DA7212 Ultra Low Power Codec

and

Power Commander™ GUI Software

Introduction

The DA7212 Evaluation Board has been designed to allow measurement and evaluation of the DA7212 device.

All Audio Codec functionalities are self-contained within the Evaluation Board (EVB).

The EVB is supplied with a USB memory stick containing various documents and a GUI to allow the user to control the DA7212.

The GUI is called Power Commander[™]. It uses a simple graphical interface, allowing the DA7212 to be controlled via a USB port of a PC.

The EVB has a number of jumper links to enable the user to change the system configuration and to allow him to make appropriate measurements, although, in reality, few jumper links are required to be altered for standard operations of the DA7212.

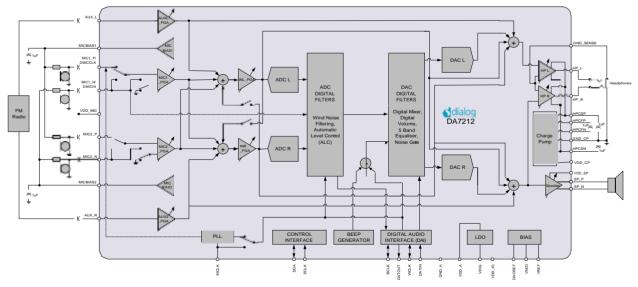


Figure :1 DA7212 Block Diagram

Table of Contents

SUMMARY	3
HARDWARE Power Supplies Audio Connections Jumpers Link Positions and Button Settings	4 6 7 8
CONTROL SOFTWARE	11
Installation	11
Control Panel Status and Controls	13 14
Control Interface	17
Codec Config Page	18
DAI and PLL Page	19
Analogue Inputs	20
Analogue Outputs	21
Mixers	22
ADC Control	23
DAC Control	24
ALC Control	25
Tone Gen	26
Codec Registers	27
TROUBLESHOOTING Software Issues Hardware Issues	28 28 28
APPENDIX A – REGISTER TEXT FILE	30
APPENDIX A – SOCKETED MINIBOARD (169-01-A)	33
REVISION HISTORY	34

Summary

This document provides some useful information to the user about the EVB and the GUI to allow testing and evaluation of the DA7212 Ultra Low Power Codec.

The hardware solution is based upon two PCBs:

- "EVALUATION MOTHERBOARD 170-03-A"
- "CUSTOMER REFERENCE BOARD 169-02-A" (DA7212 mini board)

The GUI, called Power Commander[™], requires a PC operating Windows 2000/XP/Vista/Windows 7 with a USB1.1 or USB2 interface. To run Power Commander[™] under Windows Vista, set the default installation location to "C:\Dialog Semiconductor\".

Note that Dialog recommends connecting the EVB to a 500 mA capable USB port as we cannot guarantee that a USB hub (set to 100 mA) is sufficient to operate it correctly.

See the section on Power Supplies below.

The GUI allows the user to: (i) configure the DA7212 using one of the several pre-loaded initialisation files (i.e. start-up sequences) available; (ii) write and read operations to all control registers; and (iii) monitor of device status.

Hardware

The DA7212 Evaluation Board consists of two boards:

A daughterboard containing the DA7212, and the essential external components. This board could also be used in standalone or as a module for a customer development platform.

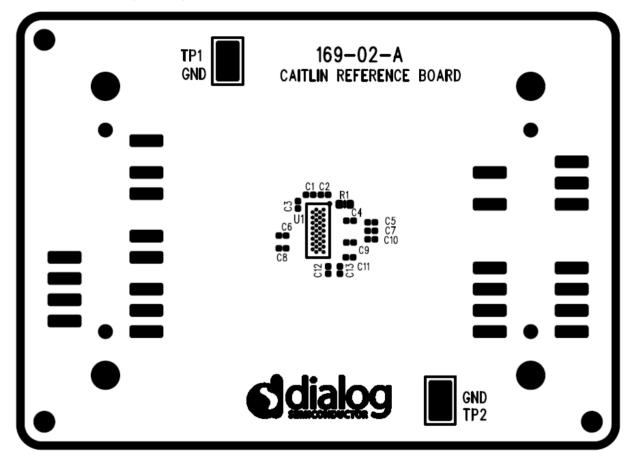


Figure 2: DA7212 Mini Board

Note a socketed mini board (169-01-A) is also available. See appendix B for more information.

A motherboard containing many circuit blocks that allows for flexible configuration and provides test access to the DA7212. It includes:

- a. USB Interface with Control Interface level shifters
- b. 1x audio optical input/output interfaces (with selection matrix)
- c. USB reset and 3.3V reset switches
- d. headphone output
- e. line out outputs
- f. auxiliary inputs
- g. analogue/digital microphone inputs
- h. master clock input
- i. power supply inputs (VBAT, GND)

A USB-I2C bridge is used for communication with the device, and there are a number of external active components to reduce the requirement for external circuitry.

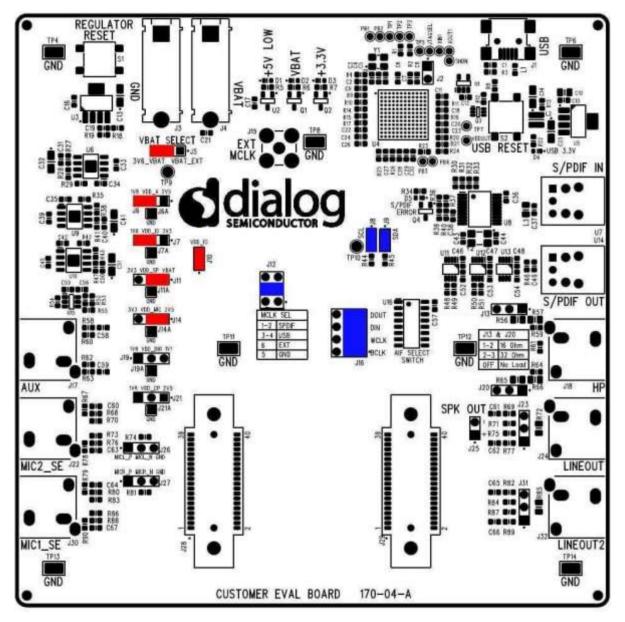
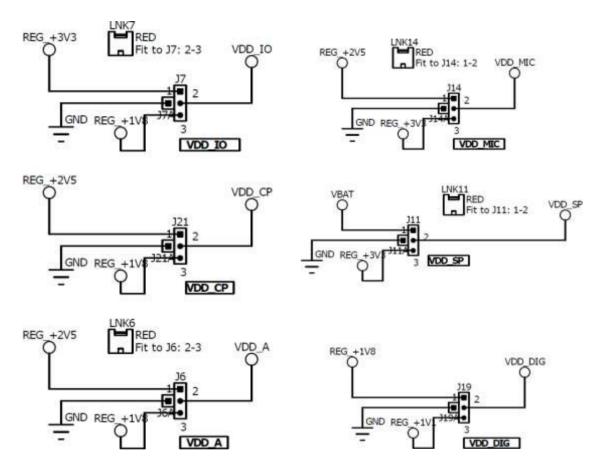


Figure 3: Mother Board – Default Jumper positions shown in Red (power) and Blue (signal)

Note: The EVB has been configured by default to work from the mother board"s on-board regulators.

Power Supplies

The DA7212 EVB is powered when a USB cable is connected to J1 (+5V_USB). With default jumper settings (J6, J7, J11, J14 and J19, J21), the DA7212 device on the daughterboard is powered form the on-board regulators.



As DA7212 supports a wide supply range the jumper configuration allows the user to select one of two on-board supplies for each supply by connecting the jumper link between pins 1&2 or 2&3 of the jumper. For maximum flexibility the jumper link can be removed and a voltage can be supplied directly onto pin 2 of the jumper with a ground connection connected to the A pin of the jumper. Current measurements on individual supplies can also be performed by connecting an ammeter between the supply and pin2 of the jumper.

Note: As VDD_IO supplies the IO voltage for the USB interface and level translators jumper J10 has been provided for current measurements on this supply of the DA7212 device. For current measurements on VDD_IO remove the jumper link and insert an ammeter between pins 1 & 2 of J10.

Note: VDD_CP and VDD_DIG are not used in DA7212 and the jumper link should be left unpopulated.

Audio Connections

Connector	Name	Function
J17	AUX	Stereo single-ended auxiliary input
J30	MIC1_SE	Stereo single-ended microphone input (connects to MIC1_P and MIC2_P)
J22	MIC2_SE	Stereo single-ended microphone input (connects to MIC1_N and MIC2_N)
J26		Mono differential microphone input Pin 1: MIC1_P Pin 2: MIC1_N Pin 3: GND
J27		Mono differential microphone input Pin 1: MIC2_P Pin 2: MIC2_N Pin 3: GND
U7	S/PDIF IN	Digital optical input
U14	S/PDIF OUT	Digital optical output
J18	HP	Stereo single-ended headphone output
J24	LINEOUT	Differential line output (AC coupled, use J25 for speaker)
J23		Differential line output (AC coupled, use J25 for speaker) Pin 1: LINE_P Pin 2: GND Pin 3: LINE_N
J25		Differential speaker output (DC coupled) Pin 1: SP_P Pin 2: SP_N
J32	LINEOUT2	Unused
J31		Unused

Table 1 170-04-A Audio Connectors

Jumpers Link Positions and Button Settings

Jumper number	Position	Function
J3 &J4		External VBAT and GND
		connection
J5	1-2, (default)	VBAT select: VBAT is
		generated from an on-board
		regulator supplied from the USB
	2-3	VBAT select: VBAT is supplied from J3&J4
J6	1-2, (default)	Connects VDD_A from onboard 1.8V supply
	2-3	Connects VDD A from
	2 3	onboard 2.5V supply
	А	GND connection for
		connecting external supply
		between pin 2 and A
J7	1-2, (default)	Connects VDD_IO from
	2-3	onboard 1.8V supply Connects VDD_IO from
	2-3	onboard 3.3V supply
	А	GND connection for
		connecting external supply
		between pin 2 and A
J8	On, (default)	Connects USB I2C SCLK to device
J9	On, (default)	Connects USB I2C SDATA to device
J10	On, (default)	Connects VDD_IO to the
JIU	on, (actually	DA7212 device.
J11	1-2	Connects VDD_SP from
		onboard 3.3V supply
	2-3, (default)	Connects VDD_SP from VBAT
	А	GND connection for
		connecting external supply
		between pin 2 and A
J12	1-2	MCLK comes from the SPDIF
	2 1 (defeult)	interface MCLK comes from the USB
	3-4, (default)	interface
	5	GND pin
	6	External MCLK pin,
		anexternal MCLK can be
		connected between pins 5

		and 6.
J13	1-2	Inserts a 160hm load across the left headphone output for test purposes
	2-3	Inserts a 320hm load across the left headphone output for test purposes
J14	1-2	Connects VDD_MIC from onboard 3.3V supply
	2-3, (default)	Connects VDD_MIC from onboard 2.5V supply
	А	GND connection for connecting external supply between pin 2 and A
J15		Allows connection of an external MCLK using an SMB connector. J12 should have it's jumper link removed when using this option.
J16	1-2, (default)	Connects the SPDIF/USB BCLK to the DA7212 device
	3	GND for connecting BCLK to/from an external source between 2-3 (for example Audio Precision PSIA cable)
	4-5, (default)	Connects the SPDIF/USB WCLK to the DA7212 device
	6	GND for connecting WCLK to/from an external source between 5-6 (for example Audio Precision PSIA cable)
	7-8, (default)	Connects the SPDIF/USB DIN to the DA7212 device
	9	GND for connecting DIN from an external source between 8-9 (for example Audio Precision PSIA cable)
	10-11, (default)	Connects the SPDIF/USB WCLK to the DA7212 device
	12	GND for connecting DOUT to an external source between 11-12 (for example Audio Precision PSIA cable)
J19	1-2	Not Used
	2-3, A	Do not connect for DA7212
J20	1-2	Inserts a 160hm load across



		the right headphone output for test purposes
	2-3	Inserts a 32ohm load across the right headphone output for test purposes
J21	1-2, (default)	Not Used
	2-3	Do not connect for DA7212
	А	
S1		Regulator Reset button: Resets the 3.3V, 2.5V, 1.8V and 1.1V regulators
S2		USB Reset button: Resets the USB sub system

Table 2: 170-04-A Jumpers Link Positions and Button Settings

Control Software

Installation

From the USB memory stick provided with the EVB box, run the "setup.exe" file (DA7212_USB\DA7212 GUI\setup.exe).

1v1	
Destination Directory Select the primary installation directory.	
All software will be installed in the following locations. To install so different locations, click the Browse button and select another de	fivare into a ectory.
Directory for DA7213_1v1	
Directory for DA7213_1v1 [C1Dalog Semiconductor/Audio\DA7213_1v1\	Browns
	Browse

Click "Next>>".

1 DA7213_1v1	
Start Installation Review the following summary before continuing.	
Adding or Changing • DA7213_1v1 Files	
Click the Next button to begin installation. Click the Back button to change the installation setting	s.
Save File) << Back Next >>	Cancel

Click "Next>>".

₩ DA7213_1v1				×
Installation Complete				
The installer has finished updating your system.				
	<< Back	Next>>	Finish	=

Click "Finish".

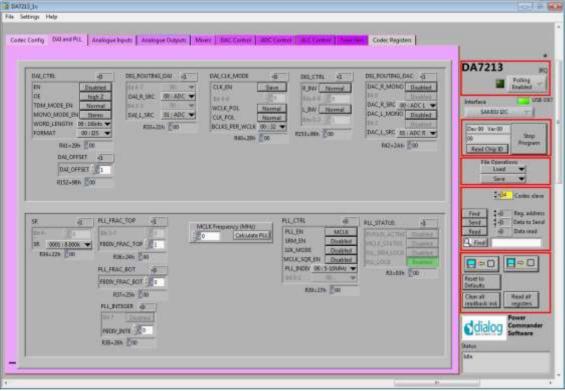
You may need to restart your computer; in this case a pop up window will appear asking you to do so.

Once your computer has restarted, plug the USB cable to the EVB and Windows should detect the USB device and automatically install the driver. If not, the driver is located on this DA7212 USB stick

Control Panel

Run the DA7212 program by clicking the shortcut on the appropriate item in the Start menu. The best setting for the PC display size is 1024x768 pixels or above. Font size on the PC display should be Normal (95dpi). It is important to note that a display size other than the recommended setting may affect the way in which the panels appear.

The following screen appears, with the "USB OK?" LED lit if the USB interface is correctly connected and operational.



To start the device, plug in the USB cable.

Figure 4 Initial Interface

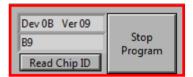
If the Reset LED is blinking yellow, it indicates that the device is not yet communicating via the I2C interface. See Troubleshooting for more details.

Status and Controls

Polling Enabled BY default the current page contents is updated via polling the I2C interface. If disabled, these readbacks are suppressed. This is used to force the communication over the bus to be silent. If this is set to automatic, the program will only poll the device while the application is the topmost window. If obscured by another program or window, polling will be disabled.

LED If the device is active this LED is green, or red if inactive.

correct.



Stop Program

This terminates the program. If there are unsaved changes, a dialog box is displayed.

This indicates the device version when the device

is active. When inactive, version status will not be

File Operatio	ns	
Load	▼	
Save	▼	

Load Loads previously saved text files, send all Registers and read back all registers.

"Load" opens a dialog box to select, view, copy or re-name a file.

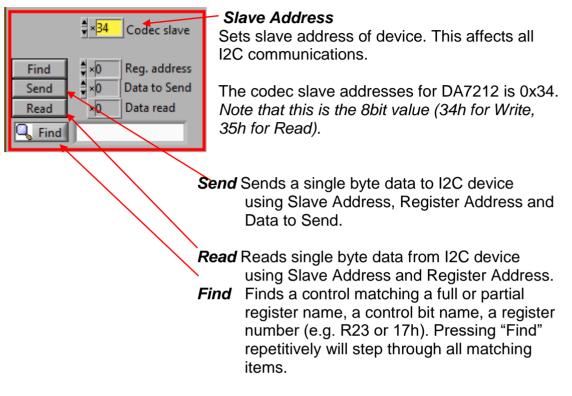
Load Codec file opens a dialog box to allow selection of a codec setup file in the "\Codec Setups" directory.

Save Saves current panel state to a text file. Selecting "Save Codec file.." saves the codec registers in a slightly different format. Selecting "Register Dump" option saves current register values to the text file. See Appendix A.

Note: Difference between "Save" and "Register Dump" is that the "Save" dumps the contents of all panel controls to the file (a save state operation); whereas, "Register Dump" reads the device contents (including status registers) into the file. Note that some codec registers do not have readback capability.



Interface Selects between USB I2C control and offline mode. Switching to offline, then back to USB reinitialises the USB interface.



Note: If Device Address does not match the port numbers on the device, this can be used to control/read any other device on the I2C bus.

Reload Configuration Clear all readback ind	Chronise Panel from Device is all the register contents of the device pdates the panel to match. Intronise Device from Panel is all the device registers to match the c. (Refresh operation)
Resets re configura	Configuration egisters to values specified in ation file for the PMIC section and default or the codec.
Clear all I2C readback indicators	Sets all readback indicators to 0.
Read All Registers	Reads all registers, comparing with the panel controls.

Control Interface

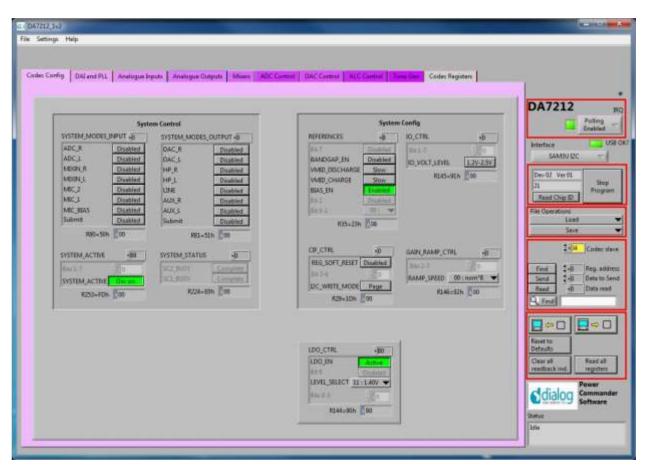
The Codec Config, DAI and PLL, Analogue Inputs, Analogue Outputs, Mixers, DAC Control, ADC Control, ALC control and Tone Gen pages all have the same format.

Each register cluster comprises a control with a mixture of Boolean toggle buttons, multi-value ring controls, or slide controls, as well as a hexadecimal indicator showing the total equivalent register value and a readback indicator showing the current register settings. The Event Register is labeled with a Register number in decimal and its hexadecimal equivalent.

The Readback indicator readings can be switched individually to decimal, octal, hexadecimal or binary by clicking on the "x", or they may all be changed at once between Hex and Binary by the "View>Binary Indicators" menu item.

Codec Config Page

The Codec Config page allows access to the System Controller as well as some basic system settings such as the references, IO levels and digital LDO. To use the System Control panel (de)select the blocks as required for the inputs and outputs and click the Submit button to apply the changes. If no blocks are active then the System Active panel can be used to disable the onchip oscillator and put DA7212 into an ultra-low power standby state. The CIF CTRL panel can be used to reset the chip and return all the registers to their hardware defaults.



DAI and PLL Page

The DAI and PLL page allows control of the digital audio interface and phaselocked loop. The DAI CTRL panel sets the format on the DAI and the DAI CLK MODE panel sets the master/slave mode as well as the clock polarity and number of BCLKS per WCLK. The DIG ROUTING DAI panel selects the data source for the DAI and DIG ROUTING DAC selects the data source for the DAC.

The PLL Control panel contains all the settings for the PLL and on-chip clocking. The SR panel sets the sample rate being used. The PLL CTRL panel sets the input clock rate, whether the PLL is enabled and whether sample rate matching (SRM) is required to track the DAI in slave mode. If the PLL is required, the three FBDIV panels control the value of the feedback divider. The required values can be calculated using the DA7212 PLL Calculator spreadsheet, or they can be determined automatically by entering the supplied MCLK frequency and pressing the Calculate PLL button. The current status of the PLL is shown in the PLL STATUS panel. The PC COUNT panel controls the behavior of the internal program counter.

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Analogue Inputs

The Analogue Inputs page controls the input amplifiers and microphone biases. Each of the GAIN panels sets the target gain for the amplifiers, and the GAIN STATUS shows the currently active gain setting. Each of the CTRL panels sets the enable, mute, and gain change behavior (ramped or zerocrossed) for the amplifiers. The MIC CTRL panels allow selection of singleended or differential input signal. The MICBIAS CTRL panel enables and sets the output level for the microphone bias outputs. The MIC CONFIG panel sets the clock and data format when digital microphones are used.

047212 312				Real Property lies
Settings Help				
AUX C GAIN 495 CAMP_GAIN LIDUEL-0.048 BUE-305 15 AUX C GAIN STATUS	Hpuff Analogue Dutputs More 1 ALIX,R,GABI -35 III - Duther R,AMP,GAIN - ISODI -0.068 849-316 - 33 ALIX,R,GAIN,STATUS	ADC Cemmi COLC Content AUC Cemmi Ten MCC 1, GAB4 4 (0) 1 (0) AMP, GAB4 001 (00) NGT+304 (01) MGC 3, GAB4 (STATUS	MC.2.5AN 40 AMP.GAN 001.0AB ¥ R38-3AN 011 MC.2.GAN STATUS	DA7212 Peting Interface SAMBUIC
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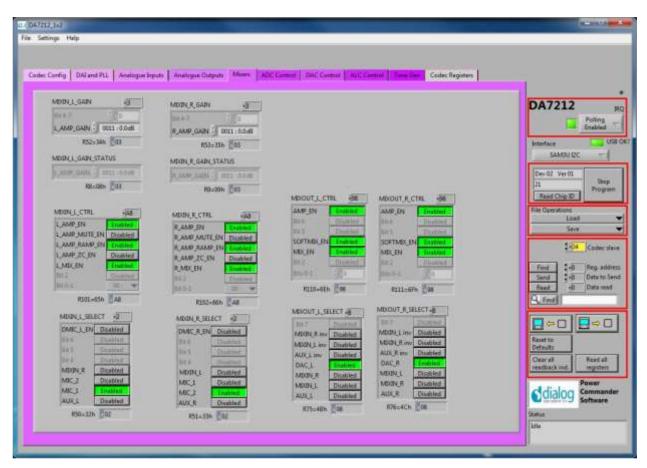
Analogue Outputs

The Analogue Outputs page controls the headphone and line (speaker) amplifiers as well as the charge pump for the headphone supplies. The GAIN, GAIN STATUS and CTRL panels behave as for the Analogue Inputs page. The Charge Pump Control controls the mode and switching behavior of the charge pump as explained in the datasheet.

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RAMP_EN	RAMP_EN Ramping	RAMP_EN Buttert	2+34 Cod
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RU07-68h Al	R108:6Ch AU	R109:60% E40	
	Charge Pump 1	Control	- Reset to
CP_CTRL	CP_VOL_THRESHOLDL 48	CP_DELAY JAS CP_DETECTOR op	Defaults
CP_EN Enabled	11x+-1	CP_ON_OFF Dec.2.1	Clear all Read readback ind. regist
CP_SMALL_SWITCH INNING	CF_THRESH_VD02	CP_FCONTROL_101_04HE CROET_DROP_001_25HW V	Power
CP_MOD 11+CPVDD/1	R148=95h 26	R150-966 A5	dialog Comm

Mixers

The Mixers page controls the behavior of the analogue input and output mixers. The GAIN, GAIN STATUS and CTRL panels behave as for the Analogue Inputs page. The MIXOUT CTRL panel also enables the Softmix feature to ramp in/out the the select inputs. The SELECT panels controls which inputs are routed to each of the four mixers.



ADC Control

The ADC Control page enables the ADC, sets the digital gain applied after the ADC and controls the behavior of the high-pass filter.

LEN Indied D.EN Destau	ADC_LGAIN VOT	ADC.R.GADI 407	DA7212
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			Réset to Defenda
			Clear all Rea readback ind. reg

DAC Control

The DAC Control page controls the DAC, the DAC filters and the DAC noise gate. The DAC FILTERS panels control the high-pass filter as well as the 5-band EQ filter. There is also an option to apply a soft mute to the DAC input signal. The DAC NG panels control the behavior of the DAC noise gate in terms of its on and off thresholds, attack/decay rates and hold time.

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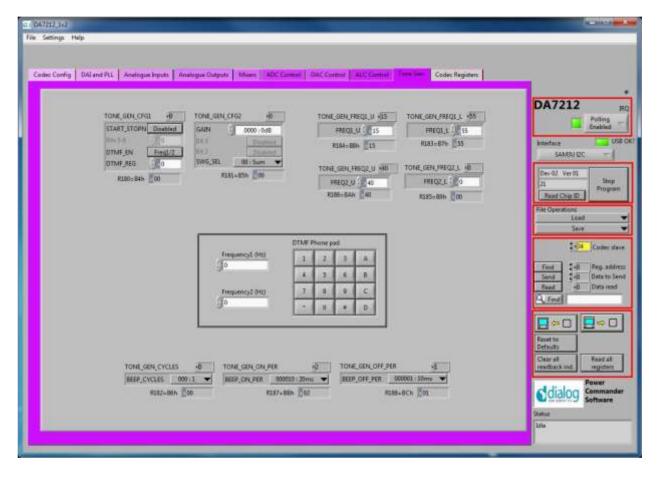
ALC Control

The ALC Control page configures the automatic level control on the record path. The ALC behavior is described in detail in the datasheet.

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Tone Gen

The Tone Gen page controls the digital tone generator at the input to the DAC. TONE GEN CFG1 panel starts the tone generator and enables a DTMF tone if required. TONE GEN CFG2 panel sets the gain applied to the tone and controls which sine-wave generator is used (or both). The TONE GEN FREQ panels set the frequency for the two generators as described in the datasheet. The DTMF Phone pad panel produces DTMF tones when the buttons are pressed. The TONE GEN CYCLES panel controls how many beeps are produced, and the TONE GEN ON and OFF PER panels control the on and off periods.



Codec Registers

This page presents the registers in a single table. The table is interactive, both receiving changes made in other controls, and passing values to other controls if changed in the table. In some conditions this register view may be useful.

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Troubleshooting

This section is an aid to resolving problems occurring in the previous sections.

Software Issues

The USB device should install without difficulty automatically. Make sure that the installation finds and uses the driver contained in the USB memory stick.

If the program is started before the USB Interface board is plugged in, the program will default to the offline mode. It can be useful to familiarise yourself with the software in a desk environment without the hardware attached. If the board is subsequently attached, move the Interface control to "USB". Make sure the USB is connected and then restart the program.

The software is optimized for a display screen size of 1024 by 768 pixels or greater, with Fonts set to Normal (96dpi).

There have been reported issues of unpredictable display effects when large fonts (120dpi) are used. This can be changed by right-clicking on the desktop, select Properties. Select the Settings tab, select Advanced, then Normal size from the drop-down box.

If communications are apparently lost, first press the "Start Device" button. This attempts to make the device go active.

Also switching the "Interface mode" to Offline, then back to USB can reinitialize the USB interface. Last resort is to unplug the USB then reconnect. The software will detect this and reinitialize.

Hardware Issues

Most hardware problems can be traced to incorrect jumper positions.

Check carefully jumper positions by comparing them with the default positions on page 7. Use the jumper table details and the board schematic as a guide to the jumper functions and locations.

Selecting USB playback

The dialog DA7212 EVB coupled with the digital IO board allows a number of audio sources to be selected with ease for testing and evaluation. One example is to stream audio from a PC to the EVB over USB, This can easily be done in the following way.



Right click on speaker symbol in task bar, circled in red



Select playback devices

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Select a pl	ayback device	below to m	nodify its settir	igs:
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Left click on Dialog US-Lab IO, then select "Set Default" and OK.

Audio played on the PC will now be streamed over USB to the digital IO board for use on the DA7212 board.

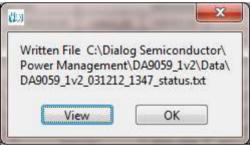
Appendix A – Register Text File

The software includes the ability to save and load a text file containing command codes representing the register addresses and data. This file is principally used to save and load setup data, but may also be used to perform a small degree of automation.

Note that at the end of the startup process, initiated by pressing "Start Device", a file "Host_configuration.txt" is loaded and run to emulate the host processor writing immediately to the device.

If the option "Settings>Reg names in file" is set from the menu, register names, rather than numbers, are used in the file, and the slave address is replaced by the word "CODEC". This is generally preferable and more readable. Names are defined in the files "Registers_DA7212.h", and "Hardware_DA7212.h" that reside in the \Data\Drivers directory. Hex codes for slave address and register address are still accepted on reading in the file.

The use of the Save\logtest.txt facility permits register contents to be transferred to the user"s own software. Clinking on Save\logtest.txt brings up the following panel, showing the location and name of the saved file. This is a Register dump of the entire device.



Example message box.

I2C Register Text File Format

The following formats are used for both read and write in the text file.

- Numbers apart from time delays are always expressed in Hex, separated by tabs. The use of "0x" in front of the hex value is optional.
- The first parameter is the device slave address in 8bit format. **OR**
- The first parameter is a token:
 - "WRITE2" or "CODEC" will write to the CODEC device at the currently selected slave address (I2C mode only).
 - "READ2" will read from the CODEC device at the values of a number of registers.

- "DELAY" or "WAIT" will implement a time delay specified up to 65535 milliseconds. The delay time is specified in decimal or hex if preceded by "0x".
- ITERATE will cause the **whole** script to be repeated the specified number of times.
- The second parameter is the register address as a name or hex value.
- The third parameter is the data.
- Comments (i.e. lines beginning with "//") are permitted in the file.
- Inline comments (i.e. //comment) are permitted.
- The data will be processed in the order written and written directly to the specified device. The screen controls will be updated once command in the file have finished.
- The use of the slave address in the file allows any device attached to the I2C bus to be controlled.
- For read operations, the result of the read is passed to the history log window.

Example files contents:

//Write to CODEC in 3 ways CODEC MIC_L 0x01 WRITE2 MIC_R 0x02 0x34 0x09 0xB1

//Read CODEC starting at DAC_R
// for next 10 registers
//Result is visible in Datalog window

READ2 DAC_R 10

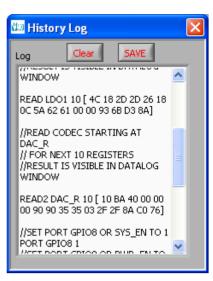
//Wait 255ms DELAY 255 WAIT 0xFF

Alternative form

//Register Dump						
//Slave	Register	Data				
0x92	0x01	0x00				
0x92	0x02	0x01				
0x92	0x03	0x02				
0x92	0x04	0x02				
0x92	0x05	0x04				
0x92	0x06	0x05				
0x92	0x07	0x06				
0x92	0x08	0x07				
0x92	0x09	0x08				

The results in the history log file are shown below.

The Read operations are in brackets following the command.



Appendix A – Socketed Miniboard (169-01-A)

A socketed miniboard is available for evaluation purposes. This PCB uses larger passive components (0402) to allow for customer experimentation. A soldered device can replace the socket on request.

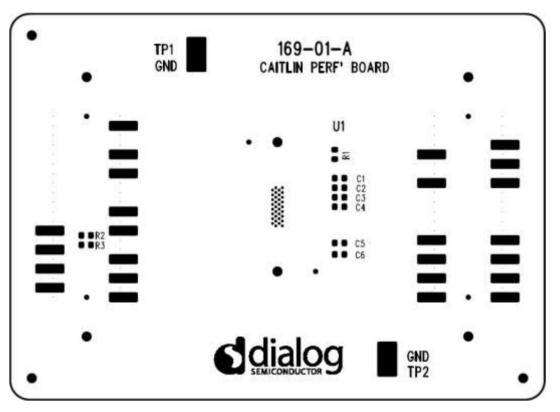


Figure 5 DA7212 Mini Board

REVISION HISTORY

REVISION	DATE	ORIGINATOR	CHANGE
1.0	28/06/2013	СМ	Initial Release
1.1	20/11/2013	CM	Updated default jumper locations
1.2	21/11/2013	PH	Added description for each page in the GUI
1.3	12/01/2022	AM	Rebranded from Dialog to Renesas

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