

# UM11873

## PCF85053ATK-ARD evaluation board

Rev. 1.0 — 17 March 2023

User manual

### Document information

Information	Content
Keywords	PCF85053ATK, I <sup>2</sup> C-bus, RTC, CPU, SRAM, Arduino header, EVK
Abstract	The PCF85053ATK-ARD evaluation board is an expansion board equipped with Arduino headers, designated for easy test and design of PCF85053ATK IC, real-time clock/calendar with alarm function, battery switchover and timestamp functionality, controlled through two Fast-mode I <sup>2</sup> C-buses. The board is fully compatible with MIMXRT1050-EVKB, LPCXpresso55S69 and MIMXRT685-EVK, including GUI software control. The board can be attached to any device equipped with Arduino headers.



Revision history

Rev	Date	Description
v.1.0	20230317	Initial version

**IMPORTANT NOTICE****For engineering development or evaluation purposes only**

NXP provides the product under the following conditions:

This evaluation kit is for use of **ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY**.

It is provided as a sample IC pre-soldered to a printed-circuit board to make it easier to access inputs, outputs and supply terminals. This evaluation board may be used with any development system or other source of I/O signals by connecting it to the host MCU computer board via off-the-shelf cables. This evaluation board is not a Reference Design and is not intended to represent a final design recommendation for any particular application. Final device in an application heavily depends on proper printed-circuit board layout and heat sinking design as well as attention to supply filtering, transient suppression, and I/O signal quality.

The product provided may not be complete in terms of required design, marketing, and or manufacturing related protective considerations, including product safety measures typically found in the end device incorporating the product. Due to the open construction of the product, it is the responsibility of the user to take all appropriate precautions for electric discharge. In order to minimize risks associated with the customers' applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards. For any safety concerns, contact NXP sales and technical support services.

## 1 Introduction

---

This document describes the PCF85053ATK-ARD demo board. The evaluation board is built around the PCF85053ATK IC and works as an expansion board which can be connected through an Arduino header to various Arduino compatible (including original Arduino Uno R3) boards. The board is intended to test and measure the characteristics of the PCF85053ATK bootable CPU RTC with two I<sup>2</sup>C-buses, 128 byte SRAM, and alarm function, produced by NXP Semiconductors.

The RTC communicates with the controller / microprocessor through two independent Fm (400 kHz) I<sup>2</sup>C-buses. Among the device under test (DUT) IC, the board is equipped with an Arduino header and the necessary components for easy testing, shortening the time to make measurements and check operation of the PCF85053ATK IC.

Additionally, the expansion board has software support and a graphical user interface (Windows platform) for the following NXP evaluation boards: MIMXRT1050-EVK Board, LPCXpresso55S69 Development Board and MIMXRT685-EVK Board.

## 2 Finding kit resources and information on the NXP web site

---

NXP Semiconductors provides online resources for evaluation board and its supported device(s) on <http://www.nxp.com>.

The information page for PCF85053ATK-ARD evaluation board is at <http://http://www.nxp.com/PCF85053ATK-ARD>. The information page provides overview information, documentation, software and tools, parametrics, ordering information and a **Getting Started** tab. The Getting Started tab provides quick-reference information applicable to using the PCF85053ATK-ARD evaluation board, including the downloadable assets referenced in this document.

### 2.1 Collaborate in the NXP community

The NXP community is for sharing ideas and tips, ask and answer technical questions, and receive input on just about any embedded design topic.

The NXP community is at <http://community.nxp.com>.

## 3 Getting ready

---

Working with the PCF85053ATK-ARD requires the kit contents, additional hardware, and a Windows PC workstation with installed software.

### 3.1 Kit contents

- Assembled and tested evaluation board in an antistatic bag
- Quick Start Guide

### 3.2 Assumptions

Familiarity with the I<sup>2</sup>C bus is helpful but not required.

### 3.3 Static handling requirements

**CAUTION**

This device is sensitive to ElectroStatic Discharge (ESD). Therefore care should be taken during transport and handling. You must use a ground strap or touch the PC case or other grounded source before unpacking or handling the hardware.

### 3.4 Minimum system requirements

This evaluation board requires a Windows PC workstation. Meeting below minimum specifications should produce great results when working with this evaluation board.

- Computer with Windows 10
- One USB port (either 3.0 or 2.0 or 1.1 compatible)
- One of three EVK boards (MIMXRT1050-EVK, LPC55S69-EVK, MIMXRT685-EVK) along with the associated firmware / GUI software
- USB cable for power and data connection between PC and EVK board (if not included in the EVK package)

## 4 Getting to know the hardware

### 4.1 PCF85053ATK-ARD features

- Equipped with Arduino Uno R3 compatible headers for direct connection to Arduino compatible MCU EVKs
- On-board connector for external access and monitoring for I<sup>2</sup>C-bus / Alert / CLKOUT
- 1.8 V / 3.3 V selectable power supply
- On-board backup battery cell
- Fully with MIMXRT1050-EVK board, including GUI (Windows 10)
- Fully compatible with LPCXpresso55S69 dev. board, including GUI (Windows 10)
- Fully compatible with MIMXRT685-EVK board, including GUI (Windows 10)

### 4.2 Kit featured components

[Figure 1](#) identifies the main components on the board. The main elements are called out in the picture. The Arduino headers (J1, J2, J3, J4) are accessible from both sides. On the top side there are pin receptacles, while on the bottom side are pin headers on the bottom side of the board.

The board was developed around the DUT IC, PCF85053ATK (U3, see [Figure 1](#)). Using the Arduino interface, the board can be attached to any board equipped with Arduino header. The PCF85053ATK-ARD expansion board communicates with the host device or EVK, through two I<sup>2</sup>C-buses, with a maximum speed of 400 kHz. For more details, see [Section 4.5](#).

Alongside the two I<sup>2</sup>C-buses, PCF85053A RTC has some additional pins with various functions. The pin ALRT# is an open-drain active-low interrupt output, therefore the ALRT# output has a 10 kΩ pull-up resistor (R8). The pin CLKOUT is also an output, at this pin the clock signal can be monitored. The pin RTC\_CLR# is an input pin which clears the internal SRAM of the RTC and resets certain registers. The reset can be initiated locally (J9), or remote through the signal switch U4 and the Arduino header. The oscillator Y1 is connected to pins OSCI and OSCO pins.

The power supply voltage of PCF85053A can be either 1.8 V or 3.3 V, using the jumper selector J5. The 3.3V voltage rail is supplied from the EVK (the motherboard) through the Arduino header, and 1.8 V is generated by the LDO voltage regulator U1. D1 is the power indicator. The PCF85053ATK-ARD board contains the backup battery (BT1), connected to VBAT power pin of the DUT through J6, which allows to supply the VBAT

pin from the backup battery or from VCC. J7 and J8 allows for VBAT and VCC line interruption and current measurements.

The level shifter U2 assures the voltage translation of the I<sup>2</sup>C-buses, ALRT, and CLKOUT signals. For more details see, the schematic diagram of PCF85053ATK-ARD board (SPF-53085\_B1.pdf).

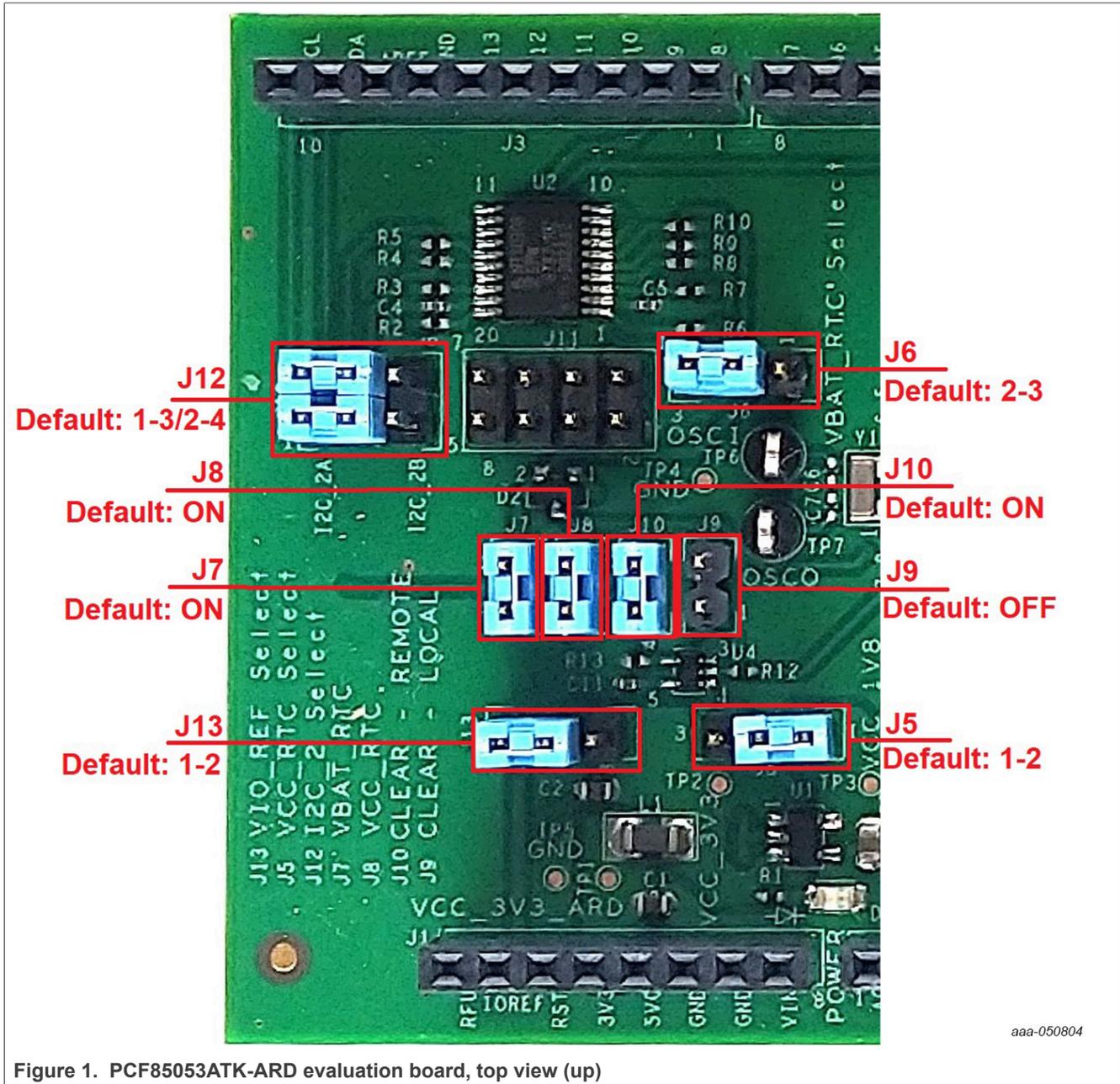
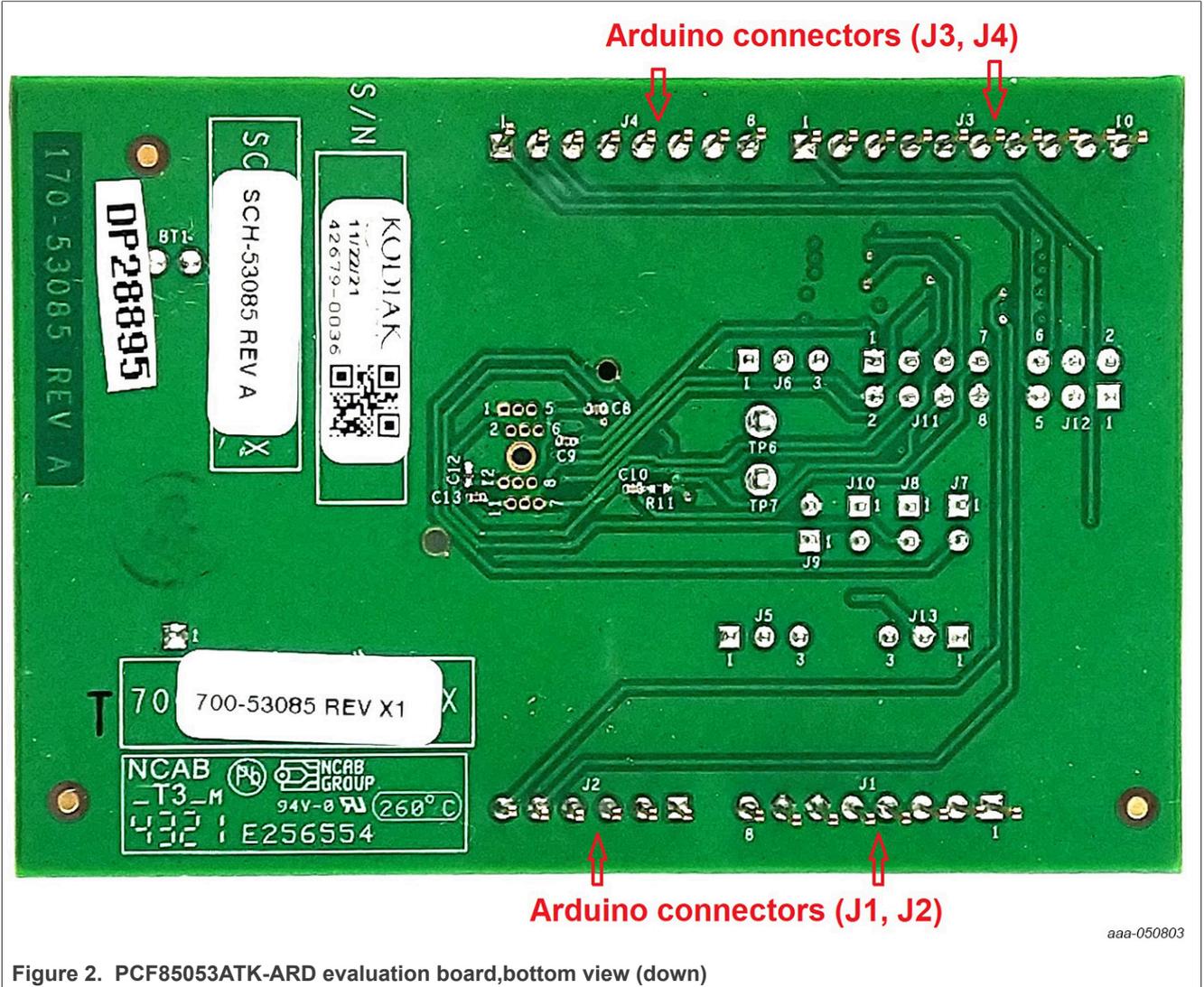


Figure 1. PCF85053ATK-ARD evaluation board, top view (up)



aaa-050803

Figure 2. PCF85053ATK-ARD evaluation board, bottom view (down)

### 4.3 Schematic diagram

The schematic diagram of PCF85053ATK-ARD is available at URL: <http://www.nxp.com/PCF85053ATK-ARD>.

### 4.4 Arduino headers

J1, J2, J3, and J4 are the mated pin headers of Arduino Uno R3 connectors, having the same electrical function and placed on the board, so that the expansion board can be directly inserted into the Arduino headers. The expansion board uses eight signal lines. See [Table 1](#) for the pin chart of connectors, and the lines used in the circuit (refer to SPF-53085\_B1.pdf schematic file).

Table 1. The pin chart of Arduino connectors and their usage

Ref Des	#	Arduino label	PCF85053ATK-ARD function
J1 (Power)	1	NC	Not used
	2	IOREF	VIO_REF_ARD
	3	RESET	Not used

Table 1. The pin chart of Arduino connectors and their usage...continued

Ref Des	#	Arduino label	PCF85053ATK-ARD function
	4	3.3V	Power supply
	5	5V	Not used
	6	GND	Power supply return
	7	GND	Power supply return
	8	Vin	Not used
<b>J2 (analog, digital, I<sup>2</sup>C)</b>	1	A0	Not used
	2	A1	Not used
	3	A2	Not used
	4	A3	Not used
	5	A4 / SDA	ARD_SDA_1
	6	A5 / SCL	ARD_SCL_1
<b>J4 (digital, UART, PWM)</b>	1	D0 / RX	ARD_SCL_2B
	2	D1 / TX	ARD_SDA_2B
	3	D2	ARD_ALRT
	4	D3 / PWM	Not used
	5	D4	Not used
	6	D5 / PWM	Not used
	7	D6 / PWM	Not used
	8	D7	Not used
<b>J3 (mixed)</b>	1	D8	ARD_CLR
	2	D9 / PWM	ARD_CLKOUT
	3	D10 / SS / PWM	Not used
	4	D11 / MOSI / PWM	Not used
	5	D12 / MISO	Not used
	6	D13 / SCK	Not used
	7	GND	Power supply return
	8	AREF	Not used
	9	A4 / SDA	ARD_SDA_2A
	10	A5 / SCL	ARD_SCL_2A

The circuit is supplied with 3.3 V from Arduino headers J1 and J3. Pin no. 4 of J1 is 3.3 V power supply, while pin no. 6, 7 of J1, and pin no. 7 of J3 represents the power supply return (ground).

### 4.5 I<sup>2</sup>C-buses

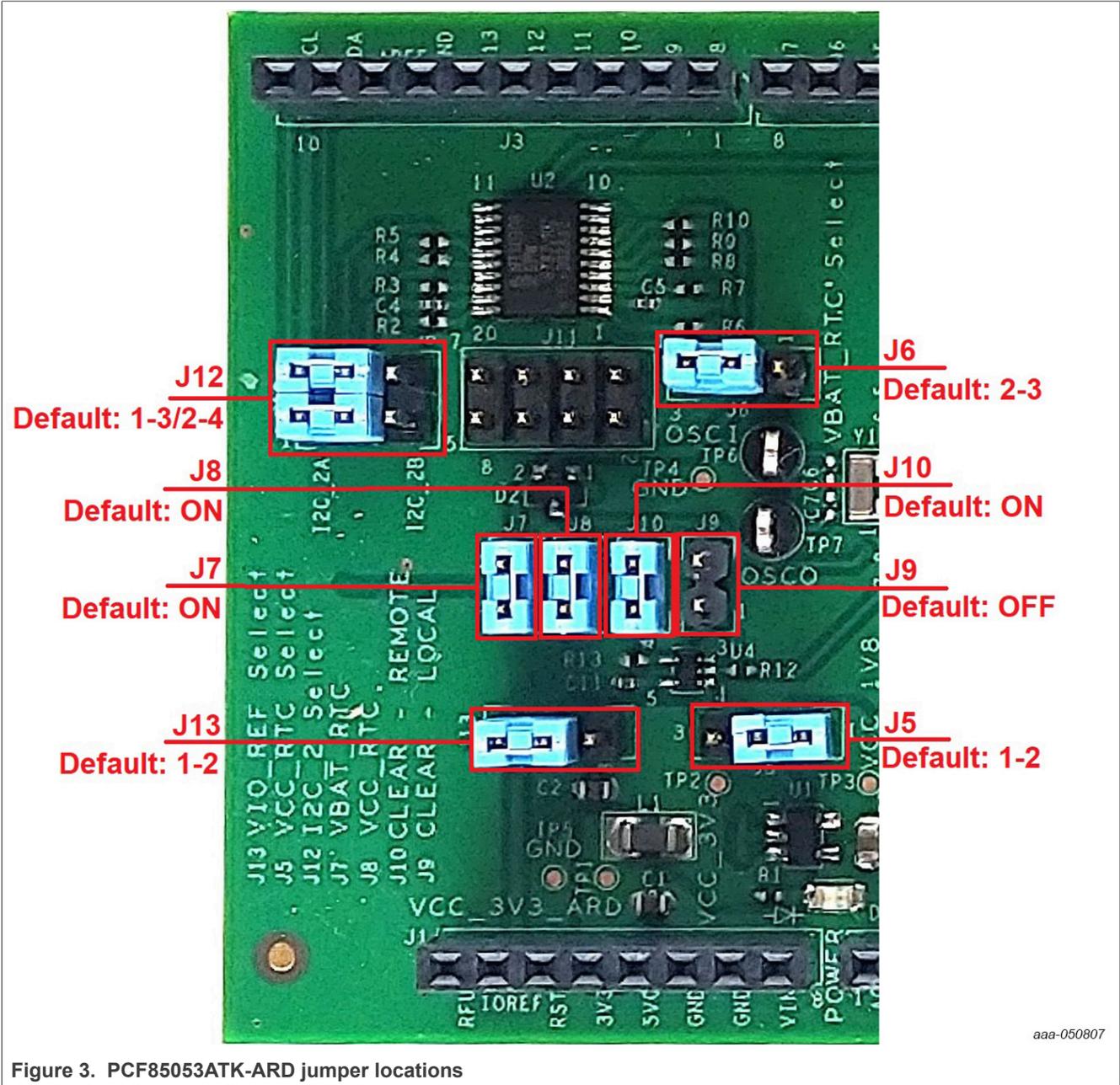
The PCF85053A includes two I<sup>2</sup>C-bus interfaces. The first I<sup>2</sup>C-bus (SDA1, SCL1) is linked to Arduino connector J2, pin 5 and pin 6. The second I<sup>2</sup>C-bus (SDA2, SCL2) can be connected either to J3 (pin 9, 10) or to J4 (pin 1, 2). J12 is the bus selector. See the SPF-53085\_B1.pdf schematic file.

### 4.6 Jumpers and test points

The board contains several jumpers and test points. [Table 2](#) and [Figure 3](#) details the jumper locations and their default configurations. [Table 3](#) describes the test points located on the PCF85053ATK-ARD board.

Table 2. PCF85053ATK-ARD jumpers

Ref Des	Label	Default	Description
J5	VCC_RTC Select	1-2	1-2: VCC_RTC from VCC_1V8
			2-3: VCC_RTC from VCC_3V3
J6	VBAT_RTC Select	1-2	1-2: VBAT_RTC from battery cell (BT1)
			2-3: VBAT_RTC from VCC_RTC
J7	VBAT_RTC	ON	ON: PCF85053ATK (U3) VBAT power-on
			OFF: PCF85053ATK (U3) VBAT power-off
J8	VCC_RTC	ON	ON: PCF85053ATK (U3) VDD power-on
			OFF: PCF85053ATK (U3) VDD power-off
J9	CLEAR - LOCAL	OFF	ON: Clear Local – on
			OFF: Clear Local – off
J10	CLEAR - REMOTE	ON	ON: Clear Remote – on
			OFF: Clear Remote – off
J12	I2C_2 Select	1-3	1-3/2-4: I <sup>2</sup> C from J3
		2-4	3-5/4-6: I <sup>2</sup> C from J4
J13	VIO_REF Select	1-2	1-2: VIO_REF from VIO_REF_ARD
			2-3: VIO_REF from VCC_3V3



aaa-050807

Table 3. PCF85053ATK-ARD test points

Ref Des	Test point / jumper label	Description
TP1	VCC_3V3_ARD	3.3 V power rail (Arduino connector)
TP2	VCC_3V3	3.3 V power rail
TP3	VCC_1V8	1.8 V power rail
TP4	GND	Ground
TP5	GND	Ground

Alongside the test points located on the board, the pin header J12 allows easy access to the signal / data lines of the PCF85053A RTC. [Table 4](#) depicts the pin chart of J12.

**Table 4. The J12 pin chart**

J12 pin no.	Function	Comment
1	RTC_SDA_1	Primary I <sup>2</sup> C interface
2	RTC_SCL_1	
3	RTC_SDA_2	Secondary I <sup>2</sup> C interface
4	RTC_SCL_2	
5	RTC_ALRT	RTC_ALRT# output
6	RTC_CLKOUT	RTC_CLKOUT output
7	RTC_CLR	RTC_CLR# input
8	GND	Ground

## 5 Installing and configuring software tools

PCF85053ATK-ARD evaluation board is designed and built as an expansion board able to work in conjunction with a motherboard equipped with an Arduino header. The board was built to be fully compatible with the following NXP Evaluation (EVK) boards:

- MIMXRT1050-EVK Board
- LPCXpresso55S69 Development Board
- i.MX 8M Mini LPDDR4 EVK Board

Each above mentioned evaluation / development board has firmware support which can be downloaded from NXP company site ([www.nxp.com/](http://www.nxp.com/)). Before starting, the EVK motherboard must be programmed with the corresponding firmware package. Additionally, a GUI application (Windows 10) is available for download from the NXP site, allowing rapid testing and operation of PCF85053ATK-ARD expansion board through the one of above mentioned EVK. The GUI application is common for all three EVKs. For details regarding installation of the EVK firmware and GUI host software on PC please download *UM11581 - Arduino Shields GUI and firmware installation* available at <https://www.nxp.com/docs/en/userguide/UM11581.pdf>.

Once the software is installed, the first step is to select the correct combination EVK – PCF85053ATK-ARD expansion board, and then the board can be controlled from the GUI interface. See [Section 6](#) and [Section 7](#) for more details regarding the operation of PCF85053ATK-ARD from GUI software.

## 6 Configuring the hardware

### 6.1 Using the PCF85053ATK-ARD with an MIMXRT1050-EVK board

[Figure 4](#) shows the required hardware for operation of the PCF85053ATK-ARD expansion board with MIMXRT1050-EVK. The following items are necessary:

- One MIMXRT1050-EVK board
- One PCF85053ATK-ARD expansion board
- One USB-A / USB Micro-B cable
- A PC with Windows 10 operating system

The MIMXRT1050-EVK motherboard can be powered by one of the three methods:

- Connecting an external 5VDC power supply to the barrel power connector (J2) on the board

- Connecting an USB cable from the PC to the Micro-B USB connector (J9) on the board
- Connecting an USB cable from the PC to the USB connector (J28) on the board.

When the PC is connected through the USB connectors J9 and J38, the EVK can be powered and at the same time linked to the PC for data exchange.

The older USB ports (from PC) are not able to deliver the necessary current (500mA), before establishing the communication, use an external power supply (connected to J2).

From J1 on the EVK board (see [Figure 4](#)) the user can select the power configuration for the motherboard. For further details, refer to the *MIMXRT1050 EVKB Board Hardware User's Guide* [\[2\]](#).

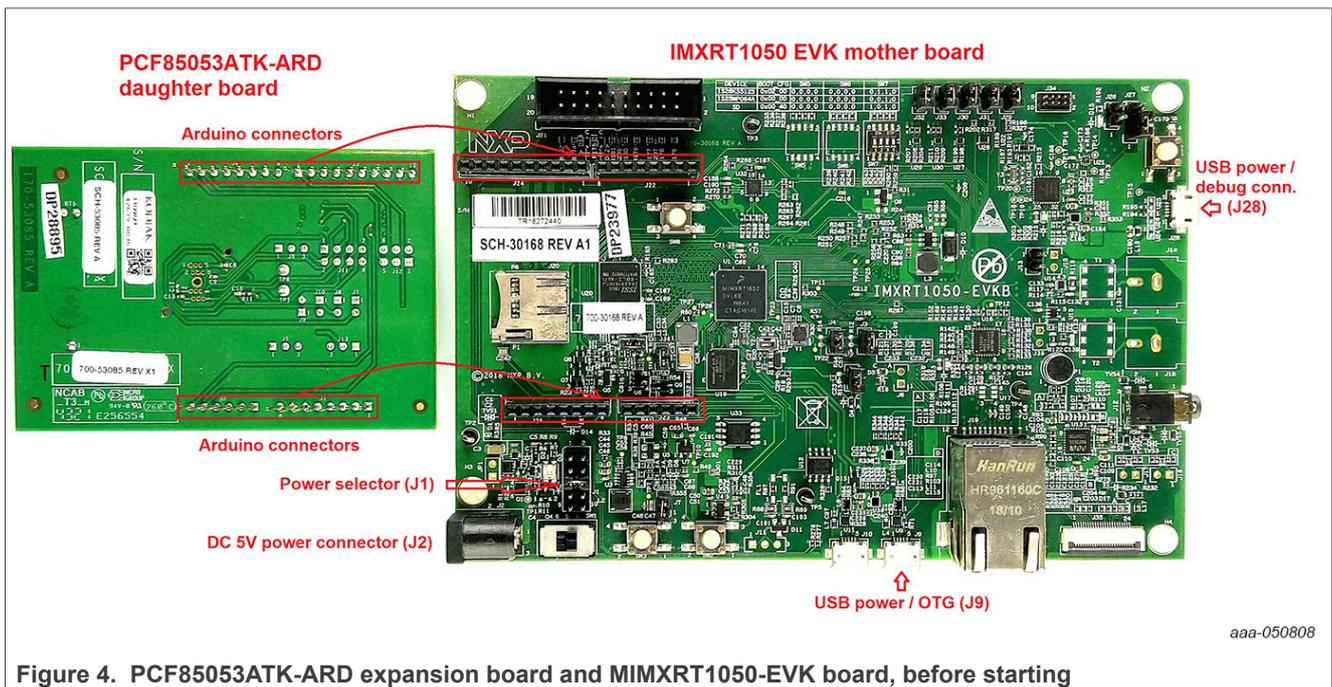
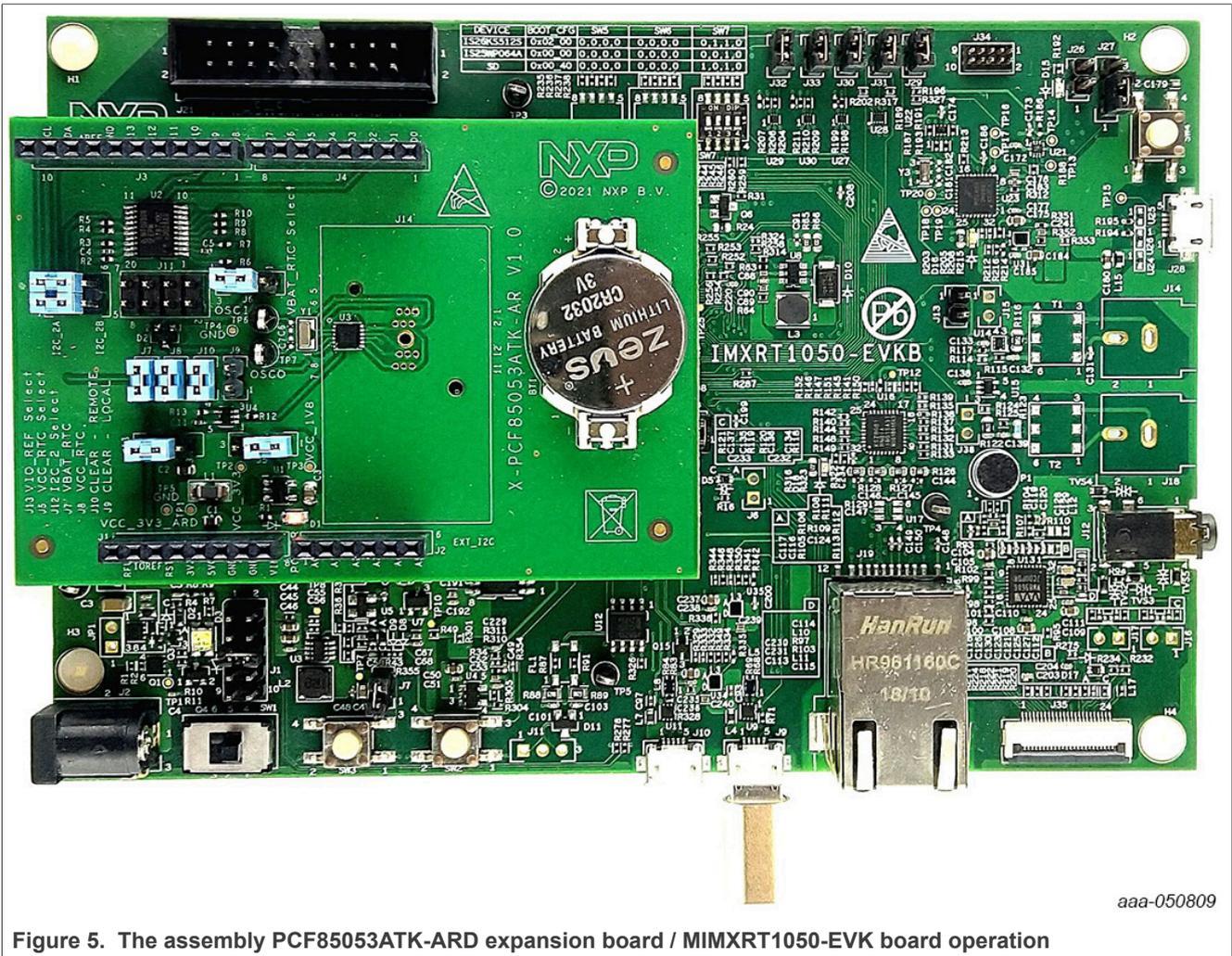


Figure 4. PCF85053ATK-ARD expansion board and MIMXRT1050-EVK board, before starting

To configure the hardware and workstation, complete the following procedure:

1. Configure the suitable power configuration of EVK (J1). If using J28 for power supply, the J1 jumper shall be placed in position 5-6. If using an external power supply (connected to J2), the jumper J1 will be placed in position 1-2.
2. Place jumpers on J12 in 1-2/3-4 position (default).
3. Insert the PCF85053ATK-ARD expansion board on the Arduino connector of the EVK (see [Figure 4](#) and [Figure 5](#)).
4. Using USB connector J9, connect the EVK board to an USB port of the computer.
5. Install the MIMXRT1050 target firmware (download from NXP site and see UM11581, Arduino [Arduino shields GUI and firmware installation manual](#) for step-by-step instructions).
6. Install GUI application (see [UM11581, Arduino shields GUI and firmware installation manual](#)).
7. Open the GUI application to operate the device from the PC. For details regarding GUI operation see [Section 7](#).

[Figure 5](#) shows the boards during the operation.



aaa-050809

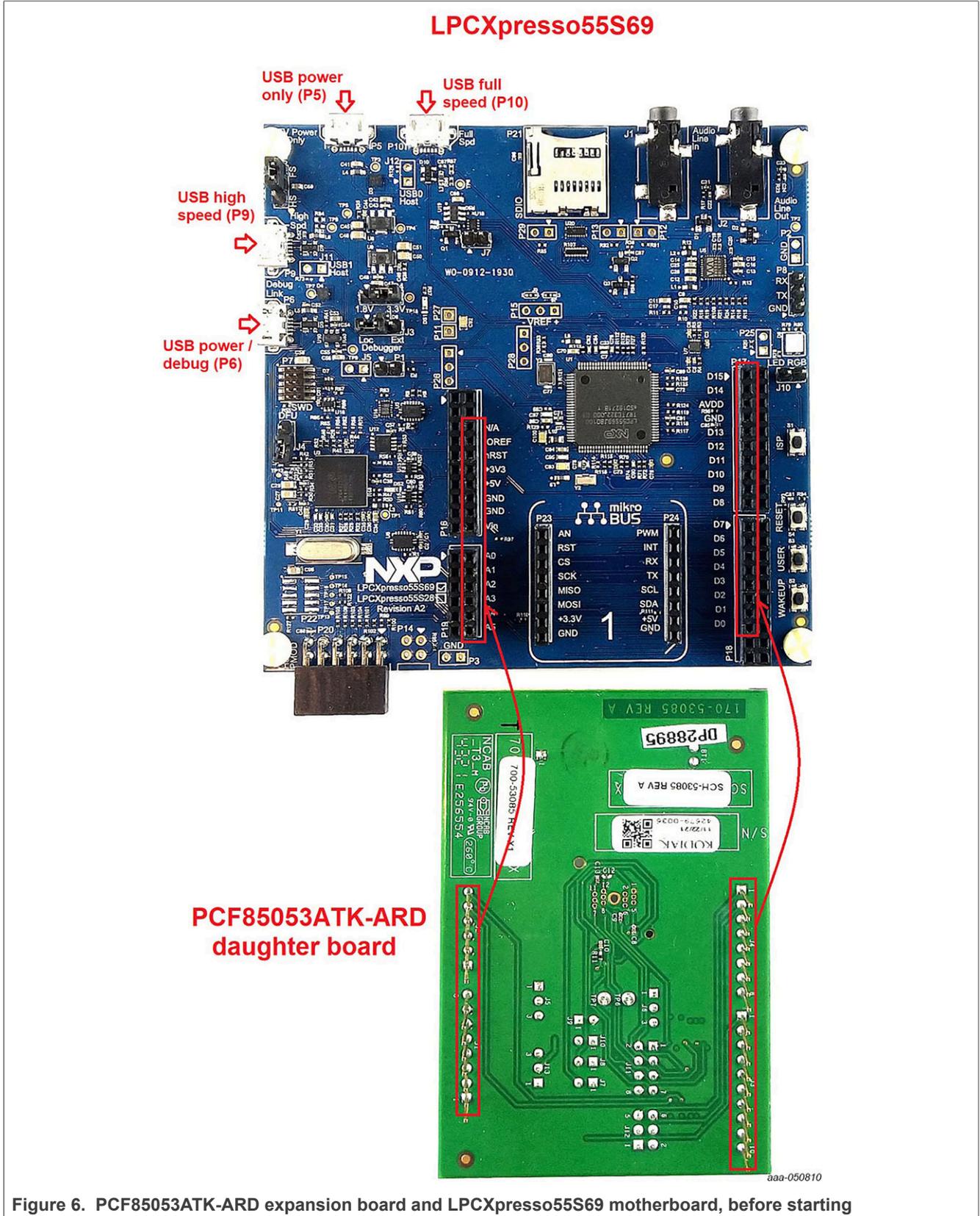
Figure 5. The assembly PCF85053ATK-ARD expansion board / MIMXRT1050-EVK board operation

### 6.2 Using the PCF85053ATK-ARD with an LPCXpresso55S69 development board

Figure 6 shows the required hardware for operation of the PCF85053ATK-ARD and LPCXpresso55S69 EVK board. This configuration consists of:

- One LPCXpresso55S69 EVK board
- One PCF85053ATK-ARD expansion board
- One USB-A / USB Micro-B cable
- A PC with Windows 10 operating system

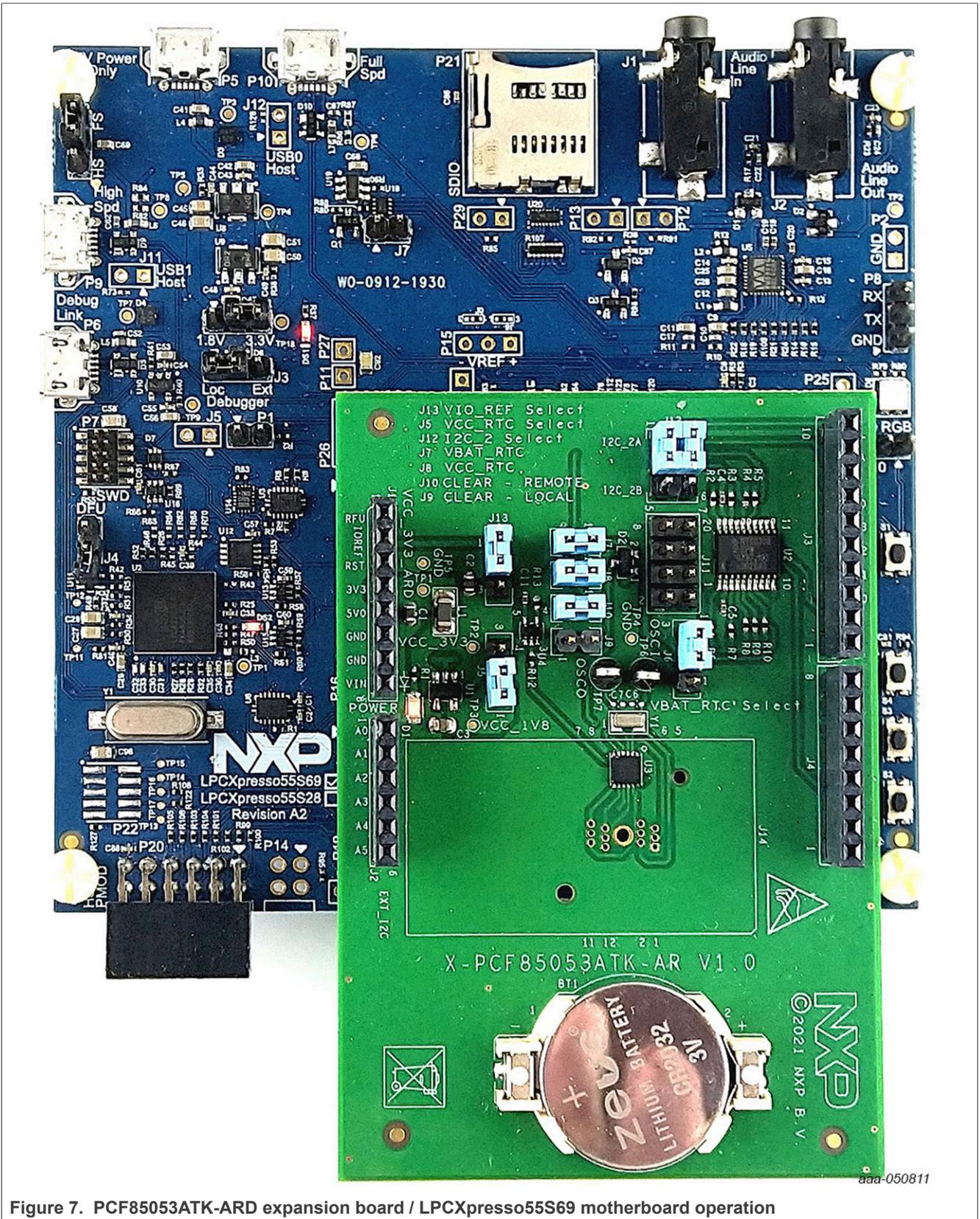
The LPCXpresso55S69 development board is equipped with four USB Micro-B connectors: P5, P6, P9 and P10. The board can be powered through any USB port. Using P6 USB connector to connect the board to the PC simplifies the start-up operation because P6 is designated for debugging and the USB cable thus accomplishes two tasks at the same time: powering the board, and serving as a data link between the EVK board and PC. For more details regarding power-up and operation of the LPCXpresso55S69 development board, see the [LPCXpresso55S69/LPCXpresso55S28 Development Board User Manual](#) [here](#).



The following steps describe how to assemble, program, and operate the configuration shown in [Figure 6](#).

1. Insert the PCF85053ATK-ARD expansion board to P16 – P19 connectors located on LPCXpresso55S69 development board (see the marked pins of P16 – P19, [Figure 6](#))
2. Place jumpers on J12 in 1-2/3-4 position (default)
3. Connect the development board using port P6 USB port of PC
4. Install the LPCXpresso55S69 target firmware (download from NXP site and read the *EVK\_Firmware\_And\_GUI\_Install\_Guide\_For\_Arduino\_Boards.pdf* instruction file)
5. Install GUI application on PC (see the instruction file called out in the previous step)
6. Open the GUI application to operate the device from the PC. For details regarding GUI operation see [Section 7](#)

[Figure 7](#) shows the two boards in operation.



aaa-050811

Figure 7. PCF85053ATK-ARD expansion board / LPCXpresso55S69 motherboard operation

### 6.3 Using the PCF85053ATK-ARD with an MIMXRT685-EVK board

The third EVK board which can be used with the PCF85053ATK-ARD board, is MIMXRT685-EVK. [Figure 8](#) shows the two boards, before assembly and operation. The following items are necessary to test and operate the board assembly:

- One MIMXRT685-EVK board
- One PCF85053ATK-ARD expansion board
- One USB-A / USB Micro-B cable
- Two jumper wires
- A PC with Windows 10 operating system

There are three ways to power-up the MIMXRT685-EVK board: through Link USB (J5), External Power USB (J6), and Target USB (J7). The Barrel connector J24 is designed to supply the digital amplifier section, therefore cannot be used to supply the MIMXRT685-EVK board. The datalink between the PC workstation and the EVK is realized through the Target USB (J7). Using the connector J7 and a USB-cable, the assembly MIMXRT685-EVK / PCF85053ATK-ARD can be simultaneously powered and connected to the PC, to be operated from the GUI application.

The user may find details regarding power-up and operation of the setup assembly in MIMXRT685-EVK UM 11159 user manual. The pdf file can be downloaded from [www.nxp.com/](http://www.nxp.com/).

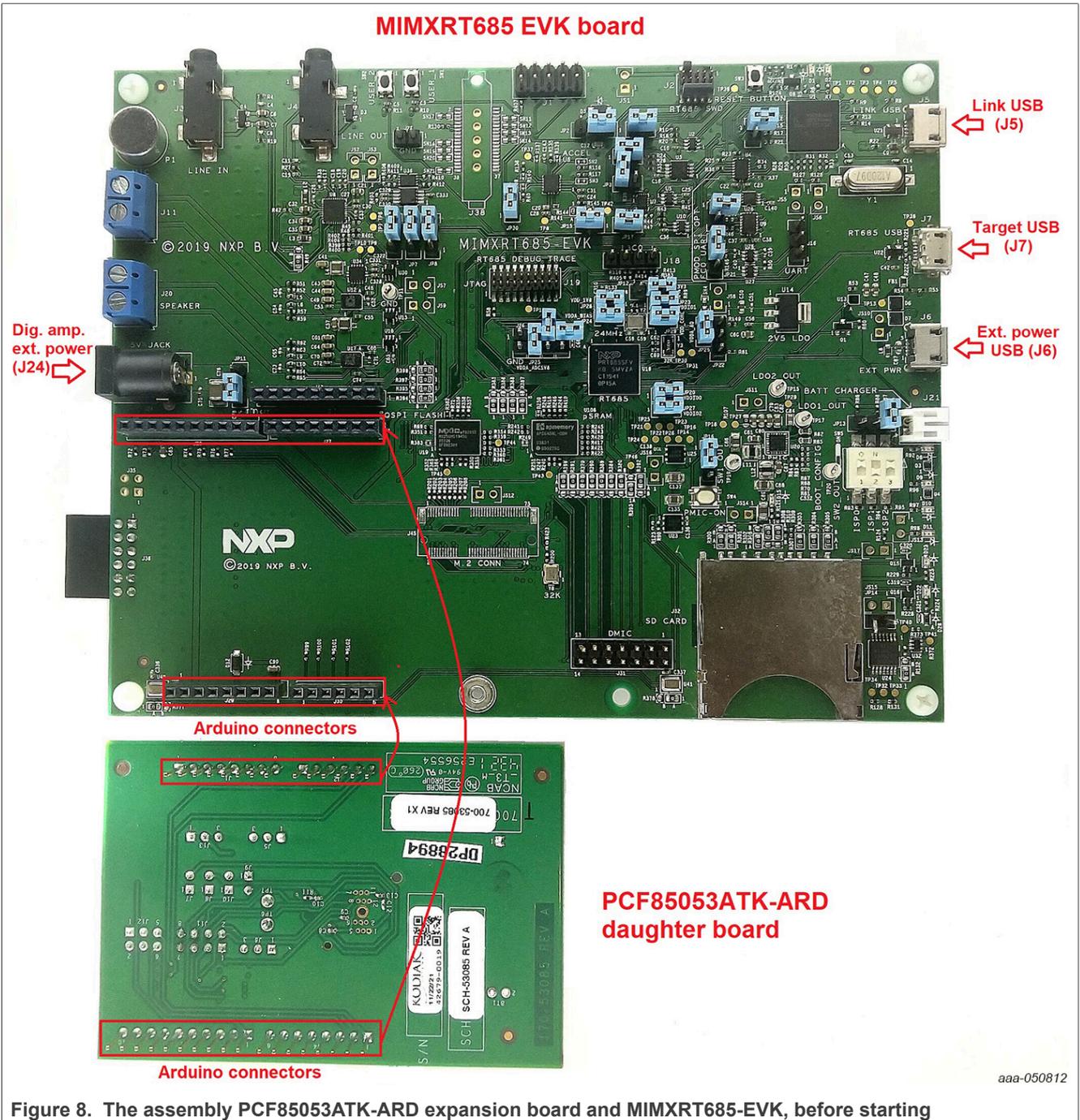


Figure 8. The assembly PCF85053ATK-ARD expansion board and MIMXRT685-EVK, before starting

To configure and operate the setup, follow the below steps:

1. Insert the PCF85053ATK-ARD onto the MIMXRT685-EVK board
2. Configure J12 jumper header as follows: connect pin 3 to pin 6, and pin 4 to pin 5 using the two jumper wires (see [Figure 9](#))
3. Power-up the EVK board using an USB Type C cable attached to PORT 2
4. Connect the EVK to the PC, using an USB Micro-B cable, attached to J7 Target USB connector
5. Install the MIMXRT1050 target firmware (download [UM11581](#), [Arduino shields GUI and firmware installation manual](#) from NXP site)

6. Install GUI application on the PC (see the instruction file referred in the above step)
7. Open the GUI application to operate the device from the PC. For details regarding GUI operation see [Section 7](#)

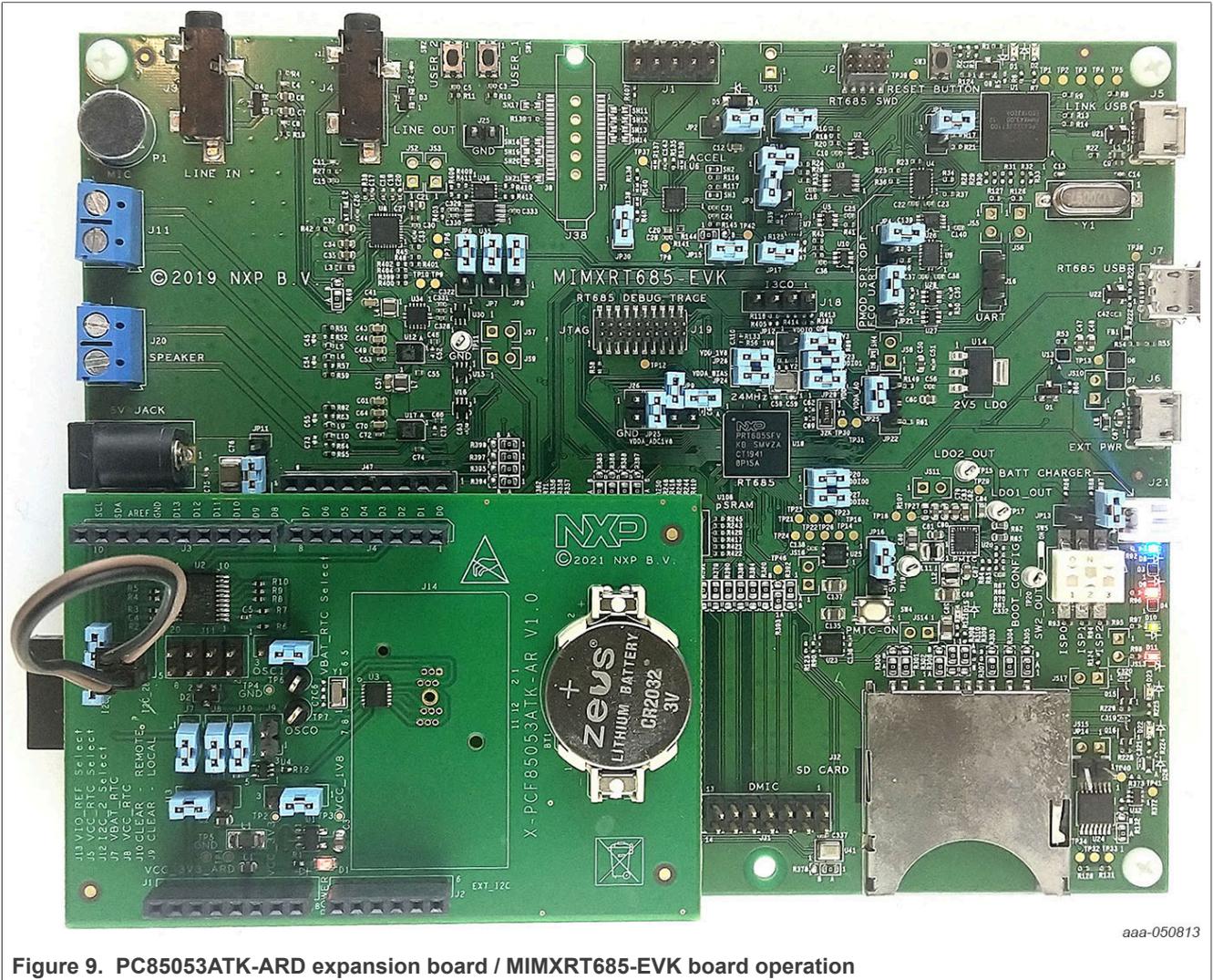


Figure 9. PC85053ATK-ARD expansion board / MIMXRT685-EVK board operation

### 6.4 Using PCF85053ATK-ARD with another device

The PCF85053ATK-ARD expansion board can be operated with any other EVK boards which has an Arduino header. There are two options to connect the board: using other EVK equipped with an Arduino header, and an EVK without Arduino header. In the first case, a firmware shall be developed according to PCF85053A specifications, and then simply attach PCF85053ATK-ARD expansion board to the EVK to operate the board. In the second case, using the pin chart of Arduino connectors ([Table 1](#)), make the necessary electrical connections (for power, I<sup>2</sup>C-bus and control lines), and develop the desired firmware, assuring that it is compliant with the IC specifications. Use PCF85053A data sheet to read details about internal registers of the DUT IC and data exchange between internal controller and the EVK. Assure correct electrical connections and avoid data conflicts on the signal lines to prevent IC damage.

## 7 GUI description

A GUI application is available for the three EVK boards from NXP Semiconductors. The application is common for all above mentioned EVKs (MIMXRT1050-EVKB, LPCXpresso55S69 and MIMXRT685-EVK), produced by NXP Semiconductors.

This section describes the GUI application and how the user can control the PCF85053ATK-ARD expansion board from the graphical interface. First, install the GUI package and software on the PC (Windows 10). For more details, see [UM11581](#).

Once installation is complete, assure that one of the mentioned three EVK with attached PCF85053ATK-ARD expansion board is connected to the PC and powered-on. Open the PCF85053-ARD GUI application. An interface appears as shown in [Figure 10](#).

The GUI application starts with **Settings** tab (marked with red arrow). The left-hand side (the yellow area) of the window provides the following settings:

- **COM PORT:** displays the port selected for communication. The port is automatically selected by the system (COM4 in the screen shot).
- **I<sup>2</sup>C speed:** display / select the I<sup>2</sup>C-bus speed. The available values is 100 kHz, and 400 kHz.

**Connect (Disconnect):** displays / selects the current status of the communication between the GUI and the PCF85053ATK-ARD expansion board. Assuming the correct parameters are chosen, clicking the **Connect** button establishes the connection with the EVK. In the bottom side of the GUI window a status bar shows in real time the status regarding connection between PC and the EVK.

- **Init Board:** initialize the DUT (sets the internal registers of PCF85053ATK to their default state).

On the right-hand side of the window, the **Device Setting** section is located. From this section, the following settings are available:

- **DM (Data Mode):** sets the time format (binary / BCD) of the RTC. Use the drop-down box to select the desired format. Under the drop-down box the register address of the RTC is specified (see the PCF85053ATK data sheet).
- **HF (Hour Format):** sets the hour format (0-24 hours / 0-12 hours).
- **DSM (Daylight Saving Mode):** 0-disable / 1-enable.

Under each control box of the **Device Settings** parameters, the address of the internal register and the corresponding bit is indicated. This feature helps to easily identify which register of PCF85053A is addressed. For more details regarding **DM**, **HF**, and **DSM** settings, see the PCF85053ATK data sheet, section 7.4.1 (Control register).

The **Read** button brings back in the GUI the current settings of the DUT register.

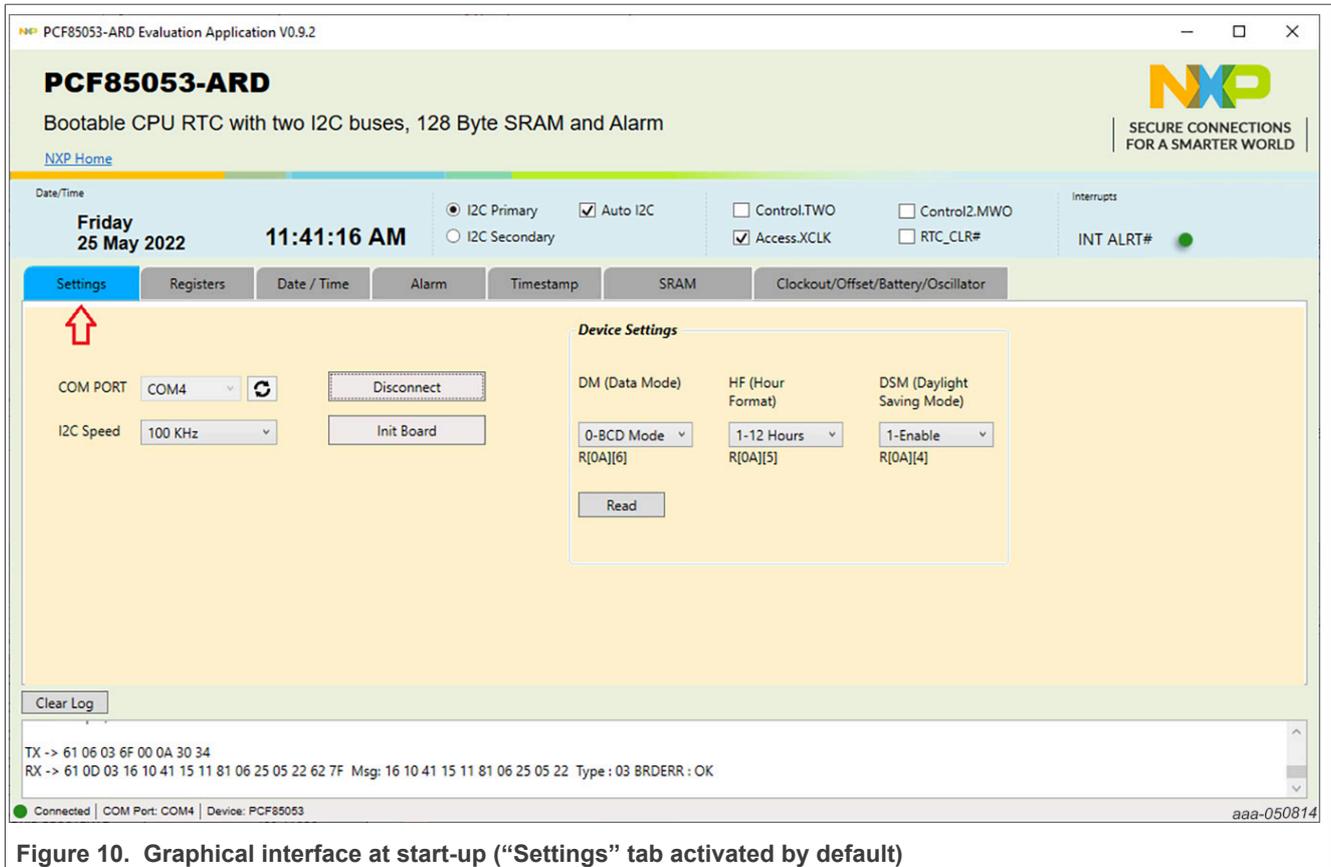


Figure 10. Graphical interface at start-up (“Settings” tab activated by default)

In the upper area (the blue region), from left to right the following data and commands are displayed:

- **Date/Time:** displays the current date and time stored in the internal registers of the RTC (see below the **Date / Time** tab description).
- **I<sup>2</sup>C-bus selection:** From this section the user can select the I<sup>2</sup>C-bus for the communication with the DUT. The **Primary I<sup>2</sup>C** allows for full control of PCF85053A while the Secondary I<sup>2</sup>C has limited write capabilities of the internal registers of the DUT. When **Auto I<sup>2</sup>C** option is active, the GUI automatically selects the right bus for the operation (i.e. if the user wants to write a register which is read-only for the **Secondary I<sup>2</sup>C**, the interface will automatically switch to the **Primary I<sup>2</sup>C**, from where the register can be written). For details, see the PCF85053ATK data sheet, section 7.1.2 (RTC register read/write capability by the two I<sup>2</sup>C buses).
- **Control.TWO, Control2.MWO, Access.XCLK, and RTC\_CLR#.** **Control.TWO** selects the **Time Write Ownership** of the PCF85053A, i.e. which I<sup>2</sup>C bus (primary or secondary) has read/write access or read-only access. For details, see the PCF85053ATK data sheet, section 7.4.1 Control register (0Ah). **Control2.MWO** selects the **Memory Write Ownership** of the PCF85053A, i.e. which I<sup>2</sup>C-bus (primary or secondary) has read/write access or read-only access to the SRAM memory of the RTC. See the PCF85053ATK data sheet, section 7.4.4 2<sup>nd</sup> Control register (0Dh) for details. **Access.XCLK** selects which the I<sup>2</sup>C-bus (primary or secondary) has write-access to the CLKOUT and oscillator control/calibration registers. See the PCF85053ATK data sheet, section 7.9 Access register (14h) for details. **RTC\_CLR#** resets the SRAM memory of the RTC (see PCF85053A data sheet, section 7.13 128 byte SRAM).
- **INT ALRT#** indicator. Monitors the status of ALRT# output (interrupt).

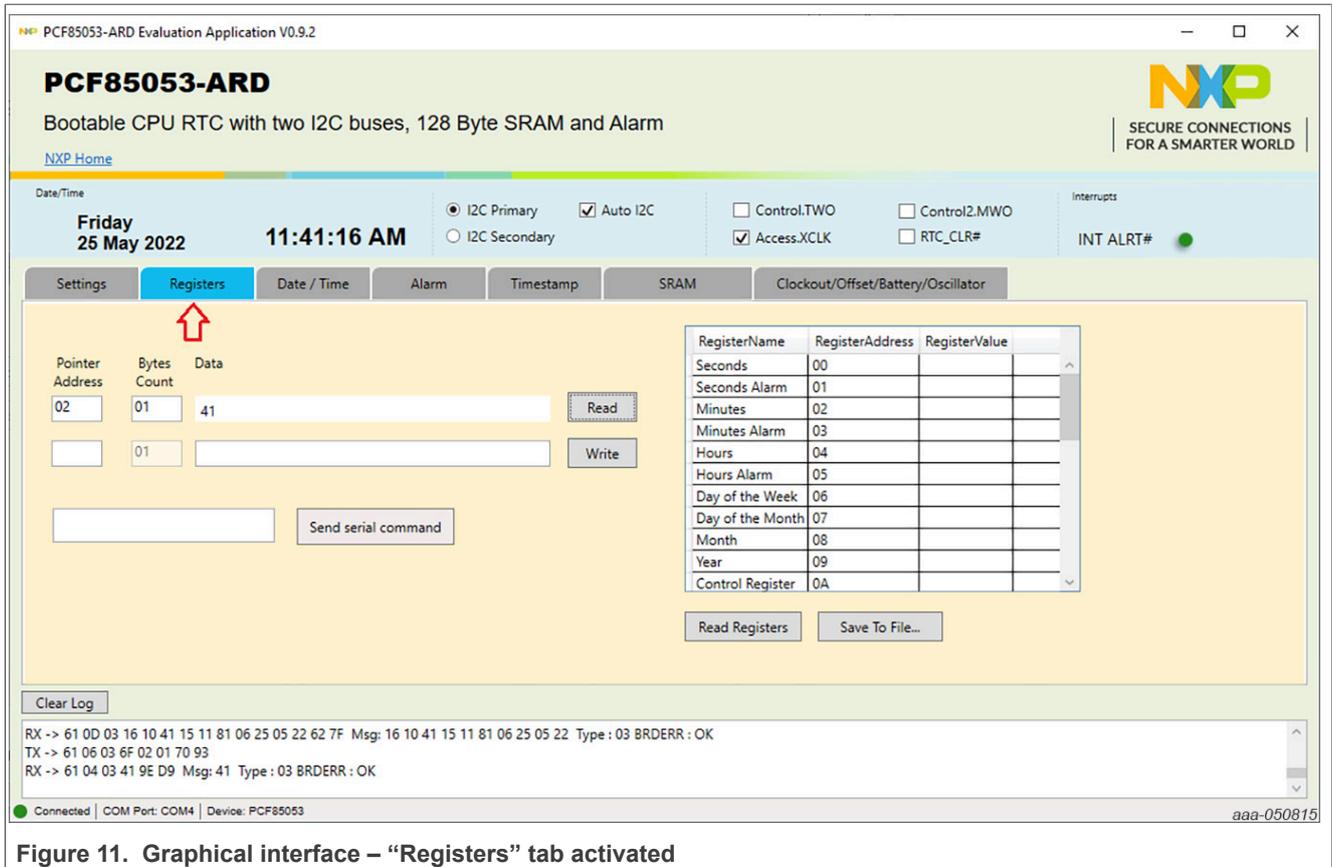


Figure 11. Graphical interface – “Registers” tab activated

The next available tab is **Registers**. Clicking on it, a new interface appears (Figure 11). On the left-hand side of the main window, the user can manually read or write the internal registers of the RTC, by specifying the register address and the number of bytes to be read or written. The serial command button is used to send commands to the EVK, and its main purpose is for tests and service (it is recommended that users avoid using this command).

On the right-hand side of the window, a table shows the entire set of the RTC internal registers. Clicking on the **Read Registers** button, the data is read from the registers and displayed in the table in the GUI. The user can also export the data using the **Save To File** button. The file format is rcfg (the file can be open with Notepad or similar application).

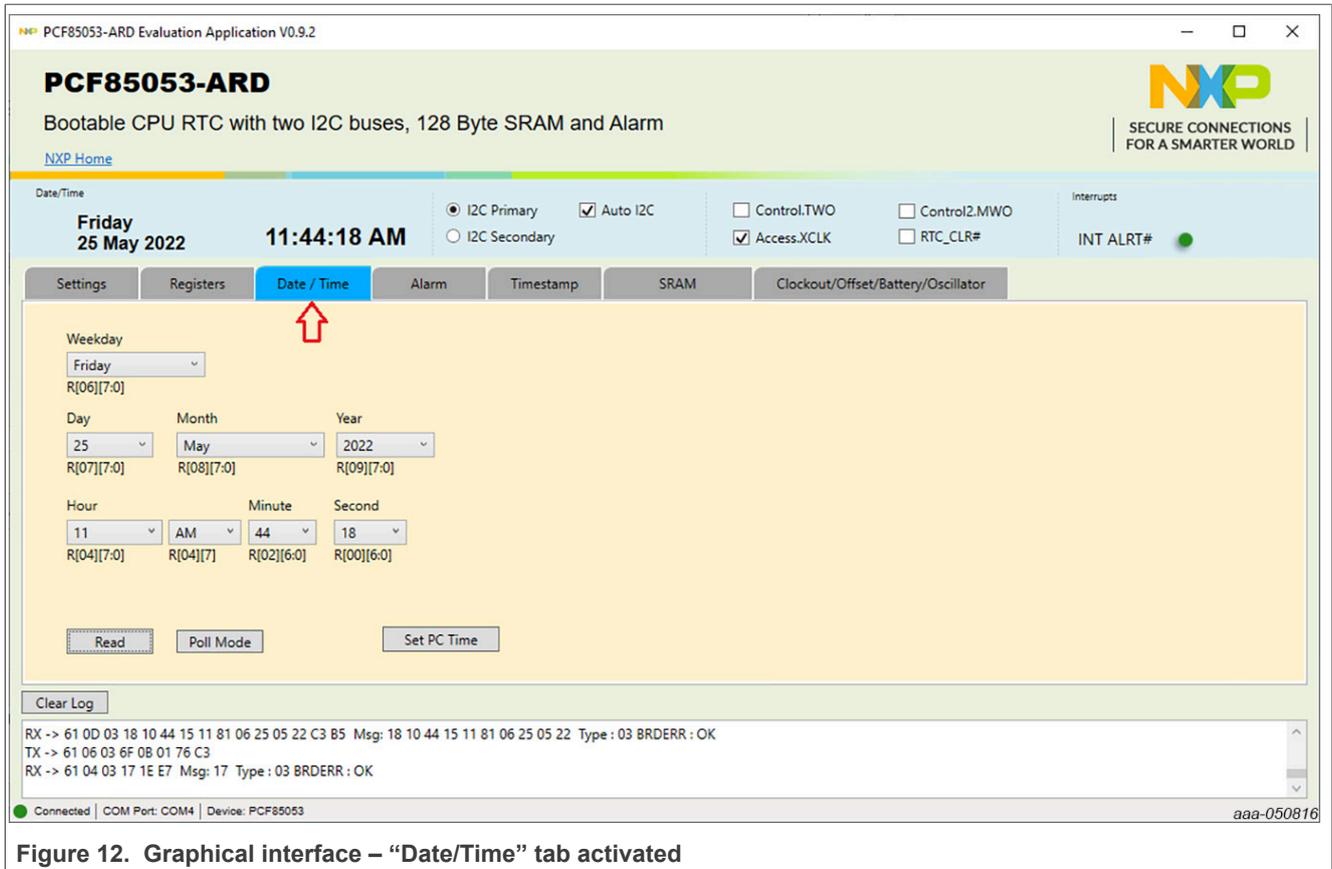


Figure 12. Graphical interface – “Date/Time” tab activated

Figure 12 shows the **Date / Time** tab. In the main window all data regarding the time and the date are present. Notice that under the each parameter the register address and relevant bits within the register are indicated. To change the parameter and write it into the register, click on the parameter’s drop-down menu. A drop-down list will be opened (i.e. for the **Weekday**, a list with the days of the week will appear). Selecting the desired value will automatically write the corresponding register. In this way all the parameters for the date and time can be written. The **Read** button will read the data from the RTC registers and update the GUI accordingly. When the **Poll Mode** is activated, the data is read from RTC and displayed in the GUI once per second. Click **Stop** to exit the Poll mode. The **Set PC Time** button will set the RTC date/time to the current date/time of the PC.

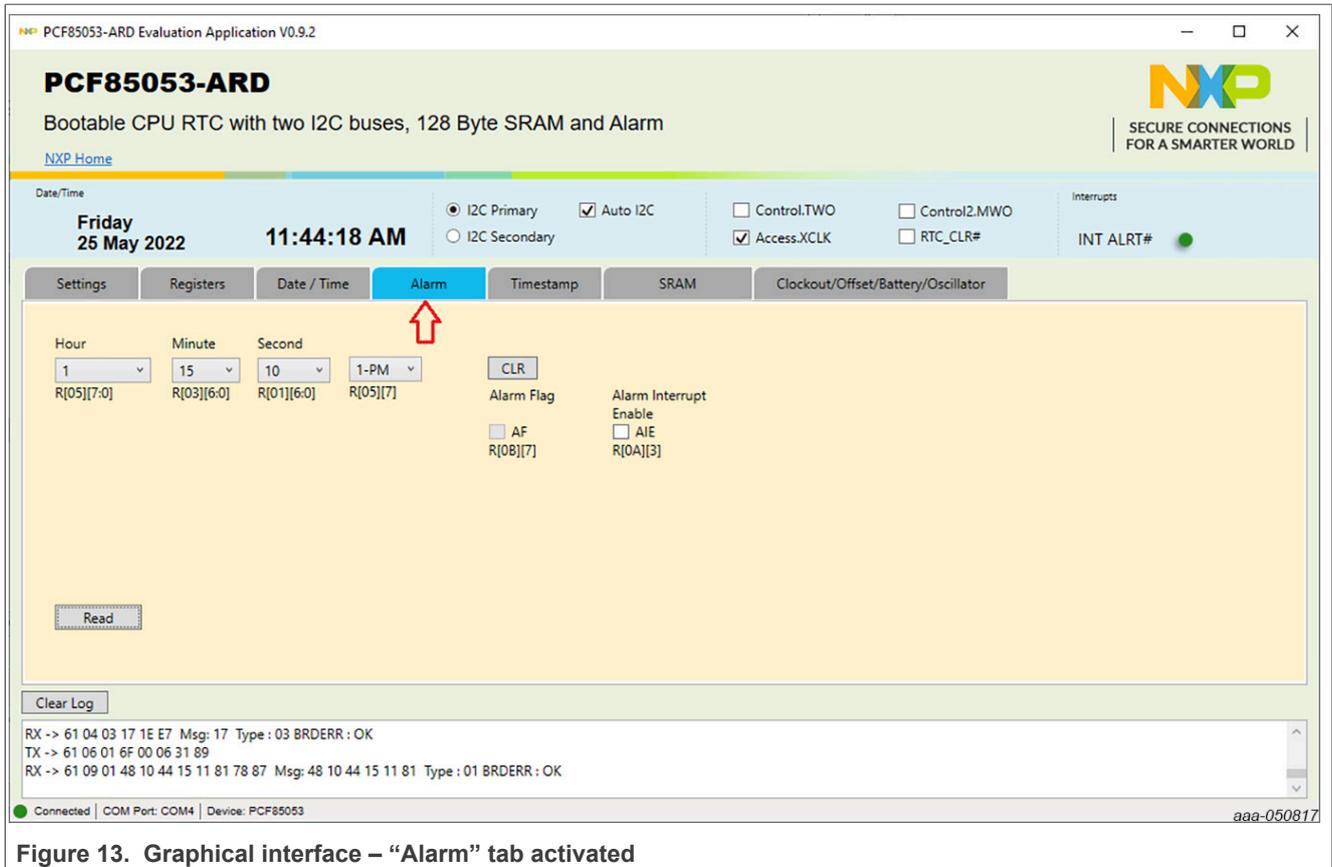


Figure 13. Graphical interface – “Alarm” tab activated

The next tab (see [Figure 13](#)) is **Alarm**. In the same fashion as the previous tab, the RTC registers for the alarm can be written. The **CLR** button will clear the alarm flag, and the AIE checkbox will enable/disable the Alarm interrupt. For more details, see the PCF85053A data sheet, section 7.4, Control, status, CLKOUT, and 2<sup>nd</sup> control register (0Ah to 0Dh).

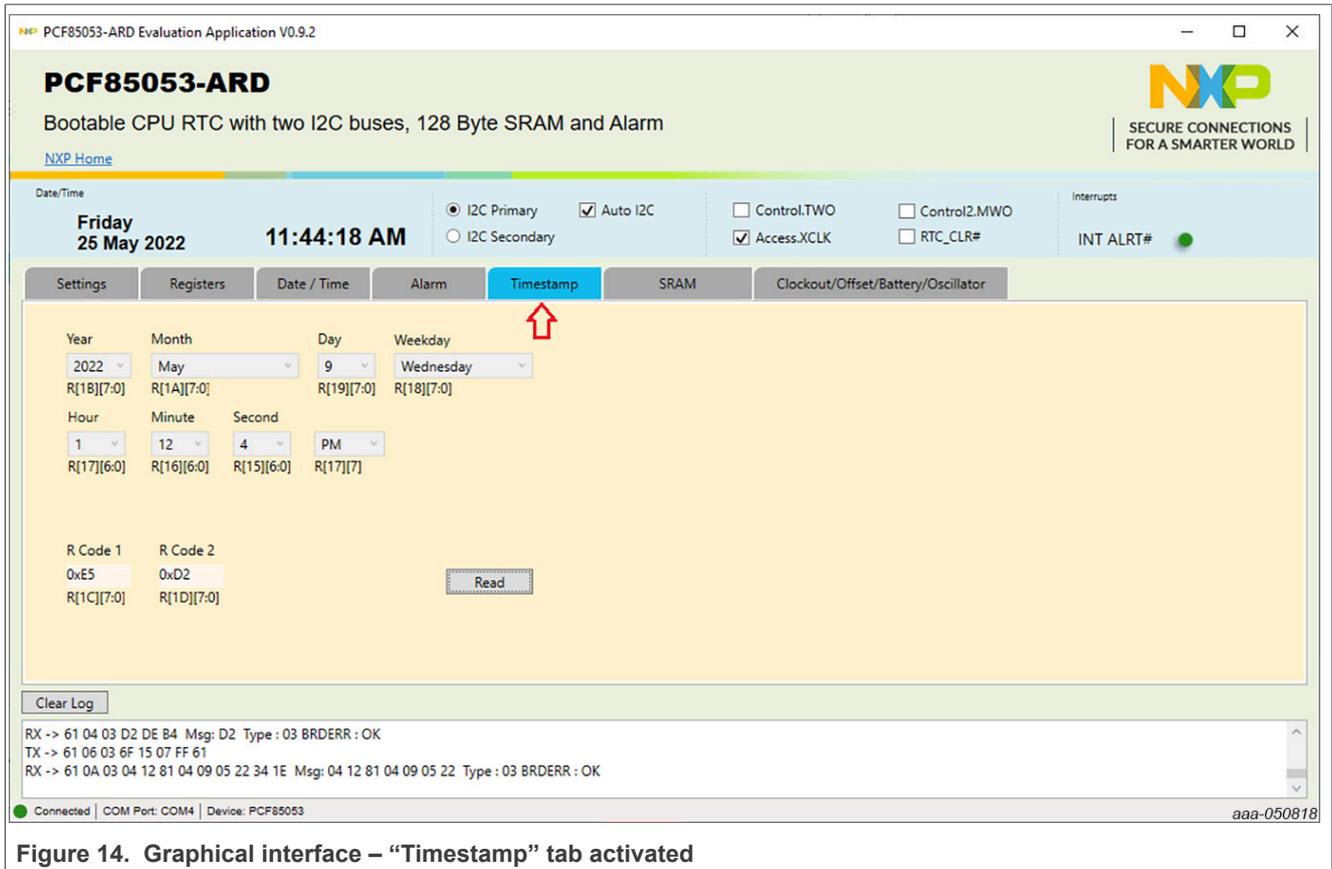


Figure 14. Graphical interface – “Timestamp” tab activated

In [Figure 14](#) the **Timestamp** tab is presented. The timestamp register records any write to the date/time registers. Alongside with the date / time data, a two-byte random number (the R code) is generated and stored by RTC at the timestamp event as unique identifier. The R code registers are at offset 1Ch to 1Dh. To quickly check the timestamp feature, go to **Date / Time** tab and click on **Set PC Time**. Coming back to **Timestamp** tab, the current date / time and the new R code is displayed. For more details, see the PCF85053A data sheet, section 7.10, Timestamp registers (15h to 1Bh), and 7.11 (R code registers).

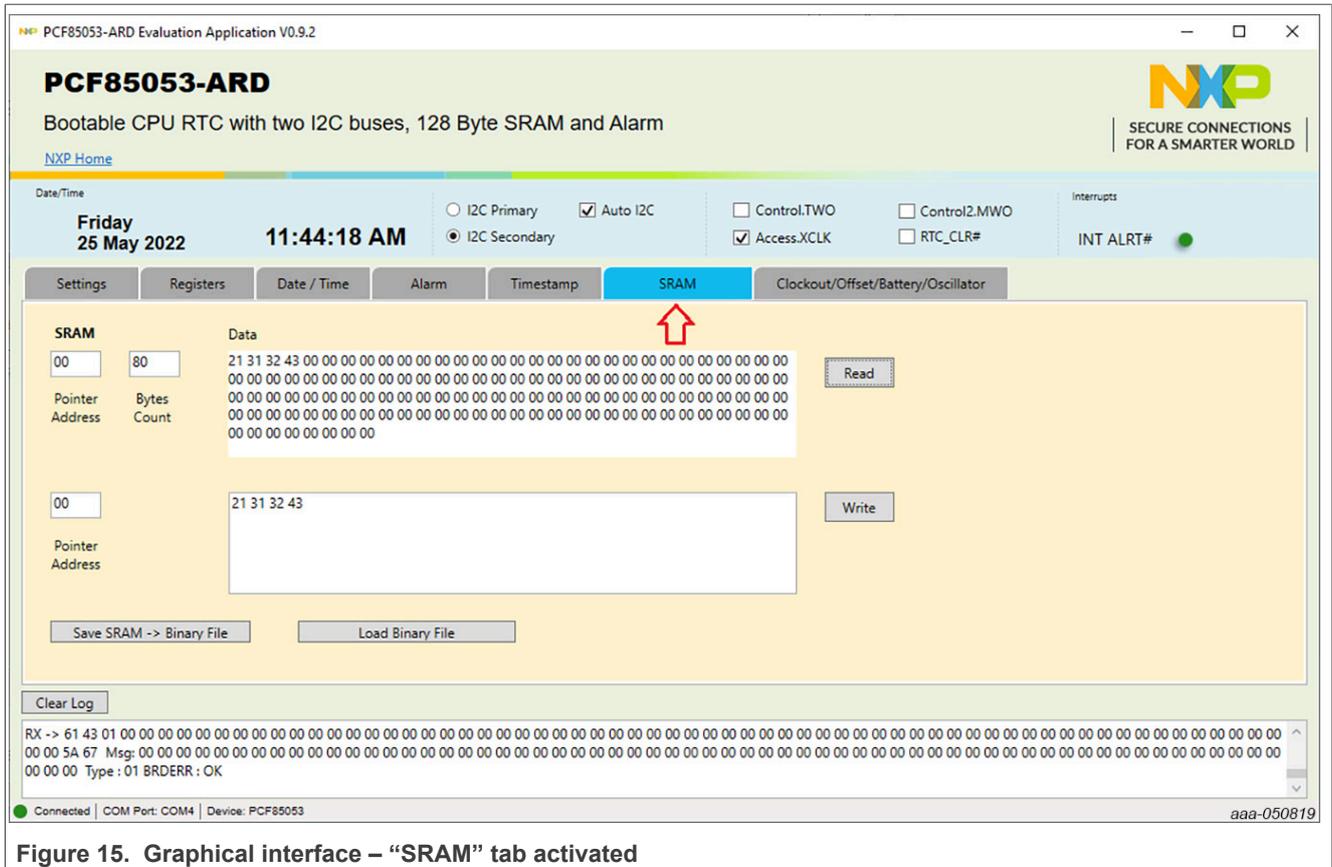


Figure 15. Graphical interface – “SRAM” tab activated

The **SRAM** tab is shown in [Figure 15](#). From here, the user can write data into the 128-byte SRAM memory of the RTC, or read the current information from the RTC’s SRAM memory. To write data, the user need to specify the address (00h to 7Fh) and enter the desired values to be written into the text field. Both the address and the data to be written must be specified in HEX format. Click the **Write** button to write the data into the SRAM memory of the RTC.

To read the data from the SRAM, the user needs to specify the address and the number of bytes to be read (both in HEX format). After clicking the **Read** button, the data will be read from the RTC SRAM and be displayed in the corresponding **Data** window.

The **Save SRAM -> Binary File** button will export the read data by creating a binary (.sbin) file. After clicking the button, complete the filename and select the path to save the file locally on the PC. In the same fashion, using the **Load Binary File**, to read a locally stored .sbin file to be written to the SRAM memory of the RTC.

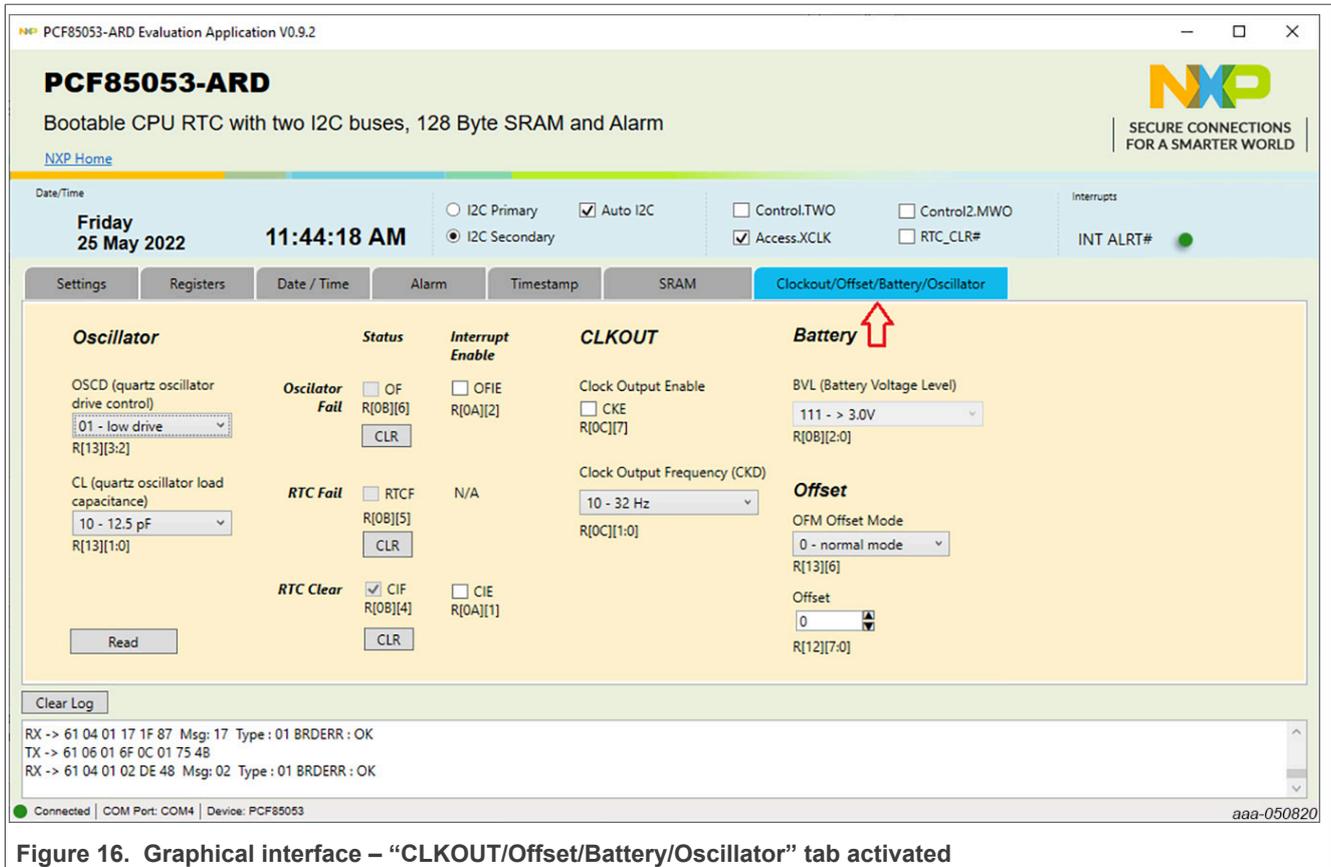


Figure 16. Graphical interface – “CLKOUT/Offset/Battery/Oscillator” tab activated

Figure 16 displays the interface of the last tab, **Clockout/Offset/Battery/Oscillator**.

From this tab, the user can manage parameters of the following registers: Oscillator (13h), Status (0Bh), Control (0Ah), CLKOUT Control ((0Ch), and Offset (12h). [Table 5](#) details the pointer address and the function of the above mentioned registers:

Table 5. CLKOUT/Offset/Battery/Oscillator tab description

Register	Pointer address	Description
Oscillator	OSCD [13h: bit 3-2]	Quartz oscillator drive control – normal, low (low series res.), high (high series res.).
	CL [13h: bit 1-0]	Quartz oscillator load capacitance – 7pF (0 0), 6 pF (0 1), 12.5 pF (1 0).
	OFM [13h: bit 6]	Offset calibration mode – normal (every 4 hours correction), fast (every 8 min. correction).
Offset	Offset [12h: bit 7-0]	Range from -128 to 127 (value in decimal). See section 7.7 (Offset register)[1].
Control	OFIE [0Ah: bit 2]	Oscillator fail interrupt enable. 0 – disable osc. fail interrupt; 1 – enable osc. fail interrupt
	CIE [0Ah: bit 1]	RTC clear interrupt enable. 0 – disable alarm interrupt; 1 – enable alarm interrupt
Status	OF [0Bh: bit 6]	Oscillator fail bit. Reset with <b>CLR</b> button. See section 7.4.2 (Status register)[1].
	RTCF [0Bh: bit 5]	RTC fail bit. Reset with <b>CLR</b> button. See section 7.4.2 (Status register)[1].
	CIF [0Bh: bit 4]	RTC clear flag. Reset with <b>CLR</b> button. See section 7.4.2 (Status register)[1].
	BVL [0Bh: bit 2-0]	Battery voltage level. See section 7.4.2 (Status register)[1] for voltage level selection.
CLKOUT Control	CKE [0Ch: bit 7]	0 – CLKOUT disable (output in high Z); 1 – CLKOUT enable
	CKD [0Ch: bit 1-0]	32.768 kHz (0 0), 1.024 kHz (0 1), 32 Hz (1 0), 1 Hz (1 1)

## 8 Abbreviations

Table 6. Abbreviations

Acronym	Description
DUT	Device Under Test
ESD	Electro Static Discharge
EVK	Evaluation Board
GUI	Graphical User Interface
I <sup>2</sup> C bus	Inter-Integrated Circuit bus
IC	Integrated Circuit
I/O	Input / Output
LED	Light Emitting Diode
PC	Personal Computer
RTC	Real-Time Clock
USB	Universal Serial Bus

## 9 References

1. *PCF85053A, Tiny Real-Time Clock/calendar with alarm function, battery switchover, time stamp input, and I<sup>2</sup>C-bus*  
Product data sheet; NXP Semiconductors;
2. *MIMXRT1050-EVKB Board Hardware User's Guide* <https://www.nxp.com/webapp/Download?colCode=MIMXRT1050EVKBHUG>  
User manual; NXP Semiconductors;
3. *i.MX RT1050 Crossover Processors Data Sheet for Consumer Products*  
Data sheet; NXP Semiconductors;
4. *UM11158 – LPCXpresso55S69/55S28 Development Boards*  
User manual; NXP Semiconductors;
5. *LPC556x 32-bit ARM Cortex®-M33; M33 coprocessor, TrustZone, PowerQuad, CASPER, 320KB SRAM; 640 KB flash, USB HS, Flexcomm Interface, SDIO, 32-bit counter/timers, SCTimer/PWM, PLU, 16-bit 1.0 Msamples/sec ADC, Comparator, Temperature Sensor, AES, PUF, SHA, CRC, RNG*  
Product data sheet; NXP Semiconductors;
6. *i.MX 8M Mini LPDDR4 EVKB Board Hardware User's Guide* <https://www.nxp.com/webapp/Download?colCode=IMX8MMEVKBHUG>  
User guide; NXP Semiconductors;
7. *i.MX 8M Mini Applications Processor Data sheet for Consumer Products*  
Data sheet; NXP Semiconductors;
8. *i.MX 8M Mini Applications Processor Reference Manual* <https://www.nxp.com/webapp/Download?colCode=IMX8MMRM>  
Reference manual; NXP Semiconductors;
9. *Arduino Uno R3 Reference Manual* <https://docs.arduino.cc/hardware/uno-rev3>  
Reference manual; NXP Semiconductors;
10. *UM11612 - IMX8MMINI-IARD interposer board*  
User manual; NXP Semiconductors;
11. *UM11581 - Arduino Shields GUI and firmware installation*  
User manual; NXP Semiconductors

## 10 Legal information

### 10.1 Definitions

**Draft** — A draft status on a document indicates that the content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included in a draft version of a document and shall have no liability for the consequences of use of such information.

### 10.2 Disclaimers

**Limited warranty and liability** — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. NXP Semiconductors takes no responsibility for the content in this document if provided by an information source outside of NXP Semiconductors.

In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of NXP Semiconductors.

**Right to make changes** — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

**Suitability for use** — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors and its suppliers accept no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

**Applications** — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

**Terms and conditions of commercial sale** — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at <http://www.nxp.com/profile/terms>, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. NXP Semiconductors hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NXP Semiconductors products by customer.

**Export control** — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

**Suitability for use in non-automotive qualified products** — Unless this data sheet expressly states that this specific NXP Semiconductors product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. NXP Semiconductors accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without NXP Semiconductors' warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond NXP Semiconductors' specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies NXP Semiconductors for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond NXP Semiconductors' standard warranty and NXP Semiconductors' product specifications.

**Translations** — A non-English (translated) version of a document, including the legal information in that document, is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

**Security** — Customer understands that all NXP products may be subject to unidentified vulnerabilities or may support established security standards or specifications with known limitations. Customer is responsible for the design and operation of its applications and products throughout their lifecycles to reduce the effect of these vulnerabilities on customer's applications and products. Customer's responsibility also extends to other open and/or proprietary technologies supported by NXP products for use in customer's applications. NXP accepts no liability for any vulnerability. Customer should regularly check security updates from NXP and follow up appropriately. Customer shall select products with security features that best meet rules, regulations, and standards of the intended application and make the ultimate design decisions regarding its products and is solely responsible for compliance with all legal, regulatory, and security related requirements concerning its products, regardless of any information or support that may be provided by NXP.

NXP has a Product Security Incident Response Team (PSIRT) (reachable at [PSIRT@nxp.com](mailto:PSIRT@nxp.com)) that manages the investigation, reporting, and solution release to security vulnerabilities of NXP products.

### 10.3 Trademarks

Notice: All referenced brands, product names, service names, and trademarks are the property of their respective owners.

**NXP** — wordmark and logo are trademarks of NXP B.V.

---

## Contents

---

<b>1</b>	<b>Introduction</b> .....	<b>4</b>
<b>2</b>	<b>Finding kit resources and information on the NXP web site</b> .....	<b>4</b>
2.1	Collaborate in the NXP community .....	4
<b>3</b>	<b>Getting ready</b> .....	<b>4</b>
3.1	Kit contents .....	4
3.2	Assumptions .....	4
3.3	Static handling requirements .....	5
3.4	Minimum system requirements .....	5
<b>4</b>	<b>Getting to know the hardware</b> .....	<b>5</b>
4.1	PCF85053ATK-ARD features .....	5
4.2	Kit featured components .....	5
4.3	Schematic diagram .....	7
4.4	Arduino headers .....	7
4.5	I2C-buses .....	8
4.6	Jumpers and test points .....	9
<b>5</b>	<b>Installing and configuring software tools</b> .....	<b>11</b>
<b>6</b>	<b>Configuring the hardware</b> .....	<b>11</b>
6.1	Using the PCF85053ATK-ARD with an MIMXRT1050-EVK board .....	11
6.2	Using the PCF85053ATK-ARD with an LPCXpresso55S69 development board .....	13
6.3	Using the PCF85053ATK-ARD with an MIMXRT685-EVK board .....	17
6.4	Using PCF85053ATK-ARD with another device .....	19
<b>7</b>	<b>GUI description</b> .....	<b>20</b>
<b>8</b>	<b>Abbreviations</b> .....	<b>28</b>
<b>9</b>	<b>References</b> .....	<b>29</b>
<b>10</b>	<b>Legal information</b> .....	<b>30</b>

---

Please be aware that important notices concerning this document and the product(s) described herein, have been included in section 'Legal information'.

---