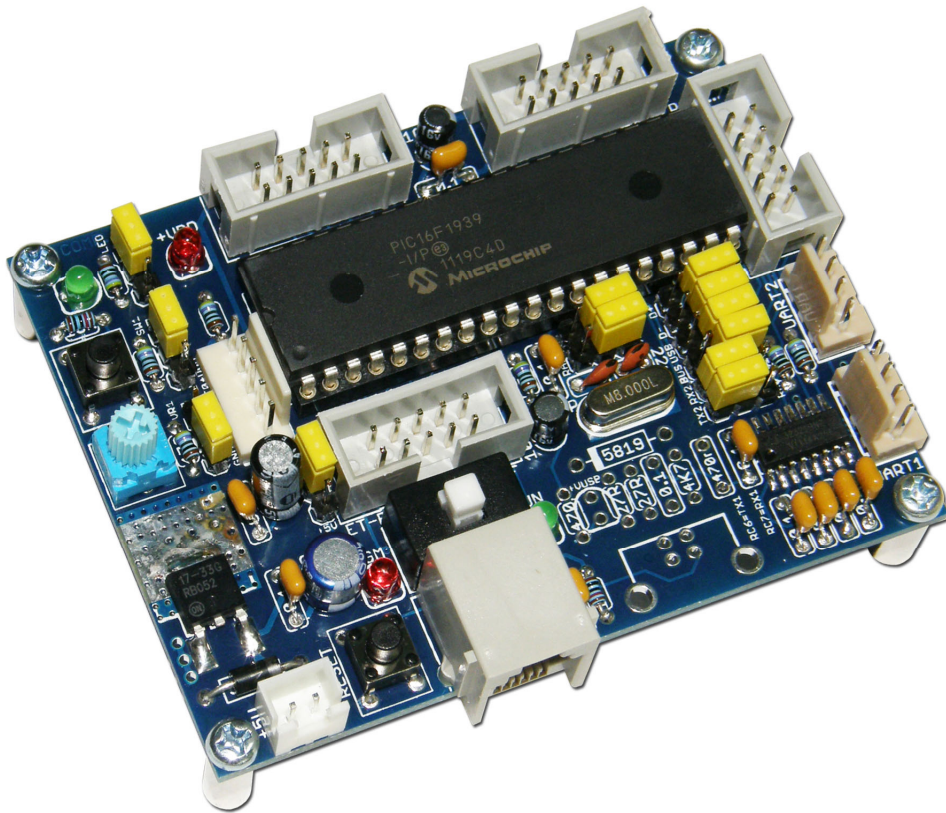


ET-BASE PIC40/1939(ICSP)



ET-BASE PIC40/1939(ICSP) is Board Microcontroller in the series of PIC that is designed to use and install Chip Microcontroller 40PIN(40PDIP) No.PIC16F1939. It is compatible with Power Supply 3.3V or 5V; so, user should choose the most suitable type according to the objectives.

Structure of Board **ET-BASE PIC40/1939(ICSP)** is designed to be mini board that is suitable for various applications and basic Training Kit. Internal board provides circuits that are necessary and convenient to use and develop program. It is flexible because it can adjust Signal I/O for various applications according to preferable objectives suitably.

Moreover, it adds more devices for initially testing Input/Output internal board, so user can use these devices to be tools for testing the operation while developing program. For example, it uses Adjustable VR to test the operation of ADC; or it uses Push-Button Switch to test the operation of Input Logic; or it uses LED to test the operation of Output Logic.

Specifications of Board

- Use MCU No.PIC16F1939(40PDIP) on board; run by the maximum frequency of 32MHz
 - 16KWord Flash/ 256Byte EEPROM/ 1024Byte SRAM
 - 36 GPIO
 - 14 Channel 10Bit ADC
 - 16 Channel Cap Sense
 - 2 Comparator
 - 4 Channel 8 Bit Timer/ 1 Channel 16 Bit Timer
 - 1 Channel EUART
 - 1 Channel I2C/ 1 Channel SPI
 - 3 Channel ECCP
 - 2 Channel CCP
- Has Crystal 8.00MHz (Run 32MHz + PLL) with Jumper to connect/disconnect signal as required
- Has 2-Channel Circuit Line Driver for UART RS232 Serial Port Communication; it uses Connector UART CPA-4Pin according to ETT Standard
 - 1-Channel for Hardware UART1, it uses Pin RC6(TX1) and RC7(RX1) according to PIC Standard
 - 1-Channel for Software UART, it uses Pin RC0(TX2) and RC1(RX2). There is Jumper to choose the operation modes either to be UART2 or GPIO(RC0/RC1) as required.
- Has Connector ICSP RJ11 according to ICD2 Standard; it is used with Programmer and Debugger that supports the operation according to the ICSP Standard of MICROCHIP such as ICD2/ICD3 or PICKit2/PICKit3.
- Has Switch to alternate signals between Program/Debug(PGM) and Normal Run (RUN); moreover, there is LED to display the operation mode of board.
- Has 4 of Header I/O 2x5 and 1 of Header CPA-5Pin
- Has Switch RESET to reset the operation of MCU internal board.
- Has Adjustable VR1 to test the operation of ADC Input, it uses RA0 with Jumper to connect/disconnect signal.
- Has SW1 to test the operation of Digital Input; it uses RA1 with Jumper to connect/disconnect signal.
- Has LED to test the operation of Digital Output; it uses RA2 with Jumper to connect/disconnect signal.
- Has Power +5VDC Input with Regulate 3.3V/1A and LED to display the operating status of Power Supply; moreover, there is Jumper to choose source of Power Supply for MCU either +5VDC or 3.3VDC
- Be Mini PCB Size: 8 x 6 cm.

Structure of Board ET-BASE PIC40/1939(ICSP)

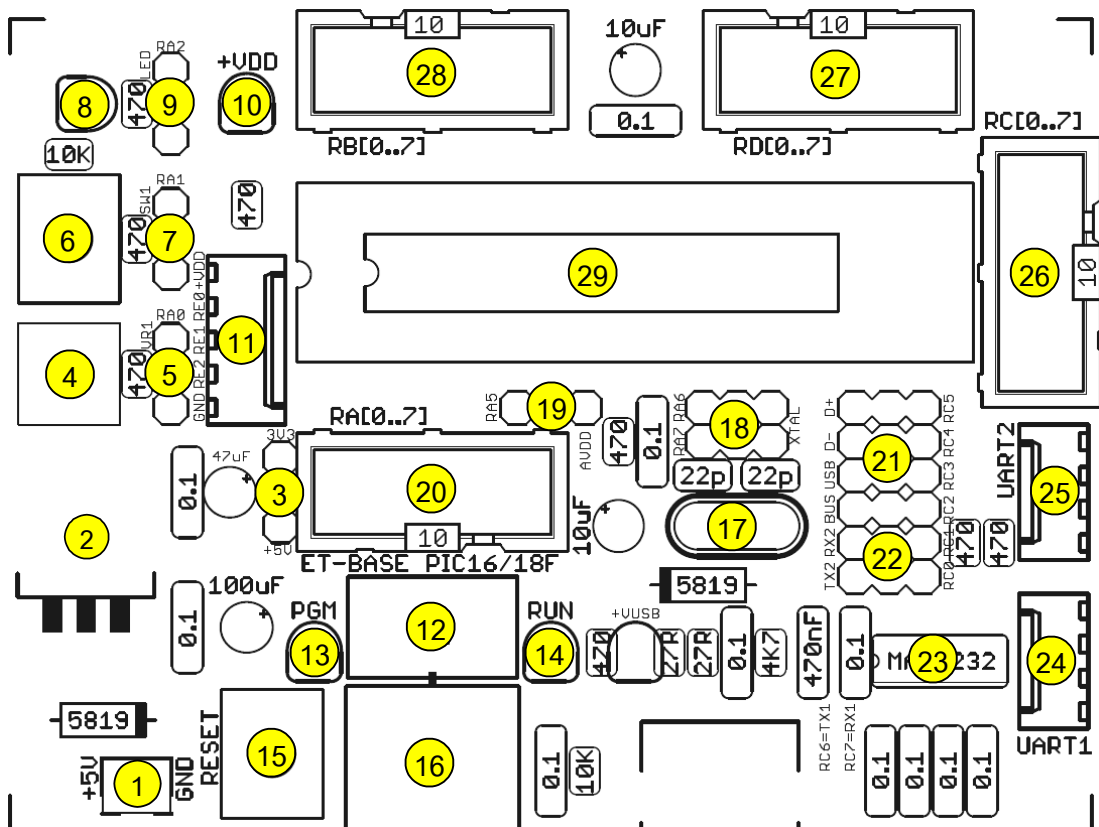
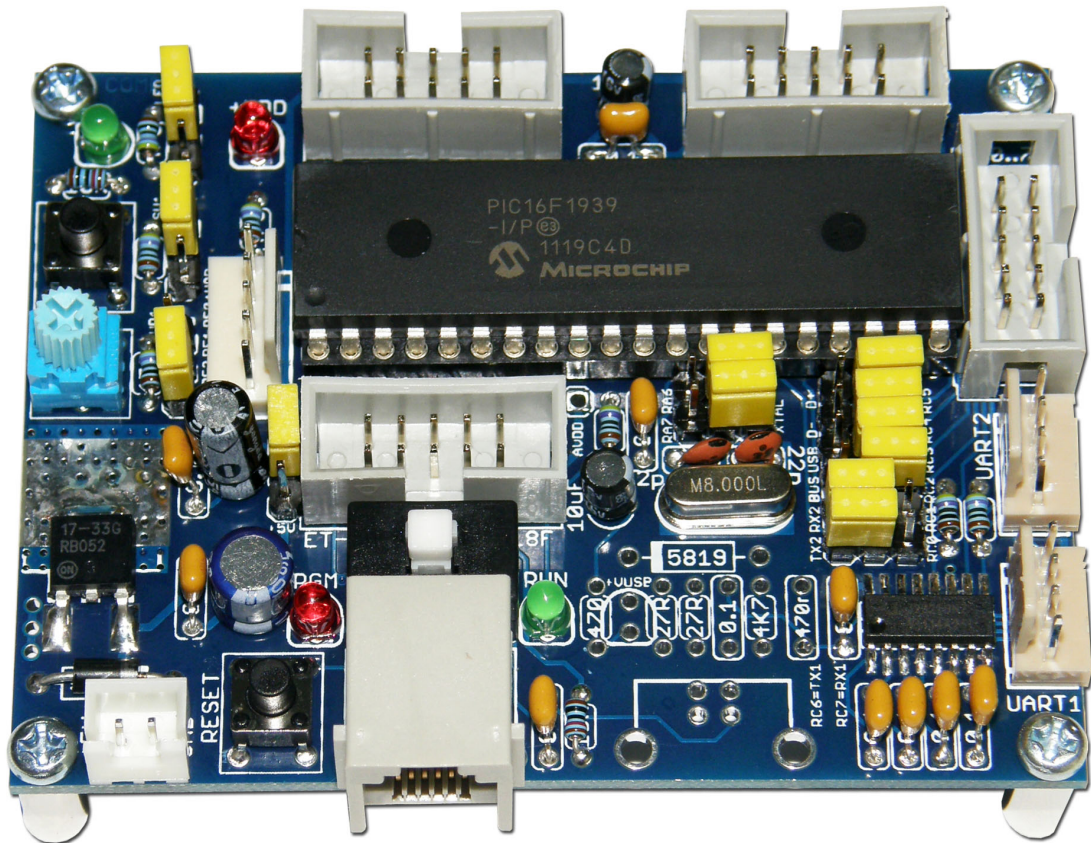


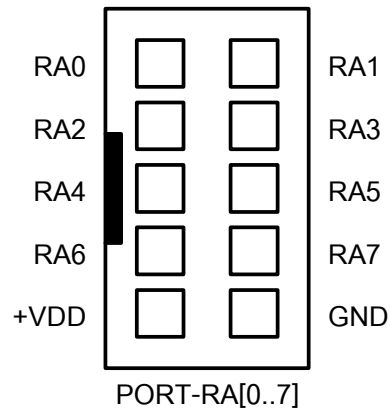
Figure shows the structure of Board ET-BASE PIC40/1939(ICSP).

- **No.1:** It is Connector +5VDC Power Supply of board.
- **No.2:** It is IC Regulate 3.3VDC/1A.
- **No.3:** It is Jumper to choose either 3.3V or 5V that is voltage level of Power Supply for MCU (+VDD).
- **No.4:** It is Adjustable VR(VR1) to test the operation of Input Analog(ADC).
- **No.5:** It is Jumper to connect/disconnect Signal RA0 and adjusted voltage from VR1.
- **No.6:** It is Push-Button Switch(SW1) to test the operation of Digital Input.
- **No.7:** It is Jumper to connect/disconnect Signal RA1 and Digital Input from SW1.
- **No.8:** It is LED to test the operation of Digital Output.
- **No.9:** It is Jumper to connect/disconnect Signal RA2 and Digital Output for LED.
- **No.10:** It is LED to display the status of Power Supply +VDD.
- **No.11:** It is Connector RE[0...2] that is used in case of installing MCU 40Pin only.
- **No.12:** It is Switch to choose the operation modes either Run(RUN) or Program (PGM).
- **No.13:** It is red LED to display status of PGM when board is running in Program Mode.
- **No.14:** It is green LED to display status of RUN when board is running in RUN Mode.
- **No.15:** It is Switch RESET to reset the operation of MCU when it is running in RUN Mode.
- **No.16:** It is Connector ICSP to interface with Programmer and Debugger according to the ICD2 Standard.
- **No.17:** It is Crystal 8.00MHz.
- **No.18:** It is Jumper to choose Pin RA6,RA7 of MCU either to interface to be GPIO at Connector RA[0...7] or Circuit Crystal.
- **No.19:** It is Jumper to choose function of Pin7 of MCU 28Pin either to be Signal RA5 of MCU by interfacing to be GPIO at Connector RA [0...7] or to be Pin +AVDD. In case of PIC16F1939, it always sets Jumper at the position of RA5.
- **No.20:** It is Connector IDE10Pin of RA[0...7].
- **No.21:** It is Jumper to choose Pin RC2,RC3,RC4,RC5 of MCU either to interface to be GPIO at Connector RC[0...7] or to interfaces with USB Bus(VUSB,VBUS,D-,D+).

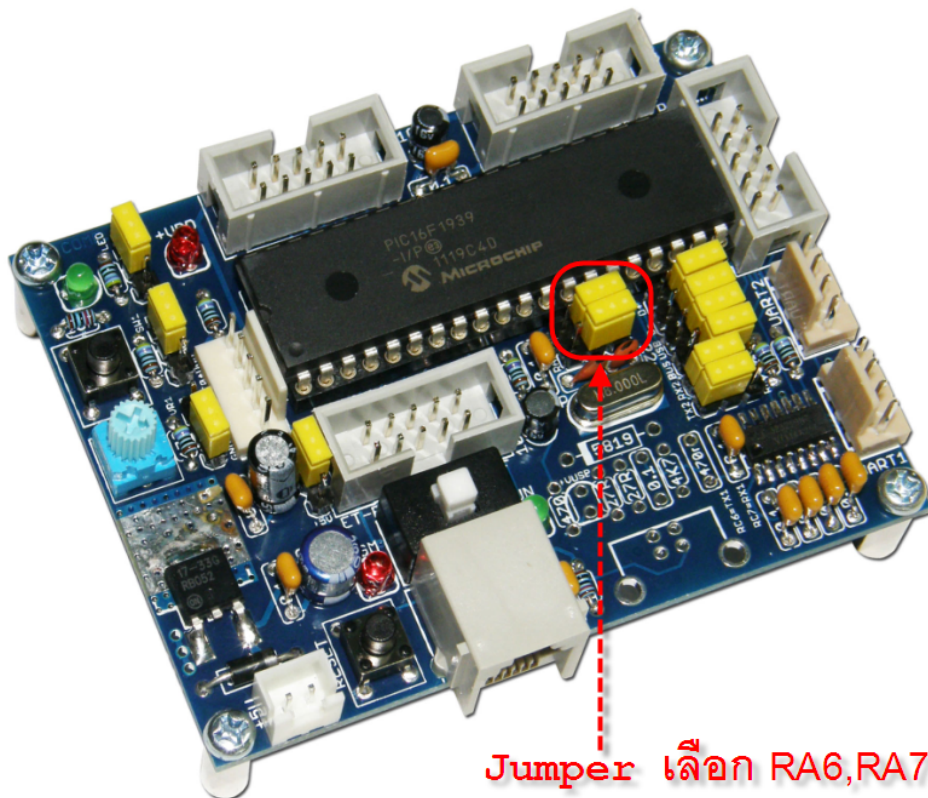
- **No.22:** It is Jumper to choose to connect Pin RC0,RC1 of MCU either to interface to be GPIO at Connector RC[0...7] or to be TX2, RX2 of UART2.
- **No.23:** It is IC Line Driver of RS232(MAX3232/ICL3232) to convert Signal Level between Signal of UART Logic and standard Signal RS232 Level of UART1, UART2.
- **No.24:** It is Connector UART1 that is Signal RS232; it supports Hardware UART that uses Pin of RC6(TX1) and RC7(RX1) to be signal for connection.
- **No.25:** It is Connector UART2 that is Signal RS232; it supports Software UART that uses Pin of RC0(TX2),RC1(RX2) to be signal for connection.
- **No.26:** It is Connector IDE10Pin of RC[0...7].
- **No.27:** It is Connector IDE10Pin of RD[0...7].
- **No.28:** It is Connector IDE10Pin of RB[0...7].
- **No.29:** It is MCU No.PIC16F1939 on board.

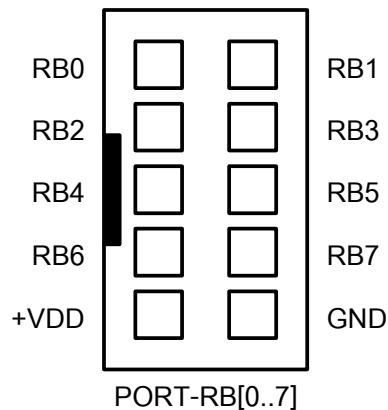
CONNECTORS

PORT RA[0..7]

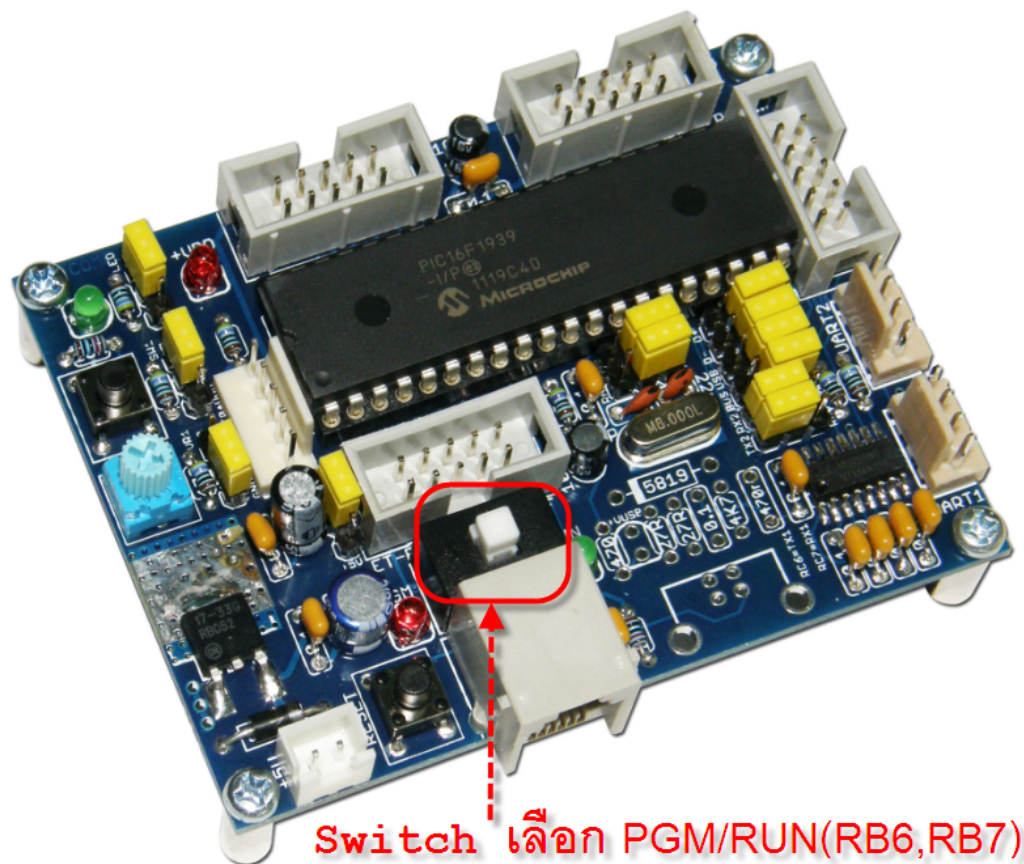


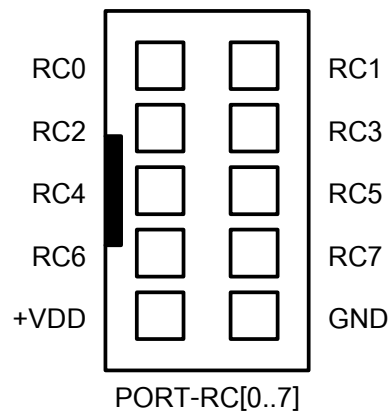
PORT-RA[0..7]: It is Signal from RA0...RA7 of MCU. Signal RA0...RA5 is directly interfaced from Pin of MCU. Signal RA6 and RA7 has Jumper to connect/disconnect signal; in this case, user can choose either to uses Signal RA6,RA7 to be GPIO or to interface with Circuit Crystal Generator. In case of using PIC16F1939, user can use Signal Clock from internal RC and user can use Signal RA6,RA7 to be GPIO as normal.



PORT RB[0..7]

PORT-RB[0..7]: It is Signal from RB0...RB7 of MCU. Signal RB0...RB5 is directly interfaced from Pin of MCU. Signal RB6 and RB7 has Switch to connect/disconnect signal; in this case, user can choose either to use Signal RB6,RB7 to be GPIO or to connect with ICSP Programmer through Connector ICSP(RJ11). If it shifts the Switch to position of RUN, it interfaces Pin RB6,RB7 to this Connector; on the other hand, if it shifts the Switch to position of PGM, it interfaces Signal RB6,RB7 of MCU with Programmer through Connector ICSP(RJ11) instead.

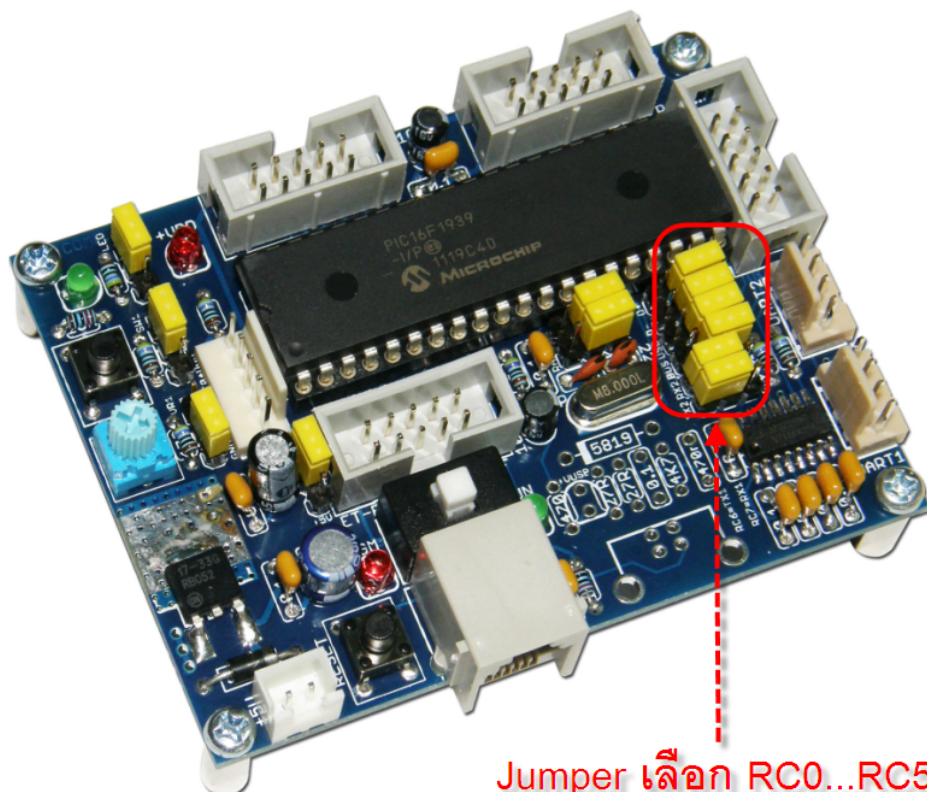


PORT-RC[0...7]

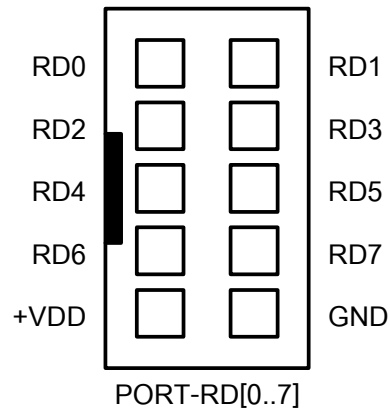
PORT-RC[0...7]: It is Signal from RC0...RC7 of MCU. Signal RC0...RC3 has been set by Jumper. Signal RC6 and RC7 are directly interfaced from Pin of MCU.

RC0,RC1: It has Jumper to set Pin RC0 and RC1 either to interface to this Connector or to interface to Circuit Line Driver of UART2(Software UART).

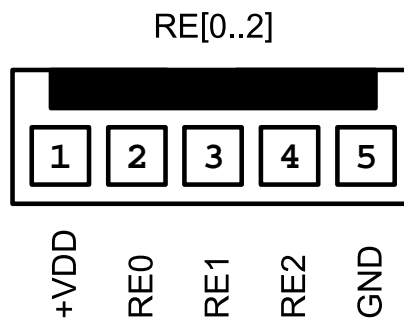
RC2...RC5: There is Jumper to choose Pin RC2...RC5 either to interface to this Connector or to interfaces to Circuit USB. In case of PIC16F1939, there is no circuit for connecting with USB internal MCU; so, user has to set Jumper of RC2, RC3, RC4, RC5 to the side of GPIO to always interface with Pin RC2, RC3, RC4, RC5 to this Connector as shown in picture below;



Jumper เลือก RC0...RC5

PORT RD[0...7]

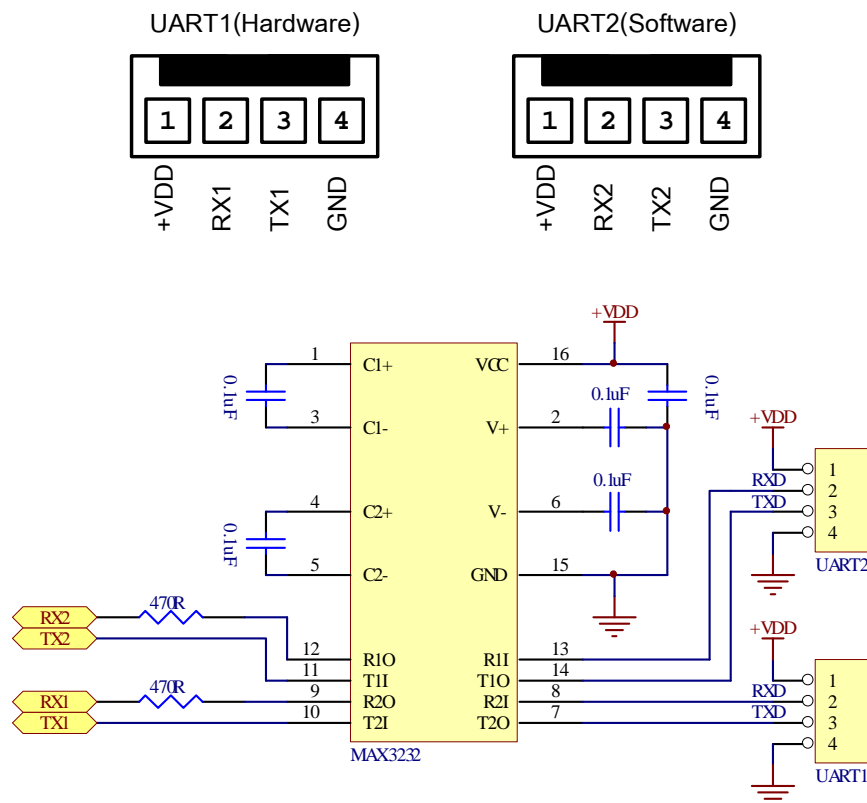
PORT-RD[0...7]: It is Signal from RD0...RD7 of MCU. All 8 Signals are directly interfaced from Pin of MCU.

PORT-RE[0..2]

PORT-RE[0...2]: It is Signal from RE0...RE2 of MCU. All 3 Signals are directly interfaced from Pin of MCU.

RS232

PORT RS232: It is Signal RS232 that has converted Signal Level by MAX3232 completely. In case of PIC16F1939, there is has 1-CH Hardware UART; it uses Pin RC6(TX1) and RC7(RX1) for connection. Moreover, it has added UART2(Software UART) for circuit of board. The second channel uses RC0(TX2) and RC1(RX2) with Jumper to connect/disconnect Signal UART2 as required. Signal of RS232 in each channel arranges Connector to be CPA-4PIN(RS232) as show in the picture below;



Cable RS232 is connected RS232 between ComPort of computer PC and Connector RS232 of Board ET-BASE PIC40/1939(ICSP) as follows;

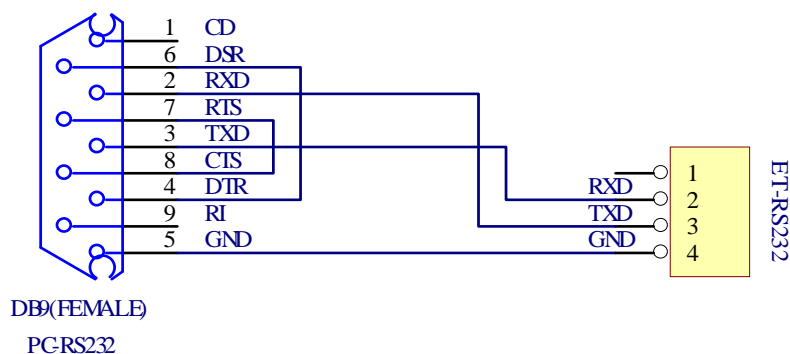
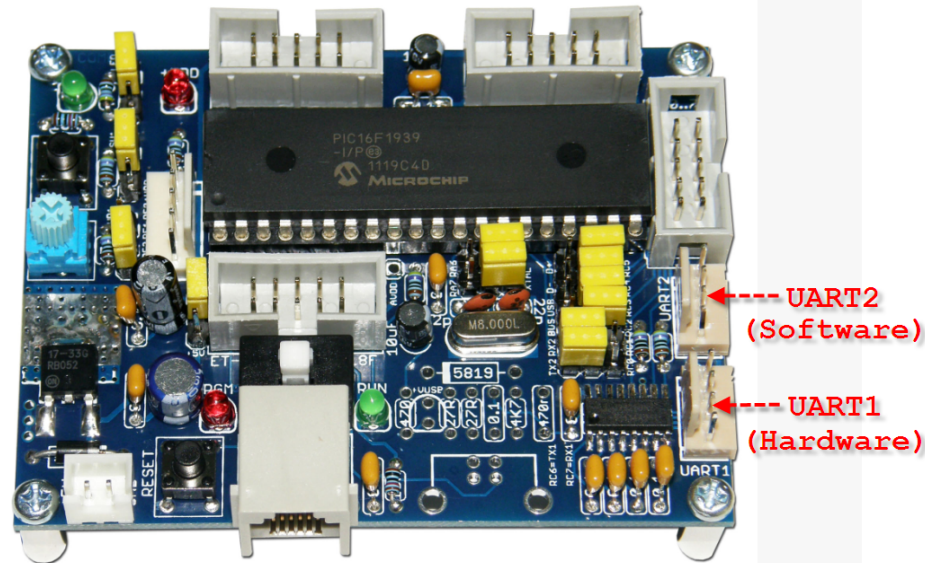


Figure shows Circuit of CABLE RS232.



NOTE: When using UART2(Software UART) to write program, user should consider the capability of Compiler to see if it can support the Library that is Software UART. If using PIC CSS Compiler to compile the language, it can use the capability of Software UART easily. If user does not require using Pin RC0/RC1 to be UART2, user can set the function of both pins to be GPIO by setting Jumper as required. Because Circuit Driver in the part of UART2 is designed to be flexible structure; moreover, there is Jumper RC0/TX2 and RC1/RX2 to connect/disconnect signal as required.

```

/*****
/* Demo Program For ET-BASE PIC40/1939 UART Demo */
/* MCU Control : PIC16F1939 */
/*          : Run 32MHz(X-TAL 8.00 MHz +PLL) */
/* +VDD Power : +5V/+3V3 Operate Voltage */
/* Function   : Demo UART1, UART2 Echo Test */
/*****
#include <16F1939.h>
#include <stdlib.h>

// Fuses: PIC16F1939(CCS Compiler)
// Fuses: LP,XT,HS,RC,INTRC_IO,ECL,ECM,ECH,NOWDT,WDT_SW,WDT_NOSL,WDT
// Fuses: PUT,NOPUT,NOMCLR,MCLR,PROTECT,NOPROTECT,CPD,NOCPD,NOBROWNOUT
// Fuses: BROWNOUT_SW,BROWNOUT_NOSL,BROWNOUT,CLKOUT,NOCLKOUT,NOIESO
// Fuses: IESO,NOFCMEN,FCMEN,WRT,WRT_EECON1000,WRT_EECON200,NOWRT
// Fuses: VCAP_A0,VCAP_A5,VCAP_A6,NOVCAP,PLL_SW,PLL,NOSTVREN,STVREN
// Fuses: BORV25,BORV19,DEBUG,NODEBUG,NOLVP,LVP
#fuses HS,PLL,NOWDT,NOPROTECT,NOLVP // X-TAL 8MHz + PLL(x4)
#use delay(clock=32000000) // 32.00 MHz

/* Config and Enable Hardware UART1(RC6=TX1,RC7=RX1) */
#use rs232(uart1, baud=9600, stream=CH1)

/* Config and Enable Software UART2(RC0=TX2,RC1=RX2) */
#define TX2 PIN_C0
#define RX2 PIN_C1
#use rs232(baud=9600, xmit=TX2, rcv=RX2, stream=CH2)

```

```

/*****
/* Main Program */
*****/
void main()
{
    char rx_buff;

    //Start-Up UART1
    fprintf(CH1, "\n\n\n\r");
    fprintf(CH1, "Demo UART1 ET-BASE PIC40/1939(ICSP)\n\r");
    fprintf(CH1, "Run 32.00 MHz(Internal 8 MHz + PLL)\n\r");
    fprintf(CH1, "UART1>");

    //Start-Up UART2
    fprintf(CH2, "\n\n\n\r");
    fprintf(CH2, "Demo UART2 ET-BASE PIC40/1939(ICSP)\n\r");
    fprintf(CH2, "Run 32.00 MHz(Internal 8 MHz + PLL)\n\r");
    fprintf(CH2, "UART2>");

    while(true)
    {
        //Verify & Echo UART1
        if(kbhit(CH1))
        {
            rx_buff = fgetc(CH1);
            if (rx_buff == 0x0D)
            {
                fprintf(CH1, "\n\r");
                fprintf(CH1, "ET-BASE PIC40/1939(ICSP)\n\r");
                fprintf(CH1, "UART1>");
            }
            else
            {
                fputc(rx_buff, CH1);          // Echo Received Characters
            }
        }

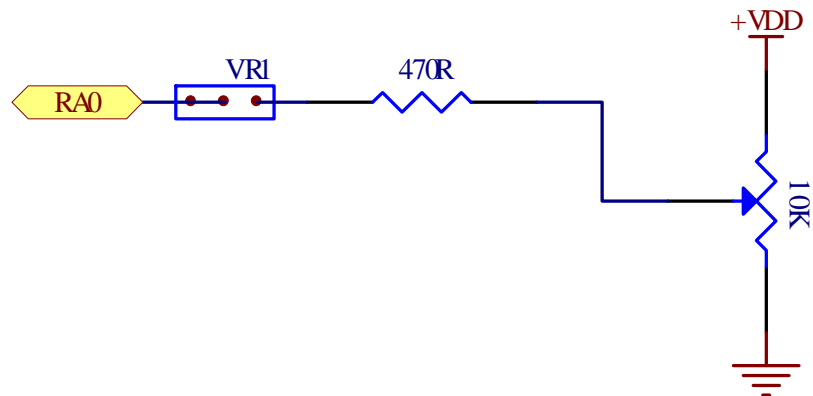
        //Verify & Echo UART2
        if(kbhit(CH2))
        {
            rx_buff = fgetc(CH2);
            if (rx_buff == 0x0D)
            {
                fprintf(CH2, "\n\r");
                fprintf(CH2, "ET-BASE PIC40/1939(ICSP)\n\r");
                fprintf(CH2, "UART2>");
            }
            else
            {
                fputc(rx_buff, CH2);          // Echo Received Characters
            }
        }
    }
}

```

This example shows Code to communicate with C Language UART (PICC CCS Compiler).

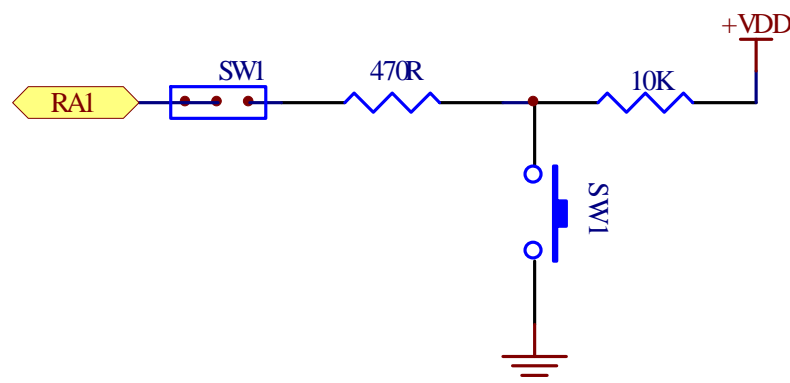
Adjustable VR

This VR1 is Adjustable Resistor to adjust voltage level between +VDD and GND to create the voltage level for testing the operation of Analog Input (ADC). The adjustable voltage of VR1 is connected to Pin RA0 of MCU and there is Jumper to connect/disconnect Signal; so, user can set this Jumper for testing the operation independently.



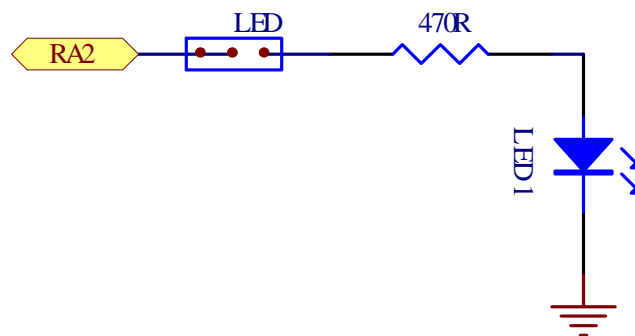
Circuit SW1

This SW1 is Circuit Push-Button Switch to create Signal LOGIC "0" and "1" to test the operation of LOGIC INPUT; for example, it is used to detect the value of pressing Switch. If the Switch is released, it is Logic "1"; on the other hand, if the Switch is pressed, it is Logic "0". The Signal Logic from this circuit is connected to Pin RA1 of MCU; moreover, there is Jumper to connect/disconnect Signal Logic from pressing Switch SW1 independently.



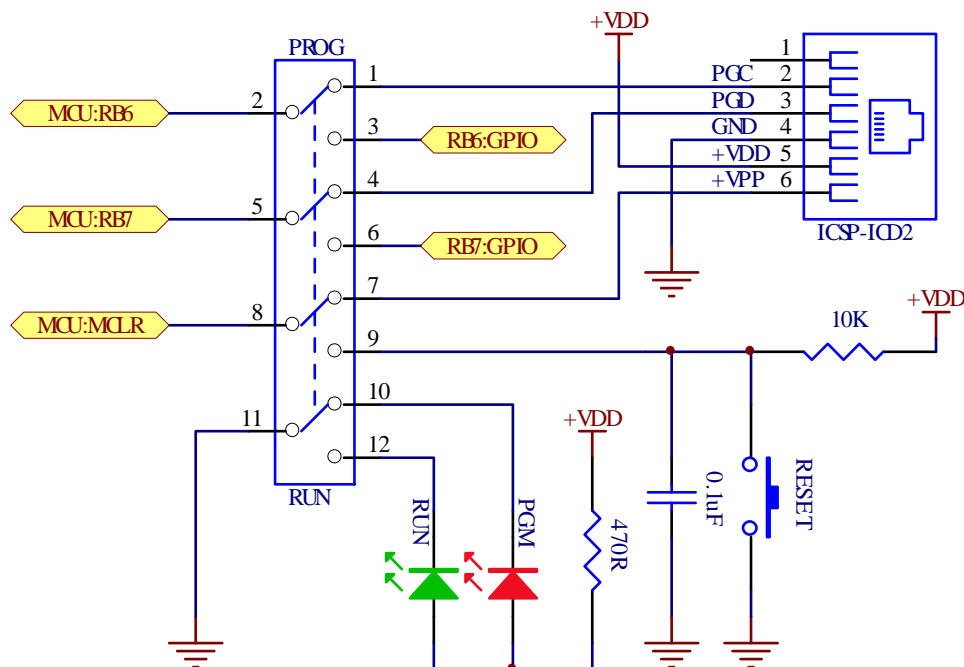
Circuit LED

LED is Circuit LOGIC Display that displays the logic result to user. It is used with Signal Logic Output; if it receives the Signal Logic "1", it makes LED ON; on the other hand, it receives the Signal Logic "0", it makes LED OFF. This Signal Logic is used to drive the LED Display in this circuit; it is connected from Pin RA2 of MCU. Moreover, there is Jumper to connect/disconnect Signal Logic from Pin RA2 to drive this LED independently.



ICSP

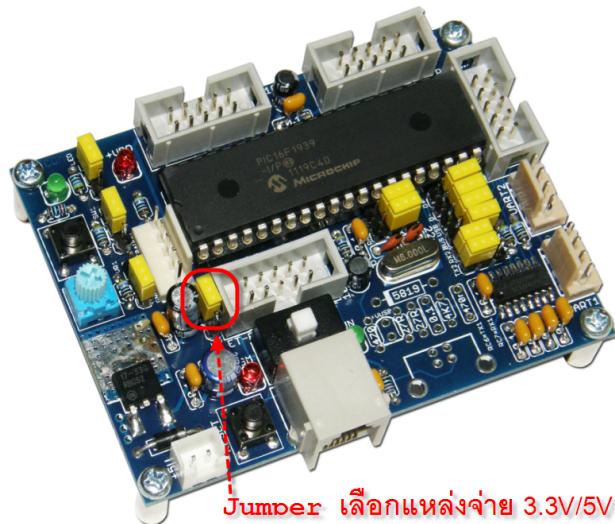
ICSP is Connector RJ11 to interface with Program Developer Kit in the series of PIC and it arranges the connector according the standard of ICSP of MICROCHIPS such as ICD2, ICD3, Pickit2 or Pickit3. It is compatible with Program Developer kit of MICROCHIPS or equivalence such as ET-PGMPIC USB (be equivalent to PICKit2), or ET-PGMPIC PK3 (be equivalent to PICKit3), or ET-ICDX (be equivalent to ICD2). When user requires using any device version, user should consider the MCU number mainly because each MCU number supports different programmer device and it has different capability as mentioned above; however, it only arranges pin for programming MCU in the same standard. The circuit of board in this part has Switch to connect/disconnect Signal of RB6, RB7, and MCLR for interfacing with either Programmer/Debugger or Normal Run; moreover, there is LED to display the current position of LED that is running. If it shifts the Switch to the side of Programmer/Debugger, the red LED of PGM is in the status ON; on the other hand, if it shifts the Switch to the side of Normal Run, the green LED of RUN is in the status of ON. It arranges pins according to the standard of ICSP as follows;



Picture shows structure of circuit in the part of connecting with ICSP of Board ET-BASE PIC40/1939(ICSP).

POWER SUPPLY

The Power Supply of this Board is compatible with external +5VDC. There is a Circuit Regulate 3.3V/1A internal board with Jumper to choose the voltage types either to be +5VDC or +3V3 that is voltage for MCU(+VDD) and Circuit I/O internal board.



Jumper เลือกแหล่งจ่าย 3.3V/5V

It uses Jumper 3V3/+5V to choose the voltage level +VDD for MCU internal board. When user requires choosing and setting any +VDD, user should consider the objectives and the connected device; in this case, MCU No.PIC16F1939 can operate well with the voltage level in the range of 1.8V to 5.5V. There are 2 voltage ranges on board that can be chosen; +5V and +3.3V. User always remembers that when user has chosen any voltage level of Power Supply for board, the Signal Logic for interfacing with external device does not exceed the level from Power Supply. For example, if using 3.3V Power Supply, the connected Signal must be 3.3V as well; on the other hand, if connecting with 5V Power Supply, it makes the MCU damaged. So, user must be careful to choose and setup the voltage level for MCU.

