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Product group : Digital ICs
Product Sub-group : ASICs, ASSPs and Gate Arrays

USB In Automotive: No Longer Just For PCs

Media inside the automobile...

Universal Serial Bus (USB) has long been the ubiquitous standard for PC peripheral connectivity, but recently it has started venturing into the automotive market. MP3-supported stereos, DVD players and advanced GPS navigation systems are all part of infotainment automotive electronics. Equipping our cars with these high-tech gadgets requires a sophisticated, yet simple, form of communication.

Reference: 18896

01/09/2006

Media inside the automobile has followed in the footsteps of consumer electronics. From eight-track players to cassettes to CDs, it's clear that MP3 is next in line. Well over 150 million consumers have an iPod or MP3-equivalent, and FM transmitters and factory-installed iPod docks are simply a band-aid until stereos incorporate direct connections. Infotainment also includes touch-screen navigation equipment, fold-down video screens and mobile-phone speaker systems: suddenly the car has become a PC on wheels. As more portable consumer electronics interface with infotainment units, a standard form of connectivity is needed that can work with nearly all devices. This same dilemma existed in the PC market over ten years ago, which led to the birth of USB. The automotive industry does not need to reinvent the wheel: nearly all consumer electronics are PC-dependent for some form of functionality (downloading MP3s, uploading pictures, etc.), and the connection most widely used is USB - so the automotive industry already has a universal standard to take advantage of.

Infotainment design using USB

To utilise USB inside the automobile, either the portable consumer device or the infotainment system must contain a USB host to control the flow of data. The USB host in these devices is not the typical host controller in your PC, but rather an optimised ASIC or embedded host IC targeted for portable consumer electronics. High-end infotainment systems (advanced GPS navigation, full-featured stereos) often contain an ASIC customised to perform some dedicated function. Since these ASICs are typically built from IP libraries, they often integrate USB host IP to support USB peripherals. Simpler systems (basic stereos, mobile phone docks) do not require as much processing power and may choose to use a very basic ASIC or an embedded microprocessor. In these cases, a USB host can be added using a discrete embedded host IC. Using such an embedded host allows the ASIC to slim down its feature set to save space and cost, while still supporting USB. A discrete embedded host can also allow quicker time-to-market. Whether a designer chooses to use an integrated or a discrete solution, all USB hosts require a host stack. The latter is essentially the brains to the host controller, enabling all USB functionality inside a consumer application. A typical host stack contains the application-programming interface, a real-time operating system and core USB drivers. When designing a USB host into an infotainment system, the application and usage model will define the necessary bandwidth requirements. For most automotive applications, full-speed USB (12 Mbps) is sufficient. For example, the average MP3 is compressed between 128 and 192Kbps, with the highest quality MP3 pushing 320Kbps, well below the 12Mbps full-speed USB can support. Even uncompressed WAV files stream from a CD transfer at a maximum data rate of 1.5Mbps, which again falls well into the range of full-speed USB. High-speed USB (480Mbps) should only be considered if the system has 1GByte or above of on-board stororage or streams high-resolution video.Automotive infotainment systems must be prepared to operate in the most extreme temperatures. To ensure proper functionality of all automotive devices in all conditions, the Automotive Electronics Council (AEC) has defined a specification known as the AEC Q100, which calls for automotive components to operate in a temperature range from -40 to +150°C, with varying grades in between. Certain car manufacturers may require all components in an infotainment system to comply with a certain grade outlined in the AEC Q100 specifications.

The USB solution

With many specifications and requirements to consider, choosing the right USB solution can be a challenge. Cypress Semiconductor's EZ-Host (CY7C67300) embedded host solution is an AEC-qualified device with whole product support. Combined with the CY4645 reference design, Cypress thus provides a turn-key solution that allows quick time-to-market and easy customisation for all infotainment platforms. Complete firmware, schematics, host stacks and documentation put control in the designer's hands.

Cypress Semiconductor
3901 North First Street
PO Box 649079
95164-9079 San Jose - USA -California
tel: +1 408 943 2600
fax: +1 408 943 2796

Company website

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3901 North First Street

PO Box 649079

95164-9079 San Jose - USA -California

tel: +1 408 943 2600

fax: +1 408 943 2796

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