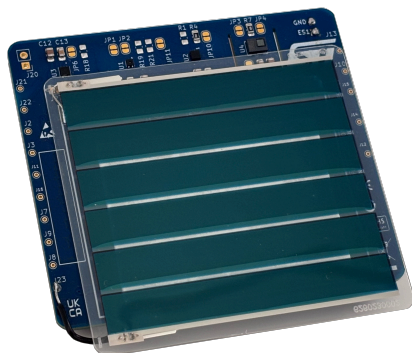


Energy harvesting expansion board for NUCLEO-WL55JC with organic photovoltaic module



Fully assembled board developed for performance evaluation only,
not available for sale

Features

- Energy harvesting board, based on an organic photovoltaic module and sensors
- **STTS22H**, **LIS2DU12**, and **SHT40-AD1B** mounted on the board:
 - **STTS22H** sensor to measure temperature with accuracy $\pm 0.5^{\circ}\text{C}$
 - **LIS2DU12** sensor to measure acceleration with selectable full scales of $\pm 2\text{ g}$, $\pm 4\text{ g}$, $\pm 8\text{ g}$, $\pm 16\text{ g}$
 - **SHT40-AD1B** sensor to measure relative humidity and temperature from Sensirion
- The board, connected to **NUCLEO-WL55JC**, can send the LoRa packet using only energy harvested from an organic photovoltaic module mounted on the board. It is a battery-free solution
- Besides running the user application, the **STM32WL55JC** manages energy through a ceramic capacitor charged by Light power, without requiring an external PMIC, while also handling radio connectivity
- The packet consists of data from sensors (**STTS22H**, **LIS2DU12**, **SHT40-AD1B**) mounted on the **STDES-DRARVESTER**
- Compatible with **NUCLEO-WL55JC** board
- Equipped with ST morpho
- RoHS compliant

Description

The **STDES-DRARVESTER** energy harvesting expansion board is a shield to be used with **NUCLEO-WL55JC**, based on **STM32WL55JC** for LoRa connectivity, with a capability of measuring temperature through the **STTS22H** sensor, acceleration through the **LIS2DU12** sensor, and temperature and relative humidity through the **SHT40-AD1B** sensor (from Sensirion).

The board is self-powered due to the energy harvested using the organic photovoltaic module mounted on it. The storage capacitor is available for storing energy harvested from the organic photovoltaic module.

The **STDES-DRARVESTER** expansion board is compatible with the ST morpho pin assignment, and it can easily be plugged onto a **NUCLEO-WL55JC**.

The **STM32WL55JC** reads sensors and stores data in an internal memory. It manages energy by buffering it on a dedicated ceramic capacitor located at the bottom of the board, using organic photovoltaic module power from both indoor and outdoor environments, without requiring an external PMIC. Additionally, it handles radio connectivity, specifically using the LoRaWAN® protocol.

The board includes ceramic capacitors to store energy, which is used to run the application (sensor reading and LoRaWAN® message transmission) during the day, as well as a Super-CAP to store energy for nighttime use.

Product summary	
Energy harvesting expansion board for NUCLEO-WL55JC with organic photovoltaic module	STDES-DRARVESTER
LPWAN dual-core 32-bit MCU based NUCLEO board	NUCLEO-WL55JC1
Temperature sensor with 0.5°C accuracy	STTS22HTR
3-Axis accelerometer	LIS2DU12TR
Digital humidity and temperature sensor	SHT40-AD1B
Applications	Energy harvesting

1 Detailed description

The **STDES-DRARVESTER** is a shield powered by an organic photovoltaic module and sensors to be used in combination with **NUCLEO-WL55JC** board with LoRaWAN® connectivity. It measures the temperature through **STTS22H** sensor, acceleration through **LIS2DU12** sensor, and humidity through **SHT40** sensor.

Organic photovoltaic module energy is stored in the capacitor. Periodically, the system wakes up, reads the sensors, and sends the data via a LoRaWAN® message. The LoRa packet consisting of these sensor's data is sent by **STM32WL55JC**.

A dedicated PMIC is not required because the **STM32WL55JC** itself can manage energy harvesting.

Both **NUCLEO-WL55JC** and **STDES-DRARVESTER** are driven by voltage buildup across storage capacitor charged by organic photovoltaic module. No external power is required.

NUCLEO-WL55JC boards are based on **STM32WL55JC**, which are long-range wireless and ultralow power devices. They embed a powerful and ultra-low-power LPWAN-compliant radio solution, supporting the following modulations: LoRa, (G)FSK, (G)MSK, and BPSK. In this application's use case, we provide a LoRaWAN® communication protocol example.

The sub-GHz radio is an ultralow power radio operating in the 150 ~ 960 MHz ISM band. LoRa and (G)FSK modulations are in transmit and receive, and BPSK and (G)MSK are in transmit only. They allow an optimal trade-off between range, data rate, and power consumption. This sub-GHz radio is compliant with the LoRaWAN® specification v1.0 and radio regulations, such as ETSI EN 300 220, EN 300 113, EN 301 166, FCC CFR 47 part 15, 24, 90, 101, and the ARIB STD-T30, T-67, and T-108.

The LoRa modulation is available in STM32WLx5xx only. These devices are designed to be extremely low power and they are based on the high-performance Arm Cortex®-M4 32-bit RISC core, operating at a frequency up to 48 MHz.

The **STM32WL55JC** wakes up using the power voltage detector (PVD) feature, embedded on the MCU. It harvests the energy through the organic photovoltaic module and, once there is voltage buildup across the storage capacitor, it crosses the threshold voltage and the MCU wakes up.

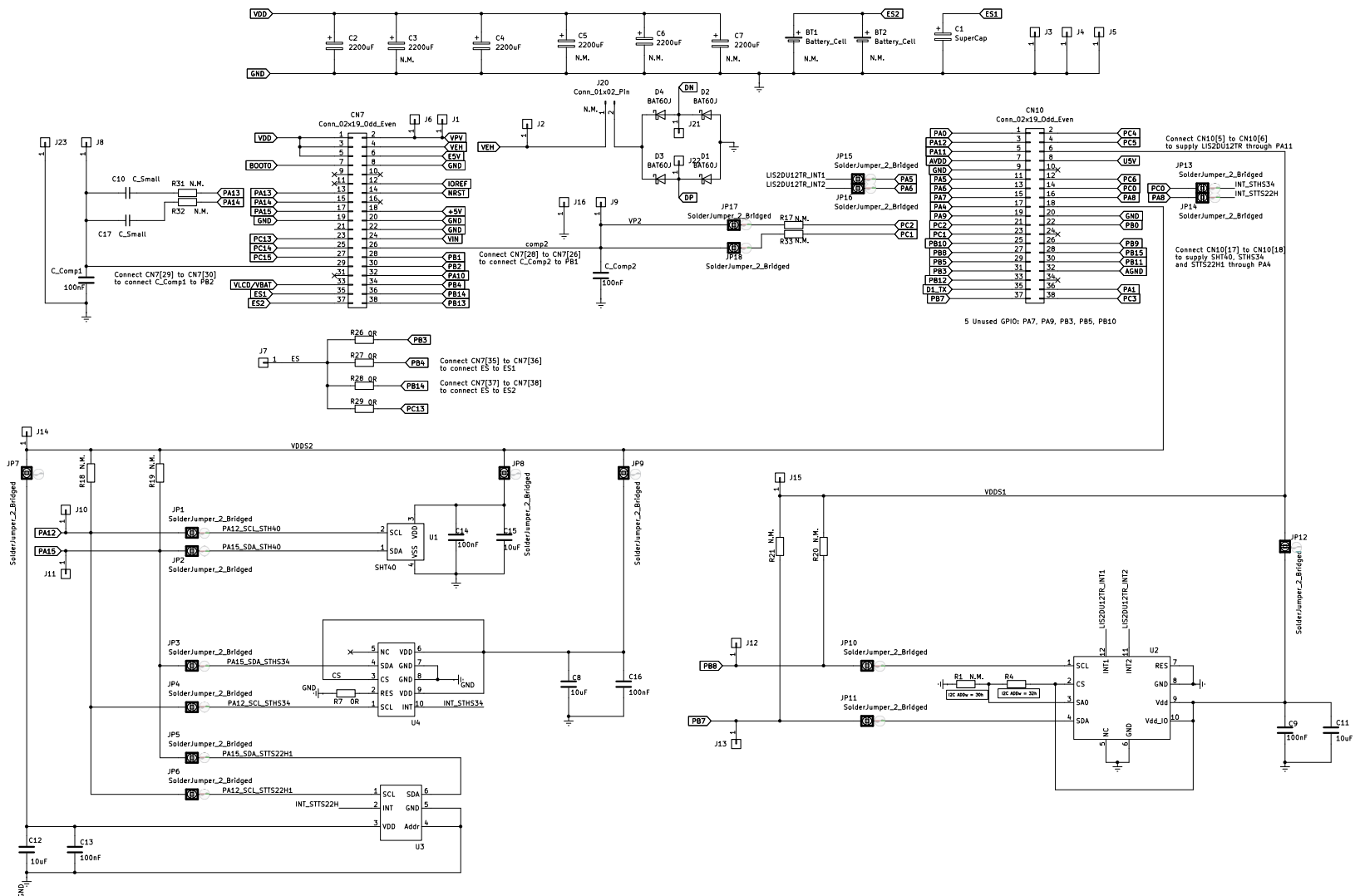
The MCU initializes all the ICs (**STTS22H**, **LIS2DU12**, **SHT40**) and it takes the reading.

The LoRa packet consisting of all the sensors data is sent. Finally, the MCU enters in STOP Mode. This step keeps repeating.

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Schematic diagrams

Figure 1. STDES-DRARVESTER circuit schematic



Revision history

Table 1. Document revision history

Date	Revision	Changes
25-Aug-2026	1	Initial release.

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