Data Sheet
Analog Automatic Solar Tracker

1 Product Overview

The **Analog Automatic Solar Tracker – RaDAR** is a fully analog, single-axis solar tracking system developed for educational use and small-scale solar energy experimentation. The system dynamically aligns photovoltaic panels with the sun using differential light sensing and an analog PID-based control architecture, improving energy capture without the use of microcontrollers or firmware.

2 Key Features

- Fully analog control architecture (no digital processing)
- Single-axis horizontal solar tracking
- Dual LDR-based differential light sensing
- Analog PID controller implemented using OP-AMPs
- PWM-based DC motor speed control
- Bidirectional motor control via analog comparator logic
- Onboard rechargeable Li-ion battery supply
- User-adjustable calibration and gain control

3 Applications

- Educational laboratories and demonstrations
- Small-scale photovoltaic system development
- Analog control system training platforms
- Renewable energy experimentation and prototyping

4 Supported Solar Panel

- Panel Type: Polycrystalline Silicon
- Nominal Voltage: 5 V
- Nominal Capacity: 200 mAh
- Panel Dimensions: 99 mm × 69 mm
- Configuration: Two-panel arrangement

5 Electrical Specifications

Parameter	Typical Value	Units	Notes
Operating Supply Voltage	±12	V	Nominal operation
Absolute Maximum Voltage	±35	V	Do not exceed
Idle Current Consumption	∼200	mA	Motor inactive
Motor Supply Voltage	12	V	Via L298N driver
Logic / Control Rail	+5	V	Internal regulation
Control Architecture	Analog PID	–	OP-AMP based

6 Power System

The system is powered by eight 3.7 V, 1000 mAh Li-ion rechargeable batteries configured to generate independent positive and negative supply rails. The battery voltages are regulated to ±12 V for analog circuitry and +5 V for auxiliary control stages.

Battery charging is performed externally by removing the cells from the battery enclosure.

7 Performance Characteristics

Parameter	Typical Value	Units	Notes
Tracking Axis	Single (Horizontal)	–	East–West
Tracking Range	±45 to ±60	deg	Mechanical limit
Response Time	Fast	–	Sun movement scale
Tracking Method	Continuous Analog Feedback	–	PID-based
Stabilization Behavior	Auto-stop	–	At perpendicular incidence

8 Sensors

- Sensor Type: Light Dependent Resistors (LDR)
- Quantity: Two active sensors
- Placement: Panel-mounted differential configuration
- Light Resistance (10 lux): 5–10 kΩ
- Dark Resistance: ∼1 MΩ
- Response Time (Rise/Fall): ∼30 ms

9 Motor and Drive System

- Motor Type: DC geared motor
- Rated Voltage: 12 V
- Rated Speed: 50 rpm
- Motor Driver: L298N dual H-bridge
- Speed Control: PWM via analog comparator
- Direction Control: Analog comparator and MOSFET logic

10 Mechanical Specifications

Parameter	Value	Notes
Overall Dimensions	260 × 180 × 177.5 mm	Approximate
Weight	0.5–1.0 kg	Estimated
Mounting Options	Table / Roof / Ground	User selectable
Enclosure Material	PLA and PETG	3D printed

11 Environmental Specifications

- Operating Temperature: Typical indoor laboratory range
- Humidity: Non-condensing environments only
- Intended Use: Indoor or sheltered outdoor use

12 Interfaces

- Battery input terminals
- DPDT power switch
- Motor output terminals
- LDR sensor input connectors

13 Limits and Reliability

- Designed for intermittent daily operation
- No thermal shutdown protection implemented
- Reliability suitable for educational and prototype use

14 Ordering Information

Model	Description
RaDAR-AST	Analog Automatic Solar Tracker