Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!

Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832
Email & Skype: info@chipsmall.com Web: www.chipsmall.com
Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

12311 Development Hardware

Reference Manual

Document Number: 12311DHRM
Rev. 0.0
10/2011

freescale™
semiconductor

How to Reach Us:

Home Page:
www.freescale.com

E-mail:
support@freescale.com

USA/Europe or Locations Not Listed:
Freescale Semiconductor
Technical Information Center, CH370
1300 N. Alma School Road
Chandler, Arizona 85224
+1-800-521-6274 or +1-480-768-2130
support@freescale.com

Europe, Middle East, and Africa:
Freescale Halbleiter Deutschland GmbH
Technical Information Center
Schatzbogen 7
81829 Muenchen, Germany
+44 1296 380 456 (English)
+46 8 52200080 (English)
+49 89 92103 559 (German)
+33 1 69 35 48 48 (French)
support@freescale.com

Japan:
Freescale Semiconductor Japan Ltd.
Headquarters
ARCO Tower 15F
1-8-1, Shimo-Meguro, Meguro-ku,
Tokyo 153-0064, Japan
0120 191014 or +81 3 5437 9125
support.japan@freescale.com

Asia/Pacific:
Freescale Semiconductor Hong Kong Ltd.
Technical Information Center
2 Dai King Street
Tai Po Industrial Estate
Tai Po, N.T., Hong Kong
+800 2666 8080
support.asia@freescale.com

***For Literature Requests Only*:**
Freescale Semiconductor Literature Distribution Center
P.O. Box 5405
Denver, Colorado 80217
1-800-521-6274 or 303-675-2140
Fax: 303-675-2150
LDCForFreescaleSemiconductor@hibbertgroup.com

Contents

About This Book

Chapter 1
Safety Information

Chapter 2
MC12311 Development Platform Overview and Description

Chapter 3
12311-MRB

Chapter 4
PCB Manufacturing Specifications

About This Book

This manual describes Freescale's 12311-MRB development platform hardware. The MC12311 development platform is a highly-integrated, cost-effective, system-in-package (SIP), sub-1GHz wireless node solution with an FSK, GFSK, MSK, or OOK modulation-capable transceiver and low-power QE32 8-bit microcontroller. The highly integrated RF transceiver operates over a wide frequency range including 315 MHz, 433 MHz, 470 MHz, 868 MHz, 915 MHz, 928 MHz, and 955 MHz in the license-free Industrial, Scientific and Medical (ISM) frequency bands.

Audience

This manual is intended for system designers.

Organization

This document is organized into the following chapters.

Chapter 1 Safety Information — Highlights some of the FCC requirements.

Chapter 2 HCS08 Development Platform Overview and Description — Provides an overview of the two boards that comprise the MC12311 development platform.

Chapter 3 Modular Reference Board — This chapter details the 12311-MRB evaluation board based on the Freescale MC12311 device.

Chapter 4 PCB Manufacturing Specifications — This chapter provides the specifications used to manufacture the various 12311-MRB printed circuit boards (PCBs).

Revision History

The following table summarizes revisions to this document since the previous release (Rev 0.0).

Revision History

Location	Revision
Entire document	First public release

Definitions, Acronyms, and Abbreviations

The following list defines the acronyms and abbreviations used in this document.

ADC	Analog to Digital Converter
AES	Advanced Encryption Standard
CTS	Clear to Send
DAC	Digital to Analog Converter
I2C	Inter-Integrated Circuit is a multi-master serial computer bus
ISM	Industrial Scientific Medical 2.4 GHz radio frequency band
JTAG	Joint Test Action Group
LGA	Land Grid Array
MAC	Media Access Controller
MCU	Microcontroller Unit
PCB	Printed circuit board
PiP	Platform in Package
PWM	Pulse-width modulation
RCM	Remote Control Module
REM	Remote Extender Board
RTS	Request to Send
SMA Connector	SubMiniature version “A” connector
SPI	Serial Peripheral Interface
SSI	Synchronous Serial Interface
TACT Switch	A switch that provides a slight “snap” or “click” to the user to indicate function.
TELCO	Telephone Company
USB	Universal Serial Bus
VCP	Virtual Com Port

Chapter 1
Safety Information

1.1 FCC Guidelines

This equipment is for use by developers for evaluation purposes only and must not be incorporated into any other device or system. This device may not be sold to the general public. Integrators will be responsible for reevaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

FCC approval of this device only covers the original configuration of this device as supplied. Any modifications to this product, including changes shown in this manual, may violate the rules of the Federal Communications Commission and Industry Canada and make operation of the product unlawful.

1.1.1 Labeling

FCC labels are physically located on the back of the board.

1.1.2 Operating Conditions

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

1.1.3 Exposure Limits

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. The antenna(s) used for this equipment must be installed to provide a separation distance of at least 8 inches (20cm) from all persons.

1.1.4 Antenna Restrictions

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional

radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

1.2 Regulatory Approval For Canada (IC RSS 210)

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

1. This device may not cause interference, and
2. This device must accept any interference, including interference that may cause undesired operation of the device.

1.2.1 26 PART 5 – Appendix

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

1. l'appareil ne doit pas produire de brouillage, et
2. l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

1.3 Electrostatic Discharge Considerations

Although damage from electrostatic discharge (ESD) is much less common on these devices than on early CMOS circuits, normal handling precautions should be used to avoid exposure to static discharge. Qualification tests are performed to ensure that these devices can withstand exposure to reasonable levels of static without suffering any permanent damage.

All ESD testing is in conformity with the JESD22 Stress Test Qualification for Commercial Grade Integrated Circuits. During the device qualification ESD stresses were performed for the human body model (HBM), the machine model (MM) and the charge device model (CDM).

All latch-up test testing is in conformity with the JESD78 IC Latch-Up Test.

When operating or handling the development boards or components, Freescale strongly recommends using at least the grounding wrist straps plus any or all of the following ESD dissipation methods:

- Flexible fabric, solid fixed size, or disposable ESD wrist straps
- Static control workstations, static control monitors and table or floor static control systems
- Static control packaging and transportation materials and environmental systems

1.4 Disposal Instructions

This product may be subject to special disposal requirements. For product disposal instructions, refer to www.freescale.com/productdisposal.

Chapter 2
MC12311 Development Platform Overview and Description

2.1 Introduction

The MC12311 development platform is an evaluation environment based on the Freescale MC12311 device. The MC12311 is a highly-integrated, cost-effective, system-in-package (SIP), sub-1GHz wireless node solution with an FSK, GFSK, MSK, or OOK modulation-capable transceiver and low-power QE32 8-bit microcontroller. The highly integrated RF transceiver operates over a wide frequency range including 315 MHz, 433 MHz, 470 MHz, 868 MHz, 915 MHz, 928 MHz, and 955 MHz in the license-free Industrial, Scientific and Medical (ISM) frequency bands. This configuration allows users to minimize the use of external components.

The MC12311 is targeted for the following low-power wireless applications:

- Automated Meter Reading
- Wireless Sensor Networks
- Home and Building Automation
- Wireless Alarm and Security Systems
- Industrial Monitoring and Control
- Wireless MBUS Standard (EN13757-4:2005)

Freescale supplements the MC12311 with tools and software that include hardware evaluation and development boards, software development IDE and applications, drivers, custom PHY usable with Freescale's IEEE 802.15.4 compatible MAC, and an available wireless MBUS solution.

The MC12311 development platform is comprised of two boards:

- 12311-Modular Reference Board (12311-MRB) - this board contains the MC12311 device with 32 MHz reference oscillator crystal, RF circuitry including antenna, and supporting circuitry. The board can be used as a simple standalone evaluation platform or as a daughter card to the other MC12311 development platform boards or to a custom, application specific motherboard.
  - — Provides compact reference design for device footprint and RF layout
  - — Provides pre-designed MC12311 hardware (device and function)
  - — Provides access to the MC12311 full set of GPIO
  - — Provides MCU BDM debug port
  - — Provides optional local 2 Mbit serial FLASH, 32.768 kHz oscillator crystal, IR "blaster" LED and power management.
- TWR-RF Board . The TWR-RF board is a motherboard for the MC12311 and 12311-MRB daughter boards, to enable its use within the Tower system. The TWR-RF board is a Tower Controller Module compatible with the Freescale Tower System. The 12311-MRB + TWR-RF can

run standalone, outside the Tower system. The following list summarizes the features of the TWR-RF Module:

- Standard sockets 100 mils J5 and J4 (2X9 and 2x10) to connect MC12311 and 12311-MRB daughter boards
- Standard header 100 mils J1 (2x20) to enable signalling path to TWR primary and secondary connectors.
- Standard header 100 mils J6 (3x12) to enable signalling to on board HW and USB interface or to TWR system Hardware
- On-board regulator to provide external supply
- Four (4) user-controllable LEDs
- Four (4) user push-button switches
- USB Type B connector

Whether the 12311-MRB is used in a simple standalone application or in combination with another host card, Freescale provides a complete software development environment called the Freescale BeeKit Wireless Connectivity Toolkit (BeeKit). BeeKit is a comprehensive codebase of wireless networking libraries, application templates, and sample applications. The BeeKit Graphical User Interface (GUI) allows users to create, modify, and update various wireless networking implementations. A wide range of software functionality is available to complement the 12311-MRB and these are provided as codebases within BeeKit.

2.2 Features

The MC12311 development platform is built around the concept of having a single daughter card (12311-MRB) that contains the MC12311 IC and all necessary I/O connections for use as a self-contained module or for connection to an application motherboard like the TWR-RF board.

Figure 2-1 shows a photo of the 12311-MRB.

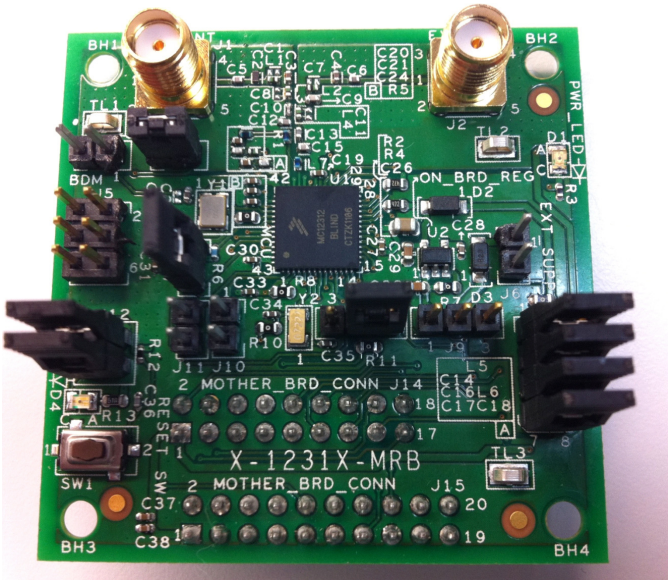

Figure 2-1. 12311-MRB

Features of the MC12311 development platform include:

- Based on Freescale's low-cost MC12311 sub-1GHz wireless node solution with an FSK, GFSK, MSK, or OOK modulation-capable transceiver and low-power QE32 8-bit microcontroller, and a functional set of MCU peripherals into a 60-pin LGA package
- Reference design area with small footprint, low cost RF node
  - Power Amplifier Output
  - Unbalance input/output port
  - Flexible RF-Front End for different bands operation
  - Programmable output power from -18 dBm to +17 dBm in 1dB steps
  - High Sensitivity: down to -120dBm at 1.2kbps
- 32 MHz reference oscillator
- BDM serial MCU debug port
- Optional secondary 32.768 kHz crystal oscillator for accurate low power timing
- Master reset switch
- Full power regulation and management
- 12311-MRB board provides
  - Required circuitry for MC12311 - crystals and RF circuitry including SMA connectors for Power Amplifier Output and Input/Output RF port
  - Local power supply regulation
  - Access to all GPIO
  - Standalone or daughter card use modes
  - BDM connector

2.2.1 TWR-RF Module

The 12311-MRB can run in the Freescale Tower System using the RF-Tower module (TWR-RF). Features of the TWR-RF module include:

- Standard sockets 100 mils J5 and J4 (2 x 9 and 2 x 10) to connect either a 1323x Modular Reference Board (1323x-MRB) or a 12311 Modular Reference Board (12311-MRB)
- Standard header 100 mils J1 (2 x 20) to enable signalling path to TWR primary and secondary connectors.
- Standard header 100 mils J6 (3 x 12) to enable signalling to on board HW and USB interface or to TWR system Hardware
- On-board regulator to provide external supply
- Four (4) user-controllable LEDs
- Four (4) user push-button switches
- USB Type B connector

Figure 2-2 shows a simplified block diagram of the Freescale Tower RF system.

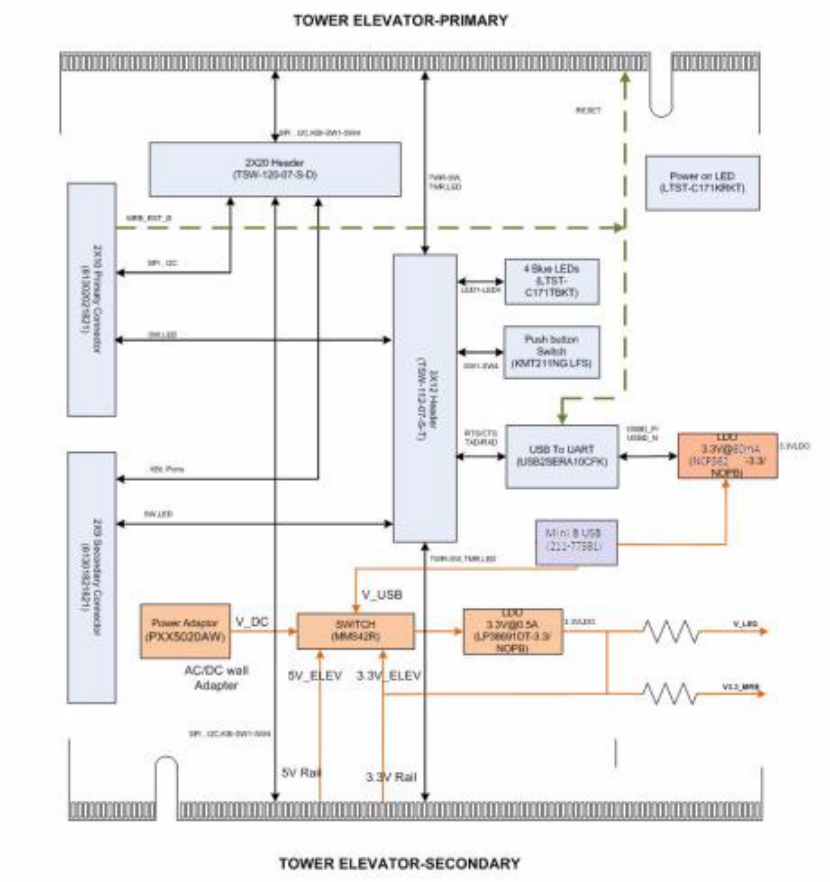

Figure 2-2. Simplified TWR-RF Block Diagram

See the TWR-RF Reference Manual for more information about the RF-Tower module.

2.3 Driver Considerations

When users first connect a 12311-MRB to a PC, they may be prompted to install drivers. If BeeKit is installed and this occurs, do not allow Windows to automatically search for and install the drivers. Instead, select manual installation and steer Windows to the following directory:

```
C:\Program Files\Freescale\Drivers
```

If installing the BeeKit software package to another drive or directory, indicate the Drivers directory created by the installer in the custom location where BeeKit was installed.

Follow the instructions as they appear on the screen to complete driver installation.

If BeeKit is not installed, be aware of the following:

- The boards use FSL USB2SER USB to UART bridge converter.
- Download the appropriate driver and follow the instructions to complete driver installation from www.freescale.com.

Chapter 3
12311-MRB

3.1 12311-MRB Overview

The 12311-MRB is an evaluation board based on the Freescale MC12311 device. The 12311-MRB provides a platform to evaluate the MC12311 device, develop software and applications. The core device is accompanied by the 32 MHz reference oscillator crystal, RF circuitry including SMA for antenna connection and/or instrumentation, and supporting circuitry.

This basic board is intended as the core module for MC12311 evaluation and application development and can be used in the following modes:

- Simple standalone evaluation platform
- Daughtercard to other Development Platform boards (TWR-RF, 1323x-RCM or 1323x-REM)
- Daughtercard to an application specific motherboard.

3.1.1 Features

The 12311-MRB provides the following features:

- Small form factor (2 x 2 inches)
- 4-Layer metal, 0.034 inch thick FR4 board
- MC12311 reference design area
  - LGA footprint and power supply bypass
  - 32 MHz reference oscillator crystal
  - RF components and layout
- Low cost RF node
  - Dual Output RF Path. Transmit/Receive (RFIO) and single Power Amplifier Transmitter (PA Boost) Output
  - Differential input/output port (typically used with a balun)
  - Programmable output power from -18 dBm to +17 dBm typical
  - High sensitivity of -120 dBm at 1.2 KBPS
  - SMA output connector for Transmit/Receive Output
  - SMA output connector for Power Amplifier
- Two connectors provided daughter card mounting
  - 20-Pin primary connector
  - 18-Pin secondary connector

  - Provide main supply voltage to board
  - Provide access to all MC12311 GPIO
- Flexible board power supply
  - 3.3 V LDO series regulator supplied
  - Regulator bypass jumper option
  - Separate external voltage source option
  - Power-on green LED
  - Jumpers allow various block current measurements
- 6-Pin BDM serial MCU debug port
- MC12311 reset switch

3.1.2 Form Factor

Figure 3-1 shows the 12311-MRB connector and header locations.

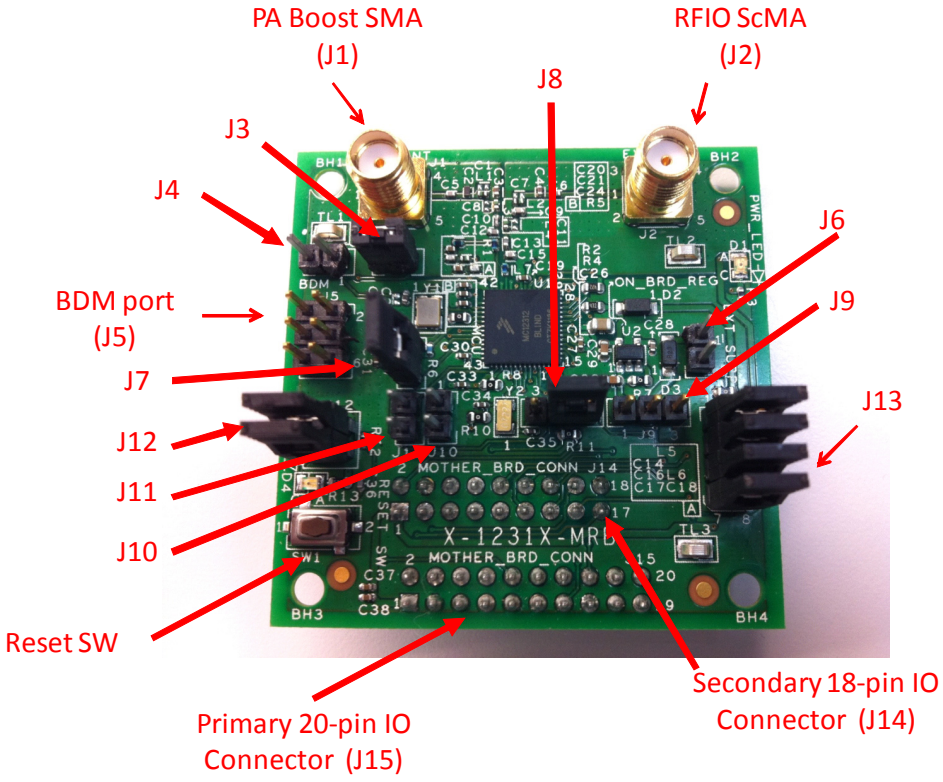

Figure 3-1. 12311-MRB

Figure 3-2 shows a footprint of the 12311-MRB with the location of the IO Headers J2 and J3. Users can create a motherboard to mount the 12311-MRB and headers J2 and J3 are used for that connection.

- Both headers have standard 0.10in / 2.54 mm pin spacing
- J2 is 20-pin and J3 is 18-pin

- Both are pin headers mounted on the bottom side of the 12311-MRB and are intended to plug into matching receptacles on the motherboard.

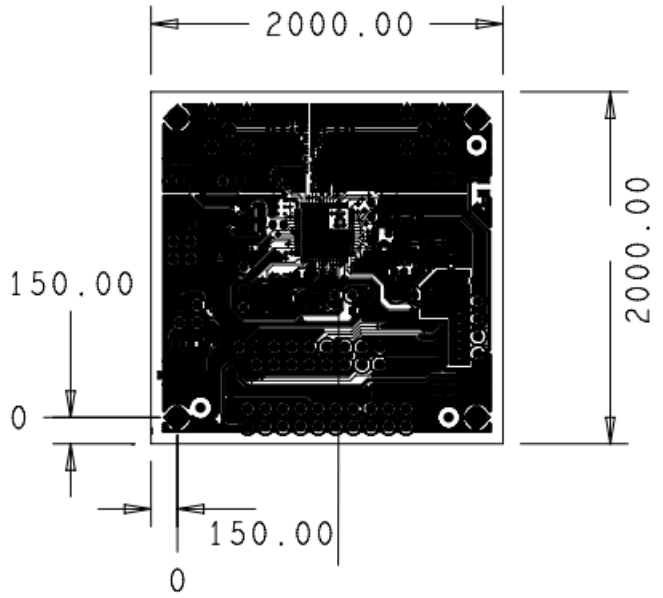

Figure 3-2. 12311-MRB Top Side (Component Side) Footprint

3.1.3 Board Level Specifications

Table 3-1. 12311-MRB Specifications

Parameter				Units	Notes/Conditions
	MIN	TYP	MAX		
General					
Size (PCB: X, Y)			51 x 51 2.01 x 2.01	mm inches	
Layer build (PCB)		0.8 0.034		mm inches	4-Layer
Dielectric material (PCB)					FR4
Power					
Voltage supply (DC) With 3.3 V regulator in use	3.50		10	V	Full module use

Table 3-1. 12311-MRB Specifications (continued)

Parameter				Units	Notes/Conditions
Current consumption			TBD	mA	
Temperature					
Operating temperature (see note)	-40	+25	+70	°C	• Operating temperature is limited to +70 °C due to switches. Basic circuit is good for a maximum temperature of +85 °C.
Storage temperature	-30	+25	+70	°C	
RF Receiver					
FSK Sensitivity		-105 to -120		dBm	
OOK Sensitivity		-112		dBm	
Adjacent channel Rejection (Offset = +/- 25 KHz or 50 KHz)		-42		dB	
2nd order Intercept point		+75		dBm	
3rd order Intercept point		+20		dBm	
RSSI dynamic range	-115		0		
RF Transmitter					
RF Power Output (RFIO pin)	-18		+13	dBm	Programmable in 1dB steps
RF Power Output (PA_Boost pin)		+17		dBm	
Adjacent channel Power (25KHz offset)			-37	dBm	
Regulatory Approval					
FCC					Product is approved accordingly to the FCC part 15 standard
CE (ETSI)					Product is approved accordingly to the EN 300 328 V1.7.1 (2006-10) standard
CE (EMC)					Product is approved accordingly to the EN 301 489-1 V1.6.1 (2005-09) and EN 301 489-17 V1.2.1 (2002-08) standards
Safety					
UL					Product is approved accordingly to the IEC 60950-1 and EN 60950-1, First Edition standards
Environment					
RoHS					Product complies with the EU Directive 2002/95/EC of 27 January 2003
WEEE					Product complies with the EU Directive 2002/95/EC of 27 January 2003

3.2 Functional Description

The 12311-MRB is built around Freescale's MC12311 56-pin LGA platform. Figure 3-2 shows a simple block diagram. This board is intended as a simple evaluation platform and as a building block for application development. The 4-layer board provides the MC12311 with its required RF circuitry, 32 MHz reference oscillator crystal, and power supply bypassing. The layout for this base level functionality can be used as a reference layout by the user target board.

In additional to the base MC12311 functionality, the 12311-MRB provides features to assist in debug, reset button, simple power manager, and expansion connectors for the GPIO. In the following sections, refer to:

- Figure 3-1 for location of connectors and features
- Figure 3-3 for the functional blocks
- Figure 3-9 for the board schematic

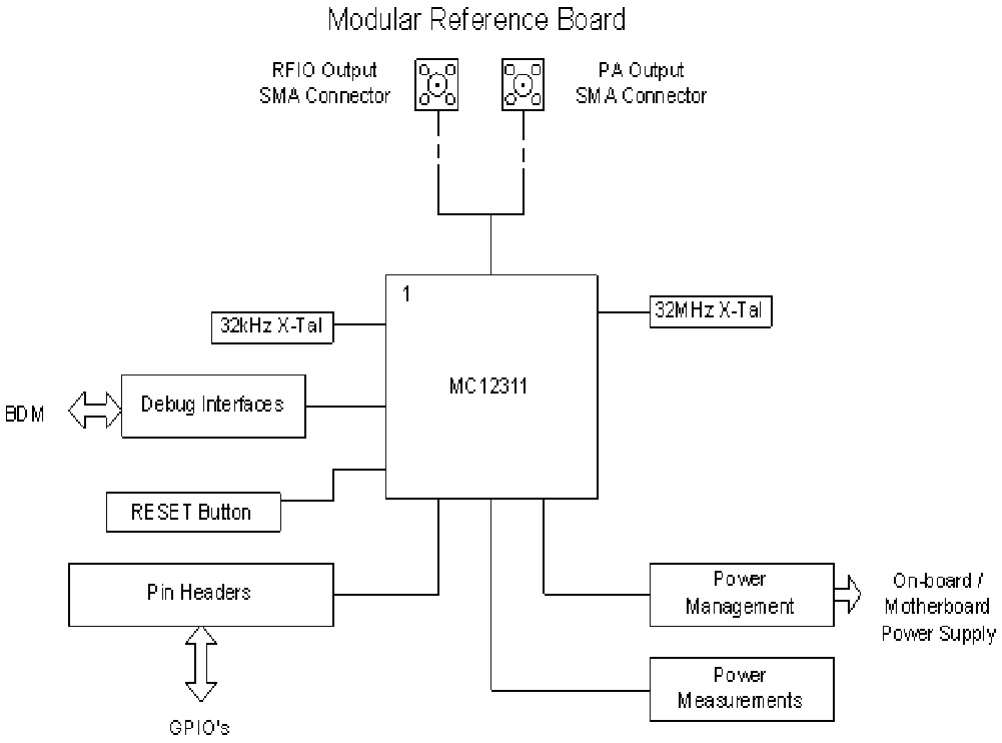

Figure 3-3. 12311-MRB Block Diagram

3.2.1 RF Performance and Considerations

The MC12311 transceiver is a single-chip integrated circuit ideally suited for today's high performance ISM band RF applications. It is intended for use as a high-performance, low-cost FSK and OOK RF transceiver for robust, frequency agile, half-duplex bi-directional RF links. The MC12311 is intended for applications over a wide frequency range, including the 433 MHz and 868MHz European and the 902-928 MHz North American ISM bands.

- Maximum RF In/Out power is +13 dBm
- Maximum Power Amplifier Output is +17dBm

The 12311-MRB utilizes a flexible RF path topology that make it suitable for working in different frequency bands by replacing a minimum number of components while providing good RF performance. Following Tables shows the different BOM according to different Frequency Bands of operation.

NOTE

See the MC12311 Data Sheet and Reference Manual for more RF design information.

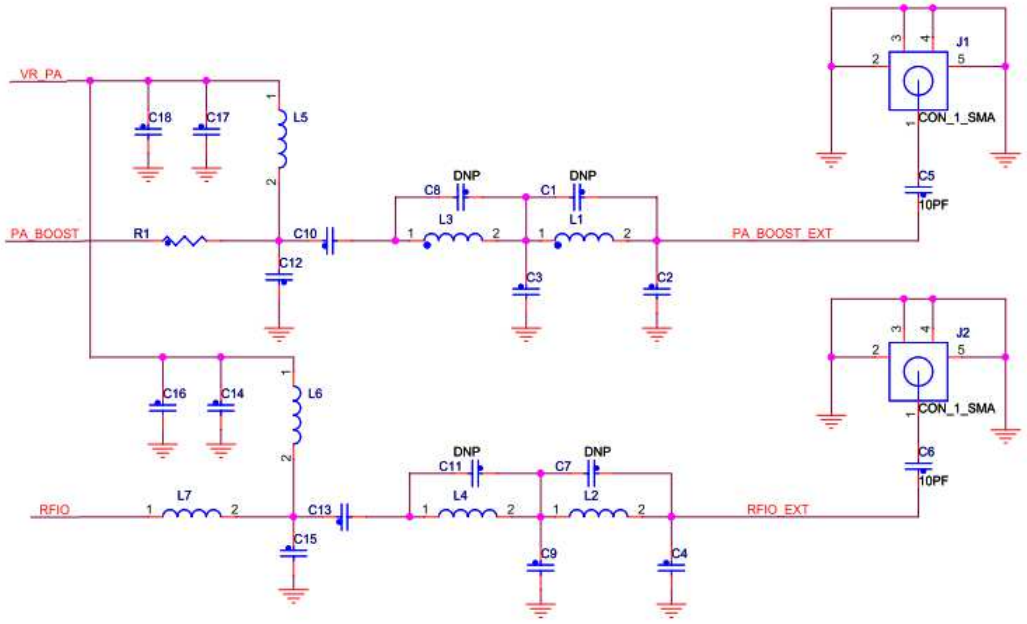

Figure 3-4. 12311-MRB RF Circuitry

3.2.2 Clocks

The MC12311 provides for two clocks:

- 32 MHz Reference Oscillator - Figure 3-5 shows the external 32 MHz external crystal Y1. This mounted crystal must meet the MC12311 specifications.
  - — Capacitors C22 and C25 provide the bulk of the crystal load capacitance.
  - — Signal DIO5/CLKOUT can be used to supply an external clock to MCU die and to measure a the 32MHz oscillator frequency.
  - — The 12311-MRB has provision for injecting an external 32 MHz clock source as an alternative to use of the onboard crystal:
    - – The crystal Y1 should be removed
    - – C23 must be mounted
    - – The external 32 MHz source is connected to 2-pin header J4.
- Optional 32.768 kHz Crystal Oscillator - Provision is also made for a secondary 32.768 kHz crystal Y2 (see Figure 3-6). This oscillator can be used for a low power accurate time base.

— The module comes provided with this Y2 crystal and its load capacitors C34 and C35.
— Load capacitors C34 and C35 provide the entire crystal load capacitance
— The 32 kHz oscillator components are supplied, but un-enabled. Zero-ohm resistors R10 and R11 enable use of IO signals PTB7 and PTB6 via the IO connector
— Use J8 to enable crystal signaling to MCU die from the DIO5 or from the 32kHz crystal.

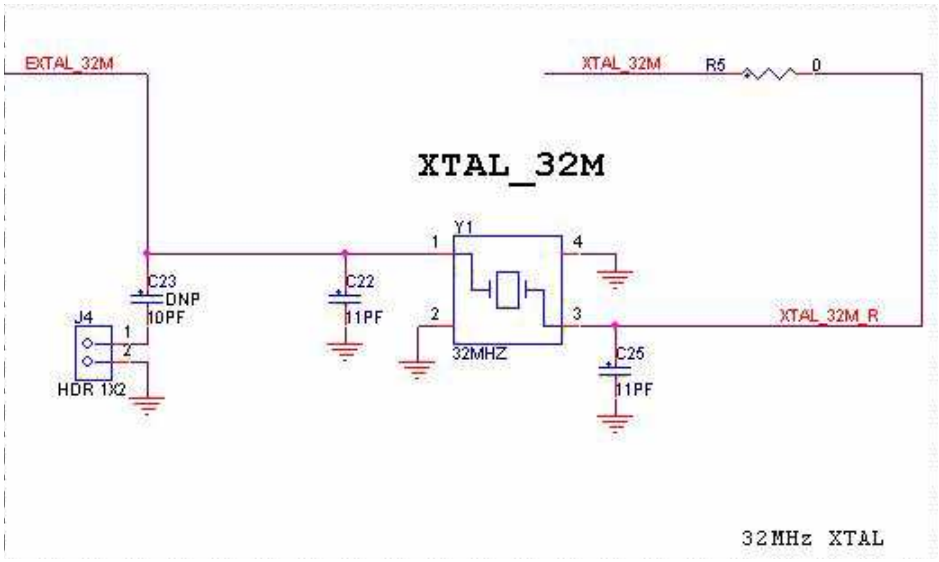

Figure 3-5. 12311-MRB 32 MHz Reference Oscillator Circuit

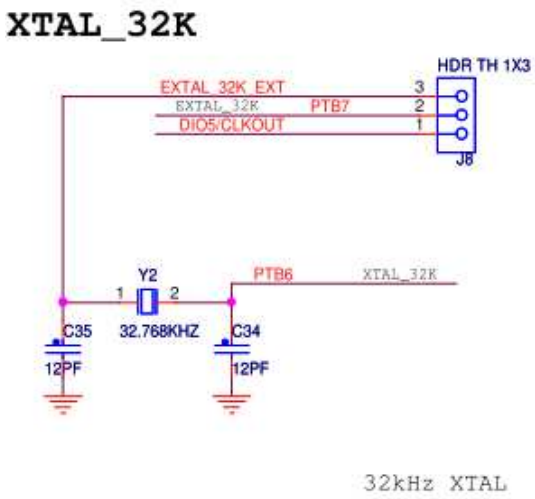

Figure 3-6. 12311-MRB 32.768 kHz Optional Oscillator Circuit

3.3 Reset and BDM Debug Port

The reset circuit and BDM port connector are shown in Figure 3-7. See Figure 3-1 for switch and header locations.

- Reset switch SW1 is active low and provides a hardware reset to the MC12311 MCU die and can also provide a RESET to the radio die by adding a jumper to J7. The Reset circuit also includes an LED for monitoring purposes.
- The 6-pin BDM 2x3 header J5 is provided to connect the MC1213x serial debug port to a standard HC9S08 debug module.

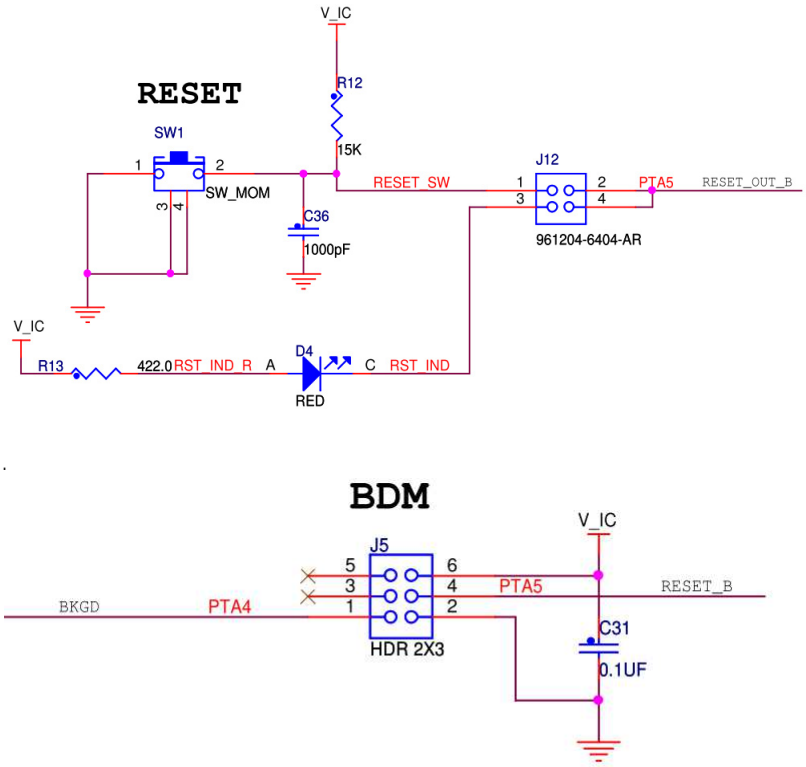

Figure 3-7. 12311-MRB Reset Switch and BDM Port

3.3.1 Power Management

The 12311-MRB power management circuit is shown in Figure 3-8.

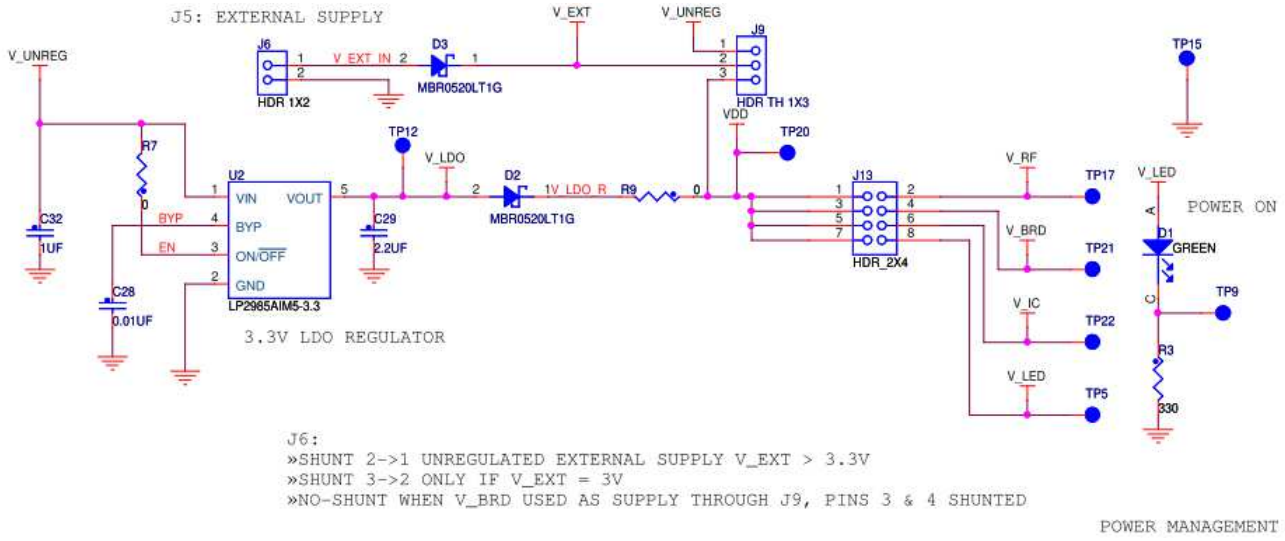

Figure 3-8. 12311-MRB Power Management Circuit

Power to the 12311-MRB can be configured in several ways and the circuit has the following features:

- Board can be supplied through the IO headers (V_BRD)
- Board can be supplied from an external DC supply (J6)
  - The external supply can be unregulated (V_UNREG) and make use of the onboard 3.3 V LDO regulator
  - The external supply voltage can be used directly without use of the LDO
- 8-Pin 2x4 header J13 provides means to supply current to various board components and also measure current if desired
- Green LED D1 is available as a power indicator.

Table 3-2 shows the header configuration information for the various power supply modes.

NOTE

- The Freescale TWR-RF development boards generate the system power supply on the motherboard and supply the voltage to the 12311-MRB through the V_BRD pin of Headers J2 and J3. In this mode, the current flows to the 12311-MRB through the pins.
- If an external supply is used via 12311-MRB header J5, current flows to the motherboard through the V_BRD pin of Headers J2 and J3. THE MOTHERBOARD SUPPLY SHOULD NOT BE USED.
- In all modes, the IO voltage supply of peripherals on a motherboard must be the same voltage as V_BRD, which is also the voltage applied to the IC MC1213x.

Table 3-2. 12311-MRB Power Configurations

Mode	Voltage Range	External Source J6	Ext Mode Select J9	Current Enable J13	Description
Source V_BRD	2.7 - 3.6 V[1]	Not used	Not used - all pins open	**Short Pins 3-4** - short other desired supplies	**Normal Operation** - The 12311-MRB main supply is supplied by the motherboard through the J15 and J14 Headers
External Source - Using LDO	3.5 - 16 V	Connected - supplies DC Voltage	Short Pins 1-2	Short pins for all desired supplies	**External voltage w/regulation** - • Input range is set by the LDO regulator. • 3.3 V is supplied to 12311-MRB; do not use motherboard supply • J14 and J15 Headers supply voltage to V_BRD pins when J13, Pins 3-4 are shorted
External Source - Not Using LDO	2.7 - 3.6 V	Connected - supplies DC Voltage	Short Pins 2-3	Short pins for all desired supplies	**External voltage w/o regulation** - • Input range is set by the onboard circuitry • 2.7 - 3.3 V is supplied to 12311-MRB • J14 and J15 Headers supply voltage to V_BRD pins

[1] The MC12311 can run as low as 1.8 V

Header J13 provides means to disable different sub-circuits or measure current and connections are described in Table 3-3. Current measurements can be made by inserting a current meter in place of a designated jumper.

Table 3-3. Power Distribution Header J13

Supply Designation	Header Pins	Description
V_RF	1 - 2	Supply voltage to MC12311 -Radio die • Normally jumpered • Supplies only the MC12311 Radio die Normally always same voltage as V_BRD
V_BRD	3 - 4	Supply voltage connected to IO Connectors J2 and J3 - • This supplies J2 and J3 if an external MRB supply is used • This voltage supplies the MRB if the motherboard is the main power • This connection is normally always jumpered
V_IC	5 - 6	Supply voltage to MC12311 -MCU die • Normally jumpered • Supplies only the MC12311 MCU die • Normally always same voltage as V_BRD
V_LED	7 - 8	Supply voltage to power indicator LED • Jumper to use indicator or IR blaster • Leave open for lowest power

3.3.2 IO Connectors J2 and J3

The two IO connectors J14 and J15 are standard 100 mil pin headers mounted on the back (non-component side) of the 12311-MRB.The primary header J15 is 20-pin and the secondary header J14 is 18-pin, and they are mounted physically in such a manner as to prevent reverse insertion of the 12311-MRB into a motherboard receptacle (see Figure 3-2). When the TWR-RF, 1323x-RCM or 1323x-REM or custom motherboard is plugged into these connectors, they allow access to MC12311 MCU GPIO.

- V_BRD is the connector supply voltage.
  - — Depending on power supply configuration, this voltage may supply the 12311-MRB from the motherboard or the 12311-MRB may supply this voltage to the motherboard. See Section 3.3.1, “Power Management”.
  - — Peripherals IO to the MC12311 and the MC12311 supply should use this same voltage

NOTE

The TWR-RF, 1323x-RCM and 1323x-REM and 12311-MRB are supplied configured for the motherboard to supply main power.

- Some of the GPIO are shared with onboard devices. Check for the 12311-MRB schematic and Table 3-4 and Table 3-5 for any conflict.
- BDM port signal PTA4/BKGD is NOT connected to the IO headers to prevent possible interference with the debug port.

Table 3-4. 20 Pin Connector

Header Pin Number	MC12311 Pin Name	Description
1	V_BRD	VDD supply to module
2	NC	
3	GND	Module ground
4	NC	
5	PTB1/TXD	UART TXD input to MCU
6	NC	
7	PTB0/RXD	UART RXD Output from MCU
8	NC	
9	PTA7	GPIO / Timer IO
10	RESET	MCU Reset
11	PTA2/SDA	I2C Bus data signal (SDA)
12	PTD4/KBI2P4	UART flow control RTS input into MCU (implemented in Freescale software)
13	PTA3/SCL	I2C Bus clock signal (SCL)
14	PTD3/KBI2P	UART flow control CTS output from MCU (implemented in Freescale software)
15	GND	Module ground
16	DIO5/CLKOUT	Reference Crystal Oscillator

Table 3-4. 20 Pin Connector (continued)

Header Pin Number	MC12311 Pin Name	Description
17	PTA0/KBI1P0	Port A Bit 0 / KBI1 Input Bit 0
18	PTA1/KBI1P1	Port A Bit 1 / KBI1 Input Bit 1
19	PTB2/KBI1P2	Port B Bit 2 / KBI1 Input Bit 2
20	PTB3/KBI1P3	Port B Bit 3 / KBI1 Input Bit 3

Table 3-5. 18 Pin Connector

Header Pin Number	MC12311 Pin Name	Description
1	V_BRD	VDD supply to module
2	PTB7/EXTAL	Port B Bit 7 - signal shared with 32.768 kHz oscillator
3	PTB6/XTAL_32K	Port B Bit 6 - signal shared with 32.768 kHz oscillator
4	GND	Module Ground
5	PTB5/TPM1CH1	Port B Bit 5
6	PTB4/TPM2CH1	Port B Bit 4
7	PTC3/TPM3CH3	Port C Bit 3
8	PTC2/TPM3CH2	Port C Bit 2
9	PTC1/TPM3CH1	Port C Bit 1
10	PTD2	Port D Bit 2
11	PTA6/TPM1CH2	Port A Bit 6
12	PTC7	Port C Bit 7
13	PTC6	Port C Bit 6
14	PTC5/TPM3CH5	Port C Bit 5
15	PTC4/TPM3CH4	Port C Bit 4
16	DIO2	Transceiver GPIO Bit 2
17	DIO3	Transceiver GPIO Bit 3
18	GND	Module ground

3.4 Schematic, Board Layout, and Bill of Material

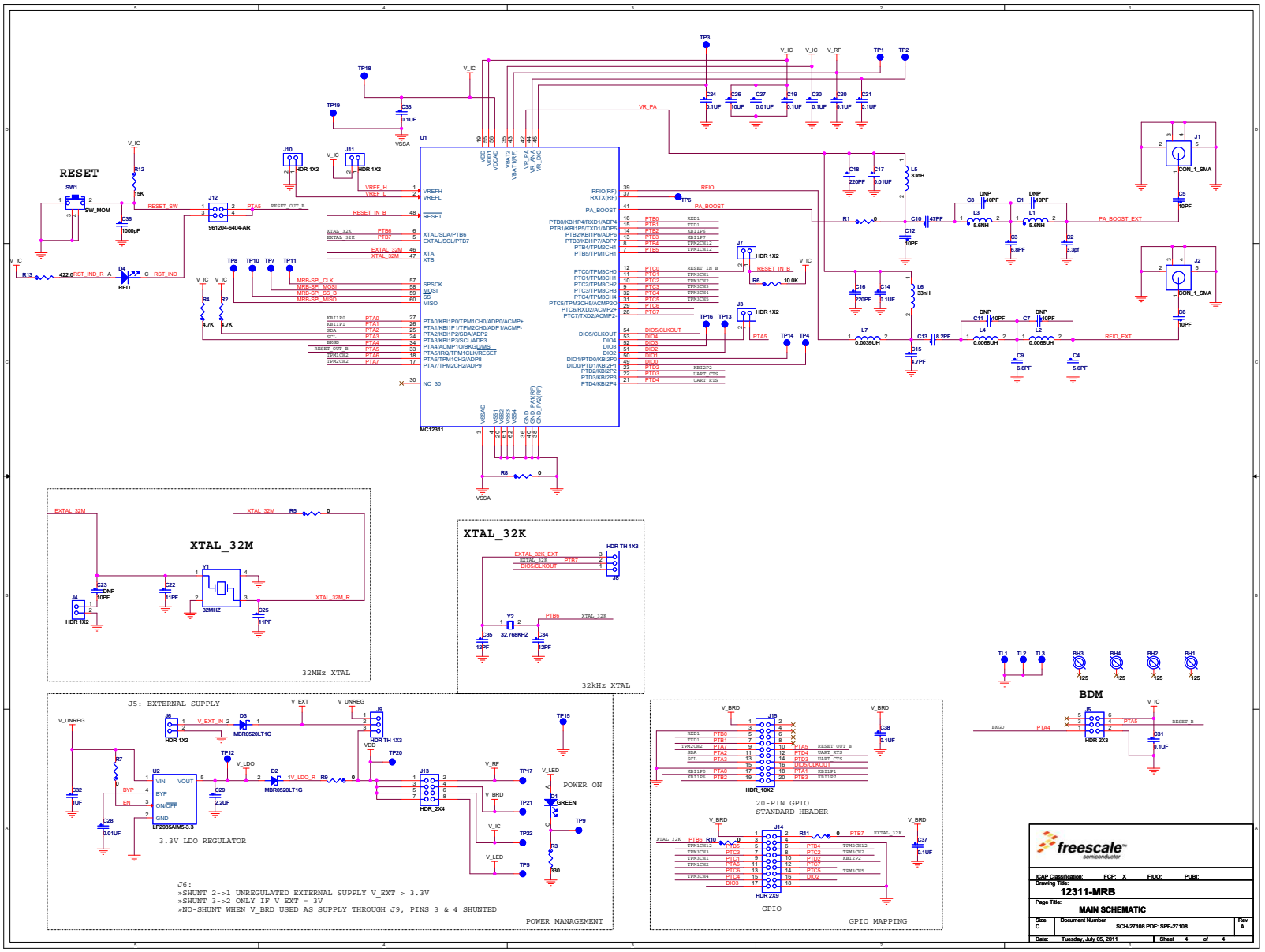

Figure 3-9. 12311-MRB Schematic