



congatec Application Note #20

Affected Products	All congatec x86 CPU modules
Subject	Create and add an HDA verb table module to a congatec BIOS
Confidential/Public	public
Author	CJR

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Revision History

Revision	Date (yyyy-mm-dd)	Author	Changes
1.0	2010-06-10	RCH	Initial release of document
1.1	2017-06-19	CJR	Minor rework and update to new template

Preface

By definition, the HDA codec is on the carrier board and application specific. Therefore, the congatec embedded BIOS of CPU modules does not contain verb table initialization for HDA codecs. However, OEMs may add these verb tables by themselves. This application note provides information and examples how to create and add HDA verb table modules into the BIOS of CPU modules.

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Symbols

The following are symbols used in this application note.



Notes call attention to important information that should be observed.



Caution

Cautions warn the user about how to prevent damage to hardware or loss of data.



Warnings indicate that personal injury can occur if the information is not observed.

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Terminology

Term	Description
HDA	High Definition Audio – The specification can be downloaded from www.intel.com
POST	Power-on Self-Test - a diagnostic testing sequence run by a computer's BIOS as the computer's power is initially turned on. The POST will determine if the computer's RAM, disk drives, peripheral devices and other hardware components are properly working.
CGUTIL	congatec System Utility – universal tool for BIOS updates and BIOS modifications.
CGOS	congatec Operating System API – software driver for the congatec Embedded Features

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1 Introduction

HDA verbs are used to configure codec-specific functions not provided by the codecspecific OS driver. Follow this application note to create and add a verb table into the congatec embedded BIOS. The congatec embedded BIOS will write the verbs from the verb table into the HDA codec during early BIOS POST.

⇒ Note

Contact your HDA codec vendor for information about the codec-specific verbs for your desired functions and the required circuitry modifications. This information is outside the scope of this application note and congatec support in general. congatec does not create nor test codec specific verbs, verb tables, and sample circuits.

2 Requirements

The following driver and applications are required:

- CGOS driver (version ≥ 1.02.014)
- CGUTIL
- Hex editor of your choice

You can download the CGOS driver and CGUTIL from the congatec website <u>www.congatec.com</u>



3 Creating an HDA Verb Table

3.1 Layout of an OEM HDA Verb Table Module

Bytes 0-7:	\$OEMHDA\$ (1st table start tag in 'readable' format)
DWORD	codec vendor and device ID
	(high word: vendor, low word: device; FFFFFFF means ignore ID)
DWORD	length of verb table in DWORDs
	including 4 DWORDs for start tag, ID and size
DWORD	data 0 (Verb0)
DWORD	data 1 (Verb1)
DWORD	:
DWORD	:
DWORD	data n (Verb n)
Bytes 0-7:	\$OEMHDA\$ (2nd table start tag in 'readable' format)
DWORD	codec vendor and device ID (FFFFFFF means ignore ID)
DWORD	length of verb table in DWORDs
	including 4 DWORDs for start tag, ID and size
DWORD	data 0 (Verb 0)
DWORD	data 1 (Verb 1)
DWORD	:
DWORD	:
DWORD	data n (Verb n)

3.2 Structure of Single Data (Verb)

There are two verb ty	pes consisting of the	following parts:	
CodecID (CID)	NodeID (NID)	VerbID (VID)	Payload
Bits 31:28	27:20	19:16	15:0
Bits 31:28	27:20	19:8	7:0

Following, an example with both types for Realtek ALC888 codec:

CID	NID	VID	Payload	Comment	Hex Value
0	01	70A	00	Set BeepGenerator to 'exter-nal PCBEEP Input'	00 17 0A 00
0	1D	707	20	PinWidget "PCBeep" to 'Output Enable'	01 D7 07 20
0	14	707	60	PinWidget "LineOut" to 'Output Enable' and 'Headphone Amplifier Enabled'	01 47 07 60
0	14	3	903F	PinWidget "LineOut" - Set Amplifier Gain	01 43 90 3F
0	1F	3	513F	PinWidget "Mixer LineOut" - Set Amplifier Gain	00 F3 51 3F

For information about the availability of verbs for your chosen HDA codec, refer to the manufacturer's datasheet or contact the manufacturer's technical support.

3.3 Example in Hexadecimal Spelling

To prepare the examples from above, switch the byte order in every DWORD right after the start tag. This means, the number of DWORDS (9) must be noted as "09 00 00 00 hex". The first verb "00 17 0A 00 hex" must be converted to "00 0A 17 00 hex" and so on.

Use a hex editor of your choice to generate a binary file as shown below and save this with your desired file name (for example: "OEM1VerbTable.bin").

Offset(d)	00	01	02	03	
00000000	24	4F	45	4D	\$OEM
00000004	48	44	41	24	HDA\$
00000008	FF	$\mathbf{F}\mathbf{F}$	$\mathbf{F}\mathbf{F}$	FF	ÿÿÿÿ
00000012	09	00	00	00	
00000016	00	OA	17	00	
00000020	20	07	D7	01	.×.
00000024	60	07	47	01	`.G.
00000028	ЗF	90	43	01	2.C.
00000032	ЗF	51	F3	00	2Qó.



4 Adding an HDA Verb Table to a BIOS ROM File

The following steps describe how to create an OEM HDA verb table module and add it to a BIOS ROM file using the congatec System Utility on a Windows 7 host system.

Congatec System Utility Version 1.5.6 (Copyright 2005-2016 congatec AG) Select Operation Target @ BIOS File @ BIOS File @ BIOS Module Modification BIOS Module Modification BIOS Setup Configuration BIOS Setup Configuration BIOS Update Close	 Start the congatec System Utility. Select "BIOS File". Click on "Select Input BIOS File"
Select Input BIOS File Look jr: AN20 BQSLR115.bin Recent Places Deskop Lobraines Lobraines Libraines File game: BQSLR115.bin File game: BQSLR115.bin File game: BQSLR115.bin File game: BQSLR115.bin File game: BIOS Files (* BIN)	4) Open the original BIOS binary file.
Select Output File To Store Modified BIOS	 5) Click on "Select original / Create new BIOS file." 6) Enter a file name (in this example "OEMBIOS1.BIN")
Select original / Create new BIOS file	Note: Changes are only applied to this file. The original BIOS binary file will remain unchanged.



Standard BIOS Version:	BQSLR115 OEM BIO	S Version:	Deactivate BIOS Write Protection	7)	Click on "BIOS Module Modification" at the CGUTIL main menu.
Current BIOS Modules:		Add Module	Save Module Data To File		
EPI Panel Data, ID: FFFFh		Delete Module	Save Module Overview	8)	Click on "Create Module" at the BIOS
		Save Module To File	Create Module		Module Modification menu.
Free: 0x2EEA0 Bytes		Save Module To File	Create Module		
Module Parameters Module Type	Module ID	Module Revision	Module Size (auto)		
EPI Panel Data	FFFFh Execution Time	01h Load Address	00001134h Entry Offset		
NONE	* NONE	FFFFFFFh	0000000h		
				-	
Close		Cancel	Apply		
Select Input Data F	ile		×	9)	Open the binary verb table file
Look <u>i</u> n: 🚺	AN20	•	⊨ 🗈 💣 💷▼		created in section 3.3 (in this examp
	BQSLR115.bin OEM1VerbTable.bin				"OEM1VerbTable.bin").
-	OEMBIOS1.BIN	Type: BIN File			
Desktop		Size: 64 bytes Date modified: 5/5/2017	10:09 AM		
Libraries					
Computer					
Network					
	le name: OEN	11VerbTable.bin	▼ <u>Open</u>	1	
Fil	ie liente. Je lie				
	les of type: (".")		Cancel		
Fil	les of type: (*.*)] = 10`) Select "OFM HDA Verb Table" from
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	es of type: (*.*)		Cancel	10)	the "Module Type" drop down list.
Fil BIOS Module Modificatio	es of type: (*.*)	S Version	Cancel Cancel Cancel Cancel Cancel Cancel	10)	the "Module Type" drop down list. Note: To distinguish between
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NONE V NONE	tion Time	Load Address FFFFFFFh	Entry Offset 00000000h
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14) Click on "Add Module".

15) Open the module created in step 13 (in this example: "OEM1VerbTable.mod").

Note: The designated OEM HDA Verb Table module must be visible in the list of "Current BIOS Modules".

- 16) Assign your OEM BIOS a unique name by entering the OEM name into the "OEM BIOS Version" field (in this example: "OEMBIOS1")
- 17) Click on "Apply" to save the changes to the OEM BIOS binary file.

"Changes successfully applied" will be displayed in red letters in the text box above the "Apply" button.

- 18) Click on "Close" at the "BIOS Module Modification" window.
- 19) Click on "Close" at the main window of the congatec System Utility.

For more information about the BIOS update process, refer to the application note "AN01_BIOS_Update.pdf" at the congatec website <u>www.congatec.com</u>