DCAN500 Evaluation Board Manual

YAMAR
EVB Manual

1. Overview

The DCAN500 evaluation board (EVB) allows easy testing of the DCAN500 device in a system. Multiple DCAN500 EVBs can communicate over a vehicle's DC powerline using the CAN2.0 A/B protocol.

Figure 1 presents the EVB. This manual describes how to use and interface with the EVB. The DCAN500 data sheet is a reference to this document.
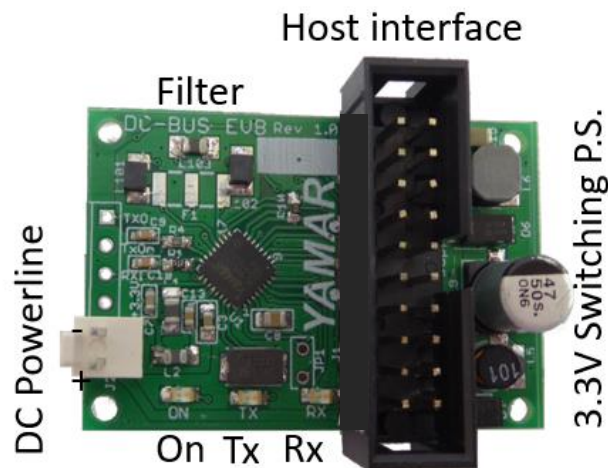

Figure 1 - DCAN500 EVB

2. DCAN500 EVB Description

2.1 Block Diagram Description

The EVB contains all the required hardware for device operation such as a line protection network, filter, 16MHz crystal, and a 3.3V switching power supply. The board is a physical layer of the CAN protocol over DC powerlines at CAN Host bitrate of up to 1Mbit/s. The EVB connects directly to a CAN controller (ECU) through its TX and RX pins connected to HDI and HDO pins in the J1 Host connector. The EVB block diagram is depicted in Figure 2. When the HDC pin is low, the data from the ECU is used to configure the DCAN500 for the desired communication frequency and other parameters as described in the DCAN500 datasheet.
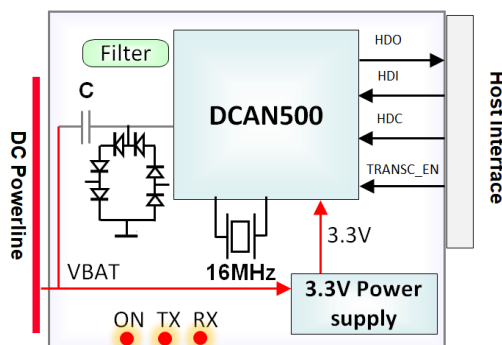

Figure 2 - DCAN500 EVB Blocks

The received data signal from the DC powerline passes through a protection network into the DCAN500 device. The DCAN500 decodes the data and output it on the HDO pin of the Host interface connector.

On the transmitter side, data from the ECU transferred to the DCAN500 on the HDI pin. The DCAN500 processes the data that is encoded into a CAN frame. At first, powerline arbitration is performed based on configured CAN message ID before transmitting the CAN frame which is encoded with an error correction code. The powerline frame is modulated on the selected carrier frequency on the TXO pin that drives the DC powerline via the protection network and coupling capacitor.

The built-in switching power supply provides the 3.3V voltage required for the DCAN500 operation. The power supply operates in a wide input voltage range between 10V and 36V. The EVB current consumption is in the range of 30mA depending on the supply input voltage (powerline voltage).

The DCAN500 internal registers, as described in the DCAN500 datasheet determine the EVB operation conditions such as carrier frequency. The CAN bitrate is determined by 100K resistors on the BR_SEL0 and BR_SEL0 resistors setting on the PCB (see Figure 4, and DCAN500 datasheet). When HDC signal low the data is directed as a command, allowing WRITE-REG and READ-REG to/from the DCAN500 internal registers.

2.2   Hardware features
- Noise robust DC powerline Communication
- CAN A/B host interfaces
- Selectable CAN bitrate between 83.3Kbps to 500kbit/s using BR_SEL[1:0] pins, and 1Mbit/s by accessing the DCAN500 bitrate configuration registers (see datasheet **Annex A** for more details).
- 251 selectable operating frequencies (5MHz to 30MHz, 100kHz spacing)
- 10V to 36V operation using switching power supply
- Indication LEDs
- Small size EVB

2.3   EVB Connectors
2.3.1   J1 – Host Interface Connector
Table 1 – J1 Host interface connector

Pin Name	Direction	PU	Pin #	Pin Name	Direction	PU	Pin #
Reserved			1	Reserved			2
NRESET	I	PU	3	Reserved			4
INH	O		5	TXON	O		6
INTERFERENCE	O		7	BUS_BUSY	O		8
BE_SEL0	I		9	BR_SEL1	I		10
RTR	O		11	TRANSC_EN	I	PU	12
NSLEEP	I	PU	13	HDC	I	PU	14
HDO	O		15	HDI	I	PU	16
VCC (3.3V) output	P		17	GND	P		18
GND	P		19	VBAT (powerline) * Requires R6 = 0Ω	P		20

All input and output signals are compatible with 3.3V CMOS logic.

2.3.2   J2 – DC Power Line and test points

Name	Pin #
TXO test-pin	1
TXON test-pin	2
RXI test-pin	3
3.3V output from the power supply	4
GND	5
VBAT DC powerline input	6

Table 2   J2 – DC Power Line and test points

VBAT input connects the EVB to the DC powerline for communication and power supply.

Power supply requirements: 10V to 36V, minimum 150mA.

2.3.3   Display LEDs

- TX LED - Indicates transmission.
- RX LED - Data output, indicates reception.
- ON LED - Indicates 3.3V power on.

2.4   Mechanical Data

The mechanical dimension is depicted in Figure 3.
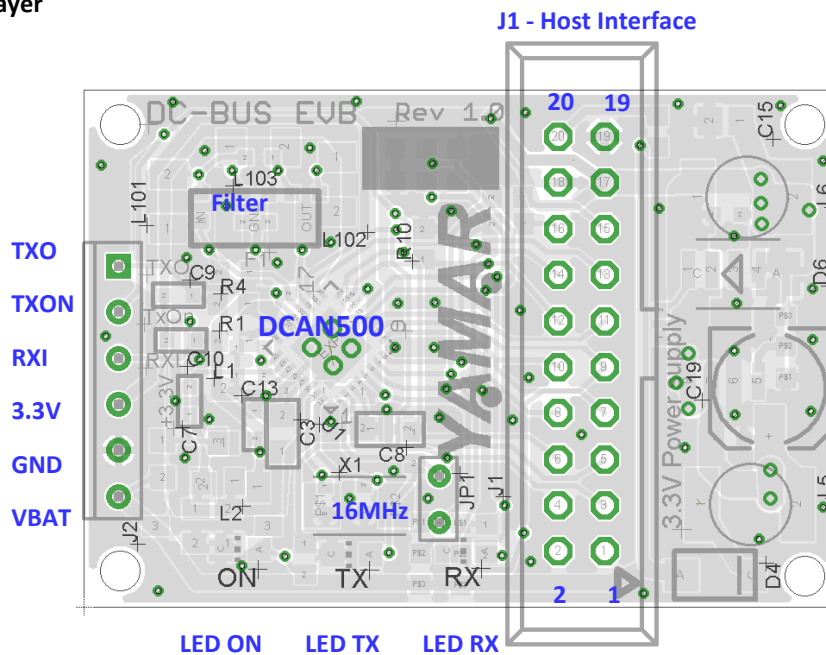
2.4.1   Top Layer

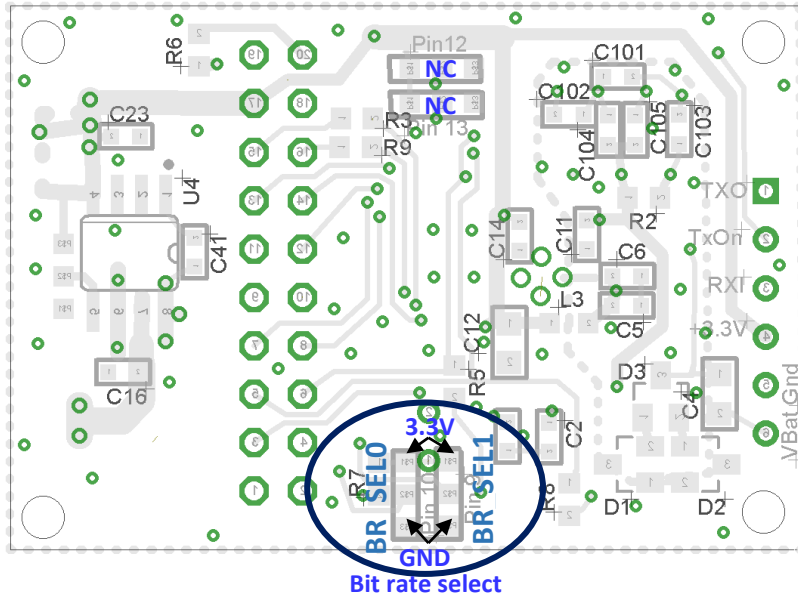**Figure 3 - EVB Top layer**

2.4.2 Bottom Layer

Figure 4 - EVB Bottom layer

3. EVB Operation

3.1 Configuration

The DCAN500 mode of operation and its settings are configured at power-up, reset, and when Host writes into its internal register (command mode, using the HDC pin). Please refer to the DCAN500 datasheet for further configuration information.

3.2 Interfacing to DCAN500 EVB

The DCAN500 EVB is designed to interface directly to any CAN controller or through a CAN transceiver.

The Host Interface connector J1 has all the signals required for the EVB proper operation. Three signals are essential; HDI, HDO, and GND (Data In, Data Out, and Ground). When designing the DCAN500 for operation on setting other than the default (frequency, Sleep, etc.), the HDC pin has to be connected to any output pin of the CAN controller for setting the DCAN500 to the desired operation. Refer to DCAN500 datasheet.

When using an external power supply instead/or in parallel to the EVB's power supply, it is recommended to add an inductor of at least 22uH in serial to the external power supply to avoid strong attenuation due to the power supply internal filtering capacitors.

3.2.1 Interfacing to a CAN controller

The DCAN500 interfaces directly to a CAN controller CAN-TX and CAN-RX pins, (3.3V logic) (TRANSC_EN pin must be tied to GND). Optionally, it is possible to interface to traditional CAN-BUS through CANH and CANL signals using an external CAN transceiver (TRANSC_EN pin should leave floated). However, do not use a mixed network containing both traditional CAN-BUS nodes and DCAN500 nodes.

The CAN communication protocol uses five pins as described in Table 3.

Table 3 - CAN interface pins

HDI	Data Input from the CAN controller.
HDC	Data/Command select input. When pulled down, the DCAN500 enters command mode, enabling access to DCAN500 control registers.
HDO	Data output to the CAN controller
RTR	Ready to Receive output (optional feature). Indicating that the device is ready to receive new data bytes from the controller (i.e. RX-FIFO is not almost full). Used to control the data flow between the controller and the DCAN500 (see DCAN500 datasheet).
TRANSC_EN	External CAN Transceiver enables pin input. When interfacing a CAN controller this pin must be tied to GND. HDI is loopback to the HDO. When interfacing a CAN transceiver this pin can be left floating. No loopback between HDO and HDI.

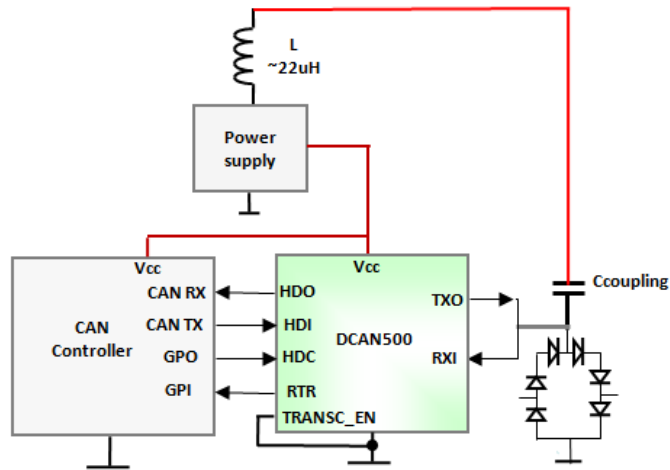Figure 5 depicts a typical DCAN500 to CAN controller interface connection.

Figure 5 - DCAN500 to CAN Controller interface

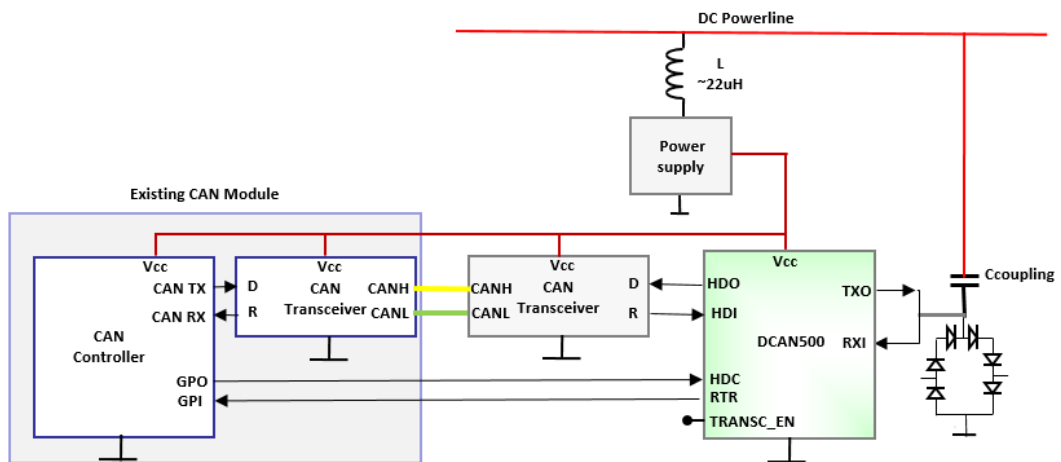Figure 6 depicts DCAN500 to CAN module connection via CAN transceiver.

Figure 6 - Optional DCAN500 to CAN controller interface via CAN transceiver.

3.3   DC-BUS EVB Test Environment

The DCAN500 test environment contains the EVB Tester board used to configure the DCAN500 EVB for its operating parameters and to interface to any CAN tool via onboard installed CAN transceiver. CAN messages from the CAN tool pass through the DC-BUS Tester to the DCAN500 EVB. Then, the message is modulated over the powerline or via DC Powerline Attenuator to a second DCAN500 that transfers the received CAN messages through a second EVB Tester to a second CAN tool for analysis.
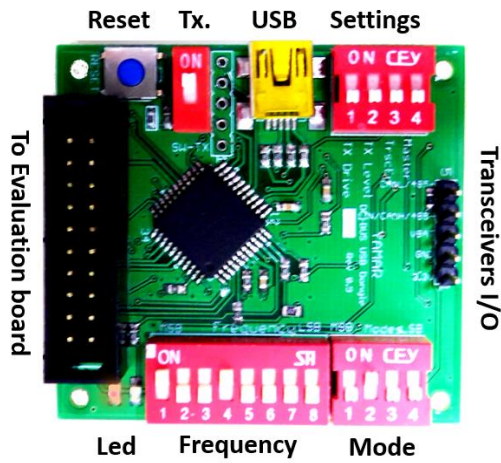
Figure 7 - EVB Tester

I.   CAN Tool to CAN Tool communication set-up (through CAN transceiver).
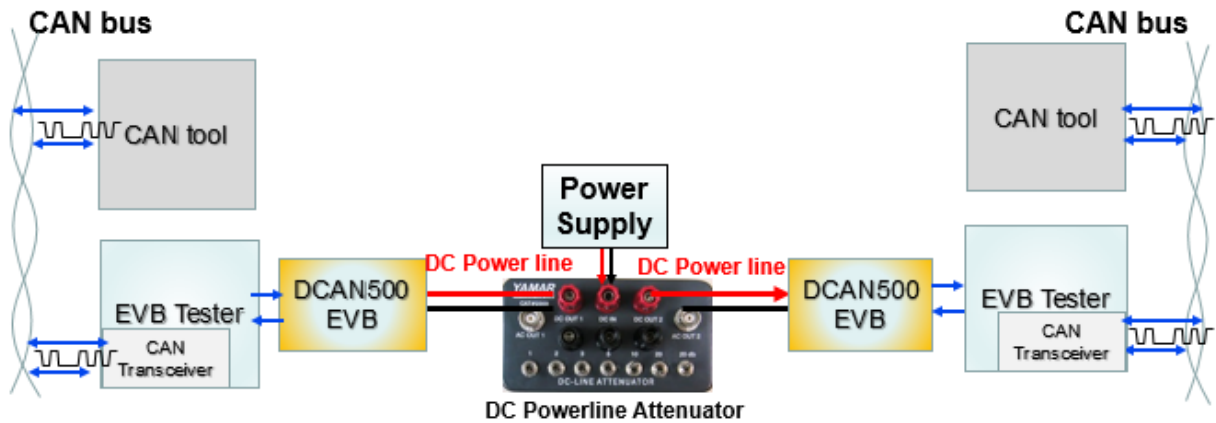

Figure 8 - CAN bus to a CAN bus via DCAN500 test environment

II. TX CAN test messages transmission from EVB Tester to Rx EVB Tester that analyzes the received test messages and indicate the results with a LED.
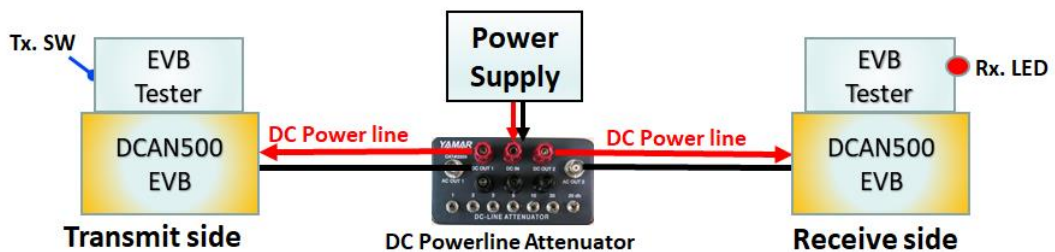

Figure 9 - EVB Tester to EVB Tester testing

3.3.1   DC Powerline attenuator

The DC-powerline attenuator is used for testing communication performance over the powerline in the lab. The attenuator allows adding attenuation (0 to 61dB) to the AC modulated signal over the battery powerlines (DC-Lines) keeping the DC voltage level unchanged.

Figure 10 - DC Powerline attenuator

3.4   EVB Quick setup

- ✓ Connect the communication signals via J1 to the CAN host.
- ✓ Set the BR_SEL[1:0] pins according to CAN host bitrate.
- ✓ Connect the EVBs to the DC powerline.
- ✓ Configure the DCAN500 if required using the HDC pin.
- ✓ Transmit and receive data to and from DCAN500 EVBs connected to the DC powerline.
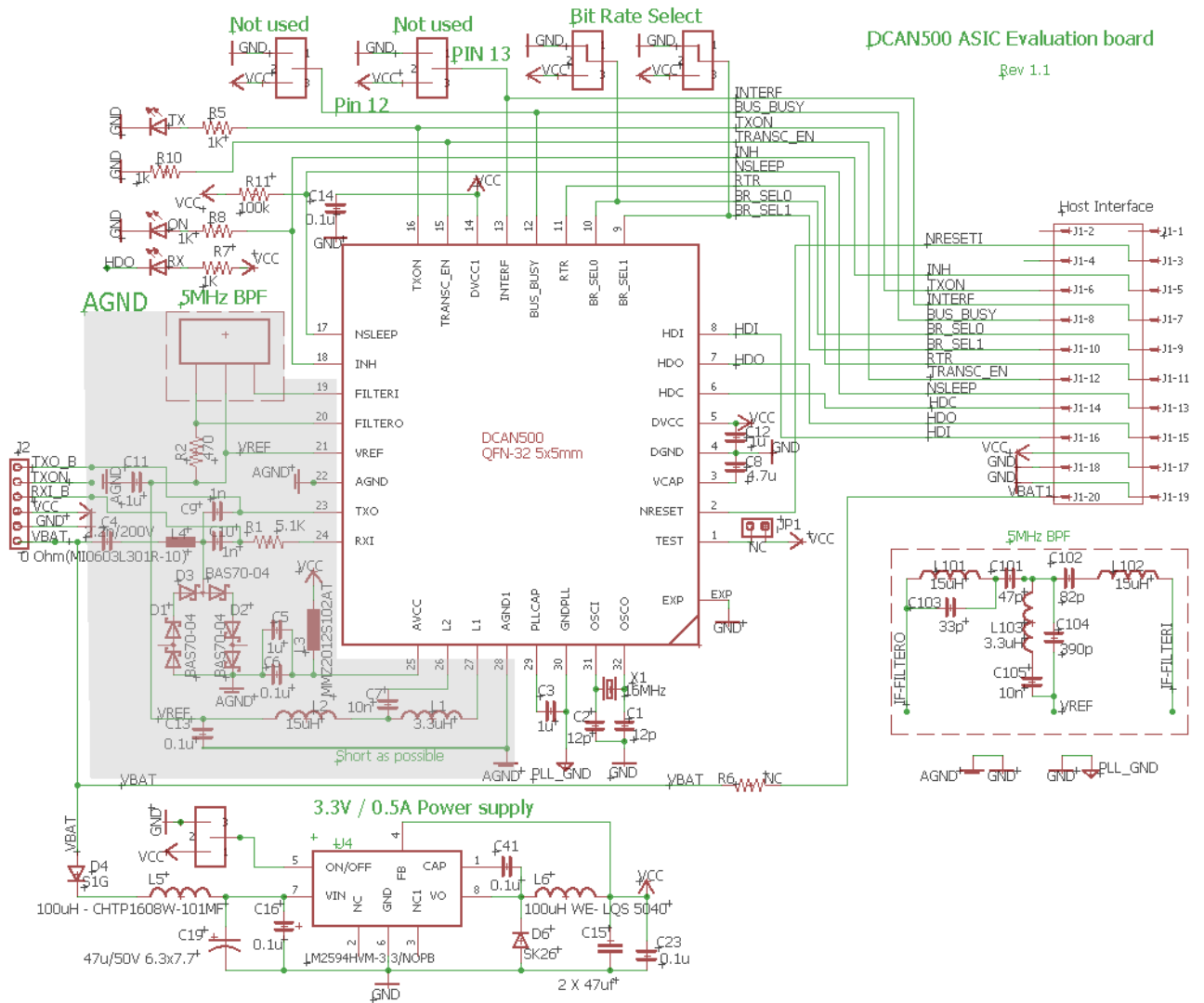
4. EVB DCAN500 schematic

Figure 11 - DCAN500 EVB circuitry

Revision History

Rev.	Date	Description
0.2	30-7-19	Initial version
1.0	4-9-19	Updated schematics and figures
1.1	15-11-2020	Update Figure 11 to rev 1.1
1.2	14-01-2021	Editing.
1.3	18-04-2023	Add 1Mbit/s Host bitrate interface option.