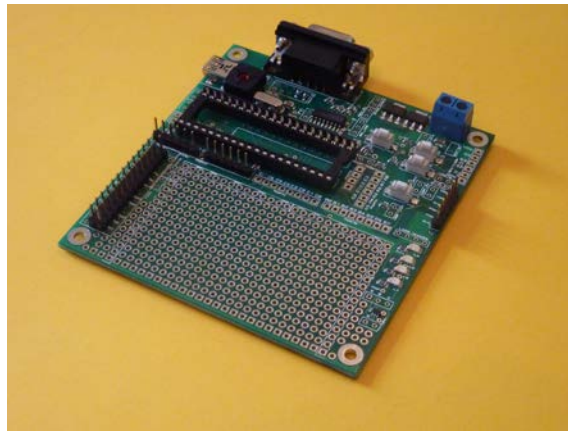


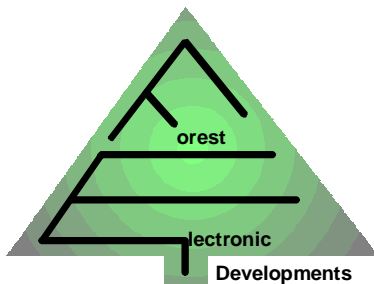
# ***The FED PIC Flex 2 Development Boards***



**THE FED PIC Flex Development board offers a host for 28 or 40 pin devices and includes LED's, switches, transistor switches, USB interface, serial port, support circuitry, LCD module support circuitry and Raspberry PI interface and optional battery charger and RS485 circuits**

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## **Forest Electronic Developments**

12 Buldowne Walk

Sway

LYMINGTON

Hampshire

SO41 6DU

Sales : +44 - (0)1590 681511

**info@fored.co.uk**

Or see the **Forest Electronic Developments** home page on the world wide web at the following URL:

**<http://www.foed.co.uk>**

## PIC development boards (PIC Flex)

FED have a number of capable development/evaluation board for PIC devices which are suitable for use with all the examples and the tutorial and full example program. Each board has the following features:

- Supports all standard pin out 16 and 18 series PIC's in 28 or 40 pin packages.
- Has on board 5v and 3.3V 1A, regulators (Note heat sinking will need to be provided for high dissipation designs).
- Links provided to support low power battery operation, USB, 3.3V, or 5V main supply.
- Serial interfaces for standard 3/5 wire serial communications link selectable as DCE or DTE.
- Crystal oscillator
- All I/O pins available on 0.1" pitch PCB matrix suitable for standard IDC connectors
- 4 Switches and pull up resistors (with link to allow Switch 4 to drive the PIC reset pin).
- 4 LED's with resistors
- 1 NPN and 1 PNP general purpose transistors with base resistors for driving relays, switching higher voltage or higher loads.
- Power LED with enable
- Full USB circuitry suitable for applications using USB PIC's with 28 or 40 pin boards e.g. 18F2550, also included link to switch to allow boot into Microchip USB bootloader.
- In Circuit Serial Programmer (ICSP) standard 6 pin connector
- Optional Battery Charger and RS485 interfaces
- LCD Module power connector and contrast trimmer.
- Allows for battery or low power operation.

### 1.1 *Important Note*

The board is supplied with no links made, this means the user must decide what power supplied are required, and the function of LED's and Switches and make the correct links before using the board.

### 1.2 *Circuit Diagrams*

The circuit diagrams and board layout are shown in Appendix 1.

### 1.3 *Power Supply and power LED*

The power supply is from a 5V or 3.3V regulator, directly from external battery or the USB connector. There are no heat sinks supplied, and applications using more than 2W MUST provide an external heat sink for the voltage regulators.

There are a wide variety of power connections options, none of these are linked on supply of the board and must be connected to enable the board. To enable the power led the ENPL link must be made. The table below shows which links to make for various power options, however other options are available by linking other connections, check the circuit.

Note that there are two power rails on board, an upper and the other for PIC and other circuitry which is either 5V or 3.3V chosen using SEL\_VDD. In practice both can be driven at 5V or 3.3V dependant on requirements.

The 5V supply drives the MAX232 serial chip and LCD if fitted. If a dual rail supply is used then level shifters must be used if the MAX232 is used, alternatively we have found that if both power rails are connected to 3.3V then even though this is below the recommended supply of the MAX232 it appears to work fine at 3.3V avoiding the need for shifting. The LCD will almost certainly require a 5V supply if used.

## FED Development Boards

	ENAB_5VREG	EXT_5V	USB_5V	REG_5V	SEL_VDD	ENAB_3V3	ICSP_3V3
Vdd 5V External 7-9V	Link			Link	Upper		
Vdd 3.3V External 5-9V	Link			Link	Lower	Link	
Vdd 5V External 5V Battery No regulator		Link			Upper		
Vdd 3.3V External 5V Battery							
Vdd 3.3V External 3.3V supply		Link			Upper		
Vdd 5V USB Supply			Link		Upper		
Vdd 3.3V USB Supply			Link		Lower	Link	

### 1.4 Reset Circuitry

The reset/Vpp pin is driven by a number of components. By default the PIC will be reset externally by D2, R1 and C12 on power up. The reset pin is also driven by the on board programmer and by the ICSP connector. The reset pin is also available as a PCB pad for I/O RE3 if this is used, however be aware that Vpp will be applied to this pad if the on board or external programmer is used. Similarly I/O pad E3 can be used as another source of reset if required.

Switch SW4 is also available for use as a reset switch. If link RESETSW is made with a short wire link then SW4 will operate as a reset switch to short the MCLR input to ground which may be pressed to manually reset the PIC at any time.

### 1.5 ICSP connector

The ICSP connector is provided for external programmers which support ICSP such as the FED PIC Key. The connections on this are as follows :

Pin	Connection	Comment
1	Vpp/MCLR	This is the Vpp input usually this pin will rise to 12V or more when programming the PIC
2	Vdd *	Connected to Vdd on the application board, you WILL need to apply power to the board if the application you have draws more power than can be supplied by your programmer. For the PIC Key this is around 30mA.
3	Gnd	Connect to the application circuit, ground connection.
4	Program Data**	Connected to the PGD pin - RB7
5	Program Clock**	Connect to the PGC pin -RB6.
6		

The two ICSP connections are used to select 5V or 3v3 power to the ICSP connector.

The link Vpp12 should be made if the programmer can supply 5V, 8V or 12.5V to the Vpp pin. Programmers which can do this include Microchip PIC Kit 3 and PIC Key MX. If an older programmer is in use then this link may be left unmade which will connect Vpp from the ICSP via a 1K resistor to avoid damage if a 12V Vpp is applied to a chip which can only accept 8V.

### 1.6 Input & Outputs

Up to 34 of the PIC I/O's are available on the port connectors at the top of the prototyping area depending on the PIC size (All available I/O pins on ports A to E except A6 and A7). The board markings clearly show the port connections.

Some PIC's have switchable PORTA bits 6 and 7 with the crystal oscillator so that these port pins become available if internal oscillator options are used. The development board does not route these connections from the crystal to avoid tracking high frequency oscillator signals around the board. If these port connections are required then X1 and capacitors C5 and C6 should be removed and the application wired directly to the pins of X1 which will be Port A bits 6 and 7 in this event.

For 28 pin devices PORT D and PORT E bits 0 to 2 are not available.

### **1.7 Vdd Core decoupling**

If a low voltage core device is used then it may require a decoupling capacitor of 100nF connected between pin 6 and ground (RA4), check data sheet for details.

### **1.8 Battery operation**

To operate from a battery it can be connected directly with the two regulators disabled (unless required). If the optional battery charger components are included then the charger will connect to the external power connector which should be disconnected from Vdd. The battery will be connected between Vdd and Ground.

### **1.9 LED's**

The four LED's are connected to the LED Anodes PCB pads via 300R resistors.

The Connections are positive going – connect the pad to +5V to light the associated LED.

### **1.10 USB**

A standard USB B connector is provided for the USB applications on the 28 and 40 pin boards, in addition a links is available on the board to connect the socket power to Vcc and a decoupling capacitor for VUSB is provided. Purchasers of the USB versions of the development board will have all the USB links and components fitted.

To use the USB the decoupling capacitor CUSB should be fitted (this is a 1uF SMD tantalum device) which connects to pin C3.

The link USB POWER may be made or released to power the board from the USB supply if required. This link is also just below the socket and is provided using standard 0.1" header and jumper.

When used with the Microchip USB bootloader it is useful to control the bootloader using a switch. Link USB\_BOOT is made to connect Switch 1 to RB0. FED provide a version of the USB bootloader which will boot into the loader when Switch 1 is pressed and the board reset using the reset switch.

Full details for use with USB is provided in the USB development board manual supplied separately on the CD.

### **1.11 Switches**

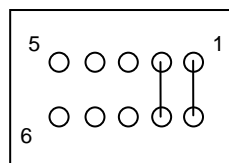
Four switches are provided and connected to PCB pads S1 to S4, they have 10K pull ups and the switch connects to ground when pressed. SW4 may be connected to the reset pin using the ENAB\_RESET link if required to make it a reset switch.

### 1.12 Serial Port

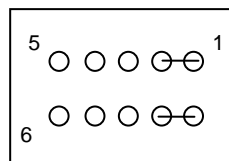
The serial port is connected via to a MAX232 RS232 modem chip U4 (a commonly used MAX232 compatible device). The serial port may be connected easily to PIC pins C6 and C7 which are the USART hardware pins on most devices which support an internal USART by making links RC6 and RC7 to the left of the 40 pin socket.

The modem chip can be connected to other I/O pins by connecting wires directly to the Rx and Tx pins on those 2 links (the upper end of each link). Rx is the output from the serial port driver, Tx is the input to the serial port driver and should usually be driven by a 1K resistor (R9 is included when Tx is driven by RC6 through the link). The port is fully powered and can be connected to a PC, or to another development board.

To support DTE mode (which allows the board to communicate with most PC's) then the links on Connector CONFIG must be made as below :

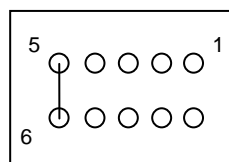


To support DCE mode (which allows the board to communicate with DTE's) then the links on Connector CONFIG must be made as below (note in this case that, if it is installed, then the on board programmer will not work) :



Links connected to pins 3, 4 and 7,8 are used for hardware flow control, see the circuit diagrams for connections.

To loop round the socket (connecting pin 2 to pin 3), simply make the link between pins 5 and 6 :



This hardware is compatible with the FED asynchronous interrupt driven serial communications library functions included with WIZPIC, PIXIE and FED PIC C.

### **1.13 LCD Module and variable resistor.**

There are four connections for the power and LCD contrast connections to a standard LCD module on the left of the prototyping area. The data connections (D4 to D7) and control signals (RS, E, RW) should be connected directly to PIC Port pins – for example 7 bits of Port D maybe used for this purpose. To connect one to one to the LCD then use D0 to D2 as RS, RW, and E respectively, and D4 to D7 as the LCD data pins D4 to D7. The BL connections and power connections are adjacent to these connections.

The 3 connections provided are for pins 1 to 3 of the LCD Module. These pins are by convention (in order) Ground, +Vcc and the LCD bias supply through a preset resistor (RV1).

There is also a 100nF decoupling capacitor provided close to the LCD module connector.

If the LCD module is not used then the resistor RV1 can be connected to input AN1 of the PIC on pin RA0 by making link POT\_A0

### **1.14 General purpose transistor switches.**

There are 3 general purpose switching transistors provided. Each has a 10K resistor to the base. The maximum switching current for each is 100mA. An example of their use would be to switch on and off an LCD back light with a current consumption of around 50mA which is too great for a PIC output. Other uses might be to drive a relay, to switch higher voltages than the board's 5V supply, or to apply power to peripheral circuitry.

There are 2 transistors, one NPN with the emitter connected to ground, and one PNP with all three connections available (E,B,C). Thus the NPN transistors can be used to switch connections to ground and the PNP can be used to switch circuitry to +5V or a higher supply.

### **1.15 Raspberry PI connector**

The R PI connector on the left of the board is a 1:1 match with a PI connector which may connect to a standard or B+ device and act as a PI peripheral, or equally may connect to any of the many hundreds of PI adaptor and interface boards to use their capabilities, for example a RTCC chip.

The links for power PI3V3 and PI5V are connected to enable the PIC Flex Vdd and 5V rails respectively (note that logic on the PI runs at 3.3V normally so level shifters may have to be employed if a 5V circuit is used on the Flex).

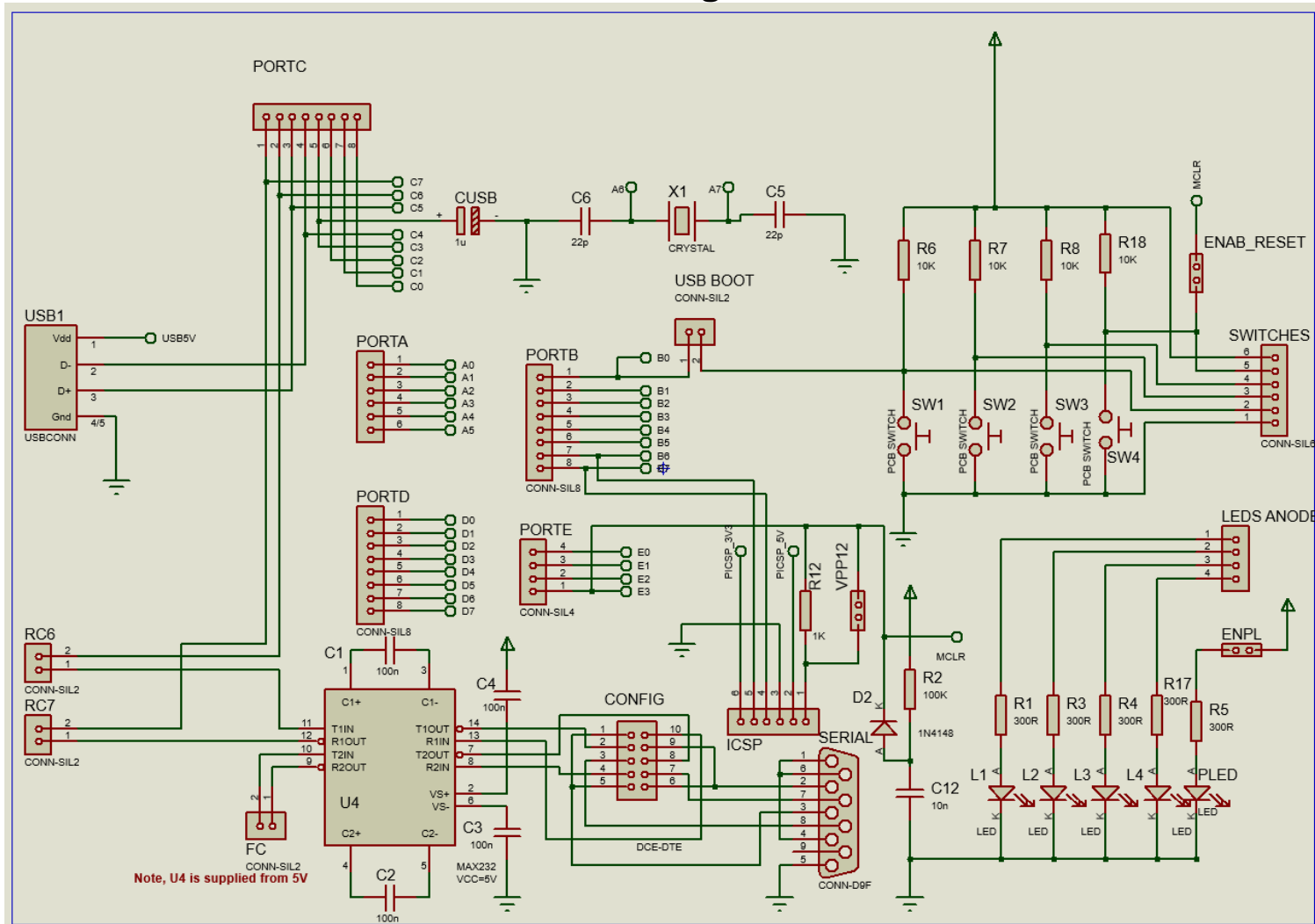
The PI TX and PI RX signals are connected to the PIC Asynchronous RX and TX pins if the links PITX and PIRX are made.

### **1.16 RS485**

The optional RS485 circuit is surface mounted under the board. This is U1, RC6 and RC7 which are the normal PIC asynchronous transmit and receive signals are connected to U1. It is necessary to enable the device prior to transmitting to seize the bus. The connection D485\_EN (which is under the PIC) is used to switch the transmitter of the chip on and off.

## FED Development Boards

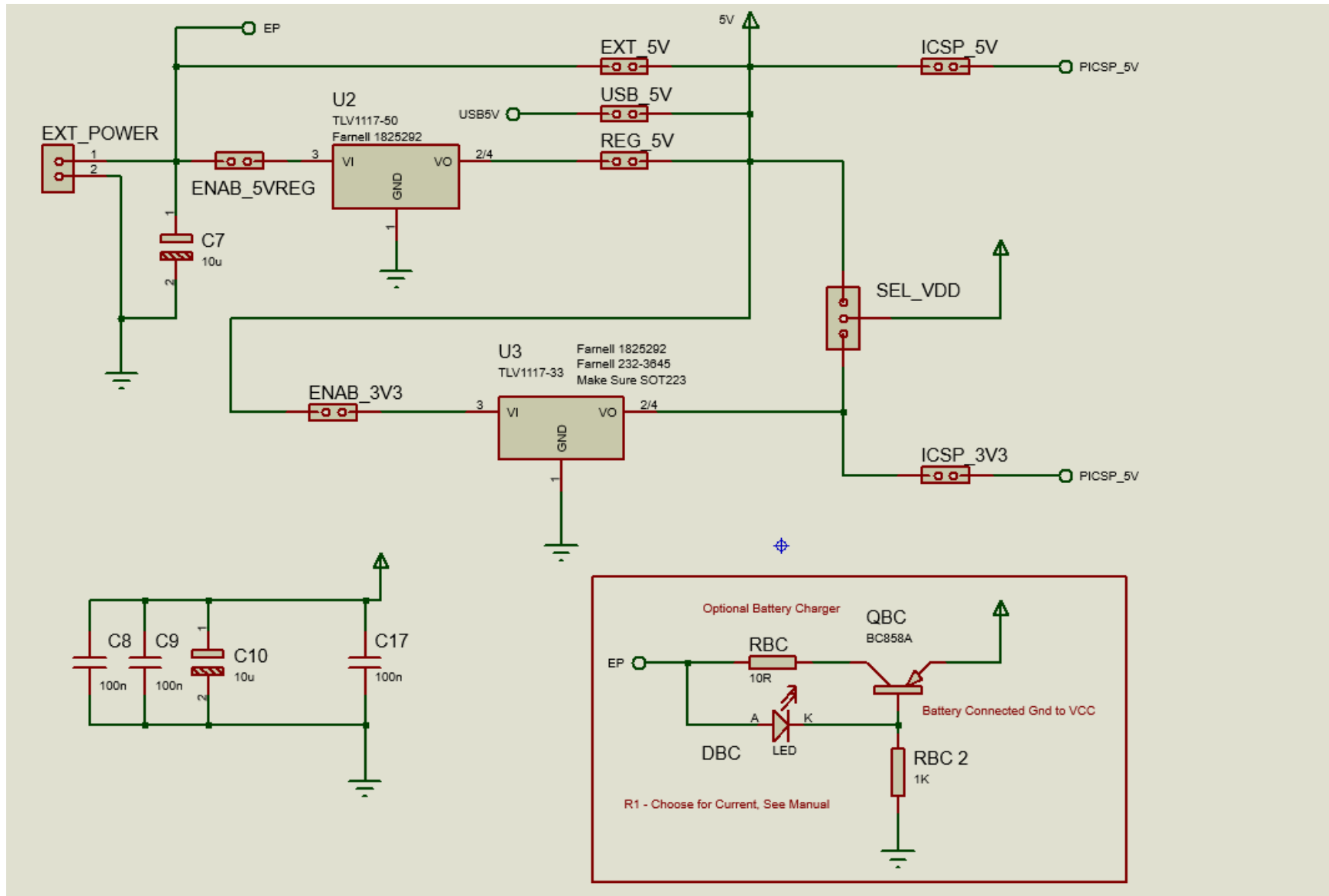
## Appendix A Circuit Diagrams



PIC Flex 28/40 pin Development Board – Sheet 1 – I/O connectors and peripheral components

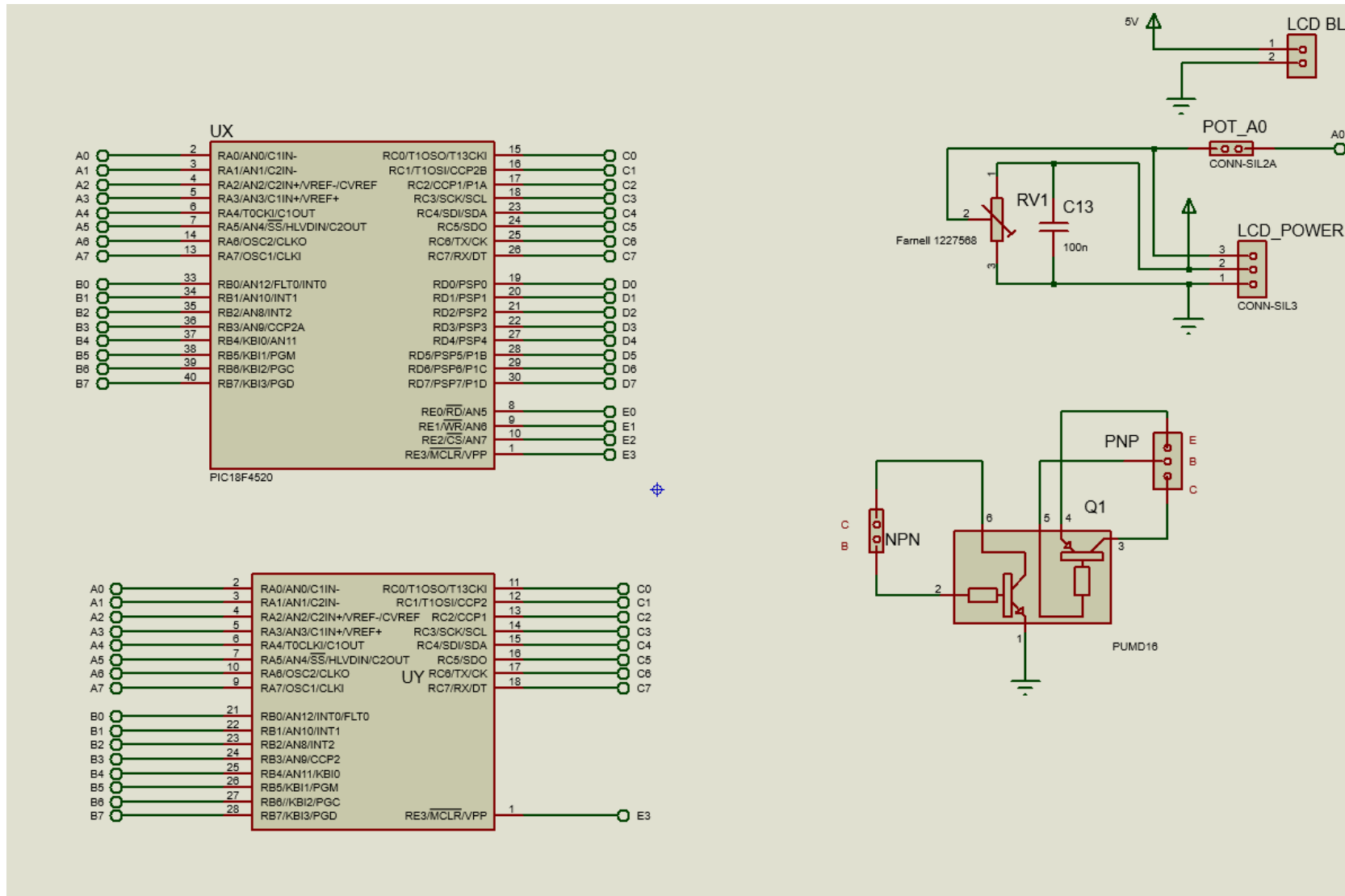


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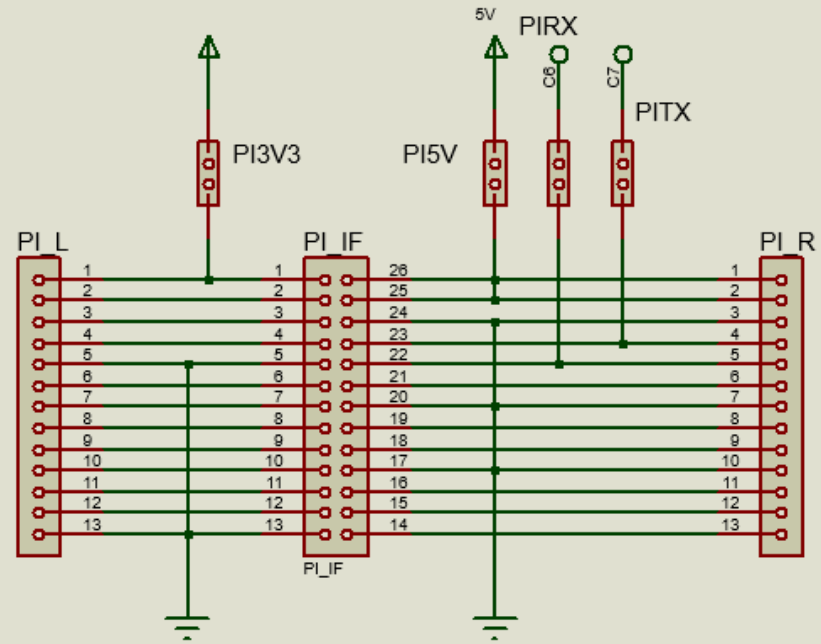
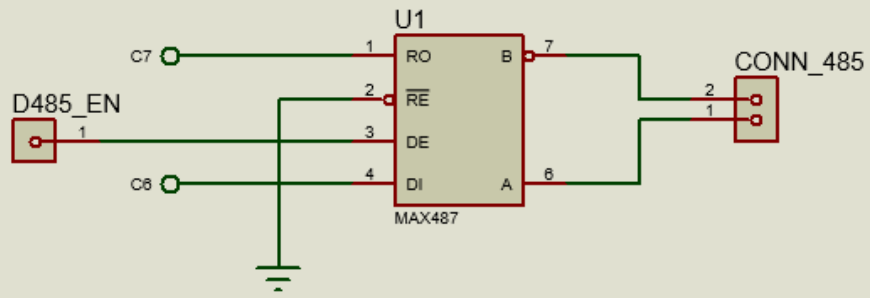
PIC Flex 28/40 pin Development Board – Sheet 2 – PIC, LCD and transistor circuits

# FED Development Boards



PIC Flex CPU, LCD Connector and Transistor

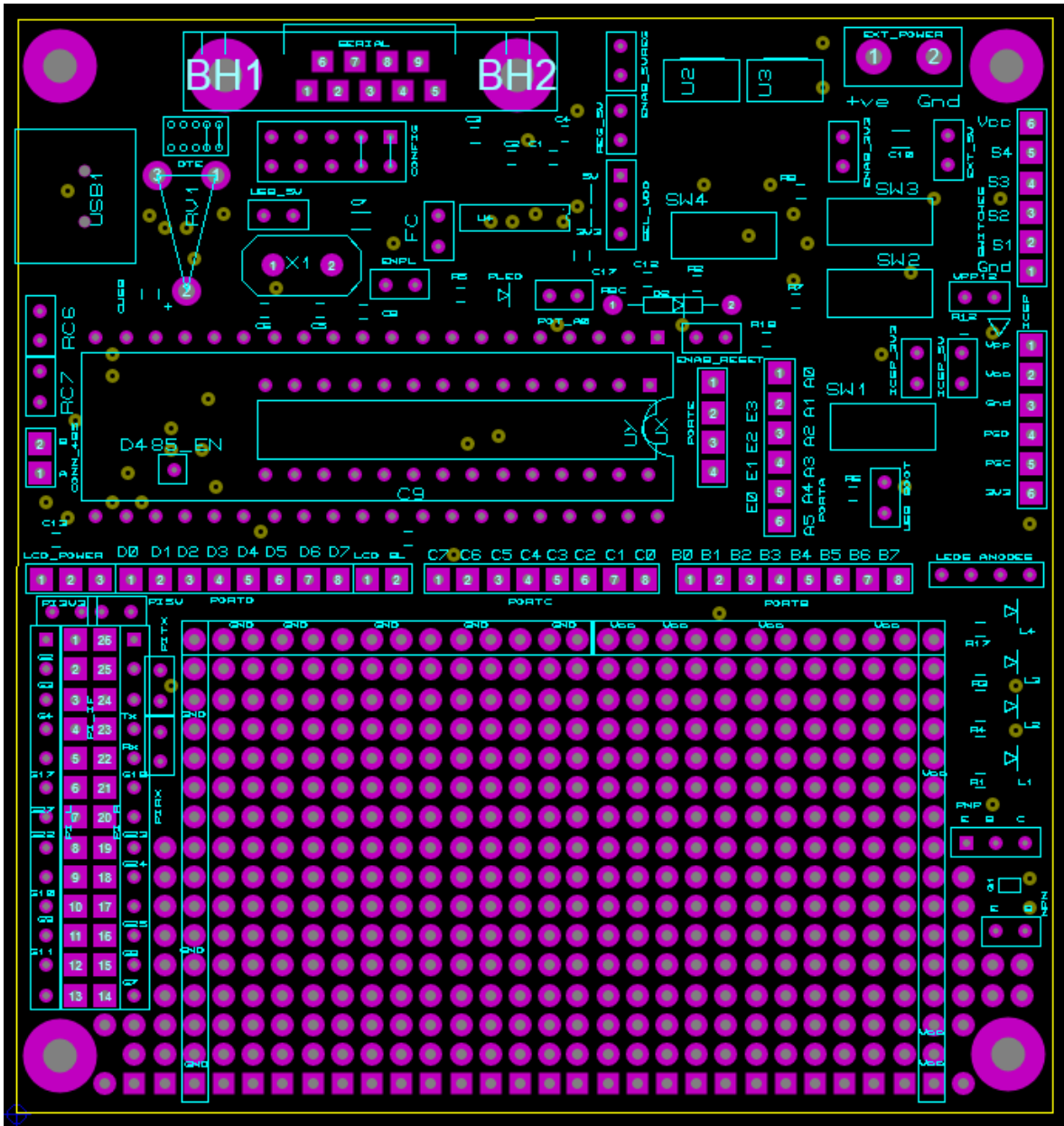
# FED Development Boards



PIC Flex, RS485 and Raspberry PI connector

## FED Development Boards

# FED Development Boards



## FED Development Boards