



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



## Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

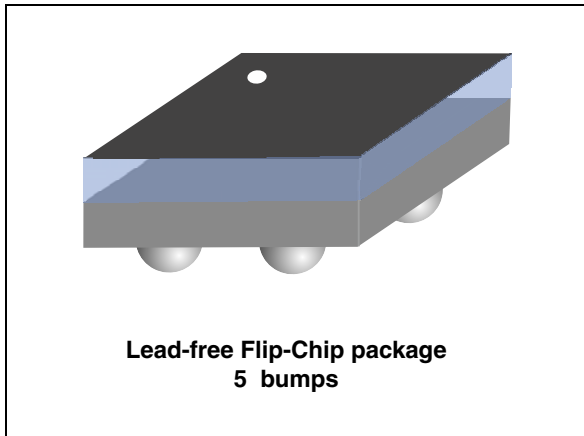
Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



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

Datasheet – production data



## 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.

## 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>

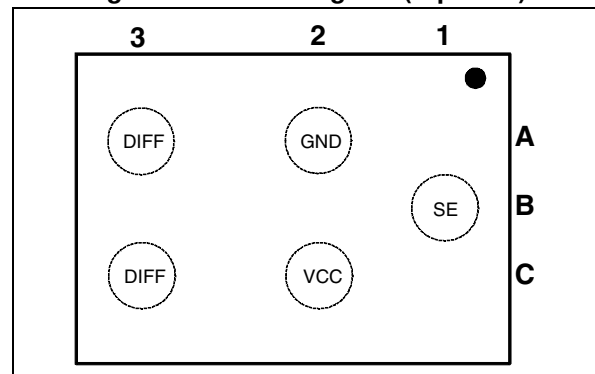
## Benefits

- 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).

**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 (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: – nRF24LE1/AP2 – nRF51422-QFAA (build code CA/C0) – nRF51822-QFAA (build code CA/C0) – nRF51822-QFAB (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 ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

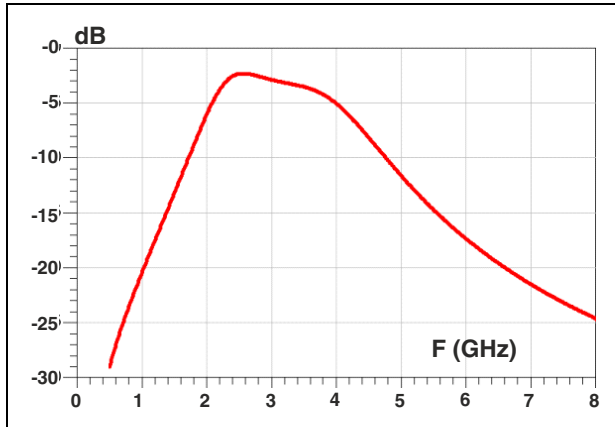


Figure 3. Return loss on SE port ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

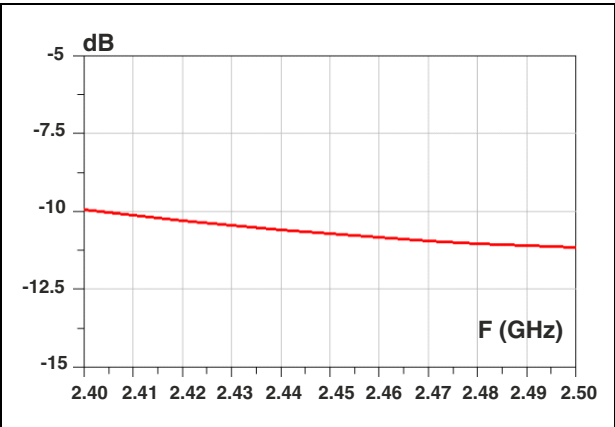


Figure 4. Return loss on DIFF port ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

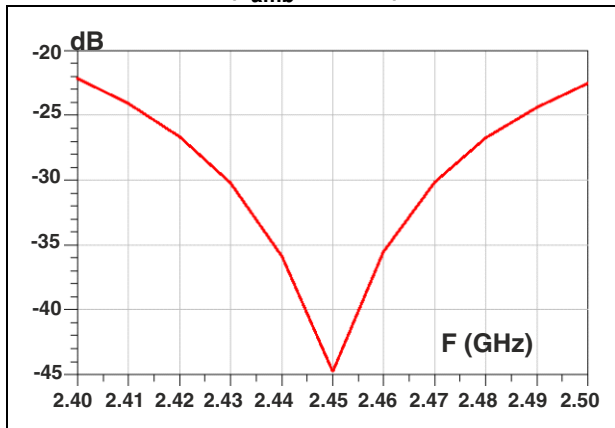


Figure 5. Amplitude imbalance ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

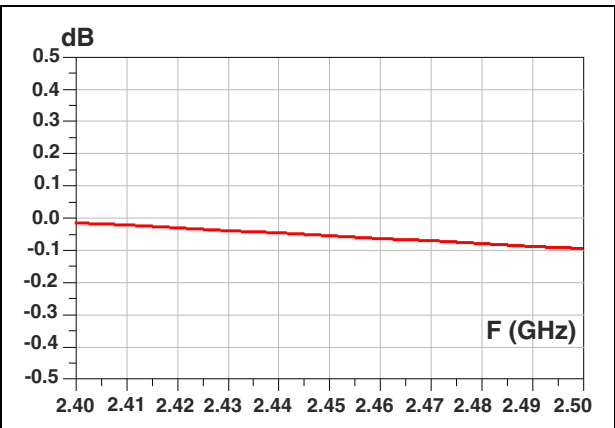
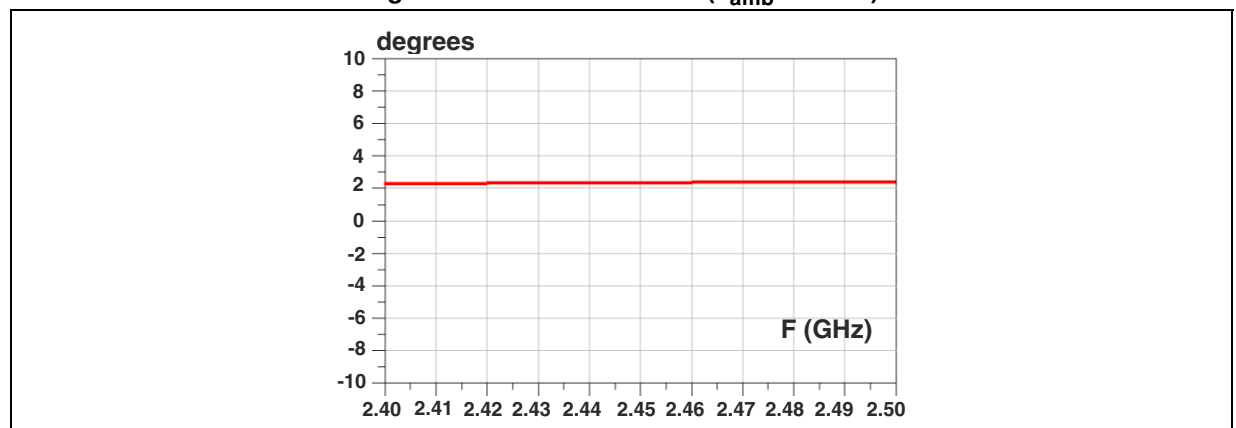


Figure 6. Phase imbalance ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )



## 2 Application information

Figure 7. Application schematic (courtesy of Nordic Semiconductor)

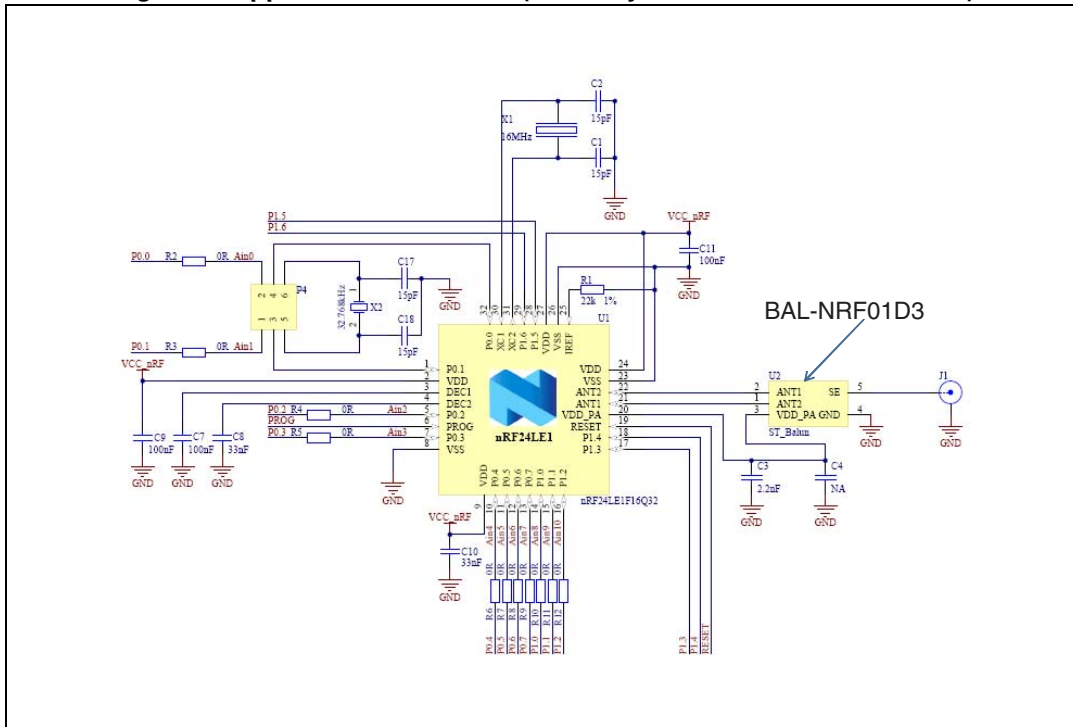


Figure 8. nRF2723 application board (courtesy of Nordic Semiconductor)

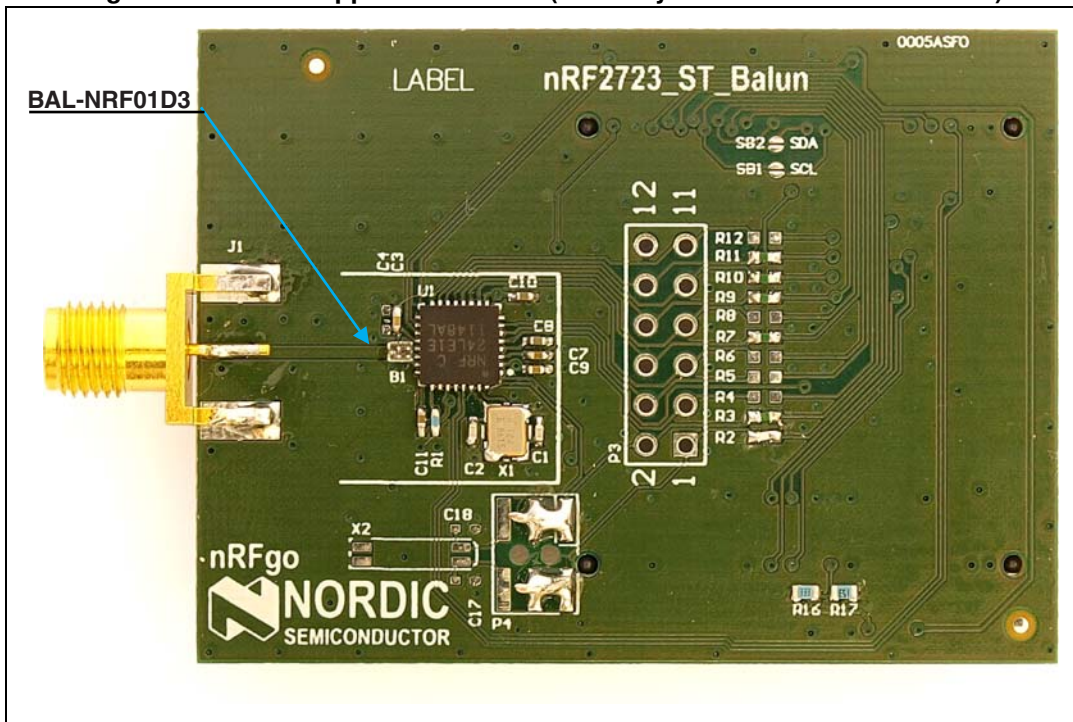


Figure 9. nRF2752 application board (courtesy of Nordic Semiconductor)



### 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)

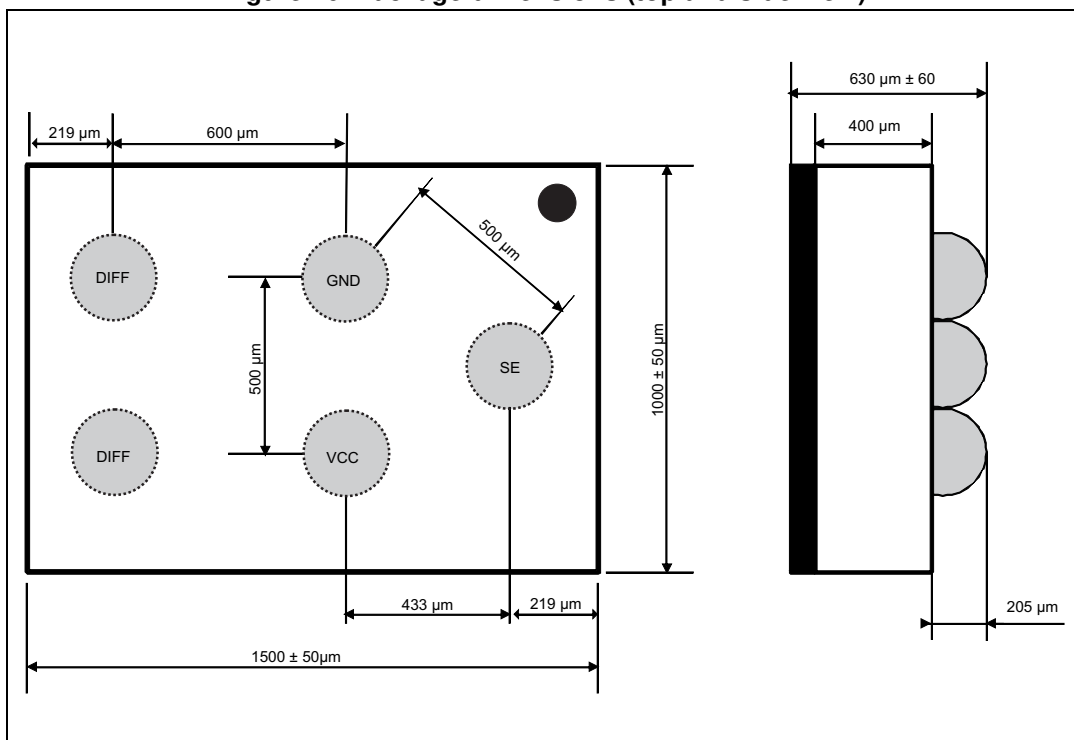


Figure 11. Marking

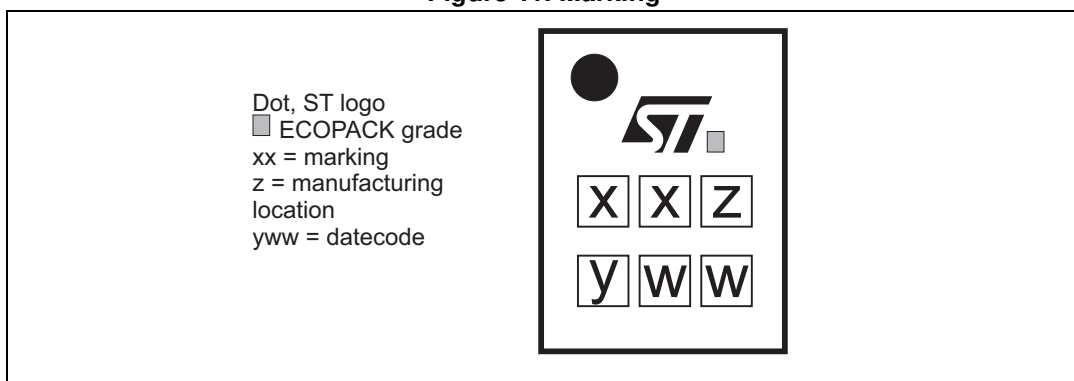
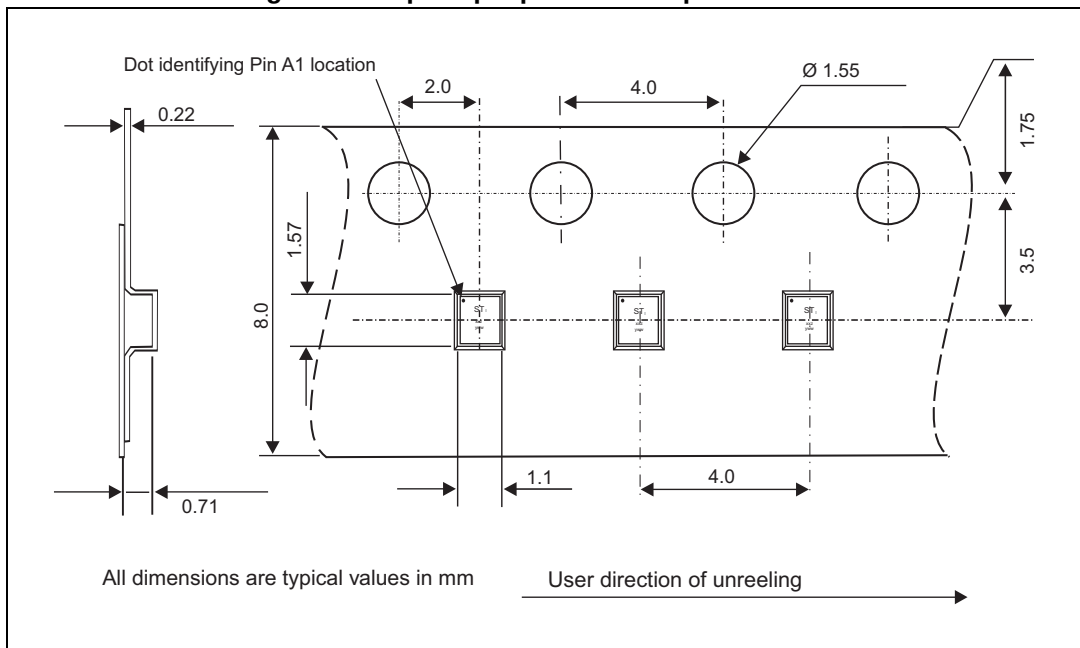


Figure 12. Flip Chip tape and reel specifications



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"

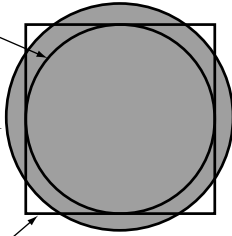


**Figure 13. Footprint - 3 mils stencil - non solder mask defined**

Copper pad diameter:  
220  $\mu\text{m}$  recommended  
180  $\mu\text{m}$  minimum  
260  $\mu\text{m}$  maximum

Solder mask opening:  
320  $\mu\text{m}$  recommended  
300  $\mu\text{m}$  minimum  
340  $\mu\text{m}$  maximum

Solder stencil opening:  
220  $\mu\text{m}$  recommended

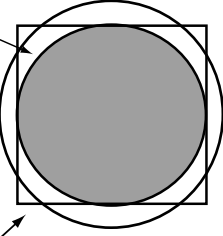


**Figure 14. Footprint - 3 mils stencil - solder mask defined**

Solder mask opening:  
220  $\mu\text{m}$  recommended  
180  $\mu\text{m}$  minimum  
260  $\mu\text{m}$  maximum

Copper pad diameter:  
320  $\mu\text{m}$  recommended  
300  $\mu\text{m}$  minimum

Solder stencil opening:  
220  $\mu\text{m}$  recommended



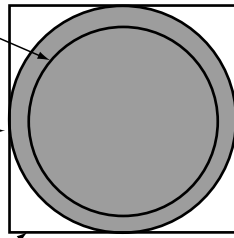
**Figure 15. Footprint - 5 mils stencil - non solder mask defined**

Copper pad diameter:  
220  $\mu\text{m}$  recommended  
180  $\mu\text{m}$  minimum  
260  $\mu\text{m}$  maximum

Solder mask opening:  
320  $\mu\text{m}$  recommended  
300  $\mu\text{m}$  minimum  
340  $\mu\text{m}$  maximum

Solder stencil opening:  
330  $\mu\text{m}$  recommended\*

\*depending on paste, it can go down to 270  $\mu\text{m}$



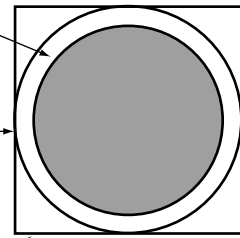
**Figure 16. Footprint - 5 mils stencil - solder mask defined**

Solder mask opening:  
220  $\mu\text{m}$  recommended  
180  $\mu\text{m}$  minimum  
260  $\mu\text{m}$  maximum

Copper pad diameter:  
320  $\mu\text{m}$  recommended  
300  $\mu\text{m}$  minimum

Solder stencil opening:  
330  $\mu\text{m}$  recommended\*

\*depending on paste, it can go down to 270  $\mu\text{m}$



## 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> .

**IMPORTANT NOTICE – PLEASE READ CAREFULLY**

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.

© 2015 STMicroelectronics – All rights reserved