

# NBXSBB022, NBXSBA022

## 3.3 V, 187.5 MHz LVPECL Clock Oscillator

The NBXSBB022/NBXSBA022 single frequency crystal oscillator (XO) is designed to meet today's requirements for 3.3 V LVPECL clock generation applications. The device uses a high Q fundamental crystal and Phase Lock Loop (PLL) multiplier to provide 187.5 MHz, ultra low jitter and phase noise LVPECL differential output.

This device is a member of ON Semiconductor's PureEdge™ clock family that provides accurate and precision clock solutions.

Available in 5 mm x 7 mm SMD (CLCC) package on 16 mm tape and reel in quantities of 1,000. Frequency stability option available as either 50 PPM NBXSBA022 or 20 PPM NBXSBB022.

### Features

- LVPECL Differential Output
- Uses High Q Fundamental Mode Crystal and PLL Multiplier
- Ultra Low Jitter and Phase Noise – 0.4 ps (12 kHz – 20 MHz)
- Hermetically Sealed Ceramic SMD Package
- RoHS Compliant
- Operating Range 3.3 V  $\pm$ 10%
- Total Frequency Stability –  $\pm$ 20 PPM or  $\pm$ 50 PPM

### Applications

- 12 Gb/s Ethernet Clock

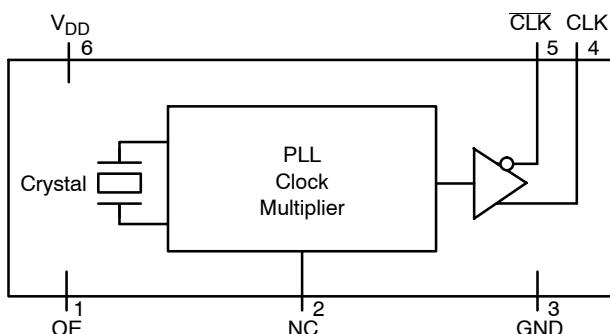
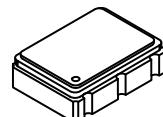


Figure 1. Simplified Logic Diagram



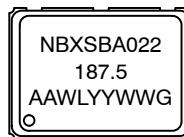
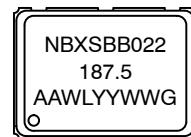
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<http://onsemi.com>



6 PIN CLCC  
TBD SUFFIX  
CASE 848AB

### MARKING DIAGRAMS



NBXSBB022 = NBXSBB022 ( $\pm$ 20 PPM)\*  
NBXSBA022 = NBXSBA022 ( $\pm$ 50 PPM)  
187.5 = Output Frequency (MHz)  
AA = Assembly Location  
WL = Wafer Lot  
YY = Year  
WW = Work Week  
G = Pb-Free Package

### ORDERING INFORMATION

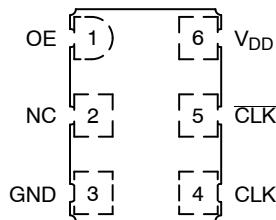
Device	Package	Shipping <sup>†</sup>
NBXSBB022LN1TAG*	CLCC-6 (Pb-Free)	1000/ Tape & Reel
NBXSBA022LN1TAG	CLCC-6 (Pb-Free)	1000/ Tape & Reel
NBXSBA022LNHTAG	CLCC-6 (Pb-Free)	100/ Tape & Reel

<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

\* Please contact factory for availability

This document contains information on a product under development. ON Semiconductor reserves the right to change or discontinue this product without notice.

## NBXSBB022, NBXSBA022



**Figure 2. Pin Connections (Top View)**

**Table 1. PIN DESCRIPTION**

Pin No.	Symbol	I/O	Description
1	OE	LVTT/LVCMOS Control Input	Output Enable Pin. When left floating pin defaults to logic HIGH and output is active. See OE pin description Table 2.
2	NC	-	No Connect.
3	GND	Power Supply	Ground 0 V.
4	CLK	LVPECL Output	Non-Inverted Clock Output. Typically loaded with 50 $\Omega$ receiver termination resistor to $V_{TT} = V_{DD} - 2$ V.
5	CLK	LVPECL Output	Non-Inverted Clock Output. Typically loaded with 50 $\Omega$ receiver termination resistor to $V_{TT} = V_{DD} - 2$ V.
6	$V_{DD}$	Power Supply	Positive power supply voltage. Voltage should not exceed 3.3 V $\pm 10\%$ .

**Table 2. OUTPUT ENABLE TRI-STATE FUNCTION**

OE Pin	Output Pins
Open	Active
HIGH Level	Active
LOW Level	High Z

**Table 3. ATTRIBUTES**

Characteristic	Value
Input Default State Resistor	170 k $\Omega$
ESD Protection	Human Body Model Machine Model
Meets or Exceeds JEDEC Standard EIA/JESD78 IC Latchup Test	

1. For additional Moisture Sensitivity information, refer to Application Note AND8003/D.

**Table 4. MAXIMUM RATINGS**

Symbol	Parameter	Condition 1	Condition 2	Rating	Units
$V_{DD}$	Positive Power Supply	$GND = 0$ V		4.6	V
$I_{out}$	LVPECL Output Current	Continuous Surge		25 50	mA
$T_A$	Operating Temperature Range			-40 to +85	°C
$T_{stg}$	Storage Temperature Range			-55 to +120	°C
$T_{sol}$	Wave Solder	See Figure 5		260	°C

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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**Table 5. DC CHARACTERISTICS** ( $V_{DD} = 3.3\text{ V} \pm 10\%$ ,  $GND = 0\text{ V}$ ,  $T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ )

Symbol	Characteristic	Conditions	Min.	Typ.	Max.	Units
$I_{DD}$	Power Supply Current (Note 2)			80	100	mA
$V_{IH}$	OE Input HIGH Voltage		2000		$V_{DD}$	mV
$V_{IL}$	OE Input LOW Voltage		GND – 300		800	mV
$I_{IH}$	Input HIGH Current OE		–100		+100	$\mu\text{A}$
$I_{IL}$	Input LOW Current OE		–100		+100	$\mu\text{A}$
$V_{OH}$	Output HIGH Voltage (Note 2)	$V_{DD} = 3.3\text{ V}$	$V_{DD} = 1145$ 2155		$V_{DD} = 895$ 2405	mV
$V_{OL}$	Output LOW Voltage (Note 2)	$V_{DD} = 3.3\text{ V}$	$V_{DD} = 1945$ 1355		$V_{DD} = 1600$ 1700	mV
$V_{OUTPP}$	Output Voltage Amplitude (Note 2)			680		mV

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

2. Measurement taken with outputs terminated with 50 ohm to  $V_{DD}$ –2 V.

**Table 6. AC CHARACTERISTICS** ( $V_{DD} = 3.3\text{ V} \pm 10\%$ ,  $GND = 0\text{ V}$ ,  $T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ ) (Note 3)

Symbol	Characteristic	Conditions	Min.	Typ.	Max.	Units
$f_{CLKOUT}$	Output Clock Frequency			187.5		MHz
$\Delta f$	Frequency Stability – NBXSBB022 – NBXSBA022	$0^\circ\text{C}$ to $+70^\circ\text{C}$ $-40^\circ\text{C}$ to $+85^\circ\text{C}$ (Note 4)			$\pm 20$ $\pm 50$	PPM
$\Phi_{NOISE}$	Phase–Noise Performance $f_{CLKout} = 187.5\text{ MHz}$	100 Hz of Carrier		–102		$\text{dBc/Hz}$
		1 kHz of Carrier		–118		$\text{dBc/Hz}$
		10 kHz of Carrier		–125		$\text{dBc/Hz}$
		100 kHz of Carrier		–126		$\text{dBc/Hz}$
		1 MHz of Carrier		–135		$\text{dBc/Hz}$
		10 MHz of Carrier		–160		$\text{dBc/Hz}$
$t_{jit}(\Phi)$	RMS Phase Jitter	12 kHz to 20 MHz		0.4	0.9	ps
$t_{jitter}$	Cycle to Cycle, RMS	1000 Cycles		2.1	10	ps
	Cycle to Cycle, Peak-to–Peak	1000 Cycles		13	35	ps
	Period, RMS	10,000 Cycles		1.4	5	ps
	Period, Peak-to–Peak	10,000 Cycles		8	25	ps
$t_{OE/OD}$	Output Enable/Disable Time				200	ns
$t_{DUTY\_CYCLE}$	Output Clock Duty Cycle (Measured at Cross Point)		48	50	52	%
$t_R$	Output Rise Time (20% and 80%)			250		ps
$t_F$	Output Fall Time (80% and 20%)			250		ps
$t_{start}$	Start–up Time			1	5	ms
	Aging	1 <sup>st</sup> Year			3	ppm
		Every Year After 1 <sup>st</sup>			1	ppm

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

3. Measurement taken with outputs terminated with 50 ohm to  $V_{DD}$ –2 V.

4. Parameter guarantees 10 years of aging. Includes initial stability at  $25^\circ\text{C}$ , shock, vibration, and first year aging.

## NBXSBB022, NBXSBA022

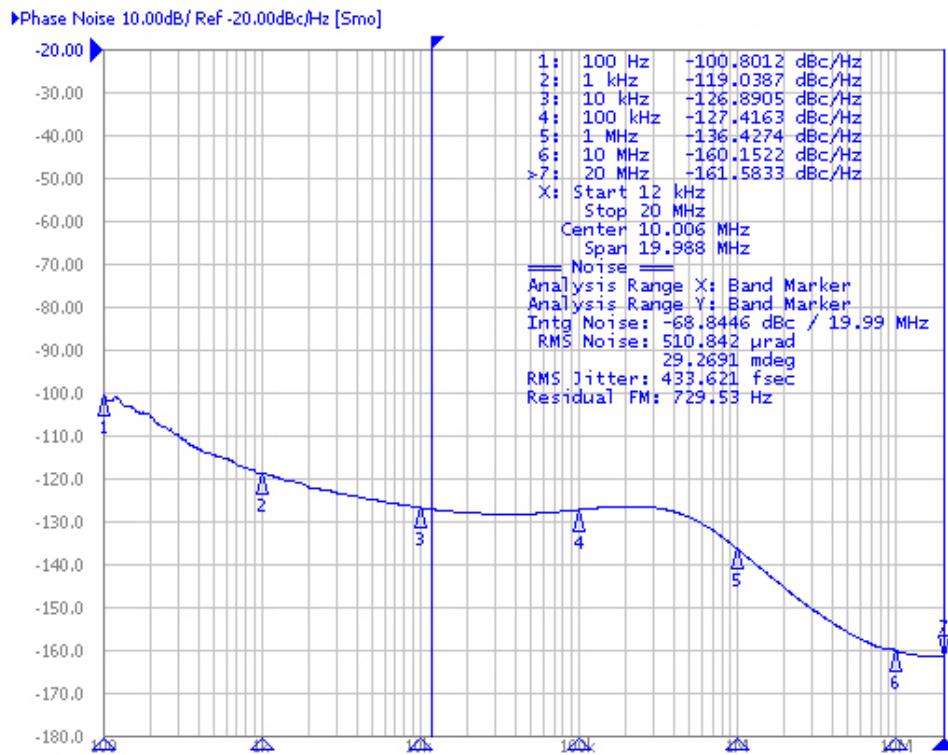
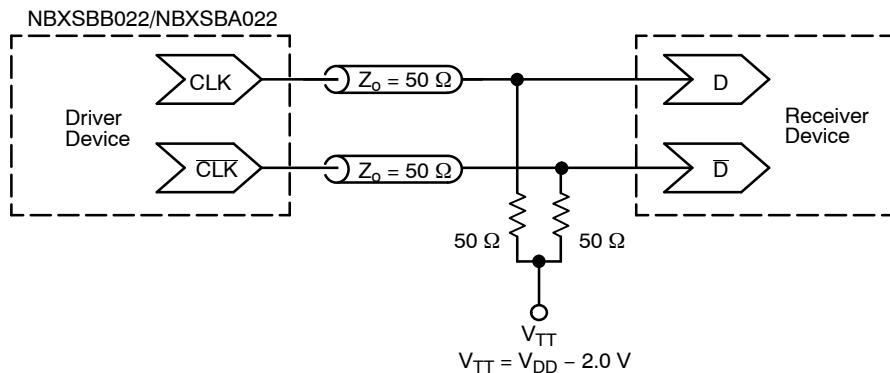


Figure 3. Typical Phase Noise Plot

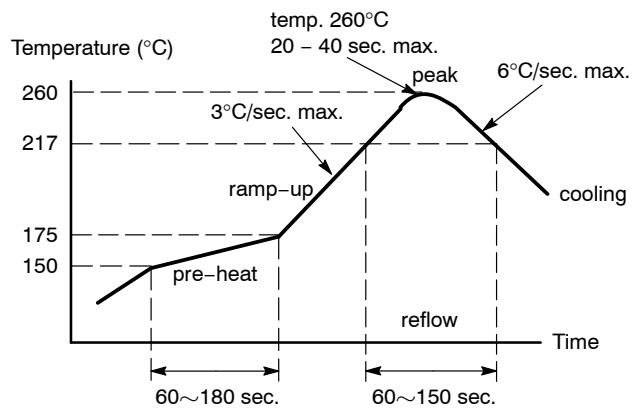
Table 7. RELIABILITY COMPLIANCE

Parameter	Standard	Method
Shock	Mechanical	MIL-STD-833, Method 2002, Condition B
Solderability	Mechanical	MIL-STD-833, Method 2003
Vibration	Mechanical	MIL-STD-833, Method 2007, Condition A
Solvent Resistance	Mechanical	MIL-STD-202, Method 215
Thermal Shock	Environment	MIL-STD-833, Method 1011, Condition A
Moisture Level Sensitivity	Environment	MSL1 260°C per IPC/JEDEC J-STD-020D

## NBXSBB022, NBXSBA022

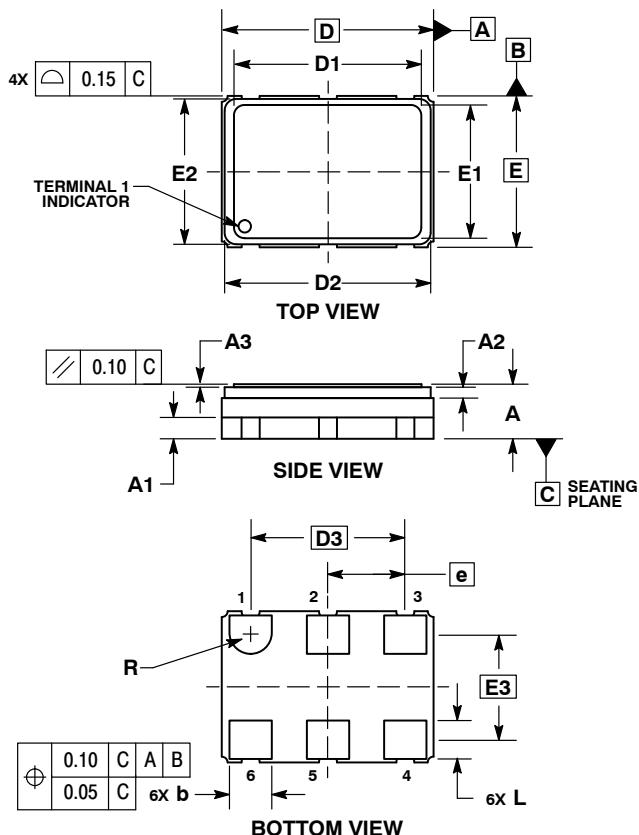


**Figure 4. Typical Termination for Output Driver and Device Evaluation  
(See Application Note AND8020/D – Termination of ECL Logic Devices.)**



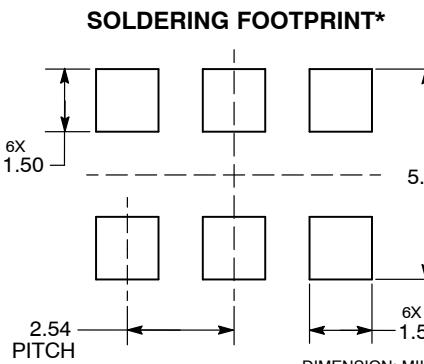
**Figure 5. Recommended Reflow Soldering Profile**

## PACKAGE DIMENSIONS

6 PIN CLCC, 7x5, 2.54P  
CASE 848AB-01  
ISSUE A

NOTES:  
 1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.  
 2. CONTROLLING DIMENSION: MILLIMETERS.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	1.70	1.80	1.90
A1	0.70	REF	
A2	0.36	REF	
A3	0.08	0.10	0.12
b	1.30	1.40	1.50
D	7.00	BS	C
D1	6.17	6.20	6.23
D2	6.66	6.81	6.96
D3	5.08	BS	C
E	5.00	BS	C
E1	4.37	4.40	4.43
E2	4.65	4.80	4.95
E3	3.49	BS	C
e	2.54	BS	C
L	1.17	1.27	1.37
R	0.70	REF	



\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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