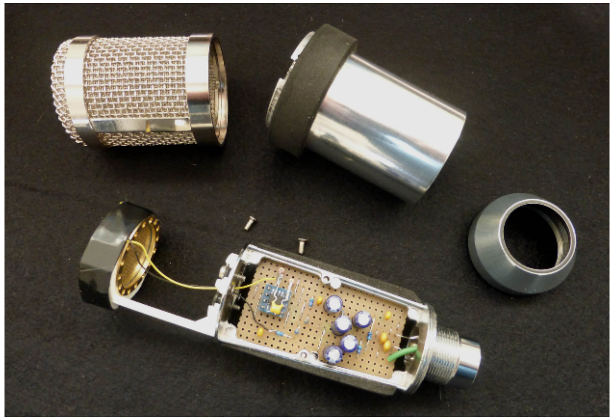
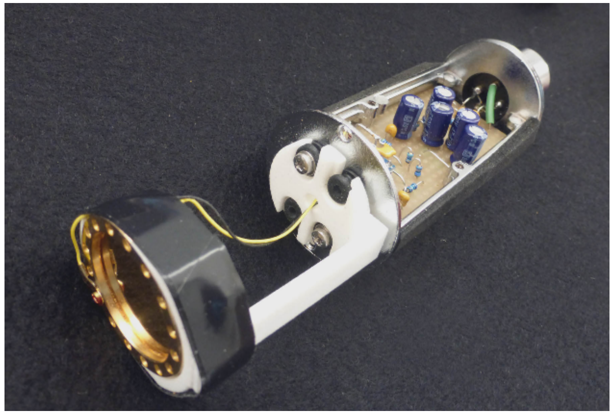
# OPIC42.SV – OPA1641 IMPEDANCE CONVERTER - FITTED INTO BM800 body

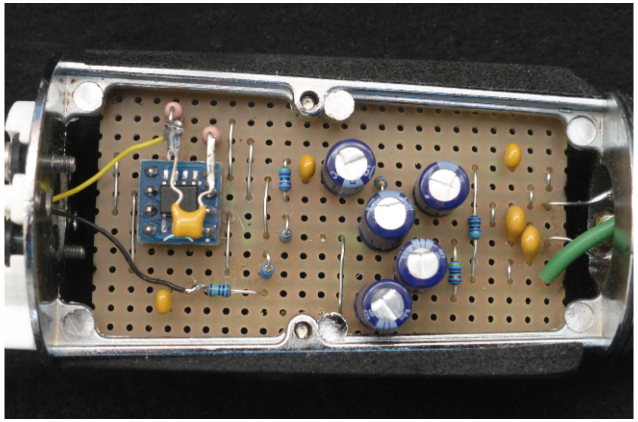
## FOR LDC CAPSULE USING 42V POLARISATION VOLTAGE

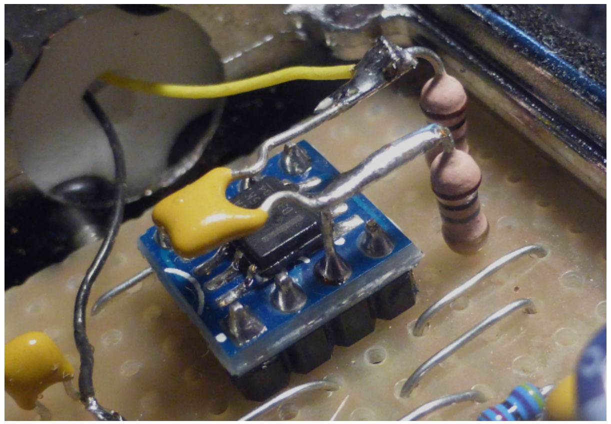
## SCHEMATIC, CIRCUIT DESCRIPTION AND STRIPBOARD LAYOUT

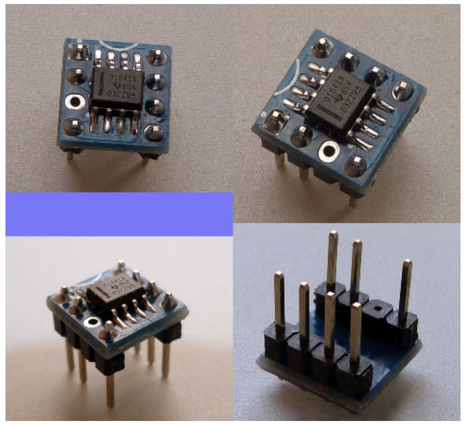




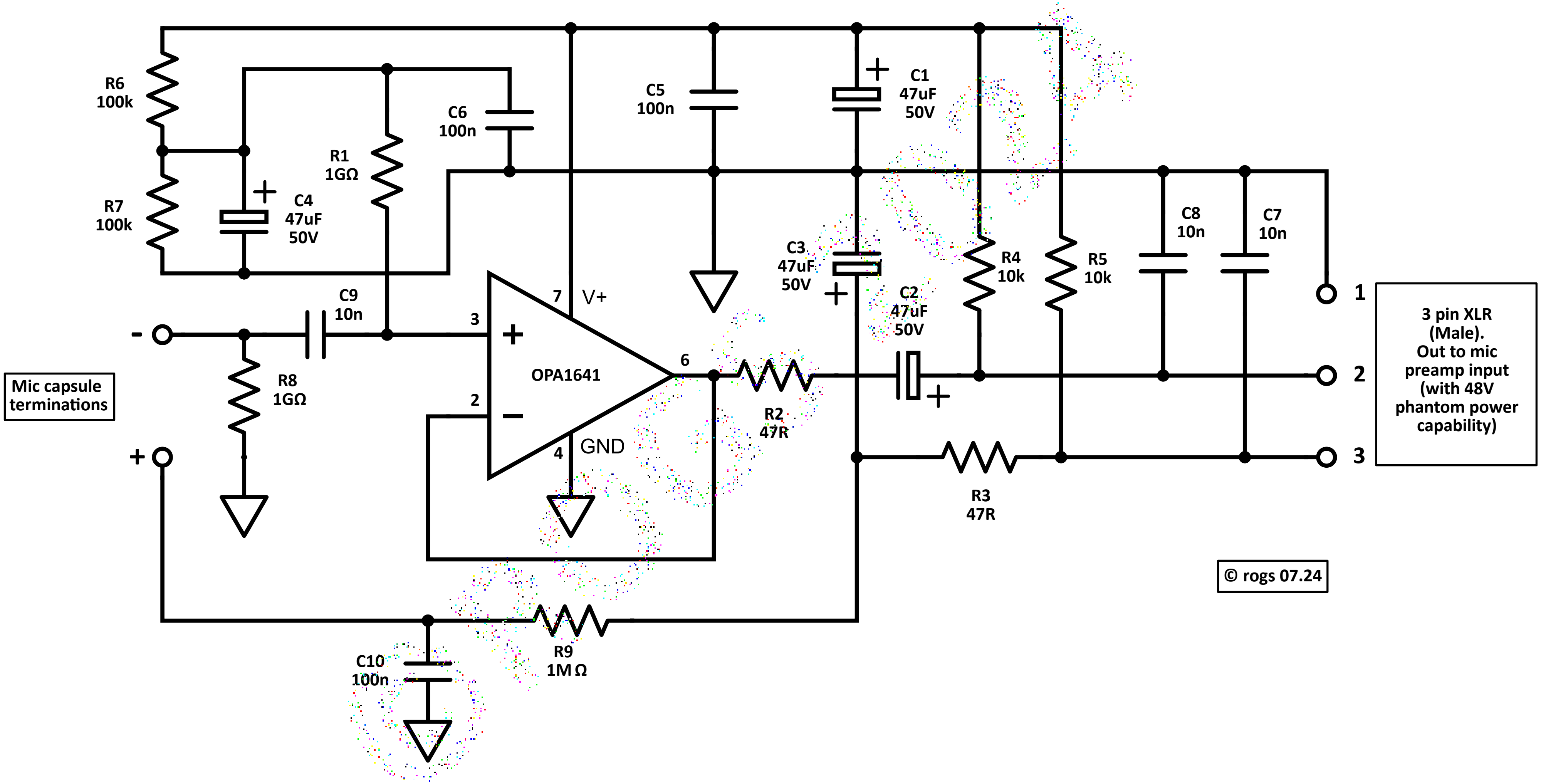








# • OPIC42.SV - using phantom power for capsule bias •



# OPIC42.SV 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.
This is a simple alternative to the more conventional use of a discrete JFET device for the task.
The OPA1641 op-amp offers low noise, low quiescent current and very low distortion, making it ideal for this task.

The op-amp is used here to provide a single sided audio output, which is impedance balanced passively, to help optimise the common mode rejection ratio (CMRR) when used with a balanced input microphone pre-amplifier, which has 48v phantom power.

## Circuit description:

The OPA1641 is configured as a zero 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 feed resistors R4 and R5 - together with the de-coupling capacitors C1 and C5 - will allow a smoothed supply voltage of around 30v to be presented to pin 7 of the opamp.

The op-amp requires a 'dual' voltage supply, and this is provided by the creation of a 'half rail' voltage of around 15v by the voltage divider R6 and R7, together with the decoupling capacitors C4 and C6.

The actual supply voltage is not critical, and the circuitry will automatically adjust the 'half rail' reference voltage to suit the supply voltage.

This 'half rail' voltage is required to bias the opamp, 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.

A second 1GΩ resistor - R8 - together with the coupling capacitor C9 allow the microphone capsule to be referenced to ground, rather than the half rail voltage at the amplifier input.
This will allow for the maximum polarisation voltage available from the phantom power supply (c.42V for this circuit ) to be applied across the capsule.

The LDC capsule used with this circuit requires an externally generated polarising DC voltage. This voltage is normally generated from a separate DC voltage multiplier fitted within the microphone.
(see OPIC project details here: www.opic.jp137.com for this option).

In this simpler application, one side of the 48v phantom power DC is used to supply the required bias. Although slightly lower than the more typical 60v of DC applied to a 34mm LDC capsule, the sensitivity is only reduced by around 3 dB, which still allows for a useful LDC microphone to be created.

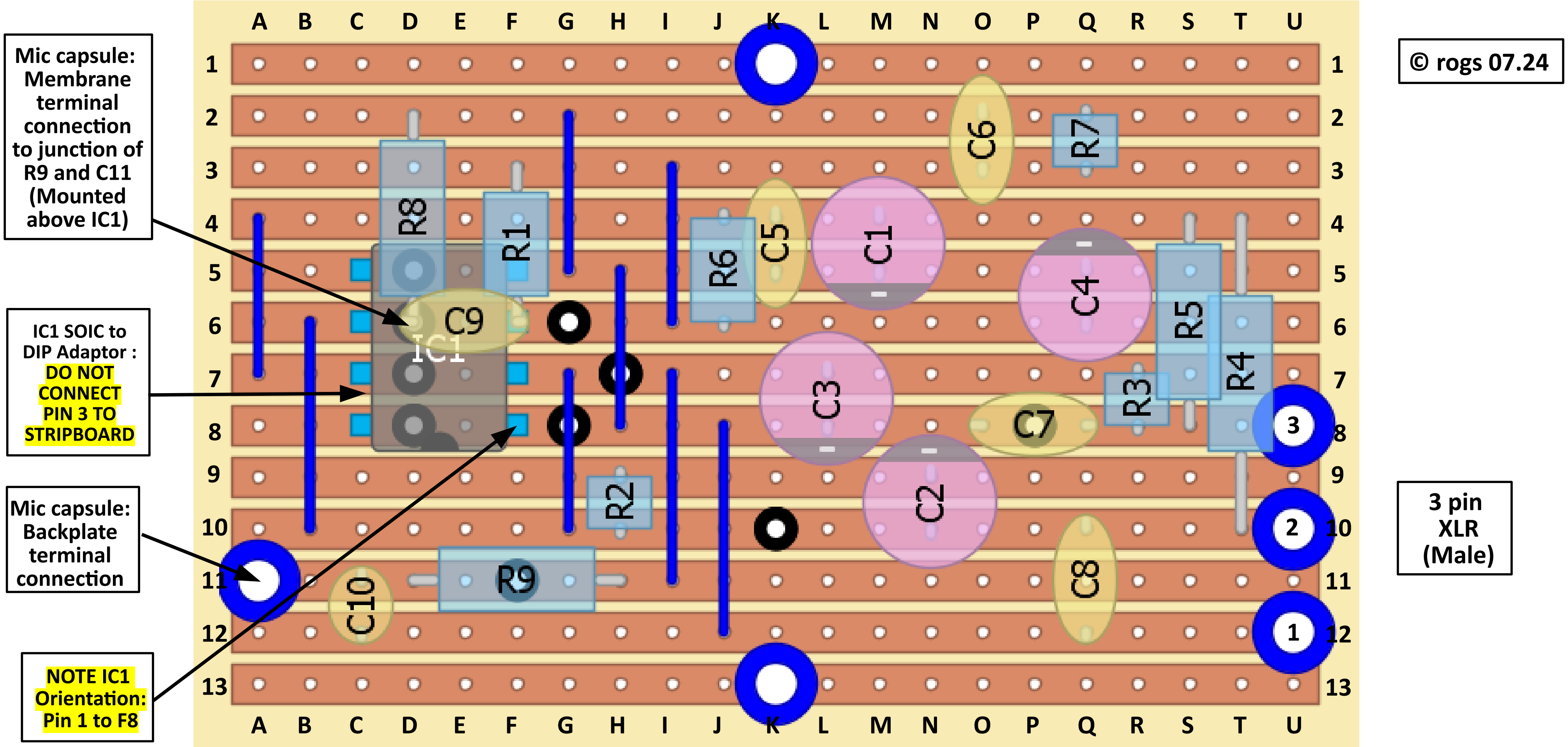
Both sides of the 48v phantom power are used to supply the opamp, via R4 and R5. Each leg provides around 1mA of current.
The phantom power DC on pin 3 of the XLR is also fed - via R8 - to one side of the capsule. There is no extra current drawn by this capsule polarisation voltage. R3 & C3 - plus R8 and C10 - provide low pass filters to de-couple any residual ripple or noise that may be present on the phantom power supply.

R3 and C3 also provide a 'passively balanced' output to pin 3 (cold) of the XLR connector, to match the impedance of the active audio output on pin 2 (There is no audio on pin 3).
This helps to maintain the Common Mode Rejection Ratio (CMRR) of the balanced output.

The op-amp audio output (pin 6) is connected via R2 and C2 to pin 2 (hot) of the XLR connector. C2 is required to isolate the DC 'half rail' voltage present on the output of the op-amp, from the XLR output.

It is the phantom power DC present on pin3 which is used to provide the capsule polarisation voltage. The capsule draws no DC current itself, and the high impedance extra low pass filter formed by R9 and C10 do not materially affect the impedance balanced output of the circuit.

C7 and C8 are included to decouple any stray RF interference which may be present.




**OPIC.42.SV – stripboard**
**Complete stripboard component layout**
**•• VIEWED FROM COMPONENT SIDE ••**

**10 x Track cuts**
**(‘spin off’ with track cutter or drill bit)**
- **D5,6,7,8 : F11 : G6,8 : H7 : K10 : P8**

**8 x wire links (TCW25 or similar)**
**(marked as vertical blue lines)**

**K1 and K13 are mounting holes**

## Fit the components to the locations listed below:

- C1 47uF 50V (M4+, M5)
- C2 47uF 50V (N10+, N9)
- C3 47uF 50V (L7+, L8)
- C4 47uF 50V (Q6+, Q5)
- C5 100n mlc (K4, K5)
- C6 100n mlc (O2, O3)
- C7 10n mlc (O8, Q8)
- C8 10n mlc (Q10, Q12)
- **C9 10n mlc**
  *(Between R1 & R8 - above IC1)*

**All resistors (except R1 & R9) are MF12 1/8th watt metal film**

- **R1 & R8 1GΩ (10%)***
  * ( RGP0207CHK1G0)

- R2 47R (H9, I10)
- R3 47R (R7, R8)

- R4 10k (T4,T10)
- R5 10k (S4,S8)
- R6 100k (J4, J6)
- R7 100k (Q2, Q3)
- R9 1M (D11, H11)

- IC1 OPA1641
  (via adaptor)
  **( Pin1 - F8 )**