

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

■GENERAL DESCRIPTION

The NJU6216 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 3-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.

The 3-stage divider generates only one frequency selected of f_0 , $f_0/2$, $f_0/4$ and $f_0/8$ internal circuits is output.

The 3-state output buffer is C-MOS compatible of high fan-out.

The input tolerant circuit ensures that 0 to 5.5 V can be applied to CONT terminal without regard to the supply voltage.

The oscillation stopping current is very low stand-by mode below 5uA, therefore, it is suitable for the portable items of the communication equipment and the like.

■FEATURES

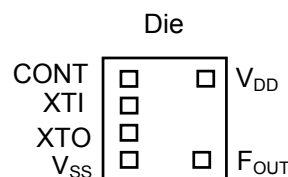
- Input Tolerant Circuit 0 to 5.5V@CONT Term.
- Frequency Stability $\pm 1\text{ppm}@V_{DD}\pm 10\%$
- Operating Voltage 1.62 to 3.63V
- Maximum Oscillation Frequency 60MHz(Fundamental)
- Low Operating Current 5mA typ.@60MHz/3.3V/15pF
- 4-Stage Divider Maximum Divider $f_0/8$
- Built-in LDO
- Oscillation Stop and Output Stand-by Function
- 3-State Output Buffer
- Variable Pull-up Resistance on-Die
- Oscillation Capacitors C_g and C_g on-Die
- Package Outline Die/Wafer
- C-MOS Technology

■PACKAGE OUTLINE



NJU6216XC-L

■PAD LOCATION



■LINE-UP TABLE

Type No.		F _{OUT}	Internal Connect			Cg/Cd
			Short	Open	N	
NJU6216	A	f ₀	A	B	-	9.3/10.7pF
	B	f ₀ /2	B	A	2	9.3/10.7pF
	C	f ₀ /4	B	A	4	9.3/10.7pF
	D	f ₀ /8	B	A	8	9.3/10.7pF

■COORDINATES

No	Pad Name	X	Y
1	CONT	-189	231
2	XTI	-189	77
3	XTO	-189	-77
4	V_{SS}	-189	-231
5	F_{OUT}	215	-231
6	V_{DD}	222	231

Starting Point: Die Center Unit[um]

Die Size: 0.70x0.75mm

Die Thickness (C-L): $140\pm 10\mu\text{m}$

Wafer Thickness (W-L): $140\pm 10\mu\text{m}$

Pad size: 90x90um

Die Substrate: V_{SS} level

■EXAMPLE OF PART NUMBER

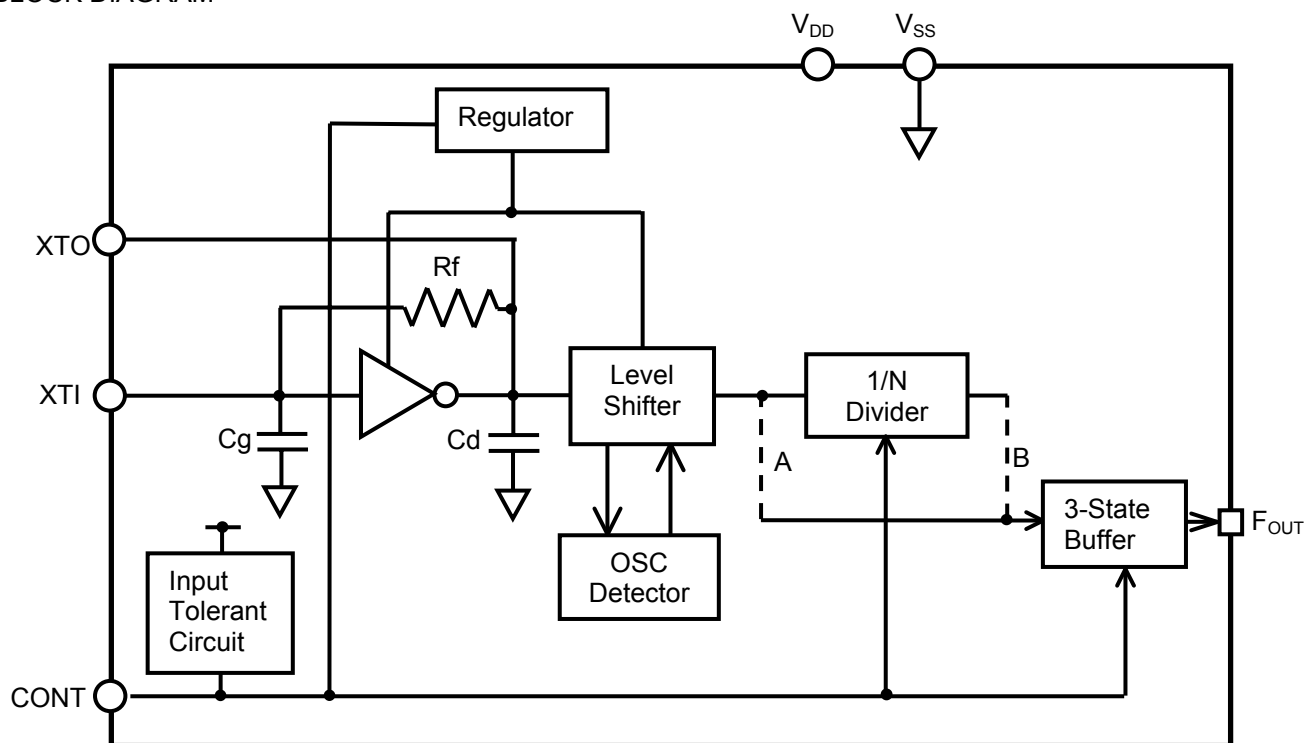
1)NJU6216AW-L

$F_{OUT}=f_0$, Wafer Thickness= $140\mu\text{m}$

2)NJU6216CC-L

$F_{OUT}=f_0/4$, Die Thickness= $140\mu\text{m}$

■BLOCK DIAGRAM



■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 and f ₀ /8 (Note1)
	L Oscillation Stop and High impedance Output
XTI	Quartz Crystal Connecting Terminals
XTO	
V _{SS}	V _{SS} =0V : GND
F _{OUT}	Frequency Output
V _{DD}	V _{DD} =1.62 to 3.63V

Note1) Refer to the line-up table.

■ABSOLUTE MAXIMUM RATINGS

(V_{SS}=0V, T_a=25°C)

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V _{DD}	-0.5 to +7.0	V
Input Voltage	V _{IN}	-0.5 to +7.0	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 +125	°C

Note2) The input voltage must not over 7.0V 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		5.5	V
Output Voltage	V_{OUT}	F_{OUT}	0		V_{DD}	V
Output Frequency Stability	df/f	$V_{DD} \pm 10\%$		± 1		ppm

($V_{DD}=1.8V$, $V_{SS}=0V$, Ta=+25°C)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Operating Current	I_{DD}	A version, $f_0=60MHz$, $C_L=15pF$		3.0	4.0	mA
		B version, $f_0/2=30MHz$, $C_L=15pF$		1.8	2.6	
		C version, $f_0/4=15MHz$, $C_L=15pF$		1.3	2.0	
		D version, $f_0/8=7.5MHz$, $C_L=15pF$		1.0	2.0	
Oscillation Stopping Current	I_{STB}	CONT= V_{SS} , No load			5	μA
Input Voltage	V_{IH}	CONT Input Tolerant Function	1.26			V
	V_{IL}				0.54	V
Output Voltage	V_{OH}	$I_{OH}=2mA$	1.62			V
	V_{OL}	$I_{OL}=2mA$			0.18	V
Input Current	I_{IN}	CONT=5.5V			1.0	μA
		CONT=0.8 V_{DD}		0.35	1.2	μA
		CONT=0.2 V_{DD}		1.0	1.75	μA
3-state Off Leakage Current	I_{OZ}	CONT= V_{SS} , $F_{OUT}=V_{DD}$ or V_{SS}			± 0.1	μA
Feedback Resistance	R_f			270		k Ω
Internal Capacitor	C_g	fosc=60MHz		9.3		pF
Internal Capacitor	C_d	fosc=60MHz		10.7		pF
Oscillation Frequency	fosc	Recommendation Note4)			60	MHz
Output Signal Symmetry	SYM	$C_L=15pF$, @ $V_{DD}/2$	45	50	55	%
Output Signal Rise Time	t_r	$C_L=15pF$, 0.1 V_{DD} to 0.9 V_{DD}		3.2	5.0	ns
Output Signal Fall Time	t_f	$C_L=15pF$, 0.9 V_{DD} to 0.1 V_{DD}		3.2	5.0	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

Note4) 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)

(V_{DD}=2.5V, V_{SS}=0V, Ta=+25°C)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Operating Current	I _{DD}	A version, f ₀ =60MHz, C _L =15pF		3.7	5.0	mA
		B version, f ₀ /2=30MHz, C _L =15pF		2.4	3.3	
		C version, f ₀ /4=15MHz, C _L =15pF		1.6	2.4	
		D version, f ₀ /8=7.5MHz, C _L =15pF		1.2	2.0	
Oscillation Stopping Current	I _{STB}	CONT=V _{SS} , No load			5	uA
Input Voltage	V _{IH}	CONT Input Tolerant Function	1.75			V
	V _{IL}				0.75	V
Output Voltage	V _{OH}	I _{OH} =4mA	2.25			V
	V _{OL}	I _{OL} =4mA			0.25	V
Input Current	I _{IN}	CONT=5.5V			1.0	uA
		CONT=0.8V _{DD}		0.4	1.2	uA
		CONT=0.2V _{DD}		1.4	2.3	uA
3-state Off Leakage Current	I _{OZ}	CONT=V _{SS} , F _{OUT} = V _{DD} or V _{SS}			±0.1	uA
Feedback Resistance	R _f			270		kΩ
Internal Capacitor	C _g	fosc=60MHz		9.3		pF
Internal Capacitor	C _d	fosc=60MHz		10.7		pF
Oscillation Frequency	fosc	Recommendation Note4)			60	MHz
Output Signal Symmetry	SYM	C _L =15pF, @V _{DD} /2	45	50	55	%
Output Signal Rise Time	t _r	C _L =15pF, 0.1V _{DD} to 0.9V _{DD}		2.2	3.7	ns
Output Signal Fall Time	t _f	C _L =15pF, 0.9V _{DD} to 0.1V _{DD}		2.2	3.7	ns
Output Disable time	t _{POZ}	C _L =15pF, R _L =1kΩ			100	ns
Output Enable Time	t _{PZO}	C _L =15pF			1	ms

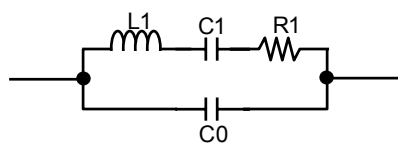
Note4) The oscillation frequency range has used NJRC's standard crystal for measurement. However it is not guaranteed. (Refer to EXAMPLE OF CRYSTAL PARAMETERS FOR MEASUREMENT CIRCUITS)

($V_{DD}=3.3V$, $V_{SS}=0V$, $T_a=+25^{\circ}C$)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Operating Current	I_{DD}	A version, $f_0=60MHz$, $C_L=15pF$		5.0	7.0	mA
		B version, $f_0/2=30MHz$, $C_L=15pF$		3.2	4.4	
		C version, $f_0/4=15MHz$, $C_L=15pF$		2.2	3.0	
		D version, $f_0/8=7.5MHz$, $C_L=15pF$		1.7	2.5	
Oscillation Stopping Current	I_{STB}	CONT= V_{SS} , No load			5	μA
Input Voltage	V_{IH}	CONT Input Tolerant Function	2.31			V
	V_{IL}				0.99	V
Output Voltage	V_{OH}	$I_{OH}=6mA$	2.97			V
	V_{OL}	$I_{OL}=6mA$			0.33	V
Input Current	I_{IN}	CONT=5.5V			1.0	μA
		CONT=0.8 V_{DD}		0.5	1.2	μA
		CONT=0.2 V_{DD}		1.5	3.3	μA
3-state Off Leakage Current	I_{OZ}	CONT= V_{SS} , $F_{OUT}=V_{DD}$ or V_{SS}			± 0.1	μA
Feedback Resistance	R_f			270		k Ω
Internal Capacitor	C_g	fosc=60MHz		9.3		pF
Internal Capacitor	C_d	fosc=60MHz		10.7		pF
Oscillation Frequency	fosc	Recommendation Note4)			60	MHz
Output Signal Symmetry	SYM	$C_L=15pF$, @ $V_{DD}/2$	45	50	55	%
Output Signal Rise Time	t_r	$C_L=15pF$, 0.1 V_{DD} to 0.9 V_{DD}		1.8	3.0	ns
Output Signal Fall Time	t_f	$C_L=15pF$, 0.9 V_{DD} to 0.1 V_{DD}		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

Note4) 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)

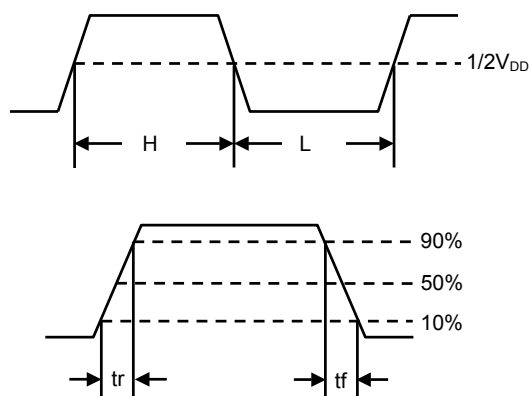
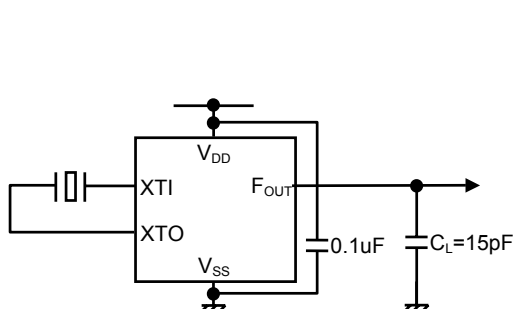
■EXAMPLE OF CRYSTAL PARAMETERS FOR MEASUREMENT CIRCUITS



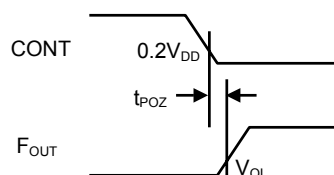
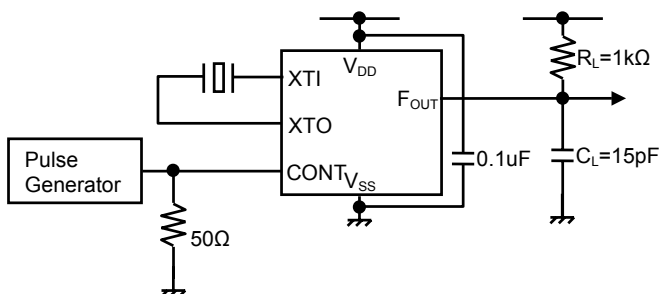
f[MHz]	R1[Ω]	L1[mH]	C1[fF]	C0[pF]
60	30.3	2.91	2.42	0.87

■MEASUREMENT CIRCUITS

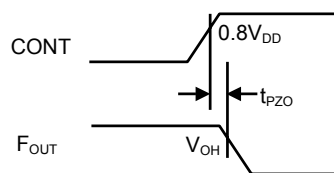
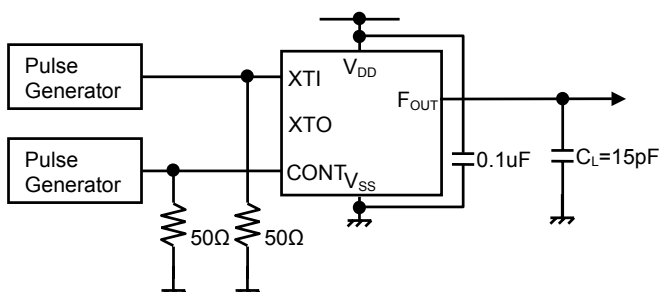
(1)Operating Current, Output Signal Symmetry, Output Signal Rise/Fall Time ($C_L=15\text{pF}$)



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



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



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