

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.

PACKAGE OUTLINE

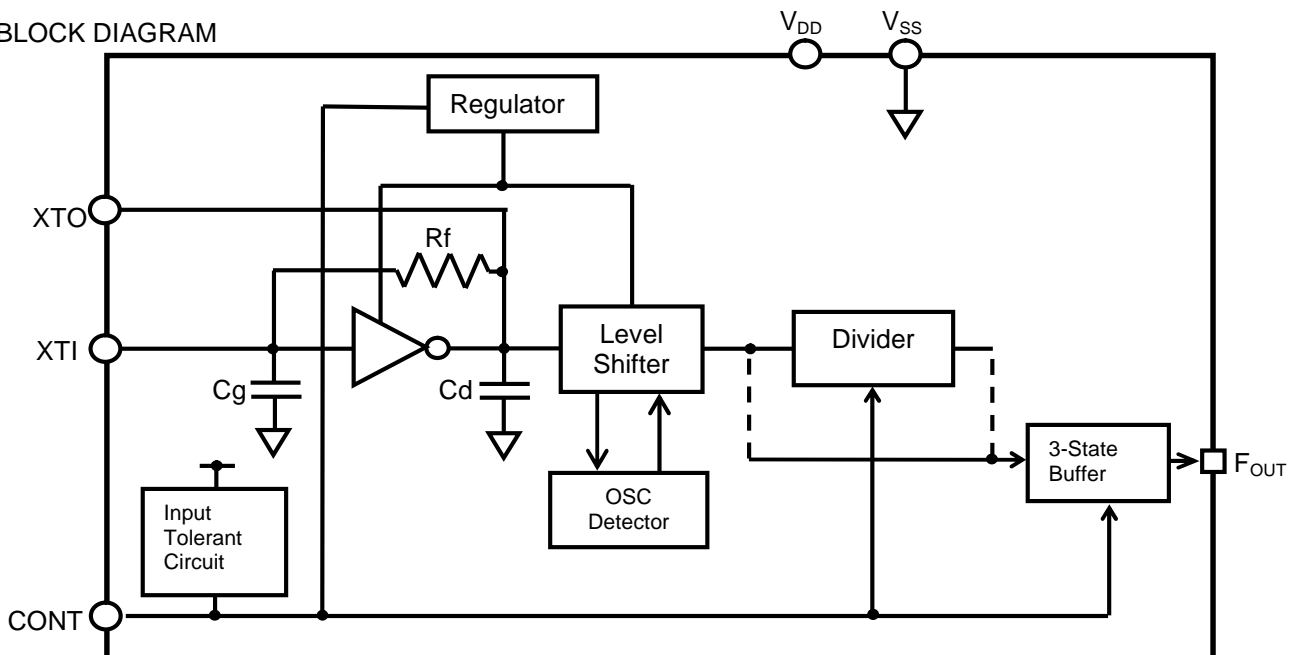


NJU6221XxC-V

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

BLOCK DIAGRAM

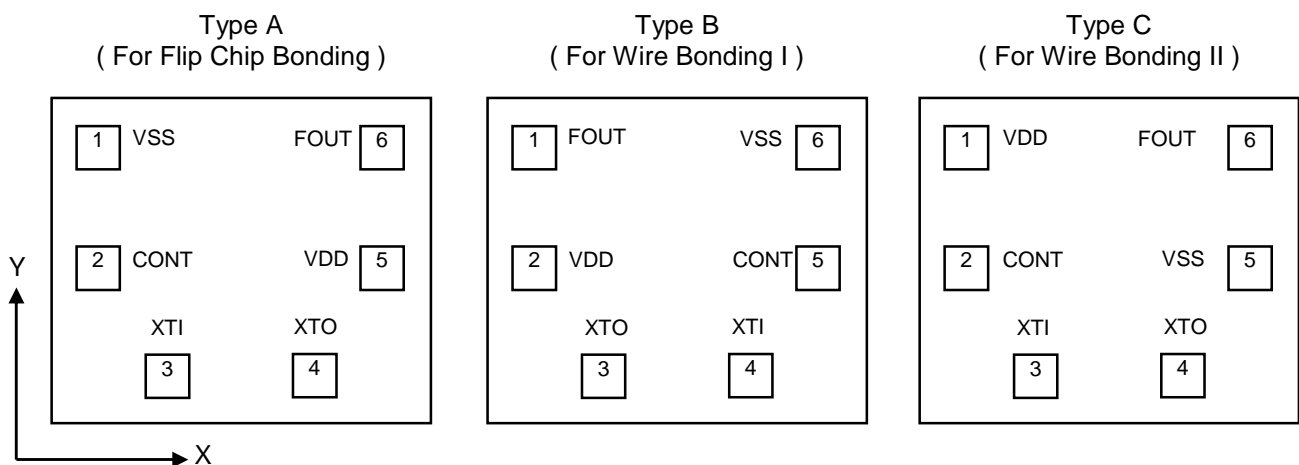


LINE-UP TABLE

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

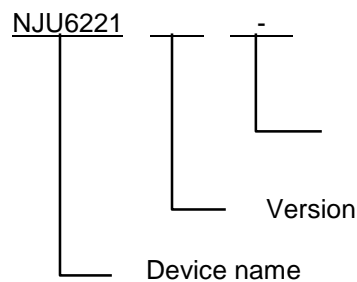
PAD LOCATION



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
	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
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 ($f_0/2$) * No load CONT=Open $f_0=60MHz$ $F_{out}=30MHz$ $V_{DD}=1.8V$		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 $f_0=60MHz$ $F_{out}=15MHz$ $V_{DD}=1.8V$		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 $f_0=60MHz$ $F_{out}=7.5MHz$ $V_{DD}=1.8V$		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 $f_0=60MHz$ $F_{out}=3.75MHz$ $V_{DD}=1.8V$		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 $f_0=60MHz$ $F_{out}=1.875MHz$ $V_{DD}=1.8V$		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 $f_0=60MHz$ $F_{out}=0.938MHz$ $V_{DD}=1.8V$		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.

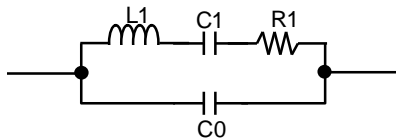
Note1) Absolute value.

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

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)

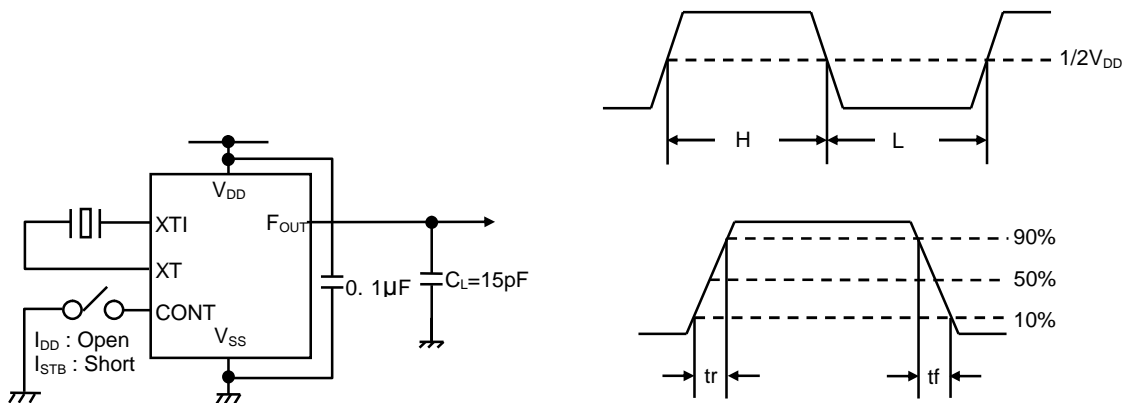
EXAMPLE OF CRYSTAL PARAMETERS FOR MEASUREMENT CIRCUITS



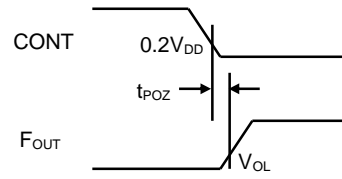
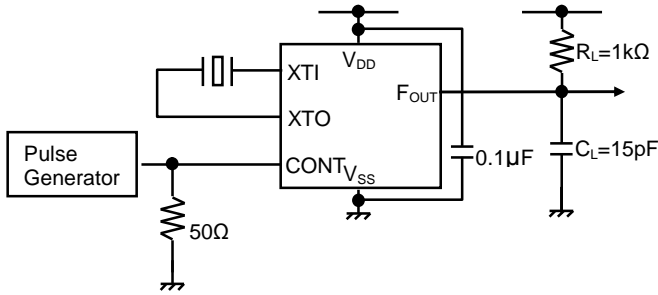
f[MHz]	R1[Ω]	L1[mH]	C1[fF]	C0[pF]
60	31.18	3.75	1.87	0.92

MEASUREMENT CIRCUITS

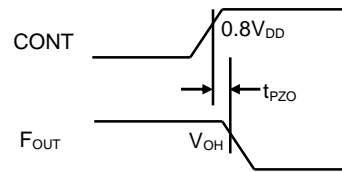
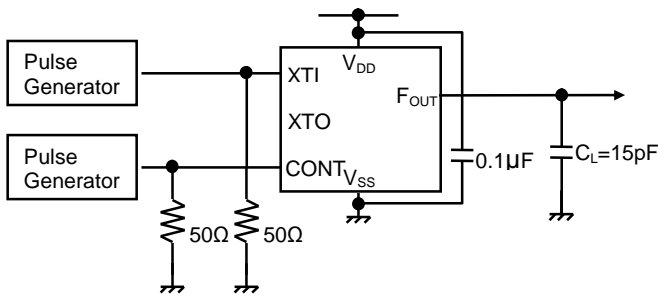
(1) Operating Current($C_L=0pF$), Output Signal Symmetry($C_L=15pF$), Output Signal Rise/Fall Time ($C_L=15pF$)



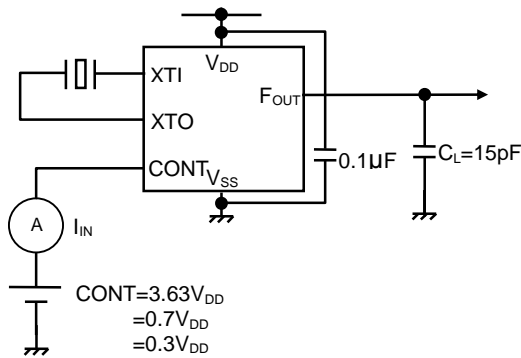
(2) Output Disable Time ($C_L=15\text{pF}, R_L=1\text{k}\Omega$)



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



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



[CAUTION]
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