# GWU2X Datasheet

## Revision History

| Date | Version | Description |
|------|---------|-------------|
| 6/29/2021 | 1.0E | Initial version published. |

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# 1 Function

## 1.1 Overview

GWU2X is the first interface bridge ASSP chip in the Gowin Gobridge family. It is a highly integrated, low-power, and single-chip solution for communicating with peripheral interfaces over USB. It is designed to bridge SPI, I2C, JTAG, and GPIO. The structure view is as shown in Figure 1-1.

**Figure 1-1 GWU2X Structure View**
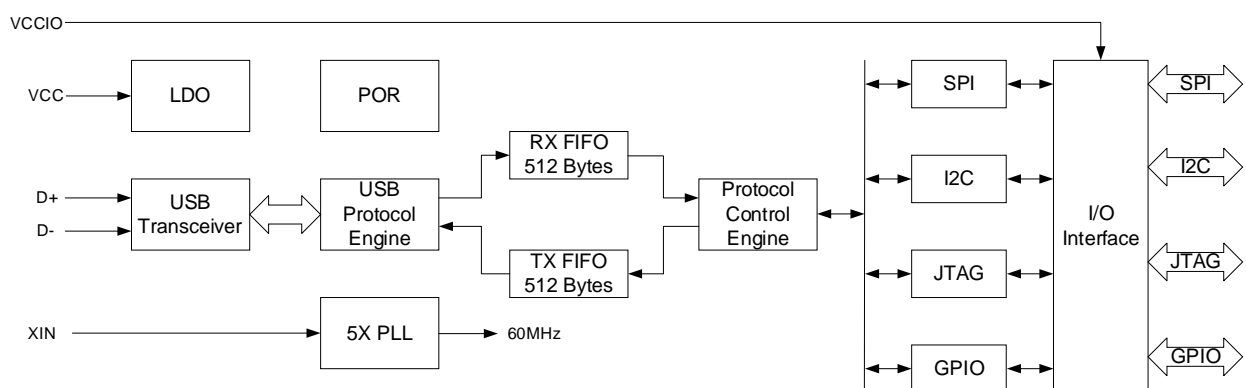


## 1.2 Features

- Supports full-speed USB device interface, compatible with the US B v1.1 specification.

- Built-in USB protocol processing, without device firmware programming.

- Supports USB to JTAG/ SPI/ I$^2$C.

- Independent I/O power supply, supports 3.3V, 2.5V, and 1.8V standards.

- 16 general-purpose input and output pins.

- Supports I2C, SPI and JTAG host interfaces with adjustable clock and independent data receive buffer.

- API provided for host device usage.

# 1.3 Typical Applications

- USB products field upgrading
- USB Industry control
- USB Flash Card Reader
- USB-based instruments
- USB-SPI Bus Interface
- USB JTAG Programmer

# 1.4 Driver Supported

GWU2X supports the WinUSB drivers as below:

- Windows XP 64 bits
- Windows 7/ Windows 10 32 bits,64 bits

# 2 Package

GWU2X package information is described in Table 2-1 as below.

**Table 2-1 Product Package Resources**

| Package | Pitch (mm) | Size (mm) |
|---------|-----------|-----------|
| QN32 | 0.5 | 5 x 5 |

# 2.1 QN32 Pin Description
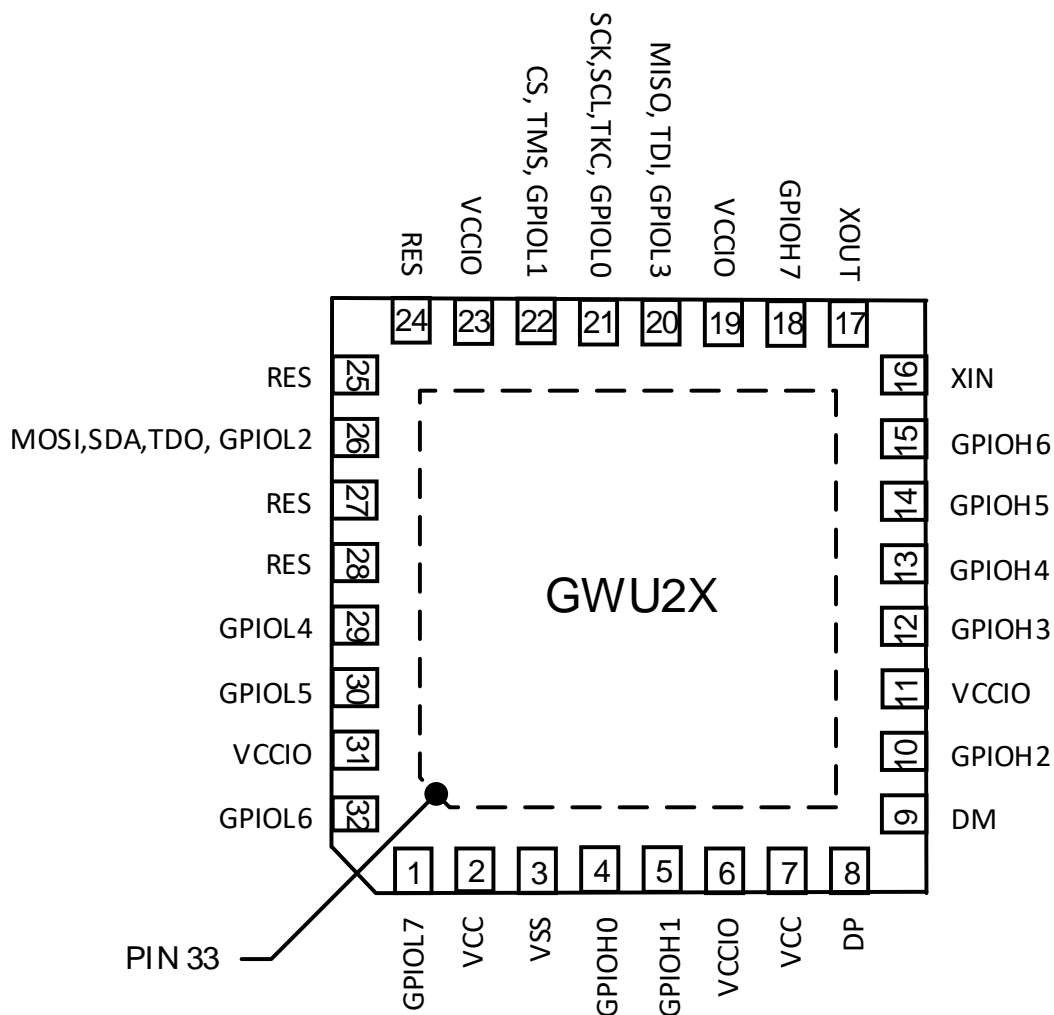


| Pin Number | Pin Name | Type | Description |
|---|---|---|---|
| 2，7， | VCC | Power Supply | Power Input |
| 6，11，19，23，31 | VCCIO | Power Supply | Input/Output pin voltage |
| 3，33 | VSS | Power Ground | Common Ground |
| 16 | XIN | Clock | Input of crystal oscillation, external crystal and oscillator capacitor |
| 17 | XOUT | Clock | Reverse output of crystal oscillation, external crystal and oscillator capacitor |
| 8 | DP | Two-Way | USB Data signal D+; 1.5K pull-up resistor needs to be connected |

| Pin Number | Pin Name | Type | Description |
|---|---|---|---|
| 9 | DM | Bidirectional | USB data signal D- |
| 21 | SCK | Output | SPI serial clock output |
| | SCL | Output | I$^2$C serial clock output |
| | TCK | Output | JTAG serial clock output |
| | GPIOL0 | Two-Way | Bidirectional port L0 |
| 22 | CS | Output | SPI slave selection |
| | TMS | Output | JTAG test mode selection |
| | GPIOL1 | Two-Way | Bidirectional port L1 |
| 26 | MOSI | Output | SPI main device data transmission. |
| | SDA | Two-Way | I2C serial data |
| | TDI | Output | JTAG main device test data output |
| | GPIOL2 | Two-Way | Bidirectional port L2 |
| 20 | MISO | Input | SPI main device data reception |
| | TDO | Input | JTAG main device test data reception |
| | GPIOL3 | Two-Way | Bidirectional port L3 |
| 29 | GPIOL4 | Two-Way | Bidirectional port L4 |
| 30 | GPIOL5 | Two-Way | Bidirectional port L5 |
| 32 | GPIOL6 | Two-Way | Bidirectional port L6 |
| 1 | GPIOL7 | Two-Way | Bidirectional port L7 |
| 4 | GPIOH0 | Two-Way | Bidirectional port H0 |
| 5 | GPIOH1 | Two-Way | Bidirectional port H1 |
| 10 | GPIOH2 | Two-Way | Bidirectional port H2 |
| 12 | GPIOH3 | Two-Way | Bidirectional port H3 |
| 13 | GPIOH4 | Two-Way | Bidirectional port H4 |
| 14 | GPIOH5 | Two-Way | Bidirectional port H5 |
| 15 | GPIOH6 | Two-Way | Bidirectional port H6 |
| 18 | GPIOH7 | Two-Way | Bidirectional port H7 |
| 24，25，27，28 | RES | | Reserved port. Need to be left floating |

# 2.2 QN32 Package Outline

**Figure 2-1 QN32 Package Outline**



BOTTOM VIEW

EXPOSED THERMAL PAD ZONE
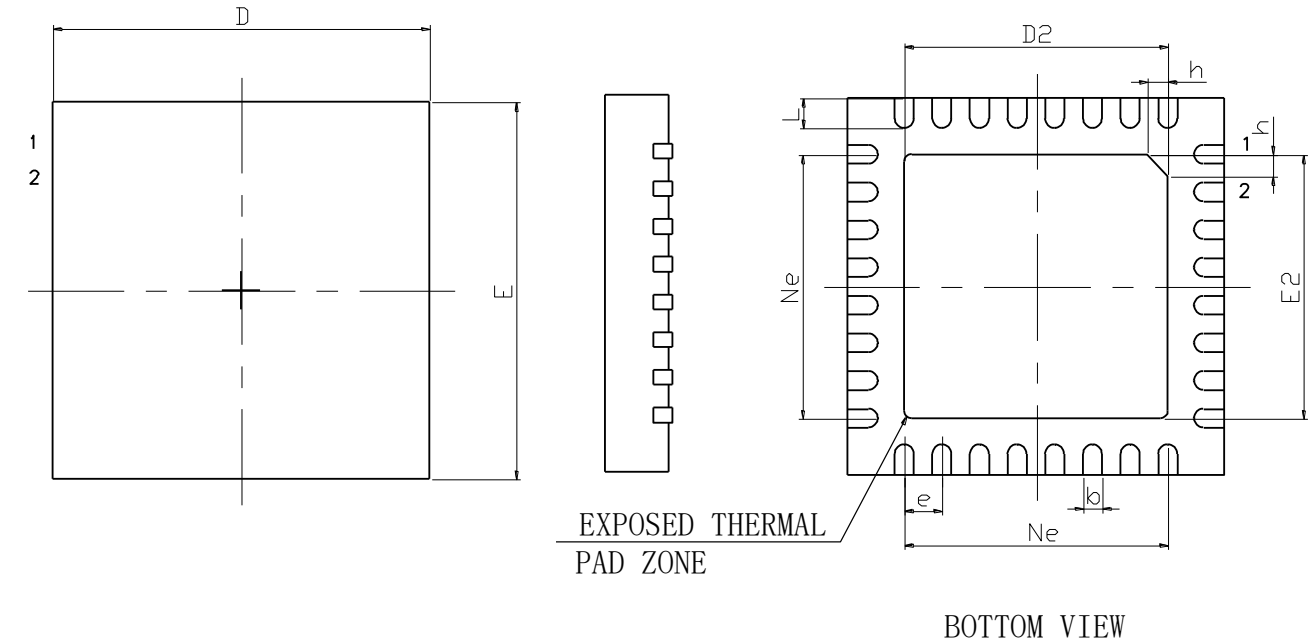
| SYMBOL | MILLIMETER | | |
|--------|------|------|------|
|        | MIN  | NOM  | MAX  |
| A      | 0.70 | 0.75 | 0.80 |
| A1     | 0    | 0.02 | 0.05 |
| b      | 0.18 | 0.25 | 0.30 |
| c      | 0.18 | 0.20 | 0.25 |
| D      | 4.90 | 5.00 | 5.10 |
| D2     | 3.40 | 3.50 | 3.60 |
| e      | 0.50BSC | | |
| Ne     | 3.50BSC | | |
| E      | 4.90 | 5.00 | 5.10 |
| E2     | 3.40 | 3.50 | 3.60 |
| L      | 0.35 | 0.40 | 0.45 |
| h      | 0.30 | 0.35 | 0.40 |

# 2.3 Package Marking

**Figure 2-2 Package Mark Meaning**

```
●
Gobridge    ──▶ Logo
XXXXXXXX    ──▶ Part Number
YYWWXXXXX   ──▶ Date Code + Internal Code
LLLLLLLLL   ──▶ Lot Number
```
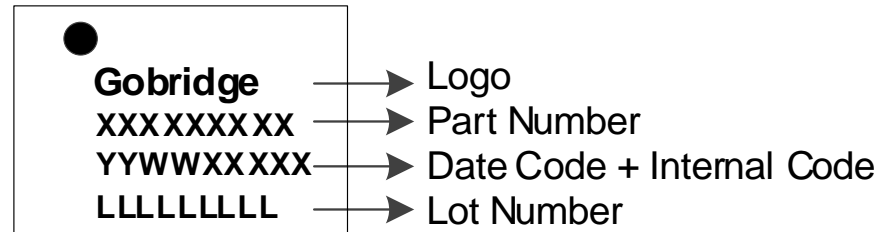
# 3 Function Description

## 3.1 Hardware Description

- Both VCC and VCCIO need to be provided for the GWU2X chip to work normally. It is suggested to connect a power decoupling capacitor with a capacity of 0.01uF ~ 0.1uF to the power pin of each chip. The synchronous serial interface voltage can be adjusted dynamically through VCCIO, with the range of 1.8V~3.3V.

- 12MHz clock signal to the XIN pin provided by an external active crystal oscillator is required for the GWU2X chip to work normally. In general, the clock signal is generated by the built-in inverter in GWU2X through the crystal oscillator with stable frequency.The peripheral circuit only needs to connect a 12MHz crystal between the XIN and XOUT pins and connect oscillating capacitors to the ground for the XIN and XOUT pins respectively.

- GWU2X chip has built-in power on reset circuit, and no external reset is required.

- The USB port of GWU2X chip has no built-in pull-up resistor, and additional 1.5K pull-up resistor needs to be provided at the DP end. It is recommended to connect the insurance resistor or inductor or ESD protection device in series for safety, and the AC-DC equivalent series resistance should be within 5Ω.

- Some pins of GWU2X chip have multiple functions, so they have different characteristics during the chip reset and in the normal working state after reset. All pins with a tri-state output have a built-in pull-up resistor. This knid of pin acts as an output pin after the chip is reset and runs the firmware. During the chip reset, tri-state output is prohibited and the built-in pull-up resistor provides the pull-up current. If necessary, the external circuit can provide an external pull-up resistor or pull-down

resistor to set the relevant pin's default level during the reset of the GWU2X chip. The resistance value of the external pull-up resistor or pull-down resistor is usually between 2KΩ and 5KΩ.

# 3.2 GPIO Interface

GWU2X provides 16 GPIO pins, all of which can be independently configured as output or input.

# 3.3 Synchronous Serial Interface

GWU2X synchronous serial port is an active serial port, which can only be used as Host/Master.　Its internal Protocol Engine Control module and the external computer driver can be applied to implement I2C serial port, SPI serial port and JTAG serial port.

## 3.3.1 I²C

The main pins of I$^2$C serial port include SCL pin and SDA pin. SCL is used for one-way output synchronous clock, open leak output and built-in pull up resistance. SDA is used for quasi-two-way data input and output, open leak output and input, and built-in pull up resistance.

The basic elements of I$^2$C serial timing include: start bit, stop bit, bit output, bit input, byte output, and byte input.

## 3.3.2 SPI

The main pins of SPI serial port include SCK pin, MISO pin, MOSI pin, and the chip selection pin of CS. SCK is used for one-way output synchronous clock, MISO is used for one-way input data, MOSI is used for one-way output data, and the chip selector pin of CS is used for device selection.

## 3.3.3 JTAG

The main pins of JTAG serial port include TMS pin, TDI pin, and TDO pin. TMS is used for mode selection, TCK is used for output synchronous clock, TDI is used for output test data, and TDO is used for input test data.

The timing sequence of JTAG serial port follows IEEE1149.1 protocol, allowing data changes on TMS, TDI and TDO signals when TCK signal falls from high to low. At the time of TCK rising edge, the data on TMS, TDI and TDO signals will remain unchanged, so as to facilitate sampling of TMS, TDI

and TDO signals with the rising edge of TCK signals

# 4 Driver

For the detailed information, please refer to:

● UG1002-1.0_GWU2X Programming Guide_U2X_IIC,

● UG1003-1.0_GWU2X Programming Guide_U2X_JTAG

● UG1004-1.0_GWU2X Programming Guide_ U2X_SPI.

# 5 Devices Characteristics and Ratings

## 5.1 Absolute Max. Ratings

**Table 5-1 Absolute Max. Ratings**

| Parameter | Description | Min. | Max. | Unit |
|-----------|-------------|------|------|------|
| TA | Ambient temperature during work | -40 | 85 | ℃ |
| TS | Ambient temperature during storage | -65 | 150 | ℃ |
| VCC | Power voltage | -0.5 | 3.75 | V |
| VCCIO | Input/Output pin voltage | -0.5 | 3.75 | V |

## 5.2 Electrical Characteristics

**Table 5-2 Electrical Characteristics**

| Parameter | Description | Min. | Typ. | Max. | Unit |
|-----------|-------------|------|------|------|------|
| VCC | Power voltage | – | 3.3 | – | V |
| VCCIO | Input/Output pin voltage | 1.8 | – | 3.465 | V |
| Icc1 | Total power supply current during operation | – | 35 | – | mA |
| VIL | Low-level input voltage | -0.3 | – | 0.35*VCCO | V |
| VIH | High-level input voltage | 0.65*VCCO | – | 3.6 | V |
| VOL | Low-level output | – | – | 0.4 | V |

| Parameter | Description | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| | voltage | | | | |
| VOH | High-level output voltage | VCCO-0.4 | – | – | V |
| UVOL | Low-level output voltage of USB | | – | 0.4 | V |
| UVOH | High-level output voltage of USB | 2.8 | – | – | V |
| UVse | Single-ended receiving threshold | 0.8 | – | 2.0 | V |
| UCom | common-mode voltage range | 0.8 | – | 2.5 | V |
| UVDif | Differential signal sensitivity | 0.2 | – | | V |

# 5.3 Timing Parameters

**Table 5-3 Timing Parameters**

| Parameter | Description | Min. | Typ. | Max. | Unit |
|-----------|-------------|------|------|------|------|
| FCLK | The Input clock signal frequency of the XIN pin | – | 12 | – | MHz |
| TPR | Reset time of power on | – | 5 | – | ms |

# 5.4 ESD Parameters

**Table 5-4 ESD Paramrters**

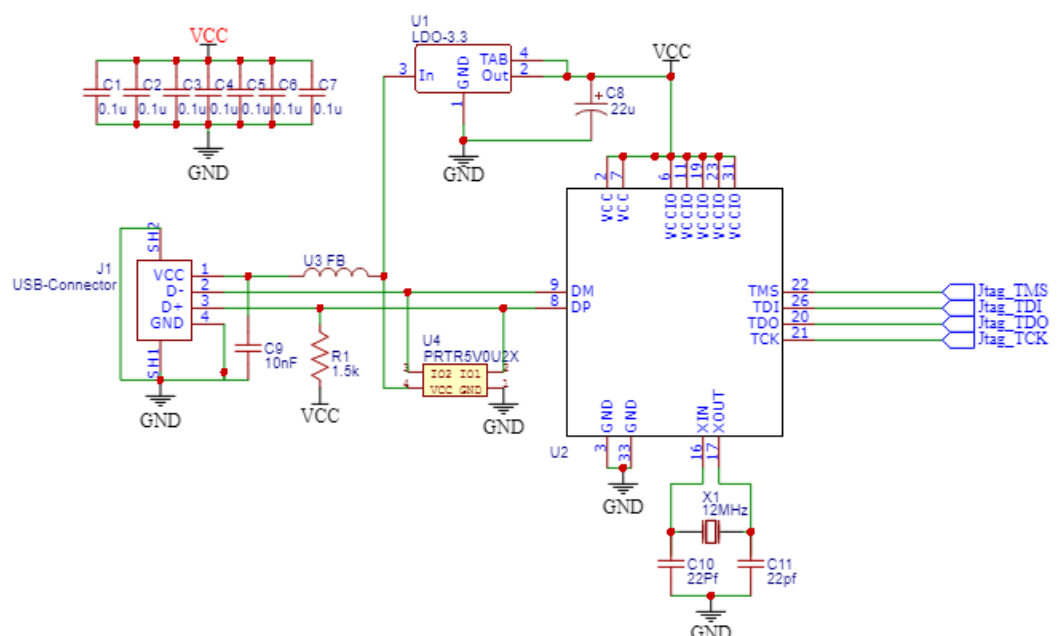| Parameter | Description | Min. | Typ. | Max. | Unit |
|-----------|-------------|------|------|------|------|
| HBM | Human Body Model | 1000 | – | – | V |
| CDM | Charged Device Model | 500 | – | – | V |

# 6 Typical Applications

# 6.1 I²C Application
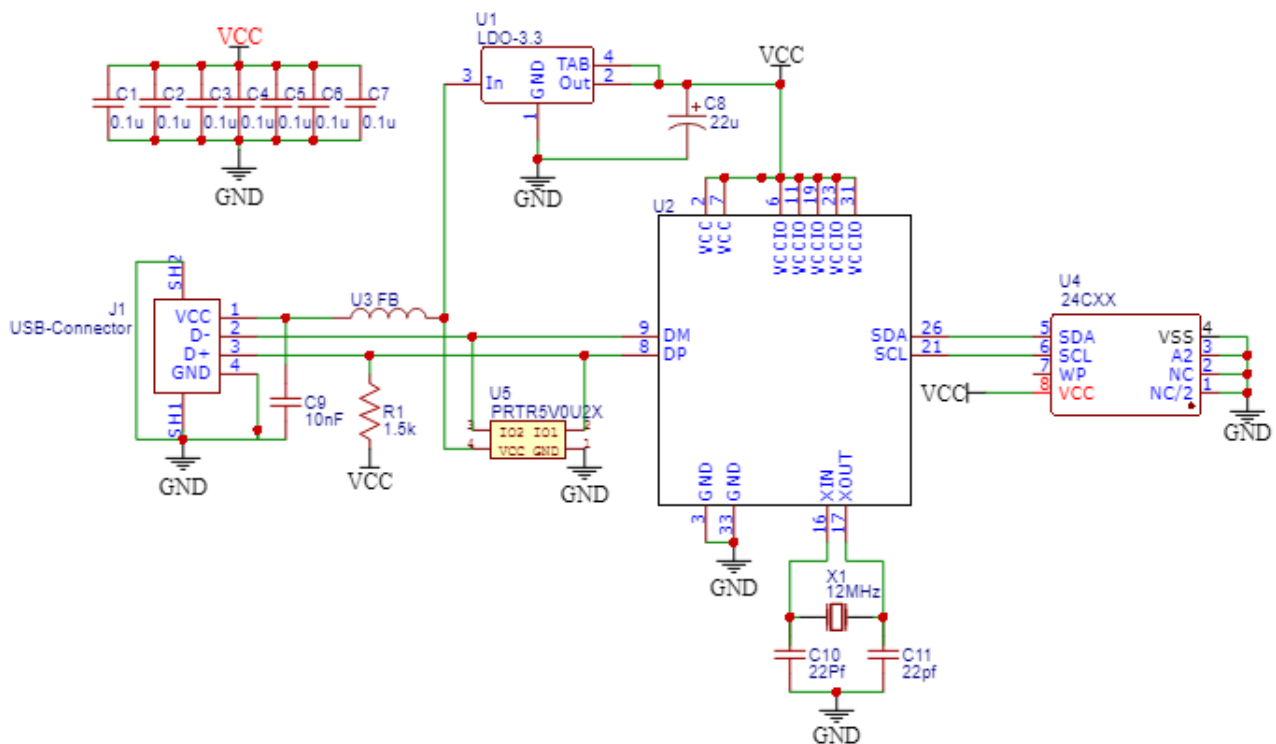
# 6.2 SPI Application
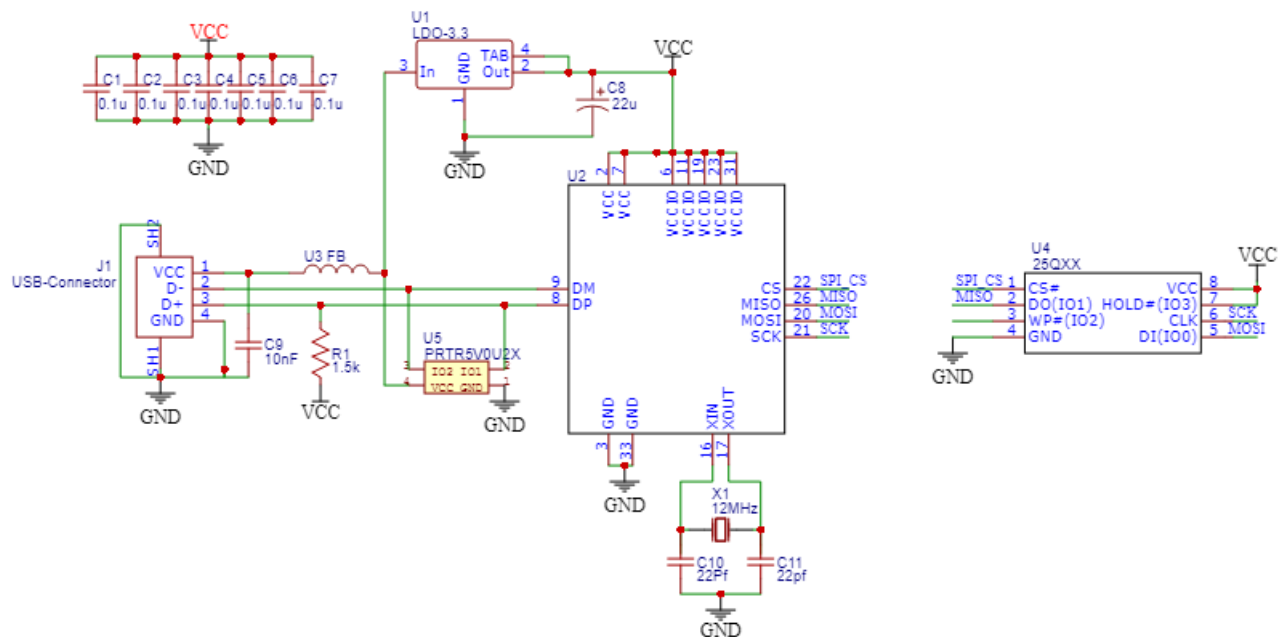


# 6.3 JTAG Application

# Terminology and Abbreviations

The terminology and abbreviations used in this manual are as shown in .

**Table A -1 Terminology and Abbreviations**

| Terminology and Abbreviations | Full Name |
| --- | --- |
| ASSP | Application Specific Standard Product |
| JTAG | Joint Test Action Group |
| $I^2C$ | Inter-Integrated Circuit |
| SPI | Serial Peripheral Interface |
| GPIO | Gowin Programmable I/O |
| QN | Quad Flat No-lead Package |
| ESD | Electronic Static Discharge |

# Support and Feedback

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