

Analog to Digital Signal

A comparator, a knob and one bit: above or below the threshold.



VCC is your board's logic voltage

DIG is pulled up to VCC, and the block in IN can put VCC on ANA. On an ESP32, ESP32-S3 or Pico, feed VCC from 3V3, never 5V: 5 V would reach a 3.3 V pin.

Pins, and which to wire

Parts up, IN at the top. An analog block plugs into IN; wire GND, VCC and DIG from OUT, and ANA if you want the number. GND is the square pad.

IN socket

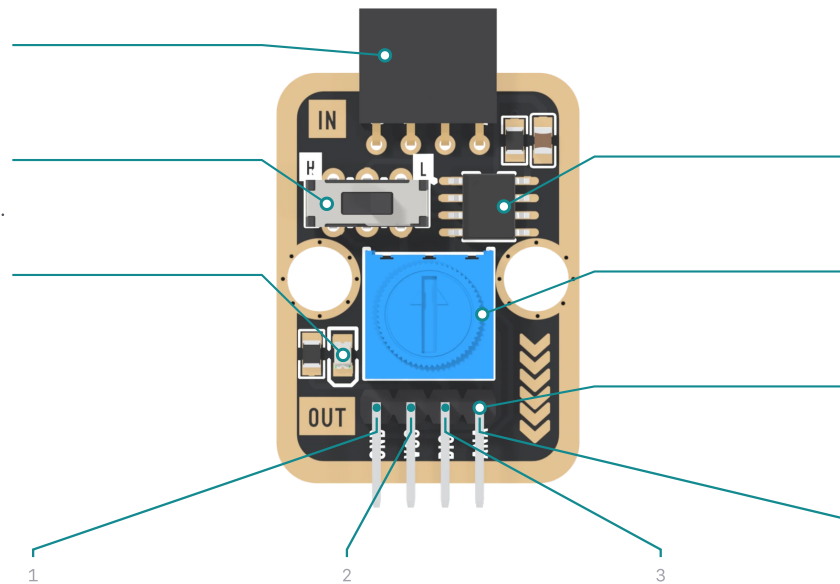
An analog block plugs in here and runs from VCC.

H / L switch

H: DIG HIGH above the knob.
L: HIGH below it.

LED lit = DIG LOW

It shows the opposite of the output.



LM393 comparator
Compares 0 V to VCC – 1.5 V.
One bit out, not a number.

Threshold knob
Keep it in the lower 55 %
from 3.3 V: 1.8 V at most.

ANA is not an input
It is the IN block's SIGNAL,
passed straight through.

Front	1	2	3	4
	GND	VCC	DIG	ANA
Threshold	GND	VCC	DIG	•
And value	GND	VCC	DIG	ANA

Lit means LOW

The red LED runs from VCC through 1 kΩ onto DIG, so it lights while DIG is LOW. H: DIG is HIGH while the input is higher than the knob. L: while it is lower.

Where the knob works

From 3.3 V

1.8 V, top of the range

The lower 55 % of the knob. Above it the answer is not promised.

From 5 V

3.5 V, top of the range

The lower 70 % of the knob. The input itself may go higher.

Response

1.3 μs, typical

Fast enough to follow noise: no hysteresis on the board, so a slow input chatters.

The knob sets a share of VCC, and only its lower part is usable. Set it by the LED: put the sensor where it should switch, and turn slowly until the LED changes.

From ON Semiconductor LM393/D at 25 °C, typical; from 0 to 70 °C the range ends at VCC – 2 V. Offset 5 mV at most. The LED's 1.1 to 2.9 mA is worked out for a red LED at about 2 V, not measured.

Steady answers, set by the knob

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

```
// DIG, ANA: Uno 2, A0. ESP32 25, 34. S3 7, 4. Pico 15, 26.
const int DIG_PIN = 2, ANA_PIN = A0;
const float FULL_MV = 5000; // Uno 5000, Pico 3300
const float HYST_MV = 50; // switch this far either side
int lastDig;
float thrMv = -1; // learned: DIG flips at the knob
bool above = false;

float readMv() {
  #if defined(ARDUINO_ARCH_ESP32)
    return analogReadMilliVolts(ANA_PIN);
  #else
    return analogRead(ANA_PIN) * FULL_MV / 1023.0;
  #endif
}

void setup() {
  Serial.begin(115200);
  pinMode(DIG_PIN, INPUT); // the board has its own pull-up
  lastDig = digitalRead(DIG_PIN);
}

void loop() {
  float mv = readMv();
  int dig = digitalRead(DIG_PIN);
  if (dig != lastDig) { lastDig = dig; thrMv = mv; }
  if (thrMv < 0) return; // not crossed the knob yet
  bool was = above;
  if (!above && mv > thrMv + HYST_MV) above = true;
  if (above && mv < thrMv - HYST_MV) above = false;
  if (above != was) Serial.println(above ? "above" : "below");
}
```

above
below
above

Serial Monitor at 115200: one line per crossing, however often DIG itself flipped on the way.

H, L and the light

The switch swaps the comparator's inputs; the threshold does not move. At H, DIG is HIGH while the input is higher than the knob; at L, while it is lower. The LED lights while DIG is LOW. With no board at all, power VCC and GND, put the sensor where it should switch, and turn the knob until the LED changes. The knob is rated for about 200 adjustments: set it and leave it.

When it does not work

DIG wanders, ANA drifts

Nothing in IN. Push an analog block fully into the socket.

DIG never changes

The knob is beyond the input, or above VCC – 1.5 V. Turn it toward the other end.

LED lit, sketch reads 1

The sketch is not reading DIG. Count OUT from the square pad.

Specifications

Comparator	LM393, one of its two used	Input range	0 to VCC – 1.5 V at 25 °C
Threshold	10 kΩ trimmer, a share of VCC	Switch	H: HIGH when higher. L: when lower
Output	Open collector, 10 kΩ pull-up to VCC	Supply	3.3 V or 5 V, the same as your board
Response	About 1.3 μs; no hysteresis	Current	Under 5 mA, plus the block in IN

Wiring

	FRONT	UNO	ESP32	S3	PICO
1	GND	GND	GND	GND	GND
2	VCC	5V	3V3	3V3	3V3
3	DIG	D2	GPIO 25	GPIO 7	GP15
4	ANA	A0	GPIO 34	GPIO 4	GP26

Hole 1 is the square pad. An analog block goes in the IN socket, parts facing the same way; its NC lands on a position wired to nothing. ANA is optional.