

## ATtiny87/ATtiny167

# Appendix A - ATtiny87/ATtiny167 Automotive Specification at 150°C

**DATASHEET** 

### **Description**

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 <a href="http://www.atmel.com">http://www.atmel.com</a>

#### 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	Test Conditions	Unit
Operating temperature	-55 to +150	°C
Storage temperature	-65 to +175	°C
Voltage on any pin except RESET with respect to ground	-0.5 to V <sub>CC</sub> + 0.5	V
Voltage on RESET with respect to ground	−0.5 to +13.0	V
Maximum operating voltage	6.0	V
DC current per I/O pin DC current V <sub>CC</sub> and GND	30 200.0	mA

#### 1.2 DC Characteristics

 $T_A = -40$ °C to +150°C,  $V_{CC} = 4.5$ V to 5.5V (unless otherwise noted)

Parameters	Test Conditions	Symbol	Min.	Тур.	Max.	Unit
Input low voltage, except XTAL1 and RESET pin	$V_{CC} = 4.5V - 5.5V$	V <sub>IL</sub>	-0.5		+0.2V <sub>CC</sub> <sup>(1)</sup>	V
Input high voltage, except XTAL1 and RESET pins	V <sub>CC</sub> = 4.5V – 5.5V	V <sub>IH</sub>	0.6V <sub>CC</sub> <sup>(2)</sup>		V <sub>CC</sub> + 0.5	V
Input low voltage, XTAL1 pin	$V_{CC} = 4.5V - 5.5V$	V <sub>IL1</sub>	-0.5		+0.1V <sub>CC</sub> <sup>(1)</sup>	V
Input high voltage, XTAL1 pin	V <sub>CC</sub> = 4.5V – 5.5V	V <sub>IH1</sub>	0.7V <sub>CC</sub> <sup>(2)</sup>		V <sub>CC</sub> + 0.5	V
Input low voltage, RESET pin	$V_{CC} = 4.5V - 5.5V$	V <sub>IL2</sub>	-0.5		0.2V <sub>CC</sub> <sup>(1)</sup>	V
Input high voltage, RESET pin	V <sub>CC</sub> = 4.5V – 5.5V	V <sub>IH2</sub>	0.9V <sub>CC</sub> <sup>(2)</sup>		V <sub>CC</sub> + 0.5	V
Input low voltage, RESET pin as I/O	V <sub>CC</sub> = 4.5V - 5.5V	V <sub>IL3</sub>	-0.5		0.2V <sub>CC</sub> <sup>(1)</sup>	V
Input high voltage, RESET pin as I/O	V <sub>CC</sub> = 4.5V - 5.5V	V <sub>IH3</sub>	0.8V <sub>CC</sub> <sup>(2)</sup>		V <sub>CC</sub> + 0.5	V
Output low voltage <sup>(3)</sup> , I/O pin except RESET	I <sub>OL</sub> = 10mA, V <sub>CC</sub> = 5V	V <sub>OL</sub>			0.8	V

Notes: 1. "Max" means the highest value where the pin is guaranteed to be read as low

- 2. "Min" means the lowest value where the pin is guaranteed to be read as high
- 3. Although each I/O port can sink more than the test conditions (20mA at  $V_{CC} = 5V$ ) under steady state conditions (non-transient), the following must be observed:
  - 1] The sum of all IOL, for all ports, should not exceed 400mA.
  - 2] The sum of all IOL, for ports C0 C5, should not exceed 200mA.
  - 3] The sum of all IOL, for ports C6, D0 D4, should not exceed 300mA.
  - 4] The sum of all IOL, for ports B0 B7, D5 D7, should not exceed 300mA.
  - If IOL exceeds the test condition, VOL may exceed the related specification. Pins are not guaranteed to sink current greater than the listed test condition.
- 4. For temperature range +125°C to +150°C only. For -40°C to +125°C, refer to ATtiny167 automotive datasheet.



#### 1.2 DC Characteristics (Continued)

 $T_A = -40$ °C to +150°C,  $V_{CC} = 4.5$ V to 5.5V (unless otherwise noted) (Continued)

Parameters	Test Conditions	Symbol	Min.	Тур.	Max.	Unit
Output high voltage <sup>(4)</sup> , I/O pin except RESET	$I_{OH} = -10 \text{mA}, V_{CC} = 5 \text{V}$	V <sub>OH</sub>	4.0			V
Input leakage current I/O pin	V <sub>CC</sub> = 5.5V, pin low (absolute value)	I <sub>IL</sub>			1	μA
Input leakage current I/O Pin	V <sub>CC</sub> = 5.5V, pin high (absolute value)	I <sub>IH</sub>			1	μA
Reset pull-up resistor		R <sub>RST</sub>	35		65	kΩ
I/O pin pull-up resistor		R <sub>PU</sub>	20		50	kΩ
	16MHz, $V_{CC} = 5V$	I <sub>CC</sub>		10	15	mA
Power supply current	8MHz, $V_{CC} = 5V$	I <sub>CC</sub>		5.5	8.0	mA
active mode	8MHz, $V_{CC} = 3V$	I <sub>CC</sub>		2.8	4.0	mA
	4MHz, $V_{CC} = 3V$	I <sub>CC</sub>		1.8	3.0	mA
	16MHz, $V_{CC} = 5V$	I <sub>CC</sub>		3.5	6.0	mA
Power supply current idle	8MHz, $V_{CC} = 5V$	I <sub>CC</sub>		1.8	3.0	mA
mode	8MHz, V <sub>CC</sub> = 3V	I <sub>CC</sub>		1.0	2.0	mA
	4MHz, $V_{CC} = 3V$	I <sub>CC</sub>		0.5	1.0	mA
	WDT enabled, V <sub>CC</sub> = 5V	I <sub>CC</sub>		7	150	μΑ
Power supply current	WDT disabled, V <sub>CC</sub> = 5V	I <sub>CC</sub>		0.18	150	μA
power-down mode	WDT enabled, V <sub>CC</sub> = 3V	I <sub>CC</sub>		5	150	μA
	WDT disabled, V <sub>CC</sub> = 3V	I <sub>CC</sub>		0.15	100	μA
Analog comparator input leakage current	$V_{CC} = 5V$ $V_{in} = V_{CC}/2$	I <sub>ACLK</sub>	-50		+50	nA
Analog comparator propagation delay	V <sub>CC</sub> = 4.0V	t <sub>ACPD</sub>		180		ns

Notes: 1. "Max" means the highest value where the pin is guaranteed to be read as low

- 2. "Min" means the lowest value where the pin is guaranteed to be read as high
- 3. Although each I/O port can sink more than the test conditions (20mA at  $V_{CC} = 5V$ ) under steady state conditions (non-transient), the following must be observed:
  - 1] The sum of all IOL, for all ports, should not exceed 400mA.
  - 2] The sum of all IOL, for ports C0 C5, should not exceed 200mA.
  - 3] The sum of all IOL, for ports C6, D0 D4, should not exceed 300mA.
  - 4] The sum of all IOL, for ports B0 B7, D5 D7, should not exceed 300mA.
  - If IOL exceeds the test condition, VOL may exceed the related specification. Pins are not guaranteed to sink current greater than the listed test condition.
- 4. For temperature range +125°C to +150°C only. For -40°C to +125°C, refer to ATtiny167 automotive datasheet.



#### 1.3 ADC Characteristics

 $T_A = -40$ °C to +150°C,  $V_{CC} = 4.5 V$  to 5.5V (unless otherwise noted)

Parameters	Test Conditions	Symbol	Min.	Тур.	Max.	Unit
Resolution	Single ended			10		Bit
Absolute accuracy	$V_{CC} = 4V$ , $V_{REF} = 4V$ , ADC clock = 200kHz	TUE		2.0	3.5	LSB
Integral non linearity	$V_{CC} = 4V$ , $V_{REF} = 4V$ , ADC clock = 200kHz	INL		0.6	2.0	LSB
Differential non linearity	$V_{CC} = 4V$ , $V_{REF} = 4V$ , ADC clock = 200kHz, Temp = -40°C to +150°C	DNL		0.4	1.5	LSB
Gain error	$V_{CC} = 4V$ , $V_{REF} = 4V$ , ADC clock = 200kHz, Temp = -40°C to +150°C		-6.0	-2.5	+2.0	LSB
Offset error	$V_{CC} = 4V$ , $V_{REF} = 4V$ , ADC clock = 200kHz, Temp = -40°C to +150°C		-3.5	+1.5	+3.5	LSB
Ref voltage		$V_{REF}$	2.56		AVCC	V

#### 1.4 Memory Endurance

EEPROM endurance: 50,000 write/erase cycles. Flash endurance: 10,000 write/erase cycles.

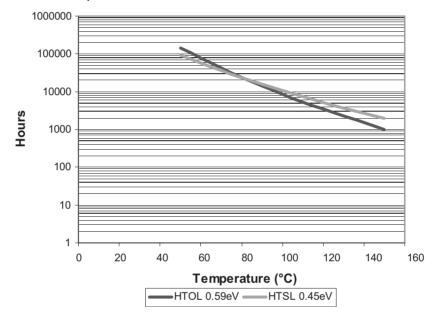
#### 2. Grade 0 Qualification

The ATtiny87/ATtiny167 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 ATtiny87/ATtiny167 lifetime would not satisfy the application end-of-life reliability requirements, Atmel<sup>®</sup> 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 ATtiny87/ATtiny167 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 2-1. AEC-Q100 Lifetime Equivalence





## 3. Ordering Information

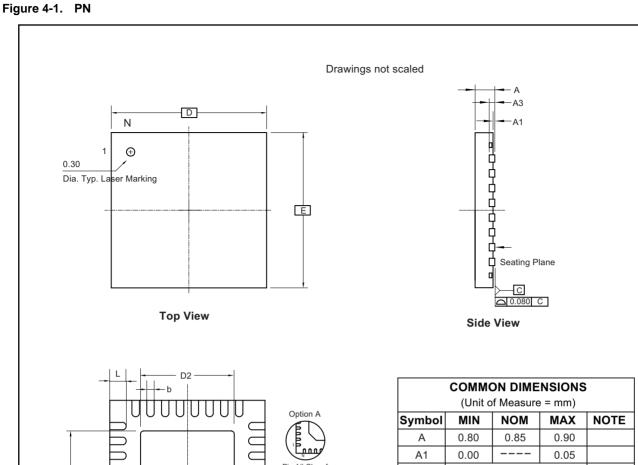
Speed (MHz)	Power Supply	Ordering Code	Package <sup>(1)</sup>	Operation Range
16 <sup>(2)</sup>	4.5V - 5.5V	ATtiny87-A15MD	PN	Extended (-40°C to +150°C)
16 <sup>(2)</sup>	4.5V - 5.5V	ATtiny87-A15XD	6G	Extended (-40°C to +150°C)
16 <sup>(2)</sup>	4.5V - 5.5V	ATtiny167-A15MD	PN	Extended (-40°C to +150°C)
16 <sup>(2)</sup>	4.5V - 5.5V	ATtiny167-A15XD	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  $\ensuremath{V_{\text{cc}}},$  see complete datasheet.

### 4. Package Information

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



See Options _	Option A  Pin 1# Chamfer (C 0.30) Option B  Pin 1# Notch (C 0.20 R)
A, B	ej⊩– n View
Botton	II view

COMMON DIMENSIONS					
Symbol	MIN	(Unit of Measure = mm)  MIN NOM MAX NOTE			
A	0.80	0.85	0.90		
A1	0.00		0.05		
A3		0.20 REF			
D/E	5.00 BSC				
D2/E2	3.00 3.10 3.20				
L	0.30	0.30 0.40 0.50			
b	0.18	2			
е	0.50 BSC				
n	32				

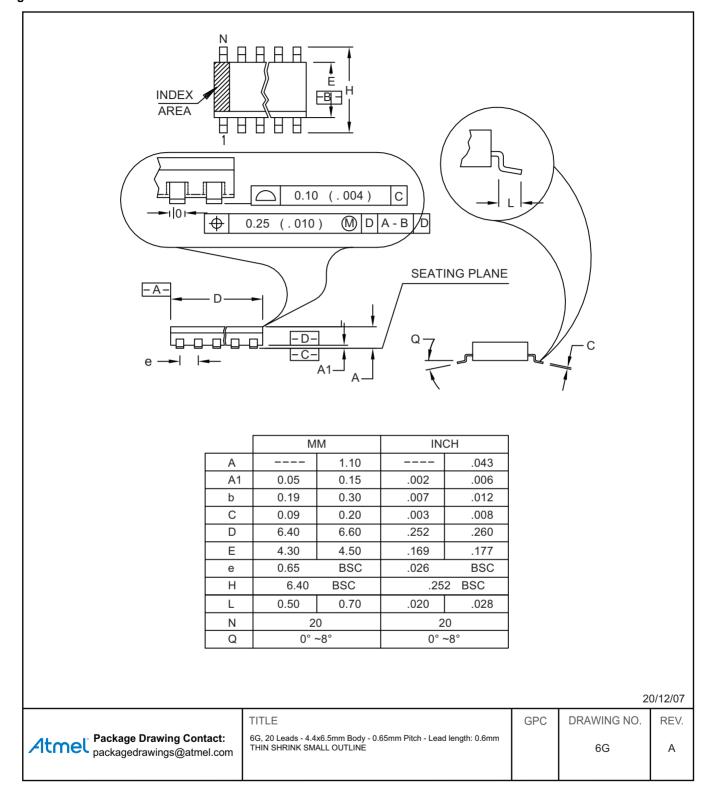
Notes: 1. This drawing is for general information only. Refer to JEDEC Drawing MO-220, Variation VHHD-2, for proper dimensions, tolerances, datums, etc.
 Dimensions b applies to metallized terminal and is measured between 0.15mm and 0.30mm from the terminal tip.
 If the terminal has the optical radius on the other end of the terminal, the dimensions should not be measured in that radius area.

01/31/12





Figure 4-2. 6G



## 5. 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
7792D-AVR-08/14	Put datasheet in the latest template
7792C-AVR-01/14	Section 3 "Ordering Information" on page 6 updated
7792B-AVR-05/09	Section 1 "Electrical Characteristics" on pages 2 to 4 updated















**Atmel Corporation** 

1600 Technology Drive, San Jose, CA 95110 USA

T: (+1)(408) 441.0311

F: (+1)(408) 436.4200

www.atmel.com

© 2014 Atmel Corporation. / Rev.: 7792D-AVR-08/14

Atmel®, Atmel logo and combinations thereof, Enabling Unlimited Possibilities®, AVR®, 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.

## **Mouser Electronics**

**Authorized Distributor** 

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Microchip:
ATTINY167-A15XD