



Organizer:



# Differential Pair Designs (DPD) February 23<sup>rd</sup> 2012.

Intensive Workshops by Dr. Eric Bogatin of Bogatin Enterprises and beTheSignal.com

We are bringing the expert to your doorstep!

Polar Instruments (Asia Pacific) Pte Ltd has partnered with Dr. Eric Bogatin, world's leading trainer and Signal Integrity Evangelist for High Speed PCB Design, Signal Integrity, Testing, Characterization and verification and to bring his expertise to Asia for the benefit of the PCB Design and Manufacturing industry in the region.

Now with hands on labs!

New in 2012 classes, we show you how to use a very easy to use simulation tool, QUCS, and how you can quickly answer common signal integrity problems. This tool runs on any laptop with a Windows OS. We provide you a copy of the tool and all the circuits used in the labs. These are yours to take back.

No previous experience is necessary. Even if you have never done any simulation before, you will find this an incredibly easy tool to use. If you are familiar with SPICE, you will find QUCS to be far easier and more versatile.

To participate in the hands on labs, you must bring your own laptop to the class.

**Ideal for Design and Fab Engineers!  
REGISTER NOW!**

**polarinstruments.asia**

Email or Fax the completed form to  
[Training@polarinstruments.asia](mailto:Training@polarinstruments.asia) or +65 68737471



February 23<sup>rd</sup>, 2012

9.00am – 5.00 pm

Holiday Inn Orchard, Singapore



**Dr. Eric Bogatin - President, Bogatin Enterprises, LLC**

Dr. Bogatin received his BS degree in physics from MIT, and MS and PhD degrees in physics from the University of Arizona in Tucson. He has written five books on signal integrity and interconnects design, over 300 papers and articles and has taught over 4,000 engineers in the last 25 years. He is a distinguished lecturer for the IEEE EMC society and lectures worldwide on signal integrity topics.

**DO NOT MISS THESE VALUABLE CLASSES!**

Registration Fee per Class:

**SGD 795\***

PLUS: upto 5% group discounts

Special Early Bird Fee:

**SGD 745\***

(before January 31<sup>st</sup> 2012)

\*Price incl. GST, tax, course materials, lunch & 2 tea breaks.

Registration Closes 15<sup>th</sup> February, 2012.

# DPD: Differential Pair Design

Overcoming the obstacles in high speed serial channels

## The cure for FUD (Fear, Uncertainty and Doubt)

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 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 above 10 Gbps.

We eliminate the confusion over:

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

## Outline

### Module 1: Differential pairs

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

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### Module 2: Losses and S-parameters

- Losses and jitter
- Conductor and dielectric loss
- SDD21 and attenuation
- Using equalization to compensate for attenuation
- Hands-on-Lab

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### Module 3: Differential circuits

- Simulating differential pairs
- Channel to channel cross talk
- Routing topologies and terminations
- Mode conversion and asymmetry
- Hands-on-lab

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### Module 4: Discontinuities

- Modelling vias and other discontinuities
- Individual and multiple discontinuities
- Making them disappear
- Limits to what is acceptable
- Hands-on-lab: series discontinuities, stub discontinuities, losses, eye diagrams

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Visit [bethesignal.com](http://bethesignal.com) or [polarinstruments.asia](http://polarinstruments.asia) for more details

# Recharge your Engineering Skills for SI Design, Test & Verification.

Also Available:

## PUBLIC / IN-HOUSE CLASSES (2-Days) & BOOT CAMPS (1 Day)

Courses on High Speed Signal Integrity Design, Principals, Testing, Characterization and Validation techniques. Intensive one day boot camps on designing for high-speed serial links like PCIe, SATA, SAS, XAUI, GigE, USB or LVDS or designing, controlling, and characterizing transmission line losses.

## ONLINE CERTIFICATION / CONTINUING EDUCATION COURSES / TRAINING – WEBINARS / LECTURES / RESOURCES

Online Certification courses on topics like essential Principals of Signal Integrity, Continuing Education Courses (CEC) and other training courses through "Design Excellence Curricula" webinars and lectures at [www.printedcircuituniversity.com](http://www.printedcircuituniversity.com)

## CORPORATE / INDIVIDUAL – ANNUAL or QUARTERLY SUBSCRIPTIONS

Time limited – annual, quarterly and soon to be offered monthly - Corporate / Individual subscriptions are available to access a wealth of resources related to SI design, test, characterization and validation at [www.printedcircuituniversity.com](http://www.printedcircuituniversity.com)

## Other Courses from Bogatin Enterprises LLC., USA:

### PDN : Power Delivery networks

Topics covered include:

- How do you select capacitors? How many, what value?
- Where should they be placed?
- When does location matter?
- How will you know if you got it right?
- What's important in the stack up design?
- When is it worth it to use ultra thin laminates?
- What are good habits every layout designer should know?

### EPSI: Essential Principles of Signal Integrity

Topics covered include:

- The value of Insertion and return loss
- Single ended and Differential parameters
- How to extract characteristic impedance and differential impedance
- Identifying mode conversion problems and solutions
- The ten item check list to evaluate all S-parameters
- The four most important patterns you will see and what they tell you

### TVD: Transparent Via Design

Topics covered include:

- 3D modelling tools
- Time and frequency domain simulation: single and multiple discontinuities
- Interpreting S-parameter models
- Mode conversion
- Analysing connectors
- Analysing traces through via hole fields
- Analysing DC blocking capacitors

For more details visit: [www.bethesignal.com](http://www.bethesignal.com) and [www.polarinstruments.asia](http://www.polarinstruments.asia)

#### About Polar Instruments, Asia Pac

[www.polarinstruments.asia](http://www.polarinstruments.asia)

Headquartered in Singapore and with offices in Japan, Polar Instruments (Asia Pacific) Pte Ltd was established in 1999, as a wholly owned subsidiary of Polar Instruments Ltd, Guernsey, UK to provide sales, marketing and after sales support to customers in the then emerging Asia Pacific region. Now an independent company, Polar Asia Pac provides a range of value added services that include market research and development, product sales, marketing, and after sales support for our principals in the Asia Pacific region covering Australasia, Japan, to the Middle East. Our services include application support, repair & calibration, on-site/off-site maintenance services, and a range of professional consulting services for training, design, test, failure/data analysis and co-relation studies related to our current market space.

#### About Wizlogix Pte Ltd

[www.wizlogix.com](http://www.wizlogix.com)

Founded in 2000, Wizlogix is a well-established and highly professional Printed Circuit Board (PCB) Design company. Currently the largest in Singapore, Wizlogix specializes in PCB design using high-end CAD software like Mentor Graphics Board Station and PADS, Cadence Allegro and Altium. It also provides full turnkey services like PCB design and fabrication to assembly for quick-turn prototype design (with component sourcing). Since 2009, it has conducted PCB SI & EMI, and IPC-CID workshops in Singapore.

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