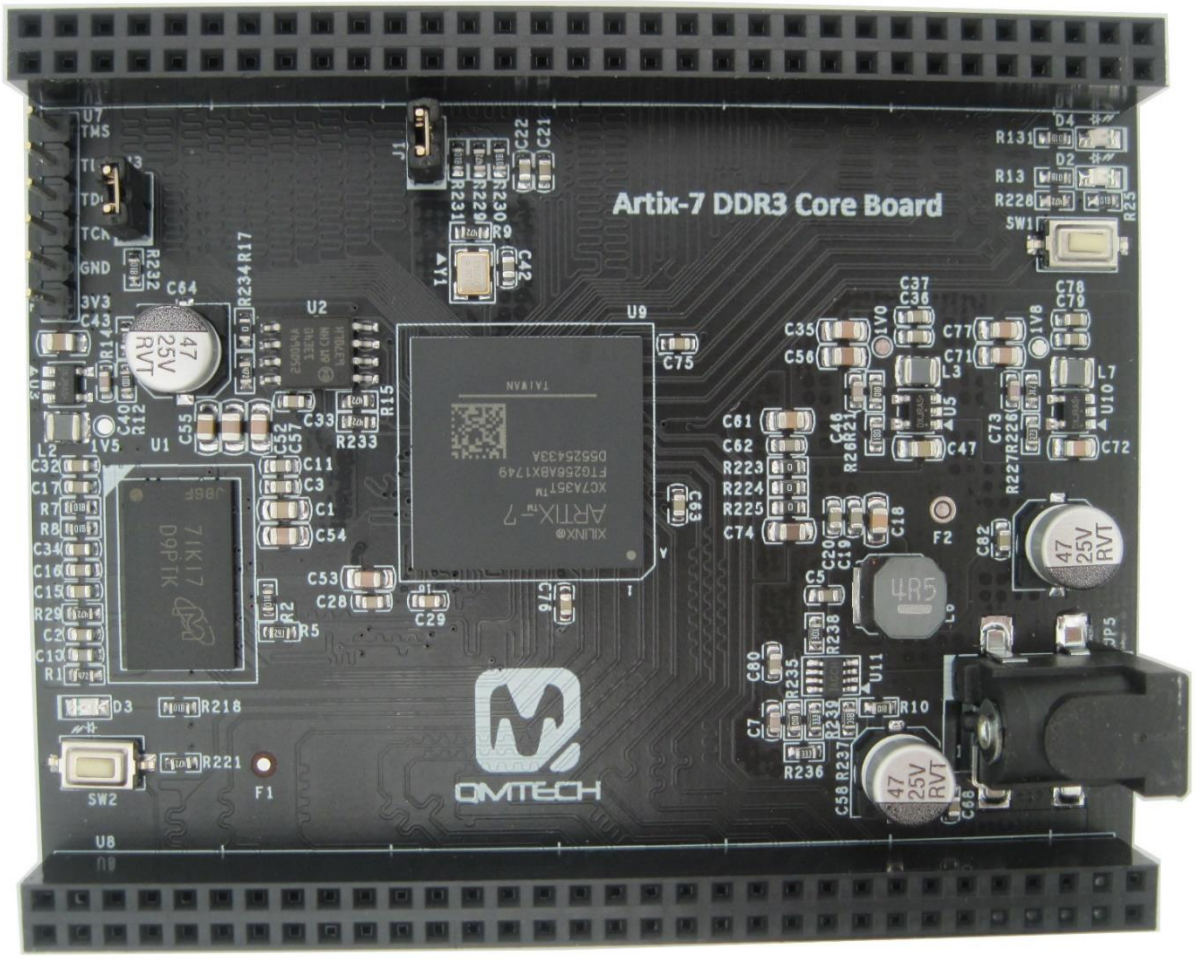
QM_XC7A35T_DDR3 CORE BOARD

USER MANUAL



Preface

The QMTech® XC7A35T DDR3 core board uses Xilinx Artix®-7 devices to demonstrate the highest performance-per-watt fabric, transceiver line rates, DSP processing, and AMS integration in a cost-optimized FPGA. Featuring the MicroBlaze™ soft processor and 1,066Mb/s DDR3 support, the family is the best value for a variety of cost and power-sensitive applications including software-defined radio, machine vision cameras, and low-end wireless backhaul.

Table of Contents

1. Introduction

1.1 Document Scope

This demo user manual introduces the QM_XC7A35T_DDR3 core board and describes how to setup the core board running with application software Xilinx Vivado 2016.4. Users may employee the on board rich logic resource FPGA XC7A35T-1FTG256C and large DDR3 memory MT41J128M16 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 QM_XC7A35T_DDR3 core board:

- On-Board FPGA: XC7A35T-1FTG256C;
- On-Board FPGA external crystal frequency: 50MHz;
- XC7A35T-1FTG256C has rich block RAM resource up to 1,800Kb;
- XC7A35T-1FTG256C has 33,280 logic cells;
- On-Board N25Q064 SPI Flash, 8M bytes for user configuration code;
- On-Board 256MB Micron DDR3, MT41J128M16JT-125:K;
- On-Board 3.3V power supply for FPGA by using MP2315 wide input range DC/DC;
- XC7A35T development board has two 64p, 2.54mm pitch headers for extending user IOs. All IOs are precisely designed with length matching;
- XC7A35T development board has 2 user switches;
- XC7A35T development board has 3 user LEDs;
- XC7A35T development board has JTAG interface, by using 6p, 2.54mm pitch header;
- XC7A35T development board PCB size is: 6.7cm x 8.4cm;
- Default power source for board is: 1A@5V DC, the DC header type: DC-050, 5.5mmx2.1mm;

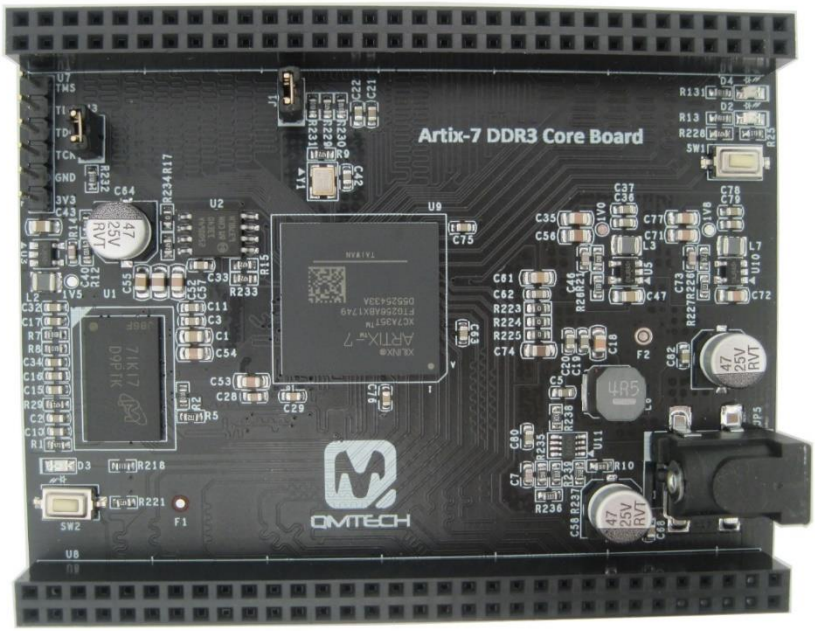


Figure 1-1. QM_XC7A35T_DDR3 Core Board Overview

2. Getting Started

The QM_XCA35T_DDR3 core board includes below item:

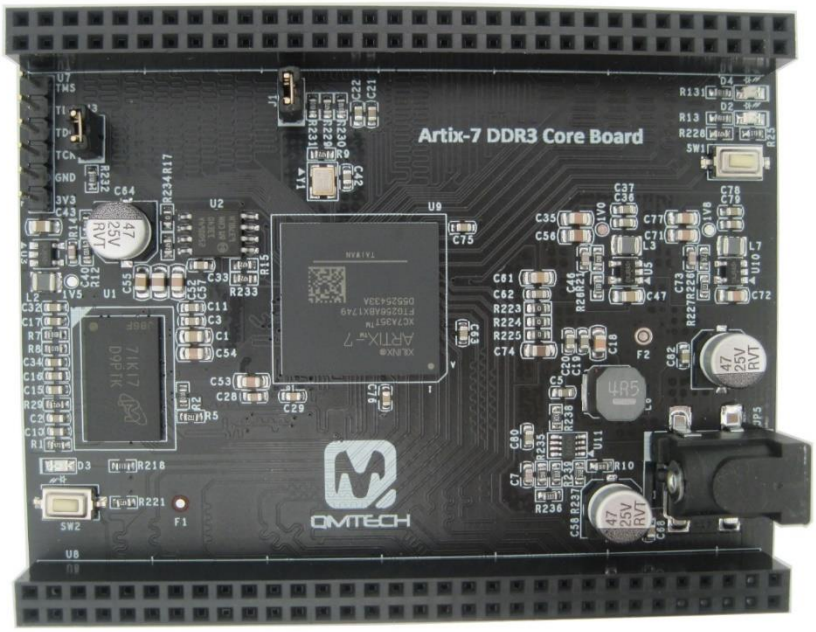


Figure 2-1. QM_XC7A35T_DDR3 Top View

Below image shows the dimension of the QM_XC7A35T_DDR3 core board: 6.7cm x 8.4cm. The unit in below image is millimeter(mm).

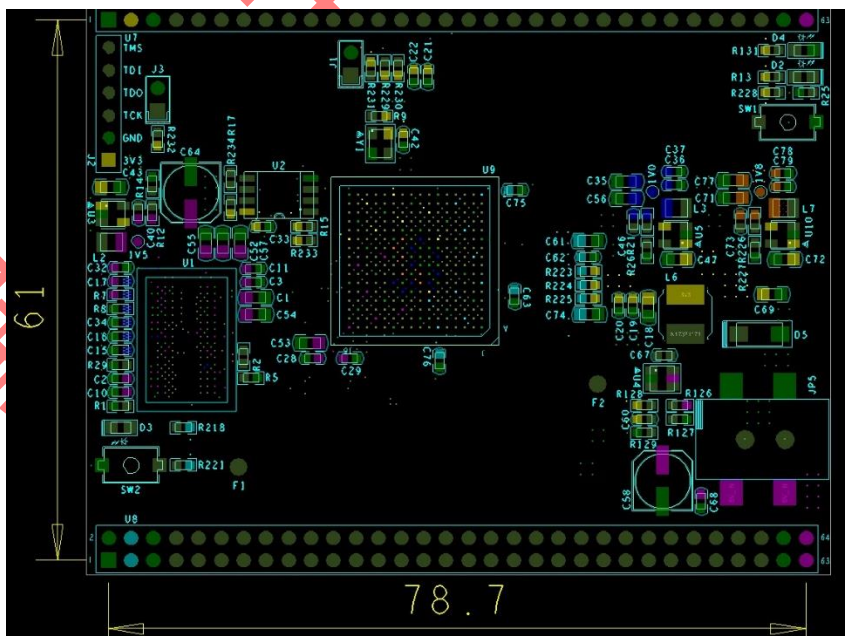


Figure 2-2. QM_XC7A35T_DDR3 Core Board Dimension

2.1 Install Development Tools

The QM_XC7A35T_DDR3 core board tool chain consists of Xilinx Vivado 2018.2, Xilinx USB platform cable, XC7A35T core board and 5V DC power supply. Below image shows the Xilinx Vivado 2018.2 development environment which could be downloaded from Xilinx office website:

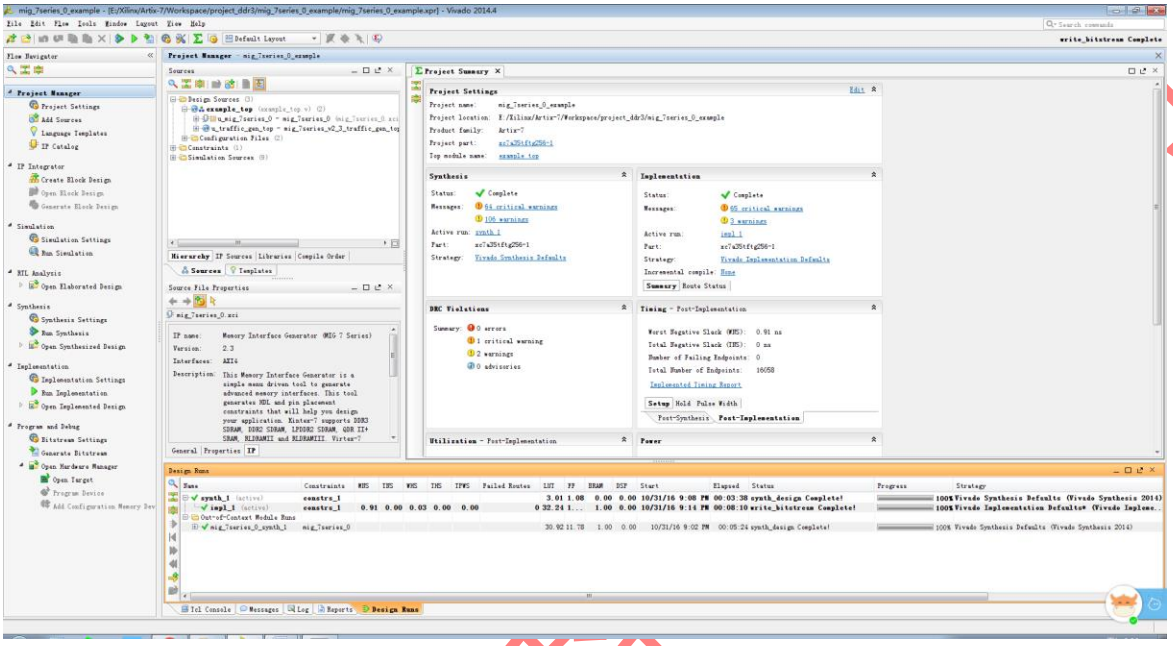


Figure 2-3. Vivado 2018.2

Below image shows the JTAG connection between Xilinx USB platform cable and XC7A35T core board:

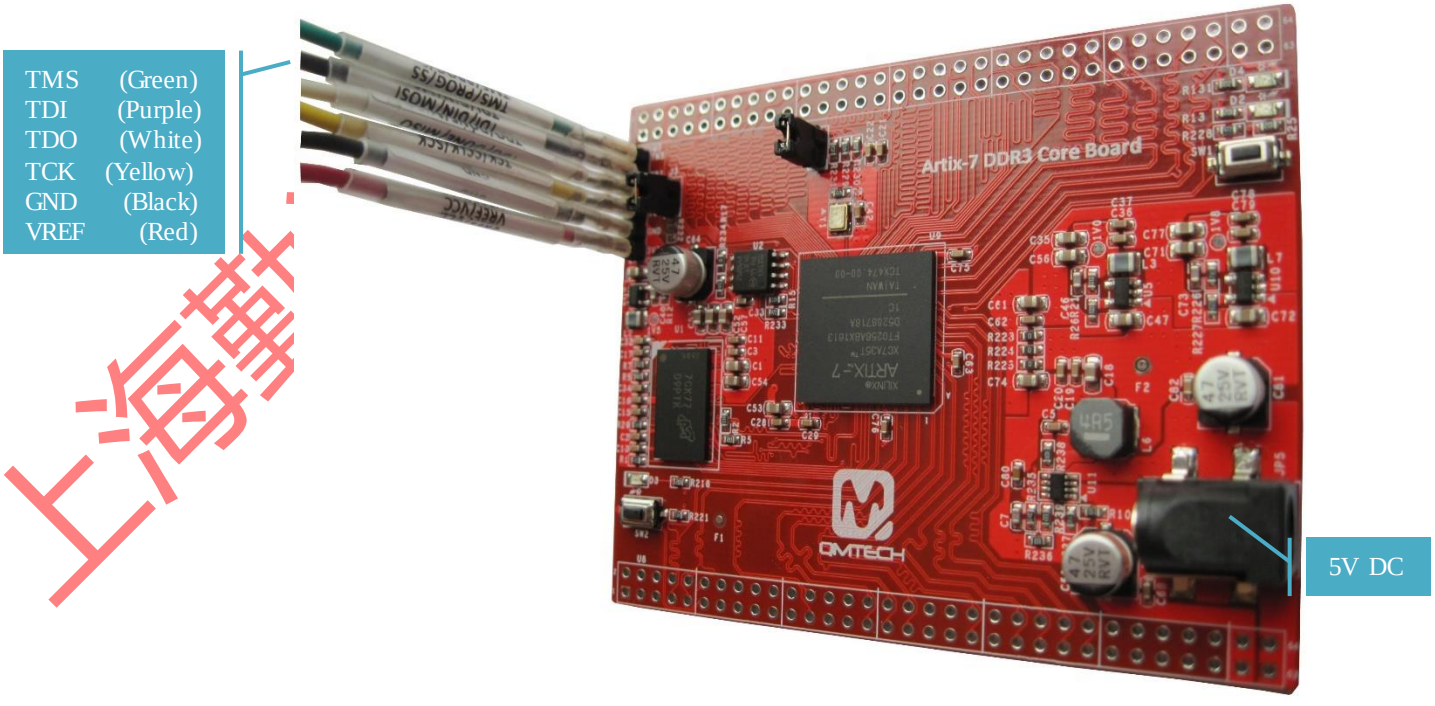


Figure 2-4. JTAG Connection and Power Supply

2.2 QM_XC7A35T_DDR3 Hardware Design

2.2.1 QM_XC7A35T_DDR3 Power Supply

The core board needs 5V DC input as power supply which could be directly injected from power header or the 64P female header U7/U8. Users may refer to the hardware schematic for the detailed design. The on board LED D4 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. However, BANK34 and BANK35 IO's power level could be changed according to detailed custom requirement. There're three 0 ohm resisters could be removed: R223/R224/ R225, and instead the BANK34 and BANK35's power supply could be injected from 64P female header U8. Detailed design refer to hardware schematic.

Note: FPGA core supply 1.0V is regulated by On-Semi DC/DC chip NCP1529 which could output maximum 1A current.

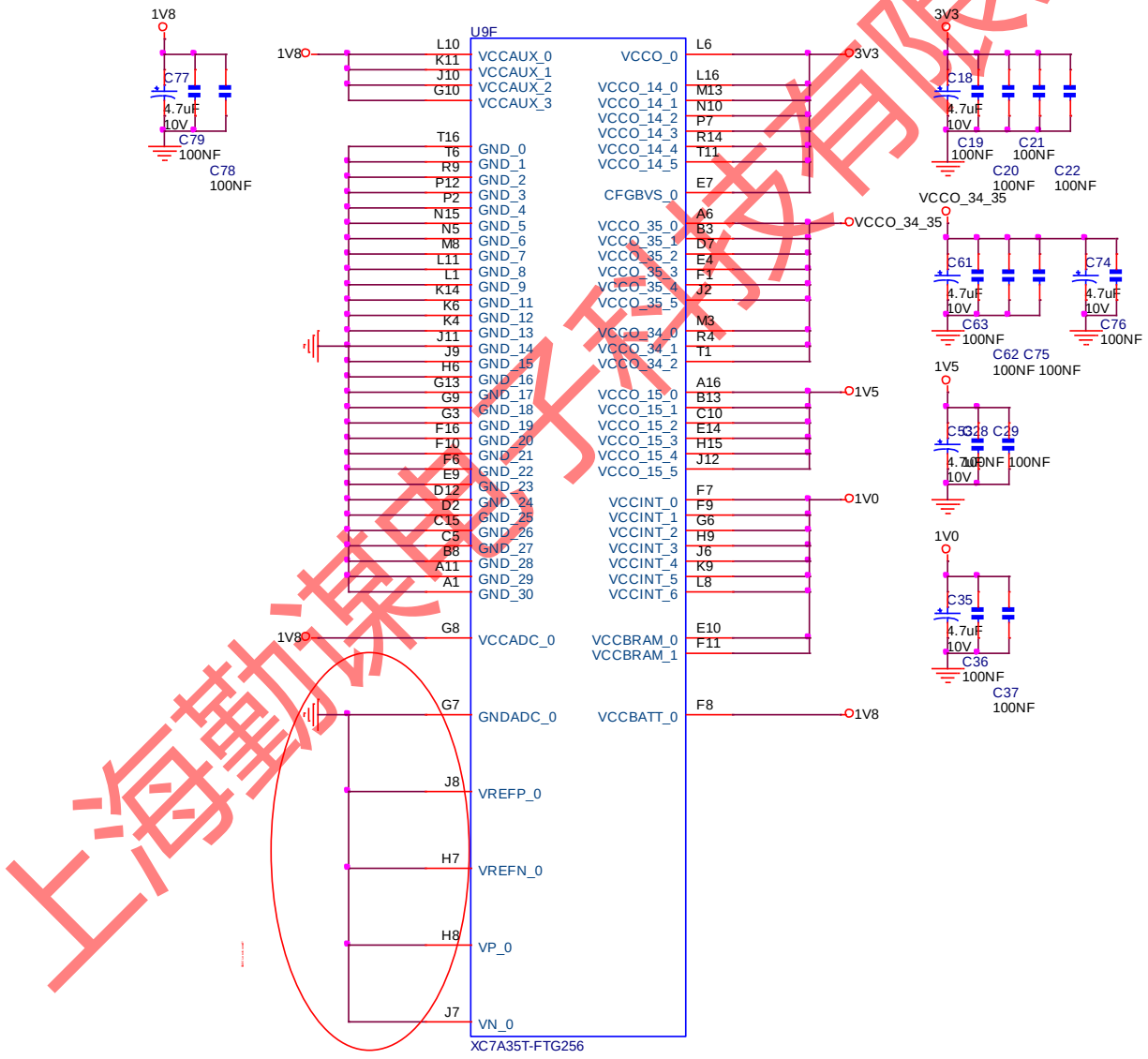


Figure 2-5. Power Supply for the FPGA

2.2.2 QM_XC7A35T_DDR3 SPI Boot

In default, QM_XC7A35T boots from external SPI Flash, detailed hardware design is shown in below figure. The SPI flash is using N25Q064 manufactured by Micron, with 64Mbit memory storage.

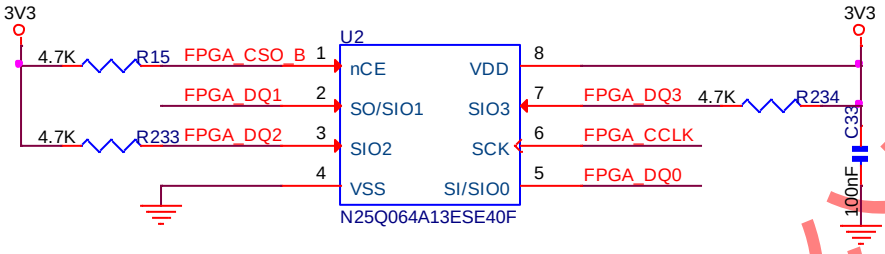


Figure 2-6. SPI Flash

The FPGA boot sequence setting M0:M1:M2 is configured as 1:0:0 which indicates FPGA will boot from SPI Flash after power on. In default, the jumper J1 is under closed status.

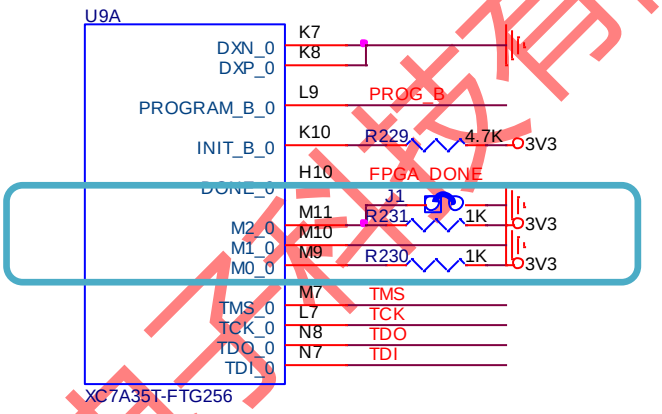


Figure 2-7. M0:M1 Hardware Settings

The LED D2 will be turned on after the FPGA successfully loading configuration file from SPI Flash during power on stage. In this case, LED D2 could be used as FPGA loading status indicator.

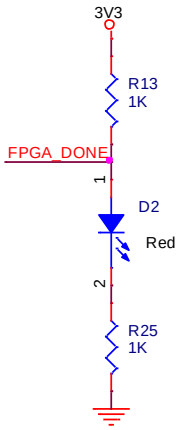


Figure 2-8. FPGA_DONE Status Indicator

2.2.3 QM_XC7A35T_DDR3 Memory

QM_XC7A35T has on board 16bit width data bus, 256MB memory size DDR3 MT41J128M16JT-125:K provided by Micron. Below image shows the detailed hardware design:

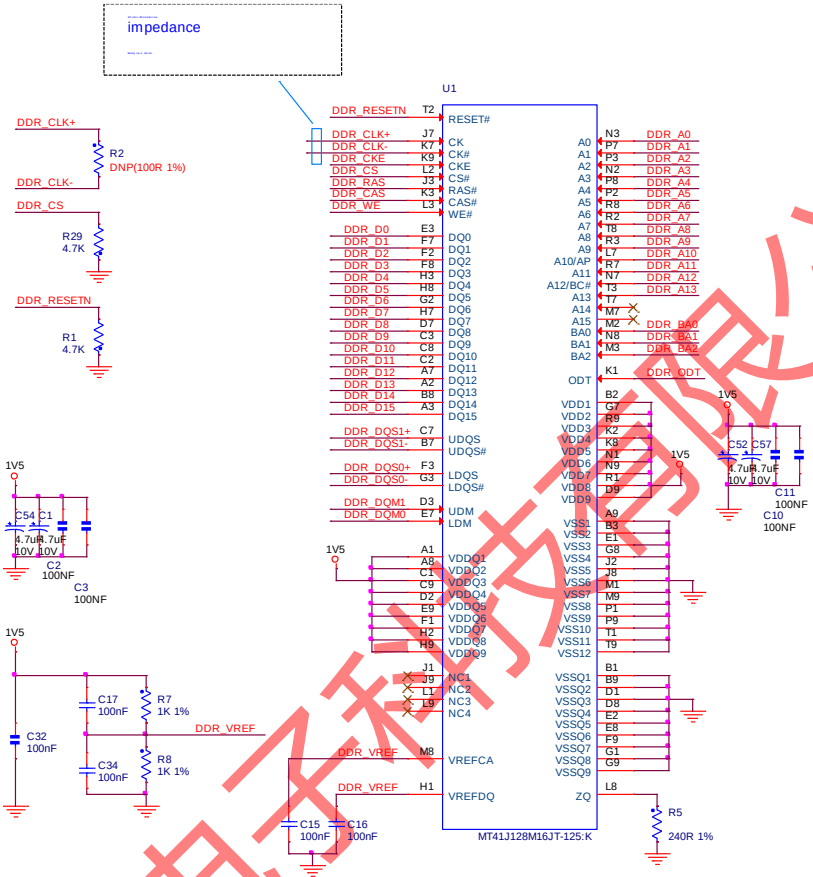


Figure 2-9. DDR3

2.2.4 QM_XC7A35T_DDR3 System Clock

FPGA chip XC7A35T-1FTG256C 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:

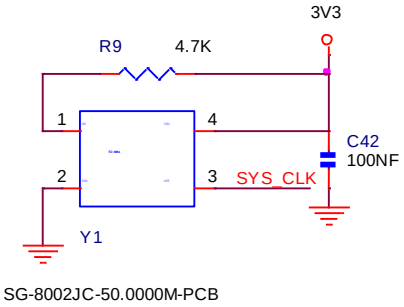


Figure 2-10. 50MHz System Clock

2.2.5 QM_XC7A35T_DDR3 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.

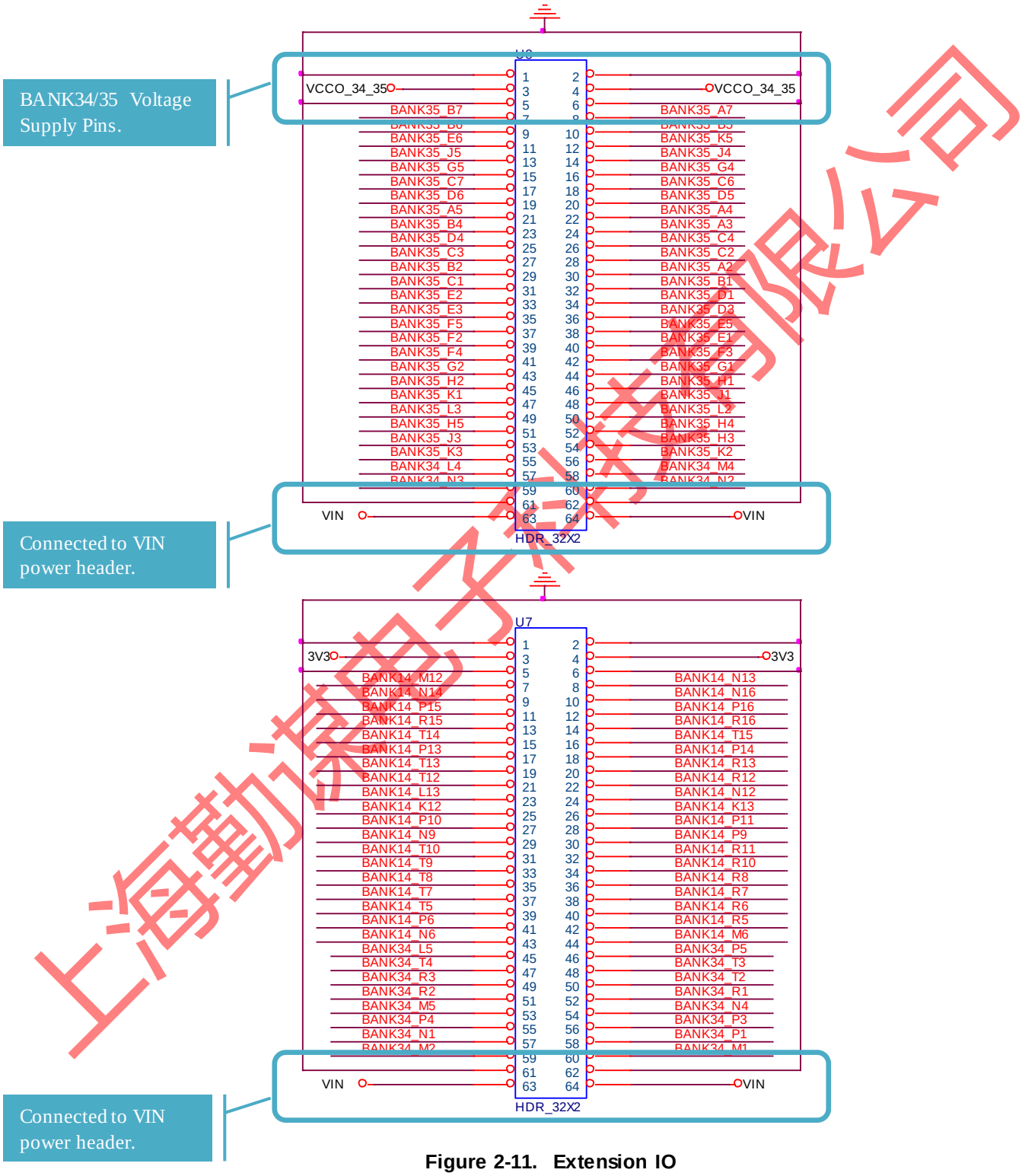


Figure 2-11. Extension IO

2.2.1 QM_XC7A35T_DDR3 3.3V Power Supply

The core 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. In normal use case, 5V DC power supply is suggested to be applied on the board. Below image shows the MP2315 hardware design:

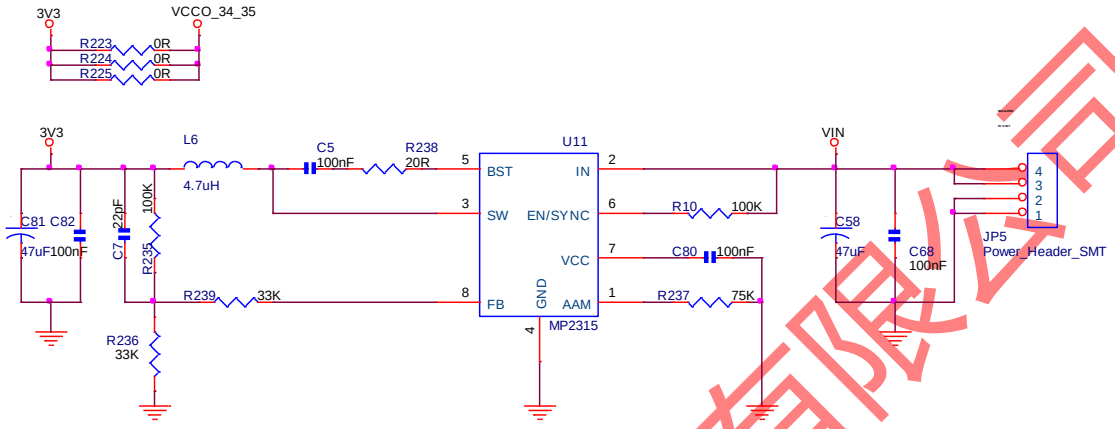


Figure 2-12. MP2315 Hardware Design

2.2.2 QM_XC7A35T_DDR3 JTAG Port

The on board JTAG port uses 6P 2.54mm pitch header which could be easily connected to Xilinx USB platform cable. Below image shows the hardware design of the JTAG port:

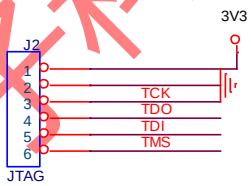


Figure 2-13. JTAG Port

2.2.3 QM_XC7A35T_DDR3 User LED

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

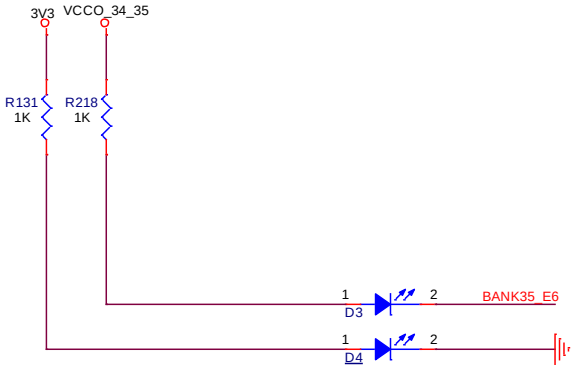


Figure 2-14. LEDs

2.2.4 QM_XC7A35T_DDR3 User Key

Below image shows the PROGRAM_B key and one user key:

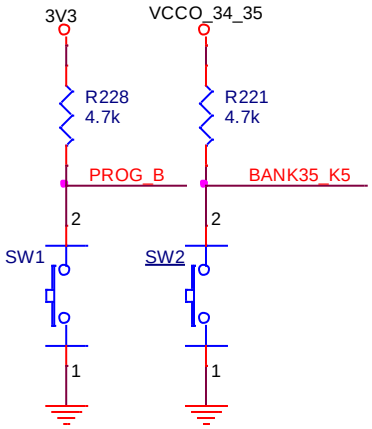


Figure 2-15. Keys

3. Reference

[1] ug470_7Series_Config.pdf
[2] ds181_Artix_7_Data_Sheet.pdf
[3] ug475_7Series_Pkg_Pinout.pdf
[4] n25q_64a_3v_65nm.pdf
[5] MT41J128M16.pdf
[6] MP2315.pdf
[7] NCP1529-D.PDF

4. Revision

Doc. Rev.	Date	Comments
0.1	05/10/2017	Initial Version.
1.0	05/14/2017	V1.0 Formal Release.
2.0	29/01/2019	V2.2 Formal Release.