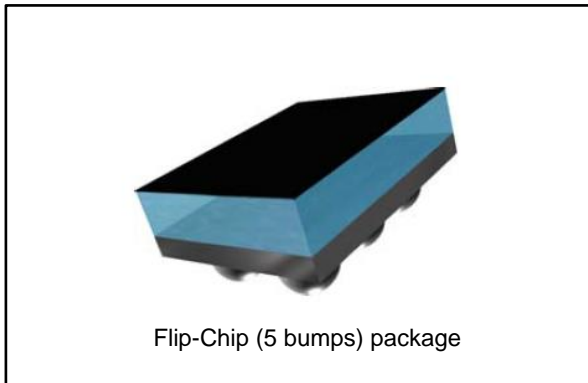


50 ohm nominal input / conjugate match balun to nRF51822-CEAA/CDAB/CFAC and nRF51422-CEAA/CDAB/CFAC

Datasheet - production data



## 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

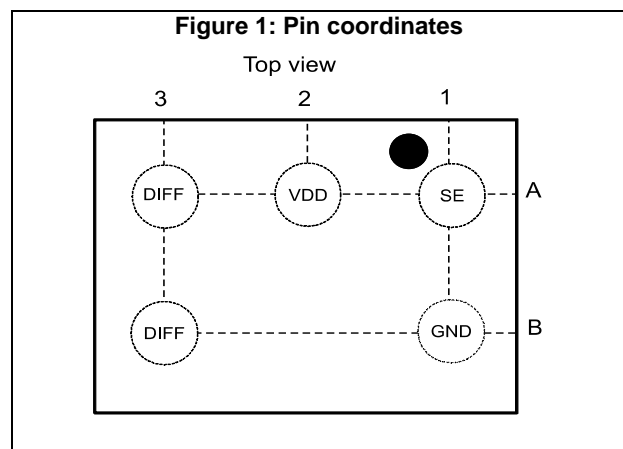
- 50  $\Omega$  nominal input / conjugate match to Nordic Semiconductor chips nRF51422-CEAA, nRF51422-CDAB, nRF51422-CFAC and nRF51822-CEAA, nRF51822-CDAB, nRF51822-CFAC
- Low insertion loss
- Low amplitude imbalance
- Low phase imbalance
- Small footprint: < 1.2 mm<sup>2</sup>

## Benefits

- Very low profile < 560  $\mu\text{m}$  after reflow
- High RF performances
- RF BOM and area reduction

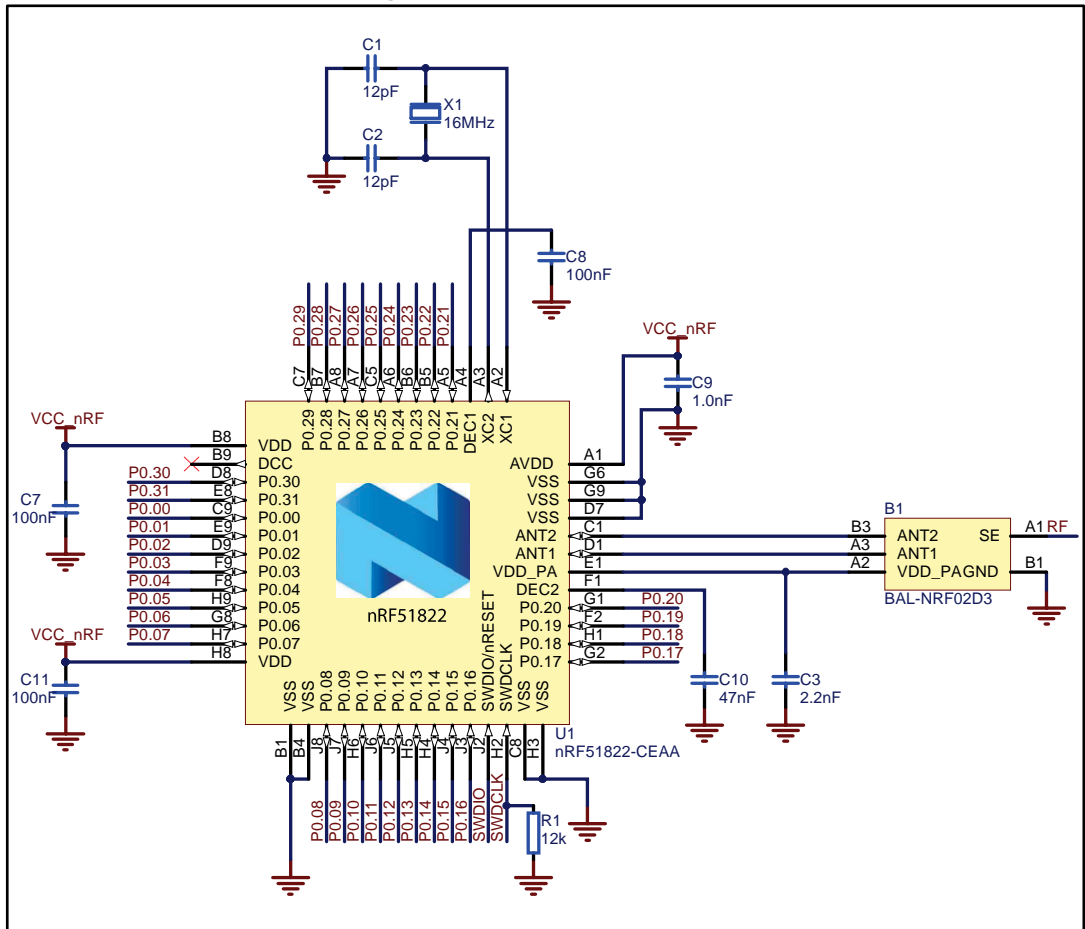
## Applications

- 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



# 1 Application

Figure 2: Application schematic



## 2 Characteristics

**Table 1: Absolute ratings (limiting values)**

Symbol	Parameter	Value			Unit
		Min.	Typ.	Max.	
$P_{IN}$	Input power $RF_{IN}$		-	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
$T_{stg}$	Storage temperature range	-55°C		+150	°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 performances ( $T_{amb} = 25\text{ °C}$ )**

Symbol	Parameter		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		°
$A_{imb}$	Amplitude imbalance			0.15		dB
2f0	2nd harmonic S21 attenuation	4880 MHz	44	10		dB
3f0	3rd harmonic S21 attenuation	7320 MHz		20		dB

## 2.2 On-board measurements

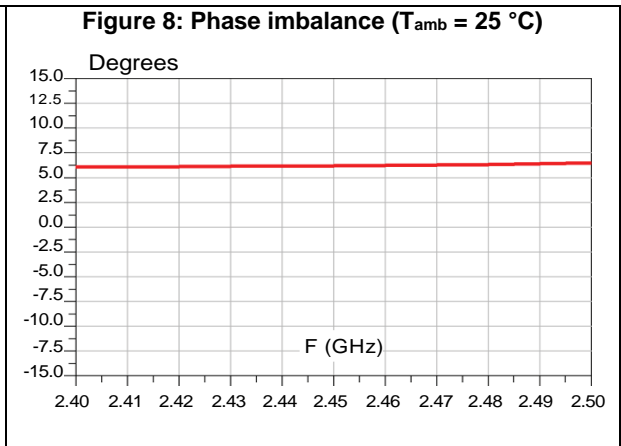
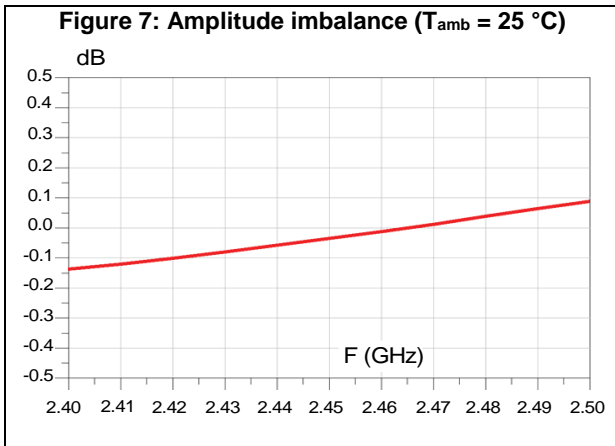
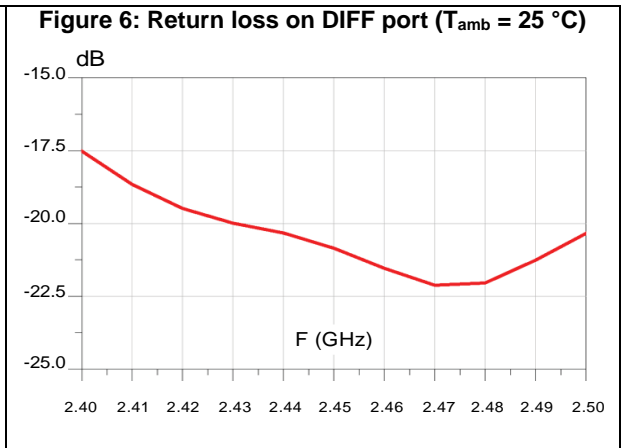
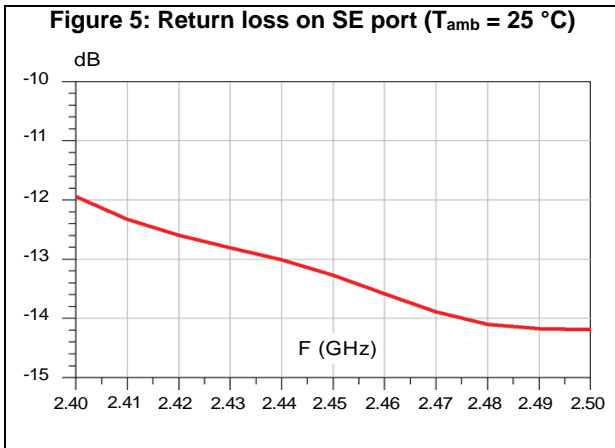
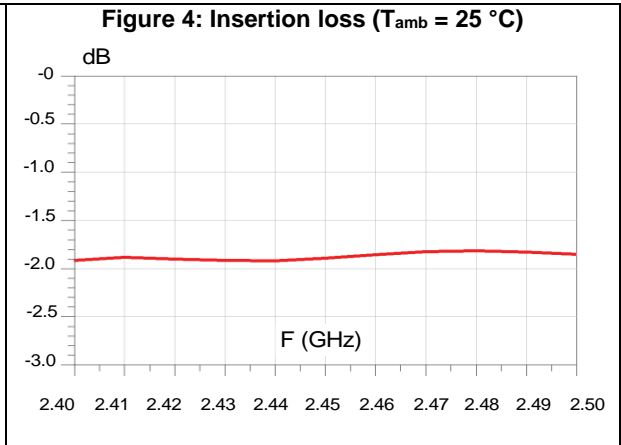
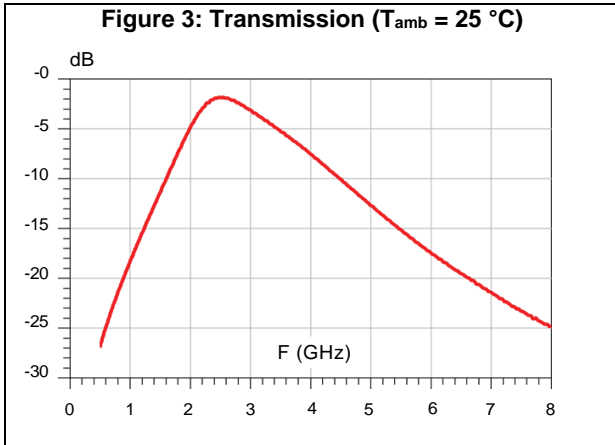


Table 4: Compatibility matrix (nRF51422)

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

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.

- Epoxy meets UL94, V0
- Lead-free package

#### 3.1 Flip-Chip 5 bumps package information

Figure 9: Flip-Chip 5 bumps package outline

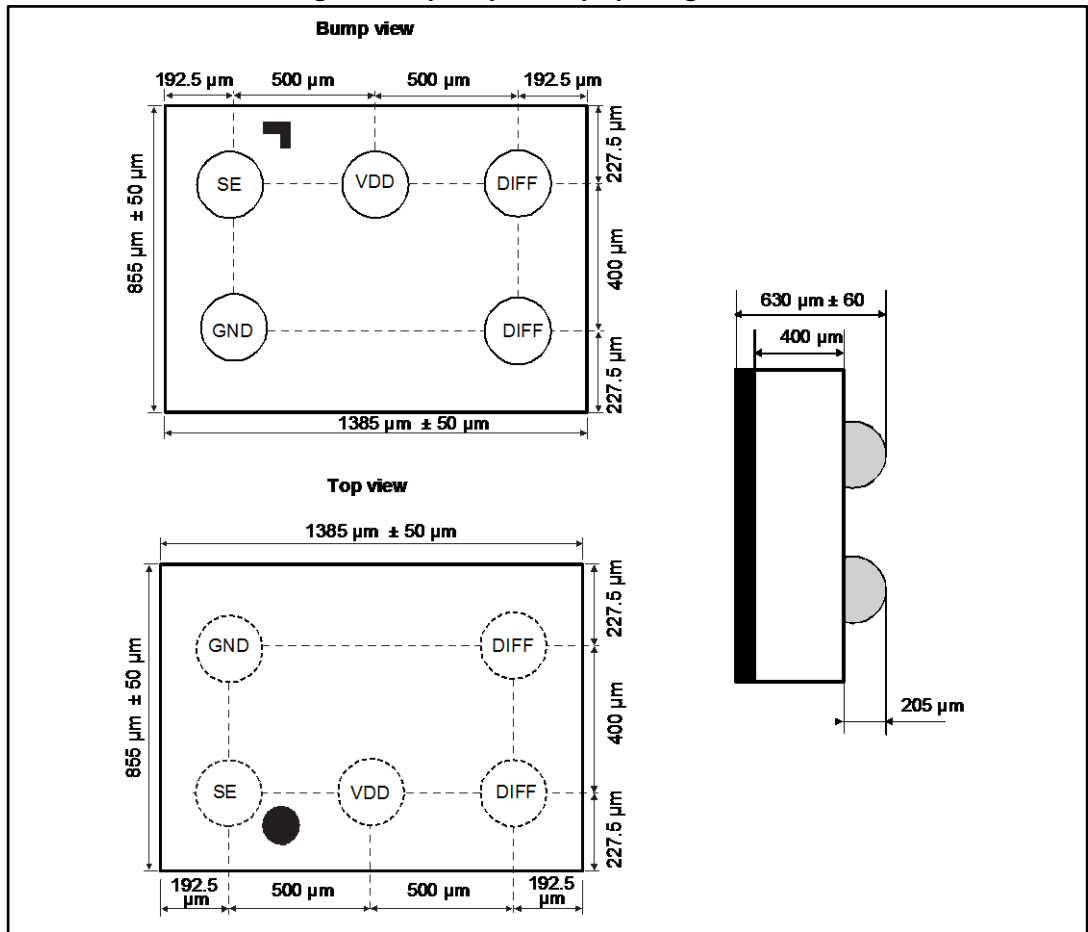


Figure 10: Recommended land pattern

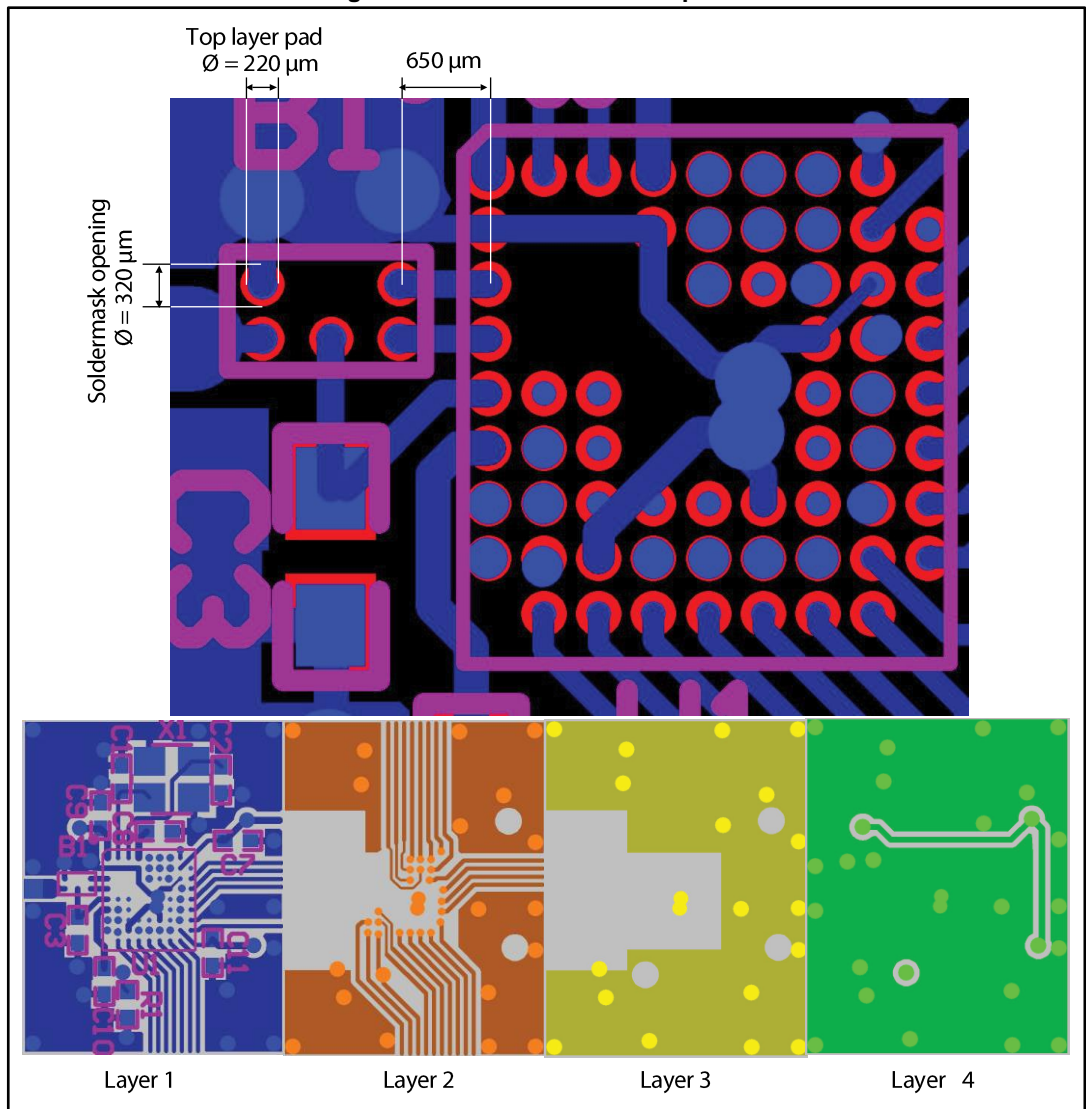
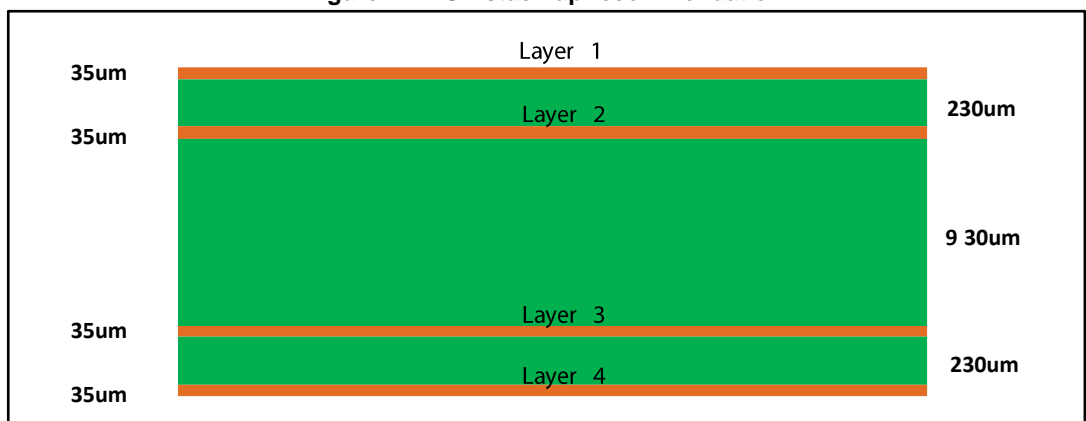


Figure 11: PCB stack-up recommendation



### 3.2 Flip-chip 5 bumps packing information

Figure 12: Marking

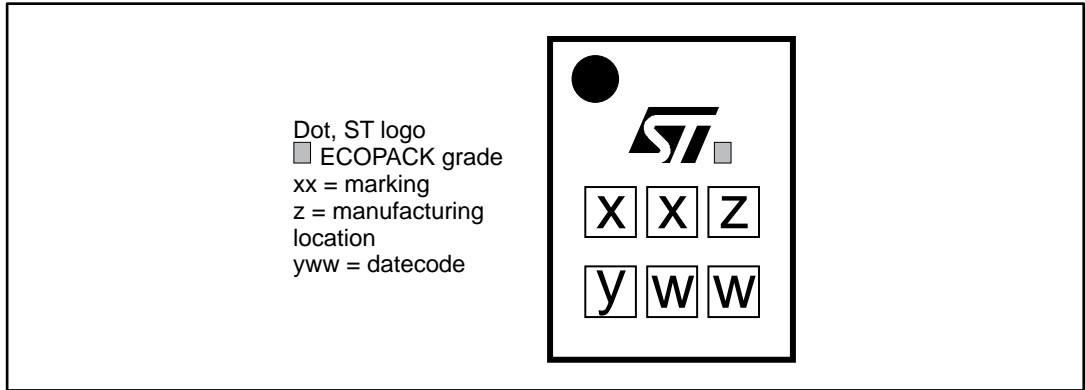
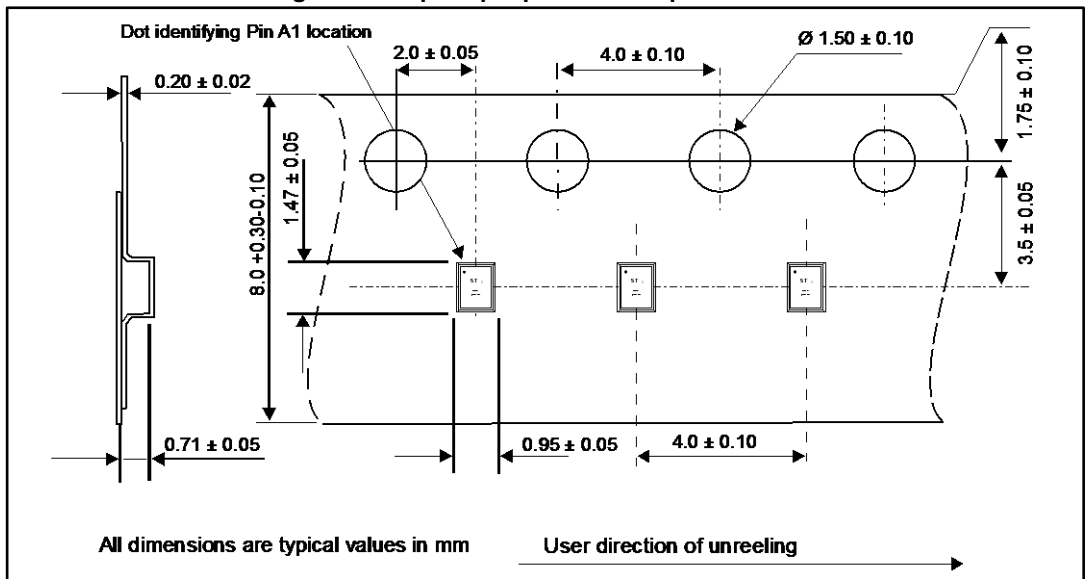


Figure 13: Flip Chip tape and reel specifications



More packing information is available in the application note:

- AN2348 Flip-Chip: "Package description and recommendations for use"
- AN4315: "BAL-NRF02D3 matched balun with integrated harmonics filter for Nordic Semiconductor ultralow power transceivers"

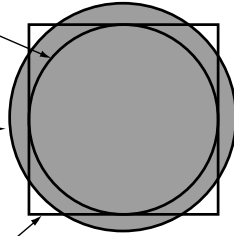


**Figure 14: Footprint - 3 mils stencil -non solder mask defined**

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

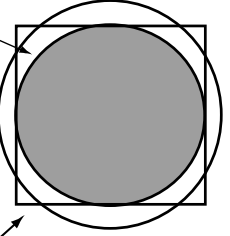


**Figure 15: Footprint - 3 mils stencil - solder mask defined**

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



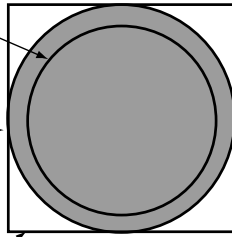
**Figure 16: Footprint - 5 mils stencil -non solder mask defined**

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  $\mu\text{m}$



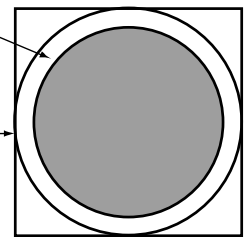
**Figure 17: Footprint - 5 mils stencil - solder mask defined**

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	Package	Weight	Base qty.	Delivery mode
BAL-NRF02D3	SK	Flip-Chip 5 bumps	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 <i>Table 1</i> .
13-Oct-2014	3	Updated <i>Figure 9</i> .
25-Mar-2015	4	Updated cover page, added <i>Table 4</i> and <i>Table 5</i> .
15-Jun-2015	5	Updated <i>Table 1</i> .
07-Dec-2016	6	Updated <i>Table 1: "Absolute ratings (limiting values)"</i> .

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