

Increasing functionality and integrating systems

Altera in home appliances

Today's *white goods*, or home appliances, are anything but the dull, black and white, standalone products from days past. To meet expanding consumer expectations and to differentiate their products, manufacturers are designing Altera® programmable logic devices (PLDs) into household staples such as refrigerators, microwave ovens, washers, dryers, air conditioners, dishwashers, and more. Altera-based solutions help you create "smart" appliances, networked and self-monitoring, with sleek designs—far more advanced than the traditional *white goods* we once knew.

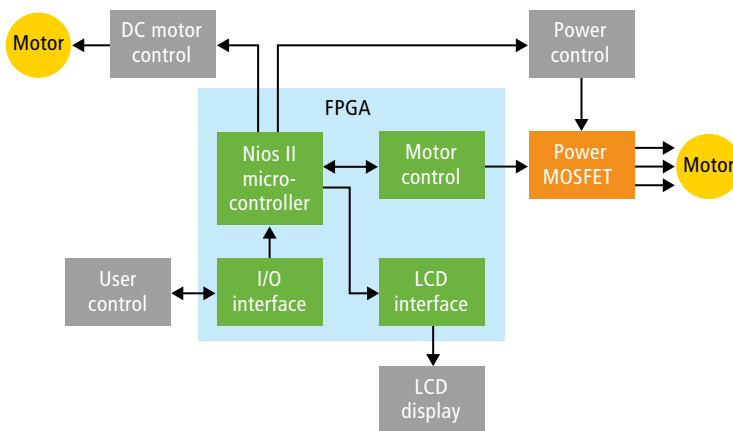
Our programmable solutions help you keep pace with the savvy consumer and their ever-expanding demands. With Altera, you can enhance product performance, appearance, and functionality, while reducing cost and beating your competition to market.

Reduce your system bill of materials cost, shorten time to market, and increase product flexibility by replacing all of the microcontrollers in your high-end designs with a single Cyclone® series FPGA and a Nios® II embedded processor, as shown in this diagram. The Cyclone series FPGA will perform the motor control function for power and thermal management, sensors, network interfacing, LCD display functionality, and more. Programmable solutions are the perfect fit for your home appliance applications—both in terms of hardware (CPUs, peripherals, and custom hardware accelerators) and software (memory interfaces). To satisfy power management and I/O expansion requirements in home appliance applications, use Altera's MAX® II CPLDs for superior performance and optimal power consumption.

With the help of our programmable logic solutions, today's appliances can incorporate:

- Connectivity to manufacturer's network for field diagnostics
- Consumer programmability for ease-of-use
- Smaller electronic form factor for more streamlined designs
- Environmental efficiency, including energy-saving designs
- Noise abatement—quieter products with less vibration
- Integrated functionality, such as a refrigerator with a built-in TV or an air-conditioner with a built-in tracking ability

FPGA-based home appliance system example



Reduce your design risks

We are committed to supporting the home appliance industry's quality and reliability requirements. As such, Altera strives to provide top-notch, defect-free products with an aggressive zero parts-per-million (PPM) roadmap. Our mold compounds and ball-grid array (BGA) substrates meet Underwriters Laboratories (UL) flammability rating (UL94 V0), which will help ensure consumer safety while operating flammable home appliances such as electric ovens. In addition, Altera PLDs reduce the risk of early product obsolescence, typical with microcontroller unit (MCU) manufacturers.

Altera software tools for home appliance applications

To enhance our home appliance solution portfolio, Altera also offers a complete and easy to use design suite that adapts to user needs, preferences, and knowledge base. Quartus® II design software allows you to design in a standard hardware description language or schematics, or use the SOPC Builder automated system integration tool to create a custom embedded processing solution programmed in ANSI C language instead of schematics or register transfer level (RTL) entry. The Nios II C-to-Hardware Acceleration (C2H) Compiler allows software engineers to automatically accelerate ANSI C language program routines with dedicated hardware implementations without knowing HDL programming. We also offer a Video and Image Processing IP Suite, with pre-verified IP cores to enhance the image quality of the graphics-displays, IP cores for home appliance network connectivity, white papers such as *Design Home Appliances with FPGAs* and *Quality of Service in Home Networking*, and more.

Altera Video and Image Processing IP Suite offers the following functions

- De-interlacer
- Color space converter
- Scaler
- Alpha blending mixer
- Gamma corrector
- Chroma resampler
- 2D filter
- 2D median filter
- Line buffer compiler

Altera in home appliance applications

Function	MAX II CPLDs	Cyclone Series FPGAs	Features	Benefits
LCD driver		✓	Built-in LVDS I/O interface; library of video and image processing functions	High integration, cost reduction, image enhancement
LCD touchscreen		✓	Platform-independent touchscreen GUI, quickly ported to your platform	Faster time to market, easy to add features to existing platform
Motor control		✓	Embedded digital signal processing (DSP) blocks, on-chip memory, and DSP intellectual property (IP) library for precise motor control applications	Flexibility; reconfigurability for DSP implementation
Pulse-width modulation (PWM)	✓	✓	Internal user flash memory oscillator (CPLD)	One single device to control several analog motor circuitries
Power management	✓	✓	Process optimized for power consumption; designed with portable consumer applications in mind	Increase product functionality while reducing power consumption
Network interface		✓	Powerline network interface with Nios II processor and Echelon powerline smart transceiver	Time to market; future proof design; flexible soft core processor
I/O expansion or peripheral replacement	✓	✓	Serial bus (I ² C, serial peripheral interface (SPI)) for I/O expansion, adding more functions or glue logic	Flexibility; expandability
Quality measurement	✓	✓	Defect density < 5 PPM for first-generation Cyclone FPGAs	Low defect density; high-quality product
Safety measurement requirement	✓	✓	Mold compounds and BGA substrates meet UL94 V0 flammability rating	Consumer safety for flammable home appliances

Want to dig deeper?

Learn more about how Altera can enable high-end home appliances at

www.altera.com/consumer

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