Antti-Brain

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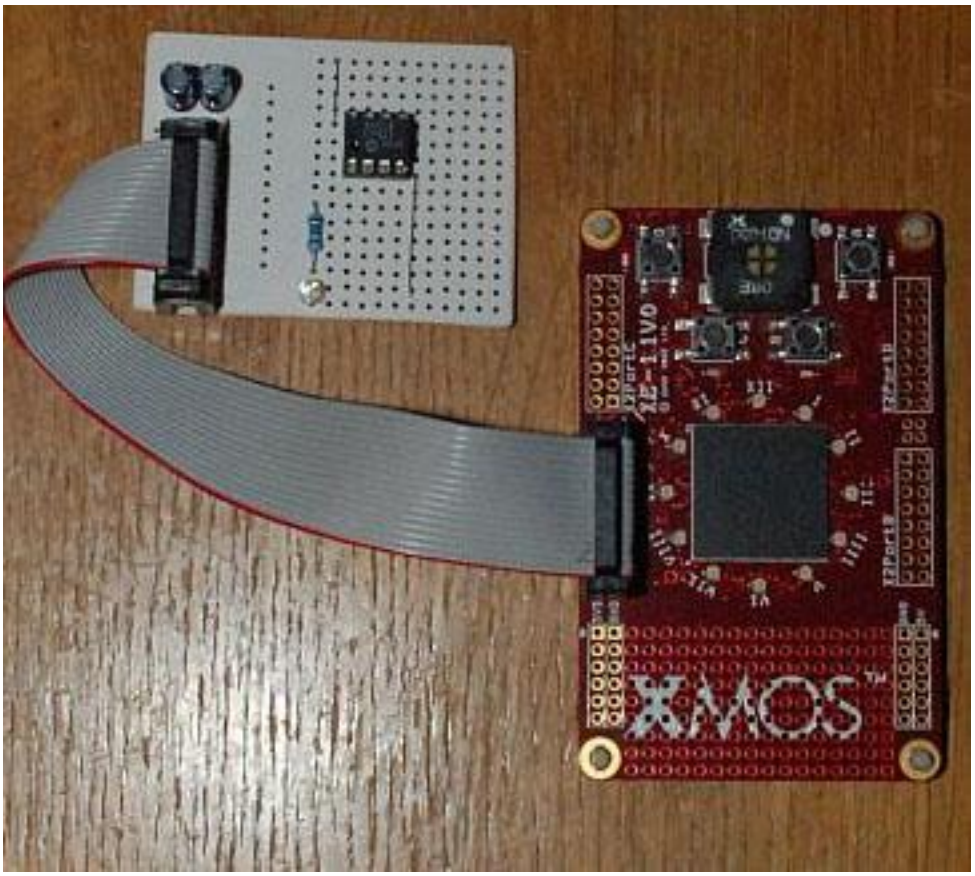

Revised on October 31, 2008

Editorial

Not nearly as complete this month issue as I wanted. But October is past now, so the issue must be out as well. We have one contributed article in this month's issue – the cover story! Thank you Leon!

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Cover Story

XMOS Software Defined Silicon

By Leon Heller

XMOS is the brainchild of Prof. David May, FRS, who designed the ground-breaking Inmos transputer 25 years ago. Although the transputer could be considered a commercial failure in spite of its technological superiority, it generated a lot of excitement at the time, and the new XMOS architecture is equally exciting:

- Four 32-bit cores each delivering 400 MIPS, giving a total of 1600 MIPS.
- Each core has 64 I/Os that can operate at 100 MHz. This means that most peripherals may be implemented in software.
- Eight hardware threads per core, with single-cycle context switching.
- Very fast (3.2 Gbit/s) communication channels (XLinks) between cores on the same chip.
- Scalable – chips can be connected together via XLinks for true parallel processing.
- JTAG debugging and programming.

There are lots of other features, but those are the most significant ones. The chip is intended for embedded applications, and can replace FPGAs and DSPs in many designs, at a fraction of the cost.

XMOS is based in Bristol, UK.

About the only drawback is the requirement for external program storage – an SPI flash device. There is 8k of OTP memory on the chip, which may be used for small applications.

The first offering, the XS1-4G, is in a 512BGA 20mm square package, and really requires an eight-layer PCB. The same device in a 144BGA 11 mm square package is being sampled, and smaller two-core and single-core devices will be available in a few months. The latter will be offered in a more hobbyist-friendly QFN or QFP package. The XS1-4G will probably sell for about $25 in small quantities, and the single-core device will be around $1 in quantity. Chips will be available from Digi-Key and Farnell.

The development tools are excellent and include a conventional C compiler and a new language based on C, called XC, which supports the unique features of the chip such as parallelism and threads. The tools may be used from the command line or via the Eclipse IDE. Real-time debugging and simulation are available. The tools are free (open-source). Most applications will be written in C or XC, but an assembler is provided.

A neat little development kit, the XC-1, is available for $99. It has the JTAG I/F built-in, using an FTDI chip, and connects to the host PC via USB. A small prototyping area is provided, and there are pads for four 2x8 headers, providing plenty of I/O. It comes with several little applications built-in, and user programs may be downloaded, debugged and executed.

A very active users' support forum, XLinkers, has been formed, and they intend to make this completely independent of XMOS themselves. They have the usual web-based support system, as well.

When launching the device, XMOS chose 50 of the companies they thought would be most interested in it, and gave each of them an XDK development kit. This is much more sophisticated than the XC-1 and includes a color touch screen, Ethernet connectivity and high-quality sound. It sells for $999. This enabled them to gain several design wins, including a networked audio breakout box and an LED tile display controller.

They are working on low-cost kits for robotics, automotive applications and industrial control.

Seminars are being held world-wide to introduce the new architecture to engineers and prospective customers. They are good value at $99, which includes one of the XC-1 kits. I attended the London seminar recently (they also had one in Munich), and found it very worthwhile. Next month they have several in the Far-East, and I would think that the USA will be next, followed by various countries in Europe.

XMOS is very keen to support entrepreneurs and hobbyists. Although they know that I'm a “one man band” they have been very helpful with free samples of the 512BGA and 144BGA parts. They are a very friendly company to deal with, and I have found them to be extremely helpful. They deserve to succeed.

Leon Heller

P.S. The small chip on the photo (see cover page) is MCP2301 ADC from Microchip. XS1-4G is now available online, min order qty 2, price 31.30 (for 2-98 pcs).

Highlights

Various interesting findings.

Nice (and) small packages

When 32 Bit processors are available in packages as small as 4x4mm, it is clear that other IC's are also needed in small packages. Here a list of some small and NOT so common IC packages.

- ODFN6 2x2.1 mm Intersil
- BGA-8 2x2 mm VTI
- QFN20 4x4 mm SiLabs
- QFN16 2.6x1.8 mm ST
- WLP9 1.6x1.6mm Maxim

Small and Cheap MCU

This is hard to choose, we list smallest packages only

Device	Package W x L	ROM K	LV ISP	IAP	I/O (In/Out)	D100	V1K
ATtiny13A	DFN10 3x3	1	Yes	Yes	5 (1/0)	0.98*	
ATtiny24	QFN20 4x4	2	Yes	Yes		1.53	
PIC10F200	SOT-23-6	0.25	No	No	3 (1/0)	0.83	
PIC10F200	DFN8 2x3	0.25	No	No	3 (1/0)	0.52	
PIC12F508	DFN8 2x3	0.5	No	No	5 (1/0)	0.63	
PIC12F508	uSOP10 3x5	0.5	No	No	5 (1/0)	0.64	
P89LPC901	SO8	1	Yes	Yes		0.76	0.63
P89LPC9103	DFN10 3x3	1	Yes	Yes	7 (1/0)	1.04	0.86
C8051F305R	DFN10 3x3	2	Yes	Yes	8	1.66	
C8051F326A	DFN10 3x3	2	Yes	Yes	6	1.95	
MC908RS08KA1	DFN6 2x3	1	No	No*	2 (1/1)	0.44	0.32
MC68HC908QT1A	DFN8 4x4	1.5	Yes	Yes	5 (1/0)	1.06*	

I will be working on this list ☺ and most likely will convert the tables from this and previous issue to excel, and make those available online (updated versions of the tables).

Touch Technologies

This funny topic. Some mimicry has been hidden behind some devices and technologies.

QST100

This device is now NOT FOR NEW DESIGNS, and for a good reason. QST100 is not a special touch IC, but PIC10F200 with custom firmware. As Atmel did purchase Quantum, so it is obvious, that Atmel does not want to sell Microchip IC's! So they say that only existing customers will be supplied. Now, to have replacement, Atmel had problems, as they do not have any MCU that can be packaged in SOT23-6, or they did not want to bother with the new package type. So as solution for the problem Atmel packaged a AVR into WSON-6 that is PCB footprint compatible with SOT23-6. This device is called QST100A, offered as WSON-6 or mSOP-10. The end user does not know the difference (PIC or AVR) being used as the base silicon. This is really interesting, as it means that Atmel has AVR's packaged in WSON-6 ! Too bad they are not sold as AVR MCU's. Maybe it is possible to reprogram the QST100A using Atmel ISP procedures. Would be nice to know. It may of course be that Atmel does preprogram the dies before packaging and the ISP is not possible in packaged QST100A.

Another interesting discovery is that QST100 uses PIC10F200 and one capacitor. But Microchip does not offer touch solution for PIC10F200, and the Microchip solution for PIC10F206 requires a diode and resistor. This is possible because of the licensing. QST is PIC10F200, but Microchip has not licensed the firmware from QRG, and as Atmel did buy QRG, well Atmel will not license it to Microchip I guess.

Microchip mTouch™

Microchip wants into the touch technology as well, but from some reason QRG never licensed their firmware to microchip, no matter that some QRG touch devices did use Microchip MCU's as base silicon.

Now Microchip has special "Touch design" web page. What we see there are 4 different methods connecting touch sensors to the PIC microcontrollers. This is a lot? Or is it? If we look closer then we see that either the number of channels is very limited (one) or then special features of the PIC MCU are required, so the support is limited to a few selected PIC family members.

Method	Uses	Pins per pad	Pins extra	Comp per pad	Comp extra
Comparator	Comparator	2	0	R + Diode	0
Comparator SR	Comparator SR	1	2	R	2R + 2C
CSM	CSM	1	0	0	0
CTMU	CTMU	1	0	0	0

The first two uses standard peripherals and special software. The last two uses dedicated peripherals and are limited only a few devices.

Quantum Research Group (QRG)

Good marketing, order COTS MCU, put some firmware, change label and sell as new IC. Not the first company to-do this, but maybe one of the most successful ones. At end of 2007 QRG seemed to license their technology (that is firmware) to Renesas and ST (maybe to others as well).

QProx™, QTouch™, QMatrix™, QWheel™ all Q's as in Quantum.

From schematic of "EVK1060A Evaluation Board", downloaded freely with no login or questions asked:

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© 2008 QRG Ltd - This drawing and its contents are strictly confidential and provided for INFORMATION PURPOSES ONLY. Under NO circumstances should the drawing and its contents be copied. sold, transferred or reproduced in whole or part without the prior written consent of QRG Ltd.

Funny isn't it? It's also interesting that when looking at Atmel web at AVR MCU's, then there is in the left pane under "AVR RISC" item "Quantum Touch Technology" that opens www.qprox.com website that now displays Atmel's logo. So it actually says directly that QT devices are relabeled AVR's.

ST has as of today 2 devices listed with QT touch technology, both seem to be not recommended for new designs. No wonder ST doesn't want to promote Atmel's technology. At Renesas website I wasn't able to find QT related information at all except the press release.

Now let's see what is re-labeled and what below the custom marking.

Device	Actual	Package		Note
QT100	PIC10F200	SOT23-6		
QT100A	AVR some?	WSON-6,mSOP10		
QT102	PIC10F200	SOT23-6		
QT110	unknown	SO8/DIP8		
QT220	unknown	SO20		
QT240	unknown	SO20		
QT1060	ATmega48	MLF28		
QT1106	unknown	MLF32		
AT42QT2160	ATmega48	MLF28		
QT60160	ATmega48	MLF32		
QT60240	ATmega48	MLF32		

ATmega48 is listed as possible device, actual device used may be different as long as it is pin compatible. Recommended devices are listed bold (as Atmel now owns QRG).

Cypress

Several PSoC's have CapSense functions, the other can use comparator and software methods but then need external passive components. The CyFi evalkit includes also modules for CapSense evalution.

Freescale

Freescale seems to push on firmware only solutions. They have some dedicated touch devices too. But they also offer firmware source code to add touch functions to almost any Freescale MCU.

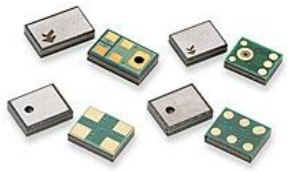
ST

ST did license the Quantum technology (that is firmware) but is phasing it out (because it is now owned by Atmel). It seems that ST promotes another technology licensed from a company in Korea.

STMPE821 is really nice, very small package, very small operation current. But it is only PREVIEW at ST so not yet orderable.

MEMS Microphone

There are already a number of players on the market, but it seems most of them don't want to deal with quantities under 1M. Knowles parts are orderable from Digikey, actual availability of the other types is not known at this time.



Knowles microphones

"No drawing" is all that opens when trying to get details. But they have sold 300mio MEMS microphones? Well to my surprise Digikey has Knowles microphones (analog ones only) in stock.

Pulse has full datasheet downloadable.

Pulse TC100E

ADI has info but says product is not in production yet.

Device	Vendor	Size	Digital	
SPM0205HD4	Knowles	4.72x3.76x1.25	Yes	
ADPM401	ADI	4.72x3.76x1	No	
ADPM421	ADI	4x3x1	Yes	
TC100E	Pulse	2.6x2x1	Yes	
TC200A	Pulse	2.33x2x1	No	
AKU1126	Akustica	2x2x1	No	
AKU2002	Akustica	4.72x3.76	Yes	
SMM310	Infineon	4.72x3.76x1.25	No	
MSM3C	Memstech	4.72x3.76x1.25	No	
SOM4514	HK Sound	4.5x4.5x1.45	No	

I have selected Pulse, as they have both analog and digital solutions in small package. Akustica analog solution is smaller (0.33mm in one dimension), but they have no small sized digital version.

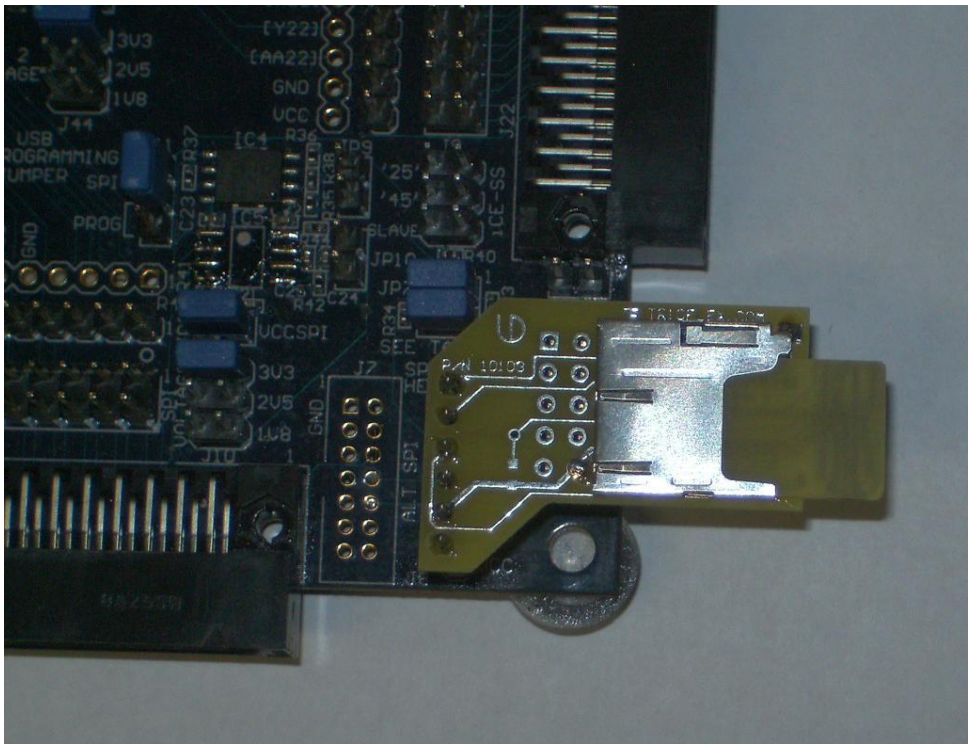
Short Stories

In this column we will list very short news, things that we found as new and interesting information in the time of reading.

SiliconBlues

Coming new column ☺

Oh just filling up the space



This is first ever demonstration of the first use of micro-UD Cards (www.udcard.org – spec to be published soon).

A micro-UD adapter is plugged to the iceMAN65 evaluation board, and SPI Flash micro-UD card is inserted to the socket. So the FPGA on the iceMAN65 does configure from the memory on the card, so it is possible to quickly change it, just take another card, swap it in, and ready you are the board has new configuration, just ideal for demonstrations.

Controller Corner

A long time ago, I did design a very simple and small "computer", in that sense it had all a computer has to have: serial terminal interface (UART), built in editor to write programs, and code memory to store them. The system was built with PIC16C84, and had 64 bytes for user program code memory. The O/S was all in the 1K of the PIC code. That code included a small interpreter that I called ARTI (A Real Tiny Interpreter). Why I am talking about this? Because two of the features of that design have re-appeared in products just released in 2008 (or about to be released in 2009).

First: the 40 core Intellasys processor array SEA40C18 has tiny CPU cores that each have 64 words of instruction memory. 64 is same as my system had, so the 64 is not so nonsense number for the code memory size at all.

Second: Propeller-2 will have development system on-chip same as my device had it. So connecting a terminal to the propeller-2 is all you need, the compiler, is all embedded.

It seems that the MULTI-CORE embedded devices are coming out from different sources. We have

- XMOS SDS
- Parallax Propeller-2
- Intellasys SEA40C18

Device	Number of cores	N of threads	Memory per core	Max clock	Max MIPS
XS1-4G	4	32	8K+64K	400MHz	1600
Propeller-2	16	16	512	160MHz	2560
SEA40C18	40	40	64+64	400Mhz?	26000 ?

Now the propeller-2 is not released the info is as latest rumors leaked to public. The 26GIPS (that is 26000 MIPS) is data from Intellasys, no idea how they calculated this number.

IdeaREG™

IdeaREG online service is not yet open, but the following should be considered as submitted and registered idea(s).

SC-70 Packaged MCU

Nobody is making them yet, but why? The SC70-6 package is really tiny, but as the technology advances so the MCU die sizes too, I bet it would be possible to package some tiny MCU into SC-70 package. Features wanted:

1. Low voltage ISP and debug over single wire, same debug protocol should also be useable for system communication in application mode
2. IAP capability
3. Minimum 512 instructions nonvolatile code memory, 2K+ preferred
4. Small high endurance data memory (64 bytes minimum 128 or 256 preferred)
5. All 4 I/O all useable
6. Capacitive sensor capability on at least 2 I/O's
7. Low power, flexible power saving modes
8. High precision on chip oscillator, with PLL
9. Low power on chip oscillator
10. Support for external crystal with auto capacitance tuning and selectable power
11. Programmable pullup and pulldown on all I/O pins, at least 2 strength levels
12. Ultra low power Real time clock and backup RAM
13. Oscillator output can be routed to I/O by fuse setting
14. Programmable current sources(sink) for direct LED drives (without resistor)
15. 1.8 to 5.5 supply range (preferable 1.1 to 5.5V)
16. On chip shunt regulator with programmable level
17. 5V tolerant I/O regardless of VCC
18. Voltage/Current input ADC at least on 2 I/O pins (for direct connection of current or voltage out type sensor)
19. On-chip temperature sensor
20. Temp measuring with external diode
21. Phantom power mode where charge is hold on capacitor connected to VCC pad and charging current is sourced from I/O pad(s)
22. Programmable LVD and BOD circuits Fuse setting and register override
23. Internal reset can be connected to I/O pad by fuse setting, polarity programmable by fuse setting
24. OTP Security key(s)
25. OTP boot area for IAP/Boot protocol firmware (1K+ ?)
26. Backup RAM for security keys for increased security when nonvolatile keys are not allowed with key destroy under application control and/or tamper
27. Security co-processor
28. Inductor DC-DC step-up converter (for white LED drive)
29. 64 Macrocell CPLD block

Hm.. tasty! Well after writing down the wanted features I bet the same features in little larger package would also make nice product. But in SC70 it would a killer. It would not matter at all what instruction

set the MCU would have, who cares. At the package size, and features listed I would definitely be ready to use any assembly or whatever language to program this tiny beast.

You think it's a dream? Sure, it is as it does not exist. But if it would be offered at 1 piece price of 49 cent? How many uses would you envision for this chip? A can imagine a lot of applications.

The list of wanted is sure too long, not all of them are required to be present, but eh, when doing a new design, if all of them are possible why not make them all? Then the single product would cover really wide area of uses.

It is not listed, but the chip should be able to work as Dallas OneWire™ device powered over single I/O line.

The IAP capability does make sense even for 512 instruction code space if the IAP customer protocol maybe be implemented in the OTP area.

Dreams… ?

Well, a long time ago, I happened to talk to some high ranking person from Microchip about the need of 8 pin MCU's. At that time NO company did see any for microcontroller in package with 8 pins. I know the person was at high position as he mostly talked about stock prices and golf. It was in Moscow at some electronics show, where Microchip was investigating the Russian market hoping to use Raab-Karcher's Russian presence via Memec as their representative. Yeah, and look now, there are plenty of microcontroller with 8 or less pins, and lots much more of them in packages smaller than DIP8.

Hm, let's put a name on this dream - TinyCon should it be.

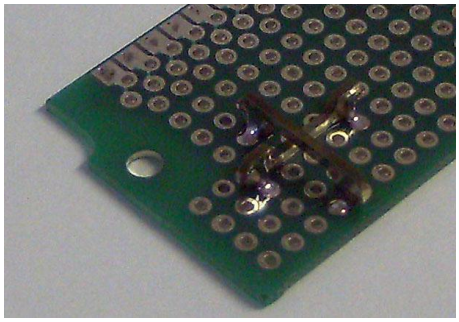
Special Offers

Check out CyFi evalkit from cypress, 69$ lots of boards ☺ But OTOH, I am not so fan of cypress wireless solutions.

Single Sided

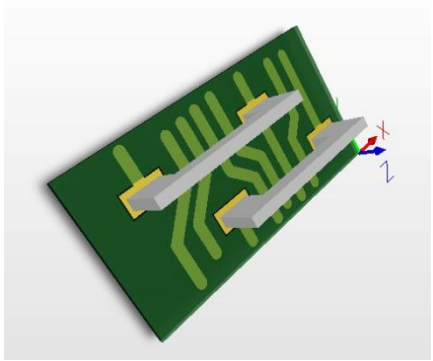
~~This is not the story initially planned for this month cover. But it has to do, the issue is overdue already a few days~~. Ok, that funny jumper thing was on the cover, but the picture initially planned for this month did make it, so the jumper story is in more proper place.

So what the **** is on the pictures? Well, I am proud to present the first product with somewhat mass production from my new company. I have 1200 pieces in stock, so can say it is more than just a proto or test PCB. The PCB is really stupid one, at least at first look. It is a PCB short. A small PCB that has only one function: to be used instead of wire connection. Designed for hand soldering and prototyping only.



This is the only demo shot of the product, it shows 2 connections over 2 connections. One double sided jumper is soldered back to PCB (reversed) the other is soldered as bridge over it. So we have 2 wires crossing another 2 wires. Why use such jumper? Well the “wire” is somewhat rigid, and ready to use, the double sided one can provide 2 connection per jumper (if soldered between 100 mil spaced holes).

Here is an example use of the single sided version of the jumper for single sided PCB. The bridge-short can jump over more wires than the normally used 0 ohm resistors.



I have a list of usage scenarios for the jumper, but the photos of those are not yet ready unfortunately. The PCB is little bit flexible, so it can be used as low quality spring contact as well, if soldered from one side only.

Kamitra is the company that made those jumper PCB's, the company who ordered them is Trioflex.

References

- Akustica http://www.akustica.com
- Pulse http://www.pulseeng.com
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