

---

## Appendix A - ATtiny261/461/861 Automotive specification at 150°C

This document contains information specific to devices operating at temperatures up to 150°C. Only deviations are covered in this appendix, all other information can be found in the complete Automotive datasheet. The complete Automotive datasheet can be found on [www.atmel.com](http://www.atmel.com)



---

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

---

**ATtiny261  
ATtiny461  
ATtiny861  
Automotive**

**Appendix A**

**Preliminary**

7793C-AVR-06/10



# 1. Electrical Characteristics

## 1.1 Absolute Maximum Ratings<sup>(1)</sup>

Operating Temperature .....	-55°C to +150°C
Storage Temperature .....	-65°C to +175°C
Voltage on any Pin except $\overline{\text{RESET}}$ with respect to Ground .....	-0.5V to $V_{CC}+0.5V$
Voltage on $\overline{\text{RESET}}$ with respect to Ground.....	-0.5V to +13.0V
Maximum Operating Voltage .....	6.0V
DC Current per I/O Pin .....	30.0 mA
DC Current $V_{CC}$ and GND Pins .....	200.0 mA

Note: 1. 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 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.

## 1.2 DC Characteristics

$T_A = -40^\circ\text{C}$  to  $150^\circ\text{C}$ ,  $V_{CC} = 2.7V$  to  $5.5V$  (unless otherwise noted)

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
$V_{IH1}$	Input High Voltage, XTAL1 pin	$V_{CC} = 2.7V$ to $5.5V$	$0.7V_{CC}^{(2)}$		$V_{CC} + 0.5$	V
$I_{ACLK}$	Analog Comparator Input Leakage Current	$V_{CC} = 5V$ $V_{in} = V_{CC}/2$	-150		+150	nA

## 1.3 ADC Characteristics (Single-ended Mode)

Symbol	Parameter	Condition	Min	Typ	Max	Unit
DNL	Differential Non Linearity	$V_{CC} = 4V$ , $V_{Ref} = 4V$ , ADC clock = 200 kHz		0.3	1.0	LSB

## 1.4 ADC Characteristics (Differential Mode)<sup>(1)</sup>

$T_A = -40^\circ\text{C}$  to  $150^\circ\text{C}$ ,  $V_{CC} = 2.7\text{V}$  to  $5.5\text{V}$  (unless otherwise noted)

Symbol	Parameter	Condition	Min	Typ	Max	Unit
	Resolution	Differential conversion, gain = 1x or 8x		8		Bit
		Differential conversion, gain = 20x or 32x		8		Bit
TUE	Absolute accuracy	Gain = 1x/8x, BIPOLAR, $V_{CC} = 5\text{V}$ , $V_{Ref} = 4\text{V}$ , ADC clock = 200 kHz		1.7	4.0	LSB
		Gain = 20x/32x, BIPOLAR, $V_{CC} = 5\text{V}$ , $V_{Ref} = 4\text{V}$ , ADC clock = 200 kHz		2.0	6.0	
		Gain = 1x/8x, UNIPOLAR, $V_{CC} = 5\text{V}$ , $V_{Ref} = 4\text{V}$ , ADC clock = 200 kHz		2.3	6.0	
		Gain = 20x/32x, UNIPOLAR, $V_{CC} = 5\text{V}$ , $V_{Ref} = 4\text{V}$ , ADC clock = 200 kHz		3.0	10.0	
INL	Integral Non Linearity	Gain = 1x/8x, BIPOLAR, $V_{CC} = 5\text{V}$ , $V_{Ref} = 4\text{V}$ , ADC clock = 200 kHz		0.3	1.5	LSB
		Gain = 20x/32x, BIPOLAR, $V_{CC} = 5\text{V}$ , $V_{Ref} = 4\text{V}$ , ADC clock = 200 kHz		0.7	3.0	
		Gain = 1x/8x, UNIPOLAR, $V_{CC} = 5\text{V}$ , $V_{Ref} = 4\text{V}$ , ADC clock = 200 kHz		1.0	3.0	
		Gain = 20x/32x, UNIPOLAR, $V_{CC} = 5\text{V}$ , $V_{Ref} = 4\text{V}$ , ADC clock = 200 kHz		2.0	8.0	
DNL	Differential Non Linearity	Gain = 1x/8x, BIPOLAR, $V_{CC} = 5\text{V}$ , $V_{Ref} = 4\text{V}$ , ADC clock = 200 kHz		0.3	1.0	LSB
		Gain = 20x/32x, BIPOLAR, $V_{CC} = 5\text{V}$ , $V_{Ref} = 4\text{V}$ , ADC clock = 200 kHz		0.4	1.2	
		Gain = 1x/8x, UNIPOLAR, $V_{CC} = 5\text{V}$ , $V_{Ref} = 4\text{V}$ , ADC clock = 200 kHz		0.4	1.0	
		Gain = 20x/32x, UNIPOLAR, $V_{CC} = 5\text{V}$ , $V_{Ref} = 4\text{V}$ , ADC clock = 200 kHz		0.8	2.5	

Note: 1. For temperature range  $+125^\circ\text{C}$  to  $+150^\circ\text{C}$  only. For  $-40^\circ\text{C}$  to  $+125^\circ\text{C}$ , refer to ATtiny261/461/861 automotive datasheet.

## 1.4 ADC Characteristics (Differential Mode)<sup>(1)</sup> (Continued)

$T_A = -40^\circ\text{C}$  to  $150^\circ\text{C}$ ,  $V_{CC} = 2.7\text{V}$  to  $5.5\text{V}$  (unless otherwise noted)

Symbol	Parameter	Condition	Min	Typ	Max	Unit
	Gain error	Gain = 1x/8x, BIPOLAR, $V_{CC} = 5\text{V}$ , $V_{Ref} = 4\text{V}$ , ADC clock = 200 kHz	-4.0	+2.0	+4.0	LSB
		Gain = 20x/32x, BIPOLAR, $V_{CC} = 5\text{V}$ , $V_{Ref} = 4\text{V}$ , ADC clock = 200 kHz	-4.0	+1.4	+4.0	
		Gain = 1x/8x, UNIPOLAR, $V_{CC} = 5\text{V}$ , $V_{Ref} = 4\text{V}$ , ADC clock = 200 kHz	-5.0	-2.6	+5.0	
		Gain = 20x/32x, UNIPOLAR, $V_{CC} = 5\text{V}$ , $V_{Ref} = 4\text{V}$ , ADC clock = 200 kHz	-5.0	-0.8	+5.0	
	Offset error	BIPOLAR, $V_{CC} = 5\text{V}$ , $V_{Ref} = 4\text{V}$ , ADC clock = 200 kHz	-4.0		+4.0	LSB
		UNIPOLAR, $V_{CC} = 5\text{V}$ , $V_{Ref} = 4\text{V}$ , ADC clock = 200 kHz	-5.0		+5.0	
$V_{REF}$	Reference voltage		2.58		$AVCC - 0.5$	V

Note: 1. For temperature range  $+125^\circ\text{C}$  to  $+150^\circ\text{C}$  only. For  $-40^\circ\text{C}$  to  $+125^\circ\text{C}$ , refer to ATtiny261/461/861 automotive datasheet.

## 1.5 System and Reset Characteristics

**Table 1-1.** Reset, Brown-out and Internal Voltage Characteristics

Symbol	Parameter	Condition	Min	Typ	Max	Unit
$V_{BG}$	Bandgap reference voltage	$V_{CC} = 3\text{V}$ , $T = 150^\circ\text{C}$	0.99	1.1	1.21	V

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

BODLEVEL [2..0] Fuses	Min $V_{BOT}$	Typ $V_{BOT}$	Max $V_{BOT}$	Unit
111	BOD Disabled			V
110	1.67	1.8	1.93	
101	2.5	2.7	2.9	
100	3.98	4.3	4.62	
011	Reserved			
010				
001				
000				

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.

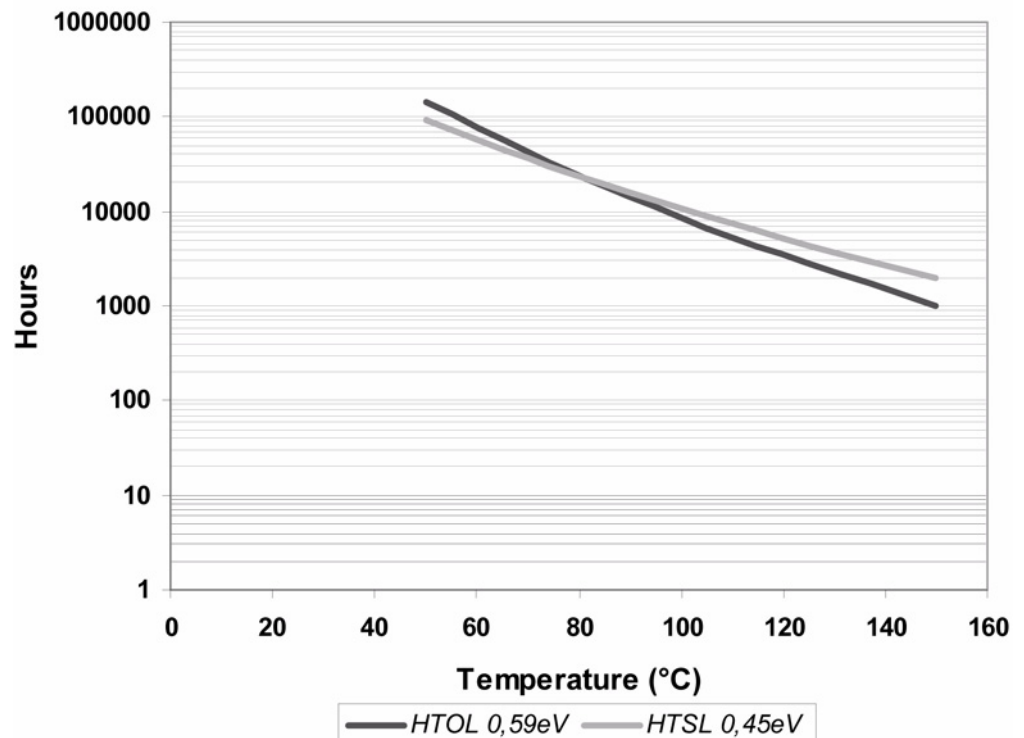
## 1.6 Grade 0 Qualification

The ATtiny261/461/861 has been developed and manufactured according to the most stringent quality assurance requirements of ISO-TS-16949 and verified during product qualification as per AEC-Q100 grade 0.

AEC-Q100 qualification relies on temperature accelerated stress testing. High temperature field usage however may result in less significant stress test acceleration. In order to prevent the risk that ATtiny261/461/861 lifetime would not satisfy the application end-of-life reliability requirements, Atmel has extended the testing, whenever applicable (High Temperature Operating Life Test, High Temperature Storage Life, Data Retention, Thermal Cycles), far beyond the AEC-Q100 requirements. Thereby, Atmel verified the ATtiny261/461/861 has a long safe lifetime period after the grade 0 qualification acceptance limits.

The valid domain calculation depends on the activation energy of the potential failure mechanism that is considered. Therefore any temperature mission profile which could exceed the AEC-Q100 equivalence domain shall be submitted to Atmel for a thorough reliability analysis

**Figure 1-1.** AEC-Q100 Lifetime Equivalence



## 2. Ordering Information

### 2.1 ATtiny261/461/861

Speed (MHz)	Power Supply	Ordering Code	Package <sup>(1)</sup>	Operation Range
16 <sup>(2)</sup>	2.7 to 5.5V	ATtiny261-ESMD	PN	Extended (-40°C to +150°C)
16 <sup>(2)</sup>	2.7 to 5.5V	ATtiny261-ESXD	6G	Extended (-40°C to +150°C)
16 <sup>(2)</sup>	2.7 to 5.5V	ATtiny461-ESMD	PN	Extended (-40°C to +150°C)
16 <sup>(2)</sup>	2.7 to 5.5V	ATtiny461-ESXD	6G	Extended (-40°C to +150°C)
16 <sup>(2)</sup>	2.7 to 5.5V	ATtiny861-ESMD	PN	Extended (-40°C to +150°C)
16 <sup>(2)</sup>	2.7 to 5.5V	ATtiny861-ESXD	6G	Extended (-40°C to +150°C)

- Notes:
1. Pb-free packaging, complies to the European Directive for Restriction of Hazardous Substances (RoHS directive). Also Halide free and fully Green.
  2. For Speed versus  $V_{CC}$ , see complete datasheet.

# ATtiny261/461/861 Automotive [Preliminary]

Package Type	
<b>PN</b>	32-pad, 5 x 5 x 1.0 mm body, lead pitch 0.50 mm, Quad Flat No-Lead/Micro Lead Frame Package (QFN/MLF): E2/D2 3.1 +/- 0.1mm
<b>6G</b>	20-leads, 4.4x6.5mm body - 0.65mmPitch - Lead Length: 0.6mm Thin Shrink Small Outline Package (TSSOP)

Figure 2-1. PN

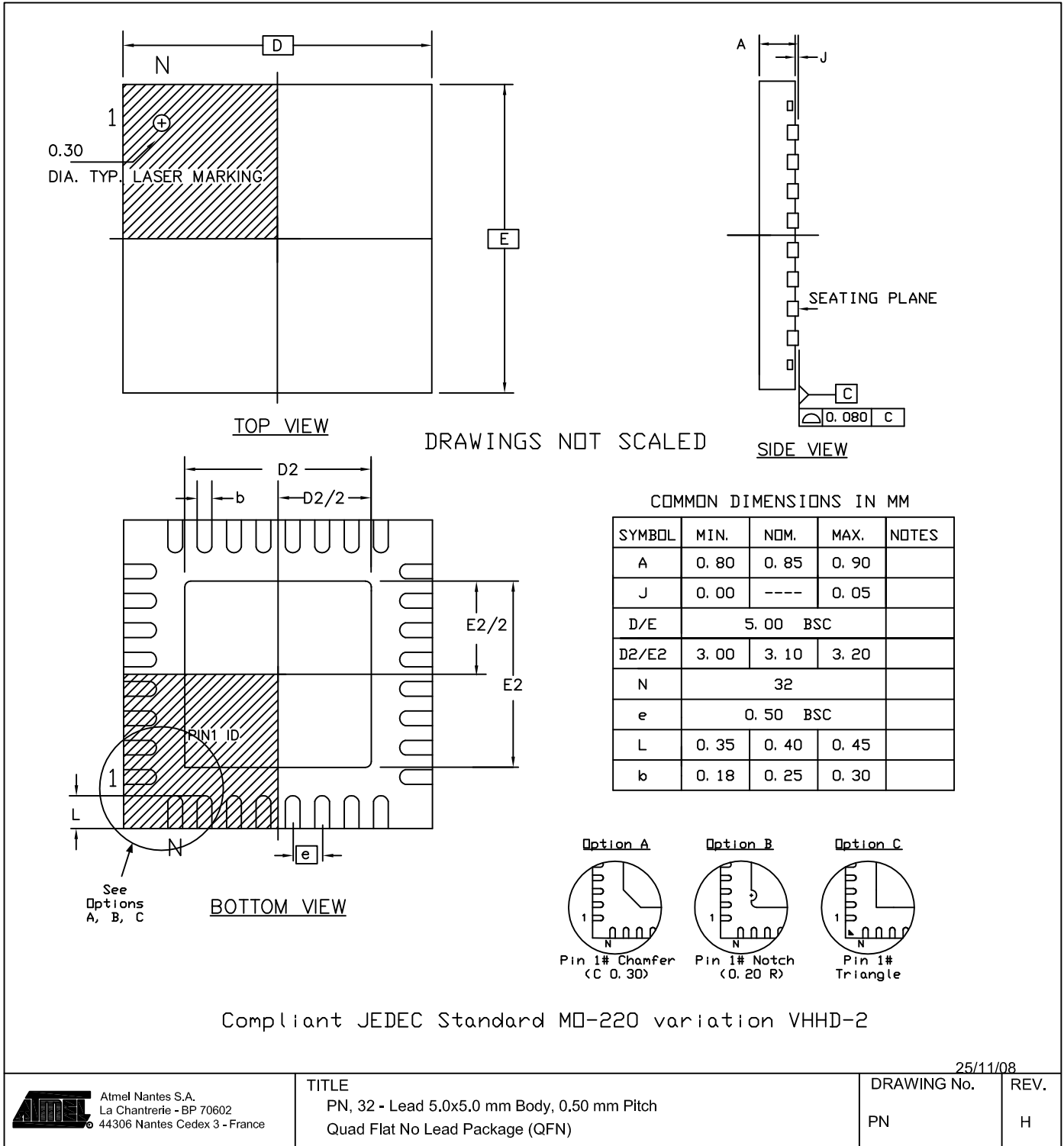
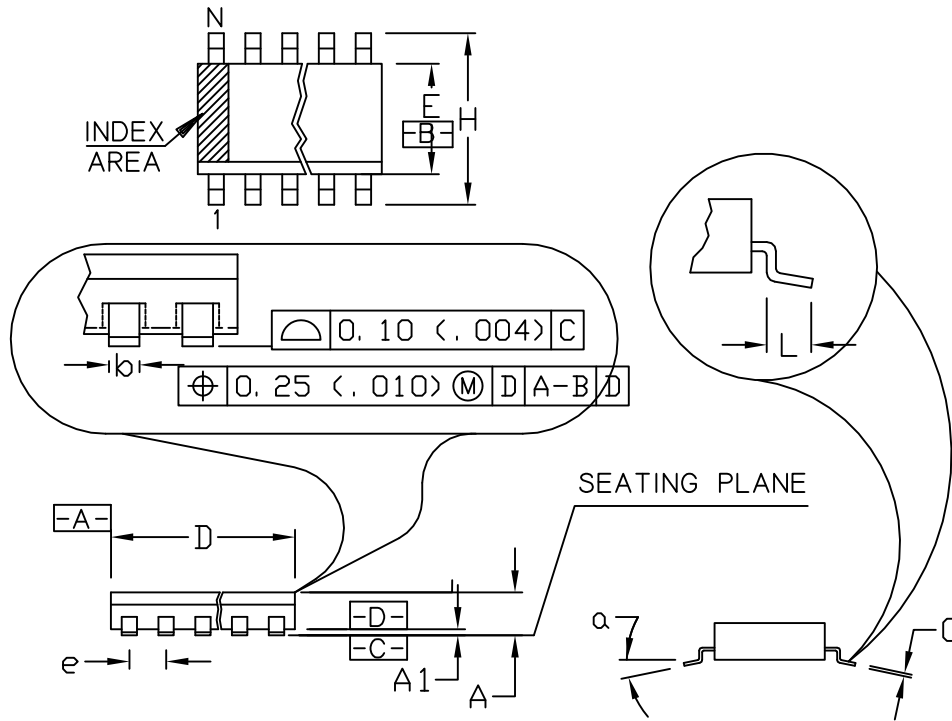




Figure 2-2. 6G



	MM		INCH	
A	----	1.10	----	.043
A1	0.05	0.15	.002	.006
b	0.19	0.30	.007	.012
C	0.09	0.20	.003	.008
D	6.40	6.60	.252	.260
E	4.30	4.50	.169	.177
e	0.65	BSC	.026	BSC
H	6.40	BSC	.252	BSC
L	0.50	0.70	.020	.028
N	20		20	
$\alpha$	0° ~8°		0° ~8°	

20/12/2007



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

TITLE  
6G, 20 Leads - 4.4x6.5mm body - 0.65mm Pitch - Lead Length: 0.6mm  
THIN SHRINK SMALL OUTLINE

DRAWING No.	REV.
6G	A

### 3. Document Revision History

#### 3.1 7793C - 06/10

1. DC characteristics updated.
2. ADC characteristics updated.
3. RC Oscillator removed.

#### 3.2 7793B - 03/10

1. DC characteristics updated.
2. ADC characteristics updated.

#### 3.3 7793A - 08/08

1. Document Creation.



## 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.

© 2010 Atmel Corporation. All rights reserved. Atmel®, Atmel logo and combinations thereof, AVR®, AVR® logo and others are registered trademarks or trademarks of Atmel Corporation or its subsidiaries. Other terms and product names may be trademarks of others.