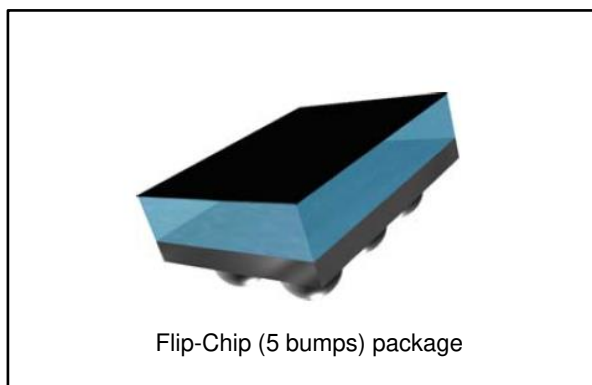


50 ohm nominal input / conjugate match balun to nRF51822-CEAA/CDAB/CFAC and nRF51422-CEAA/CDAB/CFAC

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 optimizes RF performance.

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>

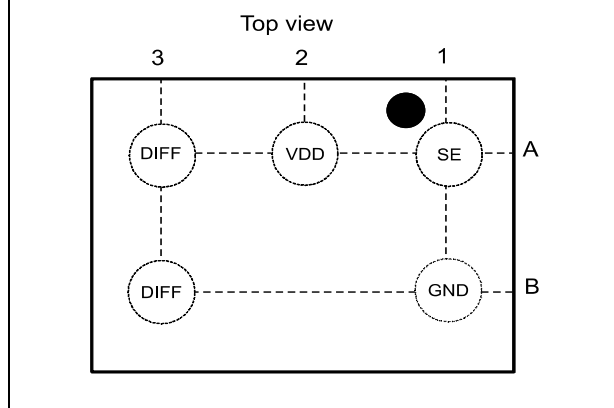
## Benefits

- Very low profile < 570  $\mu\text{m}$  after reflow with pad 260  $\mu\text{m}$  max. or < 585  $\mu\text{m}$  after reflow with pad 220  $\mu\text{m}$  typ.
- High RF performance
- RF BOM and area reduction

## Applications

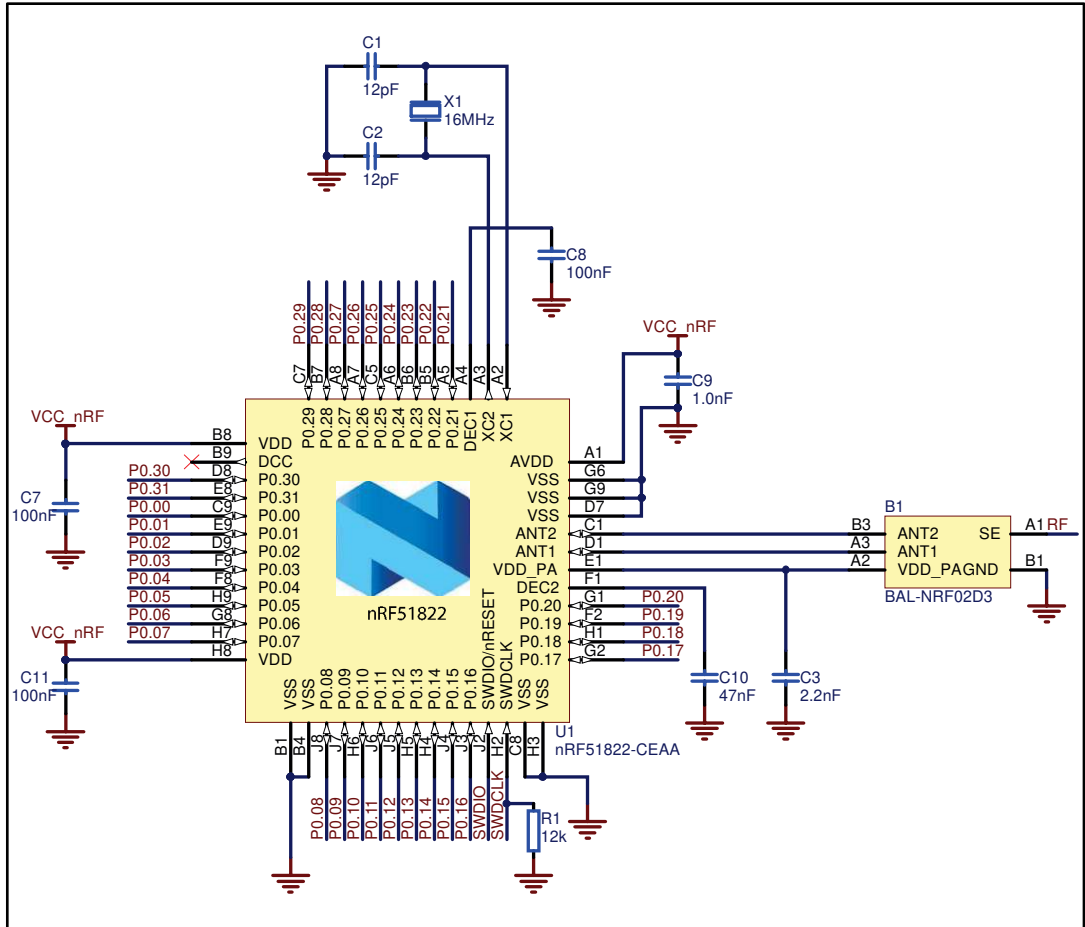
- 2.45 GHz impedance matched balun filter
- Optimized for Nordic's chip set nRF51422-CEAA, nRF51422-CDAB, nRF51422-CFAC and nRF51822-CEAA, nRF51822-CDAB, nRF51822-CFAC

Figure 1: Pin coordinates



# Application

Figure 2: Application schematic



# 1 Characteristics

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

Symbol	Parameter	Value			Unit
		Min.	Typ.	Max.	
P <sub>IN</sub>	Input power RF <sub>IN</sub>		-	20	dBm
V <sub>ESD</sub>	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 <sub>OP</sub>	Operating temperature (JESD22-A115-C), all I/O	-40	-	+105	°C
T <sub>stg</sub>	Storage temperature range	-55°C		+150	°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	-	matched	-	Ω
Z <sub>IN</sub>	Nominal input impedance	-	50	-	Ω

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

Symbol	Parameter	Value			Unit
		Min.	Typ.	Max.	
f	Frequency range (bandwidth)		2400	2540	MHz
I <sub>L</sub>	Insertion loss in bandwidth		1.9		dB
RL	Return loss in bandwidth		12		dB
φ <sub>imb</sub>	Phase imbalance		6		°
A <sub>imb</sub>	Amplitude imbalance		0.15		dB
2f <sub>0</sub>	2nd harmonic S <sub>21</sub> attenuation	4880 MHz	44	10	dB
3f <sub>0</sub>	3rd harmonic S <sub>21</sub> attenuation	7320 MHz		20	dB

### 1.1 On-board measurements

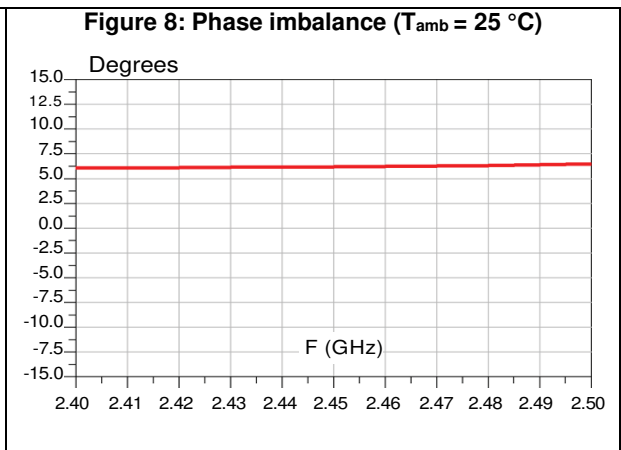
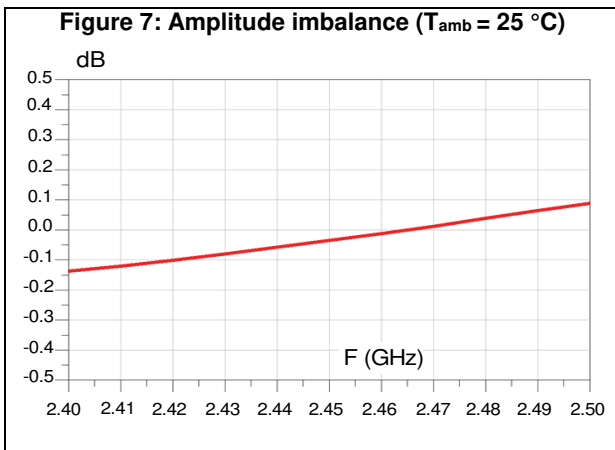
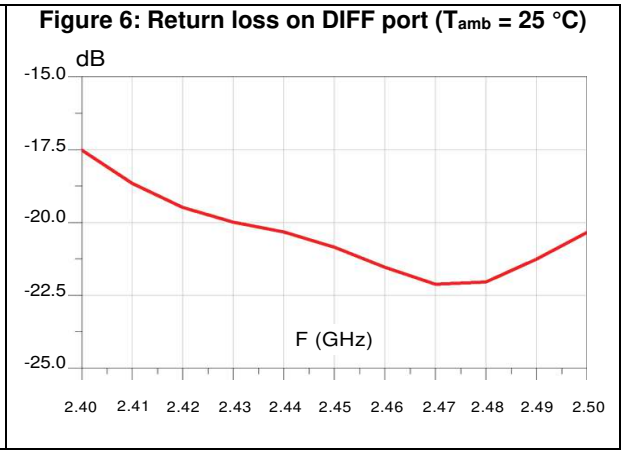
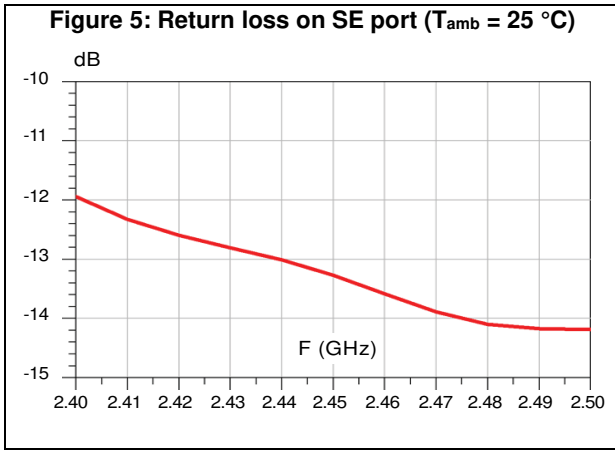
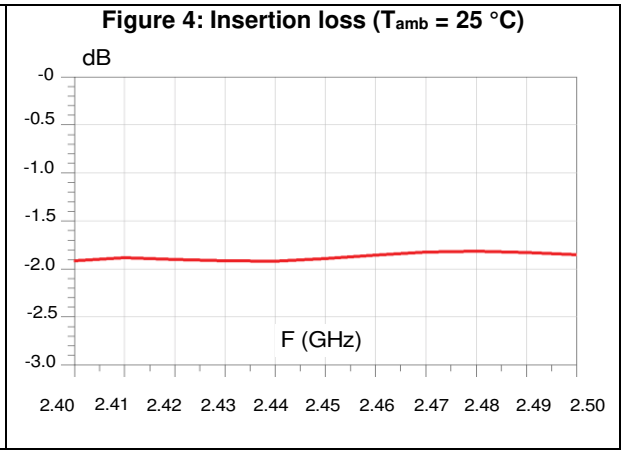
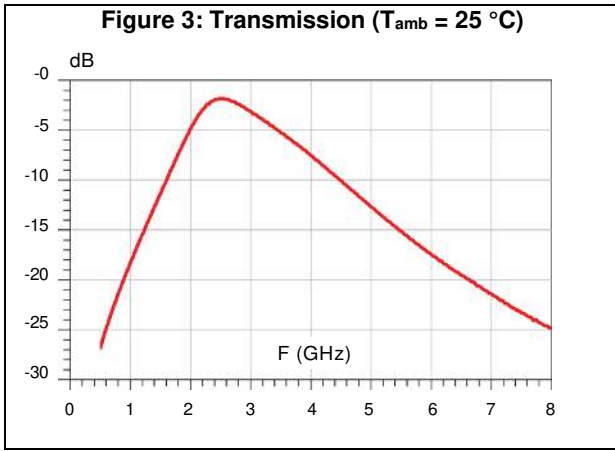


Table 4: Compatibility matrix (nRF51422)

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

## 2 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

### 2.1 Flip-Chip 5 bumps package information

Figure 9: Flip-Chip 5 bumps package outline

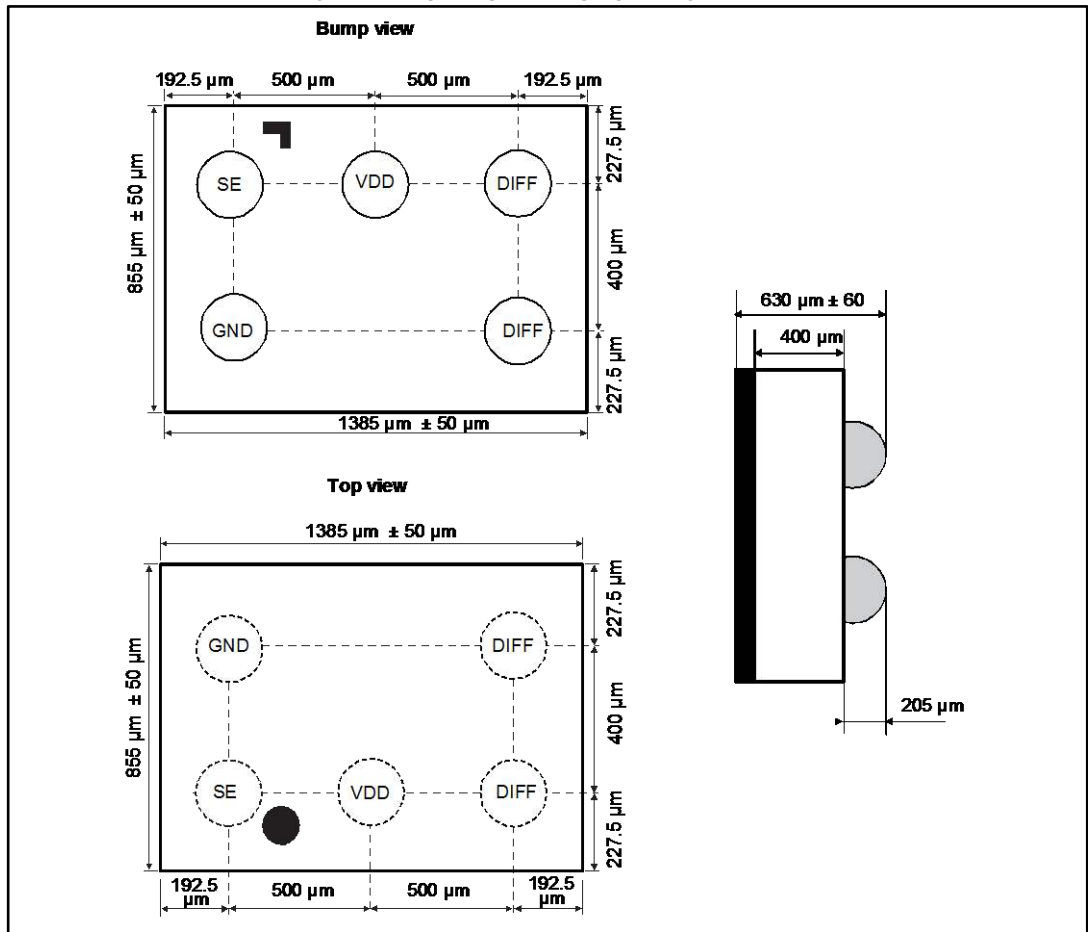


Figure 10: Recommended land pattern

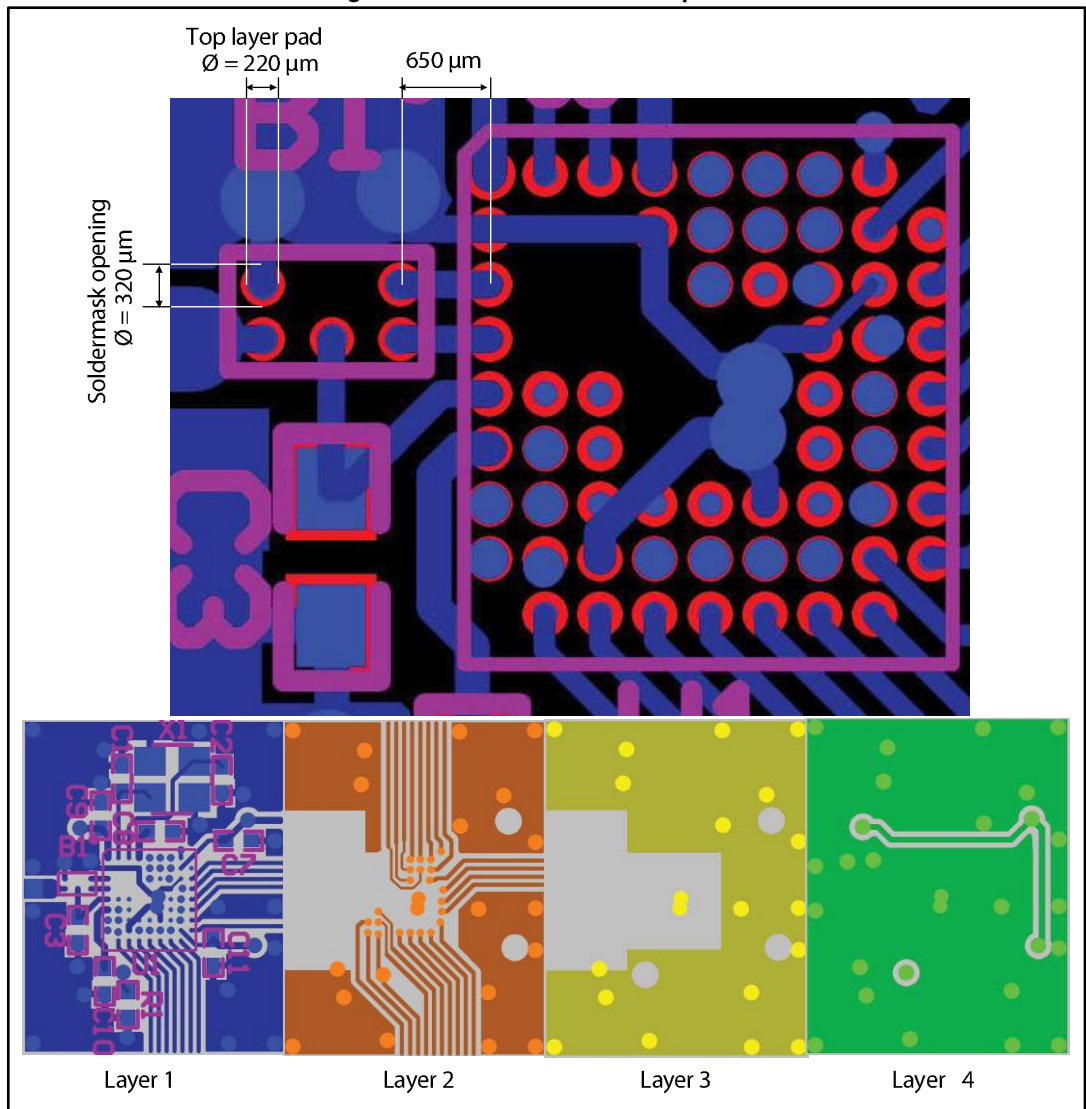
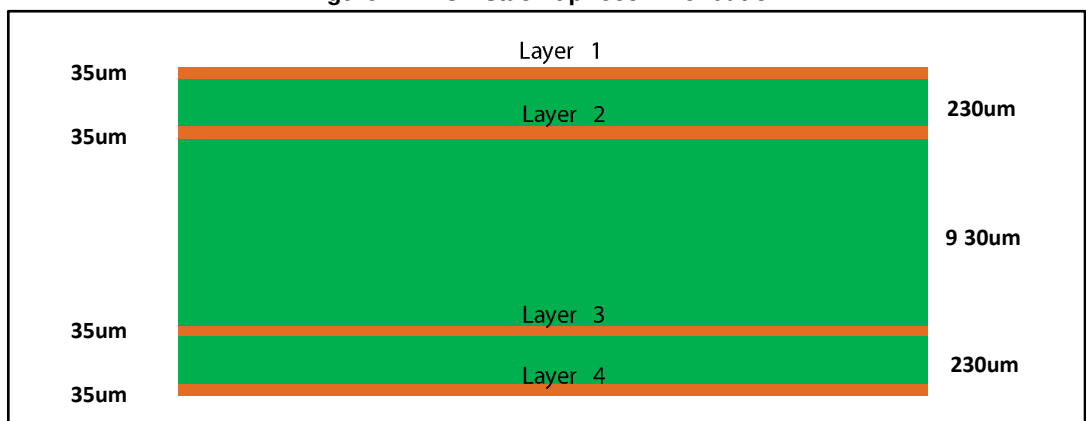


Figure 11: PCB stack-up recommendation



## 2.2 Flip-chip 5 bumps packing information

Figure 12: Marking

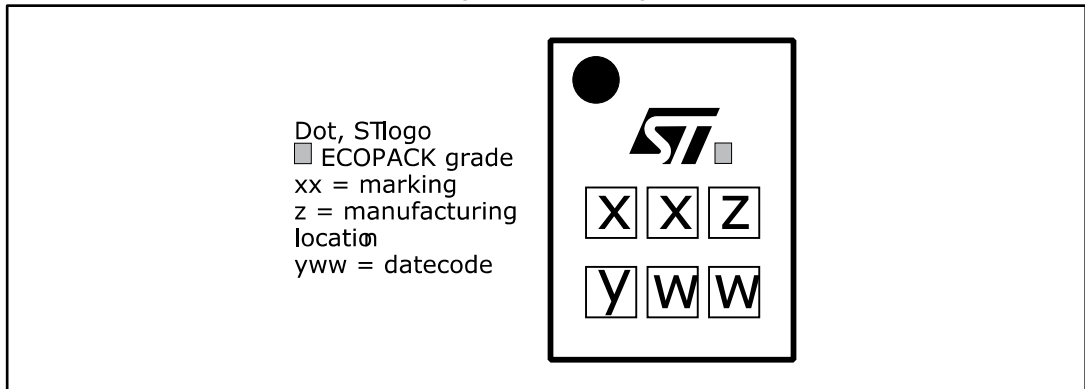
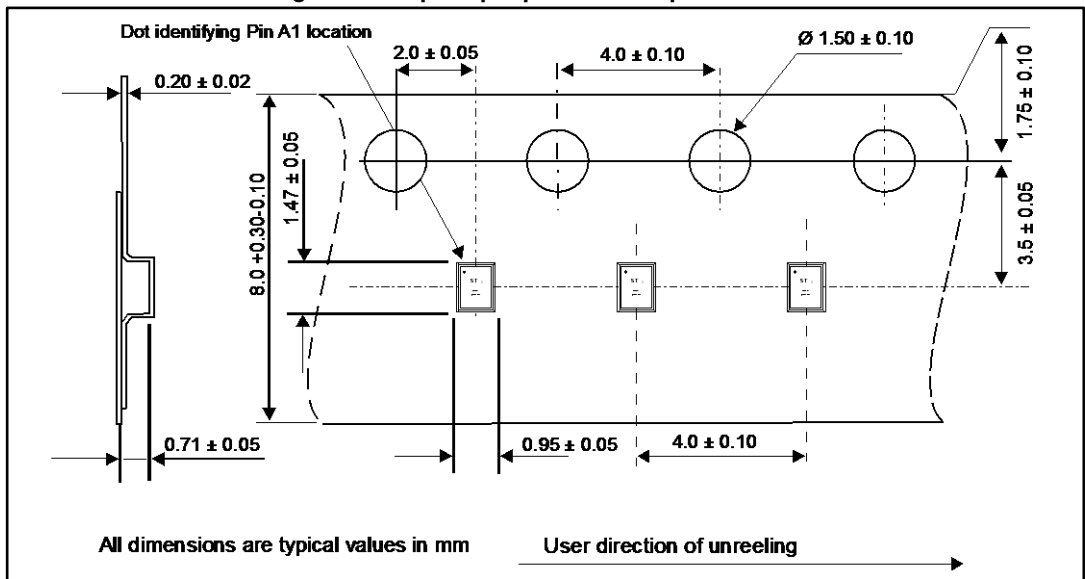


Figure 13: Flip Chip tape and reel specifications



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”

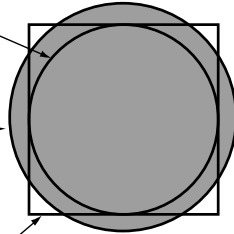


**Figure 14: Footprint - 3 mils stencil -non solder mask defined**

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

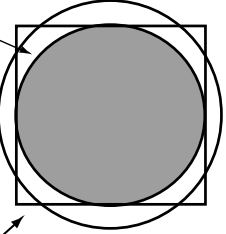


**Figure 15: Footprint - 3 mils stencil - solder mask defined**

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



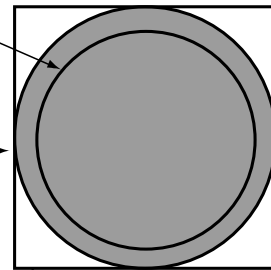
**Figure 16: Footprint - 5 mils stencil -non solder mask defined**

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  $\mu\text{m}$



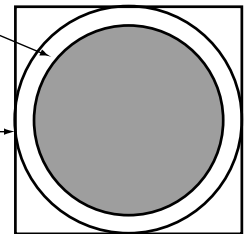
**Figure 17: Footprint - 5 mils stencil - solder mask defined**

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  $\mu\text{m}$



### 3 Ordering information

Table 6: Ordering information

Order code	Marking	Package	Weight	Base qty.	Delivery mode
BAL-NRF02D3	SK	Flip-Chip 5 bumps	1.44 mg	5000	Tape and reel

### 4 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</i> : " <i>Absolute ratings (limiting values)</i> ".
02-Aug-2017	7	Updated Section 3: "Ordering information".
14-Nov-2017	8	Updated <i>Section "Benefits"</i> .

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