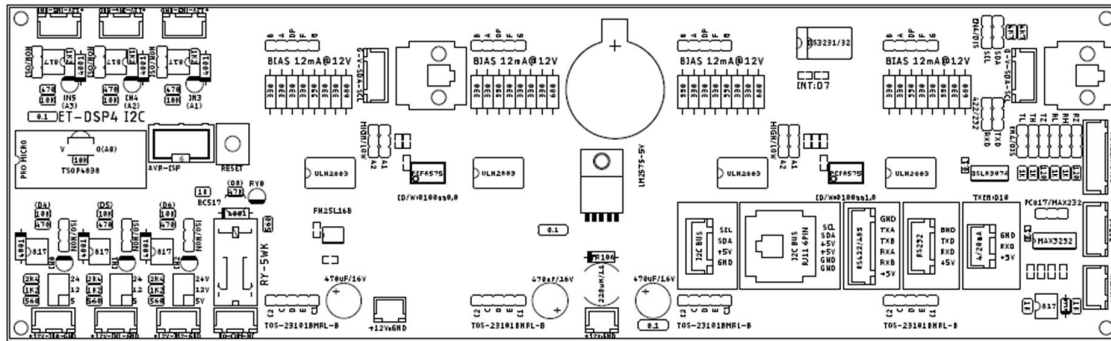


### ET-DSP4 I2C / ET-DSP6 I2C



ET-DSP4 I2C/ET-DSP6 I2C is all-purpose 7-SEGMENT Display Board and its Display is 2.3 inch high; Board ET-DSP4 ISP has 4 Digits and ET-DSP6 I2C has 6-Digits. Both Boards support and can be used together with Module MCU “PRO MICRO 32U4” that is AVR Microcontroller No.ATMEGA32U4. Program can be applied for various types of Display Board, it must be developed by C Language that is supported by MCU AVR; in this case, it uses Compiler of Codevision AVR or WinAVR or Arduino as required. This Board uses MCU ATMEGA32U4 to command and control the display of 7-SEGMENT by CHIP PCF8575 via I2C BUS. Moreover, there is CHIP RTC Real Time Clock No.DS3231 provided with BACKUP BATTERY internal board; and there is CONNECTOR I2C BUS to extend BUS in order to be externally connected to other external I2C BUS Devices, and including Serial Port Communication that can be used as either RS232 or RS485 as required.

As mentioned above, this Board includes basic and necessary resources and various types of supporting circuits on board; moreover, it is more convenient and flexible to add more external devices to be connected and used together. Developers can develop and apply both Board ET-DSP4 I2C and Board ET-DSP6 I2C for their own work conveniently. For example, Clock for showing time, Time-Switch for ON/OFF electrical appliances, Display Board for showing data, or various types of Counter device that are used as single board or multi-board in the format of network system of RS485 such as Display Board at parking area for showing and counting amount of car's entrance and exit.

### SPECIFICATIONS OF BOARD ET-DSP4 I2C MASTER

- Be used with +12VDC POWER SUPPLY via CONNECTOR WAFER 2PIN 2.5mm. to receive VOLTAGE and directly supply to 7-SEGMENT; and be supplied via CIRCUIT SWITCHING REGULATE 5V/1A No.LM2575 to be used as POWER SUPPLY for circuits internal board and circuits that are connected via I2C BUS.
- 4-Digit 7-SEGMENT Display is 2.3 inch high that uses CHIP PCF8575 to control and command the display via I2C BUS. Moreover, it can set 4 different types of Address Position of PCF8575 by JUMPER; so, it can connect 4 Boards ET-DSP4 I2C together at the same time.
- Circuit 3-CH INPUT DC as OPTO-Isolate can choose level of INPUT VOLTAGE either to be +5V, +12V or +24V independently; it uses CONNECTOR WAFER 3PIN 2.5mm.
- Circuit 3-CH INPUT DC as fixed +12V OPTO-Isolate uses CONNECTOR WAFER 3PIN 2.5mm.
- 1 of Circuit RELAY ON/OFF 1 CONTACT (0.5A/220VAC or 1A/24VDC) uses CONNECTOR WAFER 3PIN 2.5mm. (NO/COMMON/NC)
- 1-CH Infrared IR REMOTE Receiver
- 2 of CONNECTOR I2C BUS as WAFER 4PIN 2.5mm. and 2 of RJ11 6PIN FEMALE
- Circuit USB RS232 as Micro USB type for Debug and Upload Program via Boot Loader in case of developing program by Arduino
- 1-CH UART (Serial1) can choose Signal types as follows;
  - RS232 uses CONNECTOR WAFER 4PIN 2.5MM.
  - RS485 uses CONNECTOR WAFER 6 PIN 2.5MM.
- PCB Size: (Width x Length) 26 x 8 CM.

### SPECIFICATIONS OF BOARD ET-DSP6 I2C MASTER

- Be used with +12VDC POWER SUPPLY via CONNECTOR WAFER 2PIN 2.5mm. to receive VOLTAGE and directly supply to 7-SEGMENT; and be supplied via CIRCUIT SWITCHING REGULATE 5V/1A No.LM2575 to be used as POWER SUPPLY for circuits internal board and circuits that are connected via I2C BUS.
- 6-Digit 7-SEGMENT Display is 2.3 inch high that uses CHIP PCF8575 to control and command the display via I2C BUS. Moreover, it can set 2 different types of Address Position of PCF8575 by JUMPER; so, it can connect 2 Boards ET-DSP6 I2C together at the same time.
- Circuit 3-CH INPUT DC as OPTO-Isolate can choose level of INPUT VOLTAGE either to be +5V, +12V or +24V independently; it uses CONNECTOR WAFER 3PIN 2.5mm.
- Circuit 3-CH INPUT DC as fixed +12V OPTO-Isolate uses CONNECTOR WAFER 3PIN 2.5mm.
- 1 of Circuit RELAY ON/OFF 1 CONTACT (0.5A/220VAC or 1A/24VDC) uses CONNECTOR WAFER 3PIN 2.5mm. (NO/COMMON/NC)
- 1-CH Infrared IR REMOTE Receiver
- 2 of CONNECTOR I2C BUS as WAFER 4PIN 2.5mm. and 2 of RJ11 6PIN FEMALE
- Circuit USB RS232 as Micro USB type for Debug and Upload Program via Boot Loader in case of developing program by Arduino
- 1-CH UART (Serial1) can choose Signal types as followed;
  - RS232 uses CONNECTOR WAFER 4PIN 2.5MM.
  - RS485 uses CONNECTOR WAFER 6PIN 2.5MM.
- PCB Size: (Width x Length) 36 x 8 CM.

## ET-DSP4 I2C / ET-DSP6 I2C

### HOW TO SET I2C ADDRESS POSITION OF PCF8575 OF BOARD ET-DSP4 I2C

Board ET-DSP4 I2C has 4-Digit 7-Segment that uses 2 sets of CHIP No.PCF8575 to control the display; a set of CHIP PCF8575 controls the 2-Digit 7-Segment. This Board ET-DSP4 I2C can be connected together more than 1 board via I2C BUS to extend more amount of digit. There is JUMPER to setup different Address Positions of PCF8575, so the connective boards can show more than 4 digits, without any problem. For Board ET-DSP4 I2C, there are 4 types of setting JUMPER of PCF8575; so, it can connect at a maximum of 4 boards as follows;

A2	A1	2-Digit on left side	2-Digit on right side
LOW	LOW	0100001,0	0100000,0
LOW	HIGH	0100011,0	0100010,0
HIGH	LOW	0100101,0	0100100,0
HIGH	HIGH	0100111,0	0100110,0

Table shows Address Positions of PCF8575 of Board ET-DSP4 I2C.

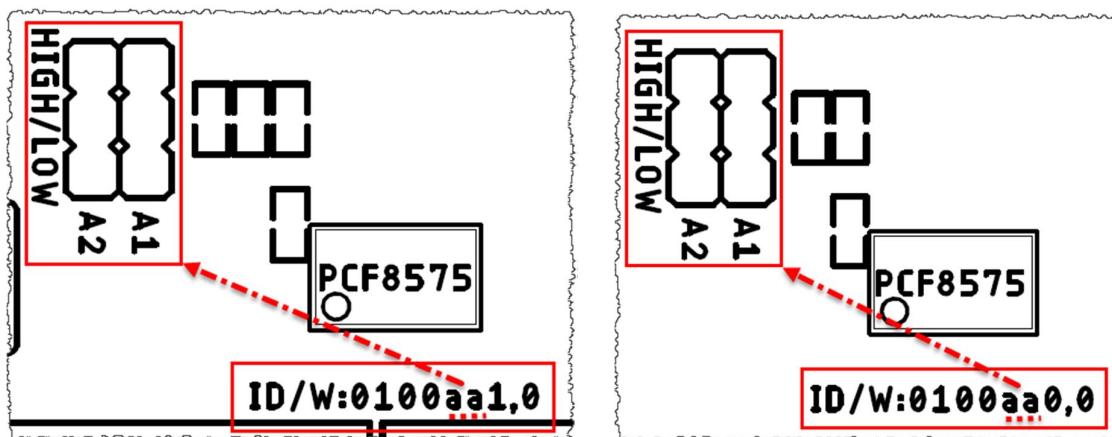


Figure shows positions of setting Address Position of PCF8575 of Board ET-DSP4 I2C.

## ET-DSP4 I2C / ET-DSP6 I2C

### HOW TO SET I2C ADDRESS POSITION OF PCF8575 OF BOARD ET-DSP6 I2C

Board ET-DSP6 I2C has 6-Digit 7-Segment that uses 3 of CHiPs No.PCF8575 to control the display; a set of CHiP PCF8575 controls the 2-Digit 7-Segment. This Board ET-DSP6 I2C can be connected together more than 1 board to extend more amount of digit; there is JUMPER to setup different Address Positions of PCF8575, so it can connect boards together, without any problem. For Board ET-DSP6 I2C, there are 2 types of setting JUMPER of PCF8575; so, it can connect at a maximum of 2 boards as follows;

A2	2-Digit on left side	2-Digit in the middle	2-Digit on right side
LOW	0100010,0	0100001,0	0100000,0
HIGH	0100110,0	0100101,0	0100100,0

Table shows Address Positions of PCF8575 of Board ET-DSP6 I2C.

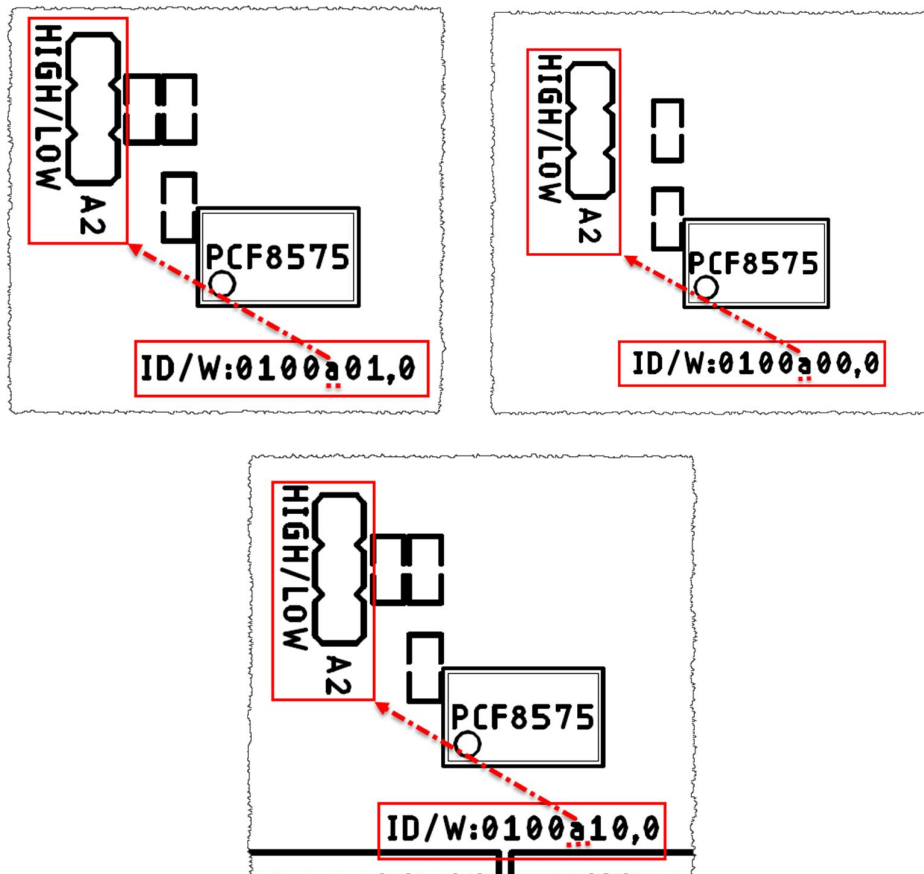
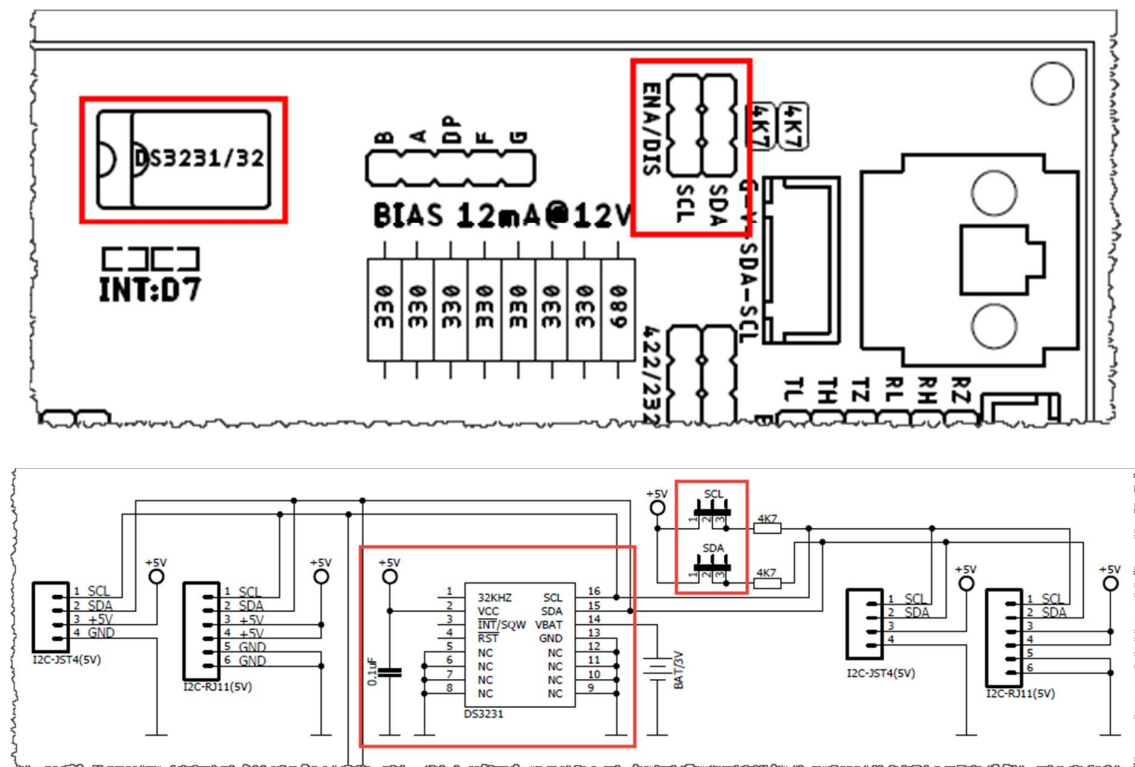


Figure shows position of setting Address Position of PCF8575 of Board ET-DSP6 I2C.

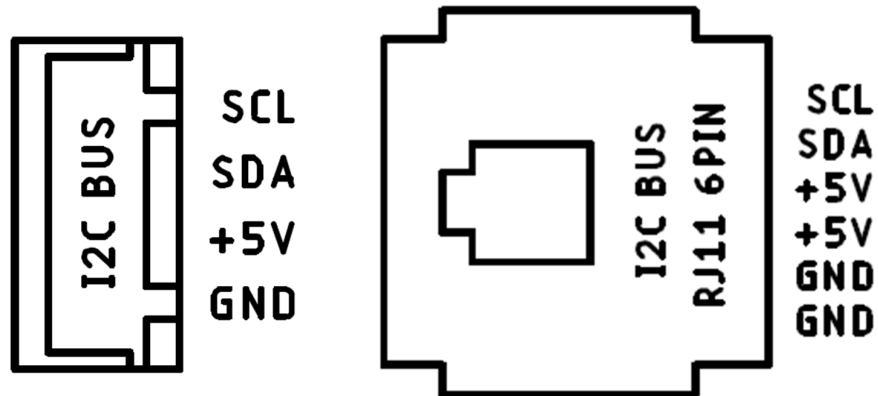
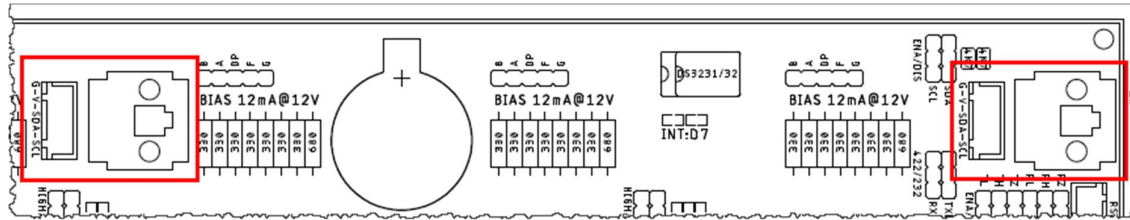
## HOW TO USE I2C BUS

I2C Communication Port of both Board ET-DSP4 I2C and ET-DSP6 I2C consists of CHIP PCF8575 to control the display of 7-Segment, it is the standard device of all boards; moreover, there is CHIP to support RTC No.DS3231 or DS3232 that is RTC: Real Time Clock, provided with CONNECTOR I2C Bus to extend and connect to external I2C Bus Devices. So, there is JUMPER on Board to choose Pull-Up between Signal SCL and Signal SDA of I2C Bus independently. Normally, it should set Jumper Pull-Up as Enable (ENA), especially Master Board and it should set JUMPER Pull-Up as Disable (DIS) for Slave Board as shown below;

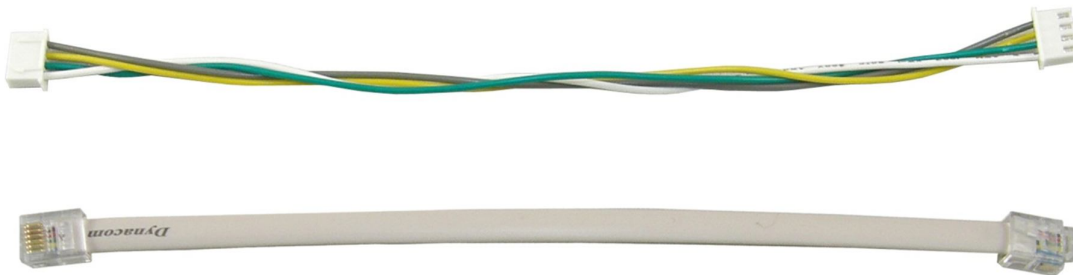


As mentioned above, there is I2C Bus internal board; moreover, it also provides CONNECTOR I2C BUS on both Board ET-DSP4 I2C and ET-DSP6 I2C to additionally connect to external Board Input/Output or Sensors such as ET-I2C DCIN8 or ET-I2C REL8. There are 2 sets of Connector WAFER 4PIN 2.5 mm. and 2 sets of RJ11 6PIN FEMALE internal Board that are parallel connected, it can connect together with other boards conveniently and easily.

## ET-DSP4 I2C / ET-DSP6 I2C



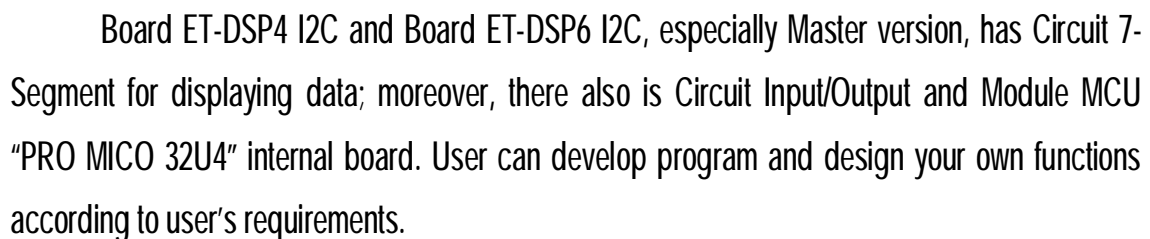
It shows feature of CONNECTOR I2C BUS.



It shows an example of Cable I2C BUS to connect and extend I2C BUS.



## HOW TO USE EXTENDED CIRCUIT OF MODULE MCU "PRO MICRO 32U4"





### DC Opto Isolate Input

Board ET-DSP4 I2C Master and Board ET-DSP6 I2C Master have 6 sets of Circuit for receiving DC INPUT OPTO-ISOLATE; in this case, it is divided into 3 channels for 3 variable voltages in a range of 5V, 12V and 24V; and another 3 channels for fixed 12V. Each set of circuit runs independently and user can choose and setup any preferable function by JUMPER.

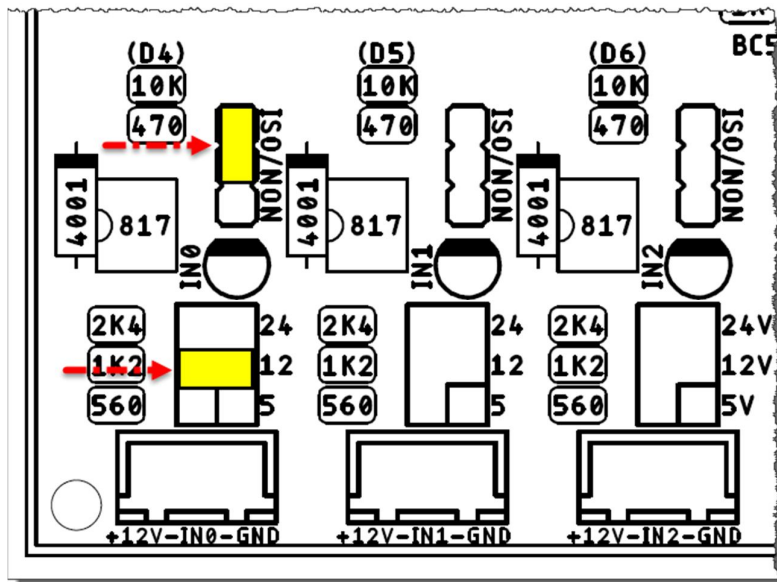
### Circuit DC Input for using with 3 Variable Voltages: 5V/12V/24V

- Can choose 3 Variable Voltages in a range of 5V or 12V or 24V
- Each channel can be used either as Isolate(ISO) or Non Isolate(NON) as preferred. If it is used as Isolate(ISO), user has to provide external voltage for the circuit by self. Or, if it is used as Non Isolate(NON), it is only used with 12V, without providing any external voltage for the INPUT of the Circuit. In this case, user can supply 12V from internal board and wait for a while until the supplied voltage from internal board passed the Contact or Junction of semiconductor and finally, return to the circuit of board by its own.

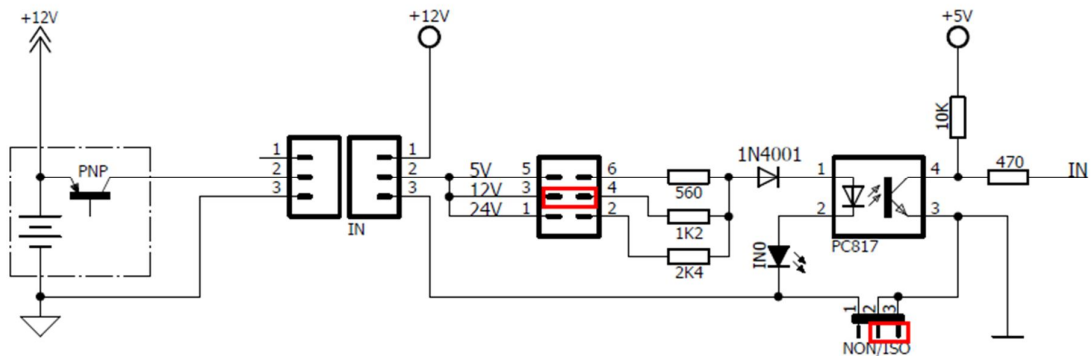
### Circuit DC Input for using with fixed 12V

For Circuit DC INPUT as fixed 12V, there are 3 sets internal board and each set has its own JUMPER to choose and setup function of each channel either as Isolate(ISO) or Non Isolate(NON) as preferred. If it is used as Isolate(ISO), user has to provide external voltage for the circuit by self. Or, if it is used as Non Isolate(NON), it is only used with 12V, without providing any external voltage for the INPUT of the Circuit. In this case, user can supply 12V from internal board and wait for a while until the supplied voltage from internal board passed the Contact or Junction of semiconductor and finally, return to the circuit of board by its own.

## ET-DSP4 I2C / ET-DSP6 I2C



It shows how to setup JUMPER as 12V Isolate.



The example shows how to connect Input PNP Sensor as 12V Isolate.

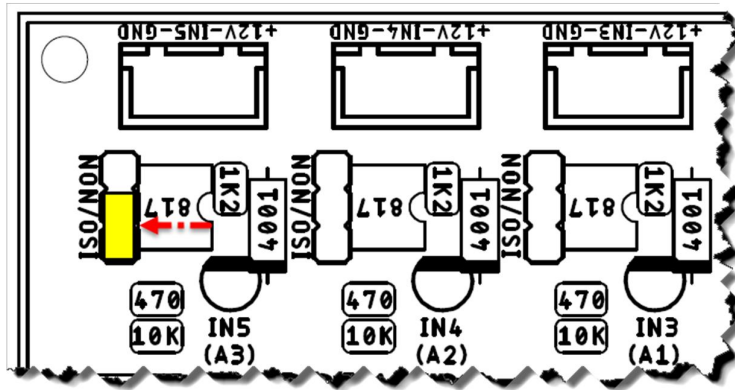
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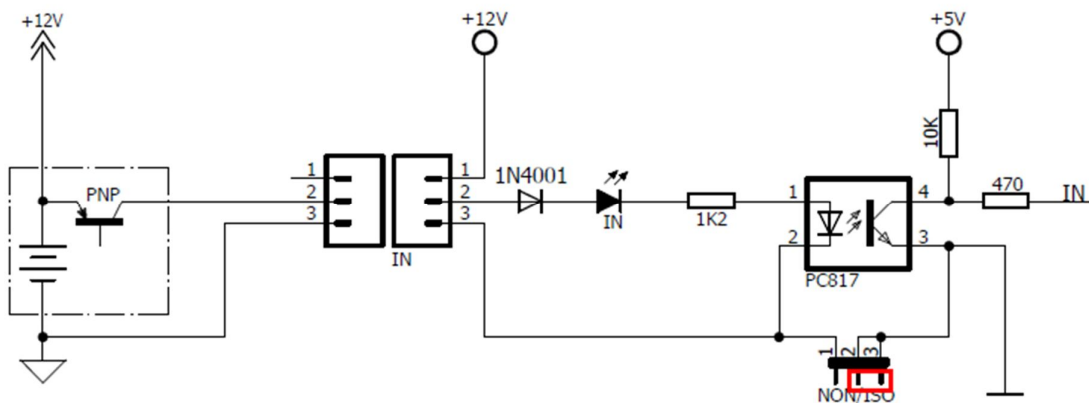
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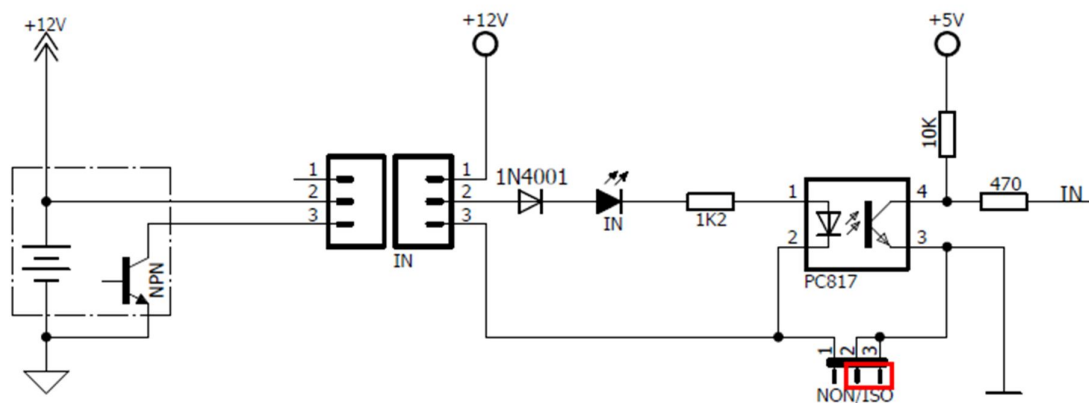
## HOW TO CONNECT INPUT AS ISOLATE



Example shows how to setup JUMPER as Isolate.



Example shows how to connect Input PNP Sensor as Isolate.

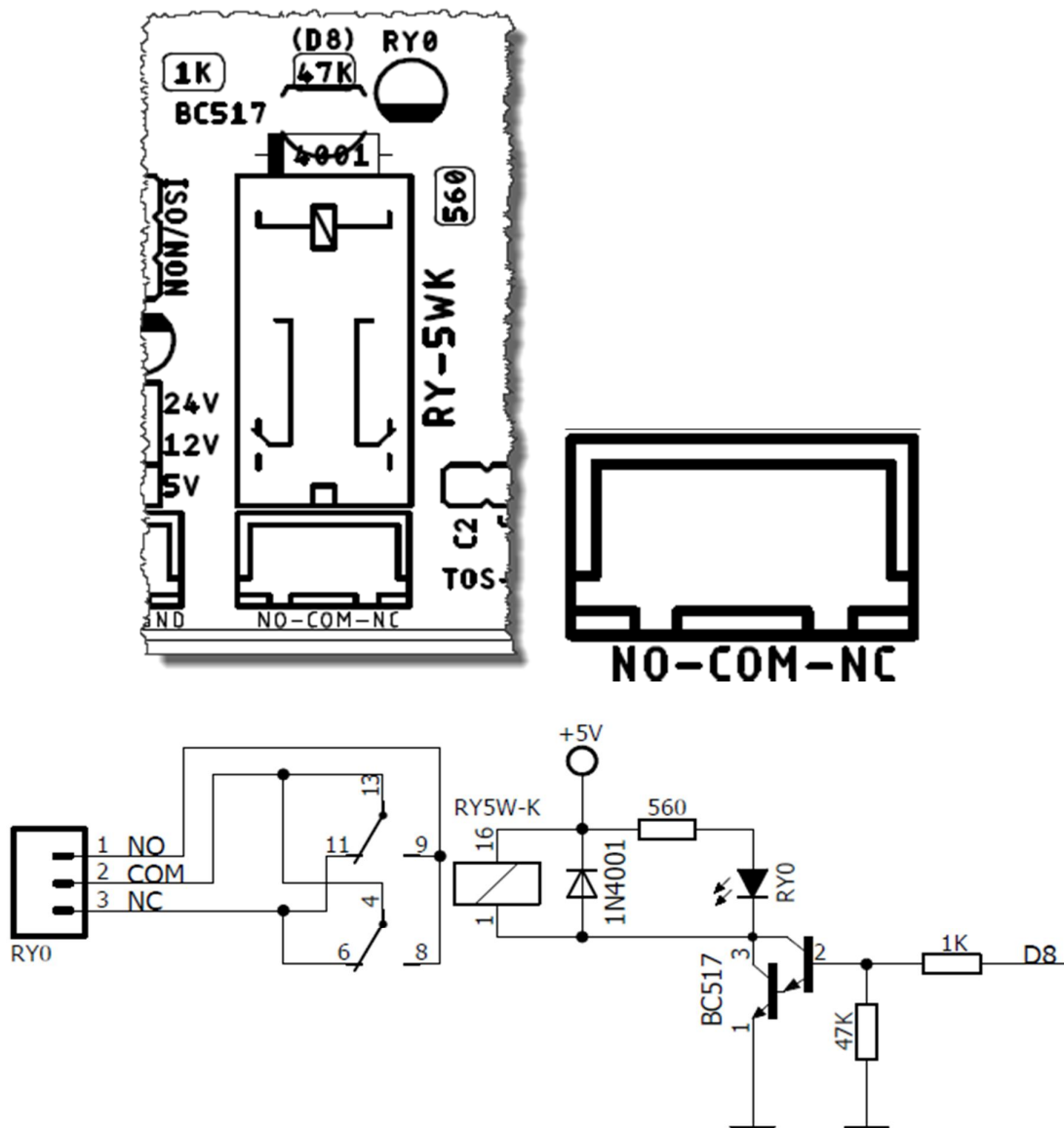


Example shows how to connect Input NPN Sensor as Isolate.



### RELAY

There is RELAY 5V/1Contact on both Board ET-DSP4 I2C and Board ET-DSP6 I2C and there is LED internal Circuit to display ON/OFF state of Board. This RELAY runs when received the Logic "1" and it stops running when received the Logic "0". If Program is developed by Arduino, it uses the signal D8 as Pin Output to control ON/OFF RELAY; moreover, there also is LED to show the running state of RELAY.



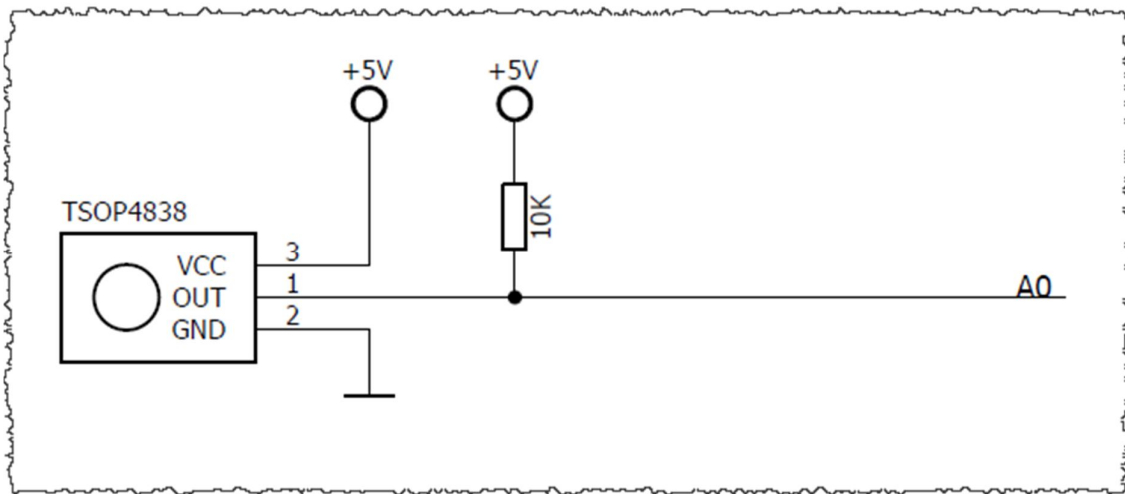
It shows positions of Connector Contact RELAY and Circuit of RELAY.



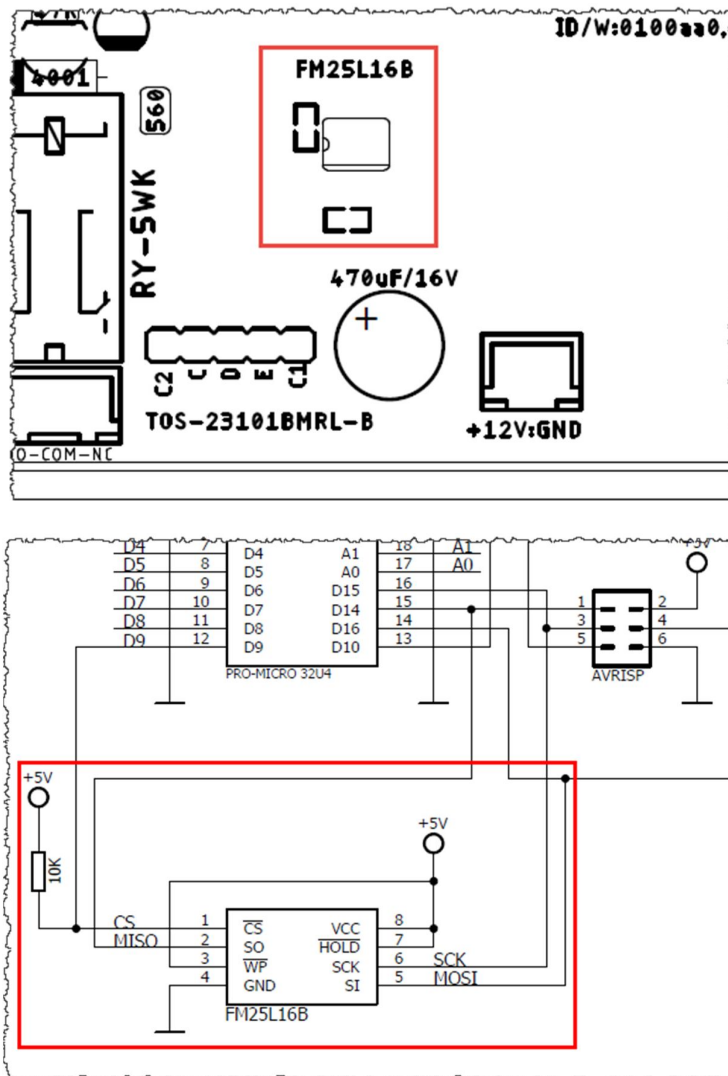


### CIRCUIT IR REMOTE RECEIVER

Board ET-DSP4 I2C/ET-DSP6 I2C has 1 Circuit IR Remote Receiver on board that can be applied to various types of IR Remote such as ET-IR REMOTE KEY to setup preferred values or functions according to user's requirements.

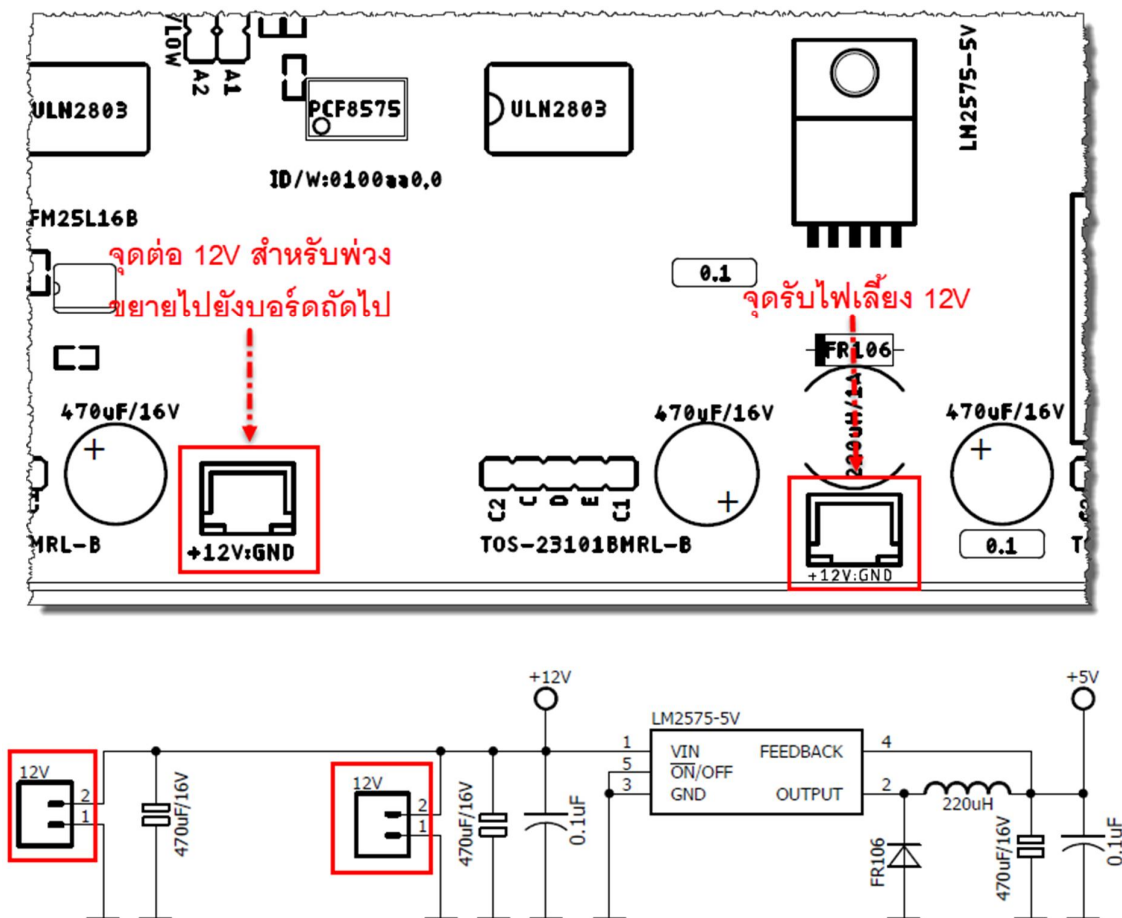


It shows Circuit IR Remote Receiver and IR Remote model "ET-IR REMOTE KEY".



## POWER SUPPLY

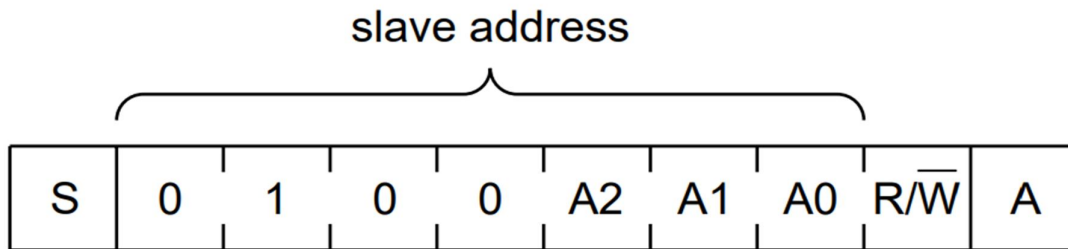
Board ET-DSP4 I2C and Board ET-DSP6 I2C can be used with +12V POWER SUPPLY that can be directly supplied to the Circuit to drive 7-Segment; and it is connected and supplied to Circuit Switching Regulate +5V/1A that will be used as POWER SUPPLY of MCU and Circuits internal board. So, the Power Supply of board must be +12VDC only. If the POWER SUPPLY is higher than +12V, it makes the LED 7-Segment damaged; on the other hand, if the POWER SUPPLY is lower than +12V, the brightness of LED 7-Segment is unstable. There are 2 sets of Connector 2Pin on board that are positions for receiving the voltage; the first position receives POWER SUPPLY for board and the second position is connected together with +12V from board to another one board if use requires connecting more than 1 board as shown below;



It shows position of CONNECTOR for connecting to POWER SUPPLY for Board.

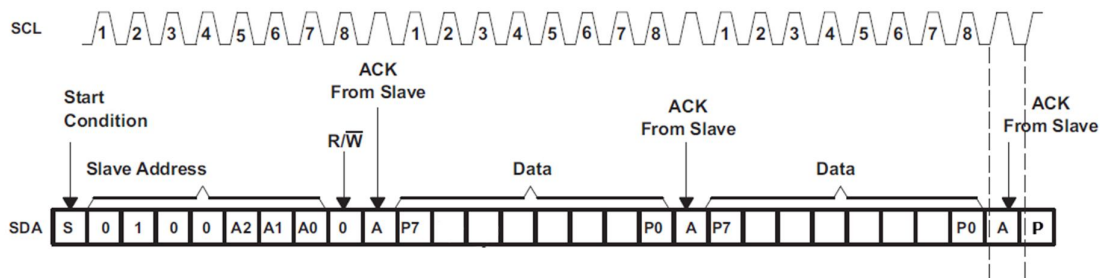
### HOW TO CONTROL DISPLAY OF BOARD ET-DSP4 I2C/ET-DSP6 I2C

Board ET-DSP4 I2C and Board ET-DSP6 I2C uses CHIP PCF8575 to control and command the display of 7-SEGMENT; it receives Signal IC BUS in the format of Slave Device and the Control Byte Code for communication is shown in the picture below;



**It shows Control Byte Code of PCF8575 (A2,A1,A0 is set by JUMPER on board).**

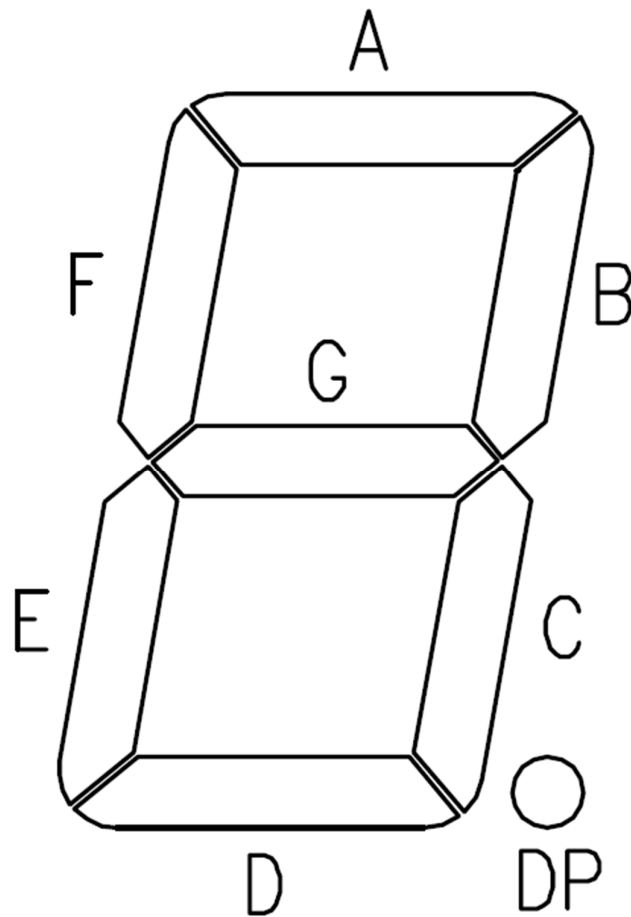
It uses PCF8575 in Output Mode to control and command the display of PCF8575. The communication's format starts when Master sends Start Condition and follows by 1 Byte of Control Byte Code of PCF8575 for writing data; next, when PCF8575 received this Control Byte Code completely, it answers the command with Acknowledge Bit; and then, Master can send the next data to control the display of the first digit and the second digit of 7-SEGMENT, respectively. Every Byte Data that is sent out by Master, PCF8575 always answers the command with Acknowledge Bit. When Master sends the Start Condition, followed by the Control Byte Code and 2 Byte Data, respectively and completely, it always sends Stop Condition to end the communication as shown in the picture below;



**It shows how to command the display of 7-SEGMENT of PCF8575 (A2,A1,A0 is set by JUMPER on board).**

### BIT DATA CONTROL FOR DISPLAY OF 7-SEGMENT

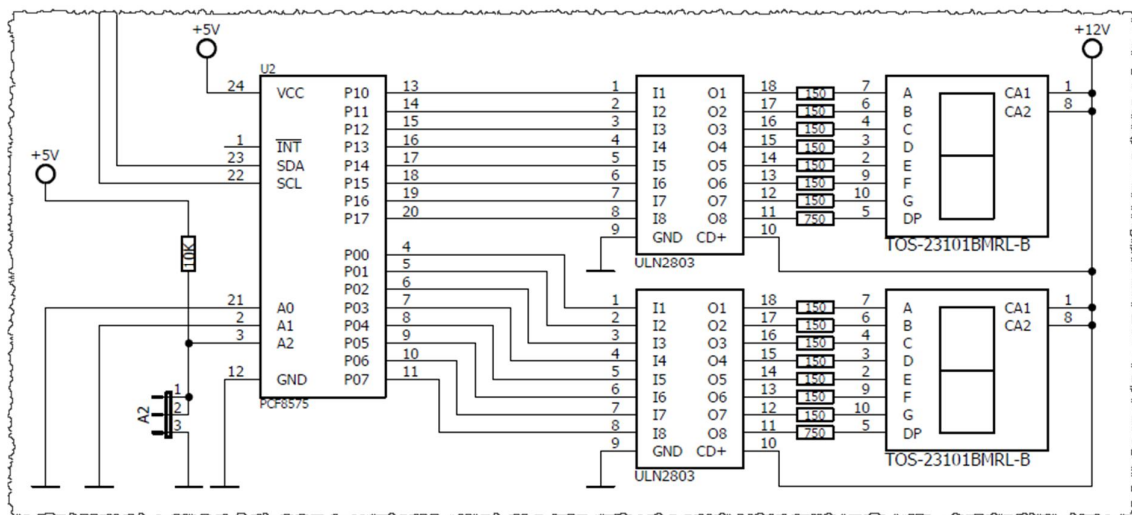
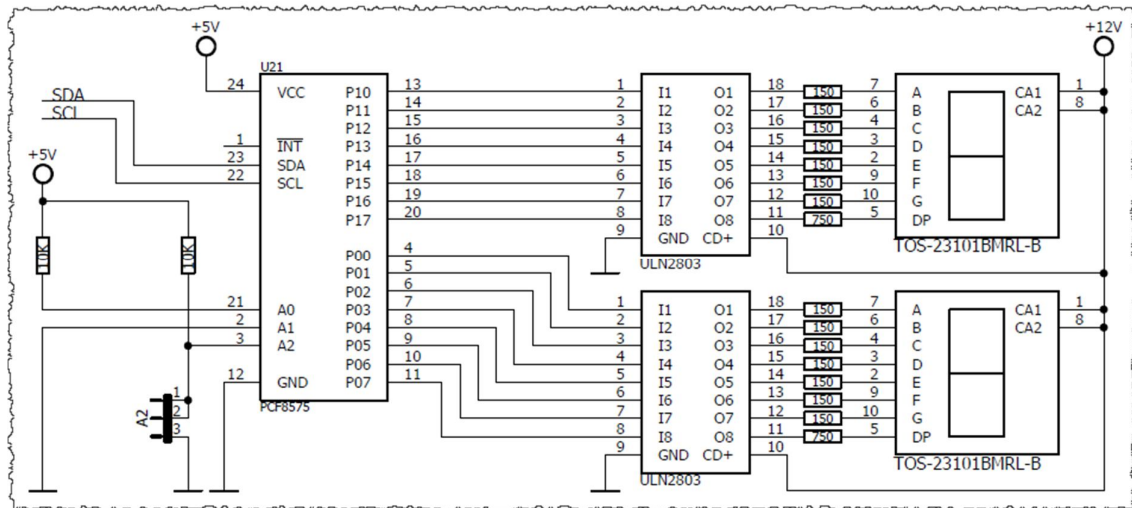
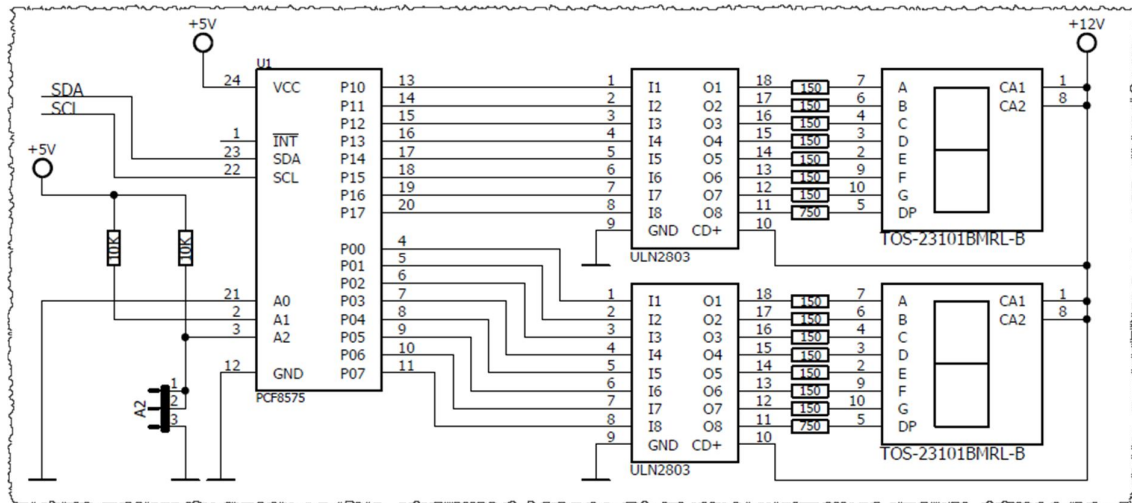
It uses 1 Byte Data to control each digit of display of 7-SEGMENT; the HIGH Data made the LED Display lit up; but, the LOW Data made the LED Display turned off. It uses BIT D0-D6 to control the display of SEGMENT A-G in alphabetical order; and it uses BIT D7 to control the display of SEGMENT-DP as follows;



7 SEGMENT	DP	G	F	E	D	C	B	A
Data Byte	D7	D6	D5	D4	D3	D2	D1	D0

Table shows position of Bit Data to control the display of 7-SEGMENT.

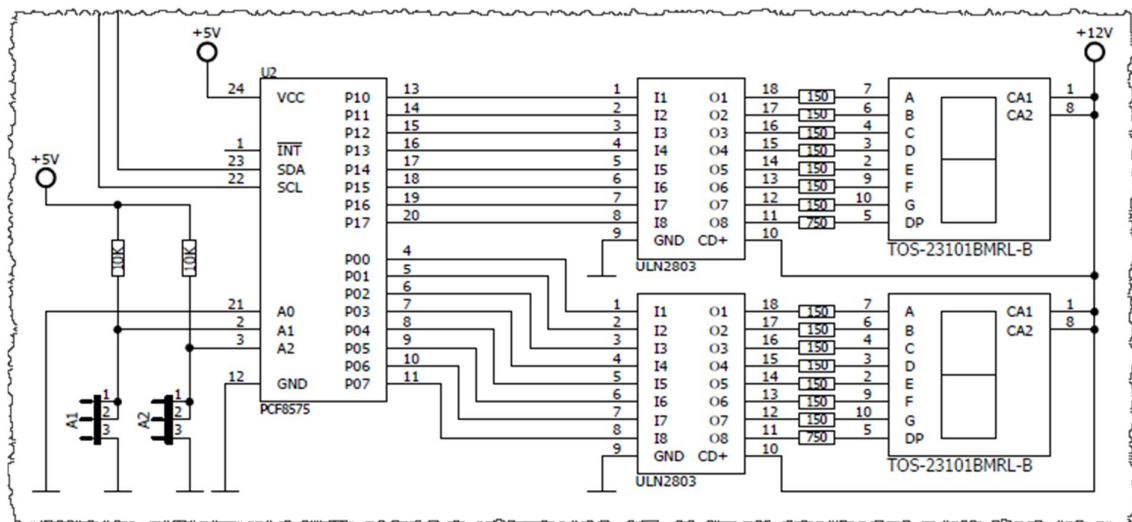
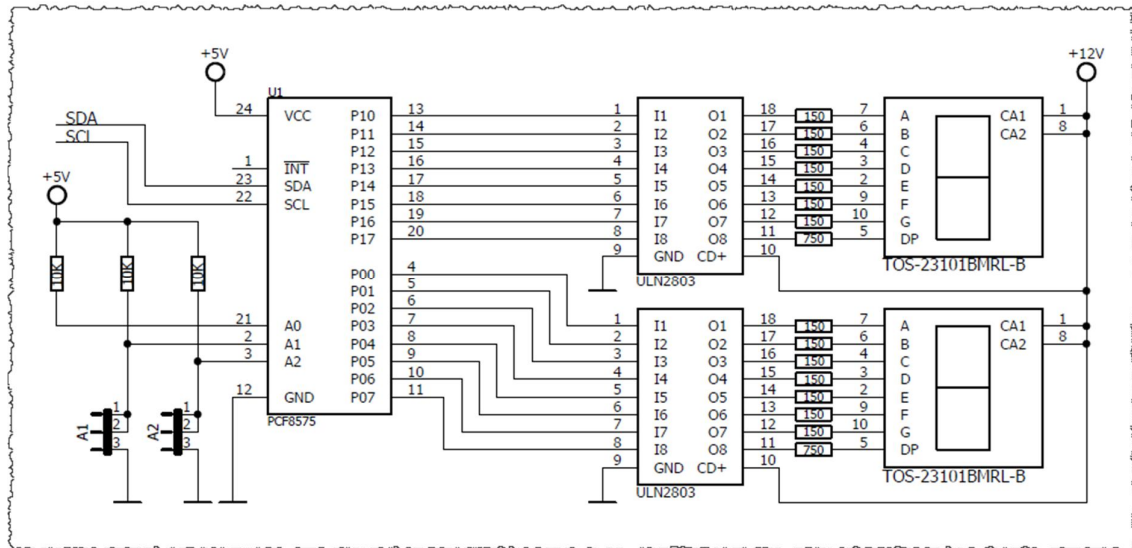
## ET-DSP4 I2C / ET-DSP6 I2C



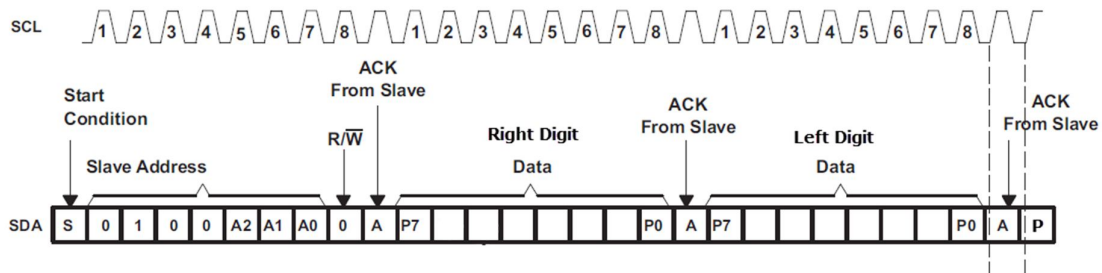
It shows the Circuit in the part of display of ET-DSP6 I2C.



## ET-DSP4 I2C / ET-DSP6 I2C



It shows the Circuit in the part of display of ET-DSP4 I2C.



It shows how to command the display of 7-SEGMENT for Board ET-DSP4 I2C/ ET-DSP6 I2C.

### Example of Writing Program ET-DSP4 I2C commanded by Arduino

```
#include <Wire.h>                                // I2C Bus

void setup()
{
    Wire.begin();                                // Initial I2C Bus
}

void loop()
{
    Wire.beginTransmission(0x21);                // Begin Write PCF8575 = 0100,001+(0:W)
    Wire.write(0x3F);                            // Right Digit Display "0" : 00111111
    Wire.write(0x06);                            // Left Digit Display "1" : 00000110
    Wire.endTransmission();                      // End I2C

    Wire.beginTransmission(0x20);                // Begin Write PCF8575 = 0100,000+(0:W)
    Wire.write(0x5B);                            // Right Digit Display "2" : 01011011
    Wire.write(0x4F);                            // Left Digit Display "3" : 01001111
    Wire.endTransmission();                      // End I2C

    While(1);
}
```

**It shows an example program that commands the Display of ET-DSP4 I2C.**

### Example of Writing Program ET-DSP6 I2C commanded by Arduino

```
#include <Wire.h>                                // I2C Bus

void setup()
{
    Wire.begin();                                // Initial I2C Bus
}

void loop()
{
    Wire.beginTransmission(0x22);                // Begin Write PCF8575 = 0100,010+(0:W)
    Wire.write(0x3F);                            // Right Digit Display "0" : 00111111
    Wire.write(0x06);                            // Left Digit Display "1" : 00000110
    Wire.endTransmission();                      // End I2C

    Wire.beginTransmission(0x21);                // Begin Write PCF8575 = 0100,001+(0:W)
    Wire.write(0x5B);                            // Right Digit Display "2" : 01011011
    Wire.write(0x4F);                            // Left Digit Display "3" : 01001111
    Wire.endTransmission();                      // End I2C

    Wire.beginTransmission(0x20);                // Begin Write PCF8575 = 0100,000+(0:W)
    Wire.write(0x66);                            // Right Digit Display "4" : 01100110
    Wire.write(0x6D);                            // Left Digit Display "5" : 01101101
    Wire.endTransmission();                      // End I2C

    While(1);
}
```

**It shows an example program that commands the Display of ET-DSP6 I2C.**