

# NBVSBA011/D

## 2.5 V/3.3 V, LVPECL Voltage-Controlled Crystal Oscillator (VCXO) PureEdge™ Product Series

The NBVSBA011/D series voltage-controlled crystal oscillator (VCXO) devices are designed to meet today's requirements for 2.5 V and 3.3 V LVPECL clock generation applications. These devices use a high Q fundamental mode crystal and Phase Locked Loop (PLL) multiplier to provide a wide range of frequencies from 60 MHz to 700 MHz (factory configurable per user specifications) with a pullable range of  $\pm 100$  ppm and a frequency stability of  $\pm 50$  ppm. The silicon-based PureEdge™ products design provides users with exceptional frequency stability and reliability. They produce an ultra low jitter and phase noise LVPECL differential output.

The NBVSBA011/D series are members of ON Semiconductor's PureEdge™ clock family that provides accurate and precision clock generation solutions.

Available in the industry standard 5.0 x 7.0 x 1.8 mm and in a new 3.2 x 5.0 x 1.2 mm SMD (CLCC) package on 16 mm tape and reel in quantities of 1,000.

### Features

- LVPECL Differential Output
- Operating Range: 2.5 V  $\pm 5\%$ , 3.3 V  $\pm 10\%$
- Ultra Low Jitter and Phase Noise – 0.5 ps (12 kHz – 20 MHz)
- Factory Configurable Frequencies from 60 MHz to 700 MHz (see Standard Frequencies in the Ordering Information Table in page 6)
- Pullable Range Minimum of  $\pm 100$  ppm
- Frequency Stability of  $\pm 50$  ppm
- Control Voltage with Positive Slope
- Voltage Control Linearity of  $\pm 10\%$
- Uses High Q Fundamental Mode Crystal
- Hermetically Sealed Ceramic SMD Package
- These Devices are Pb-Free and RoHS Compliant

### Applications

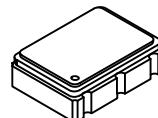
- Networking
- SONET
- 10 Gigabit Ethernet
- Networking Base Stations
- Broadcasting



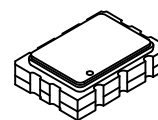
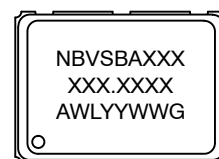
ON Semiconductor®

<http://onsemi.com>

### MARKING DIAGRAM



6 PIN CLCC  
LN SUFFIX  
CASE 848AB



6 PIN CLCC  
LU SUFFIX  
CASE 848AC



NBVSBA011/D = NBVSBA011/D ( $\pm 50$  ppm)  
XXX.XXXX = Output Frequency (MHz)  
A = 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 6 of this data sheet.

## NBVSBAxxx Series

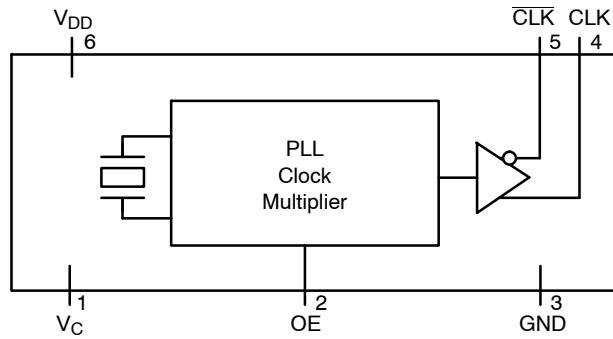


Figure 1. Simplified Logic Diagram

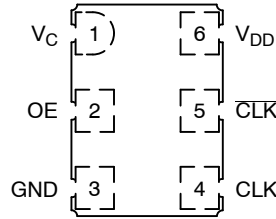


Figure 2. Pin Connections (Top View)

Table 1. PIN DESCRIPTION

| Pin No. | Symbol                  | I/O                        | Description                                                                                                                     |
|---------|-------------------------|----------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| 1       | V <sub>C</sub> (Note 1) | Analog Input               | Analog control voltage input pin that adjusts output oscillation frequency. $f_0 = V_C = 1.65 \text{ V}$                        |
| 2       | OE                      | LVTTL/LVCMOS Control Input | Output Enable Pin. When left floating pin defaults to logic HIGH and output is active. See OE pin description Table 2.          |
| 3       | GND                     | Power Supply               | Ground at 0 V. Electrical and Case Ground.                                                                                      |
| 4       | CLK                     | LVPECL Output              | Non-Inverted Clock Output. Typically loaded with 50 $\Omega$ receiver termination resistor to $V_{TT} = V_{DD} - 2 \text{ V}$ . |
| 5       | $\overline{\text{CLK}}$ | LVPECL Output              | Inverted Clock Output. Typically loaded with 50 $\Omega$ receiver termination resistor to $V_{TT} = V_{DD} - 2 \text{ V}$ .     |
| 6       | V <sub>DD</sub>         | Power Supply               | Positive Power Supply Voltage. Voltage should not exceed 2.5 V $\pm 5\%$ and 3.3 V $\pm 10\%$ .                                 |

1. Control voltage has a positive slope with a linearity of  $\pm 10\%$ ;  $V_C = 1.65 \text{ V} \pm 1 \text{ V}$ .

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          |
|------------------------------------------------------------|----------------|
| Internal Default State Resistor                            | 170 k $\Omega$ |
| ESD Protection Human Body Model<br>Machine Model           | 2 kV<br>200 V  |
| Meets or Exceeds JEDEC Standard EIA/JESD78 IC Latchup Test |                |

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

## NBVSBAXXX Series

**Table 4. MAXIMUM RATINGS**

| Symbol    | Parameter                     | Condition 1      | Condition 2                                                                        | Rating      | Units |
|-----------|-------------------------------|------------------|------------------------------------------------------------------------------------|-------------|-------|
| $V_{DD}$  | Positive Power Supply         | GND = 0 V        |                                                                                    | 4.6         | V     |
| $V_{IN}$  | Control Input ( $V_C$ and OE) |                  | $V_{IN} \leq V_{DD} + 200 \text{ mV}$<br>$V_{IN} \geq \text{GND} - 200 \text{ mV}$ |             | V     |
| $I_{out}$ | LVPECL Output Current         | Continuous Surge |                                                                                    | 25<br>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 4     |                                                                                    | 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.

**Table 5. DC CHARACTERISTICS** ( $V_{DD} = 2.5 \text{ V} \pm 5\%$ ;  $3.3 \text{ V} \pm 10\%$ , GND = 0 V,  $T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ ) (Note 3)

| Symbol      | Characteristic           | Conditions | Min.          | Typ. | Max.          | Units         |
|-------------|--------------------------|------------|---------------|------|---------------|---------------|
| $I_{DD}$    | Power Supply Current     |            |               | 90   | 110           | mA            |
| $V_{IH}$    | Input HIGH Voltage OE    |            | 2000          |      | $V_{DD}$      | mV            |
| $V_{IL}$    | Input LOW Voltage OE     |            | GND - 200     |      | 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      |            | $V_{DD}-1195$ |      | $V_{DD}-945$  | mV            |
| $V_{OL}$    | Output LOW Voltage       |            | $V_{DD}-1945$ |      | $V_{DD}-1600$ | mV            |
| $V_{OUTPP}$ | Output Voltage Amplitude |            |               | 700  |               | 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.

3. Measurement taken with outputs terminated with  $50 \Omega$  to  $V_{DD} - 2.0 \text{ V}$ . See Figure 3.

## NBVSBAXXX Series

**Table 6. AC CHARACTERISTICS** ( $V_{DD} = 2.5 \pm 5\%$ ,  $V_{DD} = 3.3 \pm 10\%$ ,  $GND = 0\text{ V}$ ,  $T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ )

| Symbol            | Characteristic                                       | Conditions                       | Min.      | Typ.   | Max.     | Units |
|-------------------|------------------------------------------------------|----------------------------------|-----------|--------|----------|-------|
| $f_{CLKOUT}$      | Output Clock Frequency                               | NBVSBA011                        |           | 122.88 |          | MHz   |
|                   |                                                      | NBVSBA027                        |           | 148.50 |          |       |
|                   |                                                      | NBVSBA018                        |           | 155.52 |          |       |
|                   |                                                      | NBVSBA017                        |           | 156.25 |          |       |
|                   |                                                      | NBVSBA015                        |           | 200.00 |          |       |
|                   |                                                      | NBVSBA024                        |           | 622.08 |          |       |
|                   |                                                      | NBVSBA026                        |           | 644.53 |          |       |
|                   |                                                      | NBVSBA041                        |           | 693.48 |          |       |
|                   |                                                      | NBVSBA037                        |           | 707.35 |          |       |
| $\Delta f$        | Frequency Stability                                  | (Note 5)                         |           |        | $\pm 50$ | ppm   |
| $t_{jit}(\phi)$   | RMS Phase Jitter                                     | 12 kHz to 20 MHz                 |           | 0.5    | 0.9      | ps    |
| $t_{jitter}$      | Cycle to Cycle, RMS                                  | 1000 Cycles                      |           | 2      | 8        | ps    |
|                   | Cycle to Cycle, Peak-to-Peak                         | 1000 Cycles                      |           | 10     | 30       | ps    |
|                   | Period, RMS                                          | 10,000 Cycles                    |           | 1      | 4        | ps    |
|                   | Period, Peak-to-Peak                                 | 10,000 Cycles                    |           | 6      | 20       | ps    |
| $t_{OE/OD}$       | Output Enable/Disable Time                           |                                  |           |        | 200      | ns    |
| $F_P$             | Crystal Pullability (Note 4)                         | $0 \leq V_C \leq 3.3\text{ V}$   | $\pm 100$ |        |          | ppm   |
| $V_{C(bw)}$       | Control Voltage Bandwidth                            | - 3 dB                           | 20        |        |          | KHz   |
| $t_{DUTY\_CYCLE}$ | Output Clock Duty Cycle<br>(Measured at Cross Point) |                                  | 45        | 50     | 55       | %     |
| $t_R$             | Output Rise Time (20% and 80%)                       |                                  |           | 245    | 400      | ps    |
| $t_F$             | Output Fall Time (80% and 20%)                       |                                  |           | 245    | 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        |       |

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 lfpm. 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.

4. Gain transfer is positive with a rate of 130 ppm/V.

5. Parameter guarantees 10 years of aging. Includes initial stability at 25°C, shock, vibration and first year aging.

## NBVSBAXXX Series

**Table 7. PHASE NOISE PERFORMANCE**

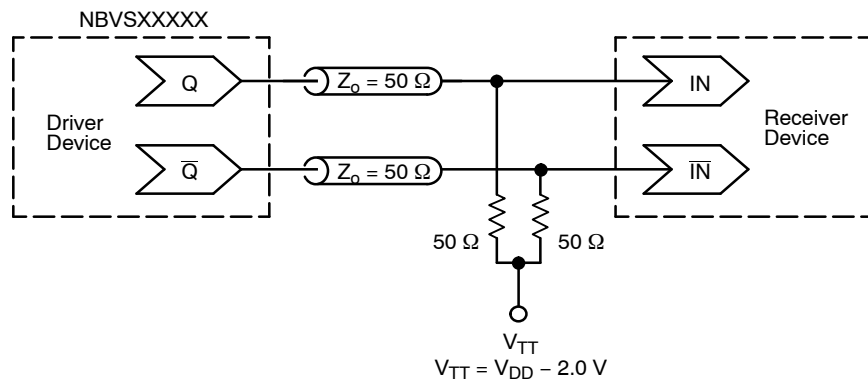
| Parameter             | Characteristic                 | Condition      | 011        | 027        | 018        | 017        | 015        | Units  |
|-----------------------|--------------------------------|----------------|------------|------------|------------|------------|------------|--------|
|                       |                                |                | 122.88 MHz | 148.50 MHz | 155.52 MHz | 156.25 MHz | 200.00 MHz |        |
| $\phi_{\text{NOISE}}$ | Output Phase-Noise Performance | 100 Hz offset  | -90        | -90        | -90        | -90        | -87        | dBc/Hz |
|                       |                                | 1 kHz offset   | -118       | -118       | -116       | -116       | -114       | dBc/Hz |
|                       |                                | 10 kHz offset  | -127       | -127       | -126       | -126       | -125       | dBc/Hz |
|                       |                                | 100 kHz offset | -127       | -127       | -126       | -126       | -125       | dBc/Hz |
|                       |                                | 1 MHz offset   | -134       | -134       | -134       | -134       | -132       | dBc/Hz |
|                       |                                | 10 MHz offset  | -160       | -160       | -160       | -160       | -158       | dBc/Hz |

**Table 8. PHASE NOISE PERFORMANCE (continued)**

| Parameter             | Characteristic                 | Condition      | 024        | 026        | 041        | 037        | Units  |
|-----------------------|--------------------------------|----------------|------------|------------|------------|------------|--------|
|                       |                                |                | 622.08 MHz | 644.53 MHz | 693.48 MHz | 707.35 MHz |        |
| $\phi_{\text{NOISE}}$ | Output Phase-Noise Performance | 100 Hz offset  | -80        | -86        | -78        | -78        | dBc/Hz |
|                       |                                | 1 kHz offset   | -106       | -107       | -105       | -105       | dBc/Hz |
|                       |                                | 10 kHz offset  | -117       | -116       | -115       | -115       | dBc/Hz |
|                       |                                | 100 kHz offset | -117       | -116       | -115       | -115       | dBc/Hz |
|                       |                                | 1 MHz offset   | -122       | -125       | -124       | -124       | dBc/Hz |
|                       |                                | 10 MHz offset  | -150       | -150       | -149       | -149       | dBc/Hz |

**Table 9. 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 3. Typical Termination for Output Driver and Device Evaluation**  
(See Application Note AND8020/D – Termination of ECL Logic Devices.)

## NBVSBAXXX Series

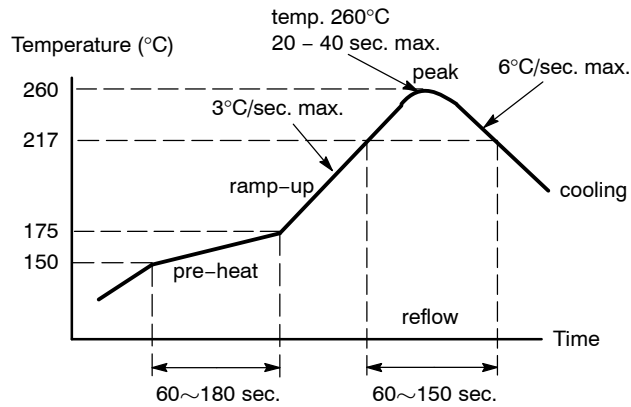


Figure 4. Recommended Reflow Soldering Profile

Table 10. ORDERING INFORMATION

| Device                    | Output Frequency (MHz) | Package         | Shipping <sup>†</sup> |
|---------------------------|------------------------|-----------------|-----------------------|
| <b>5.0 x 7.0 x 1.8 mm</b> |                        |                 |                       |
| NBVSBA011LN1TAG           | 122.88                 | CLCC-6, Pb-Free | 1000 / Tape & Reel    |
| NBVSBA027LN1TAG           | 148.50                 | CLCC-6, Pb-Free | 1000 / Tape & Reel    |
| NBVSBA018LN1TAG           | 155.52                 | CLCC-6, Pb-Free | 1000 / Tape & Reel    |
| NBVSBA017LN1TAG           | 156.25                 | CLCC-6, Pb-Free | 1000 / Tape & Reel    |
| NBVSBA015LN1TAG           | 200.00                 | CLCC-6, Pb-Free | 1000 / Tape & Reel    |
| NBVSBA024LN1TAG           | 622.08                 | CLCC-6, Pb-Free | 1000 / Tape & Reel    |
| NBVSBA026LN1TAG           | 644.53                 | CLCC-6, Pb-Free | 1000 / Tape & Reel    |
| NBVSBA037LN1TAG           | 707.35                 | CLCC-6, Pb-Free | 1000 / Tape & Reel    |
| NBVSBA041LN1TAG           | 693.48                 | CLCC-6, Pb-Free | 1000 / Tape & Reel    |
| <b>5.0 x 7.0 x 1.8 mm</b> |                        |                 |                       |
| NBVSBA011LNHTAG           | 122.88                 | CLCC-6, Pb-Free | 100 / Tape & Reel     |
| NBVSBA027LNHTAG           | 148.50                 | CLCC-6, Pb-Free | 100 / Tape & Reel     |
| NBVSBA018LNHTAG           | 155.52                 | CLCC-6, Pb-Free | 100 / Tape & Reel     |
| NBVSBA017LNHTAG           | 156.25                 | CLCC-6, Pb-Free | 100 / Tape & Reel     |
| NBVSBA015LNHTAG           | 200.00                 | CLCC-6, Pb-Free | 100 / Tape & Reel     |
| NBVSBA024LNHTAG           | 622.08                 | CLCC-6, Pb-Free | 100 / Tape & Reel     |
| NBVSBA026LNHTAG           | 644.53                 | CLCC-6, Pb-Free | 100 / Tape & Reel     |
| NBVSBA037LNHTAG           | 707.35                 | CLCC-6, Pb-Free | 100 / Tape & Reel     |
| NBVSBA041LNHTAG           | 693.48                 | CLCC-6, Pb-Free | 100 / Tape & Reel     |
| <b>3.2 x 5.0 x 1.2 mm</b> |                        |                 |                       |
| NBVSBA011LU1TAG*          | 122.88                 | CLCC-6, Pb-Free | 1000 / Tape & Reel    |
| NBVSBA027LU1TAG*          | 148.50                 | CLCC-6, Pb-Free | 1000 / Tape & Reel    |
| NBVSBA018LU1TAG*          | 155.52                 | CLCC-6, Pb-Free | 1000 / Tape & Reel    |
| NBVSBA017LU1TAG*          | 156.25                 | CLCC-6, Pb-Free | 1000 / Tape & Reel    |
| NBVSBA015LU1TAG*          | 200.00                 | CLCC-6, Pb-Free | 1000 / Tape & Reel    |

## NBVSBA000 Series

**Table 10. ORDERING INFORMATION**

| Device             | Output Frequency (MHz) | Package         | Shipping <sup>†</sup> |
|--------------------|------------------------|-----------------|-----------------------|
| 3.2 x 5.0 x 1.2 mm |                        |                 |                       |
| NBVSBA024LU1TAG*   | 622.08                 | CLCC-6, Pb-Free | 1000 / Tape & Reel    |
| NBVSBA026LU1TAG*   | 644.53                 | CLCC-6, Pb-Free | 1000 / Tape & Reel    |

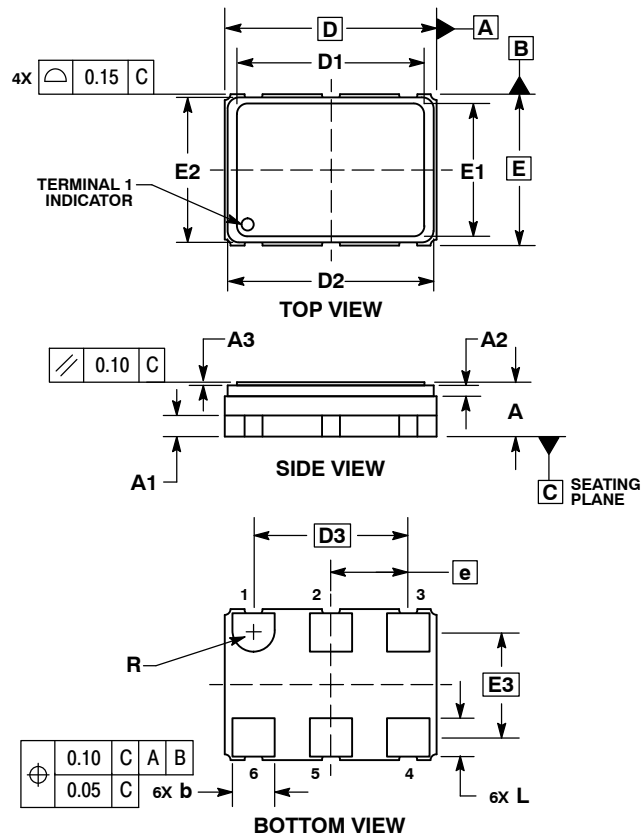
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our tape and Reel Packaging Specification Brochure, BRD8011/D.

\*Consult factory for availability.

# NBVSBAxxx Series

## PACKAGE DIMENSIONS

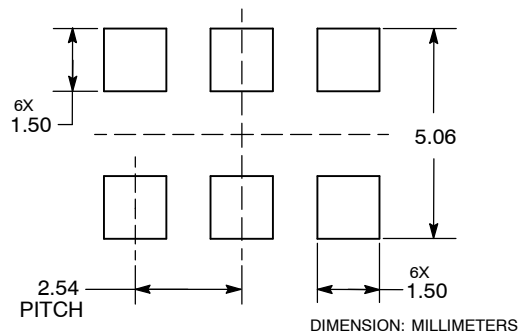
6 PIN CLCC, 7x5, 2.54P  
CASE 848AB-01  
ISSUE O



- 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    |      |      |
| L   | 1.17        | 1.27 | 1.37 |
| R   | 0.70 REF    |      |      |

### SOLDERING FOOTPRINT\*



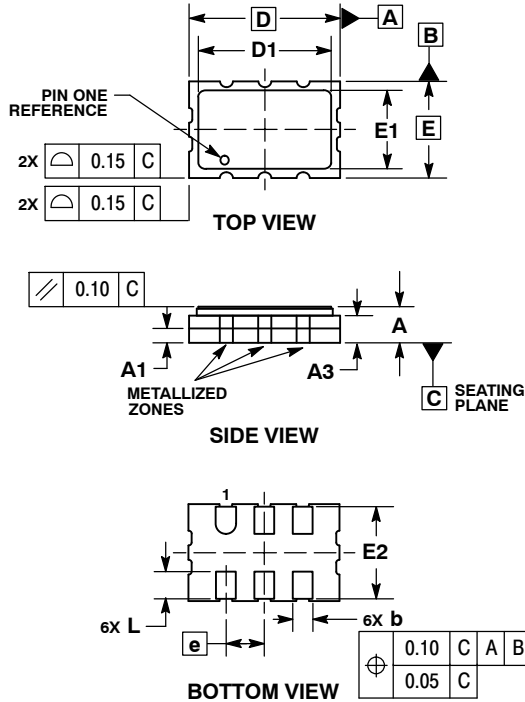
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



# NBVSBA011 Series

## PACKAGE DIMENSIONS

6 PIN CLCC, 5x3.2, 1.27P  
CASE 848AC-01  
ISSUE O

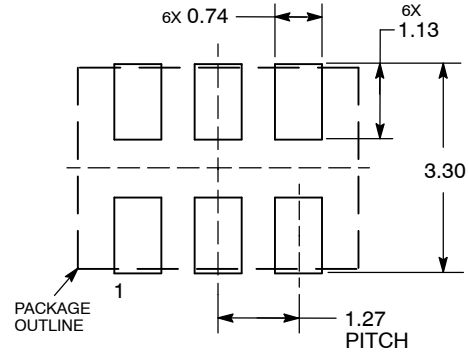


### NOTES:

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

| DIM | MIN  | MAX  |
|-----|------|------|
| A   | 1.05 | 1.35 |
| A1  | 0.35 | 0.65 |
| A3  | 0.90 | REF  |
| b   | 0.50 | 0.80 |
| D   | 5.00 | BSC  |
| D1  | 4.25 | 4.55 |
| E   | 3.20 | BSC  |
| E1  | 2.45 | 2.75 |
| E2  | 2.90 | 3.20 |
| e   | 1.27 | BSC  |
| L   | 0.75 | 1.05 |

### SOLDERING FOOTPRINT\*



DIMENSION: MILLIMETERS

\*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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