Quad Channel USB to UART Converter HARDWARE DOCUMENTATION

42.6mm

45.3mm

VCC TXA RXA GND
CHANNEL A

1V8
3V3
5V
VSELECT CH A&D

GND
RXD
TXD
VCC
CHANNEL D

GND
RXC
TXC
VCC
CHANNEL C

ub
Ubyte

VSELECT CH B&C
5V
3V3
1V8

MAKE IN INDIA

**CHANNEL B
ESP PROGAMMING**
GND IO0 RST RXB TXB VCC

Ubyte

Voltage Level Shifter for Bank 2	→ UART → **Bank 2**

↑ VCCB_BANK2

Selection Connector Bank 2

UART

5V ↑

USB TYPE C	← USB → **XR21V1414IM48TR-F**	← I2C → **EEPROM**

External Device →

3V3 ↑   1V8 ↑

3.3V 1A LINEAR VOLTAGE REGULATOR	**1.8V 1A LINEAR VOLTAGE REGULATOR**

UART

↑ VCCB_BANK1

Selection Connector Bank 1

UART

Voltage Level Shifter for Bank 1	→ UART → **Bank 1**

Quad Channel USB to UART Converter Hardware Block Diagram

1. Overview

This document details the hardware design and electrical characteristics of a USB-to-Serial interface with ESP32 support. The design integrates an **XR21V1414IM48TR-F USB-to-UART bridge**, voltage logic shifters, and an **ESP32 auto boot mode circuit**. The system is powered via **USB Type-C** and includes multiple low-dropout regulators (LDOs) for different voltage levels. Additionally, it includes an **M24C02-WMN6TP EEPROM**, which stores USB configuration settings and ensures proper system operation through I2C communication.

2. Features

- USB Type-C interface for power and data communication
- XR21V1414IM48TR-F USB-to-Quad UART bridge
- Multiple voltage level shifters for different logic levels
- Integrated EEPROM for USB configuration
- ESP32 auto-boot mode selection circuit
- Multiple power domains: 5V, 3.3V, and 1.8V
- LED indicators for UART activity
- Modular design with selectable voltage banks

3. Block Diagram Descriptions

3.1 USB Type-C Interface

- Provides power and USB data signals

3.2 XR21V1414IM48TR-F USB-to-UART Bridge

- Converts USB data to four UART channels
- Communicates with an EEPROM for configuration storage

3.3 EEPROM (M24C02-WMN6TP) Section

- Stores USB configuration settings
- Uses I2C interface for communication

3.4 Power Supply Sections

- **LDO3V3:** Converts 5V to 3.3V for main circuit operation
- **LDO1V8:** Converts 5V to 1.8V for level shifters and other low-voltage components

3.5 Voltage Logic Shifters

- **Bank1 & Bank2:** TXU0204 bidirectional voltage-level translators
- Ensures proper voltage matching between different logic levels

3.6 ESP32 Programmable Channel B

- Designed to program an external ESP32.
- Includes boot and reset switches for easy operation.
- Uses a MOSFET-based circuit to control boot and reset functions.
- Supports automatic programming mode for the ESP32, streamlining the programming process.

3.7 Selection Connector and Channels

- Enables flexible power domain selection
- Supports multiple UART channels with independent voltage (1.8V, 3.3V, 5V) control
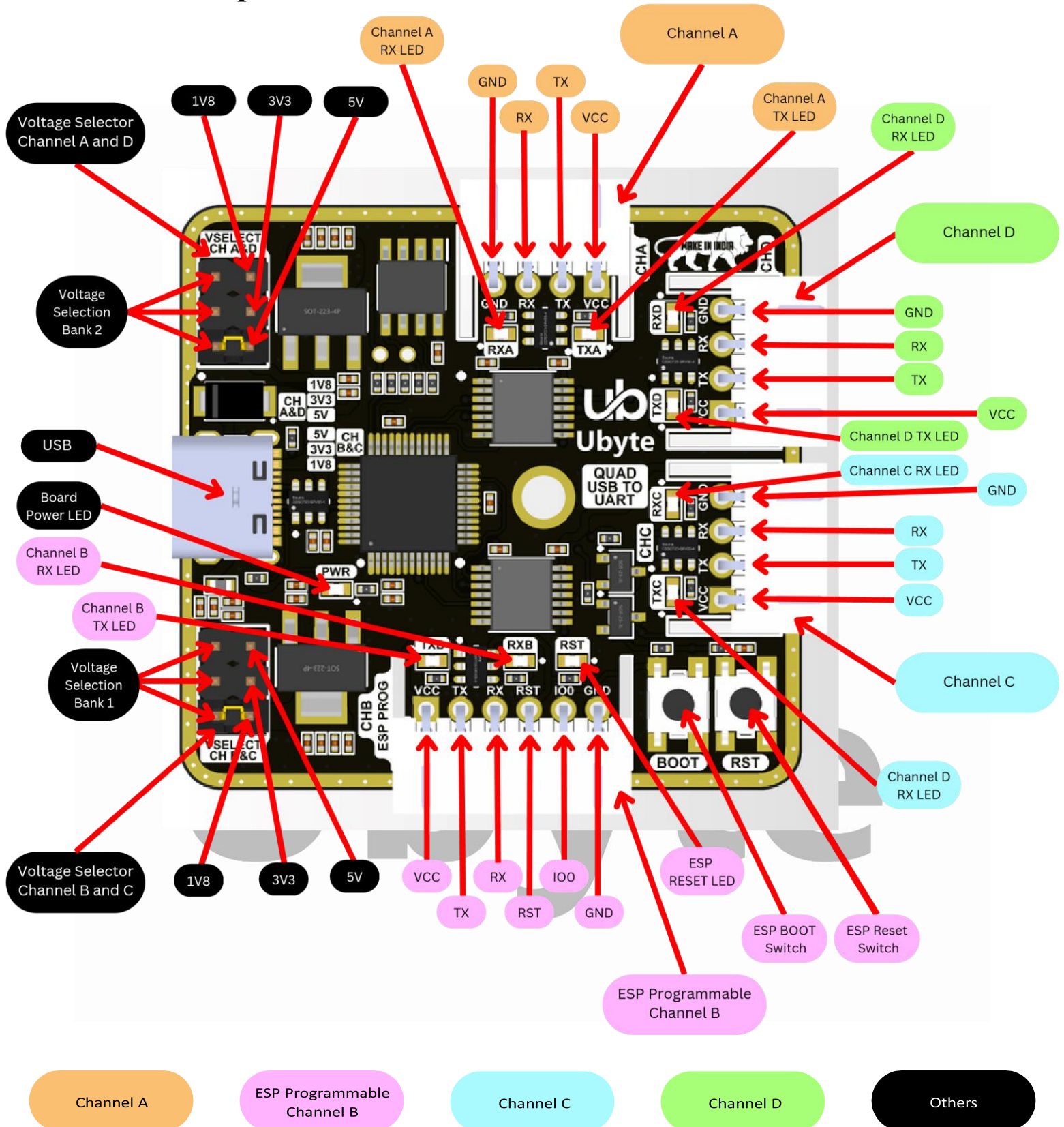
3.8 LED Indicators

- LED indicates signal transmission and reception activity.
- Power LED lights up when the board is powered on.
- LED shows the status of Channel B ESP32 boot function.

4. Electrical Characteristics

Parameter	Value
Input Voltage (USB)	5V
Output Voltage (LDO3V3)	3.3V
Output Voltage (LDO1V8)	1.8V
UART Voltage Levels	1.8V, 3.3V, 5V (Selectable)
USB Data Rate	Up to 12 Mbps

5. Board Components and Their Functions

Voltage Selector Channel A and D
1V8 3V3 5V
Voltage Selection Bank 2
USB
Board Power LED
Channel B RX LED
Channel B TX LED
Voltage Selection Bank 1
Voltage Selector Channel B and C
1V8 3V3 5V

Channel A RX LED
GND TX RX VCC
Channel A
Channel A TX LED
Channel D RX LED
Channel D
GND RX TX VCC
Channel D TX LED
Channel C RX LED
GND RX TX VCC
Channel C

VCC RX IOO
TX RST GND
ESP Programmable Channel B
ESP RESET LED
ESP BOOT Switch
ESP Reset Switch
Channel D RX LED

| Channel A | ESP Programmable Channel B | Channel C | Channel D | Others |

5.1 Voltage Selector (Channel A & D / Bank 2)

- Allows selection between different voltage levels (1.8V, 3.3V, and 5V) for channels A and D
- **Use a 2-pin header** to short the required voltage pin and the Voltage Selection Bank 2 pin, powering the channels A and D at the desired voltage level

5.2 Voltage Selector (Channel B & C / Bank 1)

- Allows selection between different voltage levels (1.8V, 3.3V, and 5V) for channels B and C
- **Use a 2-pin header** to short the required voltage pin and the Voltage Selection Bank 1 pin, powering the channels at the desired voltage level

5.3 USB Port (USB PORT)

- Provides the connection for power and data transfer to/from the board via USB

5.4 Board Power LED (PWR LED)

- Indicates that the board is receiving power from the USB or an external source

5.5 Channel A, B, C, D TX & RX LEDs

- Blink when data is transmitted (TX) or received (RX) on the respective UART channels
- Helps in debugging serial communication

5.6 UART Channels (A, B, C, D)

- Provide four independent UART interfaces
- Each includes **GND, TX, RX, and VCC** for connecting serial devices
    - o **VCC:** Powers the connected device
    - o **GND:** Common ground
    - o **TX:** Transmits data
    - o **RX:** Receives data

5.7 ESP Programmable Channel B (ESP PROG)

- Dedicated UART interface for programming an ESP module
- Includes TX, RX, RST (Reset), IO0 (Boot mode control), GND, and VCC

5.8 ESP Reset LED & ESP Boot LED

- Indicate the status of the ESP module
- The reset LED turns on when the ESP module is resetting
- The boot LED indicates when the ESP is in bootloader mode

5.9 ESP Boot Switch & ESP Reset Switch

- **Boot Switch:** Forces the ESP module into boot mode for flashing firmware
- **Reset Switch:** Resets the ESP module

6. Required Drivers

6.1 MaxLinear XR21V1414IM48TR-F USB-to-UART Driver

The **Ubyte Quad USB-to-UART** board is based on the **MaxLinear XR21V1414IM48TR-F** chip, which provides four independent USB-to-serial interfaces. To ensure proper recognition and functionality, the appropriate driver must be installed on your system.

Installation Steps:

1. Download the appropriate driver for your OS from the MaxLinear Website.
2. Extract and install the driver by following on-screen instructions.
3. Restart your system if required.
4. Connect the board via USB and verify that it appears in **Device Manager (Windows)** or /dev/ttyUSBX (Linux/macOS).
5. Additional Information MaxLinear Website.

6.2 EEPROM (M24C02-WMN6TP) Programming Guide

The board includes an onboard **M24C02-WMN6TP**, a **2-Kbit I2C-compatible serial EEPROM** from STMicroelectronics. To program or access this EEPROM, refer to official ST documentation and tools. It can also be programmed using software available on the MaxLinear website.

- **STMicroelectronics M24C02-WMN6TP Resources:**
  - **Programming Guide, Datasheet & Software Tools**: Visit ST's official page
- MaxLinear Programming Resources:
  - Software tools for programming the EEPROM are available on MaxLinear's website's section Software and Utilities : MaxLinear EEPROM Programming