

## **“OPA-Alice” microphone electronics**

Microphones convert sound into an equivalent electrical signal. Then that signal can be recorded or amplified. Condenser microphones do this starting with a capsule that has a fixed backplate and a flexible “plate” that can vibrate when exposed to air. Because the diaphragm moves, the capacitance changes. By using a layer of metal on the diaphragm and applying a voltage to the “capacitor” we can detect the voltage changes and thus the sound. This method was first used over a hundred years ago and is the basis for most of the world's best studio microphones.

The electrical signal from a condenser microphone requires a very high impedance circuit to accurately measure the voltage. Originally this was done with a vacuum tube circuit then when the Field Effect Transistor (FET) was invented, those were used. That occurred in the 1960's.

The second function of the electronics in a condenser microphone is to drive a mic preamp. To do this we need to provide a low impedance output. The mic preamp could be a couple hundred feet away so the electronics need to do this. Traditionally, this was done with an output transformer in the case of tube circuits or with a couple transistors in the case of FET circuits.

Operational Amplifiers or “Op Amps” first originated on a single chip in the late 1960's then in the 1980's and beyond the quality and characteristics improved to the point that they are used in most analog front ends for commercial equipment. There are three critical attributes for microphone electronics we need to meet; low noise, low distortion and high dynamic range.

The “Alice OPA” circuit uses the OPA1642 from Texas Instruments. This Op Amp covers the needed attributes really well, and adds in small enough power requirements that we can run the circuit from Phantom Power.

Let's look at the circuit, broken into two sections. The first highlighted in blue, takes the incoming phantom power and makes it into a clean 12VDC for the op amp section. It also provides a virtual ground for the op amps.

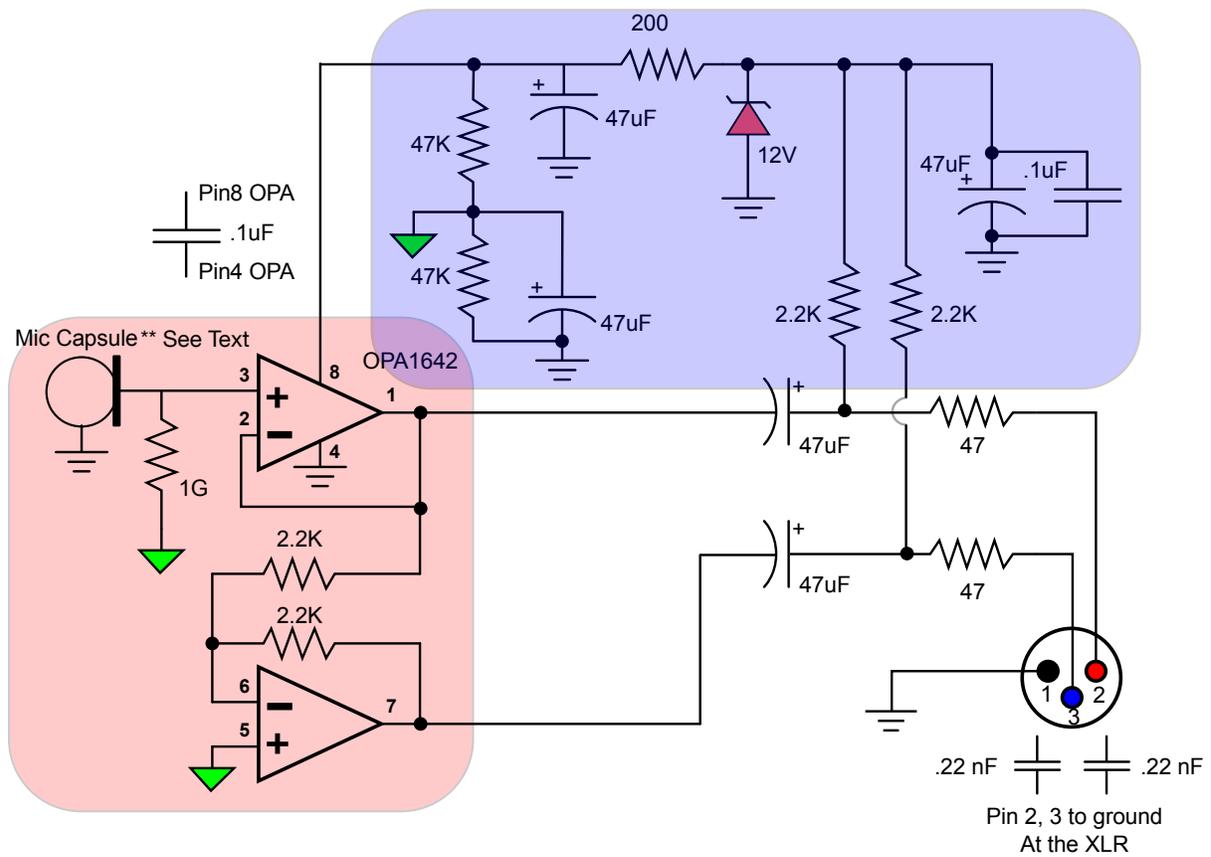
The second section, highlighted in red, is our actual circuit. The first section is a unity gain buffer that couples the incoming microphone signal via a 1gig ohm resistor. The output of the first stage drives Pin 2 of the XLR output and the second stage, a unity gain inverting buffer. This drives Pin 3 of the XLR.

Also shown on the schematic are 22nF capacitors that are mounted on the XLR connector to minimize EMI and RF interference. They are optional but highly recommended.

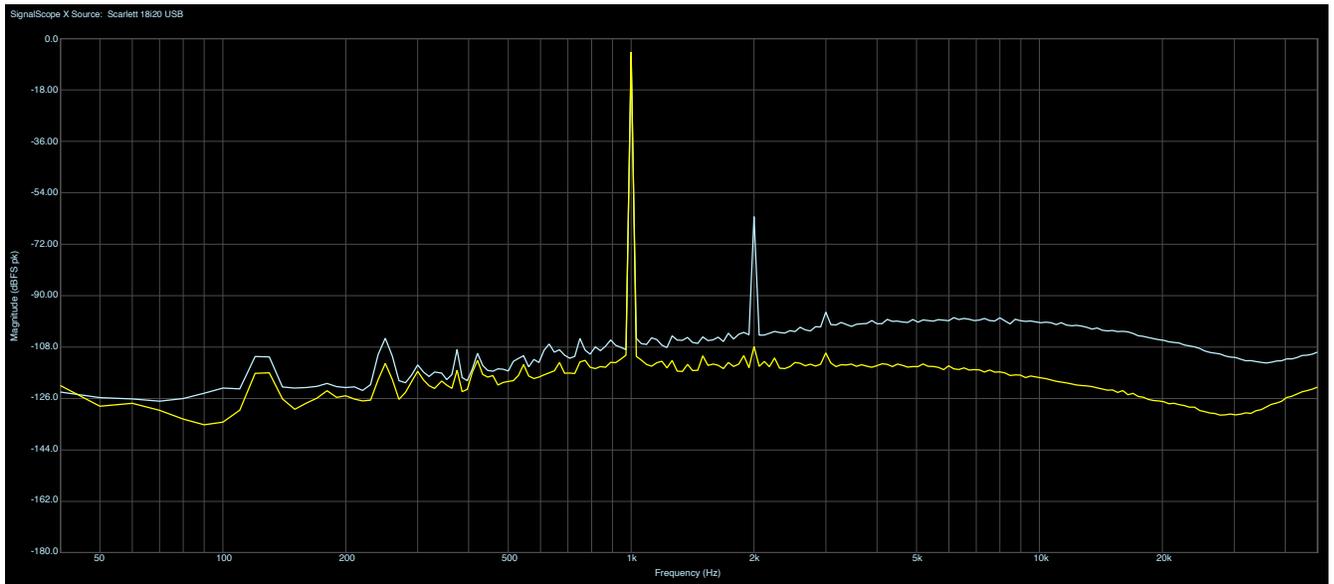
This circuit is featured in the two following Instructables and is now available in fully populated, ready to use to build your next microphone.

<https://www.instructables.com/OPA-Based-Alice-Microphones-a-Cardioid-and-a-Figur/>

<https://www.instructables.com/True-Condenser-OPA-Mics/>



The circuit performs measurably better than the typical Fet based microphone electronics. This is with a 1kHz tone applied to both a Schoeps style Fet (White) and the Op Amp circuit (Yellow). Overall circuit signal to noise ratio is >100db. This results in an extremely transparent microphone.



The two boards are shown below. There are connections for the Capsule at the top and the XLR connector on the bottom. Additionally the 12VDC from the Zener circuitry is brought out to supply the DC-DC converter bias voltage generator on the sides. There are also two screw patterns for mounting in a donor microphone body.

