

MYC-C437X

CPU Module



Product Manual

Product Overall

The MYC-C437X CPU Module is a low-cost compact-sized SOM (System on Module) based on 1GHz Sitara AM437X(AM4376, AM4377, AM4378, AM4379) ARM Cortex-A9 processors, featuring 3D graphics acceleration for rich graphical user interfaces. PRU-ICSS for industrial protocols, improved Vector Floating Point(VFP) unit and other peripherals and interfaces support like Quad-SPI, cameras, two independent eight-channel ADCs etc.

Product Feature

- ❖ Up to 1GHz TI AM437x Series ARM Cortex-A9 Processors
- ❖ 512MB DDR3 SDRAM, 4GB eMMC Flash, 32KB EEPROM
- ❖ Gigabit Ethernet PHY on board
- ❖ Support CAN, USB host, USB device, Ethernet, UART, SPI and so on
- ❖ Programmable display size (up to 2048 x 2048)
- ❖ 8 Laminates Design, Immersion Gold Process, Lead-Free
- ❖ Compact Dimensions: 45mm x 60 mm
- ❖ Two 0.8mm pitch 100-pin Board-to-Board Expansion Connectors

Applications

- ❖ Gaming Peripherals, Advanced Toys
- ❖ Home and Industrial Automation
- ❖ Consumer Medical Appliances
- ❖ Printers Weighing Scales
- ❖ Smart Toll Systems, Connected Vending Machines
- ❖ Weighing Scales, Educational Consoles

Project customization

- ❖ Matching different sizes memory chips according to customer demand
- ❖ Cutting system according to customer demand
- ❖ Assist the development of related driver according to customer demand
- ❖ Custom motherboard according to the customer's specific needs

Revision History

Rev Number	Date	Description
V1.0	2015.5.19	Initial Version
V1.1	2017.1.8	Add section 7.2

Content

1.Product Introduction.....	4
2 Hardware Parameter.....	6
2.1 CPU Features.....	6
2.2 Hardware Resource on SOM.....	7
2.3 Signals on Connector.....	9
3. Interface.....	10
3.1 Pin Order	10
3.2 Pin List.....	10
4. Hardware Design.....	11
4.1 Power.....	11
4.2 DDR3 SDRAM.....	13
4.3 eMMC	14
4.4 Nand Flash.....	15
4.5 EEPROM.....	15
4.6 EtherNET.....	16
4.7 Boot Mode.....	17
5. Electrical Parameter.....	18
6. Mechanical Parameter.....	19
7. Hardware Development Kits.....	20
Appendix 1. Warranty & Technical Support Services.....	22

1.Product Introduction

The MYC-C437X CPU Module is a low-cost compact-sized SOM (System on Module) based on 1GHz Sitara AM437X(AM4376, AM4377, AM4378, AM4379) ARM Cortex-A9 processors from Texas Instruments (TI), featuring 3D graphics acceleration for rich graphical user interfaces, PRU-ICSS for industrial protocols, improved Vector Floating Point (VFP) unit and other peripherals and interfaces support like Quad-SPI, cameras, two independent eight-channel ADCs. The product shows in figure 1-1.

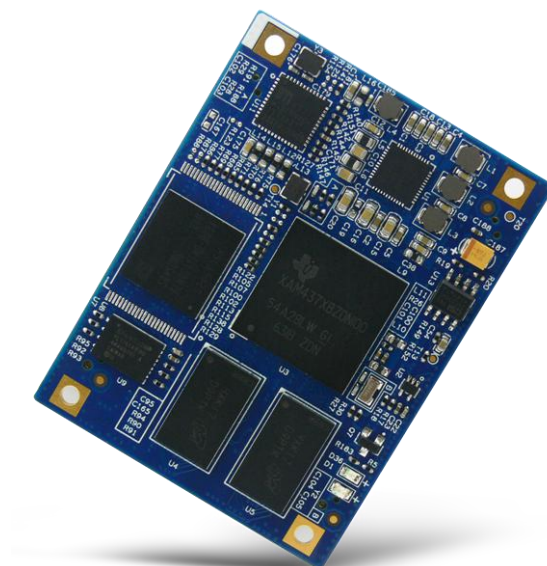


Figure 1-1 MYC-C437X CPU Module

Software and pin-for-pin compatible across devices. Table 1-1 shows the difference among the AM437X devices.

Table 1-1 AM437X Processors

	AM4376	AM4377	AM4378	AM4379
ARM Cortex-A8 Mhz(Max)	300 800 1000	800 1000	800 1000	800 1000
RPU&PRU-ICS S	PRU-ICSS	PRU-ICSS EtherCAT Slave	PRU-ICSS	PRU-ICSS EtherCAT Slave
Graphics Acceleration	No	No	Yes	Yes
Work Temp(°C)	-40 ~ 105 -40 ~ 90 0 ~ 90	-40 ~ 105 -40 ~ 90	-40 ~ 105 -40 ~ 90 0 ~ 90	-40 ~ 105

2. Hardware Parameter

2.1 CPU Features

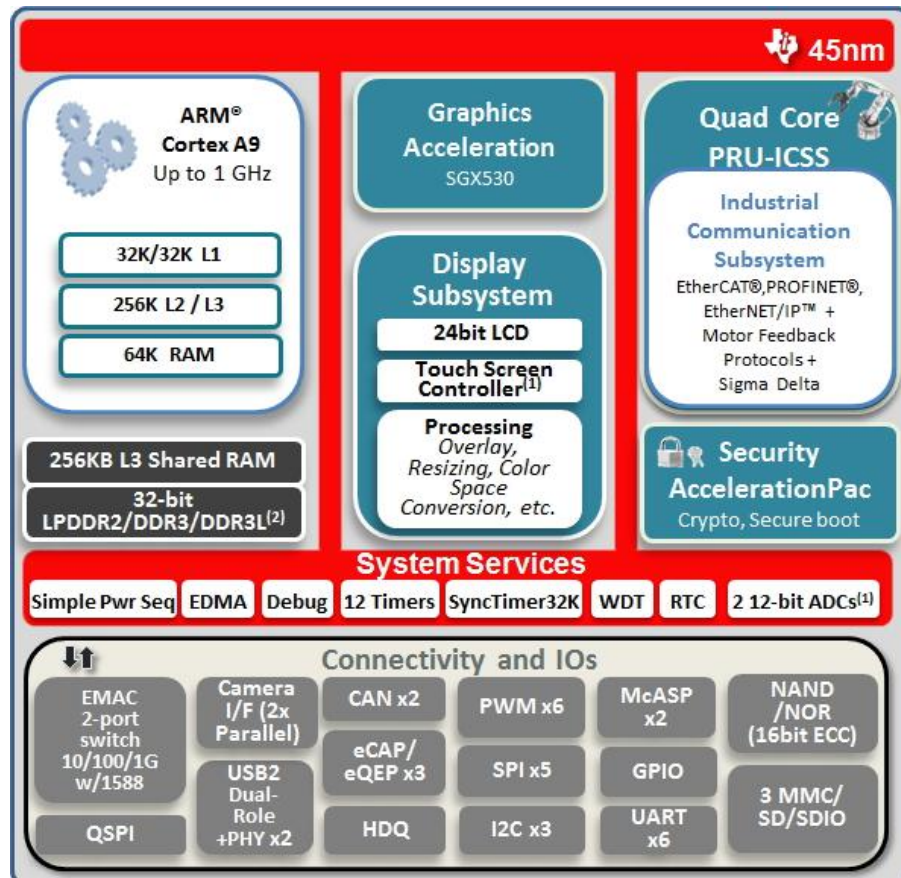


Figure 2-1 AM437X Architecture

- ◆ Up to 1000-MHz Sitara™ ARM® Cortex® -A9 32-Bit RISC processor
- ◆ NEON™ SIMD Co-processor and Vector Floating Point (VFPv3) Co-processor
- ◆ 32KB of Both L1 Instruction and Data Cache

- ◆ 256KB of L2 Cache or L3 RAM
- ◆ Emulation / Debug JTAG
- ◆ 32-Bit LPDDR2, DDR3, and DDR3L Support. Up to 1GB Addressing Space .
- ◆ General-Purpose Memory Support (NAND,NOR,SRAM) Supporting Up to 16-bit ECC
- ◆ SGX530 Graphics Engine
- ◆ Programmable Real-Time Unit Subsystem and Industrial Communication Subsystem (PRU-ICSS)
- ◆ Real-Time Clock (RTC)
- ◆ Display Subsystem
- ◆ Up to Two USB 2.0 High-Speed Dual-Role (Host or Device) Ports
- ◆ 10/100/1000 Ethernet Switch Supporting Up to Two Ports
- ◆ Two Controller Area Network Ports (CAN)
- ◆ Six UARTs, Two McASPs, Five McSPI, and Three I2C Ports,One QSPI
- ◆ Two 12-Bit Successive Approximation Register (SAR) ADCs
- ◆ Up to Three 32-Bit Enhanced Capture Modules (eCAP)
- ◆ Up to Six Enhanced High-Resolution PWM Modules (eHRPWM)
- ◆ Crypto Hardware Accelerators (AES, SHA,PKA, RNG)

2.2 Hardware Resource on SOM

The MYC-C437X CPU Module integrates the AM437X processor, 512MB DDR3 SDRAM, 4GB eMMC and Gigabit Ethernet PHY chip on board. The resource shows in figure 2-2.

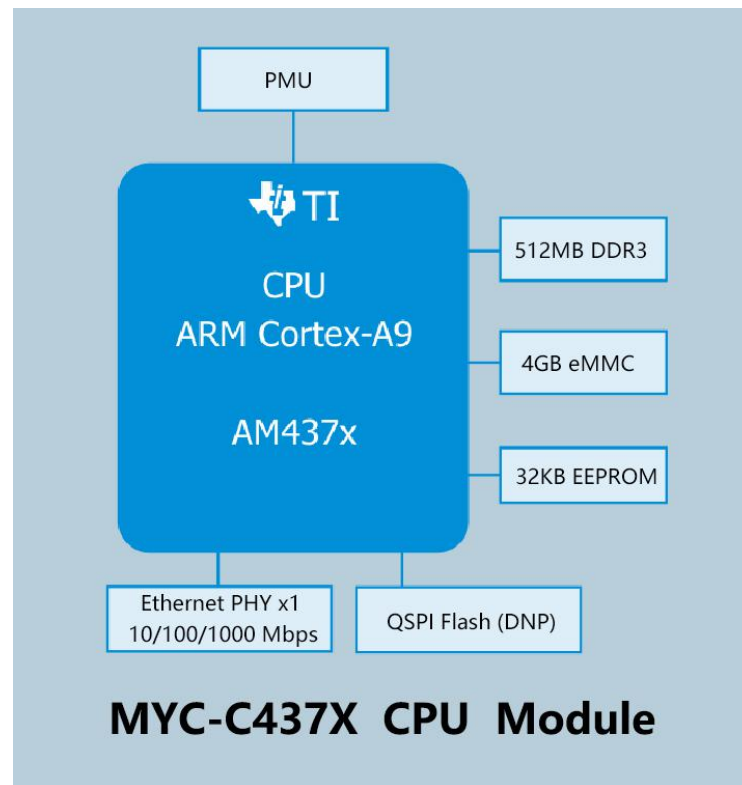


Figure 2-2 CPU Module Board

- ◆ 512MB DDR3 SDRAM
- ◆ 4GB eMMC by default (256MB / 512MB NAND FLASH)
- ◆ 32KB EEPROM
- ◆ 16MB QSPI Flash (DNP)
- ◆ 10/100/1000M Ethernet PHY
- ◆ Power LED and User LED
- ◆ Connector type:
Two 0.8mm pitch 100-pin Board-to-Board Expansion Connectors.

2.3 Signals on Connector

MYC-C437X provides signals listed in the table 2-1.

Table 2-1 Signals on Connector

Ethernet Interface	<ul style="list-style-type: none">◆ Ethernet MDI from Gigabit Ethernet PHY on board◆ 10/100/1000 Mbps Ethernet◆ Two Ethernet ports supports industrial communication Subsystem
USB 2.0 interface	2
UARTs Ports	6
I2C Interface	2
CAN Interface	2
SPI Interface	2
ADC Channels	14
MCASP Port	2
LCD Port	1
MMC/SD/SDIO	3
JTAG Port	1
GPIOs	many

Tips:The signals listed in the table due to the Pin Mux of AM437X MPU.

3. Interface

3.1 Pin Order

Two connectors with 0.8mm pin pitch are pasted on the CPU Module board. The Pin order of the connectors shows in figure 3-1.

- ◆ Connector Manufacturers : FCI
- ◆ Connector Material No : 61082-101400LF

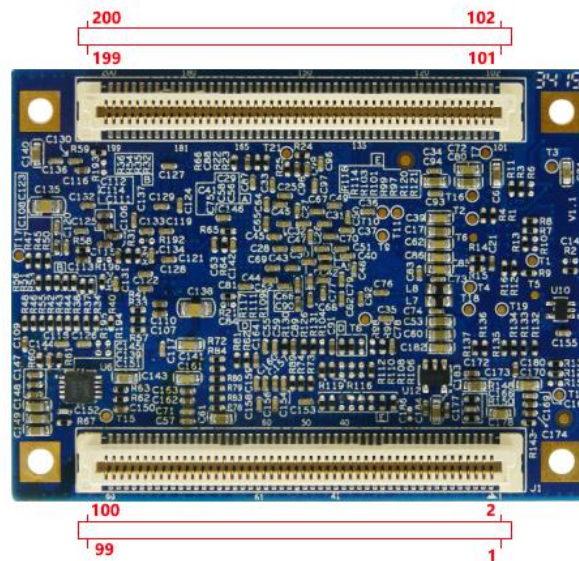


Figure 3-1 Pin Order

3.2 PIN List

Please refer to the PIN Signal description document *MYC-C437X Pin List V1.0* for detail while use the MYD-MYC437X development kit.

Please refer to the PIN Signal description document *MYC-C437X Pin List V1.1* for detail while use the MYD-MYC437X-PRU development kit.

4. Hardware Design

4.1 Power Supply

The TPS65218 is a single chip power management IC. It provides three step-down converters, three load switches, three general purpose I/O's, two battery backup supplies, one Buck-Boost converter and one LDO. The system can be supplied by a single cell Li-Ion battery or regulated 5-V supply. A coin-cell battery can be added to supply the two always-on backup supplies. The device is characterized across a -40°C to 105°C temperature range, which makes it suitable for various industrial applications.

Power rail for AM437x MPU needs to meet the value shows in table 4-1.

Table 4-1 Power Rail for AM437x MPU

	Description	MIN	NOM	MAX	Unit
VDD_CORE	For core domain	1.056	1.100	1.144	V
VDD_MPU	Nitro (1Ghz)	1.272	1.325	1.378	V
	Turbo (800Mhz)	1.210	1.260	1.326	
	OPP120(720Mhz)	1.152	1.200	1.248	
	OPP100(600Mhz)	1.056	1.100	1.144	
VDDS_DDR	for DDR3 IO domain	1.425	1.500	1.575	V
VDDS_1V8	for IO domain	1.710	1.800	1.890	V
VDDS_3V3	for IO domain	3.135	3.300	3.465	V
VDDA_ADC	for ADC, Analog	1.710	1.800	1.890	V
VDDS_PLL	for DPLL DDR,,DPLL CORE,EXTDEV,,and LCD DPLL MPU, analog	1.710	1.800	1.890	V
VDDS_OSC	for system oscillator	1.710	1.800	1.890	V

Power on sequence shows in figure 4-1.

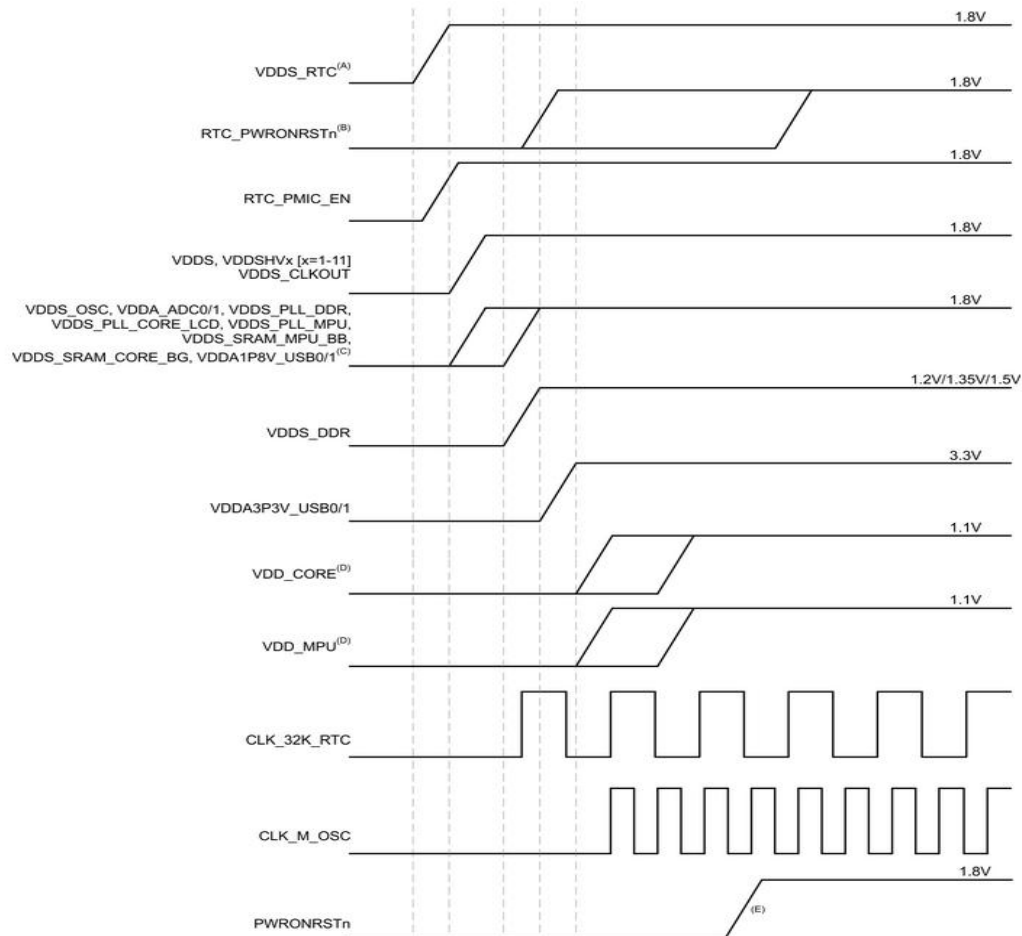


Figure 4-1 Power on Sequence

4.2 DDR3 SDRAM

AM437X SDRAM controller supports up to 2GB addressing space. MYC-C437X provides 512MB DDR3 by default. The interface circuit shows in figure 4-2.

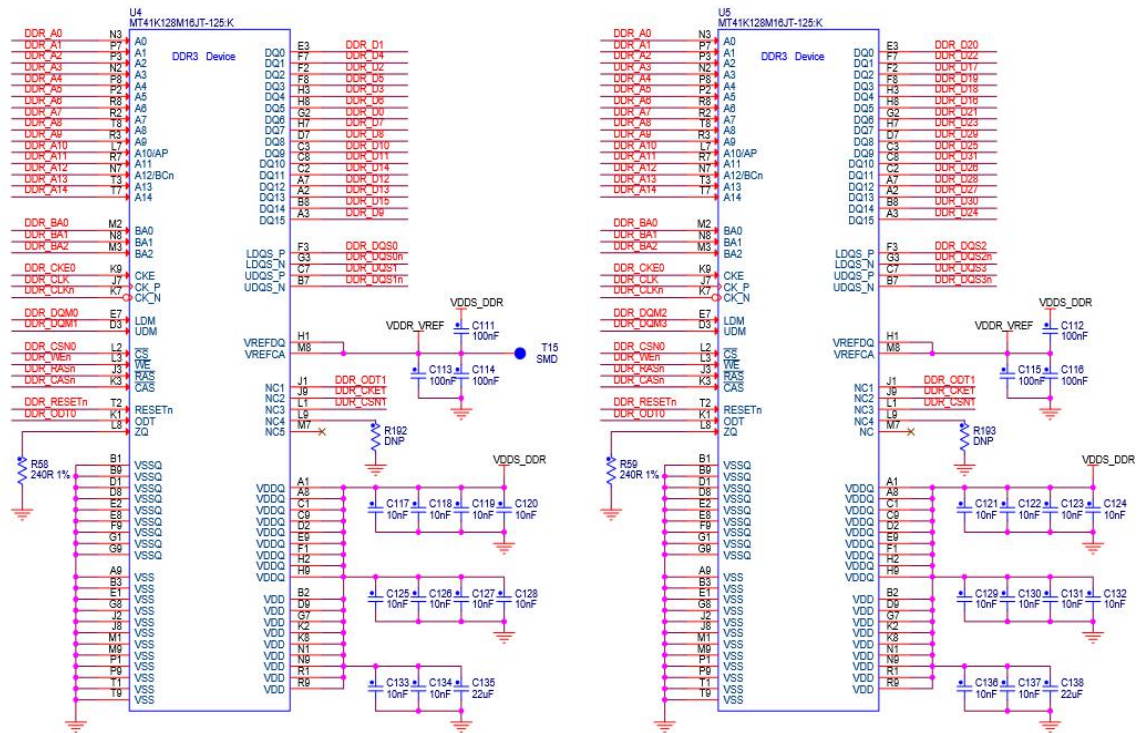


Figure 4-2 Interface Circuit of DDR3

eMMC and NAND Flash shares some of the same pins in AM437X MPU. MYC-C437X provides 4GB eMMC by default. The interface circuit shows in figure 4-3.



4.4 Nand Flash

MYC-C437X CPU module board provides the Nand Flash footprint on board, and keep DNP by default. The interface circuit shows in figure 4-4.

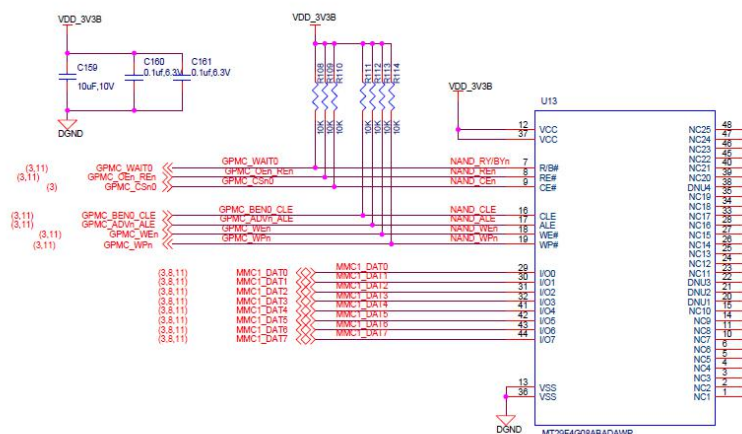


Figure 4-4 Interface Circuit of Nand Flash

4.5 EEPROM

EEPROM can be used for saving information like factory settings, device configuration and so on. The interface circuit shows in figure 4-5.

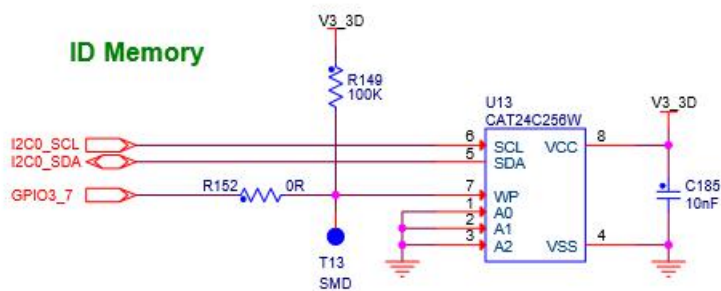


Figure 4-5 Interface Circuit of EEPROM

4.6 Ethernet

AM437X contains a 10/100/1000 Ethernet switch supports up to two ports. MYC-C437X CPU module board has one ethernet PHY on board. The interface circuit shows in figure as follows.

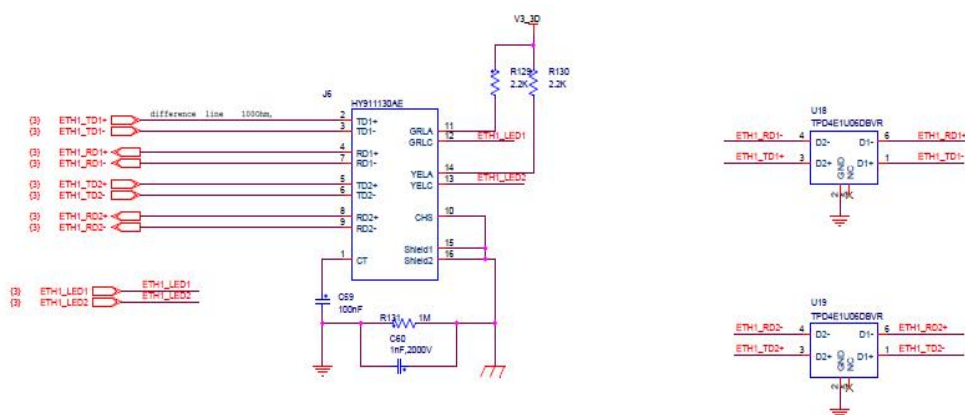


Figure 4-6 Ethernet MDI to RJ45

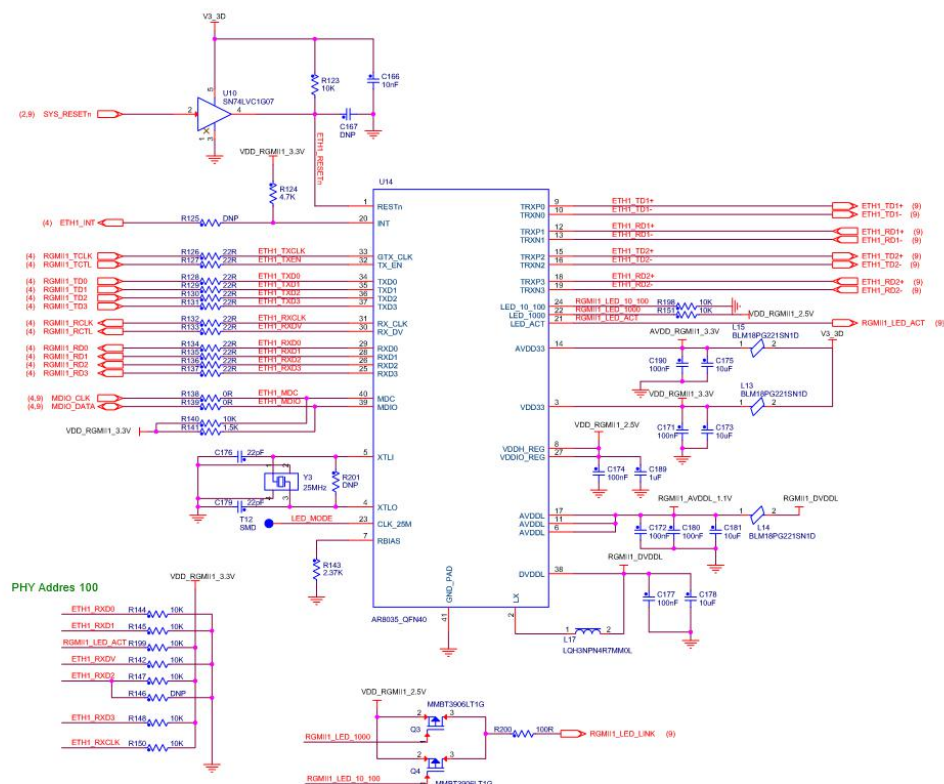


Figure 4-7 Ethernet PHY

4.7 Boot Mode

The ROM code performs platform configuration and initialization as part of the public start-up procedure. The booting device list is created based on the SYSBOOT pins. A booting device can be a memory booting device or a peripheral interface connected to a host. Once the booting device list is set up, the booting routine examines the devices enumerated in the list sequentially and either executes the memory booting or peripheral booting procedure depending on the booting device type.

For more detail about booting device, please refer to AM437X MPU data sheet. The interface circuit of booting configurations shows in figure 4-8.

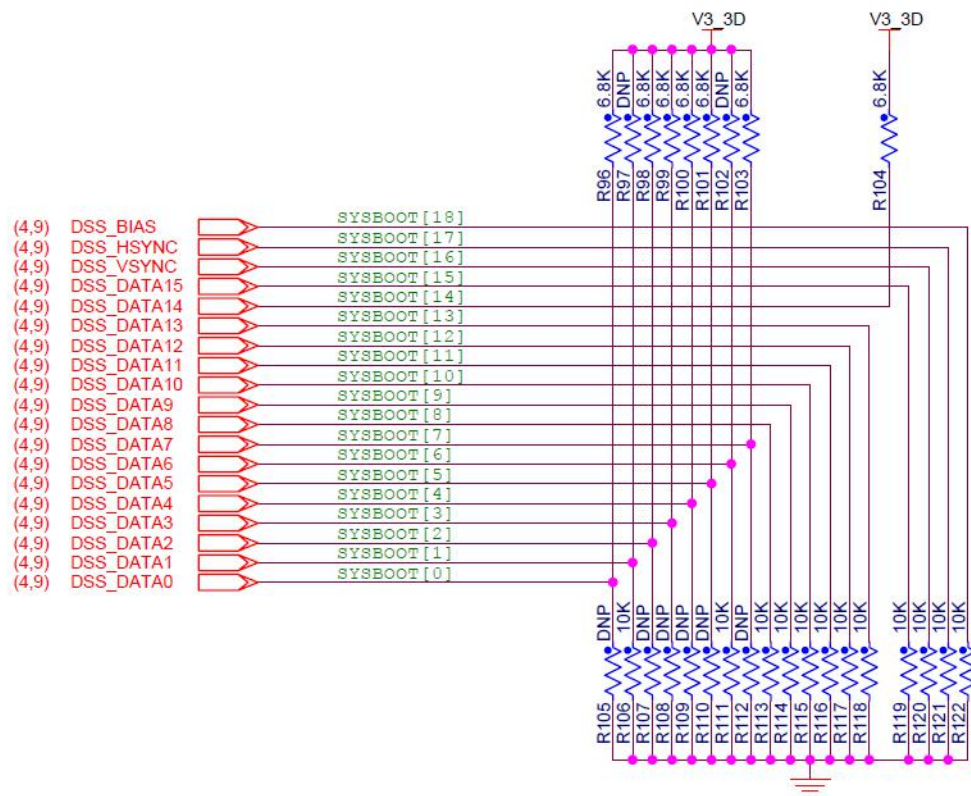


Figure 4-8 SYS_BOOT PINs Configurations

5. Electrical Parameter

5.1 Operate Temperature

Application Scenarios	Parameter					Des
	MIN	Nor.	Max	Unit		
Commercial Level	0	—	+70	°C		—
Industrial Level	-40	—	+85	°C		—

5.2 GPIO

GPIO Voltage	Label	Parameter				Des
		MIN	Nor.	MAX	Unit	
Input High voltage	V _{IH}	2.0	—	3.6	V	—
Input Low voltage	V _{IL}	-0.3	—	0.8	V	—
Output High Voltage	V _{OH}	2.9	—	—	V	—
Input Low Voltage	V _{OL}	—	—	0.4	V	—

5.3 Power Supply

Voltage	Label	Parameter				Des
		MIN	Nor	MAX	Unit	
Input Voltage	5V	4.75	—	5.25	V	—
Input Current	I _{V3.3}	—	330	—	mA	
ADC ref Voltage	VDDA_ADC0	—	—	1.8	V	Output 1.8V

6. Mechanical Parameter

- ◆ Operate Temperature:
 - ❖ Industrial Level Temperature: -40~+85 Degree
 - ❖ Commercial Level temperature: 0~+70 Degree
- ◆ Humidity: 20%~90%, Non-Condensing
- ◆ Mechanical Dimensions: 60 mm x 45 mm x 1.6mm
- ◆ Weight: 30g
- ◆ PCB Technical: 8 Layers PCB, Immersion Gold Process, Lead-Free
- ◆ Interface Type: Two 0.8mm pitch 100-pin Board-to-Board Expansion Connectors
- ◆ Mechanical information

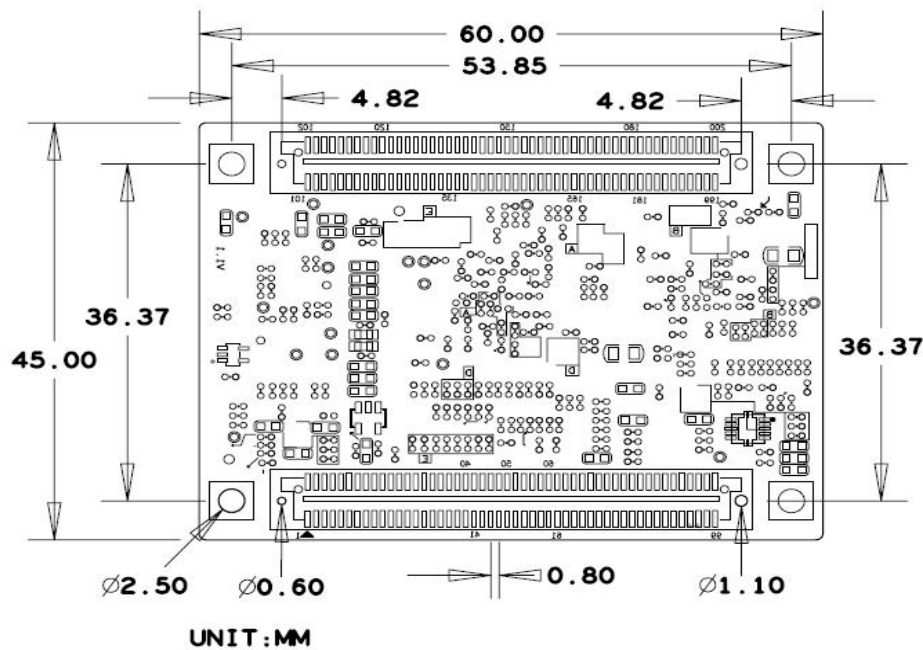


Figure 6-1 CPU Module Board

7. Hardware Development Kits

Two different development boards are offered by MYIR to accompany the development of MYC-C437X CPU module. The two development kits are designed specifically for research of different application, which are:

- ◆ MYD-C437X Development Board for general purpose development with Linux support.
- ◆ MYD-C437X-PRU Development Board for high performance industrial controlling and communication with PRU-ICSS enabled in Linux and SYS/BIOS RTOS.

7.1 MYD-AM437X Development board

The MYD-C437X is a fully-featured development board for the MYC-C437X CPU Module. The base board has brought out rich peripheral sets interfaces including serial ports, four USB Host ports, one USB Host /device port, dual Gigabit Ethernet ports, two CAN, one RS485, one Micro SD, two camera, HDMI, LCD, Touch screen, JTAG and more others. For more information, please visit the website: <http://www.myir-tech.com>.



Figure 7-1 MYD-AM437X Development Board

7.2 MYD-AM437X-PRU Development board

The MYD-C437X-PRU Development Board is a complete evaluation platform especially designed for users to take full advantages of the Programmable Real-time Unit (PRU) .The base board has brought out rich peripheral sets interfaces including three serial ports, one USB Host ports, one Mini USB port, one Gigabit Ethernet, two 10/100Mbps Ethernet ports from the PRU-ICSS subsystems, one CAN, one RS485, one Camera interface, one Micro SD, LCD, Touch screen and more others.

For more information, please visit the website: <http://www.myr-tech.com>



Figure 7-2 MYD-AM437X Development Board

Appendix 1 Warranty & Technical Support Services

MYIR Tech Limited is a global provider of ARM hardware and software tools, design solutions for embedded applications. We support our customers in a wide range of services to accelerate your time to market.

MYIR is an ARM Connected Community Member and work closely with ARM and many semiconductor vendors. We sell products ranging from board level products such as development boards, single board computers and CPU modules to help with your evaluation, prototype, and system integration or creating your own applications. Our products are used widely in industrial control, medical devices, consumer electronic, telecommunication systems, Human Machine Interface (HMI) and more other embedded applications. MYIR has an experienced team and provides custom design services based on ARM processors to help customers make your idea a reality.

The contents below introduce to customers the warranty and technical support services provided by MYIR as well as the matters needing attention in using MYIR's products.

◆ Service Guarantee

MYIR regards the product quality as the life of an enterprise. We strictly check and control the core board design, the procurement of components, production control, product testing, packaging, shipping and other aspects and strive to provide products with best quality to customers. We believe that only quality products and excellent services can ensure the long-term cooperation and mutual benefit.

◆ Price

MYIR insists on providing customers with the most valuable products. We do not pursue excess profits which we think only for short-time cooperation. Instead, we hope to establish long-term cooperation and win-win business with customers. So we will offer reasonable prices in the hope of making the business greater with the customers together hand in hand.

◆ Delivery Time

MYIR will always keep a certain stock for its regular products. If your order quantity is less than the amount of inventory, the delivery time would be within three days; if your order quantity is greater than the number of inventory, the delivery time would be always four to six weeks. If for any urgent delivery, we can negotiate with customer and try to supply the goods in advance.

◆ Technical Support

MYiR has a professional technical support team. Customer can contact us by email (support@myirtech.com), we will try to reply you within 48 hours. For mass production and customized products, we will specify person to follow the case and ensure the smooth production.

◆ After-sale Service

MYiR offers one year free technical support and after-sales maintenance service from the purchase date. The service covers:

1. Technical support service

- a) MYiR offers technical support for the hardware and software materials which have provided to customers;
- b) To help customers compile and run the source code we offer;
- c) To help customers solve problems occurred during operations if users follow the user manual documents;
- d) To judge whether the failure exists;
- e) To provide free software upgrading service.

However, the following situations are not included in the scope of our free technical support service:

- a) Hardware or software problems occurred during customers' own development;
- b) Problems occurred when customers compile or run the OS which is tailored by themselves;
- c) Problems occurred during customers' own applications development;
- d) Problems occurred during the modification of MYiR's software source code.

2. After-sales maintenance service

The products except LCD, which are not used properly, will take the twelve months free maintenance service since the purchase date. But following situations are not included in the scope of our free maintenance service:

- a) The warranty period is expired;
- b) The customer cannot provide proof-of-purchase or the product has no serial number;
- c) The customer has not followed the instruction of the manual which has caused the damage the product;
- d) Due to the natural disasters (unexpected matters), or natural attrition of the components, or unexpected matters leads the defects of appearance/function;

- e) Due to the power supply, bump, leaking of the roof, pets, moist, impurities into the boards, all those reasons which have caused the damage of the products or defects of appearance;
- f) Due to unauthorized weld or dismantle parts or repair the products which has caused the damage of the products or defects of appearance;
- g) Due to unauthorized installation of the software, system or incorrect configuration or computer virus which has caused the damage of products.

Warm tips:

- 1) MYIR does not supply maintenance service to LCD. We suggest the customer first check the LCD when receiving the goods. In case the LCD cannot run or no display, customer should contact MYIR within 7 business days from the moment get the goods.
- 2) Please do not use finger nails or hard sharp object to touch the surface of the LCD.
- 3) MYIR suggests user purchasing a piece of special wiper to wipe the LCD after long time use, please avoid clean the surface with fingers or hands to leave fingerprint.
- 4) Do not clean the surface of the screen with chemicals.
- 5) Please read through the product user manual before you using MYIR's products.
- 6) For any maintenance service, customers should communicate with MYIR to confirm the issue first. MYIR's support team will judge the failure to see if the goods need to be returned for repair service, we will issue you RMA number for return maintenance service after confirmation.

3. Maintenance period and charges

- 1) MYIR will test the products within three days after receipt of the returned goods and inform customer the testing result. Then we will arrange shipment within one week for the repaired goods to the customer. For any special failure, we will negotiate with customers to confirm the maintenance period.
- 2) For products within warranty period and caused by quality problem, MYIR offers free maintenance service; for products within warranty period but out of free maintenance service scope, MYIR provides maintenance service but shall charge some basic material cost; for products out of warranty period, MYIR provides maintenance service but shall charge some basic material cost and handling fee.

4. Shipping cost

During the warranty period, the shipping cost which delivered to MYIR should be responsible by user; MYIR will pay for the return shipping cost to users when the product is repaired. If the warranty period is expired, all the shipping cost will be responsible by users.

5. Products Life Cycle

MYIR will always select mainstream chips for our design, thus to ensure at least ten years continuous supply; if meeting some main chip stopping production, we will inform customers in time and assist customers with products updating and upgrading.

◆ Value-added Services

MYIR provides services:

- ❖ driver development base on MYIR's products, like USB, Ethernet, LCD, etc.
- ❖ BSP drivers' development, API software development, etc.
- ❖ other products like power adapter, LCD panel, etc.
- ❖ ODM/OEM services.



MYIR Tech Limited

Room 1306, Wensheng Center, Wenjin Plaza,

North Wenjin Road, Luohu District, Shenzhen, China 518020

Support Email: support@myirtech.com

Sales Email: sales@myirtech.com

Phone: +86-755-22984836

Fax: +86-755-25532724

Website: www.myirtech.com