

RSL10 Smart Shot Camera Power Consumption Measurements

AND90131/D

Overview

The RSL10 smart shot camera is a complete ultra-low-power, battery operated, edge-to-cloud platform that enables new vision applications that require compact, wireless connectivity, and low duty cycle image capture with cloud-based analytics. There are two variants of this camera platform RSL10 smart shot mono camera (SECO-RSL10-CAM-GEVB) and RSL10 smart shot color camera (SECO-RSL10-CAM-COLOR-GEVK) that are optimized for power consumption that improves the battery lifetime performance of the system. This document describes the results of power consumption measurements performed on the camera platform.

RSL10 Smart Shot Camera Design Considerations

The RSL10 smart shot camera has been designed with ultra-low-power components like onsemi’s ARX3A0 image sensor and RSL10 SiP module, and SunplusIT SPC1100A image sensor processor (ISP). On SECO-RSL10-CAM-COLOR-GEVK, onsemi’s FAN53880 power management IC (PMIC) and additional smart power management modes have been implemented on the hardware to deliver superior power consumption for

long battery operation. On SECO-RSL10-CAM-GEVB, onsemi’s NCP6925 power management IC (PMIC) is used.

Some key design considerations taken for power consumption are:

- Vision sub-system that includes the image sensor and the ISP are placed on a separate power rail. This allows the controller (RSL10) to completely power-off the vision sub-system for most of the camera operation duration and turn it on for image capture when an event is triggered.
- The RSL10 SiP module is put into deep sleep state for most of the camera operation duration while the camera is in advertising mode and connected mode when the event triggers are enabled. The RSL10 is turned into high gear only for image capture and transmission.
- High speed MIPI interface is used for connectivity between the ISP and the image sensor.
- High speed SPI interface is used for image transfer between the ISP and RSL10 controller, thereby reducing the wake-up time of the vision sub-system.

More information about the different camera modes is available in the user manual.

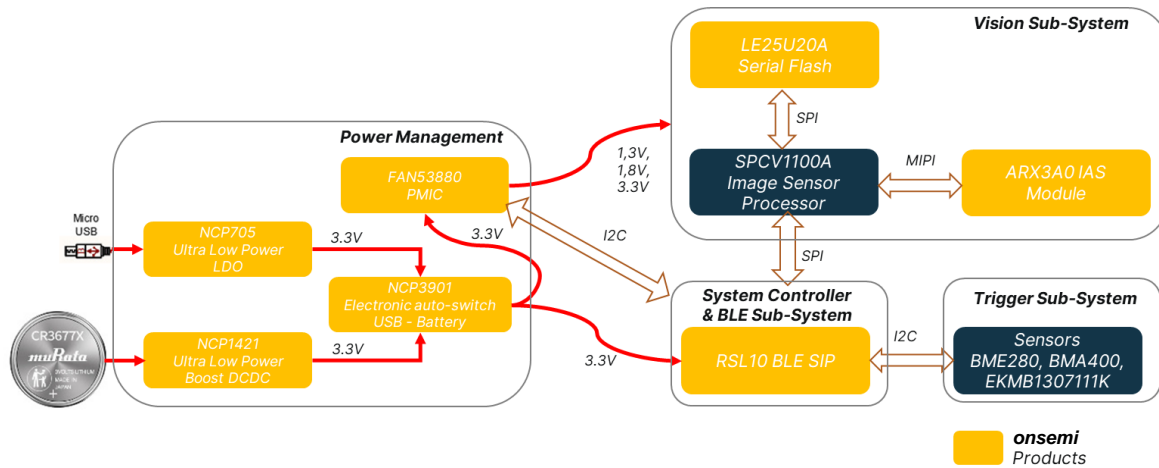


Figure 1. SECO-RSL10-CAM-COLOR-GEVK Block Diagram

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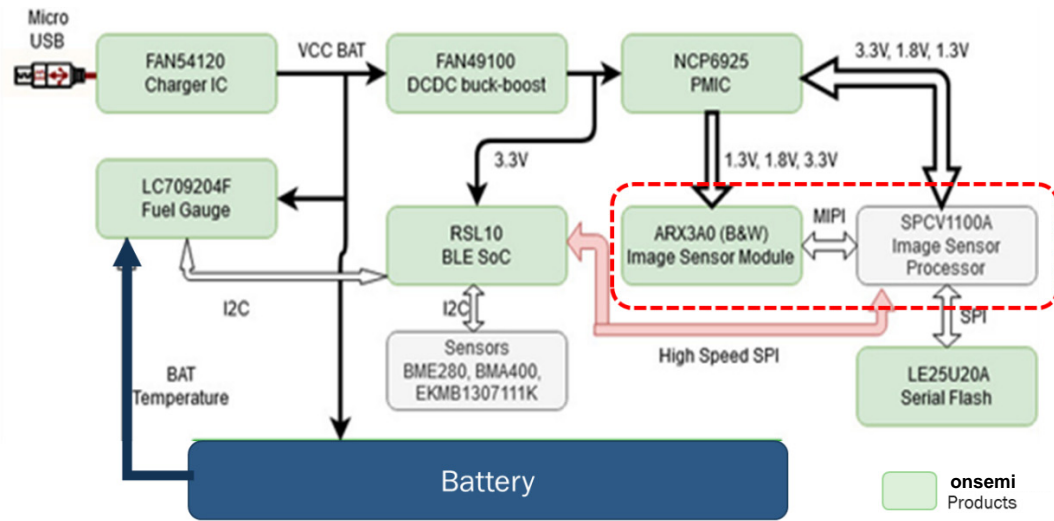


Figure 2. SECO-RSL10-CAM-GEVB Block Diagram

Test Setup

For SECO-RSL10-CAM-COLOR-GEVK:

Used BLE Connection parameters (when applicable):

- ◆ Client device: Samsung Galaxy S10+, Android 10
- ◆ App: RSL10 Smart Shot app v1.0.8
- ◆ Connection parameters: automatic
- ◆ PHY: 1 MBPS
- ◆ RSL10 TX power: 0 dBm
- ◆ Distance: < 0.5 m

RSL10 active mode configuration:

- ◆ SYSCLK = 8 MHz
- ◆ 40 KB RAM powered (5 * 8 KB blocks)

Firmware revision:

- ◆ RSL10 Smart Shot Software Package V2.1.0
- ◆ ISP: V0.0.1.6

Image sensor module:

- ◆ IAS1MOD-ARX3A0CSSC090110-GEVB – color IAS module

Power supply configuration:

- ◆ VCC_VBAT = 0 V
- ◆ VCC_3V3 = 3.3 V
- ◆ USB_VBUS0 = 0 V

For SECO-RSL10-CAM-GEVB:

Used BLE Connection parameters (when applicable):

- ◆ Client device: Samsung Galaxy S10+, Android 10
- ◆ App: RSL10 Smart Shot app v1.0.8
- ◆ Connection parameters: automatic
- ◆ PHY: 1 MBPS
- ◆ RSL10 TX power: 0 dBm
- ◆ Distance: < 0.5 m

RSL10 active mode configuration:

- ◆ SYSCLK = 8 MHz
- ◆ 40 KB RAM powered (5 * 8 KB blocks)

Firmware revision:

- ◆ RSL10 Smart Shot Software Package V2.1.0
- ◆ ISP: V0.0.1.6

Image sensor module:

- ◆ IAS1MOD-ARX3A0CSSM050110-GEVB – mono IAS module

Power supply configuration:

- ◆ VCC_VBAT0 = 4.2 V
- ◆ USB_VBUS0 = 0 V

Measurements

The tables below show the power measurements for both camera platforms.

Table 1. Power Measurements for SECO-RSL10-CAM-COLOR-GEVK

Camera State	System Description			P_{avg} W
Power Down Mode	Software induced Power Down with lowest possible power consumption where all parts are disabled. The camera can resume operation only after pressing a button.			30.36 μ W
Advertising Mode	The camera is in low-power mode waiting for connection request from the gateway. All sensors are disabled			64.35 μ W
	RSL10	Event-Trigger Sensors	Image sensor + ISP	
Connected with all triggers	The camera is in low-power mode waiting for the trigger event. All event-trigger sensors are enabled. Gateway device: Android phone with RSL10 Smart Shot app			88.77 μ W
	RSL10	Event-Trigger Sensors	Image sensor + ISP	
Connected with Continuous Image Capture	The camera is continuously taking pictures at the fastest possible rate and transmitting it to the gateway over the BLE connection. The image rate depends on scene conditions and connection parameters. Gateway device: Android phone with RSL10 Smart Shot app			136.3mW
	RSL10	Event-Trigger Sensors	Image sensor + ISP	

Table 2. Power Measurements for SECO-RSL10-CAM-GEVB

Camera State	System Description			P_{avg} W
Power Down Mode	Software induced Power Down with lowest possible power consumption where all parts are disabled. The camera can resume operation only after pressing a button.			133.6 μ W
Advertising Mode	The camera is in low-power mode waiting for connection request from the gateway. All sensors are disabled			186.1 μ W
	RSL10	Event-Trigger Sensors	Image sensor + ISP	
Connected with all triggers	The camera is in low-power mode waiting for the trigger event. All event-trigger sensors are enabled. Gateway device: Android phone with RSL10 Smart Shot app			235.2 μ W
	RSL10	Event-Trigger Sensors	Image sensor + ISP	
Connected with Continuous Image Capture	The camera is continuously taking pictures at the fastest possible rate and transmitting it to the gateway over the BLE connection. The image rate depends on scene conditions and connection parameters. Gateway device: Android phone with RSL10 Smart Shot app			165.7mW
	RSL10	Event-Trigger Sensors	Image sensor + ISP	

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The Chart 1 shows the battery lifetime performance estimation of the color and mono camera based on 2000 mAh battery. If the application requires 24 image

captures in a day, the RSL10 smart shot mono camera can last for **3.42 years** while the RSL10 smart shot color camera can last for **5.32 years** on a single battery.

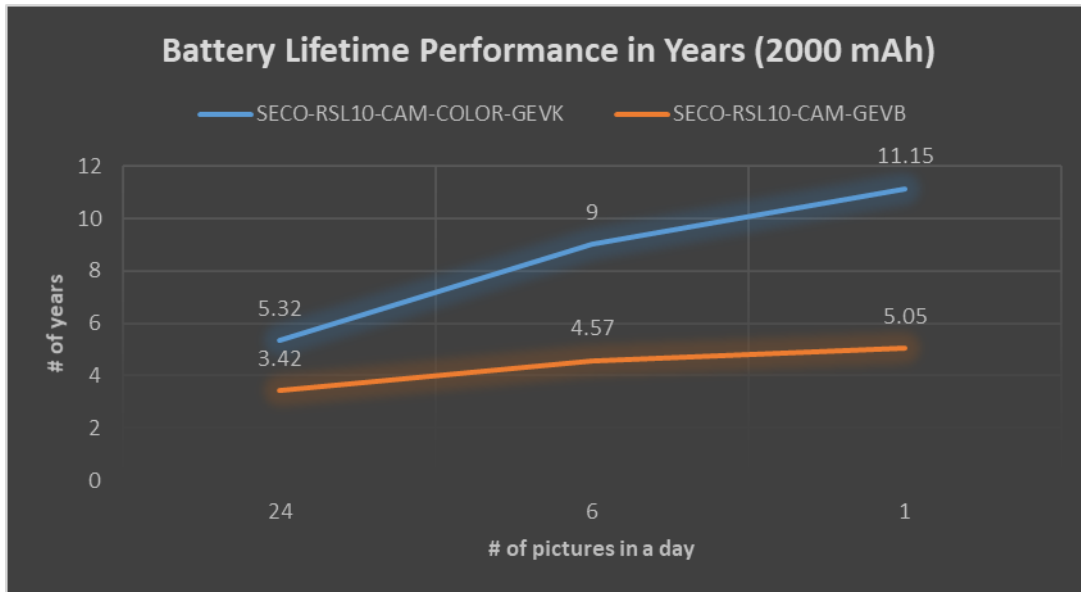


Chart 1. Battery Life Performance of the Camera

For the above use case estimation, a couple of observations can be made:

- The power consumption is unaffected by the usage of the color or mono image sensor.
- The power consumption is affected by different power management solutions optimized for different types of batteries:
 - ◆ SECO-RSL10-CAM-GEVB – Utilizes FAN49100 Buck-Boost Regulator for use with rechargeable 3.7 V LiPo battery.
 - ◆ SECO-RSL10-CAM-COLOR-GEVK – Utilizes NCP1421 Boost Converter for use with non-rechargeable 3.0 V CR3677X Lithium battery.

Additional Information

- [RSL10 Smart Shot Color Camera User Manual](#)
- [RSL10 Smart Shot Mono Camera User Manual](#)
- [RSL10 Smart Shot Software Package V2.1.0](#)

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