DRAM Tester

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 4116 memories ONLY. Please double check, before pressing the start button, that you have not put any other memory chip in the left hand socket. Failure to do so may result in damage to the chip and/or the tester.

This DRAM tester supports DRAM devices from 16K bit (e.g. TMS4116) to 256K bit (e.g. TMS41256). It can also test and identify 64Kbit parts that had faulty blocks, such as the TI TMS4532 and OKI 3732 parts used in home computers in the 1980s. The LEDs will show which of the 4 16Kbit blocks are working and therefore if the part could be used as a 32Kbit DRAM.

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.

How to Use

1. Connect the board to a USB port to provide power.
2. Put the DRAM chip in the correct socket: 4116 type in the left socket, all other types in the right socket (**DO NOT PUT ANY PART OTHER THAN 4116 IN THE LEFT 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 6 LEDs on the board to show the test result, one red and 5 green.
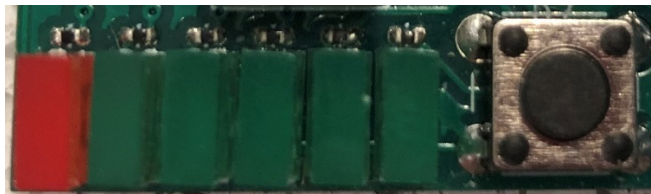
FAILED LED1 LED2 LED3 LED4 LED5   Start Button

Red LED: Faulty or no part detected.
Green LED1: Good 16Kb block at row 0..127, column 0..127
Green LED2: Good 16Kb block at row 128..255, column 0..127
Green LED3: Good 16Kb block at row 0..127, column 128..255
Green LED4: Good 16Kb block at row 128..255, column 128..255
Green LED5: All blocks are working at row 0..511, column 0..511, i.e. 256Kbit.

	Column 0..127	Column 128..255
Row 0..127	LED1	LED3
Row 128..255	LED2	LED4

Example Results

LED1	LED2	LED3	LED4	LED5	Result
On	Off	Off	Off	Off	Good 4116
On	x	On	x	Off	Good TI TMS4532-L3
x	On	x	On	Off	Good TI TMS4532-L4
On	On	x	x	Off	Good OKI M3732L
x	x	On	On	Off	Good OKI M3732H
On	On	On	On	Off	Good 4164
On	On	On	On	On	Good 41256

"x" = Don't care, so could be on or off (corresponds to a block that is not guaranteed to work in that part).

Test Times

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

TMS4116	About 5 seconds
TMS4532-L3/L4	9-17 seconds depending on number of good blocks
OKI M3732L/H	9-17 seconds depending on number of good blocks
TMS4164	About 17 seconds
TMS41256	About 65 seconds

The tests are made such that the refresh period is close to the specified maximum retention time for the part being tested.

That means close to 2ms for 128 rows on a 4116 part and close to 4ms for the 256 rows on a 4161 or 41256 part.

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

So you can be pretty sure that if a part tests as good in this tester then it should work well in a real application.

More Details

Internally, DRAM chips are arranged as a number of rows and columns. Typically, they have the same number of rows as columns and use a multiplexed address bus to select the row and column. This means that only one extra pin is needed to access quadruple the size as it will double the number of rows and columns.

256Kbit (e.g. TMS41256)

	Col 0..127	Col 128..255	Col 256..383	Col 384..511
Row 0..127	16Kb block	16Kb block	16Kb block	16Kb block
Row 128..255	16Kb block	16Kb block	16Kb block	16Kb block
Row 256..383	16Kb block	16Kb block	16Kb block	16Kb block
Row 384..511	16Kb block	16Kb block	16Kb block	16Kb block

16Kbit (e.g. TMS4116)

	Col 0..127	Col 128..255	Col 256..383	Col 384..511
Row 0..127	16Kb block			
Row 128..255				
Row 256..383				
Row 384..511				

64Kbit (e.g. TMS4164)

	Col 0..127	Col 128..255	Col 256..383	Col 384..511
Row 0..127	16Kb block	16Kb block		
Row 128..255	16Kb block	16Kb block		
Row 256..383				
Row 384..511				

256Kbit (e.g. TMS41256)

	Col 0..127	Col 128..255	Col 256..383	Col 384..511
Row 0..127	16Kb block	16Kb block	16Kb block	16Kb block
Row 128..255	16Kb block	16Kb block	16Kb block	16Kb block
Row 256..383	16Kb block	16Kb block	16Kb block	16Kb block
Row 384..511	16Kb block	16Kb block	16Kb block	16Kb block

Special Parts Used in Home Computers in the 1980s

In the 1980's when DRAM was expensive, there was a market for memory chips that were not fully working. So it was common for 64Kbit parts where one or two blocks were not working to be sold as 32Kbit parts. There were four common parts available, two where half of the rows were not reliable and two where half of the columns were not reliable as detailed below. The cells marked in red are the unreliable blocks in those parts. These parts were often used in home computers, such as for the 32K "upper" RAM in the Sinclair ZX Spectrum.

32Kbit with faulty upper rows (e.g. TMS4532-L3)

These devices were manufactured as 64Kbit parts but failed during testing.
As a result, the memory at rows 128..255 (marked in red) are not guaranteed to work and should not be used.

	Col 0..127	Col 128..255	Col 256..383	Col 384..511
Row 0..127	16Kb block	16Kb block		
Row 128..255	16Kb block	16Kb block		
Row 256..383				
Row 384..511				

32Kbit with faulty lower rows (e.g. TMS4532-L4)

These devices were manufactured as 64Kbit parts but failed during testing.
As a result, the memory at rows 0..127 (marked in red) are not guaranteed to work and should not be used.

	Col 0..127	Col 128..255	Col 256..383	Col 384..511
Row 0..127	16Kb block	16Kb block		
Row 128..255	16Kb block	16Kb block		
Row 256..383				
Row 384..511				

32Kbit with faulty upper columns (e.g. OKI M3732L)

These devices were manufactured as 64Kbit parts but failed during testing.
As a result, the memory at columns 128..255 (marked in red) are not guaranteed to work and should not be used.

	Col 0..127	Col 128..255	Col 256..383	Col 384..511
Row 0..127	16Kb block	16Kb block		
Row 128..255	16Kb block	16Kb block		
Row 256..383				
Row 384..511				

32Kbit with faulty upper columns (e.g. OKI M3732H)

These devices were manufactured as 64Kbit parts but failed during testing.
As a result, the memory at columns 0..127 (marked in red) are not guaranteed to work and should not be used.

	Col 0..127	Col 128..255	Col 256..383	Col 384..511
Row 0..127	16Kb block	16Kb block		
Row 128..255	16Kb block	16Kb block		
Row 256..383				
Row 384..511				