WF121 DEVELOPMENT KIT V.1.3.1

DATA SHEET

Monday, 05 March 2018

Document Version: 1.1

VERSION HISTORY

Date Edited	Comment
1.0	First version
1.1	Changed the 32.768kHz external oscillator reference design and changed contact information

TABLE OF CONTENTS

1 Product description

DESCRIPTION

DKWF121 is intended for evaluating the WF121 Wi-Fi module and as a basis for product development. The board contains connectors for easy development with a PC using the main host connections, USB and UART through a USB converter. Also present are headers for all the GPIO pads connected around a prototyping area for easy connection of pin headers with custom pinouts, sensors etc.

Bluegiga WF121 is a stand-alone Wi-Fi module providing fully integrated 2.4GHz 802.11 b/g/n radio, TCP/IP stack and a 32-bit micro controller (MCU) platform for embedded applications requiring simple, low-cost and low-power wireless IP connectivity. WF121 also provides flexible peripheral interfaces such as SPI, I2C, ADC, GPIO, *Bluetooth* co-existence and timers to connect various peripheral interfaces directly to the WF121 Wi-Fi module.

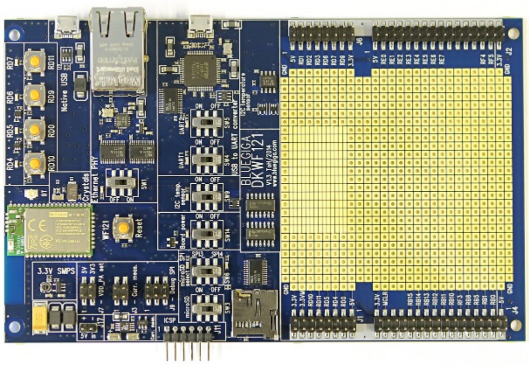
WF121 Wi-Fi module also allows end user applications to be embedded onto the on-board 32-bit MCU using a simple Bluegiga BGScript™ scripting language and free-of-charge development tools. This cuts out the need of and additional MCU and enables end users to develop smaller and lower cost Wi-Fi devices. WF121 can also be used in modem-like mode in applications where the external MCU is needed. The 802.11 access point and HTTP server functionality is also included for the easy configurations and direct connections with phones, tablets and PC's.

With an integrated 802.11 radio, antenna, single power supply, and CE, FCC and IC regulatory certifications, WF121 provides a low-risk and fast time-to-market for applications requiring Wi-Fi connectivity.

KEY FEATURES:

- USB or UART host connection
- USB converter for the UART
- Can be powered through USB
- Ethernet connection
- microSD card slot
- I2C temperature sensor
- Current measurement voltage output
- Prototyping area

PHYSICAL OUTLOOK:



2 Ordering Information

Product code	Description
WF121-A-v2	WF121 Wi-Fi Module with internal chip antenna
WF121-E-v2	WF121 Wi-Fi Module with U.FL connector
DKWF121	WF121 development kit

3 Board Description

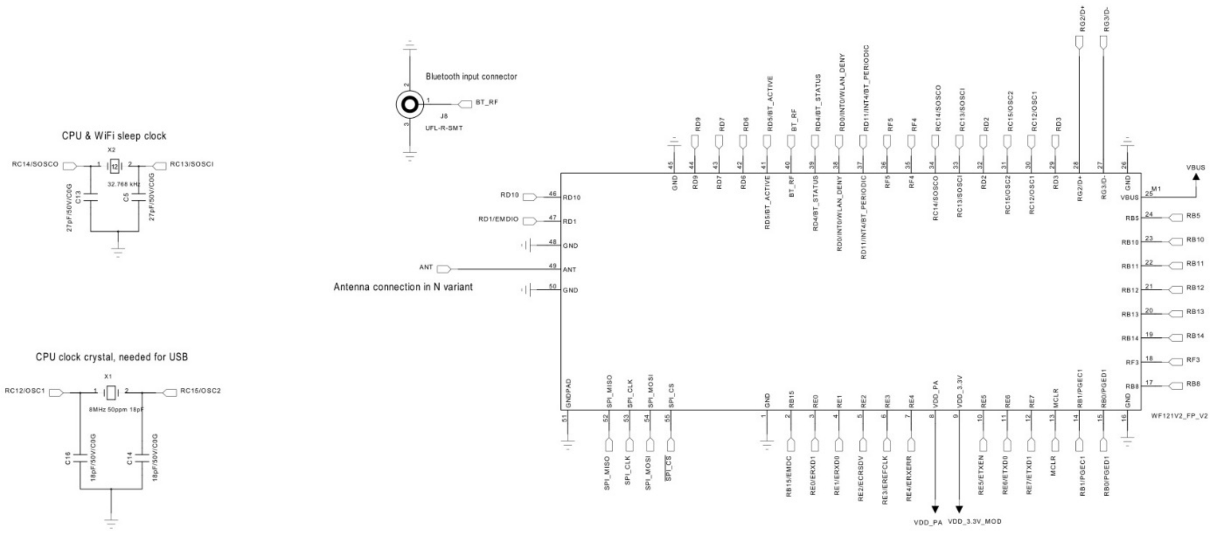
3.1 Wi-Fi Module

DKWF121 contains a WF121-A module variant, with an internal chip antenna.

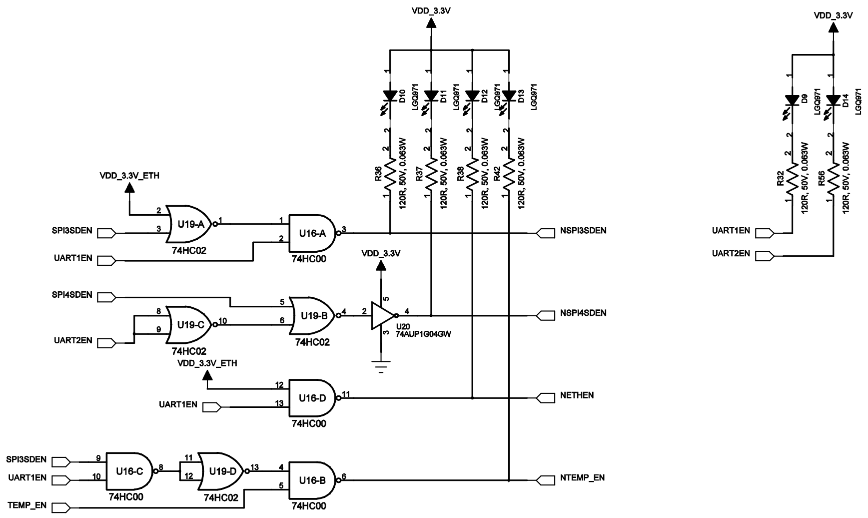
3.2 Crystals

There are two crystals assembled on DKWF121, an 8MHz crystal for the WF121 CPU clocking and a 32.768kHz crystal for the CPU real time clock. The 8MHz crystal is needed when the WF121 USB connection is used, otherwise it is not essential. The 32kHz crystal is also optional in the end application.

The crystal load capacitor values may need to be adjusted according to the used crystal characteristics and verified to work throughout the thermal range.



3.3 Conflict Protection Circuitry



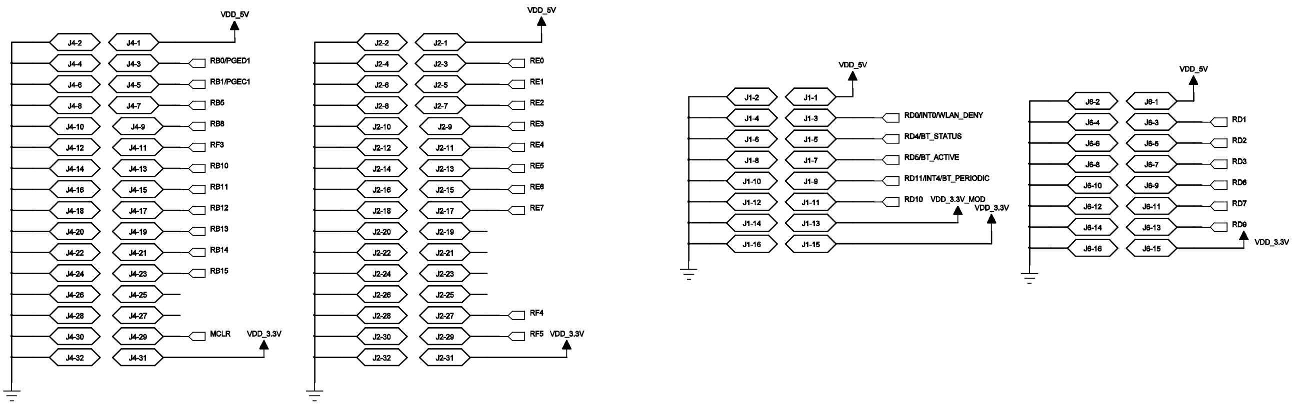
DKWF121 has a number of peripheral devices that can be configured on the same module pads. To prevent conflicts when two simultaneously enabled devices would be driving the same signals, the board contains a protection circuit that will only enable one device at a time. The enable switches for the various on-board devices have LEDs next to them to show which device is currently enabled. The enable logic has fixed enable priorities presented in the table below.

Higher priority	Lower priority
UART1	Ethernet
Ethernet	microSD SPI3
microSD SPI3	I2C thermometer *
Ethernet	GPIO's RE0-7, RD1, RB15 **
UART2	microSD SPI4

* Ethernet and I2C thermometer can be enabled simultaneously

** The module pads associated with the Ethernet can be used as GPIO's, but will not be connected to the GPIO headers when the Ethernet PHY is enabled to reduce data bus reflections

3.4 Configurable I/O Ports



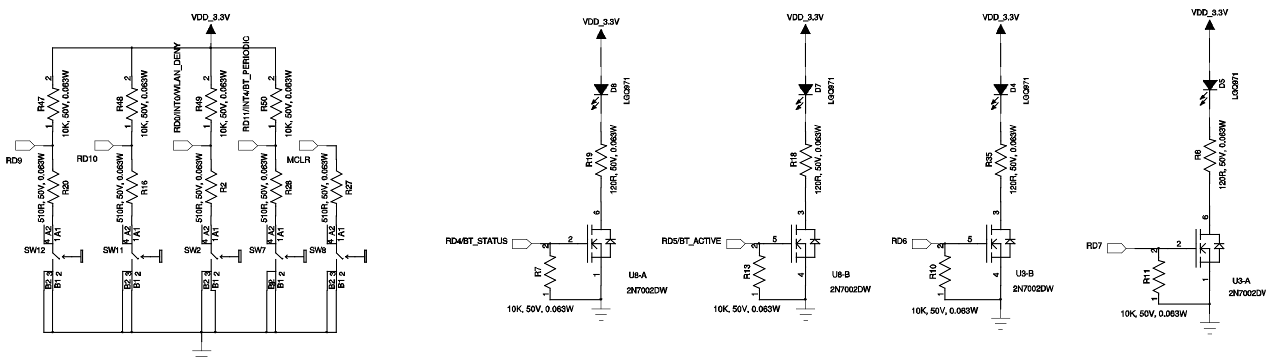
All the GPIO pads available on the WF121 are routed to pin headers for easy connection to other boards or a logic analyzer. All the signals are also available on through-hole pads on the edges of the board prototyping area for easy development prototyping.

The GPIO signals associated with the crystals are routed but not connected due to the presence of the crystals, but if required the crystals can be removed and the associated 0ohm resistors moved to connect the signals to the headers.

The signals shared for other functions like the ICSP programming interface, JTAG, UART's and Ethernet should not be driven by externally connected outputs when the mentioned functions are used to avoid damage. The UART and Ethernet signals are disconnected when the associated on-board chips are disabled with the on-board switches.

3.5 Bluetooth Coexistence

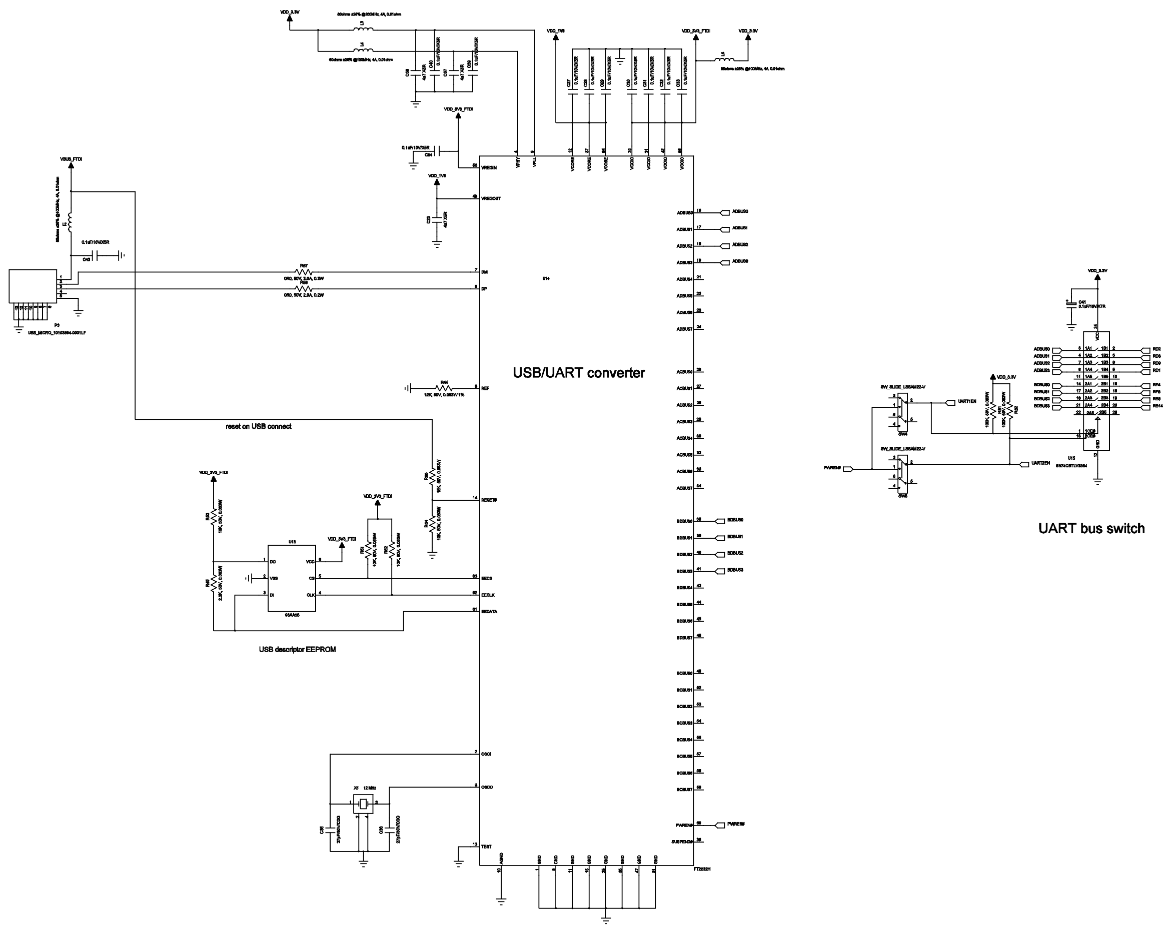
Industry standard 3-wire, Unity-3 and Unity-3e coexistence schemes are supported and the associated signals are available. The PIO pads can be configured for these functions among others. A U.FL connector is also present for antenna sharing using the module internal RF switch. As only 4 GPIO signals can be used for coexistence, antenna sharing in practice requires the use of the CSR proprietary Unity-3e scheme.



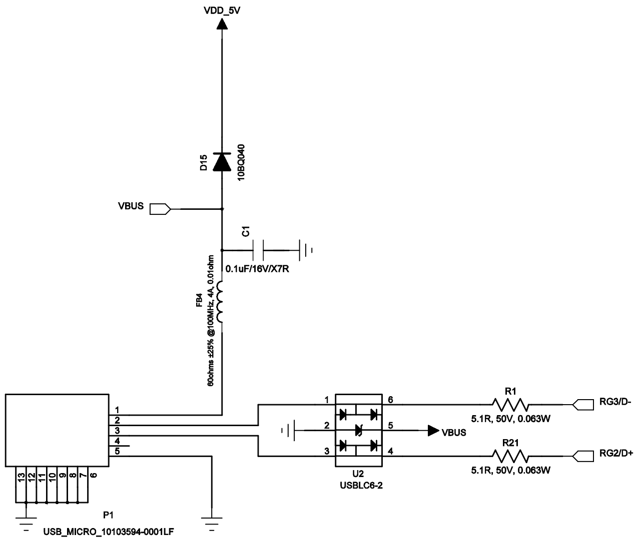
3.6 LEDs and Buttons

There are five LEDs and five pushbuttons on the DKWF121. One button is for module reset and one LED indicates that the module has a power supply present, while the other four LEDs and buttons are available for development purposes. The LEDs are buffered with MOSFETs and the buttons are open when unpressed, allowing the connected GPIO lines to be used for other purposes without disconnecting the LEDs or buttons.

3.7 USB Connections



DKWF121 contains a microUSB connector for use with USB host connection, and a separate microUSB connector with associated high speed USB-to-UART converter for UART host connection development with a PC. The converter chip is a common dual-port FTDI type that will automatically register as a virtual serial port in most operating systems with either inbuilt or automatically installed drivers.

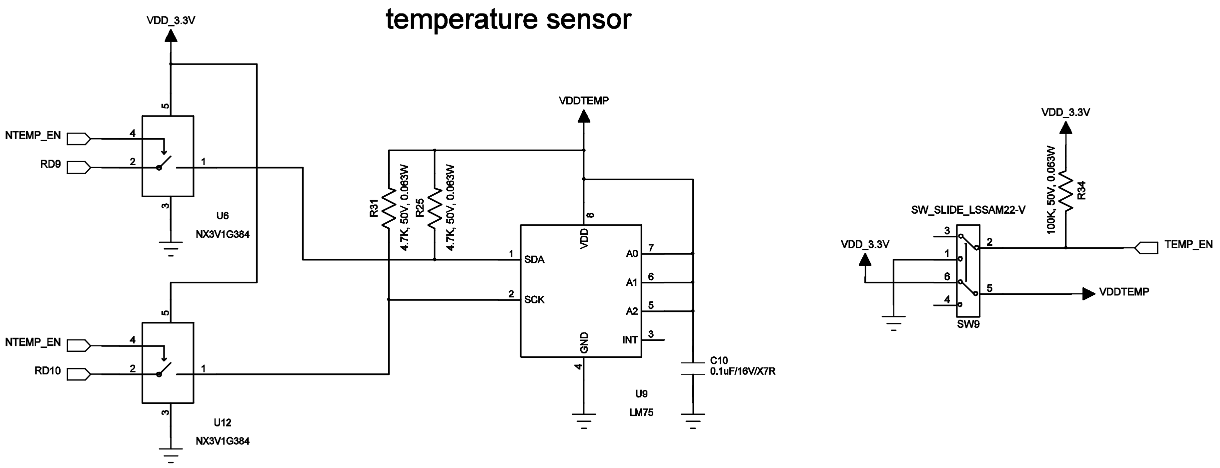


The module USB device connection only requires the data lines and the USB supplies to be connected. The VBUS line has a ferrite bead to reduce EMI coupling between the USB cable and the board supply line, and all the USB lines are connected to an ESD protection circuit. The diode on the VBUS line and on the other power inputs are present to prevent one power source from feeding power to another port in a case where two different sources are connected at the same time.

3.8 SPI

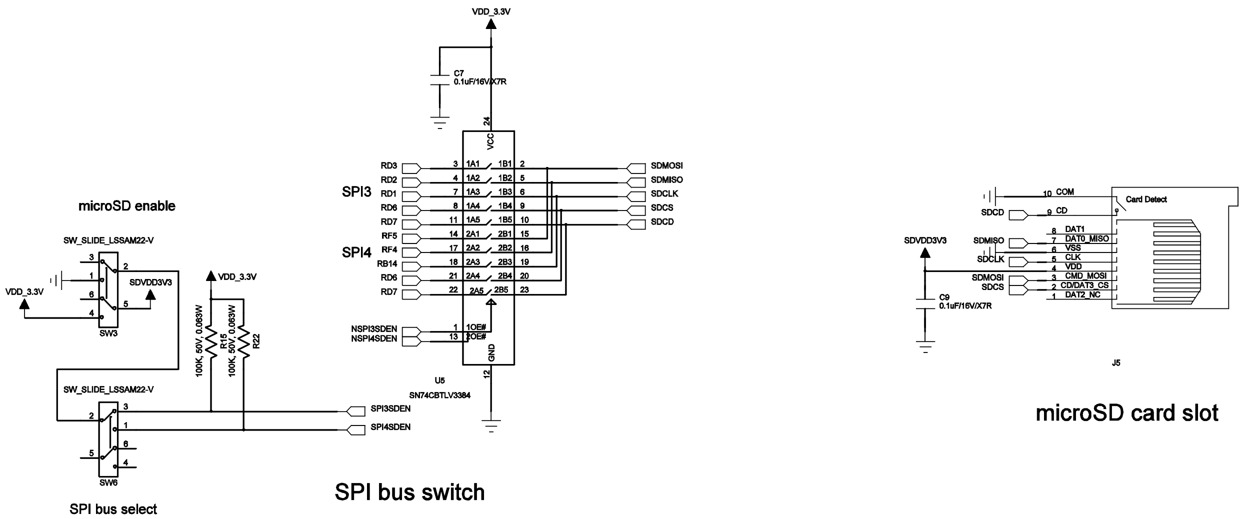
No separate connectors for SPI host connections are provided as there is no standard connector or pinout, but the signals are available on the pin headers and pads on the prototyping area edge for easy soldering of a connector with a custom pinout.

3.9 Temperature Sensor



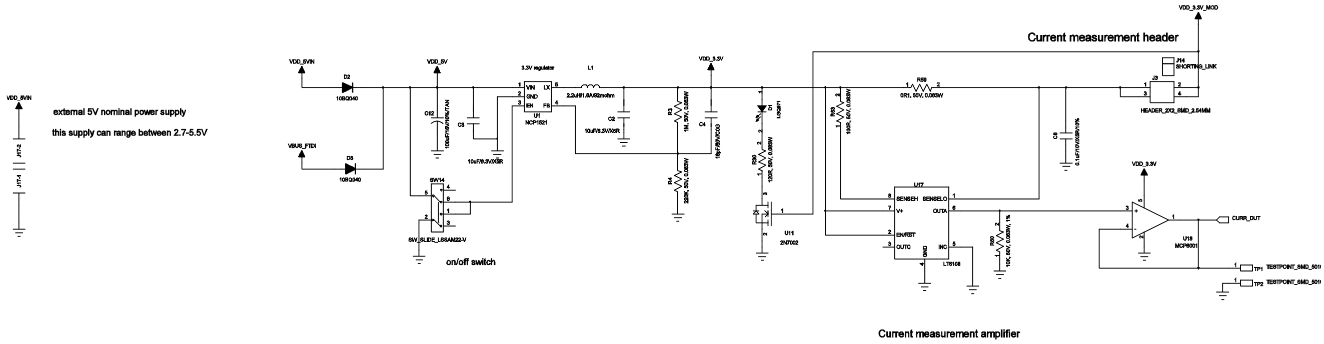
DKWF121 contains an industry standard temperature sensor type LM75B connected to an I2C bus. An example script is provided in the software package showing how to access sensors over I2C.

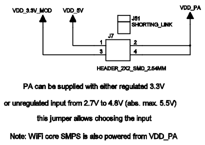
3.10 MicroSD card slot



DKWF121 contains a microSD card slot that can be connected to either SPI bus available on the WF121 module. The card can be used to store files for the HTTP server application or generic application data.

3.11 Board Power





DKWF121 can be powered by several sources.

- Both USB connectors can be used as the power supply input
- A two-pin header J17
- The signal pin headers and prototyping area connections have power connections

Note: if the on-board WF121 module does not contain firmware that operates the native USB connection, the module cannot request an increase to the USB default current limit of 100mA. Although not all USB host systems implement it, the USB specification states that the host should limit the current output to 100mA unless an increase is requested, and powering on the Wi-Fi radio will typically cause the supply voltage to sag, causing the module to crash. It is preferable to power the board through the USB/UART-converter connector, the converter chip will automatically request for an increased current limit.

The board contains a switch mode converter that converts the 5V input to the 3.3V supply required by the module. The converter is specified for output currents up to 600mA, allowing up to 200mA to be drawn for powering customer applications.

The module operates down to 2.7V, and the switch mode converter has a very low drop-out, allowing the board to be powered with the desired voltage level from the pin header. The header and the USB connectors also have series schottky diodes, increasing the minimum input voltage slightly. The 5V power connections in the prototyping area and the associated pin headers do not have series diodes. The diodes allow connection of a USB host together with a separate power supply without risk of damage.

3.12 Current Measurement

Next to the power header J17, there are two current measure test point loops for attaching an oscilloscope probe. Between these points is a voltage that corresponds to the current drawn by the module with a scaling of 10mV/mA. This voltage can be used to make measurements on the momentary current consumption profiles of the module.

Close to the test points there is a header J13 containing a jumper that connects the switch mode regulator to the module 3.3V supply pads. The jumper can be removed and the sleep mode current or the average current consumption of the module can be measured with a multimeter across the header. Note that for average consumption measurement of anything else besides sleep current a fast RMS multimeter is needed due to the pulsed nature of the consumption. Attaching a multimeter at a low current range or with long cables will introduce quite a bit of resistance on the power line and may cause module malfunction when the radio part is operating and drawing high current pulses.

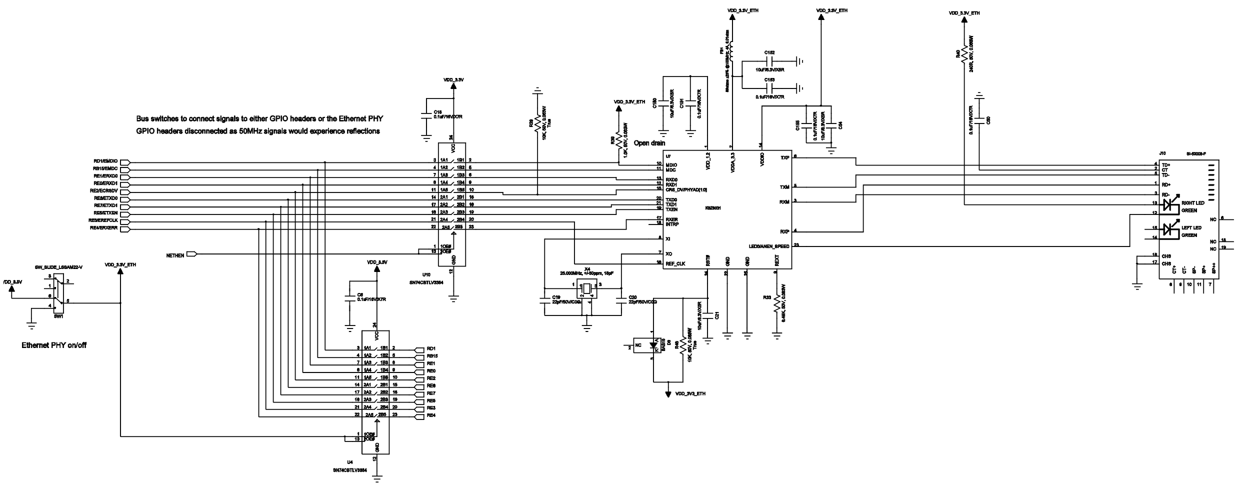
Removing the jumper also allows separation of the module supply lines from the regulator output, for example when using an external regulator to supply the 3.3V voltage to the module is desired.

3.13 VDD_PA Selection Header J7

WF121 has two power supply inputs, VDD_3.3V (VDD_3.3V_MOD line on the schematic) and VDD_PA. The VDD_3.3V pad supplies the internal processor and has a voltage range of 2.3V to 3.6V. The VDD_PA pad supplies the internal WiFi-circuitry through a switch mode converter and the WiFi power amplifier directly. The VDD_PA line can operate with input voltages between 2.7V and 5.5V, though the power consumption of the power amplifier will grow in direct proportion to the input voltage. The separate supply however allows direct connection to a lithium-ion battery, with just a small linear regulator limiting the supply voltage for the processor side.

A jumper at header J7 usually connects VDD_PA to the board 3.3V switch mode converter output. The jumper can be moved to the alternate position to supply the VDD_PA line directly from the 5V supply rail, for example for connecting directly to a lithium battery either through the power input header or through the prototyping area connections.

3.14 Ethernet

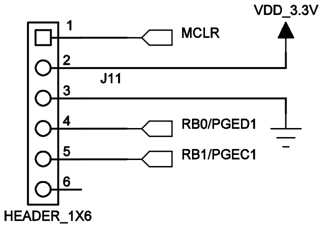


The board contains a 10/100Mbps Ethernet PHY with all the associated components, connected to the module internal Ethernet MAC with an RMII interface. The PHY chip on the DKWF121 is KSZ8081RNA.

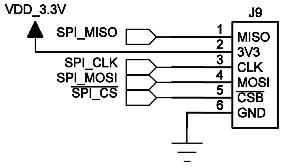
The PHY can be fully powered off and disconnected from the GPIO lines using switch SW1, allowing the GPIO lines to be used for other functions.

The Ethernet connection is fully supported by the module firmware and can be used as a data endpoint, allowing for example streaming data from Wi-Fi to the Ethernet.

3.15 Programming Connections



PicKit3 programming connector for module processor



WiFi debug SPI

DKWF121 contains a connector for direct programming of the WF121 internal processor. The Microchip proprietary ICSP bus allows programming the full firmware image using a Microchip or third party programming adapter. The pin header installed on the DKWF121 has a pinout suitable for use with the low-cost PicKit3 programming tool from Microchip.

The primary means of uploading application data is through a host connection through the Bluegiga boot loader. The programming connections should not be needed unless the internal boot loader is overwritten by the application or disabled due to the application requirements.

3.16 Debug SPI Interface

A header is provided for the module debug bus for certification RF testing. Access to internal settings and test modes is available using a CSR compatible SPI adapter and UniTest-software.

For more information contact Bluegiga technical support.

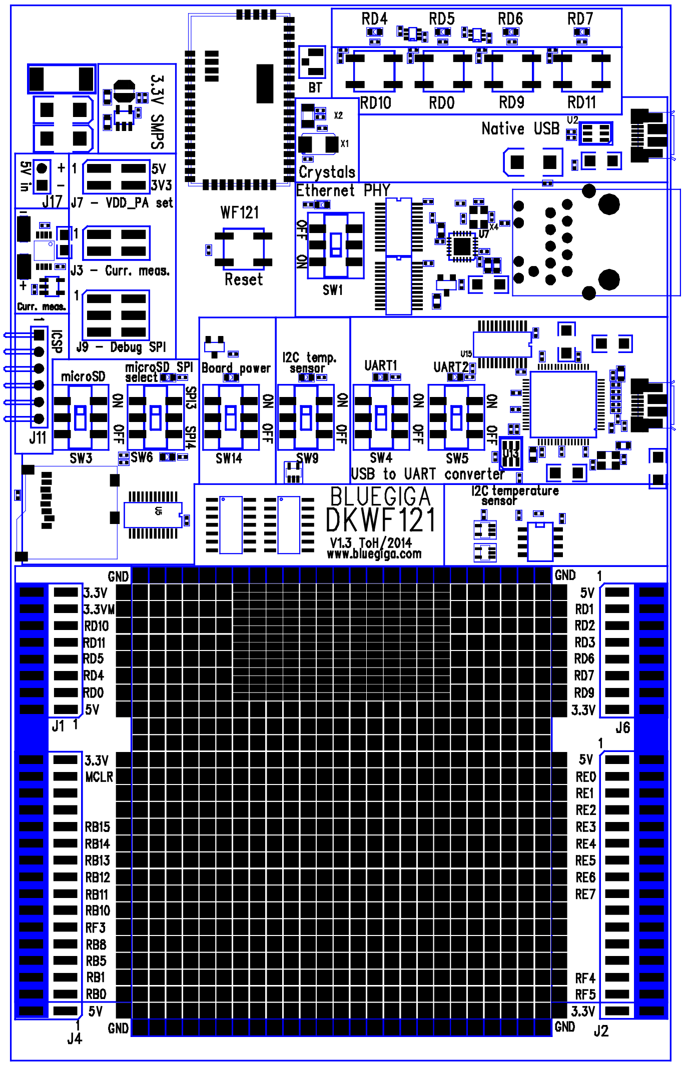
3.17 Prototyping Area

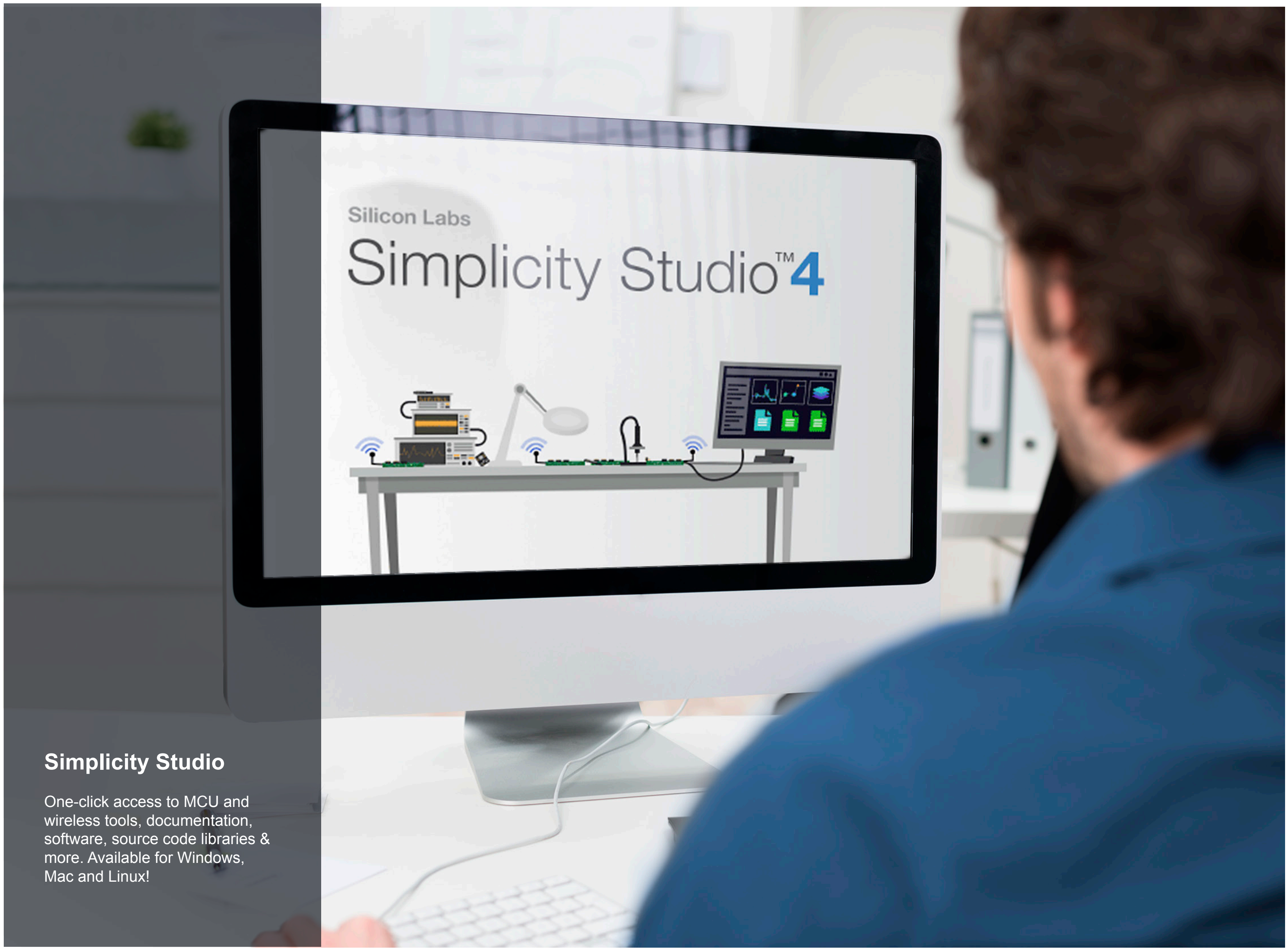
DKWF121 contains an array of through plated holes with wide pads with a 2.54mm pitch for easy addition of carrier boards, through-hole components and pin headers with a custom pinout. Also present is a smaller array of pads with no holes using 1.27mm pitch for connecting SMD components like sensors, regulators etc during system development.

All GPIO signals are routed to the prototyping area edges, though some of them are not by default connected due to function multiplexing. See other chapters for detailed descriptions of these signals.

Also present on the pin headers and pads around the prototyping area are several supply voltage rails present on the board. These can be used for powering external circuitry, or for powering the module with external power sources. The uppermost and lowest rows of pads are connected to ground.

4 Board layout





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Silicon Laboratories Inc.
400 West Cesar Chavez
Austin, TX 78701
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