EPSON × LIGHTRICITY

# Battery-less
## ePaper Display Concept



**Epson** and **Lightricity** collaborated to develop a battery-less ePaper Display (ePD) concept featuring temperature and humidity indication, along with an optional BLE module for transmitting data via Beacon, with exceptional performance thanks to **Epson's** ultra-low-power MCU **S1C17F63** and **Lightricity** ultra-high-efficiency PV Energy Harvesting technology.

## Our Strengths in IoT and Ultra-Low-Power Applications

### Lightricity

**Lightricity** is enabling sustainable IoT solutions through its patented PV energy harvesting technology. We provide miniaturized, easy-to-integrate, PV-powered devices for a wide range of IoT and low-power applications, from sensors and asset trackers to ePD for home automation and Electronic Shelf Labels.

**35%** Key performance figure: up to 35% conversion efficiency in indoor lighting conditions.

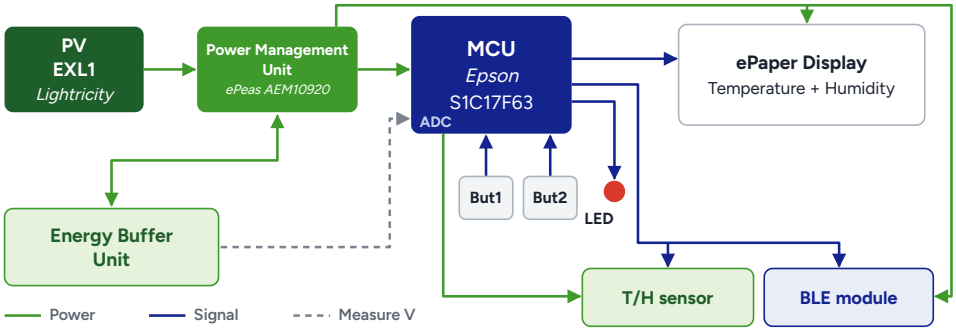
### Epson

**Epson** offers highly energy-efficient microcontrollers that enable battery-less energy harvesting-based applications. These applications support major functions such as display driving and sensor measurement, which are not possible with other common low-power MCUs.

**110 nA** Key performance figure: Deep sleep current of 110 nA with RTC active

## Product Description






A smart algorithm running on the MCU monitors the voltage of the energy unit buffer and adjusts the ePaper display's update rate accordingly. It also reserves additional PV energy so the energy buffer unit can reach its maximum charging level, enabling up to three consecutive updates when Button 2 is pressed.

## Additional Features

**Button 1:** activates the BLE Beacon option, with the BLE symbol shown on the display.

**Red LED:** when blinking, indicates unchanged T/H values (Display) or a BLE broadcast (BLE mode).

**Empty battery symbol:** informs the user that there is not enough energy to trigger a display update by pressing Button 2.

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## Our Value Proposition

The concept of PV-powered ePaper displays (ePD) is not new. However, such designs typically require relatively large PV modules because typical indoor PV conversion efficiency is low. They also generally rely on a battery, since average MCU power consumption is not optimized at the algorithm level and typical sleep currents remain relatively high. As a result, battery replacement drives maintenance costs that become a major obstacle for mass scale up.

**Lightricity's** high-efficiency PV technology combined with **Epson's** extremely energy-efficient MCUs, more of the harvested energy can be allocated to core functions such as ePD refresh, sensing, and BLE communication, while still achieving significant device miniaturization and eliminating the need for a battery across an increasing number of ePD application segments. This includes classic IoT home automation, where multiple ePD equipped sensing devices can be deployed throughout a household (place and forget), as well as very large-scale deployments such as electronic shelf labels (ESL) in supermarkets, with the integrated BLE module enabling rapid feasibility testing and validation of BLE price update protocols. Battery-less designs are also a very beneficial and power-efficient platform for asset tracking and logistics devices to measure and monitor mandatory parameters, which can be displayed on an ePD display or via a BLE function on a mobile phone.

- **Home automation**
- **Electronic shelf labels (ESL)**
- **Asset tracking**
- **Logistics**

## Performance Charts

**Typical lighting conditions** assessed in the chart below, with reference to typical environment:

| Location | Parking/Garage | Living room | Office | Supermarket |
|---|---|---|---|---|
| **Lux Level** | 50/100 | 200 | 500 | 1000 |

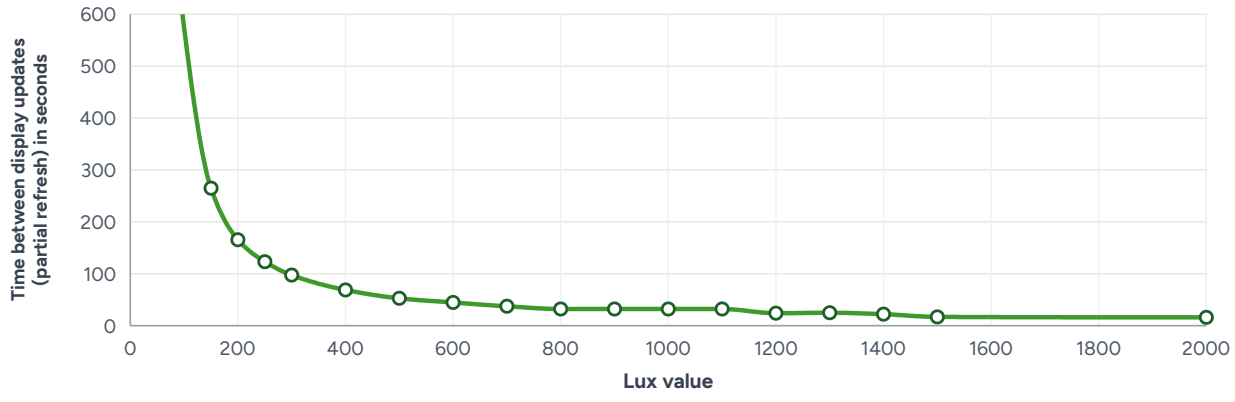



*Figure 1: time interval between two consecutive display updates (experimental data).*

CONTACT INFORMATION

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