

# Sound MCU: S1C31D41

## Demonstration Software Guide

### **"1. SOUNDPLAY\_DEMO (Sound Playback Demo)"**



Rev1.00

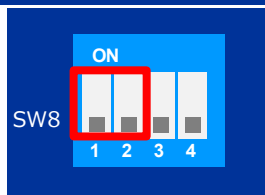
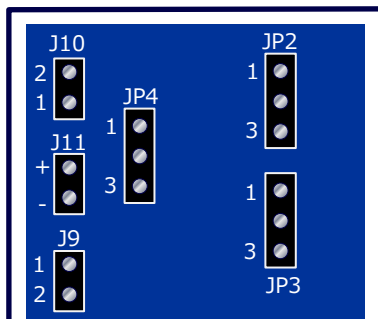
- Purpose : This document describes “SOUNDPLAY\_DEMO” software.

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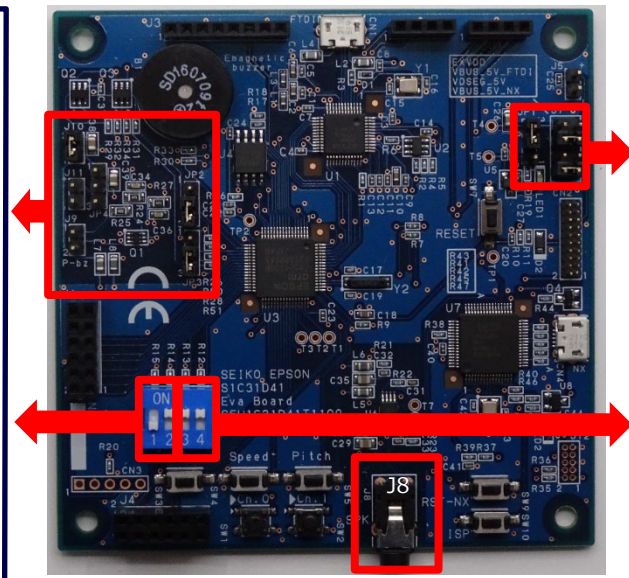
# 1. Evaluation Board

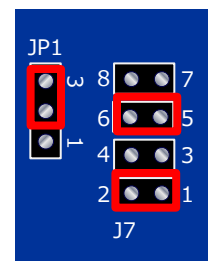
# 1.1. DIP Switch and Jumper Settings

Set the DIP switch and jumpers on the evaluation board according to each mode.



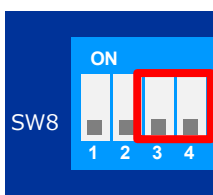
**Table1.1 Output Mode Setting**





**Table 1.2 Power Supply Setting**

Power	J7	JP1
USB 5V supply	1-2 short 3-4 open 5-6 short 7-8 open	2-3 short



**Table1.3 Demo Mode Setting**

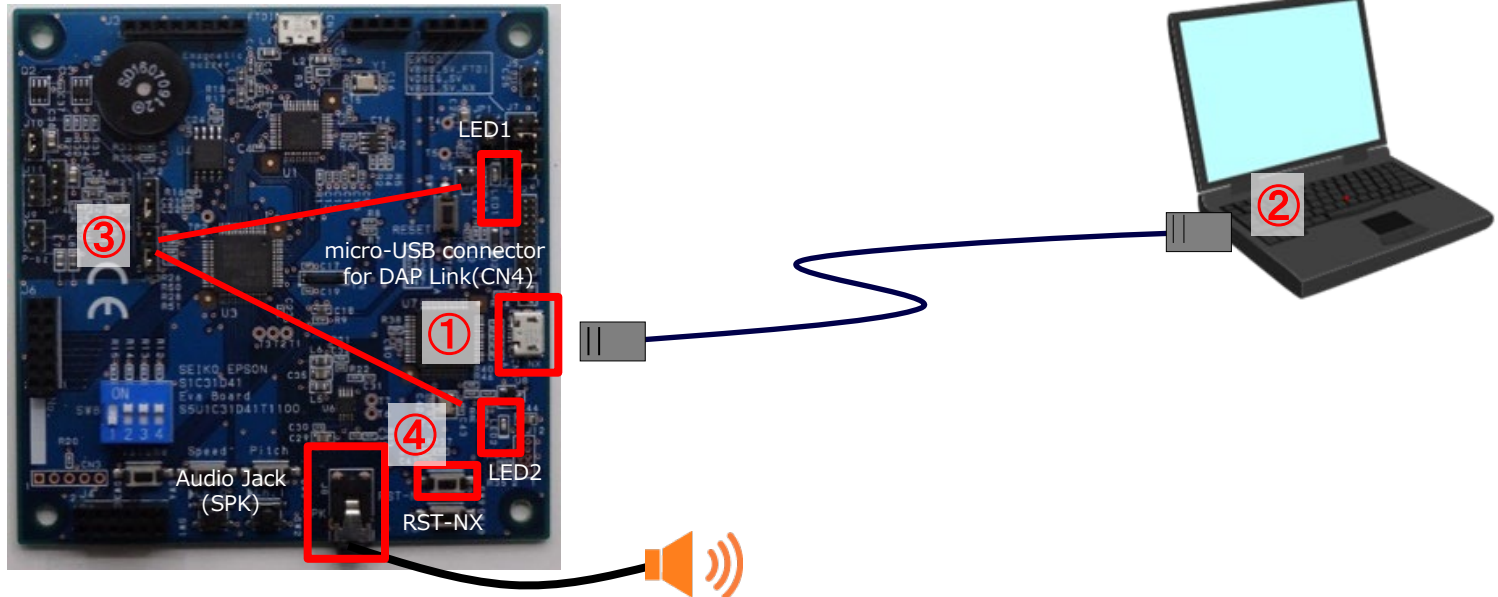
Demo Mode	SW8-3	SW8-4
Demo 0	OFF	OFF
Demo 1	OFF	ON
Internal Flash Demo	ON	OFF
Preset Demo	ON	ON

Output Mode	SW8-1	SW8-2	JP2	JP3	JP4	J10	J8	J9	J11
Speaker	OFF	OFF	-	-	1-2 open	1-2 open	Speaker	-	-
Electromagnetic Buzzer	OFF	ON	2-3 short	2-3 short	1-2 open	1-2 short	-	-	-
Piezoelectric Buzzer(USB 5V)	ON	OFF	1-2 short	1-2 short	1-2 short	1-2 open	-	Buzzer	-
Piezoelectric Buzzer(Ext. Voltage)	ON	OFF	1-2 short	1-2 short	2-3 short	1-2 open	-	Buzzer	Ext. Power

## 1.2. PC Connection

Follow the steps below to connect the PC to the evaluation board.

- ① Connect the micro USB cable to “CN4” connector on the evaluation board.
- ② Connect the micro USB cable to the USB port of the PC with IDE installed.
- ③ Make sure LED1 and LED2 on the evaluation board are lit.
- ④ Push “RST-NX” button.



## 2. Demonstration Software

## 2.1. Build and Download

Build **SOUNDPLAY\_DEMO** project in S1C31D41 peripheral sample software package and download the software to the evaluation board.

1. Double click the “SOUNDPLAY\_DEMO” workspace file to launch the IDE.
2. Build this project and download the built software to S1C31D41 on the evaluation board.

\*1: This software uses the EEPROM emulation library, **so be sure to erase the flash memory before downloading this software.**

\*2: For details on software build and download, refer to the following documents.

- S1C31 Family Peripheral Circuit Sample Software Manual

```
[s1c31d5xd41sp_verx_xx]
- [Licenses]: License group
- [Drivers]: Driver group
  - [board]: Drivers related to the evaluation board
    - [S5U1C31D41T1]
      - [ARM]
      - [IAR]
      - board.c/.h: Evaluation board setting program
      - settings.h: Definition file for setting the function of the evaluation board
    - ...
  - [CMSIS]: CMSIS Drivers
    - [Device]
      - [S1C31D41]
        - [Include]
          - S1C31D41.h: CMSIS peripheral circuit access layer header file
          - ...
        - [Source]
          - [ARM]
          - [IAR]
          - startup_S1C31D41.s: CMSIS startup program
          - system_S1C31D41.c: CMSIS peripheral circuit access layer program
      - [Driver]
      - [SVD]
    - [sePeripheralLibrary]: Peripheral circuit library
      - se_dlg.c/.h
      - se_i2c.c/.h
      - ...
  - [Middleware]: Middleware group
    - [seHWProcLibrary]: HW Processor library
    - [seEepromLibrary]: EEPROM emulation library
    - [seFlashLibrary]: Self-programming library
  - [Projects]: Sample software group
    - [Demonstration]: Various demonstration software
      - [SOUNDPLAY_DEMO]: Sound Playback Demo Project
        - [ARM]: MDK-ARM Project
          - soundplay_demo_D41.uvmpw: Workspace file
        - [IAR]: IAR EWARM Project
          - SOUNDPLAY_DEMO_D41.eww: Workspace file
        - main.c
        - ...
      - ...
    - [Applications]: Application software group
    - [Examples]: Peripheral example software group
  - README.txt
```

## 2.2. Operation Flow

**SOUNDPLAY\_DEMO** uses the SOUNDPLAY function provided by the HW processor to execute various sound playback controls by the push switch operation.

1. Get the language type of the preset demo(\*1).
2. Set System Clock as OSC3 16MHz for SOUNDPLAY.
3. Initialize the ports that control peripheral components(DIP switch, Push switch, FTDI).
4. Scan DIP switch and read the operation mode(Sound Playback, Sound ROM Update).
5. Run the following processing according to the acquired operation mode.

### **Sound Playbak Mode**

1. Initialize QSPI for access to external QSPI-Flash.
2. Set the starting address and the size of Sound ROM(Internal Flash/External QSPI-Flash)
3. Initialize the port for amplifier control.
4. Initialize T16 Timer for push switch control.
5. Call seSoundPlayInit(\*2) corresponding to the output mode to initialize SOUNDPLAY function on HWP.
6. Call seSoundPlaySetParameter(\*2) and seSoundPlayRunCommand(\*2) by Push Switch interrupt to execute Sound Play/Stop, Speed Change, Pitch Change and Volume Change.

### **Sound ROM Update Mode**

1. Initialize QSPI for access to external QSPI-Flash.
2. Initialize the SPI and wait for communication with the PC writer tool to be established.
3. After establishing communication with the PC, follow the instructions of the PC writer tool to receive the audio ROM data from the PC, and send the received audio ROM data to the external QSPI-Flash for updating.

\*1: This process is valid only in the preset demo.

\*2: For details of HWP library function specification (seSoundPlay functions), please see the following document.

• S1C31D41 Demonstration Software Guide "2. SOUNDPLAY(Sound Playback Example)" (2\_S1C31D41\_SoundPlay\_e\_revxx.pptx)



## 2.3. Demonstration Operation / Sound ROM Update

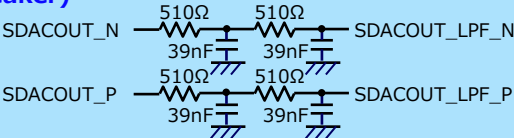
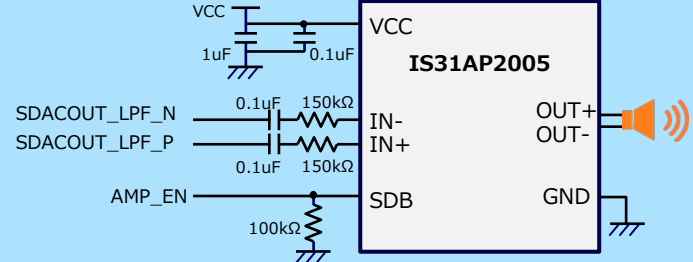
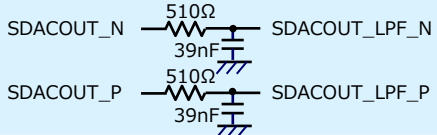
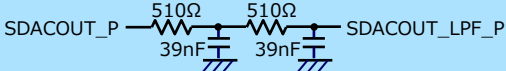
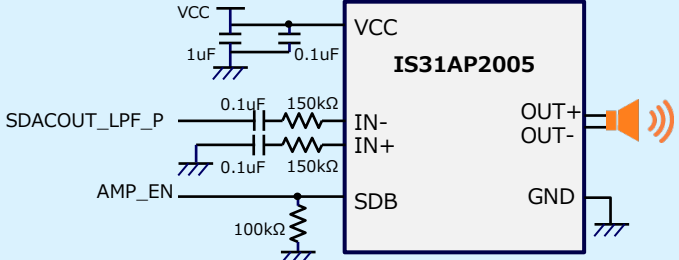
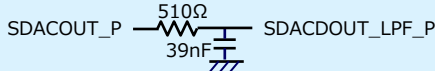
Please refer to the following documents for how to operate the demo and how to update the sound ROM.

- **S1C31D41 Evaluation Board Start Guide**
- **S1C31D41 Evaluation Board Update Tool Guide**

### 3. Recommended Circuit for Each Output Mode

# 3.1. Recommended Circuit for Speaker and Amplifier

Circuit constants depend on the amplifier, the speaker, and sound quality requirements.

MCU output	Low Pass Filter(cut off freq.:8kHz)	Amplifier Circuit(please see amplifier document)
<b>S1C31D41</b>  SDACOUT_N  SDACOUT_P  PORT AMP_EN	<b>2nd order(white noise reduction, depending on the speaker)</b> 	<b>Differential Output(board noise immunity)</b>  <p>This figure is a reference circuit, and the actual use should be based on the customer's evaluation, responsibility, and judgment.</p>
	<b>1st order(cost priority)</b> 	
<b>S1C31D41</b>  SDACOUT_P  PORT AMP_EN	<b>2nd order(white noise reduction, depending on the speaker)</b> 	<b>Single End Output(cost priority)</b>  <p>This figure is a reference circuit, and the actual use should be based on the customer's evaluation, responsibility, and judgment.</p>
	<b>1st order(cost priority)</b> 	

\* The recommended circuit amplifier is IS31AP2005 made by ISSI, which is mounted on our evaluation board. [IS31AP2005 Rev.D \(lumissil.com\)](http://lumissil.com)

## 3.2. Recommended Circuit for Electromagnetic Buzzer

Circuit constants depend on the electromagnetic buzzer, voltage, and sound pressure requirements.

### MCU output

S1C31D41

SDACOUT\_P2

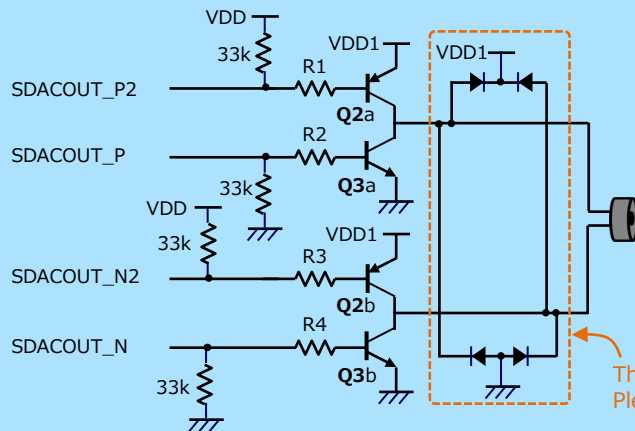
SDACOUT\_P

SDACOUT\_N2

SDACOUT\_N

### Recommended Circuit

For the resistance values R1, R2, R3, and R4, select the optimum value for the electromagnetic buzzer to be connected. The table below shows the recommended resistance values when using each electromagnetic buzzer manufactured by TDK Corporation. These values are calculated from the supply voltage to the electromagnetic buzzer (VDD1) and the specifications (DC resistance, maximum current).



This is a circuit to prevent back electromotive force.  
Please evaluate and judge whether it is necessary.

Mark	Parts
Q2	2 x PNP-Tr
Q3	2 x NPN-Tr

Power Supply	DC Resistance	Io-p(max)	Resistance R1/R2/R3/R4
3v	70Ω	40mA	4.7kΩ
5v	70Ω	70mA	2.2kΩ

\* For details on the recommended circuit, refer to the circuit diagram in "S5U1C31D41T Manual".

### 3.3. Recommended Circuit for Piezoelectric Buzzer

Circuit constants depend on the piezoelectric buzzer, voltage, current, and sound pressure requirements.

MCU output

S1C31D41

SDACOUT\_P

SDACOUT\_N

For the resistance values R1, R2, and R3, select the optimum value from the supply voltage to the piezoelectric buzzer and the target current. The table below shows the recommended resistance values for the supply voltage and target current. (When selecting a MOSFET for Q1, make sure that the applied voltage does not exceed the withstand voltage value of the MOSFET.)

Mark	Parts
Q1	2 x NMOS

Power Supply	Io-p(max)	Resistance	
		R1/R2	R3
15v	30mA	560Ω	220Ω
	20mA	820Ω	220Ω
	10mA	1.8kΩ	220Ω
	5mA	3.3kΩ	220Ω

Power Supply	Io-p(max)	Resistance	
		R1/R2	R3
12v	30mA	470Ω	180Ω
	20mA	680Ω	180Ω
	10mA	1.5kΩ	180Ω
	5mA	2.7kΩ	180Ω

Power Supply	Io-p(max)	Resistance	
		R1/R2	R3
5v	30mA	180Ω	100Ω
	20mA	270Ω	100Ω
	10mA	560Ω	100Ω
	5mA	1.0kΩ	100Ω

Power Supply	Io-p(max)	Resistance	
		R1/R2	R3
3v	30mA	100Ω	47Ω
	20mA	150Ω	47Ω
	10mA	330Ω	47Ω
	5mA	560Ω	47Ω

10mA difference makes roughly 1-3db

\* For details on the recommended circuit, refer to the circuit diagram in "S5U1C31D41T Manual".

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