Altair 680

Main Board

User's Manual

Introduction

The reproduction Altair 680 Main Board was developed from photographs of an Altair main board and measurements supplied by an Altair 680 owner. This reproduction closely resembles the original MITS main board. The mounting holes are in the same position, and the reproduction board can be installed in an original Altair 680 case. The major difference in the reproduction was additional pads to allow HC-49 sized crystals to be used. The circuitry was not changed. There is an updated parts list which improves the board. While we don't recommend it, you can use the MITS parts list if you want a completely authentic board as it would have been built in the 70s.

Main Board Manual

Use the updated parts list instead of the one in the Altair manual. Otherwise, the original MITS user manual will apply to the reproduction board. A copy of the MITS ALTAIR is included in the appendix of this manual.

Part Changes/Notes

7805 Voltage Regulator

Do not use a 7805 for the voltage regulator. The voltage from the Altair 680 power supply is close to 10V. This results in a very hot 7805, in fact, close to 100C. This required the use of a bypass resistor (R21) to reduce loading on the 7805. We find this an unacceptable way to provide regulated 5V for the Altair 680. Use part number – RBT20W24S05 from Digikey. This is a DC-DC 2 AMP high efficiency switching regulator. It does not run hot to the touch. Do not install R21.

1702 EPROMs

If you use the Peripheral Technology MIO board you don't need to use the 1702's on the main board. To disable the 1702's on the main board, simply unplug them. No other modification is necessary. The upper 4K block of EPROM on the MIO board provides memory from F100-FFFF. Addresses from F000-F0FF are not decoded since they would conflict with the Altair 680 IO.

Power Up Reset

Power up reset did not work reliably on the reproduction board. Altair owners say the original board didn't work either. It seems that with the original Altair board the common way to start the board was to place the run/halt switch in the halt position, toggle reset, and return the run/halt switch to run. The fix for this is simple. The value of the power-up reset capacitor was too small. Increasing the value of C6 fixes the problem. Reset was not being held low long enough for the processor oscillator to stabilize before coming out of reset.

PHI2 R/W

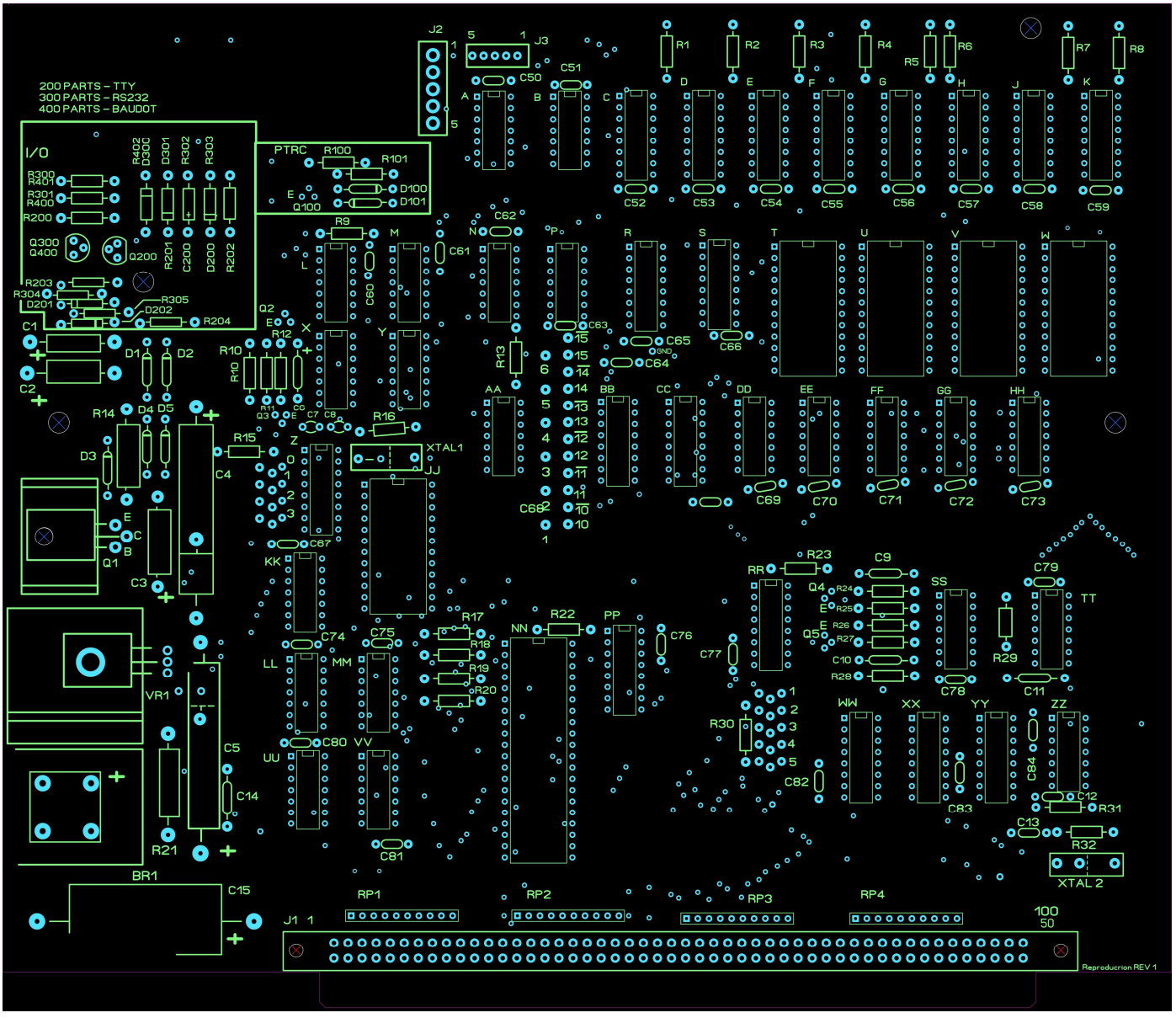
The MITS main board used a CD4050 to buffer PHI2 and R/W before sending those signals to the bus. This resulted in PHI2 and R/W being delayed by approximately 100 ns. The amount of this delay caused problems with some system configurations. The fix for this in the 70's was to unplug and bypass the CD4050. While this works for most owners, there is the possibility of the 6800 processor and clock circuit feeding a large number of chips. A modern solution for this problem is to use a 74HC4050 as a replacement for the CD4050.

Building the Reproduction Bare Board

If you have purchased the bare board, you are probably experienced in locating parts and

building boards. Feel free to build the board in any order you wish. If you want some guidance, use the steps in the MITS manual.

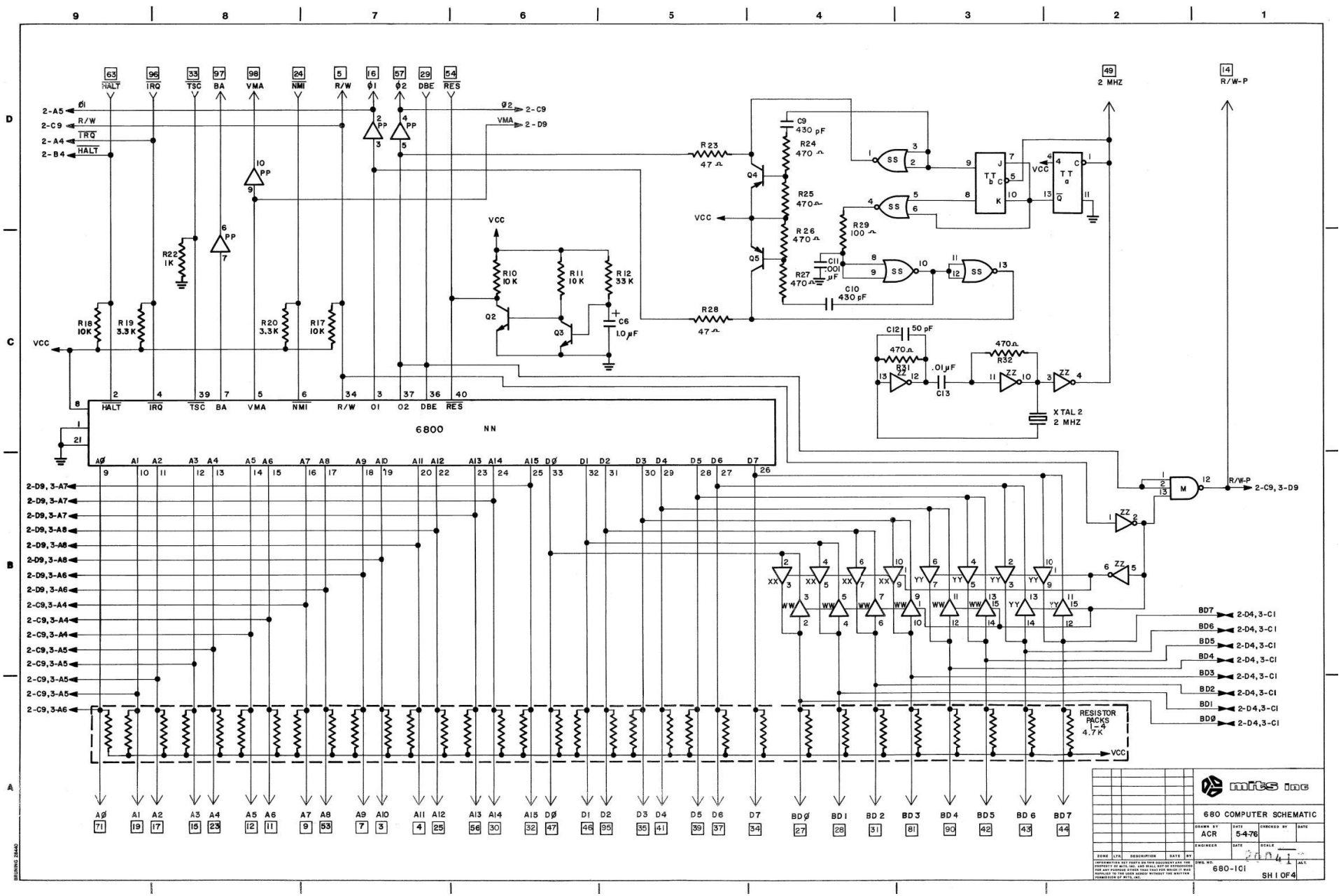
Parts Placement

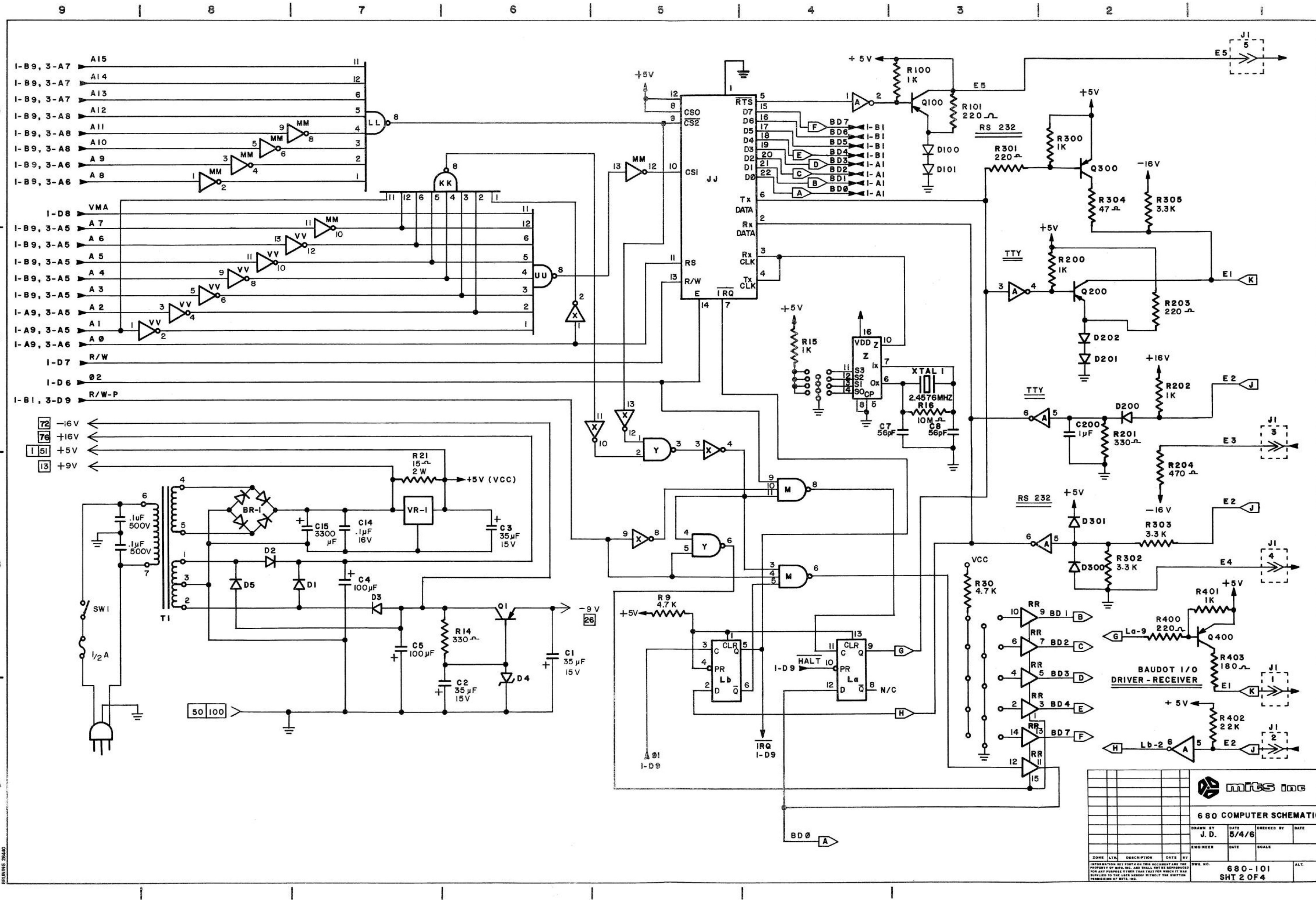


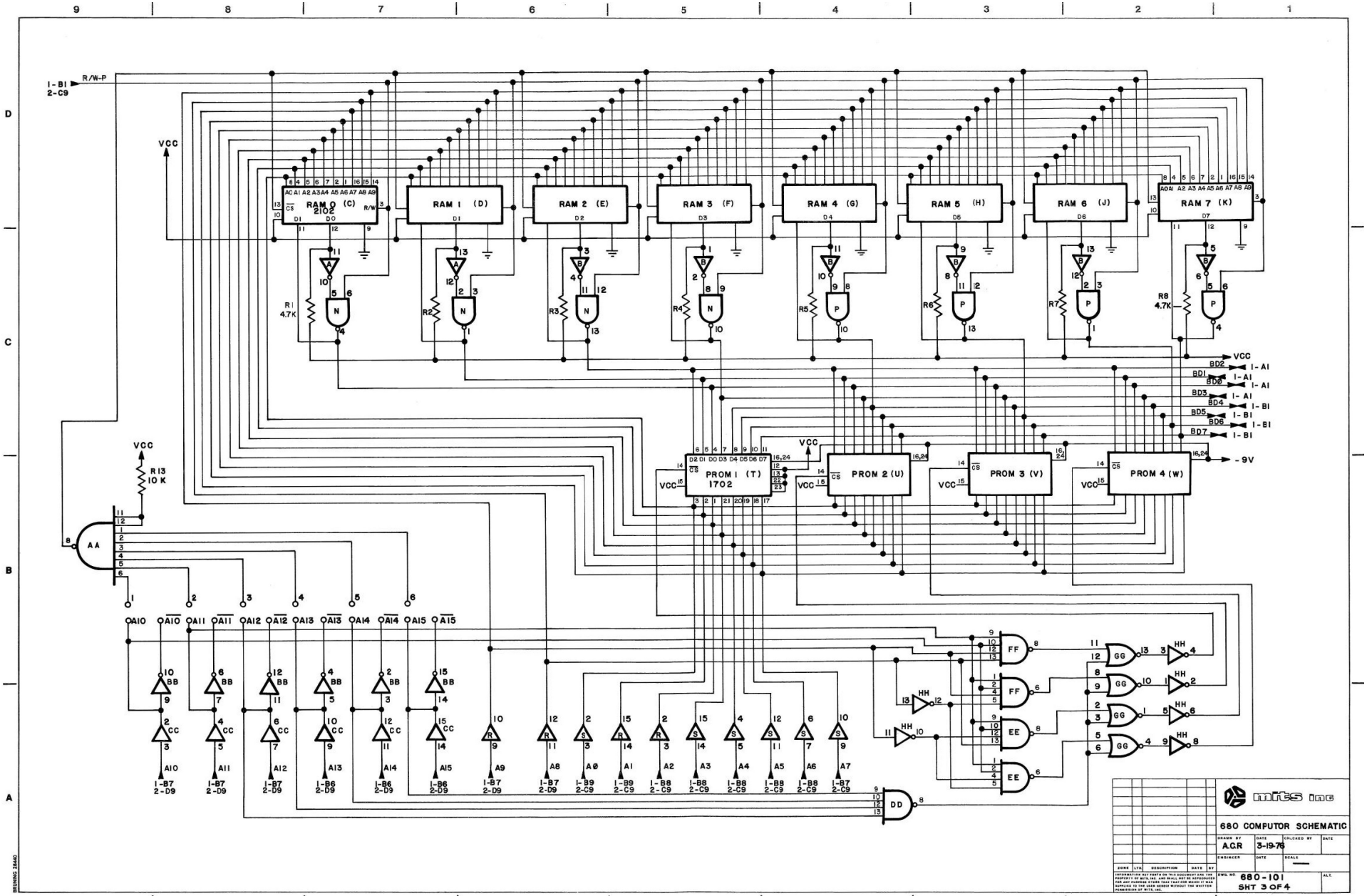
Altair 680 Main Board – Parts List

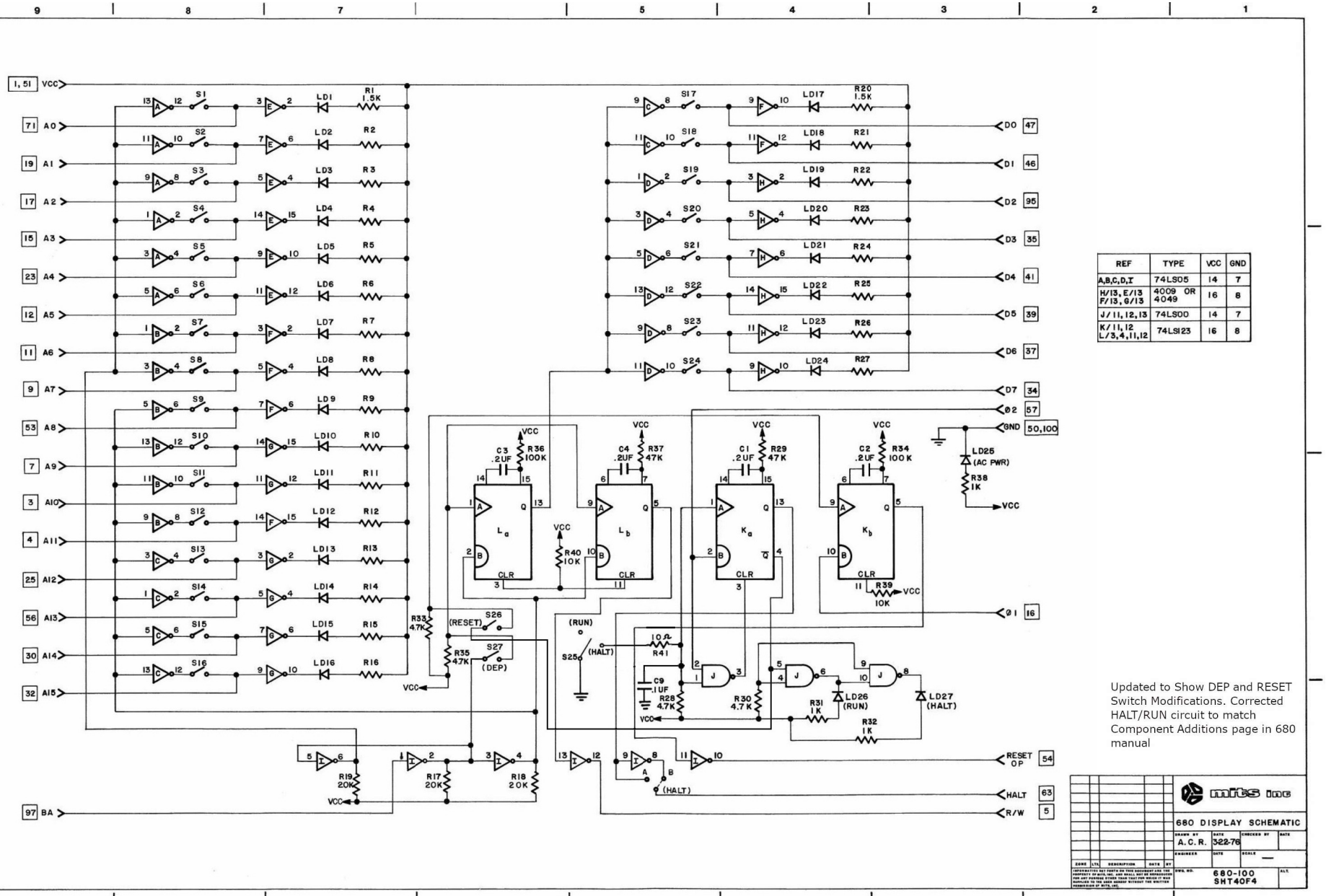
QUANTITY	DESIGNATION	DESCRIPTION
2	C1,C3	100uF 25V
1	C2	33uF 25V
2	C4,C5	1000uF 25V
1	C6	100uF 25V
2	C7,C8	56pF
2	C9,C10	430pF
1	C11	0.001uF
1	C12	50pF
1	C13	0.01uF
36	C14,C50-C84	0.1uF
1	C15	3300uF 25V
11	R1-R9,R15,R30	4.7K ohm 1/4 watt
5	R10,R11,R13,R17 R18	10K ohm 1/4 watt
1	R12	33K ohm 1/4 watt
1	R14	330 ohm 1/4 watt
1	R16	10M ohm 1/4 watt
5	R19,R20,R302,R303 R305	3.3K ohm 1/4 watt
1	R21	Do not install
2	R22,R300	1K ohm 1/4 watt
2	R23,R28	47 ohm 1/4 watt
6	R24-R27,R31,R32	470 ohm 1/4 watt
1	R29	100 ohm 1/4 watt
1	R301	220 ohm 1/4 watt
1	R304	47 ohm 1/4 watt
4	RP1-RP4	4.7K 10 pin 9 resistors 4610X-101-472LF
1	Q1	TIP-30
2	Q2,Q3	KN4401
3	Q4,Q5,Q300	2N2907
1		Heat Sink TO-220 Wakefield 290-1AB
1		Heat Sink TO-220 Wakefield 289-AB
2		6-32 nut
2		#6 lock washer
1		6-32-1/4" screw
1		6-32-1/2" screw
4	D1,D2,D3,D5	1N4004
1	D4	10V Zener
2	D300,D301	1N4148
1	VR1	5V DC-DC 2AMP Regulator - Digikey RBT20W24S05

1	BR1	Bridge Rectifier - KBPC608 3.8 AMP 800V
1	XTAL 1	2.4576 MHZ Crystal
1	XTAL 2	2.0000 MHZ Crystal
7	A,B,X,HH,MM,VV,ZZ	74LS04
8	C,D,E,F,G,H,J,K	21L02 or 2102
1	M	74LS10
2	N,P	74LS01
4	R,S,CC	4050
1	PP	CD74HC4050
1	Y	74LS00
4	AA,KK,LL,UU	74LS30
1	BB	4049
3	DD,EE,FF	74LS20
2	GG,SS	74LS02
1	TT	74LS73
4	RR,WW,XX,YY	74367 or 8T97
1	Z	4702
1	JJ	MC6850
1	NN	MC6800P
1	J2	Molex 5 pin header - 0009652058
1	J3	5 pin 0.1 header
1	J1	S100 connector Sullins - EBA50DRTH


6800
2 MHZ
R/W-P
XTAL 2
2 MHZ
RESISTOR
PACKS
1-4
4.7K
VCC
680 COMPUTER SCHEMATIC
mits inc
680-101
SH 1 OF 4


mits inc
680 COMPUTER SCHEMATIC
DRAWN BY J. D.
DATE 5/4/6
CHECKED BY
ENGINEER
SCALE
ZONE LTR. DESCRIPTION DATE BY
DWG. NO. 680-101
SHT 2 OF 4
BAUDOT I/O DRIVER-RECEIVER
RS 232
TTY
XTAL 1 2.4576MHZ
+5V (VCC)
BRUNING 28440


RAM 0 (C) 2102
RAM 1 (D)
RAM 2 (E)
RAM 3 (F)
RAM 4 (G)
RAM 5 (H)
RAM 6 (J)
RAM 7 (K)
PROM 1 (T) 1702
PROM 2 (U)
PROM 3 (V)
PROM 4 (W)
VCC
R/W-P
R13 10 K
R1 4.7K
R8 4.7K
-9V
680 COMPUTOR SCHEMATIC
A.G.R
3-19-76
680-101
SHT 3 OF 4



REF	TYPE	VCC	GND
A,B,C,D,I	74LS05	14	7
H/13, E/13 F/13, G/13	4009 OR 4049	16	8
J/11, 12, 13	74LS00	14	7
K/11, 12 L/3, 4, 11, 12	74LS123	16	8

Updated to Show DEP and RESET Switch Modifications. Corrected HALT/RUN circuit to match Component Additions page in 680 manual

mits inc

680 DISPLAY SCHEMATIC

DRAWN BY A.C.R. DATE 322-76 CHECKED BY DATE

ENGINEER DATE SCALE —

DWG. NO. 680-100 SHT4OF4 REV.

ZONE | LTR | DESCRIPTION | DATE | BY

BRUNING 28440