

---

## 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](http://www.atmel.com)



---

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

---

**ATtiny24V  
ATtiny44V  
ATtiny84V**

**Appendix B**

**Preliminary**

7819A-AVR-01/09



# 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)

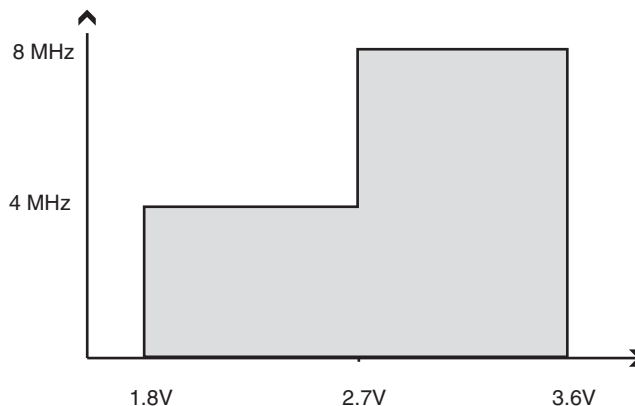
Symbol	Parameters	Condition	Min.	Typ.	Max.	Unit
$V_{\text{IL}}$	Input low voltage, except XTAL1 and $\overline{\text{RESET}}$ pin	$V_{\text{CC}} = 1.8\text{V}$ to $3.6\text{V}$	-0.5		$+0.2V_{\text{CC}}^{(1)}$	V
$V_{\text{IH}}$	Input high voltage, except XTAL1 and $\overline{\text{RESET}}$ pins	$V_{\text{CC}} = 1.8\text{V}$ to $3.6\text{V}$	$0.7V_{\text{CC}}^{(2)}$		$V_{\text{CC}} + 0.5$	V
$V_{\text{IL1}}$	Input low voltage, XTAL1 pin	$V_{\text{CC}} = 1.8\text{V}$ to $3.6\text{V}$	-0.5		$+0.2V_{\text{CC}}^{(1)}$	V
$V_{\text{IH1}}$	Input high voltage, XTAL1 pin	$V_{\text{CC}} = 1.8\text{V}$ to $3.6\text{V}$	$0.9V_{\text{CC}}^{(2)}$		$V_{\text{CC}} + 0.5$	V
$V_{\text{IL2}}$	Input low voltage, $\overline{\text{RESET}}$ pin	$V_{\text{CC}} = 1.8\text{V}$ to $3.6\text{V}$	-0.5		$+0.2V_{\text{CC}}^{(1)}$	V
$V_{\text{IH2}}$	Input high voltage, $\overline{\text{RESET}}$ pin	$V_{\text{CC}} = 1.8\text{V}$ to $3.6\text{V}$	$0.9V_{\text{CC}}^{(2)}$		$V_{\text{CC}} + 0.5$	V
$V_{\text{OL}}$	Output low voltage <sup>(3)</sup> , I/O pin except $\overline{\text{RESET}}$	$I_{\text{OL}} = 2\text{ mA}$ , $V_{\text{CC}} = 1.8\text{V}$			0.2	V
$V_{\text{OH}}$	Output high voltage <sup>(4)</sup> , I/O pin except $\overline{\text{RESET}}$	$I_{\text{OH}} = -2\text{ mA}$ , $V_{\text{CC}} = 1.8\text{V}$	1.2			V
$I_{\text{CC}}$	Power supply current	Active 4 MHz, $V_{\text{CC}} = 3\text{V}$		0.8	2.5	mA
		Idle 4 MHz, $V_{\text{CC}} = 3\text{V}$		0.2	0.5	mA
$I_{\text{CC}}$	Power-down mode	WDT disabled, $V_{\text{CC}} = 3\text{V}$		0.2	24	$\mu\text{A}$
		WDT enabled, $V_{\text{CC}} = 3\text{V}$		4	30	$\mu\text{A}$
$V_{\text{ACIO}}$	Analog comparator Input offset voltage	$V_{\text{CC}} = 2.7\text{V}$ $V_{\text{in}} = V_{\text{CC}}/2$		< 10	40	mV
$I_{\text{ACLK}}$	Analog comparator Input leakage current	$V_{\text{CC}} = 2.7\text{V}$ $V_{\text{in}} = V_{\text{CC}}/2$	-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 (2 mA at  $V_{\text{CC}} = 1.8\text{V}$ ) under steady state conditions (nontransient), the following must be observed: (1) The sum of all  $I_{\text{OL}}$ , for all ports, should not exceed 50 mA. 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 (0.5 mA at  $V_{\text{CC}} = 1.8\text{V}$ ) under steady state conditions (nontransient), the following must be observed: (1) The sum of all  $I_{\text{OL}}$ , for ports B0 to B5, should not exceed 50 mA. 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	7.3 MHz to 8.1 MHz	1.8V to 3.6V	-40°C to +85°C	±25%

## 1.5 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 = 200 kHz		2	4.0	LSB
		$V_{CC} = 1.8\text{V}$ , $V_{Ref} = 1.8\text{V}$ , ADC clock = 200 kHz 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 = 200 kHz		0.5	1.5	LSB
	Differential Non-Linearity (DNL)	$V_{CC} = 1.8\text{V}$ , $V_{Ref} = 1.8\text{V}$ , ADC clock = 200 kHz		0.2	0.7	LSB
	Gain error	$V_{CC} = 1.8\text{V}$ , $V_{Ref} = 1.8\text{V}$ , ADC clock = 200 kHz	-7.0	-3.0	+5.0	LSB
	Offset error	$V_{CC} = 1.8\text{V}$ , $V_{Ref} = 1.8\text{V}$ , ADC clock = 200 kHz	-3.5	+1.5	+3.5	LSB
$V_{REF}$	Reference voltage		1.8		$AV_{CC}$	V

## 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	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 = 125 kHz		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 = 125 kHz		0.3	1.0	LSB
	Gain Error	Gain = 1x, $V_{CC} = 1.8\text{V}$ , $V_{Ref} = 1.3\text{V}$ , ADC clock = 125 kHz	-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 = 125 kHz	-4.0	0.0	+4.0	LSB
$V_{REF}$	Reference Voltage		1.30		$AV_{CC} - 0.5$	V

## 2. Ordering Information

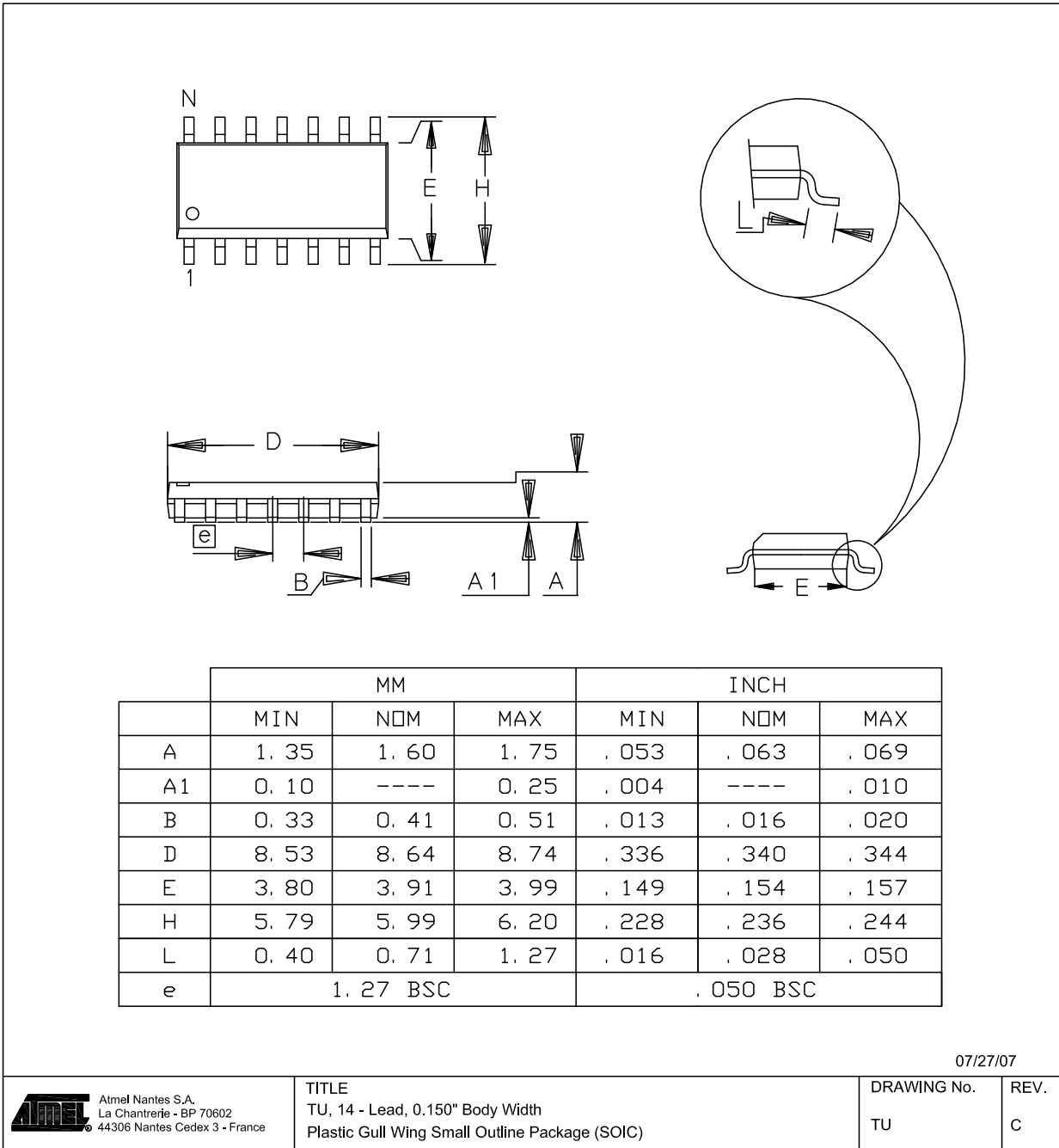
Power Supply	Speed (MHz)	ISP Flash	Ordering Code	Package	Operation Range
1.8V to 3.6V	4-8	2 KB	ATtiny24V-15SST	TU	Automotive (–40°C to +85°C)
1.8V to 3.6V	4-8	2 KB	ATtiny24V-15MT	PN	Automotive (–40°C to +85°C)
1.8V to 3.6V	4-8	4 KB	ATtiny44V-15SST	TU	Automotive (–40°C to +85°C)
1.8V to 3.6V	4-8	4 KB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

## 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 x 5.0 mm Body, 0.50 mm Pitch Quad Flat No Lead package (QFN)

Figure 3-1. TU



07/27/07

Atmel Nantes S.A.  
La Chanterie - BP 70602  
44306 Nantes Cedex 3 - France

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

DRAWING No.

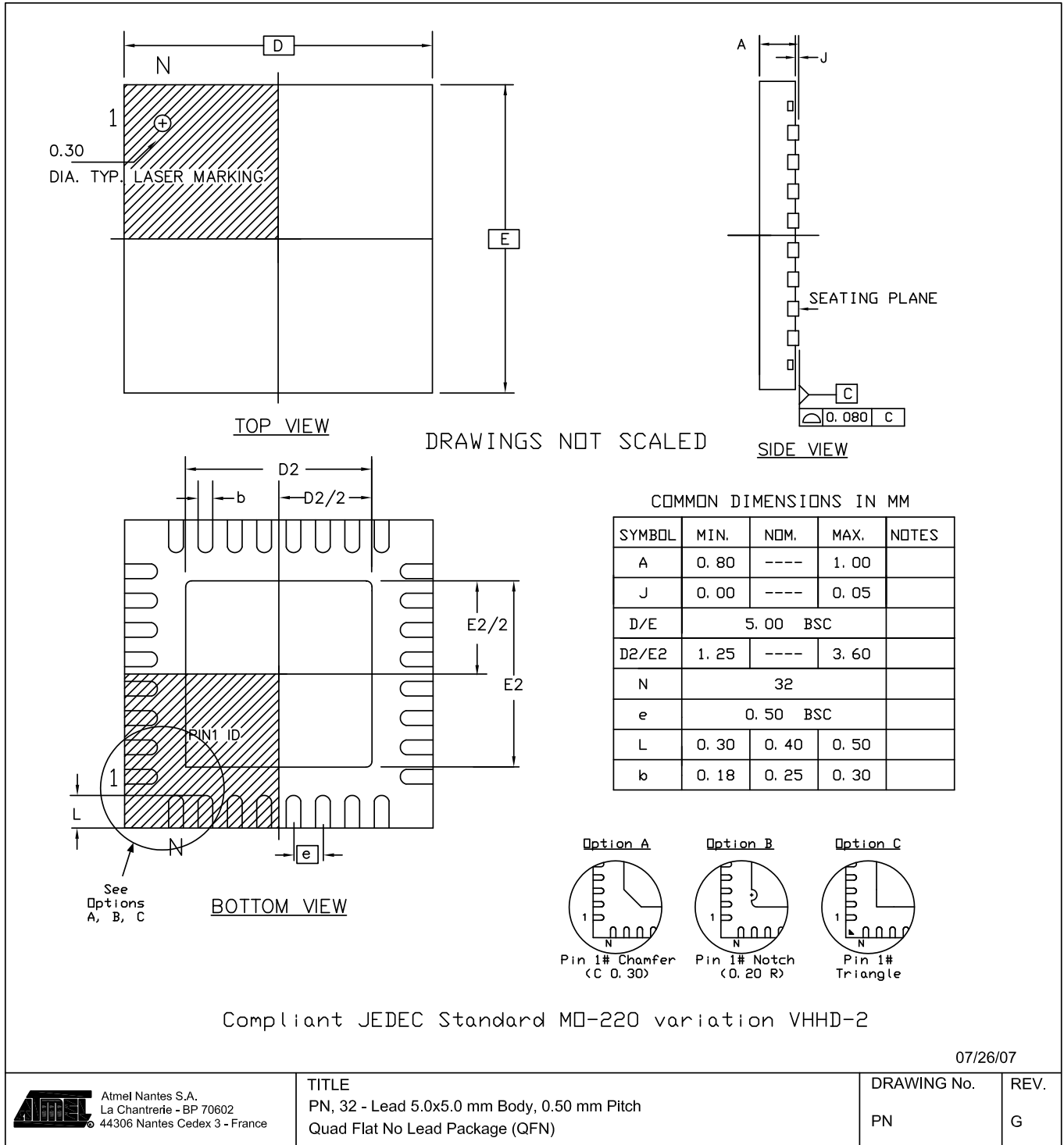
TU

REV.

C

# ATtiny24V/ATtiny44V/ATtiny84V [Preliminary]

Figure 3-2. PN





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

## Product Contact

---

**Web Site**  
[www.atmel.com](http://www.atmel.com)

**Technical Support**  
[avr@atmel.com](mailto:avr@atmel.com)

**Sales Contact**  
[www.atmel.com/contacts](http://www.atmel.com/contacts)

**Literature Requests**  
[www.atmel.com/literature](http://www.atmel.com/literature)

---

**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 ATMEL'S TERMS AND CONDITIONS OF SALE LOCATED ON ATMEL'S WEB SITE, 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 OF 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 product 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's products are not intended, authorized, or warranted for use as components in applications intended to support or sustain life.

© 2009 Atmel Corporation. All rights reserved. Atmel®, logo and combinations thereof, AVR® and others are registered trademarks or trademarks of Atmel Corporation or its subsidiaries. Other terms and product names may be trademarks of others.