TLE9893_2QKW62S_NVM_PROG_UDATA

About this document

Scope and purpose

The aim of this guide is to present the scope, the implementation, the algorithm and a demonstration of the **TLE9893_2QKW62D_NVM_PROG_UDATA** example code for the TLE989x Infineon Embedded Power ICs based on Arm® Cortex® M3. This example code can be found in the Keil µVision Pack Installer.

The full functionalities and characteristics of the embedded power devices are described in the datasheets and user's manual. Please refer to these documents for more detailed information. Furthermore, a low level (line-by-line) description of the code is not the aim of this document, although occasionally some code blocks might be reported if necessary to the comprehension.

Note: *The following information is given as a hint for the implementation of the system only and shall not be regarded as a description or warranty of a certain functionality, condition or quality of the referred devices or presented software example.*

Intended audience

Design engineers, system engineers, embedded power designers

Table of contents

1 Introduction

In the TLE9893_2QKW62S_NVM_PROG_UDATA example, data are programmed into the UDATA (user data) area of the FLASH0 bank of the device.

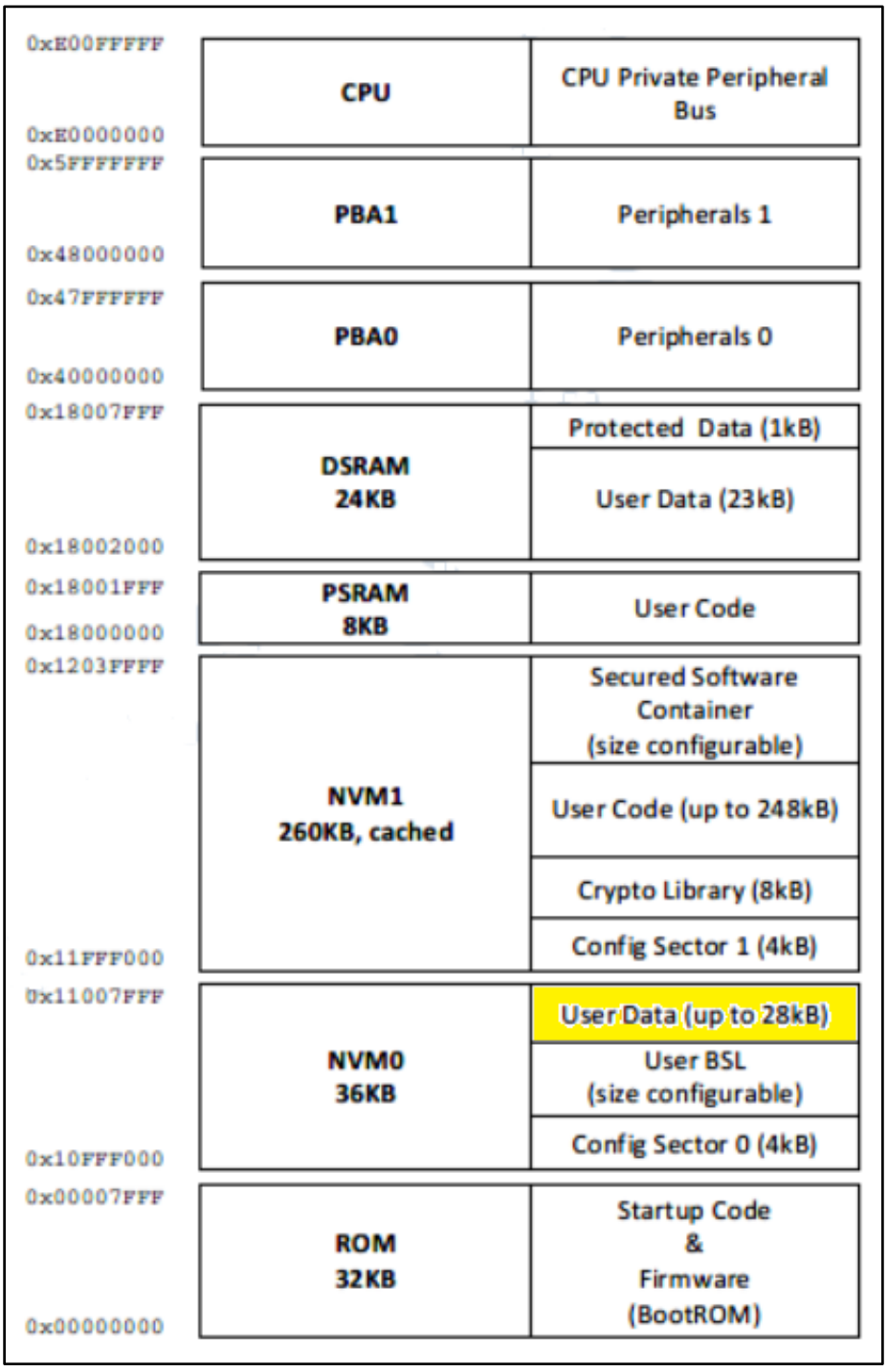

Figure 1 Memory Modules Overview

The success or fail of the write operation is indicated by LEDs via the GPIOs:

- A rising edge on P1.2 indicates that there is no user memory available on the device.
- A rising edge on P0.1 indicates that the data were successfully written into the user data area of the FLASH0 bank.
- A rising edge on P1.0 occurs if any error happened during the write operation.

In Figure 2, a successful writing operation is shown capturing the GPIO P0.1 (yellow) signal and the GPIO P1.0 (blue) signal.

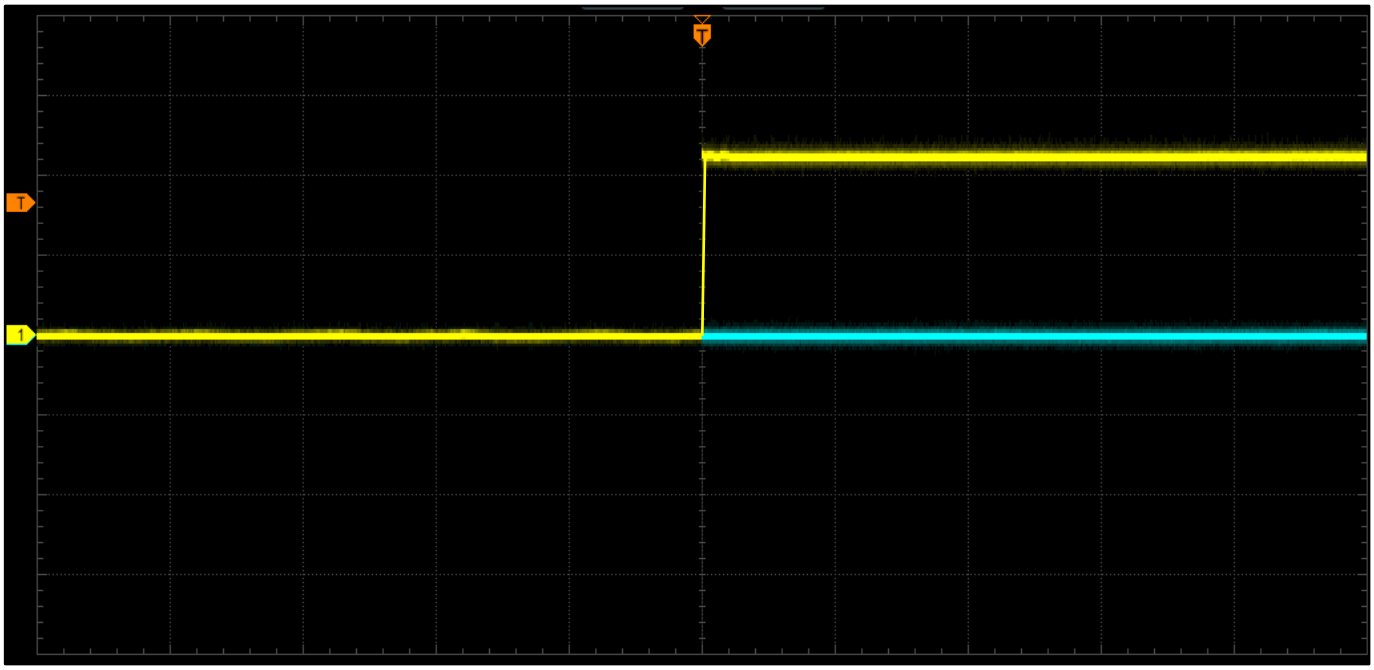

Figure 2 Capture of GPIO P0.1 (yellow) signal and GPIO P1.0 (blue) signal

The written data are then read and a checksum calculation is done over them:

- A rising edge on the GPIO P0.2 occurs if the calculation is validated correctly.
- A rising edge on the GPIO P1.1 is set in case of an error in reading or validating the data.

2 Hardware

This chapter shows how to run the TLE9893_2QKW62S_NVM_PROG_UDATA example with the TLE988X/TLE989X evaluation board. For this the project must be opened and compiled.

Figure 3 shows the TLE988X/TLE989X evaluation board. The application code must be loaded via a debugger (e.g. ULINK or J-Link) to the board. The board must be powered with 12V (red and black banana connectors).

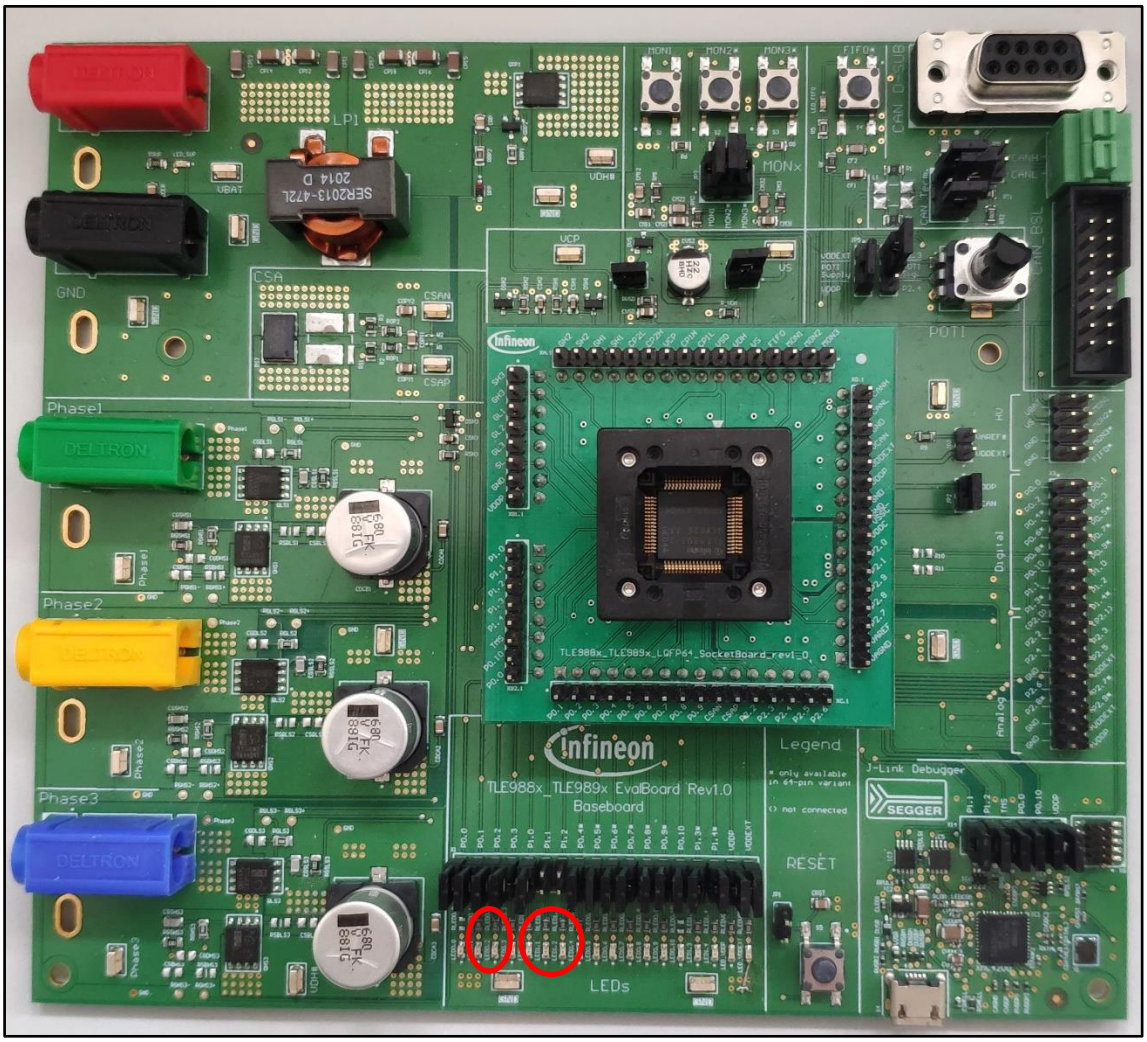

Figure 3 TLE988X/TLE989X evaluation board

3 Implementation

This chapter shows the process to follow to get a working TLE9893_2QKW62_NVM_PROG_UDATA example.

3.1 Get the example via the Pack Installer for Keil

Open the Pack Installer within the Keil IDE. See Figure 4 below.

Choose the appropriate device (here TLE9893_2QKW62S) on the left-hand side. On the right-hand side, select the tab Examples, where you can access the TLE9893_2QKW62S_NVM_PROG_UDATA example.

Clicking on “Copy” will copy the example on your computer and open it.

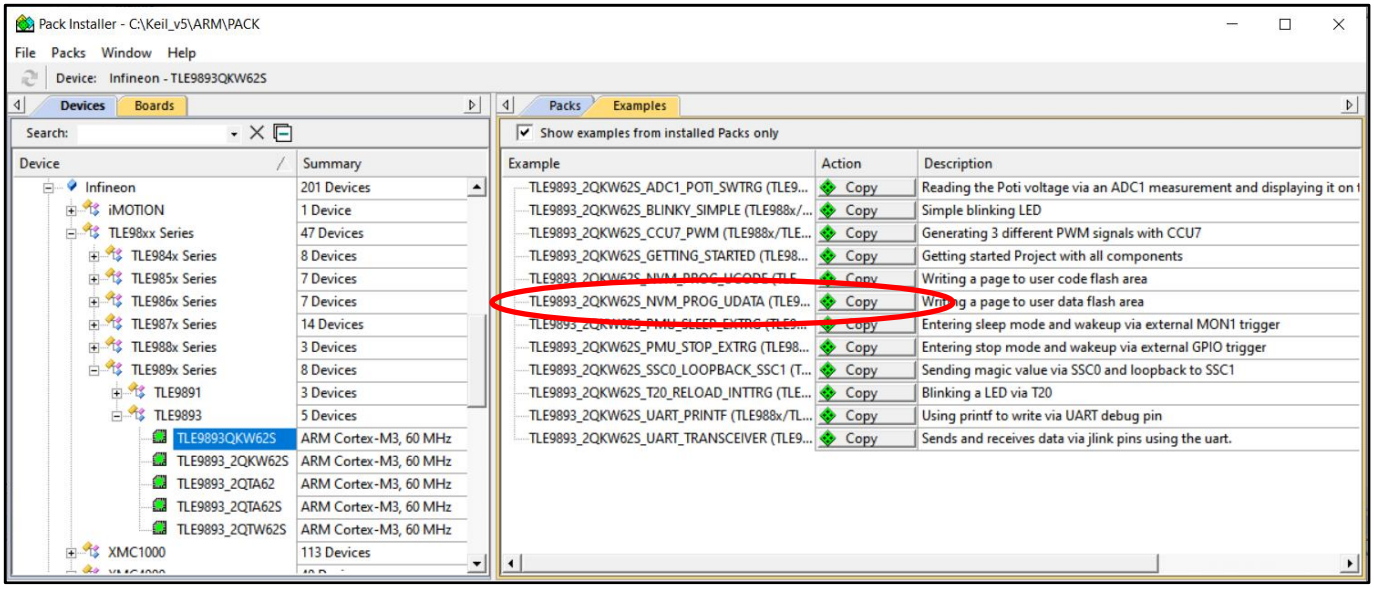

Figure 4 Keil Pack Installer

3.2 Configuration

In order to see the configured pins, start the tool Config Wizard. It is available within the Keil IDE through a shortcut in the Tools menu.

The Config Wizard opens and shows an overall status of the current pin configuration. In the example configuration, all the GPIOs P0.1, P0.2, P1.0, P1.1 and P1.2 are used as outputs.

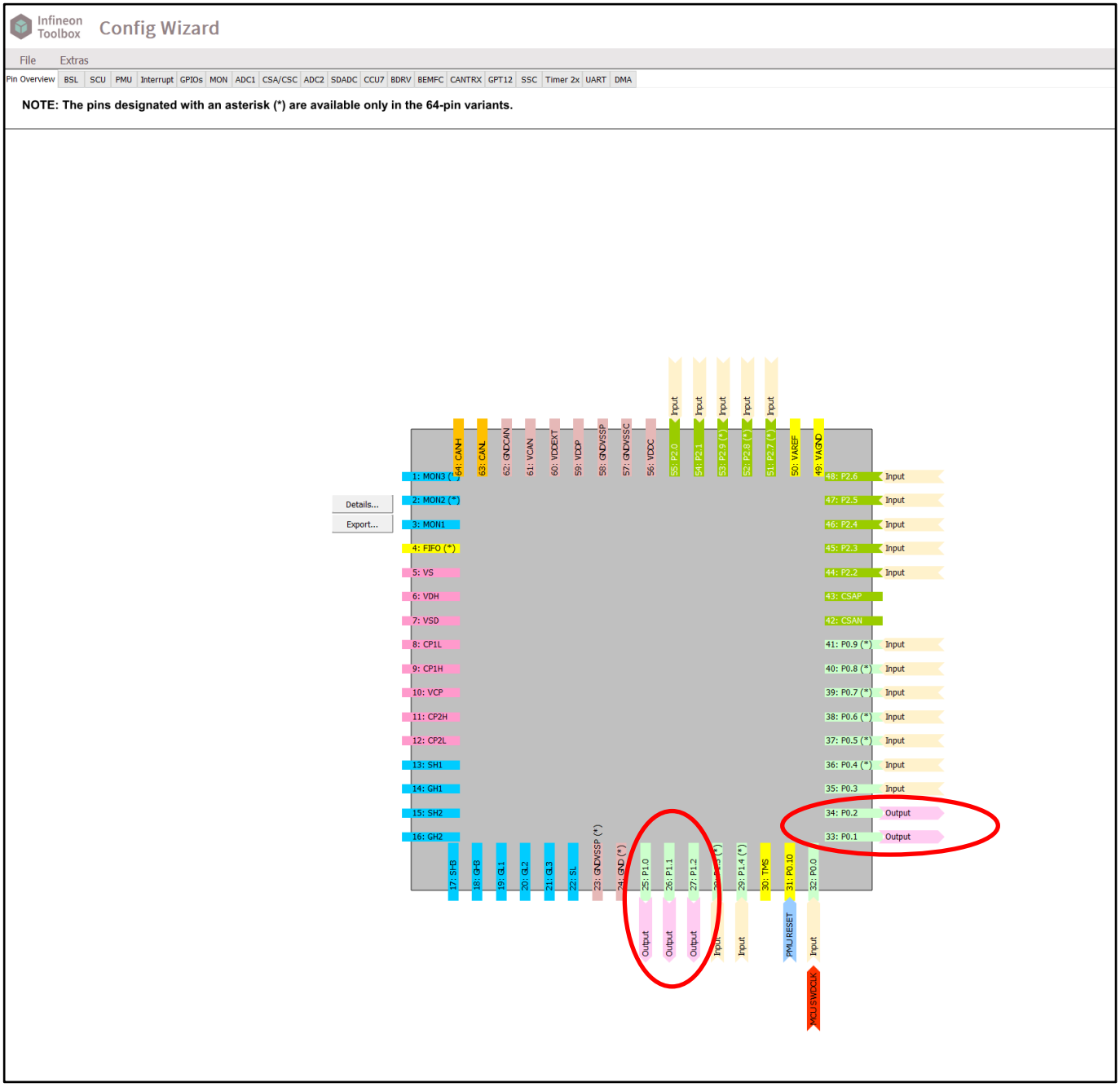

Figure 5 Config Wizard pin overview

Finally, save your configuration to take these changes into account (File -> Save).

3.3 Sample code

Figure 6 shows the application code of the TLE9893_2QKW62S_NVM_PROG_UDATA example.

In a first step an initial checksum over the data is calculated (see line 111-115).

Next the availability of user data memory is checked (line 118). In case there is no user data memory available, the GPIO P1.2 is switched to high.

The data are written to the NVM in line 130 with the API method `user_nvm_page_write(UC_FLASH0_UDATA_START, &s_pageSource)`. If the write operation is successful, the GPIO P0.1 is switched to high (line 139). Otherwise if any problems occur during the page programming, the GPIO P1.0 is set to high (line 144).

Before the endless loop, the data from the first page are read and verified. The read pointer is set to the beginning of the first page in the user data area (line 148). Then all the data from the page are read and a checksum is calculated (line 151-155). This checksum and the initial calculated checksum are compared. If the two checksums match, the GPIO P0.2 is switched to high (line 160). In case the checksums are not identical, the GPIO P1.1 is switched to high (line 165).

```
110   /* Calculate a simple xor checksum for the data quote */
111   u8_xorChecksum = 0;
112   for (u32_idx = 0; u32_idx < UC_FLASH_PAGE_SIZE; u32_idx++)
113   {
114     u8_xorChecksum ^= u8p_dataQuote[u32_idx];
115   }
116
117   /* Check if the user data are available for programming the quote */
118   if (UC_FLASH0_UDATA_SIZE == 0)
119   {
120     /* Indicate no available user data by LED P1.2 */
121     GPIO_setP12State(GPIO_STATE_HIGH);
122   }
123   else
124   {
125     /* suspend and remember all enabled interrupts */
126     (void)CMSIS_Irq_Dis();
127     /* Open SOW */
128     PMU_serviceFailSafeWatchdogSOW();
129     /* Write to the first page into the user data area of FLASH0 */
130     s32_returnValue = user_nvm_page_write(UC_FLASH0_UDATA_START, &s_pageSource);
131     /* Close SOW by regular WDT trigger */
132     PMU_serviceFailSafeWatchdog();
133     /* reenable suspended interrupts */
134     CMSIS_Irq_En();
135
136     if (s32_returnValue == ERR_LOG_SUCCESS)
137     {
138       /* Indicate a successful page write by LED P0.1 */
139       GPIO_setP01State(GPIO_STATE_HIGH);
140     }
141     else
142     {
143       /* Indicate a page write error by LED P1.0 */
144       GPIO_setP10State(GPIO_STATE_HIGH);
145     }
146
147     /* Set read pointer to first page of the user data area */
148     u8p_userData = (uint8 *) UC_FLASH0_UDATA_START;
149
150     /* Calculate a simple xor checksum for the data quote */
151     u8_verifyChecksum = 0;
152     for (u32_idx = 0; u32_idx < UC_FLASH_PAGE_SIZE; u32_idx++)
153     {
154       u8_verifyChecksum ^= u8p_userData[u32_idx];
155     }
156
157     if (u8_verifyChecksum == u8_xorChecksum)
158     {
159       /* Indicate a successful checksum verification by LED P0.2 */
160       GPIO_setP02State(GPIO_STATE_HIGH);
161     }
162     else
163     {
164       /* Indicate a wrong checksum verification by LED P1.1 */
165       GPIO_setP11State(GPIO_STATE_HIGH);
166     }
167   }
168
169   for (;;)
170   {
171     /* Main watchdog service */
172     (void) PMU_serviceFailSafeWatchdog();
173   }
174 }
```

Figure 6 TLE9893_2QKW62S_NVM_PROG_UDATA application code

References

See the code examples at **www.infineon.com**

Revision history

Document version	Date of release	Description of changes
1.0	2021-10-22	Initial version
1.1	2022-10-13	Editorial changes

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