QUICK REFERENCE · TK37

Passive Buzzer

A magnetic buzzer with no oscillator: the square wave you send is the sound.

Never leave SIGNAL HIGH A steady HIGH is silent, and the 16 Ω coil then draws about 200 mA from 3.3 V, about 300 mA from 5 V, for as long as it lasts. **End every sound with noTone() or a LOW**, and never write a duty of 255.

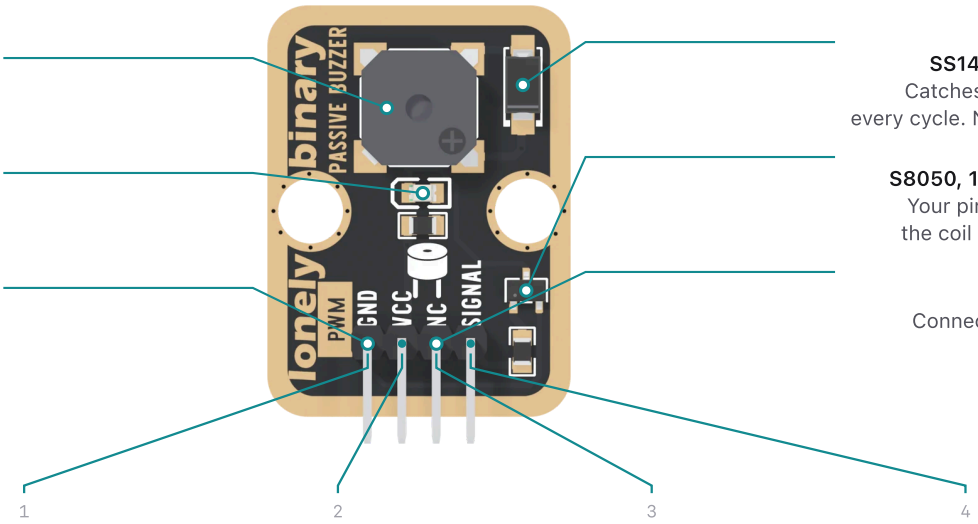
Pins, and which to wire

Parts up, header at the bottom. Wire GND, VCC and SIGNAL; NC is connected to nothing on the board. VCC may be 3V3 or 5V on any board: it never reaches SIGNAL.

MLT-8530 buzzer
A 16 Ω coil, not a piezo. Loudest at 2700 Hz.

Red LED
On with the transistor. Lit and silent: stuck HIGH.

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



SS14 flyback diode
Catches the coil's kick every cycle. Nothing to add.

S8050, 1 kΩ to its base
Your pin gives 2.5 mA; the coil takes up to 95.

NC
Connected to nothing on the board.

Front	GND	VCC	NC	SIGNAL
tone()	GND	VCC	●	SIGNAL

HIGH is silent There is no oscillator inside. The square wave on SIGNAL is the sound and its frequency is the pitch: tone(pin, 440) plays an A. digitalWrite only clicks, and a sketch written for an active buzzer leaves the coil on and silent.

Where it is loudest

Middle C, 262 Hz

22 dB under the peak

Thin and quiet. Move a tune written here up an octave or two.

C6, 1047 Hz

14 dB under the peak

The sixth octave, where the melody sketch plays. Clear enough for a tune.

Resonance, 2700 Hz

0 dB, the peak

At least 80 dB at 10 cm from 5 V. The pitch for an alarm or a keypress beep.

Pitch sets loudness as much as anything: the buzzer rings at 2700 Hz, and low notes come out far quieter. Beep at the resonance, play tunes high, and keep the duty at 50 %, as tone() does.

Loudness from the frequency-response curve in Huaneng's MLT-8530 specification (3.6 V, 50 % duty, 10 cm), read by eye to about 2 dB; not measured. Stuck-HIGH current worked out from the 16 Ω coil. The sketches compile for an ESP32-S3 and an Uno; the block has not been bench-tested for this sheet.

A melody, notes and lengths

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

```
// SIGNAL: S3 4. ESP32 4. Uno 9. Pico 15.
const int BUZZER_PIN = 4;
const int C6 = 1047, D6 = 1175, E6 = 1319, F6 = 1397, G6 = 1568;

struct Note { int hz; float beats; };
const Note TUNE[] = {          // Ode to Joy
  {E6, 1}, {E6, 1}, {F6, 1}, {G6, 1},
  {G6, 1}, {F6, 1}, {E6, 1}, {D6, 1},
  {C6, 1}, {C6, 1}, {D6, 1}, {E6, 1},
  {E6, 1.5}, {D6, 0.5}, {D6, 2},
};
const int BEAT_MS = 300;

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

void loop() {
  for (const Note &n : TUNE) {
    int ms = n.beats * BEAT_MS;
    tone(BUZZER_PIN, n.hz, ms * 9 / 10);  // sound 90 %
    delay(ms);                            // the gap
  }
  Serial.println("again in 2 s");
  delay(2000);
}
```

```
again in 2 s
```

Serial Monitor at 115200, once per tune. The LED glows faintly with each note; steady and bright means SIGNAL is stuck HIGH.

Wiring

	FRONT	S3	ESP32	UNO	PICO
1	GND	GND	GND	GND	GND
2	VCC	3V3	3V3	5V	3V3(OUT)
3	NC				
4	SIGNAL	GPIO 4	GPIO 4	D9	GP15

Hole 1 is the square pad. VCC on 3V3 keeps the buzzer inside its 2.5 to 4.5 V range; 5V is a few decibels louder, slightly over that range, and never reaches SIGNAL. SIGNAL can be any output pin for tone().

Volume is the duty cycle

tone() always sends 50 %, the loudest split. On an ESP32, `ledcAttach(pin, 2700, 8)` then `ledcWrite(pin, 64)` plays the same note about 3 dB quieter, and 13 about 16 dB. Above 128 it gets quieter again while the coil works harder, and 255 is SIGNAL held HIGH: silent, with the coil on. On an Uno, tone() is always 50 % and takes Timer2, so PWM on pins 3 and 11 stops while it plays.

When it does not work

Silent, LED dark

Nothing reaches the transistor: VCC, GND or SIGNAL, or the pin number in the sketch.

Silent, LED fully lit

SIGNAL is stuck HIGH and the coil draws about 200 mA. Use tone(); end LOW.

A click, not a note

One edge from digitalWrite. Send a wave with tone(pin, hz, ms).

Quiet low notes

Under the resonance it is 22 dB quieter at middle C. Double every frequency.

It will not stop

tone() with no length plays until noTone(). Give every call a length.

PWM elsewhere stopped

On an Uno tone() takes Timer2: pins 3 and 11. Use 5, 6 or 10.

Specifications

Buzzer	Huaneng MLT-8530, magnetic, 8.5 mm	**Coil**	16 ± 3 Ω, not a piezo
Rated	3.6 V, 2.5 to 4.5 V	**Current**	95 mA max playing, at 5 V
Loudest	2700 Hz, 80 dB min at 10 cm	**Switch**	S8050 NPN, hFE 200 to 350
SIGNAL	1 kΩ to the base, no pull-down	**Protection**	SS14 flyback across the buzzer