

QE for AFE[RA] V1.1.0

Release Note

Thank you very much for using the QE for AFE[RA] V1.1.0.

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

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1. About QE for AFE

1.1 Summary

QE for AFE[RA] 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 register into evaluation board and monitor the AFE tuning results in a waveform.

QE for AFE[RA] is a standalone version tool (.exe) running on local PC. To use this tool, you firstly need an evaluation board. QE for AFE[RA] communicates with the evaluation board by a USB cable connecting between PC and board.

1.2 Functions

The main functions are listed below:

1. Connect and operate the evaluation board
2. Set AFE related registers with GUI
3. Display graphics of the AFE tuning results and digital filter frequency response

1.3 New Functions

1.3.1 Support dynamical connection diagram on the [AFE Connection] tab

From QE for AFE[RA] V1.1.0, the connection diagram on the [AFE Connection] tab can display pins/lines connection dynamically according to AFE registers setting. If any AFE IP is enabled and the pin is used, the connection can be highlight on this diagram.

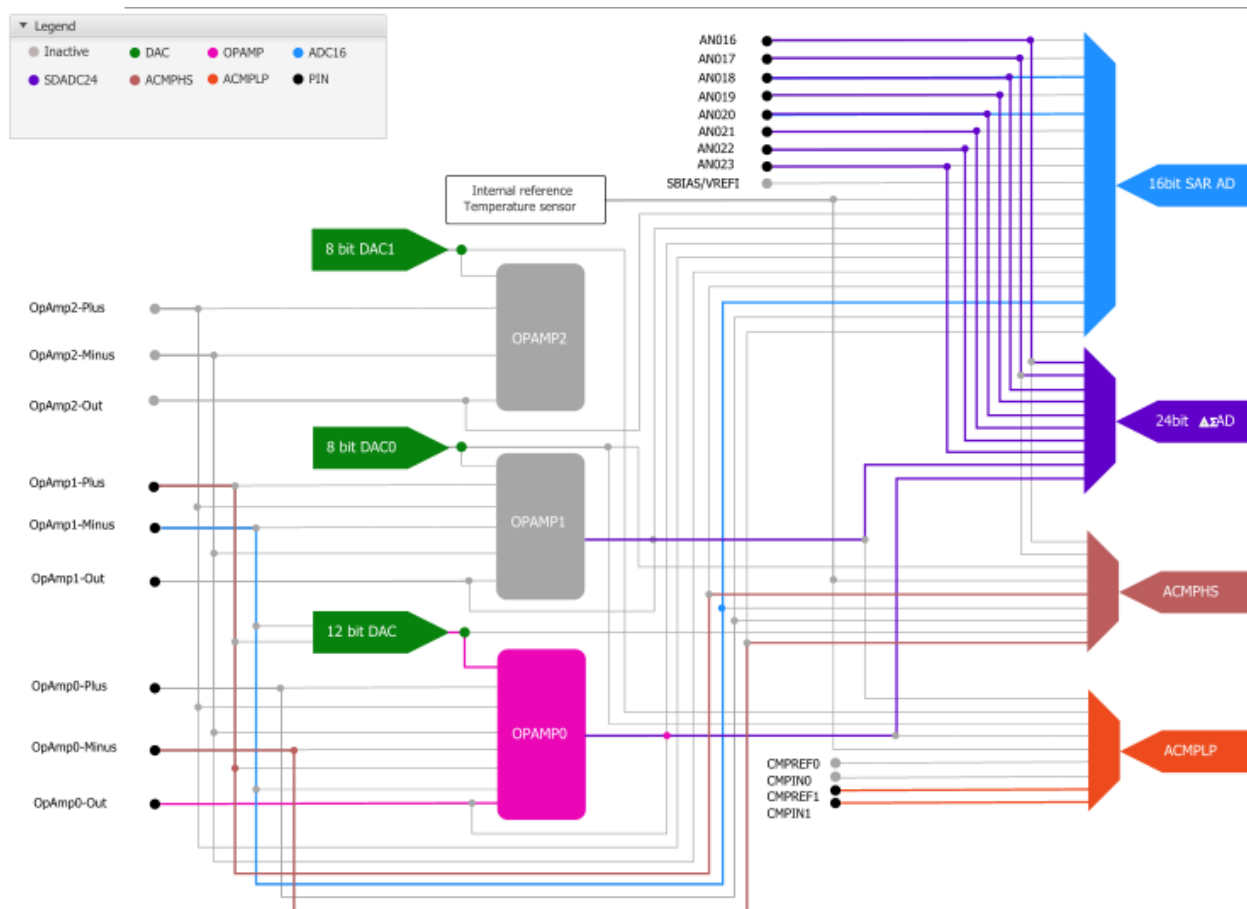


Figure 1-1. Dynamical connection diagram

1.3.2 Support new AFE peripherals

From QE for AFE[RA] V1.1.0, ACMPHS and ACMPLP are supported newly.

1.3.3 Support AVCC0 voltage setting

From QE for AFE[RA] V1.1.0, AVCC0 voltage setting is put on the top bar of the [AFE Connection] tab. Before connection with evaluation board, users can select a AVCC0 voltage. The voltage setting can be set to FW when clicking "connect" button, then user can't change it before disconnection.

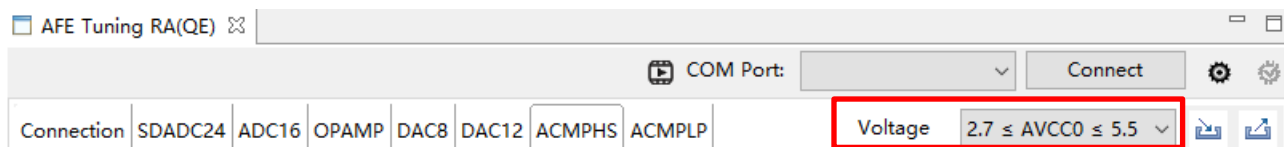


Figure 1-2. AVCC0 voltage setting

1.3.4 Support ACMPHS, ACMPLP0, ACMPLP1 monitor function

From QE for AFE[RA] V1.1.0, user can select ADC16 temperature sensor output, ADC16 internal reference voltage, ACMPHS and ACMPLP as Monitor target on [Monitor] tab.

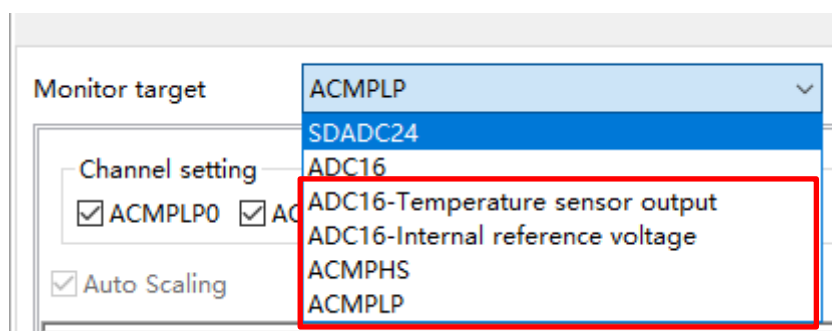


Figure 1-3. Monitor target selection

1.3.5 Support to show a video about how to use QE AFE

From QE for AFE[RA] V1.1.0, a new button is added on toolbar. By clicking this button, a video about how to use QE AFE will be open in browser.



Figure 1-4. Video button

1.3.6 Support mode selection for ADC16 monitor function

From QE for AFE[RA] V1.1.0, user can select two monitor mode for ADC16: One-shot mode and Auto mode on [Monitor] tab.

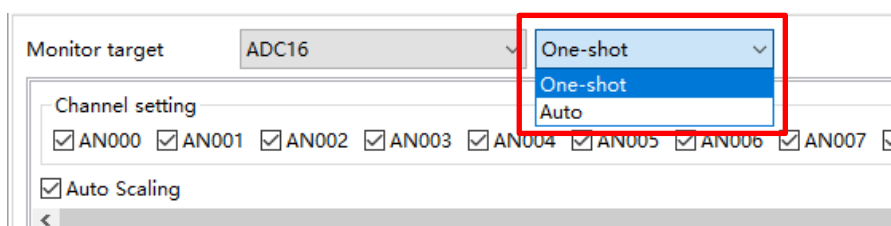


Figure 1-5. ADC16 monitor mode selection

Using One-shot mode, QE for AFE tool gets data from EK-RA2A1 board until the board communication buffer is full and stops drawing AFE tuning waveform.

Using Auto mode, QE for AFE tool resumes acquiring the data and drawing AFE tuning waveform after the EK-RA2A1 board communication buffer is full. However, if the ADC16 temperature sensor output, ADC16 internal reference voltage is selected, it will not resume

1.3.7 Support pin register setting

From QE for AFE[RA] V1.1.0, pin setting is added on ADC16, OPAMP, DAC8, DAC12, ACPHPS, ACPPLP tab page.

1.3.8 Improve DAC12, DAC8, OPAMP configuration diagram

From QE for AFE[RA] V1.1.0, DAC12, DAC8, OPAMP diagrams are configurable. The registers value is set according to the setting on diagrams automatically. User doesn't input register value by his own anymore.

1.3.9 Improve channel display on [Monitor] tab

From QE for AFE[RA] V1.1.0, on [Monitor] tab, the channel setting displays the input pin name instead of channel number, so that user can know well which pin is monitoring.

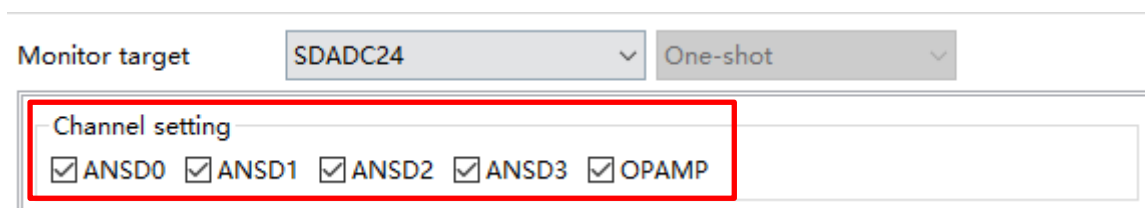


Figure 1-6. Channel setting

1.3.10 Improve SPS display on [Monitor] tab

From QE for AFE[RA] V1.1.0, the SPS value is moved from "Channel setting" area to "Parameters" setting area.

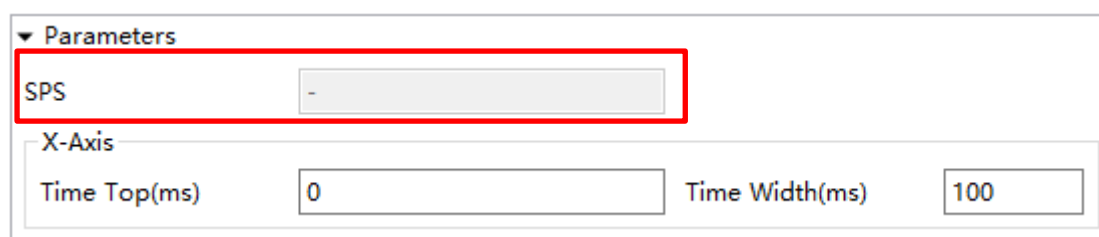


Figure 1-7. SPS setting

1.3.11 Improve clock setting for SDADC24 and ADC16

From QE for AFE[RA] V1.1.0, QE tool read the following clock from firmware and reflect them on SDADC24 and ADC16 diagrams. User can't change these clocks.

- SDADCCLK on SDADC24

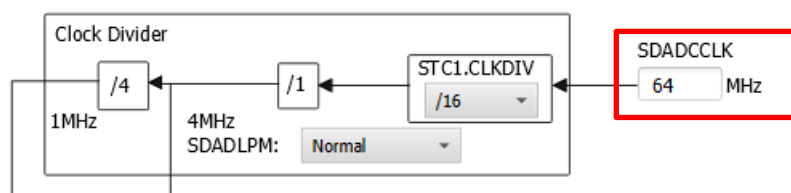


Figure 1-8. Display SDADCCLK on SDADC24

- PCLK and PCLD on ADC16

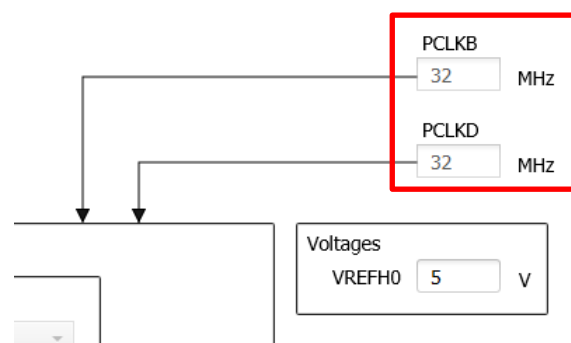


Figure 1-9. Display PCLK and PCLD on ADC16

1.3.12 Improve information displayed on [Connect setting] dialog

From QE for AFE[RA] V1.1.0, for UART connection, the maximum bitrate value can be displayed on [Connect setting] dialog, and the dialog doesn't accept bitrate input that exceed the maximum value. So that the user can set the correct bitrate easily.

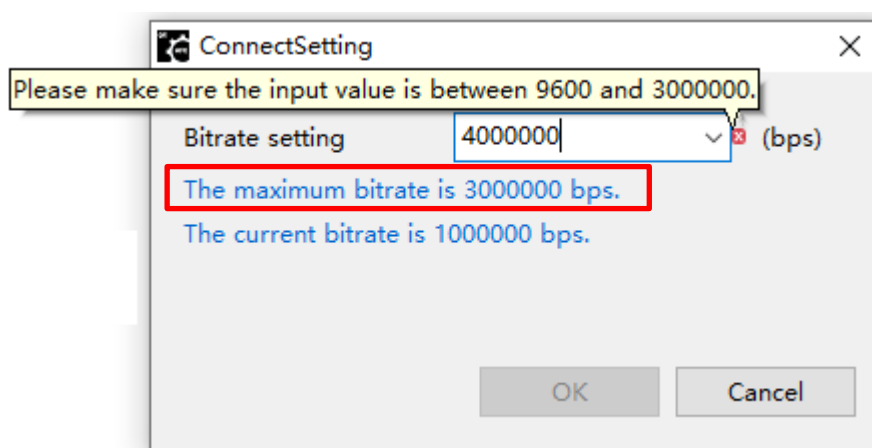


Figure 1-10. Bitrate setting dialog

1.3.13 Fix waveform display issue when AN022, AN023 and SBIAS/VREFI are selected in ADC16

When monitoring ADC16 and specifying AN022, AN023 and SBIAS/VREFI as ADC16 input, the waveform can't show.

This issue has been fixed from QE for AFE[RA] V1.1.0.

1.3.14 Fix waveform display issue when ADC16 conversion with high speed settings

When specifying lower sampling time on ADC16 setting, the waveform monitor of the ADC16 conversion results can't work.

This issue has been fixed from QE for AFE[RA] V1.1.0.

1.4 Supported Environment

- Host PC: Windows10 (64 bit)
- Evaluation board: EK-RA2A1
- Sample project: The sample project attached in the application note (RA2A1 Groupe Board Control Program for "QE for AFE": R01AN5795EJ0140) must be loaded by e2 studio and run on the evaluation board. Please refer to the application note for details.

1.5 Supported Microcontrollers

- RA Family (only MCUs that incorporate the AFE)
 - RA2A Series: RA2A1

2. Installation and Uninstallation

2.1 Installing This Product

QE for AFE[RA] is provided as a compressed package (.zip). Follow the procedure below to use this product:

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 "\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".

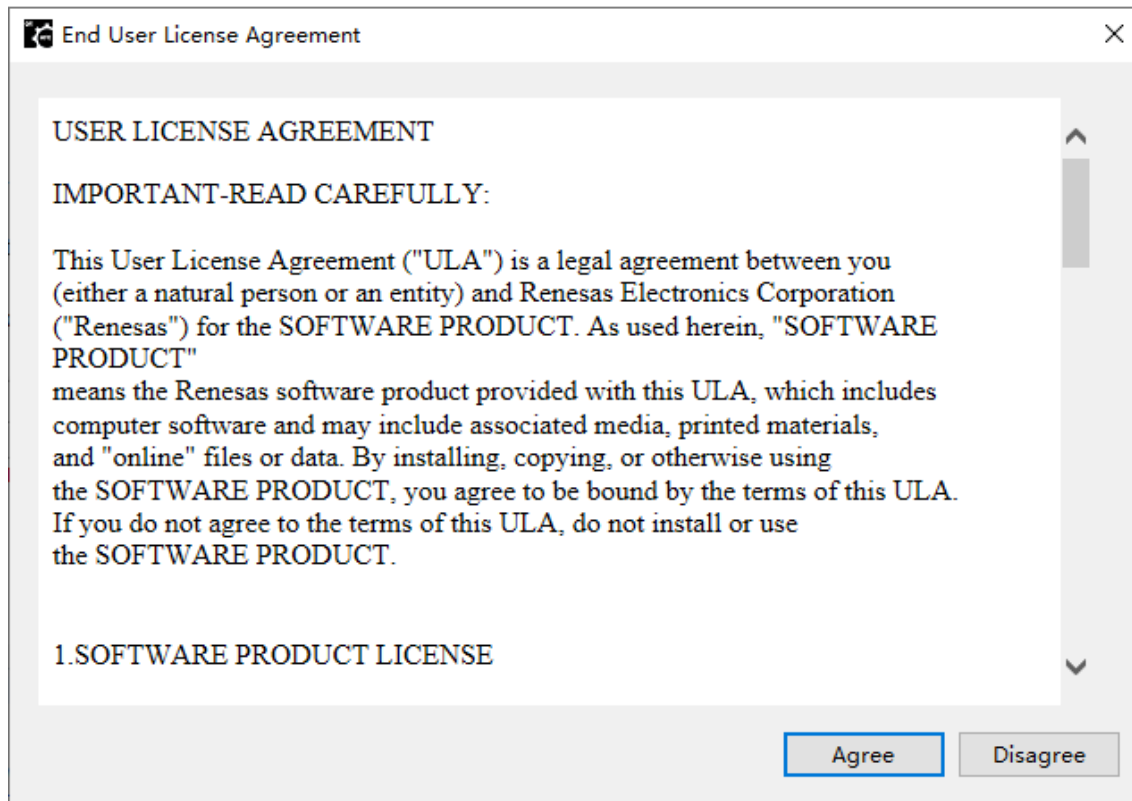


Figure 2-1. License agreement dialog

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

Delete the entire folder in which .zip package is extracted.

3. Notes / Restrictions

3.1 Usage Considerations

Please pay attention to the following items.

3.1.1 Notes on configuring SDADC24 and ADC16

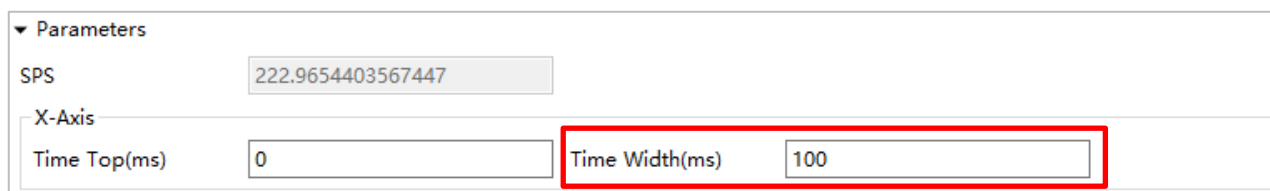
Because SDADC24 and ADC16 source clock is got from firmware on the evaluation board, please connect with evaluation board before configuring SDADC24 and ADC16.

3.1.2 Notes on Tuning Time on [Monitor] Tab

When tuning on [Monitor] tab, QE for AFE obtains the AFE tuning results from the evaluation board. If the tuning time is very long, too much data will lead to the host PC memory overflow. So, QE for AFE supports tuning time no more than 1 hour. If tuning operates for more than 1 hour, the tool will stop tuning automatically and output a message to inform user that the tuning time can't exceed 1 hour.

3.1.3 Notes on X-Axis Time Width setting on [Monitor] Tab

To display a waveform by clicking "Read AFE tuning data from file", X-Axis Time Width setting should not be too large. As a recommendation, X-Axis Time Width should be set no more than 10s with maximum SPS 15625.



The screenshot shows the 'Parameters' section of the QE for AFE GUI. Under 'Parameters', the 'SPS' value is 222.9654403567447. Under the 'X-Axis' section, there are two input fields: 'Time Top(ms)' with a value of 0, and 'Time Width(ms)' with a value of 100. The 'Time Width(ms)' field is highlighted with a red rectangle.

Figure 3-1 X-Axis Time Width setting

3.1.4 Notes on clicking [Write Value to The Target Board] button after configuring one AFE component setting

It is recommended to click [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 firmware will check the validity of the register value basing on the 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 value to the evaluation board.

3.1.5 Notes on Tuning ADC16 on [Monitor] Tab

ADC16 tuning waveform is depending on ADC16 sampling time setting:

- If ADC16 sampling time is small, QE for AFE gets ADC16 conversion result from the evaluation board and draw monitor waveform by the follow procedures:
 - 1) After user click "Start AFE Tuning" button on [Monitor] Tab in QE for AFE, ADC16 starts conversion on evaluation board.
 - 2) On evaluation board, when the A/D conversion result buffer is full, the sample project stops ADC16 conversion and send response to QE for AFE.
 - 3) QE for AFE starts to read data from evaluation board until the result buffer is empty and start to draw waveform using these data.
 - 4) QE for AFE restart ADC16 conversion, the procedure goes to 2)

Above 2) to 4) is internal communication between QE for AFE and sample project.

If "One-shot" mode is select, 2) to 4) execute only once. If "Auto" mode is selected, 2) to 4) will continue until user click "Stop AFE Tuning" button.

- If ADC16 sampling time and the bitrate are set to the specified values, which can be found in the application note (RA2A1 Groupe Board Control Program for “QE for AFE”: R01AN5795EJ0140).”, QE for AFE gets ADC16 conversion result from the evaluation board and draw monitor waveform by the follow procedures:

- 1) After user click “Start AFE Tuning” button on [Monitor] Tab in QE for AFE, ADC16 starts conversion on evaluation board.
- 2) QE for AFE reads data from evaluation board and draws the waveform continuously.
- 3) Until user clicks “Stop AFE Tuning” button, the tuning is stopped, and the waveform stops.

Selecting either “One-shot” or “Auto” mode, 1) to 3) always execute.

3.1.6 Notes on closing [AFE Tuning RA(QE)] view

Please don't close [AFE Tuning RA(QE)] view while performing monitor. If [AFE Tuning RA(QE)] view is closed by accident, after re-open it, the monitoring waveform cannot be restored.

Please perform the following procedure to restore operation:

- Click [Disconnect] button.
- Reset the EK-RA2A1 board.
- Click [Connect] button.

3.1.7 Notes on UART connection after evaluation board reset

After reset of the evaluation board, please set bitrate as 1,000,000 bps (default bitrate) in the [ConnectSetting] dialog, then click “connect” button to set up connection.

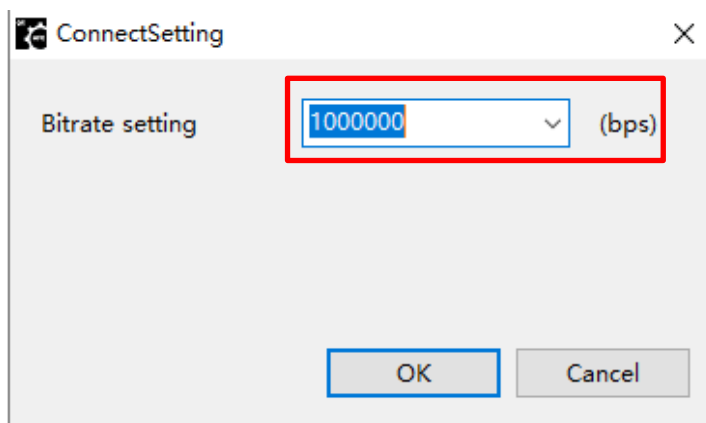


Figure 3-2 Bitrate setting

3.2 Functional Restrictions

The following restrictions apply to QE for AFE[RA] V1.1.0. These restrictions will be solved in next or future version.

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

If the video content isn't ready, you can't open the video for QE for AFE even if you press this button. After the video is published, you will be able to open it.



Figure 3-3 Video button

[Workaround]

Please wait to publish video content.

3.2.2 Restrictions on ACMPLP configuration.

- “DAC8 channel 0 output” is selected as ACMPLP0 input (refer to figure3-4 (1))
 - When switcher (A) selects Vref (refer to figure3-4 (A))
 - When ACMPLP0 is disabled (refer to figure3-4 (D))
 - When switcher (B) selects IVREF0, switcher (C) selects Vref (refer to figure3-4 (B) and (C)) and ACMPLP1 is enabled (figure3-4 (E) selects “Enable”)

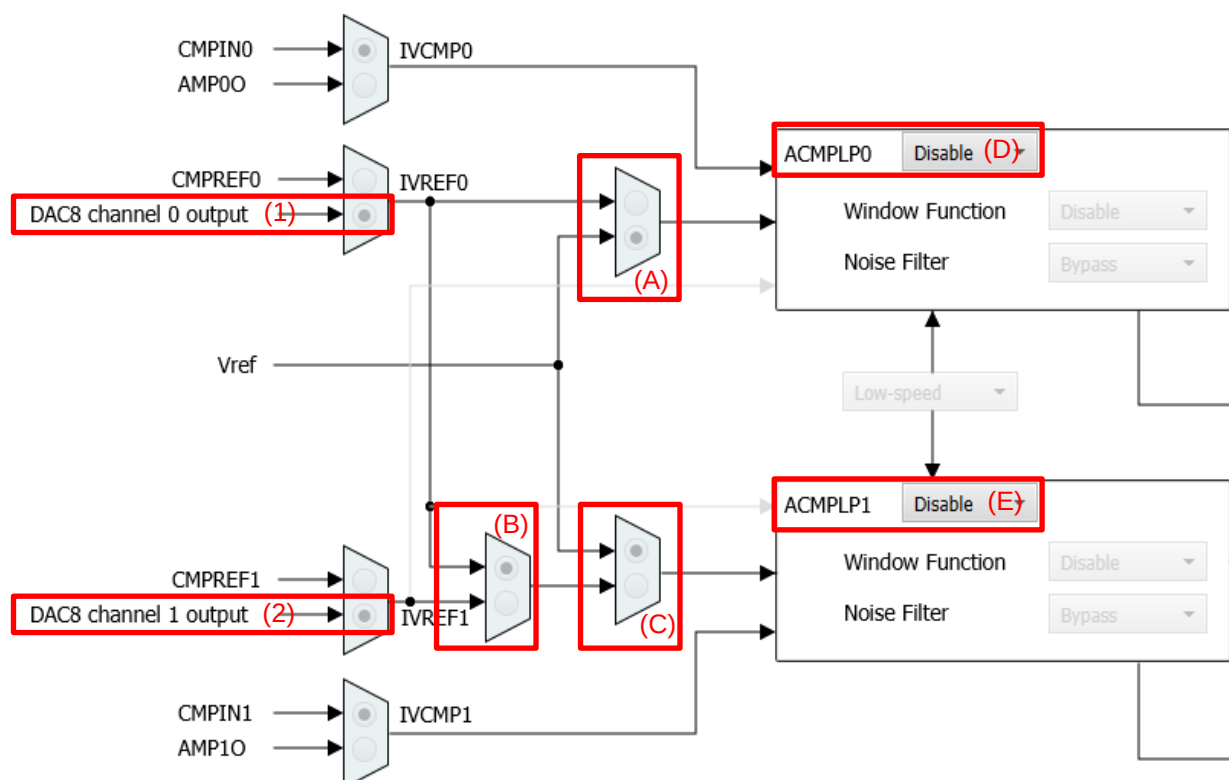


Figure 3-4 ACMPLP1 example setting

Either of above ACMPLP0 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 can't be write to test board successfully

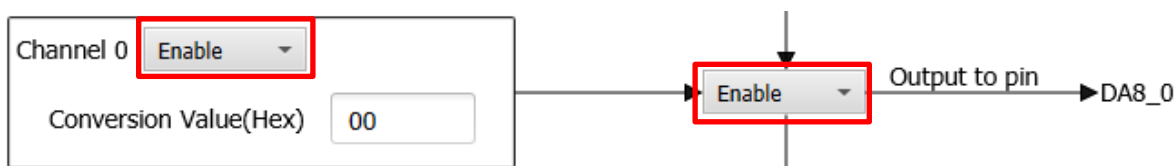


Figure 3-5 DA8_0 example setting

- 2) Select DA8_0 as OPAMP1 input in OPAMP page, AMP1PS = 80 can't be write to test board successfully.

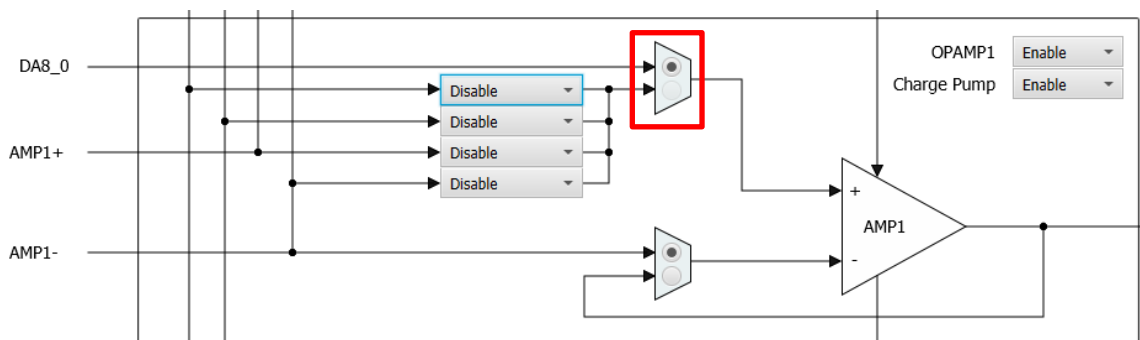


Figure 3-6 OPAMP example setting

- 3) Select IVREF3 as ACMPHS input in ACMPHS page, CMPSEL1 = 08 can't be write to test board successfully.

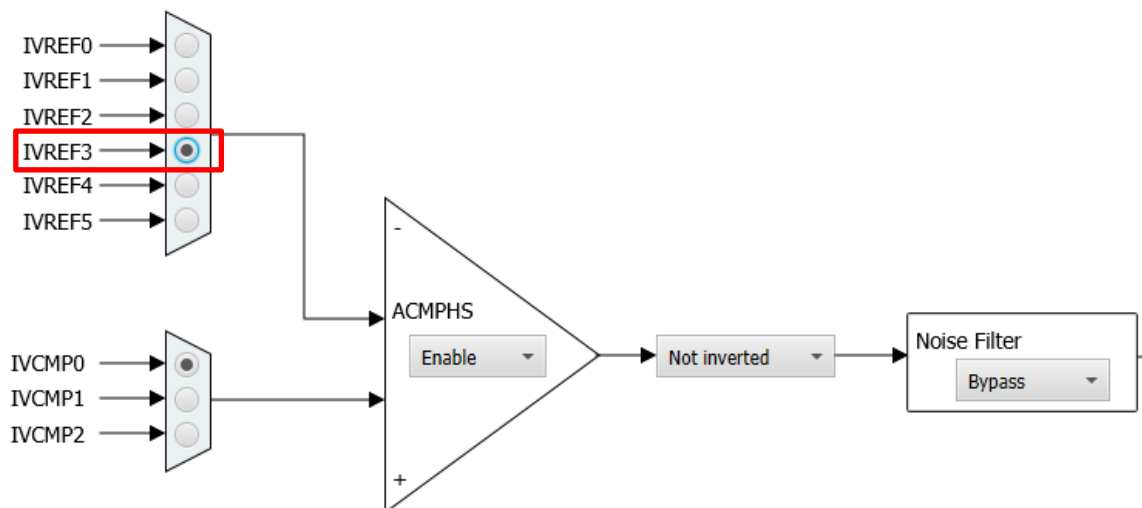


Figure 3-7 ACMPHS example setting

[Workaround]

In above ACMPPLP0 setting, (1) setting is invalid. So please change (1) from "DAC8 channel 0 output" to "CMPREF0".

- "DAC8 channel 1 output" is selected as ACMPPLP1 input (refer to figure3-4 (2))

- When switcher (B) selects IVREF0 (refer to figure3-4 (B))
- When switcher (C) selects Vref (refer to figure3-4 (C))

- When ACMPLP1 is disabled (refer to figure3-4 (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 abnormal phenomena in AFE tuning operation

When the following abnormal phenomena occur, it indicates that the data got from evaluation board has some errors under the current AFE configuration.

- (1) After a period of tuning operation, the waveform stops without any error message output in [Console] view.
- (2) User clicks "Stop AFE Tuning" button, then the waveform seems stopped but an error message output in [Console] view as the following image.

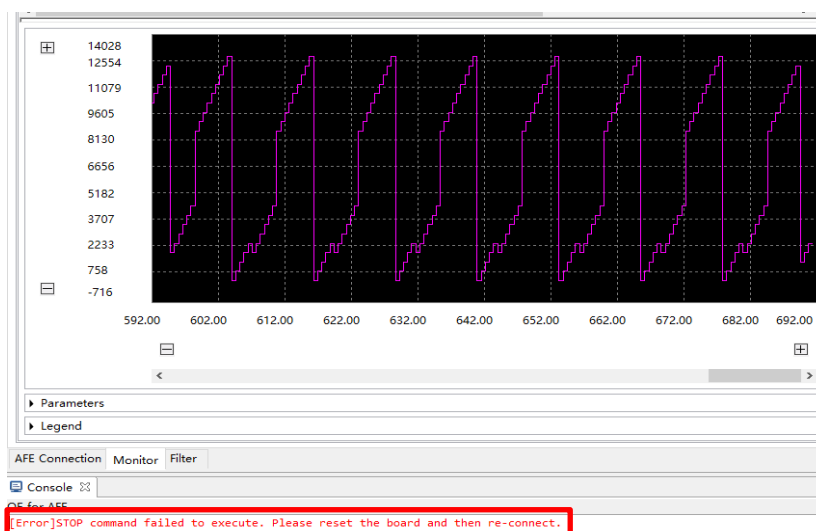


Figure 3-8 "Stop AFE Tuning" error message

- (3) User clicks “Start AFE Tuning” button, then the tuning seems work correctly but an error message output in [Console] view as the following image

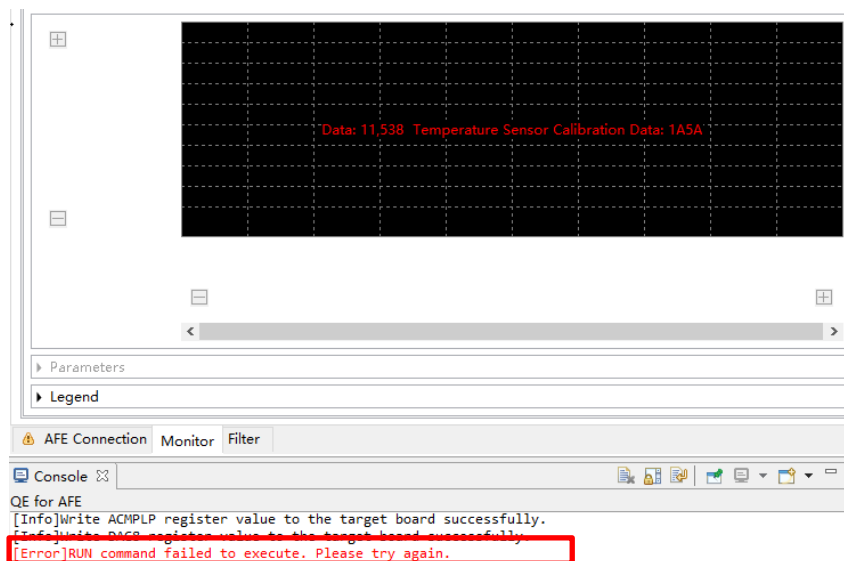


Figure 3-9 “Start AFE Tuning” error message

[Workaround]

There is no workaround. Sample project will fix this issue in future.

It is known that the following configurations may occur above abnormal phenomena, so please take care to avoid these configurations.

➤ When tuning SDADC24

- Using USB connection

Set PGACn.PGAOSR value as 64, 128 or 256 on [Filter] page (refer to the left on figure 3-10) and select single channel enabled (refer to the right on figure 3-10)

- Using UART connection

Set PGACn.PGAOSR value as 64 on [Filter] page (refer to the left on figure 3-10) and select single channel enabled (refer to the right on figure 3-10)

The abnormal phenomena (1) may be seen in a few minutes.

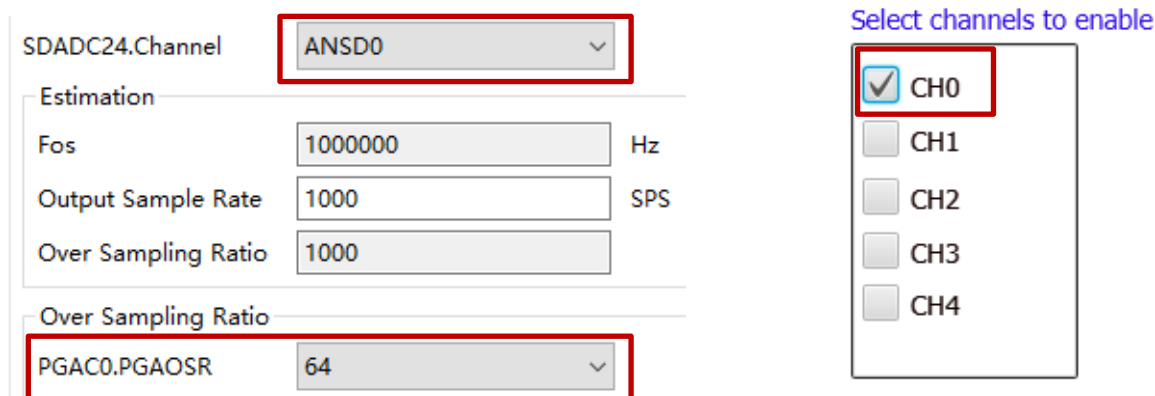


Figure 3-10 Filter (left) and SDADC24 (right) configuration

- When tuning ADC16: PCLKB frequency is 8MHz (refer to the left on figure 3-11) and the sampling time is set as a large value (refer to the right on figure 3-11)
 - Set single channel using ADC16 conversion and response sending
The abnormal phenomena (1) may be seen in a few minutes.
 - Set multiple channels using ADC16 conversion and response sending
The abnormal phenomena (2) may be seen.

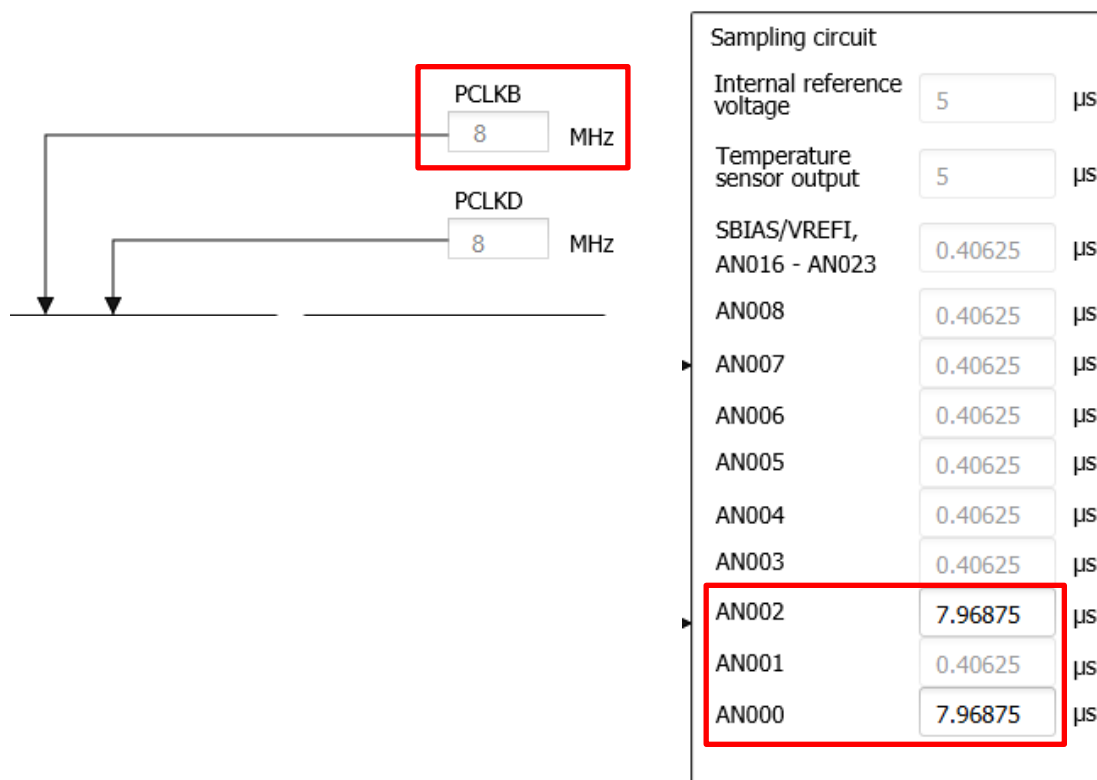


Figure 3-11 PCLKB (left) and ADC16 sampling time (right) configuration

- When tuning temperature sensor output or internal reference voltage (refer to the top on figure 3-12)
 - Clicking “Start AFE Tuning” button (refer to the bottom on figure 3-12), the abnormal phenomena (3) might be seen.

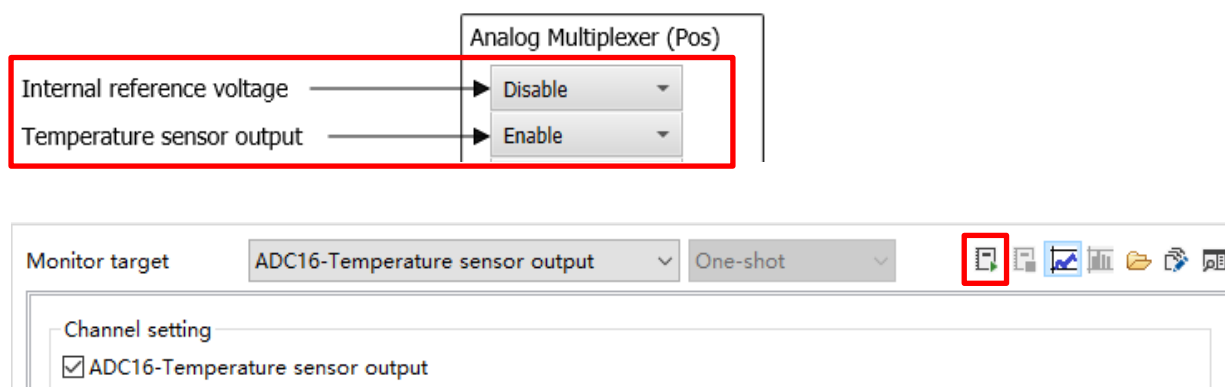


Figure 3-12 Temperature sensor output or internal reference voltage configuration (top) and “Start AFE Tuning” button (bottom)

Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Aug.20.21	-	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

Before changing from one product to another, for example to a product with a different part number, confirm that the change will not lead to problems. The characteristics of a microprocessing unit or microcontroller unit products in the same group but having a different part number might differ in terms of internal memory capacity, layout pattern, and other factors, which can affect the ranges of electrical characteristics, such as characteristic values, operating margins, immunity to noise, and amount of radiated noise. When changing to a product with a different part number, implement a system-evaluation test for the given product.

Notice

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4. You shall be responsible for determining what licenses are required from any third parties, and obtaining such licenses for the lawful import, export, manufacture, sales, utilization, distribution or other disposal of any products incorporating Renesas Electronics products, if required.
5. You shall not alter, modify, copy, or reverse engineer any Renesas Electronics product, whether in whole or in part. Renesas Electronics disclaims any and all liability for any losses or damages incurred by you or third parties arising from such alteration, modification, copying or reverse engineering.
6. Renesas Electronics products are classified according to the following two quality grades: "Standard" and "High Quality". The intended applications for each Renesas Electronics product depends on the product's quality grade, as indicated below.

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Corporate Headquarters

TOYOSU FORESIA, 3-2-24 Toyosu,
Koto-ku, Tokyo 135-0061, Japan
www.renesas.com

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