

Intel® Smart Sound Technology Driver Bring Up

User Guide

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Revision History

Document Number	Revision Number	Description	Revision Date
613171	1.0	Initial release	June 2019

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1 Introduction

1.1 Purpose and Scope of Document

This document provides installation instructions and general usage of the Intel® Smart Sound Technology (Intel® SST) Driver (formerly Audio DSP Driver).

The Intel® Smart Sound Technology Driver supports Coffee Lake (CFL), Cannon Lake (CNL), Comet Lake (CML), Ice Lake (ICL), and Whiskey Lake (WHL) platforms with Intel audio DSP integrated on Windows* 10 64-bit Operating Systems.

1.2 Acronyms and Terminology

Term	Description
ACPI	Advanced Configuration and Power Interface
BIOS	Basic Input/Output System
BKC	Best Known Configuration
CFL	Coffee Lake
CML	Comet Lake
CNL	Cannon Lake
CS	Connected-Standby (Instant Go)
CRB	Customer Reference Board
DMIC	Digital Microphone
DSP	Digital Signal Processing
FW	Firmware
Gfx	Graphics
HDA or HD-Audio	High Definition Audio
I2S	Inter-IC Sound, A data interface
ICL	Ice Lake
IHV	Independent Hardware Vendor
Intel® OED or OED	Intel® Offload Engine Driver
Intel® SST	Intel® Smart Sound Technology
Intel® WOV	Intel® Wake on Voice (Old name: LPAL, Low Power Always Listening)

Term	Description
ISV	Independent Software Vendor
LP	Low Power
MCP	Multi-Chip Package
MSFT	Microsoft* Corporation
Non-CS	Non-Connected-Standby (Non-Instant Go)
OS	Operating System
PCH	Platform Controller Hub
RVP	Reference Validation Platform
SUT	System Under Test
TBD	To be determined
UAA	Universal Audio Architecture
ULT	Ultra-Thin
VAD	Voice Activity Detection
WHL	Whiskey Lake
WOV	Wake on Voice

1.3 Related Documents and References

ID	Document Number	Title
Ref001	575270	Coffee Lake Platform Intel® Smart Sound Technology Driver for CPU and PCH Validation and Debug Guide

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2 Platform Details

2.1 Audio Subsystem Overview

Intel® Smart Sound Technology (Intel® SST) supports HD-Audio codecs connected to designs based on Cannon Lake (CNL), Coffee Lake (CFL), Comet Lake (CML), Ice Lake (ICL), and Whiskey Lake (WHL). Intel® SST is supported both on Connected Standby and Non-Connected Standby platforms. The Audio DSP in the HD-Audio controller controls both the HD-Audio codec and audio on Display Port and HDMI interfaces. This HD-Audio link for the audio codec supports multiple voltages (1.5 V / 1.8 V / 3.3 V).

Audio DSP in HD-Audio controller meets the Microsoft* UAA compliancy. With DSP integrated into the PCH, the offloaded audio goes through multi-layer audio processing inside the DSP with Intel® SST FW loaded.

Note: Be aware of All Intel® SST features available on Standard (non-InstantGo*) platforms. Intel® WOV saves power while in S0 — but currently cannot wake a system while in S3 on Standard (non-InstantGo*) platforms.

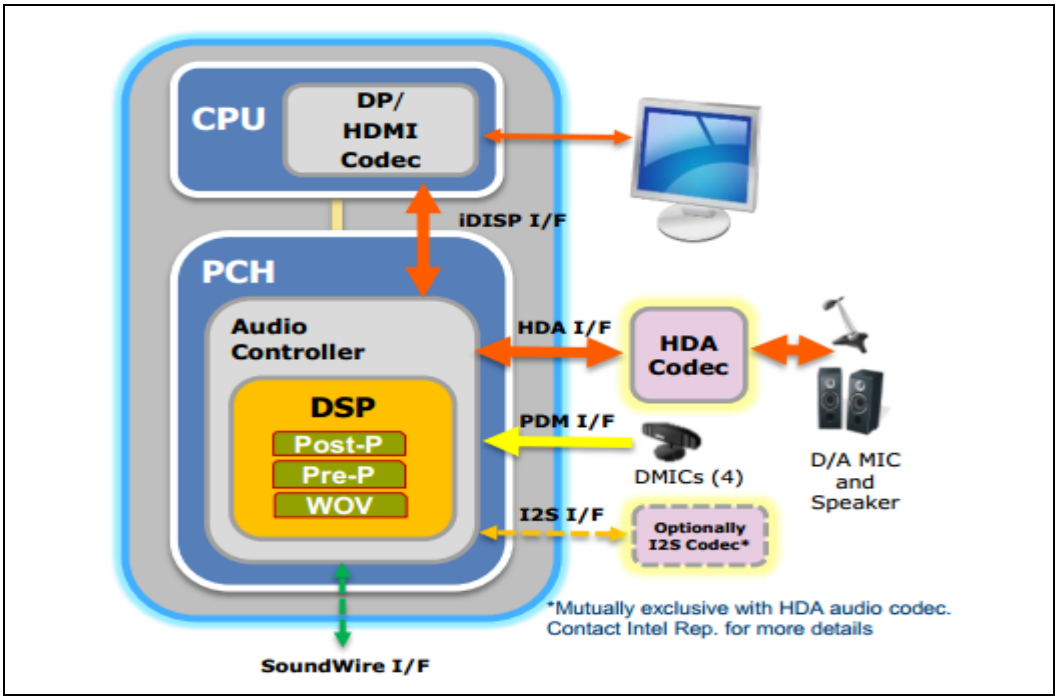


Figure 1. SoundWire-Based Smart AMP

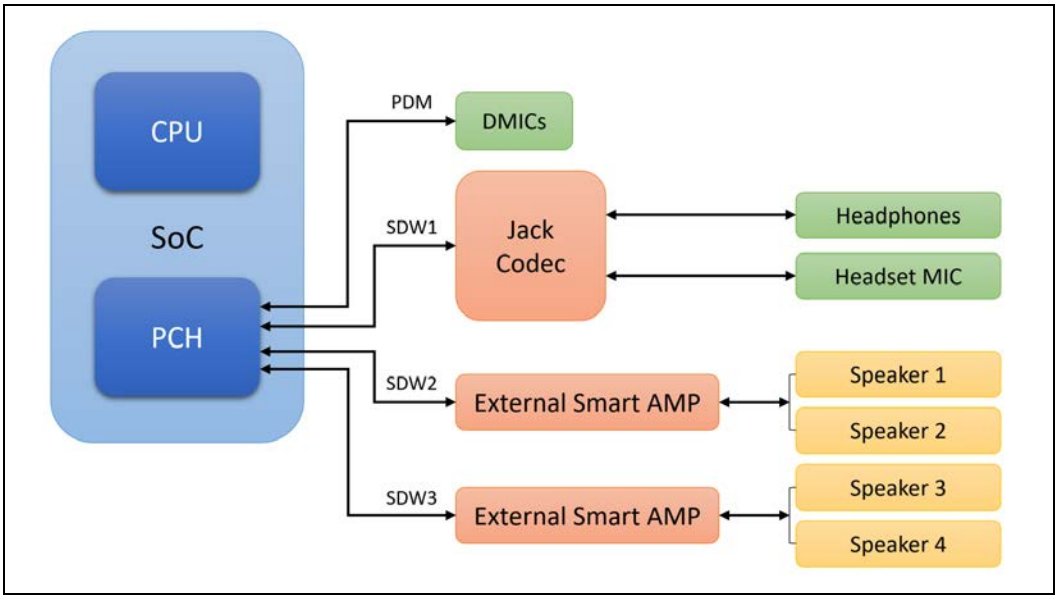
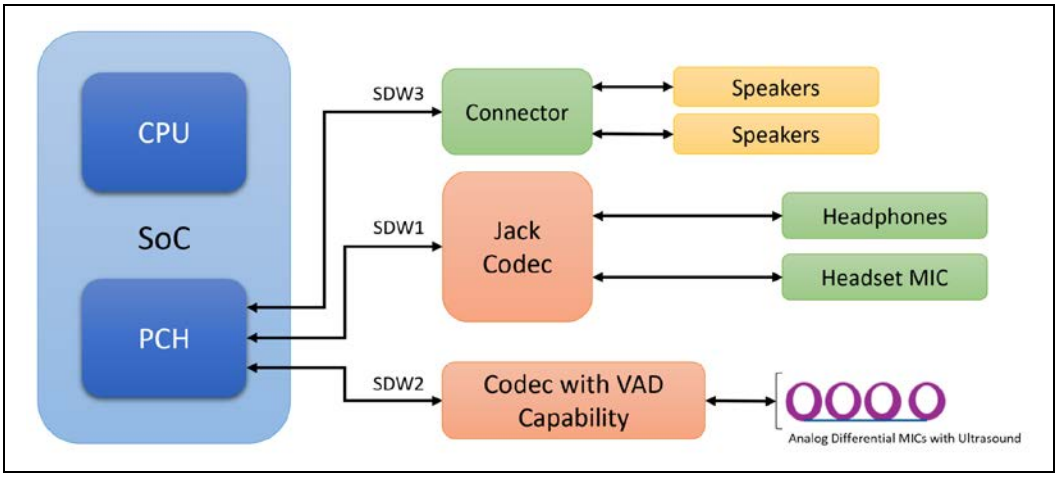


Figure 2. WOV with SoundWire-Based External VAD



2.2 System Configuration

Platform	Cannon Lake, Coffee Lake, Comet Lake, Ice Lake, Whiskey Lake
Operating System	Windows* 10 x64 RS5/RS6
BIOS	Audio DSP enabled, HDA codec enabled, SoundWire enabled

Intel® SST driver should be installed on systems with at least 1 GB of system memory. There should be sufficient hard disk space in the directory on the system in order to install this software.

2.3 Mandatory BIOS Configuration for Intel® SST

Enter BIOS by tapping F2 once the platform starts to boot.

- **For SST enable:**

Intel Advanced Menu / PCH-IO Configuration / HD Audio Configuration

HD Audio = <ENABLED>
Audio DSP Enable = <ENABLED>

Audio DSP Compliance Mode

1. If DMIC is connected to PCH, select <Non-UAA (IntelSST)>
2. If DMIC is connect to codec, select <UAA (HDA Inbox/IntelSST)>

- **For Audio codec selection:**

Intel Advanced Menu / PCH-IO Configuration / HD Audio Configuration

HDA-Link Codec Select: Depending on environment, select <Platform OnBoard> or <External connected HD-Audio codec card>

- **For Audio link selection:**

Intel Advanced Menu / PCH-IO Configuration / HD Audio Configuration

Audio Link Mode: Depending on the required Audio link select <HD Audio Link> or <SSP (I2S)> or <SoundWire> or <Advanced Link Config>

If <Advanced Link Config> is selected, the setup is as follows:

HDA Link [ ]

DMIC #0 [X]

DMIC #1 [X]

SSP #0 [ ]

SSP #1	[ ]
SSP #1	[ ]
SSP #2	[ ]
SSP #3	[ ]
SSP #4	[ ]
SSP #5	[ ]
SNDW #1	[X]
SNDW #2	[X]
SNDW #3	[ ]
SNDW #4	[ ]

[X] – Enabled [ ] – Disabled

NOTES:

1. Enable or disable the required audio link from the menu above.
2. Enable the Audio Link in RVP by following the respective rework instructions.

- **For Post-processing selection**

Intel Advanced Menu / PCH-IO Configuration / HD Audio Configuration / HD Audio DSP Features Configuration

Audio DSP Pre/Post-processing Module support: Select corresponding post-processing effect in options.

If there is Custom Module to add, select Custom Module ‘Alpha’/’Beta’/’Gamma’ and input corresponding GUID of the IP. Also, corresponding GUID mapping needs to be added in Platform ACPI code.

- **Intel® Wake on Voice (WOV) support for Personal Assistant (PA):**

Intel® Wake on Voice (WOV) is running from Intel DSP -- it could wake system up from Modern Standby (S0ix) or Ready Mode (S0 screen off). When system enters S0, Intel® WOV triggers personal assistant (PA).

Intel® WOV solution provides integrated solution that provides personalization and convenience. Intel® WOV running on DSP supports Microsoft* Windows 10 RS5/RS6 Cortana* and Amazon* Alexa as Hardware Keyword Spotter for keyword detection. Intel® WOV supports two PAs simultaneously running on the system configuration. PA selection could be Microsoft* Windows 10 RS5/RS6 Cortana*, Amazon* Alexa, or any new PA integrated with Intel® WOV.

— **Intel® Wake on Voice on DSP support for RS5/RS6 Cortana* and Amazon* Alexa simultaneously:**

To configure Intel® Wake on Voice support for Cortana* and Alexa* simultaneously, the following setup is needed:



Intel Advanced Menu / PCH-IO Configuration / HD Audio Configuration / HD Audio DSP Features Configuration

WoV (BIT 0) = <TRUE>

DSP based Speech Pre-Processing Disabled (BIT 7) = <TRUE>

VAD API Mode (BIT 8) = <Cortana HW KWS>

— **Intel® Wake on Voice on DSP support for Two PAs excluding Cortana*:**

To support two PAs excluding Cortana*, the following setup is needed:

Intel Advanced Menu / PCH-IO Configuration / HD Audio Configuration / HD Audio DSP Features Configuration

WoV (BIT 0) = <TRUE>

DSP based Speech Pre-Processing Disabled (BIT 7) = <TRUE>

VAD API Mode (BIT 8) = <Intel WOV>

NOTES:

1. For Modern Standby system, BIOS needs to add PEP constraint code to support Audio Controller being in D0:F1 state.

   ```
   Package() {"\\_SB.PCI0.HDAS",0x1, Package() {0, Package() {0xFF, 0, 0x81}}},// 15 -cAVS(HDAudio)
   ```

2. Post-processing modules can be enabled together with WOV.
3. More than one post-processing modules can be enabled depending on the resources used by ISV. For Post-processing modules combinations, contact the ISV for more information.

- **CS / Non-CS Settings:**

Intel Advanced Menu / ACPI SETTINGS

LOW POWER S0 IDLE CAPABILITY

a. If CS is supported, select <ENABLED>
b. If CS is not supported, select <DISABLED>

- **RTD3 settings:**

RTD3 should be enabled.

2.4 Action Required After Flashing BIOS / Change BIOS Settings

After flashing the new BIOS or changing ACPI table settings it is important to perform the following sequence:

1. Boot to Windows* 10.
2. Perform system reboot.

3. After reboot, perform system shutdown.

The above sequence is important to ensure that Windows* 10 reloads and uses the ACPI tables provided by a new BIOS.

S4 (hibernation) is a normal shutdown state for Windows* 10. During wake from S4 Windows* reloads ACPI tables from disk (hibernation file).

If BIOS is changed, ACPI tables generated by previous BIOS version are still stored in hibernation file on a disk. Windows* restart ensures usage of ACPI tables generated by current BIOS. Subsequent shutdown stores these new ACPI tables in hibernation file.

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3 Driver/Application Installation

Ensure the BIOS settings are configured before Intel® SST Driver installation.

The following procedure of Intel® SST Driver installation is required.

3.1 Driver Installation

Use “Have Disk…” method to install below drivers.

Browse to the unzipped Platform Milestone release folder location (example, Intel(R) _Smart_Sound_Technology_<Platform>_<Milestone>_Release_vx.xx.xx.xxx\)

1. Install BUS driver (IntcAudioBus.inf) from the subfolder Drivers over High Definition Audio Controller in Device Manager.

   Name of the device before installing driver: High Definition Audio Controller.
   Name of the device after installing driver: Intel(R) Smart Sound Technology (Intel(R) SST) Audio Controller.

2. Install OED driver (IntcOED.inf) from the subfolder Drivers over Intel High Definition DSP in Device Manager.

   Name of the device before installing driver: Intel High Definition DSP.
   Name of the device after installing driver: Intel(R) Smart Sound Technology (Intel(R) SST) OED.

Optional step only if DMIC is connected to PCH:

3. Install DMIC driver (IntcDMic.inf) from the subfolder Drivers over Digital microphone device in Device Manager

   Name of the device before installing driver: Digital Microphone Device.
   Name of the device after installing driver: Intel(R) Smart Sound Technology (Intel(R) SST).

NOTES:

1. For QS samples, install ProductionFW driver. For ES samples, install NonProductionFW driver. Otherwise, Yellow Band is seen on OED device.
2. Install the appropriate Intel® SST driver based on the platform that the drivers are being installed (for example, ICL Intel® SST drivers in ICL platforms).

3.2 Checking the Driver Version

To check the Intel® SST Driver version:

1. Open Device Manager.
2. Click the “Sound, Video and Game controllers” arrow to open the list of audio/sound devices.
3. Double click device named as “Intel(R) Smart Sound Technology”.
4. Select the “Driver” tab and verify Intel® SST Driver Version is correct
5. Double click HW Audio Codec device

6. Select the “Driver” tab and verify the Codec driver Version is correct

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4 Basic Audio DSP Features Check

4.1 Playback on System Pin

1. Prepare .wav sound file (for example 24bit, 48khz, stereo)
2. Open Windows* Media Player
3. Select and play the .wav sound file
4. Check if the sound is hearable
5. Try **different sound file extensions (.mp3, .aac**).

4.2 Playback on Offload Pin

1. Prepare .wav sound file (for example 24bit, 48khz, stereo)
2. Open Windows* 10 **Groove Music**.
3. Select and play the .wav sound file
4. Check if the sound is hearable
5. Try **different sound file extensions (.mp3, .aac)**.

4.3 WOV with Cortana*

1. Go to Cortana* Settings, turn on the options:

‘Let Cortana* respond to “Hey Cortana”’

‘Use Cortana* even when my device is locked.’

2. Let system enter Connected Standby mode.
3. Check if system wakes up when you say “**Hey Cortana**”.

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5 Separation of Intel® SST Driver From Inbox Driver on a System That is Not Audio DSP Enabled

The newest proposal between Microsoft* and Intel assures and enables customers to keep UAA compliant hardware IDs while still supporting the Intel® SST driver stack.

Systems that use the HD-A interface are recognized to be UAA compliant. Refer below for the proposals:

- **Microsoft* Inbox HD-A Bus Driver**
  - Match on PCI\CC_0403
  - Child PnP IDs are “HDAUDIO\...”
- **Intel HD-A Bus Driver**
  - Match on PCI\VEN_8086&DEV_1324&CC_040301
  - Match on PCI\VEN_8086&DEV_1234&CC_040100
  - Child PnP IDs are “INTELAUDIO\...”

As such:

Class	Subclass	Programming Interface	Drivers Supported
04	03	**00**	Microsoft* Bus Driver[1] (Windows* 7+)
04	03	**80**	Microsoft* Bus Driver[1] (Windows* 7+) Intel® SST Bus Driver (Windows* 8+)
04	**01**	00	Intel® SST Bus Driver (Windows* 8+)

NOTE:

1. Platform configuration must be UAA compliant (example, DMIC must attach to codec, I2S) for Microsoft* bus driver support.

- **Row1 with class code 040300**: Legacy systems that support the Microsoft* Inbox Bus driver that is UAA compliant.
- **Row2 with class code 040380**: This relaxes the earlier restriction of following a certain order of installation between the Gfx driver and the Intel® SST driver. Due to this new addition, the customer can now install the Gfx driver and SST driver in any order, provided that the Intel® SST driver is UAA compliant (I2S, DMIC attached to codec) etc.
- **Row3 with class code 040100**: This is for systems where the DMIC is attached to the PCH via the PDM interface thus deeming it to be a non UAA compliant system. Here the OEM still follows the order of installation where the Intel® SST driver is installed before the Gfx driver.

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