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## Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

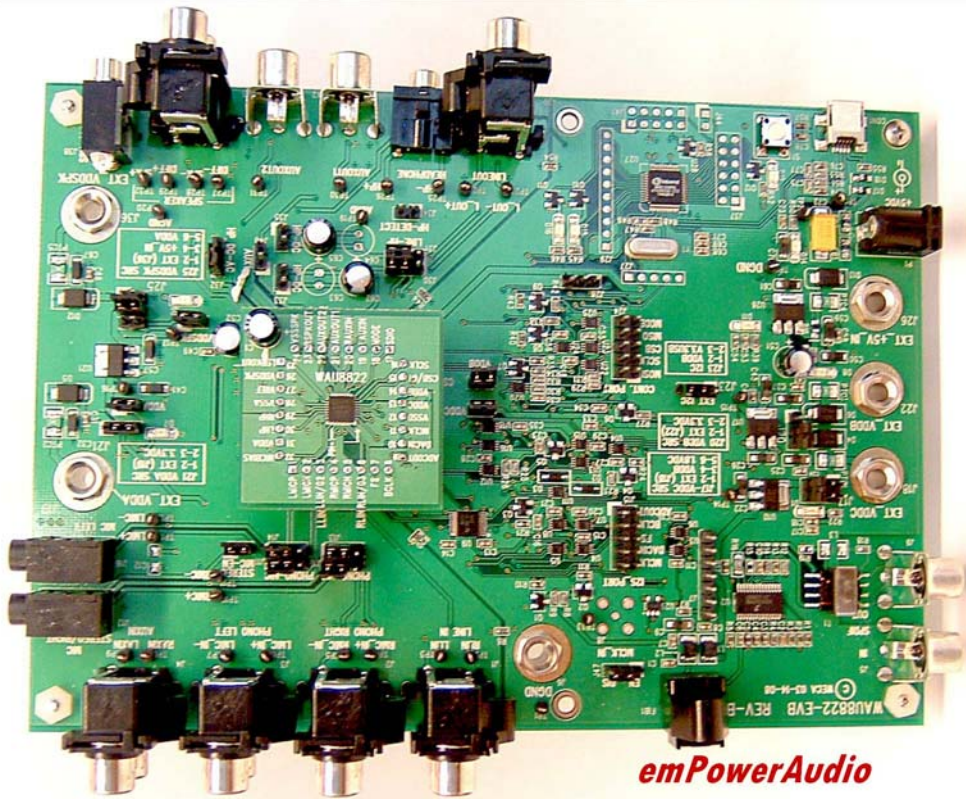
Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



# WAU8822 - EVB

## Evaluation Board User's Guide



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## Kit Contents:

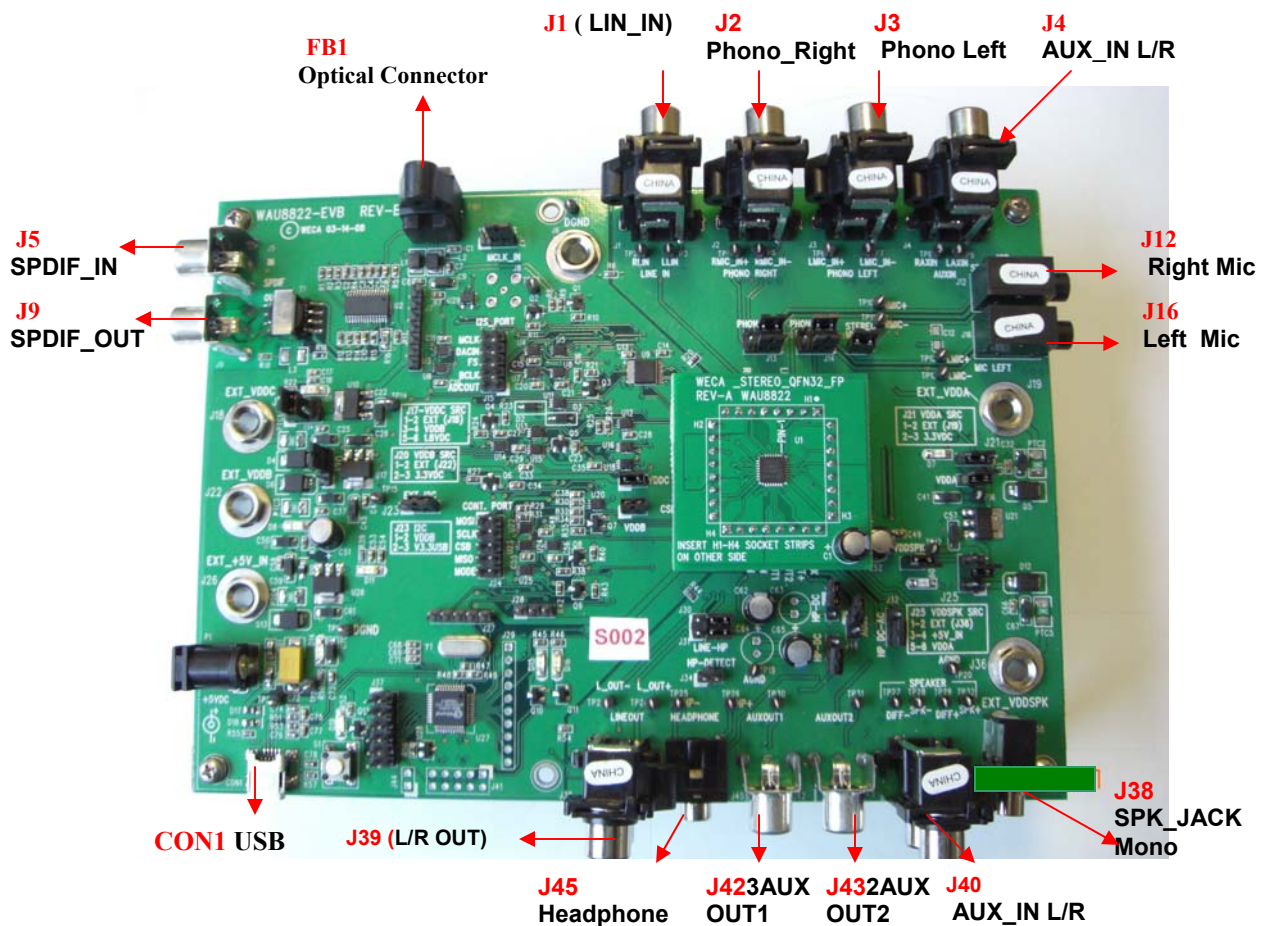
- The WAU8822-EVB Board
- Application Software CD (WAU8822-EVP)
- User's Guide (included in the supplied CD)
- USB Cable
- Data sheet

## System Description:

The WAU8822-EVB system consists of an evaluation board with audio inputs and audio outputs and application software that sends command and control via USB. Power is normally provided by USB.

## Hardware Description:

The Evaluation board is controlled via USB cable. The on board Nuvoton W681308 USB Audio controller acts as an SPI /I2C & I2S interface between the PC Software GUI and the WAU8822 audio codec.



## WAU8822 Application Software:

The WAU8822 Application software is powerful and easy to use GUI software which enables the users to control the Nuvoton WAU8822 Stereo Codec and aids system designers to develop software for their system's microcontroller by importing the register map's saved file after they are satisfied with their desired configurations. They are 3 ways to configure and control the W8822/12 Audio Codec family with the WAU8822-Application Software:

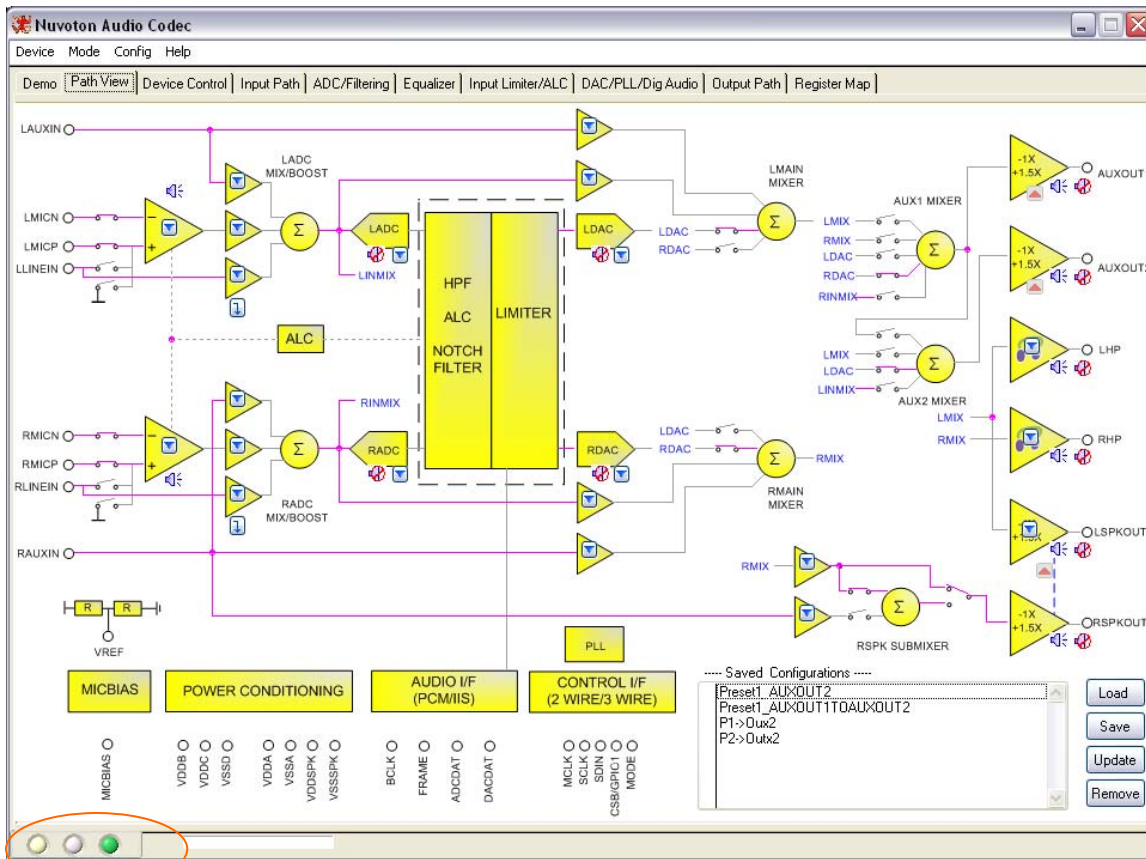
- **Demo Panel**
- **Use predefined Saved Configurations**
- **Click and configure**

### Quick Set-Up:

- 1) Install the software from the CD, follow the on screen directions
- 2) Print out the user's guide from the CD
- 3) Make sure PCB is not connected to PC
- 4) Start the program
- 5) From the Start up screen below select WAU8822 to go to Stereo GUI
- 6) Connect the WAU8822-EVB board to the USB port



The first screen you will see is a graphical representation of all relevant blocks of the WAU8822 Audio Code called path view. Each block has its own screen panel witch represents associated control registers for that block. When the board is attached to the GUI via the USB cable the Green LED is lit (4)



4, 5, 6

**Status indicators.**

In the left hand corner of the GUI there three indicators.

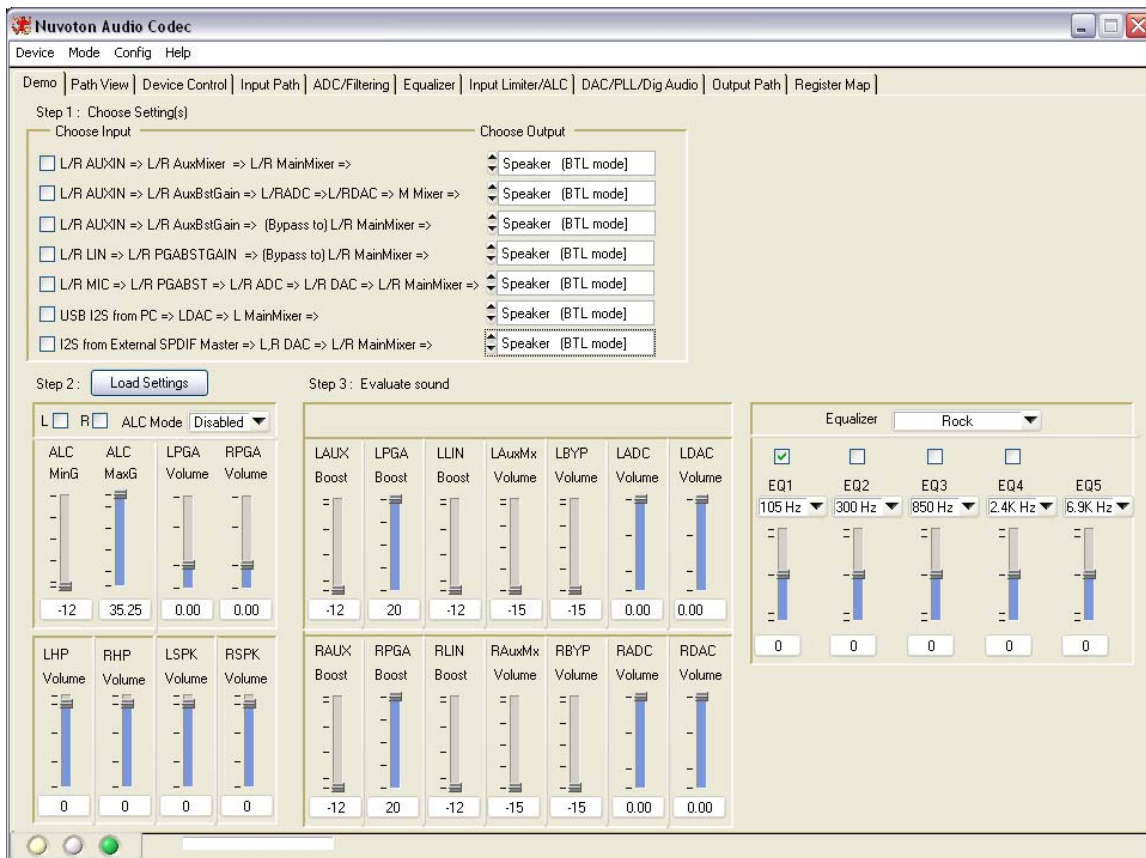
- 4) This indicator turns green when the WAU8822-EVB is attached to the USB cable.
- 5) This indicators turns solid green when the software loads setting.
- 6) This indicator blinks and stays green after the software has finished writing to the WAU8822 registers.

**Demo Panel:**

In the demo panel there are 2 easy steps for setting up and evaluating a full working path

- **Step 1.** Choose Settings (selecting input such as MIC AUX or Line in - Output such as HP, SPKR or Line-out)
- **Step 2:** Load settings (The GUI writes to each individual control register).

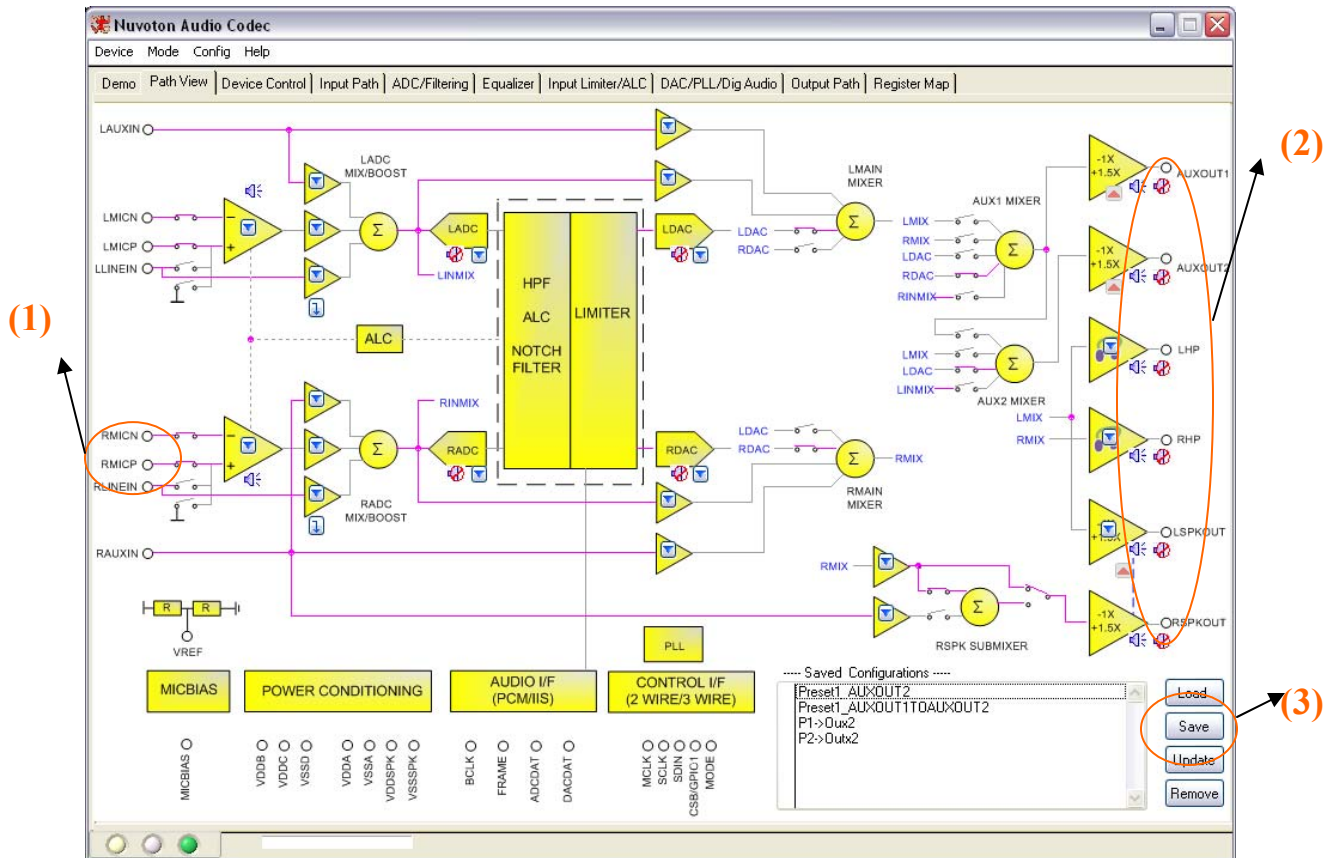
Once the desired path is set, you can evaluate the equalizer or ALC effects here as well.



## Use predefined Saved Configurations:

### Saved Configurations:

In path view panel there are some examples of saved configuration. Double clicking on a saved configuration from the menu will activate that path. Selecting a saved configuration and update also activates that path. The software will automatically write to each control register immediately. This feature can be used to tune different parameters and compare them later



### Click and Configure:

#### Path view Panel:

The WAU8822 is configured through 64 registers. Each individual bit controls a function such as mute or un-mute of input/output mixers and amplifiers.

In this panel you can set your desired input output path by clicking on the connecting lines or icons (1), (2). Notice each time a line is selected the active line is highlighted. The associated registers are written immediately so you can see and hear the immediate effect. Later you can save the path by clicking on add icon (3) for comparison with a different sets of parameters. To quickly get back to your original settings select Load.

The big blocks such as ALC, DAC, and EQ have more than one control bit. Clicking on specific block will take the users to its associated panel where you can set individual control bits for that block. Right click on that panel will take you back to the path view panel.



## Device Control Panel:

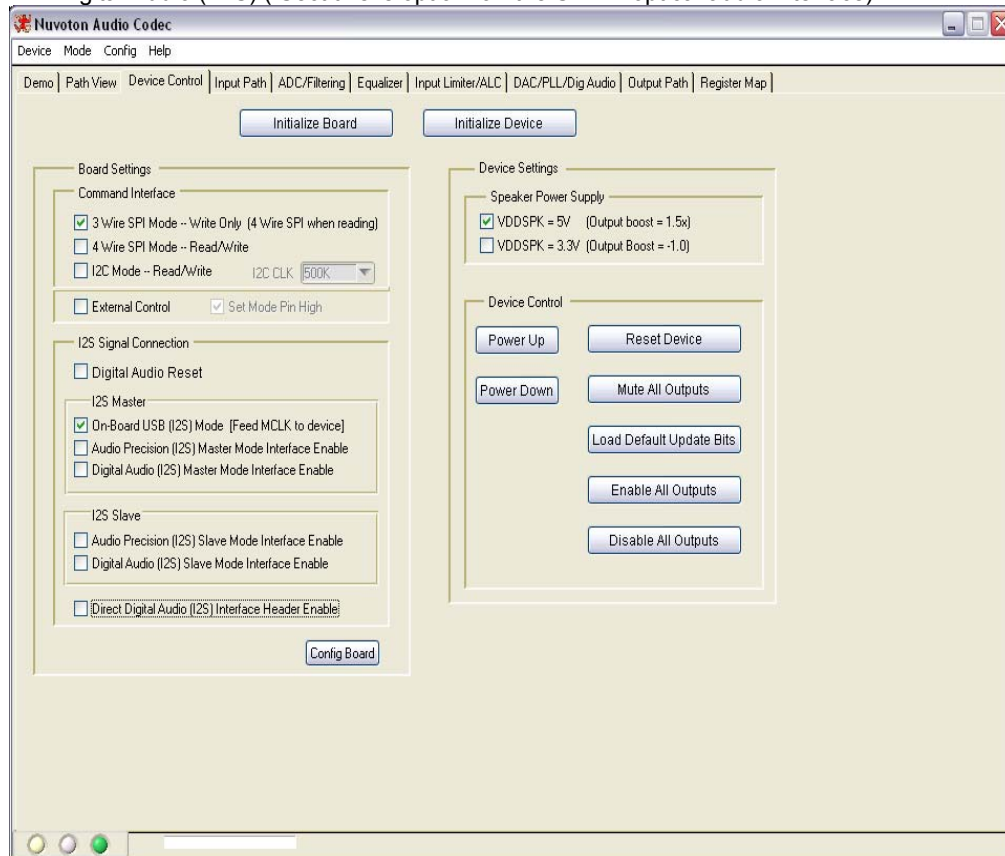
### SELECTION OF CONTROL MODE

In this panel the user's selects device interfaces for WAU8822 from one of the following options:

- 3 Wire write only
- 4 Wire read and write
- I2C read and write
- External Control

The I2S signal connection section boxes configures the W8822-EVB to operate in I2S Master or Slave Mode. In the Master mode the MCLK is generated from:

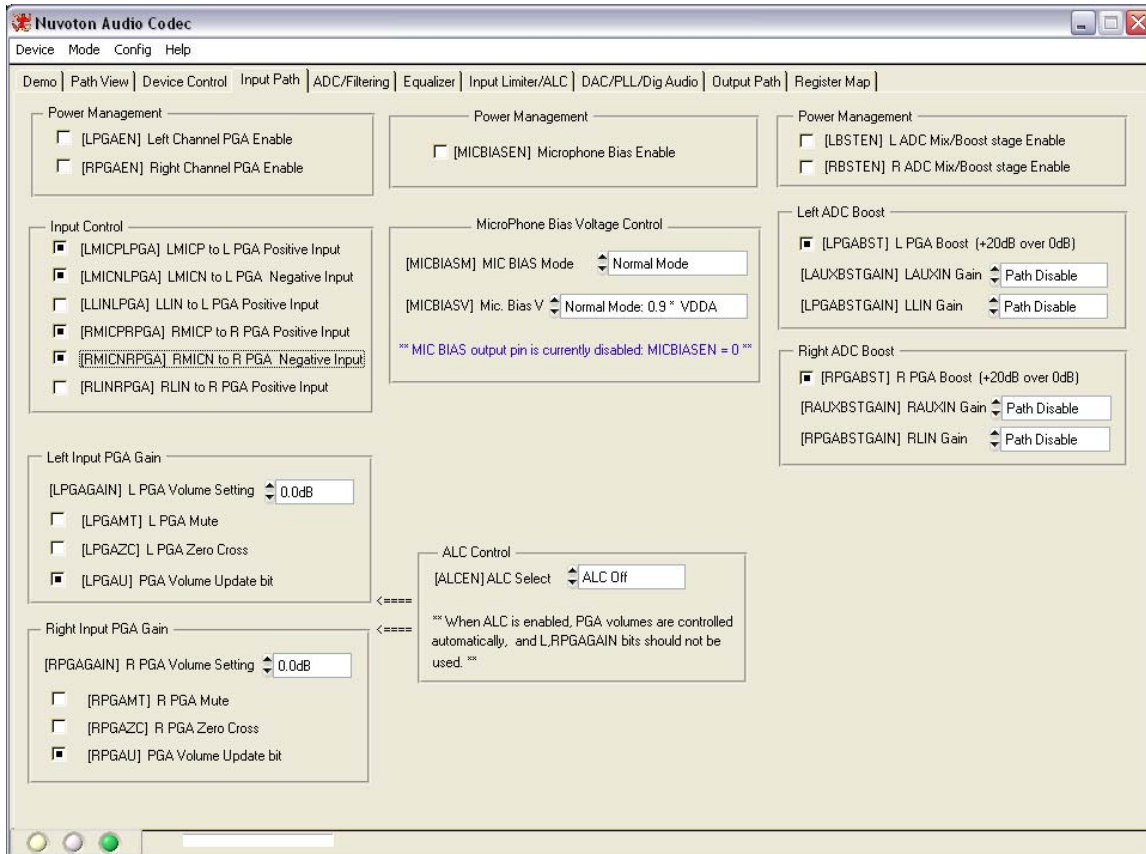
- On board USB controller ( select this option for playing Mono Audio from USB)
- Audio precision equipment
- Digital Audio ( I2S) ( Sect this is option for the SPDIF optical audio interface)



Once a device interface is selected, click on the **Config Board** button to configure the communication to the W8822-EVB board before powering up the WAU8822.

The Reset, Power up, and Power down buttons control the WAU8822. The default for 1.5X boost stage is un-checked. **Please make sure to Change J35 on the WAU8822-EVM boards to 5V or VDDA (3.5) when you change this bit.**

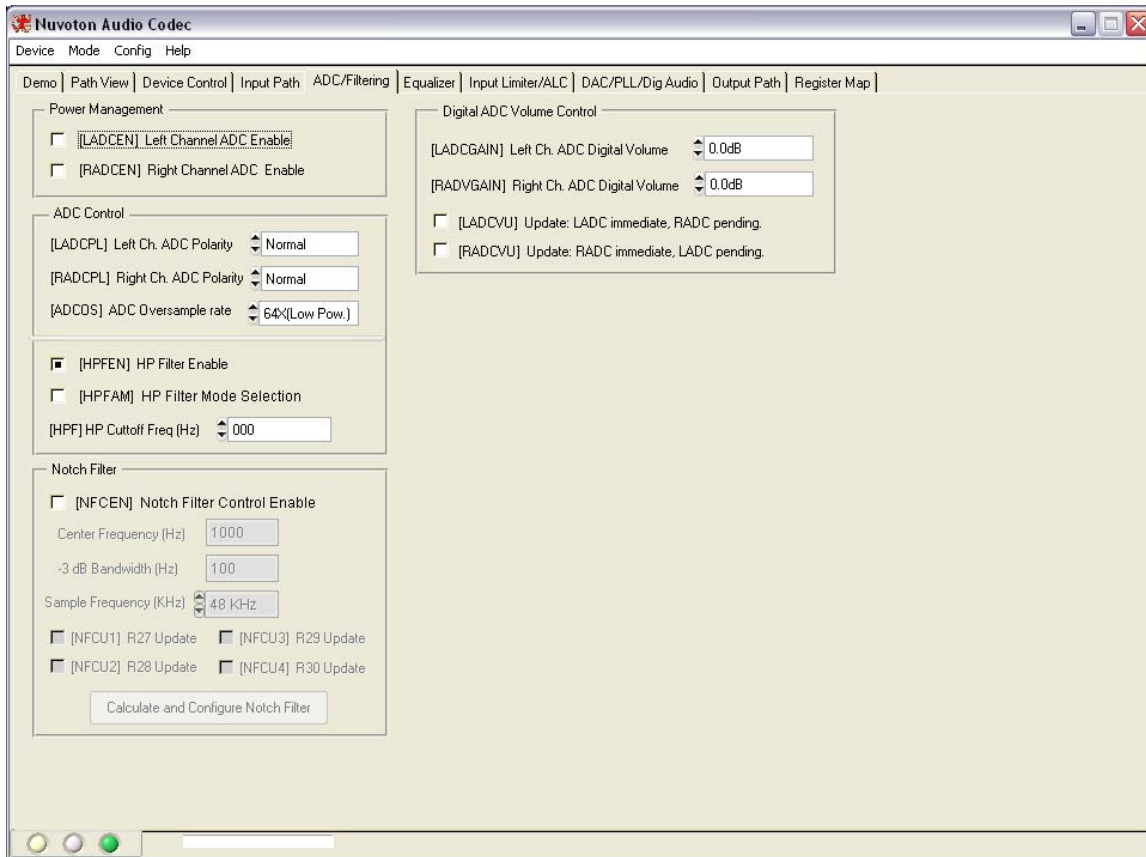
Input Signal path:



The ADC control registers and notch filter are selected in this panel. In the digital ADC volume control section a pop up ring select window selects various gains. The selected values are written to its registers automatically.

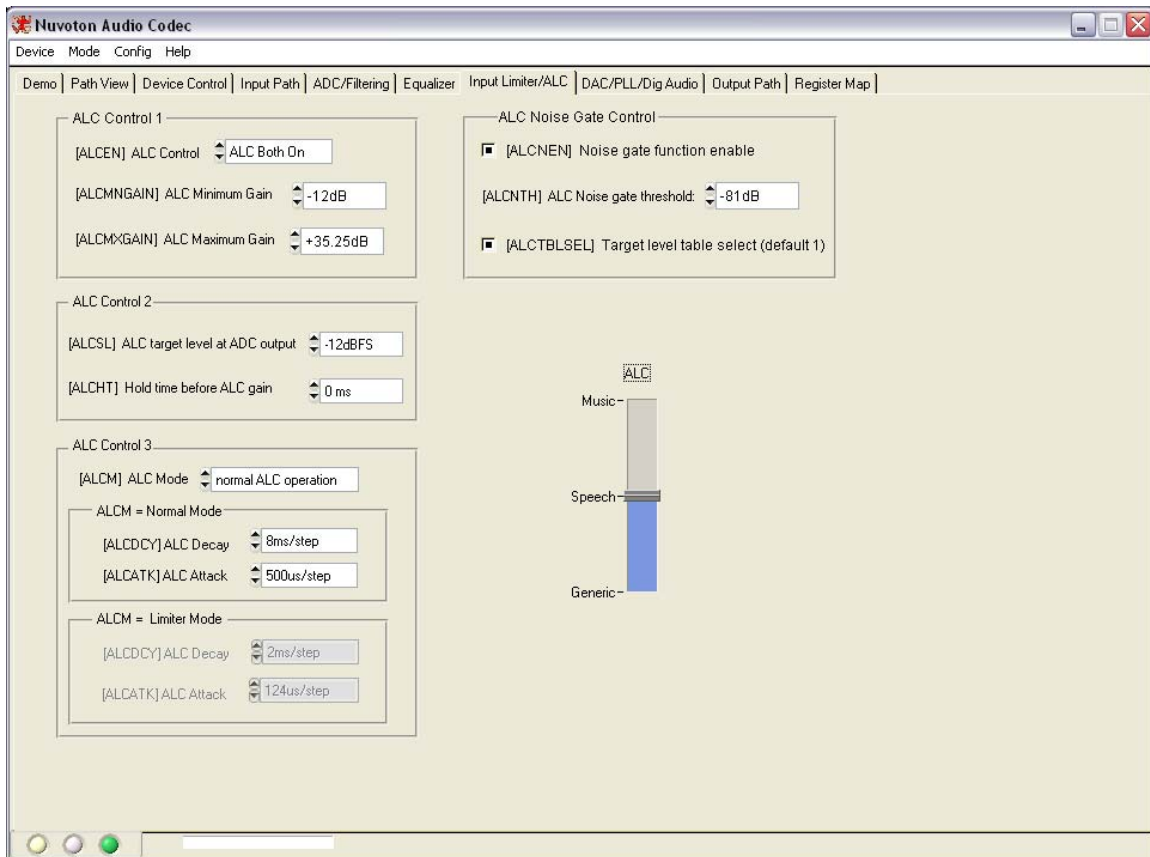
**ADC/Filtering Panel:**

The ADC control registers and notch filter is selected in this panel. In Digital ADC volume control section a pop up ring select window selects various gains. The selected values are written to its registers automatically.



### Input Limiter and ALC Panel:

In this panel aside from configuring the ALC stage to operate in normal or limiter modes, there is an ALC slider bar that sets the ALC control registers with pre defined parameters for Music, Speech and generic recording. These are suggested optimal values based on experiments and it's only a guide for further optimization for the end portable application.



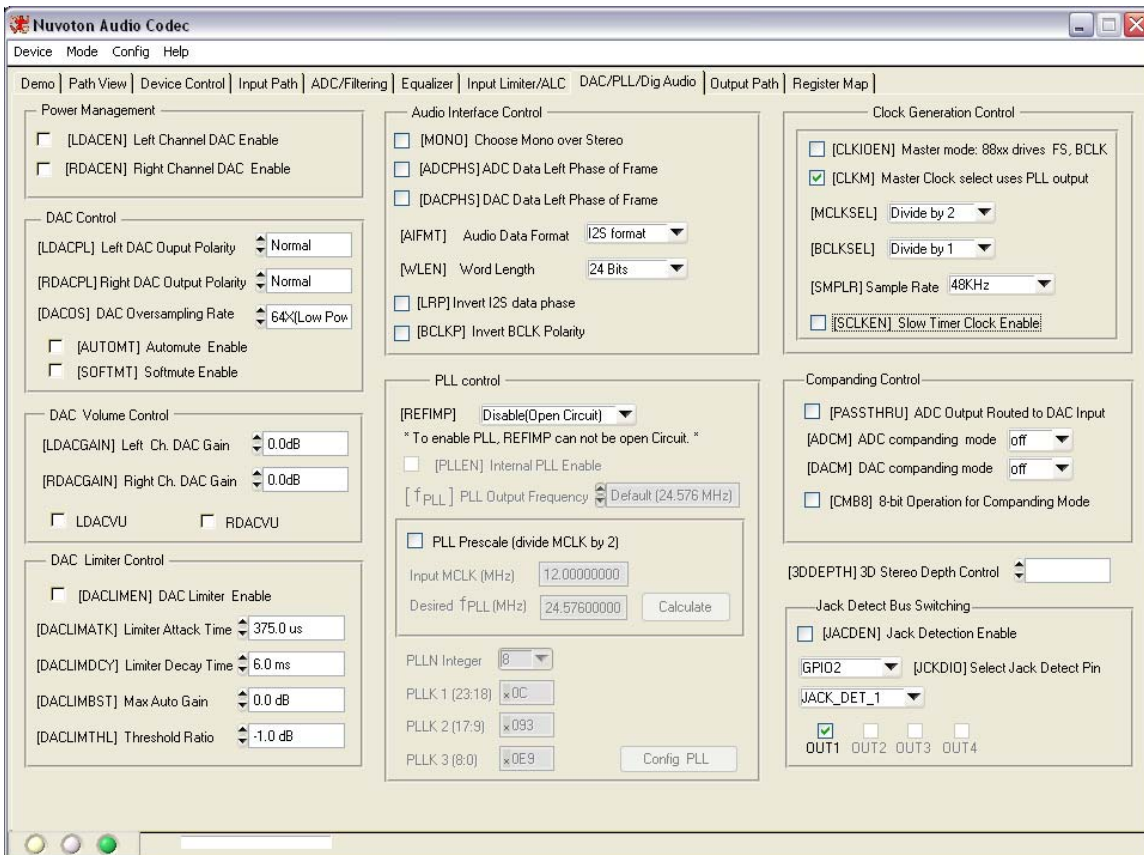
## DAC Filtering/ Digital Audio Panel:

This Panel is divided into three sections;

- PLL
- DAC
- Digital Audio Control

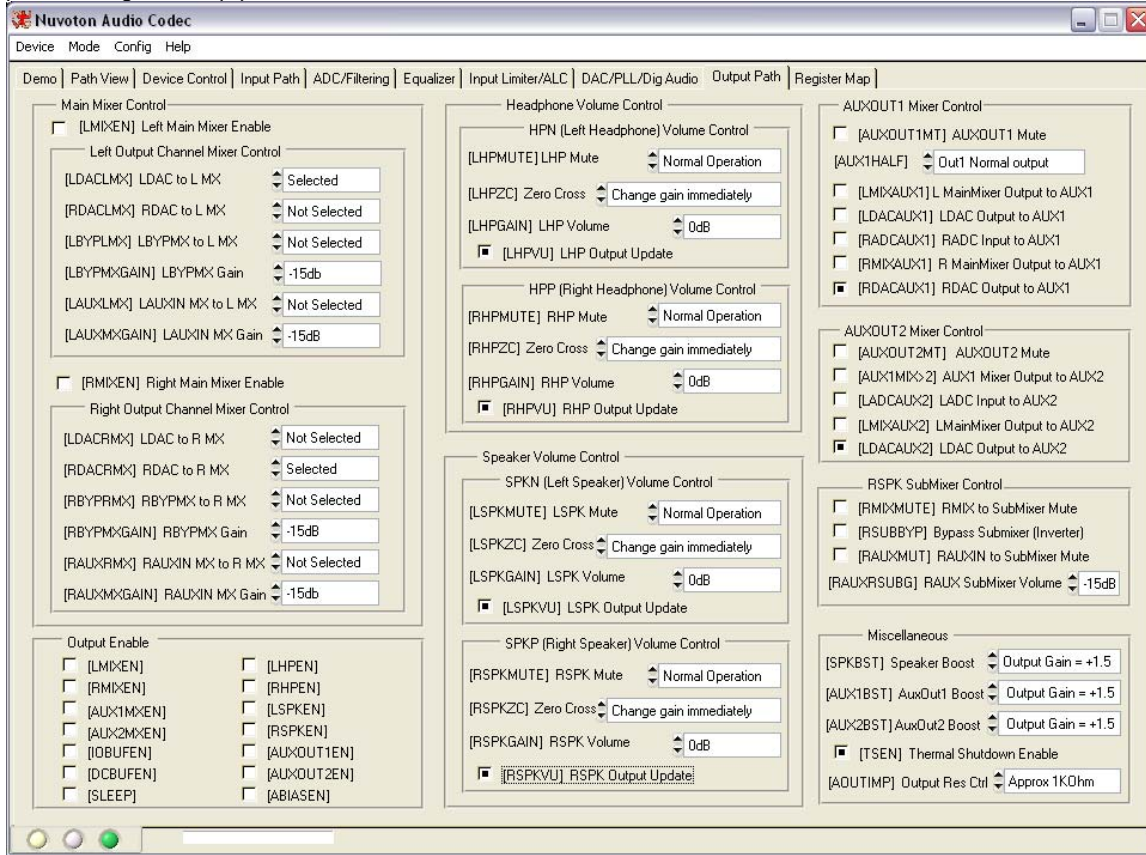
In each section control bits can be enabled or disabled. The associated registers are written automatically.

In the PLL sections the default is open circuit or disabled. There are two PLL settings (Default 12.2886 MHz) or custom setting, where valid supported frequencies are calculated given the PLL parameters. Other section in this panel enables or disables clock generation from external source, companding control, jack detect. The audio interface box also selects individual bits such as FMT and Word length.



### Output Path Panel:

In this panel all output control bits are written in real time, any selection's effect can be seen in the path view panel or register map panel.



### Register Map Panel:

In the Register map view all control address are in hex. To write to a particular register enter the register address followed by the registers new value and click write. Or you can directly enter binary number for each individual bit. To Read a register , enter a register address and click read, the value will be displayed in the register value box. You can also Read all and Update to see all register.

**WAU8822 Register Map**

	Hex Addr	Dec Addr	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Hex Val
Software_Reset	00	0	0	0	0	0	0	0	0	0	0	000
Power_Management_1	01	1	0	0	0	0	0	0	0	0	0	000
Power_Management_2	02	2	0	0	0	0	0	0	0	0	0	000
Power_Management_3	03	3	0	0	0	0	0	0	0	0	0	000
Audio_Interface	04	4	0	0	1	0	1	0	0	0	0	050
Companding	05	5	0	0	0	0	0	0	0	0	0	000
Clock_Control_1	06	6	1	0	1	0	0	0	0	0	0	140
Clock_Control_2	07	7	0	0	0	0	0	0	0	0	0	000
GPIO	08	8	0	0	0	0	0	0	0	0	0	000
Jack_Detect_1	09	9	0	0	0	0	0	0	0	0	0	000
DAC_Control	0A	10	0	0	0	0	0	0	0	0	0	000
Left_DAC_Volume	0B	11	0	1	1	1	1	1	1	1	1	OFF
Right_DAC_Volume	0C	12	0	1	1	1	1	1	1	1	1	OFF
Jack_Detect_2	0D	13	0	0	0	0	0	0	0	0	0	000
ADC_Control	0E	14	1	0	0	0	0	0	0	0	0	100
Left_ADC_Volume	0F	15	0	1	1	1	1	1	1	1	1	OFF
Right_ADC_Volume	10	16	0	1	1	1	1	1	1	1	1	OFF
EQ1-low_self	12	18	1	0	0	1	0	1	1	0	0	12C
EQ2-peak_1	13	19	0	0	0	1	0	1	1	0	0	02C
EQ3-peak_2	14	20	0	0	0	1	0	1	1	0	0	02C
EQ4-peak_3	15	21	0	0	0	1	0	1	1	0	0	02C
EQ5-high-self	16	22	0	0	0	1	0	1	1	0	0	02C
DAC_Limiter_1	18	24	0	0	0	1	1	0	0	1	0	032
DAC_Limiter_2	19	25	0	0	0	0	0	0	0	0	0	000

**Audio Codec Register Control**

Address:

Value:

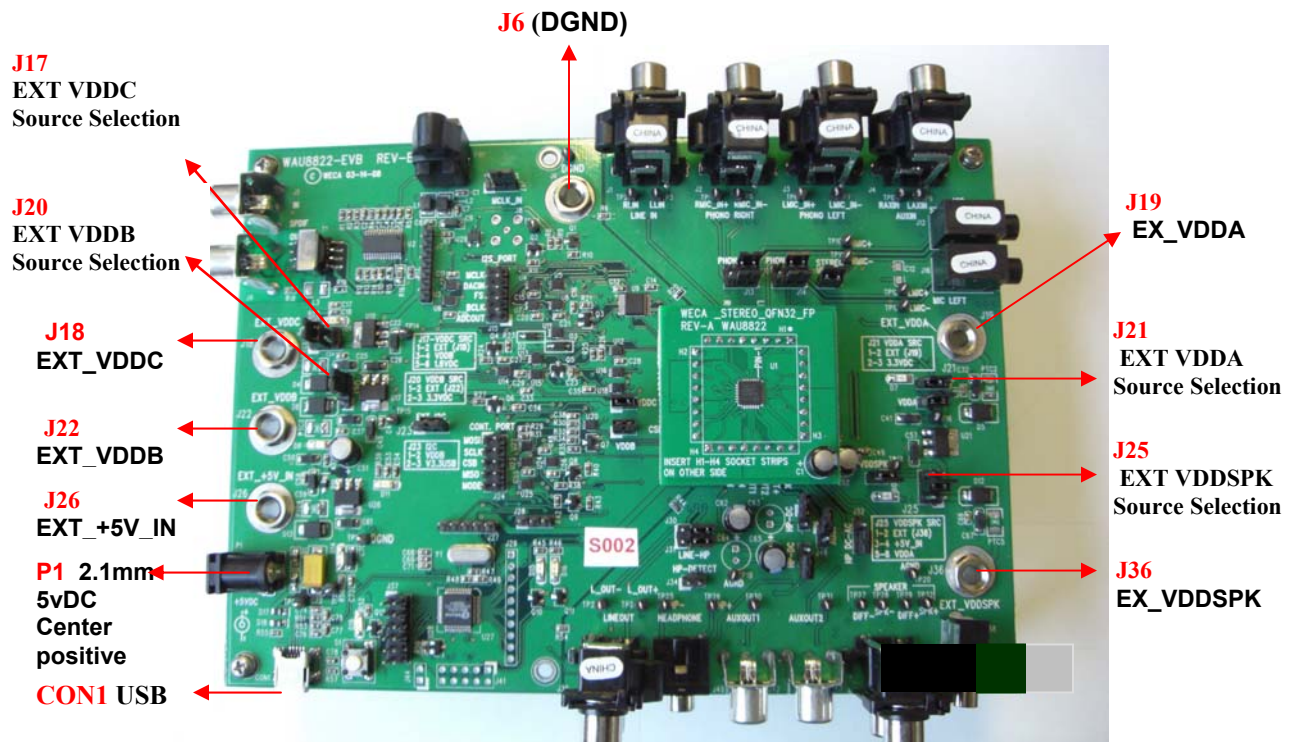
## Jumpers and Connectors:

### Power:

Power is supplied to the WAU8822-EVB USB interface via the USB connector. If preferred it is also possible to supply +5V power to the level shifters using external supplies connected via Banana jacks.

- Using a USB cable +5V can be provided by the PC at CON1.
- If needed, a stronger 5V supply can be added using the 2.1mm jack at P1.
- Using Banana jacks the various supplies of the CODEC can also be supplied externally; connections are described below: **Please make a note to change jumper J17, J20, J21 and J25 source from factory default (powered by USB) to EXT(position 1-2) as needed. See page 21 for detailed descriptions of jumpers.**

REFERENCE DESIGNATOR	SOCKET NAME	SUPPLY
J6	DGND	0V
J18	EXT_VDDC	1.6V to 3.6V
J19	EX_VDDA	2.5V to 3.6V
J22	EXT_VDDB	1.8V to 3.6V
J26	EXT_+5V_IN	+5
J36	EX_VDDSPK	2.5V to 5.0V





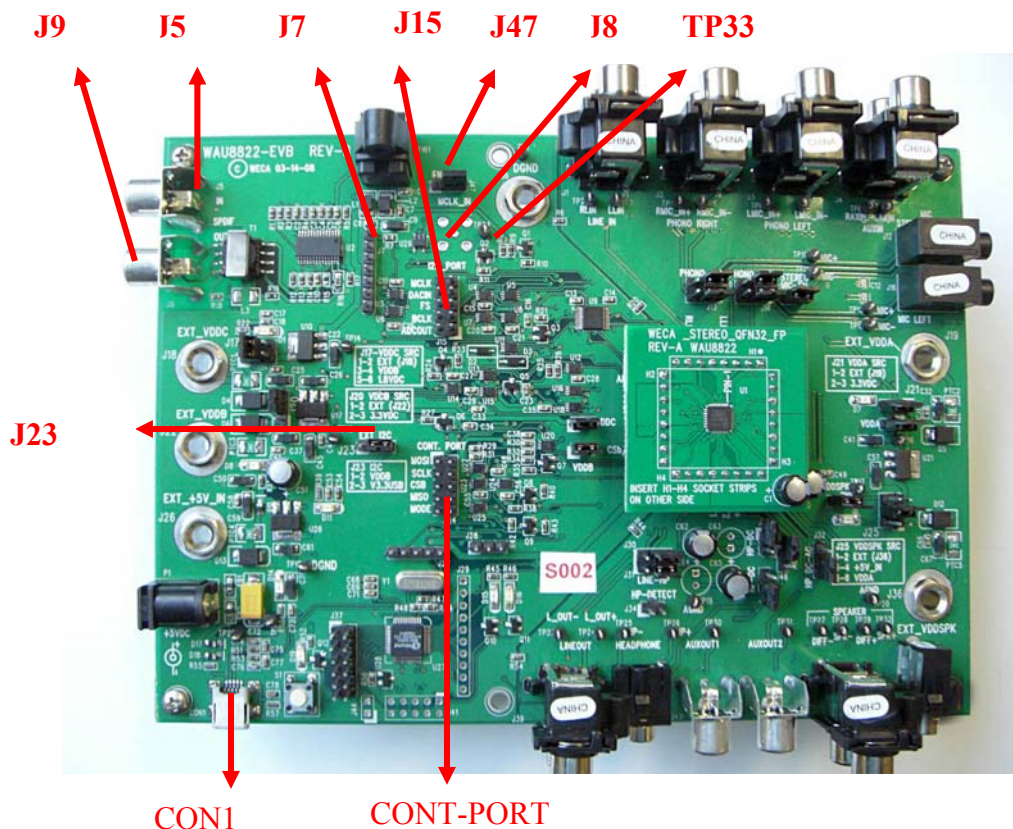
## Selecting 3.3/5V operation jumper settings:

The default setting for WAU8822-EVB VDDSPK is 5V. To select 3.3V operation set J25 (VDDSPK source) to position (5-6) and J21 to Position (2-3).

## Digital Input:

There are three methods to input the required digital signal clocks to the WAU8822 audio interface.

- An AES/EBU, UEC958, S/PDIF, EIAJ CP340/1201 signal from coaxial input can be provided via a standard phono jack (J5),
- Direct digital data can be input via a 1x7 pin header (J7)
- Digital Audio Interface is available via one side of a 2x10 pin header (J15). This supports an Audio Precision interface.



Level shifters have been included in the digital input interface path to provide signal buffering to the input signals; this allows an external clock source to be matched to the WAU8822 requirements.

The WAU8822 requires an MCLK input to produce an ADCOUT output, which can be derived either from S/PDIF signal clock recovery or by connecting an external MCLK direct to J8, TP33 or H2. The BCLK and FS clocks can also be derived from the S/PDIF signal clock recovery or by discrete input to header J7. When EVB board is attached to USB the MCLK is generated from on board 12Mhz crystal by the USB controller.

Reference Designator	Connector Style	Signal Name
J5	Phono Connector	SPDIF_IN
J7	Header	MCLK_IN
J7 pin2	Header	SPDIF_ADCCDAT_IN
J7 pin3	Header	SPDIF_FRAME_IN
J7 pin4	Header	SPDIF_BCLK_IN
J8	SMB Connector ( not populated on the board)	MCLK
J15 pin 1	Header	ADCOUT_AP
J15 pin 3	Header	BCLK_AP
J15 pin 5	Header	FS_AP
J15 pin 7	Header	DACIN_AP
J15 pin 9	Header	MCLK_AP
J47	Header	Ext MCLK enable/disable

### Digital Input Connections

**Note:** External clock to J8, TP33:

To use the WAU8822 as master you still need to apply an external clock to J8, TP33. Please disable any clock source from the board (Set J47 to position EN and in application software, please select Slave I2S mode in device selection panel see page 15)

## Digital Output:

The ADC output can be obtained in the following ways:

- Converted to an S/PDIF signal via the CS8427CS device (U2) and output from the WAU8822-EVB evaluation board via a standard Phono connector (J9).
- The ADC output data and clocks may be accessed via a 1x7 pin header (J7).
- Digital Audio Interface is available via one side of a 2x10 pin header (J15)

Level shifters have been included in the digital input interface path to provide signal buffering to the output signals; this allows external receiver requirements to be met.

Reference Designator	Connector Style	Signal Name
J7 pin2	Header	SPDIF_ADCCDAT_IN
J7 pin3	Header	SPDIF_FRAME_IN
J7 pin4	Header	SPDIF_BCLK_IN
J8	SMB Connector	MCLK
J9	Phono Connector	SPDIF_OUT
J15 pin 1	Header	ADCOUT_AP
J15 pin 3	Header	BCLK_AP
J15 pin 5	Header	FS_AP
J15 pin 7	Header	DACIN_AP
J15 pin 9	Header	MCLK_AP

## USB and External Control CONNECTIONS

The 2-wire, 3-wire or 4 wire control signals can be input from the control software via USB connector (CON1); these signals are interpreted by the Nuvoton W861308 USB Controller (U27). Alternatively it is possible to connect control signals directly via J24.

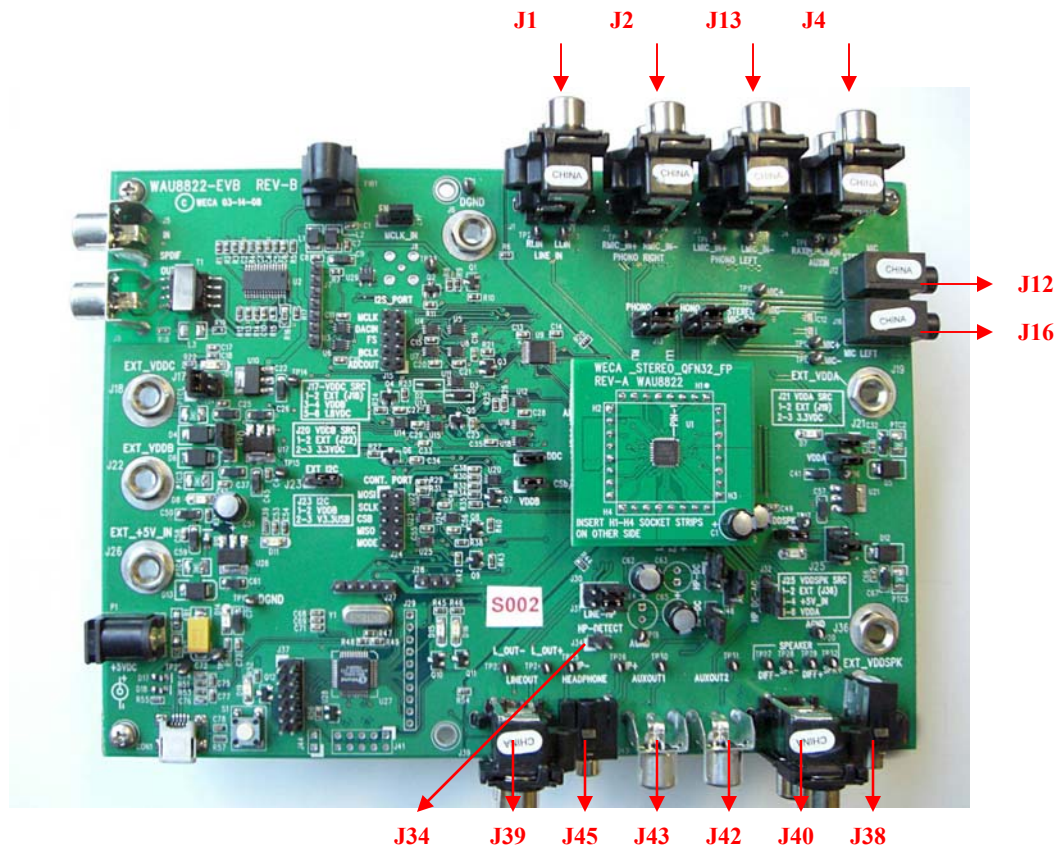
Reference Designator	Connector Style	Pin Number	Signal Name
CON1	miniUSB Type B	1	VCC
		2	USBD-
		3	USBD+
		4	NC
		5	GND
		6	SHIELD
		7	SHIELD
		8	SHIELD
		9	SHIELD

Connector	Name	Description
J15	JTAG_ICE	JTAG ICE connector
J15	I2S_PORT	Direct interface Port for IS2 ( digital audio)
J23	EXT-I2C	I2C Voltage source selection. Position (1-2) VDDDB and position (3-4) selects V3.3V USB
J24	CONT_PORT	External Signal Interface ( SPI)
J29,J37,J41	J29	For Nuvoton use to program the W681308 USB controller

**Note that J15 and J24 can be used together to connect the Nuvoton WAU8822 Audio CODEC to any external controller.**

### ANALOG INPUT

The main analog inputs can be configured in one of two ways, either input via 4 phono connectors or via two jack sockets; both of which can be used with a pair of pseudo-differential input signals. Additional auxiliary inputs and line inputs can be input via two pairs of phono connectors. Jumpers J13 and J14 select between the jack socket or phono connector for each input.



Reference Designator	Connector Style	Signal Name
J1	Phono Connector	LIN_IN
J2	Phono Connector	Phono_Right
J3	Phono Connector	Phono_Left (Input for WAU8812, and WAU8814)
J4	Phono Connector	AUX_IN L/R (Left jack is used for WAU8812, and WAU8814 AUX input)
J12	Jack Socket	Right Mic Input
J16	Jack Socket	Left Mic Input (Input for WAU8812, and WAU8814)

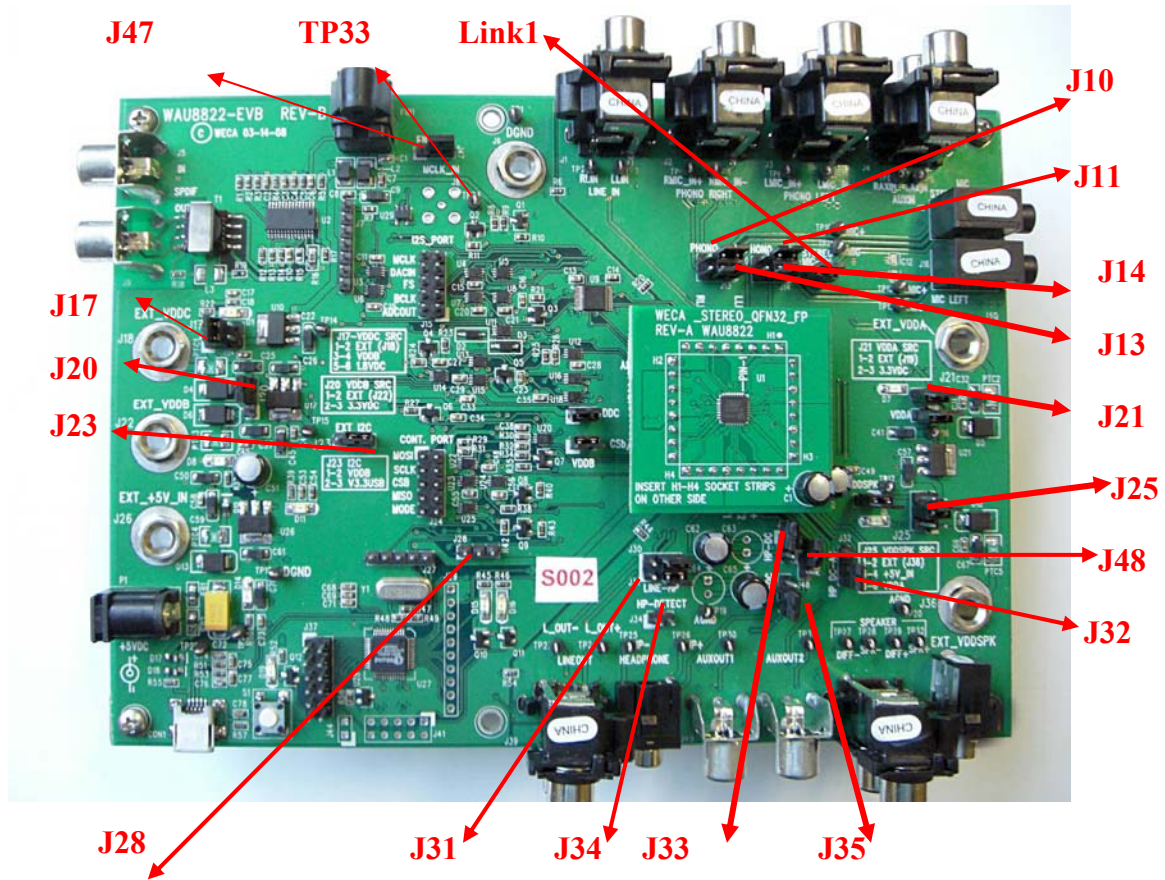
## ANALOG OUTPUT

The analog outputs can be configured in one of two ways, either input via 4 phono connectors or via two jack sockets; both of which can be used with a pair of pseudo-differential input signals.

Reference Designator	Connector Style	Signal Name
J34	Header	HP-Detect
J45	Jack Socket	Headphone (Output for WAU8812, and WAU8814)
J39	Phono Connector	L/R OUT
J42	Phono Connector	AUXOUT1
J43	Phono Connector	AUXOUT2
J40	Phono Connector	AUX_IN L/R
J38	Jack	SPK_JACK ( Mono) (Input for WAU8812, and WAU8814)

All WAU8822 pins are easily accessible via the headers running along each side of the device.

NOTE: It is possible to run a Mono Audio CODEC (e.g. WAU8812) on the WAU8822 platform by using an appropriate daughter card. In this case the left stereo inputs are connected to the Mono device.



**Jumpers:**

Jumpers	Default Position	Description
J10	1-2 (short)	Position 1-2 selects Right MIC and Position 2-3 selects Right Phono
J11	1-2 (short)	Position 1-2 selects Left MIC and Position 2-3 selects Left Phono (Input for WAU8812, and WAU8814)
J13	1-2 (short)	Position 1-2 selects Right MIC and Position 2-3 selects Right Phono
J14	1-2 (short)	Position 1-2 selects Left MIC and Position 2-3 selects Left Phono (Input for WAU8812, and WAU8814)

Jumpers	Default Position	Description
J17	3-4(short)	The 3 position jumper selects the VDDC source. Position 1-2 Sects External VDD via J18, 3-4 Selects VDDDB, and position 5-6 sects 1.8VDC
J20	2-3(short)	J20 Selects the VDDDB source, position 1-2 selects external source via J22 position 2-3 selects 3.3VDC
J21	2-3(short)	J21 Selects the VDDA source, position 1-2 selects external source via J19 position 2-3 selects 3.3VDC
J23	2-3(short)	Install for external I2C at VDDDB or I2C at 3.3V operation.
J25	3-4 (short)	Speaker VDD selection jumper. Position 1-2 selects external source via (J36), position 3-4 selects 5VDC and position 5-6 selects analog power (VDDA)
J28	2-3(short)	For Internal use with the W681308 USB controller
J30	2-3(short)	Position 1-2 Left Line_Out select and Position 2-3 selects Left HP-_Out ( Left headphone out)
J31	2-3(short)	Position 1-2 Right Line_Out select and Position 2-3 selects right HP+_Out (Right headphone out)
J32	1-2 (short)	Position 1-2 selects Headphone cap-less mode and Position 2-3 selects AC coupled headphone output
J33	(Open)	Open position selects Headphone cap-less mode and Closed Position selects DC coupled headphone output ( HP-) (Output for WAU8812, and WAU8814)
J34	1-2 (short)	Headphone detect
J35	(Open)	Open position selects Headphone cap-less mode and Closed Position selects DC coupled headphone output (HP+)
J47	2-3(short)	Install this jumper for external MCLK Position 1-2 enables external MCLK and poison 2-3 disables the external MCLK.
J48		Aux1 connection header
Link1	Closed	Stereo MIC select



### Test Points:

Reference Designator	Description	Signal Name
TP1	Digital Ground	DGND
TP2	Right Line_In	R_LIN
TP3	Left Line_In	L_LIN
TP4	Right Phono-In positive	RMIC_IN+
TP5	Right Phono-In Negative	RMIC_IN-
TP6	Left Phono-In positive	LMIC_IN+
TP7	Left Phono-In Negative	LMIC_IN-
TP8	Right Aux_IN	RAUXIN
TP9	Left Aux_IN	LAUXIN
TP10	Right Mic-In Positive	RMIC+
TP11	Right MIC-In Negative	RMIC-
TP12	Left MIC-In positive	LMIC+
TP13	Left MIC-In Negative	LMIC-
TP14	VDDC Source (J17)	J17-VDD-SRC
TP15	VDDB Source (J23)	J23 I2C
TP16	Analog Voltage test point	VDDA
TP17	Speaker VDD	VDDSPK
TP18	Digital Ground	DGND
TP19	Analog Ground	AGND
TP20	Analog Ground	AGND
TP23	LINE OUT	L_OUT-
TP24	LINE OUT	L_OUT+
TP25	Headphone	HP-
TP26	Headphone	HP+
TP27	Differential Speaker Negative	DIFF-
TP28	I Speaker Negative	SPK-
TP29	Differential Speaker Positive	DIFF+
TP332	Speaker positive	SPK+
TP31	AUXOU2	AUXOUT1
TP30	AUXOUT1	AUXOU2
TP33	External clock Input	MCLK_IN

