

## Features

- High Performance, Low Power AVR<sup>®</sup> 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: 380 $\mu$ A
  - Power-down Mode: 0.1 $\mu$ A at 1.8V



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

**ATtiny261/V  
ATtiny461/V  
ATtiny861/V**

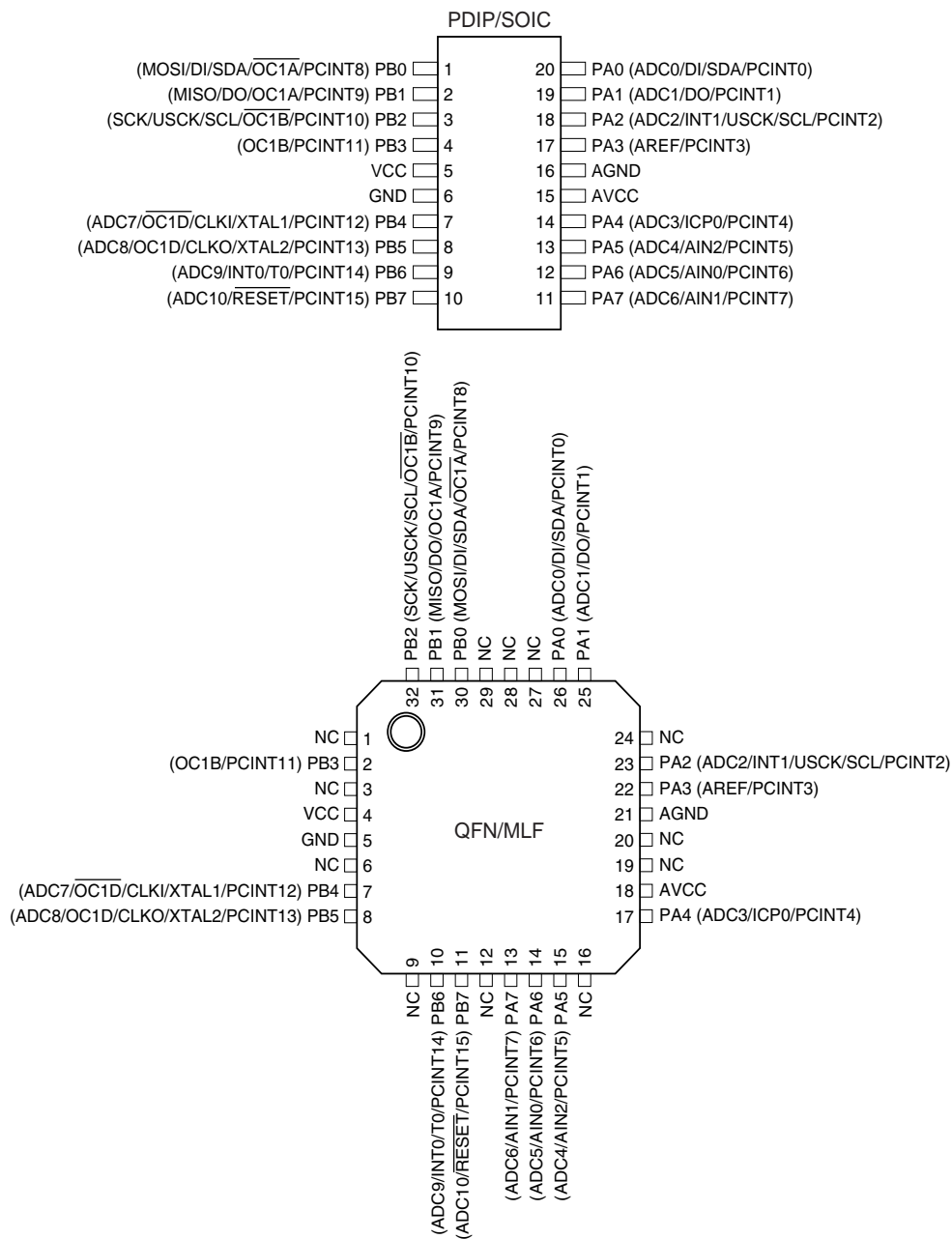
**Preliminary  
Summary**

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

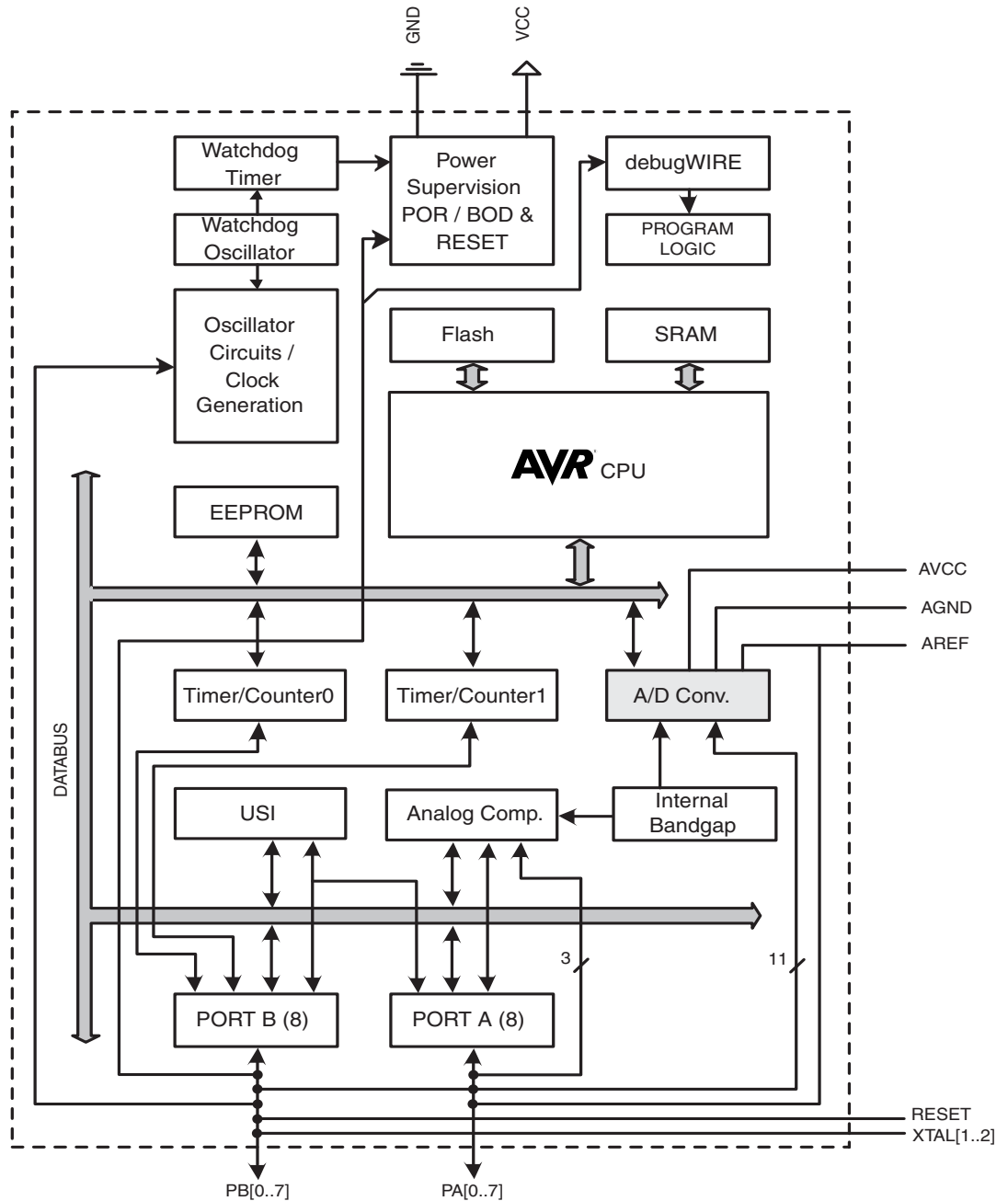
Typical values contained in this data sheet are based on simulations and characterization of other AVR microcontrollers manufactured on the same process technology. Min and Max values will be available after the device is characterized.

## 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	<a href="#">page 9</a>	
0x3E (0x5E)	SPH	–	–	–	–	–	SP10	SP9	SP8	<a href="#">page 12</a>	
0x3D (0x5D)	SPL	SP7	SP6	SP5	SP4	SP3	SP2	SP1	SP0	<a href="#">page 12</a>	
0x3C (0x5C)	Reserved										
0x3B (0x5B)	GIMSK	INT1	INT0	PCIE1	PCIE0	–	–	–	–	<a href="#">page 51</a>	
0x3A (0x5A)	GIFR	INTF1	INTF0	PCIF	–	–	–	–	–	<a href="#">page 51</a>	
0x39 (0x59)	TIMSK	OCIE1D	OCIE1A	OCIE1B	OCIE0A	OCIE0B	TOIE1	TOIE0	TICIE0	<a href="#">page 86</a> , <a href="#">page 123</a>	
0x38 (0x58)	TIFR	OCF1D	OCF1A	OCF1B	OCF0A	OCF0B	TOV1	TOV0	ICF0	<a href="#">page 87</a> , <a href="#">page 124</a>	
0x37 (0x57)	SPMCSR	–	–	–	CTPB	RFLB	PGWRT	PGERS	SPMEN	<a href="#">page 166</a>	
0x36 (0x56)	PRR	–	–	–	–	PRTIM1	PRTIM0	PRUSI	PRADC	<a href="#">page 35</a>	
0x35 (0x55)	MCUCR	–	PUD	SE	SM1	SM0	–	ISC01	ISC00	<a href="#">page 37</a> , <a href="#">page 68</a> , <a href="#">page 50</a>	
0x34 (0x54)	MCUSR	–	–	–	–	WDRF	BORF	EXTRF	PORF	<a href="#">page 44</a> ,	
0x33 (0x53)	TCCR0B	–	–	–	TSM	PSR0	CS02	CS01	CS00	<a href="#">page 70</a>	
0x32 (0x52)	TCNT0L	Timer/Counter0 Counter Register Low Byte									<a href="#">page 85</a>
0x31 (0x51)	OSCCAL	Oscillator Calibration Register									<a href="#">page 32</a>
0x30 (0x50)	TCCR1A	COM1A1	COM1A0	COM1B1	COM1B0	FOC1A	FOC1B	PWM1A	PWM1B	<a href="#">page 113</a>	
0x2F (0x4F)	TCCR1B	PWM1X	PSR1	DTPS11	DTPS10	CS13	CS12	CS11	CS10	<a href="#">page 166</a>	
0x2E (0x4E)	TCNT1	Timer/Counter1 Counter Register									<a href="#">page 121</a>
0x2D (0x4D)	OCR1A	Timer/Counter1 Output Compare Register A									<a href="#">page 121</a>
0x2C (0x4C)	OCR1B	Timer/Counter1 Output Compare Register B									<a href="#">page 122</a>
0x2B (0x4B)	OCR1C	Timer/Counter1 Output Compare Register C									<a href="#">page 122</a>
0x2A (0x4A)	OCR1D	Timer/Counter1 Output Compare Register D									<a href="#">page 123</a>
0x29 (0x49)	PLLCSR	LSM	–	–	–	–	–	–	–	<a href="#">page 89</a>	
0x28 (0x48)	CLKPR	CLKPCE	–	–	–	–	–	–	–	<a href="#">page 32</a>	
0x27 (0x47)	TCCR1C	COM1A1S	COM1A0S	COM1B1S	COM1B0S	COM1D1	COM1D0	FOC1D	PWM1D	<a href="#">page 117</a>	
0x26 (0x46)	TCCR1D	FP1E1	FPEN1	FPNC1	FPES1	FPAC1	FPF1	WGM11	WGM10	<a href="#">page 119</a>	
0x25 (0x45)	TC1H	–	–	–	–	–	–	–	–	<a href="#">page 121</a>	
0x24 (0x44)	DT1	DT1H3	DT1H2	DT1H1	DT1H0	DT1L3	DT1L2	DT1L1	DT1L0	<a href="#">page 124</a>	
0x23 (0x43)	PCMSK0	PCINT7	PCINT6	PCINT5	PCINT4	PCINT3	PCINT2	PCINT1	PCINT0	<a href="#">page 52</a>	
0x22 (0x42)	PCMSK1	PCINT15	PCINT14	PCINT13	PCINT12	PCINT11	PCINT10	PCINT9	PCINT8	<a href="#">page 52</a>	
0x21 (0x41)	WDTCR	WDIF	WDIE	WDP3	WDCE	WDE	WDP2	WDP1	WDP0	<a href="#">page 44</a>	
0x20 (0x40)	DWDR	DWDR[7:0]									<a href="#">page 35</a>
0x1F (0x3F)	EEARH	–	–	–	–	–	–	–	–	<a href="#">page 21</a>	
0x1E (0x3E)	EEARL	EEAR7	EEAR6	EEAR5	EEAR4	EEAR3	EEAR2	EEAR1	EEAR0	<a href="#">page 21</a>	
0x1D (0x3D)	EEDR	EEPROM Data Register									<a href="#">page 22</a>
0x1C (0x3C)	EEDCR	–	–	EEDM1	EEDM0	EERIE	EEMPE	EEPE	EERE	<a href="#">page 22</a>	
0x1B (0x3B)	PORTA	PORTA7	PORTA6	PORTA5	PORTA4	PORTA3	PORTA2	PORTA1	PORTA0	<a href="#">page 68</a>	
0x1A (0x3A)	DDRA	DDA7	DDA6	DDA5	DDA4	DDA3	DDA2	DDA1	DDA0	<a href="#">page 68</a>	
0x19 (0x39)	PINA	PINA7	PINA6	PINA5	PINA4	PINA3	PINA2	PINA1	PINA0	<a href="#">page 68</a>	
0x18 (0x38)	PORTB	PORTB7	PORTB6	PORTB5	PORTB4	PORTB3	PORTB2	PORTB1	PORTB0	<a href="#">page 68</a>	
0x17 (0x37)	DDRB	DDB7	DDB6	DDB5	DDB4	DDB3	DDB2	DDB1	DDB0	<a href="#">page 68</a>	
0x16 (0x36)	PINB	PINB7	PINB6	PINB5	PINB4	PINB3	PINB2	PINB1	PINB0	<a href="#">page 68</a>	
0x15 (0x35)	TCCR0A	TCW0	ICEN0	ICNC0	ICES0	ACIC0	–	–	–	<a href="#">page 84</a>	
0x14 (0x34)	TCNT0H	Timer/Counter0 Counter Register High Byte									<a href="#">page 85</a>
0x13 (0x33)	OCR0A	Timer/Counter0 Output Compare Register A									<a href="#">page 85</a>
0x12 (0x32)	OCR0B	Timer/Counter0 Output Compare Register B									<a href="#">page 85</a>
0x11 (0x31)	USIPP	–	–	–	–	–	–	–	–	<a href="#">page 137</a>	
0x10 (0x30)	USIBR	USI Buffer Register									<a href="#">page 134</a>
0x0F (0x2F)	USIDR	USI Data Register									<a href="#">page 133</a>
0x0E (0x2E)	USISR	USISIF	USIOIF	USIPF	USIDC	USICNT3	USICNT2	USICNT1	USICNT0	<a href="#">page 134</a>	
0x0D (0x2D)	USICR	USISIE	USIOIE	USIWM1	USIWM0	USICS1	USICS0	USICLK	USITC	<a href="#">page 135</a>	
0x0C (0x2C)	GPIOR2	General Purpose I/O Register 2									<a href="#">page 23</a>
0x0B (0x2B)	GPIOR1	General Purpose I/O Register 1									<a href="#">page 23</a>
0x0A (0x2A)	GPIOR0	General Purpose I/O Register 0									<a href="#">page 23</a>
0x09 (0x29)	ACSRB	HSEL	HLEV	–	–	–	–	–	–	<a href="#">page 141</a>	
0x08 (0x28)	ACSR	ACD	ACBG	ACO	ACI	ACIE	ACME	ACIS1	ACIS0	<a href="#">page 138</a>	
0x07 (0x27)	ADMUX	REFS1	REFS0	ADLAR	MUX4	MUX3	MUX2	MUX1	MUX0	<a href="#">page 154</a>	
0x06 (0x26)	ADCSRA	ADEN	ADSC	ADATE	ADIF	ADIE	ADPS2	ADPS1	ADPS0	<a href="#">page 157</a>	
0x05 (0x25)	ADCH	ADC Data Register High Byte									<a href="#">page 158</a>
0x04 (0x24)	ADCL	ADC Data Register Low Byte									<a href="#">page 158</a>
0x03 (0x23)	ADCSRB	BIN	GSEL	–	–	–	–	–	–	<a href="#">page 158</a>	
0x02 (0x22)	DIDR1	ADC10D	ADC9D	ADC8D	ADC7D	–	–	–	–	<a href="#">page 160</a>	
0x01 (0x21)	DIDR0	ADC6D	ADC5D	ADC4D	ADC3D	AREFD	ADC2D	ADC1D	ADC0D	<a href="#">page 160</a>	
0x00 (0x20)	TCCR1E	–	–	OC1OE5	OC1OE4	OC1OE3	OC1OE2	OC1OE1	OC1OE0	<a href="#">page 120</a>	

- 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
<b>ARITHMETIC AND LOGIC INSTRUCTIONS</b>					
ADD	Rd, Rr	Add two Registers	$Rd \leftarrow Rd + Rr$	Z,C,N,V,H	1
ADC	Rd, Rr	Add with Carry two Registers	$Rd \leftarrow Rd + Rr + C$	Z,C,N,V,H	1
ADIW	Rd,K	Add Immediate to Word	$Rdh:Rdl \leftarrow Rdh:Rdl + K$	Z,C,N,V,S	2
SUB	Rd, Rr	Subtract two Registers	$Rd \leftarrow Rd - Rr$	Z,C,N,V,H	1
SUBI	Rd, K	Subtract Constant from Register	$Rd \leftarrow Rd - K$	Z,C,N,V,H	1
SBC	Rd, Rr	Subtract with Carry two Registers	$Rd \leftarrow Rd - Rr - C$	Z,C,N,V,H	1
SBCI	Rd, K	Subtract with Carry Constant from Reg.	$Rd \leftarrow Rd - K - C$	Z,C,N,V,H	1
SBIW	Rd,K	Subtract Immediate from Word	$Rdh:Rdl \leftarrow Rdh:Rdl - K$	Z,C,N,V,S	2
AND	Rd, Rr	Logical AND Registers	$Rd \leftarrow Rd \bullet Rr$	Z,N,V	1
ANDI	Rd, K	Logical AND Register and Constant	$Rd \leftarrow Rd \bullet K$	Z,N,V	1
OR	Rd, Rr	Logical OR Registers	$Rd \leftarrow Rd \vee Rr$	Z,N,V	1
ORI	Rd, K	Logical OR Register and Constant	$Rd \leftarrow Rd \vee K$	Z,N,V	1
EOR	Rd, Rr	Exclusive OR Registers	$Rd \leftarrow Rd \oplus Rr$	Z,N,V	1
COM	Rd	One's Complement	$Rd \leftarrow 0xFF - Rd$	Z,C,N,V	1
NEG	Rd	Two's Complement	$Rd \leftarrow 0x00 - Rd$	Z,C,N,V,H	1
SBR	Rd,K	Set Bit(s) in Register	$Rd \leftarrow Rd \vee K$	Z,N,V	1
CBR	Rd,K	Clear Bit(s) in Register	$Rd \leftarrow Rd \bullet (0xFF - K)$	Z,N,V	1
INC	Rd	Increment	$Rd \leftarrow Rd + 1$	Z,N,V	1
DEC	Rd	Decrement	$Rd \leftarrow Rd - 1$	Z,N,V	1
TST	Rd	Test for Zero or Minus	$Rd \leftarrow Rd \bullet Rd$	Z,N,V	1
CLR	Rd	Clear Register	$Rd \leftarrow Rd \oplus Rd$	Z,N,V	1
SER	Rd	Set Register	$Rd \leftarrow 0xFF$	None	1
<b>BRANCH INSTRUCTIONS</b>					
RJMP	k	Relative Jump	$PC \leftarrow PC + k + 1$	None	2
IJMP		Indirect Jump to (Z)	$PC \leftarrow Z$	None	2
RCALL	k	Relative Subroutine Call	$PC \leftarrow PC + k + 1$	None	3
ICALL		Indirect Call to (Z)	$PC \leftarrow Z$	None	3
RET		Subroutine Return	$PC \leftarrow STACK$	None	4
RETI		Interrupt Return	$PC \leftarrow STACK$	I	4
CPSE	Rd,Rr	Compare, Skip if Equal	if (Rd = Rr) $PC \leftarrow PC + 2$ 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) $PC \leftarrow PC + 2$ or 3	None	1/2/3
SBRS	Rr, b	Skip if Bit in Register is Set	if (Rr(b)=1) $PC \leftarrow PC + 2$ or 3	None	1/2/3
SBIC	P, b	Skip if Bit in I/O Register Cleared	if (P(b)=0) $PC \leftarrow PC + 2$ or 3	None	1/2/3
SBIS	P, b	Skip if Bit in I/O Register is Set	if (P(b)=1) $PC \leftarrow PC + 2$ or 3	None	1/2/3
BRBS	s, k	Branch if Status Flag Set	if (SREG(s) = 1) then $PC \leftarrow PC + k + 1$	None	1/2
BRBC	s, k	Branch if Status Flag Cleared	if (SREG(s) = 0) then $PC \leftarrow PC + k + 1$	None	1/2
BREQ	k	Branch if Equal	if (Z = 1) then $PC \leftarrow PC + k + 1$	None	1/2
BRNE	k	Branch if Not Equal	if (Z = 0) then $PC \leftarrow PC + k + 1$	None	1/2
BRCS	k	Branch if Carry Set	if (C = 1) then $PC \leftarrow PC + k + 1$	None	1/2
BRCC	k	Branch if Carry Cleared	if (C = 0) then $PC \leftarrow PC + k + 1$	None	1/2
BRSH	k	Branch if Same or Higher	if (C = 0) then $PC \leftarrow PC + k + 1$	None	1/2
BRLO	k	Branch if Lower	if (C = 1) then $PC \leftarrow PC + k + 1$	None	1/2
BRMI	k	Branch if Minus	if (N = 1) then $PC \leftarrow PC + k + 1$	None	1/2
BRPL	k	Branch if Plus	if (N = 0) then $PC \leftarrow PC + k + 1$	None	1/2
BRGE	k	Branch if Greater or Equal, Signed	if (N $\oplus$ V = 0) then $PC \leftarrow PC + k + 1$	None	1/2
BRLT	k	Branch if Less Than Zero, Signed	if (N $\oplus$ V = 1) then $PC \leftarrow PC + k + 1$	None	1/2
BRHS	k	Branch if Half Carry Flag Set	if (H = 1) then $PC \leftarrow PC + k + 1$	None	1/2
BRHC	k	Branch if Half Carry Flag Cleared	if (H = 0) then $PC \leftarrow PC + k + 1$	None	1/2
BRTS	k	Branch if T Flag Set	if (T = 1) then $PC \leftarrow PC + k + 1$	None	1/2
BRTC	k	Branch if T Flag Cleared	if (T = 0) then $PC \leftarrow PC + k + 1$	None	1/2
BRVS	k	Branch if Overflow Flag is Set	if (V = 1) then $PC \leftarrow PC + k + 1$	None	1/2
BRVC	k	Branch if Overflow Flag is Cleared	if (V = 0) then $PC \leftarrow PC + k + 1$	None	1/2
BRIE	k	Branch if Interrupt Enabled	if (I = 1) then $PC \leftarrow PC + k + 1$	None	1/2
BRID	k	Branch if Interrupt Disabled	if (I = 0) then $PC \leftarrow PC + k + 1$	None	1/2
<b>BIT AND BIT-TEST INSTRUCTIONS</b>					
SBI	P,b	Set Bit in I/O Register	$I/O(P,b) \leftarrow 1$	None	2
CBI	P,b	Clear Bit in I/O Register	$I/O(P,b) \leftarrow 0$	None	2
LSL	Rd	Logical Shift Left	$Rd(n+1) \leftarrow Rd(n), Rd(0) \leftarrow 0$	Z,C,N,V	1
LSR	Rd	Logical Shift Right	$Rd(n) \leftarrow Rd(n+1), Rd(7) \leftarrow 0$	Z,C,N,V	1
ROL	Rd	Rotate Left Through Carry	$Rd(0) \leftarrow C, Rd(n+1) \leftarrow Rd(n), C \leftarrow Rd(7)$	Z,C,N,V	1



Mnemonics	Operands	Description	Operation	Flags	#Clocks
ROR	Rd	Rotate Right Through Carry	$Rd(7) \leftarrow C, Rd(n) \leftarrow Rd(n+1), C \leftarrow Rd(0)$	Z,C,N,V	1
ASR	Rd	Arithmetic Shift Right	$Rd(n) \leftarrow Rd(n+1), n=0..6$	Z,C,N,V	1
SWAP	Rd	Swap Nibbles	$Rd(3..0) \leftarrow Rd(7..4), Rd(7..4) \leftarrow Rd(3..0)$	None	1
BSET	s	Flag Set	$SREG(s) \leftarrow 1$	SREG(s)	1
BCLR	s	Flag Clear	$SREG(s) \leftarrow 0$	SREG(s)	1
BST	Rr, b	Bit Store from Register to T	$T \leftarrow Rr(b)$	T	1
BLD	Rd, b	Bit load from T to Register	$Rd(b) \leftarrow T$	None	1
SEC		Set Carry	$C \leftarrow 1$	C	1
CLC		Clear Carry	$C \leftarrow 0$	C	1
SEN		Set Negative Flag	$N \leftarrow 1$	N	1
CLN		Clear Negative Flag	$N \leftarrow 0$	N	1
SEZ		Set Zero Flag	$Z \leftarrow 1$	Z	1
CLZ		Clear Zero Flag	$Z \leftarrow 0$	Z	1
SEI		Global Interrupt Enable	$I \leftarrow 1$	I	1
CLI		Global Interrupt Disable	$I \leftarrow 0$	I	1
SES		Set Signed Test Flag	$S \leftarrow 1$	S	1
CLS		Clear Signed Test Flag	$S \leftarrow 0$	S	1
SEV		Set Twos Complement Overflow	$V \leftarrow 1$	V	1
CLV		Clear Twos Complement Overflow	$V \leftarrow 0$	V	1
SET		Set T in SREG	$T \leftarrow 1$	T	1
CLT		Clear T in SREG	$T \leftarrow 0$	T	1
SEH		Set Half Carry Flag in SREG	$H \leftarrow 1$	H	1
CLH		Clear Half Carry Flag in SREG	$H \leftarrow 0$	H	1
<b>DATA TRANSFER INSTRUCTIONS</b>					
MOV	Rd, Rr	Move Between Registers	$Rd \leftarrow Rr$	None	1
MOVW	Rd, Rr	Copy Register Word	$Rd+1:Rd \leftarrow Rr+1:Rr$	None	1
LDI	Rd, K	Load Immediate	$Rd \leftarrow K$	None	1
LD	Rd, X	Load Indirect	$Rd \leftarrow (X)$	None	2
LD	Rd, X+	Load Indirect and Post-Inc.	$Rd \leftarrow (X), X \leftarrow X + 1$	None	2
LD	Rd, -X	Load Indirect and Pre-Dec.	$X \leftarrow X - 1, Rd \leftarrow (X)$	None	2
LD	Rd, Y	Load Indirect	$Rd \leftarrow (Y)$	None	2
LD	Rd, Y+	Load Indirect and Post-Inc.	$Rd \leftarrow (Y), Y \leftarrow Y + 1$	None	2
LD	Rd, -Y	Load Indirect and Pre-Dec.	$Y \leftarrow Y - 1, Rd \leftarrow (Y)$	None	2
LDD	Rd, Y+q	Load Indirect with Displacement	$Rd \leftarrow (Y + q)$	None	2
LD	Rd, Z	Load Indirect	$Rd \leftarrow (Z)$	None	2
LD	Rd, Z+	Load Indirect and Post-Inc.	$Rd \leftarrow (Z), Z \leftarrow Z + 1$	None	2
LD	Rd, -Z	Load Indirect and Pre-Dec.	$Z \leftarrow Z - 1, Rd \leftarrow (Z)$	None	2
LDD	Rd, Z+q	Load Indirect with Displacement	$Rd \leftarrow (Z + q)$	None	2
LDS	Rd, k	Load Direct from SRAM	$Rd \leftarrow (k)$	None	2
ST	X, Rr	Store Indirect	$(X) \leftarrow Rr$	None	2
ST	X+, Rr	Store Indirect and Post-Inc.	$(X) \leftarrow Rr, X \leftarrow X + 1$	None	2
ST	-X, Rr	Store Indirect and Pre-Dec.	$X \leftarrow X - 1, (X) \leftarrow Rr$	None	2
ST	Y, Rr	Store Indirect	$(Y) \leftarrow Rr$	None	2
ST	Y+, Rr	Store Indirect and Post-Inc.	$(Y) \leftarrow Rr, Y \leftarrow Y + 1$	None	2
ST	-Y, Rr	Store Indirect and Pre-Dec.	$Y \leftarrow Y - 1, (Y) \leftarrow Rr$	None	2
STD	Y+q, Rr	Store Indirect with Displacement	$(Y + q) \leftarrow Rr$	None	2
ST	Z, Rr	Store Indirect	$(Z) \leftarrow Rr$	None	2
ST	Z+, Rr	Store Indirect and Post-Inc.	$(Z) \leftarrow Rr, Z \leftarrow Z + 1$	None	2
ST	-Z, Rr	Store Indirect and Pre-Dec.	$Z \leftarrow Z - 1, (Z) \leftarrow Rr$	None	2
STD	Z+q, Rr	Store Indirect with Displacement	$(Z + q) \leftarrow Rr$	None	2
STS	k, Rr	Store Direct to SRAM	$(k) \leftarrow Rr$	None	2
LPM		Load Program Memory	$R0 \leftarrow (Z)$	None	3
LPM	Rd, Z	Load Program Memory	$Rd \leftarrow (Z)$	None	3
LPM	Rd, Z+	Load Program Memory and Post-Inc	$Rd \leftarrow (Z), Z \leftarrow Z + 1$	None	3
SPM		Store Program Memory	$(z) \leftarrow R1:R0$	None	
IN	Rd, P	In Port	$Rd \leftarrow P$	None	1
OUT	P, Rr	Out Port	$P \leftarrow Rr$	None	1
PUSH	Rr	Push Register on Stack	$STACK \leftarrow Rr$	None	2
POP	Rd	Pop Register from Stack	$Rd \leftarrow STACK$	None	2
<b>MCU CONTROL INSTRUCTIONS</b>					
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) <sup>(3)</sup>	Power Supply	Ordering Code <sup>(2)</sup>	Package <sup>(1)</sup>	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	
<b>32M1-A</b>	32-pad, 5 x 5 x 1.0 mm Body, Lead Pitch 0.50 mm, Micro Lead Frame Package (MLF)
<b>20P3</b>	20-lead, 0.300" Wide, Plastic Dual Inline Package (PDIP)
<b>20S2</b>	20-lead, 0.300" Wide, Plastic Gull Wing Small Outline Package (SOIC)



## 6.2 ATtiny461

Speed (MHz) <sup>(3)</sup>	Power Supply	Ordering Code <sup>(2)</sup>	Package <sup>(1)</sup>	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	
<b>32M1-A</b>	32-pad, 5 x 5 x 1.0 mm Body, Lead Pitch 0.50 mm, Micro Lead Frame Package (MLF)
<b>20P3</b>	20-lead, 0.300" Wide, Plastic Dual Inline Package (PDIP)
<b>20S2</b>	20-lead, 0.300" Wide, Plastic Gull Wing Small Outline Package (SOIC)

## 6.3 ATtiny861

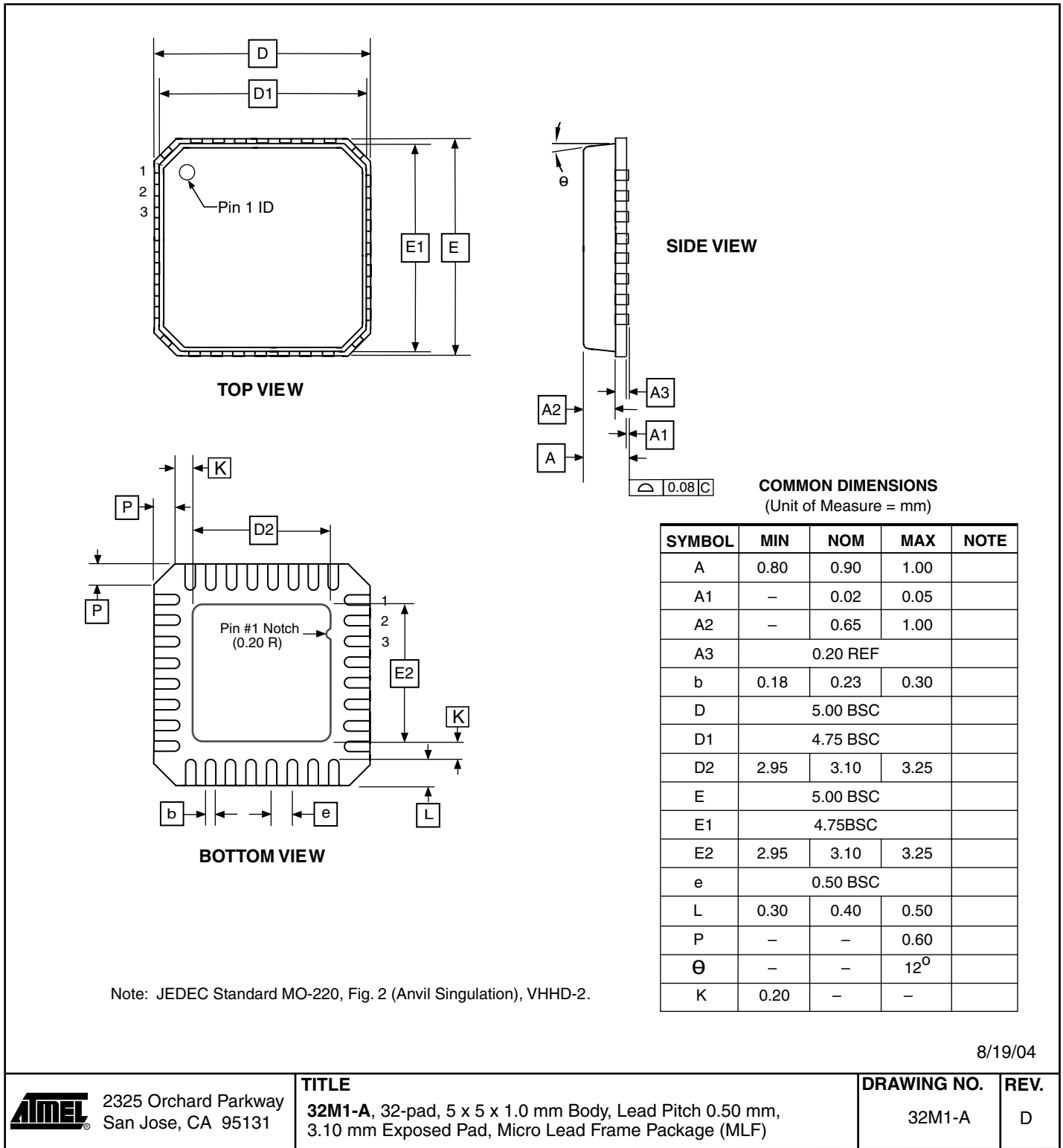
Speed (MHz) <sup>(3)</sup>	Power Supply	Ordering Code <sup>(2)</sup>	Package <sup>(1)</sup>	Operational Range
10	1.8 - 5.5V	ATtiny861V-10MU ATtiny861V-10PU ATtiny861V-10SU	32M1-A 20P3 20S2	Industrial (-40°C to 85°C)
20	2.7 - 5.5V	ATtiny861-20MU ATtiny861-20PU ATtiny861-20SU	32M1-A 20P3 20S2	Industrial (-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	
<b>32M1-A</b>	32-pad, 5 x 5 x 1.0 mm Body, Lead Pitch 0.50 mm, Micro Lead Frame Package (MLF)
<b>20P3</b>	20-lead, 0.300" Wide, Plastic Dual Inline Package (PDIP)
<b>20S2</b>	20-lead, 0.300" Wide, Plastic Gull Wing Small Outline Package (SOIC)

## 7. Packaging Information

### 7.1 32M1-A



8/19/04



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**TITLE**

**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)

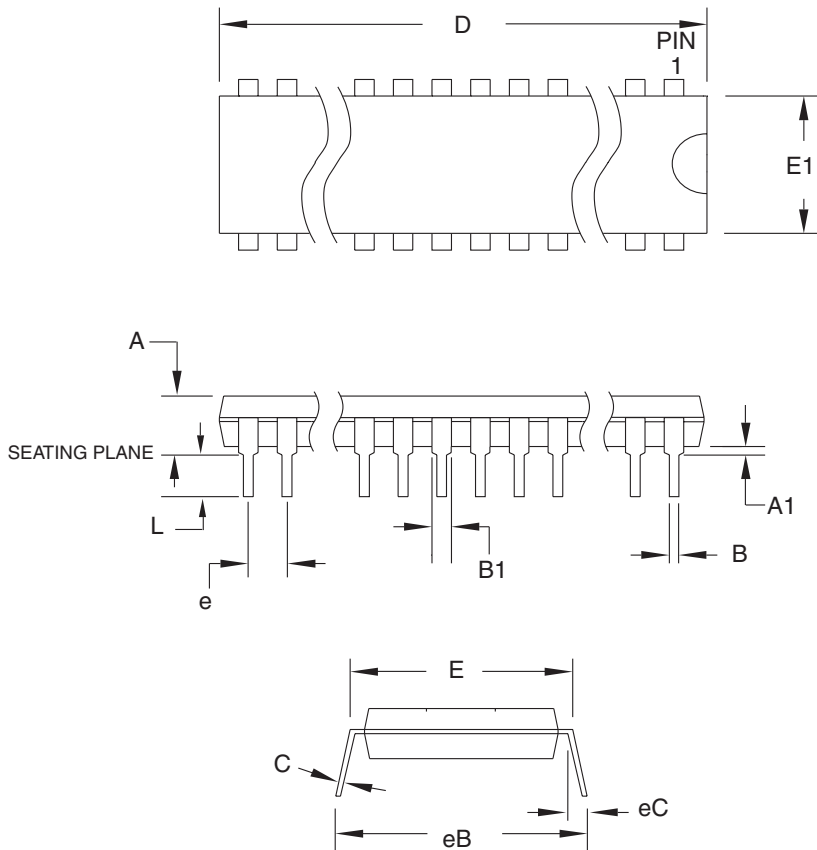
**DRAWING NO.**

32M1-A

**REV.**

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



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**TITLE**

**20P3**, 20-lead (0.300"/7.62 mm Wide) Plastic Dual  
Inline Package (PDIP)

**DRAWING NO.**

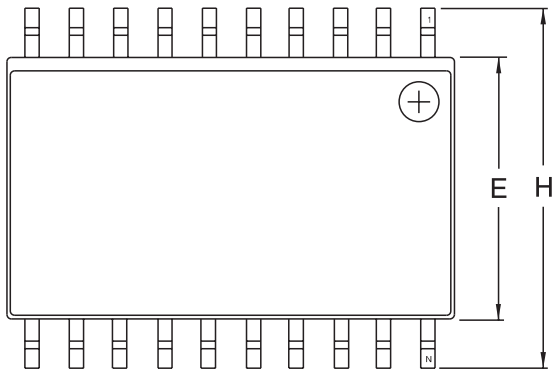
20P3

**REV.**

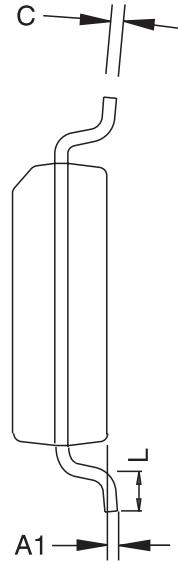
C



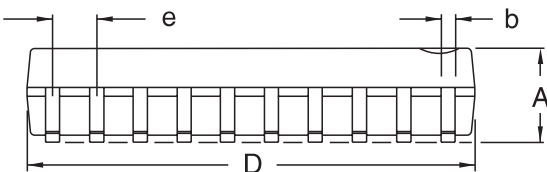
### 7.3 20S2



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.



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**TITLE**

**20S2**, 20-lead, 0.300" Wide Body, Plastic Gull Wing Small Outline Package (SOIC)

**DRAWING NO.**

20S2

**REV.**

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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