1-Wire Bus Specification Version 1.0

November 6, 2003

Rick Huang

Revision History

11/06/03 – rev 0.1

- Initial creation of the document

TOC

1. Purpose

The purpose of this document is to describe the specification of the 1-wire bus.

2. Introduction to 1-wire bus

The 1-wire bus is designed as a communication standard for the master (usually a PC) to communicate with up to 254 devices over a single cable. The maximum length of the bus is 100 meters. Version 1.0 of the specification specifies three communication methods. The most common implementation of the 1-wire bus is through a single coaxial cable. (Typically a 50ohm RG58/U cable with BNC connectors)
To simplify the implementation and cost of the 1-wire bus, the 1-wire bus is software-defined. The standard hardware for implementing the 1-wire bus is the PIC12 and PIC16 series microcontrollers.

3. Transport medium

Version 1.0 of the specification defines three types of transport medium:

1. Chip-to-chip communication, maximum defined distance is 50cm, media can be copper traces or loose wire, termination using 1.5kohm resistor on single end, 5V bus.
2. Board-to-board communication, maximum defined distance is 10m, media is flat ribbon cable, termination using 200ohm resistors on both end, 2.5V bus.
3. Long distance communication for noisy environments, maximum defined distance is 100 meters, media is RG58/U coaxial cable, termination using 100ohm resistors on both end, active termination, 2.5V bus

When utilizing a flat ribbon cable as transport medium, it is critical that the signal is sandwich between two ground cables as shown in figure 1.

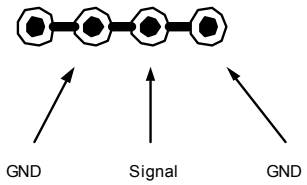

Figure 1: Signal wiring specification for a flat ribbon cable

4. Termination

The 1-wire bus utilizes shared bus architecture. To ensure data integrity, the bus must be terminated. For low cost implementation, any bus with maximum length of less than 50cm, a single ended termination can be utilized. Any other bus configuration must utilize termination on both end of the bus.

For chip-to-chip communication (copper traces), a simple single ended termination shown in figure 2 is sufficient.

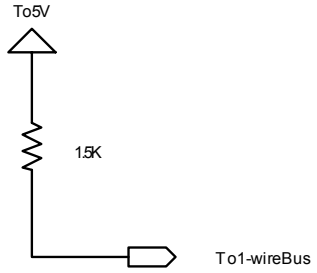

Figure 2: Termination requirement for cupper trace as media

For board-to-board communication (ribbon cable), two termination resistors are required at each end of the bus.

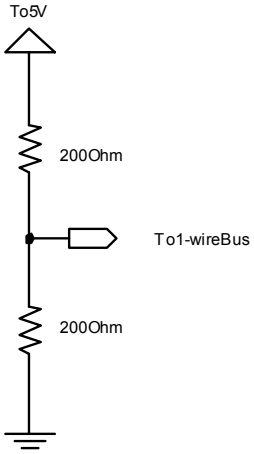

Figure 3: Termination requirement for ribbon cable as media

For long distance communication (coaxial cable), two termination resistors are required at each end of the bus.

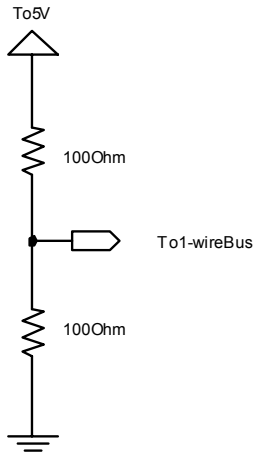

Figure 4: Termination requirement for coaxial cable as media

5. Timing and Data Packet Structure

The basic timing unit for the 1-wire bus is a cycle. A cycle is the amount of time it takes to execute one instruction. Two standard timings have been defined for the 1-wire bus, 1uS and 0.2uS. These values correspond to a PIC family processor running at clock frequencies of 4Mhz and 20Mhz respectively.

The 1-wire bus protocol utilizes a fixed length packet structure. A transmitted packet is always 259 cycles long and a received packet is always 270 cycles long. Figure 5 shows the full timing diagram.

All transmission starts with an ATTN signal follows by a single byte of address. All devices on the 1-wire bus check the address with its device address. If a match occurs, the receiving device should pull the bus low during the ACK cycle. Any device that has a different address goes into sleep mode for 200 cycles.

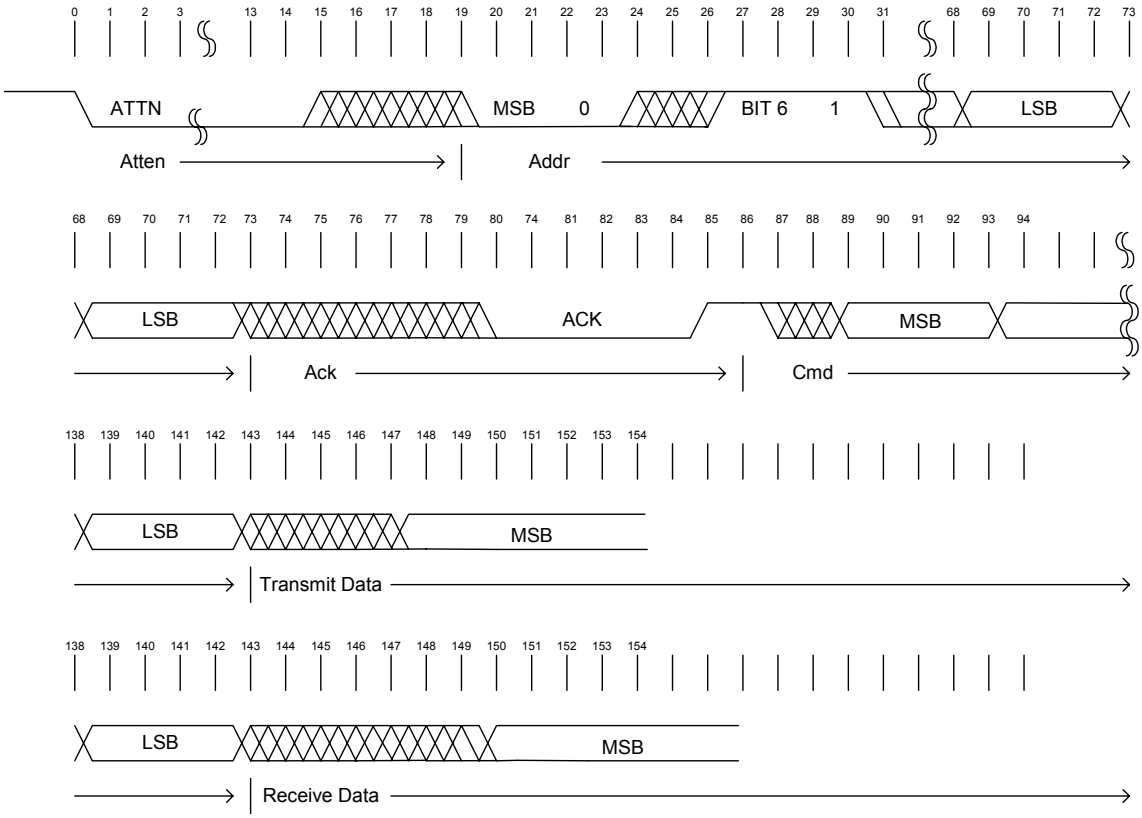

Figure 5: Transmission and receiving timing

6. Commands

There are two assigned command block. Command 0x00 to 0x79 are always transmission commands and command 0x80 to 0xff are always receiving commanda. Command 0x00 and 0x80 have special functions. These two commands write (0x00) and read (0x80) the transmission buffer on the target device.