



# ATMEL CORPORATION

## AVR Flash RISC: Product Line Reference

November 2002 Edition

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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	tiny15	tiny26	tiny28
<b>Technology</b>					
0.5 $\mu$	X	X	X		X
0.35 $\mu$				X	
<b>Features</b>					
Pins	8	8	8	20	28
Flash (KB)	1	1	1	2	2
SRAM (B)	-	-	-	128	-
EEPROM (B)	-	64	64	128	-
TWI	-	-	-	Yes <sup>1</sup>	-
SPI	-	-	-	Yes <sup>1</sup>	-
USART	-	-	-	Yes <sup>1</sup>	-
In-System Programming	ISP at 12V only	Yes	Yes	Yes	-
ADC	-	-	4, 10-bit	11, 10-bit	-
PWM	-	-	1 <sup>2</sup>	4 <sup>2</sup>	-
Timers	1	1	2	2	1
Typical Applications	Please refer to Section 4.4				
<b>Development Tools</b>					
Software	AVR Studio	AVR Studio	AVR Studio	AVR Studio	AVR Studio
Starter Kits	STK 500	STK 500, AVRISP	STK 500, AVRISP	STK500, AVRISP	STK 500
Emulation Tools	ICE200, ICE10	ICE200, ICE10	ICE 10	ICE50	ICE 10
<b>Ordering Information</b>					
Lead Time	Please See Attached Lead Time Guide				
Die Sales	X	X	X	X	
Package	8-PDIP, 8-SOIC	8-PDIP, 8-SOIC	8-PDIP, 8-SOIC	20-PDIP, 20-SOIC, 32-MLF	28-PDIP, 32-TQFP, 32-MLF
Samples	Now	Now	Now	Now	Now
Production	Now	Now	Now	Now	Now

<sup>1</sup> Using the Universal Serial Interface (USI).

<sup>2</sup> High speed PWM clocked by internal PLL.



## 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	S4433	S8515	S8535
<b>Technology</b>							
0.5μ	X	X	X	X	X	X	X
0.35μ							
<b>Features</b>							
Pins	20	8	8	20	28/32	40/44	40/44
Flash (KB)	1	2	2	2	4	8	8
SRAM (B)	-	128	128	128	128	512	512
EEPROM (B)	64	128	128	128	256	512	512
UART	-	-	-	1	1	1	1
ADC	-	-	-	-	6, 10-bit	-	8, 10-bit
In-System Programming	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PWMs	-	-	-	1	1	2	3
RTC	-	-	-	-	-	-	X
Typical Applications	Please refer to Section 4.4						
<b>Development Tools</b>							
Software	AVR Studio						
Starter Kits	STK 500, AVRISP						
Emulation Tools	ICE200, ICE 10	ICE 10	ICE10	ICE200, ICE10	ICE200, ICE10	ICE 200, ICE 10	ICE 200, ICE 10
<b>Ordering Information</b>							
Lead Time	Please See Attached Lead Time Guide						
Die Sales			X	X	X	X	X
Packages	20-PDIP, 20-SOIC, 20-SSOP	8-PDIP, 8-SOIC	8-PDIP, 8-SOIC	20-PDIP, 20-SOIC	28-PDIP, 32-TQFP	40-PDIP, 44-TQFP, 44-PLCC	40-PDIP, 44-TQFP, 44-PLCC
Samples	Now	Now	Now	Now	Now	Now	Now
Production	Now	Now	Now	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.

As Atmel moves its production from 0.5µ to 0.35µ technology, the existing 0.5µ megaAVR devices will all have their 0.35µ mirror devices with the same features. Additionally, all new 0.35µ megaAVR devices feature the revolutionary Self-Programming Memory and Read-while-Write capability. They 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, we have two new Low Power AVR devices, mega162 and mega169, 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.

Device Names	m8	m8515	m8535	m161	m162	m16	m169	m32	m64	m103	m128	
<b>Technology</b>												
0.5µ				x						x		
0.35µ	x	x	x		x	x	x	x	x		x	
<b>Features</b>												
Flash (KB)	8	8	8	16		16	16	32	64	128		
Pins	28/32	40/44	40/44	40/44		40/44	64	40/44	64	64		
SRAM (KB)	1	512B	512B	1		1	1	2	4	4		
EEPROM	512B	512B	512B	512B		512B	512	1 KB	2 KB	4 KB		
SPI	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes	Yes	
UART	1	1	1	2		1	1	1	2	1	2	
PWMs	3	2	4	4		4	4	4	6+2 <sup>3</sup>	4	6+2 <sup>3</sup>	
10-Bit ADC Channel	8 <sup>4</sup>	-	8	-		8	8	8	8	8		
ISP	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes	Yes		
Self-Programming	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes	Yes	-	Yes	
JTAG Interface	-	-	-	-	Yes	Yes	Yes	Yes	Yes	-	Yes	
Ultra Low Power	-	-	-	-	Yes	-	Yes	-	-	-		
LCD Driver	-	-	-	-		-	Yes	-	-	-		
RTC	X	-	X	X		X	X	X	X	X		
Typical Applications	<b>Please refer to Section 4.4.</b>											
<b>Development Tools</b>												
Software	AVR Studio											
Starter Kits	STK500 AVRISP	STK500 AVRISP	STK500 AVRISP	STK500 AVRISP		STK500 AVRISP	STK500+ STK502 AVRISP	STK500 AVRISP	STK500+ STK501 AVRISP	STK500+ STK501 AVRISP		
Emulation Tools	ICE50	ICE50	ICE50	ICE30	ICE50 JTAGIC	ICE50 JTAGIC	ICE50 JTAGIC	ICE50 JTAGIC	ICE50 JTAGIC	ICE50 JTAGIC	ICE30	ICE50 JTAGIC
<b>Ordering Information</b>												
Lead Time	<b>Please See Attached Lead-Time Guide.</b>											
Die Sales	X	X	X	X		X	X	X	X	X		
Packages	28PDIP 32TQFP 32MLF	40PDIP 44PLCC 44TQFP 44MLF	40PDIP 44PLCC 44TQFP 44MLF	40PDIP 44TQFP	40PDIP 44TQFP 44MLF	40PDIP 44TQFP 44MLF	64TQFP 64MLF	40PDIP 44TQFP 44MLF	64TQFP 64MLF	64TQFP	64TQFP 64MLF	
Engineering Samples	Now	Now	Q4,02	Now	Q4,02	Now	Now	Now	Q4,02	Now	Now	
General Samples	Now	Now	Q1,03	Now	Q4,02	Now	Q4,02	Now	Q1,03	Now	Now	
Production	Now	Q4,02	Q1,03	Now	Q1,03	Now	Q1,03	Now	Q1,03	Now	Now	

<sup>3</sup> 6x 16 bit and 2x 8 bit

<sup>4</sup> 6@10-bit and 2@8-bit for TQFP parts; 4@10-bit and 2@8-bit for PDIP parts.

## 4 Development Tools Guide

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

- Software: AVR Studio 3.55 and 4.05  
AVR Studio 3.55 is required for ICE10, since this is not supported in AVR Studio 4.0x. AVR Studio 4.05 by now supports the JTAGICE, ICE200 and ICE50.
- Starter Kits: STK500, STK501, **STK502**, AVR In-System Programmer, Battery Charger Kit, and Embedded Internet Toolkit
- Emulators: ICE10, **ICE40**, ICE50, ICE200, and JTAGICE.

### 4.1 Part Number Reference

Part Number	Description
<b>Starter Kits</b>	
ATSTK500	<b>STK500</b> AVR Starter Kit with AVR STUDIO Interface
ATSTK501	<b>STK501</b> Expansion of STK500 to support 64-pin megaAVR devices
<b>ATSTK502</b>	<b>STK502</b> Expansion of STK500 for <b>LCD devices</b>
ATAVRISP	<b>AVRISP</b> ISP programmer for all AVR ISP devices
AT90BCKIT	ATtiny15 & AT90S4433 Battery Charger Evaluation Kit
AT90EIT1	AVR Embedded Internet Toolkit
<b>Emulators</b>	
ATICE200	<b>ICE200</b> low cost AVR In-Circuit Emulator
ATICE10	<b>ICE10</b> Tiny and Classic AVR In-Circuit Emulator
<b>ATICE40</b>	<b>ICE40</b> AVR In-Circuit Emulator for <b>tiny26</b> and <b>mega8</b>
ATICE50	<b>ICE50</b> AVR In-Circuit Emulator for all megaAVR and new tinyAVR devices
ATJTAGICE	<b>JTAG ICE</b> low cost In-Circuit Emulator supporting all AVR with JTAG interface
ATASICICE	<b>ASICICE</b> embedded AVR core development system
ATICE10UPGR	<b>Upgrade:</b> ICEPRO to ICE10 upgrade kit
ATPOD200	<b>Replacement:</b> ICE200 POD replacement with cable (top module)
ATAVRSMMD	<b>Add-on:</b> ICE200 SOIC/PLCC/TQFP emulator adapter kit (bottom module)
ATADAP200	<b>Replacement:</b> ICE200 PDIP emulator adapter kit (bottom module)
AT90ADCPOD	<b>Replacement:</b> ICEPRO POD replacement kit
AT90ADCUG	<b>Upgrade:</b> AVRICE/ICEPRO analog upgrade kit
ATMEGAPOD	<b>Replacement:</b> megaICE, ICE30 mega103 POD replacement kit
ATMEG163POD	<b>Replacement:</b> ICE30 mega163 POD replacement kit
ATtiny15POD	<b>Replacement:</b> ICE10 POD replacement kit
64PSKT_TOP	<b>Replacement:</b> ICE30 64-pin TQFP emulator adapter (top module)
64PSKT_BOT	<b>Replacement:</b> ICE30 64-pin TQFP emulator adapter (bottom module)
ATADAPTEST	<b>Replacement:</b> ICE50 Test Adapter
ATADAPMEGA8	<b>Replacement:</b> ICE50 Mega8 Personality Adapter
ATADAPMEGA32	<b>Replacement:</b> ICE50 Mega32 Personality Adapter
ATADAPMEGA162	<b>Replacement:</b> ICE50 Mega162 Personality Adapter
ATADAPMEGA169	<b>Replacement:</b> ICE50 Mega169 Personality Adapter
ATADAPTINY26	<b>Replacement:</b> ICE50 Tiny26 Personality Adapter
ATADAPTINY28	<b>Replacement:</b> ICE50 Tiny28 Personality Adapter
ATICE50PROBE	ICE50 Probe including Flex Cables
ATJTAGPROBE	JTAG ICE Probe including Flex Cables
ATICE30UPGR	<b>Upgrade:</b> ICE30 Upgrade Kit



### 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 Timer	Brown Out Channel	In System Prog. + Self-Prog. (S)	Vcc(V)	Clock speed (MHz)	Packages (P-in)	Production
ATtiny11L	1	-	32 Registers	6	-	-	-	-	1	-	-	-	-	-	2.7-5.5	0-2	8 PDIP,SOIC	now
ATtiny11	1	-	32 Registers	6	-	-	-	-	1	-	-	-	-	-	4.0-5.5	0-6	8 PDIP,SOIC	now
ATtiny12V	1	64	32 Registers	6	-	-	-	-	1	-	-	Y	I	-	1.8-5.5	0-1	8 PDIP,SOIC	now
ATtiny12L	1	64	32 Registers	6	-	-	-	-	1	-	-	Y	I	-	2.7-5.5	0-4	8 PDIP,SOIC	now
ATtiny12	1	64	32 Registers	6	-	-	-	-	1	-	-	Y	I	-	4.0-5.5	0-8	8 PDIP,SOIC	now
ATtiny15L	1	64	32 Registers	6	-	-	-	-	2	-	-	Y	I	-	2.7-5.5	1-6	8 PDIP,SOIC	now
ATtiny26L	2	128	128	16	-	-	-	1	-	2	-	11	Y	I	2.7-5.5	0-8	20 PDIP,SOIC, 32 MLF	now
ATtiny26	2	128	128	16	-	-	-	1	-	2	-	11	Y	I	4.5-5.5	0-16	20 PDIP,SOIC, 32 MLF	now
ATtiny28V	2	-	32 Registers	20	-	-	-	-	1	-	-	-	-	-	1.8-5.5	0-1	28 PDIP, 32 TQFP, MLF	now
ATtiny28L	2	-	32 Registers	20	-	-	-	-	1	-	-	-	-	-	2.7-5.5	0-4	28 PDIP, 32 TQFP, MLF	now
AT90S1200	1	64	32 Registers	15	-	-	-	-	1	-	-	-	-	I	2.7-6.0	0-4	20 PDIP,SOIC,SSOP	now
AT90S1200	1	64	32 Registers	15	-	-	-	-	1	-	-	-	-	I	4.0-6.0	0-12	20 PDIP,SOIC,SSOP	now
AT90S2313	2	128	128	15	-	1	-	-	1	1	-	-	-	I	2.7-6.0	0-4	20 PDIP,SOIC	now
AT90S2313	2	128	128	15	-	1	-	-	1	1	-	-	-	I	4.0-6.0	0-10	20 PDIP,SOIC	now
AT90LS2323	2	128	128	3	-	-	-	-	1	-	-	-	-	I	2.7-6.0	0-4	20 PDIP,SOIC	now
AT90S2323	2	128	128	3	-	-	-	-	1	-	-	-	-	I	4.0-6.0	0-10	8 PDIP,SOIC	now
AT90LS2343	2	128	128	5	-	-	-	-	1	-	-	-	-	I	2.7-6.0	0-1	8 PDIP,SOIC	now
AT90LS2343	2	128	128	5	-	-	-	-	1	-	-	-	-	I	2.7-6.0	0-4	8 PDIP,SOIC	now
AT90S2343	2	128	128	5	-	-	-	-	1	-	-	-	-	I	4.0-6.0	0-10	8 PDIP,SOIC	now
AT90LS4433	4	256	128	20	1	1	-	-	1	1	6	Y	I	-	2.7-6.0	0-4	28 PDIP, 32 TQFP	now
AT90S4433	4	256	128	20	1	1	-	-	1	1	6	Y	I	-	4.0-6.0	0-8	28 PDIP, 32 TQFP	now
AT90S8515	8	512	512	32	1	1	-	-	1	1	-	-	-	I	2.7-6.0	0-4	40 PDIP, 44 PLCC, TQFP	now
AT90S8515	8	512	512	32	1	1	-	-	1	1	-	-	-	I	4.0-6.0	0-8	40 PDIP, 44 PLCC, TQFP	now
AT90LS8535	8	512	512	32	1	1	-	-	2	1	8	-	-	I	2.7-6.0	0-4	40 PDIP, 44 PLCC, TQFP	now
AT90S8535	8	512	512	32	1	1	-	-	2	1	8	-	-	I	4.0-6.0	0-8	40 PDIP, 44 PLCC, TQFP	now
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	1	-	Y	1	1	-	Y	S	2.7-5.5	0-8	40 PDIP, 44 PLCC, TQFP, MLF	Q402
ATmega8515	8	512	512	35	1	1	1	-	Y	1	1	-	Y	S	4.5-5.5	0-16	40 PDIP, 44 PLCC, TQFP, MLF	Q402
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	Q103
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	Q103
ATmega161L	16	512	1K	35	1	2	-	-	Y	2	1	-	Y	S	2.7-5.5	0-4	40 PDIP, 44 TQFP	now
ATmega161	16	512	1K	35	1	2	-	-	Y	2	1	-	Y	S	4.0-5.5	0-8	40 PDIP, 44 TQFP	now
ATmega162V	16	512	1K	35	1	2	-	-	Y	2	2	-	Y	S	1.8-3.6	0-1	40 PDIP, 44 TQFP, MLF	Q103
ATmega162L	16	512	1K	35	1	2	-	-	Y	2	2	-	Y	S	2.7-5.5	0-8	40 PDIP, 44 TQFP, MLF	Q103
ATmega162	16	512	1K	35	1	2	-	-	Y	2	2	-	Y	S	4.0-5.5	0-16	40 PDIP, 44 TQFP, MLF	Q103
ATmega163L	16	512	1K	32	1	1	1	-	Y	2	1	8	Y	S	2.7-5.5	0-4	40 PDIP, 44 TQFP	now
ATmega163	16	512	1K	32	1	1	1	-	Y	2	1	8	Y	S	4.0-5.5	0-8	40 PDIP, 44 TQFP	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	Q103
ATmega169L	16	512	1K	54	1	1	-	1	Y	2	1	8	Y	S	2.7-3.6	0-4	64 TQFP, MLF	Q103
ATmega323L	32	1K	2K	32	1	1	1	-	Y	2	1	8	Y	S	2.7-5.5	0-4	40 PDIP, 44 TQFP	now
ATmega323	32	1K	2K	32	1	1	1	-	Y	2	1	8	Y	S	4.0-5.5	0-8	40 PDIP, 44 TQFP	now
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	Q103
ATmega64	64	2K	4K	53	1	2	1	-	Y	2	2	8	Y	S	4.5-5.5	0-16	64 TQFP, MLF	Q103
ATmega103	128	4K	4K	48	1	1	-	-	2	1	8	-	-	I	4.0-5.5	0-6	64 TQFP	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	ICE10	ICE40	ICE50	JTAGICE	AVRISP	STK500	STK501	STK502
<b>tinyAVR</b>									
ATtiny11	•	•					•		
ATtiny12	•	•				•	•		
ATtiny15		•				•	•		
ATtiny26			•	•		•	•		
ATtiny28		•					•		
<b>AT90S</b>									
AT90S1200	•	•				•	•		
AT90S2323		•				•	•		
AT90S2343		•				•	•		
AT90S2313	•	•				•	•		
AT90S4433	•	•				•	•		
AT90S8515	•	•				•	•		
AT90S8535	•	•				•	•		
<b>megaAVR</b>									
ATmega161						•	•		
ATmega163						•	•		
ATmega323					•	•	•		
ATmega103						•	•	•	
ATmega8515				•		•	•		
ATmega8535				•		•	•		
ATmega162				•	•	•	•		
ATmega169				•	•	•	•		•
ATmega8			•	•		•	•		
ATmega16				•	•	•	•		
ATmega32				•	•	•	•		
ATmega64				•	•	•	•	•	
ATmega128				•	•	•	•	•	
Availability	Now	Now	End-Nov.	Now	Now	Now	Now	Now	End-Nov.



### 4.4 Typical Applications Guide

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

	tiny11	tiny12	tiny15	tiny28	90S2323/2343	90S1200	90S2313	90(L)S4433	90S8515	90(L)S8535	mega161(L)	mega163(L)	mega16	mega323(L)	mega103(L)	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](mailto:avr@atmel.com).

### 5.1 Data Sheet

Family	Description	Last Update
General	AVR Instruction Set	8/02
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	AT90S2313 Rev. B/C Errata	9/01
AVR	AT90S2323/LS232/S2343/LS2343 Summary	9/01
AVR	AT90S2323/LS2323/S2343/LS2343 Complete	9/01
AVR	AT90S/LS2323 Rev. F Errata	9/01
AVR	AT90S/LS2323 Rev. G Errata	9/01
AVR	AT90S/LS2343 Rev. F Errata	9/01
AVR	AT90S/LS2343 Rev. G Errata	9/01
AVR	AT90S/LS4433 Summary	9/02
AVR	AT90S/LS4433 Complete	9/02
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	9/02
megaAVR	ATmega8(L) Preliminary Complete	9/02
megaAVR	ATmega8515(L) Preliminary Summary	9/02
megaAVR	ATmega8515(L) Preliminary Complete	9/02
megaAVR	ATmega8535(L) Advance Information Summary	9/02
megaAVR	ATmega8535(L) Advance Information (Complete)	9/02
megaAVR	ATmega16(L) Preliminary Summary	9/02
megaAVR	ATmega16(L) Preliminary Complete	10/02
megaAVR	ATmega169V/169L Advance Information Summary	9/02
megaAVR	ATmega169V/169L Advance Information (Complete)	9/02
megaAVR	ATmega32(L) Preliminary Summary	10/02
megaAVR	ATmega32(L) Preliminary Complete	10/02
megaAVR	ATmega64(L) Preliminary Summary	9/02
megaAVR	ATmega64(L) Preliminary Complete	9/02
megaAVR	ATmega128(L) Preliminary Summary	9/02
megaAVR	ATmega128(L) Preliminary Complete	9/02
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(L)(V) Advance Information Summary	9/02
megaAVR	ATmega162(L)(V) Advance Information (Complete)	9/02
megaAVR	ATmega163(L) Summary	9/02
megaAVR	ATmega163(L) Complete	9/02
megaAVR	ATmega163(L) Rev. F Errata	9/01



Family	Description	Last Update
megaAVR	ATmega323(L) Preliminary Summary	9/02
megaAVR	ATmega323(L) Preliminary Complete	9/02
megaAVR	ATmega323(L) Rev. B Errata	9/01
tinyAVR	ATtiny11/12 Preliminary Summary	9/01
tinyAVR	ATtiny11/12 Preliminary Complete	9/01
tinyAVR	ATtiny11 Rev. D Errata	9/01
tinyAVR	ATtiny12 Rev. C Errata	9/01
tinyAVR	ATtiny15L Preliminary Summary	6/02
tinyAVR	ATtiny15L Preliminary Complete	6/02
tinyAVR	ATtiny26L Summary	9/02
tinyAVR	ATtiny26L Complete	9/02
tinyAVR	ATtiny28L/ATtiny28V Preliminary Summary	10/01
tinyAVR	ATtiny28L/ATtiny28V Preliminary Complete	10/01
tinyAVR	ATtiny28 Rev. D/E Errata	11/01

## 5.2 Application Notes

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	12/98
AVR035	Efficient C Coding for AVR	5/02
AVR040	EMC Design Considerations	5/02
AVR051	Setup and Use the External RC Oscillator	2/02
AVR060	JTAGICE	9/02
<i>AVR061</i>	<i>STK500 Protocol</i>	<i>9/02</i>
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	6/02
AVR081	Replacing AT90S4433 by ATmega8	7/02
AVR082	Replacing ATmega161 by ATmega162	6/02
AVR083	Replacing ATmega163 by ATmega16	9/02
AVR084	Replacing ATmega323 by ATmega32	9/02
AVR085	Replacing AT90S8515 by ATmega8515	6/02
AVR086	Replacing AT90S8535 by ATmega8535	6/02
AVR100	Accessing the EEPROM	12/98
<i>AVR101</i>	<i>High Endurance EEPROM Storage</i>	<i>9/02</i>
AVR102	Block Routines	5/02
AVR108	Setup and Use of the LPM Instructions	5/02
AVR109	Self-programming	8/02
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	8/97
AVR220	Bubble Sort	5/02



Note Number	Description	Last Update
AVR222	8-Point Moving Average Filter	5/02
<i>AVR223</i>	<i>Digital Filters with AVR</i>	<i>9/02</i>
AVR236	CRC Check of Program Memory	5/02
AVR240	4x4 Keypad-Wake Up on Keypress	5/02
AVR242	8-bit Microcontroller Multiplexing LED Drive & a 4x4 Keypad	5/02
AVR300	Software I2C™ Master Interface	5/02
AVR301	C Code for Interfacing AVR® to AT17CXX FPGA Configuration Memory	4/01
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	11/98
AVR400	Low Cost A/D Converter	5/02
AVR401	8-Bit Precision A/D Converter	8/00
AVR410	RC5 IR Remote Control Receiver	5/02
AVR450	Battery Charger for SLA, NiCd, NiMH and Li-ion Batteries	3/02
AVR460 <sup>5</sup>	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

<sup>5</sup> Please note that the source code is only available when purchasing the Embedded Internet Toolkit.