Wireless Communication Using the IrDA® Standard Protocol

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ANALOG DESIGN NOTE ADN006

The two most popular mediums in the wireless arena are Infrared (IR) and Radio Frequency (RF). When asked to develop a wireless system, you may be concerned about cost, ease-of-design, and distance requirements. IR technologies are better suited for short distance, low-to-medium data throughput, wireless communication channels. Two common types of IR technologies are currently in use. These are the TV Remote (TVR) and the IrDA (Infrared Data Association) standard protocol.

The lowest cost wireless connection technology is TVR. The trade-off with this technology is between distance and bit-rate. Usually this interface is also unidirectional. If a bidirectional, higher data bandwidth is required in your application, you may opt to design an IrDA system. This infrared communication standard has been defined by the IrDA industry-based group(1). This group has developed communication standards that are well suited for low-cost, short-range, point-to-point infrared channels. These types of channels operate over a wide range of speeds under a cross-platform environment. IrDA standards have been used to install over 300 million low-cost, short-range communication systems in laptops, printers, handheld PCs, and PDAs, to name a few.

An example of an IrDA standard embedded system is shown in Figure 1. In this system, the Primary device (PDA) searches for other IrDA standard devices. The Secondary device (Host Controller and MCP2150) will respond to queries from the Primary device.

The host controller controls the MCP2150 by sending and receiving data through its UART interface port. The MCP2150, which is positioned between the host controller UART device and infrared optical transceiver, decodes and encodes the signal.

The MCP2150 has two independent baud rates. One of the baud rates is for communication with the Primary device (PDA). The Primary device negotiates this baud rate with the MCP2150, as defined in the IrDA standard. The second baud rate is set with the two hardware pins, BAUD1 and BAUD0. This second baud rate is for communication with the host controller.

The IrDA standard is a network protocol and follows a layered approach in its definition. A model of the IrDA protocol stack is shown in Figure 2. These protocols deal with a manageable set of responsibilities and also supply needed capabilities to the layers above and below.

The MCP2150 is an IrDA Standard Protocol Stack Controller, which provides support for the IrDA standard protocol "stack" plus bit encoding/decoding.

One of the functions of the MCP2150 is to encode and decode the asynchronous serial data stream.

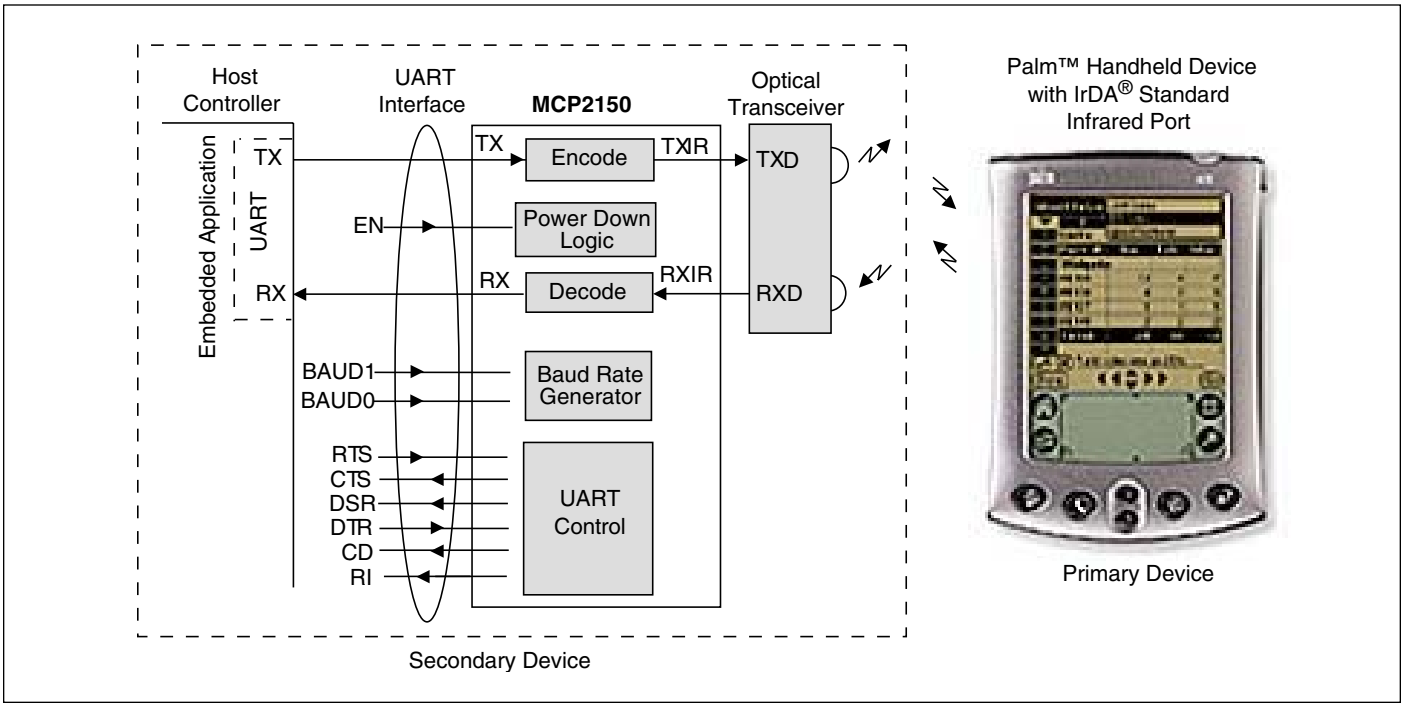

Figure 1. *The Primary Device (PDA) sends data through the infrared interface to the MCP2150. The MCP2150 then decodes this data into the UART standard. After translation, the data is sent to the Host Controller through the UART interface. The Host Controller can also send data to the MCP2150 where the data is encoded and made ready for transmission to the Primary device.*

IrTRAN-P	IrObex	IrLAN	IrCOMM [1]	IrMC
LM-IAS	Tiny Transport Protocol (Tiny TP)			
IR Link Management - Mux (IrLMP)				
IR Link Access - Mux (IrLAP)				
Asynchronous Serial IR [2, 3] (SIR) (9600 - 115200 Baud)	Synchronous Serial IR (1.15 MBaud)	Synchronous Fast IR (FIR) (4 MBaud)		

Figure 2. *This IrDA protocol stack has been defined by the IrDA industry-based group. Within the protocol stack data communications, details, as well as the data structures, are defined.*

The encode/decode translation format is shown in Figures 3 and 4. Figure 3 shows how the received IR data from the PDA is decoded to UART-formatted data. Figure 4 demonstrates how data is taken from the Host Controller, into the MCP2150, and encoded in preparation of transmission to the PDA. The IrDA bit format is the NAND of the UART signal. The bits are inverted and high pulses are shortened in order to reduce the optics power consumption. The MCP2150 decodes the IR data, which is then handled by the protocol handler state machine. The protocol handler sends the appropriate data bytes to the Host Controller in UART-formatted serial data.

The MCP2150 replaces a wired serial connection with a wireless solution. The MCP2150 allows designers to add IrDA wireless connectivity to their embedded system designs easily and cost effectively. With this device, the host UART interface allows easy connections to PC serial ports. Another product available is the MCP2155, which is best suited for serial port interfaces (ie., modems). In all cases, these point-to-point systems connect to devices of “higher intelligence”, such as PCs, PDAs, etc.. This minimizes the cost of MCP215X-type devices. The MCP215X can also serve as a primary device in these point-to-point applications. Both devices provide support for the IrDA standard protocol “stack” plus bit encoding and decoding capability.

Another product in this family from Microchip is the MCP2140, which is an IrDA standard protocol stack controller with a fixed baud communication rate of 9600. Adding IR connectivity to cost-sensitive, high volume, embedded applications was not really feasible prior to the introduction of the MCP215X and MCP2140 parts. These parts remove the requirement of the system designer needing to implement the complex IrDA stack. Finally, the MCP2120 is an infrared encoder/decoder chip.

Sending data using IR light requires some hardware and specialized communication protocols. These protocol and hardware requirements are described, in detail, in the IrDA standard specifications. The encoding/decoding functionality of the MCP2150 is designed to be compatible with the physical layer component of the IrDA standard. This part of the standard is often referred to as “IrPHY”. Additionally, the MCP2150 handles the speciallized communication protocol, IrCOMM (9-wire “cooked” service class). A complete list of IrDA standard specifications is available on the IrDA website (www.irda.org).

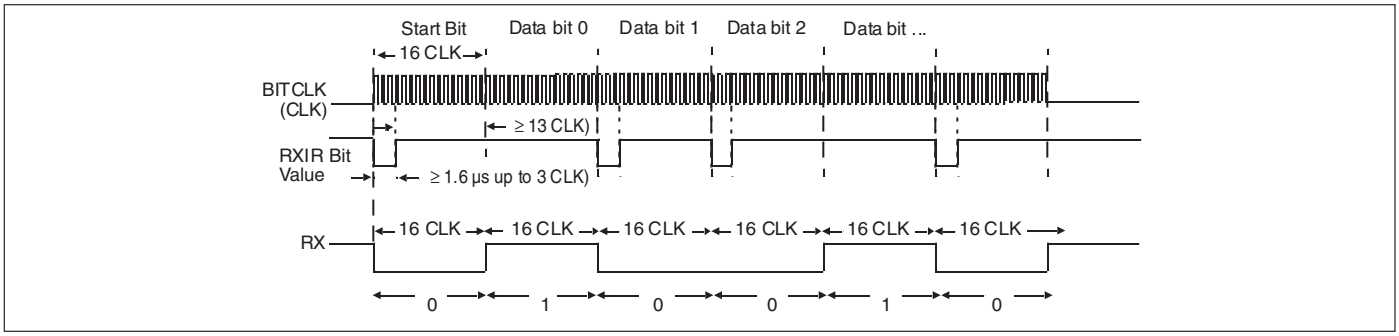

Figure 3. *Bit Encoding*

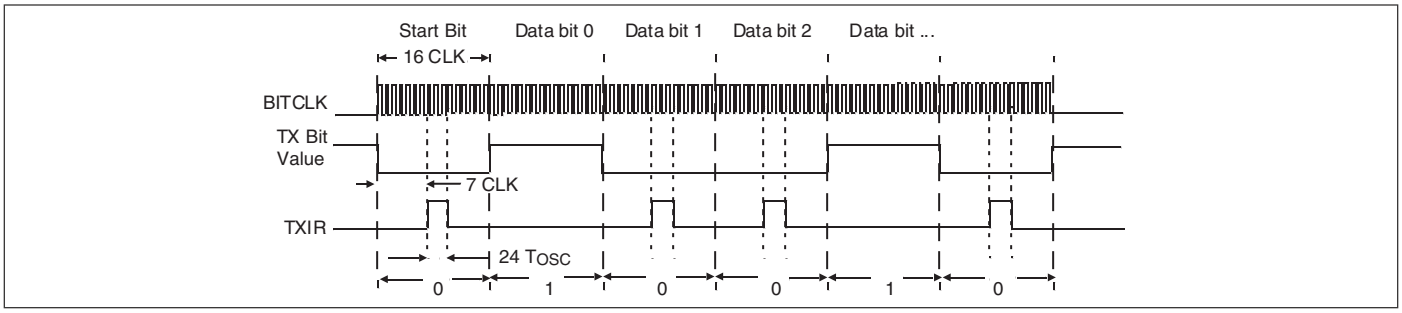

Figure 4. *Bit Encoding*

Recommend References:

[1] *www.irda.org - Trade Association for Defining Infrared Standards, IrDA System Protocol consortium web site.*

AN858 *- “Interfacing the MCP215X to a Host Controller”, Palmer, Mark, Microchip Technology Inc.*