



ATMEL CORPORATION

AVR Flash Microcontroller: Product Line Reference

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1 ATtiny Product Family

All devices of the ATtiny product family are highly integrated in small packages, with small die sizes and low to medium pin counts. They use the same AVR core architecture as the AT90S and ATmega families. The devices are generally available in PDIP and SOIC packages.

ATtiny product family is targeting the high volume consumer market, for both standard and application specific device types. All devices are highly integrated thus significantly reducing the system cost. New members of this family have differential features, such as A/D with gain stage, high frequency PWM with PLL, and integrated SRAM and EEPROM.

Products	tiny11	tiny12	tiny13	tiny15	tiny26	tiny28	tiny2313
Technology							
0.5μ	X	X		X		X	
0.35μ			X		X		X
Features							
Pins	8	8	8	8	20	28	20
Flash (KB)	1	1	1	1	2	2	2
SRAM (B)	-	-	64	-	128	-	128
EEPROM (B)	-	64	64	64	128	-	128
USI ¹	-	-	-	-	Yes ¹	-	Yes ¹
In-System Programming	ISP at 12V only	Yes	Yes	Yes	Yes	-	Yes
ADC, 10-bit	-	-	4	4	11	-	-
PWM	-	-	2	1 ²	2 ²	-	4
8-bit Timers	1	1	1	2	2	1	1
16-bit Timers	-	-	-	-	-	-	1
Typical Applications	Please refer to Section 4.4						
Development Tools							
Software	AVR Studio						
Starter Kits	STK 500	STK 500, AVRISP	STK500, AVRISP	STK 500, AVRISP	STK500, AVRISP	STK 500	STK500, AVRISP
Emulation Tools	ICE200	ICE200	ICE40 ³ ICE50	-	ICE40 ICE50	-	ICE50
Ordering Information							
Die Sales	X	X	X	X	X	X	X
Package	8-PDIP, 8-SOIC	8-PDIP, 8-SOIC	8-PDIP, 8-SOIC	8-PDIP, 8-SOIC	20-PDIP, 20-SOIC, 32-MLF	28-PDIP, 32-TQFP, 32-MLF	20-PDIP, 20-SOIC, 32-MLF
Engineering Samples	Now	Now	Now	Now	Now	Now	Q4, 03
General Samples	Now	Now	Q4, 03	Now	Now	Now	Q4, 03
Production	Now	Now	Q1, 04	Now	Now	Now	Q1, 04

¹ USI (Universal Serial Interface) configured as TWI, SPI, and USART.

² High speed PWM clocked by internal PLL.

³ Required ICE40 Upgrade Kit.



2 AT90 Product Family

Due to extremely good C-efficiency, this is the only microcontroller family in this segment where there is no code-size penalty of writing in a high-level language. All devices have 32 general-purpose registers, an Analog Comparator and a Watchdog Timer. In-system programmable flash code size ranges from 1K to 8 Kbytes. SRAM size ranges from 0 to 512 bytes, and EEPROM size from 64 to 512 bytes.

Products	S1200	S2323	S2343	S2313
Technology				
0.5 μ	X	X	X	X
0.35 μ				
Features				
Pins	20	8	8	20
Flash (KB)	1	2	2	2
SRAM (B)	-	128	128	128
EEPROM (B)	64	128	128	128
UART	-	-	-	1
ADC	-	-	-	-
In-System Programming	Yes	Yes	Yes	Yes
PWMs	-	-	-	1
8-bit Timers	1	1	1	1
16-bit Timers	-	-	-	1
RTC	-	-	-	-
Typical Applications	Please refer to Section 4.4			
Development Tools				
Software	AVR Studio			
Starter Kits	STK 500, AVRISP			
Emulation Tools	ICE200	-	-	ICE200
Ordering Information				
Die Sales	X	X	X	X
Packages	20-PDIP, 20-SOIC, 20-SSOP	8-PDIP, 8-SOIC	8-PDIP, 8-SOIC	20-PDIP, 20-SOIC
Samples	Now	No New Design	No New Design	Now
Production	Now	Now	Now	Now



3 ATmega Product Family

ATmega Product Family competes against 16 and 32-bit architectures due to its outstanding C-code density and very high performance. It is a complete family with 8 to 128K Bytes Flash devices.

All new megaAVR devices are manufactured by 0.35µ process technology. They feature the revolutionary Self-Programming Memory and Read-while-Write capability, which would be particularly suitable for applications requiring remote programming or field upgrade capability. Other differential features include Hardware Multiplier and IEEE 1149.1 Compliant JTAG Interface. Within this family, mega162 and mega169 can be operated by very low power at 1.8V, specifically designed for the latest battery operated and portable applications. And the mega169 is the first AVR device that comes with on-chip LCD driver.

MEGA Device Names	48	8	8515	8535	162	16	169	32	64	128
Technology										
0.5µ										
0.35µ	X	X	X	X	X	X	X	X	X	X
Features										
Flash (KB)	4	8	8	8	16	16	16	32	64	128
Pins	28/32	28/32	40/44	40/44	40/44	40/44	64	40/44	64	64
SRAM (KB)	512B	1	512B	512B	1	1	1	2	4	4
EEPROM	256B	512B	512B	512B	512B	512B	512	1 KB	2 KB	4 KB
SPI	1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
USART	1	1	1	1	1	1	1	1	2	2
TWI	1	1	-	1	-	1	-	1	1	1
USI	-	-	-	-	-	-	Yes	-	-	-
PWMs		3	3	4	6	4	4	4	8	8
10-Bit ADC	8	8 ⁴	-	8	-	8	8	8	8	8
ISP	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Self-Prog.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
JTAG Interface	-	-	-	-	Yes	Yes	Yes	Yes	Yes	Yes
Low Power @ 1.8V	Yes	Yes in Q104	-	-	Yes	-	Yes	-	-	-
LCD Driver	-	-	-	-	-	-	Yes	-	-	-
RTC	X	X	-	X	X	X	X	X	X	X
Typical Apps.	Please refer to Section 4.4.									
Development Tools										
Software	AVR Studio									
Starter Kits	STK500 AVRISP	STK500 AVRISP	STK500 AVRISP	STK500 AVRISP	STK500 AVRISP	STK500 AVRISP	STK500+ STK502 AVRISP	STK500 AVRISP	STK500+ STK501 AVRISP	STK500+ STK501 AVRISP
Emulation Tools	ICE50	ICE40, ICE50	ICE40 ⁵ , ICE50	ICE40 ⁵ , ICE50	ICE50 JTAGICE	ICE50 JTAGICE	ICE50 JTAGICE	ICE50 JTAGICE	ICE50 JTAGICE	ICE50 JTAGICE
Ordering Information										
Die Sales	X	X	X	X	X	X	X	X	X	X
Packages	28PDIP 32TQFP	28PDIP 32TQFP 32MLF	40PDIP 44PLCC 44TQFP 44MLF	40PDIP 44PLCC 44TQFP 44MLF	40PDIP 44TQFP 44MLF	40PDIP 44TQFP 44MLF	64TQFP 64MLF	40PDIP 44TQFP 44MLF	64TQFP 64MLF	64TQFP 64MLF
Engineering Samples	Q403	Now	Now	Now	Now	Now	Now	Now	Now	Now
General Samples	Q104	Now	Now	Now	Now	Now	Oct.03	Now	Now	Now
Production	Q104	Now	Now	Now	Now	Now	Oct.03	Now	Now	Now

⁴ 6@10-bit and 2@8-bit for TQFP parts; 4@10-bit and 2@8-bit for PDIP parts.

⁵ Required ICE40 Upgrade Kit.

4 Development Tools Guide

Atmel provides a complete range of development tools for its AVR products, including:

- Software: AVR Studio 3.56 and 4.07
AVR Studio 4.07 by now supports the JTAGICE, ICE200, ICE40 and ICE50.
- Starter Kits: STK500, STK501, STK502, and AVR In-System Programmer
- Evaluation Kits: Battery Charger Kit, and Embedded Internet Toolkit, and AVR Butterfly
- Emulators: ICE40, ICE50, ICE200, and JTAGICE.

4.1 Development Tools Reference

Part Number	Description
Starter Kits	
ATSTK500	STK500 AVR Starter Kit with AVR STUDIO Interface
ATSTK501	STK501 Expansion of STK500 to support 64-pin megaAVR devices
ATSTK502	STK502 Expansion of STK500 for LCD devices
ATAVRISP	AVRISP ISP programmer for all AVR ISP devices
Evaluation Kits	
AT90BCKIT	ATtiny15 & AT90S4433 Battery Charger Evaluation Kit
AT90EIT1	AVR Embedded Internet Toolkit
ATAVRBFLY	ATmega169 Demo Board with LCD and Speaker
Emulators	
ATICE200	ICE200 low cost AVR In-Circuit Emulator
ATICE40	ICE40 AVR In-Circuit Emulator for tiny26 and mega8
ATICE50	ICE50 AVR In-Circuit Emulator for all megaAVR and new tinyAVR devices. The kit contains: <ul style="list-style-type: none"> – PDIP personality adapters for ATmega8, ATmega162, ATmega16, ATmega32 and ATtiny26 – 64-pin TQFP personality adapters (top and bottom modules) for ATmega64 and ATmega128 – a test adapter Adapters for ATmega169 must be ordered separately.
ATJTAGICE	JTAG ICE low cost In-Circuit Emulator supporting all AVR with JTAG interface
ATASICICE	ASICICE embedded AVR core development system
ATICE10UPGR	Upgrade: ICEPRO to ICE10 upgrade kit
ATPOD200	Replacement: ICE200 POD replacement with cable (top module)
ATAVRSMMD	Add-on: ICE200 SOIC/PLCC/TQFP emulator adapter kit (bottom module)
ATADAP200	Replacement: ICE200 PDIP emulator adapter kit (bottom module)
AT90ADCPOD	Replacement: ICEPRO POD replacement kit
AT90ADCUG	Upgrade: AVRICE/ICEPRO analog upgrade kit
ATMEGAPOD	Replacement: megaICE, ICE30 mega103 POD replacement kit
ATMEG163POD	Replacement: ICE30 mega163 POD replacement kit
ATtiny15POD	Replacement: ICE10 POD replacement kit
64PSKT_TOP	Replacement: ICE30 64-pin TQFP emulator adapter (top module)



Part Number	Description
64PSKT_BOT	Replacement: ICE30 and ICE50 64-pin TQFP emulator adapter (bottom module)
ATADAPTEST ⁶	Replacement: ICE50 Test Adapter
ATADAPMEGA8 ⁶	Replacement: ICE50 Mega8 PDIP personality adapter
ATADAPMEGA32 ⁶	Replacement: ICE50 Mega8535/16/32 PDIP personality adapter
ATADAP128_TOP ⁶	Replacement: ICE50 Mega64/128 TQFP personality adapter (top module); requires one AT64PSKT_BOT as the bottom module
ATADAP169_TOP ⁷	Replacement: ICE50 Mega169 TQFP personality adapter (top module); requires one AT64PSKT_BOT as the bottom module
ATADAPMEGA162 ⁶	Replacement: ICE50 Mega8515/162 PDIP personality adapter
ATADAPTINY26 ⁶	Replacement: ICE50 Tiny26 PDIP personality adapter
ATICE50PROBE ⁶	ICE40/50 Probe including Flex Cables
ATJTAGPROBE	JTAG ICE Probe including Flex Cables
ATICE30UPGR	Upgrade: ICE30 Upgrade Kit
ATICE40UPGR	Upgrade: ICE40 Upgrade Kit to support Mega8515/8535 and Tiny13

⁶ Atmel has a replacement policy for early versions of this product. Please consult the AVR Studio 4 Help file, ICE50 section, to determine if your customers have the A9902.3.1200.C version of the ICE50 probe or adapter. If they do, please send an e-mail to avr@atmel.com including their ICE50 serial number and describing the reason for replacement in order to get approval.

⁷ This product is too new to be compatible with A9902.3.1200.C version of the ICE50 probe. Please consult the AVR Studio 4 help file, ICE50 section, to determine if your customers have the A9902.3.1200.C version of the ICE50 probe. If they do, please send an e-mail to avr@atmel.com including their ICE50 serial number for approval to get a free upgrade of the probe.

4.2 Product Selection Guide

	FLASH (KB)	EEPROM(Bytes)	RAM(Bytes)	I/O Pins	SPI	UART	TWI	USI	Hardware Multiplier	8-bit Timer	16-bit Timer	10-bit A/D Channels	Brown Out Detector	In System Prog. (!) + Self-Prog.(S)	Vcc(V)	Clock speed(MHz)	Packages (Pin)	Production
ATtiny11L	1	-	-	6	-	-	-	-	-	1	-	-	-	-	2.7-5.5	0-2	8 PDIP,SOIC	now
ATtiny11	1	-	-	6	-	-	-	-	-	1	-	-	-	-	4.0-5.5	0-6	8 PDIP,SOIC	now
ATtiny12V	1	64	-	6	-	-	-	-	-	1	-	-	-	Y	1.8-5.5	0-1	8 PDIP,SOIC	now
ATtiny12L	1	64	-	6	-	-	-	-	-	1	-	-	-	Y	2.7-5.5	0-4	8 PDIP,SOIC	now
ATtiny12	1	64	-	6	-	-	-	-	-	1	-	-	-	Y	4.0-5.5	0-8	8 PDIP,SOIC	now
ATtiny13	1	64	64	6	-	-	-	-	-	1	-	-	4	Y	1.8-5.5	0-16	8 PDIP,SOIC	Q1, 04
ATtiny15L	1	64	-	6	-	-	-	-	-	2	-	4	Y	1	2.7-5.5	1.6	8 PDIP,SOIC	now
ATtiny26L	2	128	128	16	-	-	-	1	-	2	-	11	Y	1	2.7-5.5	0-8	20 PDIP,SOIC, 32 MLF	now
ATtiny26	2	128	128	16	-	-	-	1	-	2	-	11	Y	1	4.5-5.5	0-16	20 PDIP,SOIC, 32 MLF	now
ATtiny28V	2	-	-	20	-	-	-	-	-	1	-	-	-	-	1.8-5.5	0-1	28 PDIP, 32 TQFP, MLF	now
ATtiny28L	2	-	-	20	-	-	-	-	-	1	-	-	-	-	2.7-5.5	0-4	28 PDIP, 32 TQFP, MLF	now
ATtiny2313	2	128	128	18	-	1	-	1	-	1	1	-	Y	1	1.8-5.5	0-16	20 PDIP, SOIC, 32 MLF	Q1, 04
AT90S1200	1	64	-	15	-	-	-	-	-	1	-	-	-	1	2.7-6.0	0-4	20 PDIP,SOIC,SSOP	now
AT90S1200	1	64	-	15	-	-	-	-	-	1	-	-	-	1	4.0-6.0	0-12	20 PDIP,SOIC,SSOP	now
AT90S2313	2	128	128	15	-	1	-	-	-	1	1	-	-	1	2.7-6.0	0-4	20 PDIP,SOIC	now
AT90S2313	2	128	128	15	-	1	-	-	-	1	1	-	-	1	4.0-6.0	0-10	20 PDIP,SOIC	now
AT90L S2323	2	128	128	3	-	-	-	-	-	1	-	-	-	1	2.7-6.0	0-4	8 PDIP,SOIC	now
AT90S2323	2	128	128	3	-	-	-	-	-	1	-	-	-	1	4.0-6.0	0-10	8 PDIP,SOIC	now
AT90L S2343	2	128	128	5	-	-	-	-	-	1	-	-	-	1	2.7-6.0	0-1	8 PDIP,SOIC	now
AT90L S2343	2	128	128	5	-	-	-	-	-	1	-	-	-	1	2.7-6.0	0-4	8 PDIP,SOIC	now
AT90S2343	2	128	128	5	-	-	-	-	-	1	-	-	-	1	4.0-6.0	0-10	8 PDIP,SOIC	now
ATmega48	4	256	512	23	1	1	1	-	Y	2	1	8	Y	S	1.8-5.5	0-16	28 PDIP, 32 TQFP, MLF	Q1, 04
ATmega8L	8	512	1K	23	1	1	1	-	Y	2	1	8	Y	S	2.7-5.5	0-8	28 PDIP, 32 TQFP, MLF	now
ATmega8	8	512	1K	23	1	1	1	-	Y	2	1	8	Y	S	4.5-5.5	0-16	28 PDIP, 32 TQFP, MLF	now
ATmega8515L	8	512	512	35	1	1	-	-	Y	1	1	-	Y	S	2.7-5.5	0-8	40 PDIP, 44 PLCC, TQFP, MLF	now
ATmega8515	8	512	512	35	1	1	-	-	Y	1	1	-	Y	S	4.5-5.5	0-16	40 PDIP, 44 PLCC, TQFP, MLF	now
ATmega8535L	8	512	512	32	1	1	1	-	Y	2	1	8	Y	S	2.7-5.5	0-8	40 PDIP, 44 PLCC, TQFP, MLF	now
ATmega8535	8	512	512	32	1	1	1	-	Y	2	1	8	Y	S	4.5-5.5	0-16	40 PDIP, 44 PLCC, TQFP, MLF	now
ATmega162V	16	512	1K	35	1	2	-	-	Y	2	2	-	Y	S	1.8-5.5	0-8	40 PDIP, 44 TQFP, MLF	now
ATmega162	16	512	1K	35	1	2	-	-	Y	2	2	-	Y	S	2.7-5.5	0-16	40 PDIP, 44 TQFP, MLF	now
ATmega16L	16	512	1K	32	1	1	1	-	Y	2	1	8	Y	S	2.7-5.5	0-8	40 PDIP, 44 TQFP, MLF	now
ATmega16	16	512	1K	32	1	1	1	-	Y	2	1	8	Y	S	4.5-5.5	0-16	40 PDIP, 44 TQFP, MLF	now
ATmega169V	16	512	1K	54	1	1	-	1	Y	2	1	8	Y	S	1.8-3.6	0-1	64 TQFP, MLF	Oct. 03
ATmega169L	16	512	1K	54	1	1	-	1	Y	2	1	8	Y	S	2.7-3.6	0-8	64 TQFP, MLF	Oct. 03
ATmega169	16	512	1K	54	1	1	-	1	Y	2	1	8	Y	S	4.5-5.5	0-16	64 TQFP, MLF	Oct. 03
ATmega32L	32	1K	2K	32	1	1	1	-	Y	2	1	8	Y	S	2.7-5.5	0-8	40 PDIP, 44 TQFP, MLF	now
ATmega32	32	1K	2K	32	1	1	1	-	Y	2	1	8	Y	S	4.5-5.5	0-16	40 PDIP, 44 TQFP, MLF	now
ATmega64L	64	2K	4K	53	1	2	1	-	Y	2	2	8	Y	S	2.7-5.5	0-8	64 TQFP, MLF	now
ATmega64	64	2K	4K	53	1	2	1	-	Y	2	2	8	Y	S	4.5-5.5	0-16	64 TQFP, MLF	now
ATmega128L	128	4K	4K	53	1	2	1	-	Y	2	2	8	Y	S	2.7-5.5	0-8	64 TQFP, MLF	now
ATmega128	128	4K	4K	53	1	2	1	-	Y	2	2	8	Y	S	4.5-5.5	0-16	64 TQFP, MLF	now

4.3 Tools Selection Guide

The following table shows which AVR devices are supported by which emulation tools and starter kits:

	Emulation Tools				Starter Kits			
	ICE200	ICE40	ICE50	JTAGICE	AVRISP	STK500	STK501	STK502
TinyAVR								
ATtiny11	•					•		
ATtiny12	•				•	•		
ATtiny13			•		•	•		
ATtiny15					•	•		
ATtiny26		•	•		•	•		
ATtiny28						•		
ATtiny2313			•		•	•		
AT90S								
AT90S1200	•				•	•		
AT90S2323					•	•		
AT90S2343					•	•		
AT90S2313	•				•	•		
megaAVR								
ATmega8515			•		•	•		
ATmega8535			•		•	•		
ATmega162			•	•	•	•		
ATmega169			•	•	•	•		•
ATmega48			•		•	•		
ATmega8		•	•		•	•		
ATmega16			•	•	•	•		
ATmega32			•	•	•	•		
ATmega64			•	•	•	•	•	
ATmega128			•	•	•	•	•	
Availability	Now	Now	Now	Now	Now	Now	Now	Now



4.4 Typical Applications Guide

The following table gives you a general idea of typical applications for most AVR devices.

	tiny11	tiny12	tiny15	tiny26	tiny28	90S2323/2343	90S1200	90S2313	mega8	mega8515	mega8535	mega162	mega16	mega32	mega64	mega128
Alarm System			•	•				•							•	•
Analog Telephone															•	•
Automotive Applications															•	•
Bar Code Reader										•		•				
Battery Charger			•	•					•		•	•	•	•	•	•
Battery Charger, Advanced									•		•		•	•	•	•
Blood Oxymeter															•	•
Car Alarm				•				•	•	•		•				
Communication Equipment					•											
Coprocessor	•	•				•										
Data Logger	•	•							•		•					
Dimmer			•	•												
DIP Switch Replacement		•					•									
Encryption/Decryption of Serial Data						•										
Fire Detector	•	•	•	•			•	•								
GPS															•	•
I/O Controller					•											
Industrial Control										•	•	•	•	•	•	•
Keyboard Controller					•					•		•				
Keyless Entry for Car Alarm	•	•					•									
Keypad Scanner							•									
Light Ballast			•	•												
Low Speed Modem										•		•				
Low-Cost/High Pin Count Applications					•											
Metering Applications											•		•	•		
Motor Control	•	•		•				•	•	•	•	•	•	•		
Motor Controller, 3-Phase										•	•	•	•	•	•	•
Paper Feeder															•	•
POS Terminal										•		•				
Power Management											•		•	•		
Power Meter										•		•	•	•		
Protocol Converter	•	•				•	•	•								
Remote Control					•		•					•				
Replacing External Logic	•	•				•	•									
RF Telephone										•		•				
Secure EEPROM			•			•	•									
Sensor Applications			•	•				•		•					•	•
Set-Top Box I/O Controller					•		•	•								
Signal Processing Applications	•	•														
Smart Battery											•		•	•	•	•
Smart Card Reader							•	•								
Telecom Applications									•		•				•	•
Telephone Peripherals				•				•								
Temperature Logger				•				•		•		•	•			
Tension Control				•				•		•		•	•			
Timing Control						•										
Touch Screen Sensor										•		•	•	•	•	•
Toys	•	•		•	•	•	•	•	•		•		•	•	•	•
UPS				•				•		•		•	•	•	•	•
V-Chip TV Module									•		•					
Voltage Logger								•		•		•	•			
Web Server									•		•	•	•		•	•



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 Data Sheet

The data sheets of all AVR devices can be downloaded at http://www.atmel.com/dyn/products/datasheets.asp?family_id=607.

Family	Description	Last Update
AVR	AT90S1200 Summary	3/02
AVR	AT90S1200 Complete	3/02
AVR	AT90S1200/A Rev. F Errata	9/01
AVR	AT90S2313 Summary	6/02
AVR	AT90S2313 Complete	6/02
AVR	AT90S2323/LS2323/S2343/LS2343 Summary	9/01
AVR	AT90S2323/LS2323/S2343/LS2343 Complete	9/01
AVR	AT90S/LS4433 Summary	4/03
AVR	AT90S/LS4433 Complete	4/03
AVR	AT90S/LS8535 Summary	11/01
AVR	AT90S/LS8535 Complete	11/01
AVR	AT90S/LS8535 Rev. D Errata	9/01
AVR	AT90S/LS8535 Rev. E Errata	11/01
AVR	AT90S8515 Summary	9/01
AVR	AT90S8515 Complete	9/01
AVR	AT90S8515 Rev. B Errata	9/01
AVR	AT90S8515 Rev. C Errata	9/01
megaAVR	ATmega8(L) Preliminary Summary	8/03
megaAVR	ATmega8(L) Preliminary Complete	8/03
megaAVR	ATmega8515(L) Preliminary Summary	2/03
megaAVR	ATmega8515(L) Preliminary Complete	2/03
megaAVR	ATmega8535(L) Advance Information Summary	4/03
megaAVR	ATmega8535(L) Advance Information (Complete)	4/03
megaAVR	ATmega16(L) Preliminary Summary	2/03
megaAVR	ATmega16(L) Preliminary Complete	2/03
megaAVR	ATmega169V/169L Advance Information Summary	5/03
megaAVR	ATmega169V/169L Advance Information (Complete)	5/03
megaAVR	ATmega32(L) Preliminary Summary	2/03
megaAVR	ATmega32(L) Preliminary Complete	2/03
megaAVR	ATmega64(L) Preliminary Summary	9/03
megaAVR	ATmega64(L) Preliminary Complete	9/03
megaAVR	ATmega128(L) Preliminary Summary	9/03
megaAVR	ATmega128(L) Preliminary Complete	9/03
megaAVR	ATmega161(L) Advanced Information Summary	8/02
megaAVR	ATmega161(L) Advanced Information Complete	8/02
megaAVR	ATmega161(L) Rev. E Errata	9/01
megaAVR	ATmega162(U)(L)(V) Advance Information Summary	4/03
megaAVR	ATmega162(U)(L)(V) Advance Information (Complete)	4/03
megaAVR	ATmega163(L) Summary	2/03
megaAVR	ATmega163(L) Complete	2/03
megaAVR	ATmega163(L) Rev. F Errata	9/01
megaAVR	ATmega323(L) Preliminary Summary	9/02
megaAVR	ATmega323(L) Preliminary Complete	9/02



Family	Description	Last Update
megaAVR	ATmega323(L) Rev. B Errata	9/01
tinyAVR	ATtiny11/12 Summary	7/03
tinyAVR	ATtiny11/12 Complete	7/03
tinyAVR	ATtiny11 Rev. D Errata	9/01
tinyAVR	ATtiny12 Rev. C Errata	9/01
tinyAVR	ATtiny13 Preliminary	6/03
tinyAVR	ATtiny15L Summary	6/02
tinyAVR	ATtiny15L Complete	6/02
<i>tinyAVR</i>	<i>ATtiny2313 Preliminary Summary</i>	<i>9/03</i>
<i>tinyAVR</i>	<i>ATtiny2313 Preliminary</i>	<i>9/03</i>
tinyAVR	ATtiny26(L) Preliminary Summary	6/03
tinyAVR	ATtiny26(L) Preliminary Complete	6/03
tinyAVR	ATtiny28L/ATtiny28V Summary	10/01
tinyAVR	ATtiny28L/ATtiny28V Complete	10/01
tinyAVR	ATtiny28 Rev. D/E Errata	11/01

5.2 Application Notes

All application notes for AVR product family can be downloaded at http://www.atmel.com/dyn/products/app_notes.asp?family_id=607.

Note Number	Description	Last Update
AVR000	Register and Bit-Name Definitions for the AVR Microcontroller	4/98
AVR030	Getting Started with C for AVR	5/02
AVR031	Getting Started with ImageCraft C for AVR	5/02
AVR032	Linker Command Files for the IAR ICCA90 Compiler	5/02
AVR033	Getting Start with the CodeVision AVR C Compiler	5/02
AVR034	Mixing C and Assembly Code with AVR Embedded Workbench for AVR	4/03
AVR035	Efficient C Coding for AVR	4/03
AVR040	EMC Design Considerations	5/02
AVR042	AVR Hardware Design Considerations	11/02
AVR051	Setup and Use the External RC Oscillator	2/02
AVR060	JTAGICE	9/02
AVR061	STK500 Protocol	4/03
AVR064	STK502 – A Temperature Monitoring System with LCD Output	2/03
AVR065	LCD Driver for the STK502	11/02
AVR070	Modifying AT90ICEPRO to Support Emulation of AT90	5/02
AVR072	Accessing 16-bit I/O Registers	5/02
AVR074	Upgrading AT90ICEPRO to ICE10	5/02
AVR080	ATmega103 Replaced by ATmega128	7/03
AVR081	Replacing AT90S4433 by ATmega8	7/03
AVR082	Replacing ATmega161 by ATmega162	7/03
AVR083	Replacing ATmega163 by ATmega16	7/03
AVR084	Replacing ATmega323 by ATmega32	7/03
AVR085	Replacing AT90S8515 by ATmega8515	7/03
AVR086	Replacing AT90S8535 by ATmega8535	7/03
AVR087	Migrating between ATmega8515 and ATmega162	7/03
AVR088	Migrating between ATmega8535 and ATmega16	6/03
AVR089	Migrating between ATmega16 and ATmega32	6/03
AVR090	Migrating between ATmega64 and ATmega128	6/03
AVR100	Accessing the EEPROM	12/98
AVR101	High Endurance EEPROM Storage	9/02
AVR102	Block Routines	5/02
AVR104	Buffered Interrupt Controlled EEPROM Writes	7/03



Note Number	Description	Last Update
AVR108	Setup and Use of the LPM Instructions	5/02
AVR109	Self-programming	1/03
AVR128	Setup and Use the Analog Comparator	5/02
AVR130	Setup and use the AVR Timers	2/02
AVR134	Real-Time Clock using the Asynchronous Timer	5/02
AVR180	External Brown-Out Protection	5/02
AVR182	Zero Cross Detector	3/02
AVR200	Multiply and Divide Routines	10/98
AVR201	Using the AVR Hardware Multiplier	6/02
AVR202	16-Bit Arithmetic	5/02
AVR204	BCD Arithmetic	1/03
AVR220	Bubble Sort	5/02
AVR222	8-Point Moving Average Filter	5/02
AVR223	Digital Filters with AVR	9/02
AVR236	CRC Check of Program Memory	5/02
AVR240	4x4 Keypad-Wake Up on Keypress	8/03
AVR242	8-bit Microcontroller Multiplexing LED Drive & a 4x4 Keypad	5/02
AVR243	Matrix Keyboard Decoder	1/03
AVR300	Software I2C™ Master Interface	5/02
AVR301	C Code for Interfacing AVR® to AT17CXX FPGA Configuration Memory	1/03
AVR302	Software I2C™ Slave Implementation	5/02
AVR304	Half Duplex Interrupt Driven Software UART	8/97
AVR305	Half Duplex Compact Software UART	9/97
AVR306	Using the AVR UART in C	7/02
AVR308	Software LIN Slave	5/02
AVR313	Interfacing the PCAT Keyboard	5/02
AVR314	DTMF Generator	5/02
AVR320	Software SPI Master	5/02
AVR325	High-Speed Interface to Host EPP Parallel Port	2/02
AVR335	Digital Sound Recorder with AVR and Serial Data Flash	3/02
AVR350	XmodemCRC Receive Utility for AVR	5/02
AVR360	Step Motor Controller	4/03
AVR400	Low Cost A/D Converter	5/02
AVR401	8-Bit Precision A/D Converter	2/03
AVR410	RC5 IR Remote Control Receiver	5/02
AVR415	RC5 IR Remote Control Transmitter	5/03
AVR450	Battery Charger for SLA, NiCd, NiMH and Li-ion Batteries	11/02
AVR460 ⁸	Embedded Web Server	5/02
AVR461	Quick Start Guide for the Embedded Internet Toolkit	5/02
AVR462	Reducing the Power Consumption of ATEIT1	3/02
AVR910	In-System Programming	11/00

⁸ Please note that the source code is only available when purchasing the Embedded Internet Toolkit.