UPGRADING THE TRS-80 MODEL I TO 64K OF DRAMs
by Errol Rosser

[This article is reprinted from the Sydney (New South Wales, Australia) TRS-80 Users Group Newsletter. North American readers might question the use of the word "track" within the article, we use the word "trace" to mean the same thing (the conductive foil circuit paths on a printed circuit board), so just mentally substitute "trace" where you see "track". Just in case you need it, Mr. Rosser's phone number is (02) 709-7646 (from the U.S. and Canada, 011+61+2+709-7646).]

For those readers who wish to convert their Model I's to 4164 type 64k DRAMs (Dynamic Random Access Memory), here is a modification to allow uses of Motorola 6665's or similar 128 cycle refresh 4164's. The T.I. TMS4164 is unsuitable for this application because it requires a 256 refresh cycles and the Z80 only generates 128 refresh cycles then repeats the same 128 cycles afterwards. This happens because the Z80's refresh register (R) is a 7 bit binary counter with the eighth bit as a separate single bit memory changed only by the software and the "Master Reset" signal.

These alterations have been successfully made on both a 'D' series and a 'G' series board and the track layouts were the same. If anyone finds a Model I that doesn't match, please contact me.

Please note that these modifications require the electronics board to be removed from the case and much care should be used when cutting the tracks and when soldering the straps. I used an art knife with a small blade to cut the tracks, a magnifier to check that the cuts were clean, and wire-wrap wire for the straps. The whole job took approximately two hours to complete, including testing so don't rush in expecting to do it in 10 minutes.

Figures 1, 3, & 4 are on the circuit side and 2 is on the component side.
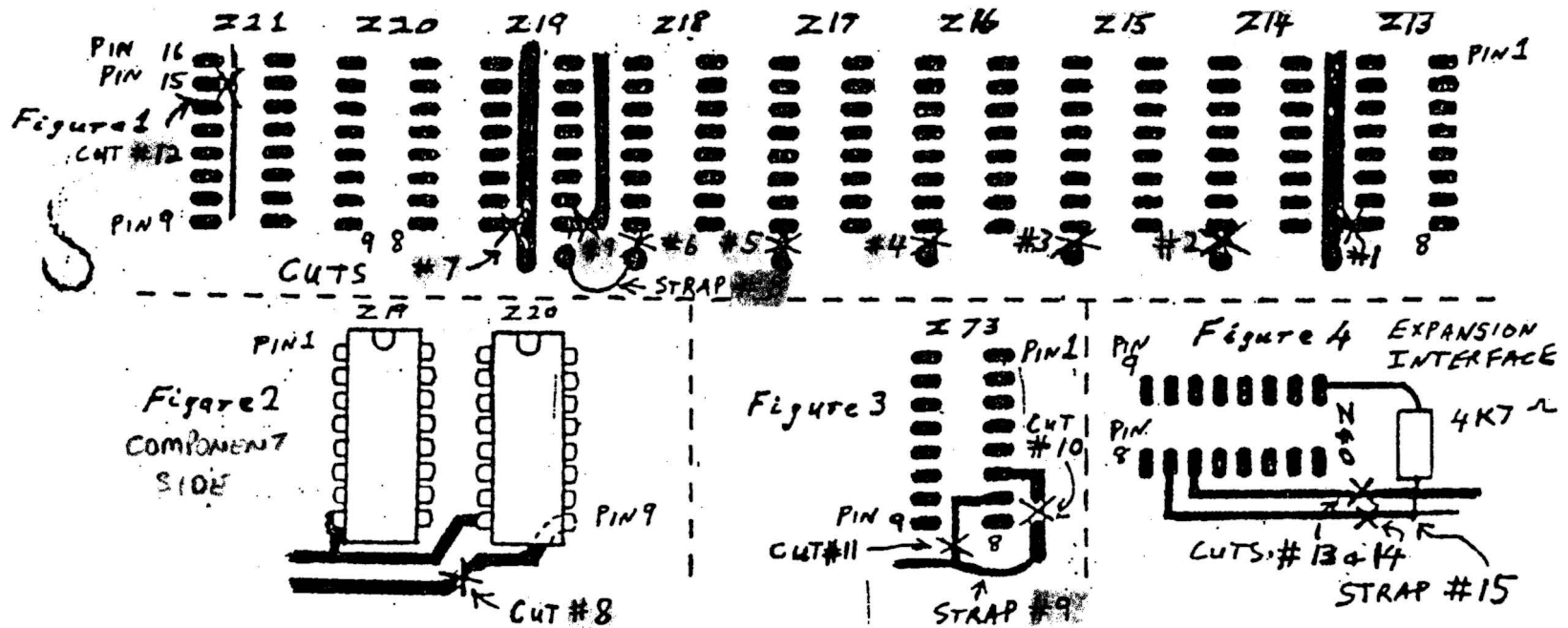
Part 1 Tracks to be cut:

(a) Remove +5V from pin 9 of Z13 to Z20	cuts #1-#8	figures 1 & 2
(b) Remove +12V from pin 8 of Z19	cut #9	figure 1
(c) O/C *RAS from Z73 pin 5	cut #10	figure 3
(d) O/C Z73 pin 6 from Z21 pins 2 & 14	cut #11	figure 3
(e) O/C A14 from Z21 pins 1 & 15	cut #12	figure 1

Part 2 Straps to be added:

(a) +5V to Z19 pin 8	strap #8	figure 1
(b) Z13 – Z20 pin 9 to Z51 pin 12	straps #1 – #7	
(c) *RAS to Z21 pins 2 & 14 at Z73	strap #9	figure 3
(d) Z73 pin 6 to Z21 pins 1 & 15	strap #11	
(e) Z38 pin 11 to Z73 pin 5 & Z51 pin 14	straps #11 & #12	
(f) Z38 pin 9 to Z51 pin 13	strap #14	

If you have an expansion interface then one alteration will be required in it to prevent the selection of the RAM sockets in there. The tracks to Z40 pins 6 & 7 are to be cut and then joined together and pulled up to +5V by a 4K7 resistor as per cuts #13 & #14 and strap #15 in figure 4.

Figure 1

Z21 Z20 Z19 Z18 Z17 Z16 Z15 Z14 Z13

PIN 16
PIN 15
Figure 1
CUT #12
PIN 9

PIN 1

CUTS #7 #6 #5 #4 #3 #2 #1 8

STRAP

Figure 2

Z19 Z20

PIN 1

Figure 2
COMPONENT
SIDE

PIN 9

CUT #8

Figure 3

Z13 PIN 1

Figure 3

CUT #10

PIN 9

CUT #11 8

STRAP #9

Figure 4

PIN 9 Figure 4 EXPANSION INTERFACE

PIN 8 4K7 Ω

CUTS #13 & 14

STRAP #15

CUT 1 , 2 , 3, 4, 5, 6, 7, 8 | 9 | 10 | 11 | 12

STRAP 8 | 1, 2, 3, 4, 5, 6, 7 | 9 | 11 | 11 & 12 | 14