

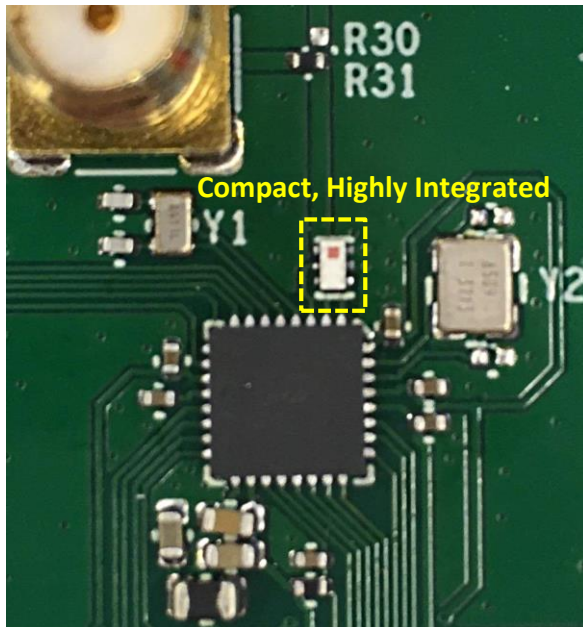
High Frequency Ceramic Solutions

Application Note: AN060

8/30/2016

G.Kuo/M.Carmona/I.Johnson

Application Note for Johanson Technology Inc. 2450BM14G0011 optimized for Texas Instruments' CC2620, CC2630, CC2640, CC2650 Wireless MCUs Operating on Differential RF with INTERNAL BIAS



Texas Instruments CC26XX

The Texas Instruments CC26XX family consists of cost-effective, ultralow power 2.4-GHz wireless MCUs. Very low active RF and MCU current and low-power mode current consumption provide excellent battery lifetime and allow for operation on small coin cell batteries and in energy-harvesting applications.

This application note describes the implementation, active measurements, schematics, and design files when pairing Johanson Technology Inc.'s 2450BM14G0011 impedance matched integrated balun-filter with Texas Instruments' PNs CC2620, CC2630, CC2640, and CC2650.

[For further layout or application assistance contact our RF technical support at <http://www.johansontechnology.com/ask-a-question>.](http://www.johansontechnology.com/ask-a-question)

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 10 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 temperature stability (4ppm). AEC-Q200 qualification is available.

Design/layout files

<http://www.johansontechnology.com/ti>

Technical Support

<http://www.johansontechnology.com/ask-a-question>



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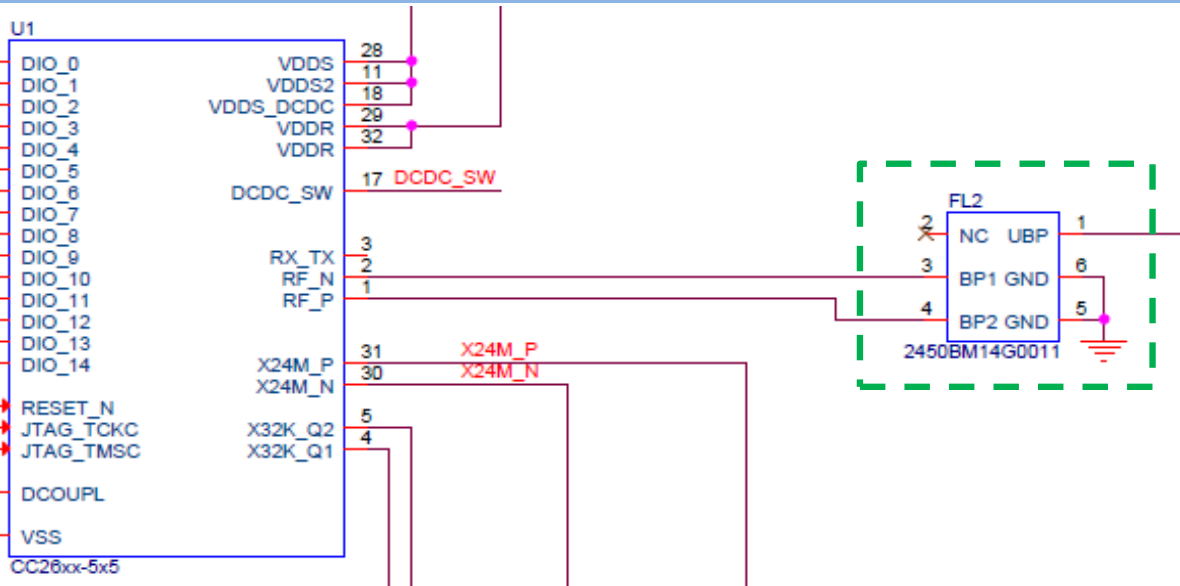
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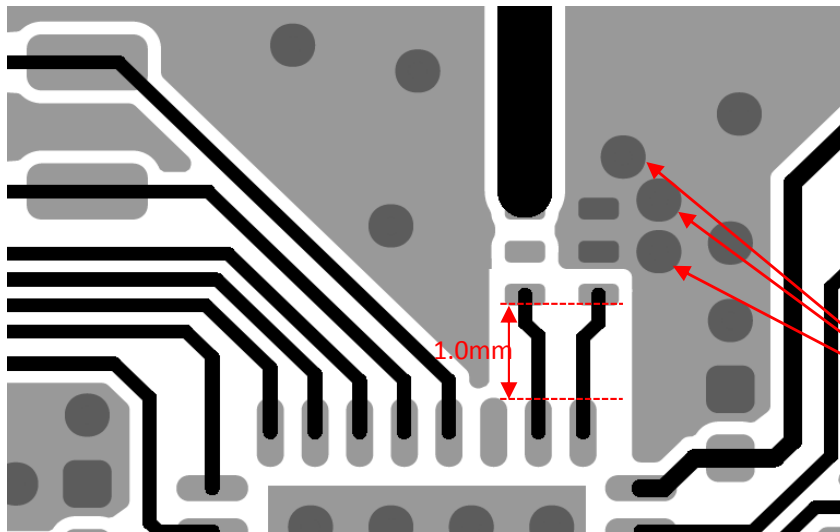
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Schematic TI CC26XX with impedance-matched filter 2450BM14G0011



PCB Layout Reference for TI CC26XX & Impedance Matched Filter 2450BM14G0011



Please note the following factors that are essential to harmonic attenuation:

- Via placement
- Differential trace length

Vias are important for proper harmonic attenuation

2450BM14G0011 PCB Footprint

For more schematic examples, download the layout files, BOM, etc. go to: www.johansontechnology.com/ti

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+5 dBm Measurements

Fundamental	2450BM14G0011	2450BM14G0011	2450BM14G0011	2450BM14G0011
	Sample 1	Sample 2	Sample 3	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	2450BM14G0011	2450BM14G0011	2450BM14G0011	2450BM14G0011
	Sample 1	Sample 2	Sample 3	Sample 4
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	2450BM14G0011	2450BM14G0011	2450BM14G0011	2450BM14G0011
	Sample 1	Sample 2	Sample 3	Sample 4
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

RX Sensitivity Measurements

MHz	2450BM14G0011	2450BM14G0011	2450BM14G0011	2450BM14G0011
	Sample 1	Sample 2	Sample 3	Sample 4
	3 V DC	3 V DC	3 V DC	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

Contact our RF Applications Engineers to revise your layout at: www.johansontechnology.com/ask-a-question



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2.4GHz Impedance Matched Balun + embedded FCC/ETSI Band Pass Filter For Texas Instruments CC2620, CC2630, CC2640, CC2650 chipsets operated on INTERNAL BIAS MODE


P/N: 2450BM14G0011

Detail Specification: 8/30/2016

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For the Full App Note and Layout Files, go to: www.johansontechnology.com/ti

General Specifications

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

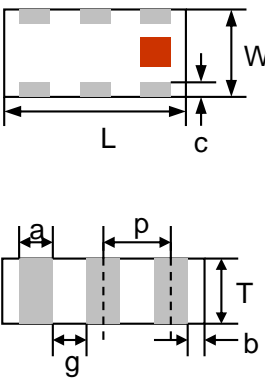
Do you need help selecting the best mini or micro 2.4GHz antenna for your application? Send us a message at: <http://www.johansontechnology.com/ask-a-question> and go to: <http://www.johansontechnology.com/antennas>

Part Number Explanation

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

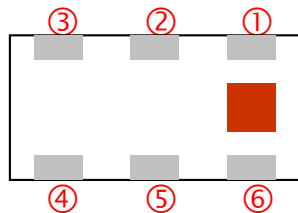
Mechanical Dimensions

	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



Terminal Configuration

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



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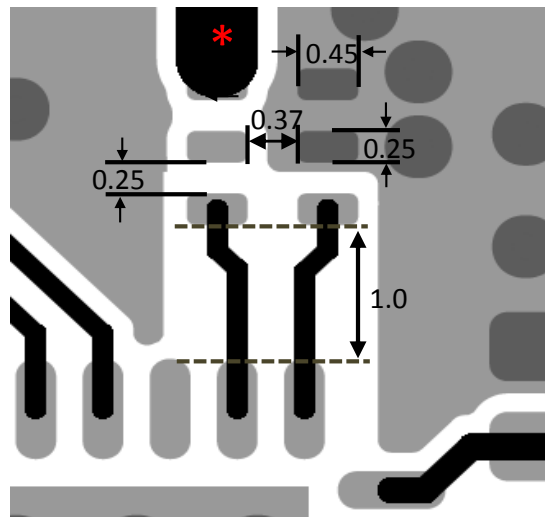
2.4GHz Impedance Matched Balun + embedded FCC/ETSI Band Pass Filter For Texas Instruments CC2620, CC2630, CC2640, CC2650 chipsets operated on INTERNAL BIAS MODE

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Mounting Considerations



* Line width should be designed to match 50Ω characteristic impedance, depending on PCB material and thickness.

□ Land

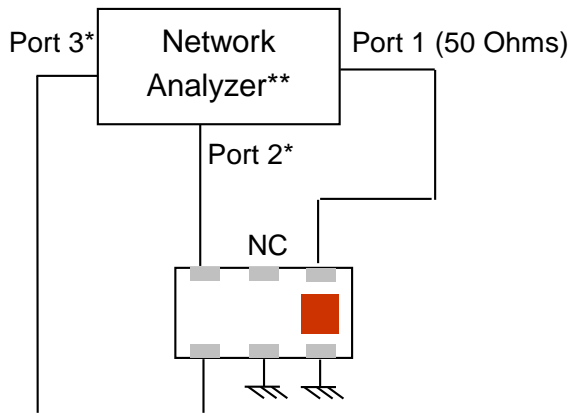
● Through-hole ($\phi 0.3/\phi 0.2$) vias to GND

Would you like us to provide the layout files of the TI chipset + 2450BM14G0011? Review your layout for free? Please go to this link to contact our RF team:
www.johansontechnology.com/ask-a-question "Applications Engineering" on the drop down question type

Units in mm

Do you need the layout/gerber files of the above? Go to: www.johansontechnology.com/ti or send us a message to review your layout at: <http://www.johansontechnology.com/ask-a-question>

Measuring Diagram



Port 1: Unbalanced Port
 Ports 2 and 3: Balanced Port

$$IL = S_{ds21}$$

$$RL = S_{ss11}$$

$$\text{Amp_balance} = \text{dB}(S(2,1)/S(3,1))$$

$$\text{Phase_balance} = \text{Phase}(S(2,1)/S(3,1))$$

* Impedance for ports 2 and 3
 = Conjugate to Balanced Impedance/2
 ** E5071C from Agilent

You can download the s-parameters at: <http://www.johansontechnology.com/ti>

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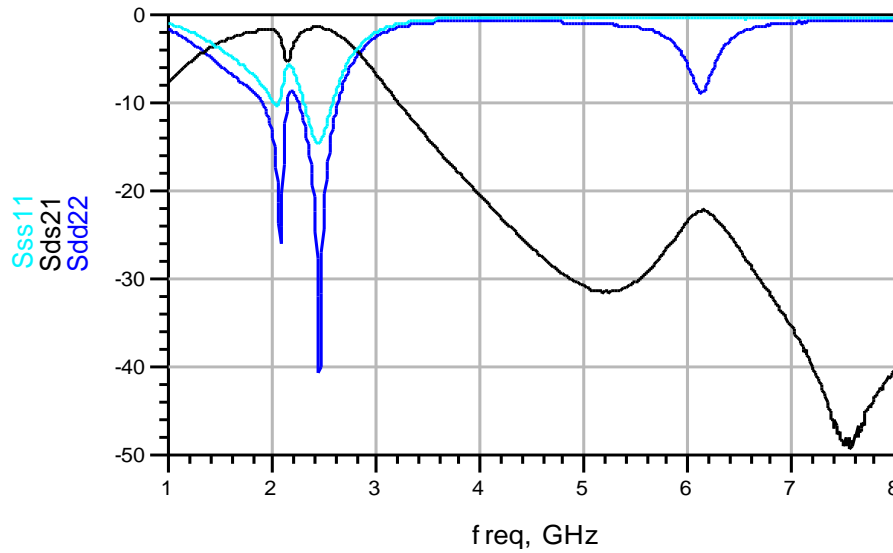
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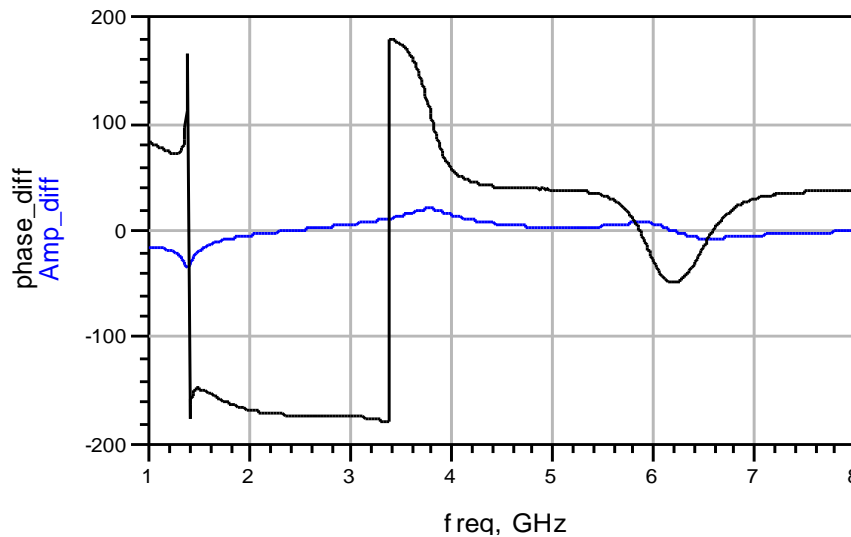
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Typical Electrical Characteristics (T=25°C)

Insertion and Return Loss



Amplitude and Phase Balance



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Application Notes, Layout Files, and more

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