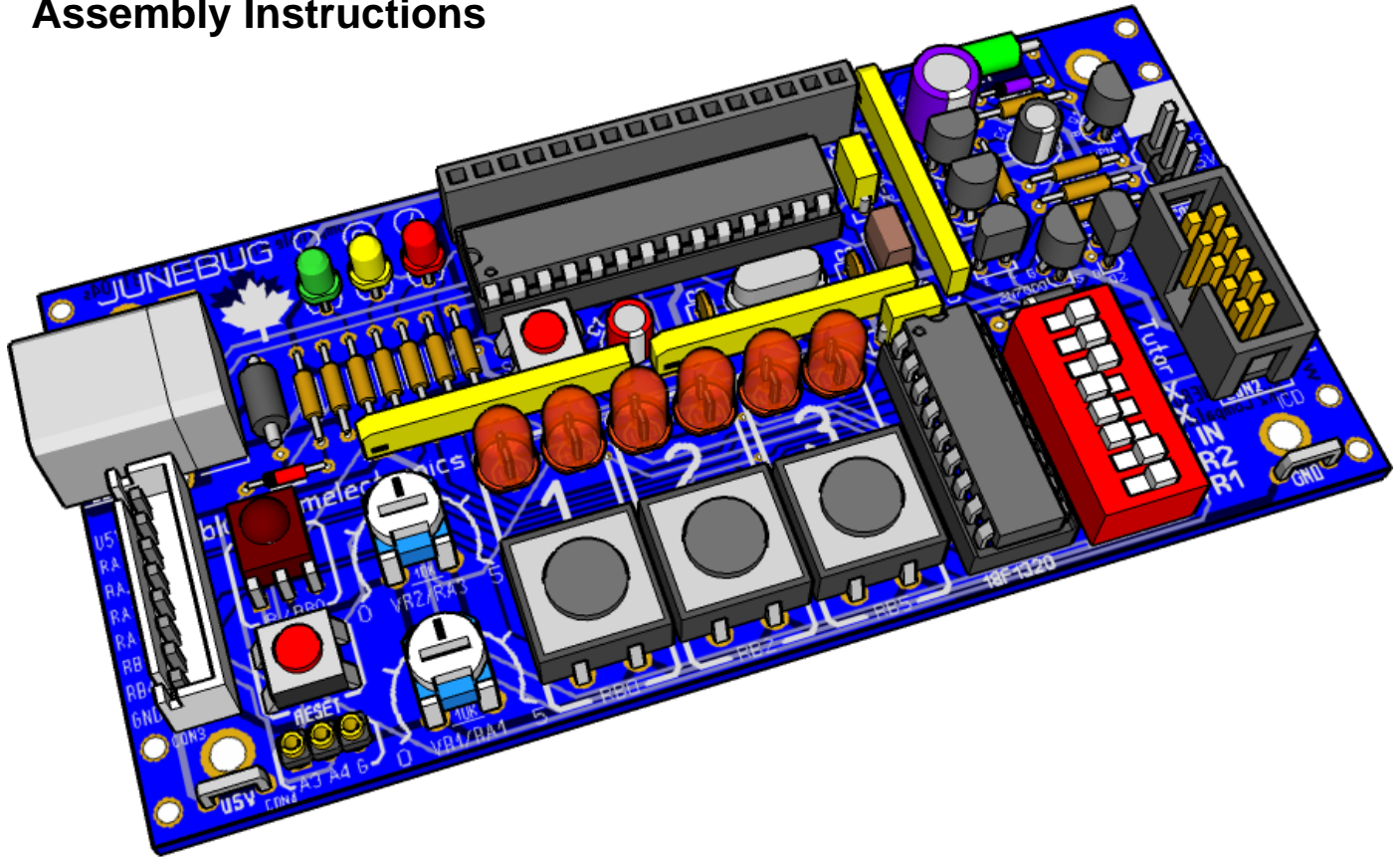


JUNEBUG *PIC LABORATORY*

Assembly Instructions



The Junebug PIC Lab

Introduction

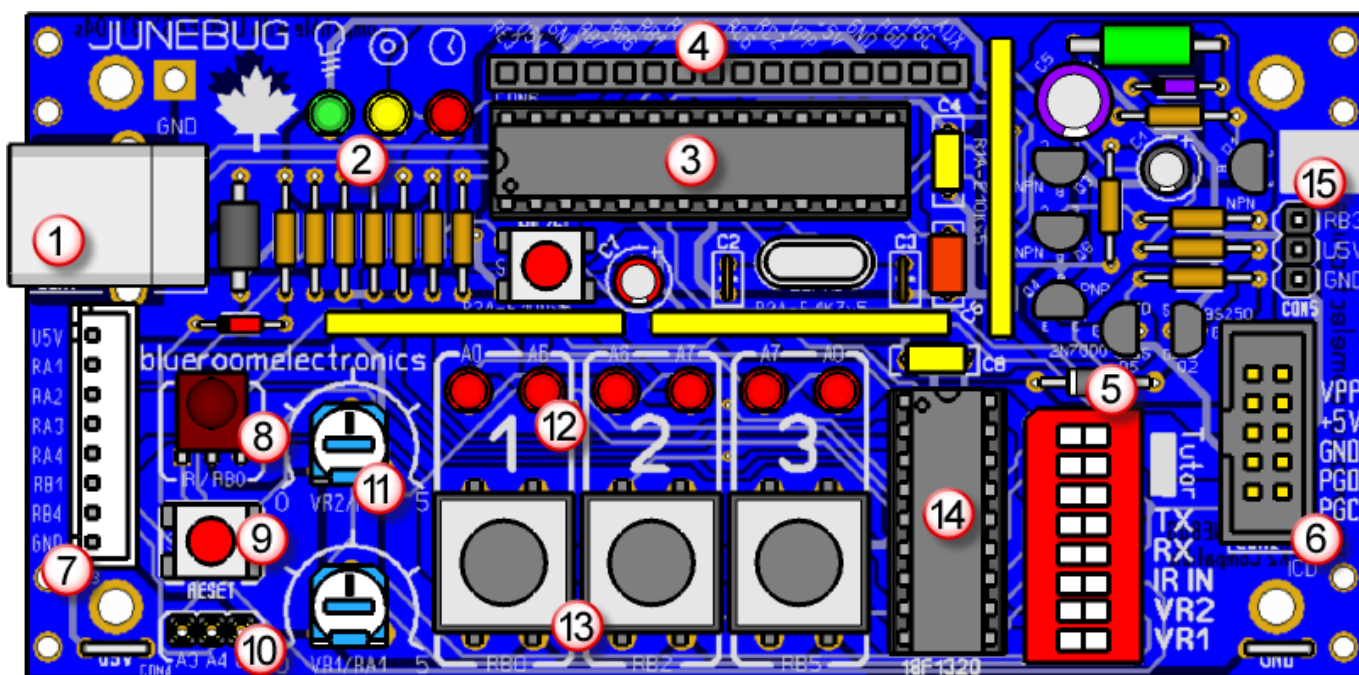
Powered from your computer's USB port the Junebug is everything you'll need in a small self-contained portable PIC Laboratory perfectly suited for students, educators and hobbyists. The Junebug is actually two independent kits in one.

An **MPLAB Compatible PICkit 2* Programmer / Debugger**, works with both the Tutor and includes two external ICD connectors for your own PIC projects. The programmer also includes a very handy UART terminal.

The **advanced PIC18F1320 Experimenter / Tutor** was designed to demonstrate the 18F1320 in a hands-on manner. With pushbuttons, LEDs (light emitting diodes), variable resistors, Infrared detector (38KHz TV type), UART (serial communications) there are literally thousands of program possibilities on this single board. Plenty of room for expansion too with the several built-in I/O expansion connectors. No jumpers to lose as all the tutor peripherals can be controlled with a single DIP switch.

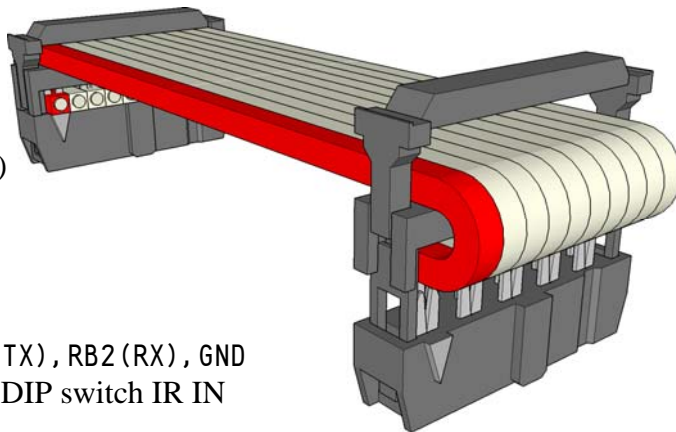
** Unlike the Microchip® PICkit 2 the Junebug does not have a programmable VDD supply (5V targets only)*

The Junebug PIC Lab Overview



PICKit 2 Compatible Programmer / Debugger & UART tool

1. USB-B connector, provides power and communication for the Junebug, Tutor & target projects
2. Programmer status Power, Target Power & Busy
3. PIC18F2550 preprogrammed with .hex
4. 18F2550 ICP, expansion & PK2 compatible
5. Tutor mode switch see page 6 for details
6. ICD programming / debugging connector (2x5 type)
**Typical ICD cable pictured right →*



PIC18F1320 Tutor / Trainer

7. USER I/O connector U5V, RA1, RA2, RA3, RA4, RB1 (TX), RB2 (RX), GND
8. 38KHz Infrared detector / demodulator enable with DIP switch IR IN
9. Reset or RA5
10. CON4 A3, A4, GND socket designed for iButton® / 1-wire®, and various small parts
11. VR1 & VR2 variable resistors on RA1 & RA3 (DIP switch selectable)
12. Six multiplexed LEDs
13. Pushbuttons on RB0, RB2 & RB5
14. PIC18F1320 for user programs and software development
15. CON5 designed for buzzers, servo motors, PWM and general I/O

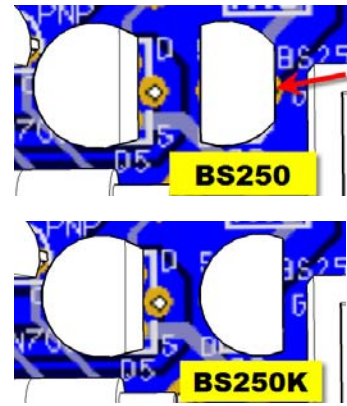
Located on the left of the Junebug; it makes some of the 18F1320 pins available for your own projects. It also gives you access to your computers USB power supply but keep in mind only 100ma is available from the USB port. If you need more, most powered USB hubs will supply 500ma to the Junebug and your target projects. Do not supply current / voltage to the U5V pin it is a 5V source.

**The ICD cable must be short to avoid communication errors with the target PIC, usually less than 8" (20cm)*

Necessary Tools *(not included in kit)*

As with any electronic kit the following tools are essential:

- Low wattage fine tip soldering iron <50W
- Resin core solder
- Wire cutters or side cutters (small)
- Needle nose pliers (small)
- Slotted screwdriver (small)
- Phillips screwdriver (small)
- Multimeter (this really is a must for any electronics project)



Assembly

Traditionally it's easiest to assemble a circuit board with the lowest profile and/or smallest parts first.

Install resistors R4 thru R17

Small signal diodes D1 & D3 (Red 1N4148)

Schottky diode D2 (1N5817)

Note: diodes use a colored band to denote polarity

Ferrite bead FB1 and 680uH inductor L1

SIP resistors R1 (10K), R2 (100ohm) & R3 (4.7K)

Capacitors C2, C3, C4, C6 & C8

Crystal Y1 (*a spacer is optional but recommend*)

IC socket for U1 & U2 (*notice notch orientation*)

Transistors Q1, Q3, Q6 (NPN) and Q4 (PNP)

P-Channel FET Q2 (BS250 or BS250K)*

N-Channel FET Q5 (2N7000)

Note: Check the datasheet for DGS orientation

3mm LED5 (green), LED6 (amber) & LED7 (red)

5mm or 3mm LED1 thru LED6 (red)

Note: LEDs have a flat side indicating polarity

Momentary Pushbuttons SW1 thru SW5

Eight position DIP Switch SW6

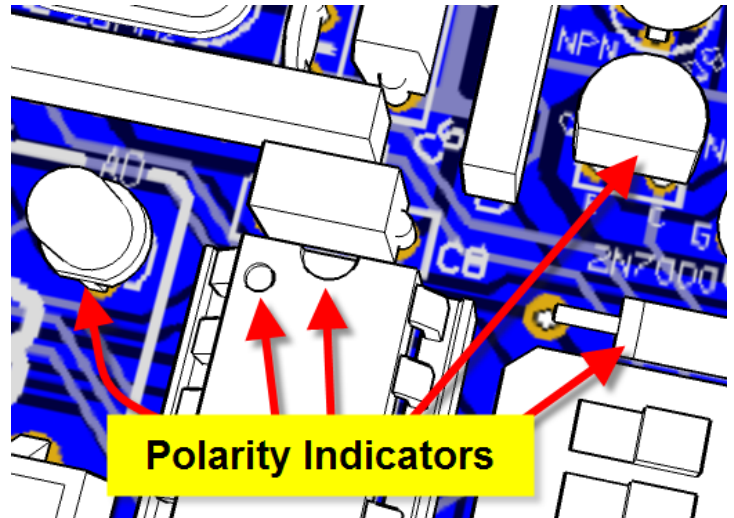
38KHz IR detector IR1 (*carefully bend leads about 45degrees before installing*)

Variable Resistors VR1 & VR2

Electrolytic Capacitors C1, C5 & C7 (*Note: polarity indicator; usually a white stripe indicating negative*)

All remaining parts including connectors CON1 thru CON8 (*take your time soldering the USB GND lugs*)

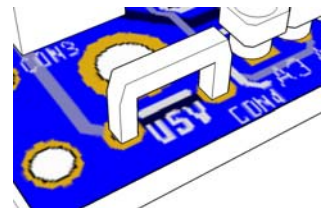
**See the BS250 illustration at the top of this page to identify the correct mounting depending on package*



Initial Testing

Connect the Junebug to your computers USB port, the green power LED should glow.

If you have a voltmeter check for approximately 5V between U5V and GND



Final Assembly

Make sure the board is unpowered then install U1 & U2. Note their orientation before inserting.

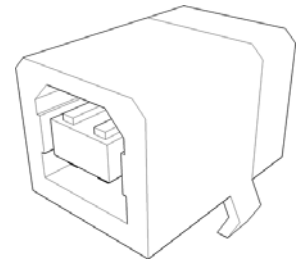
Optionally you can install small wire loops for attaching alligator clips using left over resistor leads.

Your kit includes a pre-programmed PIC18F2525 (PK2V021000.HEX) the firmware is automatically updated by MPLAB when needed. If you have a problem with the firmware holding down SW5 (directly below the 18F2550 while you connect the USB cable should initiate the bootloader (busy LED flashing) Run either the PICKit 2 or MPLAB software to initiate a reinstall of the Junebug (PICKit 2) firmware.

Parts List JUNEBUG

Capacitors

2	C2, 3	18pf thru 22pF ceramic
2	C4, 8	0.1uF monolithic
1	C6	0.47uF monolithic
1	C7	4.7uf 6.3V radial electrolytic
1	C1	22uF 25V radial electrolytic
1	C5	100uF thru 220uF

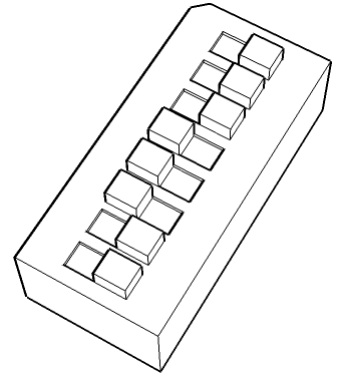


Resistors 1/4W

1	R2	100 x 5	SIP 10pin 5 independent resistors
1	R3	4.7K x 5	SIP 10pin 5 independent resistors
1	R1	10K x 5	SIP 10pin 5 independent resistors
3	R9, 11, 12	100	Brown, Black, Brown, Gold
4	R8, 13, 14, 17	330	Orange, Orange, Brown, Gold
3	R4, 5, 10	1K	Brown, Black, Red, Gold
1	R6	2.7K	Red, Violet, Red, Gold
2	R15, 16	22K	Red, Red, Orange, Gold
1	R7	100K	Brown, Black, Yellow, Gold
2	VR1, VR2	10K	10K Trimmer potentiometers

Semiconductors

2	D1, 3	1N4148 Small Signal Diode
1	D2	1N5817 Schottky Diode
1	IR1	TSOP34838 38KHz IR detector Vishay
6	LED1, 2, 3, 4, 5, 6	3mm or 5mm RED LED
1	LED7	3mm GREEN LED
1	LED8	3mm YELLOW LED
1	LED9	3mm RED LED
1	Q1, 3, 6	2N3904 NPN (EBC)
1	Q4	2N3906 PNP (EBC)
1	Q5	2N7000 N-Channel 200ma MOSFET
1	Q2	BS250P P-Channel 230ma MOSFET
1	U1	PIC18F2550 (programmed with PK2V021000.HEX firmware)
1	U2	PIC18F1320 (Tutor)

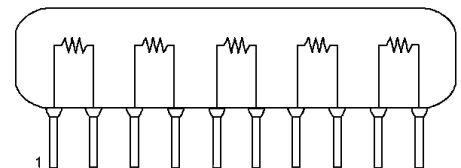


Switches

3	SW1, 2, 3	Pushbutton (Small or Large 450-1131-ND see text)
2	SW4, 5	Small pushbutton (450-1173-ND)
1	SW6	DIP Switch 8 position

Connectors

1	CON1	RA USB B connector
1	CON2	ICD 2x5 PCB Male Shrouded
1	CON4	3pin machine socket RA3, RA4, GND
1	CON7	3pin header RB3, +5V, GND
1	CON8	8pin Molex connector +5V, RA1, RA2, RA3, RA4, RB1/TX, RB4/RX, GND
1	CON6	16pin header for 18F2550 (pins 11 thru 16 are PICKit2 compatible) RE5, U5V, GND, RB7, RB6, RB1, RB0, RC7, RC6, RC2, VPP, +5V, GND, PGD, PGC, AUX

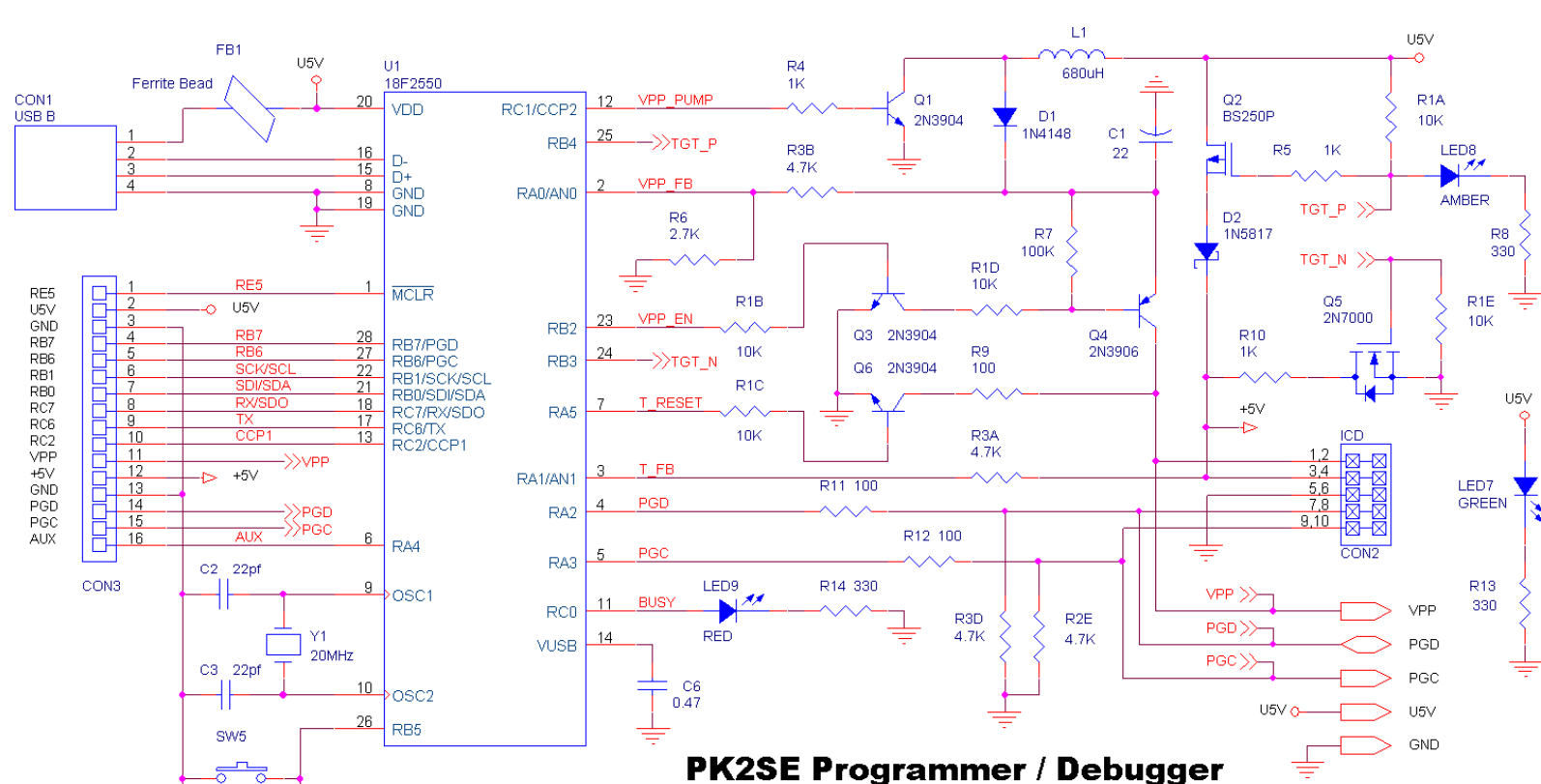


Miscellaneous

1	FB1	Ferrite Bead
1	L1	680uH inductor
1	Y1	20MHz Crystal Low profile,

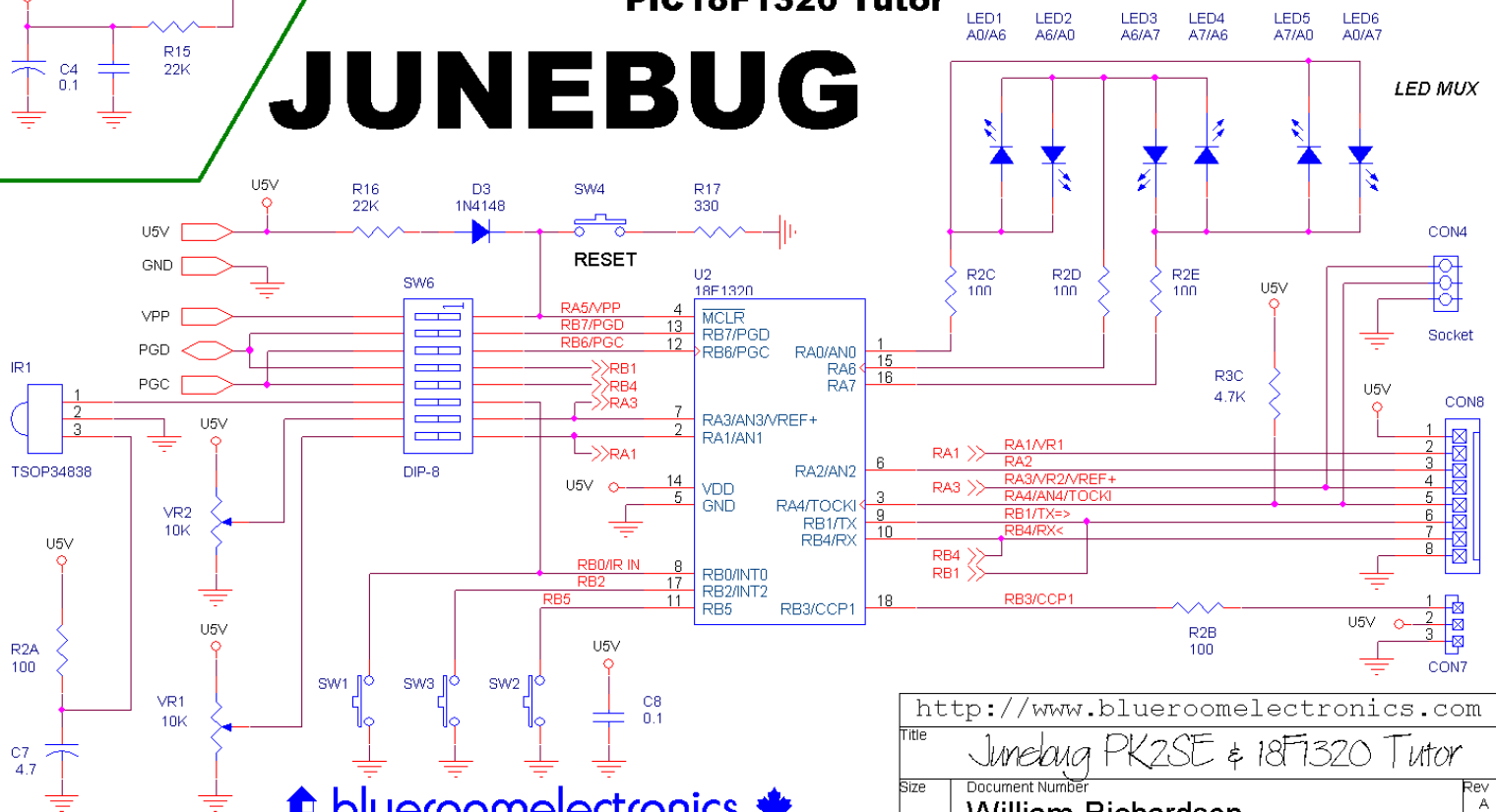
Optional Accessories

1	Enclosure	Polyview LAB-EASY BT-04 or four rubber feet
1	Insulator	crystal insulator for Y1



PIC18F1320 Tutor

JUNEBUG



http://www.blueroomelectronics.com			
Title	Junebug PK2SE & 18F1320 Tutor		
Size	Document Number	Rev A	
William Richardson			
Date:	Wednesday, December 26, 2007	Sheet	1 of 1

Complete schematic for Junebug showing both Programmer (top) & 18F1320 Tutor (bottom)

Notes:

U5V indicates the power is continuously supplied by your computer's USB port, this is normally limited to approximately 100ma. Using a powered USB hub can increase the available current 500ma.

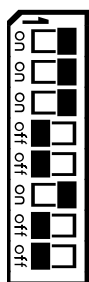
+5V indicates a switched power supply controlled by the Junebug.

DIP Switch functions (SW6)

Junebugs Tutor has an eight position DIP switch (shown in Tutor default mode)

Switch functions from 1-8 (top to bottom)

enable = on / right, disable = off / left

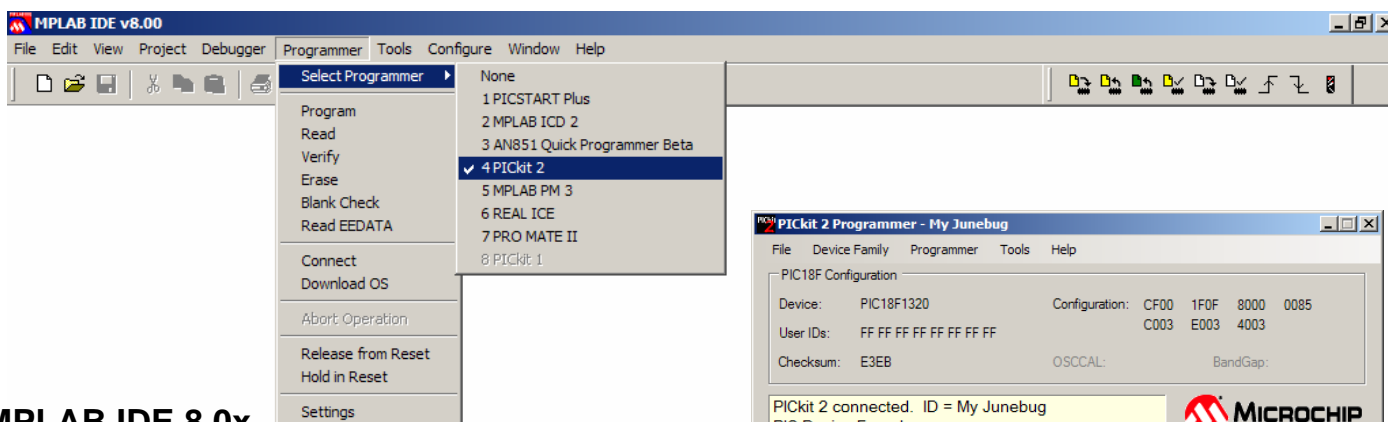


SW6-1*	Tutor	(PK2 controls 18F1320 MCLR), free running mode & SW5 RESET
SW6-2 *	Tutor	(PK2 controls 18F1320 PGD)
SW6-3 *	Tutor	(PK2 controls 18F1320 PGC)
SW6-4	TX	Uses PGD for PICKit 2 UART test mode (PICKit 2 software)
SW6-5	RX	Uses PGC for PICKit 2 UART test mode (PICKit 2 software)
SW6-6	IR IN	(38KHz IR) receiver on, <i>Pushbutton 1 is always enabled</i>
SW6-7	VR2	(0-5V pot) or USER port RA3 I/O
SW6-8	VR1	(0-5V pot) or USER port RA1 I/O

Reset switch SW4 will function when SW6-1 is off. Remember you can control reset via MPLAB.

* Turn SW6-1,2,3 OFF to when using the ICD connector (CON2)

Required Software (free download from <http://www.microchip.com>)



MPLAB IDE 8.0x

A professional all in one PIC firmware development environment, excellent for...

- Editing
- Assembling (MPASM), Compiling (C, BASIC)
- Programming, Simulation, Debugging

PICKit 2 v2.50

Provides a simple interface which is handy for...

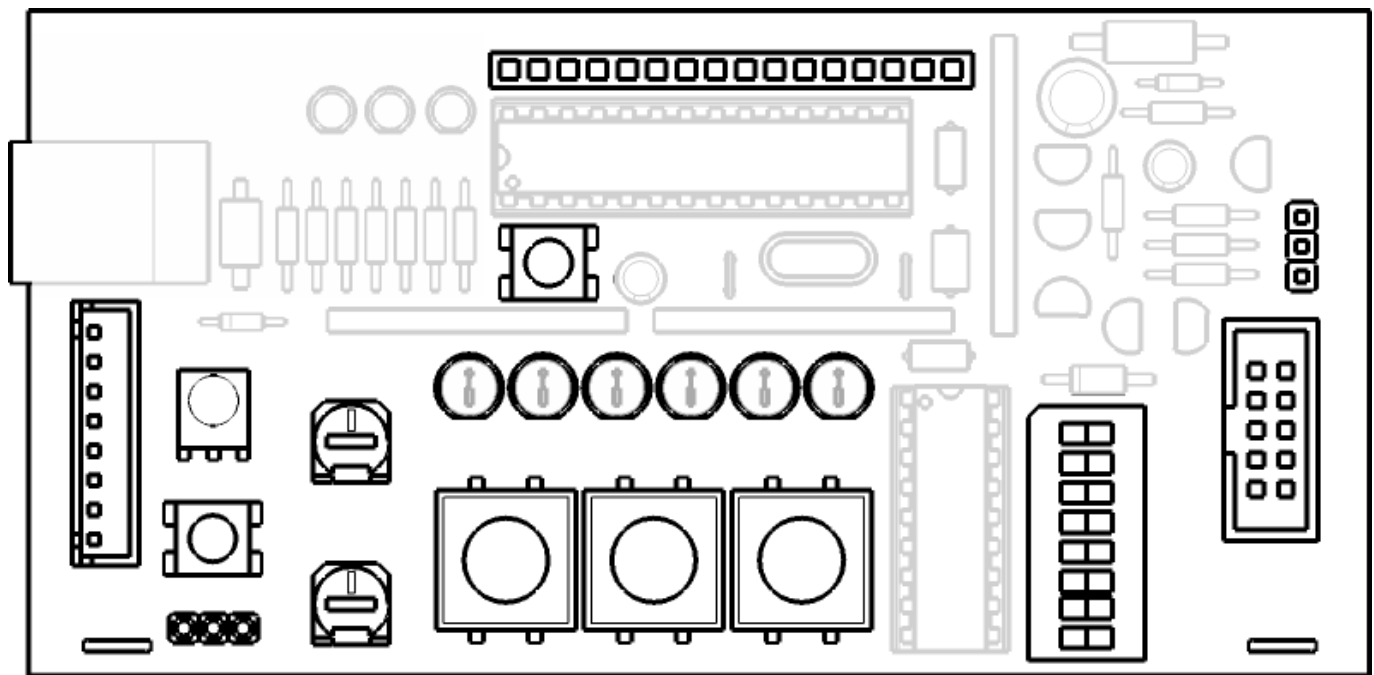
- One button Read / Write .hex files
- TTL Software Terminal UART Tool
- Junebug Diagnostics
- Personalization (you can name your Junebug)
- EEPROM programming support (I2C, SPI & Microwire)
- **New** Logic Tool, with 3 channel Logic Analyzer and I/O tool.

18F1320 Instruction Set

Mnemonic	Description	Operation	Status bits
ADDLW k	Add Literal and W	w + k → destination	C, DC, Z, OV, N
ADDWF f, d, a	Add W and f	w + f → destination	C, DC, Z, OV, N
ADDWFC f, d, a	Add W and Carry bit to f	w + f → destination	C, DC, Z, OV, N
ANDLW k, d	AND Literal and W	w and k → destination	Z
ANDWF f, d	AND W and f	w and f → destination	Z
BC n	Branch if Carry		
BN n	Branch if Negative		
BNC n	Branch if Not Carry		
BNN n	Branch if Not Negative		
BNOV n	Branch if Overflow		
BNZ n	Branch if Not Zero		
BRA n	Branch Unconditionally	Short branch	
BZ n	Branch if Zero		
BCF f, b, a	Bit Clear f	0 → f	
BSF f, b, a	Bit Set f	1 → f	
BTFSC f, b, a	Bit Test f, Skip if Clear	skip if f = 0 (2 Cycles)	
BTFSS f, b, a	Bit Test f, Skip if Set	skip if f = 1 (2 Cycles)	
BTG f, b, a	Bit Toggle f	1 → f	
CALL n, s	Call Subroutine	PC → TOS, k → PC[10:0] PCLATH[4:3] → PC[12:11]	
CLRF f	Clear f	0x00 → f, 1 → Z	Z
CLRWDT	Clear Watchdog Timer	0x00 → WDT, 1 → T0, 1 → PD	T0, PD
COMF f, d	Compliment f	f - 0xFF → destination	Z
CPFSEQ f, a	Compare f with W skip =		
CPFSGT f, a	Compare f with W skip >		
CPFSLT f, a	Compare f with W skip <		
DAW	Decimal Adjust W		C
DECF f, d, a	Decrement f	f - 1 → destination	C, DC, Z, OV, N
DECFSZ f, d, a	Decrement f Skip if Zero	f - 1 → destination skip if result = 0 (2 Cycles)	
DECSNZ f, d, a	Decrement f Skip if Not Zero	f - 1 → destination skip if result = 0 (2 Cycles)	
GOTO k	Go to address	k → PC[10:0] PCLATH[4:3] → PC[12:11]	
INCF f, d	Increment f	F + 1 → destination	C, DC, Z, OV, N
INCFSZ f, d	Increment f Skip if Zero	F + 1 → destination skip if result = 0 (2 Cycles)	
INCSNZ f, d	Increment f Skip if Not Zero	F + 1 → destination skip if result = 0 (2 Cycles)	
IORLW k, d	Inclusive OR Literal with W	w or k → destination	Z
IORWF f, d	Inclusive OR W with f	w or f → destination	Z
LFSR f, k	Move Literal to FSRx	(2 Cycles)	
MOVF f, d	Move f	f → destination	Z

MOVLB k	Move Literal to BSR[3:0]	k → w	
MOVLW k	Move Literal to W	k → w	
MOVWF f	Move W to f	w → f	
MULLW k	Multiply Literal with W	w → f	
NEGF	Negate f		C, DC, Z, OV, N
NOP	No Operation	No Operation	
POP			
PUSH			
RCALL n	Relative Call	TOS → PC, 1 → GIE	
RESET	Software Device Reset		
RETFIE	Return from interrupt	TOS → PC, 1 → GIE	
RETLW k	Return with Literal in W	k → w, TOS → PC	
RETURN s	Return from Subroutine	TOS → PC	
RLCF f, d, a	Rotate Left f through Carry	C << f << C → destination	C, Z, N
RLNCF f, d, a	Rotate Left f (No Carry)	<< f << → destination	Z, N
RLCF f, d, a	Rotate Right f through Carry	C >> f >> C → destination	C, Z, N
RLNCF f, d, a	Rotate Right f (No Carry)	>> f >> → destination	Z, N
SETF f, a	Set f	0xFF → f	
SLEEP	Enter Standby Mode	0x00 → WDT, 1 → T0, 0 → PD	T0, PD
SUBLW k	Subtract W from Literal	k - w → destination	C, DC, Z, OV, N
SUBWF f, d, a	Subtract W from f	f - w → destination	C, DC, Z, OV, N
SUBWF f, d, a	Subtract W from f	f - w → destination	C, DC, Z, OV, N
SWAPFB f, d, a	Swap nibbles in f	f[3:0] → destination [7:4] f[7:4] → destination [3:0]	
TBLRD*	Table read	w xor k → destination	
TBLRD**	Table read	w xor k → destination	
TBLRD*-	Table read	w xor k → destination	
TBLRD**	Table read	w xor k → destination	
TBLWT*	Table write	w xor k → destination	
TBLWT**	Table write	w xor k → destination	
TBLWT*-	Table write	w xor k → destination	
TBLWT**	Table write	w xor k → destination	
TSTFSZ	Test f skip if 0		
XORLW k, d	Exclusive OR Literal with W	w xor k → destination	Z
XORWF f, d	Exclusive OR W with f	w xor f → destination	Z

Template for your projects



Pushbuttons 1 2 3

The pushbuttons require the PICs internal pullups to be enabled.

38KHz IR demodulator

IR1 shares an input pin with pushbutton #1 and can be enabled by turning on DIP switch #6 (IR)

CON3 Auxiliary / EEPROM / Experimenter

Along the top edge of your Junebug is a 16 pin auxiliary connector marked CON3, it's a combination of three connectors and has a variety of functions for the more advanced Junebug experimenter.

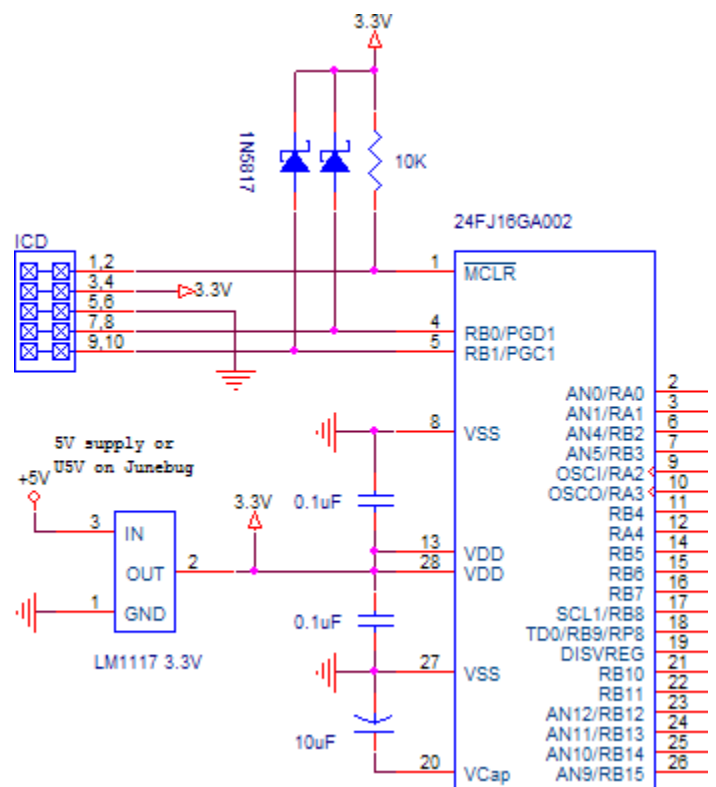
	PIN	Label	Primary 18F2550 Function	PICKit2 2.50			EEPROM	Label (pin)
ICD	1	RE3	MCLR / External VPP	UART TOOL	I/O TOOL	LOGIC ANALYZER	24LCxxx I2C GND (1,2,3) 2K VDD & SCK(5)	25LCxxx SPI VDD (3,7)
	2	U5V	USB 5V					
	3	GND	GND					
	4	RB7	External PGD					
	5	RB6	External PCC					
AUX	6	RB1	SDA	Out1				93LCxxx Microwire VDD (7)
	7	RB0	SCL					
	8	RC7	RX					
	9	RC6	TX					
	10	RC2	CCP1					
PICKit2®	11	VPP	HV 0-15V					
	12	+5V	Switched 100ma USB power					
	13	GND	GND					
	14	PGD**	Program Data					
	15	PGC**	Program Clock					
	16	AUX						

* A pair of 24LC512 EEPROMs

** 4.7K pulldown to GND

Using 3.3V PICs

Shown on the right is a PIC24FJ16GA002



Troubleshooting the Junebugs USB connection

If you get this error when running the PICkit 2 standalone software, here are a couple of quick tests.

"PICkit 2 not found. Check USB connections and use Tools->Check Communication to retry."

1. Check for 5V across the test points U5V and GND
 - Check your solder connections, USB (CON1) & Ferrite Bead (FB1)
2. Hold SW5 down when plugging in the Junebug to the USB port
 - If the BUSY LED does not flash then check the crystal (Y1)
3. Check for 3.3V across the 0.47uf capacitor (C6)
 - The preprogrammed 18F2550 may be blank or defective, contact your supplier for replacement

Junebug LED Demo (MPASM)

```
; *** Junebug 18F1320 LED sequencer demo ***
; Flashes LEDs1 thru 6 from left to right forever
; DIP Switch (SW6) must have TUTOR on (SW6-1,2,3) all other switches off
List      p=18F1320
include <p18F1320.inc>
CONFIG    OSC = INTIO2, WDT = OFF, LVP = OFF
LED      macro    x,y                ; MACRO LED <PORTA>, <TRISA>
        movlw    x
        movwf    LATA                ; LATA = x
        movlw    y
        movwf    TRISA              ; TRISA = y
        call     Delay              ; call the Delay subroutine
        endm                ; end macro
Count     equ 0                    ; delay loop counter
org       0                        ; reset vector
bsf       ADCON1, 0                ; make RA0 digital
LED1      LED b'00000001', b'10111110' ; LED <PORTA>, <TRISA>
LED2      LED b'01000000', b'10111110' ; LED <PORTA>, <TRISA>
LED3      LED b'01000000', b'00111111' ; LED <PORTA>, <TRISA>
LED4      LED b'10000000', b'00111111' ; LED <PORTA>, <TRISA>
LED5      LED b'10000000', b'01111110' ; LED <PORTA>, <TRISA>
LED6      LED b'00000001', b'01111110' ; LED <PORTA>, <TRISA>
        bra      LED1                ; loop forever
Delay     decfsz   Count, f           ; decrement Count and skip when zero
        bra      Delay              ; not zero? repeat
        return                      ; return
END
```

Junebug and other blueromelectronics kits are available at

Retail Sales



255 College St. Toronto

Ontario, Canada

Tel (416) 977-9258

Fax (416) 977-4700

creatronpart@hotmail.com

<http://www.creatroninc.com>

Online Sales



<http://www.robotshop.ca/>

RobotShop Inc.

86 Boul. des Entreprises # 108

Boisbriand, Québec, Canada J7G 2T3

Tel (450) 420-1446

Fax (450) 420-1447

Toll-free (within North America): 1-866-627-3178

eBay Sales

All kits available including bare PCBs

A photograph showing several integrated circuits (chips) and microprocessors, likely the subject of the article.

Shipping worldwide

<http://stores.ebay.ca/Creatron-Electronics>

Dealer Sales & Technical Inquiries



4544 Dufferin St. Toronto

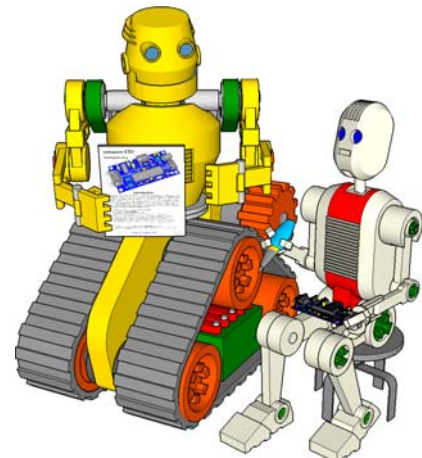
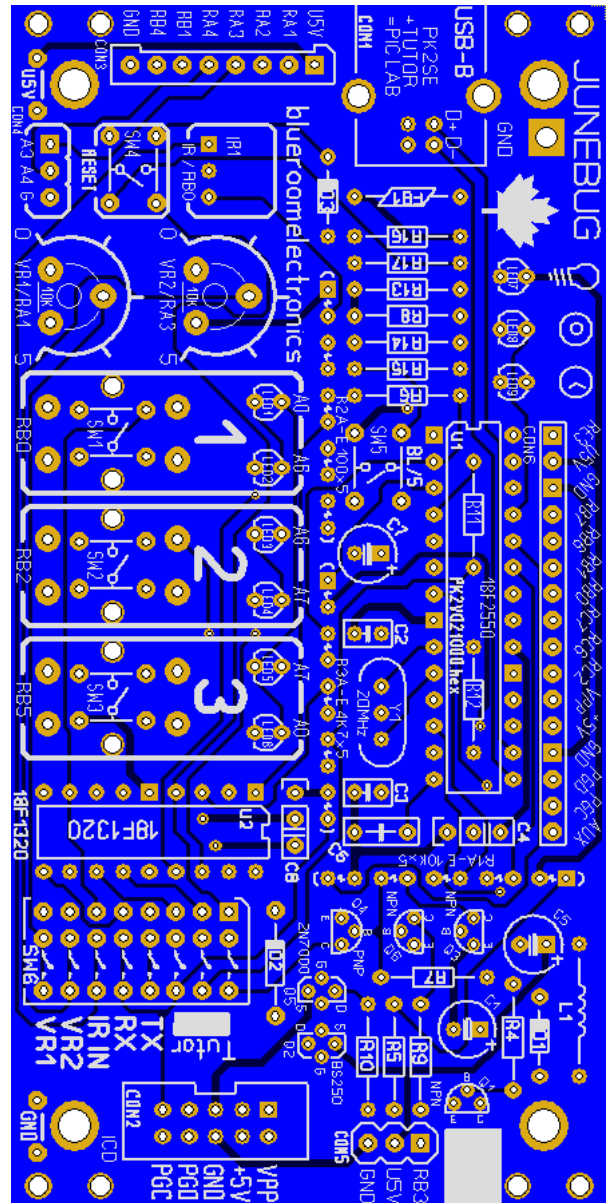
Ontario, Canada

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Smart Kits build Smart People

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revised 4/20/2008