

Safety Certifiable Application Components for NXP's i.MX 8

INTRODUCTION

The i.MX 8 Platform for Safety Certifiable Applications available from CoreAVI is comprised of safety certifiable Vulkan® SC™ drivers, OpenGL® SC libraries and safety certifiable GPU tools which have been pre-integrated and validated together to significantly de-risk the integration challenges typically faced when integrating hardware and software components from multiple suppliers. The platform is an off the shelf foundation upon which safety certifiable applications can be built with confidence.

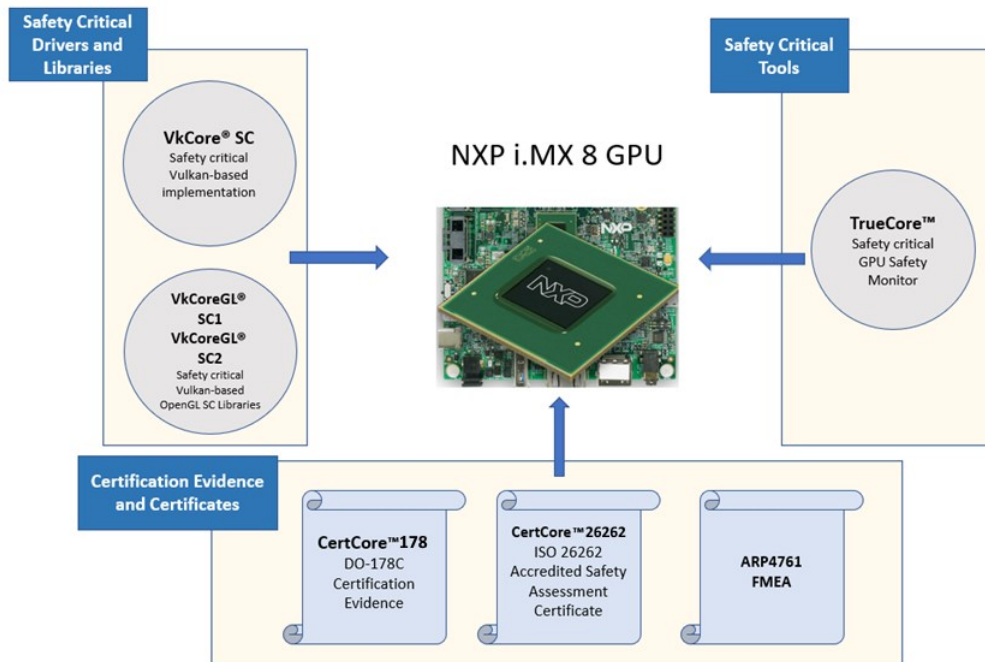


Figure 1: i.MX 8 Platform for Safety Certifiable Applications

VKCORE® SC DRIVER

Vulkan SC is a thin but wide, low-overhead graphics and compute API targeting high performance applications by offering higher performance than OpenGL as well as a more balanced CPU/GPU usage. The Vulkan SC API enables programmers to access the hardware efficiently through a common API that can be used to support both graphics and compute needs. CoreAVI's VkCore SC Vulkan SC-based driver provides the ability to access the GPU and other various hardware components on the i.MX 8 related to the input and displaying of video. The driver is designed to meet the needs of safety critical software to the highest safety levels. VkCore SC provides support for a variety of embedded and real-time operating systems including DDC-I Deos, Green Hills Integrity, Linux, Lynx Software Technologies LynxOS, SYSGO PikeOS, WindRiver VxWorks, and more.

The i.MX 8 is also supported by CoreAVI's safety critical OpenGL SC 1.0.1 and SC 2.0 certifiable graphics driver library suites, named VkCoreGL SC1 and VkCoreGL SC2. The drivers are available as standard product, developed by CoreAVI as part of its roadmap R&D investments.

CoreAVI's VkCore SC supports the i.MX 8's integrated Vivante GC7000 XSVX GPU. Partitioning of the GPU and memory resources is separated from applications using the Vulkan SC API. The driver executes deterministically, pre-allocates resources during software initialization phases, and built-in test cases validate that the hardware is working as expected.

The following video output features are supported by VkCore SC:

- An HDMI or embedded DisplayPort output
- Up to 2 LVDS display outputs.
- Gamma correction applied to the above display types.
- Standard VESA resolutions up to 3840x2160 @30hz or 2560x1024@60Hz.
- Fully customizable video resolution programming up to maximum allowed hardware pixel rates.
- Memory Based Display
 - Ability for the GPU to render to a location in system memory for another device to read that video stream.

The following video input features are supported by VkCore SC:

- A lossy H.264 video stream decoder
 - The H.264 decoder supports streams up to 1920x1080 images at 60 frames per second with support for Baseline, Main, and High H.264 profiles.
- A HDMI display input.
 - Format support includes up to 2048 width and 2048 height in pixels.
- CoreAVI's video capture from memory
 - Allows an external device to supply video streams to be read in an image data into the Vulkan environment.
- Display planes are used to allow hardware acceleration of video overlay capabilities.

Support for the i.MX 8 Vivante GC7000 XSVX GPU includes the following functionality:

- The dual GPU cores can be configured as a single GPU, or independent GPUs.
- VkCore SC provides the Vulkan SC 1.0 API specification with minor deviations:
 - Supports graphics and compute pipelines
 - Supports geometry shaders in graphics pipelines
 - Some advanced features of SPIR-V 1.4 and 1.5 are not supportable due to hardware limitations
- Power management of the GPU cores.

VKCOREGL[®] SC LIBRARIES

The OpenGL driver library operates through the Vulkan API and will allow legacy applications to run on the i.MX 8. Supported shaders include Vertex, Fragment, and Geometry. The drivers are available with certification evidence to support avionics certification to RTCA DO-178C and EUROCAE ED-12C, up to DAL A as well as accredited safety assessment certificates to support ISO 26262 ASIL D safety compliance.

Please refer to the VkCore SC and VkCoreGL SC datasheets for more detailed information on these products.

TRUECORE™

TrueCore is a GPU safety monitor library designed to interoperate with CoreAVI GPU drivers.

TrueCore uses a patented approach to provide a suite of highly engineered Initiated Built-In-Tests (IBIT). These provide test coverage of the intended function of the GPU's graphics rendering pipeline (graphics command to framebuffer memory). Through the use of several tests, each with a unique test pattern that is verified independently by the CPU, applications are provided with flexibility in optimizing test execution and result filtering that may not be present with FPGA-based approaches. In testing the graphics rendering pipeline, TrueCore is testing one or more instances of each functional IP block, thereby providing test coverage for design errors, common-mode failures, and incorrect function caused by unused and undocumented functions.

CERTIFICATION SUPPORT

CoreAVI's CertCore™ 178 provides complete FAA DO-178C /EASA ED-12C Level A certification data packages to aid in FAA DO-178C / EASA ED-12C avionics software safety certification.

CoreAVI's CertCore™ 26262 is available for programs requiring an accredited safety assessment certificate to support the automotive and advanced driver assistance systems (ADAS) safety certification of CoreAVI's graphics and video software products. CertCore 26262 includes an accredited safety assessment certificate to support ISO 26262 ASIL D safety compliance.

CoreAVI provides support ARP4761 processes and AC 20-152A objective COTS-6 with a CoreAVI developed Failure Modes & Effects Analysis (FMEA) identifying the failure modes and detection for the GC7000XSVX GPU used on the i.MX 8 family.

i.MX 8

Features and Benefits

- An application processor from NXP, the i.MX 8 QuadMax is built for advanced media processing, secure domain partitioning and innovative image processing.
 - Two Arm Cortex A72 CPU cores at 1.8 GHz
 - Shared 1MB L2 cache (w/ ECC)
 - Four Arm Cortex A53 CPU cores at 1.2 GHz
 - Shared 1MB L2 cache (w/ ECC)

- Two Arm Cortex M4F cores at 266 MHz
- Dual Vivante GC7000 XSVX GPUs
 - 8 Vec4 shaders
 - Up to 128 GFLOPS
 - Pixel fillrate of 6.4 Gpixels/second and Texel fillrate of 3.2 Gtexels/second
- Two display processors with SafeAssure
 - (1) HDMI output
 - (2) LVDS outputs
 - Failover display path
- Up to 4K video decode using H.264/H.265
- Up to 1080p video encode using H.264
- Available with extended temperature range from NXP to meet the needs of rugged embedded systems
- Supported with CoreAVI's VkCore SC Vulkan-based graphics and compute driver, VkCoreGL SC1 and VkCoreGL SC2 OpenGL libraries
- TrueCore GPU safety monitor

Please contact NXP for a full list of connectivity and security features.

The NXP i.MX 8 SoC is the next generation in application processors from NXP that is targeted towards the embedded rugged Mil/Aero/Avionics and automotive markets. The i.MX 8 offers a high degree of functional integration for advanced multi-display eCockpit systems with low virtualization software overhead.

The i.MX 8 SoC is comprised of two Arm Cortex A72 cores and four Arm Cortex A53 cores with two Vivante GC7000 XSVX GPUs. The high level of integrated processing and connectivity makes it a very compact, power efficient solution ideal for embedded applications and for use on space constrained modules.

The many feature and performance benefits offered by the i.MX 8 make it a compelling solution for any embedded application that is in development now and which has a long lifecycle requirement. With the i.MX 8 just being introduced to the market it offers the longest lifecycle of any embedded high-performance graphics/compute solution.

The i.MX 8 is a natural replacement for any system currently using the i.MX 6 or S32V234. The table on the following page provides a comparison between the i.MX 8 and previous generation SoC solutions.

DEVICE	S32V234	i.MX 6 QUAD	i.MX 6 QUAD PLUS	i.MX 8 QUAD	i.MX 8 QUADMAX
Processor Core Complex 1					
Processor Type	ARM Cortex-A53	ARM Cortex-A9	ARM Cortex-A9	ARM Cortex A53	ARM Cortex A53
Number of Cores	4	4	4	4	4
Max frequency (MHz)	1000	1000	1200	1200	1200
DMIPS/SoC	8960	10000	12000	10752	10752
Cache L2	512KB shared	1MB shared	1MB shared	1MB shared	1MB shared
Processor Core Complex 2					
Processor Type	N/A	N/A	N/A	N/A	ARM Cortex A72
Number of Cores					2
Max frequency (MHz)					1800
DMIPS/SoC					16992
Cache L2					1MB shared
Processor Core Complex 3/4					
Processor Type	Arm Cortex M4	N/A	N/A	ARM Cortex M4F	ARM Cortex M4F
Number of Cores	1			2	2
Max frequency (MHz)	133			266	266
Graphics Processing Complex					
GPU Core	VIVANTE GC3000	VIVANTE GC2000	VIVANTE GC2000+	VIVANTE GC7000	VIVANTE GC7000 XSVX
Number of Independent GPUs	1	1	1	2	2
Pixel Fillrate (Gpixels/sec)	1.6	1.25	1.6	6.4	6.4
Texel Fillrate (Gtexels/sec)		0.2		3.2	3.2
Resolution @60fps	1080P	1080P	1080P	4K	4K

For more information on CoreAVI's support for the i.MX 8 SoC, contact Sales@CoreAVI.com.

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