Features

- High Performance, Low Power AVR® 8-Bit Microcontroller
- Advanced RISC Architecture
  - 123 Powerful Instructions – Most Single Clock Cycle Execution
  - 32 x 8 General Purpose Working Registers
  - Fully Static Operation
- Non-volatile Program and Data Memories
  - 2/4/8K Byte of In-System Programmable Program Memory Flash (ATtiny261/461/861)
    Endurance: 10,000 Write/Erase Cycles
  - 128/256/512 Bytes In-System Programmable EEPROM (ATtiny261/461/861)
    Endurance: 100,000 Write/Erase Cycles
  - 128/256/512 Bytes Internal SRAM (ATtiny261/461/861)
  - Programming Lock for Self-Programming Flash Program and EEPROM Data Security
- Peripheral Features
  - 8/16-bit Timer/Counter with Prescaler and Two PWM Channels
  - 8/10-bit High Speed Timer/Counter with Separate Prescaler
    3 High Frequency PWM Outputs with Separate Output Compare Registers
    Programmable Dead Time Generator
  - Universal Serial Interface with Start Condition Detector
  - 10-bit ADC
    11 Single Ended Channels
    16 Differential ADC Channel Pairs
    15 Differential ADC Channel Pairs with Programmable Gain (1x, 8x, 20x, 32x)
  - Programmable Watchdog Timer with Separate On-chip Oscillator
  - On-chip Analog Comparator
- Special Microcontroller Features
  - debugWIRE On-chip Debug System
  - In-System Programmable via SPI Port
  - External and Internal Interrupt Sources
  - Low Power Idle, ADC Noise Reduction, and Power-down Modes
  - Enhanced Power-on Reset Circuit
  - Programmable Brown-out Detection Circuit
  - Internal Calibrated Oscillator
- I/O and Packages
  - 16 Programmable I/O Lines
  - 20-pin PDIP, 20-pin SOIC and 32-pad MLF
- Operating Voltage:
  - 1.8 - 5.5V for ATtiny261V/461V/861V
  - 2.7 - 5.5V for ATtiny261/461/861
- Speed Grade:
  - ATtiny261V/461V/861V: 0 - 4 MHz @ 1.8 - 5.5V, 0 - 10 MHz @ 2.7 - 5.5V
  - ATtiny261/461/861: 0 - 10 MHz @ 2.7 - 5.5V, 0 - 20 MHz @ 4.5 - 5.5V
- Industrial Temperature Range
- Low Power Consumption
  - Active Mode: 1 MHz, 1.8V: 380µA
  - Power-down Mode: 0.1µA at 1.8V

8-bit AVR® Microcontroller with 2/4/8K Bytes In-System Programmable Flash

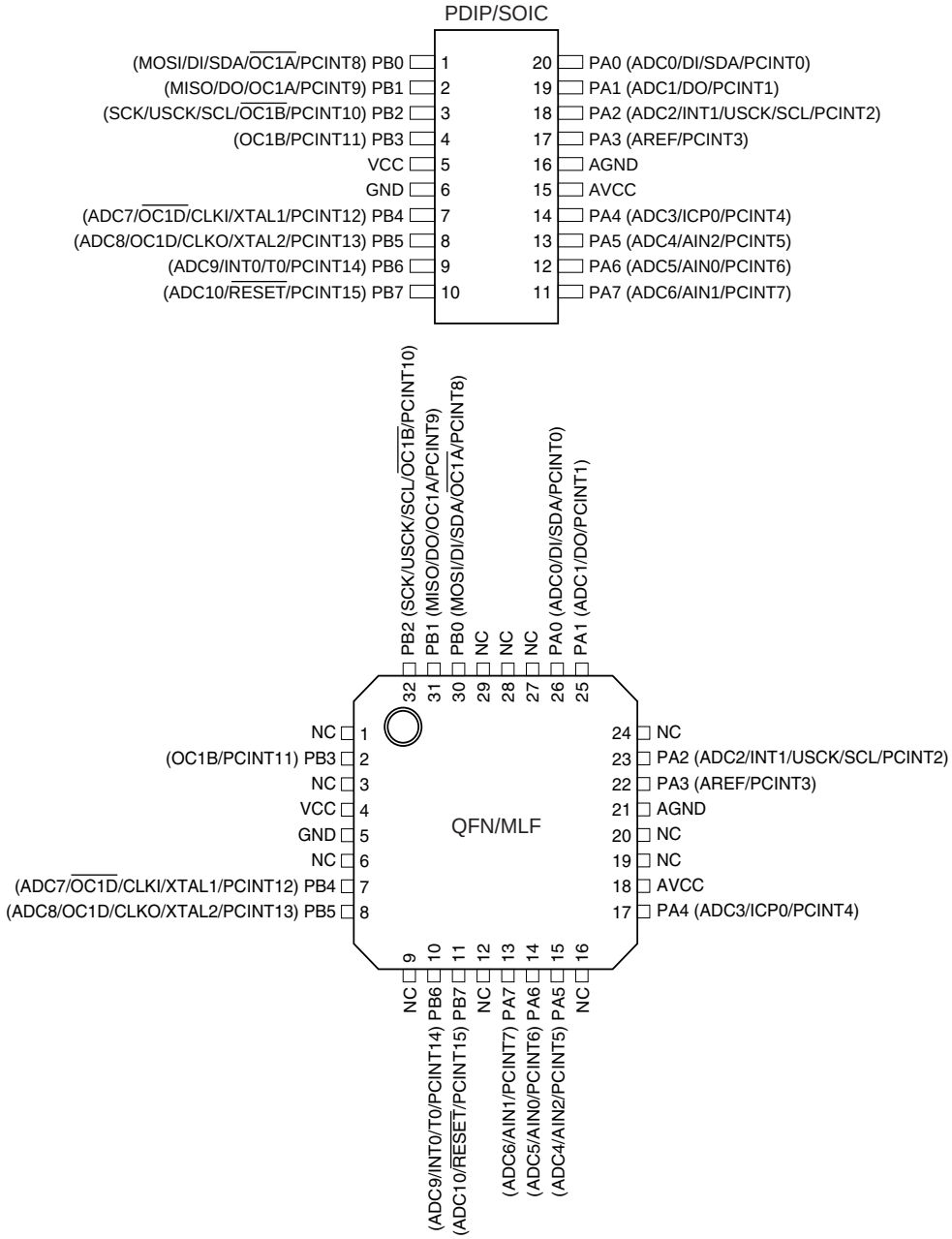
ATtiny261/V
ATtiny461/V
ATtiny861/V

Preliminary Summary

2588BS–AVR–11/06

1. Pin Configurations

Figure 1-1. Pinout ATtiny261/461/861



Note: The large center pad underneath the QFN/MLF package should be soldered to ground on the board to ensure good mechanical stability.

1.1 Disclaimer

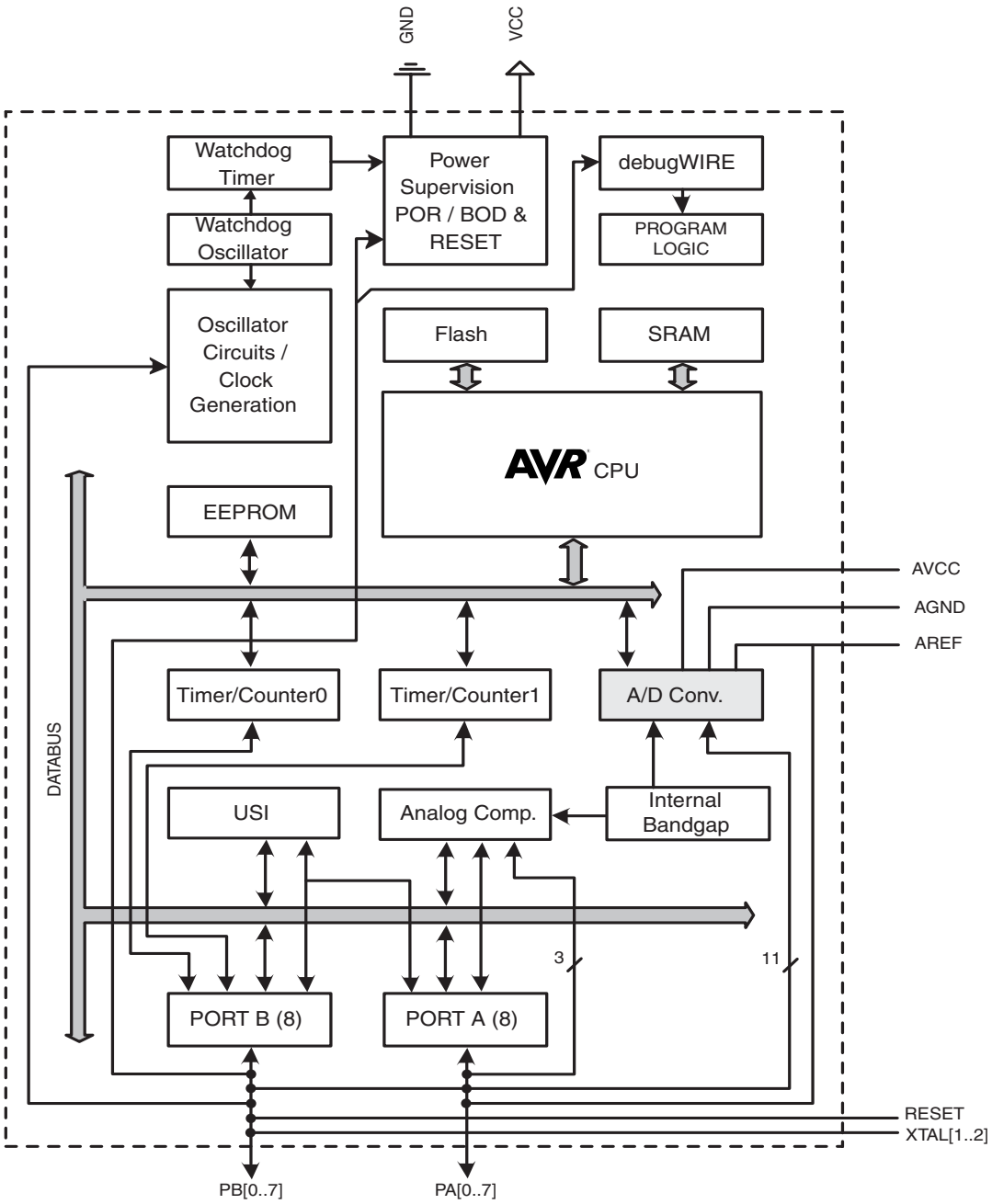
Typical values contained in this data sheet are based on simulations and characterization of other AVR microcontrollers manufactured on the same process technology. Min and Max values will be available after the device is characterized.

2. Overview

The ATtiny261/461/861 is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATtiny261/461/861 achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed.

2.1 Block Diagram

Figure 2-1. Block Diagram



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.

The ATtiny261/461/861 provides the following features: 2/4/8K byte of In-System Programmable Flash, 128/256/512 bytes EEPROM, 128/256/512 bytes SRAM, 6 general purpose I/O lines, 32 general purpose working registers, one 8-bit Timer/Counter with compare modes, one 8-bit high speed Timer/Counter, Universal Serial Interface, Internal and External Interrupts, a 4-channel, 10-bit ADC, a programmable Watchdog Timer with internal Oscillator, and three software selectable power saving modes. The Idle mode stops the CPU while allowing the SRAM, Timer/Counter, ADC, Analog Comparator, and Interrupt system to continue functioning. The Power-down mode saves the register contents, disabling all chip functions until the next Interrupt or Hardware Reset. The ADC Noise Reduction mode stops the CPU and all I/O modules except ADC, to minimize switching noise during ADC conversions.

The device is manufactured using Atmel's high density non-volatile memory technology. The On-chip ISP Flash allows the Program memory to be re-programmed In-System through an SPI serial interface, by a conventional non-volatile memory programmer or by an On-chip boot code running on the AVR core.

The ATtiny261/461/861 AVR is supported with a full suite of program and system development tools including: C Compilers, Macro Assemblers, Program Debugger/Simulators, In-Circuit Emulators, and Evaluation kits.

2.2 Pin Descriptions

2.2.1 VCC

Supply voltage.

2.2.2 GND

Ground.

2.2.3 AVCC

Analog supply voltage.

2.2.4 AGND

Analog ground.

2.2.5 Port A (PA7..PA0)

Port A is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port A output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port A pins that are externally pulled low will source current if the pull-up resistors are activated. The Port A pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Port A also serves the functions of various special features of the ATtiny261/461/861 as listed on page 65.

2.2.6 Port B (PB7..PB0)

Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Port B also serves the functions of various special features of the ATtiny261/461/861 as listed on page 61.

2.2.7 $\overline{\text{RESET}}$

Reset input. A low level on this pin for longer than the minimum pulse length will generate a reset, even if the clock is not running. The minimum pulse length is given in Table 23-3 on page 189. Shorter pulses are not guaranteed to generate a reset.

3. Resources

A comprehensive set of development tools, application notes and datasheets are available for download on http://www.atmel.com/avr.

4. Register Summary

Address	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Page
0x3F (0x5F)	SREG	I	T	H	S	V	N	Z	C	page 9
0x3E (0x5E)	SPH	–	–	–	–	–	SP10	SP9	SP8	page 12
0x3D (0x5D)	SPL	SP7	SP6	SP5	SP4	SP3	SP2	SP1	SP0	page 12
0x3C (0x5C)	Reserved	–								
0x3B (0x5B)	GIMSK	INT1	INT0	PCIE1	PCIE0	–	–	–	–	page 51
0x3A (0x5A)	GIFR	INTF1	INTF0	PCIF	–	–	–	–	–	page 51
0x39 (0x59)	TIMSK	OCIE1D	OCIE1A	OCIE1B	OCIE0A	OCIE0B	TOIE1	TOIE0	TICIE0	page 86, page 123
0x38 (0x58)	TIFR	OCF1D	OCF1A	OCF1B	OCF0A	OCF0B	TOV1	TOV0	ICF0	page 87, page 124
0x37 (0x57)	SPMCSR	–	–	–	CTPB	RFLB	PGWRT	PGERS	SPMEN	page 166
0x36 (0x56)	PRR					PRTIM1	PRTIM0	PRUSI	PRADC	page 35
0x35 (0x55)	MCUCR	–	PUD	SE	SM1	SM0	–	ISC01	ISC00	page 37, page 68, page 50
0x34 (0x54)	MCUSR	–	–	–	–	WDRF	BORF	EXTRF	PORF	page 44,
0x33 (0x53)	TCCR0B	–	–	–	TSM	PSR0	CS02	CS01	CS00	page 70
0x32 (0x52)	TCNT0L	Timer/Counter0 Counter Register Low Byte								page 85
0x31 (0x51)	OSCCAL	Oscillator Calibration Register								page 32
0x30 (0x50)	TCCR1A	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	PWM1A	PWM1B	page 113
0x2F (0x4F)	TCCR1B	PWM1X	PSR1	DTPS11	DTPS10	CS13	CS12	CS11	CS10	page 166
0x2E (0x4E)	TCNT1	Timer/Counter1 Counter Register								page 121
0x2D (0x4D)	OCR1A	Timer/Counter1 Output Compare Register A								page 121
0x2C (0x4C)	OCR1B	Timer/Counter1 Output Compare Register B								page 122
0x2B (0x4B)	OCR1C	Timer/Counter1 Output Compare Register C								page 122
0x2A (0x4A)	OCR1D	Timer/Counter1 Output Compare Register D								page 123
0x29 (0x49)	PLLCSR	LSM					PCKE	PLLE	PLOCK	page 89
0x28 (0x48)	CLKPR	CLKPCE				CLKPS3	CLKPS2	CLKPS1	CLKPS0	page 32
0x27 (0x47)	TCCR1C	COM1A1S	COM1A0S	COM1B1S	COM1B0S	COM1D1	COM1D0	FOC1D	PWM1D	page 117
0x26 (0x46)	TCCR1D	FPIE1	FPEN1	FPNC1	FPES1	FPAC1	FPF1	WGM11	WGM10	page 119
0x25 (0x45)	TC1H							TC19	TC18	page 121
0x24 (0x44)	DT1	DT1H3	DT1H2	DT1H1	DT1H0	DT1L3	DT1L2	DT1L1	DT1L0	page 124
0x23 (0x43)	PCMSK0	PCINT7	PCINT6	PCINT5	PCINT4	PCINT3	PCINT2	PCINT1	PCINT0	page 52
0x22 (0x42)	PCMSK1	PCINT15	PCINT14	PCINT13	PCINT12	PCINT11	PCINT10	PCINT9	PCINT8	page 52
0x21 (0x41)	WDTCR	WDIF	WDIE	WDP3	WDCE	WDE	WDP2	WDP1	WDP0	page 44
0x20 (0x40)	DWDR	DWDR[7:0]								page 35
0x1F (0x3F)	EEARH								EEAR8	page 21
0x1E (0x3E)	EEARL	EEAR7	EEAR6	EEAR5	EEAR4	EEAR3	EEAR2	EEAR1	EEAR0	page 21
0x1D (0x3D)	EEDR	EEPROM Data Register								page 22
0x1C (0x3C)	EECR	–	–	EEPM1	EEPM0	EERIE	EEMPE	EEPE	EERE	page 22
0x1B (0x3B)	PORTA	PORTA7	PORTA6	PORTA5	PORTA4	PORTA3	PORTA2	PORTA1	PORTA0	page 68
0x1A (0x3A)	DDRA	DDA7	DDA6	DDA5	DDA4	DDA3	DDA2	DDA1	DDA0	page 68
0x19 (0x39)	PINA	PINA7	PINA6	PINA5	PINA4	PINA3	PINA2	PINA1	PINA0	page 68
0x18 (0x38)	PORTB	PORTB7	PORTB6	PORTB5	PORTB4	PORTB3	PORTB2	PORTB1	PORTB0	page 68
0x17 (0x37)	DDRB	DDB7	DDB6	DDB5	DDB4	DDB3	DDB2	DDB1	DDB0	page 68
0x16 (0x36)	PINB	PINB7	PINB6	PINB5	PINB4	PINB3	PINB2	PINB1	PINB0	page 68
0x15 (0x35)	TCCR0A	TCW0	ICEN0	ICNC0	ICES0	ACIC0			WGM00	page 84
0x14 (0x34)	TCNT0H	Timer/Counter0 Counter Register High Byte								page 85
0x13 (0x33)	OCR0A	Timer/Counter0 Output Compare Register A								page 85
0x12 (0x32)	OCR0B	Timer/Counter0 Output Compare Register B								page 85
0x11 (0x31)	USIPP								USIPOS	page 137
0x10 (0x30)	USIBR	USI Buffer Register								page 134
0x0F (0x2F)	USIDR	USI Data Register								page 133
0x0E (0x2E)	USISR	USISIF	USIOIF	USIPF	USIDC	USICNT3	USICNT2	USICNT1	USICNT0	page 134
0x0D (0x2D)	USICR	USISIE	USIOIE	USIWM1	USIWM0	USICS1	USICS0	USICLK	USITC	page 135
0x0C (0x2C)	GPIOR2	General Purpose I/O Register 2								page 23
0x0B (0x2B)	GPIOR1	General Purpose I/O Register 1								page 23
0x0A (0x2A)	GPIOR0	General Purpose I/O Register 0								page 23
0x09 (0x29)	ACSRB	HSEL	HLEV				ACM2	ACM1	ACM0	page 141
0x08 (0x28)	ACSRA	ACD	ACBG	ACO	ACI	ACIE	ACME	ACIS1	ACIS0	page 138
0x07 (0x27)	ADMUX	REFS1	REFS0	ADLAR	MUX4	MUX3	MUX2	MUX1	MUX0	page 154
0x06 (0x26)	ADCSRA	ADEN	ADSC	ADATE	ADIF	ADIE	ADPS2	ADPS1	ADPS0	page 157
0x05 (0x25)	ADCH	ADC Data Register High Byte								page 158
0x04 (0x24)	ADCL	ADC Data Register Low Byte								page 158
0x03 (0x23)	ADCSRB	BIN	GSEL		REFS2	MUX5	ADTS2	ADTS1	ADTS0	page 158
0x02 (0x22)	DIDR1	ADC10D	ADC9D	ADC8D	ADC7D					page 160
0x01 (0x21)	DIDR0	ADC6D	ADC5D	ADC4D	ADC3D	AREFD	ADC2D	ADC1D	ADC0D	page 160
0x00 (0x20)	TCCR1E	–	-	OC1OE5	OC1OE4	OC1OE3	OC1OE2	OC1OE1	OC1OE0	page 120

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. I/O Registers within the address range 0x00 - 0x1F are directly bit-accessible using the SBI and CBI instructions. In these registers, the value of single bits can be checked by using the SBIS and SBIC instructions.
3. Some of the Status Flags are cleared by writing a logical one to them. Note that, unlike most other AVRs, the CBI and SBI instructions will only operation the specified bit, and can therefore be used on registers containing such Status Flags. The CBI and SBI instructions work with registers 0x00 to 0x1F only.

5. 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
ADIW	Rdl,K	Add Immediate to Word	Rdh:Rdl ← Rdh:Rdl + K	Z,C,N,V,S	2
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
SBIW	Rdl,K	Subtract Immediate from Word	Rdh:Rdl ← Rdh:Rdl - K	Z,C,N,V,S	2
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 ← 0xFF − Rd	Z,C,N,V	1
NEG	Rd	Two's Complement	Rd ← 0x00 − 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 • (0xFF - 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 ← 0xFF	None	1
BRANCH INSTRUCTIONS					
RJMP	k	Relative Jump	PC ← PC + k + 1	None	2
IJMP		Indirect Jump to (Z)	PC ← Z	None	2
RCALL	k	Relative Subroutine Call	PC ← PC + k + 1	None	3
ICALL		Indirect Call to (Z)	PC ← Z	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	1/2/3
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	1/2/3
SBRS	Rr, b	Skip if Bit in Register is Set	if (Rr(b)=1) PC ← PC + 2 or 3	None	1/2/3
SBIC	P, b	Skip if Bit in I/O Register Cleared	if (P(b)=0) PC ← PC + 2 or 3	None	1/2/3
SBIS	P, b	Skip if Bit in I/O Register is Set	if (P(b)=1) PC ← PC + 2 or 3	None	1/2/3
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
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

Mnemonics	Operands	Description	Operation	Flags	#Clocks
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
DATA TRANSFER INSTRUCTIONS					
MOV	Rd, Rr	Move Between Registers	Rd ← Rr	None	1
MOVW	Rd, Rr	Copy Register Word	Rd+1:Rd ← Rr+1:Rr	None	1
LDI	Rd, K	Load Immediate	Rd ← K	None	1
LD	Rd, X	Load Indirect	Rd ← (X)	None	2
LD	Rd, X+	Load Indirect and Post-Inc.	Rd ← (X), X ← X + 1	None	2
LD	Rd, - X	Load Indirect and Pre-Dec.	X ← X - 1, Rd ← (X)	None	2
LD	Rd, Y	Load Indirect	Rd ← (Y)	None	2
LD	Rd, Y+	Load Indirect and Post-Inc.	Rd ← (Y), Y ← Y + 1	None	2
LD	Rd, - Y	Load Indirect and Pre-Dec.	Y ← Y - 1, Rd ← (Y)	None	2
LDD	Rd,Y+q	Load Indirect with Displacement	Rd ← (Y + q)	None	2
LD	Rd, Z	Load Indirect	Rd ← (Z)	None	2
LD	Rd, Z+	Load Indirect and Post-Inc.	Rd ← (Z), Z ← Z+1	None	2
LD	Rd, -Z	Load Indirect and Pre-Dec.	Z ← Z - 1, Rd ← (Z)	None	2
LDD	Rd, Z+q	Load Indirect with Displacement	Rd ← (Z + q)	None	2
LDS	Rd, k	Load Direct from SRAM	Rd ← (k)	None	2
ST	X, Rr	Store Indirect	(X) ← Rr	None	2
ST	X+, Rr	Store Indirect and Post-Inc.	(X) ← Rr, X ← X + 1	None	2
ST	- X, Rr	Store Indirect and Pre-Dec.	X ← X - 1, (X) ← Rr	None	2
ST	Y, Rr	Store Indirect	(Y) ← Rr	None	2
ST	Y+, Rr	Store Indirect and Post-Inc.	(Y) ← Rr, Y ← Y + 1	None	2
ST	- Y, Rr	Store Indirect and Pre-Dec.	Y ← Y - 1, (Y) ← Rr	None	2
STD	Y+q,Rr	Store Indirect with Displacement	(Y + q) ← Rr	None	2
ST	Z, Rr	Store Indirect	(Z) ← Rr	None	2
ST	Z+, Rr	Store Indirect and Post-Inc.	(Z) ← Rr, Z ← Z + 1	None	2
ST	-Z, Rr	Store Indirect and Pre-Dec.	Z ← Z - 1, (Z) ← Rr	None	2
STD	Z+q,Rr	Store Indirect with Displacement	(Z + q) ← Rr	None	2
STS	k, Rr	Store Direct to SRAM	(k) ← Rr	None	2
LPM		Load Program Memory	R0 ← (Z)	None	3
LPM	Rd, Z	Load Program Memory	Rd ← (Z)	None	3
LPM	Rd, Z+	Load Program Memory and Post-Inc	Rd ← (Z), Z ← Z+1	None	3
SPM		Store Program Memory	(z) ← R1:R0	None	
IN	Rd, P	In Port	Rd ← P	None	1
OUT	P, Rr	Out Port	P ← Rr	None	1
PUSH	Rr	Push Register on Stack	STACK ← Rr	None	2
POP	Rd	Pop Register from Stack	Rd ← STACK	None	2
MCU CONTROL INSTRUCTIONS					
NOP		No Operation		None	1
SLEEP		Sleep	(see specific descr. for Sleep function)	None	1
WDR		Watchdog Reset	(see specific descr. for WDR/Timer)	None	1
BREAK		Break	For On-chip Debug Only	None	N/A

6. Ordering Information

6.1 ATtiny261

Speed (MHz)[3]	Power Supply	Ordering Code[2]	Package[1]	Operational Range
10	1.8 - 5.5V	ATtiny261V-10MU ATtiny261V-10PU ATtiny261V-10SU	32M1-A 20P3 20S2	Industrial (-40°C to 85°C)
20	2.7 - 5.5V	ATtiny261-20MU ATtiny261-20PU ATtiny261-20SU	32M1-A 20P3 20S2	Industrial (-40°C to 85°C)

Notes:
1. This device can also be supplied in wafer form. Please contact your local Atmel sales office for detailed ordering information and minimum quantities.
2. Pb-free packaging, complies to the European Directive for Restriction of Hazardous Substances (RoHS directive). Also Halide free and fully Green.
3. For Speed vs. V_{CC},see Figure 23.3 on page 187

Package Type	
32M1-A	32-pad, 5 x 5 x 1.0 mm Body, Lead Pitch 0.50 mm, Micro Lead Frame Package (MLF)
20P3	20-lead, 0.300" Wide, Plastic Dual Inline Package (PDIP)
20S2	20-lead, 0.300" Wide, Plastic Gull Wing Small Outline Package (SOIC)

6.2 ATtiny461

Speed (MHz)[3]	Power Supply	Ordering Code[2]	Package[1]	Operational Range
10	1.8 - 5.5V	ATtiny461V-10MU ATtiny461V-10PU ATtiny461V-10SU	32M1-A 20P3 20S2	Industrial (-40°C to 85°C)
20	2.7 - 5.5V	ATtiny461-20MU ATtiny461-20PU ATtiny461-20SU	32M1-A 20P3 20S2	Industrial (-40°C to 85°C)

Notes:
1. This device can also be supplied in wafer form. Please contact your local Atmel sales office for detailed ordering information and minimum quantities.
2. Pb-free packaging, complies to the European Directive for Restriction of Hazardous Substances (RoHS directive). Also Halide free and fully Green.
3. For Speed vs. V_{CC},see Figure 23.3 on page 187

Package Type	
32M1-A	32-pad, 5 x 5 x 1.0 mm Body, Lead Pitch 0.50 mm, Micro Lead Frame Package (MLF)
20P3	20-lead, 0.300" Wide, Plastic Dual Inline Package (PDIP)
20S2	20-lead, 0.300" Wide, Plastic Gull Wing Small Outline Package (SOIC)

6.3 ATtiny861

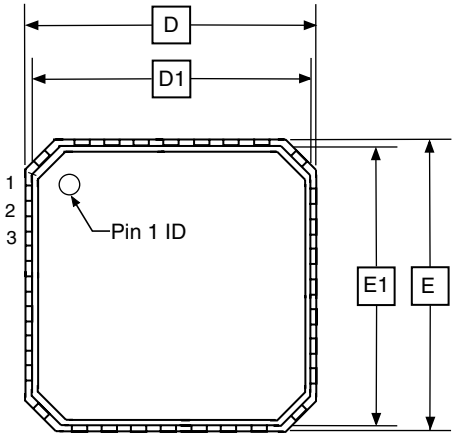
Speed (MHz)[3]	Power Supply	Ordering Code[2]	Package[1]	Operational Range
10	1.8 - 5.5V	ATtiny861V-10MU ATtiny861V-10PU ATtiny861V-10SU	32M1-A 20P3 20S2	Industrial (-40°C to 85°C)
20	2.7 - 5.5V	ATtiny861-20MU ATtiny861-20PU ATtiny861-20SU	32M1-A 20P3 20S2	Industrial (-40°C to 85°C)

Notes:
1. This device can also be supplied in wafer form. Please contact your local Atmel sales office for detailed ordering information and minimum quantities.
2. Pb-free packaging, complies to the European Directive for Restriction of Hazardous Substances (RoHS directive). Also Halide free and fully Green.
3. For Speed vs. V_{CC},see Figure 23.3 on page 187

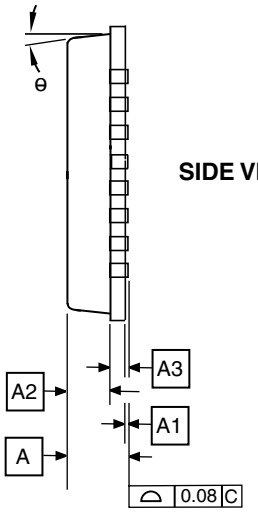
Package Type	
32M1-A	32-pad, 5 x 5 x 1.0 mm Body, Lead Pitch 0.50 mm, Micro Lead Frame Package (MLF)
20P3	20-lead, 0.300" Wide, Plastic Dual Inline Package (PDIP)
20S2	20-lead, 0.300" Wide, Plastic Gull Wing Small Outline Package (SOIC)

7. Packaging Information

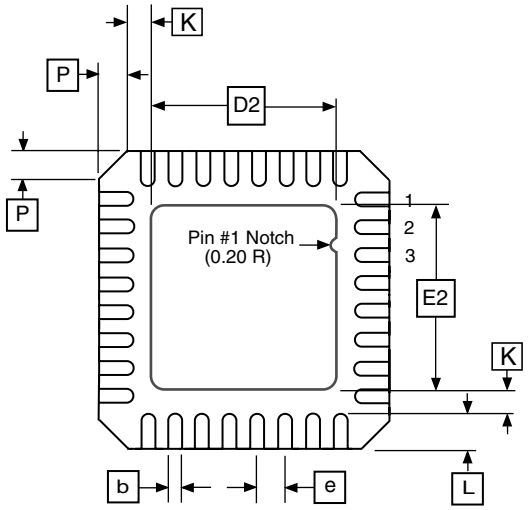
7.1 32M1-A



TOP VIEW



SIDE VIEW



BOTTOM VIEW

COMMON DIMENSIONS
(Unit of Measure = mm)

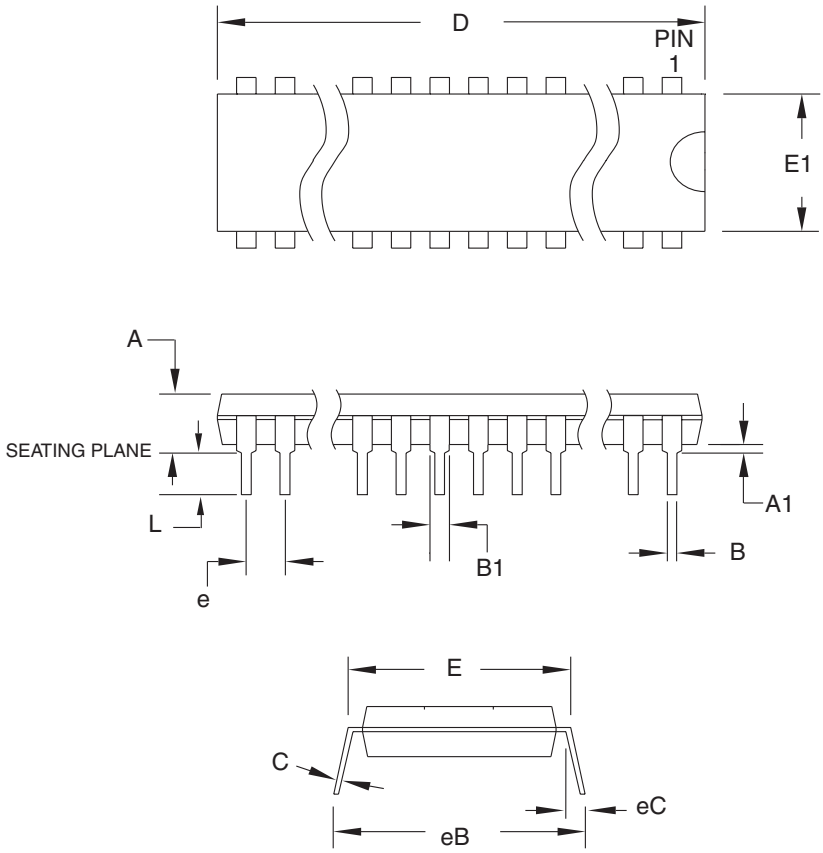
SYMBOL	MIN	NOM	MAX	NOTE
A	0.80	0.90	1.00	
A1	–	0.02	0.05	
A2	–	0.65	1.00	
A3		0.20 REF		
b	0.18	0.23	0.30	
D		5.00 BSC		
D1		4.75 BSC		
D2	2.95	3.10	3.25	
E		5.00 BSC		
E1		4.75BSC		
E2	2.95	3.10	3.25	
e		0.50 BSC		
L	0.30	0.40	0.50	
P	–	–	0.60	
θ	–	–	12^{o}	
K	0.20	–	–	

Note: JEDEC Standard MO-220, Fig. 2 (Anvil Singulation), VHHD-2.

8/19/04

	TITLE	DRAWING NO.	REV.
2325 Orchard Parkway San Jose, CA 95131	**32M1-A**, 32-pad, 5 x 5 x 1.0 mm Body, Lead Pitch 0.50 mm, 3.10 mm Exposed Pad, Micro Lead Frame Package (MLF)	32M1-A	D

7.2 20P3



COMMON DIMENSIONS
(Unit of Measure = mm)

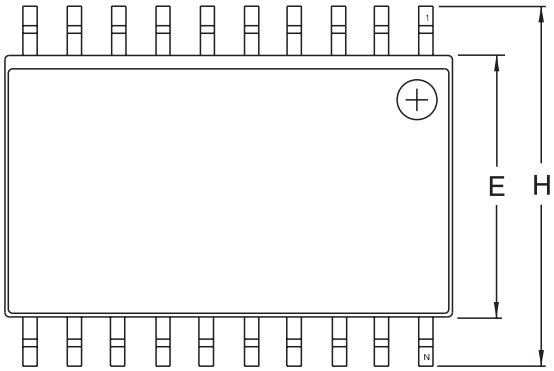
SYMBOL	MIN	NOM	MAX	NOTE
A	–	–	5.334	
A1	0.381	–	–	
D	25.493	–	25.984	Note 2
E	7.620	–	8.255	
E1	6.096	–	7.112	Note 2
B	0.356	–	0.559	
B1	1.270	–	1.551	
L	2.921	–	3.810	
C	0.203	–	0.356	
eB	–	–	10.922	
eC	0.000	–	1.524	
e	2.540 TYP			

Notes:
1. This package conforms to JEDEC reference MS-001, Variation AD.
2. Dimensions D and E1 do not include mold Flash or Protrusion. Mold Flash or Protrusion shall not exceed 0.25 mm (0.010").

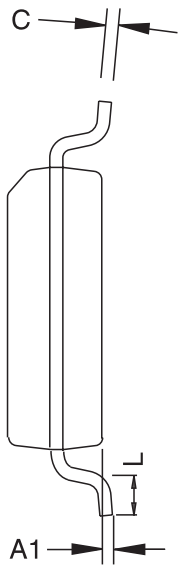
1/12/04

	TITLE	DRAWING NO.	REV.
2325 Orchard Parkway San Jose, CA 95131	**20P3**, 20-lead (0.300"/7.62 mm Wide) Plastic Dual Inline Package (PDIP)	20P3	C

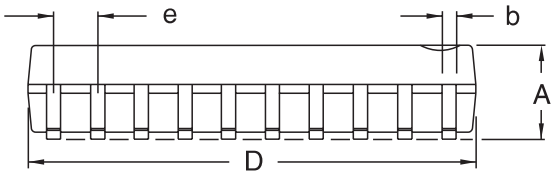
7.3 20S2



Top View



End View



Side View

COMMON DIMENSIONS
(Unit of Measure – mm)

SYMBOL	MIN	NOM	MAX	NOTE
A	2.35		2.65	
A1	0.10		0.30	
b	0.33		0.51	4
C	0.23		0.32	
D	12.60		13.00	1
E	7.40		7.60	2
H	10.00		10.65	
L	0.40		1.27	3
e	1.27 BSC			

Notes.
1. This drawing is for general information only; refer to JEDEC Drawing MS-013, Variation AC for additional information.
2. Dimension 'D' does not include mold Flash, protrusions or gate burrs. Mold Flash, protrusions and gate burrs shall not exceed 0.15 mm (0.006') per side.
3. Dimension 'E' does not include inter-lead Flash or protrusion. Inter-lead Flash and protrusions shall not exceed 0.25 mm (0.010') per side.
4. 'L' is the length of the terminal for soldering to a substrate.
5. The lead width 'b', as measured 0.36 mm (0.014') or greater above the seating plane, shall not exceed a maximum value of 0.61 mm (0.024') per side.

11/6/06

	TITLE	DRAWING NO.	REV.
2325 Orchard Parkway San Jose, CA 95131	**20S2**, 20-lead, 0.300' Wide Body, Plastic Gull Wing Small Outline Package (SOIC)	20S2	B

8. Errata

8.1 Errata ATtiny261

The revision letter in this section refers to the revision of the ATtiny261 device.

8.1.1 Rev A

No known errata.

8.2 Errata ATtiny461

The revision letter in this section refers to the revision of the ATtiny461 device.

8.2.1 Rev B

Yield improvement. No known errata.

8.2.2 Rev A

No known errata.

8.3 Errata ATtiny861

The revision letter in this section refers to the revision of the ATtiny861 device.

8.3.1 Rev B

No known errata.

8.3.2 Rev A

Not sampled.

9. Datasheet Revision History

9.1 Rev. 2588A – 11/06

1. Updated ”Ordering Information” on page 222.
2. Updated ”Packaging Information” on page 225.

9.2 Rev. 2588A – 10/06

1. Initial Revision.

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