Hardware Overview

The **SMLIGHT SLWF-09** is designed as a **modular, ESP32-based LED controller** with optional add-on boards for Ethernet, Power over Ethernet (PoE), and digital microphone functionality. This section describes the main components and interfaces of the SLWF-09 and its supported add-ons.

2.1 Main Board Features

- **ESP32-D0WD-V3** microcontroller with 16 MB flash memory
- **Pre-installed WLED firmware** for plug-and-play operation
- **Two LED control channels** by default (expandable to six via GPIO)
- **USB-C port** with UART auto-flash for firmware updates
- **Power input options**:
  - USB-C (supports PD negotiation - can drive either 5V ortr 12V LED strips)
  - VIN screw terminal (5–12V)
  - DC plug in (5-12V)
  - Wire terminal (5-12V)
  - PoE module (optional, **5V 800mA** output)
- **Two on-board buttons** for mode selection and reset
- **Expansion headers** for add-on modules (Ethernet, PoE, Microphone, future expansions)
- **Level-shifted LED outputs** for wide LED voltage compatibility (level shifting 5V)
- **DIY Terminal** - for external buttons sensors or relays.

2.2 Add-on Modules

2.2.1 Ethernet Module (Optional)

- Based on **LAN8720** Ethernet PHY
- Standard **RJ45 connector** with integrated magnetics and status LEDs
- 10/100 Mbps full-duplex operation
- Connects directly to the SLWF-09 via dedicated header
- Can be used standalone or with the PoE module

Benefits:

- Reliable, low-latency connection for installations where Wi-Fi is unstable or not preferred
- Full Home Assistant and WLED Ethernet support

2.2.2 PoE Module (Optional)

- IEEE 802.3af compliant (PoE Class 0)
- Integrated DC/DC converter provides regulated 5V (up to 800mA) power to the SLWF-09
- Connects between Ethernet add-on and network cable
- Eliminates the need for a separate power adapter

Benefits:

- Single-cable solution for both data and power
- Ideal for ceiling, wall, or inaccessible installations

2.2.3 Microphone Module (Optional)

- **ICS-43432** digital MEMS microphone
- Connects via dedicated header to ESP32 I²S pins
- Used by WLED to enable **sound-reactive LED effects**
- No additional power supply required (powered from main board)

Benefits:

- Real-time music synchronization without external sound sensors
- High-quality digital audio sampling

2.3 Physical Dimensions

- **Main Board:** approx. 57 × 30 × 23 mm
- **Ethernet Module:** approx. 60 × 18 × 15 mm
- **PoE Module:** approx. 31.5 × 28.7 × 16 mm
- **Microphone Module:** approx. 15 × 12 mm

2.4 Connectivity Summary

Interface	Description
USB-C	Power input (5V or 12V - based on switch selector) and UART programming
VIN	Screw terminal power input (5–12V)
LED OUT 1/2	Two independent addressable LED channels
Add-on Ports	Headers for Ethernet, PoE, and Microphone modules
Buttons	Boot/flash and reset/mode selection

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