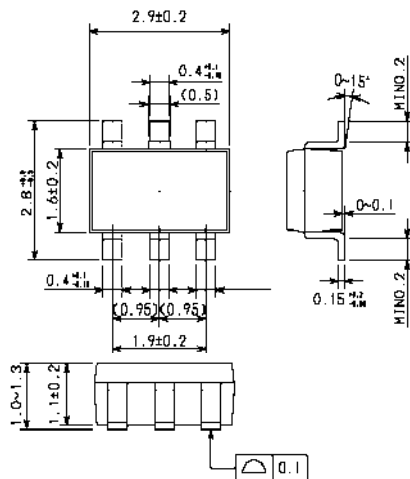
### ● Ordering Information

XC2165 ①②③④⑤⑥

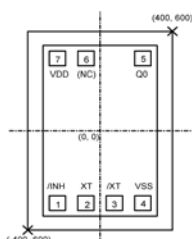
| DESIGNATOR | DESCRIPTION              | SYMBOL | DESCRIPTION                    |
|------------|--------------------------|--------|--------------------------------|
| ①          | Duty Level               | C      | : CMOS                         |
| ②          | Fixed Number             | 2      | : -                            |
| ③          | Divider Ratio            | 1      | : f0/1                         |
|            |                          | 2      | : f0/2                         |
|            |                          | 4      | : f0/4                         |
|            |                          | 8      | : f0/8                         |
| ④          | Oscillation Frequency    | A      | : 8MHz ~ 70MHz                 |
|            |                          | B      | : 16MHz ~ 120MHz               |
| ⑤          | Chip Form & Package Type | C      | : Chip form                    |
|            |                          | M      | : SOT-26 package               |
| ⑥          | Device Orientation       | T      | : Chip tray                    |
|            |                          | R      | : Embossed tape, Standard feed |
|            |                          | L      | : Embossed tape, Reverse feed  |
|            |                          | W      | : Wafer                        |

## ■ PACKAGING INFORMATION

### ● SOT-26



## ■ PAD LAYOUT



Size (Chip) : 800 × 1200 μm  
 Thickness (Chip) : 200 ± 20 μm  
 Backside (Chip) : GND level  
 Aperture (Pad) : 90 × 90 μm

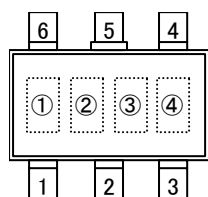
## ■ PAD DIMENSION

Unit: μm

| PIN NUMBER | PIN NAME | FUNCTION                                | PAD DIMENSIONS |       |
|------------|----------|---|----------------|-------|
|            |          |   | X              | Y     |
| 1          | / INH    | Stand-by Control                        | - 236          | - 436 |
| 2          | XT       | Crystal Oscillation Connection (Input)  | - 79           | - 436 |
| 3          | / XT     | Crystal Oscillation Connection (Output) | 79             | - 436 |
| 4          | VSS      | Ground                                  | 236            | - 436 |
| 5          | Q0       | Clock Output                            | 236            | 436   |
| 6          | (NC)     | No Connection                           | - 78           | 436   |
| 7          | VDD      | Power Supply                            | - 236          | 436   |

\*① Pull-up resistor is built-in to the stand-by control pin.

## MARKING RULE



SOT-26 (TOP VIEW)

① Represents product series (Fixed marking)

| MARK | PRODUCT SERIES |
|------|----------------|
| 5    | XC2165 series  |

② Represents oscillation frequency

| MARK | OSCILLATION FREQUENCY              |
|------|------------------------------------|
| A    | C2xA: 8MHz ~ 70MHz (Fundamental)   |
| B    | C2xB: 16MHz ~ 120MHz (Fundamental) |

③ Represents divider ratio

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

④ Represents assembly lot number  
(based on internal standards)

## ABSOLUTE MAXIMUM RATINGS

Ta=25°C

| PARAMETER                   | SYMBOL           | RATINGS  | UNITS |
|-----------------------------|------------------|--|-------|
| Supply Voltage              | V <sub>DD</sub>  | V <sub>SS</sub> – 0.3 to V <sub>SS</sub> + 7.0 | V     |
| / INH Pin Voltage           | V <sub>INH</sub> | V <sub>SS</sub> – 0.3 to V <sub>DD</sub> + 0.3 | V     |
| Q0 Pin Voltage              | V <sub>Q0</sub>  | V <sub>SS</sub> – 0.3 to V <sub>DD</sub> + 0.3 | V     |
| Q0 Output Current           | I <sub>Q0</sub>  | ± 50   | mA    |
| Power Dissipation           | P <sub>d</sub>   | 150 *  | mW    |
| Operating Temperature Range | T <sub>opr</sub> | - 40 to + 85                                   | °C    |
| Storage Temperature Range   | T <sub>stg</sub> | - 65 to + 150 (chip form)                      | °C    |
|                             |                  | - 55 to + 125 (SOT-26)                         |       |

\* SOT-26 Package: When implemented on a glass epoxy PCB.

## ■ ELECTRICAL CHARACTERISTICS

XC2165C2xAxx

1.8V Operation (Unless otherwise stated, V<sub>DD</sub> = 1.8V, f<sub>0</sub>=70MHz, No Load, Ta = - 40°C ~ + 85°C)

| PARAMETER                                | SYMBOL           | FUNCTION  | MIN.               | TYP. | MAX.               | UNIT |    |
|--|------------------|---|--------------------|------|--------------------|------|----|
| Operating Voltage                        | V <sub>DD</sub>  |   | 1.5                | 1.8  | 3.6                | V    |    |
| Crystal Oscillation Frequency            | F <sub>osc</sub> |   | 8                  | -    | 70                 | MHz  |    |
| 'H' Level Input Voltage                  | V <sub>IH</sub>  | /INH pin  | 0.7V <sub>DD</sub> | -    | -                  | V    |    |
| 'L' Level Input Voltage                  | V <sub>IL</sub>  | /INH pin  | -                  | -    | 0.3V <sub>DD</sub> | V    |    |
| 'H' Level Output Voltage                 | V <sub>OH</sub>  | Q0 pin, V <sub>DD</sub> =1.5V, I <sub>OH</sub> = - 2.0mA      | 1.0                | 1.1  | -                  | V    |    |
| 'L' Level Output Voltage                 | V <sub>OL</sub>  | Q0 pin, V <sub>DD</sub> =1.5V, I <sub>OL</sub> = 2.0mA        | -                  | 0.3  | 0.4                | V    |    |
| Supply Current 1                         | I <sub>DD1</sub> | /INH =Open,<br>f <sub>0</sub> =70MHz,<br>C <sub>L</sub> =15pF | XC2165C21Axx       | -    | 5.0                | 10.0 | mA |
|  |                  |   | XC2165C22Axx       | -    | 3.5                | 7.0  |    |
|  |                  |   | XC2165C24Axx       | -    | 3.0                | 6.0  |    |
|  |                  |   | XC2165C28Axx       | -    | 2.5                | 6.0  |    |
| Supply Current 2                         | I <sub>DD2</sub> | /INH = 'L', f <sub>0</sub> = 70MHz, C <sub>L</sub> =15pF      | -                  | 15   | 30                 | μA   |    |
| Input Pull-Up Resistance 1               | R <sub>up1</sub> | /INH = 'L'  | 0.8                | 2.0  | 6.0                | MΩ   |    |
| Input Pull-Up Resistance 2               | R <sub>up2</sub> | /INH = 0.7V <sub>DD</sub>                                     | 20                 | 50   | 150                | kΩ   |    |
| Internal Oscillation Capacity (*)        | C <sub>g</sub>   | (*)   | -                  | 10   | -                  | pF   |    |
|  | C <sub>d</sub>   | (*)   | -                  | 10   | -                  | pF   |    |
| Internal Oscillation Feedback Resistance | R <sub>f</sub>   |   | 1.2                | 3.0  | 5.5                | MΩ   |    |
| Output Off Leak Current                  | I <sub>oz</sub>  | V <sub>DD</sub> =3.6V, /INH = 'L'                             | -                  | -    | 1.0                | μA   |    |

(\*) Designed value

## ■ SWITCHING CHARACTERISTICS

XC2165C2xAxx

1.8V Operation (Unless otherwise stated, V<sub>DD</sub> = 1.8V, f<sub>0</sub>=70MHz, C<sub>L</sub>=15pF, Ta = - 40°C ~ + 85°C)

| PARAMETER                  | SYMBOL              | FUNCTION   | MIN. | TYP. | MAX. | UNIT |
|----------------------------|---------------------|--|------|------|------|------|
| Output Rise Time (*)       | Tr                  | V <sub>DD</sub> =1.8V, C <sub>L</sub> =15pF (10% to 90%) | -    | -    | 6.5  | ns   |
| Output Fall Time (*)       | Tf                  | V <sub>DD</sub> =1.8V, C <sub>L</sub> =15pF (10% to 90%) | -    | -    | 6.5  | ns   |
| Output Duty Cycle          | DUTY                | C <sub>L</sub> =15pF @ 0.5V <sub>DD</sub>                | 40   | -    | 60   | %    |
| Oscillation Start Time (*) | T <sub>osc_on</sub> | f <sub>0</sub> =8MHz                                     | -    | -    | 4.0  | ms   |

(\*) Designed value

## ■ ELECTRICAL CHARACTERISTICS (Continued)

XC2165C2xBxx

 2.5V Operation (Unless otherwise stated,  $V_{DD} = 2.5V$ ,  $f_0 = 120MHz$ , No Load,  $T_a = -40^\circ C \sim +85^\circ C$ )

| PARAMETER                                | SYMBOL    | FUNCTION                                     | MIN.         | TYP. | MAX.        | UNIT      |    |
|--|-----------|--|--------------|------|-------------|-----------|----|
| Operating Voltage                        | $V_{DD}$  |  | 1.8          | 2.5  | 3.6         | V         |    |
| Crystal Oscillation Frequency            | $F_{osc}$ |  | 16           | -    | 120         | MHz       |    |
| 'H' Level Input Voltage                  | $V_{IH}$  | /INH pin                                     | $0.7V_{DD}$  | -    | -           | V         |    |
| 'L' Level Input Voltage                  | $V_{IL}$  | /INH pin                                     | -            | -    | $0.3V_{DD}$ | V         |    |
| 'H' Level Output Voltage                 | $V_{OH}$  | Q0 pin, $V_{DD} = 1.8V$ , $I_{OH} = -2.0mA$  | 1.3          | 1.4  | -           | V         |    |
| 'L' Level Output Voltage                 | $V_{OL}$  | Q0 pin, $V_{DD} = 1.8V$ , $I_{OL} = 2.0mA$   | -            | 0.3  | 0.4         | V         |    |
| Supply Current 1                         | $I_{DD1}$ | /INH = Open,<br>$f_0 = 120MHz$ , $C_L = 5pF$ | XC2165C21Bxx | -    | 10.0        | 20.0      | mA |
|  |           |  | XC2165C22Bxx | -    | T.B.D.      | T.B.D.    |    |
|  |           |  | XC2165C24Bxx | -    | T.B.D.      | T.B.D.    |    |
|  |           |  | XC2165C28Bxx | -    | T.B.D.      | T.B.D.    |    |
| Supply Current 2                         | $I_{DD2}$ | /INH = 'L', $f_0 = 120MHz$ , $C_L = 5pF$     | -            | 15.0 | 30.0        | $\mu A$   |    |
| Input Pull-Up Resistance 1               | $R_{up1}$ | /INH = 'L'                                   | 0.8          | 2.0  | 6.0         | $M\Omega$ |    |
| Input Pull-Up Resistance 2               | $R_{up2}$ | /INH = $0.7V_{DD}$                           | 20           | 50   | 150         | $k\Omega$ |    |
| Internal Oscillation Capacity (*)        | $C_g$     | (*)  | -            | 10   | -           | pF        |    |
|  | $C_d$     | (*)  | v            | 10   | -           | pF        |    |
| Internal Oscillation Feedback Resistance | $R_f$     |  | 1.2          | 3.0  | 5.5         | $M\Omega$ |    |
| Output Off Leak Current                  | $I_{oz}$  | $V_{DD} = 3.6V$ , /INH = 'L'                 | -            | -    | 1.0         | $\mu A$   |    |

(\*) Designed value

T.B.D.: To be determined

## ■ SWITCHING CHARACTERISTICS (Continued)

XC2165C2xBxx

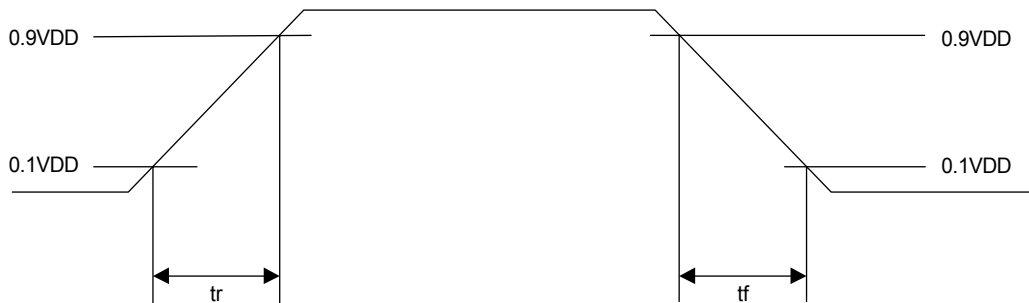
 2.5V Operation (Unless otherwise stated,  $V_{DD} = 2.5V$ ,  $f_0 = 120MHz$ ,  $C_L = 5pF$ ,  $T_a = -40^\circ C \sim +85^\circ C$ )

| PARAMETER                  | SYMBOL        | FUNCTION                                   | MIN. | TYP. | MAX. | UNIT |
|----------------------------|---------------|--|------|------|------|------|
| Output Rise Time (*)       | $T_r$         | $V_{DD} = 2.5V$ , $C_L = 5pF$ (10% to 90%) | -    | -    | 4.0  | ns   |
| Output Fall Time (*)       | $T_f$         | $V_{DD} = 2.5V$ , $C_L = 5pF$ (10% to 90%) | -    | -    | 4.0  | ns   |
| Output Duty Cycle          | DUTY          | $C_L = 5pF @ 0.5V_{DD}$                    | 40   | -    | 60   | %    |
| Oscillation Start Time (*) | $T_{osc\_on}$ | $f_0 = 16MHz$                              | -    | -    | 3.0  | ms   |

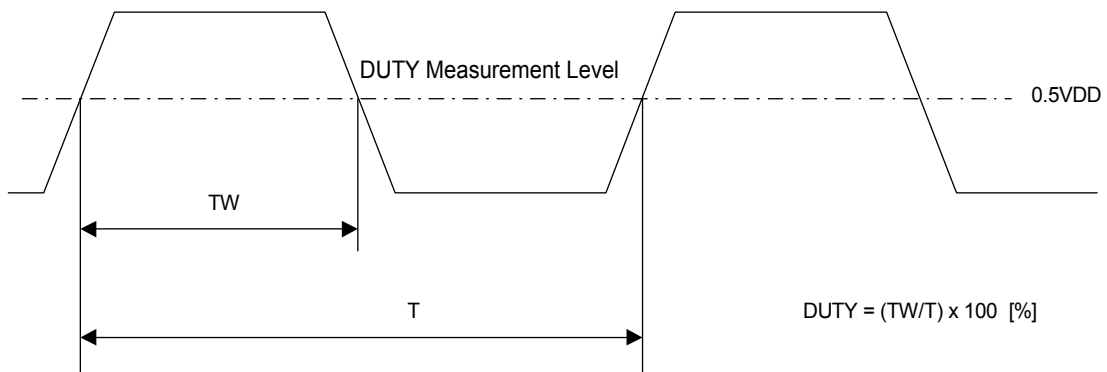
(\*) Designed value

## SWITCHING CHARACTERISTICS MEASUREMENT WAVEFORMS

(1) Output Rise Time:  $T_r$  / Output Fall Time:  $T_f$



(2) Duty Cycle



(3) Oscillation Start Time:  $T_{osc\_on}$  / Oscillation Stop Time:  $T_{osc\_off}$

