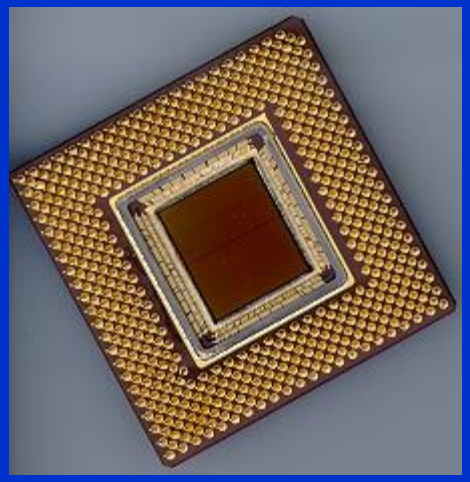

ECE 477 Digital Systems Senior Design Project

Module 3

Microcontrollers for Embedded Applications

Outline

- General μC Selection Guidelines
  - Memory Requirements / Types
  - Development Environment
  - Interfacing / Bus Expansion
- PIC Microcontrollers
- Atmel Microcontrollers
- Freescale Microcontrollers
- Analog Devices DSPs
- ATOM Boards
- ARM Modules

General μC 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?

General μC 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

General μC 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

(objective: want to "match" project requirements to μC capabilities)

General μC 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)?

General μC 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)

PLASTIC QUAD FLATPACK (QFP)

44-Lead MQFP
"PQ"

PLASTIC SHRINK SMALL OUTLINE (SSOP)

20-Lead SSOP
"SS"

28-Lead SSOP
"SS"

PLASTIC SMALL OUTLINE (SOIC)

8-Lead SOIC (EIAJ)
(.208") "SM"

8-Lead SOIC
(.150") "SN"

14-Lead SOIC
(.150") "SL"

16-Lead SOIC
(.150") "SL"

18-Lead SOIC
"SO"

28-Lead SOIC
"SO"

PLASTIC THIN QUAD FLATPACK (TQFP)

44-Lead TQFP
"PT"

64-Lead TQFP
"PT"

80-Lead TQFP
"PT"

PLASTIC THIN SHRINK SMALL OUTLINE (TSSOP)

8-Lead TSSOP
(4.4mm) "ST"

14-Lead TSSOP
(4.4mm) "ST"

20-Lead TSSOP
(4.4mm) "ST"

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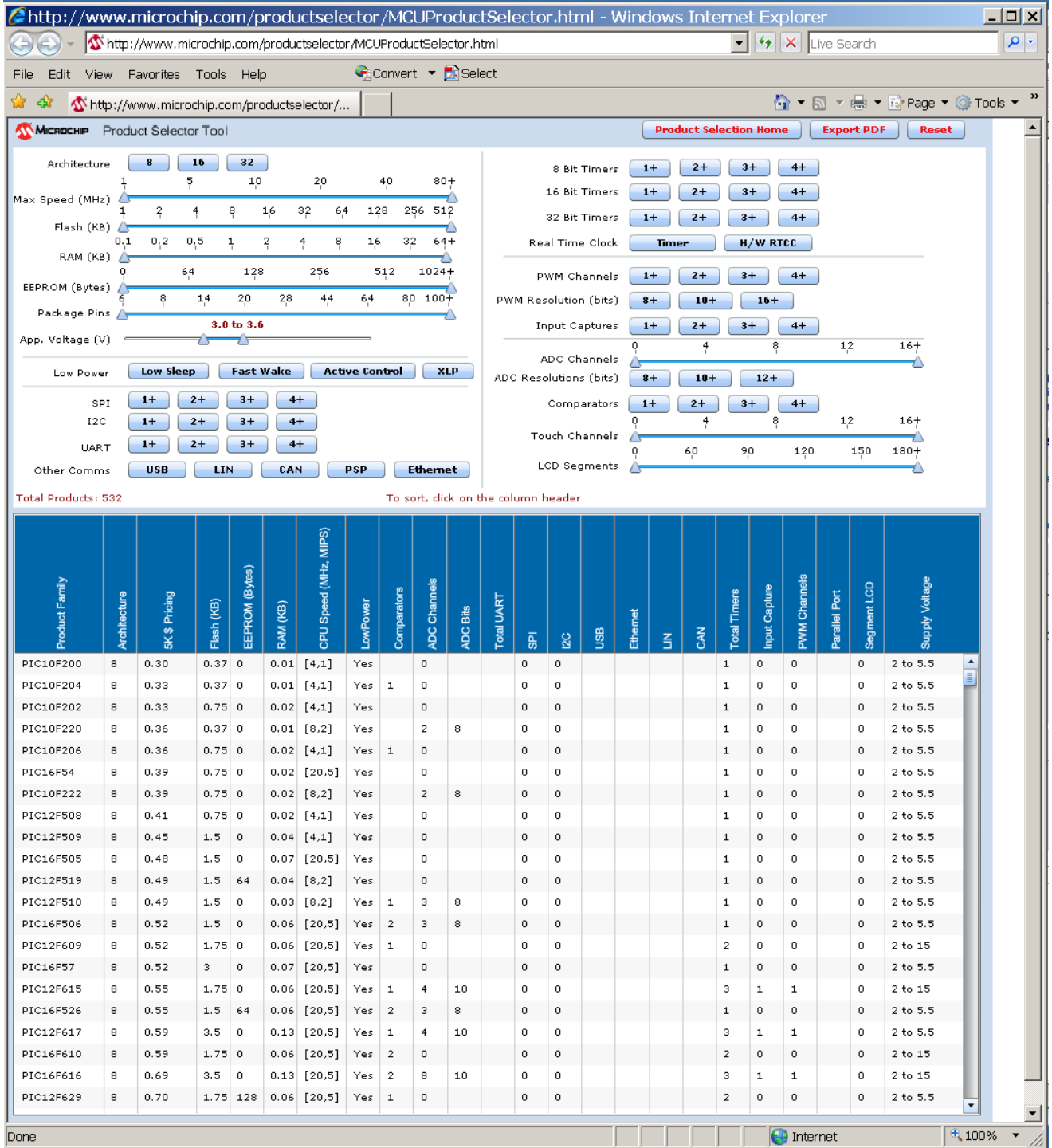
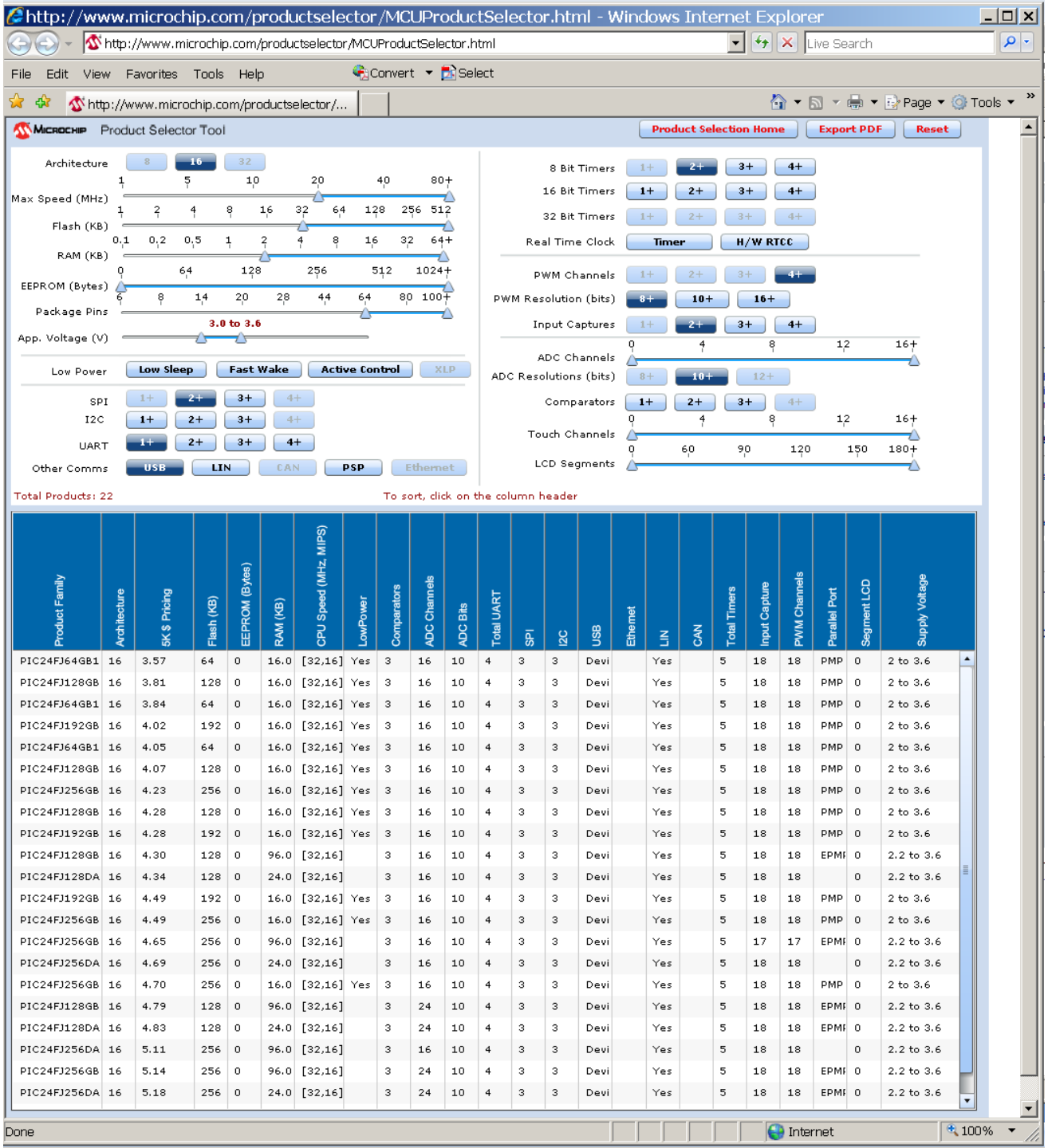
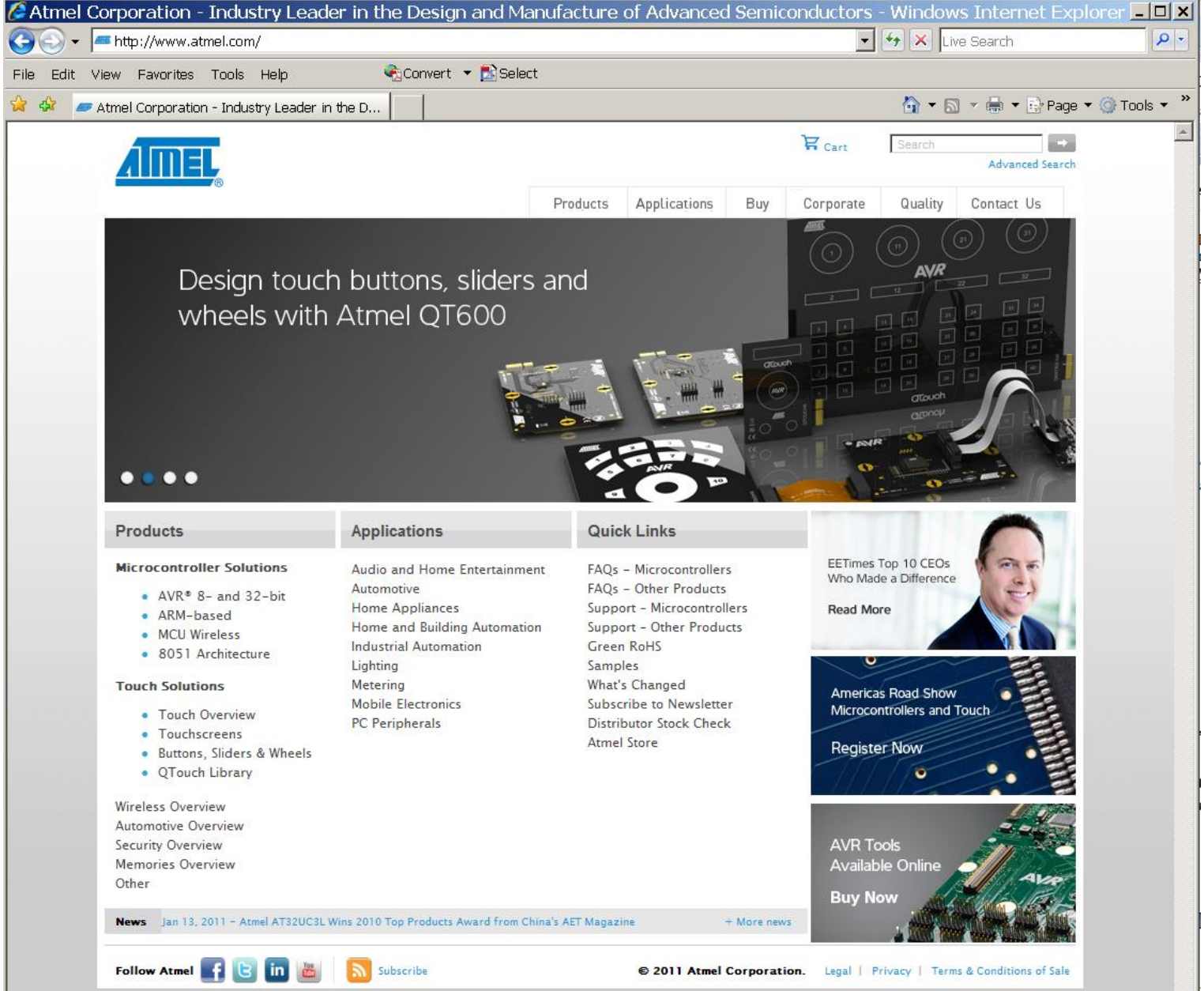


Product Family	Architecture	5K $ Pricing	Flash (KB)	EEPROM (Bytes)	RAM (KB)	CPU Speed (MHz, MIPS)	LowPower	Comparators	ADC Channels	ADC Bits	Total UART	SPI	I2C	USB	Ethernet	LIN	CAN	Total Timers	Input Capture	PWM Channels	Parallel Port	Segment LCD	Supply Voltage
PIC10F200	8	0.30	0.37	0	0.01	[4,1]	Yes		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



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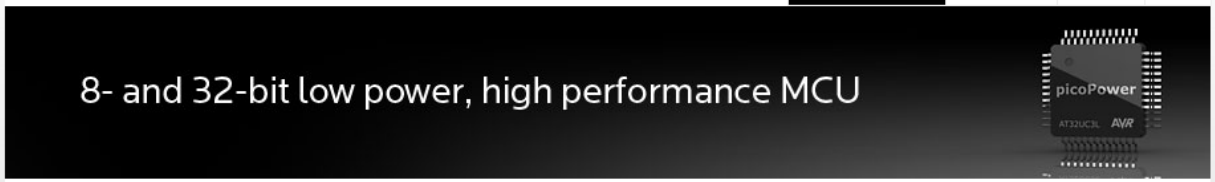

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megaAVR
tinyAVR
XMEGA

32-bit AVR UC3

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Devices	AVR Core	Hardware Multiplier	DSP Instructions	FPU	MPU/Flash Vault	HW Touch Support	Flash (Kbytes)	Boot Code (Bytes)	ISP	Self Program Memory	SRAM (Bytes)	Debug	RTC w/Osc.	16-bit Timers	Input Capture Block/Channels	Max QTouch/QMatrix Channels	PWM Channels	Enhanced PWM	Ethernet MAC 10/100	USB	Sync Serial Controller (I2S)	SPI	TWI	USART	IrDA Support/ ISO7816	LIN	10-bit A/D Single-Ended Channels	12-bit A/D Single-Ended Channels	Analog Comparator	12-bit D/A Channels or 16-bit Audio DAC	Temp. Sensor	D Cha
AT32UC3A0128	32-bit	Yes	yes	no	yes/no	no	128	included	Yes	yes	32K	JTAG/Nexus	yes	10	6/6	32/-	13	yes	1	LS/FS device + OTG	yes	2 + 4 USART	1	4	Yes/Yes	0	8	0	0	2x 16-bit	no	1
AT32UC3A0256	32-bit	Yes	yes	no	yes/no	no	256	included	Yes	yes	64K	JTAG/Nexus	yes	10	6/6	32/-	13	yes	1	LS/FS device + OTG	yes	2 + 4 USART	1	4	Yes/Yes	0	8	0	0	2x 16-bit	no	1
AT32UC3A0512	32-bit	Yes	yes	no	yes/no	no	512	included	Yes	yes	64K	JTAG/Nexus	yes	10	6/6	32/-	13	yes	1	LS/FS device + OTG	yes	2 + 4 USART	1	4	Yes/Yes	0	8	0	0	2x 16-bit	no	1
AT32UC3A1128	32-bit	Yes	yes	no	yes/no	no	128	included	Yes	yes	32K	JTAG/Nexus	yes	10	6/6	32/-	13	yes	1	LS/FS device + OTG	yes	2 + 4 USART	1	4	Yes/Yes	0	8	0	0	2x 16-bit	no	1
AT32UC3A1256	32-bit	Yes	yes	no	yes/no	no	256	included	Yes	yes	64K	JTAG/Nexus	yes	10	6/6	32/-	13	yes	1	LS/FS device + OTG	yes	2 + 4 USART	1	4	Yes/Yes	0	8	0	0	2x 16-bit	no	1
AT32UC3A1512	32-bit	Yes	yes	no	yes/no	no	512	included	Yes	yes	64K	JTAG/Nexus	yes	10	6/6	32/-	13	yes	1	LS/FS device + OTG	yes	2 + 4 USART	1	4	Yes/Yes	0	8	0	0	2x 16-bit	no	1
AT32UC3A3128	32-bit	Yes	yes	no	yes/no	no	128	included	Yes	yes	128K	JTAG/Nexus	yes	6	12/12	32/-	12	no	no	Hi-Speed device + OTG	yes	2 + 4 USART	2	4	Yes/Yes	4 (UART)	8	0	0	2x 16-bit	no	1
AT32UC3A3128S	32-bit	Yes	yes	no	yes/no	no	128	included	Yes	yes	128K	JTAG/Nexus	yes	6	12/12	32/-	12	no	no	Hi-Speed device + OTG	yes	2 + 4 USART	2	4	Yes/Yes	4 (UART)	8	0	0	2x 16-bit	no	1
AT32UC3A3256	32-bit	Yes	yes	no	yes/no	no	256	included	Yes	yes	128K	JTAG/Nexus	yes	6	12/12	32/-	12	no	no	Hi-Speed device + OTG	yes	2 + 4 USART	2	4	Yes/Yes	4 (UART)	8	0	0	2x 16-bit	no	1
AT32UC3A3256S	32-bit	Yes	yes	no	yes/no	no	256	included	Yes	yes	128K	JTAG/Nexus	yes	6	12/12	32/-	12	no	no	Hi-Speed device + OTG	yes	2 + 4 USART	2	4	Yes/Yes	4 (UART)	8	0	0	2x 16-bit	no	1
AT32UC3A364	32-bit	Yes	yes	no	yes/no	no	64	included	Yes	yes	128K	JTAG/Nexus	yes	6	12/12	32/-	12	no	no	Hi-Speed device + OTG	yes	2 + 4 USART	2	4	Yes/Yes	4 (UART)	8	0	0	2x 16-bit	no	1
AT32UC3A364S	32-bit	Yes	yes	no	yes/no	no	64	included	Yes	yes	128K	JTAG/Nexus	yes	6	12/12	32/-	12	no	no	Hi-Speed device + OTG	yes	2 + 4 USART	2	4	Yes/Yes	4 (UART)	8	0	0	2x 16-bit	no	1
AT32UC3B0128	32-bit	Yes	yes	no	yes/no	no	128	included	Yes	yes	32K	JTAG/Nexus	yes	10	6/6	32/-	13	yes	no	LS/FS device + OTG	yes	1 + 3 USART	1	3	Yes/Yes	0	8	0	0	0	no	
AT32UC3B0256	32-bit	Yes	yes	no	yes/no	no	256	included	Yes	yes	32K	JTAG/Nexus	yes	10	6/6	32/-	13	yes	no	LS/FS device + OTG	yes	1 + 3 USART	1	3	Yes/Yes	0	8	0	0	0	no	
AT32UC3B0512	32-bit	Yes	yes	no	yes/no	no	512	included	Yes	yes	96K	JTAG/Nexus	yes	10	6/6	32/-	13	yes	no	LS/FS device + OTG	yes	1 + 3 USART	1	3	Yes/Yes	0	8	0	0	2x 16-bit	no	
AT32UC3B064	32-bit	Yes	yes	no	yes/no	no	64	included	Yes	yes	16K	JTAG/Nexus	yes	10	6/6	32/-	13	yes	no	LS/FS device + OTG	yes	1 + 3 USART	1	3	Yes/Yes	0	8	0	0	0	no	
AT32UC3B1128	32-bit	Yes	yes	no	yes/no	no	128	included	Yes	yes	32K	JTAG/Nexus	yes	10	6/6	32/-	13	yes	no	LS/FS device	no	1 + 2 USART	1	2	Yes/Yes	0	6	0	0	0	no	
AT32UC3B1256	32-bit	Yes	yes	no	yes/no	no	256	included	Yes	yes	32K	JTAG/Nexus	yes	10	6/6	32/-	13	yes	no	LS/FS device	no	1 + 2 USART	1	2	Yes/Yes	0	6	0	0	0	no	
AT32UC3B1512	32-bit	Yes	yes	no	yes/no	no	512	included	Yes	yes	96K	JTAG/Nexus	yes	10	6/6	32/-	13	yes	no	LS/FS device	no	1 + 2 USART	1	2	Yes/Yes	0	6	0	0	2x 16-bit	no	
AT32UC3B164	32-bit	Yes	yes	no	yes/no	no	64	included	Yes	yes	16K	JTAG/Nexus	yes	10	6/6	32/-	13	yes	no	LS/FS device	no	1 + 2 USART	1	2	Yes/Yes	0	6	0	0	0	no	
AT32UC3C0128C	32-bit	yes	yes	yes	yes/yes	no	128	included	yes	yes	36K	JTAG/Nexus/AwIRE	yes, AST	6	12/12	-/-	16	yes	1	FS device + LS/FS OTG	yes	2 + 5 USART	3	5	yes/yes	5 (UART)	0	16	4	4x 12-bit	no	1
AT32UC3C0256C	32-bit	yes	yes	yes	yes/yes	no	256	included	yes	yes	68K	JTAG/Nexus/AwIRE	yes, AST	6	12/12	-/-	16	yes	1	FS device + LS/FS OTG	yes	2 + 5 USART	3	5	yes/yes	5 (UART)	0	16	4	4x 12-bit	no	1
AT32UC3C0512C	32-bit	yes	yes	yes	yes/yes	no	512	included	yes	yes	68K	JTAG/Nexus/AwIRE	yes, AST	6	12/12	-/-	16	yes	1	FS device + LS/FS OTG	yes	2 + 5 USART	3	5	yes/yes	5 (UART)	0	16	4	4x 12-bit	no	1
AT32UC3C064C	32-bit	yes	yes	yes	yes/yes	no	64	included	yes	yes	20K	JTAG/Nexus/AwIRE	yes, AST	6	12/12	-/-	16	yes	1	FS device + LS/FS OTG	yes	2 + 5 USART	3	5	yes/yes	5 (UART)	0	16	4	4x 12-bit	no	1
AT32UC3C1128C	32-bit	yes	yes	yes	yes/yes	no	128	included	yes	yes	36K	JTAG/Nexus/AwIRE	yes, AST	6	12/12	-/-	16	yes	1	FS device + LS/FS OTG	yes	2 + 5 USART	3	5	yes/yes	5 (UART)	0	16	4	4x 12-bit	no	1
AT32UC3C1256C	32-bit	yes	yes	yes	yes/yes	no	256	included	yes	yes	68K	JTAG/Nexus/AwIRE	yes, AST	6	12/12	-/-	16	yes	1	FS device + LS/FS OTG	yes	2 + 5 USART	3	5	yes/yes	5 (UART)	0	16	4	4x 12-bit	no	1
AT32UC3C1512C	32-bit	yes	yes	yes	yes/yes	no	512	included	yes	yes	68K	JTAG/Nexus/AwIRE	yes, AST	6	12/12	-/-	16	yes	1	FS device + LS/FS OTG	yes	2 + 5 USART	3	5	yes/yes	5 (UART)	0	16	4	4x 12-bit	no	1
AT32UC3C164C	32-bit	yes	yes	yes	yes/yes	no	64	included	yes	yes	20K	JTAG/Nexus/AwIRE	yes, AST	6	12/12	-/-	16	yes	1	FS device + LS/FS OTG	yes	2 + 5 USART	3	5	yes/yes	5 (UART)	0	16	4	4x 12-bit	no	1
AT32UC3C2128C	32-bit	yes	yes	yes	yes/yes	no	128	included	yes	yes	36K	JTAG/Nexus/AwIRE	yes, AST	3	6/6	-/-	10	yes	1	FS device + LS/FS OTG	yes	1 + 4 USART	2	4	yes/yes	4 (UART)	0	11	2	2x 12-bit	no	1
AT32UC3C2256C	32-bit	yes	yes	yes	yes/yes	no	256	included	yes	yes	68K	JTAG/Nexus/AwIRE	yes, AST	3	6/6	-/-	10	yes	1	FS device + LS/FS OTG	yes	1 + 4 USART	2	4	yes/yes	4 (UART)	0	11	2	2x 12-bit	no	1
AT32UC3C2512C	32-bit	yes	yes	yes	yes/yes	no	512	included	yes	yes	68K	JTAG/Nexus/AwIRE	yes, AST	3	6/6	-/-	10	yes	1	FS device + LS/FS OTG	yes	1 + 4 USART	2	4	yes/yes	4 (UART)	0	11	2	2x 12-bit	no	1
AT32UC3C264C	32-bit	yes	yes	yes	yes/yes	no	64	included	yes	yes	20K	JTAG/Nexus/AwIRE	yes, AST	3	6/6	-/-	10	yes	1	FS device + LS/FS OTG	yes	1 + 4 USART	2	4	yes/yes	4 (UART)	0	11	2	2x 12-bit	no	1
AT32UC3L016	32-bit	Yes	yes	no	yes/yes	yes	16	included	Yes	yes	8K	JTAG/Nexus/AwIRE	yes, AST	6	12/12	17/136	35	no	no	0	no	1 + 4 USART	2	4	no/no	4 (UART)	0	8	8	0	yes	1
AT32UC3L032	32-bit	Yes	yes	no	yes/yes	yes	32	included	Yes	yes	16K	JTAG/Nexus/AwIRE	yes, AST	6	12/12	17/136	35	no	no	0	no	1 + 4 USART	2	4	no/no	4 (UART)	0	8	8	0	yes	1
AT32UC3L064	32-bit	Yes	yes	no	yes/yes	yes	64	included	Yes	yes	16K	JTAG/Nexus/AwIRE	yes, AST	6	12/12	17/136	35	no	no	0	no	1 + 4 USART	2	4	no/no	4 (UART)	0	8	8	0	yes	1

Automotive AVR

Click on Down/Up arrows to sort. Download to Excel.

Devices	AVR Core	Hardware Multiplier	Flash (Kbytes)	Boot Code (Bytes)	ISP	Self Program Memory	EEPROM (Bytes)	SRAM (Bytes)	Debug	RTC w/Osc.	8-bit Timers	16-bit Timers	Input Capture Block/Channels	Max QTouch/QMatrix Channels	PWM Channels	Enhanced PWM	SPI	TWI	USART	CAN	LIN	10-bit A/D Single-Ended Channels	Analog Comparator
AT90CAN128 Automotive	8-bit	yes	128	included	yes	yes	4K	4K	JTAG	yes	2	2	2/3	16/64	7	no	1	1	2	1	0	8	1

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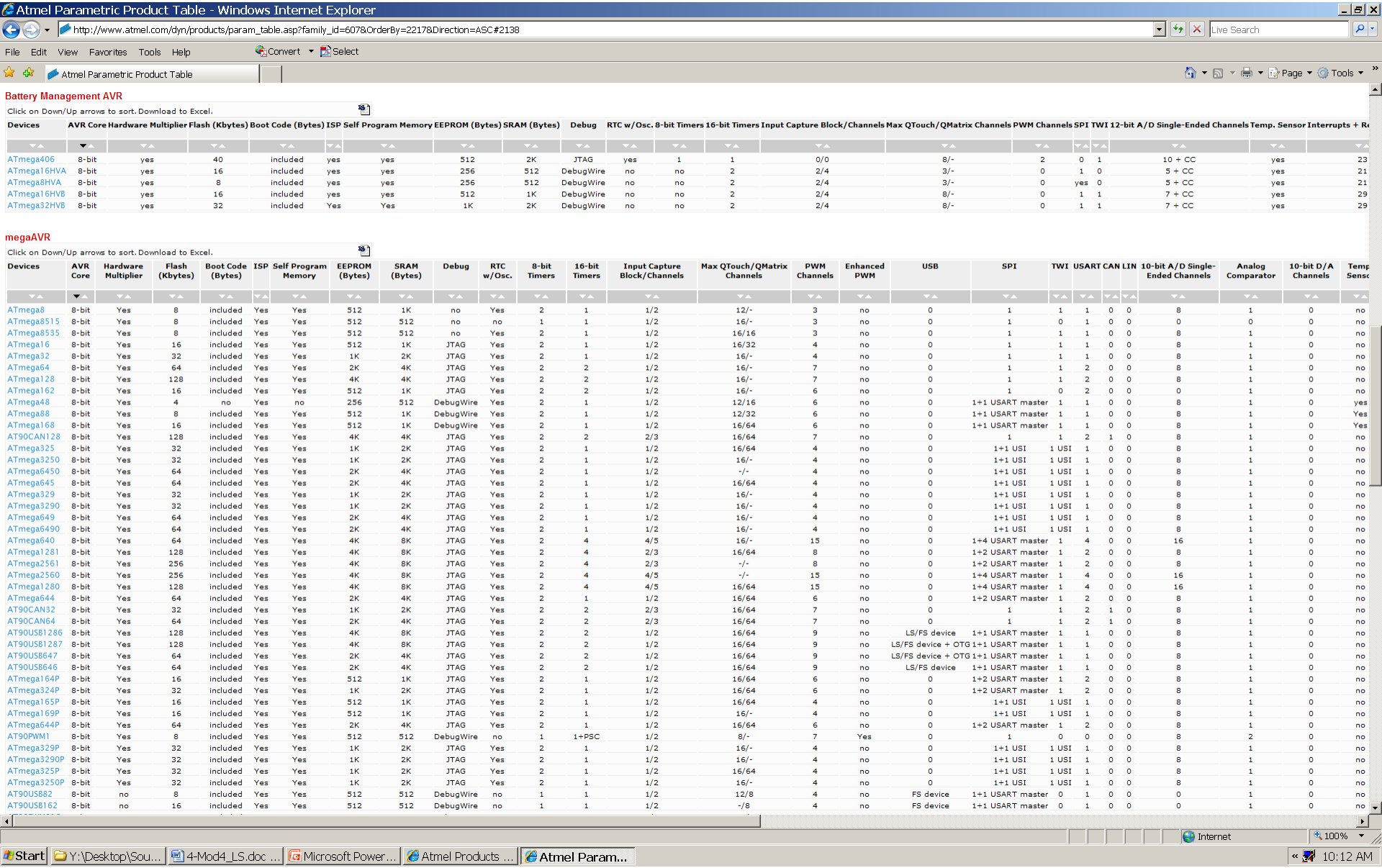
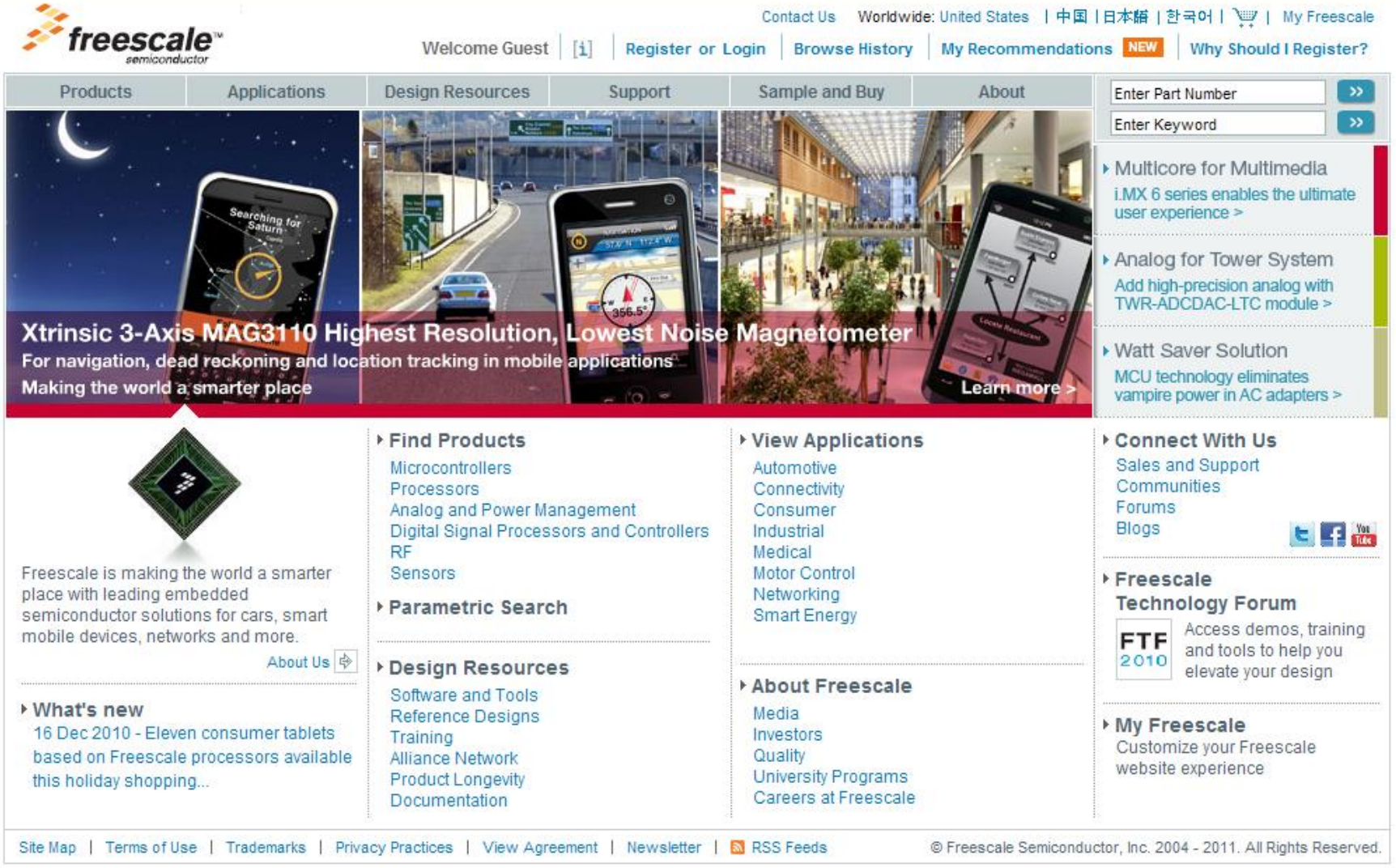
Parametric Product Table…





www.freescale.com

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

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▸ Microcontroller Selector

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- 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

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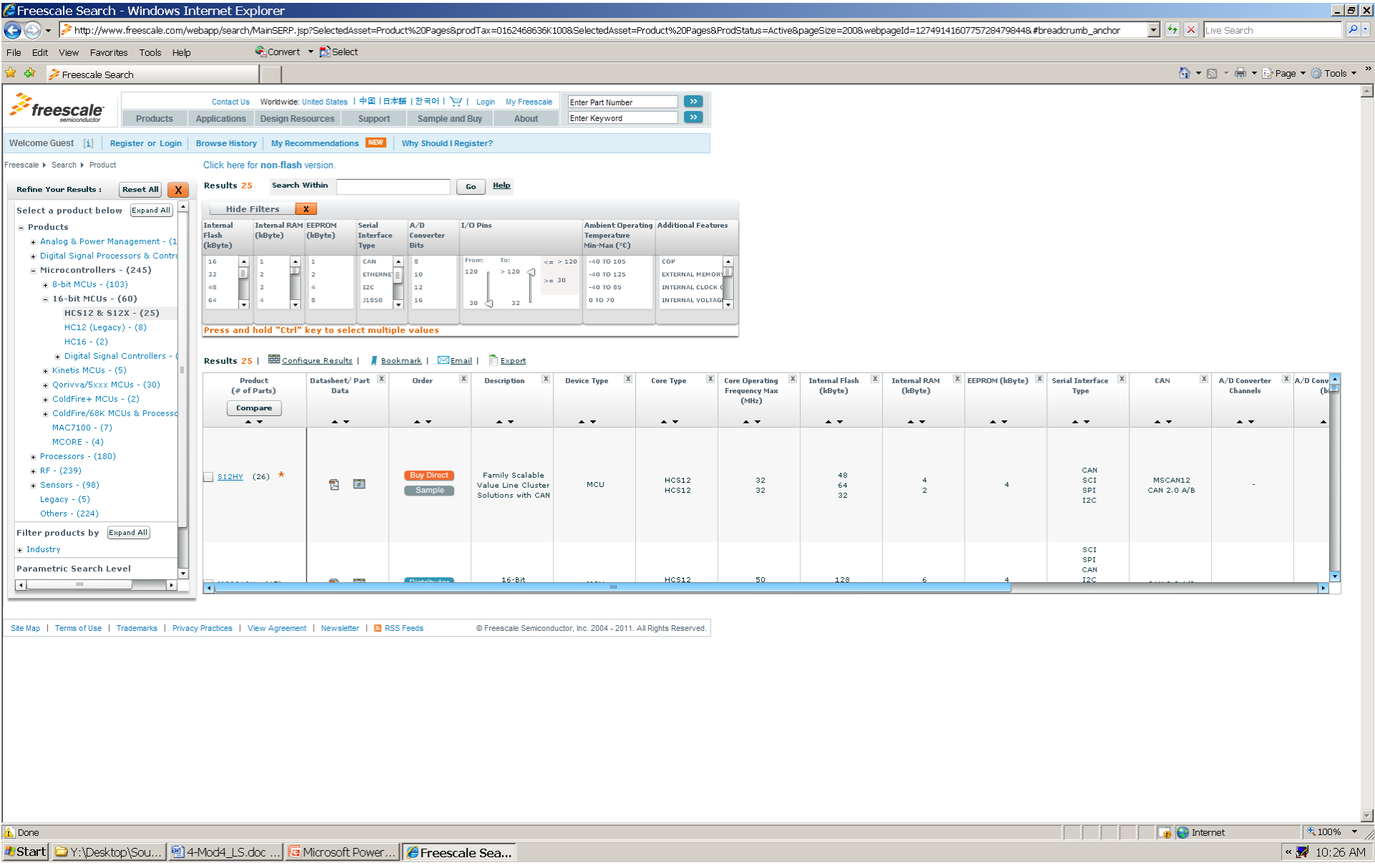
More Than You Expect brochure

Freescale 16-bit Parametric Product Table



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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)

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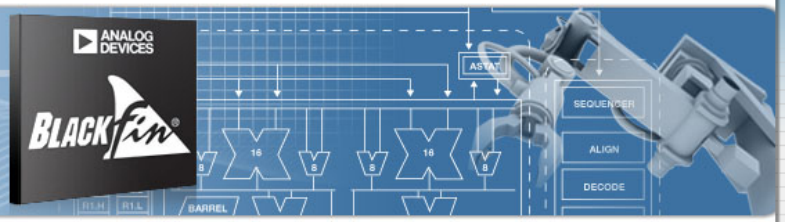
BLACKFIN PROCESSORS



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

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NEWS

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14 Sep 2010	Analog Devices Expands Blackfin® Family with Ultra Low Cost, 800 MMACs DSP
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- Why Choose Blackfin?

EVALUATE

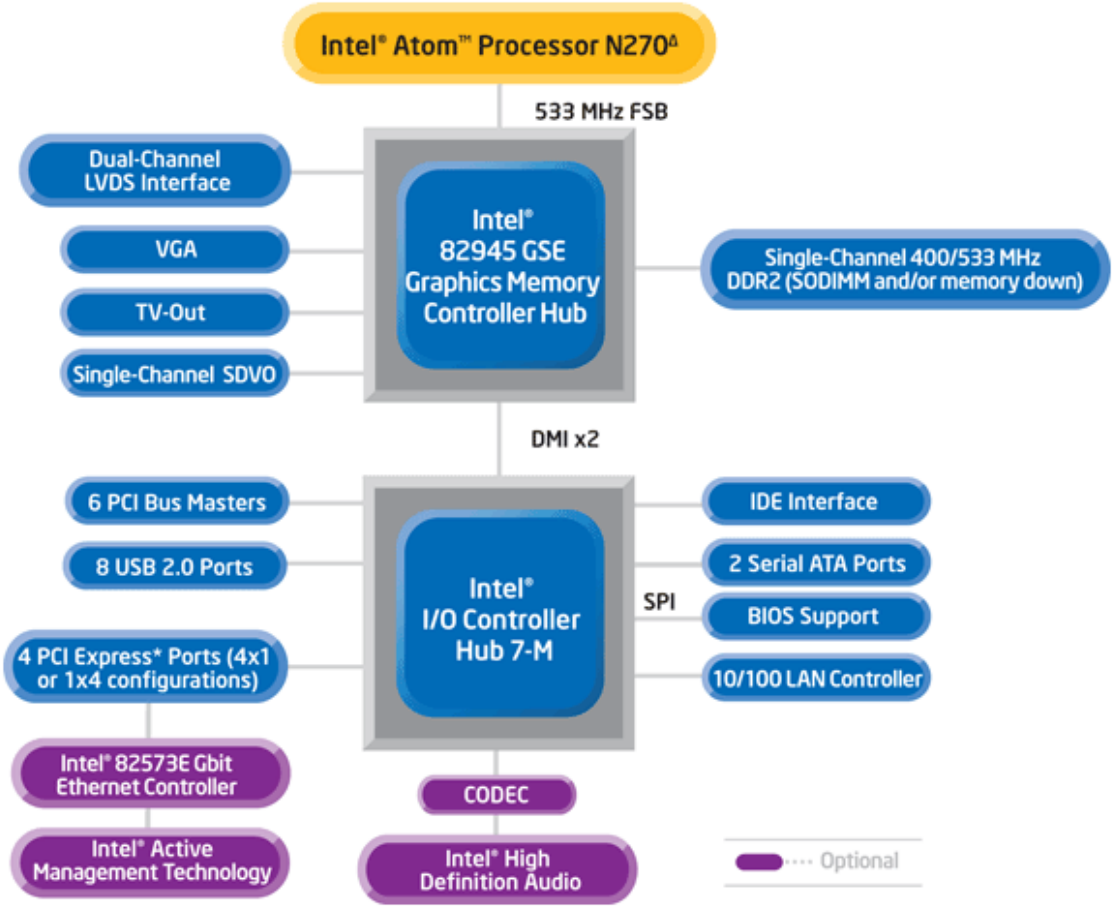
- Application Notes/EE Notes
- Data Sheets
- Development Tools Overview
- Code Examples
- Complementary Parts Guide
- Evaluation Kits
- IC Anomalies
- Manuals
- Technical Articles
- Tools Anomalies
- Tools Selection Table
- VisualDSP++ Full Version
- VisualDSP++ Registration
- VisualDSP++ Tools Upgrades

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

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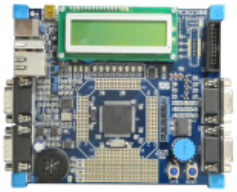

The Keil MCB2370 Evaluation Board introduces you to the NXP LPC2378 microcontroller. It allows you to create and test working programs for this advanced architecture.

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