

Probing Embedded USB Bus Designs

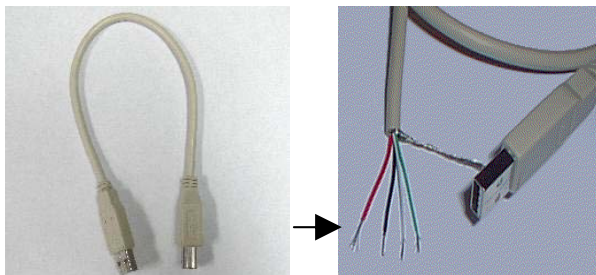
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When recording data traffic between USB devices on a PCB that does have external connectors, you may need to build your own probe to connect directly to the USB bus on the PCB. This is not difficult to do by following the instructions in this document, and the resulting probe can be used with any LeCroy USB protocol analyzer.

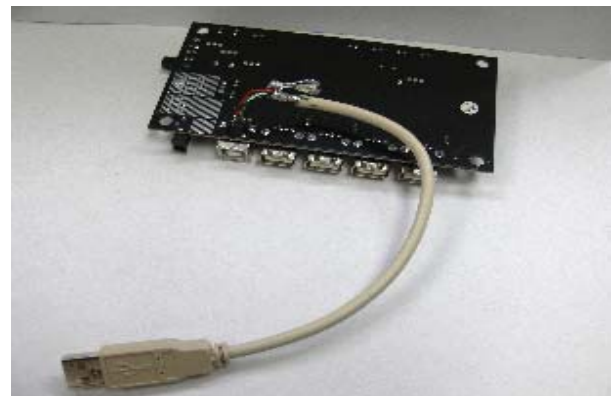
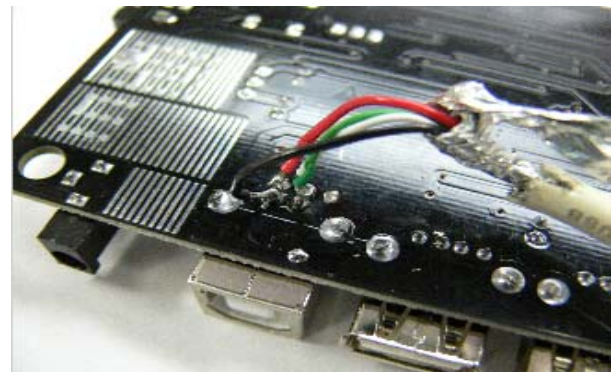
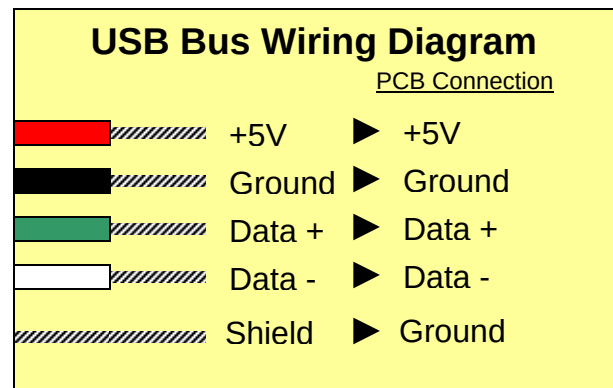
Building an Embedded Probe

We will build a probe by starting with a standard USB cable (which gives us one connector intact to plug into the analyzer). By cutting the cable, we will have access to the individual wires in the cable. The test PCB must have accessible traces or test points for the USB bus D+/D- signals and available +5V and ground connection points.

1. Take a standard USB cable with either an "A" or "B" type connector and cut a length of approximately 13 inches (34 cm) of cable, leaving the "A" or "B" end intact. Remove about 2 inches (5 cm) of the outer insulation. Pull back or unwrap the shield, or if present, leave the shield drain wire intact. Expose the four inner wires (red, black, green and white). The red and black wires are the +5V (Vbus) supply and ground, the green and white are the D+/D- signal lines. Strip approximately 3/8" (1cm) of insulation from each of the four wires.



2. Solder the D+ (green) and D- (white) wires to the corresponding bus trace on the PCB. Also solder the red (+5V) and black (ground) wires to appropriate locations on the board. Complete the connection by soldering the shield ground wire to ground on the PCB.



Connecting the Analyzer

Once the probe has been completed, the analyzer can be connected simply by plugging the “A” or “B” connector at the other end of the cable into either port of the analyzer. Examples are shown to the right using the USBTracer™, SBAE-30 and Conquest™ analyzers.

In the illustrations for this example we are using a USB hub (which then requires connection to an external host to provide bus traffic). In an embedded bus application between USB devices on a single PCB, the probe would simply be connected directly to the analyzer to provide a tap into the bus traffic.

Recommendations

Minimizing the length of the USB probe cable is important, especially at high data rates. Shorter cables typically reduce any perturbation of the USB bus and help ensure reliable capture of serial data stream by the analyzer.

Choosing an asymmetric probing point is recommended to minimize perturbation of the USB signals when the probe is connected.

