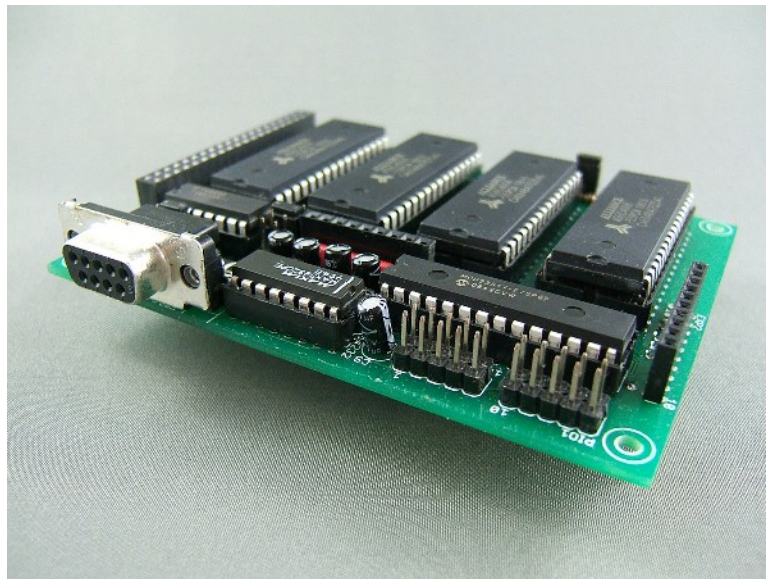


# Building Mem+ v1.00

**Version 0.90**

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Updated documentation will always be available at <http://Mikronauts.com>



*Mem+ v1.00*

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## Introduction

Morpheus is a great single board computer – and it is quite complete by itself, all you need is a PropPlug to program it.

Mem+ makes Morpheus even better, and you can have up to four Mem+ boards stacked on top of your Morpheus board.

I think you will be pleasantly surprised to find that Mem+ is considerably easier to build than Morpheus – so there is no need for this manual to have separate sections for components that are to be placed on top, or on the bottom – most components will go on the top of the board.

Please note that there are three optional sections on the Mem+ board that do not have to be populated – as a matter of fact, if you have more than one Mem+ board in your system, the options can only be populated on one of the boards.

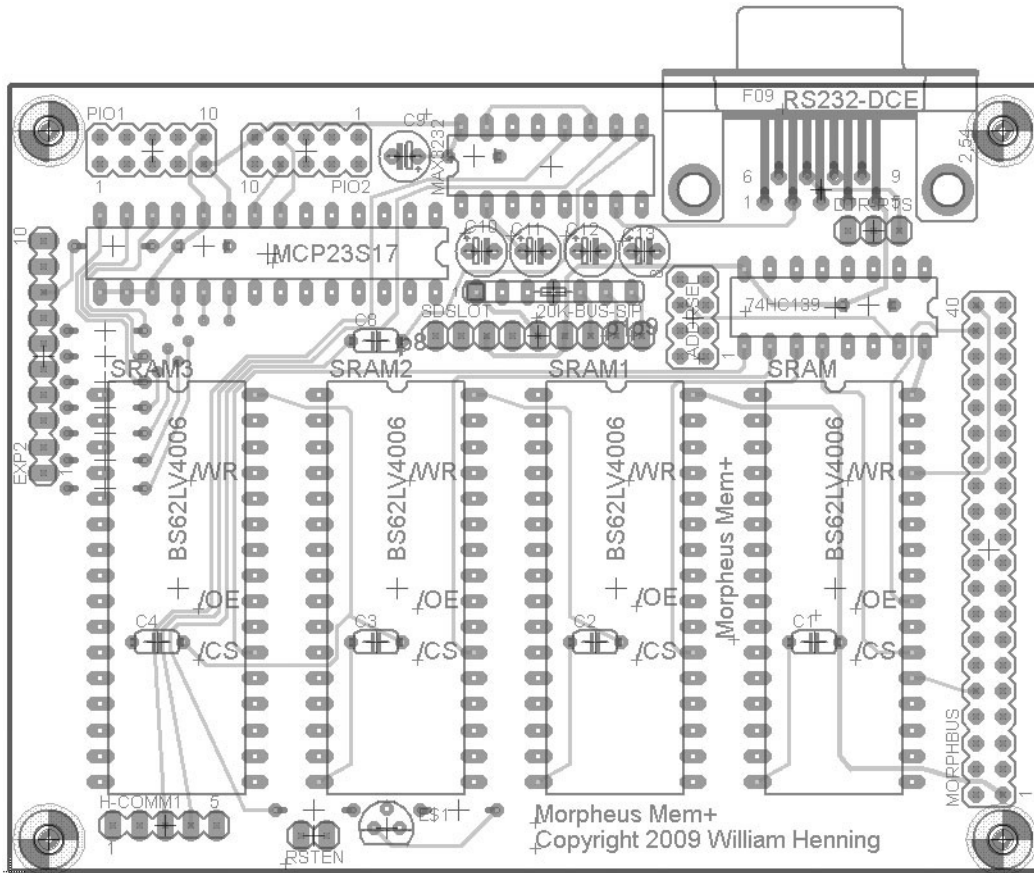
Option 1: RS232 port with Propeller programming circuit

Option 2: SD card header

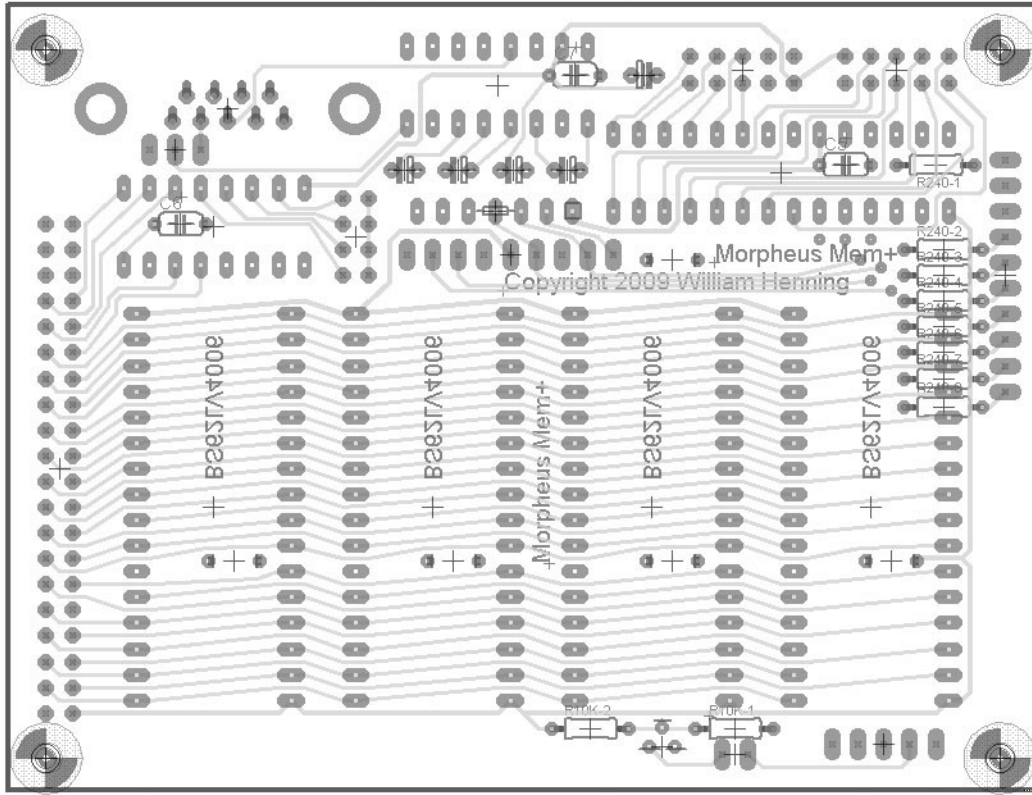
Option 3: 16 bits of parallel I/O

**Happy soldering!**

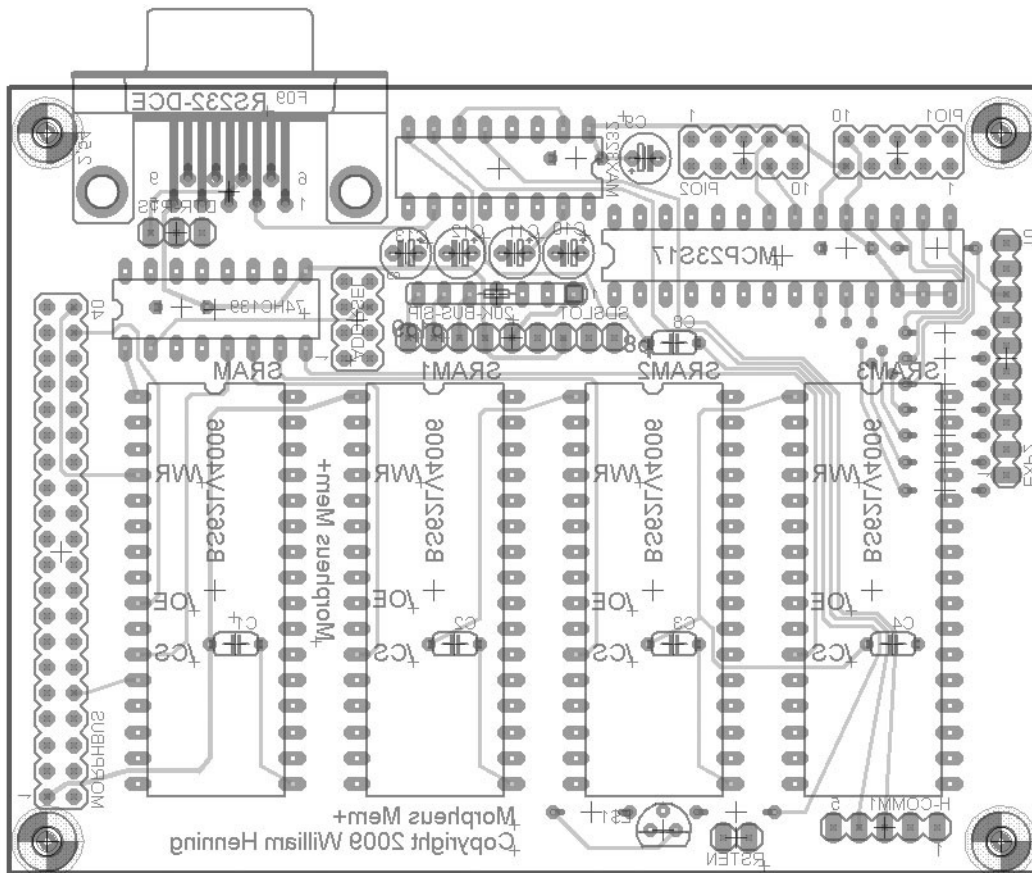
**Top of board**



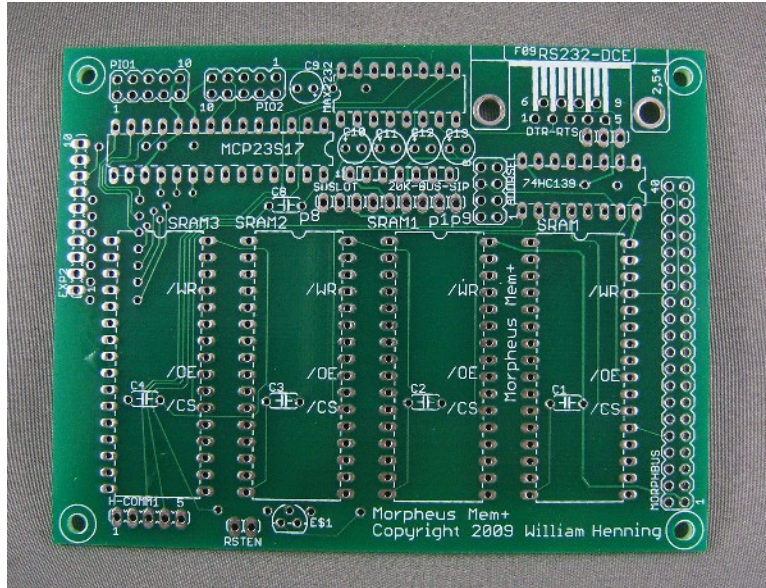
### Bottom of the Board



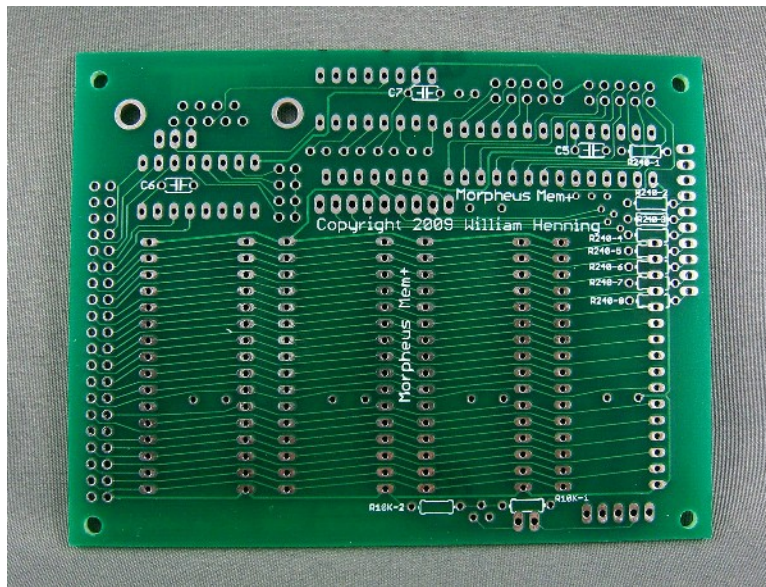
***X-Ray view of the top of the board, through the bottom***



**Top of Mem+ board:**



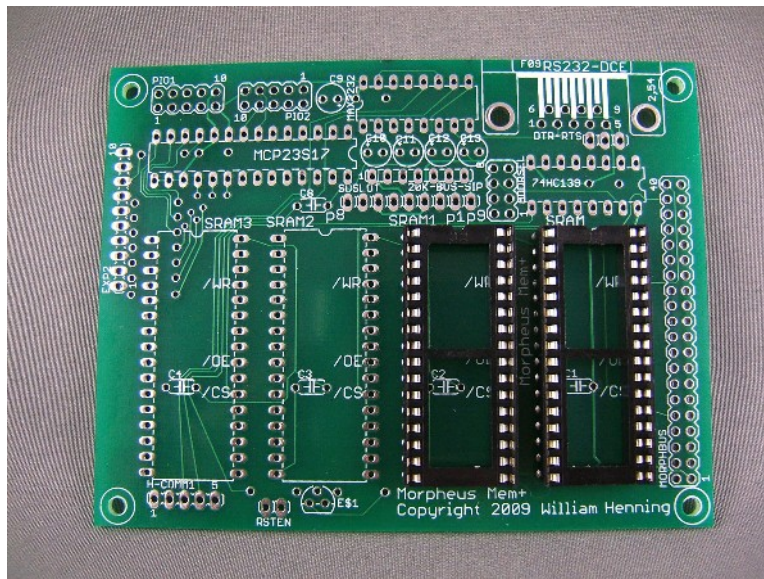
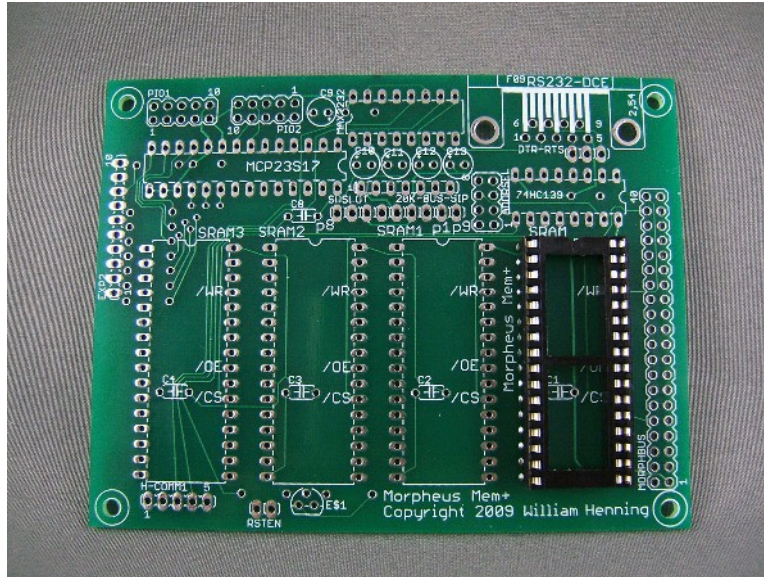
**Bottom of Mem+ board:**



## Section One – Building the board

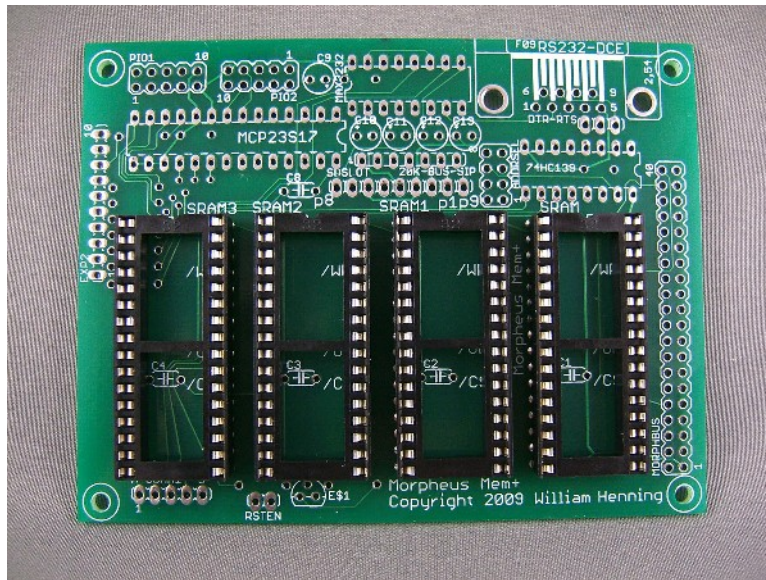
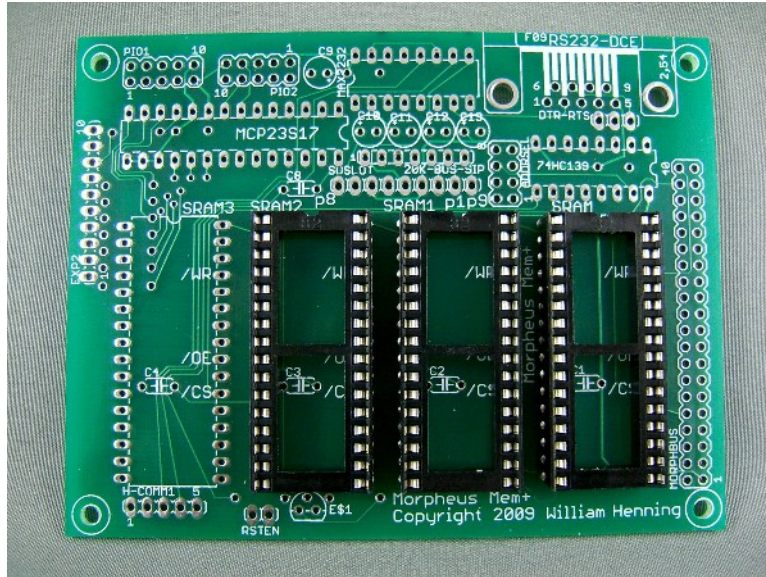
### Add the RAM sockets

Add the SRAM sockets one at a time, starting on your right

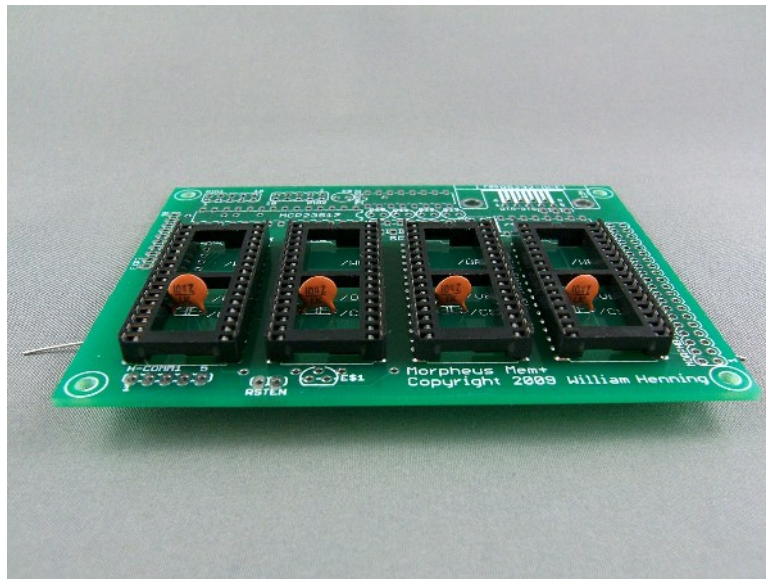
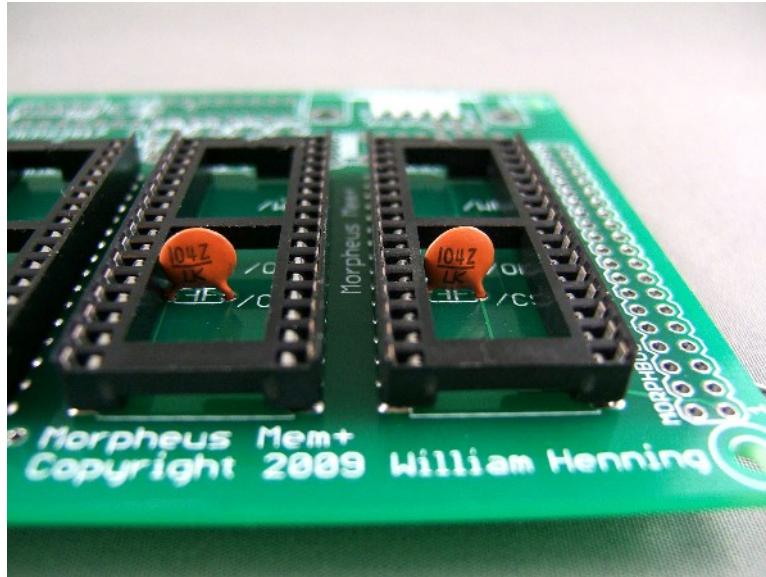




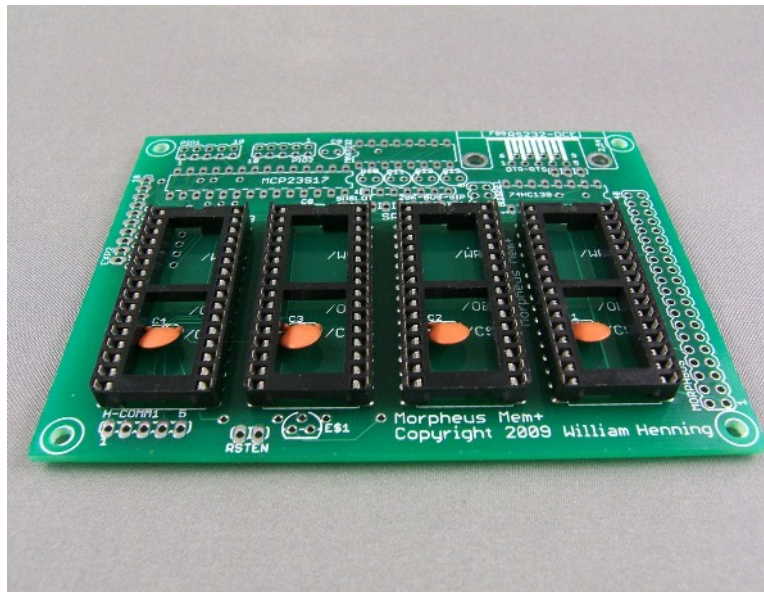
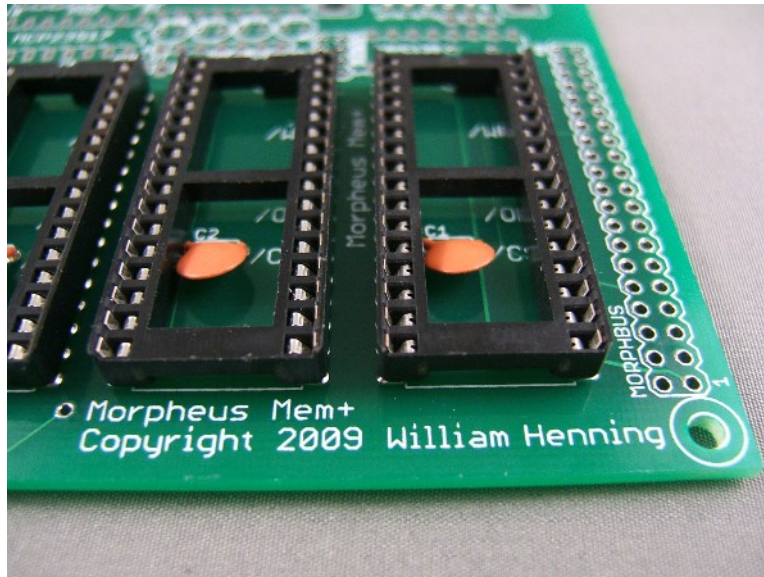
SRAM sockets - continued



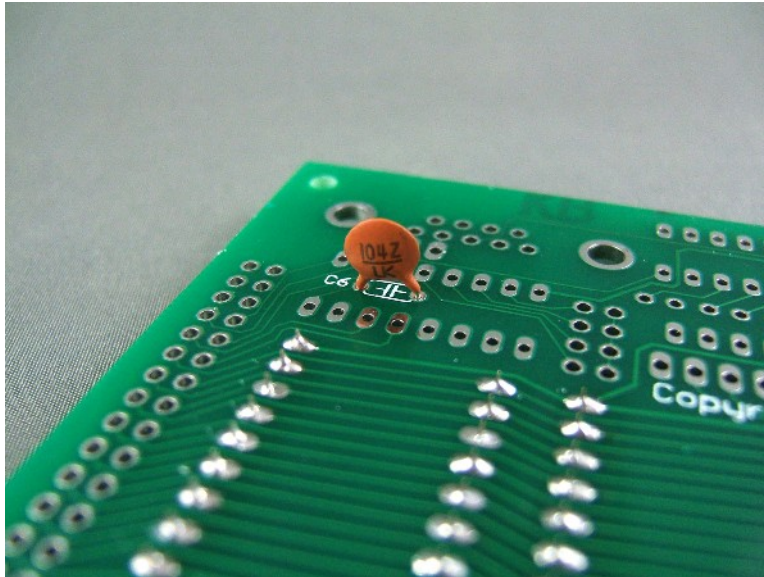
Now add decoupling capacitors C1-C5



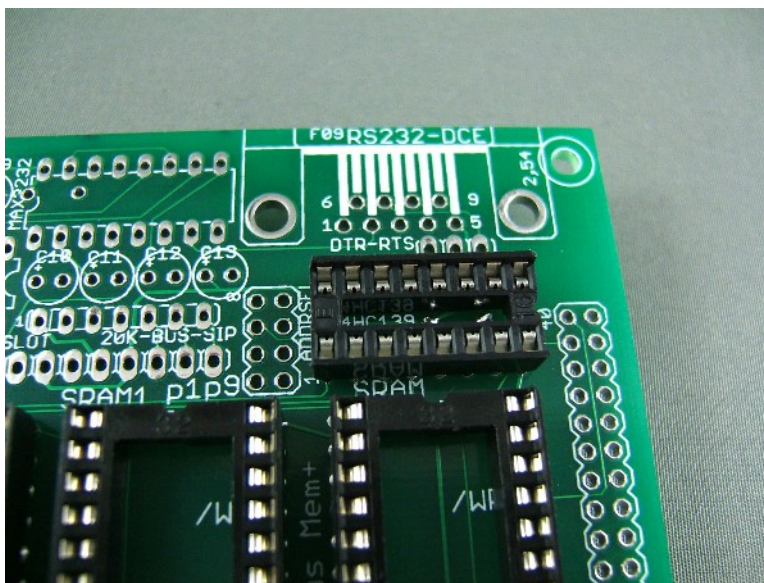
Now remove excess leads after soldering them, and bend them over so they fit under the chips



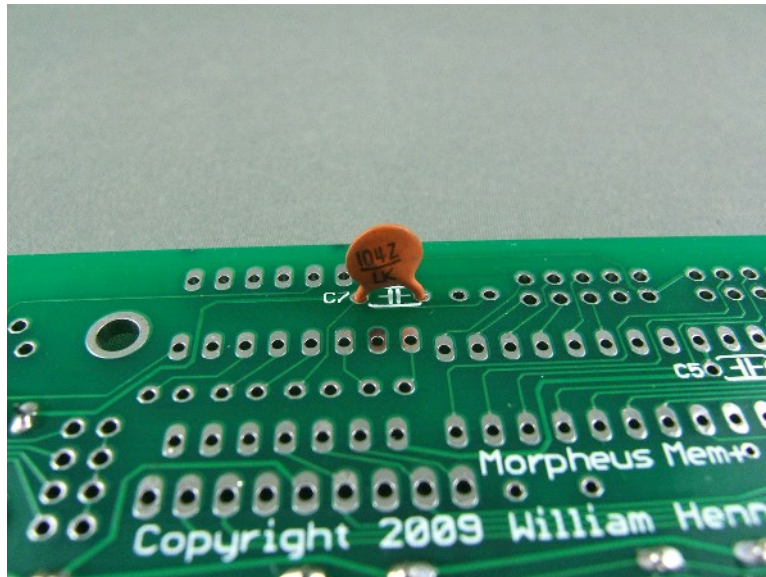
Now add the C6 decoupling capacitor for the 74HC139 on the bottom of the board



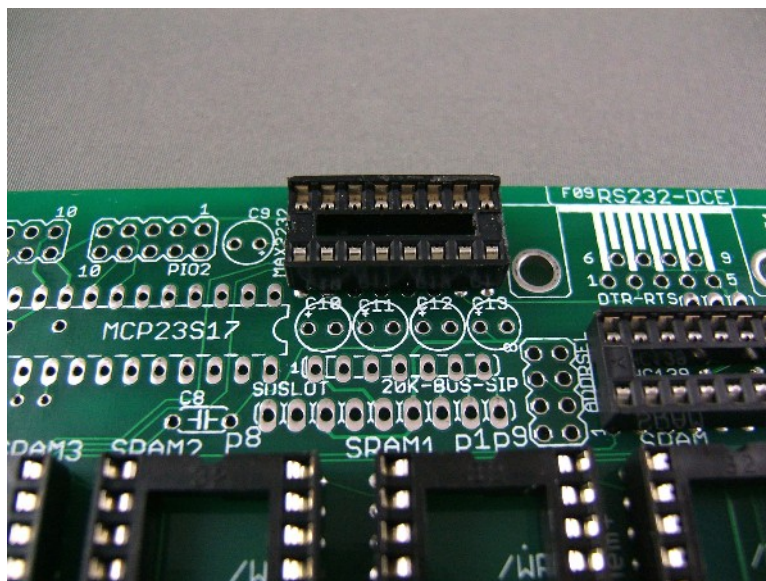
**Add the 74HC139 socket**



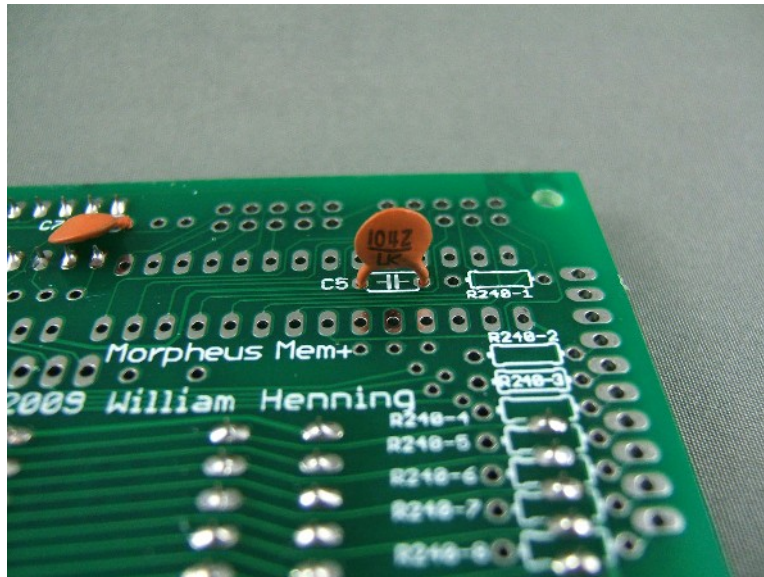
On the bottom of the board, add the C7 decoupling capacitor for the MAX3232 chip



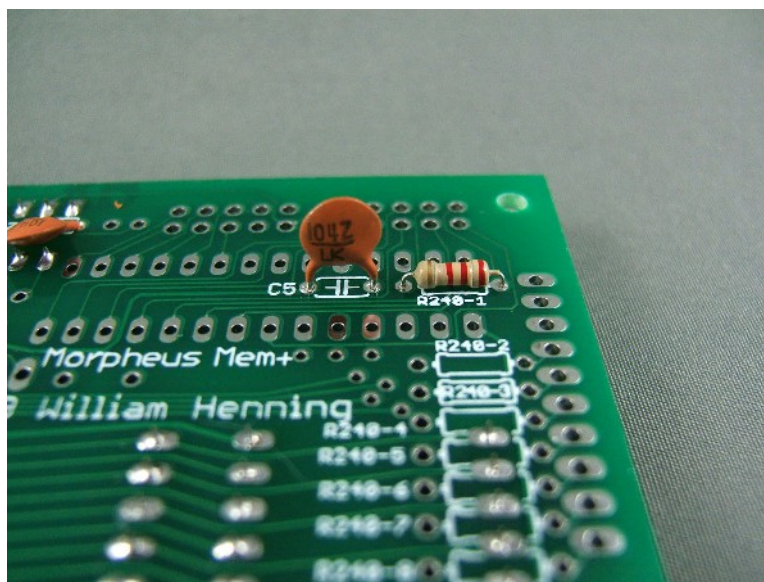
**Add the MAX3232 socket (option 1)**



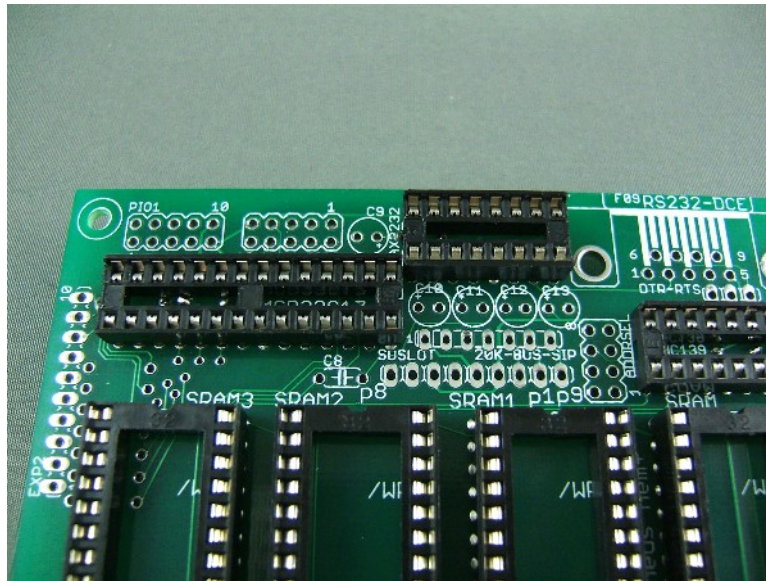
Add the C5 decoupling capacitor for the MCP23S17 on the bottom of the board



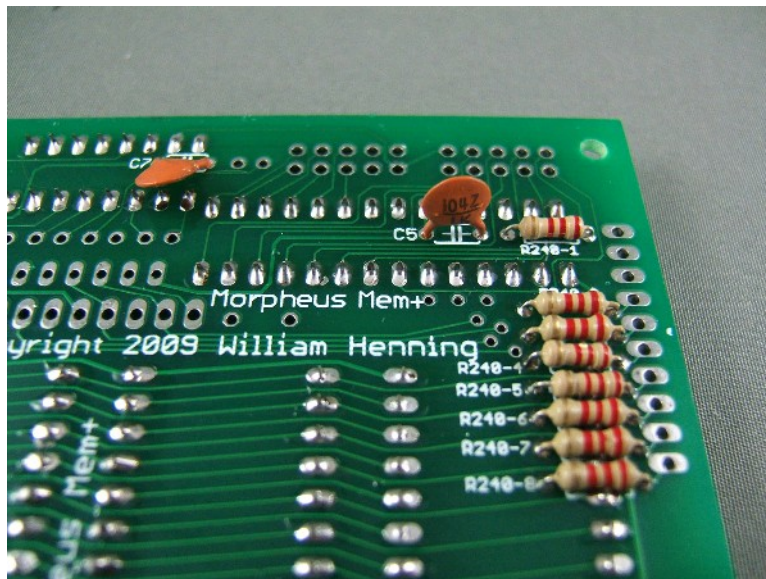
Add protection resistor R240-1 on the bottom of the board



**Add the MCP23S17 socket (option 3)**



**Add the Isolation resistors (option 2, option 3)**

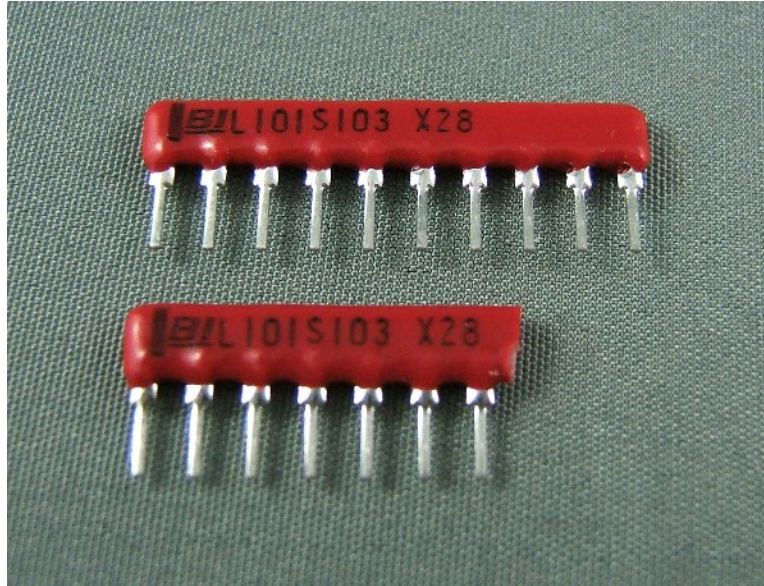


For all of these resistors, solder them from the bottom – the same side the resistors are on

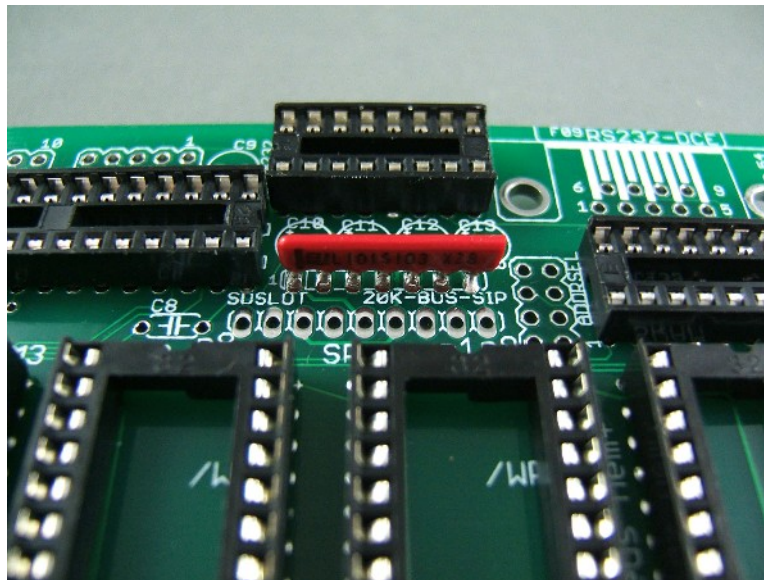
Note: R240-5 is a bit tricky, you need to insert it from the bottom at an angle and you will need to break the excess lead off by wiggling it back and forth as snippers won't fit under SRAM4 socket

### **Add the SIP for SD card (option 2)**

Before you can add the SIP package, you have to cut it down to 7 pins - remove the last three pins, but make sure you are leaving pin 1 on!

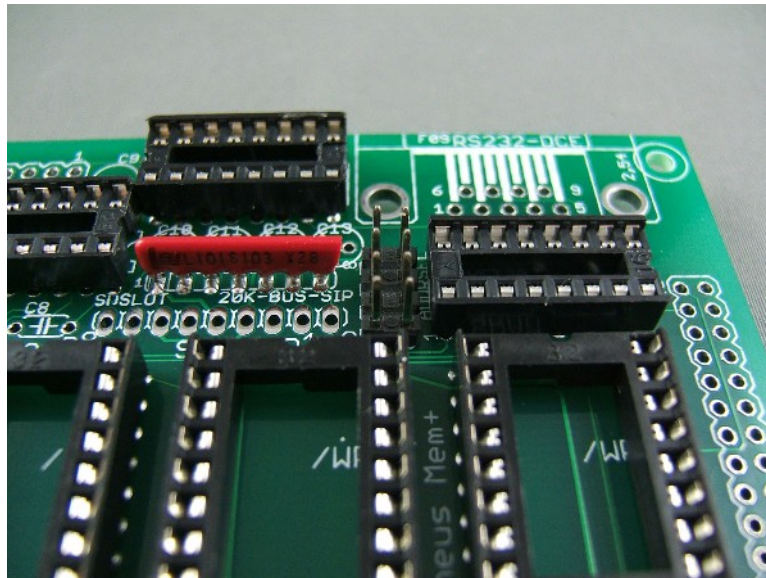


Use a multimeter to check that the last resistor's value (on ragged end) to pin 1 is 12K

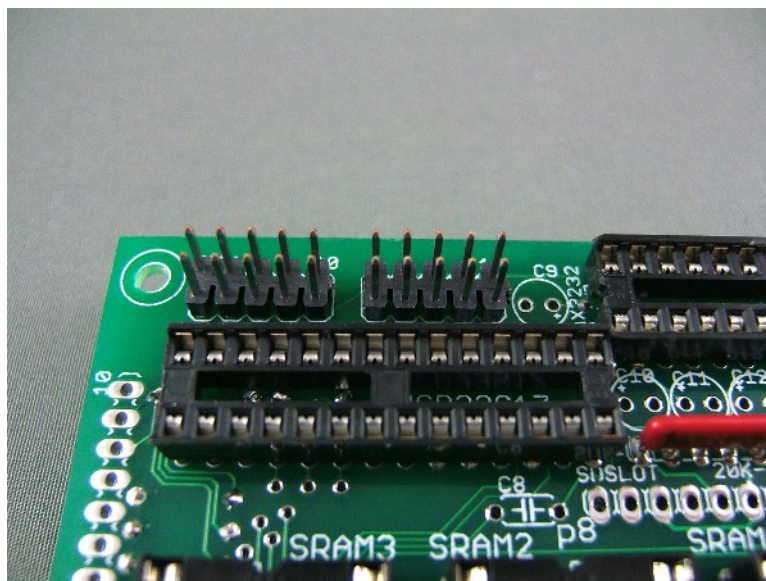




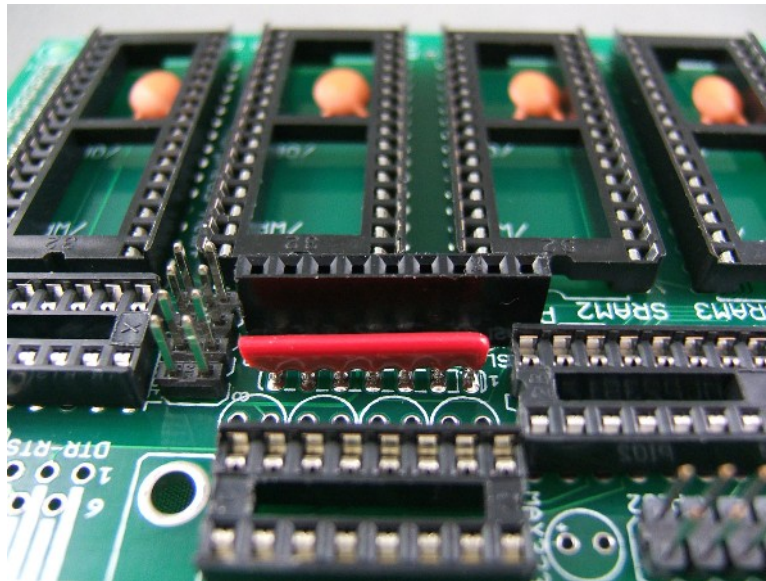
***Add the Address selection header***



***Add the Parallel I/O Expansion headers (option 3)***

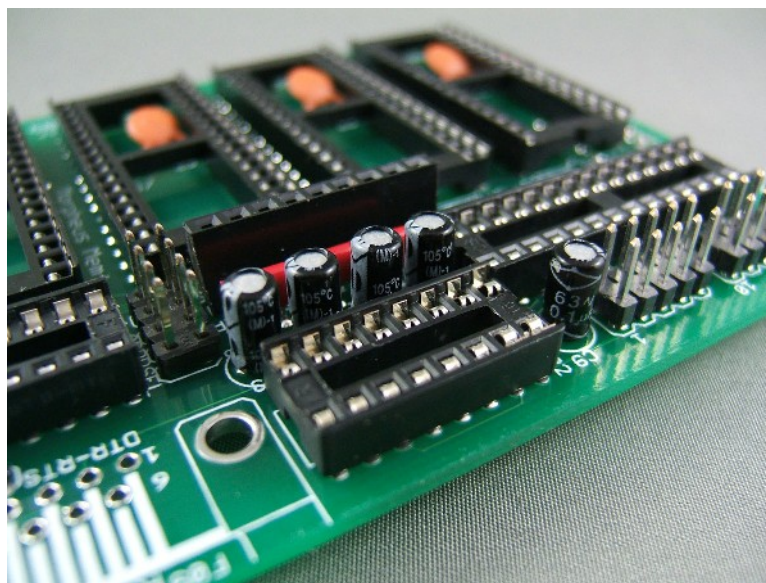


**Add the SD Card header (option 2)**



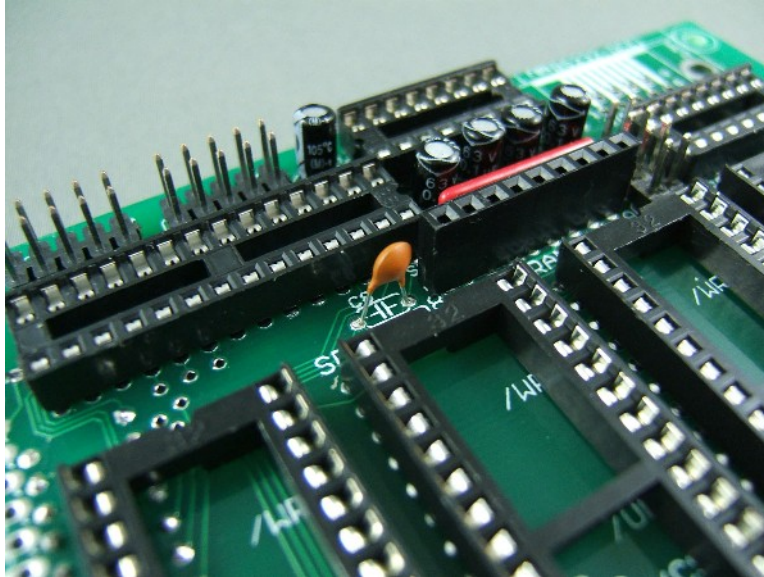
**Add the Electrolytic capacitors for the MAX3232 (option 1)**

Add C9-C13 0.1uF electrolytic capacitors for the MAX3232

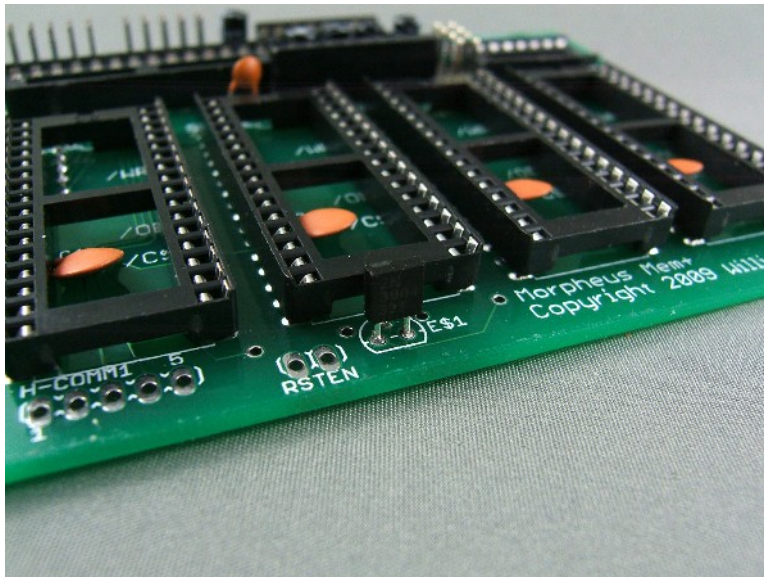


### ***Add the Propeller Reset Circuit (option 1)***

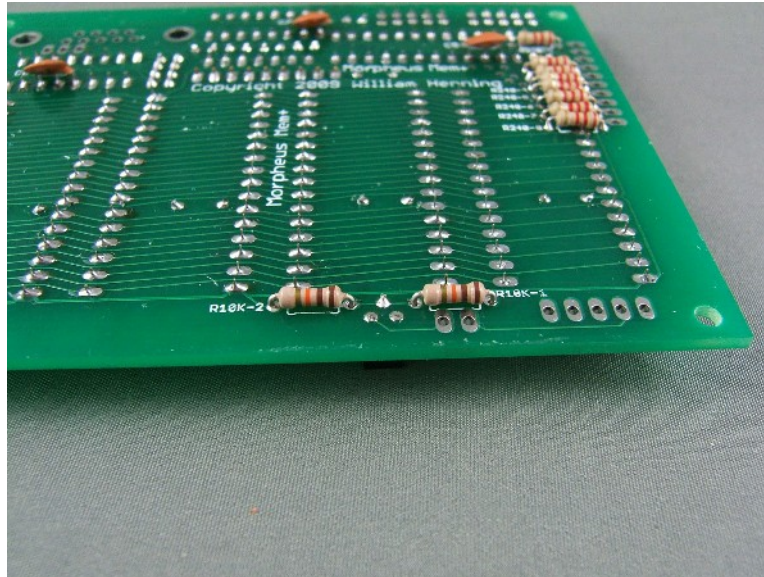
On top, add C8 10nF the ceramic capacitor for the reset circuit



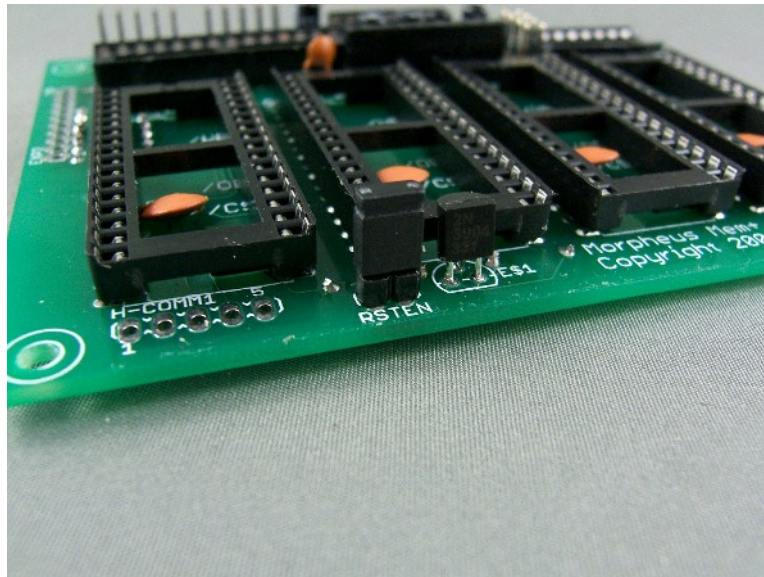
On top, add “e\$1” the 2N2904 transistor for the reset circuit



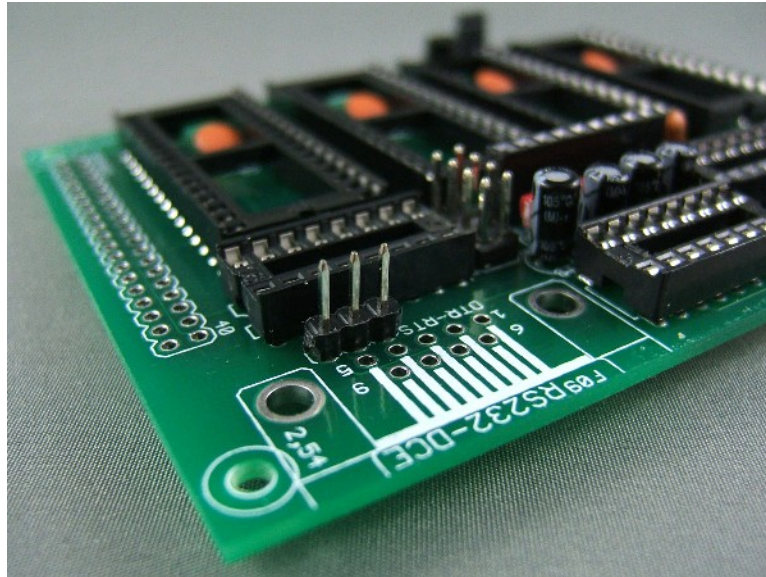
On the bottom, add r10k-1 and r10k-2 – they are easier to solder from the bottom of the board



On the top, add the RSTEN jumper



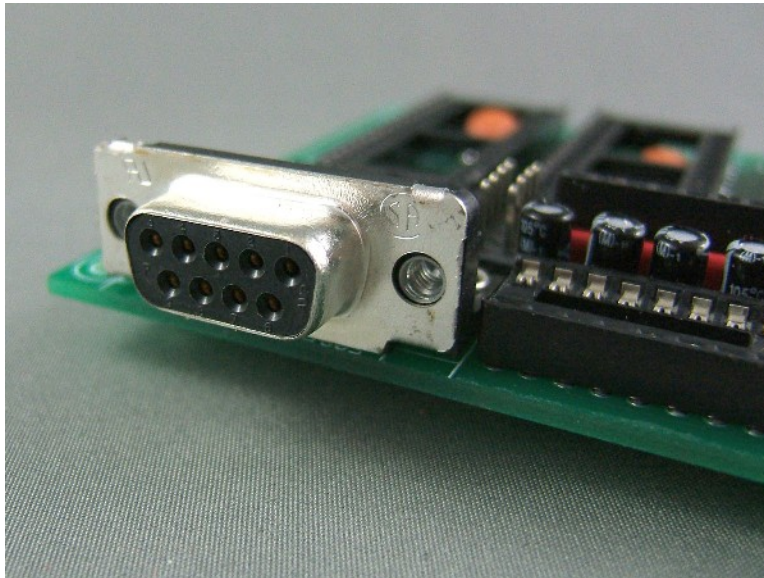
Add the DTR-RTS jumper for the MAX3232



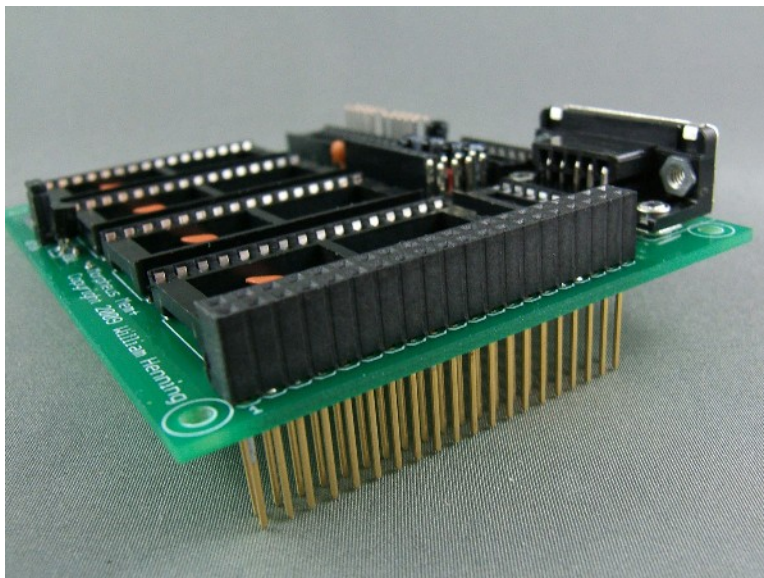
## Section Two – Installing the connectors

### *Adding the Serial port DB9F connector (option 1)*

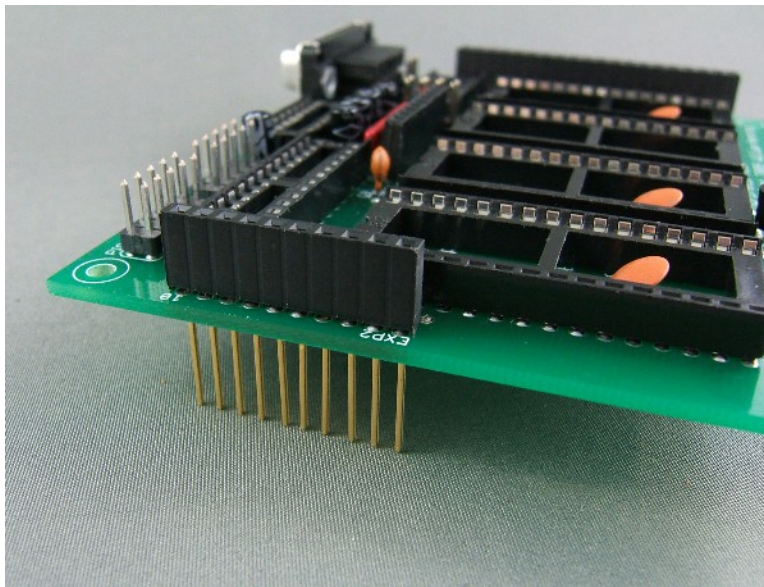
It may be better to add the DB9F after the other connectors.



### *Adding the MorphBus stacking connector*



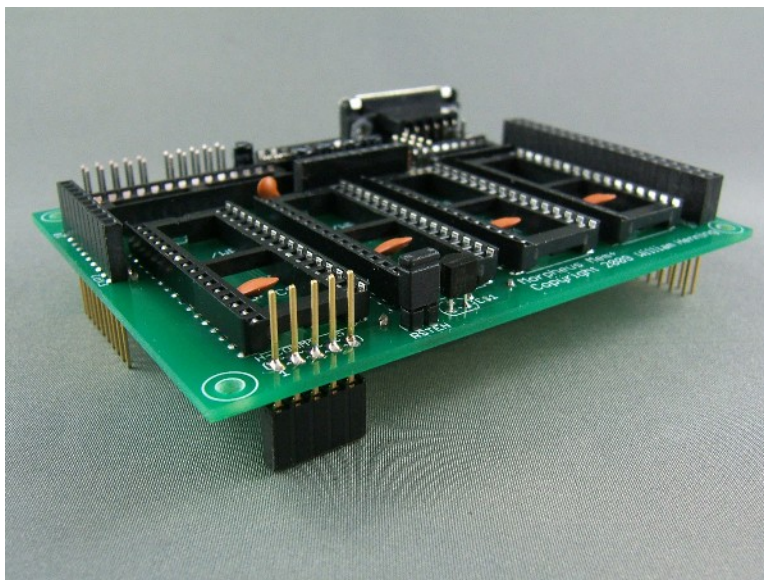
### ***Add the EXP1 stacking connector***



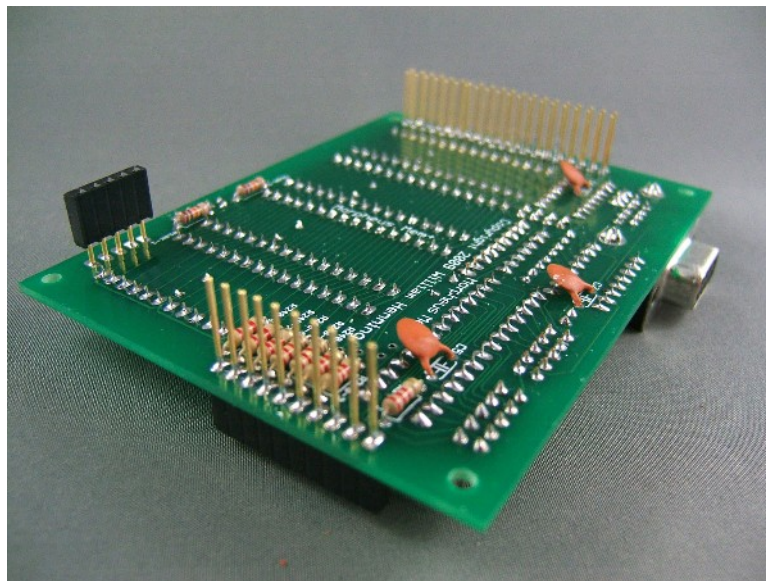
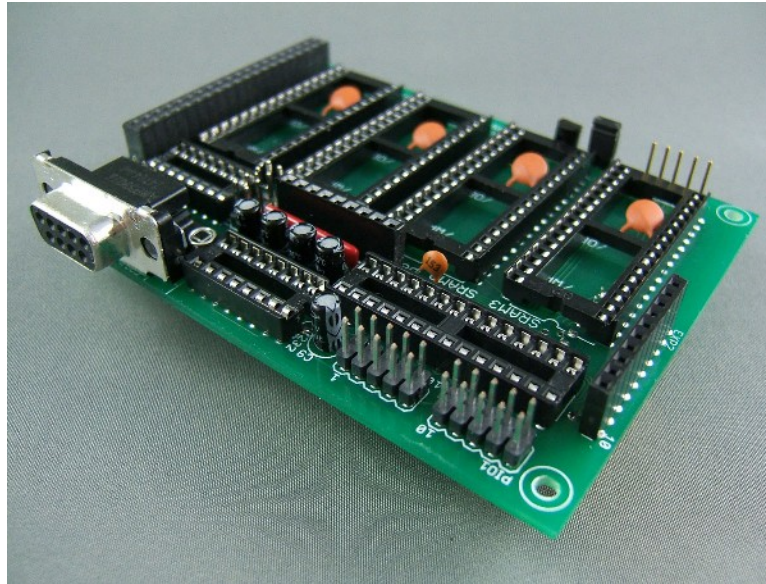
### ***Add the H-COMM1 stacking connector (option 1)***

This connector is a bit tricky to add.

You have to mount it up side down, and you have to plug the Mem+ board into your Morpheus board so you get the mounting distance right – solder this connector onto Mem+ while the two boards are stacked.



***Product shots of the finished Mem+ Board***



Now does that not look good?



## Section Three: The Smoke Test

If you have gotten this far, and are reasonably skilled at soldering, you probably have a working board, however just in case something went wrong, it would be nice to make sure that you don't fry the expensive chips!

### PLEASE TRY THESE TESTS!

#### ***Test #1: Power to Ground Shorts***

Read the resistance between 3.3V and GND somewhere handy on the board – I'd suggest pin 1 and pin 2 of EXP1 as being easy to get to.

If you read less than 300 ohms, you have a short somewhere. Look over everywhere you soldered, use a bright light and a magnifying glass.

Once you found the short, use solder wick to clear it.

Repeat this test until there are no more shorts.

#### ***Test #2: Power at Integrated Circuits***

Check the power and ground pins on the sockets for all the chips.

I **STRONGLY** suggest you print the pin out page from all the data sheets to help you test the board.

- SRAM – SRAM3
- 74HC139
- MAX3232
- MCP23S17

## **\*\*\* WARNING \*\*\***

**REMEMBER TO OBSERVE STATIC ELECTRICITY PRECAUTIONS WHEN HANDLING THE CHIPS AND A BOARD WITH CHIPS! YOU SHOULD USE A GROUNDING STRAP WHEN HANDLING STATIC SENSITIVE DEVICES!**

***Turn the power to Morpheus off, and install the Mem+ board on top of Morpheus.***

### ***Test #3: Memory test***

Install one memory chip in the socket closest to the MORPHBUS connector.

Connect the PropPlug to H-COMM2 on Morpheus (at a slight angle, you may have to bend the H-COMM2 pins out a bit)

Move the memory selection jumper to be lined up with the SD card header.

Turn Morpheus on.

Run MorphDiag, and choose the “Mem+ XMM test”

### ***Test #4: Serial port test (option 1)***

With the power off, connect a serial cable to the DB9F connector on Mem+

Turn Morpheus on.

Run a terminal program on the COM port Mem+ is connected to.

Run MorphDiag, and choose the “Mem+ Serial Test”

### ***Test #5: SD card test (option 2)***

With the power off, add the right angle Molex with an SD card plugged into it to Mem+

Turn Morpheus on.

Run MorphDiag, and choose the “Mem+ SD Card Test”

### ***Test #6: Parallel I/O test (option 3)***

With the power off, hook up LED's through 270R current limiting resistors to the parallel I/O connectors.

Turn Morpheus on.

Run MorphDiag, and choose the “Mem+ PIO Test”

**That's it! If all the tests pass, you have successfully built your first Mem+ board!**

## Appendix A: Data Sheets

SRAM: <http://www.bsi.com.tw/product/BS62LV4006.pdf>

74HC139: [http://www.nxp.com/acrobat\\_download/datasheets/74LV139\\_4.pdf](http://www.nxp.com/acrobat_download/datasheets/74LV139_4.pdf)

MAX3232: <http://datasheets.maxim-ic.com/en/ds/MAX3222-MAX3241.pdf>

MCP23S17: <http://ww1.microchip.com/downloads/en/DeviceDoc/21952b.pdf>

## Appendix B: Required Tools

- Multimeter capable of measuring at least DC Volts and Resistance
- Needle nose pliers
- Diagonal pliers
- desoldering pump
- soldering iron (ideally temperature controlled)
- solder