

# NBXDBB017, NBXDBA017, NBXHBA017, NBXSBA017

## 3.3 V, 156.25 MHz / 312.5 MHz LVPECL Clock Oscillator

The single and dual 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 selectable 156.25 MHz or 312.5 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 options available as either 50 PPM NBXDBA017, NBXSBA017, NBXHBA017 (Industrial Temperature Range) or 20 PPM NBXDBB017 (Commercial Temperature Range).

### 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)
- Selectable Output Frequency – 156.25 MHz (default) / 312.5 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
- This is a Pb-Free Device

### Applications

- Networking
- 10 Gigabit Ethernet

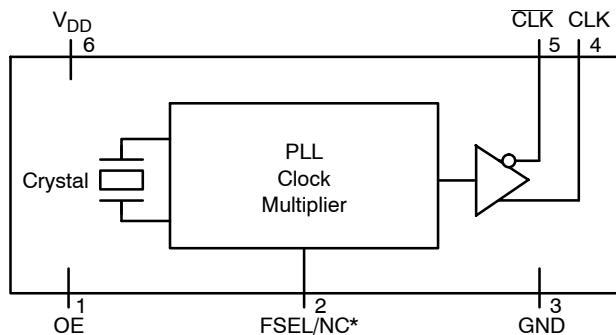


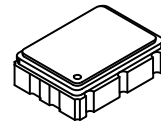
Figure 1. Simplified Logic Diagram

\* NBXSBA017 and NBXHBA017 only



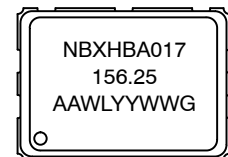
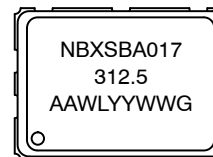
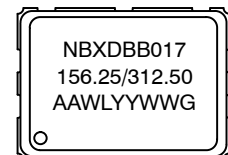
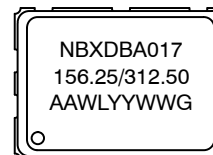
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6 PIN CLCC  
LN SUFFIX  
CASE 848AB

### MARKING DIAGRAMS



156.25/312.5 = Output Frequency (MHz)  
AA = Assembly Location  
WL = Wafer Lot  
YY = Year  
WW = Work Week  
G = Pb-Free Package

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

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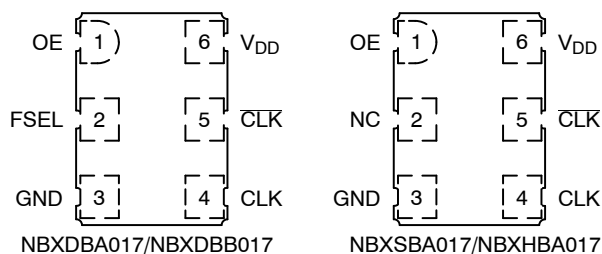


Figure 2. Pin Connections (Top View)

Table 1. PIN DESCRIPTION

Pin No.	Symbol	I/O	Description
1	OE	LVTTTL/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	FSEL/ NC*	LVTTTL/LVCMOS Control Input	Output Frequency Select Pin. Pin will default to logic HIGH when left open. See Output Frequency Select pin description Table 3.
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	$\overline{\text{CLK}}$	LVPECL Output	Inverted Clock Output. Typically loaded with 50 $\Omega$ receiver termination resistor to $V_{TT} = V_{DD} - 2 V$ .
6	V <sub>DD</sub>	Power Supply	Positive power supply voltage. Voltage should not exceed 3.3 V $\pm$ 10%.

\*NBXSBA017 and NBXHBA017 only.

Table 2. OUTPUT ENABLE TRI-STATE FUNCTION

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

Table 3. OUTPUT FREQUENCY SELECT

FSEL Pin	Output Frequency (MHz)
Open (pin will float high)	156.25
HIGH Level	156.25
LOW Level	312.5

Table 4. ATTRIBUTES

Characteristic	Value
Input Default State Resistor	170 k $\Omega$
ESD Protection	Human Body Model Machine Model 2 kV 200 V
Meets or Exceeds JEDEC Standard EIA/JESD78 IC Latchup Test	

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

Table 5. MAXIMUM RATINGS

Symbol	Parameter	Condition 1	Condition 2	Rating	Units
V <sub>DD</sub>	Positive Power Supply	GND = 0 V		4.6	V
I <sub>out</sub>	LVPECL Output Current	Continuous Surge		25 50	mA
T <sub>A</sub>	Operating Temperature Range			-40 to +85	$^{\circ}\text{C}$
T <sub>stg</sub>	Storage Temperature Range			-55 to +120	$^{\circ}\text{C}$
T <sub>sol</sub>	Wave Solder	See Figure 6		260	$^{\circ}\text{C}$

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 6. DC CHARACTERISTICS** ( $V_{DD} = 3.3 \text{ V} \pm 10\%$ ,  $GND = 0 \text{ V}$ ,  $T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ ) (Note 2)

Symbol	Characteristic	Conditions	Min.	Typ.	Max.	Units
$I_{DD}$	Power Supply Current (Note 2)			78	100	mA
$V_{IH}$	OE and FSEL Input HIGH Voltage		2000		$V_{DD}$	mV
$V_{IL}$	OE and FSEL Input LOW Voltage		$GND - 300$		800	mV
$I_{IH}$	Input HIGH Current	OE	-100		+100	$\mu\text{A}$
		FSEL	-100		+100	
$I_{IL}$	Input LOW Current	OE	-100		+100	$\mu\text{A}$
		FSEL	-100		+100	
$V_{OH}$	Output HIGH Voltage (Note 2)	$V_{DD} = 3.3 \text{ V}$	$V_{DD}-1195$ 2105		$V_{DD}-945$ 2355	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)			660		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 lpm. 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  $V_{DD}-2 \text{ V}$ . See Figure 5.

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**Table 7. 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	FSEL = HIGH		156.25		MHz
		FSEL = LOW		312.5		
$\Delta f$	Frequency Stability – NBXDBB017 – NBXDBA017/NBXSBA017/NBXHBA017	$0^\circ\text{C}$ 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 $f_{CLKout} = 156.25\text{ MHz}/312.5\text{ MHz}$ (See Figures 3 and 4)	100 Hz of Carrier		–108/–102		dBc/Hz
		1 kHz of Carrier		–122/–115		dBc/Hz
		10 kHz of Carrier		–129/–122		dBc/Hz
		100 kHz of Carrier		–129/–122		dBc/Hz
		1 MHz of Carrier		–137/–131		dBc/Hz
		10 MHz of Carrier		–161/–159		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		1	8	ps
	Cycle–to–Cycle, Peak–to–Peak	1000 Cycles		7	30	ps
	Period, RMS	10,000 Cycles		0.6	4	ps
	Period, Peak–to–Peak	10,000 Cycles		5	20	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	400	ps
$t_F$	Output Fall Time (80% and 20%)			250	400	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  $V_{DD}-2\text{ V}$ . See Figure 5.
4. Parameter guarantees 10 years of aging. Includes initial stability at  $25^\circ\text{C}$ , shock, vibration, and first year aging.

# NBXDBB017, NBXDBA017, NBXHBA017, NBXSBA017

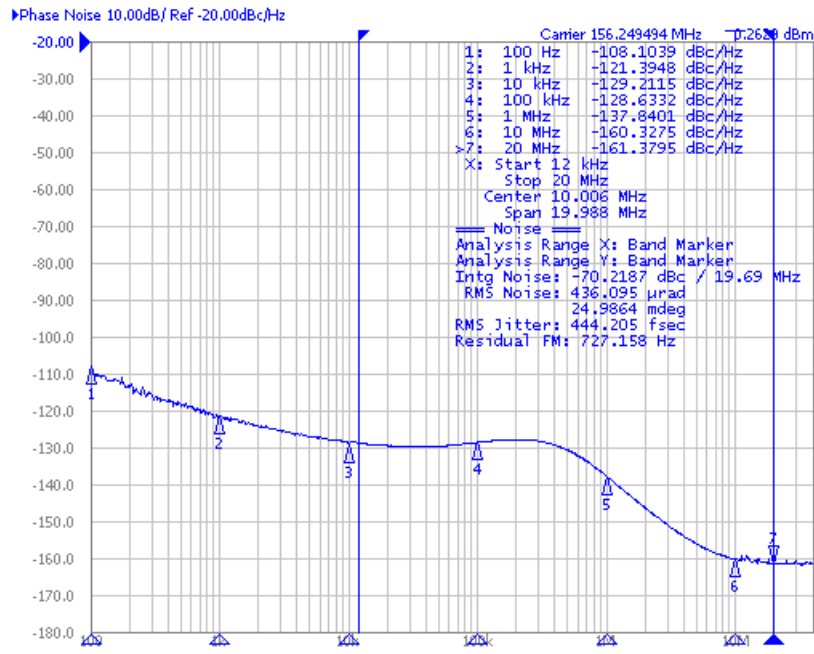


Figure 3. Typical Phase Noise Plot at 156.25 MHz

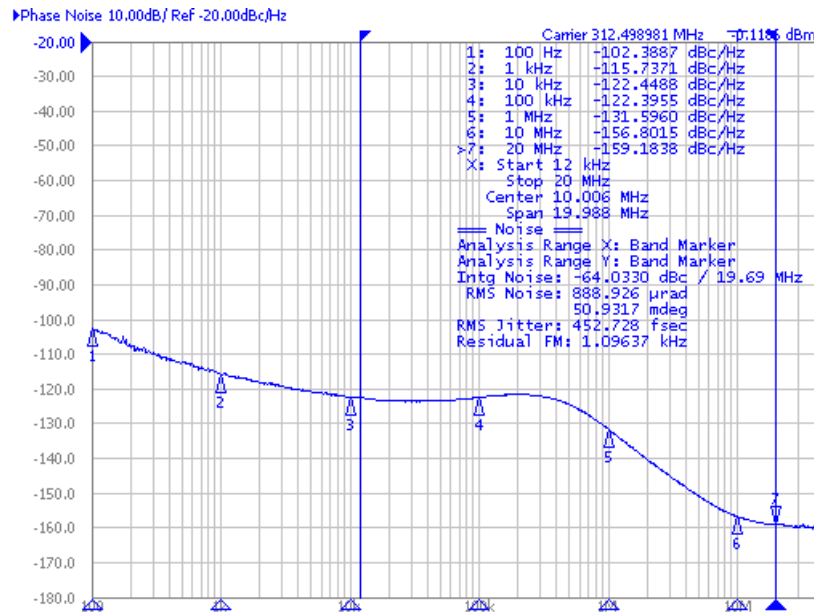


Figure 4. Typical Phase Noise Plot at 312.5 MHz

Table 8. 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

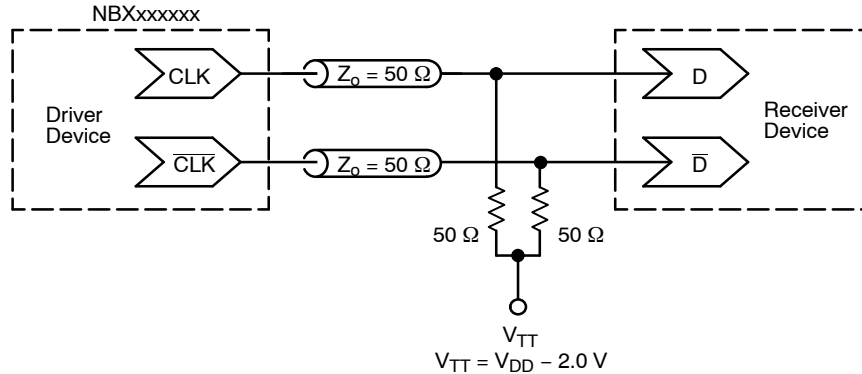


Figure 5. Typical Termination for Output Driver and Device Evaluation  
(See Application Note AND8020/D – Termination of ECL Logic Devices.)

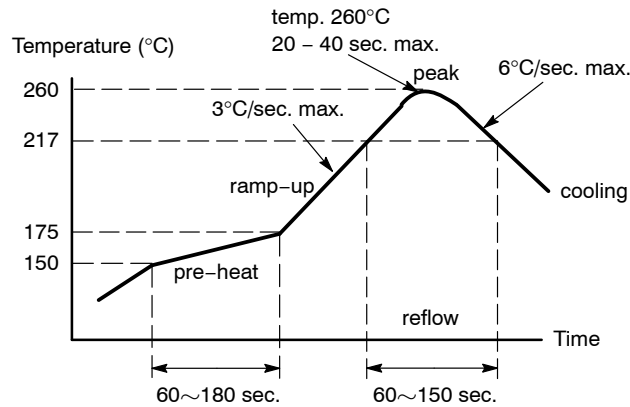


Figure 6. Recommended Reflow Soldering Profile

## NBXDBB017, NBXDBA017, NBXHBA017, NBXSBA017

### ORDERING INFORMATION

Device Order Number	Package Type	Shipping†
NBXDBB017LN1TAG	CLCC-6 (Pb-Free)	1000 / Tape & Reel
NBXDBA017LN1TAG	CLCC-6 (Pb-Free)	1000 / Tape & Reel
NBXSBA017LN1TAG	CLCC-6 (Pb-Free)	1000 / Tape & Reel
NBXHBA017LN1TAG*	CLCC-6 (Pb-Free)	1000 / Tape & Reel
NBXDBB017LNHTAG	CLCC-6 (Pb-Free)	100 / Tape & Reel
NBXDBA017LNHTAG	CLCC-6 (Pb-Free)	100 / Tape & Reel
NBXSBA017LNHTAG	CLCC-6 (Pb-Free)	100 / Tape & Reel
NBXHBA017LNHTAG*	CLCC-6 (Pb-Free)	100 / Tape & Reel

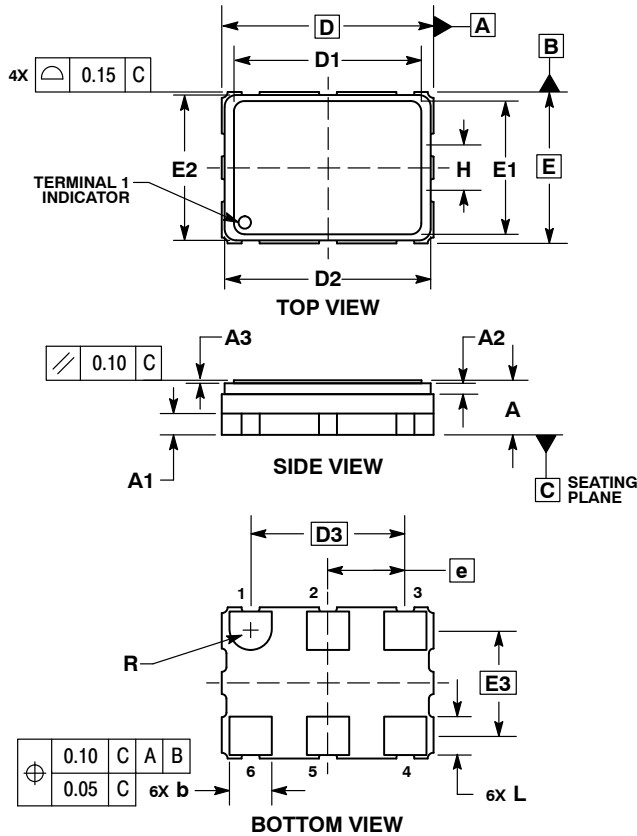
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*Please contact sales office for availability

# NBXDBB017, NBXDBA017, NBXHBA017, NBXSBA017

## PACKAGE DIMENSIONS

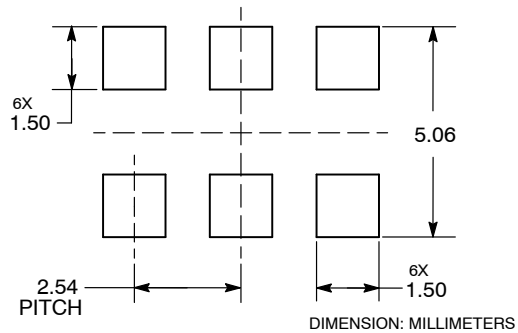
6 PIN CLCC, 7x5, 2.54P  
CASE 848AB-01  
ISSUE C



- 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 BSC		
D1	6.17	6.20	6.23
D2	6.66	6.81	6.96
D3	5.08 BSC		
E	5.00 BSC		
E1	4.37	4.40	4.43
E2	4.65	4.80	4.95
E3	3.49 BSC		
e	2.54 BSC		
H	1.80 REF		
L	1.17	1.27	1.37
R	0.70 REF		

### SOLDERING FOOTPRINT\*



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

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