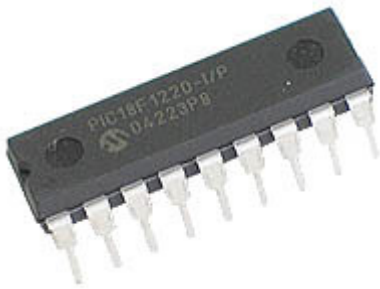
PICSYNTH V3 CHIP
9 Jan 2009.



The PICsynth V3 chip features :

Cool new Arpeggiator
Portamento
Dual oscillators with adjustable pitch Oscillator 1

The chip is designed to be connected to a decoder (74HC154) and standard organ keyboard. It scans the keyboard and produces two oscillators and one trigger output - the chip can be connected to any Waveshaper/VCF/Envelope/VCA circuits to produce a monophonic analog synth.

Full details of an analog synth can be found on www.geocities.com/picsynth/

NEW FEATURES

The chip supports new button matrix to control the Arpeggiator and Portamento :

74HC154 pin	Pin 14	Pin 15	Pin 16	Pin 17
Arpeggiator (oct 4 line)	Off	Up	Down	Up/down
Arpeggiator (oct 3 line)	Slower	Faster	Hold	Release
Portamento (oct 2 line)	Off	Slow	Med	Fast
Future use (oct 1 line)				

When the Arpeggiator is turned on you can press up to 8 keys in a chord pattern and the synth will cycle through the notes repeatedly. The default pattern is up ie lowest to highest note but can be changed to Down or Up/down.

For example if E,G,B,E (E minor chord) are held down and Up/down is selected the notes will be played in order E,G,B,E,B,G,E,G,B,E etc…

Holding down Slower will slow down the arpeggiator, holding down Faster will speed up the arpeggiator. The speed is remembered until next power off.

Pressing Hold will hold the current pattern and lock the keyboard. Pressing Release will clear the pattern and play the new pattern of held down keys. Hold is useful when you want to adjust the sound while the pattern is repeating.

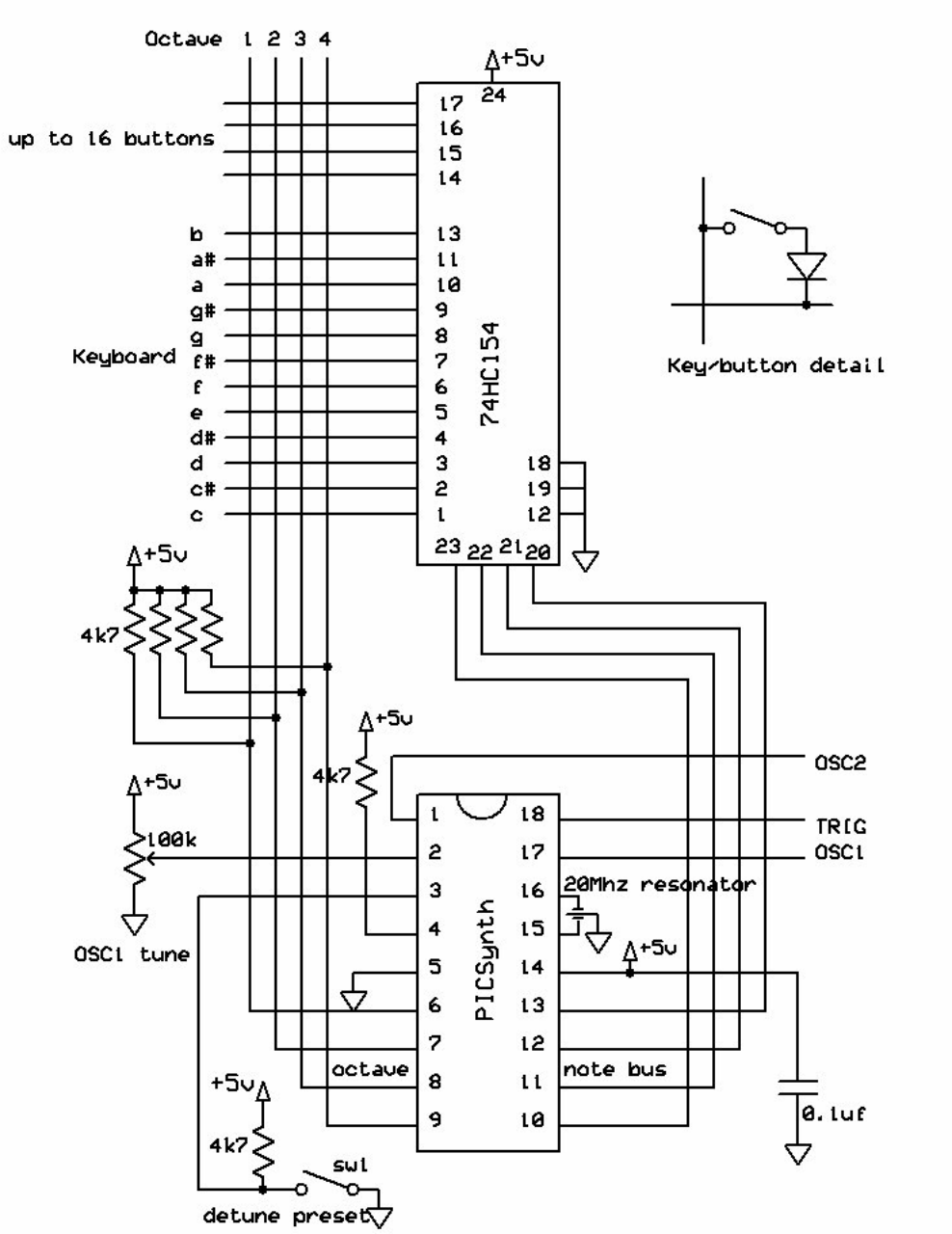
Portamento (or glide) : Portamento is turned on by pressing Portamento Slow, Med or Fast buttons. The notes will glide between each other at the rate selected.

PIN CONNECTIONS

The chip is an 18 pin package as pictured.

PIN 1 is oscillator 2 output
PIN 2 is pitch adjust pin. PIN 2 should be connected to analog voltage from 0-5v to adjust pitch of oscillator 1.
2.5V is the center position. For example connect to slider of a 100K linear pot connected between 0 and 5V.
PIN 3 is detune1 option. Normally this is made high. A low on this PIN will provide a nice close detune option across all octaves. The pitch adjust (PIN2) is disabled when PIN 3 is made low.
PIN 4 is PIC reset and should be made high.
PIN 5 is ground.
PIN 6-9 are "octave sense" lines. Pin 6 is referred to as octave 1. Pin 9 is referred to as octave 4.
PIN 10-13 is the "note bus". Pin 10 is least significant bit.
PIN 14 should be connected to regulated +5v
PIN 15 and PIN 16 should be connected to the outer pins of a ceramic oscillator.
The center pin of the ceramic oscillator is grounded.
PIN 17 is oscillator 1 output.
PIN 18 is trigger output.

The new button matrix is connected between 74HC154 pins and octave lines ie just like extra keys on the keyboard. For example when you press Arpeggiator Off button it should connect PIN 14 line of 74HC154 to octave 4 line - there must be a diode in series with each switch (cathode to 74HC154 line).



PICsynth chip and companion 74HC154

HOW THE CHIP WORKS

The PICSynth chip needs to be connected to a 20 Mhz ceramic resonator. It produces notes in range C6 (1046 Hz) - B6 (1975 Hz) by default. The actual chip supplied will be a pic18F1220 - the chip is supplied with code protect on.

The PIC outputs continuous square waves on both oscillator pins : the chip was intended to be used with a waveshaper to produce other waveforms. The PIC chip note bus cycles from 11 to 0 using postive logic. This corresponds to notes B through C. The note bus is decoded by 74HC154 decoder to 1 of 16 lines (74HC154 has negative logic output ie lines go low).

The PIC chip checks for Octave sense lines 1 thru 4 going low. The octave lines should be tied to +5V via a resistor. When a key is pressed and PIC is outputting that note on note bus, the octave line that the key is connected to will go low. The PIC checks for a low on octave sense line after every change of note on note bus. When a low octave line is found the pitch will change to the correct note in the correct octave. The PIC chip then makes trigger line high for 12 ms. This trigger pulse normally triggers an envelope generator. The PIC chip then cycles back to the start and rescans from highest note again.

Some things to note :
If the key is held down then the PIC will continue to issue trigger pulses.
If two keys are held down then the top key will be the note output.
If you hold down a low key to make a low note then press a high key the higher key will take over - the pitch changes.
If you hold down a high key and press a lower key then nothing will change ie the lower key wont be scanned until you release the higher key.
When Arpeggiator is turned on the keyboard is scanned in a similar way except up to 8 notes are scanned in one pass down the keyboard - they are then played in a pattern.

In my circuit each oscillator output is connected to a 4520 divider and range is selected via a High/Med/Low switch.

So If a key is pressed in octave 4...
The divide by 2 output produces C5 (523 Hz) to B5 (987 Hz) - H position.
The divide by 4 output produces C4 (261 Hz) to B4 (493 Hz) - M position.
The divide by 8 output produces C3 (130 Hz) to B3 (246 Hz) - L position.

If the key is pressed in octave 3 everything gets divided by 2 etc
So with a 4 octave keyboard I get
H = C2,C3,C4,C5
M = C1,C2,C3,C4
L = sub octave, C1,C2,C3

The reason PIC only produces C6-B6 in highest range is to do with speed of PIC chip. Higher notes are more difficult to get at right pitch.

Above discussion relates to perfect pitch ie PIN2 at 2.5V and PIN 3 high. The pitch of oscillator 1 can be varied by altering voltage on PIN2 or by making PIN 3 low for a fixed detune. When combined with fixed pitch oscillator 2 you get rich beating interactions.