

Analog Microphone

A capsule and one transistor. Read the swing, not a single value.



A loud sound reaches VCC

SIGNAL rests between the rails, but a loud sound swings it right up to VCC. On an ESP32, ESP32-S3 or Pico, feed VCC from 3V3, never 5V: 5 V would put 5 V on a 3.3 V analog pin.

Pins, and which to wire

Parts up, header at the bottom. Wire GND, VCC and SIGNAL; NC is connected to nothing on the board.

100 nF coupling

Passes sound, blocks the steady level.

Electret capsule

The only part that hears. Keep the foam on.

GND is the square pad

Count from it. The back prints no pin names.

S8050 transistor

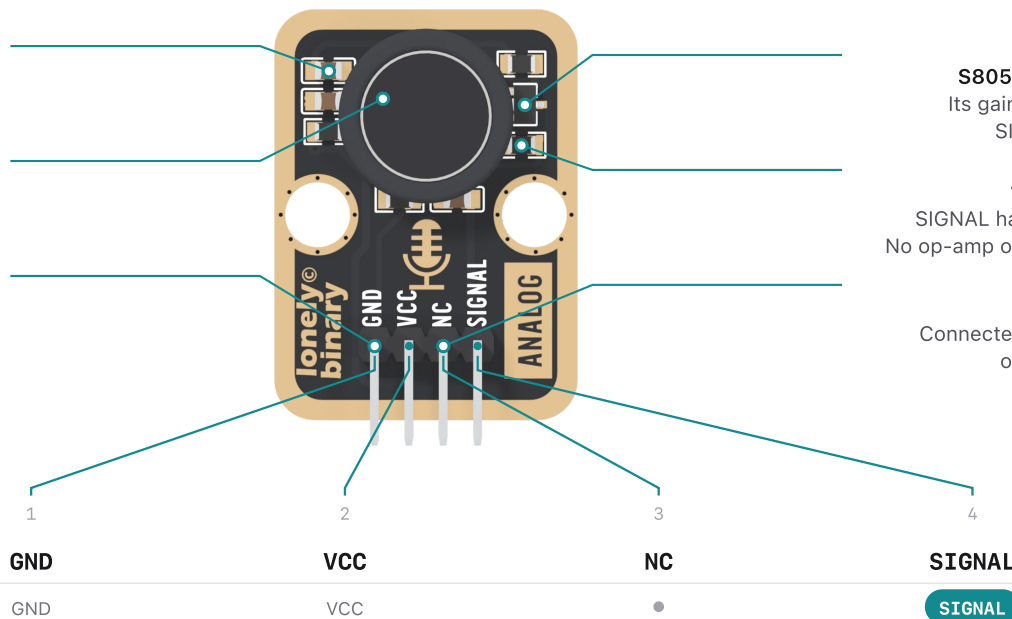
Its gain sets where SIGNAL rests.

1 kΩ to VCC

SIGNAL hangs from it. No op-amp on the board.

NC

Connected to nothing on the board.



Not a loudness level

In silence SIGNAL rests at a level set by the transistor's gain, not half the supply. Sound swings it both ways. Take the highest reading minus the lowest over 50 ms: that is the loudness.

What a sound reads

Silence, from 5 V

1.6-4.0 V resting level

About 325 to 815 on an Uno, set by the part's gain. Measure yours at start-up.

Talking, 1 m

15 mV peak to peak

About 3 counts on an Uno: lost in the reading's own wobble.

Clap, arm's length

1.5 V peak to peak

About 310 counts on an Uno. Close up it clips at VCC and near 0 V.

This block tells loud from quiet: claps, knocks, a raised voice close by. It does not hear quiet speech across a room, and it is no recording microphone. Measure the quiet swing where it will live, and set the threshold above it.

Resting levels from the S8050's graded gain, 120 to 400; swings from a comparable capsule's sensitivity, as its own is not published. Worked out, not measured. Band about 75 to 970 Hz from 5 V, 67 to 750 Hz from 3.3 V.

A clap switch, set by your room

Arduino IDE · Board: your board · ESP32-S3: USB CDC On Boot: Enabled

```
// SIGNAL: Uno A0. ESP32 34. S3 4. Pico 26.
// TK01 LED: Uno 9. ESP32 4. S3 5. Pico 15.
const int MIC_PIN = A0, LED_PIN = 9;
float threshold;
bool lampOn = false;

int swing() { // highest minus lowest over 50 ms
  int lo = 32767, hi = -1;
  unsigned long t = millis();
  while (millis() - t < 50) {
    int r = analogRead(MIC_PIN);
    if (r < lo) lo = r;
    if (r > hi) hi = r;
  }
  return hi - lo;
}

void setup() {
  Serial.begin(115200);
  pinMode(LED_PIN, OUTPUT);
  Serial.println("Keep quiet...");
  int quiet = 0;
  unsigned long t = millis();
  while (millis() - t < 1000) {
    int s = swing();
    if (s > quiet) quiet = s;
  }
  threshold = quiet + 41; // about 200 mV on an Uno
}

void loop() {
  int s = swing();
  if (s > threshold) {
    lampOn = !lampOn;
    digitalWrite(LED_PIN, lampOn ? HIGH : LOW);
    Serial.println(s);
    delay(300); // ignore the clap's echo
  }
}
```

Keep quiet...
312
298
Serial Monitor at 115200: the swing of each clap that switched the LED.

Why it rests where it does

510 kΩ feeds the S8050's base a few microamps. The transistor passes that times its gain, graded 120 to 400, through 1 kΩ, and SIGNAL rests at VCC less that drop: about 1.6 to 4.0 V from 5 V, 1.2 to 2.7 V from 3.3 V. Small sounds are amplified about 40 to 130 times from 5 V. Three 100 nF capacitors pass roughly 75 Hz to 1 kHz, strongest near 280 Hz; the one on the output rolls off above about 1.6 kHz.

When it does not work

Rests far from the middle

Normal. The transistor's gain sets the level. Measure it; never assume 512.

Reads 0 and never moves

VCC is missing or the cable is one pin over. Count from the square pad.

One clap switches twice

The clap rings and echoes. Ignore the microphone for 300 ms after each switch.

Specifications

Capsule	Electret, 9.7 mm, in a foam ring
Resting level	1.6–4.0 V from 5 V, worked out
Output	Analog only; no comparator, no LED
Supply	3.3 V or 5 V, the same as your board

Wiring

	FRONT	UNO	ESP32	S3	PICO
1	GND	GND	GND	GND	GND
2	VCC	5V	3V3	3V3	3V3
3	NC				
4	SIGNAL	A0	GPIO 34	GPIO 4	GP26

Hole 1 is the square pad. The clap switch's LED goes on a second pin: D9 (Uno), GPIO 4 (ESP32), GPIO 5 (S3), GP15 (Pico).

Talking does nothing

Speech a metre away is a few millivolts. Clap a hand's length away to test it.

Stuck at the top

GND is missing: the transistor passes no current and SIGNAL sits at VCC.

Jumps in silence

The ADC's own wobble, larger on an ESP32. Measure the quiet swing first.