
PRACTICAL POWER ELECTRONICS AND SWITCH MODE POWER SUPPLY DESIGN FOR INDUSTRY



YOU WILL LEARN HOW TO:

- Demonstrate a sound understanding of how switch mode power supplies (SMPS) operate
- Correctly select components for a switch mode power supply design
- Select the right switch mode topology for a given application
- Understand PWM and what controller to select for a given application
- Design an input stage for a switch mode power supply and correctly evaluate EMI/RFI
- Apply power transistors correctly to SMPS design
- Correctly apply high frequency transformers and select the appropriate design (including an example push - pull design application)
- Design an output section of a SMPS
- Evaluate the performance and stability of a SMPS design
- Perform a complete analysis of the noise generated by the design (EMI/RFI)
- Make an accurate assessment of the heat-sink requirements to ensure reliable operation
- Design a SMPS that complies with safety standards

WHO SHOULD ATTEND:

- Application Engineers
 - Product Designers
 - Component Suppliers
 - Instrument for Control Engineers
 - Electrical and Electronic Maintenance Technicians and Supervisors
 - Sales Engineers
 - Product Managers
 - Technicians
 - Service Technicians
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The Workshop

Power electronic circuits have revolutionised almost every device that we use today from PC's to TV's, microwave ovens and heavy industrial drives.

Switch mode power supplies (SMPS) have thus become an important part of equipment design in all types of industrial equipment and an understanding of the different types and designs has become essential for reliable operation of complex equipment.

This workshop gives you a fundamental understanding of the basic components that form a SMPS design. You will understand how the selection of components affects the different performance parameters and operation of the SMPS. Typical practical applications of the SMPSs in industry will be discussed.

The concluding section of the workshop gives you the fundamental tools in troubleshooting SMPS designs confidently and effectively.

Even though the focus of the workshop is on the direct application of this technology, you will also gain a thorough understanding of the problems that can be introduced by SMPSs such as harmonics, electrostatic discharge and EMC/EMI problems.

Pre-requisites

A fundamental knowledge of basic electrical concepts would be useful.

The Program

INTRODUCTION

BASIC CONCEPTS

- Introduction to Power Electronics Circuits
- Basic principles of PSU circuits
- Power Supply specifications
- Linear and SMPS comparison
- SMPS block diagram

TOPOLOGIES

- Non-isolated topologies
- Isolated topologies
- Comparison of topologies
- Choice of topology based on power supply specifications

IC PWM CONTROLLERS

- PWM controller review
- UC3825 block diagram
- The speed critical path
- High speed complementary blocks
- Glue or remaining blocks

THE INPUT SECTION

- Component selection and design criteria
 - Input rectifiers
 - Input filter capacitors
 - AC or DC Input line filters for RFI suppression
 - Input filter interaction with SMPS
- Input protective devices
 - Inrush current
 - Input transient voltage protection

POWER TRANSISTORS

- Transistor selection
- Gate/base drive considerations and circuits
- Design considerations for safe operating of transistor
 - Transistor losses
 - Ripple current
 - Derating factors
- Switch Protection circuits

HIGH-FREQUENCY TRANSFORMERS

- Basic transformer theory
- Core material and geometry selection
- Design of a power transformer for a converter
- Losses and temperature rise
- Winding techniques

THE OUTPUT SECTION

- Output rectification and filtering
- Power Rectifier Characteristics
- Output Power Inductor design
- Output Filter Capacitor Design

STABILITY IN SMPS

- Transfer functions
- Criteria for stability
- Control to output gain
- Design compensation network
- Loop stability measurements

EMI-RFI CONSIDERATIONS

- Noise specifications
- RFI sources in SMPS
- Filters for RFI suppression

POWER SUPPLY ELECTRICAL SAFETY STANDARDS

- Construction requirements
 - a. Spacing requirements
 - b. Dielectric test
 - c. Insulation resistance
- Transformer construction
 - a. Insulation
 - b. Dielectric strength
 - c. Insulation resistance
 - d. Temperature rating

HEAT-SINKING

- The thermal equation
- Selecting a heat-sink
- Custom heat-sink

SMPS TROUBLESHOOTING

- Safety guidelines
- Test equipment
- Safe discharge of capacitors in SMPS
- SMPS failure modes
- General SMPS troubleshooting approach
- Initial post-repair testing
- Some general SMPS repair comments
- Periodic or pulsing outputs

SUMMARY, OPEN FORUM & CLOSING