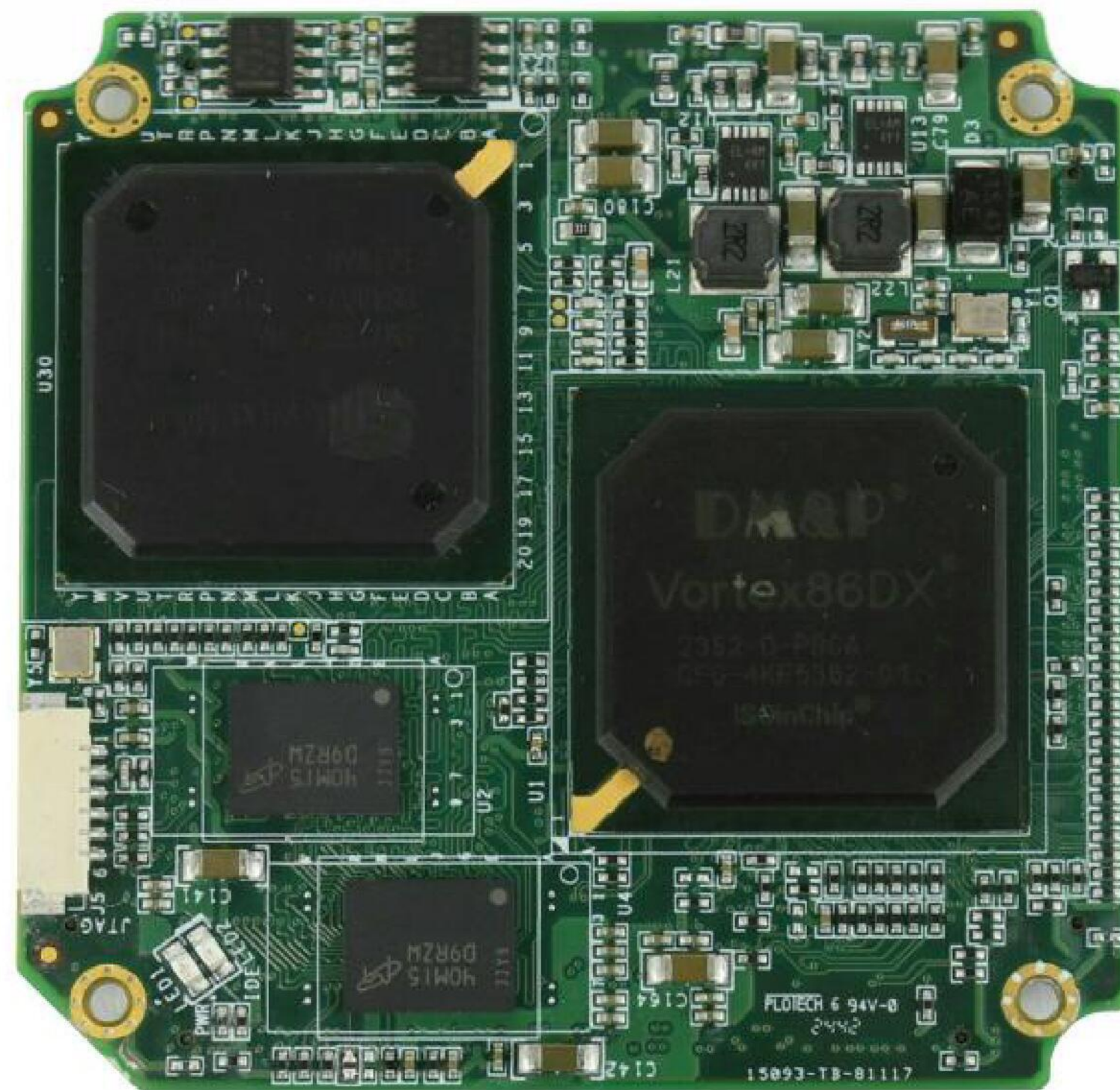




## **SOM304RD-10S** **System-on-Module**

**DM&P Vortex86DX**  
**800 MHz processor**

Ver. 1.0A



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# Revision History

| Revision  | Date           | Remark                        |
|-----------|----------------|-------------------------------|
| Ver. 1.0  | November, 2024 | First Version Released        |
| Ver. 1.0A | February, 2025 | Adding PWM/I2C testing method |



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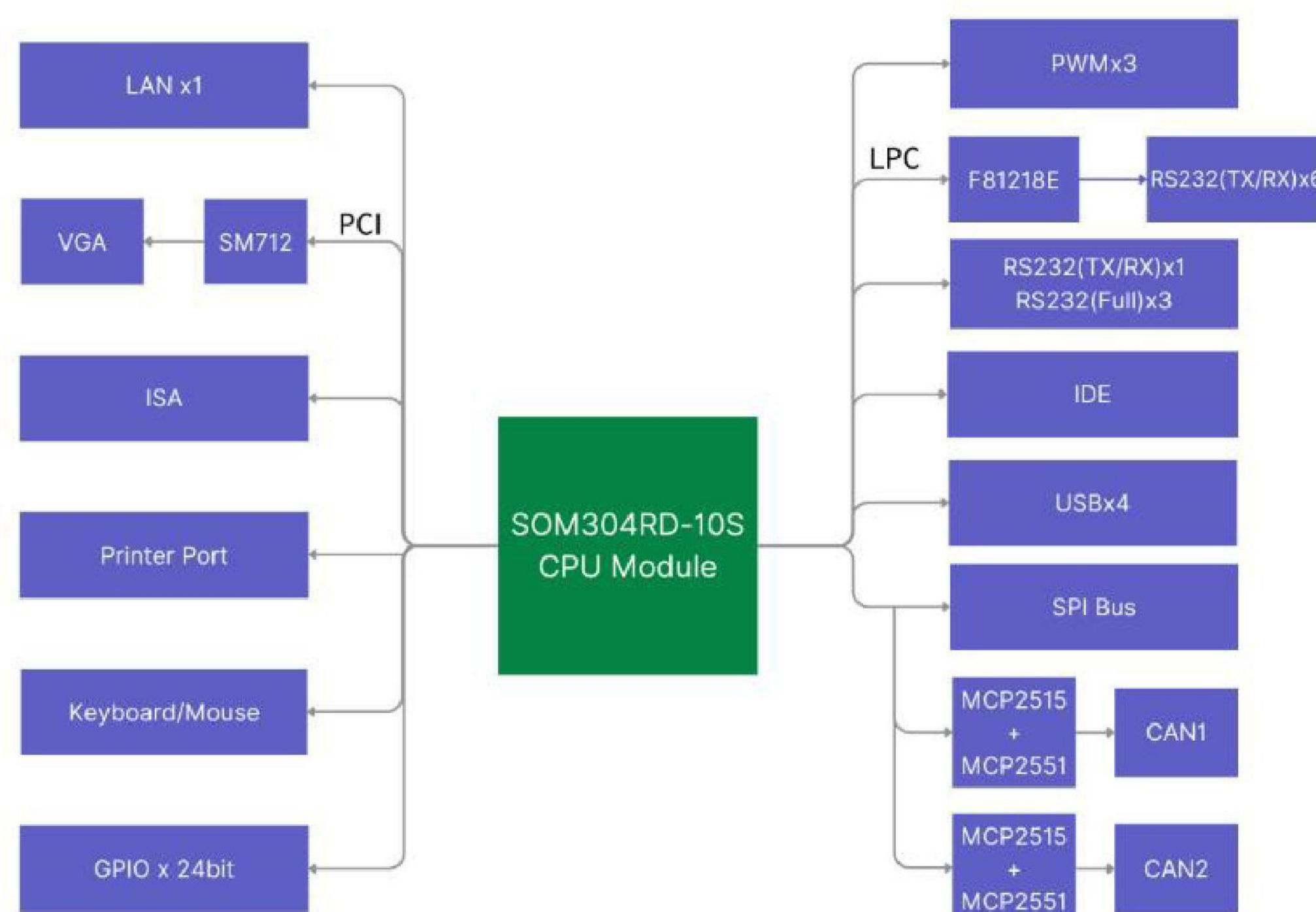
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# 1 General Information

## 1.1 Overview

SOM304RD-10S measured at only 70mm (L)\*70mm (W)\*10.5mm (H), is designed particularly as the kernel for the diverse expandable applications. Through 8 rows of 38pin connector, SOM304RD-10S is able to provide multiple functions, such as ISA BUS, RS-232, IDE, LAN, USB, CAN bus and GPIO.

## 1.2 Block diagram





## 1.3 Specifications

|                          |                                                                                                                                                                        |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Processor                | DM&P SoC CPU Vortex86DX- 800MHz<br>Real Time Clock with Lithium Battery Backup                                                                                         |
| System Memory            | 256 MB DDR2 onboard                                                                                                                                                    |
| Watchdog Timer           | Software programmable from 30.5 us to 512 seconds x2<br>sets(Watchdog 1 fully compatible with M6117D)                                                                  |
| Display                  | SM712 Chipset<br>VGA: Maximum resolution up to 1280x1024                                                                                                               |
| LAN                      | Integrated 10/100Mbps Ethernet x1                                                                                                                                      |
| I/O interface            | Enhanced IDE port (UltraDMA-100/66/33) x1<br>RS232 port x10(TX/RX x7)<br>USB port x4<br>Parallel port x1<br>24-bit GPIO<br>PWM x3<br>Keyboard/Mouse<br>SPI x1 / CAN x2 |
| Flash Disk Support       | Onboard 4MB SPI Flash Disk (optional)<br>Onboard SST Flash Disk 1GB                                                                                                    |
| Power Requirement        | Single Voltage +5V @600mA (Typical)                                                                                                                                    |
| Weight                   | 25g                                                                                                                                                                    |
| Dimensions               | 70 x 70 x 10.5mm (Without cover)                                                                                                                                       |
| Operating Temp.          | -20°C to +70°C                                                                                                                                                         |
| Operating System Support | Free DOS, DOS 6.22, PCDOS 7.1, DR-DOS, x-DOS, OS/2, Windows Embedded CE6.0, Windows XP Embedded, Embedded Linux, QNX, VxWorks, and FreeBSD                             |

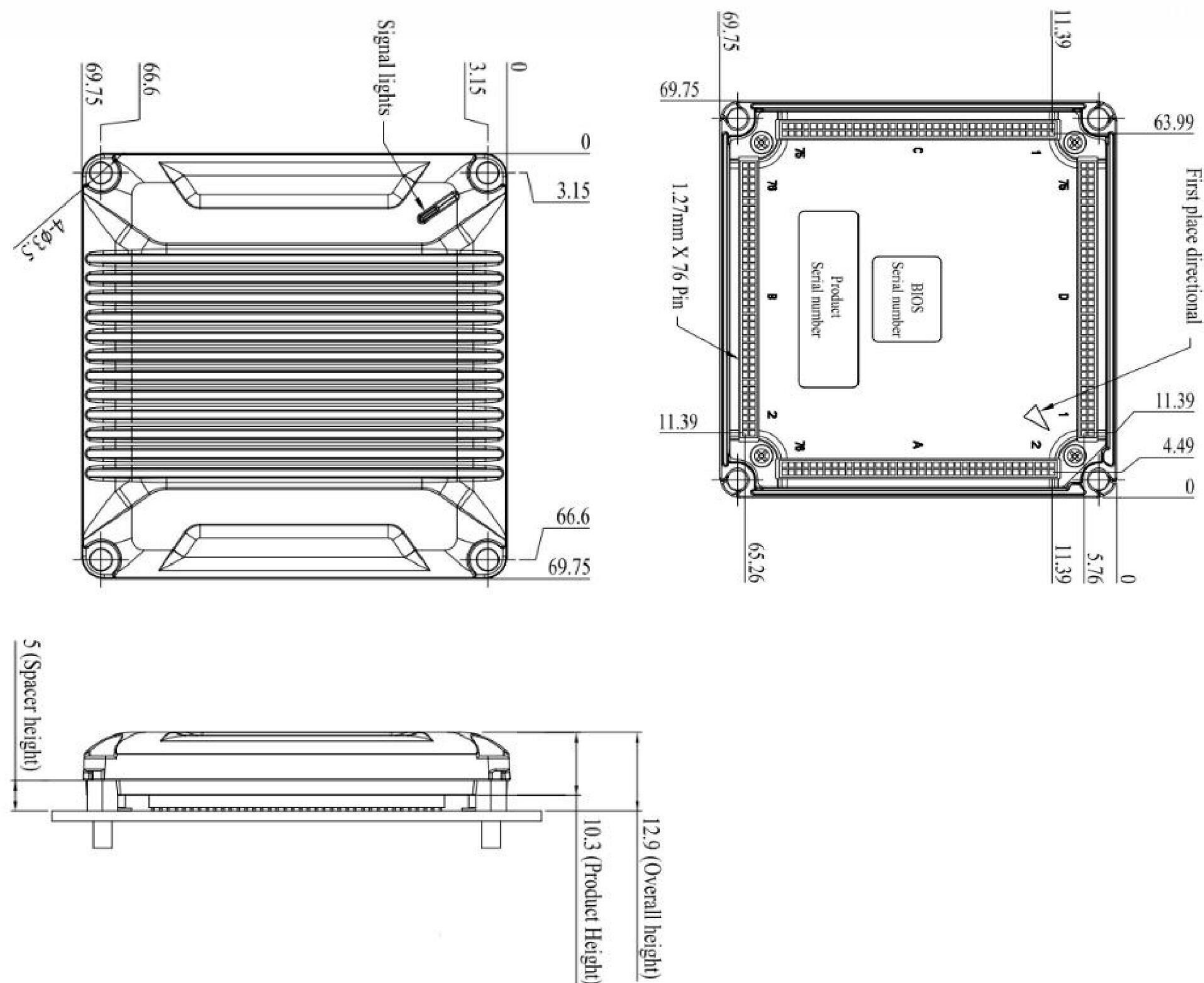
## 1.4 Ordering Information

| Part Number  | Product Description                          |
|--------------|----------------------------------------------|
| SOM304RD-10S | Vortex86DX 304-pin CPU Module with 256MB DDR |



## 2 Hardware Information

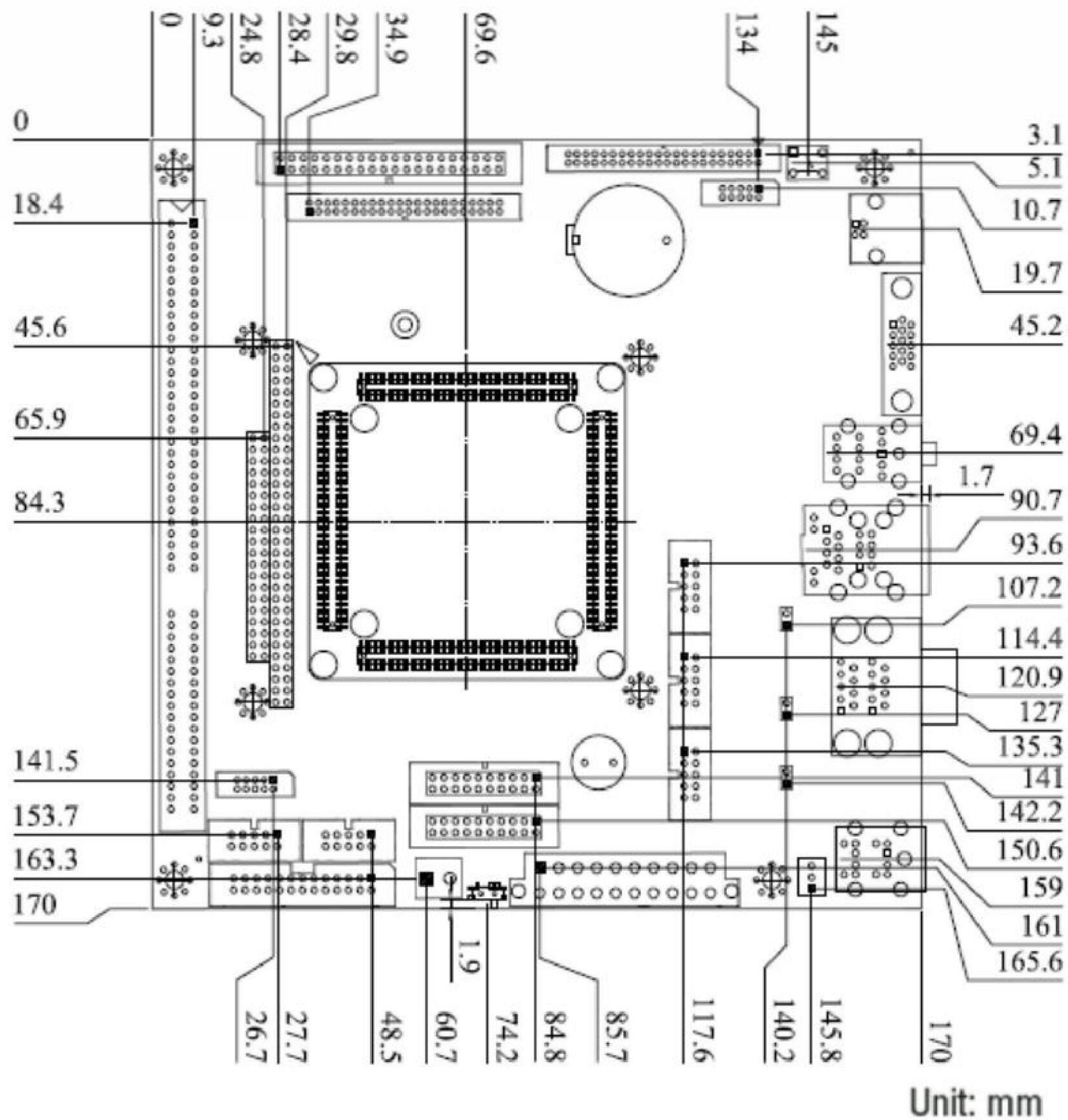
### 2.1 Module Dimension



### 2.2 Connectors on the carrier board (for module)

| Part Number        | Description                                                                                               |
|--------------------|-----------------------------------------------------------------------------------------------------------|
| PH2*38(1.27)-5.3MM | Male Connector for SOM304 SX/DX/DX2/DX3/MX+ Development Board (4 pcs are required for each SOM304 Module) |

## 2.3 DEV Board dimension

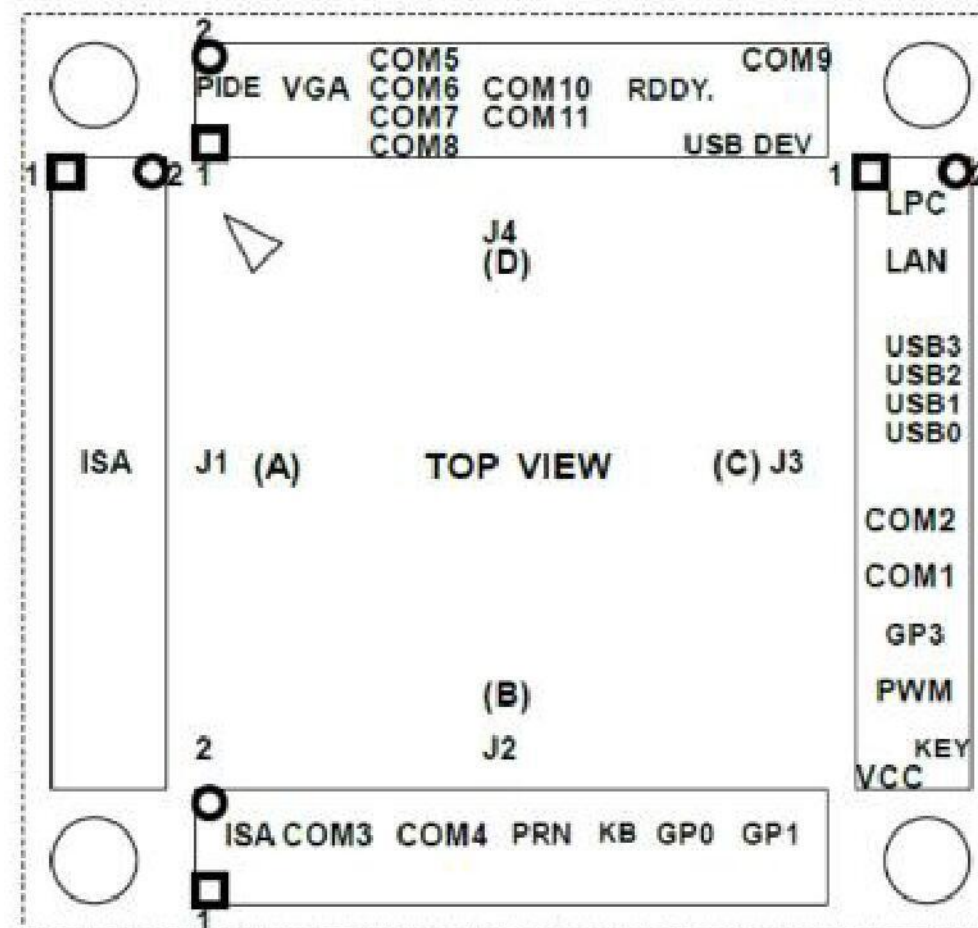


Extra test tools should be added for additional new RS232 and PWM ports



## 2.4 Pin Assignments & Jumper Settings

### 2.4.1 Pin Assignment





| J1(A) |         |     |         | J2(B) |        |     |         |
|-------|---------|-----|---------|-------|--------|-----|---------|
| Pin   | Signal  | Pin | Signal  | Pin   | Signal | Pin | Signal  |
| 1     | GND     | 2   | IOCHCK  | 1     | DRQ6   | 2   | LA17    |
| 3     | RSTDRV  | 4   | SD7     | 3     | DACK7  | 4   | MEMR    |
| 5     | IRQ9    | 6   | SD6     | 5     | DRQ7   | 6   | MEMW    |
| 7     | DRQ2    | 8   | SD5     | 7     | SD8    | 8   | SD9     |
| 9     | OWS     | 10  | SD4     | 9     | SD10   | 10  | SD11    |
| 11    | SMEMW   | 12  | SD3     | 11    | SD12   | 12  | SD13    |
| 13    | SMEMR   | 14  | SD2     | 13    | SD14   | 14  | SD15    |
| 15    | IOW     | 16  | SD1     | 15    | GPCS0  | 16  | GPCS1   |
| 17    | IOR     | 18  | SD0     | 17    | GND    | 18  | GND     |
| 19    | DACK3   | 20  | IOCHRDY | 19    | CTS3\  | 20  | DSR3\   |
| 21    | DRQ3    | 22  | AEN     | 21    | DTR3\  | 22  | RXD3\   |
| 23    | DACK1   | 24  | SA19    | 23    | RI3\   | 24  | RTS3\   |
| 25    | DRQ1    | 26  | SA18    | 25    | TXD3\  | 26  | DCD3\   |
| 27    | REFRESH | 28  | SA17    | 27    | CTS4\  | 28  | DSR4\   |
| 29    | GND     | 30  | SA16    | 29    | DTR4\  | 30  | RXD4\   |
| 31    | SYSCLK  | 32  | SA15    | 31    | RI4\   | 32  | RTS4\   |
| 33    | IRQ7    | 34  | SA14    | 33    | TXD4\  | 34  | DCD4\   |
| 35    | IRQ6    | 36  | SA13    | 35    | PPD0   | 36  | PSTB-   |
| 37    | IRQ5    | 38  | SA12    | 37    | PPD1   | 38  | PAFD-   |
| 39    | IRQ4    | 40  | SA11    | 39    | PPD2   | 40  | PERROR- |
| 41    | IRQ3    | 42  | SA10    | 41    | PPD3   | 42  | PINIT-  |
| 43    | DACK2   | 44  | SA9     | 43    | PPD4   | 44  | PSLIN-  |
| 45    | TC      | 46  | SA8     | 45    | PPD5   | 46  | PACK-   |
| 47    | BALE    | 48  | SA7     | 47    | PPD6   | 48  | PBUSY   |
| 49    | OSC     | 50  | SA6     | 49    | PPD7   | 50  | PPE     |
| 51    | MEMCS16 | 52  | SA5     | 51    | GND    | 52  | PSLCT   |
| 53    | IOCS16  | 54  | SA4     | 53    | RESET  | 54  | GND     |
| 55    | IRQ10   | 56  | SA3     | 55    | MSCLK  | 56  | KBCLK   |
| 57    | IRQ11   | 58  | SA2     | 57    | MSDATA | 58  | KBDATA  |
| 59    | IRQ12   | 60  | SA1     | 59    | VBATT  | 60  | SPEAKER |
| 61    | GND     | 62  | SA0     | 61    | GP00   | 62  | GP01    |
| 63    | IRQ15   | 64  | SBHE    | 63    | GP02   | 64  | GP03    |
| 65    | IRQ14   | 66  | LA23    | 65    | GP04   | 66  | GP05    |
| 67    | DACK0   | 68  | LA22    | 67    | GP06   | 68  | GP07    |
| 69    | DRQ0    | 70  | LA21    | 69    | GP10   | 70  | GP11    |
| 71    | DACK5   | 72  | LA20    | 71    | GP12   | 72  | GP13    |
| 73    | DRQ5    | 74  | LA19    | 73    | GP14   | 74  | GP15    |
| 75    | DACK6   | 76  | LA18    | 75    | GP16   | 76  | GP17    |



| J3(C) |                   |     |                   | J4(D) |              |     |          |
|-------|-------------------|-----|-------------------|-------|--------------|-----|----------|
| Pin   | Signal            | Pin | Signal            | Pin   | Signal       | Pin | Signal   |
| 1     | GND               | 2   | GND               | 1     | IDERST       | 2   | GND      |
| 3     | LAD0              | 4   | MTBF-OUT          | 3     | IDED7        | 4   | IDED8    |
| 5     | LAD1              | 6   | LFRAME-           | 5     | IDED6        | 6   | IDED9    |
| 7     | LAD2              | 8   | LDRQ-             | 7     | IDED5        | 8   | IDED10   |
| 9     | LAD3              | 10  | SERIRQ            | 9     | IDED4        | 10  | IDED11   |
| 11    | NC                | 12  | PCIRST-           | 11    | IDED3        | 12  | IDED12   |
| 13    | PCICLK1           | 14  | GND               | 13    | IDED2        | 14  | IDED13   |
| 15    | GND               | 16  | LINK/ACTIVE       | 15    | IDED1        | 16  | IDED14   |
| 17    | LANTX-            | 18  | LANRX-            | 17    | IDED0        | 18  | IDED15   |
| 19    | LANTX+            | 20  | LANRX+            | 19    | IDEREQ       | 20  | IDECBLID |
| 21    | DUPLEX            | 22  | VCC3-OUT          | 21    | IDEIOW       | 22  | IDESA0   |
| 23    | GND               | 24  | GND               | 23    | IDEIOR       | 24  | IDESA1   |
| 25    | USBD3-            | 26  | USBD2-            | 25    | IDERDY       | 26  | IDESA2   |
| 27    | USBD3+            | 28  | USBD2+            | 27    | IDEACK       | 28  | IDECs0   |
| 29    | USBD1-            | 30  | USBD0-            | 29    | IDEINT       | 30  | IDECs1   |
| 31    | USBD1+            | 32  | USBD0+            | 31    | AIDELED      | 32  | GND      |
| 33    | GND               | 34  | GND               | 33    | HSYNC        | 34  | BOUT     |
| 35    | PWM1_GATE         | 36  | PWM0_GATE         | 35    | VSNC         | 36  | ROUT     |
| 37    | PWM2_OUT          | 38  | PWM2_CLK          | 37    | DDCDAT       | 38  | GOUT     |
| 39    | PWM1_CLK          | 40  | PWM1_OUT          | 39    | DDCCLK       | 40  | GND      |
| 41    | PWM0_OUT          | 42  | PWM0_CLK          | 41    | GND          | 42  | GND      |
| 43    | PWM2_GATE         | 44  | TXDEN1            | 43    | GND          | 44  | RXD6\    |
| 45    | CTS1\             | 46  | DSR1\             | 45    | RXD5\        | 46  | TXD6\    |
| 47    | DTR1\             | 48  | RXD1\             | 47    | TXD5\        | 48  | GND      |
| 49    | RI1\              | 50  | RTS1\             | 49    | GND          | 50  | RXD8\    |
| 51    | TXD1\             | 52  | DCD1\             | 51    | RXD7\        | 52  | TXD8\    |
| 53    | GND               | 54  | GND               | 53    | TXD7\        | 54  | GND      |
| 55    | SPICS             | 56  | SPICLK            | 55    | GND          | 56  | RXD11\   |
| 57    | SPIDO             | 58  | SPODI             | 57    | RXD10\       | 58  | TXD11\   |
| 59    | GP34(CAN BUS CS1) | 60  | GP35(CAN BUS CS2) | 59    | TXD10\       | 60  | GND      |
| 61    | I2C1_SCL          | 62  | I2C1_SDA          | 61    | GND          | 62  | CAN1_H   |
| 63    | GP20              | 64  | GP21              | 63    | CAN0_H       | 64  | CAN1_L   |
| 65    | GP22              | 66  | GP23              | 65    | CAN0_L       | 66  | GND      |
| 67    | GP24              | 68  | GP25              | 67    | GND          | 68  | USBIN+   |
| 69    | GP26              | 70  | GP27              | 69    | SYS-FAIL-IN  | 70  | USBIN-   |
| 71    | GND               | 72  | GND               | 71    | SYS-FAIL-OUT | 72  | GND      |
| 73    | VCC               | 74  | KEY1              | 73    | SYS-SW-IN    | 74  | RXD9\    |
| 75    | VCC               | 76  | KEY0              | 75    | SYS-GPCS-IN  | 76  | TXD9\    |



## 3 System mapping

### 3.1 Memory mapping

| Memory Mapping        |                                              |       |
|-----------------------|----------------------------------------------|-------|
| Address               | Description                                  | Usage |
| 0000:0000 - 9000:FFFF | System RAM                                   | *     |
| A000:0000 - A000:FFFF | EGA/VGA Video Memory                         | *     |
| B000:0000 - B000:7FFF | MDA RAM, Hercules graphics display RAM       | *     |
| B000:8000 - B000:FFFF | CGA display RAM                              | *     |
| C000:0000 - C000:7FFF | EGA/VGA BIOS ROM                             | *     |
| C000:8000 - C000:BFFF | Boot ROM enable                              |       |
| C000:C000 - C000:FFFF | Console Redirection enable                   |       |
| D000:0000 - D700:FFFF | Expansion ROM space                          |       |
| D800:0000 - DB00:FFFF | SPI FLASH Emulation Floppy A Enable          | *     |
| DC00:0000 - DF00:FFFF | Expansion ROM Space                          |       |
| E000:0000 - E000:FFFF | USB Legacy SCSI ROM space                    |       |
| F000:0000 - F000:FFFF | Motherboard BIOS                             | *     |
| FEFA:D000 - FFFF:F000 | Standard OpenHCD USB Host Controller         | *     |
| FEFA:F800 - FFFF:FF00 | Standard OpenHCD USB Host Controller         | *     |
| FEFA:F400 - FFFF:FF00 | On board Ethernet Adapter                    | *     |
| FEFA:E000 - FFFF:F000 | Standard Enhanced PCI to USB Host Controller | *     |
| FEFA:FC00 - FFFF:FF00 | Standard Enhanced PCI to USB Host Controller | *     |



## 3.2 IO Mapping

| I/O Mapping   |                                                  |       |
|---------------|--------------------------------------------------|-------|
| I/O Address   | Owner                                            | Usage |
| 0000h - 000Fh | DMA 8237-1                                       | *     |
| 0010h - 0017h | COM9                                             |       |
| 0020h - 0021h | PIC 8259-1                                       | *     |
| 0022h - 0023h | Indirect Access Registers (6117D configuration p | *     |
| 002Eh - 002Fh | Forward to LPC BUS                               |       |
| 0040h - 0043h | Timer Counter 8254                               | *     |
| 0048h - 004Bh | PWM counter 8254                                 | *     |
| 004Eh - 004Fh | Forward to LPC BUS                               |       |
| 0060h         | Keyboard / Mouse data port                       | *     |
| 0061h         | Port B + NMI control port                        | *     |
| 0062h - 0063h | 8051 download 4k address counter                 | *     |
| 0064h         | Keyboard/ Mouse status/ command port             | *     |
| 0065h         | WatchDog0 reload counter                         | *     |
| 0066h         | 8051 download 8bit data port                     | *     |
| 0067h         | WatchDog1 reload counter                         | *     |
| 0068h - 006Dh | WatchDog1 control counter                        | *     |
| 0070h - 0071h | CMOS RAM port                                    | *     |
| 0072h - 0075h | MTBF control register                            | *     |
| 0078h - 007Ch | GPIO port 0,1,2,3,4 default setup                | *     |
| 0080h - 008Fh | DMA page register                                | *     |
| 0092h         | System control register                          | *     |
| 0098h - 009Ch | GPIO direction control                           | *     |
| 00A0h - 00A1h | PIC 8259-2                                       | *     |
| 00C0h - 00DFh | DMA 8237-2                                       | *     |
| 00E0h - 00EFh | DOS 4G Page access                               | *     |
| 0170h - 0177h | IDE1(IRQ 15)                                     |       |
| 01F0h - 01F7h | IDE0 (IRQ 14)                                    | *     |
| 0220h         | COM11 Forward to LPC BUS F81218E                 | *     |
| 0228h         | COM10 Forward to LPC BUS F81218E                 | *     |
| 0238h         | COM8 Forward to LPC BUS F81218E                  | *     |
| 0278h - 027Fh | Printer port (IRQ7, DMA 0)                       | *     |
| 02E0h         | COM6 Forward to LPC BUS F81218E                  | *     |
| 02E8h - 02EFh | COM4 (IRQ 11)                                    | *     |
| 02F8h         | COM9 (IRQ3)                                      | *     |
| 0338h         | COM7 Forward to LPC BUS F81218E                  | *     |
| 0376h         | IDE1 ATAPI device control write only register    | *     |
| 03E0h         | COM5 Forward to LPC BUS F81218E                  | *     |
| 03E8h - 03EFh | COM3 (IRQ 10)                                    | *     |
| 03F0h - 03F7h | Floppy Disk (IRQ6, DMA2)                         |       |
| 03F6h         | IDE0 ATAPI device control write only register    | *     |
| 03F8h - 03FFh | COM1 (IRQ 4)                                     | *     |
| 0480h - 048Fh | DMA High page register                           | *     |
| 0490h - 0499h | Instruction counter register                     | *     |
| 04D0h - 04D1h | 8259 Edge / level control register               | *     |
| 0CF8h - 0CFFh | PCI configuration port                           | *     |
| DE00h - DEFFh | On board LAN                                     | *     |
| FC00h - FC05h | SPI Flash BIOS control register                  | *     |
| FC08h - FC0Dh | External SPI BUS control register                | *     |



### 3.3 IRQ Mapping

| IRQ Mapping |                           |
|-------------|---------------------------|
| IRQ#        | Description               |
| IRQ0        | System Timer              |
| IRQ1        | Keyboard Controller       |
| IRQ2        | Cascade for IRQ8 – 15     |
| IRQ3        | Serial Port 9             |
| IRQ4        | Serial Port 1             |
| IRQ5        | COM5/6/7/8/10/11          |
| IRQ6        | USB                       |
| IRQ7        | Printer Port              |
| IRQ8        | Real Time Clock           |
| IRQ9        | USB/ Ethernet 10/100M LAN |
| IRQ10       | Serial Port 3             |
| IRQ11       | Serial Port 4             |
| IRQ12       | Mouse                     |
| IRQ13       | Math Coprocessor          |
| IRQ14       | Hard Disk Controller#1    |
| IRQ15       | Hard Disk Controller#2    |



## 4 Software Resources

### 4.1 ICOP Technical Resource Website

In the following website, you will find our latest user manuals, including OS support resources systems such as evaluation images for Windows Embedded Compact 7, Windows Embedded CE 6.0, Windows Embedded 5.0, and Windows XP Embedded (Win XPe). For details, please kindly visit the following link:

<http://tech.icop.com.tw/>

### 4.2 Testing CAN/SPI functionality

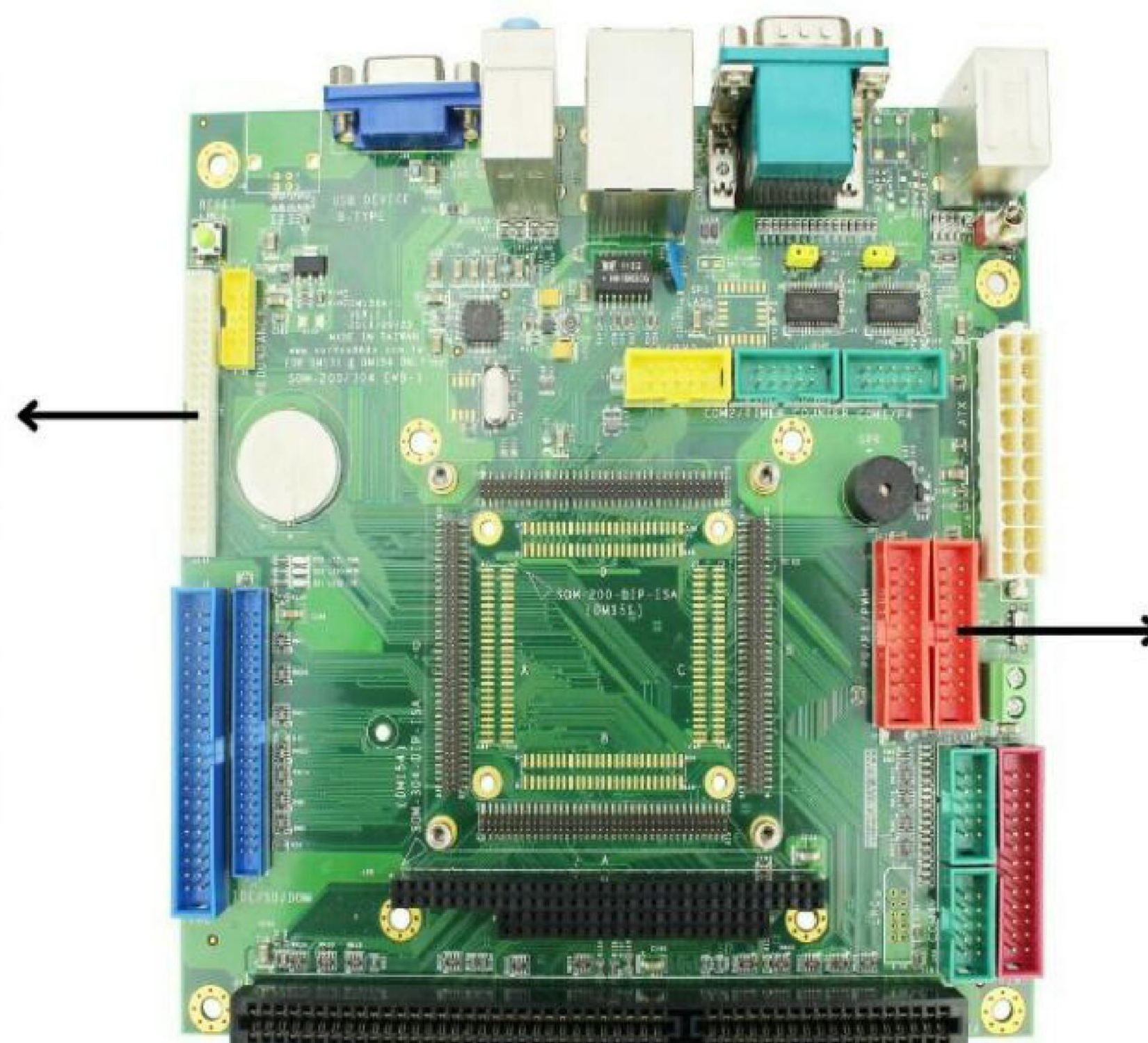
Before starting to test CAN/SPI bus & COM5/6/7/8/10/11, please download the testing tool at the link: <https://ftp.icop.com.tw/share/wKhXVmfp>

Source code for CAN Bus tool: <https://ftp.icop.com.tw/share/FcUjW2Zt>

This tool is working under DOS system, so please prepare a DOS environment for testing.

Connectors on Development board:

| Pin # | Signal Name | Pin # | Signal Name |
|-------|-------------|-------|-------------|
| 1     | VCC3        | 2     | VCC3        |
| 3     | CAN1_L      | 4     | CAN0_L      |
| 5     | CAN1_H      | 6     | CAN0_H      |
| 7     | NC          | 8     | NC          |
| 9     | GND         | 10    | GND         |
| 11    | TXD11#      | 12    | TXD10#      |
| 13    | RXD11#      | 14    | RXD10#      |
| 15    | GND         | 16    | NC          |
| 17    | NC          | 18    | NC          |
| 19    | NC          | 20    | GND         |
| 21    | NC          | 22    | NC          |
| 23    | GND         | 24    | GND         |
| 25    | TXD8#       | 26    | TXD7#       |
| 27    | RXD8#       | 28    | RXD7#       |
| 29    | NC          | 30    | NC          |
| 31    | GND         | 32    | GND         |
| 33    | GND         | 34    | GND         |
| 35    | NC          | 36    | TXD5#       |
| 37    | NC          | 38    | RXD5#       |
| 39    | NC          | 40    | GND         |
| 41    | NC          | 42    | TXD6#       |
| 43    | GND         | 44    | RXD6#       |

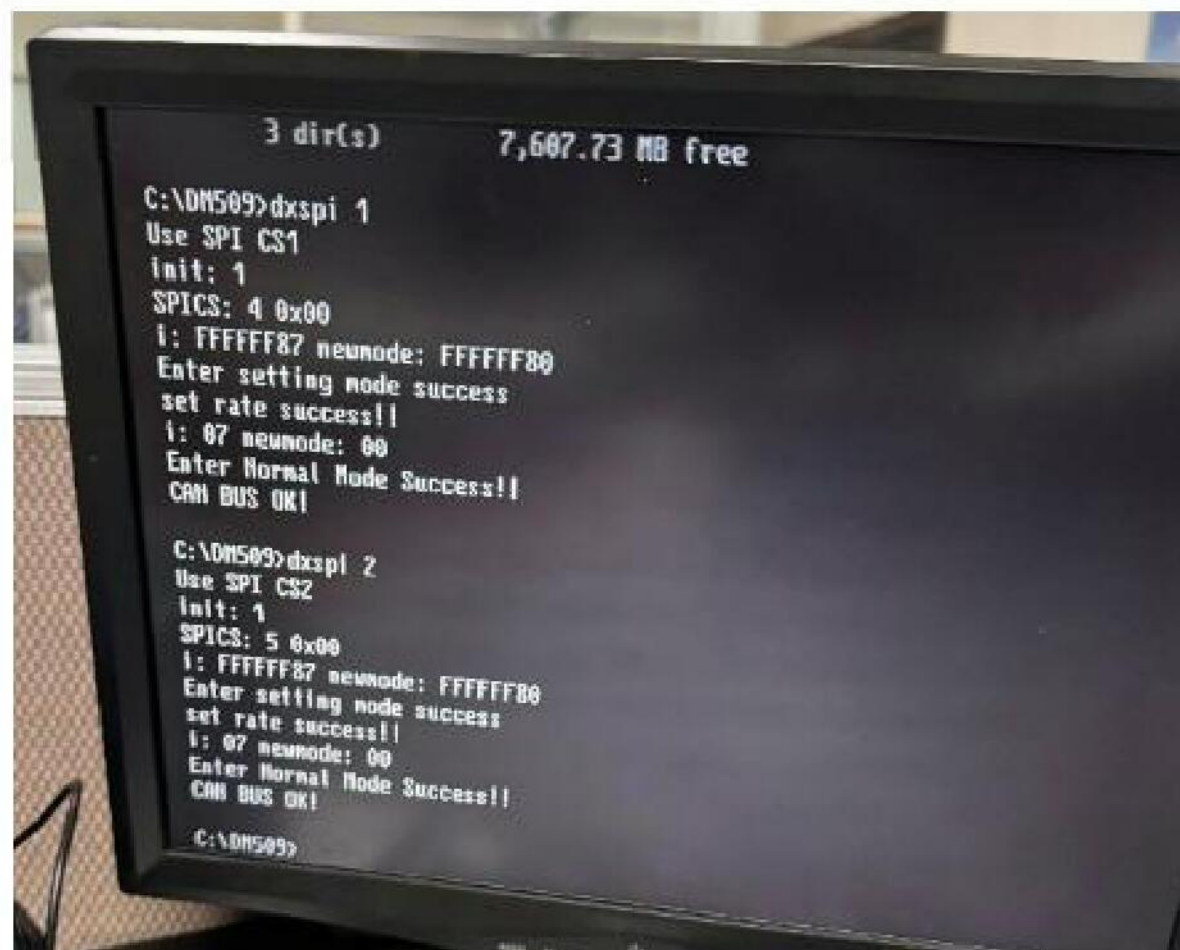


| Pin # | Signal Name | Pin # | Signal Name |
|-------|-------------|-------|-------------|
| 1     | GND         | 2     | VCC         |
| 3     | GP20        | 4     | SPICS       |
| 5     | GP21        | 6     | SPICLK      |
| 7     | GP22        | 8     | SPIDO       |
| 9     | GP23        | 10    | SPIDI       |
| 11    | GP24        | 12    | CAN-CS1     |
| 13    | GP25        | 14    | CAN-CS2     |
| 15    | GP26        | 16    | I2C1_SCL    |
| 17    | GP27        | 18    | I2C2_SDA    |
| 19    | VCC         | 20    | GND         |



### 4.2.1 Testing CAN/SPI bus

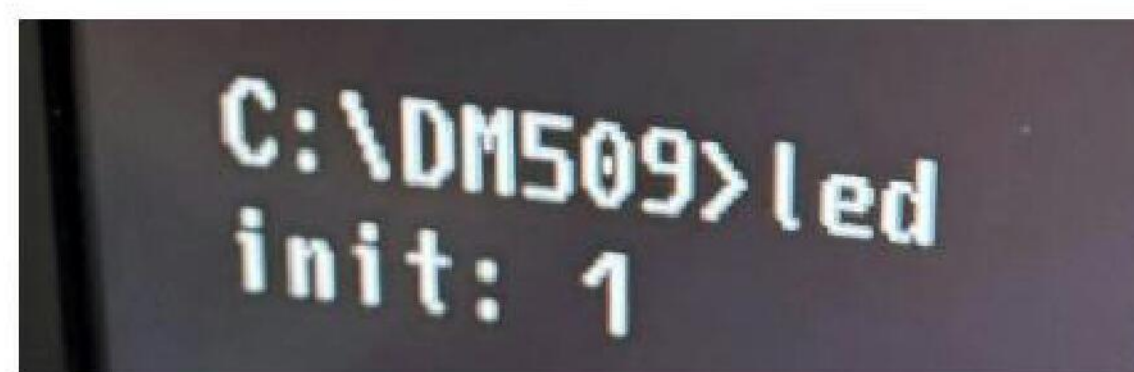
For testing CAN bus 1 & 2, access the tool folder /DM509 and type “**DXSPI1**” or “**DXSPI2**” for testing, the result will come out as the photo below:



For testing SPI, please connect the SPI bus to an LED dot matrix display. After connecting the display, please access the tool folder DM509 and type “**LED**”, and the LED will light up. Once the display lights up, it means the SPI bus is working.



LED display



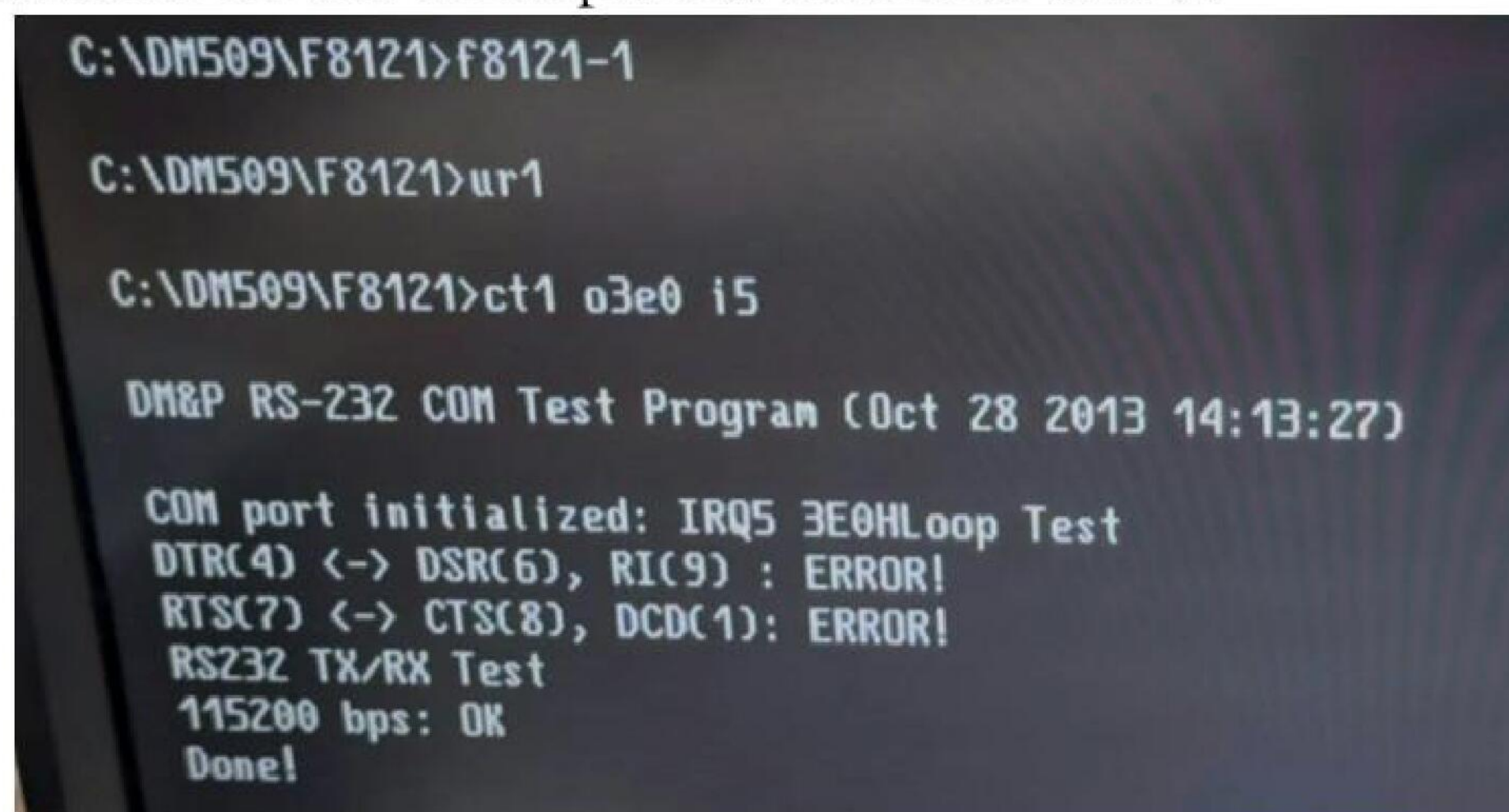


### 4.2.2 Testing COM5/6/7/8/10/11

For testing COM 5/6/7/8/10/11, please access the tool folder /DM509/f8121 and type the command below:

| COM port no. on SOM304RD-10S | Command        |
|------------------------------|----------------|
| COM5                         | <u>F8121-1</u> |
| COM6                         | <u>F8121-2</u> |
| COM7                         | <u>F8121-3</u> |
| COM8                         | <u>F8121-4</u> |
| COM10                        | <u>F8121-5</u> |
| COM11                        | <u>F8121-6</u> |

Once the above command is typed, the software will start to test the TX/RX function on the COM port as the result below:



```
C:\DM509\F8121>f8121-1

C:\DM509\F8121>ur1

C:\DM509\F8121>ct1 03e0 i5

DM&P RS-232 COM Test Program (Oct 28 2013 14:13:27)

COM port initialized: IRQ5 3E0HLoop Test
DTR(4) <-> DSR(6), RI(9) : ERROR!
RTS(7) <-> CTS(8), DCD(1): ERROR!
RS232 TX/RX Test
115200 bps: OK
Done!
```



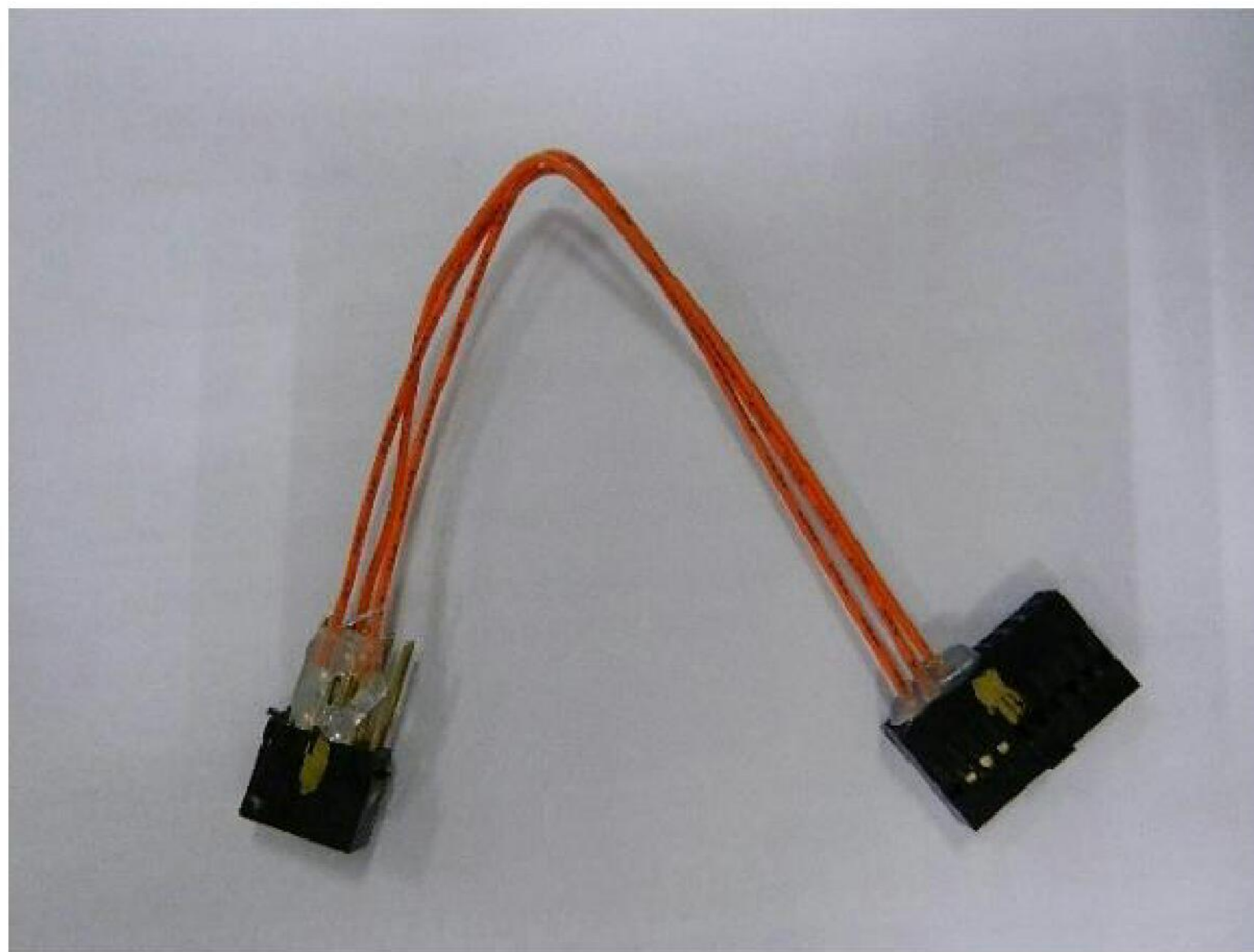
## 4.3 Testing PWM/i2C functionality

### 4.3.1 Testing PWM

Download the PWM testing tool:

<https://ftp.icop.com.tw/share/HGMwle55>

Make a cable to connect PWM to GPIO:



Pins connection on the development board

| Pin       |   | Pin       |
|-----------|---|-----------|
| J11 pin 3 | ← | J14 pin 3 |
| J11 pin 5 | ← | J14 pin 7 |
| J11 pin 7 | ← | J14 pin 4 |

Connect the cable to the development board as below:

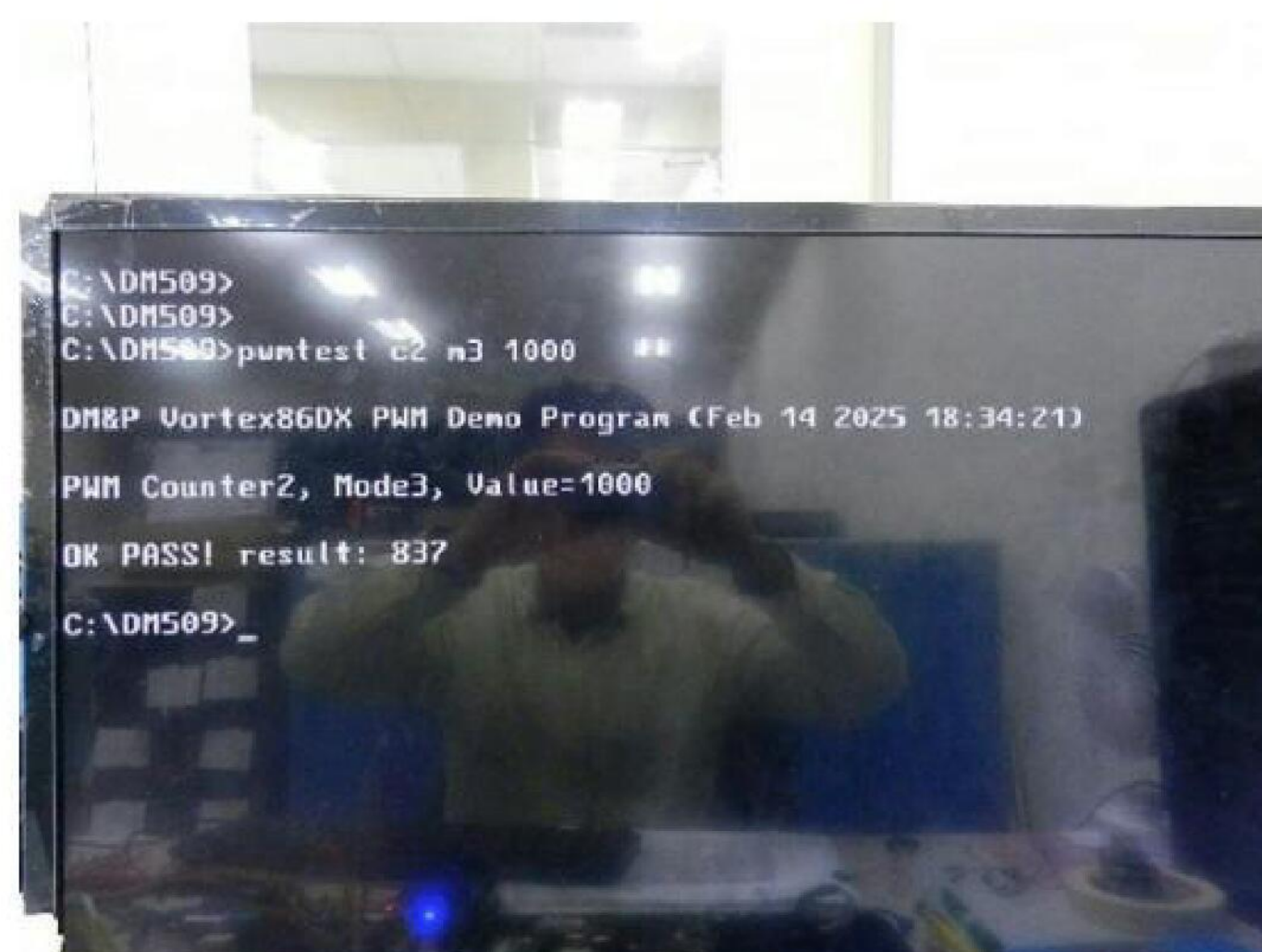
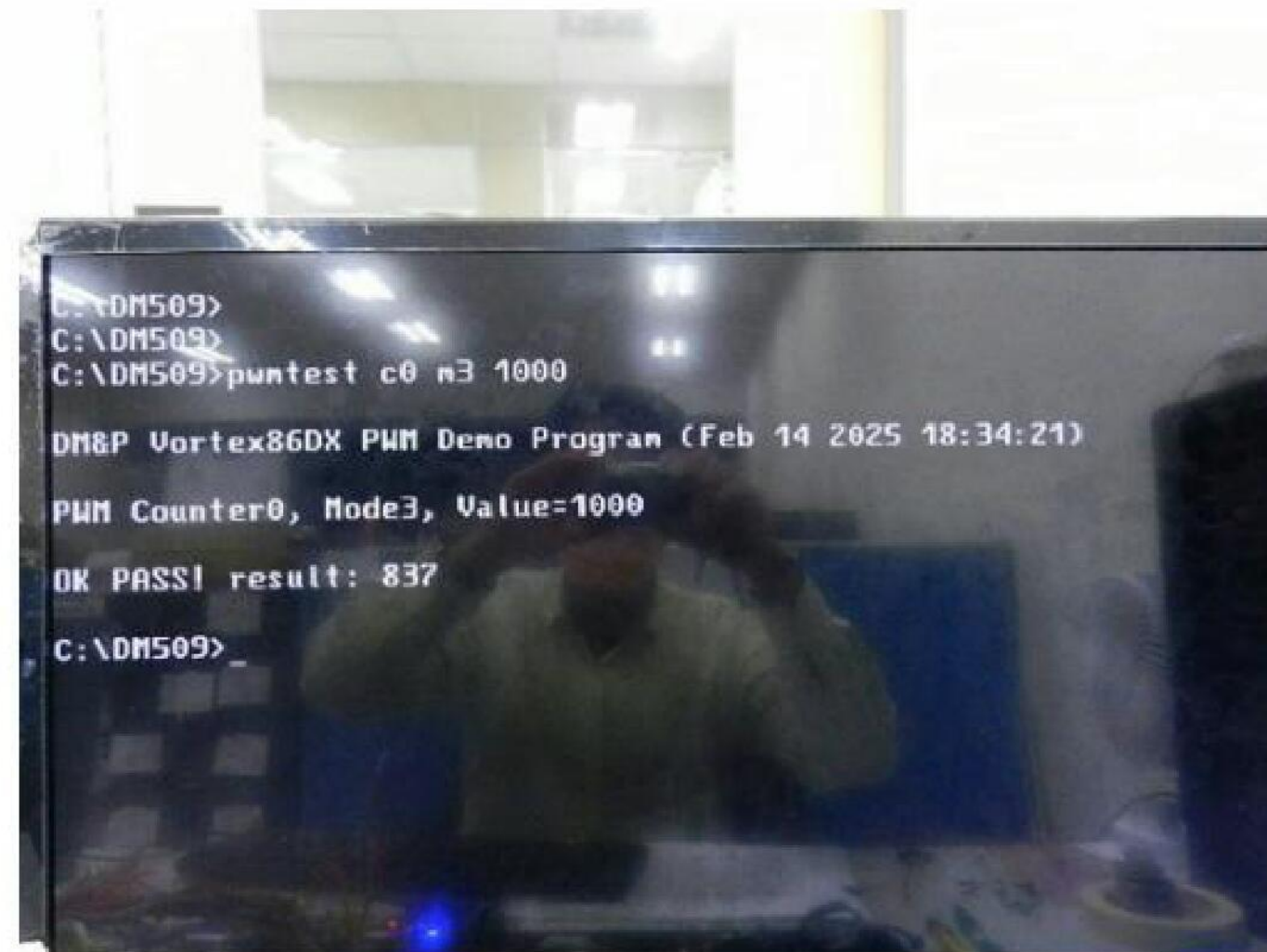




Boot up the DOS software and input command:

1. PWM0: pwmtest c0 m3 1000
2. PWM1: pwmtest c1 m3 1000
3. PWM2: pwmtest c2 m3 1000

If the function is working, it will show OK PASS at the end:



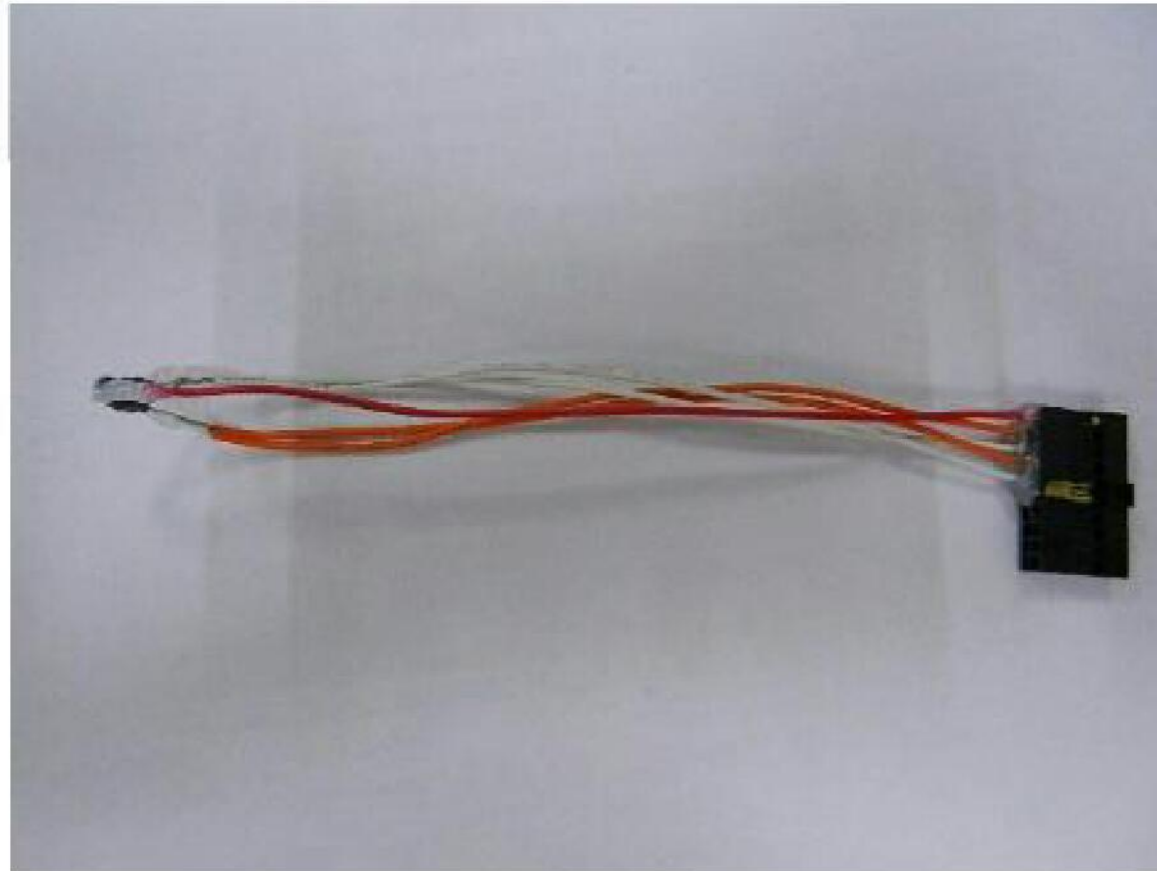


### 4.3.2 Testing i2C

Download the i2C testing tool:

<https://ftp.icop.com.tw/share/Rf9Tc5qD>

Cable for testing i2C:

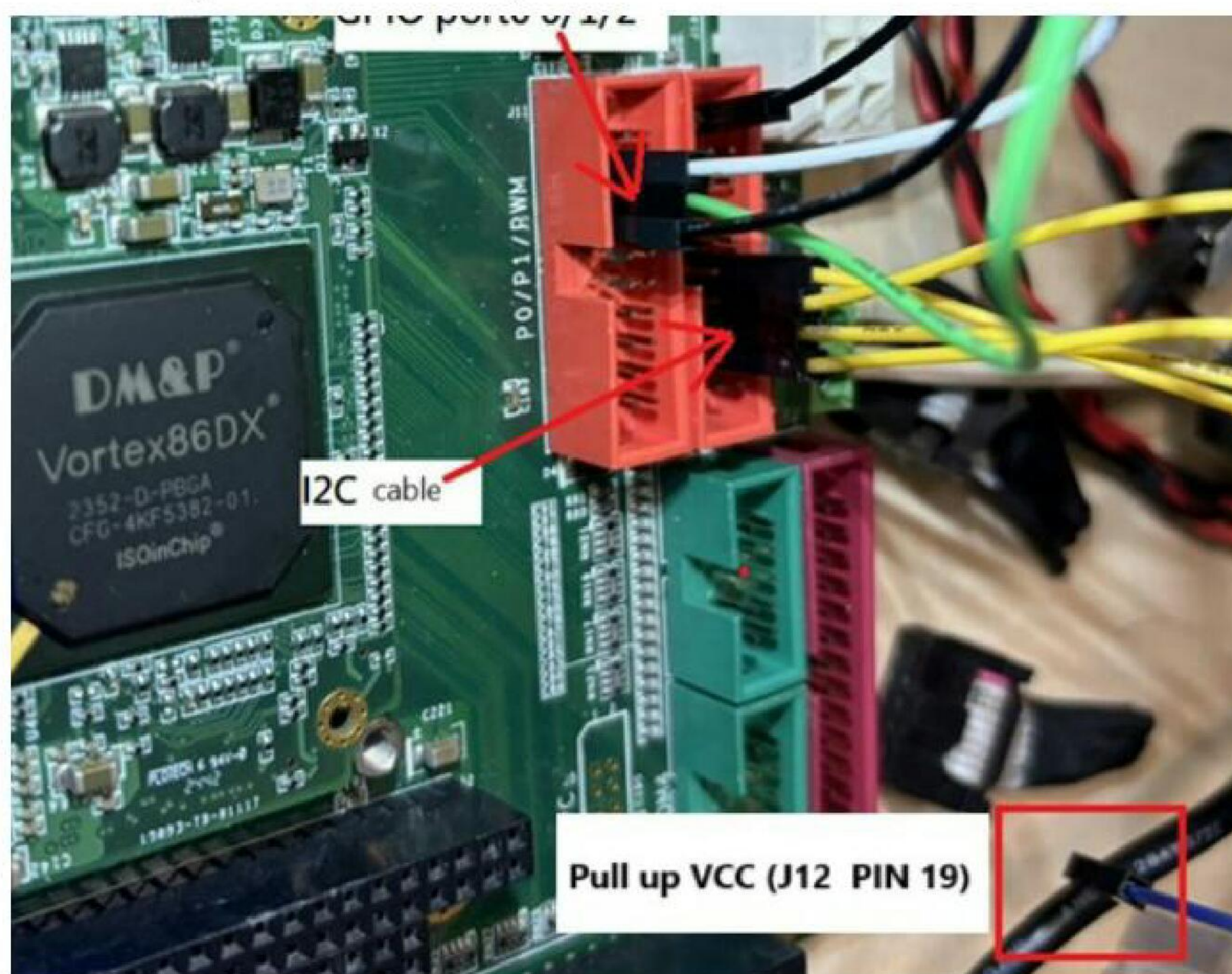


This cable to connect the J12 (i2C) connector to test the i2C function; the connection method is:

| Pin                      | Resistor | Pin             |
|--------------------------|----------|-----------------|
| J12 pin 19 (+5V) pull up | 1K ohm   | J12 pin 12 & 16 |
|                          | 1K ohm   | J12 pin 14 & 18 |

1. Connecting pin 12 & 16 to pin 19 via 1K ohm to pull high the signal
2. Connecting pin 14& 18 to pin 19 via 1K ohm to pull high the signal

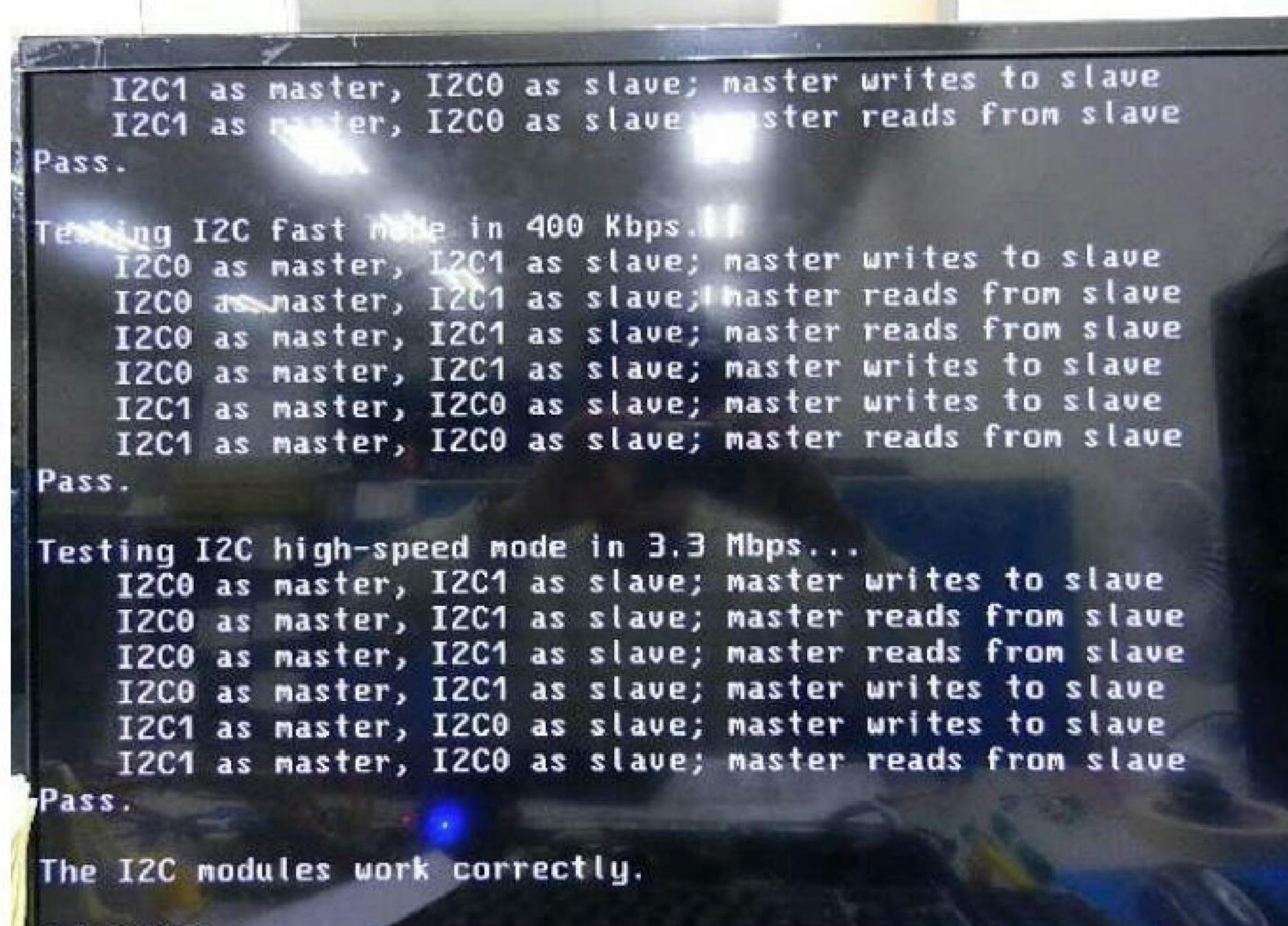
Plug the cable to J12 connector.





Run testing command under DOS; If the function is working, it will show OK PASS at the end:

- i2ctest





## 4.4 Vortex86 Processor Programming Guide

Vortex86 processor programming guide is for software programmers to build their programs more quickly and easily on Vortex86 processor.

For Vortex86DX software programming guide, please contact local suppliers or your technical support sales in ICOP or mail to [info@icop.com.tw](mailto:info@icop.com.tw)

## 5 Warranty

This product is warranted to be in good working order for a period of one year (12 months) from the date of purchase. Should this product fail to be in good working order at any time during this period, we will, at our option, replace or repair it without additional charge except as set forth in the following terms. This warranty does not apply to products damaged by misuse, modifications, accident or disaster. Vendor assumes no liability for any damages, lost profits, lost savings or any other incidental or consequential damage resulting from the use, misuse of, originality to use this product. Vendor will not be liable for any claim made by any other related party. Return authorization must be obtained from the vendor before returned merchandise is accepted. Authorization can be obtained by calling or faxing the vendor and requesting a Return Merchandise Authorization (RMA) number. Returned goods should always be accompanied by a clear problem description. Should you have questions about warranty and RMA service, please contact us directly.



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