

ICs for use with low voltage Crystal Oscillators

■ GENERAL DESCRIPTION

The XC2165 series is a CMOS IC operates in 1.5V to 3.6V with the built-in circuits for crystal oscillator and divider.

Output is selectable from any one of 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 using only an external crystal.

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

The XC2165 series is available in SOT-26 package.

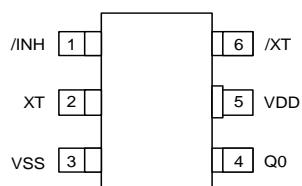
■ APPLICATIONS

- Crystal oscillation modules
- Micro computers, DSP clocks
- Communication equipment
- Various system clocks
- Cellular and portable phones

■ FEATURES

| | |
|---|--|
| Oscillation Frequency | : 8MHz~120MHz (Fundamental) |
| Divider Ratio | : f ₀ /1, f ₀ /2, f ₀ /4, f ₀ /8 |
| Output | : 3-State |
| Operating Voltage Range | : 1.5V ~ 3.6V |
| Low Current Consumption | : Stand-by function included : 30 μA (MAX.) when stand-by |
| Built-in Capacitors C_g, C_d | |
| Built-in Feedback Resistor | |
| Operating Ambient Temperature | : -40°C~ +85°C |
| Package | : SOT-26 |
| Environmentally Friendly | : EU RoHS Compliant, Pb Free |

■ PIN CONFIGURATION



SOT-26 (TOP VIEW)

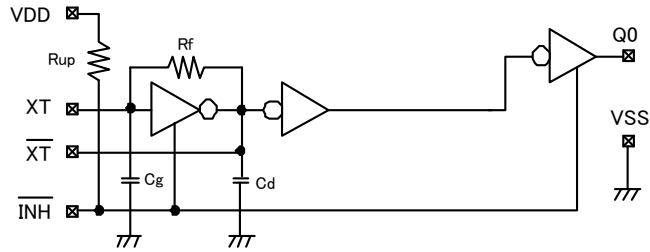
■ PIN ASSIGNMENT

| PIN NUMBER | PIN NAME | FUNCTIONS |
|------------|----------|--|
| 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) |

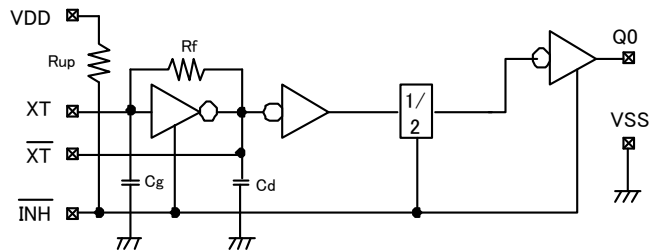
* Pull-up resistor is built-in to the stand-by control pin.

■ BLOCK DIAGRAM

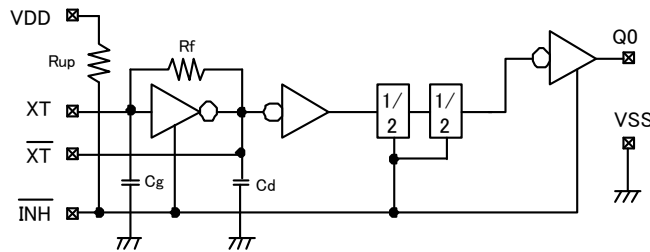
1). XC2165C21Axx/XC2165C21Bxx ($f_{OSC} = f_0/1$)



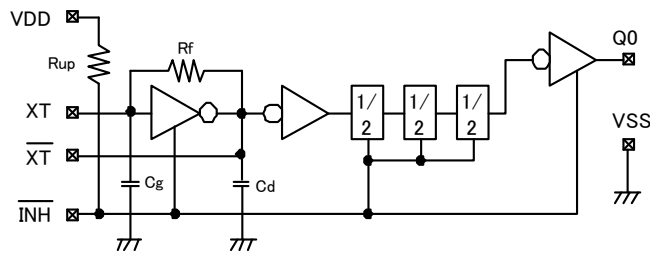
2). XC2165C22Axx/XC2165C22Bxx ($f_{OSC} = f_0/2$)



3). XC2165C24Axx/XC2165C24Bxx ($f_{OSC} = f_0/4$)



4). XC2165C28Axx/XC2165C28Bxx ($f_{OSC} = f_0/8$)



■ PRODUCT CLASSIFICATION

● Ordering Information

XC2165 ①②③④⑤⑥-⑦

| DESIGNATOR | ITEM | 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 |
| ⑤⑥-⑦ ^(*) | Package(Order Unit) | MR | SOT-26(3,000/Reel) |
| | | MR-G | SOT-26(3,000/Reel) |

(*) The "-G" suffix denotes Halogen and Antimony free as well as being fully RoHS compliant.

■ PIN FUNCTION

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

■ ABSOLUTE MAXIMUM RATINGS

Ta=25°C

| PARAMETER | SYMBOL | RATINGS | UNITS |
|-------------------------------|------------------|--|-------|
| Supply Voltage | V _{DD} | V _{SS} – 0.3 to V _{SS} + 7.0 | V |
| / INH Pin Voltage | V _{INH} | V _{SS} – 0.3 to V _{DD} + 0.3 | V |
| Q0 Pin Voltage | V _{Q0} | V _{SS} – 0.3 to V _{DD} + 0.3 | V |
| Q0 Output Current | I _{Q0} | ± 50 | mA |
| Power Dissipation | P _d | 250 | mW |
| Operating Ambient Temperature | T _{opr} | - 40 to + 85 | °C |
| Storage Temperature | T _{stg} | - 55 to + 125 | °C |

DC ELECTRICAL CHARACTERISTICS

XC2165C2xAxx

1.8V Operation (Unless otherwise stated, V_{DD} = 1.8V, f₀=70MHz, No Load, Ta = - 40°C ~ + 85°C)

| PARAMETER | SYMBOL | FUNCTION | MIN. | TYP. | MAX. | UNIT | CIRCUIT | |
|--|------------------|---|--------------------|-------------------|--------------------|------|---------|---|
| Operating Voltage | V _{DD} | | 1.5 | 1.8 | 3.6 | V | - | |
| Crystal Oscillation Frequency | f ₀ | | 8 | - | 70 | MHz | - | |
| Output Frequency | f _{OSC} | MIN : f ₀ =8MHz, MAX : f ₀ =70MHz, C _L =15pF | XC2165C21Axx | 8 | - | 70 | MHz | - |
| | | | XC2165C22Axx | 4 | - | 35 | | |
| | | | XC2165C24Axx | 2 | - | 17.5 | | |
| | | | XC2165C28Axx | 1 | - | 8.75 | | |
| 'H' Level Input Voltage | V _{IH} | /INH pin | 0.7V _{DD} | - | - | V | 1 | |
| 'L' Level Input Voltage | V _{IL} | /INH pin | - | - | 0.3V _{DD} | V | 1 | |
| 'H' Level Output Voltage | V _{OH} | Q0 pin, V _{DD} =1.5V, I _{OH} = - 2.0mA | 1.0 | 1.1 | - | V | 2 | |
| 'L' Level Output Voltage | V _{OL} | Q0 pin, V _{DD} =1.5V, I _{OL} = 2.0mA | - | 0.3 | 0.4 | V | 2 | |
| Supply Current 1 | I _{DD1} | /INH =Open, C _L =15pF | XC2165C21Axx | - | 5.0 | 10.0 | mA | 3 |
| | | | XC2165C22Axx | - | 3.5 | 7.0 | | |
| | | | XC2165C24Axx | - | 3.0 | 6.0 | | |
| | | | XC2165C28Axx | - | 2.5 | 6.0 | | |
| Supply Current 2 | I _{DD2} | /INH = 'L', f ₀ = 70MHz, C _L =15pF | - | 15 | 30 | μA | 3 | |
| Input Pull-Up Resistance 1 | R _{up1} | /INH = 'L' | 0.8 | 2.0 | 6.0 | MΩ | 4 | |
| Input Pull-Up Resistance 2 | R _{up2} | /INH = 0.7V _{DD} | 20.0 | 50.0 | 150.0 | kΩ | 4 | |
| Internal Oscillation Capacity | C _g | | - | 10 ^(*) | - | pF | - | |
| | C _d | | - | 10 ^(*) | - | pF | - | |
| Internal Oscillation Feedback Resistance | R _f | | 1.2 | 3.0 | 5.5 | MΩ | 5 | |
| Output Off Leak Current | I _{oz} | V _{DD} =3.6V, /INH = 'L' | - | - | 1.0 | μA | 6 | |

(*) Designed value

AC ELECTRICAL CHARACTERISTICS

XC2165C2xAxx

1.8V Operation (Unless otherwise stated, V_{DD} = 1.8V, f₀=70MHz, C_L=15pF, Ta = - 40°C ~ + 85°C)

| PARAMETER | SYMBOL | FUNCTION | MIN. | TYP. | MAX. | UNIT | CIRCUIT |
|-------------------|-----------------|--|------|------|--------------------|------|---------|
| Output Rise Time | t _r | V _{DD} =1.8V, C _L =15pF (10% to 90%) | - | - | 6.5 ^(*) | ns | - |
| Output Fall Time | t _f | V _{DD} =1.8V, C _L =15pF (10% to 90%) | - | - | 6.5 ^(*) | ns | - |
| Duty Cycle | DUTY | C _L =15pF @ 0.5V _{DD} | 40 | - | 60 | % | 7 |
| Output Start Time | t _{on} | f ₀ =8MHz | - | - | 4.0 ^(*) | ms | - |

(*) Designed value

■ DC ELECTRICAL CHARACTERISTICS (Continued)

XC2165C2xBxx

2.5V Operation (Unless otherwise stated, V_{DD} = 2.5V, f₀=120MHz, No Load, Ta = - 40°C ~ + 85°C)

| PARAMETER | SYMBOL | FUNCTION | MIN. | TYP. | MAX. | UNIT | CIRCUIT | |
|--|------------------|--|--------------------|-------------------|--------------------|--------|---------|---|
| Operating Voltage | V _{DD} | | 1.8 | 2.5 | 3.6 | V | - | |
| Crystal Oscillation Frequency | f ₀ | | 16 | - | 120 | MHz | - | |
| Output Frequency | f _{OSC} | MIN : f ₀ =16MHz, MAX : f ₀ =120MHz, C _L =5pF | XC2165C21Bxx | 16 | - | 120 | MHz | - |
| | | | XC2165C22Bxx | 8 | - | 60 | | |
| | | | XC2165C24Bxx | 4 | - | 30 | | |
| | | | XC2165C28Bxx | 2 | - | 15 | | |
| 'H' Level Input Voltage | V _{IH} | /INH pin | 0.7V _{DD} | - | - | V | 1 | |
| 'L' Level Input Voltage | V _{IL} | /INH pin | - | - | 0.3V _{DD} | V | 1 | |
| 'H' Level Output Voltage | V _{OH} | Q0 pin, V _{DD} =1.8V, I _{OH} = - 2.0mA | 1.3 | 1.4 | - | V | 2 | |
| 'L' Level Output Voltage | V _{OL} | Q0 pin, V _{DD} =1.8V, I _{OL} = 2.0mA | - | 0.3 | 0.4 | V | 2 | |
| Supply Current 1 | I _{DD1} | /INH =Open, f ₀ =120MHz, C _L =5pF | XC2165C21Bxx | - | 10.0 | 20.0 | mA | 3 |
| | | | 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 | μA | 3 | |
| Input Pull-Up Resistance 1 | R _{up1} | /INH = 'L' | 0.8 | 2.0 | 6.0 | MΩ | 4 | |
| Input Pull-Up Resistance 2 | R _{up2} | /INH = 0.7V _{DD} | 20.0 | 50.0 | 150.0 | kΩ | 4 | |
| Internal Oscillation Capacity | C _g | | - | 10 ^(*) | - | pF | - | |
| | C _d | | - | 10 ^(*) | - | pF | - | |
| Internal Oscillation Feedback Resistance | R _f | | 1.2 | 3.0 | 5.5 | MΩ | 5 | |
| Output Off Leak Current | I _{oz} | V _{DD} =3.6V, /INH = 'L' | - | - | 1.0 | μA | 6 | |

(*) Designed value

■ AC ELECTRICAL CHARACTERISTICS (Continued)

XC2165C2xBxx

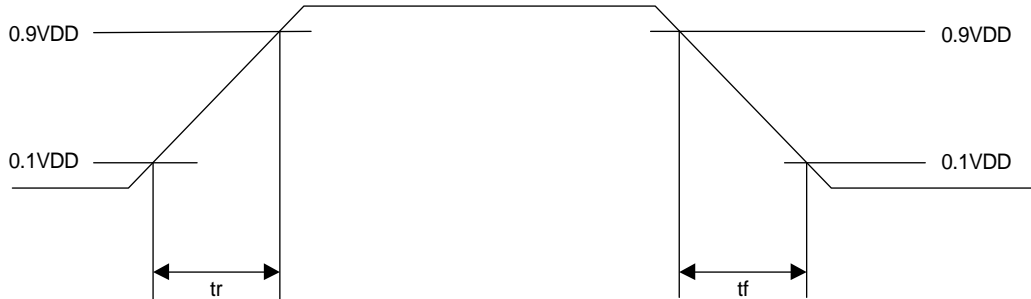
2.7V Operation (Unless otherwise stated, V_{DD} = 2.7V, f₀=120MHz, C_L=5pF, Ta = - 40°C ~ + 85°C)

| PARAMETER | SYMBOL | FUNCTION | MIN. | TYP. | MAX. | UNIT | CIRCUIT |
|------------------------|---------------------|---|------|------|--------------------|------|---------|
| 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 | - |
| Duty Cycle | DUTY | C _L =5pF @ 0.5V _{DD} | 40 | - | 60 | % | 7 |
| Oscillation Start Time | t _{osc_on} | f ₀ =16MHz | - | - | 3.0 ^(*) | ms | - |

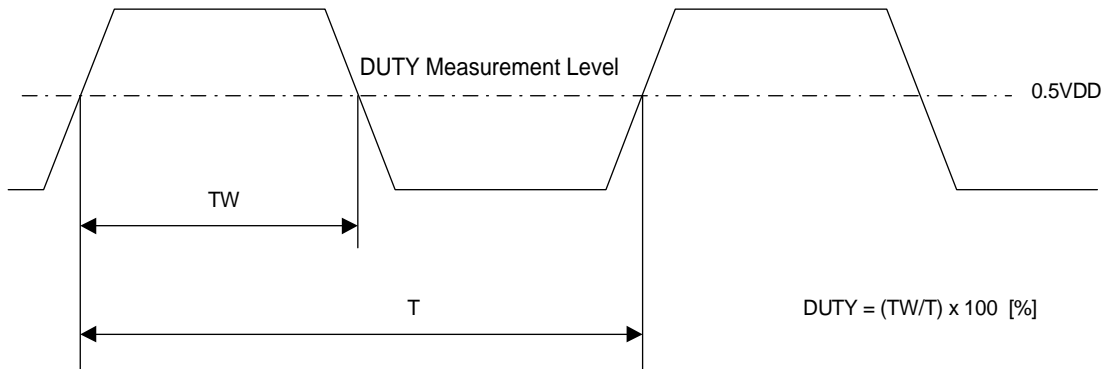
(*) Designed value

SWITCHING CHARACTERISTICS MEASUREMENT WAVEFORMS

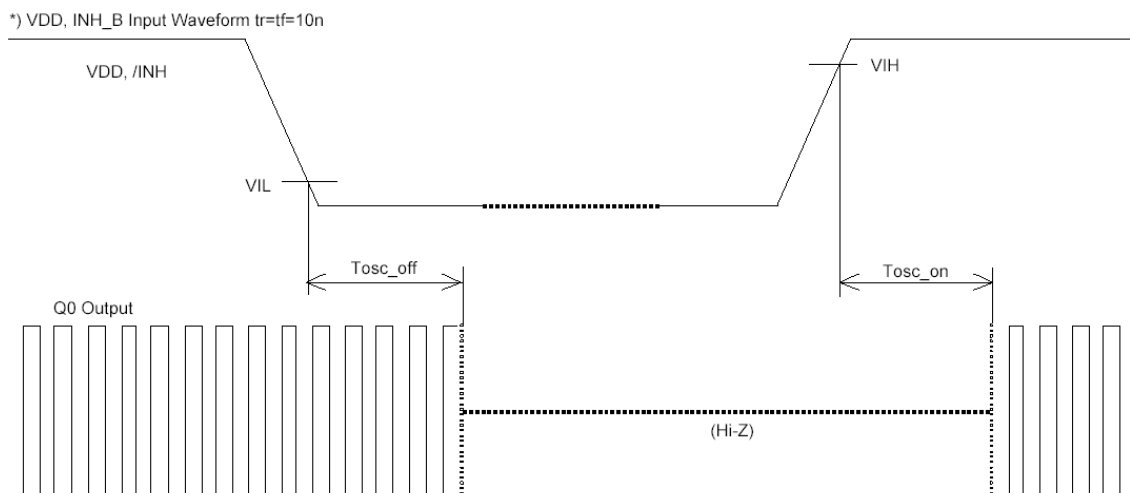
(1) Output Rise Time: t_r / Output Fall Time: t_f



(2) Duty Cycle

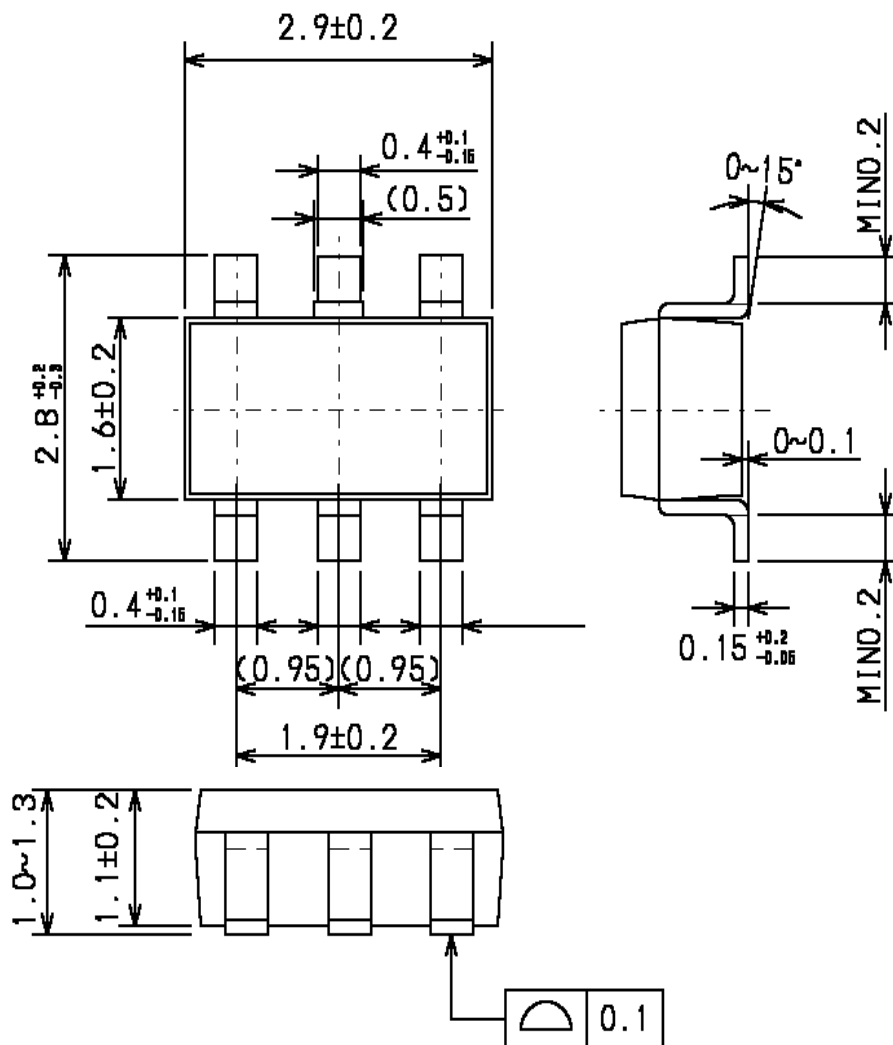


(3) Oscillation Start Time: t_{osc_on} / Oscillation Stop Time: t_{osc_off}

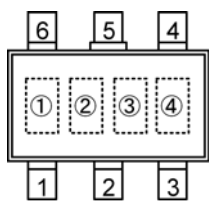


PACKAGING INFORMATION

●SOT-26



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)

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