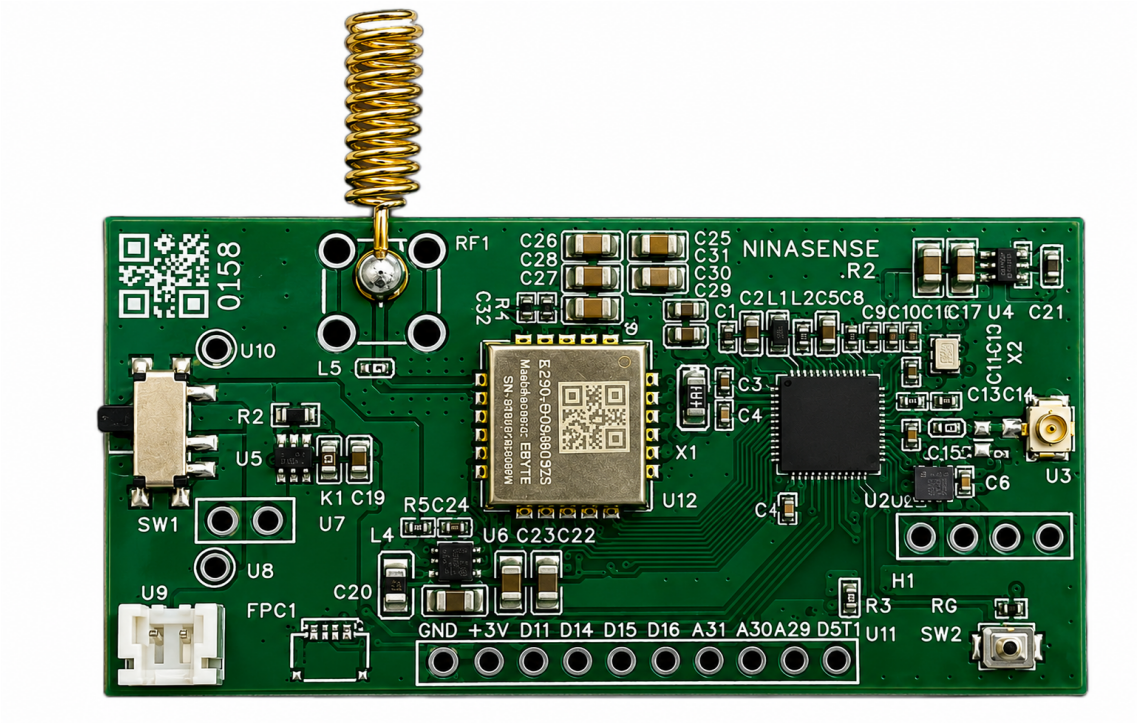
NEARMETER TECHNOLOGIES

NINASENSE - BLE + LoRa Ultra Low Power

A purpose-built ultra-low-power platform for autonomous battery-powered sensing, metering and telemetry.

nRF52832	LLCC68 LoRa	~3 uA SLEEP	BLE + SWD



Unlike conventional development boards, NINASENSE eliminates circuitry that keeps consuming energy while the microcontroller is asleep. There is no USB/Serial converter, no permanently connected LEDs, no conventional always-on LDO, and no unnecessary circuitry that can introduce significant leakage current.

The result is a platform capable of reaching approximately **3 uA in sleep mode**, making it especially suitable for remote sensors, smart metering, dataloggers, telemetry, industrial automation, environmental monitoring and battery-powered IoT devices.

1. Designed to Consume as Little as Possible

The NINASENSE power architecture was specifically designed to maximize the useful energy available from the battery.

Ultra-low-power architecture

The nRF52832 can use its internal DC/DC converter to optimize MCU power consumption. A 32.768 kHz crystal provides accurate low-power timing, allowing the firmware to spend long periods in efficient sleep states and wake only when required.

Buck-Boost with bypass

A very-low-power Buck-Boost stage maintains the system at 3 V and provides bypass operation when VBAT is above 3 V. This reduces unnecessary conversion losses while allowing the battery to be used effectively as its voltage decreases.

One 3 V domain

Keeping the board and connected peripherals in the same 3 V domain helps reduce compatibility problems and unwanted currents when sensors and external modules are attached. A regulated 3 V output is available for external peripherals and can supply up to 300 mA.

VBAT input	2.0 to 3.6 V
Reference sleep current	Approximately 3 uA
Low-power clock	32.768 kHz XTAL
MCU power optimization	Internal DC/DC
System rail	3 V
Buck-Boost	Ultra-low-power conversion with bypass when VBAT > 3 V
External output	Regulated 3 V, up to 300 mA

2. Intelligent Power and Battery Protection

- Dedicated battery measurement circuit.
- Reverse-polarity protection.
- Ideal-diode isolation and capacitive energy reservoir to minimize momentary voltage dips at the microcontroller.
- Low-ESR capacitor bank for transient support.
- Dedicated current-measurement test points for multimeter-based development and power optimization.

Because of this low-power architecture, the complete platform - including the LoRa radio - can be used in CR2032 or AAA-powered designs when the transmission profile and peak-current requirements are dimensioned appropriately.

3. Ultra-Low-Power LoRa

Long-range communication is provided by the LLCC68 transceiver, intended for low-power LoRa applications. The RF interface can be configured with an SMA connector or with a compact high-gain helical antenna.

Transceiver	LLCC68
Frequency range	850 to 930 MHz
Modulation	LoRa and FSK
RF interface	SMA or high-gain helical antenna
Helical antenna model	C-3POEM915S4
Helical antenna gain	4.5 dBi
SWR	< 1.3:1
Construction	Coiled brass wire with 18K gold-plated finish in 15 layers

This configuration enables compact devices without giving up the communication range expected from LoRa systems.

4. Bluetooth Low Energy with External Antenna Option

NINASENSE is supplied with a 2 dBi Bluetooth antenna. When an application requires greater range, enclosure separation or an externally positioned antenna, the board provides a U.FL connector for alternative BLE antennas.

Bluetooth	Bluetooth Low Energy
Standard antenna	2 dBi
External antenna	U.FL connector

5. Sensor Interfaces

The module exposes 8 general-purpose GPIOs, including 3 analog-capable inputs, for sensors, switches, digital inputs and other peripherals. A dedicated DS18B20 interface simplifies digital temperature monitoring.

On the special version, an FPC connector supports low-power Hall sensors, making NINASENSE particularly suitable for smart metering, water meters, gas meters, energy meters, pulse counters, rotary encoders, and position or movement sensing.

GPIO	8 general-purpose pins
Analog-capable inputs	3
Temperature	Dedicated DS18B20 interface
Special-version FPC	Low-power Hall sensor / metering interface

6. Low-Power Accelerometer

NINASENSE is equipped with the LIS2DH12 ultra-low-power accelerometer for motion, orientation, vibration and motion-triggered wake-up. This allows the device to remain asleep for long periods and wake only when a physical event occurs.

Accelerometer	LIS2DH12
Typical uses	Motion, orientation, vibration, event wake-up

7. Development and Firmware

NINASENSE is an open development platform rather than a closed appliance. It can run nRFClaw or conventional embedded firmware and is programmed/debugged through SWD.

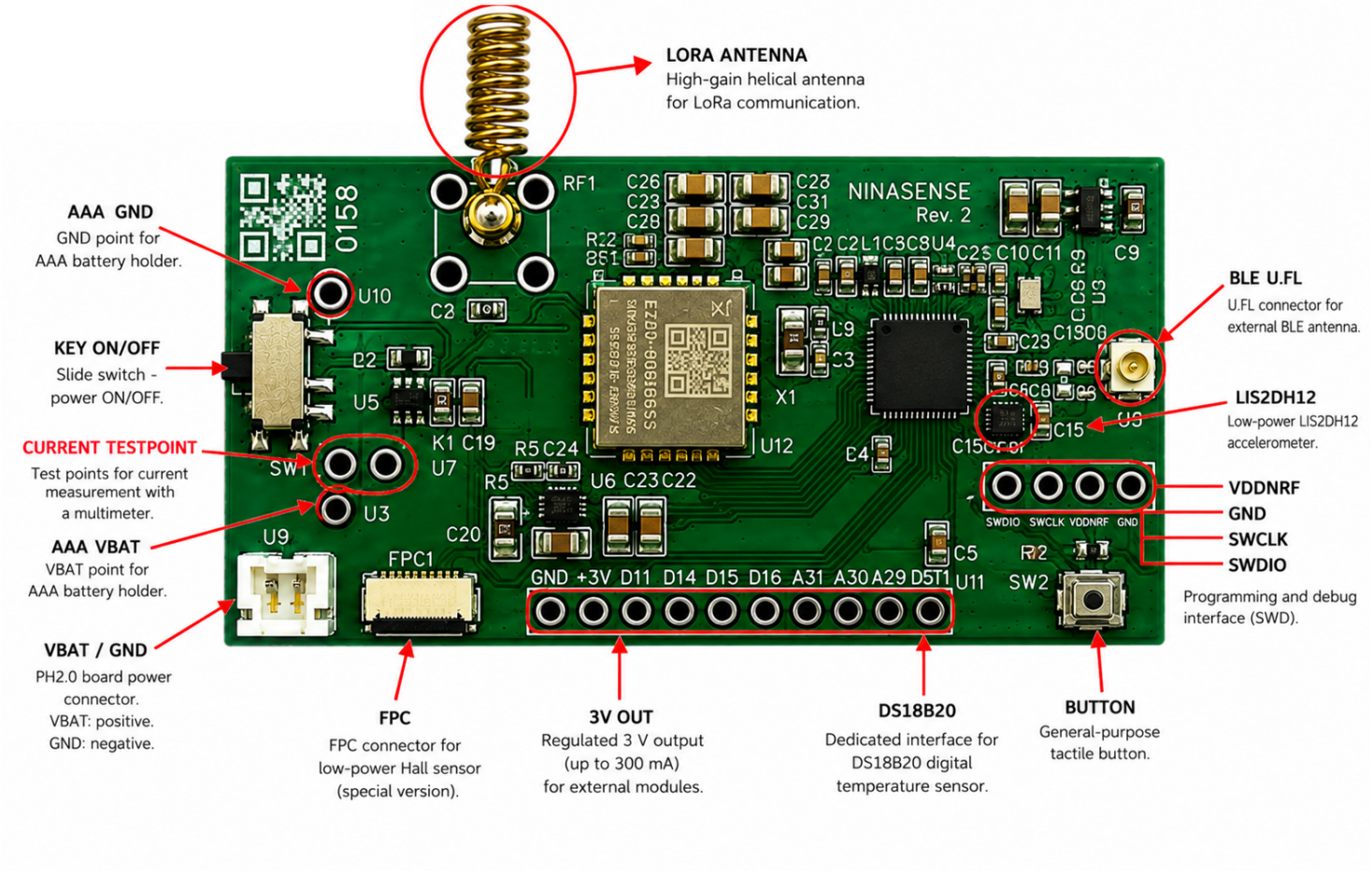
nRFClaw	AI-programmable deterministic VM platform for ultra-low-power autonomous devices
Arduino	Arduino IDE
Nordic	Nordic nRF5 SDK
RTOS	Zephyr RTOS
Embedded JavaScript	Espruino
Programming / debug	SWD

8. Recommended Applications

- Remote battery-powered sensors
- Smart metering for water, gas and energy
- LoRa telemetry and dataloggers
- Bluetooth tags, beacons and presence devices
- Industrial machine monitoring
- Environmental monitoring
- Asset tracking and identification
- Smart agriculture
- Security and event-driven sensors
- Ultra-low-power IoT prototypes

9. Hardware Map

Main interfaces, connectors, sensors, current-measurement points and SWD programming signals.

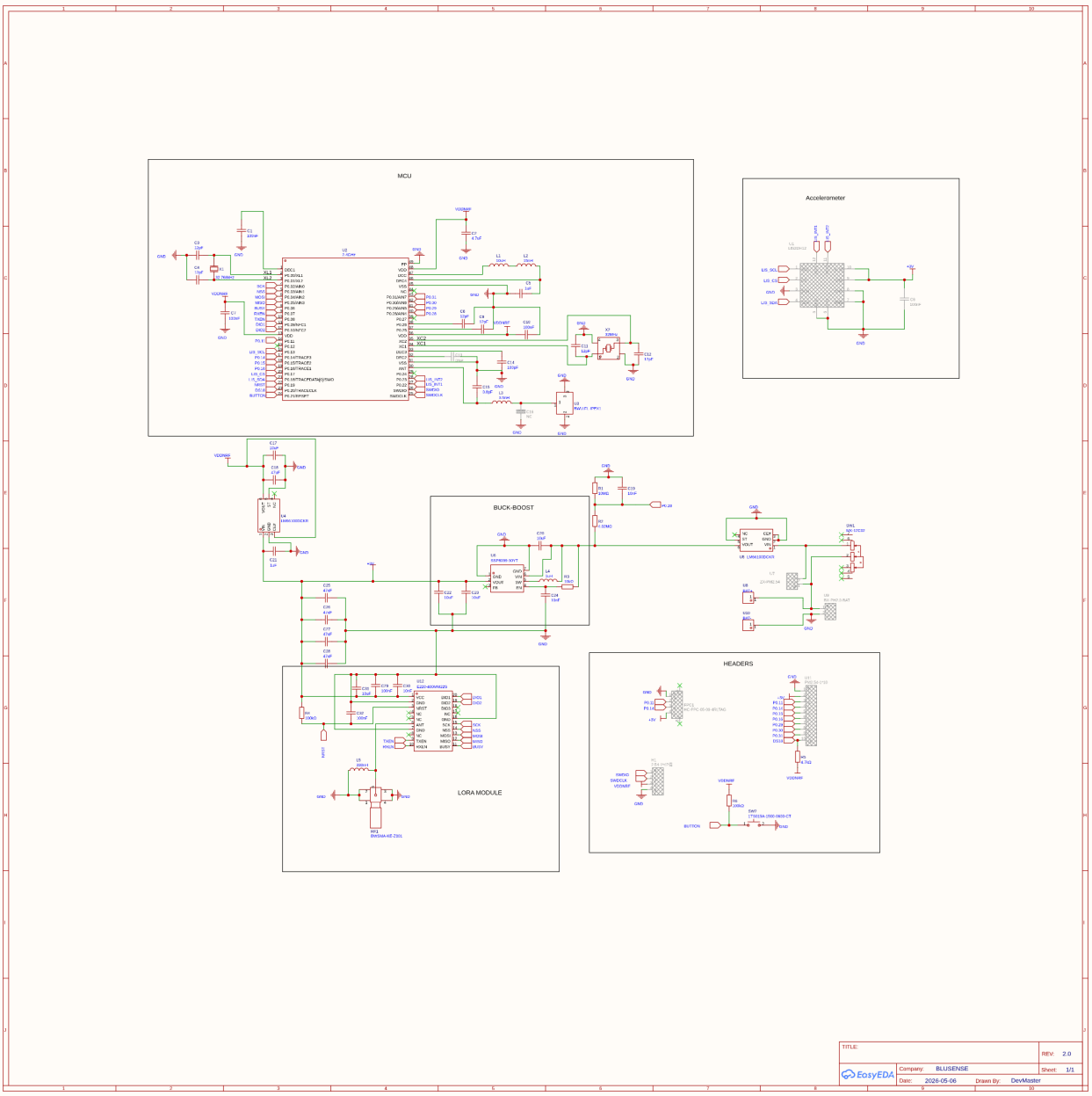


The current test points are the two U7 through-holes beside SW1 and are intended for series current measurement with a multimeter during low-power development.

10. Technical Summary

MCU	Nordic nRF52832 - ARM Cortex-M4F up to 64 MHz
Wireless	Bluetooth Low Energy + LLCC68 LoRa / FSK
Supply	2.0 to 3.6 V
Reference sleep current	~3 uA
BLE reference	~12 uA advertising every 2 s
Power architecture	Internal DC/DC + 32.768 kHz XTAL + Buck-Boost with bypass
Battery protection	Measurement, reverse-polarity protection, ideal-diode isolation, capacitive reservoir
Expansion	8 GPIO; 3 analog-capable
Sensors	DS18B20; low-power Hall via FPC; LIS2DH12
RF	BLE 2 dBi / U.FL; LoRa SMA or C-3POEM915S4 helical
External power	Regulated 3 V output, up to 300 mA
Dimensions	57 x 28 mm
PCB	4 layers

11. Electrical Schematic - NINASENSE R2



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12. Engineering Notes

Power consumption, radio range and battery autonomy depend on firmware, transmission interval, RF output power, antenna, environment, installed sensors and power source. The values in this document are reference values for the described hardware configuration.

For coin-cell operation, transmission duty cycle and peak-current demand must be engineered for the selected cell. External peripherals connected to the regulated 3 V output also become part of the total power budget.

NINASENSE

Low-power hardware for devices that are expected to stay in the field.

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