

ValveWizard Universal Amp PCBs

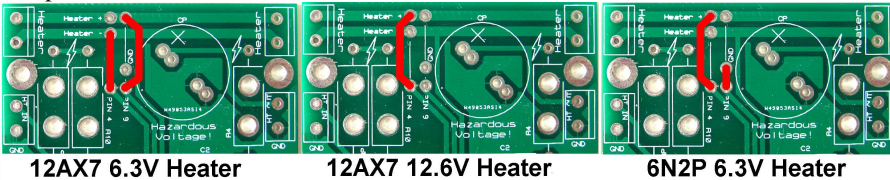
User Manual

ValveWizard, August 2018

① Triode Input PCB

General

- Connect the incoming HT/B+ and ground feeds to the pads labelled **HT IN** and **GND**. You can use 0.2"-pitch power connectors (e.g. Molex[®]) if you wish.
- Outgoing power supply feeds (RC filtered) can be taken from the pads labelled **HT OUT** and **GND**.
- Connect the incoming heater supply feeds (3 amp maximum average) to the pads labelled **Heater**.
- Outgoing heater feeds can be taken from the **Heater** pads on the opposite edge of the PCB.
- If you want to connect the PCB ground to chassis, link the two pads labelled **GND** and **CHASSIS**. This is connected to the adjacent mounting screw hole.
- Spare **GND** pads are also provided if you need them for general connections.
- Use 16mm PCB-mounted pots, or else use chassis mounted pots and free wire onto the PCB.
- Mount power resistors about 5mm up into the air to encourage air flow.
- Connect link wires as show below to configure the PCB for 12AX7/ECC83 type pin-out valves, or 6N2P/ECC88 type pin-out valves with internal screen.

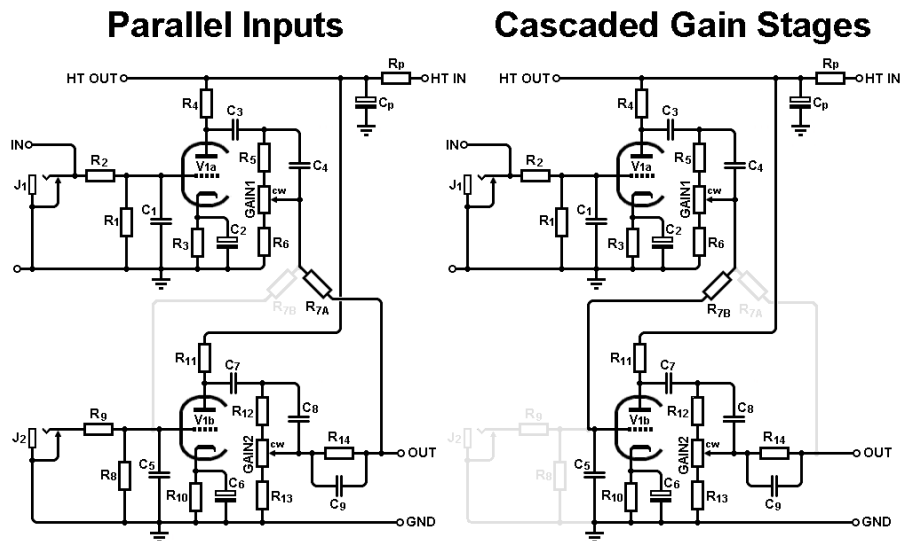


Parallel Inputs

Fit R_{7A} to create two similar input stages with individual gain pots that mix together at the output, like in a 5F6 or classic Marshall amp. Two Cliff-style jack sockets can be mounted on the PCB in an over-under configuration, or you can free wire onto the PCB.

Cascaded Gain Stages

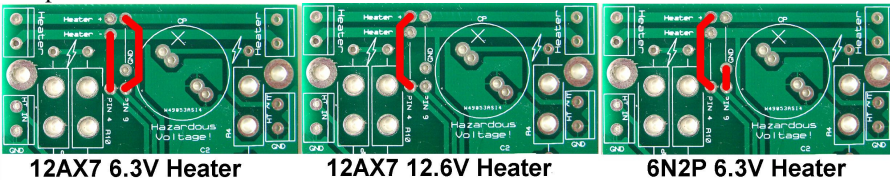
Fit R_{7B} to create one input (J_1) that cascades into another gain stage, each with its own gain pot. Of course, you don't have to use the pots if you don't want to, you can just jumper across the pads to create passive interstage-dividers, or whatever you like. If you don't want to use a jack socket because you're using the PCB as an intermediate stage in a larger amp design you can inject the input signal to the solder pad labelled **IN**.



② Cathode Follower / EQ / Cathodyne PCB

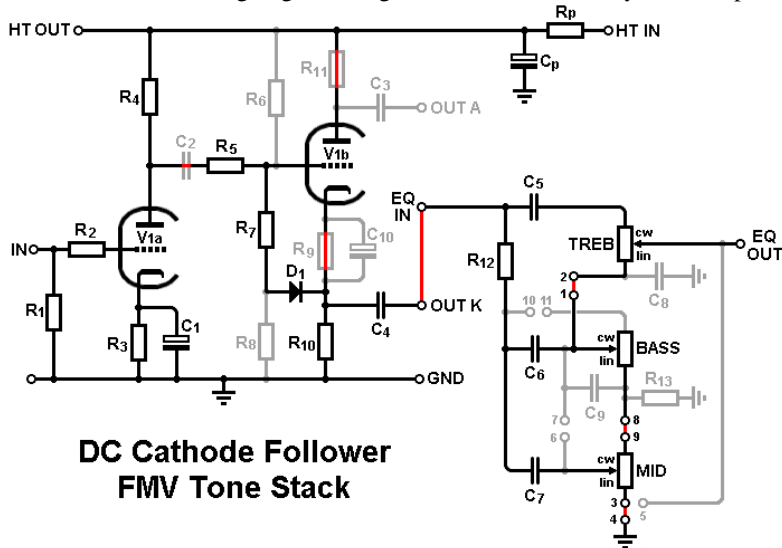
General

- Connect the incoming HT/B+ and ground feeds to the pads labelled **HT IN** and **GND**. You can use 0.2"-pitch power connectors (e.g. Molex[®]) if you wish.
- Outgoing power supply feeds (RC filtered) can be taken from the pads labelled **HT OUT** and **GND**.
- Connect the incoming heater supply feeds (3 amp maximum average) to the pads labelled **Heater**.
- Outgoing heater feeds can be taken from the **Heater** pads on the opposite edge of the PCB.
- Connect the incoming audio signal to the pad labelled **IN**.
- If you want to connect the PCB ground to chassis, link the two pads labelled **GND** and **CHASSIS**. This is connected to the adjacent mounting screw hole.
- Spare **GND** pads are also provided if you need them for general connections.
- Use 16mm PCB-mounted pots, or else use chassis mounted pots and free wire onto the PCB.
- Mount power resistors about 5mm up into the air to encourage air flow.
- Connect link wires as show below to configure the PCB for 12AX7/ECC83 type pin-out valves, or 6N2P/ECC88 type pin-out valves with internal screen.



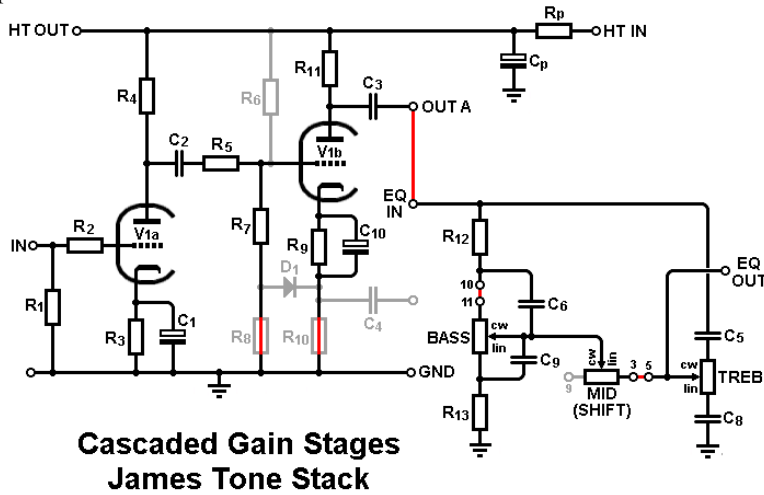
Classic Fender / Marshall Cathode Follower and FMV EQ

Configure the PCB as shown below for a classic DC-coupled cathode follower and FMV tone stack. Link wires are shown in red. If you want a James tone stack instead see the next section. The outgoing audio signal is taken from the pad labelled **EQ OUT**. If you do not want to use the tone stack then the outgoing audio signal can be taken directly from the pad labelled **OUT K**.



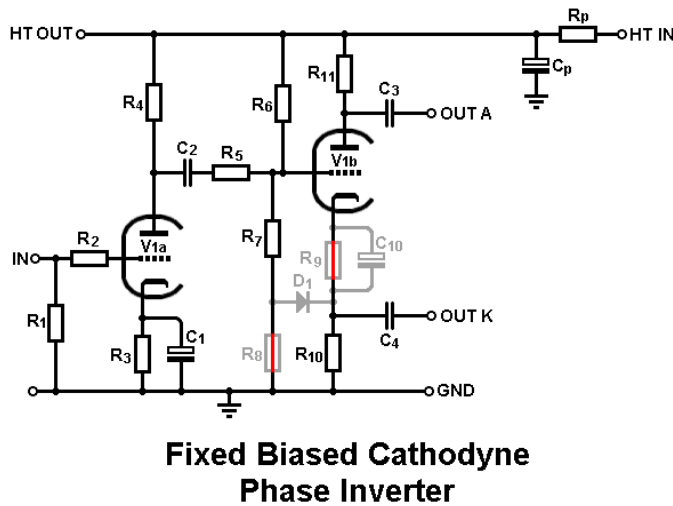
Cascaded Gain Stages and James EQ

Configure the PCB as shown below to create a pair of cascaded gain stages and optional James tone stack (drawn here in the more familiar pattern). Link wires are shown in red. If you want an FMV tone stack instead see the previous section. The outgoing audio signal is taken from the pad labelled **EQ OUT**. If you do not want to use the tone stack then the outgoing audio signal can be taken directly from the pad labelled **OUT A**.



Cathodyne Phase Inverter

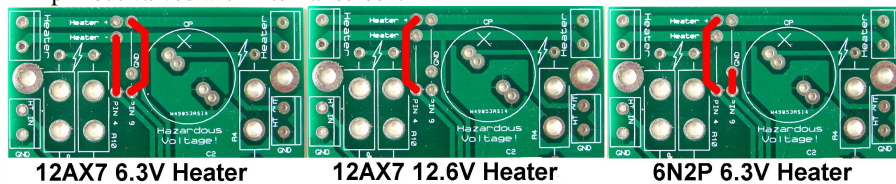
Configure the PCB as shown below to create a fixed-biased cathodyne phase inverter. Link wires are shown in red. You can alternatively implement a self-biased, DC-coupled, or level shifted circuit if you prefer. The outgoing audio signal is taken from the pads labelled **OUT A** and **OUT K**.



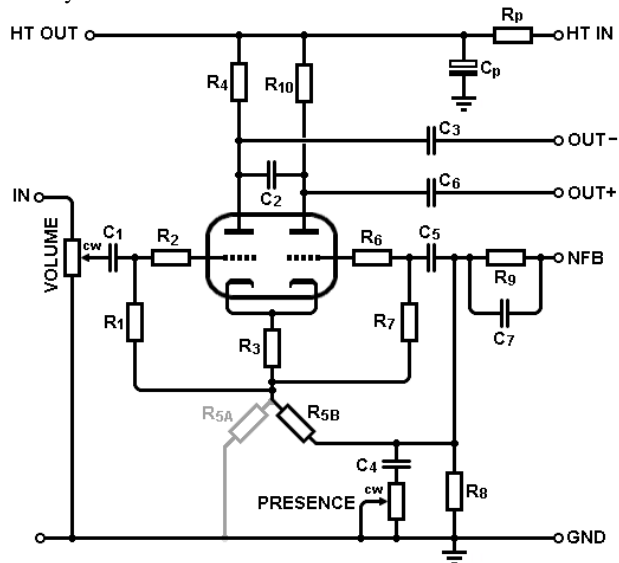
③ Long-Tailed Pair PCB

General

- Connect the incoming HT/B+ and ground feeds to the pads labelled **HT IN** and **GND**. You can use 0.2”-pitch power connectors (e.g. Molex[®]) if you wish.
- Outgoing power supply feeds (RC filtered) can be taken from the pads labelled **HT OUT** and **GND**.
- Connect the incoming heater supply feeds (3 amp maximum average) to the pads labelled **Heater**.
- Outgoing heater feeds can be taken from the **Heater** pads on the opposite edge of the PCB.
- Connect the incoming audio signal to the pad labelled **IN**.
- Outgoing audio signals are taken from the pads labelled **OUT +** and **OUT -**.
- Global negative feedback can optionally be applied to the pad labelled **NFB**.
- If you want to connect the PCB ground to chassis, link the two pads labelled **GND** and **CHASSIS**. This is connected to the adjacent mounting screw hole.
- Spare **GND** pads are also provided if you need them for general connections.
- Use 16mm PCB-mounted pots, or else use chassis mounted pots and free wire onto the PCB.
- Mount power resistors about 5mm up into the air to encourage air flow.
- Connect link wires as show below to configure the PCB for 12AX7/ECC83 type pin-out valves, or 6N2P/ECC88 type pin-out valves with internal screen.



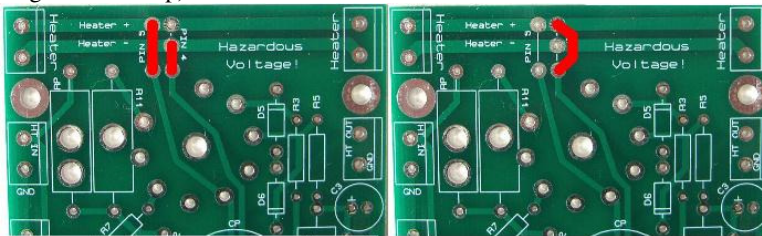
Fit R_{5A} to configure the PCB as a classic guitar-amp long-tailed pair. Global feedback and the presence control can optionally be omitted. The volume control can also be omitted by jumpering it. R_{5A} allows a more textbook/hi-fi phase inverter to be built. The ‘SPARE’ pot is free to use for whatever you want.



④ EL84 Output PCB

General

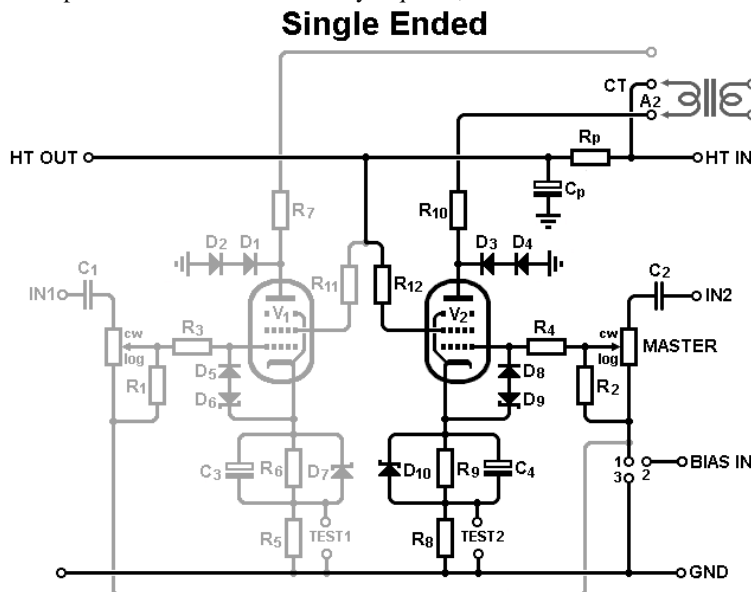
- Connect the incoming HT/B+ and ground feeds to the pads labelled **HT IN** and **GND**. You can use 0.2"-pitch power connectors (e.g. Molex[®]) if you wish.
- Outgoing power supply feeds (RC filtered) can be taken from the pads labelled **HT OUT** and **GND**.
- Connect this incoming negative bias supply (if used) to the pad labelled **BIAS**.
- For cathode bias link the pads labelled **1** and **3** together. For fixed bias link the pads labelled **1** and **2** together.
- Connect the incoming heater supply feeds (3 amp maximum average) to the pads labelled **Heater**.
- Outgoing heater feeds can be taken from the **Heater** pads on the opposite edge of the PCB.
- Cathode current can be monitored by measuring the voltage across a small (e.g. 10Ω) resistor R₅/R₈, using the pads labelled **TEST1** and **TEST2**.
- Connect the incoming audio signals to the pads labelled **IN1** and **IN2**.
- If you want to connect the PCB ground to chassis, link the two pads labelled **GND** and **CHASSIS**. This is connected to the adjacent mounting screw hole.
- Spare **GND** pads are also provided if you need them for general connections.
- Use a 16mm PCB-mounted pot, or else use a chassis mounted pot and free wire onto the PCB.
- Mount power resistors about 5mm up into the air to encourage air flow.
- Connect link wires as show below to configure the PCB for series or parallel heaters (use the parallel option if building a single-ended amp).



Parallel Heaters 6.3V Series Heaters 12.6V

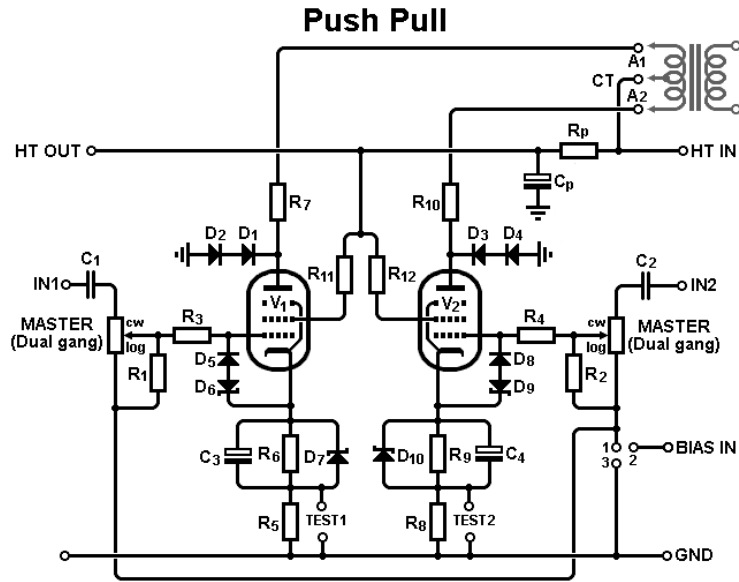
Single Ended

Use the circuit below to build a single-ended output stage. Connections to the output transformer are made to the pads labelled **CT** (HT/B+) and **A2**. Not all the components shown are necessarily required; this is at the user's discretion.



Push Pull

Use the circuit below to build a push-pull output stage. Connections to the output transformer are made to the pads labelled **CT** (HT/B+), **A2** and **A2**. Not all the components shown are necessarily required; this is at the user's discretion.



⑤ Power Supply PCB

The power supply PCB provides a host of options.

HT / B+ Supply:

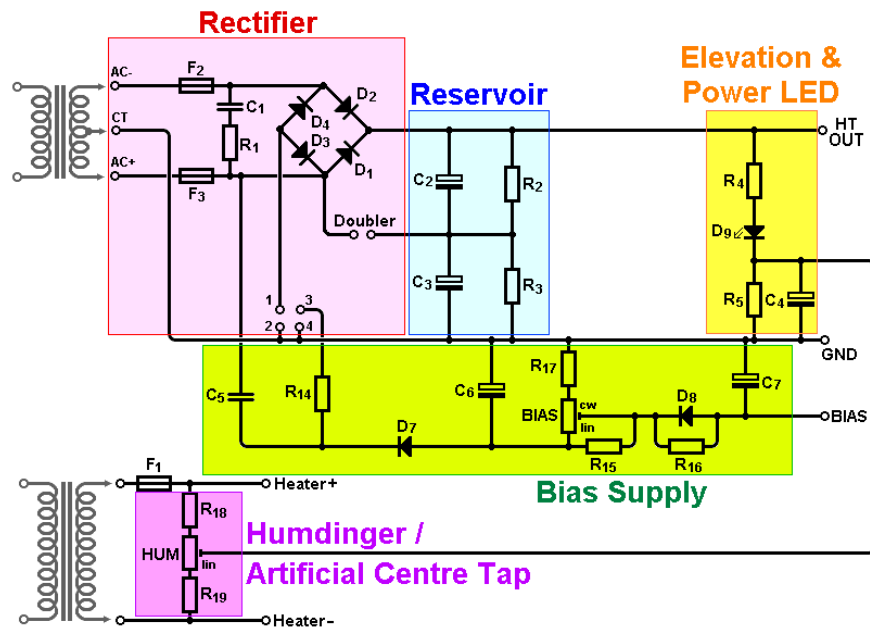
- Can use a two-phase rectifier (centre-tapped transformer);
- Bridge rectifier (single winding transformer);
- Voltage doubler;
- Fully fused (use 20mm glass time delay/slow blow fuses);
- Snubbing network;
- Single reservoir or stacked reservoir capacitors with equalising resistors;
- Power indicator LED.

Bias Supply

- Half-wave or full-wave rectifier (centre-tapped transformer);
- Capacitor-coupled (single winding transformer);
- Slow-discharge network (D₈ and R₁₆).

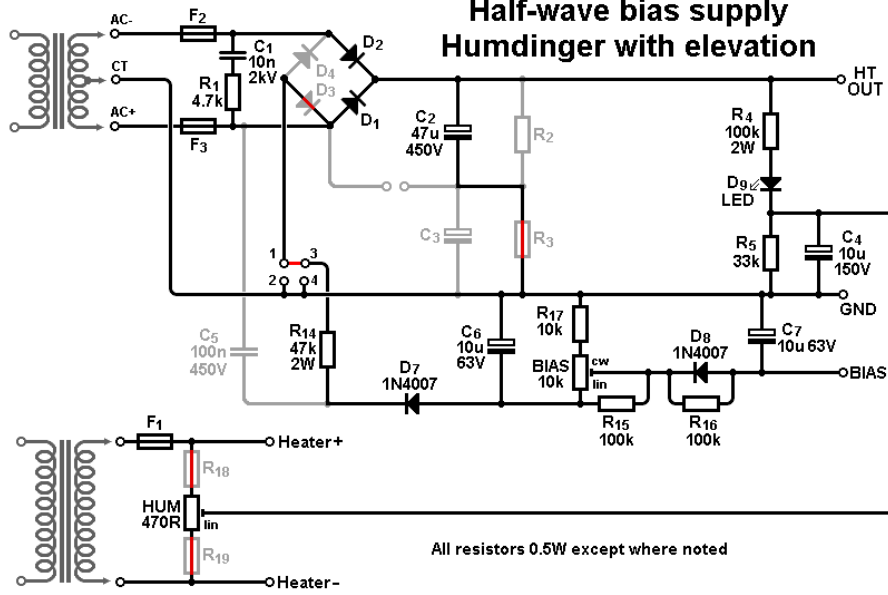
Heater Supply

- Fuse (use 20mm glass time delay/slow blow fuse);
- Humdinger or artificial centre tap;
- Elevation.

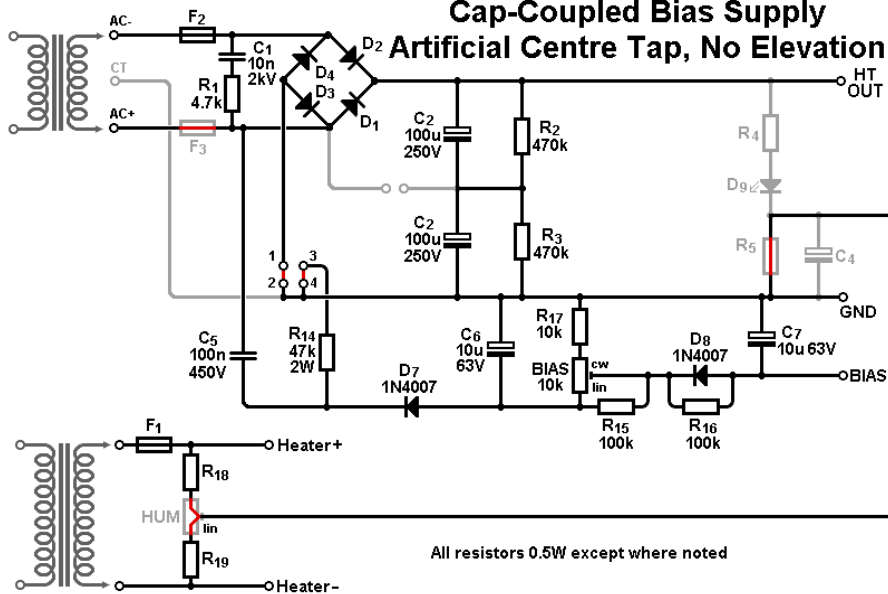


Some examples are shown below. Wire links are shown in red.

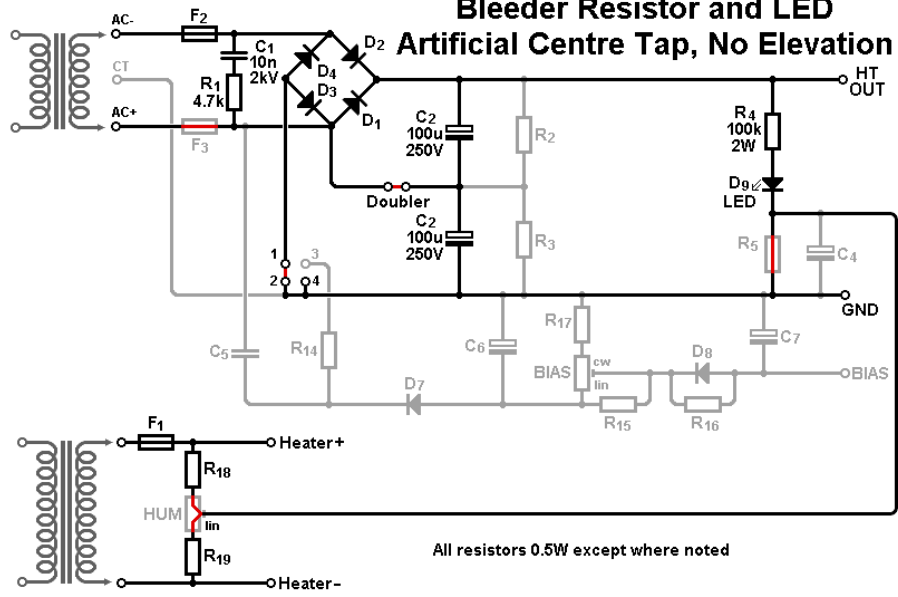
**Two-phase rectifier
Half-wave bias supply
Humdinger with elevation**



**Bridge Rectifier with Dual Caps
Cap-Coupled Bias Supply
Artificial Centre Tap, No Elevation**



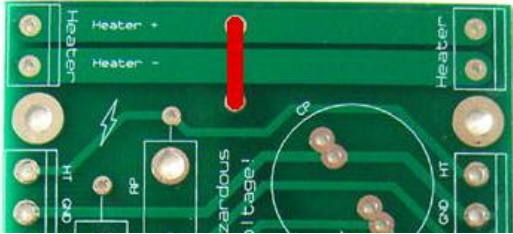
Voltage Doubler Bleeder Resistor and LED



⑥ Octal Output PCB

General

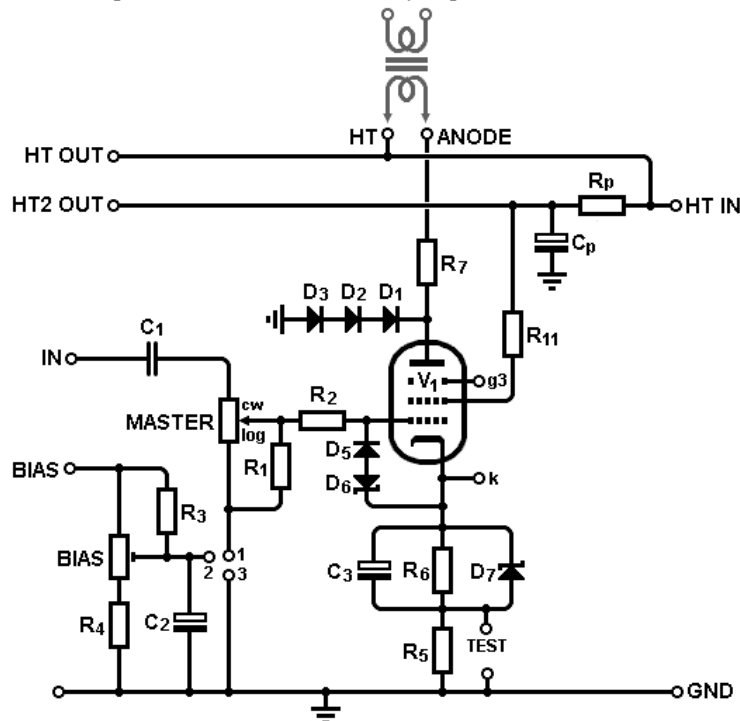
- EL34, 6L6, 5881, 6V6, KT66, KT88 and other pin-compatible valves can be used with this PCB.
- Connect the incoming HT/B+ and ground feeds to the pads labelled **HT IN** and **GND**. You can use 0.2"-pitch power connectors (e.g. Molex[®]) if you wish.
- Outgoing power supply feeds (RC filtered) can be taken from the pads labelled **HT2 OUT** and **GND**.
- Connect this incoming negative bias supply (if used) to the pad labelled **BIAS**.
- For cathode bias link the pads labelled **1** and **3** together. For fixed bias link the pads labelled **1** and **2** together.
- Connect the incoming heater supply feeds (4 amp maximum average) to the pads labelled **Heater**.
- Outgoing heater feeds can be taken from the **Heater** pads on the opposite edge of the PCB.
- Link the two pads as shown below to complete the heater circuit.



- Connect the suppressor grid to the cathode by linking the pads labelled **g3** and **k**.
- Cathode current can be monitored by measuring the voltage across a small (e.g. 10Ω) resistor R₅ using the pads labelled **TEST**.
- Connect the incoming audio signal to the pad labelled **IN**.
- If you want to connect the PCB ground to chassis, link the two pads labelled **GND** and **CHASSIS**. This is connected to the adjacent mounting screw hole.
- Spare **GND** pads are also provided if you need them for general connections.
- Use a 16mm PCB-mounted pot, or else use a chassis mounted pot and free wire onto the PCB.
- Mount power resistors about 5mm up into the air to encourage air flow.

Single Ended

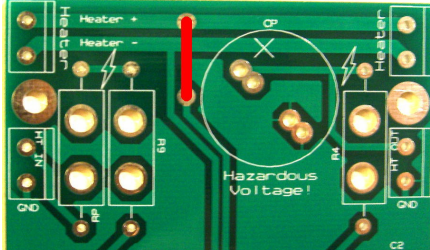
Use the circuit below to build a single-ended output stage. Connections to the output transformer are made to the pads labelled **CT** (HT/B+) and **ANODE**. Not all the components shown are necessarily required; this is at the user's discretion.



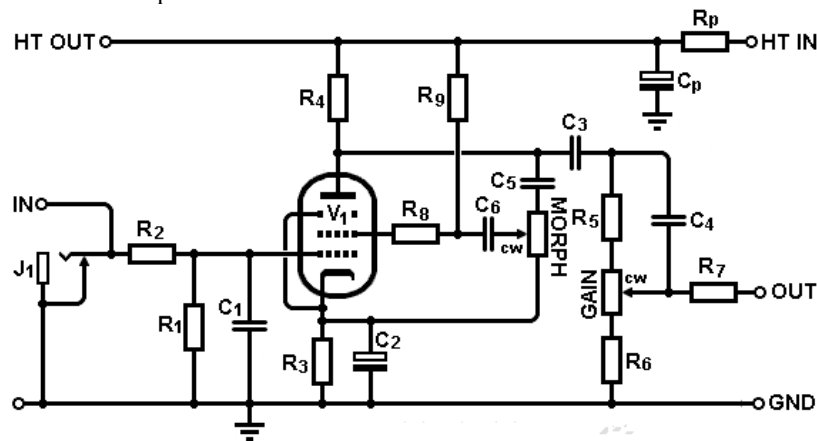
⑦EF86 Pentode Input PCB

General

- Connect the incoming HT/B+ and ground feeds to the pads labelled **HT IN** and **GND**. You can use 0.2"-pitch power connectors (e.g. Molex[®]) if you wish.
- Outgoing power supply feeds (RC filtered) can be taken from the pads labelled **HT OUT** and **GND**.
- Connect the incoming heater supply feeds (3 amp maximum average) to the pads labelled **Heater**.
- Outgoing heater feeds can be taken from the **Heater** pads on the opposite edge of the PCB.
- If you want to connect the PCB ground to chassis, link the two pads labelled **GND** and **CHASSIS**. This is connected to the adjacent mounting screw hole.
- Spare **GND** pads are also provided if you need them for general connections.
- Use 16mm PCB-mounted pots, or else use chassis mounted pots and free wire onto the PCB.
- Mount power resistors about 5mm up into the air to encourage air flow.
- Link the two pads as shown below to complete the heater circuit.



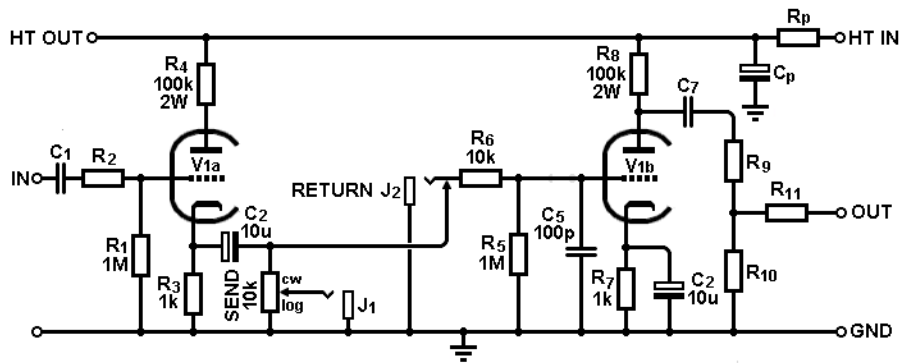
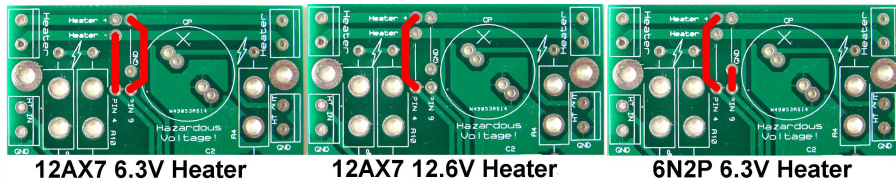
- If you don't want to use a jack socket because you're using the PCB as an intermediate stage in a larger amp design you can inject the input signal to the solder pad labelled **IN**.



⑧ Effects Loop PCB

General

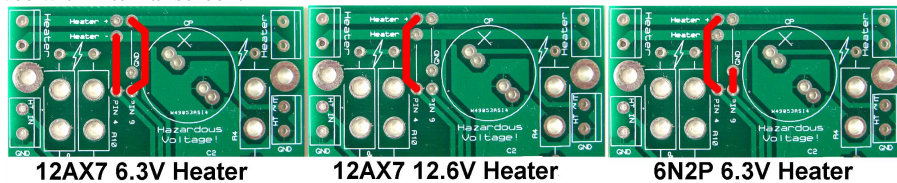
- Connect the incoming HT/B+ and ground feeds to the pads labelled **HT IN** and **GND**. You can use 0.2"-pitch power connectors (e.g. Molex[®]) if you wish.
- Outgoing power supply feeds (RC filtered) can be taken from the pads labelled **HT OUT** and **GND**.
- Connect the incoming heater supply feeds (3 amp maximum average) to the pads labelled **Heater**.
- Outgoing heater feeds can be taken from the **Heater** pads on the opposite edge of the PCB.
- Connect the incoming audio signal to the pad labelled **IN**.
- The outgoing audio signal is taken from the pad labelled **OUT**.
- If you want to connect the PCB ground to chassis, link the two pads labelled **GND** and **CHASSIS**. This is connected to the adjacent mounting screw hole.
- Spare **GND** pads are also provided if you need them for general connections.
- Use 16mm PCB-mounted pots, or else use chassis mounted pots and free wire onto the PCB.
- Mount power resistors about 5mm up into the air to encourage air flow.
- Connect link wires as show below to configure the PCB for 12AX7/ECC83 type pin-out valves, or 6N2P/ECC88 type pin-out valves with internal screen.



⑨ Tremolo PCB (Discontinued)

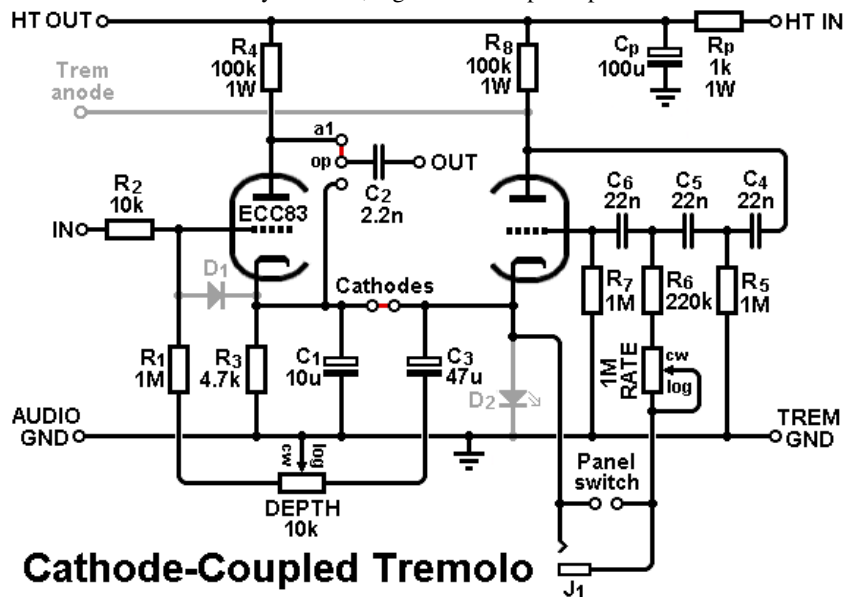
General

- Connect the incoming HT/B+ and ground feeds to the pads labelled **HT IN** and **GND**. You can use 0.2"-pitch power connectors (e.g. screw terminals) if you wish.
- Outgoing power supply feeds (RC filtered) can be taken from the pads labelled **HT OUT** and **GND**.
- Connect the incoming heater supply feeds (3 amp maximum average) to the pads labelled **Heater**.
- Outgoing heater feeds can be taken from the **Heater** pads on the opposite edge of the PCB.
- Connect the incoming audio signal to the pad labelled **IN**.
- The outgoing audio signal is taken from the pad labelled **OUT**.
- If you want to connect the PCB ground to chassis, link the two pads labelled **GND** and **CHASSIS**. This is connected to the adjacent mounting screw hole.
- Spare **GND** pads are also provided if you need them for general connections.
- Use 16mm PCB-mounted pots, or else use chassis mounted pots and free wire onto the PCB.
- Mount power resistors about 5mm up into the air to encourage air flow.
- Connect link wires as show below to configure the PCB for 12AX7/ECC83 type pin-out valves, or 6N2P/ECC88 type pin-out valves with internal screen.



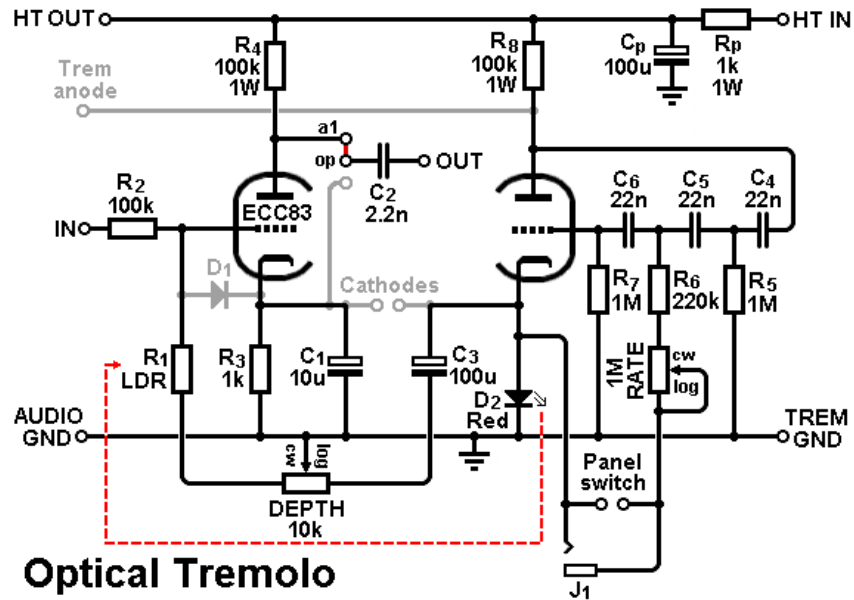
Cathode-Coupled Tremolo

This is a self-contained tremolo like the one found on the Kalamazoo Model Two. In this arrangement the low-frequency oscillator is cathode-coupled to an ordinary gain stage. As the cathode voltage (e.g. the bias voltage) oscillates it causes the gain of the audio stage to rise and fall, producing tremolo (amplitude modulation). A small bypass capacitor (C1) prevents cathode feedback at audio frequencies which would otherwise fight this gain variation, but it is too small to bypass the oscillator frequency which is less than 10Hz. The depth of modulation is controlled by introducing a larger cap (C3) which *does* bypass the oscillator frequency, gradually preventing the cathode voltage from varying. This circuit has the advantage that it needs no special parts, only standard resistors and capacitors. However, there are some disadvantages. First, the tremolo effect is quite mild because the gain of 12AX7 does not vary much with bias. Second, the DC anode voltage pulsates along with the oscillator, causing throbbing or ticking unless it is filtered out with some heavy bass-cut, e.g. a small output capacitor.



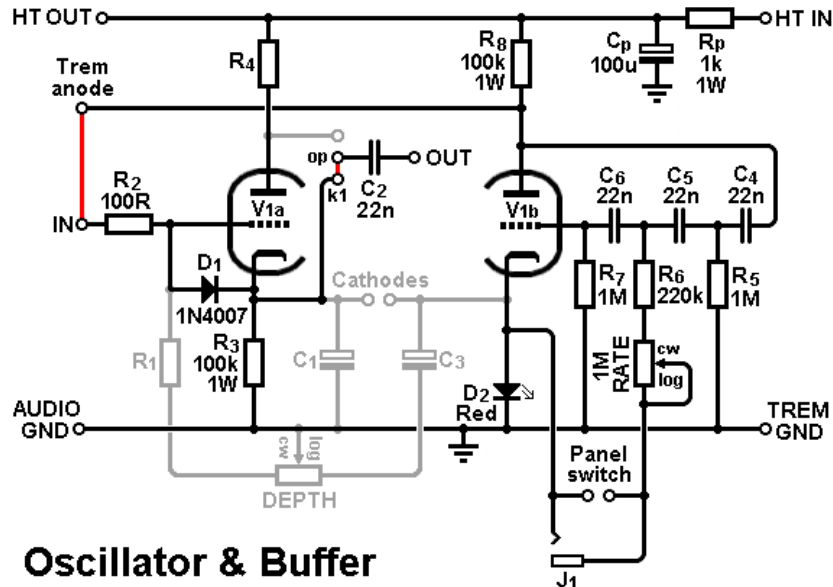
Optical Tremolo

This is a self-contained optical tremolo. The oscillator uses a LED for biasing, which will therefore flash along with the oscillations. The LED must point towards a light-dependent resistor (LDR) that forms a potential divider at the input of the gain stage. (The pair must be shielded from ambient light with heatshrink or similar). When the LED shines bright the LDR resistance goes low, attenuating the audio, and vice versa. The depth is controlled in two ways at once. As the pot is turned it gradually bypasses the LED with C3, to reduce the depth of flashing. It also adds resistance in series with the LDR, so the audio cannot be attenuated as much. This circuit has the advantage that it produces a very deep tremolo effect with less throbbing/ticking. In fact, the only ticking is caused by the LFO modulating the power supply node, so by using a small dropping resistor (R_p) and a big smoothing capacitor (C_p) it can be effectively suppressed. The disadvantage is that you need an LDR which is not a standard part anymore, but they are available on eBay from China, for example. Almost any LDR will work; simply adjust R2 to get the maximum depth you want.



Oscillator with Buffer

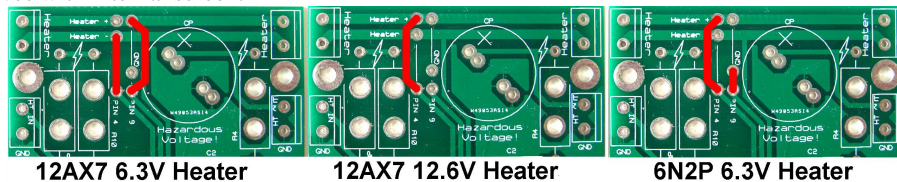
This is purely as an oscillator and buffer. The second triode is used as a DC-coupled cathode follower which can then be used to modulate the bias voltage in a fixed-biased output stage. Take a look at the Fender VibroChamp, 6G3, or 6G9 Tremolux for ideas (a depth control would need to be added off board).



⑩ Dual-Triode Output PCB

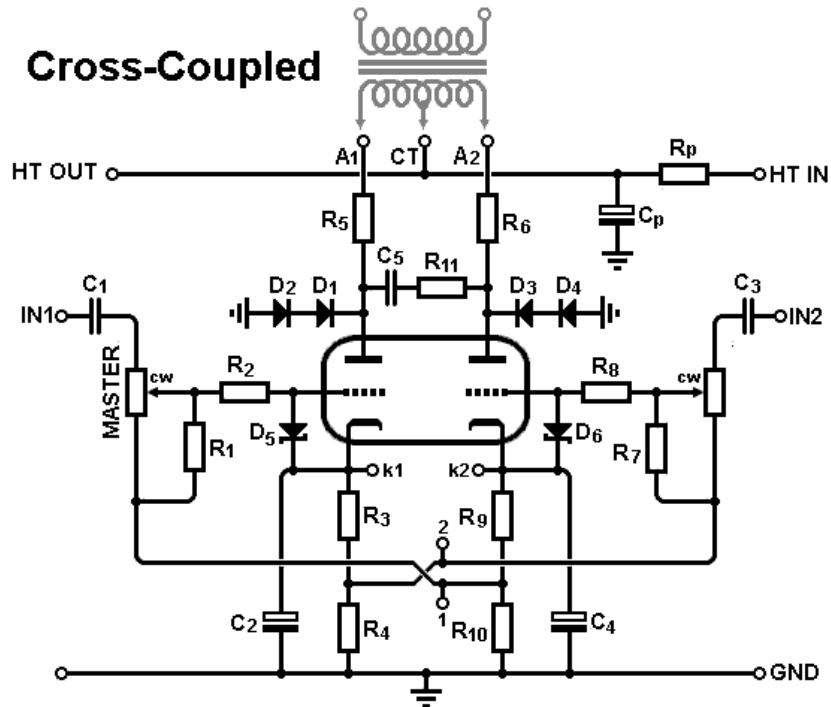
General

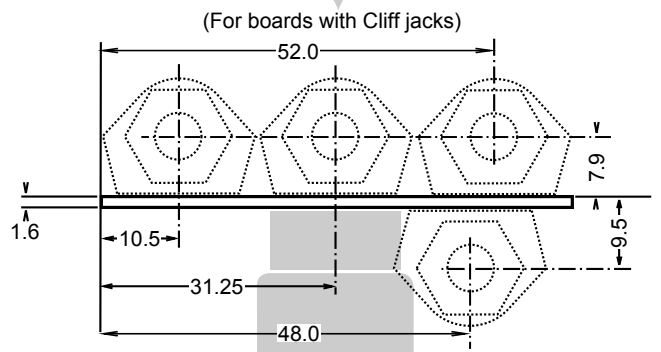
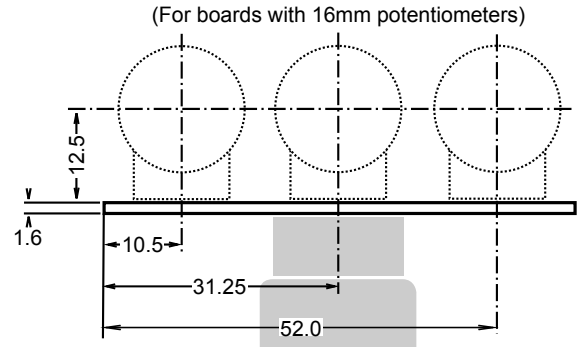
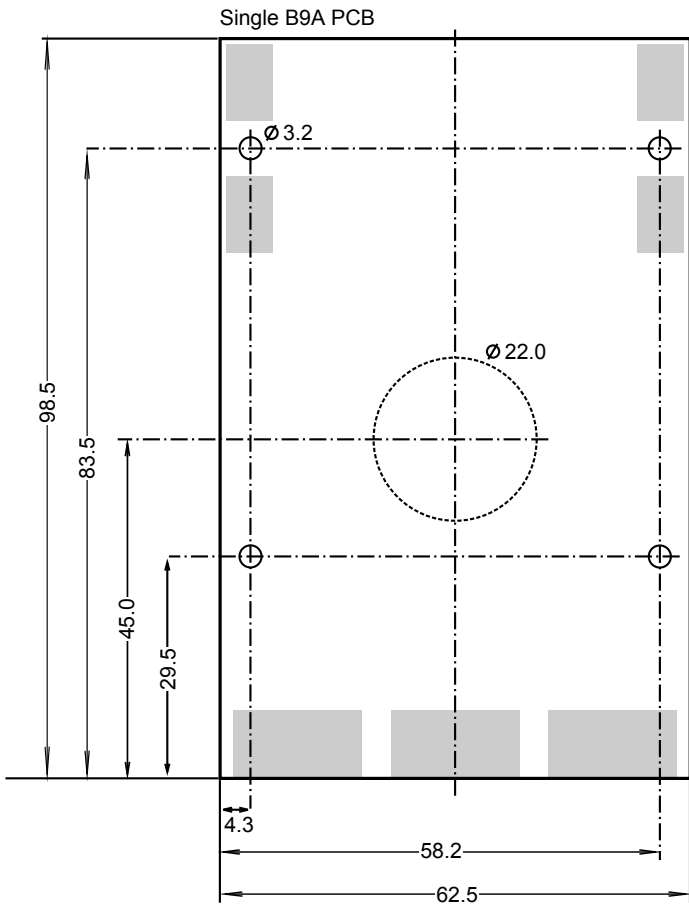
- Connect the incoming HT/B+ and ground feeds to the pads labelled **HT IN** and **GND**. You can use 0.2" pitch power connectors (e.g. screw terminals) if you wish.
- Outgoing power supply feeds (RC filtered) can be taken from the pads labelled **HT OUT** and **GND**.
- Connect the incoming heater supply feeds (3 amp maximum average) to the pads labelled **Heater**.
- Outgoing heater feeds can be taken from the **Heater** pads on the opposite edge of the PCB.
- Connect the incoming balanced audio signal to the pads labelled **IN1** and **IN2** as applicable.
- If you want to connect the PCB ground to chassis, link the two pads labelled **GND** and **CHASSIS**. This is connected to the adjacent mounting screw hole.
- Spare **GND** pads are also provided if you need them for general connections.
- Use a 16mm PCB-mounted pot, or else use a chassis mounted pot and free wire onto the PCB.
- Mount power resistors about 5mm up into the air to encourage air flow.
- Connect link wires as show below to configure the PCB for 12AX7/ECC83 type pin-out valves, or 6N2P/ECC88 type pin-out valves with internal screen.



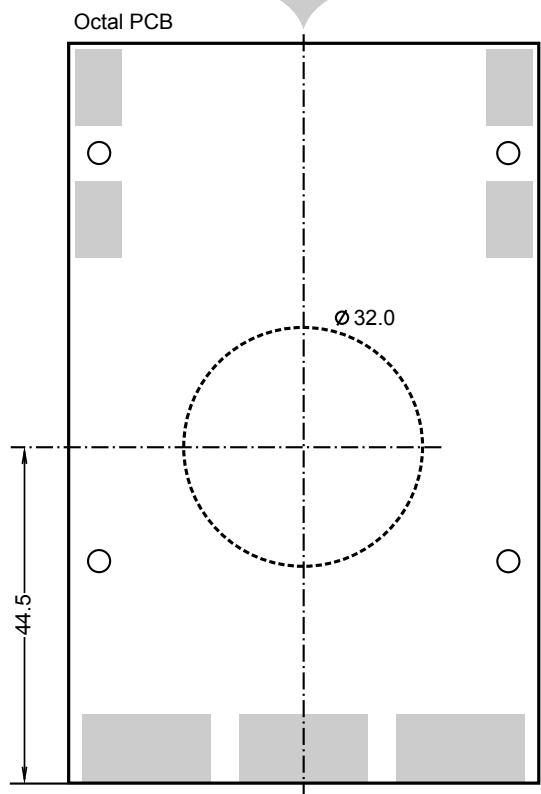
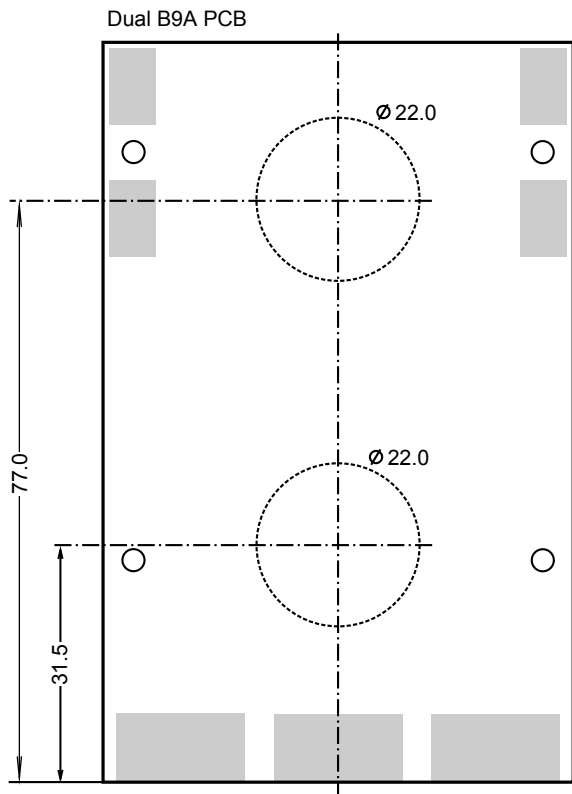
Cross-Coupled

This is a conventional push-pull output stage but with cross-coupled cathode bias. Cross-coupling is an effective way to ensure identical bias currents in each triode, which are highly stable with ageing and sample variation. Some power is wasted in the two extra bias resistors, but this is seldom a concern in a mini output stage.



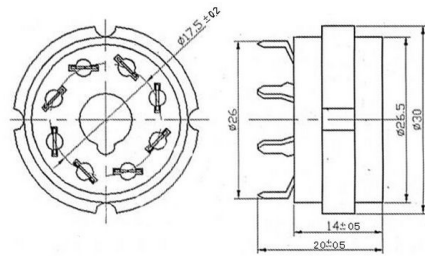
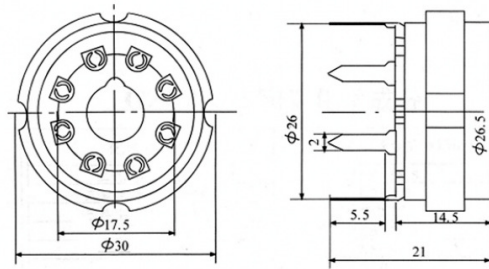


ValveWizard Universal Amp PCBs
Dimensions in millimetres +/-0.1

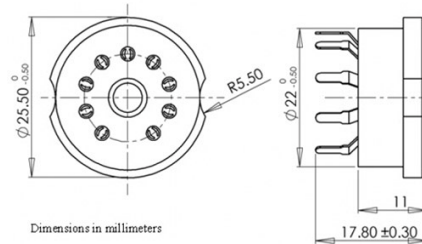
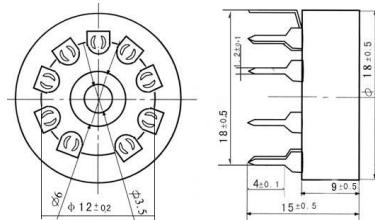


Recommended Valve Sockets

Octal



Noval



Dimensions in millimeters

