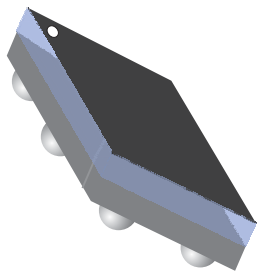
BALF-SPI-01D3

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

Datasheet – production data



Flip-Chip package 6 bumps

Figure 1. Pin coordinates (top view)

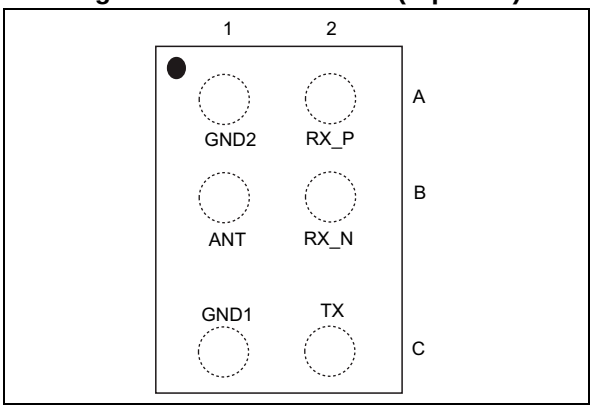
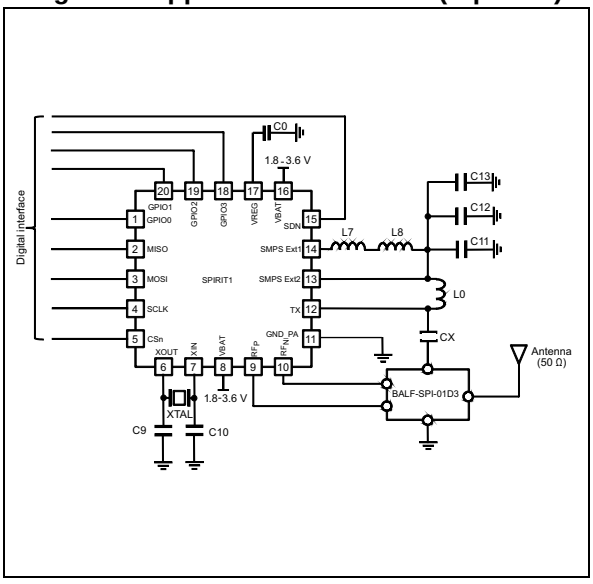


Figure 2. Application schematic (top view)



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

- 868 MHz and 915 MHz impedance matched balun filter
- Optimized for SPIRIT1 sub GHz RFIC

Description

STMicroelectronics BALF-SPI-01D3 is an ultra miniature balun. The BALF-SPI-01D3 integrates matching network and harmonics filters. Matching impedance has been customized for the SPIRIT1 ST transceiver.

The BALF-SPI-01D3 uses STMicroelectronics IPD technology on non-conductive glass substrate which optimize RF performance.

This is information on a product in full production. www.st.com

1 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 machine model, all I/O	200	-		
T_{OP}	Operating temperature (JESD22-A115-C), all I/O	-40	-	+85	°C

Table 2. 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 3. RF performance (T_{amb} = 25 °C)

Symbol	Parameter	Test condition	Value			Unit
			Min.	Typ.	Max.	
F	Frequency range (bandwidth)		779	868	956	MHz
$S21_{RX-ANT}$	Insertion loss in bandwidth without mismatch loss (RX balun)			-1.7	-2	dB
$S21_{TX-ANT}$	Insertion loss in bandwidth without mismatch loss (TX filter)			-1.4	-2	dB
$S11_{ANT}$	Input return loss in bandwidth (RX balun)			-23	-15	dB
$S11_{ANT}$	Input return loss in bandwidth (TX filter)			-15	-12	dB
ϕ_{imb}	Output phase imbalance (RX balun)		5	10	15	°
A_{imb}	Output amplitude imbalance (RX balun)			0.35	0.8	dB
Att	Harmonic levels (TX filter)	Attenuation at 2fo		-35		dBm
		Attenuation at 3fo		-40		

1.1 RF measurement (Rx balun)

Figure 3. Insertion loss (T_{amb} = 25 °C)

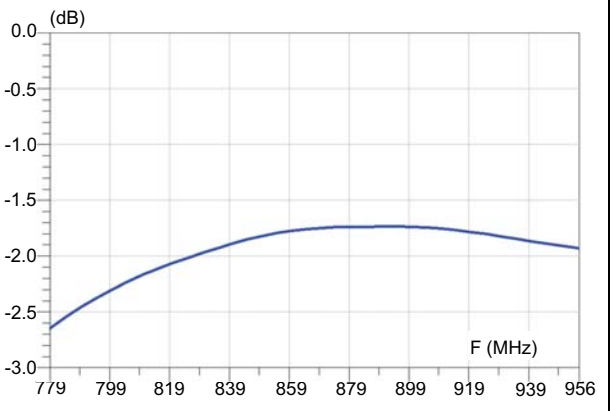


Figure 4. Return loss antenna (T_{amb} = 25 °C)

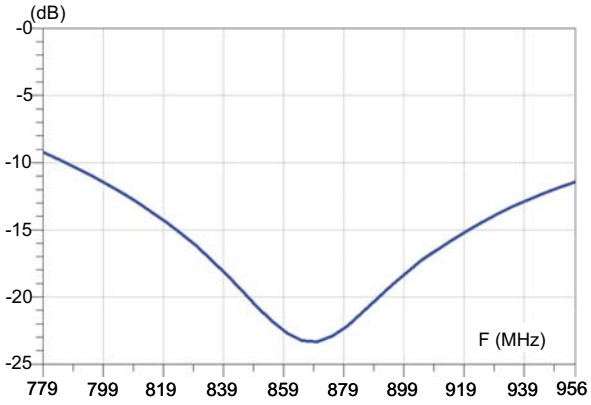


Figure 5. Phase imbalance (T_{amb} = 25 °C)

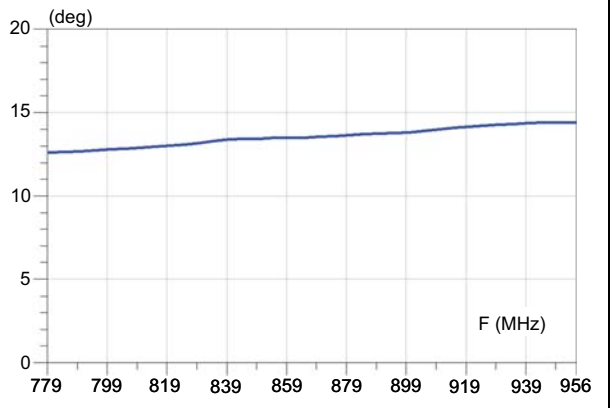
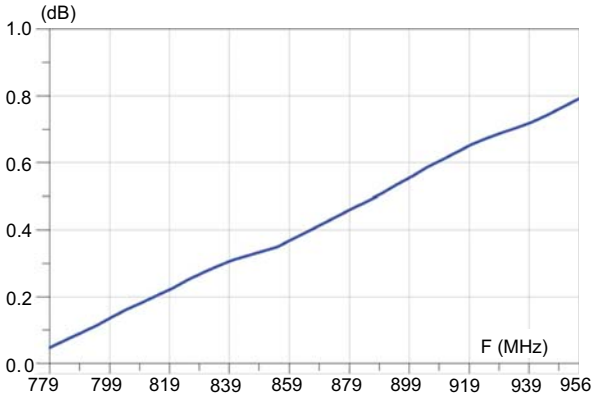


Figure 6. Amplitude imbalance (T_{amb} = 25 °C)



1.2 RF measurement (Tx filter)

Figure 7. Transmission (T_{amb} = 25 °C)

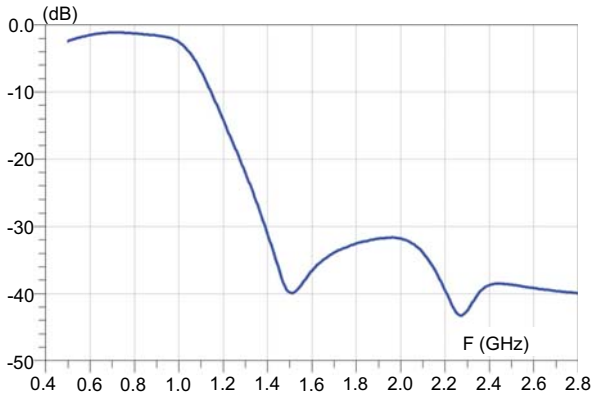


Figure 8. Insertion loss (T_{amb} = 25 °C)

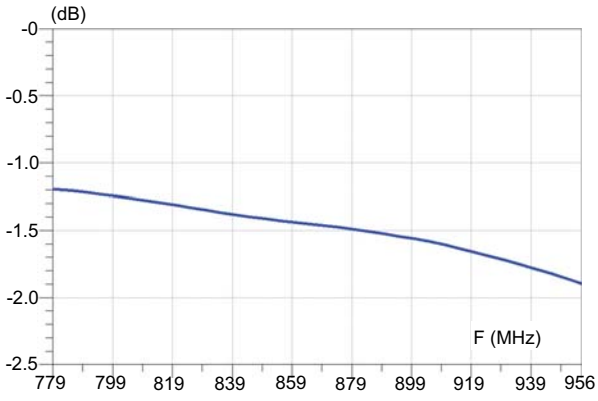


Figure 9. Attenuation (T_{amb} = 25 °C)

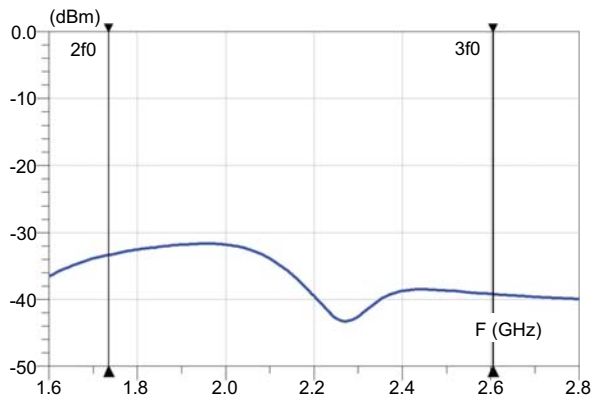
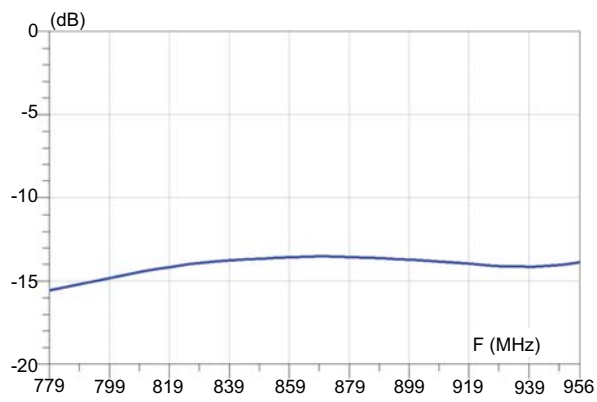


Figure 10. Return loss antenna (T_{amb} = 25 °C)



2 Application information

Figure 11. Application board EVB (4 layers)

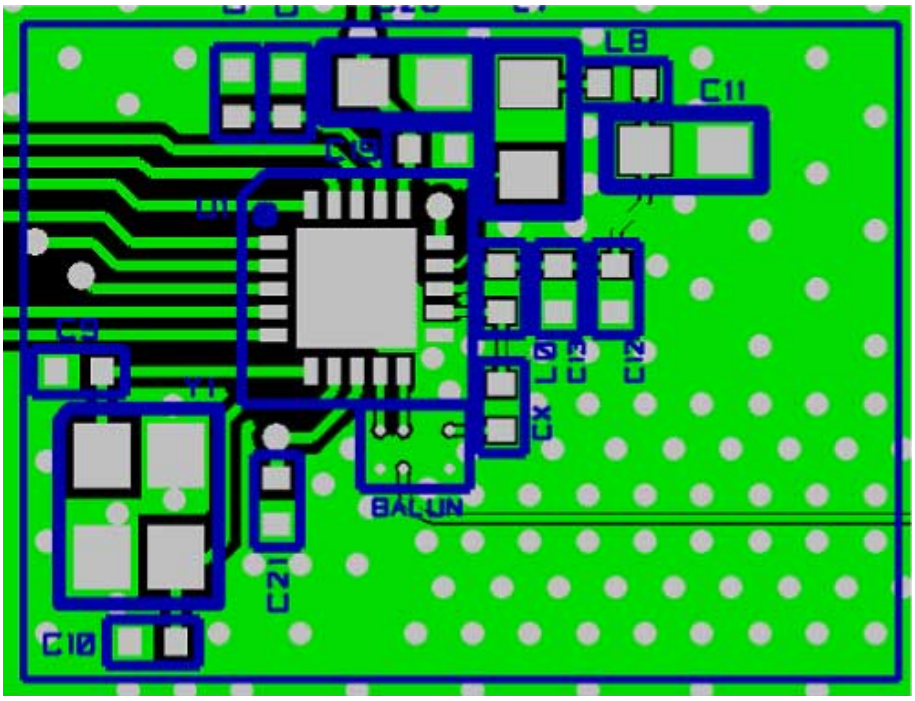


Figure 12. TX output measurements with BALF-SPI-01D3 at 868 MHz

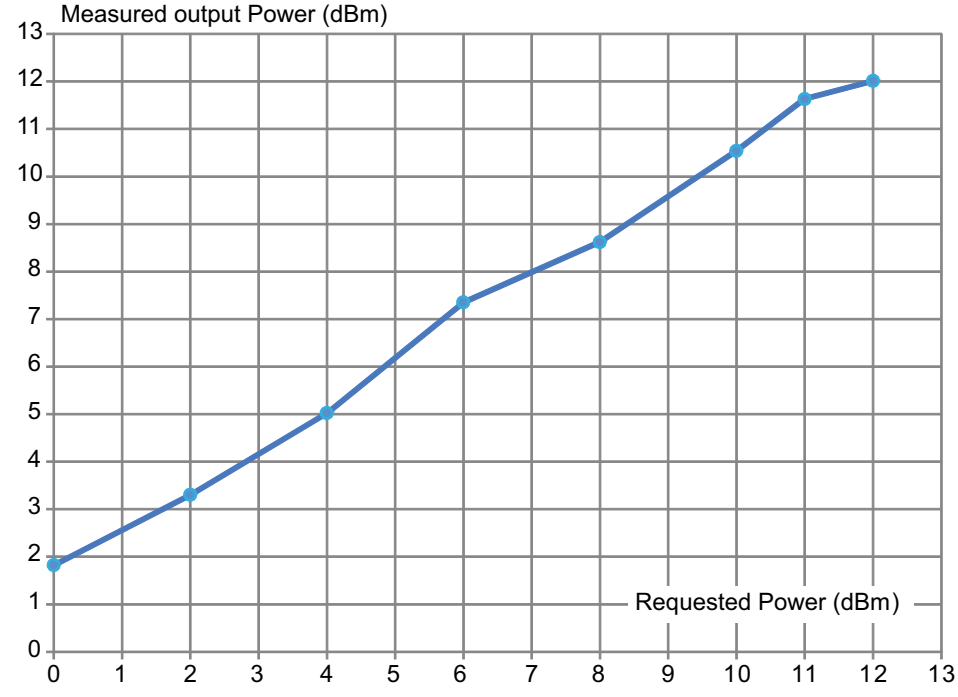


Figure 13. TX output power measurements over frequency with BALF-SPI-01D3

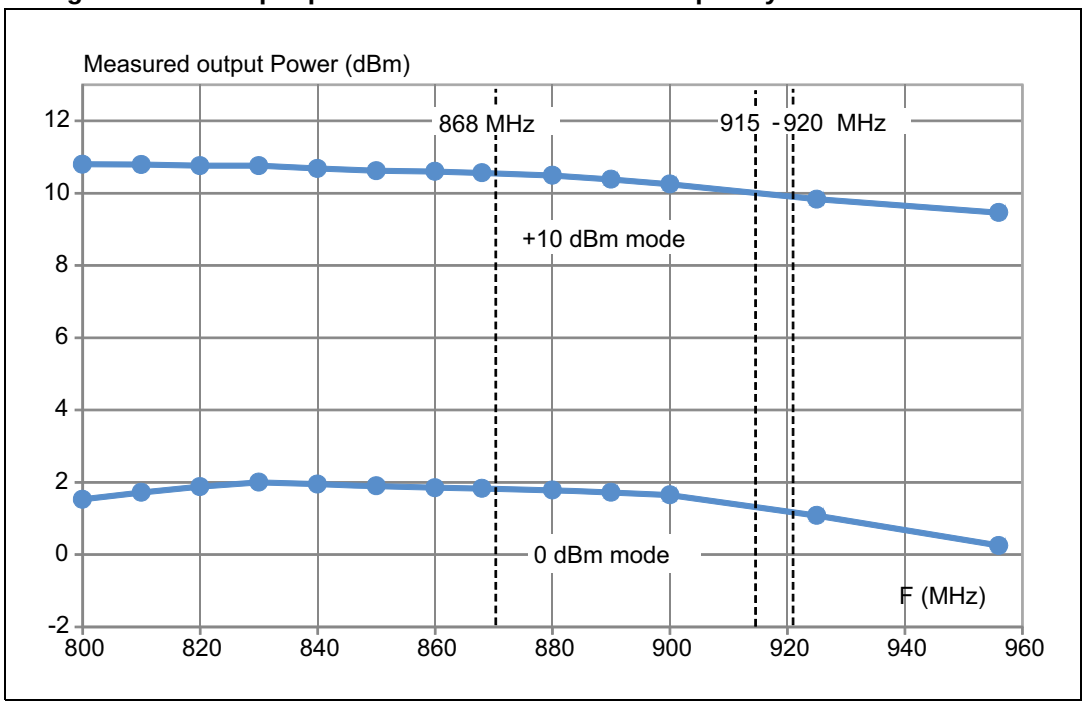
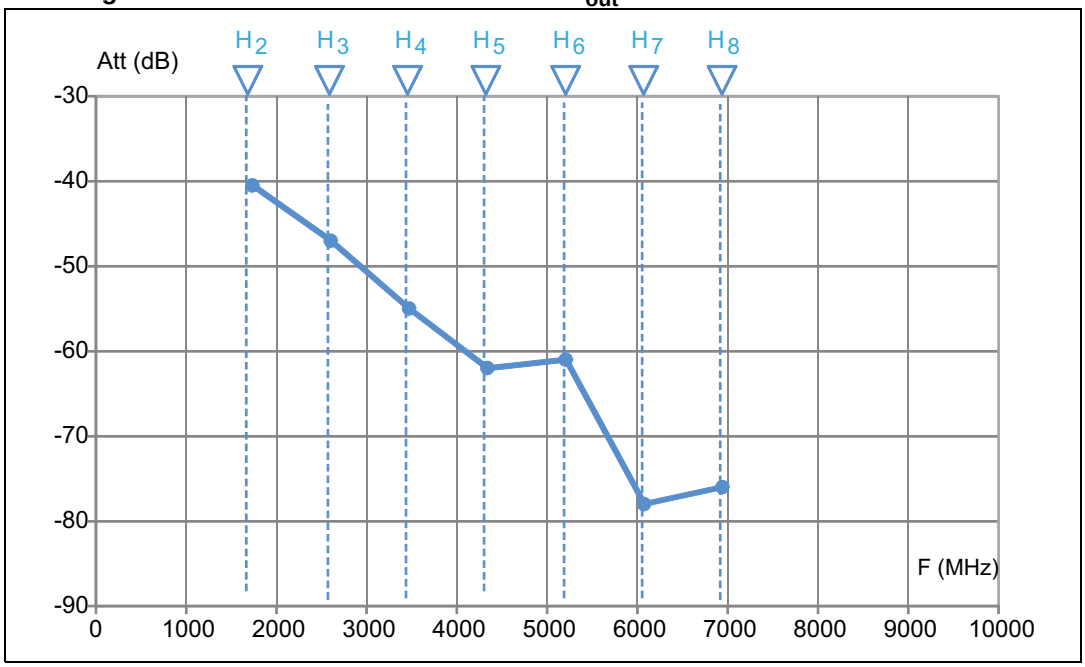


Figure 14. Harmonic measurements at P_{out} = 10 dBm with BALF-SPI-01D3



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 15. Flip-Chip package outline

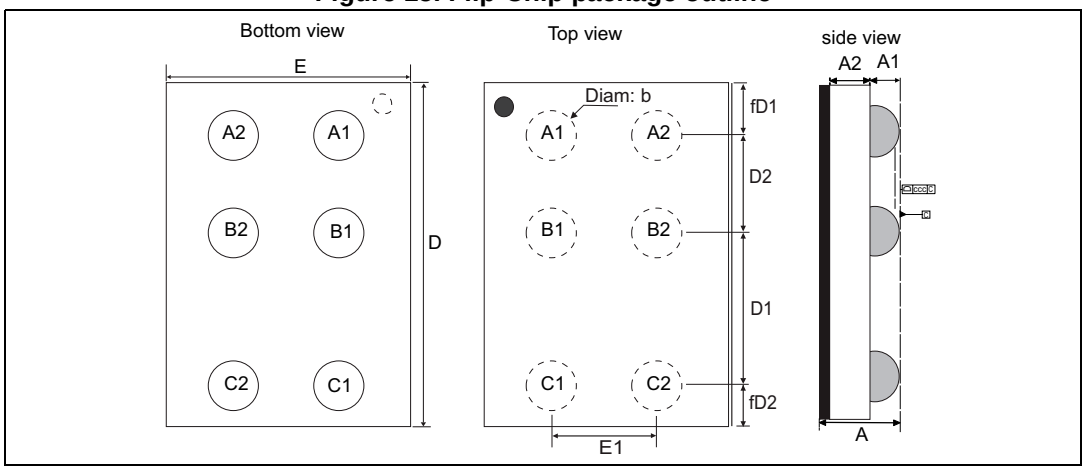


Table 4. Flip-Chip package mechanical data

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 16. Recommended balun land pattern

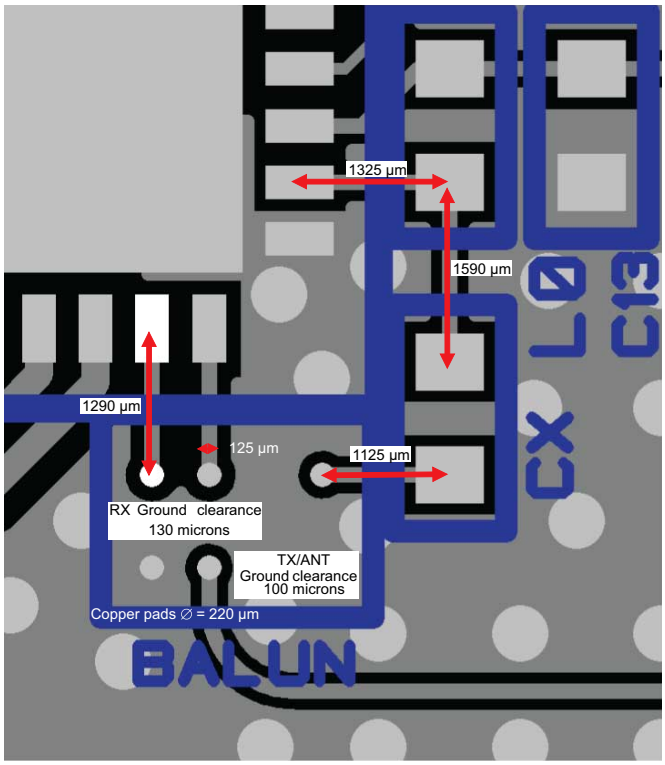


Figure 17. Footprint - 3 mils stencil -non solder mask defined

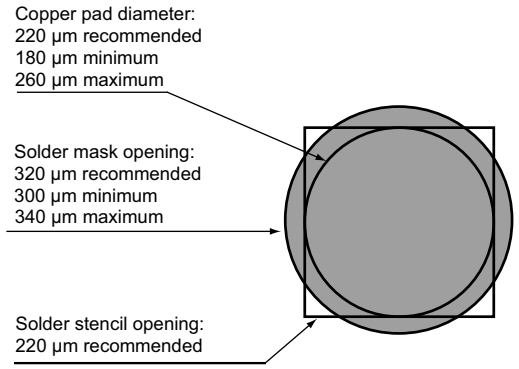


Figure 18. Footprint - 3 mils stencil - solder mask defined

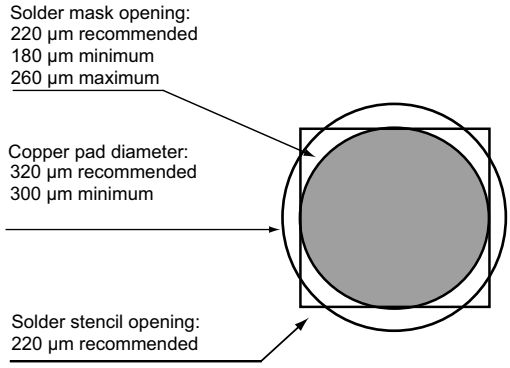


Figure 19. Footprint - 5 mils stencil -non solder mask defined

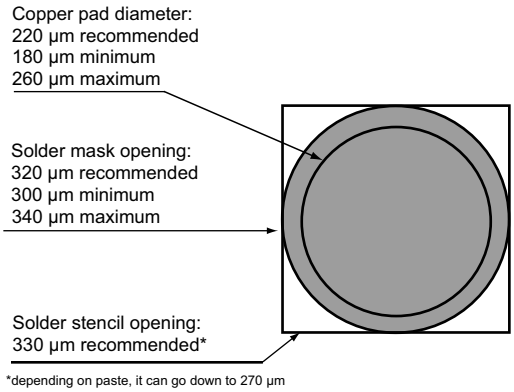


Figure 20. Footprint - 5 mils stencil - solder mask defined

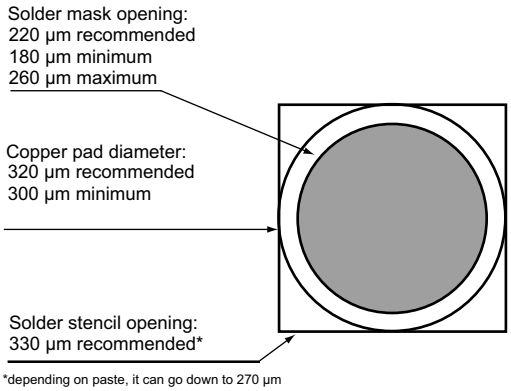


Figure 21. Marking

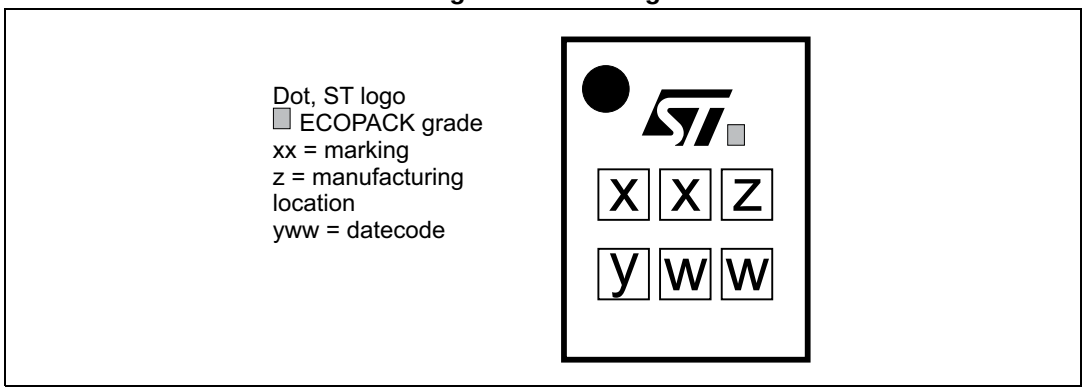
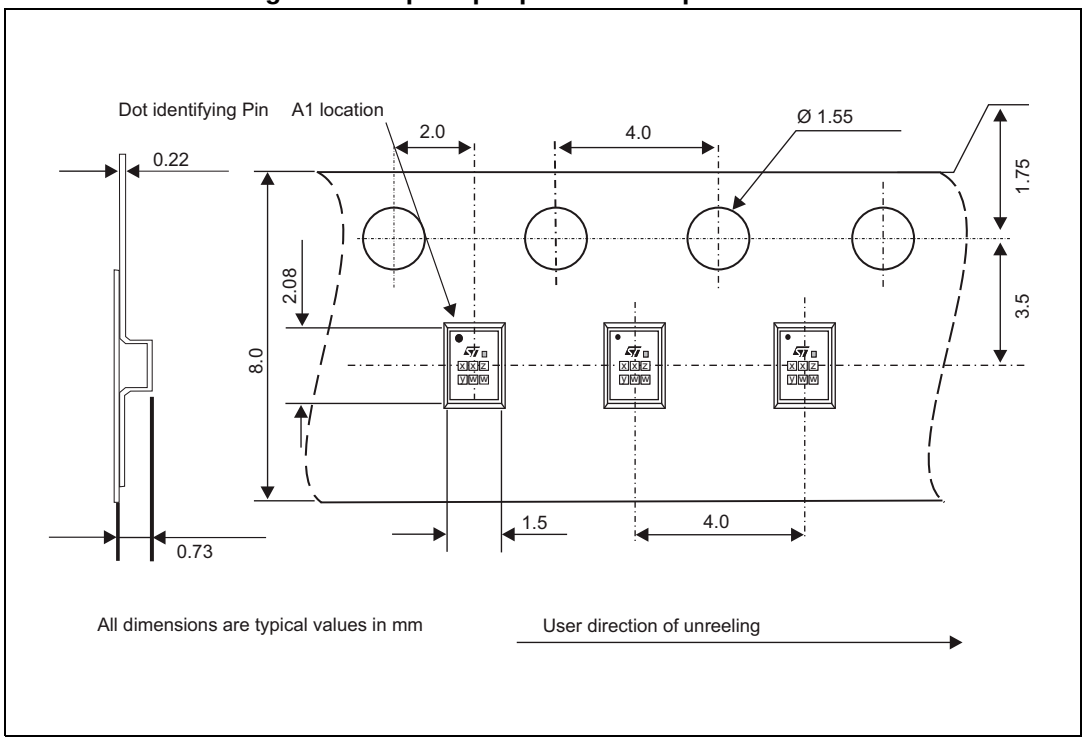


Figure 22. Flip Chip tape and reel specifications



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

4 Ordering information

Table 5. Ordering information

Order code	Marking	Weight	Base Qty	Delivery mode
BALF-SPI-01D3	SJ	3.0 mg	5000	Tape and Reel

5 Revision history

Table 6. Document revision history

Date	Revision	Changes
27-Aug-2013	1	Initial release.
03-Oct-2013	2	Updated document title. Updated Table 1 with JESD22 references.
15-May-2015	3	Updated Figure 1 and Figure 15. Added Figure 19 and Figure 20.
18-Sep-2015	4	Updated Figure 15 and added Table 4.
17-Nov-2015	5	Updated *Figure 2* and *Figure 15*.

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