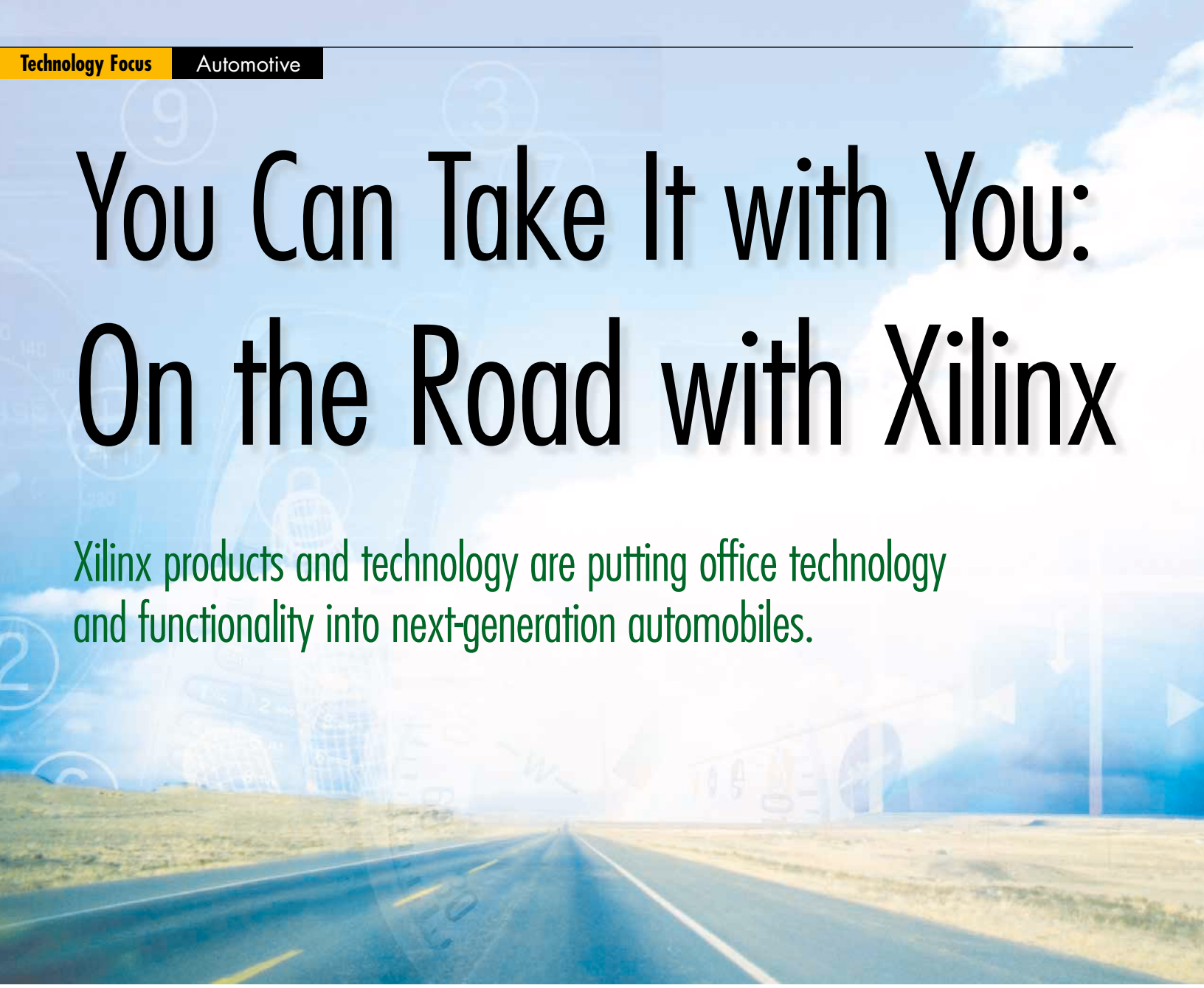
You Can Take It with You: On the Road with Xilinx

Xilinx products and technology are putting office technology and functionality into next-generation automobiles.



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Today's consumers demand the comforts of home and the productivity of the office when they drive. They also want the latest in information and safety systems for their cars. The resulting convergence requires interface standards and protocols to interconnect and interoperate. These standards and protocols are still emerging, and will get even more complicated before being standardized. The result is a manufacturing dilemma. Should manufacturers make an educated guess now as to which standard will prevail, and risk making the wrong choice? Or should they wait for the standards to be fixed, and risk getting left behind?

Xilinx has the answer. With Xilinx IQ programmable logic solutions for automotive applications, manufacturers can win the time-to-market battle risk free by using the ability to reconfigure their products to accommodate any standard – past, present, or future. Reconfigurable logic in production allows manufacturers to reconfigure the units in-car to implement new hardware-based features. Xilinx high-volume IQ FPGA and CPLD devices are cost-effective solutions that retain the traditional PLD time to market advantage. As a result, many leading telematics and infotainment product manufacturers use Xilinx programmable logic devices. These manufacturers recognize the added flexibility and time to market benefits that programmable logic solutions provide.

Driving Your Office

Information Age professionals need to be able to work from wherever they happen to be – from home, from hotel rooms, from airports, from 36,000 feet over the Atlantic. They need to take their offices with them.

The laptop computer was a critical step in the development of offices-on-the-go, but now workers are demanding even more. One result has been the in-car office. The automobile is no longer just a way to get from Point A to Point B. Now it can include GPS navigation with intelligent route finding, integrated PDA functions, built-in mobile communications, entertainment systems, and even in-dash personal computers.

Automotive electronic designers face the same challenges as designers of consumer

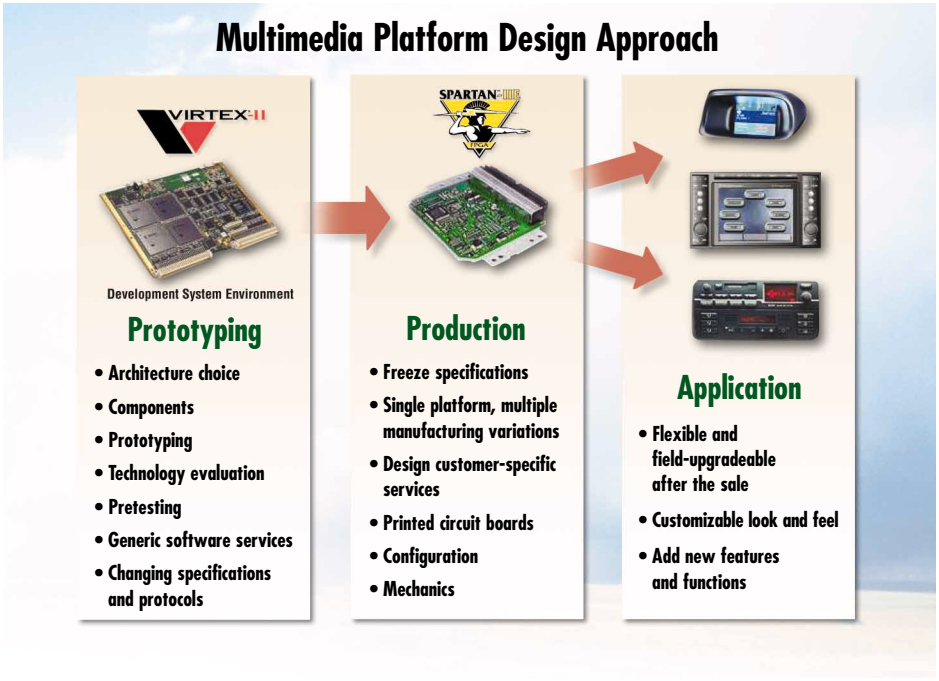


Figure 1 - Automotive multimedia platform design approach

equipment. They must grapple with time to market pressures, cost restrictions, and a profusion of new standards and protocols. They also face added challenges like a constrained design area, and the need for a simple user interface so drivers can keep their eyes on the road.

As one example of the new technology, the latest BMW 7 Series automobiles allow the driver to operate the car's heating and air conditioning, entertainment systems, wireless communications devices, navigation instruments, and PC applications, all on a single display, by means of a joy-stick type of device.

Xilinx programmable logic devices enable automotive designers to provide their customers with a more informative, productive, safe, and entertaining in-car environment. By using the flexibility, time to market advantage, and after-sale reconfigurability of Xilinx devices, manufacturers can be first to market and best in class long after the sale.

The Automotive Multimedia Platform

As more information and entertainment systems are added to automobiles, there's an inevitable conflict among the bewildering array of standards and protocols being tested, including Bluetooth™, BlueCAN, MOST (media-oriented system transport), FireWire™, CAN (controller area network), TTP (time triggered protocol), and Flex Ray™ technologies.

Designers of in-car multimedia systems may soon have to provide for traffic information systems, Internet and Web access, electronic game consoles, MPEG music download capability, digital radio reception, and mobile commerce services.

Designers must ensure that the car's multimedia system can communicate with the automobile's other devices. For example, the car should automatically detect a new mobile phone and connect it seamlessly to the car's communications network. This demand for automatic connectivity may soon extend to PDAs, portable PCs, MP3 players, and other personal portable electronic equipment.

Figure 2 - Acunia automotive development platform with Xilinx Spartan-II FPGA and CoolRunner™ CPLD onboard

As in-car and consumer functions converge – and new automotive and consumer standards and protocols emerge – designers have begun to prototype multimedia platforms that can provide as much, or as little, functionality as required. The best way to create such multimedia platforms is to design reconfigurable hardware. Engineers can program reconfigurable hardware late in the production flow to provide custom functionality on a standard hardware platform. At the same time, they can configure the hardware to accommodate new standards.

Figure 1 shows the automotive multimedia platform design approach. This concept allows upgrades throughout the life of the car. Designers can implement these upgrades remotely by means of wireless communications and Internet connectivity. Xilinx Internet Reconfigurable Logic (IRL™) technology makes this remote upgrading process possible.

With Xilinx IRL technology, designers can upgrade, modify, and fix systems long after the car leaves the dealership. For example, an engineer could remotely add a new MP3 player to an in-car multimedia system, or upgrade the system with the latest protocol. This same technology can even disable the multimedia unit if it is stolen, then re-enable it when it is returned to the rightful owner.

Multimedia System Design Flow Using FPGAs

The multimedia platform should ideally be based on one Human Machine Interface (HMI). This HMI allows the user to access all functions by means of a touch screen. If the functions are implemented in software and reconfigurable hardware, the manufacturer or dealer can upgrade the system even after the buyer has driven the car away.

The new way of developing in-car systems is to prototype with FPGAs in a generic development environment. The designer can develop the elements quickly and easily without fixing specifications. This initial prototyping phase can be realized using Virtex™-II Platform FPGAs. At this early stage, the designer can try, test, and debug the different standards, protocols, and functions by using the headroom provided by a large FPGA.

As the design firms up, the specifications are frozen. The designer can then select the specific standard, protocol, or function from the many tested. This move from prototype to production enables the designer to optimize the design and fit it into smaller, lower cost FPGAs, such as Spartan™-IIE programmable logic devices. This migration from Virtex-II to Spartan-IIE FPGAs still allows for future system upgradability via IRL connectivity.

Once the device is in production, the engineer can use the FPGA as an aid in total printed circuit board testing with JTAG techniques. If necessary, the engineer can also tweak and enhance the design even at this late stage.

Recognizing the need for intelligent prototyping platforms for use by in-car multimedia designers, leading next-generation telematics technology providers such as Acunia have produced the Xingu™ telematics platform shown in Figure 2.

Conclusion

The final stage is the look and feel of the product. Each car manufacturer can customize the product to fit into a specific dashboard (or fascia). All of the production multimedia units are built up around the standard FPGA-based platform. The designer can program this standard platform with its personality late in the production flow to accommodate last-minute design changes or end-user preferences.

For more information, visit these websites:

Xilinx Automotive IQ Solutions: ***www.xilinx.com/automotive***

Acunia: ***www.acunia.com***

BMW 7 Series Sedan: ***www.bmw.com/bmwe/products/automobiles/7er/sedan/***

Xilinx IQ Solutions – Architecting Automotive Intelligence

To address the needs of automotive telematics designers, Xilinx has created a new family of devices with an extended industrial temperature range option. This new "IQ" family consists of existing Xilinx industrial grade (I) FPGAs and CPLDs with the addition of a new extended temperature grade (Q), available for selected devices. The new IQ product grade (-40°C to +125°C ambient for CPLDs and junction for FPGAs) is ideal for automotive and industrial applications. See Table 1.

The wide range of device density and package combinations enable you to deliver cost effective, high performance, flexible solutions to meet your most extreme application needs. See Table 2.

Temperature Grade/Range °C			
Products Group	C	I	Q
FPGA	T_J = 0 to +85	T_J = -40 to +100	T_J = -40 to +125
CPLD	T_A = 0 to +70	T_A = -40 to +85	T_A = -40 to +125

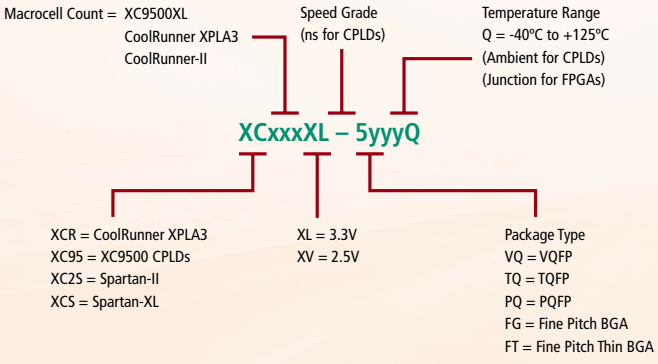
Table 1 - IQ temperature range

With Xilinx IQ devices, you can design flexibility into your application and get your product to market faster than ever before. Because many new standards are evolving – such as the MOST (media-oriented system transport) and FlexRay™ in-car bussing protocols – you need the flexibility to quickly modify your designs at any time. With our Internet Reconfigurable Logic (IRL™) capability, you can remotely and automatically modify your designs, in the field, after your product has left the factory, and even after the sale.

Device Family	Availability
Spartan-XL (3.3V)	NOW - XCS05XL, XCS10XL, XCS20XL, XCS30XL, XCS40XL
XC9500XL (3.3V)	NOW - XC9536XL, XC9572XL
CoolRunner XPLA3 (3.3V)	Q3 - 02
Spartan-II (2.5V)	Q3 - 02
CoolRunner-II (1.8V)	Q1 - 03
Spartan-IIE (1.8V)	Q1 - 03

Table 2 - Device availability schedule.

Q Grade Ordering Information



By combining our latest IQ programmable logic devices with our solutions infrastructure of high productivity software, IP cores, design services, and customer education, you can develop advanced, highly flexible products, faster than ever before.

For more information, full product selector guide, data sheets, white paper, and more, go to ***www.xilinx.com/automotive.***