

# 1 bit DRAM Tester

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This DRAM tester supports 1 bit DRAM devices from 4Kbit (e.g. MCM4096 or M4027P) to 256K bit (e.g. TMS41256).

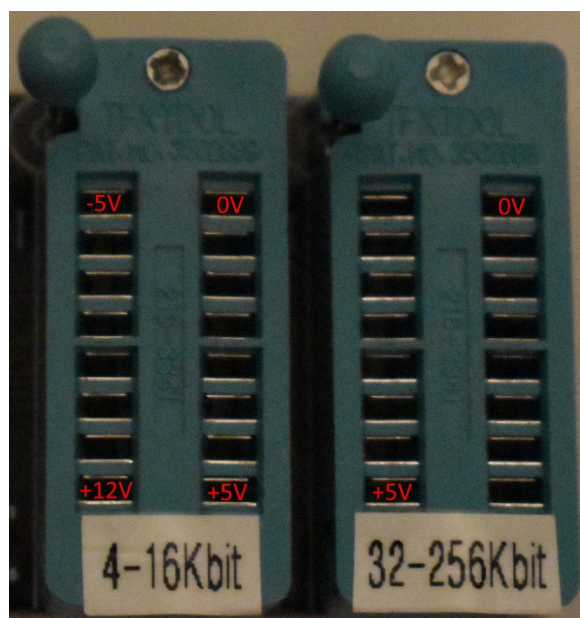
It can also test and identify parts that were sold with known faulty blocks, such as 4108 (partially failed 16Kb parts) and TMS4532/OKI 3732 (partially failed 64Kb parts) used in home computers in the 1980s. The LEDs will show which of the blocks are working and therefore if the part could be used as a 32Kbit DRAM.

The tester also supports the 128Kbit parts that were two 64Kb chips piggybacked together. Those parts have two RAS pins (RAS1 and RAS2) which the tester identifies during the test.

It has a simple power requirement, needing just 5V and drawing less than 100mA, so it can be powered from any USB port with a standard micro-USB cable.

**Please note that DRAM memories are VERY sensitive to static electricity. Please make sure that you adhere to ESD precautions when handling DRAM parts.**

**Please also note that the left hand socket is for 4Kbit-16Kbit memories ONLY.**



**Please double check, before pressing the start button, that any part you have put in the left hand socket has power pins as shown above. Failure to do so may result in damage to the chip and/or the tester.**

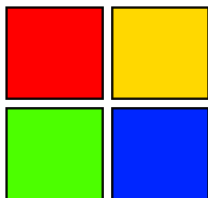
## How to Use

1. Connect the board to a USB port to provide power.
2. Put the DRAM chip in the correct socket: The left socket is for parts that require -5V on pin 1, +12V on pin8, +5V on pin 9 and 0V on pin 16 (e.g. MCM4096, M4027P, 4108 and 4116), all other types should ONLY be tested in the right socket.
3. Press the start button and wait for the result to show on the LEDs.  
Please note that the LEDs will flicker while the DRAM is being tested, this is normal.

## The Output LEDs

There are 4 RGB LEDs on the board arranged as a 2x2 array to show the test result.

On initial power-up, the LEDs should be as shown below:



This indicates that the board is working correctly.

When you press the button, all four LEDs will light YELLOW and when you release it the testing will start. While the test is running, the LEDs will flicker white and when the test is complete, the result will be shown.

If the part tries to draw too much current (e.g. due to an internal fault) then the auto-reset fuse may trigger causing the board to reset and show the four colour pattern above. In that case the DRAM is faulty.

First the tester detects the number of rows and columns in the DRAM and splits both into two halves (unless smaller than 16Kbit). The lower half of the rows are shown on the upper LEDs and the upper half are shown on the lower LEDs. The lower half of the columns are shown on the left LEDs and the upper half are shown on the right LEDs.

DRAM Capacity	No. of Rows/Cols	Capacity per LED	Pass Colour
4Kbit	64	4Kbit	Blue
16Kbit	128	4Kbit	Blue
64Kbit	256	16Kbit	Green
256Kbit	512	64Kbit	Magenta

Good 4Kbit blocks are shown as BLUE.

Good 16Kbit blocks are shown as GREEN.

Good 64Kbit blocks are shown as MAGENTA.

Bad blocks are shown as RED.

Blocks not detected do not illuminate that LED.

Blocks that pass at high speed but then fail the retention time tests will flash. This indicates that the part might work but the DRAM is out of spec.

## **Tested Devices**

The tester will support many more parts than listed here. Basically any part with the same power requirements, pinout and refresh rate as the ones listed below should also work in that same socket.

**Please make sure you do not put any part in the left hand socket that does not have the +5V. +12V, -5V power requirements with the same pinout as a 4116 or the part and/or tester may be damaged.**

### **LEFT Socket**

- Mostek MK4027P
- Motorola MCM4096
- Mostek MK4108-x0
- TI TMS4108-x0
- Mostek MK4108-x1
- TI TMS4108-x1
- ITT/STC 4116
- Mostek MK4116

### **RIGHT Socket**

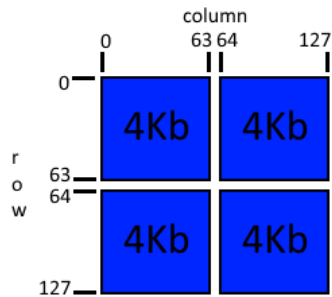
- Mostek MK4516
- Hitachi HM4816
- Intel 2118
- TI TMS4532xL3
- TI TMS4532xL4
- OKI M3732L
- OKI M3732H
- TI TMS4164
- Samsung KM4128
- TI TMS4256

## More Detail

Here is some more detail on how to interpret the output on the LEDs.

### Parts with Capacity up to 16Kbit

For parts with a capacity up to 16Kbit (4Kbit, 8Kbit & 16Kbit) such as M4027P, MCM4096, 4108 and 4116, each LED represents a 4Kb block arranged as follows:

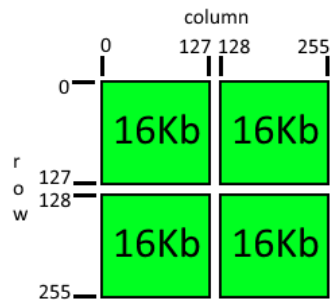


A good block will show as BLUE and a bad block as RED. A block that fails the retention time tests will flash BLUE.

Missing blocks do not light the corresponding LED.

### Parts with Capacity over 16Kbit up to 64Kbit

Parts with a capacity over 16Kbit up to and including 64Kbit (32Kbit & 64Kbit) such as TMS4532, M3732 and 4164, each LED represents a 16Kb block arranged as follows:

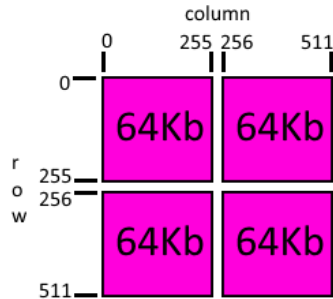


A good block will show as GREEN and a bad block as RED. A block that fails the retention time tests will flash GREEN.

Missing blocks do not light the corresponding LED.

### Parts with Capacity over 64Kbit up to 256Kbit

Parts with a capacity over 64Kbit up to and including 256Kbit (128Kbit & 256Kbit), each LED represents a 64Kb block arranged as follows:



A good block will show as MAGENTA and a bad block as RED. A block that fails the retention time tests will flash MAGENTA.

Missing blocks do not light the corresponding LED.

### Example Good Results

Part	Size	Socket	Pass
Mostek MK4027P	4 Kbit	Left	
Motorola MCM4096	4 Kbit	Left	
Mostek MK4108-x0	8 Kbit (4116 even cols only)	Left	
TI TMS4108-x0	8 Kbit (4116 even cols only)	Left	
Mostek MK4108-x1	8 Kbit (4116 odd cols only)	Left	
TI TMS4108-x1	8 Kbit (4116 odd cols only)	Left	
ITT/STC 4116	16 Kbit	Left	
Mostek MK4116	16 Kbit	Left	
Mostek MK4516	16 Kbit	Right	
Hitachi HM4816	16 Kbit	Right	
Intel 2118	16 Kbit	Right	
TI TMS4532xL3	32 Kbit	Right	
TI TMS4532xL4	32 Kbit	Right	
OKI M3732L	32 Kbit	Right	
OKI M3732H	32 Kbit	Right	
TI TMS4164	64 Kbit	Right	
Samsung KM4128	128 Kbit (piggyback)	Right	
TI TMS4256	256 Kbit	Right	

### **Approximate Test Times**

Here are some examples of the test times for this tester:

Size	Approximate Test Time
4Kb	Under 2 seconds
16Kb	About 4 seconds
32Kb	11-16 seconds depending on number of good blocks
64Kb	About 16 seconds
128Kb	About 32 seconds
256Kb	About 63 seconds

The tests are made first at high speed, then at lower speed such that the refresh period is close to the specified maximum retention time for the part being tested.

That means close to 4ms for 64 rows on an M4027 or MCM4096, 2ms for 128 rows on a 4116 part and close to 4ms for the 256 rows on a 4161 or 41256 part. If the tests pass at high speed but then subsequently fail at the lower speed then the result LED will flash rather than be steady on.

This ensures that any issues that only occur near to the maximum retention time are also detected by this tester.

So you can be sure that if a part tests as good in this tester then it should work well in a real application. Please bear in mind that a part that fails may still work in a real application, it all depends on whether the failing location is used in the application and, even if it is, whether the failed location causes any noticeable symptoms.

### **The Test Procedure**

1. Measure the size of the DRAM.
2. High speed tests
  - Fill the RAM with 1s and check that
  - Fill the RAM with 0s and check that
  - Fill the RAM with random data and check that
  - Repeat the above random data test several times
3. Lower speed tests to test the retention time
  - Fill the RAM with random data and check that
  - Repeat the above random data test several times
  - Fill the RAM with 1s and check that
  - Fill the RAM with 0s and check that