

50 Ω nominal input / conjugate match balun to SPIRIT1 434 MHz,
with integrated harmonic filter

Datasheet – production data

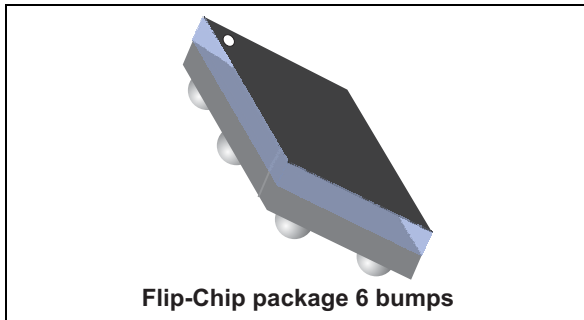


Figure 1. Pin coordinates (top view)

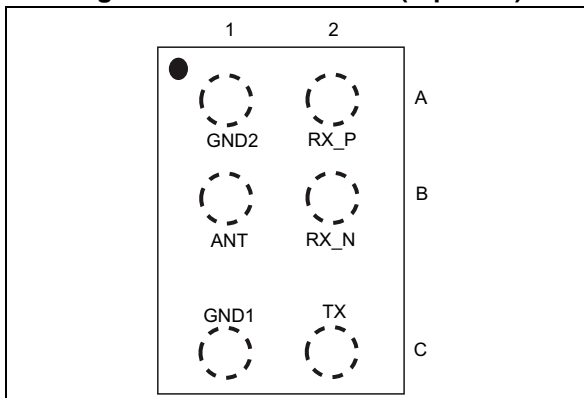
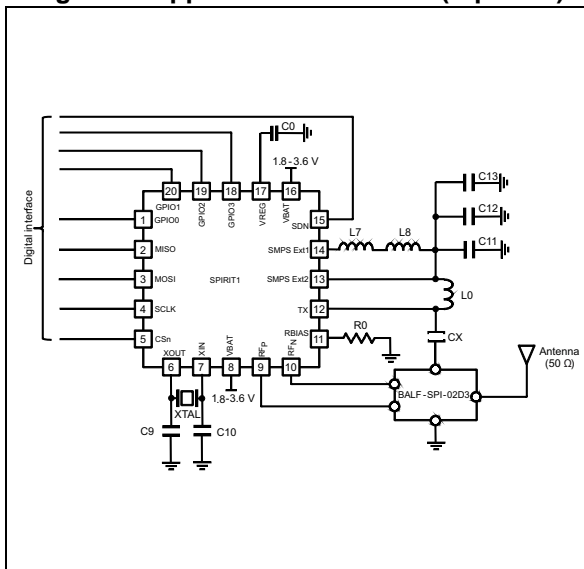


Figure 2. Application schematic (top view)



Features

- 50 Ω nominal input / conjugate match to SPIRIT1
- Low insertion loss
- Low amplitude imbalance
- Low phase imbalance
- Small footprint

Benefits

- Very low profile (< 670 μm)
- High RF performance
- RF BOM and area reduction

Applications

- 434 MHz impedance matched balun filter
- Optimized for ST chipset SPIRIT1

Description

STMicroelectronics BALF-SPI-02D3 is an ultraminiature balun. The BALF-SPI-02D3 integrates matching network and harmonics filter. Matching impedance has been customized for the SPIRIT1 ST transceiver.

The BALF-SPI-02D3 uses STMicroelectronics IPD technology on non-conductive glass substrate which optimize RF performance.

Table 1. BOM optimization at 433MHz

SMD	PN	Value
L0	LGQ15HSR15J02	150 nH
L7	LQM21FN100M70L	10 μH
L8	LQW15AN62NG00	62 nH
C11	GRM188R60J105KA01D	1 μF
C12	GRM155R71C104KA88D	100 nF
C13	GRM1555C1H331JA01D	330 pF
CX	GRM1555C1H221JA01	220 pF

1 Characteristics

Table 2. Absolute maximum ratings (limiting values)

Symbol	Parameter	Value			Unit
		Min.	Typ.	Max.	
P _{IN}	Input power RFIN			20	dBm
V _{ESD}	ESD ratings MIL STD883C (HBM: C = 100 pF, R = 1.5 kΩ, air discharge)	2000			V
	ESD ratings machine model (MM: C = 200 pF, R = 25 Ω, L = 500 nH)	200			
T _{OP}	Operating temperature	-40		+85	°C

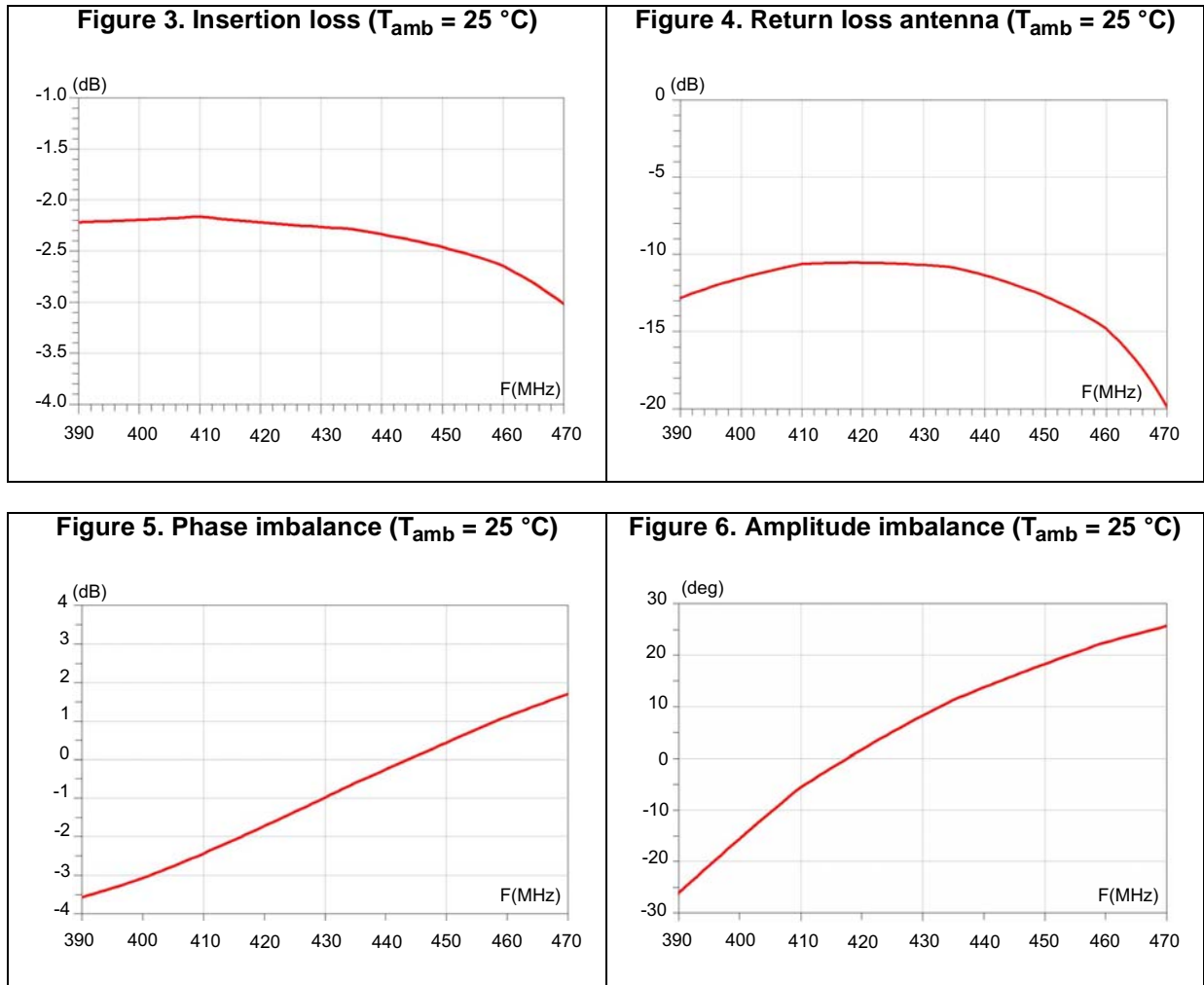
Table 3. Impedances (T_{amb} = 25 °C)

Symbol	Parameter	Value			Unit
		Min.	Typ.	Max.	
Z _{RX}	Nominal differential RX balun impedance		match to SPIRIT1		Ω
Z _{TX}	Nominal TX filter impedance				
Z _{ANT}	Antenna impedance		50		Ω

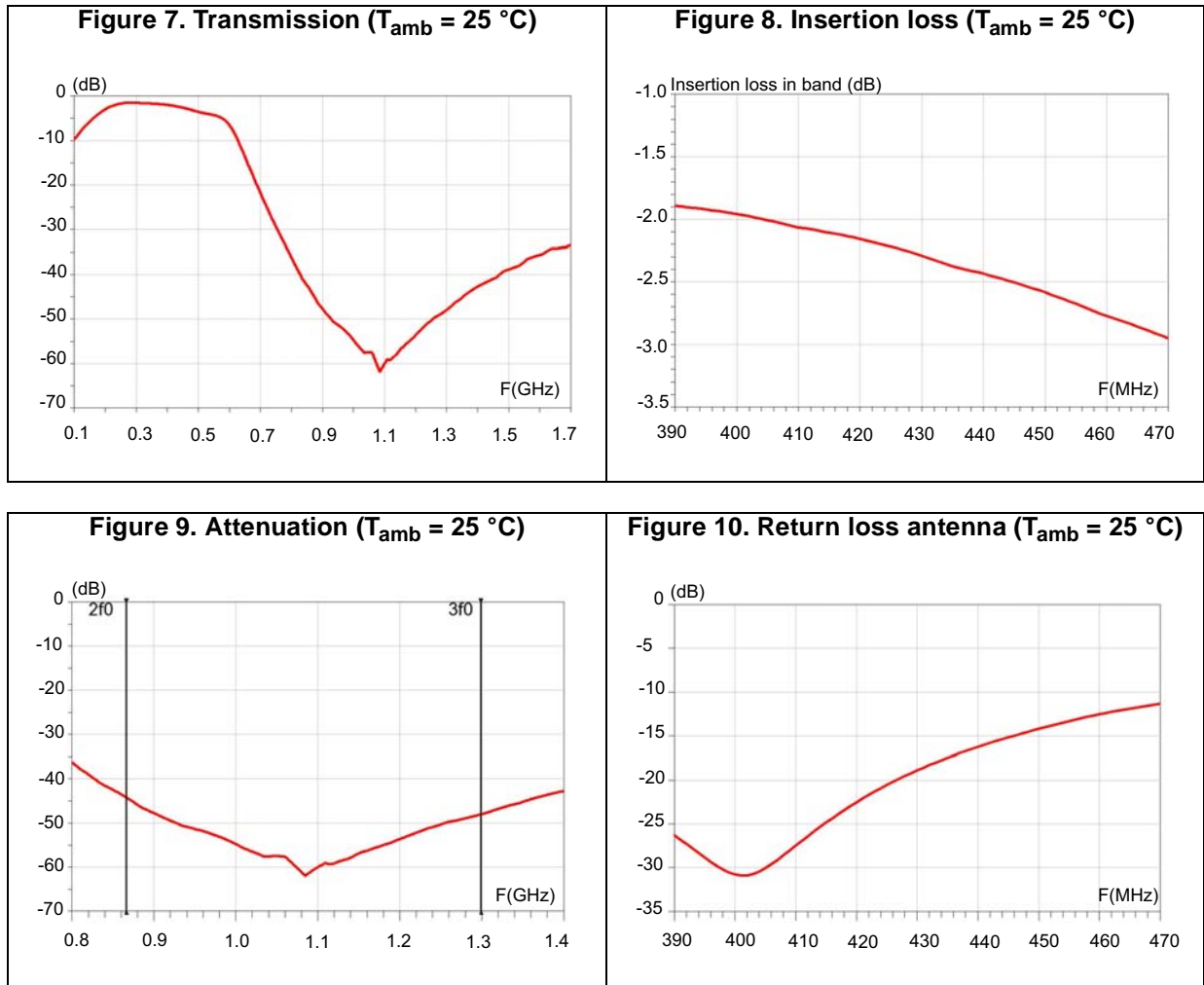
Table 4. RF performance (T_{amb} = 25 °C)

Symbol	Parameter	Test condition	Value			Unit
			Min.	Typ.	Max.	
F	Frequency range (bandwidth)	-	-	434	-	MHz
S ₂₁ _{RX-ANT}	Insertion loss in bandwidth without mismatch loss (RX balun)	-	-	-2.3	-3.2	dB
S ₂₁ _{TX-ANT}	Insertion loss in bandwidth without mismatch loss (TX filter)	-	-	-2.4	-3.2	dB
S ₁₁ _{ANT}	Input return loss in bandwidth (RX balun)	-	-	-20	-10.5	dB
S ₁₁ _{ANT}	Input return loss in bandwidth (TX filter)	-	-	-32	-11	dB
Φ _{imb}	Output phase imbalance (RX balun)	-	-30	10	30	°
A _{imb}	Output amplitude imbalance (RX balun)	-	-3.5	-1	2	dB
Att	Harmonic levels (TX filter)	Attenuation at 2fo	-40	-44	-	dBm
		Attenuation at 3fo	-40	-45	-	

1.1 RF measurement (Rx balun)



1.2 RF measurement (Tx filter)



2 Application information

Figure 11. Application board EVB (4 layers)

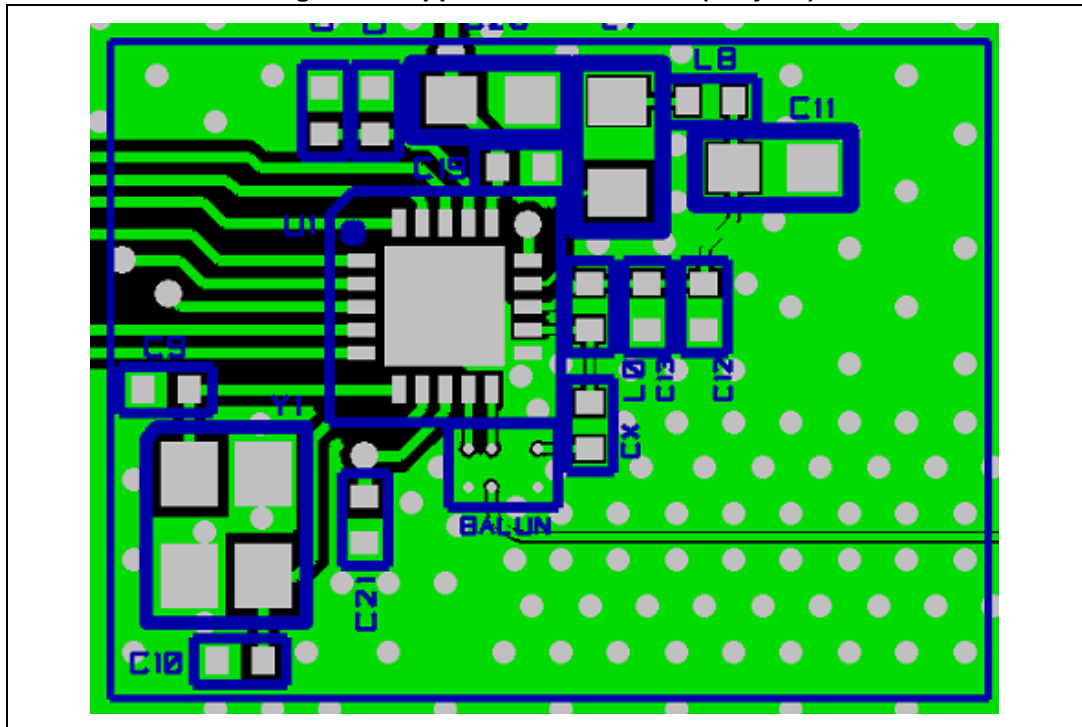


Figure 12. TX output measurements at 433 MHz (LQW15 62nH)

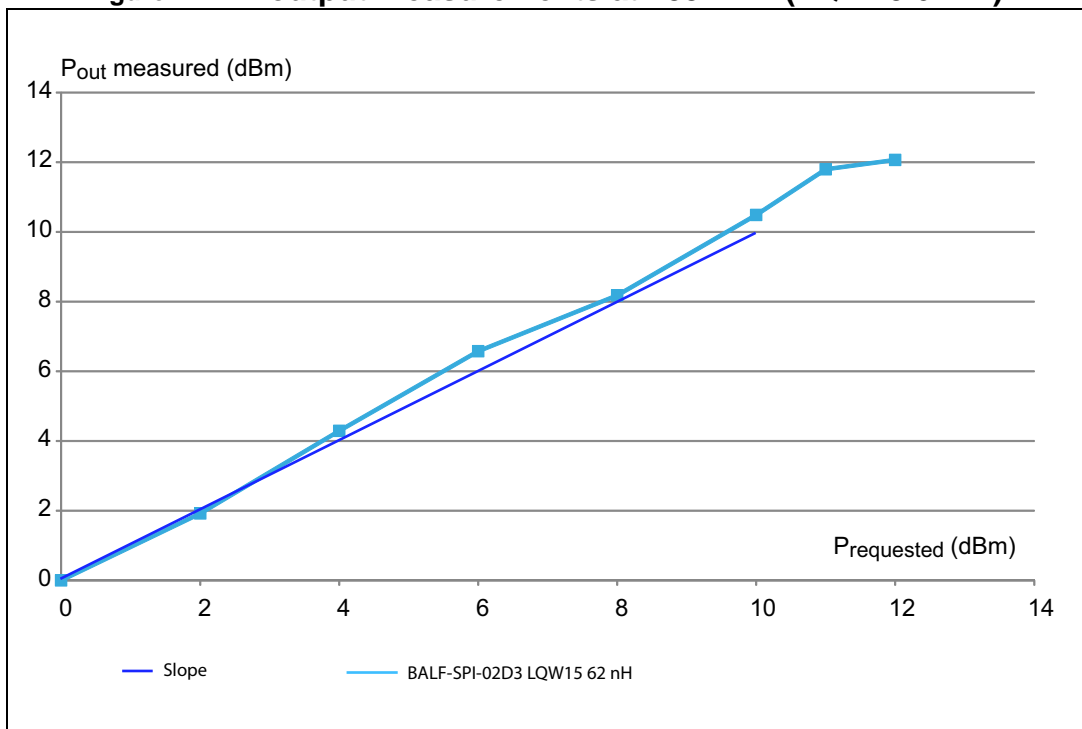
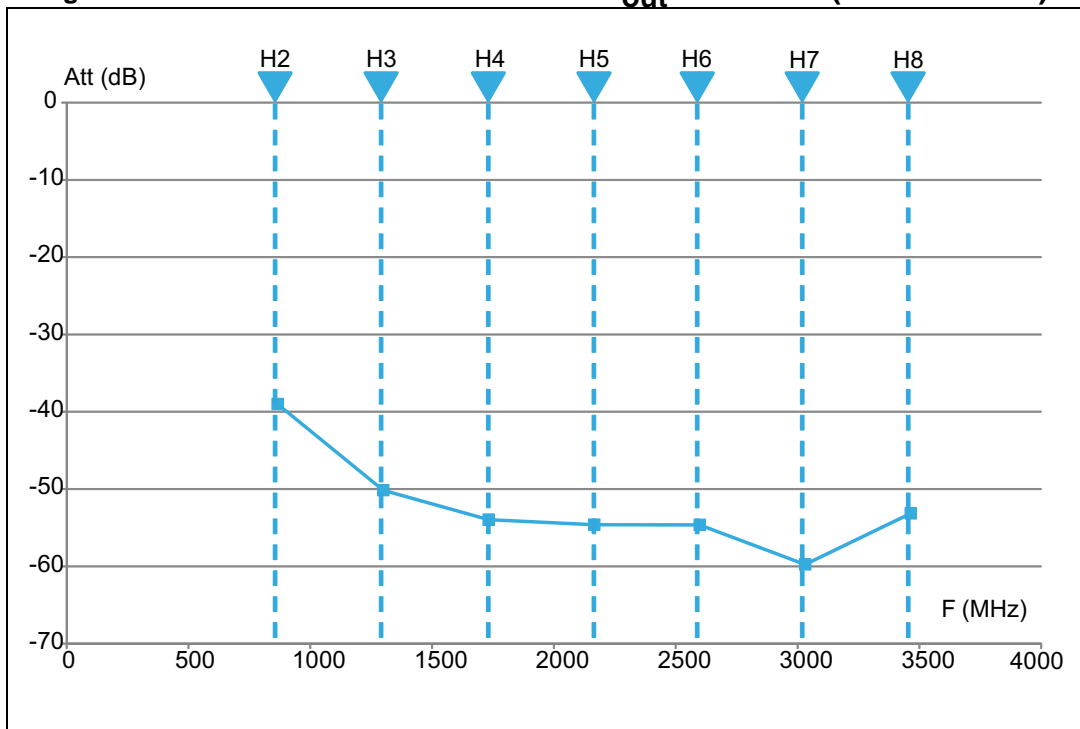


Figure 13. Harmonic measurements at $P_{out} = 10 \text{ dBm}$ (LQW15 62nH)



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. ECOPACK® is an ST trademark.

3.1 Flip-Chip package information

Figure 14. Flip-Chip package outline (top and side view)

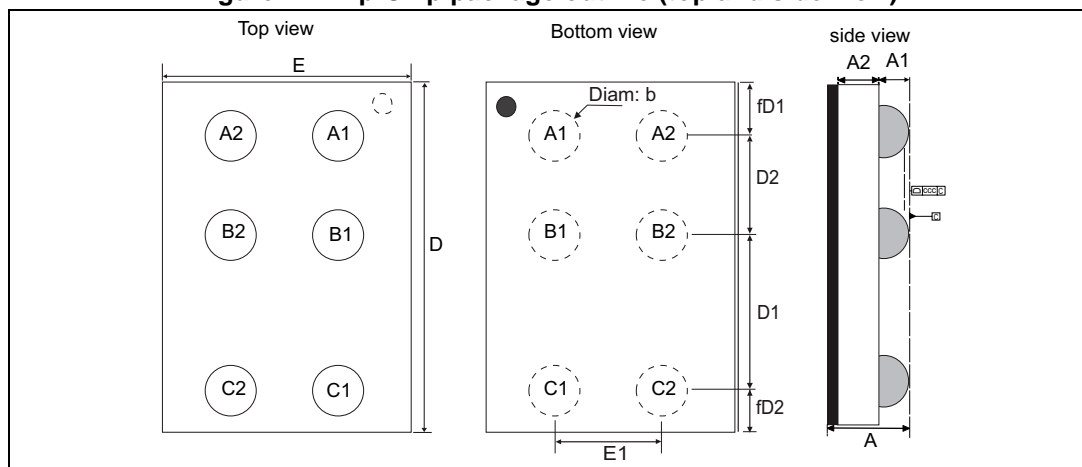


Table 5. Flip-Chip package mechanical data

Parameter	Description	Min.	Typ.	Max.	Unit
A	Bump height + substrate thickness	0.590	0.650	0.710	mm
A1	Bump height		0.200		mm
A2	Substrate thickness		0.400		mm
b	Bump diameter	0.210	0.250	0.290	mm
D	Y dimension of the die	1.950	2.000	1.950	mm
D1	Y pitch	0.960	1.000	1.040	mm
D2	Y pitch2	0.460	0.500	0.540	mm
E	X dimension of the die	1.350	1.400	1.450	mm
E1	X pitch	0.790	0.820	0.850	mm
fD1	Distance from bump to edge of die on Y axis		0.295		mm
fD2	Distance from bump to edge of die on Y axis		0.195		mm
ccc				0.05	mm

Figure 15. Recommended balun land pattern

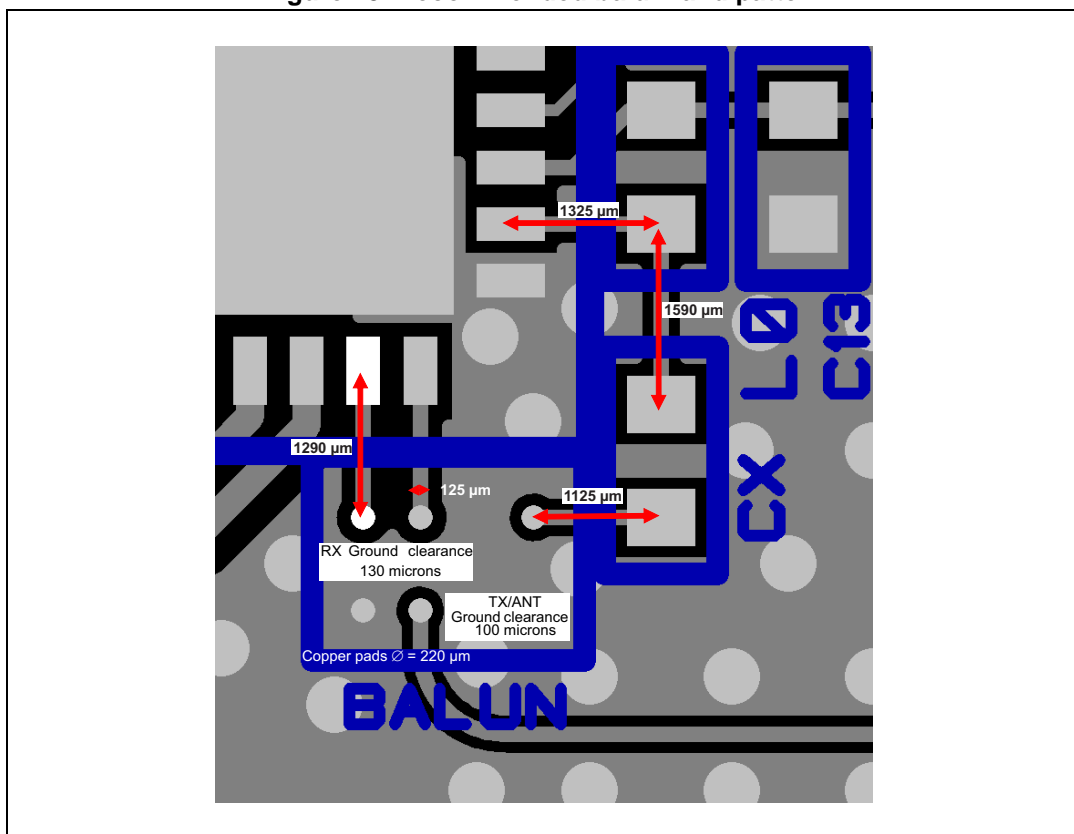


Figure 16. Footprint - 3 mils stencil - non solder mask defined

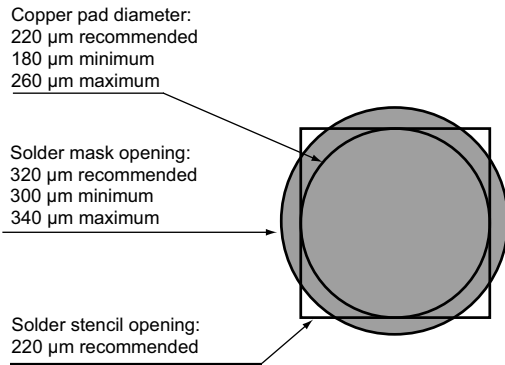


Figure 17. Footprint - 3 mils stencil - solder mask defined

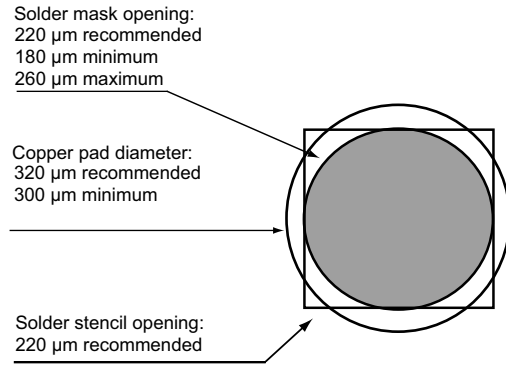


Figure 18. Footprint - 5 mils stencil - non solder mask defined

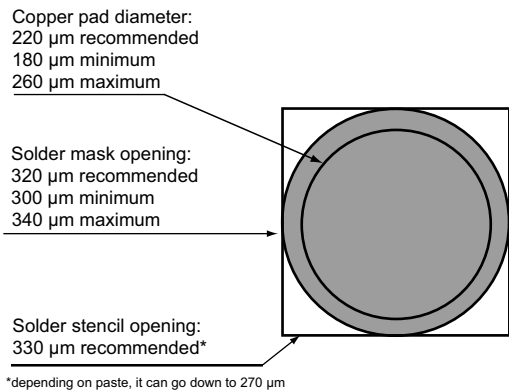


Figure 19. Footprint - 5 mils stencil - solder mask defined

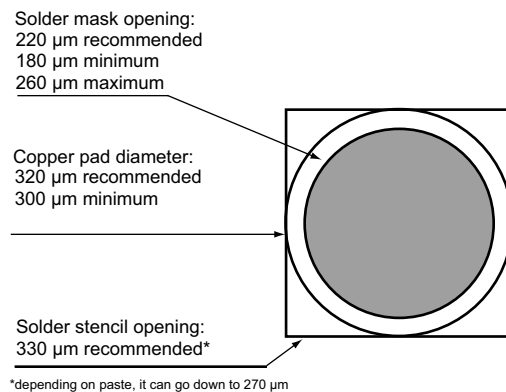


Figure 20. Marking

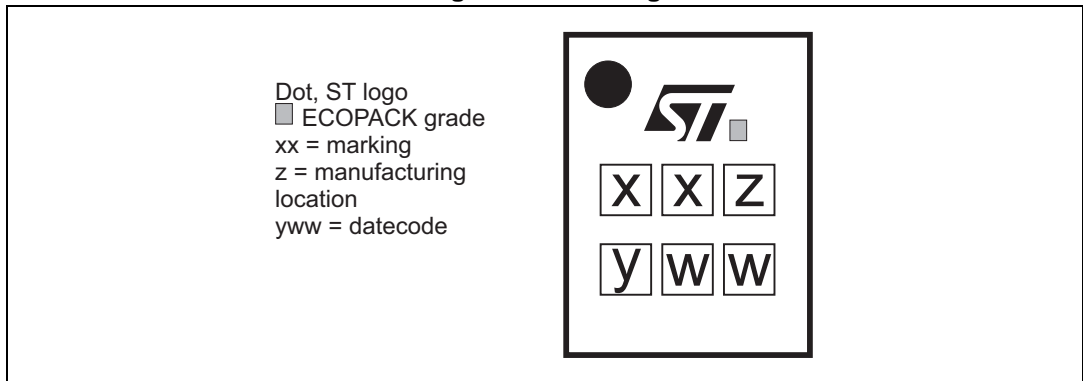
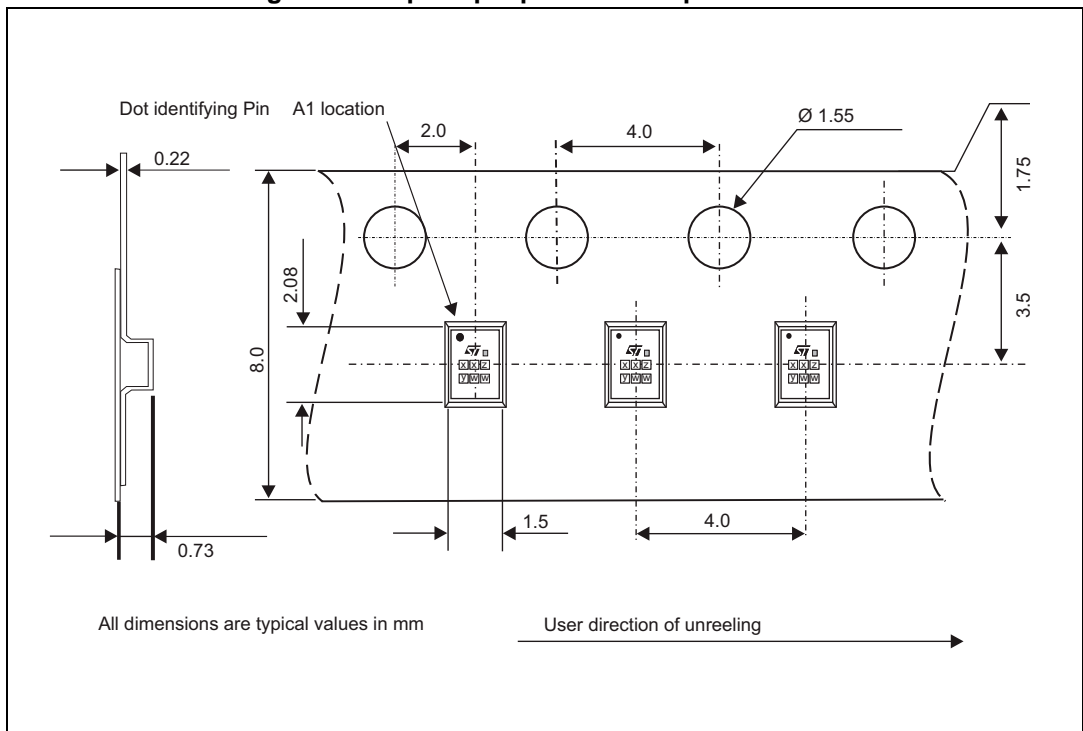


Figure 21. Flip Chip tape and reel specifications



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

4 Ordering information

Table 6. Ordering information

Order code	Marking	Weight	Base Qty	Delivery mode
BALF-SPI-02D3	TD	3.0 mg	5000	Tape and Reel

5 Revision history

Table 7. Document revision history

Date	Revision	Changes
13-Jan-2015	1	Initial release
15-May-2015	2	Updated Table 4 . Added Figure 12 , Figure 13 , Figure 18 and Figure 19 .
18-Sep-2015	3	Updated Figure 14 and added Figure 5 .

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