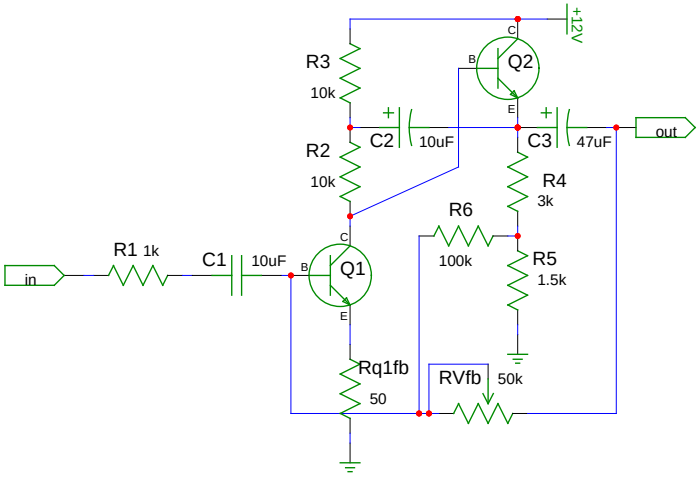
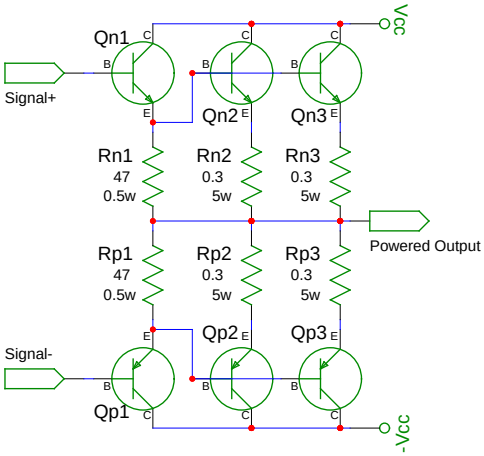
Transistor Amplifiers (2)

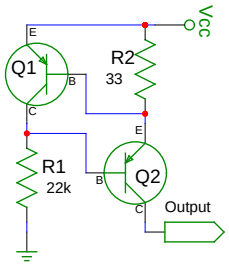
2008-07-24



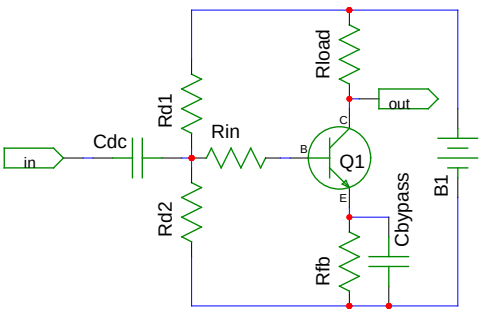
Modified ESP13 Mic PreAmp (600 ohm, Class A, inverted output)
This amp doesn't seem very suitable for usage as the input impedance of what this amp will be driving will upset the transistor bias and reduce output swing and cause premature clipping. Note that Q2 gets it's bias directly from Q1. When Q1 bias changes, so does Q2's.
The power supply needs to be very clean. Transistors are BC549.
Use metal film resistors and good film caps for lowest noise and clean phase.
Max gain is about 40x (32db). At max gain, about 0.1v Vin peak before clipping.
When feedback resistor RVfb is open, open loop gain is about 3400x;
R5 will need to be paralleled with a large capacitor.
Input noise is about -127db. At max gain, SNR should be about 87db.
Higher impedance inputs will rapidly increase noise. Output impedance is about 100 ohms.
This circuit can drive a 5-70k (20k avg set) load, but less or more without significant rebalancing isn't possible.
A higher voltage version can be made by changing R2, R3, R4, and R5.
Q1 acts as an inverting voltage amplifier. Q2 acts as a buffer with R4+R5 as negative feedback.
R1 should not be below 700R or the signal will start bottoming out.
R3 and R2 are both inverting outputs. C2 takes that and adds it to the main output.
R3 and R2 can be lowered for slightly higher output (see below).
For heavier loads, R3 and R2 will need to be lowered.
C1 should be non-polar in case of rogue phantom power on input.
The C2 output is less amplified than the Q1 collector signal.
The C2 signal has a higher bias and will clip sooner than the Q1 collector signal.
C2 can be annoying to deal with at lower voltages and high gain, just remove it.
R6 is partial feedback. R6 can be 50-200k. Higher is slightly more gain, but too high will go unstable.
Rload for this circuit shouldn't be below 5k for stable operation at high gains.
R4 and R5 bias the Q1 collector waveform up and down (keep it centered for your voltage).
Smaller R5 moves the waveform voltage up. Larger R4 moves the waveform up.
R5 helps isolates feedback from ground noise (added benefit).
Values for R4 and R5 will vary depending on transistor, but these values should be reasonable.
Vsupply=12v, R2=R3=10k, R4=2.5k, R5=800. Vsupply=12v, R2=R3=10k, R4=3k, R5=1.5k.
Vsupply=12v, R2=R3=15k, R4=2k, R5=800. Vsupply=12v, R2=R3=15k, R4=3.5k, R5=1.5k.
Vsupply=30v, R2=R3=10k, R4=16k, R5=800. Vsupply=30v, R2=R3=10k, R4=20k, R5=1.5k.
Vsupply=30v, R2=R3=15k, R4=30k, R5=800. Vsupply=30v, R2=R3=15k, R4=40k, R5=1.5k.
C1 viable range = 1-20uF. C1+R6+R5 forms a high pass filter (0.15Hz as shown).
C2 does mild gain increases, viable range = 1-100uF.
C2+R4+R5 forms a high pass filter (3.5Hz as shown, larger C2=lower freq).
C3 may be a little small. 20-100uF should probably be used, but Q1 will have to be rebiased.
Rq1fb was added for simple safety and better distortion control. Larger will reduce amplitude.
Rq1fb also has the advantage of helping to isolate the transistor from noisy grounds.



Generic Transistor Powered Amplifier Output Stage
Variations of this are very common among audio amplifiers.
Signal+ and Signal- usually come from an already baised transistor gain stage earlier in the circuit.
Qn1+Qp1 are mainly buffer stages between signal level voltages and power level output.
Qn1+Qp1 should be line driver transistors (about 1amp or so).
Qn2/3+Rn2/3+Qp2/3+Rp2/3 are paralleled output power transistor stages (5-15amp range). One stage is minimum (obviously).
More power output stages could be added to incrase the output power and drive lower ohm loads.
More power output stages will increase the load on Qn1+Qn2 and those may need to be increased.



Common Current Mirror.
Often seen in Power Amps.
These are usually feeding gain stages in place of straight resistors and offer more linear current.



Standard Class A Amp with AC Bypass
This amp has a feedback resistor for DC to prevent thermal runaway. It is bypassed with Cbypass thus allowing AC signals to pass unimpeded. DC signals are forced through Rfb since the capacitor won't allow them to pass. AC signals are amplified at whatever the beta is for the transistor. Rfb lowers the DC gain to something very small to help prevent heat build up.