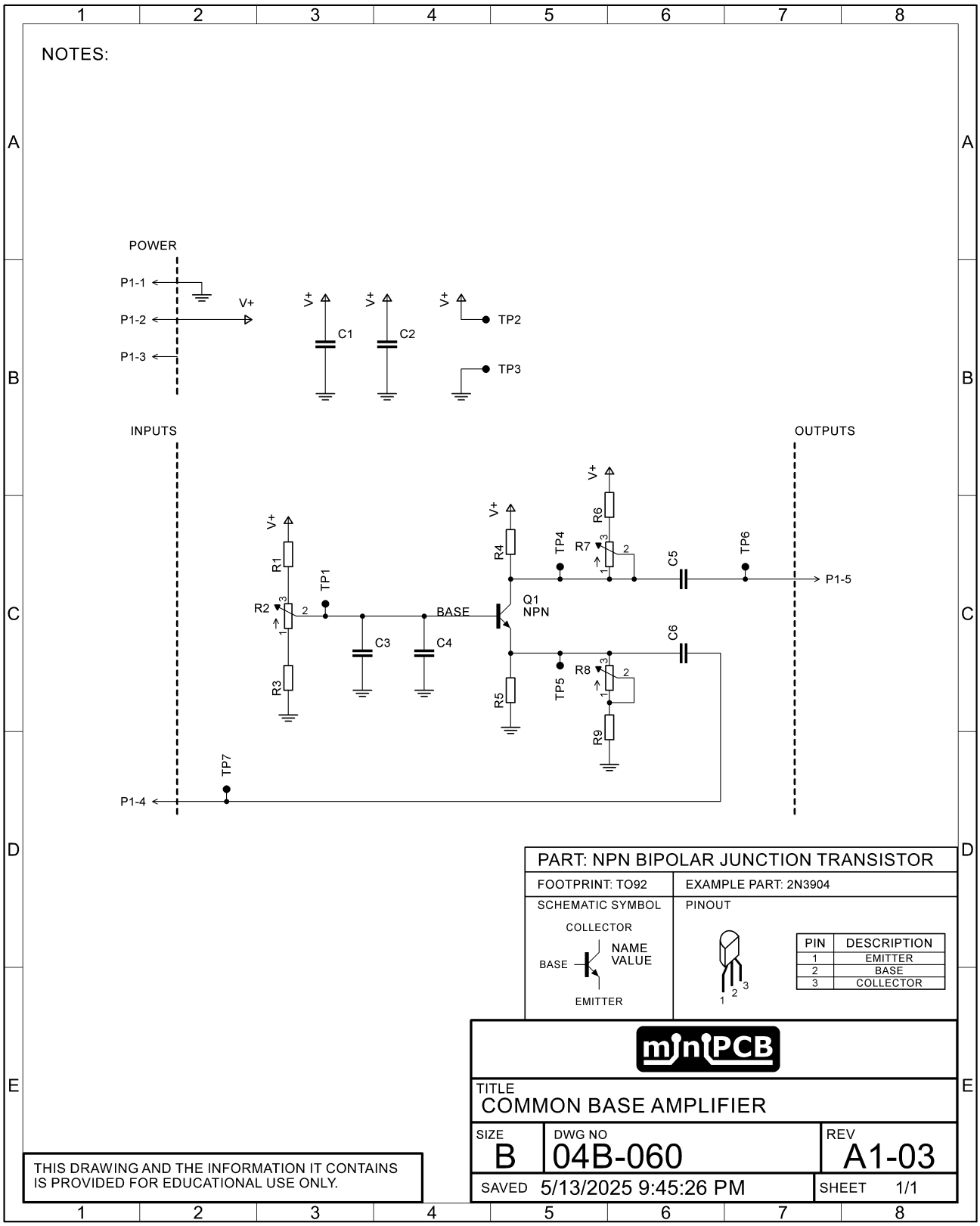
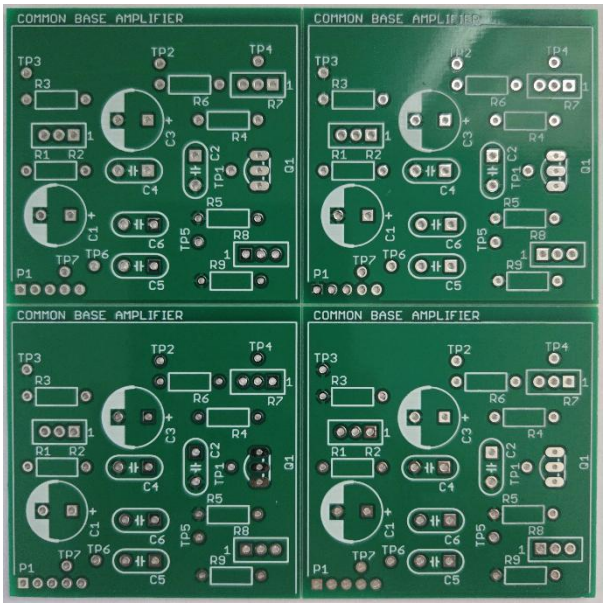
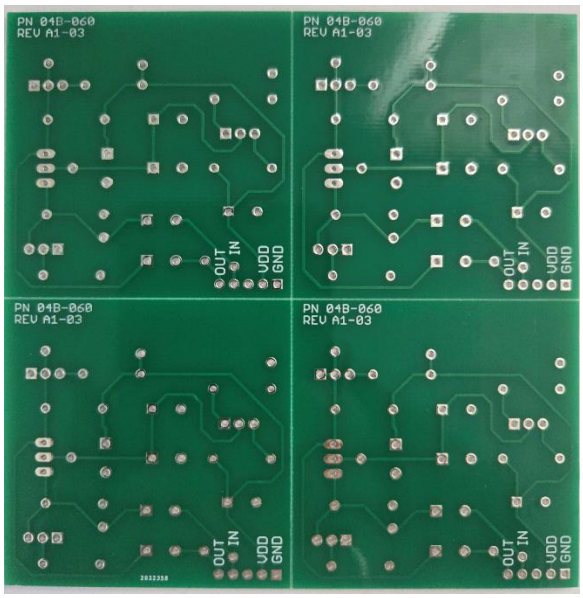
Common Base (Gate) Amplifier





Front Side



Back Side

miniPCB Part Number

PART NO	TITLE	PIECES PER PANEL
04B-060	Common Base Amplifier	4

miniPCB Revision History

REV	DESCRIPTION	DATE
A1-01	Initial Release	22OCT2023
A1-02	Updated PCB outline. Removed logo.	03DEC2024
A1-03	Added test points.	13MAY2025

Circuit Description

This miniPCB implements a single-stage common base amplifier, designed around a discrete NPN bipolar junction transistor (Q1), with optional substitution for an N-channel MOSFET or JFET. This amplifier topology features low input impedance, high voltage gain, and excellent high-frequency performance. Unlike the common emitter configuration, the input signal is applied to the emitter (or source), while the base (or gate) is held at a fixed bias voltage, and the output is taken from the collector (or drain).

Power Supply Conditioning

C1 and C2 are power rail decoupling capacitors that help suppress high-frequency noise and stabilize the DC supply voltage. TP2 and TP3 provide convenient access to the positive supply (V+) and ground (GND), respectively, for measurement and diagnostics.

Biasing Network

The base (or gate) voltage is set by a resistor divider network consisting of R1, R2 (a multiturn trimmer), and R3. This network establishes the transistor's quiescent bias point. Fine tuning of the base/gate voltage is performed using R2, allowing precise control over operating conditions. To further smooth and stabilize this bias node, C3 and C4 are included as filtering capacitors. TP1 allows direct measurement of the base (or gate) voltage.

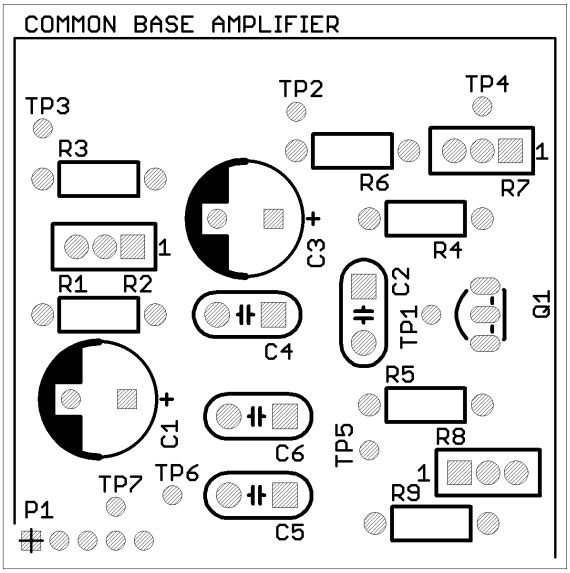


Figure 1 - Single Board, Component Outlines

Input and Emitter (Source) Network

The input signal is capacitively coupled through C6, an AC coupling capacitor that blocks DC and delivers the signal directly to the emitter (or source). The emitter is grounded through an adjustable resistance network formed by R5, R8 (a trimmer), and R9. Adjusting R8 modifies the emitter resistance, which in turn affects both DC bias and voltage gain. TP5 provides access to the emitter (or source) node for measurement.

Collector (Drain) Network and Output

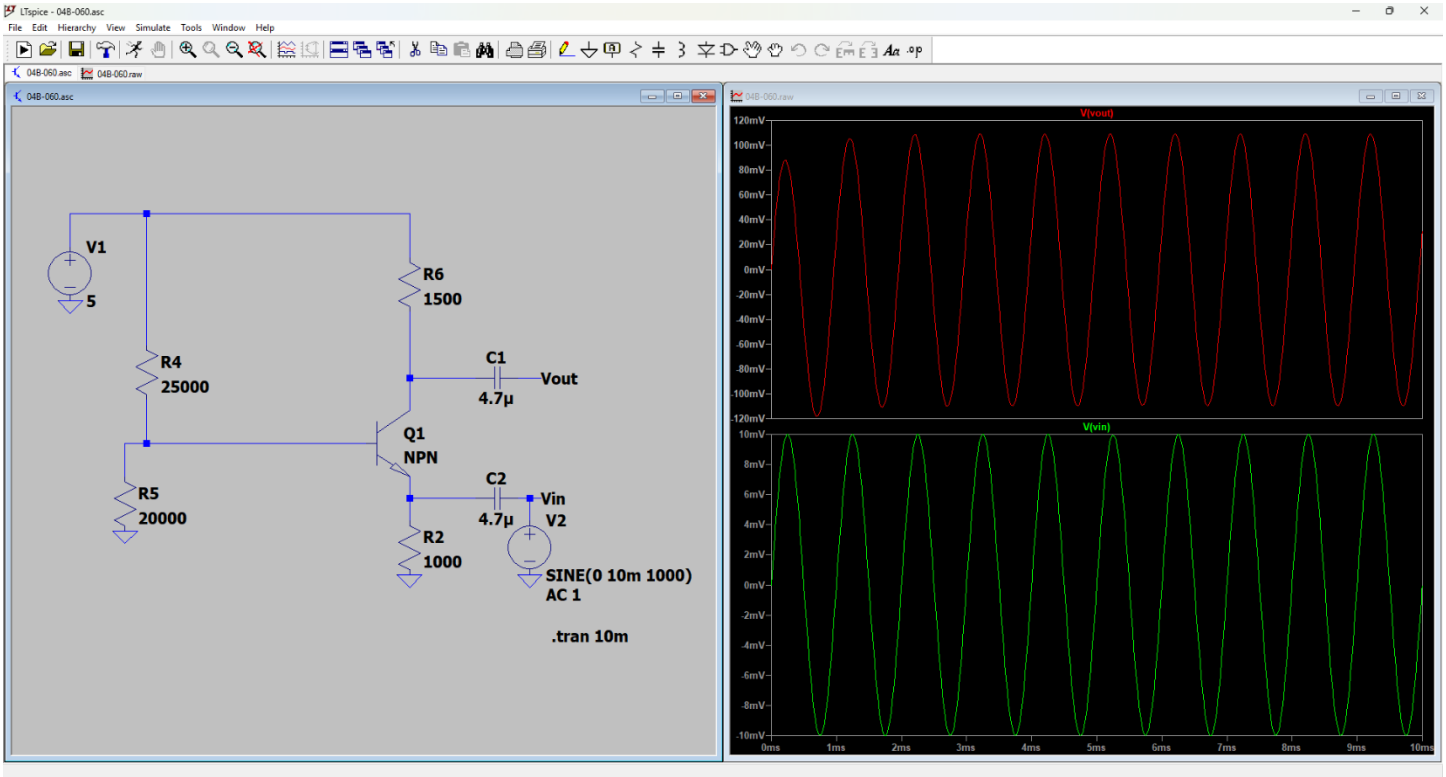
The collector (or drain) is connected to the supply rail through a resistive load composed of R4, R6, and R7 (a multiturn trimmer). This network sets the collector load and directly influences amplifier gain and output swing. Adjusting R7 allows fine control over these parameters. The amplified output is taken from the collector and passes through C5, an output decoupling capacitor that removes the DC offset. TP4 allows measurement of the collector (or drain) voltage, and TP6 provides direct access to the output signal.

Transistor Configuration

Q1 is the active gain element, installed in a TO-92 footprint with a C-B-E (Collector–Base–Emitter) pinout. The board is optimized for use with standard small-signal NPN BJTs, and is also compatible with many N-channel MOSFETs that follow the same pinout. However, most JFETs do not conform to this pinout and are not drop-in compatible without modification. This design allows users to experiment with different transistor technologies while maintaining the same amplifier topology and supporting circuitry.

Simulation in LTspice

LTspice was used to verify that selected component values produced reasonable amplifier behavior before assembling physical boards. The simulation helped confirm that the circuit was biased correctly, the signal was amplified, and the overall configuration functioned as expected with a voltage gain slightly greater than 10. While the analysis wasn't exhaustive, the simulation served as a practical check to ensure the design was sound and worth building.



Parts List

REF DES	PART TYPE	VALUE / DESCRIPTION
C1	CAPACITOR	10uF
C2	CAPACITOR	0.1uF
C3	CAPACITOR	10uF
C4	CAPACITOR	0.1uF
C5	CAPACITOR	2.2uF
C6	CAPACITOR	2.2uF
R1	RESISTOR	10kΩ
R2	RESISTOR (TRIMMER)	25kΩ
R3	RESISTOR	10kΩ
R4	RESISTOR	3.3kΩ
R5	RESISTOR	2.2kΩ
R6	RESISTOR	1kΩ
R7	RESISTOR (TRIMMER)	2kΩ
R8	RESISTOR (TRIMMER)	2kΩ
R9	RESISTOR	2.2kΩ
Q1	TRANSISTOR	2N3904
TP1-TP7	TEST POINT	KEYSTONE ELECTRONICS SERIES 5000
P1	HEADER PINS	5POS, 2.54mm PITCH, RA

Pictures of the Build

Testing Videos

Parts List (Form)

REF DES	PART TYPE	VALUE / DESCRIPTION
C1	CAPACITOR	
C2	CAPACITOR	
C3	CAPACITOR	
C4	CAPACITOR	
C5	CAPACITOR	
C6	CAPACITOR	
R1	RESISTOR	
R2	RESISTOR (TRIMMER)	
R3	RESISTOR	
R4	RESISTOR	
R5	RESISTOR	
R6	RESISTOR	
R7	RESISTOR (TRIMMER)	
R8	RESISTOR (TRIMMER)	
R9	RESISTOR	
Q1	TRANSISTOR	
TP1-TP7	TEST POINT	KEYSTONE ELECTRONICS SERIES 5000
P1	HEADER PINS	5POS, 2.54mm PITCH, RA

References

- https://www.minipcb.com/04B/04B-060.html
- https://www.youtube.com/@minipcb

Revision History

REV	DESCRIPTION	DATE
A	Initial Release	