Overview

The CT7302 serial chip is a high performance single chip digital audio bridge with sample rate converter. It supports the DSD I/F and DoP on S/PDIF input/output channels. The I2C software control mode is available on this chip.

There are 2 kind of package on CT7302 serial chip: LQFP 48 pin and QFN 32 pin. The evaluation boards also have 2 types available for these 2 different package chips:
EVM-D-C: for LQFP 48 pin
EVM-D-D: for QFN 32 pin
CT7302_EVM-D-D is a general function audio evaluation system for QFN 32pin type package. The SPDIF, I2S, DSD/DOP, SRC, DAC and MCU control are combined on this board. This architecture is simple to verify and apply CT7302/CT5302 family chip to any audio system product.

The CT7302_EVM-D-D features:

- digital audio input port
  - SPDIF Coaxial/Optical input x 2, up to 192K 24bits
  - I2S / DSD input x1, PCM up to 384K 32bits or DSD up to 2x, 5.6MHz
  - SPDIF and I2S input also support DoP input up to 2x
- digital audio output port x 3
  - SPDIF output port
  - I2S / DSD output port
- analog audio output port
  - AUX analog output with high performance I2S DAC
- Hardware control mode
  - Power on latch configuration
- Software control
  - External I2C control path to access CT7302 directly
  - 8051 MCU on board for
    Input source select
    Output Frequency select
    Indicate current input status

Block Diagram

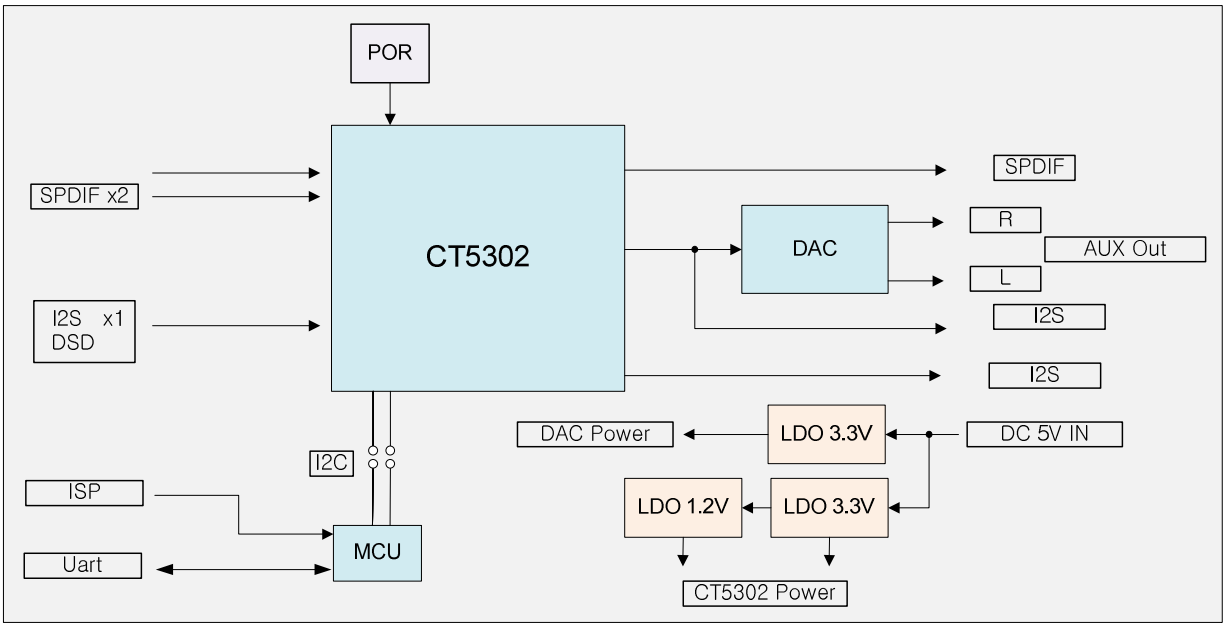

Figure1. Block diagram

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PCB Overview

EVM-D-D for QFN 32 pin

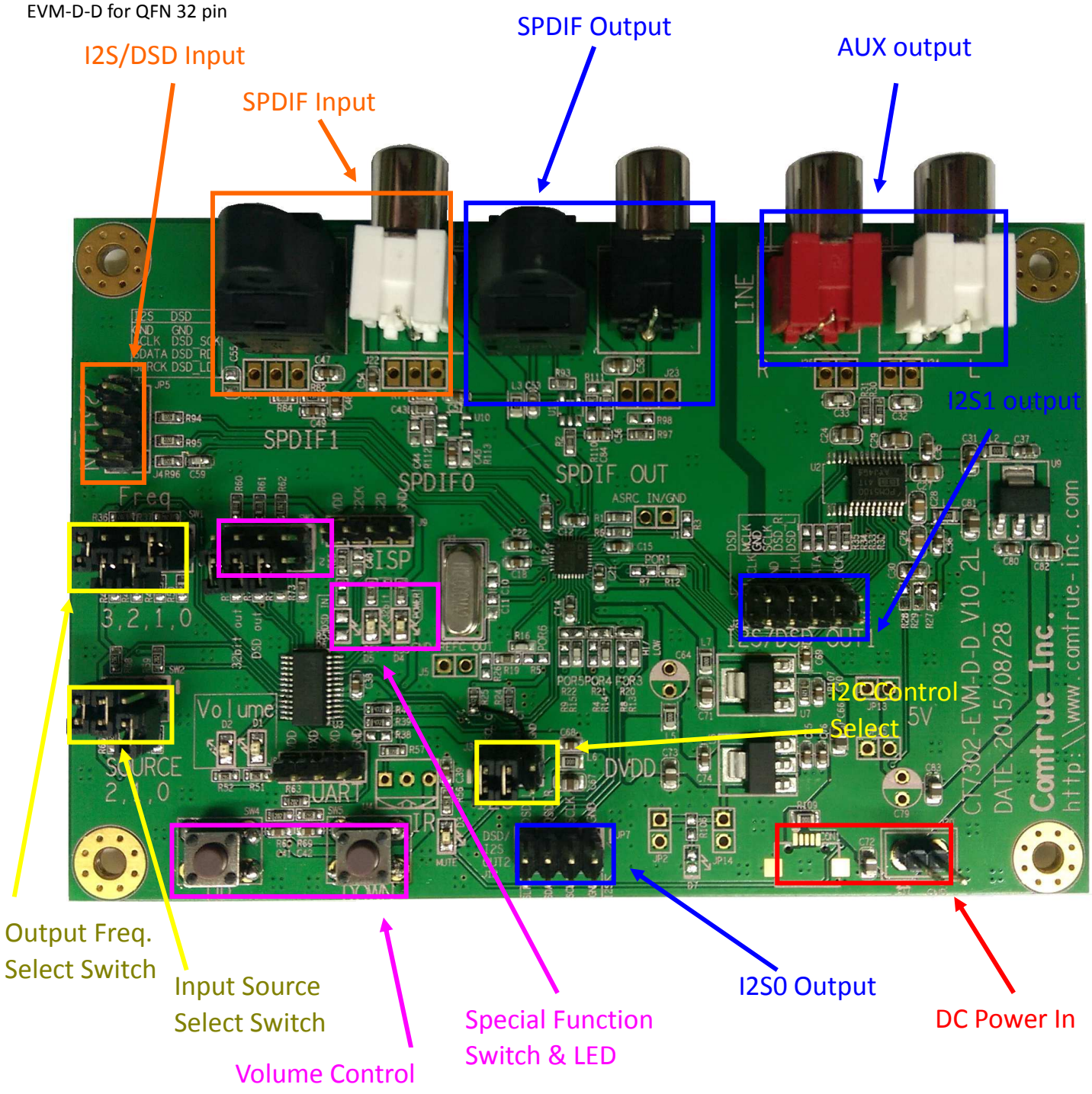

Figure2. PCB Overview

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Quickly Start

This EVM board is ready for use immediately. User can follow the procedure to set up the evaluation system for test.

1. Connect audio source to EVM board's input port I2S or SPDIF input port.
2. Select correct input source switch by SW2. (See Page9, Table 1 for detail) The default input source is set to I2S 0 input port when EVM board is released.
3. Connect audio amplifer or Line out cable to J6, J7 if you want to have analog output directly.
4. Connect evaluation board's audio output SPDIF / I2S / DSD signal to next stage PCM/DSD DAC or DSP depends on test system requirement.
   The default output format of I2S0 port is DSD mode, the output signal might invalid when input source is PCM format. Some chip without PCM to DSD converter function can't provide DSD output when PCM format input.
5. Connect power input (+5V/GND) from J20 or Mini USB connector CON1 and trun on power.
6. Turn on Source and Receiver device's power.
7. The audio signal transmits to each output port on EVM board.

For more testing, you can try:

1. Adjust output frequency by SW1. (See Page10, Table 2 for detail) The default output frequency is set to 192KHz when EVM board is released.
2. Adjust digital volume control output by SW4 and SW5.
3. Adjust DoP/PCM format output, SPDIF output format and I2S standard/Left justify format by SW3.
4. Bypass on MCU's control, use external controller's I2C control signal via J3.

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Board I/O connector, Switch, Jumper

Power:

Function	Symbol	Description
DC In	J20, CON1	+5V and Ground or Mini USB

Audio Input Port:

Port	Symbol	Description
SPDIF 0	J10, J22	Audio Input 0, RCA connector
SPDIF 1	J13, J21,	Audio Input 1, Optical RX connector
I2S/DSD 1	JP5	Audio Input 6, DIP pin connector

Audio Output Port:

Port	Symbol	Description
SPDIF Out	J18	Audio SPDIF Output, RCA connector
SPDIF Out	J16	Audio SPDIF Output, Optical TX connector
SPDIF Out	J23	Audio SPDIF Output,Reserve DIP pin connector
I2S/DSD 0	JP7	I2S0 output, default PCM format output
I2S/DSD 1	JP8	I2S1 output, default DSD format output
AUX Out	J6, J7, J24, J25	Analog AUX R/L out

MCU control interface

On board MCU control interface for system verification

Function	Symbol	Description
ISP	J9	MCU firmware update port
UART	J8	MCU RS232 communication port
I2C	J3	MCU access CT7302's register

Function control switch, connect to on board MCU. MCU use IIC path to set related register on CT7302

Function	Symbol	Description
Output Freq.	SW1	4x2 pin switch to select output frequency Short the indicate pin to set this bit to "1"
Input Select	SW2	3x2 pn switch to select input source Short the indicate pin to set this bit to "1"
Special Function	SW3	4x2 pin switch to enable special control: SW3-3: SPDIF 32 bit output SW3-2: DoP format on I2S and SPDIF port SW3-1: I2S input/output is Left Justify SW3-0: Reserve
Volume Control	SW4, SW5	Inc / Dec digital volume
IR control	U4	IR input, reserved

System status indicate LED

Function	Symbol	Description
DSD/DoP input.	D4	Indicate current input source is DSD/DoP format
32 bit data input	D5	Indicate current input source is 32 bit mode
Hi Res input	D3	Indicate current input frequency is higher than 192KHz

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External connector setting

Power Connector:

J20 and CON1 are used for system power input port. User can use Mini USB connect or direct +5V / GND pin to provide power to this EVM board and the suggestion power supply is large than 500mA.

Audio signal connector:

1. SPDIF input / output port:
   There are 2SPDIF input and 2 SPDIF output port on this evaluation board. The default connector placed on this board only reserve 1 optical input and output port. The others are RCA connector. To apply to different system application, each SPDIF input / output port also reserve 3 pins pad for user to connect to different type Coaxial / Optical connector depends on their requirement.
2. I2S input port:
   There is a I2S/DSD input port on this board. The default setting of these ports are format auto detect. DSD, DoP or PCM format are acceptable. There is no special circuit requirement on these paths and the MCLK clock input is unnecessary for CT7302/CT5302 serial chip.
3. AUX output port:
   There is an I2S audio DAC embedded on this EVM board. This is the suggestion audio output port and the performance is up to SNR 110 dB and THD+N 93dB.
4. I2S output port:
   There are 2 I2S output port and each one can be configured to I2S or DSD format output. Current firmware set the I2S port 1 is I2S out and I2S port 0 is DSD out. The I2S 0 output signal valid when selected input signal is DSD or DoP format due to there is no PCM to DSD converter function on this chip.

SPDIF input interface:

Each SPDIF input port has reserved the pull high and pull low resistors space for different system application. See figure3 for detail. The **V+**, **S** and **G** pad are used for signal connecting. The input signal connect to **S** pad and into chip S/PDIF input pin via 22Ω resistor and 0.1uF capacitor and pull high/low resistors RH/RL can be used for circuit matching.

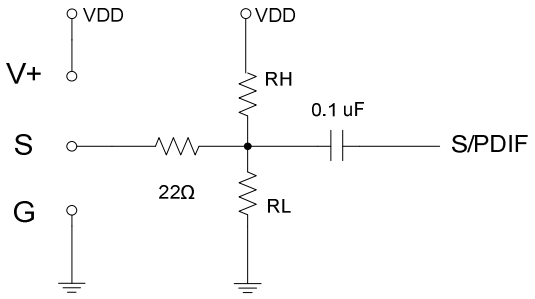

Figure3. General circuit for S/PDIF input port

It uses S and G 2 pins only when SPDIF input port is coaxial type connector. The RH resistor is disconnected and RL suggestion value is 75Ω.

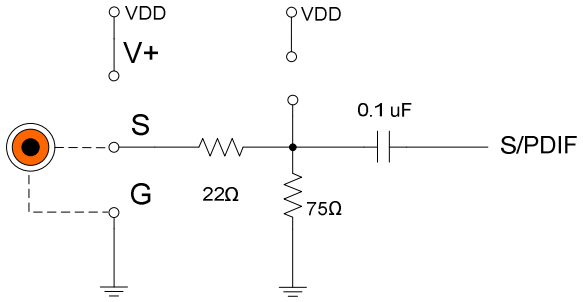

Figure4. Suggest circuit for Coaxial input port

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All of these three pins are used when SPDIF input port is Optical type connector. The recommend RH resistor value is 150Ω to enhance the optical response and the RL is disconnected.

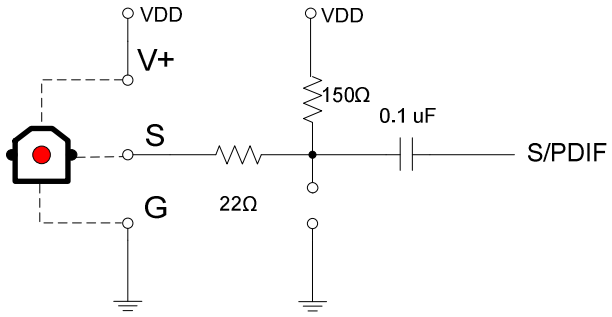

Figure5. Suggest circuit for Optical input port

SPDIF output interface:

There is a SPDIF output pin on CT7302 serial chip. The general SPDIF output circuit is different depends on the connector type. CT7302 EVM-D use this pin to drive coaxial and optical two different type connectors at the same time. The default circuit is shows as Figure 6.

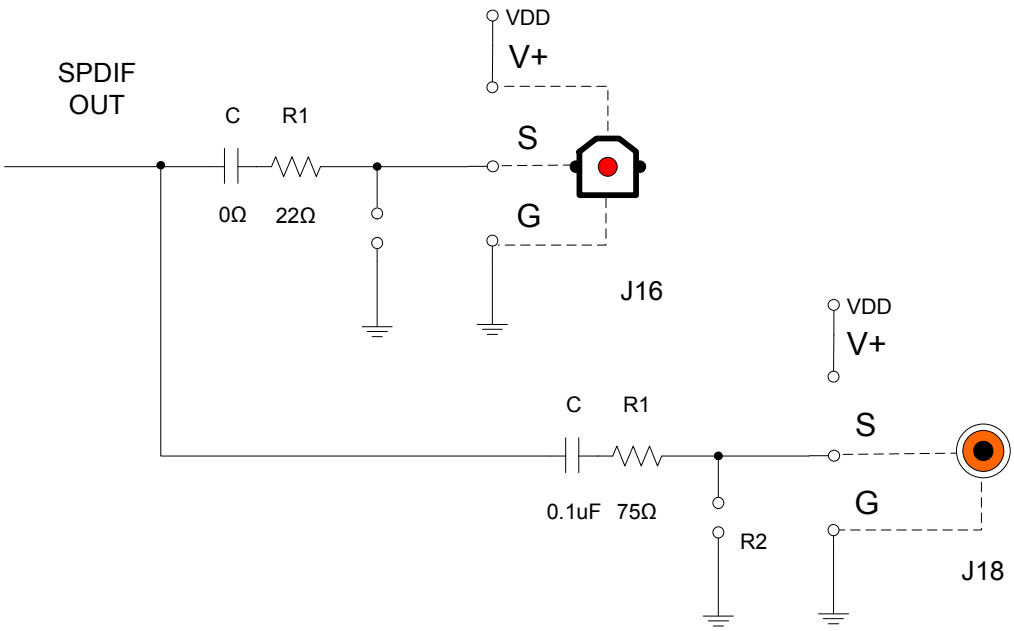

Figure6. SPDIF output port

It also reserves a port for user to connect the SPDIF output signal to their external connector as Figure 7.

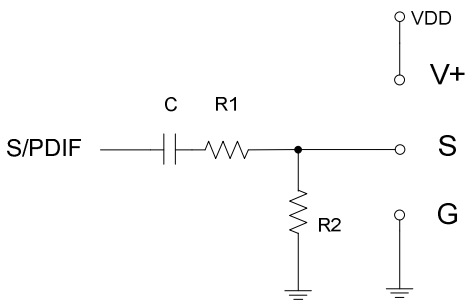

Figure7. General circuit for S/PDIF output port

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SPDIF input / output PCB placement:

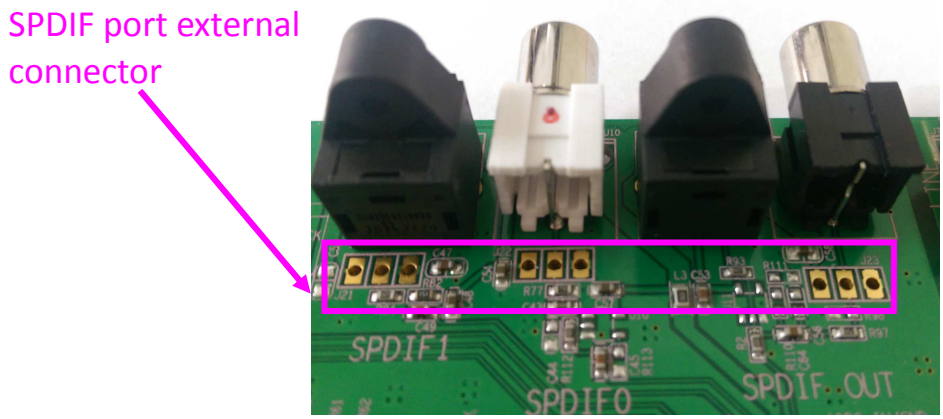

Figure8. PCB components placement of SPDIF

I2S input / output port placement:

The three I2S input port on this board and each one has SCLK / DATA / LRCK pin for PCM format or SCLK / DAT_R / DAT_L for DSD foramt input. User can connect the external signal source to these pins to transfer audio signal via I2S or DSD path. Each input can detect input format automatically and convert to PCM format depends on user's setting.

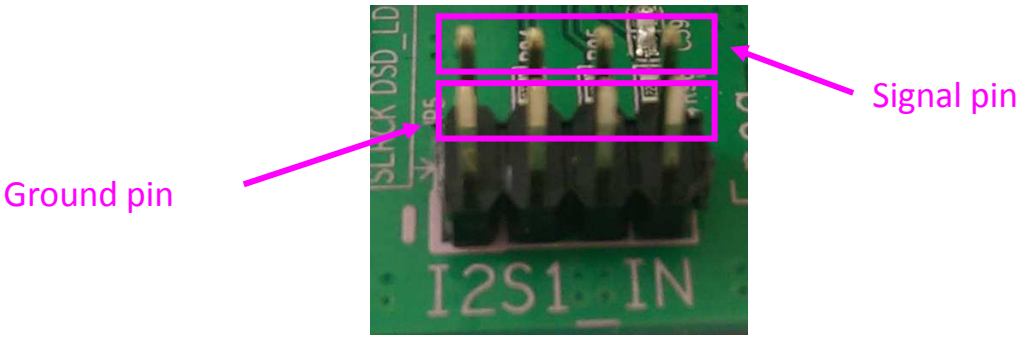

Figure9. I2S input port

Two I2S/DSD output port are available on this board. User can select one (I2S PCM at I2S1, DSD at I2S0. But DSD signal is not available when input is not DSD or DoP on this board) output to next stage DSP or DAC. (The I2S/DSD OUT text printed on PCB is wrong, It should be I2S 0, not I2S 2)

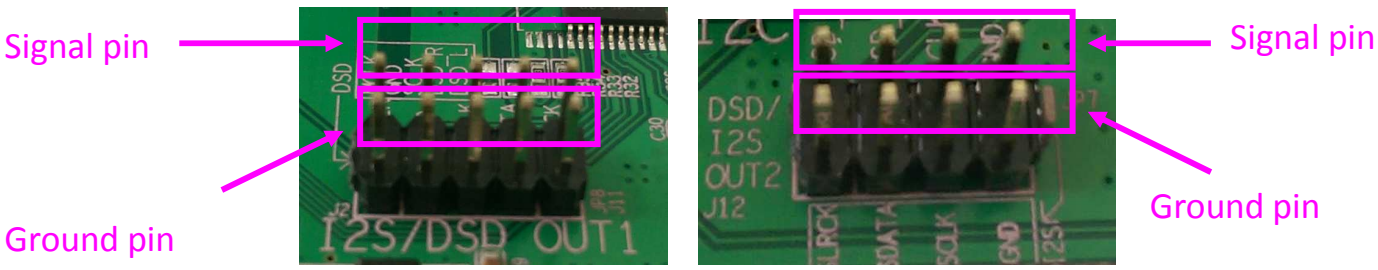

Figure10. I2S output port

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Function selection switch

There are three group function control switches on this EVM board: Input source, Output frequency and special function selection. These control pins are connected into the MCU's analog input pin on EVM board. User can use jumper to set the related pin's signal level is high or low to define the selection. The SELx pin is set to high when this pin is shorted; otherwise the level keeps to low.

Below figure shows the general circuit of these three group control pin. It uses resistors to divide the VDD and get different voltage into MCU's ADC input port to detect current switch status. The relate register will be set by MCU via I2C path according to switch configuration.

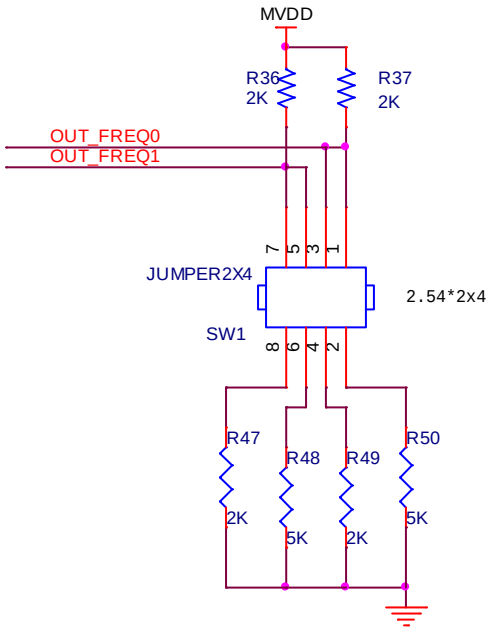

Figure11. Hardware function selection pin circuit

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Input source select:

The 3x2 pin jumpers are used for 8 input port selections. The left jumper on PCB is MSB.

Short the jumper to set the pin level to high (1) and open means low (0). MCU read the pin setting and set the related register (Register 0x04[2:0]) of CT7302.

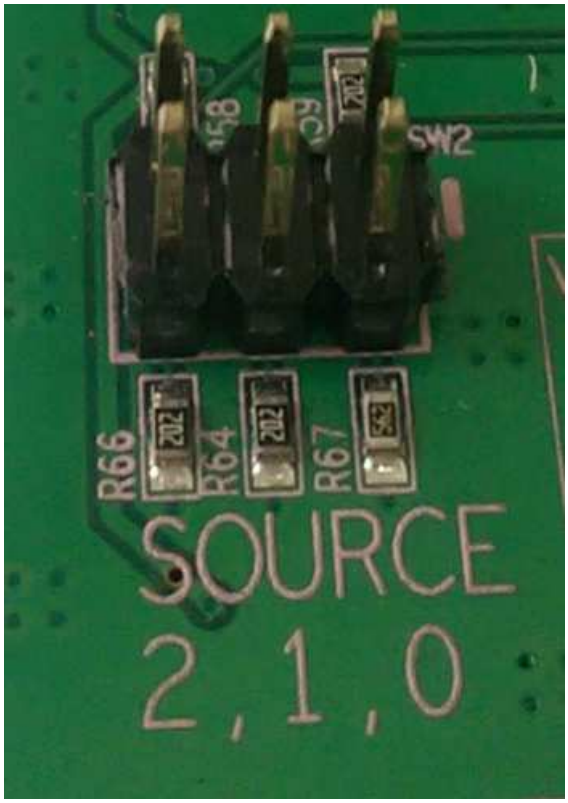

Figure12. Input Source selection jumper

The index of each input source is described at Table 1.

No	SEL2	SEL1	SEL0	Source Table	No	SEL2	SEL1	SEL0	Source Table
0	0	0	0	SPDIF 0	4	1	0	0	SPDIF 4
1	0	0	1	SPDIF 1	5	1	0	1	I2S 0
2	0	1	0	SPDIF 2	6	1	1	0	I2S 1
3	0	1	1	SPDIF 3	7	1	1	1	I2S 2

Table1. Source select mapping table

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Output frequency select:

The 4x2 pin jumpers are used for select 1of 15 output frequency. The left jumper on PCB is MSB.

Short the jumper to set the pin level to high (1) and open means low (0). MCU read the pin setting and set the related output frequency register (Register 0x05[3:0]) of CT7302.

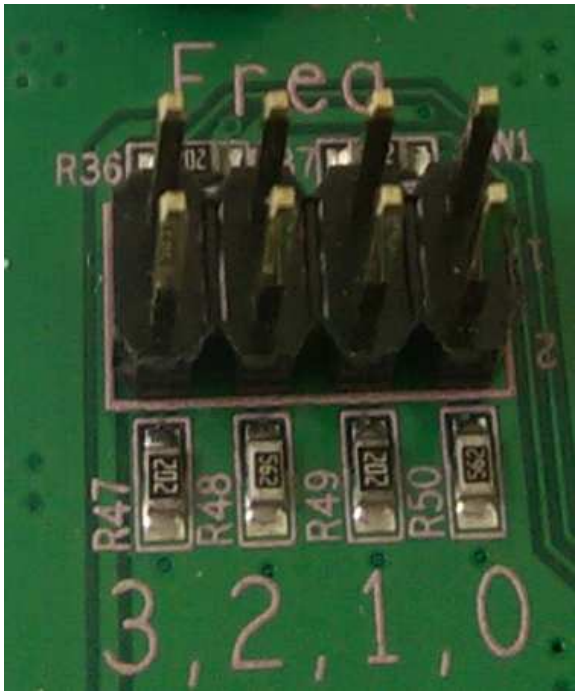

Figure13. Output Frequency selection jumper

The default SRC mode on this board is set to mode 3 and it can select output frequency from Look Up Table directly. The index and setting of output frequency is described at Table 2. The actual output frequency is limited according to IC specification.

For SRC bypass evaluation, it sets to SRC mode 0 (output bypass mode) when this switch select to 000. The output is always follow input frequency at this mode.

No	Freq3	Freq2	Freq1	Freq0	Output Frequency	No	Freq3	Freq2	Freq1	Freq0	Output Frequency
0	0	0	0	0	SRC bypass mode	8	1	0	0	0	176.4K
1	0	0	0	1	32K	9	1	0	0	1	192K
2	0	0	1	0	44.1K	10	1	0	1	0	256K
3	0	0	1	1	48K	11	1	0	1	1	352.8K
4	0	1	0	0	64K	12	1	1	0	0	384K
5	0	1	0	1	88.2K	13	1	1	0	1	512K
6	0	1	1	0	96K	14	1	1	1	0	705.6K
7	0	1	1	1	128K	15	1	1	1	1	768K

Table2. Output frequency select mapping table

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Special function select switch:

The 4x2 pin jumpers are divided to 4 special functions. Short the assigned pair jumper to enable these functions. All functions are disable when EVM board is released.

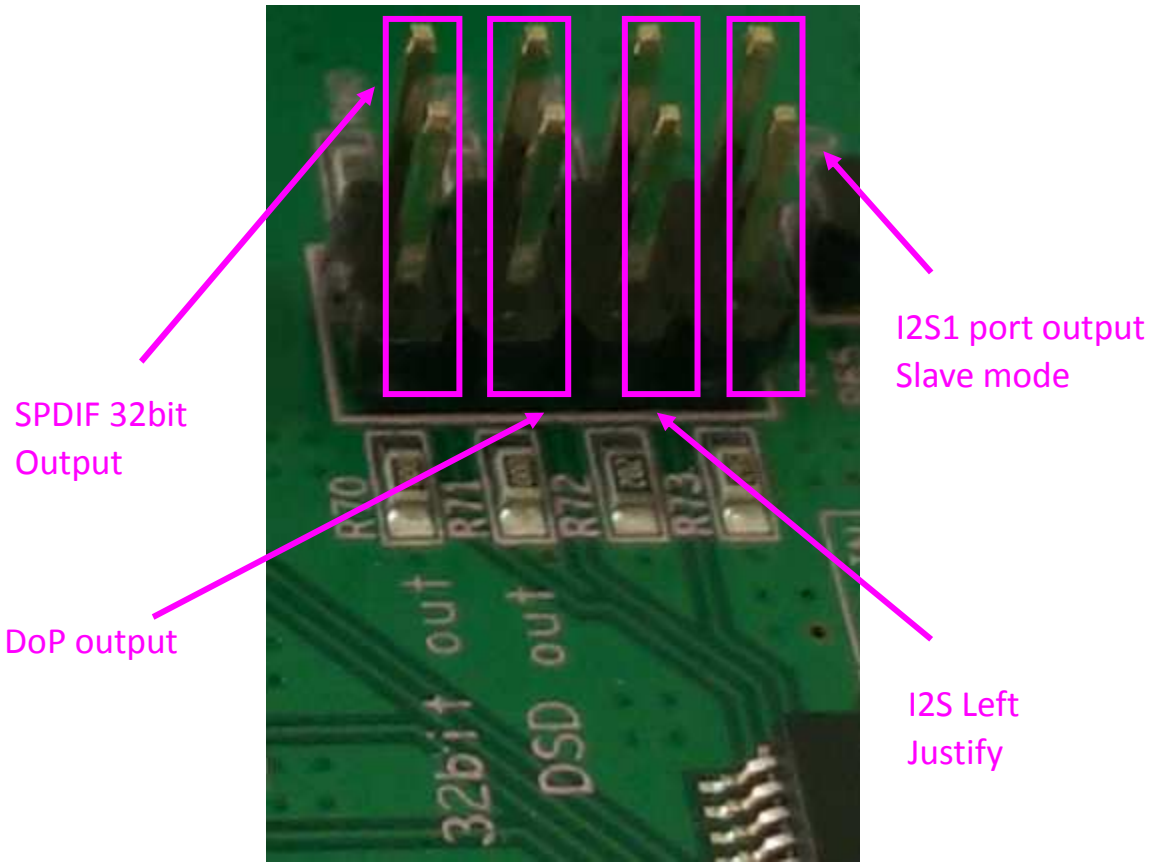

Figure14. Special function enable jumper

1. SPDIF 32 bit output mode.

   The general spec. of SPDIF depth is 24bit. Short this jumper to transmit 32 bit output on SPDIF to enhance the data resolution.

2. DoP output mode

   The typical output format on I2S and SPDIF port is PCM. Short this jumper to enable DoP output on I2S and SPDIF channel. (DSD output port is not changed)

3. I2S input and output port Left Justify mode

   The I2S format is standard mode when this jumper is open. It changes to Left Justify mode when the jumper is short to compatible with signal source or DAC.

4. I2S 1 output port slave mode

   The default I2S 1 output port is I2S master mode. Short this jumper to set this port to slave mode. The external BCLK and LRCK should connect to I2S 1 port after this jumper is shorted to avoid two I2S master device signal conflict.

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Input status display LED:

There are 3 LEDs on this evaluation board to indicate current input status: 32 bit data input, DSD/DoP input and high sample rate source input (>192KHz).

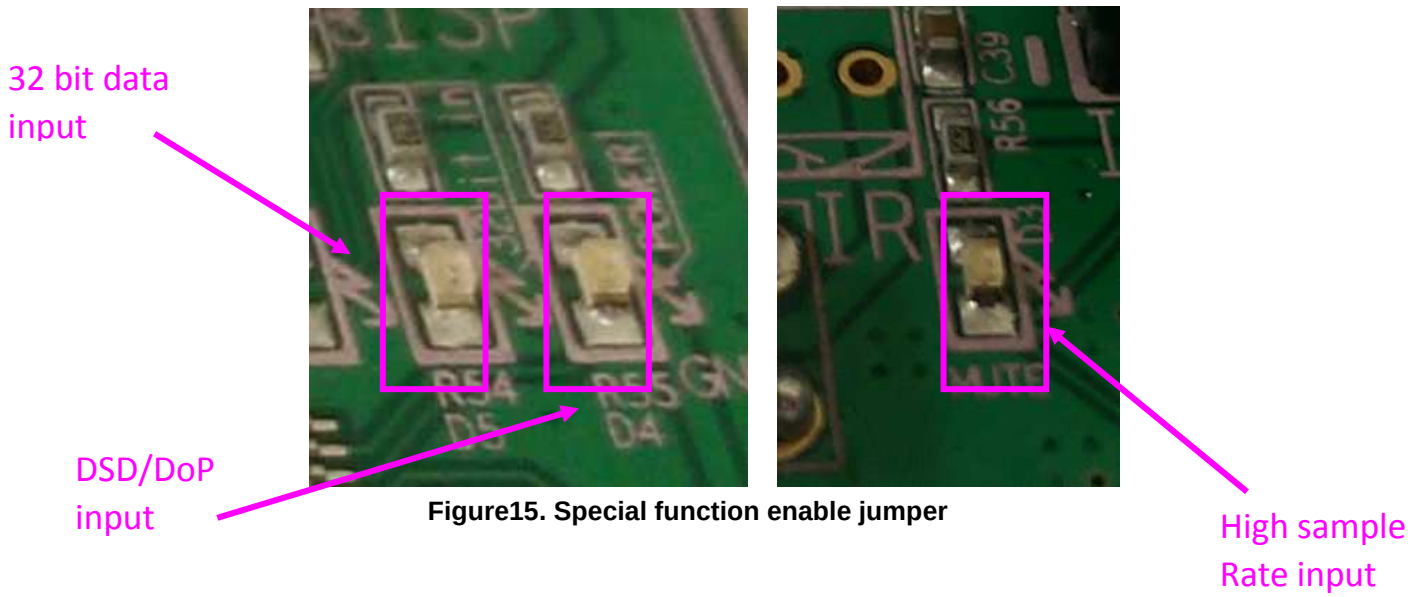

Figure15. Special function enable jumper

1. 32 bit data input.
2. DSD / DoP format source input
3. Input frequency > 192KHz

Volume control and display

The two buttons are used for volume control. Press one to increase the output volume and another one to reduce.

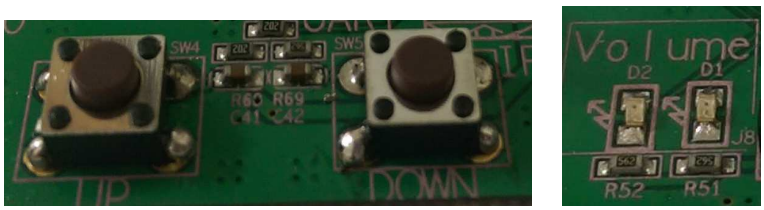

Figure16. Volume control button switch and indicate LED

One LED indicates current ouptut is < 0dB and another one is >0dB. Both of them use luminance to show the ouptut level.

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Firmware control

MCU:

The on system 8051 MCU can be used by user to develop their audio system. LED GPO and Jumper level detect GPI pins are reserve for system control. The ISP and UART port also ready for firmware update and communicate with PC command.

I2C control path:

The jumper (J3) connect MCU's I2C control pin to CT7302 to access register. The default setting of these jumpers is shorted. User can disconnect these jumpers and access CT7302 by external controller from this I2C path.

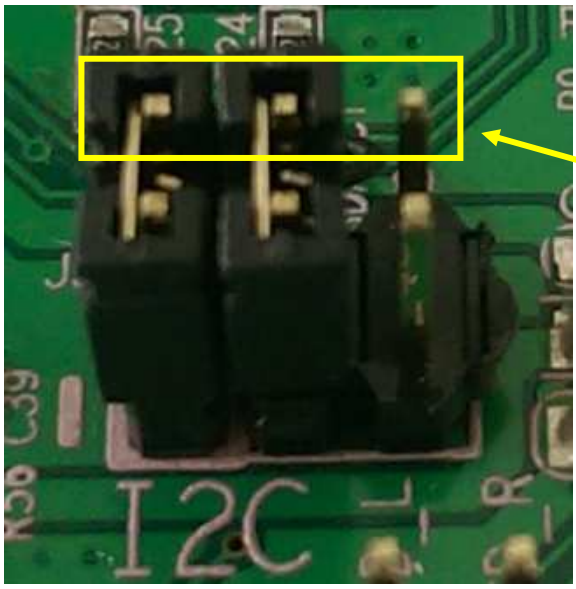

Figure17. I2C control path

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