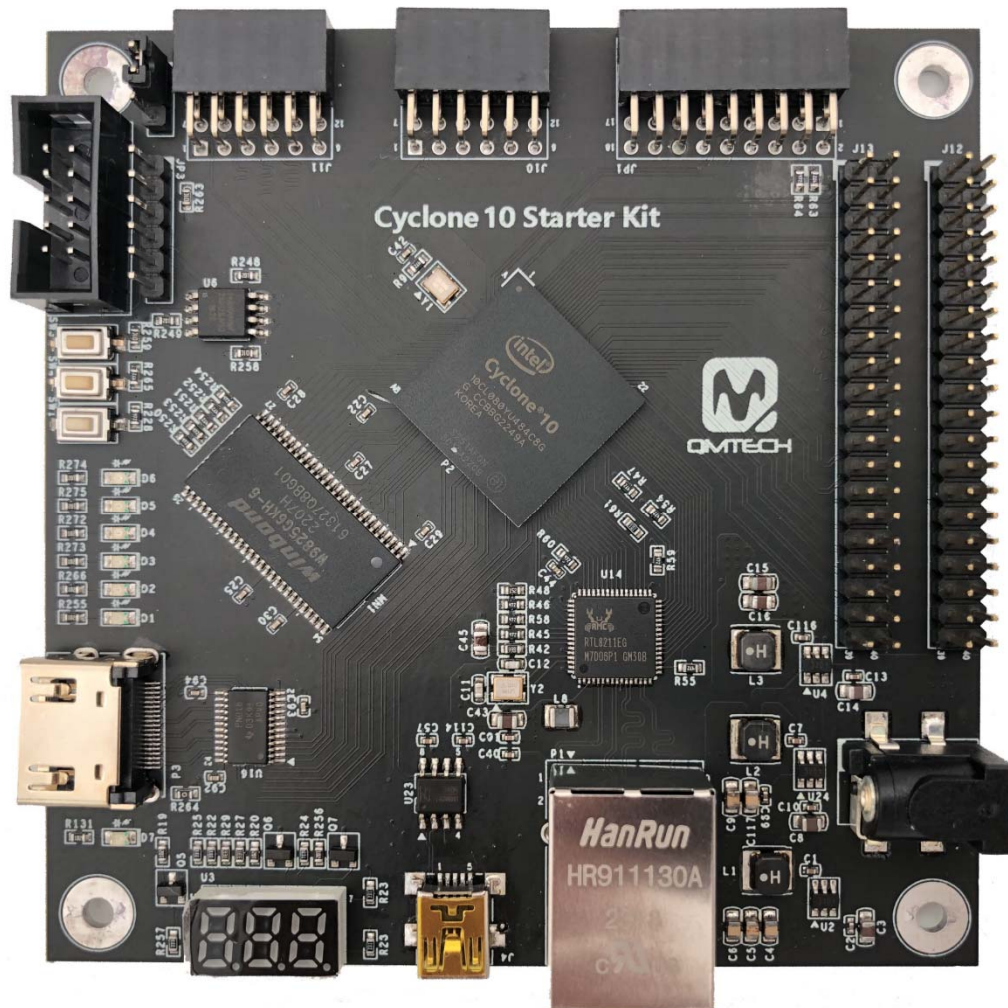# QMTECH CYCLONE10 STARTER KIT

USER MANUAL

Preface

The QMTECH® Cyclone10 Starter Kit uses Altera 10CL080 device to demonstrate the industry's lowest system cost and power, along with performance levels that make the device family ideal for differentiating your high-volume applications. All Altera Cyclone® 10 LP FPGAs require only two core power supplies for operation, simplifying your power distribution network and saving you board costs, board space, and design time. The flexibility of the Altera Cyclone® 10 LP FPGA enables you to design in a smaller, lower cost device, lowering your total system costs.

Table of Contents

1.   Introduction

1.1   Document Scope

This user manual introduces the QMTECH Cyclone10 Starter Kit and describes how to setup the demo board running with application software Altera Quartus II 18.1. Users may employee the on board rich logic resource FPGA 10CL080YU484C8G and large SDRAM memory W9825G6KH to implement various applications. The Starter Kit also has many non-multiplexed FPGA IOs for extending customized modules, such as UART module, CMOS/CCD camera module, LCD/HDMI/VGA display module etc.

1.2   Kit Overview

Below section lists the parameters of the QMTECH Cyclone10 Starter Kit:
- On-Board FPGA: 10CL080YU484C8G;
- On-Board FPGA external crystal frequency: 50MHz;
- 10CL080YU484C8G has rich block RAM resource;
- 10CL080YU484C8G has 80K Logic elements;
- On-Board W25Q128 SPI Flash, 16M bytes for user configuration code;
- On-Board 32MB Winbond SDRAM, W9825G6KH-6;
- On-Board power supply for FPGA by using TPS563201 wide input range DC/DC;
- QMTECH Cyclone10 Starter Kit provides camera interface, 2 x PMOD compatible headers, one TF card slot and two 40P Male headers for extending user IOs;
- QMTECH Cyclone10 Starter Kit provides 3 user keys;
- QMTECH Cyclone10 Starter Kit provides 7 user LEDs;
- QMTECH Cyclone10 Starter Kit provides JTAG interface, by using 10p, 2.54mm pitch header;
- QMTECH Cyclone10 Starter Kit provides GMII Ethernet by using Realtek RTL8211EG;
- QMTECH Cyclone10 Starter Kit provides 7-SEG LEDs;
- QMTECH Cyclone10 Starter Kit provides USB to UART serial port by using CH340N;
- QMTECH Cyclone10 Starter Kit provides HDMI display interface;
- QMTECH Cyclone10 Starter Kit PCB size is: 99.6mm x 99.6mm;
- Default power source for Starter Kit is: 1A@5V DC, the DC header type: DC-050, 5.5mm x 2.1mm;
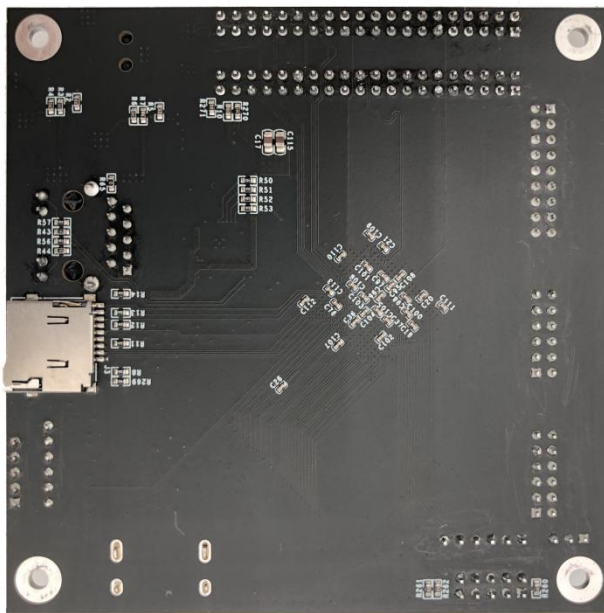
1.3   Kit Bottom View

Figure 1-1. QMTECH Cyclone10 Starter Kit Bottom View

2. Getting Started

Below image shows the dimension of the QMTECH Cyclone10 Starter Kit: 99.6mm x 99.6mm. The unit in below image is millimeter(mm).
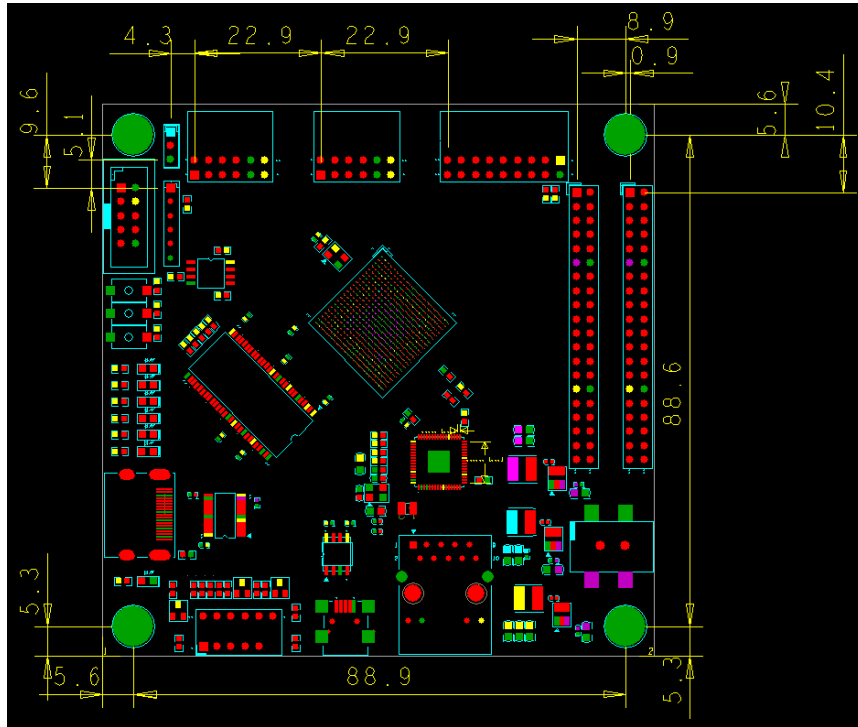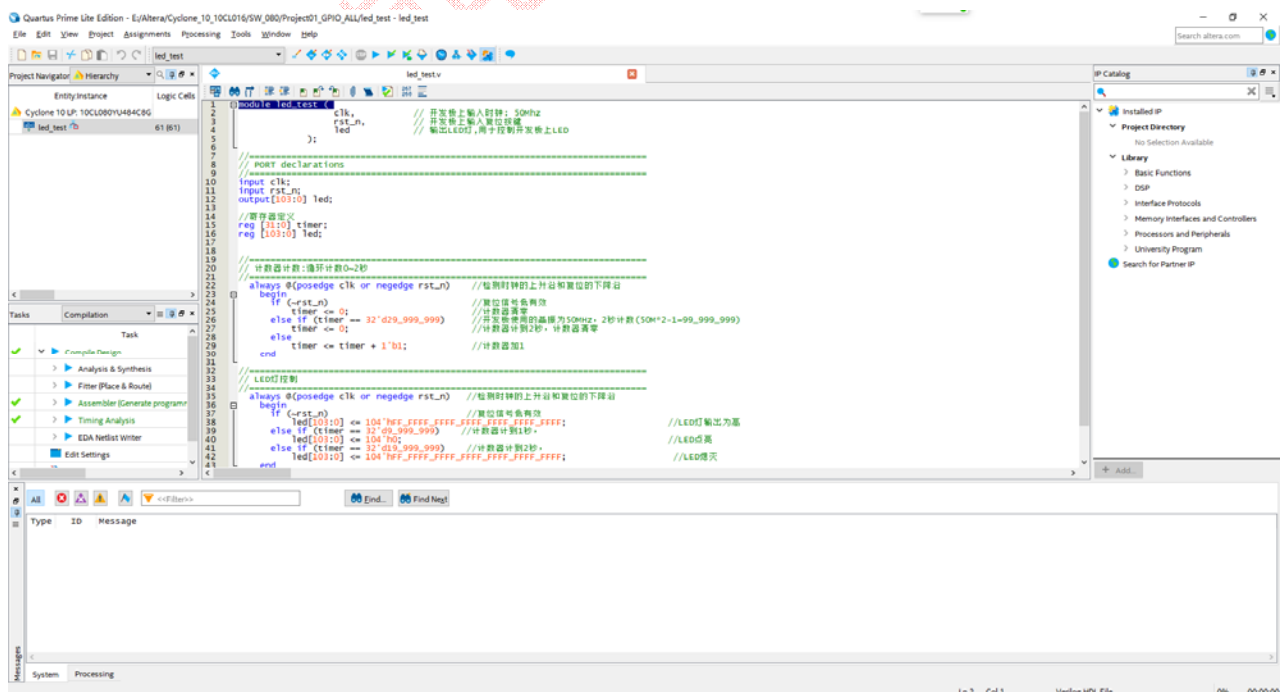

Figure 2-1. QMTECH Cyclone10 Starter Kit Dimension

To develop the 10CL080YU484C8G Starter Kit, users need to prepare the Quartus II 18.1, Altera USB Blaster cable, the Starter Kit and 5V DC power supply. Below image shows the Altera Quartus II 18.1 development environment which could be downloaded from Altera office website:

2.2 QMTECH Cyclone10 Hardware Design

2.2.1 Power Supply

The Starter Kit needs 5V DC input as power supply which could be directly injected from power header. Users may refer to the hardware schematic for the detailed design. The on board LED D7 indicates the 3.3V supply status, it will be turned on when the 5V power supply is active. In default status, all the FPGA banks IO power level is 3.3V because all the banks' power supply is 3.3V.
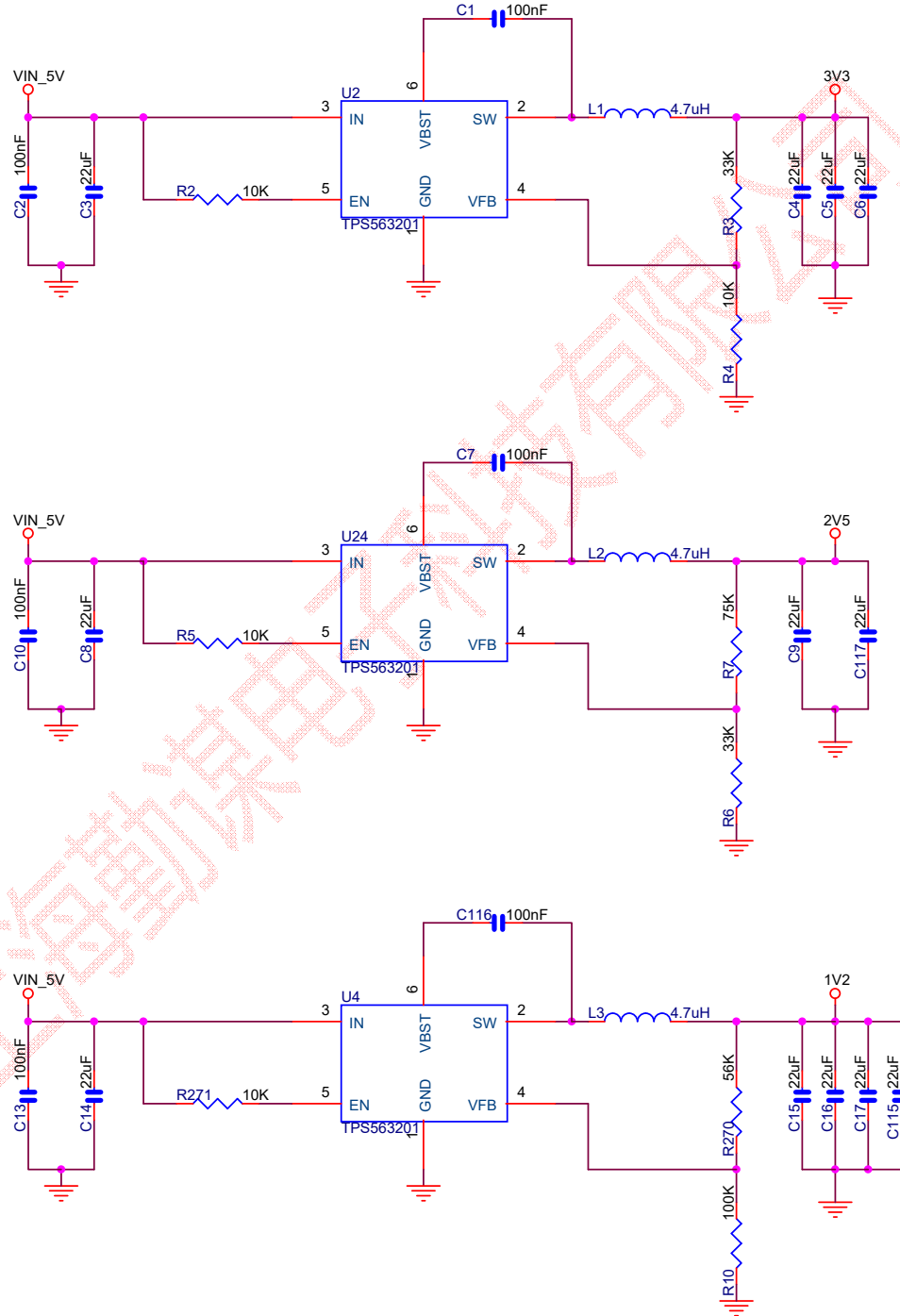

Figure 2-2. Power Supply for the FPGA

2.2.2 SDRAM Memory

QMTECH Cyclone10 Starter Kit has on board 16bit width data bus, 32MB memory size W9825G6KH-6 SDRAM provided by Winbond. Below image shows the detailed hardware design:
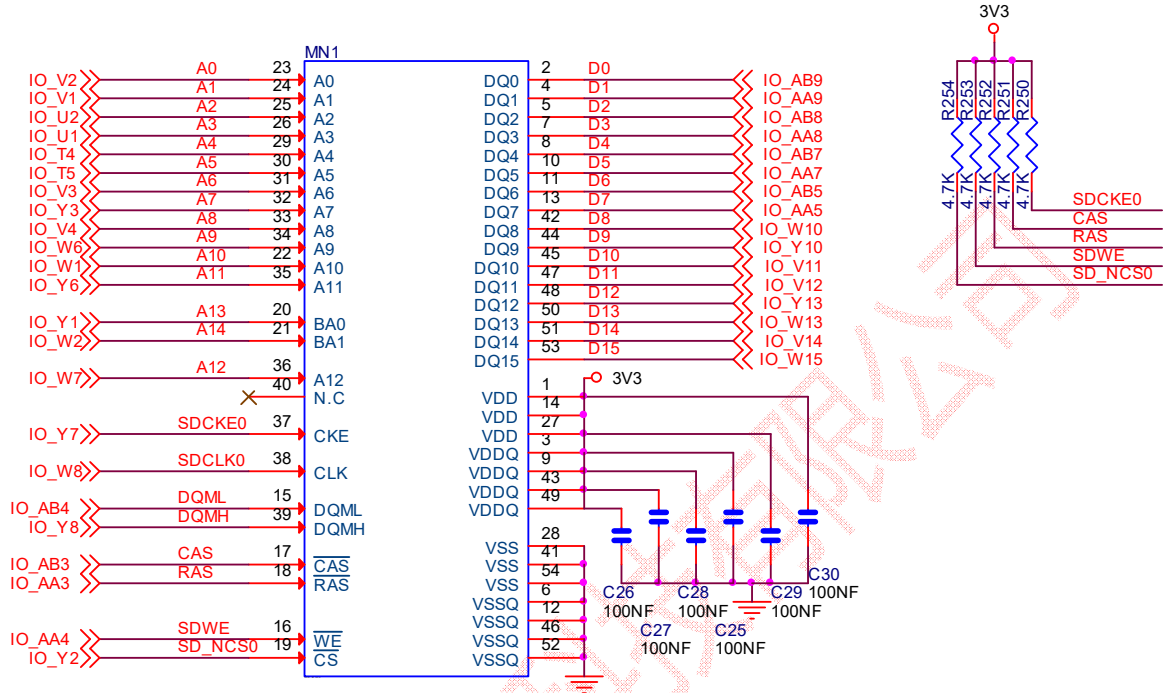

Figure 2-3. SDRAM

2.2.3 SPI Boot

QMTECH Cyclone10 Starter Kit boots from external SPI Flash, detailed hardware design is shown in below figure. The SPI flash is using W25Q128 manufactured by Winbond, with 128Mbit memory storage.

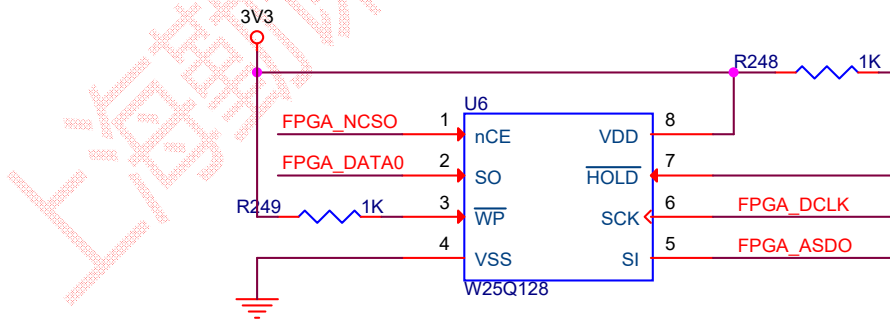Note: The SPI Flash is designed with x1 mode.

Figure 2-4. SPI Flash

Below image shows the boot pin configurations. MSEL[3:0] = 0010: AS x 1 **OR** MSEL[3:0] = 0000: PS.
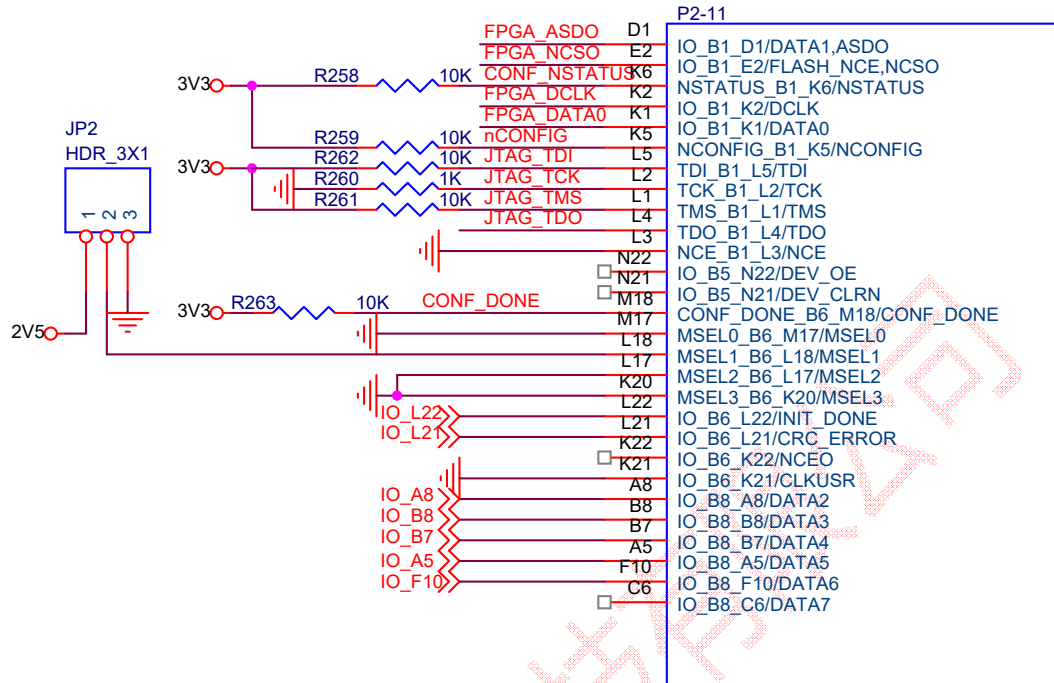

Figure 2-5. MSEL Settings

2.2.4 System Clock

QMTECH Cyclone10 Starter Kit has system clock frequency 50MHz which is directly provided by external crystal. The crystal is designed with high accuracy and stability with low temperature drift 10ppm/°c. Below image shows the detailed hardware design:
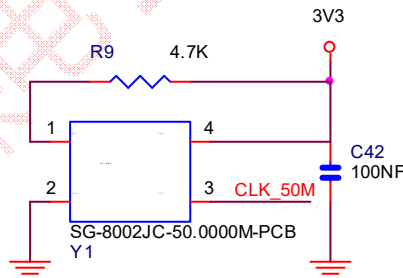

Figure 2-6. 50MHz System Clock

2.2.5 JTAG Port

The on board JTAG port uses 10P 2.54mm pitch header which could be easily connected to Altera USB blaster cable. Below image shows the hardware design of the JTAG port:
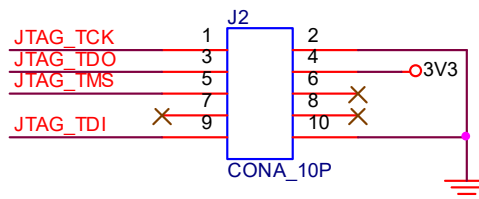

Figure 2-7. JTAG Port

2.2.6   User LEDs

Below image shows 6 user LEDs and one 3.3V power supply indicator LED:
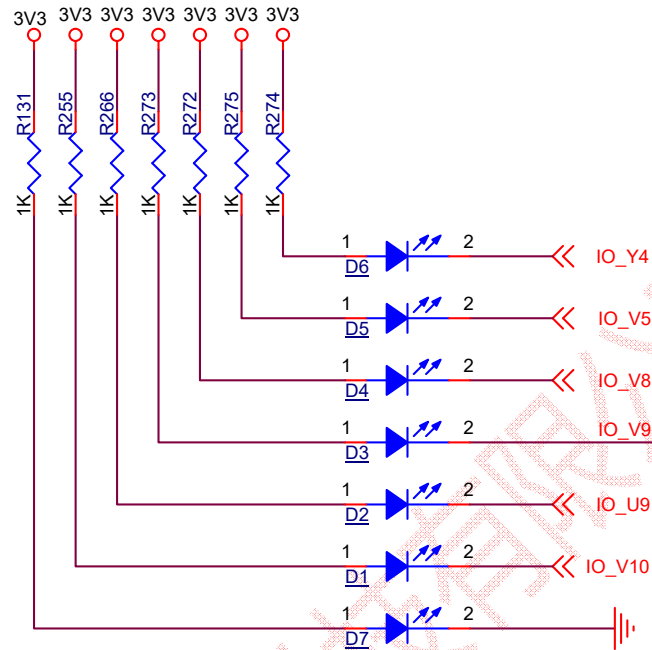

Figure 2-8. User LEDs

2.2.7   USB to Serial Port

The Starter Kit uses WCH CH340N chip to perform USB to Serial interface. This device includes a USB 2.0 full-speed function controller, USB transceiver, oscillator, and Universal Asynchronous Receiver Transmitter (UART). The maximum data transfer rates up to 2Mbps. Below image shows detailed design.
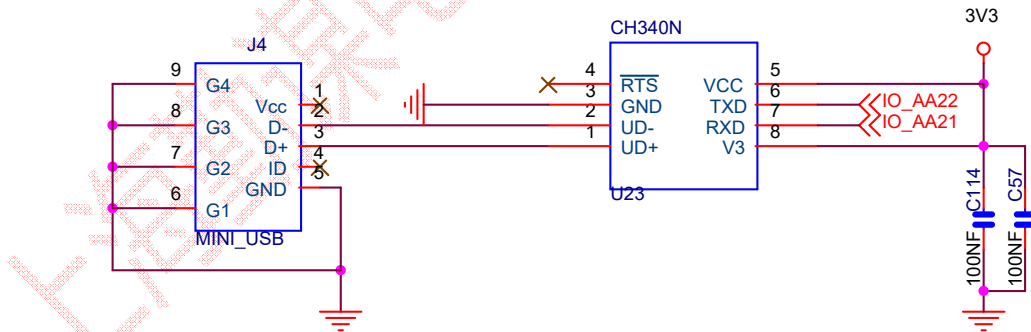

Figure 2-9. USB to UART

2.2.8 7-SEG LEDs

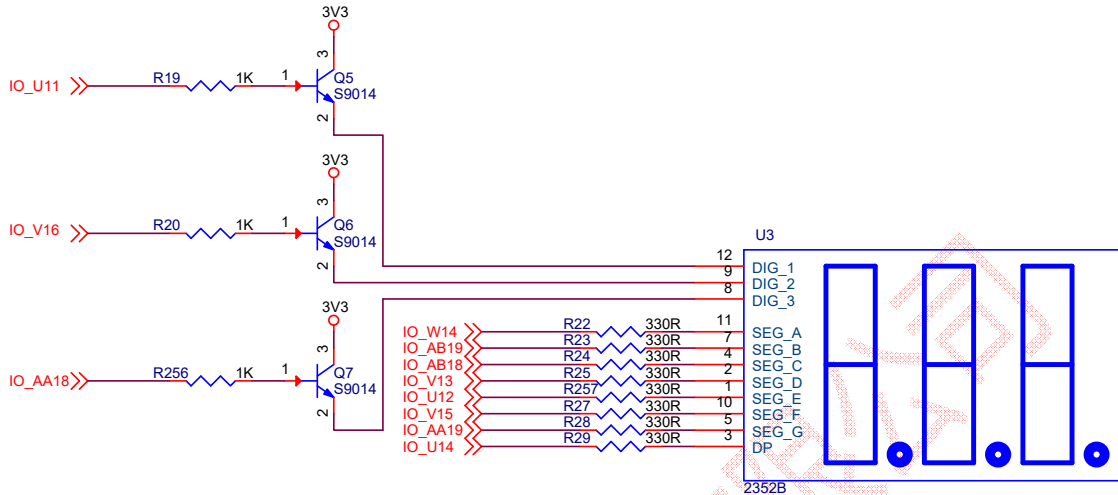Below image shows the circuit design for the 7-SEG LEDs.

Figure 2-10. 7-SEG LEDs

2.2.9 HDMI Display Interface

Below image shows the circuit design for the HDMI display interface. It uses TI's TPD12S016 chip, which is a single-chip High Definition Multimedia Interface (HDMI) device with auto-direction sensing I2C voltage level shift buffers, a load switch, and integrated low capacitance high-speed electrostatic discharge (ESD) transient voltage suppression (TVS) protection diodes.

Transition Minimized Differential Signaling (TMDS) is used for transmitting video data over the High-Definition Multimedia Interface (HDMI).
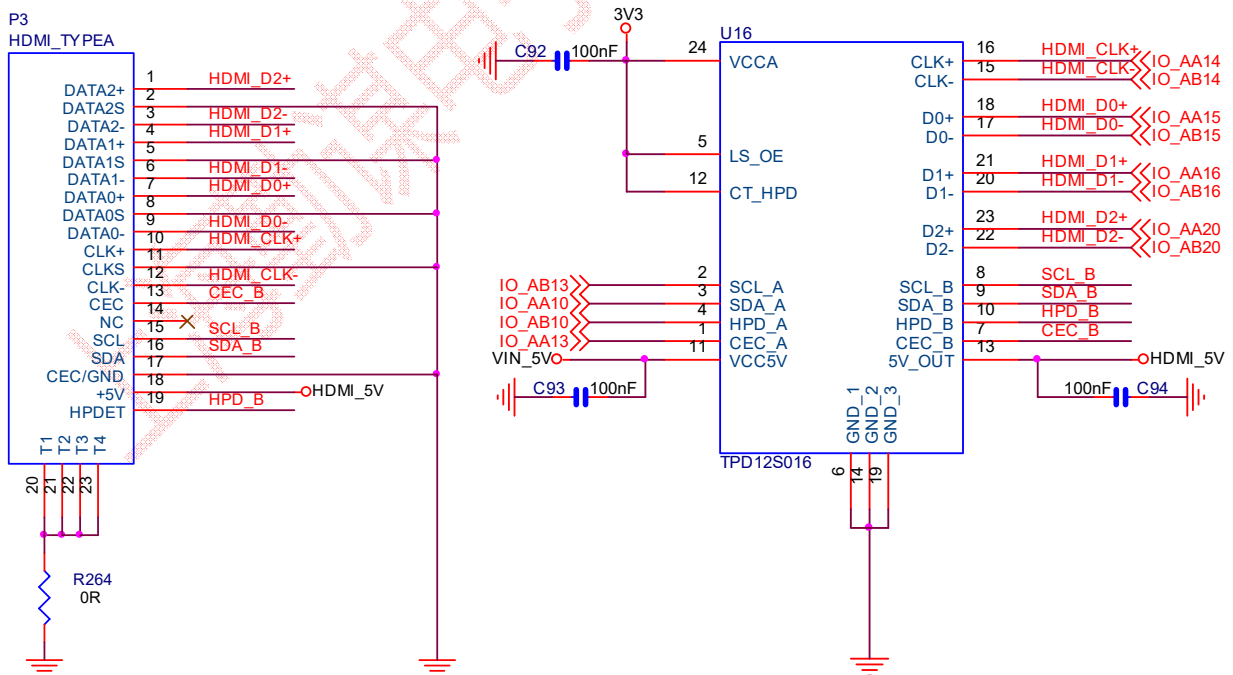

Figure 2-11. HDMI Display Interface

2.2.10 GMII Ethernet Interface

Below image shows the hardware design for the GMII interface by using Realtek's RTL8211EG chip. This device is highly integrated ethernet transceivers that comply with 10/100/1000 Base-Tx IEEE802.3 standards.
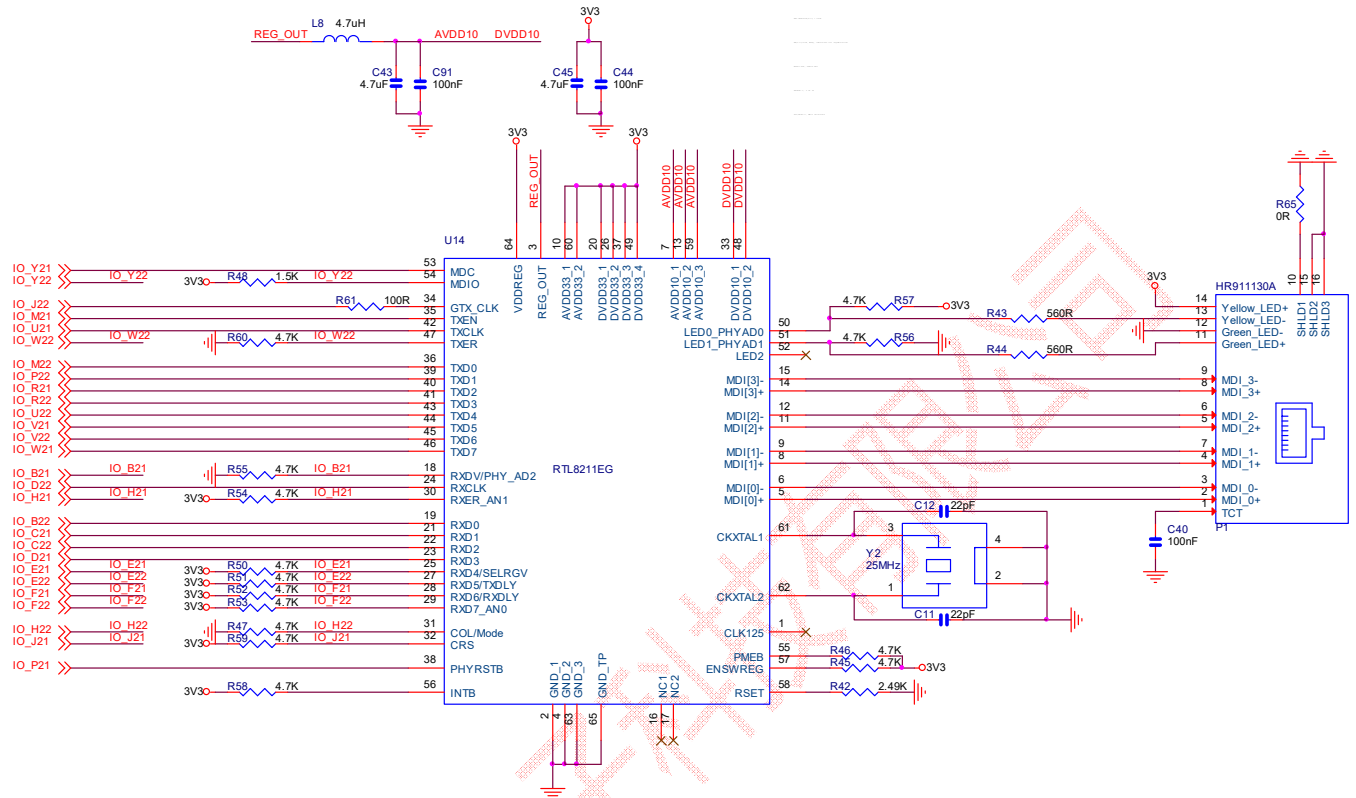

Figure 2-12.   GMII Ethernet Interface

2.2.11 User Keys

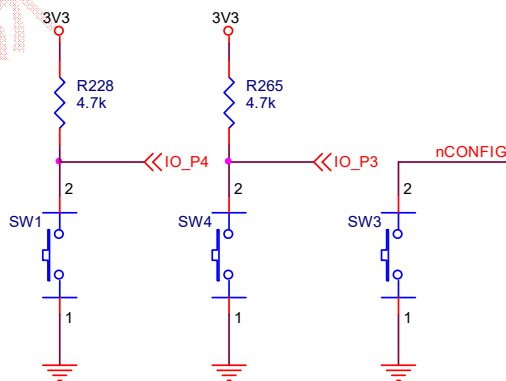Below image shows the nCONFIG key and two other user keys:

Figure 2-13.   User Keys

2.2.12 Extension IO

The Starter Kit has two 40P 2.54mm pitch male headers which could be used for extending user modules, such as ADC/DAC module, audio/video module, ethernet module, etc.
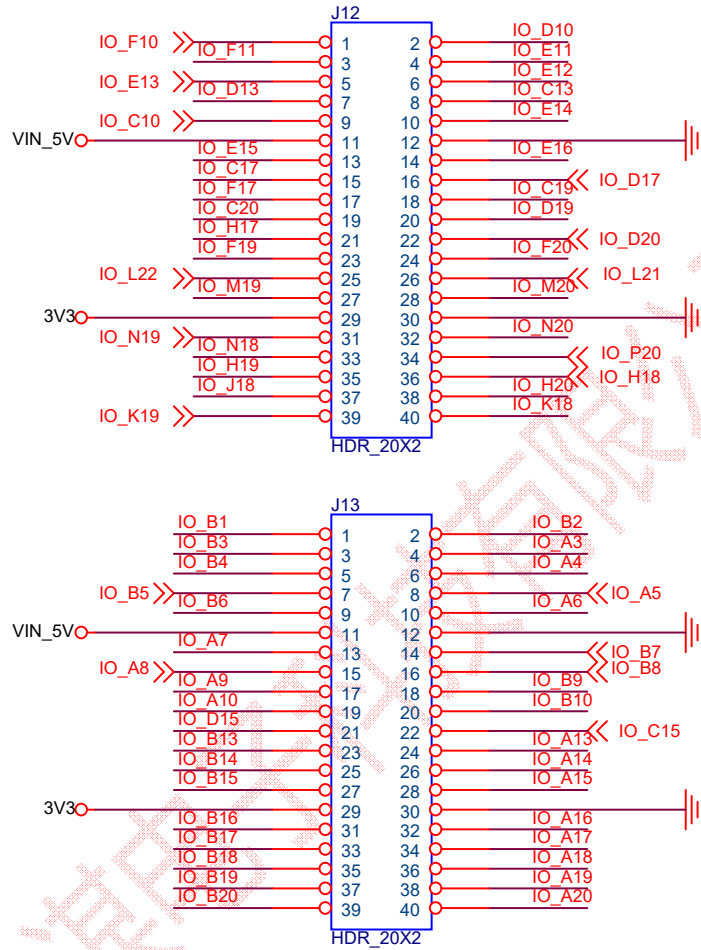

Figure 2-14. Extension IO

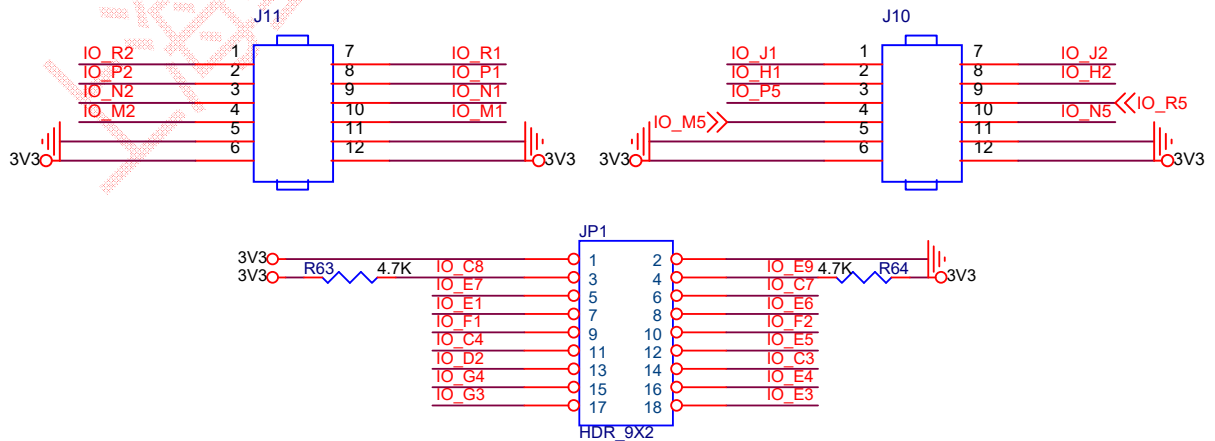The Starter Kit has 2 x PMOD compatible connectors and one camera interface.

Figure 2-15. PMOD Interface and Camera Interface

2.2.13 TF Card Slot

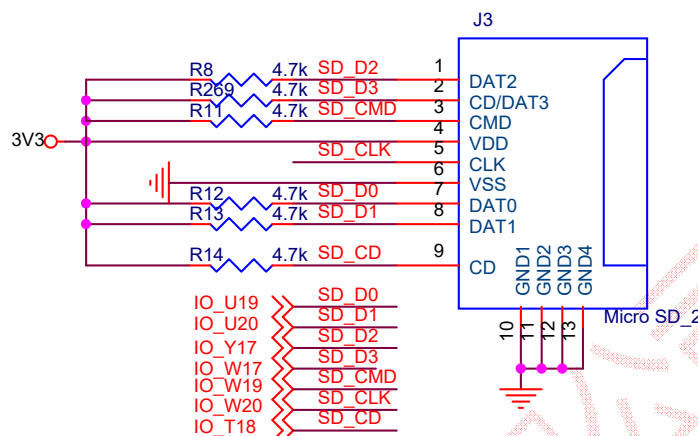The Starter Kit provides one TF card slot. Users may use it to store useful data.

Figure 2-16. TF Card Slot

3. Reference

[1] QMTECH-Cyclone10-Starter-Kit-V03.pdf
[2] c10lp-51002.pdf
[3] c10lp-51003.pdf
[4] pcg-01021.pdf
[5] cyclone-10-lp-product-table.pdf
[6] an800.pdf
[7] aib-01029.pdf

4.   Revision

Doc. Rev.	Date	Comments
0.1	10/07/2019	Initial Version.
1.0	15/07/2019	V1.0 Formal Release.
2.0	17/01/2021	Hardware upgraded to V2.0.
3.0	26/03/2024	Hardware upgraded to V3.0.