

# **PCB West Conference & Exhibition 2022**

Santa Clara, California, USA  
4 – 7 October 2022

Volume 1 of 3

ISBN: 978-1-7138-7019-7

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571



**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2022) by Printed Circuit Engineering Association (PCEA)  
All rights reserved.

Printed with permission by Curran Associates, Inc. (2024)

For permission requests, please contact Printed Circuit Engineering Association (PCEA)  
at the address below.

Printed Circuit Engineering Association (PCEA)  
PO Box 807  
Amesbury, Massachusetts  
USA 01913

Phone: (617) 327-4702

<https://pcea.net/>

**Additional copies of this publication are available from:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571 USA  
Phone: 845-758-0400  
Fax: 845-758-2633  
Email: [curran@proceedings.com](mailto:curran@proceedings.com)  
Web: [www.proceedings.com](http://www.proceedings.com)

# TABLE OF CONTENTS

## VOLUME 1

IOT PC BOARD DESIGN AND LAYOUT-(MASTERING LOW LAYER COUNT) .....	1
<i>R. Hartley</i>	
PCB ANTENNAS FOR EVERYONE .....	59
<i>B. Jordan</i>	
BIDIRECTIONAL DATA EXCHANGES ACCELERATES NPI.....	100
<i>D. Korf, H. Shah</i>	
PCB FABRICATION FOR TRADITIONAL, HDI, AND ULTRA HDI.....	126
<i>C. Hunrath, M. Trammel</i>	
FROM 2D TO 3D ELECTRONIC DEVICES .....	150
<i>D. Korf</i>	
PCB DESIGN BEST PRACTICES.....	159
<i>S. Chavez</i>	
HAS THE DESIGN INDUSTRY REALLY CHANGED THAT MUCH?.....	178
<i>G. Ferrari</i>	
LEVERAGING CFX-QPL TO INTEGRATE EQUIPMENT AND CREATE A SMART FACTORY .....	280
<i>I. Aduna</i>	
UNDERSTANDING HIGH FREQUENCY MATERIALS TEST METHODS FOR DK AND DF .....	292
<i>J. Coonrod</i>	
CABLES AND CONNECTORS: DESIGN FOR SI AND EMI .....	314
<i>K. Coates</i>	
HEAT MANAGEMENT FOR SMD, LED, AND SYSTEMS 1W - 50W (DO NOT LET THE SMOKE OUT!) .....	339
<i>K. Coates</i>	
WHAT IS A WIRE?.....	388
<i>E. Wand</i>	
HOW TO FIGHT NOISE GREMLINS! .....	429
<i>K. Coates</i>	
THE MYSTERY OF BYPASS CAPACITORS.....	452
<i>K. Coates</i>	
A MULTI-LAYERED CRASH COURSE IN PCB DESIGN .....	478
<i>K. Mackey</i>	
FLEXIBLE CIRCUITS: DESIGN THROUGH TEST WITH LESSONS LEARNED .....	491
<i>M. Finstad, N. Koop</i>	
PHYSICS FOR ELECTRONICS ENGINEERS .....	566
<i>M. Hughes</i>	

A BEGINNER’S GUIDE TO RF AND MICROWAVE PCB DESIGN – PART II..... 596  
*B. Jordan*

A BEGINNER’S GUIDE TO RF AND MICROWAVE PCB DESIGN – PART I ..... 629  
*B. Jordan*

## VOLUME 2

OPTIMIZING THE TOOL CHAIN FROM DESIGN THROUGH MANUFACTURING FOR  
PRINTED ELECTRONICS ..... 687  
*J. Veres, D. Wiens*

CIRCUIT GROUNDING TO CONTROL NOISE AND EMI ..... 703  
*R. Hartley*

PART A: FAN-OUT WAFER/PANEL-LEVEL PACKAGING AND PART B: CHIPLET DESIGN  
AND HETEROGENEOUS INTEGRATION PACKAGING (SIP) ..... 761  
*J. Lau*

MECHANICAL ISSUES IMPACTING ELECTRO-MAGNETIC INTERFERENCE ..... 858  
*R. Hartley*

PC BOARD LAYOUT OF SWITCH MODE POWER SUPPLIES..... 899  
*R. Hartley*

MAKING INTELLIGENT MATERIAL DECISIONS ..... 936  
*M. Creeden*

EVALUATING EMERGING PCB TECHNOLOGIES THROUGH INDUSTRY  
COLLABORATION..... 962  
*M. Jagernauth*

DDR2, 3, 4, ETC. PC BOARD DESIGN AND LAYOUT ..... 970  
*R. Hartley*

UNDERSTANDING THE BOARD FABRICATION PROCESS, A HAND-ON EXPERIENCE  
(PCB101)..... 999  
*G. Ferrari*

PCB WEST 2022..... 1073  
*D. Hoover, R. Fugitt*

AUTOMATING MANUAL INPECTION FOR PCBs.....1109  
*S. Fernandez*

SCIENCE-BASED PCB DESIGN: EM PHYSICS DEMYSTIFIED .....1119  
*D. Beeker*

SURFACE FINISHES FOR OPTIMUM PERFORMANCE & BETTER RELIABILITY ..... 1203  
*K. Shah*

DESIGN PRINCIPLES FOR FLEXIBLE AND RIGID-FLEX CIRCUITS..... 1239  
*V. Solberg*

### VOLUME 3

PCB DESIGNERS GUIDE FOR IMPLEMENTING ADVANCED SEMICONDUCTOR PACKAGE TECHNOLOGIES .....	1357
<i>V. Solberg</i>	
DESIGNING BOARDS WITH TODAY'S BGAS .....	1466
<i>S. Webb</i>	
PCB DESIGN FOR ENGINEERS .....	1552
<i>S. Webb</i>	
PART PLACEMENT CHOICES AND CONSEQUENCES .....	1682
<i>S. Webb</i>	
PRINCIPLES OF BUILDING A PCB STACKUP.....	1768
<i>S. Webb</i>	
DYNAMIC GUIDELINES FOR DESIGN WITH SAP (SEMI-ADDITIVE PROCESSES) .....	1826
<i>T. Chester, T. Dunn</i>	
PCB WEST 2022 - IMPROVING CIRCUIT DESIGN AND LAYOUT FOR ACCESSIBILITY AND SUCCESS .....	1852
<i>T. Chester</i>	
PCB WEST 2022 - THE MECHANICAL SIDE OF PCB'S .....	1888
<i>T. Chester</i>	

#### **Author Index**