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)[1]
    - 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® 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

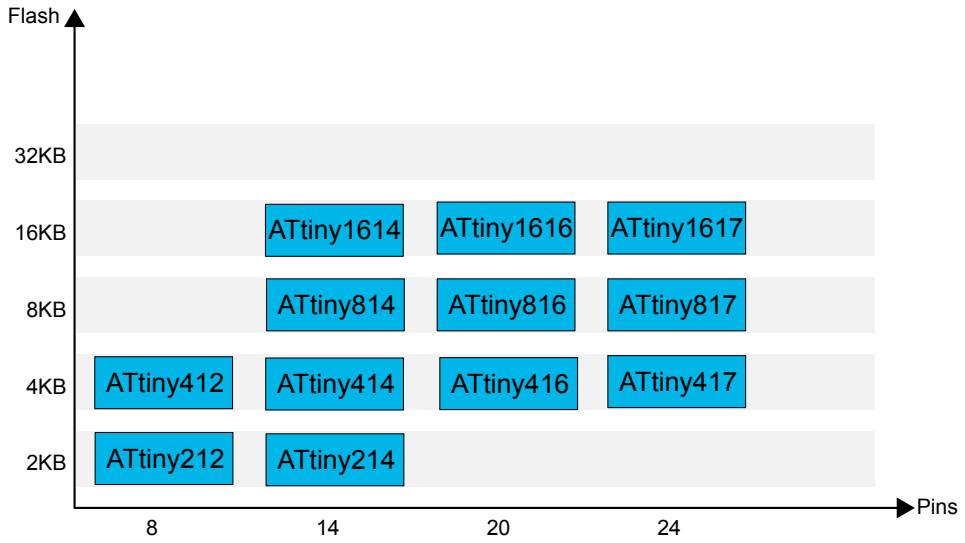
Worldwide Sales and Service....16

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.

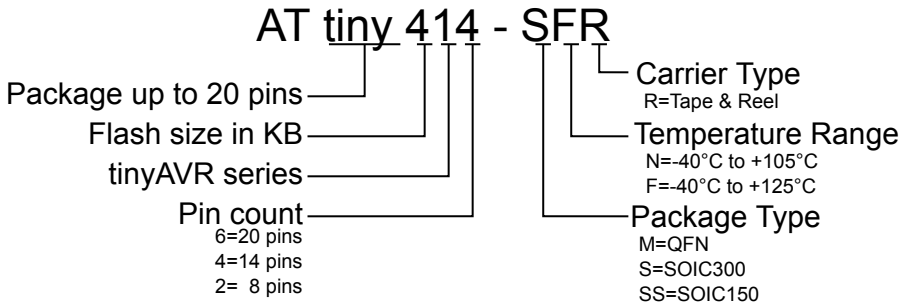
Figure 1-1. tinyAVR®1-Series Overview



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^2C)	1	1	1
ADC	1	1	1
ADC channels	10	10	10
DAC	1	1	1
AC	1	1	1
Peripheral Touch Controller (PTC)(1)	No	No	1
PTC number of self-capacitance channels(1)	-	-	6
PTC number of mutual-capacitance channels(1)	-	-	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[1]	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[1]	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[1]	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

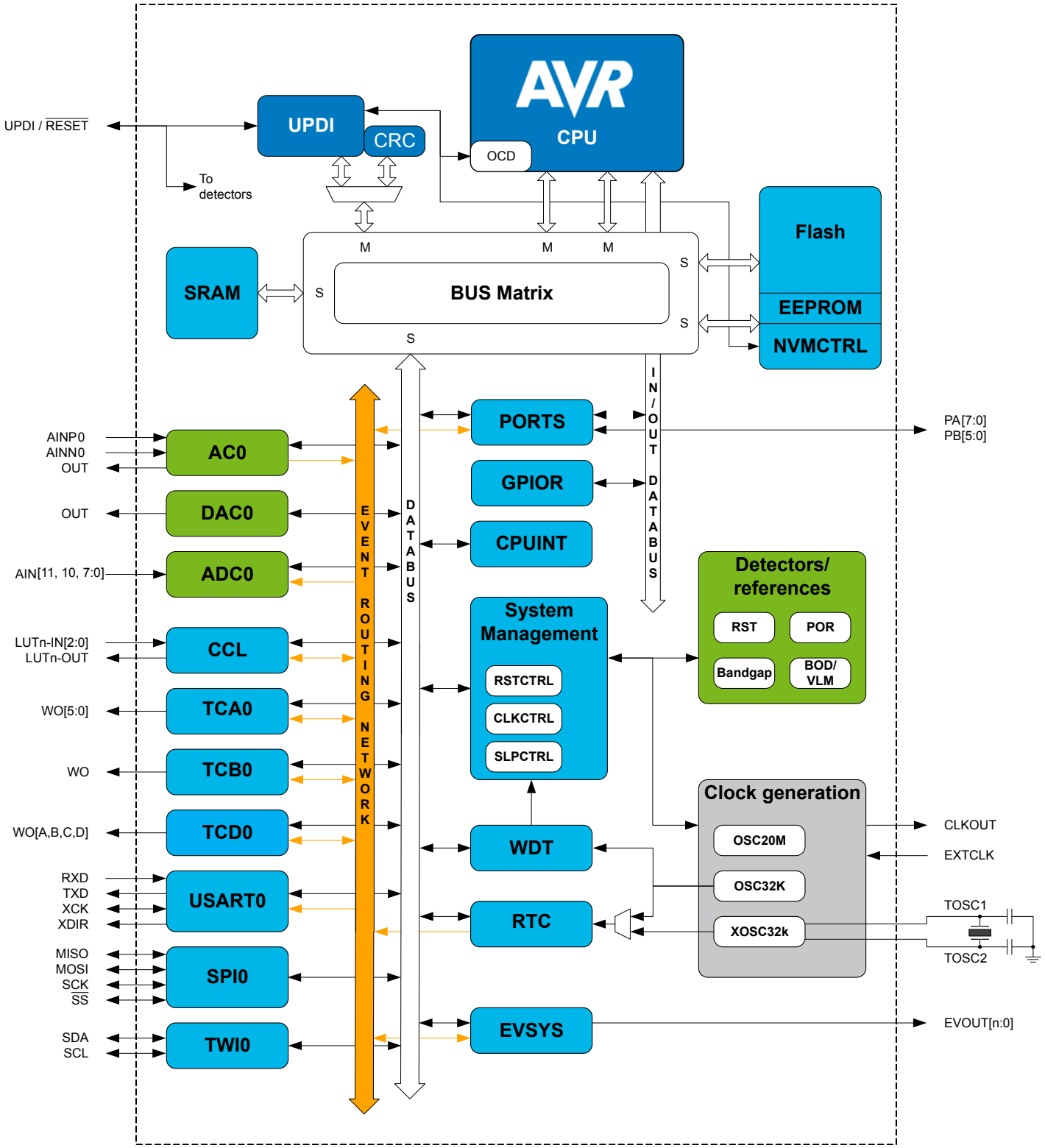
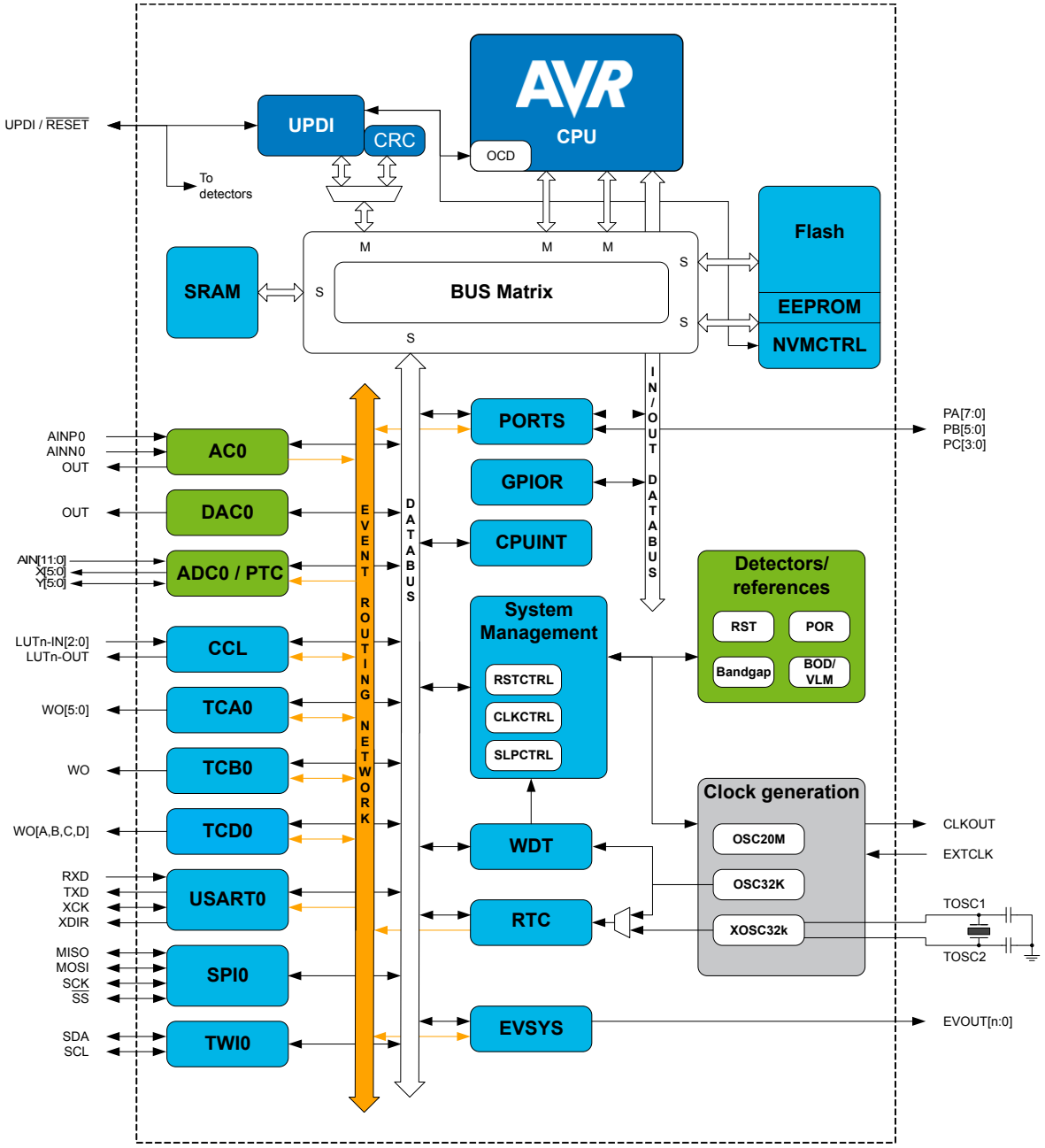
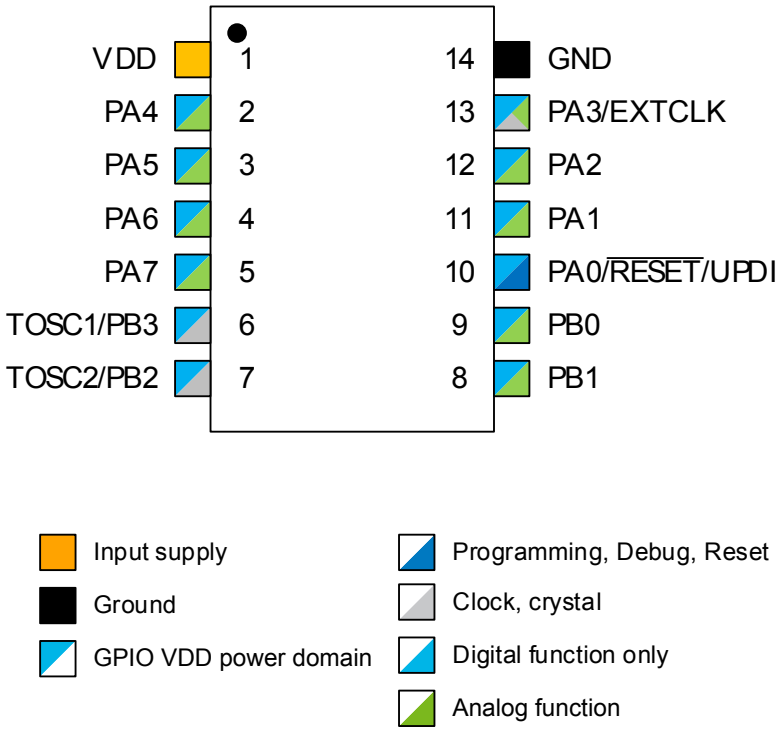


Figure 3-2. ATtiny814 Block Diagram



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 (1,2)	Other/Special	ADC0	PTC(3)	AC0	DAC0	USART0	SPI0	TWI0	TCA0	TCB0	TCD0	CCL
10	PA0	$\overline{\text{RESET}}$ 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	$\overline{\text{SS}}$		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:

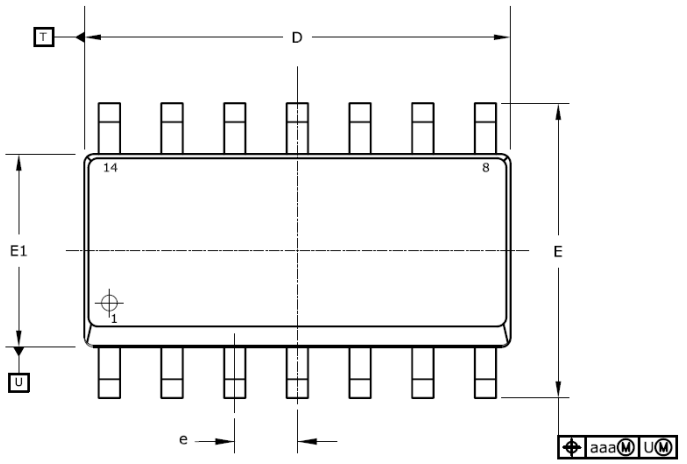
1. Pins names are of type P*xn*, with *x* being the PORT instance (A,B) and *n* the pin number. Notation for signals is PORT*x*_PIN*n*. All pins can be used as event input.
2. All pins can be used for external interrupt, where pins P*x*2 and P*x*6 of each port have full asynchronous detection.
3. PTC 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.

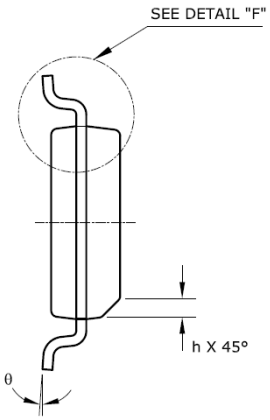
6. Package Drawings

6.1 14-pin SOIC150

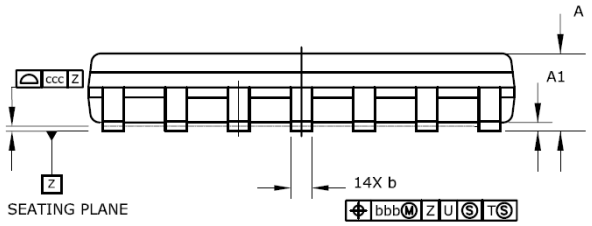
DRAWINGS NOT SCALED



TOP VIEW

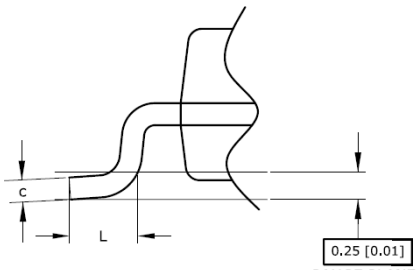


END VIEW



SEATING PLANE

SIDE VIEW



GAUGE PLANE

DETAIL 'F'

COMMON DIMENSIONS

(Unit of Measure = mm)

SYMBOL	MIN	NOM	MAX	NOTE
A	1.35	1.60	1.75	
A1	0.10	----	0.25	
D	8.55	8.65	8.75	2
E	5.80	6.00	6.20	
E1	3.80	3.90	4.00	3
L	0.40	----	1.27	
b	0.33	----	0.51	4
c	0.19	-----	0.25	
e	1.27 BSC			
h	0.25	-----	0.50	
θ	0°	-----	8°	
TOLERANCES OF FORM AND POSITION				
aaa	0.25			
bbb	0.25			
ccc	0.10			
n	14			

Notes :
1. This drawing is for general information only. Refer to JEDEC Drawing MS-012, Variation AB.
2. Dimensions D does not include mold Flash, protrusions or gate burrs. Mold Flash, protrusions and gate burrs shal not exceed 0.15mm (0.006 in) per side.
3. Dimensions E1 does not include inter-lead Flash or protrusions. Inter-lead Flash and protrusions shall not exceed 0.25mm (0.010 in) per side.
4. Dimensions b does not include Dambar protrusion. Allowable Dambar protrusion shall be 0.10mm total in excess of the b dimension at maximum material condition. Dambar cannot be located on the lower radius of the foot.

01/31/2014

Atmel	TITLE	GPC	DRAWING NO.	REV.
Package Drawing Contact: **packagedrawings@atmel.com**	TU, 14 Lds - 1.27mm Pitch, 8.65X3.90x1.60mm Body Size Plastic Small Outline Package (SOIC)	SVQ	TU	D

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	θ_{JA} [°C/W]	θ_{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:

- θ_{JA} = Package thermal resistance, Junction-to-ambient (°C/W), see Thermal Resistance Data
- θ_{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

Trademarks

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® MCUs and dsPIC® DSCs, KEELOQ® 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
Corporate Office 2355 West Chandler Blvd. Chandler, AZ 85224-6199 Tel: 480-792-7200 Fax: 480-792-7277 Technical Support: http://www.microchip.com/support Web Address: www.microchip.com **Atlanta** Duluth, GA Tel: 678-957-9614 Fax: 678-957-1455 **Austin, TX** Tel: 512-257-3370 **Boston** Westborough, MA Tel: 774-760-0087 Fax: 774-760-0088 **Chicago** Itasca, IL Tel: 630-285-0071 Fax: 630-285-0075 **Dallas** Addison, TX Tel: 972-818-7423 Fax: 972-818-2924 **Detroit** Novi, MI Tel: 248-848-4000 **Houston, TX** Tel: 281-894-5983 **Indianapolis** Noblesville, IN Tel: 317-773-8323 Fax: 317-773-5453 Tel: 317-536-2380 **Los Angeles** Mission Viejo, CA Tel: 949-462-9523 Fax: 949-462-9608 Tel: 951-273-7800 **Raleigh, NC** Tel: 919-844-7510 **New York, NY** Tel: 631-435-6000 **San Jose, CA** Tel: 408-735-9110 Tel: 408-436-4270 **Canada - Toronto** Tel: 905-695-1980 Fax: 905-695-2078	**Asia Pacific Office** Suites 3707-14, 37th Floor Tower 6, The Gateway Harbour City, Kowloon **Hong Kong** Tel: 852-2943-5100 Fax: 852-2401-3431 **Australia - Sydney** Tel: 61-2-9868-6733 Fax: 61-2-9868-6755 **China - Beijing** Tel: 86-10-8569-7000 Fax: 86-10-8528-2104 **China - Chengdu** Tel: 86-28-8665-5511 Fax: 86-28-8665-7889 **China - Chongqing** Tel: 86-23-8980-9588 Fax: 86-23-8980-9500 **China - Dongguan** Tel: 86-769-8702-9880 **China - Guangzhou** Tel: 86-20-8755-8029 **China - Hangzhou** Tel: 86-571-8792-8115 Fax: 86-571-8792-8116 **China - Hong Kong SAR** Tel: 852-2943-5100 Fax: 852-2401-3431 **China - Nanjing** Tel: 86-25-8473-2460 Fax: 86-25-8473-2470 **China - Qingdao** Tel: 86-532-8502-7355 Fax: 86-532-8502-7205 **China - Shanghai** Tel: 86-21-3326-8000 Fax: 86-21-3326-8021 **China - Shenyang** Tel: 86-24-2334-2829 Fax: 86-24-2334-2393 **China - Shenzhen** Tel: 86-755-8864-2200 Fax: 86-755-8203-1760 **China - Wuhan** Tel: 86-27-5980-5300 Fax: 86-27-5980-5118 **China - Xian** Tel: 86-29-8833-7252 Fax: 86-29-8833-7256	**China - Xiamen** Tel: 86-592-2388138 Fax: 86-592-2388130 **China - Zhuhai** Tel: 86-756-3210040 Fax: 86-756-3210049 **India - Bangalore** Tel: 91-80-3090-4444 Fax: 91-80-3090-4123 **India - New Delhi** Tel: 91-11-4160-8631 Fax: 91-11-4160-8632 **India - Pune** Tel: 91-20-3019-1500 **Japan - Osaka** Tel: 81-6-6152-7160 Fax: 81-6-6152-9310 **Japan - Tokyo** Tel: 81-3-6880- 3770 Fax: 81-3-6880-3771 **Korea - Daegu** Tel: 82-53-744-4301 Fax: 82-53-744-4302 **Korea - Seoul** Tel: 82-2-554-7200 Fax: 82-2-558-5932 or 82-2-558-5934 **Malaysia - Kuala Lumpur** Tel: 60-3-6201-9857 Fax: 60-3-6201-9859 **Malaysia - Penang** Tel: 60-4-227-8870 Fax: 60-4-227-4068 **Philippines - Manila** Tel: 63-2-634-9065 Fax: 63-2-634-9069 **Singapore** Tel: 65-6334-8870 Fax: 65-6334-8850 **Taiwan - Hsin Chu** Tel: 886-3-5778-366 Fax: 886-3-5770-955 **Taiwan - Kaohsiung** Tel: 886-7-213-7830 **Taiwan - Taipei** Tel: 886-2-2508-8600 Fax: 886-2-2508-0102 **Thailand - Bangkok** Tel: 66-2-694-1351 Fax: 66-2-694-1350	**Austria - Wels** Tel: 43-7242-2244-39 Fax: 43-7242-2244-393 **Denmark - Copenhagen** Tel: 45-4450-2828 Fax: 45-4485-2829 **Finland - Espoo** Tel: 358-9-4520-820 **France - Paris** Tel: 33-1-69-53-63-20 Fax: 33-1-69-30-90-79 **France - Saint Cloud** Tel: 33-1-30-60-70-00 **Germany - Garching** Tel: 49-8931-9700 **Germany - Haan** Tel: 49-2129-3766400 **Germany - Heilbronn** Tel: 49-7131-67-3636 **Germany - Karlsruhe** Tel: 49-721-625370 **Germany - Munich** Tel: 49-89-627-144-0 Fax: 49-89-627-144-44 **Germany - Rosenheim** Tel: 49-8031-354-560 **Israel - Ra'anana** Tel: 972-9-744-7705 **Italy - Milan** Tel: 39-0331-742611 Fax: 39-0331-466781 **Italy - Padova** Tel: 39-049-7625286 **Netherlands - Drunen** Tel: 31-416-690399 Fax: 31-416-690340 **Norway - Trondheim** Tel: 47-7289-7561 **Poland - Warsaw** Tel: 48-22-3325737 **Romania - Bucharest** Tel: 40-21-407-87-50 **Spain - Madrid** Tel: 34-91-708-08-90 Fax: 34-91-708-08-91 **Sweden - Gothenberg** Tel: 46-31-704-60-40 **Sweden - Stockholm** Tel: 46-8-5090-4654 **UK - Wokingham** Tel: 44-118-921-5800 Fax: 44-118-921-5820