AN3576

Software for VSC PHYs

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INTRODUCTION

This document details the software required for Microchip PHYs with part numbers beginning with “VSC.” It also provides instructions on how to find and download the software from GitHub. The included guidance is not applicable to Microchip PHYs with part numbers beginning with “LAN” or “KSZ.”

This document is applicable to designs that use VSC PHYs connected to an embedded processor, FPGA, or Ethernet switch from another vendor. If the PHY is part of a VSC switch architecture and is using a VSC software package (that is, WebStaX, SMBStaX, IStaX, or CEServices), the user does not need this document.

Most VSC PHYs (100M, 1G, and 10G) require some type of software to control the VSC PHY. This software consists of a known sequence of register accesses, which have been tested and verified to provide desired results. Multiple options are available including:

- U-Boot Driver
- Linux® Kernel Driver (Open Source)
- User Space API (VSC6802: PHY API and VSC6803: ETH API or MESA API)

Among the options, User Space API provides the most complete feature coverage and control for VSC PHYs. In some cases, both the Linux Kernel Driver and User Space API are available. In these cases, the User Space API expects to have complete control of the PHY, and therefore the Linux Driver should be disabled.

The use of a U-Boot Driver is often the desired way to control the VSC PHY during initial boot sequences. In this phase of boot cycle, Diagnostic Power-On Self Test (POST) may be run and the PHY may be configured to receive the necessary system initialization code to continue the boot process.

The Linux Kernel Driver is also often used to control the PHY. However, this method can only be used with the Linux operating system (OS). The drivers have been released (and upstreamed into Linux Kernel.org). Linux drivers normally support common capabilities seen across many available PHYs, regardless of vendor. Therefore, the full functionality of a particular PHY may not be provided in the driver if that functionality is not common or supported.

Note 1: Not all VSC PHYs are included in the Linux Kernel Driver. For the VSC PHYs that are included, not all PHY features may be supported by the Linux Kernel Driver, including advanced features like 1588 or MACsec).

2: When using the Linux Kernel Driver to control the PHY, the PHY API cannot be used as this creates conflicts in the control plane.

The User Space API is OS agnostic and may be used with any OS. The User Space API comprises standard C code functions for specified VSC PHYs.

Note: The User Space API employs thread blocking mechanisms to prevent multiple threads from being active within the API at the same time, as the User Space API has exclusive access and control.

All VSC PHYs, with the exception of VSC8530/31 and VSC8540/41, are supported in the User Space API.

A user should base the software on the available driver or User Space API instead of attempting to create a custom register sequence. Most VSC PHYs have an embedded microcontroller core. Some register sequences include loading commands into the microcontroller core, which runs autonomously within the VSC PHY and requires a handshake mechanism to communicate with the outside Application/API/Driver. Therefore, scripting register sequences may not

always be an appropriate option, and the handshake is handled by the driver or User Space API. In addition, the register sequences provided in the driver or User Space API have been verified to operate correctly for the functionality provided without any undesired side effects. It is recommended to use the driver as is or use it as the starting point and to adapt it to your specific environment in case designers prefer to expose and control additional features through the driver.

SECTIONS

This document covers the following topics:

SOFTWARE AVAILABILITY FOR EACH PHY

Table 1 indicates the software available for each device.

TABLE 1: PHY SOFTWARE AVAILABILITY

PHY	Advanced Features	API	Linux Driver	Linux Release (mscc.c)	U-Boot Driver	Product Page
VSC8211	No	Yes	Y*	—	Y*	https://www.microchip.com/wwwproducts/en/VSC8211
VSC8221	No	Yes	Y*	—	Y*	https://www.microchip.com/wwwproducts/en/VSC8221
VSC8501	No	Yes	Y	6.4.2	No	https://www.microchip.com/wwwproducts/en/VSC8501
VSC8502	No	Yes	Y	5.10.189	No	https://www.microchip.com/wwwproducts/en/VSC8502
VSC8514	No	Yes	Y	5.2	Y*	https://www.microchip.com/wwwproducts/en/VSC8514
VSC8512	No	Yes	No	—	No	https://www.microchip.com/wwwproducts/en/VSC8512
VSC8530	No	No	Y	4.10	Y	https://www.microchip.com/wwwproducts/en/VSC8530
VSC8531	No	No	Y	4.10	Y	https://www.microchip.com/wwwproducts/en/VSC8531
VSC8540	No	No	Y	4.10	Y	https://www.microchip.com/wwwproducts/en/VSC8540
VSC8541	No	No	Y	4.10	Y	https://www.microchip.com/wwwproducts/en/VSC8541
VSC8541RT	No	No	Y	4.10	Y	https://www.microchip.com/wwwproducts/en/VSC8541RT
VSC8504	No	Yes	Y	5.5	No	https://www.microchip.com/wwwproducts/en/VSC8504
VSC8552	No	Yes	Y	5.5	No	https://www.microchip.com/wwwproducts/en/VSC8552
VSC8572	Yes	Yes	Y**	5.5	No	https://www.microchip.com/wwwproducts/en/VSC8572
VSC8574	Yes	Yes	Y	4.2	Y**	https://www.microchip.com/wwwproducts/en/VSC8574
VSC8562	Yes	Yes	Y	5.5	Y*	https://www.microchip.com/wwwproducts/en/VSC8562
VSC8564	Yes	Yes	Y	5.5	Y*	https://www.microchip.com/wwwproducts/en/VSC8564

Note 1: **Y** = Support in the `mscc.c` file only (implemented by Microchip).
Y* = Support in the `vitesse.c` file only (implemented by Freescale)
Y** = Support in `mscc.c` and `vitesse.c` files. User must only enable one driver, the `mscc.c` option is recommended.
Adv Feature = Advanced Feature Set in PHY = MACsec, 1588, or both

2: The functionality in the file `vitesse.c` will be deprecated if there is similar functionality in `mscc.c`.

TABLE 1: PHY SOFTWARE AVAILABILITY (CONTINUED)

PHY	Advanced Features	API	Linux Driver	Linux Release (mscc.c)	U-Boot Driver	Product Page
VSC8575	Yes	Yes	Y	5.5	No	https://www.microchip.com/wwwproducts/en/VSC8575
VSC8582	Yes	Yes	Y	5.5	No	https://www.microchip.com/wwwproducts/en/VSC8582
VSC8584	Yes	Yes	Y	4.2	Y**	https://www.microchip.com/wwwproducts/en/VSC8584
VSC8489	Yes	Yes	No	—	No	https://www.microchip.com/wwwproducts/en/VSC8489
VSC8490	Yes	Yes	No	—	No	https://www.microchip.com/wwwproducts/en/VSC8490
VSC8491	Yes	Yes	No	—	No	https://www.microchip.com/wwwproducts/en/VSC8491
VSC8254	Yes	Yes	No	—	No	https://www.microchip.com/wwwproducts/en/VSC8254
VSC8256	Yes	Yes	No	—	No	https://www.microchip.com/wwwproducts/en/VSC8256
VSC8257	Yes	Yes	No	—	No	https://www.microchip.com/wwwproducts/en/VSC8257
VSC8258	Yes	Yes	No	—	No	https://www.microchip.com/wwwproducts/en/VSC8258

Note 1: **Y** = Support in the `mscc.c` file only (implemented by Microchip).
Y* = Support in the `vitesse.c` file only (implemented by Freescale)
Y** = Support in `mscc.c` and `vitesse.c` files. User must only enable one driver, the `mscc.c` option is recommended.
Adv Feature = Advanced Feature Set in PHY = MACsec, 1588, or both

2: The functionality in the file `vitesse.c` will be deprecated if there is similar functionality in `mscc.c`.

U-BOOT DRIVER SOLUTIONS

A driver in U-Boot for some of the VSC PHYs is available (U-Boot v2017.03 or later). See https://www.denx.de/wiki/U-Boot/WebHome.

To download the latest U-Boot version, refer to the FTP site, ftp://ftp.denx.de/pub/u-boot/u-boot-2020.07.tar.bz2.

Using version v2020.07 as an example, the:

- MCHP driver is located at `u-boot-2020.07/drivers/net/phy/mscc.c`.
- Freescale driver is located at `u-boot-2020.07/drivers/net/phy/vitesse.c`.

Enabling U-Boot Driver

Make sure that the CONFIG_PHY_MSCC definition is defined in the build, so the `mscc.c` file gets built and pulled into the build. When included, a `mscc.o` is generated.

For more information or documentation about U-Boot, go to https://www.denx.de/wiki/U-Boot/WebHome.

As MCHP-developed drivers become available (which are located in `mscc.c`) if similar drivers exist in the `vitesse.c` file, then the drivers in the `vitesse.c` file are deprecated.

LINUX® KERNEL DRIVER SOLUTIONS

Linux Kernel Drivers are available for many of the VSC PHYs. At a minimum, the Linux Kernel Driver supports the basic VSC PHY functionality. Advanced feature functionality (1588 and MACsec) may also be available for some devices. If the MIT Licensed Linux Driver exists, it is released via Open Source.

Download the latest driver from Linux Kernel Archives at https://www.kernel.org/.

- HTTP: https://www.kernel.org/pub/
- GIT: https://git.kernel.org/

Any Linux Kernel Driver version after version 4.10 will have all contributions for VSC8530/31 and VSC8540/41 families. Support for other VSC PHYs continues to be added over time.

It is recommended to download a tarball from one of the later stable versions of Linux. (See v5.6.14, which is the latest stable version at this time.)

In the past, Linux Kernel Drivers were developed by customers or third parties that contributed to the Open Source community. Those drivers are located in the `vitesse.c` file and are mostly for older PHY generations.

Using version 5.6.14 as an example, the:

- MCHP-developed drivers are located at `linux-5.6.14\drivers\net\phy\mscc.c`
- Freescale-developed drivers are located at `linux-5.6.14\drivers\net\phy\vitesse.c`

Prior to the Linux 5.7 release, the MCHP-developed drivers are available and located in `mscc.c`. There may be duplicated drivers developed by third parties that are deprecated. Therefore, when building the Kernel, the build configuration should be updated to exclude the deprecated drivers, as they should not be included.

With the Linux 5.7 release, the directory structure changed slightly and the `mscc.c` file was moved as support for more PHY's, and more PHY functionality was added. The updated location is: linux-5.7\drivers\net\phy\mscc\mscc_main.c.

Enabling Linux® Kernel Driver

Make sure that the CONFIG_MICROSEMI_PHY definition is defined in the build, so the `mscc.c` file gets built and pulled into the build. When included, an `mscc.o` is generated.

Many distributions of Linux for Ubuntu, Red Hat, and so on are available. These versions are correlated to the versions of the Linux Kernel Driver, which is propagated from kernel.org out to these various distributions.

USER SPACE API SOLUTIONS

User Space API Software Packages

The PHY API is a software package that is compiled with or linked to the application. The API uses accessor functions (MDIO/SPI) to control and configure the PHY registers.

There are two types of API:

1. VSC6803 ETH API (also referred to as the Microsemi Ethernet Switch API or MESA)
2. VSC6802 PHY API (*only applicable to certain legacy designs*)

The VSC6803 ETH API is recommended for all designs except for designs only applicable with VSC6802 PHY API.

The VSC6802 PHY API is only applicable to designs that use legacy versions of 1588 VSC PHYs, and those that use the 1588 Timestamping feature in those PHYs.

In the past, the VSC6802 PHY API had a software workaround that was needed for legacy versions of 1588 VSC PHYs. The issue (1588 OOS Recovery) was fixed in the hardware in 2017/2018, and since then, 1588 VSC PHYs do not require the workaround anymore. The workaround was not ported to VSC6803.

VSC PHY versions are distinguished using the suffix in their part numbers. Some part numbers do not have a suffix.

The legacy versions of 1588 VSC PHYs that require the use of VSC6802 PHY API *when using the 1588 feature* are:

- VSC8572-01
- VSC8572-04
- VSC8574-01
- VSC8574-04
- VSC8254 (no suffix)
- VSC8256 (no suffix)
- VSC8257 (no suffix)
- VSC8258 (no suffix)
- VSC8489 (no suffix)
- VSC8489-10
- VSC8489-11
- VSC8489-13
- VSC8489-14
- VSC8489-15
- VSC8490-10
- VSC8490-11
- VSC8490-13
- VSC8490-14
- VSC8491-10
- VSC8491-11
- VSC8491-13
- VSC8491-14

Note: When working with the VSC8489-16, VSC8489-17, VSC8490-17, VSC8254-01, VSC8257-01, or VSC8258-01 in an application that uses the 1588 feature, do not use VSC6802. Use VSC6803 instead.

VSC6803 - ETH API/MESA API

The product pages can be found on the Microchip website at https://www.microchip.com/wwwproducts/en/VSC6803. The **Documents** tab contains all the important reference materials for the product.

The VSC6803 ETH API is available on GitHub. Currently, the GitHub repository for ETH API contains the following ETH API releases: v2019.06, v2019.09, v2019.12, and v2020.03.

The repository can be found at https://github.com/microchip-ung/mesa.

The latest ETH API version is the default version at any given time. For obtaining earlier versions, go to the **Tags** tab and choose the associated commit for the earlier version of the code.

To obtain a specific release, download the release and artifacts for that release on GitHub. As an example, for the v2022.03 release, go to https://github.com/microchip-ung/mesa/releases/tag/v2022.03. Under the "Assets" heading, search the file, `mesa-v2022.03.tar.gz`. The file contains all the artifacts required to build the released code.

VSC6802 - PHY API

The product pages can be found on the Microchip website at https://www.microchip.com/wwwproducts/en/VSC6802. The **Documents** tab contains all the important reference materials for the product.

The current PHY API release for VSC6802 is 4.67.05. It is in maintenance mode and is not expected to change. This version of the code includes 1588 OOS Recovery for legacy versions of the VSC PHYs.

The VSC6802 PHY API is available on GitHub. Currently, the GitHub repository for PHY API contains the following PHY API releases: 4.67.03, 4.67.04, and 4.67.05.

The repository is located at https://github.com/microchip-ung/unified_api_4x.

The latest PHY API version is the default version at any given time. For obtaining earlier versions, go to the **Tags** tab and choose the associated commit for the earlier version of the code.

Note: Other versions of the VSC6802 PHY API are also available. (For example, PHY API releases 4.68, 4.68.01, 4.68.02, and 4.69.) These versions are not PHY API stand-alone releases and are not on GitHub.

APPENDIX A: REVISION HISTORY

TABLE A-1: REVISION HISTORY

Revision Level & Date	Section/Figure/Entry	Correction
DS00003576C (09-29-23)	Table 1	Corrected Linux® driver support for VSC8501/ VSC8502 based on KB "VSC8502/VSC8501 - Linux Support."
	Introduction	Changed “whereKSZ” to “KSZ.”
DS00003576B (07-22-22)	VSC6803 - ETH API/MESA API	Added file and content information on GitHub.
	All	Made minor text and formatting changes.
DS00003576A (08-03-20)	Initial release	

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