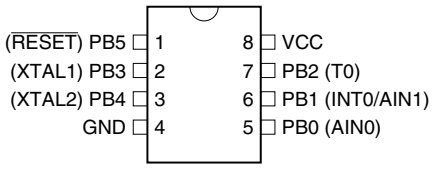
Features

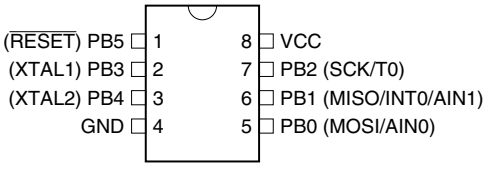
- Utilizes the AVR® RISC Architecture
- High-performance and Low-power 8-bit RISC Architecture
  - 90 Powerful Instructions – Most Single Clock Cycle Execution
  - 32 x 8 General Purpose Working Registers
  - Up to 8 MIPS Throughput at 8 MHz
- Nonvolatile Program and Data Memory
  - 1K Byte of Flash Program Memory
    - In-System Programmable (ATtiny12)
    - Endurance: 1,000 Write/Erase Cycles (ATtiny11/12)
  - 64 Bytes of In-System Programmable EEPROM Data Memory for ATtiny12
    - Endurance: 100,000 Write/Erase Cycles
  - Programming Lock for Flash Program and EEPROM Data Security
- Peripheral Features
  - Interrupt and Wake-up on Pin Change
  - One 8-bit Timer/Counter with Separate Prescaler
  - On-chip Analog Comparator
  - Programmable Watchdog Timer with On-chip Oscillator
- Special Microcontroller Features
  - Low-power Idle and Power-down Modes
  - External and Internal Interrupt Sources
  - In-System Programmable via SPI Port (ATtiny12)
  - Enhanced Power-on Reset Circuit (ATtiny12)
  - Internal Calibrated RC Oscillator (ATtiny12)
- Specification
  - Low-power, High-speed CMOS Process Technology
  - Fully Static Operation
- Power Consumption at 4 MHz, 3V, 25°C
  - Active: 2.2 mA
  - Idle Mode: 0.5 mA
  - Power-down Mode: <1 µA
- Packages
  - 8-pin PDIP and SOIC
- Operating Voltages
  - 1.8 - 5.5V for ATtiny12V-1
  - 2.7 - 5.5V for ATtiny11L-2 and ATtiny12L-4
  - 4.0 - 5.5V for ATtiny11-6 and ATtiny12-8
- Speed Grades
  - 0 - 1.2 MHz (ATtiny12V-1)
  - 0 - 2 MHz (ATtiny11L-2)
  - 0 - 4 MHz (ATtiny12L-4)
  - 0 - 6 MHz (ATtiny11-6)
  - 0 - 8 MHz (ATtiny12-8)

Pin Configuration

ATtiny11
PDIP/SOIC



ATtiny12
PDIP/SOIC



8-bit AVR® Microcontroller with 1K Byte Flash

ATtiny11
ATtiny12

Summary

Rev. 1006CS–09/01

Note: This is a summary document. A complete document is available on our web site at *www.atmel.com*.

Description

The ATtiny11/12 is a low-power CMOS 8-bit microcontroller based on the AVR RISC architecture. By executing powerful instructions in a single clock cycle, the ATtiny11/12 achieves throughputs approaching 1 MIPS per MHz, allowing the system designer to optimize power consumption versus processing speed.

The AVR core combines a rich instruction set with 32 general-purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.

Table 1. Parts Description

Device	Flash	EEPROM	Register	Voltage Range	Frequency
ATtiny11L	1K	-	32	2.7 - 5.5V	0-2 MHz
ATtiny11	1K	-	32	4.0 - 5.5V	0-6 MHz
ATtiny12V	1K	64 B	32	1.8 - 5.5V	0-1.2 MHz
ATtiny12L	1K	64 B	32	2.7 - 5.5V	0-4 MHz
ATtiny12	1K	64 B	32	4.0 - 5.5V	0-8 MHz

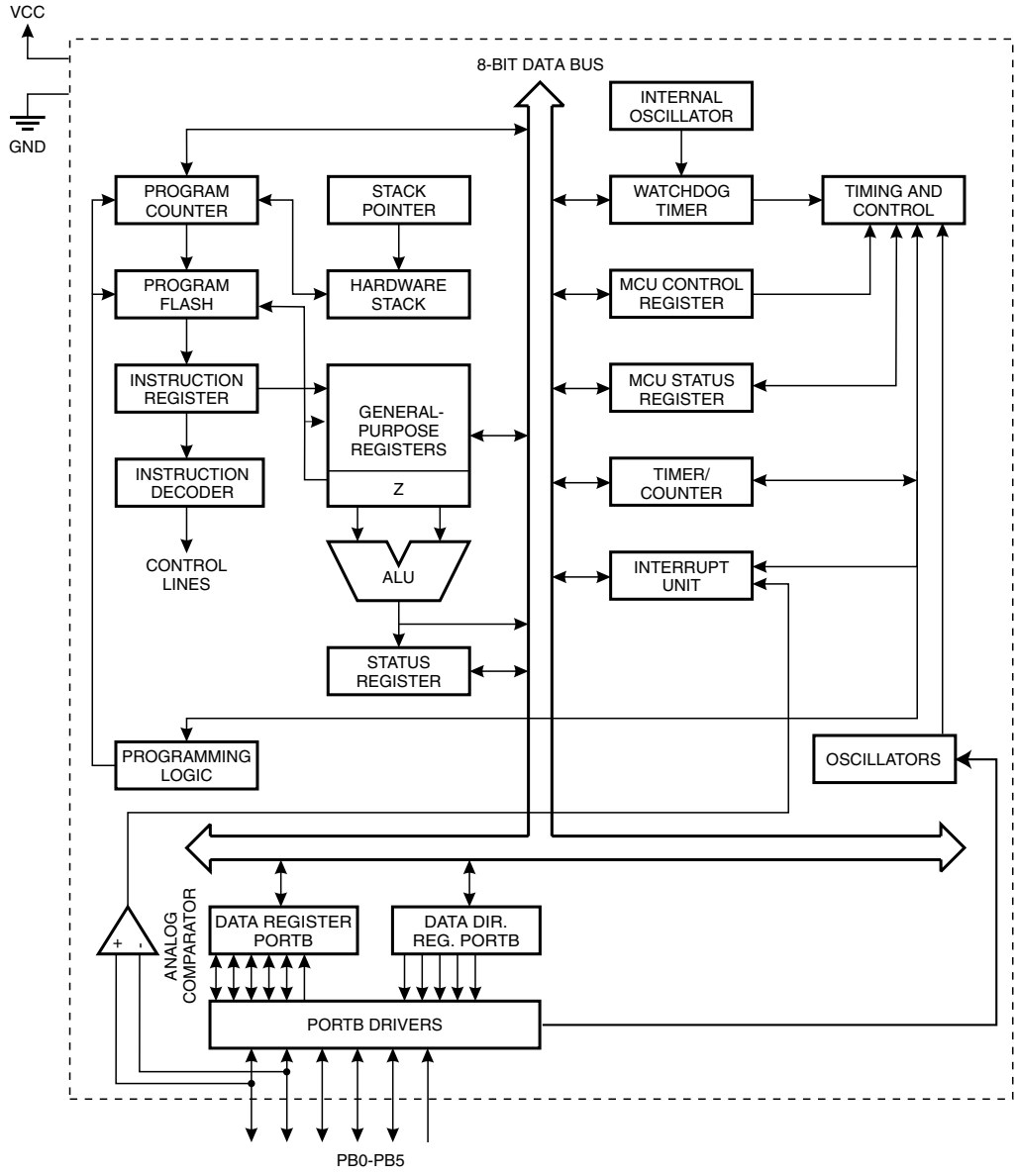
ATtiny11 Block Diagram

The ATtiny11 provides the following features: 1K bytes of Flash, up to five general-purpose I/O lines, one input line, 32 general-purpose working registers, an 8-bit timer/counter, internal and external interrupts, programmable Watchdog Timer with internal oscillator, and two software-selectable power-saving modes. The Idle Mode stops the CPU while allowing the timer/counters and interrupt system to continue functioning. The Power-down Mode saves the register contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset. The wake-up or interrupt on pin change features enable the ATtiny11 to be highly responsive to external events, still featuring the lowest power consumption while in the power-down modes.

The device is manufactured using Atmel's high-density nonvolatile memory technology. By combining an RISC 8-bit CPU with Flash on a monolithic chip, the Atmel ATtiny11 is a powerful microcontroller that provides a highly-flexible and cost-effective solution to many embedded control applications.

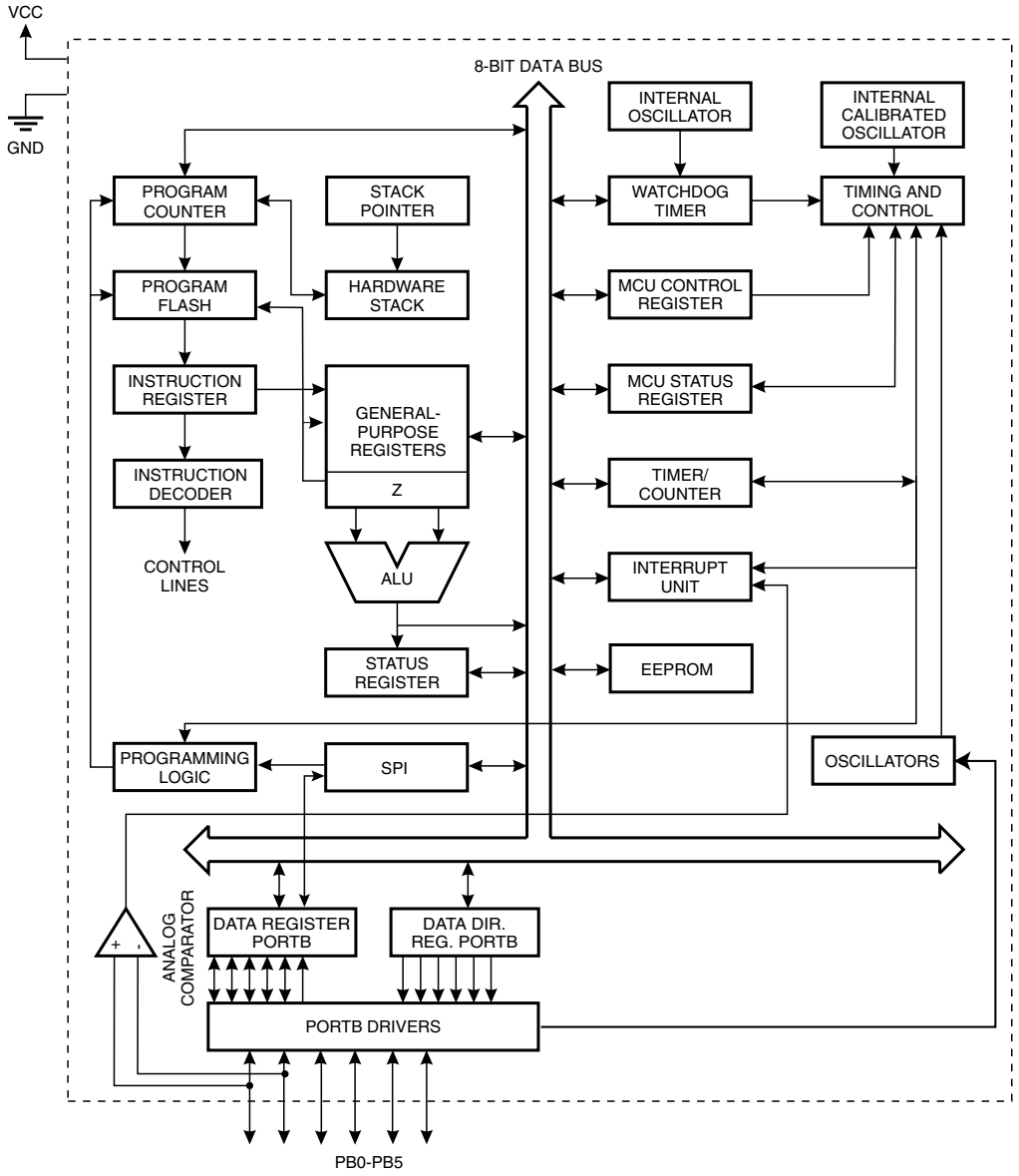
The ATtiny11 AVR is supported with a full suite of program and system development tools including: macro assemblers, program debugger/simulators, in-circuit emulators, and evaluation kits.

Figure 1. The ATtiny11 Block Diagram



ATtiny12 Block Diagram

Figure 2. The ATtiny12 Block Diagram



The ATtiny12 provides the following features: 1K bytes of Flash, 64 bytes EEPROM, up to six general-purpose I/O lines, 32 general-purpose working registers, an 8-bit timer/counter, internal and external interrupts, programmable Watchdog Timer with internal oscillator, and two software-selectable power-saving modes. The Idle Mode stops the CPU while allowing the timer/counters and interrupt system to continue functioning. The Power-down Mode saves the register contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset. The wake-up or interrupt on pin change features enable the ATtiny12 to be highly responsive to external events, still featuring the lowest power consumption while in the power-down modes.

The device is manufactured using Atmel's high-density nonvolatile memory technology. By combining an RISC 8-bit CPU with Flash on a monolithic chip, the Atmel ATtiny12 is a powerful microcontroller that provides a highly-flexible and cost-effective solution to many embedded control applications.

The ATtiny12 AVR is supported with a full suite of program and system development tools including: macro assemblers, program debugger/simulators, in-circuit emulators, and evaluation kits.

Pin Descriptions

VCC Supply voltage pin.

GND Ground pin.

Port B (PB5..PB0) Port B is a 6-bit I/O port. PB4..0 are I/O pins that can provide internal pull-ups (selected for each bit). On ATtiny11, PB5 is input only. On ATtiny12, PB5 is input or open-drain output. The port pins are tri-stated when a reset condition becomes active, even if the clock is not running. The use of pins PB5..3 as input or I/O pins is limited, depending on reset and clock settings, as shown below.

Table 2. PB5..PB3 Functionality vs. Device Clocking Options

Device Clocking Option	PB5	PB4	PB3
External Reset Enabled	Used(1)	-(2)	-
External Reset Disabled	Input(3)/I/O(4)	-	-
External Crystal	-	Used	Used
External Low-frequency Crystal	-	Used	Used
External Ceramic Resonator	-	Used	Used
External RC Oscillator	-	I/O(5)	Used
External Clock	-	I/O	Used
Internal RC Oscillator	-	I/O	I/O

Notes:
1. "Used" means the pin is used for reset or clock purposes.
2. "-" means the pin function is unaffected by the option.
3. Input means the pin is a port input pin.
4. On ATtiny11, PB5 is input only. On ATtiny12, PB5 is input or open-drain output.
5. I/O means the pin is a port input/output pin.

XTAL1 Input to the inverting oscillator amplifier and input to the internal clock operating circuit.

XTAL2 Output from the inverting oscillator amplifier.

$\overline{\text{RESET}}$ Reset input. An external reset is generated by a low level on the $\overline{\text{RESET}}$ pin. Reset pulses longer than 50 ns will generate a reset, even if the clock is not running. Shorter pulses are not guaranteed to generate a reset.

Register Summary ATtiny11

Address	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Page
$3F	SREG	I	T	H	S	V	N	Z	C	page 14
$3E	Reserved									
$3D	Reserved									
$3C	Reserved									
$3B	GIMSK	-	INT0	PCIE	-	-	-	-	-	page 25
$3A	GIFR	-	INTF0	PCIF	-	-	-	-	-	page 25
$39	TIMSK	-	-	-	-	-	-	TOIE0	-	page 26
$38	TIFR	-	-	-	-	-	-	TOV0	-	page 26
$37	Reserved									
$36	Reserved									
$35	MCUCR	-	-	SE	SM	-	-	ISC01	ISC00	page 27
$34	MCUSR	-	-	-	-	-	-	EXTRF	PORF	page 22
$33	TCCR0	-	-	-	-	-	CS02	CS01	CS00	page 32
$32	TCNT0	Timer/Counter0 (8 Bit)								page 33
$31	Reserved									
$30	Reserved									
...	Reserved									
$22	Reserved									
$21	WDTCR	-	-	-	WDTOE	WDE	WDP2	WDP1	WDP0	page 34
$20	Reserved									
$1F	Reserved									
$1E	Reserved									
$1D	Reserved									
$1C	Reserved									
$1B	Reserved									
$1A	Reserved									
$19	Reserved									
$18	PORTB	-	-	-	PORTB4	PORTB3	PORTB2	PORTB1	PORTB0	page 41
$17	DDRB	-	-	-	DDB4	DDB3	DDB2	DDB1	DDB0	page 42
$16	PINB	-	-	PINB5	PINB4	PINB3	PINB2	PINB1	PINB0	page 42
$15	Reserved									
...	Reserved									
$0A	Reserved									
$09	Reserved									
$08	ACSR	ACD	-	ACO	ACI	ACIE	-	ACIS1	ACIS0	page 39
…	Reserved									
$00	Reserved									

Notes: 1. For compatibility with future devices, reserved bits should be written to zero if accessed. Reserved I/O memory addresses should never be written.

2. Some of the status flags are cleared by writing a logical one to them. Note that the CBI and SBI instructions will operate on all bits in the I/O register, writing a one back into any flag read as set, thus clearing the flag. The CBI and SBI instructions work with registers $00 to $1F only.

Register Summary ATtiny12

Address	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Page
$3F	SREG	I	T	H	S	V	N	Z	C	page 14
$3E	Reserved									
$3D	Reserved									
$3C	Reserved									
$3B	GIMSK	-	INT0	PCIE	-	-	-	-	-	page 25
$3A	GIFR	-	INTF0	PCIF	-	-	-	-	-	page 25
$39	TIMSK	-	-	-	-	-	-	TOIE0	-	page 26
$38	TIFR	-	-	-	-	-	-	TOV0	-	page 26
$37	Reserved									
$36	Reserved									
$35	MCUCR	-	PUD	SE	SM	-	-	ISC01	ISC00	page 27
$34	MCUSR	-	-	-	-	WDRF	BORF	EXTRF	PORF	page 23
$33	TCCR0	-	-	-	-	-	CS02	CS01	CS00	page 32
$32	TCNT0	Timer/Counter0 (8 Bit)								page 33
$31	OSCCAL	Oscillator Calibration Register								page 29
$30	Reserved									
...	Reserved									
$22	Reserved									
$21	WDTCR	-	-	-	WDTOE	WDE	WDP2	WDP1	WDP0	page 34
$20	Reserved									
$1F	Reserved									
$1E	EEAR	-	-	EEPROM Address Register						page 36
$1D	EEDR	EEPROM Data Register								page 36
$1C	EECR	-	-	-	-	EERIE	EEMWE	EEWE	EERE	page 36
$1B	Reserved									
$1A	Reserved									
$19	Reserved									
$18	PORTB	-	-	-	PORTB4	PORTB3	PORTB2	PORTB1	PORTB0	page 41
$17	DDRB	-	-	DDB5	DDB4	DDB3	DDB2	DDB1	DDB0	page 42
$16	PINB	-	-	PINB5	PINB4	PINB3	PINB2	PINB1	PINB0	page 42
$15	Reserved									
...	Reserved									
$0A	Reserved									
$09	Reserved									
$08	ACSR	ACD	AINBG	ACO	ACI	ACIE	-	ACIS1	ACIS0	page 39
...	Reserved									
$00	Reserved									

Note: 1. For compatibility with future devices, reserved bits should be written to zero if accessed. Reserved I/O memory addresses should never be written.

2. Some of the status flags are cleared by writing a logical one to them. Note that the CBI and SBI instructions will operate on all bits in the I/O register, writing a one back into any flag read as set, thus clearing the flag. The CBI and SBI instructions work with registers $00 to $1F only.

Instruction Set Summary

Mnemonics	Operands	Description	Operation	Flags	#Clocks
ARITHMETIC AND LOGIC INSTRUCTIONS					
ADD	Rd, Rr	Add two Registers	Rd ← Rd + Rr	Z,C,N,V,H	1
ADC	Rd, Rr	Add with Carry two Registers	Rd ← Rd + Rr + C	Z,C,N,V,H	1
SUB	Rd, Rr	Subtract two Registers	Rd ← Rd - Rr	Z,C,N,V,H	1
SUBI	Rd, K	Subtract Constant from Register	Rd ← Rd - K	Z,C,N,V,H	1
SBC	Rd, Rr	Subtract with Carry two Registers	Rd ← Rd - Rr - C	Z,C,N,V,H	1
SBCI	Rd, K	Subtract with Carry Constant from Reg.	Rd ← Rd - K - C	Z,C,N,V,H	1
AND	Rd, Rr	Logical AND Registers	Rd ← Rd • Rr	Z,N,V	1
ANDI	Rd, K	Logical AND Register and Constant	Rd ← Rd • K	Z,N,V	1
OR	Rd, Rr	Logical OR Registers	Rd ← Rd v Rr	Z,N,V	1
ORI	Rd, K	Logical OR Register and Constant	Rd ← Rd v K	Z,N,V	1
EOR	Rd, Rr	Exclusive OR Registers	Rd ← Rd⊕Rr	Z,N,V	1
COM	Rd	One's Complement	Rd ← $FF - Rd	Z,C,N,V	1
NEG	Rd	Two's Complement	Rd ← $00 - Rd	Z,C,N,V,H	1
SBR	Rd,K	Set Bit(s) in Register	Rd ← Rd v K	Z,N,V	1
CBR	Rd,K	Clear Bit(s) in Register	Rd ← Rd • (FFh - K)	Z,N,V	1
INC	Rd	Increment	Rd ← Rd + 1	Z,N,V	1
DEC	Rd	Decrement	Rd ← Rd - 1	Z,N,V	1
TST	Rd	Test for Zero or Minus	Rd ← Rd • Rd	Z,N,V	1
CLR	Rd	Clear Register	Rd ← Rd⊕Rd	Z,N,V	1
SER	Rd	Set Register	Rd ← $FF	None	1
BRANCH INSTRUCTIONS					
RJMP	k	Relative Jump	PC ← PC + k + 1	None	2
RCALL	k	Relative Subroutine Call	PC ← PC + k + 1	None	3
RET		Subroutine Return	PC ← STACK	None	4
RETI		Interrupt Return	PC ← STACK	I	4
CPSE	Rd,Rr	Compare, Skip if Equal	if (Rd = Rr) PC ← PC + 2 or 3	None	1/2
CP	Rd,Rr	Compare	Rd - Rr	Z, N,V,C,H	1
CPC	Rd,Rr	Compare with Carry	Rd - Rr - C	Z, N,V,C,H	1
CPI	Rd,K	Compare Register with Immediate	Rd - K	Z, N,V,C,H	1
SBRC	Rr, b	Skip if Bit in Register Cleared	if (Rr(b)=0) PC ← PC + 2 or 3	None	1/2
SBRS	Rr, b	Skip if Bit in Register is Set	if (Rr(b)=1) PC ← PC + 2 or 3	None	1/2
SBIC	P, b	Skip if Bit in I/O Register Cleared	if (P(b)=0) PC ← PC + 2 or 3	None	1/2
SBIS	P, b	Skip if Bit in I/O Register is Set	if (P(b)=1) PC ← PC + 2 or 3	None	1/2
BRBS	s, k	Branch if Status Flag Set	if (SREG(s) = 1) then PC←PC + k + 1	None	1/2
BRBC	s, k	Branch if Status Flag Cleared	if (SREG(s) = 0) then PC←PC + k + 1	None	1/2
BREQ	k	Branch if Equal	if (Z = 1) then PC ← PC + k + 1	None	1/2
BRNE	k	Branch if Not Equal	if (Z = 0) then PC ← PC + k + 1	None	1/2
BRCS	k	Branch if Carry Set	if (C = 1) then PC ← PC + k + 1	None	1/2
BRCC	k	Branch if Carry Cleared	if (C = 0) then PC ← PC + k + 1	None	1/2
BRSH	k	Branch if Same or Higher	if (C = 0) then PC ← PC + k + 1	None	1/2
BRLO	k	Branch if Lower	if (C = 1) then PC ← PC + k + 1	None	1/2
BRMI	k	Branch if Minus	if (N = 1) then PC ← PC + k + 1	None	1/2
BRPL	k	Branch if Plus	if (N = 0) then PC ← PC + k + 1	None	1/2
BRGE	k	Branch if Greater or Equal, Signed	if (N ⊕ V= 0) then PC ← PC + k + 1	None	1/2
BRLT	k	Branch if Less Than Zero, Signed	if (N ⊕ V= 1) then PC ← PC + k + 1	None	1/2
BRHS	k	Branch if Half Carry Flag Set	if (H = 1) then PC ← PC + k + 1	None	1/2
BRHC	k	Branch if Half Carry Flag Cleared	if (H = 0) then PC ← PC + k + 1	None	1/2
BRTS	k	Branch if T Flag Set	if (T = 1) then PC ← PC + k + 1	None	1/2
BRTC	k	Branch if T Flag Cleared	if (T = 0) then PC ← PC + k + 1	None	1/2
BRVS	k	Branch if Overflow Flag is Set	if (V = 1) then PC ← PC + k + 1	None	1/2
BRVC	k	Branch if Overflow Flag is Cleared	if (V = 0) then PC ← PC + k + 1	None	1/2
BRIE	k	Branch if Interrupt Enabled	if (I = 1) then PC ← PC + k + 1	None	1/2
BRID	k	Branch if Interrupt Disabled	if (I = 0) then PC ← PC + k + 1	None	1/2

Instruction Set Summary (Continued)

Mnemonics	Operands	Description	Operation	Flags	#Clocks
DATA TRANSFER INSTRUCTIONS					
LD	Rd,Z	Load Register Indirect	Rd ← (Z)	None	2
ST	Z,Rr	Store Register Indirect	(Z) ← Rr	None	2
MOV	Rd, Rr	Move Between Registers	Rd ← Rr	None	1
LDI	Rd, K	Load Immediate	Rd ← K	None	1
IN	Rd, P	In Port	Rd ← P	None	1
OUT	P, Rr	Out Port	P ← Rr	None	1
LPM		Load Program Memory	R0 ← (Z)	None	3
BIT AND BIT-TEST INSTRUCTIONS					
SBI	P,b	Set Bit in I/O Register	I/O(P,b) ← 1	None	2
CBI	P,b	Clear Bit in I/O Register	I/O(P,b) ← 0	None	2
LSL	Rd	Logical Shift Left	Rd(n+1) ← Rd(n), Rd(0) ← 0	Z,C,N,V	1
LSR	Rd	Logical Shift Right	Rd(n) ← Rd(n+1), Rd(7) ← 0	Z,C,N,V	1
ROL	Rd	Rotate Left Through Carry	Rd(0) ← C, Rd(n+1) ← Rd(n), C ← Rd(7)	Z,C,N,V	1
ROR	Rd	Rotate Right Through Carry	Rd(7) ← C, Rd(n) ← Rd(n+1), C ← Rd(0)	Z,C,N,V	1
ASR	Rd	Arithmetic Shift Right	Rd(n) ← Rd(n+1), n = 0..6	Z,C,N,V	1
SWAP	Rd	Swap Nibbles	Rd(3..0) ← Rd(7..4), Rd(7..4) ← Rd(3..0)	None	1
BSET	s	Flag Set	SREG(s) ← 1	SREG(s)	1
BCLR	s	Flag Clear	SREG(s) ← 0	SREG(s)	1
BST	Rr, b	Bit Store from Register to T	T ← Rr(b)	T	1
BLD	Rd, b	Bit load from T to Register	Rd(b) ← T	None	1
SEC		Set Carry	C ← 1	C	1
CLC		Clear Carry	C ← 0	C	1
SEN		Set Negative Flag	N ← 1	N	1
CLN		Clear Negative Flag	N ← 0	N	1
SEZ		Set Zero Flag	Z ← 1	Z	1
CLZ		Clear Zero Flag	Z ← 0	Z	1
SEI		Global Interrupt Enable	I ← 1	I	1
CLI		Global Interrupt Disable	I ← 0	I	1
SES		Set Signed Test Flag	S ← 1	S	1
CLS		Clear Signed Test Flag	S ← 0	S	1
SEV		Set Twos Complement Overflow	V ← 1	V	1
CLV		Clear Twos Complement Overflow	V ← 0	V	1
SET		Set T in SREG	T ← 1	T	1
CLT		Clear T in SREG	T ← 0	T	1
SEH		Set Half Carry Flag in SREG	H ← 1	H	1
CLH		Clear Half Carry Flag in SREG	H ← 0	H	1
NOP		No Operation		None	1
SLEEP		Sleep	(see specific descr. for Sleep function)	None	1
WDR		Watch Dog Reset	(see specific descr. for WDR/timer)	None	1

Ordering Information

Power Supply	Speed (MHz)	Ordering Code	Package	Operation Range
2.7 - 5.5V	2	ATtiny11L-2PC ATtiny11L-2SC	8P3 8S2	Commercial (0°C to 70°C)
		ATtiny11L-2PI ATtiny11L-2SI	8P3 8S2	Industrial (-40°C to 85°C)
4.0 - 5.5V	6	ATtiny11-6PC ATtiny11-6SC	8P3 8S2	Commercial (0°C to 70°C)
		ATtiny11-6PI ATtiny11-6SI	8P3 8S2	Industrial (-40°C to 85°C)
1.8 - 5.5V	1.2	ATtiny12V-1PC ATtiny12V-1SC	8P3 8S2	Commercial (0°C to 70°C)
		ATtiny12V-1PI ATtiny12V-1SI	8P3 8S2	Industrial (-40°C to 85°C)
2.7 - 5.5V	4	ATtiny12L-4PC ATtiny12L-4SC	8P3 8S2	Commercial (0°C to 70°C)
		ATtiny12L-4PI ATtiny12L-4SI	8P3 8S2	Industrial (-40°C to 85°C)
4.0 - 5.5V	8	ATtiny12-8PC ATtiny12-8SC	8P3 8S2	Commercial (0°C to 70°C)
		ATtiny12-8PI ATtiny12-8SI	8P3 8S2	Industrial (-40°C to 85°C)

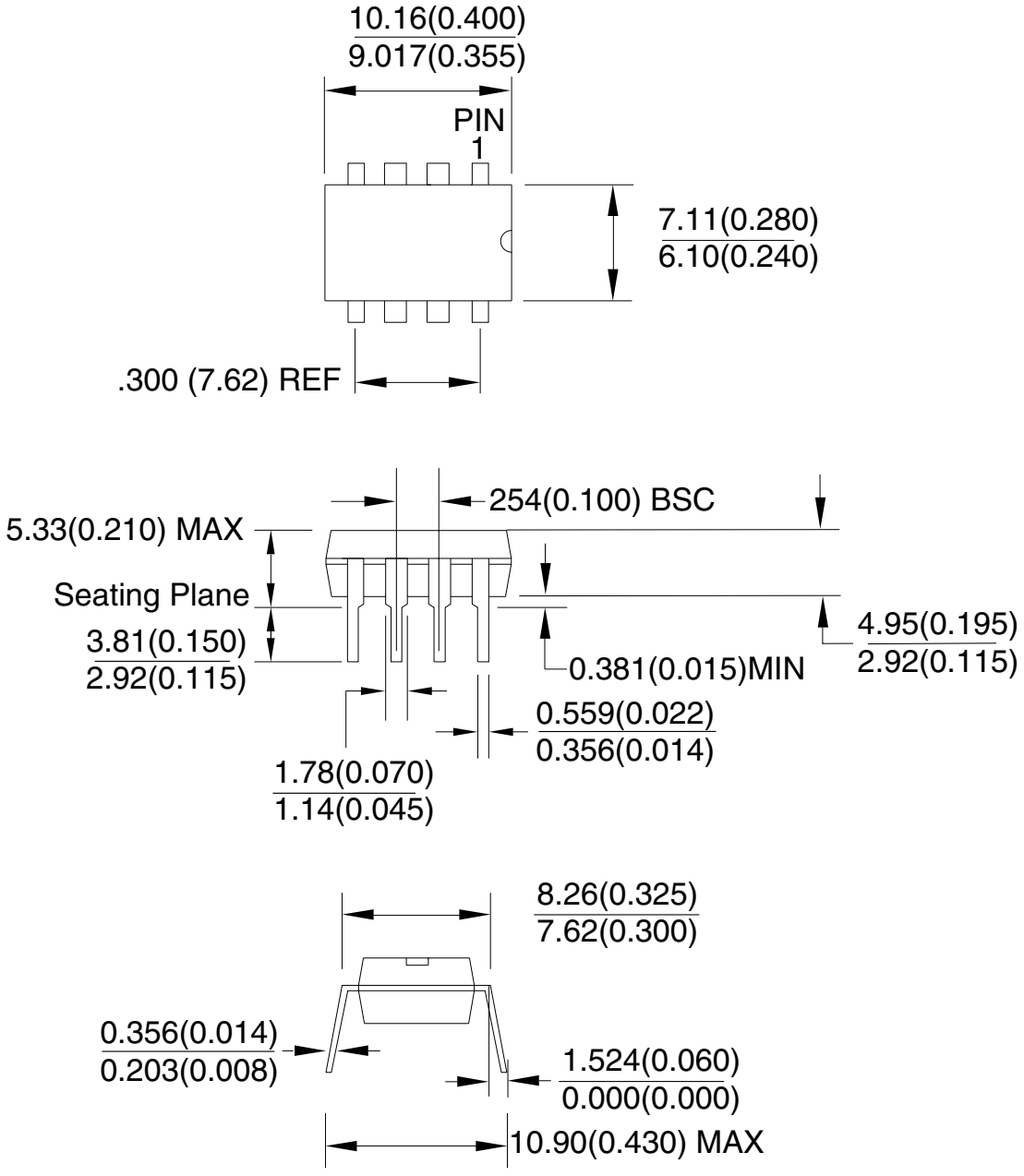
Note: The speed grade refers to maximum clock rate when using an external crystal or external clock drive. The internal RC oscillator has the same nominal clock frequency for all speed grades.

Package Type	
8P3	8-lead, 0.300" Wide, Plastic Dual Inline Package (PDIP)
8S2	8-lead, 0.200" Wide, Plastic Gull-Wing Small Outline (EIAJ SOIC)

Packaging Information

8P3

8P3, 8-lead, Plastic Dual Inline
Package (PDIP), 0.300" Wide.
Dimensions in Millimeters and (Inches)*
JEDEC STANDARD MS-001 BA



*Controlling dimension: Inches

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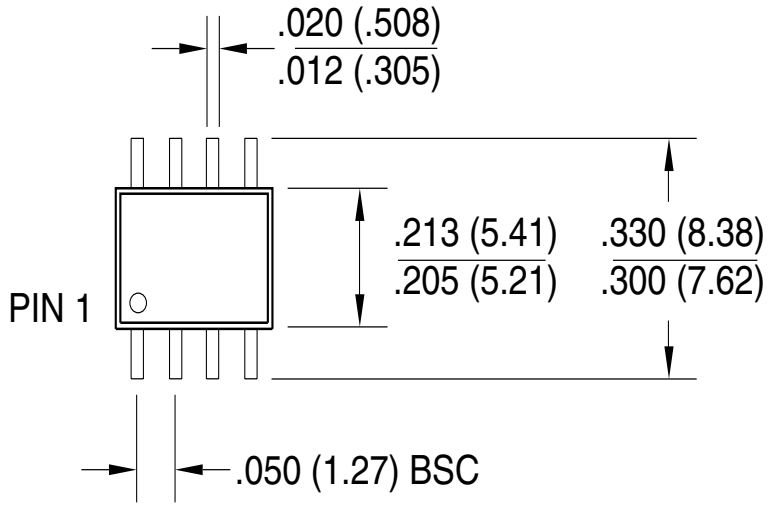
8S2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.012 (.305)
.213 (5.41)
.205 (5.21)
.330 (8.38)
.300 (7.62)
PIN 1
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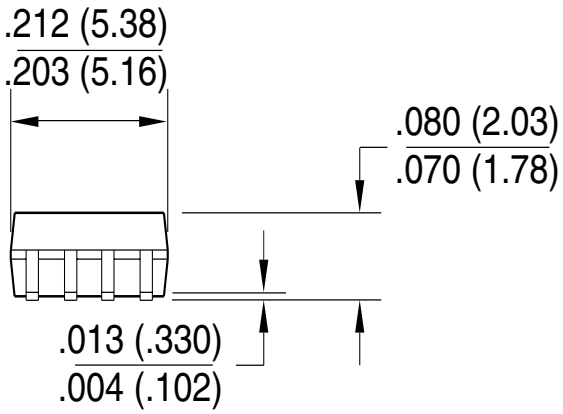
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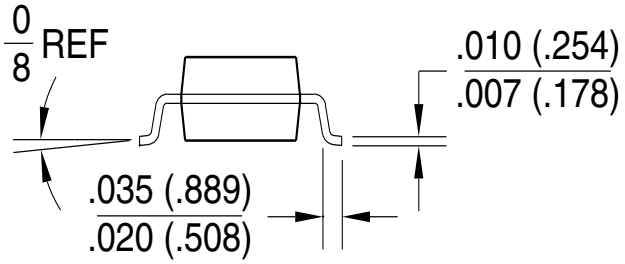
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Atmel Headquarters

Corporate Headquarters
2325 Orchard Parkway
San Jose, CA 95131
TEL (408) 441-0311
FAX (408) 487-2600

Europe
Atmel SarL
Route des Arsenaux 41
Casa Postale 80
CH-1705 Fribourg
Switzerland
TEL (41) 26-426-5555
FAX (41) 26-426-5500

Asia
Atmel Asia, Ltd.
Room 1219
Chinachem Golden Plaza
77 Mody Road Tsimhatsui
East Kowloon
Hong Kong
TEL (852) 2721-9778
FAX (852) 2722-1369

Japan
Atmel Japan K.K.
9F, Tonetsu Shinkawa Bldg.
1-24-8 Shinkawa
Chuo-ku, Tokyo 104-0033
Japan
TEL (81) 3-3523-3551
FAX (81) 3-3523-7581

Atmel Product Operations

Atmel Colorado Springs
1150 E. Cheyenne Mtn. Blvd.
Colorado Springs, CO 80906
TEL (719) 576-3300
FAX (719) 540-1759

Atmel Grenoble
Avenue de Rochepleine
BP 123
38521 Saint-Egreve Cedex, France
TEL (33) 4-7658-3000
FAX (33) 4-7658-3480

Atmel Heilbronn
Theresienstrasse 2
POB 3535
D-74025 Heilbronn, Germany
TEL (49) 71 31 67 25 94
FAX (49) 71 31 67 24 23

Atmel Nantes
La Chantrerie
BP 70602
44306 Nantes Cedex 3, France
TEL (33) 0 2 40 18 18 18
FAX (33) 0 2 40 18 19 60

Atmel Rousset
Zone Industrielle
13106 Rousset Cedex, France
TEL (33) 4-4253-6000
FAX (33) 4-4253-6001

Atmel Smart Card ICs
Scottish Enterprise Technology Park
East Kilbride, Scotland G75 0QR
TEL (44) 1355-357-000
FAX (44) 1355-242-743

e-mail
literature@atmel.com

Web Site
http://www.atmel.com

BBS
1-(408) 436-4309

1006CS–09/01/xM