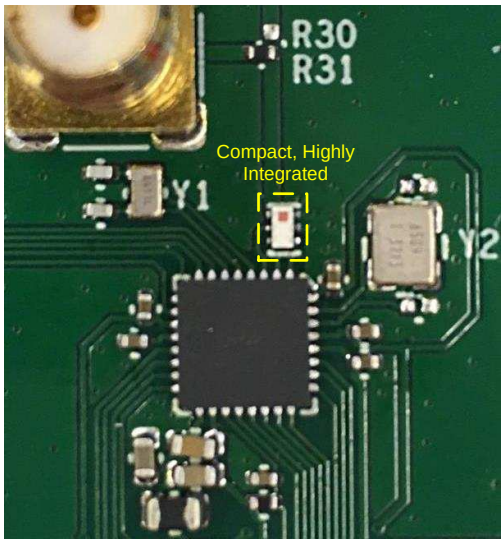
Application Report
SWRA572–August 2017

Johanson Balun for the CC26xx Device Family

Smart Connectivity Solutions

ABSTRACT

This application report describes the implementation, active measurements, schematics, and design files when pairing Johanson Technology Inc.'s 2450BM14G0011 impedance-matched integrated balun-filter with Texas Instruments' CC26xx family of cost-effective, ultra-low power, 2.4-GHz wireless MCUs.



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1 Introduction

The 2450BM14G0011 was developed in order to satisfy the space constraints of compact designs as well as layouts sensitive to assembly pick and place costs. This IPC provides the following benefits:

- Consolidates Texas Instruments' reference 9 discrete LC components into a single component
- Overall RF performance (insertion loss, return loss, output power, harmonic rejection) comparable to discrete LC solution at a fraction of the size
- Complex impedance matched to all variants of the CC26XX
- Provides harmonic rejection necessary for FCC and ETSI compliance

This front-end solution reduces implementation size area by using smaller effective PCB real estate while reducing component count, increasing performance consistency (100% RF tested before T&R), and offering excellent temperatue stability (4ppm). AEC-Q200 qualification is available.

- Design/Layout Files: http://www.ti.com/lit/zip/swrc326
- Technical Support: http://www.johansontechnology.com/ask-a-question
- 2450BM14G0011 Datasheet: https://www.johansontechnology.com/datasheets/baluns-matched/2450BM14G0011.pdf
- 2450BM14G0011T-AEC Datasheet: https://www.johansontechnology.com/downloads/2450BM14G0011T-AEC.pdf

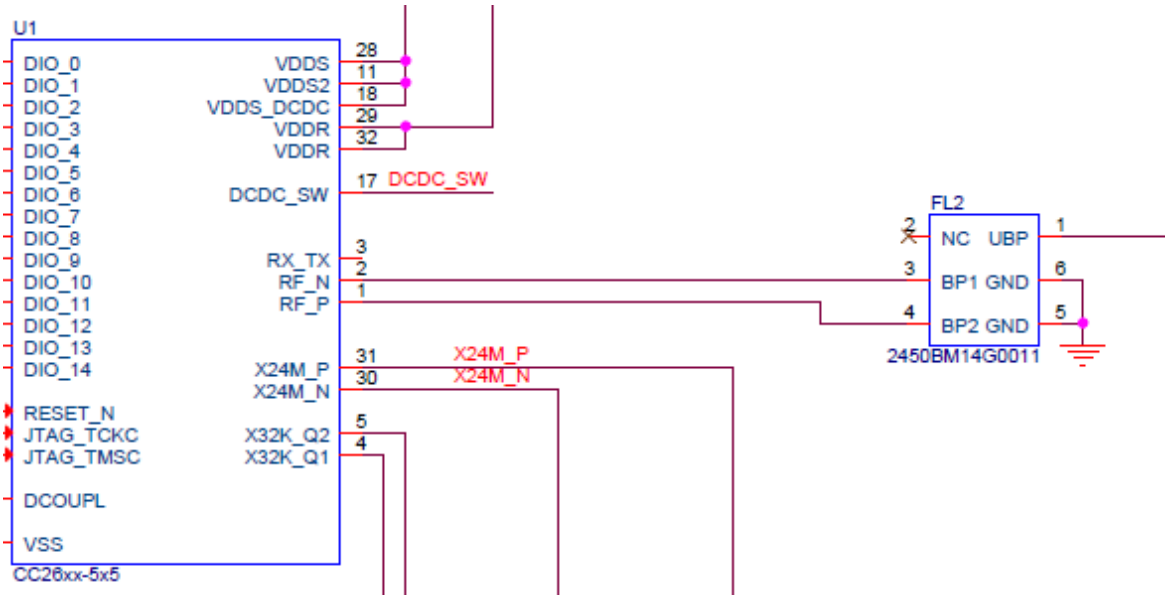


Figure 1. Schematic TI CC26XX With Impedance-Matched Filter 2450BM14G0011

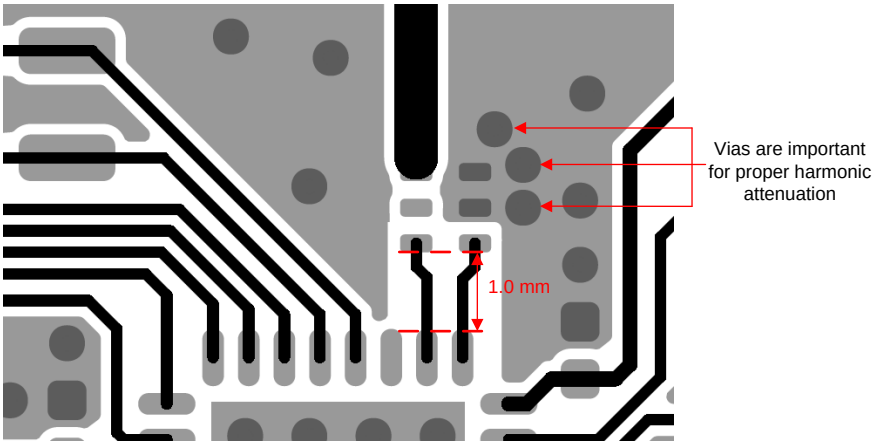


Figure 2. PCB Layout Reference for TI CC26XX and Impedance Matched Filter 2450BM14G0011

For more examples and alternative products see www.johansontechnology.com/ti.

Table 1. +5 dBm Measurements

Fundamental	2450BM14G0011 Sample 1	2450BM14G0011 Sample 2	2450BM14G0011 Sample 3	2450BM14G0011 Sample 4
MHz	dBm	dBm	dBm	dBm
2402	4.1	4.3	4.6	4.6
2426	4.1	4.2	4.5	4.5
2440	3.9	4.1	4.3	4.3
2480	3.7	3.8	4.0	4.2
2nd Harmonic				
MHz	dBm	dBm	dBm	dBm
2402	-46.5	-44.8	-44.3	-44.2
2426	-46.2	-44.9	-43.7	-43.8
2440	-46.7	-44.6	-44.3	-44.2
2480	-46.5	-44.3	-44.6	-43.7
3rd Harmonic				
MHz	dBm	dBm	dBm	dBm
2402	-48.8	-54.9	-53.1	-54.1
2426	-49.7	-55.0	-53.5	-54.6
2440	-51.1	-55.9	-54.1	-55.3
2480	-53.6	-54.9	-54.4	-54.9

Table 2. RX Sensitivity Measurements

MHz	2450BM14G0011 Sample 1/ 3 V DC	2450BM14G0011 Sample 2/ 3 V DC	2450BM14G0011 Sample 3/ 3 V DC	2450BM14G0011 Sample 4/ 3 V DC
2402	-95.7	-95.5	-95.7	-95.7
2426	-95.7	-95.8	-96.0	-95.9
2440	-95.7	-95.7	-96.0	-95.9
2480	-96.0	-95.8	-96.1	-96.1

To revise your layout, contact Johanson Technology's RF applications engineers at: www.johansontechnology.com/ask-a-question.

2 General Specifications

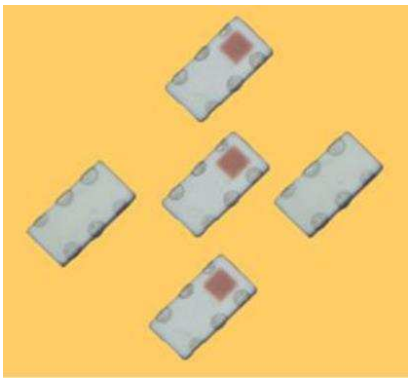


Figure 3. 2450BM14G0011

Table 3. General Specifications

Part Number	2450BM14G0011
Frequency (MHz)	2400 - 2500
Unbalanced Impedance	50 Ω
Balanced Differential Impedance	Conjugate match to TI CC2620, CC2630, CC2640, CC2650, chipsets operated on INTERNAL BIAS MODE
Insertion Loss when component measured by itself (passive insertion loss)	1.5 Typ. (1.8dB max. -40°C to+85°C)
Return Loss (dB):	9.5 min.
• 25 typ. / 14dB min. @ 4800-5000 MHz	
• 20 typ. / 15dB min. @ 7200-7500 MHz	
Phase Difference (deg.)	180 ± 10
Amplitude Difference	2.0 maximum
Power Capacity	2W max (CW)
Qty/Reel (pcs)	4,000
Operating Temperature Range	-40 ~ +85°C
Storage Temperature Range	-40 ~ +85°C
Recommended Storage Conditions of Unused Product on T&R	+5 ~ +35 °C, 5 ~ +35 °C, Humidity 45-75%
Storage Period	18 months maximum

Table 4. Part Number Explanation

P/N Suffix	Packaging Style	Bulk	Suffix = S	2450BM14G0011S
		T & R	Suffix = T	2450BM14G0011T
	Termination Style	100% Tin	Suffix = None	2450BM14G0011(T or S)

Table 5. Mechanical Dimensions

Inches		Millimeter
L	0.063 ± 0.004	1.6 ± 0.10
W	0.031 ÷ 0.004	0.8 ± 0.10
T	0.024 ± 0.004	0.6 ± 0.10
a	0.008 ± 0.004	0.2 ± 0.10
b	0.008 ± +0.1/-0.15	0.2 ± +0.1/-0.15
c	0.006 ± 0.004	0.15 ± 0.10
g	0.012 ± 0.004	0.3 ± 0.10
p	0.020 ± 0.002	0.5 ± 0.05

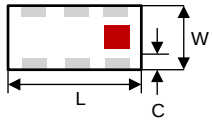


Figure 4. Mechanical Dimensions

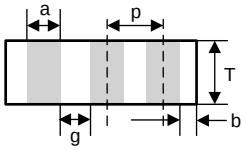


Figure 5. Mechanical Dimensions

Table 6. Terminal Configuration

No	Function	No	Function
1	Unbalanced Port (IN)	4	Balanced Port (OUT)
2	NC	5	GND
3	Balanced Port (OUT)	6	GND

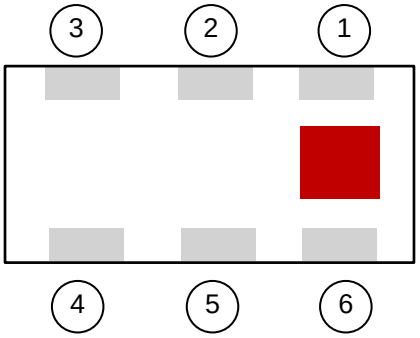


Figure 6. Terminal Configuration

2.1 Mounting Considerations

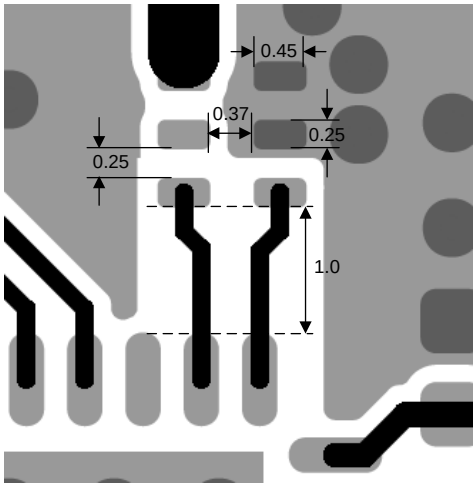
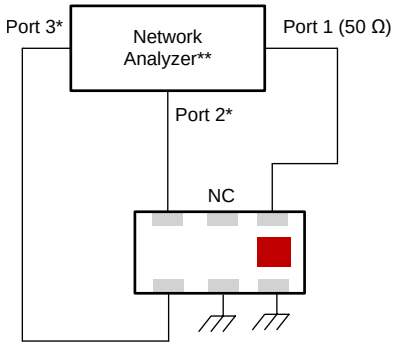


Figure 7. Mounting Considerations

- Line width should be designed to match 50Ω characteristic impedance, depending on PCB material and thickness.
  - Land
  - Through-hole (0.3/0.2) vias to GND

2.2 Measuring Diagram



(1) Impedance for ports 2 and 3 = Conjugate to Balanced Impedance/2

(2) E5071C from Agilent

Figure 8. Measuring Diagram

- Port 1: Unbalanced Port
- Ports 2 and 3: Balanced Port
  - IL=S_{ds21}
  - RL=S_{ss11}
- Amp_balance = dB(S(2,1)/S(3,1))
- Phase_balance = Phase(S(2,1)/S(3,1))

3 Typical Electrical Characteristics

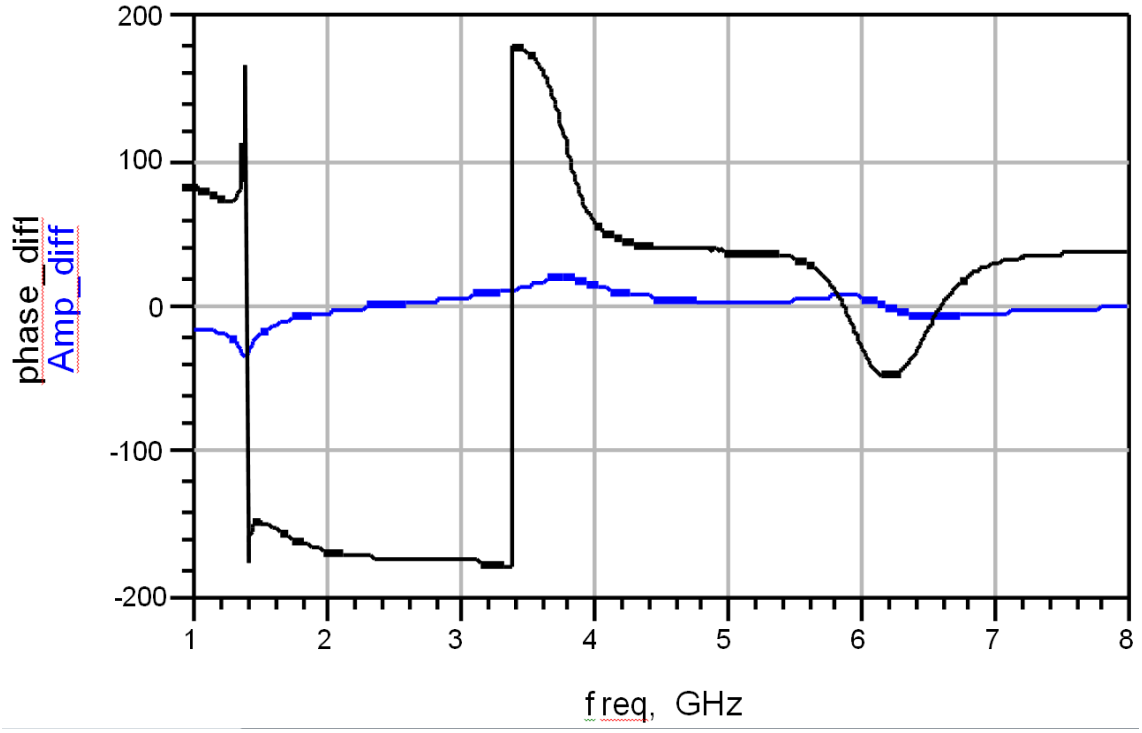


Figure 9. Insertion and Return Loss

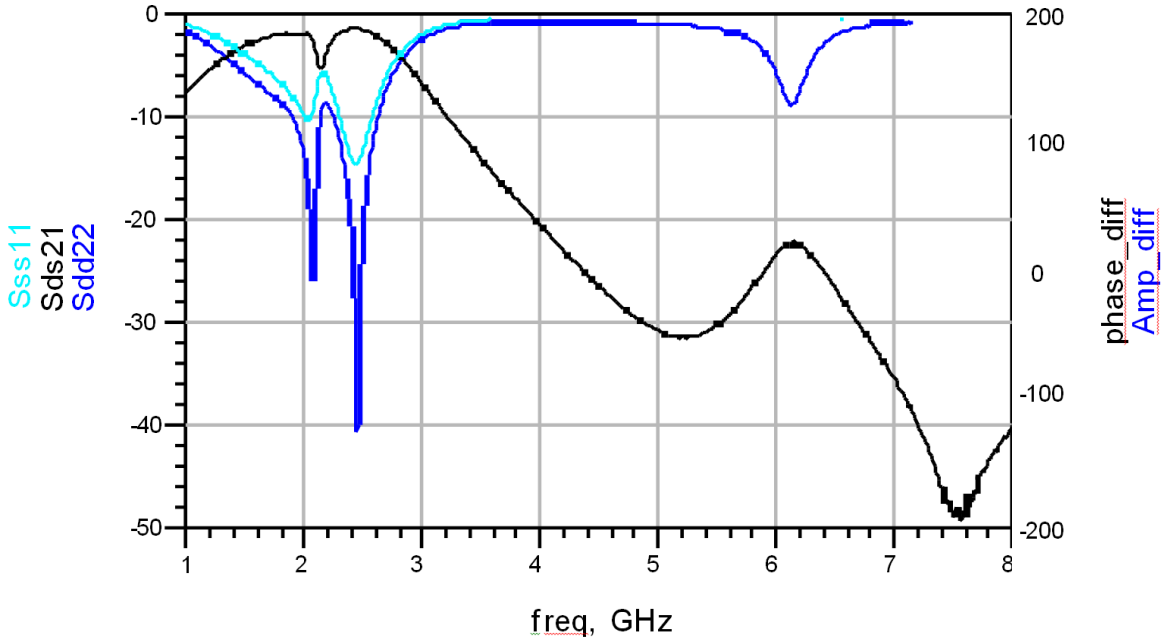


Figure 10. Amplitude and Phase Balance

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