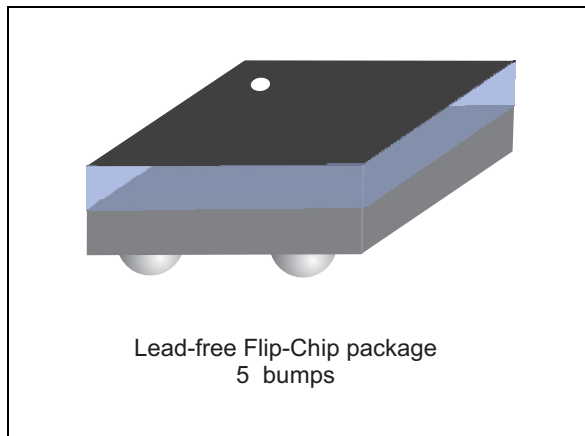


## 50 ohm nominal input / conjugate match balun to nRF51822-CEAA/CDAB/CFAC and nRF51422-CEAA/CDAB/CFAC

Datasheet – production data



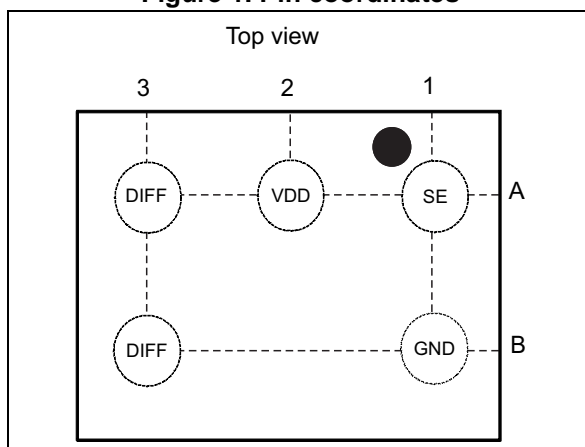
### Benefits

- Very low profile: < 560 μm after reflow
- High RF performance
- RF BOM and area reduction

### Applications

- 2.45 GHz impedance matched balun filter
- Optimized for Nordic's chip set  
nRF51422-CEAA, nRF51422-CDAB,  
nRF51422-CFAC and nRF51822-CEAA,  
nRF51822-CDAB, nRF51822-CFAC

Figure 1. Pin coordinates



### Description

STMicroelectronics BAL-NRF02D3 is an ultraminiature balun. The BAL-NRF02D3 integrates matching network and harmonics filter. Matching impedance has been customized for the following Nordic Semiconductor circuits: nRF51422-CEAA, nRF51422-CDAB, nRF51422-CFAC and nRF51822-CEAA, nRF51822-CDAB, nRF51822-CFAC.

The BAL-NRF02D3 uses STMicroelectronics IPD technology on non-conductive glass substrate which optimize RF performances.

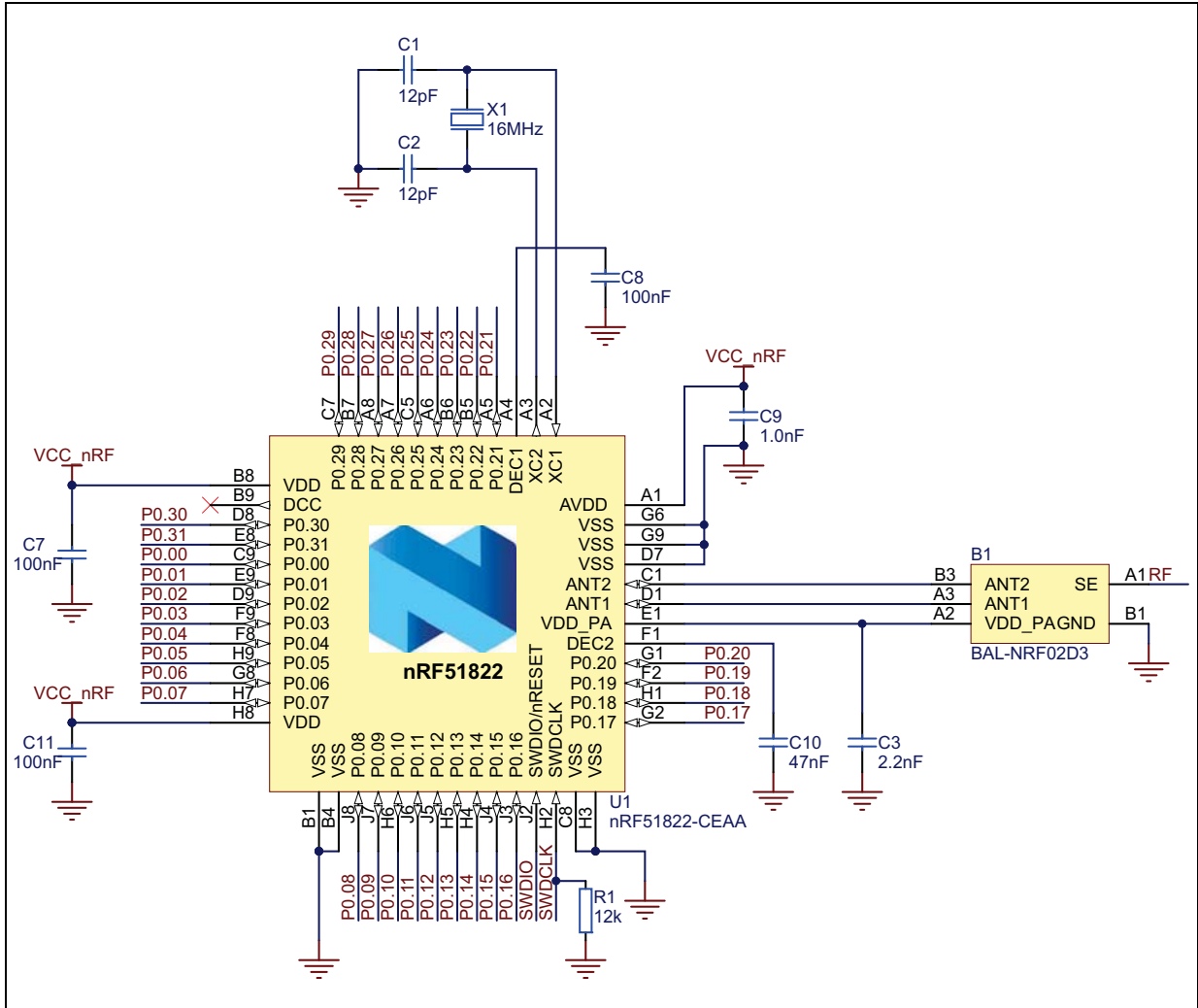
The BAL-NRF02D3 has been tested and approved by Nordic Semiconductor in the nRFgo modules.

### Features

- 50 Ω nominal input / conjugate match to Nordic Semiconductor chips nRF51422-CEAA, nRF51422-CDAB, nRF51422-CFAC and nRF51822-CEAA, nRF51822-CDAB, nRF51822-CFAC
- Low insertion loss
- Low amplitude imbalance
- Low phase imbalance
- Small footprint: < 1.2 mm<sup>2</sup>

# 1 Application

Figure 2. Application schematic



## 2 Characteristics

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

Symbol	Parameter	Value			Unit
		Min.	Typ.	Max.	
$P_{IN}$	Input Power RFIN		-	20	dBm
$V_{ESD}$	ESD ratings human body model (JESD22-A114-C), all I/O one at a time while others connected to GND	2000	-		V
	ESD ratings charge device model (JESD22-C101-C)	500	-		
	ESD ratings machine model, all I/O	200	-		
$T_{OP}$	Operating temperature (JESD22-A115-C), all I/O	-40	-	+105	°C

**Table 2. Impedances ( $T_{amb} = 25\text{ °C}$ )**

Symbol	Parameter	Value			Unit
		Min.	Typ.	Max.	
$Z_{OUT}$	Nominal differential output impedance	-	matched	-	$\Omega$
$Z_{IN}$	Nominal input impedance	-	50	-	$\Omega$

**Table 3. RF performance ( $T_{amb} = 25\text{ °C}$ )**

Symbol	Parameter	Test condition	Value			Unit
			Min.	Typ.	Max.	
F	Frequency range (bandwidth)		2400		2540	MHz
$I_L$	Insertion loss in bandwidth			1.9		dB
$R_L$	Return loss in bandwidth			12		dB
$\phi_{imb}$	Phase imbalance			6		°
Aimb	Amplitude imbalance			0.15		dB
2f0	2nd harmonic S21 attenuation	4880 MHz		10		dB
3f0	3rd harmonic S21 attenuation	7320 MHz		20		dB

## 2.1 On-board measurements

Figure 3. Transmission ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

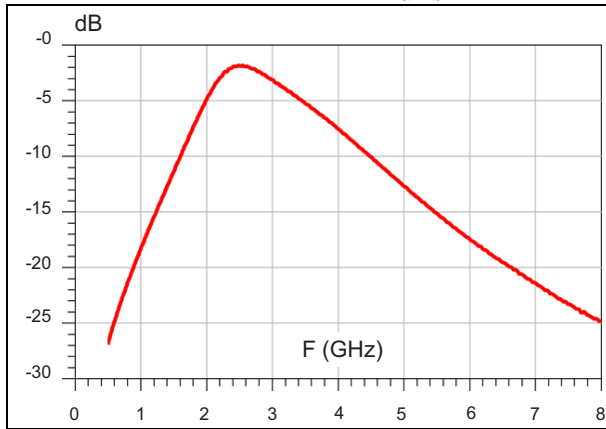


Figure 4. Insertion loss ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

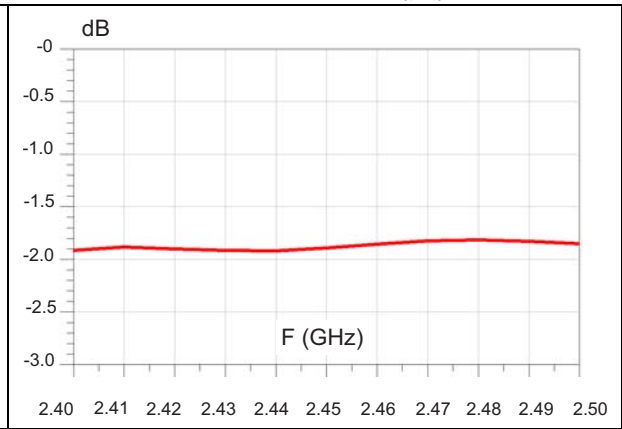


Figure 5. Return loss on SE port ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

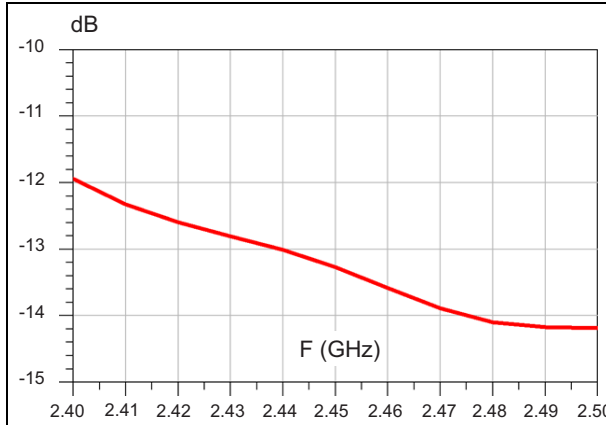


Figure 6. Return loss on DIFF port ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

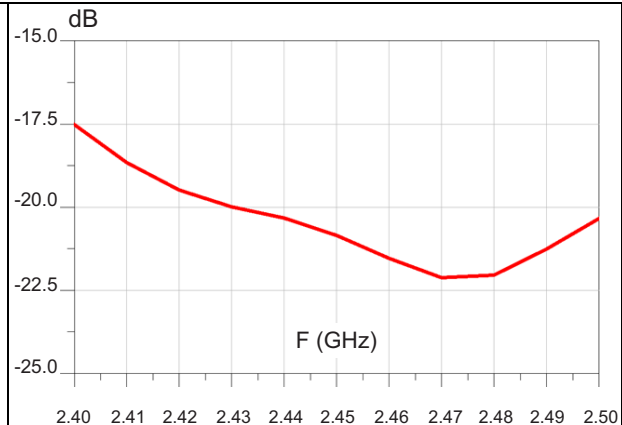


Figure 7. Amplitude imbalance ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

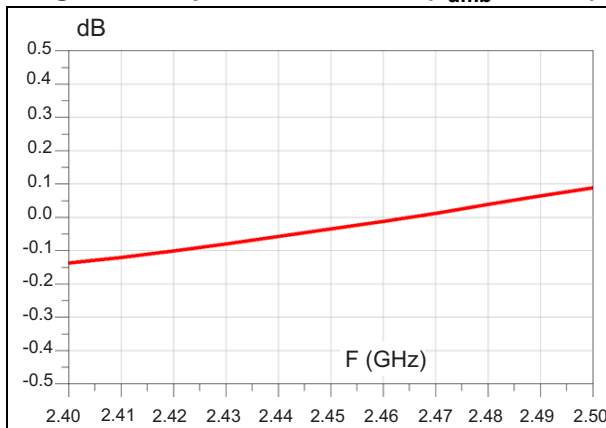


Figure 8. Phase imbalance ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

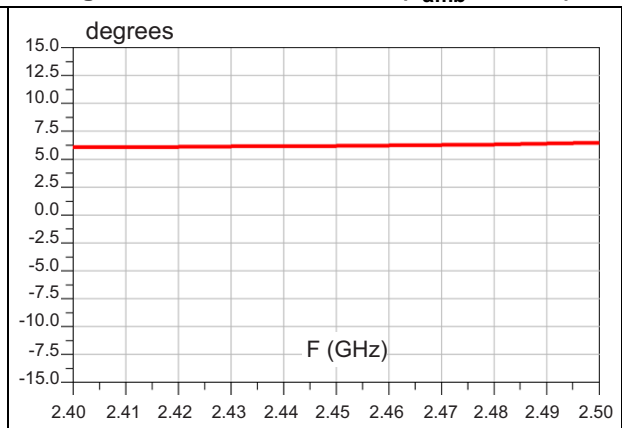


Table 4. Compatibility matrix (nRF51422)

nRF51422 IC revision	Packet/variant	Build code
1	CEAA	A0A
2	CEAA	Bx0
3	CDAB	Ax0
	CEAA	Cx0
	CFAC	Ax0

Table 5. Compatibility matrix (nRF51822)

nRF51822 IC revision	Packet/variant	Build code
1	CEAA	BA
	CEAA	B0
2	CEAA	CA0
	CEAA	DA0
	CEAA	Dx0
3	CDAB	Ax0
	CEAA	Ex0
	CFAC	Ax0

### 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 9. Package dimensions

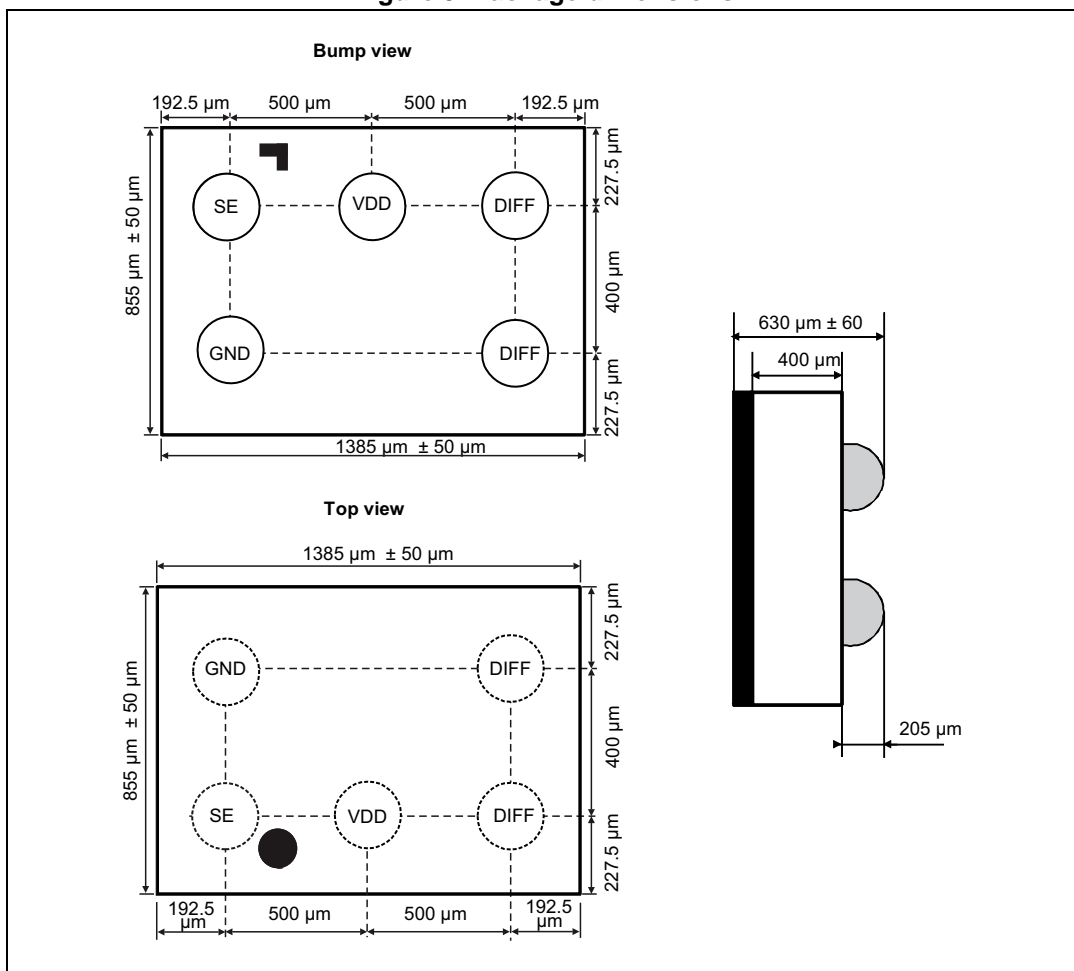


Figure 10. Recommended land pattern

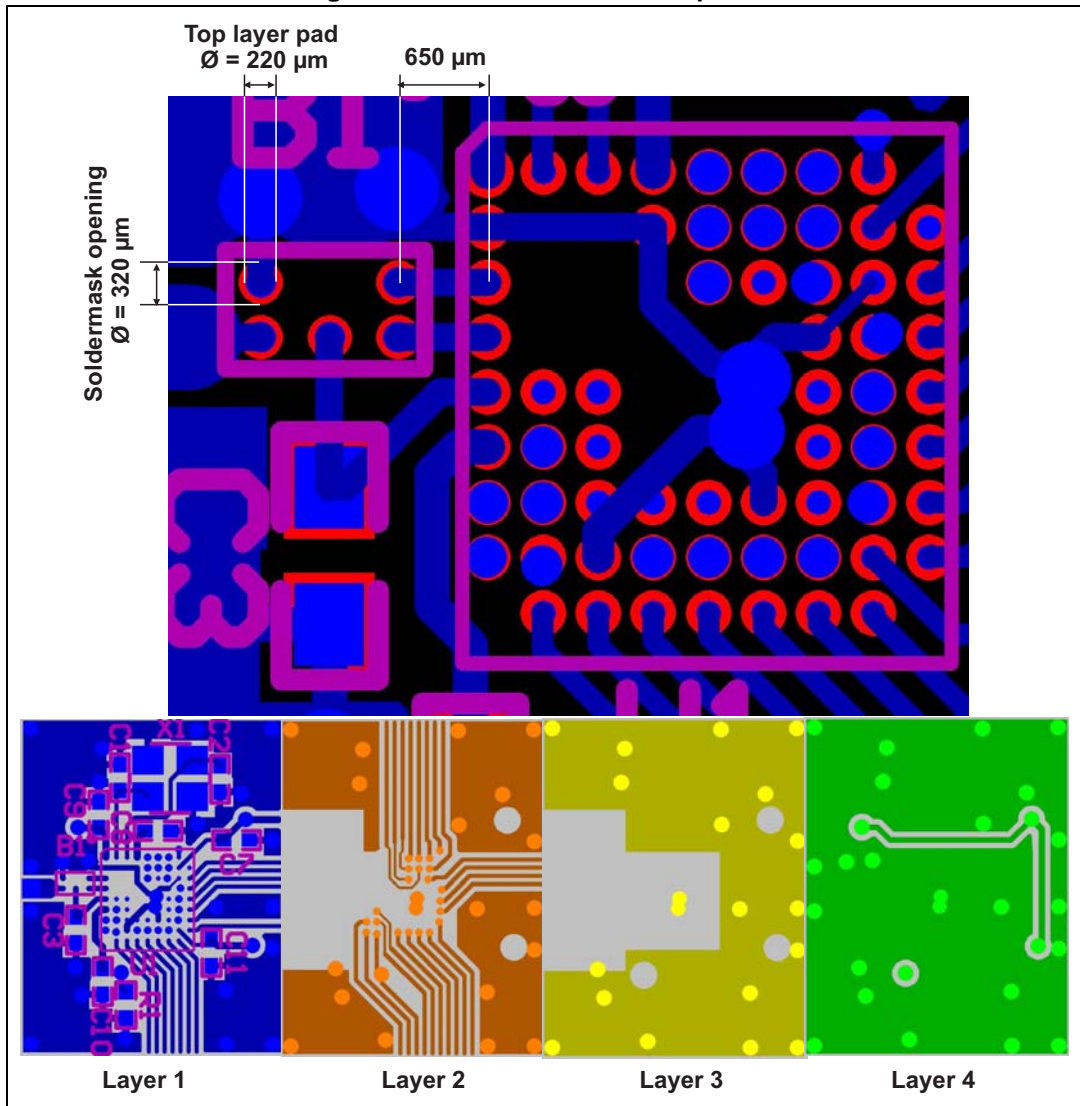


Figure 11. PCB stack-up recommendation

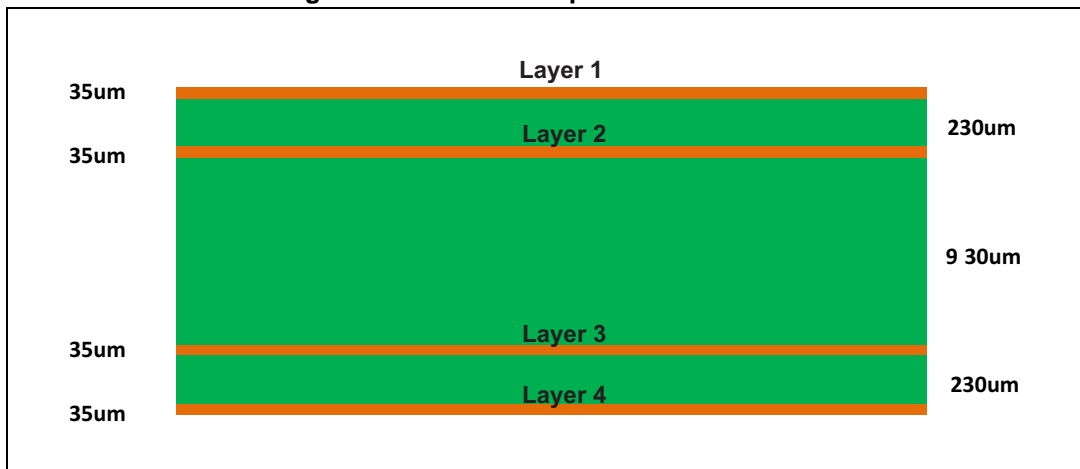


Figure 12. Marking

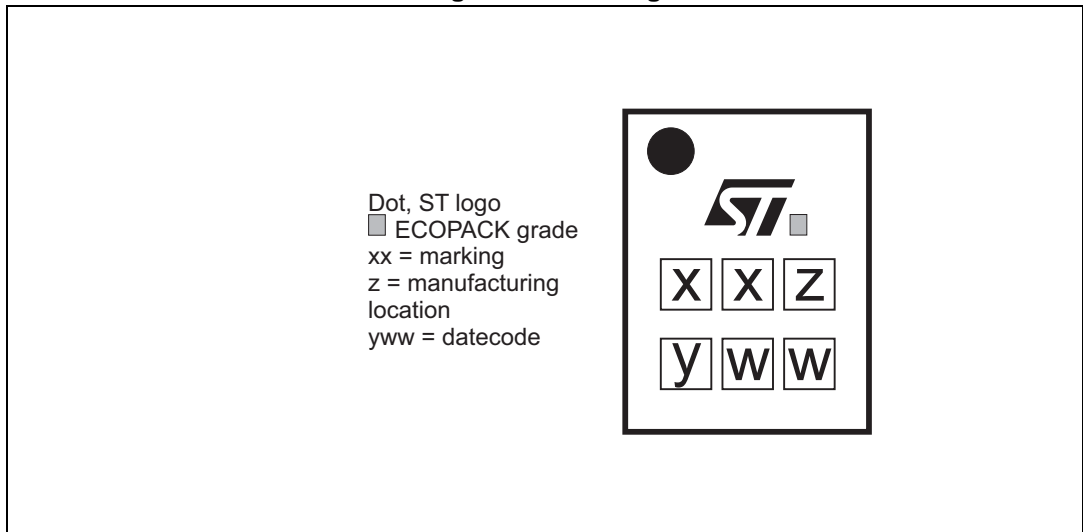
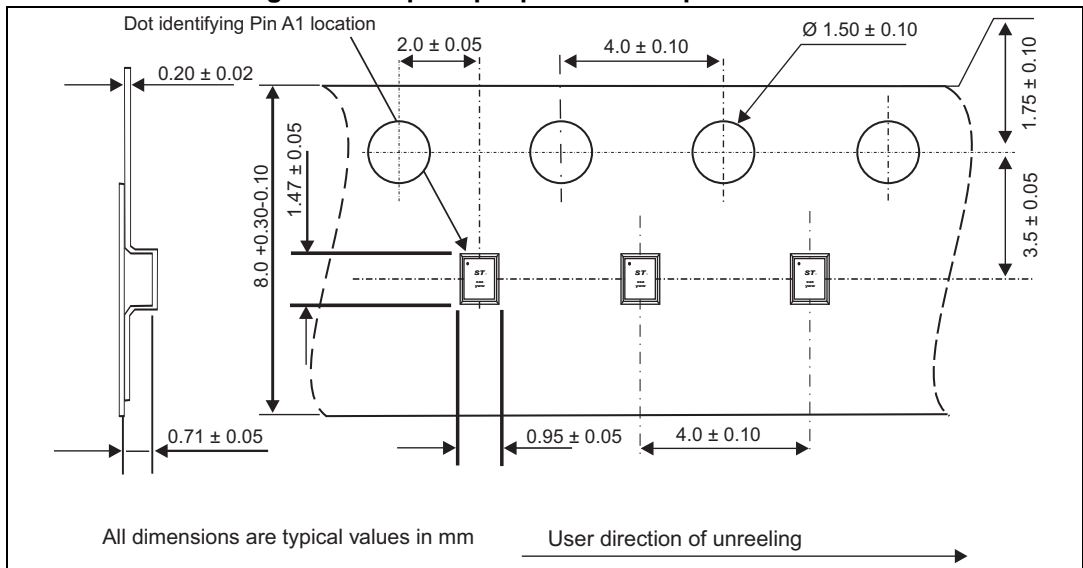


Figure 13. Flip Chip tape and reel specifications



Note: More information is available in the STMicroelectronics Application notes:  
 AN2348 Flip-Chip: "Package description and recommendations for use"  
 AN4315: "BAL-NRF02D3 matched balun with integrated harmonics filter for Nordic Semiconductor ultralow power transceivers"

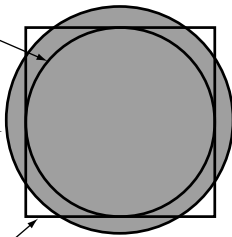


**Figure 14. Footprint - 3 mils stencil - non solder mask defined**

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

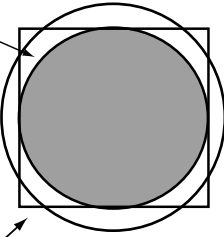


**Figure 15. Footprint - 3 mils stencil - solder mask defined**

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



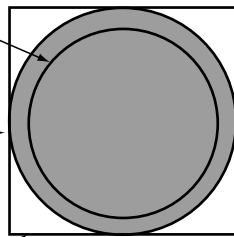
**Figure 16. Footprint - 5 mils stencil - non solder mask defined**

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  $\mu\text{m}$



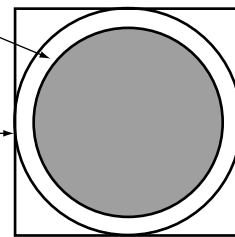
**Figure 17. Footprint - 5 mils stencil - solder mask defined**

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 6. Ordering information

Order code	Marking	Weight	Base Qty	Delivery mode
BAL-NRF02D3	SK	1.58 mg	5000	Tape and Reel

## 5 Revision history

Table 7. Document revision history

Date	Revision	Changes
02-Jul-2013	1	Initial release
30-Aug-2013	2	Updated <a href="#">Table 1</a> .
13-Oct-2014	3	Updated <a href="#">Figure 9</a> .
25-Mar-2015	4	Updated cover page, added <a href="#">Table 4</a> and <a href="#">Table 5</a> .
15-Jun-2015	5	Updated <a href="#">Table 1</a> .

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