White Paper

Programmable Platform Solutions

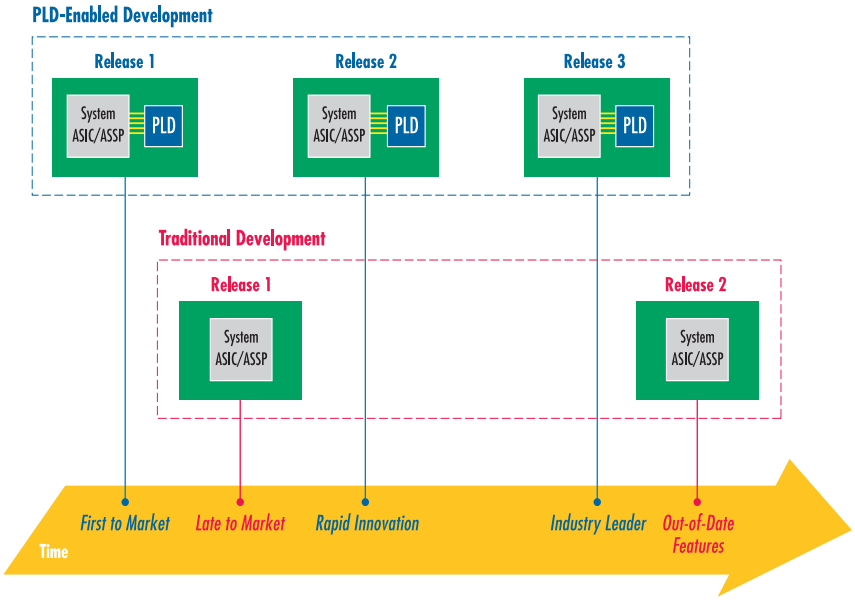
Introduction

When new generations of products are introduced as often as every quarter, designers require a product development strategy that is flexible, fast, and low cost. A PLD-based programmable platform can provide a foundation for rapid, low-cost product innovation and evolution. This platform can help designers react in real time to customer feedback and market changes; tailor features of a basic design for different users, regions, or price points; develop differentiated features before the competition; and maintain the first-mover advantage that is so critical to market success. This "design once, make many" approach improves productivity, saves development time, and ultimately saves money.

PLD Flexibility Enables Product Differentiation

To be successful in today's demanding markets, designers need to get their product to market before the competition. Application-specific integrated circuits (ASICs) and application-specific standard products (ASSPs) provide a low-cost, fixed platform for product design, but are costly, have long development times, and make product differentiation difficult. PLDs offer a new level of flexibility, incorporating the latest features customers demand into an existing design without costly respin cycles. See Figure 1.

Figure 1. PLDs Complement Standard Devices



A programmable platform using PLDs allows product developers to rapidly create new features simply by modifying programming in their design. This flexibility enables designers to create multiple versions of the same product for different segments when the product is introduced into the market. With a minimum of additional engineering effort, designers can also provide new features and upgrades in response to changing market demands and standards, as well as upgrade existing products in the field. This way, developers can continuously and cost-effectively refresh their product lines and provide differentiating capabilities.

By adopting a platform-based product design strategy, designers can set a clear path toward rapid, low-cost innovation. Equally important, a platform design strategy allows greater product differentiation with potentially increased margins. It can get products to market earlier and help keep a brand name in front of the customer with new

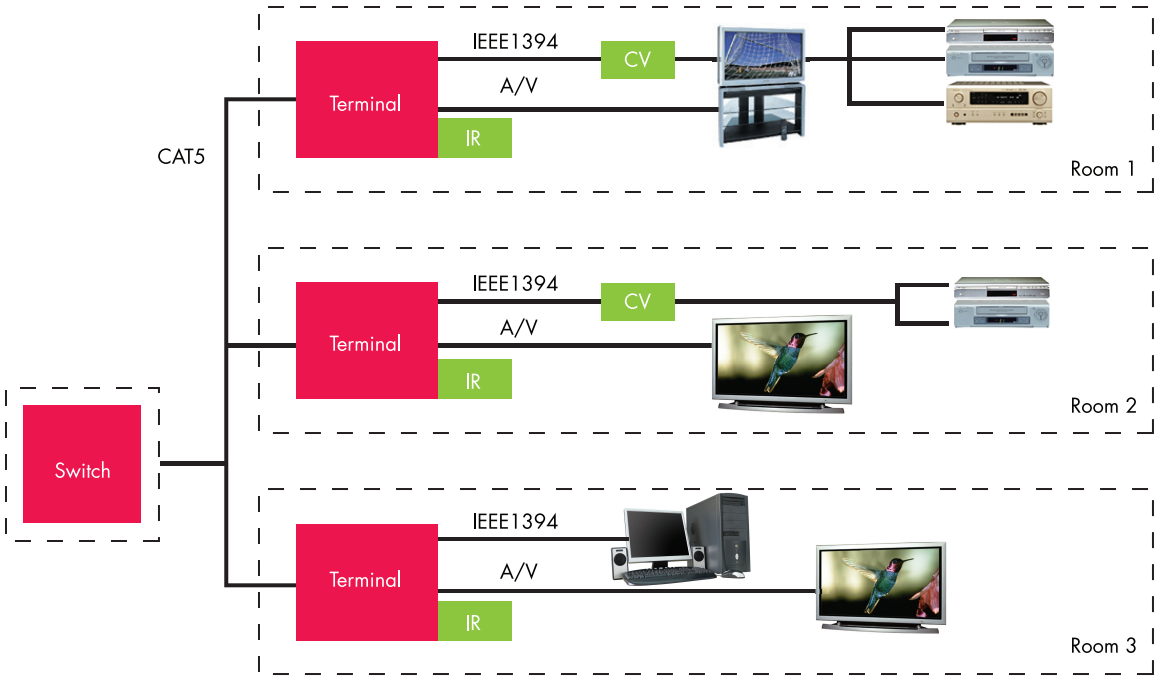
features, while reducing risk by helping obsolescence-proof a product design. Designing with a reusable electronic platform also demonstrates a company's product roadmap, which can positively influence potential investment funding. One-product companies are typically less attractive to the financial community.

PLDs Address Life-Cycle Challenges

Whether a designer is at the concept, emerging market, aggressive growth, or mature market stage of the product life cycle, a PLD-based strategy can meet the associated challenges. For example, at the concept stage, design engineers need to determine whether their great product idea would have lasting success in the market. With a PLD in the product design, designers can prototype their concepts at a fraction of the development cost and time that traditional technologies would require. At the other end of the life-cycle spectrum, the mature market stage, PLDs can be used to incorporate slight feature differentiation to ASSP products or to mimic the functionality of ASSPs that are no longer in production. These tactics can help maintain volume and price when the product has matured and market growth starts slowing.

For example, the rapidly evolving home multimedia LAN market uses PLDs to meet the requirements of greater bandwidth and much higher quality of service (QoS). A typical home multimedia system, shown in Figure 2, is based on a central switch that directs A/V traffic to terminals throughout the home for different applications. The LAN must be highly scalable and adaptable to fit an almost endless number of applications required in today's home. Terminals use CPLDs to bridge older ASSPs for continual feature evolution, eliminating the need for board redesign. In the switch, low-cost FPGAs provide a scalable platform enabling high-bandwidth multimedia content to be moved anywhere within a home network. This scalability allows a cost-effective range of products targeting home solutions.

Figure 2. Emerging Market Stage Example



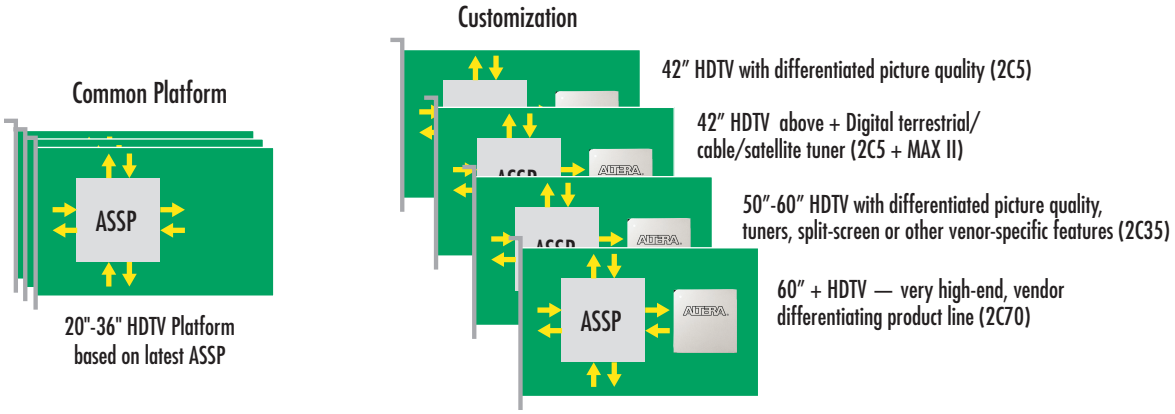
At the emerging market stage, designers are challenged to push their early-adopted products into the mainstream. To accomplish this, a PLD can be used to deliver new differentiating features, while standard, complex functions are powered by an ASSP or an ASIC.

Programmable Platform Facilitates Design in Range of Industries

A wide variety of industries relies on programmable logic to fuel quick innovation and product differentiation. For instance, the automotive market uses a programmable platform to address different market requirements in automotive graphics systems. The trend in the medical industry is to use programmable logic as a consistent hardware platform for a wide range of portable devices, simplifying recertification and preventing obsolescence issues. An example in the consumer industry is the HDTV market, which offers a wide range of display sizes and features—evidence of companies trying to establish customer leadership perceptions in a market fueled by growing customer demand. A key challenge for the HDTV industry is to strike a balance between having low-cost standard solutions and the unique intellectual property that differentiates the products. Achieving this balance can help companies continually enhance their products while keeping costs—and prices—low.

The HDTV industry uses low-cost PLDs and structured ASICs to implement features complementary to existing ASSP functionality in high-volume digital displays, simplifying development of new features and enhancements. For example, a smaller FPGA can be used in a lower-end 42-inch HDTV to improve the picture quality over an ASSP-only solution. In the top-line products, such as 60-inch displays, a large FPGA can significantly improve picture quality and add differentiated features such as increased input/output ports, multimedia networking, and streamlined user interfaces. A programmable platform approach provides an HDTV product line with a range of feature and quality requirements ahead of any ASSP roadmap and faster than competitors using an ASSP-only or ASSP-ASIC development model. See Figure 3.

Figure 3. Programmable Platform in HDTV Market



Case Study: Tait Electronics Ltd.

Market success demands ultimate flexibility and agility in product development. Take the case of veteran mobile radio maker Tait Electronics Ltd., headquartered in Christchurch, New Zealand. The company maintains a competitive position in the global market for private mobile radios (PMR) verses giant competitors through its rapid responses to customers' demands. When designing their latest mobile radio, one of the goals was developing a platform that would be easy for third parties to integrate with, and that would form the basis of several additional products. Another key factor was the need for inherent architectural flexibility to cater to future, as yet unknown, requirements. Cost, time-to-market, processing power, component packaging, and supplier relationships were also in the overall design equation.

With future product requirements unknown, it was important for Tait to have the architectural flexibility that a programmable-platform strategy allows. In the process, the manufacturer gained advantages related to cost, time-to-market, processing power, component packaging, and supplier relationships. Having a range of FPGA package options helps Tait meet customer requirements as radios continue to call for more functionality in smaller packages. The TM8100 radio, one of Tait's high-volume products, has exceeded company expectations on the system

integration front, and three follow-on products were developed using its platform design. Typically, the company has taken two to three years to launch a single product; with the programmable-platform strategy, Tait created four products in about four years.

The low cost of Cyclone® devices enabled them to utilize Altera® FPGAs as an alternative to standard technologies for the implementation of their embedded applications and signal processing solutions. Since the FPGA is used for the majority of the digital and baseband solutions, they can easily upgrade the hardware as Altera's technology improvements provide opportunities for reductions in cost and/or power consumption. The first of these opportunities was identified with the release of the Cyclone II family of devices. By changing from a first-generation Cyclone device to a Cyclone II device in the TM8100, Tait reduced the BOM cost by over two percent.

This change required relatively little engineering effort—mainly layout and power supply related—and the elapsed development time from beginning to completion was about three months. Modifying the FPGA design was a simple matter of redefining the I/O pins and pressing the Compile button in the Quartus® II software. A return on investment (ROI) of 550 percent made the enhancement easy to justify. Tait identified further cost reduction opportunities for products that use first-generation Cyclone devices. As in the previous case, BOM cost reduction is around 2 percent, and the low engineering requirements mean that the resulting ROIs are greater than 500 percent.

For Tait, the overwhelming benefits of the "design once, make many" platform strategy result from amortizing time and financial costs over the extent of their product line. In Tait's development scenario, the majority of required design work was accomplished for the first product. This development advantage plays an ongoing key role in Tait's ability to react quickly to the ever-changing communications marketplace, and allows them to be successful in competing with some of the largest communications companies in the world.

Tips for Implementing a Programmable Platform

The following five tips will help designers identify the best opportunities for implementing a programmable platform.

1. Eliminate risk and enable the product to reach the marketplace faster by considering programmable logic as a design strategy. Off-load the most tentative parts of a design to programmable logic, so changes can be made until the product is released. Relying on a fixed logic-only design methodology means waiting for the availability of a new component, and then spending even more time qualifying the component before it can be shipped in the product.

2. Consider using programmable logic when designing products with uncertain standards. For products with interface protocols that have not been standardized, PLDs allow modification of the interface late in the design cycle. When standard products are used to implement interfaces, the product release will be delayed if the interface protocol standard changes before the product goes to market. Worse, if the product is already in the marketplace, the system will need to be redesigned to comply with newer standards, resulting in obsolete inventory.

3. Consider product releases on six-month cycles. Some successful marketers revise products more frequently. Since ASIC development cycles can take up to 18 months, consider using programmable logic to add new features and functionality while waiting for the next revision of the basic product platform.

4. Use PLDs to extend product life of the base platform. As products mature, designers can spend less effort on support. Using PLDs in mature systems enables greater profitability while continuing to make required changes.

5. Create scalable products using higher density PLDs, thus allowing a broader product offering. Many products are developed from a basic model, which spawn mid- and high-end, full-featured models. The most profitable design approach involves adding more features with minimal redesign. PLDs are ideal for this—designers can use higher density devices with exactly the same form factor and number of pins, enabling more complex features without circuit-board redesign. The programmable platform can be reapplied, providing faster time-to-market than with fixed-function approaches.

PLDs: Part of a Winning Strategy

While once perceived as too expensive for high-volume applications, PLDs are now the enabling technology behind a wide range of today's latest products. At the same time, traditionally used technologies such as ASSPs and custom ASICs are proving inadequate in meeting product development and profitability challenges without PLDs.

A programmable platform allows designers to develop the core design, then swiftly create differentiating features for different price points, regions, or other market segments. Using PLDs to amortize design time and costs over the full extent of the product line—and avoid delays from silicon re-spins—can create a huge competitive advantage, saving considerable time and money. It is another way to work smarter to capture and maintain the market advantages that are increasingly challenging to attain.

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