



# **VINCULUM**

BINDING USB TECHNOLOGIES

**Future Technology Devices International Ltd.**

**V2DIP1-32**

**VNC2-32Q Development Module**

**Datasheet**

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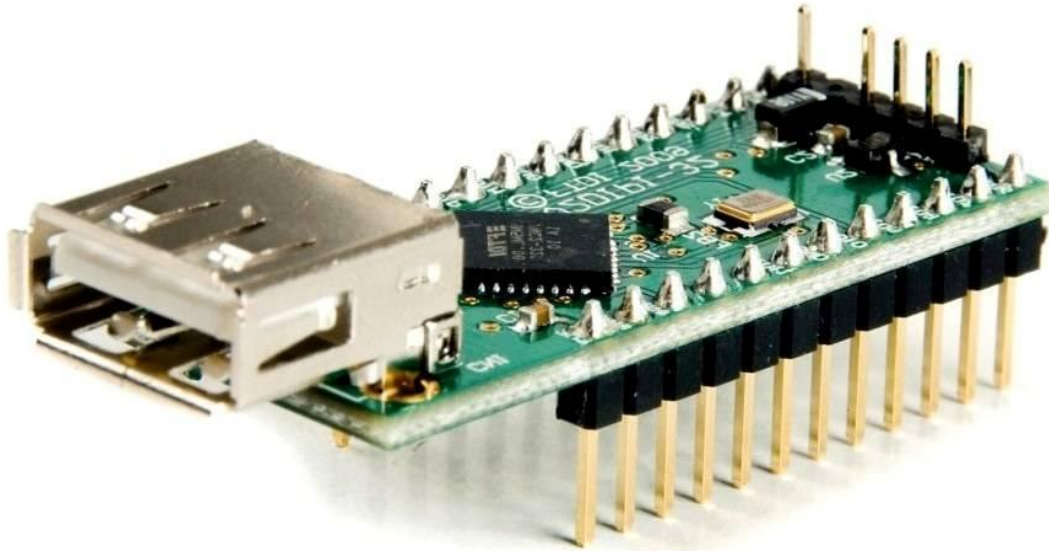
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## 1 Introduction

V2DIP1-32 module is designed to allow rapid development of designs using the VNC2-32Q IC. The V2DIP1-32 is supplied as a PCB designed to fit into a 24 pin 0.6" wide / 0.1" pitch DIP socket. The module provides access to the UART, parallel FIFO and SPI interface pins of the VNC2-32Q device via its IO bus pins. The USB port is accessed via a type A USB connector.



**Figure 1.1 - V2DIP1-32**

The VNC2 is the second of FTDI's Vinculum family of Embedded dual USB host controller devices. The VNC2 device provides USB Host interfacing capability for a variety of different USB device classes including support for BOMS (bulk only mass storage), Printer, HID (human interface devices). For mass storage devices such as USB Flash drives, VNC2 also transparently handles the FAT file structure.

Communication with non USB devices such as a low cost microcontroller is accomplished via either UART, SPI or parallel FIFO interfaces. The VNC2 provides a new cost effective solution for providing USB Host capability into products that previously did not have the hardware resources available.

The VNC2 supports the capability to enable customers to develop custom firmware using the Vinculum II development software tool suite. The development tools support compiler, linker and debugger tools complete within an integrated development environment (IDE).

The Vinculum-II VNC2 family of devices are available in Pb-free (RoHS compliant) 32-lead LQFP, 32-lead QFN, 48-lead LQFP, 48-lead QFN, 64-Lead IQFP and 64-lead QFN packages

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## 2 Features

The V2DIP1-32 incorporates the following features:

- Uses FTDI's VNC2-32Q embedded USB host controller IC device.
- USB 'A' type USB socket to interface with USB peripheral devices.
- Second USB interface port accessible via module pins if required.
- UART, parallel FIFO and SPI interfaces can be programmed to a choice of available I/O pins.
- Single 5V supply input from DIL connectors or 5V supplied via USB VBUS slave interface or debugger module.
- Auxiliary 3.3 V / 200 mA power output to external logic.
- All VNC2 signals available on 0.6" wide / 0.1" pitch DIL male connectors.
- Power and traffic indicator LED's.
- V2DIP1-32 is a Pb-free, RoHS compliant development module.
- Debugger interface pin available on DIL pins or via 6 way male header which interfaces to separate debugger module.
- Firmware upgrades via UART or debugger interface pin header
- FOC software development suite of tools to create customised firmware includes a Compiler, Linker, Debugger and Assembler all wrapped up in an easy to use Integrated Design Environment GUI.

### 3 Pin Out and Signal Description

#### 3.1 Module Pin Out

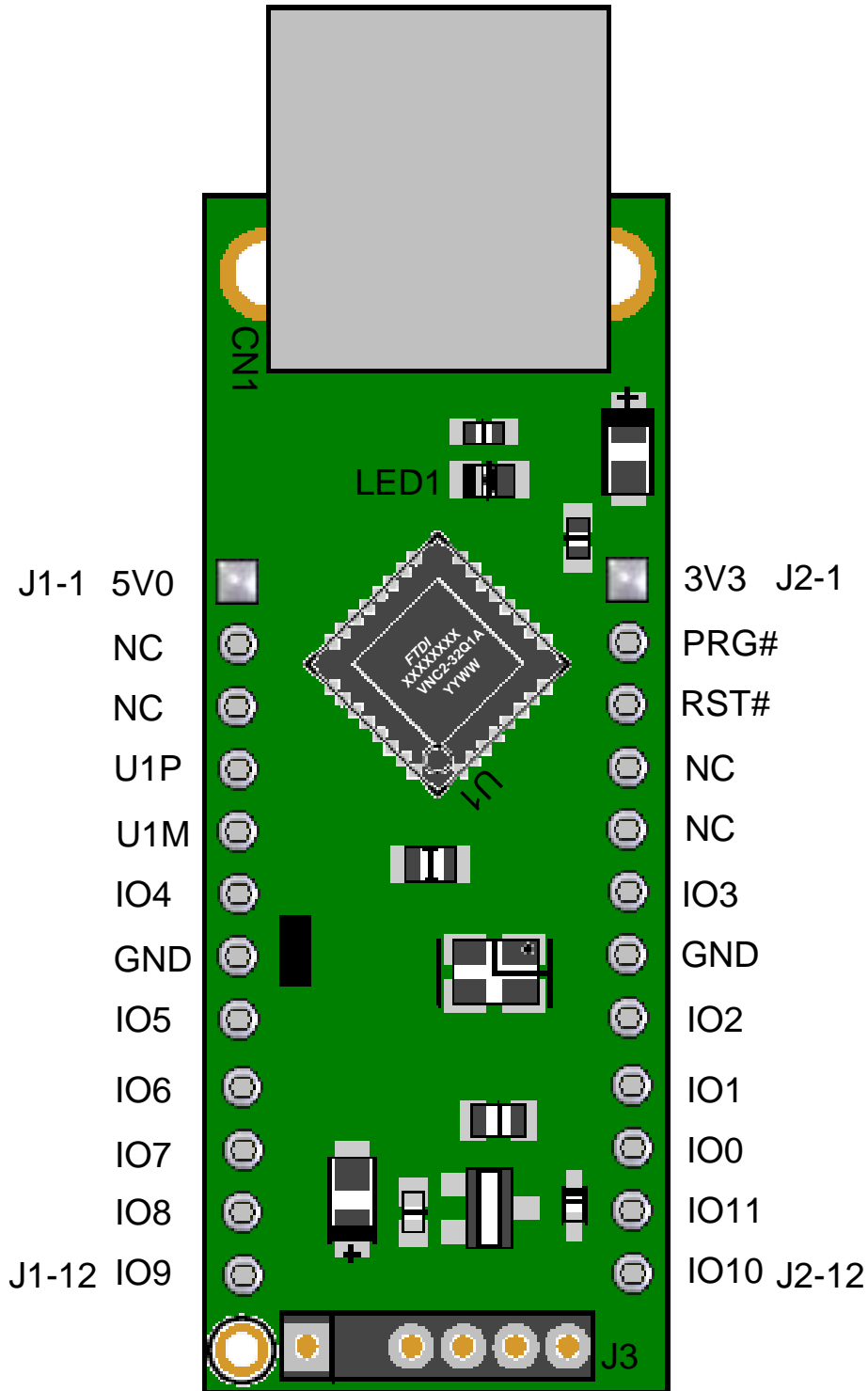


Figure 3.1 - V2DIP1-32 Module Pin Out (Top View)

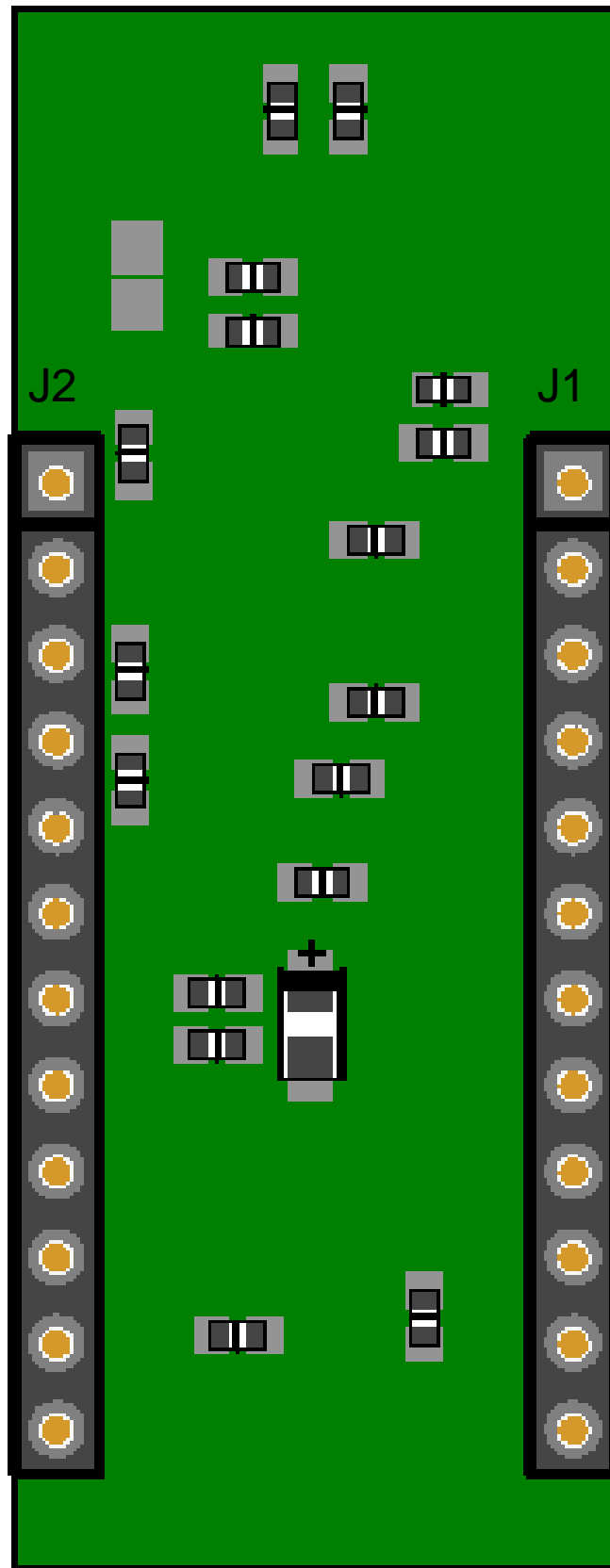


Figure 3.2 - V2DIP1-32 Module Pin Out (Bottom View)

### 3.2 Pin Signal Description

Pin No.	Name	Pin Name on PCB	Type	Description
J1-1	5V0	5V0	PWR Input	5.0V module supply pin. This pin can be used to provide the 5.0V input to the V2DIP1-32 when the V2DIP1-32 is not powered from the USB connector (VBUS) or the debugger interface. Also connected to DIL connector pins pin J3-6.
J1-2	-	-	-	Not connected
J1-3	-	-	-	Not connected
J1-4	USBD1P	U1P	I/O	USB host / slave port 1 - USBData Signal Plus with integrated pull up / pull down resistor. Module has on board 27 $\Omega$ USB series resistor. This pin can be brought out along with pin J1-5 to provide a second USBport, if required.
J1-5	USBD1M	U1M	I/O	USB host / slave port 1 - USBData Signal Minus with integrated pull up / pull down resistor. Module has on board 27 $\Omega$ USB series resistor. This pin can be brought out along with pin 5 to provide a second USB port,if required.
J1-6	IOBUS4	IO4	I/O	5V safe bidirectional data / control bus bit 4
J2-7	GND	GND	PWR	Module ground supply pin
J1-8	IOBUS5	IO5	I/O	5V safe bidirectional data / control bus bit 5
J1-9	IOBUS6	IO6	I/O	5V safe bidirectional data / control bus bit 6
J1-10	IOBUS7	IO7	I/O	5V safe bidirectional data / control bus bit 7
J1-11	IOBUS8	IO8	I/O	5V safe bidirectional data / control bus bit 8
J1-12	IOBUS9	IO9	I/O	5V safe bidirectional data / control bus bit 9
J2-1	3V3	3V3	3.3V Output from VDIP2's on board 3.3V L.D.O.	3.3V output from V2DIP1's on board 3.3V L.D.O.
J2-2	PROG#	PRG#	Input	This pin is used in combination with the RESET# pin and the UART interface to program firmware into the VNC2.
J2-3	RESET#	RST#	Input	Can be used by an external device to reset the VNC2. This pin is also used in combination with PROG# and the UART interface to program firmware into the VNC2
J1-4	-	-	-	Not connected
J1-5	-	-	-	Not connected
J2-6	IOBUS3	IO3	I/O	5V safe bidirectional data / control bus bit 3
J1-7	GND	GND	PWR	Module ground supply pin
J2-8	IOBUS2	IO2	I/O	5V safe bidirectional data / control bus bit 2
J2-9	IOBUS1	IO1	I/O	5V safe bidirectional data / control bus bit 1
J2-10	IOBUS0	IO0	I/O	5V safe bidirectional data / control bus bit 0
J2-11	IOBUS11	IO11	I/O	5V safe bidirectional data / control bus bit 11
J2-12	IOBUS10	IO10	I/O	5V safe bidirectional data / control bus bit 10

Table 3.1 - Pin Signal Descriptions

### 3.3 Default Interface I/O Pin Configuration

The 32 pin QFN VNC2-32Q device is delivered without any firmware pre-loaded. As such the IOMUX will provide a default pinout as shown in the following table:

Pin No.	Pin Name on PCB	Type	Data and Control Bus Configuration Options				
			UART Interface	SPI Slave Interface	SPI Master Interface	Parallel FIFO Interface	Debugger Interface
J2-10	IO0	I/O	NA	NA	NA	NA	Debug_if
J1-6	IO4	I/O	uart_txd	NA	NA	NA	NA
J1-8	IO5	I/O	uart_rxd	NA	NA	NA	NA
J1-9	IO6	I/O	uart_rts#	NA	NA	NA	NA
J1-10	IO7	I/O	uart_cts#	NA	NA	NA	NA
J1-11	IO8	I/O	NA	spi_s0_clk	NA	NA	NA
J1-12	IO9	I/O	NA	spi_s0_mosi	NA	NA	NA
J2-12	IO10	I/O	NA	spi_s0_miso	NA	NA	NA
J2-11	IO11	I/O	NA	spi_s0_ss#	NA	NA	NA

**Table 3.2 - Default Interface I/O Pin Configuration**



### 3.4 UART Interface

When the data and control buses are configured in UART mode, the interface implements a standard asynchronous serial UART port with flow control. The UART can support baud rates from 300 baud to 3Mbaud. The UART interface is described more fully in the VNC2 datasheet please refer to:- [FTDI website](#)

#### 3.4.1 Signal Description – UART Interface

The UART signals can be programmed to a choice of available I/O pins. **Table 3.3** explains the available pins for each of the UART signals.

<i>Available Pins</i>	<i>Name</i>	<i>Type</i>	<i>Description</i>
J2-10, J1-6, J1-11	uart_txd	Output	Transmit asynchronous data output
J2-9, J1-8, J1-12	uart_rxd	Input	Receive asynchronous data input
J2-8, J1-9, J2-12	uart_rts#	Output	Request To Send Control Output
J2-6, J1-10, J2-11	uart_cts#	Input	Clear To Send Control Input
J2-10, J1-6, J1-11	uart_dtr#	Output	Data Acknowledge (Data Terminal Ready Control) Output
J2-9, J1-8, J1-12	uart_dsr#	Input	Data Request (Data Set Ready Control) Input
J2-8, J1-9, J2-12	uart_dcd#	Input	Data Carrier Detect Control Input
J2-6, J1-10, J2-11	uart_ri#	Input	Ring Indicator Control Input. RI# low can be used to resume the PC USB Host controller from suspend.
J2-10, J1-6, J1-11	uart_tx_active	Output	Enable Transmit Data for RS485 designs. TXDEN may be used to signal that a transmit operation is in progress. The TXDEN signal will be set high one bit-time before data is transmitted and return low one bit time after the last bit of a data frame has been transmitted

**Table 3.3 - Data and Control Bus Signal Mode Options – UART**

### 3.5 Serial Peripheral Interface (SPI)

The VNC2-32Q has one SPI master module and two SPI slave modules. These modules are described more fully in a VNC2 datasheet please refer to:- [FTDI website](#)

#### 3.5.1 Signal Description - SPI Slave

The SPI Slave signals can be programmed to a choice of available I/O pins. **Table 3.4** explains the available pins for each of the SPI Slave signals.

<i>Available Pins</i>	<i>Name</i>	<i>Type</i>	<i>Description</i>
J2-10, J1-6, J1-11	spi_s0_clk spi_s1_clk	Input	Slave clock input
J2-9, J1-8, J1-12	spi_s0_mosi spi_s1_mosi	Input/Output	Master Out Slave In Synchronous data from master to slave
J2-8, J1-9, J2-12	spi_s0_miso spi_s1_miso	Output	Master In Slave Out Synchronous data from slave to master
J2-6, J1-10, J2-11	spi_s0_ss# spi_s1_ss#	Input	Slave chip select

**Table 3.4 - Data and Control Bus Signal Mode Options – SPI Slave**

#### 3.5.2 Signal Description - SPI Master

The SPI Master signals can be programmed to a choice of available I/O pins. **Table 3.5** shows the SPI master signals and the available pins that they can be mapped.

<i>Available Pins</i>	<i>Name</i>	<i>Type</i>	<i>Description</i>
J2-10, J1-6, J1-11	spi_m_clk	Output	SPI master clock input
J2-9, J1-8, J1-12	spi_m_mosi	Output	Master Out Slave In Synchronous data from master to slave
J2-8, J1-9, J2-12	spi_m_miso	Input	Master In Slave Out Synchronous data from slave to master
J2-6, J1-10, J2-11	spi_m_ss_0#	Output	Active low slave select 0 from master to slave 0
J2-10, J1-6, J1-11	spi_m_ss_1#	Output	Active low slave select 1 from master to slave 1

**Table 3.5 - Data and Control Bus Signal Mode Options – SPI Master**

### 3.6 Parallel FIFO Interface - Asynchronous Mode

The Parallel FIFO Asynchronous mode is functionally the same as the Parallel FIFO Interface available in VNC1L VDIP1 module and has an eight bit data bus, individual read and write strobes and two hardware flow control signals.

#### 3.6.1 Signal Description - Parallel FIFO Interface

The Parallel FIFO Interface signals can be programmed to a choice of available I/O pins. **Table 3.6** shows the Parallel FIFO Interface signals and the pins that they can be mapped.

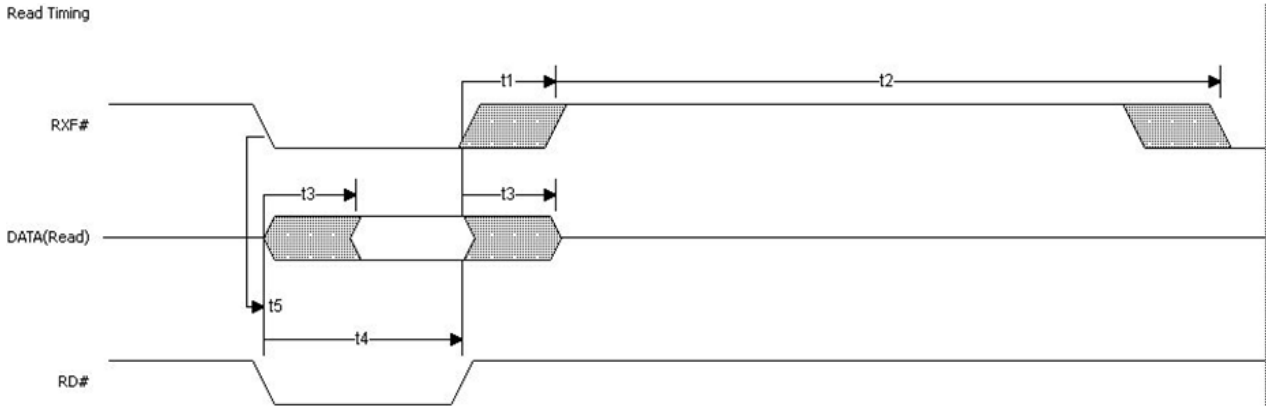
<i>Available Pins</i>	<i>Name</i>	<i>Type</i>	<i>Description</i>
J2-10, J1-6, J1-11	fifo_data[0]	I/O	FIFO data bus Bit 0
J2-9, J1-8, J1-12	fifo_data[1]	I/O	FIFO data bus Bit 1
J2-8, J1-9, J2-12	fifo_data[2]	I/O	FIFO data bus Bit 2
J2-6, J1-10, J2-11	fifo_data[3]	I/O	FIFO data bus Bit 3
J2-10, J1-6, J1-11	fifo_data[4]	I/O	FIFO data bus Bit 4
J2-9, J1-8, J1-12	fifo_data[5]	I/O	FIFO data bus Bit 5
J2-8, J1-9, J2-12	fifo_data[6]	I/O	FIFO data bus Bit 6
J2-6, J1-10, J2-11	fifo_data[7]	I/O	FIFO data bus Bit 7
J2-10, J1-6, J1-11	fifo_rxf#	Output	When high, do not read data from the FIFO. When low, there is data available in the FIFO which can be read by strobing RD# low, then high.
J2-9, J1-8, J1-12	fifo_txe#	Output	When high, do not write data into the FIFO. When low, data can be written into the FIFO by strobing WR high, then low.
J2-8, J1-9, J2-12	fifo_rd#	Input	Enables the current FIFO data byte on D0...D7 when low. Fetches the next FIFO data byte (if available) from the receive FIFO buffer when RD# goes from high to low
J2-6, J1-10, J2-11	fifo_wr#	Input	Writes the data byte on the D0...D7 pins into the transmit FIFO buffer when WR goes from high to low.

**Table 3.6 - Data and Control Bus Signal Mode Options – Parallel FIFO Interface**

### 3.6.2 Timing Diagram – Asynchronous FIFO Mode Read and Write Cycle

When in Asynchronous FIFO interface mode, the timing of a read and write operation on the FIFO interface is shown in Table 3.7 and Figure 3.3

Read Timing



Write Timing

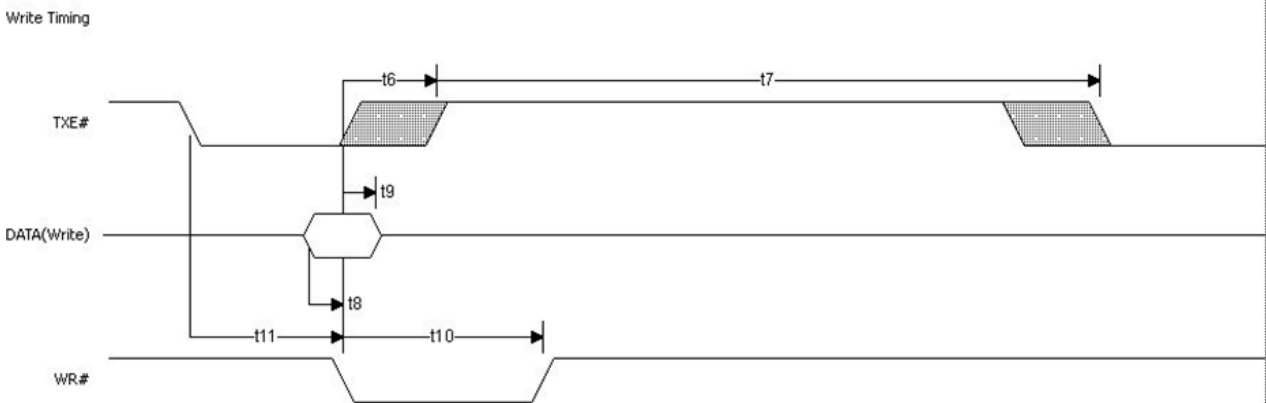


Figure 3.3 – Asynchronous FIFO Mode Read and Write Cycle.

Time	Description	Min	Max	Unit
t1	RD# inactive to RXF#	1	14	ns
t2	RXF# inactive after RD# cycle	100	-	ns
t3	RD# to Data	1	14	ns
t4	RD# active pulse width	30	-	ns
t5	RD# active after RXF#	0	-	ns
t6	WR# active to TXE# inactive	1	14	ns
t7	TXE# inactive after WR# cycle	100	-	ns
t8	DATA to TXE# active setup time	5	-	ns
t9	DATA hold time after WR# inactive	5	-	ns
t10	WR# active pulse width	30	-	ns
t11	WR# active after TXE#	0	-	ns

Table 3.7 - Asynchronous FIFO Mode Read Cycle Timing

In asynchronous mode an external device can control data transfer driving FIFO\_WR# and FIFO\_RD# inputs.

Current byte is available to be read when FIFO\_RD# goes low. When FIFO\_RD# goes high, FIFO\_RXF# output will also go high. It will only become low again when there is another byte to read.

When FIFO\_WR# goes low FIFO\_TXE# flag will always go high. FIFO\_TXE# goes low again only when there is still space for data to be written in to the module.

### 3.7 Debugger Interface

The purpose of the debugger interface is to provide access to the VNC2 silicon/firmware debugger. The debug interface can be accessed via the J2-10 pin on the DIL connector or, more easily, it can be accessed by connecting a *VNC2\_Debug\_Module* to the J3 connector. This debug module will give access to the debugger through a USB connection to a PC via the Integrated Development Environment (IDE). The IDE is a graphical interface to the VNC2 software development tool-chain and gives the following debug capabilities through the debugger interface:

- Flash Erase, Write and Program.
- Application debug - application code can have breakpoints, be single stepped and can be halted.
- Detailed internal debug - memory and register read/write access.

The Debugger Interface, and how to use it, is further described in the following applications Note [Vinculum-II Debug Interface Description](#)

#### 3.7.1 Signal Description - Debugger Interface

Table 3.8 shows the signals and pins description for the Debugger Interface pin header J3

<i>Pin No.</i>	<i>Name</i>	<i>Name On PCB</i>	<i>Type</i>	<i>Description</i>
J3-1	I00	DBG	I/O	Debugger Interface
J3-2	-	[Key]	-	Not connected. Used to make sure that the debug module is connected correctly.
J3-3	GND	GND	PWR	Module ground supply pin
J3-4	RESET#	RST#	Input	Can be used by an external device to reset the VNCL2. This pin is also used in combination with PROG# and the UART interface to program firmware into the VNC2.
J3-5	PROG#	PRG#	Input	This pin is used in combination with the RESET# pin and the UART interface to program firmware into the VNC2.
J3-6	5V0	VCC	PWR Input	5.0V module supply pin. This pin can be used to provide the 5.0V input to the V2DIP1-32 from the debugger interface when the V2DIP1-32 is not powered from the USB connector (VBUS) or the DIL connector pins J1-1 and J3-6.

**Table 3.8 - Signal Name and Description – Debugger Interface**

---

## **4 Firmware**

### **4.1 Firmware Support**

The VNC2 on the V2DIP1-32 can be programmed with the customers own firmware created using the Vinculum II firmware development tool chain or with various pre-compiled firmware profiles to allow a designer to easily change the functionality of the chip. Please refer to:- [FTDI website](#) for full details on available pre-compiled firmware

### **4.2 Available Firmware**

V2DAP firmware is currently available: USB Host for single Flash Disk and general purpose USB peripherals. Selectable UART, FIFO or SPI interface command monitor. please refer to:- [FTDI website](#) for full details.

### **4.3 Firmware Upgrades**

Refer to the debugger interface section which can be used to update the firmware.

## 5 External circuit Configuration

### 5.1 Adding a second USB Port

The external circuit configuration for adding second USB host port, with the USB activity LED, is shown below in **Figure 5.1**

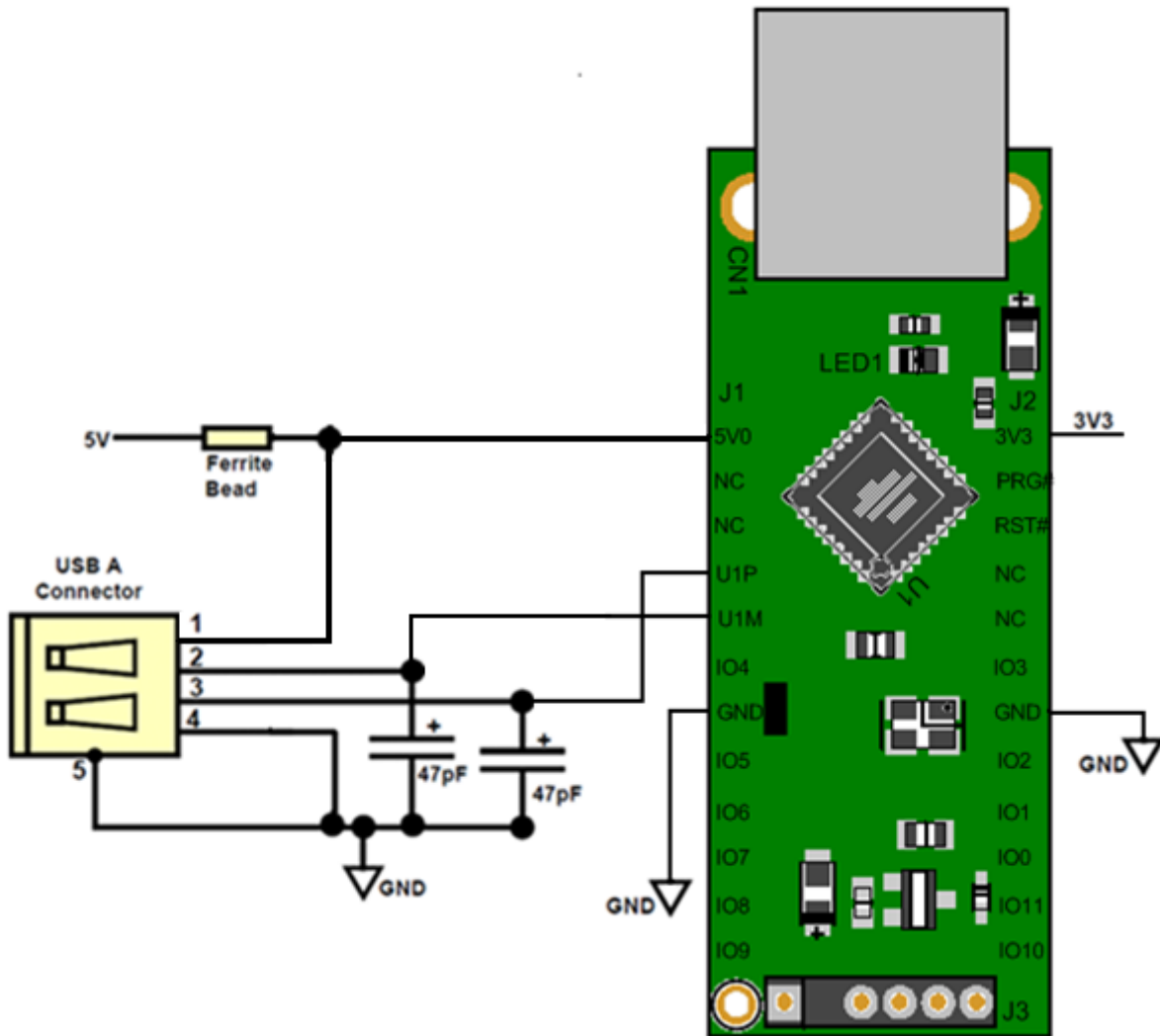
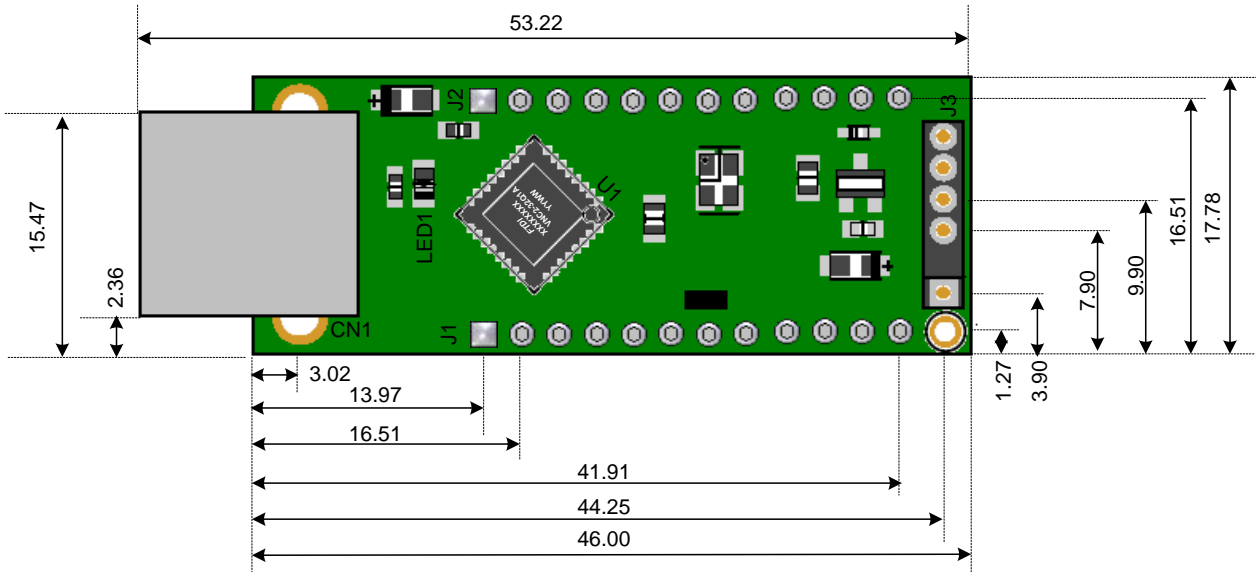
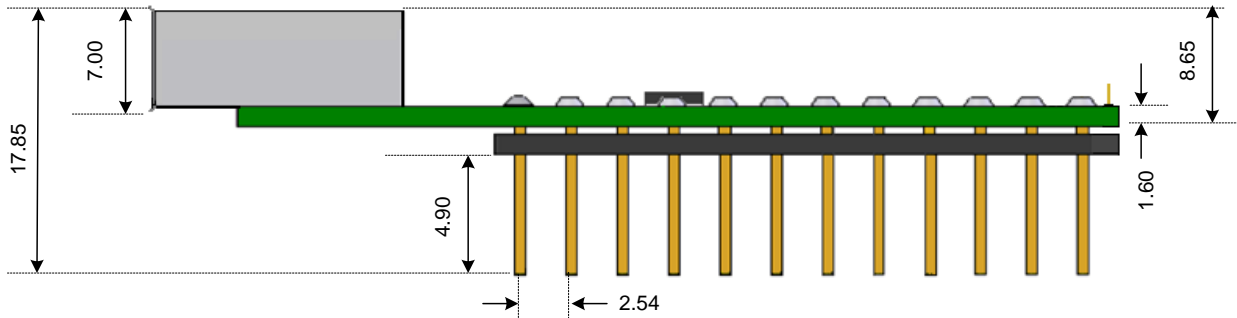


Figure 5.1 Additional USB Port Configuration

## 6 Mechanical Dimensions



**Figure 6.1 - V2DIP1-32 Dimensions (Top View)**



**Figure 6.2 - V2DIP1-32 Dimensions (Side View)**

±0.20mm Tolerance (except pitch)

All dimensions are in mm



## 7 Schematic Diagram

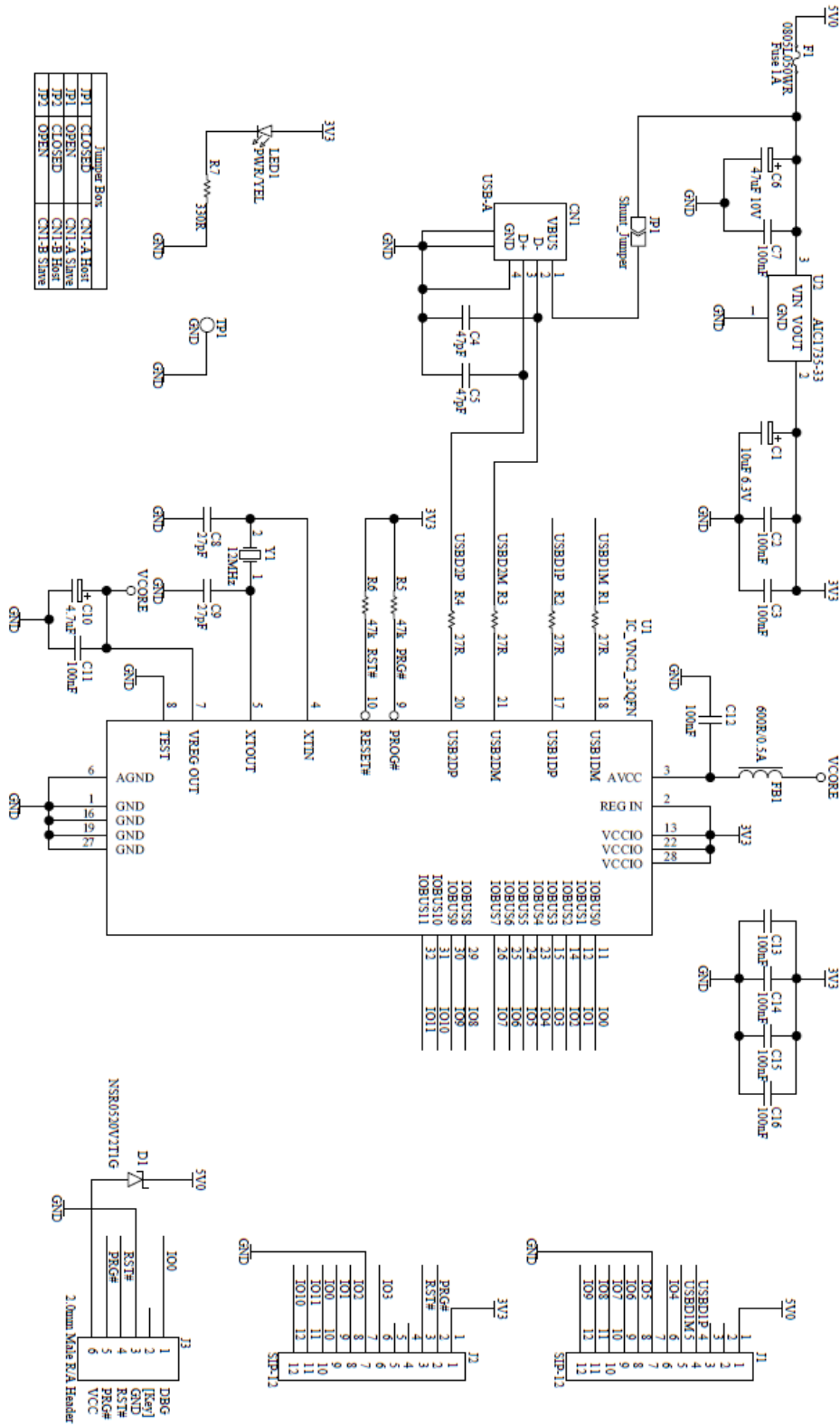


Figure 7.1 - V2DIP1-32 Schematic

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## Appendix A – References

Application and Technical Notes

[Vinculum-II IO Cell Description](#)

[Vinculum-II Debug Interface Description](#)

[Vinculum-II IO Mux Explained](#)

[Vinculum-II PWM Example](#)

[Migrating Vinculum Designs From VNC1L to VNC2-48L1A](#)

[Vinculum-II Errata Technical Note](#)

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## Appendix C – Revision History

Version 1.0      First Release

16<sup>th</sup> April 2010