Appendix B - Atmel ATtiny24V/ATtiny44V/ATtiny84V Automotive Specification at 1.8V

DATASHEET

Features

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 Atmel® ATtiny24/ATtiny44/ATtiny84 automotive datasheet can be found on http://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	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_{CC} + 0.5	V
Maximum operating voltage	6.0	V
DC current per I/O pin	30.0	mA
DC current V_{CC} and GND pins	200.0	mA

1.2 DC Characteristics

T_A = –40°C to +85°C, V_{CC} = 1.8V to 3.6V (unless otherwise noted)

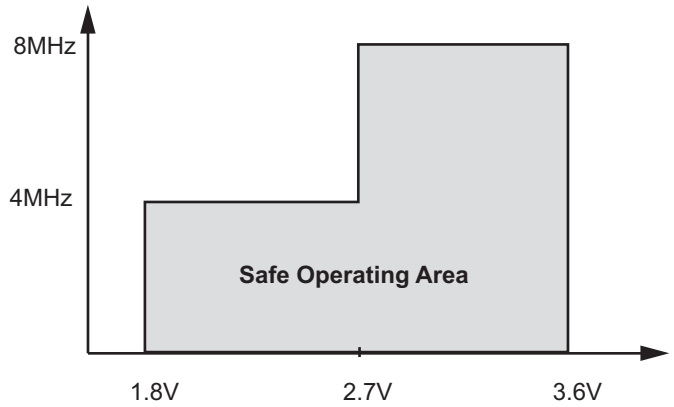
Parameters	Condition	Symbol	Min.	Typ.	Max.	Unit
Input low voltage, except XTAL1 and $\overline{\text{RESET}}$ pin	V_{CC} = 1.8V to 3.6V	V_{IL}	–0.5		+0.2V_{CC}[1]	V
Input high voltage, except XTAL1 and $\overline{\text{RESET}}$ pins	V_{CC} = 1.8V to 3.6V	V_{IH}	0.7V_{CC}[2]		V_{CC} + 0.5	V
Input low voltage, XTAL1 pin	V_{CC} = 1.8V to 3.6V	V_{IL1}	–0.5		+0.2V_{CC}[1]	V
Input high voltage, XTAL1 pin	V_{CC} = 1.8V to 3.6V	V_{IH1}	0.9V_{CC}[2]		V_{CC} + 0.5	V
Input low voltage, $\overline{\text{RESET}}$ pin	V_{CC} = 1.8V to 3.6V	V_{IL2}	–0.5		+0.2V_{CC}[1]	V
Input high voltage, $\overline{\text{RESET}}$ pin	V_{CC} = 1.8V to 3.6V	V_{IH2}	0.9V_{CC}[2]		V_{CC} + 0.5	V
Output low voltage[3], I/O pin except RESET	I_{OL} = 2mA, V_{CC} = 1.8V	V_{OL}			0.2	V
Output high voltage[4], I/O pin except RESET	I_{OH} = –2mA, V_{CC} = 1.8V	V_{OH}	1.2			V
Power supply current	Active 4MHz, V_{CC} = 3V	I_{CC}		0.8	2.5	mA
	Idle 4MHz, V_{CC} = 3V			0.2	0.5	mA
Power-down mode	WDT disabled, V_{CC} = 3V WDT enabled, V_{CC} = 3V			0.2 4	24 30	µA
Analog comparator Input offset voltage	V_{CC} = 2.7V V_{in} = V_{CC}/2	V_{ACIO}		< 10	40	mV
Analog comparator Input leakage current	V_{CC} = 2.7V V_{in} = V_{CC}/2	I_{ACLK}	–50		+50	nA

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 (2mA at V_{CC} = 1.8V) under steady state conditions (non-transient), the following must be observed: (1) The sum of all I_{OL}, for all ports, should not exceed 50mA. If I_{OL} exceeds the test condition, V_{OL} may exceed the related specification. Pins are not guaranteed to sink current greater than the listed test condition.
4. Although each I/O port can source more than the test conditions (0.5mA at VCC = 1.8V) under steady state conditions (non- transient), the following must be observed: (1) The sum of all I_{OL}, for ports B0 to B5, should not exceed 50mA. If I_{OL} exceeds the test condition, V_{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	7.3MHz to 8.1MHz	1.8V to 3.6V	–40°C to +85°C	±25%

1.5 System and Reset Characterizations

Table 1-2. BODLEVEL Fuse Coding(1)

BODLEVEL	Min V_{BOT}	Typ V_{BOT}	Max V_{BOT}	Unit	Note
111	BOD Disabled				
110	1.7	1.8	2.0	V	A
001	1.7	1.9	2.1		C
000	1.8	2.0	2.2		C
010	2.0	2.2	2.4		C
011	2.1	2.3	2.5		C
101	2.5	2.7	2.9		A

*) Type means: A = 100% tested, C = Characterized on samples

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 ADC Characteristics

T_A = –40°C to +85°C, V_{CC} = 1.8V to 3.6V (unless otherwise noted)

Parameters	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Resolution	Single ended conversion			10		Bits
Absolute accuracy (including INL, DNL, quantization error, gain and offset error)	V_{CC} = 1.8V, V_{Ref} = 1.8V, ADC clock = 200kHz			2	4.0	LSB
	V_{CC} = 1.8V, V_{Ref} = 1.8V, ADC clock = 200kHz Noise Reduction Mode			2	4.0	LSB
Integral non-linearity (INL)	V_{CC} = 1.8V, V_{Ref} = 1.8V, ADC clock = 200kHz			0.5	1.5	LSB
Differential non-linearity (DNL)	V_{CC} = 1.8V, V_{Ref} = 1.8V, ADC clock = 200kHz			0.2	0.7	LSB
Gain error	V_{CC} = 1.8V, V_{Ref} = 1.8V, ADC clock = 200kHz		–7.0	–3.0	+5.0	LSB
Offset error	V_{CC} = 1.8V, V_{Ref} = 1.8V, ADC clock = 200kHz		–3.5	+1.5	+3.5	LSB
Reference voltage		V_{REF}	1.8		AV_{CC}	V

1.7 ADC Characteristics

T_A = –40°C to +85°C, V_{CC} = 1.8V to 3.6V (unless otherwise noted)

Parameters	Test Conditions	Symbol	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} = 1.8V, V_{Ref} = 1.3V, ADC clock = 125kHz			1.6	5.0	LSB
Integral non-linearity (INL)	Gain = 1x, V_{CC} = 1.8V, V_{Ref} = 1.3V, ADC clock = 125kHz			0.7	2.5	LSB
Differential non-linearity (DNL)	Gain = 1x, V_{CC} = 1.8V, V_{Ref} = 1.3V, ADC clock = 125kHz			0.3	1.0	LSB
Gain error	Gain = 1x, V_{CC} = 1.8V, V_{Ref} = 1.3V, ADC clock = 125kHz		–7.0	+1.50	+7.0	LSB
Offset error	Gain = 1x, V_{CC} = 1.8V. V_{Ref} = 1.3V, ADC clock = 125kHz		–4.0	0.0	+4.0	LSB
Reference voltage		V_{REF}	1.30		AVCC – 0.5	V

2. Ordering Information

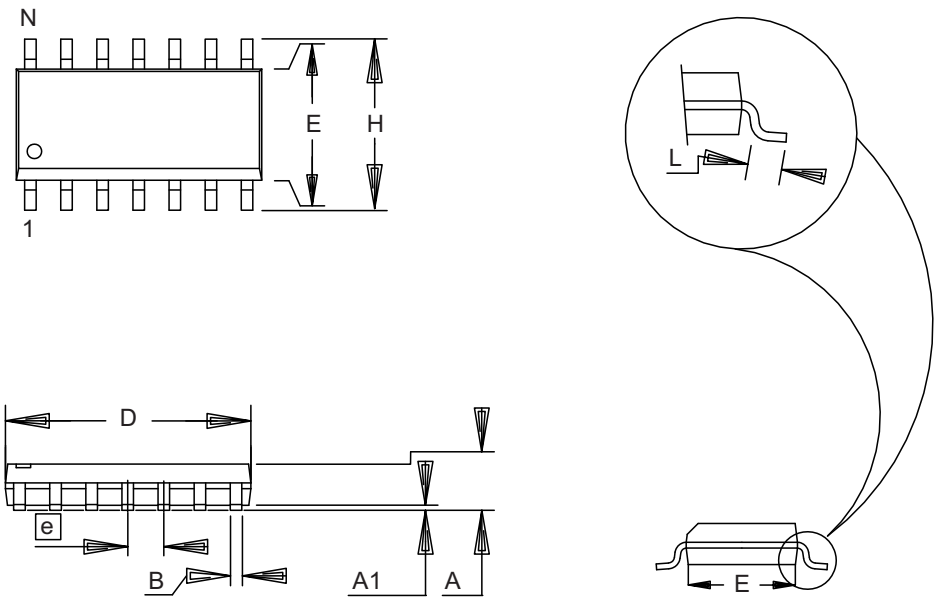
Power Supply	Speed (MHz)	ISP Flash	Ordering Code	Package	Operation Range
1.8V to 3.6V	4-8	2KB	Atmel ATtiny24V-15SST	TU	Automotive (–40°C to +85°C)
1.8V to 3.6V	4-8	2KB	Atmel ATtiny24V-15MT	PC	Automotive (–40°C to +85°C)
1.8V to 3.6V	4-8	4KB	Atmel ATtiny44V-15SST	TU	Automotive (–40°C to +85°C)
1.8V to 3.6V	4-8	4KB	Atmel ATtiny44V-15MT	PC	Automotive (–40°C to +85°C)
1.8V to 3.6V	4-8	8KB	Atmel ATtiny84V-15MT	PC	Automotive (–40°C to +85°C)

3. Package Information

Table 3-1. Package Types

Package Type	Description
TU	14-Lead, 0.150” body width Plastic gull wing small outline package (SOIC)
PC	20-lead, 4.0 × 4.0mm body, 0.50mm pitch Quad flat no-lead package (QFN)

Figure 3-1. TU

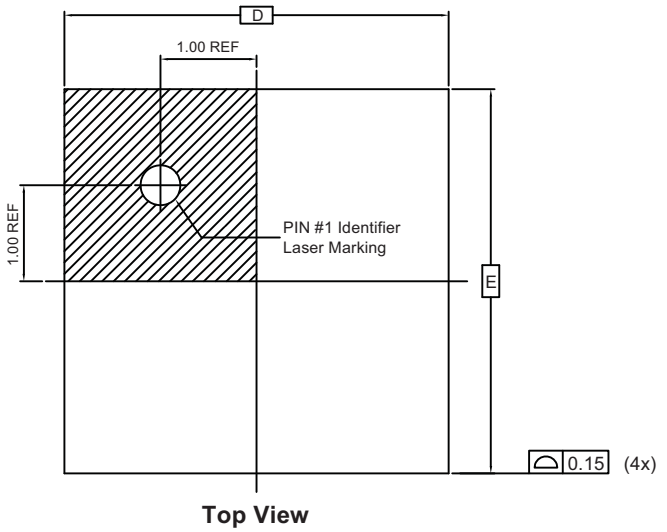


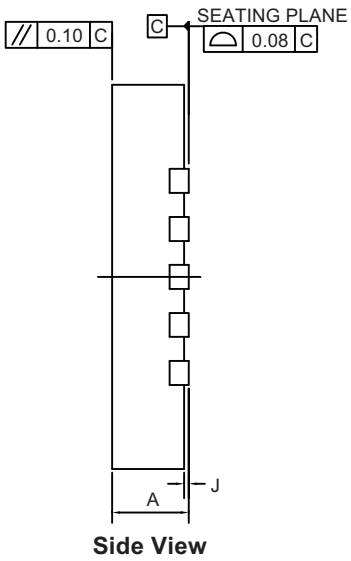
	MM			INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.35	1.60	1.75	.053	.063	.069
A1	0.10	----	0.25	.004	----	.010
B	0.33	0.41	0.51	.013	.016	.020
D	8.53	8.64	8.74	.336	.340	.344
E	3.80	3.91	3.99	.149	.154	.157
H	5.79	5.99	6.20	.228	.236	.244
L	0.40	0.71	1.27	.016	.028	.050
e	1.27 BSC			.050 BSC		

07/27/07

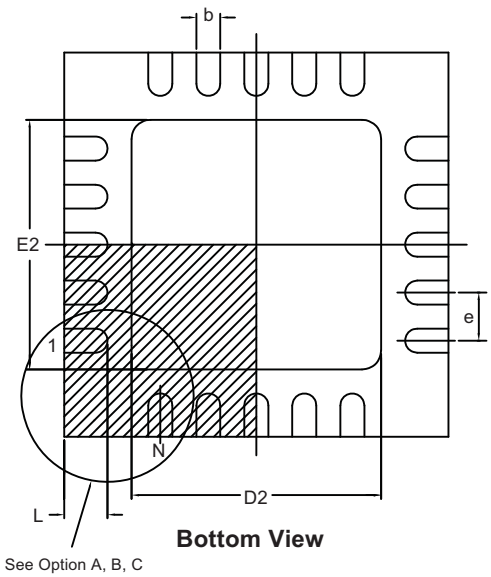
Atmel Package Drawing Contact: packagedrawings@atmel.com	TITLE	GPC	DRAWING NO.	REV.
	TU, 14 Lead, 0.150" Body Width Plastic Gull Wing Small Outline Package (SOIC)		TU	C

Figure 3-2. PC



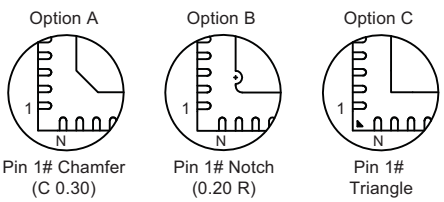


DRAWINGS NOT SCALED



COMMON DIMENSIONS IN MM

SYMBOL	MIN.	NOM.	MAX.	NOTES
A	0.70	0.75	0.80	
J	0.00	----	0.05	
D/E	3.90	4.00	4.10	
D2/E2	2.50	2.60	2.70	
N	20			
e	0.50 BSC			
L	0.35	0.45	0.55	
b	0,20	0.25	0.30	



Compliant JEDEC Standard MO-220 Variation WGGD-5

06/25/09

	TITLE	GPC	DRAWING NO.	REV.
Atmel **Package Drawing Contact:** packagedrawings@atmel.com	PC, 20-Lead - 4.0x4.0mm Body, 0.50mm Pitch Quad Flat No Lead Package (QFN)		PC	I

4. 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
7319F-AVR-07/14	• Put datasheet in the latest template
7319E-AVR-11/13	• Section 2 “Ordering Information” on page 5 updated • Section 3 “Package Information” on pages 5 to 7 updated
7319D-AVR-10/12	• Section 3 “Package Information” on pages 5 to 7 updated
7319C-AVR-10/10	• BOD values updated
7319B-AVR-09/10	• BOD values updated

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