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Sound MCU: S1C31D41 Sensor demo(fire alarm)

“Reference Design Guide”

Rev1.00

NOTES

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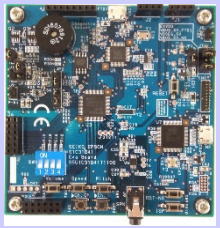
Overview

1. Overview

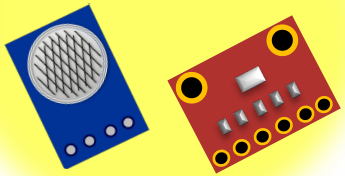
This reference design guide describes the demonstration software that reproduces the operation as a fire alarm by using the evaluation board of the Sound MCU “S1C31D41” and the sensor module.

S5U1C31D41T



Sound MCU “S1C31D41” evaluation board

Sensor module



Fire alarm

Evaluation Board “S5U1C31D41T” and external Parts

2. Evaluation Board “S5U1C31D41T” and external Parts

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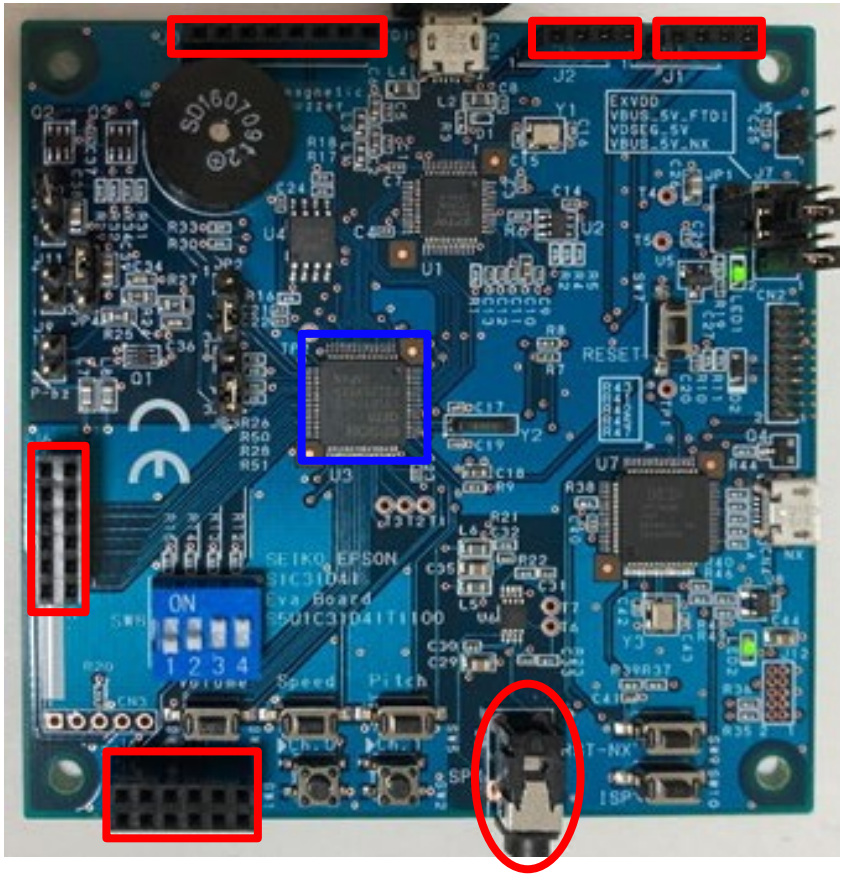


Main parts of evaluation board

- Sound MCU “S1C31D41”
- Connector for sensor module
  ※With the UPMUX (Universal Port Multiplexer) function of EPSON MCU, each connector can be set by software for GPIO and each serial communication (SPI, I2C, etc.).
- Audio jack for *speaker
  ***Default audio device**
  Please refer to Appendix to switch the audio device.

External parts

- Gas sensor module with MQ-2
- Temperature sensor module with BME280
- LED

Startup

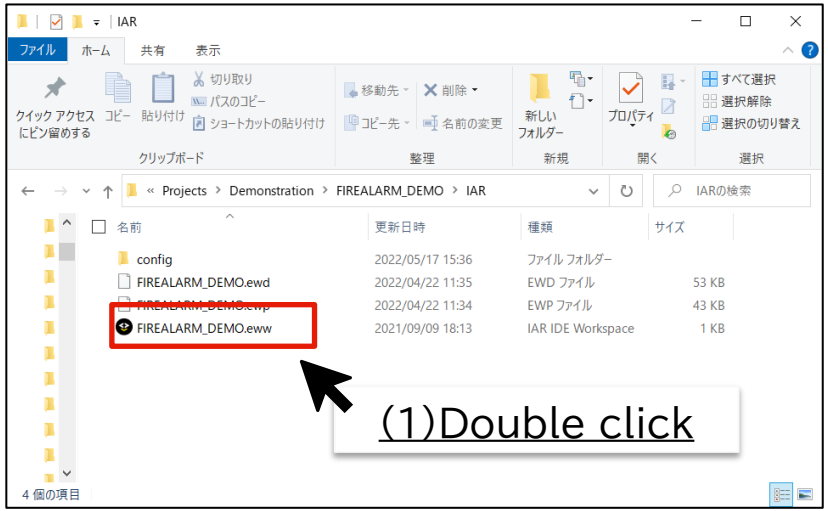
～From software writing to demonstration start～

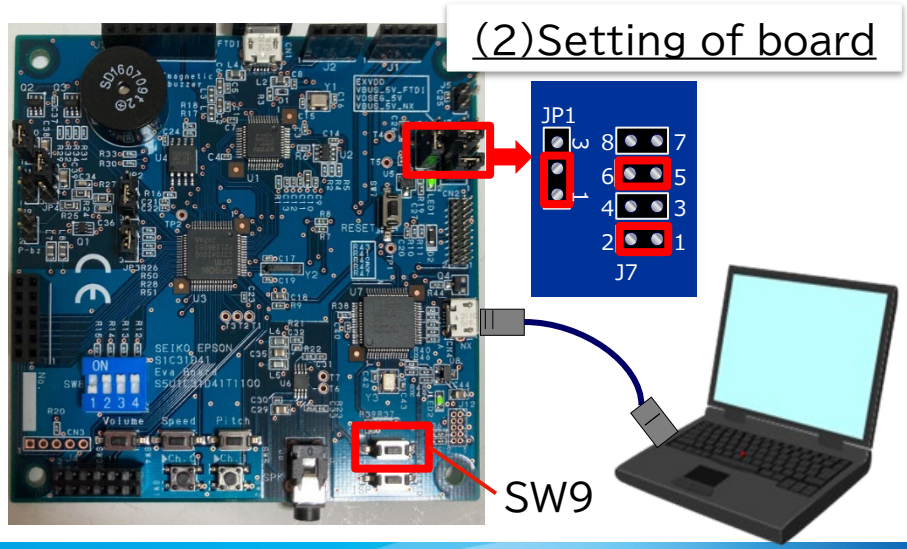
3.1 Writing Software

(1)Double-click “FIREALARM_DEMO.eww” from sample software package (s1c31d5xd41sp_ver5_00).

Folder path : s1c31d5xd41sp_ver5_00¥Projects¥Demonstration¥FIREALARM_DEMO¥IAR

(2)After setting the jumper as shown in the figure below, connect the PC to the evaluation board and push SW9.

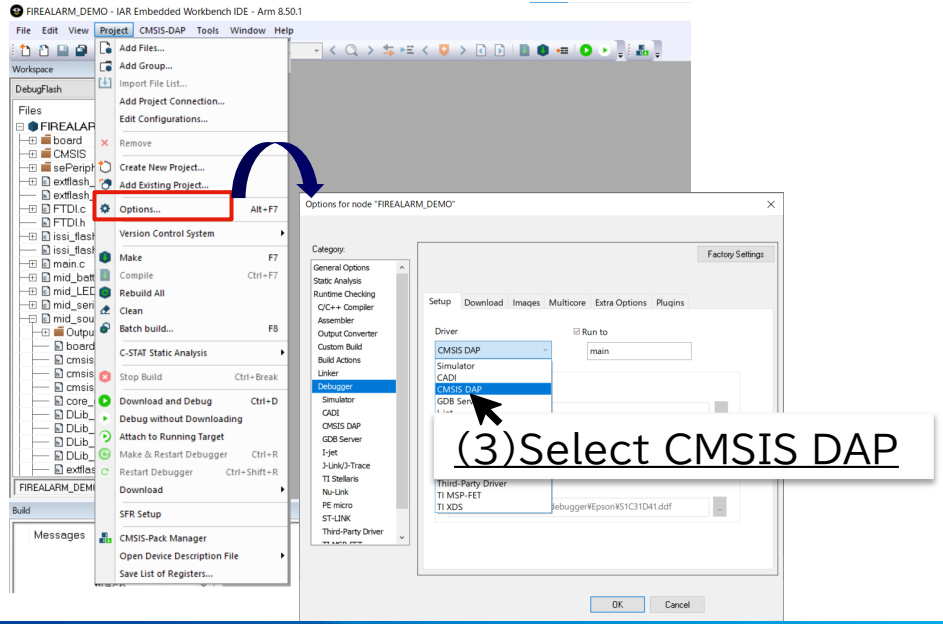


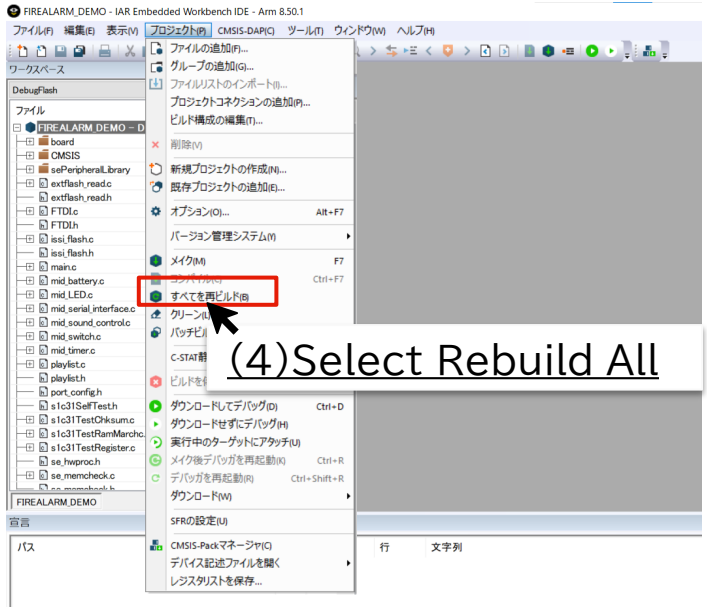


3.1 Writing Software

(3)When EWARM starts up, change the debugger to CMSIS DAP.
Project→Options→Debugger→Driver→**CMSIS DAP**

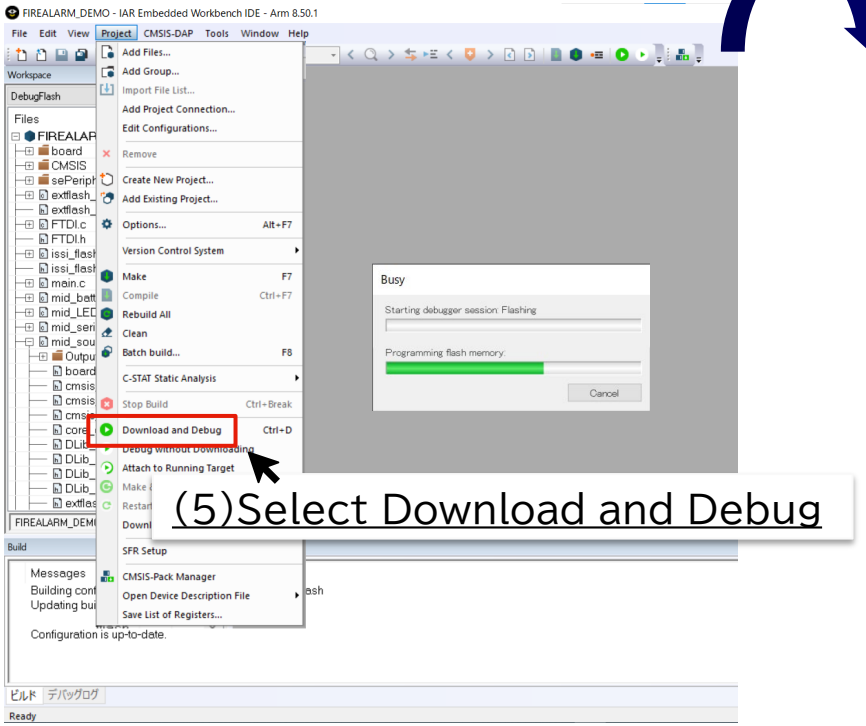
(4)Execute “Rebuild All”
Project→**Rebuild All**



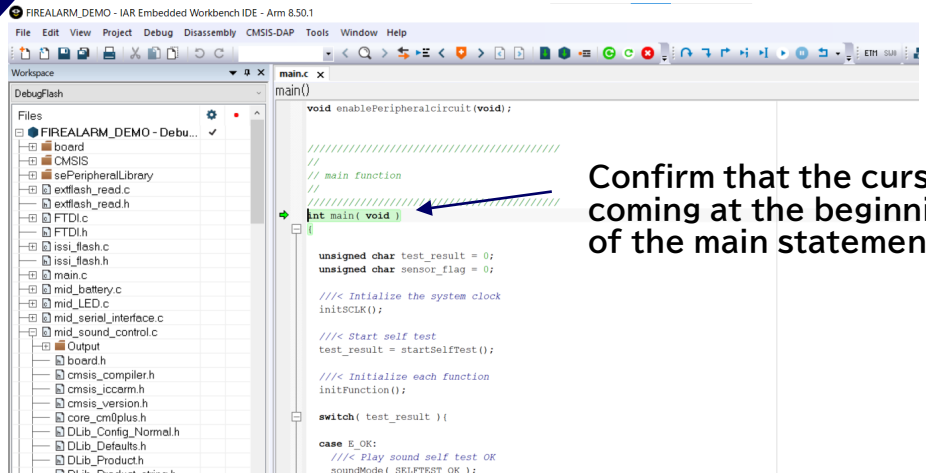


3.1 Writing Software

(5)Execute “Download and Debug”. If the writing is completed normally, the debug screen will be displayed automatically.



(5)Select Download and Debug

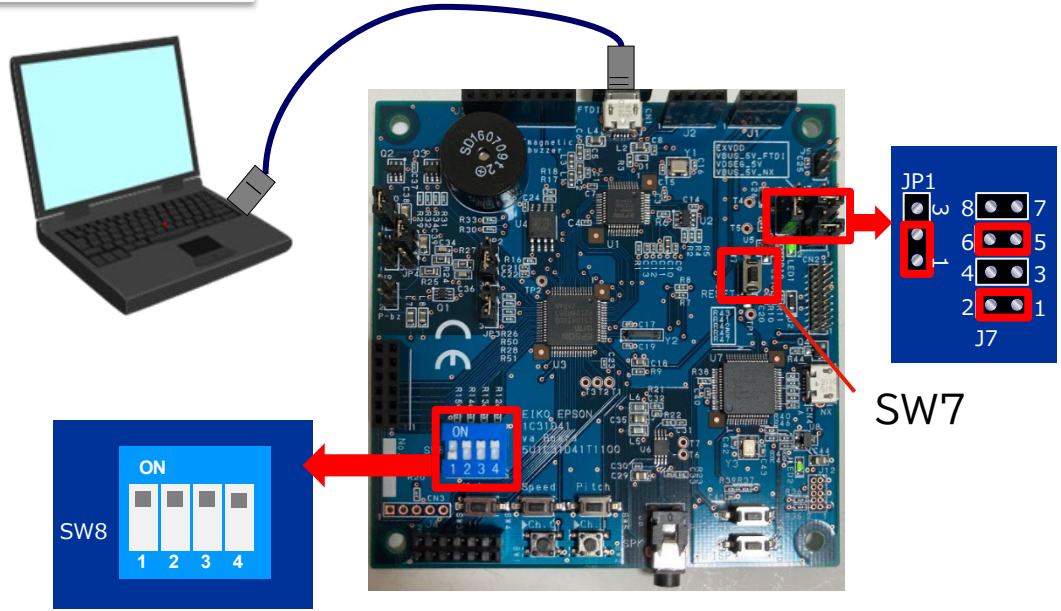


Confirm that the cursor is coming at the beginning of the main statement

3.2 Writing sound data

(1)As shown in the figure below, after setting the jumper and DIP switch, connect the PC to the evaluation board and push SW7.

(1)Setting of board

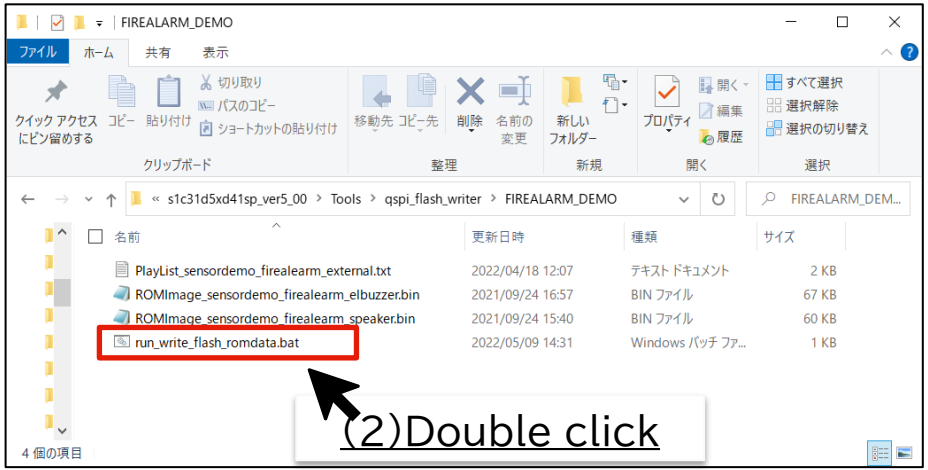


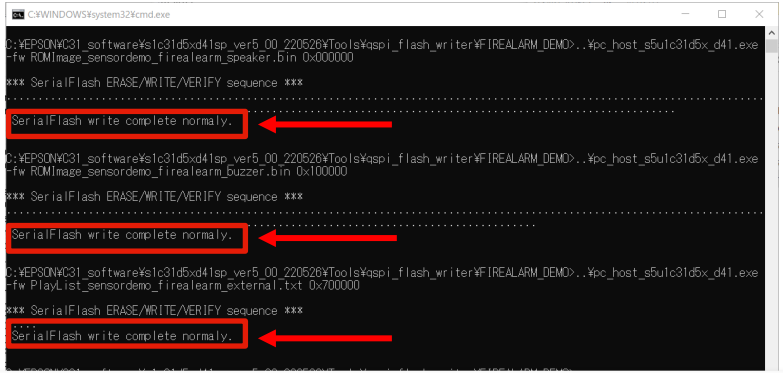
3.2 Writing sound data

(2)Double-click “run_write_flash_romdata.bat” from the sample software package (s1c31d5xd41sp_ver5_00).

Folder path : s1c31d5xd41sp_ver5_00¥Tools¥qspi_flash_writer¥FIREALARM_DEMO

(3)As shown in the lower right figure, when three “Serial Flash write complete normally” are displayed, the sound data writing is complete.





(3)Writing is completed when displayed “SerialFlash write complete normally”

3.3 Sensor module connection

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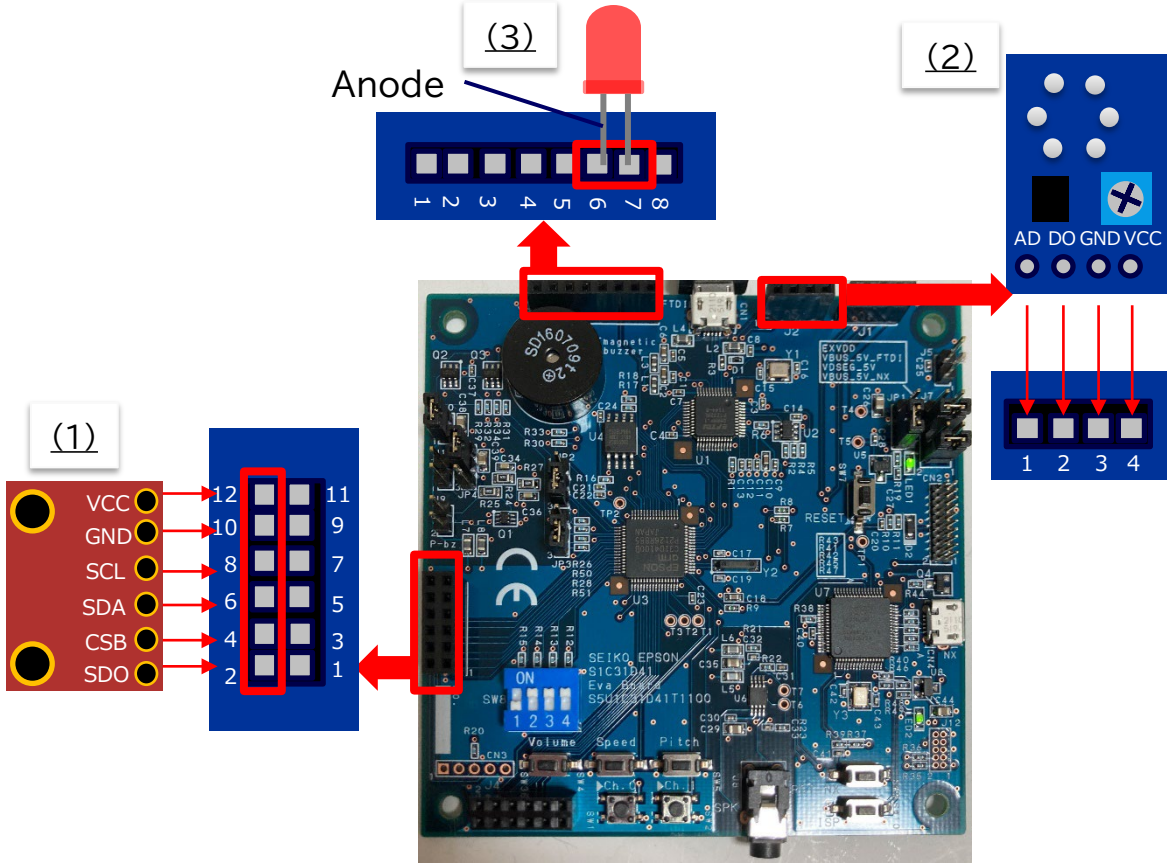
procedure

(1)Connect the temperature sensor

(2)Connect the gas sensor

(3)Connect the LED



3.4 Board setting & Demonstration start

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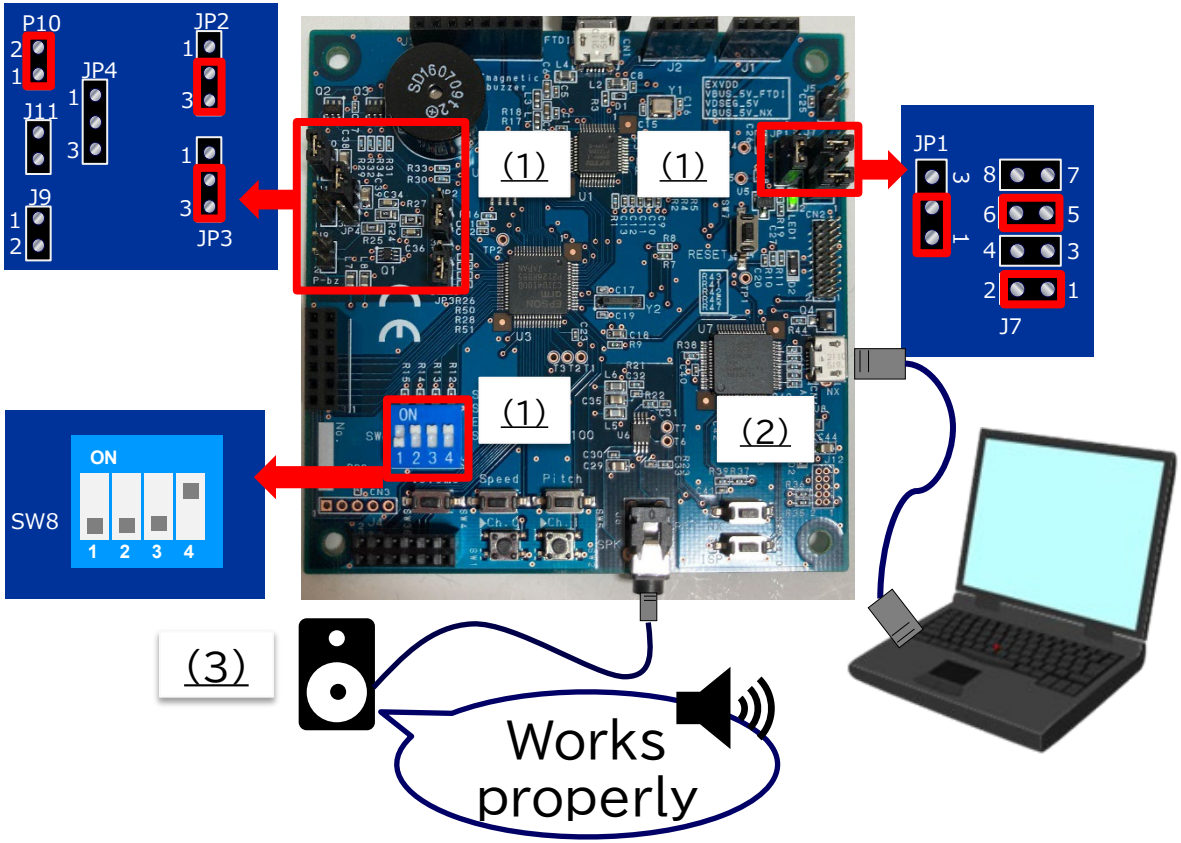
procedure

(1)Set the jumper and DIP switch of the evaluation board according to the figure.

(2)Connect the USB cable and Demonstration starts when the power is turned on

(3)Startup is complete when you hear a sound from the speaker saying “Works properly”.



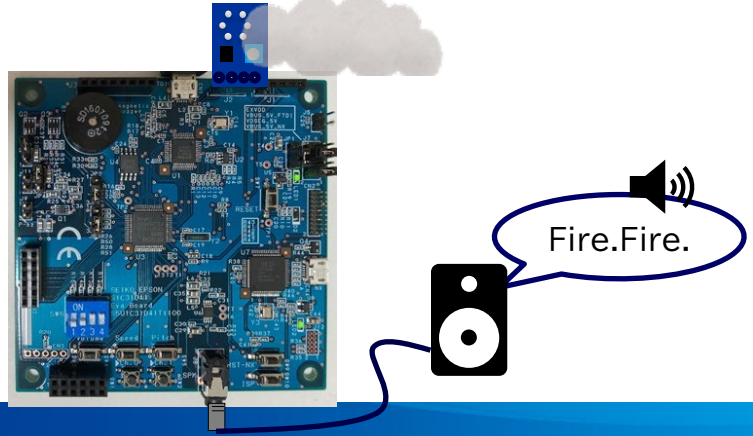
Function introduction

4.1 Fire detection

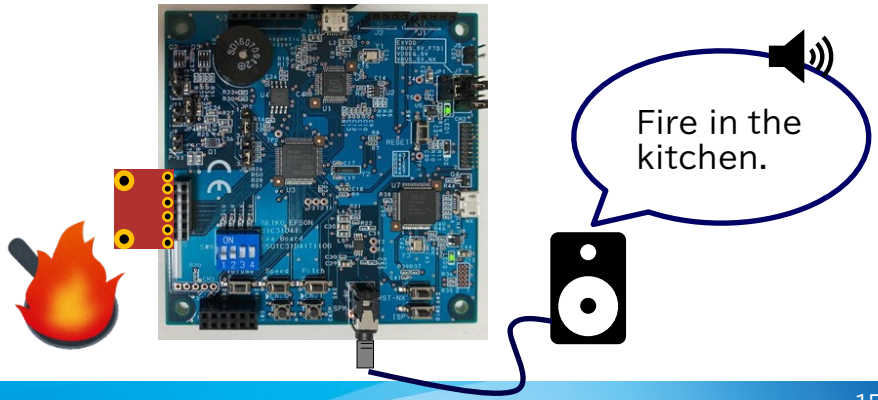
Each sensor module plays audio when it detects gas or heat. Sensing is performed even during playing, and if gas and heat is no longer detected, playing and LED flushing is finished. Audio is played even though the temperature sensor is not connected.

Target	Sentence	Play pattern	LED pattern
Gas	Fire.Fire.	Repeat	Blinking
Heat	Fire in the kitchen.	Repeat	Blinking
No connect temperature sensor	Unable to measure temperature correctly.	Repeat	Blinking

- Image of gas detection



- Image of heat detection



4.2 Other function introduction

- Detects low voltage of power supply

Plays audio when detect low voltage. If the power restored, audio play and LED flushing is finished.

Target	Sentence	Play pattern	LED pattern
Power supply voltage (threshold value of default:2.7V)	Battery low.	Repeat(10sec interval)	Lighting

- Self test

Self test of memory is performed, and the test result is notified playing audio and LED.
Self test is performed automatically when the power is turned on or when the power is reset.

Test result	Sentence	Play pattern	LED pattern
OK	Works properly	One shot	
NG			Blinking

- Stop playing

Push and hold SW1 on the evaluation board for 1 second during playing audio to stop playing. If you push SW1 again after stopping, audio will resume if there is an audio play factor (ex: Power supply voltage is lower power than threshold value). If there is no audio play factor, audio play will finish.

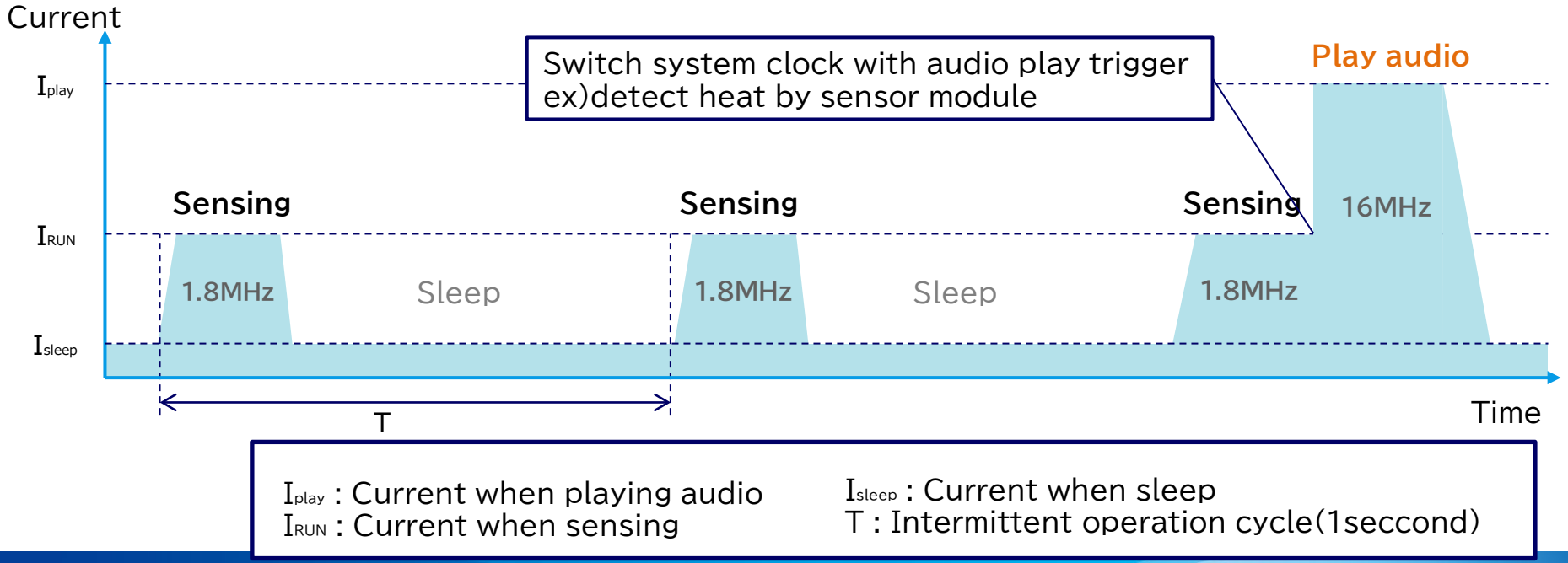
- Reset of software

With no audio playing, push and hold SW1 on the evaluation board for 1 second to reset the software.

Operation overview of Sound MCU (S1C31D41)

5.1 Intermittent operation for low power

By switching the internal system clock of the Sound MCU, efficient intermittent operation is implemented and power is reduced. It operates with a low-speed clock (1.8MHz) during sensing, and operates with a high-speed clock (16MHz) only during audio play.



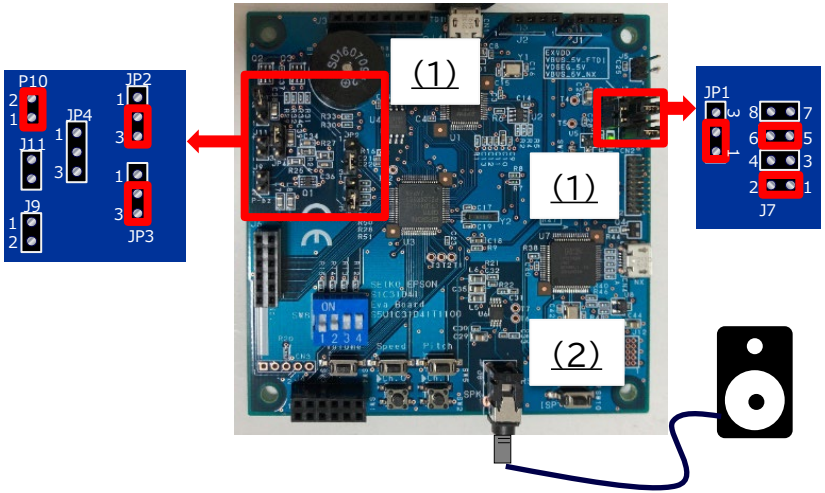
Appendix

6.1 Switching audio devices

With the evaluation board “S5U1C31D41T”, audio can be played from three devices: speaker, electromagnetic buzzer, and piezoelectric buzzer by setting the evaluation board and software.

① Speaker settings

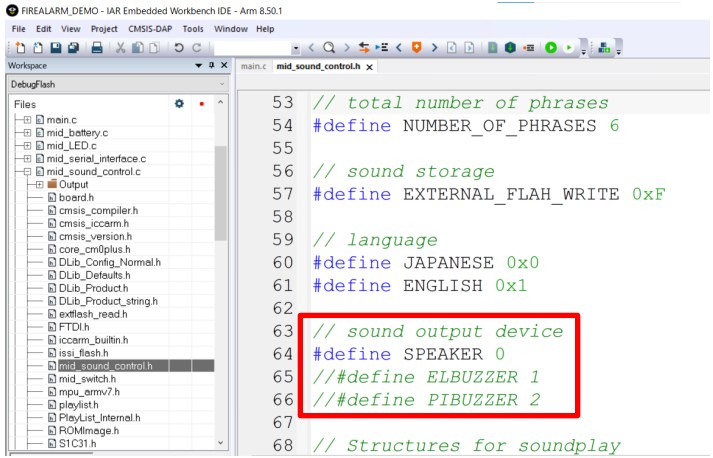
Board setting



(1)Set jumper
(2)Connect speaker

Software setting

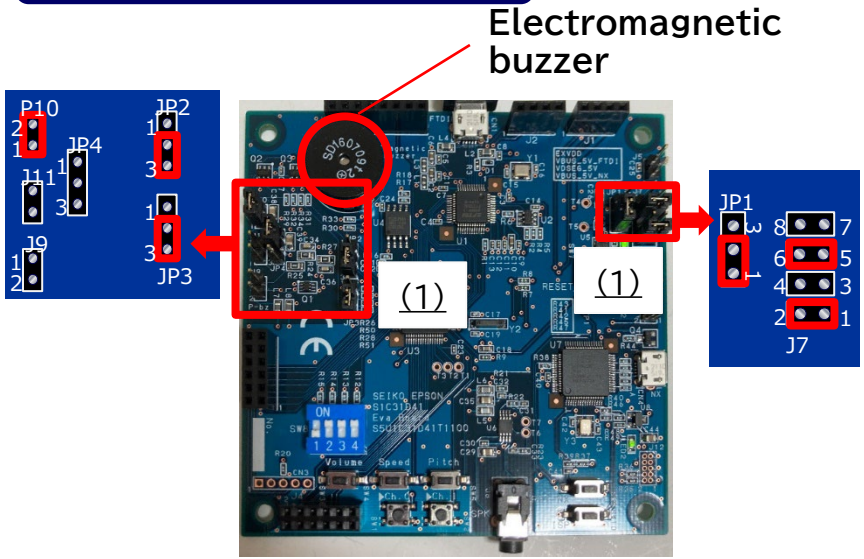
Enable “SPEAKER” defined in the header file “mid_sound_control.h” and comment out other devices



6.1 Switching audio devices

② Electromagnetic buzzer settings

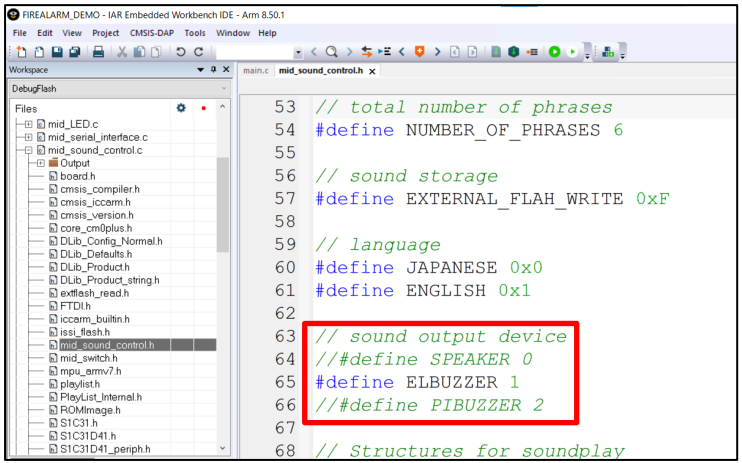
Board setting



(1)Set jumper

Software setting

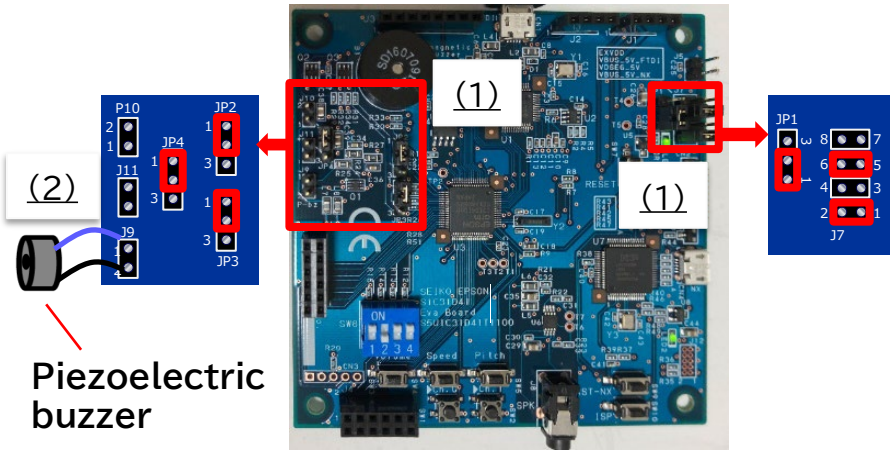
Enable “ELBUZZER” defined in the header file “mid_sound_control.h” and comment out other devices



6.1 Switching audio devices

③ Piezoelectric buzzer settings

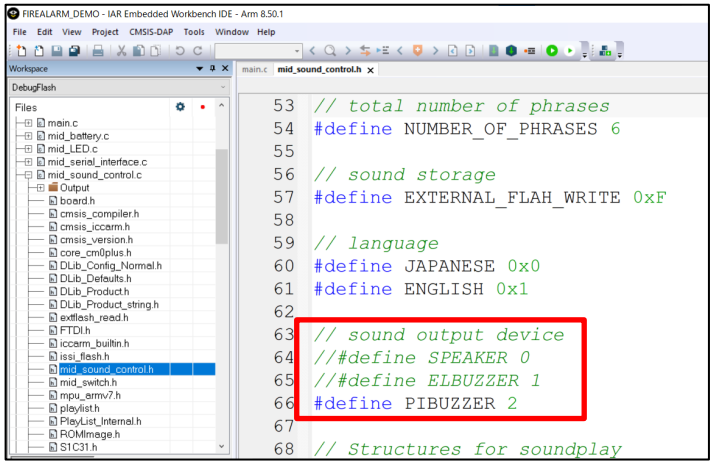
Board setting



(1)Set jumper
(2)Connect Piezoelectric buzzer to board
※Refer to the “S5U1C31D41T Manual” for the settings when supplying power to the piezoelectric buzzer from external.

Software setting

Enable “PIBUZZER” defined in the header file “mid_sound_control.h” and comment out other devices



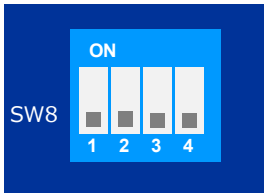
6.2 Switching sound data

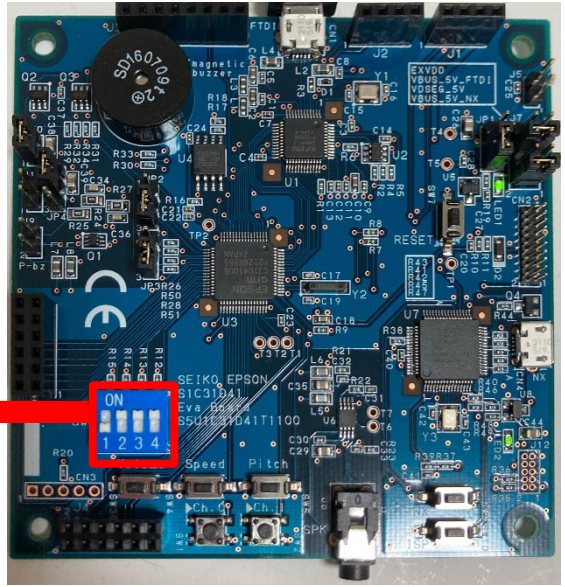
① Select language

Language can be switched by setting the DIP switch (SW8).

English

Japanese

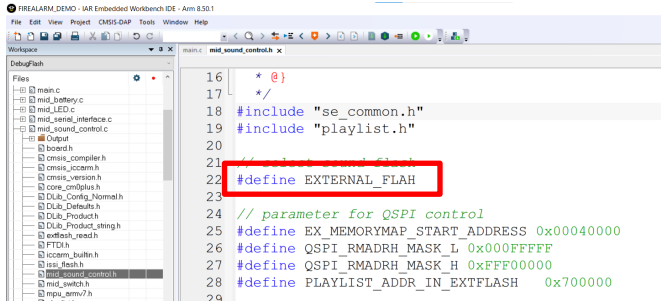




② Switching memory for sound data

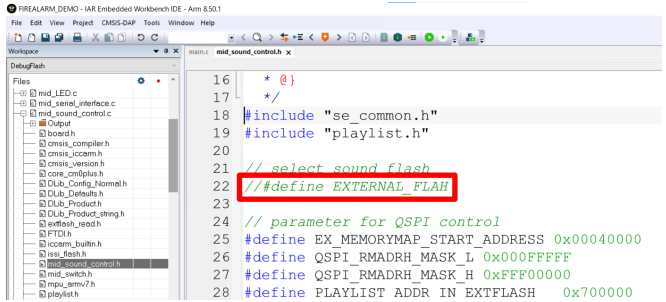
Flash memory can be switched by “EXTERNAL_FLAH” defined in the header file “mid_sound_control.h”

- Using SPI-Flash on board



```
 16    * @}
 17    */
 18  #include "se_common.h"
 19  #include "playlist.h"
 20
 21  // select sound flash
 22  #define EXTERNAL_FLAH
 23
 24  // parameter for QSPI control
 25  #define EX_MEMORYMAP_START_ADDRESS 0x00040000
 26  #define QSPI_RMADRH_MASK_L 0x000FFFFF
 27  #define QSPI_RMADRH_MASK_H 0xFFF00000
 28  #define PLAYLIST_ADDR_IN_EXTFLASH    0x700000
```

- Using internal flash of the Sound MCU “S1C31D41”



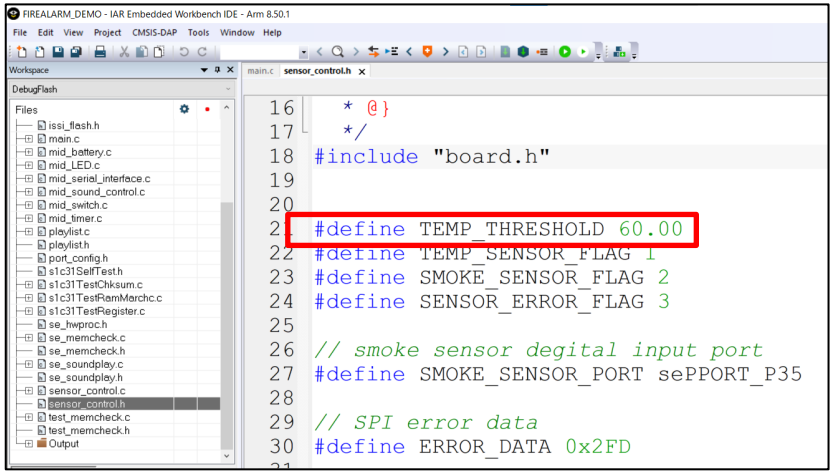
```
 16    * @}
 17    */
 18  #include "se_common.h"
 19  #include "playlist.h"
 20
 21  // select sound flash
 22  //#define EXTERNAL_FLAH
 23
 24  // parameter for QSPI control
 25  #define EX_MEMORYMAP_START_ADDRESS 0x00040000
 26  #define QSPI_RMADRH_MASK_L 0x000FFFFF
 27  #define QSPI_RMADRH_MASK_H 0xFFF00000
 28  #define PLAYLIST_ADDR_IN_EXTFLASH    0x700000
```

*”3.2 Writing sound data” cannot be executed while using the internal flash.

6.3 Threshold setting for sensor module

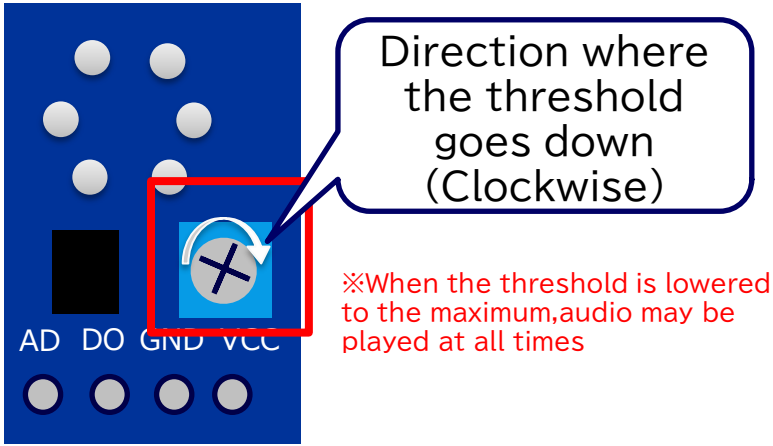
① Temperature sensor module

Change the value defined in the header file “sensor_control.h” and set the temperature threshold that triggers for the audio play.
In the case of the figure below, audio play is executed more than 60 ° C.



② Gas sensor module

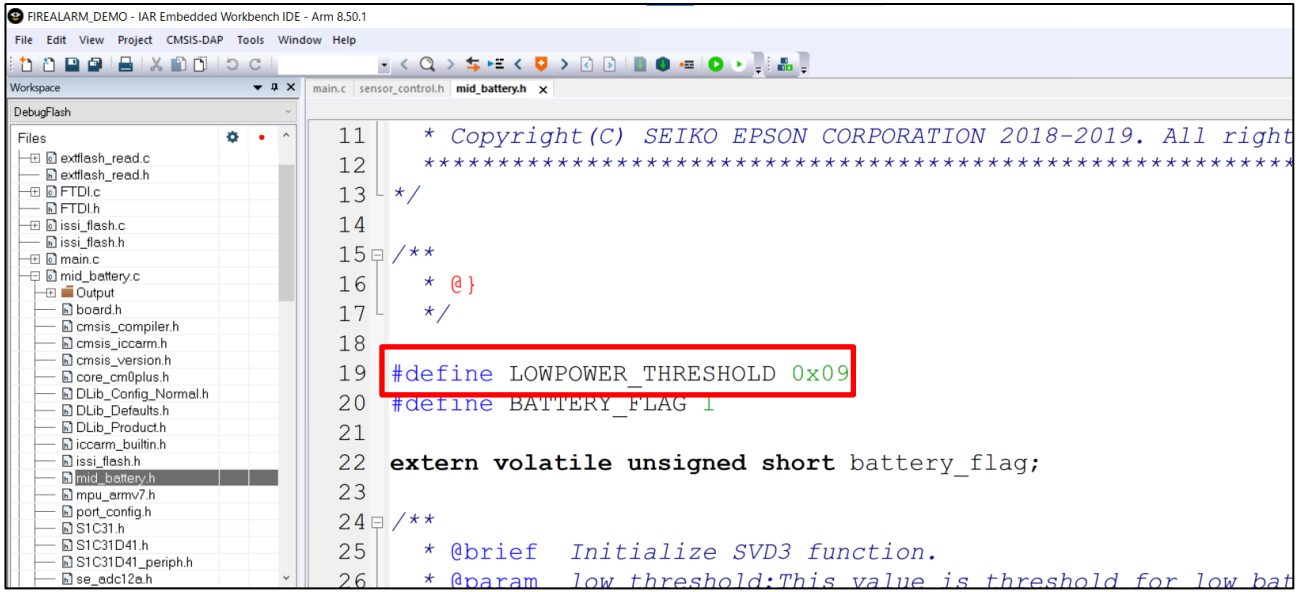
Change the gas concentration setting by adjusting the red frame in the figure below. Turning it clockwise lowers the gas concentration threshold that triggers for the audio play, and turning it counterclockwise raises the threshold.



※When the threshold is lowered to the maximum,audio may be played at all times

6.4 Threshold setting for detect low voltage

Change the value defined in the header file “mid_battery.h” to set the threshold value for detecting the low power supply voltage that triggers audio play. For the relationship between the set value and the detected voltage value, refer to the S1C31D41 manual.(23.8 Supply Voltage Detector (SVD3) Characteristics)



6.5 Self test of Flash area (checksum)

The self test function can be expanded (checksum in the Flash area) by setting the software. The target Flash area is the internal flash and the SPI-Flash on board. * If the audio Flash memory is set to the internal flash, the SPI-Flash does not perform self test.

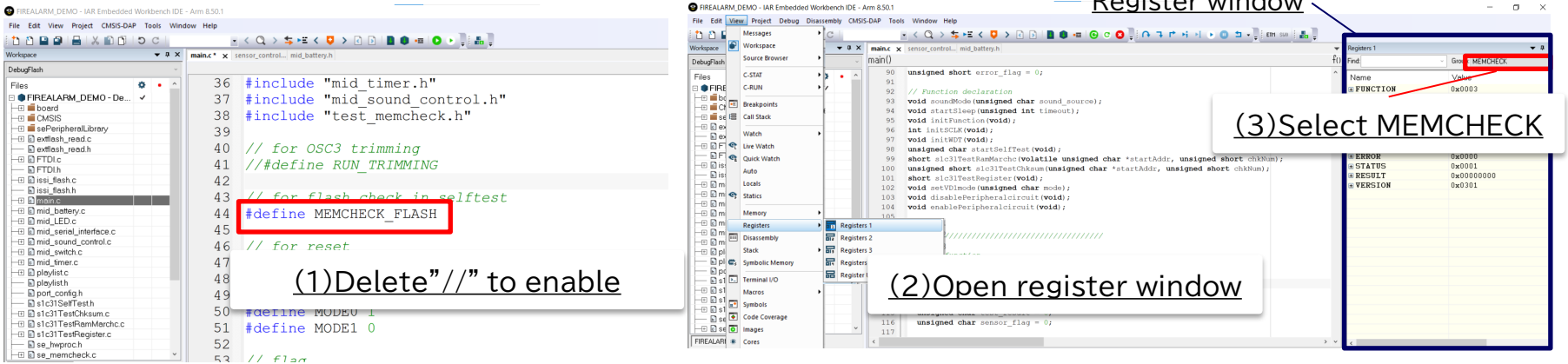
* Refer to “6.2 Switching sound data” in this document.

(1)Delete comment out(//) of “MEMCHECK_FLASH” defined in the source file ”main.c“ to enable it.

(2)Start a debug session and follow the steps below to open a register window.

View→Registers→Register 1

(3)After the register window opens, select “MEMCHECK” from the tab (Group) in the red frame in the figure.



6.5 Self test of Flash area (checksum)

(4)As shown in the figure below, set two breakpoints in the source file “main.c” and execute the program.

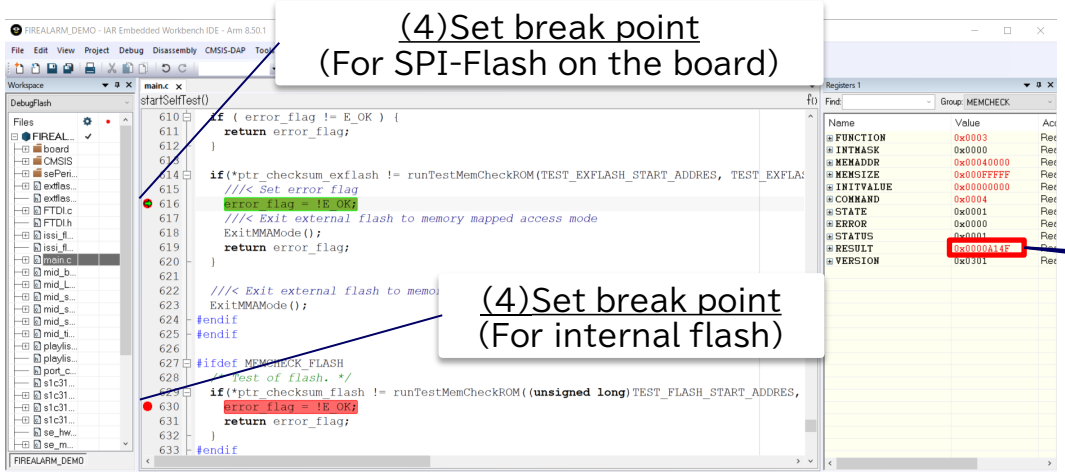
(5)Check the register value “RESULT” at the two breakpoints when it is stopped, and rewrite the initial value of the variable in the figure below.

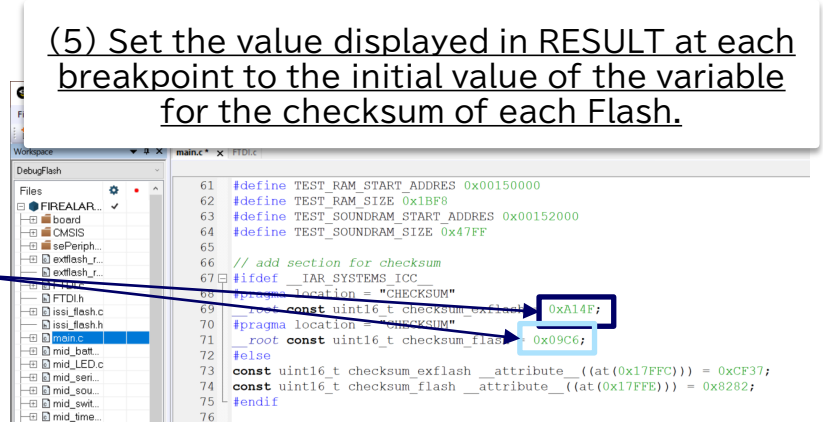
Stop at the top of the breakpoint in the figure below → Check the checksum of the SPI-Flash on the board from “RESULT” and change the initial value of the variable.

Stop at the bottom of the breakpoint in the figure below → Check the checksum of the internal flash from “RESULT” and change the initial value of the variable

※If it is not stopped at the breakpoint, it is not necessary to rewrite the initial value.

※If enabled self-test in the Flash area and changed the code or audio data, please rewrite the initial value each time.





Initial value of checksum variable (checksum_exflash) for SPI-Flash on board

Initial value of checksum variable (checksum_flash) for internal flash

7. Reference manual

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- Reference manual

Reference information	Document	Location
Sound MCU「S1C31D41」	• S1C31D41 Technical Manual	HP
Evaluation board「S5U1C31D41T」	• S5U1C31D41T Manual	
Writing software	• S1C31 Family Software Development Setup Guide • S1C31 Family Sample Software Manual	


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