External Power Supply (3.0 ~4.4V)

Figure 4. Powering the main board from the battery connector CN1.

Powering the main board via the CN1 battery connector will boot the Spresense system even if the micro USB is not connected.

Even if power is supplied from PH connector (CN1) on the main board, you can supply power from the microUSB connector on the main board and extension board. The lower limit of the voltage output of the EXT_VDD pin is about 4V.

MODIFYING THE Spresense BOARD WILL VOID THE WARRANTY. PROCEED ON YOUR OWN RISK!

1.15. How to achieve 6µA current consumption on Mainboard

It is possible to reach as low as just above 6µA during Deep Sleep using the Spresense mainboard. To achieve this the mainboard needs to be modified.

The components that needs to be removed are very small and delicate. A professional soldering iron with a very fine tip as well as a microscope is required. It is not advised to proceed if you are not fully aware of how the following changes affects the board. Some of the components are mounted due to safety reasons and these functions will be disabled after the modification.

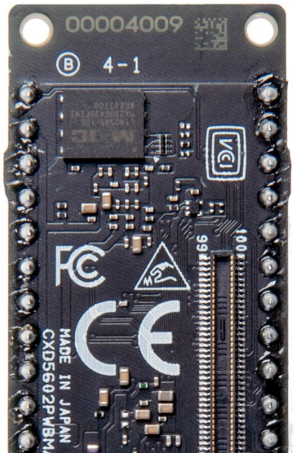
Spresense hardware documents schematics and layout:

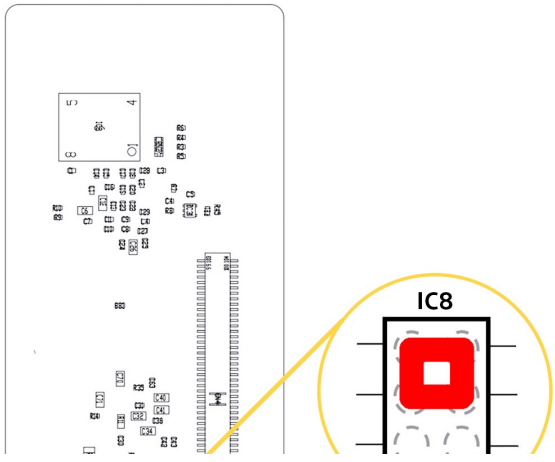
- CXD5602PWBMAIN1_schematics.pdf
- CXD5602PWBMAIN1_part_layout.pdf

1.15.1. Instructions

MODIFYING THE Spresense BOARD WILL VOID THE WARRANTY. PROCEED ON YOUR OWN RISK!

1. Remove resistor R21 to disable the POWER LED
2. Remove diode D1 for 5V_BUS.
3. Remove load switch IC8 (TCK112G) and then short pads A1,A2, B1 and B2.
4. Remove resistor R28 (XRS_PWON).
5. Remove capacitor C76 (UART_DTR).





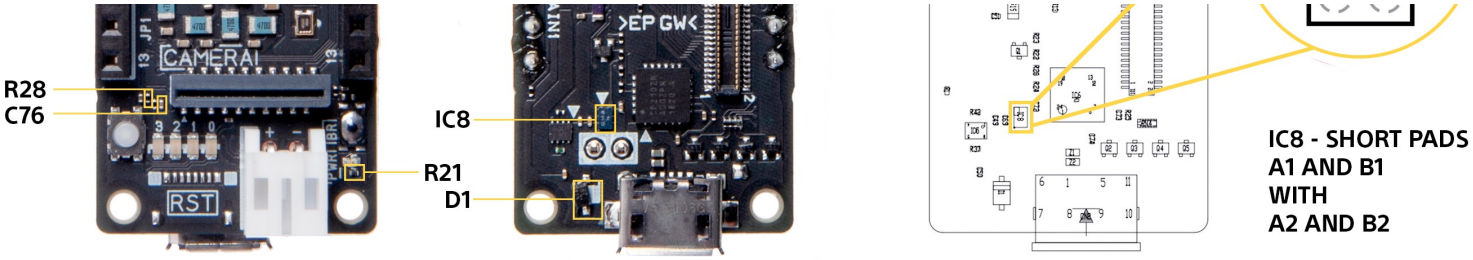


Figure 5. Placement of the components in the numbered list above.

After these modifications the Spresense mainboard cannot be powered via USB anymore so it should only be powered via the battery connector CN1. Beware of the voltage limitations on the CN1 connector.

1.15.2. Software

```
/* Sketch to achieve ~6µA during deep sleep */

#include <LowPower.h>
#include <stdlib.h>
#include <RTC.h>

#define DEEPSLEEP_TIME 5
#define AWAKE_TIME 5*1000

void setup() {
    LowPower.clockMode(CLOCK_MODE_32MHz);
    RTC.begin();
    Serial2.begin(115200);
}

void loop() {
    ledOn(LED1);

    Serial2.print("Awake for ");
    Serial2.println(AWAKE_TIME/1000);

    delay(AWAKE_TIME);
    ledOff(LED1);

    Serial2.print("Sleep for ");
    Serial2.println(DEEPSLEEP_TIME);

    LowPower.deepSleep(DEEPSLEEP_TIME);
}
```

1.16. How to use microphones

The Spresense extension board can be connected to maximum 4 analog or 8 digital microphones via JP10's 2.54mm pitch header.

The Spresense extension board is set to analog microphone mode when shipped.

To use digital microphones, the extension board needs to be configured by soldering. This configuration requires soldering of very small components and should only be attempted by people with appropriate skills and equipment.

Modifying the Spresense boards will void the warranty. Please do it at your own risk.

1.16.1. Placement of the microphone channel

The image below in this section will show where the microphone pin header (JP10 in the schematic) is located on the extension board.

In this image, the groups of A,B,C and D are analog microphone channels, and the groups of D01, D23, D45 and D67 with same color are digital microphone channels.

If the analog microphone or digital microphone input settings are set separately for each channel, sufficient input sound quality performance may not be obtained. It is recommended to set all channels to analog microphone or digital microphone input.

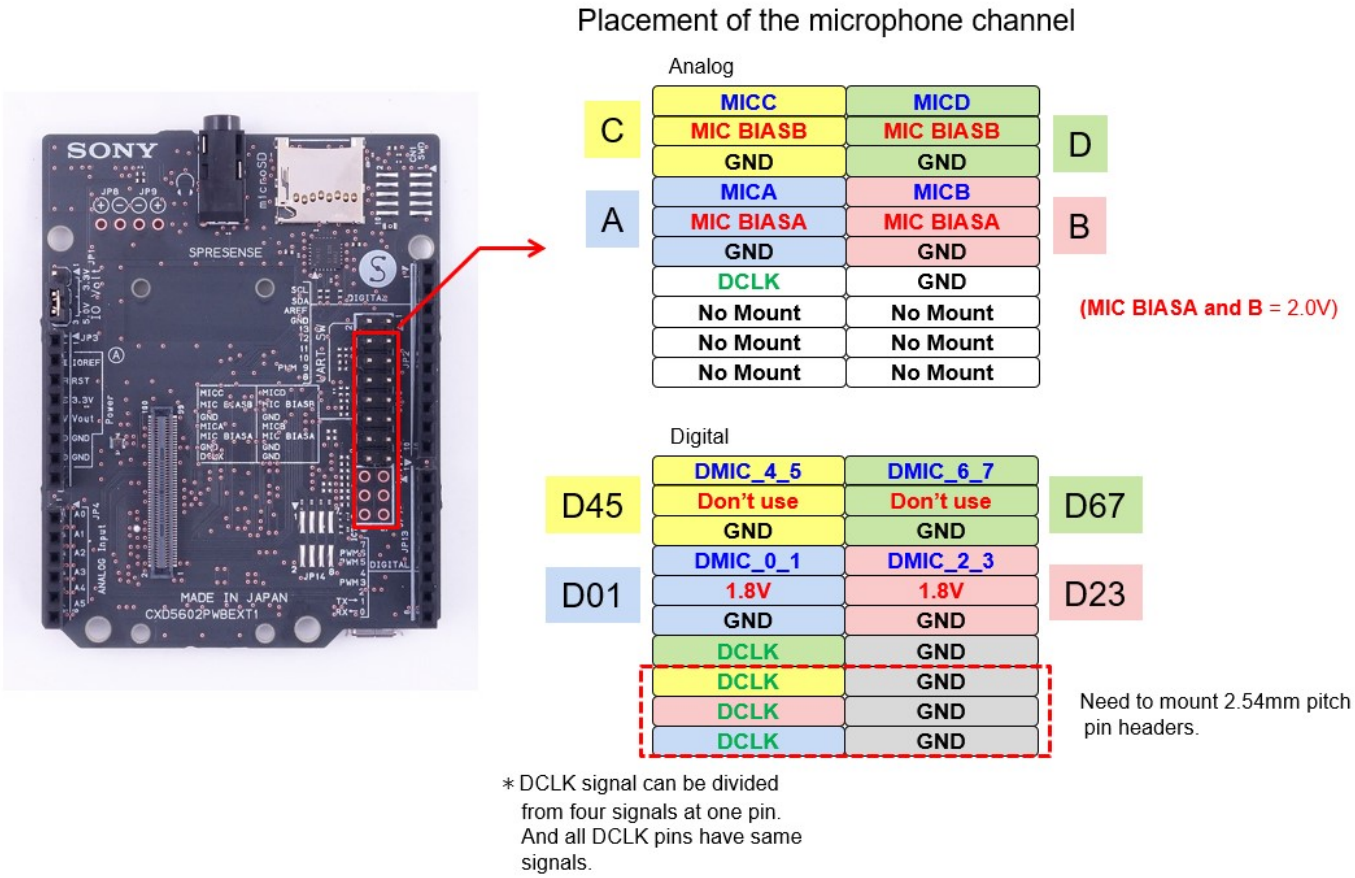


Figure 6. JP10, 2.54mm pitch microphone pin header to the left and pin description to the right.

1.16.2. How to change microphone mode from analog to digital

It is necessary to make modifications to the hardware to change the microphone mode from analog to digital.

Steps to change from analog to digital microphone mode:

- Remove R50 and mount 0 Ω to R49 (or short with a jumper wire etc).
- To enable digital a microphone channel pair, an upper and a lower pad pair on JP14 have to be shorted. Jumper wire can be soldered to connect the pads or just solder the pads together.

The best way to change microphone mode is to use 1.27mm pitch short jumpers as stated below.

- 1.27mm pitch 8pin headers (surface mount type) can be mounted on the solder pads on JP14.

This enables to select the digital microphone mode by using a jumper.

Table 8. List of 1.27mm pitch pin header models and short jumpers that can be mounted on JP14:

Vendor	Pin header	Short jumper
Samtec	FTS-104-01-L-DV-TR	
HARWIN		M50-1900005
HIROSUGI	PSM-720153-04	JS-7
JC ELECTRONICS	IKHSM28-D08G-H1.5	HSH-JB-G

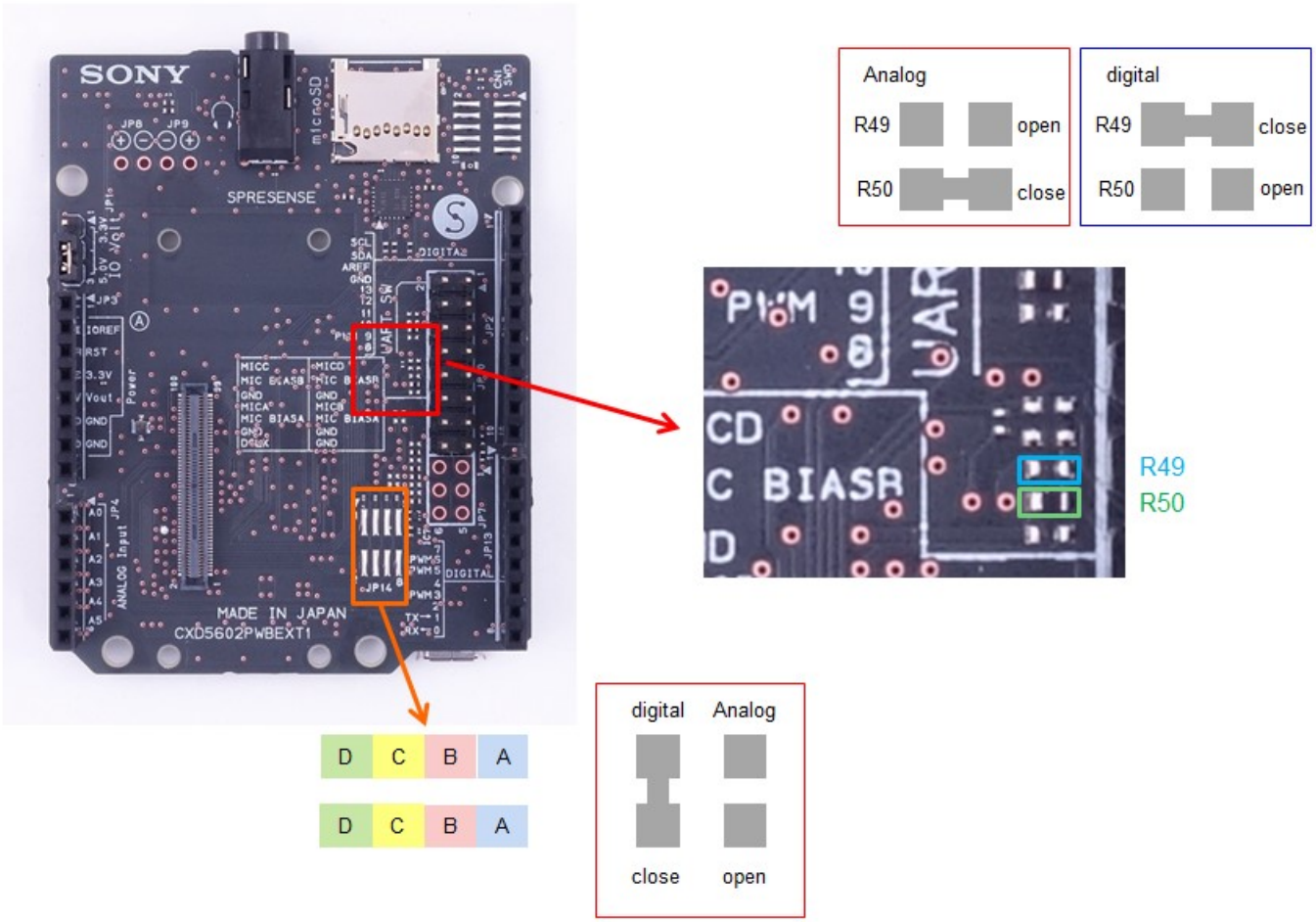


Figure 7. JP14 1.27mm pitch jumper pads.

1.16.3. How to connect analog microphones

1.16.3.1. Dynamic microphones

The microphone interface provides 4 analog microphone inputs, MICA, MICB, MICC and MICD. These terminals are AC-coupled by capacitors. It is important to use the GND on JP10 for the lowest noise operation.

1.16.3.2. Electret Microphones

2 wire electret condenser based microphones need to be biased with a 2.0V bias voltage on the input lines. To activate the bias voltage on the input line it is necessary to mount load resistors (RL) (size 1005 metric or 0402 imperial) on the extension board.

The table below will show what resistor that will activate the bias voltage for each channel on JP10.

The load resistor value is recommended for each microphone, please check the data sheet of the microphone used. The output impedance of the microphone is almost the value of the load resistor.

Table 9. Microphone channels and bias resistors:

Microphone channel	Resistor ref to mount
A	R51
B	R52
C	R47
D	R48

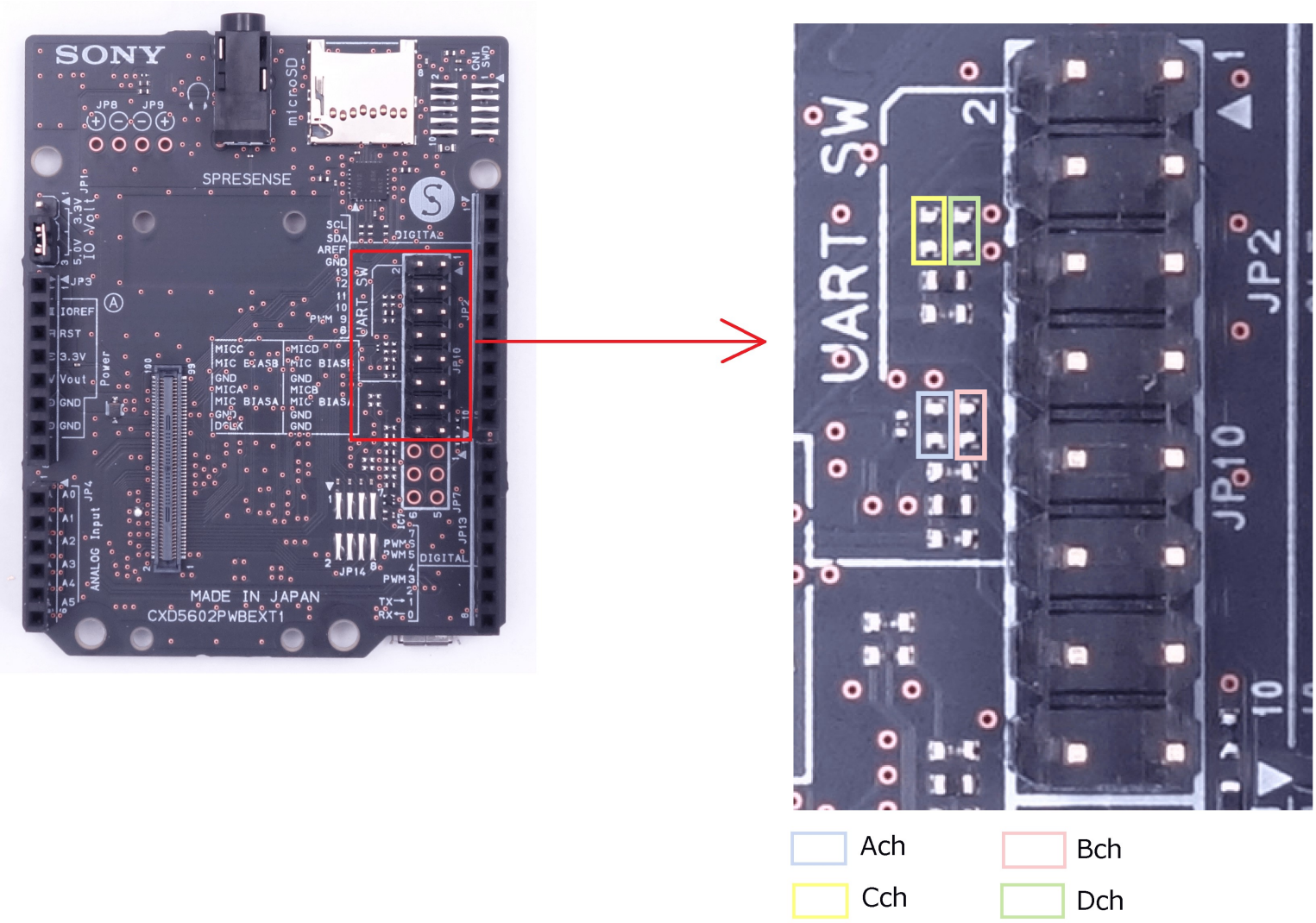


Figure 8. JP10 microphone pin header and location of bias resistors.

The following is an example of an electret microphone that can be used. The recommended microphone load resistor for the following microphones is 2.2kΩ.

Table 10. Example of an electret microphone that can be used:

Vendor	Model
CUI	CMC-5044PF-A
PUI	POM-3535P-3-R
Soberton	EM-6022P

1.16.3.3. Analog MEMS Microphones

For analog MEMS microphones the bias pins on JP10 provide power to the MEMS microphone, connect the bias pin of JP10 to the MEMS microphones power supply pin.

Table 11. Examples of analog MEMS microphone that can be used:

Vendor	Model
Knowles	SPU0414HR5H-SB
Knowles	SPH1642HT5H-1

1.16.4. How to connect digital microphones

The following way is the recommended way of connecting digital microphones to the extension board. Two digital silicon MEMS microphones can be connected using 4 pins on the JP10 pin header per microphone pair.

It is necessary to select what side each microphone in a pair is, this is done by setting the left/right select signal (LR_SEL) to LOW on one microphone and to HIGH on the other microphone. Each microphone has to connect four more pins, DMIC for data, DCLK for clock, GND to ground and VDD to 1.8V power supply.

It is possible to use the 1.8V from the MIC_BIAS pin on the extension board terminals of the A and B channel (C and D channel MIC_BIAS cannot be used).

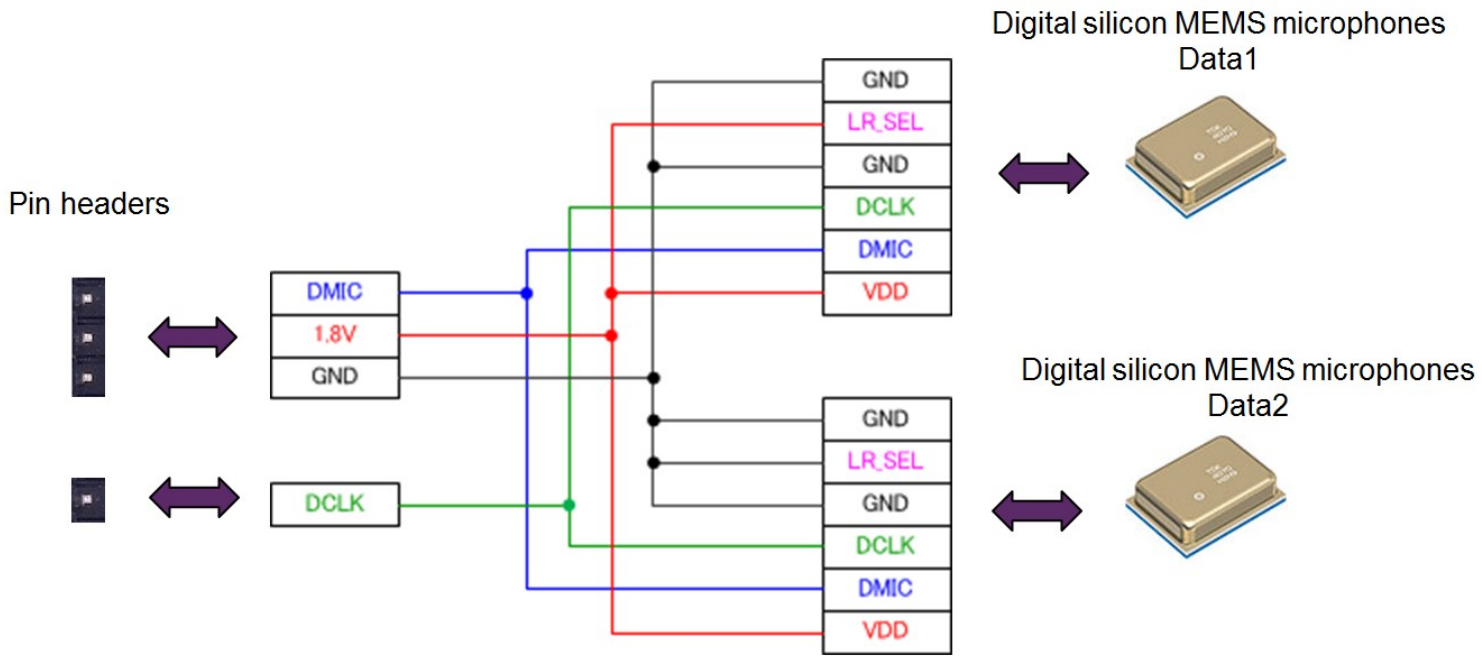


Figure 9. Recommended way of connecting digital microphones to the Spresense extension board.

Table 12. Examples of digital silicon MEMS microphones:

Vendor	Model
Knowles	SPH0641LU4H-1
Knowles	SPM0423HD4H-WB
Infineon	IM69D130