

Intel Atom[®] Processor E3900 SoC Family/Intel[®] Celeron[®] Processor N3350/Intel[®] Pentium[®] Processor N4200 Audio for Yocto Project*

User Guide

August 2017



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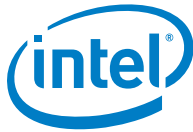
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Revision History

Date	Revision	Description
August 2017	003	Maintenance Release 3.1
June 2017	002	Maintenance Release 3
February 2017	001	Maintenance Release 2

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1.0 Introduction

This User Guide contains guidelines on setting up and validating both High Definition (HD) Audio and Low Power Engine (LPE) Audio.

The audio package is available for 64-bit systems for the Intel Atom® Processor E3900 SoC Family/Intel® Celeron® Processor N3350/Intel® Pentium® Processor N4200 on Yocto Project*.

1.1 Terminology

Table 1. Terminology

Term	Description
BIOS	Basic Input/Output System
BSP	Board Support Package
CAVS	Converged Audio Voice Speech
HD	High Definition
LPE	Low Power Engine
SoC	System-on-a-Chip
NHLT	Non HD Audio Link Table

1.2 Reference Documents

Table 2. Reference Documents

Document	Document No./Location
<i>Intel Atom® Processor E3900 SoC Family/Intel® Celeron® Processor N3350/Intel® Pentium® Processor N4200 BSP for Yocto Project*</i>	333732



2.0 Preparation of Image

During preparation of the Yocto Project* image, the following option appears when you run `./setup.sh`. Select the appropriate option for the audio driver.

- Choose option one for HD Audio driver
- Choose option two for LPE Audio driver

Select one of the following options:

1. Build kernel image with Converged Audio Voice Speech (CAVS) HD Audio driver (Default)
2. Build kernel image with CAVS SSP Audio driver
3. Build kernel image with legacy HD Audio driver

Note: The default option is to build the kernel image with the CAVS HD Audio driver. If no input is received within 20 secs, the default option is used.

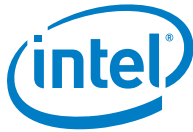
Therefore, two different images are required for HD Audio and LPE audio.

A new folder named `yocto_build` is automatically created on the same level as the `iotg-yocto-bsp-public` folder. The build process may take up to five hours to complete. Upon completion, the image is at:

```
../yocto_build/build/tmp/deploy/images/intel-corei7-64
```

Refer to Table 2 for details on building the image.

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3.0 HD Audio

This section describes the procedure to verify HD Audio.

3.1 Mandatory BIOS Settings

Mandatory BIOS settings for HDA:

```
DEVICE MANAGER > SYSTEM SETUP > SOUTH CLUSTER CONFIGURATION > HD  
AUDIO CONFIGURATION > HD-AUDIO I/O BUFFER OWNERSHIP= HD Audio  
Link owns all the I/O buffers
```

3.2 Verify Driver

1. Boot up CRB with Yocto Project*-based image by choosing the correct BIOS settings for I2S.
2. Run the following command to see the list of devices:

```
#aplay -l  
You should see a list of device as below:  
**** List of PLAYBACK Hardware Devices ****  
card 0: Intel [HDA Intel], device 0: ALC662 rev3 Analog [ALC662  
rev3 Analog]  
Subdevices: 1/1  
Subdevice #0: subdevice #0  
card 0: Intel [HDA Intel], device 1: ALC662 rev3 Digital [ALC662  
rev3 Digital]  
Subdevices: 1/1  
Subdevice #0: subdevice #0  
card 0: Intel [HDA Intel], device 3: HDMI 0 [HDMI 0]  
Subdevices: 1/1  
Subdevice #0: subdevice #0  
card 0: Intel [HDA Intel], device 7: HDMI 1 [HDMI 1]  
Subdevices: 1/1  
Subdevice #0: subdevice #0  
card 0: Intel [HDA Intel], device 8: HDMI 2 [HDMI 2]  
Subdevices: 1/1
```




3.3 Line Level Audio-out (Lime Green) and Microphone Audio-in (Pink) Test

1. Open the `alsamixer` to configure sound settings and adjust the volume using the following command:

```
#alsamixer
```

2. Press **F6** to select sound card and choose **HDA Intel**.
3. Increase the volume for **Line**.
4. Press **F5** at the **Input Source**, select **Rear Mic**.
5. Exit `alsamixer`.
6. Connect the speaker or headphones to line level audio out for the main stereo signal (Lime green).
7. Run the following command to play the `.wav` file and hear sound from speaker or headphone.

```
$aplay -Dhw:0,0 -d15 wave_file.wav
```

8. Connect the mic to the microphone audio input (pink color).
9. Run the following command to start recording and talk over the mic. Play the recorded `.wav` file again to confirm audio is going through the port.

```
$arecord -Dhw:0,0 -r48000 -c2 -d15 -fs16_LE testing.wav
```

3.4 Line Level Audio Input (Light Blue) Test

1. Open `alsamixer` to configure sound settings and adjust the volume by following command.

```
#alsamixer
```

2. Press **F6** to select sound card and choose **HDA Intel**.
3. Increased the volume for **Line**.
4. Press **F5** at the **Input Source**, select **Line**.
5. Exit `alsamixer`.
6. Connect the cable from line level audio out for main stereo signal (Lime green) to line level audio input (light blue). Doing so creates an external loop back.
7. Play the `.wav` file and record through line level audio input (light blue). Play the recorded `.wav` file again to confirm audio is going through the port.

```
#arecord -Dhw:0,0 -r48000 -c2 -d20 -fs32_LE test_line.wav &  
aplay -Dhw:0,0 -d20 wave_file.wav
```

Note: Refer to Section 4.0LPE Audio for more information regarding the test.



4.0 LPE Audio

This section describes the procedure to install and verify LPE Audio.

4.1 Mandatory BIOS Settings

Mandatory BIOS settings for I2S:

DEVICE MANAGER > SYSTEM SETUP > SOUTH CLUSTER CONFIGURATION > HD AUDIO CONFIGURATION > HD-AUDIO I/O BUFFER OWNERSHIP=I2S port owns all the I/O buffers

4.2 Firmware Installation

1. Boot up the CRB with Yocto Project*-based image by choosing the BIOS settings for I2S in [Section 4.1](#).
2. Extract the tarball in the Yocto* BSP and copy the firmware into folder `/lib/firmware`.

```
# tar -xvf audio_MR3.1_firmware.tar.bz2
#cd audio_MR3.1_firmware
#cp dsp_fw_release.bin /lib/firmware
#cp dfw_sst_bin /lib/firmware
```

4.3 Adding Option to Select Different CODEC Combination

As of this release, supported CODECs are dummy, WM8731, and TI TLV320AIC3107 CODEC. To switch to different CODEC, add the kernel boot parameters at `grub/cfg/`.

Grub configuration file is being stored at `/boot/EFI/BOOT/grub.cfg`.

1. Open `grub.cfg` to edit:
`vi /boot/EFI/boot/grub.cfg`
2. The default is `menuentry 'boot'` in `grub.cfg`. Duplicate the content to add additional entries.
3. At new boot option, modify the `menuentry` name, example:
`menuentry 'socmasterbuild'.`



4. Add a module parameter into the last line of the new boot option using the following syntax:

```
snd_soc_skl.machine=<machine_driver_name>, for example:
snd_soc_skl.machine=lhcrb_aic3107M_i2s
```

These four machine driver names are available with description:

1. **lhcrb_dummy_i2s** – dummy CODEC for both I2S Port 2 and 4
2. **lhcrb_wm8731_i2s** – dummy CODEC is for Port 2, WM8731 CODEC for Port 4
3. **lhcrb_aic3107M_i2s** – dummy CODEC is for both I2S Port 2 and 4, TLV320AIC3107 CODEC for Port 1 (SOC master, CODEC slave mode)
4. **lhcrb_aic3107S_i2s** – dummy CODEC for both I2S Port 2 and 4, TLV320AIC3107 CODEC for Port 1 (SOC slave, CODEC master mode)

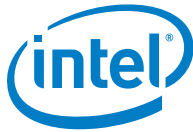
Note: Refer to the following sample for more details. The content may be different from the sample. The sample shows three new entries are added with menuentry named '**socmasterbuild**', '**socslavebuild**' and '**custom**'. Also notice that the module parameter has been added at the end of the new entry.

```
# Automatically created by OE
serial --unit=0 --speed=115200 --word=8 --parity=no --stop=1
default=socslavebuild
timeout=3

menuentry 'boot'{
linux /vmlinuz root=PARTUUID=07b4a98c-7df9-492a-be0a-29505585c1d4
rw rootwait quiet console=ttyS2,115200n8 console=tty0 video=efifb
maxcpus=4 noxsave 3 i915.is_preliminary=1 reboot=efi kmemleak=off
i915.enable_rc6=0 i915.enable_dc=0 i915.enable_ipc=1
}

menuentry 'socmasterbuild'{
linux /vmlinuz root=PARTUUID=07b4a98c-7df9-492a-be0a-29505585c1d4
rw rootwait quiet console=ttyS2,115200n8 console=tty0 video=efifb
maxcpus=4 noxsave 3 i915.is_preliminary=1 reboot=efi kmemleak=off
i915.enable_rc6=0 i915.enable_dc=0 i915.enable_ipc=1
snd_soc_skl.machine=lhcrb_aic3107M_i2s
}

menuentry 'socslavebuild'{
linux /vmlinuz root=PARTUUID=07b4a98c-7df9-492a-be0a-29505585c1d4
rw rootwait quiet console=ttyS2,115200n8 console=tty0 video=efifb
maxcpus=4 noxsave 3 i915.is_preliminary=1 reboot=efi kmemleak=off
i915.enable_rc6=0 i915.enable_dc=0 i915.enable_ipc=1
snd_soc_skl.machine=lhcrb_aic3107S_i2s
}
```



```
menuentry 'custom'{
linux /vmlinuz root=PARTUUID=07b4a98c-7df9-492a-be0a-29505585c1d4
rw rootwait quiet console=ttyS2,115200n8 console=tty0 video=efifb
maxcpus=4 noxsave 3 i915.is_preliminary=1 reboot=efi kmemleak=off
i915.enable_rc6=0 i915.enable_dc=0 i915.enable_ipc=1
acpi.debug_level=0x00000004 snd_soc_skl.machine=lhcrb_dummy_i2s
}
```

5. After saving the change, reboot, and enter grub menu. Based on the new menu entries, select the desired menu entry to load preferred machine driver.

4.4 Hardware Setup

Three types of CODEC support this release: dummy CODEC, WM8731, and TLV320AIC3107 CODEC, creating three hardware combinations.

Additional hardware used is:

- **Audio Break Out Board:** a board with I²C* and I2S lines pulling out from CRB
- **Level Shifter Board:** a board with I²C* and I2S lines pulling out from CRB and voltage level shifter for I2S

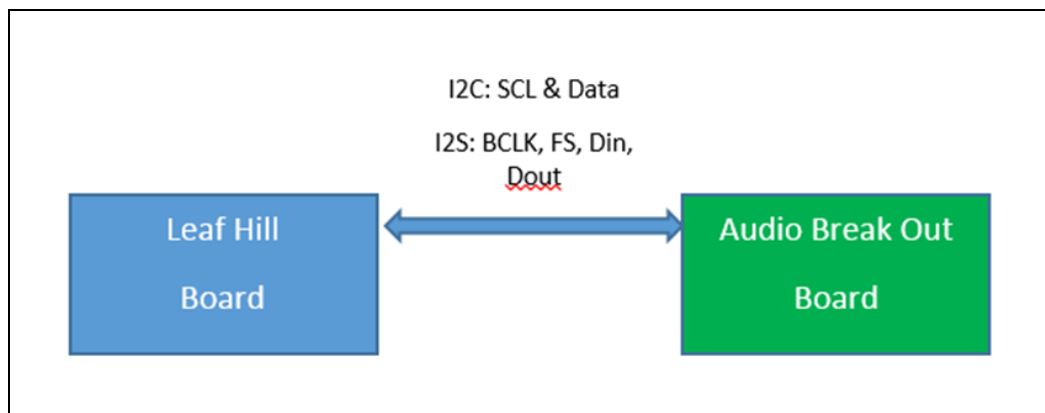
Alternatively, you can directly wire out I²C* and I2S lines from CRB to the CODECs. Refer datasheet of WM8731 and TLV320AIC3107 for more information.

Note:

- All the CODECS must be connected to CRB before powering up the CRB.
- Refer to the respective CODEC datasheets on hardware reset requirements or power-up sequence. If the sequence is not followed correctly, the CODEC may not respond properly to register reads/writes.

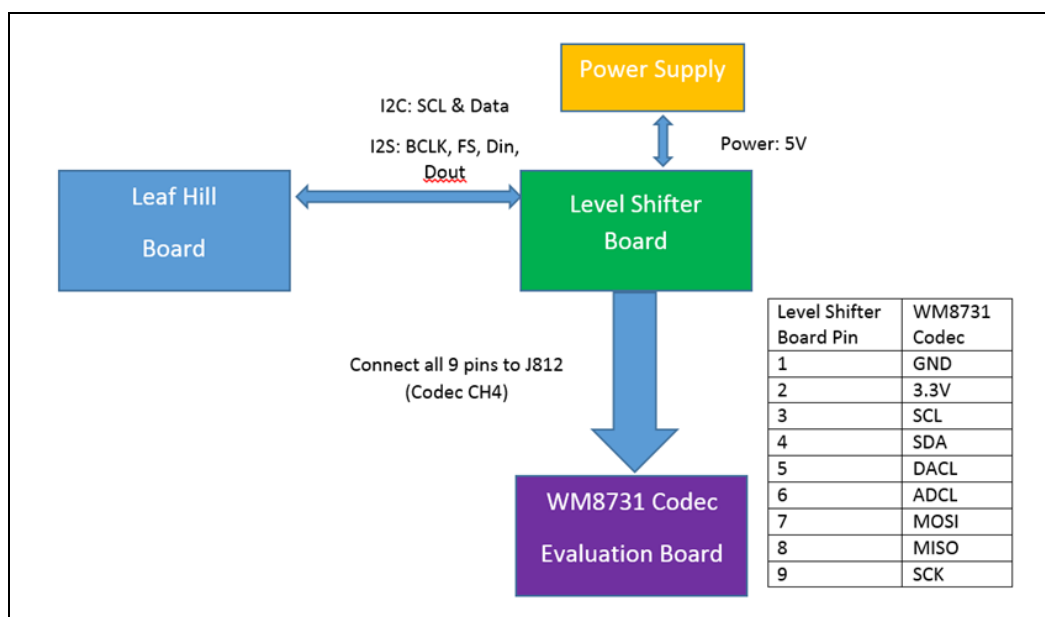
4.4.1 Combination 1 Dummy CODEC at I2S Port 2 and Port 4

Figure 1. Dummy CODEC Hardware Connection Block Diagram



4.4.2 Combination 2 Dummy CODEC at Port 2 and WM8731 Codec at Port 4

Figure 2. Wm8731 CODEC Hardware Connection Block Diagram

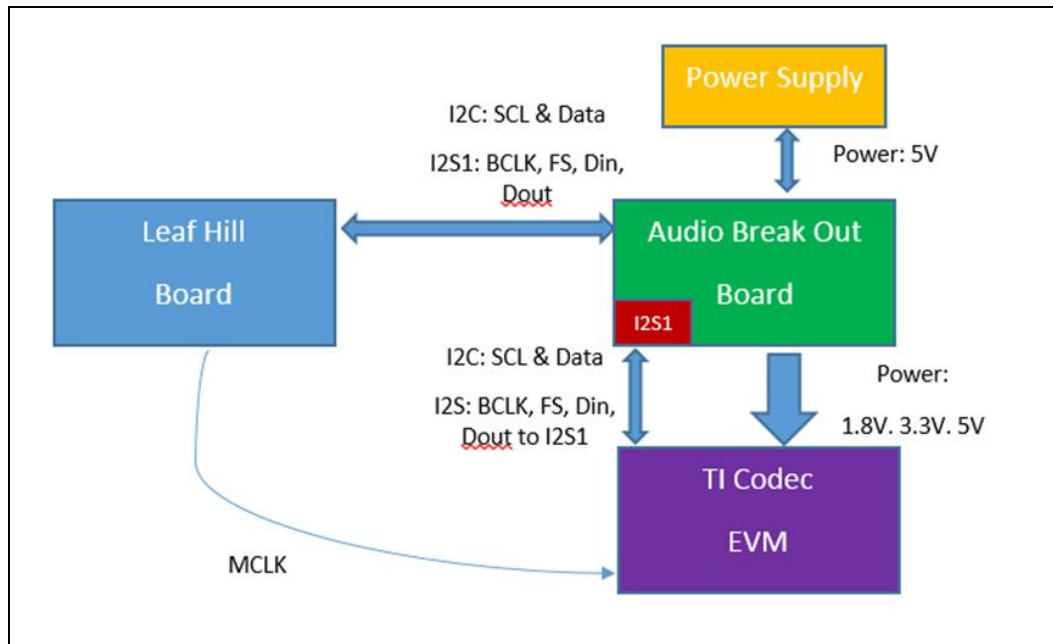


4.4.3 Combination 3 TLV320AIC3107 CODEC at Port 1, Dummy CODEC at I2S Port 2 and Port 4

Texas Instrument* (TI) TLV320AIC3107 codec is supported on SSP1. However, additional rework is required to make this work. Refer to Appendix A for rework instructions.

Texas Instrument TLV320AIC3107 codec runs in two modes: master and slave configuration. Select the desired options from grub menu during boot up.

Figure 3. TI* CODEC Hardware Connection Block Diagram





4.5 Verify Driver and Run LPE Audio

Confirm the machine driver is loaded before proceeding with the desired test. You receive a reply with the machine driver's name that was loaded, for example, `lfcrb_aic3107M_i2s`.

```
$cat /sys/module/snd_soc_skl/parameters/machine
```

4.5.1 Combination 1 Dummy CODEC at I2S Port 2 and Port 4

Use command `$aplay -l` to see a list of devices:

```
**** List of PLAYBACK Hardware Devices ****
card 0: aplilhcrbdummyi [apli-lhcrb-dummy_i2s], device 0: SSP2
Speaker (*) []
  Subdevices: 1/1
  Subdevice #0: subdevice #0
card 0: aplilhcrbdummyi [apli-lhcrb-dummy_i2s], device 2: SSP4
Speaker (*) []
  Subdevices: 1/1
  Subdevice #0: subdevice #0
```

For external loop back test, connect SDO to SDI. The script performs audio configuration, followed by playing a sine wave and capturing it. Alternatively, connect all the audio lines to audio equipment for testing.

Refer to Appendix A for recommended settings, playback, and capture commands.

4.5.2 Combination 2 Dummy CODEC at Port 2 and WM8731 Codec at Port 4

Use command `$aplay -l` to see a list of devices.

```
**** List of PLAYBACK Hardware Devices ****
card 0: aplilhcrbwm8731 [apli-lhcrb-wm8731_i2s], device 0: SSP2
Speaker (*) []
  Subdevices: 1/1
  Subdevice #0: subdevice #0
card 0: aplilhcrbwm8731 [apli-lhcrb-wm8731_i2s], device 2: wm8731
Headphone (*) []
  Subdevices: 1/1
  Subdevice #0: subdevice #0
```

Refer Appendix A for recommended settings, playback, and capture commands.



4.5.3 Combination 3 TLV320AIC3107 Codec at Port 1, Dummy Codec at I2S Port 2 and Port 4

Use command `$aplay -l` to see a list of devices.

```
**** List of PLAYBACK Hardware Devices ****
card 0: aplilhcrbaic310 [apli-lhcrb-aic3107_i2s], device 0:
AIC3107 Playback (*) []
  Subdevices: 1/1
  Subdevice #0: subdevice #0
card 0: aplilhcrbaic310 [apli-lhcrb-aic3107_i2s], device 2: SSP2
Speaker (*) []
  Subdevices: 1/1
  Subdevice #0: subdevice #0
card 0: aplilhcrbaic310 [apli-lhcrb-aic3107_i2s], device 4: SSP4
Speaker (*) []
  Subdevices: 1/1
  Subdevice #0: subdevice #0
```

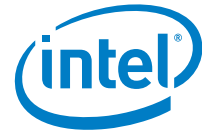
TLV320AIC3107 CODEC can be run in one of the two modes (master or slave), depend on the chosen machine driver.

Machine Driver loaded: **lhcrb_aic3107M_i2s** (soc master mode, CODEC slave mode). In this mode, the blob file must be loaded. Refer to Appendix A for recommended CODEC settings, playback, and capture commands.

```
echo 'enable' | tee /sys/kernel/debug/snd_soc_skl/nhlt/control
cat 2ch_48k_32b_in_32b_i2s1mclk_socmaster.blob | tee \
/sys/kernel/debug/snd_soc_skl/nhlt/ssp0p > /dev/null
cat 2ch_48k_32b_in_32b_i2s1mclk_socmaster.blob | tee \
/sys/kernel/debug/snd_soc_skl/nhlt/ssp0c > /dev/null
cat 2ch_48k_32b_in_32b_i2s1mclk_socmaster.blob | tee \
/sys/kernel/debug/snd_soc_skl/nhlt/ssplp > /dev/null
cat 2ch_48k_32b_in_32b_i2s1mclk_socmaster.blob | tee \
/sys/kernel/debug/snd_soc_skl/nhlt/ssplc > /dev/null
cat 2ch_48k_32b_in_32b_i2s1mclk_socmaster.blob | tee \
/sys/kernel/debug/snd_soc_skl/nhlt/ssp3p > /dev/null
cat 2ch_48k_32b_in_32b_i2s1mclk_socmaster.blob | tee \
/sys/kernel/debug/snd_soc_skl/nhlt/ssp3c > /dev/null
```

1. **Machine Driver loaded: lhcrb_aic3107S_i2s** (soc slave mode, codec master mode). In this mode, the blob file must be loaded. Refer to Appendix A for recommended CODEC settings, playback, and capture commands.

```
echo 'enable' | tee /sys/kernel/debug/snd_soc_skl/nhlt/control
cat 2ch_48k_32b_in_32b_i2s1mclk_socslave.blob | tee \
/sys/kernel/debug/snd_soc_skl/nhlt/ssp0p > /dev/null
cat 2ch_48k_32b_in_32b_i2s1mclk_socslave.blob | tee \
/sys/kernel/debug/snd_soc_skl/nhlt/ssp0c > /dev/null
```

```
cat 2ch_48k_32b_in_32b_i2s1mclk_socslave.blob | tee
/sys/kernel/debug/snd_soc_skl/nhlt/ssp1p > /dev/null
cat 2ch_48k_32b_in_32b_i2s1mclk_socslave.blob | tee
/sys/kernel/debug/snd_soc_skl/nhlt/ssp1c > /dev/null

cat 2ch_48k_32b_in_32b_i2s1mclk_socslave.blob | tee
/sys/kernel/debug/snd_soc_skl/nhlt/ssp3p > /dev/null
cat 2ch_48k_32b_in_32b_i2s1mclk_socslave.blob | tee
/sys/kernel/debug/snd_soc_skl/nhlt/ssp3c > /dev/null
```

§

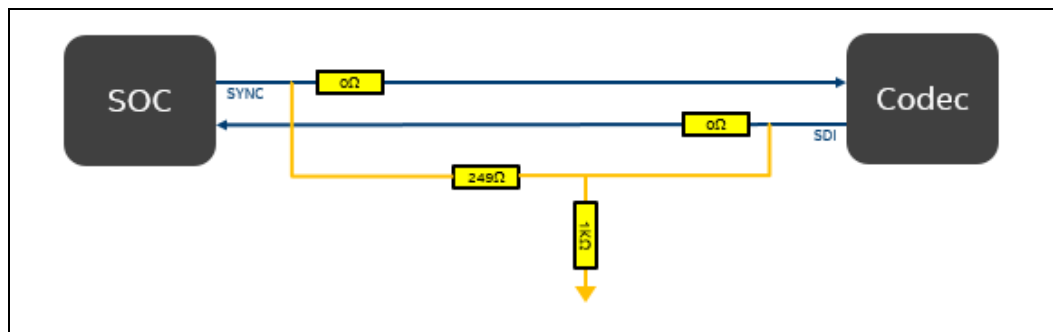
Appendix A

A.1 HDA Board Rework

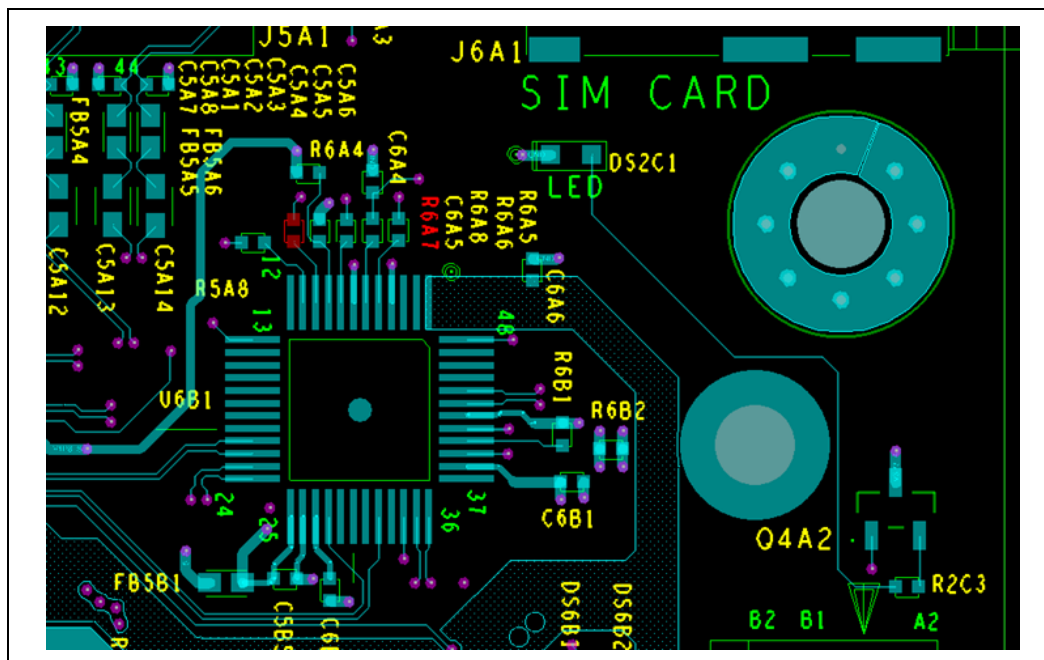
Reason: SDI signal pin on Apollo Lake SoC has been configured as input only, which inhibits SoC for driving this pin during initialization. This causes external HD Audio CODEC to be undetectable by the Audio driver.

Impact: This issue only impacts HD Audio on SOC A stepping version. This issue has been resolved in SOC B stepping version. This issue does not impact HDMI and I2S audio.

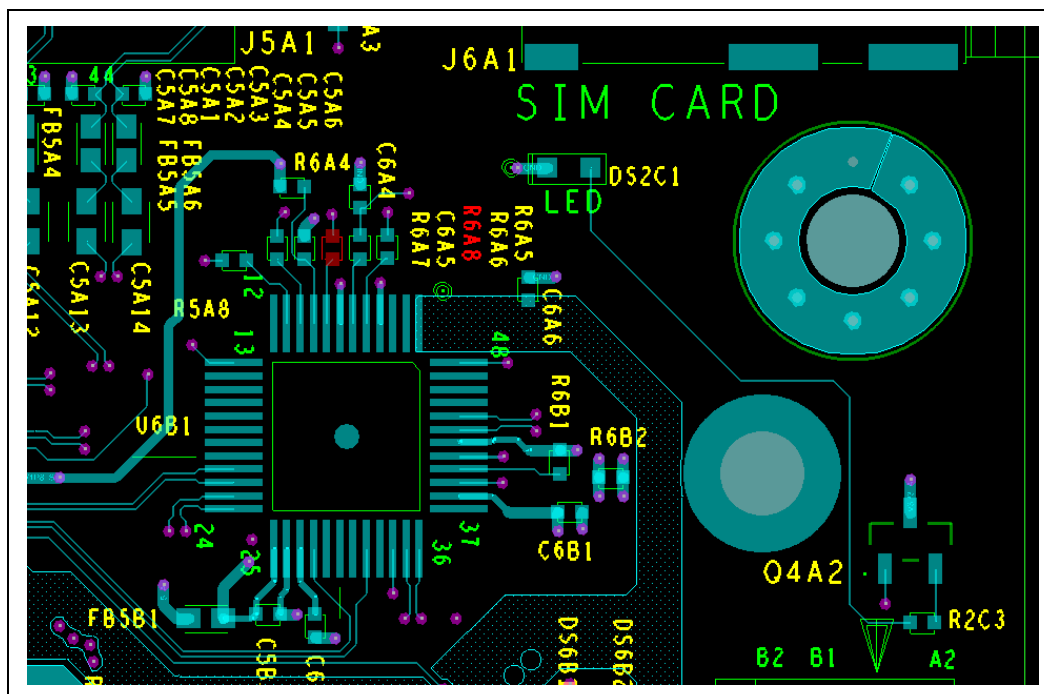
Example workaround for Leaf Hill board Fab A, B, and C:



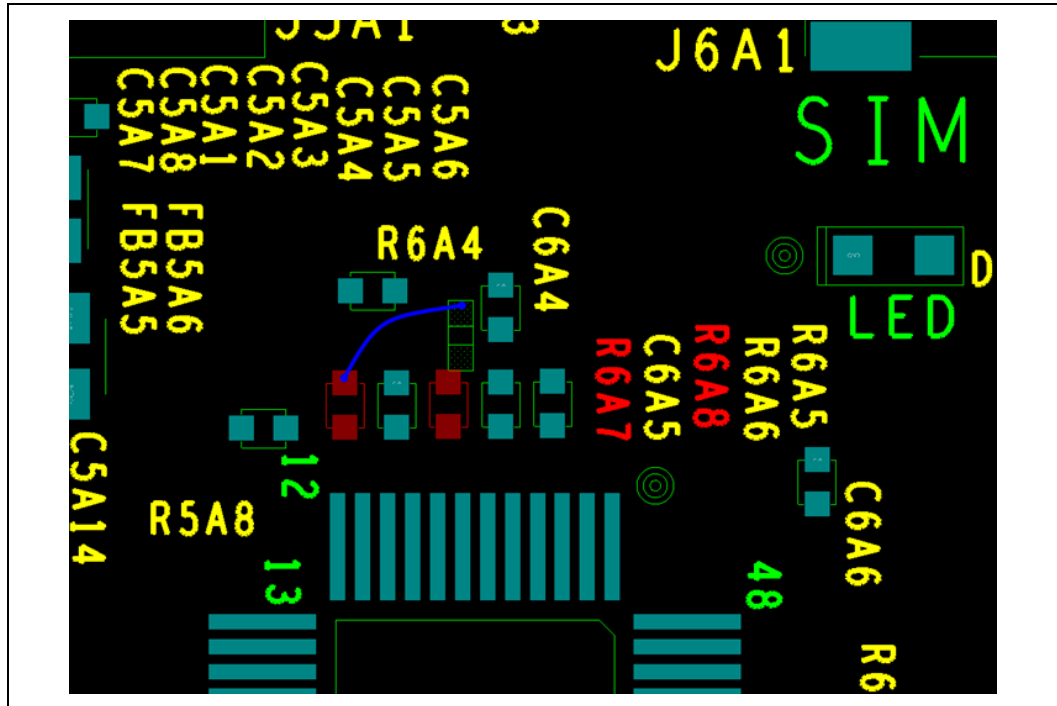
Replace R6A7 with a 0402, 0 ohm resistor as indicated in the figure:



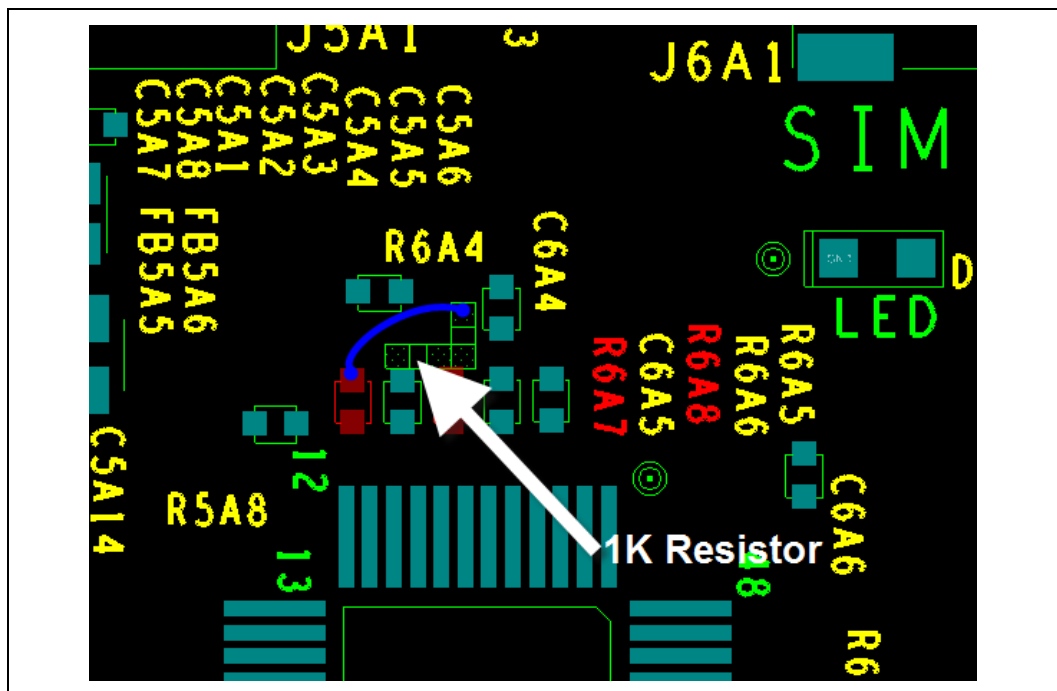
Replace R6A8 with a 0402, 0 ohm resistor as indicated in the figure:



Add a 0402, 249 ohm resistor to R6A8 pin 2 and add a jumper wire from 249 ohm pin 2 to R6A7 pin 1.



Add a 0402, 1000 ohm resistor between R6A8 pin 2 and C6A5 pin 2 (GND).





A.2 I2S Board Rework

Reason: By default, I2S1 pin set functionality is being routed out as I2S1 Bluetooth signals. For TI CODEC running on SSP1, hardware must be reworked to route the MCLK signal and all I2S1 pin set signals to audio break out card.

Impact: This rework is only needed for TI CODEC running on SSP1 port.

Note: With this rework, I2S1 Bluetooth* signal is not available.

Example rework instructions for Leaf Hill platform Fab A, B, and C:

Table 3. Workaround for I2S1 Pin Set

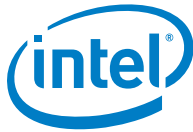
I2S1 Pin	Remove Resistor	Add 0 ohm Resistor
Frame Sync	R3T5	R2T23
Data out	R2T24	R2T25
Data in	R3T4	R2T20
BCLK	R2T21	R2T22
MCLK	-	R2T26 (if resistor is not there)

Route a wire directly from the SOC MCLK pin as some SAMTEC cables do not route MCLK signal out. It might not be available at the audio break out card. Connect the wire from MCLK directly to TI CODEC's MCLK pin.

A.3 Recommended CODEC Settings

A.3.1 Combination 1: Dummy CODEC at both I2S Port 2 and Ports

Not required



A.3.2 Combination 2: Dummy CODEC at Port 2 and WM8731 CODEC at Port 4

```
### SSP 3 Playback ###
amixer -c0 cset name='Headphone Jack Switch' 'Off'
amixer -c0 cset name='Headphone Jack Switch' 'On'

### SSP 3 Capture ###
amixer -c0 cset name='Mic Jack Switch' 'Off'
amixer -c0 cset name='Mic Jack Switch' 'On'

amixer -c0 cset name='Master Playback Volume' '120'
amixer -c0 cset name='Master Playback ZC Switch' 'Off'
amixer -c0 cset name='Sidetone Playback Volume' '0'
amixer -c0 cset name='Playback Deemphasis Switch' 'Off'
amixer -c0 cset name='ADC High Pass Filter Switch' 'Off'
amixer -c0 cset name='Input Mux' 'Mic'
amixer -c0 cset name='Output Mixer HiFi Playback Switch' 'On'
amixer -c0 cset name='Output Mixer Line Bypass Switch' 'Off'
amixer -c0 cset name='Output Mixer Mic Sidetone Switch' 'Off'
amixer -c0 cset name='Store DC Offset Switch' 'Off'

amixer -c0 cset name='Line Capture Switch' 'Off'
amixer -c0 cset name='Mic Capture Switch' 'On'
amixer -c0 cset name='Mic Boost Volume' '0'
amixer -c0 cset name='Capture Volume' '0'
```

A.3.3 Combination 3: TLV320AIC3107 CODEC at Port 1, Dummy CODEC at both I2S Port 2 and Port 4

```
amixer -c0 cset name='Headphone Jack Switch' 'Off'
amixer -c0 cset name='Headphone Jack Switch' 'On'
amixer -c0 cset name='Mic Jack Switch' 'Off'
amixer -c0 cset name='Mic Jack Switch' 'On'
amixer -c0 cset name='Left Line Mixer Line2R Bypass Volume' '0'
amixer -c0 cset name='Right Line Mixer Line2L Bypass Volume' '0'
amixer -c0 cset name='Left HP Mixer Line2R Bypass Volume' '0'
amixer -c0 cset name='Right HP Mixer Line2L Bypass Volume' '0'
amixer -c0 cset name='Left HPCOM Mixer Line2R Bypass Volume' '0'
amixer -c0 cset name='Right HPCOM Mixer Line2L Bypass Volume' '0'
amixer -c0 cset name='Line Line2 Bypass Volume' '0'
amixer -c0 cset name='HP Line2 Bypass Volume' '0'
amixer -c0 cset name='HPCOM Line2 Bypass Volume' '0'
amixer -c0 cset name='Class-D Playback Volume' '0'
amixer -c0 cset name='PCM Playback Volume' '127'
amixer -c0 cset name='Left Line Mixer PGAR Bypass Volume' '0'
amixer -c0 cset name='Left Line Mixer DACR1 Playback Volume' '118'
amixer -c0 cset name='Right Line Mixer PGAL Bypass Volume' '0'
amixer -c0 cset name='Right Line Mixer DACL1 Playback Volume' '0'
amixer -c0 cset name='Left HP Mixer PGAR Bypass Volume' '0'
```

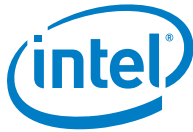


```

amixer -c0 cset name='Left HP Mixer DACR1 Playback Volume' '0'
amixer -c0 cset name='Right HP Mixer PGAL Bypass Volume' '0'
amixer -c0 cset name='Right HP Mixer DACL1 Playback Volume' '0'
amixer -c0 cset name='Left HPCOM Mixer PGAR Bypass Volume' '0'
amixer -c0 cset name='Left HPCOM Mixer DACR1 Playback Volume' '0'
amixer -c0 cset name='Right HPCOM Mixer PGAL Bypass Volume' '0'
amixer -c0 cset name='Right HPCOM Mixer DACL1 Playback Volume'
amixer -c0 cset name='Line PGA Bypass Volume' '0'
amixer -c0 cset name='Line DAC Playback Volume' '118'
amixer -c0 cset name='HP PGA Bypass Volume' '0'
amixer -c0 cset name='HP DAC Playback Volume' '118'
amixer -c0 cset name='HPCOM PGA Bypass Volume' '0'
amixer -c0 cset name='HPCOM DAC Playback Volume' '0'
amixer -c0 cset name='Line Playback Switch' 'On'
amixer -c0 cset name='HP Playback Switch' 'On'
amixer -c0 cset name='HPCOM Playback Switch' 'Off'
amixer -c0 cset name='AGC Switch' 'Off'
amixer -c0 cset name='Left AGC Target level' '0'
amixer -c0 cset name='Right AGC Target level' '0'
amixer -c0 cset name='Left AGC Attack time' '0'
amixer -c0 cset name='Right AGC Attack time' '0'
amixer -c0 cset name='Left AGC Decay time' '0'
amixer -c0 cset name='Right AGC Decay time' '0'
amixer -c0 cset name='De-emphasis Switch' 'Off'
amixer -c0 cset name='PGA Capture Volume' '0'
amixer -c0 cset name='PGA Capture Switch' 'On'
amixer -c0 cset name='ADC HPF Cut-off' '0'
amixer -c0 cset name='Output Driver Power-On time' '0'
amixer -c0 cset name='Output Driver Ramp-up step' '0'
amixer -c0 cset name='Right HPCOM Mixer PGAL Bypass Switch' 'Off'
amixer -c0 cset name='Right HPCOM Mixer DACL1 Switch' 'Off'
amixer -c0 cset name='Right HPCOM Mixer PGAR Bypass Switch' 'Off'
amixer -c0 cset name='Right HPCOM Mixer DACR1 Switch' 'Off'
amixer -c0 cset name='Right HPCOM Mixer Line2L Bypass Switch'
'Off'
amixer -c0 cset name='Right HPCOM Mixer Line2R Bypass Switch'
'Off'
amixer -c0 cset name='Left HPCOM Mixer PGAL Bypass Switch' 'Off'
amixer -c0 cset name='Left HPCOM Mixer DACL1 Switch' 'Off'
amixer -c0 cset name='Left HPCOM Mixer PGAR Bypass Switch' 'Off'
amixer -c0 cset name='Left HPCOM Mixer DACR1 Switch' 'Off'
amixer -c0 cset name='Left HPCOM Mixer Line2L Bypass Switch'
'Off'
amixer -c0 cset name='Left HPCOM Mixer Line2R Bypass Switch'
'Off'
amixer -c0 cset name='Right HP Mixer PGAL Bypass Switch' 'Off'
amixer -c0 cset name='Right HP Mixer DACL1 Switch' 'Off'
amixer -c0 cset name='Right HP Mixer PGAR Bypass Switch' 'Off'
amixer -c0 cset name='Right HP Mixer DACR1 Switch' 'On'
amixer -c0 cset name='Right HP Mixer Line2L Bypass Switch' 'Off'
amixer -c0 cset name='Right HP Mixer Line2R Bypass Switch' 'Off'
amixer -c0 cset name='Left HP Mixer PGAL Bypass Switch' 'Off'
amixer -c0 cset name='Left HP Mixer DACL1 Switch' 'On'

```

Audio for Intel Atom® processor E3900 SoC Family/Intel® Celeron® processor N3350/
Intel® Pentium® processor N4200



```
amixer -c0 cset name='Left HP Mixer PGAR Bypass Switch' 'Off'
amixer -c0 cset name='Left HP Mixer DACR1 Switch' 'Off'
amixer -c0 cset name='Left HP Mixer Line2L Bypass Switch' 'Off'
amixer -c0 cset name='Left HP Mixer Line2R Bypass Switch' 'Off'
amixer -c0 cset name='Right Line Mixer PGAL Bypass Switch' 'Off'
amixer -c0 cset name='Right Line Mixer DACL1 Switch' 'Off'
amixer -c0 cset name='Right Line Mixer PGAR Bypass Switch' 'Off'
amixer -c0 cset name='Right Line Mixer DACR1 Switch' 'On'
amixer -c0 cset name='Right Line Mixer Line2L Bypass Switch'
'Off'
amixer -c0 cset name='Right Line Mixer Line2R Bypass Switch'
'Off'
amixer -c0 cset name='Left Line Mixer PGAL Bypass Switch' 'Off'
amixer -c0 cset name='Left Line Mixer DACL1 Switch' 'On'
amixer -c0 cset name='Left Line Mixer PGAR Bypass Switch' 'Off'
amixer -c0 cset name='Left Line Mixer DACR1 Switch' 'On'
amixer -c0 cset name='Left Line Mixer Line2L Bypass Switch' 'Off'
amixer -c0 cset name='Left Line Mixer Line2R Bypass Switch' 'Off'
amixer -c0 cset name='Right Line2R Mux' '0'
amixer -c0 cset name='Right PGA Mixer Line1R Switch' 'On'
amixer -c0 cset name='Right PGA Mixer Line1L Switch' 'Off'
amixer -c0 cset name='Right PGA Mixer Line2R Switch' 'Off'
amixer -c0 cset name='Right PGA Mixer Mic3L Switch' 'Off'
amixer -c0 cset name='Right PGA Mixer Mic3R Switch' 'On'
amixer -c0 cset name='Left Line2L Mux' '0'
amixer -c0 cset name='Left PGA Mixer Line1L Switch' 'On'
amixer -c0 cset name='Left PGA Mixer Line1R Switch' 'Off'
amixer -c0 cset name='Left PGA Mixer Line2L Switch' 'Off'
amixer -c0 cset name='Left PGA Mixer Mic3L Switch' 'On'
amixer -c0 cset name='Left PGA Mixer Mic3R Switch' 'Off'
amixer -c0 cset name='Right Line1R Mux' '0'
amixer -c0 cset name='Right Line1L Mux' '0'
amixer -c0 cset name='Left Line1R Mux' '0'
amixer -c0 cset name='Left Line1L Mux' '0'
amixer -c0 cset name='Right HPCOM Mux' '0'
amixer -c0 cset name='Right DAC Mux' '0'
amixer -c0 cset name='Left HPCOM Mux' '0'
amixer -c0 cset name='Left DAC Mux' '0'
```




A.4 Playback and Capture Command

Run `aplay -l` or `arecord -l` commands to list out all the supported playback and capture device.

A.4.1 `aplay` and `arecord`

Users can run `aplay` command for playback test:

```
#aplay -Dhw:0,0 -d15 wave_file.wav
```

And `arecord` for capture test:

```
#arecord -Dhw:0,0 -r48000 -c2 -d20 -fS32_LE test_line.wav
```

The important arguments for the `aplay` and `arecord` are:

`-v, --verbose` show PCM structure and setup (accumulative)

`-r, --rate=#` sample rate

Rates are fix at 48000 for this driver `-r48000`

`-c, --channels=#` channels

Channels are fix at 2 for this driver `-c2`

`-f, --format=FORMAT` sample format (case insensitive)

The drivers support **S32_LE** format and **S24_LE**. **-fs32_LE**

`-d, --duration=#` interrupt after # seconds

Could be any duration, `-d20` for 20 sec as an example

`-D, --device=NAME` select PCM by name

Device is to select which device is the driver. Let's take combinations 1 - Dummy CODEC as an example.



```
**** List of PLAYBACK Hardware Devices ****
card 0: aplilhcrbdummyi [apli-lhcrb-dummy_i2s], device 0: SSP2
Speaker (*) []
  Subdevices: 1/1
  Subdevice #0: subdevice #0
card 0: aplilhcrbdummyi [apli-lhcrb-dummy_i2s], device 2: SSP4
Speaker (*) []
  Subdevices: 1/1
  Subdevice #0: subdevice #0
```

-Dhw:0,0 is SSP2 on the Leaf Hill CRB platform

-Dhw:0,2 is SSP4 on the Leaf Hill CRB platform.

A.4.2 ALSA Plug-in

Users can also add a **plug** command to playback and capture using ALSA plug-ins to support more audio format, as shown in this example:

```
#aplay -Dplughw:0,0 -d15 wave_file.wav -v
```

This plays the wave_file.wav in the format other than **S32_LE** and **S16_LE**.

```
#arecord -Dplughw:0,0 -r48000 -c2 -d20 -s24_3LE test_line.wav -v
```

This captures the audio and stores the file in **S24_3LE** format.

A.5 Change Default Audio Output for Pulse Audio

High-level applications such as Browser and Media player use Pulse Audio server.

To set the default audio output for Pulse Audio, edit the Pulse Audio configurations file in /etc/pulse/default.pa.

Search for the following line and change to the device you want Pulse Audio to use. The default audio output device is 0, 3, which is HDMI audio.

```
load-module module-alsa-sink device=hw:0,3
```