

USB-C's

"AUDIO ADAPTER ACCESSORY MODE"

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SUMMARY

USB-C's "Audio Adapter Accessory Mode" allows USB-C ports to accept audio signals from wired headsets that have TRS plugs or a TRRS plug when an "Audio Adapter Accessory Mode" convert from the TRS/TRRS plug(s) to USB-C plug. This capability is used on some of the less-expensive Android cell phones.

TOPICS

- Description of USB-C's "Audio Adapter Accessory Mode"
- No Analog Headsets Support "Audio Adapter Accessory Mode" Directly
- Configuration Options for an Analog Headset
- Problems Caused by USB-C's "Audio Adapter Accessory Mode"

TOPICS (continued)

- Which Models of Android Cell Phones Have USB-C Ports That Support "Audio Adapter Accessory Mode"?

DESCRIPTION OF USB-C's "AUDIO ADAPTER ACCESSORY" MODE

- The analog audio adapter shall identify itself by presenting a resistance to GND of $\leq R_a$ on both A5 (CC) and B5 (VCONN) of the USB Type-C plug. If pins A5 and B5 are shorted together, the effective resistance to GND shall be less than $R_a/2$.

DESCRIPTION OF USB-C's "AUDIO ADAPTER ACCESSORY" MODE (continued)

- A DFP (= Downstream Facing Port = host port) that supports analog audio adapters shall detect the presence of an analog audio adapter by detecting a resistance to GND of less than R_a on both A5 (CC) and B5 (VCONN).

DESCRIPTION OF USB-C's "AUDIO ADAPTER ACCESSORY" MODE (continued)

- See pages 309 and 310 of <https://www.usb.org/document-library/usb-type-cr-cable-and-connector-specification-revision-20>

- If
CC1 of the equipment end connects a
1000 ohm resistor that is grounded
(=negative) onto either CC1 or CC2 of the
host end
AND
CC2 of the equipment end connects a
1000 ohm resistor that is grounded
(=negative) onto either CC1 or CC2 of the
host end
then it indicates to the host end that the
equipment is capable of "Audio Adapter
Accessory Mode" analog audio signals

NO ANALOG HEADSETS SUPPORT "AUDIO ADAPTER ACCESSORY MODE" DIRECTLY

- Analog headsets are those with 2 TRS 3.5mm plugs or a single TRRS plug
- No analog headsets directly have a USB-C plug
- You have use a separate "Audio Adapter Accessory Mode" adapter to interface from the analog headset to the cell phone

NO ANALOG HEADSETS SUPPORT "AUDIO ADAPTER ACCESSORY MODE" DIRECTLY (continued)

- All of the models of "Android" cell phones that support "Audio Adapter Accessory Mode" are bundled with a separate "Audio Adapter Accessory Mode" adapter
- "Audio Adapter Accessory Adapters" are not allowed to be hard-wired into a headset by a manufacturer:

CONFIGURATION OPTIONS FOR AN ANALOG HEADSET

- **PASSIVE HEADSET ADAPTER**
= "Audio Adapter Accessory Mode"
adapter for connecting an analog headset to a USB-C port
- **ACTIVE HEADSET ADAPTER**
= Adapter that has a "Digital to Analog" ("DAC") chip that converts the headset's audio signals into a USB-C signal

CONFIGURATION OPTIONS FOR AN ANALOG

HEADSET (continued)

- "PASSIVE HEADSET":

Analog headset with two TRS plugs or a single TRRS plug

connects to

"Audio Adapter Accessory Mode" adapter

connects via USB-C

to

Android cell phone that has a USB-C port that capable of "Audio Adapter Accessory Mode"

CONFIGURATION OPTIONS FOR AN ANALOG HEADSET (continued)

- "ACTIVE HEADSET":
Analog headset with two TRS plugs or a single TRRS plug connects to "Digital to Analog Converter" adapter connects via USB-C to Android cell phone (any cell phone that has a USB-C jack)

PROBLEMS CAUSED BY "AUDIO ADAPTER ACCESSORY" MODE

- A diagram is shown at <https://www.soundguys.com/usb-audio-explained-18563/>
- As stated in this article:

Audio Accessory Mode is not universally supported by smartphones, causing headphones and dongle compatibility issues.

WHICH MODELS OF ANDROID CELL PHONES
HAVE USB-C PORTS THAT SUPPORT "AUDIO
ADAPTER ACCESSORY" MODE?

- See the following list of cell phones that have USB-C ports that support "Audio Adapter Accessory Mode::

Compatibility

**for Samsung Galaxy S8 / S8+ / Note 8 / S9 / S9+ / S10 / S10+ / S10e / Note 9 / A5 2017 / A
A20 / A30 / A50 / A70**

For OnePlus 2 / 3 / 3T / 5 / 5T / 6 / 6T / 7 / 7 Pro

for LG G5 / G6 / Q6 / G7 / G7 One / G8 / V20 / V30

**for Huawei P10 / P10 Plus / P10 Lite / P20 / P20 Pro / P20 Lite / Mate 20 Pro / P30 / P30 Pro /
Lite**

**Please make sure your phone has Audio Adapter Accessory Mode to ensure compatibility
with your device**



WHICH MODELS OF ANDROID CELL PHONES HAVE USB-C PORTS THAT SUPPORT "AUDIO ADAPTER ACCESSORY" MODE? (continued)

- Reference for previous slide:

<https://www.aliexpress.com/item/4001028925112.html>

WHICH MODELS OF ANDROID CELL PHONES HAVE USB-C PORTS THAT SUPPORT "AUDIO ADAPTER ACCESSORY" MODE? (continued)

- See also the following list of cell phones that have USB-C ports that support "Audio Adapter Accessory Mode":

Samsung Galaxy S9 / S9 Plus / S8 / S8 Plus / S9 / S9 Plus / Note 9 / Note 8

For OnePlus 2 / 3 / 3T / 5 / 5T / 6 / 6T

LG G5 / LG G6 / LG G7 ThinQ / LG V20 / LG V30

Nexus 6P / 5X

Apple Macbook (Usb-C compatible)

Please make sure your phone has Audio Adapter Accessory Mode to ensure compatibility with your device

WHICH MODELS OF ANDROID CELL PHONES HAVE USB-C PORTS THAT SUPPORT "AUDIO ADAPTER ACCESSORY" MODE?

- Reference for previous slide:

<https://www.maxbitt.ie/usb-c-31-type-c-to-35mm-headphone-jack-aux-adapter-cable-for-s8-s9-lg-g5-g6-g7.html>

WHICH MODELS OF ANDROID CELL PHONES
HAVE USB-C PORTS THAT SUPPORT "AUDIO
ADAPTER ACCESSORY" MODE?

- See also the following list of cell phones that have USB-C ports that support "Audio Adapter Accessory Mode":

Compatiable with: Motorola Moto Z Motorola Moto Z Force Motorola Moto Z2 Force Huawei Mate 10 Pro Huawei Mate 20 Pro Huawei P20 Huawei P20 Pro Xiaomi Mi 6 Xiaomi Mi 8 Xiaomi Mix 2 Xiaomi Note 3 The type c audio adapter is compatible with Oneplus 6T, but you need to open the "OTG" in phone setting before using, or it will not charge and audio.

WHICH MODELS OF ANDROID CELL PHONES HAVE USB-C PORTS THAT SUPPORT "AUDIO ADAPTER ACCESSORY" MODE? (continued)

- Reference for previous slide:
- <https://www.amazon.com/AD-ADTRIP-Headphone-Compatible-Motorola/dp/B07NVDT57C>

WHICH MODELS OF ANDROID CELL PHONES HAVE USB-C PORTS THAT SUPPORT "AUDIO ADAPTER ACCESSORY" MODE?

- See also the following list of cell phones that have USB-C ports that support "Audio Adapter Accessory Mode":

- Motorola Moto Z
- Motorola Moto Z Droid
- Motorola Moto Z Force
- Motorola Moto Z Play
- Motorola Moto Z2 Play
- Motorola Moto Z2 Force

WHICH MODELS OF ANDROID CELL PHONES HAVE USB-C PORTS THAT SUPPORT "AUDIO ADAPTER ACCESSORY" MODE? (continued)

- Reference for previous slide:
<https://www.androidcentral.com/the-single-usb-c-headphone-adapter-works-all-phones>

WHICH MODELS OF ANDROID CELL PHONES
HAVE USB-C PORTS THAT SUPPORT "AUDIO
ADAPTER ACCESSORY" MODE?

- See also the following list of cell phones that have USB-C ports that support "Audio Adapter Accessory Mode":

**Compatible with OnePlus 7/7 Pro,
OnePlus 6T, Huawei P20 / P20 Pro / P30
Pro/Mate 10 Pro, Moto Z, Xiaomi 8/9 SE,**

WHICH MODELS OF ANDROID CELL PHONES HAVE USB-C PORTS THAT SUPPORT "AUDIO ADAPTER ACCESSORY" MODE? (continued)

- Reference for the previous slide:
https://www.stoostarh.com/index.php?main_page=product_info&products_id=325714

WHICH MODELS OF ANDROID CELL PHONES HAVE USB-C PORTS THAT **DO NOT SUPPORT** "AUDIO ADAPTER ACCESSORY" MODE?

- Here is a list of cell phones that have USB-C ports that **do not support** "Audio Adapter Accessory Mode" so you would have to use a USB-C to 3.5mm adapter to connect an analog headset to their USB-C ports:

Motorola Moto Z2, Google Pixel 2/2 XL/3/3XL, Essential PH-1, HTC Series


WHICH MODELS OF ANDROID CELL PHONES
HAVE USB-C PORTS THAT **DO NOT SUPPORT**
"AUDIO ADAPTER ACCESSORY" MODE?
(continued)

- Reference for the previous slide:
<https://www.amazon.com/AD-ADTRIP-Headphone-Compatible-Motorola/dp/B07NVDT57C>

"PC WORLD" RANT ABOUT INCOMPATIBILITY PROBLEMS

- See <https://www.pcworld.com/article/3284186/bring-back-the-headphone-jack-why-usb-c-audio-still-doesnt-work.html>

- **Essential** – Essential PH-1
- **HTC** – U Play, U11, U11+

- 
- **Google** – Pixel 2, Pixel 2 XL, Pixel 3 and Pixel 3XL
 - **LeEco** – Le 2, Le 2 Pro and Le Max 2

WHICH MODELS OF ANDROID CELL PHONES HAVE USB-C PORTS THAT SUPPORT "AUDIO ADAPTER ACCESSORY MODE"? (continued)

- Reference for previous slide:
<https://www.dignited.com/35814/usb-c-to-3-5mm-dongle-helps-you-use-traditional-audio-jack-on-smartphones-without-one/>

MODELS OF "AUDIO ACCESSORY ADAPTER MODE" ADAPTERS

- "Audio Accessory Adapter Mode" Adapters connect a TRS/TRRS audio headset to a USB port without having an intervening "Digital to Analog" IC (Integrated Circuit) chip.
Here are some models that have received good reviews:

MODELS OF "AUDIO ACCESSORY ADAPTER MODE" ADAPTERS (continued)

- <https://www.amazon.com/Motorola-USB-C-3-5mm-Headphone-Adapter/dp/B01N0ZYNV8>
- https://www.amazon.com/Cable-Matters-2-Pack-USB-C-Adapter/dp/B07574KDJJ/ref=sr_1_7?dchild=1&keywords=audio+analog+accessory+adapter&qid=1595560856&sr=8-7

DESIGN ISSUES FOR "AUDIO ADAPTER ACCESSORY ADAPTER" MODE

- When a USB-C plug is designed into an "Audio Accessory Adapter", it has to be reversible so you end up with 4 unterminated analog audio wires (which is not good audio design because it tends to suck hum and RF interference into your "Audio Accessory Adapter"):

DESIGN ISSUES FOR "AUDIO ADAPTER ACCESSORY ADAPTER" MODE (continued)

TRRS Headset Plug:

- TRRS Tip (=Speaker Right)
- TRRS Ring 1 (=Speaker Left)
- TRRS Ring 2 (Mic or Audio Ground)
- TRRS Sleeve (Audio Ground or Mic)

DESIGN ISSUES FOR "AUDIO ADAPTER ACCESSORY ADAPTER" MODE (continued)

TRRS Headset Plug:

- TRRS Tip (=Speaker Right)
- TRRS Ring 1 (=Speaker Left)
- TRRS Ring 2 (Mic or Audio Ground)
- TRRS Sleeve (Audio Ground or Mic)

DESIGN ISSUES FOR "AUDIO ADAPTER ACCESSORY ADAPTER" MODE (continued)

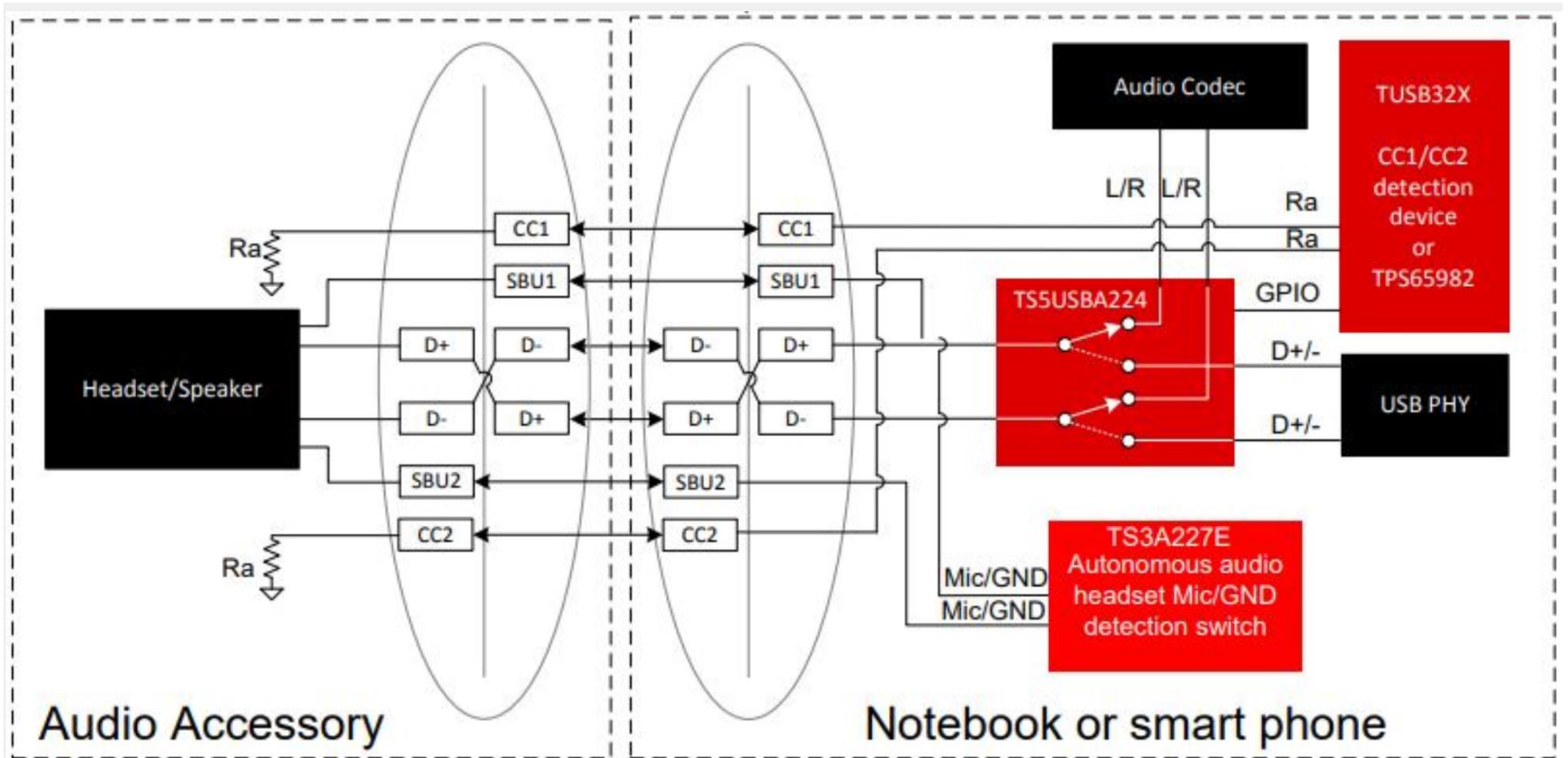
TRRS Headset Plug:

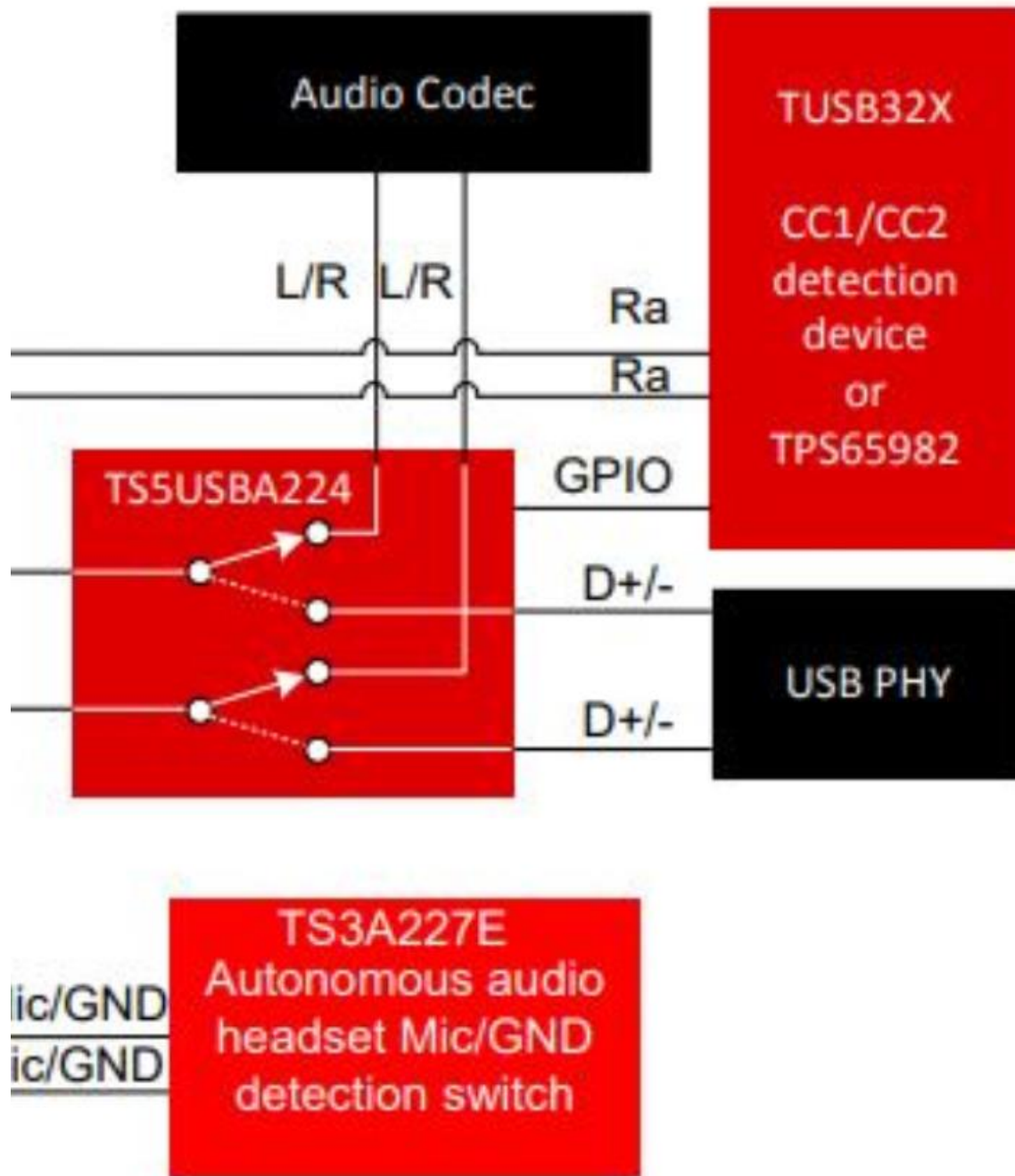
- TRRS Tip (=Speaker Right) to both A6 & B6 of USB-C plug
- TRRS Ring 1 (=Speaker Left) to both A7 & B7 of USB-C plug
- TRRS Ring 2 (Mic or Audio Ground) to A8 of USB-C plug
- TRRS Sleeve (Audio Ground or Mic) to B8 of USB-C plug

DESIGN ISSUES FOR "AUDIO ADAPTER ACCESSORY MODE" (continued)

TRRS Headset Plug:

- Various chips are probably needed inside a cell phone to make it accept the audio signals from an "Audio Adapter Accessory Mode" adapter:





DESIGN ISSUES FOR "AUDIO ADAPTER
ACCESSORY ADAPTER" MODE (continued)
In this example from Texas Instruments:
A TS5USBA224 chip switches the
A6/B6/D+/Tip and A7/B7/D-/Ring audio
lines away to the Audio CODEC chip to
protect the regular USB-C "PHY" chip that
otherwise might be fried by the analog
audio signals which are much larger than
the digital signals that the USB-C "PHY"
chip is expecting

DESIGN ISSUES FOR "AUDIO ADAPTER ACCESSORY ADAPTER" MODE (continued)

Also in this example from Texas
Instruments:

A TS3A227E chip determines whether SBU1 is mic or audio ground and it switches SBU1 and SBU2 accordingly. This chip is needed because the some headset manufacturers put the Mic line on the Ring 2 of a TRRS plug while other headset manufacturers put the Mic line on the Sleeve of a TRRS plug.