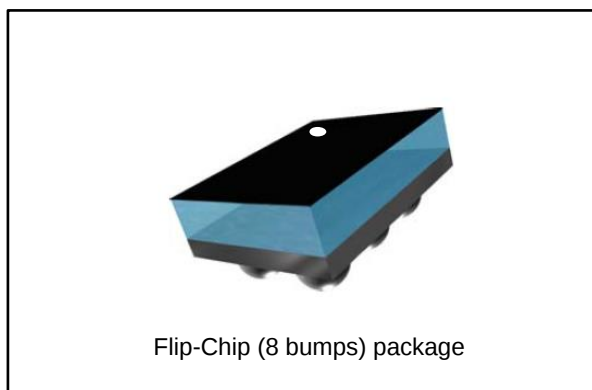


50 ohm nominal input / conjugate match balun CC1120, CC1125  
(868-928 MHz), with integrated harmonic filter

Datasheet - production data



## Description

STMicroelectronics' BALF-112X-01D3 is an ultra-miniature balun, integrating both matching network and harmonics filter.

Matching impedance has been customized for the CC1120, CC1125, CC1175 and CC1200 transceivers from Texas Instruments. The device uses STMicroelectronics' IPD technology on a non-conductive glass substrate, which optimizes RF performance.

## Features

- 50  $\Omega$  nominal input / conjugate match to CC1120, CC1125
- Low insertion loss
- Low amplitude imbalance
- Low phase imbalance
- Small footprint

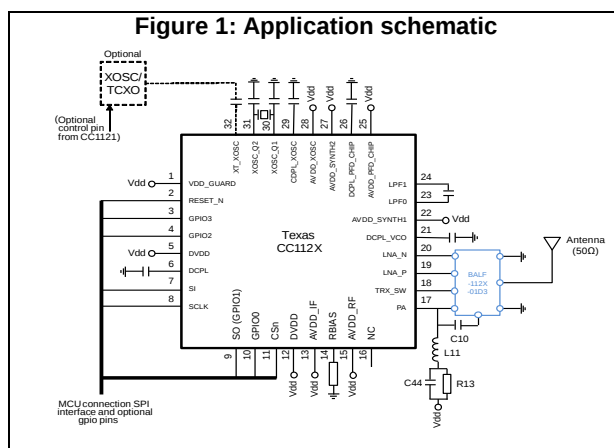
## Benefits

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

## Applications

- 868 MHz and 928 MHz impedance-matched balun filter optimized for Texas Instruments® CC1120, CC1125, CC1175, CC1200 sub-GHz RFICs.

Figure 1: Application schematic



C10 is a DC block capacitor: 0402/100 pF/50 V

# 1 Characteristics

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

| Symbol           | Parameter                                                           | Value |      |      | Unit |
|------------------|---------------------------------------------------------------------|-------|------|------|------|
|                  |                                                                     | Min.  | Typ. | Max. |      |
| P <sub>IN</sub>  | Input power RFIN                                                    |       | -    | 20   | dBm  |
| V <sub>ESD</sub> | ESD ratings MIL STD883C (HBM: C = 100 pF, R = 1.5 Ω, air discharge) | 500   | -    |      | V    |
|                  | ESD ratings machine model (MM: C = 200 pF, R = 25 W, L = 500 nH)    | 250   | -    |      |      |
| T <sub>OP</sub>  | Operating temperature                                               | -40   | -    | +85  | °C   |

**Table 2: Electrical characteristics and RF performance (T<sub>amb</sub> = 25 °C) RX balun**

| Symbol                | Parameter                      | Test condition | Value |                 |      | Unit |
|-----------------------|--------------------------------|----------------|-------|-----------------|------|------|
|                       |                                |                | Min.  | Typ.            | Max. |      |
| Z <sub>RX</sub>       | Nominal differential impedance |                |       | Match to CC112X |      | Ω    |
| Z <sub>ANT</sub>      | Antenna impedance              |                |       | 50              |      | Ω    |
| f                     | Frequency range (bandwidth)    |                | 866   |                 | 928  | MHz  |
| S <sub>21RX-ANT</sub> | Insertion loss in bandwidth    | at 868 MHz     | -2.3  | -1.9            |      | dB   |
|                       |                                | at 928 MHz     | -2.8  | -2.4            |      |      |
| S <sub>11ANT</sub>    | Input return loss in bandwidth | at 868 MHz     |       | -22             | -20  | dB   |
|                       |                                | at 928 MHz     |       | -11             | -9   |      |
| Phase_imbal           | Output phase imbalance         |                | -10   | -2.9            | 10   | °    |
| Ampl_imbal            | Output amplitude imbalance     |                | -1    | -0.3            | 1    | dB   |

Table 3: Electrical characteristics and RF performance ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ ) TX filter

| Symbol            | Parameter                      | Test condition      | Value |                 |      | Unit     |
|-------------------|--------------------------------|---------------------|-------|-----------------|------|----------|
|                   |                                |                     | Min.  | Typ.            | Max. |          |
| $Z_{TX}$          | Nominal TX impedance           |                     |       | Match to CC112X |      | $\Omega$ |
| $Z_{ANT}$         | Antenna impedance              |                     |       | 50              |      | $\Omega$ |
| f                 | Frequency range (bandwidth)    |                     | 866   |                 | 928  | MHz      |
| $S_{21_{TX-ANT}}$ | Insertion loss in bandwidth    | at 868 MHz          | -2.3  | -1.9            |      | dB       |
|                   |                                | at 928 MHz          | -2.7  | -2.3            |      |          |
| $S_{11_{ANT}}$    | Input return loss in bandwidth | at 868 MHz          |       | -8              | -6   | dB       |
|                   |                                | at 928 MHz          |       | -7              | -5   |          |
| Att               | Harmonic levels                | Attenuation at 2 fo |       | -43             | -41  | dBm      |
|                   |                                | Attenuation at 3 fo |       | -50             | -46  |          |
|                   |                                | Attenuation at 4 fo |       | -43             | -40  |          |
|                   |                                | Attenuation at 5 fo |       | -39             | -37  |          |
|                   |                                | Attenuation at 6 fo |       | -35             | -33  |          |
|                   |                                | Attenuation at 7 fo |       | -19             | -17  |          |

## 1.1 RF measurement

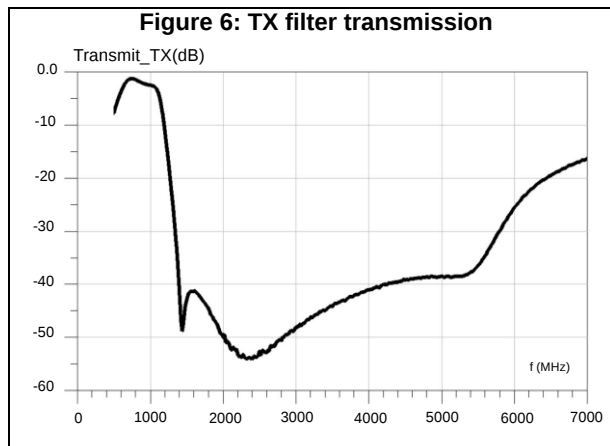
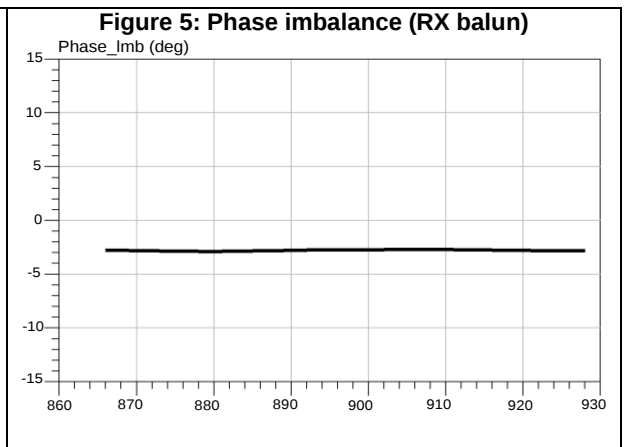
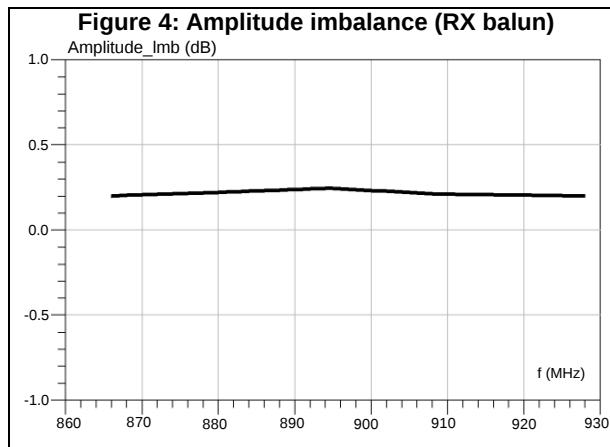
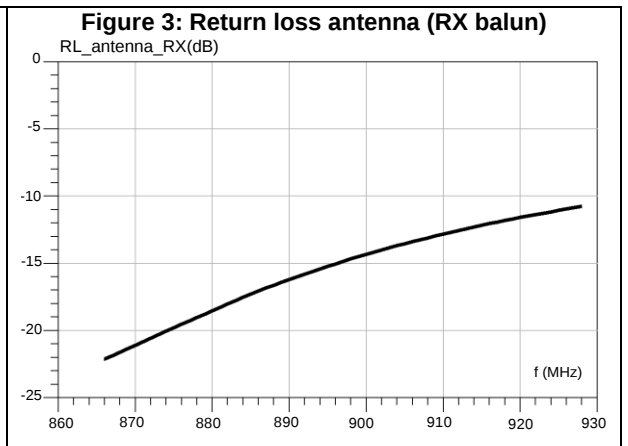


Figure 8: fo attenuation (TX filter)

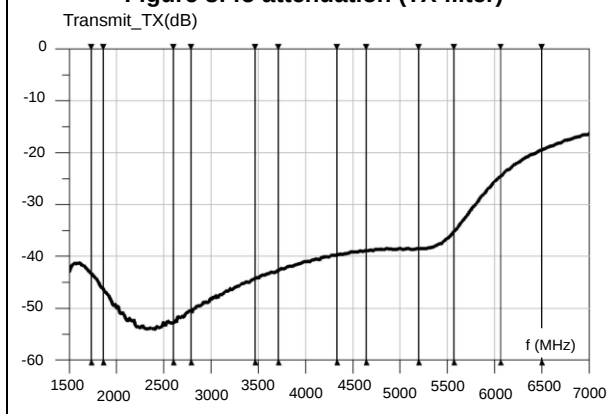
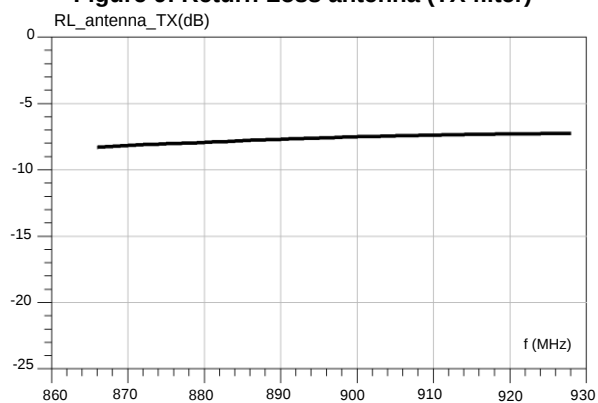


Figure 9: Return Loss antenna (TX filter)



## 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.

### 2.1 Flip-Chip CSPG 0.4 package information

Figure 10: Flip-Chip CSPG 0.4 package outline

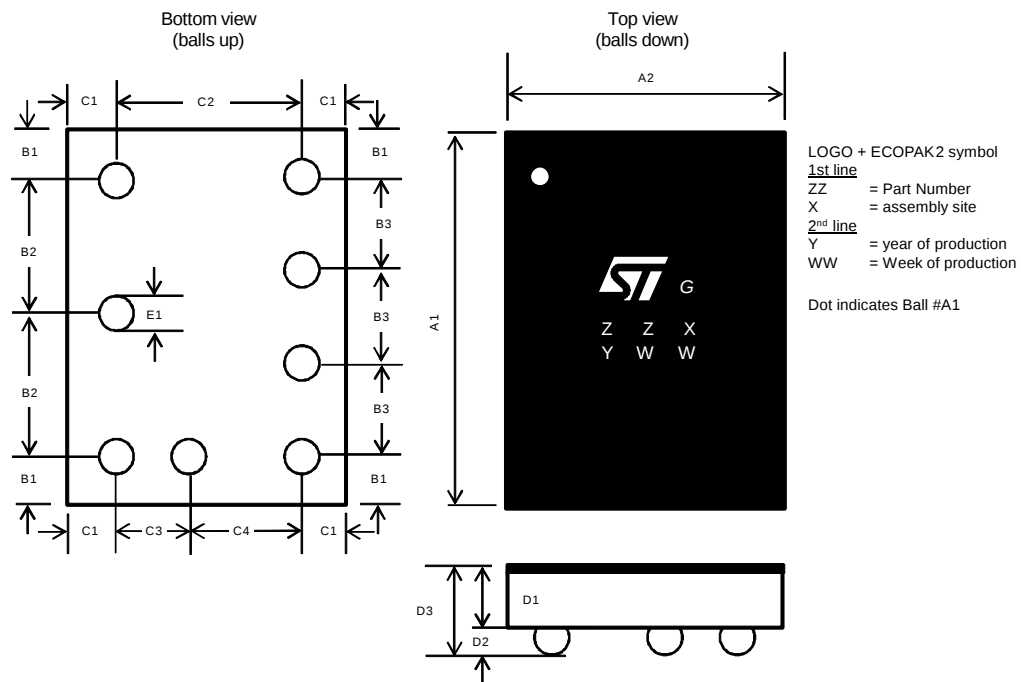


Table 4: Flip-Chip CSPG 0.4 mechanical data

| Dimensions    | Frequency | A1   | A2   | B1  | B2  | B3  | C1  | C2   | C3  | C4  | D1  | D2  | D3  | E1  |
|---------------|-----------|------|------|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|-----|
| BAL-112X-01D3 | 868 MHz   | 1950 | 1450 | 225 | 750 | 500 | 223 | 1004 | 400 | 604 | 425 | 205 | 630 | 255 |

Figure 11: Footprint - non solder mask defined

Copper pad diameter:  
220µm recommended  
180µm minimum  
260µm maximum

Solder mask opening:  
320µm recommended  
300µm minimum  
340µm maximum

Solder stencil opening:  
220µm recommended

Line to connect copper pad on solder mask opening  
should be smaller than copper pad diameter

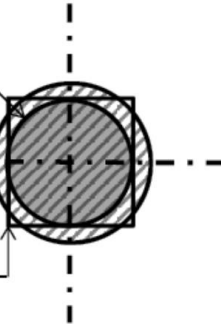


Figure 12: Footprint - solder mask defined

Solder mask opening:  
220µm recommended  
180µm minimum  
260µm maximum

Copper pad diameter:  
320µm recommended  
300µm minimum

Solder stencil opening :  
220µm recommended

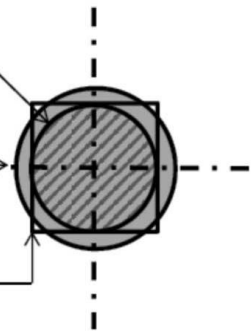


Figure 13: Ball assignment

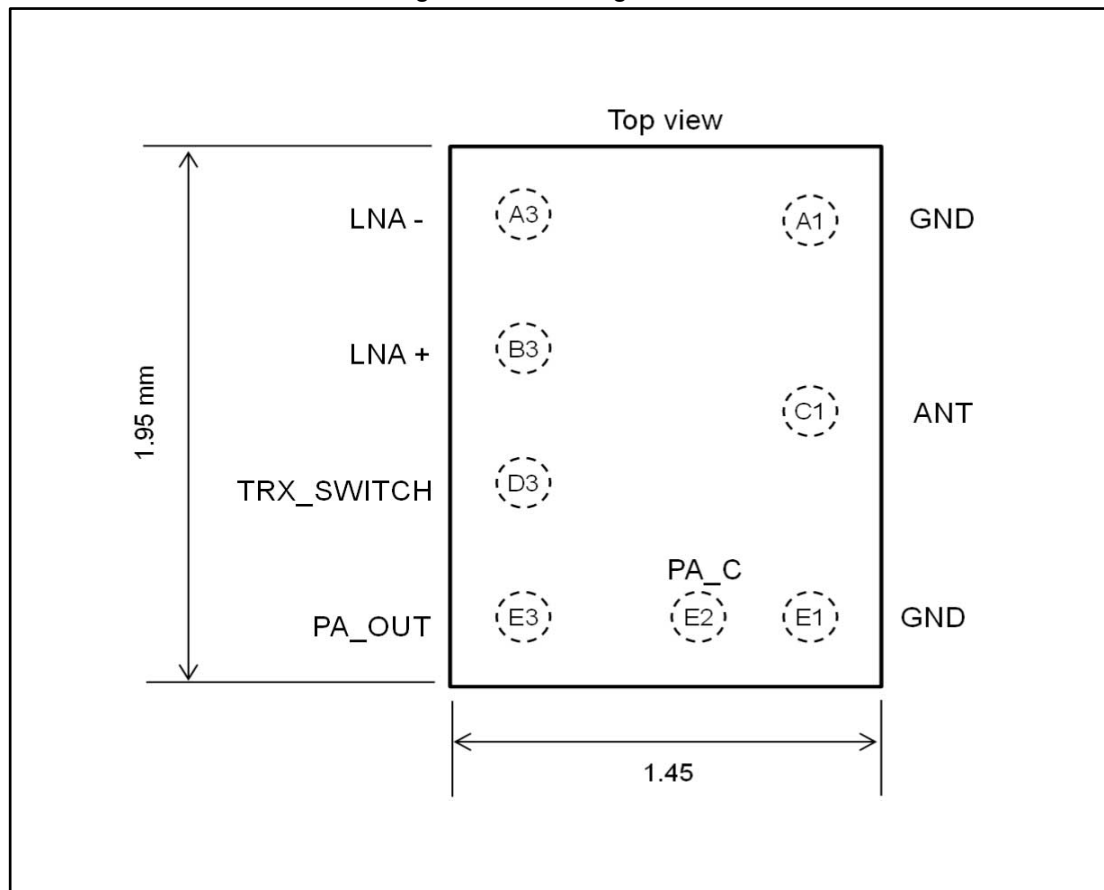
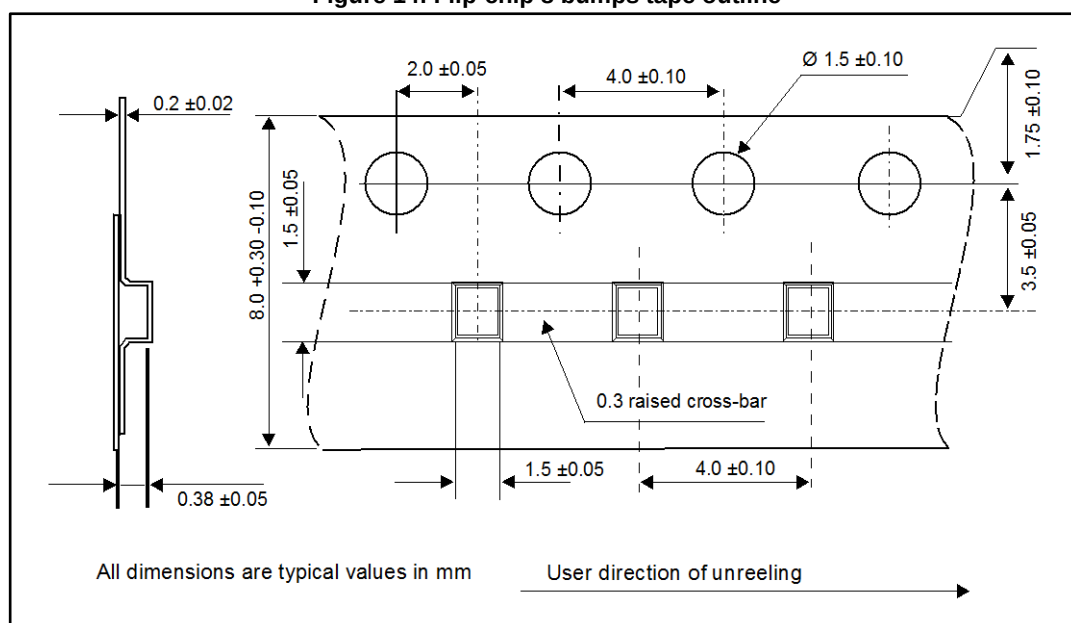


Table 5: Flip-Chip CSPG 0.4 ball description

| Ball | Name   | Designation                   |
|------|--------|-------------------------------|
| A1   | GND    | Ground                        |
| A3   | LNA-   | Connect to LNA_N              |
| B3   | LNA+   | Connect to LNA_P              |
| C1   | ANT    | Connect to antenna            |
| D3   | TRX_SW | Connect to TRX switch         |
| E1   | GND    | Ground                        |
| E2   | PA_C   | Connect to PA output thru C10 |
| E3   | PA_OUT | Connect to PA                 |

## 2.2 Flip-chip 8 bumps packing information

Figure 14: Flip-chip 8 bumps tape outline



### 3 Ordering information

Table 6: Ordering information

| Order code     | Marking | Package | Weight  | Base qty. | Delivery mode |
|----------------|---------|---------|---------|-----------|---------------|
| BALF-112X-01D3 | TF      | CSPG    | 3.02 mg | 5000      | Tape and reel |

### 4 Revision history

Table 7: Document revision history

| Date        | Revision | Changes             |
|-------------|----------|---------------------|
| 04-Jul-2016 | 1        | First issue.        |
| 20-Feb-2017 | 2        | Updated Front page. |

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