QUICK REFERENCE · TK57

Reflective Optical Sensor

Infrared out, infrared back. More light back, lower reading. Analog only.

VCC is your board's logic voltage

Over a dark surface SIGNAL rises to VCC, so 5 V on VCC is 5 V on your pin. **Wire VCC to 3V3 on an ESP32, ESP32-S3 or Pico; to 5V on an Uno.** On 5V the 120 Ω emitter resistor turns about 117 mW into heat against a 125 mW rating: inside it, and warm.

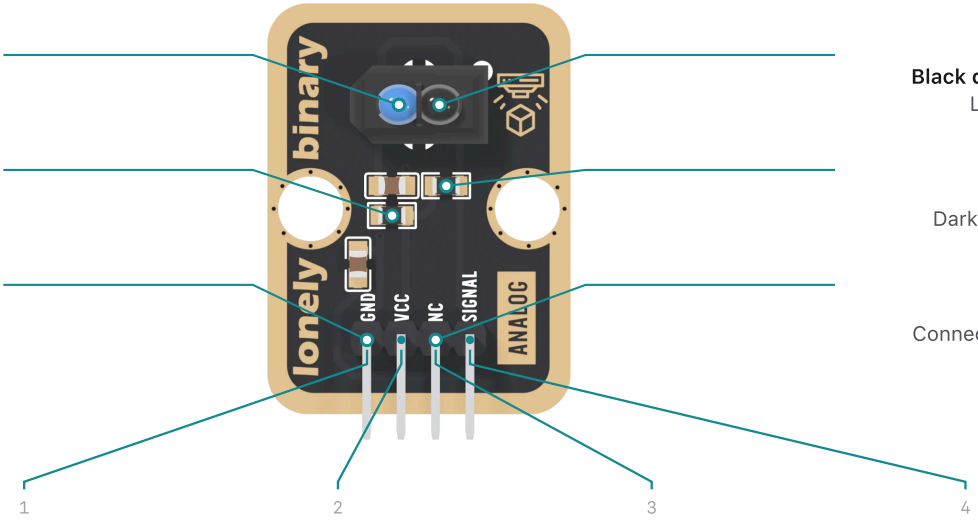
Pins, and which to wire

Parts up, header at the bottom. Wire GND, VCC and SIGNAL; NC is connected to nothing on the board. The sensor looks out of this face.

Blue dome: emitter
Infrared, always on, about 17.5 mA from 3V3.

120 Ω emitter resistor
Rated 125 mW. 5 V gives it about 117 mW: warm.

GND is the square pad
Count from it. The back prints no pin names.



Black dome: receiver
Light back pulls SIGNAL down.

4.7 kΩ pull-up
Dark or far: SIGNAL sits at VCC.

NC
Connected to nothing on the board.

Front	GND	VCC	NC	SIGNAL
Read it	GND	VCC	●	SIGNAL

It measures light coming back, not distance

It sees best at 2.5 mm and fades to a fifth of that by 15 mm. Grey card near and white paper farther away can read the same, and nothing at all reads like black. Fix the height, then compare surfaces.

What SIGNAL reads, 3 mm away

White paper

1.3 V, the lowest

About 1617 on an ESP32-S3. Close up, white reads lowest of all.

Grey card

2.6 V, in between

About 3405 on an ESP32-S3. The range where the reading means something.

Black tape, or nothing

3.2 V, near VCC

Near full scale. Dark and far read alike.

Lower means more light came back. Learn your own background and mark where the block will run, and put the threshold between them.

A model, not a measurement: the shape of Vishay's Fig. 9 (document 83760) and 2.5 % of the emitter's current returned by white paper at the peak, VCC on 3.3 V. Currents are arithmetic on the datasheet's forward voltage. The sketch compiles for an ESP32-S3 and an Uno; the block has not been bench-tested for this sheet.

The first reading, on an ESP32-S3

Arduino IDE · Board: ESP32S3 Dev Module · USB CDC On Boot: Enabled · No library

```
// The analog pin SIGNAL is wired to.
// Uno: A0. ESP32: 34. ESP32-S3: 4. Pico: 26.
const int SENSOR_PIN = 4;

#if defined(ARDUINO_ARCH_ESP32)
const int FULL = 4095;   // 12-bit on the ESP32 family
#else
const int FULL = 1023;   // 10-bit on an Uno and a Pico
#endif

void setup() {
  Serial.begin(115200);
}

void loop() {
  // More light back, LOWER: the sensor pulls SIGNAL down.
  int level = analogRead(SENSOR_PIN);

  int bars = map(level, 0, FULL, 0, 40);
  Serial.print(level);
  Serial.print('\t');
  for (int i = 0; i < bars; i++) Serial.print('#');
  Serial.println();

  delay(100);
}
```

```
4095 ########################################
1617 ###############
```

Serial Monitor at 115200, ten lines a second: full over open air, under half with white paper under the domes.

Wiring

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

Hole 1 is the square pad. VCC is the board's logic voltage: 3V3, or 5V on the Uno, whose 3.3V pin also works. SIGNAL goes to a pin with an ADC: on the ESP32s, ADC1, which keeps working with Wi-Fi on.

Counting, once each

An analog reading wobbles as an edge passes. Count a mark when the reading has gone 60 % of the way from background to mark, and re-arm only below 40 %. SIGNAL climbs back through 4.7 kΩ into 100 nF: 0.47 ms, most of the way in about a millisecond.

When it does not work

Always at the top

GND off, the back faces the surface, or too far away.

White and black the same

The ink is pale in infrared, or wrong height. Use black tape, 2 to 5 mm.

Uno tops out near 675

VCC is on 3V3. It works; 5V gives the full range.

Near 0 over black too

Sunlight or a lamp. Shade the sensor.

Numbers wander

SIGNAL on NC or another pin, or VCC missing.

Block warm on 5V

Normal: the emitter resistor takes about 117 of its 125 mW.

Specifications

Sensor	Vishay TCRT5000, about 950 nm	**Best at**	2.5 mm; a fifth of that at 15 mm
SIGNAL	Analog, 4.7 kΩ to VCC, lower with light	**Filter**	100 nF to GND, 0.47 ms
Emitter	120 Ω, always on	**Current**	About 17.5 mA at 3.3 V, 31 at 5 V
Supply	3V3, or 5V on an Uno	**Output types**	Analog only, no comparator