

THIRD EDITION

BeBOOP

TO THE BOOLEAN BOOGIE

An Unconventional Guide to Electronics



Clive "Max" Maxfield



Newnes

Bebop to the Boolean Boogie

An Unconventional Guide to Electronics

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Dedication

This book is dedicated to my Auntie Barbara, whose assiduous scrubbing in my younger years has left me the proud owner of the cleanest pair of knees in the known universe!

Foreword

My first exposure to the unique writing style of Clive (call me “Max”) Maxfield was a magazine article that he cowrote with an associate. The article was technically brilliant (he paid me to say that) and very informative, but it was the short biography at the end of the piece that I enjoyed the most. I say enjoyed the most because, as you will soon learn, Max does not necessarily follow the herd or dance to the same drummer as the masses. Trade journals have a reputation for being informative and educational, but also as dry as West Texas real estate.

Anyway, Max’s personally submitted biography not only included a message from his mom, but also made mention of the fact that he (Max) is taller than his coauthor, who just happened to be his boss at the time. Now to some people this may seem irrelevant, but to our readers (and Max’s boss), these kind of things—trivial as they may seem to the uninitiated—are what helps us to maintain our off-grid sense of the world. Max has become, for better or worse, a part of that alternate life experience.

So now it’s a couple of years later, and Max has asked me to write a few words by way of introduction to his magnum opus. Personally, I think that the title of this tome alone (hmmm, a movie?) should provide some input as to what you can expect. But, for those who require a bit more: be forewarned, dear reader, you will probably learn far more than you could hope to expect from *Bebop to the Boolean Boogie*, just because of the unique approach Max has to technical material. The author will guide you from the basics through a minefield of potentially boring theoretical mish-mash, to a Nirvana of understanding. You will not suffer that fate familiar to every reader: rereading paragraphs over and over wondering what in the world the author was trying to say. For a limey, Max shoots amazingly well and from the hip, but in a way that will keep you interested and amused. If you are not vigilant, you may not only learn something, but you may even enjoy the process. The only further advice I can give is to “expect the unexpected.”

—Pete Waddell, Publisher, *Printed Circuit Design*

Literary genius (so says his mom), and taller than Max by 1¼ inches

About this Book

Note from the author with regard to the second edition

I awoke one Saturday morning in July 1992 with the idea that it would be “sort of cool” to stroll into a bookshop and see something I’d written on the shelves. So with no clue as to what this would actually entail, I started penning the first edition of *Bebop to the Boolean Boogie*, which eventually hit the streets in 1995.

Much to my surprise, *Bebop* quickly found a following at Yale University as part of an introductory electronics course (it was subsequently adopted by a number of other universities around the world), and it soon became required reading for sales and marketing groups at a number of high-tech companies in Silicon Valley and across the USA.

Time passed (as is its wont), and suddenly it was seven years later and we were in a new millennium! Over these last few years, electronics and computing technology has progressed in leaps and bounds. In 1995, for example, an integrated circuit containing around 14 million transistors was considered to be relatively state-of-the-art. By the summer of 2002, however, Intel had announced a test chip containing 330 million transistors!

And it’s not just improvements to existing technologies, because over the last few years entirely new materials like carbon nanotubes have made their appearance on the scene. Therefore, by popular demand, I’ve completely revamped *Bebop* from cover to cover, revising the nitty-gritty details to reflect the latest in technology, and adding a myriad of new facts, topics, and nuggets of trivia. Enjoy!

Note from the author with regard to the third edition

Give me strength! Where does the time go? It’s now 2008 as I write this note—16 years after I started work on the first edition of this tome. As you may have noticed, things are racing along in technology space (where no one can hear you scream). Looking back at my notes to the second edition, I see mention of Intel introducing a chip containing “330 million transistors!” Observe the exclamation mark. As you can see, I was quite excited about this. Well, I happen to know that, in just a few days as I pen these words—on May 19, 2008—Altera will be introducing a new family of FPGAs (see [Chapter 16: Programmable ICs](#)) at the 40-nm technology node, and the largest of these devices will comprise 2.5 billion transistors!!! (I know, multiple exclamation marks are the sign of a deranged