Using the RUTDevKit Rev2 for Ultra-Low Power Applications

Gintaras Drukteinis,
RUTRONIK Electronics Worldwide, Kaunas, Lithuania

***Abstract* — the ultra-low-power microcontrollers have a combination of technologies that enables the devices to have less current leakage and power consumption. A rich variety of Ultra-Low Power MCUs exists to meet today's demand for low power applications. There is a trade-off between performance and energy consumption therefore MCU must be wisely chosen in the early stage of the development. The newest STMicroelectronics STM32L5 family member is used in Rutronik's RUTDevKit development platform. The possibilities to exploit the Ultra-Low Power feature of STM32L5 in RUTDevKit is described in this application note.**

Index Terms* — *Microcontroller (MCU), Printed Circuit Board (PCB), Switching Mode Power Supply (SMPS), Low-dropout Regulator (LDO), Real-Time Clock (RTC).

I. Introduction

The RUTDevKit Rev2 has STM32L562ZET6Q Rev B MCU and quite a few deeply embedded peripherals. To prevent current leakage, some of the peripherals that are not in use will be needed to disconnect from the power source. The CR1220 coin battery holder is intended to be a power source for low power applications in RUTDevKit (Fig. 3).

II. Current Measurement

Since RUTDevKit does not have the embedded current and power measurement monitor the custom device must be used for this purpose. For most basic needs any microammeter-millimeter can be used but for the advanced current and power measurements, the STM32 Power shield is recommended. It comes with the free PC software tool STM32CubeMonPwr.

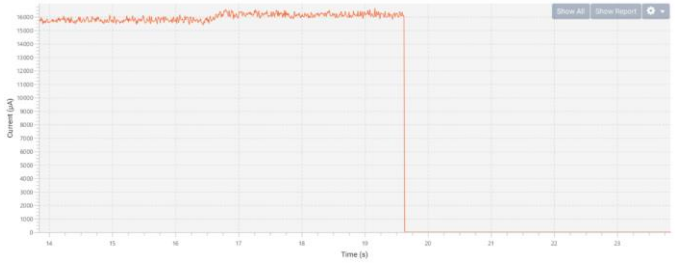

Fig. 1 Current Monitoring in Active State – ≈16000 µA.

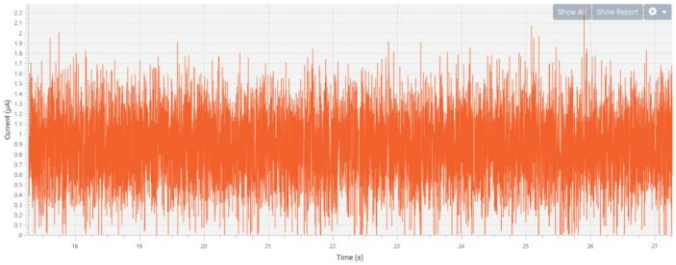

Fig. 2 Current Monitoring in Shut Down State. Average Consumption ≈900nA.

Fig. 3 RUTDevKit connected with energy meter residing in STM32L562E-DK

III. Hardware Configuration

Before the RUTDevKit is used for development or testing the low power application the onboard hardware has to be taken into consideration.

Leakage Sources	Current	Solder Bridge
TVS D10	≈30 µA	
CAN FD	≈300 µA	SB4
RS485	≈1.7 mA	SB6
PSRAM	≈150 µA	SB24, RESET
µSD Card	≈30 µA	SB2

Fig. 4 Hardware Configuration for Ultra-Low Power use.

All unnecessary hardware can be disconnected from the power source using solder bridges marked as "SBxx" on the PCB. The external OSPI PSRAM must have a RESET signal trace cut as well as it is shown. The sharp thin steel cutter and a magnifying glass are strongly advised to use for solder bridges and traces cutting.

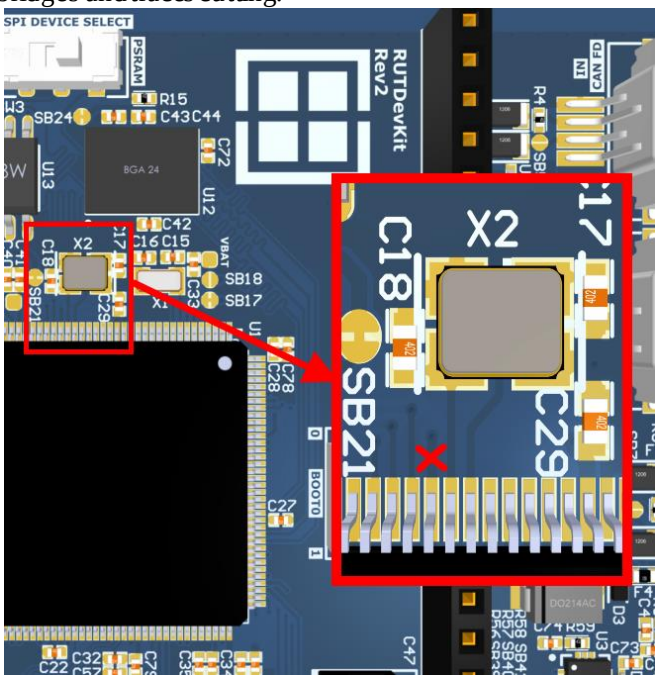

Fig. 5 External PSRAM RESET Trace Cut Location.

IV. The STM32L5 Rev B Limitations

All the Rev2 RUTDevKits come with STM32L562ZET6Q Rev B MCUs. Rev B is declared to have issues with the SMPS circuit's stability. SMPS is needed to achieve the highest power saving results at runtime since it is more efficient than integrated LDO. If the MCU is in shut-down mode, the SMPS is powered off and not used.

V. Firmware Example

The lowest power consumption of the MCU is achieved when MCU is in shut down power-saving mode. All other power-saving modes: SLEEP, STOP0, STOP1, STOP2 will consume more power. The firmware example was written to check whole the board's power consumption while MCU is in a shut-down state. RTC Timer is used to wake up the system from shut-down mode therefore the user might do the measurements of both active and shut down state continuously.

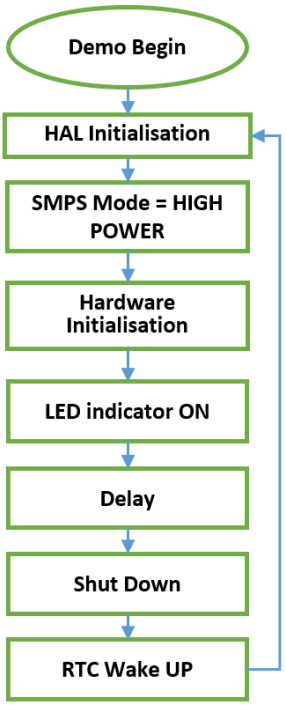

Fig. 6 Demo Firmware Algorithm.

VI. Summary

Disconnecting all possible peripherals in the RUTDevKit the overall current consumption was reduced down to 900nA in SHUTDOWN mode with RTC active. Despite the errata sheet declaring SMPS instability, this fault was unnoticed under the stable room environment conditions during the tests.

References

[1] "STM32L552xx/562xx device errata" Errata sheet ES0448, by STMicroelectronics (April 2020).
[2] "Software tool for power and ultra-low-power measurements" Data brief DB3355, by STMicroelectronics (September 2019).
[3] "RUTDevKit User Manual" user manual, by Rutronik. (May 2020). Available: www.rutronik.com

Contact:
Gintaras Drukteinis
Technical Support Engineer
RUTRONIK Elektronische Bauelemente GmbH
Jonavos g. 30
44262 Kaunas
Lithuania
gdr@rutronik.com
www.rutronik.com