Preface

High-Speed Digital Design: A Handbook of Black Magic

This is a book for digital designers. It highlights and explains analog circuit principles relevant to high-speed digital design. Teaching by example, the authors cover ringing, crosstalk, and radiated noise problems which commonly beset high-speed digital machines.

None of this material is new. On the contrary, it has been handed down by word of mouth and passed along through application notes for many years. This book simply collects together that wisdom. Because much of this material is not covered in standard college curricula, many practicing engineers view high-speed effects as somewhat mysterious, ominous, or daunting. For them, this subject matter has earned the name "black magic." The authors would like to dispel the popular myth that anything unusual or unexplained happens at high speeds. It's simply a matter of knowing which principles apply, and how.

Digital designers working at low speeds do not need this material. In low-speed designs, signals remain clean and well behaved, conforming nicely to the binary model.

At high speeds, where fast signal rise times exaggerate the influence of analog effects, engineers experience a completely different view of logic signals. To them, logic signals often appear hairy, jagged, and distorted. For their products to function, high-speed designers must know and use analog principles. This book explains what those principles are and how to apply them.

Readers without the benefit of formal training in analog circuit theory can use and apply the formulas and examples in this book. Readers who have completed a first year class in introductory linear circuit theory may comprehend this material at a deeper level.

Chapters 1–3 introduce analog circuit terminology, the high-speed properties of logic gates, and standard high-speed measurement techniques, respectively. These three chapters form the core of the book and should be included in any serious study of high-speed logic design.

The remaining chapters, 4–12, each treat specialized topics in high-speed logic design and may be studied in any order.

Appendix A collects highlights from each section, listing the most important ideas and concepts presented. It can be used as a checklist for system design or as an index to the text when facing a difficult problem.

Appendix B details the mathematical assumptions behind various forms of rise time measurement. This section helps relate results given in this book to other sources and standards of nomenclature.

Appendix C lists standard formulas for computing the resistance, capacitance, and inductance of physical structures. These formulas have been implemented in MathCad and are available from the authors in magnetic form.

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A NOTE TO THE READER

To those of you who will undoubtedly report the discovery of technical errors in the manuscript, thank you for your attention and for taking the time to write to us about it. The authors will personally send a certificate of appreciation to the first person to document each substantive technical error in the book. Please send your comments to:

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