

# TN00013

## LPC5411x and LPC546xx USART Receiver Timeout

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Technical note

### Document information

Info	Content
<b>Keywords</b>	LPC5411x, LPC546xx, USART, receiver timeout
<b>Abstract</b>	This technical note provides a work-around for the USART receiver timeout feature that does not exist in the LPC5411x and LPC546xx devices. This technical note provides a template for the user to implement the functionality as needed for the application.



**Revision history**

Rev	Date	Description
1.2	20170505	Removed LPC54S60x device. Changed LPC5460x to LPC546xx.
1.1	20161220	Added LPC54S60x/LPC5460x devices.
1	20161014	Initial version.

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## 1. Introduction

The LPC5411x and LPC546xx are ARM Cortex-M4 based microcontrollers for embedded applications.

## 2. USART receiver timeout feature

USART functions are available on all LPC5411x and LPC546xx devices as a selectable function in each Flexcomm Interface peripheral. A receiver timeout feature for USART provides a means to get data left for a time in a FIFO that has not reached its threshold to be transferred. This feature does not exist in the LPC5411x and LPC546xx devices.

The example code provided with this technical note provides a software work-around for this problem. The example code is based on the LPC5411x and can be similarly applied to LPC546xx devices.

## 3. Work-around

The work-around in this technical note uses Timer0 as a USART RX timeout timer and Flexcomm0 as USART0 peripheral in loop back mode.

The time taken to receive one character is calculated based on the baud rate, data length, start and stop bits.

```
1 char_time_secs = (1.0 / BAUD_RATE) * (NUM_DATA_BITS + NUM_STOP_BITS +  
    NUM_START_BITS);
```

The timer starts running as soon the first character is received. The total time taken to receive the remaining characters is calculated as follows:

```
2 timeout_secs = (FIFO_TRIG_LVL - 1) * char_time_secs;
```

Where FIFO\_TRIG\_LVL is the total number of characters to be received. In the example, FIFO\_TRIG\_LVL is set to 8.

As soon as the first character is received, the USART interrupt handler is invoked. In the interrupt handler Timer0 is started and the receive FIFO level trigger point is set to FIFO\_TRIG\_LVL - 1 (since the timer starts after the first character is received) and uart\_isr\_cnt is incremented to 1.

When all the characters have been received, the USART interrupt handler is invoked once again and the timer is stopped. Therefore, in this case where a timeout does not happen the uart\_isr\_cnt has value '2' and timer\_isr\_cnt has value '0'.

In the next case, 7 characters are sent and the last expected character is not sent. This causes a timeout and the timer interrupt handler is invoked. In the interrupt handler for timeout, the timer is stopped and elements in the FIFO are flushed and timer\_isr\_cnt is incremented to 1. Therefore, in this case where a timeout occurs uart\_isr\_cnt has value 1 and timer\_isr\_cnt also has value 1.

This work-around provides a template for the user to implement the timeout functionality as needed for the application.

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