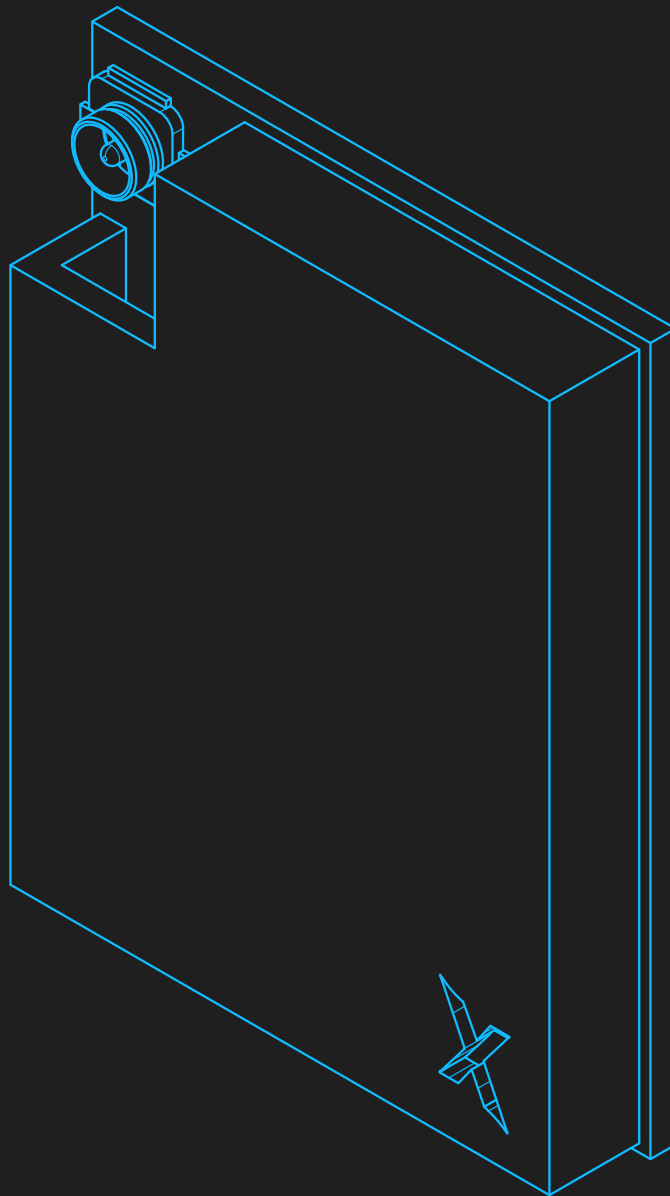# OBJEX

ELPM-S3

Extreme Low Power Module based on ESP32-S3FN8

v1.1

Overview

The ELPM-S3 is extreme-low power module based on ESP32-S3FN8. With power consumption as low as 1nA, this module is ideal for battery-powered devices and energy harvesting applications that require long battery life. It provides a cost-effective solution with lower maintenance and battery replacement costs compared to the ESP32-S3 module, making it an excellent choice for industrial applications and devices that require high performance and energy efficiency.

Features

Extreme-low power unit

— Rising/falling edge detector (1-30nA)

— Wake and forceon input (1-30nA)

— RTC (45-100nA)

— RTC isolated power supply

— Integrated LDO 3.3V@500mA

— Battery level circuit (zero leakage current)

Microcontroller and I/O

— ESP32-S3FN8 (32-bit 240MHz)

> Memory Size: 8MB Flash

> Serial Interfaces: I²C, I²S, SPI, UART, USB

> GPIO: 40 available

> WiFi - IEEE 802.11 b/g/n-compliant

> Bluetooth LE: Bluetooth 5, Bluetooth mesh

> Wi-Fi and Bluetooth share the same antenna

> Cryptographic hardware acceleration

> External PSRAM can be installed

— RGB status led (WS2812B)

> PIN: GPIO48

— Integrated I2C pullup resistors

> SDA: GPIO8

> SCL: GPIO9

— U.FL antenna connector

— Aluminium reinforced RF/EMI shield

Power latch and RTC

Behind the power consumption so low in deep sleep is a power latch combined with a smart power management system that control the ESP32-S3FN8 and all loads connected to the 3.3V path. By controlling the power supply to all connected loads, it is possible to minimize power consumption, thus increasing the life of the battery that powers the system or generally reducing the power consumption required at the source.

Applications

■ Battery-powered nodes

■ Industrial monitoring

■ Wireless sensor nodes

■ Energy harvesting

■ Home automation

■ Smart Building

■ Smart Agriculture

■ Wearable Electronics

■ Audio Applications

Recommended Operating Conditions

To ensure the proper operation of the ELPM-S3, it is recommended that the ranges of the Operating Conditions be observed.

Symbol	Parameter	Min	Max	Unit
3V3	Power supply voltage	3	3.6	V
Vin	Battery input	3	5.5	V
T	Ambient temperature	-40	+85	°C

Startup time

The power latch is capable of booting the whole system in a few milliseconds ensuring high reactivity.

Interrupt mode	Description	typ	Unit
Master Platch	Change of input status.	30	ms
RTC Wake	Programmed awakening.	80	ms
Gate/FORCEON	Gate input to GND.	20	ms
Wake	Wake input to GND.	500	ms

ESP32-S3FN8	typ	Unit
Default startup time	105	ms

It is possible to reduce the startup time of the ESP32-S3 boot by tuning the boot options.

1 | Block diagram
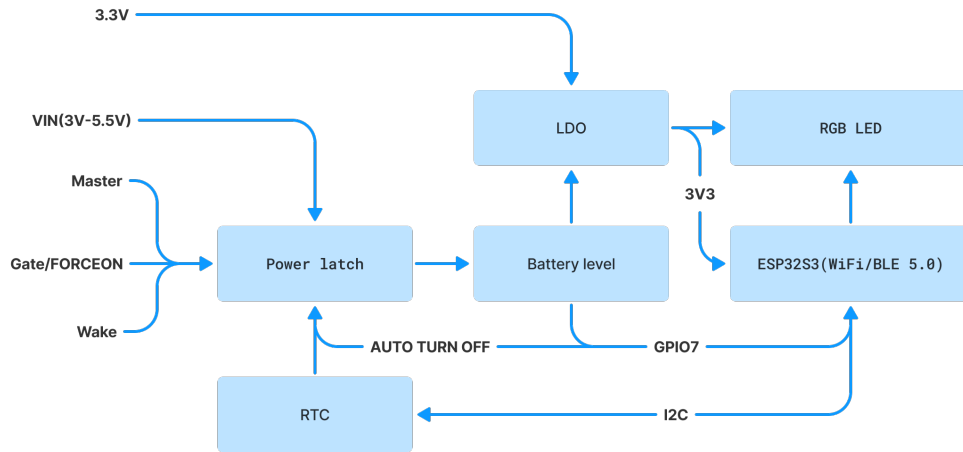
2 | Pin Overview

Pin No.	Pin name	Pin type	Pin No.	Pin name	Pin type	Pin No.	Pin name	Pin type
1	GND	Power	25	GND	Power	48	GPIO20	IO
2	3.3V	Power	26	GND	Power	49	GPIO26	IO
3	3.3V	Power	27A	Vin	Power	50	VDDSPI	Power
4	GPIO10	IO	27B	VddRTC	Power	51	GPIO28	IO
5	GPIO13	IO	28	GND	Power	52	GPIO48	RGB LED
6	Vin	Power latch	29	RTCCLK	Output	53	GPIO29	IO
7	Vin	Power latch	30	GND	Power	54	GPIO47	IO
8	Master	Power latch	31	RESET	Analog	55	GPIO32	IO
9	Wake	Power latch	32	GPIO0	IO	56	GPIO34	IO
10	GND	Power	33	GPIO1	IO	57	GPIO36	IO
11	GND	Power	34	GPIO2	IO	58	GPIO40	IO
12	Gate	Power latch	35	GPIO4	IO	59	GPIO42	IO
13	GND	Power	36	GPIO8	IO	60	GPIO41	IO
14	GND	Power	37	GPIO9	IO	61	GPIO46	IO
15	GPIO27	IO	38	GPIO3	IO	62	TXD	IO
16	GPIO30	IO	39	GPIO11	IO	63	GPIO45	IO
17	GPIO31	IO	40	GPIO5	IO	64	GPIO6	IO
18	GPIO33	IO	41	GPIO12	IO			
19	GPIO35	IO	42	XTALP	IO			
20	GPIO37	IO	43	XTALN	IO			
21	GPIO38	IO	44	GPIO17	Power			
22	GPIO39	IO	45	GPIO19	Power			
23	RXD	IO	46	GPIO18	Power			
24	GND	Power	47	GPIO21	Power			

3 | Power consumption

Work mode	Description	Temp	Vin	Min	Typ	Unit
Power latch (RTC disabled)	Master, gate/Forceon, wake input triggering the power latch. RTC not powered, terminals 27A and 27B not connected.	+20°C to +30°C	3.3V	<1	5	nA
RTC	RTC powered, terminals 27A and 27B connected. Multiple interrupt sources.	+20°C to +30°C	3.3V	40	80	nA
Deep sleep	Default deep sleep mode of ESP32-S3.	+20°C to +30°C	3.3V	6	10	µA

All measurements were made with Otii Arc Pro, Rigol DS1054Z, and Power profiler kit 2.

3.1 | Master power latch mode
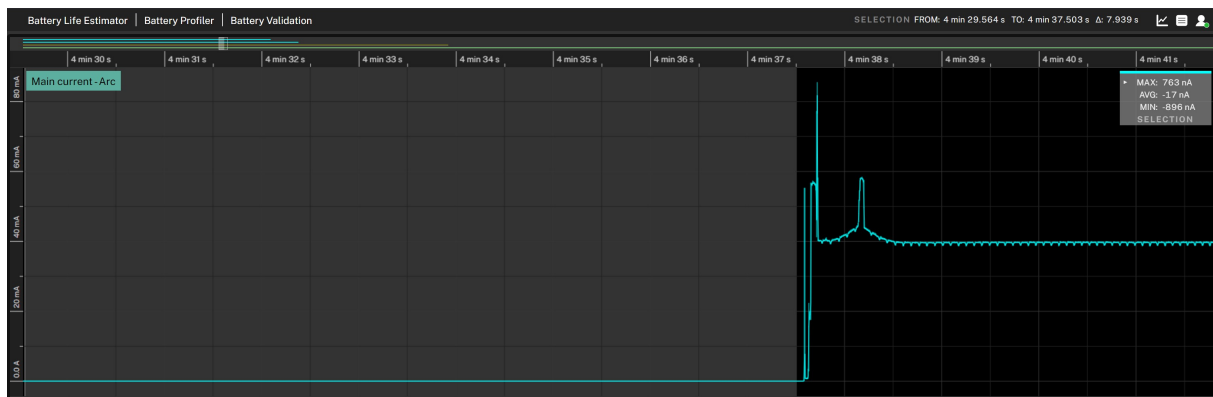
Figure 3.1: Deep sleep
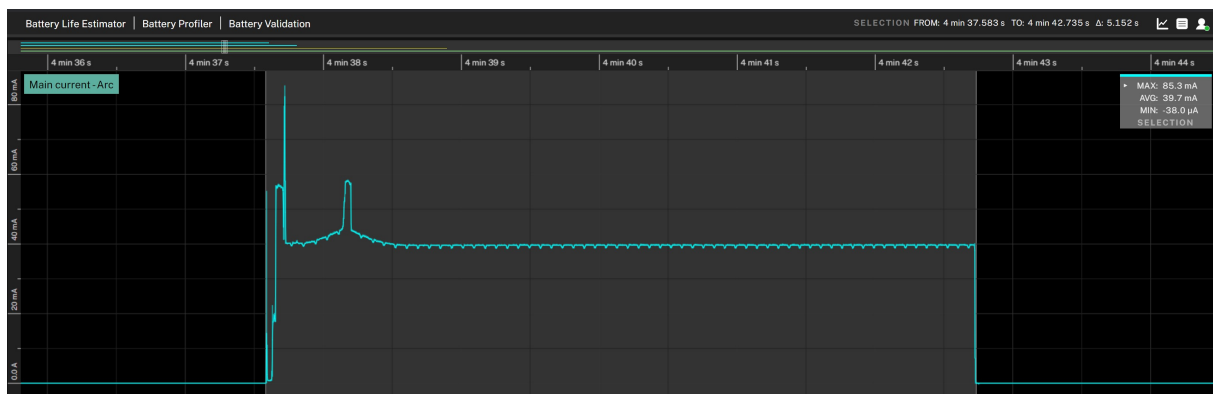
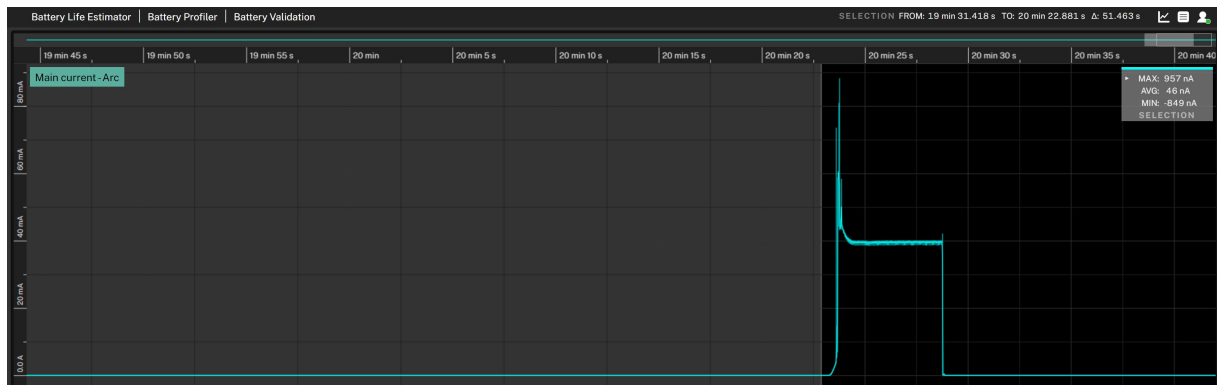**Figure 3.2:** System startup
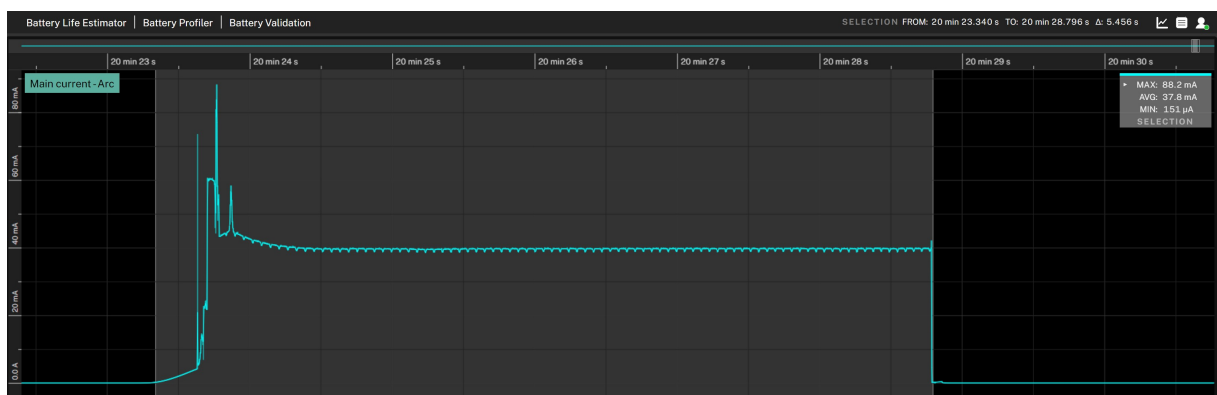
3.2 | RTC Wake mode

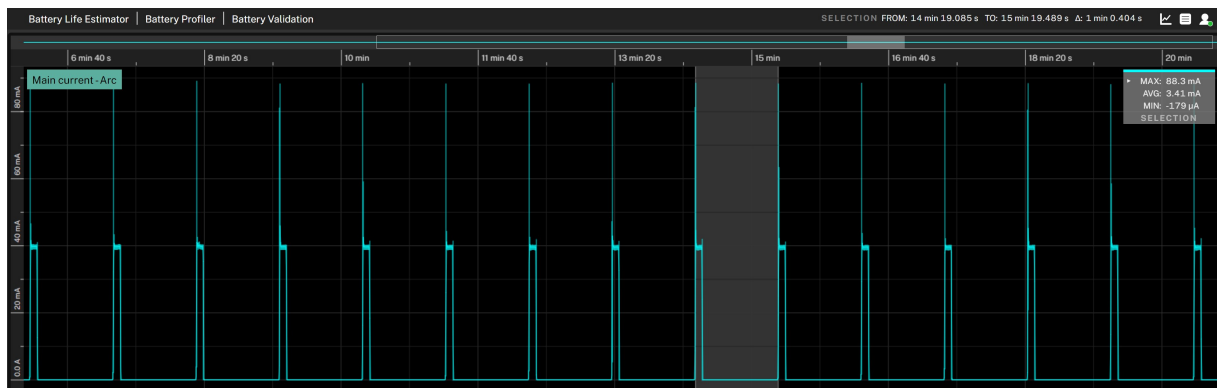**Figure 3.3:** Deep sleep
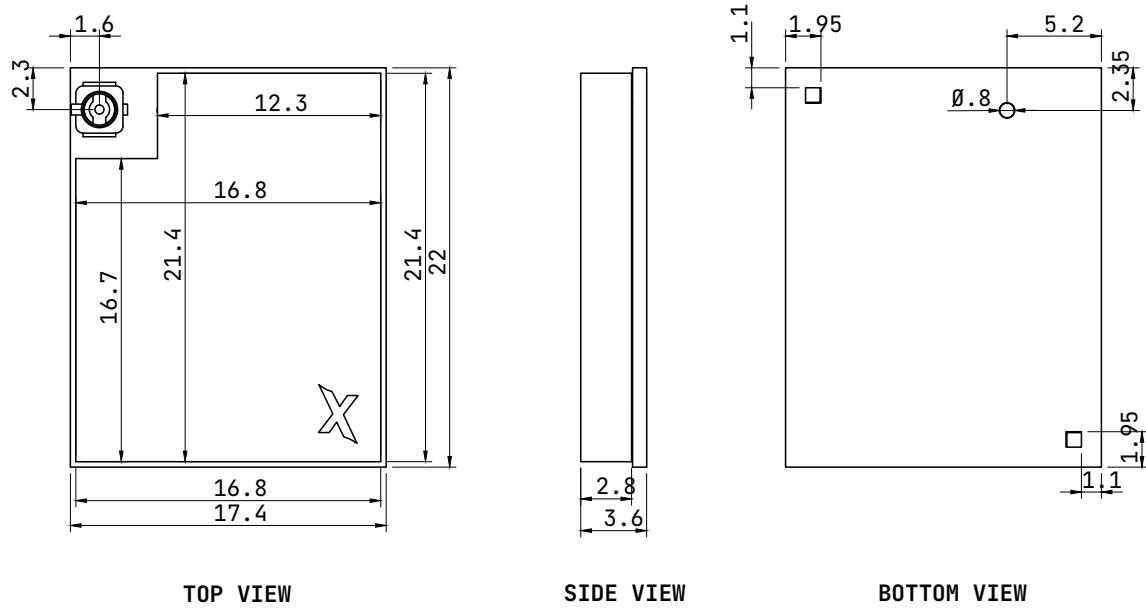

Figure 3.4: System startup

Figure 3.5: Example: Wake-up every minute

4 | **Physical Dimensions**

TOP VIEW   **SIDE VIEW**   **BOTTOM VIEW**

5 | Certification

Pending release of the ELPM-S3 version for mass production.

6 | Revision History

Revision	Date	Description
v1.1	12/13/2023	Update power consumption values, add more sections.
v1.0	12/01/2023	Creation of the document.

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