BluAX: A Portable USB-C Bitcoin Miner

Open Source Whitepaper

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Executive Summary

BluAX is an innovative open-source hardware device that enables individuals to mine Bitcoin using a single ASIC chip (BM1370). Unlike traditional mining rigs that require specialized power supplies and complex configurations, BluAX operates with any USB Type-C charger capable of supplying at least 30W. By integrating modern USB Power Delivery (USB-PD) negotiation, advanced protection circuitry, and a dual-purpose USB-C port for both power and programming, BluAX makes Bitcoin mining more accessible, portable, and safe for regular users and influencers alike.

Problem Statement

Bitcoin mining has traditionally been limited to large-scale farms or enthusiasts with technical expertise. Existing solutions require:

- **Specialized power supplies** with fixed voltage outputs.
- **Bulky, high-power rigs** that generate substantial heat and noise.
- **Complex setup** for firmware flashing and configuration.

As a result, everyday users and influencers who want to engage with Bitcoin mining at a personal scale face high entry barriers.

Solution: BluAX

BluAX provides a compact, user-friendly alternative by combining:

- **A single BM1370 miner chip** for low-power Bitcoin mining.
- **USB-C Power Delivery (PD) support** via the Texas Instruments TPS25730SR controller, enabling negotiation with standard USB-C chargers.
- **Integrated eFuse protection** (Littelfuse) to guard against overcurrent and unsafe conditions.
- **Dual-use USB-C port**: The same port used to power the device can also be used to flash firmware (.bin files) directly to the onboard ESP32 controller.

This design allows BluAX to operate safely from common USB-C chargers while offering a simple firmware update path for developers and hobbyists.

Technical Overview

Power Architecture

- **USB-C Input**: Requires a charger with a minimum rating of 30W.
- **PD Negotiation**: The TPS25730SR requests a voltage between **9V and 15V**, prioritizing **15V** for efficiency.
- **Efficiency Consideration**: At higher voltage (15V), input current is reduced, minimizing heat dissipation and improving reliability.

Protection Circuitry

- **eFuse (Littelfuse)**: Provides overcurrent protection (>5A cutoff).
- Safeguards device and charger against unsafe power conditions.

Dual-Function USB-C Port

- **Power Input**: Supplies the miner with 9–15V negotiated through PD.
- **Firmware Flashing**: Same port is used to upload firmware (.bin) directly to the **ESP32 microcontroller**, simplifying development and updates.
- Eliminates the need for additional programmers or dedicated UART ports.

Mining Core

- **ASIC**: BM1370 (Bitmain) chip.
- Provides dedicated SHA-256 computation for Bitcoin mining.
- Configurable via open-source ESP32 firmware.

Schematic

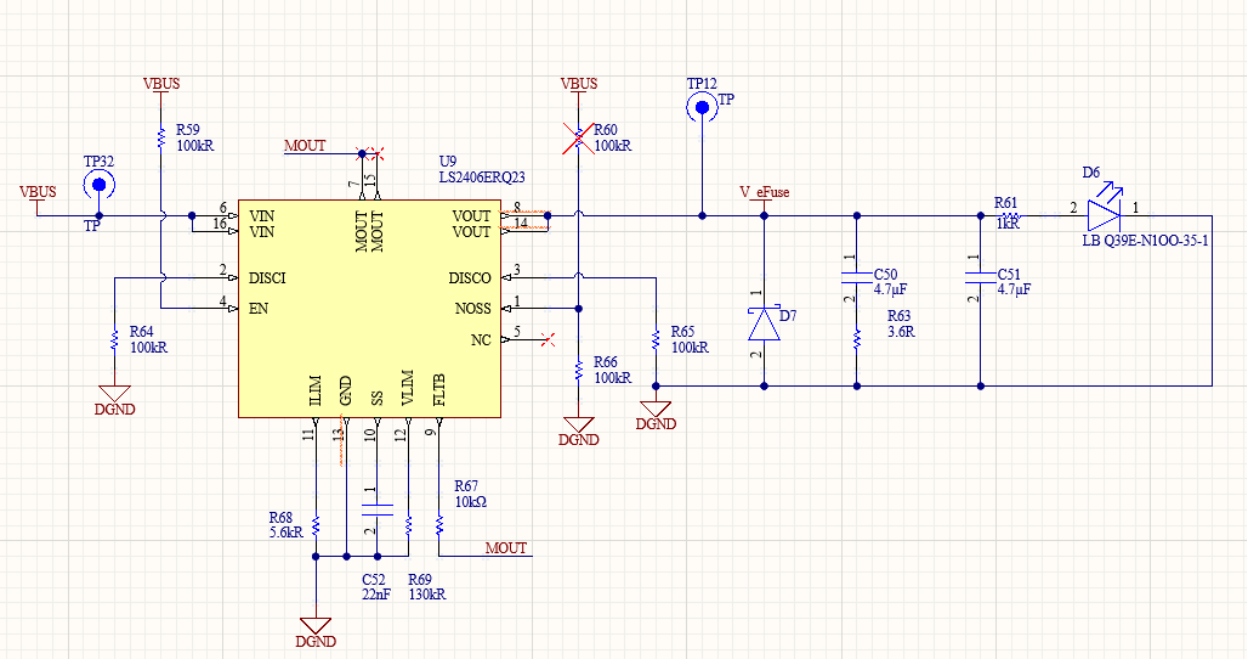

***Figure 1**: Schematic for the eFuse – Input: 9 ~ 15V , Ilim: 5A.*

The eFuse helps to prevent the inrush current during the power up due to discharged capacitors by using the soft start and limits the current to a maximum of 5 Amps.

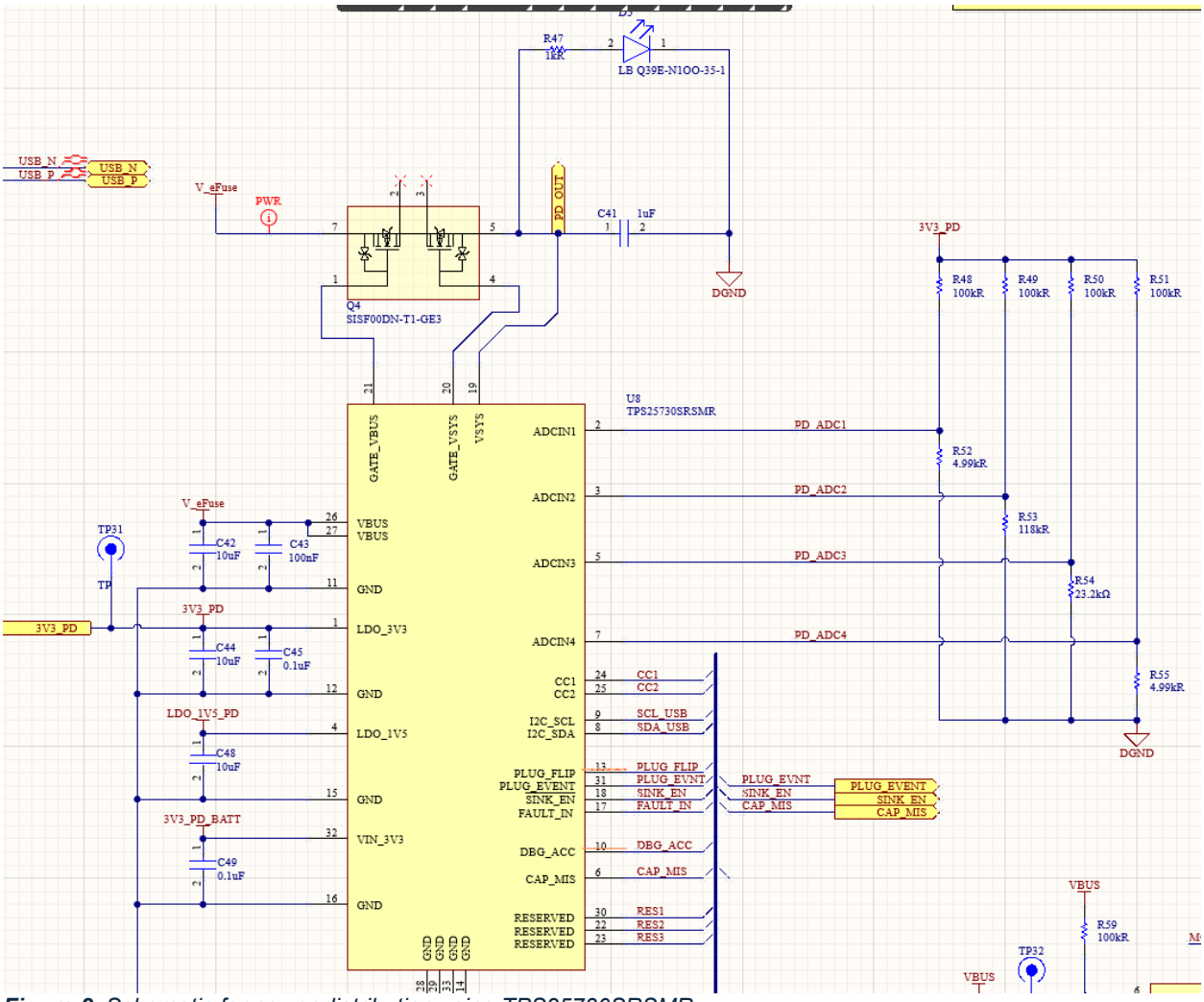

***Figure 2**: Schematic for power distribution using TPS25730SRSMR*

The ADCIN1 defines the minimum voltage configuration and ADCIN2 the maximum voltage configuration. For this design, it was considered a minimum of 9V and maximum of 15V. ADCIN3 and ADCIN4 defines the operating current and maximum current.

Key Features & Advantages

- **Plug-and-Play**: Works with off-the-shelf USB-C chargers (>30W).
- **Compact & Portable**: Single-chip miner for personal or demonstration use.
- **Safe Operation**: Integrated overcurrent protection.
- **Dual USB-C Use**: Same port for **power input** and **ESP32 firmware flashing**.
- **Open Source**: Schematics and firmware available for modification and learning.
- **Efficient Power Use**: Optimized for higher-voltage PD negotiation to reduce thermal stress.

Use Cases

1. **Personal Experimentation**
    - Individuals can mine Bitcoin at home without large rigs.
    - Great for learning about ASIC mining, USB-PD, and microcontroller firmware development.
2. **Influencers & Content Creators**
    - Portable miner for showcasing Bitcoin mining in videos, tutorials, or educational content.
3. **Educational Tool**
    - Demonstrates practical applications of USB-C PD, ASIC mining, circuit protection, and ESP32 firmware flashing.

Community & Contribution

BluAX is an **open-source project**, inviting developers, makers, and Bitcoin enthusiasts to contribute:

- **Hardware**: Improve PCB layouts, optimize thermal design.
- **Firmware**: Enhance mining efficiency, PD negotiation strategies, and ESP32 integration.
- **Community**: Share experiences, guides, and tutorials.

Conclusion

BluAX democratizes Bitcoin mining by combining accessibility, safety, and open-source transparency. Powered by everyday USB-C chargers, and programmable through the same USB-C port, it offers a lightweight entry point for individuals and influencers to engage with mining, experiment with hardware, and contribute to an open hardware ecosystem.

BluAX is not designed to compete with industrial mining operations but to inspire learning, exploration, and participation in Bitcoin technology.