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## Appendix B - Atmel ATtiny24V/ATtiny44V/ATtiny84V Automotive Specification at 1.8V

This document contains information specific to devices operating at voltage between 1.8V and 3.6V. Only deviations with standard operating characteristics are covered in this appendix. All other information can be found in the complete automotive datasheet. The complete Atmel ATtiny24/ATtiny44/ATtiny84 automotive datasheet can be found on [www.atmel.com](http://www.atmel.com).



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

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**Atmel  
ATtiny24V  
ATtiny44V  
ATtiny84V**

**Appendix B**

**Preliminary**

7819C-AVR-10/10



# 1. Electrical Characteristics

## 1.1 Absolute Maximum Ratings

Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Parameters	Value	Unit
Operating temperature	-40 to +85	°C
Storage temperature	-65 to +175	°C
Voltage on any pin except $\overline{\text{RESET}}$ with respect to ground	-0.5 to $V_{CC} + 0.5$	V
Maximum operating voltage	6.0	V
DC current per I/O pin	30.0	mA
DC current $V_{CC}$ and GND pins	200.0	mA

## 1.2 DC Characteristics

$T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ ,  $V_{CC} = 1.8\text{V}$  to  $3.6\text{V}$  (unless otherwise noted)

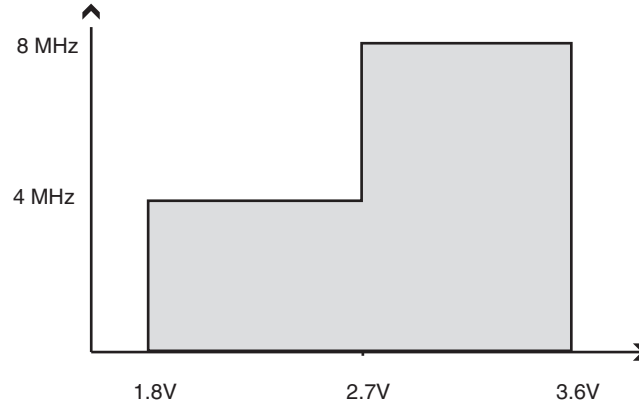
Symbol	Parameters	Condition	Min.	Typ.	Max.	Unit
$V_{IL}$	Input low voltage, except XTAL1 and $\overline{\text{RESET}}$ pin	$V_{CC} = 1.8\text{V}$ to $3.6\text{V}$	-0.5		$+0.2V_{CC}^{(1)}$	V
$V_{IH}$	Input high voltage, except XTAL1 and RESET pins	$V_{CC} = 1.8\text{V}$ to $3.6\text{V}$	$0.7V_{CC}^{(2)}$		$V_{CC} + 0.5$	V
$V_{IL1}$	Input low voltage, XTAL1 pin	$V_{CC} = 1.8\text{V}$ to $3.6\text{V}$	-0.5		$+0.2V_{CC}^{(1)}$	V
$V_{IH1}$	Input high voltage, XTAL1 pin	$V_{CC} = 1.8\text{V}$ to $3.6\text{V}$	$0.9V_{CC}^{(2)}$		$V_{CC} + 0.5$	V
$V_{IL2}$	Input low voltage, $\overline{\text{RESET}}$ pin	$V_{CC} = 1.8\text{V}$ to $3.6\text{V}$	-0.5		$+0.2V_{CC}^{(1)}$	V
$V_{IH2}$	Input high voltage, $\overline{\text{RESET}}$ pin	$V_{CC} = 1.8\text{V}$ to $3.6\text{V}$	$0.9V_{CC}^{(2)}$		$V_{CC} + 0.5$	V
$V_{OL}$	Output low voltage <sup>(3)</sup> , I/O pin except RESET	$I_{OL} = 2\text{mA}$ , $V_{CC} = 1.8\text{V}$			0.2	V
$V_{OH}$	Output high voltage <sup>(4)</sup> , I/O pin except RESET	$I_{OH} = -2\text{mA}$ , $V_{CC} = 1.8\text{V}$	1.2			V
$I_{CC}$	Power supply current	Active 4MHz, $V_{CC} = 3\text{V}$		0.8	2.5	mA
		Idle 4MHz, $V_{CC} = 3\text{V}$		0.2	0.5	mA
$I_{CC}$	Power-down mode	WDT disabled, $V_{CC} = 3\text{V}$		0.2	24	$\mu\text{A}$
		WDT enabled, $V_{CC} = 3\text{V}$		4	30	$\mu\text{A}$
$V_{ACIO}$	Analog comparator Input offset voltage	$V_{CC} = 2.7\text{V}$ $V_{in} = V_{CC}/2$		< 10	40	mV
$I_{ACLK}$	Analog comparator Input leakage current	$V_{CC} = 2.7\text{V}$ $V_{in} = V_{CC}/2$	-50		+50	nA

- Notes:
- “Max” means the highest value where the pin is guaranteed to be read as low
  - “Min” means the lowest value where the pin is guaranteed to be read as high
  - Although each I/O port can sink more than the test conditions (2mA at  $V_{CC} = 1.8\text{V}$ ) under steady state conditions (non-transient), the following must be observed: (1) The sum of all  $I_{OL}$ , for all ports, should not exceed 50mA. If  $I_{OL}$  exceeds the test condition,  $V_{OL}$  may exceed the related specification. Pins are not guaranteed to sink current greater than the listed test condition.
  - Although each I/O port can source more than the test conditions (0.5mA at  $V_{CC} = 1.8\text{V}$ ) under steady state conditions (non-transient), the following must be observed: (1) The sum of all  $I_{OL}$ , for ports B0 to B5, should not exceed 50mA. If  $I_{OL}$  exceeds the test condition,  $V_{OL}$  may exceed the related specification. Pins are not guaranteed to sink current greater than the listed test condition.

## 1.3 Maximum Speed versus $V_{CC}$

Maximum frequency is dependent on  $V_{CC}$ . As shown in Figure 1-1, the Maximum Frequency vs.  $V_{CC}$  curve is linear between  $1.8V < V_{CC} < 3.6V$ .

Figure 1-1. Maximum Frequency versus  $V_{CC}$



## 1.4 Clock Characterizations

Table 1-1. Calibration Accuracy of Internal RC Oscillator

	Frequency	$V_{CC}$	Temperature	Accuracy
User Calibration	7.3MHz to 8.1MHz	1.8V to 3.6V	-40° C to +85° C	±25%

## 1.5 System and Reset Characterizations

Table 1-2. BODLEVEL Fuse Coding<sup>(1)</sup>

BODLEVEL	Min $V_{BOT}$	Typ $V_{BOT}$	Max $V_{BOT}$	Unit	Note
111	BOD Disabled				
110	1.7	1.8	2.0	V	A
001	1.7	1.9	2.1		C
000	1.8	2.0	2.2		C
010	2.0	2.2	2.4		C
011	2.1	2.3	2.5		C
101	2.5	2.7	2.9		A

\*) Type means: A = 100% tested, C = Characterized on samples

Note: 1.  $V_{BOT}$  may be below nominal minimum operating voltage for some devices. For devices where this is the case, the device is tested down to  $V_{CC} = V_{BOT}$  during the production test. This guarantees that a Brown-out Reset will occur before  $V_{CC}$  drops to a voltage where correct operation of the microcontroller is no longer guaranteed

## 1.6 ADC Characteristics

$T_A = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{CC} = 1.8\text{V}$  to  $3.6\text{V}$  (unless otherwise noted)

Symbol	Parameters	Test Conditions	Min.	Typ.	Max.	Unit
	Resolution	Single ended conversion		10		Bits
	Absolute accuracy (Including INL, DNL, quantization error, gain and offset error)	$V_{CC} = 1.8\text{V}$ , $V_{Ref} = 1.8\text{V}$ , ADC clock = 200kHz		2	4.0	LSB
		$V_{CC} = 1.8\text{V}$ , $V_{Ref} = 1.8\text{V}$ , ADC clock = 200kHz Noise Reduction Mode		2	4.0	LSB
	Integral Non-Linearity (INL)	$V_{CC} = 1.8\text{V}$ , $V_{Ref} = 1.8\text{V}$ , ADC clock = 200kHz		0.5	1.5	LSB
	Differential Non-Linearity (DNL)	$V_{CC} = 1.8\text{V}$ , $V_{Ref} = 1.8\text{V}$ , ADC clock = 200kHz		0.2	0.7	LSB
	Gain error	$V_{CC} = 1.8\text{V}$ , $V_{Ref} = 1.8\text{V}$ , ADC clock = 200kHz	-7.0	-3.0	+5.0	LSB
	Offset error	$V_{CC} = 1.8\text{V}$ , $V_{Ref} = 1.8\text{V}$ , ADC clock = 200kHz	-3.5	+1.5	+3.5	LSB
$V_{REF}$	Reference voltage		1.8		$AV_{CC}$	V

## 1.7 ADC Characteristics

$T_A = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{CC} = 1.8\text{V}$  to  $3.6\text{V}$  (unless otherwise noted)

Symbol	Parameters	Test Conditions	Min.	Typ.	Max.	Unit
	Resolution	Differential conversion, gain = 1x BIPOLAR mode only		8		Bits
	Absolute accuracy (Including INL, DNL, quantization error, gain and offset error)	Gain = 1x, $V_{CC} = 1.8\text{V}$ , $V_{Ref} = 1.3\text{V}$ , ADC clock = 125kHz		1.6	5.0	LSB
	Integral Non-Linearity (INL)	Gain = 1x, $V_{CC} = 1.8\text{V}$ , $V_{Ref} = 1.3\text{V}$ , ADC clock = 125kHz		0.7	2.5	LSB
	Differential Non-Linearity (DNL)	Gain = 1x, $V_{CC} = 1.8\text{V}$ , $V_{Ref} = 1.3\text{V}$ , ADC clock = 125kHz		0.3	1.0	LSB
	Gain Error	Gain = 1x, $V_{CC} = 1.8\text{V}$ , $V_{Ref} = 1.3\text{V}$ , ADC clock = 125kHz	-7.0	+1.50	+7.0	LSB
	Offset Error	Gain = 1x, $V_{CC} = 1.8\text{V}$ , $V_{Ref} = 1.3\text{V}$ , ADC clock = 125kHz	-4.0	0.0	+4.0	LSB
$V_{REF}$	Reference Voltage		1.30		$AV_{CC} - 0.5$	V

## 2. Ordering Information

Power Supply	Speed (MHz)	ISP Flash	Ordering Code	Package	Operation Range
1.8V to 3.6V	4-8	2KB	Atmel ATtiny24V-15SST	TU	Automotive (–40°C to +85°C)
1.8V to 3.6V	4-8	2KB	Atmel ATtiny24V-15MT	PN	Automotive (–40°C to +85°C)
1.8V to 3.6V	4-8	4KB	Atmel ATtiny44V-15SST	TU	Automotive (–40°C to +85°C)
1.8V to 3.6V	4-8	4KB	Atmel ATtiny44V-15MT	PN	Automotive (–40°C to +85°C)
1.8V to 3.6V	4-8	8KB	Atmel ATtiny84V-15MT	PN	Automotive (–40°C to +85°C)

## 3. Package Information

Table 3-1. Package Types

Package Type	Description
TU	TU 14-Lead, 0.150" Body Width Plastic Gull Wing Small Outline Package (SOIC)
PN	PN 32-lead, 5.0 × 5.0mm body, 0.50mm pitch Quad flat no-lead package (QFN)

Figure 3-1. TU

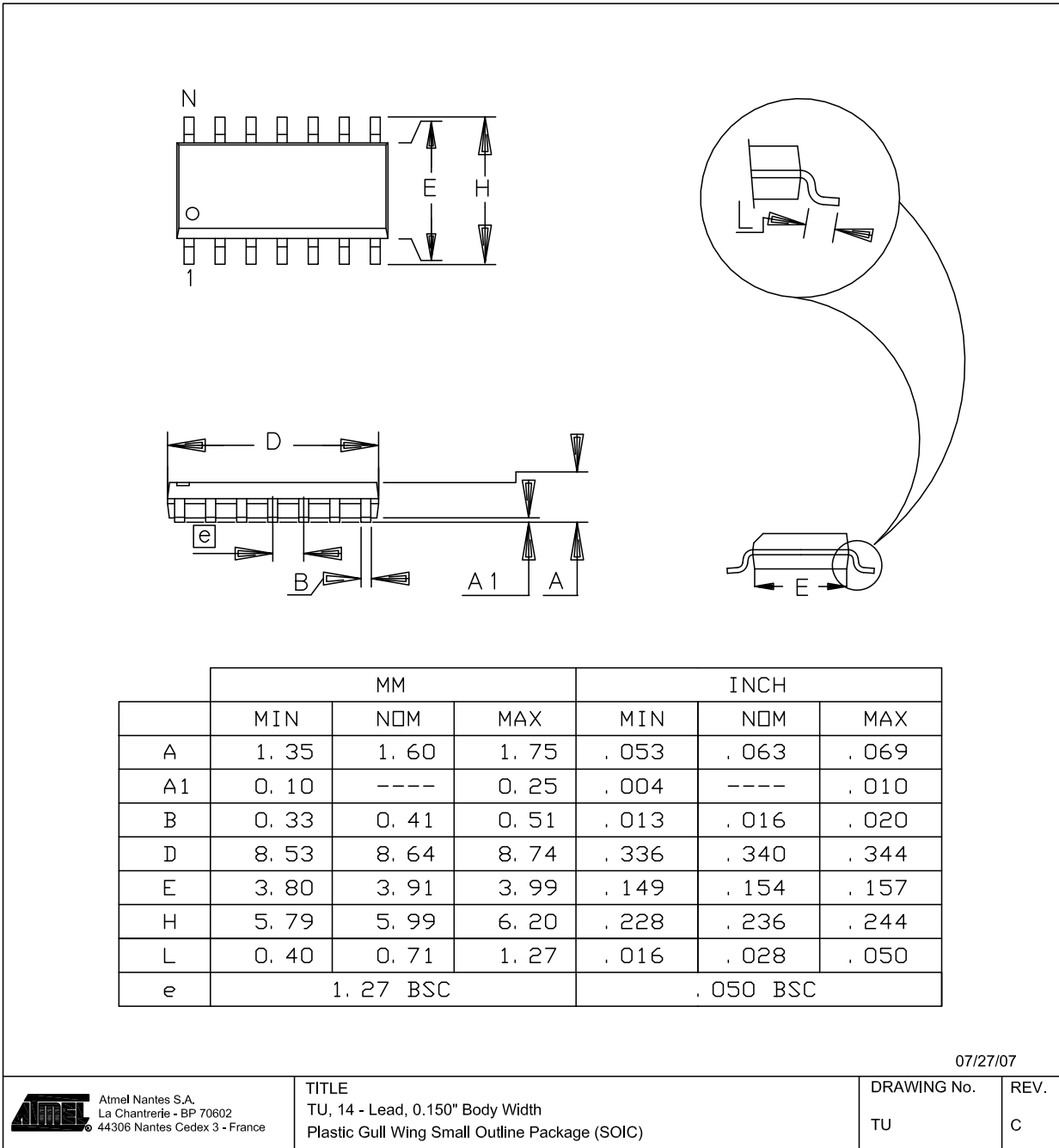
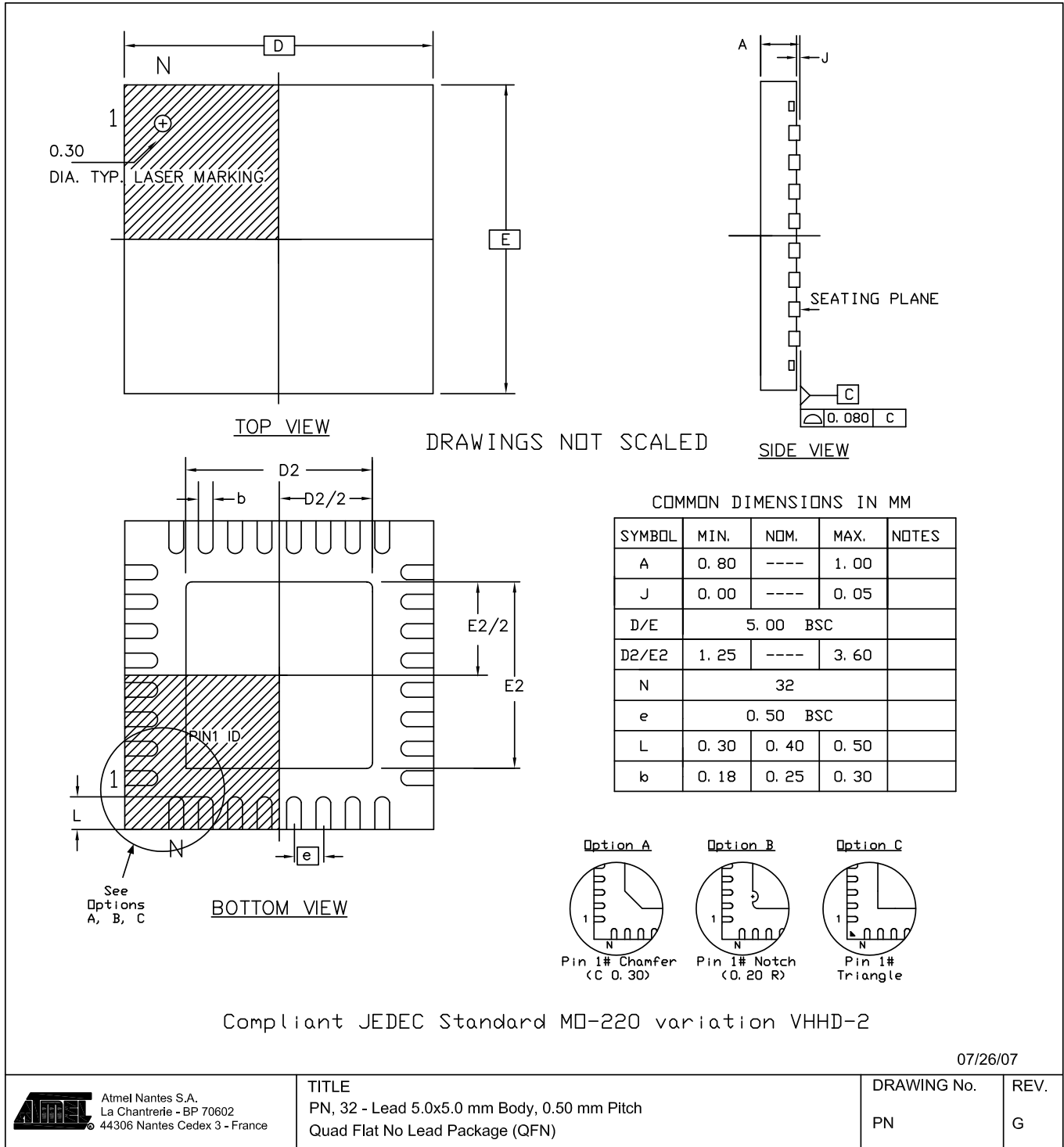


Figure 3-2. PN



## 4. Datasheet Revision History

### 4.1 Revision C - 10/10

1. BOD values updated.

### 4.2 Revision B - 09/10

1. BOD values updated.





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