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

8-bit AVR® 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[1]

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°C to 150°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)(1)

T_A = –40°C to 150°C, V_{CC} = 2.7V to 5.5V (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} = 5V, V_{Ref} = 4V, ADC clock = 200 kHz		1.7	4.0	LSB
		Gain = 20x/32x, BIPOLAR, V_{CC} = 5V, V_{Ref} = 4V, ADC clock = 200 kHz		2.0	6.0	
		Gain = 1x/8x, UNIPOLAR, V_{CC} = 5V, V_{Ref} = 4V, ADC clock = 200 kHz		2.3	6.0	
		Gain = 20x/32x, UNIPOLAR, V_{CC} = 5V, V_{Ref} = 4V, ADC clock = 200 kHz		3.0	10.0	
INL	Integral Non Linearity	Gain = 1x/8x, BIPOLAR, V_{CC} = 5V, V_{Ref} = 4V, ADC clock = 200 kHz		0.3	1.5	LSB
		Gain = 20x/32x, BIPOLAR, V_{CC} = 5V, V_{Ref} = 4V, ADC clock = 200 kHz		0.7	3.0	
		Gain = 1x/8x, UNIPOLAR, V_{CC} = 5V, V_{Ref} = 4V, ADC clock = 200 kHz		1.0	3.0	
		Gain = 20x/32x, UNIPOLAR, V_{CC} = 5V, V_{Ref} = 4V, ADC clock = 200 kHz		2.0	8.0	
DNL	Differential Non Linearity	Gain = 1x/8x, BIPOLAR, V_{CC} = 5V, V_{Ref} = 4V, ADC clock = 200 kHz		0.3	1.0	LSB
		Gain = 20x/32x, BIPOLAR, V_{CC} = 5V, V_{Ref} = 4V, ADC clock = 200 kHz		0.4	1.2	
		Gain = 1x/8x, UNIPOLAR, V_{CC} = 5V, V_{Ref} = 4V, ADC clock = 200 kHz		0.4	1.0	
		Gain = 20x/32x, UNIPOLAR, V_{CC} = 5V, V_{Ref} = 4V, ADC clock = 200 kHz		0.8	2.5	

Note: 1. For temperature range +125°C to +150°C only. For –40°C to +125°C, refer to ATtiny261/461/861automotive datasheet.

1.4 ADC Characteristics (Differential Mode)[1] (Continued)

T_A = –40°C to 150°C, V_{CC} = 2.7V to 5.5V (unless otherwise noted)

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

Note: 1. For temperature range +125°C to +150°C only. For –40°C to +125°C, refer to ATtiny261/461/861automotive 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} = 3V, T=150°C	0.99	1.1	1.21	V

Table 1-2. BODLEVEL Fuse Coding[1]

BODLEVEL [2..0] Fuses	Min V_{BOT}	Typ V_{BOT}	Max V_{BOT}	Unit
111	BOD Disabled			
110	1.67	1.8	1.93	V
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.

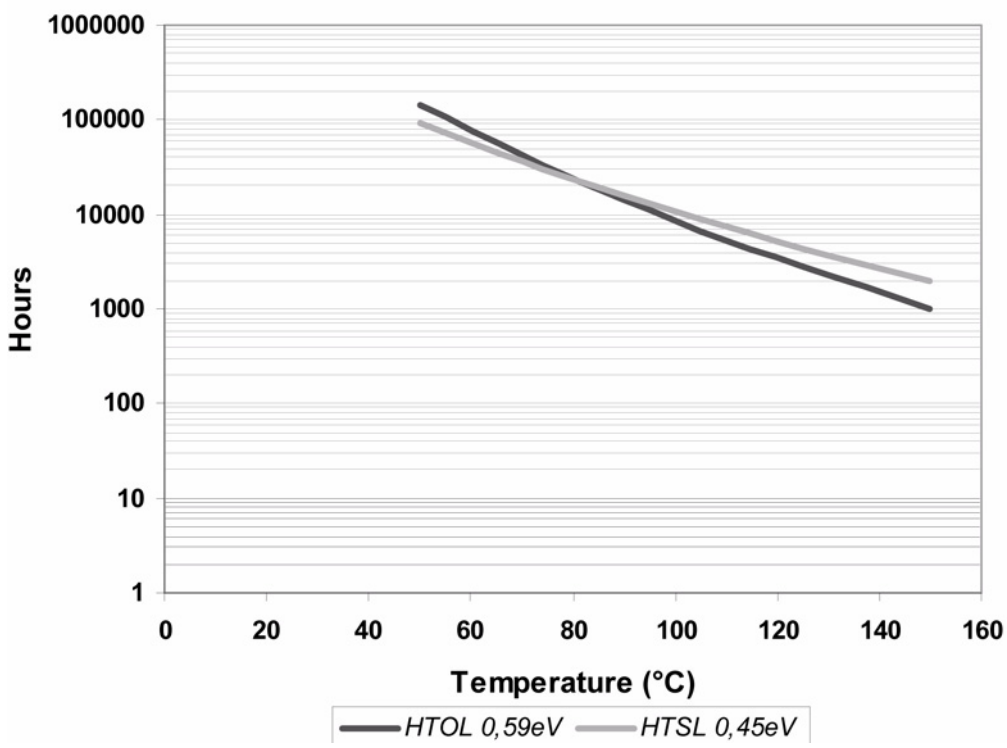
1.6 Grade 0 Qualification

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

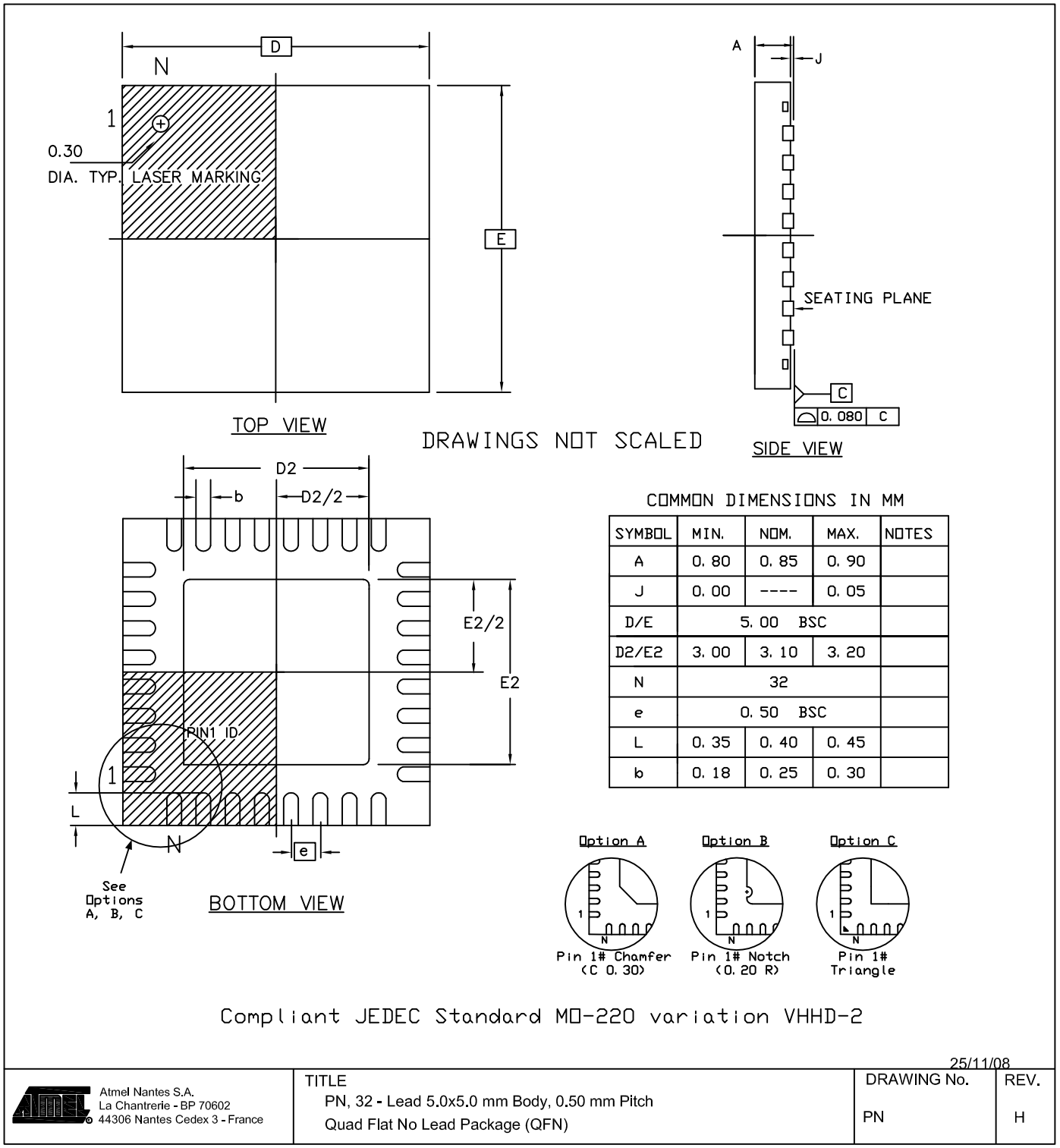
Speed (MHz)	Power Supply	Ordering Code	Package[1]	Operation Range
16[2]	2.7 to 5.5V	ATtiny261-ESMD	PN	Extended (–40°C to +150°C)
16[2]	2.7 to 5.5V	ATtiny261-ESXD	6G	Extended (–40°C to +150°C)
16[2]	2.7 to 5.5V	ATtiny461-ESMD	PN	Extended (–40°C to +150°C)
16[2]	2.7 to 5.5V	ATtiny461-ESXD	6G	Extended (–40°C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

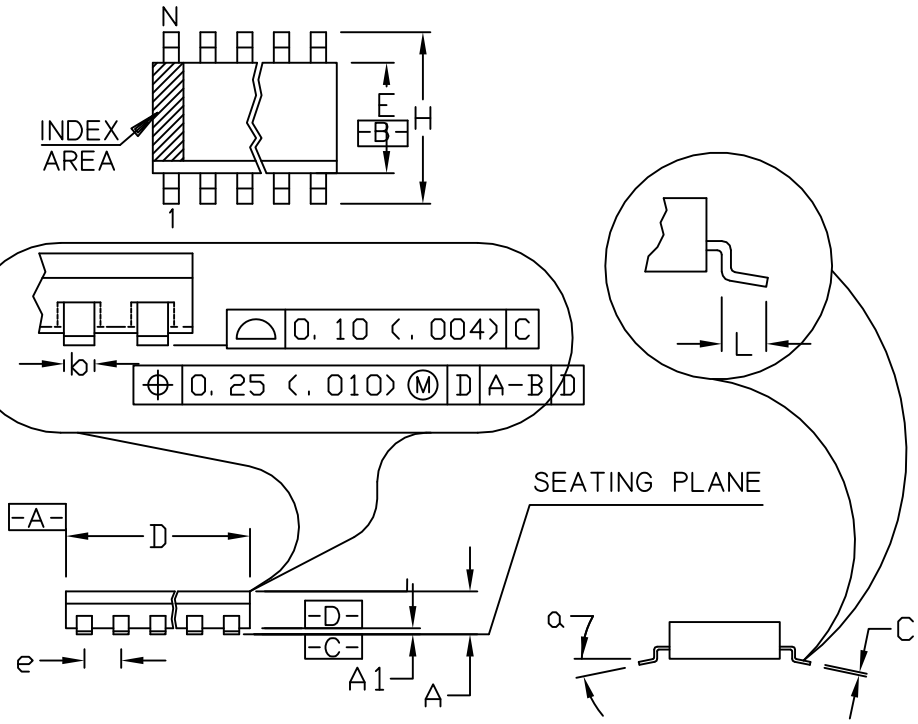
Package Type	
PN	32-pad, 5 x 5 x 1.0 mm body, lead pitch 0.50 mm, Quad Flat No-Lead/Micro Lead Frame Package (QFN/MLF): E2/D2 3.1 +/- 0.1mm
6G	20-leads, 4.4x6.5mm body - 0.65mmPitch - Lead Length: 0.6mm Thin Shrink Small Outline Package (TSSOP)

Figure 2-1. PN



SYMBOL	MIN.	NOM.	MAX.	NOTES
A	0.80	0.85	0.90	
J	0.00	----	0.05	
D/E		5.00 BSC		
D2/E2	3.00	3.10	3.20	
N		32		
e		0.50 BSC		
L	0.35	0.40	0.45	
b	0.18	0.25	0.30	

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	
α	0°~8°		0°~8°	

20/12/2007

	TITLE	DRAWING No.	REV.
Atmel Nantes S.A. La Chantrerie - BP 70602 44306 Nantes Cedex 3 - France	6G, 20 Leads - 4.4x6.5mm body - 0.65mm Pitch - Lead Length: 0.6mm THIN SHRINK SMALL OUTLINE	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.

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