
AVR098: Migration between ATmega169, ATmega329 and ATmega649

Features

- General porting considerations
- Register and bit names
- Memory
- Clock sources
- IO pins

1 Introduction

This application note summarizes the differences between ATmega169, ATmega329 and ATmega649. For detailed information on the devices please refer to the datasheets. Also note that there are separate datasheets and migration notes for Pico Power devices (P suffix in device name).

The ATmega169, ATmega329 and ATmega649 are designed to be a pin and functionality compatible sub family, but because of the differences in memory sizes and other issues mentioned in this application note there may be a need for minor modifications in the application when porting code between the devices.



8-bit **AVR**[®]
Microcontrollers

Application Note

Rev. 2580D-AVR-02/07





2 General porting considerations

To make the porting process as easy as possible, always refer to registers and bit positions using their defined names. Avoid using absolute addresses and values. In most cases, the register and bit names are unchanged from device to device. When you are porting a design, it is more convenient to include the correct definition file for the new device, rather than manually changing all your addresses and bit values. It is also considered good programming practice to use named references instead of absolute values. Some examples are shown below.

```
PORTE |= (1<<PORTE5);          // Set pin 5 on port E high
DDR  &= ~(1<<PORTE5);          // Set pin 5 on port E as input
// Configure USI
USICR = (1<<USISIE)|(0<<USIOIE)|(1<<USIWM1)|(0<<USIWM0)|
        (1<<USICS1)|(0<<USICS0)|(0<<USICK)| (0<<USITC);
```

To avoid conflicts with added features and register functionality, never access registers that are marked as reserved. Reserved bits should always be written to zero if accessed. This ensures forward compatibility, and that added features will stay in their default states if not used.

3 Register and bit names

In ATmega169 and ATmega329/649, some register bits are in different locations within a register, but neither the registers nor the bits have different names, nor are any bits relocated into other registers. Table 3-1 shows the register bits that have been moved.

Table 3-1. Moved register bits.

Bit names			
PCIE1	PCIE0	PCIF1	PCIF0

In ATmega169 the USART module is named USART, while in ATmega329/649 it is called USART0. This has consequences for all USART register and bit names, and depending on the compiler used this might have consequences when porting the code. Table 3-2 shows the register names for ATmega169 and ATmega329/649

Table 3-2. USART register names

ATmega169 Register name	Atmega169 Bit names	ATmega329/649 Register name	ATmega329/649 Bit names
UDR	RXB[7:0]	UDR0	RXB0[7:0]
	TXB[7:0]		TXB0[7:0]
UCSRA	RXC	UCSR0A	RXC0
	TXC		TXC0
	UDRE		UDRE0
	FE		FE0
	DOR		DOR0
	UPE		UPE0
	U2X		U2X0

	MPCM		MPCM0
UCSRB	RXCIE	UCSR0B	RXCIE0
	TXCIE		TXCIE0
	UDRIEN		UDRIEN0
	RXEN		RXEN0
	TXEN		TXEN0
	UCSZ2		UCSZ02
	RXB8		RXB80
	TXB8		TXB80
UCSRC	-	UCSR0C	-
	UMSEL		UMSEL0
	UPM1		UPM01
	UPM0		UPM00
	USBS		USBS0
	UCSZ1		UCSZ01
	UCSZ0		UCSZ00
	UCPOL		UCPOL0
UBRRH	UBRR[11:8]	UBRR0H	UBRR0[11:8]
UBRRL	UBRR[7:0]	UBRR0L	UBRR0[7:0]

4 Memory

The sizes of the memories are the main difference between the ATmega169 and ATmega329/649. They are all summarized in Table 4-1. The alternatives of the boot flash section size vary from part to part, and are summarized in Table 4-2. When programming the Flash and EEPROM, the memories are accessed in groups by pages. The different page sizes are listed in Table 4-3.

The EEPROM write time is different between ATmega169 and ATmega329/649. Typical programming times are listed in Table 4-4.

Table 4-1. Memory sizes

Device	FLASH [bytes]	SRAM [bytes]	EEPROM [bytes]
ATmega169	16384	1024	512
ATmega329	32768	2048	1024
ATmega649	65536	4096	2048

Table 4-2. Boot flash section sizes

Device	BOOTSZ: 11 [words]	BOOTSZ: 10 [words]	BOOTSZ: 01 [words]	BOOTSZ: 00 [words]
ATmega169	128	256	512	1024
ATmega329	256	512	1024	2048



ATmega649	512	1024	2048	4096
-----------	-----	------	------	------

Table 4-3. Programming page sizes

Device	FLASH page size [words]	EEPROM page size [bytes]
ATmega169	64	4
ATmega329	64	4
ATmega649	128	8

Table 4-4. Wait times when programming EEPROM

Device	Typical programming time
ATmega169	8.5 ms
ATmega329/649	3.3 ms

5 Clock sources

The internal RC oscillator in ATmega329/649 is based on a different design than the ATmega169. The OSCCAL register is 8-bit instead of 7-bit, where the high bit selects one of two overlapping frequency ranges. Refer to the datasheets for information on the oscillators.

6 IO pins

ATmega329/649 have an option to disable the external reset feature. The /RESET pin then becomes an input only IO pin. The reset disable feature is not available on ATmega169.



Atmel Corporation

2325 Orchard Parkway
San Jose, CA 95131, USA
Tel: 1(408) 441-0311
Fax: 1(408) 487-2600

Regional Headquarters

Europe

Atmel Sarl
Route des Arsenaux 41
Case Postale 80
CH-1705 Fribourg
Switzerland
Tel: (41) 26-426-5555
Fax: (41) 26-426-5500

Asia

Room 1219
Chinachem Golden Plaza
77 Mody Road Tsimshatsui
East Kowloon
Hong Kong
Tel: (852) 2721-9778
Fax: (852) 2722-1369

Japan

9F, Tonetsu Shinkawa Bldg.
1-24-8 Shinkawa
Chuo-ku, Tokyo 104-0033
Japan
Tel: (81) 3-3523-3551
Fax: (81) 3-3523-7581

Atmel Operations

Memory

2325 Orchard Parkway
San Jose, CA 95131, USA
Tel: 1(408) 441-0311
Fax: 1(408) 436-4314

Microcontrollers

2325 Orchard Parkway
San Jose, CA 95131, USA
Tel: 1(408) 441-0311
Fax: 1(408) 436-4314

La Chantrerie
BP 70602
44306 Nantes Cedex 3, France
Tel: (33) 2-40-18-18-18
Fax: (33) 2-40-18-19-60

ASIC/ASSP/Smart Cards

Zone Industrielle
13106 Rousset Cedex, France
Tel: (33) 4-42-53-60-00
Fax: (33) 4-42-53-60-01

1150 East Cheyenne Mtn. Blvd.
Colorado Springs, CO 80906, USA
Tel: 1(719) 576-3300
Fax: 1(719) 540-1759

Scottish Enterprise Technology Park
Maxwell Building
East Kilbride G75 0QR, Scotland
Tel: (44) 1355-803-000
Fax: (44) 1355-242-743

RF/Automotive

Theresienstrasse 2
Postfach 3535
74025 Heilbronn, Germany
Tel: (49) 71-31-67-0
Fax: (49) 71-31-67-2340

1150 East Cheyenne Mtn. Blvd.
Colorado Springs, CO 80906, USA
Tel: 1(719) 576-3300
Fax: 1(719) 540-1759

Biometrics/Imaging/Hi-Rel MPU/ High Speed Converters/RF Datacom

Avenue de Rochepleine
BP 123
38521 Saint-Egreve Cedex, France
Tel: (33) 4-76-58-30-00
Fax: (33) 4-76-58-34-80

Literature Requests

www.atmel.com/literature

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 ATMEL'S TERMS AND CONDITIONS OF SALE LOCATED ON ATMEL'S WEB SITE, 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 OF 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 product 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's products are not intended, authorized, or warranted for use as components in applications intended to support or sustain life.

© 2007 Atmel Corporation. All rights reserved. ATMEL®, logo and combinations thereof, Everywhere You Are®, AVR®, and others are the registered trademarks of Atmel Corporation or its subsidiaries. Other terms and product names may be trademarks of others.