Application Brief
Accelerating next-generation automotive designs with the TDA5 Virtualizer™ Development Kit

Texas Instruments

Introduction

Continuous innovation in high-performance, power-efficient systems-on-a-chip (SoCs) is enabling safer, smarter and more autonomous driving experiences in even more vehicles.

As another big step forward, Texas Instruments and Synopsys developed a Virtualizer Development Kit™ (VDK) for the TDA5 high-performance compute SoC family, which includes the TDA54-Q1. The TDA5 VDK enables developers to evaluate, develop and test devices in the TDA5 family ahead of initial silicon samples, providing a seamless development cycle with one software development kit (SDK) for both physical and virtual SoCs. Each device in the TDA5 family have a corresponding VDK to enable a common virtualization design and consistent user experience.

Along with the VDK, TI and Synopsys are providing additional components to create the full virtual development environment. Figure 1 provides an overview of available resources, which include:

- The virtual prototype, which is the simulated model of a TDA5 SoC.
- Deployment services from Synopsys, which are add-ons and interfaces that enable developers to integrate the VDK with other virtual components or tools.
- Documentation for the TDA5 and the TDA54-Q1 software development kit.
- Reference software examples for each TDA5 VDK and SDK to help developers get started.
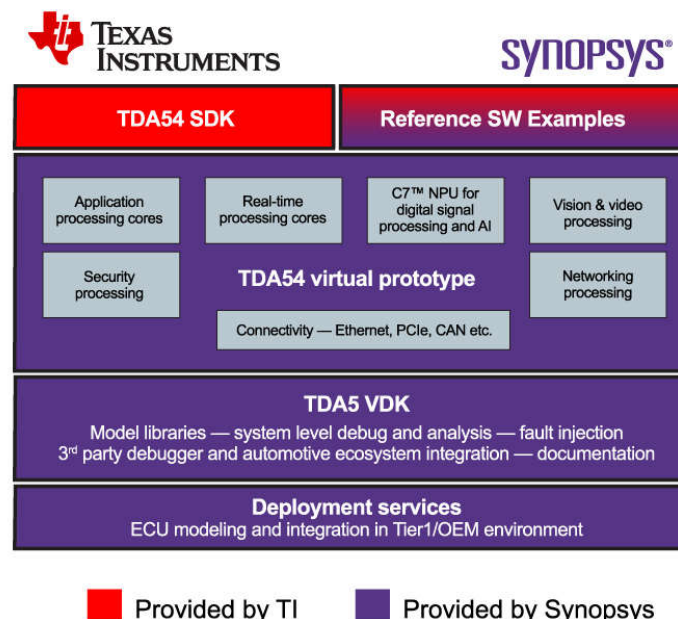
Figure 1. Block diagram showing components provided by TI and Synopsys to get started with development on the VDK

Why virtualization matters

Virtualization designs greatly reduce automotive development cycles by enabling software development without physical hardware. This allows developers to accelerate or "shift-left" development by starting software earlier and then migrating to physical hardware once available (as shown in Figure 2). Additionally, earlier software development extends to ecosystem partners, enabling key third-party software components to be available earlier.
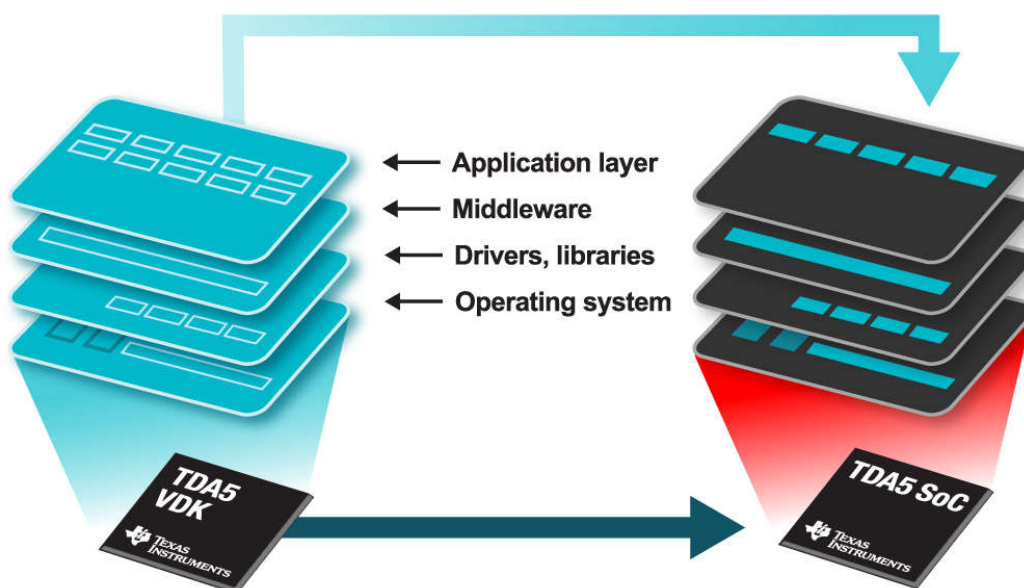
Figure 2. Visualization of how software can be migrated from VDK to SoC

Accelerating development with virtualization

The TDA5 VDK helps software developers work more effectively and efficiently, allowing them to use software-in-the-loop testing, so they can test and validate virtually without needing costly on-the-road testing.

Developers can use the TDA5 VDK to enhance debugging capabilities with deeper insights into internal device operations than what is typically exposed through the physical SoC pins. The TDA5 VDK also provides fault injection capabilities, enabling developers to simulate failures inside the device to get better information on how the software behaves when something goes wrong.

Scalability of virtualization

Scalability is another key benefit of the TDA5 VDK because virtualization platforms don't require shipping, allowing development teams to ramp faster and be more responsive with resource allocation for ongoing projects. The TDA5 VDK also enables automated test environments, since development teams can replace traditional "board farms" with virtual environments running on remote computers. This helps automakers streamline continuous integration, continuous deployment (CICD) workflows to more efficiently and effectively accomplishing testing.

Since the TDA5 VDK is also available for future TDA5 SoCs, developers can scale work across multiple projects. If a developer is using the VDK for a specific TDA5 device (for example, TDA54), they can explore other products in the TDA5 family in a virtual environment without needing to change hardware configurations.

System integration

Virtualization designs such as the TDA5 VDK serve as the foundation for developers to build complete digital twins for their designs. By virtualizing the SoC, it can be integrated with other virtual components and tools to create larger simulated systems such as full ECU networks. Figure 3 shows how developers can leverage the capabilities of the Synopsys platform to integrate the VDK with other virtual components and simulate complete designs.
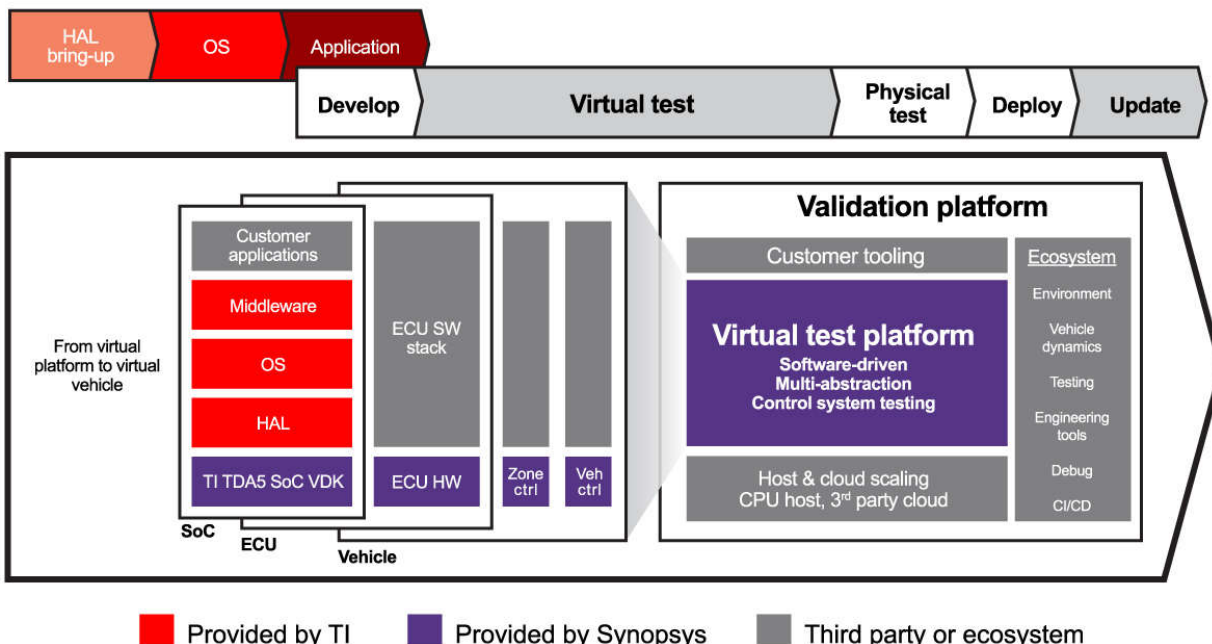
Figure 3. Diagram showing how the VDK can integrate with other virtual components and simulate complete designs

Digital environment simulation tools can also be integrated with the TDA5 VDK to enable virtual testing in simulated driving scenarios, allowing developers to quickly perform reproducible testing. The TDA5 VDK also allows developers to leverage the broad ecosystem of tools and partners from Synopsys to get the most of their virtual development experience.

Getting started with the TDA54 VDK

The TDA54 SDK is now available on TI.com to help engineers get started with the TDA54 virtual development kit. Samples of the TDA54-Q1 SoC, the first device in the TDA5 family, will be sampling to select automotive customers by the end of 2026. Contact TI for more information about the TDA5 VDK and how to get started.

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