

### Apple 1 Board Design Techniques

This document is to describe the design concepts used in the design of several Apple 1 peripheral cards. Figure 1 shows the front and back of a card. The card has a normal card edge connector on the bottom and a 44 pin male connector mounted on the back. The purpose of the two mounting methods is to be able to attach the card directly to the card edge connector on the Apple 1 board or plug it into an expansion chassis. When the 44 pin connector is installed the board cannot be plugged into the 44 pin connector on the Apple 1 due to mechanical interference although if the connector on the peripheral board is not mounted it can be plugged into that location. This is not a serious limitation because an ACI board or CFFA board would normally be plugged into the Apple 1 connector.

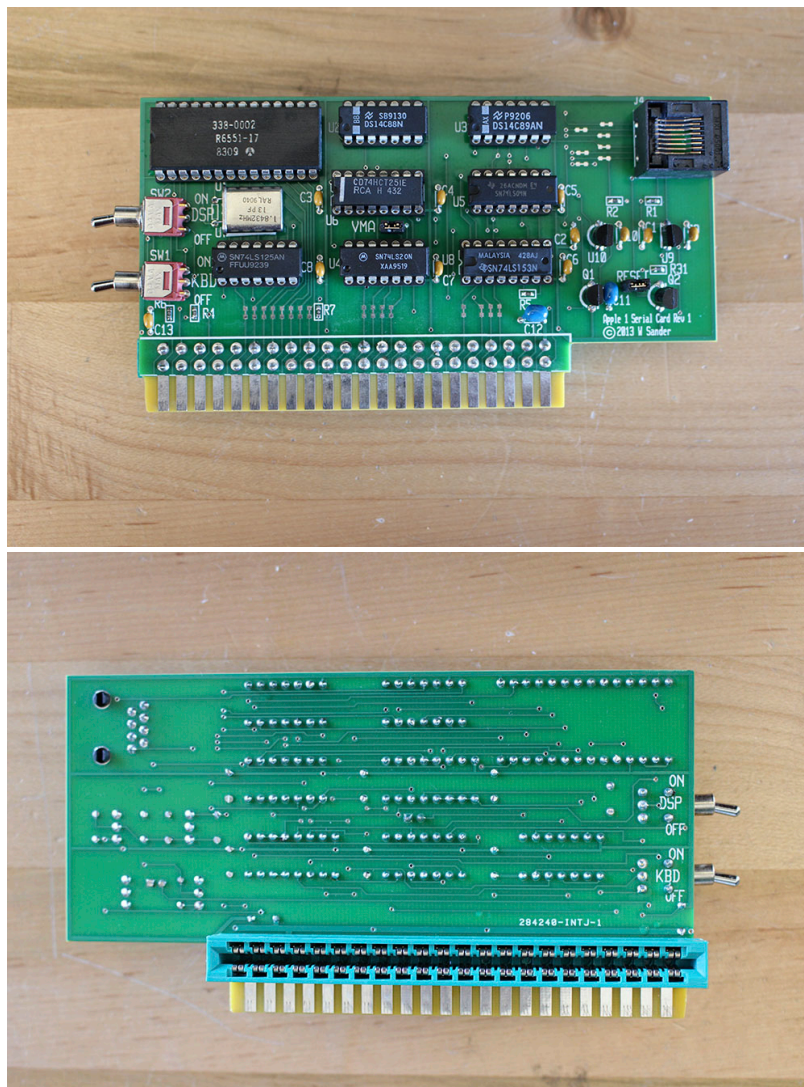


Figure 1

## Apple 1 Board Design

Figures 2 and 3 show the board plugged on to the PCB connector of the Apple 1. The card is designed to leave clearance for the Cassette cables when mounted in this fashion.

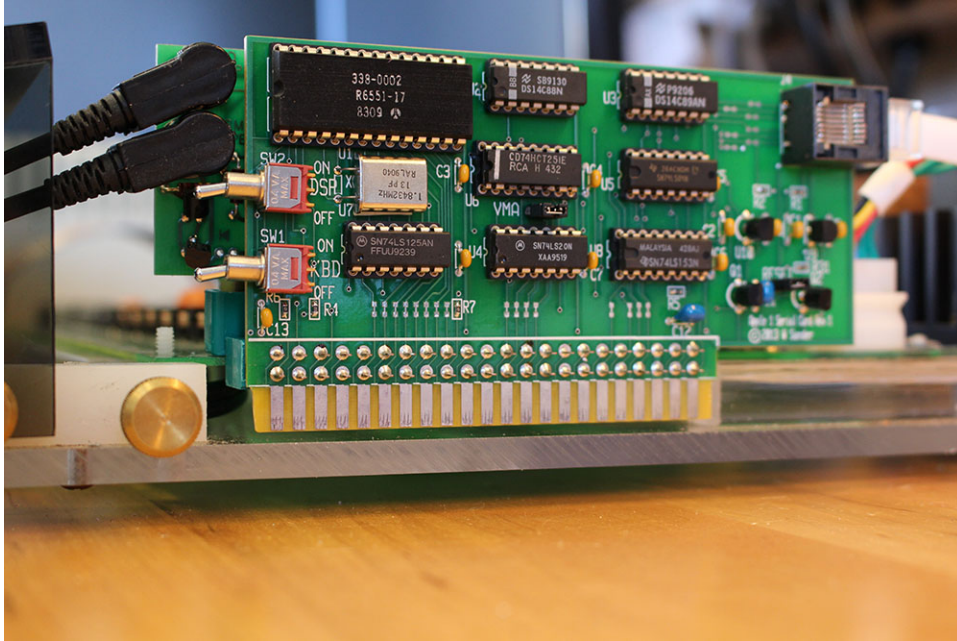


Figure 2

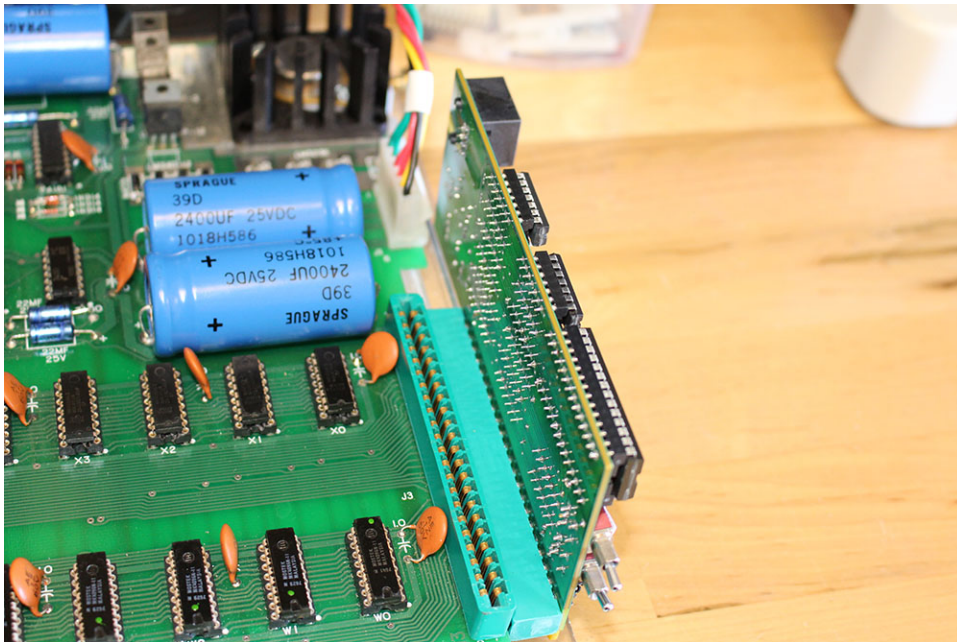


Figure 3

## Apple 1 Board Design

Figures 4 and 5 show boards mounted on an expansion chassis. Note that the connectors on the expansion chassis match the Apple 1 connector so the ACI can be moved to the expansion chassis. Also a card can be plugged on the end of the expansion chassis and even an additional expansion chassis can be plugged on the end as shown in Figure 6.

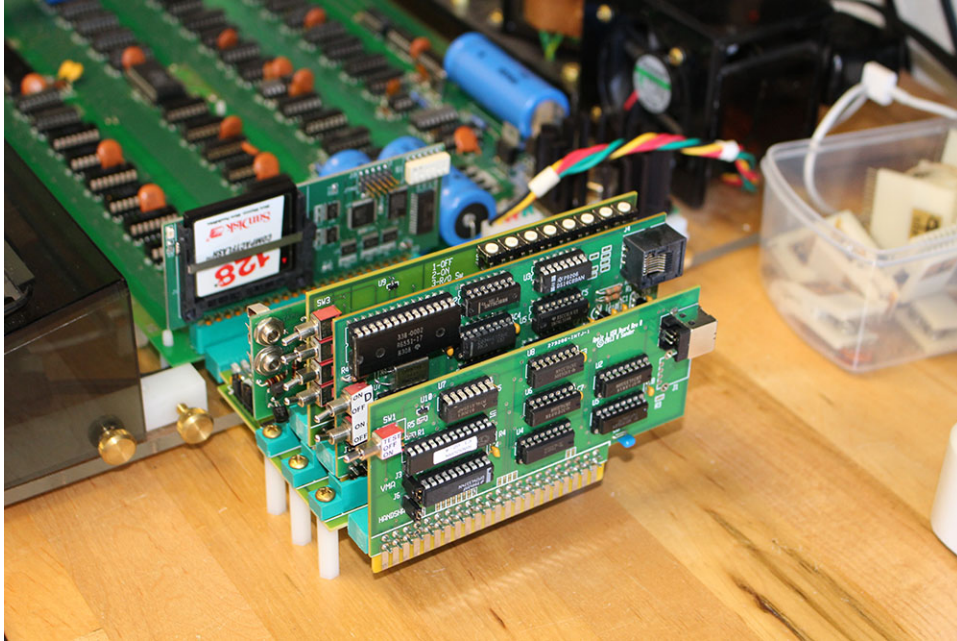


Figure 4

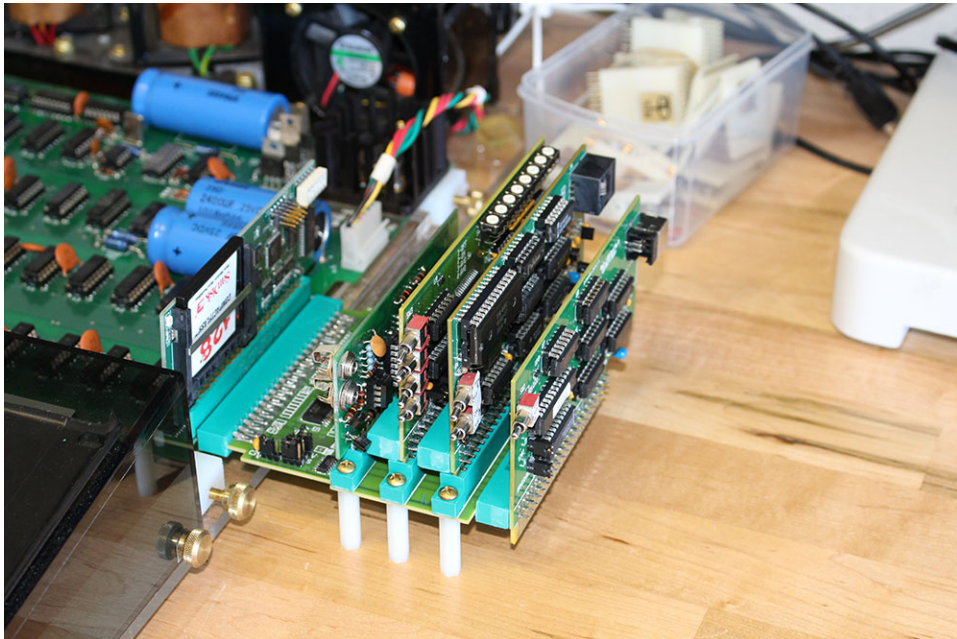


Figure 5

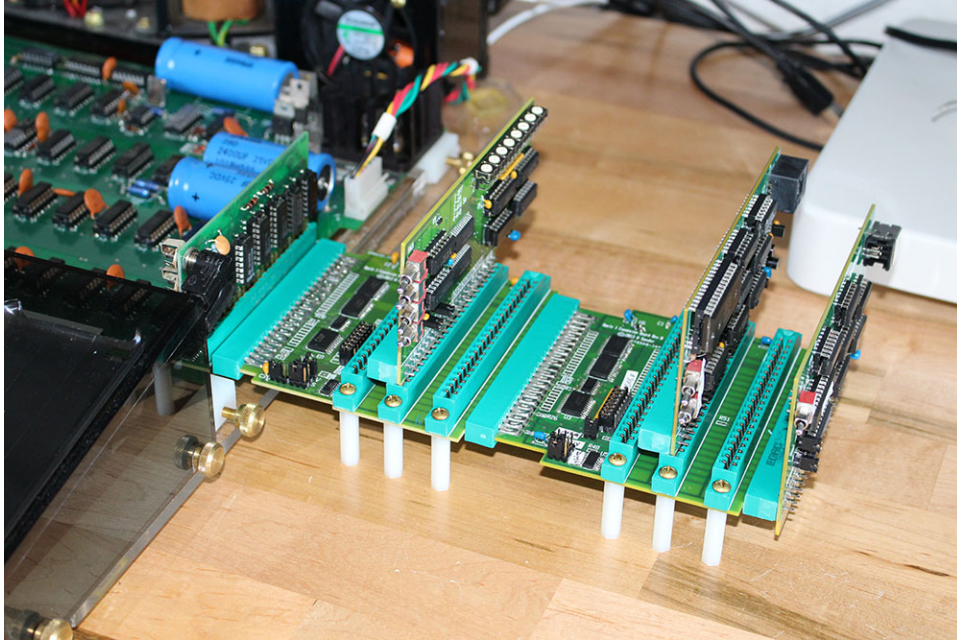


Figure 6

One of the issues with peripheral cards for the Apple 1 is that the external signals tend to be fairly noisy because of the large two layer logic board. One method of handling noisy signals is to add series resistors to damp ringing. The butterfly patterns on the traces of Figure 7 are easily cut and an 0603 surface mount resistor can be added in series with any signal that may be having a problem.

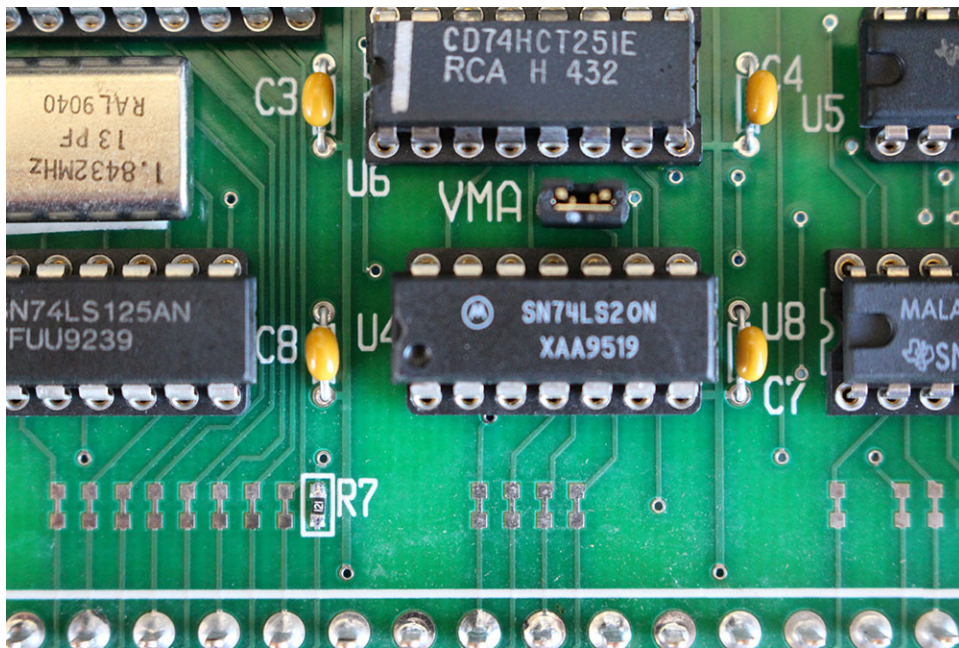


Figure 7

Figure 8 and 9 illustrate some of the configuration switch methods used. In Figure 8 shorting blocks are used for configuration including one that is an octal shorting block used to switch an 8 bit bus.

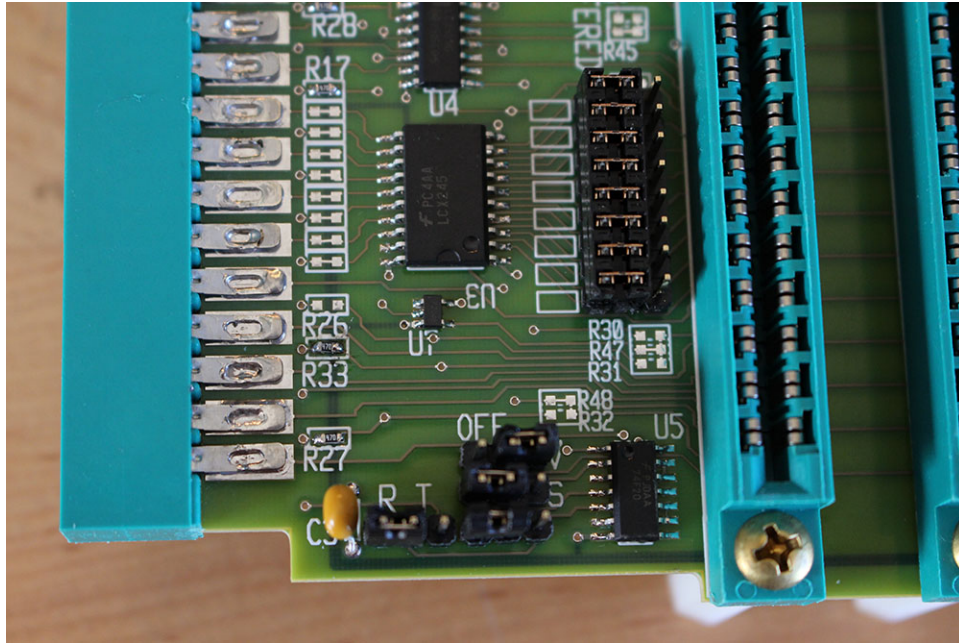


Figure 8

Figure 9 shows the use of two types of switches, the ones on the left are toggle switches, some with center off and the ones on the top are 4 position rotary switches,

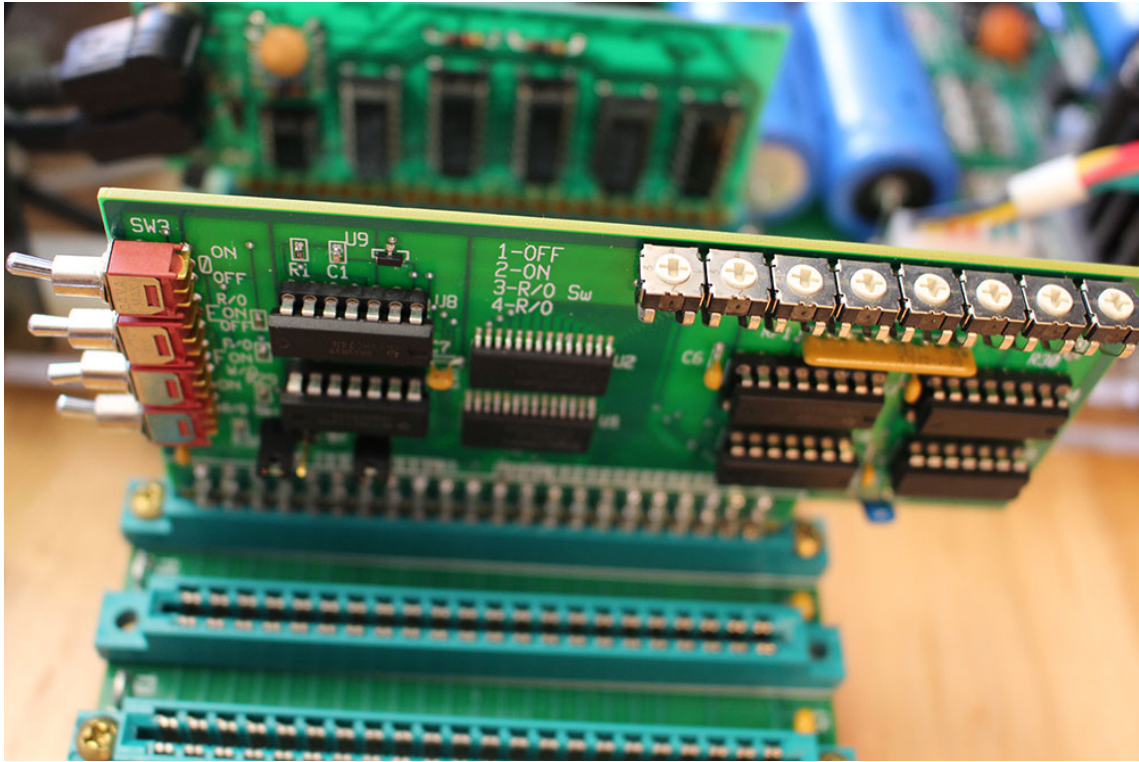


Figure 9

These design techniques have been use on a series of peripheral boards for the Apple I.