



iBeacon BCM20737 Schematic Design Guidelines

Broadcom Confidential

Revision History

<i>Revision</i>	<i>Date</i>	<i>Change Description</i>
20737-DG100-R	12/16/2014	Initial release

Broadcom Confidential

Broadcom Corporation
5300 California Avenue
Irvine, CA 92617

© 2014 by Broadcom Corporation
All rights reserved
Printed in the U.S.A.

Broadcom®, the pulse logo, Connecting everything®, and the Connecting everything logo are among the trademarks of Broadcom Corporation and/or its affiliates in the United States, certain other countries and/or the EU. Any other trademarks or trade names mentioned are the property of their respective owners.

Table of Contents

About This Document	5
Purpose and Audience	5
Acronyms and Abbreviations	5
Document Conventions	5
Technical Support	5
General Description	6
Schematic Overview	6
Baseband Section	7
Power Supply	7
Reset Circuit	8
Recovery Process	9
Reset Activation	9
EEPROM	10
Reset Switch	11
LED Circuit	12
Decoupling Capacitors for the RF Section	12
Clock Crystal	13
Low-Pass Filter	14

List of Figures

Figure 1: BCM920737 Reference Design	6
Figure 2: Baseband Section.....	7
Figure 3: UART Schematic Section	8
Figure 4: Radio Disable Circuit	9
Figure 5: EEPROM Circuit	10
Figure 6: EEPROM Recovery Circuit.....	11
Figure 7: LED Circuit.....	12
Figure 8: RF Circuit.....	12
Figure 9: Clock Crystal.....	13
Figure 10: Low-Pass Filter	14

About This Document

Purpose and Audience

This document describes the schematic guidelines for the iBeacon BCM20737 product on the MMP site.

Acronyms and Abbreviations

In most cases, acronyms and abbreviations are defined on first use.

For a comprehensive list of acronyms and other terms used in Broadcom documents, go to:

<http://www.broadcom.com/press/glossary.php>.

Document Conventions

The following conventions may be used in this document:

Convention	Description
Bold	User input and actions: for example, type exit , click OK , press Alt+C
Monospace	Code: <code>#include <iostream></code> HTML: <code><td rowspan = 3></code> Command line commands and parameters: <code>w1 [-1] <command></code>
<code>< ></code>	Placeholders for <i>required</i> elements: enter your <code><username></code> or <code>w1 <command></code>
<code>[]</code>	Indicates <i>optional</i> command-line parameters: <code>w1 [-1]</code> Indicates bit and byte ranges (inclusive): <code>[0:3]</code> or <code>[7:0]</code>

Technical Support

Broadcom provides customer access to a wide range of information, including technical documentation, schematic diagrams, product bill of materials, PCB layout information, and software updates through its customer support portal (<https://support.broadcom.com>). For a CSP account, contact your Sales or Engineering support representative.

In addition, Broadcom provides other product support through its Downloads and Support site (<http://www.broadcom.com/support/>).

General Description

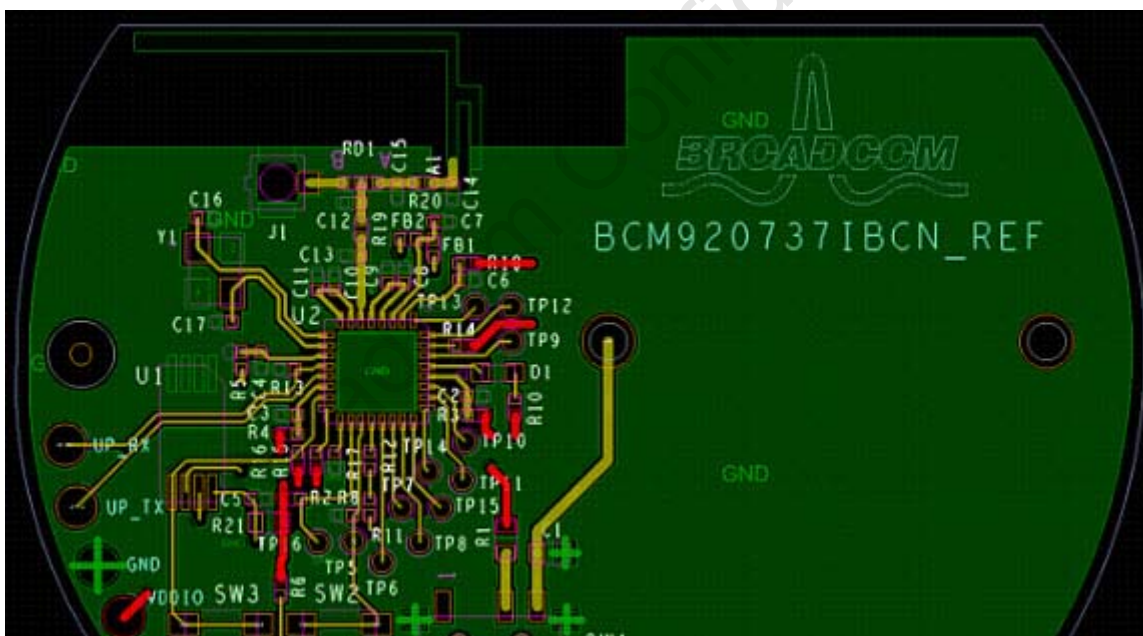
The Broadcom® BCM20737 is an advanced Bluetooth low energy (aka Bluetooth Smart) SoC that supports wireless charging, and includes advanced security features and introduces new software support for NFC pairing. The BCM20737 is designed to support the entire spectrum of Bluetooth Smart use cases for medical, home automation, accessory, sensor, Internet Of Things, and wearable market segments.

Schematic Overview

In this section, we will describe the schematic guidelines for the iBeacon BCM920737 reference design (Figure 1). This document includes:

- “Baseband Section” on page 7
- “Recovery Process” on page 9
- “Decoupling Capacitors for the RF Section” on page 12

Figure 1: BCM920737 Reference Design

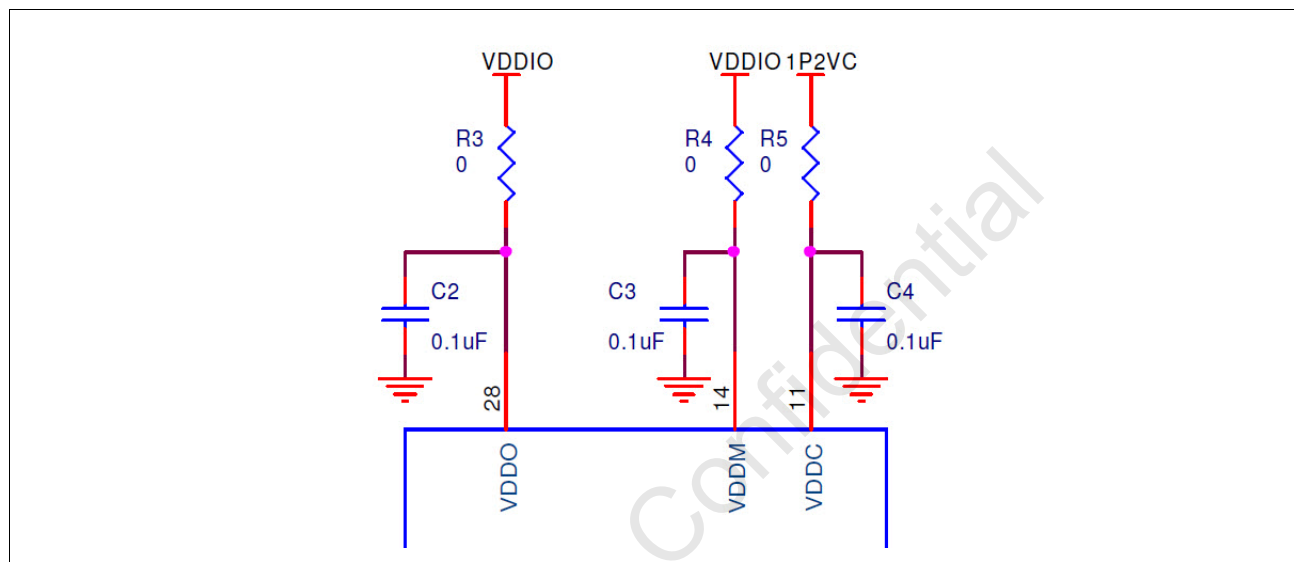


Baseband Section

Power Supply

The baseband side of the schematic receives power from the 3.3V VDDIO (Figure 2). Make sure that the value of decoupling capacitor (C2) is 0.1 μ F and that the pins are physically placed as close as possible to VDDO, pin 28 of the BCM20737.

Figure 2: Baseband Section



The VDDM (pin 14) is the power domain for the I²C and UART and the Core (VDDC) receives a 1.2V input.



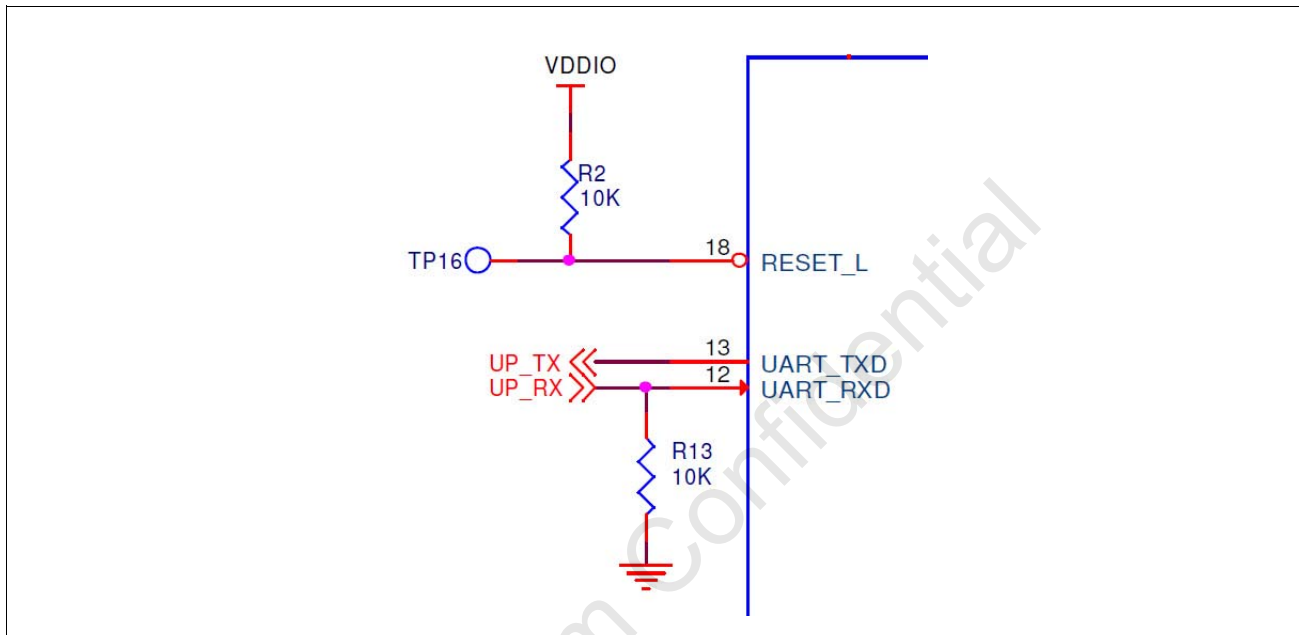
Note: Make sure that the values of the decoupling capacitors (C2, C3, and C4) are 0.1 μ F, and that they are placed as close as possible to their respective pins on the BCM20737.

Reset Circuit

The reset pin (RESET_L) is connected to a 10K pull-up resistor by default as shown in [Figure 3](#).

When using the Silicon Lab (WICED Sense Kit...USB to UART driver), place a zero ohm resistor in series with the UP_TX pin. This is used to switch between Application and HCI Modes. The UP_RX pin is connected to a 10K pull-down resistor by default.

Figure 3: UART Schematic Section

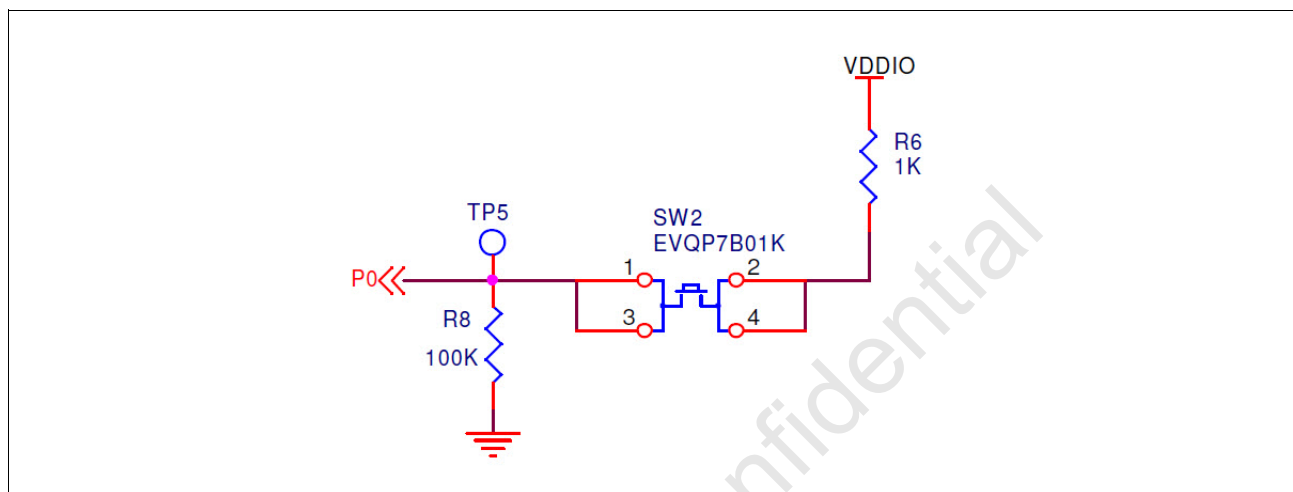


Recovery Process

Reset Activation

P0 is connected to pin 19 of the BCM20737 and is used to disable the radio. This reset signal is activated by pressing SW2 (Figure 4).

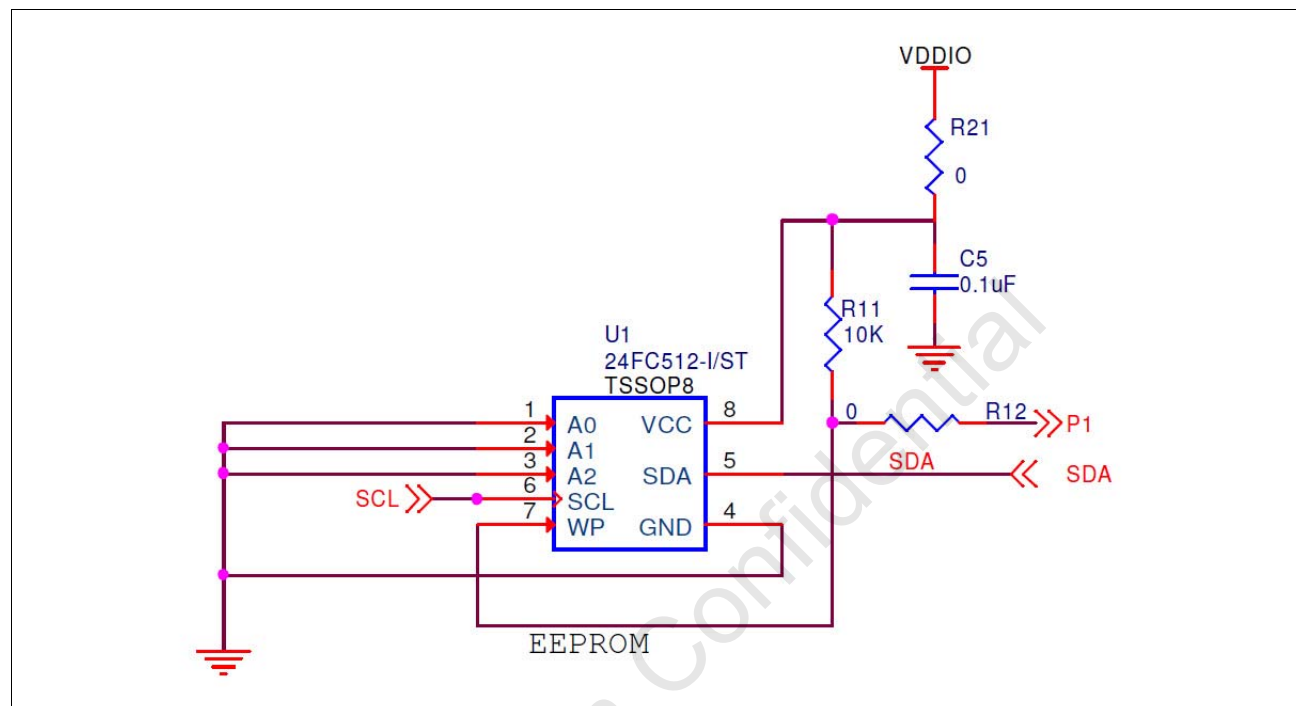
Figure 4: Radio Disable Circuit



EEPROM

The EEPROM is an I²C interface. The SDA, SCL, and P1 signals are connected to SDA, SCL, and P1 of BCM20737 (Figure 5). P1 (by default) is used as write protect for the EEPROM.

Figure 5: EEPROM Circuit

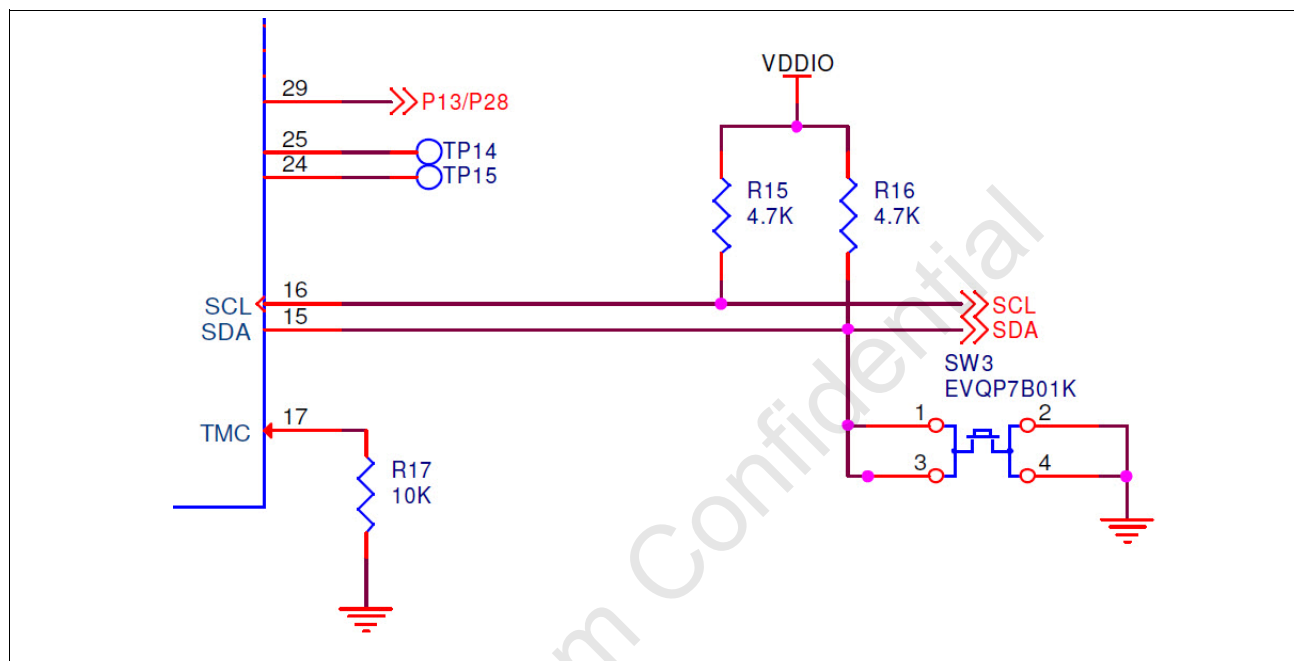


Reset Switch

Switch SW3 is used to reset the EEPROM when it becomes corrupted; this shorts the SDA signal to ground, which enables the EEPROM to recover after a reboot of the reference board.

The Test Mode Control (TMC) pin has a 10K pull-down resistor by default. When this pin is high, it forces the chip into test mode. For normal operations, this pin is pulled low.

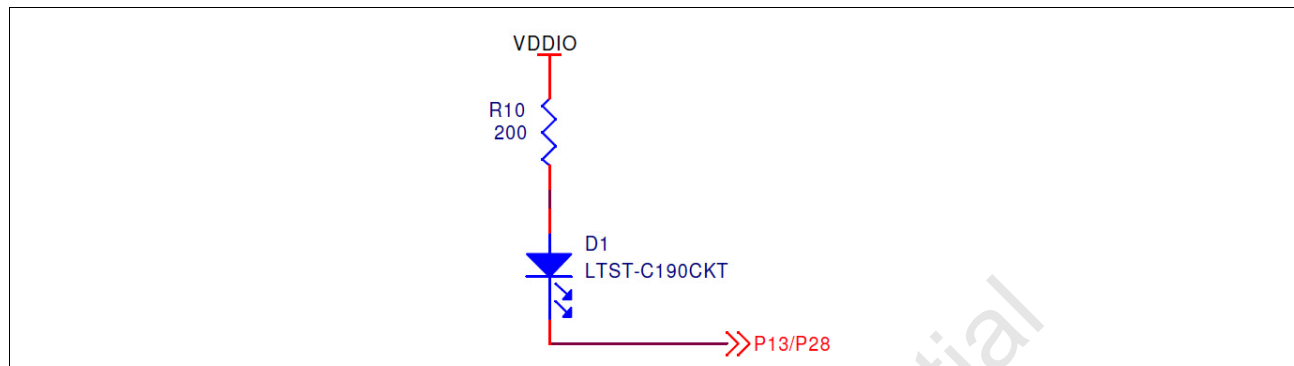
Figure 6: EEPROM Recovery Circuit



LED Circuit

The LED (D1) is connected P13 of the BCM20737 (Figure 7). This signal is one of the PWM/PPIOs which can be used to synchronize the LED.

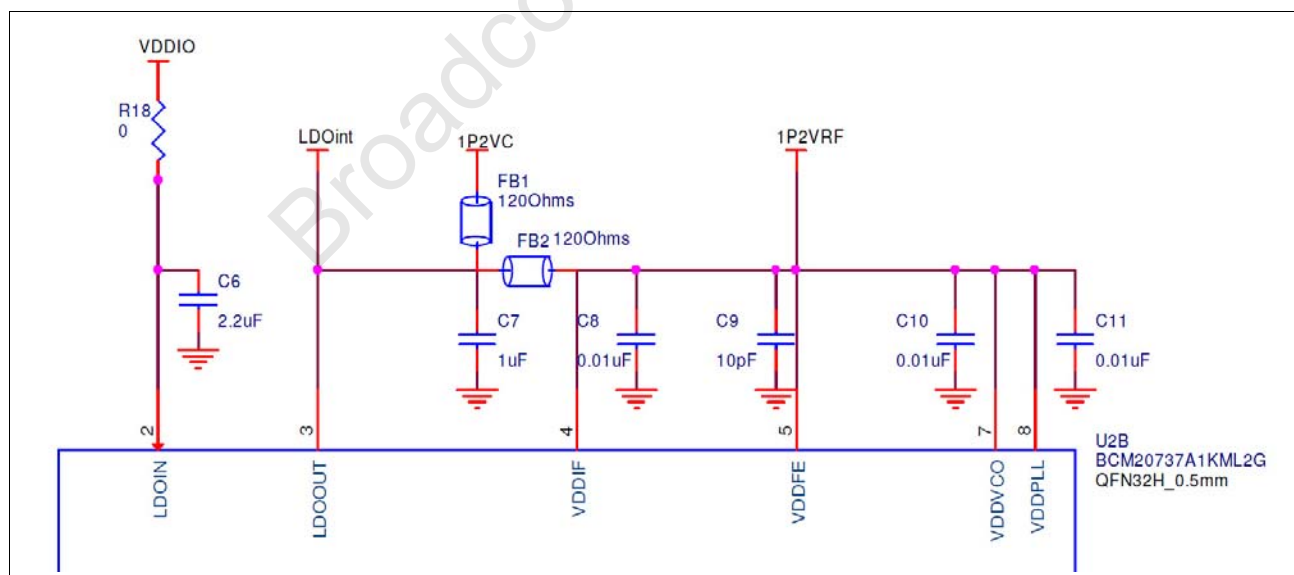
Figure 7: LED Circuit



Decoupling Capacitors for the RF Section

On the RF side, the VDDIO 3V power supply connects to the internal LDOIN and then comes out on the LDOOUT pin. The LDOOUT is split into two branches. The first branch goes through ferrite bead (FB1) and supplies the VDDC and the second branch goes through ferrite bead FB2, and supplies the RF front end (VDDIF, VDDFE, VDDVCO, and VDDPLL). These four pins have decoupling capacitors; C8, C10, and C11 use a 0.01 μ F capacitor and C9 uses a 10 pF capacitor. As in the previous recommendation, these capacitors also need to be placed as close as possible to their respective pins on the BCM20737.

Figure 8: RF Circuit

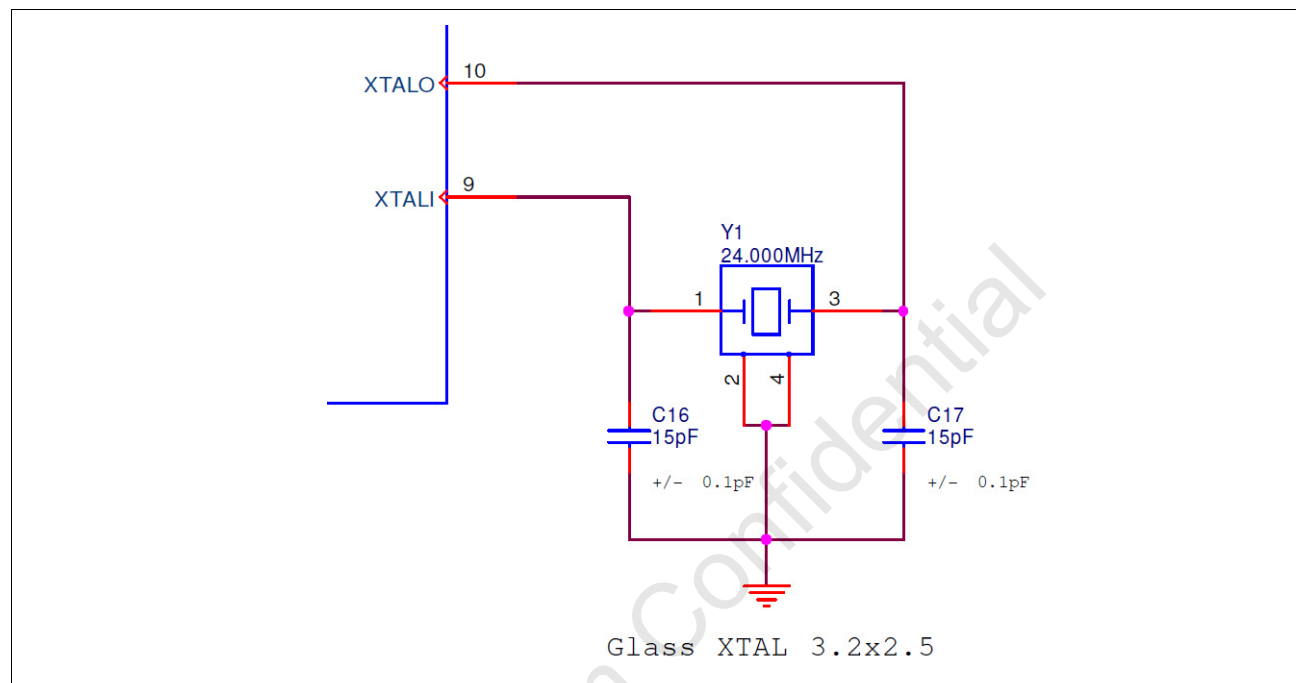


Note: It is not recommended to connect the 1.2V Core supply to this section.

Clock Crystal

The crystal section XTALO and XTALI use 15 pF capacitors (by default), which are tuned for this example. Although, depending on the layout and placement, the value of these capacitors may need to be tuned for your specific circuit.

Figure 9: Clock Crystal



Low-Pass Filter

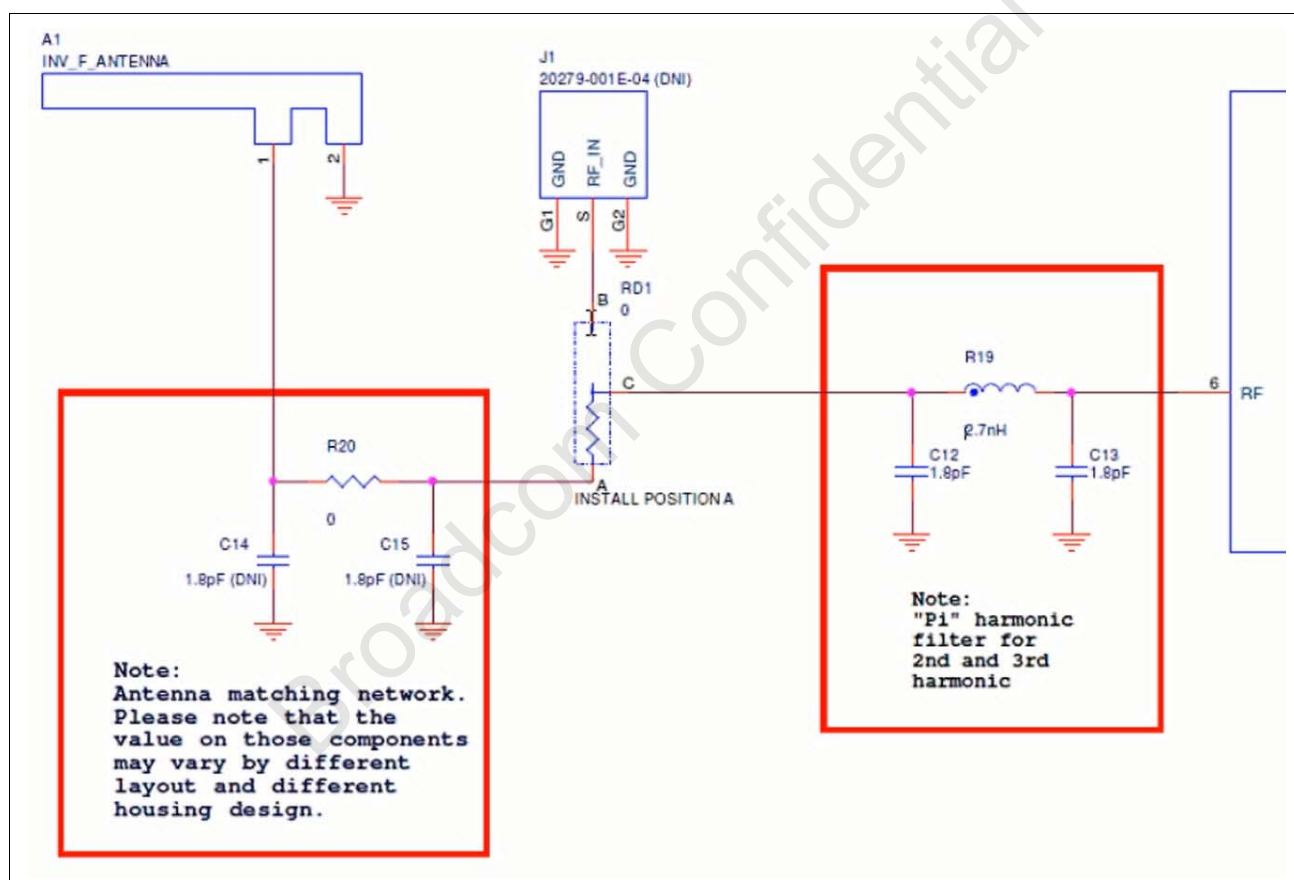
The low-pass circuit filters out the 3rd and 4th harmonics of the RF signal. The default values are a series 2.7 nH inductor and two 1.8 pF shunt capacitors on each end of the inductor. A two-way resistor is connected between the UFL connector (J1) and Peak Antenna (A1). This resistor can be moved from position-B to position-C for RF testing.

This design maintains a 50-ohm impedance throughout the circuit, so there is no need to match components. By default, we use a zero ohm resistor connected to the INV_F_ANTENNA.



Note: If this design were to be enclosed, R20, C14, and C15 may need to be adjusted for antenna matching.

Figure 10: Low-Pass Filter



Broadcom Confidential

Broadcom® Corporation reserves the right to make changes without further notice to any products or data herein to improve reliability, function, or design.

Information furnished by Broadcom Corporation is believed to be accurate and reliable. However, Broadcom Corporation does not assume any liability arising out of the application or use of this information, nor the application or use of any product or circuit described herein, neither does it convey any license under its patent rights nor the rights of others.



Broadcom Corporation

5300 California Avenue

Irvine, CA 92617

© 2014 by BROADCOM CORPORATION. All rights reserved.

20737-DG100-R

December 16, 2014

Phone: 949-926-5000

Fax: 949-926-5203

E-mail: info@broadcom.com

Web: www.broadcom.com