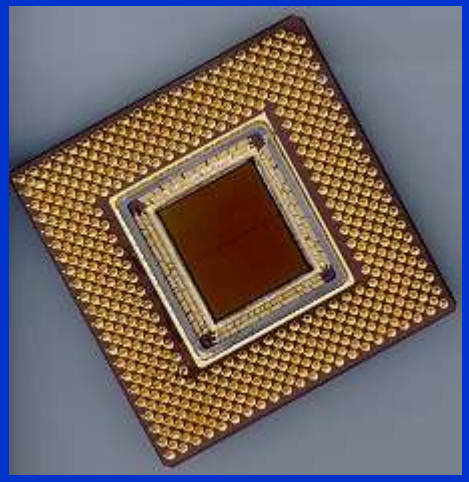


ECE 477 Digital Systems Senior Design Project

Module 1

General Guidelines

Outline

- Lab Notebook Guidelines
- On-Line Documentation Guidelines
- Patent Liability Guidelines
- Microcontroller Selection Guidelines
  - Memory Requirements / Types
  - Development Environment
  - Interfacing / Bus Expansion
- Motherboard Selections Guidelines
- Prerequisite Review Guidelines

Lab Notebooks – ***Individual***

- Used to keep track of all observations, modifications, “buggy behavior”, etc., for a product under development
- All observations, modifications, redesigns, comments, notes to yourself, etc., should be *documented as they occur*, *NOT* “after the fact”
- Each *individual* will be required to maintain an on-line lab notebook on their team’s project webpage
- This is *NOT* a BLOG !!!!

Individual Lab Notebook Entries

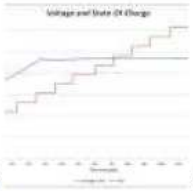
Entries will be done in HTML, but may include scanned sheets and digital pictures as well as links to hardware or software source files - most important thing is to keep it current!

October 24, 2013, 2 hours:
The I2C fuel guage (MAX17043) was connected to the STM32F4 discovery board and tested. After a few attempts, battery voltage and state-of-charge (SOC) data was retrieved from the Maxim chip. Tests with the Agilent volt meter confirmed that the voltage reading was well within the datasheet's tolerance of 5 mV (0.005 V), but further testing is required to verify that the SOC estimate is correct. Charging and discharging of the battery will need to be performed while the fuel gauge is connected and powered.

 (larger)  (larger)

During development of the fuel gauge code, overflow errors occurred on the ITM print return line (SWO) that dropped data after about ten characters set. It was determined that the buffer on the STM32F1 chip inside the ST-LINK v2 programmer was being filled too quickly. After online research, writing a divider value to a poorly-documented asynchronous clock speed register successfully allowed all characters to be sent, so printf() now works over the SWO bus reliably. Further work to get breakpoints working consistently without lock ups is still required.

October 26, 2013, 3 hours:
Continued work to exercise the fuel gauge was performed, with the battery charged using a lithium-ion compatible charger at 1 A with the fuel gauge chip continuously monitoring the charge, along with the voltmeter for comparison. Once again, the voltage reading was well within the stated 5 mV tolerance of the actual voltage, a difference likely also influenced by voltage drops across cables. The test setup is shown below:

 (larger)  (larger)  (larger)

The chart shown above, a subset of the charging graph (the complete charge sequence with this charger and a 6000 mAh battery about 50% full would take over 4 hours), shows that the chip is magically capable of sensing a slowly increasing state of charge (the state of charge is reported to the nearest percentage point, thus the step on the graph) even though the voltage is essentially constant and no current sense resistor is used. This phenomenon demonstrates that our project can successfully monitor the estimated battery state of charge.

Lab Notebook Evaluation Form

Evaluation:

Component/Criterion	Score	MPY	Points
Level of technical detail – enough detail should be included for others to reproduce your work, and not simply a "blog" (i.e., not be a log of time spent in class or what you ate at a meeting, etc.)	0 1 2 3 4 5	X 3	
Pictures, drawings and diagrams – should be included where appropriate, very large images should be linked (to thumbnails of those images)	0 1 2 3 4 5	X 1	
Update record – daily entries should be made *as work is done* (not days "after the fact"), and should reflect steady, consistent progress	0 1 2 3 4 5	X 2	
Weekly summaries – weekly summaries should be a concise summary of the major accomplishments for the preceding Sunday – Saturday period	0 1 2 3 4 5	X 1	
Technical Writing Style and Clarity – writing style should be professional and concise as well as employ good grammar, sentence structure, etc. – what you wrote should be readily understandable to one "skilled in the art"	0 1 2 3 4 5	X 3	
		TOTAL	**/ 50**

Scoring:

5	*Excellent – among the very best notebooks completed this semester*
4	*Good – all requirements were amply satisfied*
3	*Average – some areas for improvement, but all basic requirements were satisfied*
2	*Below average – some basic requirements were not satisfied*
1	*Poor – very few of the requirements were satisfied*
0	*Unacceptable*

Lab Notebook Evaluation

- Level of technical detail
  - Can we reproduce what you did from what is written in your notebook?
  - No “blogs”
- Appropriateness
  - Is the content *directly* related to the project?
  - No “personal remarks” (what you ate, etc.)
- Pictures, diagrams, etc.
  - Need to aid in understanding work done
  - Thumbnail large images to reduce inline image size (generally do not need high-res images for most lab notebook entries)

Lab Notebook Evaluation

- Update Record
  - must be within 2-3 days of actual work
- Weekly summaries
  - 2-3 sentences highlighting main points of week's work
- Technical writing style
  - use 3rd person
  - future employers may see your notebook

On-Line Documentation Guidelines

- In addition to individual lab notebooks, each group should maintain on-line hardware and software *documentation*
  - data sheets
  - application notes
  - schematics
  - code listings
- Use a version control system (your choice) to manage updates and track changes

Hardware Documentation

- Include text describing changes made to each revision of the schematic
- Include information about test setups and prototyping breadboards
- Include any “debugging notes” or general observations useful to the hardware portion of the team
- Update schematic as you prototype and *prototype as much as possible of your schematic*

Software Documentation

- Include diagnostic routines developed
  - note which SW version they work with
- As part of header of each software module, include complete history of modifications

; **Title:** *(a descriptive title of this program)*
; **Version: m.n** *(version number, following specified guidelines)*
; **Filename:** *(name of file)*
; **Author(s):** *(person who has written code)*
; **Purpose/Function of Program:** *(a brief paragraph describing the overall function performed)*
; **How Program is Run on Target System:** *(include starting address, etc.)*
; **Date Started:** *(when you first started to write this program)*
; **Update History:** *(list of changes made since first written, date of each change)*

Patent Liability Guidelines

- **Primary purpose of patent is to protect intellectual property:**

Congress shall have the power . . . to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries.

U.S. Constitution - Article 1, Section 8

Patent Liability Guidelines

- **Patent = Right to Exclude**
  - **Prevent others from making, using or selling your invention**
  - **Right to exclude ≠ Right to make**
    - **May not own all required components**
    - **Need for licensing**
  - **Patent is *not* needed to manufacture a product**
  - **Duration = 20 years from filing date**

Patent Liability Guidelines

- **Patent requirements:**
  - **Useful**
  - **Novel**
  - **Non-Obvious**

- **Patent contains:**
  - **Written description**
  - **Drawings/schematics**
  - **Claims**

Patent Liability Guidelines

- **Applying for a patent requires**
  - **extensive search of prior art**
  - **protracted negotiation with assigned patent officer**
  - **patent lawyer**
- **Many on-line patent search engines are available – see www.freepatentsonline.com or google.com/patents**
- **The official web site of the U.S. Patent Office is – www.uspto.gov (printed copies of "old" patents available for a small fee)**

Patent Liability Guidelines

- **Best time to search for possible patent infringement is at product conception stage**
- **If the possibility of infringement exists, either:**
  - **eliminate infringing function from your design**
  - **modify your design so that the infringing function is performed in a "substantially different way"**
- **Types of infringement**
  - **literal**
  - **doctrine of equivalents**

Literal Infringement

- **Exactly same function performed exactly the same way**
- **Should be “obvious”**
- **Either eliminate this function from your design -or- obtain license/pay royalty fee to use this function**
- **Note that “simply adding additional features” does not eliminate infringement**

Doctrine of Equivalents

- **Substantially same function performed substantially the same way**
- **Hypothetical examples**
  - **for fastening pieces of wood together, does a screw perform "substantially the same function" in "substantially the same way" as a nail?**
  - **for reproducing recorded music, does a vinyl LP perform "substantially the same function" in "substantially the same way" as a CD?**
  - **for the purpose of recognizing an access code (PIN) , does software running on a microcontroller perform "substantially the same function" in "substantially the same way" as a state machine realized with discrete flip-flops and gates?**

Doctrine of Equivalents

- **Need a clear understanding of mechanism ("way") – the mechanism is the *function* of interest in analyzing infringement liability under the doctrine of equivalents**
  - **hypothetical #1: "fastening" is not what is "patented"; rather, the fastening mechanism (ribbing on nail vs. threads on screw)**
  - **hypothetical #2: "music reproduction" is not what is "patented"; rather, the music reproduction mechanism (needle vibration following molded groove vs. optically reading digital data from pits molded into plastic disc)**
  - **hypothetical #3: "recognizing an access code" is not what is "patented"; rather, the access code recognition mechanism (software running on a generic embedded microcontroller vs. discrete custom hardware realizing a state machine)**

Doctrine of Equivalents

- **Stated another way, is the "software" implementation of any function the equivalent of a (digital) hardware implementation of that function under the doctrine of equivalents?**
- **Answer: "hard to say" – this is why there are patent lawyers!**
- **No case to date where software ruled the equivalent of hardware *per se* – but have been cases where functions ("algorithms") of hardware and software devices ruled as performed in "substantially the same way"**

Avoiding Infringement

- **Designing around**
- **Licensing**
  - **Straight license**
  - **Cross-license**
- **Acquiring subject patent**
- **Declaratory judgment action**
- **Ceasing manufacturing**

Microcontroller Selection Guidelines

- Memory requirements/types
  - Beware of hidden liabilities
    - Data acquisition (ADC) buffers
    - Large file storage (mp3)
    - Library routines (floating point emulation, printf)
  - Nonvolatile memory
    - Flash (code, static data)
      - in-circuit programmable?
      - programming “dongle” availability?
      - programming connector requirements?
    - EEPROM (storage of calibration or configuration parameters, history data, control panel settings)
      - granularity of erase/write?
      - software driver availability?

Microcontroller Selection Guidelines

- Volatile memory (SRAM)
  - stack
  - heap
  - I/O buffers
  - run-time variables
  - (generally no executable code except for “specialty functions” like erasing and reprogramming a sector in Flash)
  - note initialization requirements when system boots

Microcontroller Selection Guidelines

- Interfacing/Bus Expansion
  - Number of general purpose I/O pins
    - programmable data direction?
    - programmable pull device?
  - Bus expansion capability
    - multiplexed or simplex external bus?
    - “glue logic” requirements?
- Number/types of integrated peripherals
- Golden Microcontroller Selection Rule: “match” project requirements to µC capabilities as closely as practicable

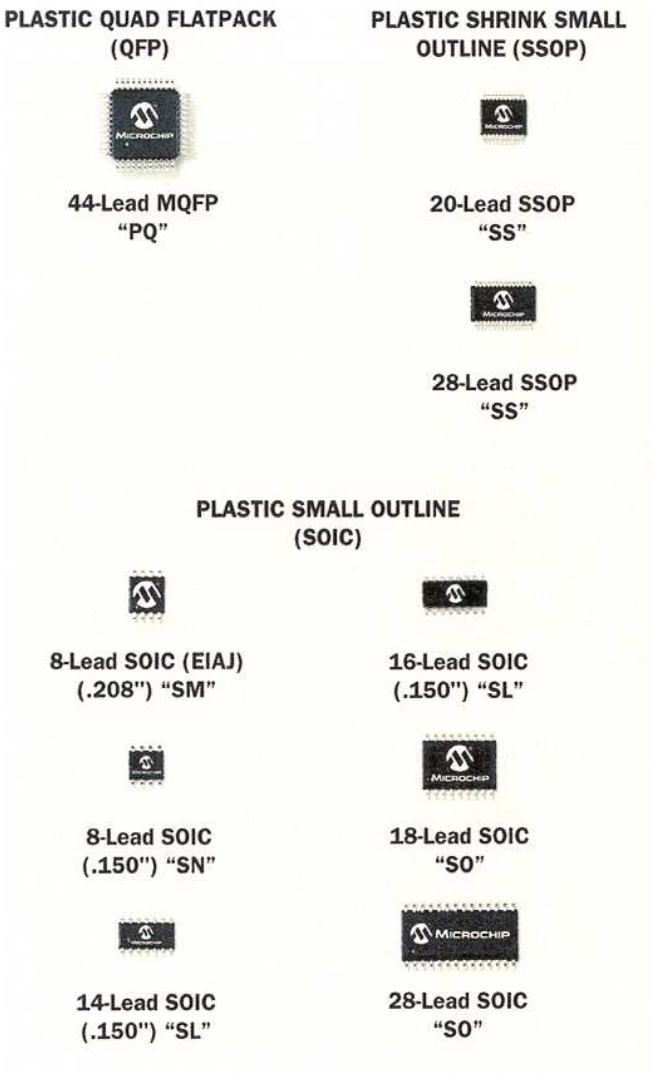
Microcontroller Selection Guidelines

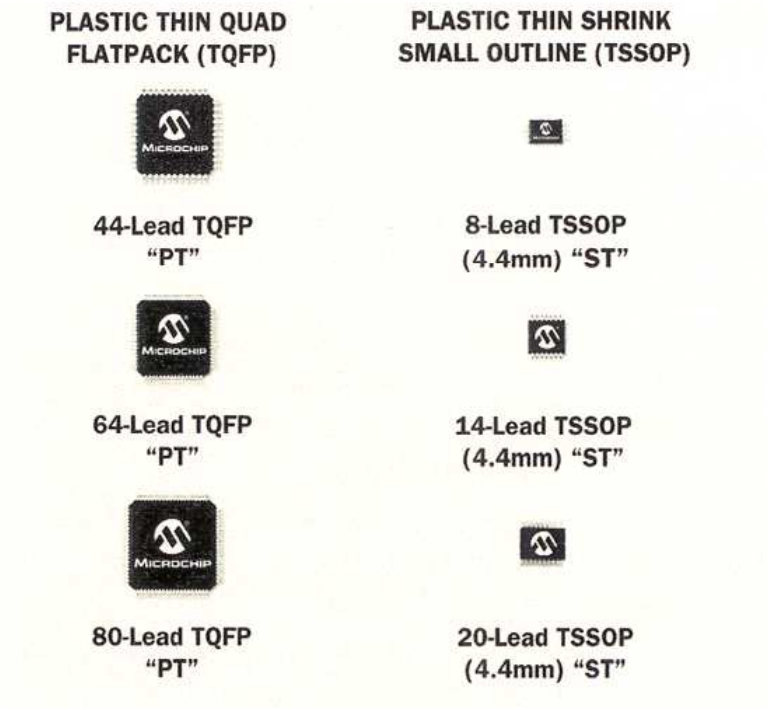
- Development environment
  - Useful to have an asynchronous serial port dedicated to debugging
  - Useful to have spare I/O pins dedicated to debugging (e.g., "heartbeat" LED)
  - In-circuit programmable Flash available for quickly downloading and testing code revs (but typically require a "programming dongle" so *be sure to include a header/connector on your PCB*)
  - BDM (background debug mode) VERY helpful *be sure to include a 6-pin BDM header on your PCB if using a Freescale microcontroller*
  - Assembler/Compiler/Linker/Loader/(Simulator)?

Microcontroller Selection Guidelines

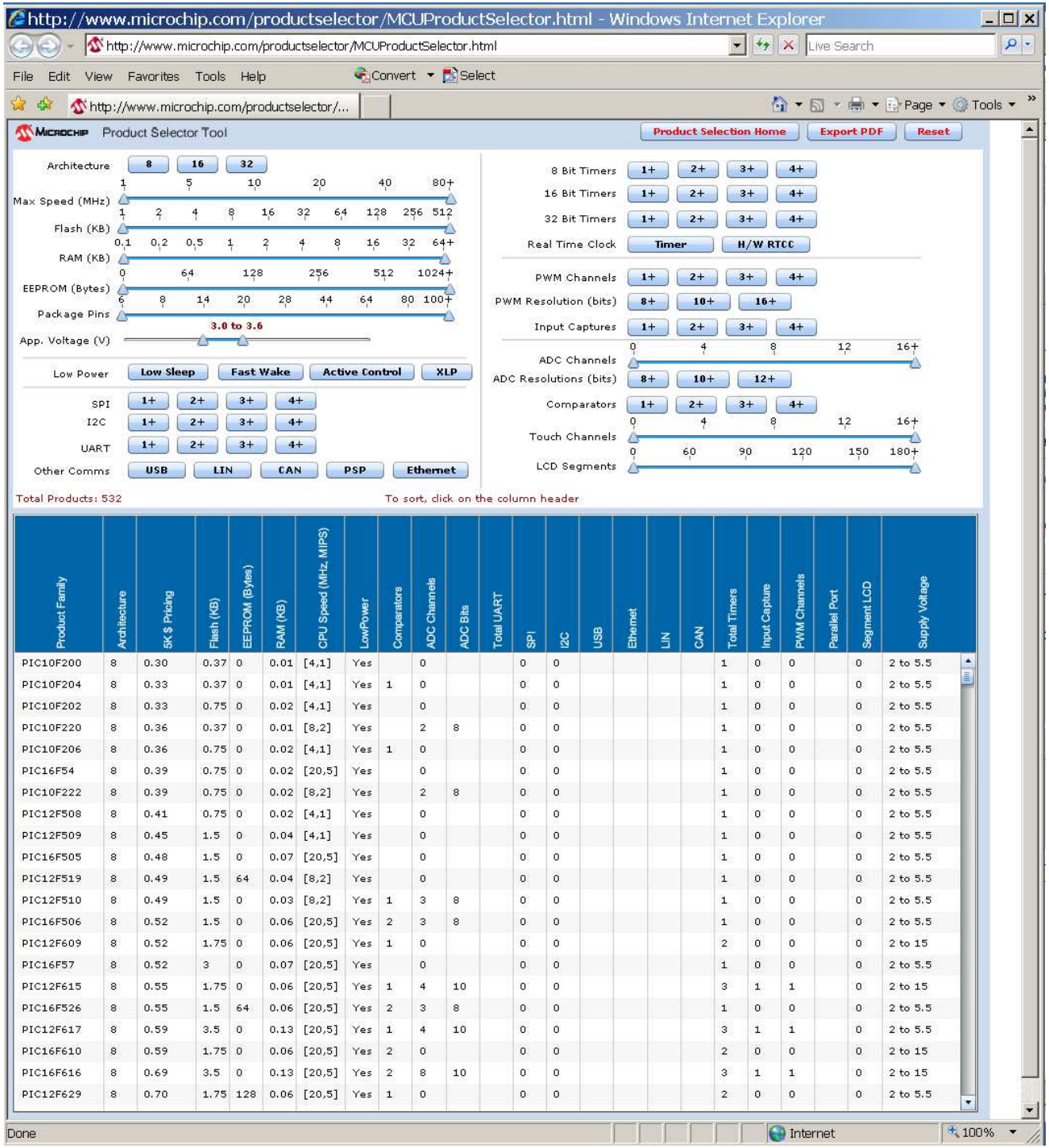
- Carefully note package options available
  - QFP, SOIC, and SSOP types generally preferable
  - QFN type “doable” (but avoid if possible)
  - watch out for “tabs” on bottom of chip
  - DIP types OK (good for prototyping) but compromise PCB density
  - avoid PGA and BGA
- Price/availability
  - get *at least* two more than you need of every IC
  - now (sooner rather than later)

Package Options (Sample)

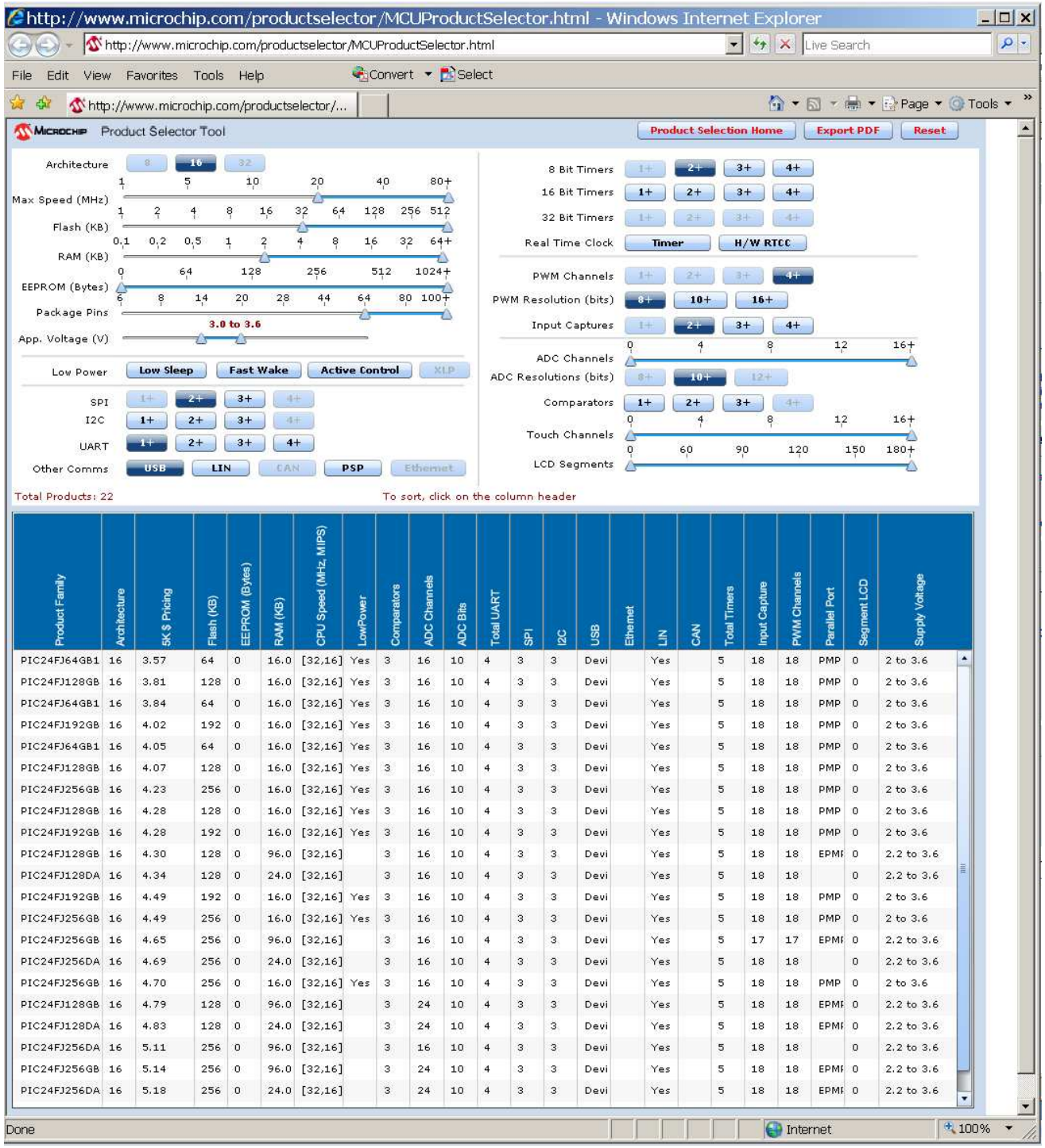





Microchip Technology Inc. is a Leading Provider of Microcontroller and Analog Semiconductors, p - Windows Internet Explorer
http://www.microchip.com/
Live Search
File Edit View Favorites Tools Help
Convert Select
Microchip Technology Inc. is a Leading Provi...
Page Tools
MICROCHIP
myMicrochip Login | English | Chinese | Japanese
Search
Home Products Design Support Applications Buy/Sample Corporate What's New
Products
MCUs & DSCs
8-bit 16-bit 32-bit
eXtreme Low Power
Analog
Interface
Memory
SST Products
Safety & Security
Wireless
Find a Product
Cost-Effective 32-bit MCUs with Ethernet, CAN & USB
MICROCHIP PIC32 PIC32MX5/6/7 32 KB RAM
1 2 3 4 5 6 7 8 9 10
News
CEO Letter to Customers
Microchip Wins Product Awards
Microchip Named Electronic Design Top 50 Employer
Microchip Completes Acquisition of SST
Follow Us On Twitter
More...
Design
Application Notes
Data Sheets
Design & Simulation Tools
Development Tools
Getting Started
MPLAB® IDE
Packaging Specifications
Software
Support
Technical Support
Training
Design Partners
Change Notification
Academic Exchange
Forum
Quality and Environmental
Applications and Markets
Audio & Speech
Automotive
CAN / LIN
Ethernet
eXtreme Low Power
Google PowerMeter
Graphics & LCD
High-Temperature
Home Appliance
Intelligent Power
KEELOQ Security
Lighting
Made for iPod
Medical Solutions
Motor Control
Touch Sensing
Smart Energy
Smoke and CO
USB
Utility Metering
WiFi
ZigBee®
Get Parts
microchip DIRECT
Distributors
Sales Contacts
Samples
Books for Sale
Here 2 Help
Tell us how we're doing?
Site Index | Legal Information | microchipDIRECT | Samples | Technical Support | Investor Information | Careers at Microchip | Contact Us | RSS Feeds
©2010 Microchip Technology Inc.
Shanghai ICP Recordal No.09049794
http://www.microchip.com



Product Family	Architecture	5K $ Pricing	Flash (KB)	EEPROM (Bytes)	RAM (KB)	CPU Speed (MHz, MIPS)	LowPower	Comparators	ADC Channels	ADC Bits	Total UART	SPI	I2C	USB	Ethernet	LIN	CAN	Total Timers	Input Capture	PWM Channels	Parallel Port	Segment LCD	Supply Voltage
PIC10F200	8	0.30	0.37	0	0.01	[4,1]	Yes		0			0	0					1	0	0		0	2 to 5.5
PIC10F204	8	0.33	0.37	0	0.01	[4,1]	Yes	1	0			0	0					1	0	0		0	2 to 5.5
PIC10F202	8	0.33	0.75	0	0.02	[4,1]	Yes		0			0	0					1	0	0		0	2 to 5.5
PIC10F220	8	0.36	0.37	0	0.01	[8,2]	Yes		2	8		0	0					1	0	0		0	2 to 5.5
PIC10F206	8	0.36	0.75	0	0.02	[4,1]	Yes	1	0			0	0					1	0	0		0	2 to 5.5
PIC16F54	8	0.39	0.75	0	0.02	[20,5]	Yes		0			0	0					1	0	0		0	2 to 5.5
PIC10F222	8	0.39	0.75	0	0.02	[8,2]	Yes		2	8		0	0					1	0	0		0	2 to 5.5
PIC12F508	8	0.41	0.75	0	0.02	[4,1]	Yes		0			0	0					1	0	0		0	2 to 5.5
PIC12F509	8	0.45	1.5	0	0.04	[4,1]	Yes		0			0	0					1	0	0		0	2 to 5.5
PIC16F505	8	0.48	1.5	0	0.07	[20,5]	Yes		0			0	0					1	0	0		0	2 to 5.5
PIC12F519	8	0.49	1.5	64	0.04	[8,2]	Yes		0			0	0					1	0	0		0	2 to 5.5
PIC12F510	8	0.49	1.5	0	0.03	[8,2]	Yes	1	3	8		0	0					1	0	0		0	2 to 5.5
PIC16F506	8	0.52	1.5	0	0.06	[20,5]	Yes	2	3	8		0	0					1	0	0		0	2 to 5.5
PIC12F609	8	0.52	1.75	0	0.06	[20,5]	Yes	1	0			0	0					2	0	0		0	2 to 15
PIC16F57	8	0.52	3	0	0.07	[20,5]	Yes		0			0	0					1	0	0		0	2 to 5.5
PIC12F615	8	0.55	1.75	0	0.06	[20,5]	Yes	1	4	10		0	0					3	1	1		0	2 to 15
PIC16F526	8	0.55	1.5	64	0.06	[20,5]	Yes	2	3	8		0	0					1	0	0		0	2 to 5.5
PIC12F617	8	0.59	3.5	0	0.13	[20,5]	Yes	1	4	10		0	0					3	1	1		0	2 to 5.5
PIC16F610	8	0.59	1.75	0	0.06	[20,5]	Yes	2	0			0	0					2	0	0		0	2 to 15
PIC16F616	8	0.69	3.5	0	0.13	[20,5]	Yes	2	8	10		0	0					3	1	1		0	2 to 15
PIC12F629	8	0.70	1.75	128	0.06	[20,5]	Yes	1	0			0	0					2	0	0		0	2 to 5.5



Product Family	Architecture	5K $ Pricing	Flash (KB)	EEPROM (Bytes)	RAM (KB)	CPU Speed (MHz, MIPS)	LowPower	Comparators	ADC Channels	ADC Bits	Total UART	SPI	I2C	USB	Ethernet	LIN	CAN	Total Timers	Input Capture	PWM Channels	Parallel Port	Segment LCD	Supply Voltage
PIC24FJ64GB1	16	3.57	64	0	16.0	[32,16]	Yes	3	16	10	4	3	3	Devi		Yes		5	18	18	PMP	0	2 to 3.6
PIC24FJ128GB	16	3.81	128	0	16.0	[32,16]	Yes	3	16	10	4	3	3	Devi		Yes		5	18	18	PMP	0	2 to 3.6
PIC24FJ64GB1	16	3.84	64	0	16.0	[32,16]	Yes	3	16	10	4	3	3	Devi		Yes		5	18	18	PMP	0	2 to 3.6
PIC24FJ192GB	16	4.02	192	0	16.0	[32,16]	Yes	3	16	10	4	3	3	Devi		Yes		5	18	18	PMP	0	2 to 3.6
PIC24FJ64GB1	16	4.05	64	0	16.0	[32,16]	Yes	3	16	10	4	3	3	Devi		Yes		5	18	18	PMP	0	2 to 3.6
PIC24FJ128GB	16	4.07	128	0	16.0	[32,16]	Yes	3	16	10	4	3	3	Devi		Yes		5	18	18	PMP	0	2 to 3.6
PIC24FJ256GB	16	4.23	256	0	16.0	[32,16]	Yes	3	16	10	4	3	3	Devi		Yes		5	18	18	PMP	0	2 to 3.6
PIC24FJ128GB	16	4.28	128	0	16.0	[32,16]	Yes	3	16	10	4	3	3	Devi		Yes		5	18	18	PMP	0	2 to 3.6
PIC24FJ192GB	16	4.28	192	0	16.0	[32,16]	Yes	3	16	10	4	3	3	Devi		Yes		5	18	18	PMP	0	2 to 3.6
PIC24FJ128GB	16	4.30	128	0	96.0	[32,16]		3	16	10	4	3	3	Devi		Yes		5	18	18	EPMI	0	2.2 to 3.6
PIC24FJ128DA	16	4.34	128	0	24.0	[32,16]		3	16	10	4	3	3	Devi		Yes		5	18	18		0	2.2 to 3.6
PIC24FJ192GB	16	4.49	192	0	16.0	[32,16]	Yes	3	16	10	4	3	3	Devi		Yes		5	18	18	PMP	0	2 to 3.6
PIC24FJ256GB	16	4.49	256	0	16.0	[32,16]	Yes	3	16	10	4	3	3	Devi		Yes		5	18	18	PMP	0	2 to 3.6
PIC24FJ256GB	16	4.65	256	0	96.0	[32,16]		3	16	10	4	3	3	Devi		Yes		5	17	17	EPMI	0	2.2 to 3.6
PIC24FJ256DA	16	4.69	256	0	24.0	[32,16]		3	16	10	4	3	3	Devi		Yes		5	18	18		0	2.2 to 3.6
PIC24FJ256GB	16	4.70	256	0	16.0	[32,16]	Yes	3	16	10	4	3	3	Devi		Yes		5	18	18	PMP	0	2 to 3.6
PIC24FJ128GB	16	4.79	128	0	96.0	[32,16]		3	24	10	4	3	3	Devi		Yes		5	18	18	EPMI	0	2.2 to 3.6
PIC24FJ128DA	16	4.83	128	0	24.0	[32,16]		3	24	10	4	3	3	Devi		Yes		5	18	18	EPMI	0	2.2 to 3.6
PIC24FJ256DA	16	5.11	256	0	96.0	[32,16]		3	16	10	4	3	3	Devi		Yes		5	18	18		0	2.2 to 3.6
PIC24FJ256GB	16	5.14	256	0	96.0	[32,16]		3	24	10	4	3	3	Devi		Yes		5	18	18	EPMI	0	2.2 to 3.6
PIC24FJ256DA	16	5.18	256	0	24.0	[32,16]		3	24	10	4	3	3	Devi		Yes		5	18	18	EPMI	0	2.2 to 3.6

www.atmel.com

Atmel Products - AVR Solutions - Windows Internet Explorer

http://www.atmel.com/products/avr/default.asp?family_id=607&source=global_nav

File Edit View Favorites Tools Help

Atmel Products - AVR Solutions

Cart Search Advanced Search

Products Applications Buy Corporate Quality Contact Us

Products > AVR Solutions

AVR Solutions

AVR 8-, 32-bit | ARM-based | Wireless | 8051

8- and 32-bit low power, high performance MCU

- Home
- Overview
- Technology
- AVR Xplain Series
- Devices
- Datasheets
- Tools & Software
- Application Notes
- Other Documents
- FAQs – MCU
- MCU Support Center
- Third Party Support
- Consultants
- University Program
- Request Samples
- What's Changed

Related News

- January 13, 2011
  Atmel AT32UC3L Wins 2010 Top Products Award from China's AET Magazine
- January 06, 2011
  Atmel and Bang & Olufsen ICEpower Collaborate To

AVR

Atmel® offers both 8-bit and 32-bit AVR flash microcontrollers.

AVR combines the most code-efficient architecture for C and assembly programming with the ability to tune system parameters throughout the entire life cycle of your key products. No other microcontrollers deliver more computing performance at a lower power consumption. Combined with industry leading development tools and design support, you get to market faster. And once there, you can easily and cost-effectively refine and improve your product offering.

It's simple: AVR works across the entire range of applications you're working on, or want to work on.

32-bit AVR UC3

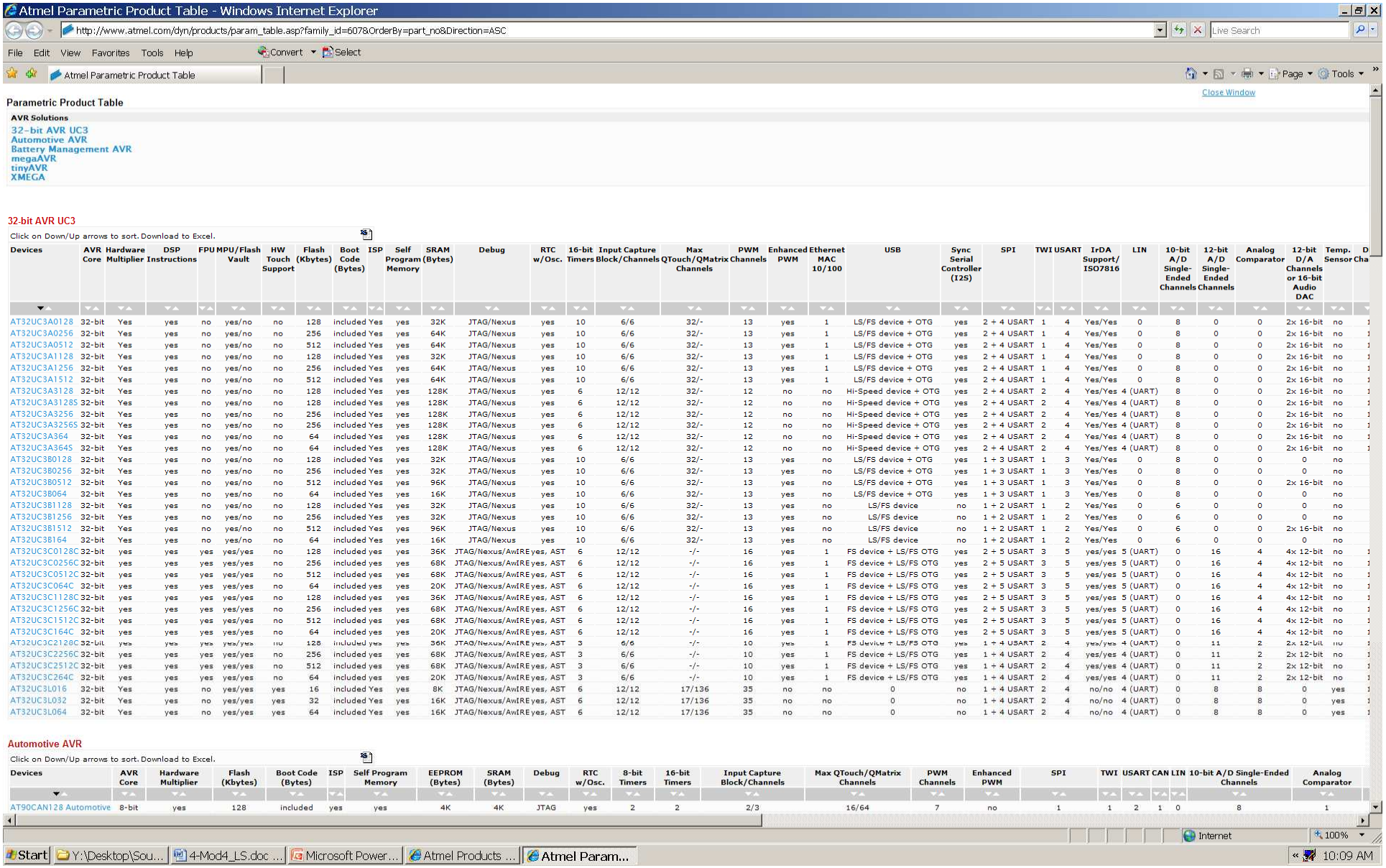
The 32-bit AVR UC3 product family is built on the high-performance 32-bit AVR architecture and optimized for highly integrated applications. The 32-bit AVR UC3 microcontrollers deliver high computational throughput, deterministic real-time control, low power consumption, low system cost, high reliability and ease of use. The 32-bit AVR CPU includes cutting-edge features such as integer and fixed point DSP arithmetic, single-cycle multiply and accumulate instructions, and single-cycle SRAM access. The peripheral DMA controller and multi-layer high-speed bus architecture make the UC3 core ideal for high throughput applications. UC3 devices are perfectly suited for portable and battery-powered applications due to their outstanding low power properties. UC3 will be offering a new series of devices with Floating Point Unit (FPU) which improves processing performance by allowing the MCU to perform arithmetic calculations on decimal numbers in fewer clock cycles with higher precision and wider dynamic range. Read more.

8/16-bit AVR XMEGA

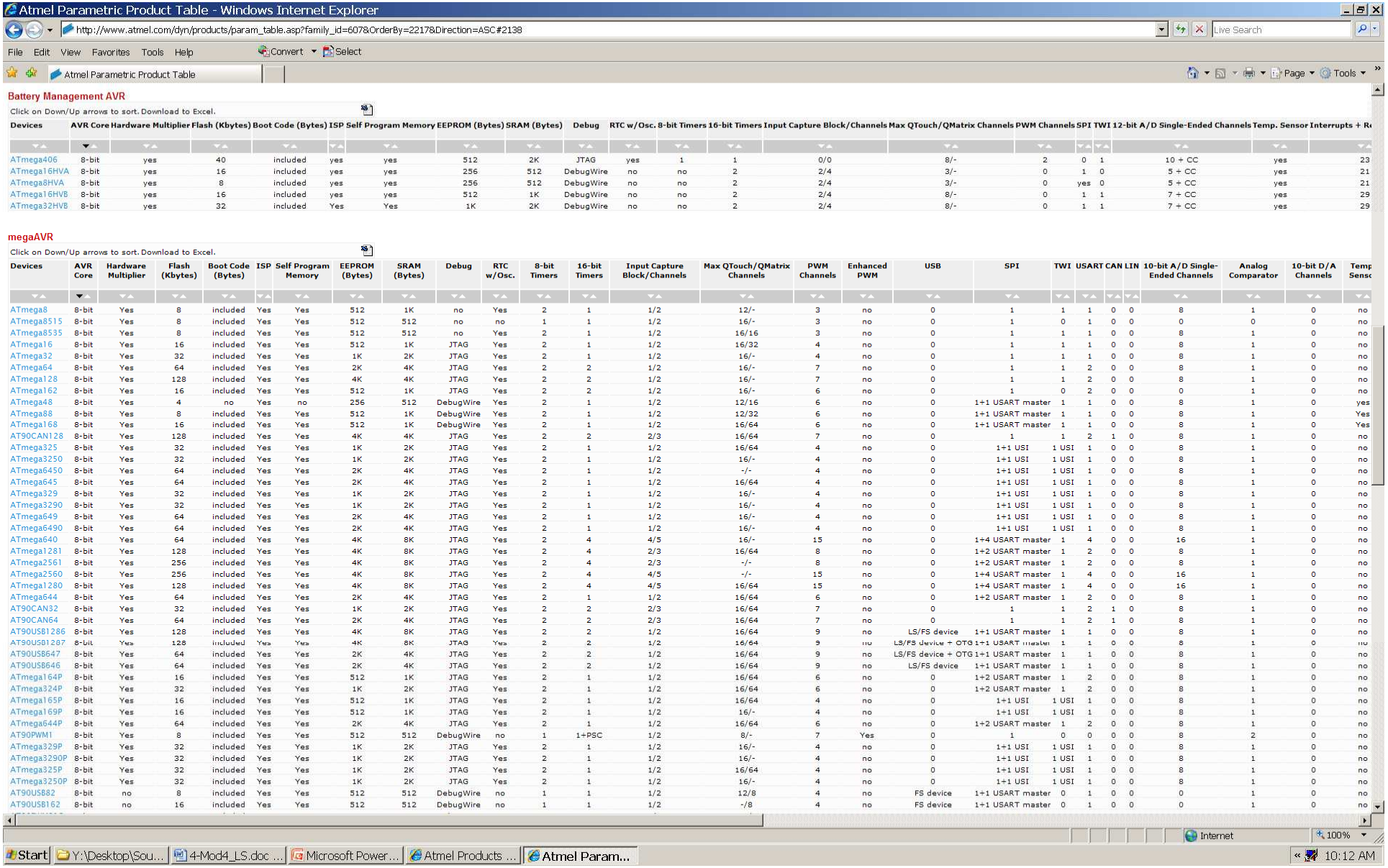
The AVR XMEGA delivers a leading combination of system performance and low-power features. With a Peripheral DMA controller, an innovative Peripheral Event System, crypto engine, and high-speed ADC and DAC, AVR XMEGA pushes the boundaries for high-performance 8/16-bit MCUs.

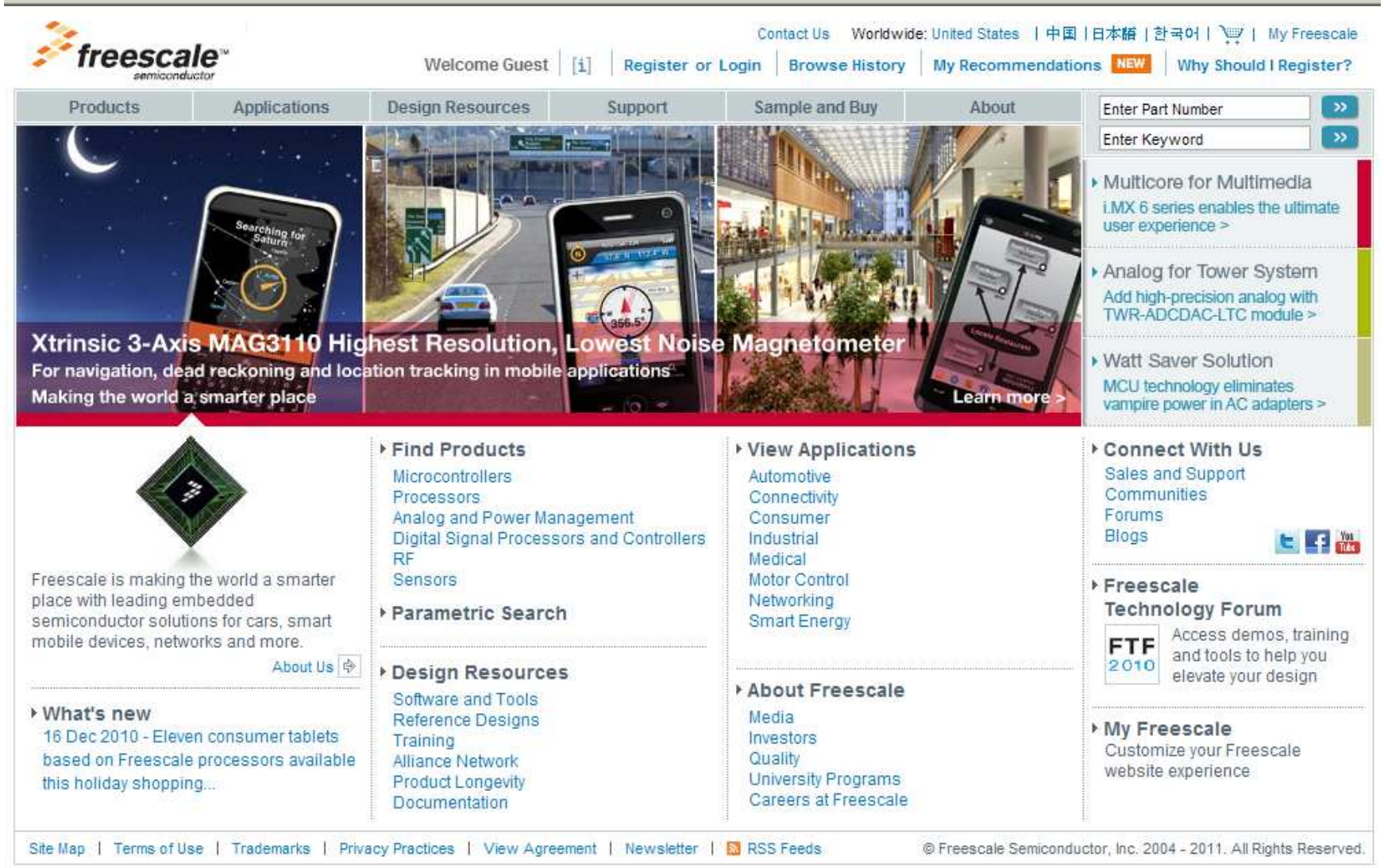
All AVR XMEGA devices are compatible with tinyAVR and megaAVR devices. Within the XMEGA family, devices are 100% code compatible across all devices from the smallest to the largest. This makes it possible to develop with any XMEGA device, and switch to any other XMEGA device later without having to change any code. This allows multi-project development teams to keep and maintain only one code base and use and re-use this across multiple projects. The result is much faster development and prototyping cycles. Read more.

Parametric Product Table



Parametric Product Table…





www.freescale.com

16-bit Microcontrollers - Windows Internet Explorer

http://www.freescale.com/webapp/sps/site/homepage.jsp?code=DRMCR16BIT

File Edit View Favorites Tools Help Convert Select

16-bit Microcontrollers

freescale semiconductor

Contact Us Worldwide: United States | 中国 | 日本語 | 한국어 | Login My Freescale

Products Applications Design Resources Support Sample and Buy About

Enter Part Number Enter Keyword

Welcome Guest [i] | Register or Login | Annotate this Page | Browse History | My Recommendations NEW | Why Should I Register? | Page Actions

Freescale ▸ 16-bit Microcontrollers

16-bit Microcontrollers

Freescale S12 and S12X MCUs provide high-performance 16-bit control for automotive and industrial applications. The S12X MCUs feature the innovative XGATE module, designed specifically to handle interrupt events without CPU intervention. As a result, the S12X controller has the high-performance capabilities you would normally expect of a 32-bit controller.

Products

▸ 16-bit Microcontrollers Parametric Search

▸ Microcontroller Selector

16-bit Microcontrollers by Family

- S12 and S12X Microcontrollers
- HC16 Microcontrollers
- 56800/E Digital Signal Controllers
- HC12 (Legacy)

16-bit Microcontrollers by Application

- Automotive
- Connectivity
- Consumer
- Energy
- Industrial
- Medical
- Motor Control

▸ Automotive Microcontrollers

Design Resources

- Getting Started
- Learn More
  - Controller Continuum – Freescale magazine *(videos)*
  - Beyond Bits – Freescale articles *(online & pdf)*
- Design Help

▸ **S12XHY Family for Lower End Instrument Cluster Applications**

Optimized, automotive, 16-bit microcontroller product line focused on low-cost and high-performance.

Learn more about the S12XHY MCU

Featured Videos

▸ **Dashboard Display of the Automotive MCU**
(Video - 1:44) TFT panel control, including video and graphic examples, driven by S12X and the latest 90nm MCUs.

▸ **Concurrent Computing in XGATE: Part 1**
(Video - 7:49) Methods for sharing resources and completing tasks with X-Gate and CPU RISC Processors utilized in S12X MCUs.

▸ **Concurrent Computing in XGATE: Part 2**
(Video - 6:51) Combine methods to create additional communication between the X-Gate and CPU Processors.

Training & Event Highlights

Live Training
- S12X Family

On-Demand Training
- 16-bit Learning Center

Events
- Freescale Technology Forum Virtual (online)

Featured Tools

CodeWarrior for HCS12(X) Microcontrollers

EVB9S12XEP100 - Evaluation Board for MC9S12XE & XS

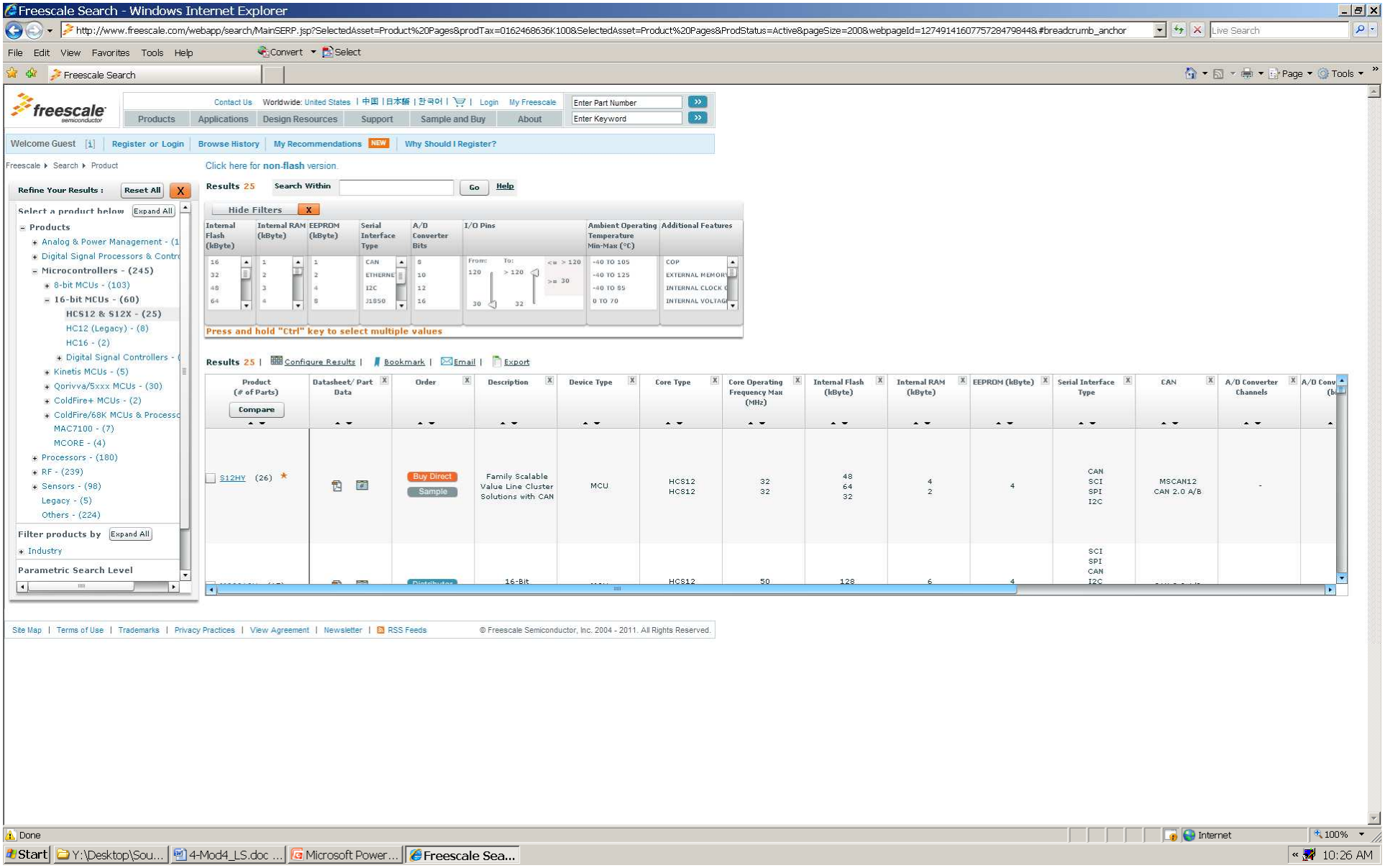
DEMO56F8013 - Demonstration Board for 56F8013

DEMO9S12NE64 - Demonstration Board for MC9S12NE64

Read More

More Than You Expect brochure

Freescale 16-bit Parametric Product Table



WORLD LEADER IN HIGH PERFORMANCE SIGNAL PROCESSING

简体中文 | 日本語 | Русский

ANALOG DEVICES

Purchase | View Cart | Samples | Sales & Distributors | Quality

Welcome User | Log In

PRODUCTS APPLICATIONS RESOURCES & TOOLS ABOUT ADI MY ANALOG

SEARCH

Parametric Search
Cross-Reference Search

PRODUCTS

- Amplifiers and Comparators
- Analog Microcontrollers
- Analog to Digital Converters
- Audio/Video Products
- Broadband Products
- Clock and Timing
- Digital to Analog Converters
- Embedded Processing and DSP
- Fiber/Optic
- Interface
- MEMS
- Power Management
- References
- RF / IF ICs
- Sensors
- Switches/Multiplexers
- Temperature Sensing and Thermal Management
- Other Products

» Product Selection Guides

View New Product Listings

last 2 weeks GO

Subscribe to New Product Notifications

Ask The Expert!

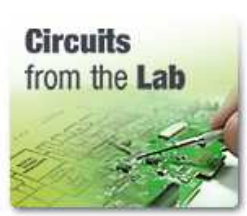
"Designing your front-end for high speed data conversion"

(Open thru February 18th)

ENGINEER ZONE Answers. Right. Now.

Ask a Question or View Thread Now

Webcast Series | Stay Up-To-Date | Design Tools | Ask the Expert



Circuits from the Lab™ are tested circuit designs that address common design challenges and have been engineered for quick and easy system integration.

BROWSE CIRCUITS LIBRARY

RESOURCES & TOOLS

- TECHNICAL DOCUMENTATION
- TRAINING, TUTORIALS & SEMINARS
- REFERENCE CIRCUITS & SOLUTIONS
- EVALUATION BOARDS & KITS
- TOOLS, SOFTWARE & SIMULATION MODELS
- PCB DESIGN RESOURCES

SAMPLES AND PURCHASE

NEWS & EVENTS

»View All

Silica UK and ADI invite you to a free 1-day seminar. Experts will discuss the key benefits of the Blackfin 16/32-bit Embedded Processors. Register here (25Jan11)

WEBCAST: Interfacing RF Components describes best practices that will help you get the most out of your RF circuit. (Starts 2/16) (20Jan11)

Analog Devices Introduces Industry's First I²S Digital MEMS Microphone (19Jan11)

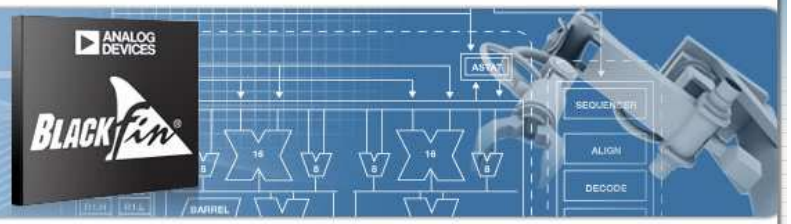
A/D Converter Behavior Modeling Webcast Shows How Simulation Can Reduce Risk and Speed Time-to-Market (18Jan11)

Subscribe to News Feed

» Sign up for Newsletters

www.analog.com

BLACKFIN PROCESSORS



Blackfin® 16/32-bit embedded processors offer software flexibility and scalability for convergent applications: multi-format audio, video, voice and image processing, multimode baseband and packet processing, control processing, and real-time security

PROCESSORS IN APPLICATIONS

- Audio
- Automotive
- Process Control
- Security & Surveillance
- Test & Measurement

SELECTION TABLE

- Product Selection Table

Follow Blackfin on Twitter

Join the Blackfin Linkedin Group

NEWS

15 Jan 2011	Analog Devices is the Conference Sponsor of DesignMED West Feb 8-10, 2011, Anaheim, CA
14 Sep 2010	Analog Devices Expands Blackfin® Family with Ultra Low Cost, 800 MMACs DSP
03 May 2010	Analog Devices Expands Development Facility in Bangalore, India.

More..

Subscribe to Press Release Feed

NEW PRODUCTS

EXPLORE

- Architectural Overview
- Beginner's Guide to DSP
- Benchmarks
- Blackfin Core Basics
- Blackfin in the News
- Customer Case Studies
- Get Started with Blackfin
- Lockbox Secure Technology
- Operating Systems
- Reference Designs
- Roadmap
- Software
- VisualDSP++ Software Free Test Drive
- Whitepapers
- Why Choose Blackfin?

EVALUATE

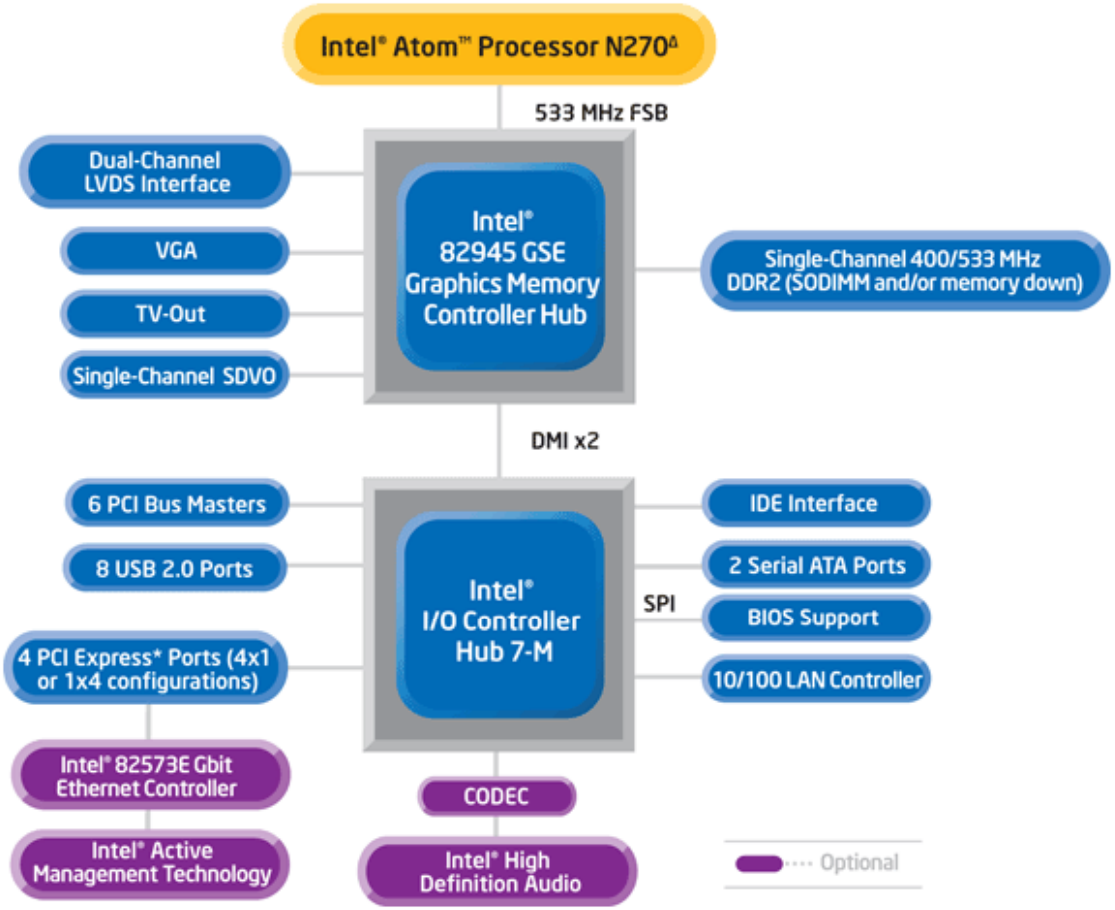
- Application Notes/EE Notes
- Data Sheets
- Development Tools Overview
- Code Examples
- Complementary Parts Guide
- Evaluation Kits
- IC Anomalies
- Manuals
- Technical Articles
- Tools Anomalies
- Tools Selection Table
- VisualDSP++ Full Version
- VisualDSP++ Registration
- VisualDSP++ Tools Upgrades

DESIGN & BUILD

- Board Design Database
- BSDL Files
- IBIS Models
- Online Technical Training Modules
- Workshops and Webcasts

SUPPORT

- EngineerZone Support Community
- Search the Knowledge Base
- Contact Technical Support
- Third Party Developers



Board Peripheral Features

- VGA port and DVI-D
- Two (2) SATA ports
- One (1) parallel ATA port (44-pin mobile header)
- Eight (8) USB 2.0 ports (four back-panel, two front-panel, one internal, one PCIe mini-card)
- One (1) PCIe x1 port
- One (1) PCIe mini-card connector for wireless adapter
- Realtek ALC268* High Definition Audio codec
- Front-panel headphone and mic-in support
- 10/100/1000 Realtek RTL8111* Ethernet Controller
- Legacy I/O:
  - PS/2
  - Serial
- 12 VDC input

http://www.intel.com/products/processor/atom/index.htm

Keil MCB2370 Evaluation Board Overview - Windows Internet Explorer

http://www.keil.com/arm/mcb2300/mcb2370.asp

File Edit View Favorites Tools Help Convert Select

Keil MCB2370 Evaluation Board Overview

ARM Development Tools

KEIL™ Tools by ARM

Home Products Events Support Search Keil.com for: Go

- ARM Development Tools
  - Product Overview
    - What's New in MDK-ARM
  - Product Selector
    - MDK-ARM
    - MDK-Basic
    - RL-ARM Real-Time Library
  - RealView Compilation Tools
    - MicroLib
    - Verification
    - Product Comparison
  - Supported Devices
  - Product Manuals
  - Knowledgebase Articles
  - Evaluation Software
- Evaluation Boards
  - ARM7 Board Comparison
    - MCB2100
    - MCB2103
    - MCB2130
    - MCB2140
    - MCB2300
      - Specifications
      - Knowledgebase Articles
      - User's Guide
      - Schematics
    - MCB2460
    - MCB2470
    - MCBSTR7
    - MCBSTR730
    - MCBSTR750
  - ARM9 Board Comparison
    - MCB2900
    - MCB2929
    - MCBSTR9
  - Cortex-M Board Comparison
    - MCB1000
    - MCB1700
    - MCBNUC1xx
    - MCBSTM32
    - MCBSTM32C
    - MCBSTM32E

MCB2370 Evaluation Board

The Keil MCB2370 Evaluation Board introduces you to the NXP LPC2378 microcontroller. It allows you to create and test working programs for this advanced architecture.

Components Included

The MCB2370 Evaluation Board includes the following:

- MCB2300 Evaluation Board populated with an LPC2378,
- RealView MDK-ARM Evaluation Tools.
- MCB2300 Quick Start Guide.

System Requirements

- PC with one available USB port,
- Windows 2000, XP and Vista,
- One CD-ROM drive,
- ULINK family USB-JTAG Adapter for high-performance Debug/Download (optional).

Evaluation Software

The MCB2370 Evaluation Board includes RealView MDK-ARM Evaluation Tools. These tools help you get started writing programs and testing the microcontroller and its capabilities. Sample applications which run on the MCB2370 are included.

http://www.keil.com/mcb2300/mcb2370.asp

Done Internet 100%

Prerequisite Review Guidelines

- Topics from ECE 270 (Module 1) you should review include:
  - How to read/interpret data sheets
  - Logic levels and noise margins
  - Interfacing different families of CMOS logic
  - Electrostatic discharge
  - Sourcing and sinking currents
  - Propagation delay and transition time
  - Effects of capacitive and resistive loads
  - Power dissipation as a function of supply voltage and switching frequency
  - Current spikes and decoupling
  - Three-state and open-drain outputs

Prerequisite Review Guidelines

- Topics from ECE 362 you should review include:
  - Embedded application software organization
  - SCI and SPI applications
  - ATD applications and analog signal conditioning
  - TIM applications
  - PWM applications and interfaces
  - Switching D.C. loads
  - Optical isolation of inputs and outputs
  - Keypad (switch matrix) and contact closure de-bouncing
  - Rotary pulse generators (RPG)
  - Position control, stepper motors, (hobbyist) servos
  - LCD interface
  - I/O expansion using shift registers
  - Bus timing analysis