

Antti-Brain

Issue 11

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Editorial



More creative work of “My Knitting Wife” is presented by our daughter Anna.

Skirt design and implementation by Anu Lukats-Sang.

I started to collect photos of the works Anu has made some while ago but then she just kept on going, making more and more and more, and never stopping. And my e-book with those works is now badly updated. This skirt is one the latest ones. Anna selected the colors, and she is actually very happy with this skirt, despite the look she has in the photo.

Wonderful colors, isn't it so?

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Cover Story

What (!@!@?) do I have there? Well it is a light bulb. Made in 1976. Supposedly used on board of Russian military air-craft TU-16. Factory serial number 935, unused, with passport and test report. Eh, sometimes I just can't let thing alone, last week was small gathering of Estonian Fox-hunters, co-located at the summit of Estonian Radio Amateur Club. So there was also some garage-sale, so this bulb is one item I had to buy, another being this:



Mica-sheets. Both item's total cost was 100 EEK (about 8 USD).

When I was active (in Estonia national fox-hunt team), we used either Russian made radio receivers or then self made ones, now there are china made receivers for the fox-hunt. Made with real rotten quality.



China made fox hunt receiver for 80 meters band.



2 meter band RX, the china one. And a real old Russian car in the back.



Better late than never, Olavi Tompson (left) is handing out World Championship 1st place price to Andres Talver. The item in the middle was later used for some consumable liquid.

FPGA FM Transmitter



Working setup! Tweezers are working as antenna.

Can an FPGA be used as FM Radio Transmitter? I didn't know, but when I first asked this myself, it did took only about 30 minutes to get the answer. And the answer is: Yes. The first experiment was rather crude, I did fire up Xilinx core generator, configured a DCM to output 105 MHz and 180 degrees version of it, connected those signals to 2:1 MUX inputs, controlled by "music" generator output. Setting up constraints for Xilinx Spartan-3A Starterkit, downloading... and it worked. It was enough to place the FM Radio just close to the Starterkit as the tones already did come out the Radio! Well the modulation ratio is very low, as there is no real frequency modulation at all, but it still works. Just need turn on the volume a bit. Would simple NCO based generation work? Changing DCM output to 210MHz, removing the phase circuit, adding 16 bit NCO, connecting 1-bit signal as lower bit. Yes this works as well, the basses are now much better too. But it seems that now I need to have at least a small wire attached as antenna, tweezers work well. Hum, I only use + 3KHz step, that still too small, let's try larger frequency one. Of course I am transmitting like ideal square wave, so it is little distorted. With +12Khz deviation

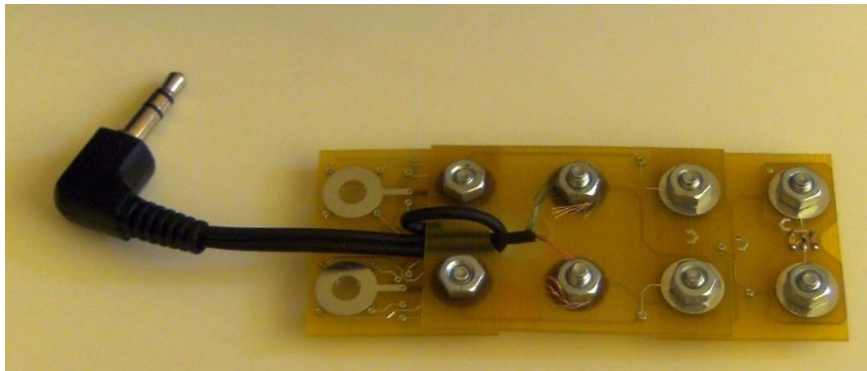
the audio level is much higher too. Actually I could use now already some real modulation instead of just square wave. Hum, now higher frequencies are more distorted then lower. Well this is really just an experiment...But there is some real application on my mind ☺

Audio LED

What happens if we connect a LED to the headphones speaker connector? Well it's easy to try out ☺ I take the cable from dead headset and some CRUVI™ boards, as I did not have CRUVI "jumper-short" boards I used two boards to make just "hole connection" I wanted to have the LED "port" to be available to exchange the boards easy (so I did not want to put the wires below the LED board directly). Done, ready, connecting to PC, hm.. nothing to see! Well I do not use my notebook for any multimedia so I do not have much audio files, looking in Windows vista sample music, starting some titles, nothing! Well then I did start some rock title and ha the RED led goes blink! I had connected only one LED to the board. Hm.. let me get some "audio generator" software, done, trying out – hum also very bad results the LED is hardly lit at all, even with maximum output levels.



Here is dual LED board connected, the LED's are in reverse polarity setting, as you can see both LED's are on.



(x) Wire Protocols

Just a small list/overview, very incomplete, just collecting info to select or create a new protocol.

Protocol	Dir	Wire	Sync.	Max speed	
I ² C™	Bi	2	Yes	3.4Mb/s	
I ² S		4?	Yes		Audio
S ² Cwire™		1	No		AAT3128 (maxim has similar)
AS ² Cwire™		1	No		AAT3129
LTC3212		1	No		Very similar to S ² Cwire
TinyWire™		1	No		Fairchild LED controller
UNIO®	Bi	1	No		Microchip new serial memories
SPI	Bi	4	Yes	100M?	
1-Wire	Bi	1	No	16Kb/s	
UART	Bi	2	No		
LIN	Bi	1	No		
CAN	Bi	2	No		
CAN-1Pin	Bi	1	No		
BDM	Bi	1	No		Motorola/Freescale background debug mode
DebugWire	Bi	1	No		Atmel debug for AVR's
aWire	Bi	1	No		Atmel debug for new AVR32's
JTAG	Bi	4	Yes	50M	
LPC	Bi	6	Yes		

AS²Cwire™

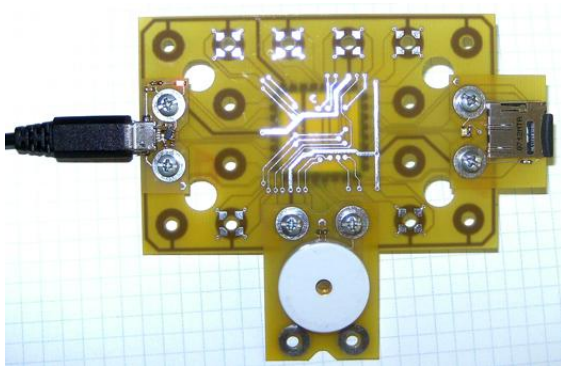
Now this is funny again, nothing is much new, well that isn't new either. Well I was (again) thinking about robust and simple serial protocols, so I was thinking about a protocol where pulse trains are transmitted. The receiver side would use MCU timer peripheral to count the edges of the signal, then the MCU does check if the timer count register is stable for some time (timeout value) and then uses the timer counter register value as command or data.

Well, AAT3129 RGB LED driver happens to use AS²Cwire™ protocol, what is about 100% same idea, well not 100% but pretty close.

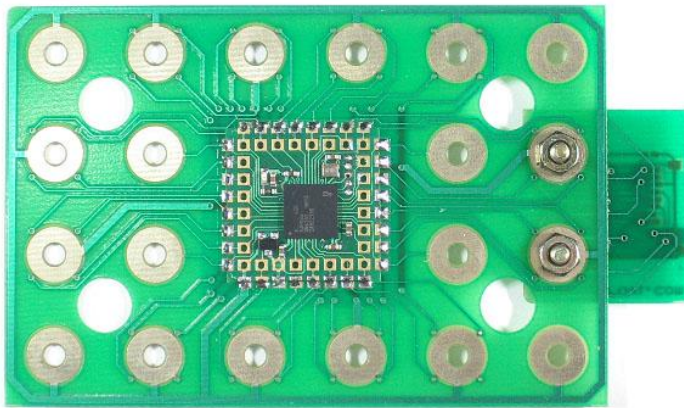
Ha, AS²Cwire is advance version of S²Cwire™ what is used in AAT3128.

My Own Processor III

Not much in this issue, working one, having fun.



Not to see but below the PCB is Silicon Blue ice65L04 based STAMP32 PCB module, and the speaker is playing a tune, executed by Classic AVR compatible soft core, that loaded the application software from the micro-SD card on the right.



The CRUVI™ + STAMP starter kit is getting ready, here production PCB's (base board and micro-SD adapter).

6/6 What's new

Things about Virtex/Spartan-6 devices. The documents and tools are now public, there are also some changes compared to previous preliminary information.

SP-601

The new Spartan-6 "Starterkit", priced \$299, amount of user I/O 8 pins. Well there are good things also, the schematic of SP-601 includes full schematic of Xilinx USB "embedded" JTAG cable solution, something that has been kept secret before. Xilinx has confirmed that the embedded cable schematic was not published by accident, but intentionally, just under condition that Xilinx provides no support for it, should users embed it into their own designs.

Spartan-6 Self Destruction

From the Xilinx documentation: "Bitstream's must not contain a sync word followed by all 1's. This condition might cause damage to the device."

This is really bad news, it make it very easy to destroy Spartan-6 devices by having invalid bitstream. This has not been the case with previous Xilinx devices.

Ok, Xilinx has now semi-officially explained this is a bug not a feature, and will be fixed in production silicon.

Xilinx released Spartan-6 documentation on 24th June, a day before Estonians had mid-summer night festivities, and there was ground blown up (to 30meters?):



History club is having fun, Loksa, Estonia 23rd June 2009.

(dead FPGA's are no fun)

Quad SPI Configuration support

Spartan-6 can now be configured from Winbond SPI flash in Quad output mode (4 bits per clock).

SPI Flash auto-detect

Cool! Well if it really works. I little wonder if the auto-detect really works for all types of dual/quad memories or not.

USERCLK

Finally it is possible also for Xilinx to switch to external clock during configuration. If I am not mistaken other FPGA vendors had this feature long time already.

On-Chip Oscillator Access

As the bold TAIL holder Xilinx has added access to the on-chip oscillator.

Suspend syncing

Possible cool feature, when the suspend is requested, then FPGA logic can do some preparation before actually entering suspend.

Spartan-6 BSCAN 4 USER instructions

This is good news, BSCAN in S-6 is now similar to the Virtex family, so it looks like 4 separate primitives, not like one with 2 USER registers.

Shorts

Stories.

OpenOCD – GPL problems

While working with STM32 demo board, actually consulting someone to program the STM32 via JTAG a found that the OpenOCD binary distribution is no longer available (at least not from yagorto). The reason being some problem with GPL license. Because the binary files are providing support for FTDI USB chips, and the library support for FTDI is not GPL licensed, so apparently ANY binary distribution that includes FTDI support is automatically a violation of GPL license. Well that doesn't change my view of GPL in any way, it is what it was and it is better that I keep it to myself.

But the problem is real, if someone wants to use let's say [Amontec](#) JTAG-Tiny JTAG cable for JTAG/Flash programming then there is real problem to get the OpenOCD binaries. Sure it is possible to recompile itself from the sources, but it is still a real PITA thing to-do.

ATtiny10

When I first looked at ATtiny10 I was disappointed because the datasheet did not say it has self-programming capability. Hum, either I did read it wrong, or the device data got updated but ATtiny10 does have IAP capability, and what even more good news it can update single words of memory, not by blocks as all other AVR's.

Pin function compare, common features

Pin	Function	ATtiny10	PIC10F22x	PIC10F206
1	GPIO bit 0	PB0	GP0	
2	Power Ground	GND	VSS (GND)	
3	GPIO bit 1	PB1	GP1	
4	GPIO bit 2	PB2	GP2	
5	Power Supply	VCC	VDD (VCC)	
6	GPIO bit 3	PB3 (I/O – weak drive)	GP3 (input only!)	
1	ADC	ADC0	AN0	-
3	ADC	ADC1	AN1	-
1	Analog Comparator	AIN0 (+)	-	CIN+
3	Analog Comparator	AIN1 (-)	-	CIN-
4	Comparator output	-	-	COUT
4	Clock output	CLKO	FOSC4	
4	Timer input	T0	T0CKI	
6	Reset input	RESET	MCLR	
1	ISP Serial Data	TPIDATA	ICSPDAT	
3	ISP Serial Clock	TPICLK	ICSPCLK	

Amazing isn't it? ATtiny10 is fully drop-in compatible with PIC10F2xxx, all PIC functions are mapped to same I/O pins. I was wondering why Atmel introduced another ISP interface for ATtiny10, but when looking at the table above it is clear, ATtiny10 when mounted on board designed for PIC10F is programmable using the same ISP header. ☺ Pretty good reason!

Ok, there is one incompatibility, the output of the comparator cannot be connected to I/O pin in ATtiny10.

Why did Atmel reduce the register count from 32 to 16? All other AVR's have 32 registers. Oh, I see Atmel kept all the GOOD registers, R16 to R31 and added 32 byte RAM, and changed hardware stack to software stack (uses RAM), this is clever.

Feature	ATtiny10	PIC10F222	PIC10F206
Voltage	1.8-5.5V	2-5.5V	
Voltage Programming	VCC=5V	VCC=5, VPP=12V	
Number of I/O	4	3	3
Number of input only pins	0	1	1
ADC inputs	4	2	0
Analog Comparator	Yes	No	Yes
POR	Yes	Yes	
Brown-out Detector	Yes	No	
RAM Size	32	23	24
General purpose registers	16	1	
Stack Levels	16 (in RAM)	2 levels in hardware	
ROM (Instructions)	512	512	
ROM Bytes	1024	756 (512 x 12 bit)	
Timer (bits)	16	8	
Timer Capture input	Yes	No	
Timer Output Compare (PWM)	Yes (2 PWM outputs)	No	
MIPS @ <2.7V	4	2	
MIPS @ <4.5	8	2	
MIPS @ >=4.5V	12	2	
Active (at 1 MIPS)	200uA @1.8V	< 175 uA @2V	
Idle current	25uA @1.8V	n/a	
Power down current	< 100nA @1.8V	100nA @2V	

List of differences (where ATtiny10 has less features)

- Analog comparator output cannot connect to I/O Pin
- ADC cannot measure own VCC
- At 1 MIPS, current is little bit more

In everything else ATtiny10 is either better or has same features.

Inductive touch AFE

Microchip is moving fast, or is fast? They published some application notes and references designs at the end of 2008 for inductive touch. I even made PCB from the reference design. And even ordered the PIC microcontroller. As microchip is not sending free samples to Europe, I ordered from local distributor. Paid the stuff, but never heard from the distributor after that.

Well now Microchip as special AFE (analog front end) for the inductive touch, but it still needs a analog multiplexer, and some extras. I wonder, it should be very easy to implement inductive touch sensor with FPGA's without ANY external components except PCB inductor. Need to try it out one day.

References

- <http://www.trioflex.com>
- <http://www.cruvi.com>

Instead of adding the URL links at the end of each issue, I will be adding them to the TrioFlex online link collection, so they can be updated more frequently.