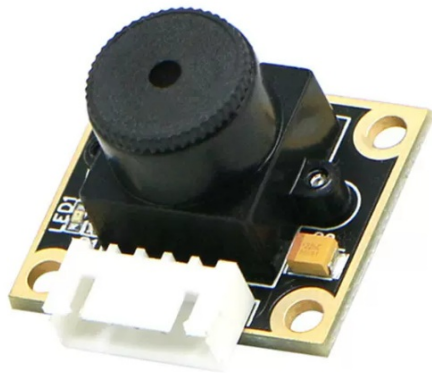


TSL1401 Linear CCD Sensor Module

128-Pixel Line-Scan Optical Sensor for High-Speed Line Tracking

Analog-output linear CCD module for intelligent vehicles, path recognition, tracking and obstacle-avoidance experiments



Parameter	Specification
Sensor array	128 linear photodiode pixels
Module size	30 × 25 mm
Weight	7.8 g
Supply voltage	DC 3.3-5 V
Output	Analog grayscale signal
Update rate	≤100 Hz
Lens	56° distortion-free lens
Detection distance	5-40 cm
Resolution	1 × 128 pixels

1. Product Overview

The TSL1401 linear CCD module integrates a 128-element photodiode array with charge-integration circuitry, an internal pixel-data hold structure and analog signal conditioning. Each pixel accumulates charge in proportion to incident light during the integration period. The module is controlled using SI and CLK signals and provides a sequential analog grayscale output, allowing a host controller to reconstruct the brightness profile across the 128-pixel line.

2. Key Selling Points & Features

- 128-pixel linear optical array provides a direct one-dimensional grayscale profile.
- Analog grayscale output enables detailed edge, line and contrast analysis rather than simple binary detection.
- Source material states acquisition rates above 50 Hz are achievable; module parameter table specifies data update frequency ≤ 100 Hz.
- Compact 30 × 25 mm module and low 7.8 g mass.
- Wide DC 3.3-5 V operating supply range.
- 56° distortion-free lens included in the specified configuration.
- 5-40 cm recommended detection distance for line-tracking use.
- Supports indoor and outdoor use according to the supplied product information.
- Suitable for single-line, double-line and varied line-tracking environments.
- Designed for high-speed intelligent-vehicle path recognition, line following and obstacle-avoidance applications.
- Simple SI + CLK timing interface with analog output makes integration practical with MCU ADC peripherals.

3. Technical Specifications

Parameter	Specification
Model	TSL1401
Product type	Linear CCD module
Sensor architecture	128-element linear photodiode array
Module dimensions	30 × 25 mm
Weight	7.8 g
Operating principle	Linear scanning / charge integration
Supply voltage	DC 3.3-5 V
Output signal	Analog grayscale signal
Data update frequency	≤ 100 Hz
Lens	56° distortion-free lens
Recommended detection distance	5-40 cm; source notes lens configuration is not intended for long-distance forward-looking detection
Resolution	1 × 128
Lighting environment	Indoor / outdoor
Supported tracking scenes	Single line, double line and varied line-tracking environments
Tracking capability	High-speed line tracking
Target applications	High-speed intelligent-vehicle path recognition, tracking and obstacle avoidance

4. Electrical Interface

Parameter	Specification
GND	Power ground
VCC	DC 3.3-5 V supply
AO	Analog grayscale-value output
CLK	Clock input; controls exposure timing and pixel grayscale-data output
SI	Serial input/control signal used for pixel grayscale acquisition and output sequencing

The module requires only the SI control signal and CLK timing signal for acquisition sequencing. The host samples the AO analog output with an ADC to obtain the relative light-intensity value for each pixel.

5. Functional Principle

The 128 photodiodes are arranged in a single linear array. Each pixel has its own integration region. During the integration interval, incident light is converted to accumulated charge; the resulting pixel values are then held and shifted out sequentially. The analog voltage at AO is proportional to the relative optical intensity seen by each pixel and to the selected integration time. By reading all 128 samples, the host obtains a one-dimensional grayscale image suitable for identifying lane/track edges and contrast transitions.

6. Mechanical Reference

Parameter	Specification
PCB overall width	30 mm
PCB overall height	25 mm
Horizontal mounting-hole spacing reference	24 mm
Vertical mounting-hole spacing reference	19 mm
Lower connector / edge reference shown	10 mm
Additional side reference shown	7 mm

The original dimension drawing contains Chinese annotations and is intentionally not reproduced. The values above were extracted from the supplied mechanical drawing.

7. Mounting Options

- Height-adjustable and angle-adjustable support bracket.
- Short-height adjustable support bracket.
- Flat intelligent-car dedicated support plate.
- Bracket kits shown with M3 hardware, XH2.54 connectors and associated cabling.

8. Typical Applications

- Intelligent line-following vehicles
- High-speed path recognition
- Single-line and double-line tracking
- Robot navigation experiments
- Track-edge / contrast detection
- Obstacle-avoidance research platforms

9. Integration Guidance

- Connect AO to an MCU analog-to-digital converter input.
- Generate SI and CLK timing according to the desired integration/exposure period and pixel-readout sequence.
- Acquire all 128 analog samples for each line scan and normalize/calibrate grayscale thresholds for the actual track surface and illumination.
- Adjust sensor height and viewing angle to obtain a clear contrast profile across the target line.
- The supplied material recommends a 5-40 cm detection distance and notes the lens configuration is not suitable for long-distance forward-looking sensing.
- Validate performance under the actual indoor/outdoor lighting environment used by the vehicle.

10. Source Notes

This datasheet was created from the supplied product package. Chinese-language parameter, function, interface, bracket and mechanical-drawing images were used only to extract information and are not reproduced in the final PDF. Unrelated recommendation assets contained in the saved webpage package were excluded. Parameters not explicitly supported by the supplied TSL1401 product material have not been invented.