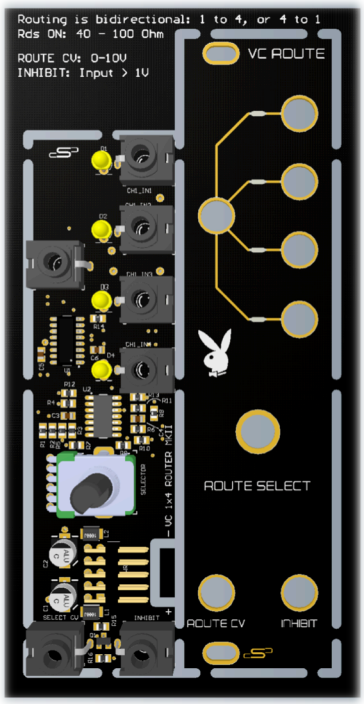
VC Route

DIY Workshop - Voltage Controlled 1x4 Router Module

Raffael Segmüller - © by Seismic Industries

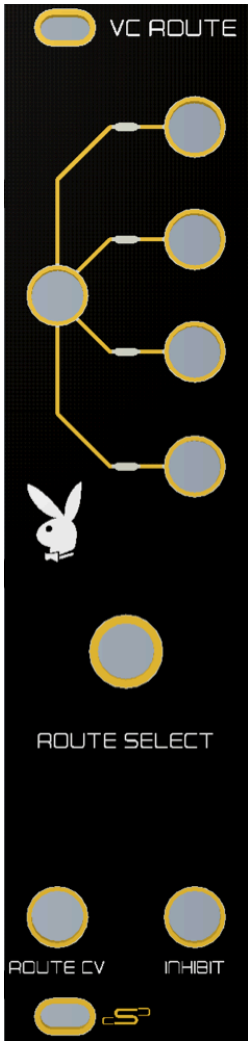


Inhalt

1 Module Description

The VC Route module is a based on the DG409 CMOS Analog Multiplexer from Intersil.

It has a 1to4 or vice versa architecture. Signals can be fed in both directions. Switching frequencies of several kHz is no problem for the circuit.



The **1to4 / 4to1** input jacks are used for the signals to be processed.

The **ROUTE SELECT** potentiometer sets the multiplexer channel manually and is summed with the voltage present at the **ROUTE CV**.

The **ROUTE CV** input is used to choose the corresponding switch in the multiplexer channel.

The **INHIBIT** is used to disable the routing function of the modules. All switches are isolated when a logic high (>1V) is present.

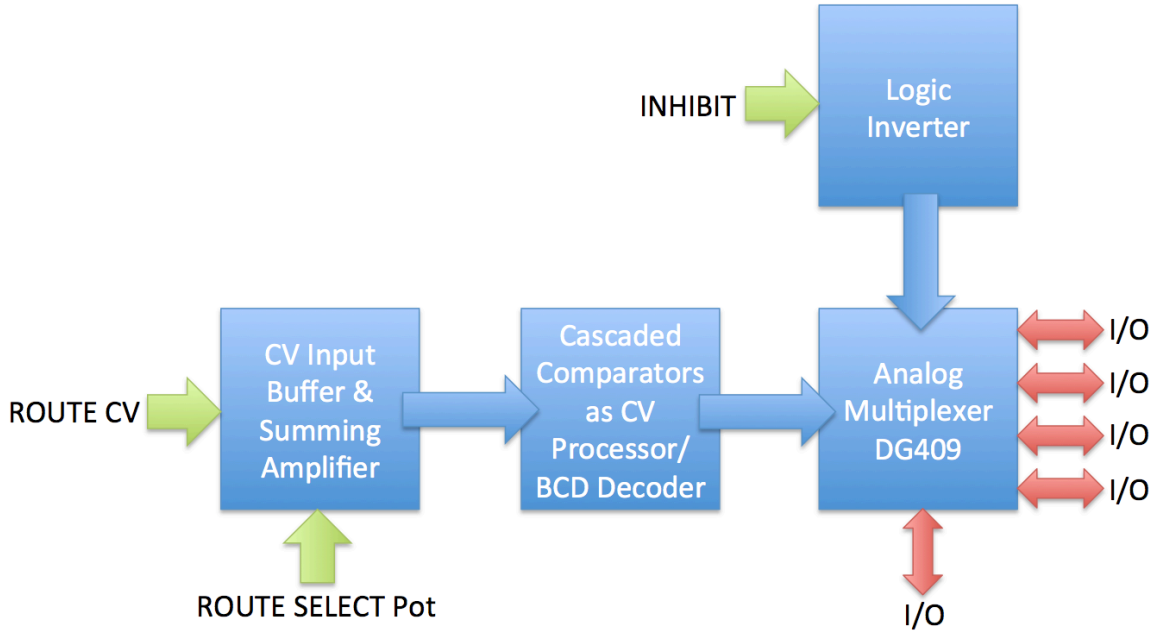
The module can be used for many purposes. For example:

- Choose waveforms from an oscillator
- Choose Filter Output (or Input) characteristics from a State Variable Filter
- Multiplexing
- Patch Variations (Open/Closed Hihats, something like that)
- By chaining two VC Route modules "back2back2" (4to1, 1to4) you can achieve complex source destination scenarios with lots of possibilities.

2 Circuit Description

The circuit can be divided into 4 main function blocks:

- CV Input Buffer / Summing Amplifier
- Cascaded Comparator / BCD Decoder
- Logic Inverter
- Analog Multiplexer



2.1 CV Input Buffer / Summing Amplifier

A CV Input Buffer (U2A) is used to achieve high input impedance for the ROUTE CV input. The summing Amplifier (U2B) allows for manual dial and simultaneous voltage control of the Routing Path.

Resistors R4 and R5 can be changed to allow for different input sensitivities. Initial configuration is 0-10V (2.5V window for each stage)

2.2 Cascaded Comparator / BCD Decoder

Two comparators (U2C & U2D) are used to decode the analog CV voltage into a 2Bit BCD signal for driving the digital decode circuit of the DG409.

2.3 Logic Inverter

The Logic Inverter circuit is necessary to modify the DG409 ENABLE input into a more usable INHIBIT input, to grant a "normally ON" working mode rather than "normally OFF".

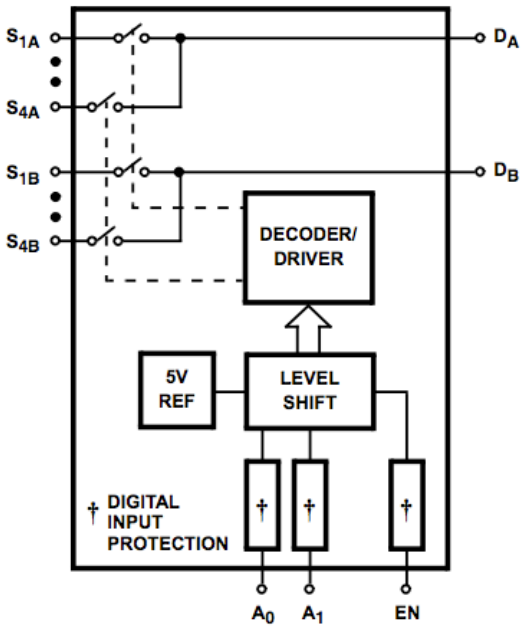
It is simply made of a single NPN Transistor.

2.4 DG409

Some of you may know the CD405x Analog Multiplexers, which in fact is quite similiar, but has some disadvantages. For example the CD405x does not allow you to process negative voltages below -1V. You can of course use some special circuit design to achieve this function with the CD405x, but it will make your circuit more complicated and requires more parts.

Therefore the DG409 was chosen over the CD4052. The DG409 had more improvements, it has lower ON resistance and faster switch transition time.(t_{TRANS} < 250ns).

The DG409 offers differential 4 channel analog CMOS multiplexers and a TTL/CMOS compatible digital decode circuit for channel selection, a voltage reference for logic thresholds and an ENABLE input for device selection when several units are present.



In the VC Route module - instead of using the two channels for differential multiplexing - one channel is used to process the actual I/O signals. The second channel is used to turn the LED's, which display the current dialed route, ON and OFF.

3 Build Instructions

3.1 Tools

Make shure you have the following tools ready:

- Soldering Iron
- Solder wire, solder wick
- Tweezers
- Side cutting plier (to cutout the PCB and frontpanel)
- Sanding Paper (for smoothing the cut edges of the PCB and frontpanel)

3.2 Build up sequence

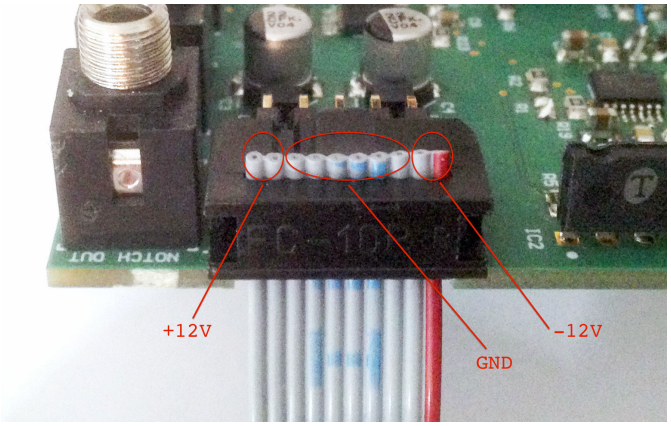
When building the kit you preferably start with the SMT components and then move on to the bigger THT ones.

A possible build up sequence is:

1. Semiconductors (like IC's, Transistors, ...)
2. Ceramic Capacitors
3. Resistors
4. Inductors
5. Electrolytic Capacitors
6. Power Connector
7. Jacks
8. LED's
    a. Cutout the frontpanel and premount it to define the length of the leds legs
    b. Solder and cut the legs
    c. Then remove the frontpanel
9. Potentiometers
10. Mechanical
    a. Mount the frontpanel
    b. Tighten the knurled nuts of the jacks
    c. Fasten the knobs of the potentiometers

3.3 Power Connection

Connect the 10 pin ribbon cable like this:



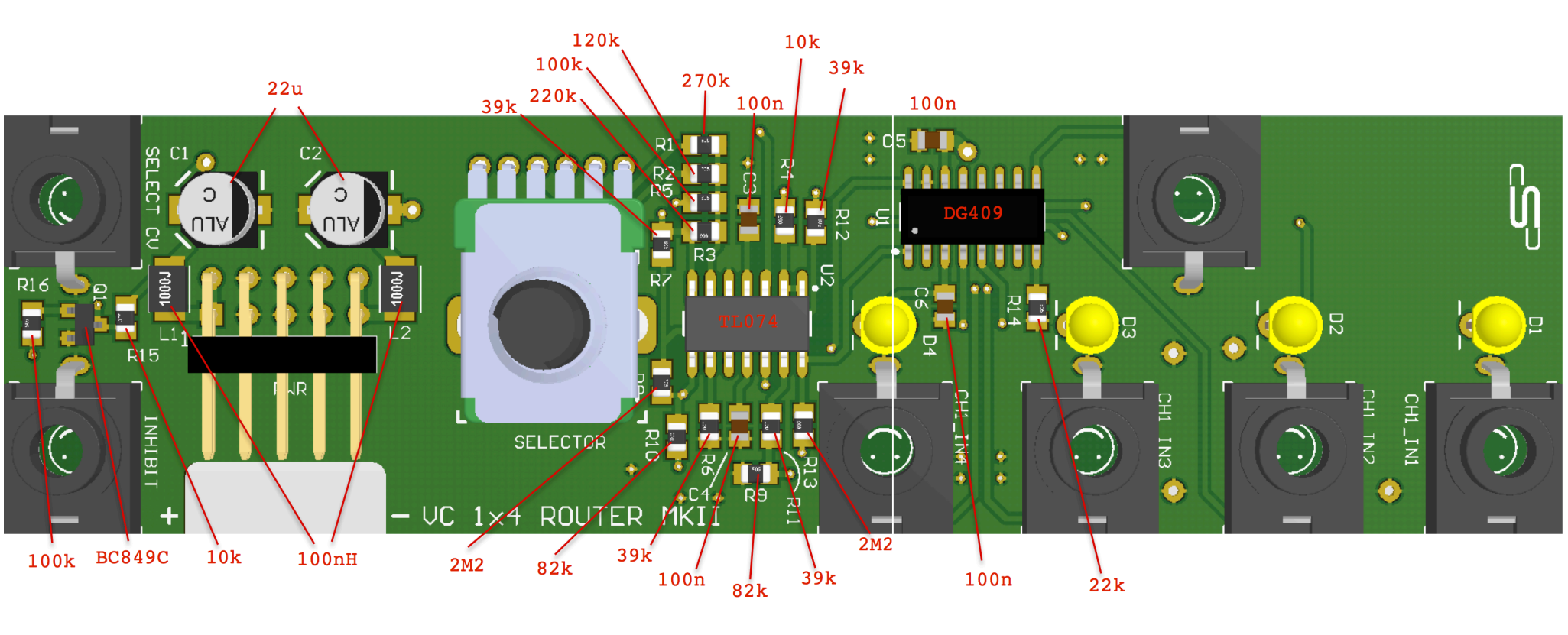
IMPORTANT:

The red wire usually carries the -12V Signal in Eurorack synthesizers. Doublecheck your power rails before powering the module up. Power inversion will destroy your module.

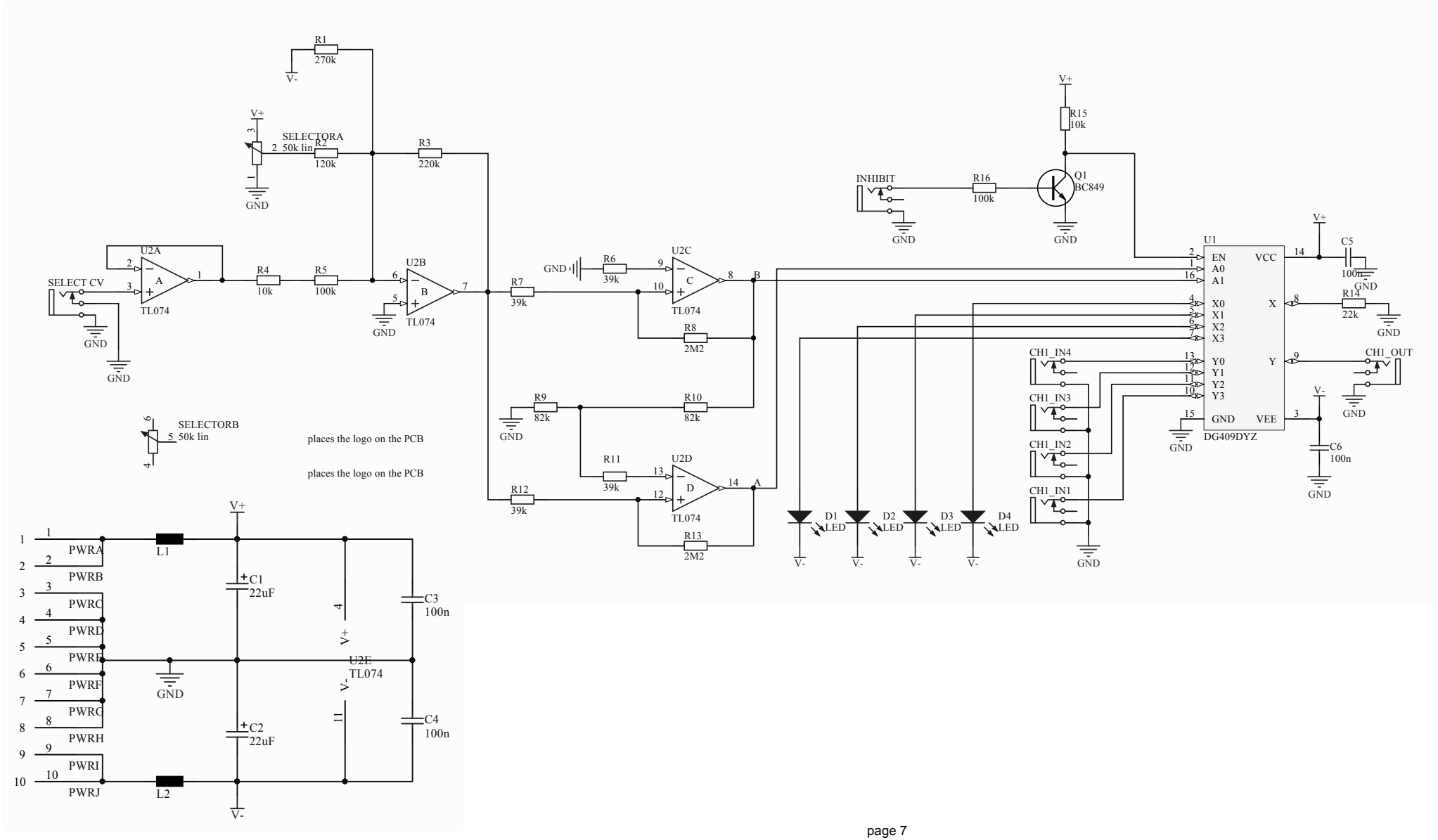
4 BOM

Comment	Designator	Qty	Value	Supplier	Mouser Part Nr
CAP PSU	C1, C2	2	22uF	Mouser	667-EEE-FK1C220R
Capacitor 0805	C3, C4, C5, C6	4	100n		
Phonejack	CH1_IN1, CH1_IN2, CH1_IN3, CH1_IN4, CH1_OUT, INHIBIT, SELECT CV	7		SI	
LED	D1, D2, D3, D4	4		Mouser	859-LTW-420D7
Inductor 100nH	L1, L2	2	100nH	Mouser	NLCV32T-R10M-PFR
Pinhead 10Pole	PWR	1			
BC849C NPN	Q1	1		Mouser	771-BC849C-T/R
Resistor 0805	R1	1	270k		
Resistor 0805	R14	1	22k		
Resistor 0805	R2	1	120k		
Resistor 0805	R3	1	220k		
Resistor 0805	R4, R15	2	10k		
Resistor 0805	R5, R16	2	100k		
Resistor 0805	R6, R7, R11, R12	4	39k		
Resistor 0805	R8, R13	2	2M2		
Resistor 0805	R9, R10	2	82k		
Pot Stereo 50k lin	SELECTOR	1	50k lin	SI	
DG409DYZ	U1	1		Mouser	968-DG409DYZ
TL074	U2	1		Mouser	511-TL074ACDT

5 Pick&Place


120k
100k
220k
39k
270k
100n
10k
39k
100n
22u
C1
C2
C3
C4
C5
C6
R1
R2
R3
R4
R5
R6
R7
R9
R10
R11
R12
R13
R14
R15
R16
Q1
L1
L2
U1
U2
DG409
TL074
SELECTOR
INHIBIT
PWR
SELECT CV
CH1_IN4
CH1 IN3
CH1 IN2
CH1_IN1
D1
D2
D3
D4
VC 1x4 ROUTER MKII
100k
BC849C
10k
100nH
2M2
82k
39k
100n
82k
39k
2M2
100n
22k

6 Schematic


R1
270k
V-
V+
SELECTORA
50k lin
R2
120k
R3
220k
GND
U2A
TL074
SELECT CV
R4
10k
R5
100k
U2B
TL074
R6
39k
U2C
TL074
R7
39k
R8
2M2
R9
82k
R10
82k
R11
39k
U2D
TL074
R12
39k
R13
2M2
SELECTORB
50k lin
places the logo on the PCB
places the logo on the PCB
INHIBIT
R16
100k
Q1
BC849
R15
10k
U1
EN
A0
A1
X0
X1
X2
X3
Y0
Y1
Y2
Y3
VCC
X
Y
VEE
GND
DG409DYZ
C5
100n
R14
22k
CH1_OUT
C6
100n
CH1_IN4
CH1_IN3
CH1_IN2
CH1_IN1
D1
LED
D2
LED
D3
LED
D4
LED
PWRA
PWRB
PWRC
PWRD
PWRE
PWRF
PWRG
PWRH
PWRI
PWRJ
L1
L2
C1
22uF
C2
22uF
C3
100n
C4
100n
U2E
TL074