4x4 LOGIC Build Manual (03/12/11)

nonlinearcircuits

MODULE DESCRIPTION:

There are 4 separate but identical circuits on the PCB. Each one can be built using a different CMOS chip for a variety of logic functions. So long as the CMOS chips are in sockets it is easy to change chips to get different logic operations

Suitable chips are

4001 NOR

4011 NAND

4071 OR

4081 AND

4077 XNOR

4030 or 4070 XOR

For me, the OR, XNOR & XOR chips are the most interesting.

What makes these circuits a little different is the way the inputs and outputs are related.

There are four inputs, call them A, B, C & D, say we have an XOR chip installed and signals on all four inputs

Output 1 will be A xor B

Output 2 will be B xor C

Output 3 will be C xor D

Output 4 will be D xor A

The important point is that your four output signals are all related to each other, this will be apparent when using the module with audio rate signals or to create complex gate sequences.

Of course you can just use inputs A and B to get a regular logic function from output 1 (or inputs C & D and output 3)

The input signals can be pretty much anything that crosses 1.1V. Outputs will be 6V.

As mentioned audio rates are fine, XOR chips give a crude but useful ring modulation effect.

BUILDING IT:

The set of three PCBs are designed to connect together using two sets of 40 pin connectors

At Futurlec these are

FHEADD40 40 Pin .100 Straight Female Double Headers

and

HEADRAD40 40 Pin .100 Right Angle Double Headers

LEDs are mounted directly on the breakout boards and inserted into LED holders on the panel. Jacks are connected to the breakout boards using wire clippings. There is a single hole on the main PCB to hold it in place with a stand-off to the panel. The combination of 16 LEDs mounted on the panel, 32 jacks connected by clippings, two 40 pin connectors and a standoff; results in a stable and strong mount for the PCB…..providing you don't sit on it.

The panel design is below, it is not to scale. If you want the FrontPanelExpress file; pm/email me.

Basically there are 8 jacks per column spaced 0.75 inch apart. The jack columns are spaced 1 inch apart. The two LED columns are 0.5 inch from each jack column (ie. in the middle)
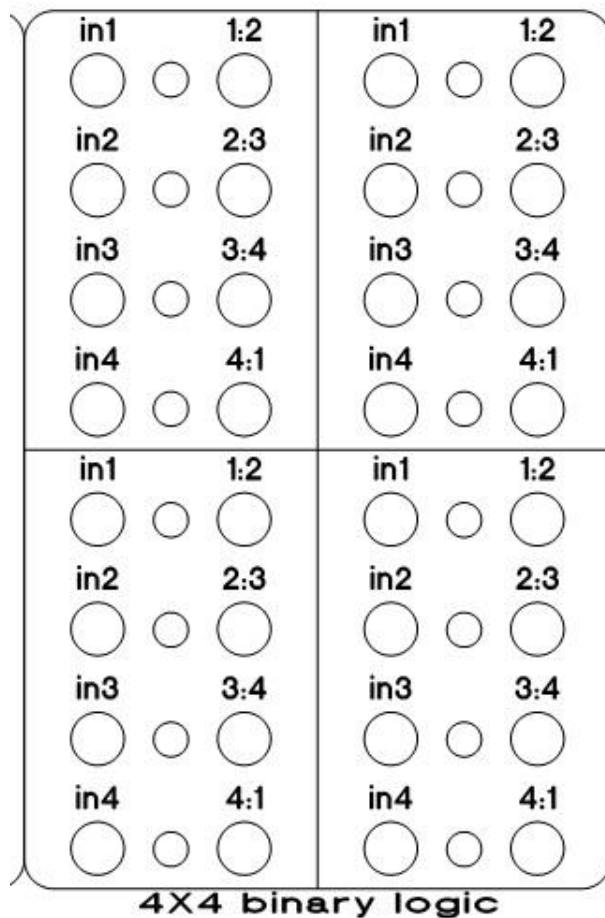
REFER TO THE SILKSCREEN IMAGE BELOW FOR THESE COMMENTS

There are 16 regular diodes marked below in red, 1N4148 are fine. It is a bit hard to see on the PCB but there is an arrow indicating direction. All of them are sitting close to pins 1, 7, 8 & 16 of each op amp, in every case the anode is closest to the op amp.

Anode ➡ Cathode

Here is the main info

All resistors marked with a "+" are 1kΩ, usually the 1kΩ resistors are arranged in groups of 6 close to a pair of transistors….must be about 100 of them. If you use superbright LEDs you will need to change two of the 1k resistors in each batch of 6 to reduce LED brightness…..have fun working that out

All unmarked resistors are 100kΩ

All 1206 SMD resistors to be placed under the PCB are 100kΩ, there are approx. 32 of these…give or take

All unmarked capacitors are for decoupling; 10nF - 100nF would suitable

The decoupling caps have a tight spacing of 2.5mm, I use these ones from Futurlec:

C100UC 0.1uF 50V Ceramic Capacitors

The three electro caps are all 10uF, get ones with 25V or higher rating.

<u>All 16 transistors are NPN</u>, the pinouts suit BC547. Any general purpose transistor will work.
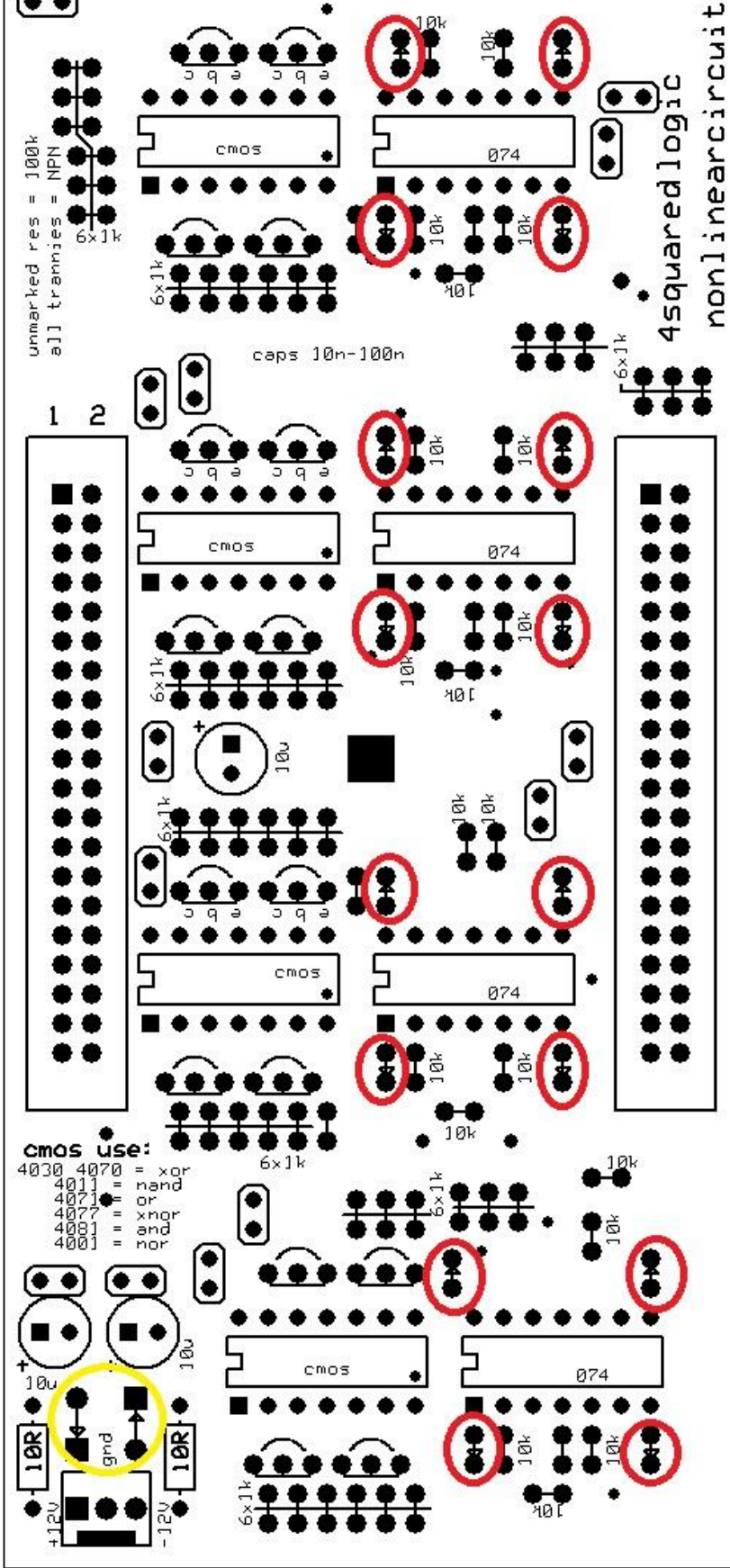
A few transistors have "ebc" to indicate the pinout.

There are two 1N4004 diodes near the power connector, marked with a yellow circle. These are to protect against the power be connected wrongly, leave them off if you like. They do nothing in normal operations.

Other resistors are two 10Ω and about twenty 10kΩ

The four op amps are TL074, TL084 will be fine too

The four CMOS chips have been discussed, choose your own
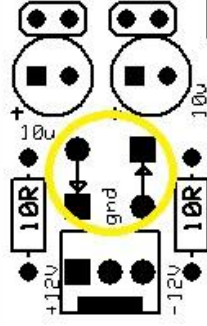
"I form the light and create darkness"

10k
10k
10k
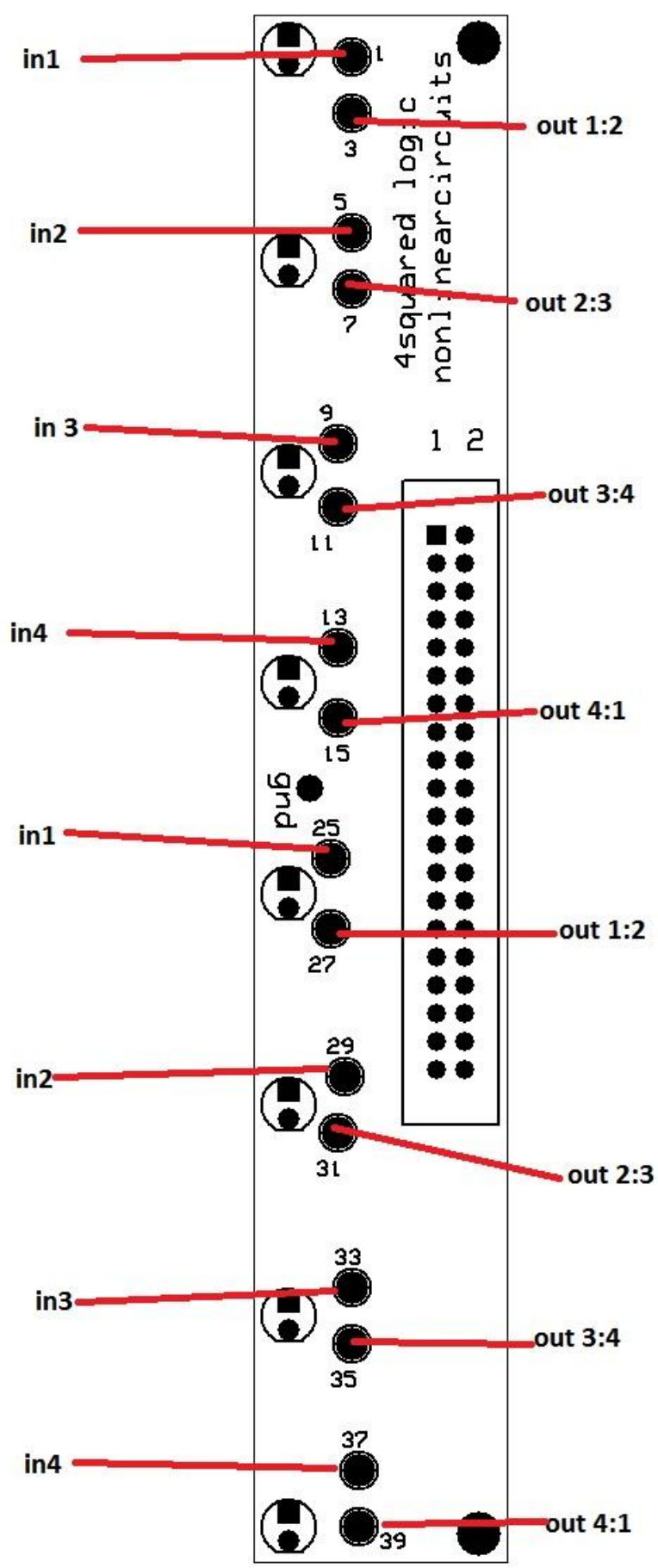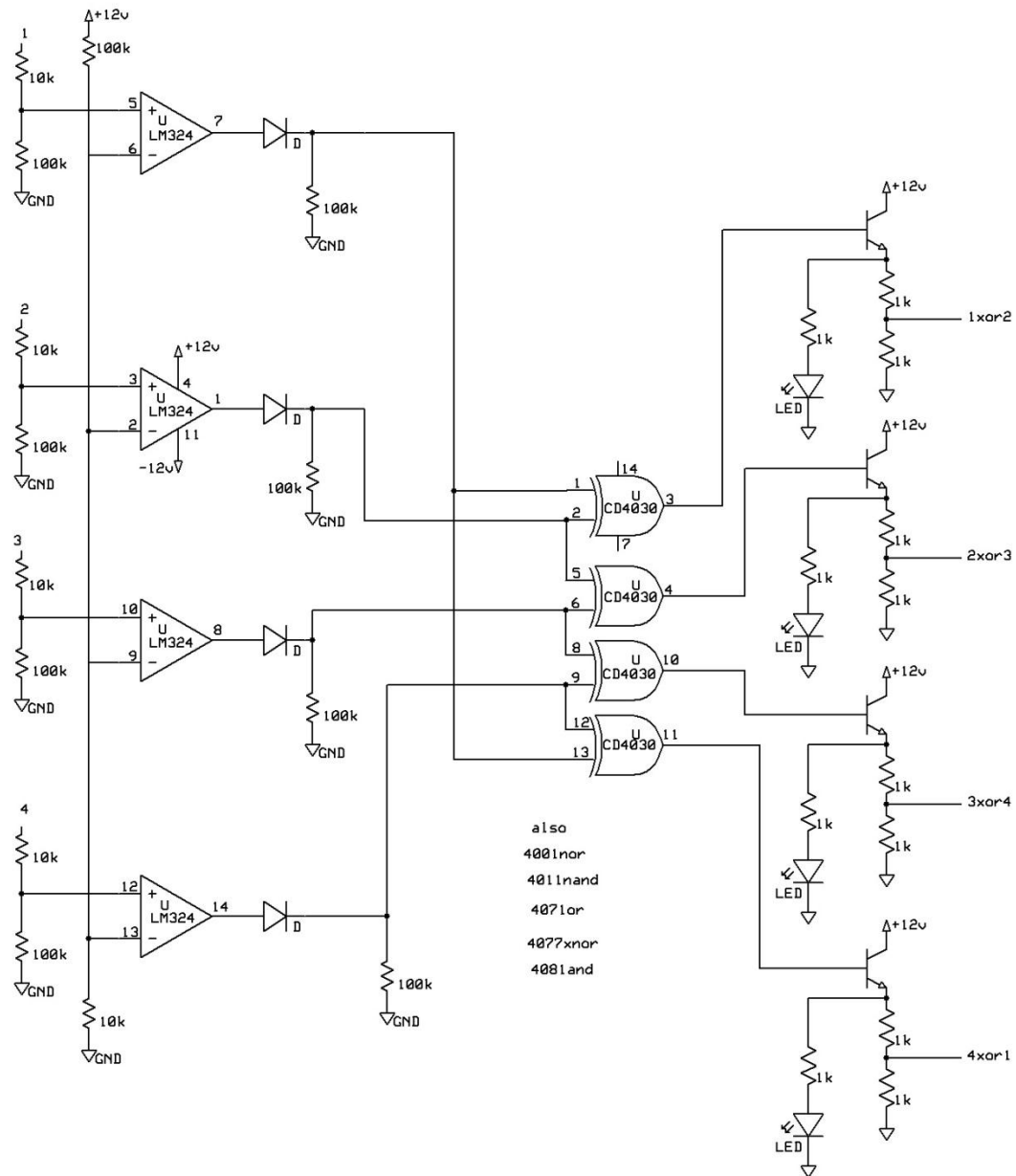cmos
074

unmarked res = 100k
all trannies = NPN
6x1k

6x1k
caps 10n-100n
6x1k
10k
10k
10k

4squaredlogic
nonlinearcircuits

1 2
10k
10k
cmos
074
6x1k
10k
10k
10k
6x1k
+
10u
10k
10k
6x1k
e b c e b c
cmos
074
10k
10k
10k

cmos use:
4030 4070 = xor
4011 = nand
4071 = or
4077 = xnor
4081 = and
4001 = nor

6x1k
10k
10k
10k
10k
10k

10u
+
10u
gnd
10R
10R
+12v -12v

6x1k
cmos
074
10k
10k
10k

in1

out 1:2

4squared logic
nonlinearcircuits

in2

out 2:3

in 3

1 2

out 3:4

in4

out 4:1

gnd

in1

out 1:2

in2

out 2:3

in3

out 3:4

in4

out 4:1

nonlinearcircuits

4x4 Logic

AndrewF	Rev 1.0	Page # or name
	28/07/2011	

also
4001nor
4011nand
4071or
4077xnor
4081and

1xor2
2xor3
3xor4
4xor1

REPEAT FOUR TIMES