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Application Note



Baudrate Calculation for UART

© Fujitsu Mikroelectronics Europe GmbH, Microcontroller Application Group

History

27 th Jan 00	Tka/MSt	V1.0	Started
28 th June 00	TKa	V1.1	New format

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Using UART0 and UART1 for data transfers with Fujitsu-Mikrocontrollers.

There exists different UART macros. For that reason care must be taken, if the baud rate is calculated.

Example:

Controller : **MB90F543**

internal clock frequency : **16 MHz**

Mode : **asynchrone Übertragung**

UART0:

Using Reload-Timer 0 for baud rate generation:

$$\text{Baudrate} = (\phi / X) / (8 \times 2 \times (n + 1))$$

Explanation of the formula:

ϕ = 16 MHz

$X = 2^1, 2^3, 2^5$ (selected by CSL-Bits of reload timer-0)

n = Reload-value of timer (minimum value is 1, otherwise no Reload-Mode possible)

+ 1: because overrun 0x0000->FFFF starts the timer again

x 2: because a High- and Low-phase is necessary for the clock

$$\text{Maximum baudrate} = (16 \text{ MHz} / 2^1) / (8 \times 2 \times (1+1)) = 250.000 \text{ bit/s}$$

Using external clock to generate the baudrate :

- maximum frequency at SCK0 : 2MHz

- calculation of baudrate: external frequency / 8

UART1:

Using Reload-Timer 0 for baud rate generation:

$$\text{baudrate} = (\phi / N) / (16 \times 2 \times (n + 1))$$

ϕ = 16 MHz

$N = 2^1, 2^3, 2^5$ (selected by CSL-bits of timer 0 register)

n = Reload-value of timer (minimum value is 1, otherwise no reload mode possible)

explanation of the formula:

+ 1: because overrun 0x0000->FFFF starts timer again

x 2: because High- and Low-phase is necessary for the clock

$$\text{maximum baudrate} = (16 \text{ MHz} / 2^1) / (16 \times 2 \times (1+1)) = 125.000 \text{ bit/s}$$

Using external clock to generate the baudrate :

- maximum frequency at SCK1 : 1MHz
- calculation of baudrate: $\text{external frequency} / 16$

To calculate versatile Baud rates, the attached excel sheet can be used. But in any case the maximum baud rates has always to be checked with the data of the corresponding hardware manual.

[an-BaudRateCalculation-V-1-1.xls](#)