



Welcome to [E-XFL.COM](https://www.e-xfl.com)

### What is "[Embedded - Microcontrollers](#)"?

"[Embedded - Microcontrollers](#)" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

### Applications of "[Embedded - Microcontrollers](#)"

#### Details

|                            |                                                                                                                                                                 |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product Status             | Active                                                                                                                                                          |
| Core Processor             | AVR                                                                                                                                                             |
| Core Size                  | 8-Bit                                                                                                                                                           |
| Speed                      | 20MHz                                                                                                                                                           |
| Connectivity               | I <sup>2</sup> C, IrDA, LINbus, SPI, UART/USART                                                                                                                 |
| Peripherals                | Brown-out Detect/Reset, POR, WDT                                                                                                                                |
| Number of I/O              | 12                                                                                                                                                              |
| Program Memory Size        | 2KB (2K x 8)                                                                                                                                                    |
| Program Memory Type        | FLASH                                                                                                                                                           |
| EEPROM Size                | 64 x 8                                                                                                                                                          |
| RAM Size                   | 128 x 8                                                                                                                                                         |
| Voltage - Supply (Vcc/Vdd) | 1.8V ~ 5.5V                                                                                                                                                     |
| Data Converters            | A/D 10x10b; D/A 1x8b                                                                                                                                            |
| Oscillator Type            | Internal                                                                                                                                                        |
| Operating Temperature      | -40°C ~ 105°C (TA)                                                                                                                                              |
| Mounting Type              | Surface Mount                                                                                                                                                   |
| Package / Case             | 14-SOIC (0.154", 3.90mm Width)                                                                                                                                  |
| Supplier Device Package    | 14-SOIC                                                                                                                                                         |
| Purchase URL               | <a href="https://www.e-xfl.com/product-detail/microchip-technology/attiny214-ssnr">https://www.e-xfl.com/product-detail/microchip-technology/attiny214-ssnr</a> |



# ATtiny214/414/814

---

## AVR® Microcontroller with Core Independent Peripherals and picoPower® Technology

---

### Introduction

---

The ATtiny214/414/814 microcontrollers are using the high-performance low-power AVR® RISC architecture, and is capable of running at up to 20MHz, with up to 2/4/8KB Flash, 128/256/512bytes of SRAM and 64/128bytes of EEPROM in a 14- pin package. The series uses the latest technologies with a flexible and low power architecture including Event System and SleepWalking, accurate analog features and advanced peripherals. Capacitive touch interfaces with driven shield are supported with the integrated QTouch® peripheral touch controller.

### Features

---

- CPU
  - AVR® 8-bit CPU
  - Running at up to 20MHz
  - Single Cycle I/O Access
  - Two-level Interrupt Controller
  - Two-cycle Hardware Multiplier
- Memories
  - 2/4/8KB In-system self-programmable Flash Memory
  - 64/128B EEPROM
  - 128/256/512B SRAM
- System
  - Power-on Reset (POR)
  - Brown-out Detection (BOD)
  - Clock Options:
    - 16/20MHz Low Power Internal RC Oscillator
    - 32.768kHz Ultra Low Power (ULP) Internal RC Oscillator
    - 32.768kHz External Crystal Oscillator
    - External Clock Input
  - Single Pin Unified Program Debug Interface (UPDI)
  - Three Sleep Modes:
    - Idle with All Peripherals Running and Mode for Immediate Wake Up Time
    - Standby
      - Configurable Operation of Selected Peripherals
      - SleepWalking Peripherals
    - Power Down with Wake-up Functionality

- Peripherals
  - 6-channel Event System
  - One 16-bit Timer/Counter Type A with Dedicated Period Register, Three Compare Channels (TCA)
  - One 16-bit Timer/Counter type B with Input Capture (TCB)
  - One 12-bit Timer/Counter type D Optimized for Control Applications (TCD)
  - One 16-bit Real Time Counter (RTC) Running from External Crystal or Internal RC Oscillator
  - One USART with Fractional Baud Rate Generator, Auto-baud, and Start-of-frame Detection
  - Master/Slave Serial Peripheral Interface (SPI)
  - Master/Slave TWI with Dual Address Match
    - Standard Mode (Sm, 100kHz)
    - Fast Mode (Fm, 400kHz)
    - Fast Mode Plus (Fm+, 1MHz)
  - Configurable Custom Logic (CCL) with Two Programmable Lookup Tables (LUT)
  - Analog Comparator (AC) with Low Propagation Delay
  - 10-bit 115ksps Analog to Digital Converter (ADC)
  - 8-bit Digital to Analog Converter (DAC)
  - Five Selectable Internal Voltage References: 0.55V, 1.1V, 1.5V, 2.5V and 4.3V
  - Automated CRC Memory Scan
  - Watchdog Timer (WDT) with Window Mode, with Separate On-chip Oscillator
  - Peripheral Touch Controller (PTC)<sup>(1)</sup>
    - Capacitive Touch Buttons, Sliders and Wheels
    - Wake-up on Touch
    - Driven Shield for Improved Moisture and Noise Handling Performance
    - Six Self-capacitance and Nine Mutual-capacitance Channels
  - External Interrupt on All General Purpose Pins
- I/O and Packages:
  - 12 Programmable I/O Lines
  - 14-pin SOIC150
- Temperature Ranges:
  - -40°C to 105°C
  - -40°C to 125°C Temperature Graded Device Options Available
- Speed Grades:
  - 0-5MHz @ 1.8V – 5.5V
  - 0-10MHz @ 2.7V – 5.5V
  - 0-20MHz @ 4.5V – 5.5V

**Note:**

1. Only Available in Devices with 8KB Flash.

## Table of Contents

---

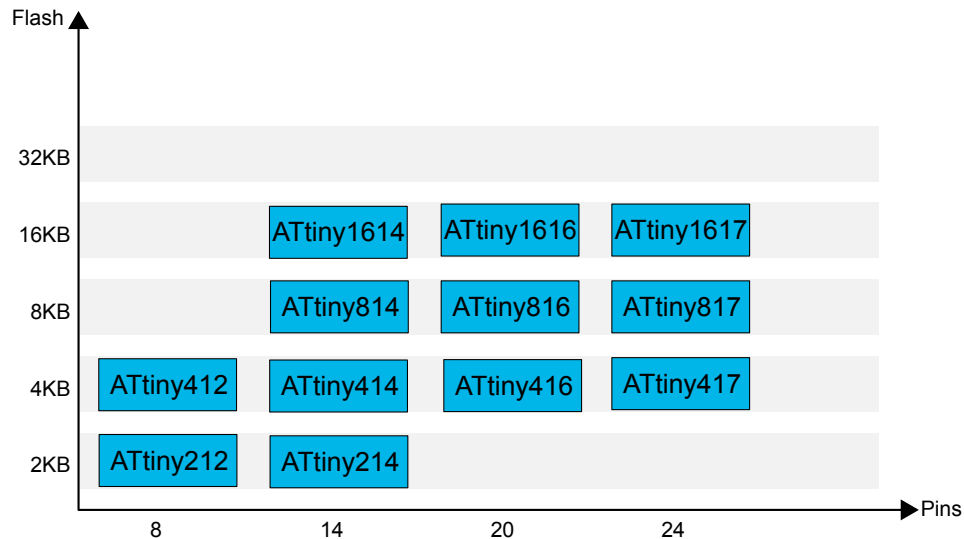
|                                                 |    |
|-------------------------------------------------|----|
| Introduction.....                               | 1  |
| Features.....                                   | 1  |
| 1. tinyAVR <sup>®</sup> 1-Series Overview.....  | 4  |
| 1.1. Configuration Summary.....                 | 5  |
| 2. Ordering Information.....                    | 6  |
| 2.1. ATtiny214.....                             | 6  |
| 2.2. ATtiny414.....                             | 6  |
| 2.3. ATtiny814.....                             | 6  |
| 3. Block Diagram.....                           | 7  |
| 4. Pinout.....                                  | 9  |
| 4.1. 14-pin SOIC.....                           | 9  |
| 5. I/O Multiplexing and Considerations.....     | 10 |
| 5.1. Multiplexed Signals.....                   | 10 |
| 6. Package Drawings.....                        | 11 |
| 6.1. 14-pin SOIC150.....                        | 11 |
| 7. Thermal Considerations.....                  | 12 |
| 7.1. Thermal Resistance Data.....               | 12 |
| 7.2. Junction Temperature.....                  | 12 |
| The Microchip Web Site.....                     | 13 |
| Customer Change Notification Service.....       | 13 |
| Customer Support.....                           | 13 |
| Microchip Devices Code Protection Feature.....  | 13 |
| Legal Notice.....                               | 14 |
| Trademarks.....                                 | 14 |
| Quality Management System Certified by DNV..... | 15 |
| Worldwide Sales and Service.....                | 16 |

## 1. tinyAVR® 1-Series Overview

The figure below shows the tinyAVR 1-series, laying out pin count variants and memory sizes:

- Vertical migration can be done upwards without code modification, since these devices are pin compatible and provide the same or even more features. Downward migration may require code modification due to fewer available instances of some peripherals.
- Horizontal migration to the left reduces the pin count and therefore also the available features.

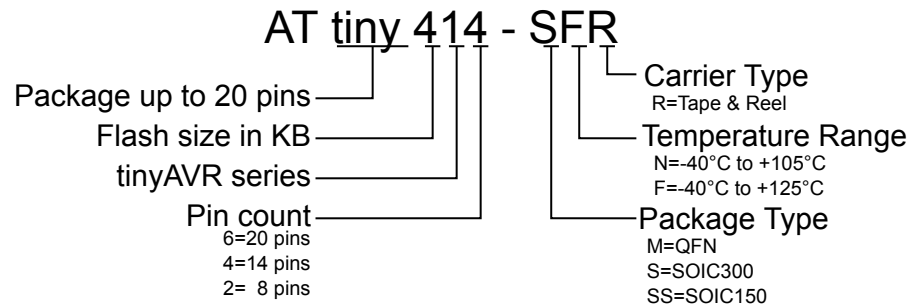
**Figure 1-1. tinyAVR®1-Series Overview**



Devices with different Flash memory size typically also have different SRAM and EEPROM.

The name of a device of the series contains information as depicted below:

**Figure 1-2. Device Designations**



## 1.1 Configuration Summary

### 1.1.1 Peripheral Summary

Table 1-1. Peripheral Summary

|                                                          | ATtiny214 | ATtiny414 | ATtiny814 |
|----------------------------------------------------------|-----------|-----------|-----------|
| Pins                                                     | 14        | 14        | 14        |
| SRAM                                                     | 128B      | 256B      | 512B      |
| Flash                                                    | 2KB       | 4KB       | 8KB       |
| EEPROM                                                   | 64B       | 128B      | 128B      |
| Max. frequency (MHz)                                     | 20        | 20        | 20        |
| 16-bit Timer/Counter type A (TCA)                        | 1         | 1         | 1         |
| 16-bit Timer/Counter type B (TCB)                        | 1         | 1         | 1         |
| 12-bit Timer/Counter type D (TCD)                        | 1         | 1         | 1         |
| Real Time Counter (RTC)                                  | 1         | 1         | 1         |
| USART                                                    | 1         | 1         | 1         |
| SPI                                                      | 1         | 1         | 1         |
| TWI (I <sup>2</sup> C)                                   | 1         | 1         | 1         |
| ADC                                                      | 1         | 1         | 1         |
| ADC channels                                             | 10        | 10        | 10        |
| DAC                                                      | 1         | 1         | 1         |
| AC                                                       | 1         | 1         | 1         |
| Peripheral Touch Controller (PTC) <sup>(1)</sup>         | No        | No        | 1         |
| PTC number of self-capacitance channels <sup>(1)</sup>   | -         | -         | 6         |
| PTC number of mutual-capacitance channels <sup>(1)</sup> | -         | -         | 9         |
| Custom Logic/Configurable Lookup Tables                  | 1         | 1         | 1         |
| Window Watchdog                                          | 1         | 1         | 1         |
| Event System channels                                    | 6         | 6         | 6         |
| General purpose I/O                                      | 12        | 12        | 12        |
| External interrupts                                      | 12        | 12        | 12        |
| CRCSCAN                                                  | 1         | 1         | 1         |

**Note:**

1. The PTC takes control over the ADC while the PTC is used.

## 2. Ordering Information

### 2.1 ATtiny214

**Table 2-1. ATtiny214 Ordering Codes**

| Ordering Code <sup>(1)</sup> | Flash | Package Type (GPC) | Leads | Power Supply | Operational Range         | Carrier Type |
|------------------------------|-------|--------------------|-------|--------------|---------------------------|--------------|
| ATtiny214-SSNR               | 2KB   | SOIC150 (SVQ)      | 14    | 1.8V - 5.5V  | Industrial (-40°C +105°C) | Tape & Reel  |
| ATtiny214-SSFR               | 2KB   | SOIC150 (SVQ)      | 14    | 1.8V - 5.5V  | Industrial (-40°C +125°C) | Tape & Reel  |

1. Pb-free packaging complies to the European Directive for Restriction of Hazardous Substances (RoHS directive). Also Halide free and fully Green.

### 2.2 ATtiny414

**Table 2-2. ATtiny414 Ordering Codes**

| Ordering Code <sup>(1)</sup> | Flash | Package Type (GPC) | Leads | Power Supply | Operational Range         | Carrier Type |
|------------------------------|-------|--------------------|-------|--------------|---------------------------|--------------|
| ATtiny414-SSNR               | 4KB   | SOIC150 (SVQ)      | 14    | 1.8V - 5.5V  | Industrial (-40°C +105°C) | Tape & Reel  |
| ATtiny414-SSFR               | 4KB   | SOIC150 (SVQ)      | 14    | 1.8V - 5.5V  | Industrial (-40°C +125°C) | Tape & Reel  |

1. Pb-free packaging complies to the European Directive for Restriction of Hazardous Substances (RoHS directive). Also Halide free and fully Green.

### 2.3 ATtiny814

**Table 2-3. ATtiny814 Ordering Codes**

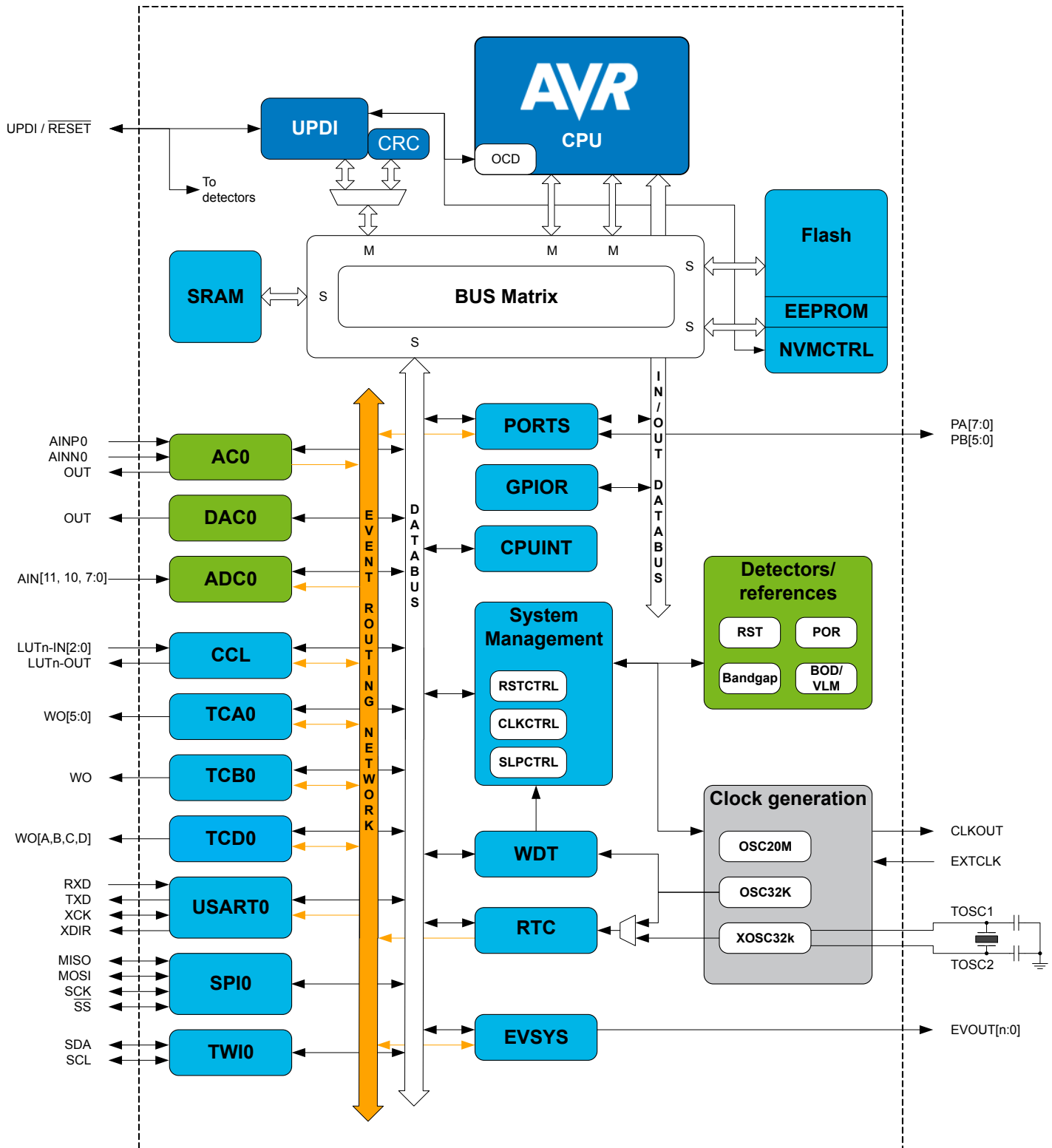
| Ordering Code <sup>(1)</sup> | Flash | Package Type (GPC) | Leads | Power Supply | Operational Range         | Carrier Type |
|------------------------------|-------|--------------------|-------|--------------|---------------------------|--------------|
| ATtiny814-SSNR               | 8KB   | SOIC150 (SVQ)      | 14    | 1.8V - 5.5V  | Industrial (-40°C +105°C) | Tape & Reel  |
| ATtiny814-SSFR               | 8KB   | SOIC150 (SVQ)      | 14    | 1.8V - 5.5V  | Industrial (-40°C +125°C) | Tape & Reel  |

**Note:**

1. Pb-free packaging complies to the European Directive for Restriction of Hazardous Substances (RoHS directive). Also Halide free and fully Green.

### 3. Block Diagram

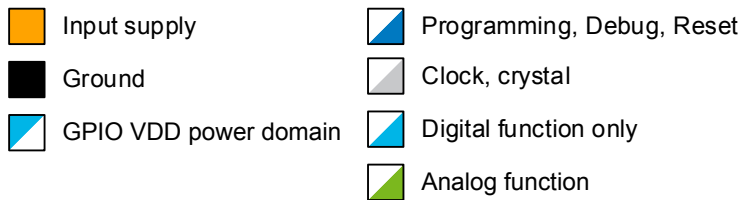
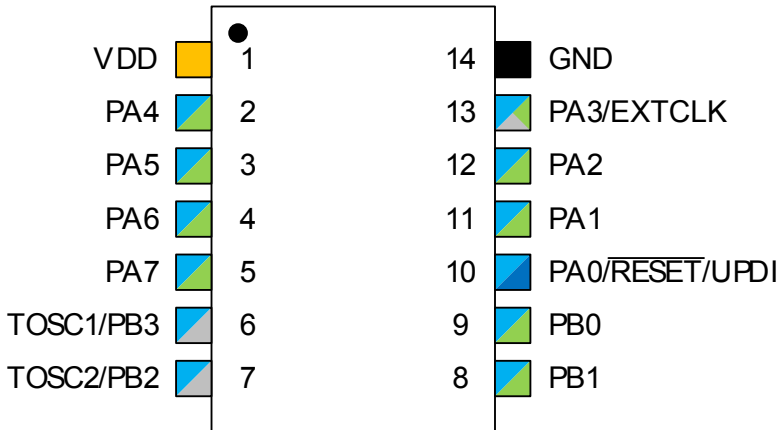
### Figure 3-1. ATtiny214 / ATtiny414 Block Diagram





## 4. Pinout

### 4.1 14-pin SOIC



## 5. I/O Multiplexing and Considerations

### 5.1 Multiplexed Signals

**Table 5-1. PORT Function Multiplexing**

| SOIC 14-pin | Pin Name <sup>(1,2)</sup> | Other/Special | ADC0  | PTC <sup>(3)</sup> | AC0   | DAC0 | USART0 | SPI0 | TWI0 | TCA0 | TCB0 | TCD0 | CCL      |
|-------------|---------------------------|---------------|-------|--------------------|-------|------|--------|------|------|------|------|------|----------|
| 10          | PA0                       | RESET<br>UPDI | AIN0  |                    |       |      |        |      |      |      |      |      | LUT0-IN0 |
| 11          | PA1                       | BREAK         | AIN1  |                    |       |      | TXD    | MOSI | SDA  |      |      |      | LUT0-IN1 |
| 12          | PA2                       | EVOUT0        | AIN2  |                    |       |      | RxD    | MISO | SCL  |      |      |      | LUT0-IN2 |
| 13          | PA3                       | EXTCLK        | AIN3  |                    |       |      | XCK    | SCK  |      | WO3  |      |      |          |
| 14          | GND                       |               |       |                    |       |      |        |      |      |      |      |      |          |
| 1           | VDD                       |               |       |                    |       |      |        |      |      |      |      |      |          |
| 2           | PA4                       |               | AIN4  | X0/Y0              |       |      | XDIR   | SS   |      | WO4  |      | WOA  | LUT0-OUT |
| 3           | PA5                       |               | AIN5  | X1/Y1              | OUT   |      |        |      |      | WO5  | WO   | WOB  |          |
| 4           | PA6                       |               | AIN6  | X2/Y2              | AINN0 | OUT  |        |      |      |      |      |      |          |
| 5           | PA7                       |               | AIN7  | X3/Y3              | AINP0 |      |        |      |      |      |      |      | LUT1-OUT |
| 6           | PB3                       | TOSC1         |       |                    |       |      | RxD    |      |      | WO0  |      |      |          |
| 7           | PB2                       | TOSC2, EVOUT1 |       |                    |       |      | TxD    |      |      | WO2  |      |      |          |
| 8           | PB1                       |               | AIN10 | X4/Y4              |       |      | XCK    |      | SDA  | WO1  |      |      |          |
| 9           | PB0                       |               | AIN11 | X5/Y5              |       |      | XDIR   |      | SCL  | WO0  |      |      |          |

**Note:**

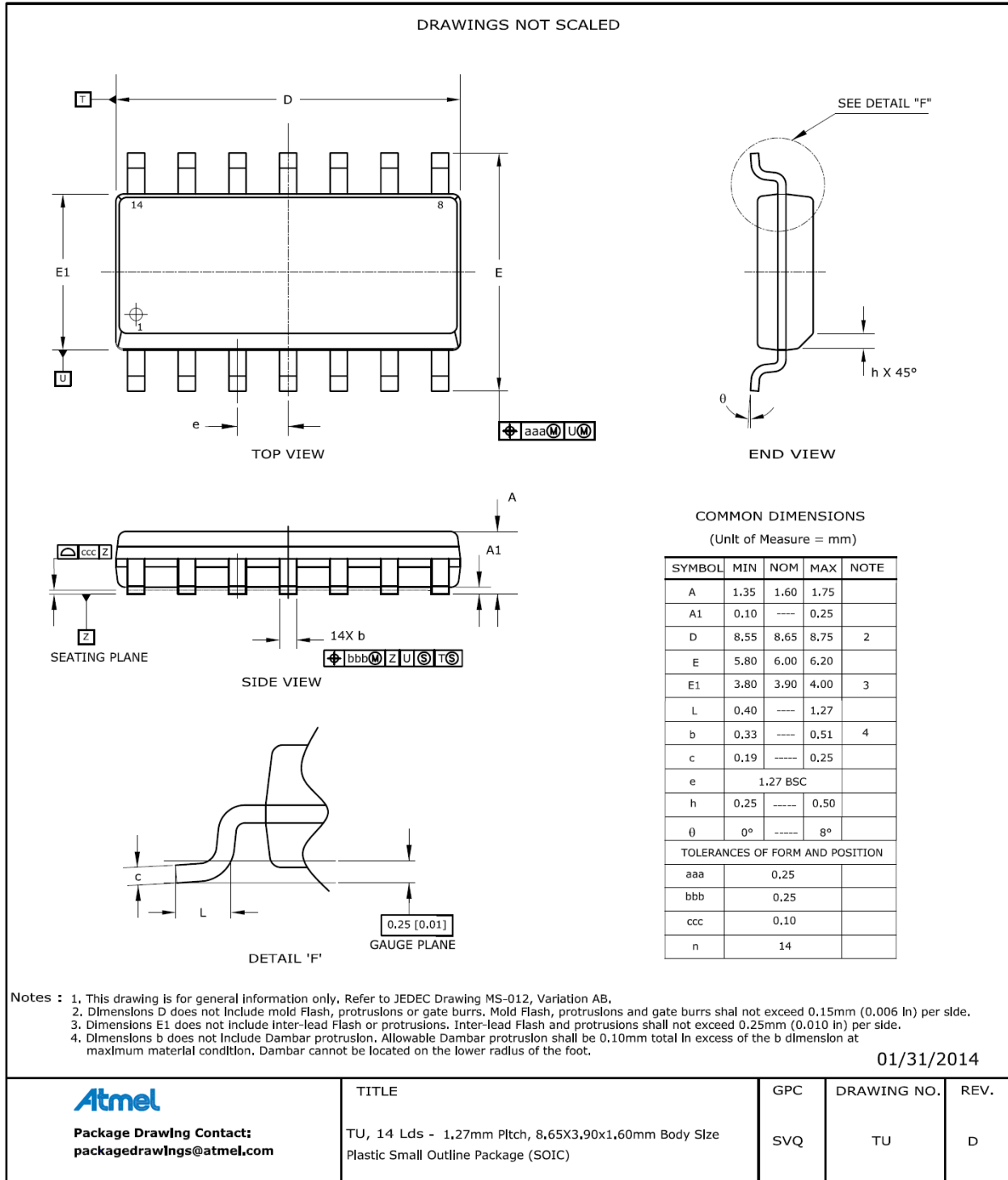
1. Pins names are of type P<sub>x</sub><sub>n</sub>, with *x* being the PORT instance (A,B) and *n* the pin number. Notation for signals is PORT<sub>x</sub>\_PIN<sub>n</sub>. All pins can be used as event input.
2. All pins can be used for external interrupt, where pins P<sub>x</sub>2 and P<sub>x</sub>6 of each port have full asynchronous detection.
3. PTC is only available in devices with 8KB Flash (ATtiny814). Every PTC line can be configured as X-line or Y-line.



**Tip:** Signals on alternative pin locations are in `typewriter` font.

## 6. Package Drawings

### 6.1 14-pin SOIC150



## 7. Thermal Considerations

### 7.1 Thermal Resistance Data

The following table summarizes the thermal resistance data depending on the package.

**Table 7-1. Thermal Resistance Data**

| Package Type         | $\theta_{JA}$ [°C/W] | $\theta_{JC}$ [°C/W] |
|----------------------|----------------------|----------------------|
| 14-pin SOIC150 (SVQ) | 58                   | 26                   |

#### Related Links

[Junction Temperature](#)

### 7.2 Junction Temperature

The average chip-junction temperature,  $T_J$ , in °C can be obtained from the following:

1.  $T_J = T_A + (P_D \times \theta_{JA})$
2.  $T_J = T_A + (P_D \times (\theta_{HEATSINK} + \theta_{JC}))$

where:

- $\theta_{JA}$  = Package thermal resistance, Junction-to-ambient (°C/W), see Thermal Resistance Data
- $\theta_{JC}$  = Package thermal resistance, Junction-to-case thermal resistance (°C/W), see Thermal Resistance Data
- $\theta_{HEATSINK}$  = Thermal resistance (°C/W) specification of the external cooling device
- $P_D$  = Device power consumption (W)
- $T_A$  = Ambient temperature (°C)

From the first equation, the user can derive the estimated lifetime of the chip and decide if a cooling device is necessary or not. If a cooling device is to be fitted on the chip, the second equation should be used to compute the resulting average chip-junction temperature  $T_J$  in °C.

#### Related Links

[Thermal Resistance Data](#)

---

## The Microchip Web Site

---

Microchip provides online support via our web site at <http://www.microchip.com/>. This web site is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the web site contains the following information:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQ), technical support requests, online discussion groups, Microchip consultant program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

---

## Customer Change Notification Service

---

Microchip's customer notification service helps keep customers current on Microchip products. Subscribers will receive e-mail notification whenever there are changes, updates, revisions or errata related to a specified product family or development tool of interest.

To register, access the Microchip web site at <http://www.microchip.com/>. Under "Support", click on "Customer Change Notification" and follow the registration instructions.

---

## Customer Support

---

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

Customers should contact their distributor, representative or Field Application Engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

Technical support is available through the web site at: <http://www.microchip.com/support>

---

## Microchip Devices Code Protection Feature

---

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.

- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as “unbreakable.”

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip’s code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

## Legal Notice

Information contained in this publication regarding device applications and the like is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION, INCLUDING BUT NOT LIMITED TO ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE. Microchip disclaims all liability arising from this information and its use. Use of Microchip devices in life support and/or safety applications is entirely at the buyer’s risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

## Trademarks

The Microchip name and logo, the Microchip logo, AnyRate, AVR, AVR logo, AVR Freaks, BeaconThings, BitCloud, CryptoMemory, CryptoRF, dsPIC, FlashFlex, flexPWR, Helder, JukeBlox, KeeLoq, KeeLoq logo, Klear, LANCheck, LINK MD, maXStylus, maXTouch, MediaLB, megaAVR, MOST, MOST logo, MPLAB, OptoLyzer, PIC, picoPower, PICSTART, PIC32 logo, Prochip Designer, QTouch, RightTouch, SAM-BA, SpyNIC, SST, SST Logo, SuperFlash, tinyAVR, UNI/O, and XMEGA are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

ClockWorks, The Embedded Control Solutions Company, EtherSynch, Hyper Speed Control, HyperLight Load, IntelliMOS, mTouch, Precision Edge, and Quiet-Wire are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Adjacent Key Suppression, AKS, Analog-for-the-Digital Age, Any Capacitor, AnyIn, AnyOut, BodyCom, chipKIT, chipKIT logo, CodeGuard, CryptoAuthentication, CryptoCompanion, CryptoController, dsPICDEM, dsPICDEM.net, Dynamic Average Matching, DAM, ECAN, EtherGREEN, In-Circuit Serial Programming, ICSP, Inter-Chip Connectivity, JitterBlocker, KlearNet, KlearNet logo, Mindi, MiWi, motorBench, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICkit, PICtail, PureSilicon, QMatrix, RightTouch logo, REAL ICE, Ripple Blocker, SAM-ICE, Serial Quad I/O, SMART-I.S., SQI, SuperSwitcher, SuperSwitcher II, Total Endurance, TSHARC, USBCheck, VariSense, ViewSpan, WiperLock, Wireless DNA, and ZENA are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

SQTP is a service mark of Microchip Technology Incorporated in the U.S.A.

Silicon Storage Technology is a registered trademark of Microchip Technology Inc. in other countries.

GestIC is a registered trademark of Microchip Technology Germany II GmbH & Co. KG, a subsidiary of Microchip Technology Inc., in other countries.

All other trademarks mentioned herein are property of their respective companies.

© 2017, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

ISBN: 978-1-5224-1894-8

## Quality Management System Certified by DNV

---

### ISO/TS 16949

Microchip received ISO/TS-16949:2009 certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona; Gresham, Oregon and design centers in California and India. The Company's quality system processes and procedures are for its PIC<sup>®</sup> MCUs and dsPIC<sup>®</sup> DSCs, KEELOQ<sup>®</sup> code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.

## Worldwide Sales and Service

| AMERICAS                                                                                                                                                                                                                                                                                                      | ASIA/PACIFIC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | ASIA/PACIFIC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | EUROPE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Corporate Office</b><br>2355 West Chandler Blvd.<br>Chandler, AZ 85224-6199<br>Tel: 480-792-7200<br>Fax: 480-792-7277<br>Technical Support:<br><a href="http://www.microchip.com/support">http://www.microchip.com/support</a><br>Web Address:<br><a href="http://www.microchip.com">www.microchip.com</a> | <b>Asia Pacific Office</b><br>Suites 3707-14, 37th Floor<br>Tower 6, The Gateway<br>Harbour City, Kowloon<br><b>Hong Kong</b><br>Tel: 852-2943-5100<br>Fax: 852-2401-3431<br><b>Australia - Sydney</b><br>Tel: 61-2-9868-6733<br>Fax: 61-2-9868-6755<br><b>China - Beijing</b><br>Tel: 86-10-8569-7000<br>Fax: 86-10-8528-2104<br><b>China - Chengdu</b><br>Tel: 86-28-8665-5511<br>Fax: 86-28-8665-7889<br><b>China - Chongqing</b><br>Tel: 86-23-8980-9588<br>Fax: 86-23-8980-9500<br><b>China - Dongguan</b><br>Tel: 86-769-8702-9880<br><b>China - Guangzhou</b><br>Tel: 86-20-8755-8029<br><b>China - Hangzhou</b><br>Tel: 86-571-8792-8115<br>Fax: 86-571-8792-8116<br><b>China - Hong Kong SAR</b><br>Tel: 852-2943-5100<br>Fax: 852-2401-3431<br><b>China - Nanjing</b><br>Tel: 86-25-8473-2460<br>Fax: 86-25-8473-2470<br><b>China - Qingdao</b><br>Tel: 86-532-8502-7355<br>Fax: 86-532-8502-7205<br><b>China - Shanghai</b><br>Tel: 86-21-3326-8000<br>Fax: 86-21-3326-8021<br><b>China - Shenyang</b><br>Tel: 86-24-2334-2829<br>Fax: 86-24-2334-2393<br><b>China - Shenzhen</b><br>Tel: 86-755-8864-2200<br>Fax: 86-755-8203-1760<br><b>China - Wuhan</b><br>Tel: 86-27-5980-5300<br>Fax: 86-27-5980-5118<br><b>China - Xian</b><br>Tel: 86-29-8833-7252<br>Fax: 86-29-8833-7256 | <b>China - Xiamen</b><br>Tel: 86-592-2388138<br>Fax: 86-592-2388130<br><b>China - Zhuhai</b><br>Tel: 86-756-3210040<br>Fax: 86-756-3210049<br><b>India - Bangalore</b><br>Tel: 91-80-3090-4444<br>Fax: 91-80-3090-4123<br><b>India - New Delhi</b><br>Tel: 91-11-4160-8631<br>Fax: 91-11-4160-8632<br><b>India - Pune</b><br>Tel: 91-20-3019-1500<br><b>Japan - Osaka</b><br>Tel: 81-6-6152-7160<br>Fax: 81-6-6152-9310<br><b>Japan - Tokyo</b><br>Tel: 81-3-6880-3770<br>Fax: 81-3-6880-3771<br><b>Korea - Daegu</b><br>Tel: 82-53-744-4301<br>Fax: 82-53-744-4302<br><b>Korea - Seoul</b><br>Tel: 82-2-554-7200<br>Fax: 82-2-558-5932 or<br>82-2-558-5934<br><b>Malaysia - Kuala Lumpur</b><br>Tel: 60-3-6201-9857<br>Fax: 60-3-6201-9859<br><b>Malaysia - Penang</b><br>Tel: 60-4-227-8870<br>Fax: 60-4-227-4068<br><b>Philippines - Manila</b><br>Tel: 63-2-634-9065<br>Fax: 63-2-634-9069<br><b>Singapore</b><br>Tel: 65-6334-8870<br>Fax: 65-6334-8850<br><b>Taiwan - Hsin Chu</b><br>Tel: 886-3-5778-366<br>Fax: 886-3-5770-955<br><b>Taiwan - Kaohsiung</b><br>Tel: 886-7-213-7830<br><b>Taiwan - Taipei</b><br>Tel: 886-2-2508-8600<br>Fax: 886-2-2508-0102<br><b>Thailand - Bangkok</b><br>Tel: 66-2-694-1351<br>Fax: 66-2-694-1350 | <b>Austria - Wels</b><br>Tel: 43-7242-2244-39<br>Fax: 43-7242-2244-393<br><b>Denmark - Copenhagen</b><br>Tel: 45-4450-2828<br>Fax: 45-4485-2829<br><b>Finland - Espoo</b><br>Tel: 358-9-4520-820<br><b>France - Paris</b><br>Tel: 33-1-69-53-63-20<br>Fax: 33-1-69-30-90-79<br><b>France - Saint Cloud</b><br>Tel: 33-1-30-60-70-00<br><b>Germany - Garching</b><br>Tel: 49-8931-9700<br><b>Germany - Haan</b><br>Tel: 49-2129-3766400<br><b>Germany - Heilbronn</b><br>Tel: 49-7131-67-3636<br><b>Germany - Karlsruhe</b><br>Tel: 49-721-625370<br><b>Germany - Munich</b><br>Tel: 49-89-627-144-0<br>Fax: 49-89-627-144-44<br><b>Germany - Rosenheim</b><br>Tel: 49-8031-354-560<br><b>Israel - Ra'anana</b><br>Tel: 972-9-744-7705<br><b>Italy - Milan</b><br>Tel: 39-0331-742611<br>Fax: 39-0331-466781<br><b>Italy - Padova</b><br>Tel: 39-049-7625286<br><b>Netherlands - Druenen</b><br>Tel: 31-416-690399<br>Fax: 31-416-690340<br><b>Norway - Trondheim</b><br>Tel: 47-7289-7561<br><b>Poland - Warsaw</b><br>Tel: 48-22-3325737<br><b>Romania - Bucharest</b><br>Tel: 40-21-407-87-50<br><b>Spain - Madrid</b><br>Tel: 34-91-708-08-90<br>Fax: 34-91-708-08-91<br><b>Sweden - Gothenberg</b><br>Tel: 46-31-704-60-40<br><b>Sweden - Stockholm</b><br>Tel: 46-8-5090-4654<br><b>UK - Wokingham</b><br>Tel: 44-118-921-5800<br>Fax: 44-118-921-5820 |