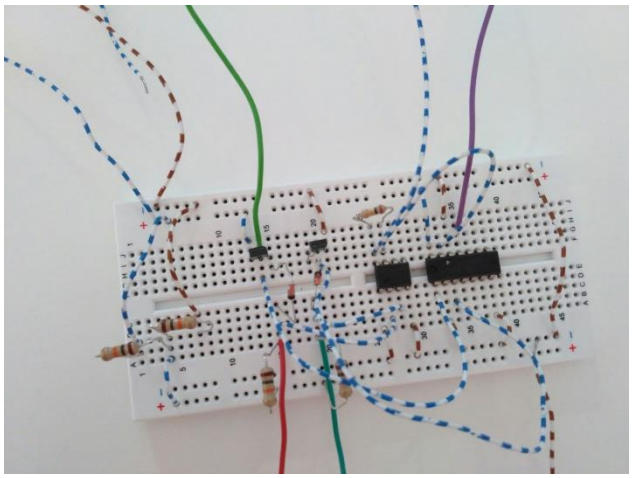
Keerthi Datta K R (01647641), Maja Ovcarik (11775894), Yashas Nagaraj Udupa (1647695)

3. Exercise 2: CAN Transceiver Assembly

1.Provide the list of components of your transceiver and explain why you chose each of them.

- pMOSFET 1 https://www.conrad.at/de/mosfet-diodes-incorporated-zvp2110a-1-p-kanal-700-mw-to-92-3-563632.html
- nMOSFET 1 https://www.conrad.at/de/mosfet-diodes-incorporated-zvnl110a-1-n-kanal-700-mw-to-92-3-563625.html
    - PMOS and NMOS used to switch the input we receive from TX pin
- Diodes 2 https://www.conrad.at/de/z-diode-zpd33-gehaeuseart-halbleiter-do-35-diotec-zener-spannung-33-v-leistung-max-ptot-502-mw-180041.html
    - To transfer PMOS source output from TX to CAN_high
    - To pass CAN_low to NMOS drain.
- Resistors – 10k Ω
    - To divide voltage
- Inverter https://www.conrad.at/de/logik-ic-gate-texas-instruments-cd4077be-xnor-exclusive-nor-4000b-pdip-14-173347.html
    - To invert state of signal
- Comparator https://www.conrad.at/de/linear-ic-komparator-texas-instruments-lm311p-mehrzweck-dtl-mos-offener-kollektor-offener-emitter-rtl-ttl-pdip-8-175994.html
    - Used to get differential signal from CAN_Low and CAN_high

2. Provide a schematic of the circuit and highlight the driver and comparator, as in Figure 3.1.



Picture 1. Circut

Purple wire – RX

Light green – TX

Red wire – CAN_High

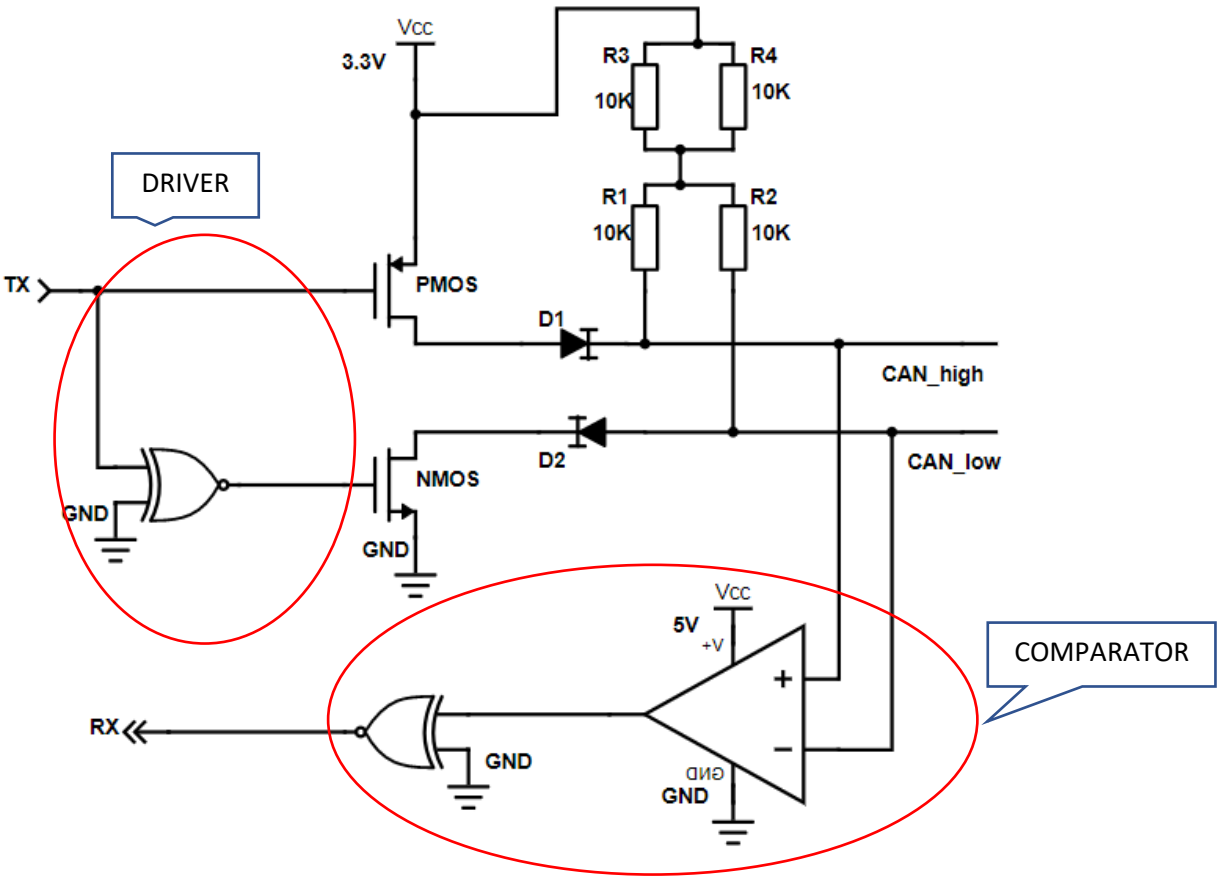
Green wire – CAN_Low

Blue wire – VCC (3.3V)

Brown wire – GND

8-Dip -> Comparator

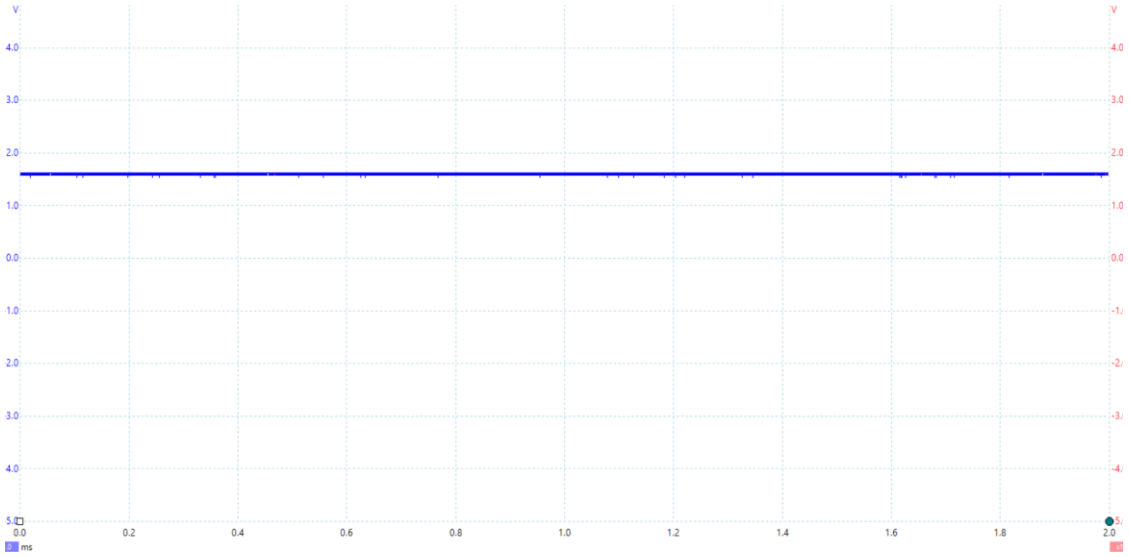
14-Dip -> NOR Inverter



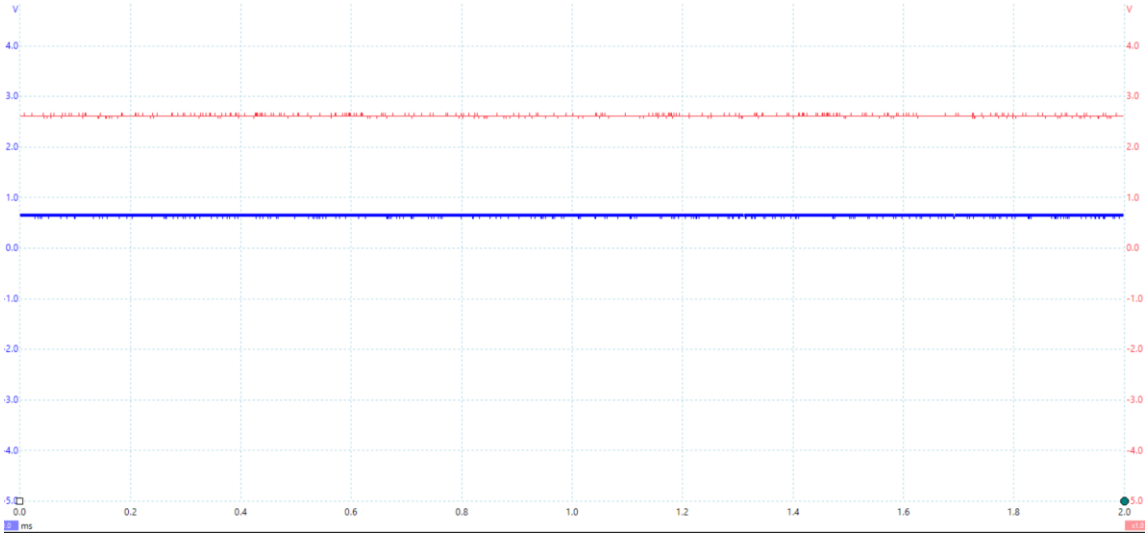
Picture 2. Schematic

3. Explain how the transceiver works and provide a screenshot showing its behavior based on the signals CANH, CANL, Tx and Rx.

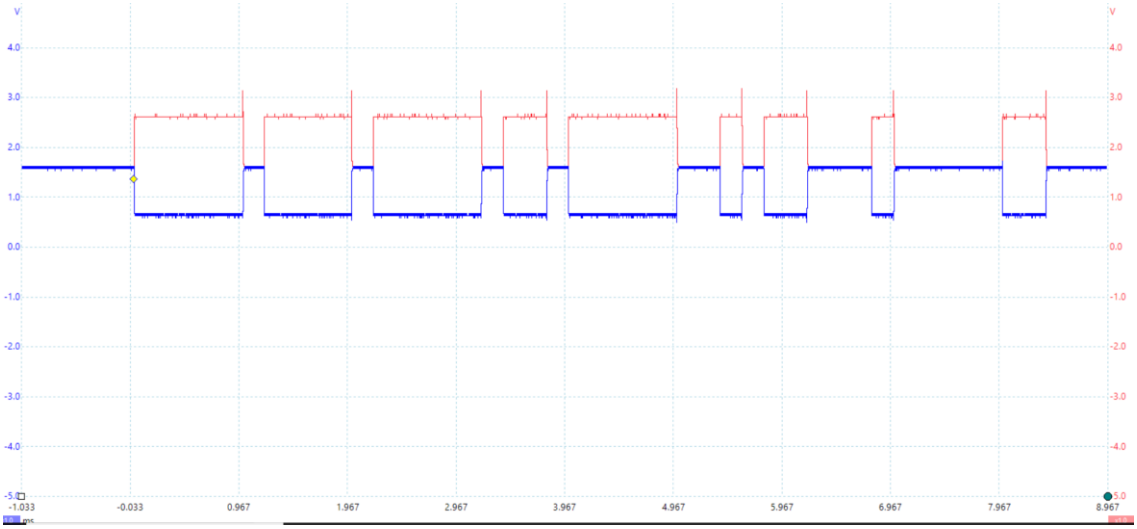
- Main purpose of transceiver is to communicate between ECUs. In our case it's communication between two MSP430, with transceiver in between.
- One MSP430 at the transmitting end is connected to TX pin of transceiver and the other MSP430 is connected to RX pin at the receiving end of the transceiver.
- Whatever signal value received at TX, transceiver process the signal to the RX trough different combination of components.
- If signal value of TX is 0, PMOS pass VCC to the diode and the diode transfers it to CAN_high output. At the same time, input for NMOS is inverted and diode allows CAN_low to pass through the NMOS transistor to ground. In our case, voltage of CAN_low is 0.7V and CAN_high is 2.6V.
- If TX signal value is 1, according to logic mentioned before, CAN_low and CAN_high gets the same value (VCC/2). In our case, this value is 1.65 V and the state of the bus is recessive.



Picture 3. CAN_low and CAN_high - TX=1



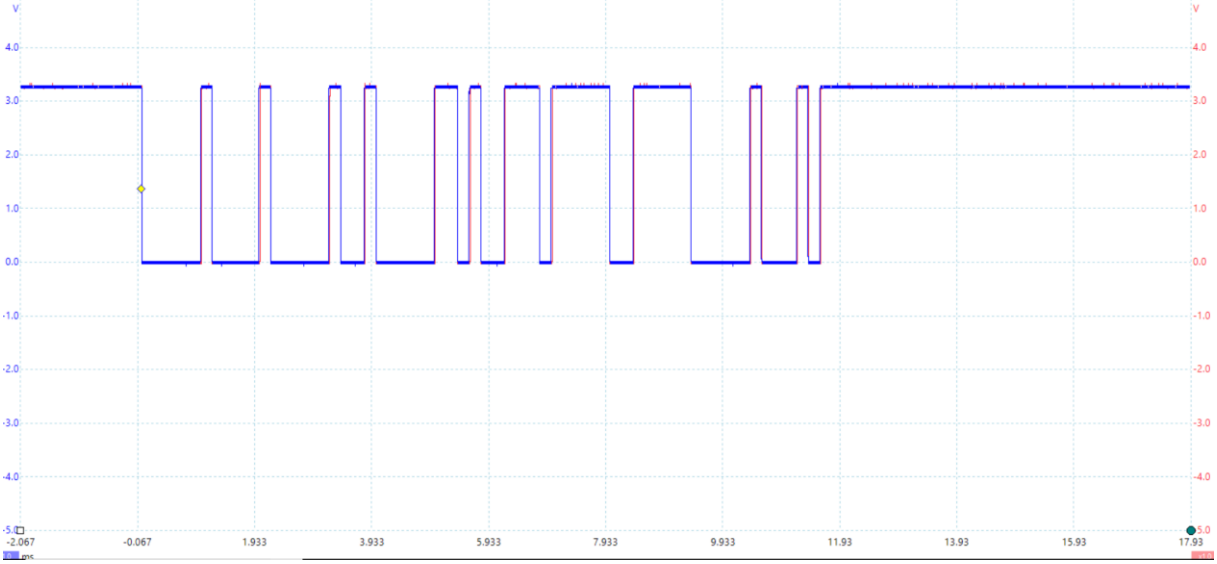
Picture 4. CAN_low and CAN_high TX=0



Picture 5. CAN_low and CAN_high - differential signal

4. Check and explain the behavior of the Rx signal in case the comparator has no hysteresis.

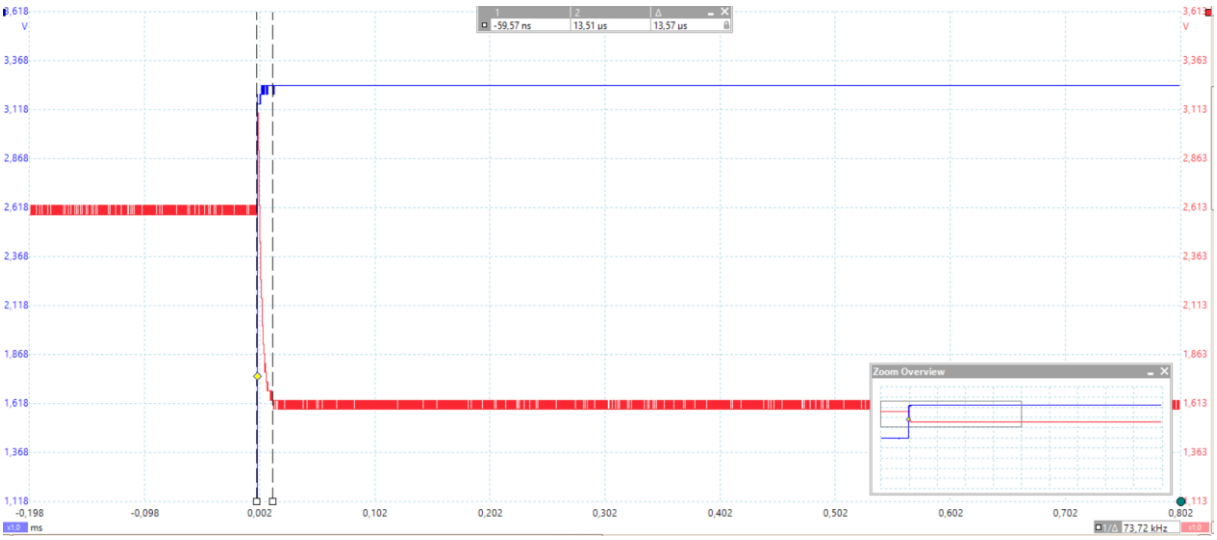
If comparator has no hysteresis, RX and TX would be completely synchronized. Otherwise there is small delay between RX and TX signals even for small baud rate. We can see that in picture 4.



Picture 6. Baud rate 5000

5. What is the propagation time from Tx to the lines CANH and CANL? And from the lines CANH and CANL to Rx?

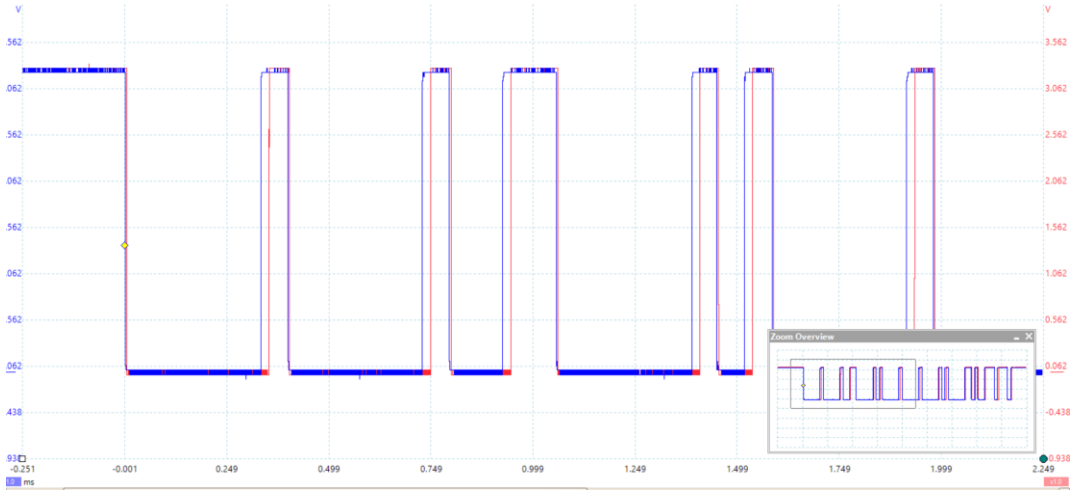
- As we can see in the picture below -> propagation time is 13.57µs



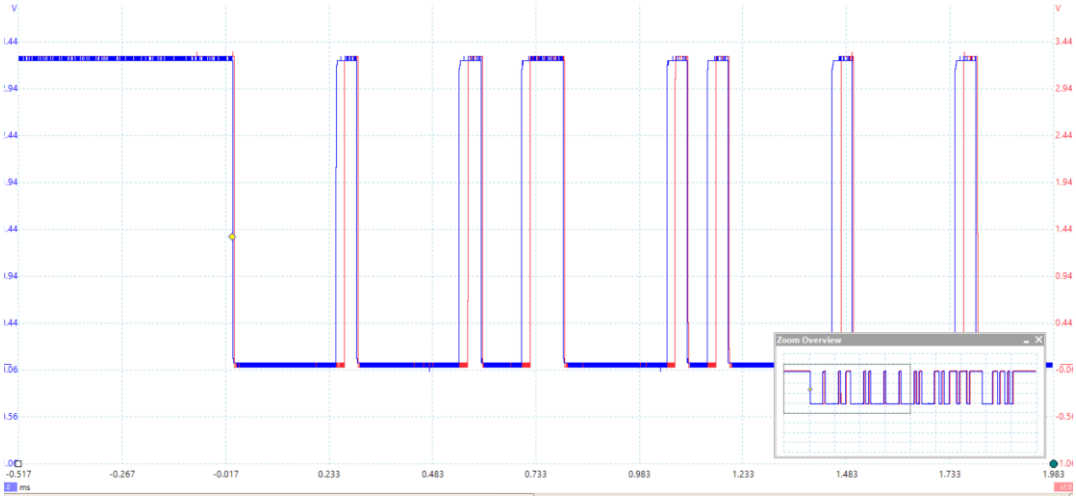
Picture 7. CAN propagation time

6. What is the transceiver’s maximum supported baud rate? Explain how this value was obtained.

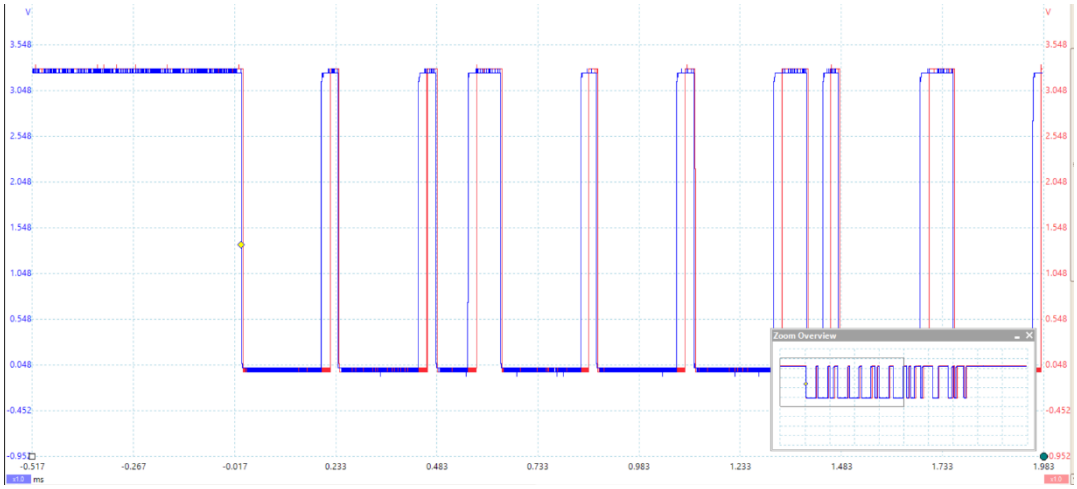
- Transceiver's maximum supported baud rate is 22000, everything higher than this baud rate results with RX reflects TX less than 50% of a bit width.



Picture 8. Baud rate 15000



Picture 9. Baud rate 20000



Picture 10. Baud rate 25000