

---

# AVR1303: Use and configuration of IR communication module

## Features

- IrDA 1.4 compatible for baud rates up to 115.2 Kbit/s
- Selectable transmitter pulse modulation schemes:
  - 3/16 of baud rate period
  - Fixed pulse period, 8 bit programmable
  - Pulse modulation disabled
- Optimal spike filtering for receiver
- Can be used by any USART

## 1 Introduction

The Infrared communication module (IRCOM) encodes and decodes data according to the IrDA<sup>®</sup> communication protocol for baud rates up to 115.2 Kbit/s. The module is an extension module that must be used together with an optional USART.

This application note describes the basic functionality of the IRCOM module in the AVR<sup>®</sup> XMEGA<sup>™</sup> with code examples to get up and running quickly. A driver interface written in C is included as well.

Advanced usage, such as usage together with the XMEGA Event System, is outside the scope of this application note. Please refer to the device datasheets and other relevant application notes for details.



---

8-bit **AVR**<sup>®</sup>  
Microcontrollers

---

Application Note

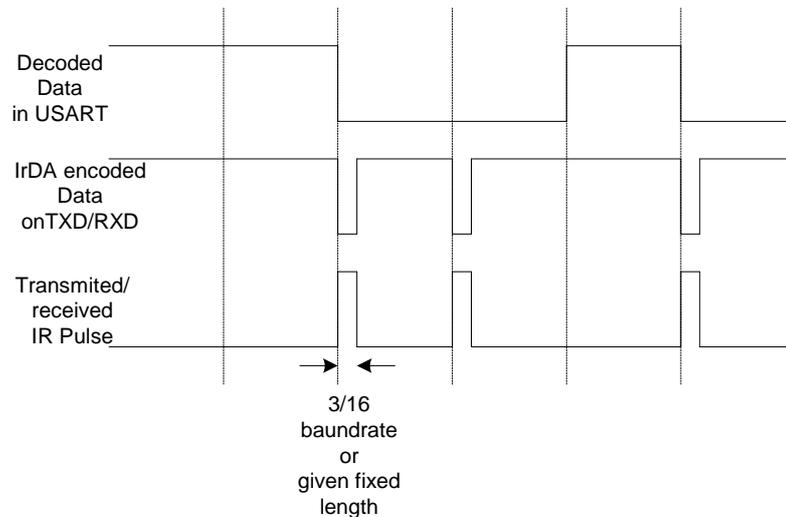
Rev. 8104C-AVR-07/08



## 2 Theory of Operation

The encoding/decoding scheme for baud rates up to 115.2 Kbit/s in the IrDA communication protocol is very simple. The data is transmitted serial, and the transmitter sends out an infrared pulse with a specified pulse length (normally  $\frac{3}{16}$  of the baud rate) whenever data is zero. The data on the TXD/RXD pins are the inverted value of the transmitted/received infrared pulse. Figure 2-1 illustrates the encoding/decoding principle.

**Figure 2-1** Encoding/decoding scheme.



NOTE: The module does not ensure that data have the right Frame Format. This must be done by user software.

### 2.1 The XMEGA IRCOM module

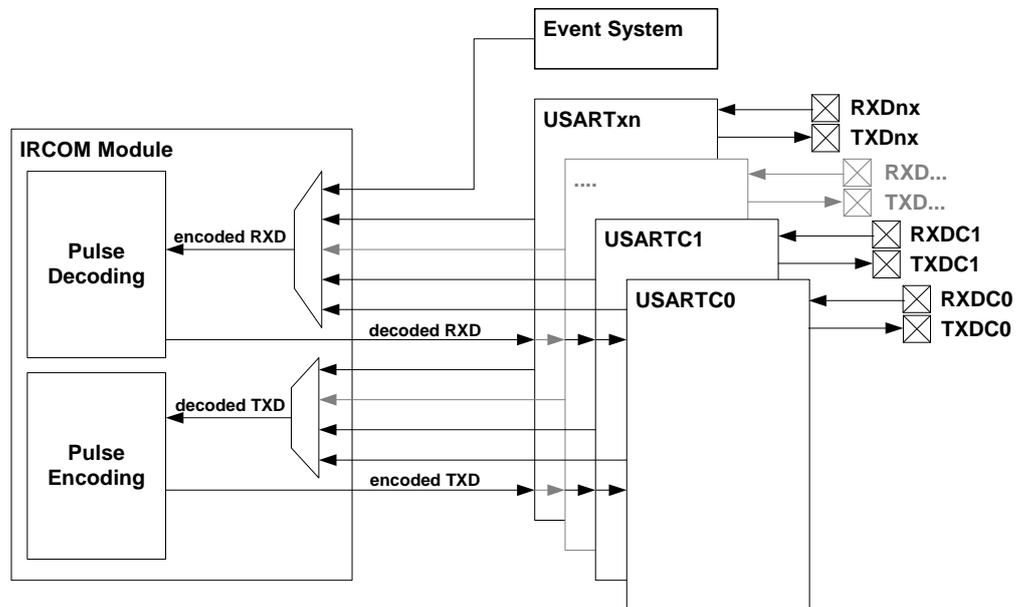
The IRCOM module is an extension module that is used together with a USART. The IRCOM can be used with any of the USART in the device as shown in Figure 2-2.

Setting an USART in IrDA mode enables the IRCOM module. The module can only be used in combination with one USART at a time, thus IrDA mode must not be set for more than one USART at a time. This must be ensured in the user software.

For more information on how to set up and use the USART please refer to the device datasheet or the application note "AVR1307: using the XMEGA USART"

Note that the USART must not be used in double speed mode for the IrDA module to function properly. The IrDA module uses  $\frac{3}{16}$  parts of the baud rate to generate the correct IrDA signal, while setting the double speed mode in the USART module will reduce the samples to 8 and it will incorrectly generate a  $\frac{3}{8}$  part signal.

Figure 2-2 IRCOM module connection



## 2.2 Transmitter/receiver pulse length

Two registers determine the Transmitter and Receiver pulse length. By default the pulse lengths are to 3/16 of the USART's baud rate. The second scheme possible to use is a fixed pulse length scheme that is dependent on the system clock. The number of system clock periods for the pulse duration can be set from 1 to 254. When using this scheme it is up to the user to guarantee that the Transmitter/Receiver pulse length and baud rate combination are within IrDA specification. It is also possible to turn off the pulse length encoding sending the signal unchanged through. This can be useful if events are used as the receiver input.

## 2.3 Event as receiver input

The XMEGA Event System can be used as the receiver input. This enables IRCOM or USART input from other sources than the corresponding RXD pin. Any Event including Events from IO pins can be used as input. If Event System input is enabled, input from the USART's RXD pin is automatically disabled.

For more information about the Event System, please refer to the device datasheet or the application note "AVR1303: Getting Started with the XMEGA Event System".



## 3 IRCOM drivers

This application note includes a source code package with a basic driver implemented in C. It is written in the IAR Embedded Workbench<sup>®</sup> compiler.

The code example sends all values between 0 and 255 and checks that the values received are equal to the values sent. It can be tested, using a loop-back wire between I/O pins PC2 and PC3.

The USART driver used in this application note is polling the interrupt flags. In CPU intensive applications, an interrupt-based driver can be more efficient. Information about an interrupt based driver can be found in the application note "AVR1307: using the XMEGA USART". By using an interrupt controlled driver, the CPU will not have to check if data are received or transmitted, but will automatically be notified when this occurs. The choice of polled versus interrupt-driven drivers is application dependent, and often relies on protocol used for data transfers.

Note that this driver is written to be highly readable and as a general example how to use the peripheral module. When using the driver in an application it may be desirable to copy relevant parts of the code to where it is needed, to reduce to number of function calls. This can both speed up the code and reduce the code footprint.

### 3.1 Doxygen documentation

All source code is prepared for automatic documentation generation using Doxygen. Doxygen is a tool for generating documentation from source code by analyzing the source code and using special keywords. For more details about Doxygen please visit <http://www.doxygen.org>. Precompiled Doxygen documentation is also supplied with the source code accompanying this application note, available from the *readme.html* file in the source code folder.



## Headquarters

---

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

## International

---

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

---

**Atmel Europe**  
Le Krebs  
8, Rue Jean-Pierre Timbaud  
BP 309  
78054 Saint-Quentin-en-  
Yvelines Cedex  
France  
Tel: (33) 1-30-60-70-00  
Fax: (33) 1-30-60-71-11

---

**Atmel 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

## Product Contact

---

**Web Site**  
[www.atmel.com](http://www.atmel.com)

**Technical Support**  
[avr@atmel.com](mailto:avr@atmel.com)

**Sales Contact**  
[www.atmel.com/contacts](http://www.atmel.com/contacts)

**Literature Request**  
[www.atmel.com/literature](http://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.

© 2008 Atmel Corporation. All rights reserved. Atmel®, logo and combinations thereof, AVR® and others, are the registered trademarks, XMEGA™ and others are trademarks of Atmel Corporation or its subsidiaries. Other terms and product names may be trademarks of others.