## [HowTo] Get full NVMe Support for all Systems with an AMI UEFI BIOS - Special Topics / NVMe Support for old Systems - Win-Raid Forum

## @ all:

Please read this before posting into this thread:

This thread has been designed by me for users, who want to do the required BIOS modification themselves by following this guide. Users, who want to get an already modded BIOS, may search for it within <u>>this< 2.4k</u> Sub-Forum or post their request into <u>>this< 492</u> one.

The main topic of this thread is the procedure of the NVMe specific BIOS modification and the support in case of appearing problems. Users, who don't know how to flash a modded BIOS or how to avoid a clean OS installation, should search for a guide/solution by using the Forum's "Search" box and post their request into the related specific thread.

## What is NVMe?

#### ▼ Wikipedia Info: (open/hide by a click)

NVMe is a specification for accessing Solid-State Drives (SSDs), which are attached through the PCI Express (PCIe) bus. "NVM" stands as an acronym for "Non-Volatile Memory", which is used in SSDs.

While Advanced Host Controller Interface (AHCI) interface has the benefit of legacy software compatibility, it does not deliver optimal performance when an SSD is connected via PCI Express bus. This is because AHCI was developed back at the time when the purpose of a host bus adapter (HBA) in a system was to connect the CPU/memory subsystem with a much slower storage subsystem based on rotating magnetic media. Such an interface has some inherent inefficiencies when applied to SSD devices, which behave much more like DRAM than like spinning media.

NVMe has been designed from the ground up, capitalizing on the low latency and parallelism of PCI Express SSDs, and fulfilling the parallelism of contemporary CPUs, platforms and applications. At a high level, the basic advantages of NVMe over AHCI relate to its ability to exploit parallelism in host hardware and software, manifested by differences in depth of command queues, interrupts processing, the number of uncacheable register accesses etc., resulting in various performance improvements.

The table below summarizes high-level differences between the basic NVMe and AHCI device interfaces:

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	AHCI	NVMe
Maximum queue depth	1 command queue;	65536 queues;
maximum queue aepin	32 commands per queue	65536 commands per queue
Uncacheable register accesses	6 per non-queued command;	2 per command
(2000 cycles each)	9 per queued command	2 per commanu
MSI-X	single interrupt;	2048 MSI-X interrupts
and interrupt steering	no steering	2046 MSI-X Interrupts
Parallelism	requires synchronization lock	no locking
and multiple threads	to issue a command	no locking
Efficiency	command parameters require	gets command parameters
for 4 KB commands	two serialized host DRAM fetches	in one 64 Bytes fetch

#### High-level comparison of AHCI and NVMe<sup>[3]</sup>

#### Who can benefit from an NVMe SSD?

Answer: (open/hide by a click)

Everything seems to be prepared for a drastical SSD performance boost by the new data transfer standard named NVMe:

The latest Windows Operating Systems from Win8.1 up natively do support NVMe. For Win7 and Server 2008 R2 users I recommend to read the start post of <a href="https://www.enablestate.org">>this< 240</a> thread.

Nearly all mainboard manufacturers are meanwhile offering new BIOS versions with full NVMe support for their mainboards with an Intel 9-Series or X99 Chipset.

Many consumer SSDs with NVMe support are already available or will be available soon.

There is no doubt, that users with an up-to-date mainboard, whose BIOS contains the required NVMe module(s), will benefit from the performance boost initiated by an NVMe supporting SSD.

#### What about MBs with an UEFI BIOS, but w/o NVMe Support?

▼ **Answer:** (open/hide by a click)

When I started this thread in April 2015, these were the most interesting questions regarding NVMe support:

Is it possible to give natively not supported systems the option to boot off an NVMe SSD by modding the BIOS?

If yes, which modules have to be inserted and how has it to be done?

After having done the related test with my old Intel Z68 system I found in June 2015 the first time answers to the questions. My success report can be found here: <a href="https://winraid.level1techs.com/t/howto-get-full-nyme-support-for-all-systems-with-an-ami-uefi-bios/30901/117">https://winraid.level1techs.com/t/howto-get-full-nyme-support-for-all-systems-with-an-ami-uefi-bios/30901/117</a>. 562

After this first success the method has been optimized and successfully tested with nearly all existing mainboard models.

Since February 2017 we know for sure, that the insertion of the natively missing NVMe module into the UEFI BIOS enables the ability to boot off an NVMe SSD for all natively not supported Intel and AMD Chipset systems.

You can find the well approved latest version of my Guide within the next chapter.

## Guide about how to get full NVMe support

(valid for all Intel/AMD chipset systems with an AMI UEFI BIOS)

(last updated: 12/04/2022)

Changelog:

Guide structure optimized (as good as possible)

## This is what you should know:

#### ▼ **Details:** (open/hide by a click)

It is no problem to get a PCIe or M.2 connected NVMe SSD working with an old system without modifying the mainboard BIOS, if

a) the NVMe SSD will be used just for the **storage** of data (as drive D:, E: etc.)

#### and

b) an appropriate NVMe driver is present within the Operating System (either natively or loaded/integrated),

## but the usage of such SSD as bootable system drive C: (incl. the boot sector) usually requires a special mainboard BIOS EFI module, which has to be loaded while booting.

Note: Some NVMe SSDs like Samsung's 950 Pro SSD are natively bootable in LEGACY mode (CSM and loading of Option ROMs has to be enabled within the BIOS), because their Controller chip contains its own NVMe supporting Option ROM module.

#### These are the best pre-conditions for a successful implementation and configuration of an NVMe SSD as bootable system drive:

The desired OS should be Win10 or Win11 (due to their native NVMe support).

The mainboard BIOS should offer the required UEFI boot settings.

It should be possible to get a modded BIOS successfully flashed into the system's BIOS chip.

The on-board SATA Controller should not been set to "RAID" mode within the BIOS.

Tip: Before you start with the preparations, I recommend to read  $\geq$  this  $\leq$  1.4k report written by our Forum member Paulos7.

#### Alternative methods to use an NVMe SSD as bootable drive with older systems (no BIOS modding required):

**"Clover-EFI Bootloader Method"** (the related guide written by our Forum member Nyctophilia can be found <u>>here< 1.5k</u>)

**"DUET-USB Boot Method"** (the related guides written by our Forum members noInk resp. mireque can be found <u>>here< 480</u>, <u>>here< 112</u> and <u>>here< 95</u>.

#### This is what you will need:

▼ **Details:** (open/hide by a click)

#### 1. A modern unzip tool like WinRAR v6.xx or 7-Zip v2xxx

(has to support the RAR5 compression)

## 2. A mainboard with an AMI Aptio UEFI BIOS

#### 3. The desired BIOS version for the related mainboard model

as extracted "pure" BIOS file (not an \*.exe one), original or already pre-modified

#### 4. An appropriate UEFI BIOS modding tool

These are the alternatives:

#### a) An Aptio IV compatible AMI UEFI MMTool

(easy to use and usually best choice for AMI Aptio IV BIOSes: v4.50.0.23)

Important: These tools are not free available.

Tip: Do a Google search for "MMTool Aptio 4.50.0023", join the listed TweakTown site, scroll down to the "AMI (UEFI) BIOS Tools" section and download the desired tool.

#### b) CodeRush's UEFITool

(very good tool for users with advanced BIOS modding knowledge)

The currently latest version can be downloaded from here (as RAR archive):

## <u>>UEFITool v0.28.0< 1.4k (>MIRROR< 327)</u>

Advantage: This tool is free available, works very reliable and can be used with **all** AMI UEFI BIOSes without any restrictions.

Attention: The usage of the UEFITool is not recommended, if the opened BIOS contains one or more listed "Pad-Files" within or just beneath the "DXE Driver Volume". A possible BIOS modding issue (removal of a natively present or addition of a natively not present "Pad File") is caused by a wrong BIOS configuration and not by the UEFITool.

## 5. An appropriate EFI NVME BIOS module

(has to be inserted into the "DXE Driver Volume" of the mainboard's UEFI BIOS)
You have the choice between 2 different NVMe files:
a) NvmExpressDxe\_5.ffs dated 09/20/2021
(uncompressed size: 18 KB, best choice for systems without native NVMe support)

>Download link (MEGA)< 2.3k or ≥Mirror link (OneDrive)< 622 and</p>

## b) NvmExpressDxe\_Small.ffs dated 04/01/2018

(uncompressed size: only 6 KB, recommended for BIOSes with limited DXE Driver Volume space)
>Download Link (MEGA)
888 or <a href="https://www.astacharrendect.edu/astacharrendec

Both sorts of NVMe modules have been compiled and optimized by our Forum member Ethaniel on the basis of the currently latest source code UDK2018, which had been built by the EDK2/Clover Team for rather different purposes regarding the NVMe usage.

The file named "NvmExpress\_Small.ffs" contains just the required code to support booting off an NVMe SSD and should be taken, if there is not enough space available within the BIOS (resp. its DXE Driver Volume) for the insertion of the bigger sized "NvmExpressDxe\_5" module.

Both NVMe modules have been successfully tested. For details look  $\geq$ here< 214 and  $\geq$ here< 62.

Notes:

The "Small" variant should be taken, if the BIOS tool gives you the message "File size exceeds the BIOS volume size" while trying to insert one of the above mentioned uncompressed modules.

After having successfully inserted any of the above offered NVMe modules the related name "NvmExpressDxe\_5" resp. "NvmExpressDxe\_Small" will be shown by the related BIOS tool.

Credits go to

a) the **EDK2 Team** resp. the Clover Team at InsanelyMac (<a>>LINK< 41</a>) for the source file UDK2018,

b) our Forum member **davidm71** for his efforts to make the source file usable as additionally insertable EFI NVMe BIOS module, which is loaded while booting off an NVMe SSD in UEFI mode and

c) to our Forum member Ethaniel for having completely re-structured, optimized, shrinked and re-compiled the NVMe modules.

Since these special NVMe modules worked until now with **all** tested mainboards, whose BIOS is an AMI UEFI one, there is no doubt for me, that it will properly work with your special mainboard UEFI BIOS as well.

#### This is what you should do:

## Step 1 - Preparation:

▼ **Open Guide:** (open/hide by a click)

Create a separate folder within the root of any PC partition, name it anyhow (here: D:\Source BIOS) and copy the "pure" (completely extracted) source BIOS file into that folder.

Additionally you should create another, but currently empty folder for the later created modded BIOS (example: D:\Mod BIOS).

#### Only for ASUS BIOSes with the suffix \*.CAP:

To avoid problems while trying to flash later on the modded \*.CAP file via the ASUS USB Flashback method, it is recommended to extract the "Body" of the original \*.CAP BIOS. This can easily be done with the UEFITool by opening the \*.CAP file, doing a right-click onto the "AMI Aptio Capsule", choosing the "Extract body..." option and saving it as \*.ROM file.

<u>>Here<</u> you can find the complete instructions layed down by Lost\_N\_BIOS.

Unzip the downloaded AMI Aptio MMTool resp. the UEFITool and the chosen NvmExpressDxE module into the "Source BIOS" folder.

## Step 2 - BIOS modification (2 alternative Methods):

#### A. Guide for the usage of AMI's MMTool 4.50.0023:

(easiest and usually successful method for AMI Aptio IV BIOSes)

#### • **Open Guide:** (open/hide by a click)

#### a) Opening the BIOS file and finding the target DXE Volume:

Double-click onto the file named MMTool.exe.

Click onto the "Load Image" button and navigate to the folder, where the source BIOS is located. If it should not yet been shown within the pop-up window, choose the file type option "All files (\*)", which is located at the bottom of the "MM Open" window.

After having double-clicked onto the BIOS file, which you want to get modified, you will see a picture similar to this one:

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01         01         CpuDxe         0000187B         E03ABADF-E536-4E88-B3A0-B77F7i           01         02         ASUSPDSTMessagePEI         000003CE         1A331FB8-C466-454A-B684-73ADA2           01         03         FileSystem         000046F         93022F8C-1F09-47EF-B8B2-5814FFft           01         04         000064F         93022F8C-1F09-47EF-B8B2-5814FFft           01         04         000002D7         9221315B-308B-4685-813E-1B1BF4           01         06         CORE_DXE         000002D7         9221315B-308B-4685-813E-1B1BF4           01         06         CORE_DXE         000002D7         9221315B-308B-4685-813E-1B1BF4           01         06         CORE_DXE         00000513A         B5253C4A-383A-41E8-A82E-44984           01         08         Ft8bUpdate         00000027A         97D3EF84-C68B-4A82-A080-5F8A4(           01         09         ASUSXBBUpdate         0000027A         7D1E1A81-08E1-4449-8F04-9EF68C           01         08         PcBus         0000027A         3C1DE39F-D207-408A-AACC-731CF1           01         08         PcBus         000007273         3C1DE39F-D207-408A-AACC-731CF1           01         00         EBC         0000136A         93A0016-AE55-4288-828D-D22FDE <t< td=""><td>00</td><td>00</td><td></td><td>0000FFB8</td><td>CEF5B9A3-476D-497F-</td><td>9FDC-E98143</td><td>3</td></t<>	00	00		0000FFB8	CEF5B9A3-476D-497F-	9FDC-E98143	3
01         02         ASUSP0STMessagePEI         000003CE         1A931F88-C466-454A-8684-73ADA2           01         03         FileSystem         0000464F         93022F8C-1F09-47EF-B8B2-5814FF6           01         04         000002D3         DAC2B117-85FB-4964-A312-0DCC7           01         05         000002D7         92213158-308B-4685-8132-181BF4           01         06         CORE_DXE         000002F4         CBC59C4A-383A-412B-A8EE-4498A1           01         06         CORE_DXE         00000EF4         CBC59C4A-383A-412B-A8EE-4498A1           01         07         Runtime         00000EF4         CBC59C4A-383A-412B-A8EE-4498A1           01         08         FIB5Update         00000E7A         57D3EF64-C64B-4482-A080-5F8A4(           01         09         ASUSXBBUpdate         00000273         3C1DE 39F-D207-408A-AACC-731CF1           01         0A         ReFlash         00007273         3C1DE 39F-D207-408A-AACC-731CF1           01         0D         EBC         0000180A         13AC5DD-0730-11D4-805B-00AA0           01         0D         EBC         0000180A         13AC5DD-0730-11D4-805B-00AA0           01         0F         ECFWUpdate         00001946         58265240-A0FD-4663-825-1230E4           0	01	00		00002018	17088572-377F-44EF-8	F4E-B09FFF4	4
01         03         FileSystem         0000464F         93022F8C-1F09-47EF-BB82-5814FF(           01         04         00006103         DAC28117-B5FB-4364-A312-00 CC7           01         05         000002D7         9221315B-30B8-4685-813E-1B1BF4           01         06         CORE_DXE         000213A8         5AE3737E-4EAE-41AE-8240-354658           01         07         Runtime         00006EF4         CBC59C4A-383A-41EB-A8EE-4496A           01         08         FIBbUpdate         0000027A         5703EF84-C648-4482-A4808-578A4(           01         08         Reflash         0000027A         5703EF84-C648-4482-A4808-578A4(           01         0A         Reflash         0000027A         5703EF84-C648-4482-A4808-578A4(           01         0A         Reflash         0000027A         70E1A818-0BE1-4449-BF04-9EF68C           01         0A         Reflash         000007273         3C1DE39F-D207-408A-AACC-731CF1           01         0B         PoiBus         00001733         9F3A0016-AE55-4288-829D-D22FD5           01         0D         EBC         0000180A         13AC6DD-0730-1104-B068-00AA0           01         0E         ECDXE         00001966         E79A7050-8109-4001-83C0-2A3C74           01	01	01	CpuDxe	0000187B	E03ABADF-E536-4E88-	B3A0-B77F7	£
01         04         000061D3         DAC2B117.85FB-4964-A312-0DCC7           01         05         000002D7         9221315B-308B-4685-613E-1B1BF4           01         06         CORE_DXE         000002D7         9221315B-308B-4685-613E-1B1BF4           01         06         CORE_DXE         000012BAB         5AE3737E-4EAE-41AE-8240-35465B           01         07         Runtime         00006EF4         CBC59C4A-383A-41EB-A6EE-4498A1           01         08         FtBbUpdate         0000009B         0DE08EE-6E73-4764-A883-37A47.           01         09         ASUSXBBUpdate         0000027A         57D3EF84-C64B-4A82-A080-5F8A4.           01         04         ReFlash         0000213A         70E1A818-08E1-44498FD4-9EF68C           01         0B         PciBus         00007273         3C1DE39F-D207-408A-AACC-731CF1           01         0C         AmiBoardInfo         00005134         9F3A0016-AE55-4288-629D-D22FDC           01         0D         EBC         0000180A         13ACSDD-730-11D-48068-00AA0           01         0E         ECDXE         00001946         585C6240-A0FD-46C3-9825-123064           01         0F         ECFWUpdate         00001946         585C6240-A0FD-46C3-9825-1123064           01	01	02	ASUSPOSTMessagePEI	000003CE	1A931FB8-C466-454A-8	3684-73ADA2	2
01         05         000002D7         9221315B-30BB-4685-813E-1B1BF4           01         06         CORE_DXE         000213AB         5AE3F37E-4EAE-41AE-8240-35465B           01         07         Runtime         000002D7         DED86EF-6E79-4764-AAB3-37AF7.           01         08         FtBbUpdate         0000090B         DDED86EF-6E79-4764-AAB3-37AF7.           01         09         ASUSXBBUpdate         00000213A         70E1A818-0BE1-4449-8FD-49EF68C           01         0A         ReFlash         0000213A         70E1A818-0BE1-4449-8FD-49EF68C           01         0A         Reflash         0000773         3C1DE 39F-0207-408A-AACC-731CFI           01         0C         AmiBoardInfo         00005134         9F3A0016-AE55-4288-8290-022FD2           01         0D         EBC         0000190A         13AC6D0-7300-110-48068-00AA0           01         0E         ECDXE         00001956         E79A7050-8109-4001-83C0-2A3C74           01         0F         ECPWUpdate         00001956         E79A7050-8109-4001-83C0-2A3C74           01         0F         ECPWUpdate         00001946         58566240-A0F0-46C3-3825-1E3064           01         0F         ECPWUpdate         000019561         2CA21958-67A7-441A-A04A-7090993.     <	01	03	FileSystem	0000464F	93022F8C-1F09-47EF-E	BB2-5814FF	E
01         06         CORE_DXE         000219AB         5AE3F37E-4EAE-41AE-8240-35465B           01         07         Runtime         00006EF4         CBC59C4A-383A-41EB-A8EE-4498AI           01         08         Ft8bUpdate         0000090B         0DE08EE-6E79-4764-A883-37A47;           01         09         ASUSXB8Update         00000E7A         57D3EF84-C64B-4A82-A980-5F8A4(           01         0A         ReFlash         00000273         3C1DE 39F-D207-408A-AACC-731CF1           01         0B         PciBus         00007273         3C1DE 39F-D207-408A-AACC-731CF1           01         0C         AmiBoardInfo         000015134         9F3A0016-AE55-4288-829D-D22FD3           01         0D         EBC         00001056         E79A7050-8109-40D1-83C0-2A3C74           01         0F         ECFWUpdate         0000156         E79A7050-8109-40D1-83C0-2A3C74           01         0F         ECFWUpdate         00001946         58C5C240-A0FD-46C3-3825-123064           01         0F         ECFWUpdate         00001561         2CA21958-67A7-441A-404A-709099;           01         10         00005531         2CA21958-67A7-441A-404A-709099;         111           10         01000EF1         D31FAA2D-8436-47A1-441A-A04A-709099;         111	01	04		000061D3	DAC2B117-B5FB-4964-	A312-0DCC7	-
01         07         Runtime         00006EF4         CBC59C4A-383A-41EB-A8EE-4498AI           01         08         FIBbUpdate         0000090B         0DD08EE-6E79-4764-A883-37A47;           01         09         ASUSXB8Update         0000027A         57D3EF84-C64B-4A82-A080-5F8A4(           01         0A         ReFlash         0000213A         70E1A818-0BE1-44498FD4-3EF68C           01         0B         PciBus         00007273         3C1DE39F-027-408A-AACC-731CFI           01         0C         AmiBoardInfo         000015134         9F3A0016-AE55-4288-829D-022FDE           01         0D         EBC         0000180A         13AC6DD0-730-0110-4B-068-00AA0           01         0E         ECDXE         00001966         E79A7050-8109-40D1-83C0-2A3C74           01         0F         ECFWUpdate         00001966         E79A7050-8109-40D1-83C0-2A3C74           01         0F         ECFWUpdate         00001946         585C6240-A0FD-46C3-825-123064           01         10         00005E31         2CA21958-67A7-441A-404A-709099;           01         11         S10RasicI/DXe         000005E1         2CA2195A-67A7-441A-404A-709099;	01	05		000002D7	9221315B-30BB-46B5-8	313E-1B1BF4	
01         08         Ft8bUpdate         0000090B         0DED86EF-6E79-4764-A483-37A47;           01         09         ASUSX8BUpdate         0000027A         57D3EF84-C648-A482-A080-5F8A4(           01         0A         Reflash         0000213A         70E1A818-08E1-44498-482-A080-5F8A4(           01         0A         Reflash         0000213A         70E1A818-08E1-44498-482-A080-5F8A4(           01         0B         PoiBus         00007273         3C1DE39F-D207-408A-AACC-731CF1           01         0C         AmiBoardInfo         00005134         9F3A0016-AE55-4288-823D-D22FD2           01         0D         EBC         0000180A         13AC6DD0-73D0-11D4-8068-00AA0           01         0E         ECDXE         00001346         585C6240-A0FD-46C3-9825-1123064           01         0F         ECFWUpdate         00001546         585C6240-A0FD-46C3-9825-1123064           01         0F         ECFWUpdate         00001543         585C6240-A0FD-46C3-9825-1123064           01         0         0         00005513         2CA21958-67A7-441A-404A-7090993;           01         11         S10RasicI/DDxe         000005613         2CA21958-67A7-441A-404A-7090993;	01	06	CORE_DXE	000219AB	5AE3F37E-4EAE-41AE-	8240-35465E	3
01         09         ASUSXBBUpdate         00000E7A         57D3EF84-C64B-4A82-AD90-5F8A4(           01         0A         ReFlash         0000213A         70E1A818-0BE1-4449-BFD-49EF68C           01         0B         PciBus         00007273         3C1D239F-0207-408A-AACC-731CFI           01         0C         AmiBoardInfo         00005134         9F3A0016-AE55-4288-8290-022FD3           01         0D         EBC         0000180A         13AC6DD-7300-110-48068-00AA0           01         0E         ECDXE         00001056         E79A7050-8109-4001-83C0-2A3C74           01         0F         ECPWUpdate         00001563         2CA21958-67A7-441A-A04A-709093;           01         10         00005E31         2CA21958-67A7-441A-A04A-709093;         01114           01         11         SI0RasicI/Dxe         00000167         D31FAA20-R436-4F3-44AA-04A-709093;	01	07	Runtime	00006EF4	CBC59C4A-383A-41EB-	A8EE-4498A	
01         0A         ReFlash         0000213A         70E1A818-0BE1-4449-BFD4-3EF68C           01         0B         PciBus         00007273         3C1DE 39F-D207-408A-AACC-731CFI           01         0C         AmiBoardInfo         00005134         9F3A0016-AE55-4288-829D-D22FD3           01         0D         EBC         0000180A         13ACEDD0-7300-1104-8068-00AA0           01         0E         ECDXE         00001056         E79A7050-8109-40D1-83C0-2A3C74           01         0F         ECFWUpdate         00001563         2CA21958-67A7-441A-A04A-709099;           01         10         00005E31         2CA21958-67A7-441A-A04A-709099;         0111           11         SI0RasicI0Dxe         00000F11         D31FAA20-8436-421-34-940FC47C7F	01	08	FtBbUpdate	0000090B	0DED86EE-6E79-4764	AA83-37A47	2
01         08         PciBus         00007273         3C1DE39F-D207-408A-AACC-731CFI           01         0C         AmiBoardInfo         00005134         93A0016-AE55-4288-829D-D22FD5           01         0D         EBC         0000180A         13AC6D0-7300-11D 4-B068-00AA0           01         0E         ECDXE         00001966         E79A7050-8109-40D1-83C0-2A3C74           01         0F         ECFw/Update         00001946         58565240-A0FD-46C3-9825-1E3064           01         10         00005E31         2CA21958-67A7-441A-A04A-709099;           01         11         SU0RasicI0Dxe         000005E31         D31EAA20-8436-43-9-49A0F-047C7F	01	09	ASUSXBBUpdate	00000E7A	57D3EF84-C64B-4AB2-	AD80-5F8A4	(
01         0C         AmiBoardInfo         00005134         9F3A0016AE55-4288-829D-D22FDE           01         0D         EBC         0000180A         13AC6DD0-73D0-11D4-B06B-00AA0           01         0E         ECDXE         00001966         E79A7050-8109-40D1-B3C0-2A3C74           01         0F         ECFwUpdate         00001946         585C6240-A0FD-46C3-9B25-1E3064           01         10         00005E31         2CA21958-67A7-441A-A04A-709093;           01         11         SIDBasicI0Dxe         00000FE1         D31FA420-B436-4F3-494A6-C49093;	01	0A	ReFlash	0000213A	70E1A818-0BE1-4449-E	3FD 4-9E F680	
01         0D         EBC         0000180A         13AC6DD0-73D0-11D4-8068-00AA0           01         0E         ECDXE         00001056         E79A7050-8109-40D1-83C0-2A3C74           01         0F         ECPWUpdate         00001946         58566240-A0FD-46C3-8825-1E3064           01         10         00005E31         2CA21958-67A7-441A-A04A-709099;           01         11         SI0RasicI0Dxe         000006E1         D31FAA20-8436-4F3-49A6F-747CF	01	OB	PciBus	00007273	3C1DE39F-D207-408A-	AACC-731CF	1
01         0E         ECDXE         00001056         E79A7050-8109-40D1-83C0-2A3C74           01         0F         ECFWUpdate         00001946         58565240-A0FD-46C3-9825-1E3064           01         10         00005E31         2CA21958-67A7-441A-A04A-709099;           01         11         SIGRasicIODxe         00000FE1         D31EAA20-8436-43-43-441A-644-709099;	01	0C	AmiBoardInfo	00005134	9F3A0016-AE55-4288-8	329D-D22FD3	
01         0F         ECFWUpdate         00001946         585C6240-A0FD-46C3-9825-1E3064           01         10         00005E31         2CA21958-67A7-441A-A04A-709099;           01         11         SIDBasicI0Dxe         000006F1         D31EAA20-8436-4E34-9A06-C47C7E ¥	01	0D	EBC	00001B0A	13AC6DD0-73D0-11D4	-B06B-00AAC	)
01         0F         ECFWUpdate         00001946         585C6240-A0FD-46C3-9825-1E3064           01         10         00005E31         2CA21958-67A7-441A-A04A-709099;           01         11         SIDBasicI0Dxe         000006F1         D31EAA20-8436-4E34-9A06-C47C7E ¥	01	0E	ECDXE	00001056	E79A7050-8109-40D1-8	33C0-2A3C74	4
01 10 00005E31 2CA21958-67A7-441A-A04A-709099: 01 11 SIDBasid0Dxe 000006E1 D31EAA20-8436-4E34-9A06-047C7E ♥							
01 11 SIDBasicIDDxe 000006E1 D31EAA20-8436-4E34-9A06-C47C7E *	01	10		00005E31	2CA21958-67A7-441A-/	A04A-709099	¢ .
	01		SIOBasicIODxe	000006F1	D31EAA20-8436-4E34-	9406-047078	× .
	<						

Scroll down within the great MMTool window until you find the module with the FileName "CSMCORE".

Click onto the line with the FileName "CSMCORE". After having done that, the number of the Volume will be shown within the box named "Vol. Index" in the upper part of the MMTool GUI.

Here is the related picture of my test BIOS:

MMTo	ol Aptio-	P8Z68-V-ASUS-3603.ROM		_		$\times$
Load Im	age	Insert Replace Delete Extract 0	CPU Patch Rom	Hole		
Loga III	ago			1		
Save Im	age	Module file			Browse	
Save Imag	je as	Vol. Index 01				
		For Option ROM	1 only	Insert FFS Options -	1	
Create R	eport	🗌 Link Prese	nt	Insert As is		
Close		Vendor ID Devi	ce ID	C Insert Compressed	Insert	
					Insert	
Volume	Index	FileName	Source size	GUID		^
01	53	ACPIRAM	000012DF	37DA43A1-BB9A-4805	5-9B92-0BDE1	t:
01	54	BootPriority	00000834	5F6A843E-D188-41A3	-BA3C-A83D8	35
01	55	ASUSFTMDXE	00000772	3C35B99D-D4B7-4885	5-ABD9-2BEA	4
01	56	ASUS MEUpdate DXE	000016EF	68DB9E58-4B9C-4E60	)-8DA6-9A714	4[
01	57		000EC30B	5F8E4250-CF9E-402B	-9921-796096	35
01	58	AcpiPlatform	00001B30	8B5FBABD-F51F-4942	BF16-16AAA	č.
01	59	AcpiPlatformSmi	00000904	DFD8D5CC-5AED-482	0-A2B6-5C55	ίE
01	5A	PlatformInfo	00000647	1314216C-CB8D-4210	-B854-06231	3
01	5B	SMBIOSUpdateData	0000060F	B98999A4-E96F-475A	-99FC-762126	3F
01	5C	CSMCORE	00036E06	A062CF1F-8473-4AA3	-8793-600BC4	1
01	5D		00000409	A08276EC-A0FE-4E06	6-8670-385336	31
01	5E	BIOSBLKIO	00001948	25ACF158-DD61-4E64	4-9A49-55851	E
01	5F	CsmVideo	00002429	29CF55F8-B675-4F5D	-8F2F-B87A3E	Ξ
01	60	CmosManagerSmm	00001AC5	6869C5B3-AC8D-4973	3-8B37-E354D	Æ
01	61	EzFlashDxe	00000A87	FC63ED62-949D-4FB0	)-B754-D5584	AE.
01	62	EzFlash	00006FDE	3470CCF0-6054-11DD		
01	63		000057EA	3DCE5A33-0152-4B67		
01	64		00003118	0E0DB566-F7A9-4DB		
01	65	EzSetun	00007FE5	210DCB72-BC14-4A19		
<					>	

In my test BIOS it was the Volume "01", but this is just an example. In other BIOSes the CSMCORE module may be within a Volume with another number (e.g. "04" or "02:01.00").

Since the CSMCORE module is present within nearly all AMI UEFI BIOSes and always located within the DXE Volume, where the NVMe module has to be inserted, you are now within the target Volume.

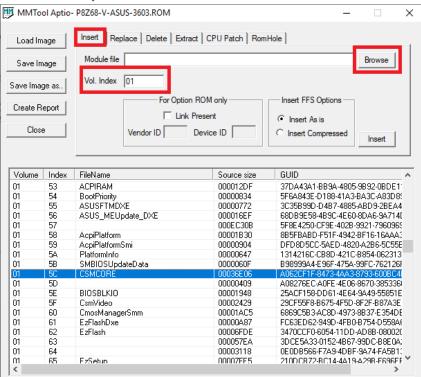
Note: In the very rare case, that the MMTool doesn't show any module named "CSMCORE", you should scroll down the MMTool window with the listed modules until you find the first ones with the letters "DXE" within its name. This way you can be sure, that you are within the correct "DXe Driver Volume", where the NVMe module has to be inserted.

#### b) Insertion of the NVMe module

Make sure, that the correct DXE Driver Volume number (usually with the CSMCORE module within it) has been written into the Vol. Index box.

Click onto the "Insert" tab on the on-top MMTool menu bar.

Here is the related picture:



Click onto the "Browse" button and navigate the folder, where your desired NVMe module as "pure" \*.ffs file is located.

Double-click onto the \*.ffs file you want to get inserted.

Now you will see a picture like this:

MMToo	ol Aptio-	P8Z68-V-ASUS-3603.ROM		- 0
Load Im	ane	Insert Replace Delete Extract	CPU Patch Rom	Hole
2000 111	ago j			
Save Im	age	Module file D:\Source BIOS\NvmEx	pressDxe_5.ffs	Browse
Save Imag	ge as	Vol. Index 01		
Courte D		For Option ROI	I only	Insert FFS Options
Create R	eport	Link Prese	ent	Insert As is
Close	•	Vendor ID Devi	ce ID	C Insert Compressed
Volume	Index	FileName	Source size	GUID
01	53	ACPIBAM	000012DF	37DA43A1-BB9A-4805-9B92-0BDE1
01	54	BootPriority	00000834	5F6A843E-D188-41A3-BA3C-A83D8
01	55	ASUSFTMDXE	00000772	3C35B99D-D4B7-4885-ABD9-2BEA4
01	56	ASUS MEUpdate DXE	000016EF	68DB9E58-4B9C-4E60-8DA6-9A714[
01	57	- · -	000EC30B	5F8E4250-CF9E-402B-9921-7960965
01	58	AcpiPlatform	00001B30	885FBABD F51F-4942-BF16-16AAA3
01	59	AcpiPlatformSmi	00000904	DFD8D5CC-5AED-4820-A286-5C55E
01	5A	Diversity of the		
	34	PlatformInfo	00000647	1314216C-CB8D-421C-B854-062313
01	5B	Platforminto SMBIOSUpdateData	00000647 0000060F	1314216C-CB8D-421C-B854-062313 B98999A4-E96F-475A-99FC-762126F
01	5B	SMBIOSUpdateData	0000060F	B98999A4-E96F-475A-99FC-762126F
01 01	5B 5C	SMBIOSUpdateData	0000060F 00036E06	B98999A4-E96F-475A-99FC-762126F A062CF1F-8473-4AA3-8793-600BC4I
01 01 01	58 5C 5D	SMBIOSUpdateData CSMCORE	0000060F 00036E06 00000409	B9899944-E96F-475A-99FC-762126F A062CF1F-8473-4AA3-8793-600BC4I A08276EC-A0FE-4E06-8670-385336I
01 01 01 01 01	5B 5C 5D 5E	SMBIOSUpdateData CSMCORE BIOSBLKIO	0000060F 00036E06 00000409 00001948	B9899944-E96F-475A-99FC-762126F A062CF1F-8473-4AA3-8793-600BC4I A08276EC-A0FE-4E06-8670-385336i 25ACF158-DD61-4E64-9A49-55851E
01 01 01 01 01 01	58 5C 5D 5E 5F	SMBIOSUpdateData CSMCORE BIOSBLKIO CsmVideo	0000060F 00036E06 00000409 00001948 00002429	B38999A4-E96F-475A-99FC-762126F A062CF1F-8473-4AA3-8739-600BC4I A08276EC-A0FE-4E06-8670-385336 25ACF158-DD61-4E64-9A49-55851E 29CF55F8-B675-4F5D-8F2F-B87A3E
01 01 01 01 01 01 01 01	58 5C 5D 5E 5F 60	SMBIOSUpdateData CSMCORE BIOSBLKIO CsmVideo CmosManagerSmm	0000060F 00036E06 00000409 00001948 00002429 00001AC5	B38939A4-E36F-475A-39FC-762126F A062CF1F-8473-4AA3-8733-600BC4I A08276EC-A0FE-4E-06-6670-385336i 25ACF158-DD61-4E64-9A49-55851E 23CF55F8-B675-4F5D-8F2F-B87A3E 6869C5B3-AC8D-4973-8B37-E354DE
01 01 01 01 01 01 01 01 01	58 5C 5D 5E 5F 60 61	SMBIOSUpdateData CSMCORE BIOSBLKIO CsmVideo CmosManagerSmm EzFlashDxe	0000060F 00036E06 00000409 00001948 00002429 00001AC5 00000A87	B38393944-E36F-475A-99FC-762126F A062CF1F-8473-4AA3-8793-600BC4I A08276EC-A0FE-4E06-8670-385336i 25ACF158-DD61-4E64-9A49-55851E 29CF55F8-8675-4F5D-8F2F-887A3E 6868C56B3-AC8D-4973-8B37-E354DE FC63ED62-949D-4FB0-B754-D558Af
01 01 01 01 01 01 01 01 01 01	58 5C 5D 5E 5F 60 61 62	SMBIOSUpdateData CSMCORE BIOSBLKIO CsmVideo CmosManagerSmm EzFlashDxe	0000060F 00036E06 00000409 00001948 00002429 00001AC5 00000A87 00000A87	B 38999A4-E 96F-475A-99FC-762126F A062CF1F-8473-4AA3-8733-600BC4I A08276EC-A0FE-4E06-8670-385336i 25ACF158-DD51-4E64-9A49-55581E 29CF55F8-B675-4F5D-8F2F-B87A3E 6663C5B3-AC20-4973-8B37-E 35A0E FC63ED62-3940-4F90-8754-0558A4 3470CCF0-6054-11DD-AD88-08002(

You can choose within the "Insert FFS Options" area of the MMTool GUI, whether you want to get the previously chosen module inserted "as it is" (normal option) or in "compressed" form (option in case of limited space within the DXE Volume). Note: Don't touch the "For Option ROM only" area of the MMTool GUI!

Now you can click onto the "Insert" button, which is on the upper right hand side below the "Browse" button (see above picture).

After having done that, the insertion of the desired NVMe module should be done automaticly and correctly by the MMTool.

Note: If the MMTool should not be able to insert the desired module properly, the MMTool will give you a meaningful error message (e.g. **"Not enough space within the Volume"**). In this case you should try to get the "small" variant of the NVMe module in "compressed" form inserted. If there should not even be enough space for this small sized module, I recommend to follow the advices given by MeatWar within the first post of <u>>this<19</u> thread.

As final step you have to store the modded BIOS:

Click onto the button "Save Image as...", navigate to the previously created folder for the modded BIOS (e.g. D:\Mod BIOS) and give the modded BIOS a meaningful name (with the same extension as the original BIOS).

Now you have stored your modded BIOS within the related folder.

#### c) Verification of the successful insertion

Open the modded BIOS as written above by running the MMTool.

Scroll down the content of the MMTool window showing the various modules of the DXE Volume (where the CSMCORE is located) until you come to bottom of that Volume.

The last (undermost) "DXE Driver" module of the related Volume Number should now be new and named either "NvmExpressDxe\_5" or "NvmExpressDxe\_small" (depending on the module variant you had previously inserted.

A picture like this is the proof, that the NVMe module has been successfully inserted:

MMToo	ol Aptio-	P8Z68-V-ASUS	S-3603_mod.ROM		_		Х
Load Im	age	Insert Repla	ace   Delete   Extra	ct CPU Patch Rom	Hole		. 1
Save Im	nage	Module file				Browse	
Save Imag		Vol. Index					
Jave inlag	je as	,	Ear Option	ROM only	Insert FFS Options		
Create R	eport				insent in 5 Options		
~					Insert As is		
Close	•		Vendor ID	Device ID	O Insert Compressed	Insert	
Volume	Index	FileName		Source size	GUID		
01	98	EpuHwModeD		00000B9B	21E34727-3881-4DEE		
01	99	OnBrdDevDX		00001A03	1DACE8EE-CD97-491	E-8A0C-305D	DE DE
01	9A	ASUS_EUPS>		00000AA0	D36DDD2D-1C66-421		
01	9B	ASUS_EUPPE		00000520	7DADBC98-6489-4D1		
01	9C	SynBootablet\	/ar	00000F5B	BFD8ABE9-C091-6543		
01	9D	ProjectSxSMI		0000130A	3F78CB8D-72EE-4148		
01	9E	ProjectDXE		00000EEF	010216CD-9C09-4EB5		
01	9E	Pciel aneDXE		00000CB7	2F4DDD35-F8C0-46D		
01	A0	NvmExpressD	xe_5	00004640	5BE3BDF4-53CF-46A		
02	00	MemoryInit		0002B202	3B42EF57-16D3-44CE		
03	00	MemoryInit		0002B202	3B42EF57-16D3-44CE		
04	00			00009C18	17088572-377F-44EF-		
04	01	UsbBotPeim		00002C5A	8401A046-6F70-4505-		
04	02	Recovery		000028C8	E008B434-0E73-440C		
04	03	CRBPEI		000007DA	0D1ED2F7-E92B-4562		
04	04	ECPEI		00000954	1B2501AD-1116-4958	-B8C3-2739C	21
04	05	WdtPei		00000796	1D88C542-9DF7-4244	-AA90-02B61	1F
04	06	CORE_PEI		0000A612	92685943-D810-47FF		
04	07	SIOBasicIOPe		00000824	0B4BDCEE-74B2-45AI	1.91E1.8E661	27

#### Warning:

Very rarely even AMI's AptioIV MMTool may touch a **"Pad-file"** of the BIOS while executing its NVMe module insertion task. To avoid later problems after having flashed the modded BIOS, I recommend insistently to compare the entire "DXE Driver Volume" of the original and the just modified BIOS regarding the presence and location of Pad-files by using the UEFITool (the MMTool doesn't show the "Pad-files"). The best visual way for such comparison is to open the original and modded BIOS side by side. For details look <u>>here<</u>. The only difference between the original and the modded BIOS should be, that a new DXE driver named "NvmExpressDxe\_5" resp. "NvmExpressDxe\_small" has been added. All other listed modules and Pad-files should stay untouched by the BIOS modification.

If you should realize, that a natively present Pad-file module is missing within the modded BIOS or a natively not present Pad-file has been added within the modded BIOS, post a report into this thread, but don't flash this modded BIOS!

If everything looks fine, you can be sure, that the related module has been properly inserted into the correct GUID section, and you can save the modded BIOS and give it an appropriate name and suffix (usually similar to the original BIOS).

**Only for ASUS BIOSes, whose capsule had been removed by extracting the "Body", but shall be flashed by using the ASUS USB Flashback feature:** Don't forget to re-insert the original capsule and to save the modded BIOS as \*.CAP file according to <a href="https://www.extracting.com">>this</a> 187 guide written by MeatWar.

#### B. Guide for the usage of the UEFITool:

(only recommended for users with advanced BIOS modding knowledge)

• Open Guide: (open/hide by a click)

#### a) Opening the BIOS file and finding the target DXE Volume:

Double-click onto the file named UEFITool.exe.

Use the full size option to see the complete content of the UEFITool GUI.

Click onto "File" from the UEFITool menu bar, choose the option "Open image file..." and navigate to the folder, where the source BIOS is located. If it should not yet been shown within the pop-up window, choose the file type option "All files (\*)", which is located just above the "Open" button.

After having double-clicked onto the BIOS file, which you want to get modified, you will see a picture similar to one of these:

UEFITool 0.25.1 - P8Z68-V-ASUS-3603.ROM					- 🗆 ×
Eile Action Hglp Structure					Information
Name >Intel image	Action	Type Image	Subtype Intel	Text	Full size: 800000h (8388608) Flash chips: 1 Masters: 3 PCH straps: 18 CPU straps: 1
Messages					
UEFITool 0.25.1 - 297Ex62.70 Eile Action Help					ار × □ –
Structure					Information
Name >AMI Aptio capsule	Action	Type Capsule	Subtype Aptio signed	Text	Capsule GUID: 4A3CA688-7723-48F8-803D-578CC1FEC44D Full size: 801000h (8392704) Header size: 1000h (4096) Image size: 600000h (6291456) Flags: 00010001h
Messages parseImageFile: Aptio capsule signature ma	ay become inv	valid after ima	ge modification	s	

Expand the shown image resp. capsule by clicking onto the right-direction arrow in front of them. Now you should see the main contents of the BIOS inclusive the most important "BIOS region".

After having expanded the "BIOS region" by hitting onto the right-direction arrow in front of it, you will see a picture like one of these:

Eile Action Help Structure					Information
Name Plane Descriptor region GbE region NE region >80.80000000000000000000000000000000000	Action	Type Image Region Region Volume Padding Volume Volume Volume Volume Volume	Subtype Intel Descriptor GbE NE BIOS FFSv2 Non-empty FFSv2 FFSv2 FFSv2 FFSv2 FFSv2 FFSv2 FFSv2 FFSv2 FFSv2	Text	Full size: 800000h (8388608) Flash chips: 1 Masters: 3 PCH straps: 18 CPU straps: 1
Messages					

DEFITool 0.25.1 - Z97Ex62.70						-		×
Eile Action Hglp Structure					Information			
Name           ▼ANT Aptio capsule           ▼Intel image           Descriptor region           BE region           ▼BIOS region           ▼BIOS region           >808CE578-8A3D-4F1C-9935-896185C32003           >808CE578-8A3D-4F1C-9935-896185C32003           >808CE578-8A3D-4F1C-9935-896185C32003           >808CE578-8A3D-4F1C-9935-896185C32003           >808CE578-8A3D-4F1C-9935-896185C32003           >808CE578-8A3D-4F1C-9935-896185C32003           >808CE578-8A3D-4F1C-9935-896185C32003           >808CE578-8A3D-4F1C-9935-896185C32003           >808CE578-8A3D-4F1C-9935-896185C32003	Action	Type Capsule Image Region Region Region Volume Volume Volume Volume Volume Volume	Subtype Aptio signed Intel Descriptor GbE NE BIOS FFSv2 FFSv2 FFSv2 FFSv2 FFSv2 FFSv2 FFSv2	Text	Capsule GUID: dA3CA688-7723-48FB-4 Full size: 801000h Header size: 1000h Image size: 600000h Flags: 00010001h	8392784	4)	44D
parseImageFile: Aptio capsule signature may	/ become inv	alid after imag	e modifications					
Opened: Z97Ex62.70								

Due to the complicated and mainboard specific internal structure of the "BIOS region", it may be rather time consuming to find the DXE Volume, where all the EFI modules are located and where an additional EFI module like the NVMe one has to be inserted. The easiest way to find it, is to use the "Search" option of the UEFITool.

This is what I recommend to do after having opened the source BIOS with the UEFITool:

Click onto the menu tab "File" and choose the option "Search...". Now you will get access to the UEFITool "Search" pop-up window.

Click onto the tab "Text" and enter the word "DXE" into the Text box (the "Unicode" option will be checked by default). This is the related picture:

🚳 Search			?	$\times$
Hex pattern Text: DXE	GUID	Text		
Text search o	ptions			
Case sens	sitive			
	C	)K	Cano	el

Once you have hit the "OK" button, you will get a picture like this:

5			
UEFITool 0.25.1 - P8Z68-V-ASUS-3603.ROM			- 🗆 ×
Eile Action Help			
Structure			Information
Name VIntel image Descriptor region KE region NE region SEGEE578-8A3D-4F1C-9935-896185C32DD3 Padding > 8C8EE578-8A3D-4F1C-9935-896185C32DD3 > 8C8EE578-8A3D-4F1C-9935-896185C32DD3 > 8C8EE578-8A3D-4F1C-9935-896185C32DD3 > 8C8EE578-8A3D-4F1C-9935-896185C32DD3 > 8C8EE578-8A3D-4F1C-9935-896185C32DD3	Image Int Region Dev Region Gbi Region ME Region BI Volume FF5 Volume FF5 Volume FF5	criptor ys iv2 empty iv2 empty iv2 empty iv2 empty iv2	Full size: 800000h (8388608) Flash chips: 1 Masters: 3 PCH straps: 18 CPU straps: 1
Messages			
Unicode text "DXE" found in User interface			1
Unicode text "DXE" found in User interface			
Unicode text "DXE" found in User interface			
Unicode text "DXE" found in User interface			
Unicode text "DXE" found in User interface			
Unicode text "DXE" found in User interface	section at offset Eh		
Unicode text "DXE" found in User interface	and the state of the state		

Double click onto any line of the "Messages" you can see at the bottom of the UEFITool GUI. The result is a picture like this one:

UEFITool 0.25.1 - P8Z68-V-ASUS-3603.ROM				- 🗆 X
Eile Action Hglp Structure				Information
Lie 2(10) Hgg Structure Name > 8C3270BD-8982-4F55-9F79-856AD7E987C5 > 3090911C-510E-4834-95A7-7E3E10EE6778 > 04EAAAA1-29A1-1107-8838-00500473D4E8 > 36006009-198A-4617-8483-60919A41ACFC > 8FE205C9-5817-4F8F-9375-89614AF8E199 > 89940707-99FE-4308-9A21-79EC38EAC21 > 78828899-6188-1105-9A50-0090273FC140 > 16271FCA-5509-4A33-93FC-5A3E8128DE86 > 221F104f-034C-48EA-8288-87A967280607 *CD04562C-6864-440A3-A881-C80358282920 DXE dependency section PE32 image section User interface section S077FEF00-4404-47E7-A4C7-6673580F8050 > 87375FC9-4405-47E7-A4C7-6673580F8050 > 63315827-04A5-487A-8090-CFC338E52C9 Mesages	Action Type File File File File File File File Fil	Subtype DXE driver Freeform SWM module DXE driver DXE driver DXE driver DXE driver DXE driver DXE driver DXE driver DXE dependen Compressed User interfa DXE driver DXE driver	Text SMIFlash USBRT UHCD USBINTIS OEMDXE Setup CRBDXE CRBSMI CSpLibDXE AssoBottErrbai	Flash chips: 1 Masters: 3 PCH straps: 18 CPU straps: 1
Unicode text "DXE" found in User interface Unicode text "DXE" found in User interface	section at offset 12h section at offset 16h section at offset 12h section at offset 10h section at offset Eh	•		

As you can see, you are now within the "Compressed section" of a "DXE driver" (which one doesn't matter).

This verifies, that you are now within the DXE Volume of the BIOS (= location, where the EFI modules are stored and can be inserted).

If you close the sub-folders of the related DXE driver GUID by clicking onto the downside arrow in front of it, you will get a picture like this, where all the GUIDs are listed, which are inside the DXE Volume:

NameActionTypeSubtypeTextIntel imageImageIntelDescriptor regionRegionObiObi regionRegionObiNE regionRegionBiosStateS78 eA3D-4F1C-9935-896185C32003VolumePaddingPaddingNon-emptyStateS78 eA3D-4F1C-9935-896185C32003VolumePrisvaRegionBiosStateS78 eA3D-4F1C-9935-896185C32003VolumePrisvaPaddingPaddingPaddingPaddingRewJA031FB4-4664-54A-6488-B3A0-877778E034FEFilePileRawCpuDxeJA031FB4-586-4684-73A0A2C08508FilePilePriePadding-S586-4864-73A0A2C08508FilePS87458-8430-471F-8082-5814FF604075FileJA031FB4-864-7340A2C08508FilePS8-4964-A312-00CC7061B98FileFileFreeformJ0213158-3088-4684-7340A2C08508FileFileDXE correC0E506C4-3834-4184-8240-93546585F181EFileDXE driverS6825937E-4484-40482-A080-55844C1A9547J061086E-6679-4764-AA82-370A2748123FileDXE driverS610930-0023-4004_ACC-3316C0371003J061086E-6679-4764-AA82-330A2174823FileDXE driverJ061086E-6679-4764-AA82-370A22F823FileDXE driverJ061086E-6679-4764-AA82-370A22F823FileDXE driverJ061086E-6679-4764-AA82-370A22F823FileDXE driverJ061086E-6679-4764-AA82-370A	acture						Information
IntelImageIntelFlahHips: 1DescriptorRegionDescriptorMasters: 3Ober regionRegionRegionDescriptorRegionRegionRegionMEVEIOS regionRegionBIOSSBGEC578-8A3D-4F1C-9935-896185C32D03VolumeFFSv2PaddingPaddingNon-emptyVSC8EC578-8A3D-4F1C-9935-896185C32D03VolumeFFSv2PaddingPaddingNon-emptyVSC8EC578-8A3D-4F1C-9935-896185C32D03VolumeFFSv2Jobashaon-E536-4E88-83A0-47778E084FEFileDXE driverCuber Code-45As-Me80-7534DC200568FileDXE driverJobaster Lesse-8340-47778E084FEFileDXE driverJobaster Lesse-8340-47778E084FEFileDXE driverJobaster Lesse-8340-47178E084FEFileDXE driverJobaster Lesse-8340-47778E08468FileDXE driverJobaster Lesse-8340-47778E08468FileDXE driverJobaster Lesse-8434A4A312-00CC7061898FileFreeformJobaster Lesse-8344-418-840-354658588188FileDXE driverStabster Lesse-8344-418-840-354658588188FileDXE driverStabster Lesse-83-046-734A12-043-343-37442748123FileDXE driverStabster Lesse-8440-854658588188FileDXE driverStabster Lesse-8440-8546-5344249-854682762A8FileDXE driverStabster Lesse-8440-862-34440-854682-73402CFileDXE driverStabster Lesse-8440-862-34440-854682-73402CFileDXE driver	PC	Action	Type	Subtype	Text	^	Full size: 800000h (8388608)
Descriptor         Region         Descriptor           GbE region         Region         GbE         PKI straps: 18           GbE region         Region         GbE         PKI straps: 18           VEIOS region         Region         HE         PKI straps: 18           VEIOS region         Region         HE         PKI straps: 18           VEIOS region         Region         BE         PKI straps: 18           VEIOS region         PAdding         Non-empty         PKI straps: 18           Value         FFSv2         PADAMADF-ESIG-4688-B3A0-4FIC-9935-896185C32003         Volume         FFSv2           17088572-377F-44FE-8F4E-080FFF6464070         File         Rds         CpuDxe         File           > 93022F61-1690-47EF-8F4E-680A-73ADA2CB050B         File         PE         PE         Filesystem         Filesystem           > 902213158-0886-4658-8181E-181EF14712803         File         DXE driver         FILesystem         File           > 505056F4-4573-4764-414E-8240-354658581EB         File	ntol imago					1.1	Flash chips: 1
GbE         Region         Region         GbE         PCH straps: 18           ME         region         Region         NE           PEIGS region         Region         NE         PAGIN         PAGIN           PSIGS region         Region         NE         PAGIN         PAGIN         PAGIN           PSIGS region         Region         Non-empty         PAGIN         PAGINA         PAGINA         PAGINA							
ME         Region         NE           VBIOS region         Region         BIOS           SR3CES78-8A3D-4F1C-9935-896185C32D03         Volume         FFSv2           Padding         Padding         Non-empty           VSCSCE578-8A3D-4F1C-9935-896185C32D03         Volume         FFSv2           Value         FFSv2         Cpu0xe           17088572-377F-44EF-8F4E-809FFF46A070         File         Raw           > 1033ABA0F-ES36-4E88-83A0-87778E034FE         File         DXE driver         Cpu0xe           > 10331F84-C666-453A-8684-73ADA2C00508         File         DXE driver         FileSystem           > 04022817-85F8-4964-A312-00CC77061B98         File         FreeForm         FileSystem           > 04022817-85F8-4964-A312-00CC77061B98         File         FreeForm         SAE3F37E-4EAE-41AE-8240-35A658581E8         File           > 04025016-6579-4674E-41AE-8240-35A658581E8         File         DXE driver         Runtime           > 05005064E-6579-4764-A4383-37A427E48123         File         DXE driver         Runtime           > 57035F84-C648-44A82-A088-57644         File         DXE driver         RUSSABBipdate           > 57035F84-C648-44A82-A088-5744         File         DXE driver         RUSSABBipdate           > 57035F84-C648-44482-A083-5742F84123							
BIOS         Region         BIOS           > R0305         Volume         FFSv2           > R0305         Volume         FFSv2           17089572-3775-445E-8461-80507E6464070         File         Raw           > 10931F88-C466-454A-8084-73ADA2C80560         File         DXE driver           > 93022F82-1690-475E-8082-5814FE600F5         File         DXE driver           > 93022F82-1690-475E-8082-5814FE600F5         File         DXE driver           > 93022F82-666-453A-8082-5814FE600F5         File         Freeform           > 92213158-3088-4685-813E-1818F4712B03         File         Freeform           > 90213158-3088-4685-813E-1818F4712B03         File         DXE core           > 0605086E-679-4764-4A48-8324-354659581EB         File         DXE core           > 0005208E-679-4764-4A48-3408-35669581EB         File         DXE driver           > 0005208E-679-4764-4A482-3086-578442         File         DXE driver         FIbUpdate           > 570315F84-C648-4A82-A086-578442         File         DXE driver         ASUSXBBUpdate         F							CPU straps: 1
> 8C8CE578-8A3D-4F1C-9935-896185C32003       Volume       FFSv2         Padding       Padding       Non-empty         Volume       FFSv2         17088572-377F-4AEF-8F4E-809FFF464070       File       Raw         26038AD0F-E536-4E88-83A0-877F78E834FE       File       DXE         19088572-377F-4AEF-8F4E-809FF746634FE       File       PEI module         > 60338ADF-E536-4E88-83A0-877F78E834FF       File       PEI module         > 93032F8C-1F69-37FF-8082-5814FF6090F5       File       PEI module         > 93022F8C-1F69-37EF-8082-5814FF6090F5       File       File         > 93025F8C-1F69-347E4-1882-5814FF6090F5       File       Freeform         > 92213158-3088-4685-8138-1818F4712803       File       Freeform         > 92213158-3088-4685-8138-1818F4712803       File       Freeform         > 5645976-4A81-4A18-8240-5346585858181E       File       DXE core         > 0602086E-6E79-3764-4A82-37A472F48123       File       DXE driver       Runtime         > 0502594F-6279-3764-4A82-37A472F48123       File       DXE driver       Runtime         > 505036F84-C649-4A82-A080-558A4C1A0547       File       DXE driver       Rustime         > 570516F84-C649-4A82-A080-55627F07088       File       DXE driver       Rel38h       V         >							
Padding         Padding         Non-empty           V8282E578=8A3D-4F1C-9935-896185C32003         Volume         FFSv2           17088572-377F-44EF-8F4E-8095FFF646A070         File         Raw           > 1003A8A0F-E536-4E88-83A0-87778E834FE         File         OXE driver         CpuDxe           > 1003A8A0F-E536-4E88-83A0-87778E834FE         File         OXE driver         CpuDxe           > 1003A8A0F-1536-4E88-83A0-87778E834FE         File         OXE driver         Filesystem           > 93022F82-1F09-47EF-1882-5814FF6090F5         File         OXE driver         Filesystem           > 04021817-85F8-4904-A312-00CC77061898         File         Freeform           > 02211358-0888-4685-8181-181EF47121203         File         Freeform           > 0402082F-672-4724-A14F-8240-35465858188         File         DXE driver         R0XE driver           > 0405086F-672-4724-A43A-33-37472F48123         File         DXE driver         RUTIme           > 0405086F-672-4724-A43A-83-37472F48123         File         DXE driver         RUSX88010date           > 57035F84-C648-4449-8F04-9E68C7F02A8         File         DXE driver         RSUX88010date           > 70618418-08E1-4449-8F04-9E68C7F02A8         File         DXE driver         Re18ah         V           > 70618418-08E1-4449-8F04-9E68C7F02A8							
V8C8CE578-8A3D-4F1C-9935-896185C32D03         Volume         FFSv2           17088572-377F-44EF-8F4E-809FFF46A070         File         Raw           5603A80AF-5536-4588-4380-8777F82E834FE         File         DXE driver         CpuDxe           >14931F08-C466-454A-8684-73ADA2C80508         File         DXE driver         CpuDxe           >14931F08-C466-454A-8684-73ADA2C80508         File         DXE driver         Filesystem           >93022F8C-1F09-47EF-8882-5814FE         File         DXE driver         Filesystem           >904C2817-58F4-906-454312-00C77061898         File         Freeform         Filesystem           >9221315B-308B-4685-813E-181BF4712803         File         Freeform         CORE_0XE           >56425937E-4484-41AF-8240-334659558181E         File         DXE driver         Runtime           >0602086EE-6679-4764-A83-37A472F48123         File         DXE driver         Runtime           >00E086EE-6679-4764-A82-3080-5758A4C1A9547         File         DXE driver         Runtime           >00E086EE-6679-4764-A82-3080-5758A4C1A9547         File         DXE driver         RUNTime           >50015676-0332-4080-4576A42         File         DXE driver         RUNTime           >00E086EE-6679-4764-383-576702A8         File         DXE driver         RUNTime           >0							
17088572-377F-44EF-8F4E-809FFF46A070       File       Raw         >160318400F-E536-4E88-83A0-877778E034FE       File       DXE driver       CpuDxe         >1A031FB8-4664-53A-4E88-83A0-877778E034FE       File       PEI module       ASUSPOSTNessagePEI         >93022F8C-1609-47EF-8882-5814FF6090F5       File       PEI module       ASUSPOSTNessagePEI         >93022F8C-1609-47EF-8882-5814FF6090F5       File       DXE driver       FileSystem         >DAC28117-85F8-4964-A312-00CC77061898       File       Freeform         >92213158-8088-4685-8138-1818F4712803       File       Freeform         >54653F37E-4484-41AE-8240-53465858581E8       File       DXE core       CORE_DXE         >0600806E-679-4764-4A312-00CC7061893       File       DXE driver       Runtime         >0600806E-679-4764-4A32-37A472F48123       File       DXE driver       Runtime         >0060806E-661-6493-4764-4A82-3080-558A4C1A9547       File       DXE driver       RustSX8BUpdate         >7061A318-08E1-4449-BF04-9EF68C7F02A8       File       DXE driver       ReFlash       V         >7061A318-08E1-4449-8EF04-9EF68C7F02A8       File       DXE driver       Reflash       V         >7061A318-08E1-4449-BF04-9EF68C7F02A8       File       DXE driver       Reflash       V							
> E03A8A0F-E536-4E88-03A0-077F78E034FE       File       DXE driver       CpuDxe         > 1A931F88-C466-45AA-0804-73A0A2C00500       File       PEI module       ASUSPOSTNessagePEI         > 93022F8C-1090-47EF-0802FS       File       DXE driver       Filesystem         > DAC20117-085F8-4064-A312-00CC77061080       File       Freeform         > 92213158-3088-4655-3818-108164712003       File       Freeform         > 5423F37E-4EAE-41AE-8240-3546505E81E8       File       DXE core       CORE_DXE         > 000E080EF-6F79-47C4-MA82-30402F48123       File       DXE driver       Runtime         > 000E080EF-6F79-47C4-MA83-37A02F48123       File       DXE driver       FUBUpdate         > 5703EF84-C648-4A82-A088-558A4C1A0547       File       DXE driver       ASUSX08Update         > 5703EF84-C648-4A82-0808-556A4C1A0547       File       DXE driver       ReFlash         > 7001E1881-08E1-4449-8F04-9EF68C7F0208       File       DXE driver       ReFlash         > 5002082-0034-0034-004-04E5027F0208       File       DXE driver       ReFlash							
> 1A931F88-C466-454A-8684-73ADA2C80508       File       PEI module       ASUSPOSTMessagePEI         > 93022F8C-1F09-476F-8882-5814FF090F5       File       DXC B017-58F-4906-4312-00C277061898       File       Filesystem         > 0AC2817-58F-4906-4312-00C270601898       File       Freeform       Filesystem         > 92213158-3088-4685-813E-1818F4712803       File       Freeform       CORE_0XE         > 5625372F-44EA-41AE-8240-354658581E8       File       DXE core       CORE_0XE         > 00E086EE-6E79-4764-AA83-37A472F48123       File       DXE driver       Runtime         > 00E086EE-6E79-4764-AA83-37A472F48123       File       DXE driver       F18bUpdate         > 57051F84-C648-4A82-A080-5F8A4C1A0547       File       DXE driver       ASUSXBBUpdate         > 70E1A818-08E1-44494-E404-9F6627F02A8       File       DXE driver       ReFlash         > 70E1A818-08E1-44494-E404-9F6627F02A8       File       DXE driver       ReFlash         > XEDEDEF CO32-400A-AACE-334CE0710023       File       DXE driver       ReFlash       V					CouDxe		
>93022F8C-1F09-47EF-8882-5814FF609DF5       File       DXE driver       FileSystem         >0AC2E117-85F8-4964-A312-00CC77061898       File       Freeform         >92213158-8088-4658-5813E1-818F4712803       File       Freeform         >5685937E-44EAE-41AE-8240-3346595581E8       File       DXE core         >00E0866F-657-4764-AA81-37A472F48123       File       DXE driver       RUMIme         >00E086F-657-4764-AA81-37A472F48123       File       DXE driver       FtBbupdate         >570516F84-C468-AA82-A080-558A4C1A0547       File       DXE driver       RUMIme         >70E1A818-08E1-4449-BF04-9EF68C7F02A8       File       DXE driver       ReFlash         >70E1A818-08E1-4449-BF04-9EF68C7F02A8       File       DXE driver       Reflash							
> DAC28117-85F8-4964-A312-00CC77061898     File     Freeform       > 92213158-3088-4665-813E-181E4712803     File     Freeform       > 5AE3F37E-4EAE-41AE-8240-3546585881E8     File     DXE core     CORE_DXE       > C0E550EA-33A-41EB-A8EE-4498AE567E4     File     DXE driver     Runtime       > 00E086EE-6E79-4764-AA82-3080-5F8A4C1A9547     File     DXE driver     Ft8bUpdate       > 5703EF84-C464-A482-A080-5F8A4C1A9547     File     DXE driver     ASUSXBBUpdate       > 70E1A818-08E1-4449-BE1-495F762A8     File     DXE driver     Rentime	> 93022F8C - 1F09 - 47EF - B8B2 - 5814FF609DF5		File				
> 5AE3F37E-4EAE-41AE-8240-3546585E81EB     File     DXE care     CORE_DXE       > C0F59CAA-383A-41E0-ABE-4498AEA567E4     File     DXE driver     Runtime       > 00E086EC-6759-47C4-AAB3-37A472F48123     File     DXE driver     FUBUpdate       > 570516F84-C648-4AB2-A080-578AAC1A0547     File     DXE driver     ASUSXBBUpdate       > 7051A818-08E1-4449-BFD4-9EF68C7F02A8     File     DXE driver     ReFlash	>DAC2B117-85F8-4964-A312-0DCC77061898		File	Freeform			
>C8C59C4A-383A-41E8-A8EE-4498AEA567E4     File     DXE driver     Runtime       >000E086EE-6679-4764-A883-37A72EF48123     File     DXE driver     FtBbbgdate       >57D3EF84-C648-4A82-A080-37FA84C1A9547     File     DXE driver     ASUSXB8Update       >70E1A818-08E1-4449-8FD4-9EF68C7F02A8     File     DXE driver     Reflash	> 9221315B-3088-4685-813E-1818F47128D3		File	Freeform			
> C8C59C4A-383A-41E8-A8EE-4498AEA567E4         File         DXE driver         Runtime           > 00ED86EE-6E79-4764-A8B3-37A472F48123         File         DXE driver         FtBbbgdate           > 57D3EF84-C648-4A82-A980-5F8A4C1A9547         File         DXE driver         ASUSXBBupdate           > 70E1A818-0B1-4449-AFDA-9EF60E7F02A8         File         DXE driver         ReFlash	> 5AE3F37E-4EAE-41AE-8240-3546585E81EB		File	DXE core	CORE DXE		
>>7051EF84-C648-4A82-A080-SF8A4C1A9547         File         DXE driver         ASUSXBBUpdate           >70E1A818-08E1-4449-BFD4-9EF6BC7F02A8         File         DXE driver         ReFlash           >>20E0620F0203-4000-A0CF-231EE027         File         DXE driver         Bellach	> CBC59C4A-383A-41EB-A8EE-4498AEA567E4		File	DXE driver			
>70E1A818-0BE1-4449-BEF04-9EF68C7F02A8 File DXE driver ReFlash	> 0DED86EE-6E79-4764-AA83-37A472F48123		File	DXE driver	FtBbUpdate		
SCIREDOL RAR ANDA ANCE THEETOTEDOT ELLA DYE deliver Bellow	> 57D3EF84-C648-4AB2-AD80-5F8A4C1A9547		File	DXE driver	ASUSXBBUpdate		
SCIDEDAE DOG 4004 AACC 731CED7E1D07 ELLA DYE daluan Belbus	> 70E1A818-0BE1-4449-BFD4-9EF68C7F02A8		File	DXE driver	ReFlash		
Messages	3 3C10F30F 0307 4004 AACC 731CF07F1007		cile.	ove datura	DelDur	~	
	isages						

Important: Make sure, that the target DXE Volume contains a module named "CSMCORE".

Reason: Some BIOSes contain more than 1 DXE Volume, but only the one with the CSMCORE module is suitable for the insertion of a natively not present EFI module.

Note: In the very rare case, that no module named CSMCORE is listed, you have to search for the upmost Volume, which contains modules with the letters "DXE" within their name.

#### b) Insertion of the NVMe module

Once you have expanded the DXE Volume, scroll down to the **undermost module, which is listed within the DXE Volume and has a GUID** (no matter, whether its Subtype is "DXE driver" or "Freeform" and whether it is listed at the rightmost column with a "text").

Here is the related picture (**in this example** it is the DXE File named "PcieLaneDXE", but - depending on the specific BIOS - it may have any other or even no name):

UEFITool 0.28.0 - P8Z68-V-ASUS-3603.ROM				-	$\times$
ile <u>A</u> ction H <u>e</u> lp					
tructure					
lame	Action	Туре	Subtype	Text	
> CD84562C-6864-40A3-A081-C8D35E82B920		File	DXE driver	CspLibDxe	
> 077AFE00-4404-47E7-A4C7-B673580F8D5D		File	DXE driver	RemoveASFDXE	
> 52715B77-04A5-487A-B980-CDC371B5BEC8		File	PEI module	AsusPostErrPei	
> 54AB7A17-AD08-4F86-83C2-4CF398EBC0AD		File	DXE driver	AsusPostErrDxe	
> 21E34727-3881-4DEE-8020-D8908A980311		File	DXE driver	EpuHwModeDxe	
> 1DACE8EE-CD97-491E-8A0C-305D6437323C		File	DXE driver	OnBrdDevDXE	
> D36DDD2D-1C66-4210-B77A-2FD9F920E51F		File	DXE driver	ASUS_EUPSxSMI	
> 7DADBC98-6489-4D1C-907A-8EE243AF805B		File	PEI module	ASUS_EUPPEI	
> BFD8ABE9-C091-6543-A94D-136E5BADD22D		File	DXE driver	SynBootabletVar	
> 3F78CB8D-72EE-414E-B023-DACA003BDDF5		File	DXE driver	ProjectSxSMI	
> 010216CD-9C09-4EB5-B7DA-D0A2865092D4		File	DXE driver	ProjectDXE	
> 2F4DDD35-F8C0-46D2-B0E3-A701360D7499		File	DXE driver	PcieLaneDXE	
Volume tree space		Free space			
> 8C8CE578-8A3D-4F1C-9935-896185C32DD3		Volume	FFSv2		
> 8C8CE578-8A3D-4F1C-9935-896185C32DD3		Volume	FFSv2		
Padding		Padding	Non-empty		
> 8C8CE578-8A3D-4F1C-9935-896185C32DD3		Volume	FFSv2		
> 8C8CE578-8A3D-4F1C-9935-896185C32DD3		Volume	FFSv2		

Right-click onto the GUID of the **undermost** listed "DXE driver" or "Freeform" module, choose the option "Insert after...", navigate to the EFI NVMe module file you want to insert (must have the suffix \*.ffs!), and double-click onto it.

After having done that, you hopefully will see a picture like this:

UEFITool 0.28.0 - P8Z68-V-ASUS-3603.ROM					-	>
e <u>A</u> ction H <u>e</u> lp						
ucture						
ame	Action	Туре	Subtype	Text		
> CD84562C-6864-40A3-A081-C8D35E82B920		File	DXE driver	CspLibDxe		
> 077AFE00-4404-47E7-A4C7-B673580F8D5D		File	DXE driver	RemoveASFDXE		
> 52715B77-04A5-487A-B980-CDC371B5BEC8		File	PEI module	AsusPostErrPei		
> 54AB7A17-AD08-4F86-83C2-4CF398EBC0AD		File	DXE driver	AsusPostErrDxe		
> 21E34727-3881-4DEE-8020-D8908A980311		File	DXE driver	EpuHwModeDxe		
> 1DACE8EE-CD97-491E-8A0C-305D6437323C		File	DXE driver	OnBrdDevDXE		
> D36DDD2D-1C66-4210-B77A-2FD9F920E51F		File	DXE driver	ASUS_EUPSxSMI		
> 7DADBC98-6489-4D1C-907A-8EE243AF805B		File	PEI module	ASUS_EUPPEI		
> BFD8ABE9-C091-6543-A94D-136E5BADD22D		File	DXE driver	SynBootabletVar		
> 3F78CB8D-72EE-414E-B023-DACA003BDDF5		File	DXE driver	ProjectSxSMI		
> 010216CD-9C09-4EB5-B7DA-D0A2865092D4		File	DXE driver	ProjectDXE		
> 2F4DDD35-F8C0-46D2-B0E3-A701360D7499		File	DXE driver	PcieLaneDXE		
> 5BE3BDF4-53CF-46A3-A6A9-73C34A6E5EE3	Insert		DXE driver	NvmExpressDxe_5		
Volume free space		Free space				
> 8C8CE578-8A3D-4F1C-9935-896185C32DD3		Volume	FFSv2			
> 8C8CE578-8A3D-4F1C-9935-896185C32DD3		Volume	FFSv2			
Padding		Padding	Non-empty			
> 8C8CE578-8A3D-4F1C-9935-896185C32DD3	Rebuild	Volume	FFSv2			

Note: If the UEFITool should not be able to insert the desired module properly, it will give you the message **"Not enough space within the Volume"**. In this case you should try to get the "small" variant of the NVMe module inserted. If there should not even be enough space for this small sized module, I recommend to follow the advices given by MeatWar within the first post of <a href="https://www.englistics.org">>>this</a> 19 thread.

Don't forget to save the modded BIOS as final step of the modding procedure. You can start it either by clicking onto "File" > "Save image file..." or by hitting CTRL+S. Then you can navigate to the folder, which has been designed for the modded BIOS (e.g. D:\Mod BIOS), choose a meaningful BIOS file name with an appropriate suffix (you can use any suffix, if you choose the "All files" option) and click onto the "Save" button.

#### c) Verification of the successful insertion

Immediately after you have saved the modded BIOS the UEFITool will offer you the option to open the reconstructed file. Click onto "Yes". If you had already closed the UEFITool, you will have to re-run the tool as written above.

Expand the content of the "BIOS region" and its GUIDs until you have found the specific GUID again, which contains the modules of the Subtype "DXE driver".

Scroll down and search for the "DXE driver" with the right hand text "NvmExpressDxE\_5" resp. "NvmExpressDxe\_small" (depending on what you had inserted).

Expand the sub-sections of the freshly inserted NVMe module by clicking onto the downside arrows.

UEFITool 0.28.0 - P8Z68-V-ASUS-3603_mod.ROM				-	2
le <u>A</u> ction H <u>e</u> lp					
tructure					
lame	Action	Туре	Subtype	Text	
> 077AFE00-4404-47E7-A4C7-B673580F8D5D		File	DXE driver	RemoveASFDXE	
> 52715B77-04A5-487A-B980-CDC371B5BEC8		File	PEI module	AsusPostErrPei	
> 54AB7A17-AD08-4F86-83C2-4CF398EBC0AD		File	DXE driver	AsusPostErrDxe	
> 21E34727-3881-4DEE-8020-D8908A980311		File	DXE driver	EpuHwModeDxe	
> 1DACE8EE-CD97-491E-8A0C-305D6437323C		File	DXE driver	OnBrdDevDXE	
> D36DDD2D-1C66-4210-B77A-2FD9F920E51F		File	DXE driver	ASUS_EUPSxSMI	
> 7DADBC98-6489-4D1C-907A-8EE243AF805B		File	PEI module	ASUS_EUPPEI	
> BFD8ABE9-C091-6543-A94D-136E5BADD22D		File	DXE driver	SynBootabletVar	
> 3F78CB8D-72EE-414E-B023-DACA003BDDF5		File	DXE driver	ProjectSxSMI	
> 010216CD-9C09-4EB5-B7DA-D0A2865092D4		File	DXE driver	ProjectDXE	
> 2F4DDD35-F8C0-46D2-B0E3-A701360D7499		File	DXE driver	PcieLaneDXE	
5BE3BDF4-53CF-46A3-A6A9-73C34A6E5EE3		File	DXE driver	NvmExpressDxe_5	
PE32 image section		Section	PE32 image		
User interface section		Section	User interface		
Volume free space		Free space			
> 8C8CE578-8A3D-4F1C-9935-896185C32DD3		Volume	FFSv2		
> 8C8CE578-8A3D-4F1C-9935-896185C32DD3		Volume	FFSv2		
Padding		Padding	Non-empty		

#### Warning:

In some cases the UEFITool may remove an existing **"Pad-file"** of the BIOS or create a natively not present Pad-file while executing its NVMe module insertion task (trying to "repair" a supposedly wrong BIOS structure). To avoid later problems after having flashed the modded BIOS, I recommend insistently to compare the entire "DXE Driver Volume" of the original and the just modified BIOS regarding the presence and location of Pad-files by using the UEFITool (the MMTool doesn't show the "Pad-files"). The best visual way for such comparison is to open the original and modded BIOS side by side. For details look <u>here<</u>. The only difference between the original and the modded BIOS should be, that a new DXE driver named "NvmExpressDxe\_5" resp. "NvmExpressDxe\_small" has been added. All other listed modules should be untouched by the BIOS modification.

# If you should realize, that within the modded BIOS a natively present Pad-file module is missing resp. has been moved or a natively not present Pad-file has been added by the UEFITool, post a report into this thread, but don't flash this modded BIOS!

If everything looks fine, you can be sure, that the related module has been properly inserted into the correct GUID section, and you can save the modded BIOS and give it an appropriate name and suffix (usually similar to the original BIOS).

Only for ASUS BIOSes, whose capsule had been removed by extracting the "Body", but shall be flashed by using the ASUS USB Flashback feature: Don't forget to re-insert the original capsule and to save the modded BIOS as \*.CAP file according to  $\geq$ this< 187 guide written by MeatWar.

## Step 3 - Flashing of the modded BIOS:

The related detailed Guide can be found  $\geq$ here<. If you have a question regarding the BIOS flashing procedure or if you should run into a problem while trying to flash your modded BIOS, please post into  $\geq$ this< 189 thread and not here.

## Warning:

Please keep in mind, that this is the only really risky part of this Guide.

For BIOS modding beginners it is strictly recommended

a) to double-check the integrity of their modded BIOS and

## b) to read carefully <u>>this</u> Guide

## before flashing any modified BIOS.

## ▼ Additional Notes: (open/hide by a click)

The preparation and the exact BIOS Flashing procedure depends on the mainboard's manufacturer and maybe even on the mainboard model (for details look into the manual of your mainboard).

As medium for the modded BIOS during the flashing procedure you should take a 100% working and freshly FAT32 formatted USB 2.0 Flash Drive. It should contain just the modded "pure" BIOS file and nothing else.

It is not recommended to flash a modded BIOS from within the OS.

After having successfully flashed the modded BIOS, don't forget to re-enter the BIOS, to redo your personal BIOS settings and to make sure, that your system will be able to boot in UEFI mode.

Users, who don't know where to find the specific BIOS settings, which are mentioned within this Guide, should set the BIOS language to "English".

## Success verification (the NVMe SSD has to be connected!):

Enter the "BOOT" section of the BIOS and make sure, that "CSM" has been set to "Enabled". Then look for the listed bootable Disk Drives.

If you now can see a new disk drive named "PATA" or "PATA\_SS", you can be sure,

a) that you have correctly inserted the NVMe module into the BIOS and

b) that the modded BIOS has been successfully flashed.

**Don't try to boot off the listed disk drive named "PATA" or "PATA\_SS"!** You will not succeed, because the required Option ROM is usually missing within the NVMe SSD. Nobody (except the user of a Samsung 950 PRO) is able to boot off an NVMe SSD in LEGACY mode.

## Step 4 - Installation of Win10/11 onto the NVMe SSD:

• **Open Guide:** (open/hide by a click)

## A. Preparation/Notes:

If not already done, you can now insert the NVMe SSD resp. its M.2>PCIe adapter into the M.2 port resp. PCIe slot, which offers the best possible performance and doesn't share the PCI lanes with other devices (please look into your mainboard manual).

Enter the BIOS and look for the changes, which were caused by the BIOS modification (insertion of the NVMe EFI module). Don't be afraid about the fact, that the **NVMe SSD's manufacturer and model will not be shown there** (it will be bootable nevertheless later on). The only difference should be, that within the "BOOT" section now a new "**Legacy Mode**" device named "**PATA**" or "**PATA\_SS**" is listed (only visible, when CSM has been temporarily set to "Enabled"). That is your NVMe SSD, but don't try to boot off it - only Samsung 950 Pro SSDs can boot in Legacy mode, because it has the required NVMe Option ROM in-the-box. All other NVMe SSDs can only boot in "UEFI Mode", but this requires the creation of an EFI Boot Sector named "**Windows Boot Manager**", which will be done during the installation of the OS (see next step).

## B. Best/safest procedure to get Win10/11 properly installed onto an NVMe SSD:

Save the important data, which are currently on the NVMe SSD.

Create an UEFI mode bootable USB Flash drive containing the desired Win10 image by using the latest version of the tool Rufus (important: choose the UEFI mode partition table = GPT).

Here is a picture, which shows the most important Rufus settings:

🖋 Rufus 3.17.1846 (Portable)	_		×
Drive Properties			
CPRA_X64FRE (F:) [64 GB]			$\sim$
Boot selection 22000.376.Cobalt-X64-DE-CLIENTCORE.ISO	× Ø	SELECT	<b> </b>
Image option Standard Windows 11 Installation (TPM 2.0 +	Secure Boot)		~
Partition scheme GPT V	Target system UEFI (non CSM)		~ ?
<ul> <li>Show advanced drive properties</li> </ul>			
Format Options ———			
Volume label CCRA_X64FRE_DE-DE_DV5			
File system	Cluster size		
Large FAT32 (Default) 🗸 🗸	32 kilobytes (Default)		~
<ul> <li>Show advanced format options</li> </ul>			
Status			
READ	Y		
§ i ≵ ⊞	START	CLOSE	
Using image: 22000.376 Cobalt-X64-DE-CLIENT	CORFISO		

Important note: Usually the USB Flash Drive has to be **FAT32** formatted to be bootable in **UEFI mode**, but this file system cannot be created, if any file within the ISO file (e.g. the install.wim) is bigger sized than 4 GB. In this case the tool Rufus will automaticly format the USB Flash Drive by using the **NTFS** file system, but nevertheless makes it possible to boot the USB Flash Drive in **UEFI mode** (provided, that the **"Secure Boot"** option within the BIOS has been set to **"Disabled"**).

Enter the BIOS and navigate to the "BOOT" section and - if applicable - the "SECURITY" or "Keys" section.

Make sure, that the "Secure Boot" and "Fast Boot" options have been set to **Disabled**. The "Compatibility Support Module" (CSM) can either be set to "Disabled" as well (better option, but requires full UEFI compatibility of the graphics adapter) or to "Enabled" with the ability/preference to load EFI BIOS modules for the Storage Disk Drives. If you see BIOS options for the "OS type", choose "other OS". This will disable the Secure Boot setting.

#### Tip to avoid SATA/NVMe interferences during the OS installation:

It is recommended to temporarily unplug all SATA connected devices and additionally to disable the on-board SATA Controller(s) within the "Storage Configuration" section of the BIOS before starting the OS installation.

These measures of precaution can/should be reversed once the OS installation onto the NVMe SSD has been successfully completed.

Insert the prepared USB Flash drive and boot off it in UEFI mode (the related bootable USB drive should be shown by the Boot Manager with the prefix "[UEFI]").

When you come to the point, where you have to decide onto which Drive and which partition the OS shall be installed, **delete all existing partitions** from your NVME supporting SSD.

After having done that, let the Win10/11 Setup create a new partition for your future drive C: on the related SSD.

Then point to this just created partition as the desired future OS location.

The rest should be done by the Setup automaticly.

You will get a message, that some additional partitions have to be created. Accept that and follow the advice of the Setup where to install the OS.

Once the OS is up and running, shut down the computer, remove the bootable USB Flash driver and reconnect all your previously used storage drives.

Before you restart cour computer, make sure, that the NVMe SSD resp. its listed "Windows Boot Manager" is on top of the bootable storage drives.

#### C. Data Recovery from the previously used system drive: (not recommended)

Since the required **boot sector** of an **NVMe** SSD is **not compatible** with the boot sector of a **SATA** SSD (although both boot partitions may be named "Windows Boot Manager"), you will not succeed by simply transfering the data of your previously used SATA SSD to the NVMe SSD.

On the other hand a clean install of the currently latest OS version is a good opportunity to get rid of the complete data garbage, which has been accumulated in the past and decreased the performance of the system drive.

That is why I strongly recommend to do a clean OS installation onto the NVMe SSD and not to try a recovery of the previous used drive C: data.

## This is what you hopefully will get:

## ▼ Benchmark Results: (open/hide by a click)

Here are some benchmark results I got with my Z68 system running 2 different NVMe supporting SSDs:

400 GB Intel 750 PCIe SSD:

-									
🔁 Ai	nvil's Storage U	tilities 1.1.0 (2014-Jan	uary-1)				-		×
File	Benchmarks	IOmeter   System	Info Settings	Test size 1GB 💌	Drive 🔳 🛛 🕻		Screenshot Help		
SSI	D Benchr	nark					NVMe INTEL SS	SDPEDI 400GB	
								40000	
	Read	Resp. time	MB read	IOPS	MB/s				
	Seq 4MB	3,0215ms	2.048,0	330,96	1.323,85				
	4K	0,0938ms	520,6	10.661,92	41,65				
	4K.QD4	0,0966ms	2.021,4	41.397,56	161,71		3.660,34		
	4K QD16	0,1104ms	7.074,5	144.884,36	565,95	Run read	<sup>3.660,34</sup> 3.660,34		
	32K	0,1912ms	2.454,2	5.230,02	163,44				
	128K	0,3406ms	5.510,6	2.936,06	367,01		9.587,62	7 60	
	Write	Resp. time	MB written	IOPS	MB/s	Run	9.50	7,62	
	Seq 4MB	4,3359ms	1.024,0	230,63	922,52				
	4K	0,0227ms	640,0	43.966,71	171,74	Deres	<sup>5.927,28</sup> 5.927,28		
	4K QD4	0,0279ms	640,0	143.293,88	559,74	Run write	333,5,527,20		
	4K QD16	0,0711ms	640,0	225.156,73	879,52				
		0 Pro 64-Bit Build (1058	36)	Drive 100 CB	Intel 750 NVMe	CCD	NVMe INTEL SSDPEDMW Drive C: 243.6/223.1GB fre		
	68-V/3603, LGA1	155 2500K CPU @ 3.30GHz			ntel NVMe v1.3.		NTFS - Cluster size 4096B	e (91.0%)	
	nory: 16.281 MB						Storage driver IaNVMe		
	ofessional Ed			Chipsed Intel 2	68, OS: Win10 x	04 P10	Alignment 580608KB OK		
							Compression 100% (Incomp	ressible)	
		050 D 14	2.22 <b>2</b> (	1	DOT 1	1)			

256 GB Samsung 950 Pro M.2 SSD (connected via M.2>PCIe adapter card):

🙃 Ar	nvil's Storage U	tilities 1.1.0 (2014-Janu	uary-1)				-		×		
File	Benchmarks	IOmeter   System	Info Settings	Test size 1GB 🔹	Drive 🔳 c: (win10	x64 on 950	Screenshot Help				
SSE	SSD Benchmark NVMe Samsung SSD 950 SCSI Disk Device 256GB/1800										
	Read	Resp. time	MB read	IOPS	MB/s						
	Seq 4MB	2.6855ms	2.048.0	372.36	1.489.45						
	4K	0.0766ms	637.3	13.051.47	50.98						
	4K QD4	0.0798ms	2.447.4	50.122.33	195.79		4.618.62				
	4K QD16	0.1022ms	7.644.2	156.551.67	611.53	Run read	4.618.62				
	32K	0.1177ms	3.986.6	8.495.74	265.49						
	128K	0.1828ms	10.267.5	5.470.17	683.77		8.101.11 8.10				
	Write	Resp. time	MB written	IOPS	MB/s	Run	8.10	1.11			
	Seq 4MB	4.3320ms	1.024.0	230.84	923.35						
	4K	0.0259ms	640.0	38.653.22	150.99		<sup>3.482.49</sup> 3.482.49				
	4K QD4	0.0481ms	640.0	83.084.00	324.55	Run write	3.462.49				
	4K QD16	0.1910ms	640.0	83.757.73	327.18						
P8Z6 Intel	58-V/3603, LGA (R) Core(TM) i5-	2500K CPU @ 3.30GHz	5)	Drive : 256 GB S NVMe Driver: S	ams. NVME v1.4	4.7.16	NVMe Samsung SSD 950 Drive C: 194.8/170.9GB free NTFS - Cluster size 4096B Storage driver nvme				
	ofessional Ed			Chipset: Intel Zé	58, OS: Win10 xé	54 Pro	Alignment 580608KB OK Compression 100% (Incomp	ressible)			

<sup>256</sup> GB Samsung SM951 NVMe M.2 SSD (connected via M.2>PCIe adapter card):

🙆 An	wil's Storage U	-		×					
File	Benchmarks	i   IOmeter   System	Info Settings 1	fest size 1GB 💌	Drive 🔳 c: (win10	x64 on sm9	Screenshot Help		
SSD	) Bench	mark				NVMe :	SAMSUNG MZVPV2 Device 2	56 SCSI	Disk xw7
							Device 1		
	Read	Resp. time	MB read	IOPS	MB/s				
	Seq 4MB	2.7168ms	2.048.0	368.08	1.472.32				
	4K	0.0762ms	641.1	13.128.78	51.28				
	4K QD4	0.0789ms	2.475.1	50.689.21	198.00		4.563.79		
	4K QD16	0.0948ms	8.236.9	168.692.10	658.95	Run read	4.563.79		
	32K	0.1274ms	3.683.3	7.849.23	245.29				
	128K	0.2043ms	9.187.0	4.894.51	611.81		8.629.00	0.00	
	Write	Resp. time	MB written	IOPS	MB/s	Run	0.02	9.00	
	Seq 4MB	3.1758ms	1.024.0	314.88	1.259.53				
	4K	0.0264ms	640.0	37.820.40	147.74	Bun write	4.065.20		
	4K QD4	0.0425ms	640.0	94.134.19	367.71	Hun write	4.065.20		
	4K QD16	0.1687ms	640.0	94.855.85	370.53				
		10 Pro 64-bit Build (1058	6)	Driver 256 CB S	Computing EMOE1	NIVAA	NVMe SAMSUNG MZVPV Drive C: 170.3/145.2GB fre		Disk D
	8-V/3603, LGA (B) Core(TM) /5	.1155 -2500K CPU @ 3.30GHz			Samsung SM951 Sams, NVMe v1.4		NTFS - Cluster size 40968	e (05.2%)	
	ory: 16.281 M				68, OS: Win10 x		Storage driver <b>nvme</b>		
Pro	ofessional E	dition					Alignment 580608KB OK Compression 100% (Incomp	ressible)	
				•					

## Any feedback is much appreciated!

If you are satisfied with my work/support, you can send a *donation* to my personal Win-RAID CA PayPal account by clicking onto <a href="https://www.english.com">https://www.english.com</a> link.

Good luck!

Dieter (alias Fernando)

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