

**DKWF121 – WF121-A 802.11 B/G/N  
MODULE EVALUATION BOARD**

PRELIMINARY DATA SHEET

Wednesday, 16 May 2012

Version 0.5



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## VERSION HISTORY

Version	Comment
0.1	First draft
0.2	Restructured, added schematics and board drawing
0.3	Schematics redraw according to board corrections
0.4	Added note about USB current limit, made a small schematic correction
0.5	Updated product information, added image, ordering codes

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# 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.

The WF121 is a self-contained Wi-Fi module providing a fully integrated 2.4GHz 802.11 b/g/n radio and a 32-bit microcontroller (MCU) platform, making it an ideal product for embedded applications requiring simple, low-cost and low-power wireless TCP/IP connectivity. WF121 also provides flexible interfaces for connecting to various peripherals.

WF121 allows end user applications to be embedded onto the on-board 32-bit microcontroller using a simple Bluegiga BGScript™ scripting language. This cuts out the need of an external MCU and allows the development of smaller and lower-cost products. However WF121 can also be used in modem-like mode in applications where the external MCU is needed.

With an integrated 802.11 radio, antenna, single power supply, and regulatory certifications, WF121 provides a low-risk and fast time-to-market for applications requiring Wi-Fi connectivity. This combined with Bluegiga's excellent customer service will turn your Internet-of-Things applications into reality.

## KEY FEATURES:

- USB or UART host connection
- USB converter for the UART
- Can be powered through USB
- Current measurement voltage output
- Prototyping area

## PHYSICAL OUTLOOK:



## 2 Ordering Information

Product code	Description
WF121-A-G	WF121-A, global RF settings
WF121-E-G	WF121-E, global RF settings
WF121-N-G	WF121-N, global RF settings (MoQ: 5000)
DKWF121	WF121 development kit

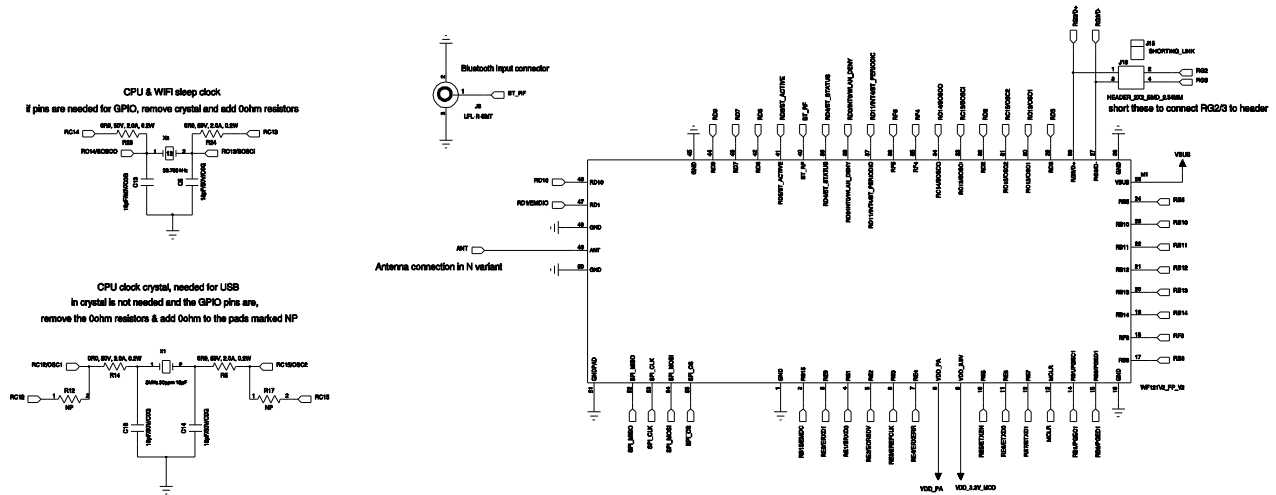
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# 3 Board Description

## 3.1 WiFi Module

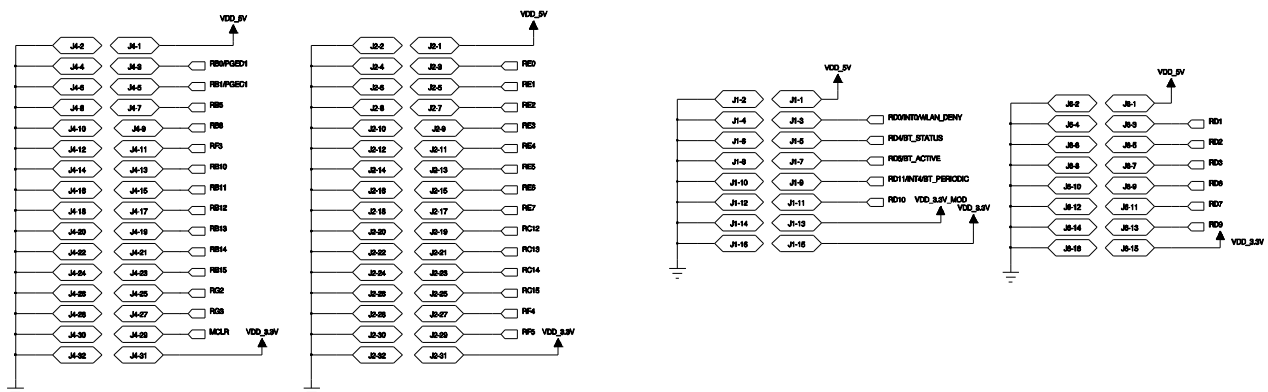
DKWF121 contains a WF121-A module variant, with an internal chip antenna.



## 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, and if extra GPIO are needed, the 0ohm resistors connecting the crystals to the module can be removed and moved to connect the pin headers and prototyping area pads to the module pads. The pads are not connected to the pin headers by default as crystal connections are always sensitive to noise.

## 3.3 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.

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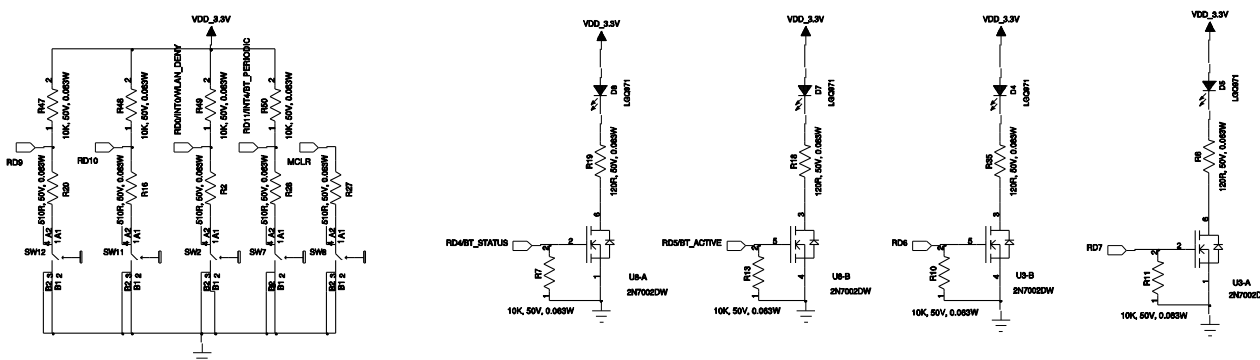
The GPIO signals associated with the crystals are routed but not connected due to the presence of the crystals, but if required the crystals can be removed and the associated 0ohm resistors moved to connect the signals to the headers.

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.

The USB pins are by default disconnected from the pin headers, but can be connected by adding two jumpers to the specific header.

### 3.4 Bluetooth Coexistence

Industry standard 2-wire and 3-wire, as well as Unity-3, Unity-4, Unity-3e coexistence schemes are supported as well as the Unity+ -extension, 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 or 3e+ scheme.



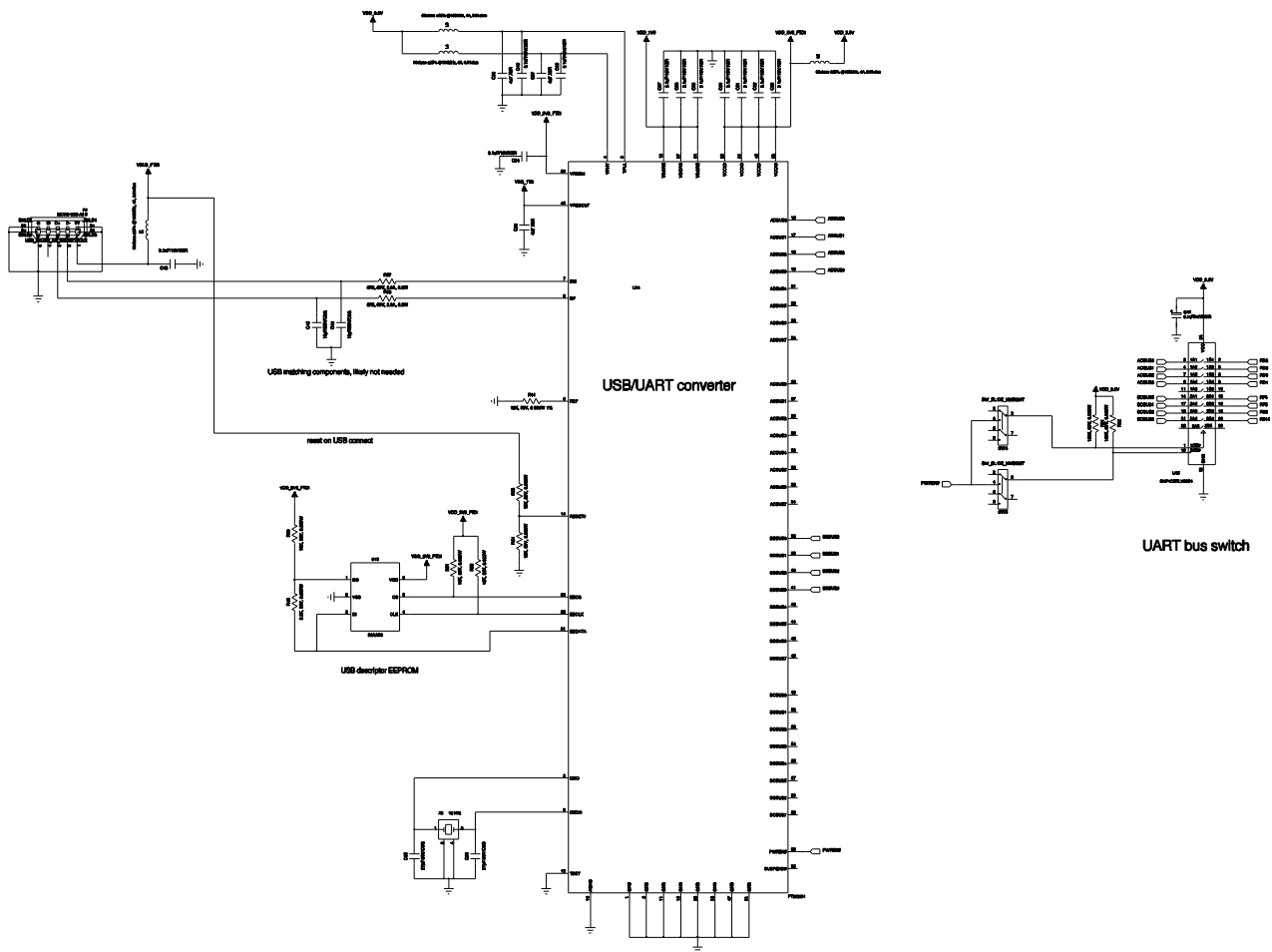
### 3.5 LEDs and Buttons

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.

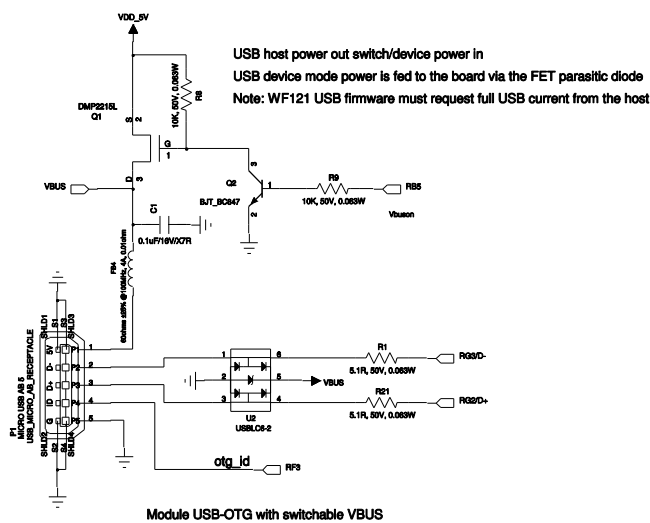
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### 3.6 USB Connections



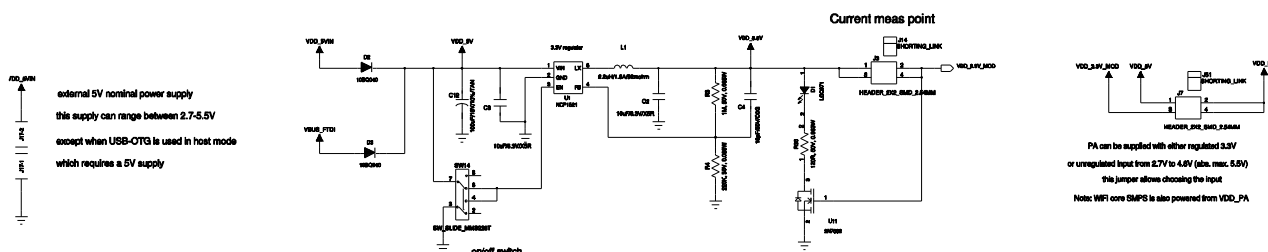
DKWF121 contains a microUSB connector for use with USB host connection, and a separate microUSB connector with associated high speed USB-to-UART converter for UART host connection development with a PC. The converter chip is a common FTDI type that will automatically register as a virtual serial port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



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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.

### 3.7 Board Power



DKWF121 can be powered by several sources.

- Both USB connectors can be used as the power supply input
- A two-pin header
- 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 using the module with high transmit duty cycles may cause the USB host to go into current limit, possibly causing the module to crash. It is preferred 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, but the current measure output and USB host functionality require a regulated 5V input. 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.

### 3.8 Current Measurement Point J13

Header J13 contains a jumper that connects the switch mode regulator to the module 3.3V supply pads. The jumper can be removed and the average current consumption of the module can be measured with a multimeter or a series resistor can be inserted for measuring the momentary current consumption of the module with an oscilloscope. 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.

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.

### 3.9 VDD\_PA Selection Header J7

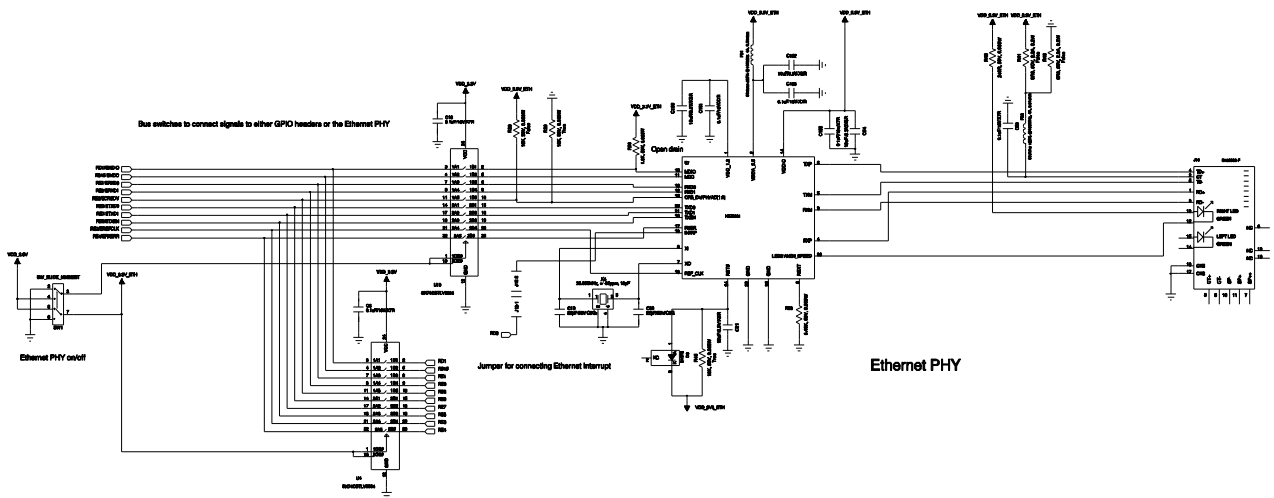
WF121 has two power supply inputs, VDD\_3.3V (VDD\_3.3V\_MOD line on the schematic) and VDD\_PA. The VDD\_3.3V pad supplies the internal processor and has a voltage range of 2.3V to 3.6V. The VDD\_PA pad supplies the internal WiFi-circuitry through a switch mode converter and the WiFi power amplifier directly. The

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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.

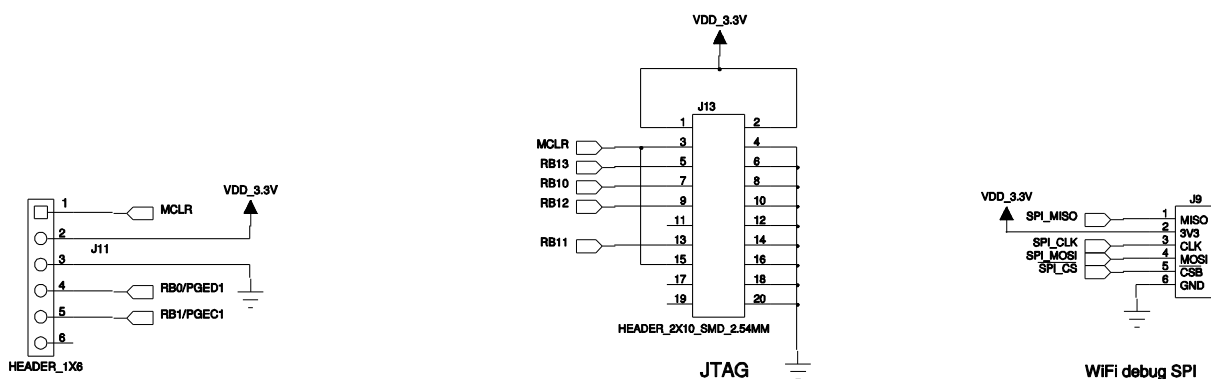
A jumper at header J7 usually connects VDD\_PA to the board 3.3V switch mode converter output. The jumper can be moved to the alternate position to supply the VDD\_PA line directly from the 5V supply rail, for example for connecting directly to a lithium battery either through the power input header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

### 3.10 Ethernet



The board contains a 10/100Mbps Ethernet PHY with all the associated components, connected to the module internal Ethernet MAC with an RMI interface. 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 interface is not yet supported by the Bluegiga software.

### 3.11 Programming Connections



PickKit3 programming connector for module processor

DKWF121 contains two connectors that allow 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-

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cost PicKit3 programming tool from Microchip. A JTAG connection is also available for basic boundary scans and device programming. The JTAG does not support full device testing and debugging.

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.

### 3.12 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.

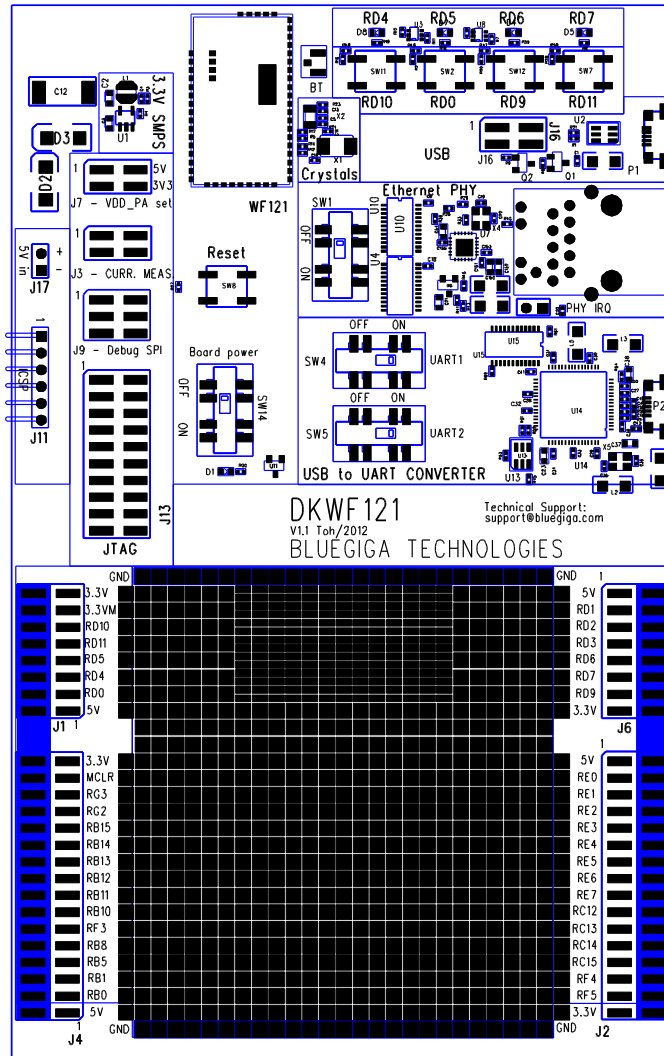
### 3.13 Prototyping Area

DKWF121 contains an array of through plated holes with wide pads with a 2.54mm raster 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 1.27m raster 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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