ALTERA®

Consumer Electronics Solutions November 2005

Rapid, Low-Cost Innovation—The Winning Consumer Electronics Strategy

Consumer electronics—such as digital televisions, portable media players, and educational toys—are in a state of constant advancement. New generations of products are introduced to market more rapidly than ever before. Windows of opportunity for market success are shrinking, causing manufacturers to look for new, flexible, low-cost, and fast development solutions.

While ASSPs and ASICs provide a low-cost, fixed platform for your products, ASSPs reduce the ability to differentiate and to add the latest in-demand features; ASICs are notorious for significantly jeopardizing on-time delivery and for their high development cost. Solely relying on ASICs and ASSPs can put you behind your competitors with late-to-market, "me-too" products. To stay ahead, you must leverage a product development model that inspires rapid, low-cost innovation: A strategy that gets you a durable first-mover advantage.

What if you could:

- Develop and innovate your products rapidly
- React in real-time to customer feedback and market changes
- Deliver differentiated feature sets ahead of the competition
- Sustain first-to-market advantage
- Tailor features on a basic design for different users or geographies

Today's winning strategy enables all this by incorporating programmable logic devices (PLDs)—the ultimate solution for rapid, low-cost innovation. This strategy may use ASICs or ASSPs to implement the base platform functionality and leverages low-cost PLDs to deliver the latest in-demand features—on time—for your next product release. A PLD strategy will give you rapid, low-cost innovation cycles and greater product differentiation to increase margins; it can get you to market first and keep you in the lead. Plus, you reduce risk—with a PLD you can always modify the design even after production.

The industry's momentum is quickly moving away from the traditional standard product development model to this new flexible model that delivers enormous competitive advantages. You can already find PLDs in the latest flat-panel televisions, set-top boxes, DVD recorders, personal media players, electronic educational toys, and many other consumer products, worldwide.

Altera's extensive line of low-cost PLDs, including field programmable gate arrays (FPGAs), complex programmable logic devices (CPLDs) and structured ASICs, enables you to have a winning strategy, while minimizing your total cost of ownership.

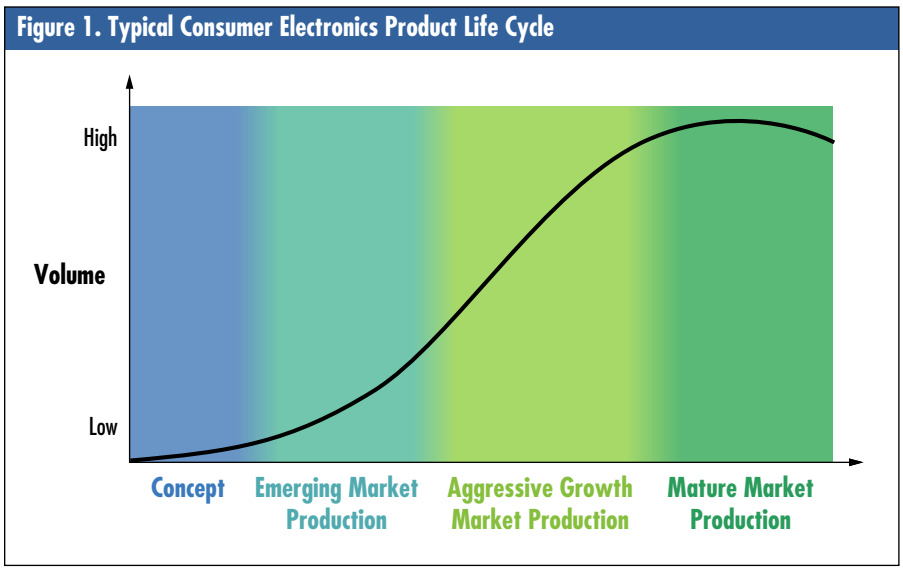
Stay Competitive & Innovative Throughout Product Life Cycles

Altera can help you tailor a PLD strategy to quickly and cost-effectively overcome market hurdles throughout the consumer electronics product life-cycle stages (see Figure 1). Life-cycle stages include:

- Concept
- Emerging Market
- Aggressive Growth Market
- Mature Market

Whatever the life-cycle stage of your application, Altera's industry-leading products enable accelerated product revisions and rapid, low-cost innovation from prototype through commercial availability.

Figure 1. Typical Consumer Electronics Product Life Cycle



PLDs Complement ASSPs & ASICs to Drive Rapid Innovation

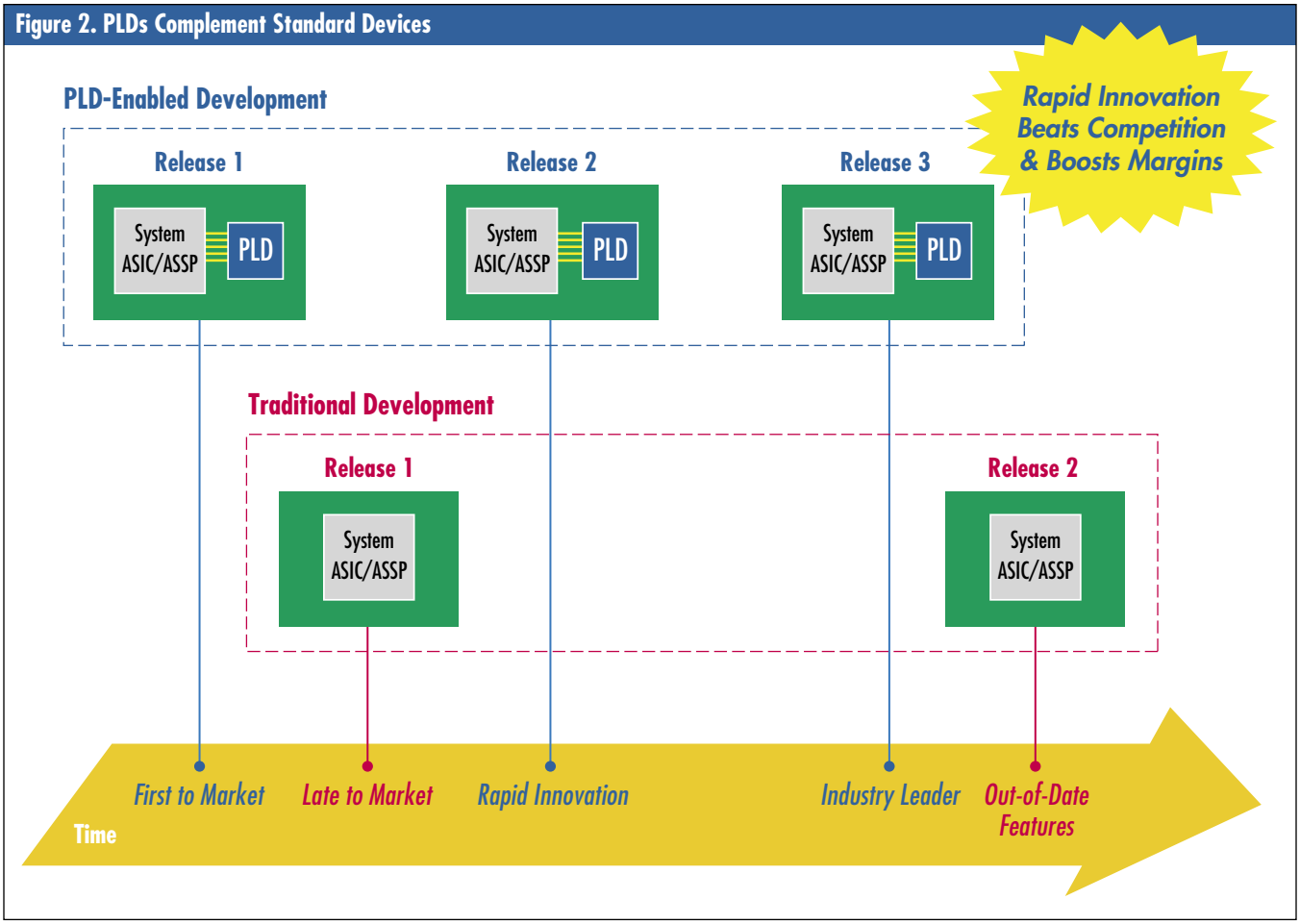
Competitively priced, differentiated products are critical to your company's survival in the consumer electronics market. After a new product specification is set, ASIC development can begin. Unfortunately, ASICs typically have at least a one-year development cycle. During this time the product requirement may change due to changing standards, consumer demand, and more. Programmable logic gives you a low-cost solution to this digital dilemma. FPGAs and CPLDs can complement an existing ASSP or ASIC in your design, adding new features or improving the quality of the standard solution.

Altera® PLDs can be programmed late in the development cycle without changing the basic ASIC or ASSP platform. They allow for innovation without waiting for the re-spin cycles of ASICs or ASSPs (see Figure 2). This helps maximize differentiation, minimize development time, reduce risk, and provide a true competitive advantage in the race for market share.

PLDs complement your ASIC or ASSP to help you:

- Minimize risk caused by changing market demands
- Boost profit margins
- Extend the life of your latest ASSP or your latest ASIC platform and add enhancements or additional functionality
- Gain market leadership by releasing a valuable product ahead of the competition.

Figure 2. PLDs Complement Standard Devices



Product Life Cycle: Market Challenges & Solutions

The following scenarios and solutions illustrate how Altera can help you overcome barriers to market success at each stage of the product life cycle.

Concept Stage

Scenario:

- You have a great idea for a new product with the potential to bring your company substantial future revenue.
- Existing ASSPs do not adequately support the development of your product.
- Since your product concept is unproven in the marketplace, the probability of reaching high-volume production without any changes is too risky to justify developing an ASIC.
- In order to succeed, you need to beat potential competitors to market and establish yourself as a market leader.

Solution:

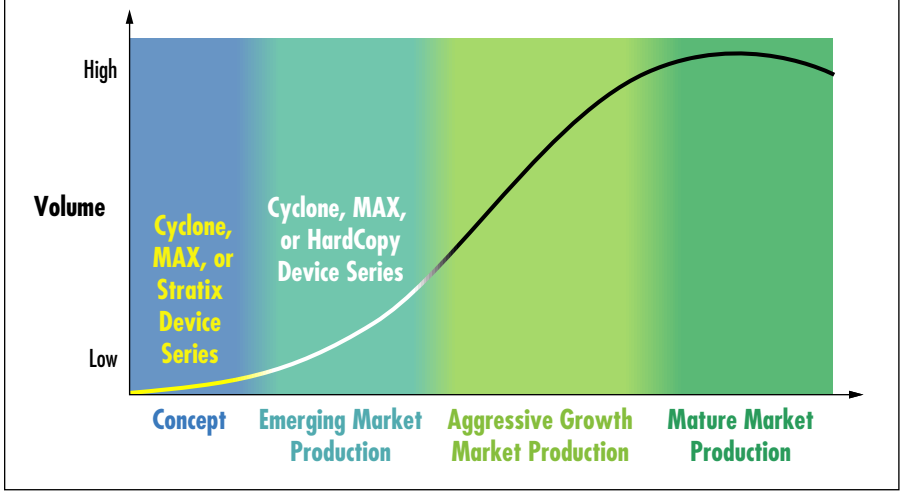
Altera solutions surmount many challenges of the Concept stage. Altera reprogrammable solutions are ideal for prototyping leading-edge consumer products at a fraction of the development cost and time of traditional technologies. Designing with Altera allows you to know product viability sooner to determine consumer interest. Whether you want to develop a concept product by adding enhancements to older ASSPs or ASICs, or develop a new, highly complex function from scratch, Altera has the right solution. Because Altera products are reprogrammable, you'll eliminate costly and time-consuming silicon re-spins for ASIC design changes and long and uncertain waiting periods for new versions of ASSPs. In the Concept stage, Altera solutions save time and money and enable leading-edge designs.

See Table 1 and Figure 3 for Altera's optimal product solutions for Concept stage designs.

Table 1. Altera Products for Concept & Emerging Market Stages

Altera Solutions: Innovation Throughout a Product's Life	Concept Stage	Emerging Market Stage
Cyclone™ FPGA Series ■ Industry's lowest-cost FPGA solution ■ Reprogrammable ■ Rapid prototyping and high-volume production requirements support ■ Design flexibility to differentiate products as you go into production without cost pressure of a custom ASIC or ASSP	✔	✔
MAX® CPLD Series ■ Industry's lowest-cost CPLD solution ■ Non-volatile ■ Reprogrammable ■ Rapid innovation	✔	✔
Stratix® FPGA Series ■ Prototyping for low-volume consumer products needing ASIC-like performance and features ■ Reprogrammable	✔	
HardCopy® Structured ASIC Series ■ Identical footprint with Stratix series devices guarantees a seamless design migration path from prototype to production device at a fraction of the development cost and risk of traditional custom-ASIC solutions		✔

Figure 3. Product Life Cycle: Altera Products for Concept & Emerging Market Stages



Emerging Market Stage

Scenario:

- Your product is commercially available and early adopters find it attractive, but success as a mainstream consumer electronics product is still to be determined.
- As early adopters start to use the product, you get customer feedback about desired or required changes to make it more attractive.
- You hope to develop your next product generation using one of the newly emerging ASSPs, however their functionality and feature sets are fixed, and you do not want to release a "me-too" product.
- Despite your product's early market success, the volumes are still low, the retail price is high, and the market potential does not yet justify investment in an ASIC.
- You and your competitors are all vying to gain market leadership through innovation.

Solution:

Altera provides the optimum technology for consumer electronics products in the Emerging Market stage. Altera solutions focus your development efforts on implementing the features and enhancements that are critical to establish yourself as a market leader. If you already use an ASSP or an ASIC, you can keep it for standard, yet complex, functions and use Altera PLDs or structured ASICs for the latest high-value features. This methodology allows you to add differentiating features for a longer period of time and to innovate faster than alternative silicon technologies. When a market is not yet firmly established or standards set, an Altera PLD strategy gives you the competitive advantage.

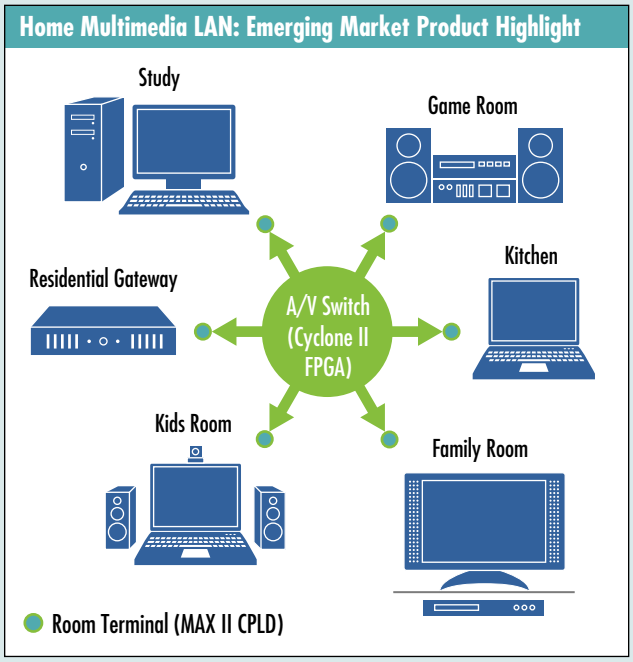
See Table 1 and Figure 3 for Altera's optimal product solutions for Emerging Market stage designs.

Emerging Market Case Study

The rapidly evolving home multimedia LAN is one example of the many emerging market products utilizing PLDs today. Multimedia LANs require greater bandwidth and much higher quality-of-service (QoS) than traditional home data LANs, as they must seamlessly share real-time audio/video content throughout the home. To meet these challenges with minimal risk, companies engaging in this exciting market must design low-cost solutions that are easily and quickly adaptable to changing requirements and evolving standards.

A typical home multimedia LAN architecture, shown below, is based on a central switch that directs audio/video traffic to terminals in each multimedia center or device location in a house. The multimedia LAN must be highly scalable and adaptable to fit almost endlessly possible implementations required in today's homes.

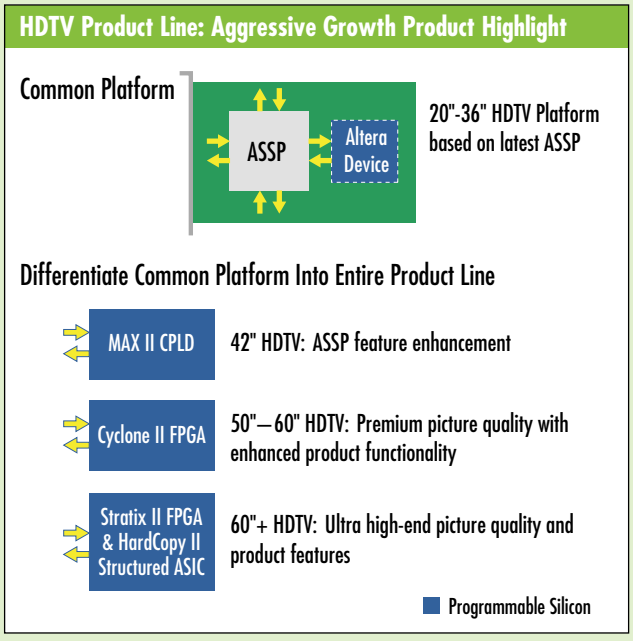
As with most emerging applications, existing PLDs are the most cost-effective technology to enable multimedia home LANs. Altera's low-cost PLDs provide the flexibility, adaptability, and low-cost structure these applications require. Terminals utilize MAX II CPLDs to bridge older ASSPs for continual feature evolution, eliminating the need for board redesign. MAX II CPLDs allow introduction of new products more rapidly into the marketplace to maximize sales. In the switch, low-cost Cyclone II FPGAs provide a scalable platform that enables high-bandwidth multimedia content to be moved anywhere within the home network. This scalability allows you to create a cost-effective range of product offerings targeting home solutions.



Aggressive Growth Market Case Study

The fast-growing HDTV market is just one of many aggressive growth markets that have products using PLDs today. To be a leader in a market experiencing rapid consumer interest, you must distinguish yourself from your competition. In the case of the HDTV market, a complete offering of HDTV display sizes and features is a clear path to establishing yourself as a leader in the eyes of the consumers. In a market that may still look for continuous product enhancements, as well as increasing retail price competition, you must balance your use of low-cost standard solutions with the unique intellectual property to differentiate your products.

As with many aggressive growth market applications, PLDs are the most cost-effective technology for an HDTV product line. Altera's low-cost PLDs and structured ASICs enable you to quickly and easily implement features complementary to the existing ASSP functionality in your mainstream DTV displays. Altera PLDs also allow for easy development and feature enhancement for the newer, larger displays. The figure below illustrates how you can develop a range of HDTVs utilizing your mainstream ASSP platform along with a programmable silicon solution. You can take your existing 20" to 36" HDTV platform, based on the latest ASSP available, and add a MAX II CPLD for additional product features, resulting in a differentiated 42" HDTV platform. For even larger display sizes, such as 50" to 60" HDTVs, you can leverage a Cyclone II device to provide premium picture upgrade, along with even more product features than the ASSP-only base model. For 60" displays or larger, you can leverage a Stratix II FPGA or HardCopy II structured ASIC, which will provide ultra-high-end picture quality and more differentiated features, such as increased input/output ports, multimedia networking, or streamlined user interfaces. Altera PLDs enable an HDTV product line to meet a range of feature and quality requirements ahead of the ASSP roadmap—faster than competitors using an ASSP-only or ASSP-ASIC development model.



Aggressive Growth Market Stage

Scenario:

- Your product is now attractive to a quickly growing consumer market, so much so that you are often increasing your forecast for the market demand in upcoming quarters.
- The ASSP roadmaps are in-line with your feature and price expectations, however the schedule for each generation is usually slower than your development schedule requires.
- You have high confidence in the market potential of your product, and you are open to investing in ASIC development to enhance ASSP capabilities, but ASIC development is also slower than your schedule requires.
- Being a market leader is getting tougher everyday, as new competition continues to bring products to market; you are determined to maintain a strong position through high-quality, differentiated products.
- You need a supplier who can react quickly to your increasing forecast in order to satisfy market demand.

Solution:

As your technology becomes increasingly popular with consumers, Altera products help you quickly and aggressively innovate to secure marketplace gains. An Altera PLD strategy makes innovation cost-effective, too. Altera reprogrammable solutions enable ongoing innovation between major ASIC or ASSP updates, shortening time to commercial availability of high-quality consumer electronics. The flexibility of designing with Altera products also allows you to quickly respond to a market with shifting preferences.

See Table 2 and Figure 4 for Altera's optimal product solutions for Aggressive Growth Market stage designs.

Table 2. Altera Products for Aggressive Growth & Mature Market Stages

Altera Solutions: Innovation Throughout a Product's Life	Aggressive Growth Market Stage	Mature Market Stage
Cyclone FPGA Series ■ Industry's lowest-cost FPGA solution: increases product functionality at a fraction of the cost of ASIC solutions ■ Rapid innovation for feature updates and differentiation with up to 820,992 equivalent ASIC gates	✔	✔
MAX CPLD Series ■ Industry's lowest-cost CPLD solution ■ Migrating to a standard product solution unnecessary, eliminating extra cost ■ Continued innovation while volume ramps significantly ■ Feature updates and differentiation with up to 26,520 equivalent ASIC gates	✔	✔
HardCopy Structured ASIC Series ■ Applicable for medium-volume production products ■ Stratix FPGA series prototyping reduces development risk	✔	✔

Mature Market Stage

Scenario:

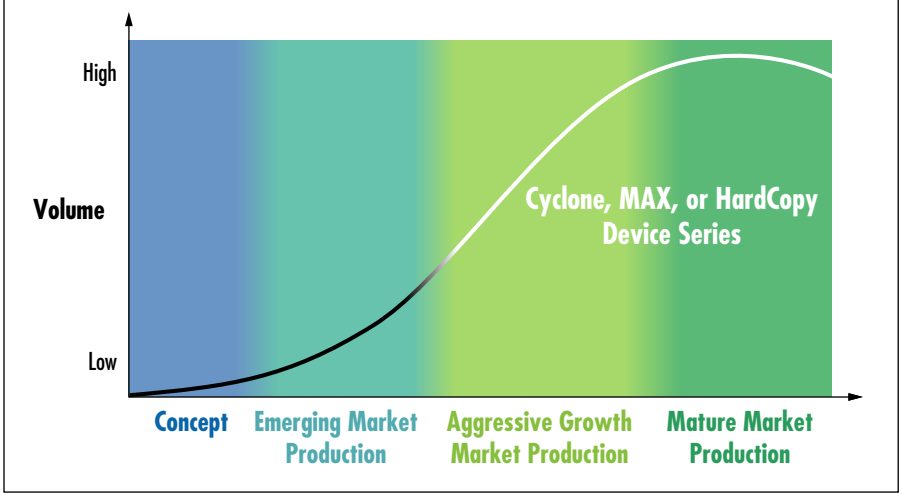
- Your product is now mainstream in the consumer electronics market.
- ASSPs have integrated all of the standard functionality. Innovation is occurring at a low rate; in fact, some ASSPs are already being made obsolete.
- You have already developed ASICs to add your unique intellectual property to your product. You do not plan to invest in further ASIC development, unless there is a major shift in feature requirements to compete in this market.
- Although innovation is limited, you find that slight feature upgrades may stimulate the market, helping to maintain your product image, volumes, and prices.

Solution:

When an application matures and market growth slows down, an Altera low-cost PLD strategy can help you continue to maintain volume and price. Altera FPGAs and CPLDs allow you to add slight feature differentiation to your ASSP products. In addition, Altera devices can be used to mimic the functionality of ASSPs no longer in production.

See Table 2 and Figure 4 for Altera's optimal product solutions for Mature Market stage designs.

Figure 4. Product Life Cycle: Altera Products for Aggressive Growth & Mature Market Stages



PLD Cost Reduction

Since the introduction of PLDs, the price of implementing a system has been rapidly decreasing while product functionality and complexity have been increasing. In 1995, for example, it would take 63 PLDs to obtain the equivalent logic density of a single PLD in 2005 (see table below). The continuous cost reduction is possible because PLDs leverage the most advanced process technologies in the industry and are built to suit the needs of many more customers than just a few large volume opportunities. Continuous innovation and design enhancements will allow these trends to continue into the future.

PLD Metrics & Timeline

Metric	1995	2005	2015
Process Technology	0.42 µm	90 nm	22 nm
Equivalent ASIC Gates	35K	2.2M	18M
Transistor Count	3M	460M	3B
Equivalent ASIC Gates Purchased for $5	440	50K	500K

Being a Leader in the Consumer Electronics Market

In today's competitive marketplace, innovation, differentiation, and flexibility in product development are critical to your company's success. Throughout consumer electronics product life cycles, an Altera PLD strategy can help maintain your competitive edge. Altera PLDs and structured ASICs can get your product concept to market first or help you innovate between major ASSP or ASIC revisions more rapidly than your competitors. Altera has a wide range of devices to drive rapid, low-cost innovation in leading-edge consumer electronics designs.

Learn More

To learn more about Altera solutions and how you can develop a winning strategy for your consumer electronics products, visit the Altera consumer solutions web page at **www.altera.com/solutions/consumer** or contact your local Altera representative.

Altera Offices

Altera Corporation
101 Innovation Drive
San Jose, CA 95134
USA
Telephone: (408) 544-7000
www.altera.com

Altera European Headquarters
Holmers Farm Way
High Wycombe
Buckinghamshire
HP12 4XF
United Kingdom
Telephone: (44) 1 494 602 000

Altera Japan Ltd.
Shinjuku i-Land Tower 32F
6-5-1, Nishi-Shinjuku
Shinjuku-ku, Tokyo 163-1332
Japan
Telephone: (81) 3 3340 9480
www.altera.co.jp

Altera International Ltd.
2102 Tower 6
The Gateway, Harbour City
9 Canton Road
Tsimshatsui Kowloon
Hong Kong
Telephone: (852) 2945 7000

GB-CONSUMER-2.0