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**Commodore International Spare Parts GmbH  
Braunschweig, West Germany**

***SERVICE MANUAL***

**A500 PLUS**  
***INCLUDES A501 PLUS***  
***RAM EXPANDER***

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## **A500 PLUS SPECIFICATIONS**

### **INTRODUCTION**

The A500 Plus is a feature enhanced version of the A500 personal computer.

### **FEATURES**

**CPU:** 7.16 MHz 68000 NTSC; 7.09 MHz 68000 PAL

**Memory:** 1 Megabyte standard expandable to 2 MB with addition of A501 Plus

**Kickstart ROM:** 512K (V2.04)

**Mass Storage Memory:** Internal, 3.5 inch FDD mounted on the right side, the same as the A500.

**Additional Features:** Real Time Clock (on-board) with battery backup.

### **APPEARANCE**

The A500 Plus appearance shall be the same as the A500. A new logo plate has been added to distinguish "A500" from "A500 Plus". The color is the same light beige as the current A500.

### **WHAT'S ADDED**

1 Meg on-board memory expandable to 2 Meg.

8375 FAT AGNUS which supports 2 Meg. of Chip RAM

On-board Real Time Clock

8373 ECS Denise

Full ECS support

V2.04 in ROM

### **CUSTOM CHIPS**

The A500 Plus shall contain the same custom chip set as the A500, except for the 8375 2Meg. FAT AGNUS and 8373 ECS Denise.

### **SYSTEM I/O**

#### **EXTERNAL SYSTEM I/O**

External floppy, Serial, Parallel, Mouse, Joystick, Stereo Audio Ports

These Ports remain unchanged from their A500 counterparts.

### **MEMORY MAP**

The A500 Plus Memory Map is the same as the A500 Memory Map.

## A501 PLUS SPECIFICATIONS

### DESCRIPTION

The A501 Plus is a memory expansion board for the Amiga 500 Plus personal computer. It has 1 MB of "chip" memory and interfaces directly to the A500 Plus memory expansion slot. Unlike the A501, the A501 Plus doesn't have a Real Time Clock (RTC), the A500 Plus has a built-in RTC.

The A501 can be used in either the A500 or A500 Plus personal computer, has 512K of memory and includes a Real Time Clock. The A500 maps the A501 into pseudo-fast memory while the A500 Plus maps it into chip memory. In addition, when used in an A500 Plus system, the internal (built-in) RTC is selected.

Both the A501 and A501 Plus uses the same printed circuit board (PCB). In the A501 Plus, the RTC and refresh feature components are not loaded.

### MEMORY TYPE

The A501 Plus shall use 256K x 4 120ns DRAMs.

### PIN DESCRIPTIONS

| <i>PIN NAME</i> | <i>PIN<br/>NUMBER</i> | <i>SIGNAL<br/>DIRECTION</i> | <i>DESCRIPTION</i>  |
|-----------------|-----------------------|-----------------------------|---|
| +5              | 1-2, 51-52            | I                           | +5 Volts  |
| GND             | 3-4, 21-22,<br>53-54  |                             | Signal Ground   |
| XDRD (0-15)     | 5-20                  | I/O                         | Memory Data Bus   |
| XDRA (0-8)      | 23-31                 | I                           | Memory Address Bus  |
| /EXTICK         | 32                    | O                           | Active low. When this signal is asserted, it allows the A500 to detect the presence of an A501. The A501 Plus does not use this signal. |
| /XCLKS          | 33                    | I                           | Active low. When this signal is asserted, the external RTC is selected. This signal is not used in the A501 Plus.                       |
| /XOE            | 34                    | I                           | Active low. When this signal is asserted, data can be read from the expansion memory.   |
| /XCASL          | 35                    | I                           | Active low. This signal strobes the column address into DRAMs and corresponds to the low byte of the data word.                         |
| /XCASU          | 36                    | I                           | Active low. This signal strobes the column address into the DRAMs and corresponds to the high byte of the data word.                    |
| /XRAS1          | 37                    | I                           | Active low. This signal strobes the row address into the DRAMs and corresponds to the upper 512K of the expansion RAM.                  |
| /XRAS0          | 38                    | I                           | Active low. This signal strobes the row address into the DRAMs and corresponds to the lower 512K of the expansion RAM.                  |
| /XWE            | 39                    | I                           | Active low. When this signal is asserted, data is written into the expansion memory.  |
| NC              | 40, 56                |                             | Not connected.  |
| XD (0-3)        | 41-44                 | I/O                         | RTC Data bus. These lines are not used in the A501 Plus.  |
| XA (2-5)        | 45-48                 | I                           | RTC Address Bus. These lines are not used in the A501 Plus.   |
| /XCLKRD         | 49                    | I                           | Active low. When this signal is asserted, data can be read from the RTC. This signal is not used in the A501 Plus.                      |
| /XCLKWR         | 50                    | I                           | Active low. This signal strobes the data and address into the RTC. This signal is not used in the A501 Plus.                            |
| +12V            | 55                    | I                           | +12 Volts. This is used on the A501 to charge the battery. This line is not used on the A501 Plus.                                      |

**A501 PLUS SPECIFICATIONS (Continued)****FACTORY DEFAULT JUMPER SETTINGS**

|                  | <b>JP1</b>  | <b>JP2A</b>             | <b>JP2B</b>             | <b>JP3</b>   | <b>JP9</b> |
|------------------|-------------|-------------------------|-------------------------|--|------------|
| <b>A501</b>      | 1-2 shorted | 1-2 open<br>2-3 shorted | 1-2 open<br>2-3 shorted | 1-2 shorted<br>1-2 shorted<br>1-1 open<br>2-2 open | 1-2 open   |
| <b>A501 Plus</b> | 1-2 shorted | 1-2 shorted<br>2-3 open | 1-2 shorted<br>2-3 open | 1-2 shorted<br>1-2 shorted<br>1-1 open<br>2-2 open | 1-2 open   |

**Jumper****Function**

|            |   |
|------------|---|
| JP1        | When 1-2 are shorted, /EXTICK detection is enabled. This jumper has no effect on the A501 Plus, because it does not use /EXTICK detection.  |
| JP2A, JP2B | When 2-3 are shorted (1-2 open), it enables the refresh feature in the A501. Refresh components U11-U13 must be loaded in the A501. The refresh feature is only required on the A501 to compensate for refresh deficiencies in older revs of the A500.  |
| JP3        | Swaps upper and lower bank DRAMs. When 1-2 are shorted (1-1 and 2-2 open), /XRAS0 and /XRAS1 selects the lower and upper banks respectively. Conversely, when 1-1 and 2-2 are shorted, /XRAS0 selects the upper bank while /XRAS1 selects the lower bank RAMs.  |
| JP9        | Overwrites /XCLKS. When 1-2 are shorted, /XCLKS is permanently enabled and the A501 (external) RTC is always selected. This jumper is normally open. Selection of internal or external RTC is done by the A500 or A500 Plus via the /XCLKS line. RTC components U9, U11-U13, C9, C11-C13, C911, C913, R911-R915, D11-D9123, BT9, TC9 and Y9 must be loaded in the A501. |

**DIMENSIONS**

|         |         |
|---------|---------|
| Length: | 5.5 in. |
| Width:  | 3.5 in. |

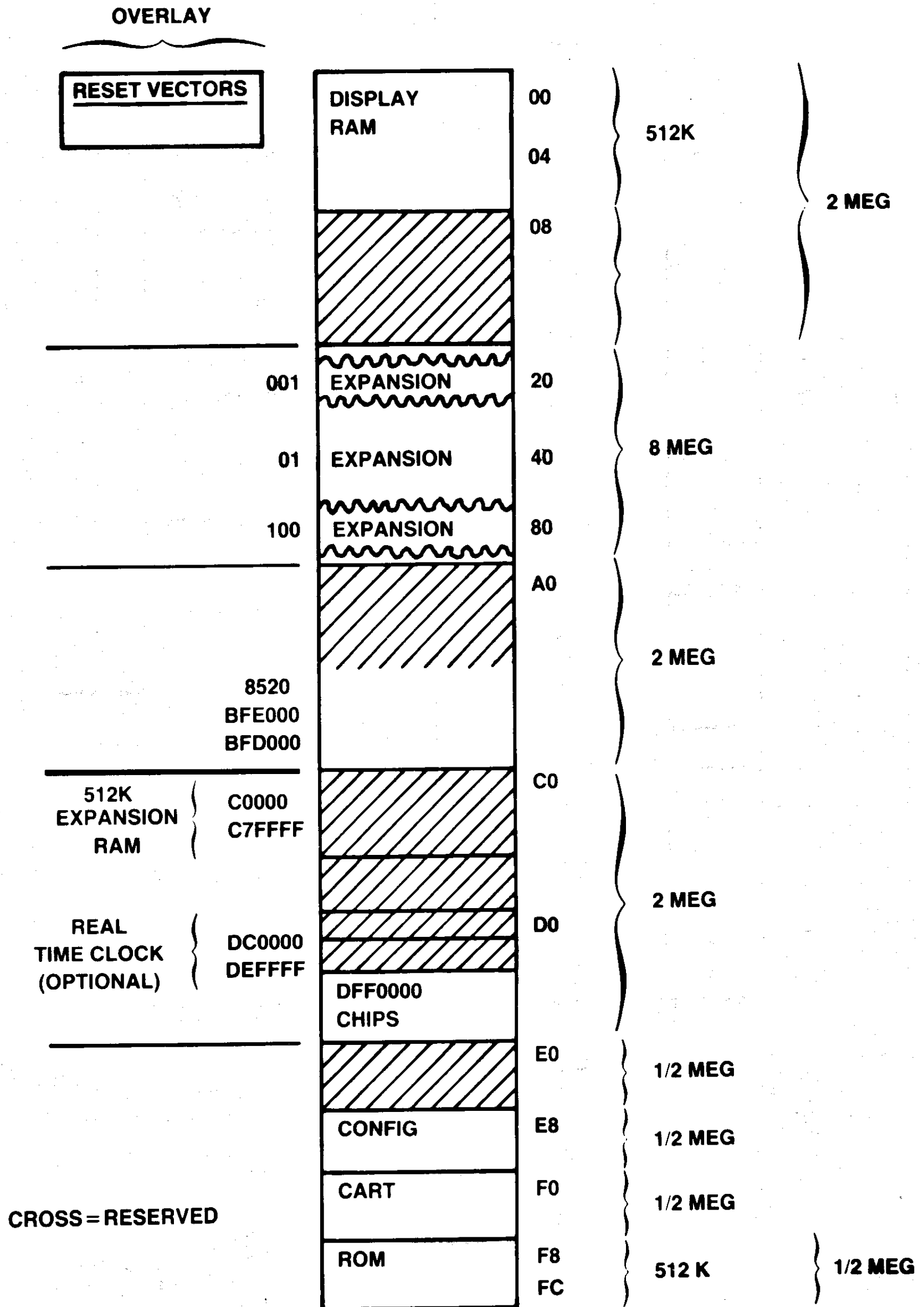
**POWER**

|        |   |
|--------|---|
| +5VDC  | @330 mA MAX for A501 Plus<br>@280 mA MAX for A501 |
| +12VDC | @15 mA MAX for A501<br>Not Used on A501 Plus      |

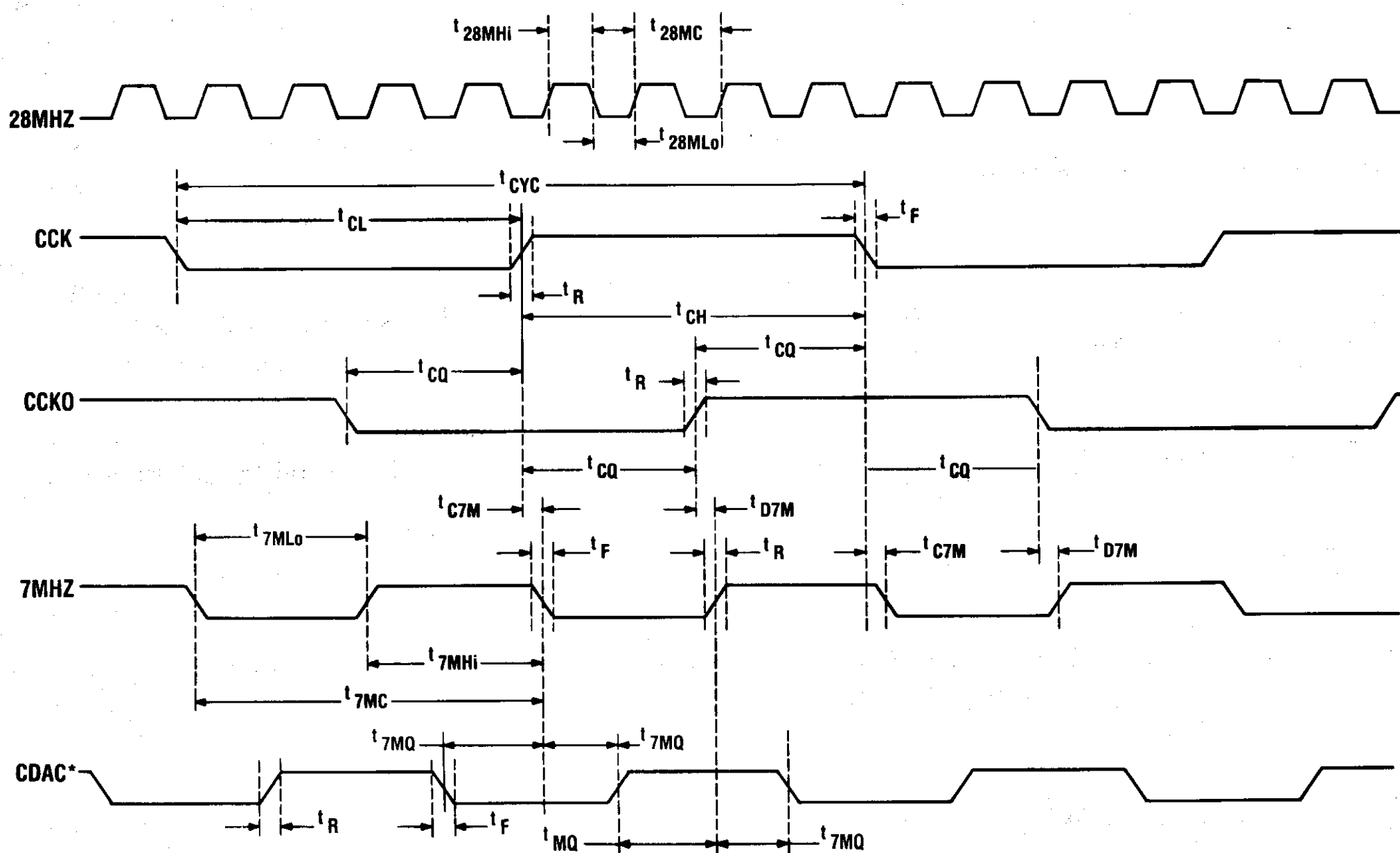
**ENVIRONMENT**

|                       |                                |
|-----------------------|--------------------------------|
| Operating Temperature | 0 to +55°C                     |
| Humidity              | Up to 90% without condensation |

# AMIGA 500 PLUS MEMORY MAP



## 8375 AGNUS (Continued)



Clock Relations

## CLOCK RELATIONS (Refer to Figure above)

|                                    | SYMBOL | MIN   | MAX | UNIT |
|------------------------------------|--------|-------|-----|------|
| 2.4.1 28MHz clock cycle            | t28MC  | 34.57 |     | ns   |
| 2.4.2 28MHz clock high             | t28MHi | 12.0  |     | ns   |
| 2.4.3 28MHz clock low              | t28MLo | 12.0  |     | ns   |
| 2.4.4 CCK clock cycle              | tcyc   | 260   | 290 | ns   |
| 2.4.5 CCK clock high               | tch    | 130   | 150 | ns   |
| 2.4.6 CCK clock low                | tcl    | 130   | 150 | ns   |
| 2.4.7 CCK-CCKQ clock separation    | tcq    | 65    | 75  | ns   |
| 2.4.8 7MHz clock cycle             | t7MC   | 130   | 150 | ns   |
| 2.4.9 7MHz clock high              | t7MHi  | 65    | 75  | ns   |
| 2.4.10 7MHz clock low              | t7MLo  | 65    | 75  | ns   |
| 2.4.11 7MHz-CDACQ clock separation | t7MQ   | 30    | 40  | ns   |
| 2.4.12 CCK to 7MHz delay           | tc7M   | 0     | 15  | ns   |
| 2.4.13 CCKQ to 7MHz delay          | tq7M   | 0     | 15  | ns   |
| 2.4.14 Clock rise time             | tr     | 0     | 10  | ns   |
| 2.4.15 Clock fall time             | tf     | 0     | 10  | ns   |

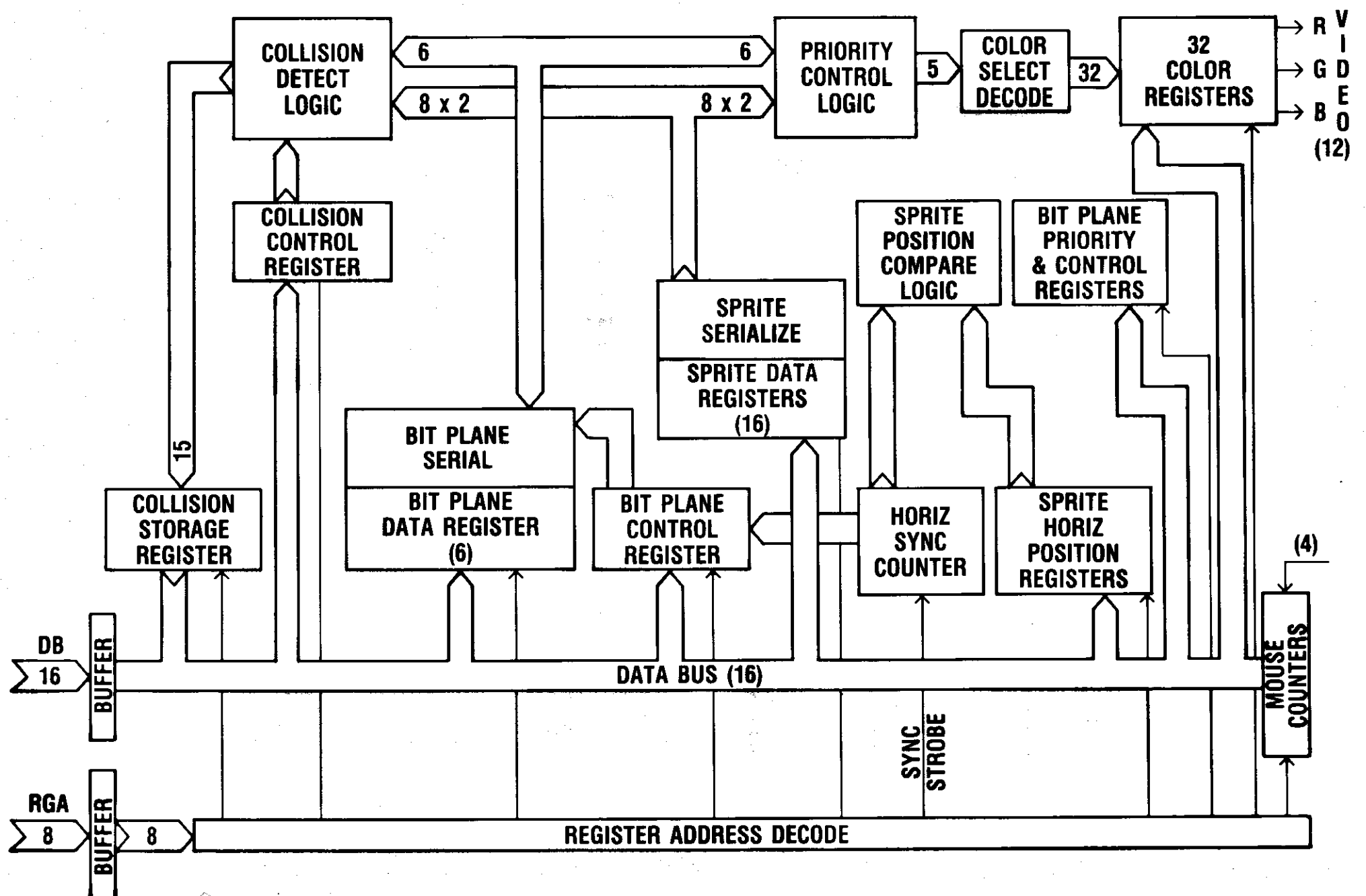
**8373 DENISE HI RES**

## MAIN FUNCTIONS

- Display data buffer, encode display object to RGB colors.
- Bitplane & Sprite display. Parallel data from data bus is retained in six (6) Bitplane and eight pairs of Sprite data buffers.
- Bitplane Data loaded and serialized during display activity.
- Sprite Data loaded during display inactivity — individual serialization occurs when Sprite position Compare logic detects equality between the Sync Counter and any Sprite Position Register.
- Six (6) lines of Bitplane & eight (8) pairs of serial data go to Priority control logic which selects only one (1) of the Sprites or one (1) of the separate Bitmap images to produce the five (5) bit color select code at its output. This five (5) bit code then selects one of the thirty-two (32) color registers to produce the twelve (12) bit RGB video output.
- The Bitplane and Sprite serial lines also go to the Collision Detect Logic, which detects real time coincidence between them, and sets appropriate bits in the Collision Storage register. This register is read and cleared by the 68000.
- The four (4) “mouse counters” are controlled by the two (2) mouse-joystick connectors. These count the pulses representing the horizontal and vertical motion of two (2) “mouse” controllers, and are read by the 68000.

## CHIP ELEMENTS

**32 Color Registers; Bitplane Priority and Control Registers; Color Select Decoder; Priority Control Logic; 16 Sprite Serial Lines; Sprite Data Registers; Bit Plane Control Registers; Two (2) Mouse Connectors; Sprite Position Compare Logic; Sprite Horizontal Control Registers; Bit Plane Serializer Collision Detect Logic; Collision Control Register; Collision Storage Register; Buffer — Data Bus; Buffer — Register Address Decode; Bit Plane Data Registers Video: RGB; Sprite Serialization.**



### **Denise Block Diagram**



## 8364 PAULA

Paula is the Port, Audio and Uart chip. Its main function is the four audio channels. It also contains the I/O ports, (Disk and Pots), Serial Port (Uart), and the Interrupt Control and Status Register.

### D TO A CONVERTERS

The four audio channels each have a DMA pointer register, data register, period, (frequency), register and volume register. Each channel has an on chip D to A (digital to analog) converter on the output. The four channels are grouped into a right and left audio output.

### DISK CONTROL

The disk controller has registers for data read, data write and control. It also contains a Precompensation Output circuit, a Data separator input circuit with a digital phase lock loop.

### UART CONTROL

The serial port uart included in Paula contains Data registers, Control registers, Transmit, (TRN), and receive registers.

### POT CONTROL

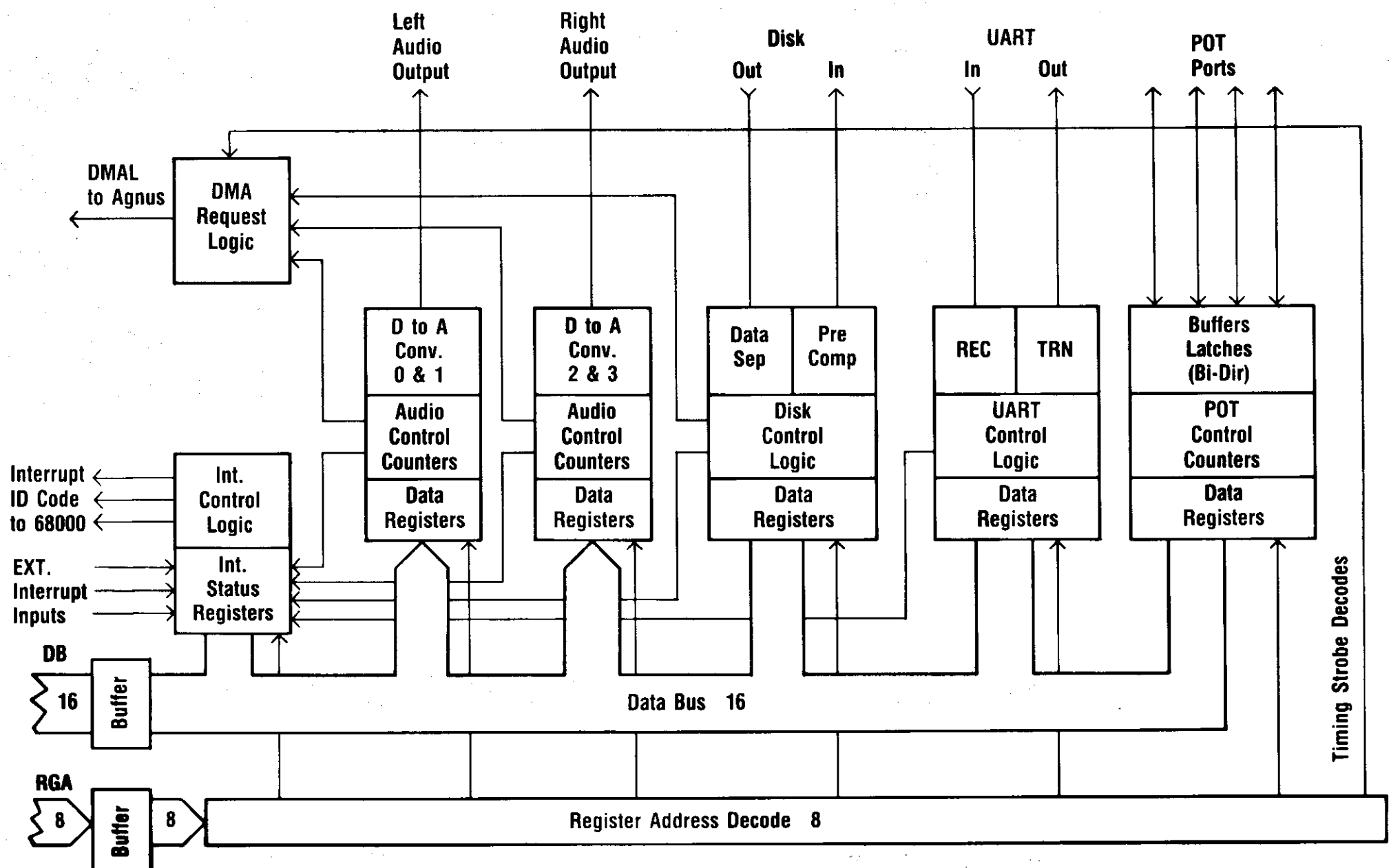
The four pot ports are general purpose I/O ports. They have counters for simple A to D (digital to analog) conversion of an external capacitor charging, which could also be used for analog joystick controllers.

### INTERRUPT CONTROL

The audio, disk and uart controllers all set their own Interrupt Status register bits.

### DMA REQUEST LOGIC

The audio and disk controllers also go to the DMA request logic, (remember: they are DMA users), causing the DMAL signal to request DMA cycles from Agnus.



**Paula Block Diagram**

## GARY CUSTOM CONTROL CHIP

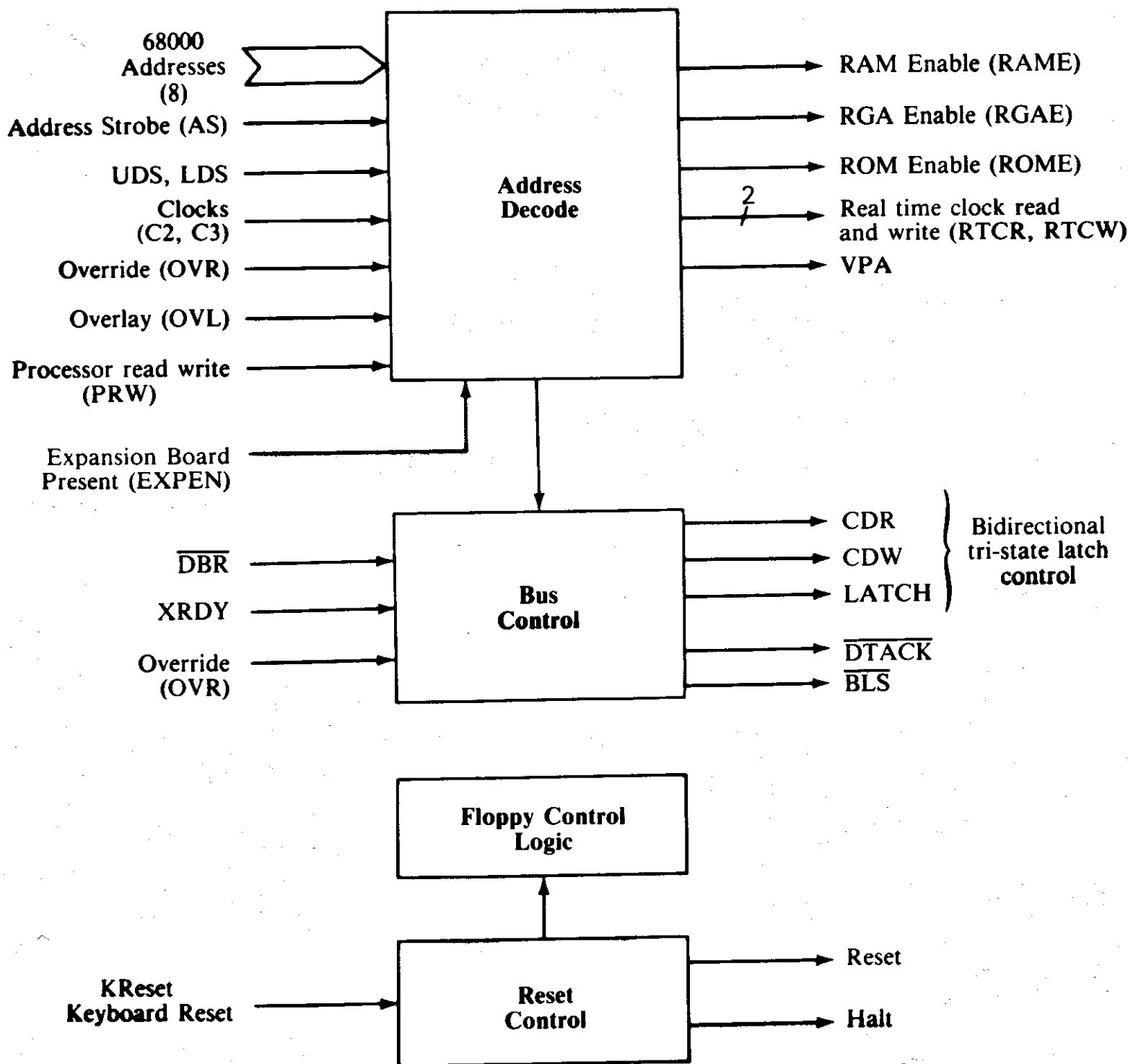
### FEATURES

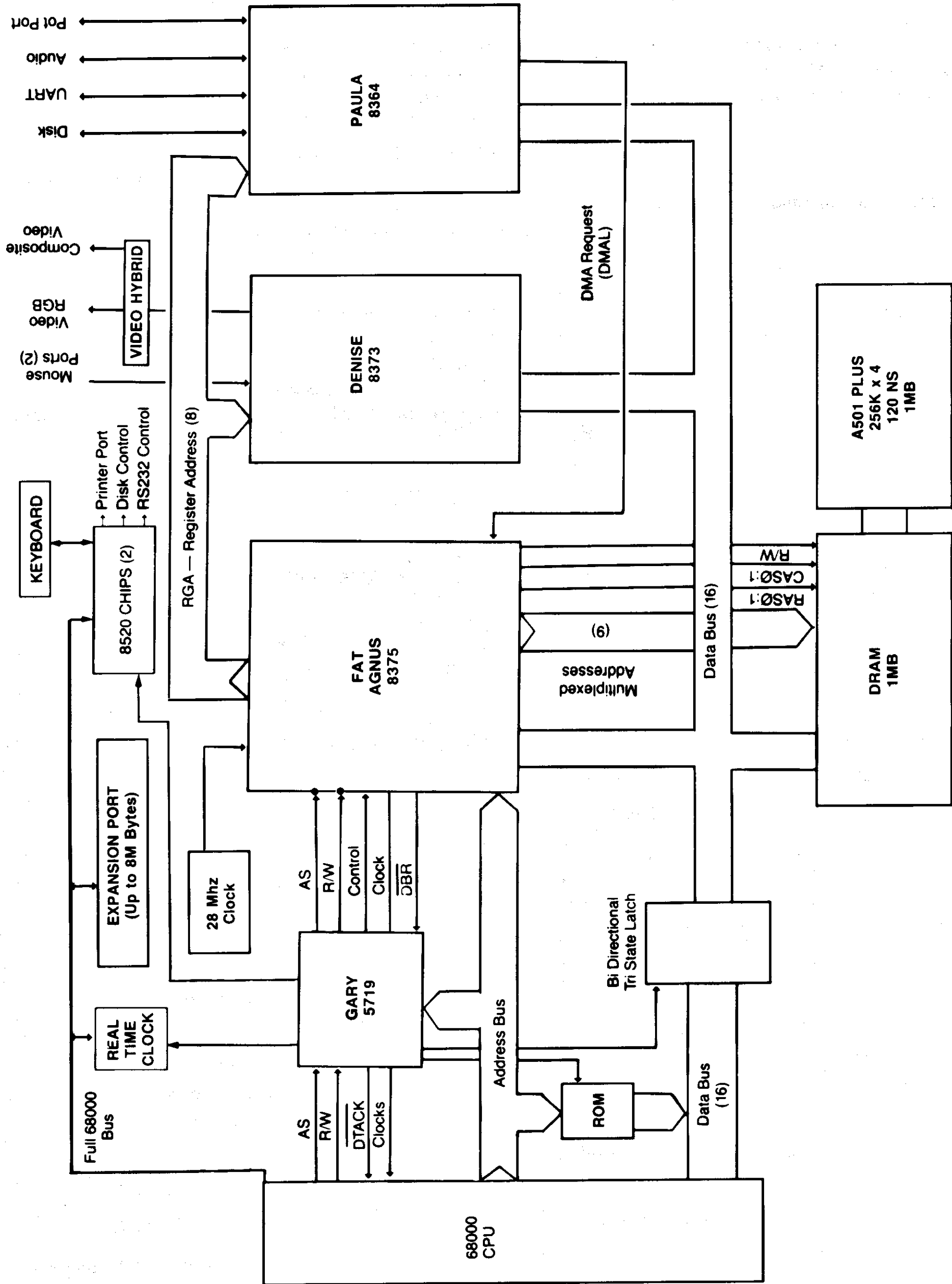
- Provides all bus control signals.
- Provides all address decoding.
- Generates the 68000 VPA signal.
- Handles some of the floppy circuitry.
- Provides keyboard reset interface.

For signal descriptions,  
see Schematic #312813, sheet 1 of 10

|         |    |    |       |
|---------|----|----|-------|
| GND1    | 1  | 48 | Vcc3  |
| VPA     | 2  | 47 | MTRX  |
| DEL     | 3  | 46 | MTRON |
| DEB     | 4  | 45 | DKWDB |
| KBRESET | 5  | 44 | DKWEB |
| Vcc1    | 6  | 43 | DTACK |
| MTR     | 7  | 42 | HLT   |
| DKWE    | 8  | 41 | RST   |
| DKWD    | 9  | 40 | GND3  |
| LDS     | 10 | 39 | A23   |
| UDS     | 11 | 38 | A22   |
| R/W     | 12 | 37 | A21   |
| AS      | 13 | 36 | A20   |
| BGACK   | 14 | 35 | A19   |
| BLIT    | 15 | 34 | A18   |
| SEL     | 16 | 33 | A17   |
| Vcc2    | 17 | 32 | EXRAM |
| REGEN   | 18 | 31 | XRDY  |
| BLISS   | 19 | 30 | OVL   |
| RAMEN   | 20 | 29 | OVR   |
| ROMEN   | 21 | 28 | CCK   |
| CLKRD   | 22 | 27 | CCKQ  |
| CLKWR   | 23 | 26 | CDAC  |
| GND2    | 24 | 25 | LATCH |

## GARY BLOCK DIAGRAM





A500 PLUS BLOCK DIAGRAM

## **THEORY OF OPERATION**

The AMIGA 500 Plus computer is a high-performance system with advanced graphics and audio features. The principal hardware features consist of the 68000 microprocessor which runs at 7.2 MHz, 1MB RAM, expandable to 2MB, and configurable to 8MB, 2 parallel I/O chips, one control chip (GARY) and 3 custom VLSI chips that provide the unique capabilities for animation, graphics and sound.

### **68000 MICROPROCESSOR**

The 68000 is the CPU of the system. All other resources are under software control via control data issued from it. All 3 custom chips have control registers that are written by the 68000.

The 68000 communicates with the rest of the computer via its address bus, data bus and control lines. Notice that in the block diagram the 3 custom chips do not reside directly on the 68000 buses. When the 68000 starts a bus cycle that is intended for the custom chips or the display RAM, the bus control chip detects whether or not the display RAM buses are available. The control chip will not assert the acknowledge signal (/DTACK) back to the 68000 until the display RAM buses are available. Once the 68000 receives /DTACK it completes the bus cycle. Connecting the display RAM buses to the 68000 buses is discussed further in the section on bus control. Because the display RAM is capable of approximately twice the bandwidth of the 68000, the 68000 is usually not delayed by waiting for the display buses to become available.

The 68000 can fetch instructions from:

- Display RAM
- ROM

The 68000 can read and write data directly to:

- Display RAM
- Parallel I/O Chips
- 3 Custom I.C.s
- ROM

The 68000 transmits data and control to and from the peripherals via the parallel I/O and the 3 custom chips.

7M is the processor clock to the 68000. C1, C3 and CDAC are used to clock the custom chips and determine the timing of signals to the memory arrays.

### **ROM**

The ROM contains the kernel and DOS routines; it is 128K × 16.

### **PARALLEL I/O**

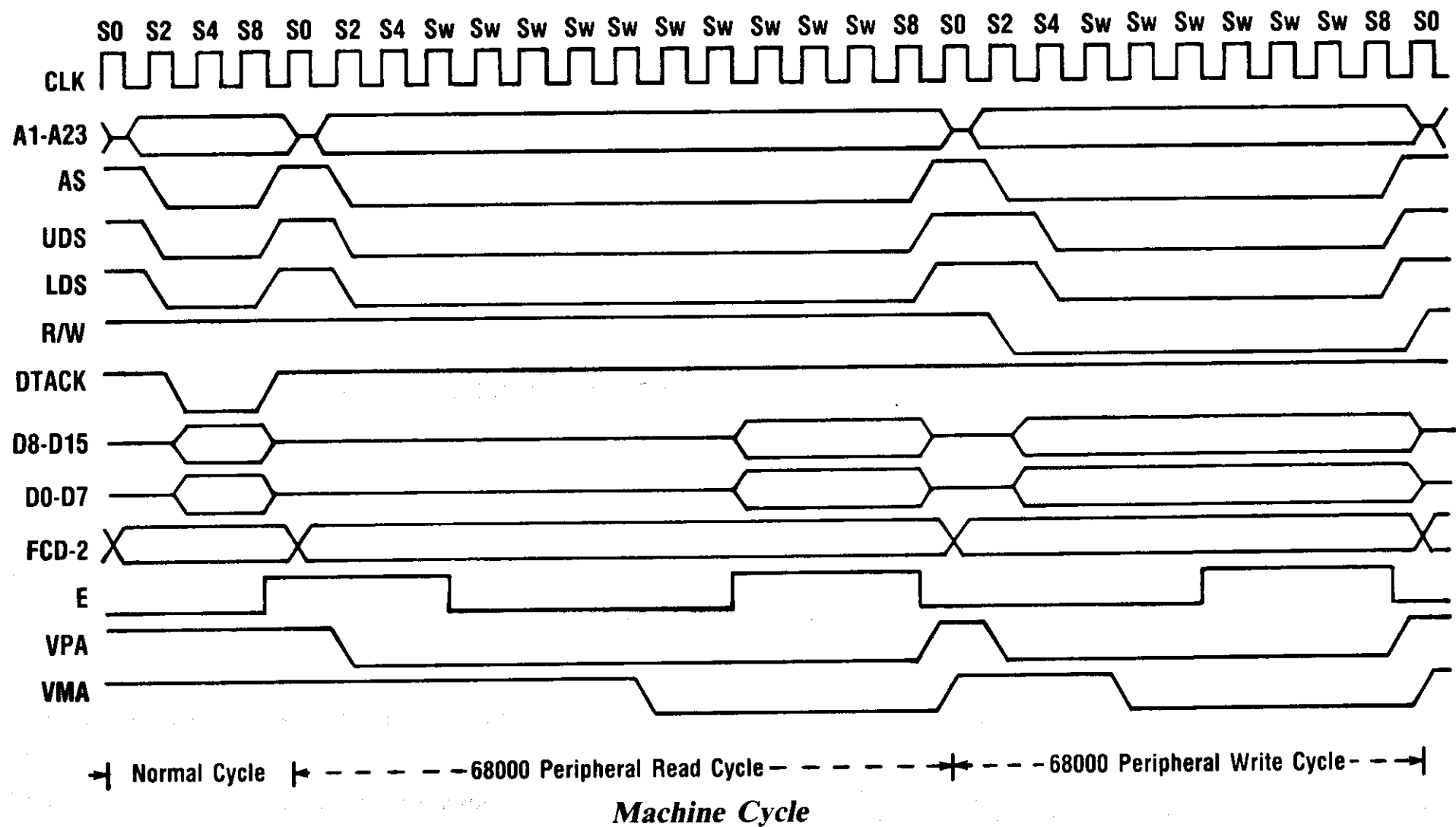
The 2 multipurpose 8520 I/O chips provide the following:

- I/O to and from the parallel port connector
- Control lines to and from the joystick/mouse ports
- A control line to the front panel LED
- Internal control lines
- Keyboard control lines, clock and data
- Serial port control lines
- Floppy disk interface control lines
- Internal timers

These 2 chips reside on the 68000 buses and are read and written by the 68000.

## THEORY OF OPERATION (Continued)

## CPU SIGNAL SUMMARY



| Signal Name                  | Mnemonic  | Input/Output | Active State           | Three State |
|------------------------------|---|--------------|------------------------|-------------|
| Address Bus                  | A1-A23  | Output       | High                   | Yes         |
| Data Bus                     | D0-D15  | Input/Output | High                   | Yes         |
| Address Strobe               | $\overline{AS}$   | Output       | Low                    | Yes         |
| Read/Write                   | R/ $\overline{W}$   | Output       | Read-High<br>Write-Low | Yes         |
| Upper and Lower Data Strobes | $\overline{UDS}$ , $\overline{LDS}$                       | Output       | Low                    | Yes         |
| Data Transfer Acknowledge    | $\overline{DTACK}$  | Input        | Low                    | No          |
| Bus Request                  | $\overline{BR}$   | Input        | Low                    | No          |
| Bus Grant                    | $\overline{BG}$   | Output       | Low                    | No          |
| Bus Grant Acknowledge        | $\overline{BGACK}$  | Input        | Low                    | No          |
| Interrupt Priority Level     | $\overline{IPL0}$ , $\overline{IPL1}$ , $\overline{IPL2}$ | Input        | Low                    | No          |
| Bus Error                    | $\overline{BERR}$   | Input        | Low                    | No          |
| Reset                        | $\overline{RESET}$  | Input/Output | Low                    | No*         |
| Halt                         | $\overline{HALT}$   | Input/Output | Low                    | No*         |
| Enable                       | E   | Output       | High                   | No          |
| Valid Memory Address         | $\overline{VMA}$  | Output       | Low                    | Yes         |
| Valid Peripheral Address     | $\overline{VPA}$  | Input        | Low                    | No          |
| Function Code Output         | FC0, FC1, FC2   | Output       | High                   | Yes         |
| Clock                        | CLK   | Input        | High                   | No          |
| Power Input                  | Vcc   | Input        | —                      | —           |
| Ground                       | GND   | Input        | —                      | —           |

\*Open Drain

A0 is internal to 68000

## THEORY OF OPERATION (Continued)

**CLOCKS GENERATOR**

The entire computer board is run synchronously to the 3.57954Mhz color clock (C1). This is accomplished by generating a number of sub-multiple frequencies from our master 28.63636Mhz crystal oscillator. The following are the primary clocks on the board:

| Name | Description                    |
|------|--------------------------------|
| C1   | The 3.579545Mhz Color Clock    |
| C2   | C1 shifted 45 degrees later    |
| C3   | C1 shifted 90 degrees later    |
| C4   | C1 shifted 135 degrees later   |
| 7M   | C1 XORed with C3* (7.15909Mhz) |
| DAC  | 7M shifted 90 degrees later    |

7M is the processor clock for the 68000 microprocessor. C1-C4 and DAC are used to clock the custom chips and for determining the timing of signals to the memory arrays.

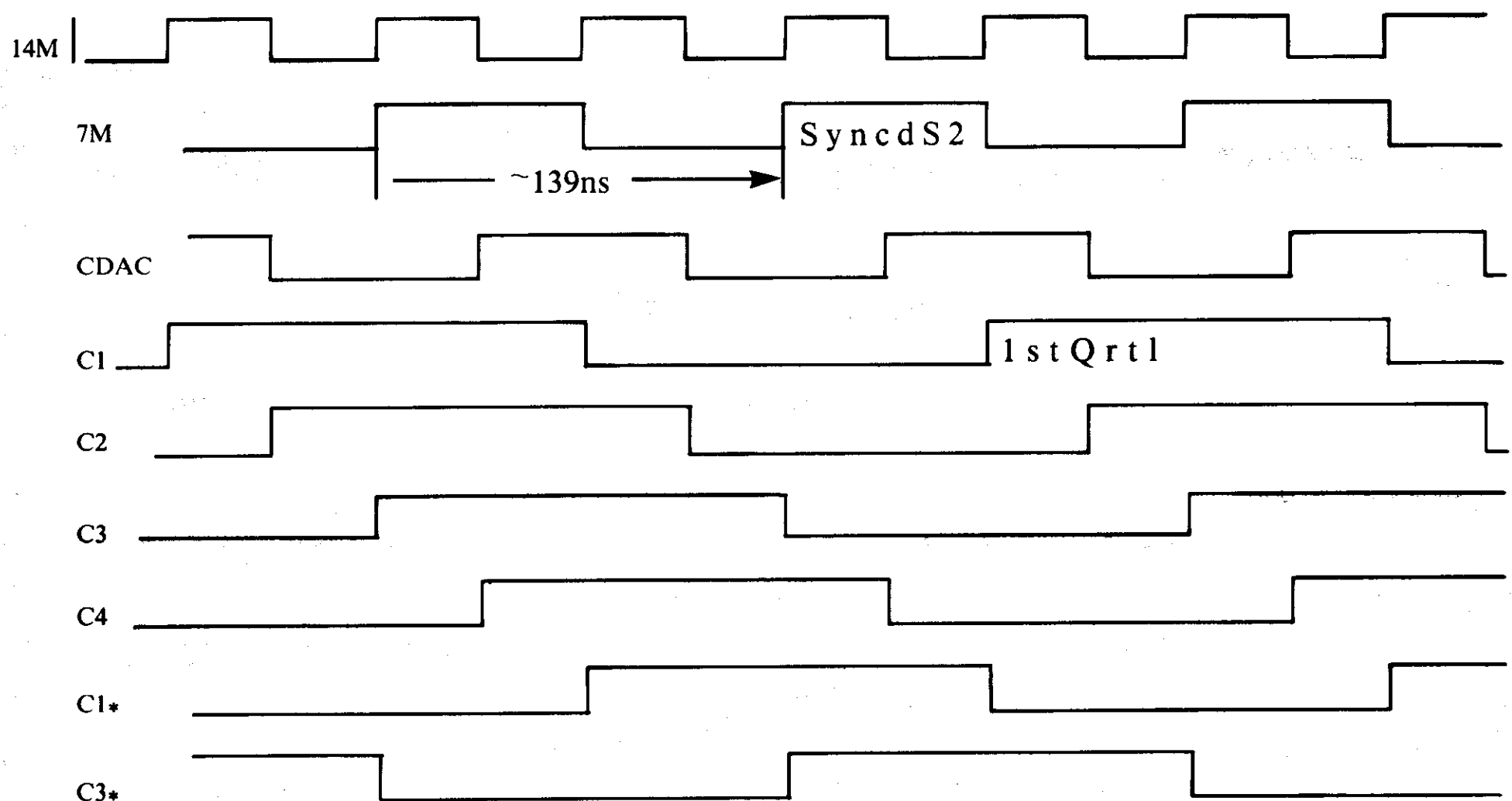
The above frequencies are true for NTSC Amigas. A PAL Amiga will operate slightly slower, with a main clock of 28.37516Mhz. This is divided down to get  $7M = 7.09379Mhz$  and  $C1 = 3.546895Mhz$ . A special circuit is required to take five fourths of C1 to derive the PAL colorburst frequency of 4.43361875Mhz.

The following clocks are available at the edge connector:

| Name | Pin | Description    |
|------|-----|----------------|
| C3*  | 14  | C3 inverted    |
| CDAC | 15  | DAC equivalent |
| C1*  | 16  | C1 inverted    |

Note that 7M (the processor clock) is not available at the connector; it can be easily generated by:  
 $C3^* \text{ XNOR } C1^* = 7M \text{ equivalent}$

If you need a 14.31818Mhz synchronous clock, you can generate it by:  
 $(7M \text{equiv}) \text{ XOR } (CDAC) = 14M \text{ equivalent}$



Amiga System Clocks

**THEORY OF OPERATION (Continued)****THE 3 CUSTOM CHIPS**

The 3 custom chips provide very fast manipulation of graphics and audio data in the display RAM. All the major functions in the chips are DMA driven; that is, streams of data are moved between the custom chips and display RAM under DMA control. These streams of data are acted upon by the custom chips. Fat Agnus, custom chip #1, contains 25 dedicated purpose DMA counters.

The 3 chips have control registers which are usually loaded by the 68000. However, Fat Agnus also has the capability of loading control registers in the other 2 custom chips. When Fat Agnus performs a bus cycle, it outputs a code on the Register Address Bus telling the other 2 chips the nature of the bus cycle. This is necessary because many of the bus cycles provide data to or from the other 2 chips, thus they must cooperate appropriately.

In addition to manipulating data in the display RAM, the custom chips output streams of data to the video output circuits and audio output circuits, and they move data to and from the floppy disks and serial port.

Note that the display RAM buses can be completely isolated from the 68000 buses by Fat Agnus and Data Bus drivers. Thus, Fat Agnus can be performing a bus cycle on the display buses simultaneously with the 68000 performing a bus cycle on its buses. This parallelism increases throughout.

**BUS CONTROL, ADDRESS/DATA MUX, ADDRESS DRIVER**

The bus control logic resides in the control chip (GARY) and Fat Agnus. They provide 3 major functions, they:

- Synchronize the 68000 to the current phase of C1

- Arbitrate between the 68000 and Fat Agnus for the display buses

- Generate DRAM timing for the video RAM bus drivers appropriate to the current cycle

Synchronizing the 68000 to C1 is straightforward, since the 68000 is clocked by 7M which is twice the frequency and synchronous to C1. If the 68000 starts a bus cycle in the wrong phase of C1, the bus control chip merely delays /DTACK long enough so that the 68000 will complete the bus cycle in the desired phase relationship to C1. This phase relationship is necessary because the custom chips and the display RAM are clocked by C1.

Arbitration is very simple. Fat Agnus tells the bus control prior to taking the display RAM buses by asserting an input to the control chip (GARY) called /DBR. Whenever Fat Agnus has the display buses and the 68000 wants them, the 68000 is held off by not giving it /DTACK. In this state the 68000 has no effect on the display buses until the bus controller enables the bus drivers.

Fat Agnus generates the DRAM timings and does all address multiplexing. If the 68000 is running a video memory cycle, its addresses are routed through Fat Agnus onto the multiplexed address lines. If the custom chips are running a memory cycle the addresses are routed to the multiplexed address lines from internal address register.

**DISPLAY RAM**

The display RAM is a 512K read/write memory that resides on the RAM address and RAM data buses. It is expandable to 1M bytes by the addition of the RAM expansion module. It is implemented using standard 256K  $\times$  1 dynamic RAMs, refreshed by Fat Agnus.

The display RAM is really used for much more than just holding graphics data. It also stores code and data for the 68000.

**CUSTOM CONTROL CHIPS**

The Amiga's animation, graphics and sound are produced by three custom chips. Fat Agnus (8375), High Res Denise (8373) and Paula (8364). A fourth custom chip, Gary serves as the control chip. The following pages include feature lists, and block diagrams for these chips.

## 8375 AGNUS 2MEG

### GENERAL

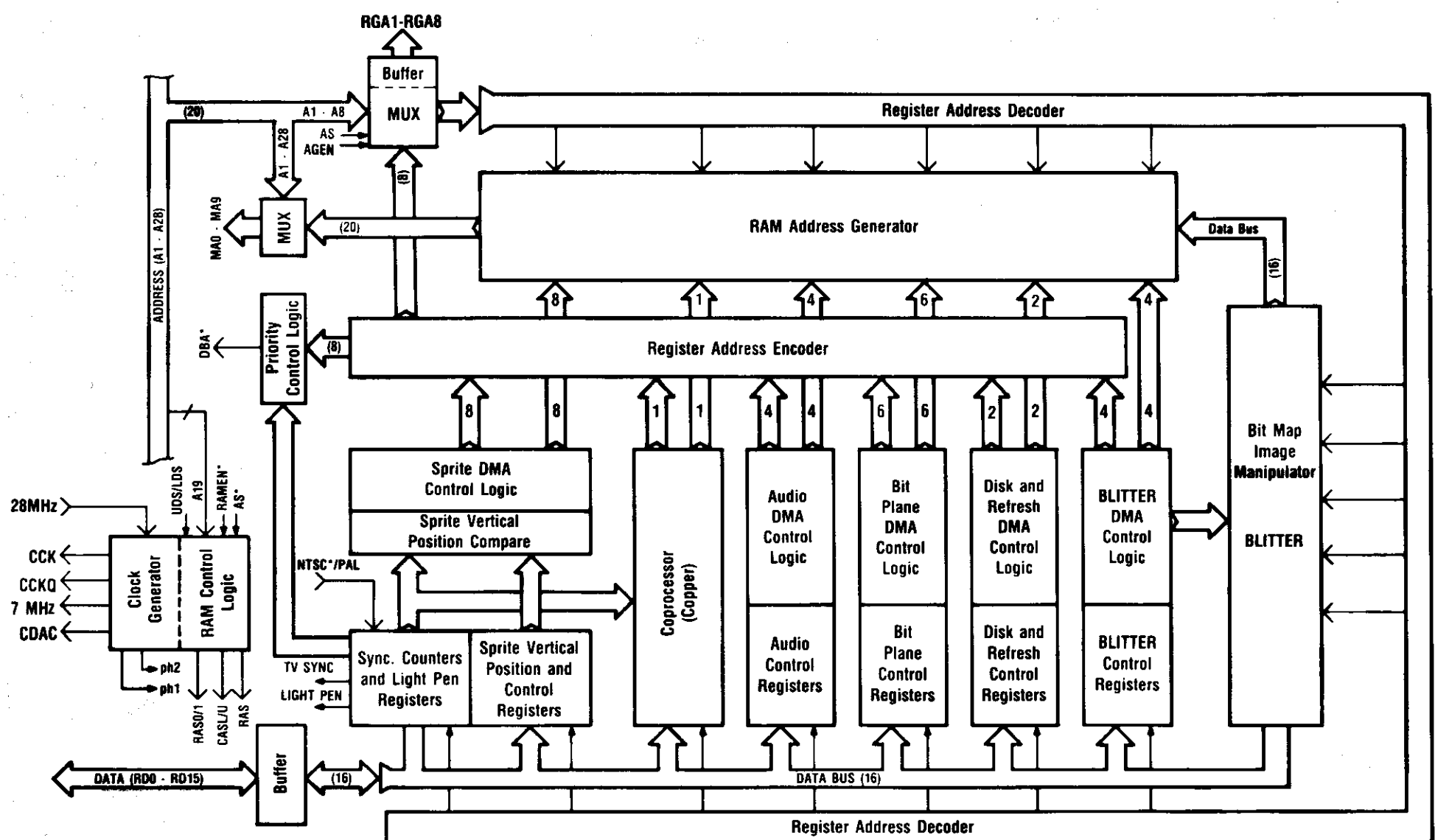
This device is an address generator type IC. Its main function is as a RAM address generator and register address encoder that shall produce all DMA addresses for 25 channels.

The block diagram for this device shows the DMA control and address bus logic. The output of each controller indicates the number of DMA channels driving the Register Address Encoder and RAM Address Generator.

The RAM Address Generator contains an 20 bit pointer register for each of the 25 DMA channels and also it contains pointer restart (backup) registers and jump registers for six (6) of the channels. A full 20 bit adder carries out the pointer increments and adds for jumps.

The priority control logic looks at the pipe-lined DMA request from each controller and stages the DMA cycles based upon their programmed priority and sync counter time slot. Then it signals the processor to get off the bus by asserting the DBR line. The following is a brief description of the device's major operational modes.

A control register determines which 256 possible logic operations is to be performed as the source images are combined and how far they are to be moved (Barrel shifted). In addition to the image combining and movement powers, the Blitter can be programmed to do line drawing or area fill between lines.



**Agnus 8375 Block Diagram**

### BLITTER

The procedure for moving and combining bit mapped images in memory received the name Bit Blit from a computer instruction that did block transfers of data on bit boundaries. These routines became known as Bit Blitters or Blitters. The Blitter DMA Controller is preloaded with the address and size of three (3) source images (A, B, and C) and one (1) destination (D) in the dynamic RAM. These images can be as small as a single character or as large as twice the screen size. They can be full images or smaller windows of a larger image. The actual pixel resolution is controlled by the BLTSIZE (BLTSIZH and BLTSIZV) registers which contain up to 15 bits for the image height (15 bits = 32K dots max.) and up to 11 bits for the image width (11 bits = 2k words = 32K pixels max.). After one word of each source image is sequentially loaded into the source buffer (A, B, C) they are shifted and then combined together in the logic unit to perform image movement overlay, masking, and replacements. The result is captured in the destination buffer (D) and sent back to the RAM memory destination address. This operation is repeated until the complete image has been processed. The unit has extensive pipelining to allow for shifter and logic unit propagation time, while the next set of source words is being fetched.



**8375 AGNUS (Continued)**

**BITPLANE ADDRESSING**

Some computer bitmap displays are organized so that the bitplanes for each pixel are all located within the same address. This is called pixel addressing. If the entire data word of one address is used for a single pixel with 8 bit planes, the data word will look like this. (numbers are bitplanes): 12345678-----

The data compression can be improved by packing more than one pixel into a single address like this: 1234567812345678 or like this, if there are only 4 bitplanes: 1234123412341234

The IC device, uses a bitmap technique called Bitplane Addressing. This separates the bitplanes in memory. To create a 4 plane (16 color) image, the bitplane display DMA channels fetch from 4 separate areas of memory like this:

```
1111111111111111
2222222222222222
3333333333333333
4444444444444444
```

These are held in buffer register and are used together as pixels, one bit at a time, by the display (left to right).

This technique allows reduced odd numbers of bitplanes (such as 3 or 5) while maintaining packing efficiency and speed. It also allows grouping bitplanes into 2 separate images, each with independent hardware high speed image manipulation, line draw, and area fill.

**DMA CHANNEL FUNCTIONS**

Each channel has an 20 bit RAM address pointer that is placed on the MA memory address bus, and is used to select the location of the DMA data transfer from anywhere in 1M words (2M bytes) of RAM.

An eight (8) bit destination address is simultaneously placed on the register address bus (RGA), sending the data to the corresponding register.

In a typical DMA channel, almost all channels have DRAM as source and chip registers as destination.

The pointer must be preloaded and is automatically incremented each time a data transfer occurs.

Each controller utilizes one or more of these DMA channels for its own purposes. The following is a brief summary of these controllers and the DMA channels they use.

**A-Blitter (four (4) channels)**

The Blitter uses four (4) DMA channels, Three source and one (1) destination as previously described.

Once the Blitter has been started, the four (4) DMA channels are synchronized and pipelined to automatically handle the data transfers without further processor intervention. The images manipulated in memory, independent of the display (bitplane DMA).

**B-Bitplane (six (6) channels)**

The bitplane controller continuously (during display) transfers display data from memory to display buffer registers. There are six (6) DMA channels to handle the data from six (6) independent bit planes. The buffers convert this bitplane data into pixel data for the display.

**C-Copper (one (1) channel)**

The Copper is a co-processor that uses one of the DMA channels to fetch its instructions. The DMA pointer is the instruction counter and must be preloaded with the starting address of the Copper's instructions.

The Copper can move (write) data into chip registers. It can skip, jump, and wait (halt). These simple instructions give great power and flexibility because of the following features.

When Copper is halted, it is off the data bus, using no bus cycles until the wait is over. The programmed wait value is compared to a counter that keeps track of the TV beam position (beam counter) and when they are equal, the Copper will resume fetching instructions.

It can cause interrupts, reload the color registers, start the Blitter or service the audio. It can modify almost any register inside or outside the IC device, based on the TV screen coordinates given by the Beam Counter and the actual address encoded on the RGA Bus.

**8375 AGNUS (Continued)****DMA CHANNEL FUNCTIONS (Continued)****D-Audio (four (4) channels)**

There are four (4) audio channels, all of which are located outside of the audio DMA Controller section of Agnus. Each controller is independent and uses one DMA channel from the DMA Controller and fetches its data during a dedicated timing slot within horizontal blanking. This is accomplished by a controller asserting the DMAL input on the DMA Controller.

**E-Sprites (eight (8) channels)**

There are eight (8) independent Sprite controllers, each with its own DMA channel and its own dedicated time slot for DMA data transfer. Sprites are line buffered objects that can move very fast because their positions are controlled hardware registers and comparators.

Each sprite has two (2) sixteen bit data registers that define a 16 pixel wide Sprite with 4 colors. Each has a horizontal position register, a vertical start position register and a vertical stop position register. This allows variable vertical size sprites.

The Sprite DMA controller fetches image and position data automatically from anywhere in 2 Megabytes of memory depending on device pin configuration.

Sprites can be run automatically in DMA mode or they can be loaded and controlled by the microprocessor.

Each Sprite can be re-used vertically as often as desired. Horizontal re-using is also allowed with microprocessor control.

**F-Disk (one (1) channel)**

The disk controller, which is located outside of the DMA, uses a single DMA channel from the device. The controller uses the DMA time slot for data transfer and can read or write a block of data up to 128K anywhere in 2 Megabytes of memory depending on device pin configuration.

**G-Memory Refresh (one (1) channel)**

The refresh controller uses a single DMA channel with its own time slots. It places RAS addresses on the memory address bus (MA) during these slots, in order to refresh the dynamic RAM. Memory is refreshed on every raster line.

During the DMA no data transfer actually takes place. The register address bus (RGA) is used to supply video synchronizing codes. At this time RAS1\* and RAS are low. CASU\* and CASL\* are inactive during this cycle.

**RAM AND REGISTER ADDRESSING**

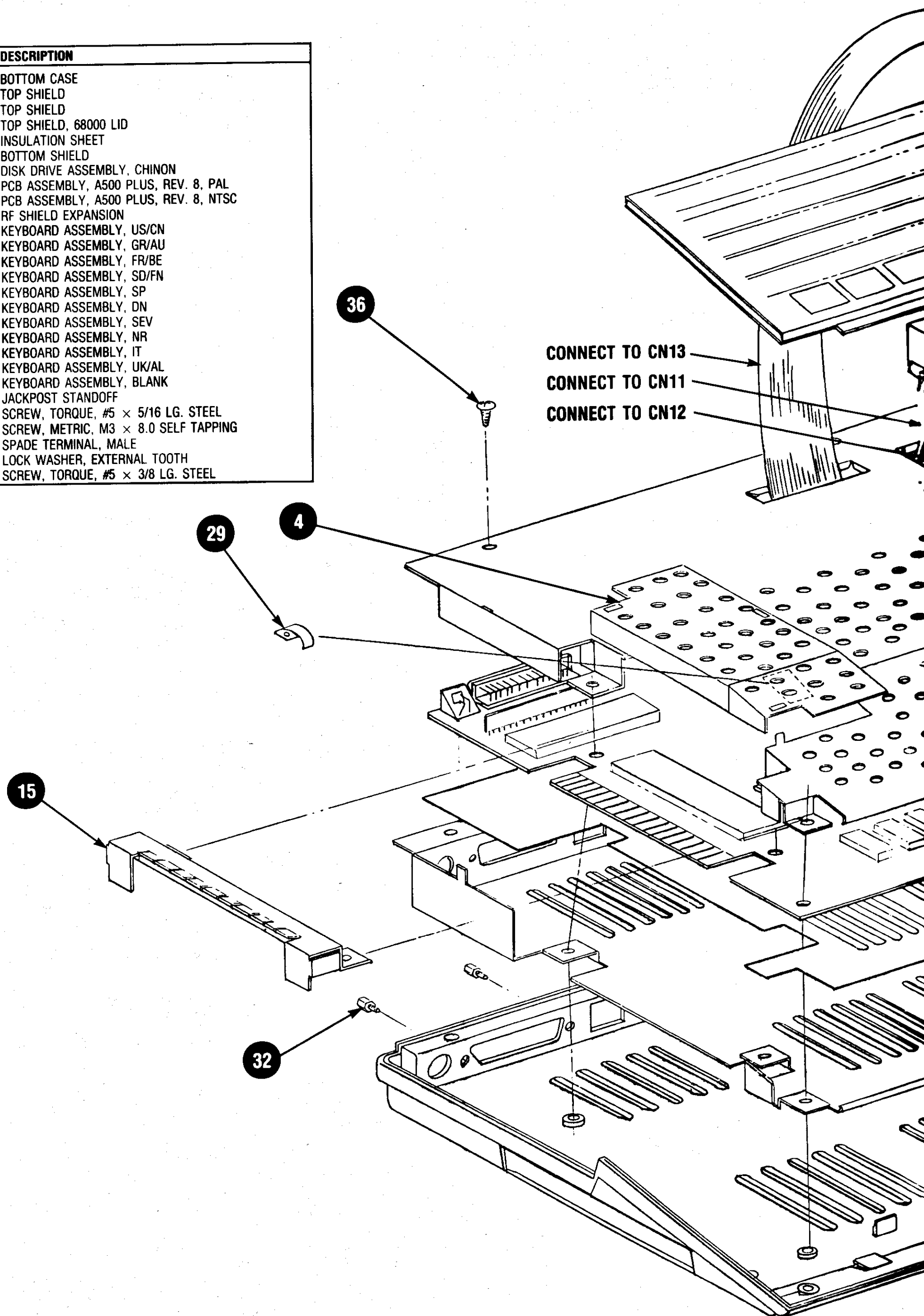
The device generates RAM addresses from two sources, the processor or the device performing DMA cycles. The processor accesses RAM whenever AS\* and RAMEN\* are both low. At this time, the device also multiplexes the processor address (A1-A20) onto the MA bus. During row address time A9-A17 and A19 are placed onto MA0-MA8, MA9, respectively; during column address time A1-A8, A18 and A20 are placed onto MA0-MA7, MA8 and MA9, respectively. In the 1 meg configuration, A19 is still used to determine the RAS line to be asserted. If A19 is low RAS0\* is active and if high RAS1\* is active. In the 2 meg option RAS will always be active on a RAM access. The IC will assert CASL\* if LDS\* is low or CASU\* if UDS\* is low.

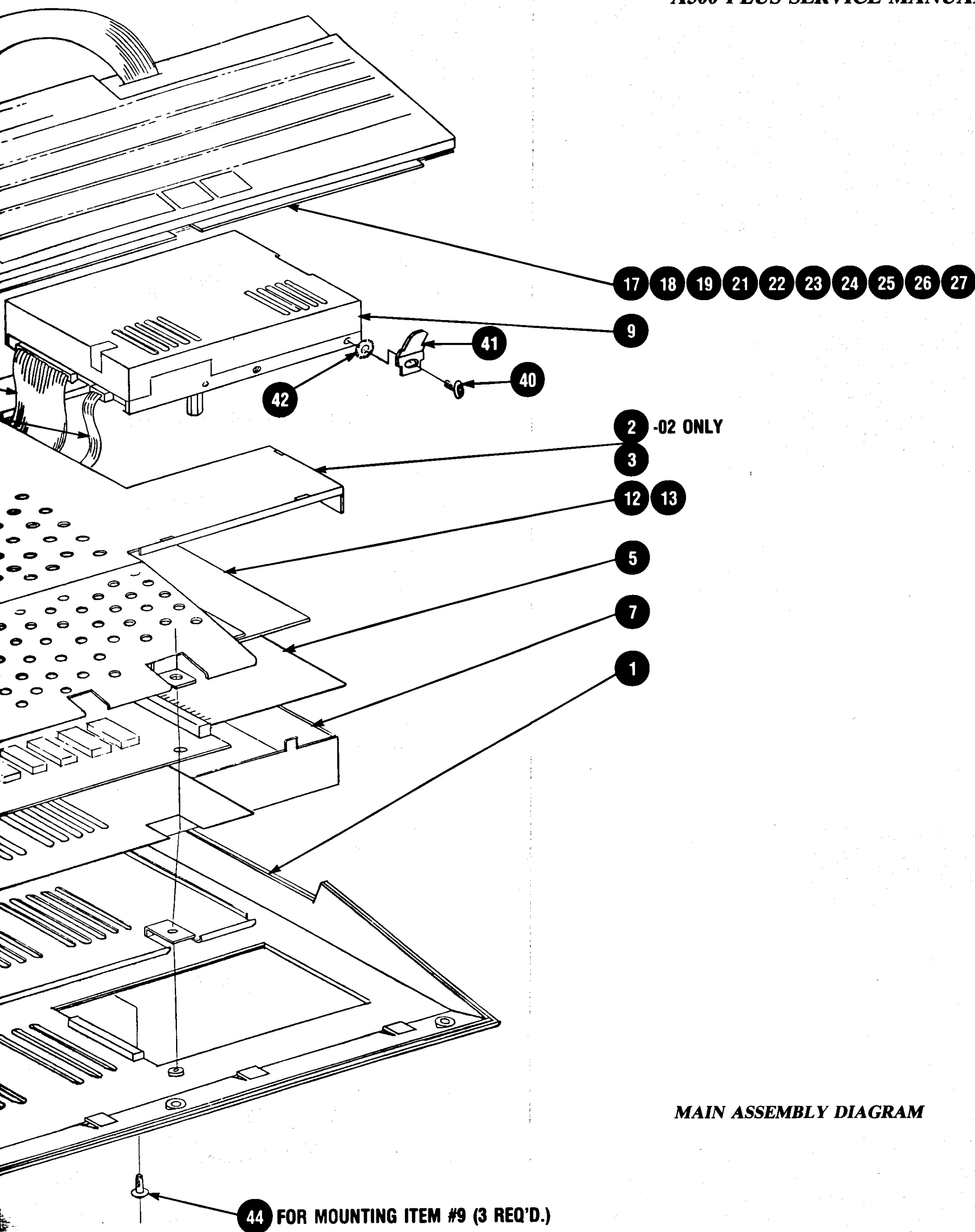
When the device needs to do a DMA cycle, the device disables the processor from accessing RAM by asserting the Data Bus Request Line (DBR\*). At this time, the device multiplexes its generated RAM address onto the MA lines and will activate RAS and the proper RAS0\* or RAS1\* line unless it is a refresh cycle where all RAS lines are active. During a DMA cycle, the IC device will also assert both CASU\* and CASL\*, unless it is a refresh cycle where they both remain inactive.

The device also generates RGA addresses from either the processor or device DMAs, each of which is selected by an internal multiplexer. This multiplexer allows the processor to perform a register read/write access when AS\* and RGEN\* are both low. The device then takes the low order byte of the processor address A1 to A8 and reflects its value on the RGA output bus RGA1 to RGA8. The device will reflect the status of PRW input on the RRW output line, to indicate a memory read or write operation.

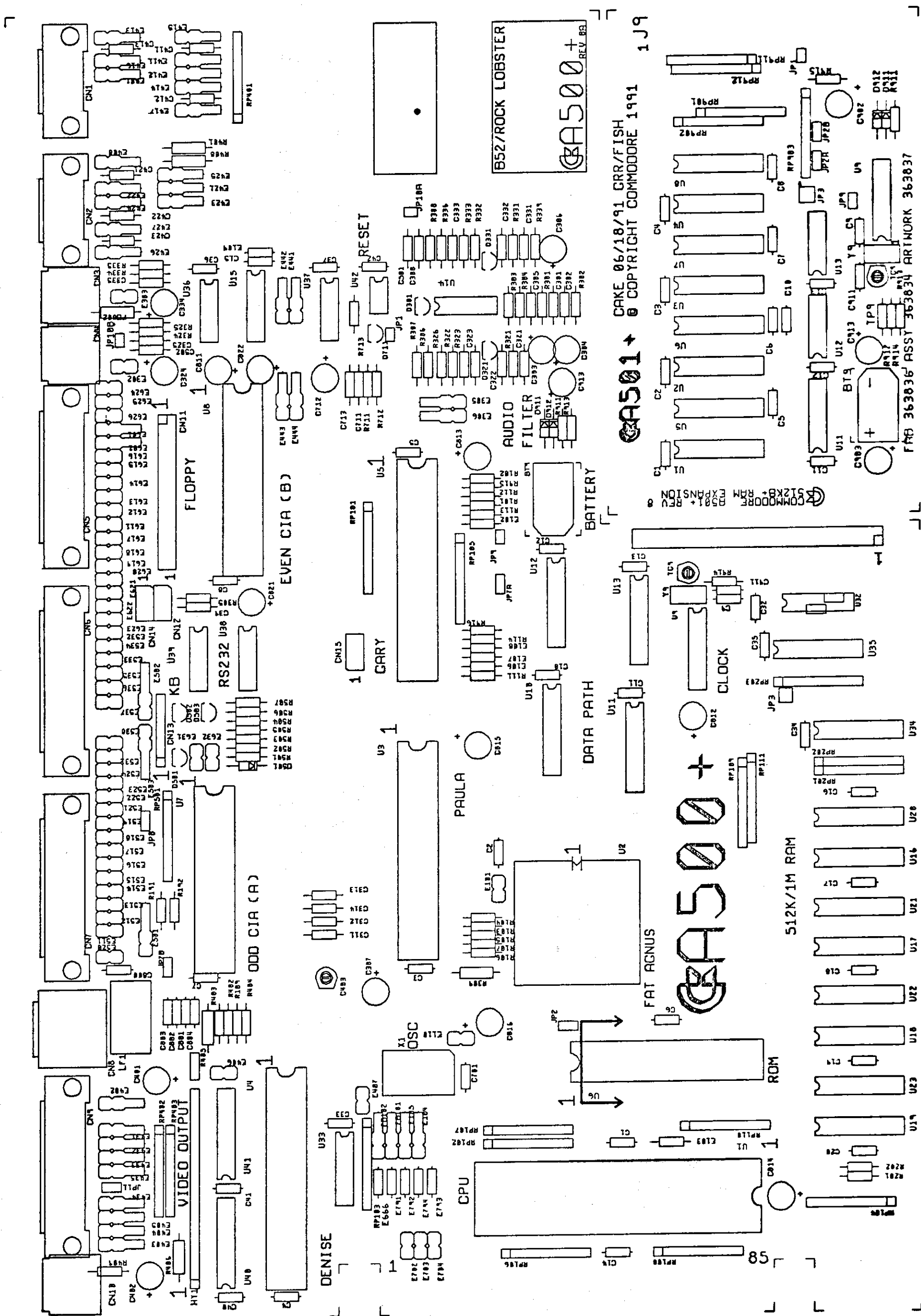
During a device DMA cycle, the device prevents the processor from doing a register access by asserting the DBR\* line. The device will then place the contents of its register address encoder onto the RGA bus.

| ITEM NO. | PART NO.  | DESCRIPTION                           |
|----------|-----------|---------------------------------------|
| 1        | 312506-01 | BOTTOM CASE                           |
| 2        | 332358-01 | TOP SHIELD                            |
| 3        | 312504-02 | TOP SHIELD                            |
| 4        | 332359-01 | TOP SHIELD, 68000 LID                 |
| 5        | 312589-01 | INSULATION SHEET                      |
| 7        | 312590-01 | BOTTOM SHIELD                         |
| 9        | 312594-01 | DISK DRIVE ASSEMBLY, CHINON           |
| 12       | 312812-01 | PCB ASSEMBLY, A500 PLUS, REV. 8, PAL  |
| 13       | 312812-02 | PCB ASSEMBLY, A500 PLUS, REV. 8, NTSC |
| 15       | 327038-01 | RF SHIELD EXPANSION                   |
| 17       | 312502-01 | KEYBOARD ASSEMBLY, US/CN              |
| 18       | 312502-02 | KEYBOARD ASSEMBLY, GR/AU              |
| 19       | 312502-03 | KEYBOARD ASSEMBLY, FR/BE              |
| 20       | 312502-05 | KEYBOARD ASSEMBLY, SD/FN              |
| 21       | 312502-06 | KEYBOARD ASSEMBLY, SP                 |
| 22       | 312502-07 | KEYBOARD ASSEMBLY, DN                 |
| 23       | 312502-08 | KEYBOARD ASSEMBLY, SEV                |
| 24       | 312502-09 | KEYBOARD ASSEMBLY, NR                 |
| 25       | 312502-04 | KEYBOARD ASSEMBLY, IT                 |
| 26       | 312502-12 | KEYBOARD ASSEMBLY, UK/AL              |
| 27       | 312504-99 | KEYBOARD ASSEMBLY, BLANK              |
| 32       | 390251-01 | JACKPOST STANDOFF                     |
| 36       | 390146-01 | SCREW, TORQUE, #5 × 5/16 LG. STEEL    |
| 40       | 906800-03 | SCREW, METRIC, M3 × 8.0 SELF TAPPING  |
| 41       | 252177-01 | SPADE TERMINAL, MALE                  |
| 42       | 905650-11 | LOCK WASHER, EXTERNAL TOOTH           |
| 44       | 390146-02 | SCREW, TORQUE, #5 × 3/8 LG. STEEL     |





**MAIN ASSEMBLY DIAGRAM**



A500 PLUS PCB ASSEMBLY 312812

## Commodore International Spare Parts List

### A500 PLUS SHIPPING ASSEMBLIES

Commodore part numbers are provided for reference only and do not indicate the availability of spare parts from Commodore. Industry standard parts (Resistors, Capacitors, Connectors) should be secured locally. Part number information may vary according to country, some parts may not be available in all countries. Part Numbers are subject to change, see Parts (Section 2) of current Techtopics for current numbers.

| SHIPPING ASSY A500 PLUS |   | SHIPPING ASSY A500 PLUS (Continued) |                                     |
|-------------------------|---|-------------------------------------|-------------------------------------|
| 535008-01               | U.S.  | 315938-01                           | SOFTWARE SUB ASSY U.S.              |
| 535008-02               | CN  | 315938-02                           | SOFTWARE SUB ASSY CN                |
| 535008-03               | UK  | 315938-03                           | SOFTWARE SUB ASSY UK                |
| 535008-04               | GR  | 315938-04                           | SOFTWARE SUB ASSY GR                |
| 535008-05               | FR  | 315938-05                           | SOFTWARE SUB ASSY FR                |
| 535008-06               | IT  | 315938-06                           | SOFTWARE SUB ASSY IT                |
| 535008-07               | SP  | 315938-07                           | SOFTWARE SUB ASSY SP                |
| 535008-08               | SG  | 315938-08                           | SOFTWARE SUB ASSY SG                |
| 535008-09               | SF  | 315938-09                           | SOFTWARE SUB ASSY SF                |
| 535008-10               | AU (NOT USED)   | 315938-10                           | SOFTWARE SUB ASSY NR                |
| 535008-11               | NR  | 315938-11                           | SOFTWARE SUB ASSY SD                |
| 535008-12               | SD  | 315938-12                           | SOFTWARE SUB ASSY FN                |
| 535008-13               | FN  | 315938-13                           | SOFTWARE SUB ASSY NE                |
| 535008-14               | NE  | 315938-14                           | SOFTWARE SUB ASSY DN                |
| 535008-15               | DN  | 315938-15                           | SOFTWARE SUB ASSY BF                |
| 535008-16               | BF  | 315938-16                           | SOFTWARE SUB ASSY AL                |
| 535008-17               | BD (NOT USED)   | 315938-17                           | SOFTWARE SUB ASSY PG                |
| 535008-18               | AL  | 318994-01                           | QUICK CONNECT FOR A500              |
| 535008-19               | CEL (NOT USED)  | 363328-01                           | INTRODUCING THE A500 ENGLISH        |
| 535008-20               | PG  | 368382-01                           | INTRODUCING THE A500 GERMAN         |
| 319999-02               | BOX MASTER SHIPPING A500 PLUS (SUB FOR 319999-03)         | 368383-01                           | INTRODUCING THE A500 FR             |
| 312585-03               | BOX PACKING A500 PLUS                                     | 368384-01                           | INTRODUCING THE A500 IT             |
| 363642-01               | MAIN ASSY US/CN   | 368385-01                           | INTRODUCING THE A500 SP             |
| 363642-02               | MAIN ASSY GR/AU   | 368388-01                           | INTRODUCING THE A500 NR             |
| 363642-03               | MAIN ASSY FR/BE   | 368389-01                           | INTRODUCING THE A500 SW             |
| 363642-04               | MAIN ASSY SD/FN   | 368390-01                           | INTRODUCING THE A500 FINNISH        |
| 363642-05               | MAIN ASSY SP  | 368391-01                           | INTRODUCING THE A500 DUTCH          |
| 363642-06               | MAIN ASSY DN  | 368392-01                           | INTRODUCING THE A500 DANISH         |
| 363642-07               | MAIN ASSY SEV   | 368395-01                           | INTRODUCING THE A500 PORTUGUESE     |
| 363642-08               | MAIN ASSY NR  | 368398-01                           | QUICK CONNECT GUIDE A500 GERMAN     |
| 363642-09               | MAIN ASSY NE/AL   | 368399-01                           | QUICK CONNECT GUIDE A500 FR         |
| 363642-10               | MAIN ASSY UK  | 368400-01                           | QUICK CONNECT GUIDE A500 ITALIAN    |
| 363642-11               | MAIN ASSY IT  | 368401-01                           | QUICK CONNECT GUIDE A500 SPANISH    |
| 363642-12               | MAIN ASSY PG  | 368404-01                           | QUICK CONNECT GUIDE A500 NORWEGIAN  |
| 363642-99               | MAIN ASSY BLANK KEYBOARD                                  | 368405-01                           | QUICK CONNECT GUIDE A500 SWEDISH    |
| 251006-03               | POLYBAG ANTI STATIC                                       | 368406-01                           | QUICK CONNECT GUIDE A500 FINNISH    |
| 324257-01               | BAG DRYING AGENT  | 368407-01                           | QUICK CONNECT GUIDE A500 DUTCH      |
| 312583-01               | ENDCAP LEFT   | 368408-01                           | QUICK CONNECT GUIDE A500 DANISH     |
| 312583-02               | ENDCAP RIGHT  | 368411-01                           | QUICK CONNECT GUIDE A500 PORTUGUESE |
| 380928-01               | MILL BOARD WITH FOAM                                      |                                     |                                     |
| 312503-01               | POWER SUPPLY UL/CSA 110V                                  |                                     |                                     |
| 312503-02               | POWER SUPPLY BSI 240V                                     |                                     |                                     |
| 312503-03               | POWER SUPPLY VDE 220V                                     |                                     |                                     |
| 312503-04               | POWER SUPPLY SEV 220V                                     |                                     |                                     |
| 312503-05               | POWER SUPPLY SAA 220V                                     |                                     |                                     |
| 327124-02               | MOUSE ASSY  |                                     |                                     |
| 390925-01               | CABEL 25 PIN SCART TO 23 PIN D SUB W/2 R FOR TV CONN      |                                     |                                     |
| 318143-02               | GLUE WHITE  |                                     |                                     |
| 380929-01               | MILLBOARD   |                                     |                                     |
| 368084-01               | SEAL TAMPER EVIDENT (PLACE ON BOX FLAPS)                  |                                     |                                     |
| 311847-01               | PLASTIC HANDLE  |                                     |                                     |
| 999104-01               | ADHESIVE TAPE TRANSPARENT 50MM (ON MASTER SHIP BOX FLAPS) |                                     |                                     |
| 310397-01               | BOX ACCESSORY   |                                     |                                     |
| 332417-01               | SPACER CARDBOARD  |                                     |                                     |
| 332263-01               | SHEET TOP/BOTTOM  |                                     |                                     |
| 332264-01               | SHEET SIDE  |                                     |                                     |
| 390533-01               | POWER PLUG FUSED U.K.                                     |                                     |                                     |

## Commodore International Spare Parts List

### A500 PLUS MAJOR ASSEMBLIES

Commodore part numbers are provided for reference only and do not indicate the availability of spare parts from Commodore. Industry standard parts (Resistors, Capacitors, Connectors) should be secured locally. Part number information may vary according to country, some parts may not be available in all countries.

| MAIN ASSY A500 PLUS |  | AMIGA CONSUMER SOFTWARE SUB ASSEMBLY V2.0 |   |
|---------------------|--|---|---|
| 363642-01           | MAIN ASSY A500 PLUS U.S./CANADA                                | 315938-01                                 | AMIGA CONSUMER SOFTWARE SUB ASSEMBLY U.S.A.             |
| 363642-02           | MAIN ASSY A500 PLUS GERMANY/AUSTRIA                            | 315938-02                                 | AMIGA CONSUMER SOFTWARE SUB ASSEMBLY CANADA             |
| 363642-03           | MAIN ASSY A500 PLUS FRANCE/BELGIUM                             | 315938-03                                 | AMIGA CONSUMER SOFTWARE SUB ASSEMBLY U.K.               |
| 363642-04           | MAIN ASSY A500 PLUS SWEDEN/FINLAND                             | 315938-04                                 | AMIGA CONSUMER SOFTWARE SUB ASSEMBLY GERMANY            |
| 363642-05           | MAIN ASSY A500 PLUS SPAIN/S. AMERICA                           | 315938-05                                 | AMIGA CONSUMER SOFTWARE SUB ASSEMBLY FRANCE             |
| 363642-06           | MAIN ASSY A500 PLUS DENMARK                                    | 315938-06                                 | AMIGA CONSUMER SOFTWARE SUB ASSEMBLY ITALY              |
| 363642-07           | MAIN ASSY A500 PLUS SWITZERLAND                                | 315938-07                                 | AMIGA CONSUMER SOFTWARE SUB ASSEMBLY SPAIN              |
| 363642-08           | MAIN ASSY A500 PLUS NORWAY                                     | 315938-08                                 | AMIGA CONSUMER SOFTWARE SUB ASSEMBLY SWITZERLAND-GERMAN |
| 363642-09           | MAIN ASSY A500 PLUS NETHERLANDS                                | 315938-09                                 | AMIGA CONSUMER SOFTWARE SUB ASSEMBLY SWITZERLAND-FRENCH |
| 363642-10           | MAIN ASSY A500 PLUS U.K.                                       | 315938-10                                 | AMIGA CONSUMER SOFTWARE SUB ASSEMBLY NORWAY             |
| 363642-11           | MAIN ASSY A500 PLUS ITALY                                      | 315938-11                                 | AMIGA CONSUMER SOFTWARE SUB ASSEMBLY SWEDEN             |
| 363642-12           | MAIN ASSY A500 PLUS PORTUGAL                                   | 315938-12                                 | AMIGA CONSUMER SOFTWARE SUB ASSEMBLY FINLAND            |
| 363642-99           | MAIN ASSY A500 PLUS BLANK KEYBOARD PAL                         | 315938-13                                 | AMIGA CONSUMER SOFTWARE SUB ASSEMBLY NETHERLANDS        |
| 312506-01           | BOTTOM CASE  | 315938-14                                 | AMIGA CONSUMER SOFTWARE SUB ASSEMBLY DENMARK            |
| 332358-01           | TOP SHIELD   | 315938-15                                 | AMIGA CONSUMER SOFTWARE SUB ASSEMBLY BELGIUM-FRENCH     |
| 312504-02           | TOP SHIELD (SUB FOR 332358-01 & 332359-01)                     | 315938-16                                 | AMIGA CONSUMER SOFTWARE SUB ASSEMBLY AUSTRALIA          |
| 332359-01           | TOP SHIELD 68000 LID (USE W/332358-01)                         | 315938-17                                 | AMIGA CONSUMER SOFTWARE SUB ASSEMBLY PORTUGAL           |
| 312589-01           | INSULATION SHEET   | 368244-01                                 | MANUAL USING THE AMIGA WORKBENCH ENGLISH                |
| 312590-01           | BOTTOM SHIELD  | 367813-01                                 | DISK ASSY WORKBENCH 2.04 U.S. (INTERNATIONAL) 3.5"      |
| 312594-01           | DISK DRIVE ASSY CHINON   | 367814-01                                 | DISK ASSY WORKBENCH 2.04 CANADIAN-FRENCH 3.5"           |
| 312594-02           | DISK DRIVE ASSY PANASONIC (SUB FOR 312594-01)                  | 367815-01                                 | DISK ASSY WORKBENCH 2.04 U.K. 3.5"                      |
| 312812-01           | PCB ASSY A500 PLUS REV 8 PAL                                   | 367816-01                                 | DISK ASSY WORKBENCH 2.04 GERMAN 3.5"                    |
| 312812-02           | PCB ASSY A500 PLUS REV 8 NTSC                                  | 367817-01                                 | DISK ASSY WORKBENCH 2.04 FRENCH/BELGIUM 3.5"            |
| 327038-01           | RF SHIELD EXPANSION  | 367818-01                                 | DISK ASSY WORKBENCH 2.04 ITALIAN 3.5"                   |
| 312502-01           | KEYBOARD ASSY U.S./CAN   | 367819-01                                 | DISK ASSY WORKBENCH 2.04 SPANISH 3.5"                   |
| 312502-02           | KEYBOARD ASSY GR/AU  | 367820-01                                 | DISK ASSY WORKBENCH 2.04 SWISS 3.5"                     |
| 312502-03           | KEYBOARD ASSY FR/BE  | 367821-01                                 | DISK ASSY WORKBENCH 2.04 NORWEGIAN 3.5"                 |
| 312502-04           | KEYBOARD ASSY IT   | 367822-01                                 | DISK ASSY WORKBENCH 2.04 SWEDISH/FINNISH 3.5"           |
| 312502-05           | KEYBOARD ASSY SD/FN  | 367823-01                                 | DISK ASSY WORKBENCH 2.04 DANISH 3.5"                    |
| 312502-06           | KEYBOARD ASSY SP   | 367824-01                                 | DISK ASSY EXTRAS 2.04 INTERNATIONAL 3.5"                |
| 312502-07           | KEYBOARD ASSY DN   | 367825-01                                 | DISK ASSY FONTS 2.04 INTERNATIONAL 3.5"                 |
| 312502-08           | KEYBOARD ASSY SEV  | 318843-01                                 | DISKETTE FOLDER 3.5"                                    |
| 312502-09           | KEYBOARD ASSY NR   | 318896-04                                 | SOFTWARE LICENSE AGREEMENT ENGLISH                      |
| 312502-12           | KEYBOARD ASSY UK   | 318708-02                                 | SOFTWARE LICENSE AGREEMENT GERMAN                       |
| 312502-99           | KEYBOARD ASSY BLANK  | 380913-02                                 | POLY BAG CATCH 120MM X 170MM                            |
| 312472-01           | KEYBOARD SUPPORT   | 400808-01                                 | SERVICE SUB ASSY A500 SERIES                            |
| 390251-01           | JACKPOST STANDOFF  | 318882-01                                 | CARD WARRANTY CANADA                                    |
| 390251-03           | JACKPOST STANDOFF (SUB FOR 390251-01)                          | 325249-01                                 | CARD WARRANTY U.K.                                      |
| 324530-02           | JACKPOST STANDOFF (SUB FOR 390251-01)                          | 320046-06                                 | CARD WARRANTY GERMANY                                   |
| 390146-01           | SCREW TORQUE #5 X 5/16 LG STEEL (QTY 4) USE ON TOP SHIELD & RF | 325254-01                                 | CARD WARRANTY FRANCE                                    |
| 390177-01           | SCREW TORQUE #5 X 5/16 LG (SUB FOR 390146-01)                  | 332408-01                                 | CARD WARRANTY SWITZERLAND                               |
| 906883-03           | SCREW PAN HEAD 2.9 X 8 SELF TAPPING (SUB FOR 390146-01)        | 368014-01                                 | CARD WARRANTY AUSTRALIA                                 |
| 906800-03           | SCREW METRIC M3 X 8.0 SELF TAPPING (QTY 4 — USE W/312594-01)   | 312341-02                                 | CARD DISK REPLACEMENT U.S.                              |
| 252177-01           | SPADE TERMINAL MALE  | 318556-02                                 | CARD DISK REPLACEMENT CANADA                            |
| 905650-11           | LOCK WASHER EXTERNAL TOOTH                                     | 368363-01                                 | MANUAL USING THE AMIGA WORKBENCH FRENCH                 |
| 390146-02           | SCREW TORQUE #5 X 3/8 LG STEEL (QTY 6 — USE W/312506-01)       | 368364-01                                 | MANUAL USING THE AMIGA WORKBENCH ITALIAN                |
| 390177-02           | SCREW TORQUE #5 X 3/8 LG (SUB FOR 390146-02)                   | 368365-01                                 | MANUAL USING THE AMIGA WORKBENCH GERMAN                 |
| 906883-04           | SCREW PAN HEAD 2.9 X 9.5 SELF TAPPING (SUB FOR 390146-02)      | 368366-01                                 | MANUAL USING THE AMIGA WORKBENCH SPANISH                |
| 312591-01           | RAM EXPANSION DOOR   | 368367-01                                 | MANUAL USING THE AMIGA WORKBENCH DANISH                 |
| 312595-01           | COVER EXPANSION  | 368368-01                                 | MANUAL USING THE AMIGA WORKBENCH DUTCH                  |
| 312505-02           | TOP CASE   | 368369-01                                 | MANUAL USING THE AMIGA WORKBENCH NORWEGIAN              |
| 363946-02           | NAMEPLATE  | 368370-01                                 | MANUAL USING THE AMIGA WORKBENCH SWEDISH                |
| 950150-03           | RUBBER FEET  |   |   |
| 363641-01           | LABEL RATING PAL (MADE IN GERMANY)                             |   |   |
| 363641-02           | LABEL RATING NTSC (MADE IN GERMANY)                            |   |   |
| 363641-03           | LABEL RATING PAL (MADE IN USA) (SUB FOR 363641-01)             |   |   |
| 363641-04           | LABEL RATING NTSC (MADE IN USA) (SUB FOR 363641-02)            |   |   |
| 363641-05           | LABEL RATING PAL (MADE IN HONG KONG)                           |   |   |
| 363641-06           | LABEL RATING NTSC (MADE IN HONG KONG)                          |   |   |
| 363641-07           | LABEL RATING PAL (MADE IN PHILIPPINES)                         |   |   |
| 363641-08           | LABEL RATING NTSC (MADE IN PHILIPPINES)                        |   |   |
| 316416-01           | LABEL WARNING POWER OFF  |   |   |
| 325090-02           | STICKER SEAL WARRANTY  |   |   |
| 364137-01           | SPRING FINGER  |   |   |
| 363641-09           | LABEL RATING PAL (MADE IN HK)                                  |   |   |
| 363641-10           | LABEL RATING NTSC (MADE IN HK)                                 |   |   |
| 332348-01           | TAPE MYLAR   |   |   |
| 366648-01           | LABEL BAR CODE BLANK   |   |   |
| 366649-01           | LABEL BAR CODE BLANK   |   |   |



## Commodore International Spare Parts List

### A500 PLUS PCB Components

### PCB Assembly #312812 (-01 — PAL; -02 — NTSC)

Commodore part numbers are provided for reference only and do not indicate the availability of spare parts from Commodore. Industry standard parts (Resistors, Capacitors, Connectors) should be secured locally. Part number information may vary according to country, some parts may not be available in all countries.

| IC COMPONENTS                              |  |  | CAPACITORS (Continued)      |  |  |
|--|--|--|-----------------------------|--|--|
| 901882-01                                  | MC1488                                   | U38  | 900463-16                   | MLC AXIAL X7R 1000 PF                  | C411-C413, C421-C423   |
| 901883-01                                  | MC1489                                   | U39  | 900463-23                   | MLC AXIAL X7R 3900 PF                  | C323, C333   |
| 390086-01                                  | LF347                                    | U14  | 900463-26                   | MLC AXIAL X7R 6800 PF                  | C322, C332   |
| 901523-01                                  | NE555                                    | U42  | 900463-36                   | MLC AXIAL X7R .047 UF                  | C311-C314  |
| 390084-03                                  | MC68000 8 MHZ                            | U1   | 900463-37                   | MLC AXIAL X7R .1 UF                    | C321, C331   |
| 318072-01                                  | MOS 5719 R2 GARY                         | U5   | 251894-18                   | ELEC ALUM RAD 1000 UF 10V              | C307, C401, C402   |
| 390979-01                                  | ROM 256K X 16 KICKSTART 2.04             | U6   | 251894-50                   | ELEC ALUM RAD 47 UF 35V                | C821, C822   |
| 252127-02                                  | MOS 8364 R7 PAULA                        | U3   | 390101-02                   | ELEC ALUM RAD 100 UF 16V               | C811-C816  |
| 390544-01                                  | MOS 8375 AGNUS 2 MEG PAL                 | U2   | 390101-04                   | ELEC ALUM RAD 22 UF 35V                | C303, C304, C324, C334   |
| 390544-02                                  | MOS 8375 AGNUS 2 MEG NTSC                | U2   | 390101-06                   | ELEC ALUM RAD 10 UF 35V                | C306, C712   |
| 318029-02                                  | MOS 8520 R4 AMIGA CIA                    | U7, U8   | 900410-13                   | ELEC TANT RAD 4.7 UF 16V               | C913   |
| 318050-01                                  | 74F244                                   | U35  | <b>RESISTORS — 1/4W, 5%</b> |  |  |
| 318052-01                                  | 74F258                                   | U33  | 901550-01                   | CF 1K                                  | R191, R192, R303-R305, R324, R334, R713, R915, R916              |
| 318073-01                                  | OKI MSM6242B RTC                         | U9   | 901550-19                   | CR 4.7K                                | R201, R202, R402, R403, R404, R503, R504                         |
| 318099-04                                  | DRAM 256K X 4 120NS                      | U16-U23  | 901550-20                   | CF 10K                                 | R306, R308, R322, R323, R332, R333, R339, R501, R505, R506, R914 |
| 318099-02                                  | DRAM 256K X 4 100NS (SUB FOR -04)        | U16-U23  | 901550-22                   | CF 47K                                 | R712   |
| 390227-06                                  | 74HCT245                                 | U40, U41   | 901550-23                   | CF 2.7K                                | R307, R502   |
| 390090-01                                  | 74FF139                                  | U32  | 901550-49                   | CF 100 OHM                             | R507   |
| 390108-01                                  | 74F373                                   | U34  | 901550-56                   | CF 47 OHM                              | R103-R107, R113  |
| 390229-03                                  | VIDEO HYBRID                             | HY1  | 901550-57                   | CF 390 OHM                             | R325, R335   |
| 390433-02                                  | MOS 8373 R4 DENISE HI RES                | U4   | 901550-58                   | CF 470 OHM                             | R911, R913   |
| 901521-11                                  | 74LS157                                  | U15  | 901550-64                   | CF 10 OHM                              | R301, R302   |
| 901521-13                                  | 74LS244                                  | U10, U12   | 901550-82                   | CF 470K                                | R326, R336   |
| 901521-29                                  | 73LS373                                  | U11, U13   | 901550-84                   | CF 1 MEG OHM                           | R711   |
| 901521-31                                  | 73LS32                                   | U37  | 901550-89                   | CF 150 OHM                             | R409, FB102  |
| 901521-37                                  | 74LS05                                   | U36  | 901550-90                   | CF 27 OHM                              | R101, R102   |
| 390433-01                                  | MOS 8373 R3 DENISE HI RES                | U4   | 901550-94                   | CF 68 OHM                              | R109, R111, R112, R114, E104, E105, FB101                        |
| <b>IC SOCKETS</b>                          |  |  | 901550-108                  | CF 360 OHM                             | R321, R331   |
| 904150-06                                  | 40 PIN DIP                               | U7, U8   | <b>RESISTORS — 1/2W, 5%</b> |  |  |
| 904150-10                                  | 64 PIN DIP                               | U1   | 901600-55                   | CF 0.47 OHM                            | R405   |
| 390185-01                                  | 84 PIN PLCC                              | U2   | 901600-15                   | CF 47 OHM                              | E501-E503  |
| 251313-01                                  | 48 PIN DIP                               | U3-U5  | 901600-36                   | CF 1 OHM                               | R309   |
| 251313-02                                  | 48 PIN DIP (SUB FOR -01)                 | U3-U5  | 901600-50                   | CF 4.7 OHM                             | R401, R406, R408   |
| 904150-09                                  | 42 PIN DIP                               | U6   | 901600-48                   | CF 5.1 OHM (SUB FOR -50)               | R401, R406, R408   |
| <b>CONNECTORS</b>                          |  |  | <b>RESISTOR NETWORKS</b>    |  |  |
| 252122-01                                  | RCA JACK WHITE AUDIO                     | CN4  | 390227-05                   | 68 OHM SIP 10 PIN 5 ELE                | RP201-RP203  |
| 252122-03                                  | RCA JACK YELLOW COMPOSITE                | CN10   | 390227-06                   | 47 OHM SIP 10 PIN 5 ELE                | RP402, RP403   |
| 252122-04                                  | RCA JACK BLACK AUDIO                     | CN3  | 390227-08                   | 39 OHM SIP 10 PIN 5 ELE                | RP103  |
| 390248-01                                  | RCA JACK METAL (SUB FOR 252122-01 & -04) | CN3, CN4, CN10   | 390227-03                   | 22 OHM SIP 10 PIN 5 ELE (SUB FOR -08)  | RP103  |
| 252167-01                                  | 5 PIN SQUARE DIN POWER                   | CN8  | 902410-07                   | 10K SIP 10 PIN 9 ELEMENT               | RP501  |
| 325516-04                                  | 4 PIN FLOPPY POWER (INT. FLOPPY PWR.)    | CN12   | 902410-08                   | 4.7K SIP 10 PIN 9 ELEMENT              | RP101, RP102, RP401  |
| 903345-17                                  | HEADER 34 PIN W/KEY (INTERNAL FLOPPY)    | CN11   | 902410-11                   | 470 OHM SIP 10 PIN 9 ELEMENT           | RP104  |
| 350903-01                                  | HEADER 34 PIN W/KEY (SUB FOR 903345-17)  | CN11   | <b>MISCELLANEOUS</b>        |  |  |
| 390224-01                                  | HEADER 56 PIN MALE RT ANGLE (EXPANSION)  | P9   | 380393-01                   | BATTERY NICAD 3.6V 60MAH               | BT9  |
| 390241-03                                  | D SUB 23 PIN FEMALE DB23s EXT. FLOPPY    | CN5  | 251842-02                   | EMI FILTER 100 PF                      | E511-E519, E521-E524, E611-E626, E631, E632                      |
| 390241-05                                  | D SUB 25 PIN FEMALE CB25s (CENTRONICS)   | CN7  | 390275-01                   | EMI FILTER 6800 PF                     | E302, E303, E411-E414, E421-E424                                 |
| 390242-01                                  | D SUB 9 PIN MALE DB9p (JOYSTICK)         | CN1, CN2   | 390275-02                   | EMI FILTER 150 PF                      | E402, E434, E532, E534   |
| 390242-03                                  | D SUB 23 PIN MALE DB23p (VIDEO)          | CN9  | 390297-01                   | EMI FILTER 270 PF                      | E305, E306   |
| 390242-05                                  | D SUB 25 PIN MALE DB25p (RS-232)         | CN6  | 390297-04                   | EMI FILTER 470 PF                      | E415-E417, E425-E427, E441-E444, E520, E531, E533, E535-E538     |
| 903326-08                                  | 8 PIN SIL W/KEY (KEYBOARD)               | CN13   | 390297-05                   | EMI FILTER .01 UF                      | E101, E110, E401, E403-E408, E601, E602, E702-E704               |
| <b>OSCILLATORS, TRANSISTORS AND DIODES</b> |  |  | 251578-02                   | LINE FILTER                            | LF1  |
| 390254-01                                  | TRANSISTOR JFET MPF102/PN4302            | Q321, Q331   | 252133-01                   | FERRITE BEAD LONG                      | FB802  |
| 902658-01                                  | TRANSISTOR NPN 3904                      | Q501, Q711   | 903025-06                   | FERRITE BEAD LONG (SUB FOR 252133-01)  | FB802  |
| 902707-01                                  | TRANSISTOR PNP 3906                      | Q301, Q502, Q503   | 903025-08                   | FERRITE BEAD LONG (SUB FOR 252133-01)  | FB802  |
| 900850-01                                  | DIODE 1N4148                             | D501, D911, D912   | 252173-01                   | FERRITE BEAD RADIAL                    | E431-E433, E435  |
| 390017-01                                  | DIODE 1N914 (SUB FOR 900850-01)          | D501, D911, D912   | 903025-01                   | FERRITE BEAD AXIAL (SUB FOR 252173-01) | E431-E433, E435  |
| 252344-01                                  | OSCILLATOR 28.37516 MHZ (PAL)            | X1   | 366648-01                   | LABEL BAR CODE BLANK                   |  |
| 325566-14                                  | OSCILLATOR 28.63636 MHZ (NTSC)           | X1   | 366649-01                   | LABEL BAR CODE BLANK                   |  |
| 900560-01                                  | CRYSTAL 32.768 HZ                        | Y9   |                             |  |  |
| <b>CAPACITORS</b>                          |  |  |                             |  |  |
| 251029-06                                  | TRIMMER 6.8 PF - 45 PF                   | TC9  |                             |  |  |
| 390082-01                                  | MLC AXIAL Z5U .01UF                      | C7-C8, C10, C12, C15, C32-C37, C39, C308, C701, C713, C800-C803                            |                             |  |  |
| 390082-02                                  | MLC AXIAL Z5U .1UF                       | C711   |                             |  |  |
| 390082-04                                  | MLC AXIAL Z5U .33UF                      | C1-C6, C9, C11, C13, C14, C16-C20, C40-C42, C301, C302, C305, C325, C335, C501, C502, C804 |                             |  |  |
| 900462-21                                  | MLC AXIAL NPO 22 PF                      | C911, E666   |                             |  |  |
| 900462-29                                  | MLC AXIAL NPO 47 PF                      | E403, E102, E103, E106-E109, E791-E794   |                             |  |  |



## Commodore International Spare Parts List

### A501 PLUS SHIPPING ASSEMBLIES

Commodore part numbers are provided for reference only and do not indicate the availability of spare parts from Commodore. Industry standard parts (Resistors, Capacitors, Connectors) should be secured locally. Part number information may vary according to country, some parts may not be available in all countries. Part Numbers are subject to change, see Parts (Section 2) of current Techtopics for current numbers.

| SHIP ASSY A501 PLUS |                                     | SHIP ASSY A501 PLUS (Continued) |                         |
|---------------------|-------------------------------------|---------------------------------|-------------------------|
| 535009-01           | SHIP ASSY A501 PLUS INTERNATIONAL   | 312602-01                       | TRAY BOX                |
| 364039-01           | MAIN ASSY A501 PLUS                 | 319120-03                       | BOX INDIVIDUAL          |
| 241006-04           | BAG ANTI STATIC                     | 368084-01                       | SEAL TAMPER EVIDENT     |
| 318778-02           | BAG ANTI STATIC (SUB FOR 241006-04) | 319200-03                       | BOX MASTER SHIPPING 1/4 |
| 368412-01           | LEAFLET INSTRUCTION                 |                                 |                         |

## Commodore International Spare Parts List

### A501 PLUS MAJOR ASSEMBLIES

Commodore part numbers are provided for reference only and do not indicate the availability of spare parts from Commodore. Industry standard parts (Resistors, Capacitors, Connectors) should be secured locally. Part number information may vary according to country, some parts may not be available in all countries. See Section 3 for Dis-assembly diagrams.

| MAIN ASSY A501 PLUS |                     | MAIN ASSY A501 PLUS (Continued) |                                   |
|---------------------|---------------------|---------------------------------|-----------------------------------|
| 364039-01           | MAIN ASSY A501 PLUS | 312609-01                       | TAPE PRESSURE SENSITIVE           |
| 312606-01           | TOP SHIELD          | 363834-01                       | PCB ASSEMBLY A501 PLUS            |
| 312608-01           | BOTTOM SHIELD       | 366648-01                       | LABEL BAR CODE BLANK 0.5" X 1.75" |
| 312607-01           | INSULATION SHEET    | 366649-01                       | LABEL BAR CODE BLANK 0.5" X 1.00" |

## Commodore International Spare Parts List

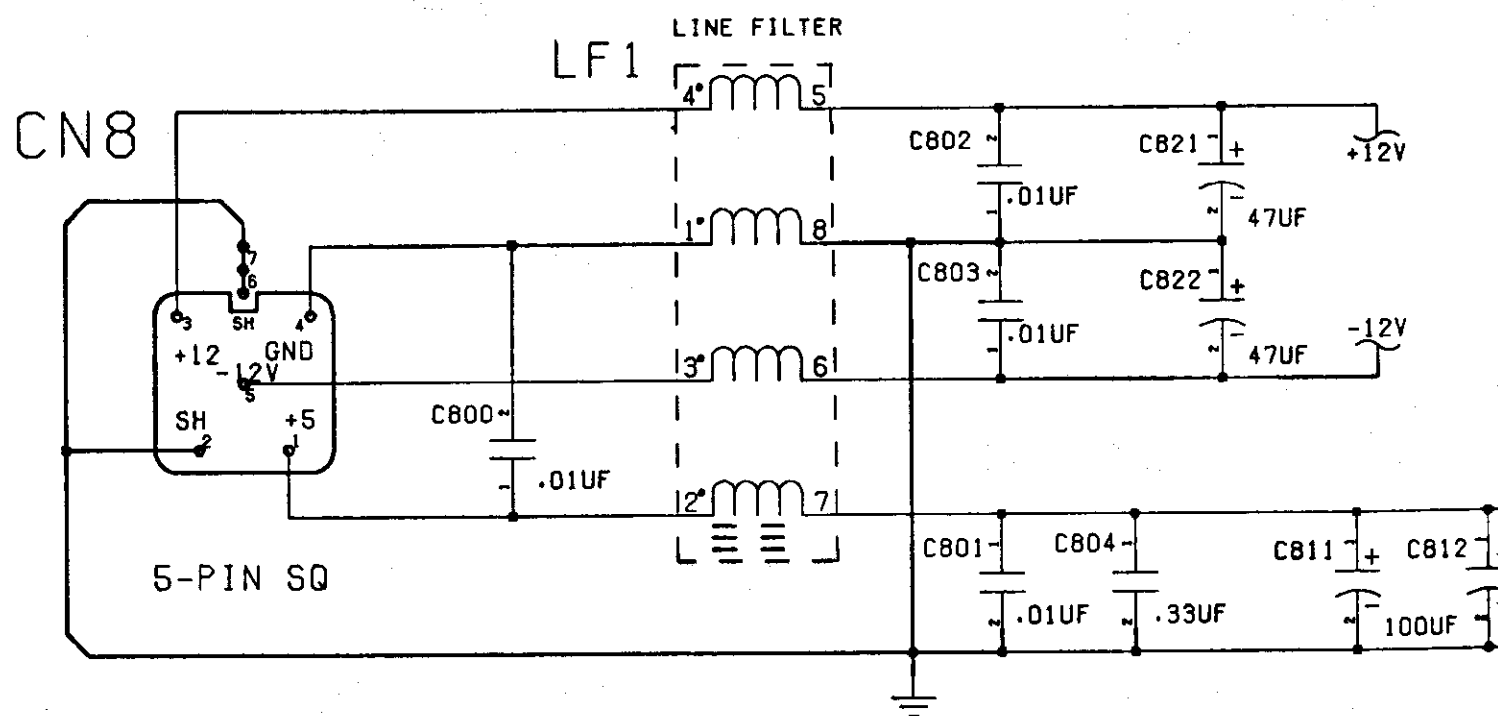
### A501 PLUS PCB Components

### PCB Assembly #363834

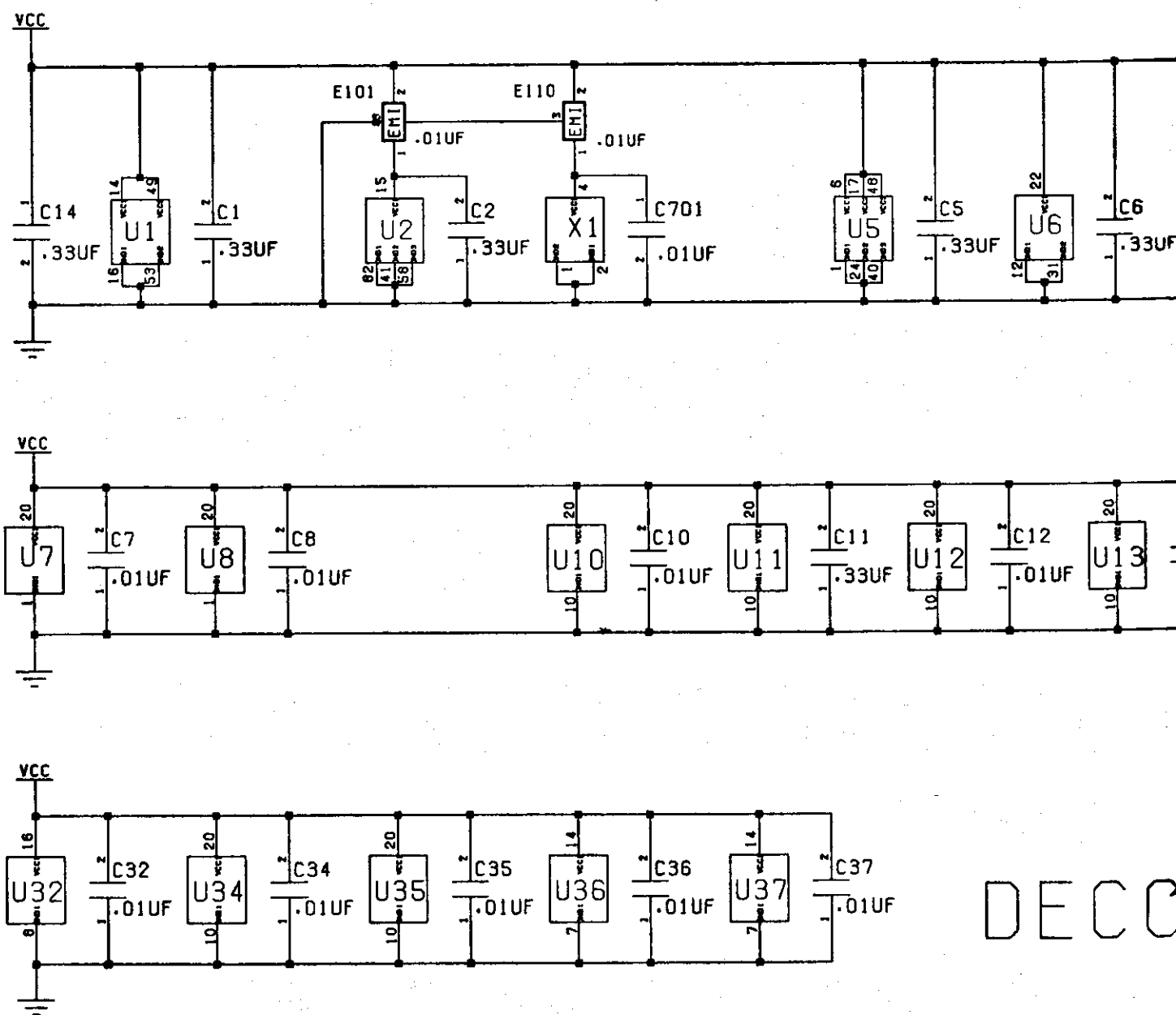
Commodore part numbers are provided for reference only and do not indicate the availability of spare parts from Commodore. Industry standard parts (Resistors, Capacitors, Connectors) should be secured locally. Part number information may vary according to country, some parts may not be available in all countries.

| IC COMPONENTS |   |           | RESISTOR NETWORKS |                                   |             |
|---------------|---|-----------|-------------------|-----------------------------------|-------------|
| 318099-04     | DRAM 256K X 4 120NS                     | U1-U8     | 390227-05         | 68 OHM SIP 10 PIN 5 ELEMENT       | RP901-RP903 |
| 318099-02     | DRAM 256K X 4 100NS (SUB FOR 318099-04) | U1-U8     | MISCELLANEOUS     |                                   |             |
| CONNECTORS    |   |           | 366648-01         | LABEL BAR CODE BLANK 0.5" X 1.75" |             |
| 380311-05     | FEMALE HEADER 56 PIN R ANGLE            | J9        | 366649-01         | LABEL BAR CODE BLANK 0.5" X 1.00" |             |
| CAPACITORS    |   |           |                   |                                   |             |
| 390082-04     | MLC AXIAL Z5U 0.33UF                    | C1-C8     |                   |                                   |             |
| 390101-02     | ELEC ALUM RAD 100UF 16V                 | C902,C903 |                   |                                   |             |

# POWER INPUT

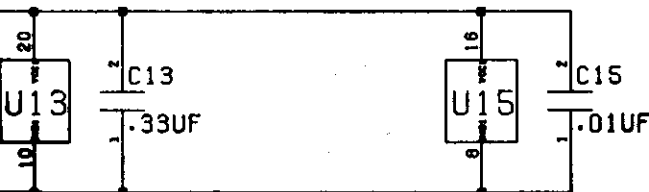
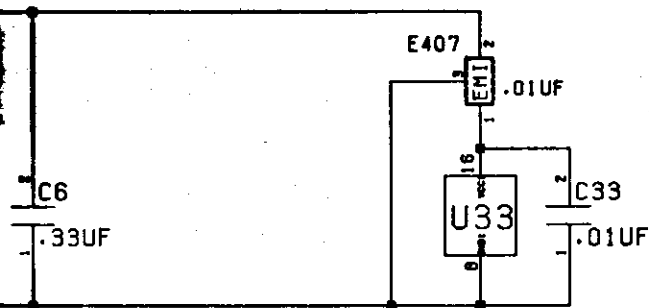
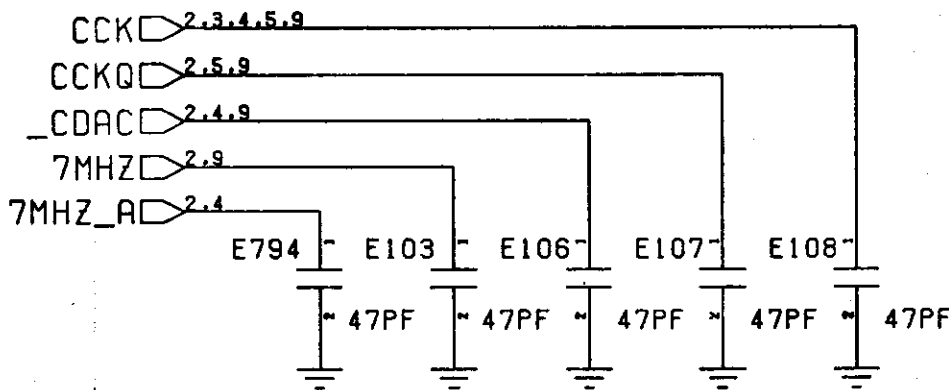
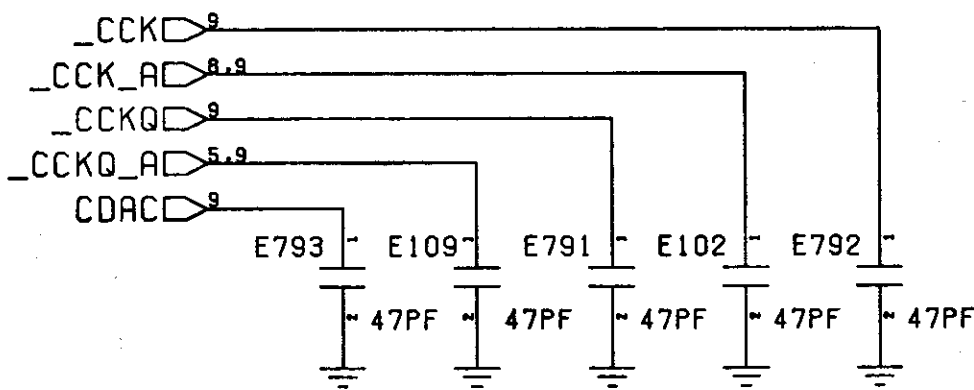
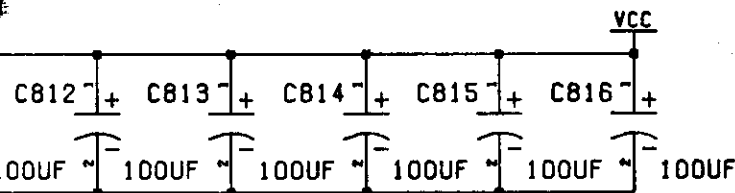


NOTE: HEAVY LINES INDICATE A SINGLE POINT CONNECTION

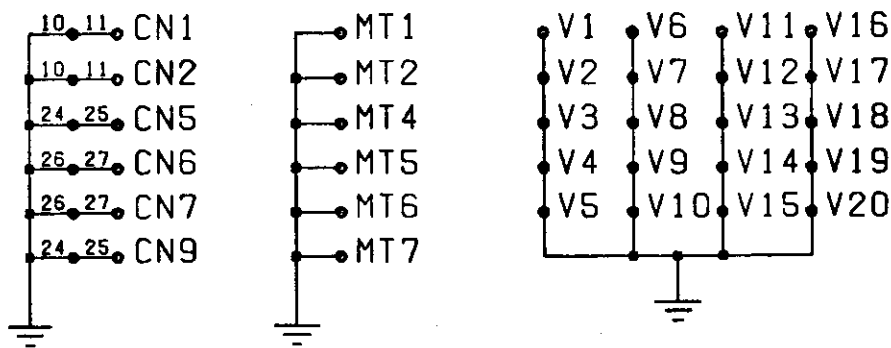


DECC

FCC GOOBERS

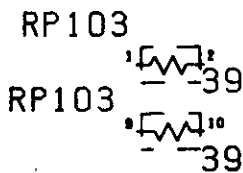


GROUNDING HOLES, &C.



COUPLING

SPARES



## JUMPERS AND STUFF

| REF | TYPE | DESCRIPTION            | PAGE |
|-----|------|------------------------|------|
| JP1 | BLOB | MEMORY EXPANSION SENSE | 3    |
| JP2 | BLOB | REFRESH KLUDGE BYPASS  | 2    |
| JP3 | BLOB | EXPANSION RAS SELECT   | 2    |
| JP9 | BLOB | RTC SELECT DISABLE     | 3    |

## CON

| REF | TY |
|-----|----|
| J9  | 56 |

## SIGNAL GLOSSARY

| SIGNAL    | DESCRIPTION (AREA)                 | PAGES |
|-----------|------------------------------------|-------|
| A[23:1]   | PROCESSOR ADDRESS BUS (68000)      | 3     |
| D[15:0]   | PROCESSOR DATA BUS (68000)         | 3     |
| CASL/U    | COLUMN ADDRESS STROBE (DRAM)       | 2,3   |
| CCK/CCKQ  | COLOR CLOCK / QUADRATURE (CHIPS)   | 3     |
| CLKRD/WR  | REAL TIME CLOCK READ / WRITE (RTC) | 3     |
| CLKCS     | REAL TIME CLOCK CHIP SELECT (RTC)  | 3     |
| DRA[8:0]  | DRAM ADDRESS BUS (DRAM)            | 2,3   |
| DRD[15:0] | DRAM DATA BUS (DRAM)               | 2,3   |
| RASO/1    | ROW ADDRESS STROBE (DRAM)          | 2,3   |

REVISION HISTORY

| REV | DESCRIPTION                        | DATE     | APRVL | MANAGER |
|-----|------------------------------------|----------|-------|---------|
| -   | FOR OLDER REVISION 3/5 BOARDS      |          |       |         |
|     | SEE SCHEMATIC 312511-01            |          |       |         |
| -   | FOR OLDER REVISION 6C BOARDS       |          |       |         |
|     | SEE SCHEMATIC 312988-01            |          |       |         |
|     |                                    |          |       |         |
| 0   | PCB A501+ R8 ENGINEERING PROTOTYPE | 06/18/91 | GRR   |         |
| 1   | ADVANCE ENGINEERING RELEASE        | 7/19/91  | GRR   | G.A.    |
|     |                                    |          |       |         |
|     |                                    |          |       |         |
|     |                                    |          |       |         |
|     |                                    |          |       |         |
|     |                                    |          |       |         |

CONNECTORS

| TYPE    | DESCRIPTION          | PAGE |
|---------|----------------------|------|
| 56-RAFH | MEM. EXP. MAIN-BOARD | 3    |


|    |
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| ES |
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
KEY COMPONENTS


| REF   | CHIP | DESCRIPTION         | PAGE |
|-------|------|---------------------|------|
| U1-U4 | ASST | DRAM 256KX4, 120 NS | 3    |
| U5-U8 | ASST | DRAM 256KX4, 120 NS | 3    |
| U9    | 6242 | REAL TIME CLOCK     | 8    |
|       |      |                     | 5    |

# Schematic #363835, Rev. 0

## Sheet 2 of 3


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
\_XDRA(8:0) 

\_XOE 










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\_XCASU 







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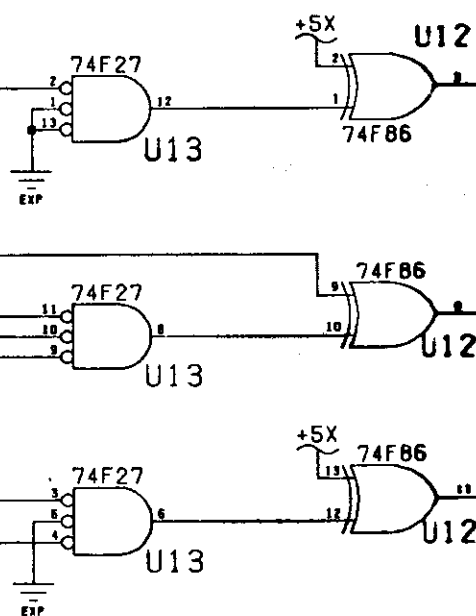
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 RP901 3  4 68  
 RP901 5  6 68  
 RP901 7  8 68  
 RP901 9  10 68  
 RP902 9  10 68  
 RP902 7  8 68  
 RP902 5  6 68  
 RP902 1  2 68

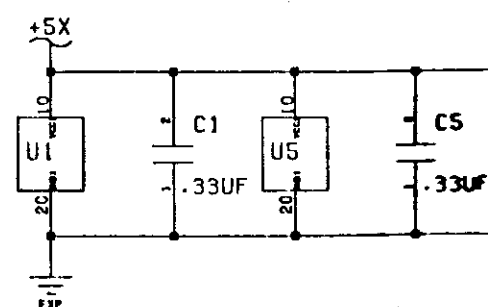
JP2B 

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 RP903 2  1 68  
 RP903 4  3 68  
 RP903 9  10 68  
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 RP903 6  5 68

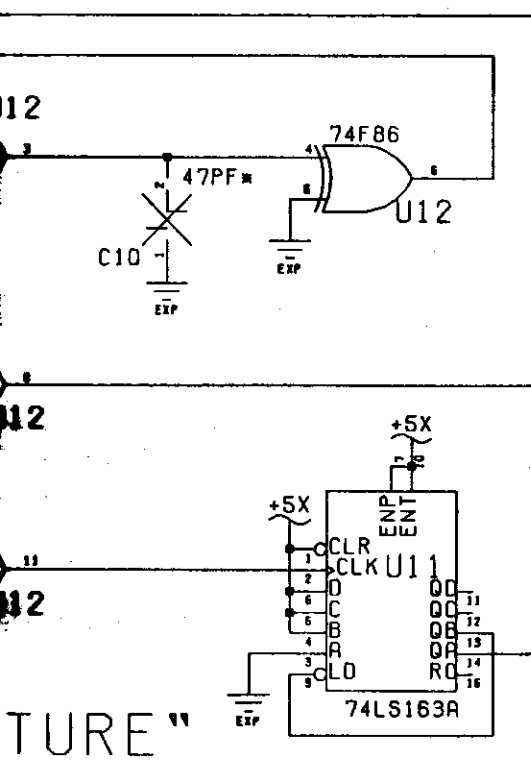
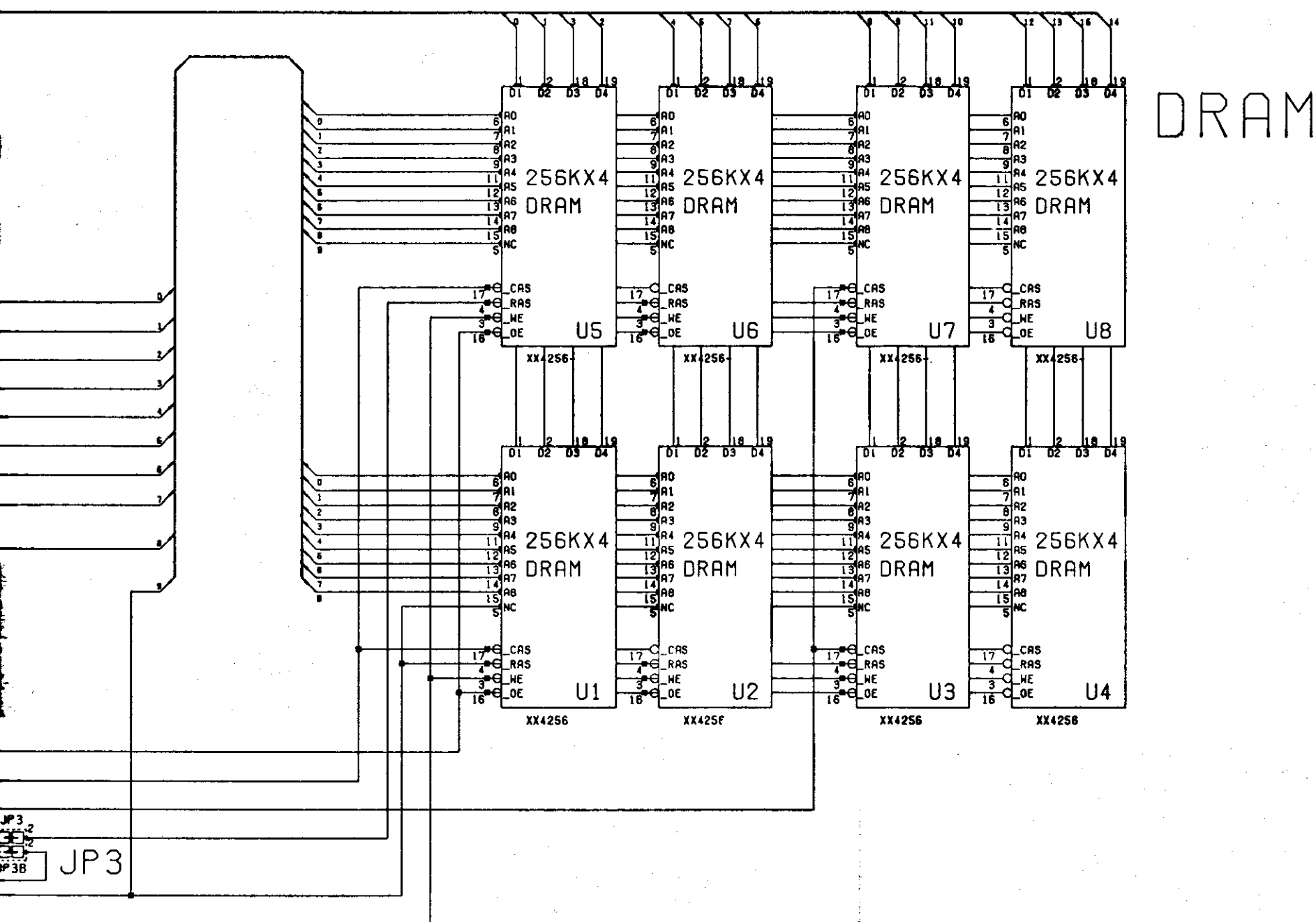
JP2A 



REFRESH "FEATU

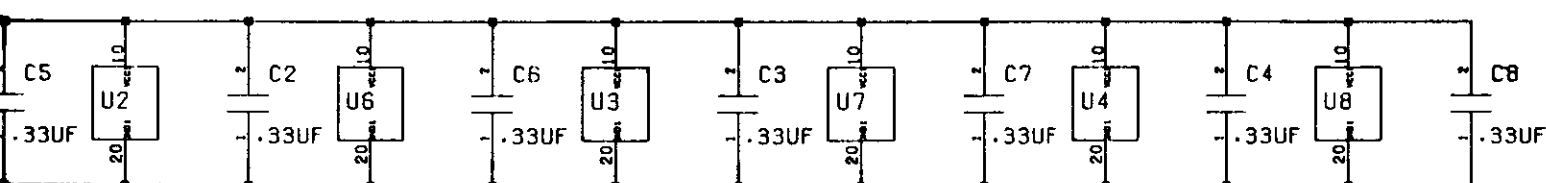




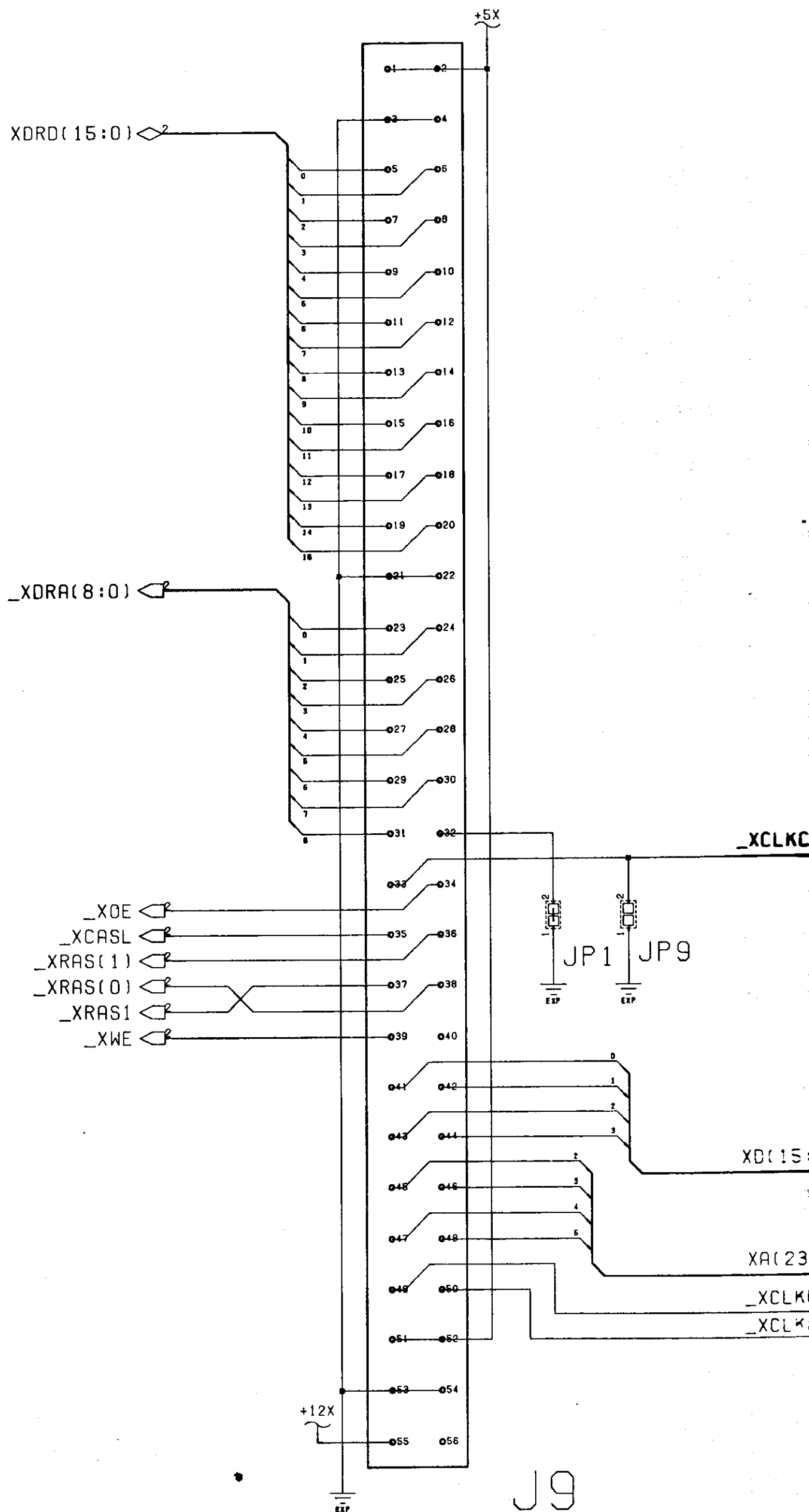


NOTE: U5-U8 ARE ONLY LOADED FOR A501+ CONFIGURATION  
U11-U13 ARE ONLY LOADED FOR A501 COMPATIBILITY

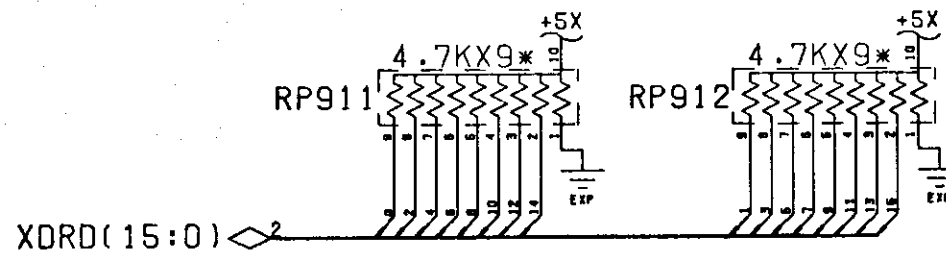
U1-U4 ARE GENERIC 256K-BIT X 4 120 NS DRAM  
C10 IS OPTIONAL A8/RAS SETUP TIME CONTROL  
RP911,RP912 ARE OPTIONAL DRD TERMINATION  
TP9 IS CLOCK CALENDAR FREQUENCY TEST POINT



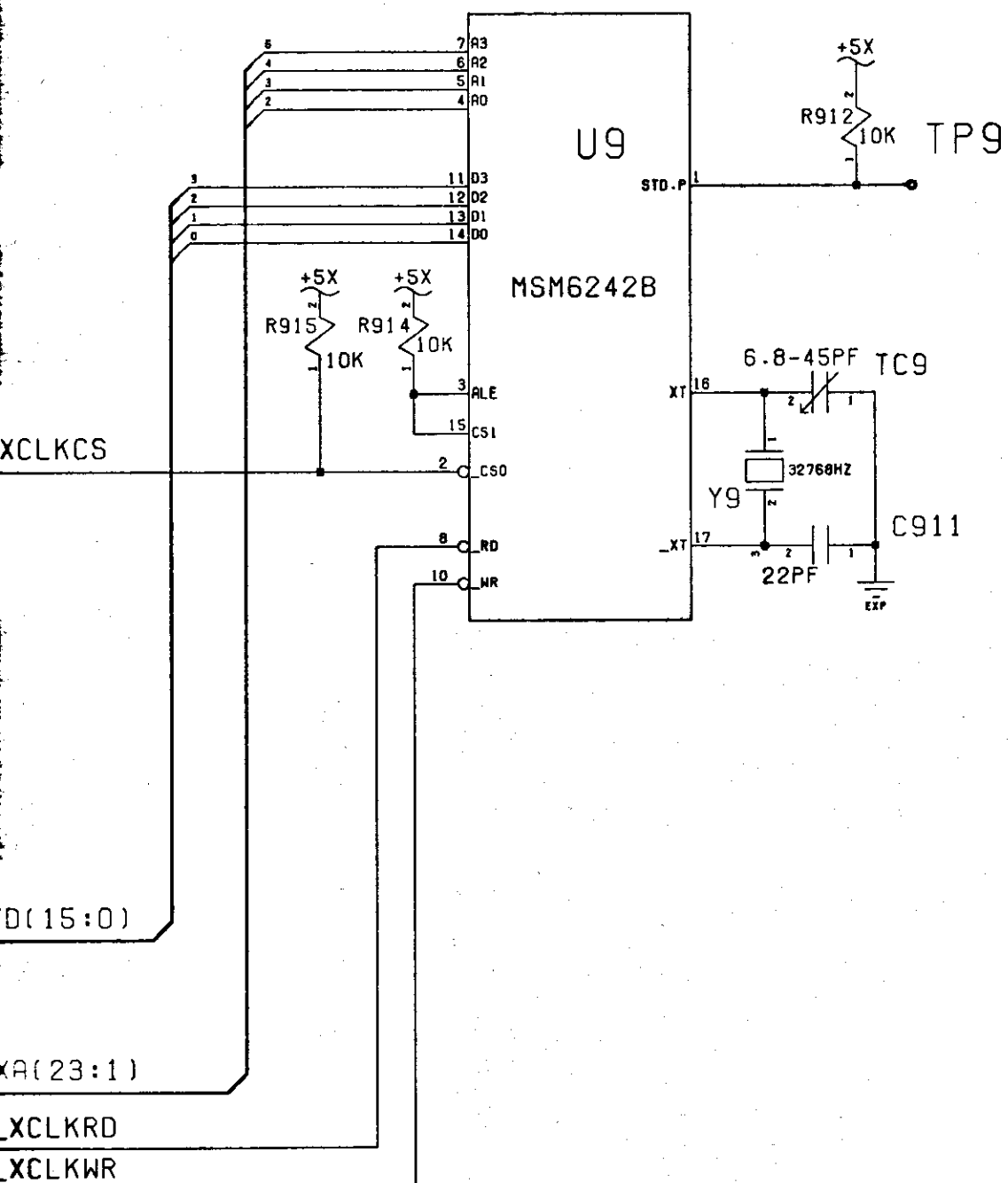
# MEMORY EXPANSION



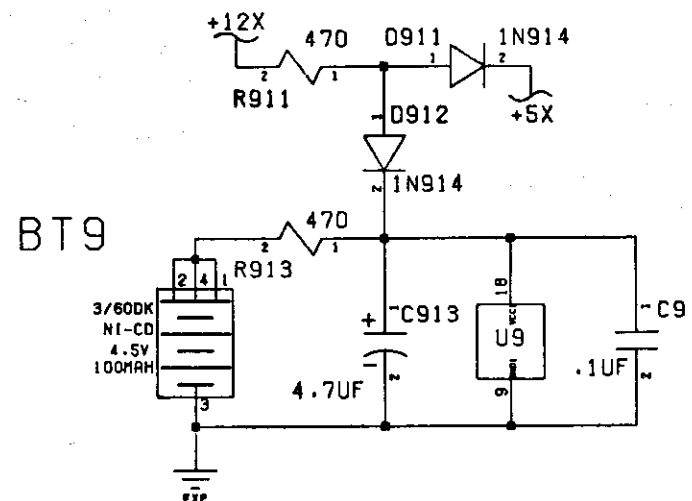
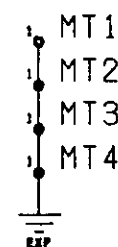
# OPTIONAL TERMINATION



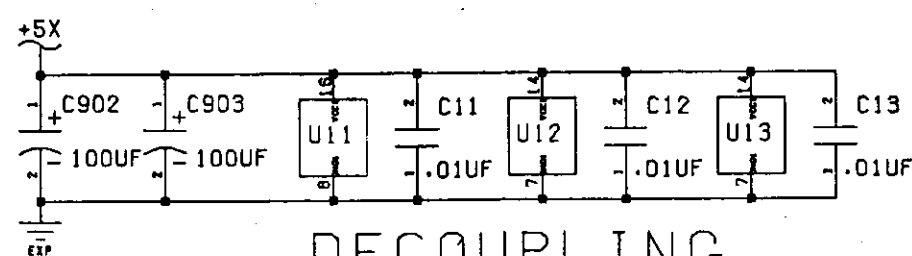
# REAL TIME CLOCK



# MOUNTING TABS



# REAL TIME POWER



# DECOUPLING

REAL TIME CLOCK COMPONENTS ARE ONLY LOADED FOR A501 COMPATIBILITY

## JUMPERS AND STUFF

| REF  | TYPE | DESCRIPTION            | PAGE |
|------|------|------------------------|------|
| JP1  | BLOB | KEYBOARD RESET         | 7    |
| JP2  | BLOB | CO VS. 08 ADDRESS MAP  | 2    |
| JP3  | BLOB | EXPANSION RAS SELECT   | 3    |
| JP4  | BLOB | BYPASS 2M-BYTE DECODER | 3    |
| JP7  | BLOB | EXPANSION/TICK OPTION  | 6,8  |
| JP8  | BLOB | LIGHT PEN PORT SELECT  | 5    |
| JP9  | BLOB | ON-BOARD RTC BYPASS    | 8    |
| JP10 | BLOB | RS232 AUDIO I/O CUTOFF | 5    |
| JP11 | BLOB | TTL VS RS170 COMP SYNC | 4    |

## SIGNAL GLOSSARY

| SIGNAL     | DESCRIPTION (AREA)                   | PAGES    |
|------------|--------------------------------------|----------|
| 28MHZ      | 28.63636 MHZ MASTER CLOCK            | 2        |
| 7MHZ       | 7.15909 MHZ PROCESSOR CLOCK          | 2,4,9,10 |
| A[23:1]    | PROCESSOR ADDRESS BUS (68000)        | 2,6,8,9  |
| ACK        | DATA ACKNOWLEDGE (PARALLEL PORT)     | 6        |
| AS         | ADDRESS STROBE (68000)               | 2,9      |
| AUDIN      | AUDIO INPUT (RS232 PORT)             | 5,6      |
| AUDOUT     | AUDIO OUTPUT (RS232 JACK)            | 5,6      |
| BEER       | BUS ERROR (68000)                    | 2,9      |
| BG         | BUS GRANT (68000)                    | 2,9      |
| BGACK      | BUS GRANT ACKNOWLEDGE (68000)        | 2,9      |
| BLISS      | BLITTER SLOWDOWN (CHIPS)             | 2        |
| BLIT       | CHIP MEMORY ACCESS (CHIPS)           | 2        |
| BR         | BUS REQUEST (68000)                  | 2,9      |
| BUSY       | DEVICE BUSY (PARALLEL PORT)          | 6        |
| CASL/U     | COLUMN ADDRESS STROBE (DRAM)         | 2,3      |
| CCK/CCKQ   | COLOR CLOCK / QUADRATURE (CHIPS)     | 2-5,9,10 |
| CDAC       | 7.15909 MHZ QUADRATURE CLOCK (CHIPS) | 2,4,9,10 |
| CHNG       | MEDIA CHANGE (FLOPPY)                | 6,7      |
| CLKRD/WR   | READ-TIME CLOCK READ / WRITE (RTC)   | 2,8      |
| COMP       | MONOCHROME COMPOSITE VIDEO (VIDEO)   | 4        |
| CSYNC      | COMPOSITE SYNC (VIDEO)               | 2,4      |
| CTS        | CLEAR TO SEND (RS232 PORT)           | 6        |
| D[15:0]    | PROCESSOR DATA BUS (68000)           | 2,6,8,9  |
| DIR        | STEP DIRECTION (FLOPPY)              | 6,7      |
| DKRD       | DISK READ DATA (FLOPPY)              | 5,7      |
| DKWD       | DISK WRITE DATA (FLOPPY)             | 5,7      |
| DKWE       | DISK WRITE ENABLE (FLOPPY)           | 5,7      |
| DMAL       | CHIP DMA REQUEST LINE (CHIPS)        | 2,5      |
| DRA[8:0]   | DRAM ADDRESS BUS (DRAM)              | 2,3      |
| DRD[15:0]  | DRAM DATA BUS (DRAM)                 | 2-5,8,9  |
| DSR        | DATA SET READY (RS232 PORT)          | 6        |
| DTACK      | DATA TRANSFER ACKNOWLEDGE (68000)    | 2,9      |
| DTR        | DATA TERMINAL READY (RS232 PORT)     | 6        |
| E          | PERIPHERAL ENABLE CLOCK (68000)      | 2,6,9    |
| EXTICK     | EXPANSION PRESENT / RTC TICK         | 2,6,8,9  |
| FC[2:0]    | FUNCTION CODE (68000)                | 2,9      |
| FIRE0/1    | FIRE BUTTON 0/1 (JOYSTICKS)          | 5,6      |
| HLT        | PROCESSOR HALT (68000)               | 2,9      |
| HSYNC      | HORIZONTAL SYNC (VIDEO)              | 2,4,6    |
| INDEX      | INDEX PULSE (FLOPPY)                 | 6,7      |
| INT[2,3,6] | INTERRUPT REQUEST (CHIPS)            | 2,5,6,9  |
| IORESET    | I/O RESET                            | 6,7,9    |
| IPL[2:0]   | INTERRUPT PRIORITY LEVEL (68000)     | 2,5,9    |
| KBCLOCK    | KEYBOARD CLOCK (KEYBOARD)            | 6,7      |
| KBDATA     | KEYBOARD DATA (KEYBOARD)             | 6,7      |
| KBRESET    | KEYBOARD RESET (KEYBOARD)            | 7        |
| LDS/UDS    | UPPER / LOWER DATA STROBES (68000)   | 2,9      |
| LED        | POWER ON LED / AUDIO FILTER DISABLE  | 5,6,7    |
| LEFT/RIGHT | LEFT RIGHT AUDIO (AUDIO)             | 5        |

| SIGNAL   |
|----------|
| LPEN     |
| MTR      |
| MTRO     |
| MOV/MOH  |
| M1V/M1H  |
| OVL      |
| OVR      |
| PIXELSW  |
| POTOX/OY |
| POT1X/1Y |
| POUT     |
| PPD[7:0] |
| RAMEN    |
| REGEN    |
| RAS0/1   |
| RDY      |
| RESET    |
| RG[8:1]  |
| R/G/B    |
| RJ       |
| ROMEN    |
| RTS      |
| RST      |
| RXD      |
| RW       |
| SEL      |
| SEL[3:0] |
| SIDE     |
| STEP     |
| TRKO     |
| TXD      |
| VMA      |
| VPA      |
| VSYNC    |
| WE       |
| WPROT    |
| XCLK     |
| XCLKEN   |
| XRDY     |

## CONNECTORS

| REF  | TYPE   | DESCRIPTION            | PAGE |
|------|--------|------------------------|------|
| CN1  | DB9P   | MOUSE/JOYSTICK 1       | 5    |
| CN2  | DB9P   | MOUSE/JOYSTICK 2       | 5    |
| CN3  | RCA-J  | RIGHT AUDIO OUTPUT     | 5    |
| CN4  | RCA-J  | LEFT AUDIO OUTPUT      | 5    |
| CN5  | DB23S  | EXTERNAL FLOPPY        | 7    |
| CN6  | DB25P  | RS232 SERIAL PORT      | 6    |
| CN7  | DB25S  | PARALLEL PRINTER PORT  | 6    |
| CN8  | SQ DIN | POWER SUPPLY CONNECTOR | 10   |
| CN9  | DB23P  | VIDEO OUTPUT           | 4    |
| CN10 | RCA-J  | COMPOSITE VIDEO        | 4    |
| CN11 | DIL-34 | INTERNAL FLOPPY SIGNAL | 7    |
| CN12 | SIL-4  | INTERNAL FLOPPY POWER  | 7    |
| CN13 | SIL-8  | KEYBOARD CONNECTOR     | 7    |
| P1   | EDGE86 | EXPANSION CONNECTOR    | 9    |
| P9   | RA-56H | MEM. EXP. MAIN-BOARD   | 8    |

[illegible]

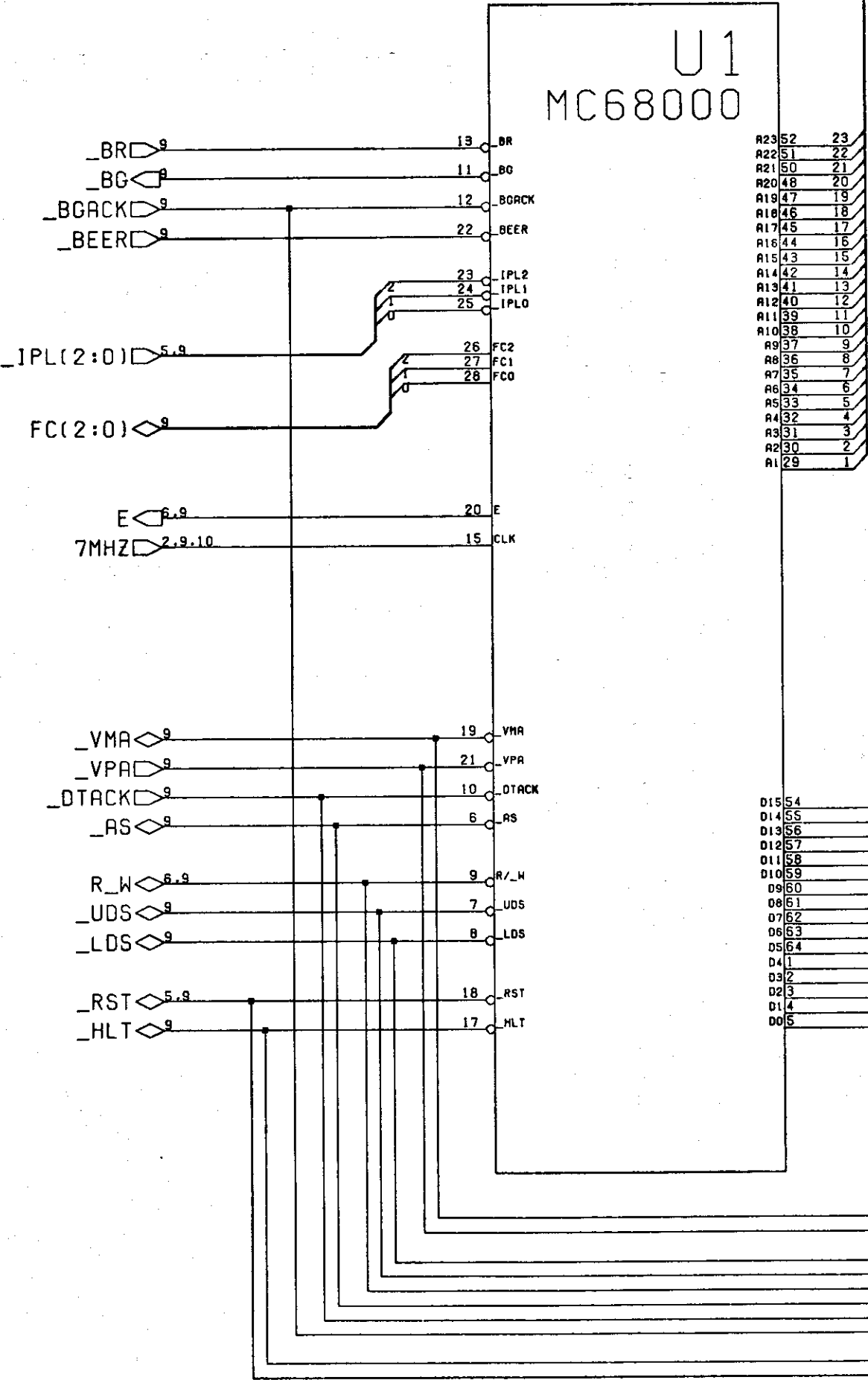
# REVISION HISTORY

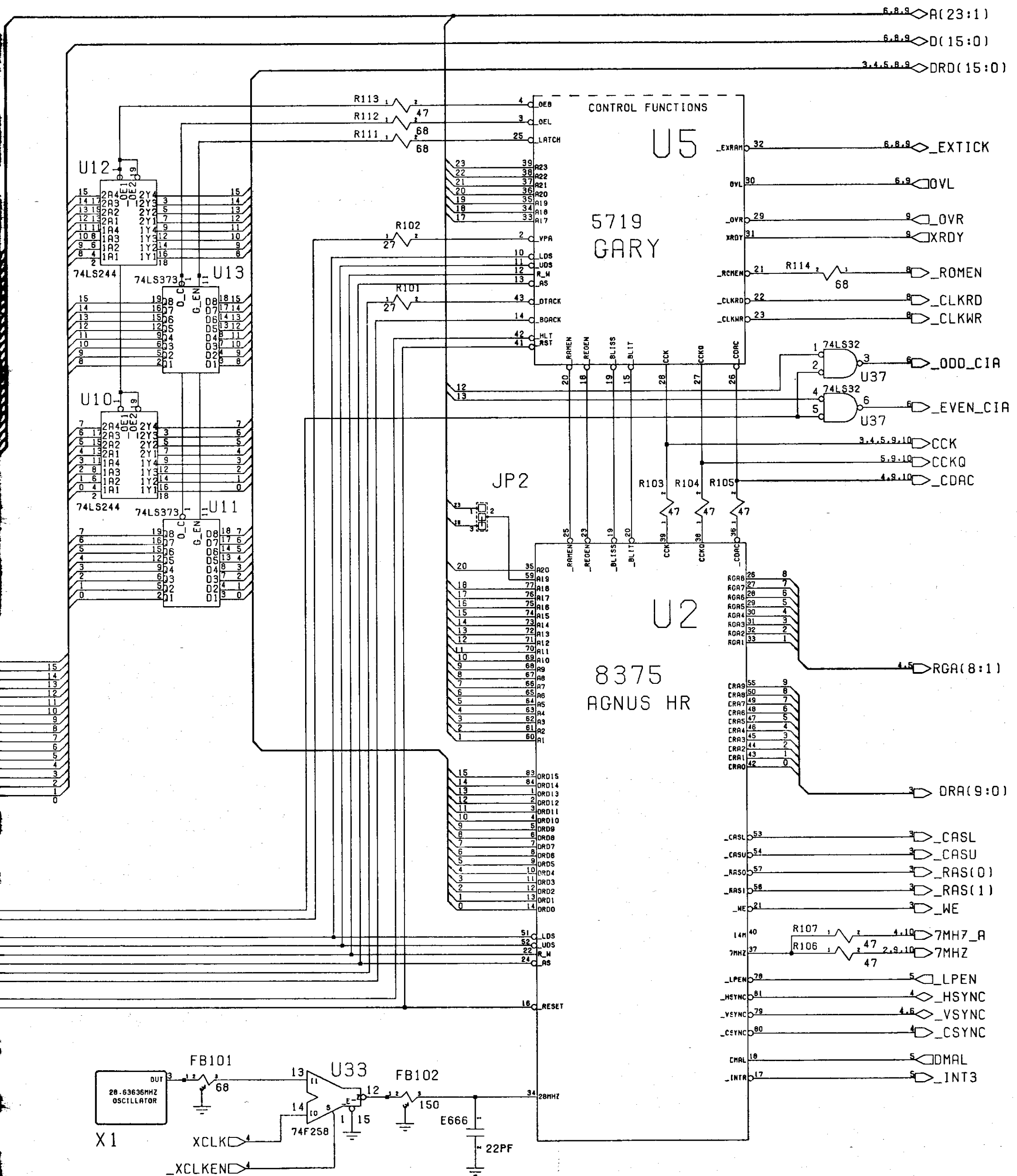
[illegible]

## KEY COMPONENTS

| REF    | CHIP  | DESCRIPTION           | PAGE |
|--------|-------|-----------------------|------|
| U1     | 68000 | 68000 PROCESSOR, 8MHZ | 2    |
| U2     | 8375  | AGNUS HR              | 2    |
|        |       |                       |      |
| U3     | 8364  | PAULA                 | 5    |
| U4     | 8373  | DENISE HR             | 4    |
|        | 8362  | DENISE                | OBS  |
| U5     | 5719  | GARY                  | 2,7  |
| U6     | ASST  | ROM 256KX16, 200 NS   | 8    |
| U7-8   | 8520  | AMIGA VIA, 1 MHZ      | 6    |
| U9     | 6242  | REAL TIME CLOCK       | 8    |
| U14    | LF347 | BIMOS OP-AMP          | 5    |
|        | TL084 | BIMOS OP-AMP          | ALT  |
| U38    | 1488  | EIA LINE DRIVER       | 6    |
| U39    | 1489  | EIA LINE RECEIVER     | 6    |
| U42    | NE555 | TIMER                 | 7    |
| U16-19 | ASST  | DRAM 256KX4, 120 NS   | 3    |
| U20-23 | ASST  | DRAM 256KX4, 120 NS   | 3    |
| X1     | OSC   | TTL 28.63636 MHZ NTSC | 2    |
|        | OSC   | TTL 28.37512 MHZ PAL  | ALT  |
|        |       |                       |      |
| HY1    | ASST  | VIDEO HYBRID          | 4    |
|        |       |                       |      |
|        |       |                       |      |
|        |       |                       |      |

NOTE: VARIOUS COMPONENTS ARE FOR EMI CONTROL  
AND MAY BE LOADED WITH FUNNY THINGS...



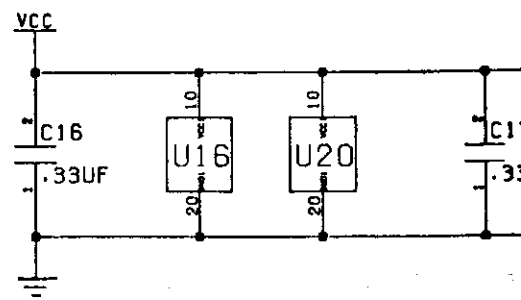
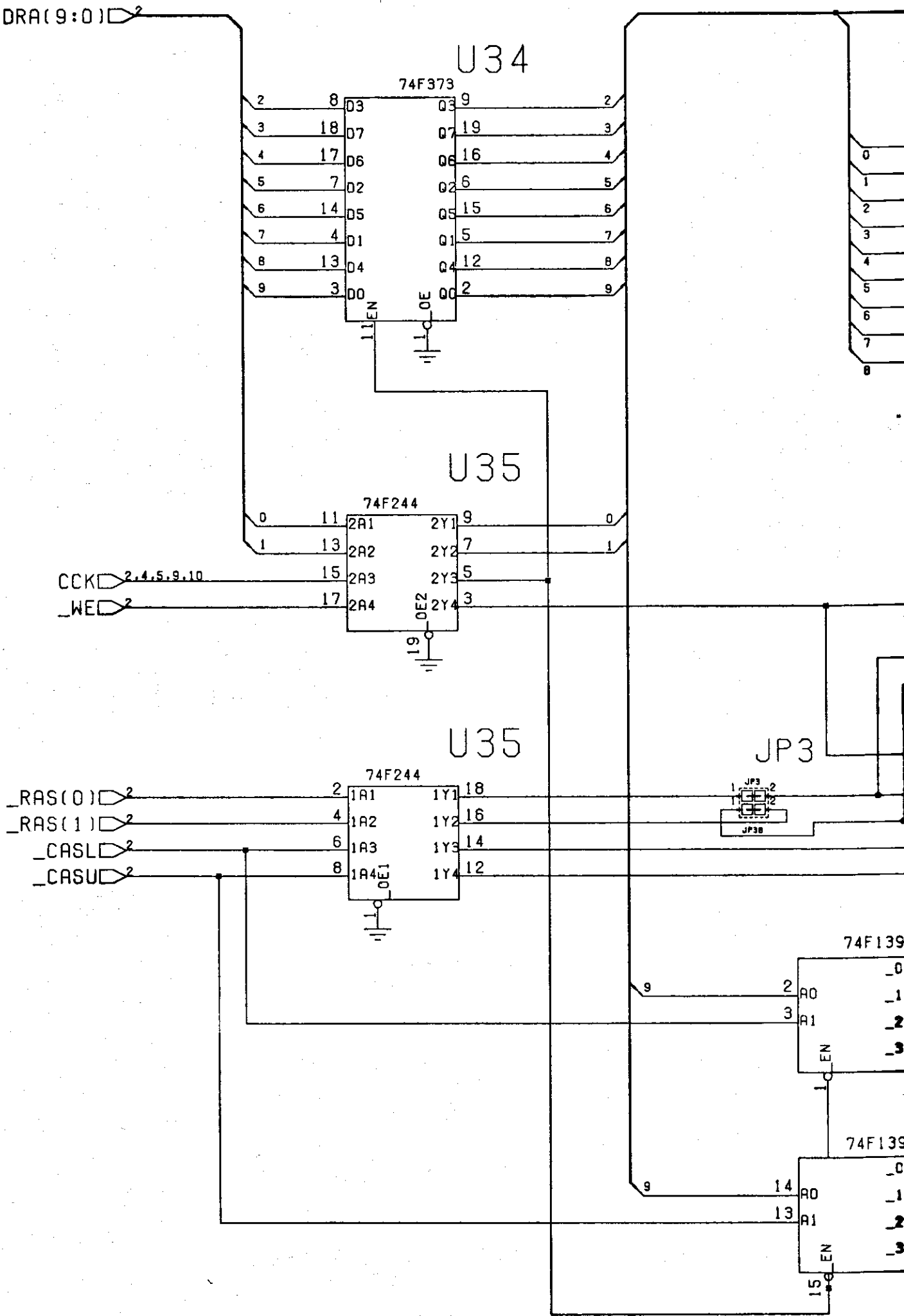


NOTE: PAL USES 28.37516 MHZ

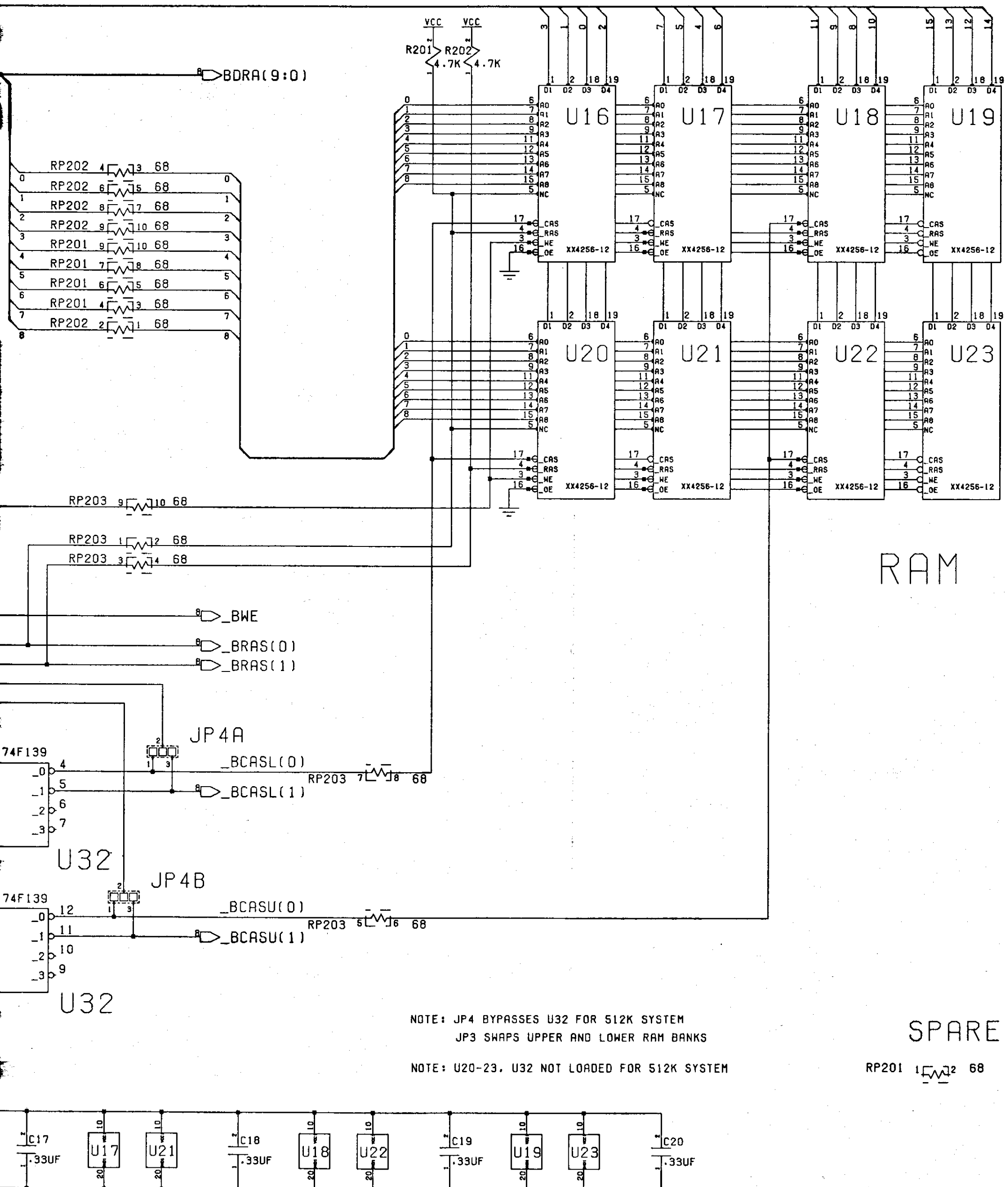
Schematic #312813, Rev. 1  
Sheet 3 of 10

DRD(15:0) 2,4,5,8,9

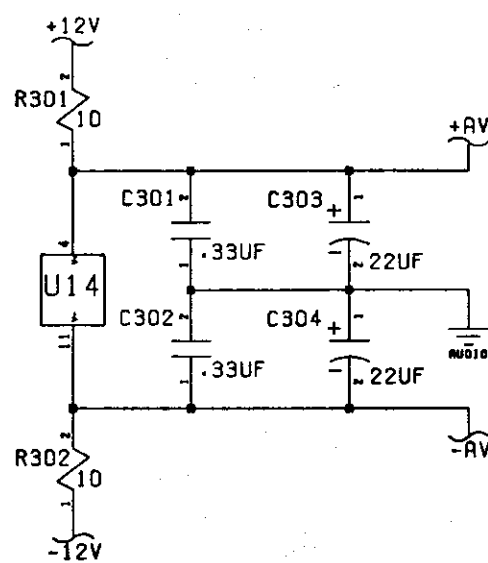
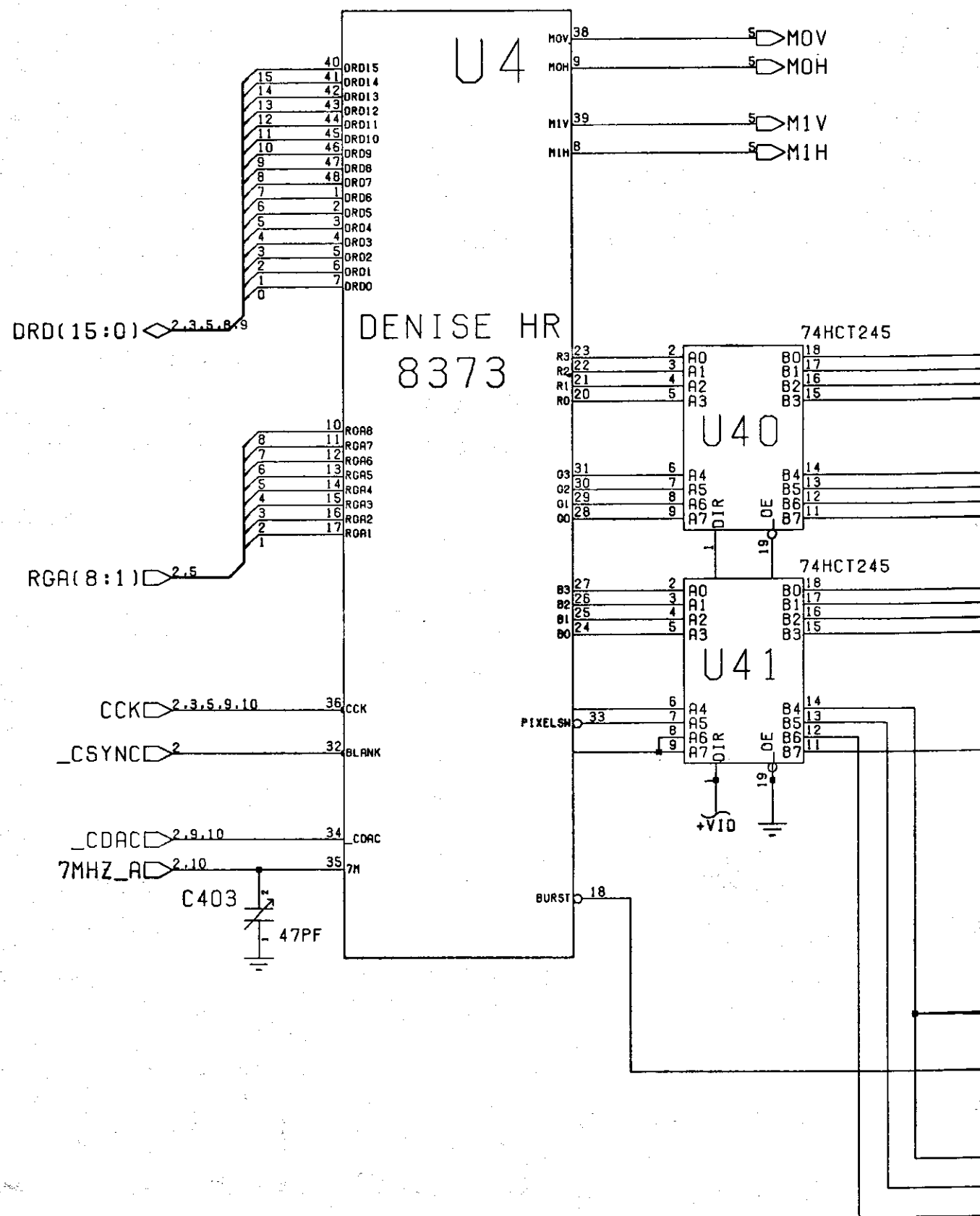
DRA(9:0) 2



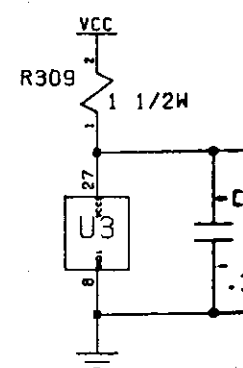




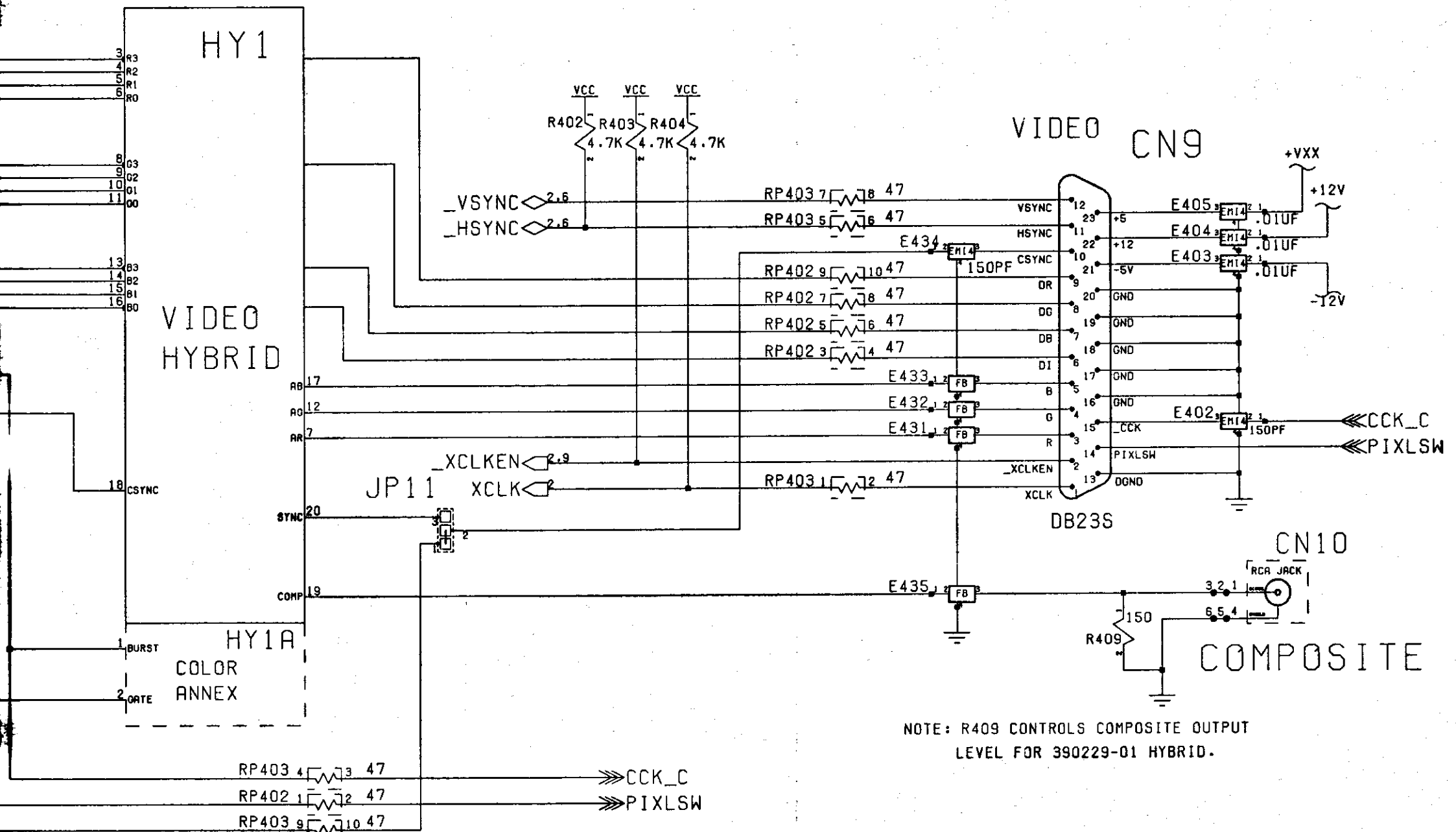
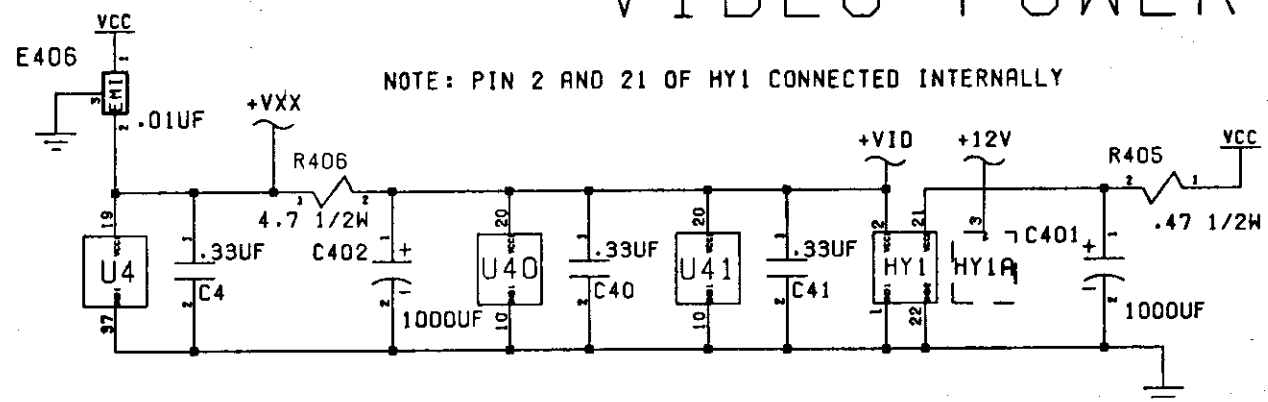
**Schematic #312813, Rev. 1**  
**Sheet 4 of 10**



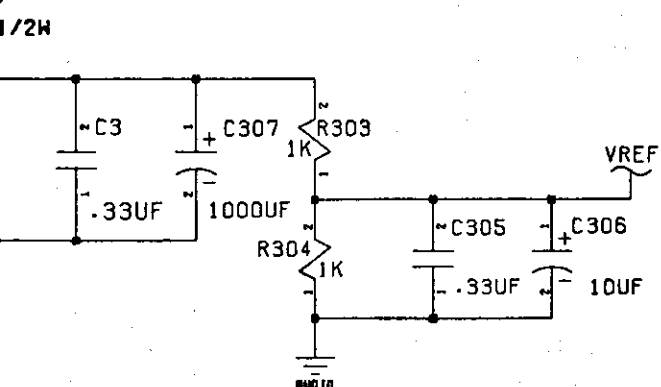
AUDIO POW



# VIDEO POWER



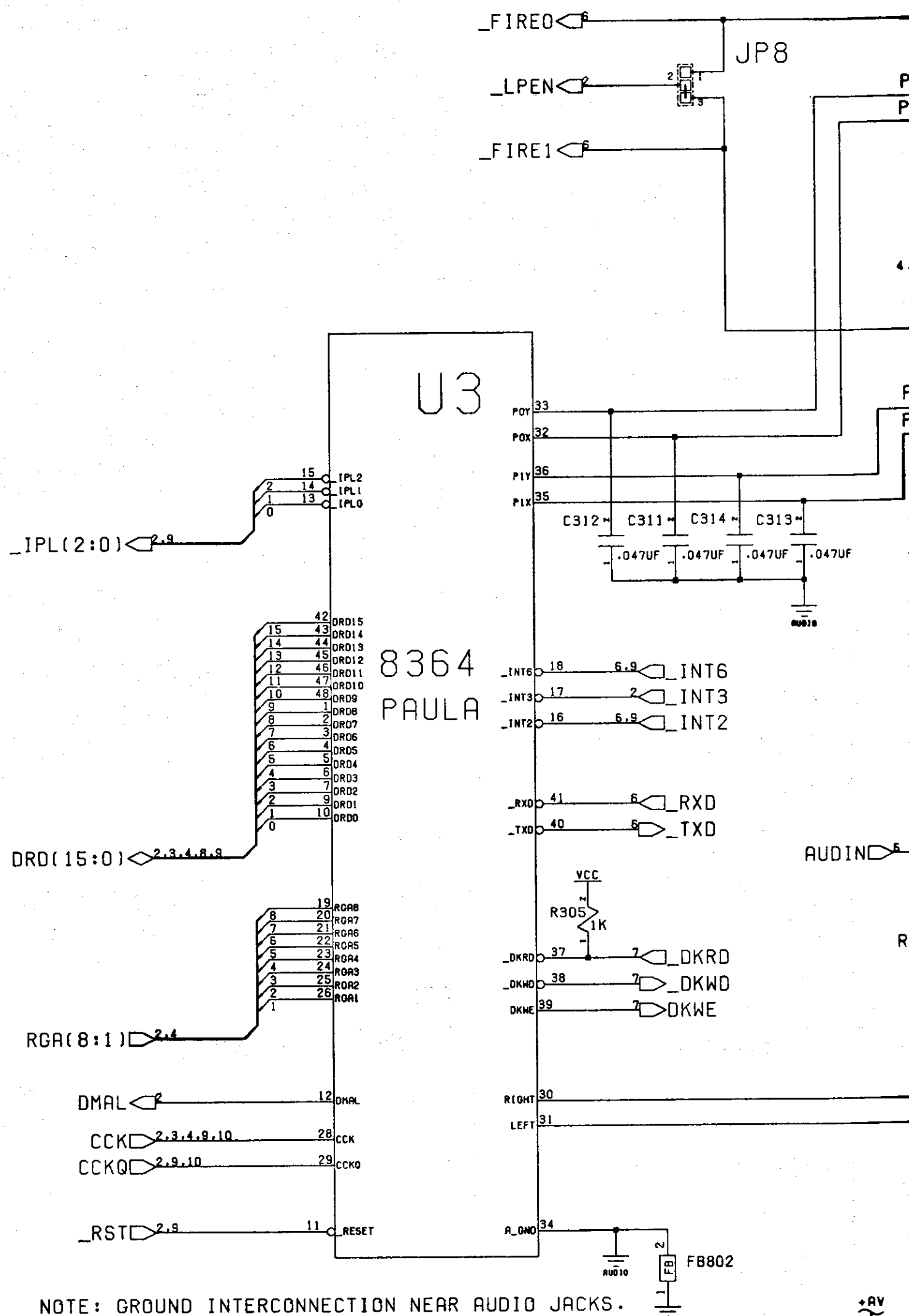
## POWER



NOTE: COMPONENTS DESIGNATED AS EXXX MAY BE LOADED WITH EMI FILTERS, FERRITE BEADS OR RESISTORS!

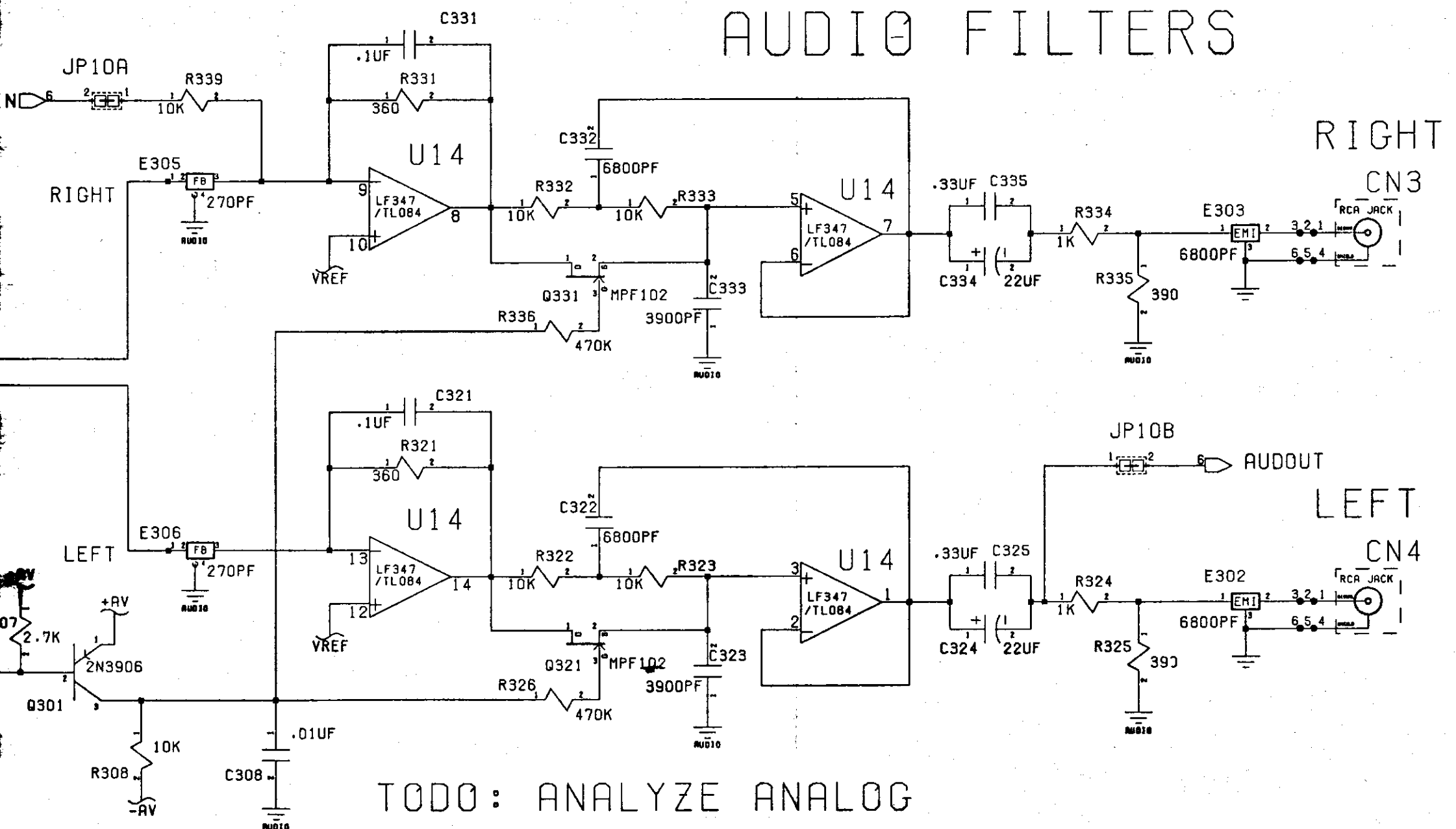
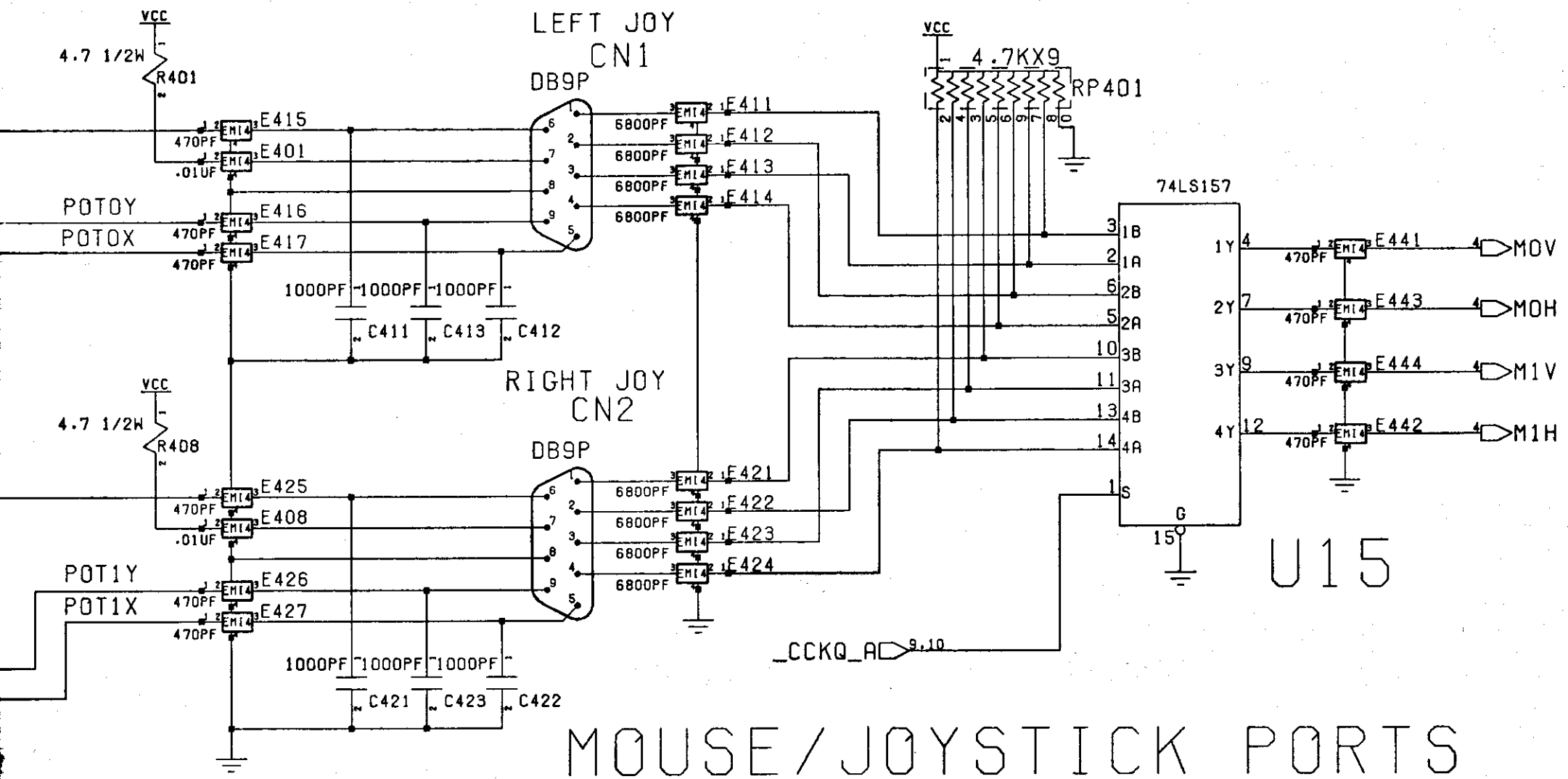
# Schematic #312813, Rev. 1

Sheet 5 of 10

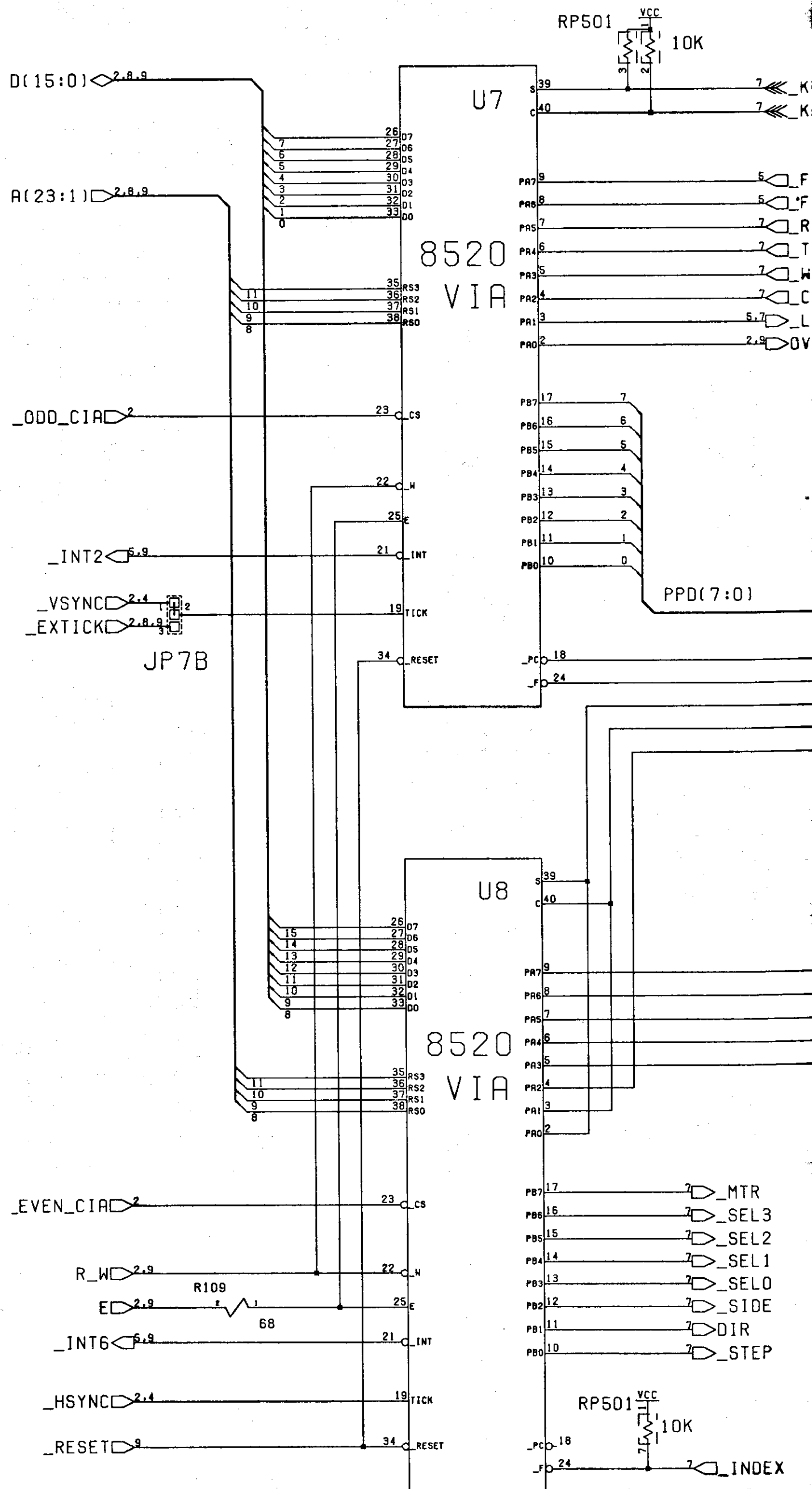


NOTE: GROUND INTERCONNECTION NEAR AUDIO JACKS.

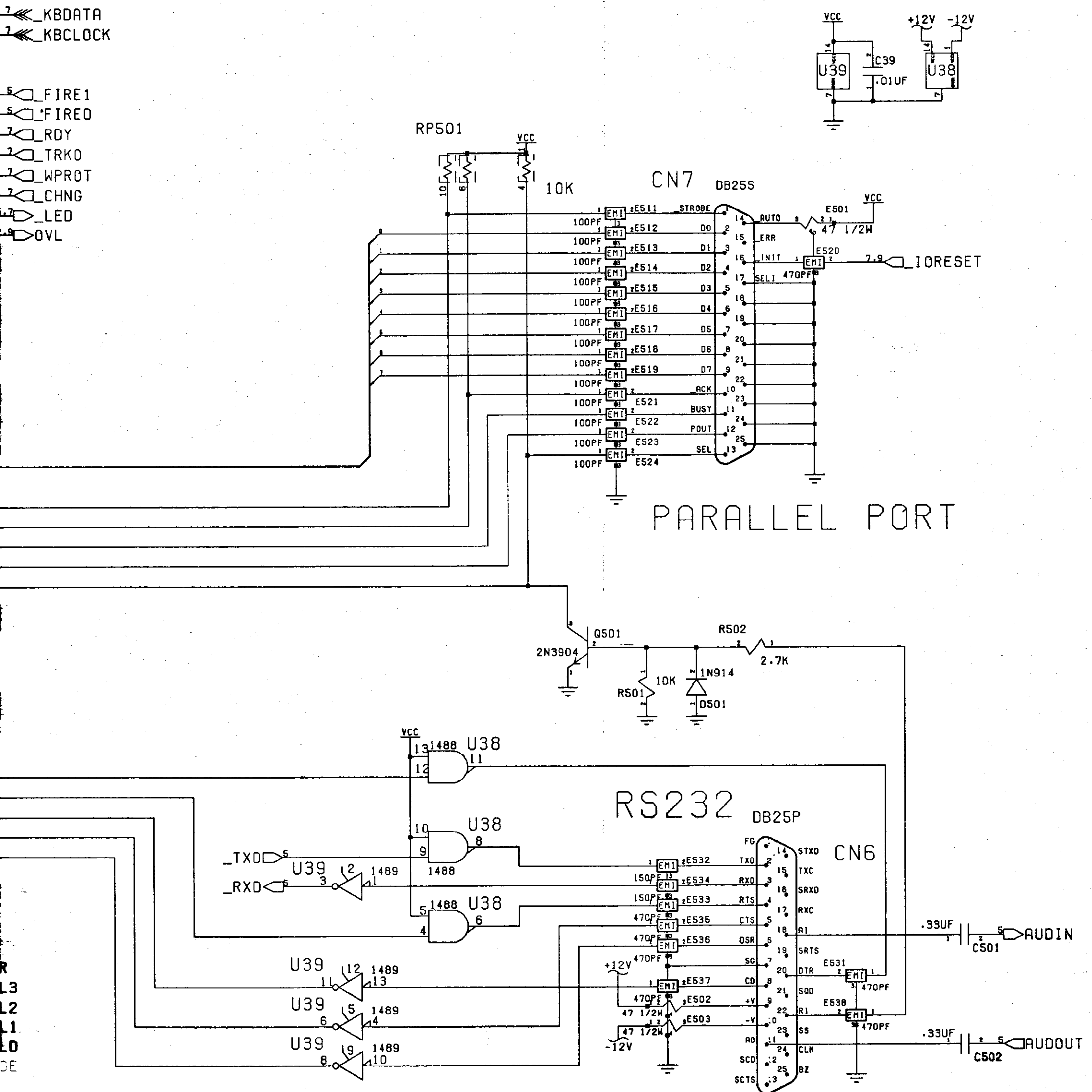
NOTE: LED OFF, FILTERS BYPASSED



Schematic #312813, Rev. 1  
Sheet 6 of 10

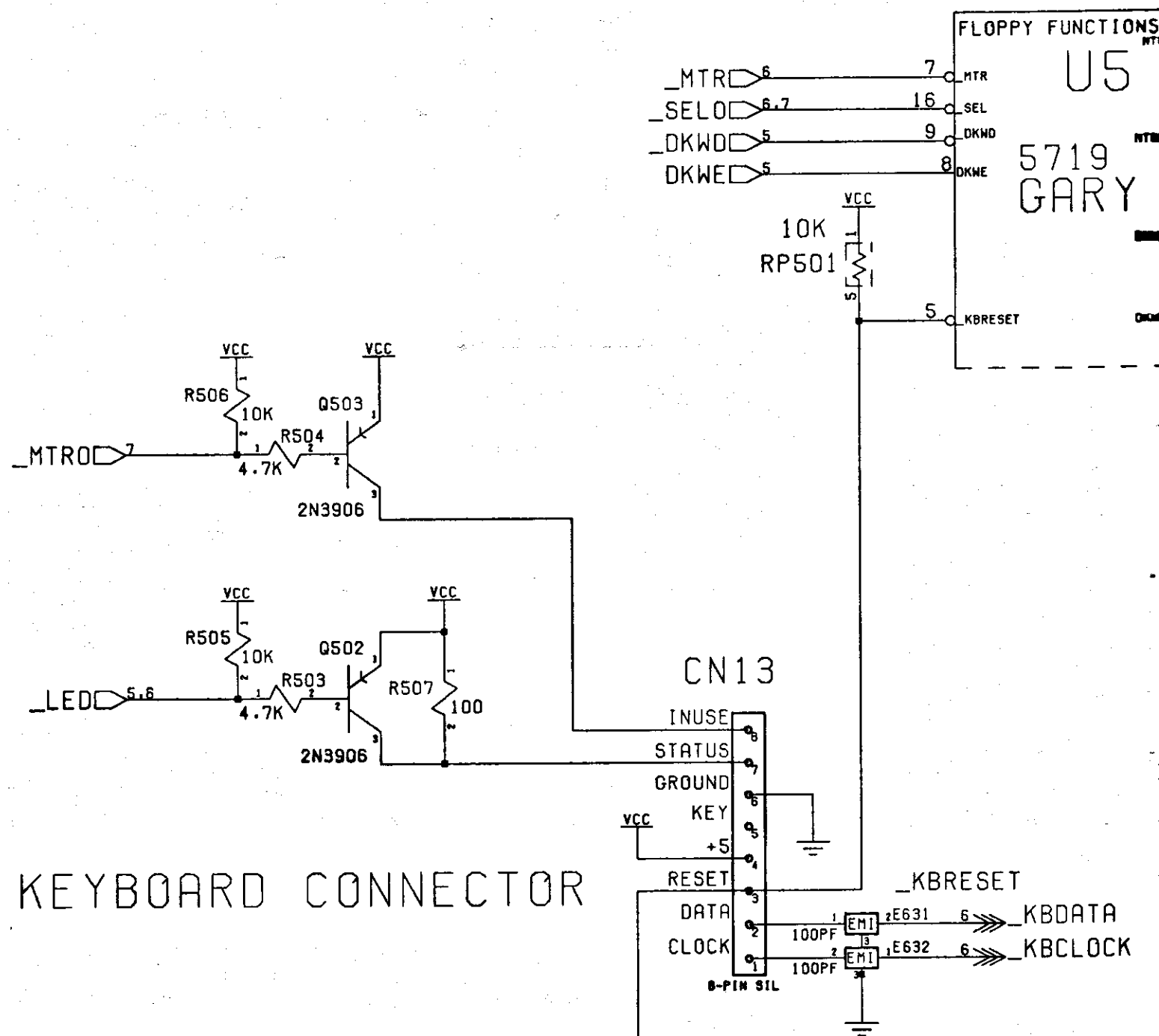


## RS232 DECOUPLING

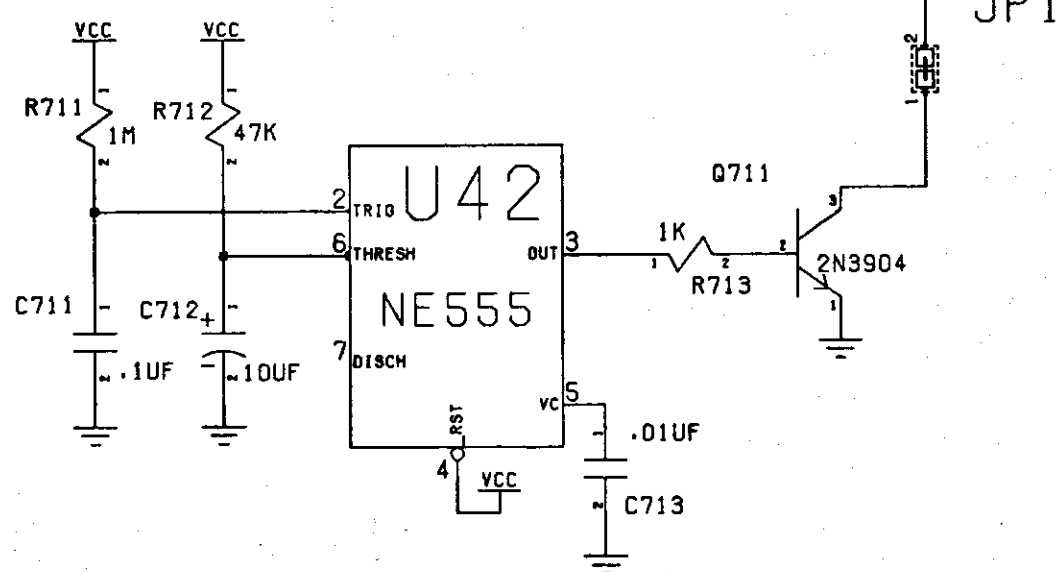


NOTE: E501-503 ARE LOADED WITH 47 OHM 1/2 W RESISTORS

# FLOPPY LOGIC



## KEYBOARD CONNECTOR



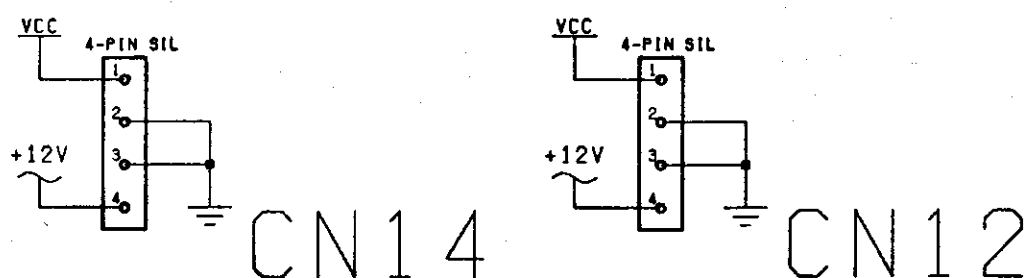
## POWER UP RESET

IDE

\_INT2  
\_OVRD  
XRDY

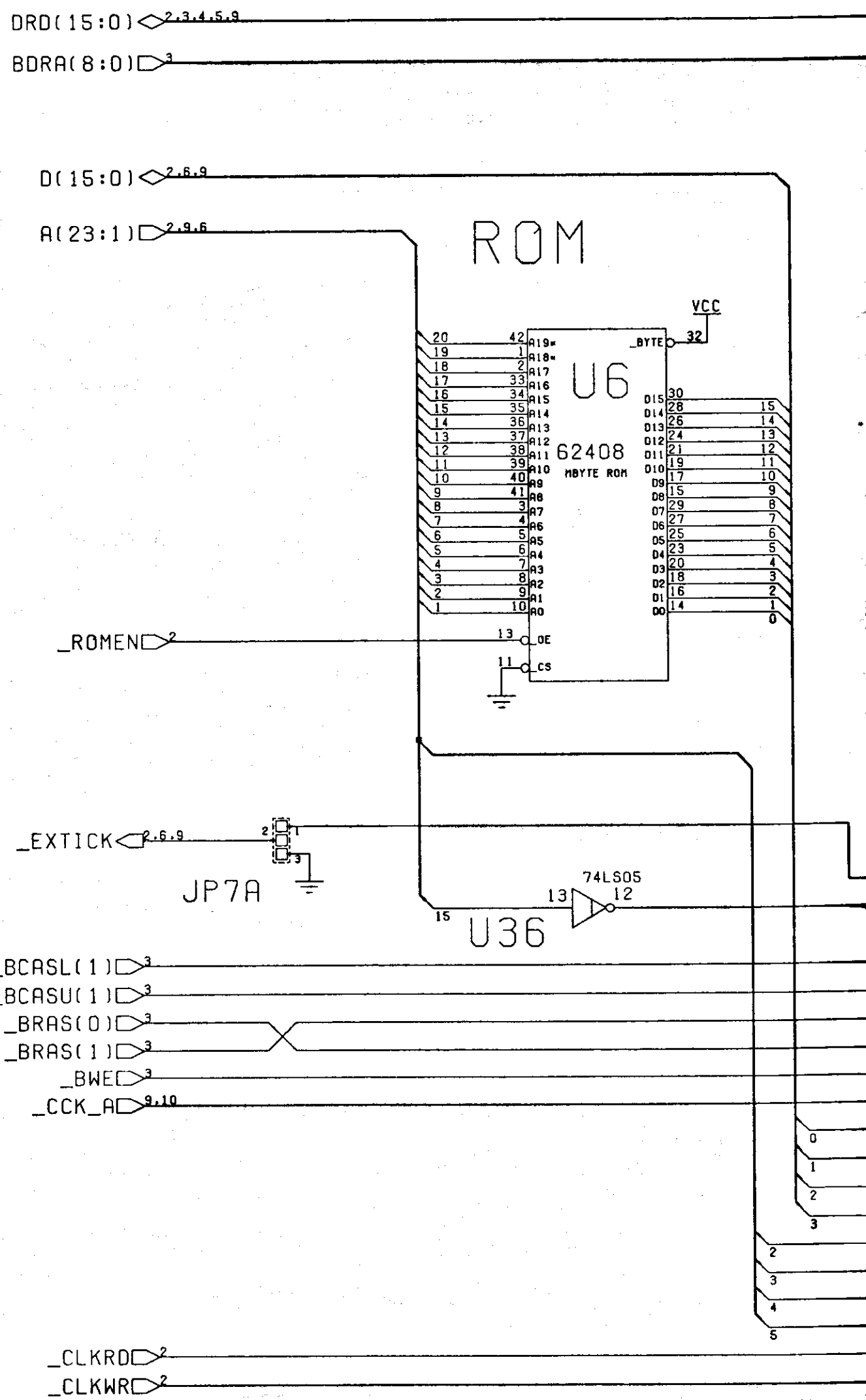
IDE





DECOUPLING

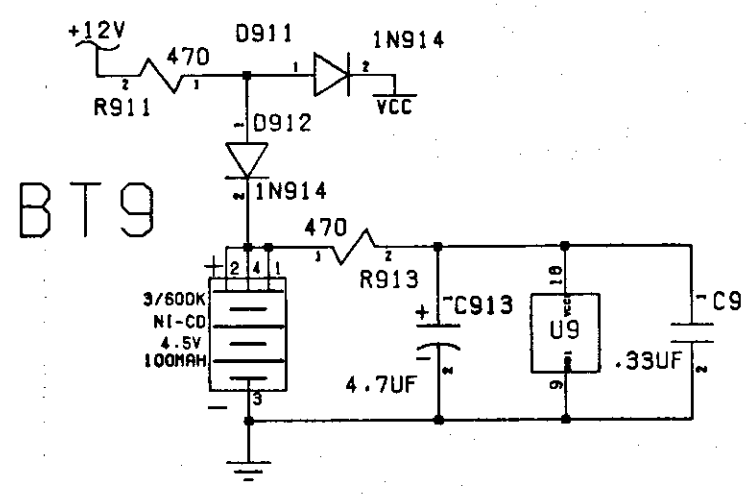
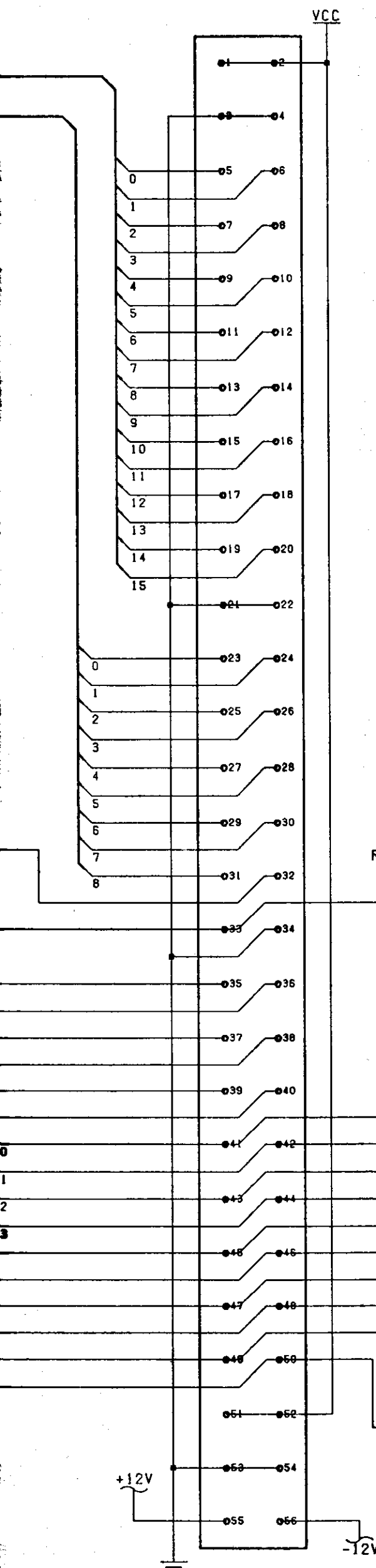
MEMORY EX



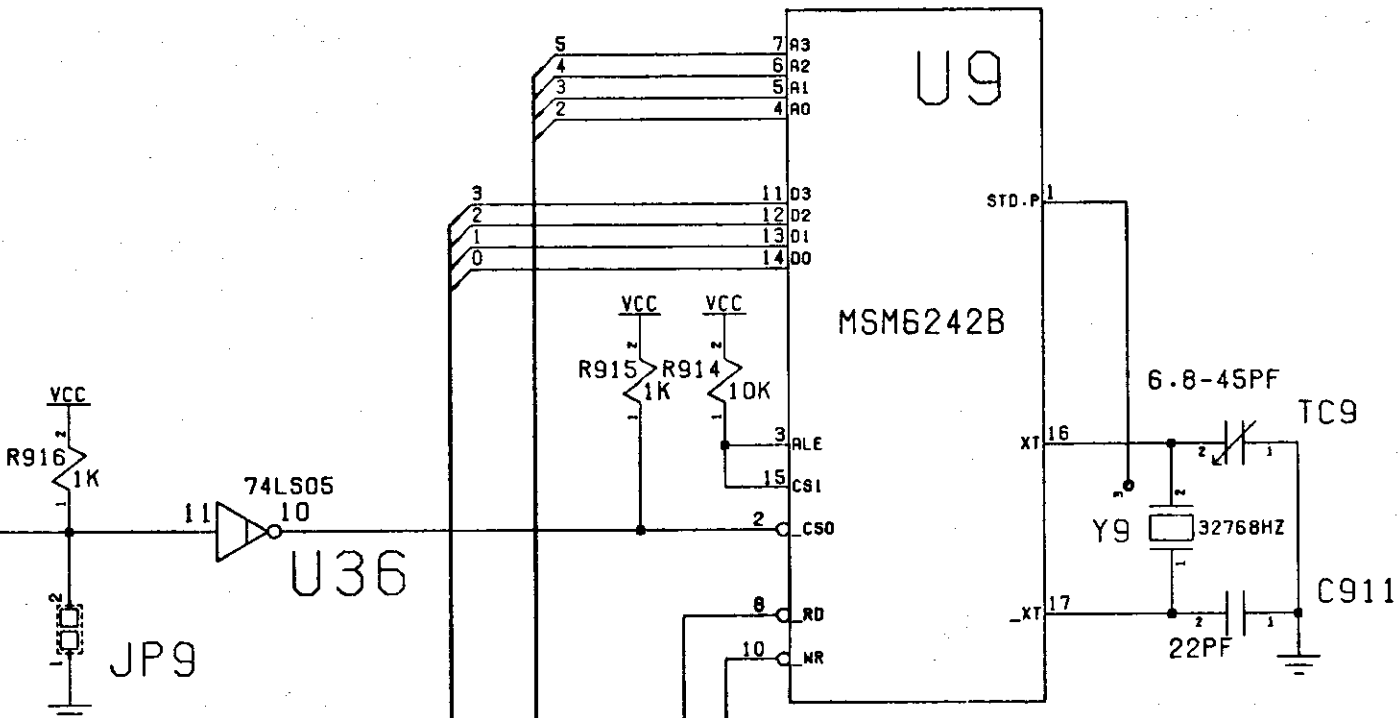
NOTE: ONLY

EXPANSION

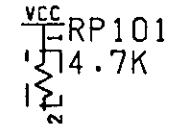
REAL TIME POWER



REAL TIME CLOCK

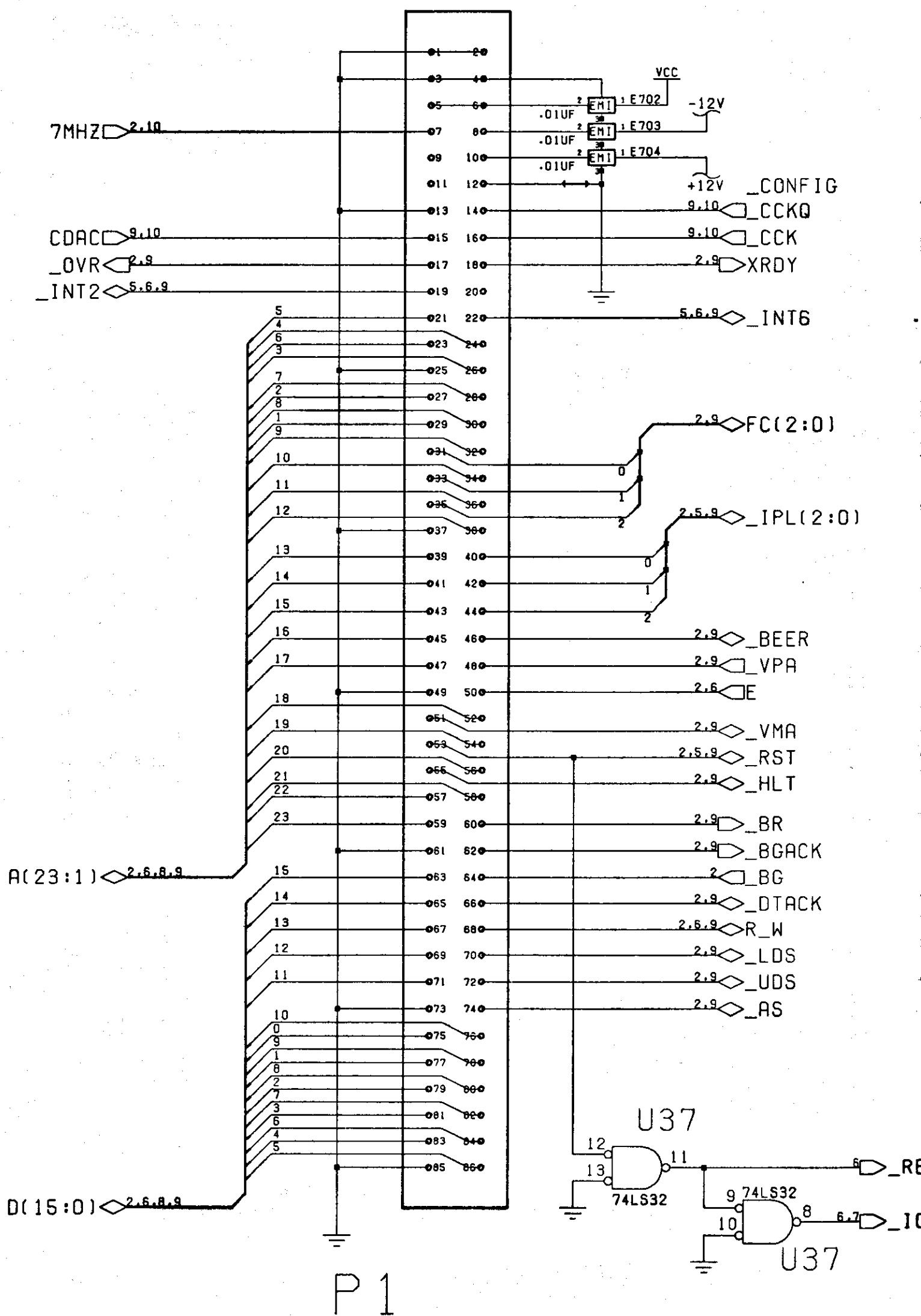


SPARE



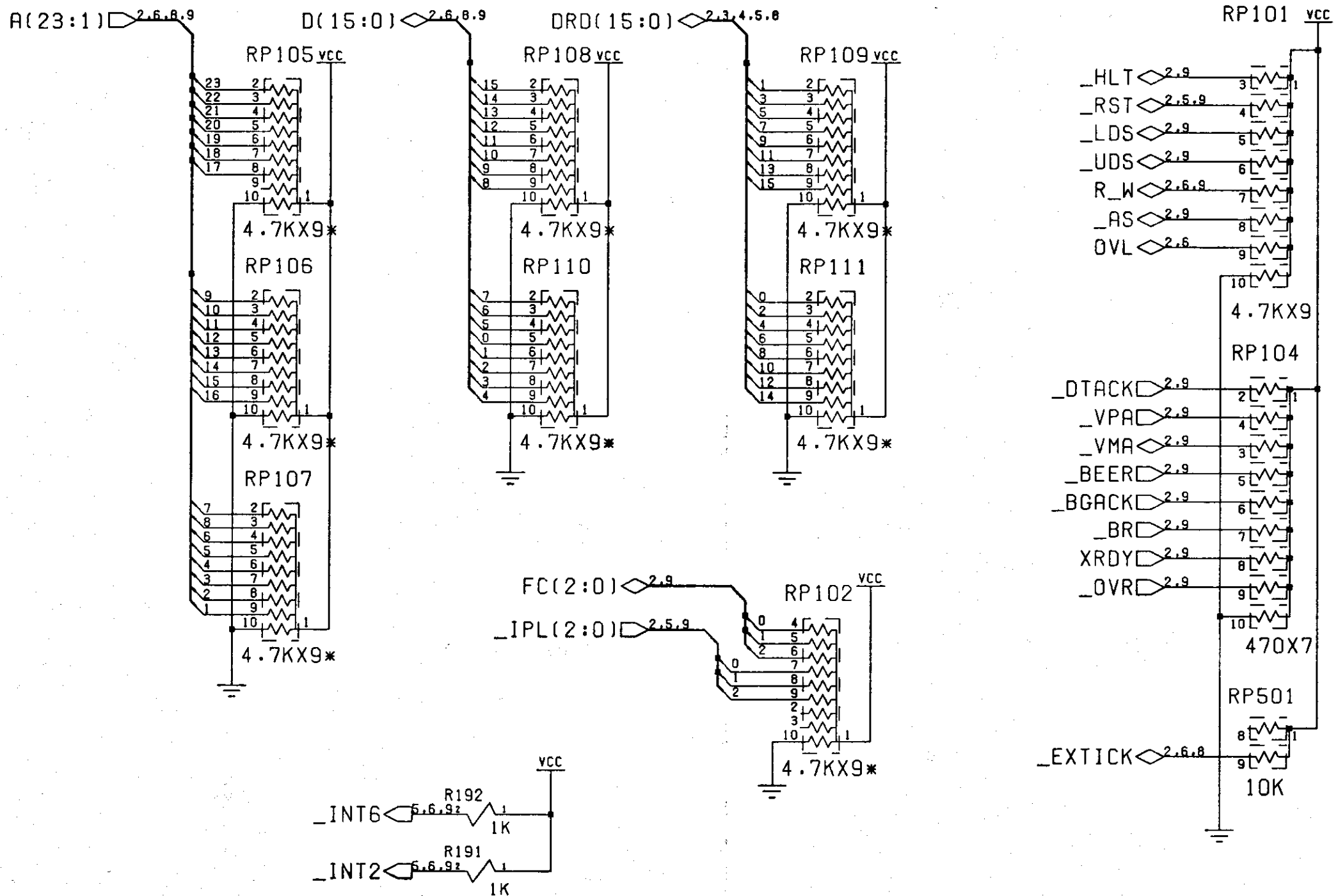
P9

# EXPANSION BUS

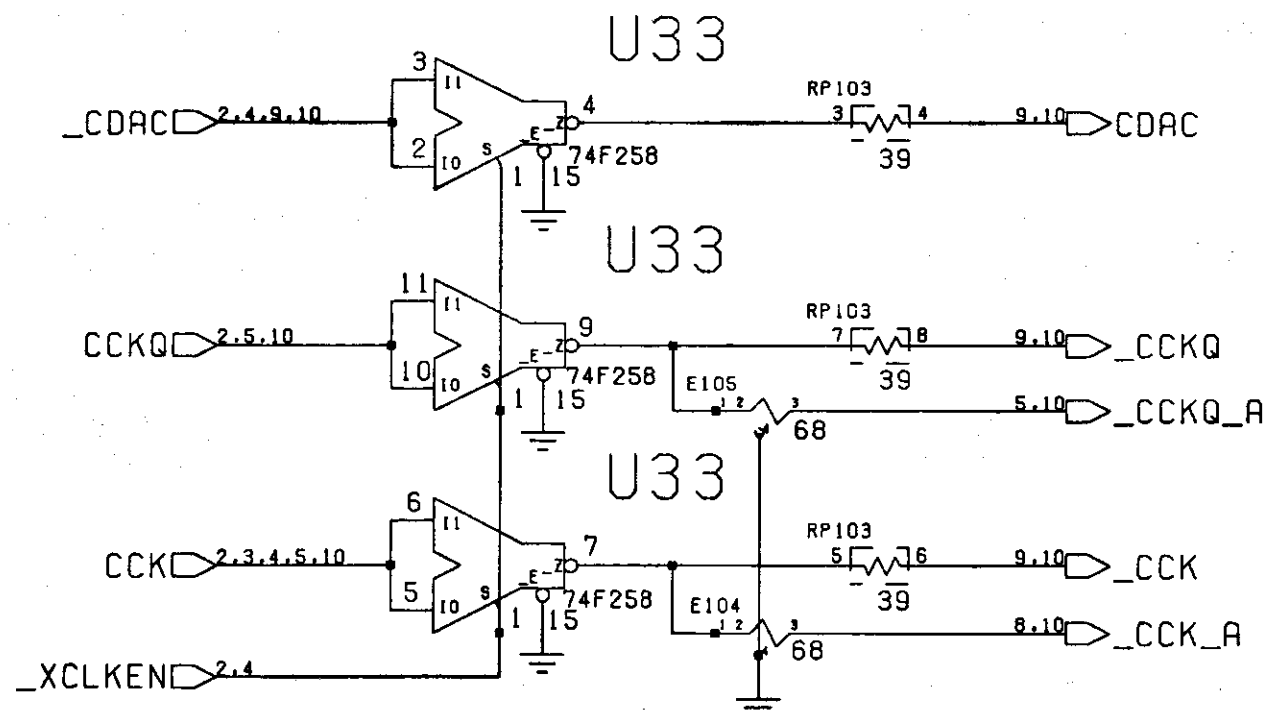


BUFFERED RESETS

## EXPANSION BUS TERMINATION AND PULLUPS



## CLOCK DISTRIBUTION



NOTE: RP105-RP111 ARE OPTIONAL INTERNAL BUS TERMINATION, AND ARE NOT NORMALLY LOADED.