

A 1-day Intensive Workshop from
Bogatin Enterprises and beTheSignal.com

Differential Pair Boot Camp

Overcoming the obstacles to high speed serial link design

Presented on Oct 4, 2010 in San Jose, CA
by Dr. Eric Bogatin, Signal Integrity Evangelist

The cure for FUD (Fear, Uncertainty, Doubt):

In this practical, intensive training class, you will walk away with the understanding, skills, and tools needed to solve real problems.



Are you designing one of the alphabet soup high speed serial links like PCIe, SATA, SAS, XAUI, GigE, USB or LVDS? Then all of your interconnects are differential pairs and eliminating signal integrity problems in your design will determine whether your product works or not.

This one-day, intensive training will bring you “up to speed” on how to design the physical interconnects of your channel to improve the signal quality and achieve the bit rate you need. We eliminate the myth-conceptions that dominate the industry and show you the right way of designing differential pairs that operate up to 10 Gbps.

We eliminate the confusion over:

• Tight or loose coupling	• Transparent via design
• Differential mode vs odd mode impedance	• Mode conversion and length matching
• Conductor loss and copper roughness	• S-parameters without tears
• Dielectric loss	• The limits to FR4

At the end of this training program, you will be able to:

- Identify the four important high speed problems and their root cause
- Select tight or loose coupling for your design
- Know the right tools to use to optimize your stack up
- Estimate the loss budget for your design
- Select the lowest cost materials that will work for your application
- Use S-parameter specifications to select components
- Estimate when mode conversion is a problem and what to do about it
- Design the termination strategy for your design
- Integrate DC blocking caps that are transparent
- Make your vias disappear
- Select connectors that work
- Design a robust high speed serial link

Admission fee: \$295 (\$245 for subscribers at beTheSignal.com)
Includes access to the online version: CEC-410 Differential Pair Boot Camp

How Do I Register?

Online at www.beTheSignal.com, call 913-393-1305 or email info@beTheSignal.com for questions and group discounts.





Differential Pair Boot Camp

Overcoming the obstacles to high speed serial link design

Every attendee earns 0.6 CEUs for attendance and an additional 1.4 CEUs upon completion of the online continuing education curriculum: Differential Pair Boot Camp at www.beTheSignal.com

• Module 1 Differential pairs

- The four multi gigabit problems
- Differential and common signals
- Differential impedance, odd mode impedance
- Stack up design: walk the line principle
- Channel to channel cross talk
- Tight or loose coupling?

Module 2: Losses and S-parameters

- Why frequency dependent loss is important
- Losses and jitter
- What frequencies to worry about: bandwidth of serial links
- Conductor and dielectric loss
- Estimating losses: approximations, field solvers
- How to make sense of S-parameters
- SDD21 and attenuation
- Using equalization to compensate for attenuation
- Length- bandwidth tradeoffs

Module 3: Differential circuits

- Simulating differential pairs
- Unscrambling eyes: SBR, PDA, step response, PRBS
- Routing topologies and terminations
- Mode conversion and asymmetry
- SCD21, SCD11 and mode conversion
- Impact of mode conversion on jitter
- Compensation

Module 4: Engineering discontinuities

- S-parameter behavioral models
- Transmission line approximations
- Reflection noise with mis-matched terminations
- Reflection noise with CML drivers
- Multiple discontinuities
- Engineering DC blocking capacitor designs
- Transparent via design
- When to worry about stubs
- Link analysis



Special bonus!

Send your differential pair questions to doctorisin@beTheSignal.com and they will be answered either at the boot camp or in the FAQ with the online version

Visit www.beTheSignal.com