Low Operating Current Fundamental Quartz Crystal Oscillator IC

■GENERAL DESCRIPTION

The NJU6365 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.

The operating voltage is from 1.8V to 3.6V and high frequency-stability based on most suitable oscillation circuit including Cg, Cd and Rf.

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, and the operating current is lower than 1.5mA at 3.3V and 16MHz.

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

■PACKAGE OUTLINE

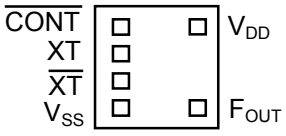
NJU6365XC-X

■FEATURES

- ●High Frequency-Stability for Operating Voltage
- ●Low Operating Current 1.5mA max@3.3V
- ●Operating Voltage 1.8 to 3.6V
- ●Maximum Oscillation Frequency 32MHz
- ●Fan-out 1.2mA min@2.5V
- ●5-Stage Divider Maximum Divider $f_0/32$
- ●Oscillation Stop and Output Stand-by Function
- ●3-State Output Buffer
- ●Oscillation Capacitors Cg and Cg on-Die
- ●Package Outline Thin-Die/Wafer
- ●C-MOS Technology

■PAD LOCATION

Thin-Die



■LINE-UP TABLE

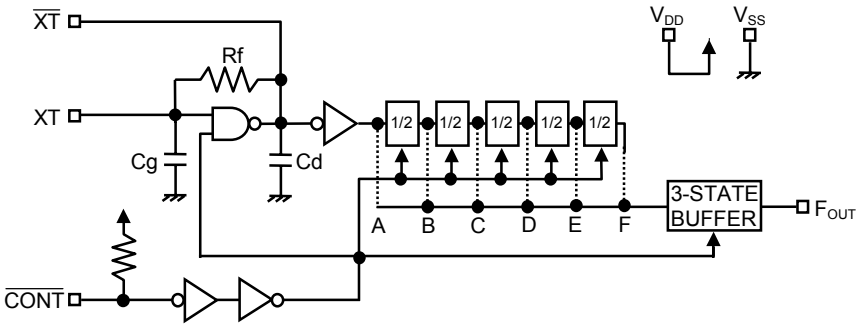
Type No.		F_{OUT}	Internal Connect	Cg/Cd
NJU6364	A	f_0	Connected A Line	8/9pF
	B	$f_0/2$	Connected B Line	8/9pF
	C	$f_0/4$	Connected C Line	8/9pF
	D	$f_0/8$	Connected D Line	8/9pF
	E	$f_0/16$	Connected E Line	8/9pF
	F	$f_0/32$	Connected F Line	8/9pF

■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-Die Thickness(C-D): 200±20um
Thin-Die Thickness(C-L): 140±10um
Wafer Thickness(W-H): 200±20um
Wafer Thickness(W-L): 140±10um
Pad Size: 90x90um
Die Substrate: V_{DD} Level

■BLOCK DIAGRAM



■TERMINAL DESCRIPTION

SYMBOL	FUNCTION
$\overline{CONT}$	Oscillation and 3-state Output Buffer Control

$\overline{CONT}$	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 / $\overline{XT}$	Quartz Crystal Connecting Terminals
V_{SS}	V_{SS}=0V
F_{OUT}	Frequency Output
V_{DD}	V_{DD}=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) 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}		1.8		3.6	V

(V_{DD}=2.5V,Ta=25°C)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Operating Current	I_{DD}	A version,fosc=16MHz,C_L=5pF			1.0	mA
		B version,fosc=16MHz,C_L=5pF			0.8	
		C version,fosc=16MHz,C_L=5pF			0.5	
		D version,fosc=16MHz,C_L=5pF			0.5	
		E version,fosc=16MHz,C_L=5pF			0.5	
		F version,fosc=16MHz,C_L=5pF			0.5	
Oscillation Stopping Current	I_{STB}	$\overline{CONT}$=V_{SS}, No load			1	uA
Stand-by Current	Ist	$\overline{CONT}$=XT=V_{SS}, No load Note4)			1	uA
Input Voltage	V_{IH}		1.75		2.5	V
	V_{IL}		0		0.75	V
Output Current	I_{OH}	V_{OH}=2.25V	1.2			mA
	I_{OL}	V_{OL}=0.25V	1.2			mA
Input Current	I_{IN}	$\overline{CONT}$=0.8V_{DD}		3.6	5.5	uA
		$\overline{CONT}$=0.2V_{DD}		0.3	0.5	uA
3-state Off Leakage Current	I_{OZ}	$\overline{CONT}$=V_{SS}, F_{OUT}= V_{DD} or V_{SS}			±0.1	uA
Feedback Resistance	Rf			255		kΩ
Internal Capacitor	Cg/Cd	fosc=16MHz		8/9		pF
Maximum Oscillation Frequency	F_{MAX}		32			MHz
Output Signal Symmetry	SYM	C_L=5pF, @V_{DD}/2	45	50	55	%
Output Signal Rise Time	tr	C_L=5pF,10% to 90%		4	8	ns
Output Signal Fall Time	tf	C_L=5pF,90% to 10%		4	8	ns
Output Disable time	t_{PLZ}	C_L=5pF,R_{UP}=10kΩ			200	ns
Output Enable Time	t_{PZL}	C_L=5pF,R_{UP}=10kΩ			200	ns

Note4) Excluding input current on $\overline{CONT}$ Terminal.

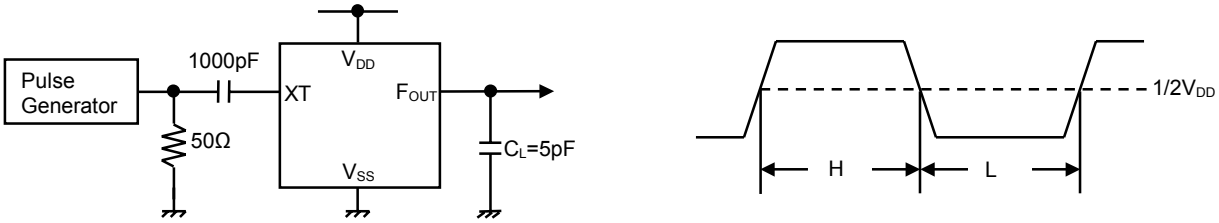
(V_{DD}=3.3V,Ta=25°C)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Operating Current	I_{DD}	A version,fosc=16MHz,C_L=5pF			1.5	mA
		B version,fosc=16MHz,C_L=5pF			1.2	
		C version,fosc=16MHz,C_L=5pF			1.0	
		D version,fosc=16MHz,C_L=5pF			1.0	
		E version,fosc=16MHz,C_L=5pF			1.0	
		F version,fosc=16MHz,C_L=5pF			1.0	
Oscillation Stopping Current	I_{STB}	$\overline{CONT}$=V_{SS}, No load			1	uA
Stand-by Current	Ist	$\overline{CONT}$=XT=V_{SS}, No load Note4)			1	uA
Input Voltage	V_{IH}		2.31		3.3	V
	V_{IL}		0		0.99	V
Output Current	I_{OH}	V_{OH}=2.97V	1.5			mA
	I_{OL}	V_{OL}=0.33V	1.5			mA
Input Current	I_{IN}	$\overline{CONT}$=0.8V_{DD}		6.5	10	uA
		$\overline{CONT}$=0.2V_{DD}		0.5	1	uA
3-state Off Leakage Current	I_{OZ}	$\overline{CONT}$=V_{SS}, F_{OUT}= V_{DD} or V_{SS}			±0.1	uA
Feedback Resistance	Rf			255		kΩ
Internal Capacitor	Cg/Cd	fosc=16MHz		8/9		pF
Maximum Oscillation Frequency	F_{MAX}		32			MHz
Output Signal Symmetry	SYM	C_L=5pF, @V_{DD}/2	45	50	55	%
Output Signal Rise Time	tr	C_L=5pF,10% to 90%		3	6	ns
Output Signal Fall Time	tf	C_L=5pF,90% to 10%		3	6	ns
Output Disable time	t_{PLZ}	C_L=5pF,R_{UP}=10kΩ			150	ns
Output Enable Time	t_{PZL}	C_L=5pF,R_{UP}=10kΩ			150	ns

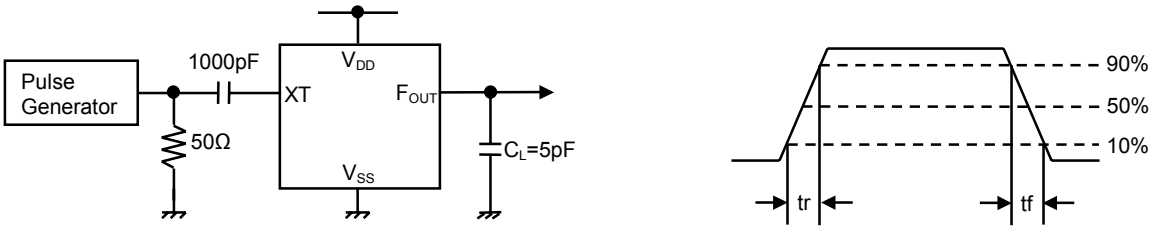
Note4) Excluding input current on $\overline{CONT}$ Terminal.

■MEASUREMENT CIRCUITS

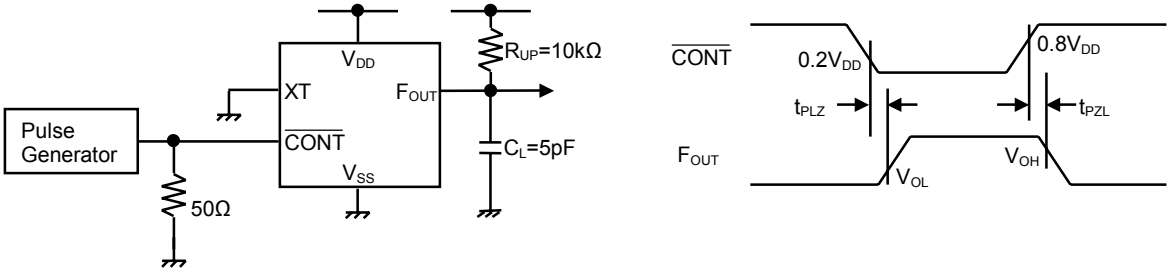
(1)Output Signal Symmetry(C_L=5pF)



(2)Output Signal Rise/Fall Time(C_L=5pF)

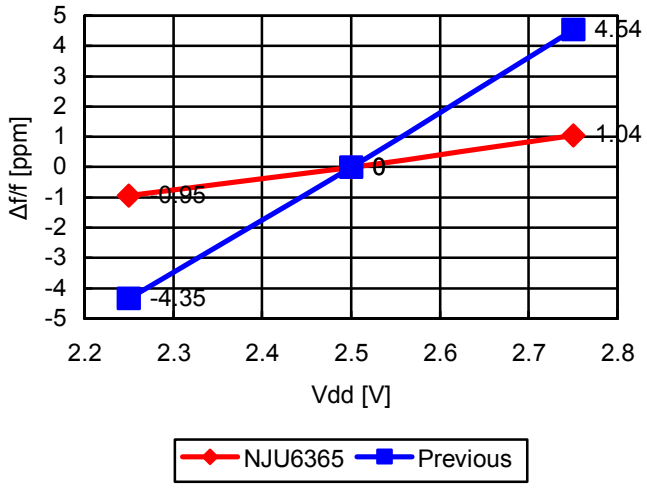


(3)Output Disable/Enable Time(C_L=5pF,R_{UP}=10kΩ)

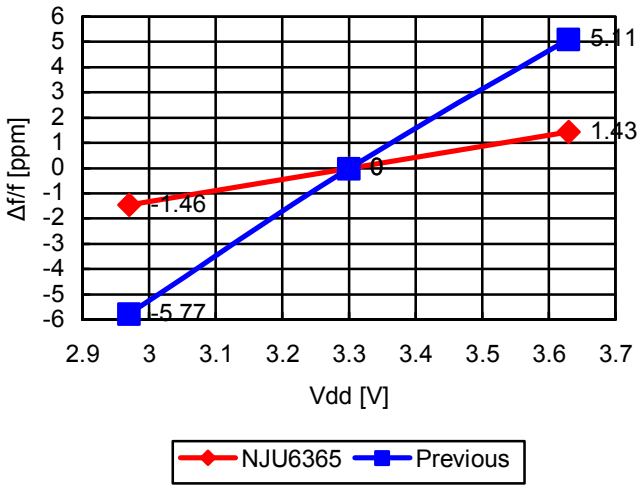


■FREQUENCY STABILITY CHARACTERISTICS EXAMPLE

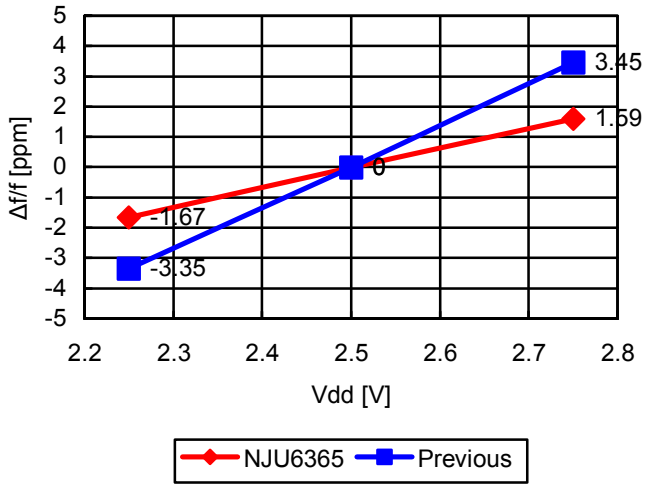
fcenter=16MHz, Vdd=2.5V±10%



fcenter=16MHz,Vdd=3.3V±10%



fcenter=32MHz, Vdd=2.5V±10%



fcenter=32MHz, Vdd=3.3V±10%