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AN2400

Using Event System on ATtiny817

Introduction

The event system is a set of features that allows peripherals to interact without intervention from the CPU. It enables the possibility for a change of state in one peripheral to automatically trigger actions in other peripherals. Several peripheral modules can generate events, often on the same conditions as interrupt requests. These events are routed through the event routing system to the event users, where certain actions can be triggered by the event. It is designed to provide short and predictable response times between peripherals, allowing for autonomous peripheral control and interaction, and also for synchronized timing of actions in several peripheral modules. It is a powerful tool for reducing the complexity, size, and execution time of the software.

Features

- Flexible Routing of Peripheral Events:
  - Up to four asynchronous event channels and two synchronous event channels available
  - Up to ten asynchronous user channels and two synchronous user channels available
- Ability to Control Peripherals Independent of CPU

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1. Event System Overview

The event system can be divided into three distinct parts:

- Event Generators
- The Event Routing Network
- Event Users

The system block diagram is illustrated below and each module will be described in the following sections.

Figure 1-1. Block Diagram

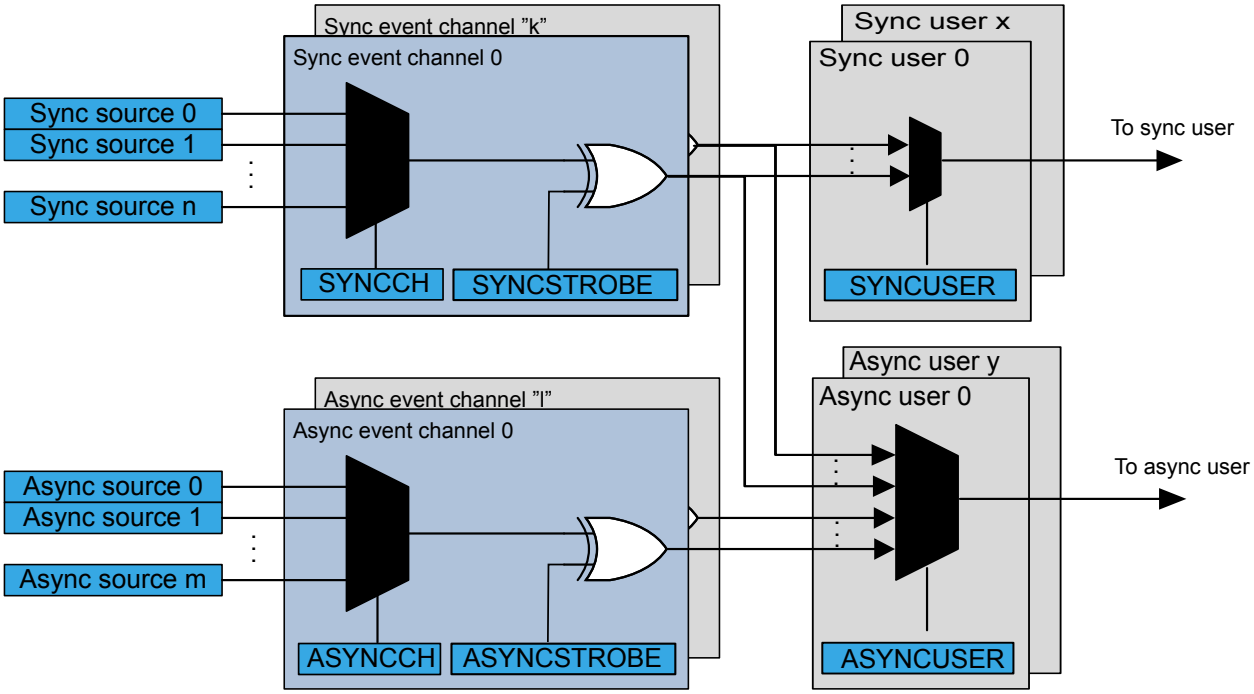
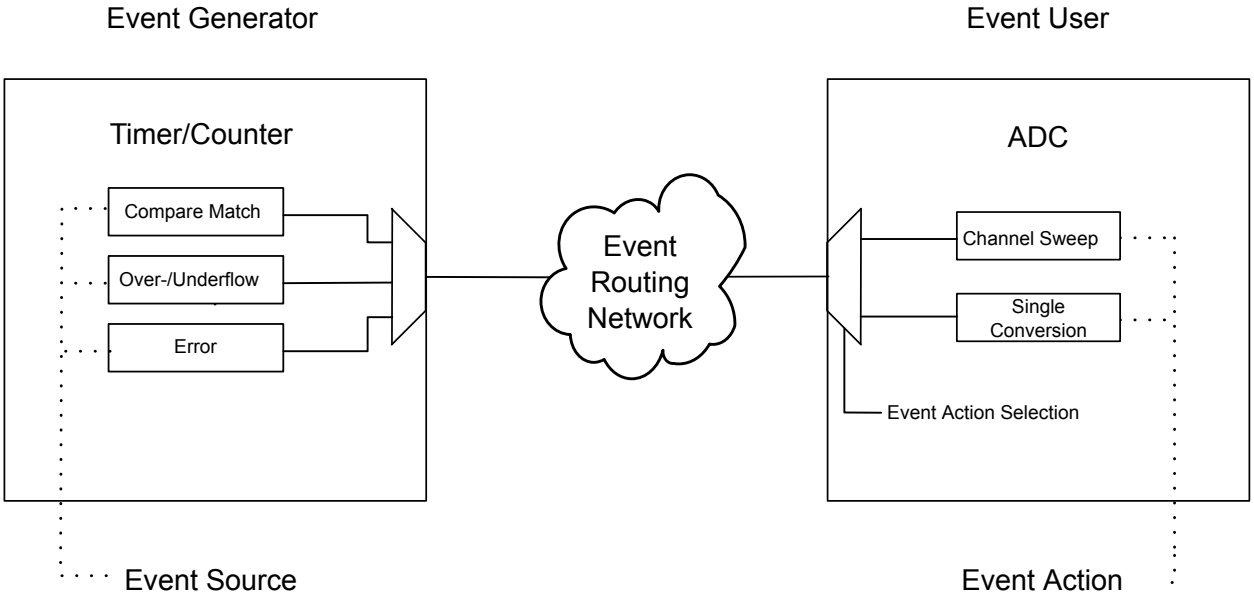


Figure 1-2. Example of Event Source, Generator, User, and Action



1.1 What is an Event?

An event, as used in this document, is an indication that a change of state within a peripheral has occurred. A peripheral capable of generating events is called an event generator. One event generator may be able to generate events on several changes within the peripheral. Each of these is an individual event source. As an example, a timer/counter module is an event generator with several event sources, since it can generate events on overflow and compare/capture.

1.2 Event Generator

An event generator is a peripheral module having one or more event sources. There is generally a strong correlation between the available event sources and the available interrupt belonging to a peripheral module. An event generator is feeding all its event sources to the event routing system, and is not aware of which event source is being used by other modules.

A channel path can be either asynchronous or synchronous to the main clock. The mode must be selected based on the requirements of the application.

For ATtiny817, there are four asynchronous event channels (registers ASYNCCH0, ASYNCCH1, ASYNCCH2, ASYNCCH3) and two synchronous channels (registers SYNCCH0, SYNCCH1), which are used to configure the event source.

Only one trigger from an event generator peripheral can be routed on each channel, but multiple channels can use the same generator source. Multiple peripherals can use events from the same channel.

1.3 Event Routing Network

The Event Routing Network handles the routing of events from the event generator to the event user. The Event Routing Network consists of six event channels. Every event source from every event generator is connected to the inputs of each of the event channels.

1.4 Event User

An event user is a peripheral module that can make use of an event to trigger an action, referred to as an event action. An event user selects the event source to react to by selecting an event channel. The actual event source is determined by the multiplexer setting in the selected event channel. There are ten asynchronous user channels and two synchronous user channels, corresponding to register ASYNCUSERn and SYNCUSERn (n refers to the channel number).

1.5 Software Event

It is possible to generate either events from software. The generated events are injected directly in the event channels. The event channel does not need to have an event source associated with it to use the manual event generation possibilities. If an event source is associated with the event channel, the manually generated event has priority and will override the peripheral event.

In a Software Event, the CPU can override an event channel line by writing to the respective strobe register location. The write to the strobe register will invert the current value on the event channel for one system clock cycle.

1.6 Events and Sleep Modes

The event system is operative in Active mode and Standby Sleep mode. In all other sleep modes, peripheral modules will not be able to communicate using the event system.

2. Example

The example shows how to use the event system, including two event configurations, covering both asynchronous and synchronous events. It has instructions on how to set up each part of the system. The example project is available at Atmel® | START.

2.1 Input Capture

Any event source can be used to trigger an input capture on TCB. This can be used to timestamp events.

2.1.1 Configuration

This example shows how to configure TCB for input capture, triggered by a change on the input of the I/O port pin, PC5.

- Configure TCB with the desired frequency and period
- Configure asynchronous event channel 2 to use the PC5 event as event input
- Select asynchronous user channel 0 to use asynchronous event channel 2 as event input channel
- Set event action for TCB to “Input Capture Event” and enable TCB
- Configure PC5 as input

TCB will now perform an input capture every time there is a falling edge on the input of PC5.

2.2 ADC Conversion on Timer/Counter Overflow

The ADC can be configured to do a conversion on any event. In this example, a timer/counter overflow event is used. This can be very useful when the timer/counter is used for PWM generation, as the ADC sampling can be synchronized to the PWM.

2.2.1 Configuration

This example shows how to configure a conversion of ADC0 on an overflow of TCA, using synchronous event channel 0.

- Configure TCA with the desired frequency and period
- Select TCA overflow event as an event source for synchronous event channel 0
- Configure asynchronous user channel 1 (ADC0) to use synchronous event channel 0 as event input
- Configure the ADC0 for an ADC conversion triggered by an event

3. Get Source Code from Atmel | START

The example code is available through Atmel | START, which is a web-based tool that enables configuration of application code through a Graphical User Interface (GUI). The code can be downloaded for both Atmel Studio 7.0 and IAR Embedded Workbench® via the direct example code-link(s) below, or the *BROWSE EXAMPLES* button on the Atmel | START front page.

Atmel | START web page: http://start.atmel.com/

Example Code

http://start.atmel.com/#example/Atmel%3Aavr42815_using_event_system_on_attiny817%3A0.0.1%3A%3AApplication%3AAVR42815_-_Using_ATtiny817_Event_System%3A

Press *User guide* in Atmel | START for details and information about example projects. The *User guide* button can be found in the example browser, and by clicking the project name in the dashboard view within the Atmel | START project configurator.

Atmel Studio

Download the code as an .atzip file for Atmel Studio from the example browser in Atmel | START, by clicking *DOWNLOAD SELECTED EXAMPLE*. To download the file from within Atmel | START, click *EXPORT PROJECT* followed by *DOWNLOAD PACK*.

Double-click the downloaded .atzip file and the project will be imported to Atmel Studio 7.0.

IAR Embedded Workbench

For information on how to import the project in IAR Embedded Workbench, open the Atmel | START User guide, select *Using Atmel Start Output in External Tools*, and *IAR Embedded Workbench*. A link to the Atmel | START user guide can be found by clicking *About* from the Atmel | START front page or *Help And Support* within the project configurator, both located in the upper right corner of the page.

4. Revision History

Doc. Rev.	Date	Comments
A	07/2017	Initial document release. Microchip DS00002400A replaces Atmel 42815A.

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