Summary

This application note makes a short cross analysis of ASSP and FPGA graphics display controllers (GDC) targeting mid- and high-volume embedded GUI applications. Abilities of FPGA based graphics controllers, designed by right IP cores and SW tools, are often overlooked by embedded designers who are used to design products based on ASSP graphics controllers. Xilinx® Spartan®-6 and Virtex®-6 FPGAs combined by Xylon logicBRICKS™ IP cores can make customized graphics controllers which provide exact feature sets and require minimal investments.

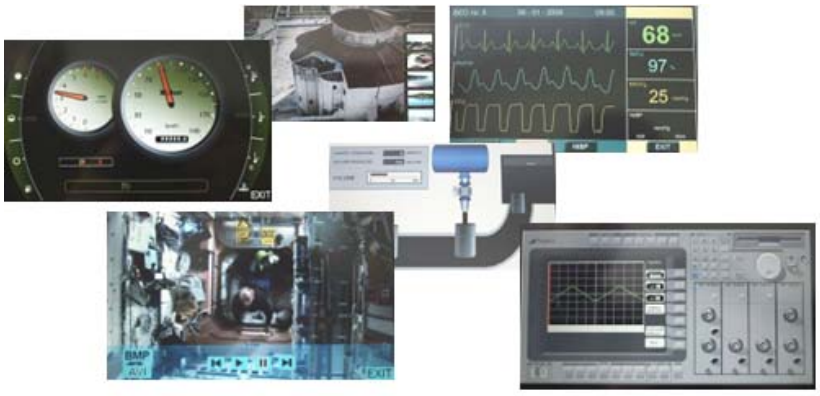


Figure 1: Example GUIs designed by Xylon's logicBRICKS IP cores

Introduction

Designers of embedded systems featuring Graphical User Interface (GUI) face several design challenges which must be overcome in order to design functional and attractive cost-sensitive products. Selection of right graphics controller makes a significant impact on end product's features and its market success.

Graphics controllers can be realized in ASIC, ASSP or FPGA technologies. The ASIC graphics controllers play role in very high-volume applications which can withstand ever increasing manufacturing and NRE costs. Such applications are not targeted by the other two semiconductor technologies, which can be efficiently deployed in mid- to high-volume applications (up to several 1M units).

Until recently, ASSP graphics controllers have been the only designers' alternative for design of GUI embedded systems for the mid- and the high-volume applications. This trend has been changed by emergence of advanced low-cost FPGA devices capable to implement graphics controller's functions in just a portion of available silicon resources.

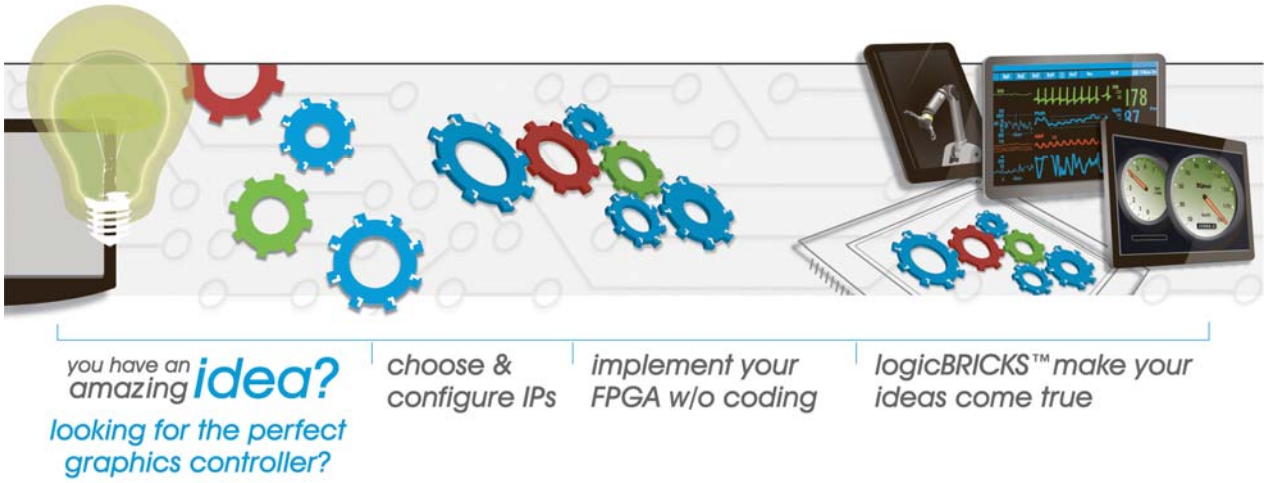
Xilinx® Spartan®-6 and Virtex®-6 FPGAs make an excellent silicon basis for development of customized graphics controllers. Xilinx's implementation tools, such as the Xilinx Platform Studio and the EDK, enable designers to manage the great complexity of FPGA chips through an intuitive and user-friendly GUI-based interface. Designers can work with FPGAs as system platforms, and design complex Systems on Chip (SoC) by mixing predefined functions blocks called IP cores.

FPGAs have a great ability to decrease system's BOM by absorbing different silicon from the PCB. Consequently, it reduces overall manufacturing costs. Additionally, many embedded systems use FPGAs for different purposes. In such systems, graphics controller's functions can be implemented in the FPGA at no cost, or at the minimal cost associated to the FPGA's silicon resources.

Xylon provides several logicBRICKS™ IP cores which can be used for development of customized graphics controllers. These IP cores come with software drivers and can be used with several industry leading GUI development software tools. Xylon's IP cores are fully compatible with the Xilinx Platform Studio and the EDK, and designers familiar with the tools can immediately start designing with logicBRICKS.

Xylon's Low-Volume IP Program provides a quick and simple online purchasing and licensing. Very competitive pricing allow logicBRICKS users to invest minimally, and include advanced graphics functions to Xilinx FPGA designs.

Competitive Xylon's pricing can be illustrated by an example of advanced graphics controller based on the logiCVC-ML Compact Video Controller and the logiBITBLT Bit Block Transfer 2D Graphics Accelerator. IP license fees for such controller implemented in up to 5,000 product units cost as low as 0.59 € / unit. This IP cost /unit ratio becomes even smaller with an increase in a number of the manufactured product units.



Cross Analysis: ASSP and FPGA Graphics Controllers

	ASSP GDC	Xylon GDC
FEATURES	ASSP GDCs offer very comprehensive feature sets, which usually cover many features of no interest for the particular design. The features setup can be controlled only by software. At last, you pay for unwanted features.	Xylon and Xilinx based GDCs can provide an exact setup of GDC features required by application. Configurability is provided at both, hardware and software level. Achievable features are fully competitive with those provided by ASSPs with a small number of exceptions. A vast majority of 2D and 2.5D GUIs can be fully supported with FPGA GDCs.
PERFORMANCE	Used as benchamarks! Have similar performances as FPGA GDCs; sometimes better due to clock speed or architecture advantages, and sometimes limited by the fixed chip's architecture.	Fully competitive in the field of 2D and 2.5D graphics. In some high-end and special applications the FPGA GDCs may be the best class graphics solutions. Follow this link to learn more logicBRICKS in such applications.
SW SUPPORT	Fully supported by ASSP manufacturers and third-party SW suppliers.	FPGA GDCs often lack good software support and a small choice of software tools for GUI design can make a big disadvantage. Xylon's GDCs are well supported by third-party GUI

		development tools, and this fact differentiates our logicBRICKS IP cores from other FPGA IP cores. The level of provided SW support for GUI developments is competitive to the level provided by the most popular ASSP GDCs.
AVAILABILITY & OBSOLESCENCE	This has become a very important issue in the embedded market. The ASSP suppliers sometimes cannot assure the availability of particular device during expected product's lifetime. You are forced to invest in a stock that may remain unused. Non-continued obsolete ASSPs can generate significant production problems and require big design changes, or product's discontinuation. In case of obsolete or unavailable ASSPs, a great deal of the developed software cannot be inherited. Additionally, the designers are forced to learn new tools compatible with ASSP replacements.	Xylon GDCs are compatible with the FPGA devices manufactured by Xilinx - the global FPGA leader and a reliable silicon provider. FPGAs are generic components usable for different purposes and functionally defined during a configuration process. Product manufacturers can have simplified stocks, or order new batches when it is necessary. Additionally, the soft-IP nature of Xylon logicBRICKS prevents obsolescence even at the Xilinx FPGA component level. In a case of FPGA device family discontinuation, the GDC can be implemented in the new replacement FPGAs. Xilinx development tools, like the Xilinx Platform Studio and the EDK integrated software solutions, provide unified design environment that shall remain compatible with even currently unavailable Xilinx FPGA devices. This way the system designers do not have to change and discard already known design techniques and tools. Re-usability of already developed software can be elevated on a new and high level.
FLEXIBILITY	ASSPs have a predetermined feature sets and missing features cannot be easily integrated into final products. Workarounds are possible with additional silicon components only. Upon deployment in the field, the product integrating the ASSP GDC can be changed only at the software level.	The flexibility of the FPGA devices is unattainable for other semiconductor technologies. Changes at hardware and software levels are possible even on the FPGA products deployed in a field. The GDC feature setups can be trimmed to fulfill requirements of the whole manufacturer's line up. This way less featured products can use smaller and cheaper FPGA devices, while more advanced products can use bigger FPGA devices available in the same package, which offer more silicon resources for advanced features. Potential manufacturer's savings can be very high with the preserved SW compatibility through the whole product's line up.
CONNECTIVITY	ASSPs have a rich and predetermined IO connectivity abilities which enable interfacing to many different MCU types. In certain cases, this interface can be hard or even impossible to implement.	FPGA technology allows foran easy interfacing to different MCU types and allows a great designing freedom. FPGA graphics controller can utilize almost any standard or proprietary bus standard for the MCU interfacing, i.e. SPI bus (logiHAC Automotive Hybrid Cluster Platform) or PCIe® (logiCRAFT-CC Companion Chip Platform).

SKILLS	Required hardware skills mostly relate to the PCB design, while these requirements are quite higher for software skills. Design teams working with different GDCs must be familiar with different software tools.	Slightly higher requirements upon hardware skills for design team unfamiliar with the FPGA. The design teams with basic FPGA knowledge do not need any new skills. Level of the required software skills equal to the ASSP related skills. Switch from the ASSP to the Xylon FPGA GDC may be a trivial task if designers already know SW tools running on the Xylon GDC. The product line up can be supported by a unified and single design environment.
PRICE	Benchmark price! Developers often pay for unneeded features. Accordingly to customers' responses collected by Xylon, users of ASSP graphics controllers typically utilize between 30% and 70% of available feature sets.	There is wrong perception in the market that FPGA silicon always cost more than the ASSP silicon. However, besides not very cost sensitive applications requiring high-end FPGA advantages, there is innumerous number of every-day applications that can benefit from the FPGA on the cost's side. It must be noted that Xilinx FPGAs with an integrated Xylon logicBRICKS GDC may be cheaper than competitive ASSPs even in product volumes counting several hundreds of thousands. There are two main reasons: an excellent price/performance ratio provided by Xilinx, and logicBRICKS configurability enabling an exact GDC features setup. This statement is valid for embedded system architecture using the FPGA as the ASSP GDC replacement. The logicBRICKS graphics IP cores are an extremely cost effective way of adding GUI functionality to existing FPGA designs – they can be integrated for a fraction of time and cost requested by an in-house development.

Revision History

Version	Date	Note
1.00	26.01.2010.	Initial Xylon Release

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