



ATMEL® CORPORATION

AVR® Microcontrollers: Product Line Reference

August 2007 Edition

Table of Contents

1	AVR Product Family	2
1.1	PRODUCT SELECTION GUIDE - TINYAVR®	2
1.2	PRODUCT SELECTION GUIDE - MEGA AVR®	3
1.3	PRODUCT SELECTION GUIDE – PICOPOWER™ AVR	4
1.4	PRODUCT SELECTION GUIDE - AVR FOR LCD, USB, CAN, LIGHTING	5
1.5	PRODUCT SELECTION GUIDE – AVR Z-LINK®	5
1.6	PRODUCT SELECTION GUIDE – AUTOMOTIVE AVR	6
1.7	PRODUCT SELECTION GUIDE – AVR32 AP FAMILY	6
1.8	PRODUCT SELECTION GUIDE – AVR32 UC3 FAMILY	7
2	Application Area in Focus: An Introduction to AVR32 Studio.....	8
2.1	INTRODUCTION	8
2.2	STRUCTURE	8
2.2	FUNCTIONALITY	8
2.3	EASE OF USE	9
3	Automotive Qualification Status.....	10
4	AVR Development Tools	11
4.1	PRICE REFERENCE	11
4.2	AVR STUDIO® TOOLS AND DEVICE SUPPORT	12
5	Documentation.....	13
5.1	DATASHEETS	13
5.2	APPLICATION NOTES	15
6	AVR Product Line and Regional Contacts.....	18



1 AVR Product Family

1.1 Product Selection Guide - tinyAVR®

Device	Status	Flash (Kbytes)	EEPROM (Kbytes)	SRAM (Bytes)	Max I/O Pins	F _{max} (MHz)	V _{cc} (V)	16-bit Timers	8-bit Timer	PWM (ch)	RTC	SPI	USART	I ² C	SP	10-bit A/D (ch.)	Analog Comparator	Brown Out Detector	Watchdog	On Chip Oscillator	Hardware Multiplier	Interrupts	Ext Interrupts	Self Program Memory	Packages	Green Packages
ATtiny11	N	1	--	--	6	6	2.7-5.5	--	1	--	--	--	--	--	--	--	Yes	--	Yes	Yes	--	4	1	--	PDIP8, SOIC8	PDIP8, SOIC8
ATtiny12	P	1	0.064	--	6	8	1.8-5.5	--	1	--	--	--	--	--	Yes	--	Yes	Yes	Yes	Yes	--	5	1	--	PDIP8, SOIC8	PDIP8, SOIC8
ATtiny13	P	1	0.064	64	6	20	1.8-5.5	--	1	2	--	--	--	--	Yes	4	Yes	Yes	Yes	Yes	--	9	6	Yes	PDIP8, SOIC8, SSOIC8, MLF20	PDIP8, SOIC8, SSOIC8, MLF20
ATtiny15L	N	1	0.064	--	6	1.6	2.7-5.5	--	2	1	--	--	--	--	Yes	4	Yes	Yes	Yes	Yes	--	8	1(+5)	--	PDIP8, SOIC8	
ATtiny25	P	2	0.128	128	6	20	1.8-5.5	--	2	4	--	USI	--	USI	Yes	4	Yes	Yes	Yes	Yes	--	15	7	Yes		PDIP8, SOIC8, MLF20
ATtiny45	P	4	0.256	256	6	20	1.8-5.5	--	2	4	--	USI	--	USI	Yes	4	Yes	Yes	Yes	Yes	--	15	7	Yes		PDIP8, SOIC8, MLF20
ATtiny85	P	8	0.512	512	6	20	1.8-5.5	--	2	4	--	USI	--	USI	Yes	4	Yes	Yes	Yes	Yes	--	15	7	Yes		PDIP8, SOIC8, MLF20
ATtiny28L	P	2	--	--	11	4	1.8-5.5	--	1	--	--	--	--	--	--	--	Yes	--	Yes	Yes	--	5	2(+8)	--	PDIP28, MLF32, TQFP32	PDIP28, MLF32, TQFP32
ATtiny24	P	2	0.128	128	12	20	1.8-5.5	1	1	4	--	USI	--	USI	Yes	8	Yes	Yes	Yes	Yes	--	17	12	Yes		PDIP14, SOIC14, MLF20
ATtiny44	P	4	0.256	256	12	20	1.8-5.5	1	1	4	--	USI	--	USI	Yes	8	Yes	Yes	Yes	Yes	--	17	12	Yes		PDIP14, SOIC14, MLF20
ATtiny84	I	8	0.512	512	12	20	1.8-5.5	1	1	4	--	USI	--	USI	Yes	8	Yes	Yes	Yes	Yes	--	17	12	Yes		PDIP14, MLF20
ATtiny26	N	2	0.128	128	16	16	2.7-5.5	--	2	2	--	USI	--	USI	Yes	11	Yes	Yes	Yes	Yes	--	11	1	--	PDIP20, SOIC20, MLF32	PDIP20, SOIC20, MLF32
ATtiny261	I	2	0.128	128	16	20	1.8-5.5	1	1	5	--	USI	--	USI	Yes	11	Yes	Yes	Yes	Yes	--	19	18	Yes		PDIP20, SOIC20, MLF32
ATtiny461	P	4	0.256	256	16	20	1.8-5.5	1	1	5	--	USI	--	USI	Yes	11	Yes	Yes	Yes	Yes	--	19	18	Yes		PDIP20, SOIC20, MLF32
ATtiny861	P	8	0.512	512	16	20	1.8-5.5	1	1	5	--	USI	--	USI	Yes	11	Yes	Yes	Yes	Yes	--	19	18	Yes		PDIP20, SOIC20, MLF32
ATtiny2313	P	2	0.128	128	18	20	1.8-5.5	1	1	4	--	USI	1	USI	Yes	--	Yes	Yes	Yes	Yes	--	8	2	Yes	PDIP20, SOIC20, MLF20	PDIP20, SOIC20, MLF20

Status: I - Device under introduction, P - Device in production, N - not recommended for new designs



1.2 Product Selection Guide - megaAVR®

Device	Status	Flash (Kbytes)	EEPROM (Kbytes)	SRAM (Bytes)	Max I/O Pins	F _{max} (MHz)	V _{cc} (V)	16-bit Timers	8-bit Timer	PWM (ch)	RTC	SPI	USART	I ² C	ISP	10-bit AD (channels)	Analog Comparator	Brown Out Detector	Watchdog	On Chip Oscillator	Hardware Multiplier	Interrupts	Ext Interrupts	Self Program Memory	Packages	Green Packages
ATmega48	P	4	0.256	512	23	20	1.8-5.5	1	2	6	Yes	1+USART	1	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	26	26	Yes	PDIP28, MLF32, TOFP32	PDIP28, MLF32, TOFP32
ATmega8	P	8	0.512	1024	23	16	2.7-5.5	1	2	3	Yes	1	1	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	18	2	Yes	PDIP28, MLF32, TOFP32	PDIP28, MLF32, TOFP32
ATmega88	P	8	0.512	1024	23	20	1.8-5.5	1	2	6	Yes	1+USART	1	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	26	26	Yes	PDIP28, MLF32, TOFP32	PDIP28, MLF32, TOFP32
ATmega168	P	16	0.512	1024	23	20	1.8-5.5	1	2	6	Yes	1+USART	1	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	26	26	Yes	PDIP28, MLF32, TOFP32	PDIP28, MLF32, TOFP32
ATmega8535	P	8	0.512	512	32	16	2.7-5.5	1	2	4	--	1	1	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	20	3	Yes	PDIP40, MLF44, TOFP44, PLCC44	PDIP40, MLF44, TOFP44
ATmega16	P	16	0.512	1024	32	16	2.7-5.5	1	2	4	Yes	1	1	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	20	3	Yes	PDIP40, MLF44, TOFP44	PDIP40, MLF44, TOFP44
ATmega32	P	32	1	2048	32	16	2.7-5.5	1	2	4	Yes	1	1	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	19	3	Yes	PDIP40, MLF44, TOFP44	PDIP40, MLF44, TOFP44
ATmega644	P	64	2	4096	32	20	1.8-5.5	1	2	6	Yes	1+USART	1	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	31	32	Yes		PDIP40, MLF44, TOFP44
ATmega8515	P	8	0.512	512	35	16	2.7-5.5	1	1	3	--	1	1	--	Yes	--	--	Yes	Yes	Yes	Yes	16	3	Yes	PDIP40, MLF44, TOFP44, PLCC44	PDIP40, MLF44, TOFP44
ATmega162	P	16	0.512	1024	35	16	1.8-5.5	2	2	6	Yes	1	2	--	Yes	--	Yes	Yes	Yes	Yes	Yes	28	3	Yes	PDIP40, MLF44, TOFP44	PDIP40, MLF44, TOFP44
ATmega128	P	128	4	4096	53	16	2.7-5.5	2	2	8	Yes	1	2	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	34	8	Yes	MLF64, TOFP64	MLF64, TOFP64
ATmega165	N	16	0.512	1024	54	16	1.8-5.5	1	2	4	Yes	1+USI	1	USI	Yes	8	Yes	Yes	Yes	Yes	Yes	23	17	Yes	MLF64, TOFP64	MLF64, TOFP64
ATmega325	P	32	1	2048	54	16	1.8-5.5	1	2	4	Yes	1+USI	1	USI	Yes	8	Yes	Yes	Yes	Yes	Yes	23	17	Yes	MLF64, TOFP64	MLF64, TOFP64
ATmega64	P	64	2	4096	54	16	2.7-5.5	2	2	8	Yes	1	2	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	34	8	Yes	MLF64, TOFP64	MLF64, TOFP64
ATmega645	P	64	2	4096	54	16	1.8-5.5	1	2	4	Yes	1+USI	1	USI	Yes	8	Yes	Yes	Yes	Yes	Yes	23	17	Yes	MLF64, TOFP64	MLF64, TOFP64
ATmega1281	P	128	4	8192	54	16	1.8-5.5	4	2	10	Yes	1+USART	2	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	48	17	Yes		MLF64, TOFP64
ATmega2561	P	256	4	8192	54	16	1.8-5.5	4	2	10	Yes	1+USART	2	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	48	17	Yes		MLF64, TOFP64
ATmega3250	I	32	1	2048	69	16	1.8-5.5	1	2	4	Yes	1+USI	1	USI	Yes	8	Yes	Yes	Yes	Yes	Yes	32	17	Yes	TOFP100	TOFP100
ATmega6450	I	64	2	4096	69	16	1.8-5.5	1	2	4	Yes	1+USI	1	USI	Yes	8	Yes	Yes	Yes	Yes	Yes	32	17	Yes	TOFP100	TOFP100
ATmega640	I	64	4	8192	86	16	1.8-5.5	4	2	16	Yes	1+USART	4	Yes	Yes	16	Yes	Yes	Yes	Yes	Yes	57	32	Yes		TOFP100, BGA100
ATmega1280	P	128	4	8192	86	16	1.8-5.5	4	2	16	Yes	1+USART	4	Yes	Yes	16	Yes	Yes	Yes	Yes	Yes	57	32	Yes		TOFP100, BGA100
ATmega2560	P	256	4	8192	86	16	1.8-5.5	4	2	16	Yes	1+USART	4	Yes	Yes	16	Yes	Yes	Yes	Yes	Yes	57	32	Yes		TOFP100, BGA100

Status: I - Device under introduction, P - Device in production, N - not recommended for new designs



1.3 Product Selection Guide – picoPower™ AVR

Device	Status	Flash (Kbytes)	EEPROM (Kbytes)	SRAM (Bytes)	Max I/O Pins	F _{max} (MHz)	V _{cc} (V)	Specific Features	16-bit Timers	8-bit Timer	PWM (ch)	RTC	SPI	USART	TWI	ISP	10-bit A/D (channels)	Analog Comparator	Brown Out Detector	Watchdog	On Chip Oscillator	Hardware Multiplier	Interrupts	Ext Interrupts	Self Program Memory	Green Packages
ATmega48P	F	4	0.256	512	23	16	1.8-5.5		1	2	6	Yes	1+USART	1	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	26	26	Yes	MLF32, TQFP32
ATmega88P	F	8	0.512	512	23	16	1.8-5.5		1	2	6	Yes	1+USART	1	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	26	26	Yes	MLF32, TQFP32
ATmega168P	F	16	1	1024	23	16	1.8-5.5		1	2	6	Yes	1+USART	1	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	26	26	Yes	MLF32, TQFP32
ATmega164P	P	16	0.512	1024	32	20	1.8-5.5		1	2	6	Yes	1+USART	2	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	31	32	Yes	PDIP40, MLF44, TQFP44
ATmega324P	P	32	1	2048	32	20	1.8-5.5		1	2	6	Yes	1+USART	2	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	31	32	Yes	PDIP40, MLF44, TQFP44
ATmega644P	I	64	2	4096	32	20	1.8-5.5		1	2	6	Yes	1+USART	2	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	31	32	Yes	PDIP40, MLF44, TQFP44
ATmega165P	P	16	0.512	1024	54	16	1.8-5.5		1	2	4	Yes	1+USI	1	USI	Yes	8	Yes	Yes	Yes	Yes	Yes	23	17	Yes	MLF64, TQFP64
ATmega325P	I	32	1	2048	54	16	1.8-5.5		1	2	4	Yes	1+USI	1	USI	Yes	8	Yes	Yes	Yes	Yes	Yes	23	17	Yes	MLF64, TQFP64
ATmega3250P	I	32	1	2048	69	16	1.8-5.5		1	2	4	Yes	1+USI	1	USI	Yes	8	Yes	Yes	Yes	Yes	Yes	32	17	Yes	TQFP100
ATmega169P	P	16	0.512	1024	54	16	1.8-5.5	LCD 4x25	1	2	4	Yes	1+USI	1	USI	Yes	8	Yes	Yes	Yes	Yes	Yes	23	17	Yes	MLF64, TQFP64
ATmega329P	I	32	1	2048	54	16	1.8-5.5	LCD 4x25	1	2	4	Yes	1+USI	1	USI	Yes	8	Yes	Yes	Yes	Yes	Yes	25	17	Yes	MLF64, TQFP64
ATmega3290P	I	32	1	2048	69	16	1.8-5.5	LCD 4x40	1	2	4	Yes	1+USI	1	USI	Yes	8	Yes	Yes	Yes	Yes	Yes	25	32	Yes	TQFP100

Status: F - Future Design, I - Device under introduction, P - Device in production, N - not recommended for new designs



1.4 Product Selection Guide - AVR for LCD, USB, CAN, Lighting

Device	Status	Flash (Kbytes)	EEPROM (Kbytes)	SRAM (Bytes)	Max. I/O Pins	F _{max} (MHz)	V _{cc} (V)	Specific Features	16-bit Timers	8-bit Timer	PWM (ch)	RTC	SPI	USART	I ² C	SP	10-bit A/D (channels)	Analog Comparator	Brown Out Detector	Watchdog	On-Chip Oscillator	Hardware Multiplier	Interrupts	Ext Interrupts	Self Program Memory	Packages	Green Packages
ATmega406	P	40	0.512	2048	18	1	4-25	Smart battery	1	1	1	Yes	-	-	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes	23	4	Yes		LOFP48
AT90PWM2	P	8	0.512	512	19	16	2.7-5.5	PWM	1	1	7	Yes	1	Yes	--	Yes	8	Yes	Yes	Yes	Yes	Yes	--	4	Yes		SO24
AT90PWM3	P	8	0.512	512	27	16	2.7-5.5	PWM	1	1	10	Yes	1	Yes	--	Yes	11	Yes	Yes	Yes	Yes	Yes	--	4	Yes		SO32, MLF32
AT90CAN32	I	32	1	2048	53	16	2.7-5.5	CAN controller	2	2	8	Yes	Yes	2	--	Yes	8	Yes	Yes	Yes	Yes	Yes	34	8	Yes	MLF64, TOFP64	MLF64, TOFP64
AT90CAN64	I	64	2	4096	53	16	2.7-5.5	CAN controller	2	2	8	Yes	Yes	2	--	Yes	8	Yes	Yes	Yes	Yes	Yes	34	8	Yes	MLF64, TOFP64	MLF64, TOFP64
AT90CAN128	P	128	4	4096	53	16	2.7-5.5	CAN controller	2	2	8	Yes	Yes	2	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	34	8	Yes	MLF64, TOFP64	MLF64, TOFP64
AT90USB82	I	8	0.512	512	22	16	2.7-5.5	USB	1	1	5	--	Yes	1	--	Yes	--	Yes	Yes	Yes	Yes	--	29	8	Yes		MLF32
AT90USB162	I	16	0.512	512	22	16	2.7-5.5	USB	1	1	5	--	Yes	1	--	Yes	--	Yes	Yes	Yes	Yes	--	29	8	Yes		MLF32, TOFP32
AT90USB646	I	64	2	4096	48	16	2.7-5.5	USB	2	2	8	Yes	Yes	1	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	34	8	Yes		MLF64
AT90USB647	I	64	2	4096	48	16	2.7-5.5	USB+OTG	2	2	8	Yes	Yes	1	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	34	8	Yes		MLF64, TOFP64
AT90USB1286	I	128	4	8192	48	16	2.7-5.5	USB	2	2	8	Yes	Yes	1	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	34	8	Yes		MLF64
AT90USB1287	I	128	4	8192	48	16	2.7-5.5	USB+OTG	2	2	8	Yes	Yes	1	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	34	8	Yes		MLF64, TOFP64
ATmega169	N	16	0.512	1024	54	16	1.8-5.5	LCD 4x25	1	2	4	Yes	1+USI	1	USI	Yes	8	Yes	Yes	Yes	Yes	Yes	23	17	Yes	MLF64, TOFP64	MLF64, TOFP64
ATmega329	P	32	1	2048	54	16	1.8-5.5	LCD 4x25	1	2	4	Yes	1+USI	1	USI	Yes	8	Yes	Yes	Yes	Yes	Yes	25	17	Yes	MLF64, TOFP64	MLF64, TOFP64
ATmega3290	P	32	1	2048	69	16	1.8-5.5	LCD 4x40	1	2	4	Yes	1+USI	1	USI	Yes	8	Yes	Yes	Yes	Yes	Yes	25	32	Yes	TOFP100	TOFP100
ATmega649	I	64	2	4096	54	16	1.8-5.5	LCD 4x25	1	2	4	Yes	1+USI	1	USI	Yes	8	Yes	Yes	Yes	Yes	Yes	25	17	Yes	MLF64, TOFP64	MLF64, TOFP64
ATmega6490	I	64	2	4096	69	16	1.8-5.5	LCD 4x40	1	2	4	Yes	1+USI	1	USI	Yes	8	Yes	Yes	Yes	Yes	Yes	25	32	Yes	TOFP100	TOFP100

Status: F - Future Design, I - Device under introduction, P - Device in production, N - not recommended for new designs

1.5 Product Selection Guide – AVR Z-Link®

Product	Status	AVR	Radio	Flash (KB)	EEPROM (KB)	RAM (KB)	ISM Band [GHz]	Sensitivity [dBm]	Output power [dBm]	Supply V _{cc} [V]	I/Os
ATmega64RZA	I	mega644	RF230	64	1	4	2.4	-101	3	1.8-3.6	32
ATmega64RZAP	I	mega644P	RF230	64	1	4	2.4	-101	3	1.8-3.6	32
ATmega128RZA	I	mega1281	RF230	128	4	8	2.4	-101	3	1.8-3.6	54
ATmega128RZB	I	mega1280	RF230	128	4	8	2.4	-101	3	1.8-3.6	86
ATmega256RZA	I	mega2561	RF230	256	4	8	2.4	-101	3	1.8-3.6	54
ATmega256RZB	I	mega2560	RF230	256	4	8	2.4	-101	3	1.8-3.6	86

Status: I - Device under introduction, P - Device in production, N - not recommended for new designs



1.6 Product Selection Guide – Automotive AVR

Device	Status	Flash (Kbytes)	EEPROM (Kbytes)	SRAM (Bytes)	Max I/O Pins	F. max (MHz)	Vcc (V)	Specific Features	16-bit Timers	8-bit Timer	PWM (ch)	RTC	SPI	USART	TWI	ISP	10-bit A/D (ch.)	Analog Comparator	Brown Out Detector	Watchdog	On-Chip Oscillator	Hardware Multiplier	Interrupts	Ext Interrupts	Self Program Memory	Packages	Green Packages
ATtiny25 Automotive	I	2	0.128	128	6	16	2.7-5.5		--	2	4	--	USI	--	USI	Yes	4	Yes	Yes	Yes	Yes	--	15	7	Yes		SOIC8
ATtiny45 Automotive	P	4	0.256	256	6	16	2.7-5.5		--	2	4	--	USI	--	USI	Yes	4	Yes	Yes	Yes	Yes	--	15	7	Yes		SOIC8
ATtiny85 Automotive	I	8	0.512	512	6	16	2.7-5.5		--	2	4	--	USI	--	USI	Yes	4	Yes	Yes	Yes	Yes	--	15	7	Yes		SOIC8
ATtiny24 Automotive	I	2	0.128	128	12	16	2.7-5.5		1	1	4	--	USI	--	USI	Yes	8	Yes	Yes	Yes	Yes	--	17	12	Yes		SOIC14, MLF20
ATtiny44 Automotive	I	4	0.256	256	12	16	2.7-5.5		1	1	4	--	USI	--	USI	Yes	8	Yes	Yes	Yes	Yes	--	17	12	Yes		SOIC14, MLF20
ATtiny84 Automotive	I	8	0.512	512	12	16	2.7-5.5		1	1	4	--	USI	--	USI	Yes	8	Yes	Yes	Yes	Yes	--	17	12	Yes		MLF20
ATmega48 Automotive	P	4	0.256	512	23	16	2.7-5.5		1	2	6	Yes	1+USART	1	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	26	26	Yes		MLF32, TQFP32
ATmega88 Automotive	P	8	0.512	1024	23	16	2.7-5.5		1	2	6	Yes	1+USART	1	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	26	26	Yes		MLF32, TQFP32
ATmega168 Automotive	P	16	0.512	1024	23	16	2.7-5.5		1	2	6	Yes	1+USART	1	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	26	26	Yes		MLF32, TQFP32
ATmega164P Automotive	I	16	0.512	1024	32	16	2.7-5.5		1	2	6	Yes	1+USART	2	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	31	32	Yes	TQFP 44	TQFP 44 OFN 44
ATmega324P Automotive	I	32	1	2048	32	16	2.7-5.5		1	2	6	Yes	1+USART	2	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	31	32	Yes	TQFP 44	TQFP 44 OFN 44
ATmega644P Automotive	I	64	2	4096	32	16	2.7-5.5		1	2	6	Yes	1+USART	2	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	31	32	Yes	TQFP 44	TQFP 44 OFN 44
AT90CAN32 Automotive	I	32	1	2048	53	16	2.7-5.5	CAN controller	2	2	8	Yes	Yes	2	--	Yes	8	Yes	Yes	Yes	Yes	Yes	34	8	Yes	MLF64	MLF64, LGFP64
AT90CAN64 Automotive	I	64	2	4096	53	16	2.7-5.5	CAN controller	2	2	8	Yes	Yes	2	--	Yes	8	Yes	Yes	Yes	Yes	Yes	34	8	Yes	MLF 64	MLF 64 LQFP 64
AT90CAN128 Automotive	P	128	4	4096	53	16	2.7-5.5	CAN controller	2	2	8	Yes	Yes	2	Yes	Yes	8	Yes	Yes	Yes	Yes	Yes	34	8	Yes	MLF64, TQFP64	MLF64, TQFP64

Status: I - Device under introduction, P - Device in production, N - not recommended for new designs

1.7 Product Selection Guide – AVR32 AP family

Device	Status	SRAM (Kbytes)	DSP Instructions	Vector Multiplier Coprocessor	Ethernet MAC 10/100	USB Device	LCD Controller	UART USART DBGU	10-bit A/D (channels)	PWM (channels)	Max I/O Pins	Audio DAC (16-bit)	PDC (channels)	External Bus Interface	SDRAM interface	16-bit Timers	RTC	SPI	AC97	Camera Interface	PS/2	SSC	TWI / I2C	MCI	Watchdog Timer	POR	BOD	On-chip RC Oscillator	Crystal Oscillator	PLL	CPU Core	ECCC	MMU/MPU	JTAG	Power Supply (V)	Green Packages
AT32AP7000	I	32	Yes	Yes	2	1 x HS	2048 x 2048 24-bit	4	-	4	160	Stereo	20	Yes	Yes	3	1	2	1	CMOS	Yes	3	1	1	Yes	Yes	-	-	2	2	AP	Yes	MMU	Yes	1.65-1.95 Core 3.0-3.6 IO	256 CTBGA
AT32AP7001	I	32	Yes	Yes	0	1 x HS	-	4	-	4	90	Stereo	20	Yes	Yes	3	1	2	1	CMOS	Yes	3	1	1	Yes	Yes	-	-	2	2	AP	Yes	MMU	Yes	1.65-1.95 Core 3.0-3.6 IO	208 VQFP
AT32AP7002	I	32	Yes	Yes	0	1 x HS	2048 x 2048 18-bit	4	-	4	85	Stereo	20	Yes	Yes	3	1	2	1	CMOS	Yes	3	1	1	Yes	Yes	-	-	2	2	AP	Yes	MMU	Yes	1.65-1.95 Core 3.0-3.6 IO	196 CTBGA

Status: I - Device under introduction, P - Device in production, N - not recommended for new designs



1.8 Product Selection Guide – AVR32 UC3 family

Product	Status	RAM (Bytes)	I/O Pins	UART/USART	SPI	TWI (I2C compliant)	USB2 Full Speed	OTG	Ethernet MAC 10/100	Ext Bus Interface	system bus layers	Peripheral DAM ch	Synchronous Serial Controller	16-bit Timer	OS Timer	PWM Channels	Vcc Range (V)	Clock Speed (MHz)	Package	Pb-free, Green a)	Temp. Range
AT32UC3A0512	I	64	109	4	2	1	1	Y	1	1	6	15	1	3	1	7	3,3	66	QFP144	Y	-40°C to +85°C
AT32UC3A0256	I	64	109	4	2	1	1	Y	1	1	6	15	1	3	1	7	3,3	66	QFP144	Y	-40°C to +85°C
AT32UC3A0128	I	32	109	4	2	1	1	Y	1	1	6	15	1	3	1	7	3,3	66	QFP144	Y	-40°C to +85°C
AT32UC3A1512	I	64	69	4	2	1	1	Y	1	0	6	15	1	3	1	7	3,3	66	QFP100	Y	-40°C to +85°C
AT32UC3A1256	I	64	69	4	2	1	1	Y	1	0	6	15	1	3	1	7	3,3	66	QFP100	Y	-40°C to +85°C
AT32UC3A1128	I	32	69	4	2	1	1	Y	1	0	6	15	1	3	1	7	3,3	66	QFP100	Y	-40°C to +85°C
AT32UC3B0256	I	32	44	3	1	1	1	Y	0	0	5	7	1	3	1	7	3,3	60	QFP/QFN64	Y	-40°C to +85°C
AT32UC3B0128	I	32	44	3	1	1	1	Y	0	0	5	7	1	3	1	7	3,3	60	QFP/QFN64	Y	-40°C to +85°C
AT32UC3B064	I	16	44	3	1	1	1	Y	0	0	5	7	1	3	1	7	3,3	60	QFP/QFN64	Y	-40°C to +85°C
AT32UC3B1256	I	32	28	2	1	1	1	N	0	0	5	7	0	3	1	7	3,3	60	QFP/QFN48	Y	-40°C to +85°C
AT32UC3B1128	I	32	28	2	1	1	1	N	0	0	5	7	0	3	1	7	3,3	60	QFP/QFN48	Y	-40°C to +85°C
AT32UC3B164	I	16	28	2	1	1	1	N	0	0	5	7	0	3	1	7	3,3	60	QFP/QFN48	Y	-40°C to +85°C

Status: I - Device under introduction, P - Device in production, N - not recommended for new designs

2 Application Area in Focus: An Introduction to AVR32 Studio

Written by Design Engineer Tore Olsen.

2.1 Introduction

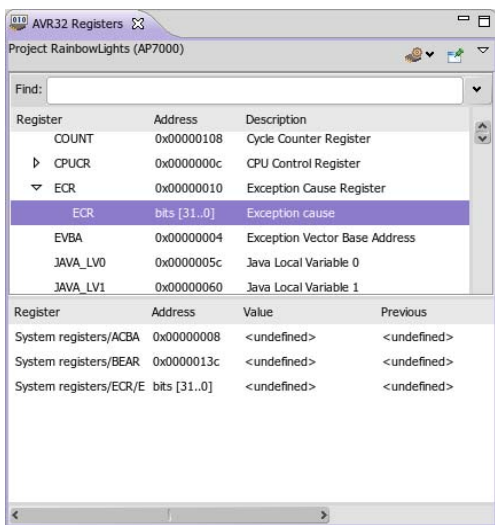
AVR32 Studio is Atmel’s integrated development environment (IDE) for the AVR32 microcontroller family. It is a complete solution for developing and debugging applications for the AVR32 MCUs and MPUs, providing an easy-to-learn, easy-to-use front end to Atmel’s development tools. In this article we present some of the highlights of AVR32 Studio.

2.2 Structure

Initially Atmel has provided a tool chain including the GNU Compiler (GCC), GNU Debugger (GDB), standard C libraries, and utilities for programming the AVR32 devices. Until now these tools have been using a command line interface, and development typically required manually maintaining a makefile. With AVR32 Studio, Atmel integrates the various development tasks, from project creation via coding and building to deployment and debugging, into a single graphical user interface (GUI). This simplifies the task of setting up and managing projects and speeds up the development process.

AVR32 Studio is Built on Eclipse™. Eclipse is an applications platform where a large network of vendors and individuals extend the functionality. With projects such as the C/C++ Development Environment (CDT) and the Device Software Development Platform (DSDP), Eclipse is quickly becoming a standard within the embedded systems development community. Eclipse enables increased functionality by providing high quality frameworks and the ability to add third party plug-ins. By enforcing user interface consistency it reduces the learning curve of the IDE.

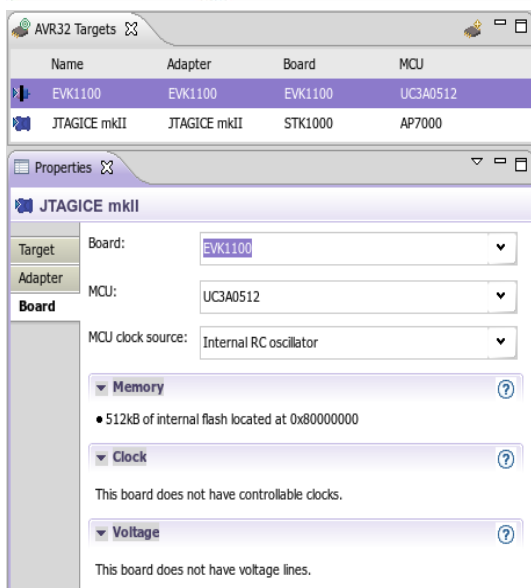
2.2 Functionality



With AVR32 Studio, C/C++ projects for AVR32 are created easily with a wizard. Multiple projects in the user’s workspace can be developed simultaneously, and project dependencies ensure executables are built in the correct order. The C/C++ editor has all the state-of-the-art features for simplifying code writing such as syntax highlighting, automated code formatting, and source indexing of code to provide tab-completion of function and variable names. The editor also generates an outline of the source for quick navigation.

AVR32 Studio's highly flexible GUI lets users customize the workspace to suit their individual needs and improve efficiency. All the most frequently used views for debugging are available: registers, variables, breakpoints, expressions, memory, and disassembly. While debugging applications, the AVR32 Registers view is used to watch I/O or System registers. This searchable view is also useful

when writing applications since it displays every register on the microcontroller in a logical hierarchy – right down to the individual bits and their meaning.



The tools used for debugging and programming code on the AVR32 parts are displayed in the *AVR32 Targets* view. Providing easy access to actions such as programming Flash or reading the register file, this view defines the target as a combination of Adapter, Board, and Microcontroller. Each target holds all of the information needed to program and debug the microcontroller, both for devices with on-chip Flash, and systems using an onboard CFI-compatible Flash.

The UC3 microcontroller family, with its on-chip Flash memory, has fuses that control the lock bits, the behavior of the Brown Out Detector (BOD) etc. With the Fuse Editor the fuse settings may be read from target, presented and edited in a descriptive form, and saved to a file. The settings can then be applied to a target manually or be automatically set by launching the application.

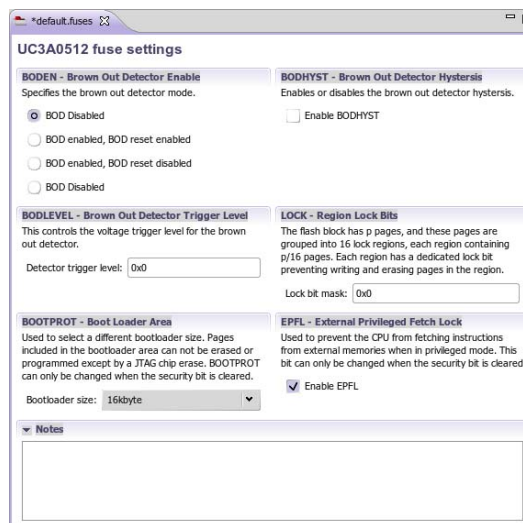
2.3 Ease of use

AVR32 Studio is an easy-to-use IDE for AVR32 developers. It comes with interactive tutorials covering topics such as project creation, debugging, and deployment. Each tool typically provides one or more tutorials demonstrating the tool’s capabilities.

Updates for AVR32 Studio are released on Atmel’s website, and new features including documentation and tutorials can be installed from within the IDE using the update manager. Plug-ins from third parties can be integrated into AVR32 Studio using the same mechanism. The update manager can also be configured to run automatically, either periodically or upon start.

With the release of AVR32 Studio 1.0, Atmel provides a feature-complete IDE for developing applications for the AVR32 architecture. In the coming releases support for additional tools and extra features for the AVR32 will be added, while keeping in sync with the Eclipse platform for integration with third parties – making AVR32 Studio the preferred environment for developing applications for the AVR32 architecture.

AVR32 Studio can be downloaded from Atmel’s website at the following location: www.atmel.com/dyn/products/tools_card.asp?tool_id=4116 or by navigating through www.atmel.com/avr32 and clicking on ‘Tools & Software’ and select AVR32 Studio.



3 Automotive Qualification Status

The following table gives an overview of the current automotive qualification status.

Device	Comment	Datasheet Available	Production (including PPAP/Qual.)
ATtiny24		Jun 07	Sep 07
ATtiny44		Jun 07	Aug 07
ATtiny84		Jun 07	Dec 07
ATmega164P		Jun 07	Jun 07
ATmega88V	Low-voltage version	Jun 07	Jul 07

Automotive AVR parts where the qualification is done:

- AT90CAN32/64/128
- ATmega48
- ATmega88
- ATmega88 (150°C)
- ATmega168
- Atmega324P
- Atmega644P
- ATtiny25
- ATtiny45
- ATtiny85
- ATtiny45 (150°C)



4 AVR Development Tools

Atmel provides a complete range of development tools for the AVR products.

4.1 Price Reference

Part Number	Description	Resale Price	Disti Cost
Software			
AVR Studio 4.13	Front end software for AVR development tools	Free	Free
AVR32 Studio	Front end software for AVR32 development tools	Free	Free
Starter Kits			
ATSTK500	AVR Starter Kit with AVR Studio Interface	\$79.00	\$63.00
ATSTK501	Expansion of STK500 to support 64-pin megaAVR devices	\$79.00	\$63.00
ATSTK502	Expansion of STK500 for 64-pin LCD AVR devices	\$99.00	\$79.00
ATSTK503	Expansion of STK500 for 100-pin megaAVR devices	\$119.00	\$94.00
ATSTK504	Expansion of STK500 for 100-pin LCD AVR devices	\$119.00	\$94.00
ATSTK505	Expansion of STK500 for 14-pin SOIC and 20-pin PDIP AVR devices	\$79.00	\$63.00
ATSTK520	Expansion of STK500 for 90PWM devices	\$79.00	\$63.00
ATSTK525	Starter Kit for AT90USB646/647/1286/1287	\$199.00	\$159.00
ATSTK526	Starter Kit for AT90USB82/162	\$199.00	\$159.00
ATSTK1000	Starter Kit for AVR32AP7xxx devices	\$499.00	\$400.00
AT90EIT1	AVR Embedded Internet Tool Kit	\$299.00	\$239.00
Evaluation Kits			
AVR Butterfly	ATmega169 Demo Board with LCD and Speaker	\$19.99	\$16.00
ATAVRFBKIT	DALI Dimmable Fluorescent Ballast Kit	\$199.00	\$159.00
AVRRTOS	AVR Real Time Operating System development kit	\$69.00	\$55.00
AT90USBKEY	AVR USB Key Demonstration Kit	\$29.99	\$24.00
ATAVRRZ200	Z-Link Demonstration Kit	\$499.00	\$410.00
ATAVRRZ201	Z-Link Demonstration Kit	\$229.00	\$179.00
ATAKSTK512-3	Remote Access Control – Unidirectional Kit 315 MHz	\$330.00	\$255.00
ATAKSTK512-4	Remote Access Control – Unidirectional Kit 434 MHz	\$330.00	\$255.00
ATEVK1100	Evaluation kit for AVR32 UC3A series	\$129.00	\$103.00
<i>ATEVK1101</i>	<i>Evaluation kit for AVR32 UC3B series</i>	<i>\$79.00</i>	<i>\$63.00</i>
<i>ATAVRAUTOEK1</i>	<i>AVR Automotive Evaluation Kit</i>	<i>\$188.00</i>	<i>\$150.00</i>
Development Kits			
ATAVRMC100	BLDC Motor Control with AT90PWM3	\$199.00	\$159.00
ATAVRMC200	AC Induction Motor Kit	\$299.00	\$239.00
ATAVRMC201	Induction Motor for ATAVRMC200	\$99.00	\$79.00
ATDVK90CAN1	DVK90CAN1 Development Kit for AT90CAN devices	\$115.00	\$90.00
ATAVRSB100	Smart Battery Development Kit for Atmega406	\$299.00	\$239.00
ATAVRISP2	AVRISP mkII is an ISP programmer for all AVR ISP devices	\$34.00	\$27.00
ATAVRRZ502	Z-Link RF Accessory Kit	\$99.00	\$79.00
ATAVRRZ541	Z-Link Packet Sniffer Kit	\$229.00	\$179.00
ATAVRDRAGON	AVR Dragon is a starter kit supporting On-Chip Debugging and programming for AVR.	\$49.00	\$39.00
ATNGW100	Network Gateway design kit and development board for the AT32AP7000	\$89.00	\$71.00



Part Number	Description	Resale Price	Disti Cost
Emulators			
ATJTAGICE2	JTAGICE mkII On-Chip Debugger supporting all AVR and AVR32 with debugWIRE or JTAG interface	\$299.00	\$239.00
JTAGPROBE	JTAGICE mkII Probe including Flex Cables	\$39.00	\$31.00
ATADAPCAN01	STK500/501 90CAN128 CAN adapter	\$19.00	\$14.00
ATAVRAUTO102	AVR Automotive Debugger	\$85.00	\$68.00

4.2 AVR Studio® Tools and Device Support

AVR Studio 4.13 with the latest Service Pack supports all new Atmel debug platforms and devices. Some of the old devices are not supported. See below for a table of currently supported tools and devices in AVR Studio. This support is in progress, and the table below is not guaranteed to be complete when this is read. This information can also be found in the AVR Studio online help and on www.atmel.com/avr

The latest AVR Studio SW can be found on: www.atmel.com/dyn/products/tools_card.asp?tool_id=2725

Device	Simulator/Assembler	JTAGICE mkII	Starter kit	AVR Dragon	AVRISP mkII
ATtiny11	•		ATSTK500	• ⁽¹⁾	
ATtiny12	•		ATSTK500	• ⁽¹⁾	•
ATtiny13	•	•	ATSTK500	•	•
ATtiny15	•		ATSTK500	• ⁽¹⁾	•
ATtiny24	•	•	ATSTK500 + ATSTK505	•	•
ATtiny25	•	•	ATSTK500	•	•
ATtiny26	•		ATSTK500 (+ATSTK505)	• ⁽¹⁾	•
ATtiny261	•	•	ATSTK500 (+ATSTK505)	•	•
ATtiny28	•		ATSTK500	• ⁽¹⁾	
ATtiny44	•	•	ATSTK500 + ATSTK505	•	•
ATtiny45	•	•	ATSTK500	•	•
ATtiny461	•	•	ATSTK500 (+ATSTK505)	•	•
ATtiny84	•	•	ATSTK500 + ATSTK505	•	•
ATtiny85	•	•	ATSTK500	•	•
ATtiny861	•	•	ATSTK500 (+ATSTK505)	•	•
ATtiny2313	•	•	ATSTK500	•	•
ATmega48	•	•	ATSTK500	•	•
ATmega8	•		ATSTK500	• ⁽¹⁾	•
ATmega88	•	•	ATSTK500	•	•
ATmega8515	•		ATSTK500	• ⁽¹⁾	•
ATmega8535	•		ATSTK500	• ⁽¹⁾	•
ATmega16	•	•	ATSTK500	•	•
ATmega162	•	•	ATSTK500	•	•
ATmega164P	•	•	ATSTK500	•	•
ATmega165	•	•	ATSTK500 + ATSTK502	•	•
ATmega165P	•	•	ATSTK500 + ATSTK502	•	•
ATmega168	•	•	ATSTK500	•	•
ATmega169	•	•	ATSTK500 + ATSTK502	•	•
ATmega169P	•	•	ATSTK500 + ATSTK502	•	•
ATmega32	•	•	ATSTK500	•	•
ATmega324P	•	•	ATSTK500	•	•
ATmega325	•	•	ATSTK500 + ATSTK502	•	•
ATmega325P	•	•	ATSTK500 + ATSTK502	•	•
ATmega3250	•	•	ATSTK500 + ATSTK504	•	•
ATmega3250P	•	•	ATSTK500 + ATSTK504	•	•



Device	Simulator/ Assembler	JTAGICE mkII	Starter kit	AVR Dragon	AVRISP mkII
ATmega329	•	•	ATSTK500 + ATSTK502	•	•
ATmega329P	•	•	ATSTK500 + ATSTK502	•	•
ATmega3290	•	•	ATSTK500 + ATSTK504	•	•
ATmega3290P	•	•	ATSTK500 + ATSTK504	•	•
ATmega64	•	•	ATSTK500 + ATSTK501	• ⁽¹⁾	•
ATmega640	•	•	ATSTK500 + ATSTK503	• ⁽¹⁾	•
ATmega644	•	•	ATSTK500	• ⁽¹⁾	•
ATmega644P	•	•	ATSTK500	• ⁽¹⁾	•
ATmega645	•	•	ATSTK500 + ATSTK502	• ⁽¹⁾	•
ATmega6450	•	•	ATSTK500 + ATSTK504	•	•
ATmega649	•	•	ATSTK500 + ATSTK502	•	•
ATmega6490	•	•	ATSTK500 + ATSTK504	•	•
ATmega128	•	•	ATSTK500 + ATSTK501	• ⁽¹⁾	•
ATmega1280	•	•	ATSTK500 + ATSTK503	• ⁽¹⁾	•
ATmega1281	•	•	ATSTK500 + ATSTK501	• ⁽¹⁾	•
ATmega2560	•	•	ATSTK500 + ATSTK503	• ⁽¹⁾	•
ATmega2561	•	•	ATSTK500 + ATSTK501	• ⁽¹⁾	•
ATmega406	•	•		•	
AT90CAN32	•	•	ATSTK500 + ATSTK501 + ATADAPCAN1	•	•
AT90CAN64	•	•	ATSTK500 + ATSTK501 + ATADAPCAN1	• ⁽¹⁾	•
AT90CAN128	•	•	ATSTK500 + ATSTK501 + ATADAPCAN1	• ⁽¹⁾	•
AT90PWM2	•	•	ATSTK500 + ATSTK520	•	•
AT90PWM3	•	•	ATSTK500 + ATSTK520	•	•
AT90USB646	•	•	ATSTK500 + ATSTK525	• ⁽¹⁾	•
AT90USB647	•	•	ATSTK500 + ATSTK525	• ⁽¹⁾	•
AT90USB1286	•	•	ATSTK500 + ATSTK525	• ⁽¹⁾	•
AT90USB1287	•	•	ATSTK500 + ATSTK525	• ⁽¹⁾	•
AT90USB82	•	•	ATSTK500 + ATSTK526	• ⁽¹⁾	•
AT90USB162	•	•	ATSTK500 + ATSTK526	• ⁽¹⁾	•
AT32AP7000		•	ATSTK1000		
AT32AP7001		•	ATSTK1000		
AT32AP7002		•	ATSTK1000		
AT32UC3A0			ATEVK1100		
AT32UC3A1			ATEVK1100		

⁽¹⁾ Programming only

5 Documentation

All documents listed can be downloaded from Atmel Corporation's web site: <http://www.atmel.com> under the product section. For other documentation, please send your request to avr@atmel.com.

5.1 Datasheets

The datasheets of all AVR devices can be downloaded.

AVR: http://www.atmel.com/dyn/products/datasheets.asp?family_id=607.

AVR32: http://www.atmel.com/dyn/products/datasheets.asp?family_id=682

Family	Devices	Language	Preliminary	Summary	Complete	Last Update
Auto AVR	ATtiny25/45/85 Automotive	English	X		X	03/07
Auto AVR	Appendix A - ATtiny45 Automotive specification at 150°C	English	X		X	03/07



Family	Devices	Language	Preliminary	Summary	Complete	Last Update
Auto AVR	Appendix B - ATtiny25/45/85 Automotive Specification at 1.8V	English	X		X	04/07
Auto AVR	ATtiny24/44/84 Automotive	English	X		X	05/07
Auto AVR	ATmega48/88/168 Automotive	English			X	03/07
Auto AVR	ATmega88 Automotive - 150°C Specification - Appendix A	English	X			03/07
Auto AVR	ATmega164P/324P/644P	English	X		X	04/07
Auto AVR	AT90CAN32/64/128 Automotive	English	X		X	01/07
CAN AVR	AT90CAN32/64/128	English	X	X	X	07/07
LCD AVR	ATmega169(V)	English		X	X	07/06
LCD AVR	ATmega169(V)	Chinese	X		X	09/04
LCD AVR	ATmega329/3290/649/6490	English	X	X	X	04/07
Lighting AVR	AT90PWM2, AT90PWM3	English	X		X	12/06
AVR Z-Link	AT86RF230 ZigBee™/IEEE 802.15.4-Transceiver	English	X		X	06/07
megaAVR	ATmega48/88/168	English	X	X	X	07/07
megaAVR	ATmega48/88/168	Chinese	X		X	02/05
megaAVR	ATmega8(L)	English		X	X	07/07
megaAVR	ATmega8(L)	Chinese			X	07/04
megaAVR	ATmega8515(L)	English		X	X	10/06
megaAVR	ATmega8515(L)	Chinese			X	09/04
megaAVR	ATmega8535(L)	English	X	X	X	10/06
megaAVR	ATmega8535(L)	Chinese	X		X	09/04
megaAVR	ATmega16(L)	English		X	X	03/07
megaAVR	ATmega16(L)	Chinese			X	10/04
megaAVR	ATmega162(V)	English		X	X	03/07
megaAVR	ATmega164P/324P/644P	English	X	X	X	04/07
megaAVR	ATmega165(V)	English	X	X	X	08/06
megaAVR	ATmega32(L)	English		X	X	10/06
megaAVR	ATmega32(L)	Chinese	X		X	09/04
megaAVR	ATmega325/3250/645/6450	English	X	X	X	04/07
megaAVR	ATmega64(L)	English		X	X	10/06
megaAVR	ATmega64(L)	Chinese	X		X	09/04
megaAVR	ATmega640/1280/1281/2560/2561	English	X	X	X	01/07
megaAVR	ATmega644	English	X	X	X	02/07
megaAVR	ATmega128(L)	English		X	X	10/06
megaAVR	ATmega128(L)	Chinese			X	05/04
picoPower megaAVR	ATmega164P/324P/644P	English	X	X	X	02/07
picoPower megaAVR	ATmega165P(V)	English	X	X	X	11/06
picoPower megaAVR	ATmega325P/3250P	English	X	X	X	12/06
picoPower LCD megaAVR	ATmega169P(V)	English	X	X	X	11/06
picoPower LCD megaAVR	ATmega329P/3290P	English	X	X	X	12/06
Smart Battery AVR	ATmega406	English	X	X	X	07/06
tinyAVR	ATtiny11/12	English		X	X	06/07
tinyAVR	ATtiny13	English	X	X	X	10/04
tinyAVR	ATtiny13	Chinese	X		X	01/07
tinyAVR	ATtiny15L	English		X	X	06/07
tinyAVR	ATtiny2313	English	X	X	X	04/06
tinyAVR	ATtiny2313	Chinese	X		X	07/04
tinyAVR	ATtiny24/44/84	English	X	X	X	02/07
tinyAVR	ATtiny25/45/85	English	X	X	X	12/06
tinyAVR	ATtiny26(L)	English		X	X	06/07
tinyAVR	ATtiny26(L)	Chinese	X		X	12/03



Family	Devices	Language	Preliminary	Summary	Complete	Last Update
tinyAVR	ATtiny261/461/861	English	X	X	X	11/06
tinyAVR	ATtiny28(L)(V)	English		X	X	07/06
USB AVR	AT90USB1287/1286/646/647	English	X		X	07/06
USB AVR	AT90USB82/162	English	X		X	03/07
USB AVR	USB DFU Bootloader Datasheet	English				04/06
AVR32	AT32AP7000	English	X	X	X	07/07
AVR32	AT32AP7001	English	X	X	X	07/07
AVR32	AT32AP7002	English	X	X	X	07/07
AVR32	AVR32 Architecture Manual	English	X		X	02/06
AVR32	AVR32 Technical Reference Manual	English	X		X	03/07
AVR32	AVR32 Java Technical Reference Manual	English	X		X	10/06
UC3	AT32UC3A0512, AT32UC3A0256, AT32UC3A0128, AT32UC3A1512, AT32UC3A1256, AT32UC3A1128	English	X	X	X	03/07
UC3	AT32UC3B0256, AT32UC3B0128, AT32UC3B064, AT32UC3B1256, AT32UC3B1128, AT32UC3B164	English	X	X	X	07/07

5.2 Application Notes

The application notes for all AVR devices can be downloaded.

AVR: http://www.atmel.com/dyn/products/app_notes.asp?family_id=607

AVR32: http://www.atmel.com/dyn/products/app_notes.asp?family_id=682

Note Number	Description	Last Update
AVR000	Register and Bit-Name Definitions for the AVR Microcontroller	04/98
AVR001	Conditional Assembly and Portability Macros	03/05
AVR030	Getting Started with IAR Embedded Workbench for Atmel AVR	10/04
AVR031	Getting Started with ImageCraft C for AVR	05/02
AVR032	Linker Command Files for the IAR ICCA90 Compiler	05/02
AVR033	Getting Started with the CodeVision AVR C Compiler	05/02
AVR034	Mixing C and Assembly Code with AVR Embedded Workbench for AVR	04/03
AVR035	Efficient C Coding for AVR	01/04
AVR040	EMC Design Considerations	06/06
AVR042	AVR Hardware Design Considerations	06/06
AVR053	Calibration of the Internal RC Oscillator	05/06
AVR054	Run-time calibration of the internal RC oscillator	02/06
AVR055	Using a 32kHz XTAL for run-time calibration of the internal RC	02/06
AVR060	JTAGICE	01/04
AVR061	STK500 Protocol	04/03
AVR063	LCD Driver for the STK@504	04/06
AVR064	STK502 – A Temperature Monitoring System with LCD Output	02/06
AVR065	LCD Driver for the STK502	02/06
AVR067	JTAGICE mkII Communication Protocol	04/06
AVR068	STK500 Communication Protocol	06/06
AVR069	AVRISP mkII Communication Protocol	02/06
AVR070	Modifying AT90ICEPRO to Support Emulation of AT90	05/02
AVR072	Accessing 16-bit I/O Registers	05/02
AVR073	Accessing 10- and 16-bit registers in ATtiny261/461/861	12/06
AVR074	Upgrading AT90ICEPRO to ICE10	05/02
AVR080	ATmega103 Replaced by ATmega128	01/04
AVR081	Replacing AT90S4433 by ATmega8	07/03
AVR082	Replacing ATmega161 by ATmega162	01/04
AVR083	Replacing ATmega163 by ATmega16	09/05



Note Number	Description	Last Update
AVR084	Replacing ATmega323 by ATmega32	07/03
AVR085	Replacing AT90S8515 by ATmega8515	01/04
AVR086	Replacing AT90S8535 by ATmega8535	07/03
AVR087	Migrating between ATmega8515 and ATmega162	07/03
AVR088	Migrating between ATmega8535 and ATmega16	01/04
AVR089	Migrating between ATmega16 and ATmega32	06/03
AVR090	Migrating between ATmega64 and ATmega128	06/03
AVR091	Replacing AT90S2313 by ATtiny2313	10/03
AVR092	Replacing ATtiny11/12 by ATtiny13	10/03
AVR093	Replacing AT90S1200 by ATtiny2313	10/03
AVR094	Replacing ATmega8 by ATmega88	04/05
AVR095	Migrating between ATmega48, ATmega88 and ATmega168	02/04
AVR096	Migrating from ATmega128 to AT90CAN128	03/04
AVR097	Migration between ATmega128 and ATmega2561	07/06
AVR098	Migration between ATmega169, ATmega329 and ATmega649	02/07
AVR099	Replacing AT90S4433 by ATmega48	07/04
AVR100	Accessing the EEPROM	09/05
AVR101	High Endurance EEPROM Storage	09/02
AVR102	Block Routines	05/02
AVR103	Using the EEPROM Programming Modes	03/05
AVR104	Buffered Interrupt Controlled EEPROM Writes	07/03
AVR105	Power Efficient High Endurance Parameter Storage in Flash Memory	09/03
AVR106	C functions for reading and writing to Flash memory	08/06
AVR107	Interfacing AVR serial memories	03/05
AVR108	Setup and Use of the LPM Instructions	05/02
AVR109	Self-programming	06/04
AVR120	Characterization and Calibration of the ADC on an AVR	02/06
AVR121	Enhancing ADC resolution by oversampling	09/05
AVR128	Setup and Use the Analog Comparator	05/02
AVR130	Setup and use the AVR Timers	02/02
AVR131	Using the AVR's High-speed PWM	09/03
AVR132	Using the Enhanced Watchdog Timer	11/03
AVR133	Long Delay Generation Using the AVR Microcontroller	02/04
AVR134	Real-Time Clock using the Asynchronous Timer	08/06
AVR135	Using Timer Capture to Measure PWM Duty Cycle	10/05
AVR136	Low-jitter Multi-channel Software PWM	05/06
AVR137	Writing Software Compatible for AT90PWM2/3 and AT90PWM2B/3B	12/06
AVR140	ATmega48/88/168 family run-time calibration of the Internal RC oscillator	09/06
AVR151	Setup and use of the SPI	09/05
AVR155	Accessing I2C LCD Display Using the AVR 2-Wire Serial Interface	09/05
AVR180	External Brown-Out Protection	05/02
AVR182	Zero Cross Detector	01/04
AVR191	Anti-Pinch Algorithm for AVR Adaptation Procedure	11/06
AVR200	Multiply and Divide Routines	05/06
AVR2001	AT86RF230 Software Programmer's Guide	07/07
AVR2005	Design Considerations for the AT86RF230	08/07
AVR201	Using the AVR Hardware Multiplier	06/02
AVR202	16-Bit Arithmetic	05/02
AVR204	BCD Arithmetic	01/03
AVR220	Bubble Sort	05/02
AVR221	Discrete PID controller	05/06
AVR222	8-Point Moving Average Filter	05/02
AVR223	Digital Filters with AVR	09/02
AVR230	DES Bootloader	04/05
AVR231	AES Bootloader	08/06
AVR236	CRC Check of Program Memory	05/02



Note Number	Description	Last Update
AVR240	4x4 Keypad-Wake Up on Keypress	06/06
AVR241	Direct driving of LCD display using general I/O	05/04
AVR242	8-bit Microcontroller Multiplexing LED Drive & a 4x4 Keypad	05/02
AVR243	Matrix Keyboard Decoder	01/03
AVR244	UART as ANSI Terminal Interface	11/03
AVR245	Code Lock with 4x4 Keypad and I2C™ LCD	10/05
AVR270	USB Mouse Demonstration	02/06
AVR271	USB Keyboard Demonstration	02/06
AVR272	USB CDC Demonstration UART to USB Bridge	04/06
AVR273	USB Mass Storage Implementation	04/06
AVR274	Single-wire Software UART	03/07
AVR276	USB Software Library for AT90USBxxx Microcontrollers	02/07
AVR277	On-The-Go (OTG) add-on to USB Software Library	07/07
AVR301	C Code for Interfacing AVR® to AT17CXX FPGA Configuration Memory	01/04
AVR303	SPI-UART Gateway	03/05
AVR304	Half Duplex Interrupt Driven Software UART	08/97
AVR305	Half Duplex Compact Software UART	09/05
AVR306	Using the AVR UART in C	07/02
AVR307	Half Duplex UART Using the USI Module	10/03
AVR308	Software LIN Slave	05/02
AVR309	Software Universal Serial Bus (USB)	02/06
AVR310	Using the USI Module as a I2C Master	09/04
AVR311	Using the TWI Module as a I2C Slave	10/04
AVR312	Using the USI Module as a I2C Slave	09/05
AVR313	Interfacing the PCAT Keyboard	09/05
AVR314	DTMF Generator	05/02
AVR315	Using the TWI Module as a I2C Master	10/04
AVR316	SMBus Slave Using the TWI Module	10/05
AVR317	Using the USART on the ATmega48/88/168 as a SPI master	11/04
AVR318	Dallas 1-Wire® Master	10/04
AVR319	Using the USI module for SPI communication	11/04
AVR320	Software SPI Master	09/05
AVR322	LIN v1.3 Protocol Implementation on Atmel AVR Microcontrollers	12/05
AVR323	Interfacing GSM modems	02/06
AVR325	High-Speed Interface to Host EPP Parallel Port	02/02
AVR328	USB Generic HID Implementation	01/06
AVR329	USB Firmware Architecture	02/06
AVR335	Digital Sound Recorder with AVR and Serial Data Flash	04/05
AVR336	ADPCM Decoder	01/05
AVR341	Four and five-wire Touch screen Controller	07/07
AVR350	XmodemCRC Receive Utility for AVR	09/05
AVR360	Step Motor Controller	04/03
AVR400	Low Cost A/D Converter	05/02
AVR401	8-Bit Precision A/D Converter	02/03
AVR410	RC5 IR Remote Control Receiver	05/02
AVR411	Secure Rolling Code Algorithm for Wireless Link	04/06
AVR414	User Guide - ATAVRRZ502 - Accessory Kit	12/06
AVR415	RC5 IR Remote Control Transmitter	05/03
AVR433	Power Factor Corrector (PFC) with AT90PWM2 Re-triggable High Speed PSC	03/06
AVR434	PSC Cookbook	10/06
AVR435	BLDC/BLAC Motor Control Using a Sinus Modulated PWM Algorithm	09/06
AVR440	Sensorless Control of Two-Phase Brushless DC Motor	09/05
AVR441	Intelligent BLDC Fan Controller with Temperature Sensor and Serial Interface	09/05
AVR442	PC Fan Control using ATtiny13	09/05
AVR443	Sensor-based control of three phase Brushless DC motor	02/06
AVR444	Sensorless control of 3-phase brushless DC motors	10/05



Note Number	Description	Last Update
AVR446	Linear speed control of stepper motor	06/06
AVR447	Sinusoidal driving of three-phase permanent magnet motor using ATmega48/88/168	06/06
AVR448	Control of High Voltage 3-Phase BLDC Motor	05/06
AVR449	Sinusoidal driving of 3-phase permanent magnet motor using ATtiny261/461/861	10/06
AVR450	Battery Charger for SLA, NiCd, NiMH and Li-ion Batteries	09/06
AVR452	Sensor-based Control of Three Phase Brushless DC Motors Using CAN128 64 32 or mega128 64 usi	03/06
AVR453	Smart Battery Reference Design	02/06
AVR454	Users Guide – ATAVRSB100 – Smart Battery Development Board	06/06
AVR460	Embedded Web Server	05/02
AVR461	Quick Start Guide for the Embedded Internet Toolkit	05/02
AVR462	Reducing the Power Consumption of ATEIT1	03/02
AVR465	Energy meter	07/04
AVR480	Anti-Pinch System for Electrical Window	12/06
AVR492	Brushless DC Motor Control using AT90PWM3	05/07
AVR493	Sensorless Commutation of Brushless DC Motor (BLDC) using AT90PWM3 and ATAVRMC100	07/06
AVR494	AC Induction Motor Control Using the constant V/f Principle and a Natural PWM Algorithm	12/05
AVR495	AC Induction Motor Control Using the Constant V/f Principle and a Space-vector PWM Algorithm	02/06
AVR500	Migration between Atmega64 and Atmega645	09/04
AVR501	Replacing ATtiny15 with ATtiny25	03/05
AVR502	Migration between Atmega165 and ATmega325	11/04
AVR503	Replacing AT90S/LS2323 or AT90S/LS2343 with ATtiny25	09/05
AVR504	Migrating from ATtiny26 to ATtiny261/461/861	10/06
AVR505	Migration between Atmega16/32 and ATmega164/324/644	06/06
AVR506	Migration from Atmega169 to ATmega169P	02/07
AVR507	Migration from ATmega329 to ATmega329P	11/06
AVR508	Migration from ATmega644 to ATmega644P	07/06
AVR509	Migration between ATmega169P and ATmega329P	11/06
AVR510	Migration between ATmega329/649 and ATmega3290/6490	07/06
AVR511	Migration from ATmega3290 to ATmega3290P	11/06
AVR513	Migration Note from Atmega165 to Atmega165P	03/07
AVR514	Migration Note from Atmega325 to Atmega325P	03/07
AVR910	In-System Programming	11/00
AVR911	AVR Open-source Programmer	07/04
AVR914	CAN & UART based Bootloader for AT90CAN32, AT90CAN64, & AT90CAN128	05/06
AVR32000	Introduction to AVR32 header files	05/06
AVR32100	Using the AVR32 USART	04/06
AVR32101	Configuring the AVR32 Interrupt Controller	04/06
AVR32102	Using the AVR32 SDRAM Controller	05/06
AVR32105	Master and Slave SPI Driver	05/06
AVR32107	Using TWI as a master on the AVR32	04/06
AVR32108	Peripheral Direct Memory Access Driver	05/06
AVR32110	Using the AVR32 Timer/Counter	05/06
AVR32111	Using the AVR32 PIO Controller	05/06
AVR32113	Configuration and Use of the Memory Management Unit	09/06

6 AVR Product Line and Regional Contacts

Area	Name	Title	Office	Email
Worldwide	Peter Jones	Managing Director Tactical Marketing	+44 7785 22 5034	pjones@atmel.com



Area	Name	Title	Office	Email
Worldwide	Ingar Fredriksen	Director of Product Marketing, 8-bit AVR	+47 7288 4360	ifredriksen@atmel.com
Worldwide	Odd Jostein Svendsli	Director of Product Marketing, Battery Tech.	+47 7289 7543	oj@atmel.com
Worldwide	Øyvind Strøm	Director of Product Marketing, AVR32 Prod.	+47 9300 8014	ostroem@atmel.com
Worldwide	Haakon Skar	Director of Product Marketing, AVR32 AP7	+47 7289 7645	hskar@atmel.com
Worldwide	Magnus Pedersen	Director of Product Marketing, AVR RF	+47 7289 7647	mpedersen@atmel.com
Worldwide	Jukka Eskelinen	Director of Product Marketing, tinyAVR®	+358 9 4520 8220	jeskelinen@atmel.com
Worldwide	Michel Passemard	Director of Product Marketing, Automotive	+33 240 18 1965	michel.passemard@nto.atmel.com
Worldwide	Bernard Bancelin	Product Marketing Manager – CAN	+33 240 18 1815	bernard.bancelin@nto.atmel.com
Worldwide	Jean Desuché	Product Marketing Manager – Lighting	+ 33 240 18 1879	jean.desuche@nto.atmel.com
Worldwide	Jean-Christophe Lawson	Product Marketing Manager – USB	+33 240 18 1987	jean-christophe.lawson@atmel.com
Worldwide	Kristian Sæther	Product Marketing Manager	+47 7289 7594	ksaether@atmel.com
Worldwide	Andreas Eieland	Product Marketing Manager	+47 7289 7534	aeieland@atmel.com
Worldwide	Virginie Klingler	Tactical Marketing - Automotive AVR	+33 240 18 1512	virginie.klingler@nto.atmel.com
Asia	Florence Chao	Tactical Marketing Manager	+1 408 451 4890	cchao@atmel.com
Asia	Manish Vadher	Tactical Marketing Director	+33 24018 1769	manish.vadher@nto.atmel.com
Asia Pacific	Pierre Roux	Tactical Marketing Manager, 32-bit AVR	+85 227219778	Pierre.roux@rfo.atmel.com
Asia Pacific	Edmund Au	Application Manager	+852 9193 4753	eau@atmel.com
Japan	Pål Ronny Kastnes	Application Engineer	+81 3 3523 3597	pkastnes@atmel.com
China, Australia, New Zealand	Arild Rødland	Technical Marketing Manager	+47 7288 4388	arodland@atmel.com
South Europe, UK	Franco Cartolano	Technical Marketing Manager	+39 039 605 6955	fcartolano@atmel.com
Europe	Detlef Schick	Automotive Technical Marketing Manager	+49 89 319 70285	detlef.schick@atmel.com
Central Europe and Scandinavia	Heiko Hoffmann	TMM OEM Controller Business	+49 89 319 70 253	heiko.hoffmann@atmel.com
Europe	Martina Knott	Distribution Manager, 32-bit AVR	+33 24018 1812	martina.knott@nto.atmel.com
Europe	Nelly Le Ruyet	Distribution Manager, 8-bit AVR	+33 4 4253 6401	nlruyet@atmel.fr
North America	Raghu Raghavan	Distribution Marketing Manager, 8-bit Products	+1 408 436 4118	rraghavan@atmel.com
North America	Tatjana Stojak	Distribution Marketing Manager, 32-bit Products	+1 408 436 4297	tstojak@atmel.com
North America	Scott Avery	Tactical Marketing Director	+1 408 436 4290	savery@atmel.com
North America	Daniel Rohn	Automotive Technical Marketing Manager	+1 847 466 3620	drohn@atmel.com



Area	Name	Title	Office	Email
North America	John Carey	West Coast Technical Marketing Manager	+1 714 450 1210	jcarey@atmel.com
North America	David Arnold	East Coast Technical Marketing Manager	+1 919 846 3395	darnold@atmel.com
North America	Neil Rice	Central US Technical Marketing Manager	+ 1 469 366 3108	nrice@atmel.com

To receive AVR Product Update each month, please email to: AVRinfo@atmel.no with the subject field "Subscribe AVR Product Monthly Update".

© 2007 Atmel Corporation. All Rights Reserved. Atmel[®], logo and combinations thereof, AVR[®], megaAVR[®], tinyAVR[®], Z-Link[®] and others, are registered trademarks, picoPower[™] and others are trademarks of Atmel Corporation or its subsidiaries. Other terms and product names may be trademarks of others.