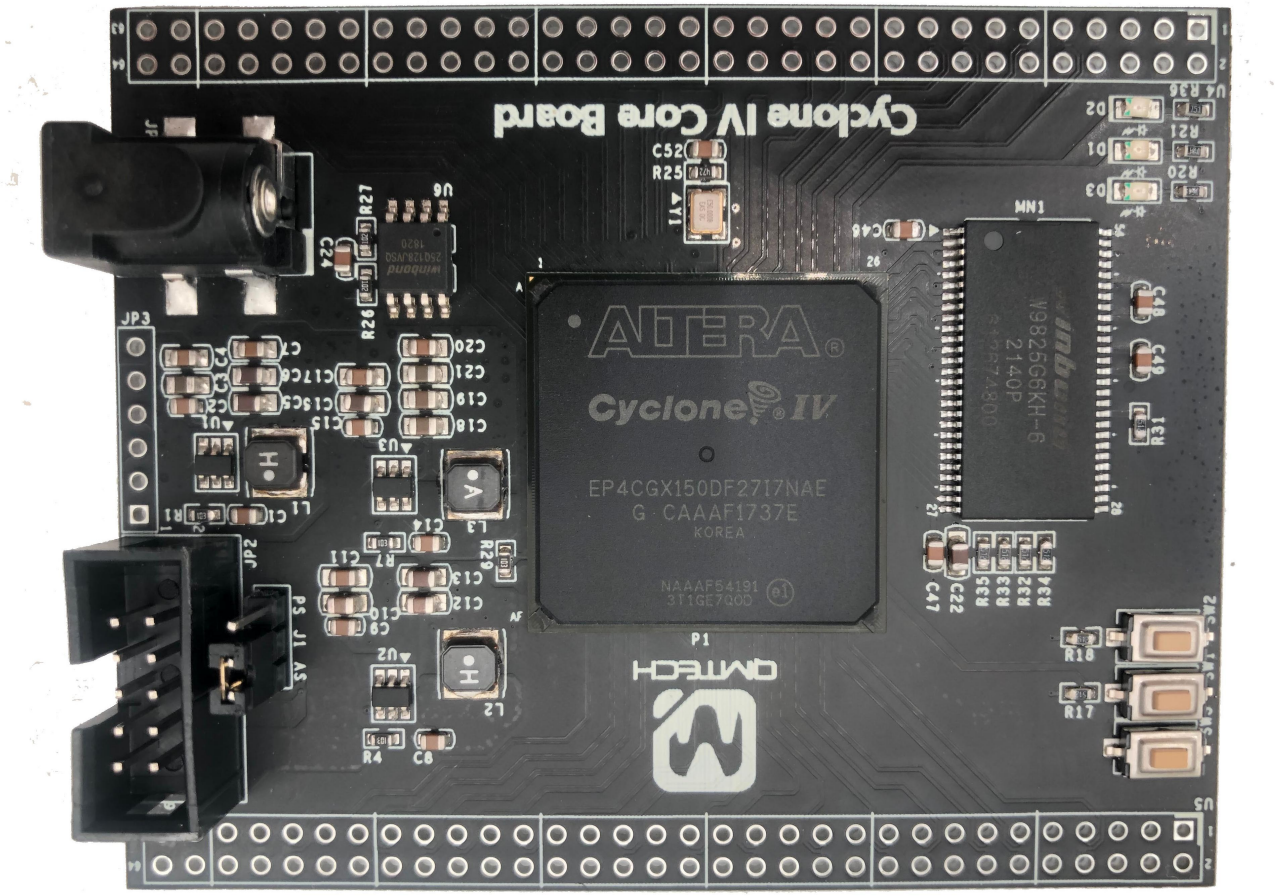
CYCLONE IV EP4CGX150 CORE BOARD

USER MANUAL



Preface

The QMTECH® Cyclone IV Core Board uses Intel(Altera) EP4CGX150 device to demonstrate Intel's leadership in offering power-efficient FPGAs. With enhanced architecture and silicon, advanced semiconductor process technology, and power management tools, power consumption for Cyclone IV FPGAs has been reduced by up to 25 percent compared to Cyclone® III FPGAs. The result is the lowest power consumption of any comparable FPGA.

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1. Introduction

1.1 Document Scope

This demo user manual introduces the Cyclone IV EP4CGX150 core board and describes how to setup the core board running with application software Altera Quartus II 15.1. Users may employee the on board rich logic resource FPGA EP4CGX150DF27I7N and large SDRAM memory W9825G6KH-6 to implement various applications. The core board also has 108 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 Cyclone IV EP4CGX150 core board:

- On-Board FPGA: EP4CGX150F27I7N;
- On-Board FPGA external crystal frequency: 50MHz;
- EP4CGX150F27I7N has rich block RAM resource up to 6.4Mb;
- EP4CGX150F27I7N has 150K 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 is using TPS563201 wide input range DC/DC;
- EP4CGX150F27I7N core board has two 64p, 2.54mm pitch headers for extending user IOs.
- EP4CGX150F27I7N core board has 3 user switches;
- EP4CGX150F27I7N core board has 3 user LEDs;
- EP4CGX150F27I7N core board has JTAG interface, by using 10p, 2.54mm pitch header;
- EP4CGX150F27I7N core board PCB size is: 6.7cm x 8.4cm;
- Default power source for core board is: 1A@5V DC, the DC header type: DC-050, 5.5mmx2.1mm;

1.3 Kit Top View

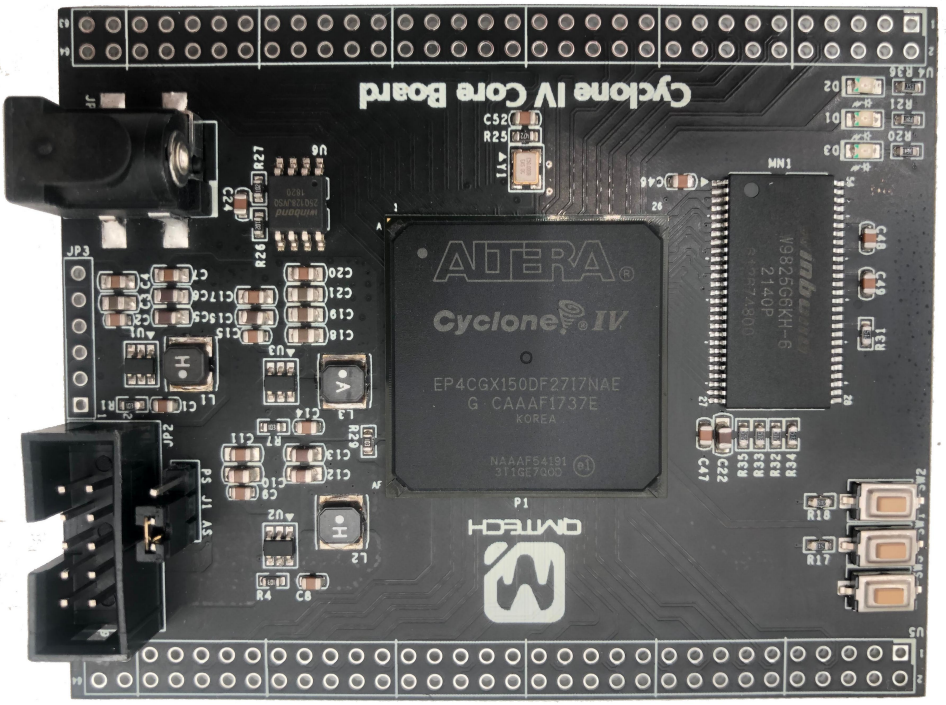


Figure 1-1. Cyclone IV EP4CGX150 Top View

2. Getting Started

Below image shows the dimension of the Cyclone IV EP4CGX150 core board: 67.1mm x 84.1mm. The unit in below image is millimeter(mm).

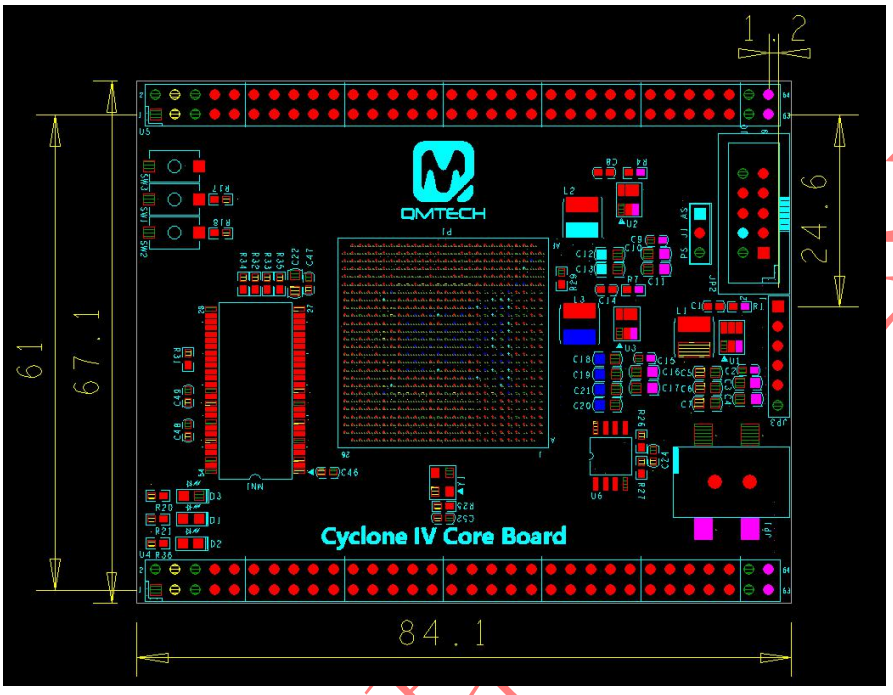
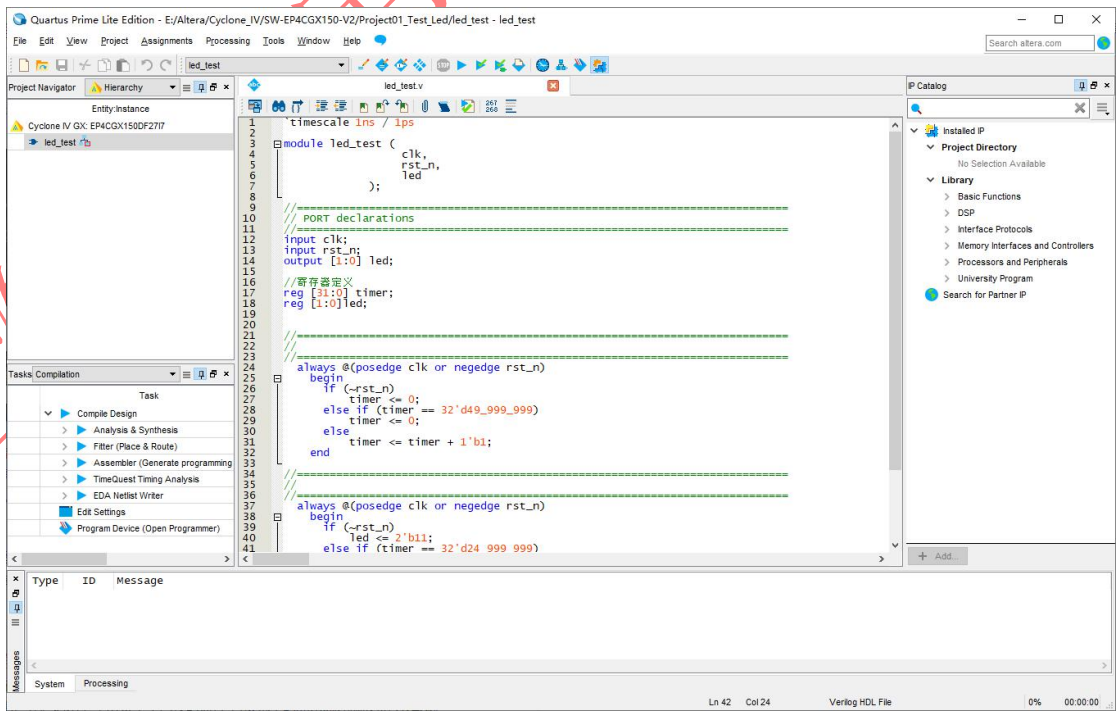


Figure 2-1. Cyclone IV EP4CGX150 Dimension

Besides the Cyclone IV EP4CGX150 core board, users need to prepare the Altera Quartus II 15.1, Altera USB Blaster cable and 5V DC power supply. Below image shows the Altera Quartus II 15.1 development environment which could be downloaded from Altera(Intel) office website:



2.2 Cyclone IV EP4CGX150 Hardware Design

2.2.1 Cyclone IV EP4CGX150 Power Supply

The core board needs 5V DC input as power supply which could be directly injected from power header or the 64P header U4/U5. Users may refer to the hardware schematic for the detailed design. The on board LED D3 indicates the 3.3V supply, 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 bank power supply is 3.3V.

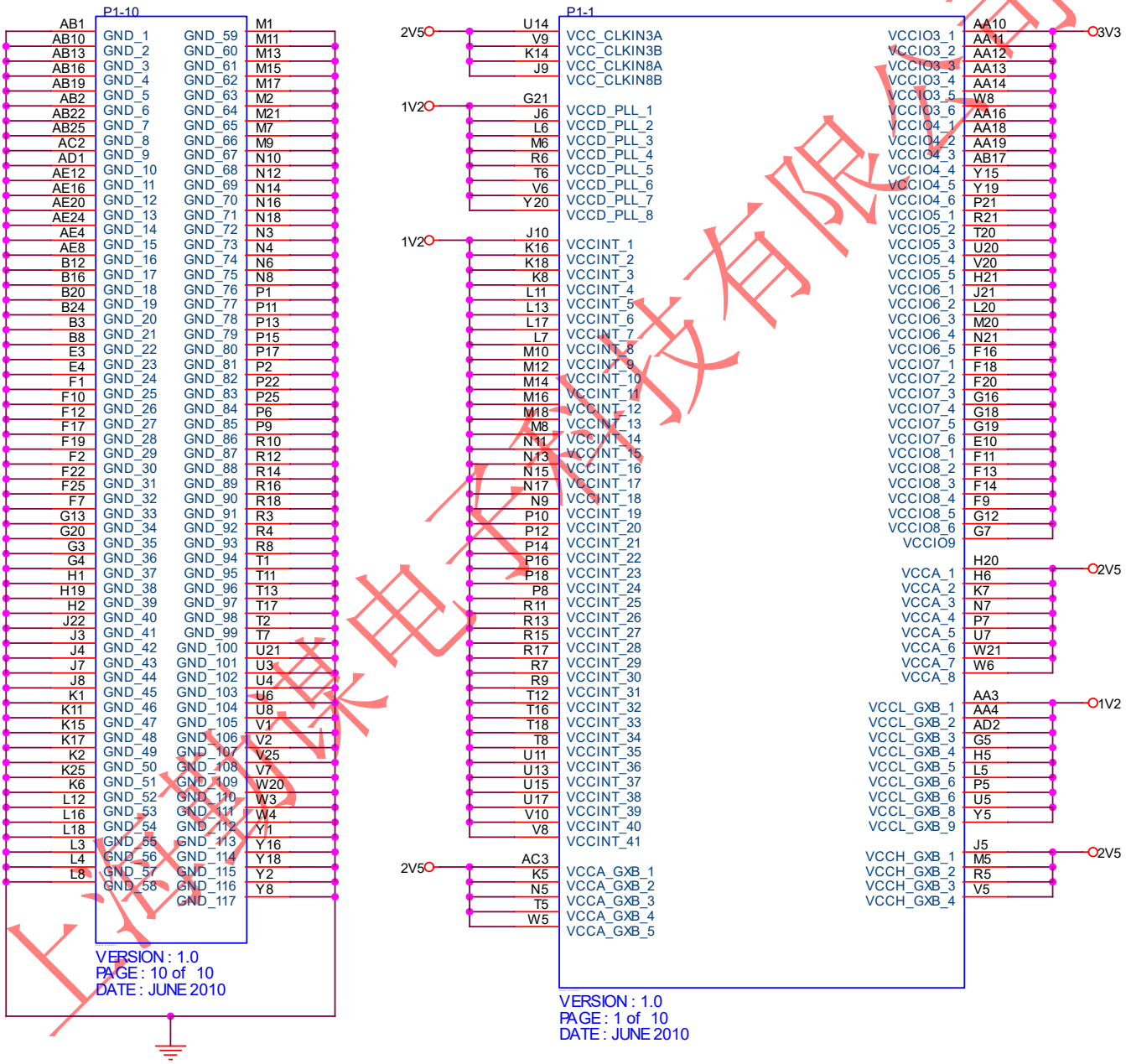


Figure 2-2. Power Supply for the FPGA

2.2.2 Cyclone IV EP4CGX150 SDRAM Memory

Cyclone IV EP4CGX150 has on board 16bit width data bus, 32MB memory size W9825G6KH-6 SDRAM provided by Winbond. Below image shows the detailed hardware design:

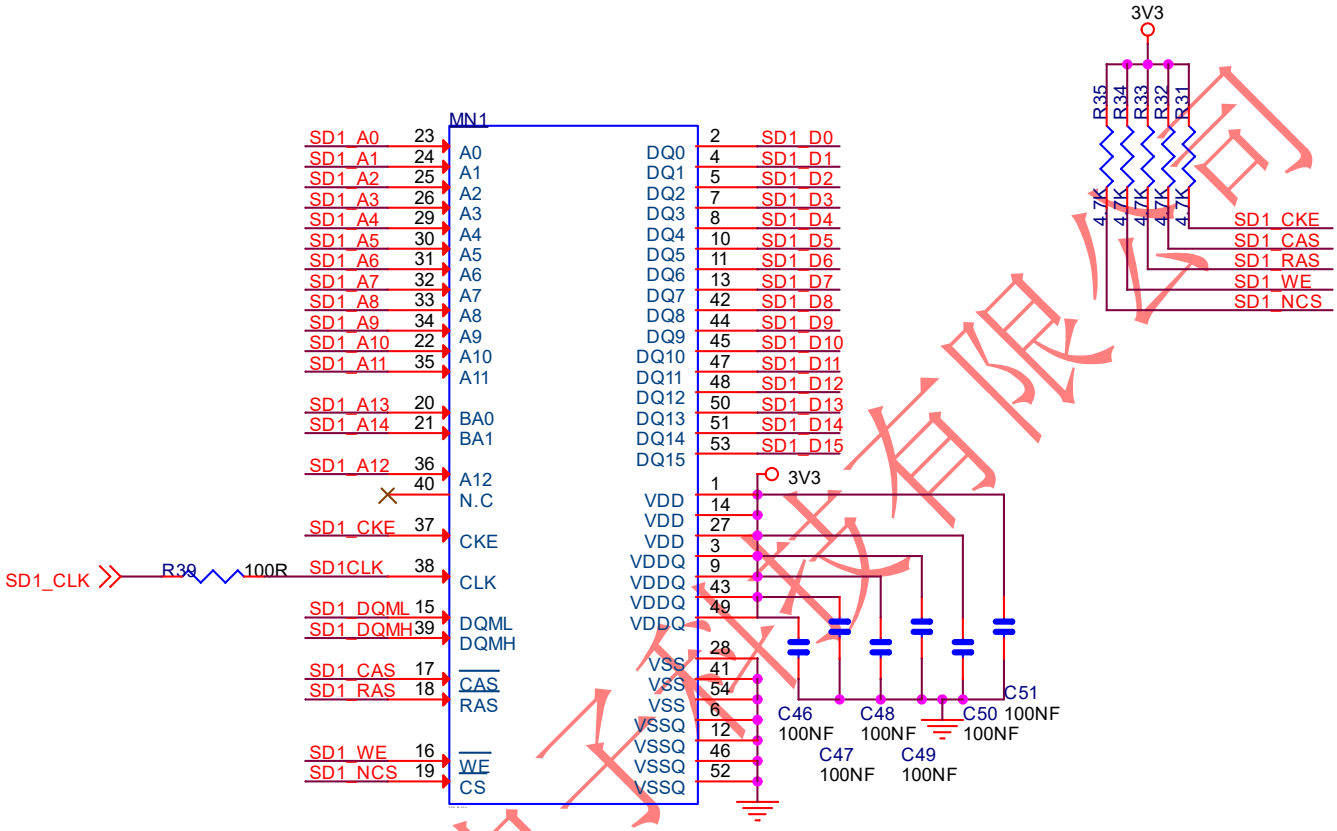


Figure 2-3. SDRAM

2.2.3 Cyclone IV EP4CGX150 SPI Boot

Cyclone IV EP4CGX150 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.

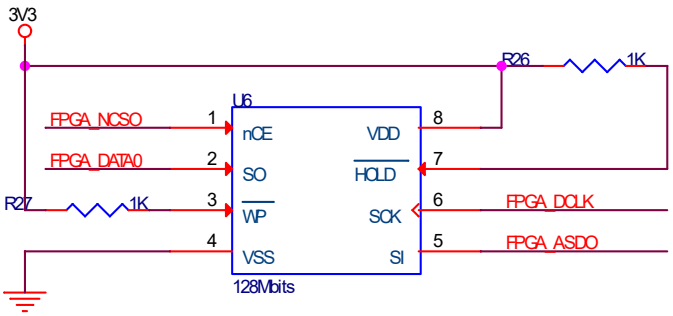


Figure 2-4. SPI Flash

Below image shows the hardware configuration of MSEL[3:0]: 001X, in which way will make the FPGA boot from Active Serial (x1 or x4) Standard Mode or PS Standard Mode:

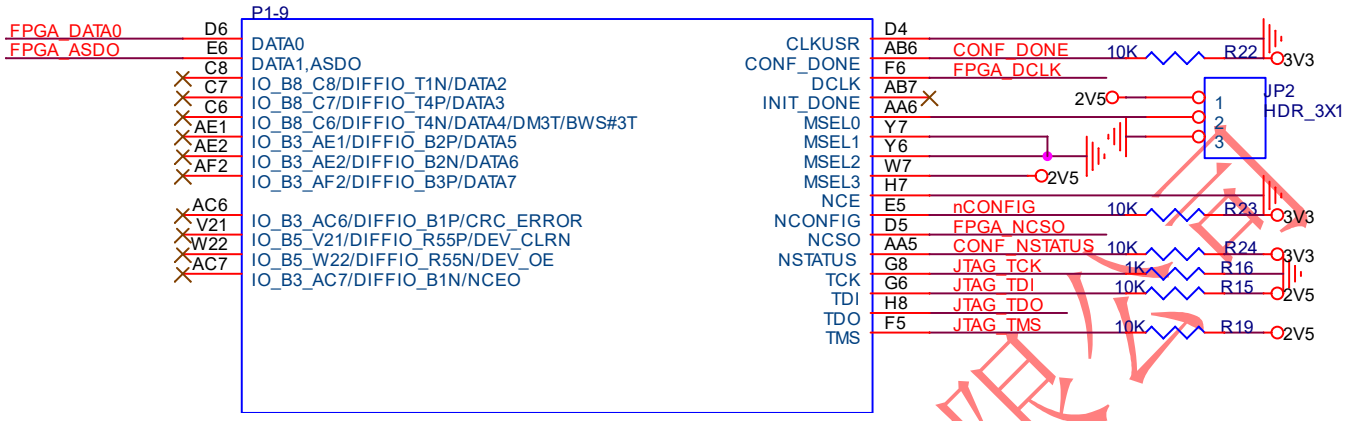


Figure 2-5. MSEL Settings

2.2.4 Cyclone IV EP4CGX150 System Clock

The Cyclone IV EP4CGX150 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:

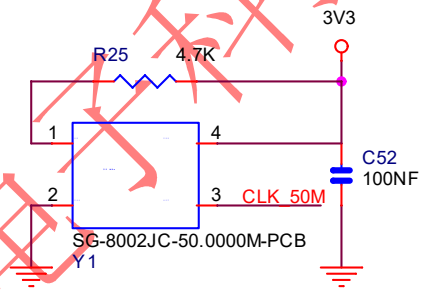


Figure 2-6. 50MHz System Clock

2.2.1 Cyclone IV EP4CGX150 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:

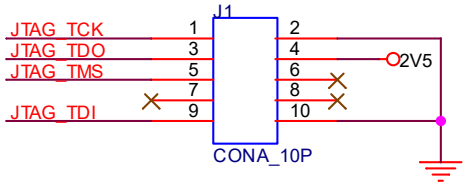


Figure 2-7. JTAG Port

2.2.2 Cyclone IV EP4CGX150 Power Supply

The core board's power supply is using high efficiency DC/DC chip TPS563201 provided by TI. The TPS563201 supports wide voltage input range from 4.5V to 17V. In normal use case, 5V DC power supply is suggested to be applied on the board. Below image shows the TPS563201 hardware design:

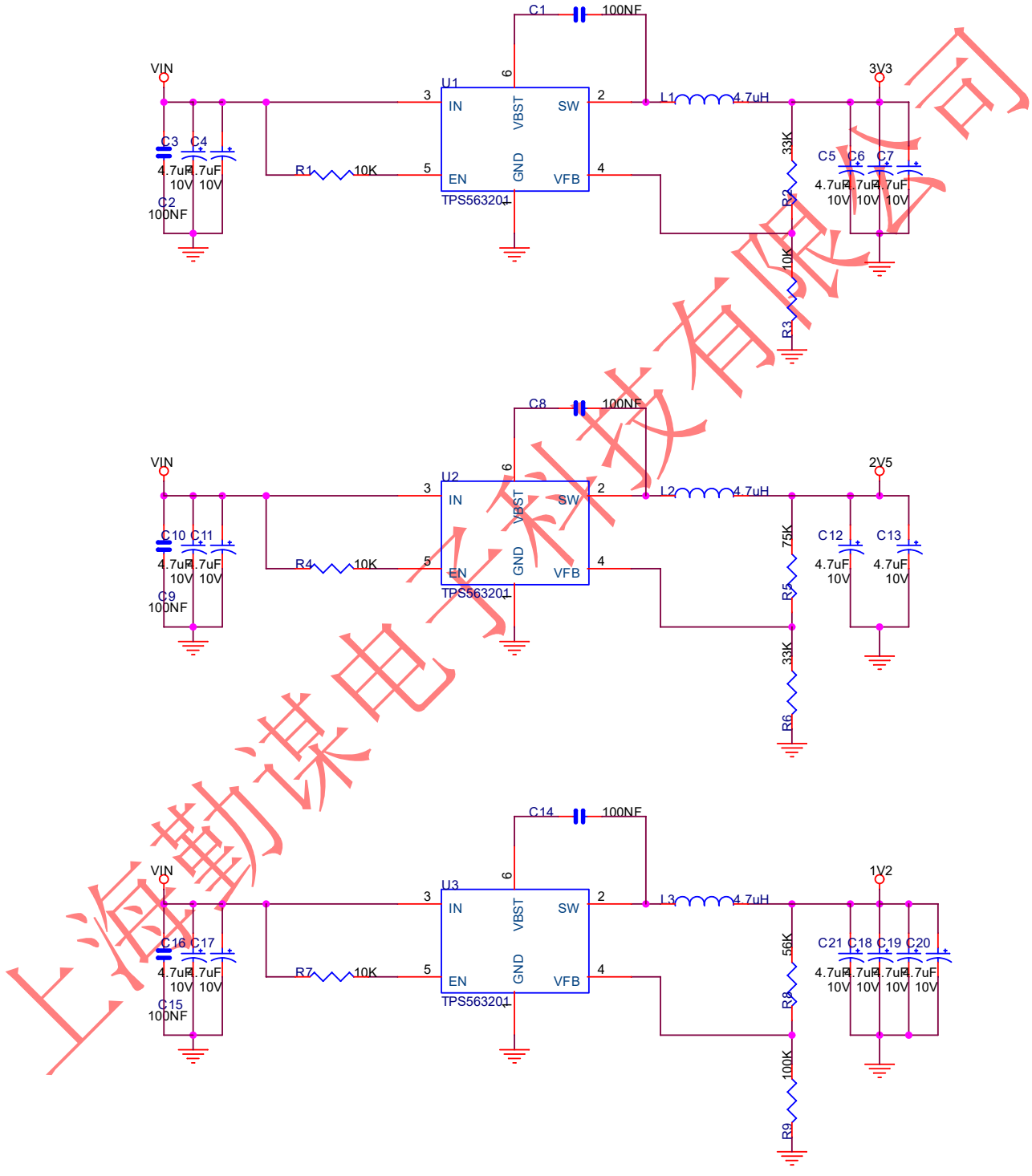


Figure 2-8. TPS563201 Hardware Design

2.2.3 Cyclone IV EP4CGX150 Extension IO

The core board has two 64P 2.54mm pitch female headers which are used for extending user modules, such as ADC/DAC module, audio/video module, ethernet module, etc.

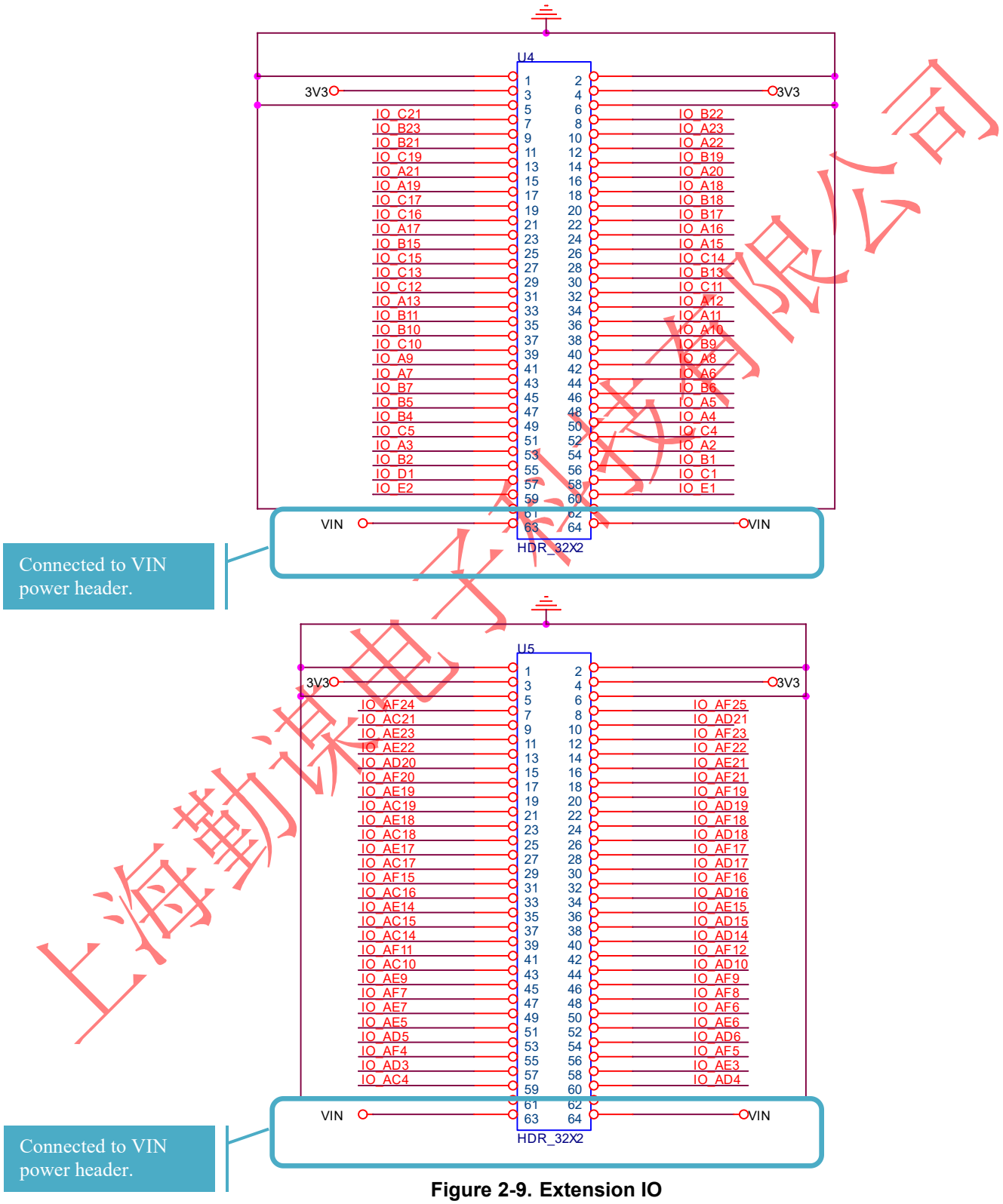


Figure 2-9. Extension IO

2.2.4 Cyclone IV EP4CGX150 User LED

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

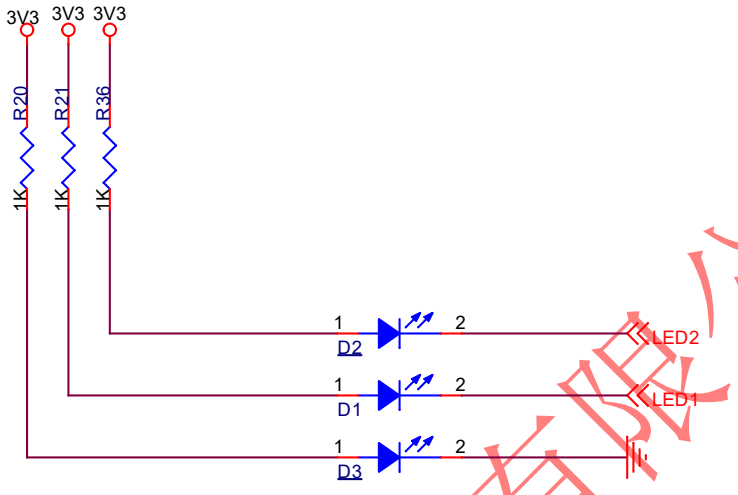


Figure 2-10. User LEDs

2.2.5 Cyclone IV EP4CGX150 User Key

Below image shows the nCONFIG key and two user keys:

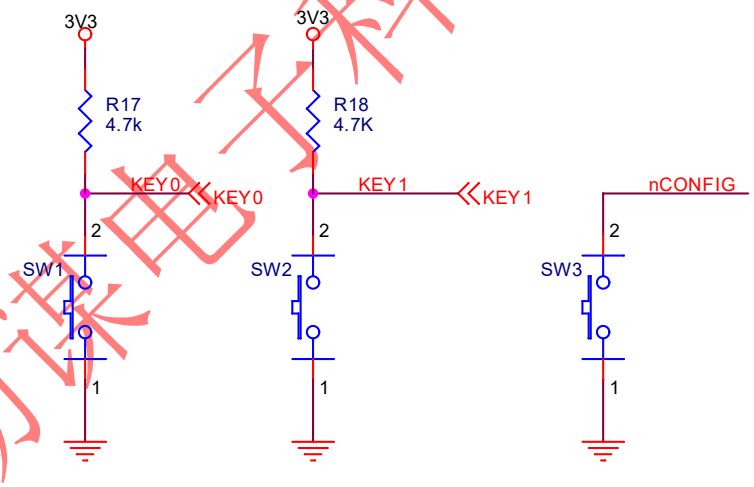


Figure 2-11. User Keys

3. Reference

[1] ep4cgx150df2-core-board.pdf
[2] an592.pdf
[3] an592_ch.pdf
[4] cyiv-5v1.pdf
[5] cyiv-5v2.pdf
[6] cyiv-5v3.pdf
[7] pcg-01008.pdf

4. Revision

Doc. Rev.	Date	Comments
0.1	10/01/2022	Initial Version.
1.0	21/02/2022	V1.0 Formal Release.