



Organizer:



# Power Delivery Networks (PDN)

## October 18<sup>th</sup> 2011

Intensive Workshop 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!**

Every PDN design is custom. You can't take one set of rules and apply them to all designs. But many of the important PDN design questions are often answered with "it depends." Unique to this class, you will learn how to use three easy to use simulation tools that will help you answer it depends questions in your next design. They each run on a lap top with a Windows operating system. The spreadsheet uses MS Office Excel.

We provide a copy of the three tools: an excel spread sheet, the Altera power tool and QUCS, with example files and the training to get you quickly up to speed solving practical problems.

No previous simulation experience is necessary. Even if you have never done any simulation before, you will find these incredibly easy to use and powerful enough to answer important questions.

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

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

**polarinstruments.asia**

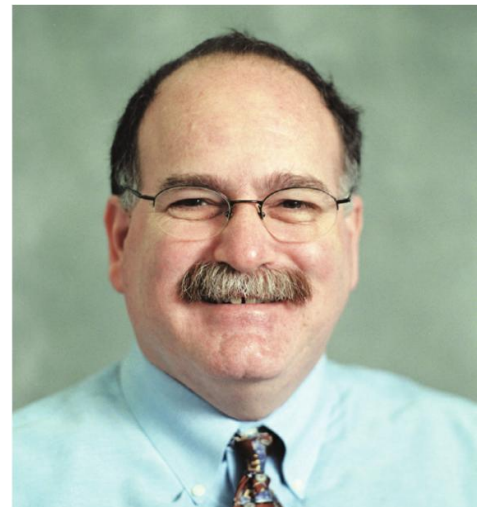
Email or Fax the completed form to  
**training@polarinstruments.asia** or +65 68737471  
or call +65 6873 7470

Partner:



**October 18<sup>th</sup>, 2011  
9.00am – 5.00 pm**

**Holiday Inn Singapore  
Orchard City Centre  
Cavenagh Road**



**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.

**DON'T MISS THESE VALUABLE  
CLASSES! (Register by 10<sup>th</sup>  
October)**

Registration Fee  
**S\$ 795\***

**PLUS:** upto 5%  
group discounts

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

**Special  
Early Bird Fee:  
S\$ 745\*  
(before September  
30<sup>th</sup> 2011)**

# PDN: Power Delivery Networks

## Designing a cost effective and robust PDN

This one-day class, designed and offered by Signal Integrity Evangelist **Dr. Eric Bogatin**, shows you how to design power distribution networks including the board stack up, capacitor selection and mounting design. More importantly, this class will build your engineering intuition about the behavior of capacitors, planes and systems so that you will be able to perform your own analysis rather than just learn rules to follow. Optimize the power delivery network in your next design with the skills and tools you gain from this class.

### 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?

There are many myths associated with power integrity: just use 3 capacitors per pin, use as large a capacitor value as you can, stack capacitors on top of each other to get them closer to the device, or use surface traces from the capacitor to the power pin. The way to separate myth from reality is by putting in the numbers. In addition to introducing the important principles, a key feature of this class is illustrating how to apply analysis tools such as rules of thumb, approximations and numerical simulations to provide guidance in achieving first time success.

## Class Outline

<p><b>PDN Problems and Solutions</b></p> <ul style="list-style-type: none"><li>• The impact from rail collapse</li><li>• Establishing a target impedance</li><li>• The impedance profile and all of its elements</li><li>• What makes a PDN robust and cost effective</li><li>• Real vs ideal capacitors</li></ul> <p>1</p>	<p><b>Sculpting the impedance profile</b></p> <ul style="list-style-type: none"><li>• Reducing parallel peak impedance by design</li><li>• The importance of ESL and its physical origin</li><li>• Role of ESR</li><li>• Selecting capacitors; 1, 3 or more values?</li><li>• Practical guidelines to reduce the impedance peaks</li></ul> <p>2</p>
<p><b>Practical tradeoffs for capacitors and board stack up</b></p> <ul style="list-style-type: none"><li>• Estimating mounting inductance of capacitors</li><li>• Estimating the spreading inductance in planes</li><li>• Holes in planes</li><li>• When is location important?</li><li>• What every layout engineer should know</li></ul> <p>3</p>	<p><b>Hands on Lab</b></p> <ul style="list-style-type: none"><li>• Calculating ESL of capacitors: answering location questions</li><li>• Board stack up tradeoffs</li><li>• Impedance profiles: which is better 1, 3 and 10 capacitors?</li><li>• Impedance profiles of the entire system</li><li>• Peak impedance and ESL</li></ul> <p>4</p>

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:

### SPSI : S parameters for SI

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

### 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:

- Single ended Vias
- Differential Vias
- Corners, bends and serpentine
- Neck downs in BGA fields
- Solder balls
- Connectors
- Terminating resistors
- 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 and China, 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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