

CMOS 32-BIT SINGLE CHIP MICROCONTROLLER

# **S5U1C31D51T2 Manual**

**(S1C31D51 BUZZER Evaluation Board)**

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## 1. Overview

S5U1C31D51T2 (S1C31D51 Buzzer Evaluation Board) is a BUZZER evaluation board for buzzer speech playback function using S1C31D51, a single-chip microcontroller manufactured by Seiko EPSON. This board can be used in combination with S1C31D51 evaluation board (S5U1C31D51T1).

This board implements circuits that can drive an electromagnetic buzzer and a piezoelectric buzzer by output signal from S1C31D51. An electromagnetic buzzer (SD160709 made by TDK Corporation) and a piezoelectric buzzer (PS1720P02 made by TDK Corporation) are included in S5U1C31D51T2 to be used for buzzer speech evaluation.

Figure 1.1 shows the external view of S5U1C31D51T2.

Figure 1.2 shows the external view of S5U1C31D51T2 connected with S5U1C31D51T1.



Figure 1.1 S5U1C31D51T2 External View

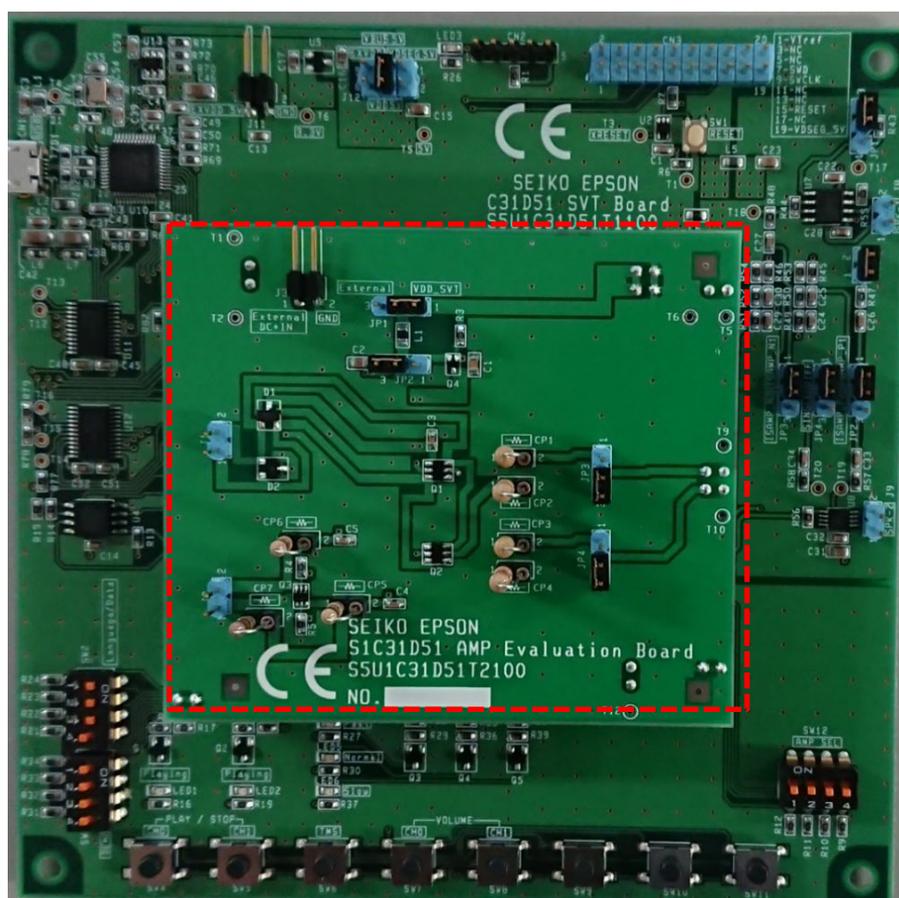


Figure 1.2 S5U1C31D51T2 External View connected with S5U1C31D51T1

## 2. Name and Function of Each Part

## 2. Name and Function of Each Part

Table 2.1 lists the main parts on S5U1C31D51T2. Also Figure 2.1 shows the layout of the parts on the board.

Table 2.1 List of Main Parts

| Name                         | Part Number        | Description  | Remarks |
|------------------------------|--------------------|--|---------|
| Jumper                       | JP1                | For power selection  |         |
| Jumper                       | JP2                | For power selection  |         |
| Jumper                       | JP3, JP4           | For circuit selection (electromagnetic buzzer /piezoelectric buzzer) |         |
| Connector                    | J1                 | For electromagnetic buzzer connection                                |         |
| Connector                    | J2                 | For piezomagnetic buzzer connection                                  |         |
| Connector                    | J3                 | For external power supply  |         |
| Transistor                   | Q1, Q2             | Discrete circuit for electromagnetic buzzer                          |         |
| Transistor                   | Q3                 | Discrete circuit of piezoelectric buzzer                             |         |
| Socket for resistor inserted | CP1, CP2, CP3, CP4 | Discrete circuit for electromagnetic buzzer                          |         |
| Socket for resistor inserted | CP5, CP6, CP7      | Discrete circuit for piezoelectric buzzer                            |         |

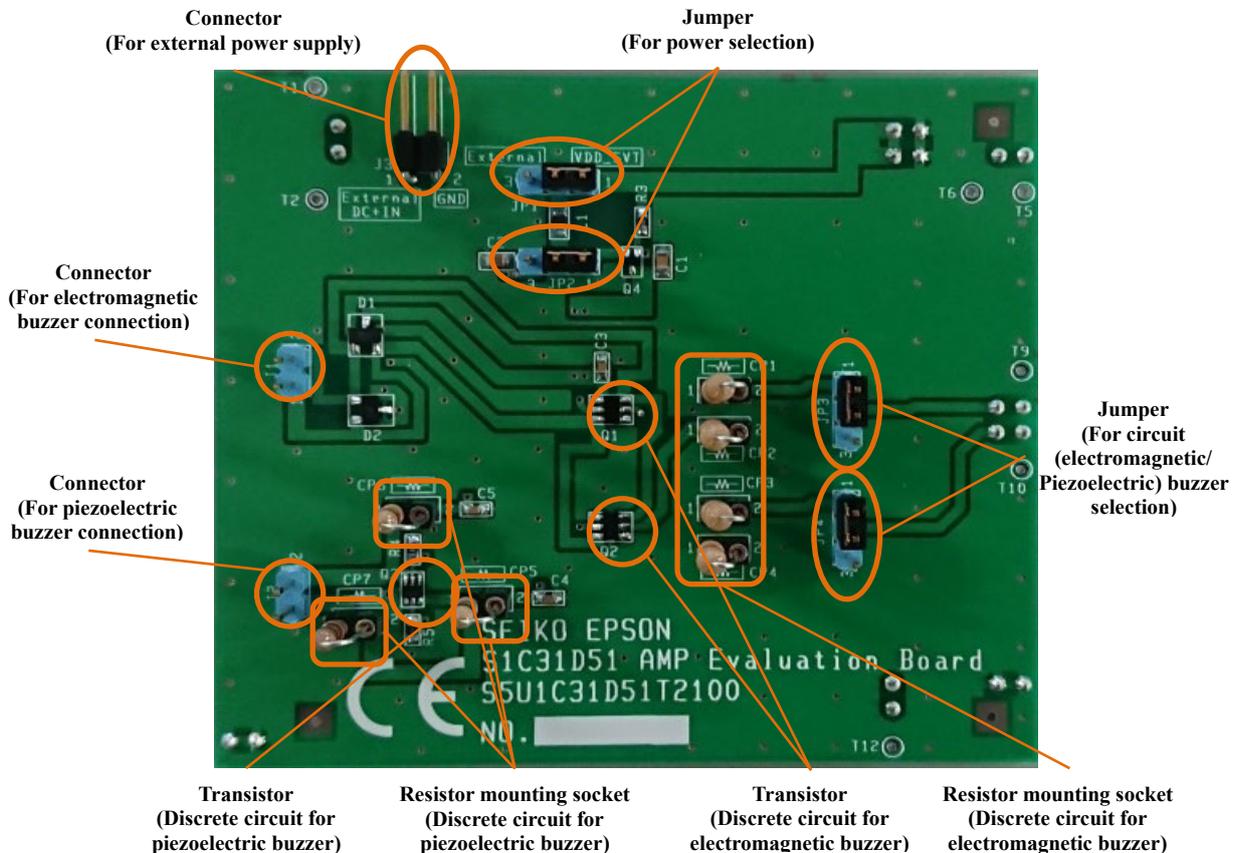


Figure 2.1 Layout of Main Parts

### 3. Settings

#### 3.1 Jumpers

Table 3.1.1 shows Jumper settings.

Table 3.1.1 Jumper Settings

| Jumper: JP1/JP2/JP3/JP4                                    |  |  |
|--|--|--|
| JP1  | JP2  | JP3/JP4  |
| <b>1-2 Short (Disable the external power supply)</b>       | <b>1-2 Short (Enable the power for Electromagnetic Buzzer)</b> | <b>1-2 Short (Select the circuit for Electromagnetic Buzzer)</b> |
| 2-3 Short (Enable the external power supply)* <sup>1</sup> | 2-3 Short (Enable the power for Piezoelectric Buzzer)          | 2-3 Short (Select the circuit for Piezoelectric Buzzer)          |

\* **Bold letters are the factory settings.**

\*1, Be sure to supply external power while the power of the S1C31D51 evaluation board(S5U1C31D51T1) to be connected is supplied.

#### 3.2 Resistors

Table 3.2.1 shows Resistor mountings. The optimum resistors for included buzzers have been mounted.

Table 3.2.1 Resistors

| Socket: CP1/CP2/CP3/CP4/CP5/CP6/CP7 |         |         |         |                                |        |        |
|-------------------------------------|---------|---------|---------|--------------------------------|--------|--------|
| For Electromagnetic buzzer drive    |         |         |         | For Piezoelectric buzzer drive |        |        |
| CP1                                 | CP2     | CP3     | CP4     | CP5                            | CP6    | CP7    |
| 2.2kohm                             | 2.2kohm | 2.2kohm | 2.2kohm | 180ohm                         | 180ohm | 100ohm |

#### 3.3 Connectors

Table 3.3.1 shows Connector settings. Use Electromagnetic/Piezoelectric buzzer included in S5U1C31D51T2.

The buzzer drive circuits implemented on S5U1C31D51T2 have resistance value (see Table 3.2.1) optimized for buzzers included in the package. **Please be sure to change/adjust the resistance value from CP1 to CP7 and power (supplied from J3) when using a buzzer other than the one included in the package. Note that the board may be damaged by a large current if it is driven by an incorrect resistance value or incorrect power supply.**Please refer to Appendix for the resistance value and power supply adjustment when using a buzzer other than the included buzzer.

Table 3.3.1 Connectors

| Connector: J1/J2/J3  |   |                          |
|--|---|--------------------------|
| J1   | J2  | J3                       |
| To connect Electromagnetic Buzzer (SD160709 made by TDK Corporation) | To connect Piezoelectric Buzzer (PS1720P02 made by TDK Corporation) | To supply external power |

\*1, Be sure to supply external power while the power of the S1C31D51 evaluation board(S5U1C31D51T1) to be connected is supplied.

### 3. Settings

#### 3.4 Jumper settings for S1C31D51 evaluation board (S5U1C31D51T1)

Table 3.4.1 shows the jumper settings for the S1C31D51 evaluation board (S5U1C31D51T1) to connect S5U1C31D51T2.

Table 3.4.1 Jumper settings for S5U1C31D51T1 connected with S5U1C31D51T2

| Jumpers on S5U1C31D51T1: J3/J4/J5/J6 |        |         |        |         |        |         |        |
|--------------------------------------|--------|---------|--------|---------|--------|---------|--------|
| J3                                   |        | J4      |        | J5      |        | J6      |        |
| Pin No.                              | Status | Pin No. | Status | Pin No. | Status | Pin No. | Status |
| 51-52                                | Open   | 45-46   | Open   | 1 - 2   | Open   | 1 - 2   | Open   |
| Others                               | Short  | Others  | Short  | 21-22   | Open   | 43-44   | Open   |
|                                      |        |         |        | 23-24   | Open   | 45-46   | Open   |
|                                      |        |         |        | 43-44   | Open   | Others  | Short  |
|                                      |        |         |        | Others  | Short  |         |        |

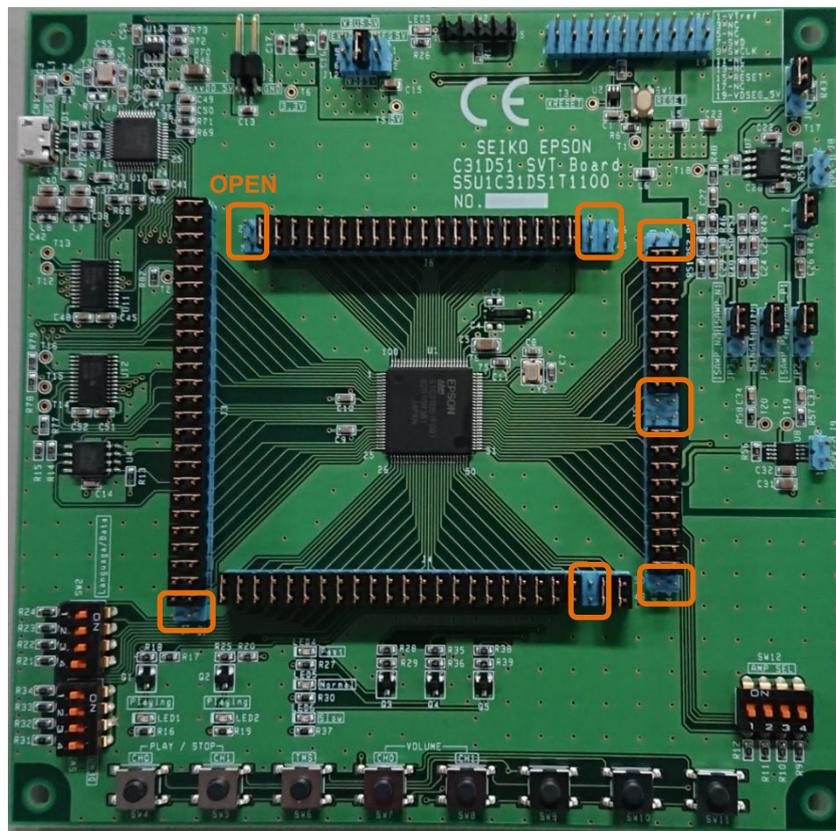


Figure 3.4.1 Jumper settings for S5U1C31D51T1 connected with S5U1C31D51T2

## 4. Usage

### 4.1 Running of the demo software

The demo software can perform 2-channel mixing, TSM(Time-scale-modification), etc, of speech playback on electromagnetic or piezoelectric buzzer by operating push switch (SW4, SW5, ..., SW10) on the board.

The following steps show to run the demo software using electromagnetic and piezoelectric buzzer.

- 1) Set Jumpers (JP1/JP2/JP3/JP4) according to the buzzer used. (see Table 3.1.1)
- 2) Connect S5U1C31D51T2 to S1C31D51 evaluation board (S5U1C31D51T1). (see Table 3.4.1)
- 3) Connect buzzer. (Electromagnetic buzzer to J1, or Piezoelectric buzzer to J2. Both buzzers are included in this product.)
- 4) Set SW12 on the S5U1C31D51T1 according to buzzer used.
- 5) Supply 5V power over Micro-USB cable to be connected.
- 6) Push SW1 (RESET) to reset the S5U1C31D51T1.
- 7) Push SW4 (PLAY/STOP-CH0) or SW5 (PLAY/STOP-CH1) to start speech/audio playback.

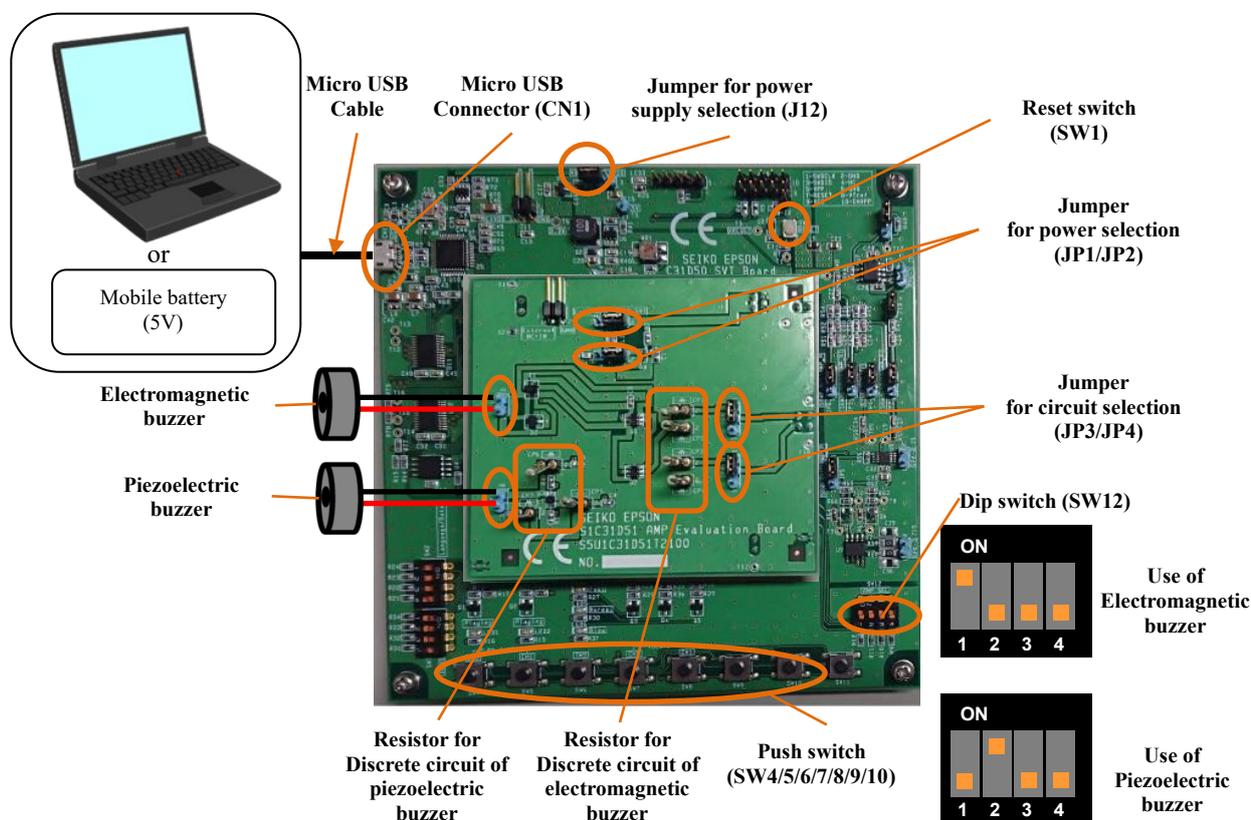
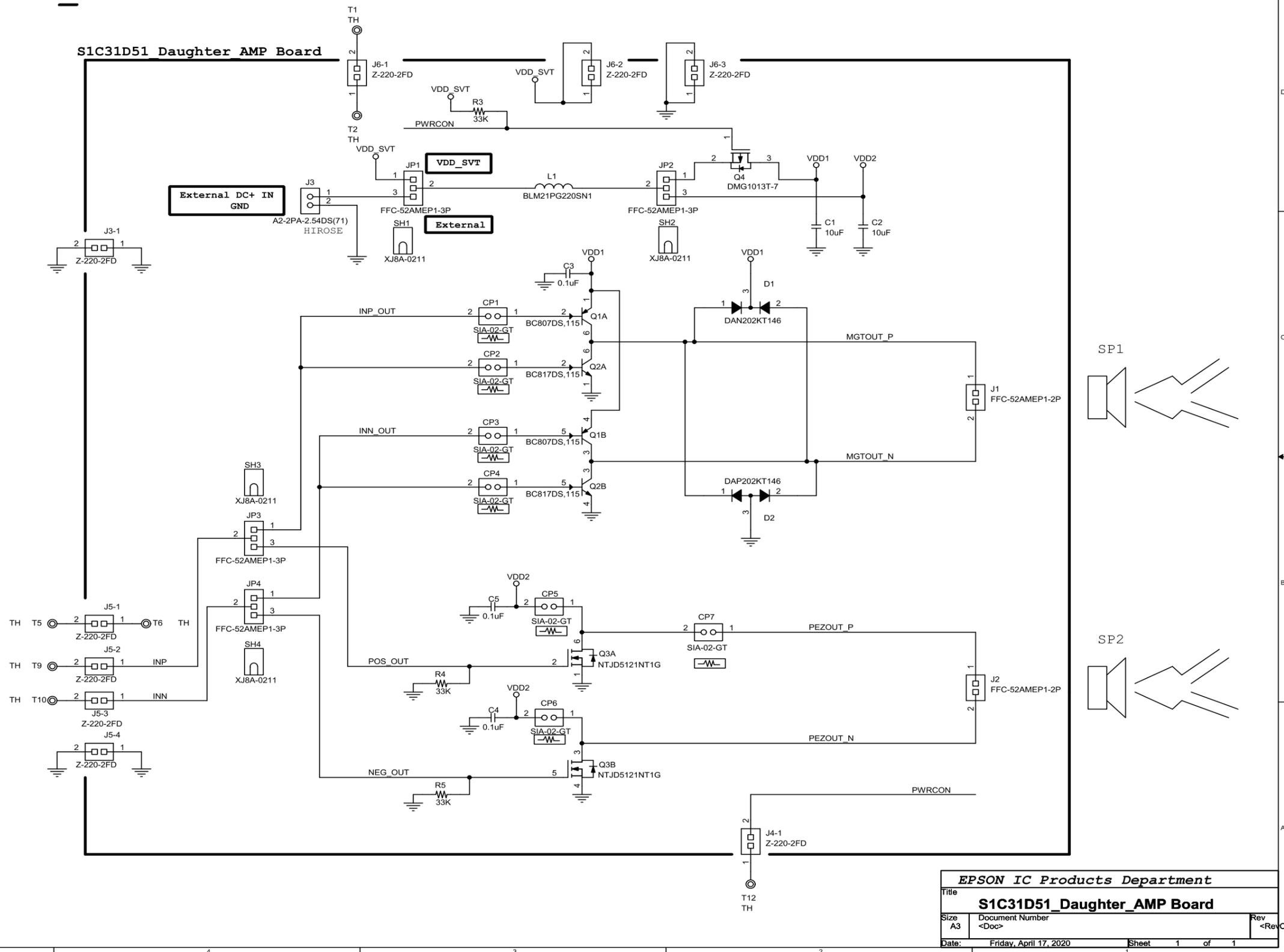


Figure 4.1.1 Layout of Main Parts for running of the demo software

Appendix A Circuit Diagrams

**S1C31D51\_Daughter\_AMP Board**



|   |                          |               |
|---|--------------------------|---------------|
| EPSON IC Products Department                |                          |               |
| Title<br><b>S1C31D51_Daughter_AMP Board</b> |                          |               |
| Size<br>A3                                  | Document Number<br><Doc> | Rev<br><RevC> |
| Date:<br>Friday, April 17, 2020             | Sheet<br>1               | of<br>1       |

## Appendix B Parts List

Note ! Parts are subject to change without notice.

| Item | Quantity | Reference  | Part              | Manufacture   | Other Comment |
|------|----------|--|-------------------|---------------|---------------|
| 1    | 7        | CP1,CP2,CP3,CP4,CP5,CP6,<br>CP7                  | SIA-02-GT         | JAPAN CONNECT |               |
| 2    | 2        | C1,C2  | CL21A106KAFN3NE   | Samsung       |               |
| 3    | 3        | C3,C4,C5   | CL10B104KB8NNNC   | Samsung       |               |
| 4    | 1        | D1   | DAN202KT146       | ROHM          |               |
| 5    | 1        | D2   | DAP202KT146       | ROHM          |               |
| 6    | 4        | JP1,JP2,JP3,JP4                                  | FFC-52AMEP1-3P    | HONDA TSUSHIN |               |
| 7    | 2        | J1,J2  | FFC-52AMEP1-2P    | HONDA TSUSHIN |               |
| 8    | 1        | J3   | A2-2PA-2.54DS(71) | HIROSE        |               |
| 9    | 9        | J3-1,J4-1,J5-1,J5-2,J5-3,<br>J5-4,J6-1,J6-2,J6-3 | Z-220-2FD         | HONDA TSUSHIN |               |
| 10   | 1        | L1   | BLM21PG220SN1     | MURATA        |               |
| 11   | 1        | Q1   | BC807DS,115       | Nexperia      |               |
| 12   | 1        | Q2   | BC817DS,115       | Nexperia      |               |
| 13   | 1        | Q3   | NTJD5121NT1G      | ON Semi.      |               |
| 14   | 1        | Q4   | DMG1013T-7        | DIODES        |               |
| 15   | 3        | R3,R4,R5   | RMCF0603JT33k0    | Stackpole     |               |
| 16   | 4        | SH1,SH2,SH3,SH4                                  | XJ8A-0211         | OMRON         |               |
| 17   | 2        | CP5,CP6  | CF14JT180R        | Stackpole     |               |
| 18   | 1        | CP7  | CF14JT100R        | Stackpole     |               |
| 19   | 4        | CP1,CP2,CP3,CP4                                  | CF12JT2K20        | Stackpole     |               |
| 20   | 1        |  | PS1740P02CE       | TDK           |               |
| 21   | 1        |  | SD160709          | TDK           |               |

## Appendix C Recommended circuit for Buzzer connection

### C.1 Recommended circuit for Electromagnetic buzzer connection

Figure C.1.1 shows the recommended circuit when connecting the electromagnetic buzzer. Select the resistance R1 to R4 in Fig C.1.1 so that they are optimized for the electromagnetic buzzer to be connected. Table C.1.1 shows the recommended resistance values for each electromagnetic buzzer made by TDK corporation. These values are calculated from the supply voltage to electromagnetic buzzer (VDD1) and specification of DC resistance, maximum current.

Note that the board may be damaged by a large current if both transistor Q1/Q2 switch on when (a)/(b) are in the Hi-Z. Therefore, when using this recommended circuit, do not supply VDD1 power while (a)/(b) are in the Hi-z.

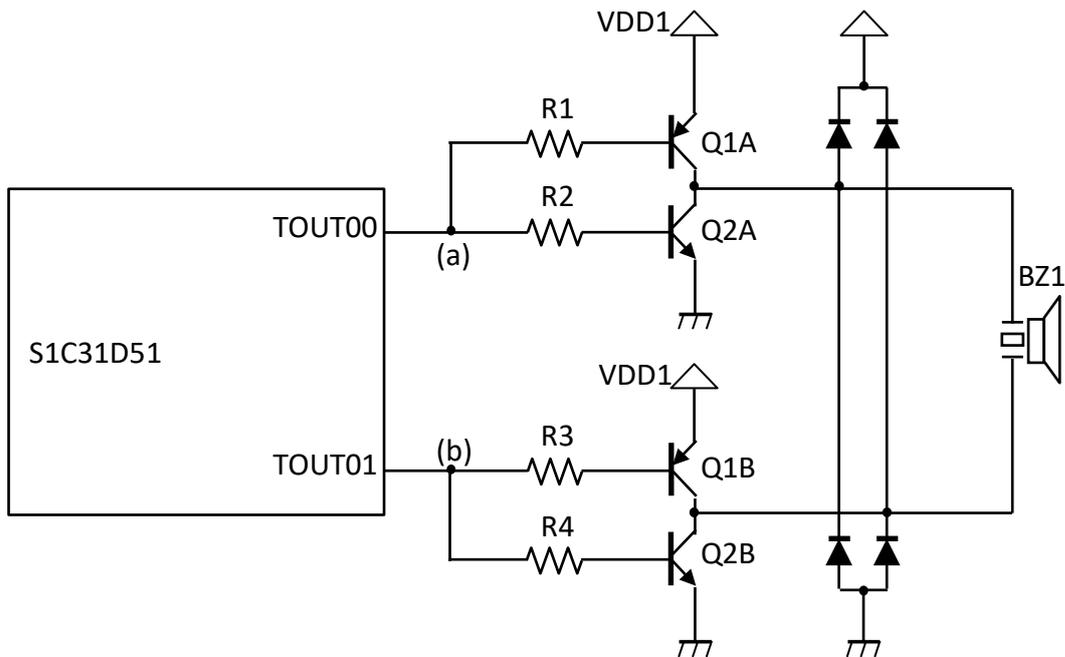


Fig C.1.1 Recommended circuit for electromagnetic buzzer

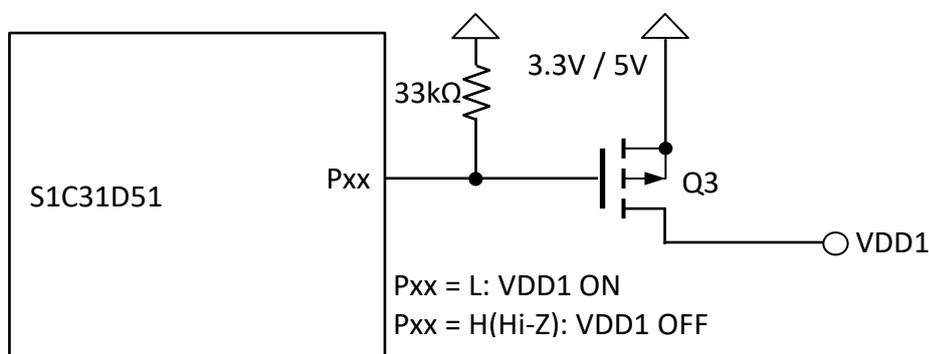


Fig C.1.2 The circuit to control power supply(VDD1) for electromagnetic buzzer

The circuit shown in Figure C.1.2 is implemented on S5U1C31D51T2 to control power supply (VDD1) for electromagnetic buzzer. In the demo software described in Chapter 4, this circuit avoids (a)/(b) becoming Hi-Z state by Pxx=L(VDD1=ON) before the start of speech playback and Pxx=H(VDD1=OFF) after the end of playback to prevent a large current.

Table C.1.2 Recommended resistance for electromagnetic buzzer made by TDK

| BZ1 Type      | Power supply (VDD1 (V)) | DC Resistance (Ohm) | Io-p(max) (mA) | Resistance R1/R2/R3/R4(k Ohm) |
|---------------|-------------------------|---------------------|----------------|-------------------------------|
| SD160709      | 3                       | 70                  | 40             | 4.7                           |
|               | 5                       | 70                  | 70             | 2.2                           |
| SDR08540M3-01 | 3                       | 16                  | 85             | 6.8                           |
|               | 5                       | 16                  | 85             | 13                            |
| SD160701      | 3                       | 50                  | 60             | 2.7                           |
| SD1614T5-A1   | 5                       | 70                  | 80             | 4.7                           |

## C.2 Recommended circuit for Piezoelectric buzzer connection

Figure C.2.1 shows the recommended circuit when connecting the piezoelectric buzzer. Select the resistance R5 to R7 in Fig C.2.1 so that they are optimized for the piezoelectric buzzer to be connected. Table C.2.1 shows the recommended resistance values for supply voltage and target current. (In selecting the MOSFET for Q4, Note that supplied voltage (VDD2) does not exceed the withstand voltage value of the MOSFET.)

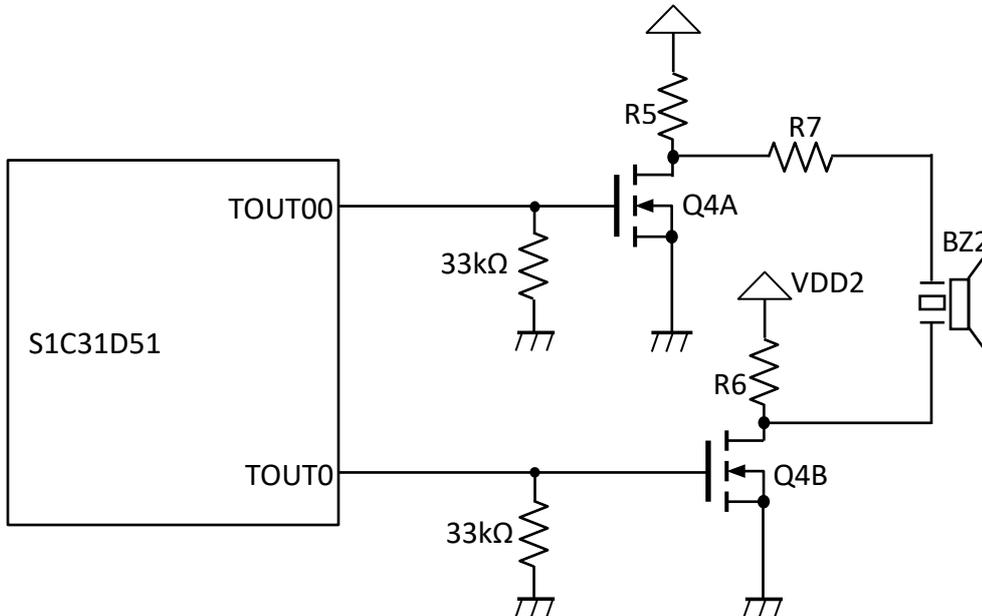


Fig C.1.1 Recommended circuit for piezoelectric buzzer

Table C.1.1 Recommended resistance for supplied power and target current

| VDD2 (V) | Target Current(mA) | R5/R6 (Ohm) | R7 (Ohm) | VDD2 (V) | Target Current(mA) | R5/R6 (Ohm) | R7 (Ohm) |
|----------|--------------------|-------------|----------|----------|--------------------|-------------|----------|
| 15       | 30                 | 560         | 220      | 5        | 30                 | 180         | 100      |
| 15       | 20                 | 820         | 220      | 5        | 20                 | 270         | 100      |
| 15       | 10                 | 1.8 k       | 220      | 5        | 10                 | 560         | 100      |
| 15       | 5                  | 3.3 k       | 220      | 5        | 5                  | 1.0 k       | 100      |
| 12       | 30                 | 470         | 180      | 3        | 30                 | 100         | 47       |
| 12       | 20                 | 680         | 180      | 3        | 20                 | 150         | 47       |
| 12       | 10                 | 1.5 k       | 180      | 3        | 10                 | 330         | 47       |
| 12       | 5                  | 2.7 k       | 180      | 3        | 5                  | 560         | 47       |



### America

#### Epson America, Inc.

Headquarter:  
3131 Katella Ave.  
Los Alamitos, CA 90720, USA  
Phone: +1-800-463-7766

San Jose Office:  
2860 Zanker Road Suite 204  
San Jose, CA 95134, USA  
Phone: +1-800-463-7766

### Europe

#### Epson Europe Electronics GmbH

Riesstrasse 15, 80992 Munich,  
Germany  
Phone: +49-89-14005-0      FAX: +49-89-14005-110

### Asia

#### Epson (China) Co., Ltd.

4th Floor, Tower 1 of China Central Place, 81 Jianguo Road, Chaoyang  
District, Beijing 100025 China  
Phone: +86-10-8522-1199      FAX: +86-10-8522-1120

#### Shanghai Branch

Room 601-603, Building A One East, No.325 East Longhua Road,  
Shanghai 200023, China  
Phone: +86-21-5330-4888      FAX: +86-21-5423-4677

#### Shenzhen Branch

Room 804-805, 8 Floor, Tower 2, Ali Center, No.3331  
Keyuan South RD(Shenzhen bay), Nanshan District, Shenzhen  
518054, China  
Phone: +86-755-3299-0588      FAX: +86-755-3299-0560

#### Epson Taiwan Technology & Trading Ltd.

15F, No.100, Songren Rd, Sinyi Dist, Taipei City 110, Taiwan  
Phone: +886-2-8786-6688

#### Epson Singapore Pte., Ltd.

438B Alexandra Road,  
Block B Alexandra TechnoPark, #04-01/04, Singapore 119968  
Phone: +65-6586-5500      FAX: +65-6271-7066

#### Epson Korea Co.,Ltd

10F Posco Tower Yeoksam, Teheranro 134 Gangnam-gu,  
Seoul, 06235, Korea  
Phone: +82-2-3420-6695

---

#### Seiko Epson Corp.

#### Sales & Marketing Division

#### MD Sales & Marketing Department

29th Floor, JR Shinjuku Miraina Tower, 4-1-6 Shinjuku,  
Shinjuku-ku, Tokyo 160-8801, Japan