Debugging USB Buses in Embedded System Designs

USB (Universal Asynchronous Receiver-Transmitter)

USB is a very familiar bus. USB has the characteristic of hot plugging; when USB plugs into the Host, the Host can check that at once and the software will mark out that, that is to say plug and play. USB connection supplies device with power supply, the supplied voltage is DC +5V and the electric current is about 100mA~500mA.

USB has 4 connections, two of those are power supply and grounding lines, the other two are D+ and D- signal lines. However, the signals of the signal lines are generally opposite, for example, one signal is High, and the other must be Low. Figure 1, the differential signal can improve the anti- noise and anti-jamming ability, USB, namely, makes use of the differential signal of D+ D-two signal lines to realize the aim of high-speed transmission.

When USB Host End connects without device , D+ D- will have a 1.5KΩResistance grounding line to make sure the two lines in the state of grounding.

USB supports 127 addresses, that is to say, one USB system supports 127 devices at best, and the Host will inquire every Hub to learn the connected state.

As for USB1.1, it can be divided into High-speed and Low-speed modes .The Low-speed transmission rate is 1.5M/s and the High-speed transmission rate is 12M/s.When USB1.1 is High-speed mode, that is to say 12M/s, the width of per bit is about 83.3ns.

Packet is the least unit to consist of USB transmission. When USB transmits, packet makes the Computer Host End and USB device on every Hub communicate and transmit, and Zeroplus Logic Analyzer can help the engineer directly encode the captured signals and display them in the software, in order to let the user analyze USB signal directly.

ZEROPLUS Logic Analyzer VS Other brand Logic Analyzer

The Device under Test is USB Bluetooth Dongle (USB1.1) ; we capture the same signal through the two kands of Logic Analyzer and go on comparing to the same signals:

How does using Logic Analyzer connect to the USB device under test?
ZEROPLUS Logic Analyzer made corresponding measure fixture for USB1.1 module as below:
The measure fixture can help user leave out multifarious connection steps and finish connecting to the Device under Test directly.

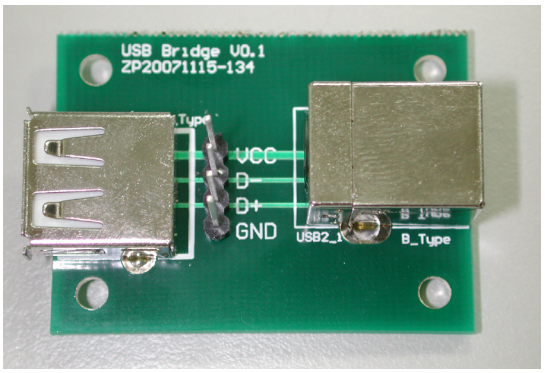
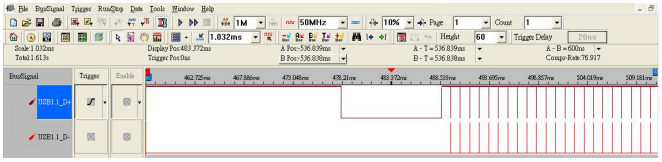


Figure1

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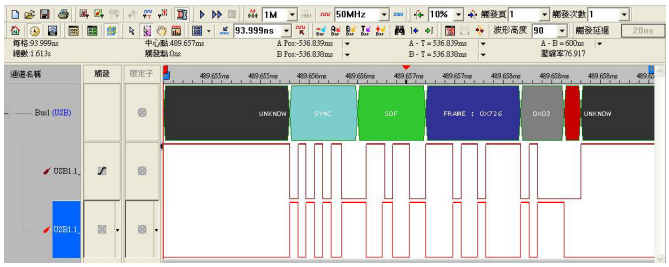
Using Zeroplus PC Based Logic Analyzer

☞ Use Zeroplus Logic Analyzer (Install USB1.1)



USB Bluetooth Dongle Figure captured by Zeroplus Logic Analyzer

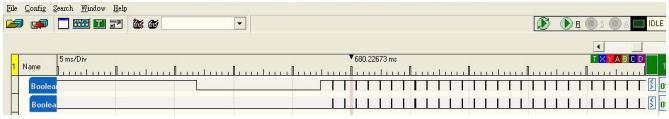
☞ Prepare for analyzing signal captured by Zeroplus Logic Analyzer



Using Zeroplus Logic Analyzer USB bus module, you can know the packet structure through BUS easily.

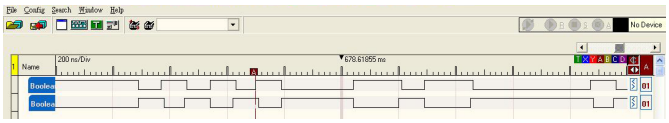
Using other Brand Logic Analyzer

☞ Use Other Brand Logic Analyzer



USB Bluetooth Dongle Figure captured by Other Brand Logic

☞ Prepare for analyzing signal captured by Other Brand Logic Analyzer



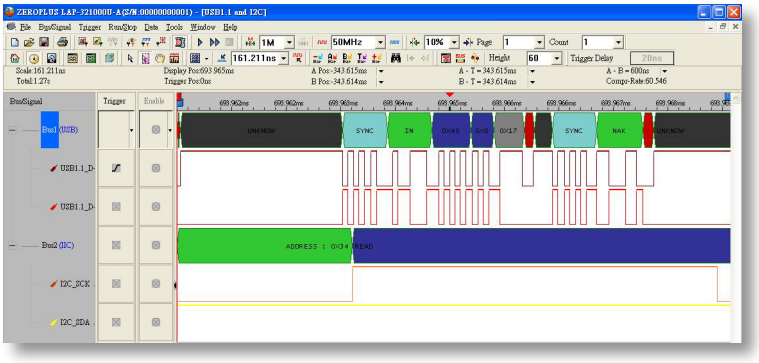
The Other Brand Logic Analyzer doesn't have USB bus module, so encoding to the signal is impossible.

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Advantages of analyzing USB signal by Zeroplus Logic Analyzer

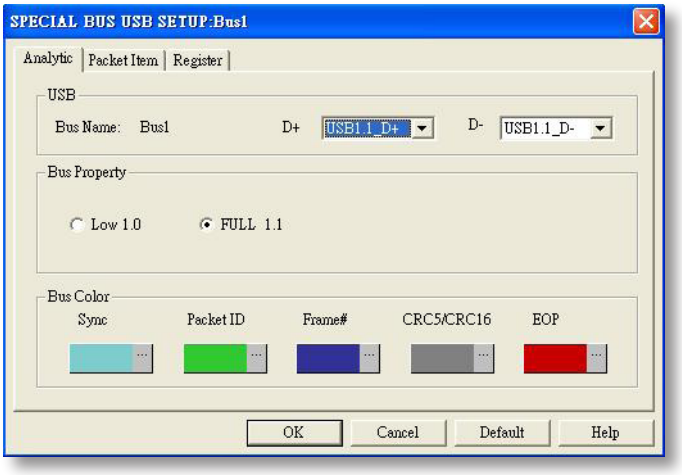
Because the Logic Analyzer has the characteristic of many channels, as long as there are enough channels, the Logic Analyzer can measure many groups of serial signals at the same time, for example, Figure (measured USB1.1 and IIC signals)

It can be seen two groups of buses, one is USB1.1, and the other is I2C bus.



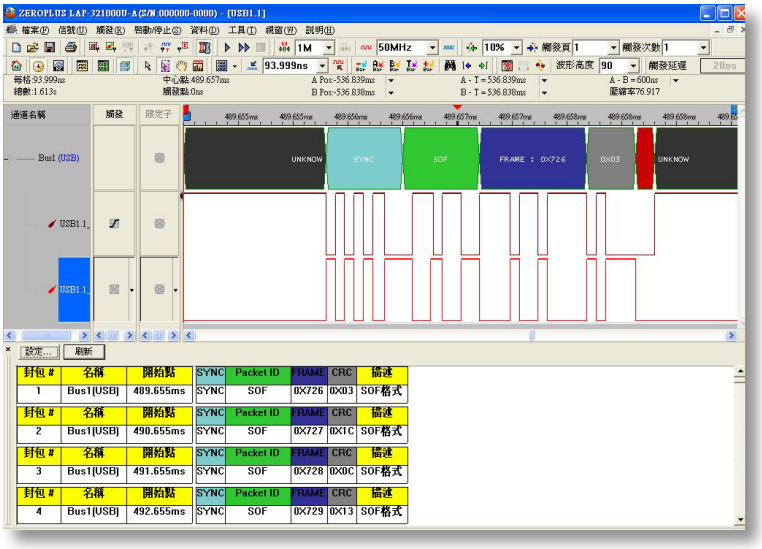
USB Bus Module Dialog Box

Bus Module setup is convenience and celerity, as the Figure displays, user only need set D+ and D- pins and signal speed, then click OK ,the bus module encodes to the USB signal immediately.



Bus Packet List

For the convenience of analyzing and improving efficiency, Zeroplus Logic Analyzer adds bus packet list function in the new edition software, the bus packet list can adopt packet segment displaying the serial signal and display the data ontent in vertical mode, Figure displays the result of USB1.1 signal displayed by bus packet list.



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Conclusion

Serial Bus or Parallel Bus is often used in embedded system design, bus it takes a lot of time to analyze those signals with oscillograph, Zeroplus PC-Based Logic Analyzer can supply engineers more powerful Trigger Function, multiple Bus Encoding Module and convenient Find Data Function, in order to make engineers exploit products handy.

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