Fixing audio with AppleALC

So to start, we'll assume you already have Lilu and AppleALC installed, if you're unsure if it's been loaded correctly you can run the following in terminal(This will also check if AppleHDA is loaded, as without this AppleALC has nothing to patch):

```
kextstat | grep -E "AppleHDA|AppleALC|Lilu"
```

If all 3 show up, you're good to go. And make sure VoodooHDA **is not present**. This will conflict with AppleALC otherwise.

If you're having issues, see the Troubleshooting section

Finding your layout ID

So for this example, we'll assume your codec is ALC1220. To verify yours, you have a couple options:

- Checking motherboard's spec page and manual
- Check Device Manager in Windows
- Run `cat` in terminal on Linux
    - `cat /proc/asound/card0/codec#0 | less`

Now with a codec, we'll want to cross reference it with AppleALC's supported codec list:

- AppleALC Supported Codecs

With the ALC1220, we get the following:

```
0x100003, layout 1, 2, 3, 5, 7, 11, 13, 15, 16, 21, 27, 28, 29, 34
```

So from this it tells us 2 things:

- Which hardware revision is supported(`0x100003`), only relevant when multiple revisions are listed with different layouts
- Various layout IDs supported by our codec(`layout 1, 2, 3, 5, 7, 11, 13, 15, 16, 21, 27, 28, 29, 34`)

Now with a list of supported layout IDs, we're ready to try some out

Note: If your Audio Codec is ALC 3XXX this is likely false and just a rebranded controller, do your research and see what the actual controller is.

- An example of this is the ALC3601, but when we load up Linux the real name is shown: ALC 671

Testing your layout

To test out our layout IDs, we're going to be using the boot-arg `alcid=xxx` where xxx is your layout. Remember that to try layout IDs **one at a time**. Do not add multiple IDs or alcid boot-args, if one doesn't work then try the next ID and etc

```
config.plist
├── NVRAM
  ├── Add
    ├── 7C436110-AB2A-4BBB-A880-FE41995C9F82
          ├── boot-args | String | alcid=11
```

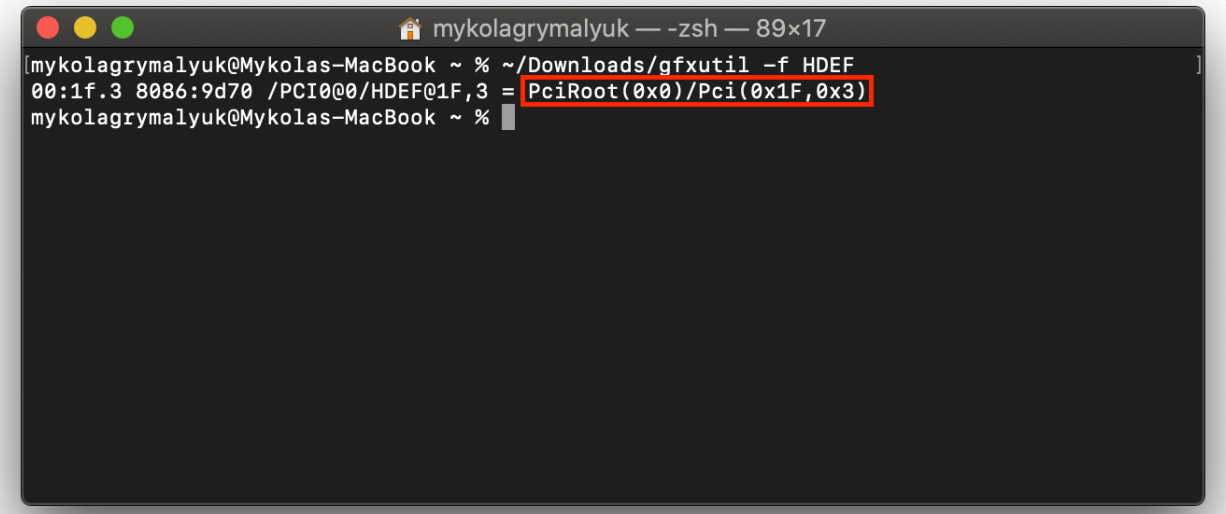
Making Layout ID more permanent

Once you've found a Layout ID that works with your hack, we can create a more permanent solution for closer to how real macs set their Layout ID.

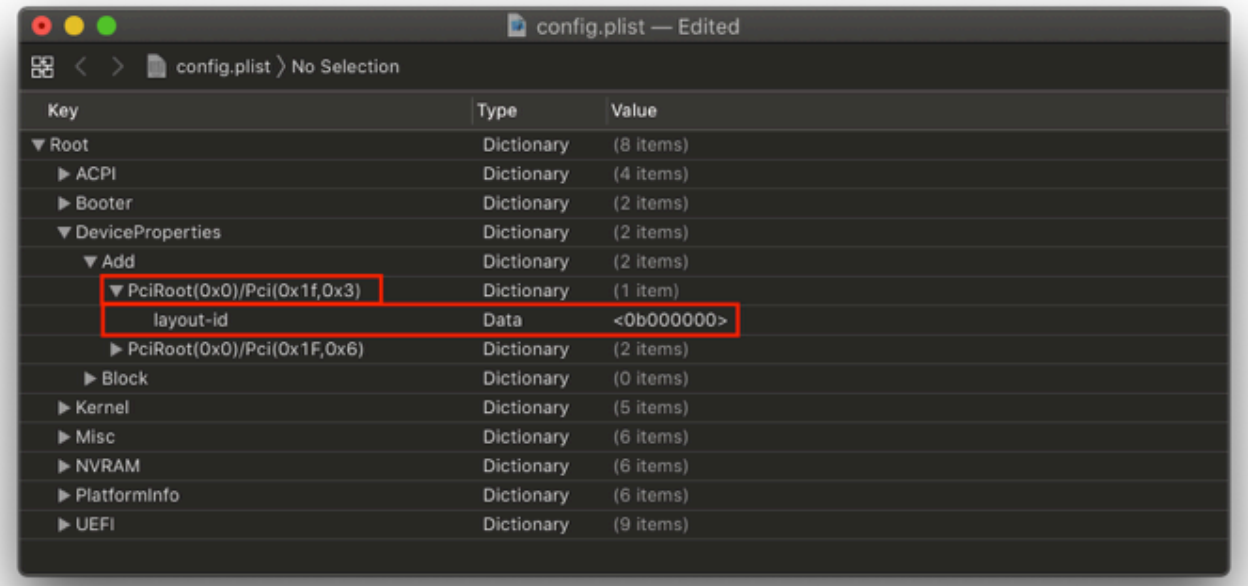
With AppleALC, there's a priority hierarchy with which properties are prioritized:

1. `alcid=xxx` boot-arg, useful for debugging and overrides all other values
2. `alc-layout-id` in DeviceProperties, **should only be used on Apple hardware**
3. `layout-id` in DeviceProperties, **should be used on both Apple and non-Apple hardware**

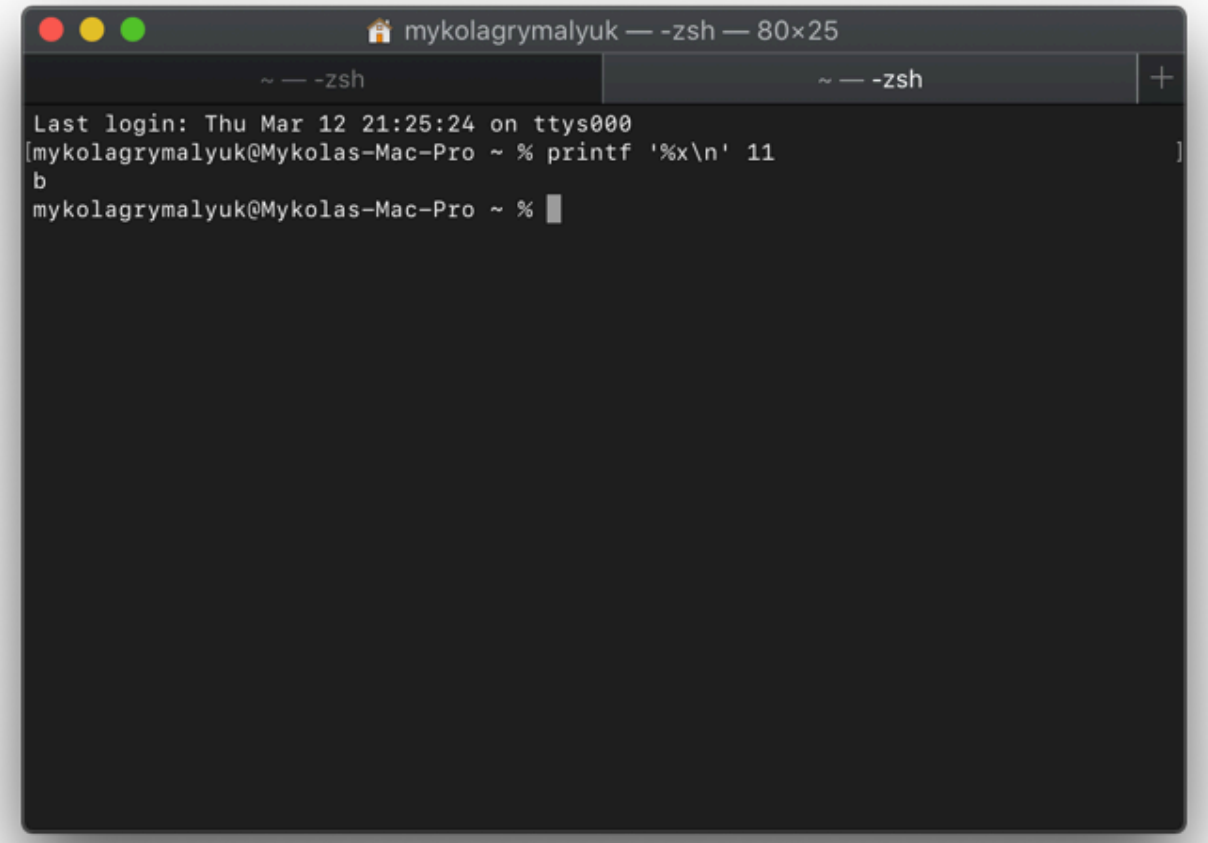
To start, we'll need to find out where our Audio controller is located on the PCI map. For this, we'll be using a handy tool called gfxutil then with the macOS terminal:



Then add this PciRoot with the child `layout-id` to your config.plist under DeviceProperties -> Add:



Note that AppleALC can accept both Decimal/Number and Hexadecimal/Data, generally the best method is Hex as you avoid any unnecessary conversions. You can use a simple decimal to hexadecimal calculator to find yours. `printf '%x\n' DECI_VAL`:



So in this example, `alcid=11` would become either:

- `layout-id | Data | <0B000000>`
- `layout-id | Number | <11>`

Note that the final HEX/Data value should be 4 bytes in total(ie. `0B 00 00 00`), for layout IDs surpassing 255(`FF 00 00 00`) will need to remember that the bytes are swapped. So 256 will become `FF 01 00 00`

- HEX Swapping and data size can be completely ignored using the Decimal/Number method

Reminder: You **MUST** remove the boot-arg afterwards, as it will always have

the top priority and so AppleALC will ignore all other entries like in DeviceProperties

Miscellaneous issues

No Mic on AMD

- This is a common issue with when running AppleALC with AMD, specifically no patches have been made to support Mic input. At the moment the "best" solution is to either buy a USB DAC/Mic or go the VoodooHDA.kext method. Problem with VoodooHDA is that it's been known to be unstable and have worse audio quality than AppleALC

Same layout ID from Clover doesn't work on OpenCore

This is likely do to IRQ conflicts, on Clover there's a whole sweep of ACPI hot-patches that are applied automagically. Fixing this is a little bit painful but SSDTTime 's `FixHPET` option can handle most cases.

For odd cases where RTC and HPET take IRQs from other devices like USB and audio, you can reference the HP Compaq DC7900 ACPI patch example in the trashOS repo

Kernel Panic on power state changes in 10.15

- Enable PowerTimeoutKernelPanic in your config.plist:
  - `Kernel -> Quirks -> PowerTimeoutKernelPanic -> True`

Troubleshooting

So for troubleshooting, we'll need to go over a couple things:

- Checking if you have the right kexts
- Checking if AppleALC is patching correctly
- Checking AppleHDA is vanilla
- AppleALC working inconsistently
- AppleALC not working correctly with multiple sound cards
- AppleALC not working from Windows reboot

Checking if you have the right kexts

To start, we'll assume you already have Lilu and AppleALC installed, if you're unsure if it's been loaded correctly you can run the following in terminal(This will also check if AppleHDA is loaded, as without this AppleALC has nothing to patch):

```
kextstat | grep -E "AppleHDA|AppleALC|Lilu"
```

If all 3 show up, you're good to go. And make sure VoodooHDA **is not present**. This will conflict with AppleALC otherwise. Other kexts to make sure you do not have in your system:

- RealtekALC.kext
- CloverALC.kext
- VoodooHDA.kext
- HDA Blocker.kext
- HDAEnabler#.kext(# can be 1, 2, or 3)

> Hey Lilu and/or AppleALC aren't showing up

Generally the best place to start is by looking through your OpenCore logs and seeing if Lilu and AppleALC injected correctly:

```
14:354 00:020 OC: Prelink injection Lilu.kext () - Success
14:367 00:012 OC: Prelink injection AppleALC.kext () - Success
```

If it says failed to inject:

```
15:448 00:007 OC: Prelink injection AppleALC.kext () - Invalid Parameter
```

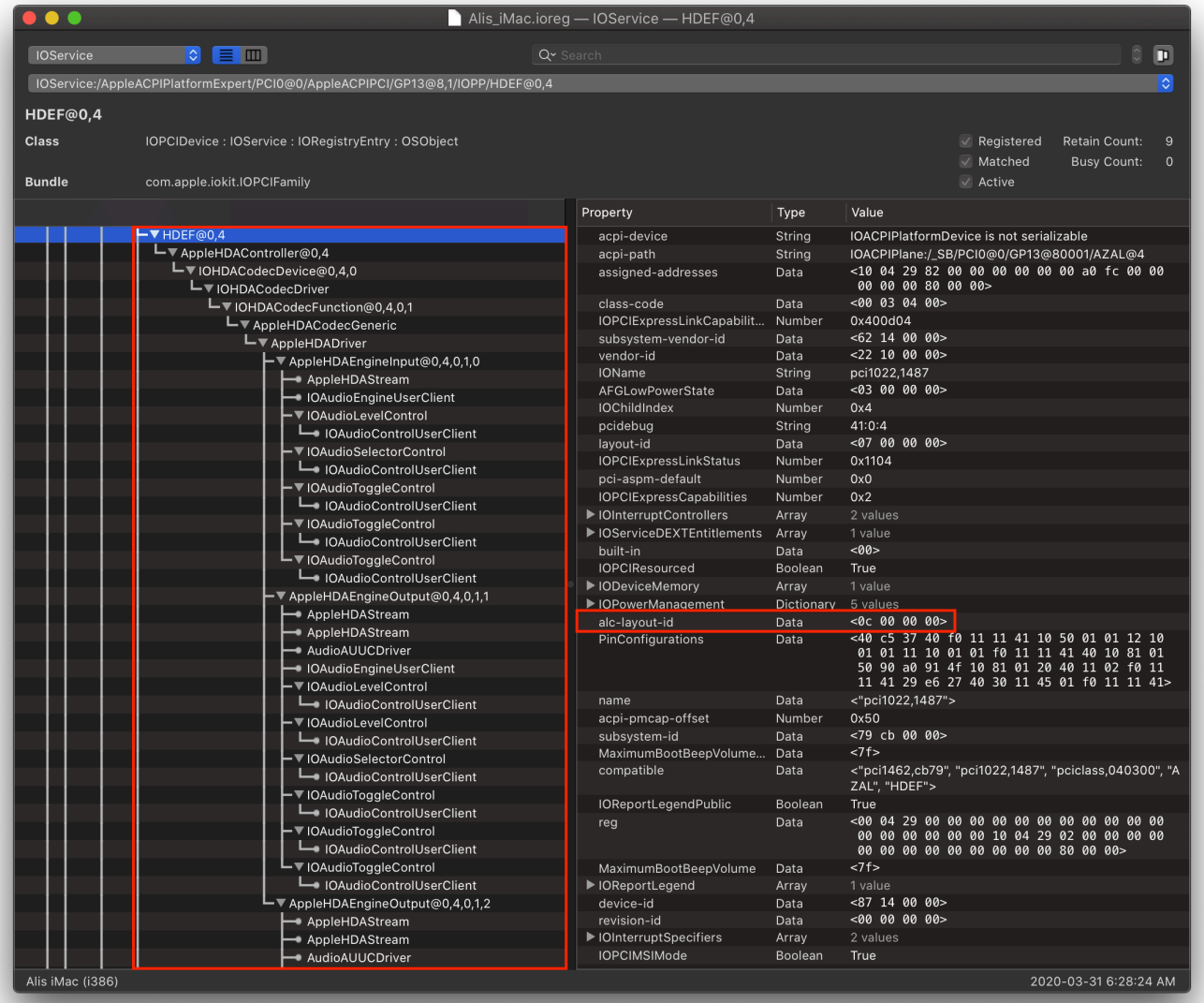
Main places you can check as to why:

- **Injection order**: Make sure that Lilu is above AppleALC in kext order
- **All kexts are latest release**: Especially important for Lilu plugins, as mismatched kexts can cause issues

Note: To setup file logging, see OpenCore Debugging .

Checking if AppleALC is patching correctly

So with AppleALC, one of the most easiest things to check if the patching was done right was to see if your audio controller was renamed correctly. Grab IORegistryExplorer and see if you have an HDEF device:

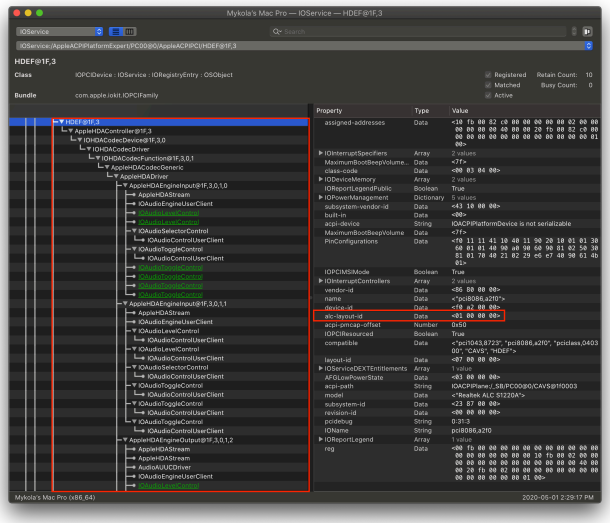
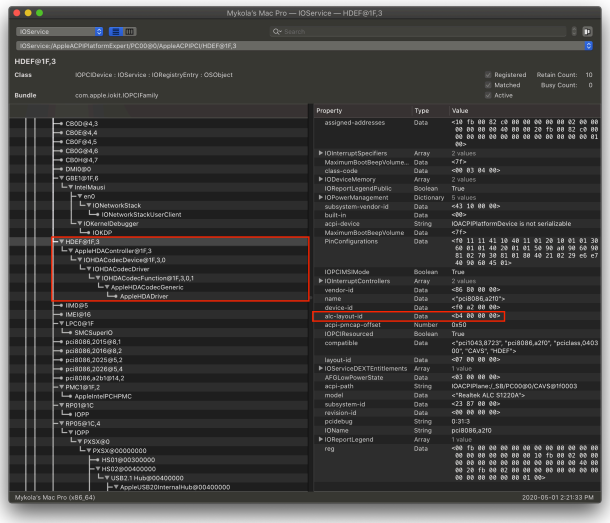


As you can see from the above image, we have the following:

- HDEF Device meaning our rename did the job
- AppleHDAController attached meaning Apple's audio kext attached successfully
- `alc-layout-id` is a property showing our boot-arg/DeviceProperty injection was successful
    - Note: `layout-id | Data | 07000000` is the default layout, and `alc-layout-id` will override it and be the layout AppleHDA will use

Note: **Do not rename your audio controller manually**, this can cause issues as AppleALC is trying to patch already. Let AppleALC do it's work.

More examples:

Correct layout-id	Incorrect layout-id
	

As you can see from the above 2, the right image is missing a lot of AppleHDAInput devices, meaning that AppleALC can't match up your physical ports to something it can understand and output to. This means you've got some work to find the right layout ID for your system.

Checking AppleHDA is vanilla

This section is mainly relevant for those who were replacing the stock AppleHDA with a custom one, this is going to verify whether or not yours is genuine:

```
sudo kextcache -i / && sudo kextcache -u /
```

This will check if the signature is valid for AppleHDA, if it's not then you're going to need to either get an original copy of AppleHDA for your system and replace it or update macOS(kexts will be cleaned out on updates). This will only happen when you're manually patched AppleHDA so if this is a fresh install it's highly unlikely you will have signature issues.

AppleALC working inconsistently

Sometimes race conditions can occur where your hardware isn't initialized in time for AppleHDAController resulting in no sound output. To get around this, you can either:

Specify in boot-args the delay:

Or Specify via DeviceProperties(in your HDEF device):

```
alc-delay | Number | 1000
```

The above boot-arg/property will delay AppleHDAController by 1000 ms(1 second), note the ALC delay cannot exceed 3000 ms

AppleALC not working correctly with multiple sound cards

For rare situations where you have 2 sounds cards(ex. onboard Realtek and an external PCIe card), you may want to avoid AppleALC patching devices you either don't use or don't need patching(like native PCIe cards). This is especially important if you find that AppleALC will not patch you onboard audio controller when the external one is present.

To get around this, we'll first need to identify the location of both our audio

controllers. The easiest way is to run gfxutil and search for the PCI IDs:

Now with this large output you'll want to find your PciRoot pathing, for this example, lets use a Creative Sound-Blaster AE-9PE PCIe audio card. For this, we know the PCI ID is `1102:0010`. So looking through our gfxutil output we get this:

```
66:00.0 1102:0010 /PC02@0/BR2A@0/SL05@0 = PciRoot(0x32)/Pci(0x0,0x0)/Pci(0x0,0
```

From here, we can clearly see our PciRoot pathing is:

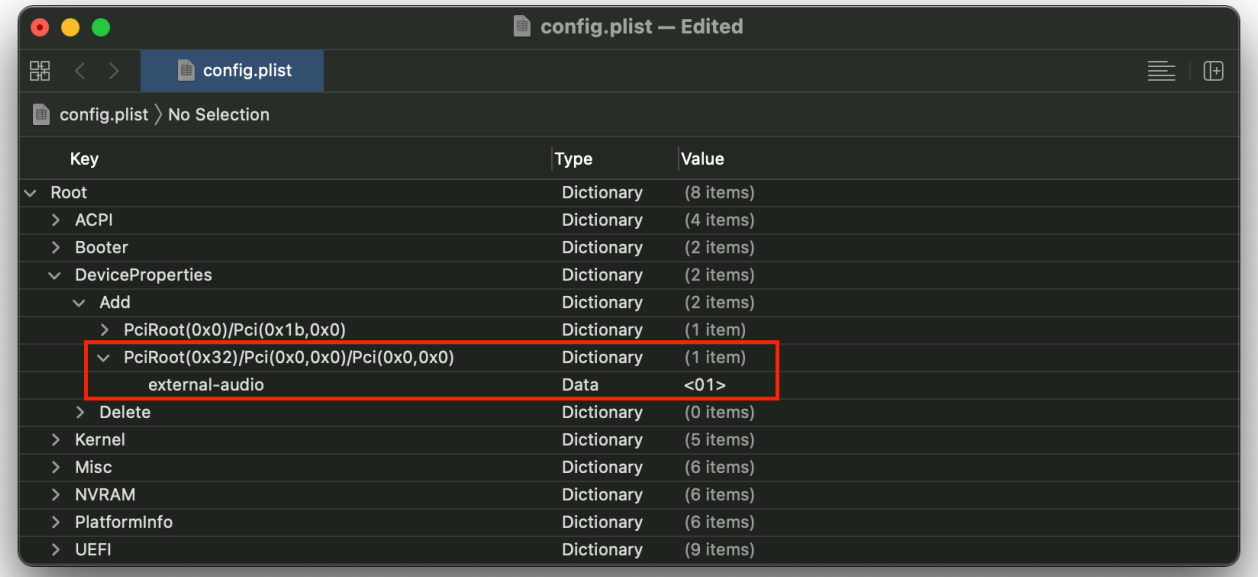
```
PciRoot(0x32)/Pci(0x0,0x0)/Pci(0x0,0x0)
```

- **Note**: This will assume you know both the Vendor and Device ID of the external sound card. For reference, these are the common Vendor IDs:
  - Creative Labs: `1102`
  - AsusTek: `1043`
- **Note 2**: Your ACPI and PciRoot path will look different, so pay attention to **your** gfxutil output

Now that we have our PciRoot pathing, we can finally open up our config.plist and add our patch.

Under DeviceProperties -> Add, you'll want to add your PciRoot(as a Dictionary) with the child called `external-audio`:

```
DeviceProperties
| --- > Add
 | --- > PciRoot(0x32)/Pci(0x0,0x0)/Pci(0x0,0x0)
  | ----> external-audio | Data | 01
```



And with this done, you can reboot and AppleALC should now ignore your external audio controller!

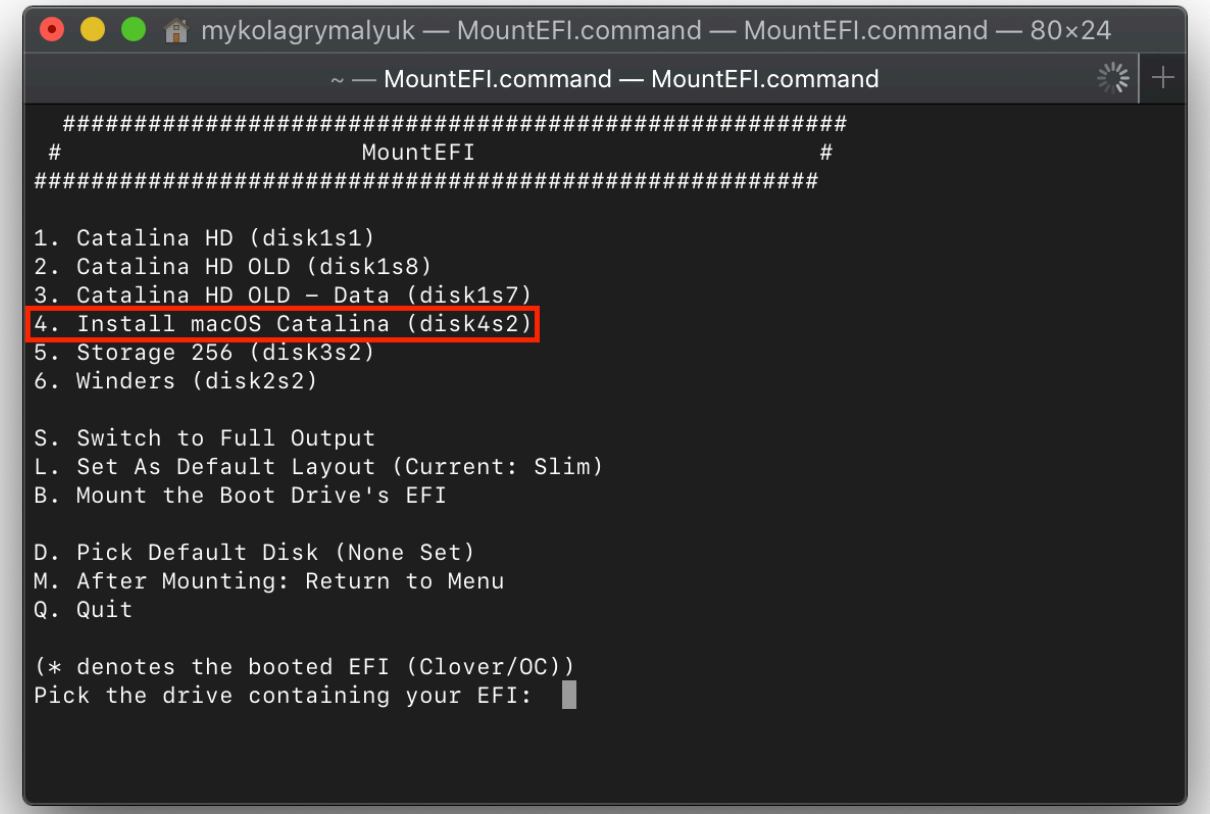
AppleALC not working from Windows reboot

If you find that rebooting from Windows into macOS breaks audio, we recommend either adding `alctsel=1` to boot-args or add this property to your audio device in DeviceProperties:

```
DeviceProperties
| --- > Add
 | --- > PciRoot(0x32)/Pci(0x0,0x0)/Pci(0x0,0x0)(Adjust to your device)
  | ----> alctsel | Data | 01000000
```

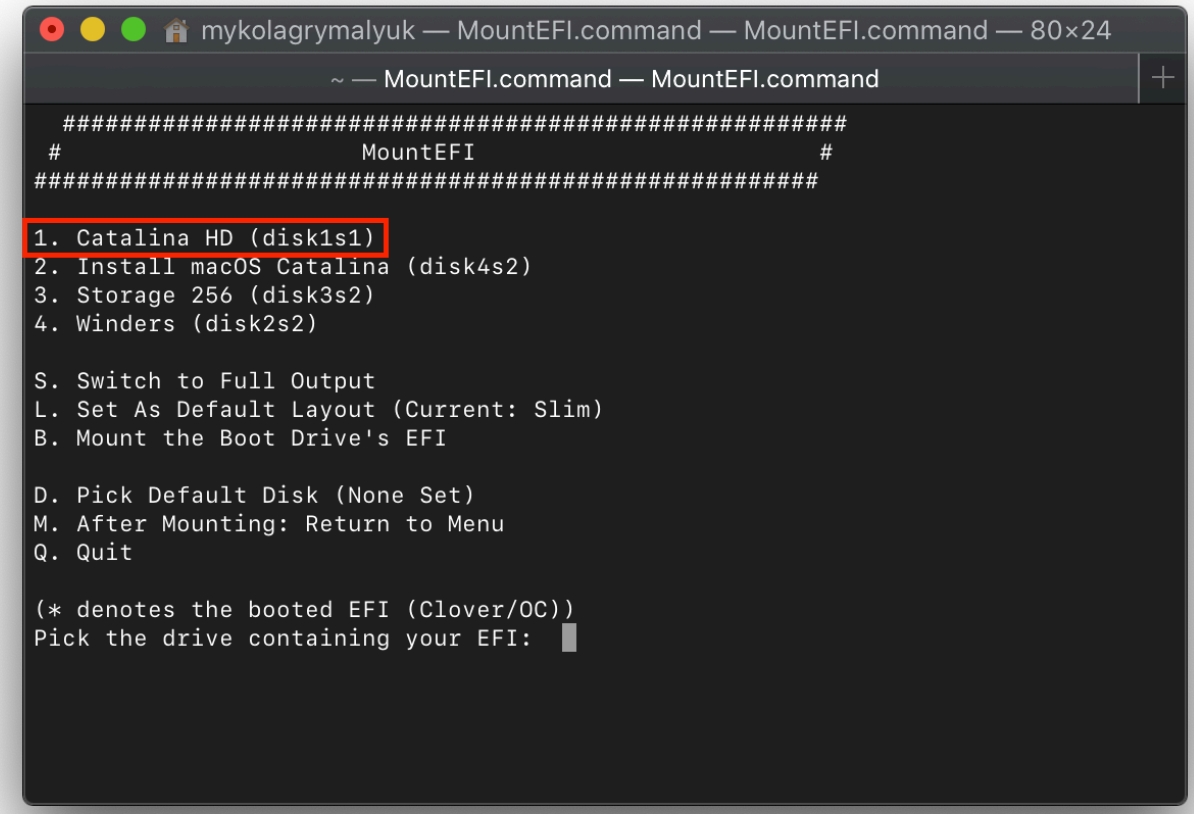
So to start, we'll first want to grab OpenCore off of our installer. To do this, we'll be using a neat tool from CorpNewt called MountEFI

For this example, we'll assume your USB is called `Install macOS Catalina`:

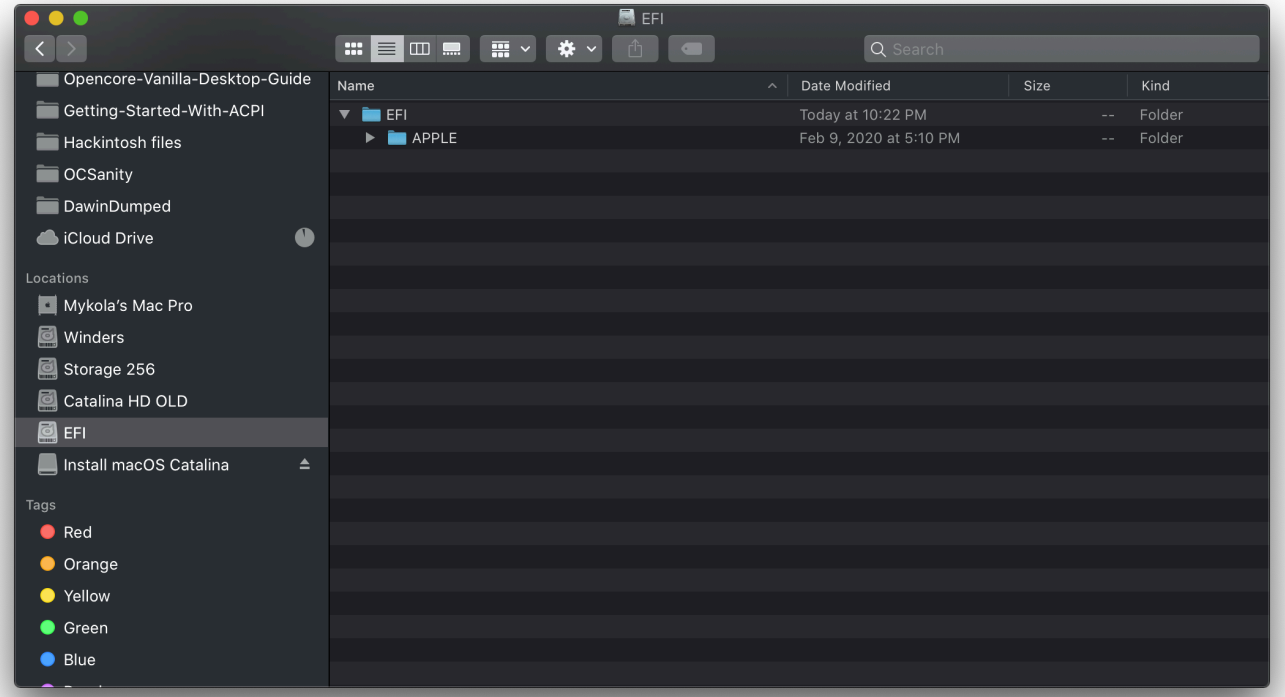


Once the EFI's mounted, we'll want to grab our EFI folder on there and keep in a safe place. We'll then want to **eject the USB drive's EFI** as having multiple EFI's mounted can confuse macOS sometimes, best practice is to keep only 1 EFI mounted at a time(you can eject just the EFI, the drive itself doesn't need to be removed)

Note: Installers made with gibMacOS's MakeInstall.bat on Windows will default to a Master Boot Record(MBR) partition map, this means there is no dedicated EFI partition instead being the BOOT partition that mounts by default in macOS.



Now with this done, lets mount our macOS drive. With macOS Catalina, macOS is actually partitioned into 2 volumes: System Partition and User Partition. This means that MountEFI may report multiple drives in it's picker but each partition will still share the same EFI(The UEFI spec only allows for 1 EFI per drive). You can tell if it's the same drive with disk**X**sY (Y is just to say what partition it is)



When you mount your main drive's EFI, you may be greeted with a folder called `APPLE`, this is used for updating the firmware on real Macs but has no effect on our hardware. You can wipe everything on the EFI partition and replace it with the one found on your USB

Special notes for legacy users

When transferring over your EFI, there are still boot sectors that need to be written to so your non-UEFI BIOS would be able to find it. So don't forget to rerun the `BootInstall.command` on your macOS drive