Realtek USB Audio Roadmap

Agenda

- Introduction
- Product Roadmap
- Product Application and Approach
- CVAA for Monitor/TV
- Hearing Protection
- Added and Improved Features

USB Audio Experience

USB AUDIO PRODUCTS

- **Voice Recording/Pre-processing**
- **Audio Communication**
- **Speech Capture/ Recognition**
- **Audio Content Playback/Post-processing**

Realtek USB Audio Codec

Audio Performance

- DSD Format Decode
- 384KHz/32-bits
- 2Vrms FSOV
- DAC SNR 120dB

USB Compliance

- USB2.0 Full/High Speed
- UAC 1.0
- UAC 2.0
- USB ADC 3.01 Spec
- USB HID Class Standard

Power Consumption

- LPM/L1 Protocol
- DC/DC Converter
- Cap-Saving HP AMP
- Suspend/Idle Mode

Firmware Update & Security

- Embedded SPI Flash
- DFU Mode
- ECDSA
- CFU Mode
- SHA256
- FW Auto Recovery

USB Audio Codec Roadmap

Value

ALC4030U

- ☑ Stereo DAC / 3CH ADC
- ☑ 384KHz-32bits Sample Rate
- ☑ HW EQ for Playback/Record
- ☑ I2C/I2S Master Mode
- ☑ Embedded 64KB Flash
- ☑ Class G Headphone AMP

ALC4032

- ☑ DAC SNR 110dB
- ☑ DAC THD+N -90dB
- ☑ ***DC/DC Converter***
- ☑ I2C Master Mode
- ☑ ***Embedded Dual Bank Flash***
- ☑ ***DFU/CFU FW Update***

Expandable

ALC4058

- ☑ ***Stereo DAC SNR 120dB***
- ☑ 384KHz-32bits Sample Rate
- ☑ ***SHA256/ECDSA FW Security***
- ☑ DSD / DoP Format Decode
- ☑ ***2Vrms Cap-saving HP AMP***
- ☑ ***Embedded Dual Bank Flash***
- ☑ I2C/I2S Master Mode

ALC4050/H

- ☑ Stereo DAC /up to 5CH ADC
- ☑ 384KHz-32bits Sample Rate
- ☑ DSD / DoP Format Decode
- ☑ ***Support LPM/L1 Mode***
- ☑ ***I2C/I2S Master/Slave Mode***
- ☑ RTK 2nd Gen. Hybrid ANC

Higher Tier

ALC4080/82

- ☑ ***10CH DAC SNR 120dB***
- ☑ ***6CH ADC SNR 110dB***
- ☑ 384KHz-32bits Sample Rate
- ☑ ***SHA256/ECDSA FW Security***
- ☑ DSD / DoP Format Decode
- ☑ ***2Vrms Cap-saving HP AMP***
- ☑ ***DFU/CFU FW Update***

ALC5516P

- ☑ ***On-chip DSP up to 70MHz***
- ☑ ***RTK UniVoice Pre-Process***
- ☑ ***MSFT Teams Headset Logo***
- ☑ 384KHz-32bits Sample Rate
- ☑ DSD / DoP Format Decode
- ☑ UART / DMIC / GPIOs

Coming Soon

ALC4052

- ☑ Stereo DAC / 4CH ADC
- ☑ 192KHz-32bits Sample Rate
- ☑ ***12-Band HW EQ for Playback***
- ☑ ***9-Band HW EQ for Recording***
- ☑ ***2 Sets of I2C/I2S Interface***
- ☑ Class G Headphone AMP
- ☑ ***Hearing Protection (G616)***
- ☑ ***DC/DC Converter***
- ☑ ***3x3 LED PWM Matrix***
- ☑ ***SHA256/ECDSA FW Security***
- ☑ ***Embedded Dual Bank Flash***
- ☑ ***DFU/CFU FW Update***
- ☑ ***I2S/I2C Master & Slave Mode***
- ☑ 4CH DMIC / S/PDIF-Out
- ☑ UART / GPIOs / PWM
- ☑ QFN48 (6x6) / QFN68 (8x8)
- ☑ ***ES: Aug. '22, MP: Q4 '22***

ALC4052 High Configurable Codec

6 x 6mm 48pin MQFN (ALC4044)
8 x 8mm 68pin MQFN (ALC4052)

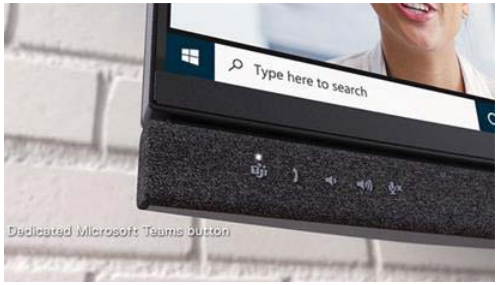
Applications:
- USB Audio Products
- Conferencing Systems
- Audio Content Playback/capture

- High Audio Quality and Performance
  - DAC: 110dB SNR / -90dB THD+N
  - 12-Band HW EQ for Playback (1xLPF, 1xHPF, 5xBPF, 5xBi-quad)
  - 9-Band HW EQ for Recording (1xLPF, 1xHPF, 3xBPF, 4xBi-quad)
  - ADC: 95dB SNR
- Audio sample rate: 8, 16, 22.05, 24, 32, 44.1, 48, 88.2, 96, 192kHz
- Impedance Sensing (Android Headset Spec.)
- Hearing Protection (EN50332, G616 Guidelines)
- Analog and digital channels/path Mixer
- USB DFU / MSFT CFU FW Update Modes
- Auto-recovery w/ Dual-bank Flash Structure Design
- Hardware CRC32 Error-detection
- ECDSA Digital Signature Algorithm / SHA256 Secure Hash Algorithm
- Support LPM-L1 Protocol for configurable Low Power and Performance modes
- USB UAC 1.0/2.0 and ADC3.0 USB HID Class Specification Compliant
- Integrated DC-DC Converter for Ultra-low Power Consumption and Single Power Supply From 3~5.5V
- I2S Master and Slave mode support
- 9xPWN LED Output Pins for 3x3 LED Matrix
- Three 16-bits for R/G/B LED
- SPI/I2S/I2C/UART/SPDIF-Out
- ES: Aug. Y2022, MP: Q4 Y2022

USB Audio Solution Selection

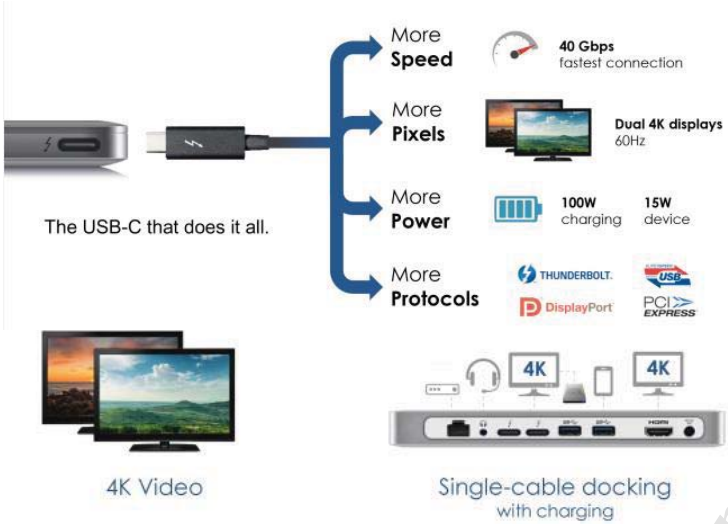
	Multi-function Dock/Soundcard/Motherboard			
	Dongle / Dock / USB Audio Accessories			
	Headset / Microphone / Speakerphone			
	ALC5516	**ALC4032**	**ALC4050/H**	**ALC4058/80/82**
USB I/F	**USB2.0 Full Speed/High Speed**			
Audio Class	**USB Audio Class 1.0 / 2.0, Audio Device Class 3.01**			
Sample Rate	384KHz, 32-bit/ DSD/ DoP	192KHz, 24-bit	384KHz, 32-bit/ DSD/ DoP	384KHz, 32-bit/ DSD/ DoP
DAC	2ch DAC, 9-Band HW EQ SNR = 100dB THD+N = -80dB	2ch DAC, 7-Band HW EQ SNR = 110dB THD+N = -90dB	2ch DAC, 9-Band HW EQ SNR = 100dB THD+N = -85dB	**ALC4080/82: 10ch DAC** **ALC4058: 2ch DAC** 2Vrms HP AMP, SNR = 120dB THD+N = -90dB
ADC	Mic-In / Line-In 6-Band HW EQ w/ AGC AMIC x 5ch DMIC x 4ch	Mic-In / Line-In 6-Band HW EQ w/ AGC AMIC x 2ch DMIC x 2ch	Mic-In / Line-In 6-Band HW EQ w/ AGC **ALC4050/H: AMIC x 3ch / 5ch** DMIC x 4ch	Mic-In / Line-In **ALC4080/82: AMIC x 6ch** **ALC4058: AMIC x 4ch** DMIC x 4ch
Digital I/O Interface	SPI Interface UART GPIOs Jack Detection PWM Tri-color LED Driver	SPI Interface I2C Master Mode GPIOs Jack Detection w/ GHS PWM Tri-color LED Driver	SPI Interface I2C/I2S Master/Slave UART / GPIOs Jack Detection w/ GHS PWM Tri-color LED Driver	SPI Interface I2C/I2S Master GPIOs Jack Detection PWM Tri-color LED Driver
DSP/Security	RTK UniVoice Pre-Processing	N/A	RTK 2nd Gen. Hybrid ANC	FW Update Authentication
Memory	N/A	256KB Flash w/ Dual Bank	64KB Flash	ALC4058/80: 512KB flash w/Dual Bank
Package	MQFN-76 (9x9)	MQFN-48 (5x5)	ALC4050: MQFN-48 (6x6) ALC4050H: MQFN-56 (7x7)	ALC4058/80: MQFN-48 (6x6) ALC4082: MQFN-68 (8x8)

USB Audio Product and Market Transition



- **Multimedia Equipment with Integrated Audio Features:**
  - PC Monitor with Speakers / Web Cam with Microphone
    - USB interface for data return path to the PC (button controls, volume sync between monitor and PC…etc.)
    - USB audio device for independent control and audio data capturing
- **Communication Equipment:**
  - Conferencing Monitor / Speakerphone
    - USB interface for plug 'n play audio features with abilities to extend audio functions (microphone processing integrated in DSP, smart AMP…etc.)
    - UC and MS logo complaints (Teams, Zoom, Webex…etc.)
    - APPs status LED indicator, volume control indicators, multiple button controls sync with PC
    - Audio jack with GHS support for switching between group and individual user scenario

The New and Next Docking Station



Speakerphone with integrated multi-port adaptor

Conferencing monitor with connectivity hub

Applications:

- *Adaptor (AC) or USB powered device with audio features*
- *Built-in speakers*
- *Line-out, headphone or headset audio jack*

User Experience:

- *Connect a USB-C laptop or MacBook with only A USB-C or Thunderbolt 3 cable*
- *USB-C monitor works as a docking station also charge external devices*
- *Physical button controls (Vol+/-/Mute…etc.) for quick and easy access*
- *OSD for speaker volume controls / adjustments synchronized between monitor and PC*
- *Extendable for audio related features to communicate between monitor and PC*

Conferencing Speakerphone

Applications and Scenarios:

- *Mobile Speakerphone powered by USB*
- *Integrated Conferencing Device Solution*
- *Extensive Connectivity for fast and easy set-up*

UC Platform Compatible for Best VOIP User Experience:

- *360-degree microphone with echo cancelation and noise reduction*
- *Skype, Teams, Cortana Near-field & Zoom Compliant*
- *Easy to start, hang up calls and mute/unmute and adjust the volume*

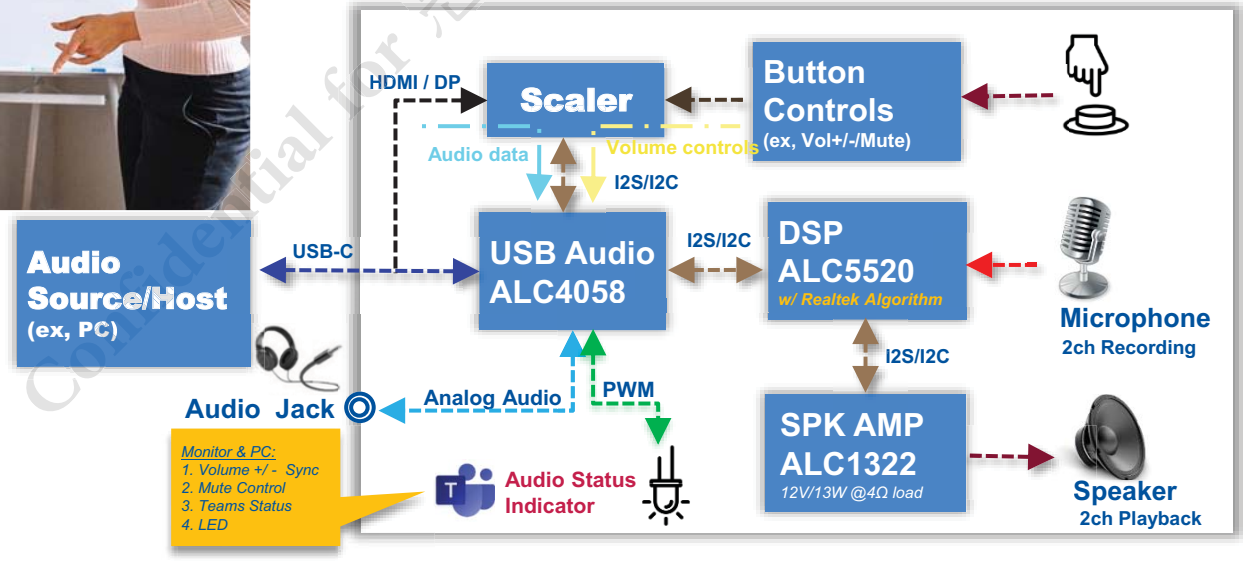
Monitor with Audio - Conferencing

Application:

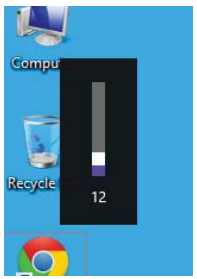
- *Conferencing Monitor*
- *Remote Learning*

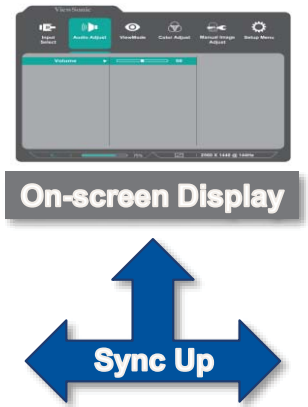
Best VOIP User Experience

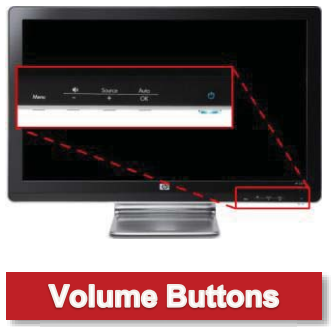
- *Skype Room System Compliant*
- *Teams & Cortana Near-field compliant*
- *Zoom Compliant*



Monitor with Audio - Output Only

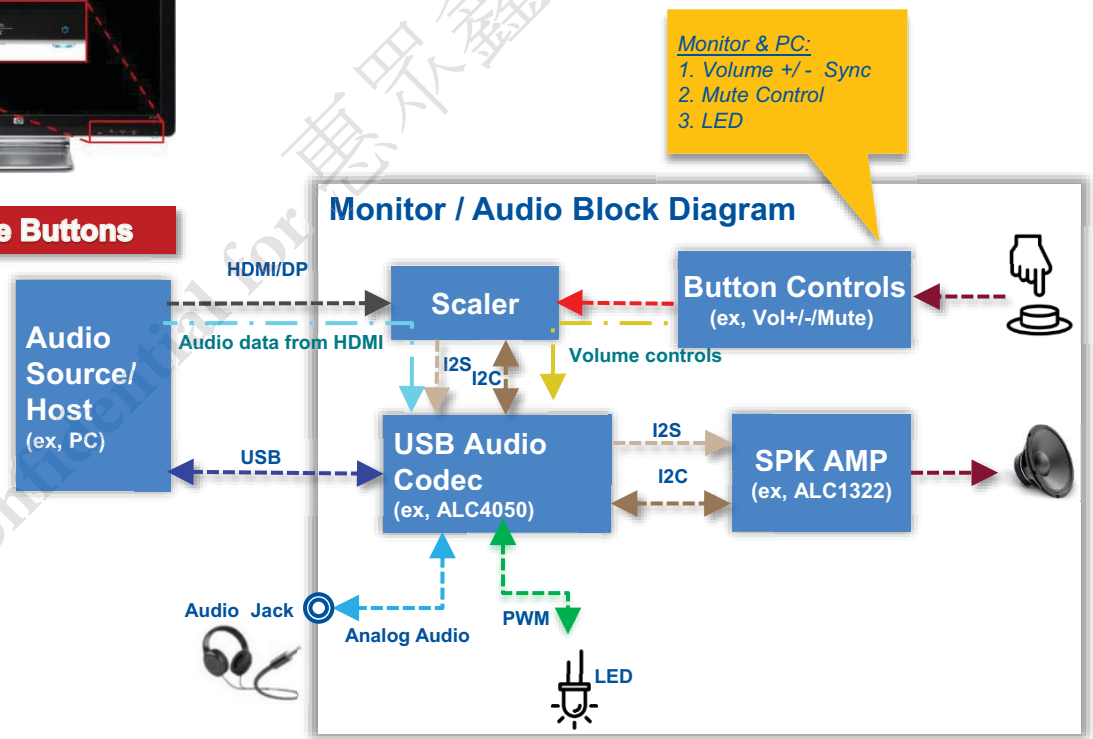






Applications:

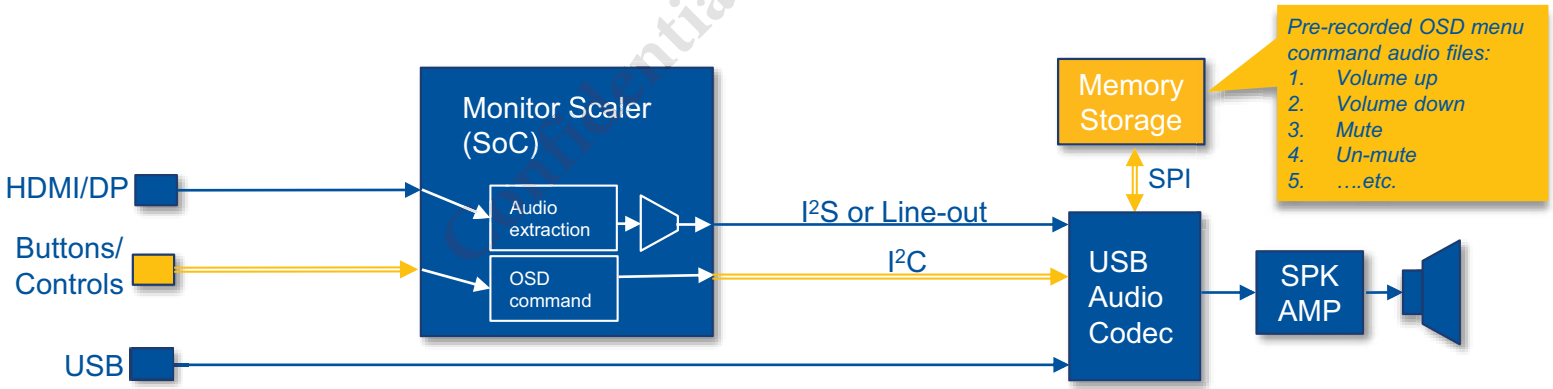
- Selectable audio source between HDMI and USB interface
- OSD and buttons controls via Scalar
- Speaker AMP controlled by USB audio codec
- USB audio codec communicate/sync between monitor and PC
- LED indicators controlled by USB audio codec



21st Century Communications and Video Accessibility Act (FCC-CVAA)

Audio Block Implementation Option 1

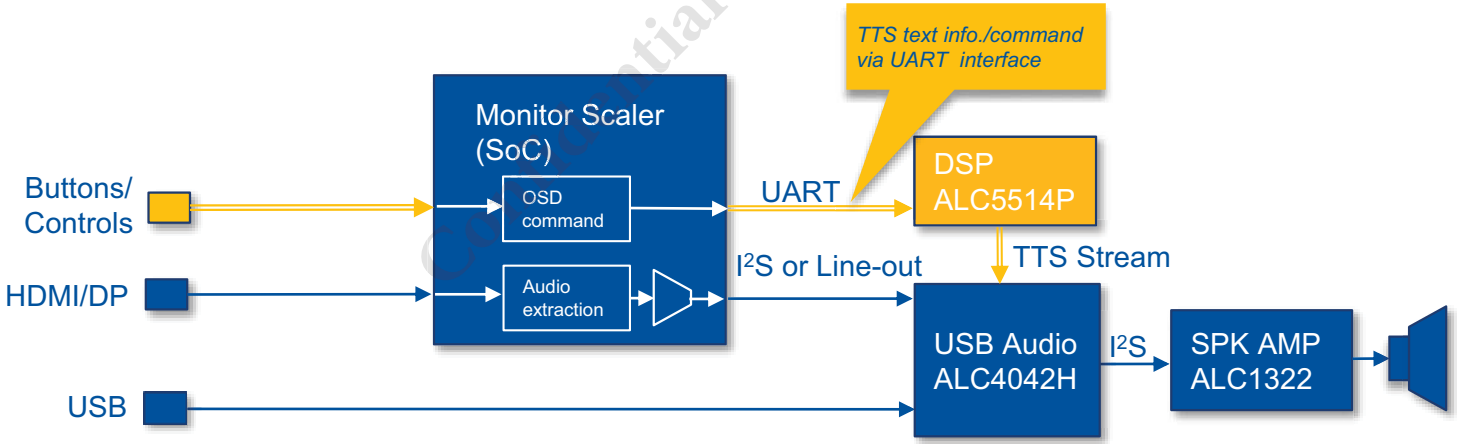
- **Pre-recorded command audio file**
  - Codec support PCM audio file playback from designate storage location(flash, memory…etc.) to DAC or other pass-through path of audio stream(I^2S, audio line out…etc.)
  - Most cost effective implementation to meet the regulation
  - More effort for supporting multi-language and further firmware update



21st Century Communications and Video Accessibility Act (FCC-CVAA) - Realtek CVAA Solution

Realtek Audio Block Implementation

- **Text-to-speech(TTS) on DSP**
  - Small DSP ALC5514P with Text-to-speech(TTS) algorithm pre-installed.
  - Scaler sends the text info./command via UART to the DSP for speech conversion, the playback of speeches has higher priority or mixed with other audio streams from Scaler SoC or USB audio codec.
  - Lower total rBOM cost compare to the competitor's existing solution and follow the same hardware structure and protocols to easy solution adaption
  - Less efforts for multi-language support via firmware update or further maintenance



Hearing Protection

- **Ensure people using headsets with a safe listening level and eliminate potentially harmful sound spikes.**
- **Impulse loud sounds:** Sudden and very loud sounds from the headset can be very disturbing and damaging hearing.
  - The maximum output level of the device is less than the Acoustic Shock Protective Device Limit (ASPDL). The Max SPL from 100 Hz to 8KHz should under **102 dBSPL (G616), 140 dBSPL (OSHA)**

- **High average sound level:** Long term exposure to sound as call service center and office headset users over the course of a working day may suffer in hearing damage.
  - An A-weighted time average level less than **85dBA** for duration of **8hrs**, **80dBA** for **16hrs** or **90dBA** for **4hrs(US)**, **82dBA** for **16hrs** or **88dBA** for **4hrs(EU)**.

- **G616 (Australia, Communications Alliance):** Australian regulatory requirements for telecommunications equipment.
- **EN 50332 (European Standard for Sound system equipment), OSHA Regulations 29 CFR 1910.95 (The Occupational Safety and Health Administration):** The EU and US (Noise At Work) safety requirements.
- Australian research and standardization work within audio and telecommunication has focused a lot on avoiding hearing damage. Industry Guideline G616, the guideline does not provide any mandatory requirements. As such, compliance with G616 cannot be claimed, as it is only providing guidance and is not a Standard.