

1.8V Operating Voltage Fundamental Quartz Crystal Oscillator IC with Input Tolerant Function

■ GENERAL DESCRIPTION

The NJU6221 series is a C-MOS quartz crystal oscillator IC realized excellent frequency stability for fundamental (up to 60MHz) oscillation, and consists of an oscillation amplifier, a 6-stage divider, a 3-state output buffer, a built-in LDO and a input tolerant circuit. The operating voltage is from 1.62V to 3.63V, and the LDO holds down the characteristic change of the oscillation amplifier for operating voltage variation, and has been stabilized oscillation frequency. ($\pm 1\text{ppm}@V_{DD}\pm 10\%$)

The 6-stage divider generates only one frequency selected at the factory shipment of f_0 , $f_0/2$, $f_0/4$, $f_0/8$, $f_0/16$, $f_0/32$ and $f_0/64$ internal circuits is output. The 3-state output buffer is C-MOS compatible.

The input tolerant circuit ensures that 0 to 3.63 V can be applied to CONT terminal without regard to the supply voltage. The oscillation stopping current is very low stand-by mode, therefore, it is suitable for the portable items of the communication equipment and the like.

■ FEATURES

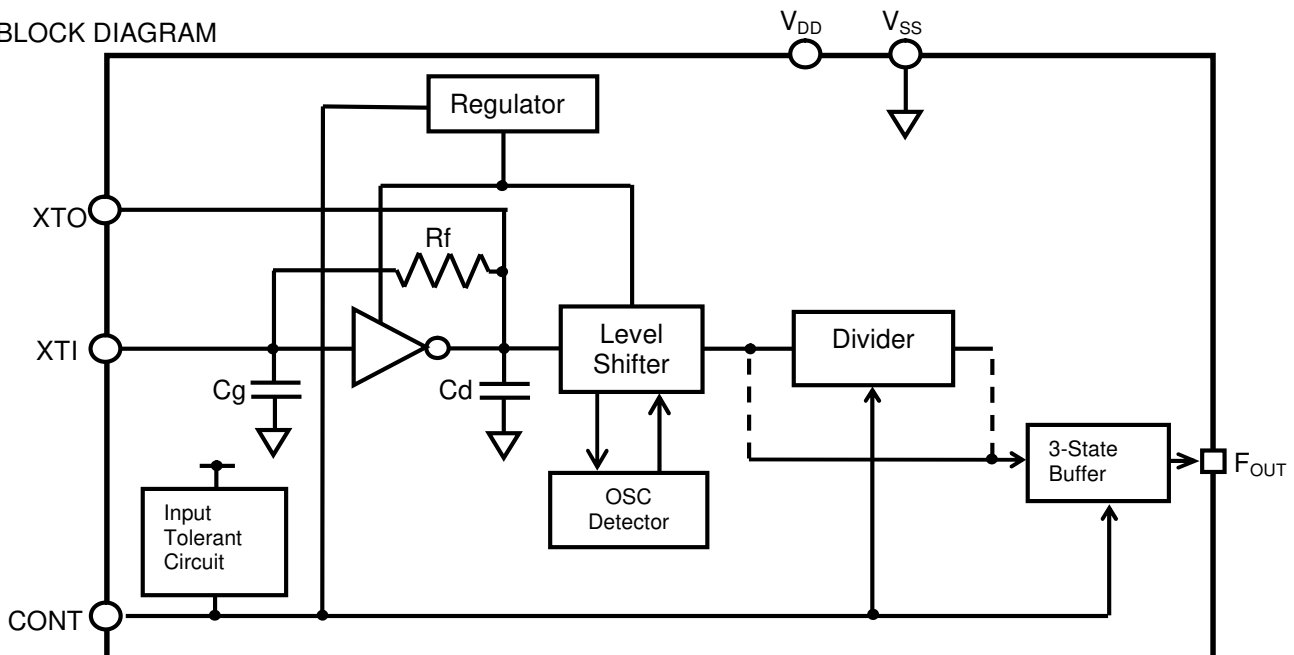
- Maximum Oscillation Frequency 60MHz(Fundamental)
- Frequency Stability $\pm 1\text{ppm}@V_{DD}\pm 10\%$
- Wide Operating Voltage 1.62 to 3.63V
- Low Operating Current 2mA typ.@60MHz/3.3V
- 6-Stage Divider Maximum Divider $f_0/64$
- Built-in LDO
- Input Tolerant Circuit 0 to 3.63V@CONT Term.
- Oscillation Stop and Output Stand-by Function
- 3-State Output Buffer
- Variable Pull-up Resistance on-Die (CONT: Pull-up Resistance large at the Stand-by mode.)
- Oscillation Capacitors C_g and C_g on-Die
- C-MOS Technology
- Package Outline Die/Wafer

■ PACKAGE OUTLINE



NJU6221XxC-V

■ BLOCK DIAGRAM

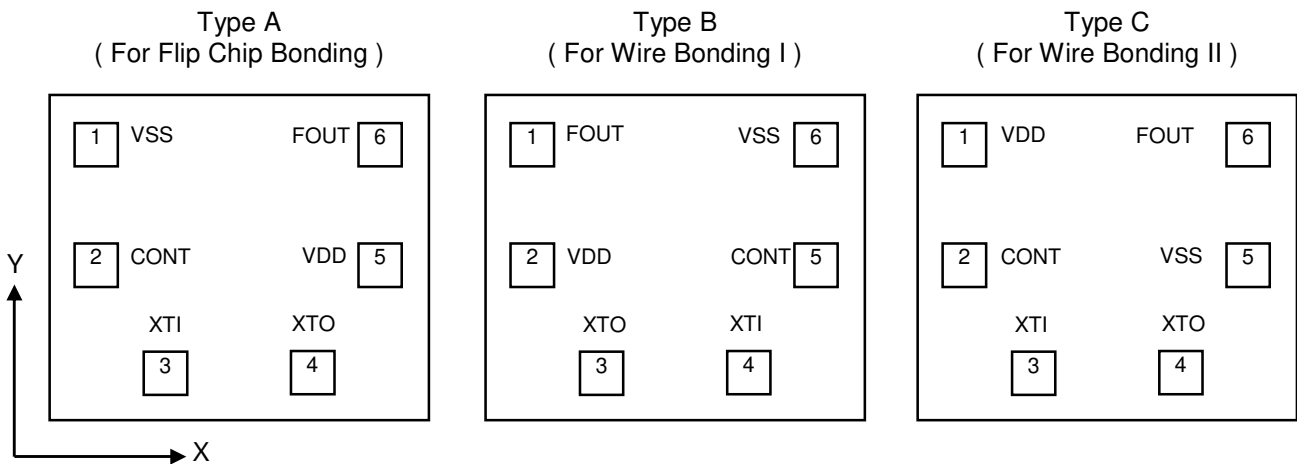


LINE-UP TABLE

Type No.	F _{OUT}	Version		
		Type A	Type B	Type C
NJU6221	f ₀	A1	B1	C1
	f ₀ /2	A2*	B2*	C2*
	f ₀ /4	A3*	B3*	C3*
	f ₀ /8	A4*	B4*	C4*
	f ₀ /16	A5*	B5*	C5*
	f ₀ /32	A6*	B6*	C6*
	f ₀ /64	A7*	B7*	C7*

* Under development

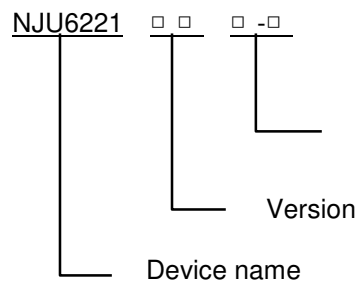
PAD LOCATION



COORDINATES

Pad No.	X	Y
1	-261.5	198.5
2	-261.5	-21.5
3	-146.5	-211.5
4	144.5	-211.5
5	260.5	-21.5
6	260.5	198.5

PART NUMBER



W-H: Wafer (200μm)
W-B: Wafer (160μm)
WS4-V: 1/4Wafer(130μm)
C-V: Chip(130μm)

Starting Point: Die Center Unit[μm]
Die Size: 0.73x0.63mm
Die Thickness (C-V): 130±15μm
Wafer Thickness(WS4-V): 130±15μm
Wafer Thickness (W-B): 160±20μm
Wafer Thickness (W-H): 200±20μm
Pad size: 80x80μm
Die Substrate: V_{SS} level

■ TERMINAL DESCRIPTION

SYMBOL	FUNCTION						
CONT	Oscillation and 3-state Output Buffer Control						
	<table border="1"> <tr> <td>CONT</td> <td>F_{OUT}</td> </tr> <tr> <td>H or OPEN</td> <td>Output either one frequency selected of f₀, f₀/2, f₀/4, f₀/8, f₀/16, f₀/32 and f₀/64 Note1)</td> </tr> <tr> <td>L</td> <td>Oscillation Stop and High impedance Output</td> </tr> </table>	CONT	F _{OUT}	H or OPEN	Output either one frequency selected of f ₀ , f ₀ /2, f ₀ /4, f ₀ /8, f ₀ /16, f ₀ /32 and f ₀ /64 Note1)	L	Oscillation Stop and High impedance Output
	CONT	F _{OUT}					
H or OPEN	Output either one frequency selected of f ₀ , f ₀ /2, f ₀ /4, f ₀ /8, f ₀ /16, f ₀ /32 and f ₀ /64 Note1)						
L	Oscillation Stop and High impedance Output						
L	Oscillation Stop and High impedance Output						
XTI XTO	Quartz Crystal Connecting Terminals						
V _{SS}	GND terminal (V _{SS} =0V)						
F _{OUT}	Frequency Output (3-State Output Buffer)						
V _{DD}	V _{DD} =1.62 to 3.63V						

Note1) Refer to the line-up table.

■ FUNCTIONAL DESCRIPTION

● Standby Function

When CONT Terminal goes “Low”, the F_{OUT} Terminal output becomes High impedance.

CONT	F _{OUT}	Oscillator
High(Open)	Frequency output	Normal operation
Low	High impedance	Stopped

● Variable Pull-up Resistance

The CONT Terminal pull-up resistance changes in response to the input level. When CONT is tied “LOW” level, the pull-up resistance is large, reducing the current consumed by the resistance. When CONT is left open circuit, the pull-up resistance is small, which increases the input susceptibility to external noise. However, the pull-up resistance ties the CONT Terminal “High” level to prevent external noise from unexpectedly stopping the output.

■ ABSOLUTE MAXIMUM RATINGS

(V_{SS}=0V, Ta=25°C)

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V _{DD}	-0.5 to +4.0	V
Input Voltage	V _{IN}	-0.5 to +4.0	V
Output Voltage	V _O	-0.5 to V _{DD} +0.5	V
Input Current	I _{IN}	±10	mA
Output Current	I _O	±25	mA
Operating Temperature Range	T _{opr}	-40 to +85	°C
Storage Temperature Range	T _{stg}	-55 to +150	°C

Note2) The input voltage must not over 4.0V because of limit specified.

Note3) Decoupling capacitor should be connected between V_{DD} and V_{SS} due to the stabilized operation for the circuit.

■ ELECTRICAL CHARACTERISTICS

(Ta=+25°C)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Operating Voltage	V _{DD}	fosc=60MHz	1.62		3.63	V
Input Voltage	V _{IN}	CONT	0		3.63	V
Output Voltage	V _{OUT}	F _{OUT}	0		V _{DD}	V
Output Frequency Stability	df/f	V _{DD} ±10%		±1		ppm

($V_{DD}=1.62$ to $3.63V$, $V_{SS}=0V$, $T_a=+25^{\circ}C$)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT	
Operating Current	I_{DD}	x1 version (f_0) No load CONT=Open $f_0=60MHz$ $F_{out}=60MHz$	$V_{DD}=1.8V$		1.250	1.875	mA
			$V_{DD}=2.5V$		1.625	2.500	
			$V_{DD}=3.3V$		2.000	3.000	
		x2 version ($f_0/2$) *	$V_{DD}=1.8V$		1.125	1.750	
			$V_{DD}=2.5V$		1.500	2.250	
			$V_{DD}=3.3V$		1.875	2.875	
		x3 version ($f_0/4$) *	$V_{DD}=1.8V$		1.000	1.500	
			$V_{DD}=2.5V$		1.25	1.875	
			$V_{DD}=3.3V$		1.625	2.500	
		x4 version ($f_0/8$) *	$V_{DD}=1.8V$		0.940	1.440	
			$V_{DD}=2.5V$		1.125	1.750	
			$V_{DD}=3.3V$		1.375	2.125	
		x5 version ($f_0/16$) *	$V_{DD}=1.8V$		0.875	1.375	
			$V_{DD}=2.5V$		1.060	1.625	
			$V_{DD}=3.3V$		1.310	2.000	
		x6 version ($f_0/32$) *	$V_{DD}=1.8V$		0.875	1.375	
			$V_{DD}=2.5V$		1.060	1.625	
			$V_{DD}=3.3V$		1.250	1.875	
		x7 version ($f_0/64$) *	$V_{DD}=1.8V$		0.875	1.375	
			$V_{DD}=2.5V$		1.060	1.625	
			$V_{DD}=3.3V$		1.250	1.875	
Oscillation Stopping Current	I_{STB}	CONT= V_{SS} , No load			10	μA	
Output Voltage	V_{OH}	$I_{OH}=4mA$	$V_{DD}-0.4$			V	
	V_{OL}	$I_{OL}=4mA$			0.4	V	
Input Voltage	V_{IH}	CONT Input Tolerant Function	$0.7V_{DD}$			V	
	V_{IL}	CONT			$0.3V_{DD}$	V	
Input Current Note4)	I_{IN}	CONT= $3.63V$			1	μA	
		CONT= $0.8V_{DD}$			8	μA	
		CONT= $0.2V_{DD}$			5	μA	
3-state Off Leakage Current	I_{OZ}	CONT= V_{SS} , $F_{OUT}=V_{DD}$ or V_{SS}			± 0.1	μA	

* Under development and tentative value.

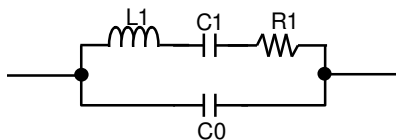
Note1) Absolute value.

($V_{DD}=1.62$ to $3.63V$, $V_{SS}=0V$, $T_a=+25^{\circ}C$)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT	
Feedback Resistance	Rf			545		kΩ	
Internal Capacitor	Cg	fosc=60MHz		7.5		pF	
	Cd	fosc=60MHz		8.5		pF	
Oscillation Frequency	fosc	Recommendation Note1)			60	MHz	
Output Signal Symmetry	SYM	$C_L=15pF$, @ $V_{DD}/2$	45	50	55	%	
Output Signal Rise Time	tr	$C_L=15pF$ $0.1V_{DD}$ to $0.9V_{DD}$	$V_{DD}=1.8V$		3.2	5.0	ns
			$V_{DD}=2.5V$		2.2	3.7	ns
			$V_{DD}=3.3V$		1.8	3.0	ns
Output Signal Fall Time	tf	$C_L=15pF$ $0.9V_{DD}$ to $0.1V_{DD}$	$V_{DD}=1.8V$		3.2	5.0	ns
			$V_{DD}=2.5V$		2.2	3.7	ns
			$V_{DD}=3.3V$		1.8	3.0	ns
Output Disable time	t _{POZ}	$C_L=15pF$, $R_L=1k\Omega$			100	ns	
Output Enable Time	t _{PZO}	$C_L=15pF$			1	ms	

Note1) The oscillation frequency range has used NJRC's standard crystal for measurement. However it is not guaranteed. (Refer to EXAMPLE OF CRYSTAL PARAMETERS FOR MEASUREMENT CIRCUITS)

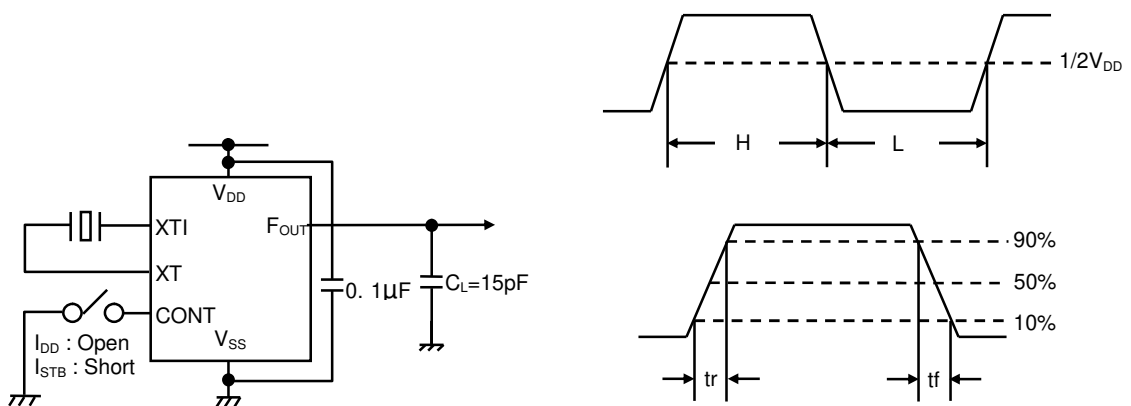
■ EXAMPLE OF CRYSTAL PARAMETERS FOR MEASUREMENT CIRCUITS



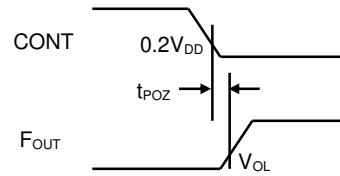
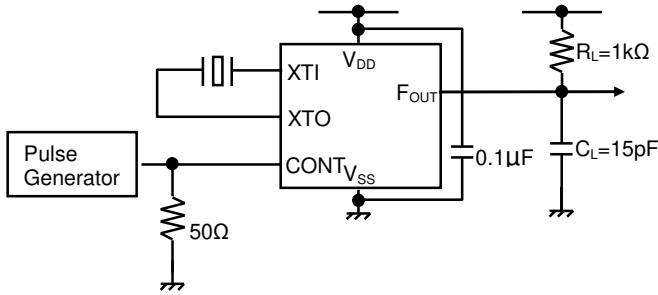
f[MHz]	R1[Ω]	L1[mH]	C1[fF]	C0[pF]
60	31.18	3.75	1.87	0.92

■ MEASUREMENT CIRCUITS

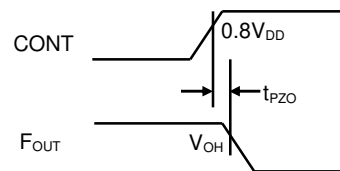
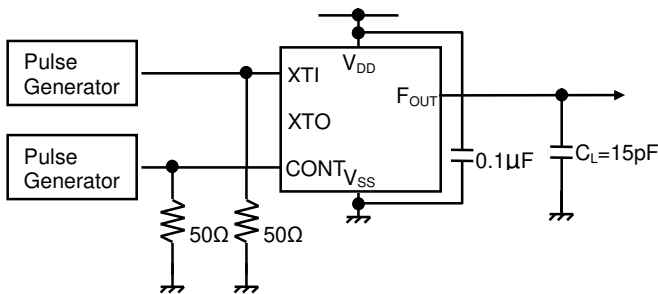
(1) Operating Current ($C_L=0pF$), Output Signal Symmetry ($C_L=15pF$), Output Signal Rise/Fall Time ($C_L=15pF$)



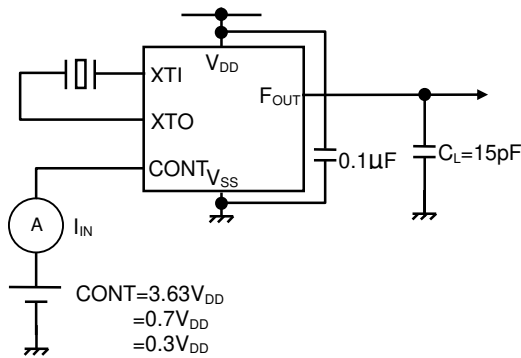
(2) Output Disable Time ($C_L=15\text{pF}, R_L=1\text{k}\Omega$)



(3) Output Enable Time ($C_L=15\text{pF}$)



(4) Input Current ($C_L=15\text{pF}$)



[CAUTION]
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