



ATtiny261/ATtiny461/ATtiny861

Appendix A - Automotive Specification at 150°C

DATASHEET

Introduction

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

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	Min.	Typ.	Max.	Unit
Operating temperature	-55		+150	°C
Storage temperature	-65		+175	°C
Voltage on any pin except RESET with respect to ground	-0.5		$V_{CC} + 13.0$	V
Voltage on $\overline{\text{RESET}}$ with respect to ground	-0.5		+13.0	V
Maximum operating voltage		6.0		V
DC current per I/O pin		30		mA
DC current V_{CC} and GND pins		200		mA

1.2 DC Characteristics

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

Parameter	Condition	Symbol	Min.	Typ.	Max.	Unit
Input high voltage, XTAL1 pin	$V_{CC} = 2.7\text{V}$ to 5.5V	V_{IH1}	$0.7V_{CC}^{(2)}$		$V_{CC} + 0.5$	V
Analog comparator input leakage current	$V_{CC} = 5\text{V}$ $V_{in} = V_{CC}/2$	I_{ACLK}	-150		+150	nA

1.3 ADC Characteristics (Single-ended Mode)

Parameter	Condition	Symbol	Min.	Typ.	Max	Unit
Differential non linearity	$V_{CC} = 4\text{V}$, $V_{Ref} = 4\text{V}$, ADC clock = 200kHz	DNL		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)

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

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

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

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

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

Note: 1. For temperature range $+125^\circ\text{C}$ to $+150^\circ\text{C}$ only. For -40°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

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

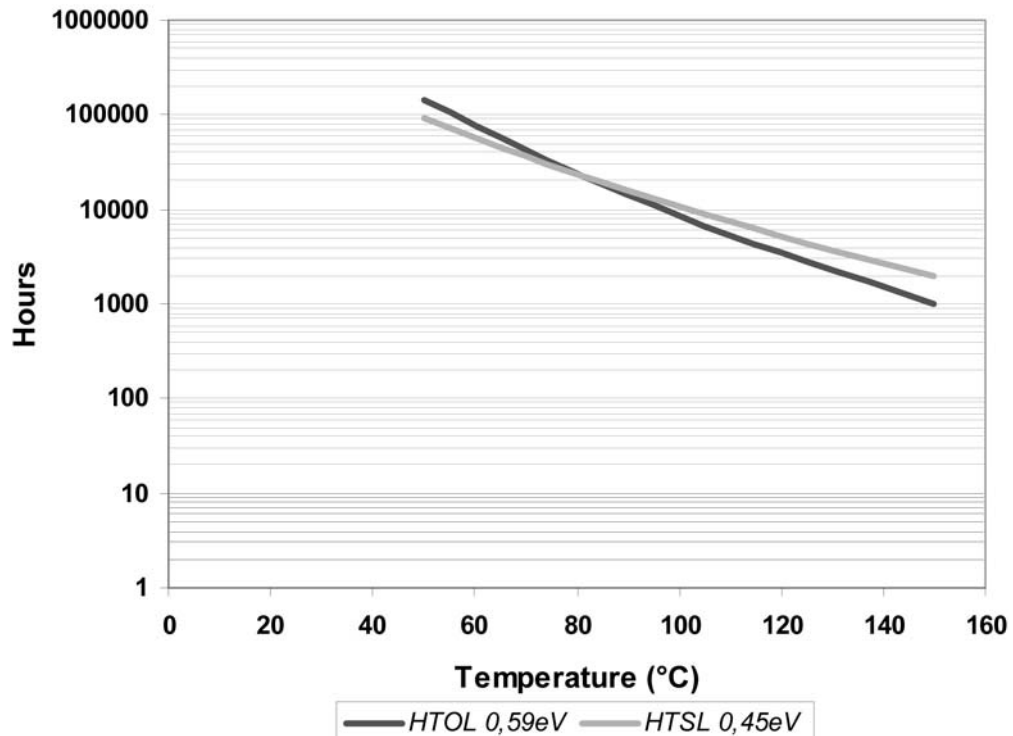
1.6 Grade 0 Qualification

The Atmel® 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 Atmel 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 Atmel 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.

2.2 Package Types

Package Type	
PN	32-pad, 5 × 5 × 1.0mm body, lead pitch 0.50mm, quad flat no-lead/micro lead frame package (QFN/MLF): E2/D2 3.1 ±0.1mm
6G	20-leads, 4.4 × 6.5mm body - 0.65mm pitch - lead length: 0.6mm, thin shrink small outline package (TSSOP)

Figure 2-1. PN

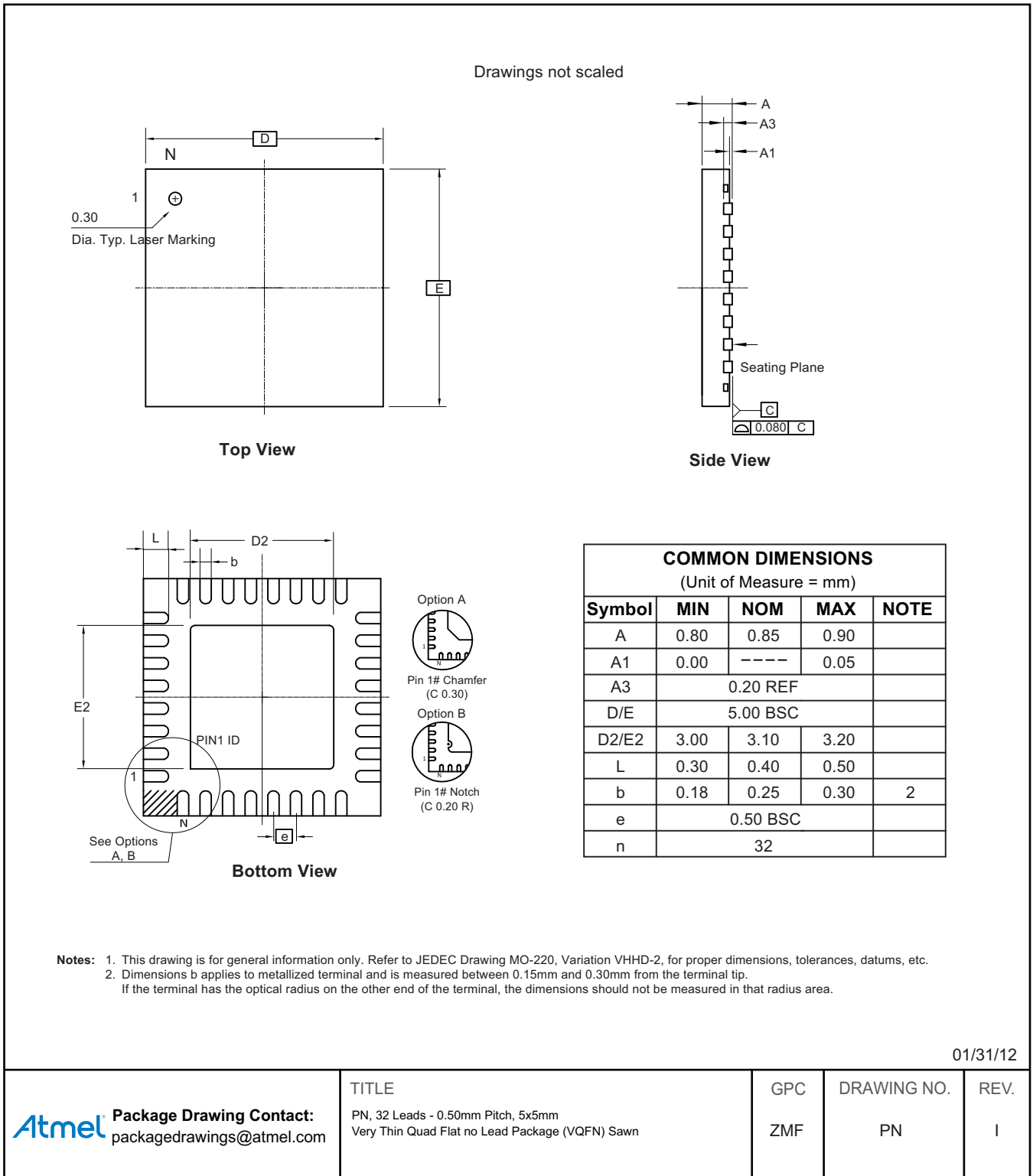
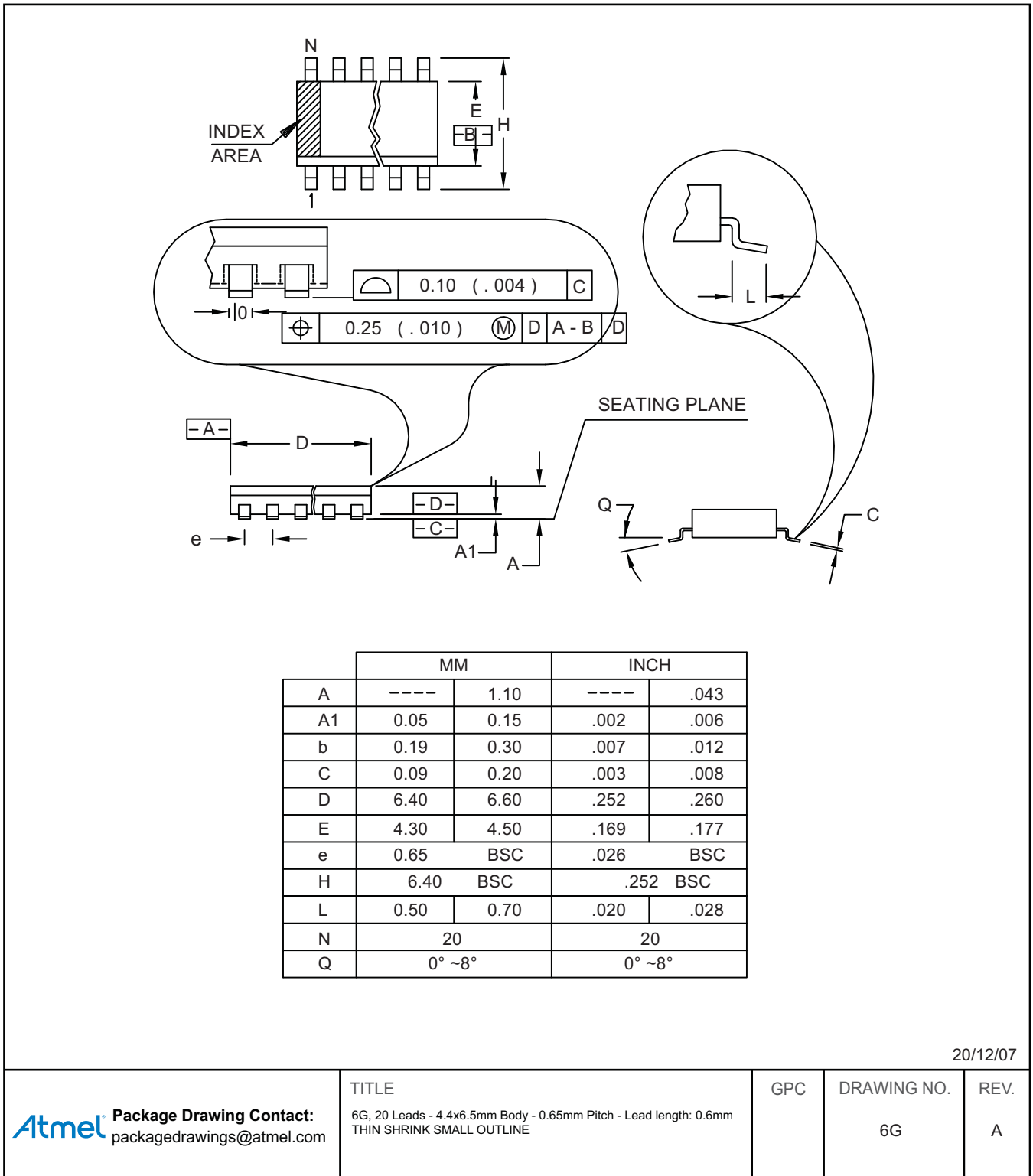


Figure 2-2. 6G



20/12/07

Atmel Package Drawing Contact:
packagedrawings@atmel.com

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

GPC

DRAWING NO.

6G

REV.

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3. 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
7793D-AVR-04/14	<ul style="list-style-type: none">• Put datasheet in the latest template
7793C-AVR-06/10	<ul style="list-style-type: none">• DC characteristics updated• ADC characteristics updated• RC oscillator removed
7793B-AVR-03/10	<ul style="list-style-type: none">• DC characteristics updated• ADC characteristics updated
7793A-AVR-08/08	<ul style="list-style-type: none">• Document creation.



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