High-Speed Noise and Grounding Seminar

More Black Magic, with Dr. Howard Johnson

1. Principles of Mixed Signal Isolation

[EE BASICS, MANAGEMENT] Definition of Noise and Grounding
Subject Matter. Purpose of Studying Noise and Grounding.
Overview of program.

[CROSSTALK, EE BASICS, MIXED SIGNALS] PCB Ground Plane
Resistance. Slots in the Ground Plane Control the Flow of
Audio-Frequency Current. Can a CPU Draw Audio-Frequency
Currents?. Example of Entangled System.

[CAPACITANCE, EXAMPLES] Current Flows in Loops. Return Path
for an Antenna. Measuring Capacitance. Handheld Capacitance
Meter. Example: Capacitance of Scope Chassis to Earth.
Approximate Values of Capacitance.


2. Ground Bounce (SSO)


[CHIP PACKAGING, CROSSTALK, GROUND BOUNCE] SSO Test Setup and theory (introduction to movie).


3. PCB Reference Planes

[REFERENCE PLANES, RETURNING SIGNAL CURRENT] Distribution of High-Frequency Current Underneath a Signal Trace.


4. System-Level Grounding


[EM FIELDS, EXAMPLES] Lightning EMF Equivalent Circuit. Lightning Balls.

5. Clock-Related Noise Issues


[EMC, TERMINATION] Live Discussion of Signal Spectra.


**Clock Modulation.** *HSNG Seminar* (2015): 5.90-5.94.


6. Connectors


[CROSSTALK, EXAMPLES, MIXED SIGNALS, SILAB HSNG] Mixed-Signal Isolation: Parts II-III, "RF Connectors" and "Achieving 120 dB Isolation": Showing the importance of a good ground attachment between the connector and your PCB.


[CROSSTALK, EXAMPLES, MIXED SIGNALS, SILAB HSNG] Mixed-Signal
Isolation: Part III "PCB Traces": Showing two traces on the same side of the same board, and what it takes to attain 120 dB isolation between the two traces. Effects of grounding, good connector layout, and shielding.


7. System Test


HSNG Seminar—Extra Material

RoHS with Joe Fjelstad. HSNG Seminar (2015). [RELIABILITY, SILAB HSNG, SOLDERING] Lead-free solder is not a "green" solution. Lead-free solder actually damages the environment more than 60/40 solder. System-reliability impact of lead-free solder.

About This Course

High-Speed Noise and Grounding focuses on mixed-signal applications involving high-speed digital electronics used in conjunction with sensitive analog circuits such as radio receivers, GPS devices and cell phones. This course addresses the critical issues of noise and grounding that are seen in
many advanced signal processing applications today, including avionics, telemetry and guidance systems.

Main topics

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Who should watch this course?

- Digital logic designers
- System architects
- EMC specialists
- Military, medical, or high-reliability specialists
- Analog engineers working on mixed-signal applications
- Applications engineers
- Anyone who works with mixtures of digital and analog technology

This is a practical course. It is filled with examples, explanations, and classroom demonstrations. Anyone who works with high-speed digital signals will understand and benefit from the material presented.

Go to the course

How to view this course

The author recommends that you view no more than one hour at a time. It may help for you to print out the notes pages for each lecture and take written notes. The sections in the notes marked Points to Remember are not often highlighted in the lecture, but offer good opportunities for personal thought and reflection.

The three courses provide a certain degree of redundancy. Each begins with a section designed to make each attendee aware of certain basic concepts and vocabulary peculiar to that course. Where there is overlap, the author emphasizes different aspects of the core material, uses different examples, and approaches the subjects from varying angles. He recommends that you watch all three courses, all the way through, including all the extra movies.

The course materials cover much more material than could possibly be presented in the six days of lecture that we were able to film. Dr. Johnson arranged the slides with extra material to give himself the flexibility to focus on specific issues of interest to each particular class and to respond to questions. We include the full set of student materials here for your reference, even though some of those slides were not filmed. To help you keep on track, slide numbers appear on the right side of the course contents listing.

In addition to the student course materials, the collection includes a full set of instructor materials in Powerpoint format. The instructor materials include original source artwork that may be of
interest to those attempting to teach these courses. The necessary animation files, should you wish to use them independent of the lectures, are also available.

Go to the course  Get the animations

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