

RL78/G23

Sensor BME280 Sample Sketch (Arduino™ sketch)

Introduction

This application note explains how to display the values obtained from the BME280 temperature, humidity, and barometric pressure sensor on an LCD module using the Arduino library for the RL78/G23-64p Fast Prototyping Board (FPB).

Target Device

Board	: RL78/G23-64p Fast Prototyping Board
Sensor	: Grove-Barometer_Sensor-BME280
LCD module	: EMB-LCD-1602A

Trademarks

Arduino is a trademark of Arduino SA.

Grove is a trademark of Seeed Studio.

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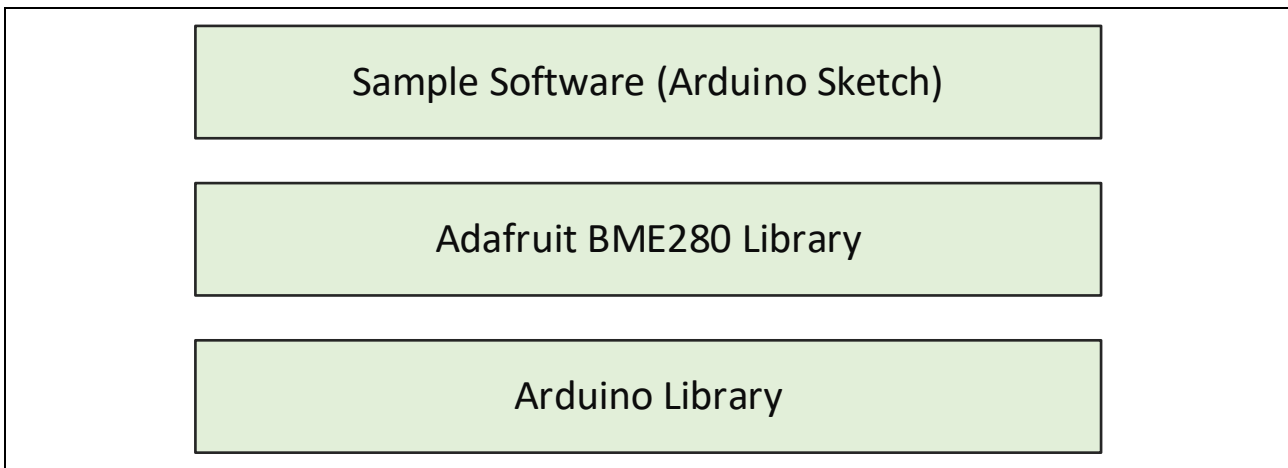
1. System Overview

This system consists of a RL78/G23-64p Fast Prototyping Board (FPB), a BME280 temperature, humidity, and barometric pressure sensor (hereafter, "BME280") and an LCD module. The Arduino™ IDE is used for program development and writing. In addition to the Arduino Library, the Adafruit BME280 library is used to control the BME280.

In this system, the temperature (°C), humidity (%), and barometric pressure (hPa) data obtained from the BME280 are displayed on an LCD module. After the board is powered on, the system checks whether the sensor is properly connected. If the connection is normal, the data will be shown on the LCD module after one second.

The block structure of the sample sketch used in this system is shown in Figure 1-1.

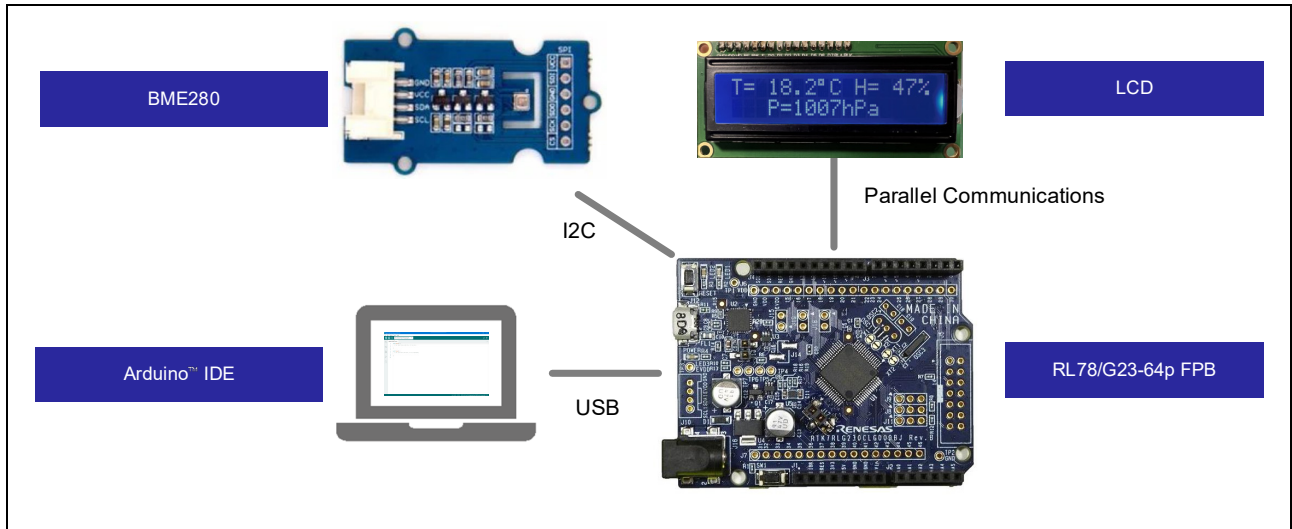
Figure 1-1 Software Block Diagram



1.1 Module Used

The system configuration diagram is shown in Figure 1-2.

Figure 1-2 System Configuration

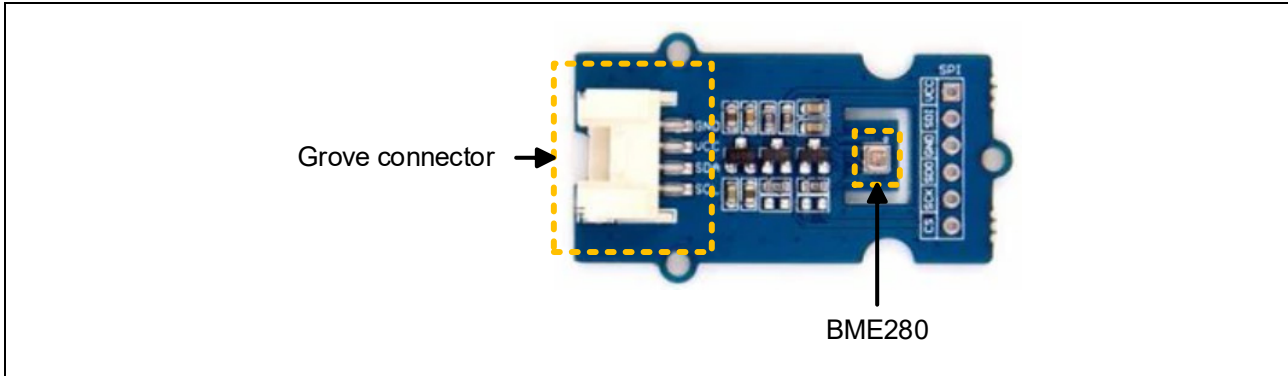


1.1.1 BME280 Temperature, Humidity & Pressure Sensor

The BME280 is a compact sensor capable of measuring temperature, humidity, and barometric pressure. It supports communication via I²C or SPI, making it easy to interface with microcontrollers such as Arduino. In this system, the sensor is connected using the I²C communication protocol.

The Grove-type BME280 used in this system is shown in Figure 1-3.

Figure 1-3 Grove-type BME280



1.1.2 LCD module

This is a display used for showing characters, numbers, and symbols. In this system, an LCD module equipped with the HD44780-compatible 1602A LCD driver is used, allowing for a display of 16 characters × 2 lines. This LCD module supports a parallel communication interface, and it is controlled via parallel communication using the Arduino LiquidCrystal library.

The LCD module used in this system is shown in Figure 1-4.

Figure 1-4 LCD module

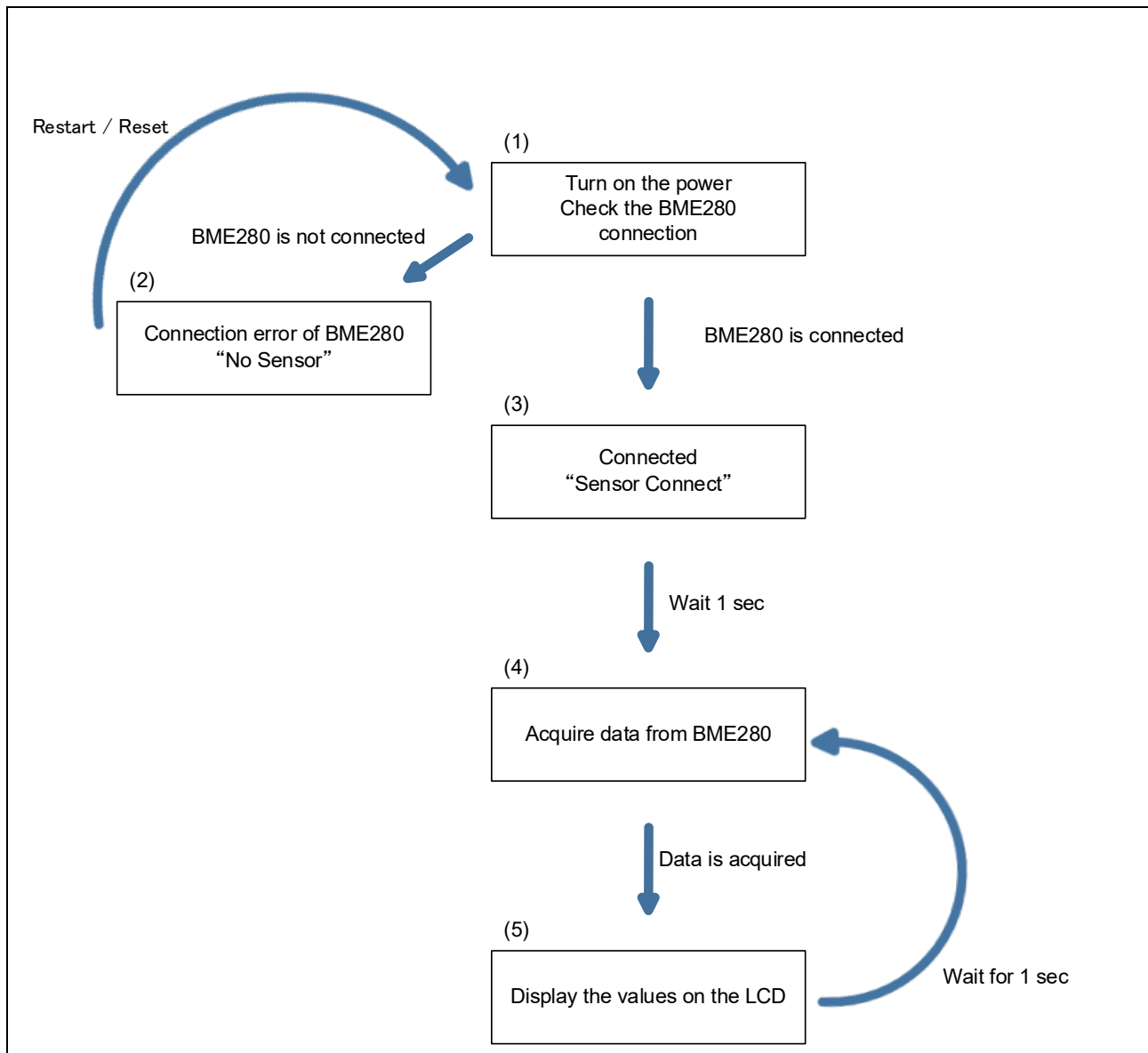


1.2 Operation Overview

Figure 1-5 shows an overview of the operation.

- (1) After power is turned on, check if the sensor is connected.
- (2) If the sensor is not connected, "No sensor" is displayed on the LCD module.
Restart or press the reset switch to return to (1).
- (3) If the sensor is connected, "Sensor Connect" is displayed on the LCD module for 1 second.
- (4) Acquire sensor information.
- (5) After displaying the acquired values on the LCD module, wait 1 second and return to (4).

Figure 1-5 Operation overview



2. Operation Confirmation Conditions

The operation check environment of this system is as follows.

Table 2-1 Operation Confirmation Conditions (Hardware)

Item	Description
Board	RL78/G23-64p Fast Prototyping Board – RTK7RLG230CLG000BJ
Wireless module	Grove - BME280
Temperature and Humidity sensor	EMB-LCD-1602A
Operating voltage	5V

Table 2-2 Operation Confirmation Conditions (Software)

Item	Description	Version
OS	Windows 11	-
Integrated development environment (IDE)	Arduino™ IDE	2.3.6
Library	RL78/G23-64p FPB Library	2.6.0

3. Build Development Environment

How to connect boards and how to set up the Arduino™ IDE are explained.

This system uses Arduino™ IDE 2.3.6. If you have not installed Arduino™ IDE 2.3.6 or later, please install it.

<https://www.arduino.cc/en/software>

3.1 Board Connection

Figure 3-1 shows the connection between the evaluation board, the BME280, and the LCD module.

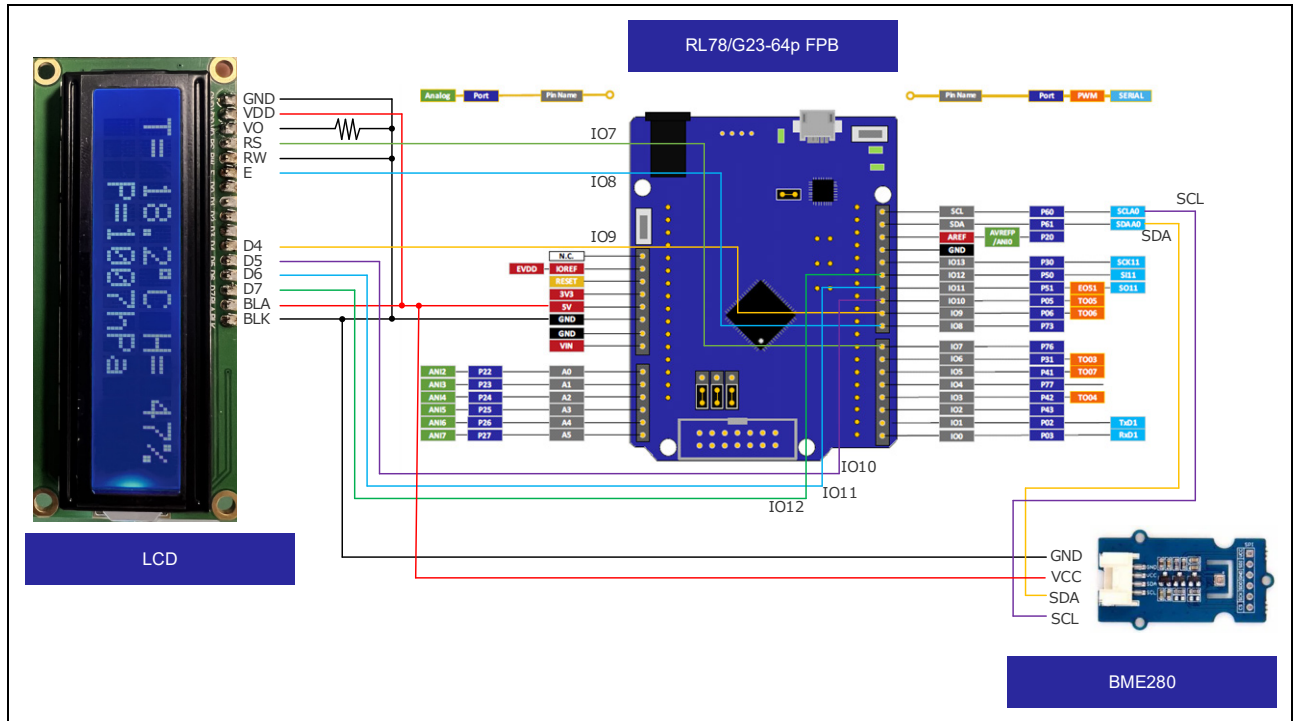
In this system, power is supplied to the evaluation board via USB. Please check the circuitry of the evaluation board and configure the jumpers as necessary.

In this system, the jumpers on the evaluation board are configured as follows.

Table 3-1 Jumper Settings of Evaluation Board

Jumper	Settings	Function
J8	1-2 short	COM port debug
J9		
J11		
J13	Open	
J17	1-2 short	5V power supply to MCU

Figure 3-1 Connection of Evaluation Board, BME280, and LCD module



3.2 List of Pins Used

The following shows the pins used in this system.

Table 3-2 List of Pins Used in This System

Item	Arduino™ signal name	Pin number of MCU	Pin name
I ² C	SDA	18	P61
	SCL	17	P60
LCD control	IO7	23	P76
	IO8	26	P73
	IO9	30	P06
	IO10	31	P05
	IO11	34	P51
	IO12	33	P50
V _{DD}	5V	-	-
GND	GND	-	-

Please see the following manual for details of the board.

- RL78/G23-64p Fast Prototyping Board User's Manual (R20UT4814)
- [RL78G23 64pin Fast Prototyping Board · renesas/Arduino Wiki · GitHub](#)

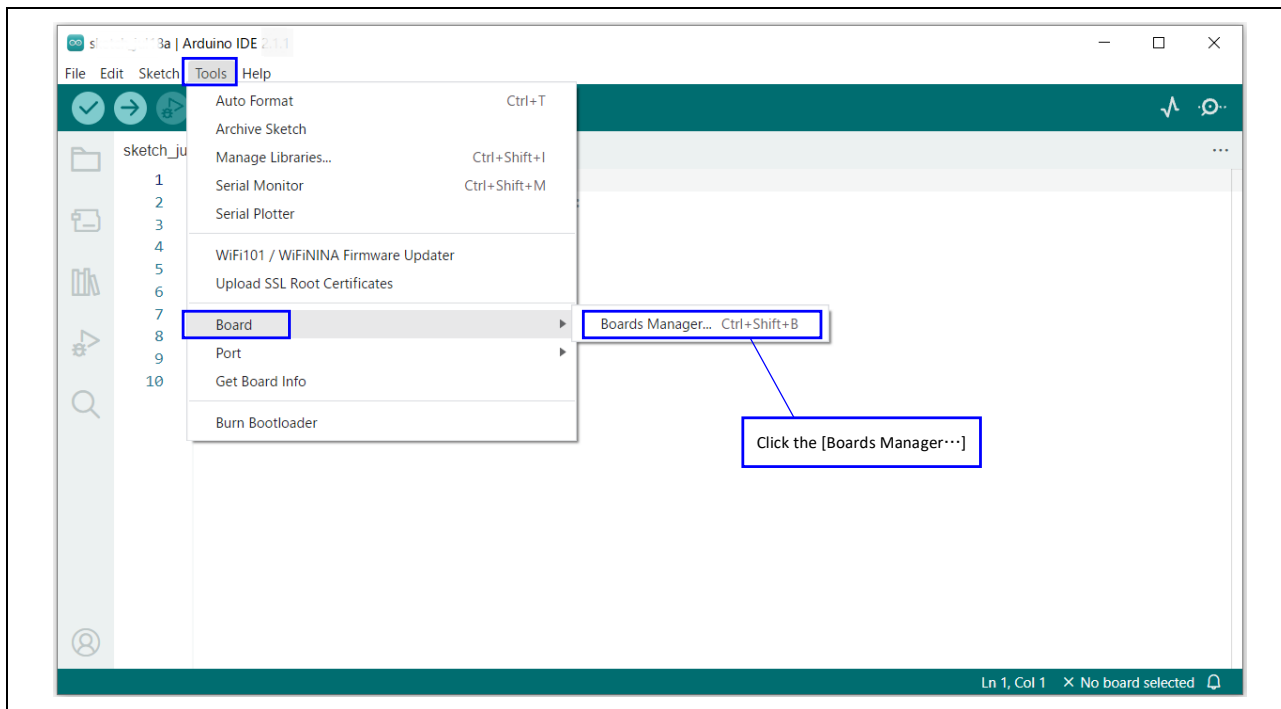
3.3 Setup of Arduino™ IDE

The setup procedure of Arduino™ IDE is explained.

Remark. The setup procedure is almost the same as the procedure explained on the [Quick Start Guide · renesas/Arduino Wiki](#) · GitHub. The sample sketch to flash LED is described on the above site. Refer to it if required.

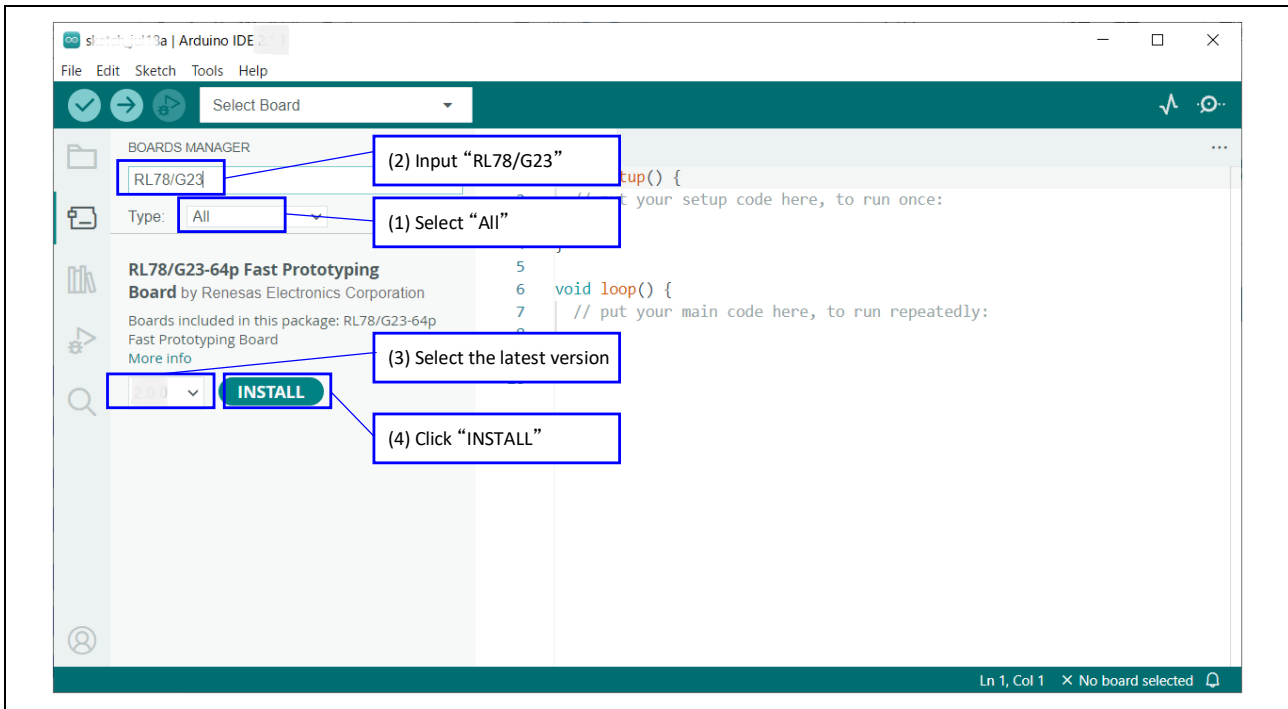
1. Start the Arduino™ IDE.
2. Select the [Tools] – [Board] – [Board Manager...] menu.

Figure 3-2 Selection of [Board Manager...]



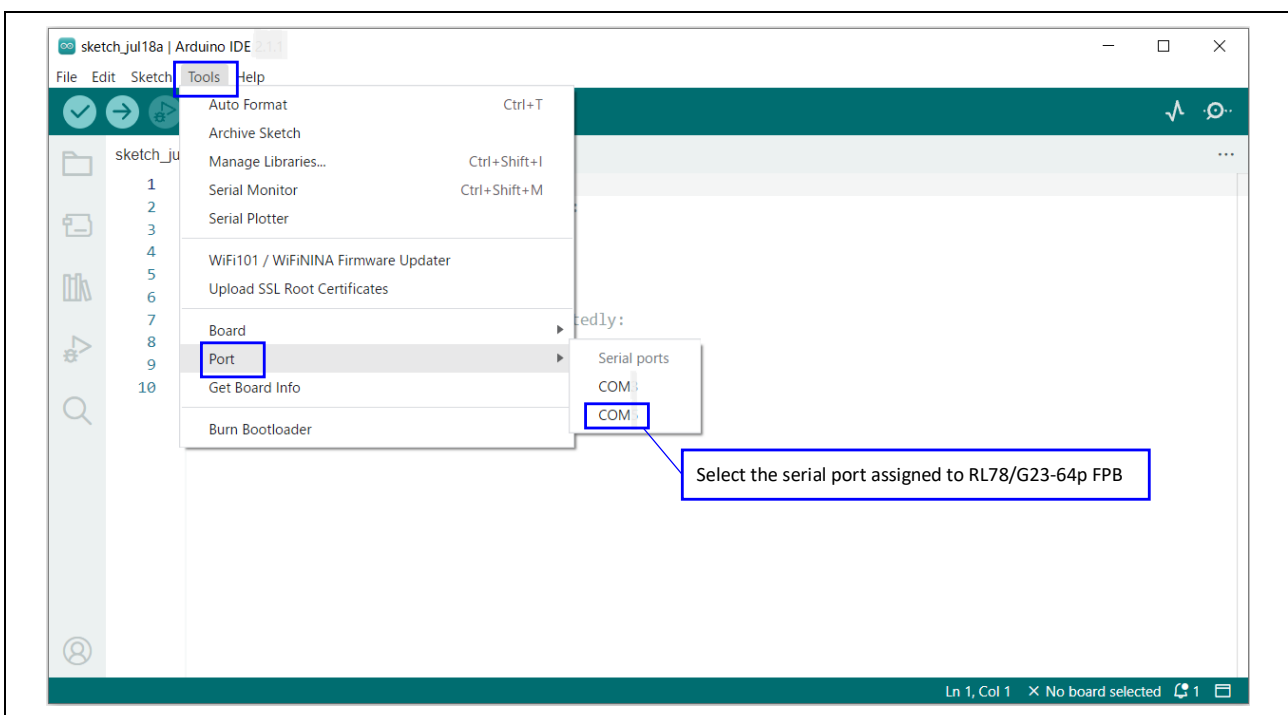
3. Select “All” at the [Type] and input “RL78/G23” in the textbox. Then, “RL78/G23-64p Fast Prototyping Board” is displayed. Next, click the [INSTALL].

Figure 3-3 Installation of Board Manager



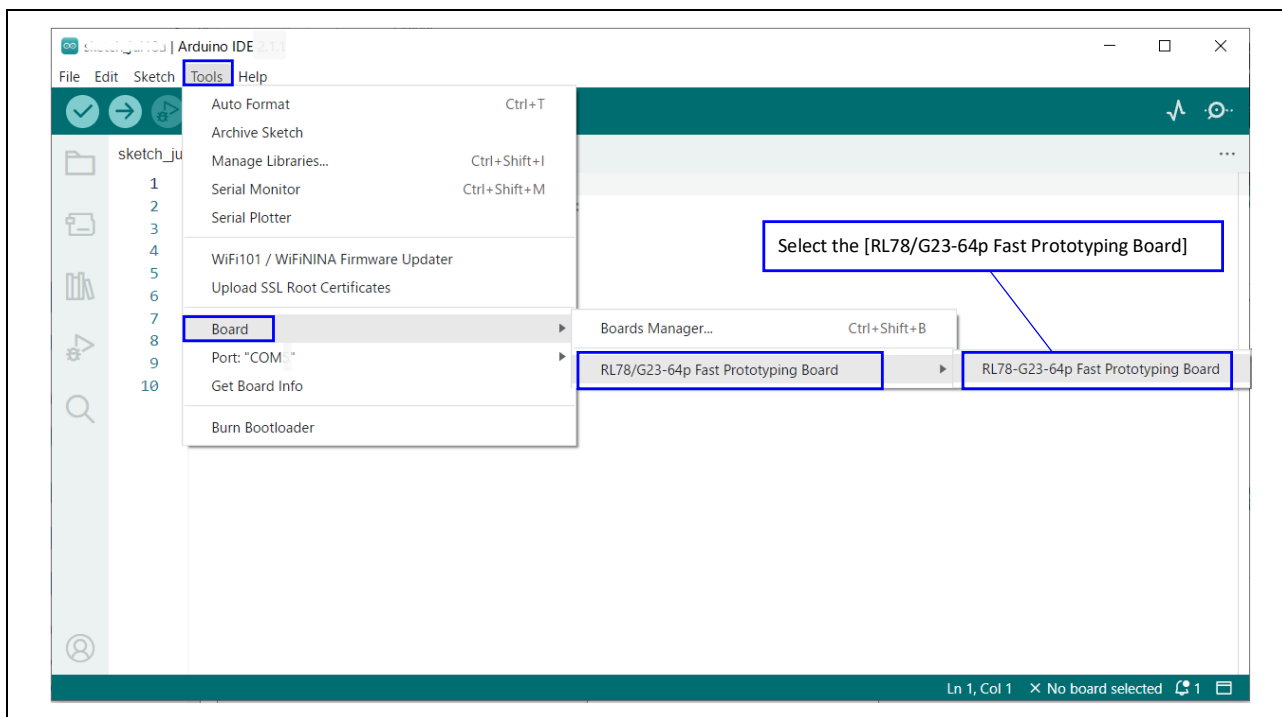
4. Select the serial port assigned to the RL78/G23-64p FPB from the [Tools] - [Port] menu. COM port number can be checked at the Device Manager of Windows.

Figure 3-4 Selection of serial port



- 5. Select the [Tools] - [Board] - [RL78/G23-64p Fast Prototyping Board] - [RL78/G23-64p Fast Prototyping Board] menu.

Figure 3-5 Selection of board



4. Software Descriptions

4.1 Sample Sketch Overview

This sample code is a sample sketch that executes on the Arduino™ IDE and consists of the libraries shown in Table 4-1.

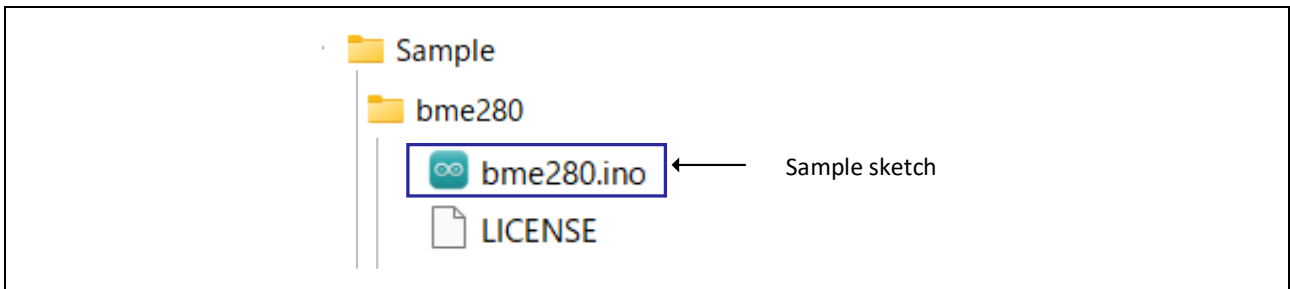
Table 4-1 Sample code overview of the library used

Library used	Description
Adafruit BME280 Library	Communicate with the BME280 via I ² C and acquire temperature, humidity, and barometric pressure data.
LiquidCrystal	Control LCD module and display the characters.

The file structure is shown below.

Please refer to "4.3 API Functions" for the API functions used, and "4.4 Operation Check Procedure of Sample Sketch" for details on the sample sketch.

Figure 4-1 File structure of sample code



4.2 Sketch Example used in Sample Code

This sample code uses sketch examples provided by Arduino™ IDE. The method for referencing the sketch examples is shown below.

4.2.1 Adafruit BME280 Library - bme280test

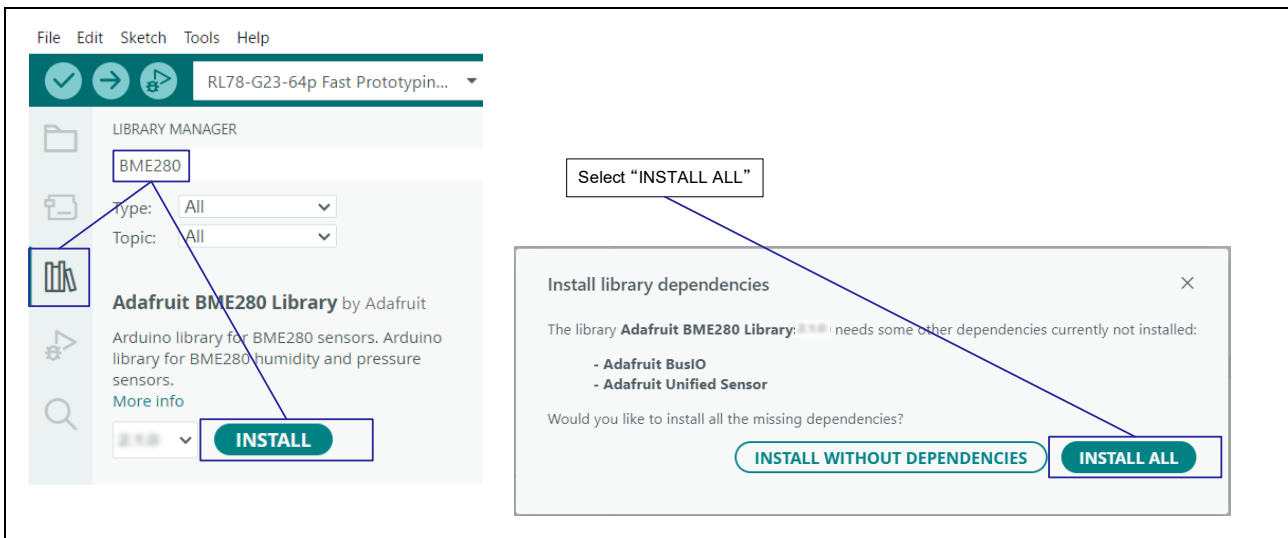
This is an example sketch that uses the Adafruit BME280 Library to communicate with the BME280 via I²C. This library is distributed under the BSD license.

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To reference this, use the following procedure:

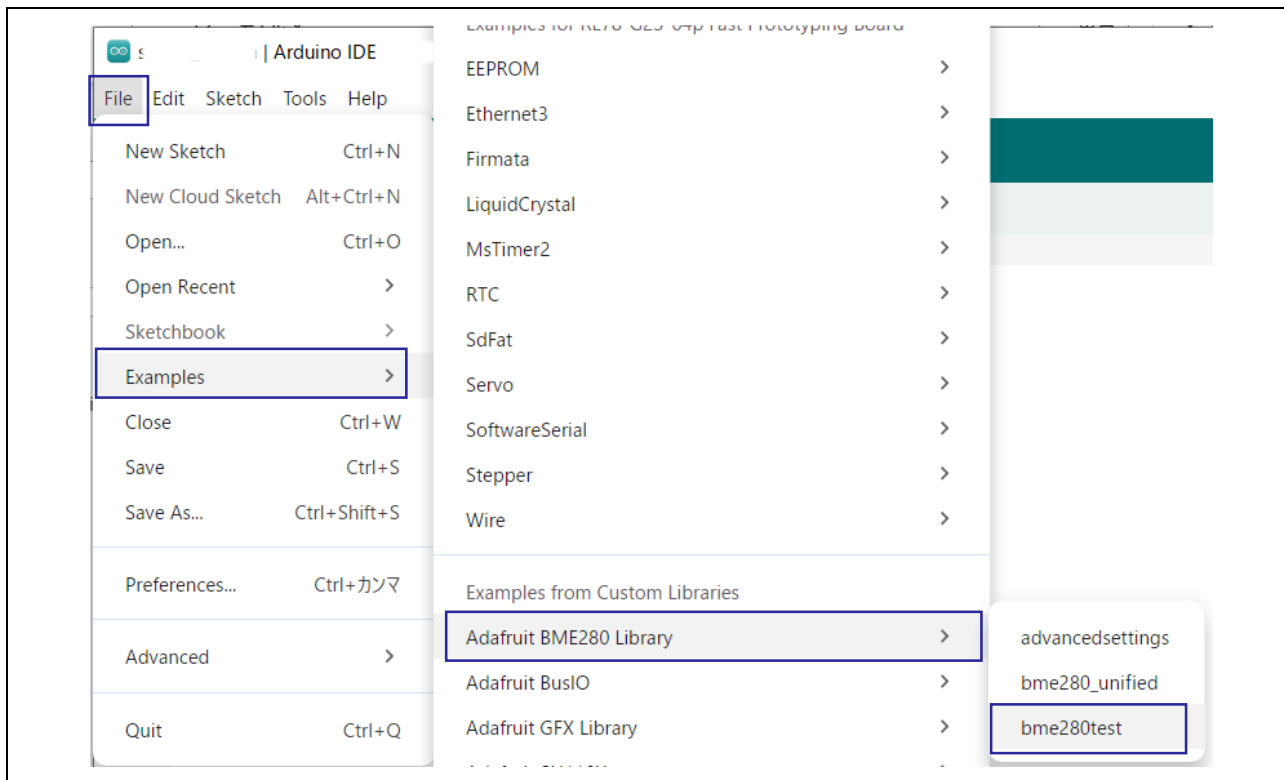
1. Start the Arduino™ IDE.
2. Open the library manager on the left side of the screen, search for [BME280] in the search field, and install [Adafruit BME280 Library].

Figure 4-2 Installation of Adafruit BME280 Library



3. Click the [Files] - [Examples] - [Adafruit BME280 Library] - [bme280test] .

Figure 4-3 Selection of Adafruit BME280 Library - bme280test



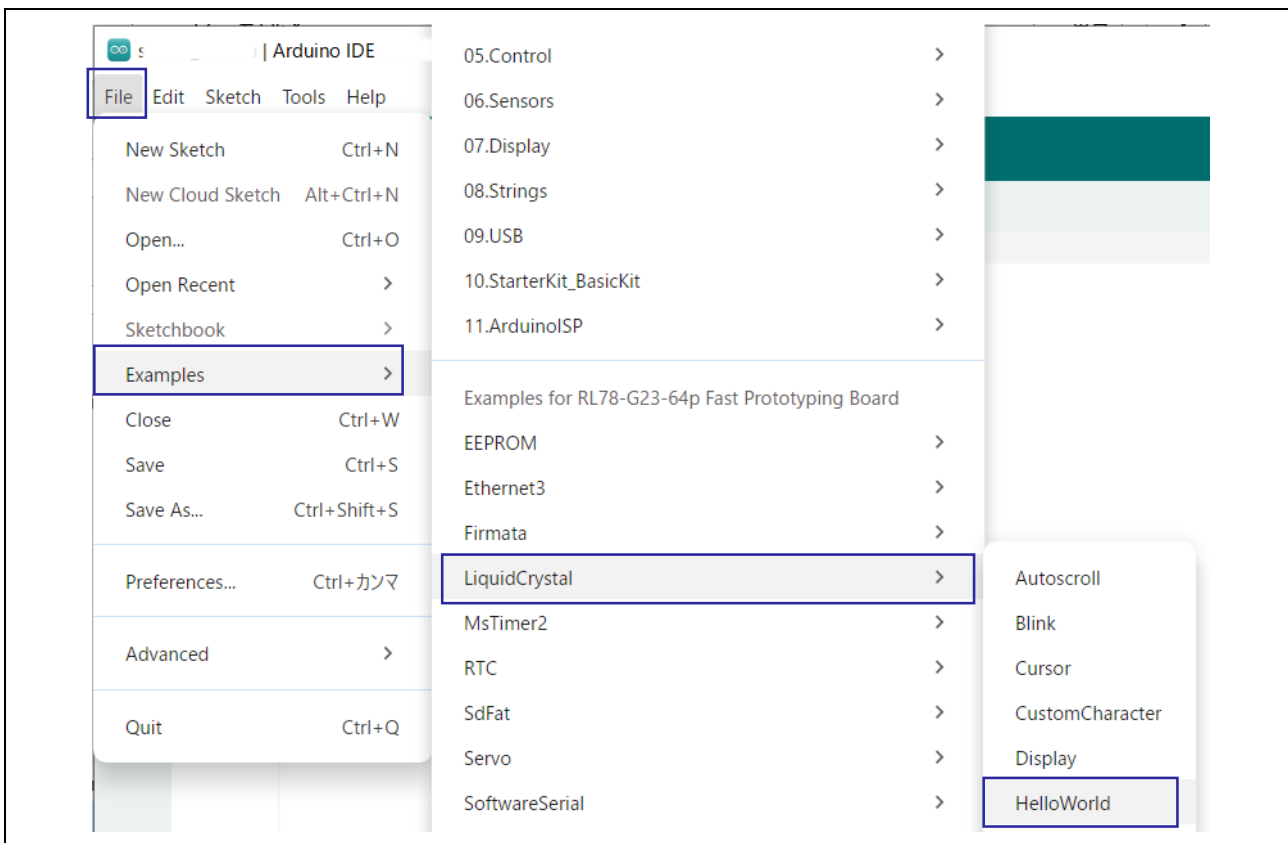
4.2.2 LiquidCrystal - HelloWorld

This is an example sketch that uses the LiquidCrystal library to display characters on the LCD module via parallel communication.

To reference this, use the following procedure:

1. Start the Arduino™ IDE.
2. Click the [Files] - [Examples] - [LiquidCrystal] - [HelloWorld].

Figure 4-4 Selection of LiquidCrystal - HelloWorld



4.3 API Functions

The API functions of each library used in this sample sketch are shown below.

Table 4-2 List of APIs

API name	Function
lcd.clear ()	Clear the LCD module display
Wire.begin ()	Start I ² C communication
lcd.begin(cols, rows)	Initialize the LCD module and set the number of column (cols) and row (rows)
lcd.setCursor(cols, rows)	Position the LCD cursor at the specified column (cols) and row (rows)
lcd.print()	Output text to the LCD module
lcd.write ()	Output a character code to the LCD module
delay(ms)	Delay the program for the specified time (ms) The unit is milliseconds
String(value)	Convert a numeric value to a String object
String.length()	Obtain the length of a string
bme280.begin()	Initialize I ² C communication with the BME280
bme280.readTemperature ()	Acquire temperature data from the BME280
bme280.readHumidity ()	Acquire humidity data from the BME280
bme280.readPressure ()	Acquire barometric pressure data from the BME280

For API function specifications of each library, refer to the website of Arduino™ and the other.

[API List · renesas/Arduino Wiki · GitHub](#)

[LiquidCrystal - Arduino Reference](#)

[delay\(\) - Arduino Reference](#)

[String\(\) | Arduino Documentation](#)

[Adafruit BME280 Library | Arduino Documentation](#)

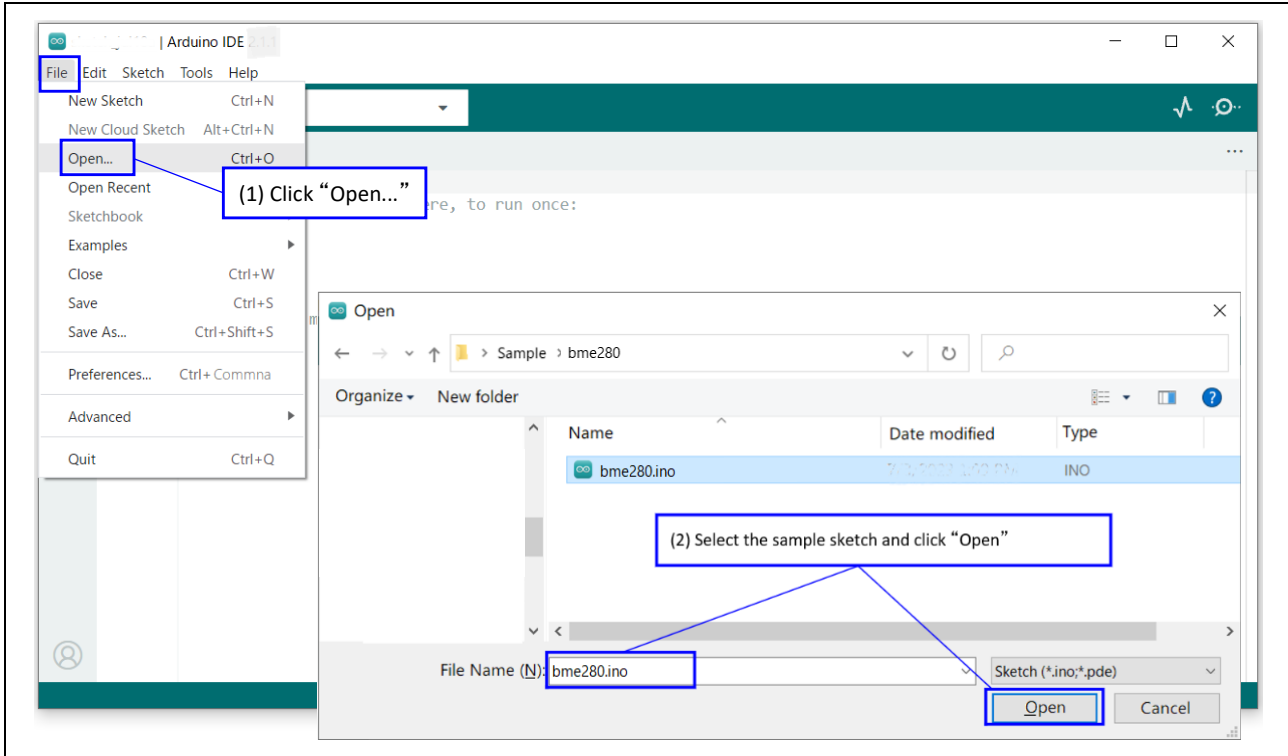
4.4 Operation Check Procedure of Sample Sketch

The procedure for checking the operation of this sample sketch is shown below.

Perform "3.3 Setup of Arduino™ IDE" in advance.

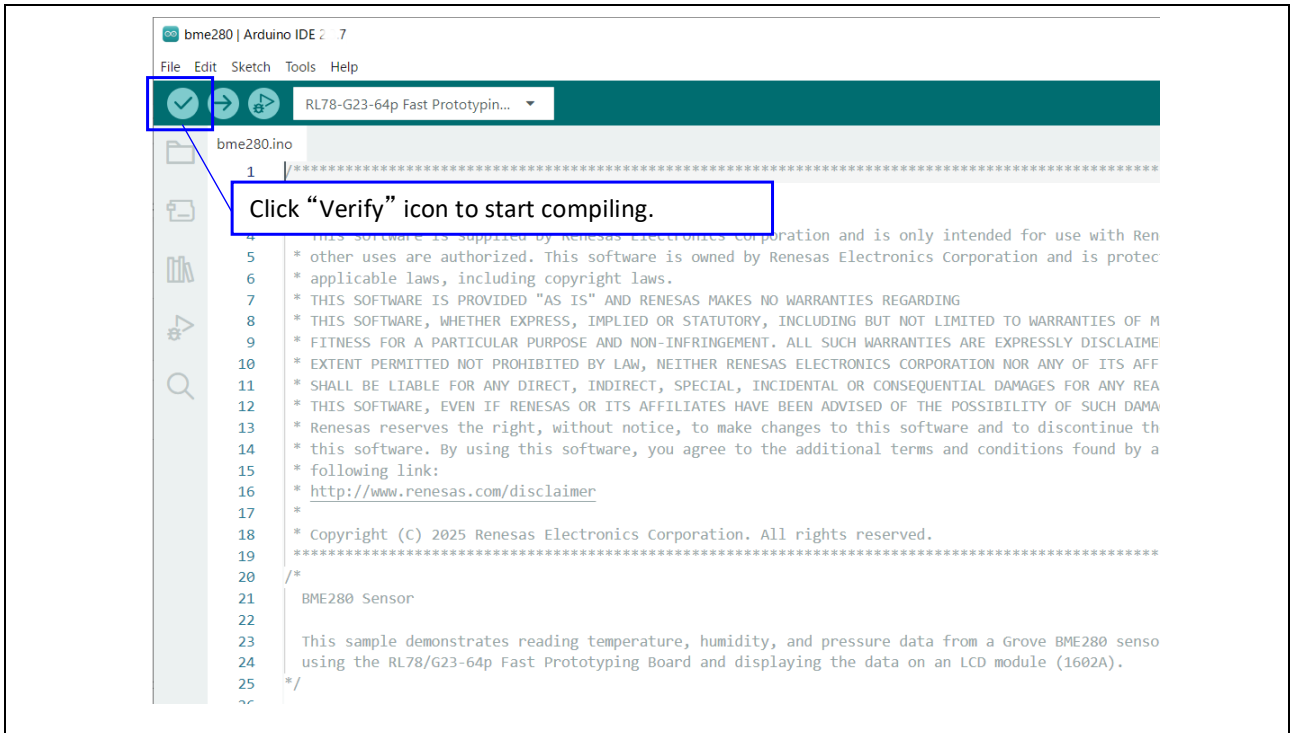
1. Click the [File] - [Open...] menu and open the sample sketch.

Figure 4-5 Open Sample Sketch



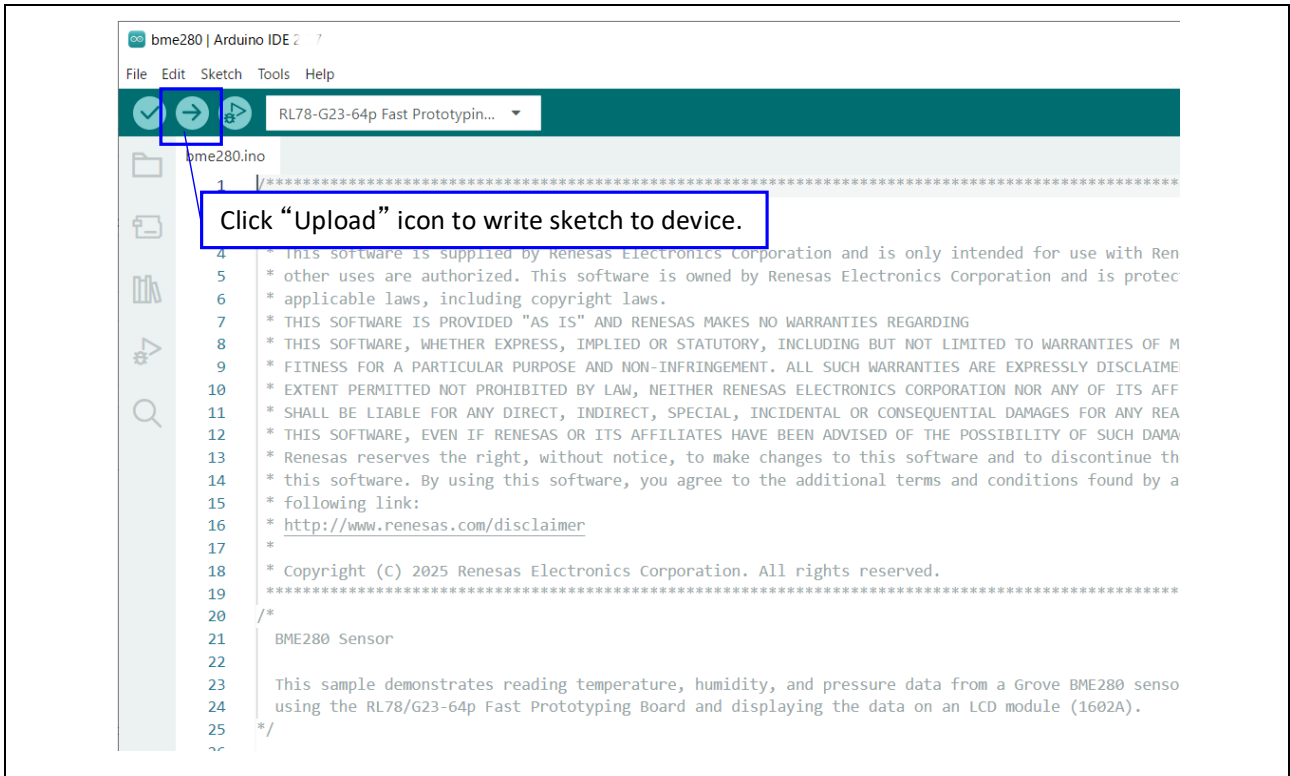
2. Click the [Verify] icon and compile sketch.

Figure 4-6 Compile Sample Sketch



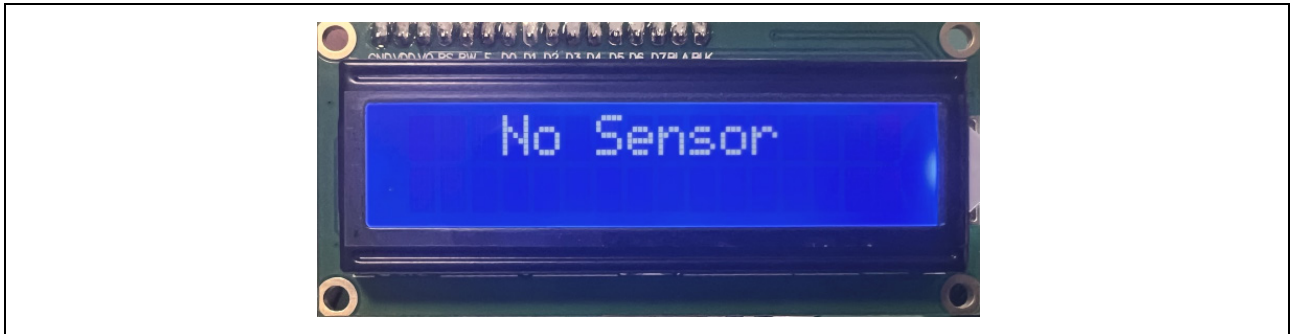
- 3. After compiling is finished, click the [Upload] icon and write sketch to the device.

Figure 4-7 Write Sample Sketch to Device



4. After the writing is completed, the microcontroller will start working and check the connection with BME280. If no connection, "No Sensor" is displayed on the LCD.

Figure 4-8 LCD module display when BME280 is not connected



5. After connection with the BME280 is confirmed, "Sensor Connect" is displayed on the LCD. After 1 second, the sensor value is displayed and updated every 1 second.

Figure 4-9 LCD module display after BME280 connection is completed

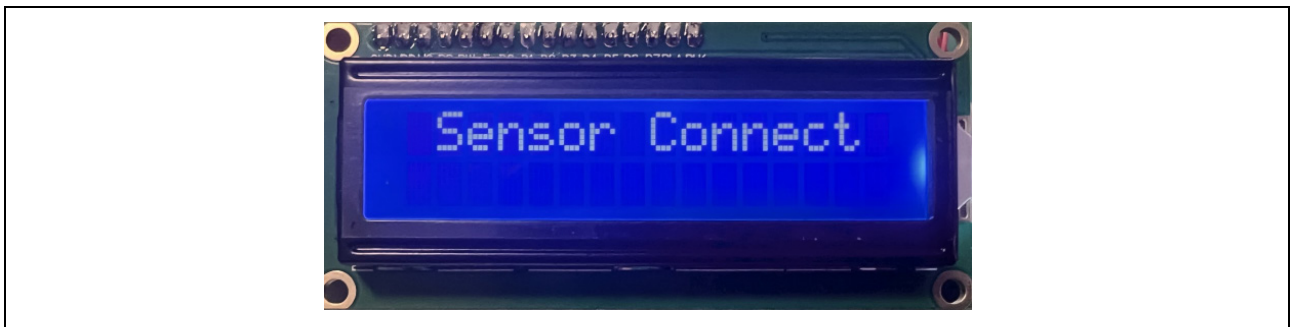


Figure 4-10 LCD module display

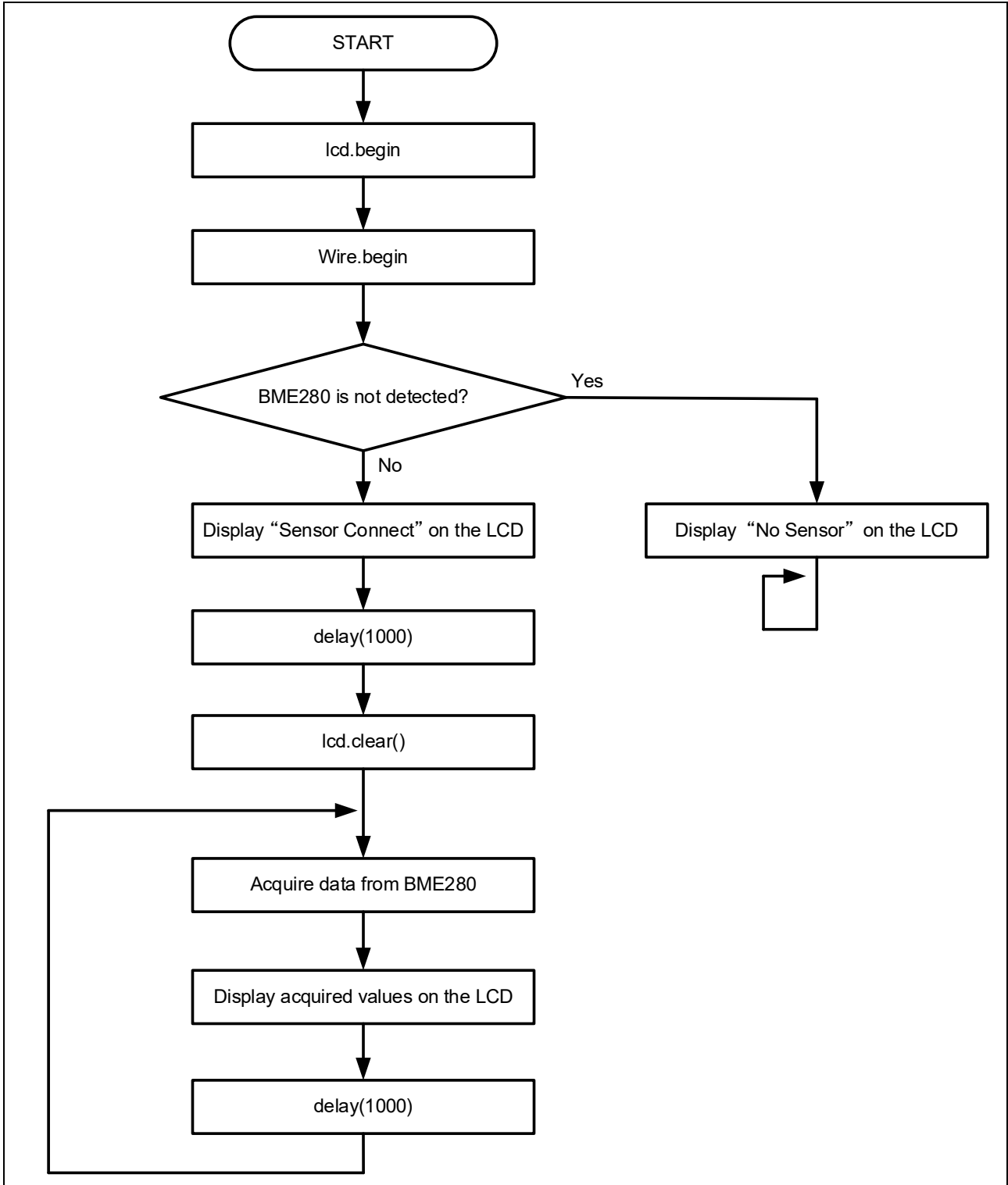


4.5 Flowchart

4.5.1 Main Process

The flowchart for the sample sketch is shown below.

Figure 4-11 Main Processing Flowchart



5. Troubleshooting

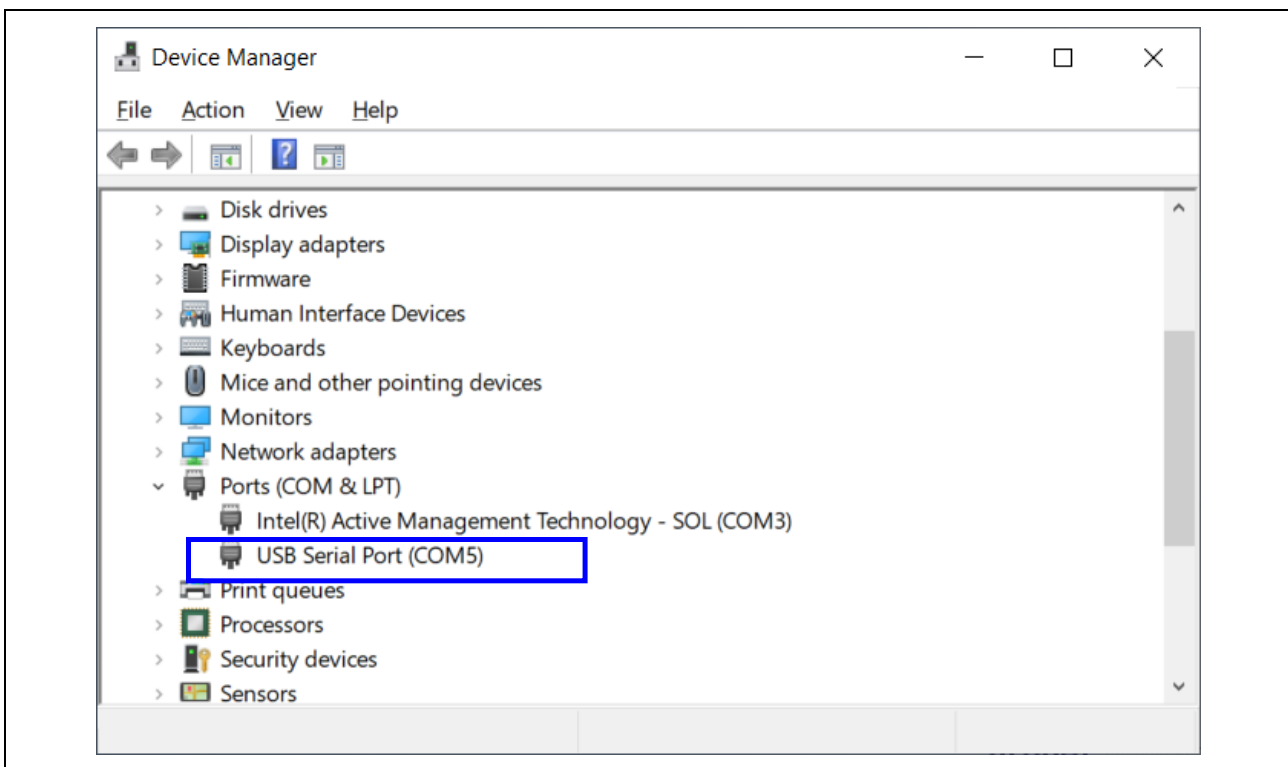
5.1 COM port is not displayed on the Windows Device Manager

When connecting the PC and the evaluation board for the first time, the PC may not recognize the board, and the COM port may not be displayed in Windows Device Manager.

If the COM port is not displayed, install the driver of the USB-to-serial converter (FT232RQ) implemented on the evaluation board by following the steps below.

1. Download the latest driver installer for the target OS from FTDI's website and install it.
<https://ftdichip.com/drivers/vcp-drivers/>
2. After installation, "USB Serial Port (COMx)" is displayed under the "Ports (COM & LPT)" on the Device Manager. In the following figure, COM5 is the target COM port

Figure 5-1 Windows Device Manager after installation of device driver



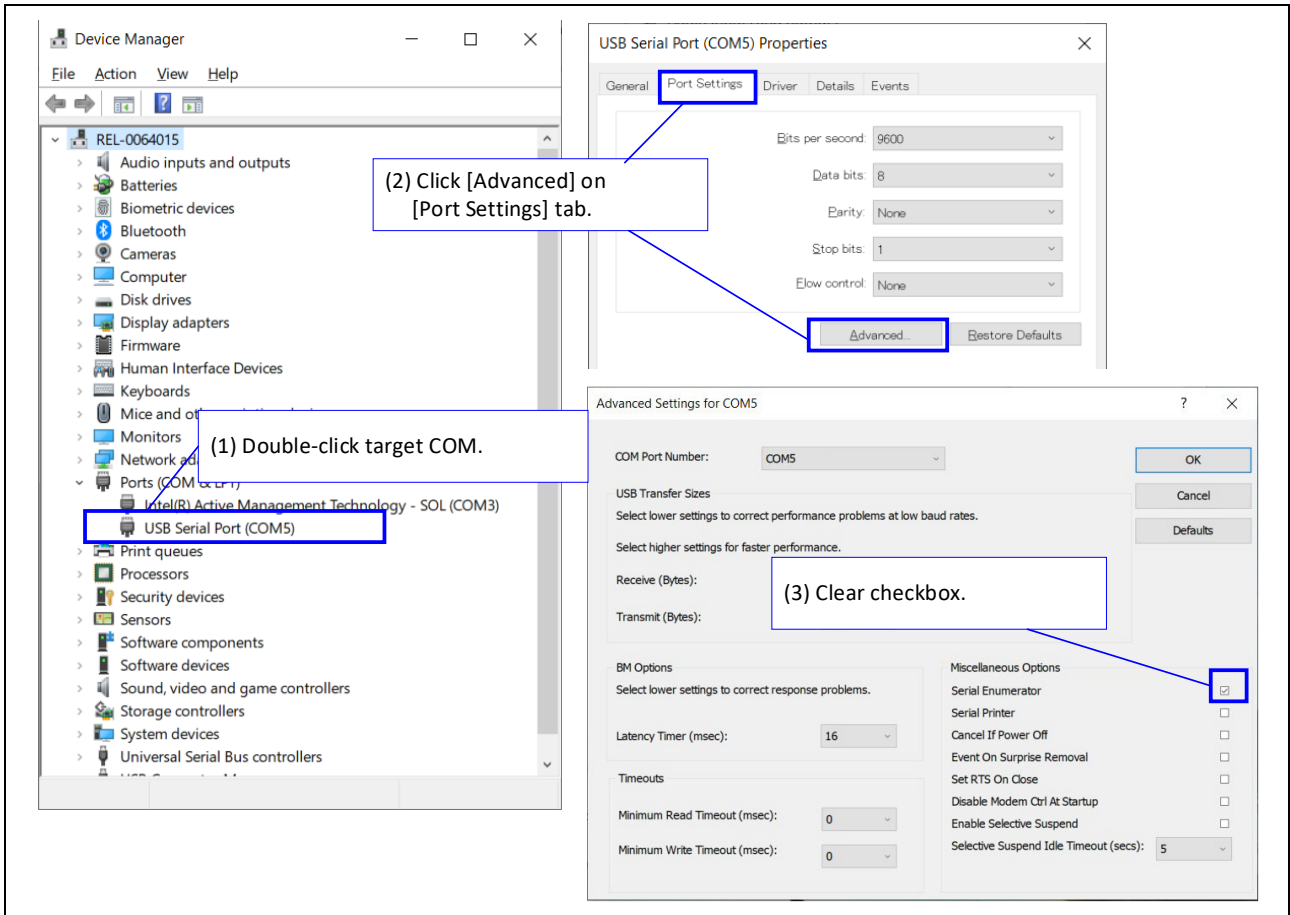
For details of USB-to-serial converter and COM port, refer to "5.11 USB-to-Serial Converter" and "5.12 USB-to-Serial Converter Reset Header" in RL78/G23-64p Fast Prototyping Board User's manual.

5.2 Program is not written correctly to RL78/G23-64p Fast Prototyping Board

It may not be connected correctly the PC and the evaluation board even if “USB Serial Port (COMx)” is displayed.

If the program is not written correctly, double-click the target COM port on Windows Device Manager and clear the checkbox of [Serial Enumerator].

Figure 5-2 Setting Example of Target COM



6. Sample Sketch

This application note provides the sample sketch.

Sample sketches are available on the Renesas Electronics website.

7. Reference Documents

- RL78/G23 User's Manual: Hardware (R01UH0896)
- RL78/G23-64p Fast Prototyping Board User's Manual (R20UT4814)

(The latest versions can be downloaded from the Renesas Electronics website).

Technical update

(The latest versions can be downloaded from the Renesas Electronics website.)

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Revision History

Rev.	Date	Description	
		Page	Summary
1.00	Feb 20, 2026	-	First edition

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

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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.

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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.

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