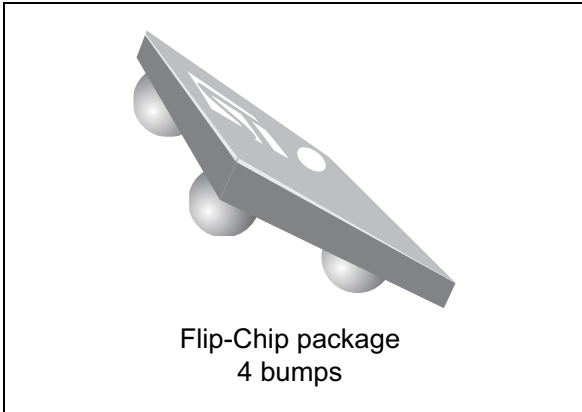


50 ohm, conjugate match to CC2541 transformer balun

Datasheet – production data



## Description

STMicroelectronics BAL-CC25-02D3 is an ultra miniature balun which integrates a matching network in a monolithic glass substrate. This has been customized for the CC2541 RF transceivers.

It's a design using STMicroelectronics IPD (integrated passive device) technology on non-conductive glass substrate to optimize RF performance.

## Features

- 2.45 GHz balun with integrated matching network
- Matching optimized for following CC2541
- Low insertion loss
- Low amplitude imbalance
- Low phase imbalance
- Coated Flip-Chip on glass
- Small footprint: < 0.88 mm<sup>2</sup>

## Benefits

- Very low profile
- High RF performance
- PCB space saving versus discrete solution
- BOM count reduction
- Efficient manufacturability

Figure 1. Pin configuration (top view)

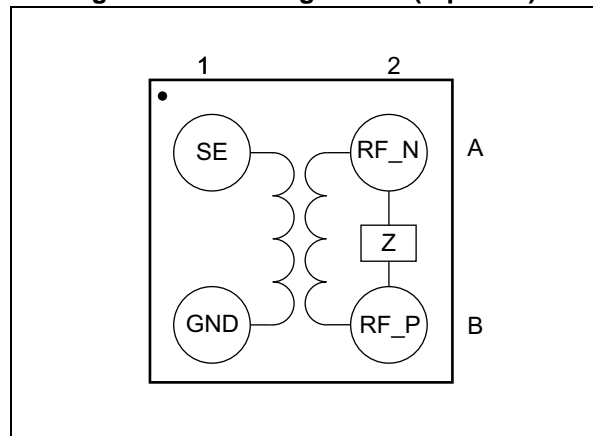
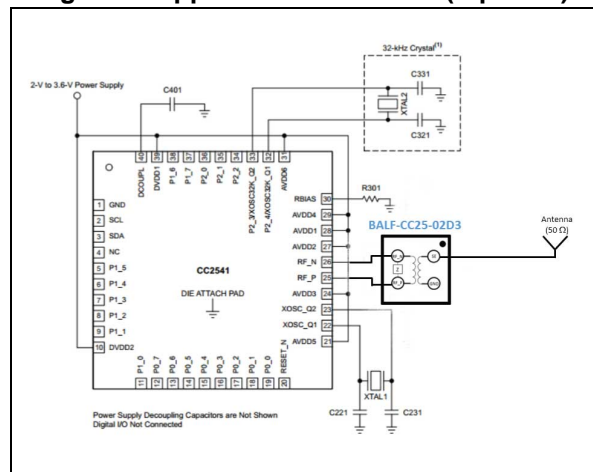


Figure 2. Application schematic (top view)



# 1 Characteristics

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

Symbol	Parameter	Value	Unit
$P_{IN}$	Input power $RF_{IN}$	20	dBm
$V_{ESD}$	ESD ratings MIL STD883C (HBM: C = 100 pF, R = 1.5 $\Omega$ , air discharge)	2000	V
	ESD ratings machine model (MM: C = 200 pF, R = 25 $\Omega$ , L = 500 nH)	500	
	ESD ratings charged device model (CDM, JESD22-C101D)	500	
$T_{OP}$	Operating temperature	-40 to + 105	$^{\circ}C$

**Table 2. Electrical characteristics - RF performance ( $T_{amb} = 25^{\circ}C$ )**

Symbol	Parameter	Value			Unit
		Min.	Typ.	Max.	
$Z_{OUT}$	Nominal differential output impedance	Conjugate match to CC2541			$\Omega$
$Z_{IN}$	Nominal input impedance		50		
F	Frequency range (bandwidth)	2379		2507	
$I_L$	Insertion loss in bandwidth		1.6	1.8	dB
$R_{L\_SE}$	Single ended return loss in bandwidth	9	10		dB
$R_{L\_DIFF}$	Differential ended return loss in bandwidth	9	17		dB
$\Phi_{imb}$	Phase imbalance		7		$^{\circ}$
$A_{imb}$	Amplitude imbalance		0.6		dB

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

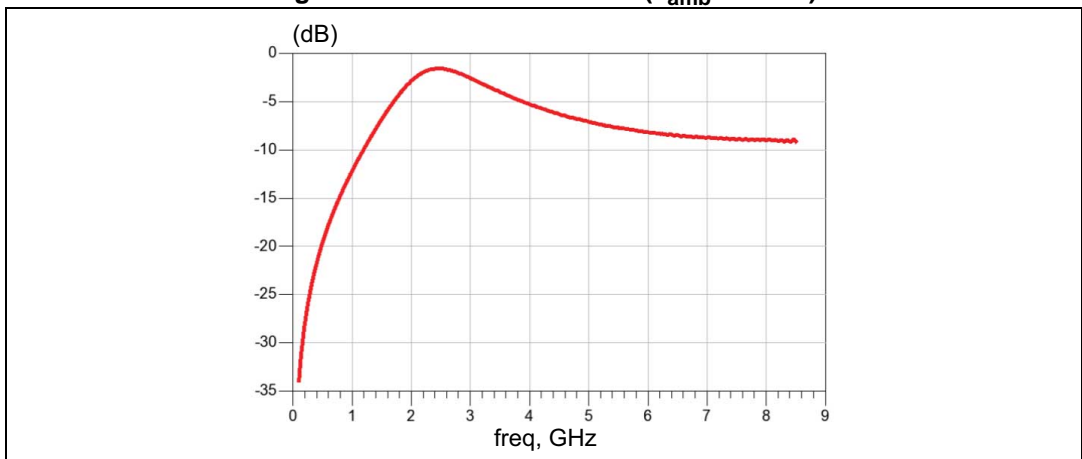


Figure 4. Insertion loss ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

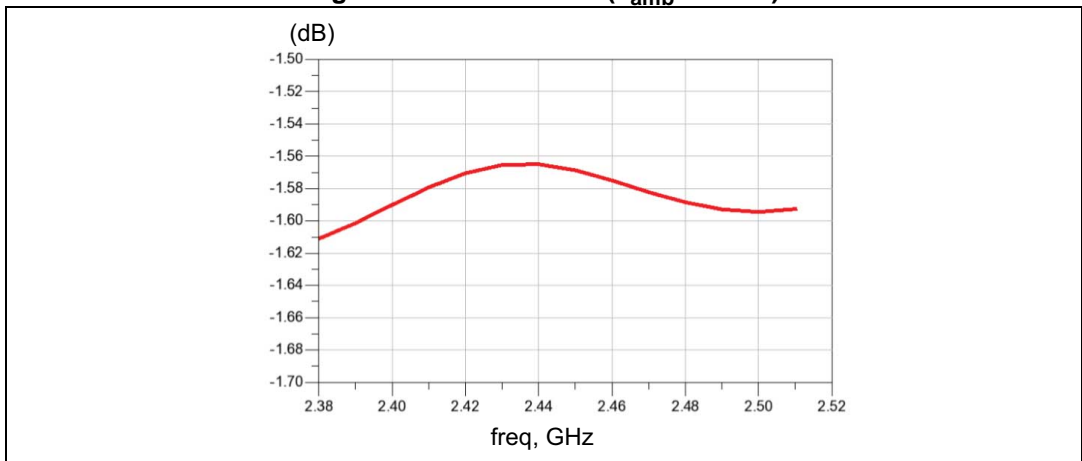


Figure 5. Return loss on SE port ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

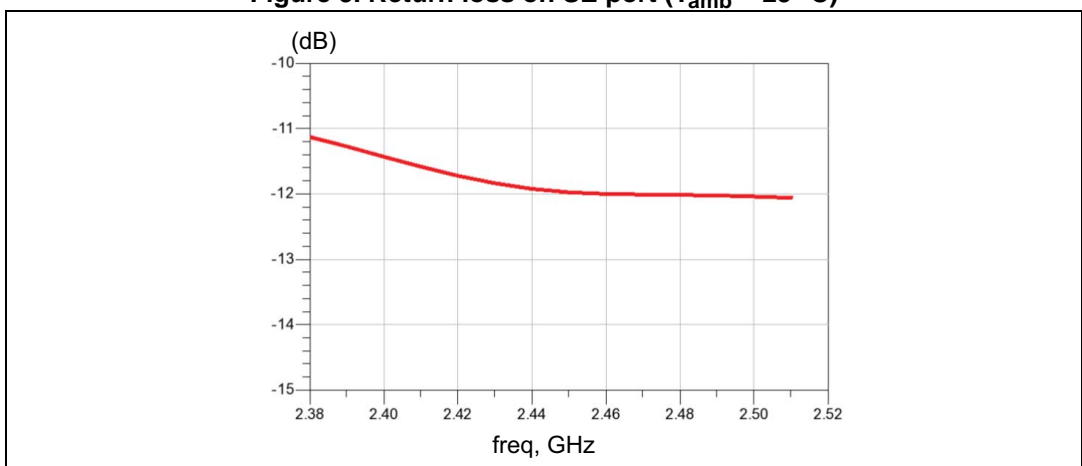


Figure 6. Return loss on DIFF port ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

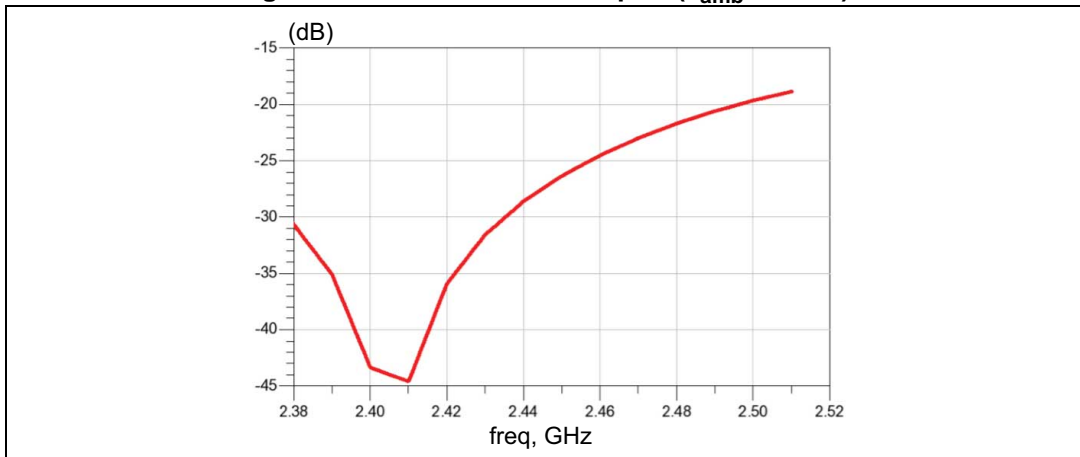


Figure 7. Amplitude imbalance ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

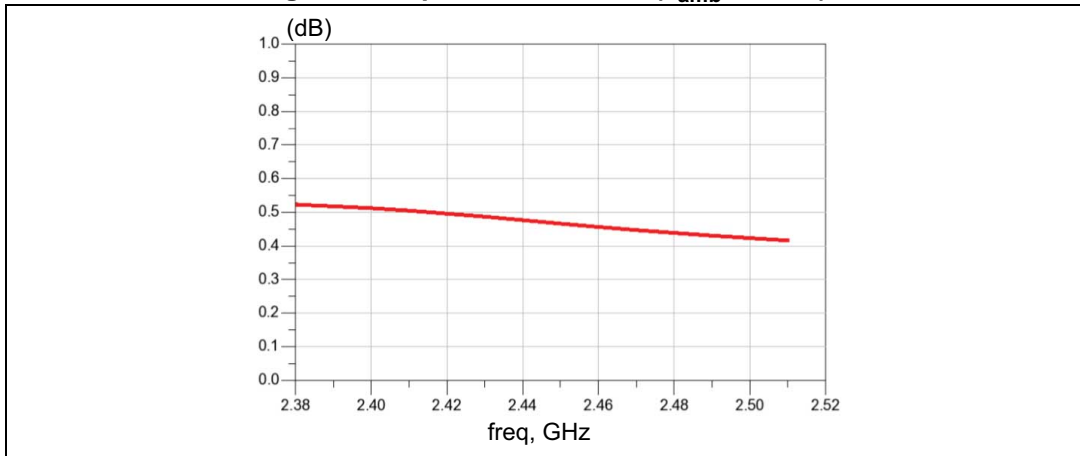
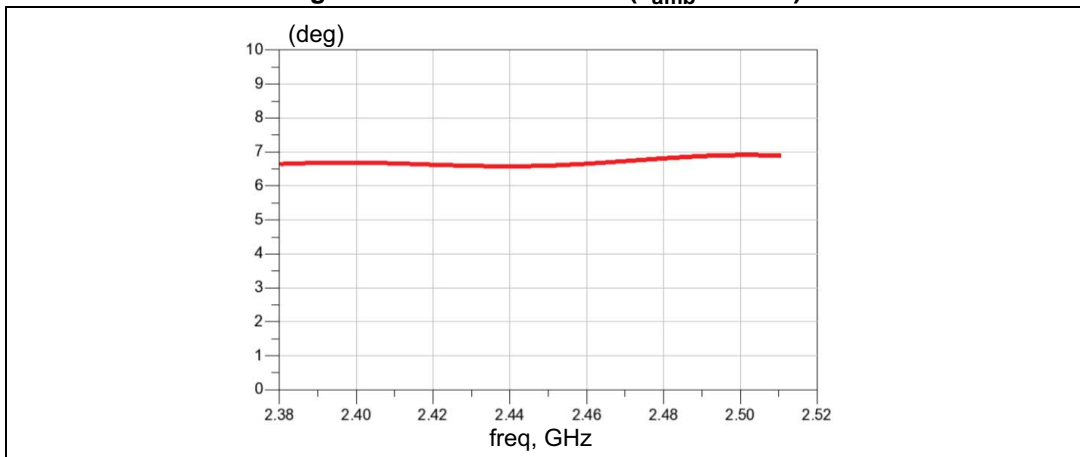


Figure 8. Phase imbalance ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ )



## 2 Package information

- Epoxy meets UL94, V0
- Lead-free package

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

### 2.1 Flip-Chip package information

Figure 9. Flip-Chip package outline

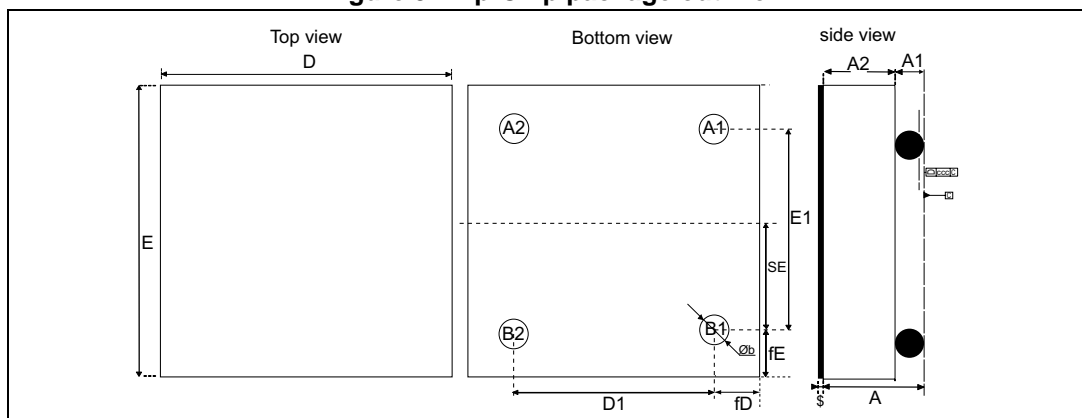


Table 3. Flip-Chip package mechanical data

Parameter	Description	Min.	Typ.	Max.	Unit
A	Bump height + substrate thickness	0.570	0.630	0.690	mm
A1	Bump height	0.155	0.205	0.255	mm
A2	Substrate thickness		0.400		mm
b	Bump diameter	0.215	0.255	0.295	mm
D	Y dimension of the die	0.890	0.940	0.990	mm
D1	Y pitch		0.500		mm
E	X dimension of the die	0.890	0.940	0.990	mm
E1	X pitch		0.500		mm
SE			0.250		mm
fD	Distance from bump to edge of die on Y axis		0.220		mm
fE	Distance from bump to edge of die on X axis		0.220		mm
ccc				0.05	mm
\$			0.025		mm

Figure 10. Footprint

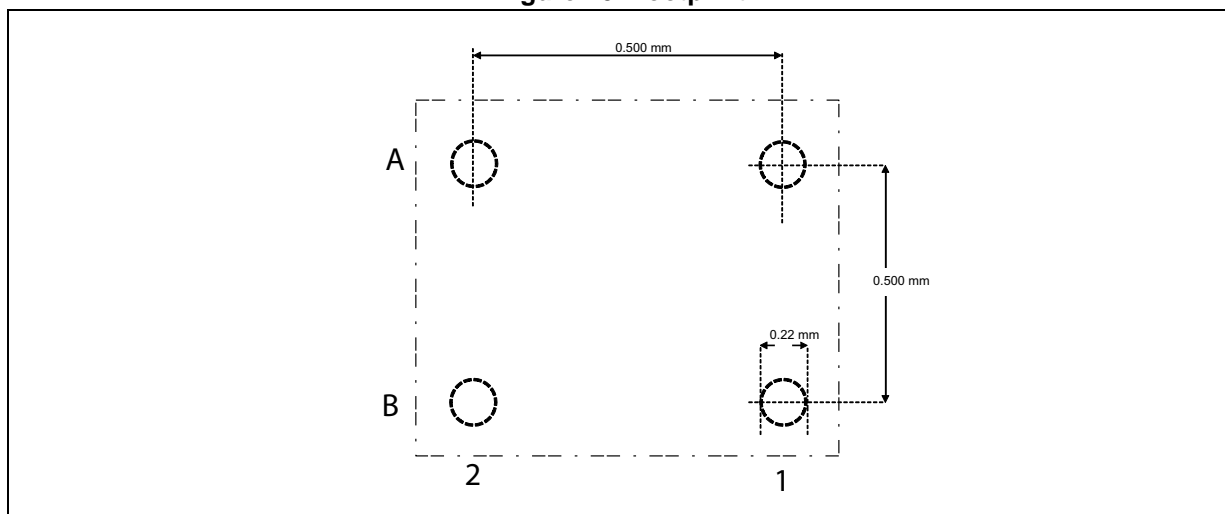
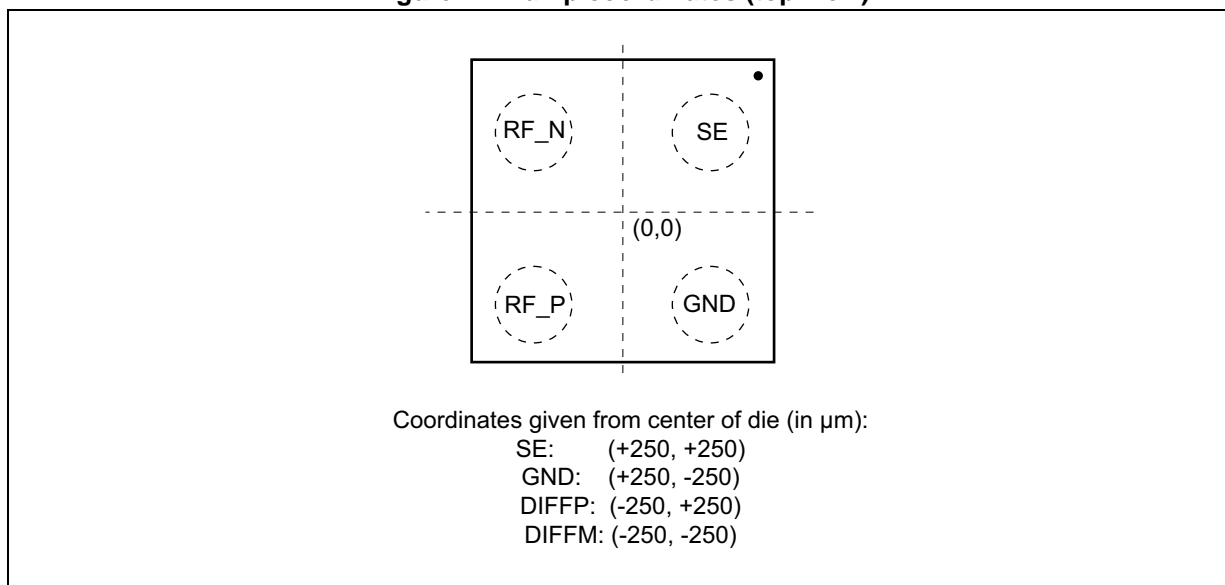


Figure 11. Bump coordinates (top view)

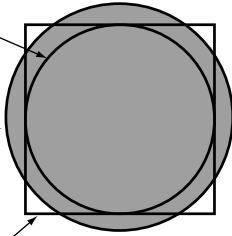


**Figure 12. Footprint - 3 mils stencil - non solder mask defined**

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

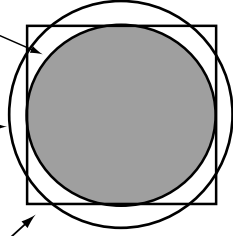


**Figure 13. Footprint - 3 mils stencil - solder mask defined**

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



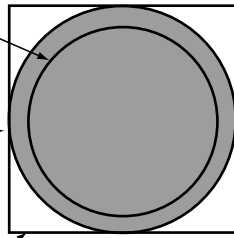
**Figure 14. Footprint - 5 mils stencil - non solder mask defined**

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 15. 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  $\mu\text{m}$

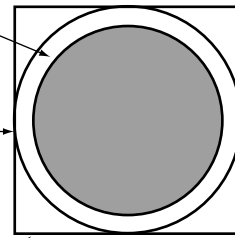


Figure 16. PCB layout recommendation

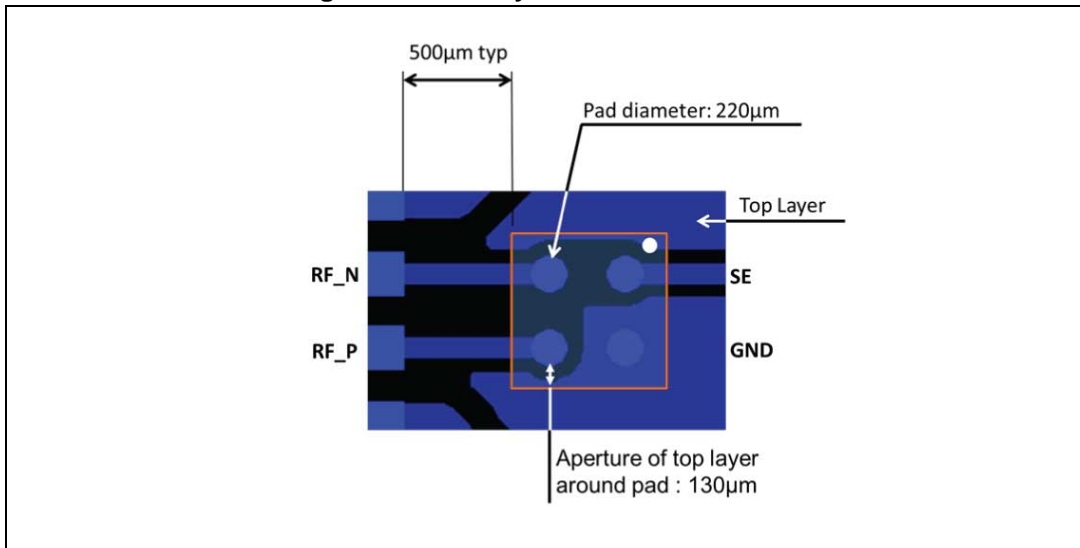
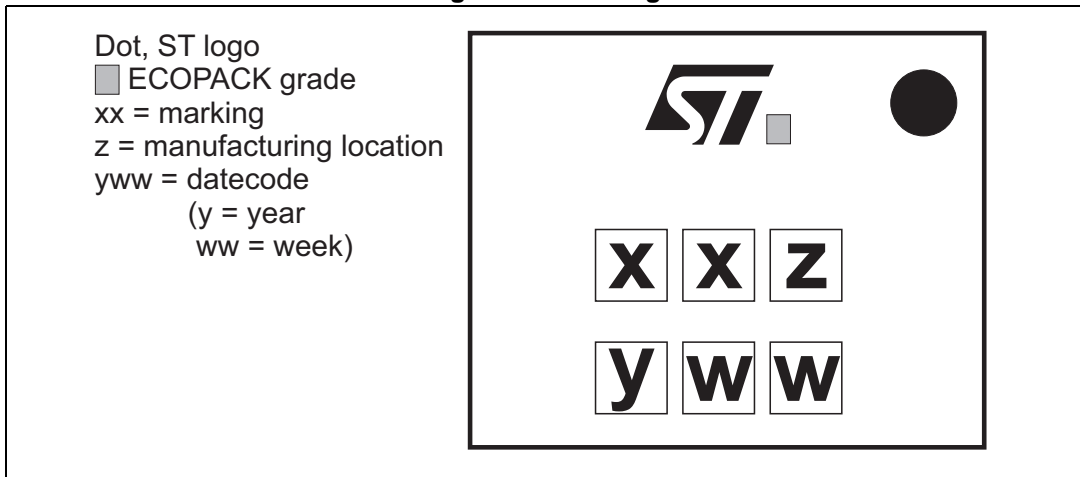


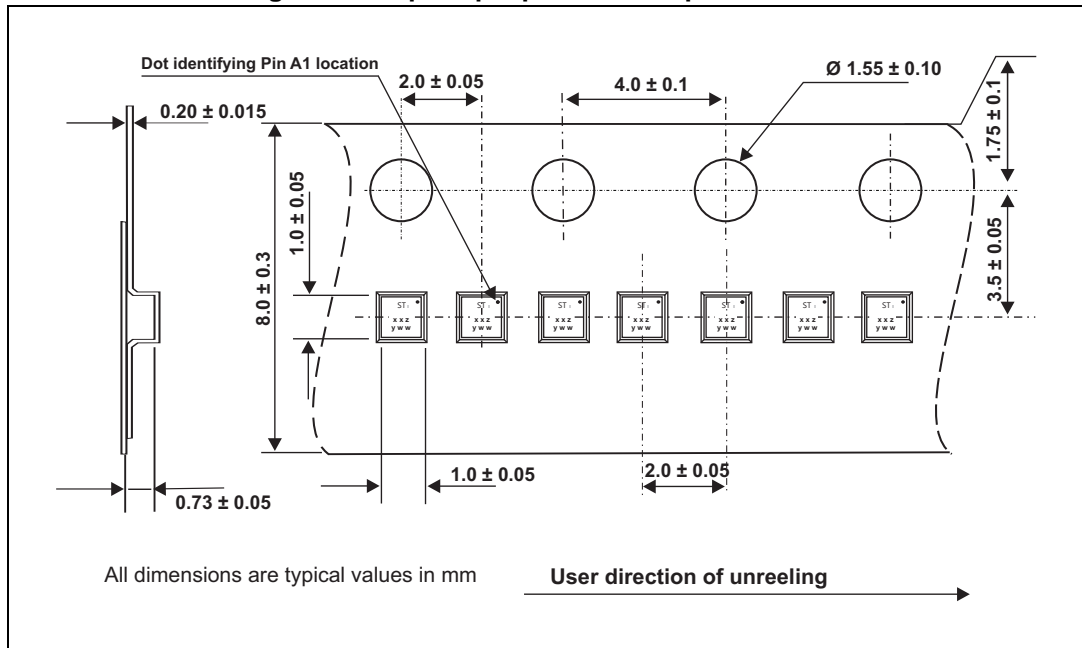
Figure 17. Marking



Note: More information is available in the STMicroelectronics Application note: AN2348 Flip-Chip: "Package description and recommendations for use"



Figure 18. Flip Chip tape and reel specifications



Note: More information is available in the application note:  
 AN2348: "Flip Chip: package description and recommendations for use"

### 3 Ordering information

**Table 4. Ordering information**

Order code	Marking	Package	Weight	Base qty	Delivery mode
BAL-CC25-02D3	TE	Flip Chip	1.07 mg	5000	Tape and reel (7")

### 4 Revision history

**Table 5. Document revision history**

Date	Revision	Changes
17-Nov-2015	1	Initial release

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