

Inverter BMW-330e Hybrid 2018

BMW 8742493 / Bosch 0437508310

I've got an inverter and take a deep look in it.

The seals are rubber form seals and look reusable.

Inside the inverter is a DC/DC converter for 12V below, the IGBT's with driver board in the middle and the controller with resistors that look's as a lot of 12V current measurement and auxiliary power supply on the top.

I am not sure if the inverter or parts of it can be used with an open source board. It is technical complex, and there are some components that don't show me its function.

Up to now I concentrate me on the IGBT driver Board.

There are three rivets on the top, under the rivets are the screws that connect the output connector for the motor and the inverter inside. You have to remove them before you can dismantle the top, may be a spot weld drill can be used, because the normal drill wants to slip out of centre and destroys the housing.



The rest of the dismantling is possible with screwdrivers size TX10 to TX27 (partly secure with hole in it).

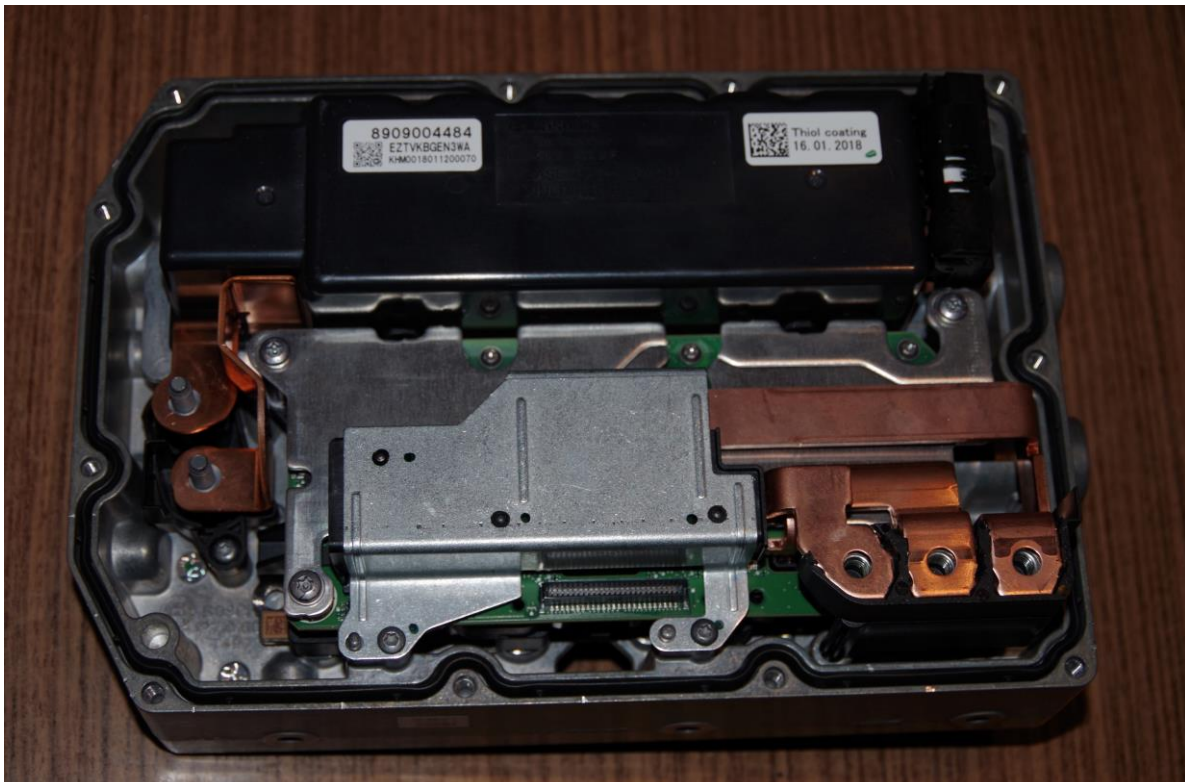
First remove the lower part of the case, there are 11 screws on the outer edge and a clamp around the 12V DC connection secured with a screw that have to remove. Take care of the cooling water.

Next step is to remove the cover with the DC connector and cable to the controller inside, then there are two screws from the HV-DC and 9 screws that hold the DC/DC converter in the case.

Then you can access the two screws that connects the IGBT and the DC connector.

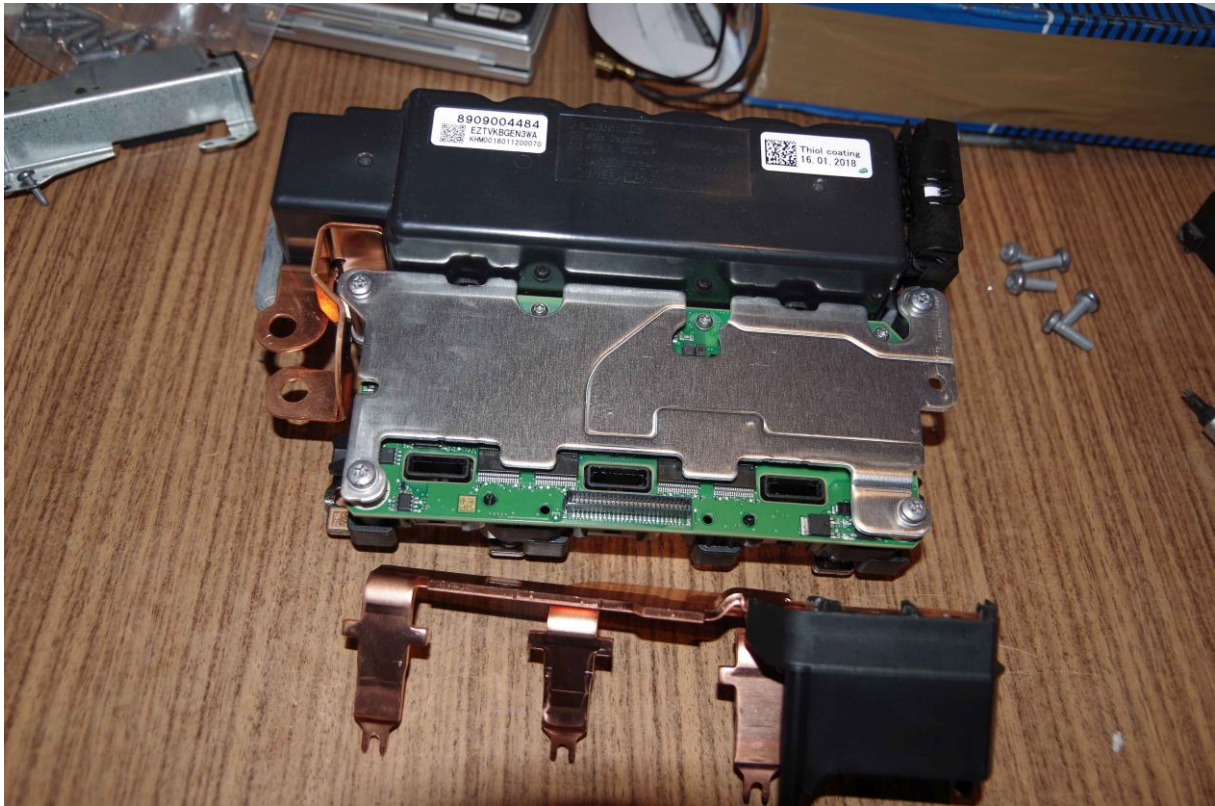


Remove the 11 screws on the outer edge of the top cover and then the tree screws on the top and two screws from below. Now you should be able to remove the top cover with controller and power connections. There is a 50 pol erni connector between the controller and the driver board.





I've dismantled the inverter further. I'm not sure if it is a good idea when you want to use it, because the busbars are pressed in the busbars of the IGBT module. The connection between the driver board and the IGBT module is also pressed in. But to reach the driver board for measurement you have to remove the busbars, the cover and the board.

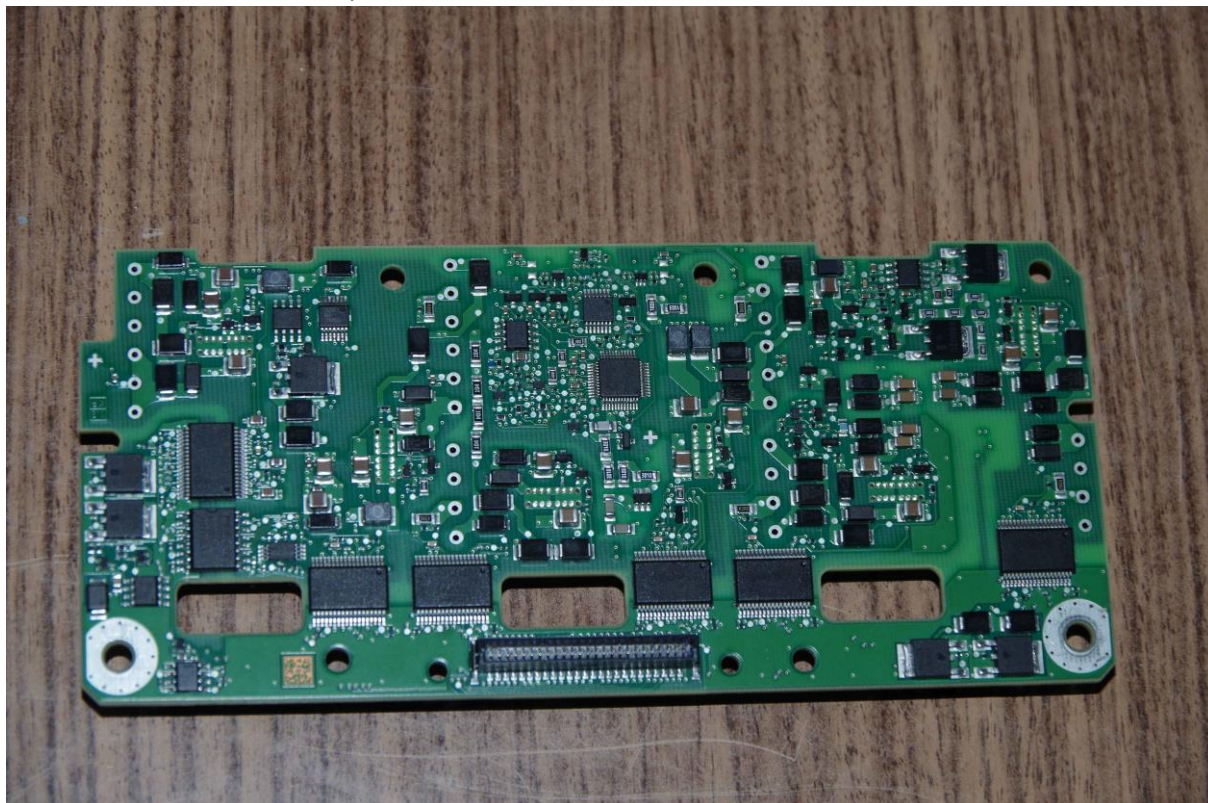


The driver board without cover

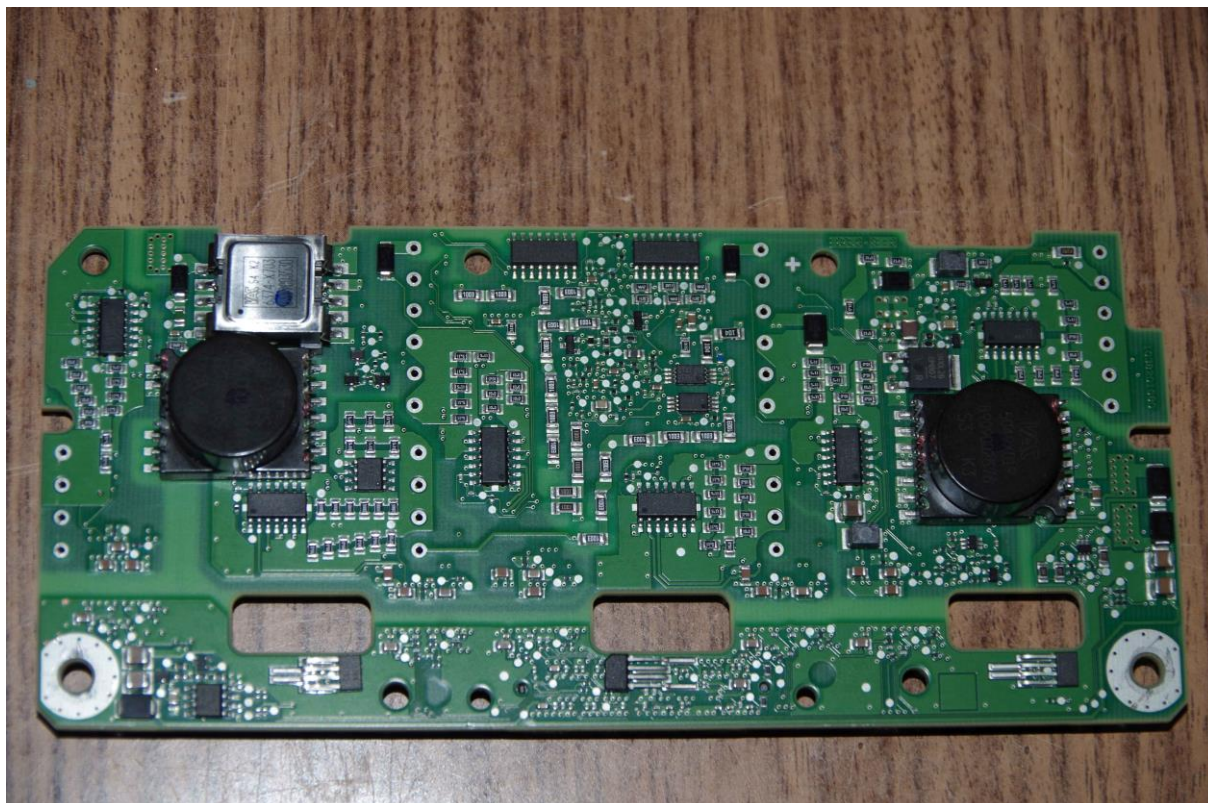




The driver board from the top



The bottom side of the driver board



I've found following functional assemblies on the driver board:

Three current sensors, in the middle is a MLK91209 and two A1366 for the outer phases, all they are 5V supply with 2,5V centered signal and separate connected to the 50 pol connector.

Six IGBT driver 1EDI2001AS with boost 1EBN1001AE. They have to be configured via SPI bus for use or you need to pull up the debug pin to 5V on each of the driver. The SPI bus and the PWM inputs connect to the 50 pol connector. Power supply for signals will be 5V. Separate fault signal for low side and high side.

There are two separate power supplies for the drivers from the controller board, I expect 12V but it can be 5V to 15V because of the voltage range from the driver IC (FAN3216). The driver needs +15V and -8V on the output side.

- One transformer for the supply of the low side from the IGBT's, there is no switching regulator on the driver board, only two FET driver and two FET, so signals came from the controller board.
- A second transformer for the supply of the high side from the IGBT's, also no switching regulator on the driver board, only two FET driver and two FET, so signals came from the controller board.

The part that irritated me:

The third transformer, it looks like it is supplied from phase U and W of the IGBT module. May be as emergency supply, or only if the motor is running. It has its own switching regulator (NCV887100) and supply the  $\mu$ C (MC9S12GA128MLF) on the board and two boost driver (ADUM3224) to the high side of the IGBT (U, W) that are connected to the  $\mu$ C. The outside world connection is via iso-driver (UM1402w). I'm not sure if it is ignored, what will be. It is possibly only for measuring voltage and temperature, but I expect that it will be used for other functions.

Next steps will be emulating the signals for the power supply of the driver and electrical testing.

The table shows my findings, when there is a resistor value in the table it is in series with the input.

The driver are in line on the SPI bus as numbered. Before using the power stage, the designation to the IGBT's must be proofed.

Stecker 50pol IGBT			
a1	+ ISO Trafo High FAN2	b1	
a2	GND1_Anst	b2	+ ISO POWER Trafo LOW FAN1
a3	INP_470hm(3)	b3	GND1_Anst
a4	INP_470hm(6)	b4	INP_470hm(5)
a5	NFLTA_1ED2001(3,5,6)	b5	GND1_Anst
a6	NFLTB_1ED2001(3,5,6)	b6	NFLTA_1ED2001(1,2,4)
a7	GND1_Anst	b7	NFLTB_1ED2001(1,2,4)
a8	INP_470hm(2)	b8	INP_470hm(1)
a9	GND1_Anst	b9	INP_470hm(4)
a10	Emitter BC856DW(3) über 2,6k, Low Side? Prim	b10	UM1402 VOd
a11	NRST/RDY_1ED2001	b11	
a12		b12	GND1_Anst
a13	UM1402 VOc	b13	GND1_Anst
a14	500Ohm FAN1_INA	b14	GND1_Anst
a15	GND1_Anst	b15	500Ohm FAN1_INB
a16	500Ohm FAN2_INB	b16	500Ohm FAN2_INA
a17		b17	EN_1ED2001
a18	SDO_1ED2001	b18	+5V_VCC1_1ED2001 + FAN2+UM1402VE1(LP2951)
a19	GND1_Anst	b19	SDI_1ED2001
a20	GND1_Anst	b20	NCS_1ED2001
a21	GND1_Anst	b21	SCLK_1ED2001
a22	OUT_A1366_I1	b22	+5V_I
a23		b23	OUT_MLX91209_I2
a24	OUT_A1366_I3	b24	GND_I
a25		b25	
INSTP_1ED2001 = GND_Anst			

UM1402 VIa(3) Emitter BC856DW(1), Low Side? Prim
UM1402 VOa(14) Transistor Low Side über Kondensator Sek
UM1402 VIb(4) PS0/RXD0
UM1402 VOb(13)
UM1402 VIc(12) PS3/TXD1
UM1402 VOc (5) a13
UM1402 VId(11) Basis BC856DW ?, Low Side Sek
UM1402 VOd(6) b10
UM1402 VE1 = VDD1
UM1402 VE2=VDD2=VDDA MC9S12