

## 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 f<sub>0</sub>, f<sub>0</sub>/1, f<sub>0</sub>/2, f<sub>0</sub>/4 and f<sub>0</sub>/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.

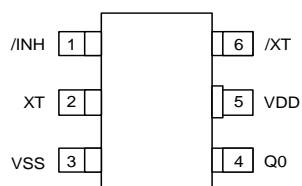
### ■ APPLICATIONS

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

### ■ FEATURES

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

### ■ PIN CONFIGURATION



SOT-26 (TOP VIEW)

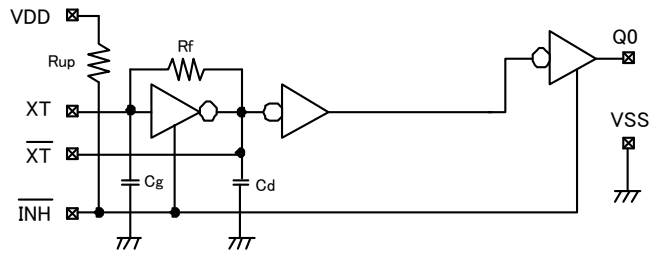
### ■ PIN ASSIGNMENT

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)

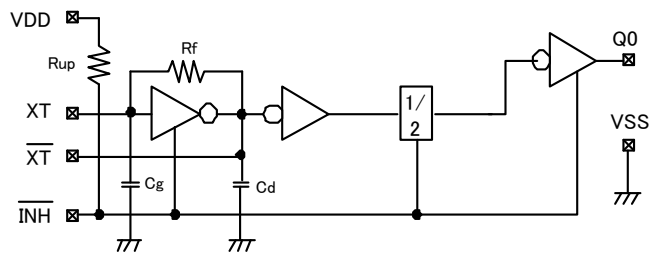
\* Pull-up resistor is built-in to the stand-by control pin.

## ■ BLOCK DIAGRAM

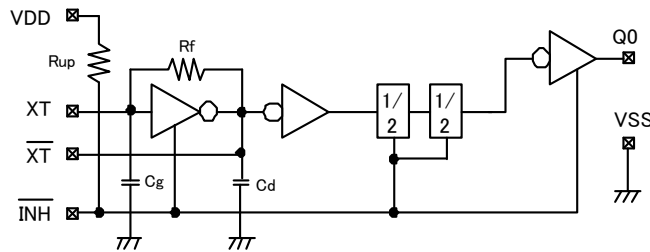
1). XC2165C21Axx/XC2165C21Bxx (  $f_{OSC} = f_0/1$  )



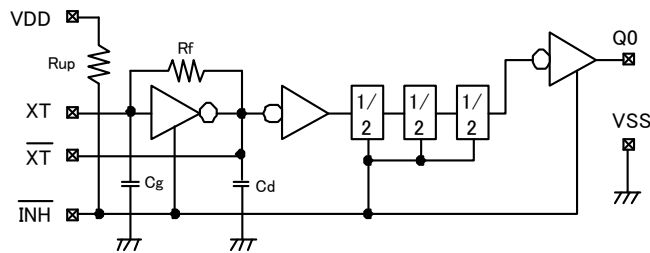
2). XC2165C22Axx/XC2165C22Bxx (  $f_{OSC} = f_0/2$  )



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 <sup>(*)</sup>	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 <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>	250	mW
Operating Ambient Temperature	T <sub>opr</sub>	- 40 to + 85	°C
Storage Temperature	T <sub>stg</sub>	- 55 to + 125	°C

## DC ELECTRICAL CHARACTERISTICS

XC2165C2xAxx

1.8V Operation (Unless otherwise stated,  $V_{DD} = 1.8V$ ,  $f_0=70MHz$ , No Load,  $T_a = -40^{\circ}C \sim +85^{\circ}C$ )

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	$\mu A$	3	
Input Pull-Up Resistance 1	Rup1	/INH = 'L'	0.8	2.0	6.0	$M\Omega$	4	
Input Pull-Up Resistance 2	Rup2	/INH = $0.7V_{DD}$	20.0	50.0	150.0	$k\Omega$	4	
Internal Oscillation Capacity	$C_g$		-	$10^{(*)}$	-	pF	-	
	$C_d$		-	$10^{(*)}$	-	pF	-	
Internal Oscillation Feedback Resistance	Rf		1.2	3.0	5.5	$M\Omega$	5	
Output Off Leak Current	$I_{oz}$	$V_{DD}=3.6V$ , /INH = 'L'	-	-	1.0	$\mu A$	6	

(\*) Designed value

## AC ELECTRICAL CHARACTERISTICS

XC2165C2xAxx

1.8V Operation (Unless otherwise stated,  $V_{DD} = 1.8V$ ,  $f_0=70MHz$ ,  $C_L=15pF$ ,  $T_a = -40^{\circ}C \sim +85^{\circ}C$ )

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<sub>DD</sub> = 2.5V, f<sub>0</sub>=120MHz, No Load, Ta = - 40°C ~ + 85°C)

PARAMETER	SYMBOL	FUNCTION	MIN.	TYP.	MAX.	UNIT	CIRCUIT	
Operating Voltage	V <sub>DD</sub>		1.8	2.5	3.6	V	-	
Crystal Oscillation Frequency	f <sub>0</sub>		16	-	120	MHz	-	
Output Frequency	f <sub>OSC</sub>	MIN : f <sub>0</sub> =16MHz, MAX : f <sub>0</sub> =120MHz, C <sub>L</sub> =5pF	XC2165C21Bxx	16	-	120	MHz	-
			XC2165C22Bxx	8	-	60		
			XC2165C24Bxx	4	-	30		
			XC2165C28Bxx	2	-	15		
'H' Level Input Voltage	V <sub>IH</sub>	/INH pin	0.7V <sub>DD</sub>	-	-	V	1	
'L' Level Input Voltage	V <sub>IL</sub>	/INH pin	-	-	0.3V <sub>DD</sub>	V	1	
'H' Level Output Voltage	V <sub>OH</sub>	Q0 pin, V <sub>DD</sub> =1.8V, I <sub>OH</sub> = - 2.0mA	1.3	1.4	-	V	2	
'L' Level Output Voltage	V <sub>OL</sub>	Q0 pin, V <sub>DD</sub> =1.8V, I <sub>OL</sub> = 2.0mA	-	0.3	0.4	V	2	
Supply Current 1	I <sub>DD1</sub>	/INH =Open, f <sub>0</sub> =120MHz, C <sub>L</sub> =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 <sub>DD2</sub>	/INH = 'L', f <sub>0</sub> = 120MHz, C <sub>L</sub> =5pF	-	15.0	30.0	μA	3	
Input Pull-Up Resistance 1	R <sub>up1</sub>	/INH = 'L'	0.8	2.0	6.0	MΩ	4	
Input Pull-Up Resistance 2	R <sub>up2</sub>	/INH = 0.7V <sub>DD</sub>	20.0	50.0	150.0	kΩ	4	
Internal Oscillation Capacity	C <sub>g</sub>		-	10 <sup>(*)</sup>	-	pF	-	
	C <sub>d</sub>		-	10 <sup>(*)</sup>	-	pF	-	
Internal Oscillation Feedback Resistance	R <sub>f</sub>		1.2	3.0	5.5	MΩ	5	
Output Off Leak Current	I <sub>oz</sub>	V <sub>DD</sub> =3.6V, /INH = 'L'	-	-	1.0	μA	6	

(\*) Designed value

## AC ELECTRICAL CHARACTERISTICS (Continued)

XC2165C2xBxx

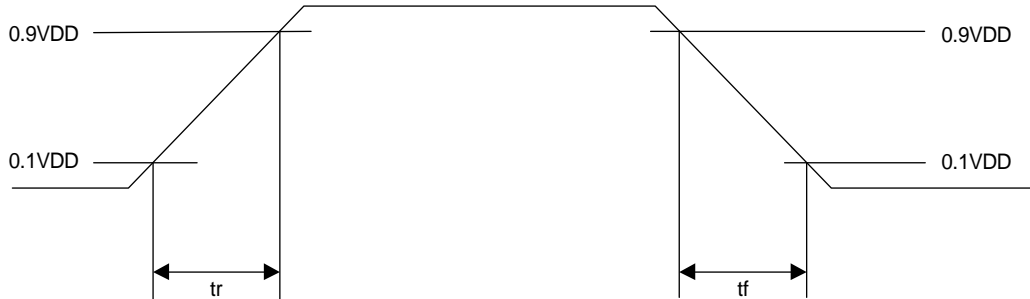
 2.7V Operation (Unless otherwise stated, V<sub>DD</sub> = 2.7V, f<sub>0</sub>=120MHz, C<sub>L</sub>=5pF, Ta = - 40°C ~ + 85°C)

PARAMETER	SYMBOL	FUNCTION	MIN.	TYP.	MAX.	UNIT	CIRCUIT
Output Rise Time	t <sub>r</sub>	V <sub>DD</sub> =2.5V, C <sub>L</sub> =5pF (10% to 90%)	-	-	4.0 <sup>(*)</sup>	ns	-
Output Fall Time	t <sub>f</sub>	V <sub>DD</sub> =2.5V, C <sub>L</sub> =5pF (10% to 90%)	-	-	4.0 <sup>(*)</sup>	ns	-
Duty Cycle	DUTY	C <sub>L</sub> =5pF @ 0.5V <sub>DD</sub>	40	-	60	%	7
Oscillation Start Time	t <sub>osc_on</sub>	f <sub>0</sub> =16MHz	-	-	3.0 <sup>(*)</sup>	ms	-

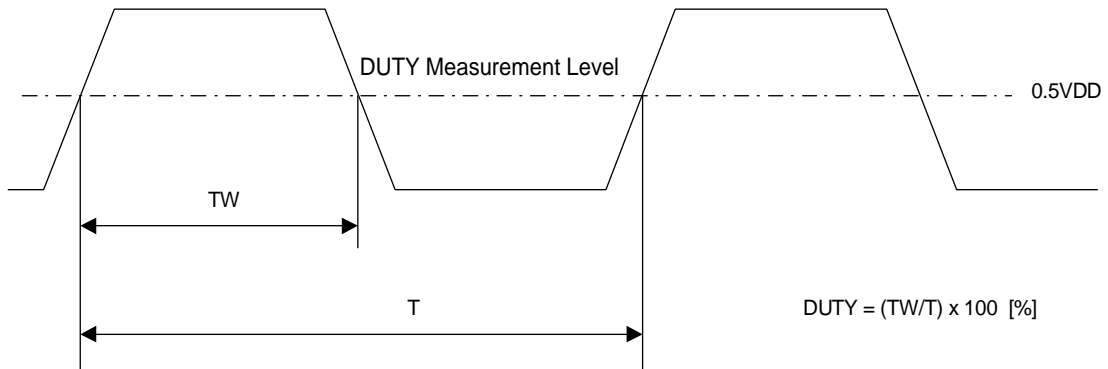
(\*) Designed value

## SWITCHING CHARACTERISTICS MEASUREMENT WAVEFORMS

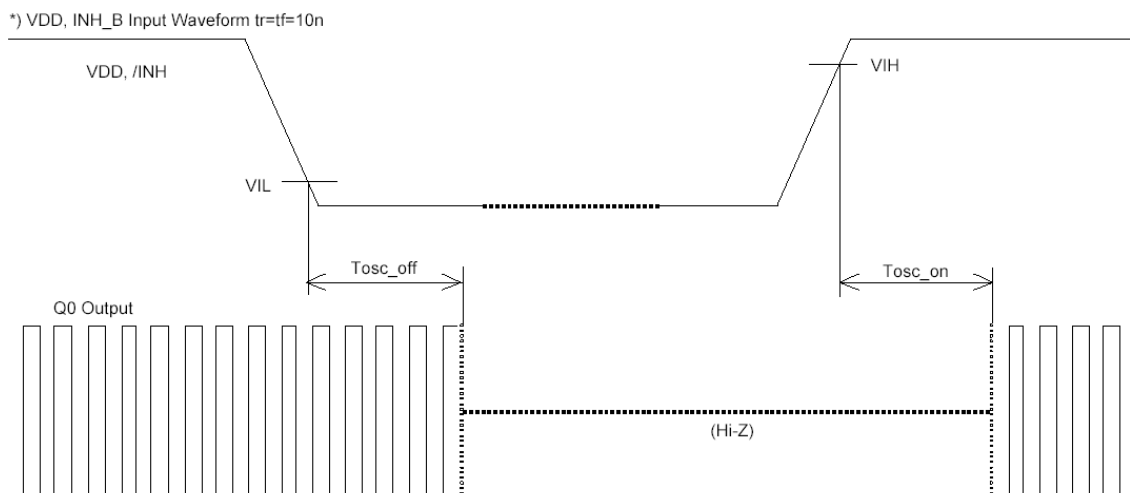
(1) Output Rise Time:  $t_r$  / Output Fall Time:  $t_f$



(2) Duty Cycle

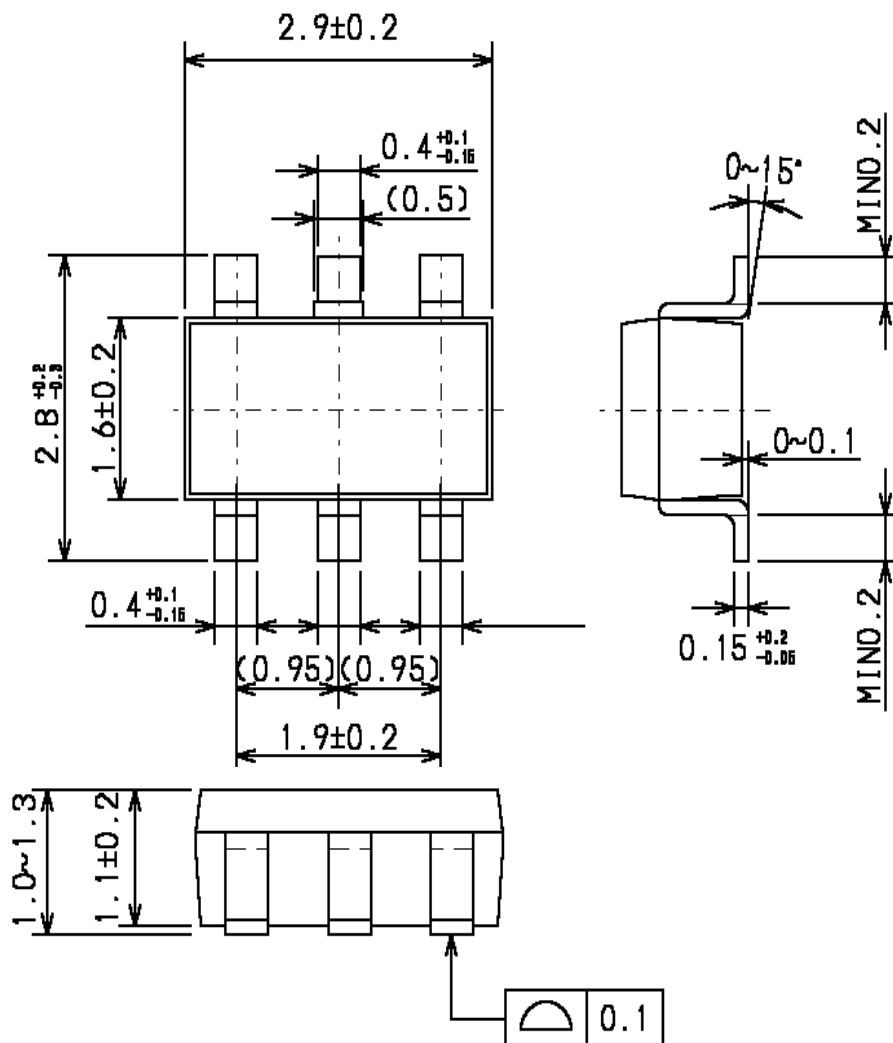


(3) Oscillation Start Time:  $t_{osc\_on}$  / Oscillation Stop Time:  $t_{osc\_off}$

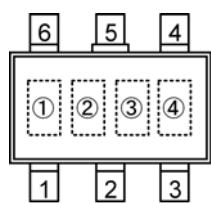


## PACKAGING INFORMATION

●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	$f_0/1$	B	$f_0/2$
C	$f_0/4$	D	$f_0/8$

④ represents assembly lot number  
(based on internal standards)

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