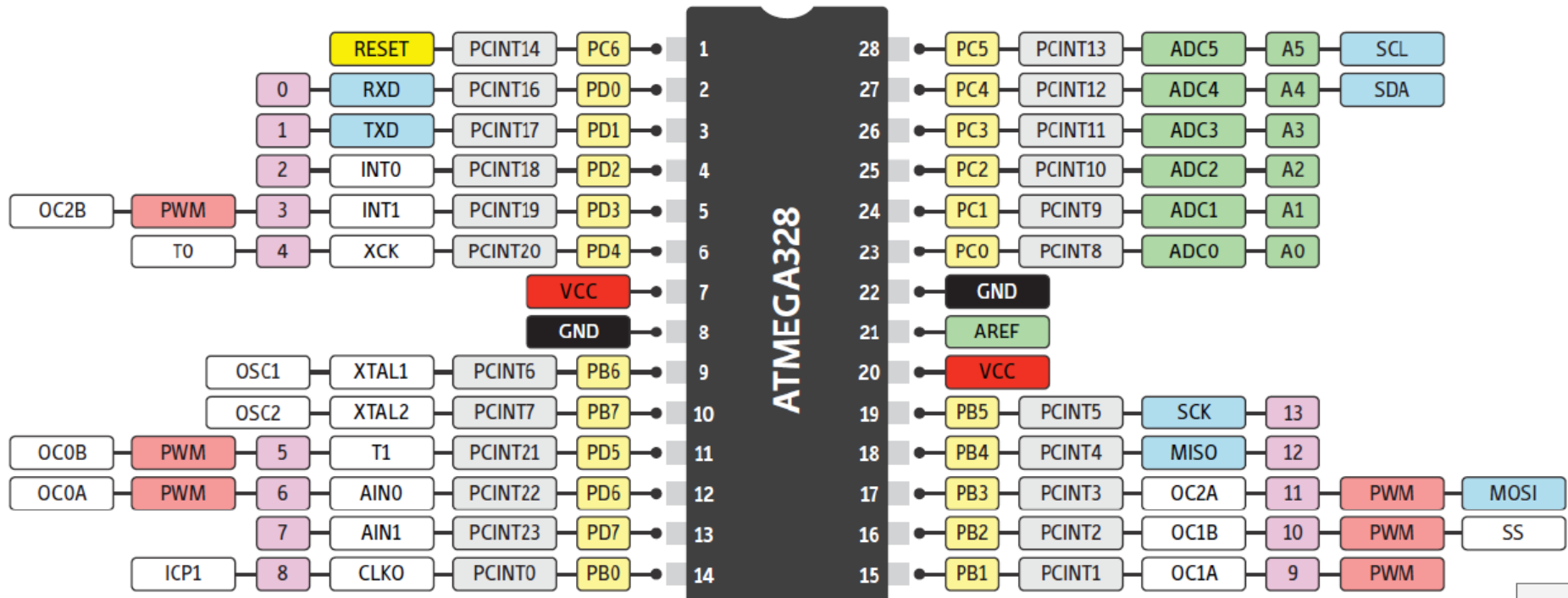


PRIMENA MIKROKONTROLERA

USART - Universal Synchronous Asynchronous Receiver Transceiver

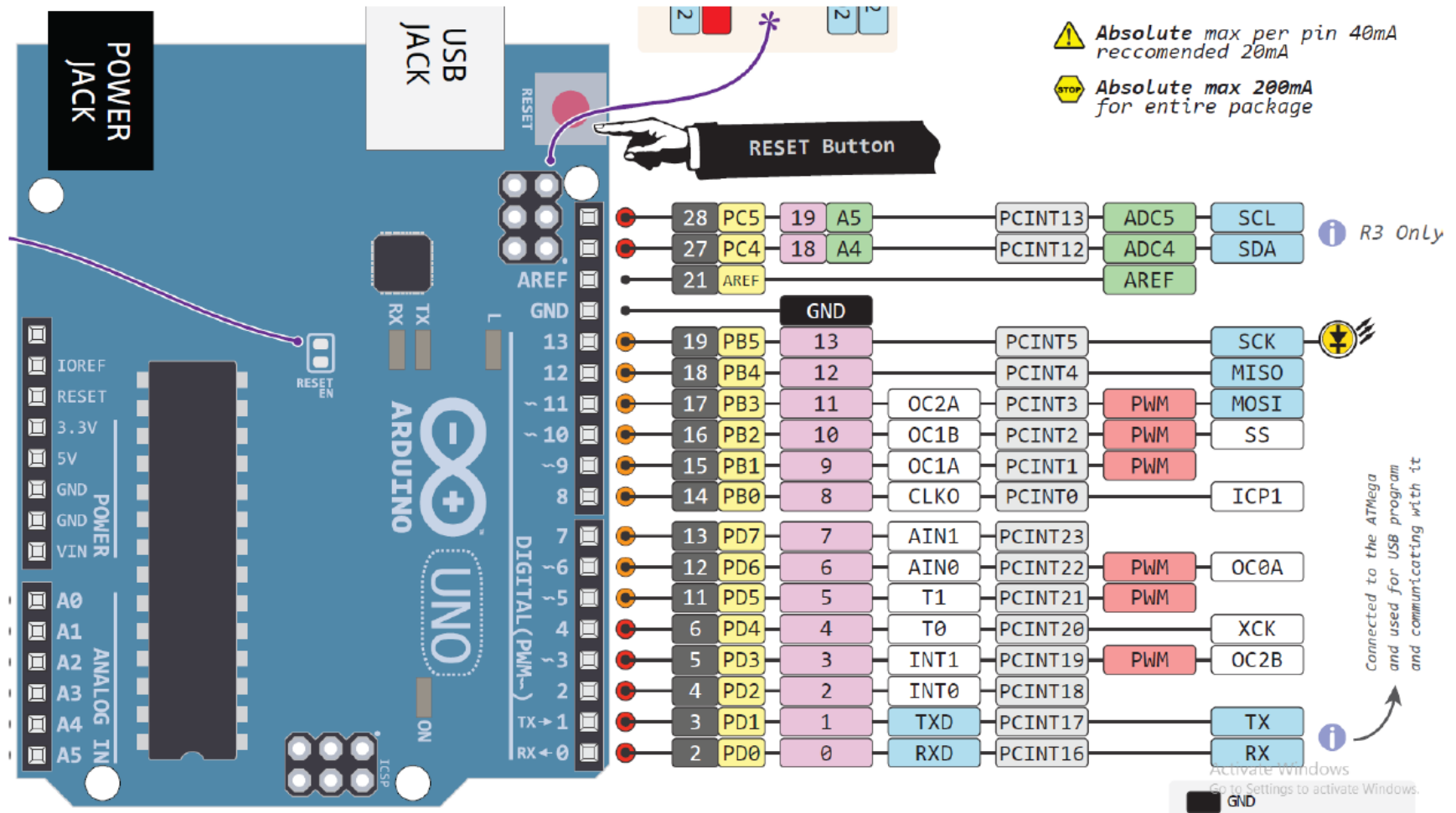
prof. dr Zoran Milivojević
dr Nataša Nešić, viši predavač

Mikrokontroler ATmega328P



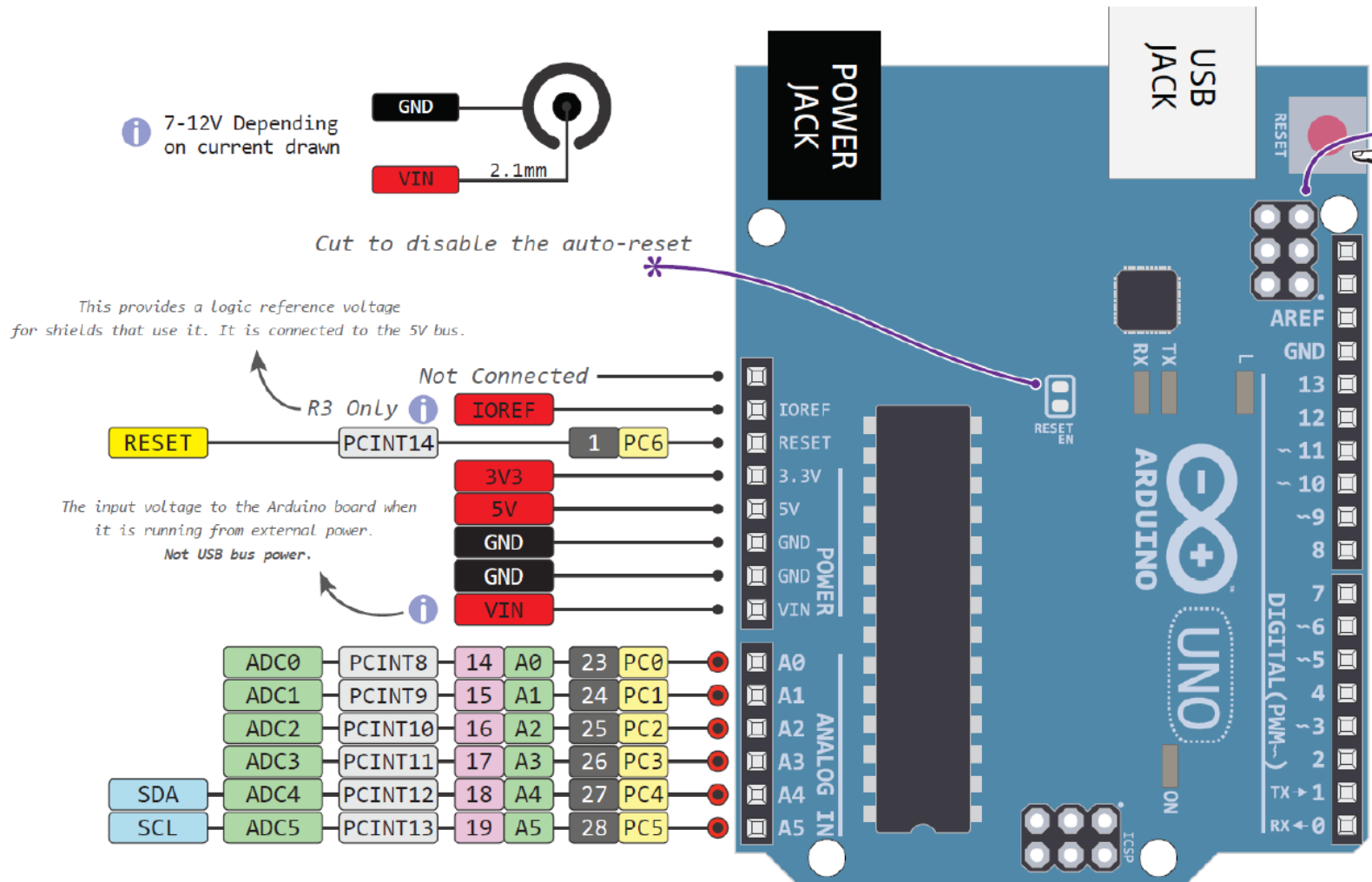
Slika 1. PINOUT dijagram mikrokontrolera ATmega328P.

Arduino UNO

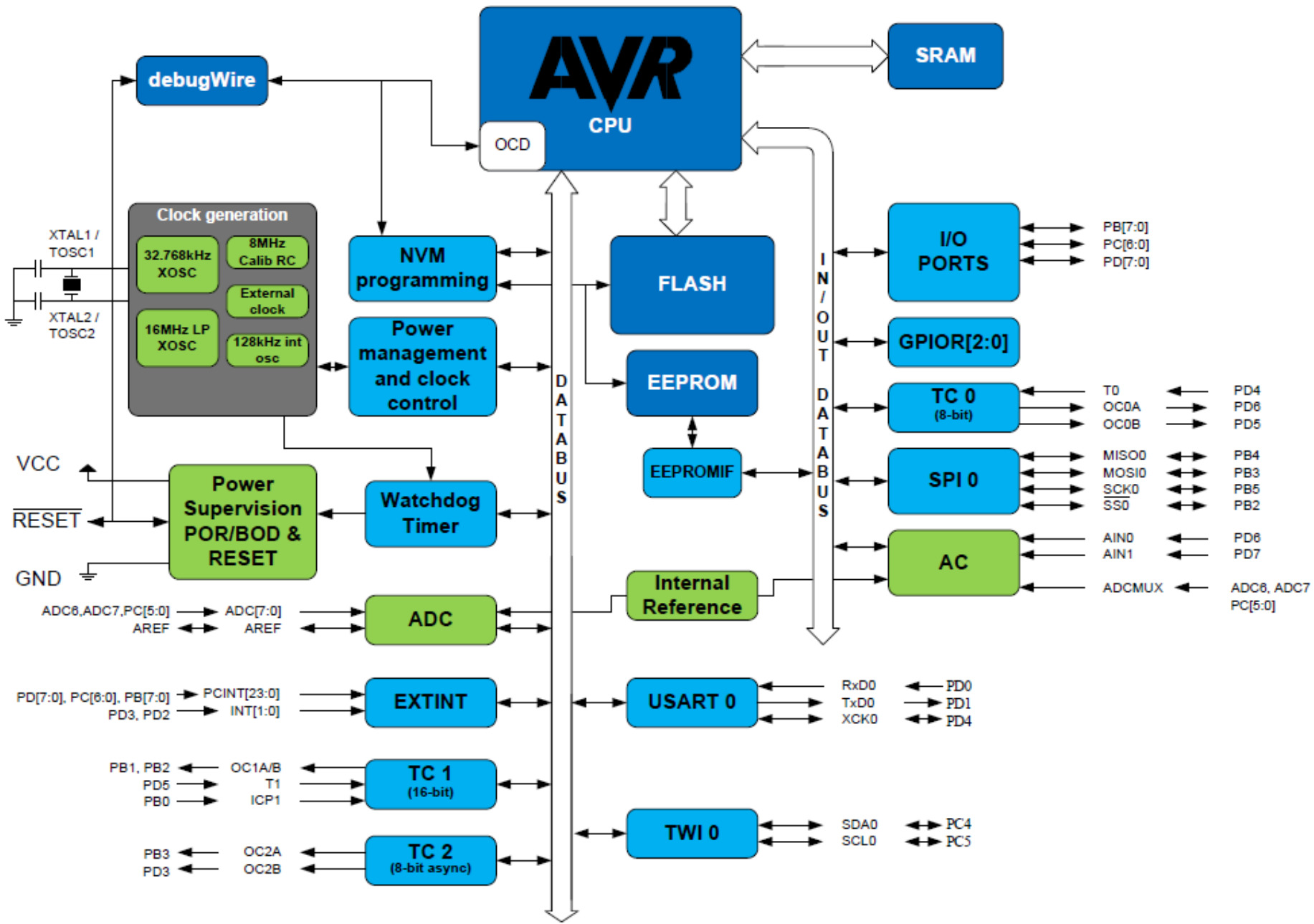


Slika 5. Deo 2 pinout dijagram Arduino UNO sistema.

Arduino UNO

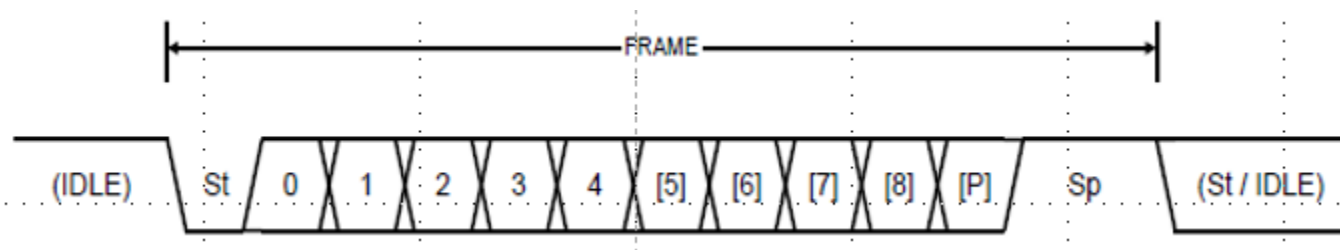


Slika 4. Deo 1 pinout dijagram Arduino UNO sistema.



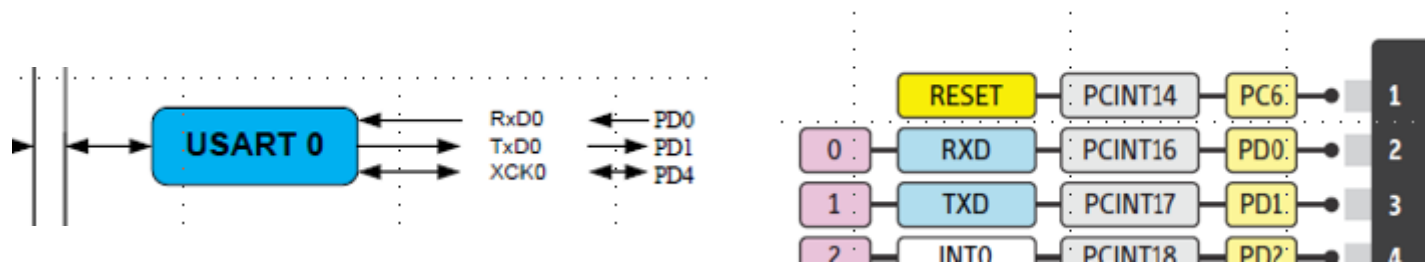
USART

- Napisati program za slanje podataka preko serijskog porta brzinom 9600 bps, sa formatom:
 - start bit
 - 8 bita data
 - 2 stop bita



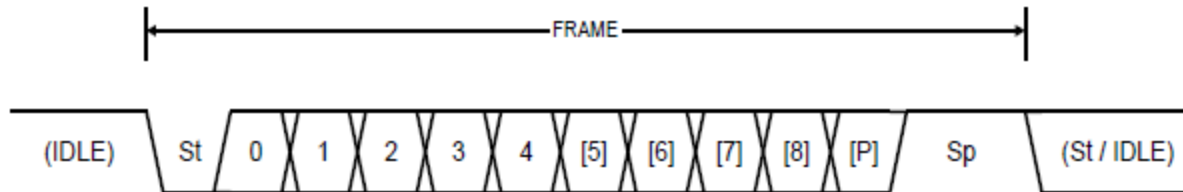
USART

- Osciloskopom snimate napon na TXD pinu.
- Za sinhronizaciju osciloskopa koristiti signal **Test_Pin** na pinu PD2.
- Na graficima signala uociti starp, stop i data bitove.



USART – format prenosa

- 1 start bit
- 5, 6, 7, 8, or 9 data bits
- no, even or odd parity bit
- 1 or 2 stop bits



St	Start bit, always low.
(n)	Data bits (0 to 8).
P	Parity bit. Can be odd or even.
Sp	Stop bit, always high.
IDLE	No transfers on the communication line (RxDn or TxDn). An IDLE line must be high.


```
#include <stdint.h>
#include <avr/io.h>
#include <util/delay.h>

#define Test_Pin 2 // pin za sinhronizaciju prilikom
                  // snimanja signala osciloskopom

#define FOSC 16000000 // takt procesora
#define BAUD 9600 // brzina prenosa
#define MYUBRR FOSC/16/BAUD-1

void USART_Init( unsigned int ubrr)
{
    UBRROH = (unsigned char) (ubrr>>8); /*Set baud rate */
    UBRROL = (unsigned char)ubrr;

    UCSR0B = (1<<RXEN0) | (1<<TXEN0); // Doyvola predaje/prijema

    UCSR0C = (1<<USBS0) | (3<<UCSZ00); /* format: 8data, 2stop bit */
}
```

```
void setup()
```

```
{  
    pinMode(Test_Pin, OUTPUT);  
  
    USART_Init(MYUBRR);  
  
}
```

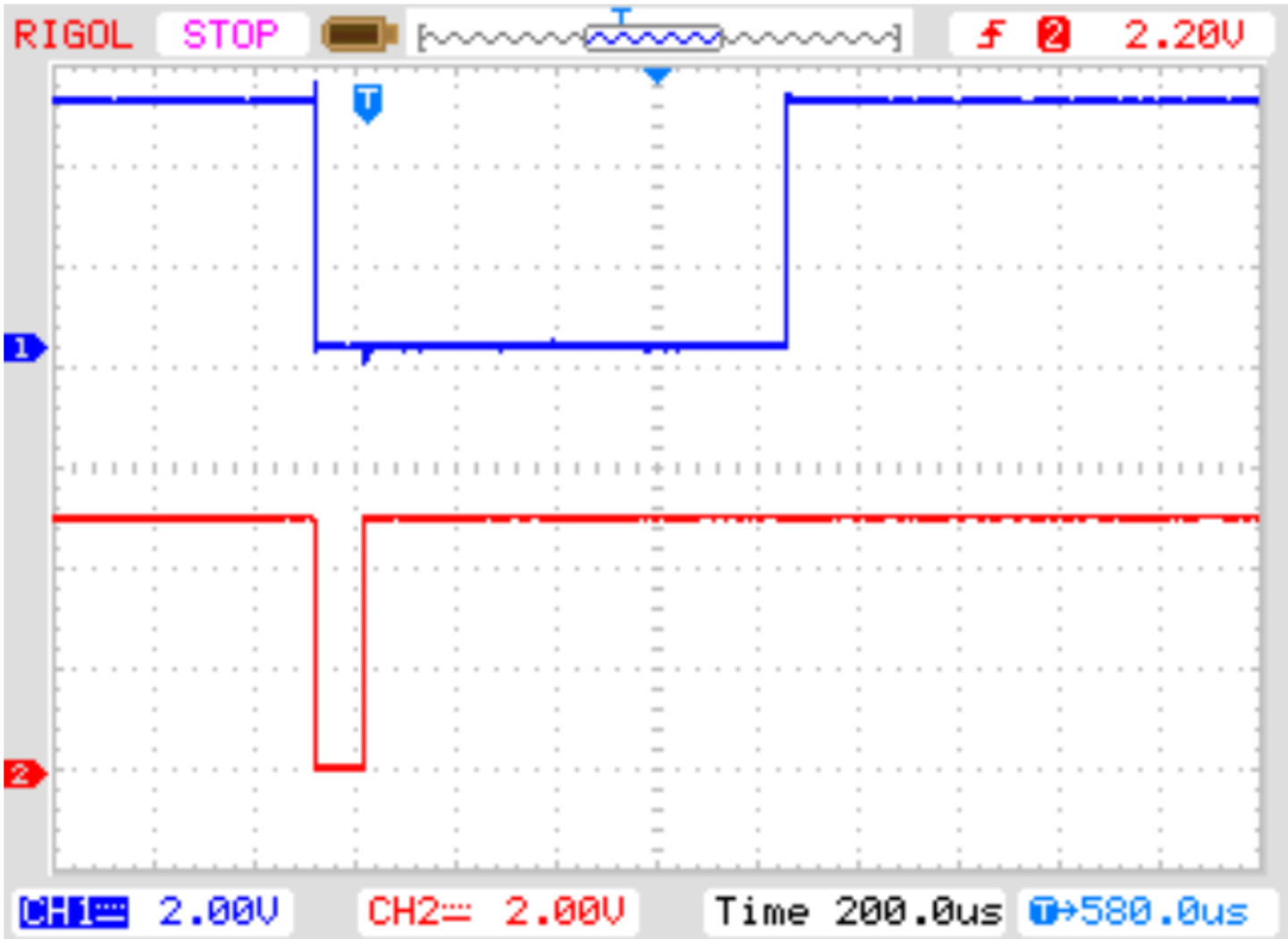
```
void USART_Transmit( unsigned char data )
```

```
{  
  
    while ( !( UCSRA & (1<<UDRE0) ) ) // cekanje da se  
        ; //bufer isprazni  
  
    UDR0 = data; // slanje podatka  
}
```

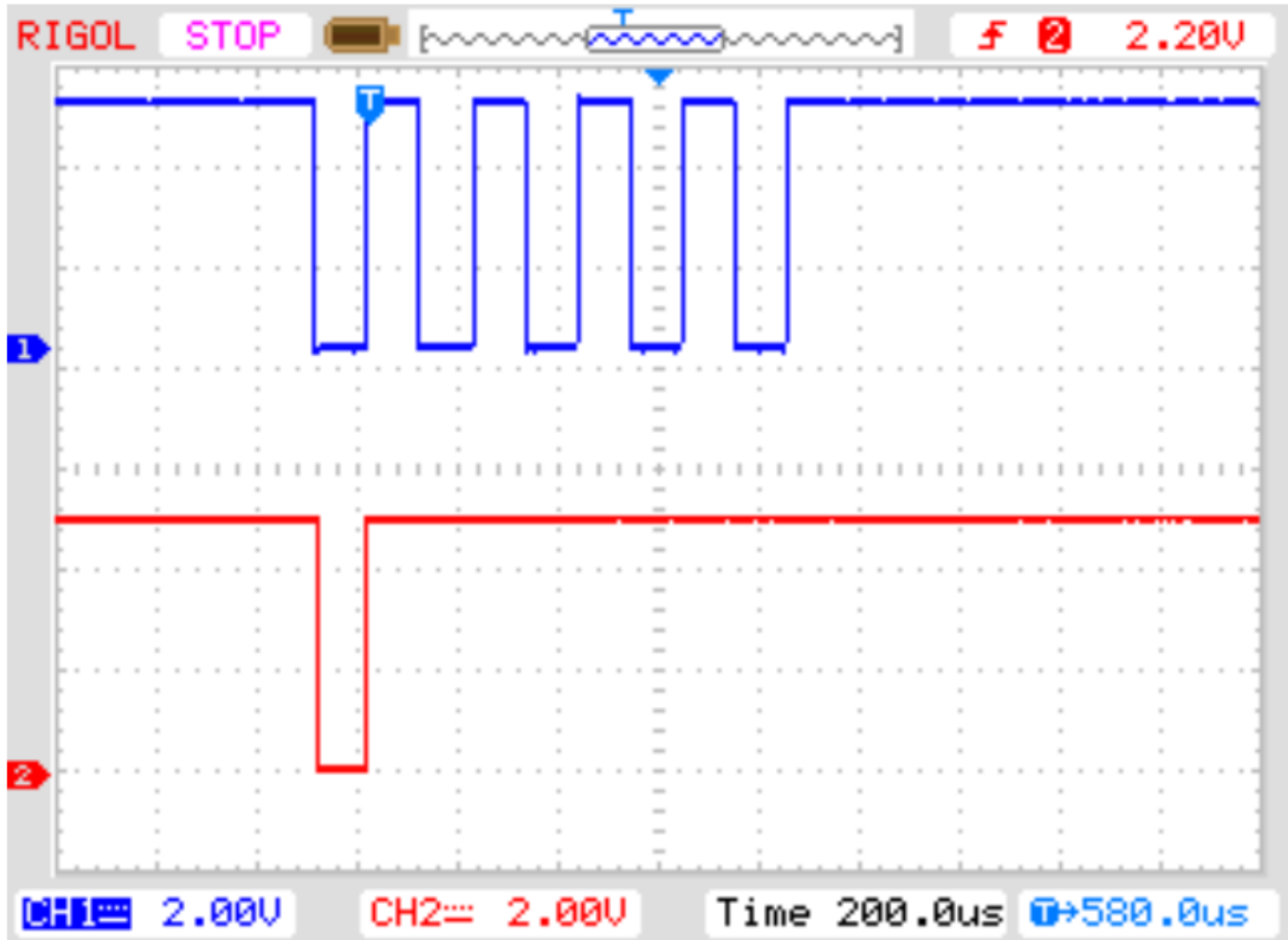
```
void loop()
```

```
{  
    USART_Transmit(0xff) ;  
  
    digitalWrite(Test_Pin, LOW);  
    delayMicroseconds(100);  
    digitalWrite(Test_Pin, HIGH);  
    delay(2);  
}
```

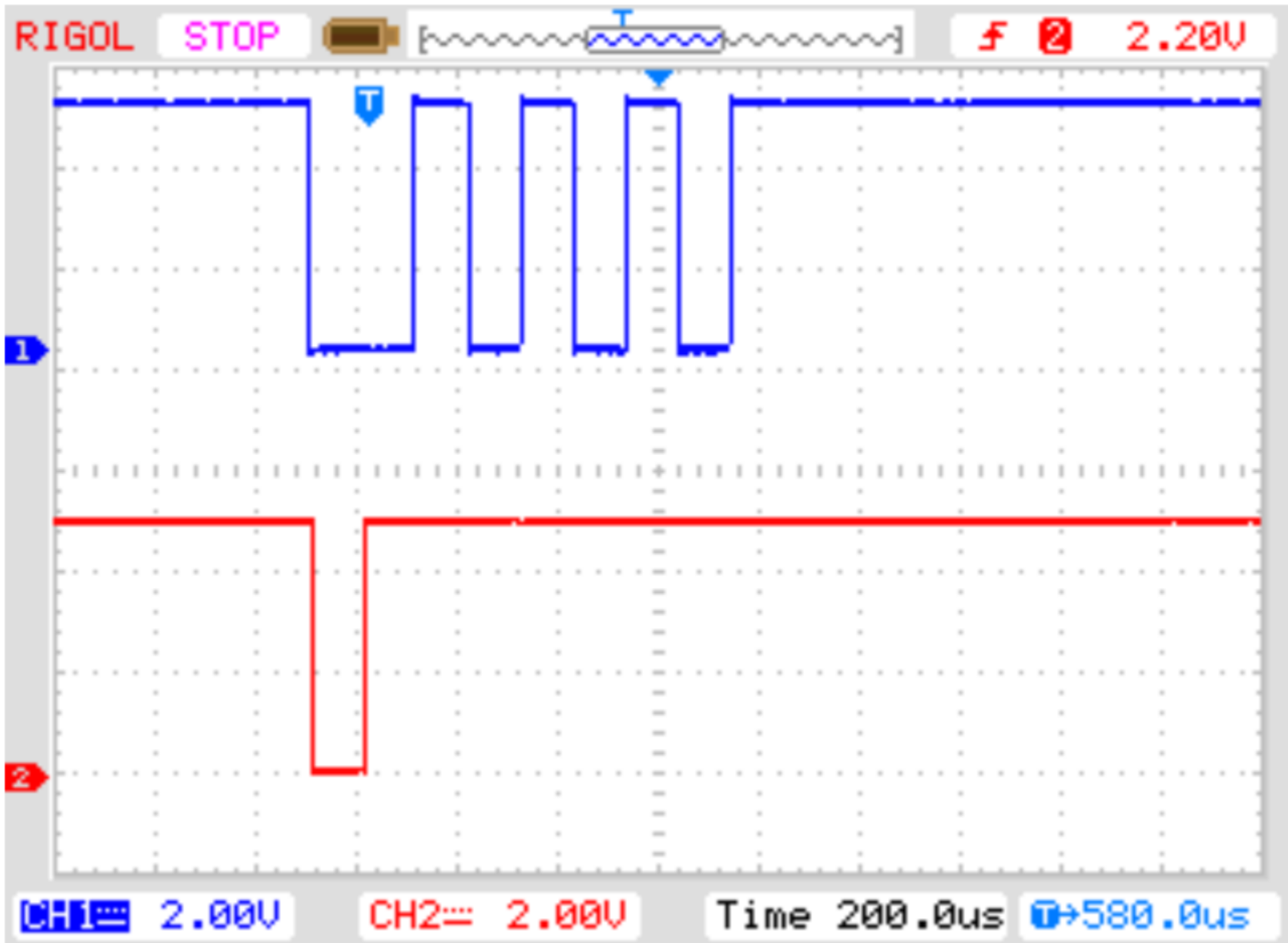
data=0 (b0000000, 0x00)



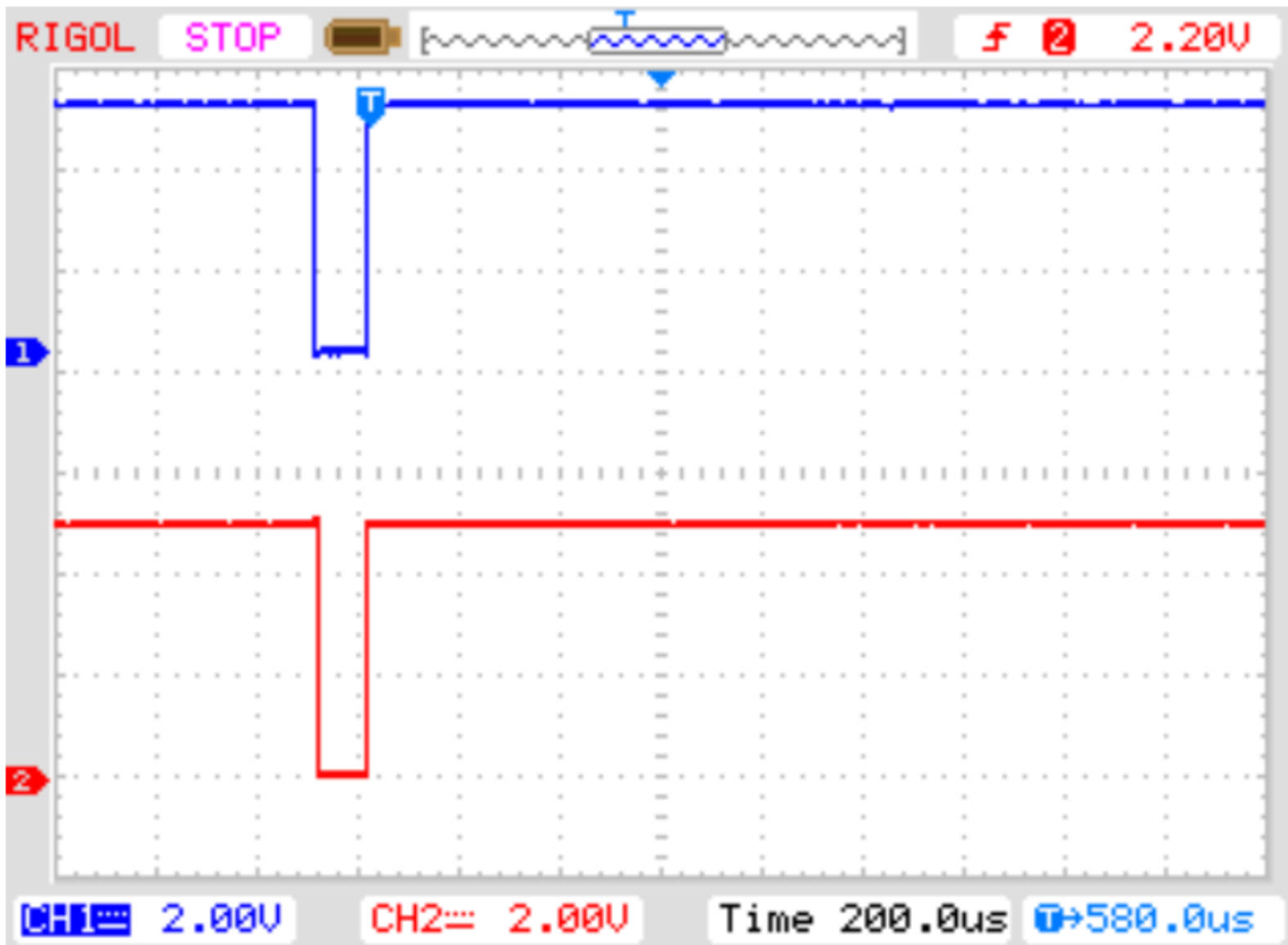
data=85 (b01010101, 0x55)



data=170 (b10101010, 0xaa)



data=255 (b11111111, 0xff)



• **HVALA NA PAŽNJI**