

# QE for AFE V2.2.0

## Release Note

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Thank you very much for using the QE for AFE V2.2.0.

This release note covers product installation, restrictions, and so on. Please read this document before using the product.

### Contents

1.	About QE for AFE .....	3
1.1	Summary .....	3
1.2	Functions .....	3
1.3	New Functions.....	3
1.3.1	Support RA2A2.....	3
1.3.2	Support [AFE Overview (QE)] view .....	4
1.3.3	Improve workflow when working in e <sup>2</sup> studio .....	4
1.3.4	Specify adjustment program download location in e <sup>2</sup> studio [Preference] menu .....	5
1.3.5	Eliminate the limitation of installation path .....	5
1.3.6	Eliminate the limitation of using e <sup>2</sup> studio installation package .....	5
1.4	Supported Environment.....	6
1.5	Supported Microcontrollers .....	6
2.	Installation and Uninstallation .....	7
2.1	Installing This Product .....	7
2.1.1	Install from the "Renesas Software Installer" menu of e <sup>2</sup> studio .....	7
2.1.2	Install using QE (zip file) downloaded from the Renesas website .....	7
2.2	Updating This Product.....	8
2.3	Uninstalling This Product.....	8
2.3.1	Uninstall Plugin Version .....	8
2.3.2	Uninstall Standalone Version .....	8
3.	Notes / Restrictions.....	9
3.1	Usage Considerations .....	9
3.1.1	Notes on reading Board Control Program application note .....	9
3.1.2	Notes on pressing [Write Value to The Target Board] button after configuring an AFE component setting .....	9
3.1.3	Notes on ADC One-shot and Auto mode selection on [Monitor] View .....	10
3.1.4	Notes on closing [AFE Monitor (QE)] view of e2 studio plugin version .....	10
3.1.5	Notes on OPAMP trimming function failed using Emulator connection .....	10
3.1.6	Notes on downloading AFE adjustment project .....	11

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3.1.7	Notes on monitoring RA2A2 SDADC24 conversion result.....	13
3.2	Functional Restrictions .....	15
3.2.1	Restrictions on showing a video about how to use QE AFE .....	15
3.2.2	Restrictions on ACMPLP configuration .....	16
3.2.3	Restrictions on migration pin allocation to Smart Configurator .....	18
	Revision History .....	19

## 1. About QE for AFE

### 1.1 Summary

QE for AFE is an evaluation tool for embedded system development that performs graphical tuning with an integrated analog front end (AFE). Using this tool, you can configure AFE registers, write registers into the evaluation board, and monitor the AFE tuning results in a waveform.

To use this tool, you must have a board that supports QE for AFE. QE for AFE is connected between PC and the board through a USB cable and communicates with the board.

### 1.2 Functions

The main functions are listed below:

1. Connect and operate the evaluation board
2. Config AFE-related registers with GUI
3. Display graphics of the AFE tuning results and digital filter frequency response
4. Display graphics of the user application measurement values
5. Generate code with RX SmartConfigurator or RA FSP when working as e<sup>2</sup> studio plug-in

### 1.3 New Functions

#### 1.3.1 Support RA2A2

QE for AFE V2.2.0 starts to support RA2A2.

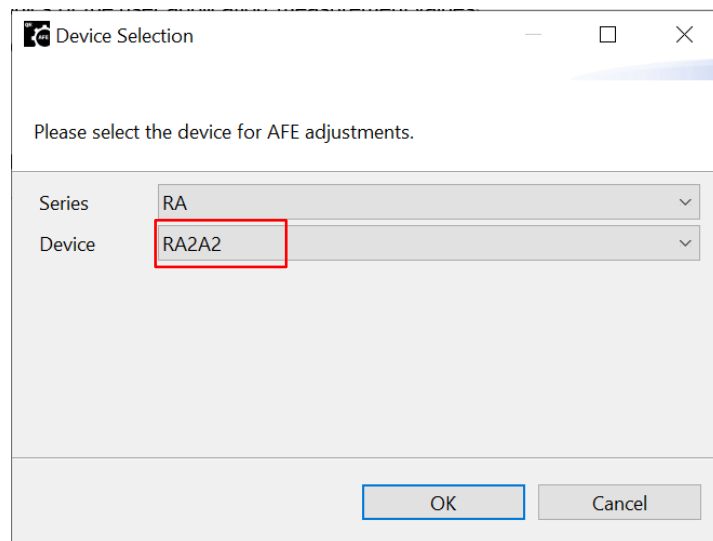


Figure 1-1. Support RA2A2

### 1.3.2 Support [AFE Overview (QE)] view

A [AFE Overview (QE)] page is newly supported in the Stand-alone version, which makes it easier to open help documents, release notes, and download the sample program by clicking the links on this page.

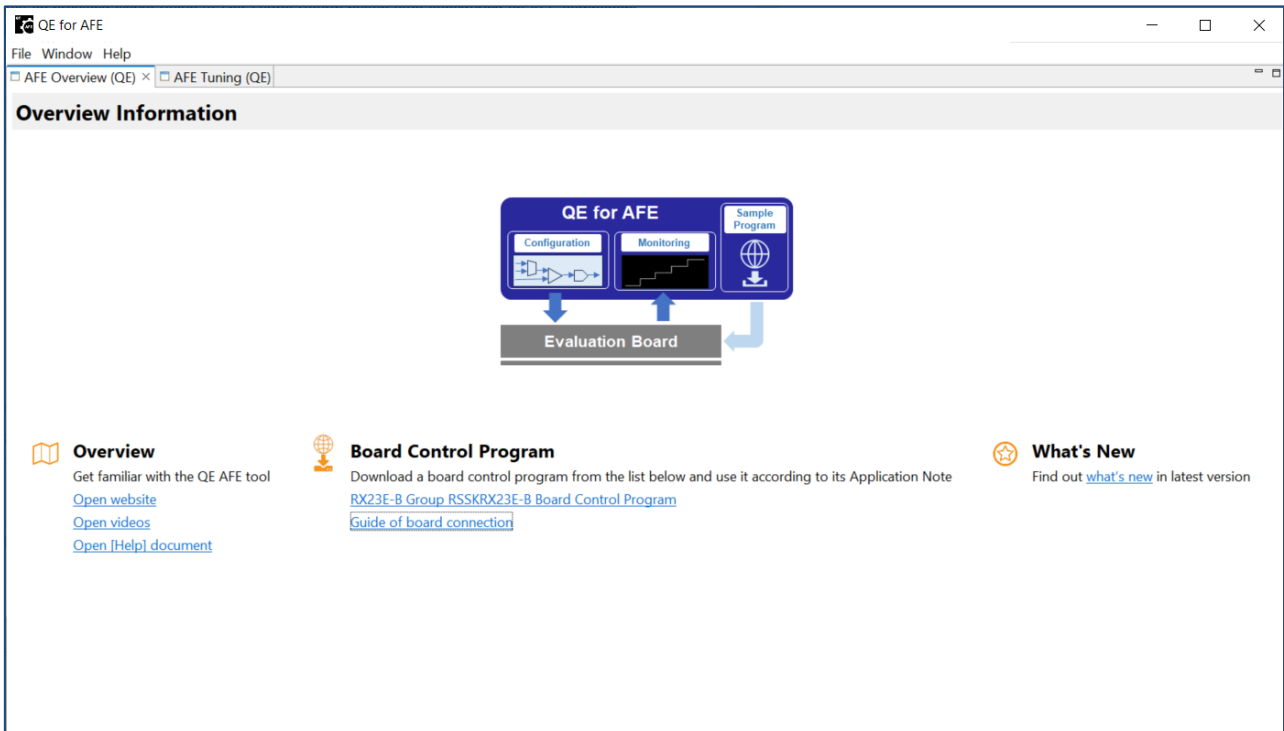


Figure 1-2. [AFE Overview (QE)] view

### 1.3.3 Improve workflow when working in e<sup>2</sup> studio

In previous version, "Disconnect" button is in the "Connect to Board" step of workflow. From V2.2.0, a new step "Disconnect from Board" is added at the end of workflow when working in e<sup>2</sup> studio. In this way, it is more in line with the user's actual operation sequence.

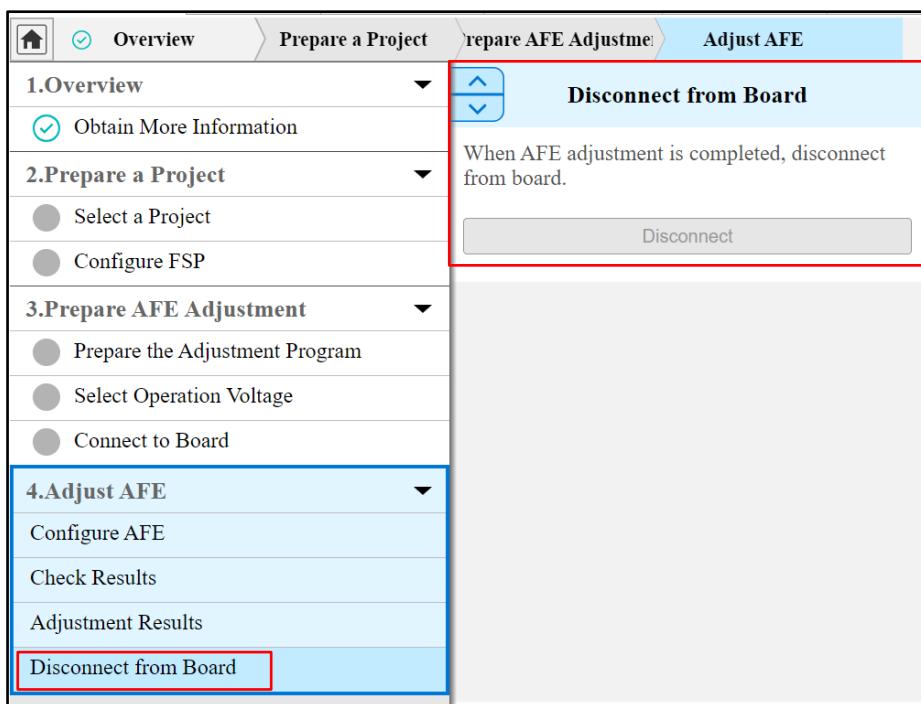


Figure 1-3. [Disconnect from Board] in workflow

### 1.3.4 Specify adjustment program download location in e<sup>2</sup> studio [Preference] menu

The adjustment program download location can be specified in e<sup>2</sup> studio menu:

[Windows] > [Preferences] > [Renesas] > [Renesas QE] > [QE for AFE].

Using this setting page, the download location can be changed, and the downloaded package can be found under the specified folder.

If You create a [Target Board Name] folder in this location and place a adjustment program (zip file) that corresponds to the target board, this adjustment program will be displayed in the [Select program for AFE adjustment] combo box list.

Folder structure:

- For RA2A1: {Path specified in [QE for AFE]}/RA2A1/xxxx.zip
- For RX23E-B: {Path specified in [QE for AFE]}/RX23EB/xxxx.zip
- For RA2A2: {Path specified in [QE for AFE]}/RA2A2/xxxx.zip

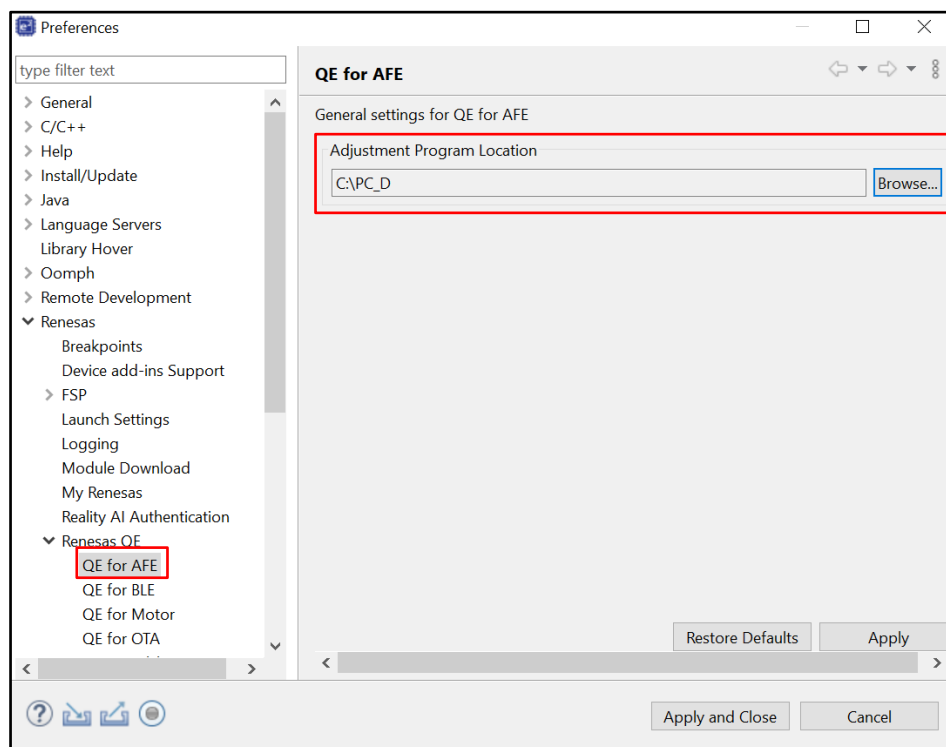


Figure 1-4. To specify adjustment program download location

### 1.3.5 Eliminate the limitation of installation path

The limitation that QE for AFE will not work properly if the installed location folder name starting with "u" (lowercase) is eliminated from V2.2.0.

### 1.3.6 Eliminate the limitation of using e<sup>2</sup> studio installation package

The limitation that RX and RA device families must be selected when using e<sup>2</sup> studio installation package is eliminated from V2.2.0.

## 1.4 Supported Environment

- RA2A1
  - Windows 10 (64-bit version), Windows 11 (64-bit version)
  - Renesas e<sup>2</sup> studio 2024-01 and later
  - Evaluation board: EK-RA2A1
  - RA2A1 Group Board Control Program for “QE for AFE” in application note R01AN5795EJ0200  
*Note: Board control program should be built with FSP3.6.0.*
- RX23E-B
  - Windows 10 (64-bit version), Windows 11 (64-bit version)
  - Renesas e<sup>2</sup> studio 2024-01 and later
  - Evaluation board: RSK RX23E-B
  - RX23E-B Group Board Control Program for “QE for AFE” in application note R01AN6364EJ0100
- RA2A2
  - Windows 10 (64-bit version), Windows 11 (64-bit version)
  - Evaluation board: EK-RA2A2
  - Renesas e<sup>2</sup> studio 2024-01 and later
  - RA2A2 Group Board Control Program for “QE for AFE” in application note R01AN7280EJ0210  
*Note: The board control program should be built with FSP5.2.0.*

## 1.5 Supported Microcontrollers

- RA Family (only MCUs that incorporate the AFE)
  - RA2A Series: RA2A1, RA2A2
- RX Family (only MCUs that incorporate the AFE)
  - RX200 Series: RX23E-B

## 2. Installation and Uninstallation

### 2.1 Installing This Product

Use either of the following procedure to install this product.

#### 2.1.1 Install from the "Renesas Software Installer" menu of e<sup>2</sup> studio

1. Start e<sup>2</sup> studio.
2. Select the "Renesas Views" - "Renesas Software Installer" menu of e<sup>2</sup> studio to open the "Renesas Software Installer" dialog box.
3. Select the "Renesas QE" and click the "Next >" button
4. Select the "QE for AFE (v2.2.0)" check box and click the "Finish" button.
5. Check that the "Renesas QE for AFE" check box is selected in the "Install" dialog box and click the "Next >" button.
6. Check that the "Renesas QE for AFE" check box is selected as the target of installation and click the "Next>" button.
7. After confirming the license agreements, if you agree to the license, select the "I accept the terms of the license agreements" radio button, and click the "Finish" button.
8. When the dialog box for selecting a trusted certificate appears, check the displayed certificate, and then click on the "Trust Selected" button to continue installation.
9. Restart the e<sup>2</sup> studio by following the instructions on the screen.
10. Start this product from the "Renesas Views" - "Renesas QE" menu of e<sup>2</sup> studio. For details about how to use this product, see the "Help" menu of e<sup>2</sup> studio.

#### 2.1.2 Install using QE (zip file) downloaded from the Renesas website

A downloaded zip file has both a plugin version and a standalone version.

##### 2.1.2.1 Install Plugin Version

1. Extract the downloaded zip file.
2. Start the e<sup>2</sup> studio.
3. Click on "Help", and then click on the "Install New Software..." menu item to open the "Install" dialog box.
4. Click on the "Add..." button to open the "Add Repository" dialog box.
5. Click on the "Archive..." button, select the installation file (zip file under the QE-AFE folder) in the opened file selection dialog box, and then click on the "Open" button.
6. Click on the "Add" button in the "Add Repository" dialog box.
7. Expand the "Renesas QE" item shown in the "Install" dialog box, select the "Renesas QE for AFE" check box, and then click on the "Next>" button.  
\*If you check off the "Contact all update sites during install to find required software" checkbox, you can shorten the installation time.
8. Confirm that the installation target is "Renesas QE for AFE", and then click on the "Next>" button.
9. After checking the license, select the "I accept the terms of the license agreements" radio button if you agree it, and then click on the "Finish" button.
10. When the dialog box for selecting a trusted certificate appears, check the displayed certificate, and then click on the "Trust Selected" button to continue the installation.
11. Restart the e<sup>2</sup> studio by following the instructions on the screen.
12. Start this product from the "Renesas Views" - "Renesas QE" menu of the e<sup>2</sup> studio. For details about how to use this product, see the "Help" menu of e<sup>2</sup> studio.

### 2.1.2.2 Install Standalone Version

1. Extract “.zip” file to a user-specified location on the PC.  
Note: Please do not put the tool under OS program folder (C:\Program Files)
2. Start this product by double clicking “\QE-AFE\eclipse\qe-afe.exe”.
3. For the first time this product starts, there is a dialog of license agreement. After checking the license, you can select “Agree” or “Disagree”.

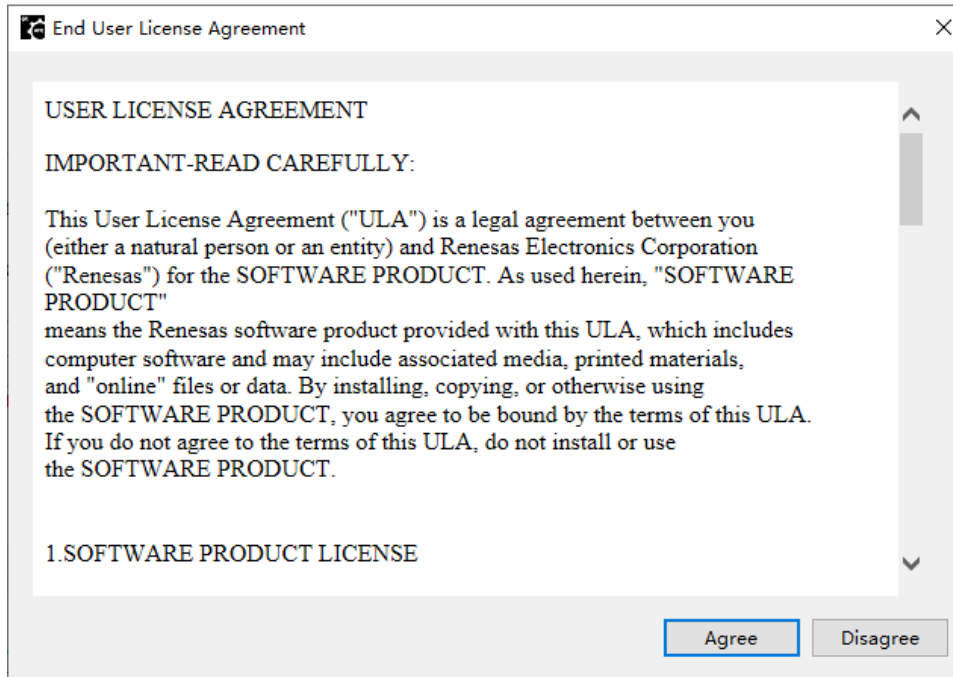


Figure 2-1. License agreement dialog

4. If “Agree” is selected in above step, the product is launched then you can use it; if “Disagree” is selected in above step, the product won’t be launched.

## 2.2 Updating This Product

If you have already used this product, you can update it in the same way as the procedure for installation.

## 2.3 Uninstalling This Product

Follow the procedure below to uninstall this product.

### 2.3.1 Uninstall Plugin Version

1. Start the e<sup>2</sup> studio.
2. Select “Help -> About e<sup>2</sup> studio” to open the “About e2 studio” dialog box.
3. Click the “Installation Details” button to open the “e2 studio Installation Details” dialog box.
4. Select “Renesas QE for AFE” displayed on the “Installed Software” tabbed page and click on the “Uninstall...” button to open the “Uninstall” dialog box.
5. Check the displayed information and click on the “Finish” button.
6. Restart the e2 studio by following the instructions on the screen.

### 2.3.2 Uninstall Standalone Version

Delete the entire folder which .zip package is extracted.



### 3. Notes / Restrictions

#### 3.1 Usage Considerations

Please pay attention to the following items.

**Table 3-1 List of Limitation**

✓ : Applicable, -: Not Applicable

No	Description	RA2A1	RX23E-B	RA2A2
1	Notes on reading Board Control Program application note	✓	✓	✓
2	Notes on pressing [Write Value to The Target Board] button after configuring an AFE component setting	✓	-	✓
3	Notes on ADC One-shot and Auto mode selection on [Monitor] View	✓	-	✓
4	Notes on closing [AFE Monitor (QE)] view of e <sup>2</sup> studio plugin version	✓	✓	✓
5	Notes on OPAMP trimming function failed using Emulator connection	✓	-	-
6	Notes on downloading AFE adjustment project	✓	✓	✓
7	Notes on monitoring RA2A2 SDADC24 conversion result	-	-	✓

##### 3.1.1 Notes on reading Board Control Program application note

QE for AFE works with the control program operating on the evaluation board. So when using this product, please read the related Board Control Program application note first and use the recommended parameters in the application note. The parameters to be concerned include:

- System clock setting
- Sampling time of communication I/F
- Default bitrate setting of UART connection

##### 3.1.2 Notes on pressing [Write Value to The Target Board] button after configuring an AFE component setting

It is recommended to press [Write Value to The Target Board] button each time completing one AFE component configuration and move to next AFE component configuration. The reason is that the board control program checks the validity of the new register value according to the existing register value on the evaluation board. Keeping the register values on the evaluation board always consistent with the GUI configuration can avoid unexpected errors when writing new registers values to the evaluation board.

### 3.1.3 Notes on ADC One-shot and Auto mode selection on [Monitor] View

ADC has 2 monitoring modes: One-shot and Auto. The waveform of these 2 modes is depending on ADC sampling time setting:

- When ADC sampling time is short (performing high-speed conversion)
  - One-shot mode: QE for AFE reads data from evaluation board and draws the waveform only once
  - Auto mode: QE for AFE reads data from evaluation board and draws the waveform continuously until the "Stop AFE Monitoring" button is pressed
- When ADC sampling time is long (performing low-speed conversion)
  - Either One-shot mode or Auto mode, the waveform are same: QE for AFE reads data from evaluation board and draws the waveform continuously until the "Stop AFE Monitoring" button is pressed.

*Note: for detailed procedure of One-shot measurement and Auto measurement, please refer to RA2A1 board control program application note chapter "1.1.2 Measured Value Transmission Operation during A/D Conversion and Comparison"*

### 3.1.4 Notes on closing [AFE Monitor (QE)] view of e2 studio plugin version

In e<sup>2</sup> studio plugin version, if multiple [AFE Monitor (QE)] views are open under different perspectives, closing one [AFE Monitor (QE)] view while the monitor is running, the monitor won't be stopped (the tuning result still can be observed after switching to another perspective). Closing the [AFE Monitor (QE)] view of all perspectives can end the tuning process.

### 3.1.5 Notes on OPAMP trimming function failed using Emulator connection

When using Emulator connection mode, OPAMP trimming function occasionally fails. The failed phenomenon is that even click "Next" and wait a while on Step1 or Step2, the wizard can't move to next step. So to execute OPAMP trimming function successfully, please take priority to use USB or UART connection mode.

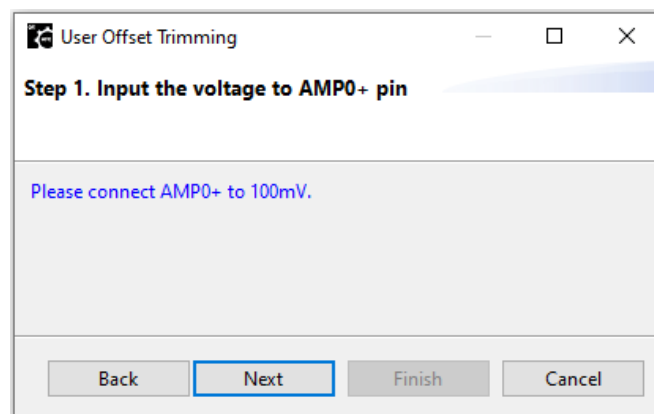


Figure 3-1 OPAMP trimming function dialog

### 3.1.6 Notes on downloading AFE adjustment project

1. To download AFE adjustment project, please kindly take note to set the region using the following steps. Otherwise, project can't be downloaded.
  - 1) Select [Window] > [Show View]>[Smart Browser] menu.
  - 2) Select [Setting] in the Smart Browser [View menu].
  - 3) Select one region in the settings dialog and click [Apply and Close] button.

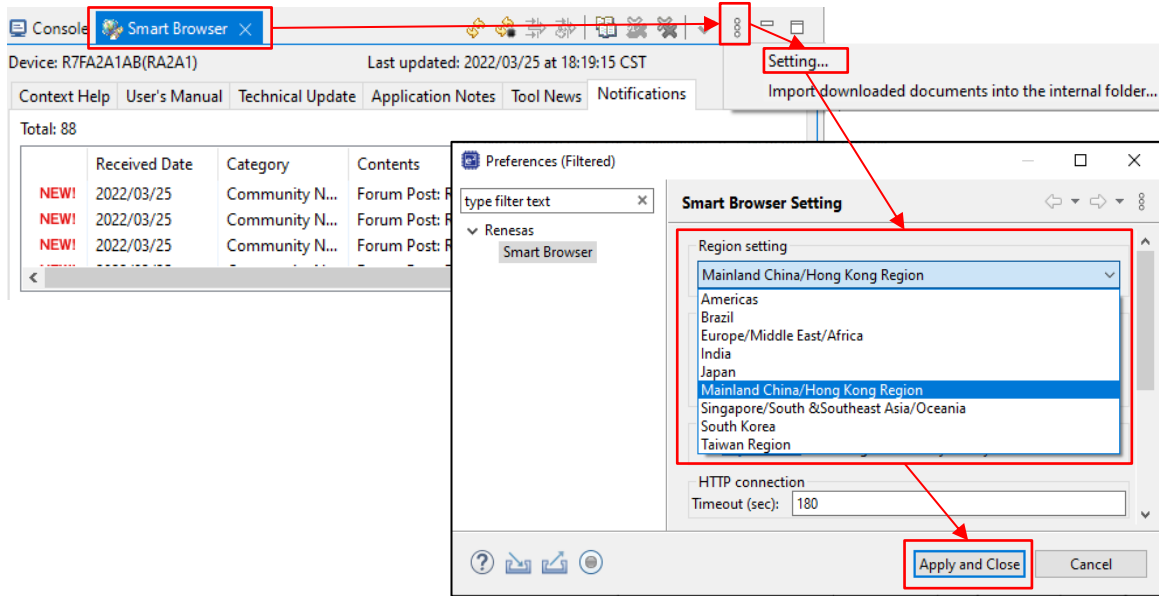


Figure 3-2 (a) Smart Browser Region setting

2. If there is no adjustment program displayed in the download list after you selected the [Download AFE Adjustment Project] in the AFE Workflow (QE), you can follow the steps below to download the AFE adjustment program from Renesas website and place it in the specified folder manually.
  - 1) Download the AFE adjustment program for the target board you want to use from the Renesas website.
    - RA2A1: RA2A1 Group Board Control Program for 'QE for AFE' (R01AN5795EJ0200)
    - RX23E-B: RX23E-B Group RSSKRX23E-B Board Control Program Application Note (R01AN6364EJ0100)
    - RA2A2: RA2A2 Group Board Control Program for 'QE for AFE' (R01AN7280EJ0210)
  - 2) Place the downloaded zip file in the folder specified in [Window] > [Settings] > [Renesas QE] > [QE for AFE] under the following conditions.

Folder structure:

- For RA2A1: {Path specified in [QE for AFE]}/RA2A1/xxxx.zip
- For RX23E-B: {Path specified in [QE for AFE]}/RX23EB/xxxx.zip
- For RA2A2: {Path specified in [QE for AFE]}/RA2A2/xxxx.zip

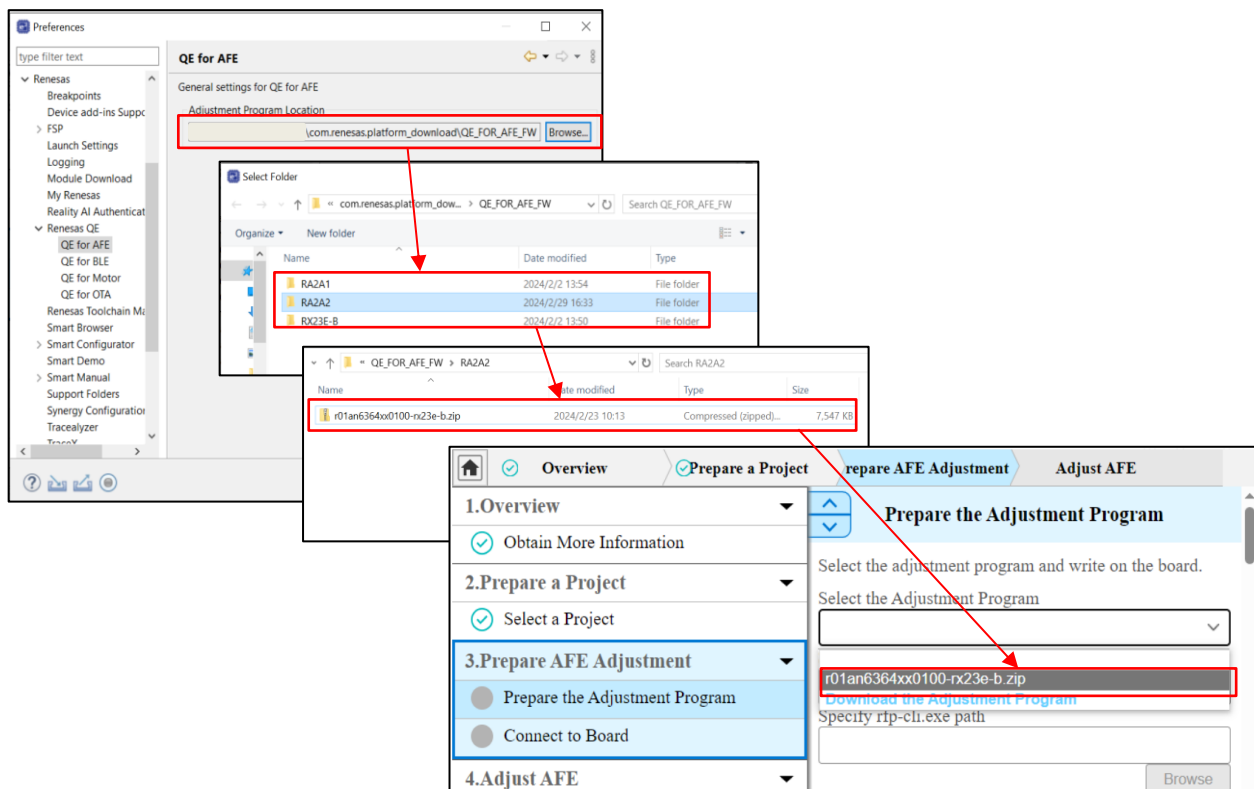


Figure 3-2 (b) Operation when the AFE adjustment program is obtained from the Web

### 3.1.7 Notes on monitoring RA2A2 SDADC24 conversion result

RA2A2 SDADC24 sampling rate is high, which leads to a large amount of conversion results. The large amount of data consume a lot of PC memory and have an impact on the waveform drawing performance. To ensure drawing waveform real-time, the following restrictions are applied when performing SDADC24 monitoring function:

- 1) The waveform “Auto scaling” option is disabled during monitoring.

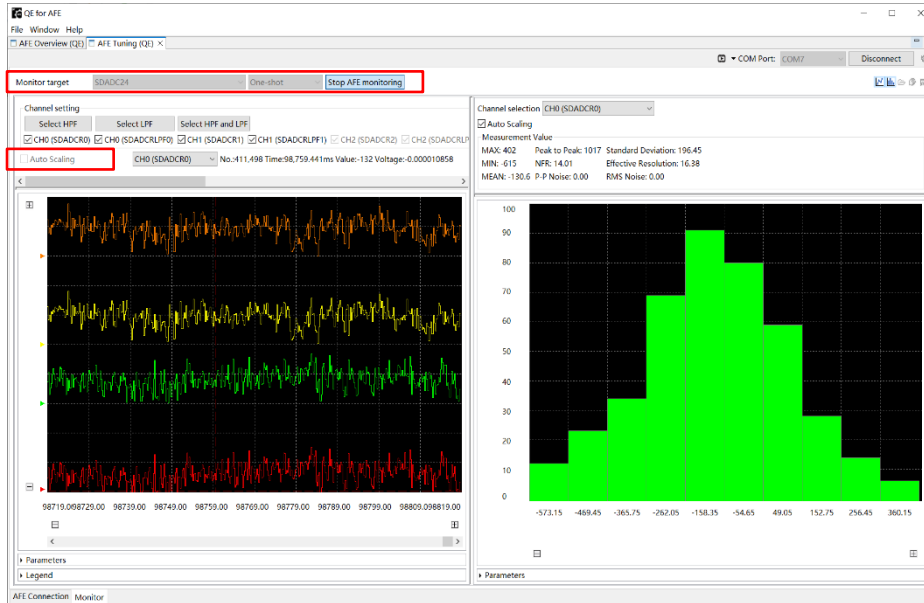


Figure 3-3 (a) “Auto scaling” option is disabled

- 2) The monitoring time is limited within 5 minutes. When the time is up, monitoring automatically stops and outputs a message in console view.



Figure 3-3 (b) Monitoring automatically stops

In some cases, the message “[Error] STOP command failed to execute.” is output in console view together. When you met this case, please click “Stop AFE monitoring” button manually.

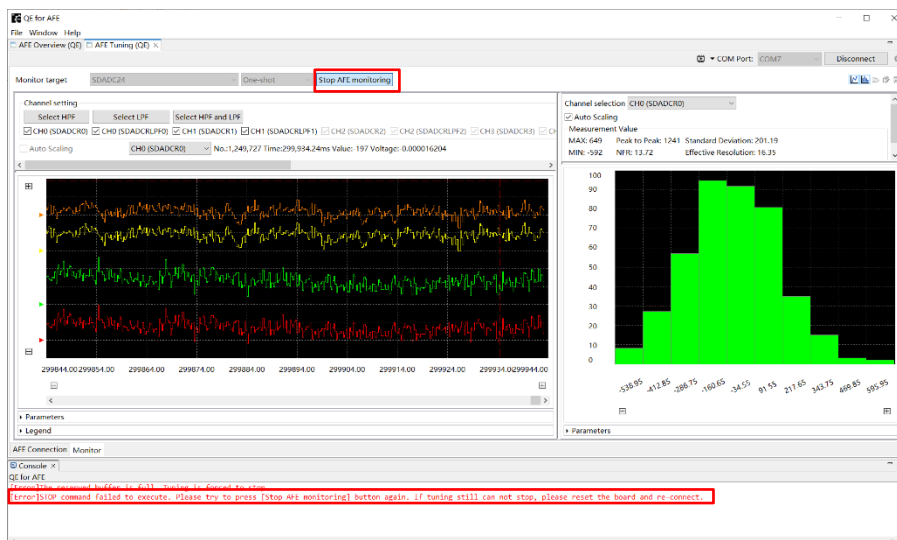


Figure 3-3 (c) Stop monitoring manually

## 3.2 Functional Restrictions

The following restrictions apply to QE for AFE V2.2.0. These restrictions will be solved in the next or future version.

**Table 3-2 List of Restrictions**

✓: Applicable, -: Not Applicable

No	Description	RA2A1	RX23E-B	RA2A2
1	Restrictions on showing a video about how to use QE AFE	-	✓	✓
2	Restrictions on ACMPLP configuration	✓	-	-
3	Restrictions on migration pin allocation to Smart Configurator	-	✓	-

### 3.2.1 Restrictions on showing a video about how to use QE AFE

The video is not ready for publish, so you can't open the video even if you press the video button.



**Figure 3-4 Video button**

[Workaround]

Please wait for the video content published.

### 3.2.2 Restrictions on ACMLP configuration

- “DAC8 channel 0 output” is selected as ACMLP0 input (refer to figure3-5 (1))
  - When switcher (A) selects Vref (refer to figure3-5 (A))
  - When ACMLP0 is disabled (refer to figure3-5 (D))
  - When switcher (B) selects IVREF0, switcher (C) selects Vref (refer to figure3-5 (B) and (C)) and ACMLP1 is enabled (figure3-5 (E) selects “Enable”)

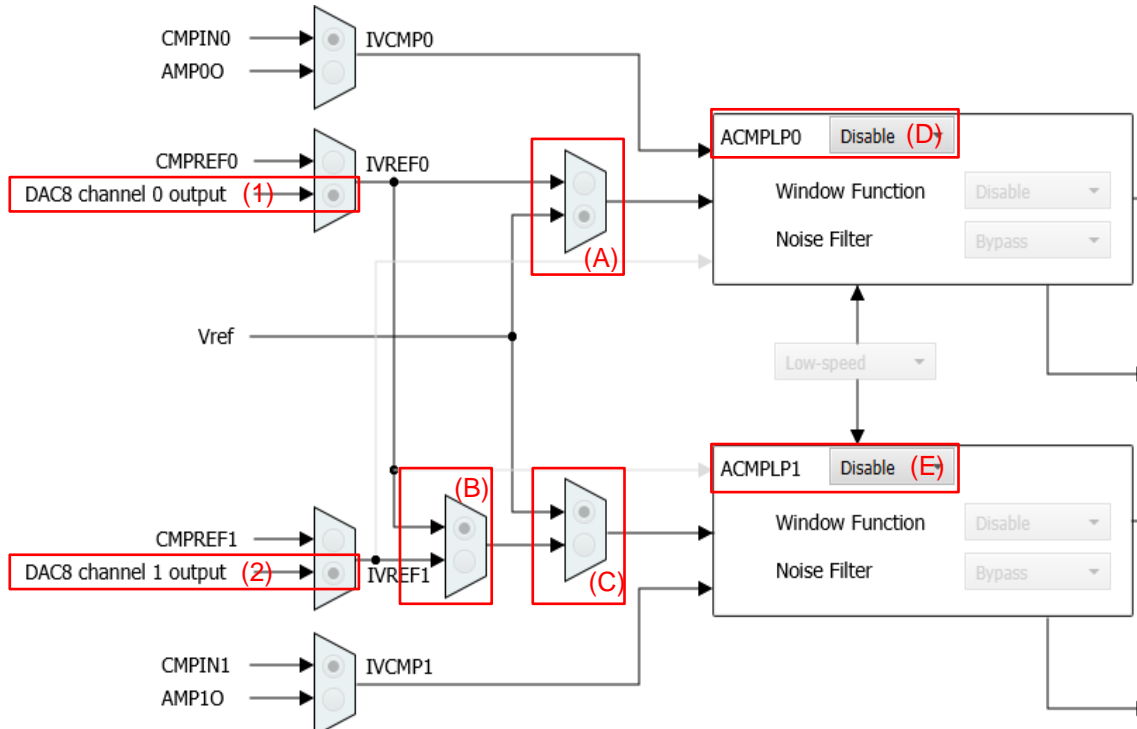


Figure 3-5 ACMLP1 example setting

Either of above ACMLP0 settings will cause the register value cannot be successfully written to the EK-RA2A1 board with the following 1) – 3) settings.

- 1) Set P013 as DA8\_0 function in DAC8 page (P013PFS = 0A018000)

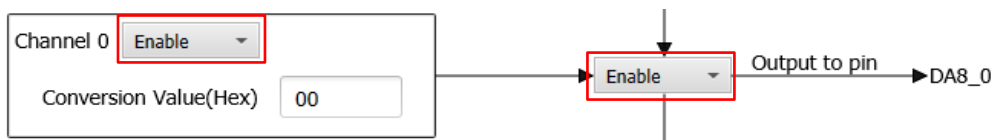


Figure 3-6 DA8\_0 example setting



2) Select DA8\_0 as OPAMP1 input in OPAMP page (AMP1PS = 80)

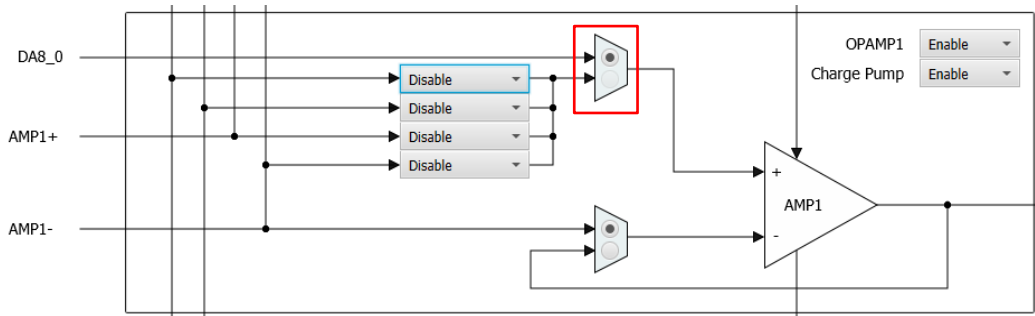


Figure 3-7 OPAMP example setting

3) Select "DAC8 channel 0 output" as input in ACMPHS page (CMPSEL1 = 08)

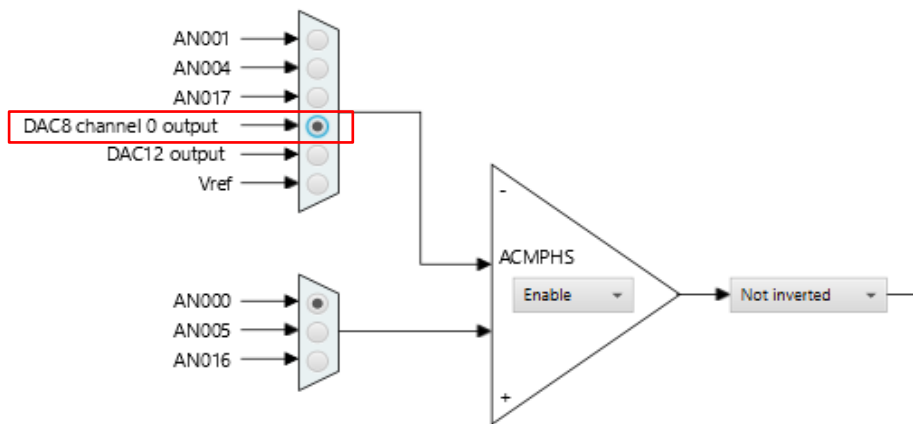


Figure 3-8 ACMPHS example setting

[Workaround]

In above ACMPLP0 setting, (1) setting is invalid. So please change (1) from "DAC8 channel 0 output" to "CMPREF0".

- "DAC8 channel 1 output" is selected as ACMPLP1 input (refer to figure3-5 (2))
  - When switcher (B) selects IVREF0 (refer to figure3-5 (B))
  - When switcher (C) selects Vref (refer to figure3-5 (C))
  - When ACMPLP1 is disabled (refer to figure3-5 (E))

Either of above ACMPLP1 settings will cause the same limitations 1) and 2) as selecting" DAC8 channel 0 output "above.

[Workaround]

In above ACMPLP1 setting, (2) setting is invalid. So please change (2) from "DAC8 channel 1 output" to "CMPREF1".

### 3.2.3 Restrictions on migration pin allocation to Smart Configurator

When reflecting AFE setting to Smart Configurator, in certain case, the pin allocation in QE for AFE might be lost in Smart Configurator [Pin] > [Pin Functions] setting.

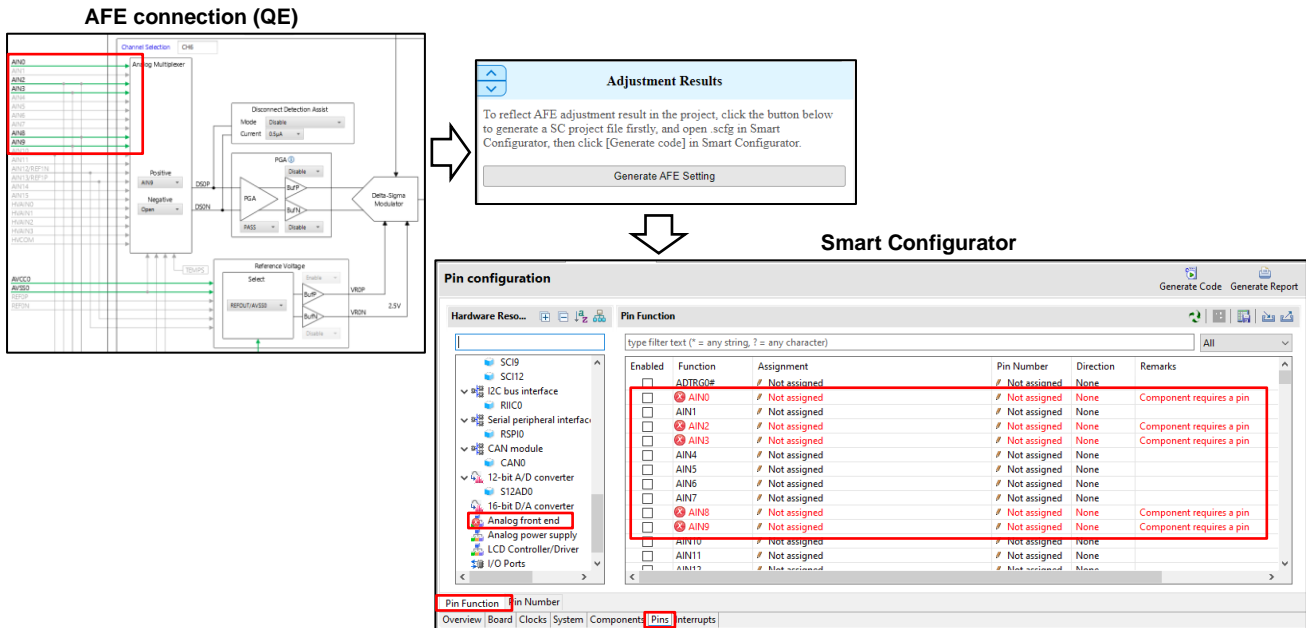


Figure 3-9 Missing pin allocation

[Workaround]

After “Generate AFE Setting” operation, please open Smart Configurator [Pin] > [Pin Functions] and check. If the AFE module on the left tree display an error, then manually select the pins on the right table according to QE for AFE setting.

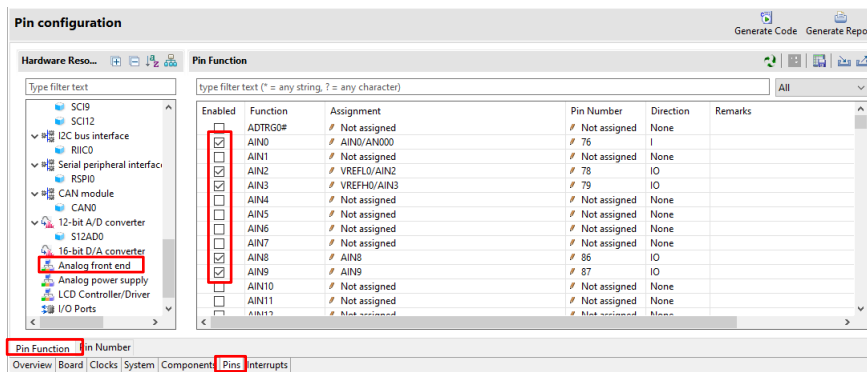


Figure 3-10 Select the pins manually

**Revision History**

Rev.	Date	Description	
		Page	Summary
1.00	Mar.14.24	-	First edition issued.

## General Precautions in the Handling of Microprocessing Unit and Microcontroller Unit Products

The following usage notes are applicable to all Microprocessing unit and Microcontroller unit products from Renesas. For detailed usage notes on the products covered by this document, refer to the relevant sections of the document as well as any technical updates that have been issued for the products.

### 1. Precaution against Electrostatic Discharge (ESD)

A strong electrical field, when exposed to a CMOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop the generation of static electricity as much as possible, and quickly dissipate it when it occurs. Environmental control must be adequate. When it is dry, a humidifier should be used. This is recommended to avoid using insulators that can easily build up static electricity.

Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors must be grounded. The operator must also be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions must be taken for printed circuit boards with mounted semiconductor devices.

### 2. Processing at power-on

The state of the product is undefined at the time when power is supplied. The states of internal circuits in the LSI are indeterminate and the states of register settings and pins are undefined at the time when power is supplied. In a finished product where the reset signal is applied to the external reset pin, the states of pins are not guaranteed from the time when power is supplied until the reset process is completed. In a similar way, the states of pins in a product that is reset by an on-chip power-on reset function are not guaranteed from the time when power is supplied until the power reaches the level at which resetting is specified.

### 3. Input of signal during power-off state

Do not input signals or an I/O pull-up power supply while the device is powered off. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements. Follow the guideline for input signal during power-off state as described in your product documentation.

### 4. Handling of unused pins

Handle unused pins in accordance with the directions given under handling of unused pins in the manual. The input pins of CMOS products are generally in the high-impedance state. In operation with an unused pin in the open-circuit state, extra electromagnetic noise is induced in the vicinity of the LSI, an associated shoot-through current flows internally, and malfunctions occur due to the false recognition of the pin state as an input signal become possible.

### 5. Clock signals

After applying a reset, only release the reset line after the operating clock signal becomes stable. When switching the clock signal during program execution, wait until the target clock signal is stabilized. When the clock signal is generated with an external resonator or from an external oscillator during a reset, ensure that the reset line is only released after full stabilization of the clock signal. Additionally, when switching to a clock signal produced with an external resonator or by an external oscillator while program execution is in progress, wait until the target clock signal is stable.

### 6. Voltage application waveform at input pin

Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between  $V_{IL}$  (Max.) and  $V_{IH}$  (Min.) due to noise, for example, the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between  $V_{IL}$  (Max.) and  $V_{IH}$  (Min.).

### 7. Prohibition of access to reserved addresses

Access to reserved addresses is prohibited. The reserved addresses are provided for possible future expansion of functions. Do not access these addresses as the correct operation of the LSI is not guaranteed.

### 8. Differences between products

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