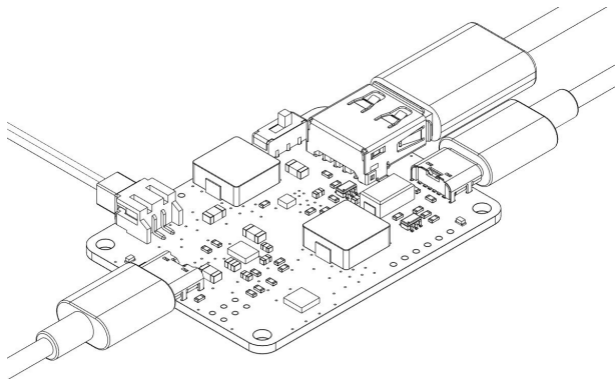# AmpRipper 3000 V1.0

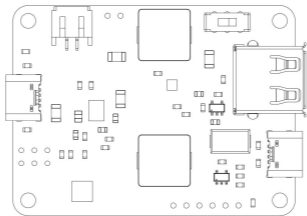## 5V-3A Charge/Boost
Uninterruptible Power Supply

Overview

The AmpRipper 3000 is a next-gen power supply for all your portable/rechargeable projects! With Narrow VDC PowerPath Management and a 9A peak switching current, you'll be able to power your high-current projects and fast charge your battery with a single module. The AmpRipper can operate with most 3.7-4.2V lithium ion or polymer batteries, but to get the most out of this product please use batteries with ≥3000mAh capacity and high discharge capacity (≥2C).

At the core of the AmpRipper is the MP2624 4.5A switching-mode battery charger and the MP3423 9A synchronous boost converter. The MP2624 employs a constant current/constant voltage charge profile, with a fast-charge rate of up to 2.4A. The MP2624's load-sharing architecture allows for seamless transitions between charge and discharge modes. Power to your project will not be interrupted, even if the battery is disconnected!

The MP3423 synchronous boost converter has 90%+ efficiency at 5V output (up to 3A!). The 9A peak switching current means you won't get any nasty voltage dips at high current outputs. Just make sure your battery can handle it! Synchronous operation means you can disconnect the 5V output completely by connecting the (EN)able pin to ground.

PLEASE REVIEW THIS ENTIRE MANUAL BEFORE USING THE AMPRIPPER 3000. FOLLOW ALL GUIDELINES ON PG.7 (WARNINGS & SAFETY). FAILURE TO COMPLY WITH THE GUIDELINES AND WARNINGS IN THIS DOCUMENT MAY RESULT IN DAMAGE TO THE UNIT, BATTERY FAILURE, FIRE, OR EXPLOSION.
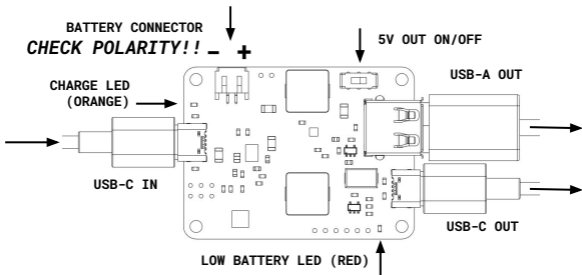

NOTE: For questions or concerns about your product, please send an email to: contact@kickstart-design.com.

Operation Notes

The USB-C input is configured as a UFP (upstream facing port) for 5V power input only. The USB-C output is a DFP (downstream facing port) and the USB-A output is a DCP (dedicated charging port), both regulated at 5.25V. This configuration works with most 5V USB-A/C 2.0 and 3.0 devices but may not work with some proprietary devices. Short, thick, & high-quality cables are recommended for high current applications. Both USB-A/C outputs can be connected at the same time, but keep in mind that the total output power is divided. **Due to the nature of the design, the input current will always be greater than the output current (up to 2X greater).** Therefore, it is essential to use high-quality batteries with max discharge values ≥2X the desired output. Likewise, the pass-through current may be limited to ≤2A with a 3A input. When using as an uninterruptible power supply, keep in mind that output loads >2A will deplete the battery over time. **PCB will get hot (up to 120°C) during high-current applications.** Allow space between PCB and other components and use a cooling system!

There are 2 LED's: one for indicating charge status and one for low battery. The charge LED will glow solid orange when charging and will turn off once charging is complete. **Power will continue to flow after the charge is complete, so it is normal for the led's to turn off during operation.** The charge cycle will restart automatically if the battery drops below 4.0V. The charge LED will blink rapidly if the charge is suspended (caused by thermal protection, over-voltage protection, or insufficient charge current). The low battery indicator will glow bright red when the battery voltage drops below 3.3V. The system has an absolute minimum battery voltage of 3.0V. Once the battery dips below 3.0V, all operation will be suspended.

BATTERY CONNECTOR
CHECK POLARITY!!

CHARGE LED (ORANGE)

USB-C IN

5V OUT ON/OFF

USB-A OUT

USB-C OUT

LOW BATTERY LED (RED)

Technical Specifications

Input Power[1]: 5-5.5V/3A DC via USB-C connector (max. 3A[1])

➔   Up to 2.4A fast-charge (continuous current mode)

Output Power[2]: 5.25V/3A DC via USB-C, USB-A, and 5V out pin (max. total 3A[2])

➔   5V-3A DC (pulse)/5V-2A DC (continuous)
➔   USB-C (DFP)/USB-A (DCP)

Charge Voltage: 4.2V

Low Battery Voltage Range: 3.0-3.3V

Battery Voltage Protection: 3.0V

➔   Charge & boost functions are suspended if the battery voltage drops below 3.0V

Battery Auto-Recharge Threshold: 4.0V

Constant Current Charge Timer: 8 hrs.

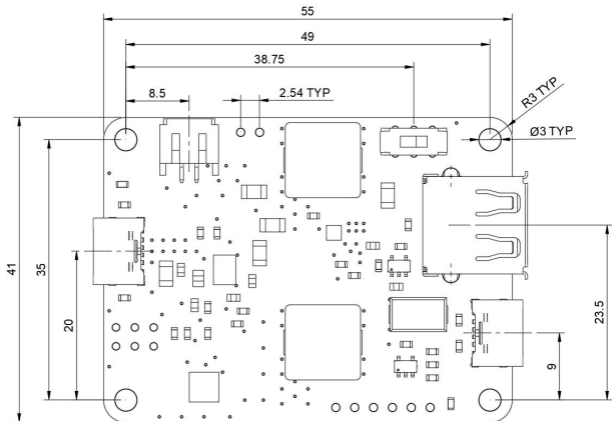➔   Charge will be suspended if battery voltage does not reach 4.2V within 8 hrs.

Battery Requirements[3]:

➔   3.7-4.2V lithium ion/polymer only
➔   Single-cell or 1S[N]P series-parallel packs with external voltage balancing circuitry
➔   ≥3000mAh with high discharge capacity (≥2C[3])
➔   JST PH-2.0 Connector. **Some third-party batteries have JST connectors wired opposite from the standard. Connecting these to the AmpRipper will damage your product. Always check the polarity before connecting.**

Environment[2,4,5]:

➔   PCB operating temperature: 0–120°C
➔   Battery operating temperature: 0-60°C (10k thermistor connected)

Physical Specifications

➔ **Dimensions:** 55mm x 35mm x 10mm / 2.17" x 1.38" x 0.39"
➔ **Weight:** 17g / 0.6 oz.
➔ Lengthwise mounting hole center-to-center dimension (49mm) aligns with the Raspberry Pi mounting holes. If mounting to a Raspberry Pi, please use appropriately spaced standoffs to give clearance for thermal dissipation.

NOTE: Digital 3D models can be provided upon request. Please email requests to contact@kickstart-design.com.

Pinouts

BAT(+): Positive battery terminal, connected directly to the positive (+) pin of the JST connector. Can also be used to measure battery voltage directly.

BAT(-): Negative battery terminal, connected directly to the negative (-) pin of the JST connector.

NTC: Connect to the battery thermistor (10k) for battery thermal protection (optional). Charge will be suspended if (NTC) is out of the pre-set range (0-60°C).

LS: Load share output from the charge controller. Voltage will equal the battery voltage when discharging and the system voltage when charging (3.0-4.2V).

LBO: Low battery output from the voltage reference IC. Voltage on this pin is regulated at 1.24V when the battery voltage (VBAT) is above the minimum threshold (3.3V). If VBAT is ≤3.3V, LBO will equal VBAT.

EN: Boost converter enable input. EN is pulled high to (LS) normally. Connecting EN to ground disconnects the output from the input completely. **NOTE: you cannot connect (EN) to (LBO) for "auto-shut off" when battery is low.**

GND: Power ground. The boost converter is not isolated from the charge controller, the input ground is the same as the output ground.

5V: 5.25V regulated output from the boost converter.

Programing Pins:

5VIN: Connected to the on-board ATtiny85 (VCC). This pin is not connected during operation.

MOSI: Connected to the on-board ATtiny85 (PB0). Used for I2C communication to the MP2624.

MISO: Connected to the on-board ATtiny85 (PB1).

SCK: Connected to the on-board ATtiny85 (PB2). Used for I2C communication to the MP2624.

RST: Connected to the on-board ATtiny85 (PB5).

NOTE: Do not use the programming pins during operation as it may interfere with the charge controller or damage the other components. We highly recommend keeping the pre-loaded charge settings. If you wish to experiment with the charge settings, please contact Kickstart Design (contact@kickstart-design.com) for detailed instructions.

Warnings & Safety

1. This product should only be connected to an external power supply rated at 5V/3A DC or 5.5V/ 3A DC minimum. Any external power supply used with the AmpRipper 3000 shall comply with relevant regulations and standards applicable in the country of intended use. Due to the nature of this product, we can not guarantee functionality with all peripherals and power supplies.

2. This product is designed to output 5V-3A DC (pulse)/ 5V-2A DC (continuous) from a rechargeable lithium ion/polymer battery and/or 5-5.5V DC input. While using this product, ensure that the continuous output current is ≤2A to avoid depleting the attached battery. Do not attempt to continuously draw 2-3A without additional heatsink or cooling systems as this product may reach temperatures of up to 120°C. Pass-through current may be limited to ≤2A when battery is removed or not present.

3. Only use this product with high-quality 3.7-4.2V lithium-ion or lithium-polymer batteries. Only use ≥3000mAh cells with high discharge capacity (≥2C). Only use this product with single-cell or 1S[N]P series-parallel battery packs with external voltage balancing circuitry. Some third-party batteries have JST connectors wired opposite from the standard. Connecting these to the AmpRipper 3000 will damage your product. Double check the polarity before connecting. Failure to follow these specifications may result in battery failure, fire, damage, or explosion. Due to the nature of this product, we can not guarantee safety and functionality with all batteries. Always review the battery manufacturer's datasheet before using with the AmpRipper 3000.

4. This product should be operated in a well-ventilated environment and, if used inside a case, the case should not be covered.

5. This product should be placed on a stable, flat, non-conductive surface in use and should not be contacted by conductive items.

6. All peripherals used with this product should comply with relevant standards for the country of use and be marked accordingly to ensure that safety and performance requirements are met.

7. Where peripherals are connected that do not include the cable or connector, the cable or connector must offer adequate insulation and operation in order that the relevant performance and safety requirements are met.

To avoid malfunction or damage to this product please observe the following:

1. Do not expose to water, moisture or place on a conductive surface whilst in operation.
2. Do not expose it to external heat from any source
3. Take care whilst handling to avoid mechanical or electrical damage to the printed circuit board and connectors.
4. Avoid handling the printed circuit board whilst it is powered and only handle by the edges to minimise the risk of electrostatic discharge damage.

Note: Failure to comply with the guidelines and warnings in this document may result in damage to the unit, battery failure, fire, or explosion.