



## ATtiny24V/ATtiny44V/ATtiny84V

---

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

---

**DATASHEET**

#### Features

---

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 <http://www.atmel.com>.

# 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 $V_{\text{CC}} + 0.5$	V
Maximum operating voltage	6.0	V
DC current per I/O pin	30.0	mA
DC current $V_{\text{CC}}$ and GND pins	200.0	mA

## 1.2 DC Characteristics

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

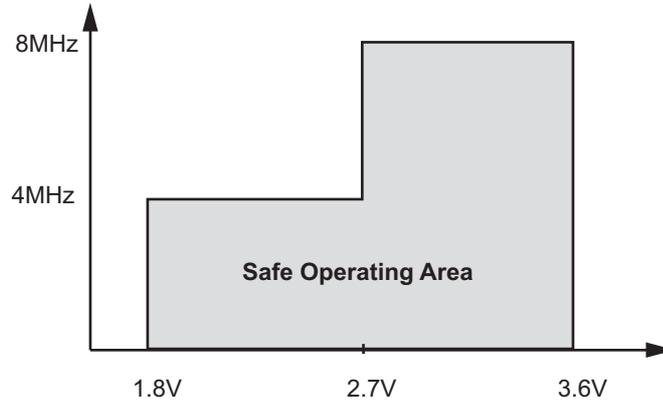
Parameters	Condition	Symbol	Min.	Typ.	Max.	Unit
Input low voltage, except XTAL1 and $\overline{\text{RESET}}$ pin	$V_{\text{CC}} = 1.8\text{V}$ to $3.6\text{V}$	$V_{\text{IL}}$	–0.5		$+0.2V_{\text{CC}}^{(1)}$	V
Input high voltage, except XTAL1 and $\overline{\text{RESET}}$ pins	$V_{\text{CC}} = 1.8\text{V}$ to $3.6\text{V}$	$V_{\text{IH}}$	$0.7V_{\text{CC}}^{(2)}$		$V_{\text{CC}} + 0.5$	V
Input low voltage, XTAL1 pin	$V_{\text{CC}} = 1.8\text{V}$ to $3.6\text{V}$	$V_{\text{IL1}}$	–0.5		$+0.2V_{\text{CC}}^{(1)}$	V
Input high voltage, XTAL1 pin	$V_{\text{CC}} = 1.8\text{V}$ to $3.6\text{V}$	$V_{\text{IH1}}$	$0.9V_{\text{CC}}^{(2)}$		$V_{\text{CC}} + 0.5$	V
Input low voltage, $\overline{\text{RESET}}$ pin	$V_{\text{CC}} = 1.8\text{V}$ to $3.6\text{V}$	$V_{\text{IL2}}$	–0.5		$+0.2V_{\text{CC}}^{(1)}$	V
Input high voltage, $\overline{\text{RESET}}$ pin	$V_{\text{CC}} = 1.8\text{V}$ to $3.6\text{V}$	$V_{\text{IH2}}$	$0.9V_{\text{CC}}^{(2)}$		$V_{\text{CC}} + 0.5$	V
Output low voltage <sup>(3)</sup> , I/O pin except $\overline{\text{RESET}}$	$I_{\text{OL}} = 2\text{mA}$ , $V_{\text{CC}} = 1.8\text{V}$	$V_{\text{OL}}$			0.2	V
Output high voltage <sup>(4)</sup> , I/O pin except $\overline{\text{RESET}}$	$I_{\text{OH}} = -2\text{mA}$ , $V_{\text{CC}} = 1.8\text{V}$	$V_{\text{OH}}$	1.2			V
Power supply current	Active 4MHz, $V_{\text{CC}} = 3\text{V}$	$I_{\text{CC}}$		0.8	2.5	mA
	Idle 4MHz, $V_{\text{CC}} = 3\text{V}$			0.2	0.5	mA
Power-down mode	WDT disabled, $V_{\text{CC}} = 3\text{V}$				0.2	24
	WDT enabled, $V_{\text{CC}} = 3\text{V}$			4	30	
Analog comparator Input offset voltage	$V_{\text{CC}} = 2.7\text{V}$ $V_{\text{in}} = V_{\text{CC}}/2$	$V_{\text{ACIO}}$		< 10	40	mV
Analog comparator Input leakage current	$V_{\text{CC}} = 2.7\text{V}$ $V_{\text{in}} = V_{\text{CC}}/2$	$I_{\text{ACLK}}$	–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  $V_{\text{CC}} = 1.8\text{V}$ ) under steady state conditions (non-transient), the following must be observed: (1) The sum of all  $I_{\text{OL}}$ , for all ports, should not exceed 50mA. If  $I_{\text{OL}}$  exceeds the test condition,  $V_{\text{OL}}$  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  $V_{\text{CC}} = 1.8\text{V}$ ) under steady state conditions (non-transient), the following must be observed: (1) The sum of all  $I_{\text{OL}}$ , for ports B0 to B5, should not exceed 50mA. If  $I_{\text{OL}}$  exceeds the test condition,  $V_{\text{OL}}$  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)

Parameters	Test Conditions	Symbol	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
Reference voltage		$V_{REF}$	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)

Parameters	Test Conditions	Symbol	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
Reference voltage		$V_{REF}$	1.30		$AV_{CC} - 0.5$	V

## 2. Ordering Information

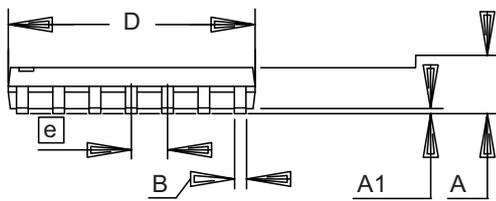
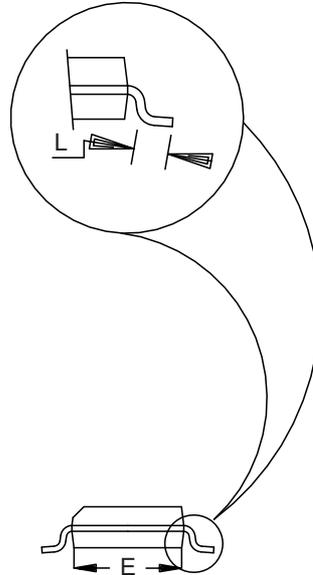
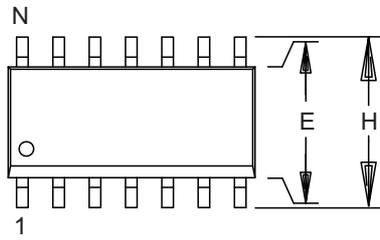
Power Supply	Speed (MHz)	ISP Flash	Ordering Code	Package	Operation Range
1.8V to 3.6V	4-8	2KB	Atmel ATtiny24V-15SST	TU	Automotive (–40°C to +85°C)
1.8V to 3.6V	4-8	2KB	Atmel ATtiny24V-15MT	PC	Automotive (–40°C to +85°C)
1.8V to 3.6V	4-8	4KB	Atmel ATtiny44V-15SST	TU	Automotive (–40°C to +85°C)
1.8V to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

## 3. Package Information

Table 3-1. Package Types

Package Type	Description
TU	14-Lead, 0.150" body width Plastic gull wing small outline package (SOIC)
PC	20-lead, 4.0 × 4.0mm body, 0.50mm pitch Quad flat no-lead package (QFN)

Figure 3-1. TU



	MM			INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.35	1.60	1.75	.053	.063	.069
A1	0.10	-----	0.25	.004	-----	.010
B	0.33	0.41	0.51	.013	.016	.020
D	8.53	8.64	8.74	.336	.340	.344
E	3.80	3.91	3.99	.149	.154	.157
H	5.79	5.99	6.20	.228	.236	.244
L	0.40	0.71	1.27	.016	.028	.050
e	1.27 BSC			.050 BSC		

07/27/07

**Atmel** Package Drawing Contact:  
packagedrawings@atmel.com

TITLE  
TU, 14 Lead, 0.150" Body Width  
Plastic Gull Wing Small Outline Package (SOIC)

GPC

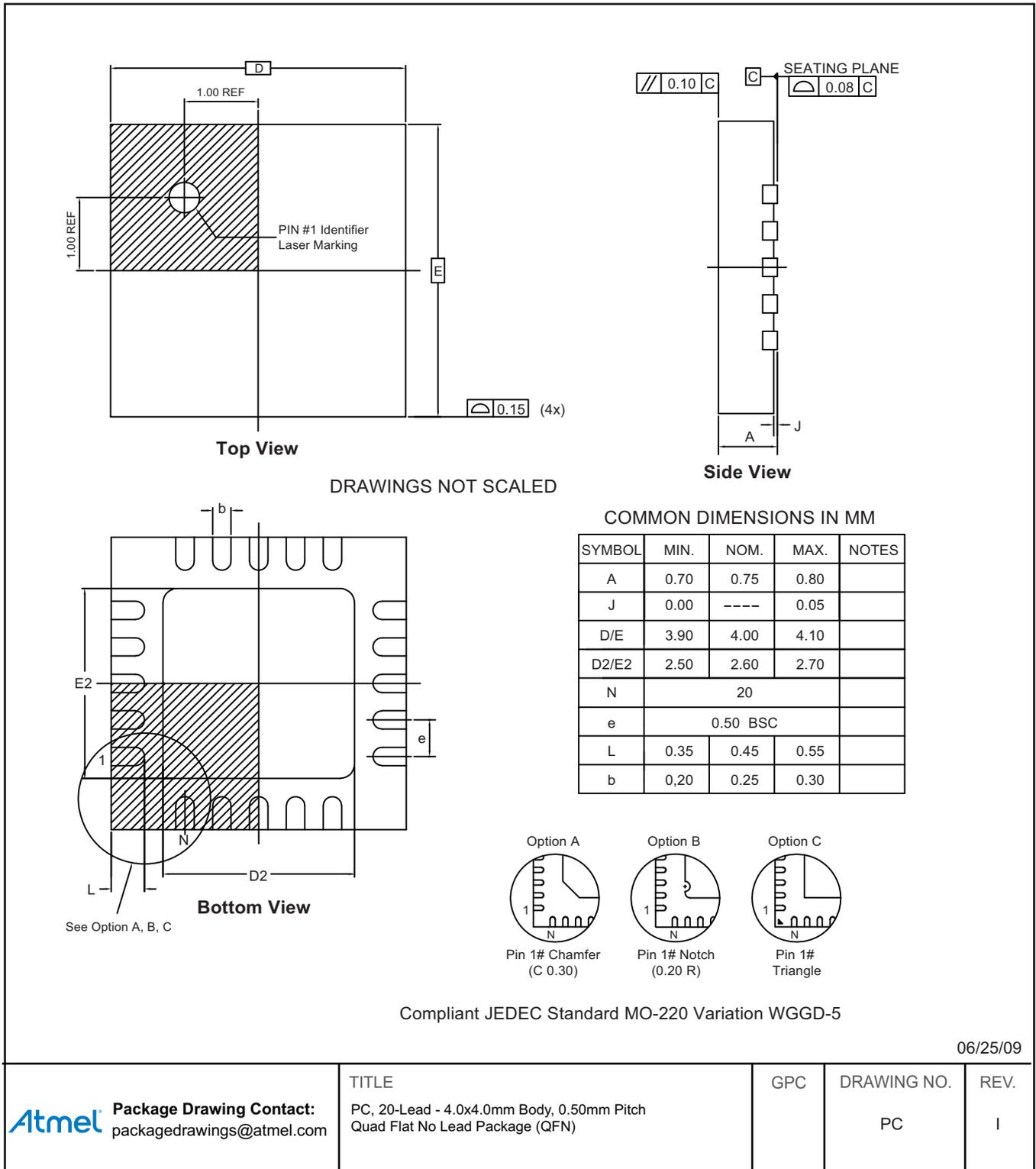
DRAWING NO.

REV.

TU

C

Figure 3-2. PC



## 4. Revision History

Please note that the following page numbers referred to in this section refer to the specific revision mentioned, not to this document.

Revision No.	History
7319F-AVR-07/14	<ul style="list-style-type: none"><li>• Put datasheet in the latest template</li></ul>
7319E-AVR-11/13	<ul style="list-style-type: none"><li>• Section 2 “Ordering Information” on page 5 updated</li><li>• Section 3 “Package Information” on pages 5 to 7 updated</li></ul>
7319D-AVR-10/12	<ul style="list-style-type: none"><li>• Section 3 “Package Information” on pages 5 to 7 updated</li></ul>
7319C-AVR-10/10	<ul style="list-style-type: none"><li>• BOD values updated</li></ul>
7319B-AVR-09/10	<ul style="list-style-type: none"><li>• BOD values updated</li></ul>



**Atmel Corporation** 1600 Technology Drive, San Jose, CA 95110 USA T: (+1)(408) 441.0311 F: (+1)(408) 436.4200 | [www.atmel.com](http://www.atmel.com)

© 2014 Atmel Corporation. / Rev.: 7819F-AVR-07/14

Atmel®, Atmel logo and combinations thereof, Enabling Unlimited Possibilities®, and others are registered trademarks or trademarks of Atmel Corporation in U.S. and other countries. Other terms and product names may be trademarks of others.

**DISCLAIMER:** The information in this document is provided in connection with Atmel products. No license, express or implied, by estoppel or otherwise, to any intellectual property right is granted by this document or in connection with the sale of Atmel products. EXCEPT AS SET FORTH IN THE ATMEL TERMS AND CONDITIONS OF SALES LOCATED ON THE ATMEL WEBSITE, ATMEL ASSUMES NO LIABILITY WHATSOEVER AND DISCLAIMS ANY EXPRESS, IMPLIED OR STATUTORY WARRANTY RELATING TO ITS PRODUCTS INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTY OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT. IN NO EVENT SHALL ATMEL BE LIABLE FOR ANY DIRECT, INDIRECT, CONSEQUENTIAL, PUNITIVE, SPECIAL OR INCIDENTAL DAMAGES (INCLUDING, WITHOUT LIMITATION, DAMAGES FOR LOSS AND PROFITS, BUSINESS INTERRUPTION, OR LOSS OF INFORMATION) ARISING OUT OF THE USE OR INABILITY TO USE THIS DOCUMENT, EVEN IF ATMEL HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. Atmel makes no representations or warranties with respect to the accuracy or completeness of the contents of this document and reserves the right to make changes to specifications and products descriptions at any time without notice. Atmel does not make any commitment to update the information contained herein. Unless specifically provided otherwise, Atmel products are not suitable for, and shall not be used in, automotive applications. Atmel products are not intended, authorized, or warranted for use as components in applications intended to support or sustain life.

**SAFETY-CRITICAL, MILITARY, AND AUTOMOTIVE APPLICATIONS DISCLAIMER:** Atmel products are not designed for and will not be used in connection with any applications where the failure of such products would reasonably be expected to result in significant personal injury or death ("Safety-Critical Applications") without an Atmel officer's specific written consent. Safety-Critical Applications include, without limitation, life support devices and systems, equipment or systems for the operation of nuclear facilities and weapons systems. Atmel products are not designed nor intended for use in military or aerospace applications or environments unless specifically designated by Atmel as military-grade. Atmel products are not designed nor intended for use in automotive applications unless specifically designated by Atmel as automotive-grade.