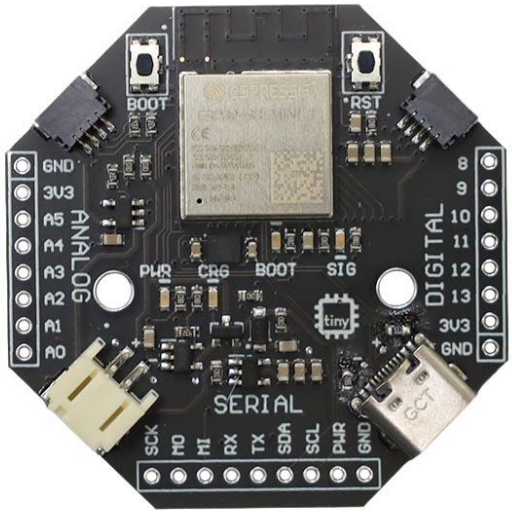
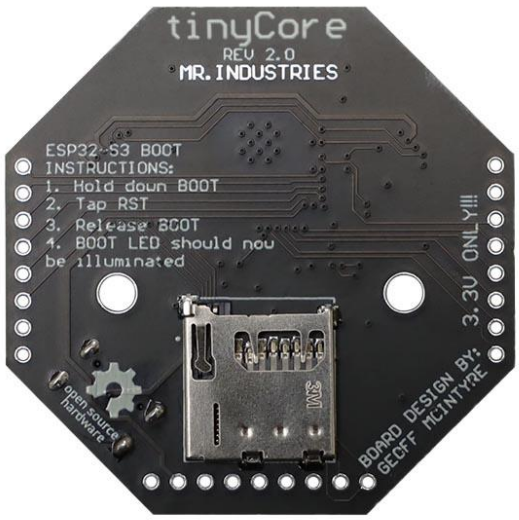
User Datasheet

Version 2.1





Description: tinyCore has been designed from the ground up to be an intuitive PCB for learning advanced electronics. The board itself is a highly integrated platform based on the ESP32-S3 chip and includes must-have features such as: Battery Management & Charging, USB-C, QWIIC connectors, Programmable LEDs, a Micro SD Slot, and a 6-DoF IMU. We believe that this board will help speed up your learning and design process within embedded systems.

Target Audience: Students, Hobbyists, Young Professionals

tinyCore ESP32-S3 Technical Specifications

Processor:

- Dual-core Xtensa LX7 32-bit processor
- Operating frequency up to 240 MHz
- RISC-V Ultra Low Power Co-processor (ULP)

Memory:

- 8 MB of Flash
- 512 KB of SRAM
- 384 KB of ROM
- No PSRAM

Security:

- Hardware acceleration for: AES-128/256, SHA-2, RSA, RNG, HMAC
- Secure Boot
- Flash Encryption
- Digital Signature

Peripherals:

- 23 programmable GPIOs with support for interrupt/wake-up
- 14-channel 12-bit SAR ADC with up to 14 ADC channels
- I2S, I2C, UART, SPI, USB Serial/JTAG
- Micro SD Card via SPI
- 6-DOF IMU (Motion sensor)
- USB-C for Serial Bootloader and HID/MIDI control

Connectivity:

- 2.4 GHz Wi-Fi 5 (802.11 b/g/n)
- Bluetooth Low Energy (BLE)
- Supports mesh networking

Power Management:

- Ultra-low deep-sleep current of 8μA (RTC timer + RTC memory + ULP active)
- 3.3V LDO Power Regulator (up to 6V)
- Dedicated LDO for I2C power

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2.1: Recommended Operating Conditions

2.2: Power Consumption

The following table shows measured current consumption for the tinyCore v2.0 under various operating conditions at 3.3V supply voltage.

Power Consumption Summary:

Operating Mode	USB Power	Battery Power	Description
Sleep Modes			
Deep Sleep	4.0 mA	**10 µA**	RTC timer + RTC memory active, all peripherals off
Light Sleep	6.0 mA	**2.1 mA**	CPU paused, RAM retained, peripheral wake-up enabled
Low Power Modes			
Modem Sleep	40 mA	~38.5 mA	CPU active, Wi-Fi/Bluetooth radios disabled
CPU Only	40 mA	~38.5 mA	All peripherals disabled, CPU at full speed
Wireless Modes			
Wi-Fi Connected (Idle)	48 mA	~46.5 mA	Connected to access point, no data transfer
Wi-Fi Transmitting	75 mA	~73.5 mA	Active data transmission
Wi-Fi Scanning	110 mA	~108.5 mA	Continuously scanning for networks
BLE Advertising	72 mA	~70.5 mA	Broadcasting advertisement packets
BLE Connected (Idle)	75 mA	~73.5 mA	Maintained connection, no data transfer
BLE Transmitting	75 mA	~73.5 mA	Active data transmission over BLE
Peripheral Modes			
IMU Active Sampling	42 mA	~40.5 mA	Continuous motion sensor data acquisition (50ms)
All LEDs On	43.5 mA	N/A	Status/boot LEDs illuminated
All Peripherals Active	80 mA	~78.5 mA	Wi-Fi + BLE + IMU + LEDs simultaneously

Notes:

- During battery power (LiPo connected), both PWR and CHRG LEDs are disabled. Each LED on-board takes around 1.5mA when at full brightness.
- All measurements were taken at room temperature (25°C)

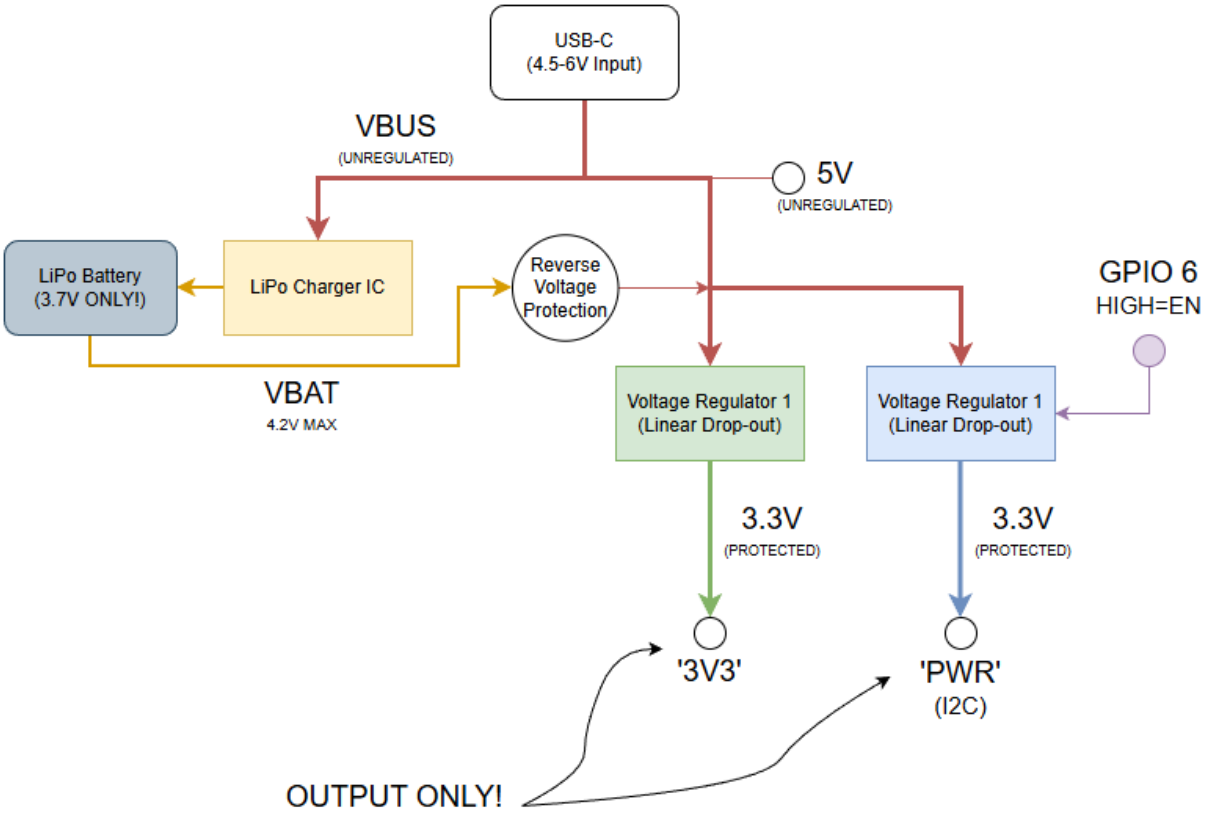
Battery Life Estimation

For battery-powered applications, use the following typical values:

Application Profile	Typical Current	Estimated Battery Life*
Deep Sleep with Periodic Wake-up	15 µA average	**2-3 years**
Light Sleep IoT Sensor	5 mA average	**20-30 days**
Active Wi-Fi Data Logger	50 mA average	**4-6 days**
Continuous BLE Beacon	70 mA average	**2-3 days**

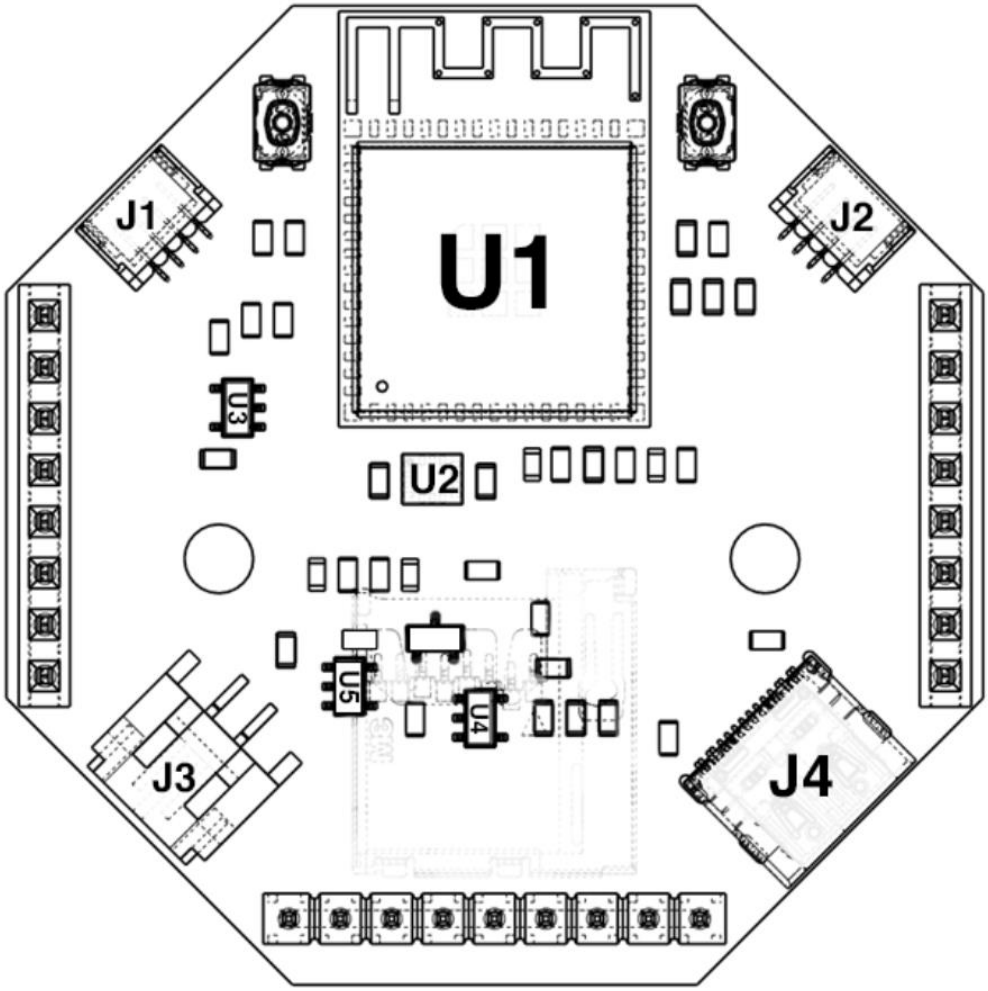
**Estimated with 1000 mAh LiPo battery, including self-discharge and temperature derating*

2.3: Power Tree



3. Functional Overview

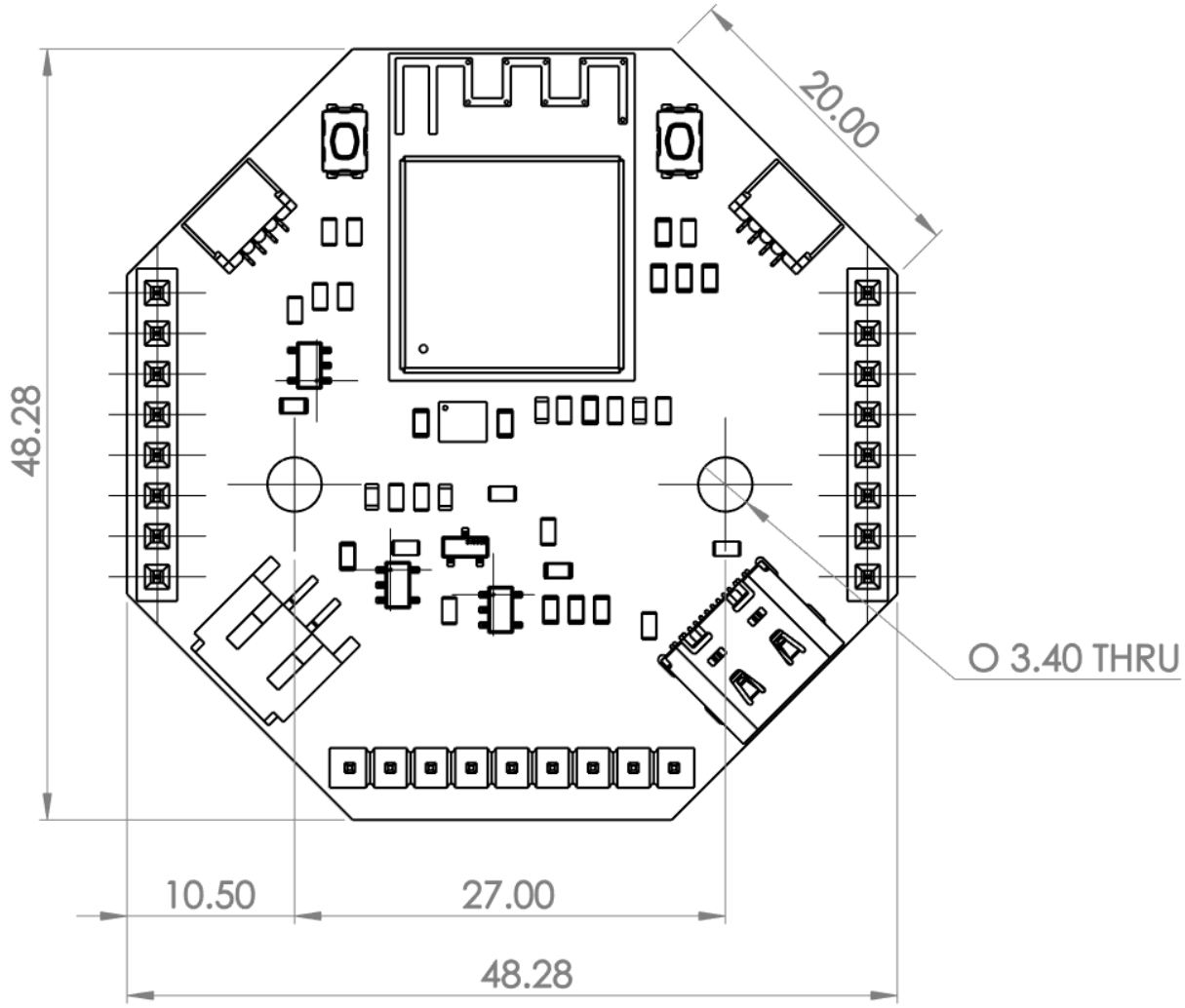
3.1: Board Topology (High Level)



Ref.	Description
U1	ESP32-S3-MINI-1-N8 Microcontroller
U2	LSM6DSOTR 6-DoF Inertial Measurement Unit
U3, U4	AP2112K-3.3TRG1 LDO Regulator
U5	MCP73831 LiPo Charge Management
J1, J2	STEMMA/Qwiic JST SH 4-pin I2C Connectors
J3	S2B-PH-SM4-TB JST PH 2-Pin LiPo Battery Connector
J4	USB4105-GF-A USB-C Connector

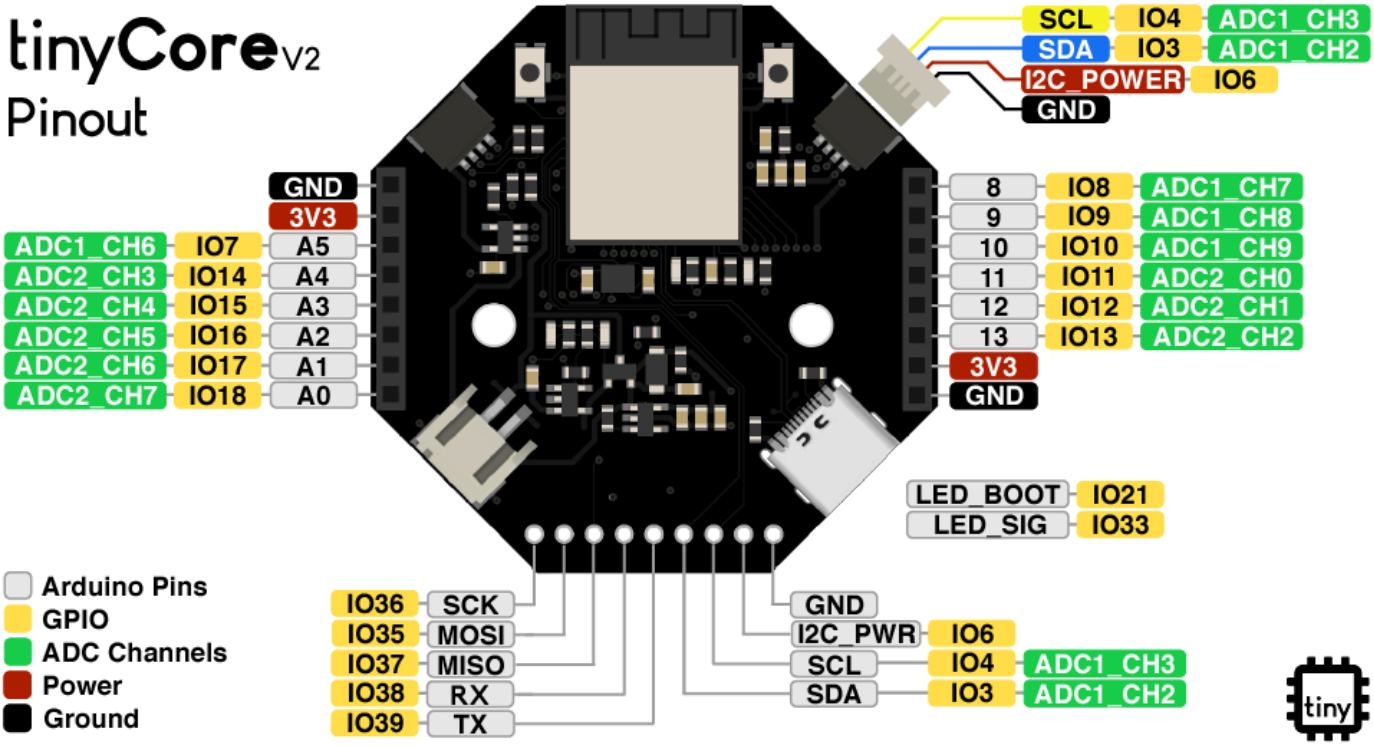
3.2 Board Outline & Mounting Holes

The board was designed to be an octagon of approximately 50x50mm. The mounting holes are made for standard M3 Screws, and the headers are standard 2.45mm spacing.



4. Connector Pinouts

4.1: Pinout Diagram



4.2: Analog Pins

Pin	Function	Type	Description
1	GND	Power	Ground
2	+3V3	Power	+3V3 Power Rail (Output Only!)
3	A5	Analog/GPIO	Analog input 5 /GPIO7
4	A4	Analog/GPIO	Analog input 4 /GPIO14
5	A3	Analog/GPIO	Analog input 3 /GPIO15
6	A2	Analog/GPIO	Analog input 2 /GPIO16
7	A1	Analog/GPIO	Analog input 1 /GPIO17
8	A0	Analog/GPIO	Analog input 0 /GPIO18

4.3: Digital Pins

Pin	Function	Type	Description
1	D8	Digital/GPIO	Digital pin 8/GPIO
2	D9	Digital/GPIO	Digital pin 9/GPIO

3	D10	Digital/GPIO	Digital pin 10/GPIO
4	D11	Digital/GPIO	Digital pin 11/GPIO
5	D12	Digital/GPIO	Digital pin 12/GPIO
6	D13	Digital/GPIO	Digital pin 13/GPIO
7	+3V3	Power	+3V3 Power Rail (Output Only!)
8	GND	Power	Ground

4.4: Serial Pins

Pin	Function	Type	Description
1	SCK	SPI/GPIO	SPI Serial Clock Output
2	MOSI	SPI/GPIO	SPI Main Out Secondary In
3	MISO	SPI/GPIO	SPI Main In Secondary Out
4	RX	Serial/GPIO	Serial Receive
5	TX	Serial/GPIO	Serial Transmit
6	SDA	I2C/GPIO	I2C Data Line
7	SCL	I2C/GPIO	I2C Clock Line
8	I2C_POWER	Power	Separate I2C +3V3 Power Rail (Default On, GPIO 6, HIGH=EN, Output Only!)
9	GND	Power	Ground

5. Board Operation

5.1 Getting Started – Arduino IDE

5.2 Sample Sketches

5.3 Online Resources

6. Company Information

tinyCore is developed and maintained by **MR.INDUSTRIES**: McIntyre-Reeves Industries LLC, based in Boulder, Colorado.

7. Relevant Links

Reference	Link
Arduino IDE	https://www.arduino.cc/en/Main/Software
Espressif ESP-IDF	https://docs.espressif.com/projects/esp-idf/en/stable/esp32s3/get-started/index.html
MR. INDUSTRIES Website	https://mr.industries
MR. INDUSTRIES Docs	https://docs.mr.industries
Official YouTube Channel	https://www.youtube.com/@MISTER.INDUSTRIES

8. Revision History

Date	Revision	Changes
3/23/25	1	Datasheet Release
8/21/25	2	Added power and code examples
12/1/25	3	Added power tree