

ALTERA®

Cyclone

The Lowest-Cost FPGA Ever



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The Cyclone Device Family: Low Cost by Design



Altera's Cyclone™ device family has taken the industry by storm. Designed from the

ground up based on extensive input from hundreds of customers, the Cyclone family offers the ideal combination of cost, density, features, and performance for volume-driven applications. The Cyclone device family offers all this for as little as 99 cents per 1,000 logic elements (LEs). Thousands of customers have used Cyclone devices in applications ranging from plasma displays and wireless basestations to printers and hand-held radios. Cyclone devices are the lowest-cost FPGAs ever, making them a flexible alternative to ASICs and standard products for high-volume applications. With Cyclone FPGAs system designers building high-volume applications in the consumer, communications, computer peripheral, automotive, and industrial markets have access to the time-to-market advantages of programmable logic.

The New ASIC Alternative

The increasing complexity of ASIC design is a major barrier for customers who need to get competitive products to market quickly. Without clear visibility into end-market demand, companies are finding it more difficult to justify the costly up-front non-recurring engineering (NRE) charges required for ASIC development. Consequently, system designers have been searching for a risk-free alternative that will get their products to market in less time with less up-front investment.



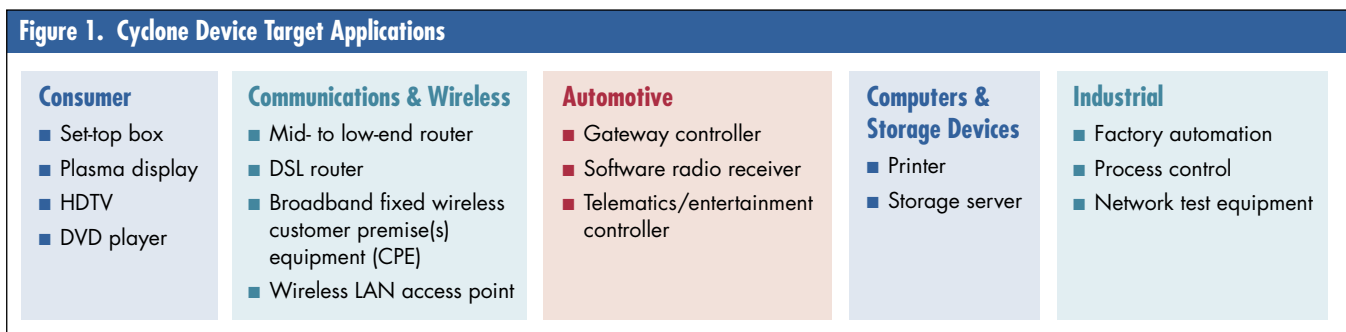
Cyclone devices—at ASIC prices—have arrived to put programmable logic in the hands of volume-driven system designers. Combined with the inherent value of FPGAs—off-the-shelf, customizable products that require no up-front costs and no minimum order quantities (MOQs)—designers now have a programmable and scalable option for their high-volume, low-cost requirements.

Packed with logic resources and features unmatched by any other low-cost FPGA, Cyclone devices are well equipped to integrate many complex, system-level functions (see Table 1).

Table 1. Cyclone Device Highlights

Feature	Benefits
Embedded Memory	The Cyclone embedded memory structure consists of columns of 4,608-bit memory blocks. Each memory block supports multiple configurations, including true dual-port and single-port RAM, ROM, and first-in first-out (FIFO) buffers.
External Memory Interfaces	Cyclone devices have dedicated interfaces to support high-speed memory devices including 133-MHz (266-Mbps) double data rate (DDR) SDRAM and fast cycle RAM (FCRAM) devices. The devices also support single data rate (SDR) SDRAM interfacing.
I/O Standard Support	Single-ended I/O standard support includes LVTTTL, LVCMOS, PCI, SSTL-2, and SSTL-3. For differential signaling requirements, Cyclone devices have up to 129 LVDS-compatible I/O pins that are capable of data transfer at up to 640 Mbps.
Clock Management Circuitry	Eight low-skew, global clock networks span the entire device, fed by four dedicated input clock pins. Phase-locked loops (PLLs), each with three output taps, feature frequency synthesis and phase-shifting capabilities for complete system clock management on- and off-chip.
Nios® Embedded Processor	The industry's most widely used embedded soft-core processor can be configured to suit the specific requirements of low-cost, Cyclone device-based designs. Each Nios processor consumes minimal logic, leaving plenty of resources for other system functions.
Intellectual Property (IP)	Accelerate system design with IP functions that are developed, tested, and licensed by Altera and Altera Megafunction Partners Program (AMPP SM) partners. Available functions include PCI, memory controllers, fast Fourier transforms (FFTs), and more.
Serial Configuration Devices	Altera's new serial configuration device family is designed to deliver the lowest possible total-solution cost. These devices can store configuration data while using remaining resources for general-purpose storage.

Table 2. Cyclone Family Overview					
Feature	EP1C3	EP1C4	EP1C6	EP1C12	EP1C20
LEs	2,910	4,000	5,980	12,060	20,060
M4K RAM Blocks	13	17	20	52	64
Total RAM Bits	58K	76K	90K	234K	288K
PLLs	1	2	2	2	2
Maximum User I/O Pins	104	301	185	249	301
Available Packages	100-pin thin quad flat pack (TQFP) 144-pin TQFP	324-pin FineLine BGA® (FBGA) 400-pin FBGA	144-pin TQFP 240-pin plastic quad flat pack (PQFP) 256-pin FineLine BGA (FBGA)	240-pin PQFP 256-pin FBGA 324-pin FBGA	324-pin FBGA 400-pin FBGA



Cyclone devices offer a targeted feature set optimized for its low-cost architecture. The Cyclone FPGA family consists of five members (see Table 2 for device overview), all of which are available in multiple packages for a variety of system and price requirements.

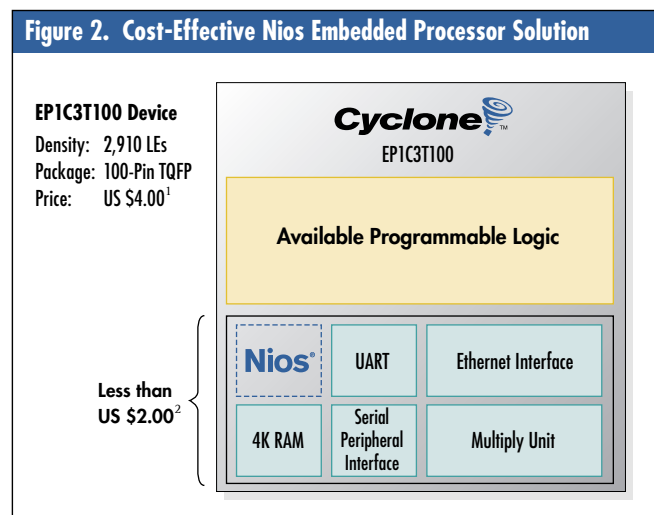
performed without incurring additional costs, staving off obsolescence and extending usability beyond that of many off-the-shelf microprocessors and microcontrollers.

Paving New Paths for FPGAs

Cyclone devices bring FPGAs to non-traditional application spaces for FPGAs in new and existing markets, including consumer, communications, wireless, storage, automotive, and industrial (see Figure 1). Cyclone devices enable companies in these cost-driven markets to quickly introduce competitive and innovative products.

Nios Embedded Processor Solutions

Nios® The Nios embedded processor is a configurable RISC soft processor core that enables processor-based applications in Cyclone devices. A full-featured, performance-optimized Nios processor with peripherals can be tailored for the specific requirements of virtually any system. With a Nios processor in a Cyclone device, an embedded RISC processor costs less than US \$2.00 (see Figure 2). Updates are quickly and easily



Notes: ¹Pricing for 250K units in 2004.

²Nios processor and peripherals use about 1,400 LEs.

The Complete Low-Cost Solution

To fully realize the value proposition of Cyclone devices in your system-on-a-programmable-chip (SOPC) designs, Altera has developed a new low-cost serial configuration device family. Cyclone devices are also fully supported in the free Quartus® II Web Edition design software, reducing overall development costs even further.

Low-Cost Configuration Devices

To complement the Cyclone device family, Altera introduces new serial configuration devices. These devices are priced for volume applications at, on average, less than 10% the price of the corresponding Cyclone device. The two types of serial configuration devices (1 Mbit and 4 Mbit) are offered in a space-saving 8-pin small-outline integrated circuit (SOIC) package, as shown in Table 3. To add even more value, any unused memory in these devices can be used for general-purpose storage; for example, to store the software code for Nios embedded processors.

Table 3. Serial Configuration Devices

Configuration Device	Capacity	Target Cyclone Devices
EPCS1	1 Mbyte	EP1C3, EP1C6
EPCS4	4 Mbytes	All Cyclone Devices



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Development Tools



QUARTUS® II

Take a Cyclone design from concept to device configuration entirely within the Quartus II Web Edition software, available at no charge on the Altera web site at www.altera.com. Additionally, Cyclone devices are supported in Altera's flagship Quartus II software (version 2.2 service pack 2 and higher), the industry's most comprehensive SOPC design environment, offering a full suite of programmable logic design verification tools, and seamless integration with third-party EDA software. The Quartus II software offers advanced block-based design capabilities with the LogicLock™ design methodology and hardware verification tools.

Contact Altera Today

The Cyclone device family is a cost-effective and flexible solution for your volume-driven system designs. Learn more about the Cyclone FPGA advantages by visiting the Altera web site today at www.altera.com/cyclone.