# Atmel ATtiny24V/ATtiny44V/ATtiny84V

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

**PRELIMINARY 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 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)

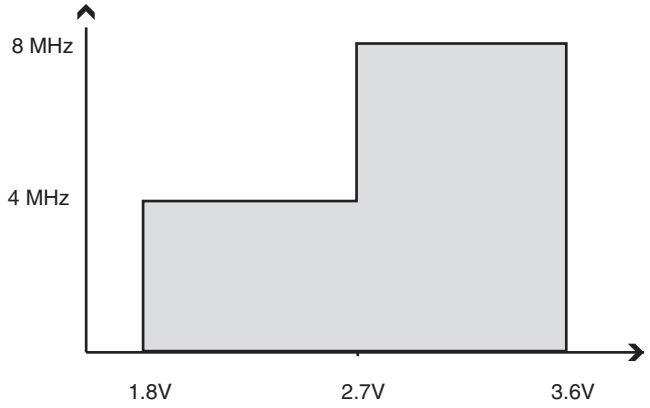
| Symbol | Parameters | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{IL}$ | Input low voltage, except XTAL1 and $\overline{\text{RESET}}$ pin | $V_{CC}$ = 1.8V to 3.6V | –0.5 | | +0.2$V_{CC}$(1) | V |
| $V_{IH}$ | Input high voltage, except XTAL1 and $\overline{\text{RESET}}$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

| Symbol | Parameters | Test Conditions | 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 |
| $V_{REF}$ | Reference voltage | | 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)

| Symbol | Parameters | Test Conditions | 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 |
| $V_{REF}$ | Reference Voltage | | 1.30 | | AVCC – 0.5 | V |

## 2. Ordering Information

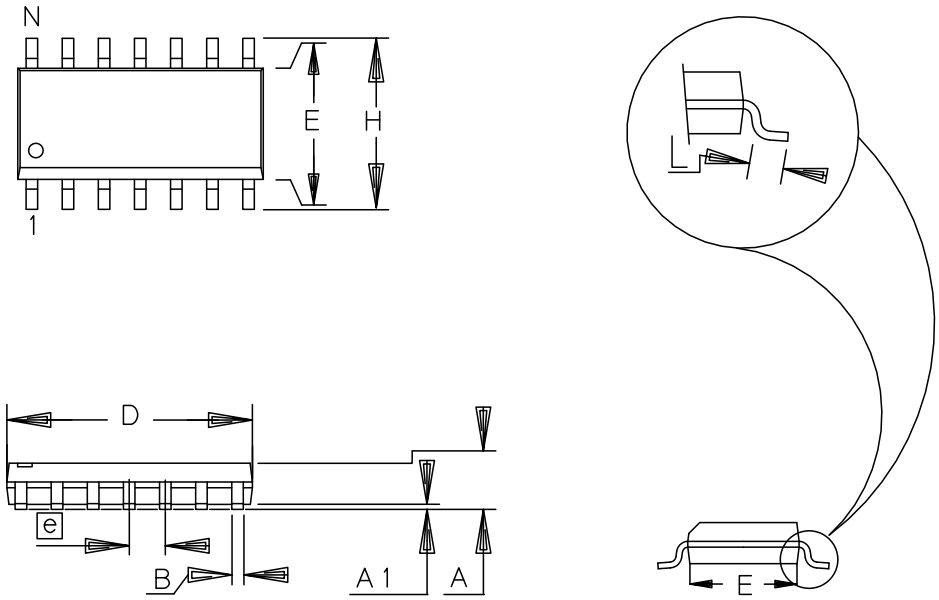
| Power Supply | Speed (MHz) | ISP Flash | Ordering Code | Package | Operation Range |
|---|---|---|---|---|---|
| 1.8V to 3.6V | 4-8 | 2KB | Atmel ATtiny24V-15SST | TU | Automotive (–40°C to +85°C) |
| 1.8V to 3.6V | 4-8 | 2KB | Atmel ATtiny24V-15MT | PN | Automotive (–40°C to +85°C) |
| 1.8V to 3.6V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

## 3. Package Information

**Table 3-1. Package Types**

| Package Type | Description |
|---|---|
| TU | TU 14-Lead, 0.150” Body Width<br>Plastic Gull Wing Small Outline Package (SOIC) |
| PC | PN 32-lead, 5.0 × 5.0mm body, 0.50mm pitch<br>Quad flat no-lead package (QFN) |

**Figure 3-1. TU**

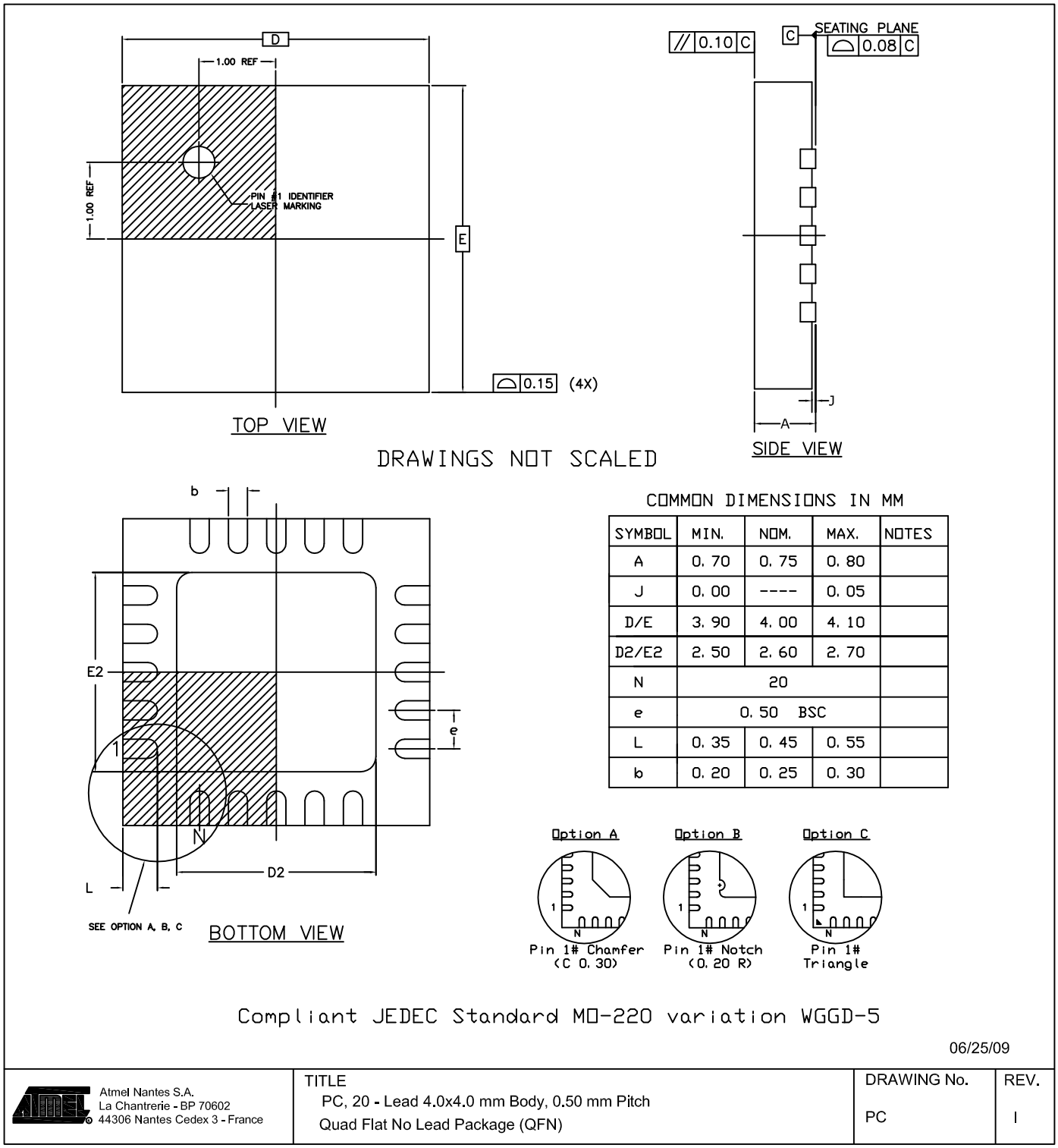



| | MM | | | INCH | | |
|---|---|---|---|---|---|---|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 1.35 | 1.60 | 1.75 | .053 | .063 | .069 |
| A1 | 0.10 | ---- | 0.25 | .004 | ---- | .010 |
| B | 0.33 | 0.41 | 0.51 | .013 | .016 | .020 |
| D | 8.53 | 8.64 | 8.74 | .336 | .340 | .344 |
| E | 3.80 | 3.91 | 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 Nantes S.A.<br>La Chantrerie - BP 70602<br>44306 Nantes Cedex 3 - France | TITLE<br>TU, 14 - Lead, 0.150" Body Width<br>Plastic Gull Wing Small Outline Package (SOIC) | DRAWING No.<br>TU | REV.<br>C |
|---|---|---|---|

**Figure 3-2. PC**




| 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 | |

| | | | |
|---|---|---|---|
| Atmel Nantes S.A.<br>La Chantrerie - BP 70602<br>44306 Nantes Cedex 3 - France | TITLE<br>PC, 20 - Lead 4.0x4.0 mm Body, 0.50 mm Pitch<br>Quad Flat No Lead Package (QFN) | DRAWING No.<br>PC | REV.<br>I |

# 4. Datasheet Revision History

## 4.1 Revision D - 10/12

1. Section 3 “Package Information” on page 5 to 7 updated.

## 4.2 Revision C - 10/10

1. BOD values updated.

## 4.3 Revision B - 09/10

1. BOD values updated.

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