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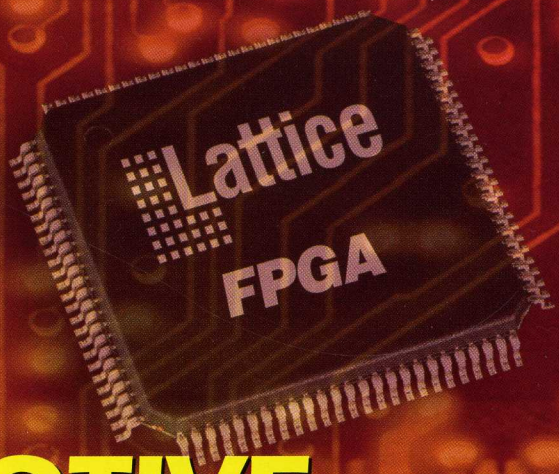

AUTOMOTIVE

FPGAs aid infotainment

INDUSTRIAL PCs

Keeping tube passengers informed

RTOS

Problems for consumer devices

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Convergence: It's not easy

Modern vehicles are seeing a convergence of entertainment systems

KERRY HOWELL LOOKS AT THE DISRUPTION CAUSED BY CONVERGENCE IN AUTOMOTIVE ENTERTAINMENT AND HOW FPGAS CAN HELP

Driving to work, I was channel hopping my favourite radio stations to find some music that I'd like; all the while, my IPod is in the back of the car with my gym cloths, and it contains hours of music that I know I like. Now, I could connect the IPod using the cassette tape adapter, but it squeaks and rattles while it plays. I also have an FM transmitter, but I'm always disappointed in the audio quality and volume.

I thought of the Convergence conference in October last year, where I was intrigued by a company that makes consumer add-on devices that allow IPods, or other media player devices, to function in many of today's automotive entertainment systems. This made me think of my first car, in which I hand-built metal brackets to install my FM radio-cassette player underneath the steering column (I am forever thankful that I bypassed investing in eight-track tapes).

I thought about the contrast between those metal brackets and the last car I purchased, which has a radio with integrated cassette and CD player. Within a year of buying that car,

continued on page 26

continued from page 25

Some Volvo cars have an IPod adapter and digital jukebox accessories

I got rid of all my cassette tapes. I do have lots of CDs, but I don't like to carry them in the car because of a lack of storage. Besides, I just listen to my same 14 songs over and over again.

There are several audio system options available to consumers: radio systems with CD-MP3 players, satellite radio and HD radio, to name a few. But after helping my son install a new CD-MP3 stereo in his car, I know I don't want to go through that experience again. I just want the vehicle I purchase to be able to handle all of the latest data formats. My friends echo this preference when we discuss automotive audio systems. Unfortunately, the rate of change in consumer audio-video transport mediums is moving so fast that automotive manufacturers can't keep up using their current design methods.

One of my favourite songs reminds me of the convergence of consumer products in automotive applications: Ringo Starr's "It Don't Come Easy".

Consumer devices impact multimedia

If I go to an car dealer today, I would find it possible to pur-

continued on page 28

continued from page 26

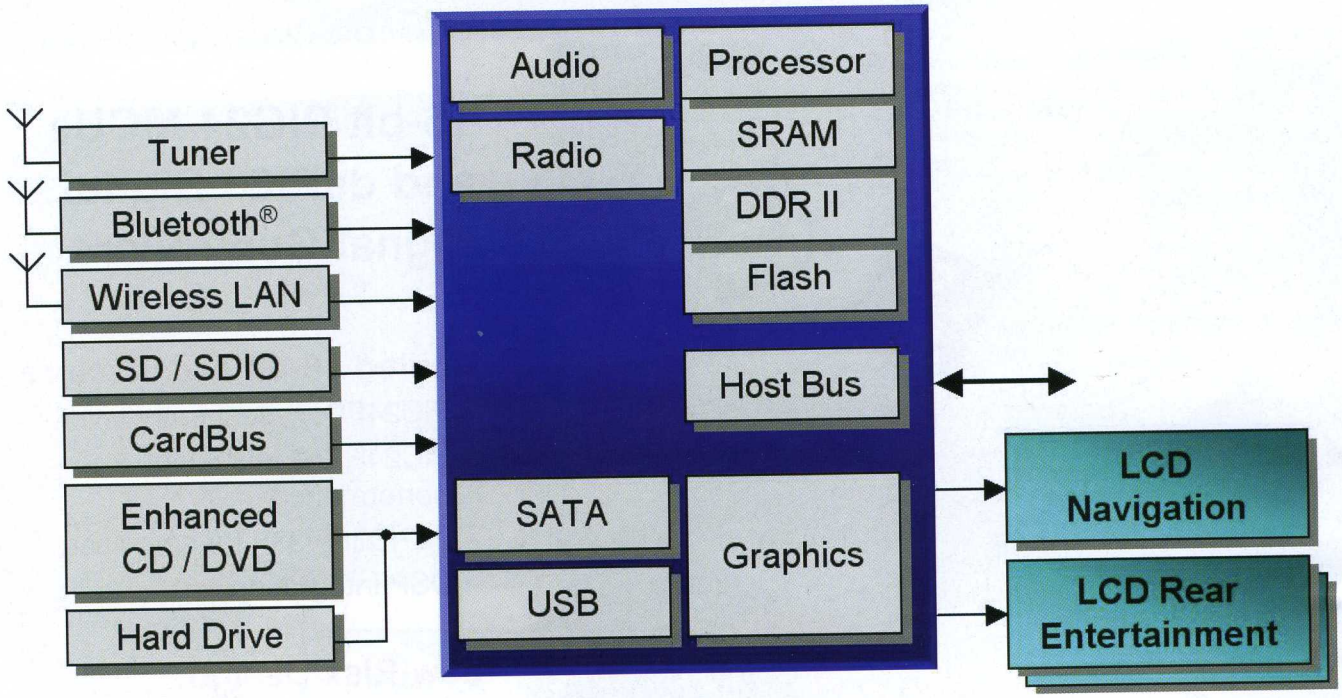


Fig. 1: Advanced multimedia system

Enquiry No: 19

chase a vehicle with an audio system that includes AM, FM and satellite radio, and that will play standard CD or CDs with MP3 music. Some systems also have an audio port, where an external audio source can be connected, and some cutting edge vehicles have an optional IPod connection. Video systems have become common over the past five years, and many manufacturers offer optional video systems for DVD playback with single or multiple screens.

A typical option for automotive video systems is the ability to connect an external device such as a video game for rear seat passenger pacification.

Today, music can be stored and transported with CD, DVD, Blueray, HD-DVD, flash memory cards and portable hard drives. Audio files can be stored and played from a variety of portable media players and even mobile phones. Now, video content is moving to the same portable mediums.

The typical vehicle radio has an AM-FM tuner installed, but even this is evolving with different world standards to deliver additional content. These new RF transmissions standards include Dab+, HD radio, DRM, XM, Sirius, FMExtra, T-DMB and ISDB-TSB.

Now let's add a few more connection types, such as Bluetooth, Wi-Fi and Wimax, which also have the potential to transfer audio and video data. In fact, there are public proposals to allow the download of a movie wirelessly while the car gets its petrol tank filled.

With this avalanche of new technologies, how can the automotive manufacturers keep up with all the new standards?

Interfaces used in automotive

Automotive entertainment manufacturers are looking for new, quick ways to add new and additional functionality to their multimedia systems.

Fortunately, the consumers now are accustomed to using expansion cards for PCs such as Cardbus, and smaller form factor media like the SD memory cards in digital cameras. Even some of the exercise machines I use have Cardbus slots so the memory card can record workout statistics.

Consumer confidence in handling removable options allows automotive manufacturers to create plug-in modules using the Din form factor, and it also allows for smaller sized options such as Cardbus, Express Card, SD/SDIO or USB.

A quick search of the internet reveals that SD memory cards are available in 2, 4 and 8Gbyte capacities and can store audio, pictures, video and document data. According to the SD Association, a 4Gbyte card will store either 1200 6Mpixel images, 100min of MPeg 2 video or 68 hours of music. And a variety of SDIO cards are being developed.

The system shown in Fig. 1 has many of the advanced interfaces and expansion devices beyond the typical AM-FM radio. Bluetooth for communications with a phone, and wireless lan for internet access and traffic updates, SD/SDIO and Cardbus for IO device and memory expansion.

There are also enhanced forms of DVD drive (HD-DVD or

continued on page 30

Enquiry No: 20

continued from page 29

Blueray) that connect with either parallel or serial ATA connection and a hard drive with the serial ATA interface. USB is added for additional device connections.

This flexible system architecture offers users a means of connecting the multimedia system with current consumer products and the expandability options to connect with other products in the future.

Programmable logic devices

In a perfect world, there would be a system controller with all the necessary device interfaces for today and the future. This controller would draw no power, operate to 150°C and would be free. As there is not a product that provides all these features, Fig. 2 shows an example of a distributed system that can fulfil most of these goals. This example has three main modules, the radio-audio processor, a main control processor (typically based on an Arm processor) and an FPGA that is the IO processor.

The FPGA based IO processor offloads the main processor subsystem from having to handle the low-level IO function and interfaces. This design is shown using an FPGA that includes four serdes channels.

Why an FPGA with serdes? Because several of the interfaces (serial ATA and PCI Express) require a serdes channel to separate the clock while decoding the data. While this could be done with a standard FPGA with external serdes, cost is the compelling reason to use an FPGA that has these interfaces along with having parts of the interface protocol integrated into the hardware IO structure. To make the design easier for the automotive designer, each of the IO interfaces is supported with standard FPGA IP cores.

This distributed architecture makes future upgrades and changes easier as they affect only the local subsystem. For instance, the radio may be upgraded to an FPGA based soft radio; as this is a separate module it could be changed without having to change the IO and processor systems.

Summary

While today it is not easy to play audio and video content from the latest consumer devices within a vehicle, the use of FPGAs in new automotive multimedia designs will enable the use of expandable systems. Having expandability with interfaces such as SD/SDIO allows the easy addition of new connections with the latest devices and will offer new and expanded features.

FPGAs offer the flexibility of quickly and inexpensively adapting to new standards and interfaces not found with other types of products. The use of FPGAs in automotive multimedia help the design engineers move away from Ringo Starr and into the realm of The Eagles in "Take it Easy".

I look forward to the day where I can easily listen to my preferred audio content wherever I travel, using whichever transport format I have available. But for now, because of my usual inability to find the genre and artist that I like, my daily commute will consist of listening to AM talk radio. Now, if it just didn't have commercials... ■

Kerry Howell is a senior automotive marketing specialist for Lattice Semiconductor

Enquiry No: 21

continued on page 32

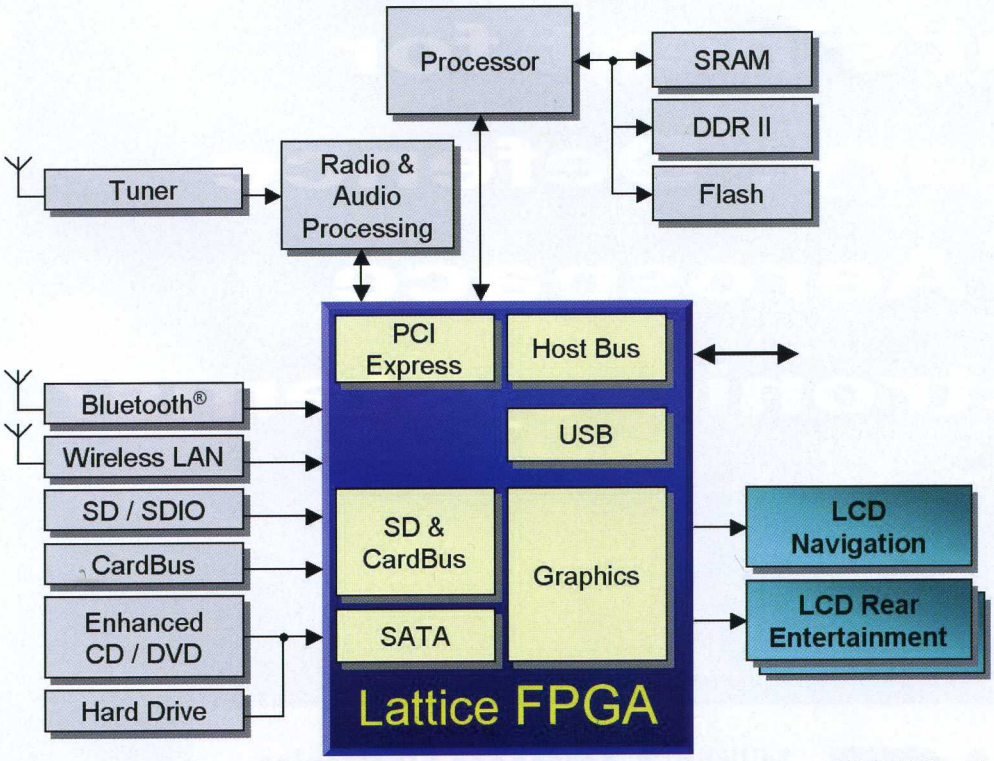
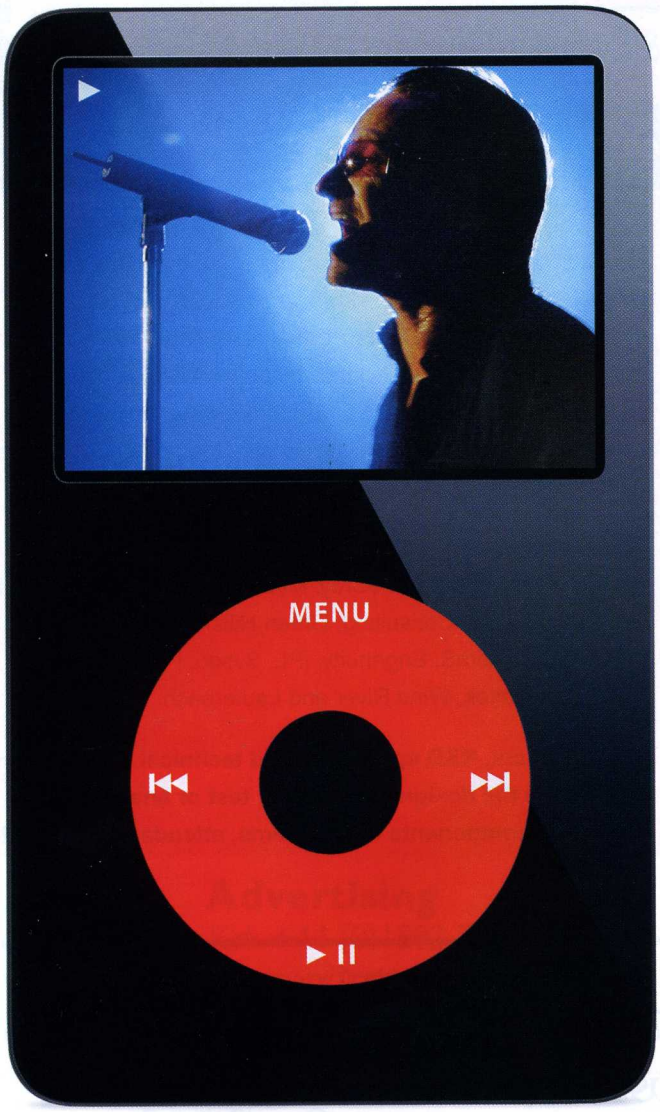
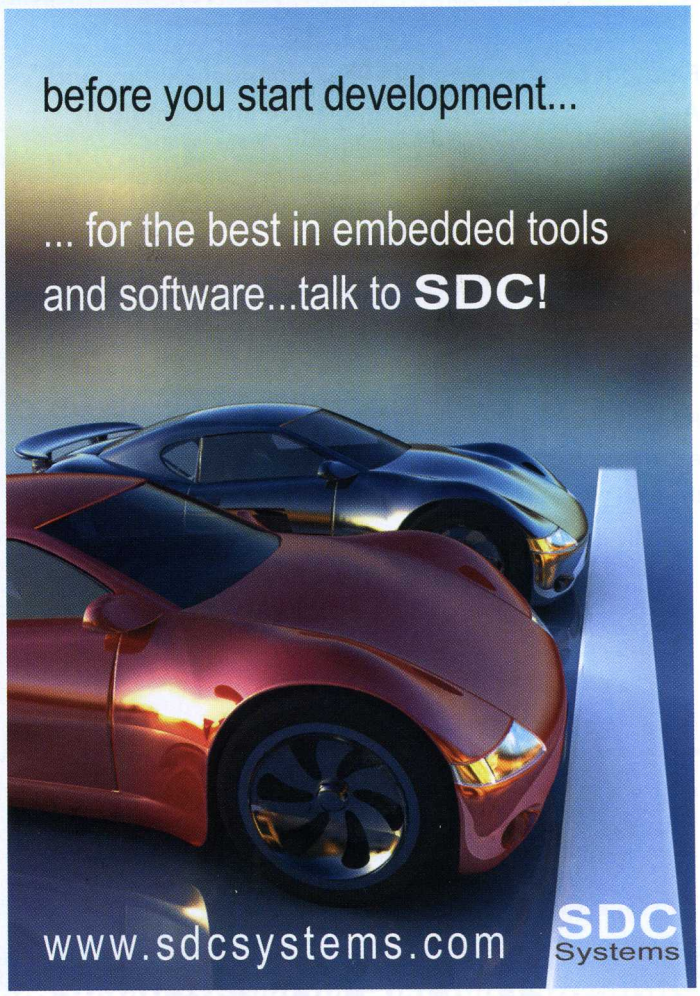


Fig. 2: FPGA multimedia IO controller



Connectivity for Apple's IPod is appearing in some of the latest vehicles



Enquiry No: 22