Henry Muyshondt, SMSC



USB is the interface of choice for many of today's consumer electronics products. Everything from cameras, to telephones and media players, as well as portable navigation devices use USB. Even devices with wireless interfaces, such as a Bluetooth phones, need to be connected to charge their batteries. USB provides the perfect interface: it is in widespread use and has a very well defined connector that makes it easy for both carmakers and device makers to use.

Dr. Matthias Stümpfle, Head of System Architecture and Platforms at Daimler AG says: "USB is the most ubiquitous consumer interface today. Its widespread use makes it an attractive way to connect the consumer's digital world with the sophisticated entertainment systems of the car. However, to put such an interface in a car requires much more than performing some stress tests on a commercial IC. Automotive applications demand high quality and reliability levels that require component designers to have the automobile in mind when they first begin creating their ICs. Furthermore, the whole supply chain needs to be tuned to quickly respond to any issues and to identify the root cause of any problems that are found along the way. USB, along with a robust and reliable MOST information and entertainment backbone, can help decouple the different development cycles of the automotive and consumer industries, while allowing car makers to quickly deliver new functions available in the consumer environment."

USB Hubs

Published on Electronic Component News (http://www.ecnmag.com)

Many of today's microcontrollers are starting to include a USB port or two in their design. Often, however, there is a requirement for multiple devices to be attached to a single host. This is where a USB hub comes into play, both to attach devices external to the vehicle as well as to connect to devices embedded within the car. UB hubs provide multiple downstream ports that connect to a single port on the microcontroller. As car makers seek to become part of their customer's digital world, obvious applications include connecting to telephones, iPods and other media players. Embedded components that are not accessible to the user also use USB often. Devices like Bluetooth radios are available with USB interfaces. Mass storage is available in the form of USB drives that are both inexpensive and more reliable than their rotating media counterparts. Hubs allow the connection of both embedded and external consumer devices.

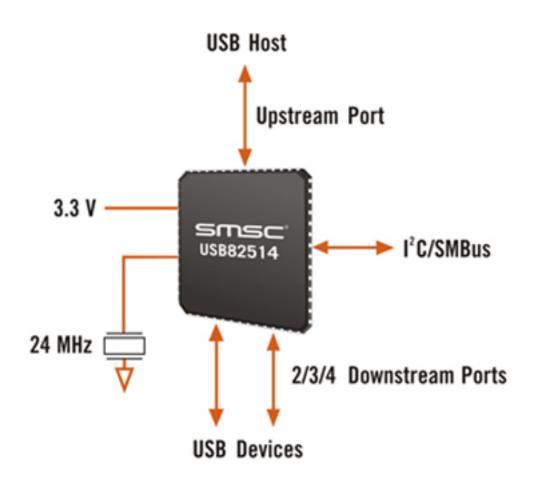


Figure 1. A USB Hub provides multiple connection points.

USB Transceivers

Many microcontrollers leave out the analog portion of the USB interface, because analog circuits don't scale well into smaller digital geometries. Leaving analog circuitry out of a very small geometry device can result in cost savings so microcontrollers often implement an interface called ULPI (UTMI+ Low Pin Interface; UTMI stands for USB 2.0 Transceiver Macrocell Interface) that connects to external USB transceivers. These transceivers then connect to actual devices.

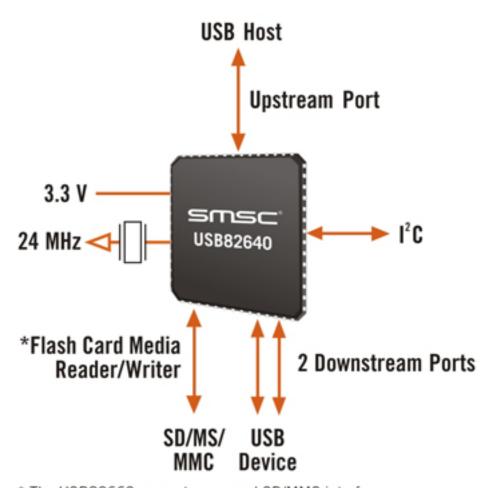
There is a lot of value in having the component that connects to the outside world be external to the processor in charge of the functions of a device. The central

Published on Electronic Component News (http://www.ecnmag.com)

processor can be less expensive if the number of I/O pins is reduced to have a single USB port and if it can be a mostly digital device that can truly take advantage of the smaller silicon geometries available today. In addition, an external USB IC, whether a hub or transceiver, protects these high-value components from accidental damage coming in from the outside world. They can also result in a better consumer experience because if damage occurs it may only affect the external USB port, instead of damaging the processor that typically controls the whole system.

USB Card Readers

Memory cards are also widely used and have rapidly come down in price while increasing storage capacity. A hub/card reader combo device makes it easy to update navigation data by replacing an SD card. Such an interface is significantly less expensive than a complete CD or DVD player. The occupants' entertainment content can also be stored in a similar device so rather than support a multitude of consumer media players, an entertainment system just needs to support a few file formats and can provide its own playback functions.



^{*} The USB82660 supports a second SD/MMC interface

Figure 2. A USB Flash Medi Reader/Hub Combination to connect to solid state memory.

Reducing System Cost:

Raw Versus Managed Flash Memory

One subtle way that a card reader can significantly reduce system cost is by using

Published on Electronic Component News (http://www.ecnmag.com)

managed memory instead of the typical raw Flash memory that stores a microcontroller's programs. As Flash memory moves from Single Level Cells (SLC) to Multi Level Cells (MLC), storage density is doubled or even tripled. A given area of silicon can store two, three or more times the number of bits. However, these increased densities are also more sensitive to problems such as reading or writing to a cell disturbing the cells around it, or reducing the endurance – the number of erase/program cycles – of the memory. While SLC memory could be used with relatively little memory management, MLC memory requires the use of various methods to reduce these adverse effects. It is possible to save almost half the area of a given memory size or to provide twice the memory in the same space, but memory management becomes critical.

The problem is that these methods vary by specific Flash technology and they need to be implemented in the host processor, taking away computing cycles from other applications. Enter the common Multimedia Card (MMC) format. It has been widely available for consumer products for years now and contains the intellectual property needed to manage memory. MMC memory has a small controller inside that takes care of all the functions needed to manage Flash memory. It can provide wear leveling, moving data around as cells wear out, making sure the appropriate blocks of memory are read or written, etc. It also provides ECC error correction that is critical for the higher density memories, all without taxing the host microcontroller that only needs to read or write to a fixed memory location. The MMC format provides a standard interface to the microcontroller and all the

Published on Electronic Component News (http://www.ecnmag.com)

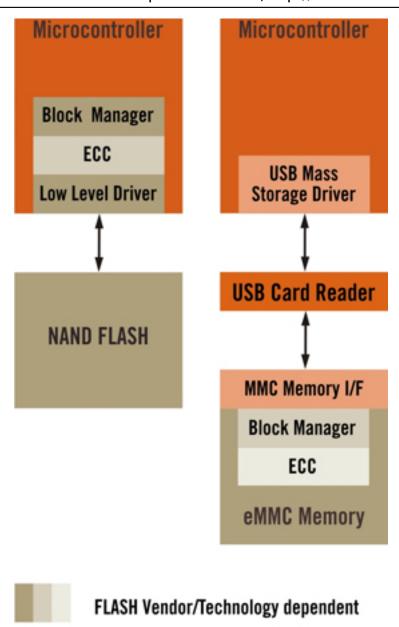


Figure 3. Raw versus managed Flash memory.

technology- specific memory management is carried out within the MMC card. Using MMC is so efficient that there is now an embedded MMC (eMMC) format. A card reader can easily enable any microcontroller with a USB port to use eMMC without having to implement the full card reader functionality within the microcontroller, with its attendant compatibility issues. A dual card reader can be used to simultaneously connect eMMC as well as an external memory card provided by a consumer.

Semiconductor Suppliers Exhibit Dedicated Automotive Focus

The automotive world has very exacting quality and reliability requirements. Cars are on the road for 15 years or more and have harsh environmental conditions that range from extreme cold to extreme heat. The cost of a failure in the field is very high so any issues that come up have to be quickly contained. Car makers have to find the root cause of every single failure and they need corrective actions to be implemented quickly. The components they use require defect rates close to 0

Published on Electronic Component News (http://www.ecnmag.com)

defects per million (dpm). It is not sufficient to submit a commercial IC to some additional stress tests (such as the Automotive Engineering Councils AEC-Q100 test) to be able to call them automotive grade. As a matter of fact, the lot sizes called out for AEC-Q100 testing result in statistical failure rates of just under 1,000 dpm. Semiconductor suppliers to the automotive industry should have a proven internal operations structure that is dedicated to automotive applications. From design to verification, from manufacturing to service and support, a dedicated automotive focus is needed in order to ensure the low dpm rates expected by the industry.

SMSC has a line of USB products that have been defined with TrueAuto™ quality in mind. They include the USB82514 USB 2.0 Hub, which can be configured with up to four downstream USB ports. SMSC's USB82640 combines a two-port USB 2.0 hub with a flash media card controller that supports the Secure Digital (SD), Multi Media Card (MMC) and Sony Memory Stick formats. The USB82660 adds a second flash media reader that supports SD and MMC. Both interfaces also support the SDIO interface used by many embedded devices, such as Wi-Fi (aka WLAN) radios and GPS receivers. The USB83340 is a USB 2.0 ULPI Transceiver that can be used with microcontrollers that have a ULPI interface, providing flexibility to designers that need an efficient interface.

Henry Muyshondt is director, business development at SMSC. For more information, contact SMSC, 80 Arkay Dr., Hauppauge, NY 11788; 631-435-6000; www.smsc.com [1]

Source URL (retrieved on 05/25/2013 - 4:33pm):

http://www.ecnmag.com/articles/2010/02/usb-connects-car-makers-consumer

Links:

[1] http://www.smsc.com