DC-DC TPS61023 Boost Converter Module

DEVLAB FACTOR

Mfr. Part #: UE0087

Product Reference Manual (V1.0)

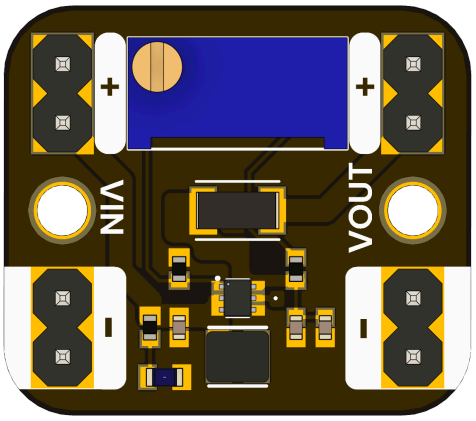
Description

The **UNIT DevLab Boost Converter Module** is a compact, high-efficiency DC-DC step-up (boost) regulator engineered to transform low input voltages into a stable, elevated output voltage suitable for embedded electronic systems. It is built upon the TPS61023 from Texas Instruments, a synchronous switching regulator designed for dependable performance at extremely low input voltages.

The module accommodates input voltages as low as 0.5 V, with cold-start functionality commencing from 0.7 V, rendering it appropriate for single-cell LiPo batteries, USB power sources, supercapacitors, and compact solar panels. The output voltage can be continuously adjusted using an integrated multi-turn precision potentiometer, enabling precise regulation suitable for sensitive loads such as microcontrollers, sensors, and RF modules in low-power, portable, and space-constrained applications.

DevLab format compatibility.

The module is fully aligned with the **DevLab** modular ecosystem design philosophy, following its core principles of rapid prototyping, mechanical flexibility, and standardized functional integration. However, this module does not implement the DevLab JST-SH 1.0 mm connector. Electrical interfacing is provided exclusively through standard 2.54 mm Dupont pin headers for input and output power connections.



Key Features

- High-efficiency DC–DC boost regulator
- Ultra-low input voltage operation (0.5 V minimum)
- Cold-start from 0.7 V
- Adjustable output voltage up to 5.5 V
- Output current capability up to 1 A (application-dependent)
- Up to 96 % conversion efficiency
- High-frequency switching at approximately 2 MHz
- Integrated multi-turn precision potentiometer
- Built-in protection features:
- Overcurrent Protection (OCP)
- Thermal Shutdown

Hardware Features

- **Core Regulator IC:** TPS61023 synchronous boost converter
- **Input Voltage Range:** 0.5 V – 5.5 V
- **Startup Voltage:** ≥ 0.7 V
- **Adjustable Output Voltage:** Up to 5.5 V
- **Maximum Output Current:** Up to 1 A (thermal and electrical limits apply)
- **Switching Frequency:** ~2 MHz
- **Control Method:** Fixed-frequency PWM boost regulation
- **Voltage Adjustment:** Onboard multi-turn potentiometer
- **Input Interface:** VIN+ / VIN–
- **Output Interface:** VOUT+ / VOUT–
- **Protection Systems:**
- Short-circuit protection
- Overcurrent protection
- Thermal shutdown
- Undervoltage lockout
- **PCB Dimensions:** 20.3 mm × 17.78 mm
- **Mounting:** Breadboard and PCB integration compatible

Applications

- **Battery-powered embedded systems:** Boosting 3.0–3.7 V LiPo cells to regulate 5 V for microcontrollers and logic circuits.
- **Sensor power conditioning:** Supplying stable voltage to analog, digital, and mixed-signal sensor networks.
- **Portable electronics:** Voltage step-up for handheld devices, test instruments, and wearable systems.
- **LED driver supply rails:** Powering high-voltage LED strings from low-voltage sources.
- **Solar and energy harvesting systems:** Boosting low-level photovoltaic output into regulated usable rails.
- **Prototyping and educational electronics:** Fast integration into breadboards, test platforms, and development boards.

CONTENTS

1 The Board

1.1 Accessories

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2 Ratings

2.1 Recommended Operating Conditions

Symbol	Description	Min	Typ	Max	Unit
VIN	Input Voltage	0.5	3.7	5.5	V
VSTART	Startup Voltage (Cold Start)	0.7	0.9	1.8	V
VOUT	Output Voltage (Adjustable)	1.8	5.0	5.5	V
IOUT	Output Current (VOUT = 5 V)	—	—	1.0	A
η	Conversion Efficiency	—	92	96	%
fSW	Switching Frequency	1.8	2.0	2.2	MHz
IQ	Quiescent Current (Regulator)	—	15	25	µA
TSD	Thermal Shutdown Temperature	140	160	180	°C
UVLO	Undervoltage Lockout (Typical)	0.45	0.50	0.55	V

2.2 Output Current Capability at VOUT = 5 V

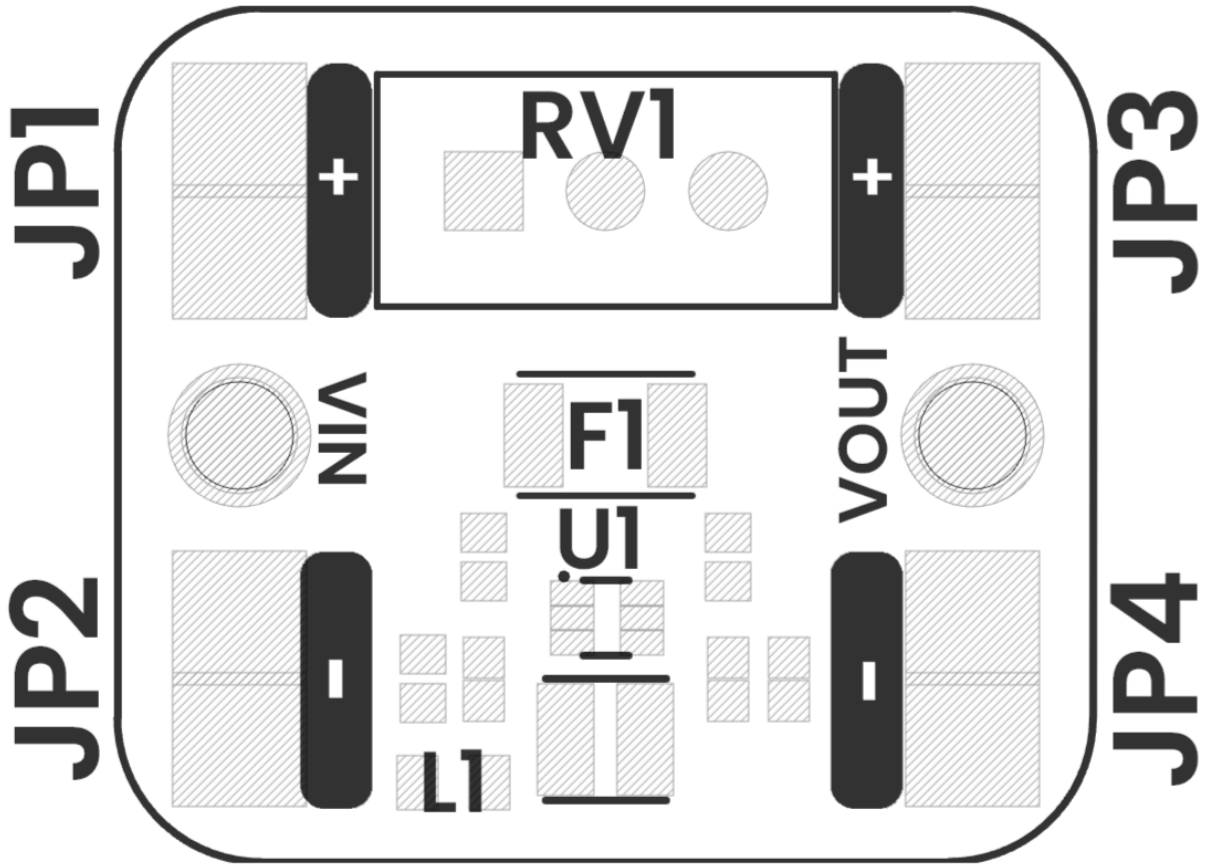
VIN	IOUT (Typical)
2.0 V	300 mA
2.5 V	500 mA
3.0 V	800 mA
3.5 V	930 mA
4.0 V	1.0 A

3 Functional Overview

The **UNIT DevLab Boost Converter Module** is a highly efficient DC-DC step-up power regulator utilizing the TPS61023 from Texas Instruments. The device functions as a synchronous switching boost converter that elevates a low input voltage to a regulated higher output voltage through fixed-frequency PWM control at approximately 2 MHz, facilitating the use of compact external components and attaining high conversion efficiency.

During operation, the internal control loop persistently monitors the output voltage via a feedback network and adaptively modifies the duty cycle of the switching stage to ensure a stable regulated output amidst changing input voltage and load conditions. The module enables operation at ultra-low input voltages, including cold-start functionality from 0.7 V, ensuring dependable resumption from discharged batteries or energy-harvesting sources. Integrated protection mechanisms, including overcurrent protection (OCP), thermal shutoff, and undervoltage lockout (UVLO), guarantee safe and reliable operation throughout the entire operating range. The output voltage can be precisely adjusted by the user through an integrated multi-turn precision potentiometer, allowing for accurate calibration across a broad spectrum of embedded power applications.

3.2 Board Topology



Top View of Board Topology

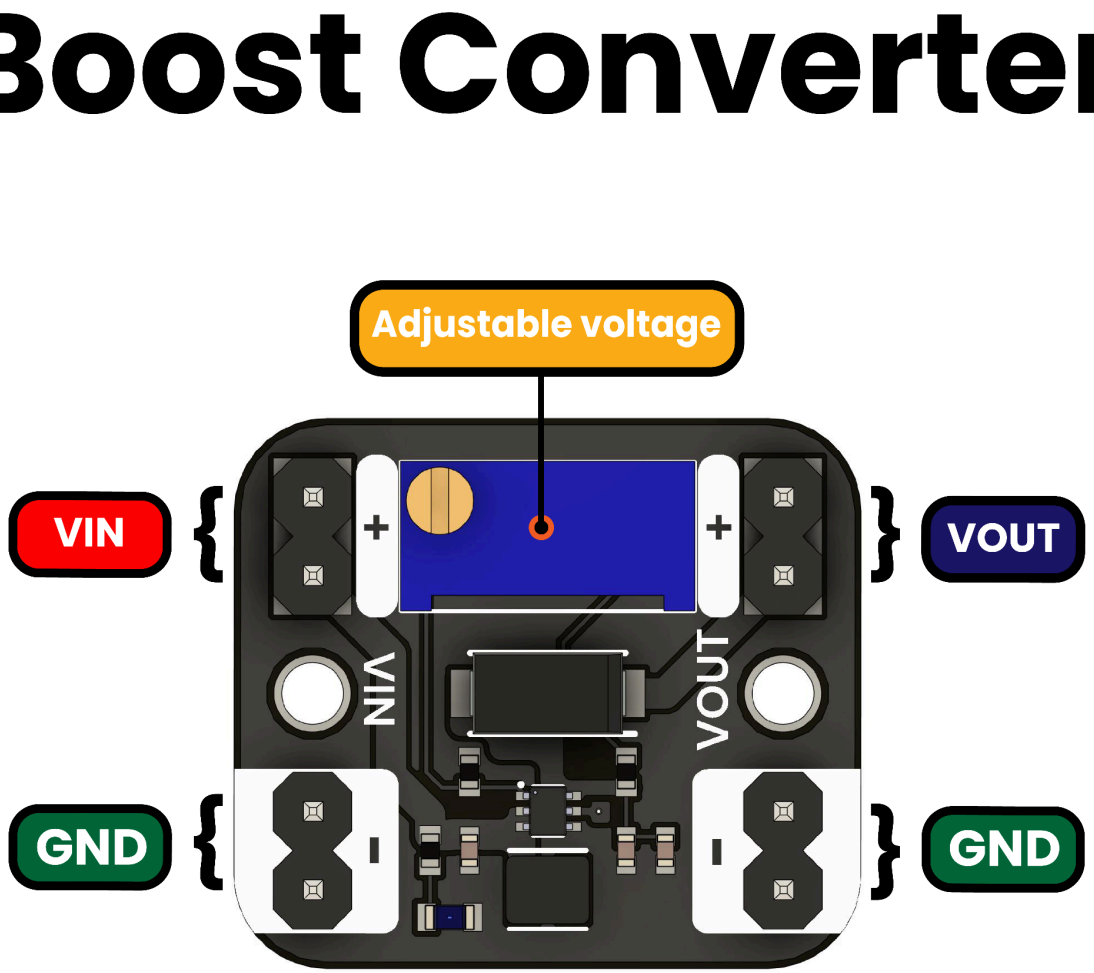
Views of UNIT DevLab Boost Converter Module Topology

Table 3.2.1 - Components Overview

Reference	Component	Description
U1	TPS61023	Main boost converter IC by Texas Instruments
RV1	Potentiometer (multi-turn)	Allows precise adjustment of the output voltage
L1	Power Indicator LED	Lights up when input voltage is present
F1	Resettable Fuse (1 A)	Protects the circuit from overcurrent conditions
JP1	VIN+ Pad	Positive terminal for power supply input
JP2	VIN– Pad	Ground terminal for power supply input
JP3	VOUT+ Pad	Positive terminal for boosted output
JP4	VOUT– Pad	Ground terminal for boosted output

4 Connectors & Pinouts

4.1 General Pinout



UNIT DevLab Boost Converter Module General Pinout

4.2 Pinout General Description

Label	Function	Description
VIN	Input Voltage	Positive input voltage. Connect the positive terminal of the power supply here.
GND (Input)	Ground	Input ground reference. Connect to the negative terminal of the supply.
VOUT	Output Voltage	Boosted positive output. Provides the regulated higher output voltage.
GND (Output)	Ground	Output ground. Connect to the load ground or system ground.
POT	Output Adjustment	Multi-turn precision potentiometer used to set the output voltage accurately.

5 Board Operation

5.1 Getting Started
Wire Up (Electrical Connections)
Input Power Connection
Connect the low-voltage input power source to the module:

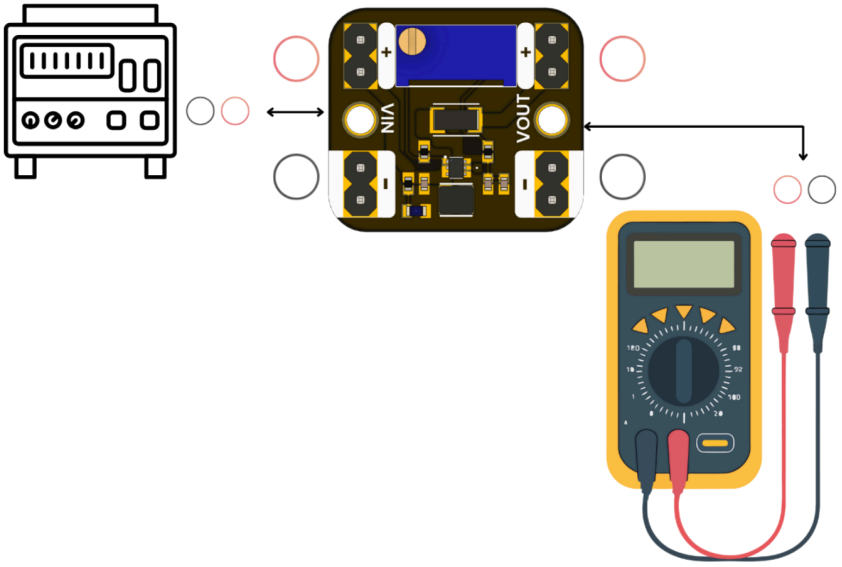
- VIN+ → Connect to the positive terminal of the input supply.
- VIN– (GND Input) → Connect to the negative terminal (ground) of the input supply.

Ensure that the input voltage remains within the specified operating range (recommended: 1.8 V to 5.5 V). The input source may be a LiPo cell, a 5 V USB rail, a supercapacitor, or another low-voltage power source.

Output Load Connection
Connect the load to the boosted output terminals:

1. VOUT+ → Connect to the positive terminal of the load.
2. VOUT– (GND Output) → Connect to the load ground.

The input and output grounds must share a common reference to ensure proper regulation.



Adjust Output Voltage

1. Use a small insulated screwdriver to rotate the onboard multi-turn precision potentiometer (POT).
2. Adjustment behavior:
    a. Clockwise rotation: Increases the output voltage.
    b. Counter-clockwise rotation: Decreases the output voltage.
3. Measure the output voltage directly across VOUT+ and VOUT– using a calibrated digital multimeter.
4. Adjust the voltage slowly in small increments due to the fine resolution of the multi-turn potentiometer.

Test Under Load

After setting the desired output voltage under no-load conditions, connect the intended load.

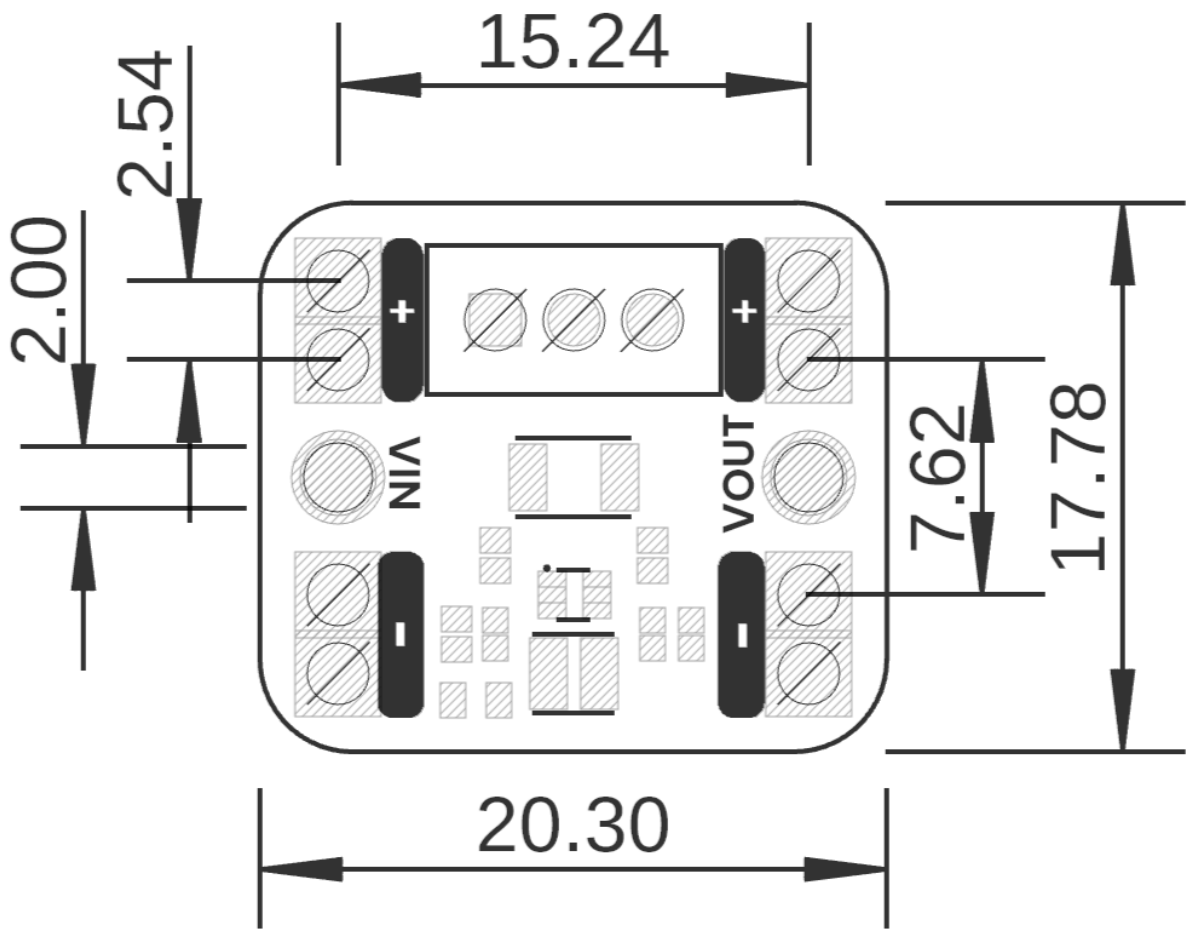
Verify:

- Output voltage regulation stability.
- Absence of excessive voltage drop.
- No abnormal temperature rise on the regulator IC.
- For high-current operation (above 800 mA), ensure:
- Adequate airflow or thermal dissipation.
- Input voltage is sufficiently high to support the required output power.

Important Safety and Setup Notice

- Always begin with the potentiometer rotated fully counter-clockwise (minimum output voltage) before applying input power.
- Apply input power first, then gradually increase the output voltage while monitoring with a multimeter.
- Never connect sensitive electronic loads before verifying the output voltage level.
- Exceeding the rated voltage or current may activate overcurrent protection (OCP) or thermal shutdown, or damage connected devices.

6 Mechanical Information



Mechanical dimensions in millimeters

Mechanical dimensions in millimeters

7 Company Information

Company name	UNIT Electronics
Company website	https://uelectronics.com/
Company Address	Salvador 19, Cuauhtémoc, 06000 Mexico City, CDMX

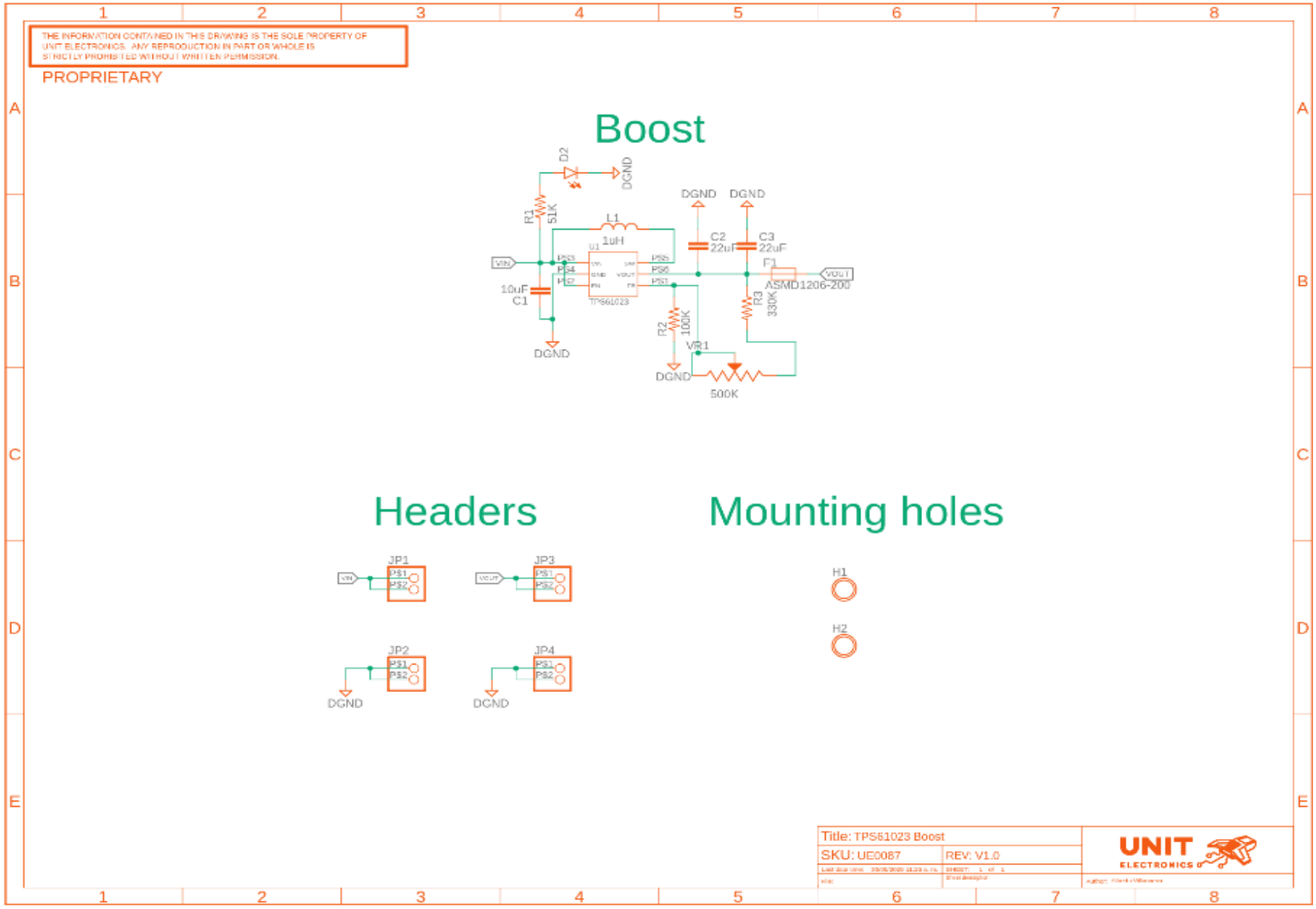
8 Reference Documentation

Ref	Link
Documentation	https://github.com/UNIT-Electronics-MX/devlab_dc_dc_tps61023_boost_converter_module/
Getting Started Guide	https://wiki.uelectronics.com/wiki/devlab-dc-dc-tps61023-boost-converter-module

9 Appendix

9.1 Schematic

(*https://github.com/UNIT-Electronics-MX/devlab_dc_dc_tps61023_boost_converter_module/blob/main/hardware/unit_sch_v_0_1_0_ue0087_tps61023_boost.pdf*)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PROPRIETARY
Boost
D2
DGND
R1
51K
L1
1uH
DGND
DGND
C2
22uF
C3
22uF
F1
ASMD1206-200
VOUT
VIN
10uF
C1
TPS61023
R2
100K
R3
330K
VR1
500K
DGND
DGND
Headers
Mounting holes
JP1
JP2
JP3
JP4
DGND
DGND
H1
H2
Title: TPS61023 Boost
SKU: UE0087
REV: V1.0
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