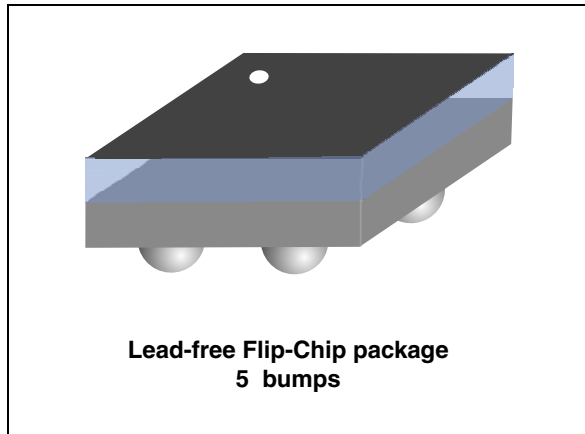


50  $\Omega$  nominal input / conjugate match balun to nRF51422-QFAA, nRF24LE1, nRF51822-QFAA/AB, with integrated harmonic filter

Datasheet – production data



## Features

- 50  $\Omega$  nominal input / conjugate match to Nordic Semiconductor chips nRF24LE1 QFN32, nRF24AP2-1CH, nRF24AP2-8CH, nRF51422-QFAA (build code CA/C0), nRF51822-QFAA (build code CA/C0) and nRF51822-QFAB (build code AA/A0)
- Low insertion loss
- Low amplitude imbalance
- Low phase imbalance
- Small footprint: < 1.5 mm<sup>2</sup>

## Benefits

- Very low profile: < 595  $\mu$ m after reflow
- High RF performance
- RF BOM and area reduction

## Applications

- 2.45 GHz impedance matched balun filter
- Optimized for Nordic's chip set nRF24LE1/AP2, nRF51422-QFAA (build code CA/C0), nRF51822-QFAA (build code CA/C0) and nRF51822-QFAB (build code AA/A0).

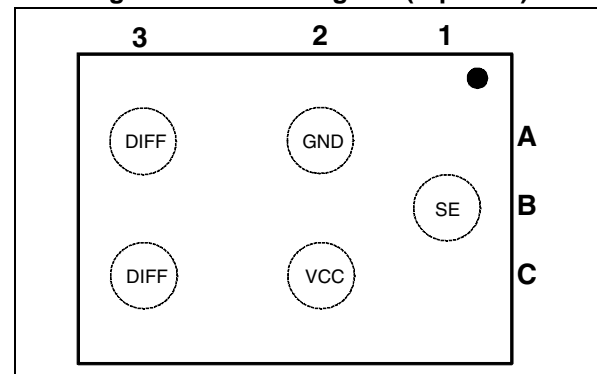
## Description

STMicroelectronics BAL-NRF01D3 is an ultraminiature balun. The BAL-NRF01D3 integrates matching network and harmonics filter. Matching impedance has been customized for the following Nordic Semiconductor circuits: nRF24LE1 QFN-32 pins, nRF24AP2-1CH, nRF24AP2-8CH, nRF51422-QFAA (build code CA/C0), nRF51822-QFAA (build code CA/C0) and nRF51822-QFAB (build code AA/A0).

The BAL-NRF01D3 uses STMicroelectronics IPD technology on non-conductive glass substrate which optimize RF performance.

The BAL-NRF01D3 has been tested and approved by Nordic Semiconductor in their nRF2723 and nRF2752 nRFgo modules.

**Figure 1. Pinout diagram (top view)**



# 1 Characteristics

**Table 1. Absolute maximum ratings (limiting values)**

| Symbol           | Parameter  | Value |      |      | Unit |
|------------------|--|-------|------|------|------|
|                  |  | Min.  | Typ. | Max. |      |
| P <sub>IN</sub>  | Input Power RFIN   |       |      | 20   | dBm  |
| V <sub>ESD</sub> | ESD ratings MIL STD883C<br>(HBM: C = 100 pF, R = 1.5 kΩ , air discharge) | 2000  |      |      | V    |
|                  | ESD ratings charge device model (JESD22-C101-C)                          | 500   |      |      |      |
|                  | ESD ratings machine model (MM: C = 200 pF, R = 25 Ω , L = 500 nH)        | 200   |      |      |      |
| T <sub>OP</sub>  | Operating temperature  | -40   |      | +105 | °C   |

**Table 2. Impedances (T<sub>amb</sub> = 25 °C)**

| Symbol           | Parameter                             | Value |  |      | Unit |
|------------------|---------------------------------------|-------|--|------|------|
|                  |                                       | Min.  | Typ.   | Max. |      |
| Z <sub>OUT</sub> | Nominal differential output impedance |       | conjugate match to:<br>– nRF24LE1/AP2<br>– nRF51422-QFAA<br>(build code CA/C0)<br>– nRF51822-QFAA<br>(build code CA/C0)<br>– nRF51822-QFAB<br>(build code AA/A0) |      | Ω    |
| Z <sub>IN</sub>  | Nominal input impedance               |       | 50   |      | Ω    |

**Table 3. RF performance (T<sub>amb</sub> = 25 °C)**

| Symbol           | Parameter                   | Test condition | Value |      |      | Unit |
|------------------|-----------------------------|----------------|-------|------|------|------|
|                  |                             |                | Min.  | Typ. | Max. |      |
| F                | Frequency range (bandwidth) |                | 2400  |      | 2540 | MHz  |
| I <sub>L</sub>   | Insertion loss in bandwidth |                |       | 2.25 |      | dB   |
| R <sub>L</sub>   | Return loss in bandwidth    |                |       | 10   |      | dB   |
| Φ <sub>imb</sub> | Phase imbalance             |                |       | 3    |      | °    |
| A <sub>imb</sub> | Amplitude imbalance         |                |       | 0.1  |      | dB   |
| 2f <sub>0</sub>  | 2nd harmonic filtering      | 4880 MHz       |       | 10   |      | dB   |
| 3f <sub>0</sub>  | 3rd harmonic filtering      | 7320 MHz       |       | 20   |      | dB   |

### 1.1 On-board simulations

Figure 2. Transmission ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

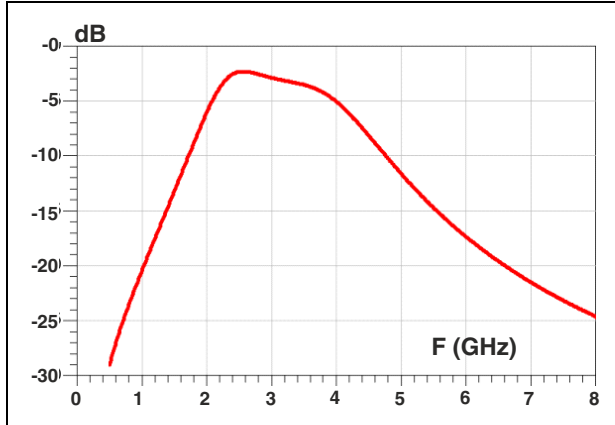


Figure 3. Return loss on SE port ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

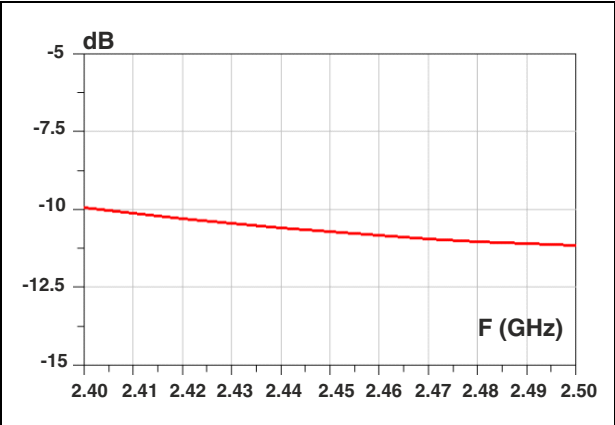


Figure 4. Return loss on DIFF port ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

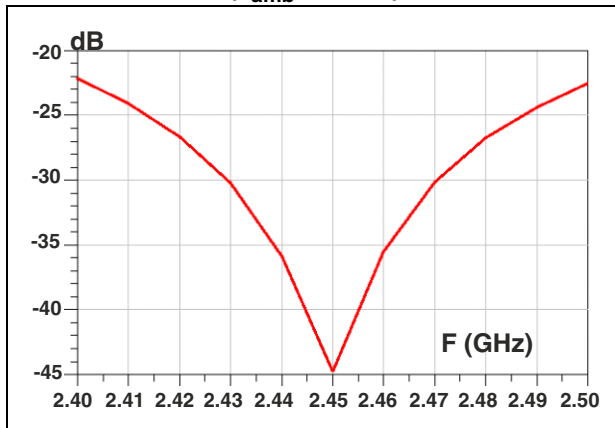


Figure 5. Amplitude imbalance ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

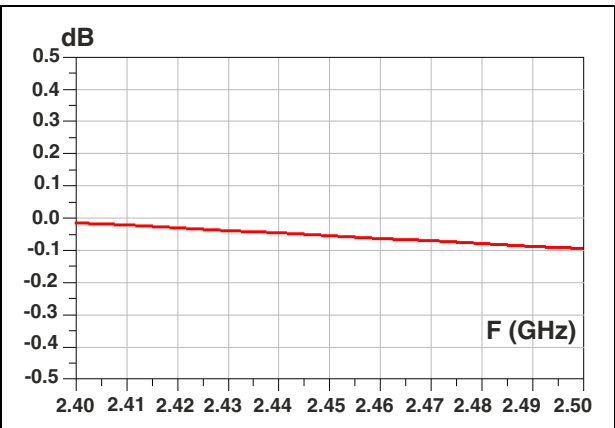
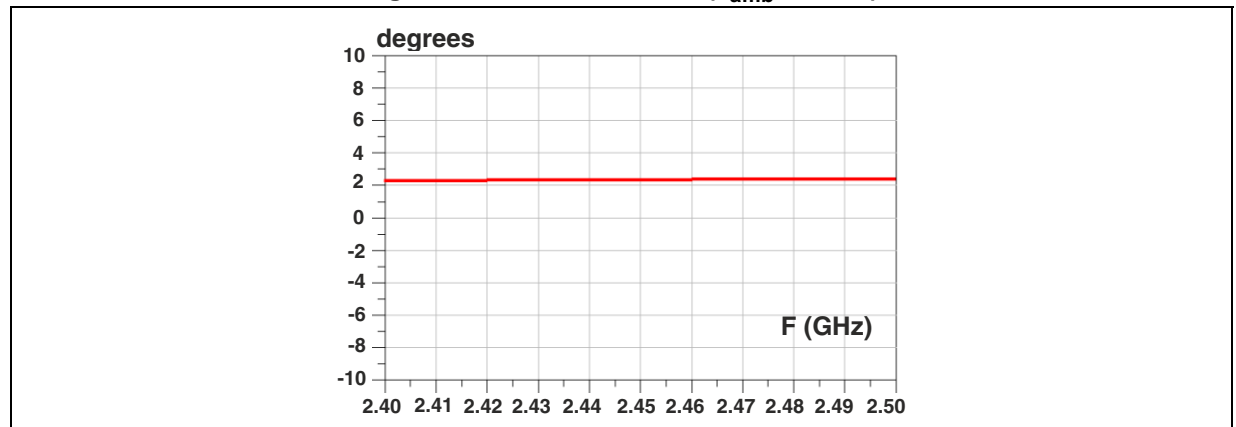


Figure 6. Phase imbalance ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )



## 2 Application information

Figure 7. Application schematic (courtesy of Nordic Semiconductor)

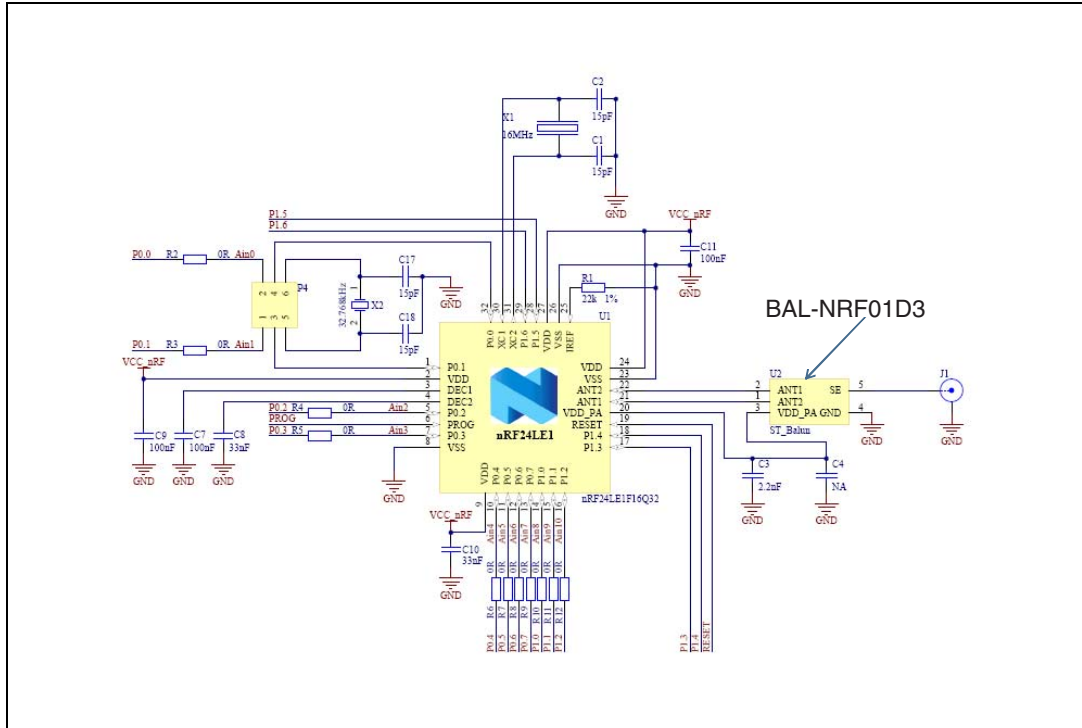


Figure 8. nRF2723 application board (courtesy of Nordic Semiconductor)

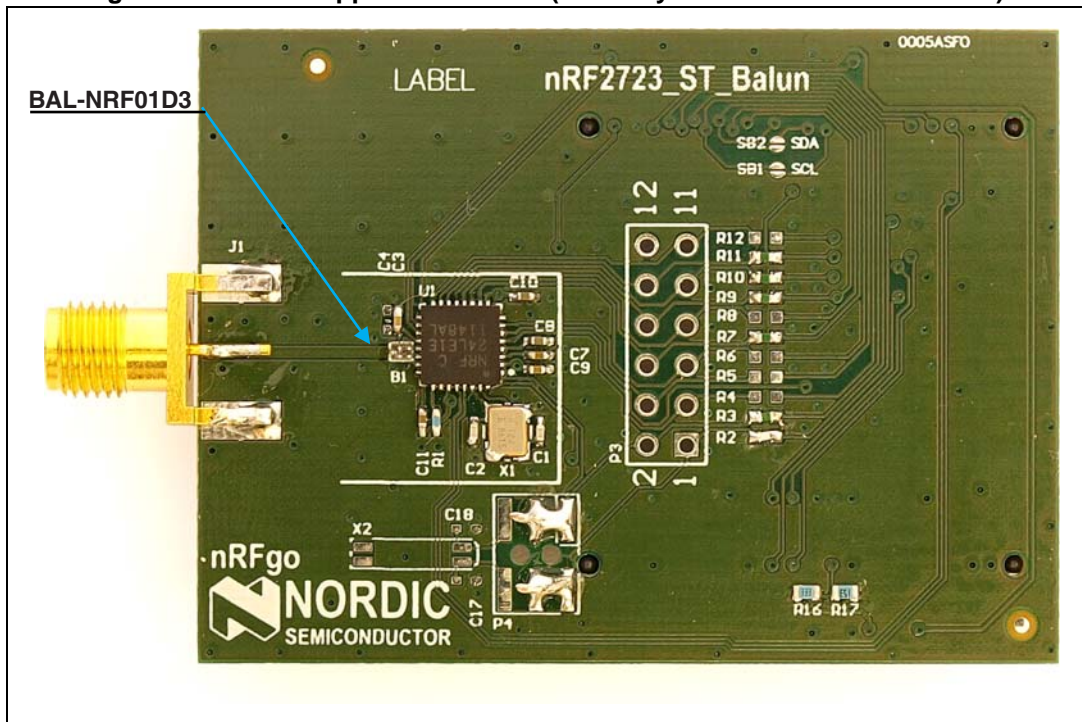


Figure 9. nRF2752 application board (courtesy of Nordic Semiconductor)



### 3 Package information

- Epoxy meets UL94, V0
- Lead-free package

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK® is an ST trademark.

Figure 10. Package dimensions (top and side view)

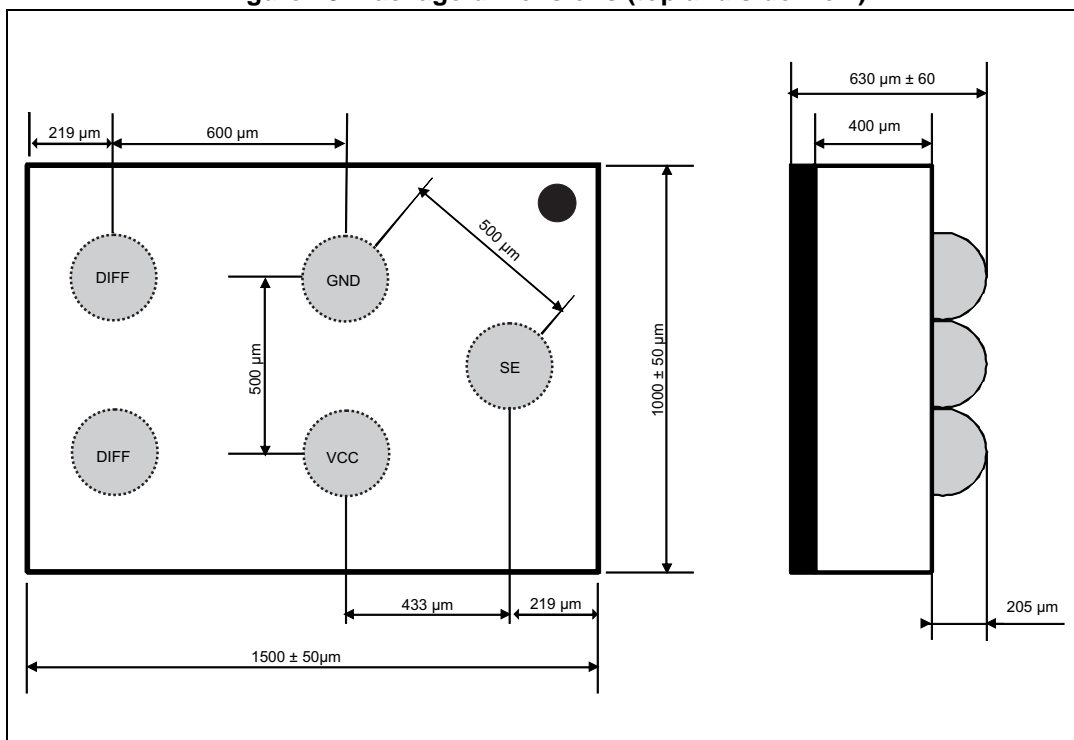


Figure 11. Marking

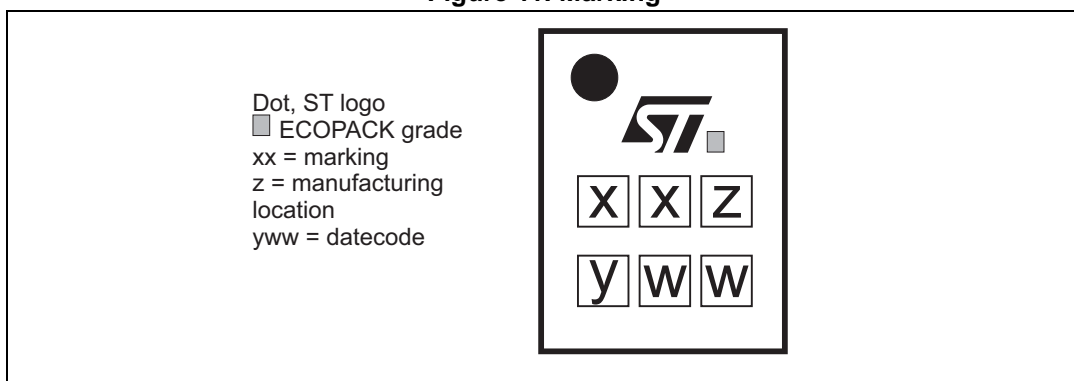
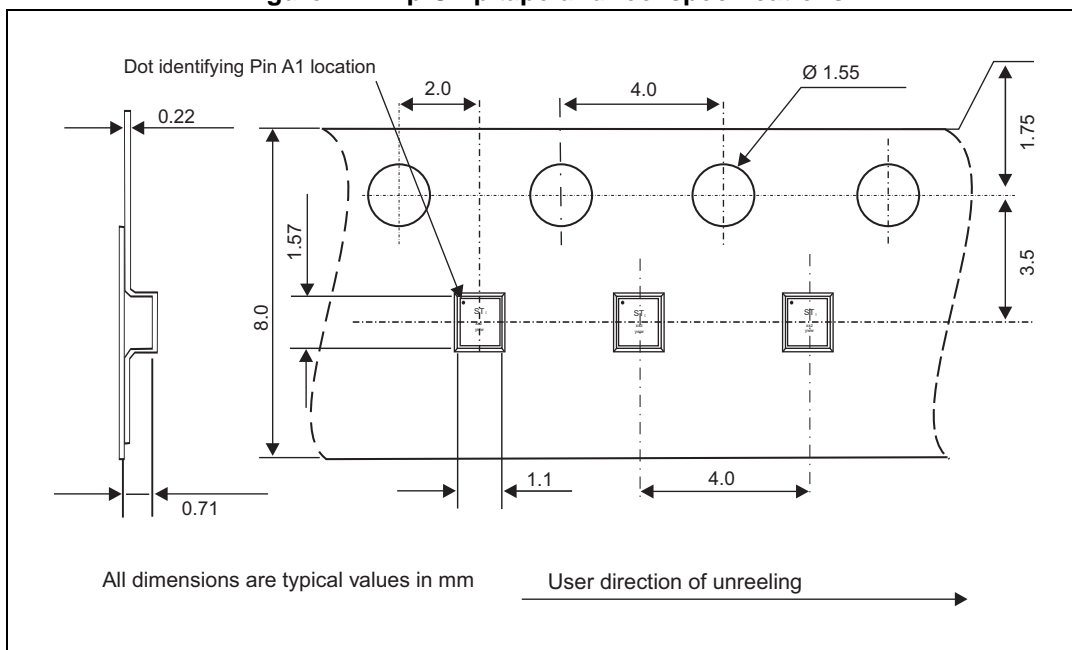
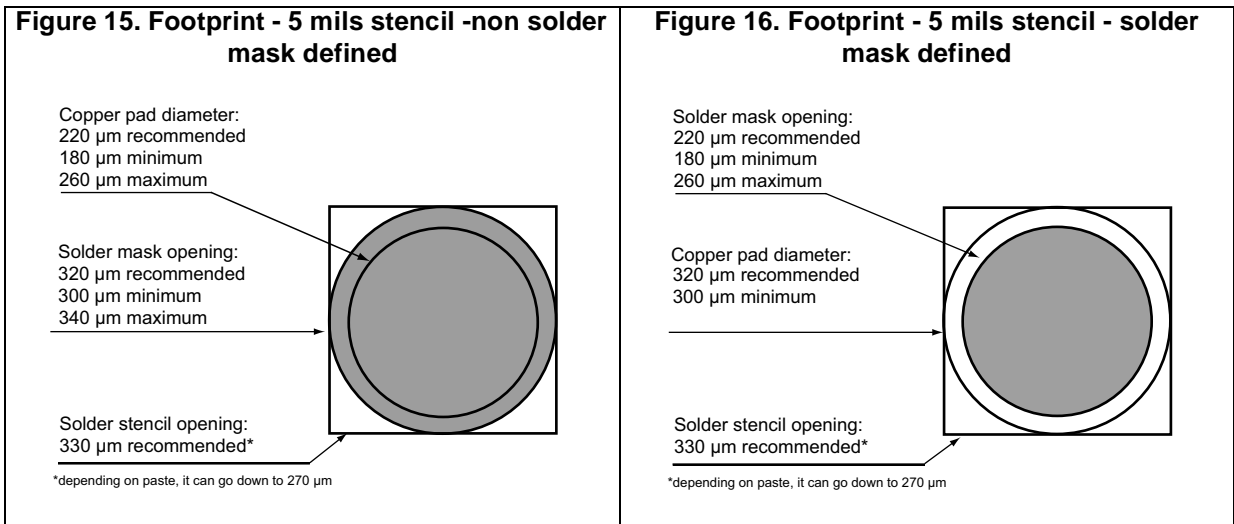
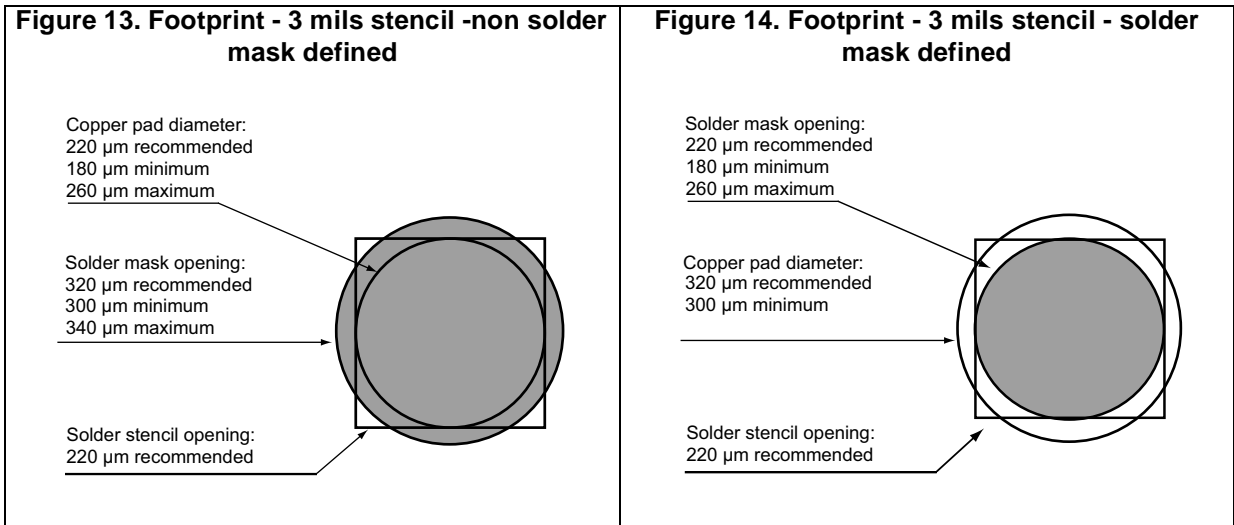


Figure 12. Flip Chip tape and reel specifications



Note: More information is available in the STMicroelectronics Application notes:  
 AN2348 Flip-Chip: "Package description and recommendations for use"  
 AN4111: "BAL-NRF01D3 matched balun with integrated harmonics filter for Nordic Semiconductor chips with ultralow power transceivers"





## 4 Ordering information

Table 4. Ordering information

| Order code  | Marking | Weight  | Base Qty | Delivery mode |
|-------------|---------|---------|----------|---------------|
| BAL-NRF01D3 | SC      | 1.82 mg | 5000     | Tape and Reel |

## 5 Revision history

Table 5. Document revision history

| Date        | Revision | Changes  |
|-------------|----------|--|
| 15-Oct-2012 | 1        | Initial release  |
| 13-Nov-2012 | 2        | Added references to nRF51 series. Added <a href="#">Figure 9</a> . Updated y-axis labels in <a href="#">Figure 2</a> .                   |
| 04-Mar-2013 | 3        | Updated footprint illustrations in <a href="#">Figure 13</a> , and <a href="#">Figure 14</a> .   |
| 06-Aug-2013 | 4        | Added dimensions in <a href="#">Figure 10</a> . Updated marking orientation in <a href="#">Figure 11</a> and <a href="#">Figure 12</a> . |
| 13-Jan-2014 | 5        | Updated document title and product references.   |
| 07-Jul-2015 | 6        | Updated <a href="#">Table 1</a> .  |

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