

iBolit — simple diagnostics cartridge for MSX


About the project











Русская версия находится здесь: [iBolit — простой картридж-диагност для MSX](#)

iBolit is a simple diagnostics cartridge. During the previous years we've seen numerous messages from MSX users, whose computers suddenly stopped working after being removed from the storage or after another power cycle. Many people complained about black screens or about total power failure. It's a known fact that RAM and other elements may go bad during storing or at power-on. Diagnosing those problems usually starts from checking the power rails, clock signals, reset signal's state and activity on data and address bus. It has been decided to create a simple diagnostics cartridge that could help to perform the initial check of a computer and rule out the most common problems.

The cartridge that we named "iBolit" (see [W Doctor Aybolit](#)) was created using the GAL22V10 programmable logic chips, LED assemblies and volt/ammeters from the PC's USB socket tester dongles. There's a cartridge slot installed on the top of iBolit cartridge's board. There one can insert any cartridge including the one with MSX diagnostics ROM (there are a few, but it would be nice to create a universal one). The GAL firmware is very primitive — if there's a high level on input, the LED connected to the output will light up. The cartridge is fairly cheap to build — maximum 12-15 Euro - and is relatively easy to assemble. The daughterboard with voltmeters is detachable.

Components

The parts for assembling the cartridge can be purchased from these sellers on  AliExpress:

-  [buy the one with gray case and USB connectors on the left and right side](#)
-  [buy 2 converters](#)
-  [buy 2x5 pin headers](#)
-  [buy 2x5 pin connectors](#)
-  [also buy blue and yellow colors](#)
-  [or use a different 5mm LED](#)
-  [buy 1kOhm SMD resistor assemblies](#)
-  [this LED is for the -12v voltmeter](#)
-  [buy 10uF and 47uF capacitors](#)
-  [buy 50-pin angled slot connector](#)

Important information

Please read the following notes carefully:

- It's highly recommended to install ceramic capacitors everywhere on the board. For the DC-DC converters the ceramic 10uF capacitors are a must
- To adapt the voltmeters to work with iBolit, you need to first carefully open the USB tester's case with a knife and remove the board. Then desolder both indicator panels (mark one indicator panel to know where it came from) and desolder both USB connectors from the board. After that solder the indicator panels back to the board, but as low as possible. And finally solder two 4-pin pin headers to the board, the pins will have to be forced into the board because the distance between the holes is not 2.54mm
- The voltmeter with a separate red LED is for -12v, it should be installed on the lowest position of the daughterboard. See the reference images
- To install a small red LED to the -12v voltmeter (this step is optional), solder the cathode to the upper GND track and anode to the second pin from the top. See the reference images. The LED should be a bit above the voltmeter's board
- Please note that LED assemblies may have incorrect key position! So please always test the LED assemblies with multimeter in the diode testing mode to find the correct polarity. The cathode should be on the right, like marked on the board
- The pins of both DC-DC converters should be carefully bent at 90 degree angle and the converters have to be installed face-down. See the reference images
- The GAL chips need to be programmed with the firmware before use. A widespread TL866 programmer will do just fine. Use the .JED firmware file from the "Firmware" folder and the "GAL22V10D" chip type when programming
- Instead of one blue and two red LED assemblies you might want to install one red and two blue LED assemblies. Make your own

choice. It's recommended to install the yellow LED assembly at the rightmost position.
Example:

1	2	3	4
Blue	Red	Red	Yellow
CLOCK	/RD	/RESET	/BUSDIR
	/WR	/INT	/MERQ
D7	A7	A15	/IORQ
D6	A6	A14	/M1
D5	A5	A13	/WAIT
D4	A4	A12	/RFSH
D3	A3	A11	/SLTSL
D2	A2	A10	/CS12
D1	A1	A9	/CS2
D0	A0	A8	/CS1

If you are installing the green LED assembly, you need to select a different value for the resistor assembly, for example 330 Ohm instead of 1kOhm

- Before inserting the diagnostics board into the MSX slot it's highly recommend to make sure that +5v on the slot is within acceptable range (not more than 6-7v!), otherwise the diagnostics board may be damaged. The device doesn't have the over-voltage protection on the +5v rail
- The daughterboard with voltmeters is detachable. When it is detached, no power will be supplied to the upper cartridge slot. If you need to use the cartridge slot without the attached daughterboard, you need to put 5 jumpers horizontally on 5 pairs of pins of the connector

JP1 pinout (on cartridge board)

9 7 5 3 1

10 8 6 4 2

Assignment	Pin number	
	Input (from MSX slot)	Output (to upper slot)
+5v	10	9
GND	8	7
+12v	6	5
GND	4	3
-12v	2	1

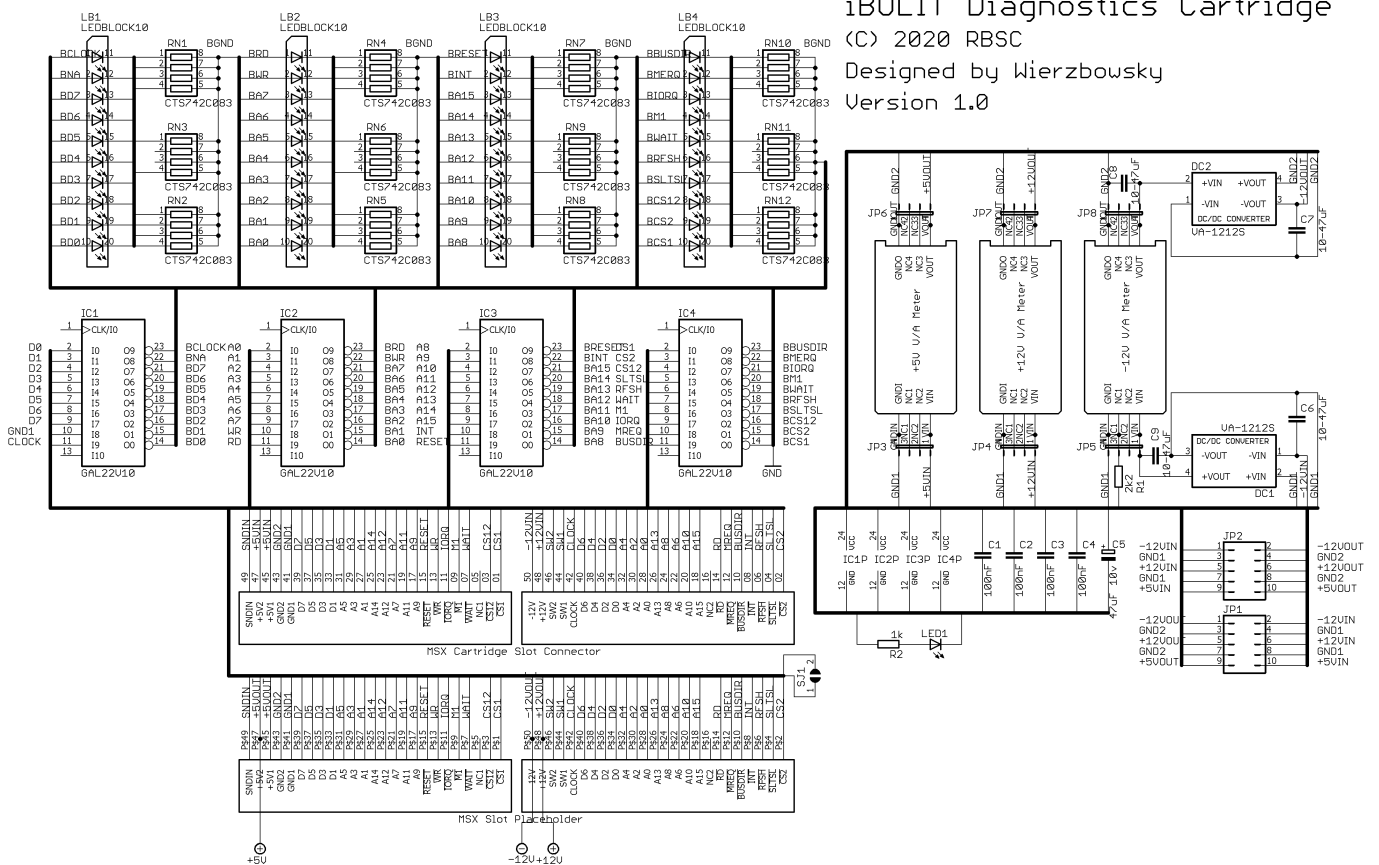
JP2 pinout (on daughterboard)

1 3 5 7 9

2 4 6 8 10

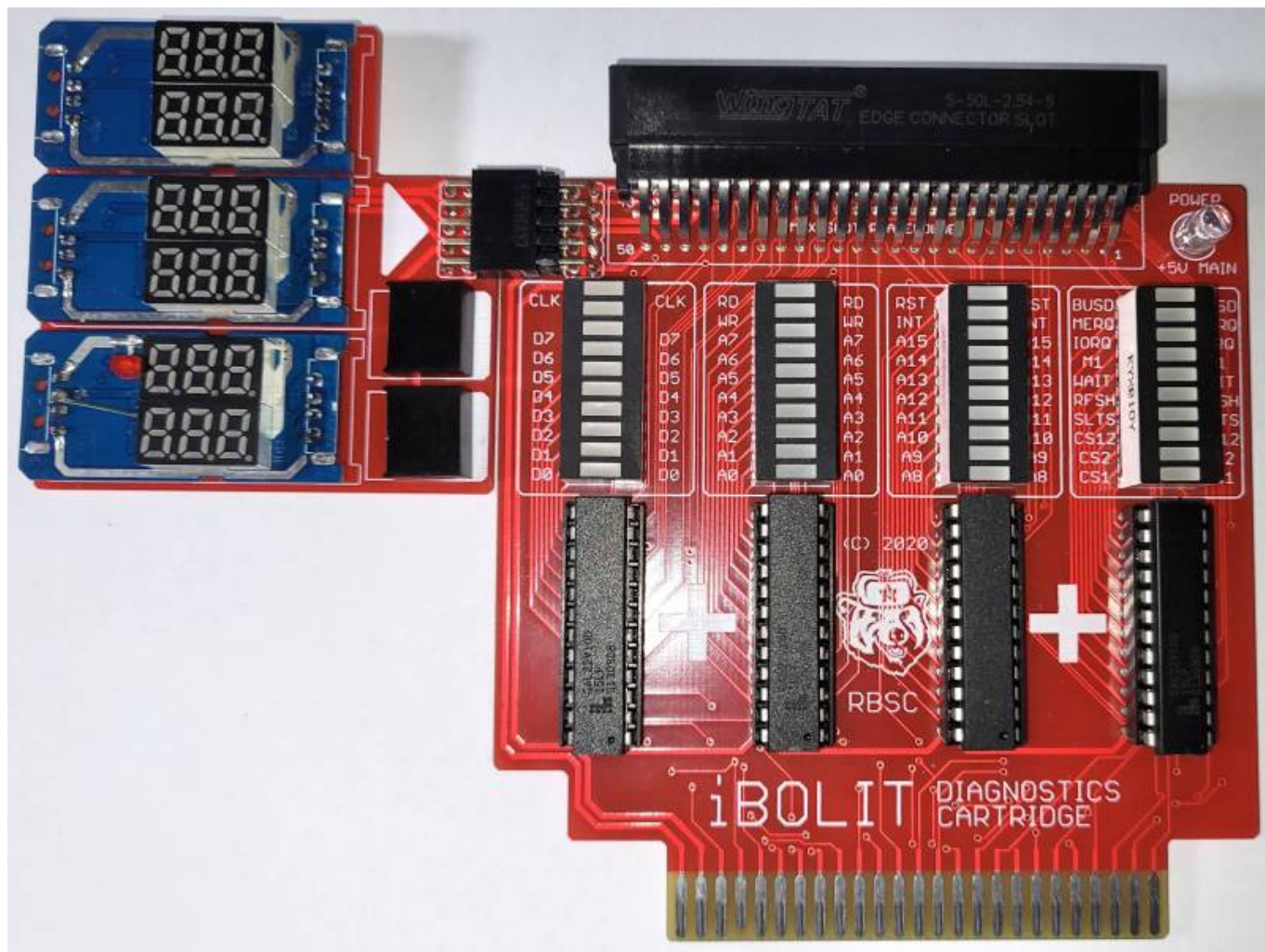
Assignment	Pin number	
	Input (from MSX slot)	Output (to upper slot)
+5v	10	9
GND	8	7
+12v	6	5
GND	4	3
-12v	2	1

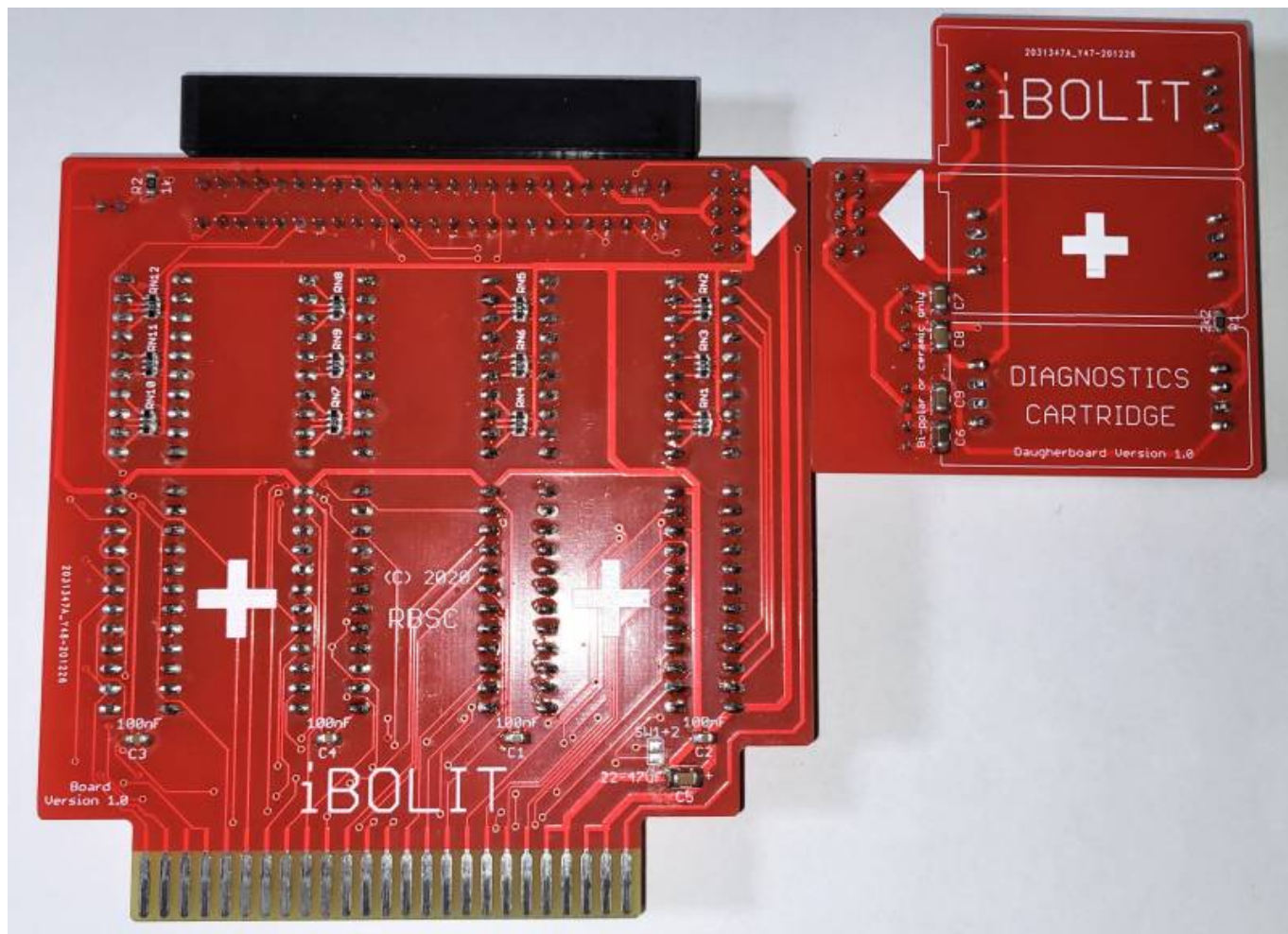
Schematics

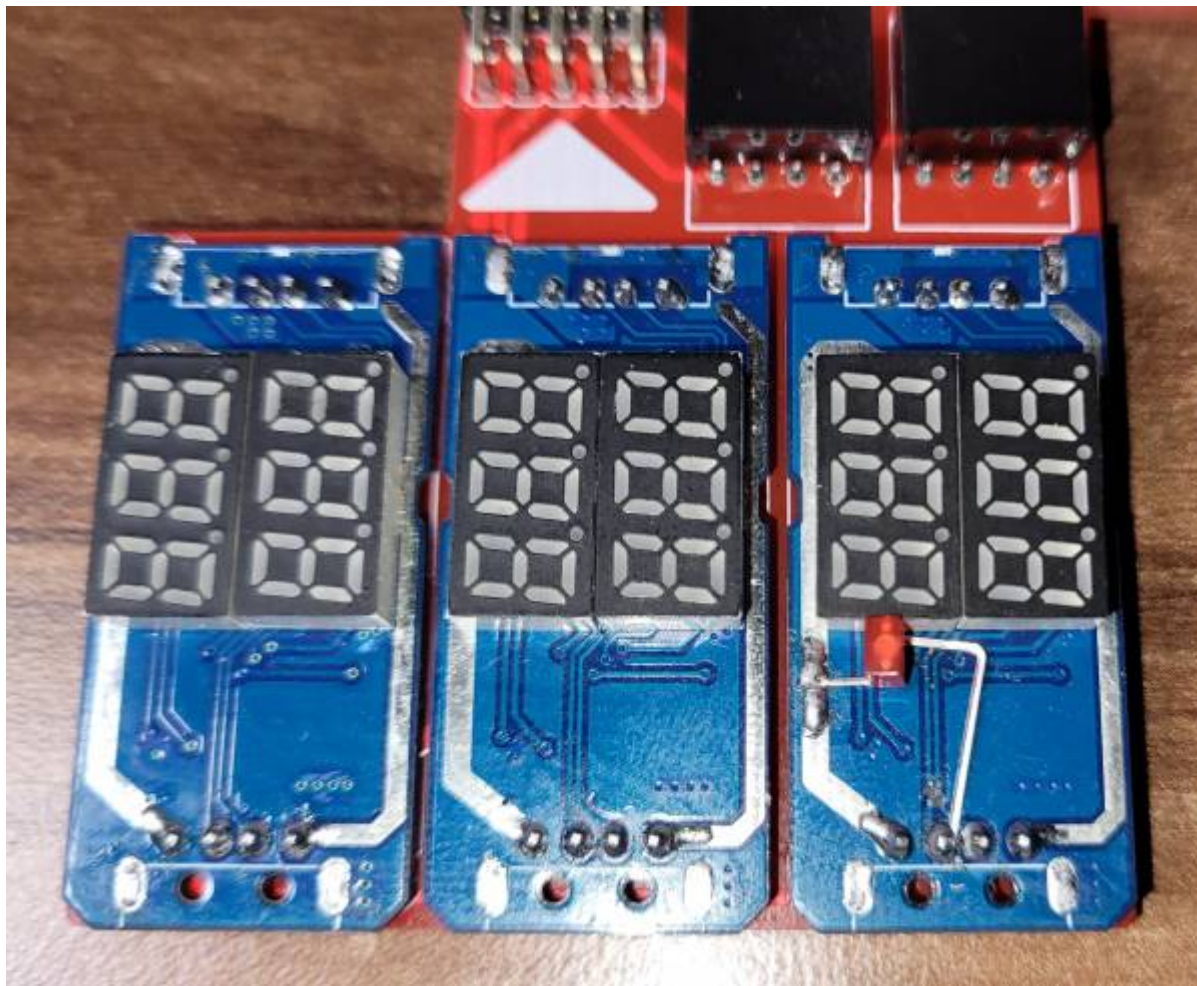


iBOLIT Diagnostics Cartridge
(C) 2020 RBSC
Designed by Wierzbowsky
Version 1.0

Pictures of the board







Video

Here are the videos of the iBolit cartridge running a diagnostics ROM from the [Carnivore2](#) cartridge that is installed into the upper cartridge slot:

[Testing iBolit with Carnivore2](#)

[Testing iBolit with Carnivore2 in the dark](#)

Firmware for GAL chip

You can download the firmware for the GAL chip from the repository or from here:

[ibolit_gal.zip](#)

Links

[Repository on GitHub](#)

[Simple diagnostics cartridge - topic on msx.org forum](#)

[YouTube video: Testing iBolit with Carnivore2](#)

<https://sysadminmosaic.ru/en/msx/ibolit/ibolit>

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