High Frequency Ceramic Solutions

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

Compact, Highly Integrated

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.

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

JOHANSON TECHNOLOGY

www.johansontechnology.com

Ver. 1.0

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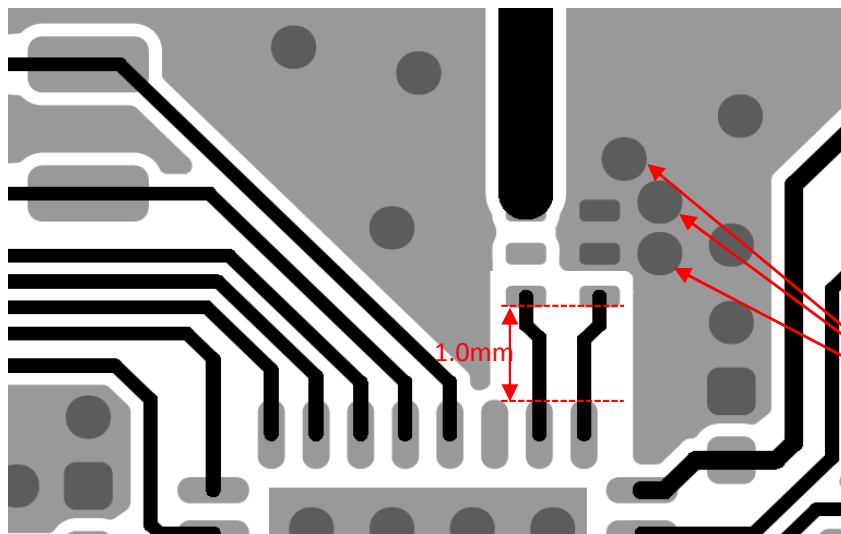
Application Note for Johanson Technology Inc. 2450BM14G0011 optimized for Texas Instruments' CC2620, CC2630, CC2640, CC2650 Wireless MCUs Operating on Differential RF with INTERNAL BIAS

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

1.0mm

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

High Frequency Ceramic Solutions

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

+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	2450BM14G0011 Sample 1	2450BM14G0011 Sample 2	2450BM14G0011 Sample 3	2450BM14G0011 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 Sample 1	2450BM14G0011 Sample 2	2450BM14G0011 Sample 3	2450BM14G0011 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 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

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

JOHANSON TECHNOLOGY

Ver. 1.0

High Frequency Ceramic Solutions

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

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

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. -40C to+85C)
Return Loss (dB)	9.5 min.

Attenuation Differential mode (dB):

25 typ. / 14dB min. @ 4800-5000 MHz

20 typ. / 15dB min. @ 7200-7500 MHz

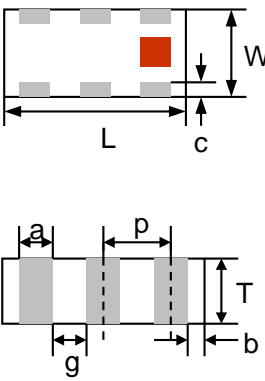|	
Phase Difference (deg.)	180 ± 10
Amplitude Difference	2.0 max.
Power Capacity	2W max (CW)
Qty/Reel (pcs)	4,000
Operating Temp. Range	-40 ~ +85°C
Storage Temp. Range	-40 ~ +85°C
Recommended Storage Conditions of Unused Product on T&R	+5 ~ +35 °C, Humidity 45-75%
Storage Period	18 months max.

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
		T & R	Suffix = T	E.g. 2450BM14G0011T
	Termination Style	100% Tin	Suffix = None	E.g. 2450BM14G0011(T or S)
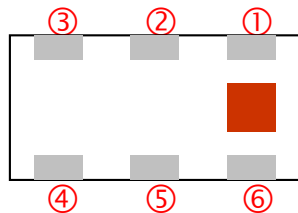
Mechanical Dimensions

	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

Johanson Technology, Inc. reserves the right to make design changes without notice.
All sales are subject to Johanson Technology, Inc. terms and conditions.
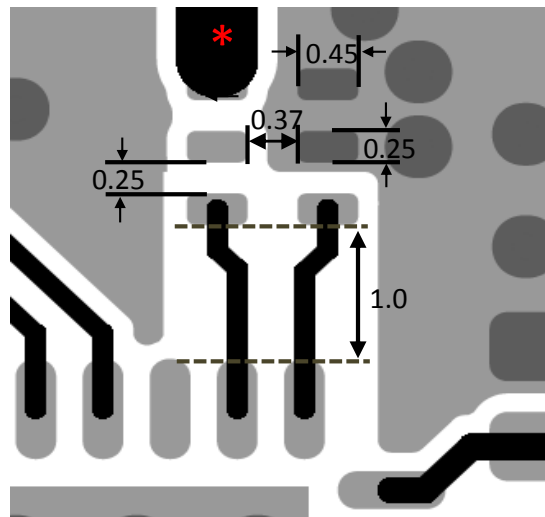
Ver 1.2

High Frequency Ceramic Solutions

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

Page 2 of 4

Mounting Considerations

0.45

0.37

0.25

0.25

1.0

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

☐ Land

🟡 Through-hole (ϕ 0.3/ϕ 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 3*

Network Analyzer**

Port 1 (50 Ohms)

Port 2*

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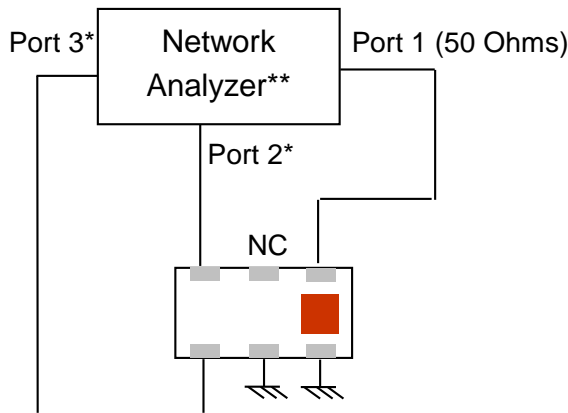
Port 1: Unbalanced Port
Ports 2 and 3: Balanced Port
IL=S_{ds21}
RL=S_{ss11}
Amp_balance = dB(S(2,1)/S(3,1))
Phase_balance = Phase(S(2,1)/S(3,1))

*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

JOHANSON TECHNOLOGY

Ver 1.2

High Frequency Ceramic Solutions

2.4GHz Impedance Matched Balun + embedded FCC/ETSI Band Pass Filter For Texas Instruments CC2620, CC2630, CC2640, CC2650 chipsets operated on INTERNAL BIAS MODE
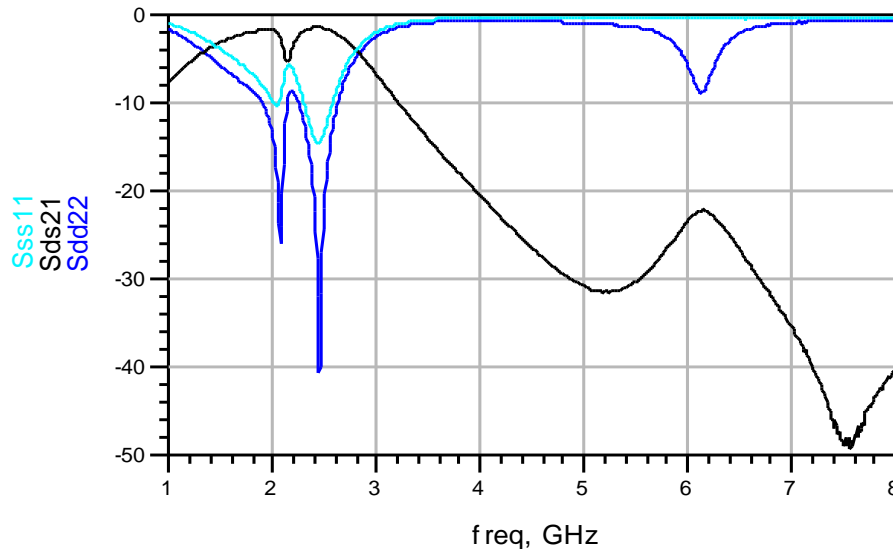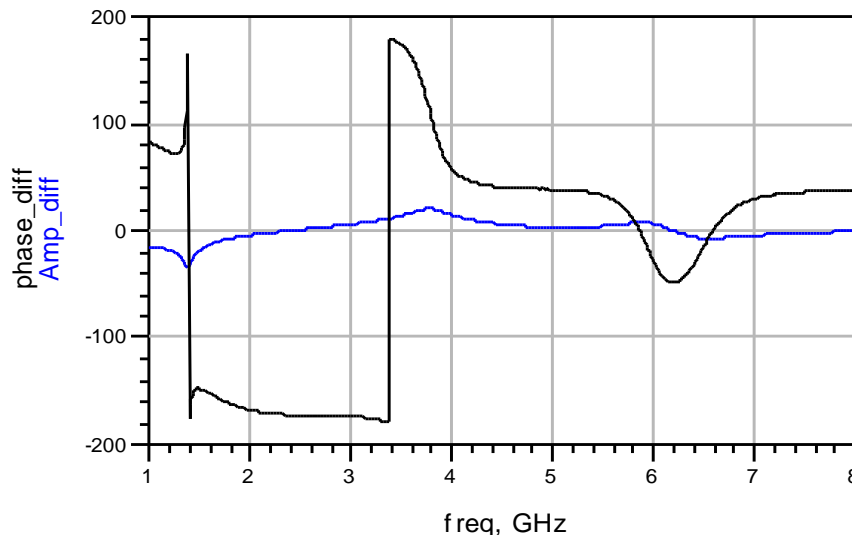
P/N: 2450BM14G0011

Detail Specification: 8/30/2016

Page 3 of 4

Typical Electrical Characteristics (T=25°C)

Insertion and Return Loss

Amplitude and Phase Balance

Johanson Technology, Inc. reserves the right to make design changes without notice.
All sales are subject to Johanson Technology, Inc. terms and conditions.

JOHANSON TECHNOLOGY

Ver 1.2

www.johansontechnology.com
4001 Calle Tecate • Camarillo, CA 93012, USA • TEL +1.805.389.1166

2016 Johanson Technology, Inc. All Rights Reserved

High Frequency Ceramic Solutions

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

Page 4 of 4

Application Notes, Layout Files, and more

www.johansontechnology.com/ti

Packaging information

www.johansontechnology.com/tape-reel-packaging

Soldering Information

www.johansontechnology.com/ipcsoldering-profile

MSL Info

www.johansontechnology.com/msl-rating

Recommended Storage Condition and Max Shelf Life

www.johansontechnology.com/recommended-storage-conditions

RoHS Compliance

www.johansontechnology.com/rohs-compliance

Antenna layout and tuning techniques

www.johansontechnology.com/tuning

Antenna layout review, tuning, and characterization services

www.johansontechnology.com/ipc-antenna-services