

台灣新竹·交通大學·電機與控制工程研究所·808實驗室
電力電子系統晶片、數位電源、DSP控制、馬達與伺服控制
Lab-808: Power Electronics Systems & Chips Lab., NCTU, Taiwan
<http://pemclab.cn.nctu.edu.tw/>

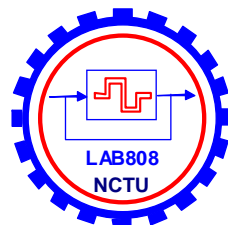
電源電路之EMI防治

EMI Reduction Techniques for Power Supplies

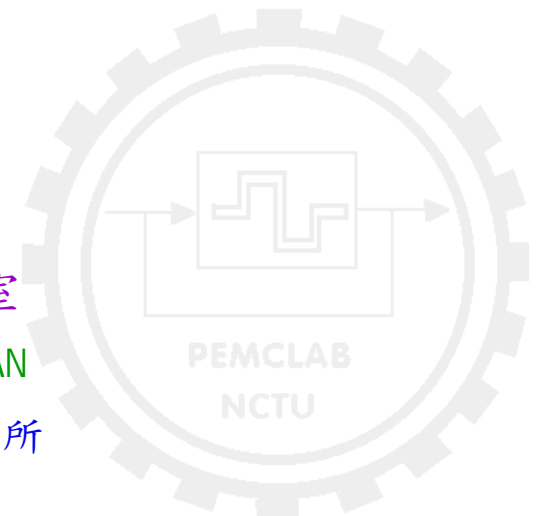
鄒應嶼 教授

國立交通大學 電機與控制工程系

2007年11月15日

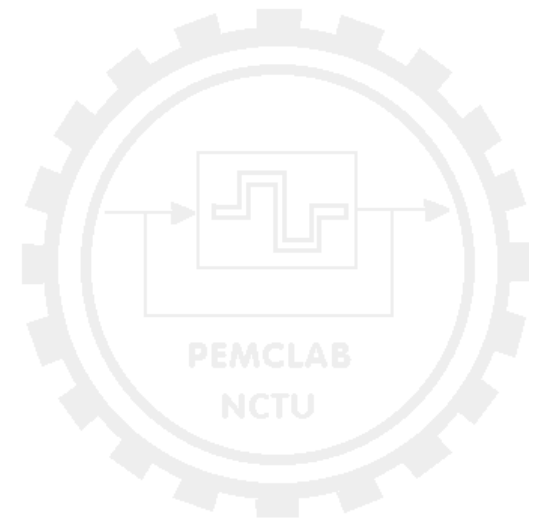


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Power Electronics Systems & Chips, NCTU, TAIWAN
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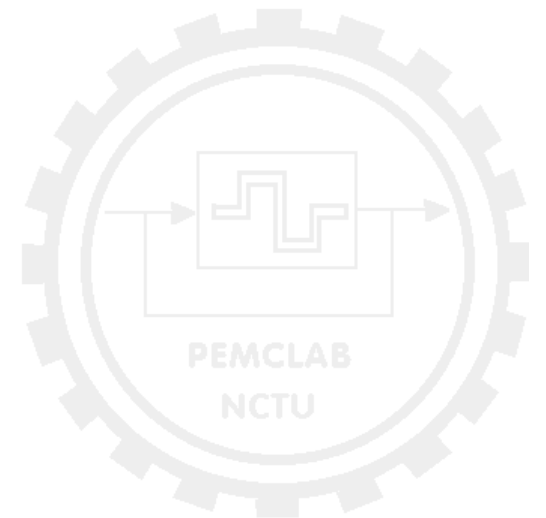
Why EMC is Important?

- **EMC is an indispensable requirement for an electronic product!**
- **EMC is the law for electronics!**
- **EMC stands for a state of harmoniousness of the designed electronic system.**
- **A senior engineer must understand EMC!**



Why EMC is “So” Important?

- This is an age of fast and faster!
- Faster means smaller, and smaller means more severe interference between circuits and components!



Why EMC is Difficult?

- Theory \leftrightarrow Practice
- Components \leftrightarrow System
- Analog \leftrightarrow Digital
- Signal \leftrightarrow Power
- EMI is invisible in the circuit schematics but dose exist in the circuits!
- EMC stands for **E**verything **M**ust be **C**onstrained!



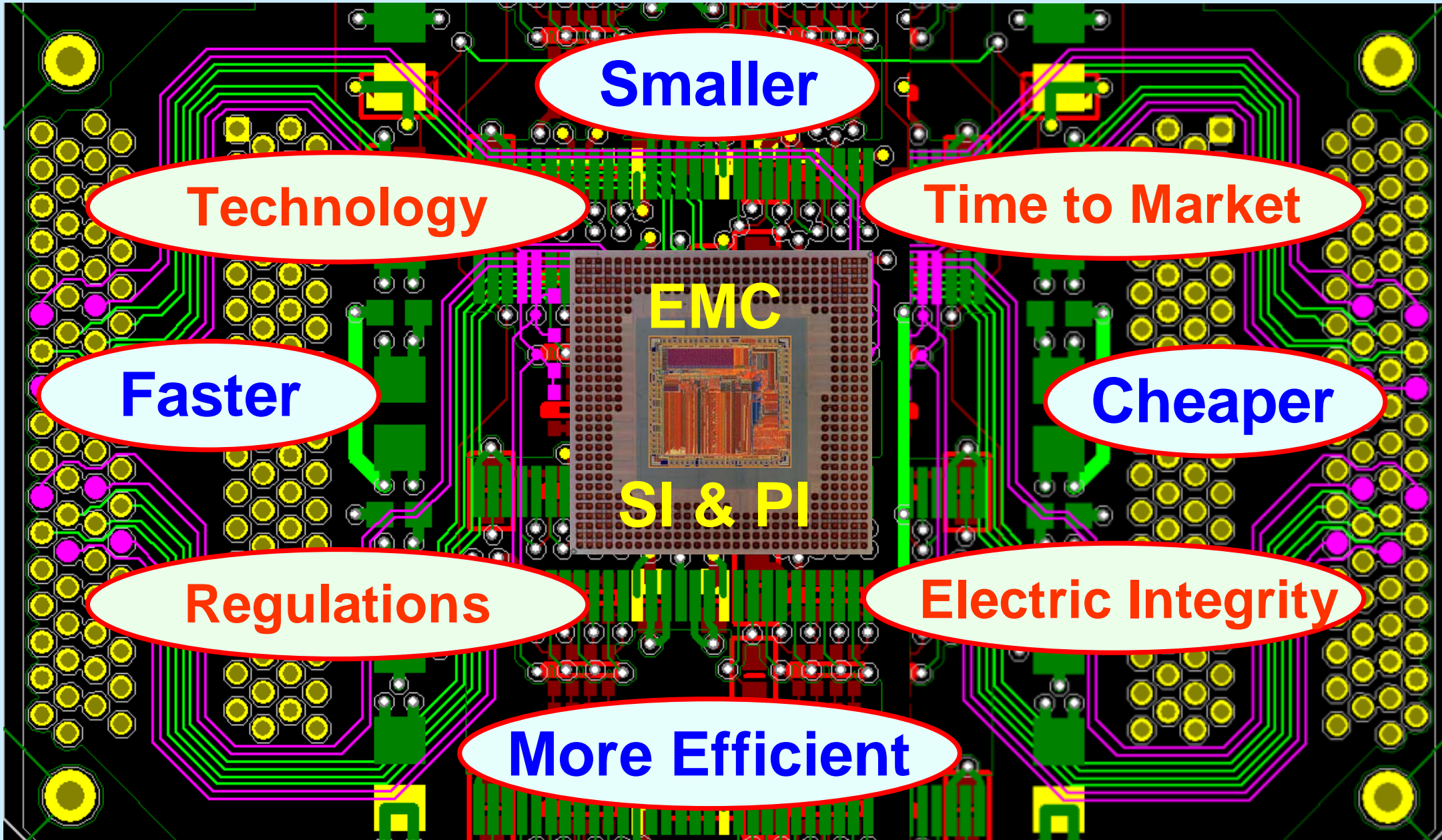
Why Digital Engineers Don't Believe in EMC?

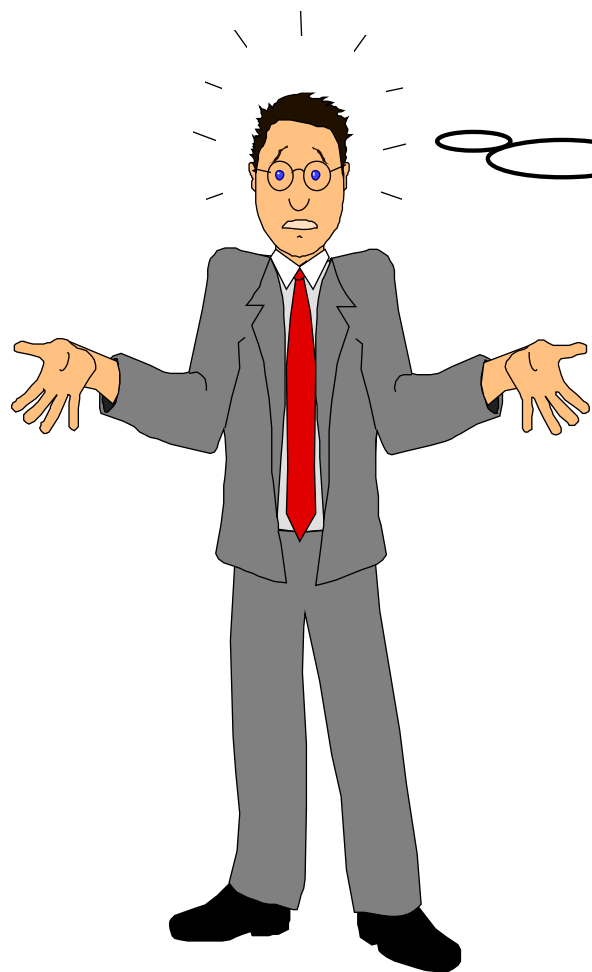
- Digital engineers don't believe current flows in loops!
- Digital engineers don't believe in the H-field!
- Digital engineers don't believe gates are differential amplifiers!
- Digital engineers don't believe in electromagnetic waves!
- Digital engineers don't believe an understanding of EMC will advance their careers!
- Digital engineers do not know about electro-magnetic-dynamics!



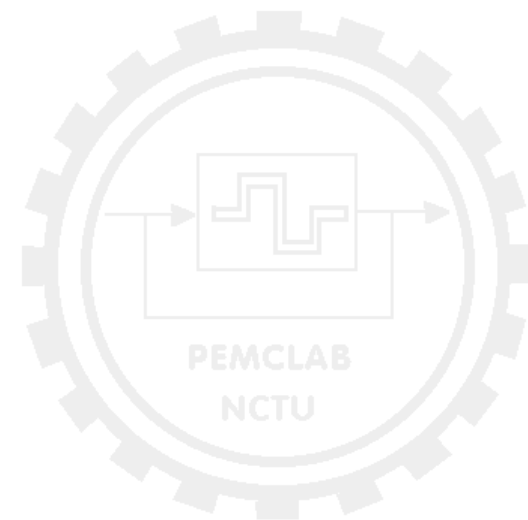
By Howard W. Johnson, author of [High-Speed Digital Design: A Handbook of Black Magic](#)

EMC: Driving Force to the Future





What do you know about EMC?



What do you know about EMC?

- Do you know the characteristic impedance of free space?
- Do you know the high-frequency equivalent circuit of a capacitor?
- Do you know the frequency spectrum of a periodical trapezoidal waveform?
- Do you know what is the common-mode noise?
- Do you know the differences between single-point and multi-point grounding techniques?
- Do you know the signal characteristics (waveform and power) of the trace you are wiring?

If you don't know either, you should take a course on basic EMC!



Take a Lesson on “EMI Reduction Techniques”



電子系統電磁干擾防治技術

電子系統電磁干擾防治技術（12小時）

課程簡介： 電磁相容是所有電子產品不可缺少的認證程序與設計觀念，瞭解電磁干擾的來源，是電磁干擾防制技術正本清源的方法。本課程首先介紹電磁相容的基本觀念與理論基礎，其次的說明電磁相容認證法規在設計電子產品所造成的限制，進一步說明一些基本的電磁干擾防制技術與印刷電路板設計原則，最後以印刷電路板為例，說明降低電磁干擾的方法。本課程特別著重於電子系統中高頻開關式電源供應器所產生的電磁干擾，使工程師能在設計的初始階段即瞭解高頻電源電路的電磁干擾來源，從而有效的藉由一些系統化的設計與分析方法，降低電源系統的電磁輻射干擾。

從基本的電磁相容原理，學習電子產品電磁干擾防制的系統化設計方法。

課程綱要：

1. Introduction
2. Introduction to EMI/EMC
3. Basic Theory
4. EMI Regulations
5. EMI Reduction Techniques
6. EMC in High-Frequency Digital Systems
7. EMC in Power Electronic Equipment
8. PCB Design for EMC Compliance