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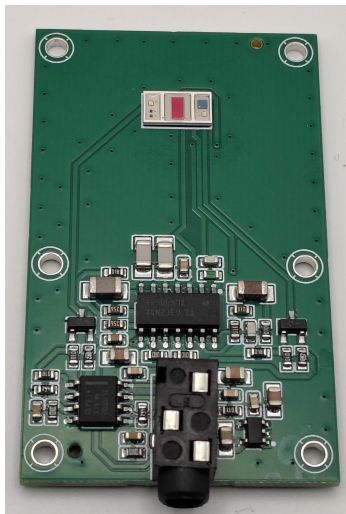
# ODAX PPG Standard

## Datasheet

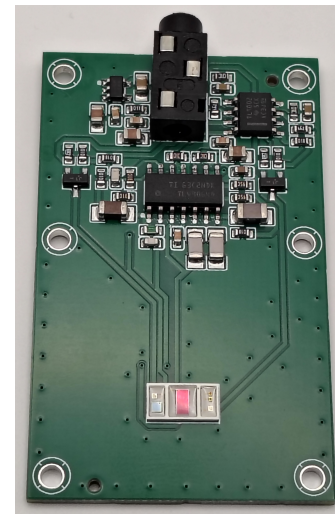
Green reflective finger pulse sensor

### Product Summary

Standard grade optical pulse sensor for reflective photoplethysmography (PPG) at the finger. The board uses an ams OSRAM **SFH 7072** optical module with **two green emitters and an IR-cut photodiode**. An analog signal path removes the steady optical background, amplifies pulse variations and provides a filtered voltage output for a host ADC.



(a) View A



(b) View B

**Figure 1:** ODAX PPG Standard assembled board.

|                        |                           |
|------------------------|---------------------------|
| Product family         | PPG Standard Grade Analog |
| SKU / Part number      | ODAX-PPG-SR1-100-STD-R1   |
| Document / Revision    | ODAX-PPG-SR1-R1 / R1      |
| Document date / Status | 2026-10-20 / Preliminary  |
| Nominal PCB size       | 52.5 mm × 32 mm           |

# 1 Electrical and Optical Characteristics

Values below are nominal design values unless marked otherwise. They are not measured production limits. The board provides an analog waveform; pulse detection and rate estimation are performed by the host.

## 1.1 Electrical Characteristics

| Parameter                    | Nominal / range   | Conditions and interpretation                                                                            |
|------------------------------|-------------------|----------------------------------------------------------------------------------------------------------|
| External supply, VCC         | 3.0 V to 5.0 V    | Design evaluation range. Use 3.3 V or 5.0 V nominal; check LED current regulation at the low end.        |
| Internal analog supply       | 2.5 V             | LP5907MFX-2.5 regulator; this is separate from VCC.                                                      |
| Buffered reference           | 1.25 V            | Half the regulated analog supply; nominal settled output baseline.                                       |
| Green LED drive              | 6.10 mA each      | Calculated setpoint for each of two continuously driven emitters.                                        |
| Total board current          | Not characterized | The two LED branches alone contribute approximately 12.2 mA.                                             |
| TIA transimpedance           | 47 k $\Omega$     | Photodiode current-to-voltage conversion.                                                                |
| AC-stage gain                | 20 V/V            | Nominal midband gain magnitude, approximately 26 dB.                                                     |
| High-pass corner             | 0.159 Hz          | Nominal first-order corner of the AC-coupled gain stage.                                                 |
| Gain-stage upper pole        | 36.2 Hz           | Additional first-order low-pass response.                                                                |
| Active LPF natural frequency | 19.4 Hz           | Second-order stage; not the overall $-3$ dB bandwidth.                                                   |
| Output, VOUT                 | Analog, DC-biased | Centered near 1.25 V after settling. Swing is limited by the 2.5 V analog supply and amplifier headroom. |
| Output series resistance     | 1 k $\Omega$      | Followed by 10 nF to ground. Use a high-impedance ADC input.                                             |

## 1.2 Optical Configuration

The fitted component is the **ams OSRAM BIOFY SFH 7072** (U4). This board uses its two green LEDs and IR-cut detector in a **reflective** arrangement: the emitter and detector face the same side of the finger. The green centroid wavelength is typically 530 nm at the manufacturer's 20 mA, 25 °C test condition; the board uses the lower drive current listed above.<sup>[1]</sup> The module's red and infrared emitters and broadband detector are unused in this implementation. There is no SpO<sub>2</sub> output.

## 1.3 User Interface: CN1 (PJ-3200)

| CN1 terminal | Signal | Direction | Connection                                 |
|--------------|--------|-----------|--------------------------------------------|
| 2            | VCC    | Input     | External DC supply.                        |
| 3            | GND    | Reference | Common return for the supply and host ADC. |
| 4            | VOUT   | Output    | Filtered PPG voltage to the host ADC.      |

Verify the plug tip/ring/sleeve mapping on the actual cable before applying power. The jack carries power and signal; it is not an audio connection.

## 2 Operation and Key Equations

Green light illuminates the finger and the photodiode collects returning light. Changes in the returned intensity produce a small AC photocurrent on a larger background. The signal passes through a transimpedance amplifier, an AC-coupled gain stage and an active low-pass filter.

### 2.1 Green Emitter Drive

The TLV9002 and two MOSFET current sinks drive the green emitters. Each channel uses a 240 k $\Omega$ /10 k $\Omega$  divider and an 8.2  $\Omega$  sense resistor. With the fitted 2.5 V regulator, the buffered reference is 1.25 V:

$$I_{\text{LED}} = \frac{V_{\text{ref}}}{R_{\text{sense}}} \frac{R_{\text{bottom}}}{R_{\text{top}} + R_{\text{bottom}}} = \frac{1.25 \text{ V}}{8.2 \Omega} \frac{10}{240 + 10} \approx 6.10 \text{ mA}. \quad (1)$$

This is the current setpoint while the driver has sufficient voltage headroom. Constant current does not make optical output independent of temperature, finger placement or tissue properties.

### 2.2 Photodiode Conversion

The TLV9064 front end uses a 47 k $\Omega$  feedback resistor in parallel with 10 pF. For a signed photodiode current  $I_{\text{PD}}$  defined as positive into the summing node, the low-frequency conversion is:

$$V_{\text{TIA}} = V_{\text{ref}} - I_{\text{PD}} R_{\text{TIA}}, \quad R_{\text{TIA}} = 47 \text{ k}\Omega. \quad (2)$$

The sign depends on the current convention; the transimpedance magnitude is 47 mV per 1  $\mu$ A. Large background light can saturate this stage before the subsequent high-pass filter acts.

### 2.3 AC Coupling and Gain

The 10  $\mu$ F coupling capacitor and 100 k $\Omega$  input resistor suppress steady optical offsets and slow baseline changes:

$$f_{\text{HP}} = \frac{1}{2\pi R_{\text{in}} C_{\text{HP}}} = \frac{1}{2\pi (100 \text{ k}\Omega)(10 \mu\text{F})} \approx 0.159 \text{ Hz}. \quad (3)$$

The two series 1 M $\Omega$  feedback resistors set an inverting midband gain of 20. Their 2.2 nF parallel feedback capacitor adds an upper pole near 36.2 Hz.

### 2.4 Output Low-Pass Filter

The unity-gain active filter uses two 95.3 k $\Omega$  resistors, 100 nF feedback capacitance and 74 nF reference capacitance (47 nF plus 27 nF):

$$f_0 = \frac{1}{2\pi \sqrt{R_{17} R_{18} C_{14} C_{15}}} = \frac{1}{2\pi \sqrt{(95.3 \text{ k}\Omega)^2 (100 \text{ nF})(74 \text{ nF})}} \approx 19.4 \text{ Hz}. \quad (4)$$

The filter reduces high-frequency content. Its natural frequency is not a guaranteed pulse-rate limit or the complete signal path's  $-3$  dB corner. Motion within the pulse band remains in the output.

### 3 Representative LTspice Results

These plots illustrate simulated behavior, not board measurements. The model uses LT1800 amplifier macromodels and ideal references in place of the fitted amplifiers and regulator.

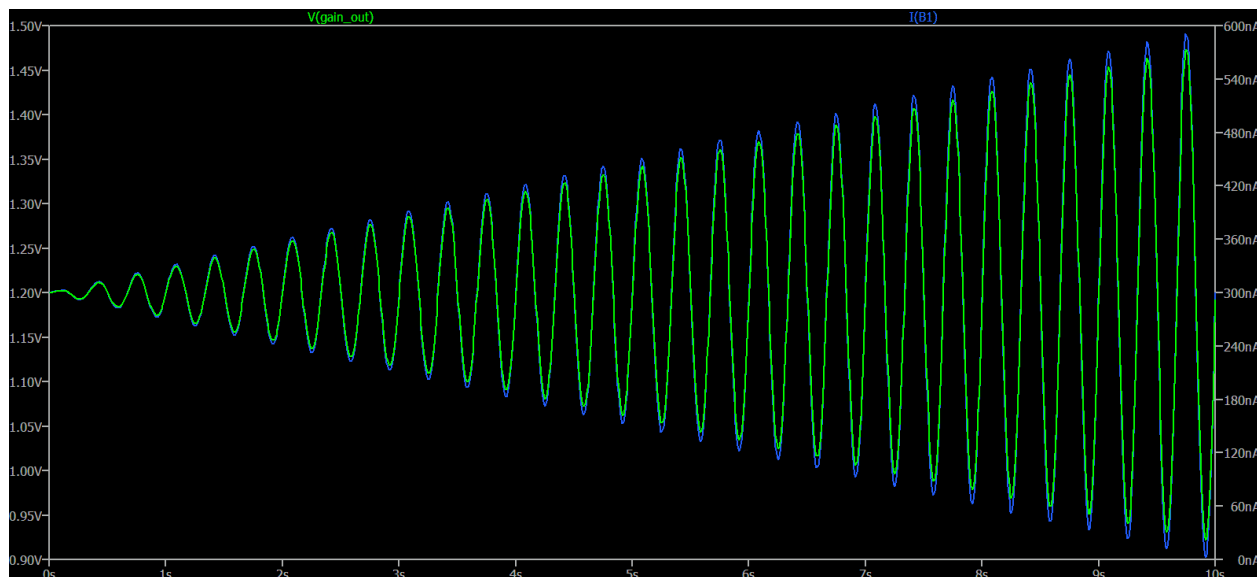


**Figure 2: AC gain-stage time response.** Green: gain-stage voltage, left axis. Blue: modeled photodiode current, right axis.

The modulation increases over the 10s run, producing approximately 0.90 V to 1.47 V at the gain-stage node, before the output filter. The simulated baseline is near 1.20 V; the fitted board's nominal reference is 1.25 V.

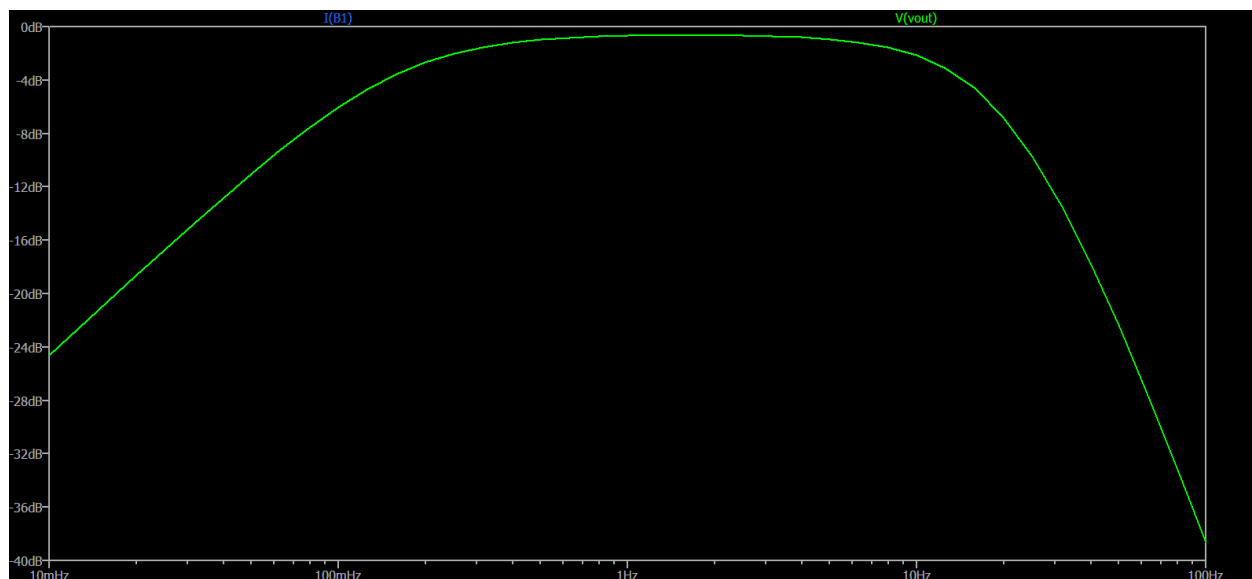


**Figure 3: Overall frequency response.** The green V(vout) trace shows low-frequency rejection and high-frequency roll-off.

The sweep covers 10 mHz to 100 Hz. The dB scale uses the simulation's excitation and reference; it is not a voltage-gain specification. Component-derived stage values are given on page 3. No measured noise or pulse-rate accuracy is implied.

## 4 Mechanical Information

All dimensions are nominal and in millimetres unless otherwise stated.

| Feature                                       | Nominal            |
|-----------------------------------------------|--------------------|
| PCB length                                    | 52.5               |
| PCB width                                     | 32.0               |
| PCB thickness                                 | 1.6                |
| Mounting holes (count)                        | 6                  |
| Hole diameter                                 | 2.2                |
| Outer hole spacing                            | $47.0 \times 27.0$ |
| Middle to end column                          | 20.5               |
| Height from PCB underside to top of connector | 6.6                |

**Dimensional notes.** Nominal dimensions are not manufacturing tolerances. Verify the delivered board, particularly the mounting-hole diameter, before making close-fitting mounting hardware. Allow additional clearance for soldered pins below the board and for the plug beyond the board edge.

### 4.1 Mounting and Optical Access

Keep the SFH 7072 optical face unobstructed and provide gentle, stable finger contact. Add cable strain relief to limit motion. Mounting-hole pads connect to GND; account for this when selecting conductive fasteners or an enclosure.

## 5 Application and Integration

### 5.1 Getting Started

1. With power off, verify the cable mapping to VCC, GND and VOUT in Section 1.3. Connect the output to a high-impedance host ADC and share the signal ground.
2. Apply a clean supply within the design range. A 3.3 V or 5.0 V nominal source is a practical starting point. Keep VOUT within the host ADC's permitted input range; the board analog domain is 2.5 V even when VCC is 5 V.
3. Rest the finger pad over the optical package with light, consistent pressure. Shield the sensing area from strong ambient light and support the hand and cable.
4. Allow the baseline to settle after power-up or repositioning. The nominal high-pass time constant is 1 s, so several seconds of settling may be needed; discard this interval.
5. As an initial acquisition setting, sample at 100–200 samples/s. Check the waveform for clipping, motion and baseline drift before choosing host filtering and peak-detection thresholds.
6. Estimate pulse rate from accepted pulse intervals: divide 60 by the interval in seconds to obtain beats per minute. Reject corrupted intervals and validate the algorithm in its intended use.

### 5.2 Interpreting the Output

Pulse amplitude depends on placement, pressure, tissue properties, ambient illumination and motion. The high-pass stage removes steady background from the downstream signal but cannot recover a saturated photodiode front end. Filtering also cannot remove motion that overlaps the pulse frequencies. Check the waveform again after moving the finger.

Board-level pulse-rate accuracy, noise floor, temperature range and absolute maximum ratings are not specified. The nominal frequency calculations and simulated voltage spans are not guaranteed limits. Intended applications include finger-pulse experiments, biofeedback and analog biosignal acquisition; medical diagnostic performance is not specified.

## 6 Ordering and Document Information

| Part number             | Description                                                                             |
|-------------------------|-----------------------------------------------------------------------------------------|
| ODAX-PPG-SR1-100-STD-R1 | Standard grade assembled green reflective PPG sensor board, analog output, revision R1. |

### 6.1 Component References

- [1] ams OSRAM, [SFH 7072 datasheet](#), version 1.6, 2023-08-11. Optical configuration and wavelength reference.
- [2] Texas Instruments, [LP5907MFX-2.5/NOPB](#) and [LP5907 datasheet](#). Fitted regulator variant and analog-rail basis.

**Revision history:** R1 — 2026-10-20. Initial preliminary datasheet for the standard grade PPG board. Electrical values use the fitted 2.5 V regulator and nominal 1.25 V reference.