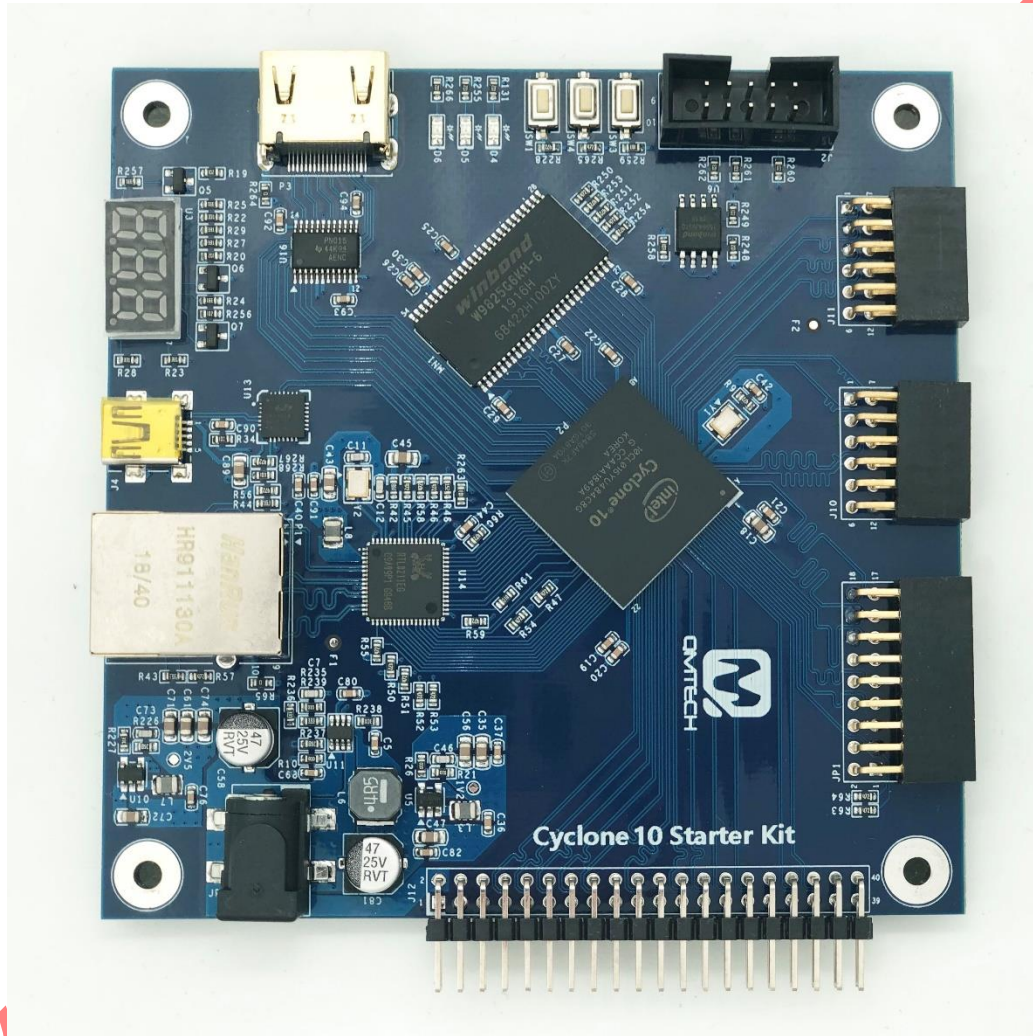


# QMTECH CYCLONE10 STARTER KIT

## USER MANUAL



### Preface

The QMTECH® Cyclone10 Starter Kit uses Intel® (Altera) 10CL016 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 Intel® 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 Intel® Cyclone® 10 LP FPGA enables you to design in a smaller, lower cost device, lowering your total system costs.



QMTECH

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# 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 Intel Quartus II 18.1. Users may employ the on-board rich logic resource FPGA 10CL016YU484C8G and large SDRAM memory W9825G6KH to implement various applications. The Starter Kit also has many non-multiplexed FPGA I/Os 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: 10CL016YU484C8G;
- On-Board FPGA external crystal frequency: 50MHz;
- 10CL016YU484C8G has rich block RAM resource;
- 10CL016YU484C8G has 16K Logic elements;
- On-Board N25Q064 SPI Flash, 8M bytes for user configuration code;
- On-Board 32MB Winbond SDRAM, W9825G6KH-6;
- On-Board 3.3V power supply for FPGA by using MP2315 wide input range DC/DC;
- QMTECH Cyclone10 Starter Kit provides camera interface, 2xPMOD headers and 40P Male header for User I/Os;
- QMTECH Cyclone10 Starter Kit provides 3 user switches;
- QMTECH Cyclone10 Starter Kit provides 3 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 CP2102N;
- QMTECH Cyclone10 Starter Kit provides HDMI display interface;
- QMTECH Cyclone10 Starter Kit PCB size is: 9.96cm x 9.96cm;
- Default power source for Starter Kit is: 1A@5V DC, the DC header type: DC-050, 5.5mmx2.1mm;

## 1.3 Kit Top View



Figure 1-1. QMTECH Cyclone10 Starter Kit Top 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).

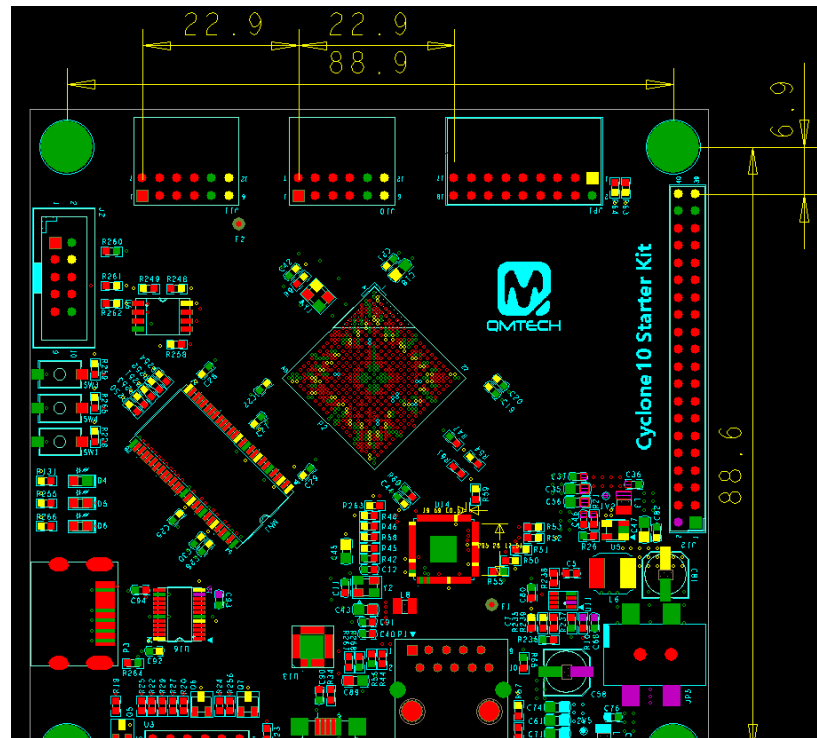
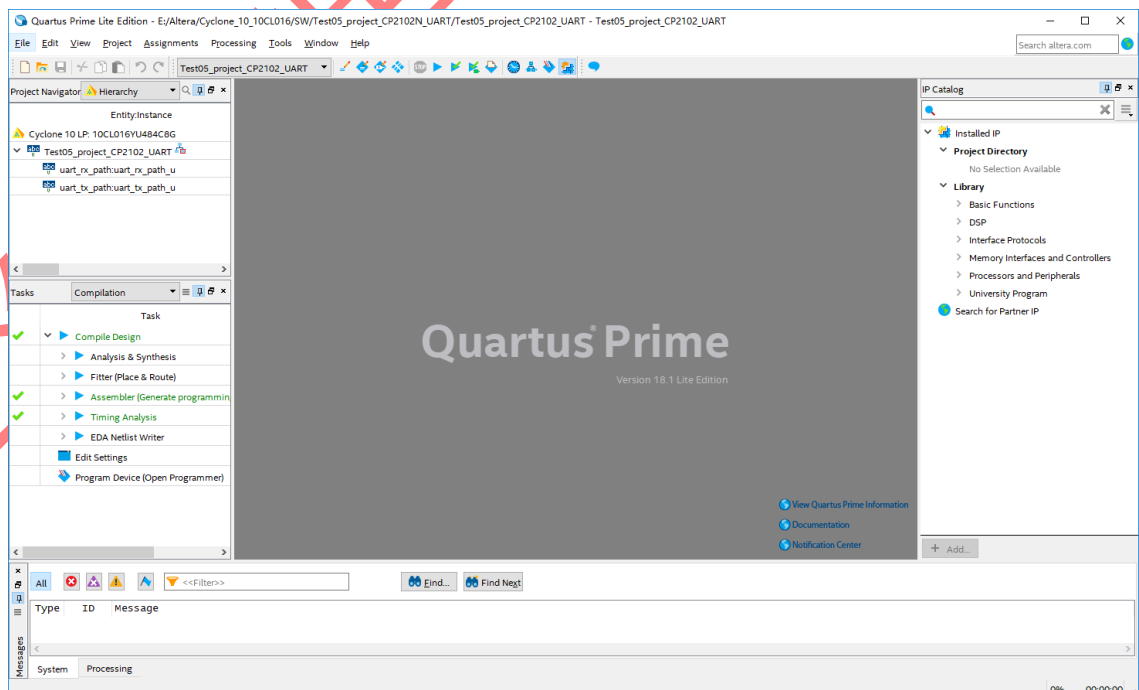


Figure 2-1. QMTECH Cyclone10 Starter Kit Dimension

The QMTECH Cyclone10 Starter Kit toolchain consists of Intel Quartus II 18.1, Intel USB Blaster cable, 10CL016YU484C8G Starter Kit and 5V DC power supply. Below image shows the Intel Quartus II 18.1 development environment which could be downloaded from [Intel office website](https://www.intel.com/content/www/us/en/programmable/development-software/quartus-prime.html):



## 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 D4 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.

Note: FPGA core supply 1.2V is regulated by On-Semi DC/DC chip NCP1529 which could output maximum 1A current. The board's 3.3V power supply is using high efficiency DC/DC chip MP2315 provided by MPS Inc. The MP2315 supports wide voltage input range from 4.5V to 24V.

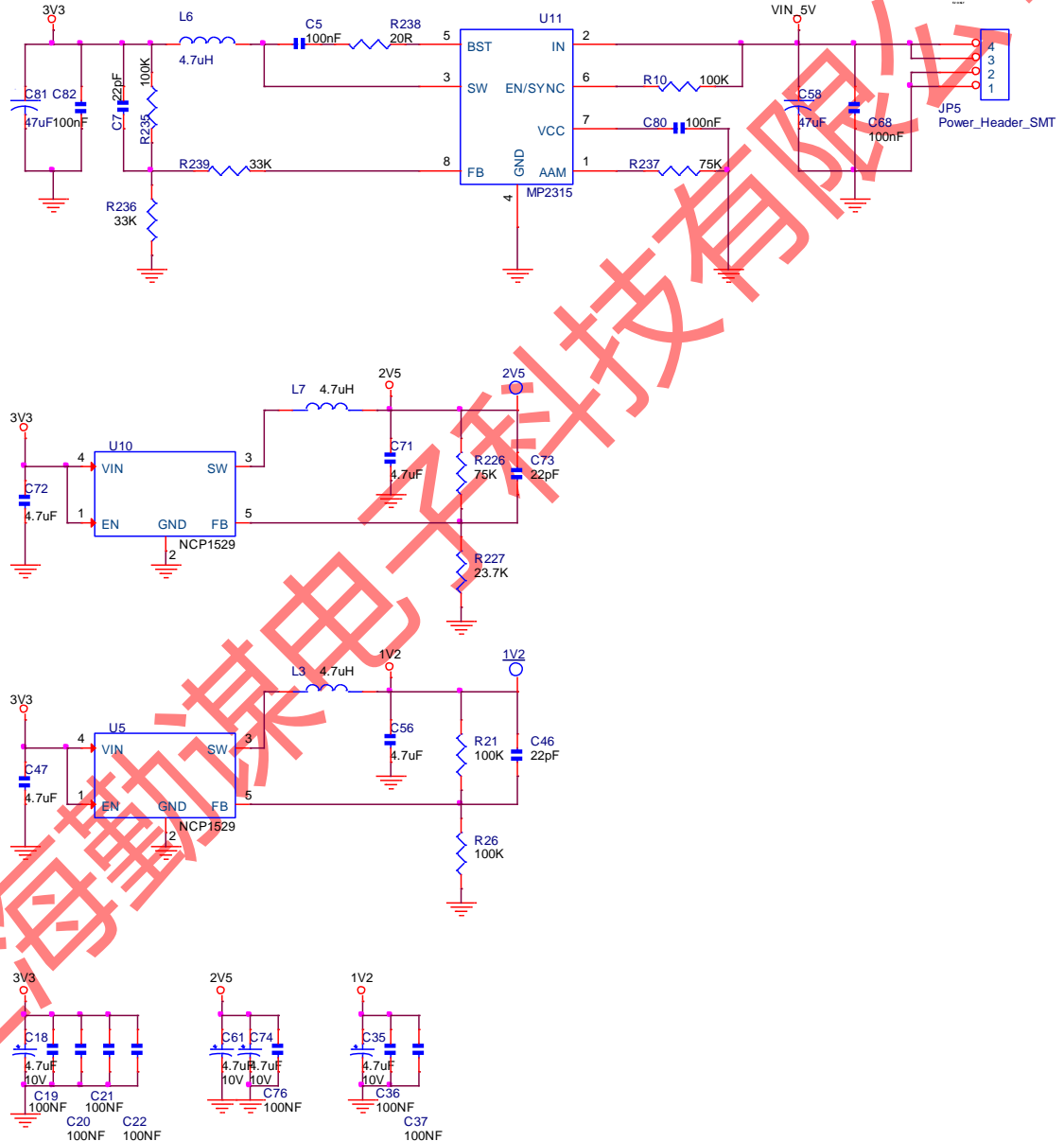


Figure 2-2. Power Supply for the FPGA

### 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:

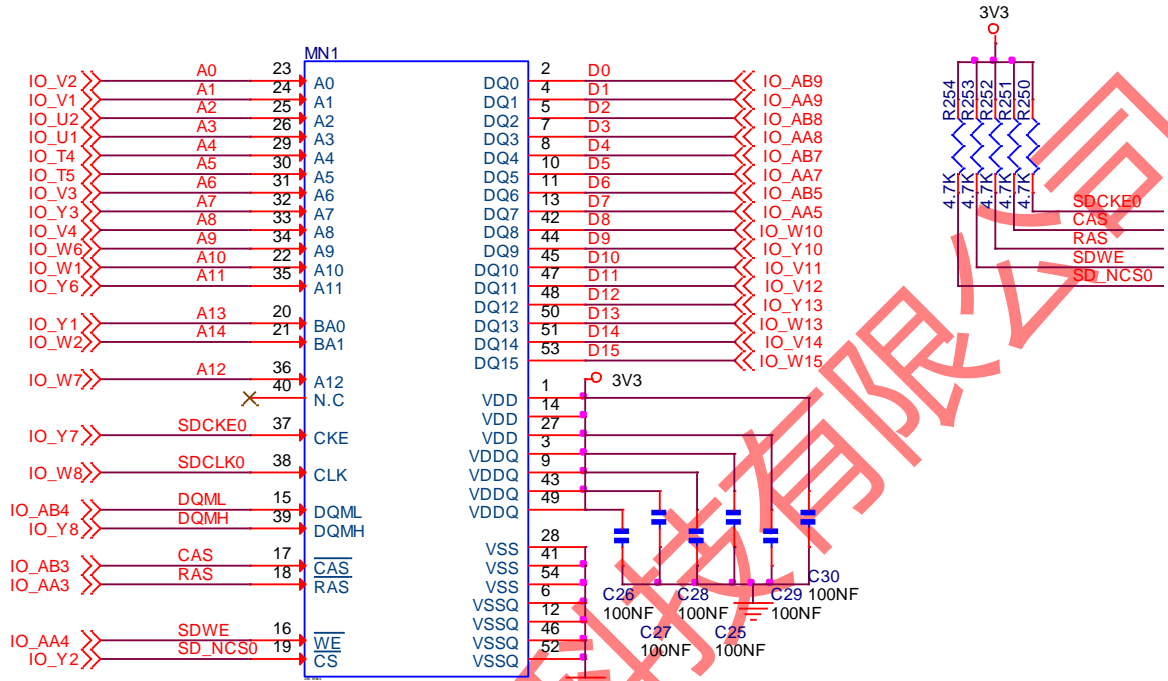


Figure 2-3. SDRAM

### 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 W25Q64 manufactured by Winbond, with 64Mbit memory storage.

Note: The SPI Flash is designed with x1 mode.

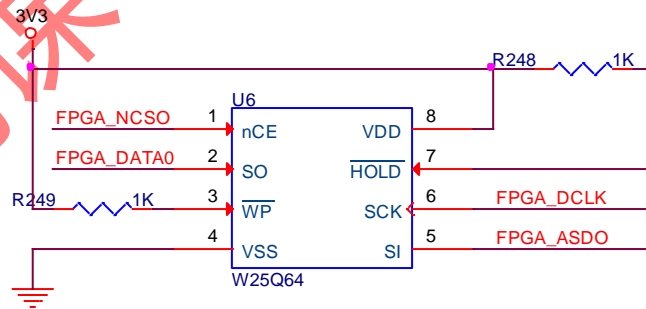


Figure 2-4. SPI Flash

Below image shows the hardware configuration of MSEL[2:0]=101: AS x 1; Fast POR, 3.3V IO:



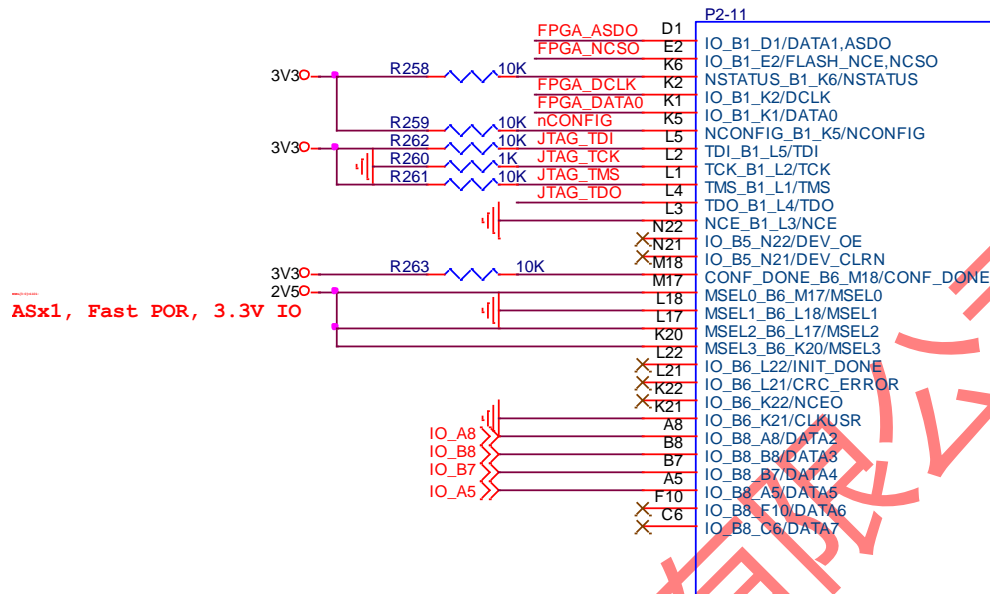


Figure 2-5. MSEL Settings

## 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:

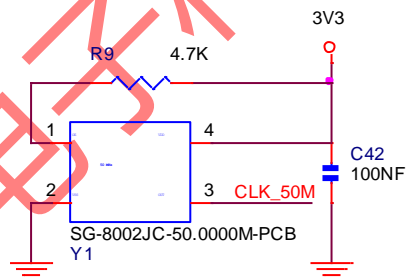


Figure 2-6. 50MHz System Clock

## 2.2.5 JTAG Port

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

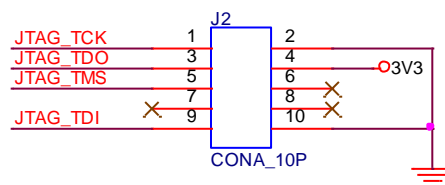


Figure 2-7. JTAG Port

### 2.2.6 User LEDs

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

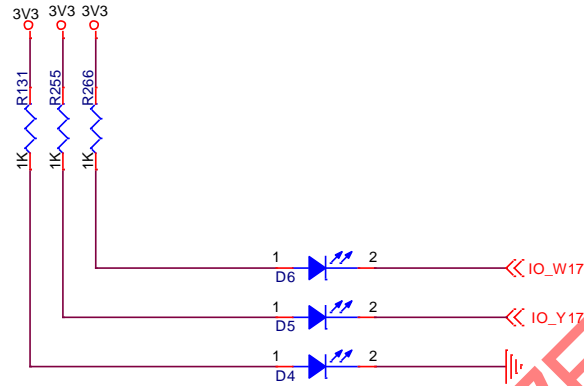


Figure 2-8. User LEDs

### 2.2.7 USB to Serial Port

The Starter Kit uses Silicon Labs CP2102N 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 3Mbps. Below image shows detailed design.

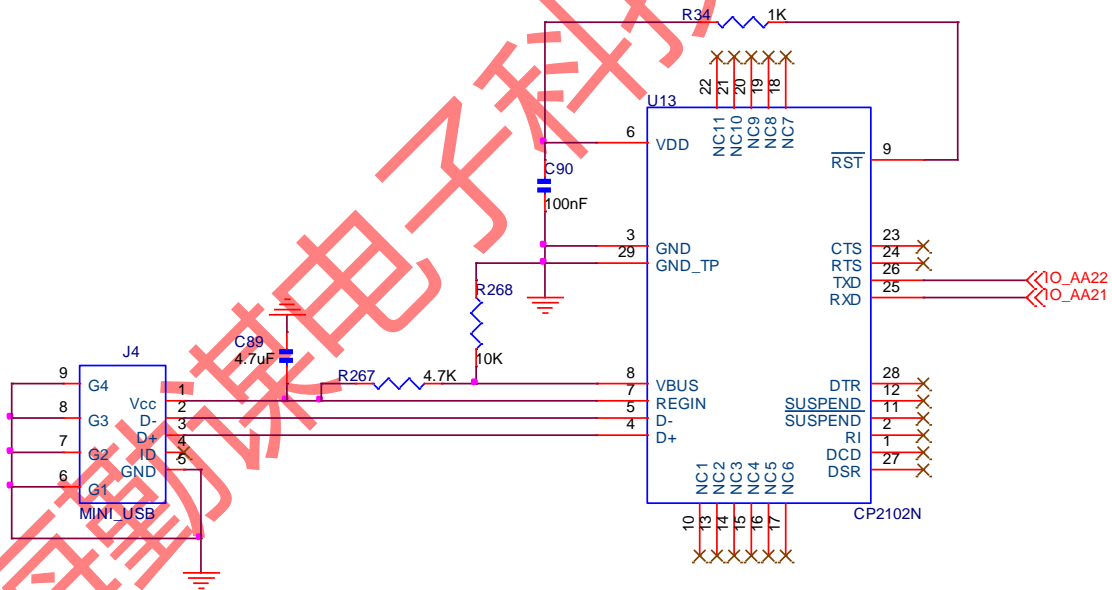


Figure 2-9. USB to UART



### 2.2.8 7-SEG LEDs

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

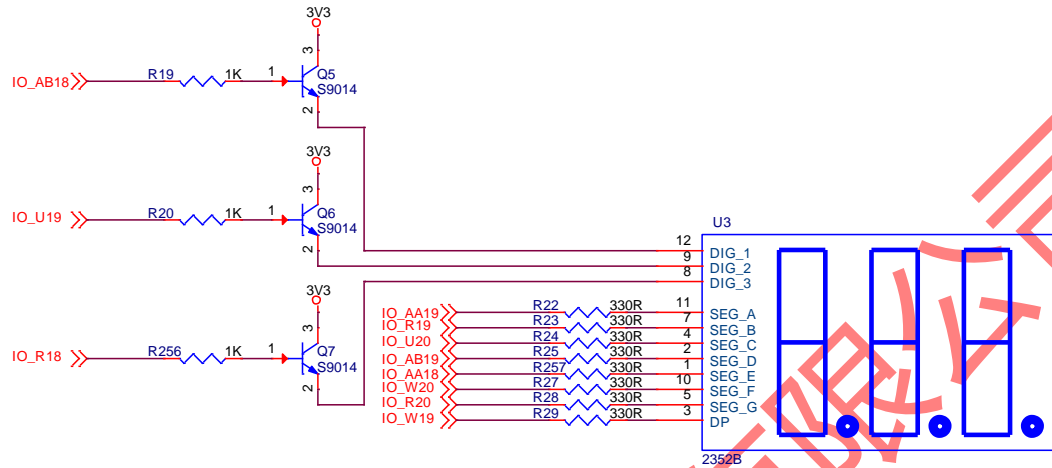


Figure 2-10. 7-SEG LEDs

### 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).

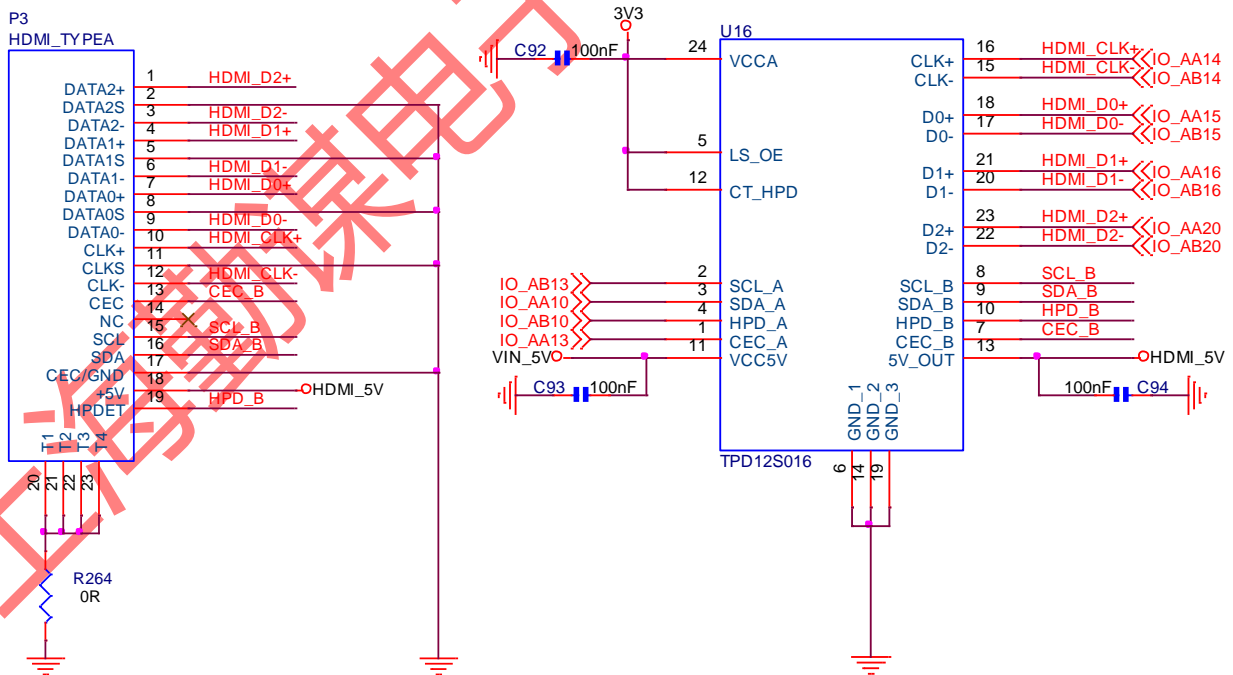


Figure 2-11. HDMI Display Interface

### 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.

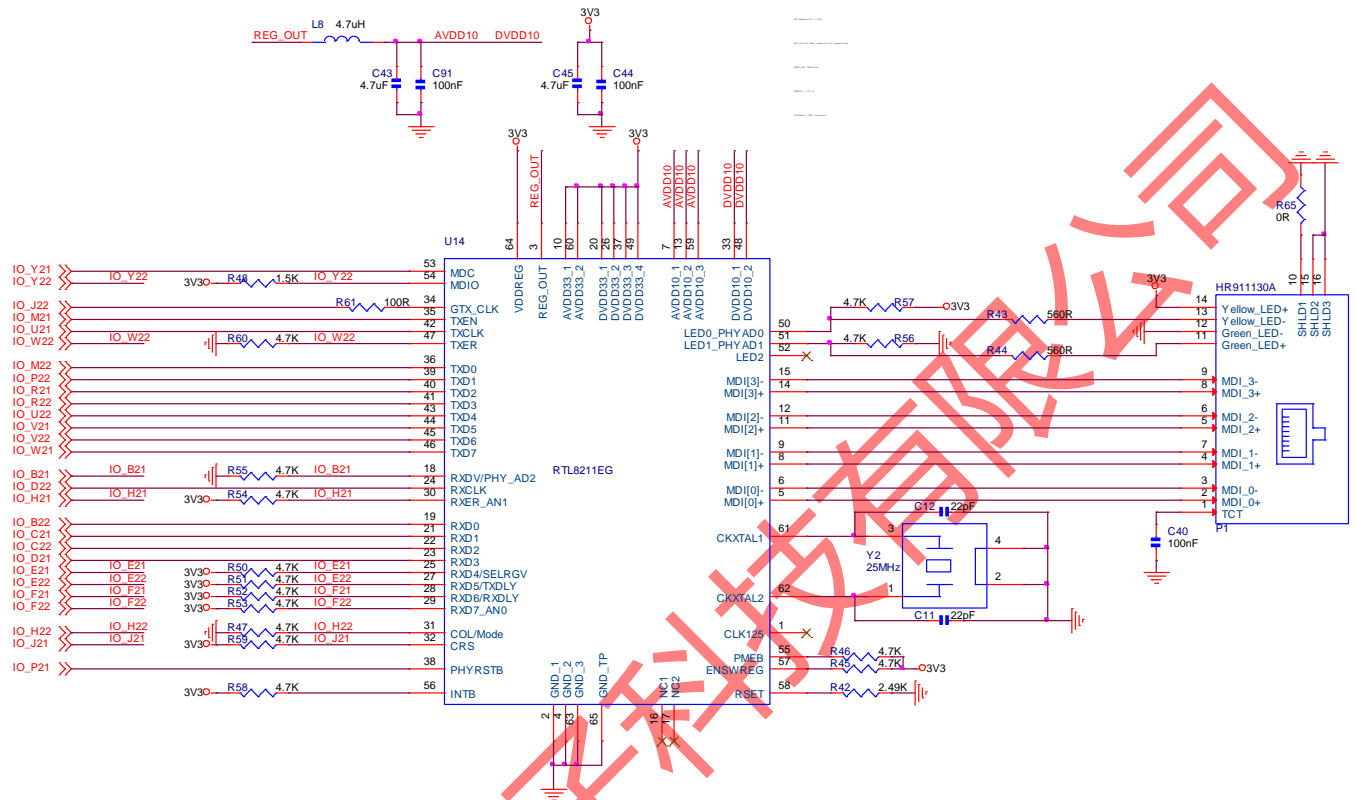


Figure 2-12. GMII Ethernet Interface

### 2.2.11 User Keys

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

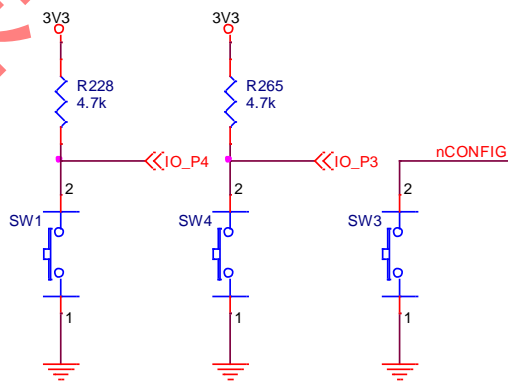


Figure 2-13. User Keys

### 2.2.12 Extension IO

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

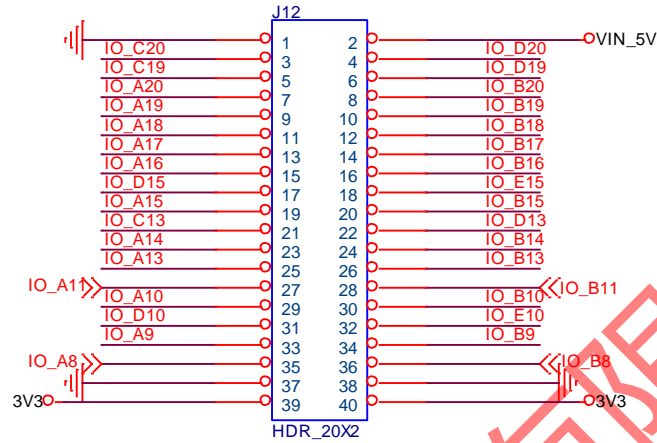


Figure 2-14. Extension IO

The Starter Kit has 2 PMOD interface and one camera interface.

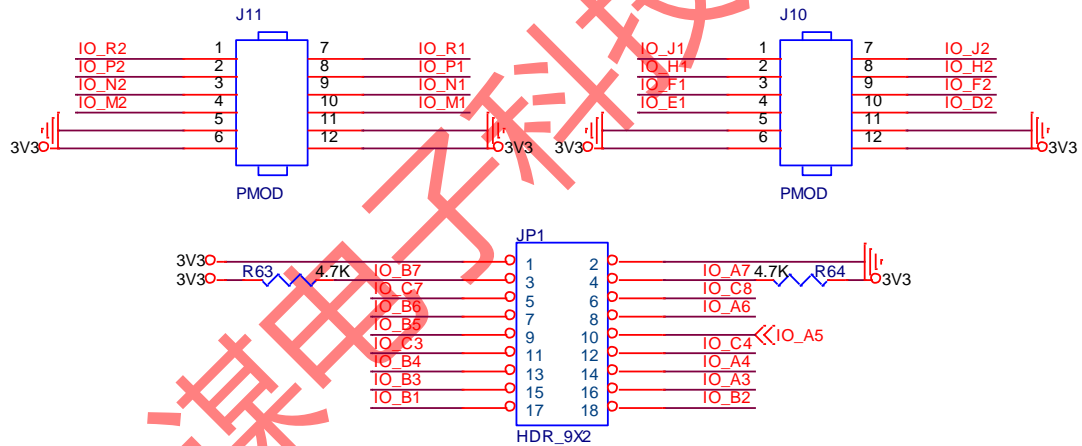


Figure 2-15. PMOD Interface and Camera Interface

### 3. Reference

- [1] hw-cyclone10-10cl016-V01.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

上海勤谋电子科技有限公司

#### 4. Revision

Doc. Rev.	Date	Comments
0.1	10/07/2019	Initial Version.
1.0	15/07/2019	V1.0 Formal Release.

上海勤谋电子科技有限公司