

1.5V Operation Fundamental Quartz Crystal Oscillator

■GENERAL DESCRIPTION

The NJU6369 series is a C-MOS IC for fundamental quartz crystal oscillator that consists of an oscillation amplifier, 5-stage divider and 3-state output buffer, and can oscillate at 1.5V very low voltage.

The 5-stage divider generates only one frequency selected of $f_0, f_0/2, f_0/4, f_0/8, f_0/16$ and $f_0/32$ by internal circuits is output.

The oscillation amplifier is realized very low stand-by current using NAND circuit.

The 3-state output buffer is C-MOS compatible.

■FEATURES

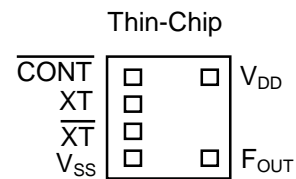
- Operating Voltage 1.5 to 3.6V
- Maximum Oscillation Frequency 40MHz@1.5V
40MHz@1.8V
60MHz@ $\geq 2.5V$
- Low Operating Current
- High Fan-out $I_{OH}/I_{OL}=2mA@1.8V$
 $I_{OH}/I_{OL}=5mA@2.5V$
 $I_{OH}/I_{OL}=6mA@3.3V$
Maximum Divider $f_0/32$
- 5-Stage Divider
- Oscillation Stop and Output Stand-by Function
- 3-State Output Buffer
- Oscillation Capacitors C_g and C_d on-chip
- Package Outline Thin-Chip
- C-MOS Technology

■PACKAGE OUTLINE



NJU6369XC-D

■PAD LOCATION



■LINE-UP TABLE

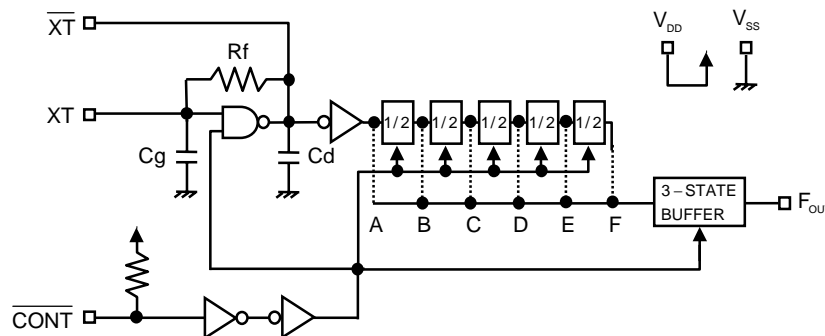
Type No.	F _{OUT}	Internal Connect	C _g /C _d	
NJU6369	A	f_0	Connected A Line	8/9pF
	B	$f_0/2$	Connected B Line	8/9pF
	C	$f_0/4$	Connected C Line	8/9pF
	D	$f_0/8$	Connected D Line	8/9pF
	E	$f_0/16$	Connected E Line	8/9pF
	F	$f_0/32$	Connected F Line	8/9pF

■COORDINATES

No	Pad Name	X	Y
1	\overline{CONT}	-178	231
2	XT	-178	77
3	\overline{XT}	-178	-77
4	V _{SS}	-178	-231
5	F _{OUT}	206	-231
8	V _{DD}	206	231

Starting Point: Chip Center Unit[um]
 Chip Size: 0.7x0.75mm
 Thin-Chip Thickness: 200±20um
 Pad Size: 90x90um

■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, f ₀ /8, f ₀ /16 and f ₀ /32 Note1)
	L	Oscillation Stop and High impedance Output
XT	Quartz Crystal Connecting Terminals	
$\overline{\text{XT}}$		
V _{SS}	V _{SS} =0V	
F _{OUT}	Frequency Output	
V _{DD}	V _{DD} =1.8V/2.5V/3.3V	

Note1) Refer to the line-up table.

■ABSOLUTE MAXIMUM RATINGS

(Ta=25°C)

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

Note2) If the supply voltage(V_{DD}) is less than 7.0V, the input voltage must not over the V_{DD} level though 7.0V is 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}		1.5		3.6	V

(V_{DD}=1.8V, Ta=25°C)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Operating Current	I _{DD}	A version, fosc=16MHz, C _L =15pF			2	mA
		B version, fosc=16MHz, C _L =15pF			1.5	
		C version, fosc=16MHz, C _L =15pF			1	
		D version, fosc=16MHz, C _L =15pF			1	
		E version, fosc=16MHz, C _L =15pF			1	
		F version, fosc=16MHz, C _L =15pF			1	
Oscillation Stopping Current	I _{STB}	CONT=V _{SS} , No load		1	3	uA
Stand-by Current	I _{st}	CONT=XT=V _{SS} , No load Note4)			1	uA
Input Voltage	V _{IH}		1.26		1.8	V
	V _{IL}		0		0.54	V
Output Current	I _{OH}	V _{OH} =1.62V	2			mA
	I _{OL}	V _{OL} =0.18V	2			mA
Input Current	I _{IN}	CONT=0.8V _{DD}		3.0	4.5	uA
		CONT=0.2V _{DD}		0.5	0.7	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			255		KΩ
Internal Capacitor	C _g /C _d	fosc=16MHz		8/9		pF
Maximum Oscillation Frequency	F _{MAX}		40			MHz
Output Signal Symmetry	SYM	C _L =15pF, @V _{DD} /2	45	50	55	%
		C _L =30pF, @V _{DD} /2	40	50	60	
Output Signal Rise Time	tr	C _L =15pF, 10% to 90%		3	6	ns
		C _L =30pF, 10% to 90%		6	10	
Output Signal Fall Time	tf	C _L =15pF, 90% to 10%		3	6	ns
		C _L =30pF, 90% to 10%		6	10	
Output Disable time	T _{PLZ}	C _L =15pF, R _{UP} =10kΩ			250	ns
Output Enable Time	T _{PZL}	C _L =15pF, R _{UP} =10kΩ			250	ns

Note4) Excluding input current on CONT Terminal.

($V_{DD}=2.5V, T_a=25^{\circ}C$)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Operating Current	I_{DD}	A version, $f_{osc}=16MHz, C_L=15pF$			3	mA
		B version, $f_{osc}=16MHz, C_L=15pF$			2.5	
		C version, $f_{osc}=16MHz, C_L=15pF$			2	
		D version, $f_{osc}=16MHz, C_L=15pF$			2	
		E version, $f_{osc}=16MHz, C_L=15pF$			2	
		F version, $f_{osc}=16MHz, C_L=15pF$			2	
Oscillation Stopping Current	I_{STB}	$CONT=V_{SS}$, No load		2	5	μA
Stand-by Current	I_{st}	$CONT=XT=V_{SS}$, No load Note4)			1	μA
Input Voltage	V_{IH}		1.75		2.5	V
	V_{IL}		0		0.75	V
Output Current	I_{OH}	$V_{OH}=2.25V$	5			mA
	I_{OL}	$V_{OL}=0.25V$	5			mA
Input Current	I_{IN}	$CONT=0.8V_{DD}$		7.5	12.0	μA
		$CONT=0.2V_{DD}$		1.2	2.0	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			255		$K\Omega$
Internal Capacitor	C_g/C_d	$f_{osc}=16MHz$		8/9		pF
Maximum Oscillation Frequency	F_{MAX}		60			MHz
Output Signal Symmetry	SYM	$C_L=15pF, @V_{DD}/2$	45	50	55	%
		$C_L=30pF, @V_{DD}/2$	45	50	55	
Output Signal Rise Time	t_r	$C_L=15pF, 10\%$ to 90%		2.8	5.5	ns
		$C_L=30pF, 10\%$ to 90%		4.5	9	
Output Signal Fall Time	t_f	$C_L=15pF, 90\%$ to 10%		2.8	5.5	ns
		$C_L=30pF, 90\%$ to 10%		4.5	9	
Output Disable time	T_{PLZ}	$C_L=15pF, R_{UP}=10k\Omega$			200	ns
Output Enable Time	T_{PZL}	$C_L=15pF, R_{UP}=10k\Omega$			200	ns

Note4) Excluding input current on CONT Terminal.

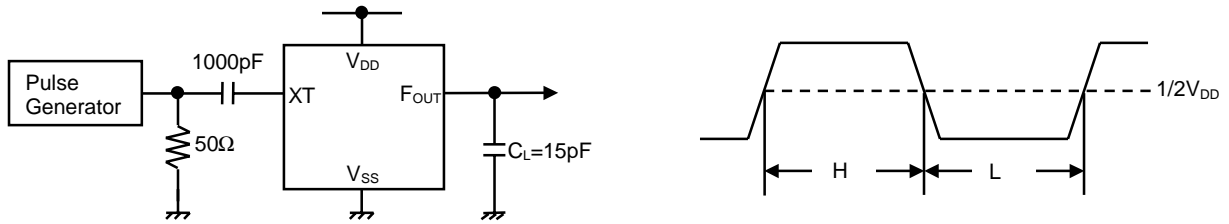
($V_{DD}=3.3V, T_a=25^{\circ}C$)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Operating Current	I_{DD}	A version, $f_{osc}=16MHz, C_L=15pF$			5	mA
		B version, $f_{osc}=16MHz, C_L=15pF$			4	
		C version, $f_{osc}=16MHz, C_L=15pF$			3	
		D version, $f_{osc}=16MHz, C_L=15pF$			3	
		E version, $f_{osc}=16MHz, C_L=15pF$			3	
		F version, $f_{osc}=16MHz, C_L=15pF$			3	
Oscillation Stopping Current	I_{STB}	$CONT=V_{SS}$, No load		2	5	μA
Stand-by Current	I_{st}	$CONT=XT=V_{SS}$, No load Note4)			1	μA
Input Voltage	V_{IH}		2.31		3.3	V
	V_{IL}		0		0.99	V
Output Current	I_{OH}	$V_{OH}=2.97V$	6			mA
	I_{OL}	$V_{OL}=0.33V$	6			mA
Input Current	I_{IN}	$CONT=0.8V_{DD}$		10.0	15.0	μA
		$CONT=0.2V_{DD}$		1.8	3.0	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			255		$K\Omega$
Internal Capacitor	C_g/C_d	$f_{osc}=16MHz$		8/9		pF
Maximum Oscillation Frequency	F_{MAX}		60			MHz
Output Signal Symmetry	SYM	$C_L=15pF, @V_{DD}/2$	45	50	55	%
		$C_L=30pF, @V_{DD}/2$	45	50	55	
Output Signal Rise Time	t_r	$C_L=15pF, 10\%$ to 90%		2.5	5	ns
		$C_L=30pF, 10\%$ to 90%		4	8	
Output Signal Fall Time	t_f	$C_L=15pF, 90\%$ to 10%		2.5	5	ns
		$C_L=30pF, 90\%$ to 10%		4	8	
Output Disable time	T_{PLZ}	$C_L=15pF, R_{UP}=10k\Omega$			150	ns
Output Enable Time	T_{PZL}	$C_L=15pF, R_{UP}=10k\Omega$			150	ns

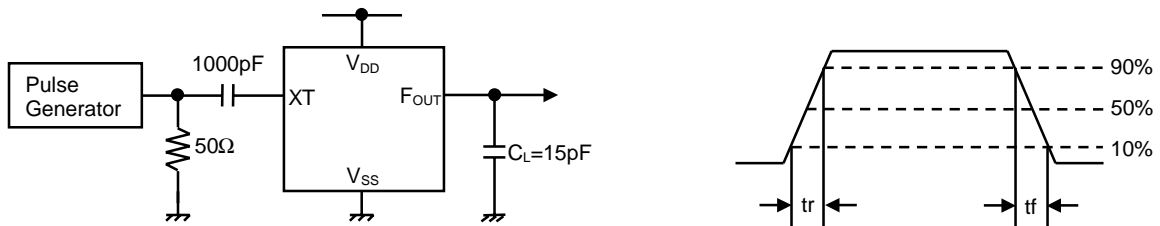
Note4) Excluding input current on CONT Terminal.

MEASUREMENT CIRCUITS

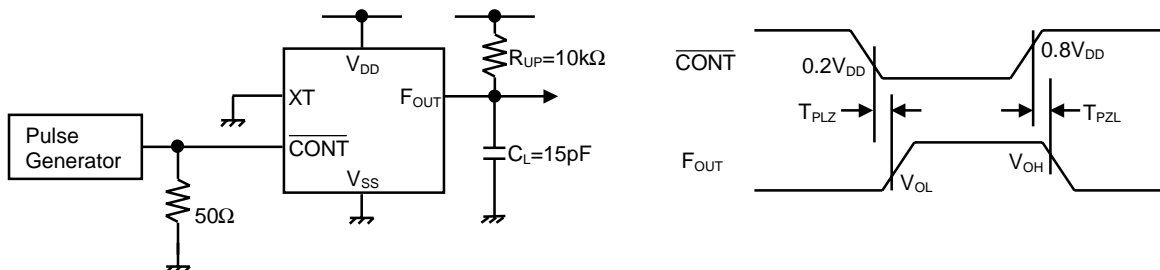
(1) Output Signal Symmetry ($C_L=15\text{pF}$)



(2) Output Signal Rise/Fall Time ($C_L=15\text{pF}$)



(3) Output Disable/Enable Time ($C_L=15\text{pF}, R_{UP}=10\text{k}\Omega$)



[CAUTION]
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