32KB Upgrade for M100 and PC-8201

by Steve Adolph

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- Use this upgrade if you can't get the custom OEM ram modules, and you want to upgrade to 32k in the M100, or 2x32k in the PC-8201

- This upgrade uses 62256 class of 32kB SRAM chips in 28 pin DIL packages
  - There are tons of different part numbers that fit this category
  - In general you want low power versions
  - The part you use should match the pinout shown in this document

- 3 Steps in the process
  - Step 1: Removal and/or de-activation of existing 8KB ram modules
  - Step 2: Installation of new 32KB ram chip(s)
  - Step 3: Installation of 74HC138 decoder to generate the chip select(s)

Preparation

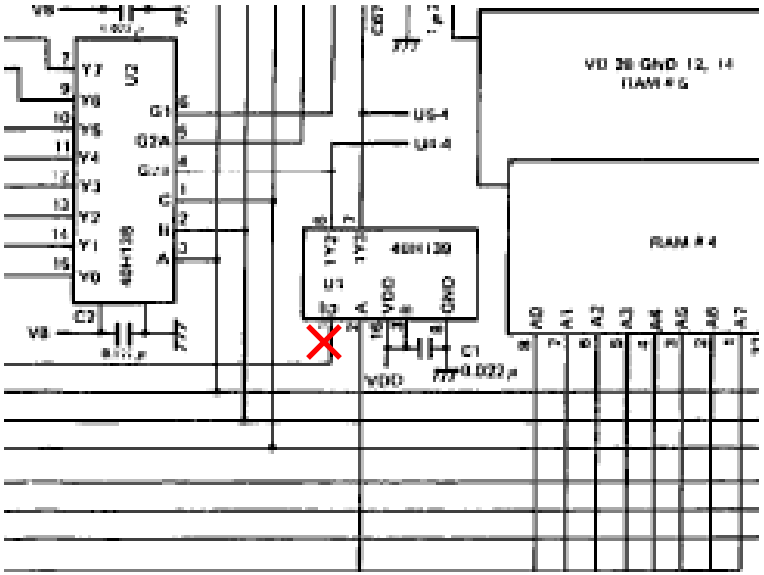
- What you will need:
  - Xacto knife for cutting PCB traces
  - Some 5 minute epoxy or similar
  - One or two 62256 type ram chip
  - 74HC138 decoder chip
  - Solder, wire-wrap wire, wire strippers, pliers, philips screwdriver
  - Solder pump or solder wick for removing solder

- To get started:
  - Open the case, disconnect the top from bottom
  - Remove all socketed ram modules
  - Remove the motherboard from the case
    - Be careful to remember how to put it back together!

Step 1: PC-8201 ram disable

To disable the soldered-in ram-

- Disconnect IO/M from pin 1 of U1
  - Cut the track on the primary side of the board, near pin 1
  - Or, clip the pin at the chip, leaving a shoulder to solder to



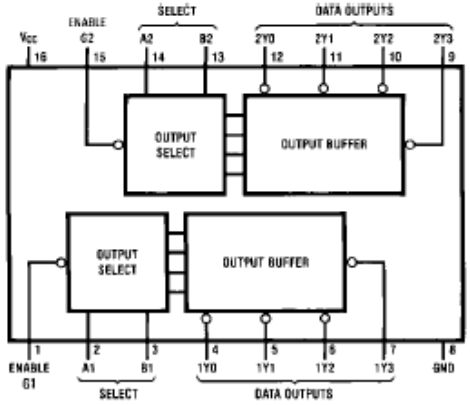
- Solder a wire from pin 1 of U1 to pin 16 of U1 to tie cut signals to +5V
  - This disables the 74HC139 decoder, making the 4 downstream 74HC138 decoders inoperative as well.

Truth Table

Inputs			Outputs			
Enable	Select					
G	B	A	Y0	Y1	Y2	Y3
H	X	X	H	H	H	H
L	L	L	L	H	H	H
L	L	H	H	L	H	H
L	H	L	H	H	L	H
L	H	H	H	H	H	L

H = HIGH Level
L = LOW Level
X = Don't Care

Pin Assignments for DIP, SOIC, SOP and TSSOP

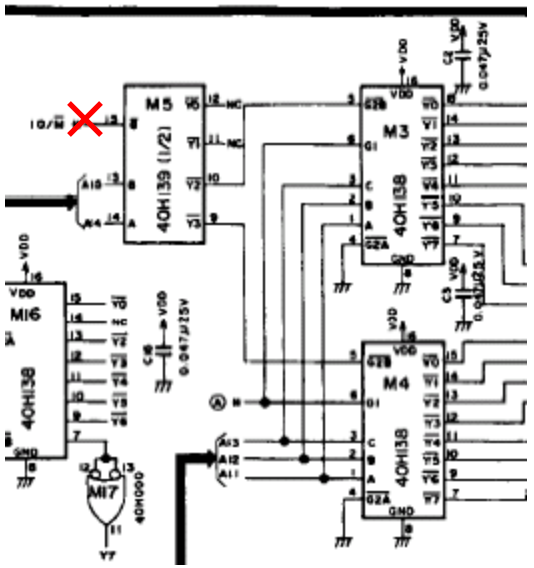


Step 1: M100 ram disable

To disable the soldered in ram-

- Disconnect IO/M from pin 15 of M5
  - Either cut a track, being careful to maintain other connections
  - Or, clip the pin at the chip, leaving a shoulder to solder to

- Solder a wire from pin 15 of M5 to pin 16 of M5 to tie cut signal to +5V
  - This disables the 74HC139 decoder, making the 2 downstream 74HC138 decoders inoperative as well.



Truth Table

Inputs			Outputs			
Enable	Select					
G	B	A	Y0	Y1	Y2	Y3
H	X	X	H	H	H	H
L	L	L	L	H	H	H
L	L	H	H	L	H	H
L	H	L	H	H	L	H
L	H	H	H	H	H	L

H = HIGH Level
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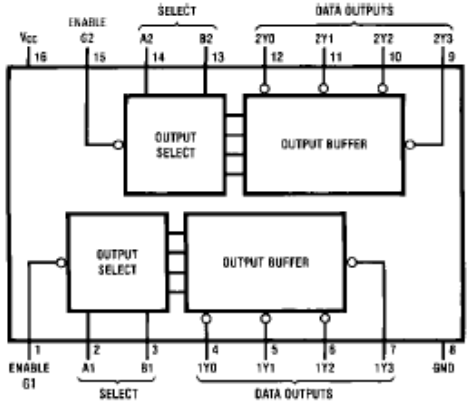
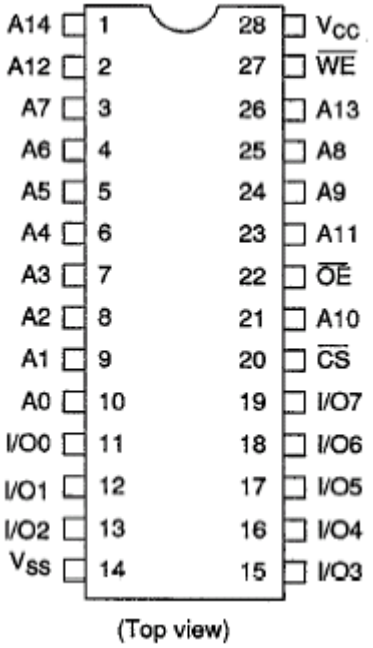
Pin Assignments for DIP, SOIC, SOP and TSSOP



62256 Ram chips



- 28 pin DIP package, see truth table below
- The /CS signal is a special signal in that it toggles between VB and GND, not +5 and GND. /CS signal is the only control that can put the chip in sleep mode, and is the only signal used to enable the device for a read/write
- /OE should be grounded in this application
- /WE should be = /WR signal in M100

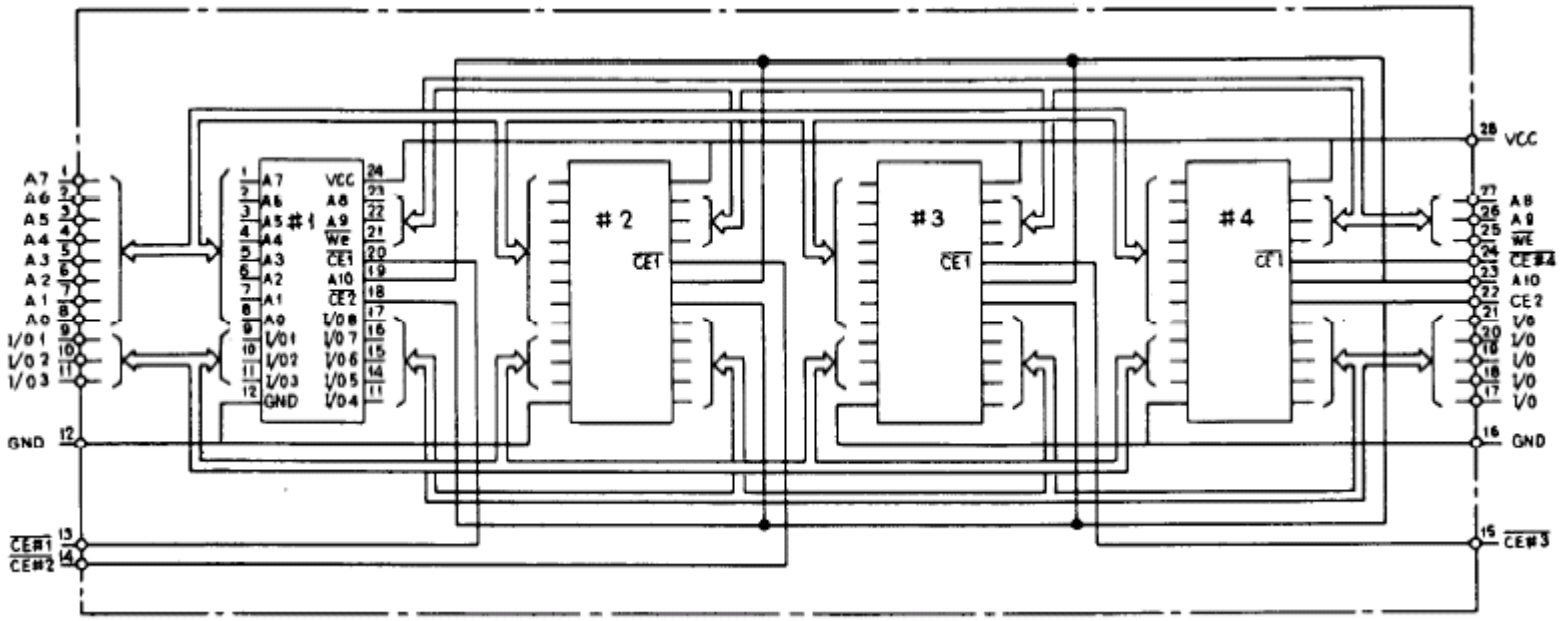
Truth Table

$\overline{CS}$	$\overline{OE}$	$\overline{WE}$	Mode	V_{CC} current	I/O pin	Reference cycle
H	x	x	Not selected	I_{SB}, I_{SB1}	High Z	—
L	L	H	Read	I_{CC}	Dout	Read cycle No. 1–3
L	H	L	Write	I_{CC}	Din	Write cycle No. 1
L	L	L	Write	I_{CC}	Din	Write cycle No. 2

Note: x means H or L

M100 Ram Module Socket

- Lots of pins are in the right place, some are not
- For reference, the below diagram shows the pinout of the M100 ram module

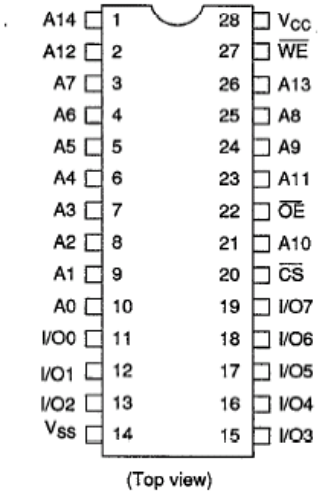


Step 2: Preparation of the socket

Socket

A7	1		28	VB
A6	2		27	A8
A5	3		26	A9
A4	4		25	/WR
A3	5		24	xx
A2	6		23	A10
A1	7		22	xx
A0	8		21	D7
D0	9		20	D6
D1	10		19	D5
D2	11		18	D4
GND	12		17	D3
xx	13		16	GND
xx	14		15	xx

62256



- solder a wire to
  - VB pin 28
  - /WR pin 25
  - pin 16 GND

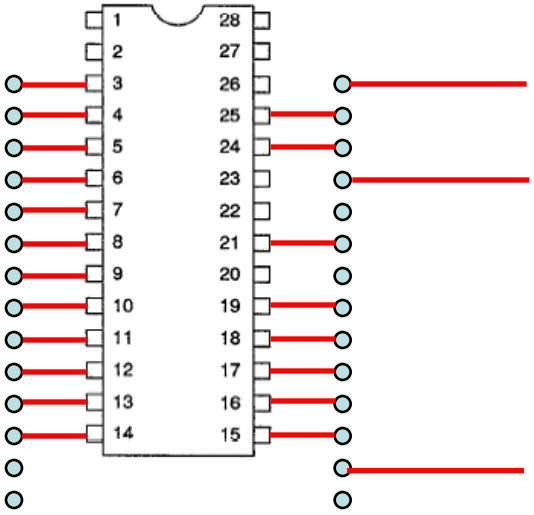
- bend chip leads away from the socket so that the ram chip is clear to be inserted.

Step 2: Insert Ram chip in socket

Socket

A7	1		28	VB
A6	2		27	A8
A5	3		26	A9
A4	4		25	/WR
A3	5		24	/CExx
A2	6		23	A10
A1	7		22	RAMRST
A0	8		21	D7
D0	9		20	D6
D1	10		19	D5
D2	11		18	D4
GND	12		17	D3
xx	13		16	GND
xx	14		15	xx

62256 in socket



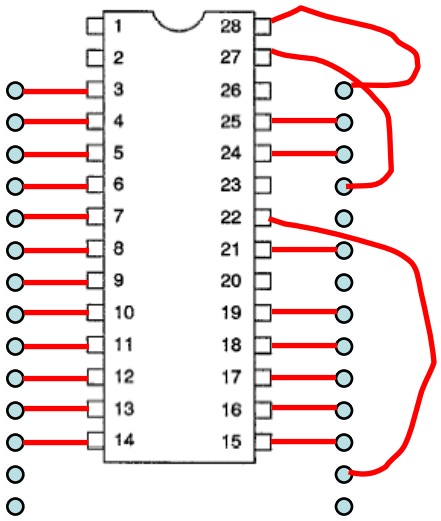
- Spread leads of ram chip to fit socket
- clip chip pins 1, 2, 28, 27, 26, 23, 22 and 20 at the shoulder, leave the stub
- bend stub up and away from the socket pin, so that access to both the socket pin and the ram stub pin is possible.
- insert ram chip(s) into ram module socket(s)
- you should still have three wires unconnected on socket pin 28, 25 and 16

Step 2: connect power and /WR

Socket

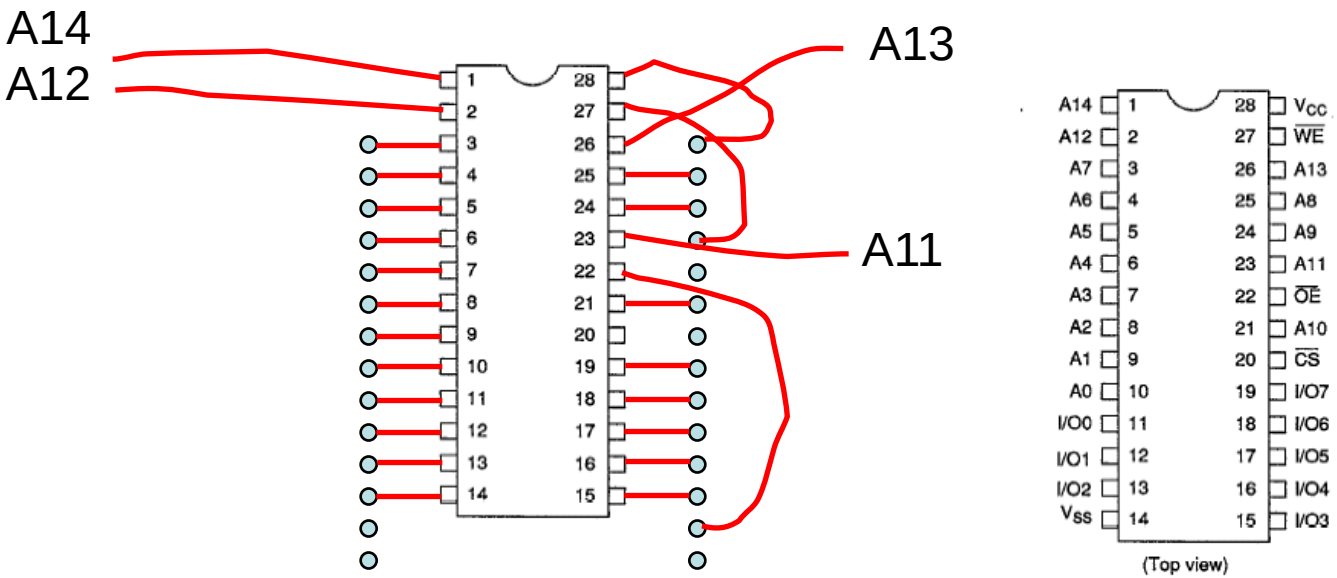
A7	1		28	VB
A6	2		27	A8
A5	3		26	A9
A4	4		25	/WR
A3	5		24	/CExx
A2	6		23	A10
A1	7		22	RAMRST
A0	8		21	D7
D0	9		20	D6
D1	10		19	D5
D2	11		18	D4
GND	12		17	D3
xx	13		16	GND
xx	14		15	xx

62256 in socket



- Vb -solder lead from pin 28 of socket to pin 28 of ram chip
- /WE - solder lead from pin 25 of socket to pin 27 of ram chip
- /OE - solder lead from pin 16 of socket to pin 22 of ram chip

Step 2: connect missing address lines



Line	M100 location	PC-8201 location (note – connect on underside of PCB)
A14	pin 14 of M5	Pin 2 U1
A13	pin 3 of M4	Pin 3 U4
A12	pin 2 of M4	Pin 2 U4
A11	pin 1 of M4	Pin 1 U4

PC-8201 note: make sure these wires stay clear of case, when reassembling.

Step 3: generating /CS1 (and /CS2)

- Use a 74HC138 decoder to generate /CS1, /CS2
  - You can purchase them on eBay, or otherwise, or
  - you can de-solder and reused one of the unused 74HC138s.
    - Unused means – no ram chips hanging off of it!
    - In PC8201, there are 3 spares – U3, U4, U5.
    - In 8k M100, there is one spare – M3
    - No spares in 24k M100.

- Proper /CS requirements
  - it will toggle between +5V and GND during normal operation
  - It will be pinned at Vb when the chip is in protect/standby mode
    - This happens when reset is hit, or the machine is off
  - This is done by powering the 74HC138 from Vb.

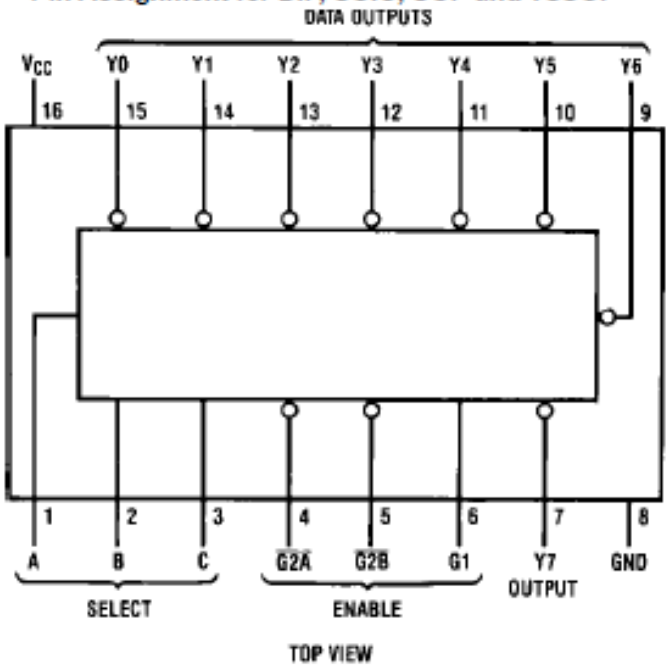
Step 3: location for 74HC138

- Preparation
  - You will want to glue the chip on it's back so the pins are up in the air
  - Bend the chip leads gently outwards so that they are more gull-winged, and don't stick up quite so high.

- Placement
  - in both models, you can place the chip on the board between the socket pins of an unused ram module socket.
    - In PC-8201, it is easier to place it on the "internal" side, not in the expansion bay.
    - In the M100, it must be placed internally.

74HC138 decoder

Pin Assignment for DIP, SOIC, SOP and TSSOP



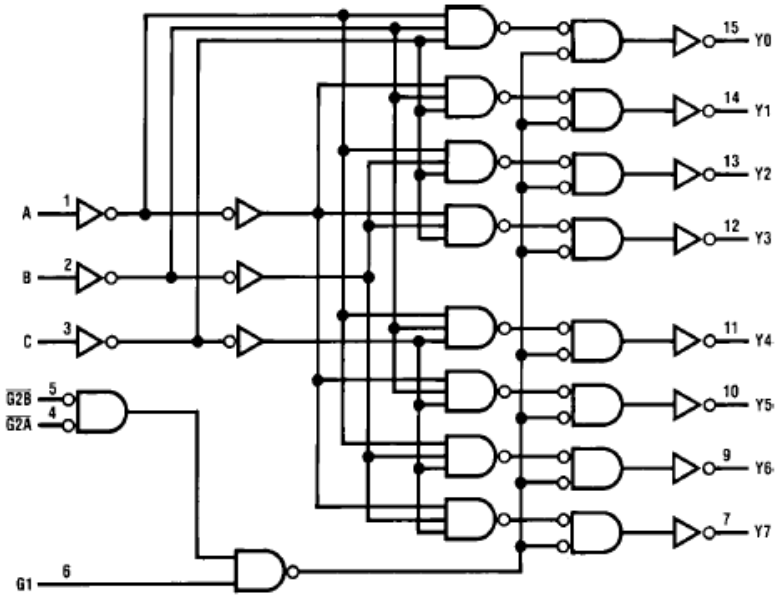
Truth Table

Inputs					Outputs							
Enable		Select										
G1	$\overline{G2}$ (Note 1)	C	B	A	Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7
X	H	X	X	X	H	H	H	H	H	H	H	H
L	X	X	X	X	H	H	H	H	H	H	H	H
H	L	L	L	L	L	H	H	H	H	H	H	H
H	L	L	L	H	H	L	H	H	H	H	H	H
H	L	L	H	L	H	H	L	H	H	H	H	H
H	L	L	H	H	H	H	H	L	H	H	H	H
H	L	H	L	L	H	H	H	H	L	H	H	H
H	L	H	L	H	H	H	H	H	H	L	H	H
H	L	H	H	L	H	H	H	H	H	H	L	H
H	L	H	H	H	H	H	H	H	H	H	H	L

H = HIGH Level, L = LOW Level, X = don't care

Note 1: $\overline{G2}$ = G2A+G2B

Logic Diagram



Step 3: 74HC138 connections

74HC138	M100	PC-8201
1, A	A15 (pin 13 M5)	A15 (pin 12 U23)
2, B	GND (pin 12 any ram socket)	/STDRAM (pin 5 U3)
3, C	Vb (pin 28 any ram socket)	/BANK2 (pin 5 U5)
4, /G2A	RAMRST (pin 22 any ram socket)	/POWER (pin 22 any ram socket)
5, /G2B	IO/M (pin 15 M5)	IO/M (pin 1 U1)
6, G1	A* (pin 6 M4)	E (pin 6 U3)
10, /CS1	Connect to 62256 /CS	Connect to 62256 /CS, bank 1
12, /CS2	N/A	Connect to 62256 /CS, bank 2
8, GND	GND (pin 12 any ram socket)	GND (pin 12 any ram socket)
16, Vcc	Vb (pin 28 any ram socket)	Vb (pin 28 any ram socket)

Finishing up:

- Glue down any wires that need to be tacked in place
- Reassemble the unit
- Test it out/debug as needed