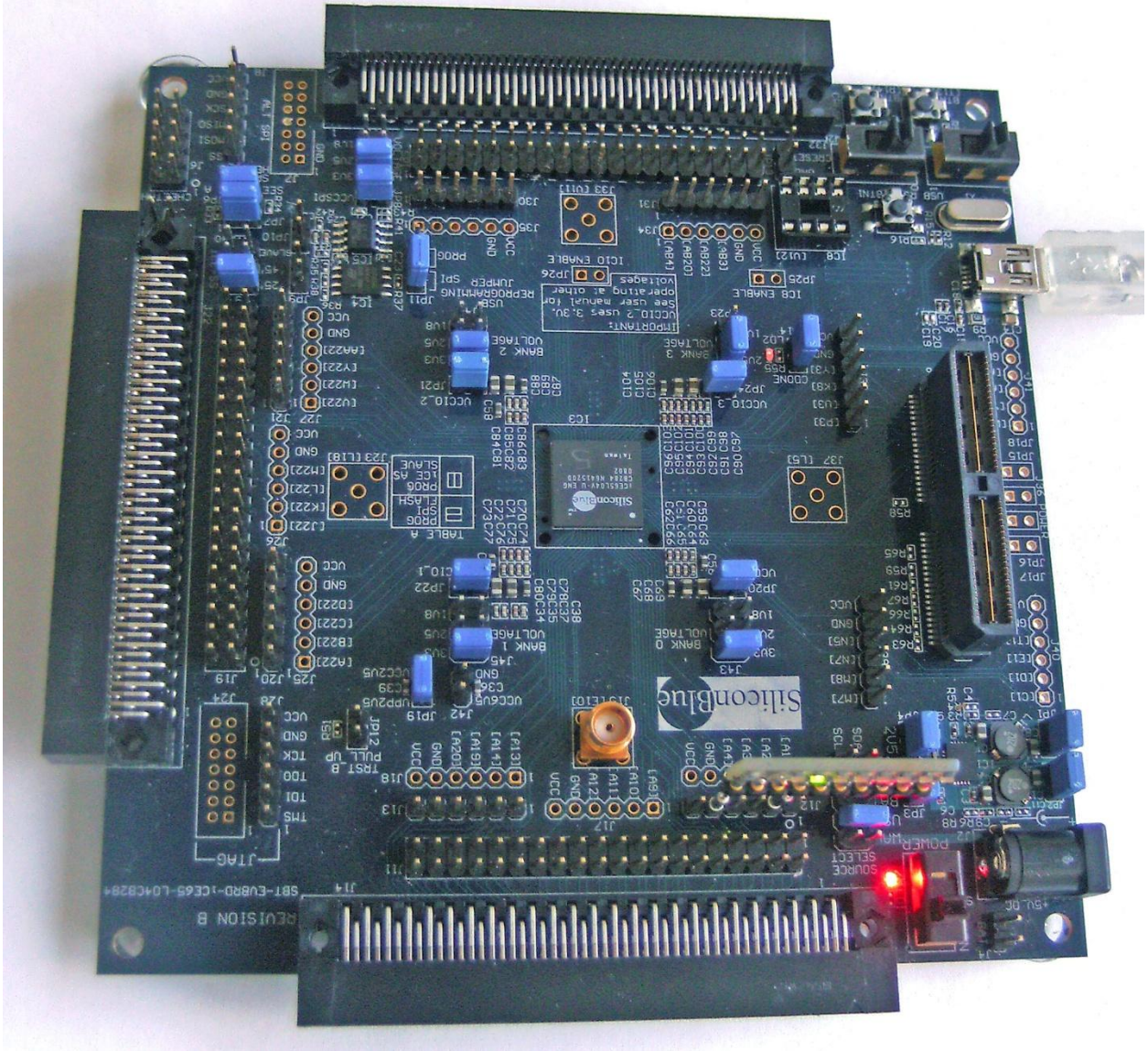
Antti-Brain^iR

Issue 1, September 2008



Revised on Monday, September 30, 2008

Editorial

First draft for public comments. It's mid September today, so the draft will be out now. I had fun collecting and presenting this information.

Minor revisions added, possible will be final version for the September issue.

Last revision, September is to be over, so have to close the issue.

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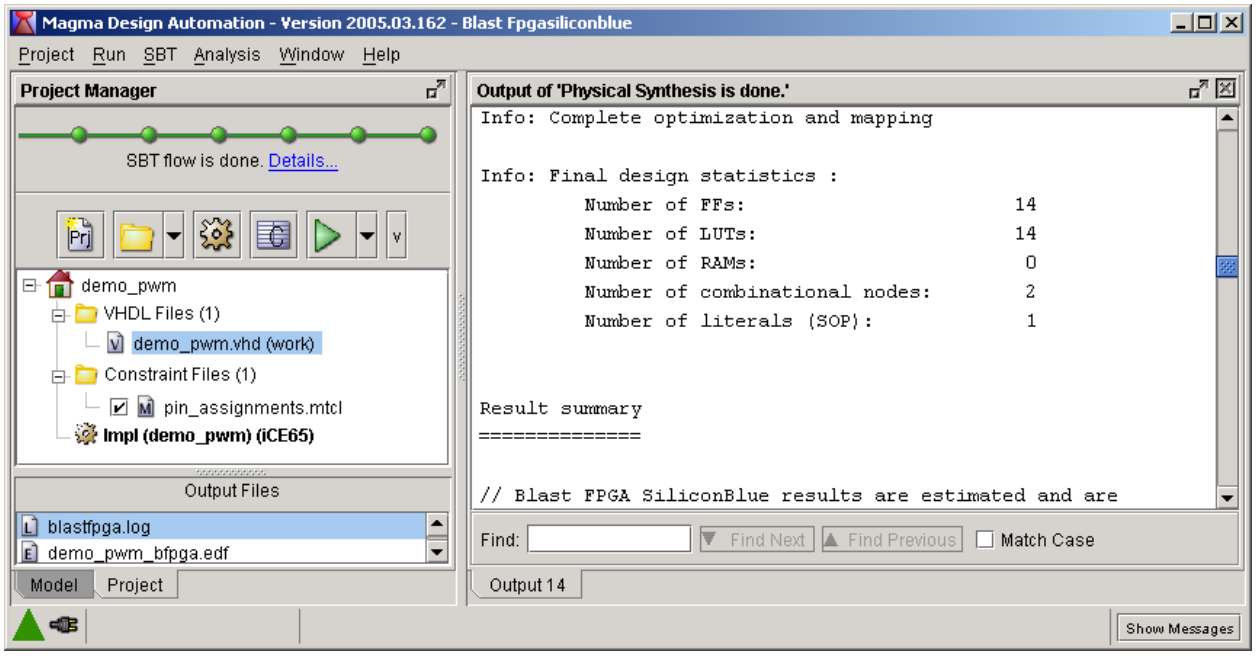
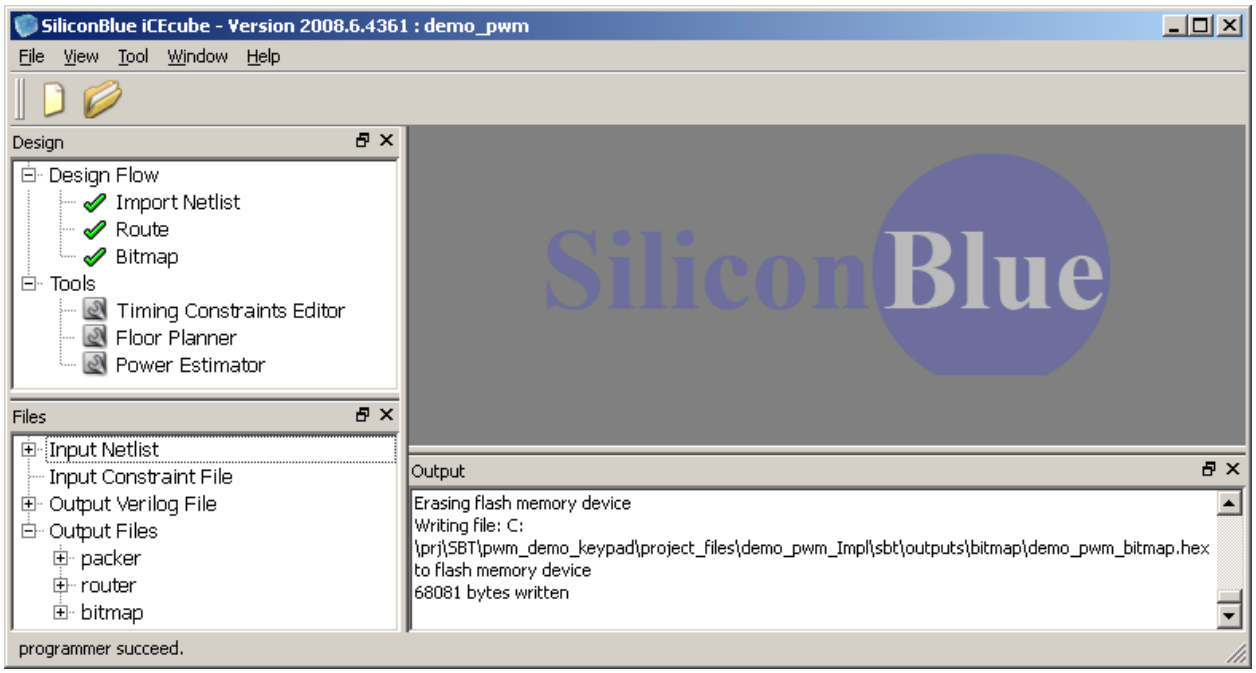
Cover Story

On the front page, two hours after receiving the SBT tools license. LED is blinking! As I have iCEman65 Rev B so I had to make adapter to connect something to the 6Pin Header port. The fastest was to do gender benders and connect Sipsik[iR] LED board. The LED is actually blinking, it doesn't show in the PDF document, but I really tried to shoot many times until the shot captured the LED in on state. The VHDL was written from scratch, and new bitstream file was generated. So it's really not preloaded or something fake.

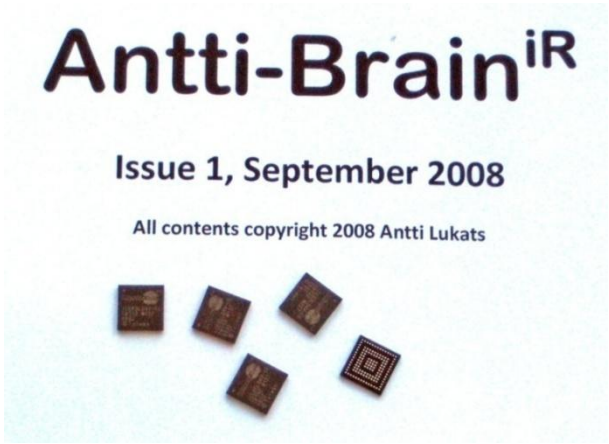


Here the VHDL file name is still pwm as I re-used existing demo project, the content is however fully rewritten and the constraints changed as well to map the LED's from my counter to the header JP12.

BIG FAT RED WARNING: Do not connect disconnect add on gadgets while powered. And DO NOT use your notebooks USB port to derive power when doing any experiments. I wanted to check out something, so I connected my LED adapter, and powered iCEman65 from my notebook via USB. The LED's did not blink, so well must be wrong header? I was too lazy to look my own magazine front matter so I just tried another header. Well I had even forgotten what header I uses so I tried the 40 pin headers. Until my notebook did shut off. And it did not turn on power any more. I disconnected everything expect power supply, still my notebook looked like completely dead. Removed power cord, removed notebook battery. Tried again, still nothing. Deep breath, already thinking what to do next, one more attempt, and this time the notebook did turn on. But… it could have been dead also. Both the 6 pin, and 40 pin headers have power supply and ground pins next to each other. In the 6 pin header the power is bank I/O voltage so short circuit would probably do less damage, but in the 40 pin header there are 5V and GND close, those I did accidentally short.



Here the SBT GUI used to flash the SPI memory. The tool could also be invoked from command line or script. All SBT implementation tools are invoked automatically when pressing the green Arrow button in the Blast GUI.

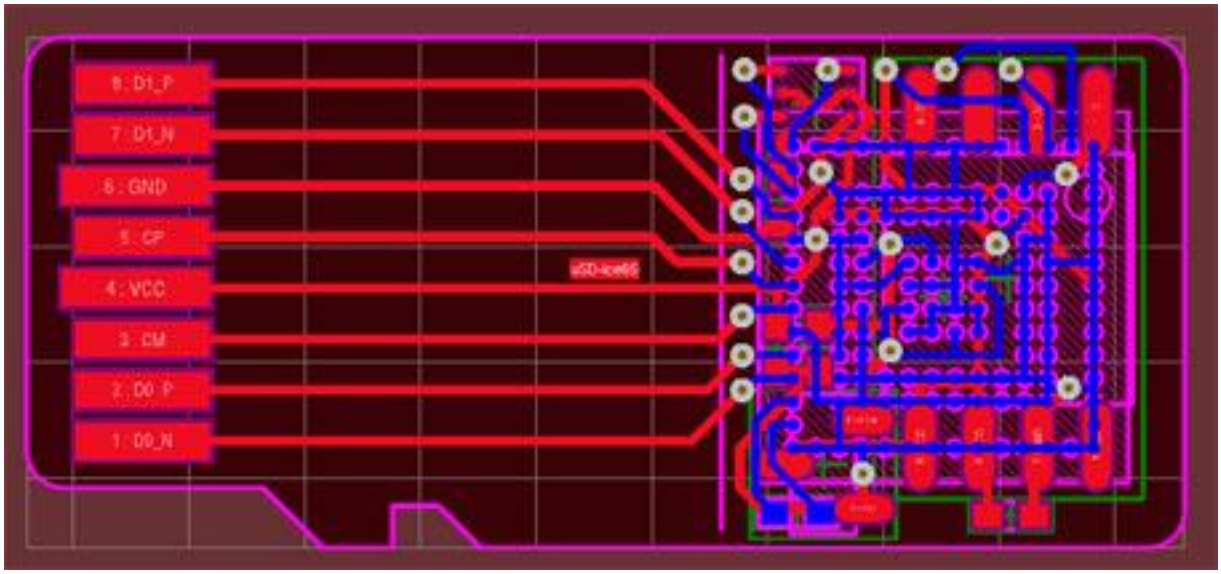


And here are 65L04 samples in 8x8mm EasyBGA package.

A small note to PCB designers. The EasyBGA is not so easy. This was a little surprise for me, because I have done two layer PCB's with Actel 3 row 0.5mm pitch QFN, and with Lattice XP2 3 row 0.5mm pitch BGA, the EasyBGA isn't necessary easier! Of course all depend how many I/O's are actually needed.

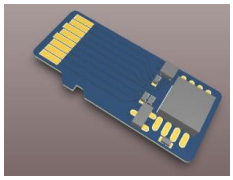
My first iCE65 design

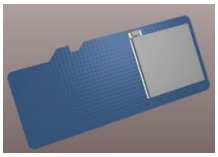
Here it is, I was rather proud when I got the routing done and DRC reported no violations.



Two layer PCB, all rules set for the technology of the local factory, prepared to go production on Monday. But after finishing the PCB design, I did think a little, and decided to checkout something. The design uses very little I/O so I decided to use only one bank, and connected VCC I/O of the unused banks to GND. I did read very carefully the datasheet about the special pins. JTAG is powered from bank 1, but if all tied ground it should disable JTAG, so that should be ok. Then I looked the CDONE and CRESET, one is output (so no external pull-up required), the other has internal pull-up (so no external necessary). CBSELx are don't care. So I happily connected all my I/O to bank 3 and tied down banks 0,1,2. Until I did think, but hey the CRESET to what supply is it internally pulled? Well that is bank 2, and I have happy grounded the supply for bank 2. Ok, just to be sure I wanted to test it. The first test resulted in my notebook to be dead (see big red warning). The next test I made with wall supply, and as I guessed disconnecting JP12 (VCC_IO2) forces the iCE65 to stay in reset. It actually stays in reset till VCC_IO2 is connected and configures normally. Ok, good I have to redo all the design. But eh, this was not the only mistake I made! Bank 3 does not support 3.3V I/O voltage at all. And I had selected bank 3 for my I/O's, while it is the most flexible bank (LVDS/ODT/DDR only available in bank 3).

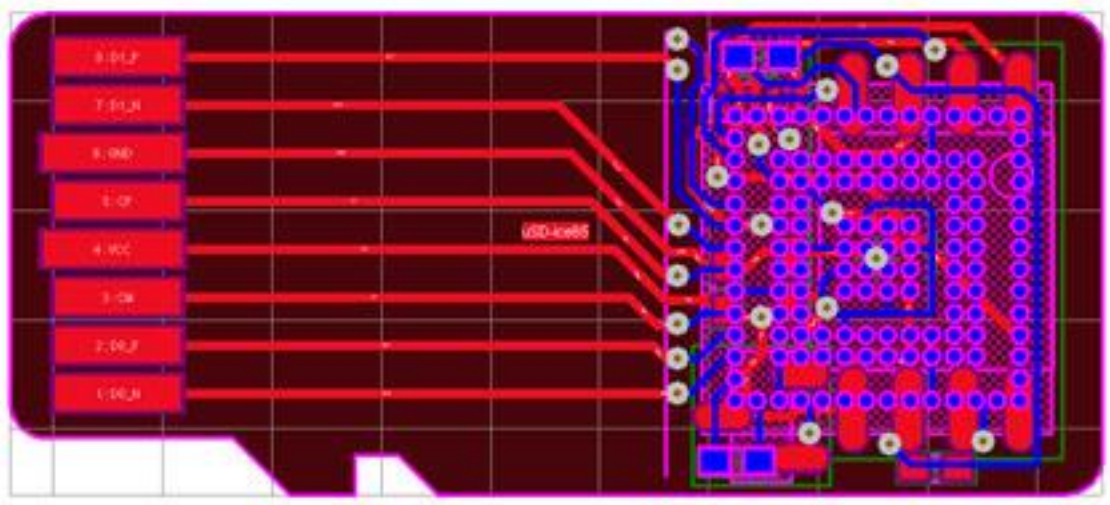
So happily I discovered those design error before submitting the design to the PCB fabrication.





Bottom side : 3 Axis MEMS sensor, 1.2V LDO, AT45DB161D, bypass caps
Top side: iCE65L04V CB132 + LED

Well the rerouting wasn't so hard, now bank 2 is used as only bank, banks 0,1,3 are unused as their VCC IO's also grounded.



As you can see the number of via's required did not increase.

PCB Rules

Track/Clearance: 0.2mm top, 0.15mm bottom (the FPGA side)

Via: 0.2/0.55mm hole/pad

There is one exception, SPI_VCC diagonal fan-out track is 0.12mm wide

Highlights

When looking for GPS IC, I stumbled on the note that Atheros is planning single IC with GPS-Wifi-Bluetooth. Well it doesn't seem so farfetched as TI already has single chip IC with GPS + Bluetooth+ FM/RDS RX/TX!

FM Radio IC

I was looking an easy FM Radio IC for a high volume (100k+?) project. Sure, the obvious choice was to look Philips (or now NXP). I did that, and did find some IC's also. But when Philips was kind of PITA in regard of buying components, and now their wireless is already transferred to another new company (ST-NXP Wireless) so I went looking for alternatives. The first selection I made was Sanyo LV24030LP. It has small 4x4 mm footprint and needs no external components. It is nice, really nice, if you only need FM receive. As soon as you want also to have R(B)DS support, Sanyo has no fully integration solution to offer. They have RDS decoders but the two IC solution was out of the question because of the PCB space constraints. So Sanyo was abandoned for the project. I had TEA5766 still in consideration, 3.3x3.3mm, FM Radio with RDS, 11 external components. Then I remembered that nice girl from SiLabs who gave me their FM Radio demonstration USB stick at some exhibition, and looked SiLabs solutions. The result is that SiLabs is the winner for this project with their Si4721. Here is the comparison table.

Device	Size mm/Area	Externals	RDS	Bluetooth	Digital Audio	Any reference	FM TX
NS953M	7x7	0*	No	No	No	No	No
LV24030	4x4	0*	No	No	No	No	No
Si4721	3x3	0*	Yes	No	Yes	Yes	Yes
TEA5766	3.3x3.3	11	Yes	No	No	No	No
STLC2690	36mm^2	10	YES	Yes	Yes	Yes?	Yes
BL6450	36mm^2		Yes	Yes	?	No*	Yes
SN761633	6x6	12	RX	No	No	No	Yes
BlueCore7	3.6x3.2	10	Yes	Yes	Yes	No*	Yes

The table above doesn't include all selection criteria, but even so it's clearly visible why SiLabs is the ultimate winner. SiLabs supports any reference, that is almost any external reference clock can be used as reference for the radio subsystem, and as clock for the digital audio interface as well. Si4721 offers not only R(B)DS receiver but also FM Transmitter and R(B)DS transmitter as well. And both the receive and transmit can use digital interface disabling the on-chip audio ADC/DAC circuits.

When looking at the table CSR's BC-7 may look as superior IC, but it's very new, close to not available. Also it includes Bluetooth what wasn't a requirement for my project. The CSR small package is 0.4mm BGA's and that makes the PCB design more complex. CSR's QFN packages are 6x6 and that makes them rather large already. Si4721 full datasheet isn't also directly available, but it took only a minor delay to get it. And it cleared all the blanks I had. The 32Khz oscillator option is not useable when using the digital audio interface, but as the reference clock range is so wide, it made the extra oscillator completely unnecessary so Si4721 reduced one more system component. Another good thing about Si4721 is that there is a full family of pin-compatible products, so even same PCB could also offer AM, SW and WB options. But not all are available in single IC.

BL6450 from TI is only available for cell phone manufacturers, we just list them to keep list complete as we know it at time of writing.

Niigata's NS953M is actually tiny BGA looking module, it is based on NS953B which is 5x5mm but needs lots of externals so makes no sense to use as IC, and well it looks like obsolete and abandoned anyway as the original manufacturers website no longer carries any information about the product.

It is surprising to see that 3 vendors support FM TX with RDS, this is feature that doesn't look like very widely used.

Digital Radio/TV IC

One word: Siano! After looking DVB chipset offering from BIG vendors, and then finding Siano, well, I just could not believe what their SMS11xx family IC's are capable!

Wireless USB

First forget Cypress, they use the same for some name for shitty things. The real WUSB is coming.

This is our winner above Wisair single chip WUSB IC WSR601. One chip does it all, boot from SPI flash.

Device	Vendor	Size	BG	Interface	Notes
WSR601	Wisair	10x10 ?	1	USB/SDIO	
RTU7105	Realtek	?		USB/SDIO/GPIO	
WQU210	WiQuest	10x10	1,3	USB/PCIe	
SC5401	Staccato	5x5	1,3,6	SDIO	
SC4502	Staccato	5x5	1,3,6	USB	need ULPI PHY
AL5100/AL5300	Alereon	?/?	all	CF+/GPIO/SDIO/USB ULPI	2 IC's + ULPI PHY
TZC7200	Tzero	7x7/19x19		PCI/TS/GPIO	2 IC's
A-150	Artimi	10x10	n/a	PCI/SPI/UART/GPIO32	need PHY
ISP3582	NXP	3.36x3.36	n/a	SDIO/GPIO with DMA	uses Realtek PHY

NXP solution is better to forget it needs external PHY, and all the NXP wireless is transferred to ST-NXP, and their webmaster hasn't returned from summer vacation, so that all the links are empty.

3D Sensor

Winner is known. We cannot at present time announce the device or specifications, but we can say that the ultimate winner for 3D sensor IC is known, it has all we have been hoping for. We have product datasheet and availability information, but it is still confidential. Will be announced as soon as the official press release comes out. At the moment would be winner from the public datasheets Kionix KXSD9.

Device	Vendor	Size mm	Axis	Output	Power
ADXL-330	ADI	4x4	3	Analog	180uA
LIS331DL	ST	3x3	3	Digital	280uA
KXSD9	Kionix	3x3	3	Digital	50uA
ML8953A	OKI	5x5	3	Digital	200uA
MMA7455L	Freescale	3x5	3	Digital	400uA
H30CD	Hitachi	2.9x2.9x0.92	3	Digital	270uA
SCA3000-E01	VTI	7x7x1.8	3	Digital	120uA
TBA	TBA	small	3	Analog/Digital	low
ADIS-16350	ADI	23x23x23	6*	SPI	33mA

In the table power is given for low power operational mode if this is available.

Gyroscope

The oldest entry here is Epson (now Epson-Toyocom) with their XV-3500CB. The ADI devices are not really single IC's but some monstrous modules. The winner is Invensense with IDG-600.

Device	Vendor	Size mm	Axis	Output	Power
XV-3500CB	Epson	3.2x5	Z	Analog	2.1mA
LISY300AL	ST	7x7	Z	Analog	4.8mA
LY530AL	ST	5x5x1.6	Z	Analog/Digital	
IDG-600	InvenSense	4x5	X,Y	Analog	?
ADIS-16060	ADI	8x8x5	Z	SPI	6mA
ADIS-16350	ADI	23x23x23	6*	SPI	33mA

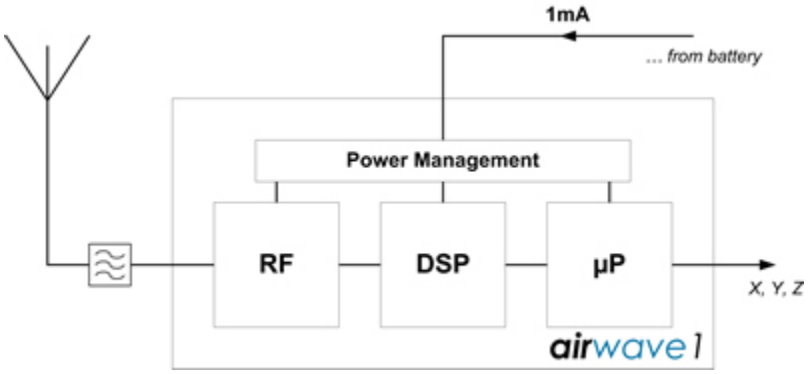
IDG-600 is current winner, but well it could be better if digital output option would be available. Well, not always we get what we want.

GPS IC

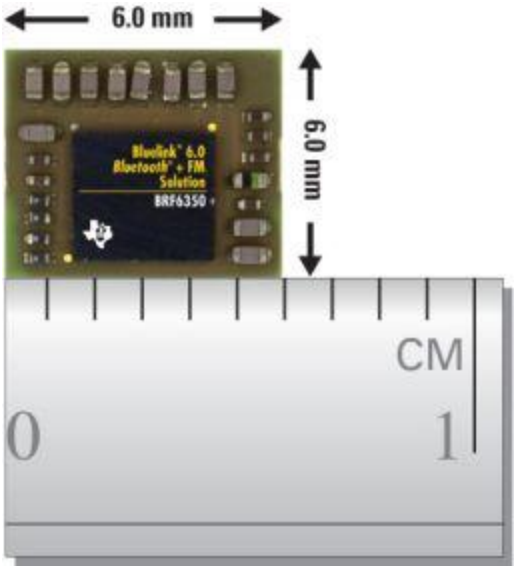
Oops! While starting the research the first link offered GPS chipset market study report for lousy 995$. Following list includes single chip GPS receivers. Two chip solutions are not included. MCM solutions are included. NL5500 TI's navilink-6 includes GPS, Bluetooth and FM Radio RX/TX.

Device	Vendor	Size mm	PCB mm^2	Power	Externals	Hosted
AirWave1	Air Semi	?		1mA	Crystal, SAW, SPI Flash	
GSD3tw	SiRF	3.12x3.17	30			
PMB2525	Infineon	3.6x3.7				
NL5500	TI	?	36			
ATR0630P1	Atmel	7x10			Crystal, SAW	
STA8058	ST	7x11	300			
uN3010	Atheros	5x5			TCXO	optional
NX3	Nemerix	6x6				Yes
BCM4750	Broadcom	3.6x3.6	35			Yes
UBX-G5010	u-Blox	8x8	100		19 Ext, Crystal	

UBX is actually manufactured by Atmel, u-Blox is only licensing their ARM software. But the u-Blox 5 chipset info's are not to be found at Atmel any more. Hosted solutions are not truly autonomous.



Voila, this is what I did not expect to find. A single chip GPS consuming 1mA in full operational mode, and loading it's code from external SPI flash.



Hm.. the above image was found at NL5500 but it looks like bluelink not navilink, well it is to be assumed that the NL5500 isn't much larger than this either.

Note: most TI high-integration IC's are only available for 1Mio+/year consumers, so it not much worth looking at TI.

The GPS IC winner is not easy to choose. If we look low power then AirWave of course, but this sounds too good to be true, so it is to be seen if and when they have working silicon. More realistic winner is SiRF. UBX comes to play if we need UBX protocol support, as example for the paparazzi UAV autopilot.

Small Package FPGA

We have several projects where PCB area is at premium, so, looking for the FPGA solutions, we got the following list:

FPGA Package sizes

1. 3x4 mm 65L04 SiliconBlue
2. 4x4 mm AGL030 Actel
3. 4x5 mm 65L08 SiliconBlue
4. 5x5 mm
    - AGL030 Actel
    - EPM240Z Altera
5. 5x6 mm 65L16 SiliconBlue
6. 6x6 mm
    - AGL060 Actel
    - EPM240/570 Altera
    - 65L02 SiliconBlue
    - PolarPro QuickLogic
7. 7x7 mm EPM570Z Altera
8. 8x8 mm
    - A3P/IGLOO Actel
    - Mach-XO all, XP2-5,XP2-8 Lattice
    - 65L02,65L04 SiliconBlue
    - PolarPro/ArticLink QuickLogic
    - S3E Xilinx (external configuration memory!)

Xilinx is listed only conditionally as S3E needs external configuration memory. And as S3E family is already moved to MATURE devices, so it is not recommended for new designs.

Ultra Low Power MCU

Very preliminary comparison of some of the known players.

Device	Vendor	Core	Clock	Vcc min	Icc @32KHz	Power uA@MHz
EFM™32	Energy Micro	Cortex-A3				
AVR/P	Atmel	AVR	20	1.8		300
C8051F921	SiLabs	8051	25	0.9*	90uA	300
MSP43F5x	TI	MSP430	18	1.8		165
AT91SAM7L64	Atmel	ARM	36	1.8		500
PIC16FJ48GA004	Microchip	PIC24	32			330
HT47C06L	Holtek	PIC	0.1	1.2	10uA	
EM6812	EM	CoolRisc	10	2		120
EM6682	EM	CoolRisc	0.8	0.9	4uA	
MC9S08QE8	Freescale	HCS08	20	1.8	7uA	510
MCF51QE128	Freescale	ColdFire	50	1.8	50uA	2400

The 0.9V MCU's from SiLabs are not really running at 0.9V, they have on-chip DC-DC and require and external inductor for the DC-DC converter to operate. EM6682 is mask ROM version. All other are customer programmable.

Small Package MCU

For another project I needed small and low profile MCU, so the hunt was/is on.

Device	Vendor	Core/Family	Package/Size	Notes
	NEC	78K0	BGA 1.93x2.34x0.45	
	NEC	78K0	uTSOP10 3x6?	
	Holtek	PIC	uTSOP10 3x6	
	OKI	ARM7	BGA 4x4x0.5	
	SiLabs	8051	DFN10 3x3x0.9	
	NXP	8051	DFN10 3x3x0.85	
	Microchip	PIC10	DFN8 3x2x0.9	4 I/O's
	Microchip	PIC10	SOT-23-6 3.2x2.5x1.2	4 I/O's

The table is not final. Only NEC and OKI have MCU's with package height <0.6mm. Only devices in packages smaller than SO-8 or DFN20 are listed.

Serial Flash

Table summaries fastest speed and largest size.

Device	Vendor	Clock	Capacity MByte	Deep power down	Notes
S25FL128P	Spansion	104	16	Yes	
SST26VF032	SST	80	4	No	Quad
W25QV64V	Winbond	80	8	Yes	Quad
M25P128	Numonyx	50	16	Yes	
M25P32	Numonyx	75	4	Yes	
AT45DB642D	Atmel	66	8	Yes	
AT25DF641	Atmel	100	8	Yes	Dual

Smallest package per density

Device	Vendor	Package/Size mm	Capacity	Notes
AT25DF081	Atmel	BGA 2x3 *?	1M	1.8V only
M25P10A	Numonyx	QFN 2x3x0.55	128K	
M25P05A	Numonyx	TSOP 6.4x3x1.2	64K	
W25Q16V	Winbond	QFN 6x5x0.75	4M	Quad
AT25DF321A	Atmel	QFN 6x5x0.55	4M	Dual
M25P128	Numonyx	QFN 8x6x0.85	16M	

Note: AT25DF061 uBGA-11 package outline info and drawings are not available, size estimated based on pitch and grid size.

Not Recommended

Here we list devices and technologies not recommended for new designs. Or just not recommended.

Mini-USB connectors

This was a surprise to me at first, but actually I can understand it, and support the decision. All USB Mini connectors are not recommended by the last USB documents and guidelines (deprecation note from 23 May 2007). Only connectors that should be used as standard and micro-USB connectors. I cannot find the links confirming the following, but when I am not mistaken, China does not allow mini-USB use at all anymore.

Micro-USB still isn't wide-spread. We have already connector samples, but I haven't found any micro-USB cable yet. For sure it is not available at Wal-Mart.

Mini-SD

A few years ago mini-SD was big a PCB area saving compared to standard SD cards. But as of today, they should be considered totally out and not recommended as micro-SD gives much more savings. With 16GB micro-SD cards being available there is no reason to use mini-SD any more.

Hmm.. well there could be a case where mini-SD makes sense as SDA does allow mini-SDIO cards to be manufactured (micro-SDIO does not exist). But there are very limited number of mini-SDIO cards available. So it doesn't seem to be much popular.

Note: UD Card Standard does allow micro-SD form factor I/O function and combo cards.

Recommended

Things we recommend for a reason.

CAD Tools

This is a matter of taste of course, but our choice is Altium Design Summer 2008.

Components for production

Here we list components that we recommend to be used if ordering product development and/or manufacturing from ABC.

Type	Device	
Serial Flash	AT45DB161D SO-8 Wide	
SD Socket	G6174-50 (micro-SD)	http://www.wieson.com
LDO low current	SOT-23 OGI type (UR6225 like)	http://www.utc-ic.com
Crystal	12Mhz, 25MHz SMD 3.2x2.5	

In the above table may for some components generic replacements be used. As example the LDO and micro-SD socket have multiply vendors.

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.

2MByte Serial Flash in DIP8

While we have not touched or used any components in DIP package for a long time, it was interesting to see that Winbond offers 2Mbyte serial flash in DIP8 package W25X64, supply range 2.3 to 3.6V.

Serial Flash with standard deep power down

While we did know B9/AB commands are used by Atmel Dataflash, then after seeing that SiliconBlue FPGA's supports SPI flash power down features, we went looking for other devices too. And as positive surprise we discovered that M25 from Numonyx (previously ST), W25 from Winbond and S25 from Spansion support this feature. Serial flash from SST doesn't have the deep power down support.

ARM Cortex-M3 toolchain

While devkitPro is not primary intended to be used with thumb-2 devices, DKA release R23 can be used with the out of the box installation. We did compile some LED blink demos and tried out the compiled code on STM32 MCU's. More support for thumb-2 libraries is coming in release R24 (we have the pre-release version of it).

Avnet RDC Google Groups

This is not really big news, but I had just deleted my S3A Starter kit group at Google when I found that Avnet is now using Google groups as support forum. So my original idea wasn't that bad, I just had not as much fun with the S3A kit as I initially hoped.

UD Card Association

No further information at present time, stay tuned ☺ http://www.udcard.org

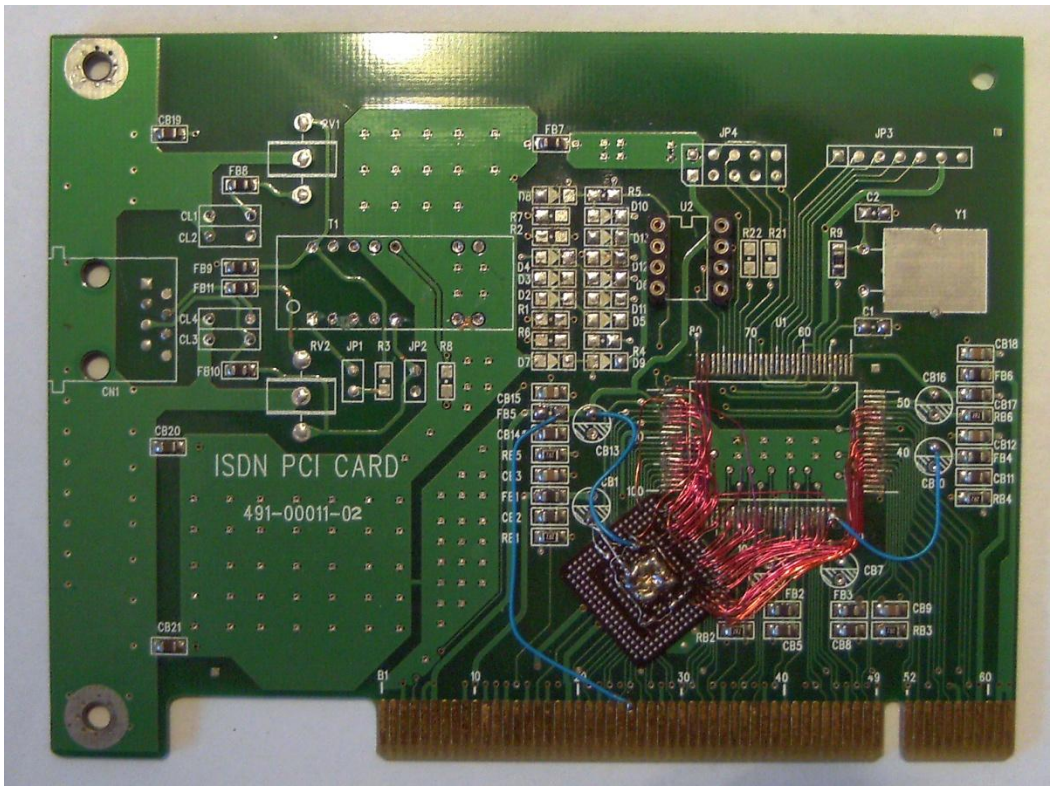
SiliconBlues

Coming new column ☺

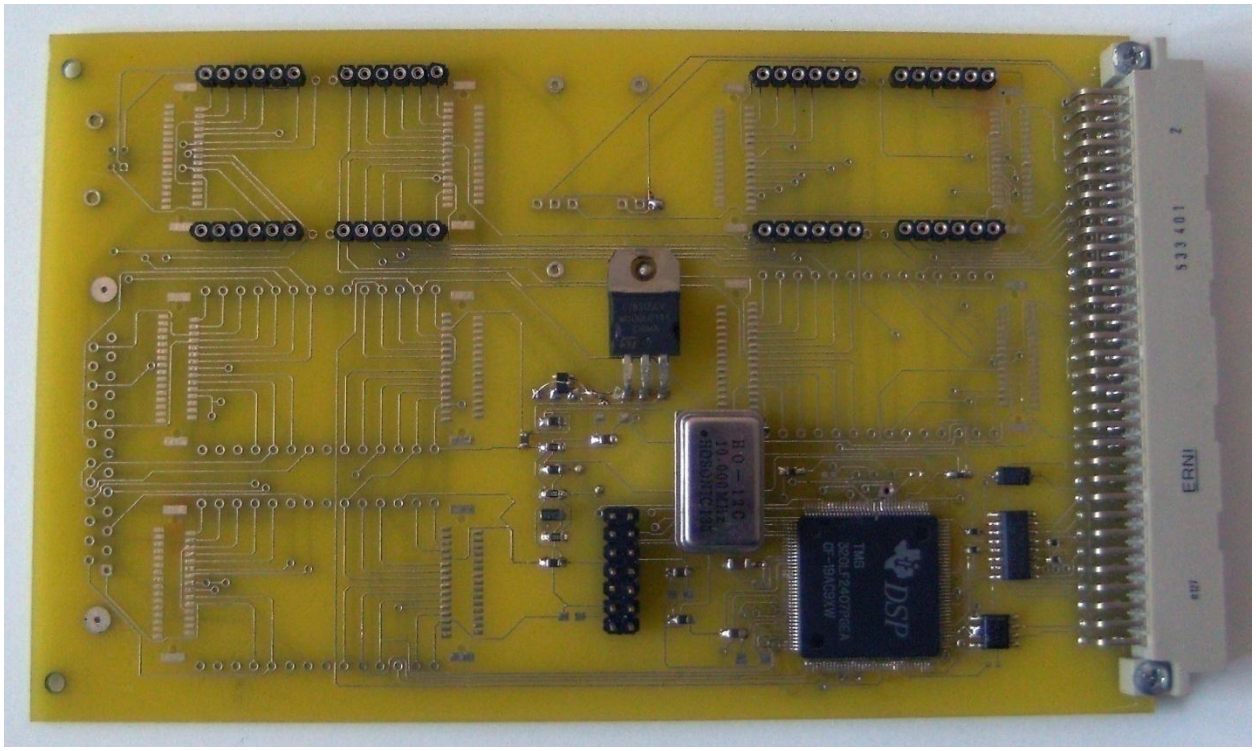
Controller Corner

Piccolo™

Very long time I did obtain TMS32010 in DIP40 package. I never got doing anything with it. TI has gone long way since they made DSP's in DIP package. Now their new Piccolo's are offered in packages as small as TSSOP38 with 8x11 mm PCB footprint. I have attempted to use TI DSP with different success before, here is an unsuccessful attempt:



Based on TMS32C6205, this prototype never worked. The 0.8mm pitch BGA is really hard to solder without binocular microscope. I tried to get the PCI interface working as first but it never enumerated. A more successful design is here:



TMS24LF207 Euro-Card design with 6 slots for add-ons. This board actually worked and was even installed in large automotive test system (project total cost over 500KEUR). The DSP was only used to do some CAN message translation. Doesn't look much impressive, but the board was done in great rush, design files submitted to fabrication maybe half day after design start. I had some modules for this board, ADC, DAC, PWM controlled FET.

At that time TMS24LF24xx was fresh and new, and TMS28F was just about announced. I looked at 28F also, but it only had a few devices and very little package options. So I did not get my hands dirty with TMS28F back then.

I made another attempt with TMS24LF24xx, for some TI sponsored thing I wrote some article, and built some prototype. It was supposed to demonstrate TMS24LF2401 (the smallest package) as small module that connects directly to the 9V battery (special PCB design). I submitted that article and received some TI development kit as award as well. But I wasn't exited enough to make more products with TI chips.

The new Piccolo, may change this! TSSOP38 is really a lovely package. And the Piccolo has nice features.

- Internal 10Mhz oscillator 3%
- PLL, dynamic change
- 60 MHz operation
- Single supply
- 8x11mm footprint (smallest package)
- 128 bit OTP Key
- Flash memory
- User OTP memory
- 12Bit, 4.6MSPS ADC
- Boot from UART/I^2C/SPI/CAN/Parallel port 8 or 16 bit wide

Now there are drawbacks as well, this is the tool support. When working with TMS32LF24xx I used some of TI's starter kits that also worked as JTAG programmer/emulator. And I looked hard to implement own JTAG programming cable and software, but TI is really bad in that concern the information needed is really not available. I did actually pretty lot of reverse engineering to rebuild TI JTAG dongle, but that work was not completed. Ok the Piccolo has flexible boot options, so the JTAG isn't that necessary at all.

Pricing and availability of the Piccolo's is not available at the moment.

IdeaREG™

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

R/C Receiver IC

After doing research to find single chip R/C (Radio Control) receiver IC, I found – nothing. There are some listed as being made by TI or Ferranti, but all seem to be abandoned or/and obsolete. When comparing the features presented in SiLabs Radio IC offerings, it seems to be plausible to expect that a 72MHz band R/C receiver based on the Si74xx patented design would be piece of cake for SiLabs. All of the components needed for the receiver are present in Si47xx base silicon, so the added features are possible with few changes in the digital part/firmware, so no actual analog/RF design NRE would be involved. As for today, I see SiLabs as the only company who could be able to offer single chip easy to use R/C receiver solution.

After some more online research, maybe a sub 2.4GHz R/C receiver IC is not any reasonable. All the big names are moving to 2.4GHz. Cheap R/C receiver/transmitter IC's are available from Nuvoton (formerly Winbond) in die form (W55RFS27 family). Well the Nuvoton IC is not full featured/professional R/C receiver IC, so I would still welcome similar IC (but full featured) from SiLabs. But more sense would probably make single chip 2.4GHz R/C transceiver. Futaba 2.4GHz receiver contains way too many IC's!

Special Offers

FPGA and PSoC/Capsense for 39$

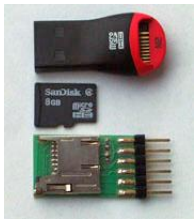
Avnet's promotional price is hard to beat. S3A400, PSoC device and programmer, Capsense demo all for one low price of $39. Limit 5 per customer! When looking at the components included, well there is really not a dime of profit left in that price. This lower than most JTAG/flash programmer or MCU starter kits are sold. Ok, Cypress FirstTouch™ is priced at $29, but when you want anything more then you pay also more.

Single Sided

While single sided PCB may look like nonsense, as the price of two layer PCB's in small volumes is almost the same, there are still cases where single sided PCB's make sense.

6Pin micro-SD Adapter

The first prototype of the adapter was done with press and peel technology, so it had to be single sided. And we left the production design also single sided, there is need for an 0 ohm resistor that is used as wire bridge, but it makes the PCB truly single sided.



Micro-SD adapter for the 6Pin header system. Please notice that the micro-SD USB reader in the photo is not so nice as it looks. It is dual mode adapter for micro-SD and M2, so the connector is specially designed for both card types, making the micro-SD insertion a little complicated.

Here we see the bottom is really flat, so it easy to be fixed with double sided scotch® tape ☺

This adapter is compatible with many Xilinx FPGA development boards, and it is also compatible with iceMAN65 from SiliconBlue.

The adapter is available from Trenz-Electronic. As special promotion new orders of Xilinx development boards have this adapter bundled as free bonus.

While designed primary to be used with FPGA boards having the 6-Pin header, the adapter can be used with other systems as well.

Xilinx EDK reference design and sample code examples should be available soon. Operation is possible in SPI mode, or in SD 1-Bit mode either by GPIO bit-bang or then using special SD Card IP-Core.

Car Radio

Why even consider single sided PCB's? I just clicked news on NXP site, and followed their press release from 23 September 2008 about TEF66xx Car Radio IC's. And what we read there as Feature? Single layer PCB possible. Well Full AM/FM Radio tuner that requires 31 passives and all of it including all RF part all routed on single sided PCB? Well possible, and even suggested/recommended by the IC vendor.

So the single sided PCB designs do exist in the real world.

References

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- Siano http://www.siano-ms.com
- IdeaREG http://www.ideareg.com (not open to public)
- Epson http://www.epsontoyocom.co.jp/english/index.html
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