OPIC Project – Adjustable Voltage Multiplier

Stripboard version for LDC capsule

Designed to fit into a BM800 or Neumann 'style' body

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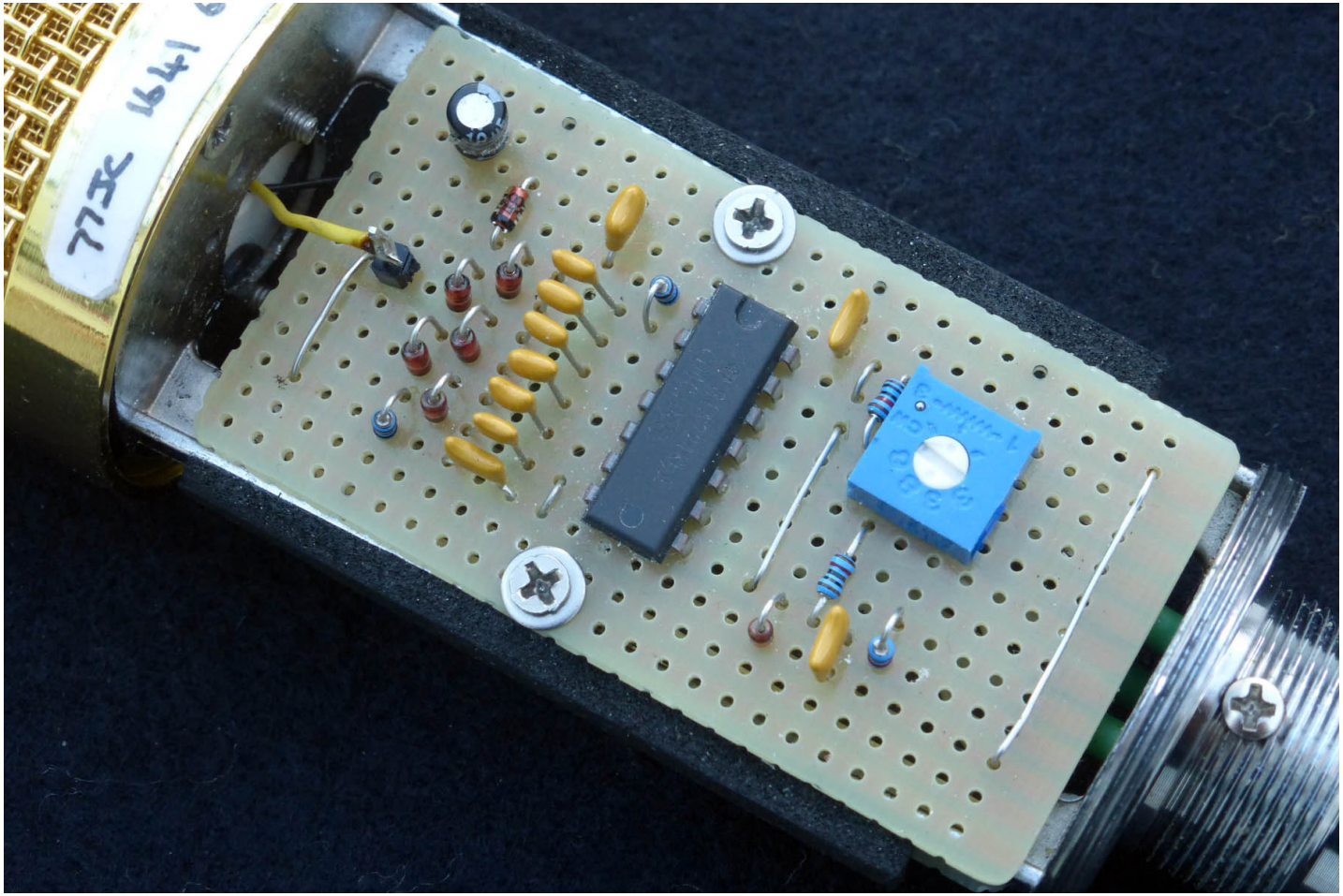
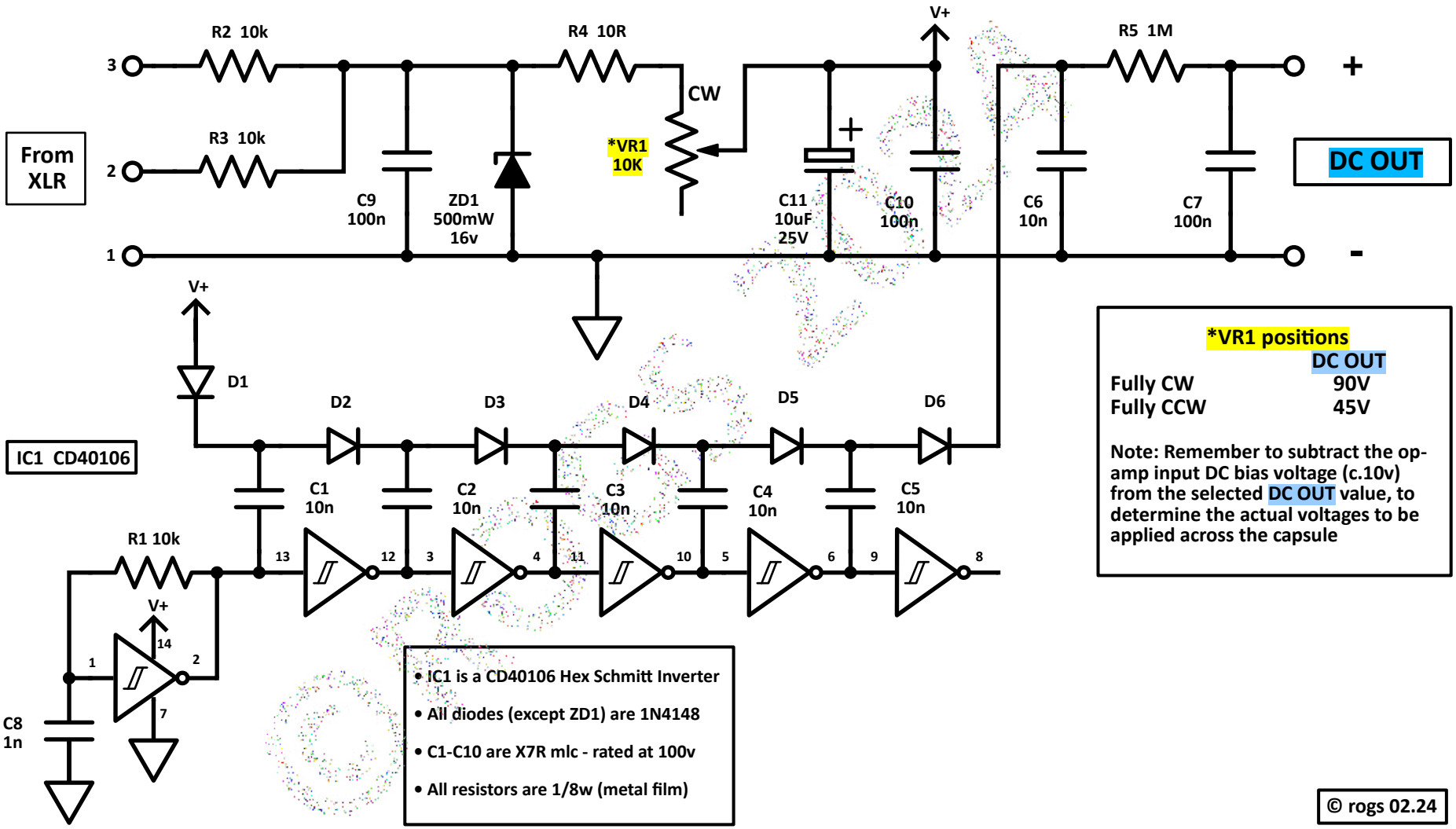


CD40106 ADJUSTABLE DC VOLTAGE MULTIPLIER (45 TO 90V range)
Schematic Diagram



***VR1 positions**

	DC OUT
Fully CW	90V
Fully CCW	45V

Note: Remember to subtract the op-amp input DC bias voltage (c.10v) from the selected DC OUT value, to determine the actual voltages to be applied across the capsule

- IC1 is a CD40106 Hex Schmitt Inverter
- All diodes (except ZD1) are 1N4148
- C1-C10 are X7R mlc - rated at 100v
- All resistors are 1/8w (metal film)

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OPIC Adjustable Voltage Multiplier Circuit Description

Overview:

The circuitry shown in the schematic is designed to provide a high voltage DC output - between 45v and 90v - to be applied as the polarisation voltage required by a conventional condenser microphone capsule.
(Note that this facility is not required for electret capsules, which are pre-polarised as part of their manufacturing process)

This particular circuit uses a single CD40106 Schmitt Hex inverter IC - working as a Dickson Charge Pump - to generate a maximum 90v DC output from a 16 volt regulated DC supply input.

You can find more details of the Dickson Charge Pump concept here:

https://en.wikipedia.org/wiki/Voltage_multiplier#Dickson_charge_pump

Circuit description:

In this schematic, an oscillator running at c.125KHz is formed by R1, C8 and pins 1 and 2 of a CMOS CD40106 Hex inverter IC.
All 6 inverters - including the oscillator - are connected serially, with each output connected to the following input. The output of the final stage is not used. The particular order of serial connection is not critical, and is selected here to simplify the stripboard layout.

Each sequential output will provide an opposite polarity output signal to the previous stage, thus providing the 2 alternate polarity clocks required to create a voltage multiplying charge pump.

Each in/out junction is further connected to one terminal of a 10nF capacitor, the second terminal of which is connected to a diode 'chain' formed by a series of 1N4148 diodes, D1 to D6.

This arrangement will permit the DC supply to the IC to be multiplied, with each diode stage adding c.15V to the output of the previous one, so that the voltage at the cathode of the final diode - D6 - is within the range 45v to 90v DC, depending on the position of VR1, the output calibration potentiometer.

The output DC from D6 cathode is decoupled by C6, and then further filtered by the low pass filter formed by R5 and C7. The value selected for this filter will attenuate the ultrasonic clock pulses at c.125KHz by around 95dB, to provide a low ripple DC polarisation voltage for the capsule.

Note that the final DC output has a high impedance because of the value of R5, but as the load is only the mic capsule – which is essentially just a capacitor – there is very little drop in output voltage from the DC value measured at the cathode of D6, with respect to 'ground' (-V).

However, you will observe a drop in DC value of around 10% if you attempt to measure the value at the R5 - C7 junction with a conventional DMM, which is likely to have an impedance of around 10MΩ.

The circuit is powered by 48v phantom power. Feed resistors R2 and R3 take the phantom power voltage from both terminals of the balanced XLR plug. The Zener diode ZD1 will set the voltage at the junction of the 2 feed resistors to 16v. In total around 2.5mA is drawn from the phantom power supply – around 1.5mA for the CD40106 and around 1mA by the zener diode.

The exact value of the DC output at D6 cathode (the best place to measure it accurately with a DMM) will depend on the setting of VR1.
In a fully clockwise position (CW), the DC level measured will be c.90V.
In the fully counterclockwise (CCW) position, the value will be around 45V.

The actual DC supply voltage at pin 14 of the CD40106 hex inverter IC will vary between c.8v and 16v, depending on the position of VR1.

It should be noted that the latter few stages of the multiplier can develop up to 90v DC across the 10nF capacitors in the multiplier chain - and this is also true of C9 and C10.
It is recommended that all the capacitors C1 thru C10 are all rated at 100v to simplify things.
(If it is necessary to include 63v capacitors, then only C4,5,6 & 7 actually need to have a 100v rating.)

Remember to subtract the value of the OPA1641 op-amp 'half rail' input DC bias (c.10v) from the selected DC multiplier output voltage, when calculating the actual DC voltage being applied across the capsule.

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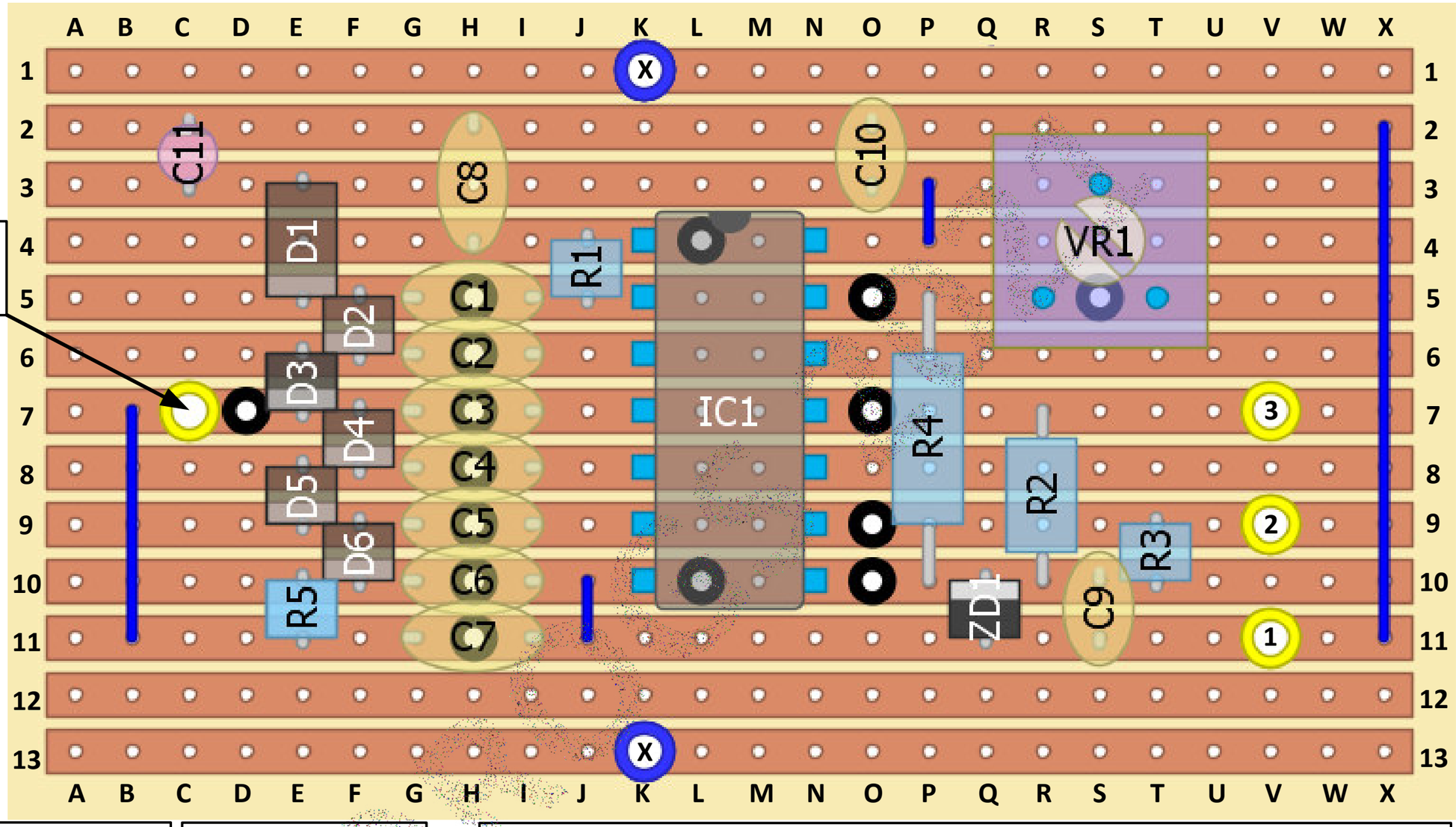
OPIC: 40106 Adjustable Voltage Multiplier - Complete stripboard component layout •• VIEWED FROM COMPONENT SIDE ••



- Adjust VR1 to obtain required DC output level
- Max. voltage in fully clockwise (CW) position

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- K1 and K13 ('X') are mounting holes
- 4 x TCW wire links - TCW25 or similar (marked as blue lines on schematic)
- 15 x track cuts - use track cutter or drill bit (marked as black & white dots on schematic)

Fit the components to the locations listed below:

- C1 10nF mlc (G-I,5)
- C2 10nF mlc (G-I,6)
- C3 10nF mlc (G-I,7)
- C4 10nF mlc (G-I,8)
- C5 10nF mlc (G-I,9)
- C6 10nF mlc (G-I,10)
- C7 100nF mlc (G-I,11)
- C8 1nF mlc (H2,H4)
- C9 100nF mlc (S10,S11)
- C10 100nF mlc (O2,O3)
- C11 10uF 16v elec (C3+,C2)

Resistors are 1/8w metal film

- R1 10k (J4, J5)
- R2 10k (R7, R10)
- R3 10k (T9, T10)
- R4 10R (P5, P10)
- R5 1M (E10, E11)

- **n.b. C3 thru C10 (mlc) capacitors are 100V X7R**

- **Diodes D1-D7 are 1N4148 (anode location 1st)**
- D1 (E3,5) • D2(F5,6)
- D3 (E6,7) • D4 (F7,8)
- D5 (E8,9) • D6 (F9,10)
- ZD1 16v 500mW zener: (Q11(a),Q10(k))
- IC1 CD40106 **(Pin1 – K4)**
- VR1 10K – R5,S3,T5