Mandatory Assignment

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# Calculate the delays

## Calculate the delay. The clock frequency is 16MHz

delay:

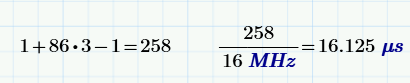
ldi r20, 86

loop1:

dec r20

brne loop1

Solution



## Calculate the delay. The clock frequency is 16MHz

delay:

ldi r20, 100

loop1:

nop

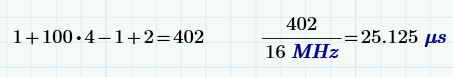
dec r20

brne loop1

nop

nop

Solution



## Calculate the delay. The clock frequency is 16MHz

delay:

ldi r20, 200

loop1:

nop

dec r20

nop

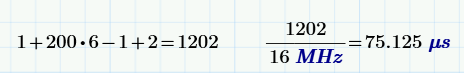
nop

brne loop1

nop

nop

Solution



## Calculate the delay. The clock frequency is 16MHz

delay:

ldi r18, 180

loop2:

ldi r20, 199

loop1:

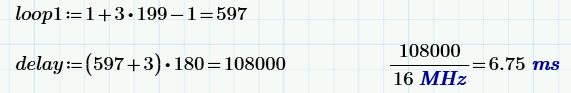
dec r20

brne loop1

dec r18

brne loop2

Solution



## Calculate the delay. The clock frequency is 16MHz

delay:

ldi r18, 11

loop2:

nop

ldi r20, 15

loop1:

nop

nop

dec r20

nop

brne loop1

nop

nop

dec r18

brne loop2

nop

nop

nop

Solution



## Calculate the delay. The clock frequency is 16MHz

delay:

ldi r16, 14

loop3:

ldi r18, 11

loop2:

ldi r20, 15

loop1:

dec r20

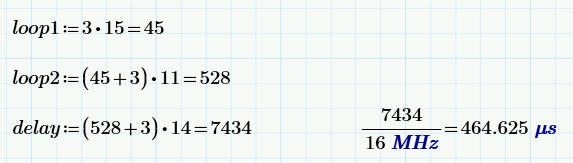
brne loop1

dec r18

brne loop2

dec r16

brne loop3

Solution

## Calculate the delay. The clock frequency is 16MHz

delay:

ldi r16, 14

loop3:

nop

ldi r18, 110

loop2:

nop

ldi r20, 150

loop1:

dec r20

brne loop1

nop

nop

dec r18

brne loop2

dec r16

nop

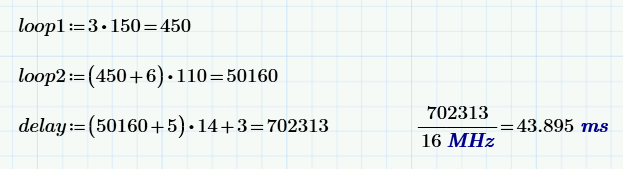
brne loop3

nop

nop

nop

Solution



# Create delays

## Your microcontroller is connected to a 16MHz clock. Create a delay that is around (+- 5%):

Solution



You could choose a loop of 5 clocks and run it 32 times ()

delay:

ldi r16, 32

loop1:

nop

nop

dec r16

brne loop1

## Your microcontroller is connected to a 16MHz clock. Create a delay that is around (+- 5%):

Solution



If you divide this number with 16, you get a round number:

So make a loop that take 16 clocks and run it 168 times:

delay:

ldi r16, 168

loop1:

nop

nop

nop

nop

nop

nop

nop

nop

nop

nop

nop

nop

nop

dec r16

brne loop1

## Your microcontroller is connected to a 16MHz clock. Create a delay that is around (+- 5%):

Solution



One way of doing this is to create an innerloop that takes 495 clocks. Then an outer loop that add 5 clocks, and then runs 32 times.

delay:

ldi r17, 32

loop2:

ldi r16, 99

loop1:

nop

nop

dec r16

brne loop1

nop

nop

dec r17

brne loop2