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. (±1ppm@V_{DD}±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.

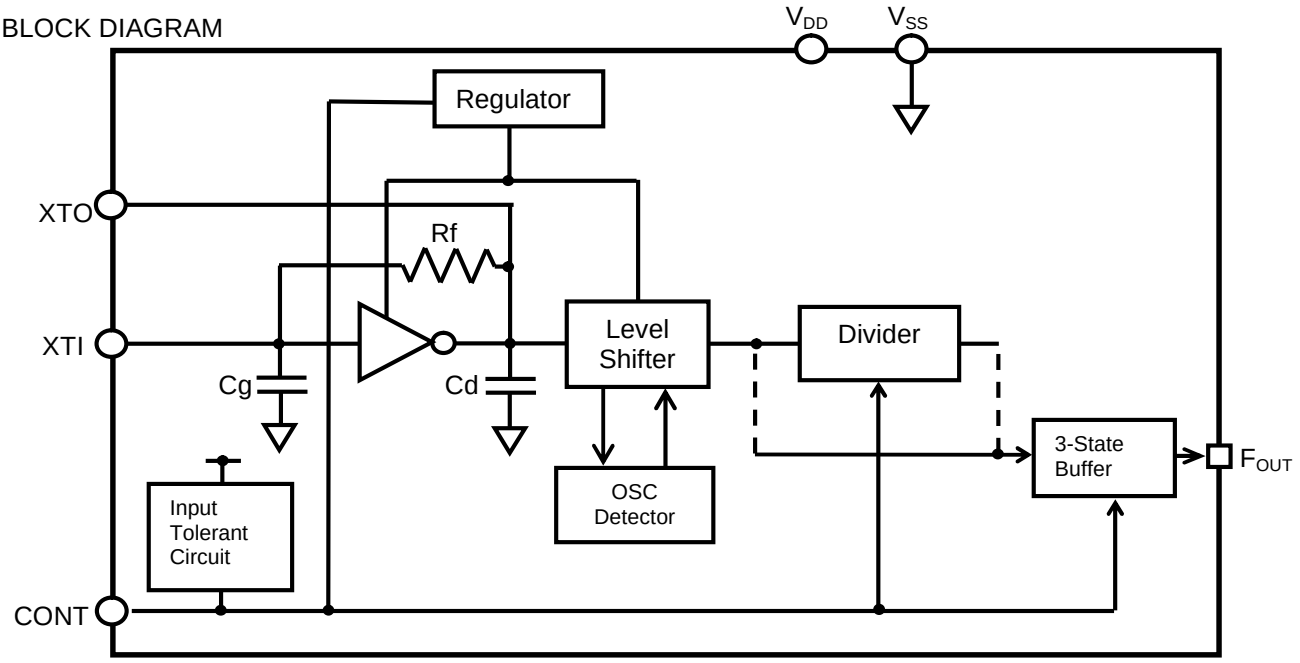
■PACKAGE OUTLINE

NJU6221XxC-V

■FEATURES

- ●Maximum Oscillation Frequency 60MHz(Fundamental)
- ●Frequency Stability ±1ppm@V_{DD}±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 Cg and Cg on-Die
- ●C-MOS Technology
- ●Package Outline Die/Wafer

■BLOCK DIAGRAM

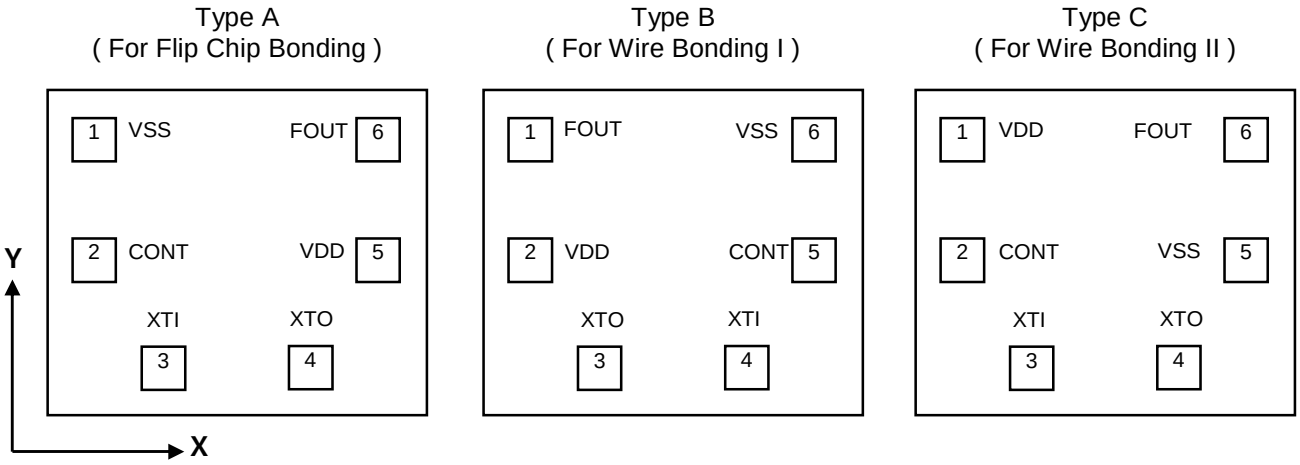


■LINE-UP TABLE

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

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

■PART NUMBER

NJU6221 □□ □-□

- NJU6221: Device name
- □□: Version
- □-□: W-H: Wafer (200μm), W-B: Wafer (160μm), WS4-V:1/4Wafer(130μm), C-V: Chip(130μm)

■TERMINAL DESCRIPTION

SYMBOL	FUNCTION
CONT	Oscillation and 3-state Output Buffer Control CONT: 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) CONT: L → Oscillation Stop and High impedance Output
XTI	Quartz Crystal Connecting Terminals
XTO	
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	Topr	-40 to +85	°C
Storage Temperature Range	Tstg	-55 to +150	°C

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

Note3) Decupling 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, Ta=+25°C)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
Operating Current	I_{DD}	x1 version (f_0) No load CONT=Open f_0=60MHz Fout=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) * No load CONT=Open f_0=60MHz Fout=30MHz	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) * No load CONT=Open f_0=60MHz Fout=15MHz	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)* No load CONT=Open f_0=60MHz Fout=7.5MHz	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)* No load CONT=Open f_0=60MHz Fout=3.75MHz	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)* No load CONT=Open f_0=60MHz Fout=1.875MHz	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)* No load CONT=Open f_0=60MHz Fout=0.938MHz	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.

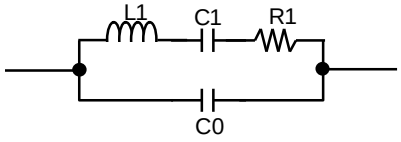
Note1) Absolute value.

(V_{DD}=1.62 to 3.63V, V_{SS}=0V, Ta=+25°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=1kΩ				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)

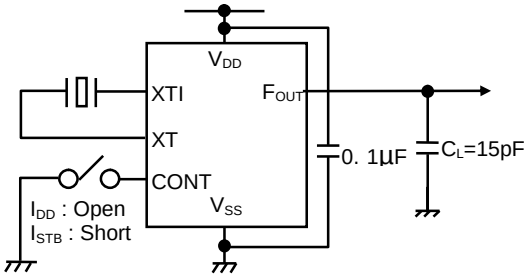
■EXAMPLE OF CRYSTAL PARAMETERS FOR MEASUREMENT CIRCUITS

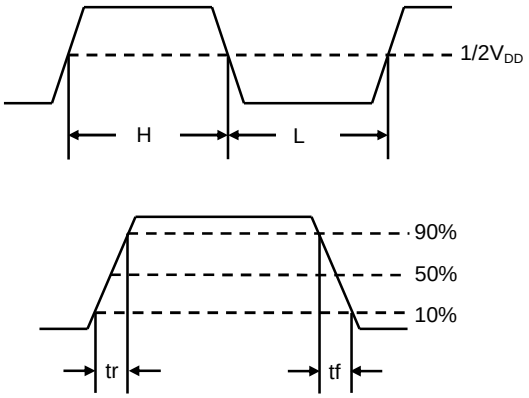


f[MHz]	R1[Ω]	L1[mH]	C1[fF]	C0[pF]
60	31.18	3.75	1.87	0.92

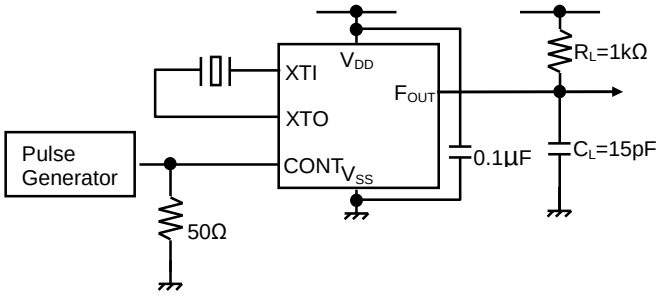
■MEASUREMENT CIRCUITS

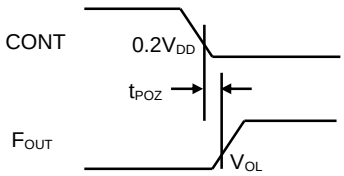
(1)Operating Current(C_L=0pF), Output Signal Symmetry(C_L=15pF), Output Signal Rise/Fall Time (C_L=15pF)



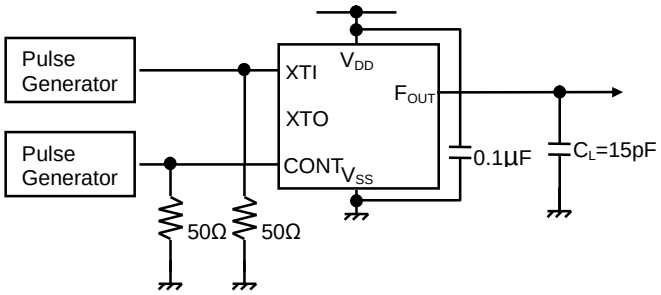


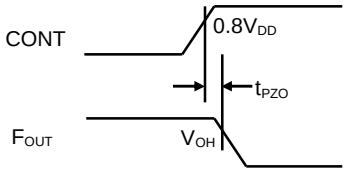
(2)Output Disable Time (C_L=15pF,R_L=1kΩ)





(3)Output Enable Time (C_L=15pF)





(4)Input Current (C_L=15pF)