



## **Anthony Burch's "Single Top FPGA Tips" – hopefully something for everyone**

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**For valued BurchED Newsletter Subscribers**

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I thought about writing a "Top Ten" or "Favourite Recipes" type report for BurchED Newsletter subscribers. I will definitely still do that later.

At the moment, though, I was considering that I have a wide range of subscribers, right through from "not yet started" to "experienced" FPGA designers. So I came up with the idea of "Single Top FPGA Tips", where I write a tip for each designer, depending on where they are now.

So here is my list of "Single Top FPGA Tips". I hope you enjoy them, and I hope there is something there just for you.

I welcome your comments. Please email me at [anthony@burched.com](mailto:anthony@burched.com)

### **Single Top Tip #1 (For the "not yet started" FPGA designer)**

My advice is to buy an FPGA evaluation board and implement your very first simple circuit. There are many great low cost FPGA boards out there, including the Xilinx Spartan-3E Starter Kit (S3EBOARD), which is a good one that I personally use.

Also possibly some of the other Digilent ones, including NEXYS2 and BASYS, although I have not personally used NEXYS2 or BASYS yet.

## **Single Top Tip # 2 (For the "just started" FPGA designer)**

Do some research and find out how to do "reliable FPGA designs". For example, what is Synchronous Design, why shouldn't I "gate clocks", what is clock skew, what are global routing resources and why should I register asynchronous signals into the chip and across clock domains.

## **Single Top Tip #3 (For the Microcontroller designer who has just started with FPGAs)**

"Think hardware!"...Try to avoid thinking in terms of "sequences of instructions" when implementing an FPGA circuit. This means that if you are writing VHDL or Verilog code to describe your circuits, remember that the HDL code is describing an actual hardware circuit, rather than a series of logical steps or stored instructions with "calculate, evaluate and branch" type sequences.

Learn about state machines and remember that the world of FPGAs is more about "parallel hardware" and state machines than fixed hardware executing stored instructions (like a microcontroller).

Also, watch Video #2 at <http://www.burched.com/freevideos.ag.php> which includes the question "And how is that different to a microcontroller?"

## **Single Top Tip #4 (For the slightly more experienced FPGA designer who wants to put "a microcontroller or three" on their chip)**

FPGA designers quickly discover that all modern FPGAs are large enough to actually put whole "soft" microcontrollers on their chip, along with all of their other circuitry and peripherals. This is often called a "System on chip". If you want to try this I recommend getting started with the Xilinx PicoBlaze, which is a free, small and popular "soft" microcontroller.

## **Single Top Tip #5 (For the “slightly more experienced” FPGA designer)**

Check that you are avoiding clock glitches by never sourcing a clock signal from combinatorial logic. Route the global clock signal to all of your flip-flops and machines, and always use Clock Enable inputs (often decode and clock enable for one clock cycle). Also avoid Set/Reset glitches by using Synchronous Set/Reset on your flip-flops instead of Asynchronous Clear.

## **And finally...Single Top Tip #6 (For the experienced FPGA designer)**

Well, if you are “very experienced”, this one is old.

I guess “very experienced” designers have seen almost everything and have had the opportunity to make almost every mistake first-hand before.

Here’s the tip: Perform functional and Timing Simulation to verify the performance of your design. Using just the Timing Analyzer does not count as verification.

There are a lot more tips, but these are just my “Single Top Tips”. Please feel free to email me to share your own “Top Tips”.

Thanks!

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PS. If you haven’t already, don’t forget to check out the BurchED Getting Started With Xilinx FPGAs Video Guide. The first 6 videos are free (no signup required). Just click on the View\_Free\_Videos link at <http://www.BurchED.com>

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