
I/O Expansion Bus for 7188X/7188E User's Manual

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1. Introduction

1.1 What is the I/O Expansion Bus?

The I-7188XA, I-7188XC, I-7188XB, I-7188XG, I-7188EX, I-7188EG & 7521 all support I/O expansion buses. The I/O expansion bus can be used to implement various I/O functions such as D/I, D/O, A/D, D/A, Timer/Counter, UART, flash memory, battery backup SRAM & other I/O functions. Nearly all kinds of I/O functions can be implemented on this bus.

1.2 Using I-7188 I/O Expansion Boards:

The I-7188X series can plug an I/O Expansion board inside the main body. To install it, users have to loosen the screw and remove the shell of I-7188XA / I-7188XC / I-7188XB / I-7188EX / I-7188XG / I-7188EG. The supported I/O expansion boards are as below. It will be more.

1.3 Overview:

Even though the 7000 family is so powerful, there are some applications that cannot be solved, such as:

- High speed applications
- Special hardware requirement applications
- Special software requirement applications
- Combine special hardware & software applications

So we developed an I/O expansion bus in the 7188X / 752N / 7188E family to solve all these applications above. The I/O expansion bus can be used to implement various I/O functions such as D/I, D/O, A/D, D/A, Timer/Counter, UART,

flash memory, battery backup SRAM & other I/O functions. **Nearly all kinds of I/O functions can be implemented in this bus.**

The I/O expansion bus includes serial & parallel interface. The parallel interface is very similar to an ISA bus, so the user can move the old ISA bus design to the I/O expansion bus with very little modification. The power consumption table is given as follows:

| | 7188XC | 7188XB / XG | 7188EX / EG | Note: Power consumption of 7-SEG LED is 140 mA For example: 7188XCD=140+140=280 So I/O=550-280=270 mA max. |
|----------------------------|-----------|-------------|-------------|---|
| CPU Module | 140mA@5V | 260mA@5V | 290mA@5V | |
| I/O Expansion Board | 410mA@5V | 290mA@5V | 260mA@5V | |
| Total Max. | 550 mA@5V | 550 mA@5V | 550 mA@5V | |

Note:The **7188XA(D)** supports I/O expansion bus but does not support user defined pins, so the 7188XA only supports X002, X003, X560, X600, X601, X607, X608.

The I/O pins of serial bus are programmable. They can be programmed as D/I, or D/O. Some pins can be configured to D/I or D/O or timer input or timer output. There are many serial interface devices today. The features of these serial devices are given as follows:

- Smaller size compared to parallel devices.
- Lower cost compared to parallel devices.
- Easier to design for isolation application.

The serial interface of an I/O expansion bus can link to these serial devices very easily. The combination of serial & parallel interface makes the I/O expansion bus very easy & powerful for various industry applications. These are many design examples given in this manual and all hardware circuit & software driver sources are OPENING for all user. From these examples, the users can buy these examples or modify them for their special requirements. The system design steps are given as follows:

Step 1: List all functions required.

Step 2: For all functions, go to step 3. If all functions are solved → STOP.

Step 3: If this function can be solved by the 7000 module → Go to step 2 for next function.

Step 4: If this function can be solved by 7188X+X??? → Go to step 2 for next function.

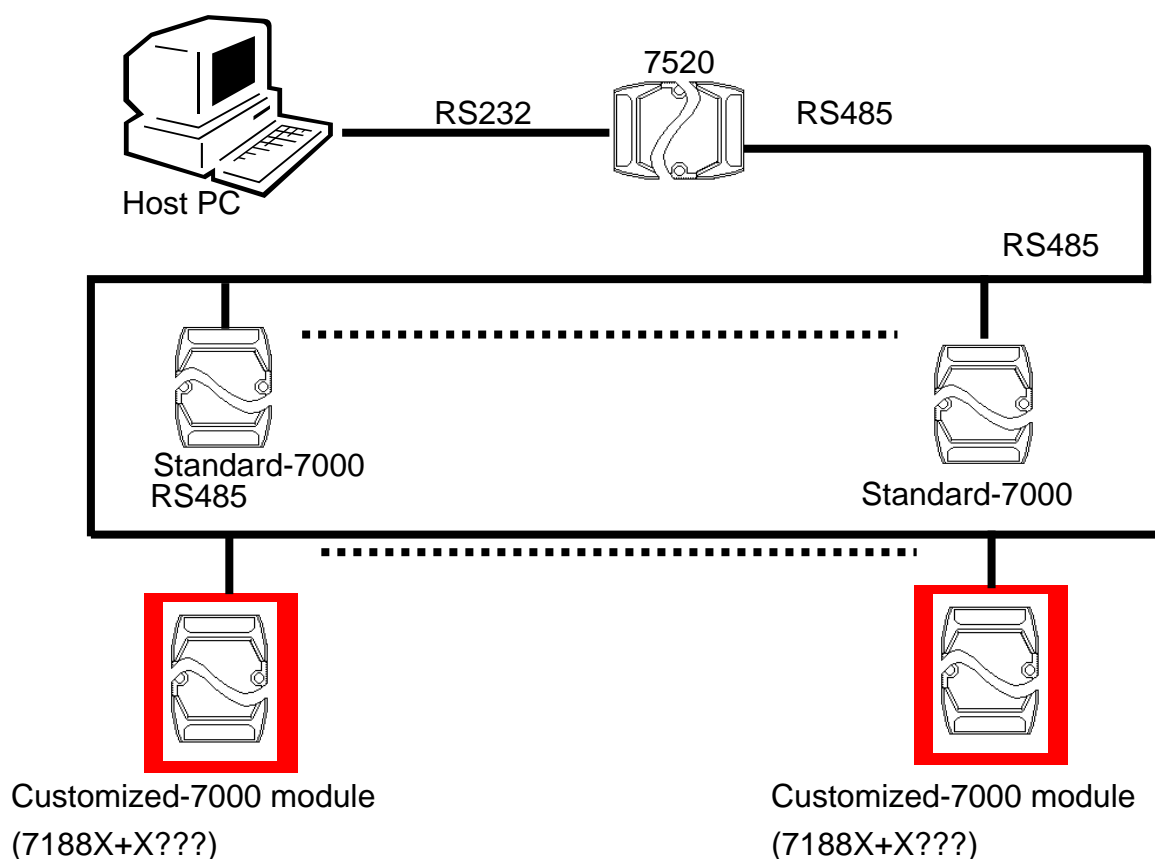
Step 5: Now user must design special hardware on the I/O expansion bus.

Step 6: User writes their special software driver based on this new hardware.

Step 7: Refer to “**7521/7522/7523/24/27 Software User’s manual**” for firmware. Modify & download this firmware into the CPU module, this module now will work as a customized 7000 module.

Step 8: Go to step 2 for next function.

After the above steps, user can combine the **standard-7000 modules & customized-7000 modules** to solve all applications in the same RS-485 network. This customized solution diagram is given as follows:



The design of a I/O Expansion Bus make the idea of a“Customized-7000 Module” come true. The features of a“Customized-7000 Module” are given as follows:

- 7188X+X??? → Single module solution → “Customized-7000 Module”
- 7000 compatible command sets & RS-485 networking
- Easy hardware/software interface for users to design & manufacture their special hardware & software
- Time-to-market ODM solution for user’s special requirements (any high speed, complex or combined functions of D/I/O, A/D, D/A,, etc.)
- Robust, stable, flexible, time-to-market & cost-effective total solution.

1.4 Reconfiguring the 7188XC(D)/7521(D)

From pin-4 to pin-8 of the 7188XC(D)/7521(D) there are three D/O & two D/I pins. For the application of “Customized 7000 Modules”, these 5 D/I/O pins can be hardware reconfigured to other functions as follows:

Step 1: Remove the reconfiguration-resistor as follows:

If DO3 is reconfigured, remove R19

If DO2 is reconfigured, remove R20

If DO1 is reconfigured, remove R21

If DI3 is reconfigured, remove R22

If DI2 is reconfigured, remove R23

Then, the onboard D/I/O functions can be disabled.

Step 2: Install a 5-pin male reconfiguration-jumper into the TP0 of the 7188XC(D)/7521(D)

Step 3: Design a 5-pin female reconfiguration-jumper in X??? for Connection to TP1. Then the external signals from pin-4 to pin-8 can be connected to X???. The user can refigure these 5 D/I/O pins to their special requirements now.

Note: If the DO2 is reconfigured to D/I, its initial state must be High. If its initial state is LOW, system clock will be reduced to 10M. So all clock-related libraries will only be at half-speed.

Refer to next page for more information.

Example:

The X100 is an 8-channel D/I board designed for the 7188X(D) / 7521(D). It removes all 5 resistors, R19 ~ R23, and reconfigures all these pins as D/I pins. It installs another 5-pin female reconfiguration-jumper into TP1 of the 7188XC(D)/7521(D). Therefore, user can select the original 3_DO_2_DI functions or new 5_DI functions by setting the jumper in different positions.

The I-7188XB(D), I-7188XG(D), I-7188EX(D), I-7188EG(D) has 14 user-defined pins. But the I-7188XB(D), I-7188XG(D), I-7188EX(D), I-7188EG(D) & I-7188XA(D) don't support the reconfiguration-resistor. So the user-defined pins of the 7188X / 7521 family are given as follows:

| Module | User defined pins | Reconfiguration pins | Customized I/O pins |
|-------------------------|-------------------|----------------------|---------------------|
| 7188XA (D) | 0 | 0 | 0+0=0 |
| 7188XB (D) | 14 | 0 | 14+0=14 |
| 7188XC (D) | 3 | 5 | 3+5=8 |
| 7188XG (D) | 14 | 0 | 14+0=14 |
| 7188EX (D) | 14 | 0 | 14+0=14 |
| 7188EG (D) | 14 | 0 | 14+0=14 |
| 7521 (D) | 3 | 5 | 3+5=8 |
| 7522 / 23 / 24 / 27 (D) | 0 | 0 | 0+0=0 |

Note: The **7188XA(D)** supports I/O expansion bus but does not support user defined pins, so the 7188XA only supports X002, X003, X560, X600, X601, X607, X608.

1.5 How to download program under the MiniOS7 ?

1. Create a file folder named "7188X" in your hard drive.
For example, "c:\7188X".

For Dos, Windows 95 & Windows 98 Users:

2. Copy \Napdos\MiniOS7\utility\7188xw.exe.
from the CD_ROM into your "7188X" folder.
3. Run "\7188X\7188xw.exe" in your hard drive. A "7188xw" screen
will appear.

For Windows NT, Windows 2000 & Windows XP Users:

2. Copy \Napdos\MiniOS7\utility\7188xw.exe.
from the CD_ROM into your "7188X" folder.
3. Run "\7188X\7188xw.exe" in your hard drive. A "7188xw" screen
will appear.
4. Link COM1 or COM2 of your PC to COM1 of the I-7188XC controller
through a RS232 cable.
5. Power off the I-7188XC controller, connect pin "INIT" to "INIT COM"
and then power it up.
6. If the connection is Ok, messages will appear on the 7188xw screen.

```
*****
**** 7188x Ver. 1.01.0 02/23/2000 *****
***          Press F1 for help.          ****
*****
ICP_DAS MiniOS7 for 7188x Ver. 1.03 build 014,May 09 2001 14:30:36
SRAM:512K, FLASH MEMORY:512K
Serial number= 5A 5A 5A 5A 5A 5A 5A 5A
7188x>
```

To burn an ISaGRAF embedded driver, follow the following steps.

8. Copy the program of the correct version into your "7188X" folder.
For example, version 1.25,
copy \Napdos\Appication\application 11\english\7188xc\PWM.exe to
C:\7188X\PWM.exe

-
9. Power off the I-7188XC controller, connect pin "INIT" to "INIT COM" and then power it up.
 10. Type "del" and reply "y" to delete the current driver.
7188x> del
Total File number is 2, do you really want to delete(y/n)?
 11. Type "load", then press ALT_E and then type "pwm.exe".
It will take about 15 seconds to finish.
7188x> load
File will save to 8000:0000
StartAddr-->7000:FFFF
Press ALT_E to download file!
Input filename:PWM.exe
Send file info. total 260 blocks
Block 260
Transfer time is: 15.122000 seconds
Back to Terminal mode
 12. Type "load" again, then press ALT_E and then type "autoexec.bat" .
7188x> load
File will save to 9037:000C
StartAddr-->9000: 037B
Press ALT_E to download file!
Input filename:autoexec.bat
Send file info. total 1 blocks
Block 1
Transfer time is: 0.060000 seconds
Back to Terminal mode
 13. Type "dir" to make sure "autoexec.bat" and "PWM.exe" are well burned.
7188X> dir
0) PWM.exe 09/01/2002 22:21:23 66396[1035C]8002:0000-9037:000C
1) autoexec.bat 04/13/2001 16:50:27 20[00014]9039:000C-903B:0000
Total File number is 2 Free space=392240 bytes
 14. Press ALT_X to exit "7188x".
 15. Remove the connection between "INIT" - "INIT COM", reset the I-7188XC controller.

2. Reference Guide

2.1 This manual can also be found at :

CD\NAPDOS\7188X\manual\hardware\iobus_e.pdf

ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/7188x/manual/hardware/iobus_e.pdf

2.2 Software Installation & Demo Programs:

2.2.1 Software Installation:

Refer to “7521/7522/7523/7524/7527 Software User’s Manual” for software installation.

The software driver will be updated frequently. Software driver and User’s manual download at: CD\NAPDOS\7188X\manual and

<ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/7188x/manual>

2.2.2 Demo program:

X series for I-7188XA

<ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/7188x/minios7/7188xa/demo/bc/ioexpbus/>

X series for I-7188XB

<ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/7188x/minios7/7188xb/demo/bc/ioexpbus/>

X series for I-7188XC

<ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/7188x/minios7/7188xc/demo/bc/ioexpbus/>

X series for I-7188EX

<ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/7188e/minios7/demo/bc/ioexpbus/>

X series for I-7188XG (English_manu, Driver, Demo)

<ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/isagraf/7188xg/>

X series for I-7188EG (English_manu, Driver, Demo)

<ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/isagraf/7188eg/>

2.2.3 Performance:

CD \Napdos\7188x\manual\hardware\x-Performance

<ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/7188x/manual/hardware/x-performance/>

3. Wire Connection :

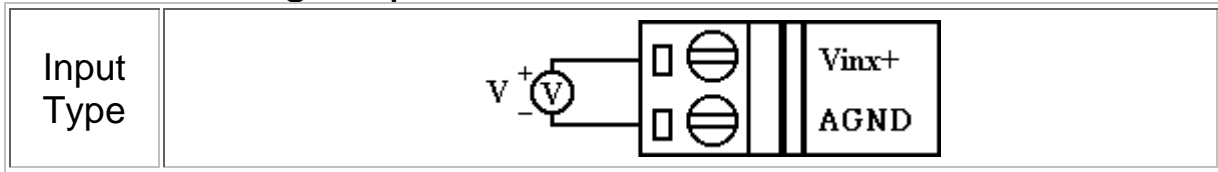
3.1 Digital Input Wire Connection :

| Input Type | ON State DI value as 0 | OFF State DI value as 1 |
|----------------|----------------------------------|-----------------------------------|
| Relay Contact | | |
| TTL/CMOS Logic | | |
| Open Collector | | |

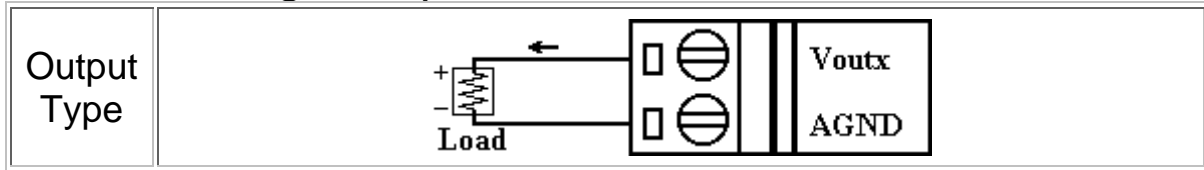
3.2 Digital Output Wire Connection :

| Output Type | ON State DO value as 0 | OFF State DO value as 1 |
|-----------------|----------------------------------|-----------------------------------|
| Drive Relay | | |
| Resistance Load | | |

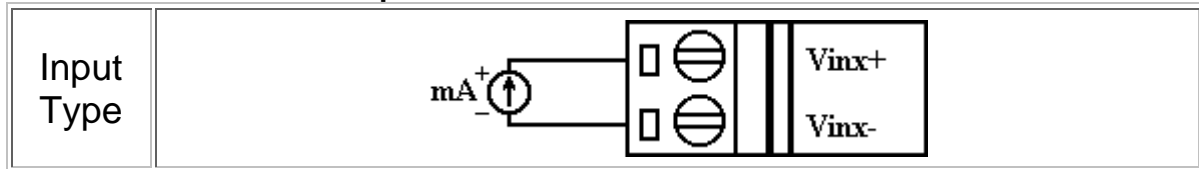
3.3 Voltage Input Wire Connection:



3.4 Voltage Output Wire Connection:



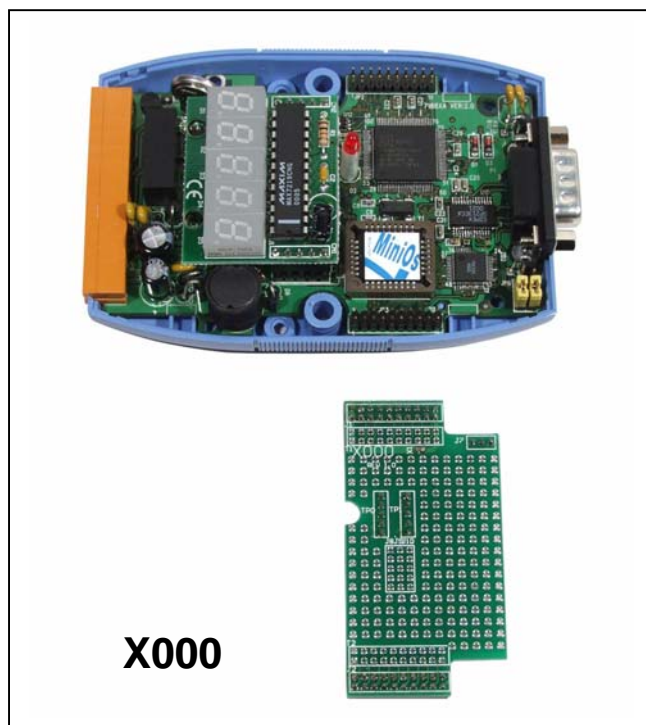
3.5 Current Input Wire Connection:



4. Mounting of I/O Expansion Bus

4.1 Minimal mounting with 7-segment display

Before mounting:

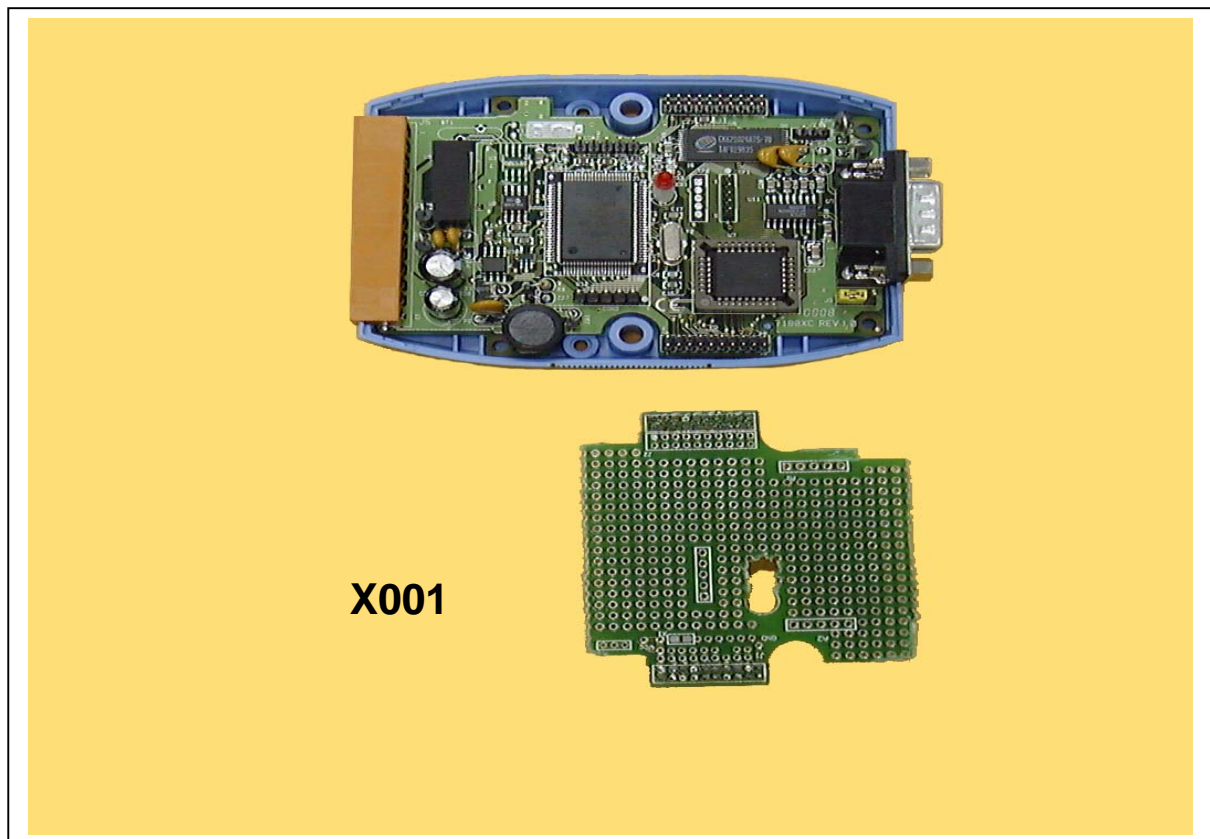


After mounting:

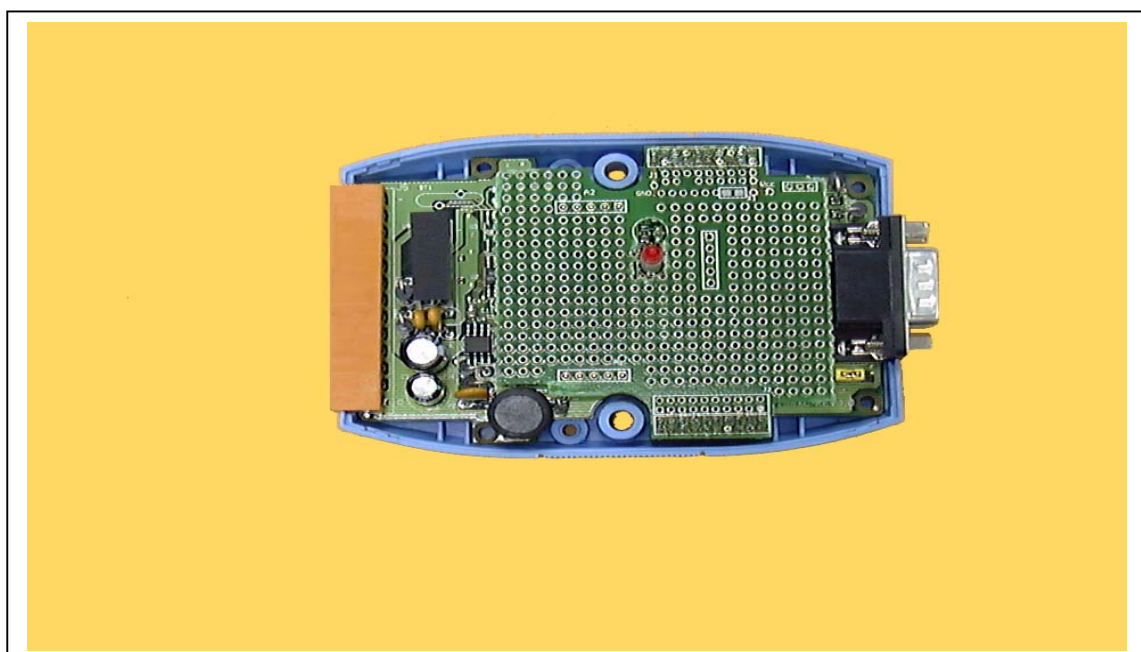


4.2 Medium mounting without 7-SEG display

Before mounting:

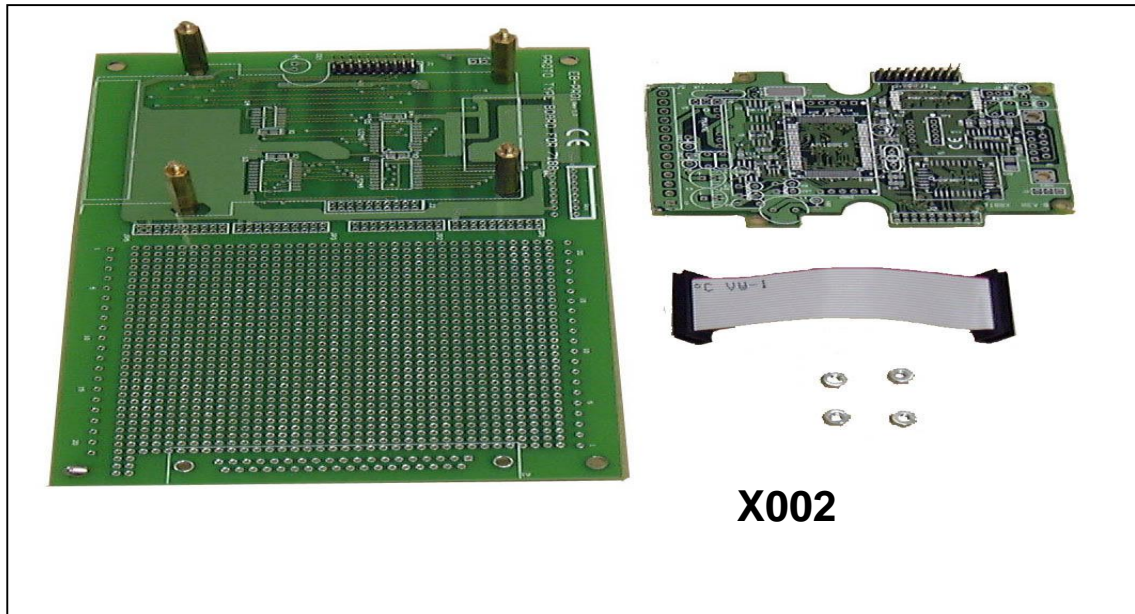


After mounting:

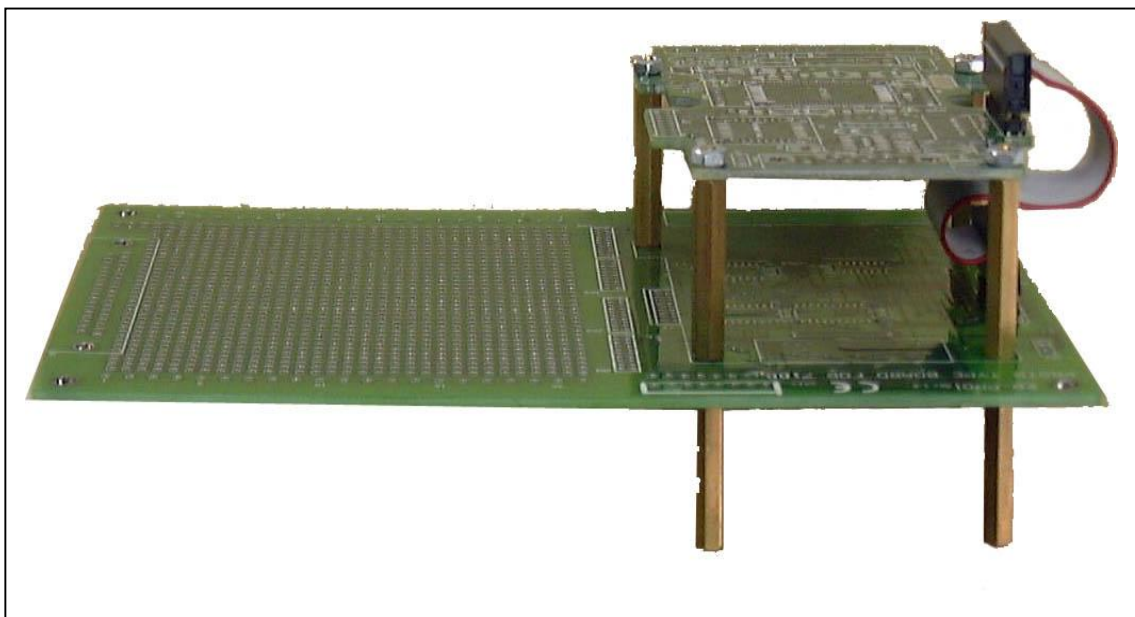


4.3 Mounting without CASE

Before mounting:

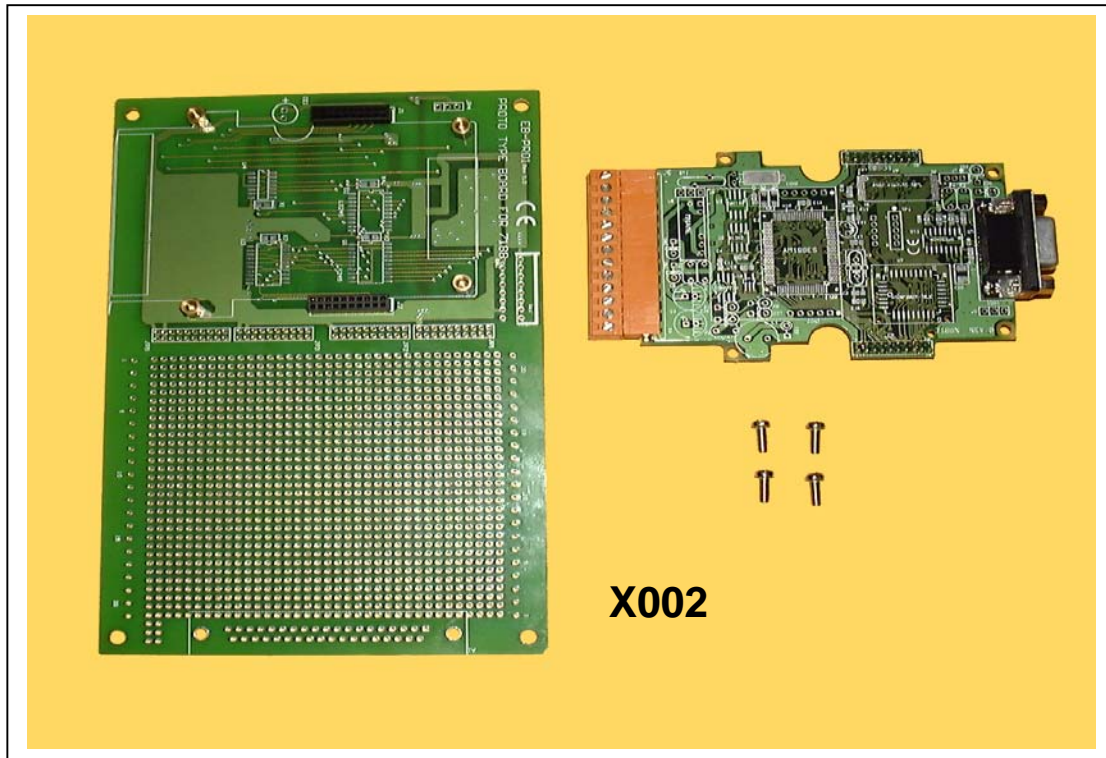


After mounting:

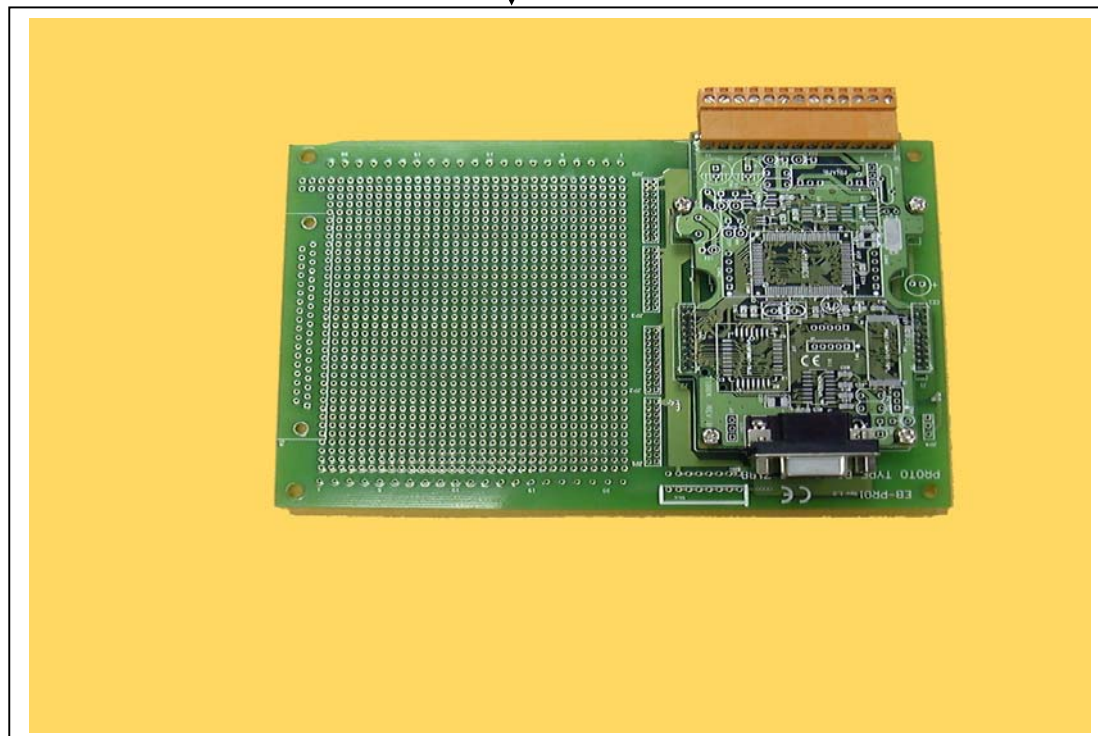


4.4 ODM mounting without CASE

Before mounting:



After mounting:



5. I/O Expansion Bus

The I/O expansion bus of 7188X/7188E series can be divided into 3 groups as follows:

1. Power supply & reset signals: VCC, GND, RESET, /RESET
2. Parallel Bus:
 - System clock: CLOCKA
 - Asynchronous ready control: ARDY
 - Address bus: A0 ~ A6, A7 (7188XC & 7521 series without A7)
 - Data bus: D0 ~ D7
 - Interrupt control: INT0, INT1, INT4 (7188XC & 7521 series without INT4)
 - Chip select & read/write strobe: /CS, /WR, /RD
3. Serial Bus: TO_0, TO_1, TI_0, TI_1, SCLK, DIO9, DIO4, DI

5.1 Definition

The definition of I/O expansion bus is given as follows:

5.1.1 J1 Pin definition:

| No | Name | Description |
|----|--------|--|
| 1 | GND | Ground of PCB |
| 2 | GND | Ground of PCB |
| 3 | CLOCKA | Synchronous clock output of CPU |
| 4 | ARDY | Asynchronous ready input (level sensitive, OPEN=ready) |
| 5 | INT0 | Interrupt request input of channel 0 (asynchronous, active high) |
| 6 | INT1 | Interrupt request input of channel 1 (asynchronous, active high) |
| 7 | VCC | Power supply of PCB |
| 8 | RESET | Power up reset pulse (active high) |
| 9 | GND | Ground of PCB |
| 10 | /RESET | Power up reset pulse (active low) |
| 11 | TO_0 | Timer output 0 of CPU (can be used as programmable D/I/O) |
| 12 | TO_1 | Timer output 1 of CPU (can be used as programmable D/I/O) |
| 13 | TI_0 | Timer input 0 of CPU (can be used as programmable D/I/O) |
| 14 | TI_1 | Timer input 1 of CPU (can be used as programmable D/I/O) |
| 15 | SCLK | Common serial clock output of 7188 series |
| 16 | DIO9 | Programmable D/I/O bit |
| 17 | DIO4 | Programmable D/I/O bit |
| 18 | DIO14 | Programmable D/I/O bit |
| 19 | VCC | Power supply of PCB |
| 20 | VCC | Power supply of PCB |

5.1.2 J1 Description:

- CLOCKA: 20.2752M Hz for I-7188XC
- CLOCKA: 40M Hz for I-7188XA, I-7188XB, I-7188XG, I-7188EX, I-7188EG
- ARDY: let this pin OPEN for no wait states applications
- INT0, INT1: let these two pins OPEN for no interrupt applications
- TO_0, TO_1: can be used as CPU's timer output or programmable D/I/O
- TI_0, TI_1: can be used as CPU's timer input or programmable D/I/O
- DIO4, DIO9, DIO14: programmable D/I/O bit
- SCLK: the 7188X/7188E series use this signal as a CLOCK source to drive all on-board serial devices, so it is always be programmed as D/O. Change this signal to other configuration will cause serious errors. User can use this signal to drive external serial devices without any side effects.

5.1.3 J2 Pin definition:

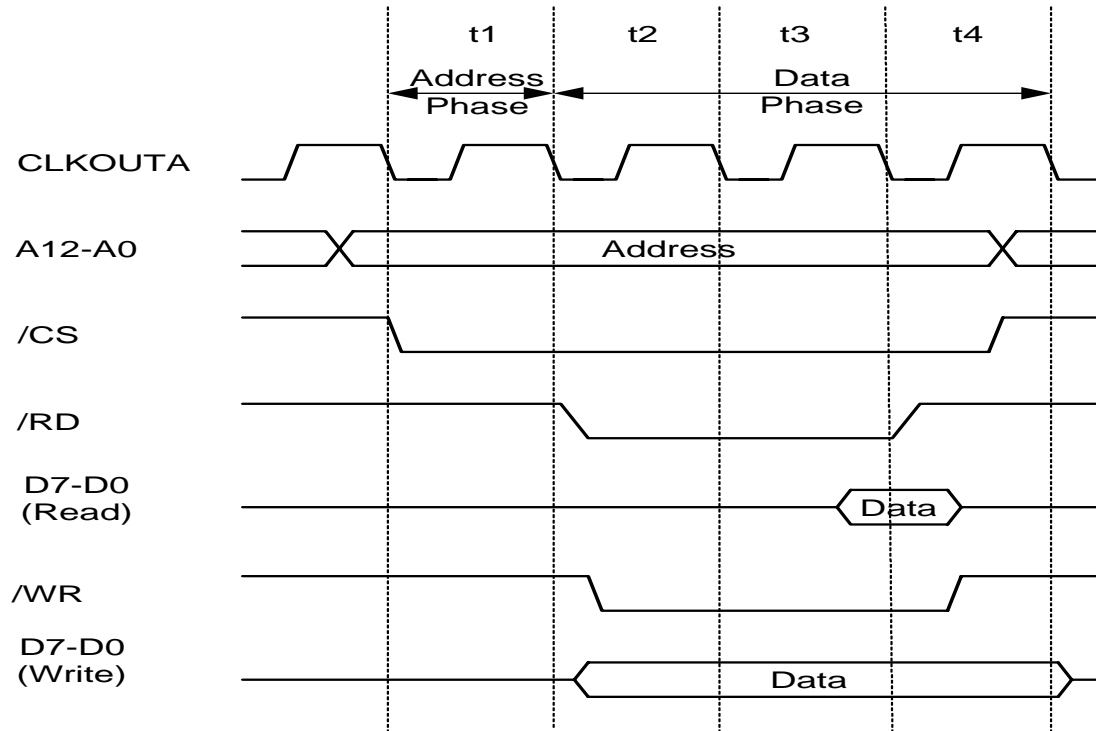
| No | Name | Description |
|----|-------------|---|
| 1 | A0 | Address bus |
| 2 | D0 | Data bus |
| 3 | A1 | Address bus |
| 4 | D1 | Data bus |
| 5 | A2 | Address bus |
| 6 | D2 | Data bus |
| 7 | A3 | Address bus |
| 8 | D3 | Data bus |
| 9 | A4 | Address bus |
| 10 | D4 | Data bus |
| 11 | A5 | Address bus |
| 12 | D5 | Data bus |
| 13 | A6 | Address bus |
| 14 | D6 | Data bus |
| 15 | A7 or N/C | This pin is reserved & must be N/C for 7188XC & 7521 series |
| 16 | D7 | Data bus |
| 17 | INT4 or N/C | Interrupt request input of channel 4(asynchronous, active high), this pin is reserved & must be N/C for 7188XC & 752N series |
| 18 | /WR | Write strobe output (synchronous, active low) |
| 19 | /CS | Chip select output (synchronous, active low) |
| 20 | /RD | Read strobe output (synchronous, active low) |

5.1.4 J2 Description:

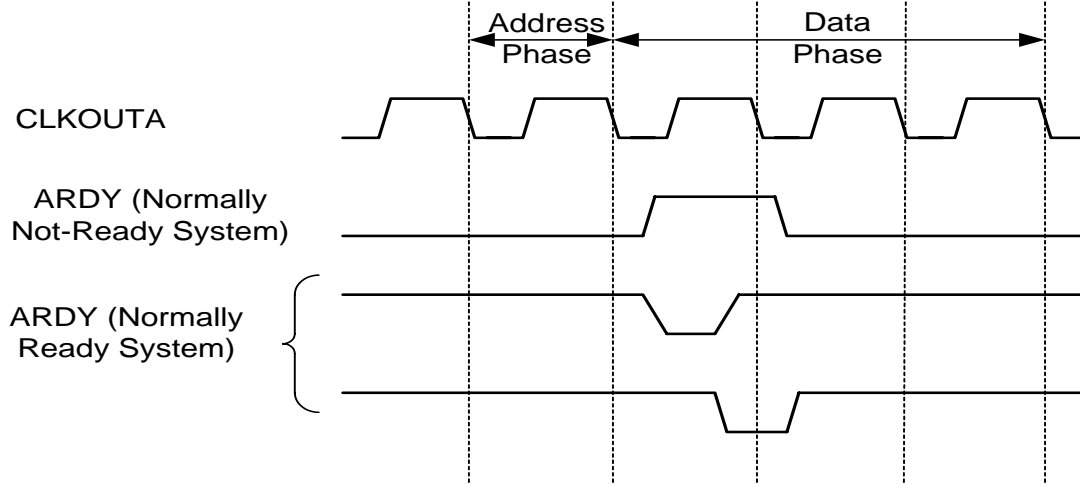
- Address bus (output): A0 ~ A6, A7
- Data Bus (tri-state, bi-direction): D0 to D7
- INT4: let this pin OPEN for no interrupt applications
- /CS, /RD, /WR: These 3 signals will synchronous to CLOCKA (in J1.3) & asynchronous to ARDY (J1.4)
- The CS\ will be active if program input/output from I/O address 0 to 0xff.
- **The pin_15 & pin_17 are reserved by 7188XC & 7521 series; user must left these two pins N/C for 7188XC & 7521 series.**

5.2 Parallel Bus

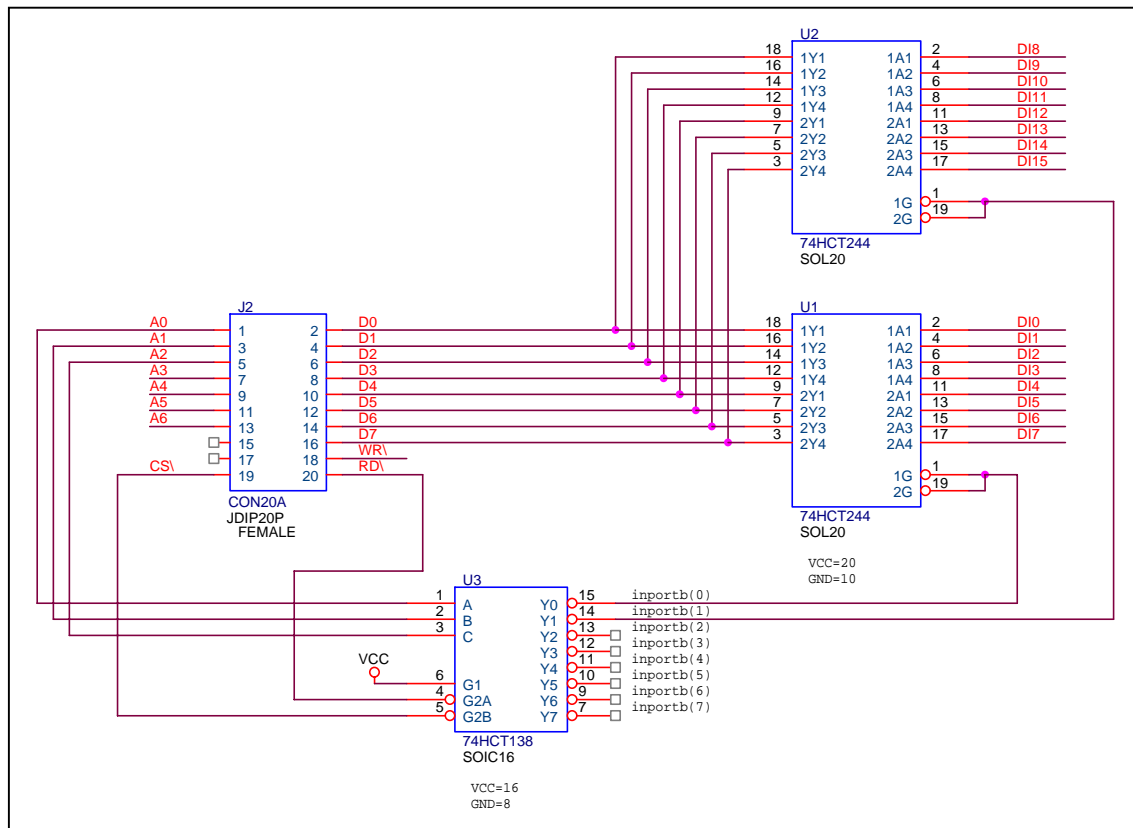
5.2.1 Timing Diagram



| | | | | |
|--------|-------|-------|-------|-------|
| Case 1 | t_w | t_w | t_w | t_4 |
| Case 2 | t_3 | t_w | t_w | t_4 |
| Case 3 | t_2 | t_3 | t_w | t_4 |
| Case 4 | t_1 | t_2 | t_3 | t_4 |



5.2.2 Address decode & D/I CKT



The CS\ will be active if program input/output from I/O address BASE+0 to BASE+0xff.

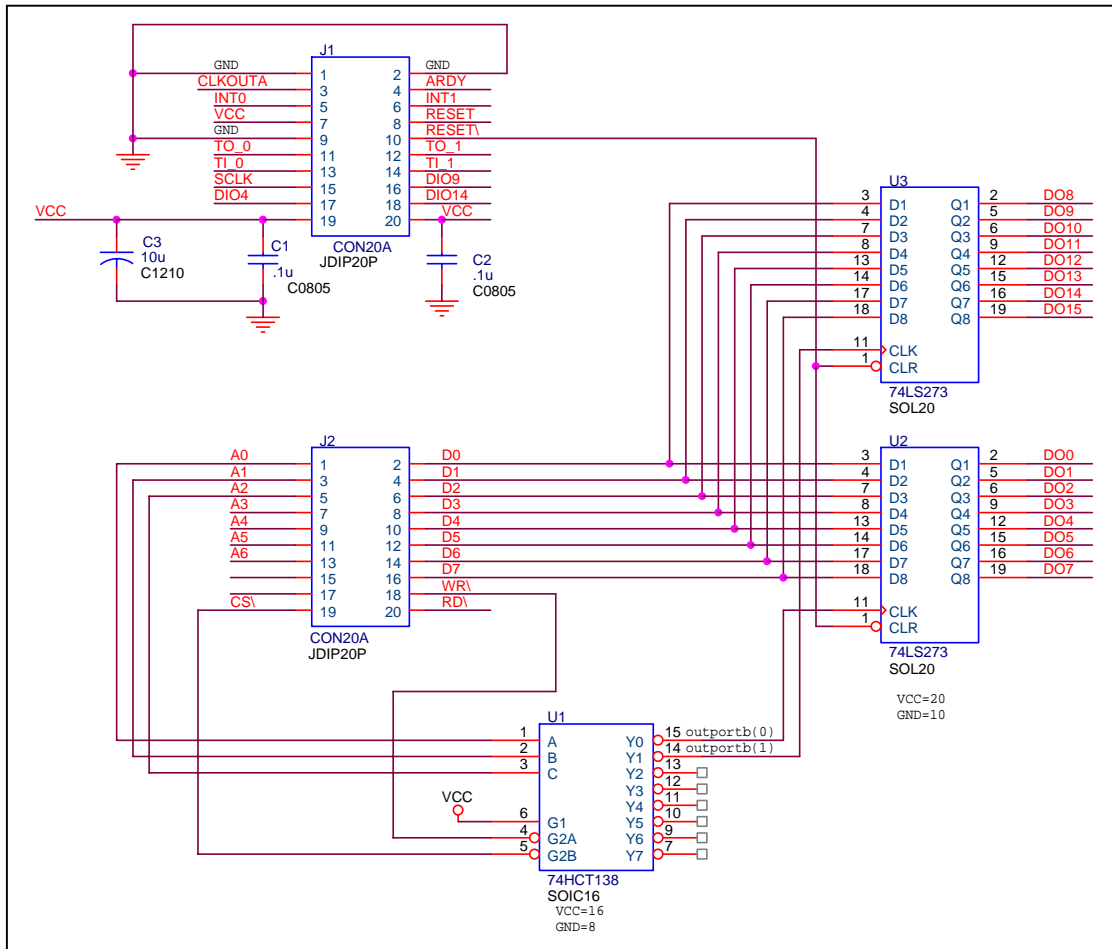
Read DI 0 to 7 → DI_0_7=inportb (BASE+0);

Read DI 8 to 15 → DI_8_15=inportb (BASE+1);

The power-up default value of BASE is 0.

It is **not** recommended to change the value of BASE from 0 to another value.

5.2.3 Address decode & D/O CKT



The CS\ will be active if program input/output from I/O address $\text{BASE}+0$ to $\text{BASE}+0\text{xff}$.

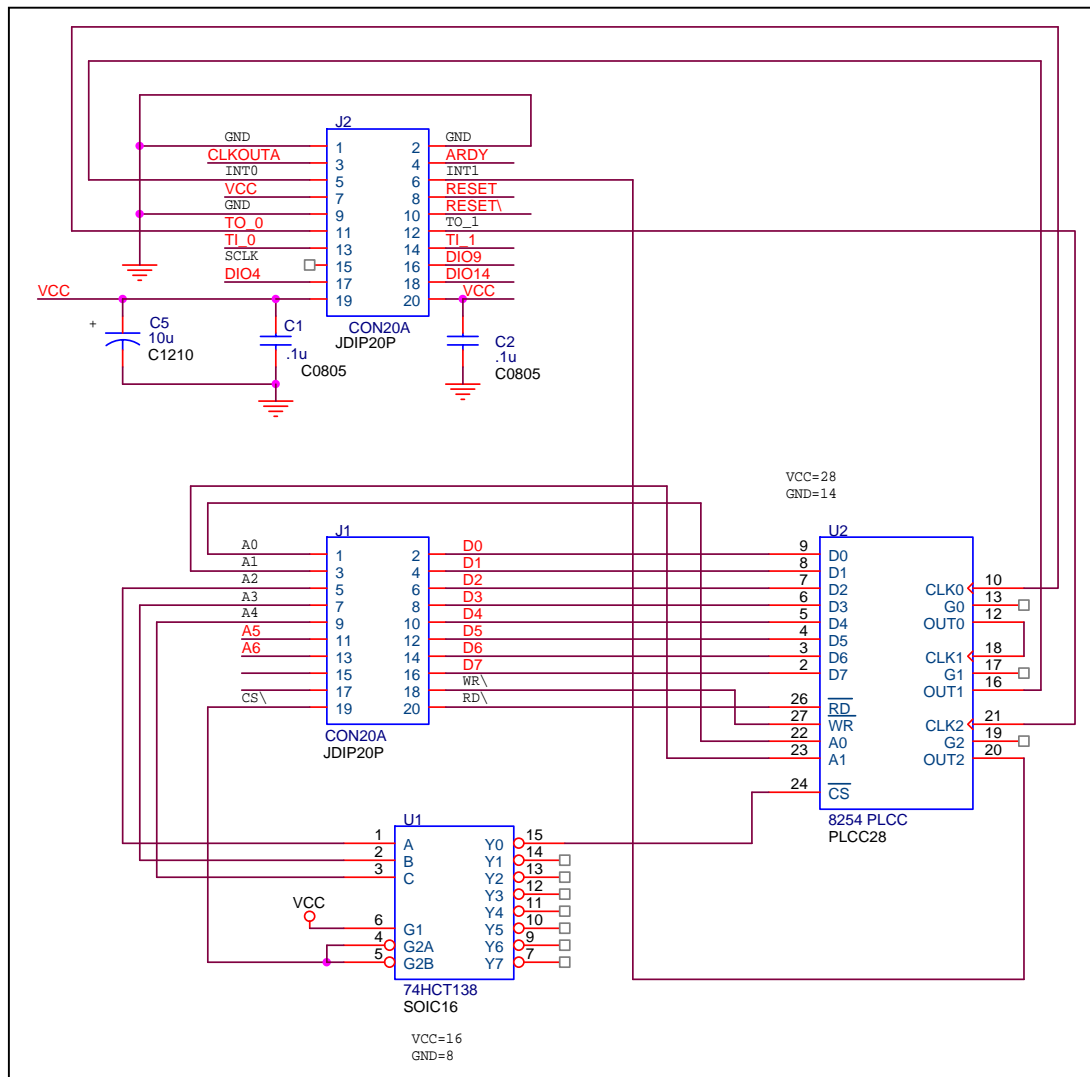
Write value_1 to DO 0 to 7 \rightarrow `outputrb (BASE+0, value_1);`

Write value_2 to DO 8 to 15 \rightarrow `outputrb (BASE+1, value_2);`

The power-up default value of BASE is 0.

It is **not** recommended to change the value of BASE from 0 to another value.

5.2.4 8254 & interrupt



The addressing space of 8254 is from BASE+0 to BASE+3 as follows:

Timer/Counter_0 → BASE+0

Timer/Counter_1 → BASE+1

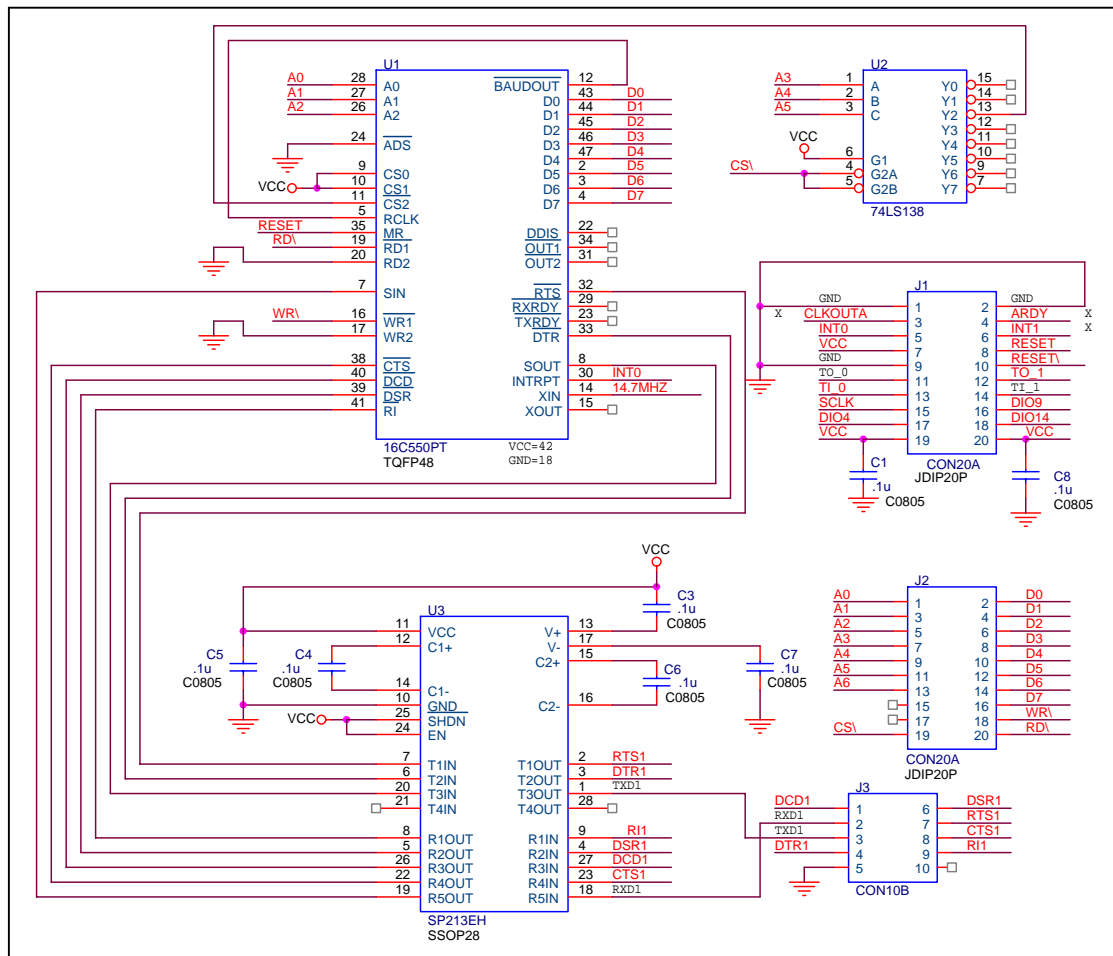
Timer/Counter_2 → BASE+2

Control word → BASE+3

The power-up default value of BASE is 0.

It is **not** recommended to change the value of BASE from 0 to another value.

5.2.5 16550 & interrupt



The addressing space of 16550 is from BASE+0x10 to BASE+0x17 as follows:

| | | |
|-----------------|--------------------------------------|----|
| Txbuf=BASE+0x10 | /* tx buffer | */ |
| Rxbuf=BASE+0x10 | /* rx buffer | */ |
| Dll=BASE+0x10 | /* baud lsb | */ |
| Dlh=BASE+0x11 | /* baud msb | */ |
| Ier=BASE+0x11 | /* int enable register | */ |
| Fcr=BASE+0x12 | /* FIFO control register | */ |
| Iir=BASE+0x12 | /* Interrupt Identification Register | */ |
| Lcr=BASE+0x13 | /* line control register | */ |
| Dfr=BASE+0x13 | /* Data format register | */ |
| Mcr=BASE+0x14 | /* modem control register | */ |
| Lsr=BASE+0x15 | /* line status register | */ |
| Msr=BASE+0x16 | /* modem status register | */ |
| Scr=BASE+0x17 | /* Scratch register | */ |

The power-up default value of BASE is 0.

It is **not** recommended to change the value of BASE from 0 to another value.

Note: it is compatible to **COM3** of 7188XC/7188XB/7188E library.

5.3 Serial Bus

| Pin | Name | Default | D/I/O mode | Normal mode |
|-------|-------|---------|------------|---------------------------------|
| J1.11 | TO_0 | D/I | I/O_10 | Timer output channel_0 |
| J1.12 | TO_1 | D/I | I/O_1 | Timer output channel_1 |
| J1.13 | TI_0 | D/I | I/O_11 | Timer input channel_0 |
| J1.14 | TI_1 | D/I | I/O_0 | Timer input channel_1 |
| J1.15 | SCLK | D/O | I/O_26 | UZI, don't change to this mode |
| J1.16 | DIO9 | D/I | I/O_9 | A19, don't change to this mode |
| J1.17 | DIO4 | D/I | I/O_4 | DT/R, don't change to this mode |
| J1.18 | DIO14 | D/I | I/O_14 | MCS0, don't change to this mode |

Every pin can be configured by mode control register & direction control register as follows:

| Mode control register=0xff70 | Direction control register=0xff72 | Programmable Function |
|------------------------------|-----------------------------------|--|
| 0 | 0 | Normal mode |
| 0 | 1 | D/I with pull-up/pull-down resistor (10K) |
| 1 | 0 | D/O |
| 1 | 1 | D/I without pull-up/pull-down register (10K) |

After the I/O pins are configured, user can read /write to **data register, 0xff74**, to access these I/O pins. Refer to Sec. 2.3.1 or Sec. 2.3.2 for demo program.

5.3.1 Using the D/I/O 4

SetDio4Dir(int dir) /* select D/I or D/O first */

```
{
  if(dir){ /* set to input */
    output(0xff70, mport(0xff70)&~(1<<4)); /* set MODE to 0 */
    output(0xff72, mport(0xff72)|(1<<4)); /* set DIR to 1 */
  }
  else { /* set to output */
    output(0xff70, mport(0xff70)|(1<<4)); /* set MODE to 1 */
    output(0xff72, mport(0xff72)&~(1<<4)); /* set DIR to 0 */
  }
}
```

OutDio4(int data) /* set the D/O_4 ON or OFF */

```
{
  if(data) /* set D/O_4 ON */
    output(0Xff74, mport(0Xff74)|(1<<4));
  else /* set D/O_4 OFF */
    output(0Xff74, mport(0Xff74)&~(1<<4));
}
```

GetDio4(void) /* read the status of D/I_4 */

```
{
  return mport(0Xff74)&0x0010;}
}
```

5.3.2 Using the D/I/O 14

```
SetDio14Dir(int dir) /* select D/I or D/O first */
{
  if(dir){ /* set to input */
    output(0xff70, mport(0xff70)&~(1<<14)); /* set MODE to 0 */
    output(0xff72, mport(0xff72)|(1<<14)); /* set DIR to 1 */
  }
  else { /* set to output */
    output(0xff70, mport(0xff70)|(1<<14)); /* set MODE to 1 */
    output(0xff72, mport(0xff72)&~(1<<14)); /* set DIR to 0 */
  }
}
```

```
OutDio14(int data) /* set the D/O_14 ON or OFF */
{
  if(data) /* set D/O_14 ON */
    output(0Xff74, mport(0Xff74)|(1<<14));
  else /* set D/O_14 OFF */
    output(0Xff74, mport(0Xff74)&~(1<<14));
}
```

```
GetDio4(void) /* read the status of D/I_14 */
{
  return mport(0Xff74)&0x4000;
}
```

5.3.3 Using the SCLK

The 7188 series use this signal as a CLOCK source to drive all on-board serial devices, so it is always be programmed as D/O. Change this signal to other configuration will cause serious errors. User can use this signal to drive external serial devices without any side effects. The software driver provides two subroutine to set SCLK high or low as follows:

```
ClockLow(); /* SCLK=0=Low */
ClockHigh(); /* SCLK=1=High */
```

6. Selection Guide

6.1 Expansion Board for Prototype, Testing

| Model | Description | Size | Used with I-7188XA/ XB / XC / XG / EX / EG |
|-------|---------------------------|---------------|---|
| X000 | Photo type (Small size) | 64mm x 32mm | XA / XC |
| X001 | Photo type (Large size) | 64mm x 70mm | XA / XC |
| X002 | Photo type | 114mm x 170mm | XA / XC / XB / XG / EX / EG |
| X003 | Self-test | 64mm x 32mm | XA / XC |
| X004 | Self-test | 64mm x 36mm | XB / XG / EX / EG |
| X005 | Photo type (Small size) | 64mm x 36mm | XB / XG / EX / EG |
| X006 | Photo type (Large size) | 72mm x 65mm | XB / XG / EX / EG |
| | | | |
| | | | |

6.2 I/O Expansion Board for D/I/O, Timer/Counter

| Model | Description | D/I | D/O | Relay Output | Counter/ Timer | Used with I-7188XA/ XB / XC / XG / EX / EG |
|-------|---------------|---|-----|-----------------|--|---|
| X100 | DI | 8 | -- | -- | -- | XC |
| X101 | DO | -- | 8 | -- | -- | XC |
| X102 | Relay Output | -- | -- | 2 | -- | XC |
| X103 | DI | 7 | -- | -- | -- | XC |
| X104 | DI, DO | 8 (each channel can be programmed to DI/DO) | | -- | -- | XC |
| X105 | DI, DO | 8 (each channel can be programmed to DI/DO) | | -- | -- | XC |
| X106 | DI, DO | Can be used as 2 channels DO or 3 channels DI | | -- | -- | XC |
| X107 | DI, DO | 6 | 7 | -- | -- | XB / XG / EX / EG |
| X108 | PWM | 2 Channels PWM | | -- | -- | XC |
| X109 | Photo MOS | -- | -- | 7 | -- | XB / XG / EX / EG |
| X110 | DI | 14 | -- | -- | -- | XB / XG / EX / EG |
| X111 | DO | -- | 13 | -- | -- | XB / XG / EX / EG |
| X400 | Timer/Counter | -- | -- | -- | 3 channels 16-bit timer/ counter | XC |

6.3 I/O Expansion Board for A/D, D/A, DI, DO

| Model | Description | D/I | D/O | A/D | Input Range | D/A | Output Range | Used with I-7188XA/ XB / XC / XG / EX / EG |
|-------|------------------|-----|-----|-----|-------------------|-----|--------------|---|
| X200 | A/D | -- | -- | 1 | 0~2.5V | -- | -- | XC |
| X201 | A/D | -- | -- | 4 | 0~20Ma | -- | -- | XC |
| X202 | A/D | -- | -- | 7 | 0~20Ma | -- | -- | XB / XG / EX / EG |
| X203 | A/D, DI, DO | 2 | 6 | 2 | 0~20mA | -- | -- | XB / XG / EX / EG |
| X300 | D/A | -- | -- | -- | -- | 2 | 0~4.095V | XC |
| X301 | A/D, D/A | -- | -- | 1 | 0~2.5V | 1 | 0~4.095V | XC |
| X302 | A/D, D/A | -- | -- | 1 | +/- 5V | 1 | +/- 5V | XC |
| X303 | A/D, D/A, DI, DO | 4 | 6 | 1 | +/- 5V | 1 | +/- 5V | XB / XG / EX / EG |
| X304 | A/D, D/A, DI, DO | 4 | 4 | 3 | +/- 5V | 1 | +/- 5V | XB / XG / EX / EG |
| X305 | A/D, D/A, DI, DO | 2 | 2 | 7 | +/- 5V | 1 | +/- 5V | XB / XG / EX / EG |
| X306 | A/D, D/A | -- | -- | 2 | +/- 10V | -- | -- | XC |
| X307 | A/D, D/A | 2 | 2 | 8 | +/- 10V | -- | -- | XB / XG / EX / EG |
| X308 | A/D, DO | -- | 6 | 4 | 0~10V | -- | -- | XB / XG / EX / EG |
| X310 | A/D, D/A, DI, DO | 3 | 3 | 2 | 0~20mA / 0~10V | 2 | 0~10V | XB / XG / EX / EG |
| | | | | | | | | |
| | | | | | | | | |

6.4 I/O Expansion Board for RS-232/422/485, DI, DO

| Model | Description | D/I | D/O | Channels | Speed | Used with I-7188XA/ XB / XC / XG / EX / EG |
|-------|-------------|-----|-----|---|--------|---|
| X500 | RS-232 | -- | -- | One channel (9-wire) ** Without Case ** | 115.2K | XC |
| X501 | RS-232 | -- | -- | One channel (5-wire) | 115.2K | XC |
| X502 | RS-232 | -- | -- | One channel (3-wire), and one channel (5-wire) | 115.2K | XC |
| X503 | RS-232 | -- | -- | One channel (5-wire) | 115.2K | XB / XG / EX / EG |
| X504 | RS-232 | -- | -- | One channel (5-wire), and one channel (9-wire) | 115.2K | XB / XG / EX / EG |
| X505 | RS-232 | -- | -- | Three channels (5-wire) | 115.2K | XB / XG / EX / EG |
| X506 | RS-232 | -- | -- | Six channels (3-wire) | 115.2K | XB / XG / EX / EG |

| Model | Description | D/I | D/O | Channels | Speed | Used with I-7188XA/ XB / XC / XG / EX / EG |
|-------|------------------|-----|-----|--|--------|---|
| X507 | RS-422 | 4 | 4 | One channel TxD+, TxD-, RxD+, RxD- | 115.2K | XB / XG / EX / EG |
| X508 | RS-232 | 4 | 4 | One channel (5-wire) | 115.2K | XB / XG / EX / EG |
| X509 | RS-232 | 4 | 4 | Two channels (3-wire) | 115.2K | XB / XG / EX / EG |
| X510 | RS-232 | 5 | 5 | One channels (3-wire), and EEPROM: 128K * 2 bytes | 115.2K | XB / XG / EX / EG |
| X511 | RS-485 | -- | -- | Three channels (Data+, Data-) | 115.2K | XB / XG / EX / EG |
| X512 | RS-232 RS-485 | -- | -- | one channel RS-485 Three channels RS-232 (3-wire) | 115.2K | XB / XG / EX / EG |
| X560 | RS-232 | -- | -- | Three channels (3-wire), and 8M bytes NAND Flash ** Without Case ** | 115.2K | XA / XC / XB / XG / EX / EG |
| | | | | | | |
| | | | | | | |

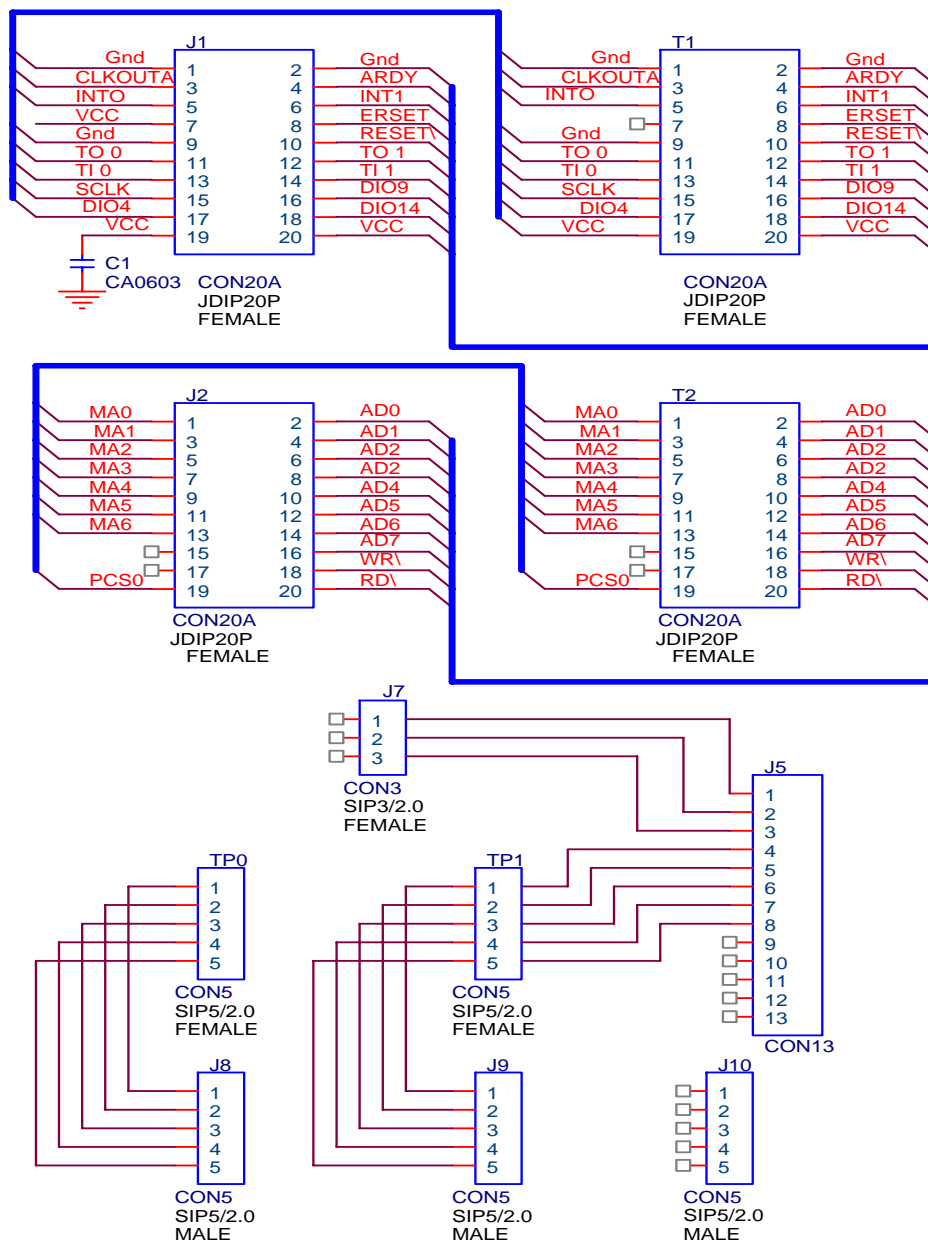
6.5 I/O Expansion Board for SRAM, Flash

| Model | Description | Flash Disk | Battery Backup SRAM Disk | Used with I-7188XA/ XB / XC / XG / EX / EG |
|-------|------------------------------|------------------------|-----------------------------|---|
| X600 | Flash Rom | 4M bytes NAND Flash | -- | XA / XC / XB / XG / EX / EG |
| X601 | Flash Rom | 8M bytes NAND Flash | -- | XA / XC / XB / XG / EX / EG |
| X607 | Battery backup SRAM board | -- | 128 K bytes | XA / XC / XB / XG / EX / EG |
| X608 | Battery backup SRAM board | -- | 512 K bytes | XA / XC / XB / XG / EX / EG |
| | | | | |

7.X0xx I/O Expansion Boards

7.1 X000 :Prototype Board

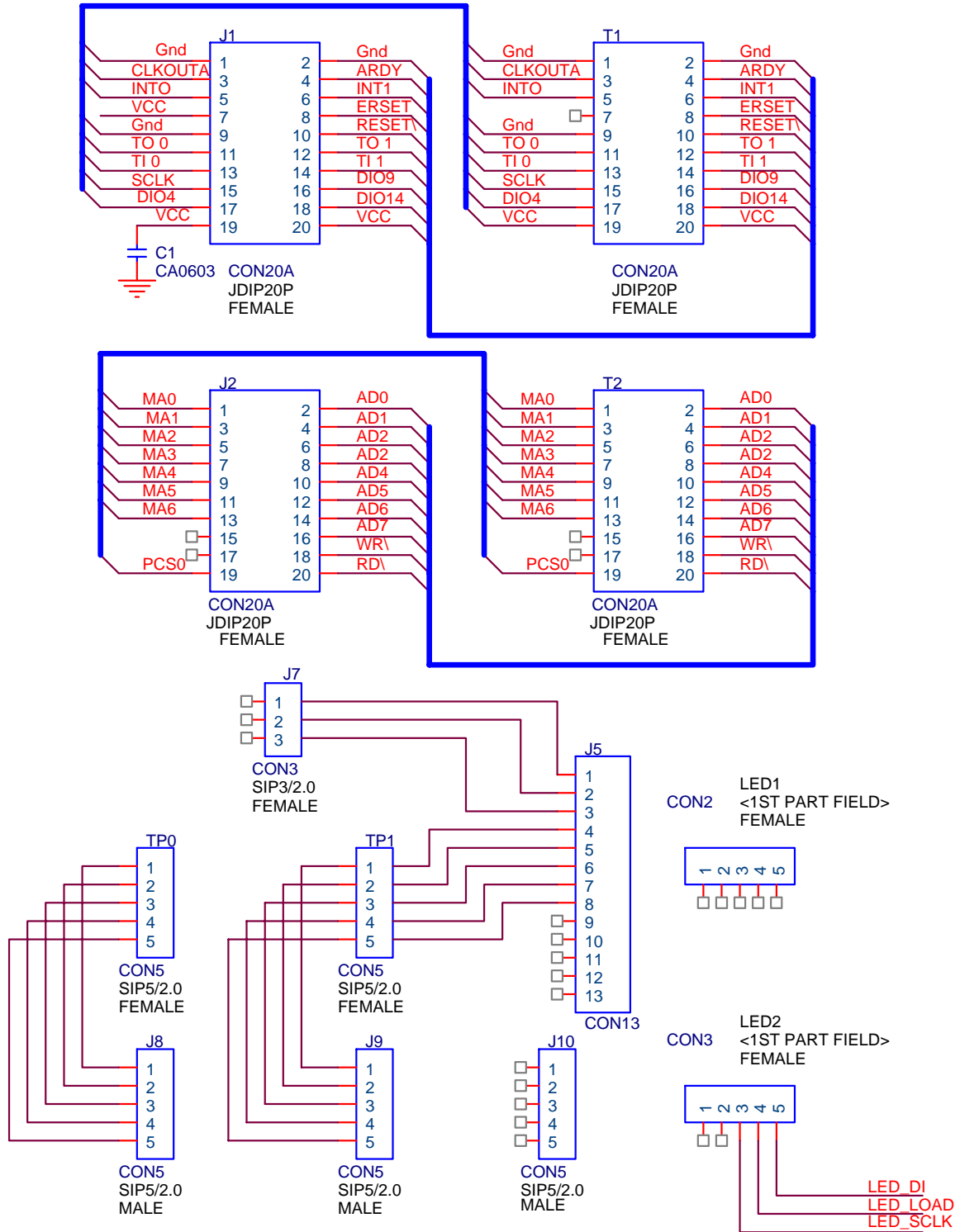
■ Size : 65mm * 35mm



On Board : JP8 , JP9 (close)
 Daughter Board : JP9 , JP10 (close)

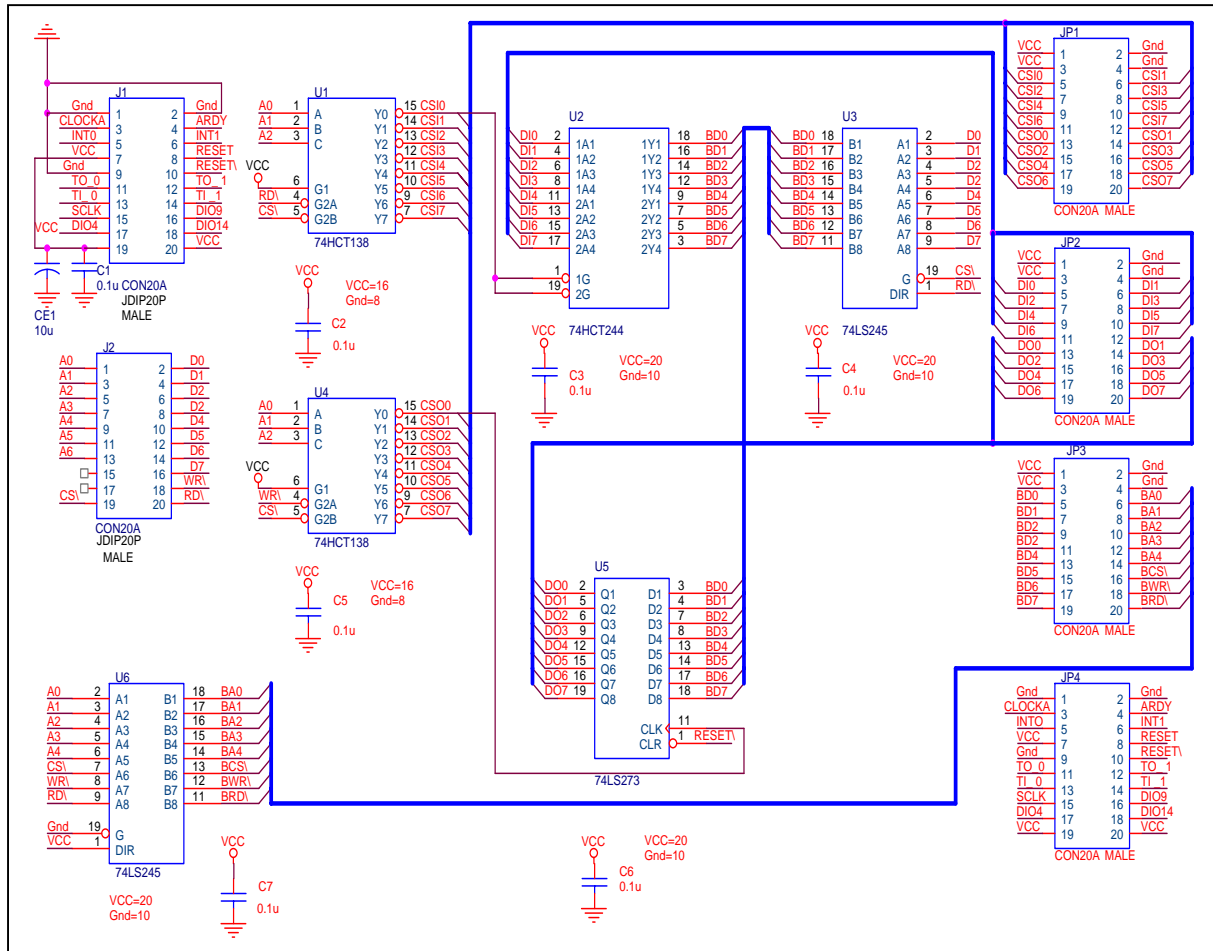
7.2 X001: Prototype Board

■ Size : 65mm * 35mm



7.3 X002 : Prototype Board

Size : 115mm * 170mm



7.4 X003: Test Board 1

- For I-7188XA (D), I-7188XC (D) & 7521
- Power consumption : 0.2W
- The X003 is self board. It can test DI, DO, System clock, Data Bus, Serial Bus.
- When you want to test DI and DO of I-7188XC (D) or I-7521, Please connect DI1 to DO1, DI2 to DO2, DI3 to DO3.

When you want to test DI and DO of I-7188XA (D) or I-7521, Please connect DI1 to DO1, DI2 to DO2.

7.5 X004: Test Board 2

- For I-7188XB (D), I-7188XG (D), I-7188EX (D), I-7188EG (D)
- Power consumption : 0.2W
- The X004 is self board. It can test DI, DO, System clock, Data Bus, Serial Bus.
- When you want to test DI and DO of I-7188XB (D) or I-7188XG (D), Please connect DI1 to DO1. and connect for define pins: 1 to 8, 2 to 9, 3 to 10, 4 to 11, 5 to 12, 6 to 13, 7 to 14.

When you want to test DI and DO of I-7188EX (D) or I-7188EG (D), Please define pins: 1 to 8, 2 to 9, 3 to 10, 4 to 11, 5 to 12, 6 to 13, 7 to 14.

Run dido.exe for I-7188XB(D) / I-7188XG(D).

```
7188XB>dido
Test DI/DO 1(Please connect DI1 to DO1)
Set Do 1 to Low
Now DI1 is low -->[ DI ----> OK ].
Set Do1 to High
Now DI1 is high -->[ DI ----> OK ].
Set Do1 to Low
Now DI1 is low -->[ DI ----> OK ].

S_CLK --> DIO9 OK!!!
DIO4 --> DIO14 OK!!!
DIO4 <-- DIO14 OK!!!

Data Bus Test OK!

Test Timer 0
10 Timer0/INT0 Test OK
Test Timer 1
10(00000) Timer1/INT1 Test OK
```

Run dido.exe for I-7188EX(D) / I-7188EG(D).

```
i7188e>dido
S_CLK --> DIO9 OK!!!
DIO4 --> DIO14 OK!!!
DIO4 <-- DIO14 OK!!!

Data Bus Test OK!
Test Timer 0
10 Timer0/INT0 Test OK
Test Timer 1
10(00000) Timer1/INT1 Test OK
```

Run dido.exe for I-7188XB(D) / I-7188XG(D).

```
7188XB>dido
Test DI/DO 1(Please connect DI1 to DO1)
Set Do 1 to Low
Now DI1 is low -->[ DI ----> OK ].
Set Do1 to High
Now DI1 is high -->[ DI ----> OK ].
Set Do1 to Low
Now DI1 is low -->[ DI ----> OK ].

S_CLK --> DIO9 OK!!!
DIO4 --> DIO14 OK!!!
DIO4 <-- DIO14 OK!!!

Data Bus Test OK!

Test Timer 0
10 Timer0/INT0 Test OK
Test Timer 1
10(00000) Timer1/INT1 Test OK
```

8. X1xx I/O Expansion Boards

8.1 X100: DI * 8

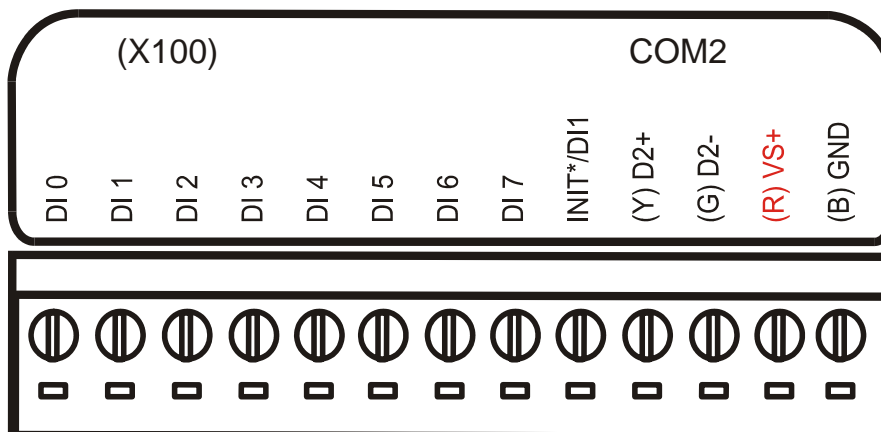
8.1.1 Specifications:

For I-7188XC (D)

Digital Input :

- Channels : 8
Input Range / Type : Logic high level (3.5V~30V),
Logic low level (0V~1V)
- Isolated : none.

8.1.2 Pin Assignment:



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

8.1.3 Jumper Setting:

Note: user should remove R19, R20, R21, R22 and R23 in the 7188XC first.

- **J1:** I/O expansion bus, connect to J1 of 7188XC
- **J2:** I/O expansion bus, connect to J2 of 7188XC
- **J7:** Three channels of 8 DI
- **TP0:** Original function on 7188XC
- **TP1:** Five channels of 8 DI
- **Jumper:** Select **TP0** or **TP1** function
 - TP0:** J9 and J8 closed
 - TP1:** J9 and J10 closed

8.1.4 Programming:

DiVal = inportb(BASE); /* for all 8-channels */

- Note:**
1. The default value of BASE is 0.
 2. It is **not** recommended to change the value of BASE from 0 to another value.
 3. DiVal=0 → all 8-channel are Low
DiVal=1 → Chennel_0 is High, the other channels are Low
DiVal=0xff → all 8-channel are High

8.2 X101: DO * 8

8.2.1 Specifications:

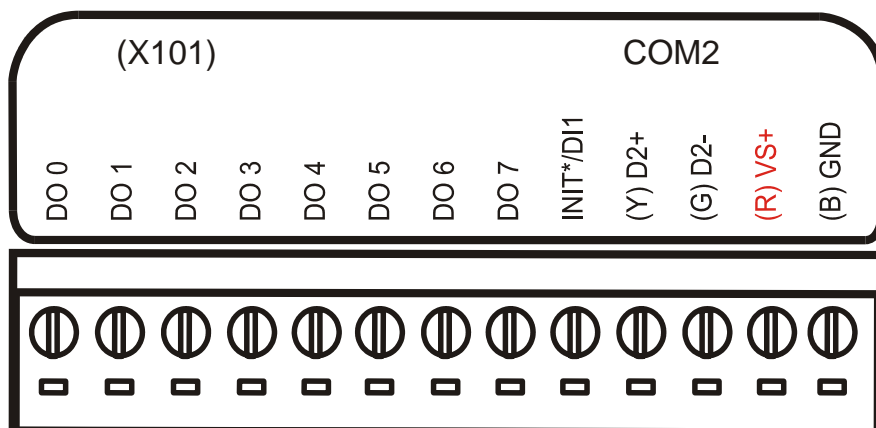
For I-7188XC (D)

Power consumption: 0.4 W

Digital Output:

- Channels: 8
- Output: TTL level
High Voltage : 2.4V (Min)
Low Voltage : 0.8 (Max)
- Sink current: 64mA (Max)
- Isolated: none.

8.2.2 Pin Assignment:



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

8.2.3 Jumper Setting:

- **Note:** user should remove R19, R20, R21, R22 and R23 in the 7188XC first.
- **J1:** I/O expansion bus, connect to J1 of 7188XC
- **J2:** I/O expansion bus, connect to J2 of 7188XC
- **J7:** Three channel of 8 D/O
- **TP0:** Original function on 7188XC
- **TP1:** Five channel of 8 D/O
- **Jumper:** Select **TP0** or **TP1** function
 - TP0:** JP9 and JP8 closed
 - TP1:** JP9 and JP10 closed

8.2.4 Programming:

`outportb(BASE, DoVal); /* for all 8-channels */`

- Note:**
1. The default value of BASE is 0.
 2. It is **not** recommended to change the value of BASE from 0 to another value.
 3. DoVal=0 → turn all 8-channel OFF
DoVal=1 → turn channel_0 ON, the other channels OFF
DoVal=0xff → turn all 8-channel ON

8.3 X102: Relay * 2

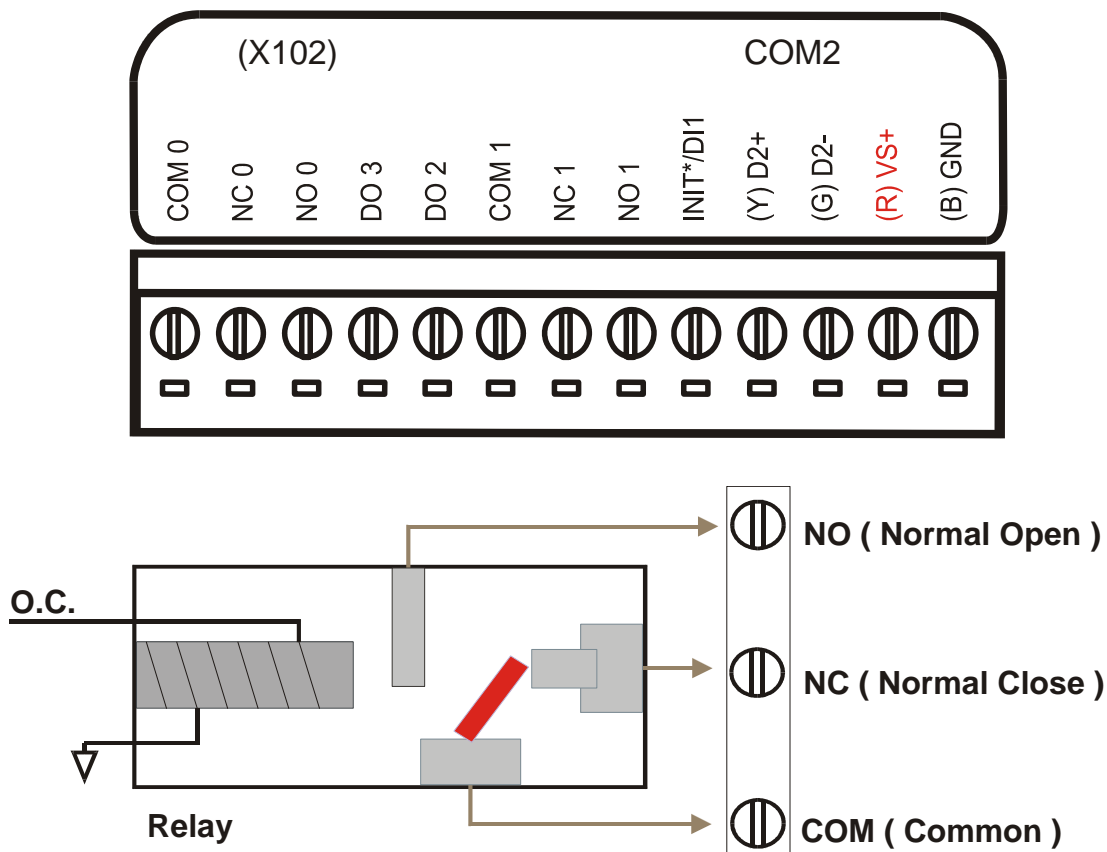
8.3.1 Specifications :

For I-7188XC (D)

Relay Output :

- Channels : 2 (Form "C")
- Max. Switching voltage : 220Vdc, 250Vac
- Max. Switching current : 2A
- Max. Carrying current : 2A
- Surge Strength : 1,500V
- Electrical endurance :
Typical 500,000 operation at 30Vdc / 1A
Typical 100,000 operation at 125Vac / 0.5A
- Relay on time (typical) : 6ms
- Relay off time (typical) : 6ms

8.3.2 Pin Assignment:



8.3.3 Jumper Setting:

- **Note:** user should remove R19, R20, R21, R22 and R23 in the 7188XC first.
- **J1:** I/O expansion bus, connect to J1 of 7188XC
- **J2:** I/O expansion bus, connect to J2 of 7188XC
- **J7:** One channel of relay output
- **TP0:** Original function on 7188XC
- **TP1:** One channel of relay output
- **Jumper:** Select **TP0** or **TP1** function
 - TP0:** JP9 and JP8 closed
 - TP1:** JP9 and JP10 closed

8.3.4 Programming:

```
SetDio4Dir( 0 );      // Set channel-0 to DO
SetDio14Dir( 0 );    // Set channel-1 to DO
```

```
SetDio4Low();        // Turn channel_0 relay OFF
SetDio14Low();       // Turn channel_1 relay OFF
```

```
SetDio4High();       // Turn channel_0 relay ON
SetDio14High();      // Turn channel_1 relay ON
```

8.4 X103: Isolated DI * 7

8.4.1 Specifications:

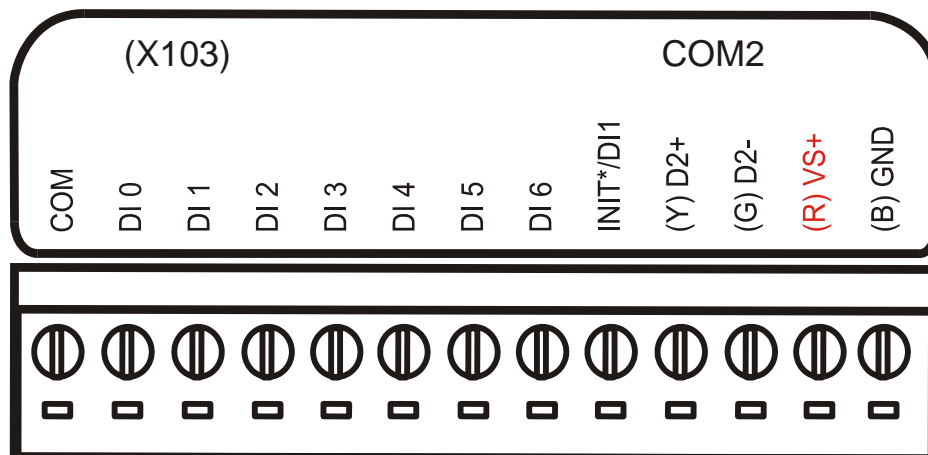
For I-7188XC (D)

Power consumption: 0.3 W

Digital Input :

- Channels : 7
Input Range / Type : Logic high level (3.5V~30V),
Logic low level (0V~1V)
- Isolated digital input.

8.4.2 Pin Assignment:



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

8.4.3 Jumper Setting:

- **Note:** user should remove R19, R20, R21, R22, R23 in the 7188XC first.
- **J1:** I/O expansion bus, connect to J1 of 7188XC
- **J2:** I/O expansion bus, connect to J2 of 7188XC
- **J7:** Two channels of isolated DI
- **TP0:** Original function on 7188XC
- **TP1:** Five channels of isolated DI
- **Jumper:** Select **TP0** or **TP1** function
 - TP0:** JP9 and JP8 closed
 - TP1:** JP9 and JP10 closed

8.4.4 Programming:

```
SetTo10Dir(1); XDI1=GetTo1(); // set to D/I & read D/I, channel_1
SetTi1Dir(1); XDI2=GetTi1(); // set to D/I & read D/I, channel_2
SetDio9Dir(1); XDI3=GetDio9(); // set to D/I & read D/I, channel_3
SetDio14Dir(1); XDI4=GetDio14(); // set to D/I & read D/I, channel_4
SetDio4Dir(1); XDI5=GetDio4(); // set to D/I & read D/I, channel_5
SetTi0Dir(1); XDI6=GetTi0(); // set to D/I & read D/I, channel_6
SetTo0Dir(1); XDI7=GetTo0(); // set to D/I & read D/I, channel_7
```

8.5 X104: D/I/O * 8, single-bit

8.5.1 Specifications:

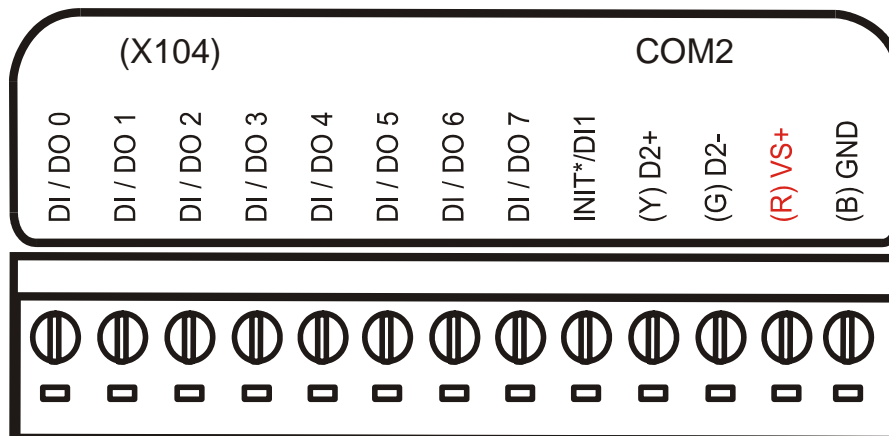
For I-7188XC (D)

Power consumption: 0.3 W

Digital Input / Output:

- Channels: 8
Input / Output: each channel can be programmed to D/I or D/O.
- Input Range: 0~5V(Max)
- Isolated: none.

8.5.2 Pin Assignment:



Note: Provide functions of DI and DO from CPU.

8.5.3 Jumper Setting:

- **Note:** user should remove R19, R20, R21, R22 and R23 in the 7188XC first.
- **J1:** I/O expansion bus, connect to J1 of 7188XC
- **J2:** I/O expansion bus, connect to J2 of 7188XC
- **J7:** Three channels of 8 D/I/O
- **TP0:** Original function on 7188XC
- **TP1:** Five channels of 8 D/I/O
- **Jumper:** Select **TP0** or **TP1** function
 - TP0:** JP9 and JP8 closed
 - TP1:** JP9 and JP10 closed

8.5.4 Programming:

Software library

```
void SetDio4Dir(int dir);  
void SetDio4High(void);  
void SetDio4Low(void);  
int GetDio4(void);
```

```
void SetDio9Dir(int dir);  
void SetDio9High(void);  
void SetDio9Low(void);  
int GetDio9(void);
```

```
void SetDio14Dir(int dir);  
void SetDio14High(void);  
void SetDio14Low(void);  
int GetDio14(void);
```

```
void SetTi1Dir(int dir);
void SetTi1High(void);
void SetTi1Low(void);
int GetTi1(void);
```

```
void SetTo1Dir(int dir);
void SetTo1High(void);
void SetTo1Low(void);
int GetTo1(void);
```

```
void SetTi0Dir(int dir);
void SetTi0High(void);
void SetTi0Low(void);
int GetTi0(void);
```

```
void SetTo0Dir(int dir);
void SetTo0High(void);
void SetTo0Low(void);
int GetTo0(void);
```

```
void SetDo1High(void);
void SetDo1Low(void);
int GetDo1(void);
```

```
void SetDo2High(void);
void SetDo2Low(void);
int GetDo2(void);
```

```
void SetDo3High(void);
void SetDo3Low(void);
int GetDo3(void);
```

```
int GetDi2(void);
int GetDi3(void);
```

```
void ClockHighLow(void);
void ClockHigh(void);
void ClockLow(void);
```

8.6 X105: D/I/O * 8, 8-bit

8.6.1 Specifications:

For I-7188XC

Power consumption: 0.3 W

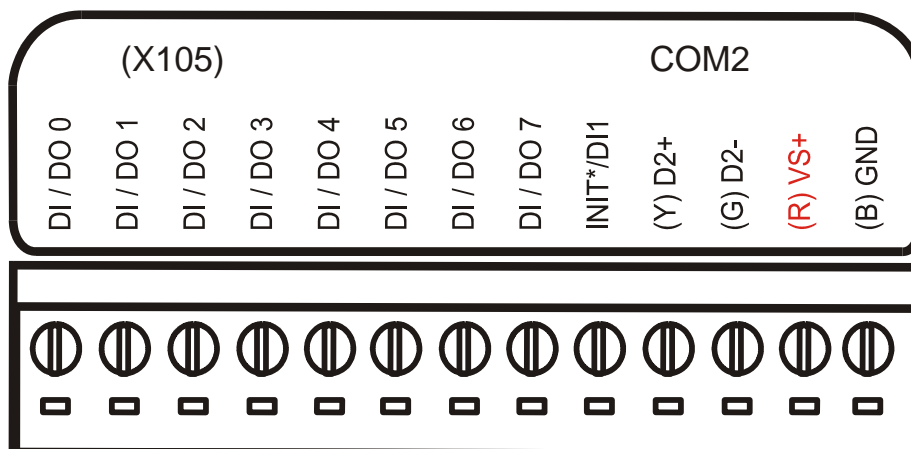
Digital Input:

- Channels: 8
Input Range / Type: Logic high level (3.5V~30V),
Logic low level (0V~1V)
- Isolated: none

Digital Output:

- Channels: 8
- Output: TTL level
- Isolated: none

8.6.2 Pin Assignment:



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

8.6.3 Jumper Setting:

■ **Note:** user should remove R19, R20, R21, R22 and R23 in the 7188XC first.

■ **J1:** I/O expansion bus, connect to J1 of 7188XC

■ **J2:** I/O expansion bus, connect to J2 of 7188XC

■ **J7:** Three channels of 8 D/I/O

■ **TP0:** Original function on 7188XC

■ **TP1:** Five channels of 8 D/I/O

■ **Jumper:** Select **TP0** or **TP1** function

TP0: JP9 and JP8 closed

TP1: JP9 and JP10 closed

8.6.4 Programming

`DiVal = inportb(BASE); /* for all 8-channels */`

Note: 1. The default value of BASE is 0.
2. It is **not** recommended to change the value of BASE from 0 to another value.

3. `DiVal=0x00` → all 8-channel are Low

`DiVal=0x01` → Channel_0 is High, the other channels are Low

`DiVal=0xFF` → all 8-channel are High

`outportb(BASE, DoVal); /* for all 8-channels */`

Note: 1. The default value of BASE is 0.
2. It is **not** recommended to change the value of BASE from 0 to another value.

3. `DoVal=0x00` → turn all 8-channel OFF

`DoVal=0x01` → turn channel_0 ON, the other channels OFF

`DoVal=0xFF` → turn all 8-channel ON

DIO14 is used to select D/I or D/O

If DIO14 is **LOW** → **select D/O*8** → D/I is read-back value of D/O

If DIO14 is **HIGH** → **select D/I*8** → D/I signals are come from J5

Select D/I*8 as following:

```
SetDio14Dir(0);          /* select DIO14 as D/O      */
SetDio14High();         /* select D/I*8            */
DiVal=inportb(BASE);    /* read D/I*8 (from J5)    */
```

Select D/I*8 as following:

```
SetDio14Dir(0);          /* select DIO14 as D/O      */
SetDio14Low();          /* select D/O*8            */
outportb(BASE,DoVal);   /* set value of D/O*8 (to J5) */
DiVal=inportb(BASE);    /* D/O*8 read back        */
```

8.7 X106: DO *2 or DI *3

8.7.1 Specifications:

For I-7188XC

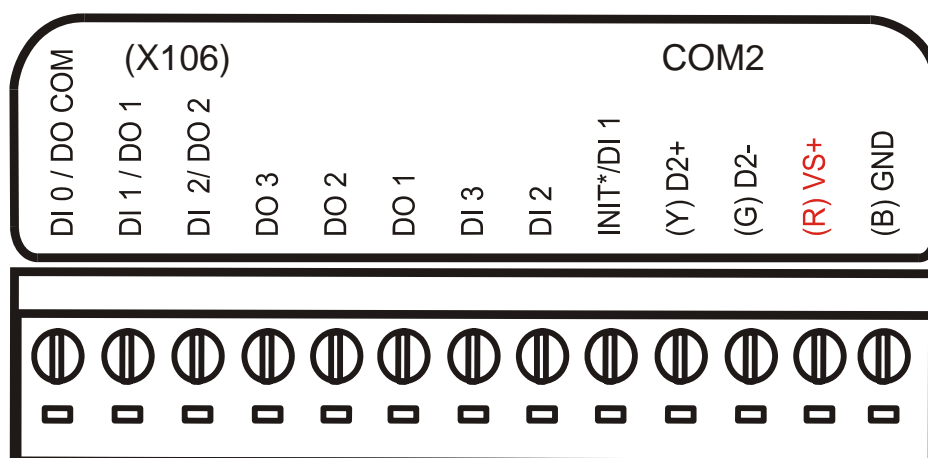
Digital Input:

- Channels: 3
Input Range / Type: Logic high level (3.5V~30V),
Logic low level (0V~1V)
- Isolated: none

Digital Output:

- Channels:3
- Open-collector Output: 250 mA / 30V max
- Isolated: none

8.7.2 Pin Assignment:



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

8.7.3 Jumper Setting:

- **J1:** I/O expansion bus, connect to J1 of 7188XC
- **J2:** I/O expansion bus, connect to J2 of 7188XC
- **J7:** Three channels of D/I or two channels of D/O
- **Jumper:** Select **D/I** or **D/O** function
 - D/I:** j4, j5, j6 select 2-3 (default setting)
 - D/O:** j4, j5, j6 select 1-2

8.7.4 Programming

- **DO**

```
SetDio4Dir( 0 );           // Set D/O channel_1
SetDio14Dir( 0 );         // Set D/O channel_2
SetDio4Low();             // Turn D/O channel_1 OFF
SetDio14Low();           // Turn D/O channel_2 OFF
SetDio4High();           // Turn D/O channel_1 ON
SetDio14High();          // Turn D/O channel_2 ON
```

- **DI**

```
Data = SetTo1Dir( 1 );    // Set D/I channel_1
Data = SetTo0Dir( 1 );    // Set D/I channel_2
Data = SetDio9Dir( 1 );   // Set D/I channel_3
Data = GetTo1Dir( );      // Read D/I channel_1
Data = GetTo0Dir( );      // Read D/I channel_2
Data = GetDio9Dir( );     // Read D/I channel_3
```

8.8 X107: DI * 6 and DO * 7

8.8.1 Specifications:

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

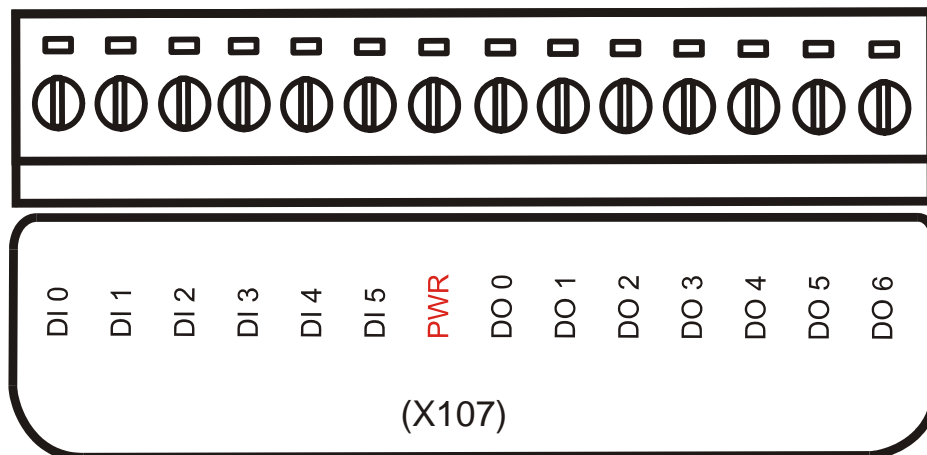
Digital Input :

- Channels: 6
Input Range / Type: Logic high level (3.5V~30V),
Logic low level (0V~1V)
- Isolated: none

Digital Output:

- Channels: 7
- Open-collector Output: 100 mA / 30V max
- Isolated: none

8.8.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

8.8.3 Programming :

DiVal = **inportb(BASE);** /* for all 6 channels */

- Note:**
1. The default value of BASE is 1.
 2. It is **not** recommended to change the value of BASE from 0 to another value.
 3. DiVal=0x00 → all 6-channel are Low
DiVal=0x01 → Chennel_0 is High, the other channels are Low
DiVal=0x3F → all 6-channel are High

outportb(BASE, DoVal); /* for all 7 channels */

- Note:**
1. The default value of BASE is 0.
 2. It is **not** recommended to change the value of BASE from 0 to another value.
 3. DoVal=0x00 → turn all 7-channel OFF
DoVal=0x01 → turn chennel_0 ON, the other channels OFF
DoVal=0x7F → turn all 7-channel ON

8.9 X108: PWM * 2

8.9.1 Specifications:

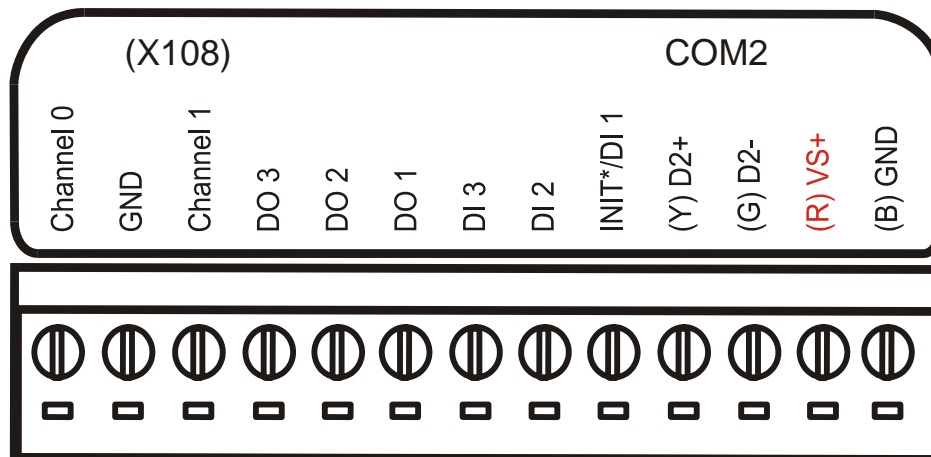
For I-7188XC

Power consumption: 0.5 W

Frequency :

- Low frequency : 40Hz
- High frequency : 100KHz
- Open-collector output: 250mA/30V, Max (Per channel)

8.9.2 Pin Assignment:



8.9.3 Programming :

Note: How to download PWM.exe, Refer to Section 1.5

1. Download :

COM1 will download PWM.exe & AUTOEXEC.bat

So \$aaB0115200 --> change COM1 to 115200

So \$aaB09600 --> change COM1 to 9600

2. default setting:

address=01, baud rate=9600

3. Command Sets :

Press Alt + L [Enter] under MinOS7.

Example of how frequency is used.

```
<*** Change to use COM2 ***>
<change to Line Mode>
#01A0 10000 1 1
```

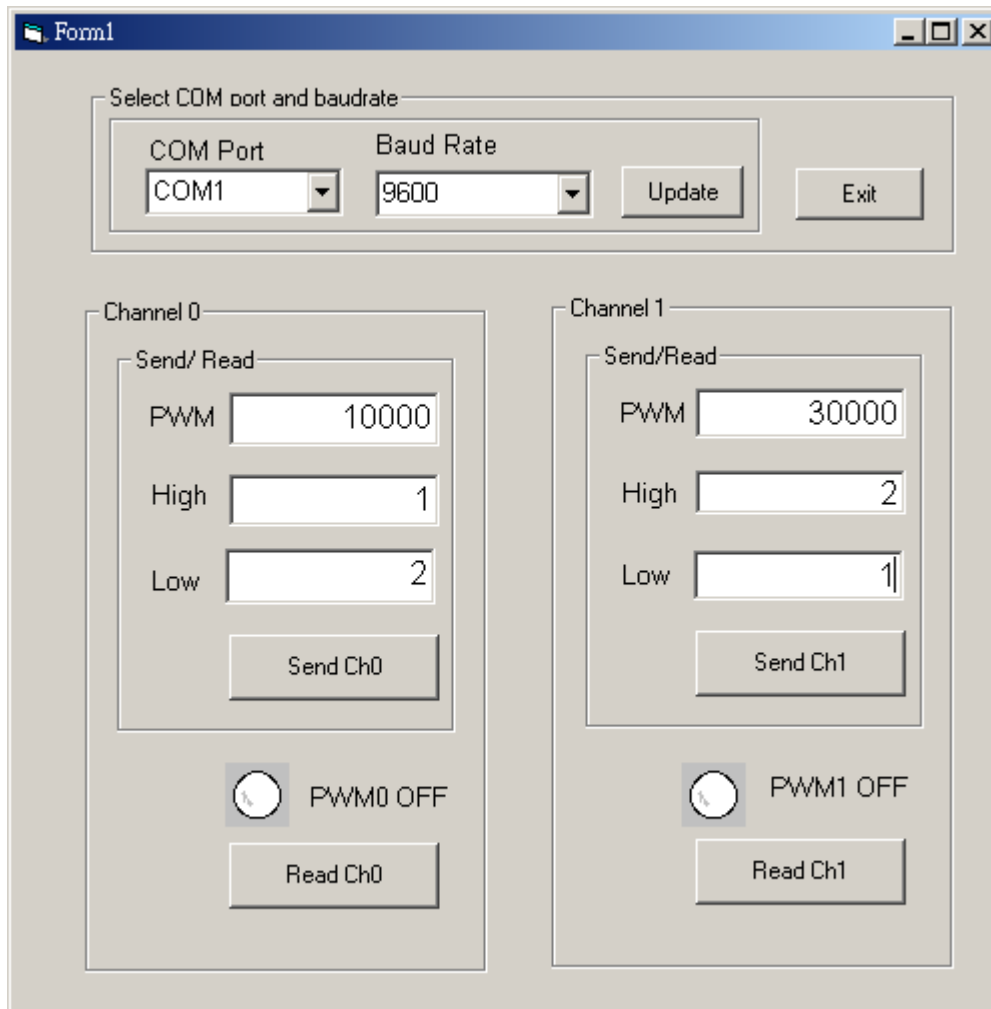
| | | |
|---------------------------|-------------------------------------|-----------------------|
| #aaA0 (freq) (high) (low) | --> !aa chan_0 (freq) (high) (low) | --> set pwm-0 |
| #aaB00 | --> !aa chan_0 OFF | --> turn pwm-0 off |
| #aaB01 | --> !aa chan_0 On | --> turn pwm-0 on |
| #aaC0 | --> !aa (freq) (high) (low) (OnOff) | --> read pwm-0 status |
| #aaA1 (freq) (high) (low) | --> !aa chan_1 (freq) (high) (low) | --> set pwm-1 |
| #aaB10 | --> !aa chan_1 OFF | --> turn pwm-1 off |
| #aaB11 | --> !aa chan_1 On | --> turn pwm-1 on |
| #aaC1 | --> !aa (freq) (high) (low) (OnOff) | --> read pwm-1 status |

4. testing procedure :

| | |
|---------------|------------------------|
| \$01M | --> !01PWM |
| #01A0 100 1 1 | --> !01 chan_0 100 1 1 |
| #01C0 | --> !01 100 1 1 1 |
| #01A1 200 2 1 | --> !01 chan_1 200 2 1 |
| #01C1 | --> !01 200 2 1 1 |
| #01B10 | --> !01 chan_1 Off |
| #01C1 | --> !01 200 2 1 0 |

#01B00 --> !01 CHAN_0 Off
#01C0 --> !01 100 1 1 0

5. Run Visual Basic:



8.10 X109: PhotoMOS Relay * 7

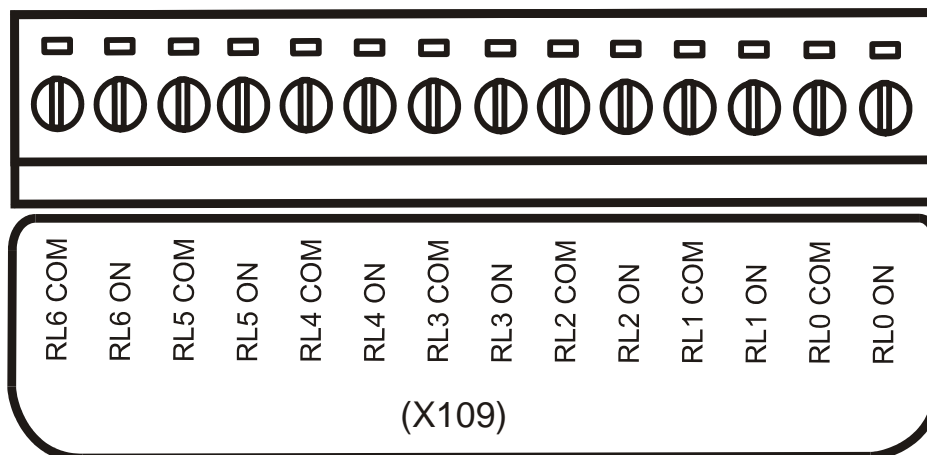
8.10.1 Specifications:

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

- Channels: 7 (Form A)
- Continuous load current: 120mA (peak AC)
- Peak load current: 0.3A
- Output Off state leakage current : 1Ua
- Output On resistance : 25Ohm
- Load voltage : 350V(peak AC)
- Turn On time : 0.23ms (Typical)
- Turn Off time : 0.04ms (Typical)
- Input / Output Isolation : 1,500V AC



8.10.2 Pin Assignment :



8.10.3 Programming :

outputb(BASE, DoVal); /* for all 7-channels */

- Note:**
1. The default value of BASE is 0.
 2. It is **not** recommended to change the value of BASE from 0 to another value.
 3. DoVal=0x00 → turn all 7-channel OFF
 DoVal=0x01 → turn channel_0 ON, the other channels OFF
 DoVal=0x7F → turn all 7-channel ON

8.11 X110: 14 Channels D/I

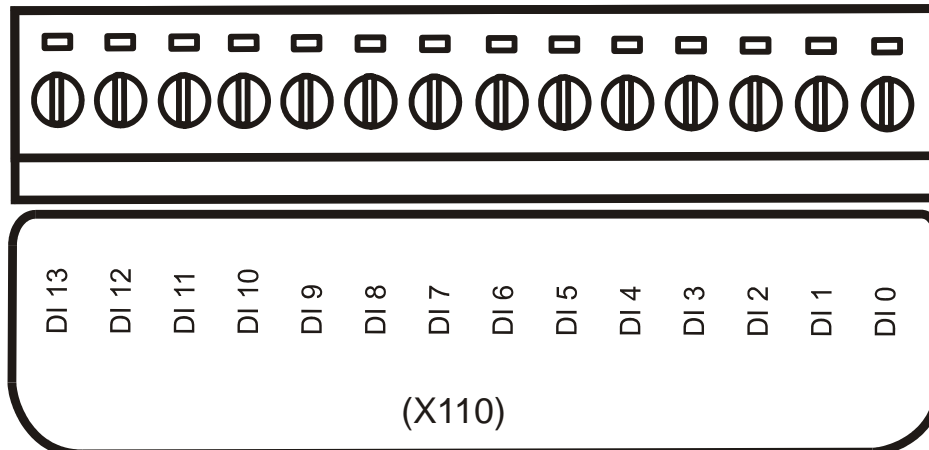
8.11.1 Specifications:

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Digital Input :

- Channels: 14
Input Range / Type: Logic high level (3.5V~30V),
Logic low level (0V~1V)
- Isolated: none

8.11.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

8.11.3 Programming :

```
iValue = inpw(port);          /* for all 14-channel */
```

```
DiVal=0x0000      → all 14-channel are Low  
DiVal=0x0001      → Chennel_0 is High, the other channels are Low  
DiVal=0x3FFF      → all 14-channel are High
```

8.12 X111: 13 Channels D/O

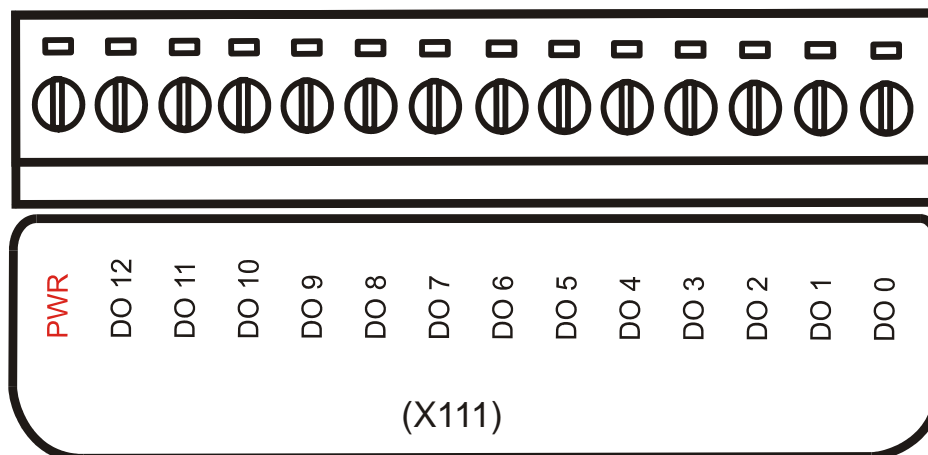
8.12.1 Specifications:

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Digital Output:

- Channels: 13
- Open-collector Output: 100 mA / 30V max
- Isolated: none

8.12.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

8.12.3 Programming :

outpw(port, DoVal); /* for all 13-channels */

Please notice that Base address "0x0080" not used.

- DoVal=0x0000 → turn all 13-channel OFF
- DoVal=0x0001 → turn channel_0 ON, the other channels OFF
- DoVal=0x2000 → turn all 13-channel ON

9. X2xx I/O Expansion Boards

9.1 X200: AD*1

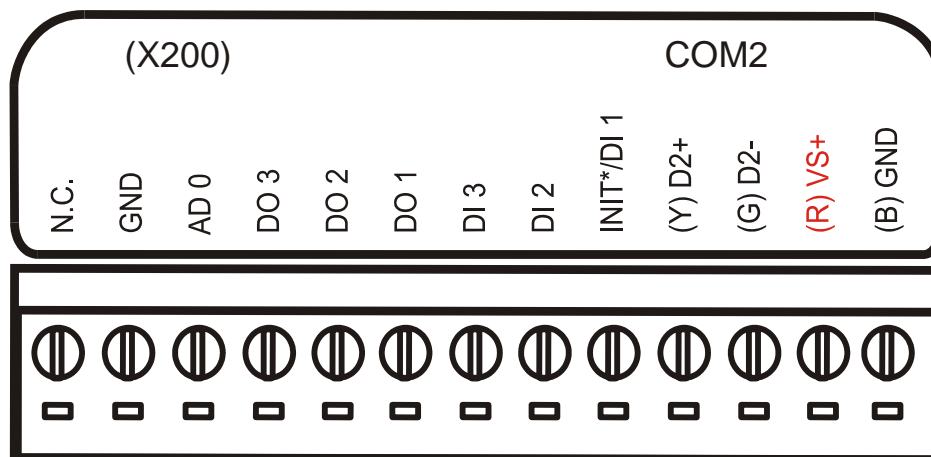
9.1.1 Specifications :

For I-7188XC

Analog Input:

- Channel : 1 (Single-Ended)
- Resolution : 12bit
- Input Range/Type : 0 ~ 2.5 V
- Sampling rate : 900 Hz
- Isolated : none

9.1.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

9.1.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

9.2 X201: AD*1

9.2.1 Specifications :

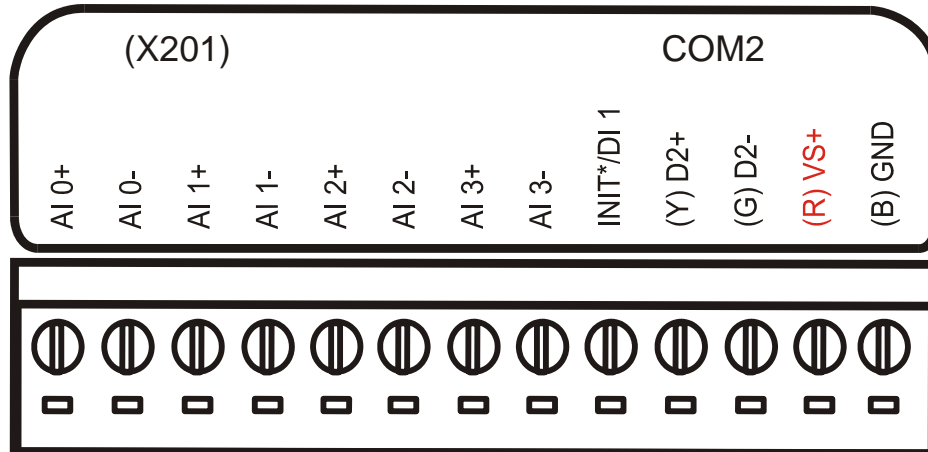
For I-7188XC

Power consumption: 0.4W

Analog Input:

- Channel : 1 (Differential)
- Resolution : 12bit
- Input Range/Type : 0 ~ 20mA
- Sampling rate : 900 Hz
- Isolated : none

9.2.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

9.2.3 Jumper Setting:

- **Note:** user should remove R19, R20, R21, R22, R23 in the 7188XC first.
- **J7:** I1+, I1-, I2+
- **TP0, TP1:** I2-, I3+, I3-, I4+, I4-
- **TP0:** Original function on 7188XC
- **TP1:** Five channels of isolated DI
- **Jumper:** Select **TP0** or **TP1** function
 - TP0:** JP9 and JP8 closed
 - TP1:** JP9 and JP10 closed

9.2.4 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

9.3 X202: AD*7

9.3.1 Specifications :

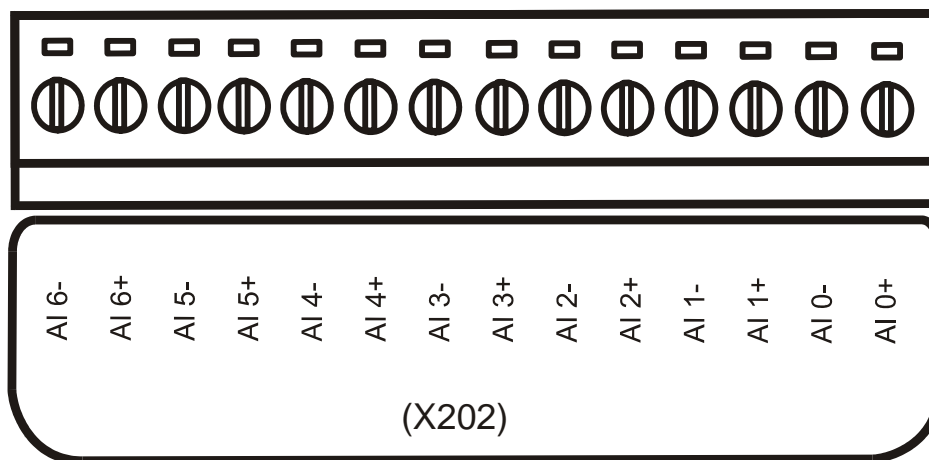
For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Power consumption: 0.7W

Analog Input:

- Channel : 7 (Differential)
- Resolution : 12bit
- Input Range/Type : 0 ~ 20mA
- Sampling rate : 1800 Hz
- Isolated : none

9.3.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

9.3.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

9.4 X203: AD*2 + DO*6 + DI*2

9.4.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Power consumption: 0.7W

Analog Input:

- Channel : 2 (Differential)
- Resolution : 12bit
- Input Range/Type : 0 ~ 20mA
- Sampling rate : 1800 Hz

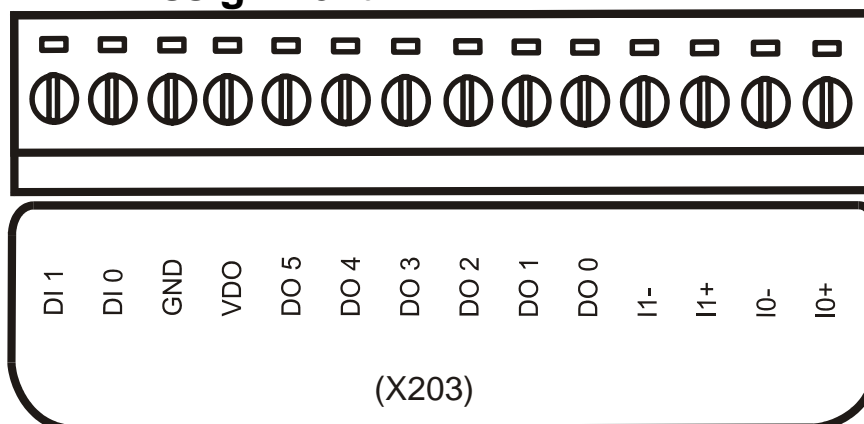
Digital Input :

- Channels: 2
Input Range / Type: Logic high level (3.5V~30V),
Logic low level (0V~1V)
- Isolated: none

Digital Output:

- Channels: 6
- Open-collector Output: 100 mA / 30V max
- Isolated: none

9.4.2 Pin Assignment :



Note: Refer to section 3. for A/D, D/A, DI, DO wire connection.
For Software Installation & Demo Program, Refer to Section 2.2.2

10. X3xx I/O Expansion Boards

10.1 X300: DA * 2

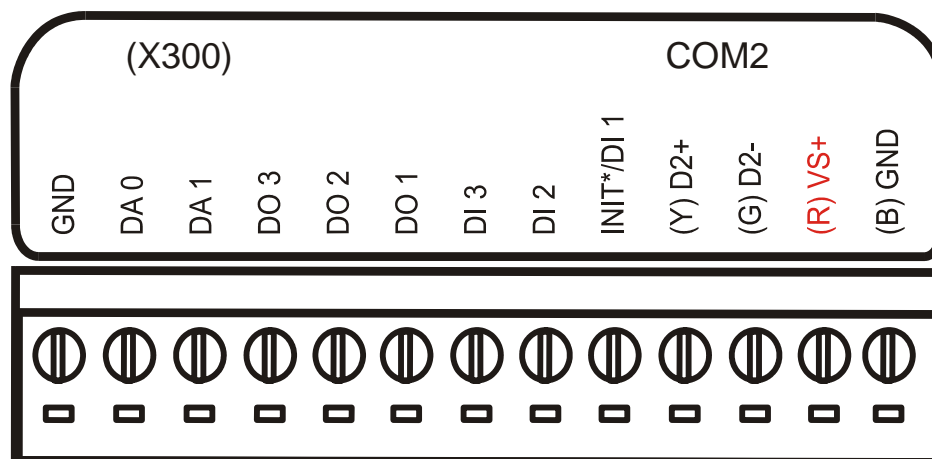
10.1.1 Specifications :

For I-7188XC

Analog Output:

- Channel : 2
- Resolution : 12bit
- Input Range/Type : 0 ~ 4.095V
- Sampling rate : 650 Hz
- Isolated : none

10.1.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

10.1.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

10.2 X301: DA * 1 + AD * 1

10.2.1 Specifications :

For I-7188XC

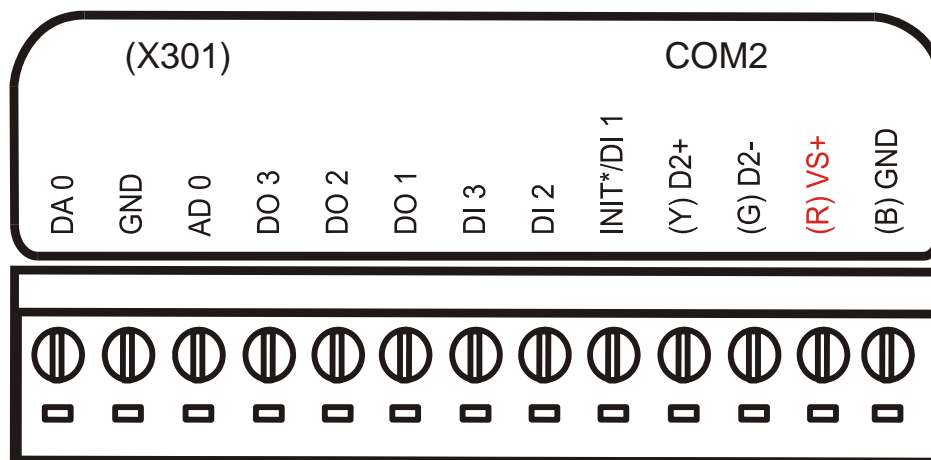
Analog Output:

- Channel : 1
- Resolution : 12bit
- Input Range/Type : 0 ~ 4.095V
- Sampling rate : 650 Hz
- Isolated : none

Analog Input:

- Channel : 1 (Single-Ended)
- Resolution : 12bit
- Input Range/Type : 0 ~ 2.5V
- Sampling rate : 900 Hz
- Isolated : none

10.2.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

10.2.3 Programming :

void AnalogOutput(int DataIn)

DataIn = 0 – 4095

(Note 4095 → 4.095V)

int AnalogIn(void)

Return value= 0 - 4095

Mapping formula: $V_{ref} / 4096$

(Note: $V_{ref}=2.5v$)

For Software Installation & Demo Program, Refer to Section 2.2.2

10.3 X302: DA * 1 + AD * 1

10.3.1 Specifications :

For I-7188XC

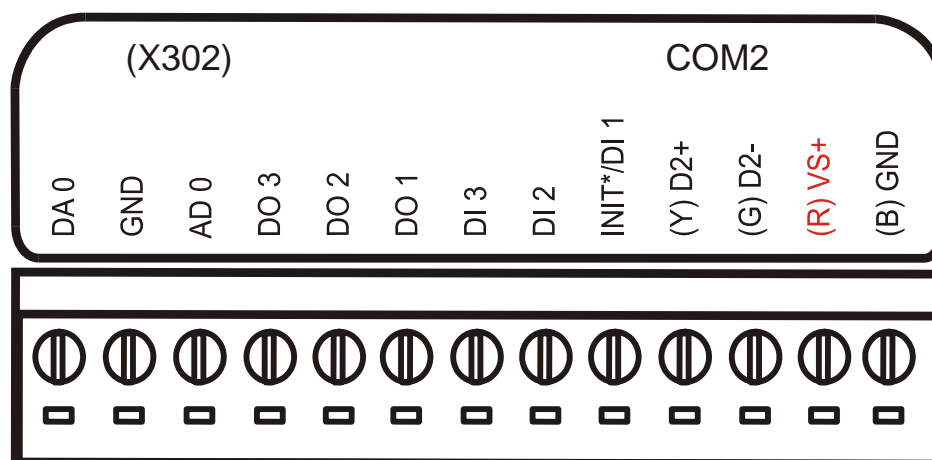
Analog Output:

- Channel : 1
- Resolution : 12bit
- Input Range/Type : +/- 5V
- Sampling rate : 650 Hz
- Isolated : none

Analog Input:

- Channel : 1 (Single-Ended)
- Resolution : 12bit
- Input Range/Type : +/- 5V
- Sampling rate : 900 Hz
- Isolated : none

10.3.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

10.3.3 Programming :

void AnalogOutput(int DataIn)

DataIn = 0 – 4095

(Note 4095→ 4.095V)

int AnalogIn(void)

Return value= 0 - 4095

Mapping formula: $V_{ref} / 4096$ (Note: $V_{ref}=5v$)

For Software Installation & Demo Program, Refer to Section 2.2.2

[Software specific]

| | | | | |
|---------------------|-------|-------|-------|-------|
| Input/Output range: | -5.0V | -0.0V | +0.0V | +5.0V |
| Decimal integer: | 0 | 2047 | 2048 | 4095 |
| Hexadecimal: | 000 | 7FF | 800 | FFF |

[A/D]

sampling rate: 1800 data/sec (with floating conversion)
Accuracy==> Typical: +/- 1 LSB (+- 2.4 mV)
Maximum: +/- 2 LSB (+- 4.8 mV)

[D/A]

throughput : 1300 data/sec (with floating conversion)
Accuracy==> Typical: +/- 1 LSB (+- 2.4 mV)
Maximum: +/- 2 LSB (+- 4.8 mV)

10.4 X303: AD*1 + DA*1 + DO*6 + DI*4

10.4.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Analog Output:

- Channel : 1
- Resolution : 12bit
- Input Range/Type : +/- 5V
- Sampling rate : 1300 Hz
- Isolated : none

Analog Input:

- Channel : 1 (Single-Ended)
- Resolution : 12bit
- Input Range/Type : +/- 5V
- Sampling rate : 1800 Hz
- Isolated : none

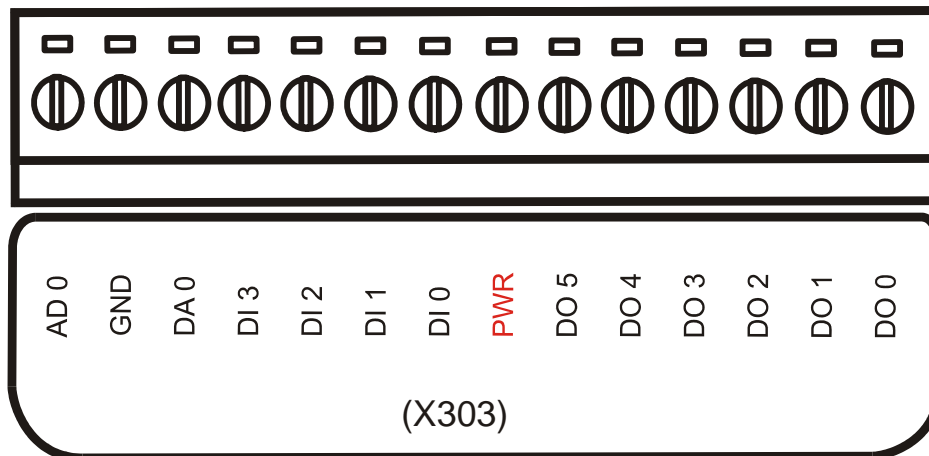
Digital Input :

- Channels: 4
Input Range / Type: Logic high level (3.5V~30V),
Logic low level (0V~1V)
- Isolated: none

Digital Output:

- Channels: 6
- Open-collector Output: 100 mA / 30V max
- Isolated: none

10.4.2 Pin Assignment :



Note: Refer to section 3. for A/D, D/A, DI, DO wire connection.

10.4.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

[Software specific]

| | | | | |
|---------------------|-------|-------|-------|-------|
| Input/Output range: | -5.0V | -0.0V | +0.0V | +5.0V |
| Decimal integer: | 0 | 2047 | 2048 | 4095 |
| Hexadecimal: | 000 | 7FF | 800 | FFF |

[A/D]

| | |
|----------------|--|
| sampling rate: | 1800 data/sec (with floating conversion) |
| Accuracy==> | Typical: +/- 1 LSB (+- 2.4 mV) |
| | Maximum: +/- 2 LSB (+- 4.8 mV) |

[D/A]

| | |
|--------------|--|
| throughput : | 1300 data/sec (with floating conversion) |
| Accuracy==> | Typical: +/- 1 LSB (+- 2.4 mV) |
| | Maximum: +/- 2 LSB (+- 4.8 mV) |

[D/O]

throughput: can generates 2KHz square wave signals.

10.5 X304: AD*3 + DA*1 + DO*4 + DI*4

10.5.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Analog Output:

- Channel : 1
- Resolution : 12bit
- Input Range/Type : +/- 5V
- Sampling rate : 1300 Hz
- Isolated : none

Analog Input:

- Channel : 3 (Single-Ended)
- Resolution : 12bit
- Input Range/Type : +/- 5V
- Sampling rate : 1800 Hz
- Isolated : none

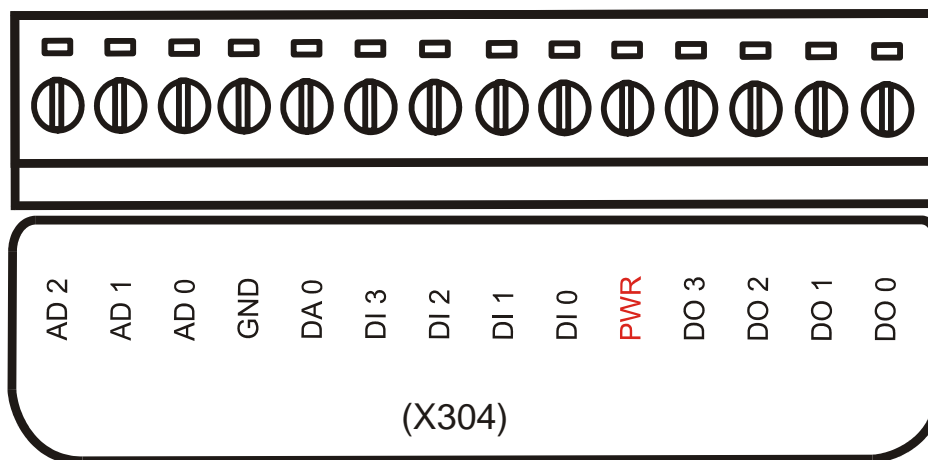
Digital Input :

- Channels: 4
Input Range / Type: Logic high level (3.5V~30V),
Logic low level (0V~1V)
- Isolated: none

Digital Output:

- Channels: 4
- Open-collector Output: 100 mA / 30V max
- Isolated: none

10.5.2 Pin Assignment :



Note: Refer to section 3. for A/D, D/A, DI, DO wire connection.

10.5.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

[Software specific]

| | | | | |
|---------------------|-------|-------|-------|-------|
| Input/Output range: | -5.0V | -0.0V | +0.0V | +5.0V |
| Decimal integer: | 0 | 2047 | 2048 | 4095 |
| Hexadecimal: | 000 | 7FF | 800 | FFF |

[A/D]

| | |
|----------------|--|
| sampling rate: | 1800 data/sec (with floating conversion) |
| Accuracy==> | Typical: +/- 1 LSB (+- 2.4 mV) |
| | Maximum: +/- 2 LSB (+- 4.8 mV) |

[D/A]

| | |
|--------------|--|
| throughput : | 1300 data/sec (with floating conversion) |
| Accuracy==> | Typical: +/- 1 LSB (+- 2.4 mV) |
| | Maximum: +/- 2 LSB (+- 4.8 mV) |

[D/O]

throughput: can generates 2KHz square wave signals.

10.6 X305: AD*7 + DA*1 + DO*2 + DI*2

10.6.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Analog Output:

- Channel : 1
- Resolution : 12bit
- Input Range/Type : +/- 5V
- Sampling rate : 1300 Hz
- Isolated : none

Analog Input:

- Channel : 7 (Single-Ended)
- Resolution : 12bit
- Input Range/Type : +/- 5V
- Sampling rate : 1800 Hz
- Isolated : none

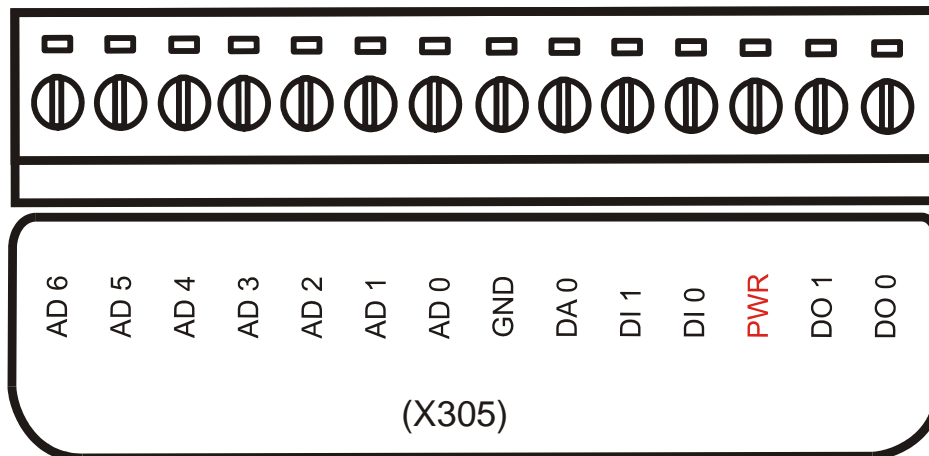
Digital Input :

- Channels: 2
Input Range / Type: Logic high level (3.5V~30V),
Logic low level (0V~1V)
- Isolated: none

Digital Output:

- Channels: 2
- Open-collector Output: 100 mA / 30V max
- Isolated: none

10.6.2 Pin Assignment :



Note: Refer to section 3. for A/D, D/A, DI, DO wire connection.

10.6.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

[Software specific]

| | | | | |
|---------------------|-------|-------|-------|-------|
| Input/Output range: | -5.0V | -0.0V | +0.0V | +5.0V |
| Decimal integer: | 0 | 2047 | 2048 | 4095 |
| Hexadecimal: | 000 | 7FF | 800 | FFF |

[A/D]

| | |
|----------------|--|
| sampling rate: | 1800 data/sec (with floating conversion) |
| Accuracy==> | Typical: +/- 1 LSB (+- 2.4 mV) |
| | Maximum: +/- 2 LSB (+- 4.8 mV) |

[D/A]

| | |
|--------------|--|
| throughput : | 1300 data/sec (with floating conversion) |
| Accuracy==> | Typical: +/- 1 LSB (+- 2.4 mV) |
| | Maximum: +/- 2 LSB (+- 4.8 mV) |

[D/O]

throughput: can generates 2KHz square wave signals.

10.7 X306: AD*2

10.7.1 Specifications :

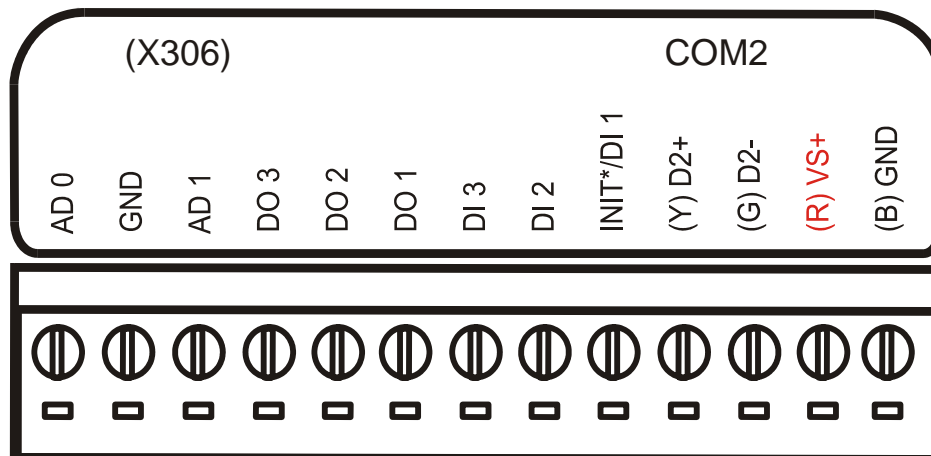
For I-7188XC

Power consumption: 0.4W

Analog Input:

- Channel : 2 (Single-Ended)
- Resolution : 12bit
- Input Range/Type : + / - 10 V
- Sampling rate : 900 Hz
- Isolated : none

10.7.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

10.7.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

10.8 X307: AD*8

10.8.1 Specifications :

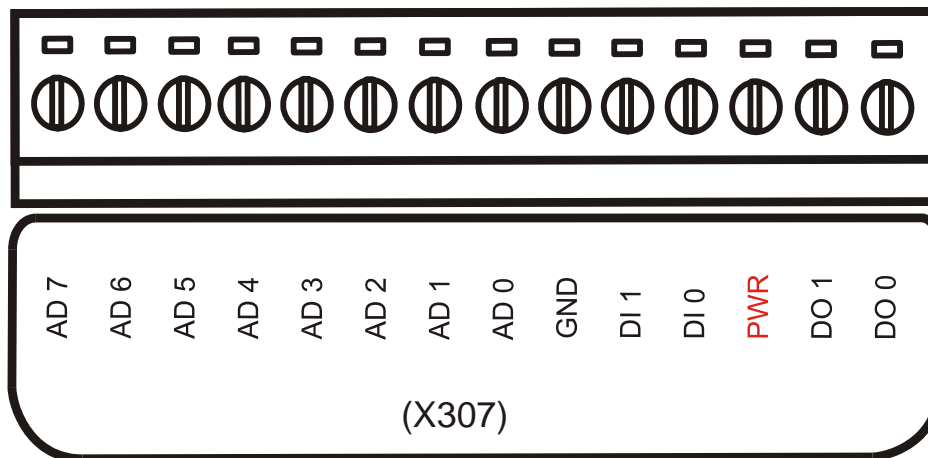
For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Power consumption: 0.7W

Analog Input:

- Channel :8 (Single-Ended)
- Resolution : 12bit
- Input Range/Type : + / - 10V
- Sampling rate : 1800 Hz
- Isolated : none

10.8.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

10.8.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

10.9 X308: AD*4 + DO*6

10.9.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

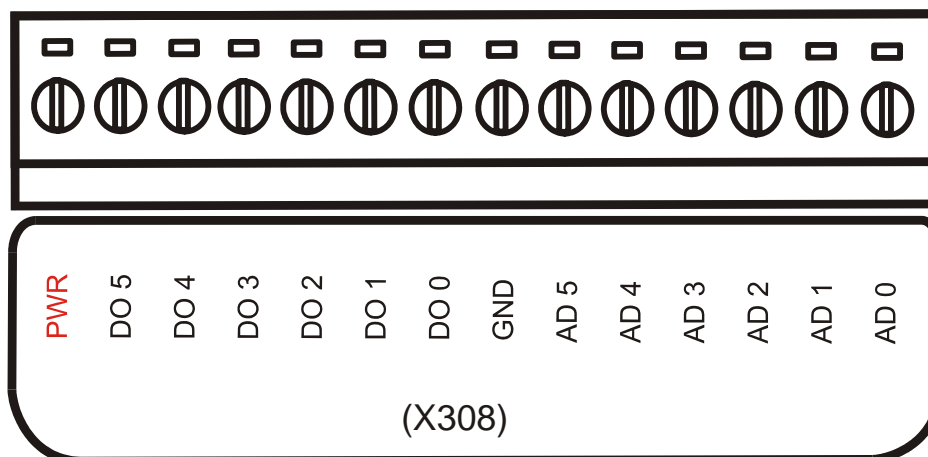
Analog Input:

- Channel : 4 (Single-Ended)
- Resolution : 12bit
- Input Range/Type : 0 ~ 10V
- Sampling rate : 1800 Hz
- Isolated : none

Digital Output:

- Channels: 6
- Open-collector Output: 100 mA / 30V max
- Isolated: none

10.9.2 Pin Assignment :



Note: Refer to section 3. for A/D, D/A, DI, DO wire connection.

10.9.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

[Software specific]

| | | | | |
|---------------------|-----|------|------|------|
| Input/Output range: | 0V | 4.9V | 5V | 10V |
| Decimal integer: | 0 | 2047 | 2048 | 4095 |
| Hexadecimal: | 000 | 7FF | 800 | FFF |

[A/D]

sampling rate: 1800 data/sec (with floating conversion)

Accuracy==> Typical: +/- 1 LSB (+- 2.4 mV)
Maximum: +/- 2 LSB (+- 4.8 mV)

[D/O]

throughput: can generates 2KHz square wave signals.

10.10 X310: AD*2 + DA*2 + DO*3 + DI*3

10.10.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Analog Output:

- Channel : 2
- Resolution : 12bit
- Input Range/Type : 0 ~ 10V
- Sampling rate : 1300 Hz
- Isolated : none

Analog Input:

- Channel : 2 (Differential)
- Resolution : 12bit
- Input Range/Type :
Ch0 : 0 ~ 20 mA
Ch1 : 0 ~ 10 V
- Sampling rate : 1800 Hz
- Isolated : none

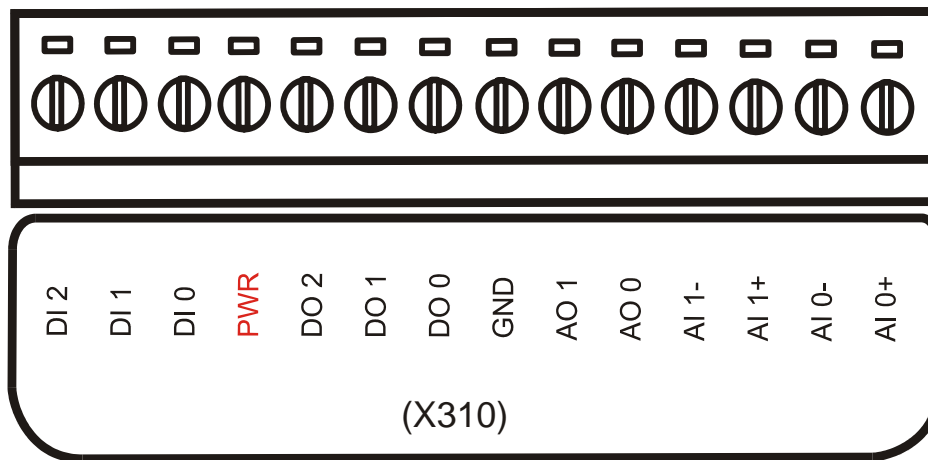
Digital Input :

- Channels: 3
Input Range / Type: Logic high level (3.5V~30V),
Logic low level (0V~1V)
- Isolated: none

Digital Output:

- Channels: 3
- Open-collector Output: 100 mA / 30V max
- Isolated: none

10.10.2 Pin Assignment :



Note: Refer to section 3. for A/D, D/A, DI, DO wire connection.

10.10.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

[Software specific]

| | | | | |
|---------------------|-----|------|------|------|
| Input/Output range: | 0V | 4.9V | 5.0V | 10V |
| Decimal integer: | 0 | 2047 | 2048 | 4095 |
| Hexadecimal: | 000 | 7FF | 800 | FFF |

[A/D]

| | |
|----------------|--|
| sampling rate: | 1800 data/sec (with floating conversion) |
| Accuracy==> | Typical: +/- 1 LSB (+- 2.4 mV) |
| | Maximum: +/- 2 LSB (+- 4.8 mV) |

[D/A]

| | |
|--------------|--|
| throughput : | 1300 data/sec (with floating conversion) |
| Accuracy==> | Typical: +/- 1 LSB (+- 2.4 mV) |
| | Maximum: +/- 2 LSB (+- 4.8 mV) |

[D/O]

throughput: can generates 2KHz square wave signals.

11. X4xx I/O Expansion Boards

11.1 X400:Timer/counter *3

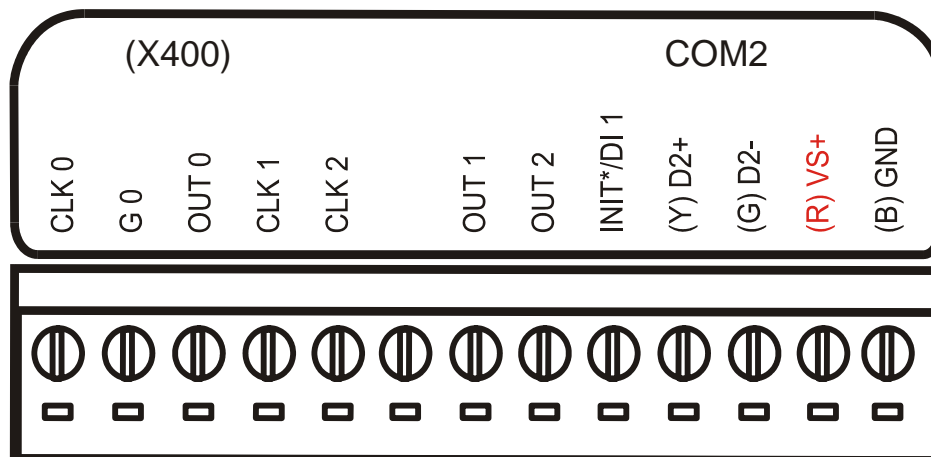
11.1.1 Specifications :

For I-7188XC

Analog Input:

- Channel : 3
16 bit timer/counter
- Isolated : none

11.1.2 Pin Assignment & Jumper Setting :



Note: You can used 3 channels 16-bit counters or 1 channel 16-bit and 1 channel 32-bit

- J7: for counter-0
- TP0: Original function on 7188XC
- TP1: for counter1, counter2

Jumper setting for 8254:

| | 1-2 ON | 2-3 ON |
|------|----------------------------|----------------------|
| CLK0 | T1 → CLK0=TO_0 | T1 → CLK0=pin1 of J5 |
| G0 | T2 → G0=always High | T2 → G0=pin2 of J5 |
| OUT0 | OUT0 to INT0 & pin3 of J5 | |
| | | |
| CLK1 | T4 → CLK1=TO_1 | T4 → CLK0=pin4 of J5 |
| G1 | Always High | |
| OUT1 | OUT1 to T3.1 & T5.1 & T6.1 | |
| | | |
| CLK2 | T3 → CLK2=OUT1 | T3 → CLK2=pin5 of J5 |
| G2 | Always High | |
| OUT2 | OUT2 to T5.3 & T7.1 | |

- T1 is used to select internal TO_0 or external signal for CLK0
- T2 is used to select High or external signal for G0
- T3 is used to control 16-bit/32-bit counter. 1-2 select 32-bits counter, 2-3 select two 16-bit counters
- T4 is used to select internal TO_1 or external signal for CLK1
- T5 is used to select OUT1 or OUT2 to INT1
- T6 is used to select OUT1 to pin-7 of J5
- T7 is used to select OUT2 to pin-8 of J5

11.1.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

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12. X5xx I/O Expansion Boards

12.1 X500: RS232 * 1

12.1.1 Specifications

For I-7188XC

Parallel I/O :

- RS-232 port : 1
- COM3 : TXD, RXD, RTS, CTS, DSR, DTR, DCD, RI, GND
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Modem control
- Isolated : none

12.1.2 Pin Assignment & Jumper Setting

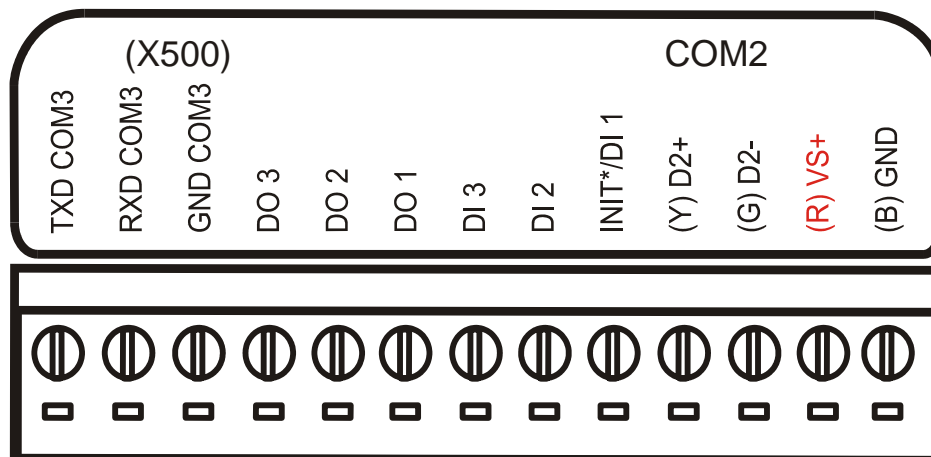
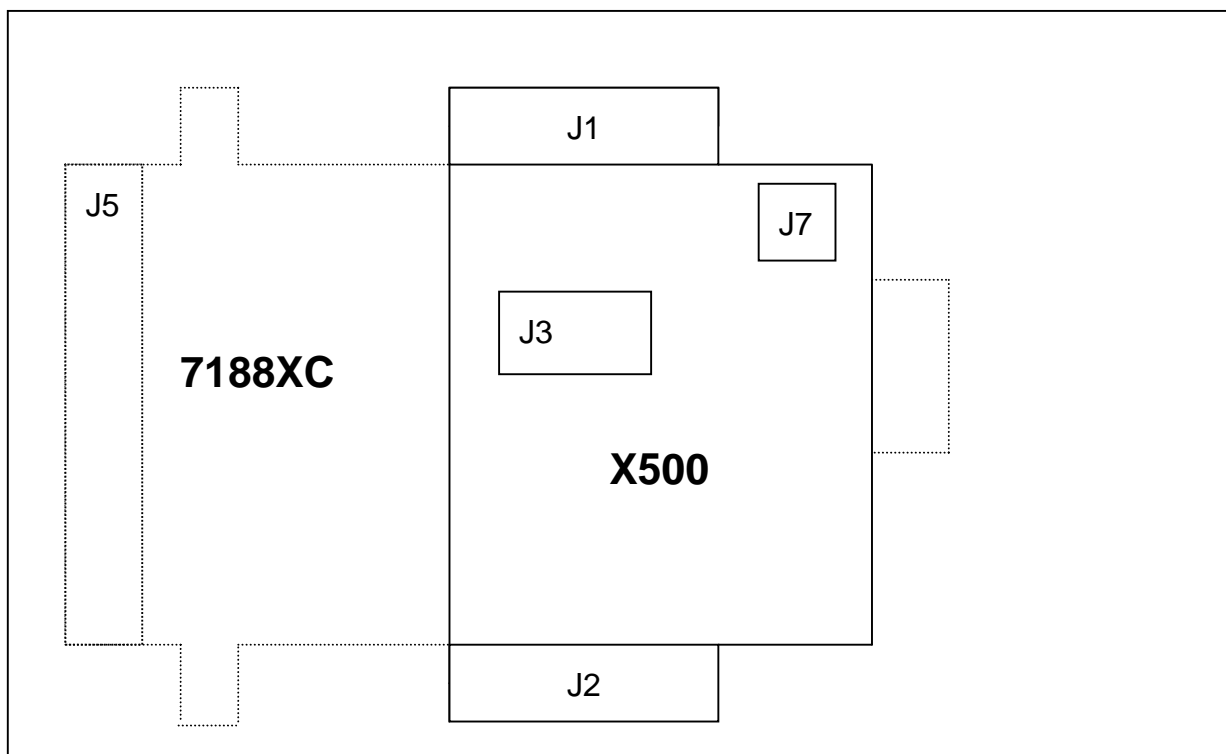


Figure 1

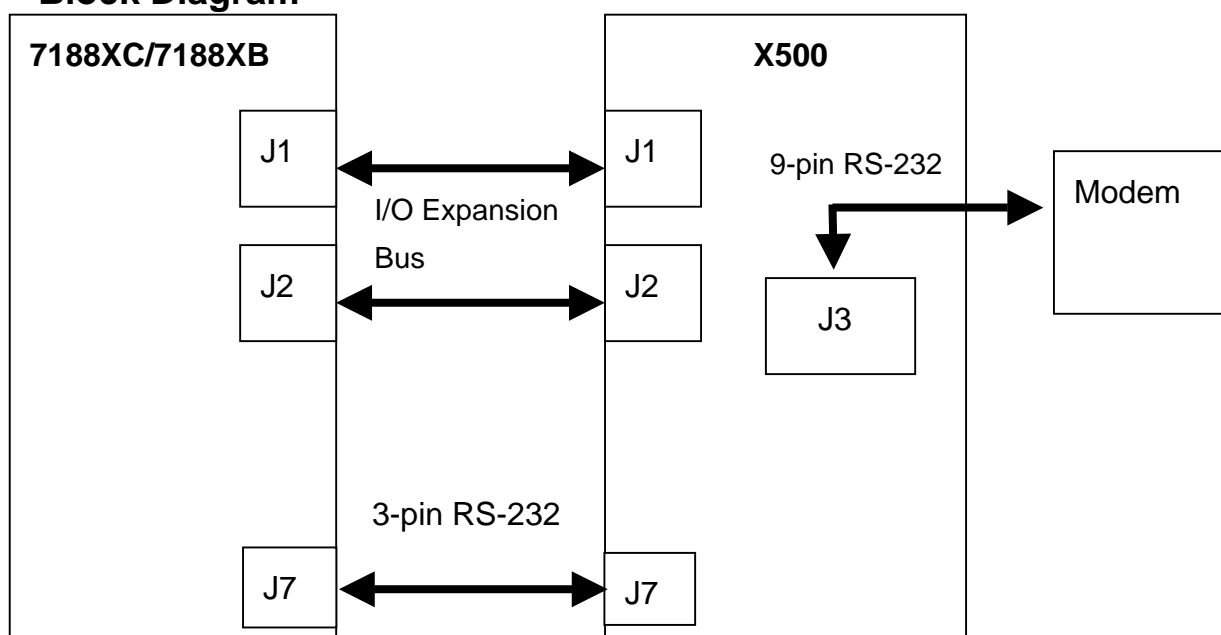
Note: There are two type of functions in X500.

1. COM3 : TXD, RXD, RTS, CTS, DSR, DTR, DCD, RI, GND
This function without case.
2. COM3 : TXD, RXD, GND
This function with case.



- **J1:** I/O expansion bus, connect to J1 of 7188XC
- **J2:** I/O expansion bus, connect to J2 of 7188XC
- **J7:** Three wires of RS-232 (RXD, TXD, GND)
Pin Assignment : refer to Figure 1 on page 90.
- **J3:** 9-pin connector of RS-232, connect to modem

Block Diagram



12.1.3 Programming :

Compatible to **COM3** of 7188X software library

int InstallCom3(unsigned long baud, int data, int parity, int stop);

int RestoreCom3(void);

int IsCom3(void);

int ToCom3(int data);

int ToCom3Str(char *str);

int ToCom3Bufn(char *buf,int no);

int printCom3(char *fmt,...);

void ClearTxBuffer3(void);

int SetCom3FifoTriggerLevel(int level);

int SetBaudrate3(unsigned long baud);

int ReadCom3(void);

int ClearCom3(void);

int DataSizeInCom3(void);

int WaitTransmitOver3(void);

int IsTxBufEmpty3(void);

int IsCom3OutBufEmpty(void);

12.2 X501: RS232 * 1

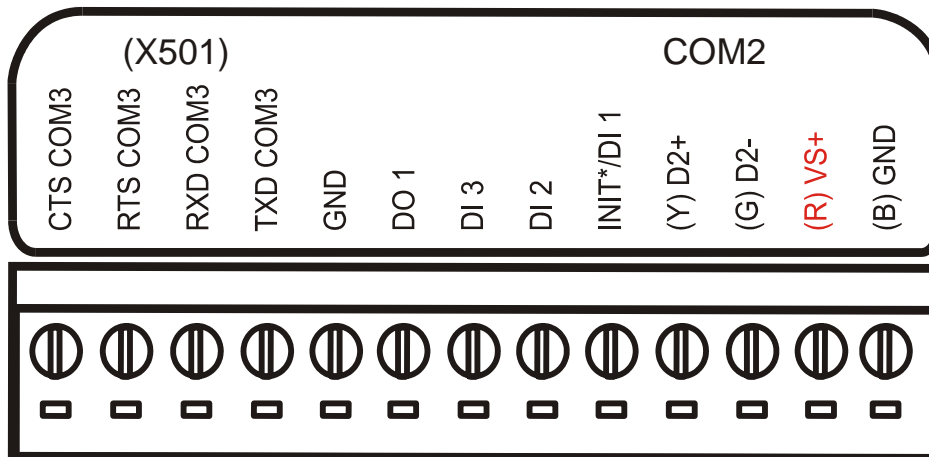
12.2.1 Specifications

For I-7188XC

Parallel I/O :

- RS-232 port : 1
- COM3 : TXD, RXD, RTS, CTS, GND
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Isolated : none

12.2.2 Pin Assignment :



12.2.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

12.3 X502: RS232 * 1

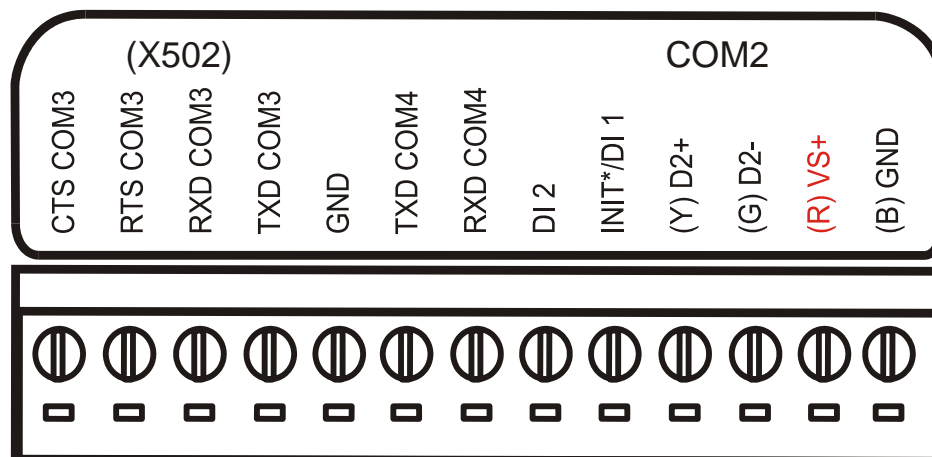
12.3.1 Specifications

For I-7188XC

Parallel I/O :

- RS-232 port : 2
- COM3 : TXD, RXD, RTS, CTS, GND
- COM4: TXD, RXD, GND
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Isolated : none

12.3.2 Pin Assignment :



12.3.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

12.4 X503: RS232 * 1

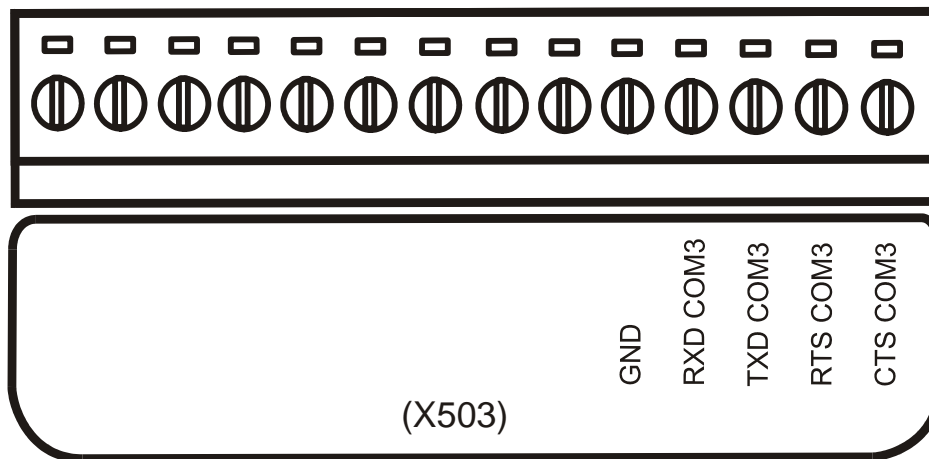
12.4.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Parallel I/O :

- RS-232 port : 1
- COM3 : TXD, RXD, RTS, CTS, GND
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Isolated : none

12.4.2 Pin Assignment :



12.4.3 Programming :

I-7188E4 and X503 + I-7188EX are software the same.

I-7523 and X503 + I-7188XB are software the same.

For Software Installation & Demo Program, Refer to Section 2.2.2

12.5 X504: RS232 * 2

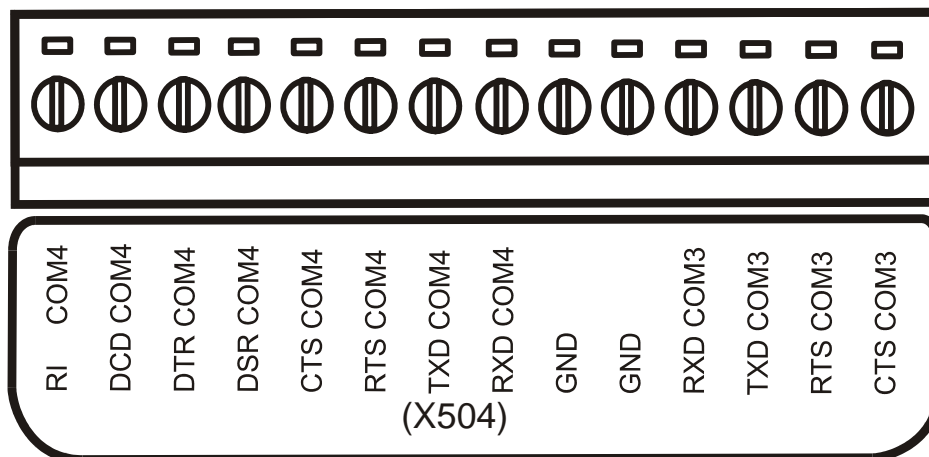
12.5.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Parallel I/O :

- COM3 : TXD, RXD, RTS, CTS, GND
- COM4 : TXD, RXD, RTS, CTS, DSR, DTR, DCD, RI, GND
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Modem control
- Isolated : none

12.5.2 Pin Assignment :



12.5.3 Programming :

I-7188E4 and X504 + I-7188EX are software the same.

For Software Installation & Demo Program, Refer to Section 2.2.2

12.6 X505: RS232 * 3

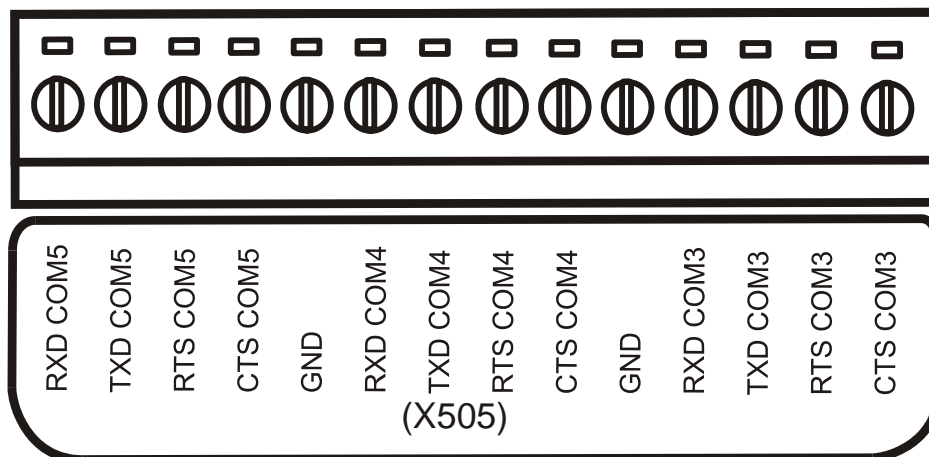
12.6.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Parallel I/O :

- COM3 : TXD, RXD, RTS, CTS, GND
- COM4 : TXD, RXD, RTS, CTS, GND
- COM5 : TXD, RXD, RTS, CTS, GND
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Isolated : none

12.6.2 Pin Assignment :



12.6.3 Programming :

I-7188E5 and X505 + I-7188EX are software the same.

I-7524 and X505 + I-7188XB are software the same.

For Software Installation & Demo Program, Refer to Section 2.2.2

12.7 X506: RS232 * 6

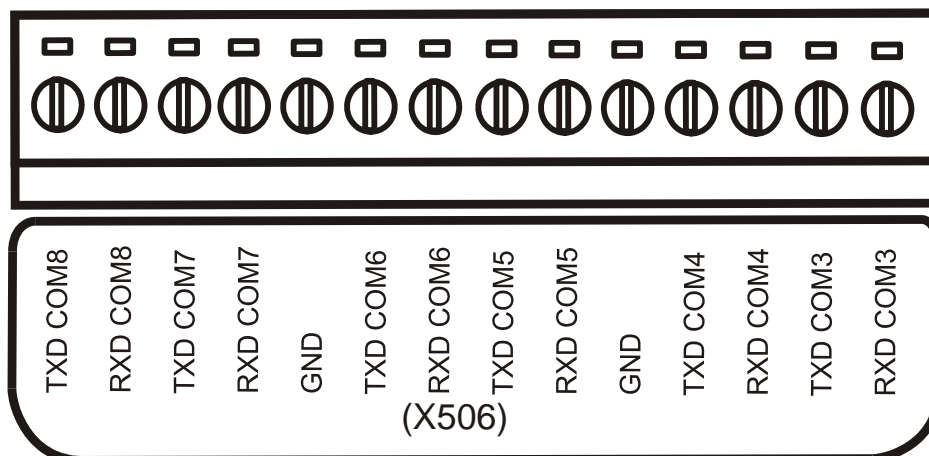
12.7.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Parallel I/O :

- COM3 : TXD, RXD, GND
- COM4 : TXD, RXD, GND
- COM5 : TXD, RXD, GND
- COM6 : TXD, RXD, GND
- COM7 : TXD, RXD, GND
- COM8: TXD, RXD, GND
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Isolated : none

12.7.2 Pin Assignment :



12.7.3 Programming :

I-7188E8 and X506 + I-7188EX are software the same.

I-7527 and X506 + I-7188XB are software the same.

For Software Installation & Demo Program, Refer to Section 2.2.2

12.8 X507: RS422 * 1 + DO*4 + DI*4

12.8.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Parallel I/O :

- COM3 : TxD+, TxD -RxD+, RxD -
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Isolated : none

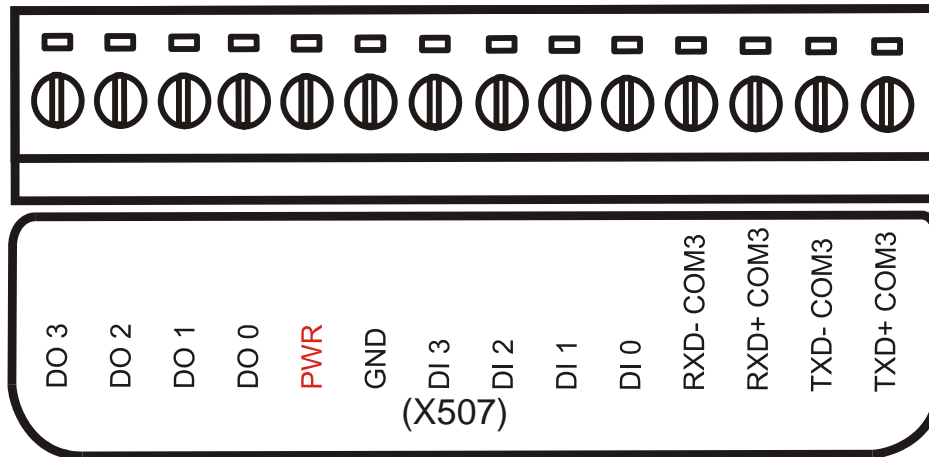
Digital Input :

- Channels: 4
Input Range / Type: Logic high level (3.5V~30V),
Logic low level (0V~1V)
- Isolated: none

Digital Output:

- Channels: 4
- Open-collector Output: 100 mA / 30V max
- Isolated: none

12.8.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

12.8.3 Programming :

I-7188E3 and X507 + I-7188EX are software the same.

I-7522A and X507 + I-7188XB are software the same.

For Software Installation & Demo Program, Refer to Section 2.2.2

12.9 X508: RS232 * 1 + DO*4 + DI*4

12.9.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Parallel I/O :

- COM3 : TXD, RXD, RTS, CTS, GND
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Isolated : none

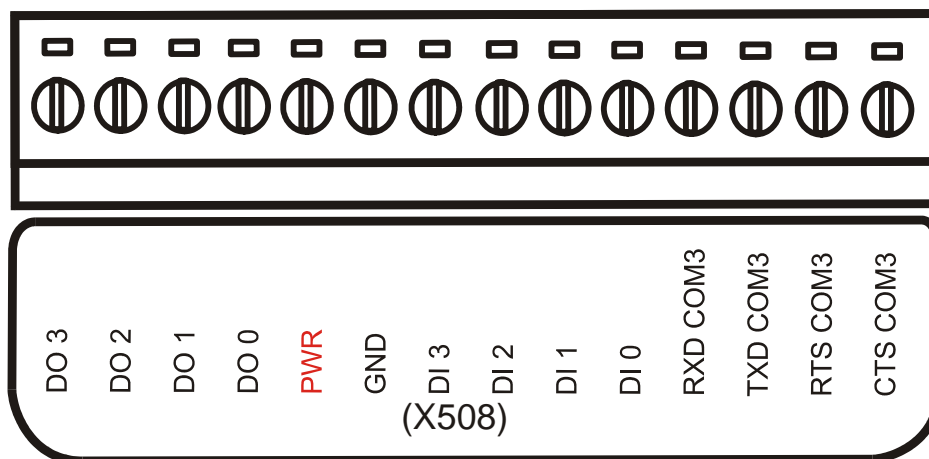
Digital Input :

- Channels: 4
Input Range / Type: Logic high level (3.5V~30V),
Logic low level (0V~1V)
- Isolated: none

Digital Output:

- Channels: 4
- Open-collector Output: 100 mA / 30V max
- Isolated: none

12.9.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

12.9.3 Programming :

I-7188E3-232 and X508 + I-7188EX are software the same.

I-7522A and X508 + I-7188XB are software the same.

For Software Installation & Demo Program, Refer to Section 2.2.2

12.10 X509: RS232 * 2 + DO*4 + DI*4

12.10.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Parallel I/O :

- COM3 : TXD, RXD, GND
- COM4 : TXD, RXD, GND
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Isolated : none

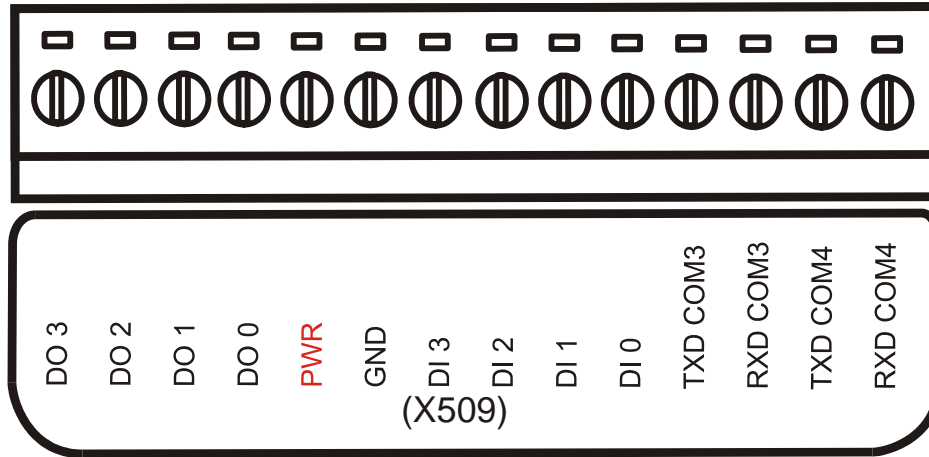
Digital Input :

- Channels: 4
Input Range / Type: Logic high level (3.5V~30V),
Logic low level (0V~1V)
- Isolated: none

Digital Output:

- Channels: 4
- Open-collector Output: 100 mA / 30V max
- Isolated: none

12.10.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

12.10.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

12.11 X510: RS232 * 1 + DO*5 + DI*5

12.11.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

EEPROM: 128K * 2 bytes For X510

EEPROM: 128K * 1 bytes For X510-128

Parallel I/O :

- COM3 : TXD, RXD, GND
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Isolated : none

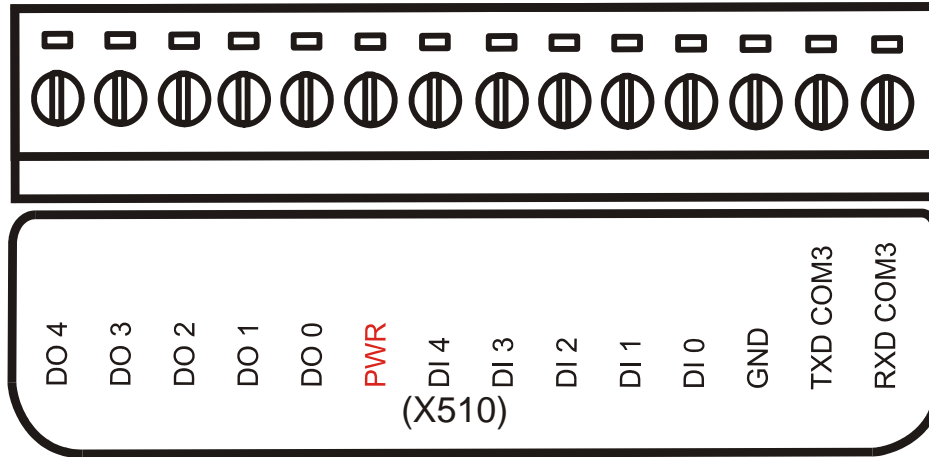
Digital Input :

- Channels: 5
Input Range / Type: Logic high level (3.5V~30V),
Logic low level (0V~1V)
- Isolated: none

Digital Output:

- Channels: 5
- Open-collector Output: 100 mA / 30V max
- Isolated: none

12.11.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

12.11.3 Programming :

I-7188E3 and X510 + I-7188EX are software the same.

For Software Installation & Demo Program, Refer to Section 2.2.2

12.12 X511: RS485 * 3

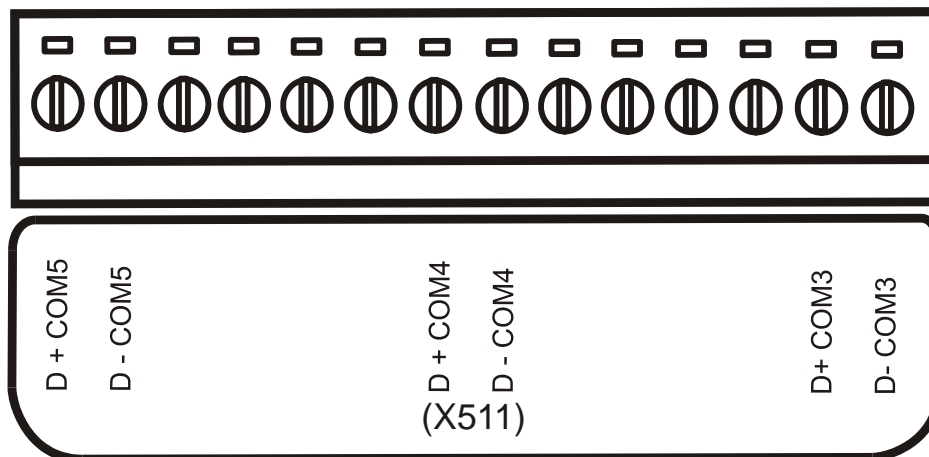
12.12.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Parallel I/O :

- COM3 : Data+, Data-
- COM4 : Data+, Data-
- COM5 : Data+, Data-
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Isolated : none

12.12.2 Pin Assignment :



12.12.3 Programming :

I-7188E5 and X511 + I-7188EX are software the same.

I-7524 and X511 + I-7188XB are software the same.

For Software Installation & Demo Program, Refer to Section 2.2.2

12.13 X512: RS-232 * 4 + RS485 * 1

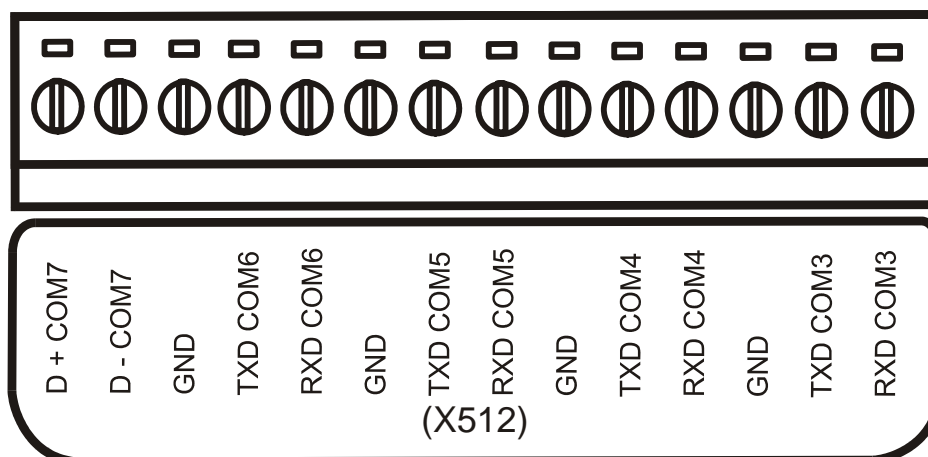
12.13.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Parallel I/O :

- COM3 : TXD, RXD, GND
- COM4 : TXD, RXD, GND
- COM5 : TXD, RXD, GND
- COM6 : TXD, RXD, GND
- COM7 : Data+, Data-
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Isolated : none

12.13.2 Pin Assignment :



12.13.3 Programming :

I-7188E8 and X512 + I-7188EX are software the same.

I-7527 and X512 + I7188XB are software the same.

For Software Installation & Demo Program, Refer to Section 2.2.2

12.14 X560: RS-232 * 3 + 8 M Flash

12.14.1 Specifications :

* * The module without case. * *

For I-7188XA, I-7188XC, I-7188XB, I-7188XG, I-7188EX, I-7188EG

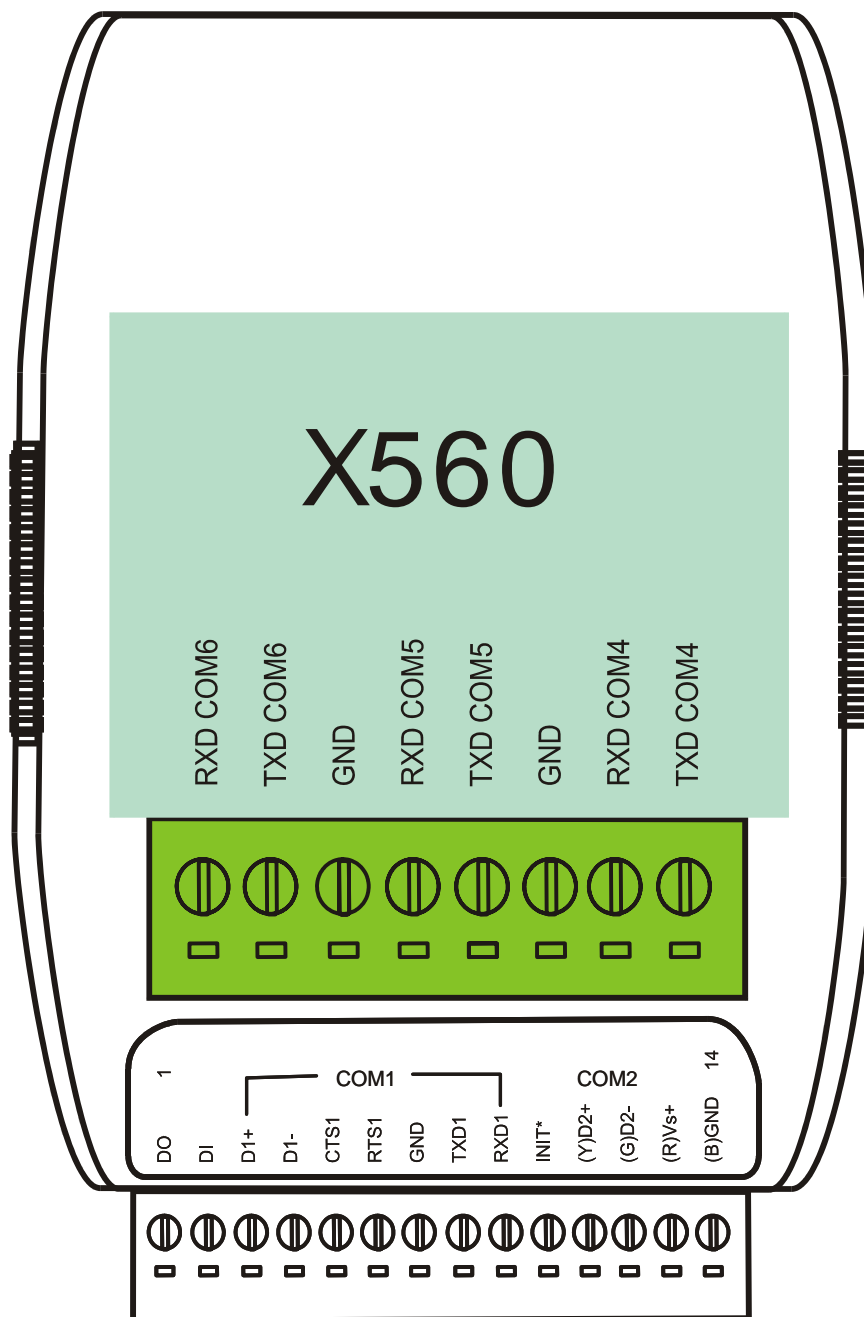
Parallel I/O :

- COM4 : TXD, RXD, GND
- COM5 : TXD, RXD, GND
- COM6 : TXD, RXD, GND
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Isolated : none

Storage flash, 8M bytes :

- Endurance : 1,000,000 Program/Erase Cycles
- Data Retention : 10 years

12.14.2 Pin Assignment :



12.14.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

13. X6xx I/O Expansion Boards

13.1 X600 and X601 : Flash ROM

13.1.1 Specifications

For I-7188XA, I-7188XC, I-7188XB, I-7188XG, I-7188EX, I-7188EG

Power consumption: 0.5W

X600: storage flash, 4M bytes

Endurance : 1,000,000 Program/Erase Cycles

Data Retention : 10 years

X601: storage flash, 8M bytes

Endurance : 1,000,000 Program/Erase Cycles

Data Retention : 10 years

13.1.2 Software Library :

```
int X600_Init(int wBaseAddr, int wType);
int X600_Reset_FLASH(void);
int X600_WP_FLASH(char wp);
void X600_Read_FLASH_ID(int *maker, int *device);
void X600_Read_FLASH_Status(int *status);
int X600_MarkBadPage(unsigned int wAddr);
int X600_Erase_FLASH(unsigned int wAddr);
int X600_Erase_FLASH_Unconditional(unsigned int wAddr);
int X600_Write_FLASH(unsigned int wAddr, char buf1[], char buf2[]);
int X600_Read_FLASH(unsigned int wAddr, char buf1[], char buf2[]);
```

13.1.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

13.2 X607 and X608: SRAM

13.2.1 Specifications

X607 : 128K bytes battery backup

X608 : 512K bytes battery backup

For I-7188XA, I-7188XC, I-7188XB, I-7188XG, I-7188EX, I-7188EG

*** X607 and X608 are support file system. ***

Power consumption: 0.5W

Introduction:

There are two modes of power supplies to SRAM, I-7188(VCC) mode and battery mode. The voltage of the battery is 3 V, the voltage of I-7188 mode is 5 V. I-7188 (VCC) is the primary power supply when it is powered on. SRAM will consume the battery power if I-7188 power off.

SRAM requires a minimum of 2.0 V at battery mode. Data loss happens when power voltage is less than 2.0 V. An automatic backup will take place when I-7188 is power off. The battery is replaceable. However, there is a risk to loose data during the process of changing batteries.

Specifications:

1. The minimum data retention supply voltage is 2.0V
2. The X607 can provide 9 years backup time
(Shutdown 24 hours everyday).
3. The X608 can provide 2 years backup time.
(Shutdown 24 hours everyday).
4. Operating temperature: +0°C to +70°C

13.2.2 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2