CAN-level shifter for MOPS

Technical Information / Short User Manual

Peter Kind, University of Wuppertal, 8.8.2023
kind@uni-wuppertal.de

General

The “CAN-level shifter” (also called “CAN-loop breaker” or “CAN-Adapter”) is a small circuit, which converts the normal CAN-level of a commercial CAN-interface (typ. 5 V or 3.3 V) to the 1.2 Volt CAN level needed by the MOPS chip. **The MOPS chip has an internal voltage of 1.2 V and would be damaged, if a normal CANH/CANL signal with levels higher than 1.2 V is applied.**

The circuit consist of a 5-V-CAN-transceiver (CANH/L to RX/TX) and a 1.2-V-CAN-transceiver (CANH/L to RX/TX). Between both transceivers is a so called loop breaker logic, for details see Appendix, circuit description item d).

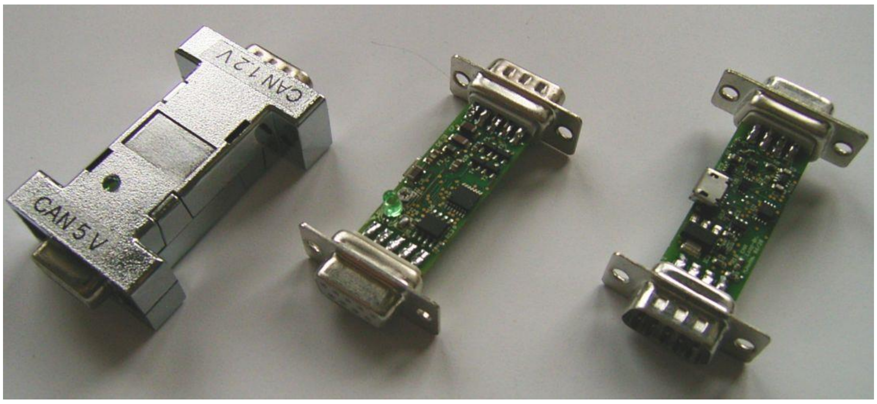


Fig. 1, left: The CAN-Level shifter in double-SUBD9-Box. Middle/right: both sides of inside circuit

Usage

The CAN-level shifter has at the "CAN 5-Volt-side" a SUBD9-female connector. Here the SUBD9-male connector of a commercial CAN-interface (e.g. USB-CAN-interface) is connected. A 120 Ohm termination resistor is already in the level shifter device.

The commercial USB-CAN-interface is connected via USB to a PC.

The CAN-level shifter has at the "CAN 1.2-Volt-side" a SUBD9-male connector. Here the SUBD9-female connector of the CAN bus of the MOPS chip is connected. This CAN bus needs an external 120 Ohm (or 100 Ohm) termination resistor.

The CAN-level shifter has at one side in the middle a USB-micro-socket. Here a Micro-USB-cable is connected to provide a 5-V-power. This socket is only for 5-V-powering, no USB data function!
With power, the green LED near the CAN-5-V-SUBD is on.

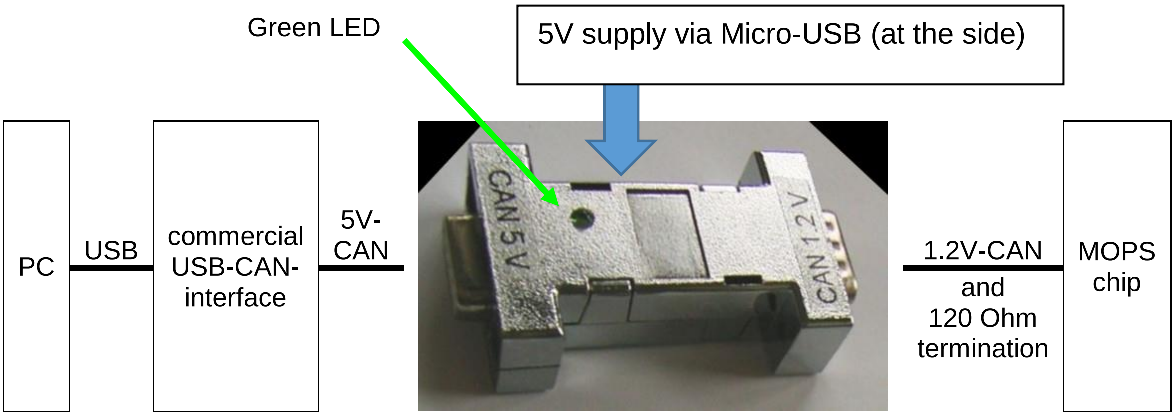


Fig. 2: Connections of the CAN-Levelshifter

Pin assignment

"CAN 5-Volt-side" a SUBD9-female connector.		
Pin	**Signal** (name in schematic)	**comment**
2	CANL_1	5V-CAN-Bus L
3	GND	(CAN-Bus GND)
7	CANH_1	5V-CAN-Bus H
1,4,5,6,8,9	NC	No connection

"CAN 1.2-Volt-side" a SUBD9-male connector.		
Pin	**Signal** (name in schematic)	**comment**
2	CANL_2	1.2-V-CAN-Bus L
3	GND	(CAN-Bus GND)
7	CANH_2	1.2-V-CAN-Bus H
1,4,5,6,8,9	NC	No connection

USB-micro-socket.		
Pin	**Signal** (name in schematic)	**comment**
1	+5V_USB	5 V (power supply plus)
2	NC	No connection
3	NC	No connection
4	NC	No connection
5	GND	GND (and power supply GND)

Appendix: circuit description, layouts and schematics

Circuit description (see schematic on following page)

The circuit consists of 4 functionality groups:

a) At the upper left on the schematic the device "CAN1" (IC6) is a commercial CAN driver (e.g. PCA82C250T) to transform the 5-Volt-CANH/CANL into the unidirectional RX1 and TX1 signals.

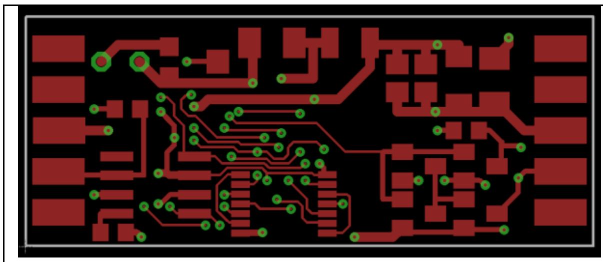
b) In the middle part of the schematic is the 1.2-Volt-CAN-interface, designed by Wuppertal.
The signal "TX2_1.2V" is driven by the MOSFETs T1..T4 into CANH_2/CANL_2 which is the 1.2-V-CAN-bus. The bus signals are received and transformed into "RX2_5V" by a fast comparator IC8 (TLV3501).

c) The logic level downscaling of TX is done by IC9, its supply voltage VB needs to be adjusted by TR1 to have a “clean” signal by the MOSFET-driver. One can change the values of R10 and TR1 to 470 Ohm and 1 kOhm (10 times smaller, even for lower supply voltages)

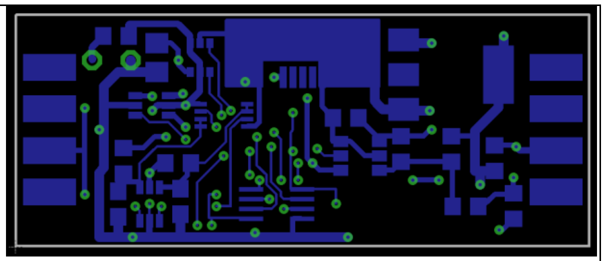
d) The most tricky part is the so called loop breaker at the upper side of the schematic between signals TX1/RX2 and TX2_5V/RX2_5V. One can NOT feed the RX1 (from IC6) directly as TX2_5V into the 1.2-Volt-driver, because this creates a loop: A dominant bit would cause a dominant state on the 1.2-V-CANH/L, this will cause a dominant bit RX2_5V and this - if also feed directly back to IC6 as TX1 - causes a dominant state on the 5-Volt-CANH/L, which causes a dominant state on RX1 and so on ... One needs an arbitration logic to prevent this loop. The circuit between IC31 and IC32 is based on a design of Texas instruments (TIDA-01487: Isolated CAN FD Repeater Reference Design).

e) To power the device, a Micro-USB-connector (X3, right side of schematic) is foreseen.

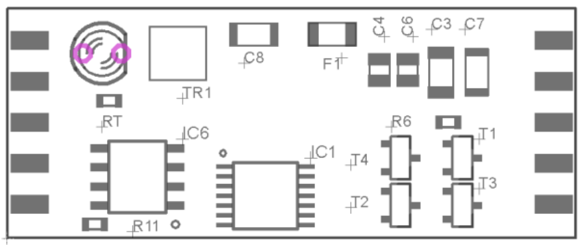
Layouts



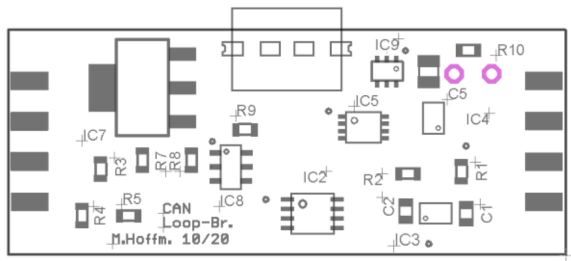
Top layout



Bottom layout (mirrored)

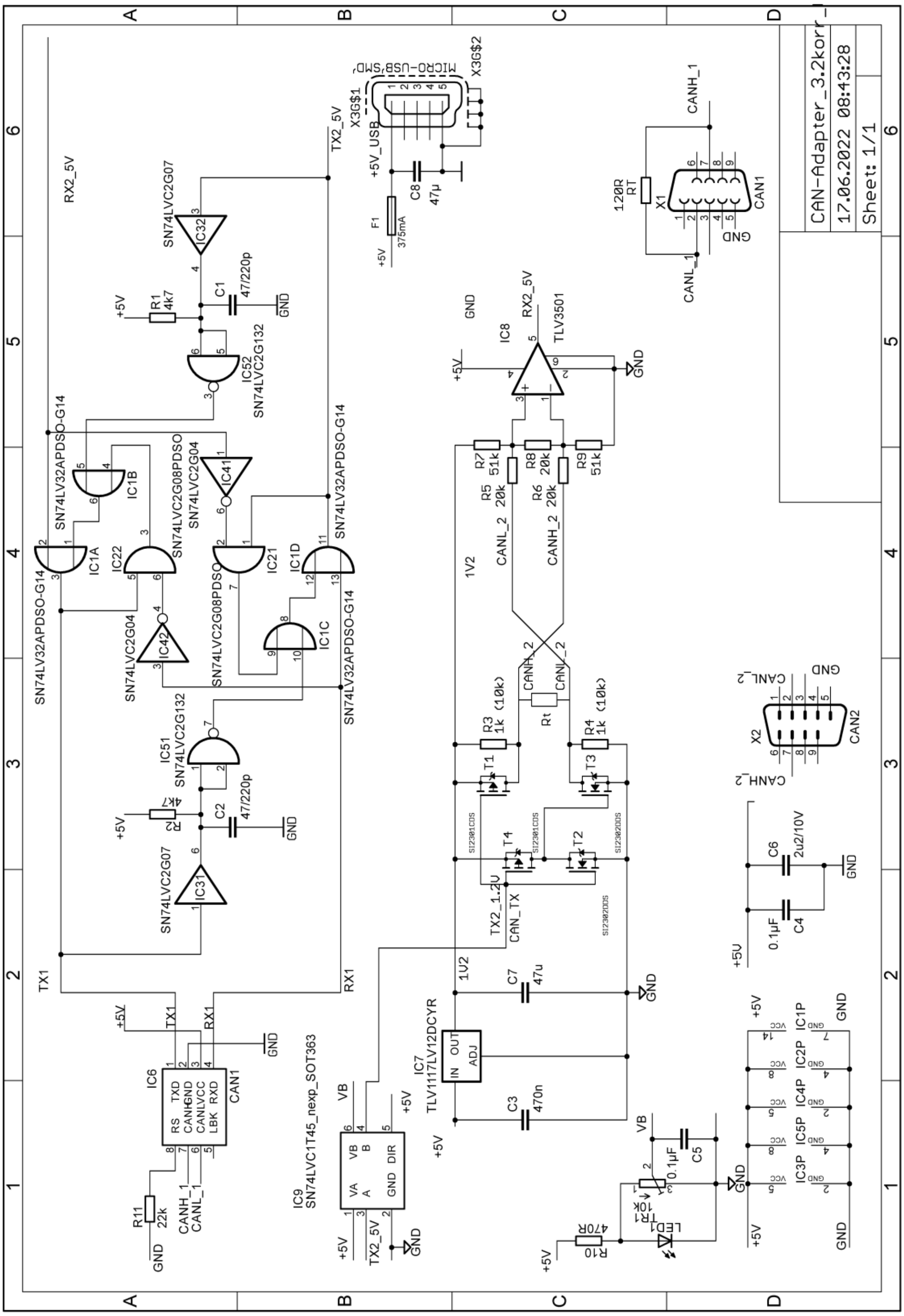


Top placement



Bottom placement

Schematic



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