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

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.

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.

Warning

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

1 Introduction

HDA verbs are used to configure codec-specific functions not provided by the codec-specific 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 www.congatec.com

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; FFFFFFFF 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 (FFFFFFFF 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 types 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:

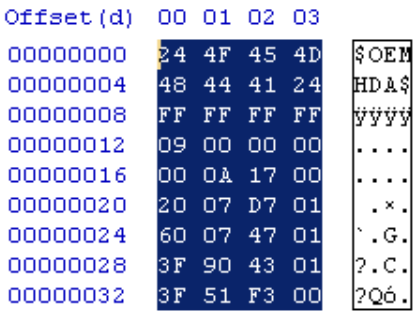
CID	NID	VID	Payload	Comment	Hex Value
0	01	70A	00	Set BeepGenerator to 'exter-nal PCBEEP Input'	00 17 0A 00
0	1D	707	20	PinWidget "PCBeep" to 'Output Enable'	01 D7 07 20
0	14	707	60	PinWidget "LineOut" to 'Output Enable' and 'Headphone Amplifier Enabled'	01 47 07 60
0	14	3	903F	PinWidget "LineOut" -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

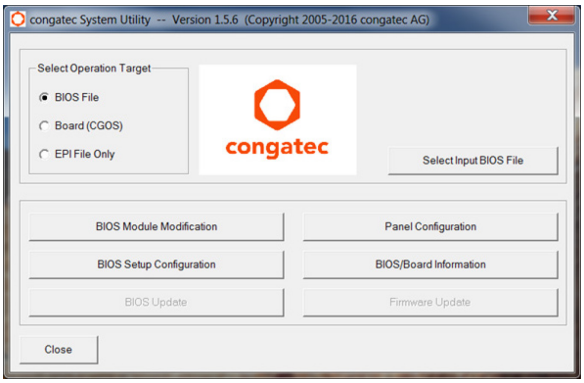
To prepare the examples from above, switch the byte order in every DWORD right after the start tag. This means, the number of DWORDS (9) must be noted as “09 00 00 00 hex”. The first verb “00 17 0A 00 hex” must be converted to “00 0A 17 00 hex” and so on.

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”).

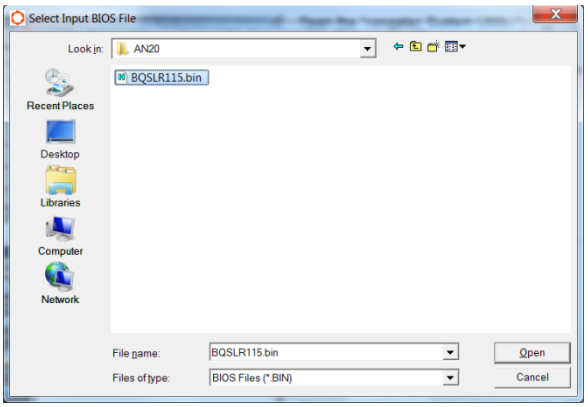


4 Adding an HDA Verb Table to a BIOS ROM File

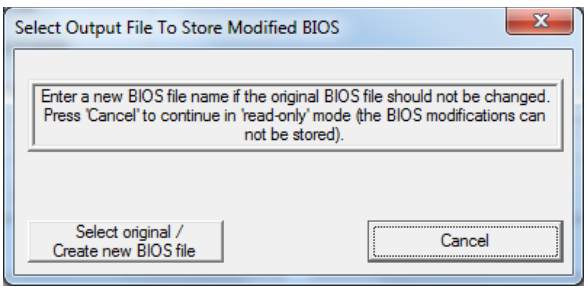
The following steps describe how to create an OEM HDA verb table module and add it to a BIOS ROM file using the congatec System Utility on a Windows 7 host system.



1) Start the congatec System Utility.
2) Select "BIOS File".
3) Click on "Select Input BIOS File"

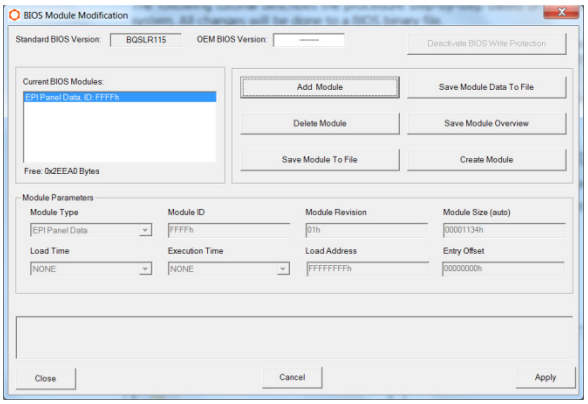


4) Open the original BIOS binary file.



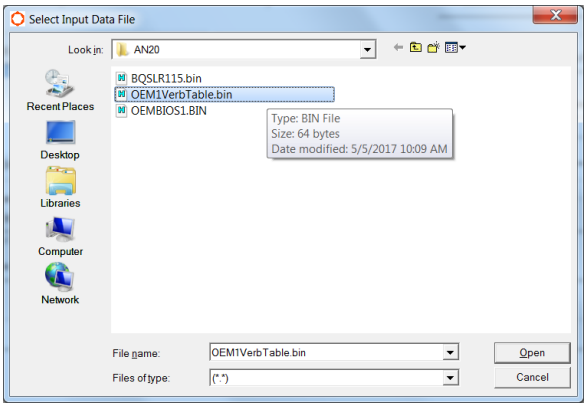
5) Click on "Select original / Create new BIOS file."
6) Enter a file name (in this example "OEMBIOS1.BIN")

   Note: Changes are only applied to this file. The original BIOS binary file will remain unchanged.

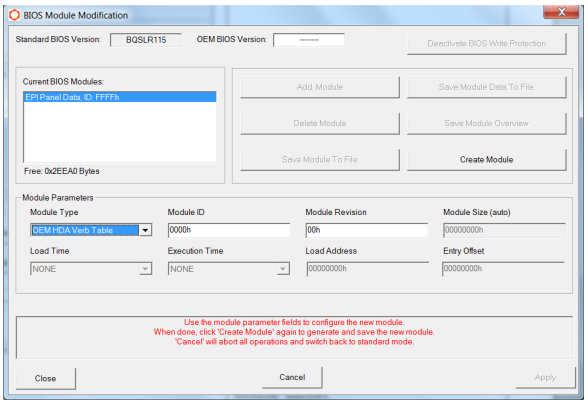


7) Click on “BIOS Module Modification” at the CGUTIL main menu.

8) Click on “Create Module” at the BIOS Module Modification menu.



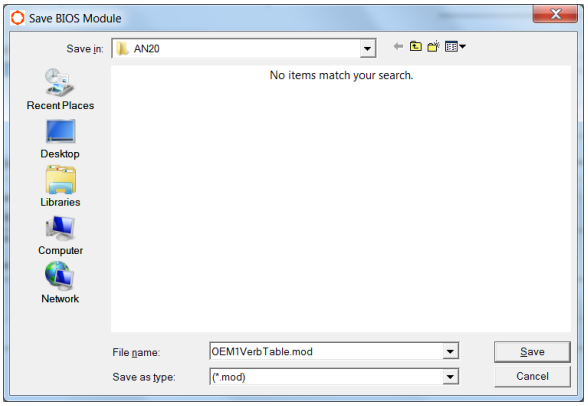
9) Open the binary verb table file created in section 3.3 (in this example: “OEM1VerbTable.bin”).



10) Select “OEM HDA Verb Table” from the “Module Type” drop down list.

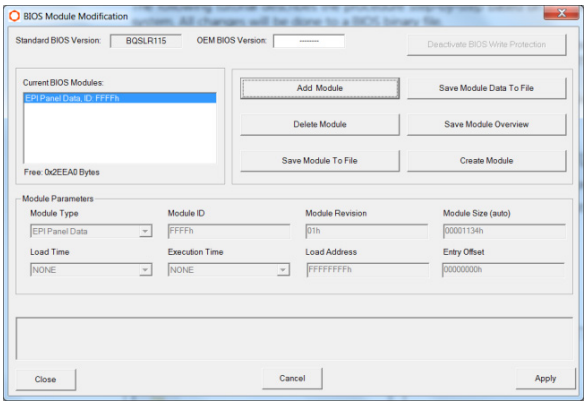
Note: To distinguish between multiple verb tables/revisions, it is possible to add a “Module ID” and “Module Revision” for each “OEM HDA Verb Table” module.

11) Click on “Create Module”.

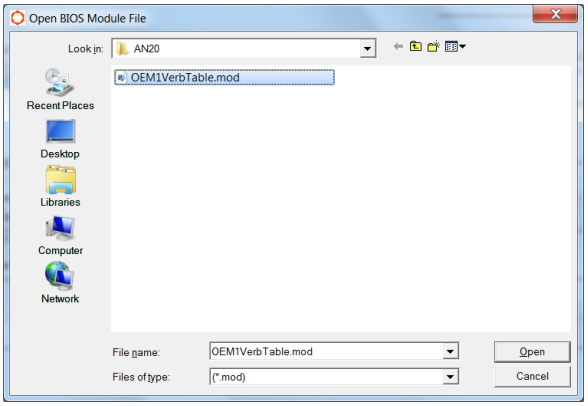


12) Enter a module file name (in this example: “OEM1VerbTable.mod”).

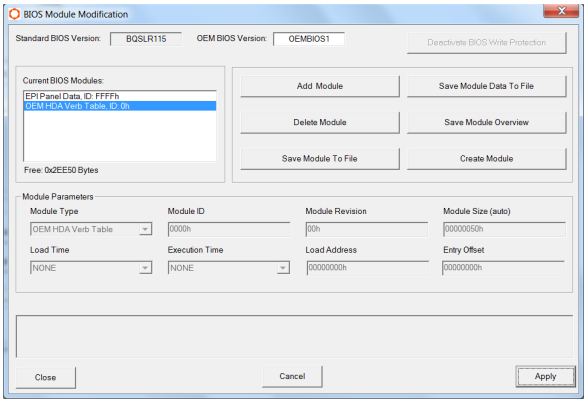
13) Click on “Save” to create the OEM HAD verb table BIOS module.



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 www.congatec.com