Introduction

- Dave Anders aka prpplague
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- Board Bringup
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- Board Bringup
- Codebreaker / Mastermind
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- Information to cover
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  - Schematics
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  - Scientific Method
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  - Tools
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  - PCB
  - Assembly
  - Scientific Method
  - Tools
  - Test Case
Schematics

- Datasheet Errors and Omissions
Datasheet Errors and Omissions
Cut-n-Paste is evil
Datasheet Errors and Omissions
Cut-n-Paste is evil
Mode and Value Errors
- 1K vs 10K
- SPI vs I2C
- Clock Source
- Clock Frequency
Footprint Errors
- Footprint Errors
- Connector Pin Swap
PCB

- Footprint Errors
- Connector Pin Swap
- Back Annotation
  - Ground Pins
  - Voltage Pins
PCB

- Footprint Errors
- Connector Pin Swap
- Back Annotation
  - Ground Pins
  - Voltage Pins
  - Signal Polarity
Assembly

- Component Swap
Assembly

- Component Swap
- Component Rotation
Assembly

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- Component Swap
- Component Rotation
- Component Substitution
  - SN75LVDS83 – 3.3V level part
  - SN75LVDS83B – 1.8V level part
Assembly

- Component Swap
- Component Rotation
- Component Substitution
- Do-Not-Install (DNIs)
Scientific Method

- Observe
Scientific Method

- Observe
- Theory
Scientific Method

- Observe
- Theory
- Test
Scientific Method

- Observe
- Theory
- Test
- Analyze
Tools

- Hardware
  - Multimeter
  - Logic Analyzer
  - Oscilloscope
  - JTAG
- Known Working Devices
  - I2c based eeprom
  - Spi based ADC
  - USB hub
  - Loopback Plugs
Tools

- **Hardware**
- **Software**
  - Sigrok – logic analyzer application
  - OpenOCD – on chip debugger using JTAG
  - Gerbv – Gerber file viewer
  - Devmem2 – read/write physical memory address
  - Fb-test – framebuffer pattern test
  - Evtest – reports input events
  - Uart-loopback – uart/spi loopback utility
  - I2c utils – i2c device scan and detection
Tools

- Hardware
- Software
  - http://www.elinux.org/BoardBringup_Utilities
Tools

- Hardware
- Software
- Root Filesystem
  - Angstrom console-image via OE
Example Test Case

- Observe – USB devices do not enumerate
Example Test Case

- Observe – USB devices do not enumerate
- Theory – USB PHY is not communicating
Example Test Case

- Observe – USB devices do not enumerate
- Theory – USB PHY is not communicating
- Test – Use devmem2 to read PHY's ID
Example Test Case

- Observe – USB devices do not enumerate
- Theory – USB PHY is not communicating
- Test – Use devmem2 to read PHY's ID
- Analyze – Failed to read the ID
Example Test Case

- Observe – USB PHY supports multiple modes
- Theory – USB PHY mode resistors incorrect
- Test – Check physical board and schematic
- Analyze – Found both resistors DNI
Summary

- Common Issues
Summary

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- Scientific Method
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- Common Issues
- Scientific Method
- Open Source Tools
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- Common Issues
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- Open Source Tools
- Questions?