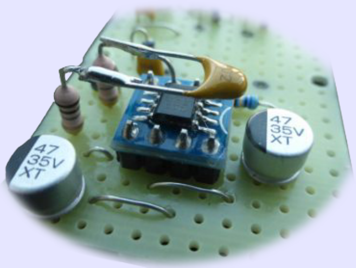
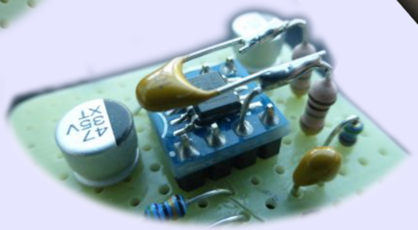
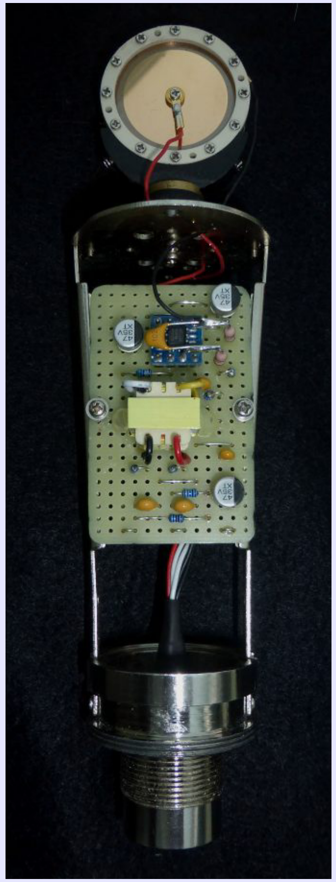
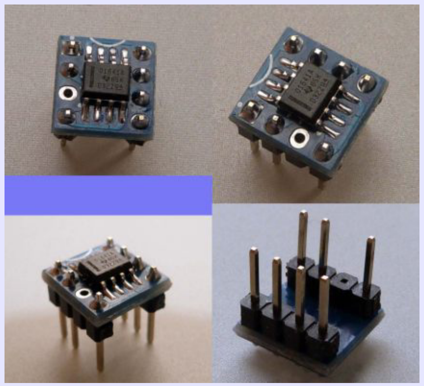
• OPIC.45TX - Op-amp Impedance Converter - with Adjustable Dual Output Voltage Multiplier •

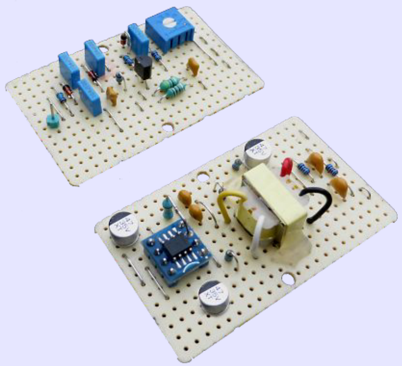
- ***Transformer coupled fully balanced output***
- ***Multi-pattern Version for Dual Sided LDC capsules***
- ***Updated strip boards – simplified construction***
- ***Designed to fit into a U87 or BM800 style body***







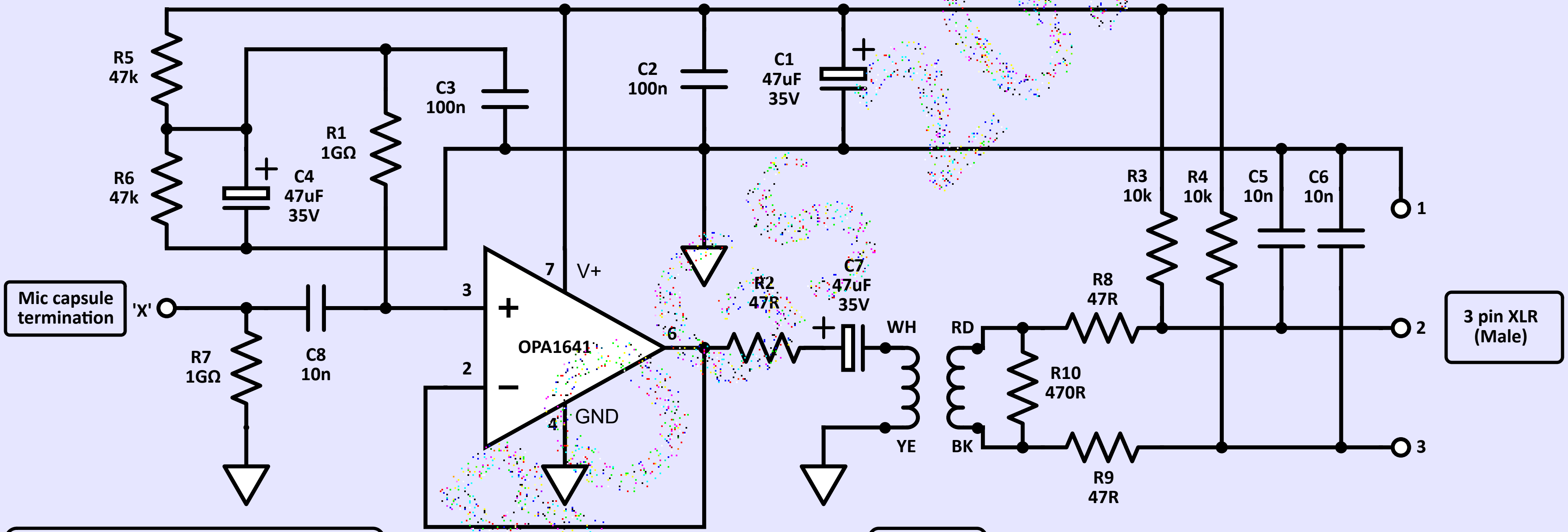




11.24: • Original version

01.25: • Ident corrections
• R10 added to Tx secondary
• VM idents revised

• OPIC.45TX - Op Amp Impedance Converter Schematic •



- *The 'X' connection is made to the capsule backplate.*
- *Both capsule membrane terminations are taken from the Voltage Multiplier outputs.*

TX 1

NTE-1
(Neutrik)

OPIC.45TX Circuit description

Overview:

The circuitry shown in the schematic uses a Texas Instruments OPA1641 JFET op-amp as an impedance converter for a condenser microphone capsule.
The circuit offers a simple alternative to the more conventional use of a discrete JFET device to perform this function..

The OPA164* series of op-amps offer low noise, very low distortion and low quiescent current, making them ideal for this task. There is also no need for any bias adjustments to be included, which further simplifies construction.

A single OPA1641 op-amp is used here to provide a single sided audio output. This output is connected to a Neutrik transformer type NTE-1, to provide an isolated balanced audio output - via pins 2 and 3 of the XLR connector - to the attached mic preamp.

Circuit description:

The OPA1641 is configured as a unity gain non-inverting buffer. The op-amp output is connected directly to the inverting input to achieve this.

The amplifier draws around 1.8mA of quiescent current, and this is provided by the 48v phantom power supply from the mic preamp.
The resistor summing network R3 and R4 - together with the de-coupling capacitors C1 and C2 - will allow a smoothed supply voltage of around 22v to be presented to pin 7 of the op-amp.
The actual value of the supply voltage to the op-amp is not critical, and the values selected for R3 and R4 will ensure the maximum permitted value is not exceeded.

The op-amp requires a 'dual' voltage supply, and this is provided by the creation of a 'half rail' voltage of around 11v by the voltage divider R5 and R6, together with the decoupling capacitors C3 and C4.

This 'half rail' voltage is required to bias the op-amp, so that the output can swing symmetrically around this reference voltage.
It is fed to the non-inverting input of the op-amp via R1, the high value 1GΩ resistor required to bias the purely capacitive capsule for effective function.
To allow the capsule to be referenced to 0v (gnd) rather than the op-amp ‘half rail’ bias, a second 1GΩ resistor - R7 - is connected between the capsule input connection and 0v (gnd). This is AC coupled to the op-amp input via C8.

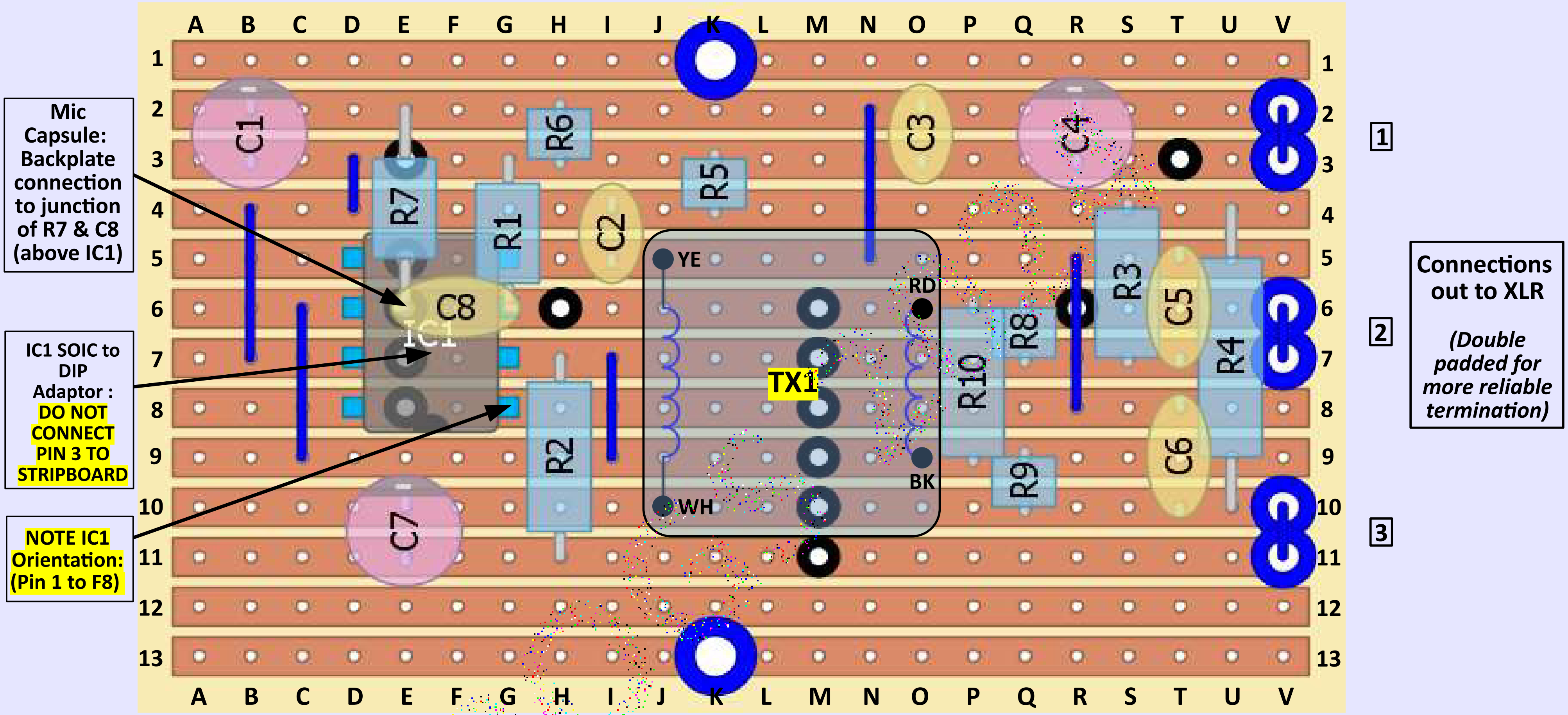
This configuration allows for the capsule backplate to be connected to 0v (gnd) via R7, and for a dual membrane capsule to have equal value DC polarisation voltages applied to the capsule membranes, with the polarity selected as required.

The dual membrane LDC capsule used in this version requires externally generated polarising DC voltages. (See the 'Dual VM' schematic description for more details.)
The 'X' input connection on the schematic is connected to the capsule backplate, so that it becomes referenced to 0v (gnd) via R7.
The dual VM outputs are applied to each capsule membrane to suit the required response pattern. Both capsules to the positive voltage for an omni pattern, each membrane to opposite polarity voltages for figure of 8, and a single positive connection to the front membrane only for cardioid pattern selection.

The op-amp output (pin 6) is connected via R2 and C7 to one end of the output transformer (TX1) primary winding. The other end of that winding is connected to 0v (gnd).
The secondary winding is connected to pins 2 and 3 of the XLR connector, which provides a balanced output signal to the attached mic pre-amp.

R8 and R9 are included in series with the transformer secondary to allow for output impedance modifications. The nominal value is fitted as 47R, but this value can be changed to suit any specific requirements.
R10 is connected across the secondary winding of the transformer, to minimise any HF ‘ringing’ that may result from parasitic inductances.

C5 and C6 are included to decouple any stray RF interference which may be present to ground.



OPIC.45TX – stripboard

Complete stripboard component layout

• VIEWED FROM COMPONENT SIDE •

- K1 and K13 are mounting holes
- 9 x TCW links (marked as blue lines)
- 14 x 'spin off' track cuts (marked as black and white dots)

Fit the components listed below:

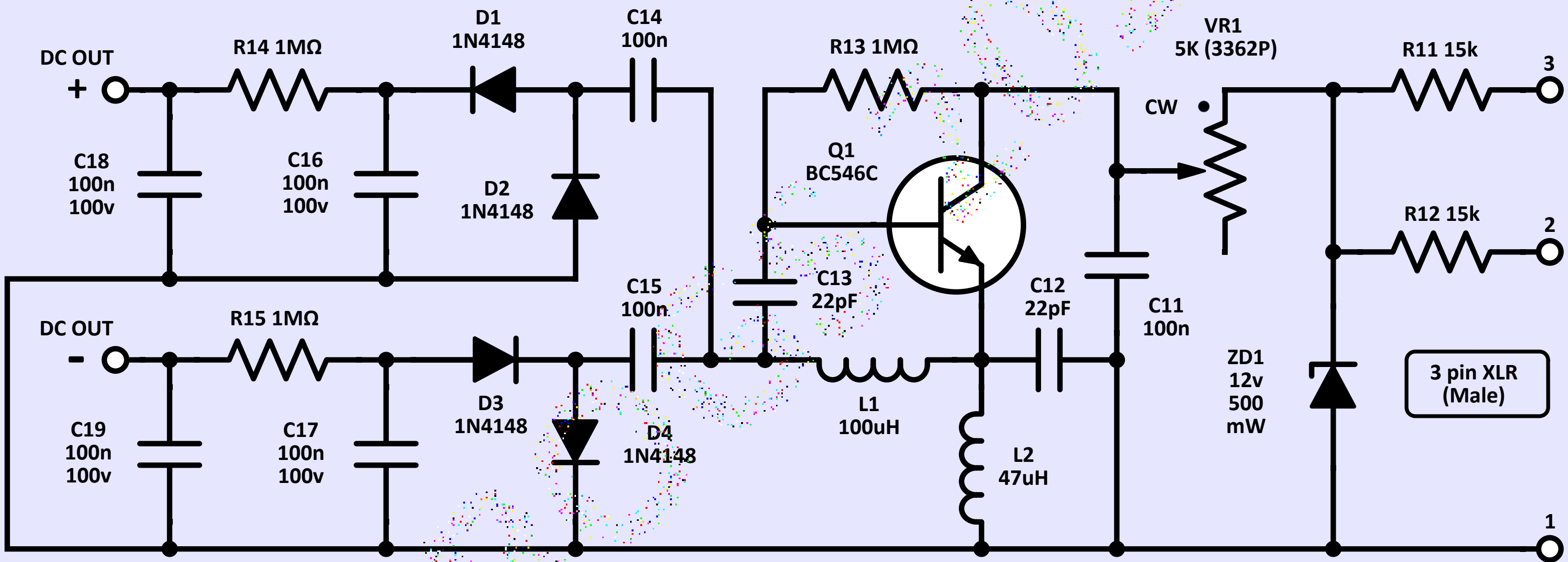
All resistors except R1 & R7 are MF12 (1/8w)

- C1 47uF 35V
- C2 100n 63V mlc
- C3 100n 63V mlc
- C4 47uF 35V
- C5 10n 63V mlc
- C6 10n 63V mlc
- C7 47uF 35V
- C8 10n 63V mlc

- R1 & R7 1GΩ (10%) (RGP0207CHK1G0 or similar)
- R2 47R
- R3 10k
- R4 10k
- R5 47k
- R6 47k
- R8 47R
- R9 47R
- R10 470R

- IC1 OPA1641 (via adaptor) **(Pin1 - F8)**
- TX1 NTE-1 (Neutrik)

• OPIC.45TX - ADJUSTABLE DUAL VOLTAGE MULTIPLIER •



Typical results with component values shown:

- **Output voltages: c. ±55v to ±95v**
  (Adjust using VR1 - max volts clockwise (CW))
- Oscillator frequency: c. 2MHz
- Current: c. 2.5mA
- Resistor and capacitor idents revised 01.25

OPIC.45 - Adjustable Dual Voltage Multiplier

Overview:

The circuitry shown in this schematic is designed to provide dual polarity high voltage DC outputs - adjustable between ±55v and ±95v - to be applied as the opposite polarisation voltages required by each membrane of a dual sided conventional large diameter condenser microphone capsule.

This will enable 3 alternative response patterns - Omni, Figure of 8 or Cardioid - to be selected for the microphone.

DC power to the circuitry is supplied from the 48v phantom power of the connected mic pre-amp. About 2.5mA will be drawn by this circuit.

Circuit description:

This particular circuit is based on a Hartley oscillator, the output of which is coupled to 2 x voltage doubling circuits, one of which provides a positive output voltage, the second a negative one.

There are a number of alternative possible configurations for a Hartley oscillator. The one chosen for this project follows the format used by Schoeps, in their famous 'CMC5' microphone schematic.

There are many online technical items on Hartley oscillators. The notes here:

https://learnabout-electronics.org/Oscillators/osc21.php

provide some interesting insights, particularly regarding mutual coupling of the inductors, which can play an important role in the layout of the oscillator components.

In this schematic, a Hartley oscillator running at c.2MHz is formed by the components connected to Q1. The amplitude of the oscillator output, which is taken from the junction of L1 and C13, will be a sine wave that will vary in amplitude between c.55v and 95v (p-p), depending on the position of VR1.

Notice the positions of the 2 inductors L1 and L2 on the stripboard. Although not critical, it is recommended that the inductors are laid with the same orientation, in adjacent 0.1" stripboard rows. That should provide for an appropriate level of mutual inductive coupling between the inductors, for reliable oscillator operation.

(N.B. - The resistor and capacitor idents on this stripboard start as C11 and R11, to avoid confusion with component idents on the main stripboard).

The oscillator output is fed - via C14 - to the junction of D1 anode and D2 cathode. D1 and D2 - in conjunction with C14 and C16 - form a voltage doubling circuit, which will produce a rectified DC output of between +55v and +95v at D1 cathode.
R14 and C18 act as a low pass filter, to allow a smoothed DC voltage to be present at the junction of those two components. This DC output is connected to one membrane of the capsule.

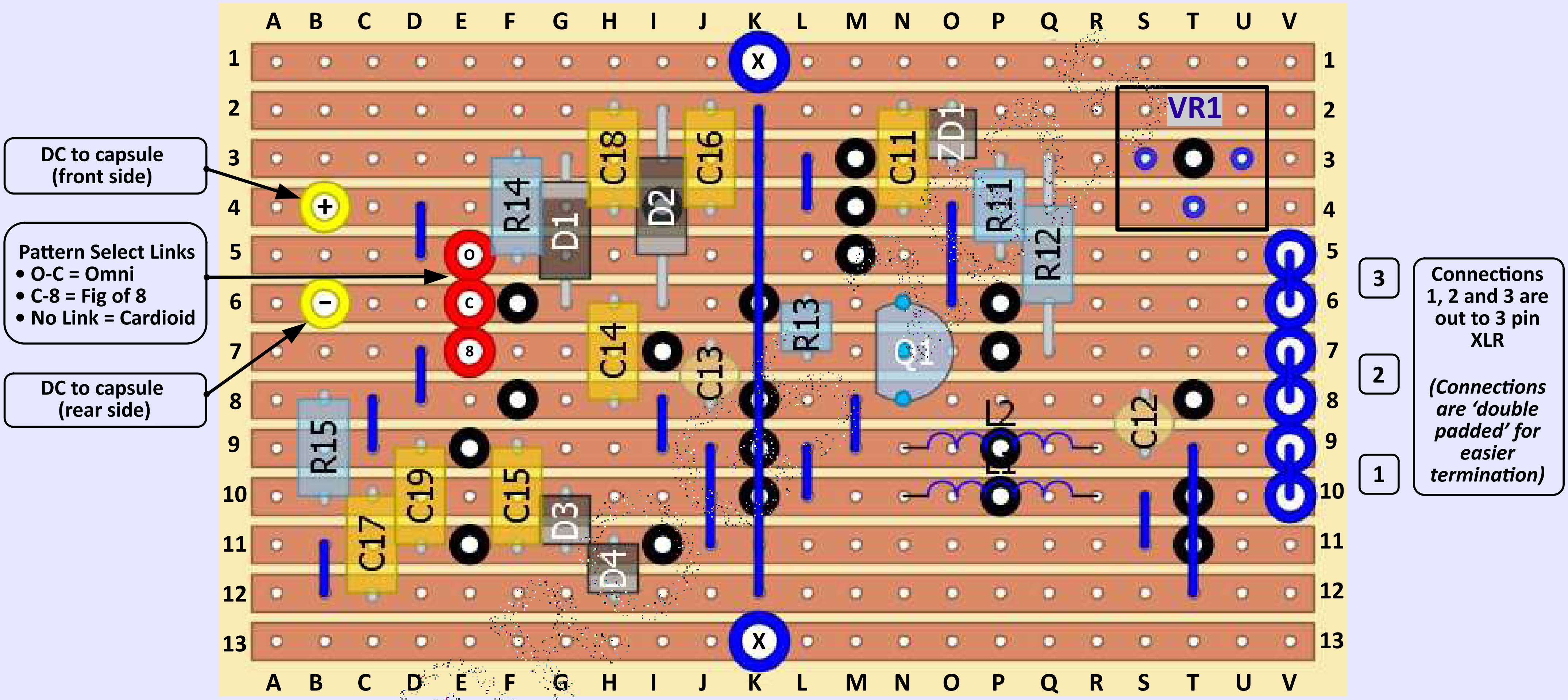
The oscillator output is also fed - via C15 - to the junction of D3 cathode and D4 anode. The same voltage doubling process takes place, using C15 and C17, but this time creating a negative DC output, because of the reverse orientations of D3 and D4.
In this case R15 and C19 act as the low pass filter. The negative DC output is connected to the other membrane of the capsule.

Note that capacitors C16,17,18 & 19 need to be rated at 100v rather than the more common 63v type that can apply to other capacitors in this circuit.

R11 and R12 will feed both legs of the 48 v phantom power from the mic pre-amp to the cathode of ZD1. The regulated 12v DC supply from this point is fed - via the adjustable resistor VR1 - to the collector of Q1.
C11 serves to decouple this supply.
The variable DC available at this point will determine the amplitude of the oscillator output, and the value of the final DC outputs as a result.

To determine the actual value of DC being supplied to the output, it is recommended that DMM measurements are taken from either D1 cathode or D3 anode, and not from the actual output terminations themselves. This will minimise the effect the impedance of the DMM has on the observed voltage readings.

• OPIC.45TX: Dual Voltage Multiplier - Stripboard Layout •



Components:

• K1 and K13 ('X') are mounting holes

• 16 x TCW wire links - TCW25 or similar (marked as blue lines on schematic)

• 22 x track cuts – 'spin off' with track cutter or drill bit (marked as black & white dots on schematic)

• Do not forget track cut under D2 (I4)

Semiconductors:
- Q1: BC546
- D1,2,3 & 4: 1N4148
- ZD1: 12v 500mW Zener Diode

Inductors (Bourns 78F or similar):
- L1: 100uH
- L2: 47uH

Capacitors:
- C11,14,15,16,17,18 & 19: 100nF **100v** (PET box cap - 0.2")
- C12,C13: 22pF ceramic (0.1")

Resistors (all 1/8w metal film):
- R11 & 12: 15k
- R13,14 & 15: 1M
- VR1: 5K (Bourns type 3362P or 3386P)