Overview

In the past, cell phones, digital cameras, PDAs, audio players and other mobile devices required proprietary wired interfaces for connecting to PCs. Dozens of connection methods existed, including proprietary expansion ports and cradles, a variety of different memory card interfaces, even proprietary USB connectors. Because of this, connecting mobile devices to each other was virtually impossible.

USB On-the-Go (OTG) defines an industry standard cable and protocol that simplifies the numerous proprietary connection methods between PCs and mobile devices, and allows mobile devices to share data with each other and with PCs. Because OTG permits mobile devices to adopt the host or peripheral role (dual-role) and to switch roles on demand, users can connect and transfer data from a variety of devices without having to remove and reinstall the cable.

With memory sizes on mobile devices approaching 1GB, a ubiquitous wired interface simplifies a variety of data sharing applications, including hot syncing mobile devices to PCs, transferring pictures, songs, videos and other files between mobile devices and enabling mobile devices from different manufacturers to share common accessories, such as cables, carkits, printers and storage devices. OTG also addresses the unique needs of mobile devices for smaller connectors and lower power consumption.

QUALCOMM's USB OTG Solution

QUALCOMM is committed to providing a complete OTG solution to its customers. Many of the company's Mobile Station Modem™ (MSM™) devices, including the MSM6150™, MSM6250™, MSM6275™, MSM6500™, MSM6550™, MSM6700™ and MSM6800™, include an OTG controller to enable communication between a number of other devices, such as printers, cameras, PDAs and keyboards. QUALCOMM's PM6650™ power management device includes an OTG transceiver, as well as support for USB charging and analog carkits. All QUALCOMM OTG products are compliant with the following industry standards:

- USB 2.0 Specification, www.usb.org/developers/docs
- On-the-Go Supplement, Revision 1.0A, www.usb.org/developers/onthego
- CEA-936-A Mini-USB Analog Carkit Interface, http://global.ihs.com/

The high level of integration between the MSM chipsets and the PM6650 power management chip allows for the full implementation of an OTG interface with minimal circuit board complexity, as indicated in Figure 1.

With the configuration shown in Figure 1, the following functions are supported through a mini-USB port on a mobile device:

- Act as USB host to other devices
- Act as USB peripheral to other devices
- Draw current from PCs or carkits to power phones or charge batteries
- Provide output power to other USB peripherals
- Communicate via Universal Asynchronous Receiver Transmitter (UART) with Mini-USB analog carkits and with car stereos
- Send analog speaker signals and receive analog microphone signals from carkits or car stereos

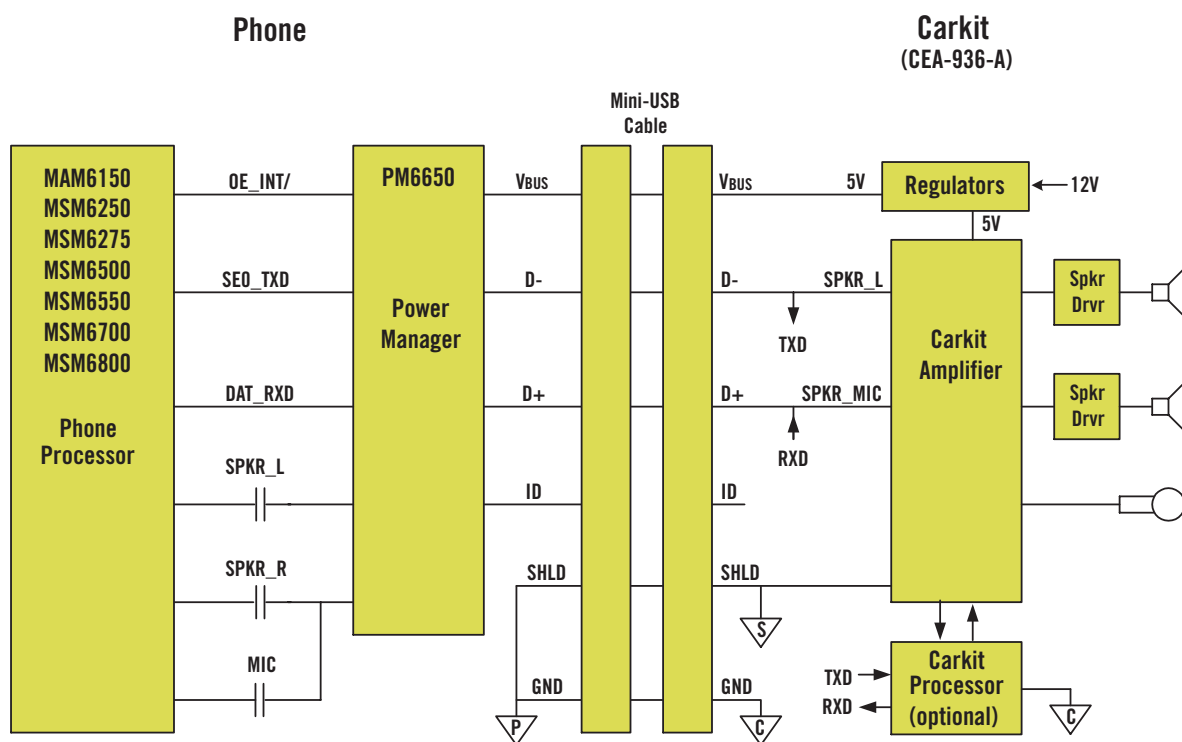Figure 2 shows the implementation of the above OTG features in the PM6650 device.

Figure 1 Carkit Interface Diagram

USB On-the-Go (OTG)

Connectors

The USB specification requires that each USB cable have a Type-A plug on one end, and a Type-B plug on the other end. In standard USB, the Type-A plug goes to the PC (host), and the Type-B plug goes to the peripheral. This cabling arrangement prevents two peripherals from being connected to each other.

To connect two mobile devices together, one of the mobile devices needs to accept a Mini-A plug, while the other needs to accept a Mini-B plug. The OTG Supplement defines a Mini-AB receptacle that can accept either a Mini-A plug or a Mini-B plug. This Mini-AB receptacle can be used only on devices that include an OTG controller.

Since QUALCOMM's MSM6150, MSM6250, MSM6275, MSM6500, MSM6550, MSM6700 and MSM6800 products include an OTG controller, devices based on these chipsets are able to use the Mini-AB receptacle, and thus connect with PCs, other OTG devices and the installed base of standard USB peripherals.

Host Negotiation Protocol

In standard USB, the Type-A plug goes to the PC (host), and the Type-B plug goes to the peripheral. When two OTG devices are connected, the device with the Mini-A plug defaults to being host, while the device with the Mini-B plug defaults to being peripheral. The OTG Supplement defines a Host Negotiation Protocol (HNP) that allows two OTG devices to swap the roles of host and peripheral, in a way that is transparent to the user.

Low Power Features

In standard USB, the PC host (or A-device) outputs 500mA, and the PC also powers the bus continuously, even when a peripheral is not connected. These requirements are not practical for mobile devices, however, such as cell phones and PDAs. For USB OTG, the A-device is required to output only 8mA, and can supply power only when it is requested from either the user or the B-device.

QUALCOMM's MSM6150, MSM6250, MSM6275, MSM6500, MSM6550, MSM6700 and MSM6800 chipset solutions support both of these features, allowing for maximum power savings in mobile devices.

Applications

Typical applications that QUALCOMM's OTG interface enables include:

- Hot syncing cell phones and PDAs to PCs
- Transferring pictures between digital cameras, cell phones and PDAs
- Transferring songs between audio players, car stereos and cell phones
- Connecting laptops and PDAs to cell phones to access the web
- Connecting cell phones to car stereos, performing position location, navigation and remote auto diagnostics
- Connecting portable keyboards to PDAs and cell phones

Featuring smaller connectors, host capability for mobile devices, low power features and host negotiation protocol, USB OTG is rapidly becoming the industry standard wired interface for mobile devices.

QUALCOMM's Complete Solution — Our Commitment to Our Partners

QUALCOMM CDMA Technologies is enabling the future of communications. We work closely with our manufacturer and operator partners to develop solutions that meet market needs today and provide the technology foundation for the wireless communications of tomorrow. Our world-class CDMA engineers create detailed reference designs to accelerate testing and deployment for our partners. And our chipsets and system software are fully integrated and able to bring advanced features and functionality to today's wireless devices. With QUALCOMM CDMA Technologies, manufacturers and operators can offer sophisticated wireless solutions that succeed in the global marketplace.
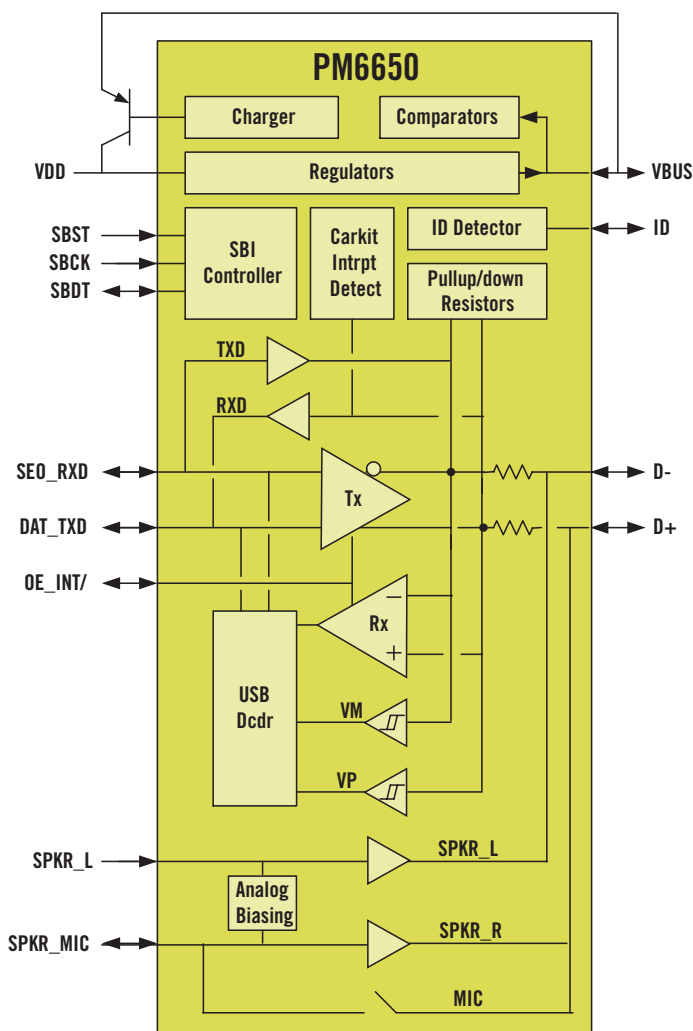

Figure 2 PM6650 Device Diagram