# Appendix B - 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 ATtiny24/ATtiny44/ATtiny84 automotive datasheet can be found on www.atmel.com



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

ATtiny24V ATtiny44V ATtiny84V

Appendix B

**Preliminary** 

KTTIC

7819A-AVR-01/09



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#### 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 RESET with respect to ground	-0.5 to V <sub>CC</sub> + 0.5	V
Maximum operating voltage	6.0	V
DC current per I/O pin	30.0	mA
DC current V <sub>CC</sub> and GND pins	200.0	mA

#### 1.2 DC Characteristics

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

Symbol	Parameters	Condition	Min.	Тур.	Max.	Unit
V <sub>IL</sub>	Input low voltage, except XTAL1 and RESET pin	V <sub>CC</sub> = 1.8V to 3.6V	-0.5		+0.2V <sub>CC</sub> <sup>(1)</sup>	V
V <sub>IH</sub>	Input high voltage, except XTAL1 and RESET pins	V <sub>CC</sub> = 1.8V to 3.6V	0.7V <sub>CC</sub> <sup>(2)</sup>		V <sub>CC</sub> + 0.5	V
V <sub>IL1</sub>	Input low voltage, XTAL1 pin	V <sub>CC</sub> = 1.8V to 3.6V	-0.5		+0.2V <sub>CC</sub> <sup>(1)</sup>	V
V <sub>IH1</sub>	Input high voltage, XTAL1 pin	V <sub>CC</sub> = 1.8V to 3.6V	0.9V <sub>CC</sub> <sup>(2)</sup>		V <sub>CC</sub> + 0.5	V
$V_{IL2}$	Input low voltage, RESET pin	$V_{CC} = 1.8V \text{ to } 3.6V$	-0.5		+0.2V <sub>CC</sub> <sup>(1)</sup>	V
$V_{IH2}$	Input high voltage, RESET pin	V <sub>CC</sub> = 1.8V to 3.6V	0.9V <sub>CC</sub> <sup>(2)</sup>		V <sub>CC</sub> + 0.5	٧
V <sub>OL</sub>	Output low voltage <sup>(3)</sup> , I/O pin except RESET	I <sub>OL</sub> = 2 mA, V <sub>CC</sub> = 1.8V			0.2	V
V <sub>OH</sub>	Output high voltage <sup>(4)</sup> , I/O pin except RESET	$I_{OH} = -2mA, V_{CC} = 1.8V$	1.2			V
	Dower cumply current	Active 4 MHz, V <sub>CC</sub> = 3V		0.8	2.5	mA
1	Power supply current	Idle 4 MHz, V <sub>CC</sub> = 3V		0.2	0.5	mA
I <sub>CC</sub>	Power-down mode	WDT disabled, $V_{CC} = 3V$ WDT enabled, $V_{CC} = 3V$		0.2 4	24 30	μΑ
V <sub>ACIO</sub>	Analog comparator Input offset voltage	$V_{CC} = 2.7V$ $V_{in} = V_{CC}/2$		< 10	40	mV
I <sub>ACLK</sub>	Analog comparator Input leakage current	$V_{CC} = 2.7V$ $V_{in} = V_{CC}/2$	-50		+50	nA

1. "Max" means the highest value where the pin is guaranteed to be read as low Notes:

- 2. "Min" means the lowest value where the pin is guaranteed to be read as high
- 3. Although each I/O port can sink more than the test conditions (2 mA at VCC = 1.8V) under steady state conditions (nontransient), the following must be observed: (1) The sum of all IOL, for all ports, should not exceed 50 mA. If IOL exceeds the test condition, VOL may exceed the related specification. Pins are not guaranteed to sink current greater than the listed test condition.
- 4. Although each I/O port can source more than the test conditions (0.5 mA at VCC = 1.8V) under steady state conditions (nontransient), the following must be observed: (1) The sum of all IOL, for ports B0 to B5, should not exceed 50 mA. If IOL exceeds the test condition, VOL may exceed the related specification. Pins are not guaranteed to sink current greater than the listed test condition.

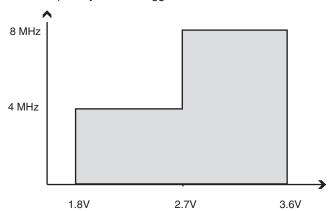
ATtiny24V/ATtiny44V/ATtiny84V [Preliminary] 2

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### 1.3 Maximum Speed versus V<sub>CC</sub>

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<sub>CC</sub>



### 1.4 Clock Characterizations

Table 1-1. Calibration Accuracy of Internal RC Oscillator

	Frequency	V <sub>cc</sub>	Temperature	Accuracy
User Calibration	7.3 MHz to 8.1 MHz	1.8V to 3.6V	-40°C to +85°C	±25%





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### 1.5 ADC Characteristics

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

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

### 1.6 ADC Characteristics

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

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

### http://w/whtiny24V/Aftiny44V/ATtiny84V [Preliminary]

### **Ordering Information**

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

### **Package Information**

Table 3-1. Package Types

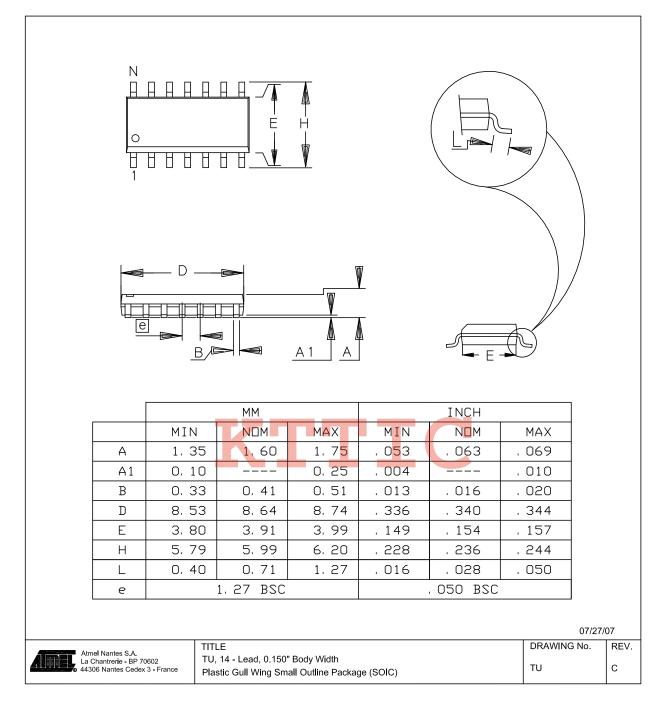
Package Type	Description
111	TU 14-Lead, 0.150" Body Width Plastic Gull Wing Small Outline Package (SOIC)
PN	PN 32-Lead, 5.0 x 5.0 mm Body, 0.50 mm Pitch Quad Flat No Lead ackage (QFN)





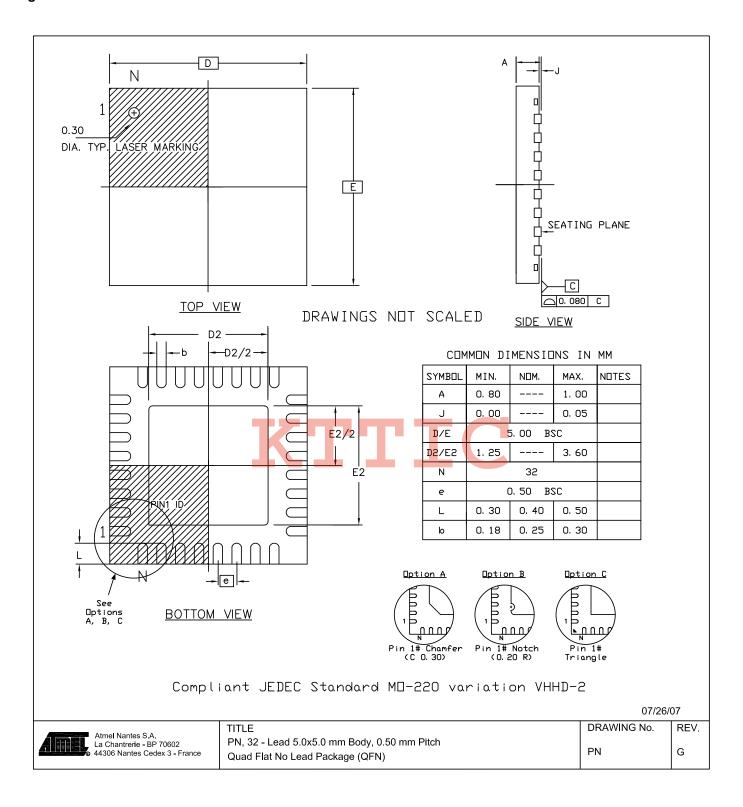
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Figure 3-1. TU



## KTTIC\_http://w/withinybtiv/Artiny44V/ATtiny84V [Preliminary]

Figure 3-2. PN





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#### Headquarters

Atmel Corporation

2325 Orchard Parkway San Jose, CA 95131

USA

Tel: 1(408) 441-0311 Fax: 1(408) 487-2600

#### International

Atmel Asia

Unit 1-5 & 16, 19/F BEA Tower, Millennium City 5 418 Kwun Tong Road Kwun Tong, Kowloon Hong Kong

Tel: (852) 2245-6100 Fax: (852) 2722-1369 Atmel Europe

Le Krebs 8, Rue Jean-Pierre Timbaud BP 309 78054

Saint-Quentin-en-Yvelines Cedex France

Tel: (33) 1-30-60-70-00 Fax: (33) 1-30-60-71-11

Atmel Japan

9F, Tonetsu Shinkawa Bldg. 1-24-8 Shinkawa Chuo-ku, Tokyo 104-0033

Tel: (81) 3-3523-3551 Fax: (81) 3-3523-7581

#### **Product Contact**

Web Site

www.atmel.com

Technical Support

avr@atmel.com

Sales Contact

www.atmel.com/contacts

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