## ALTOII MEMORY

### ADDRESS MAPPING

The mapping of addresses to memory chips can be altered by the setting of the "memory configuration switch". This switch is located at the top of the backplane of the AltoII. If the switch is in the alternate position, the first and second 32K portions of memory are exchanged.

The AltoII memory system is organized around 32-bit doublewords. Stored along with each doubleword is 6 bits of Hamming code and a Parity bit for a total of 39 bits:

| | |
|---|---|
| bits 0-15 | even data word |
| bits 16-31 | odd data word |
| bits 32-37 | Hamming code |
| bit 38 | Parity bit |

Things are further complicated by the fact that two types of memory chips are used: 16K chips in machines with extended memory and 4K chips for all others.

The bits in a 1-word deep slice of memory are called a group. A group contains 4K or 16K doublewords, depending on the chip type. The bits of a group on a single board are called a subgroup. Thus a subgroup contains 10 of the 40 bits in a group. There are 8 subgroups on a memory board. Subgroups are numbered from the high 3 bits of the address: for 4K chips this means MAR[0-2]; for 16K chips (i.e., an Alto with extended memory) this means BANK.MAR[0]:

| Subgroup | Chip Positions | |
|---|---|---|
| 7 | 81-90 | |
| 6 | 71-80 | |
| 5 | 61-70 | |
| 4 | 51-60 | |
| 3 | 41-50 | |
| 2 | 31-40 | |
| 1 | 21-30 | |
| 0 | 11-20 | Nearest the edge connector |

The location of the bits in group 0 is:

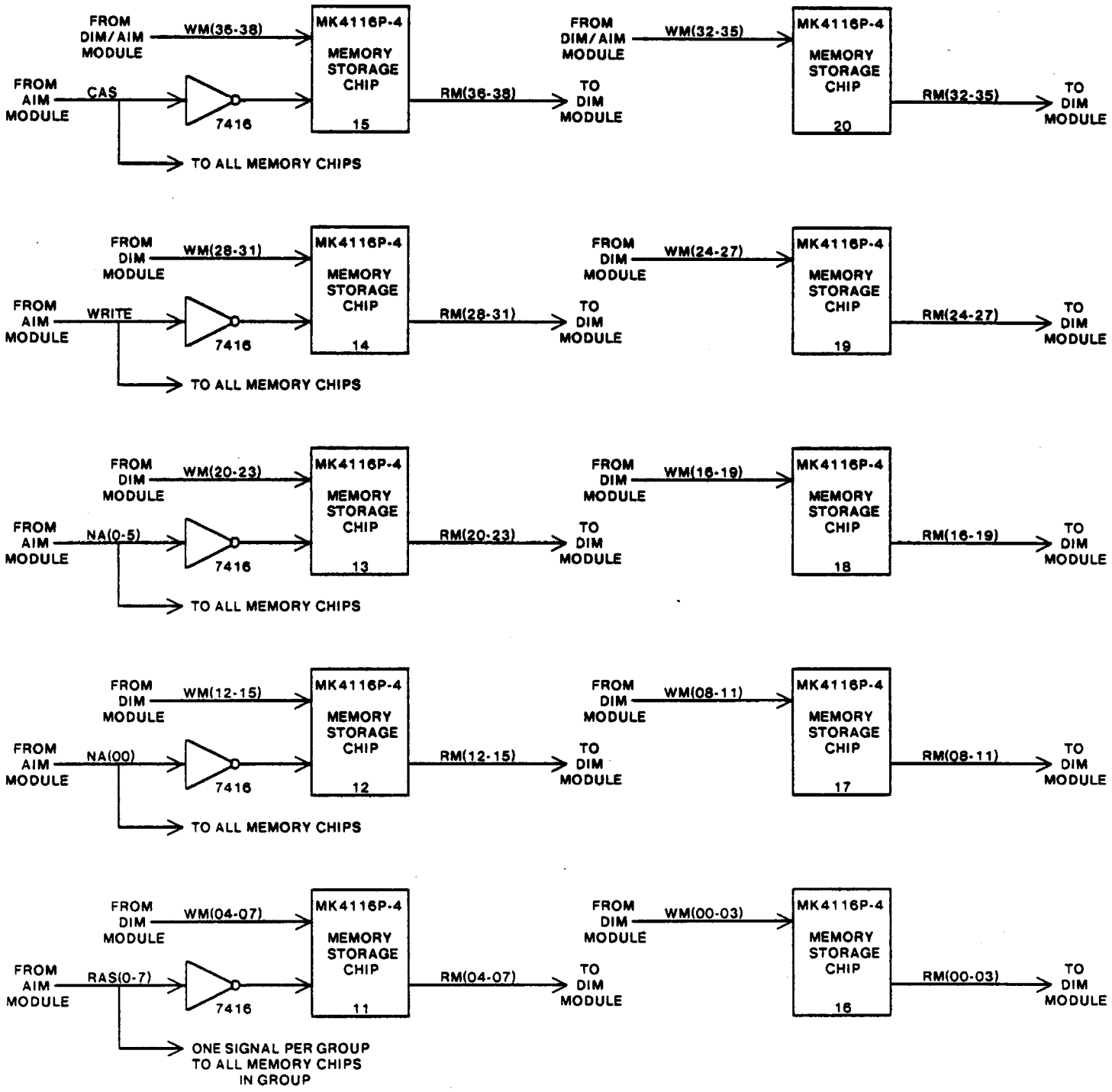
| CARD 1 | CARD 2 | CARD 3 | CARD 4 |
|---|---|---|---|
| 32 24 16 08 00 | 33 25 17 09 01 | 34 26 18 10 02 | 35 27 19 11 03 |
| 36 28 20 12 04 | 37 29 21 13 05 | 38 30 22 14 06 | xx 31 23 15 07 |

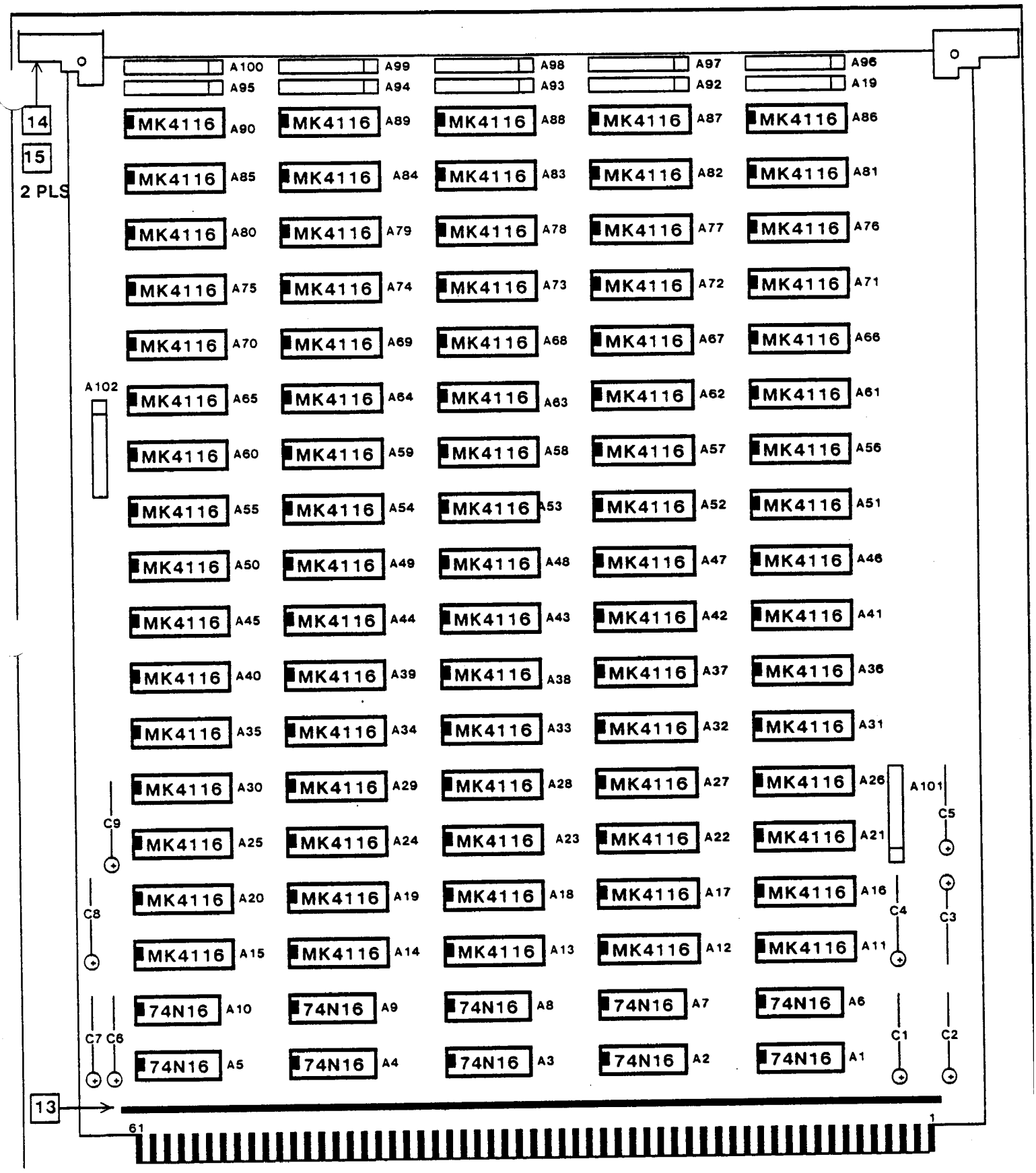
chip position 11

Chips 15, 25, 35, 45, 55, 65, 75, and 85 on board 4 aren't used. If you are out of replacement memory chips, you can use one of these, but then the board with the missing chips will only work in Slot 4.

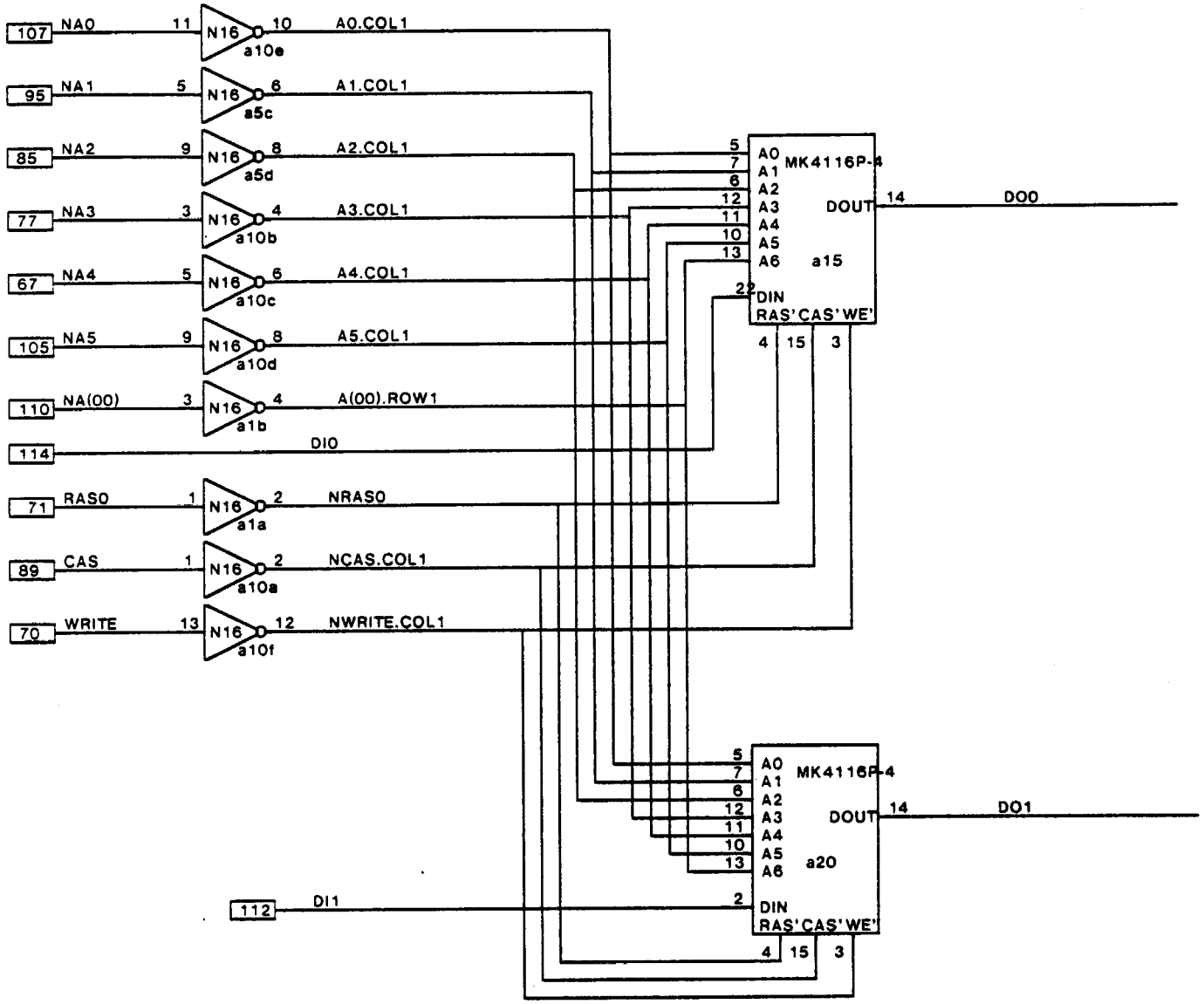
# MEMORY STORAGE MODULE

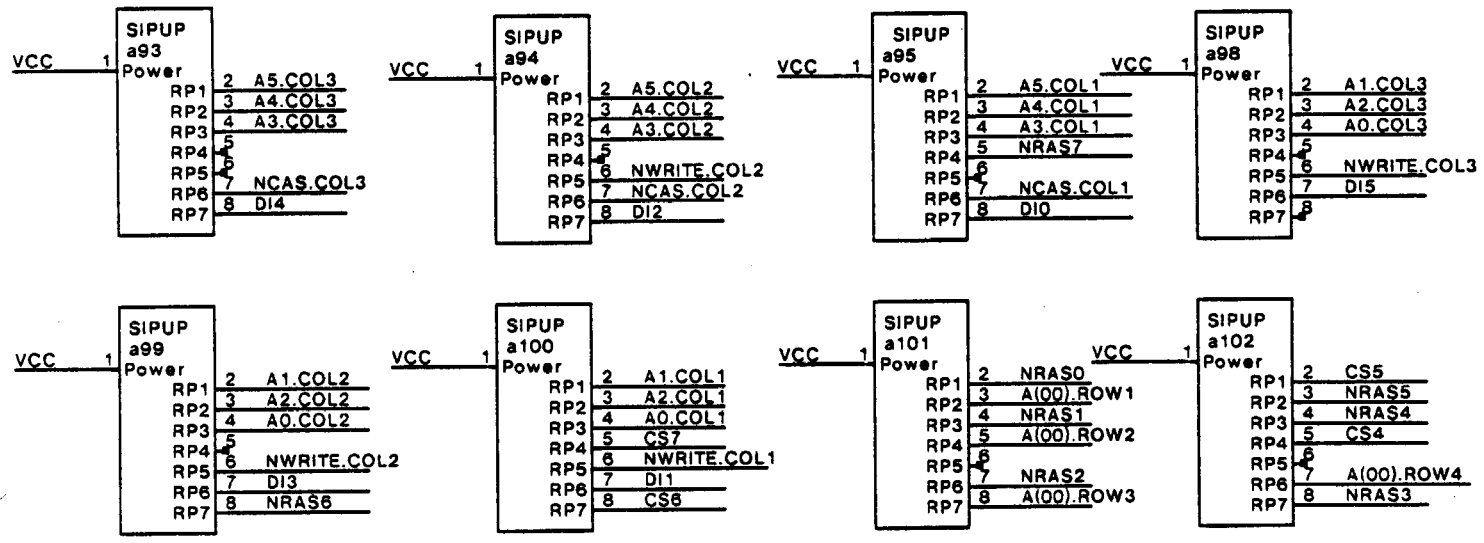
(ONE SUBGROUP, ALL EIGHT SUBGROUPS ARE IDENTICAL)



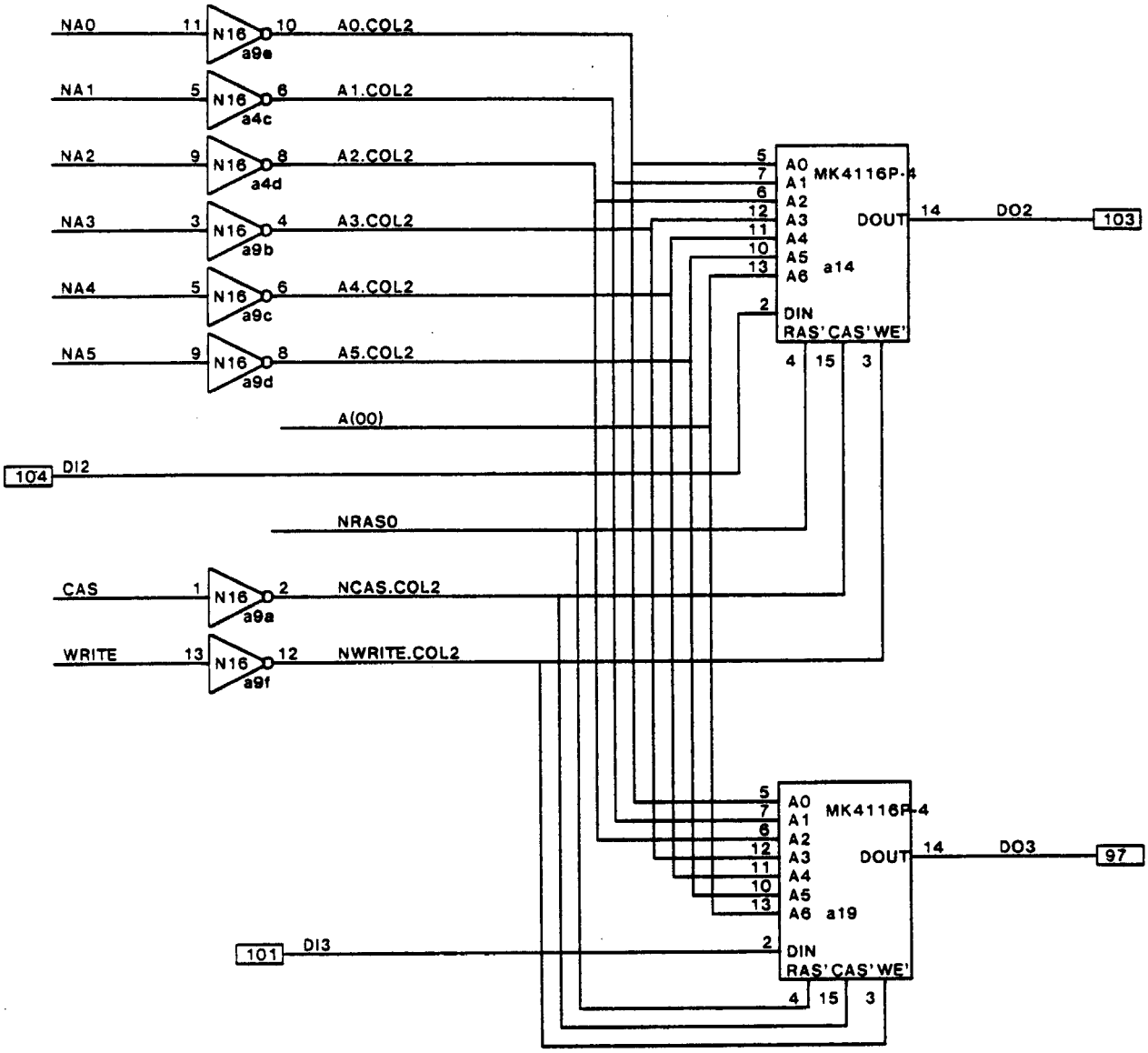



| | | | |
|---|---|---|---|
| PROPRIETARY NOTE ON SHEET 1 APPLIES TO ALL SHEETS | | FILE: MEM256K03.SIL | |
| TITLE: Assembly, Printed Wiring<br>256K STORAGE<br>ALTO II XM | DWG. SIZE A41 | DWG. NO. 217189<br>SHEET 3 OF 4 | SHEET REV. B |

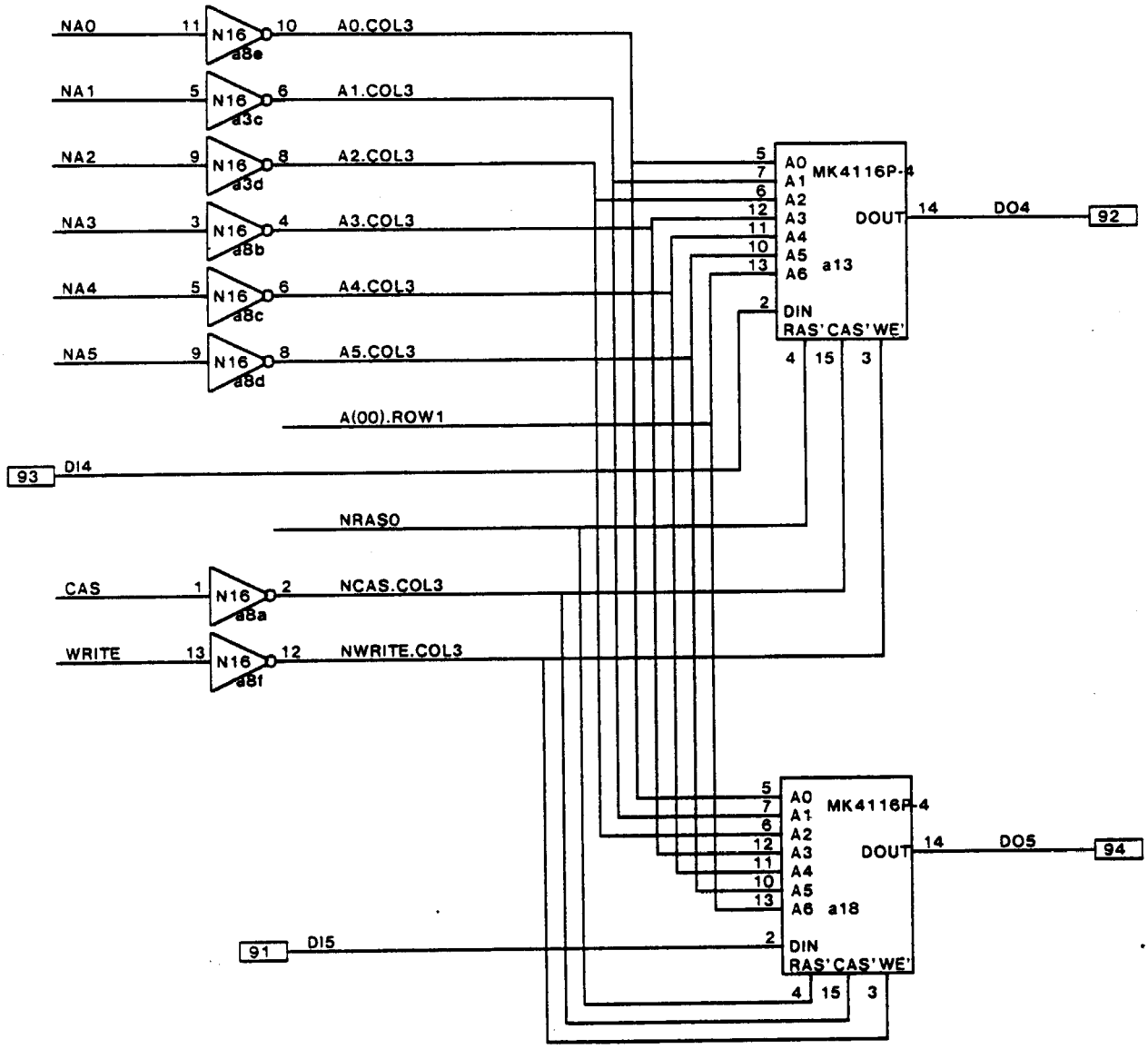


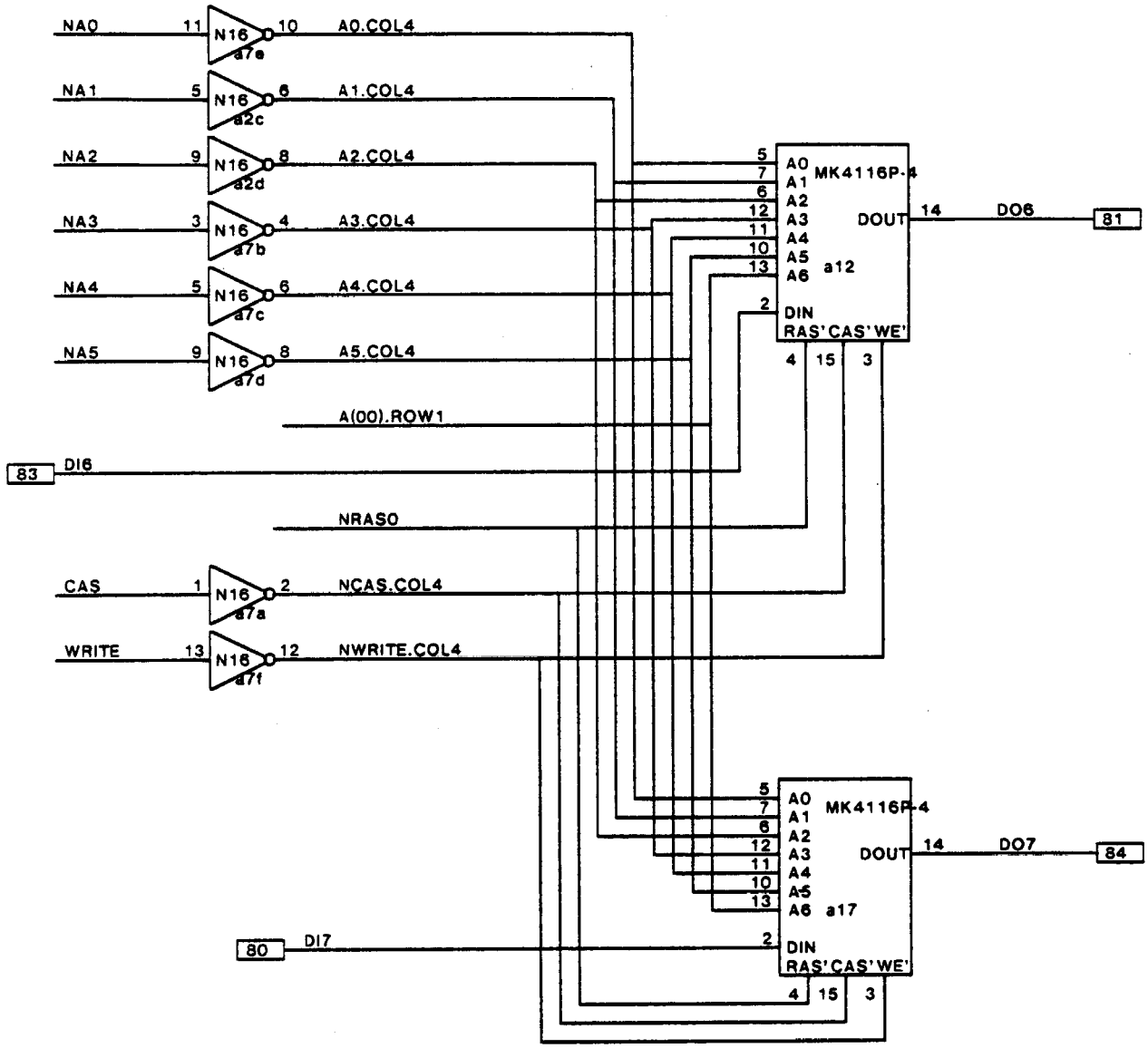

| XEROX SPG | Project ALTO2 | ASSEMBLY, P.W.-- 256K STORAGE | File MEM256K05.SIL | Designer N. TOBEL | Rev B | Date 11/24/80 | Page 05 |
|---|---|---|---|---|---|---|---|



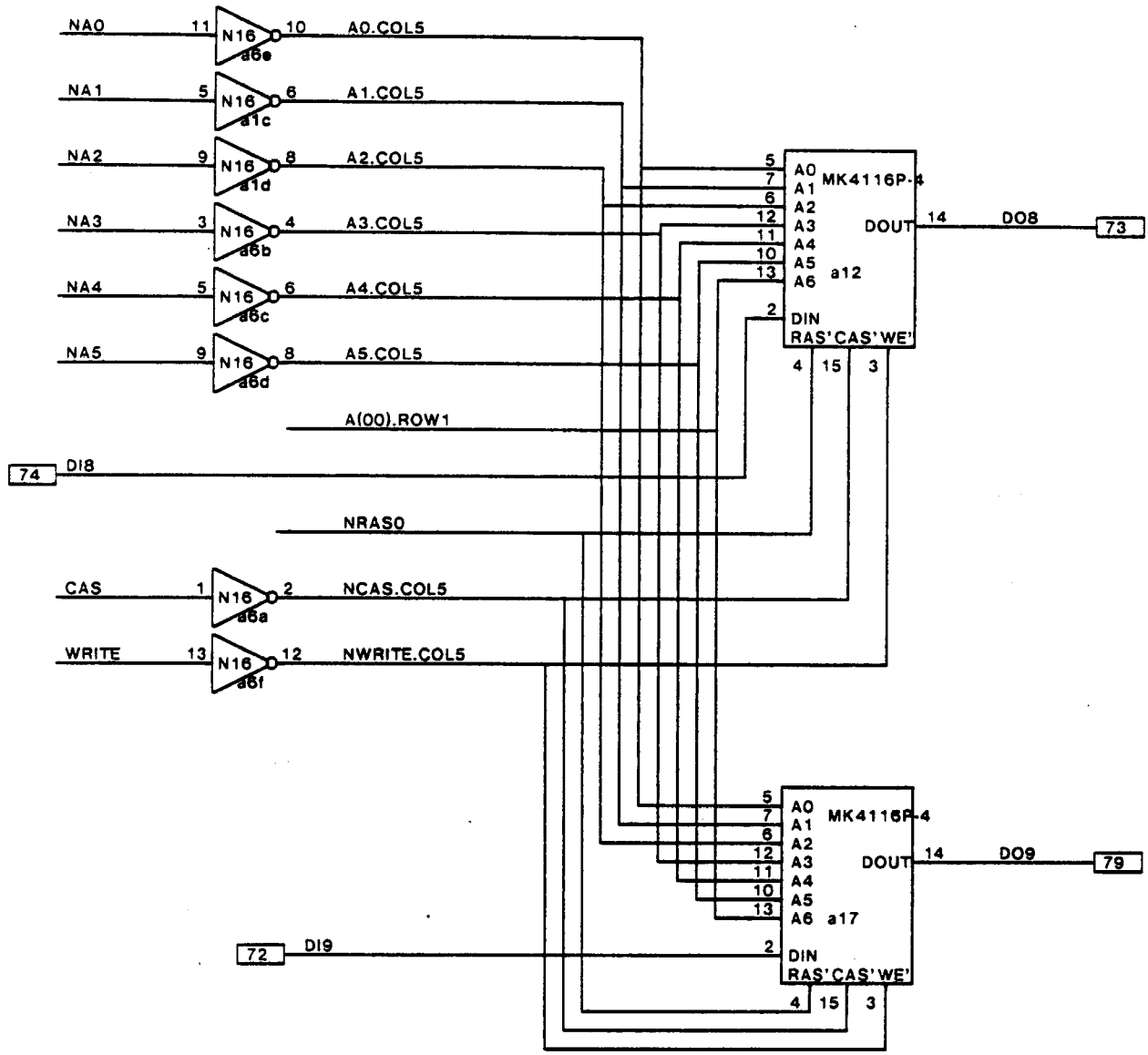

| XEROX SPG | Project ALTO2 | ASSEMBLY, P.W.-- 256K STORAGE | File MEM256K06.SIL | Designer N.TOBEL | Rev B | Date 12/10/80 | Page 06 |
|---|---|---|---|---|---|---|---|

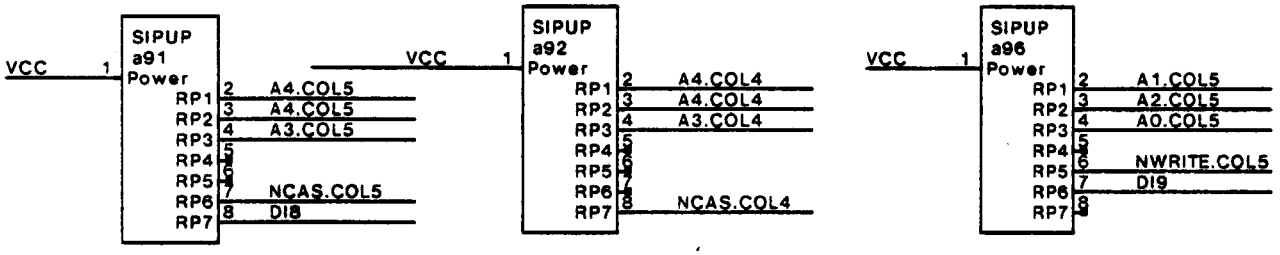



| XEROX SPG | Project ALTO2 | ASSEMBLY, P.W.-- 256K STORAGE | File MEM256K07.SIL | Designer N.TOBEL | Rev B | Date 12/10/80 | Page 07 |
|---|---|---|---|---|---|---|---|

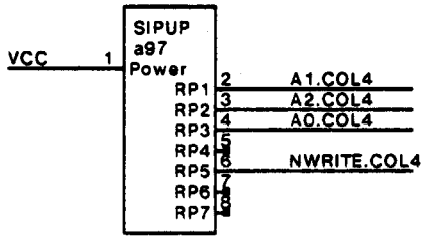



| XEROX SPG | Project ALTO2 | ASSEMBLY, P.W.-- 256K STORAGE | File MEM256K08.SIL | Designer N.TOBEL | Rev B | Date 12/10/80 | Page 08 |
|---|---|---|---|---|---|---|---|

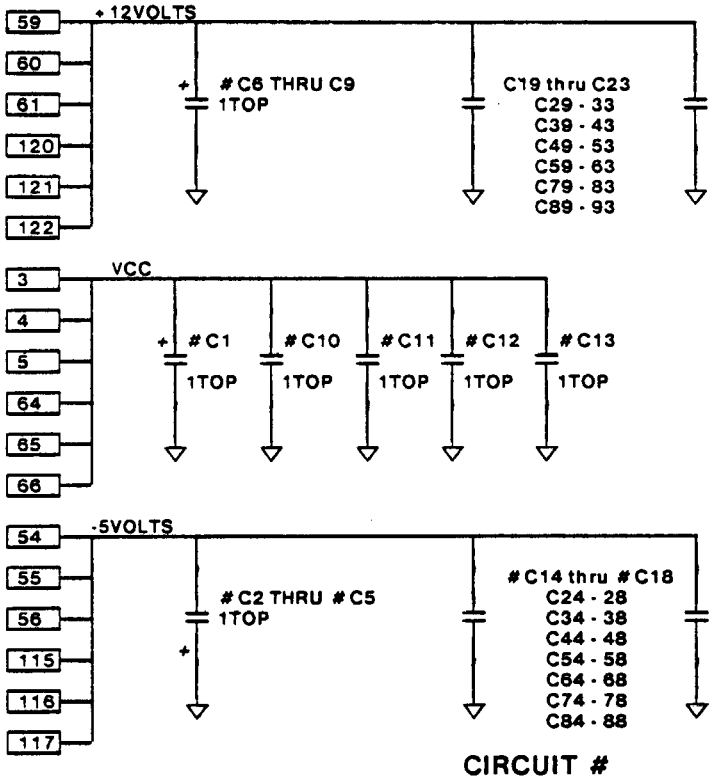



220 OHMS




| XEROX SPG | Project ALTO2 | ASSEMBLY, P.W.-- 256K STORAGE | File MEM256K09.SIL | Designer N.TOBEL | Rev B | Date 12/10/80 | Page 09 |
|---|---|---|---|---|---|---|---|



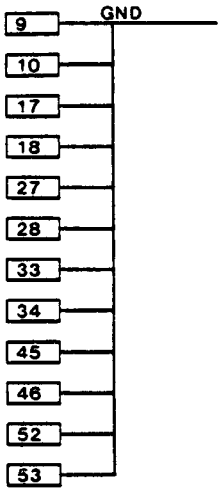




**TABLE II**

**MEMORY CHIP REFERENCE DESIGNATOR**

**CIRCUIT #**

| ROW # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1 | A15 | A20 | A25 | A30 | A35 | A40 | A45 | A50 | A55 | A60 | A65 | A70 | A75 | A80 | A85 | A90 |
| 2 | A14 | A19 | A24 | A29 | A34 | A39 | A44 | A49 | A54 | A59 | A64 | A69 | A74 | A79 | A81 | A89 |
| 3 | A13 | A18 | A23 | A28 | A33 | A38 | A43 | A48 | A53 | A58 | A63 | A68 | A73 | A78 | A82 | A88 |
| 4 | A12 | A17 | A22 | A27 | A32 | A37 | A42 | A47 | A52 | A57 | A62 | A67 | A72 | A77 | A83 | A87 |
| 5 | A11 | A16 | A21 | A26 | A31 | A36 | A41 | A46 | A51 | A56 | A61 | A66 | A71 | A76 | A84 | A86 |

| CKT # | INP. PIN | SIGNAL NAME | INVERTER REF. | IN | OUT | PULLUP RESISTOR |
|---|---|---|---|---|---|---|
| 1 | 71 | RAS0 | A1 | 1 | 2 | A101 R2 |
| | 110 | NA(00) | A1 | 3 | 4 | A101 R3 |
| 2 | 79 | RAS1 | A2 | 1 | 2 | A101 R4 |
| | 110 | NA(00) | A2 | 3 | 4 | A101 R5 |
| 3 | 90 | RAS2 | A3 | 1 | 2 | A101 R7 |
| | 110 | NA(00) | A3 | 3 | 4 | A101 R8 |
| 4 | 86 | RAS3 | A3 | 11 | 10 | A102 R8 |
| | 110 | NA(00) | A4 | 11 | 10 | A102 R7 |
| 5 | 102 | RAS4 | A4 | 1 | 2 | A102 R4 |
| | 110 | CS4 | A3 | 13 | 12 | A102 R5 |
| 6 | 106 | RAS5 | A5 | 11 | 10 | A102 R3 |
| | 110 | CS4 | A5 | 3 | 4 | A102 R2 |
| 7 | 111 | RAS6 | A5 | 1 | 2 | A99 R8 |
| | 110 | CS4 | A5 | 13 | 12 | A100 R8 |
| 8 | 99 | RAS7 | A4 | 13 | 12 | A95 R5 |
| | 110 | CS4 | A4 | 3 | 4 | A100 R5 |

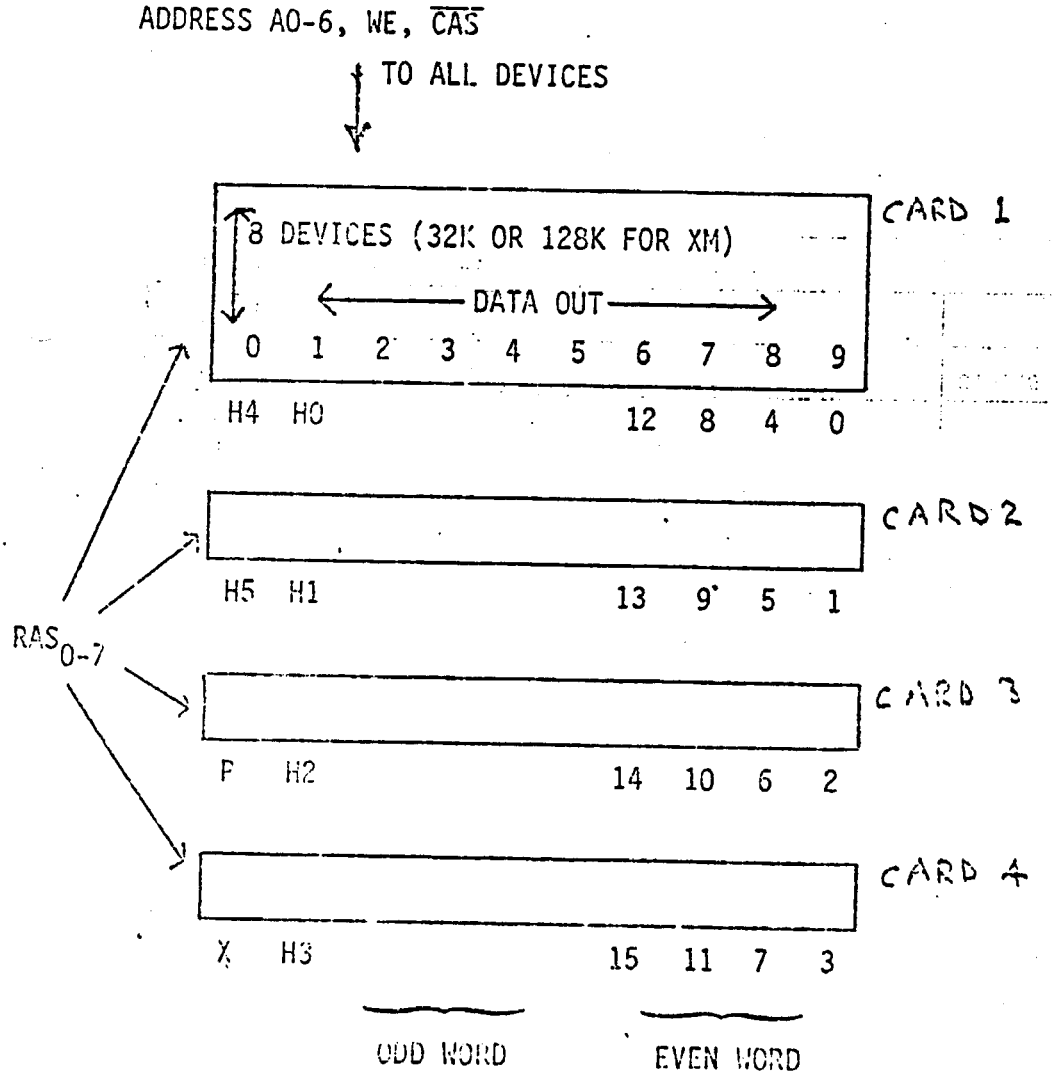
**TABLE I**

NOTE: FOR THE 32K X 10
THE RAMS ARE MK4096

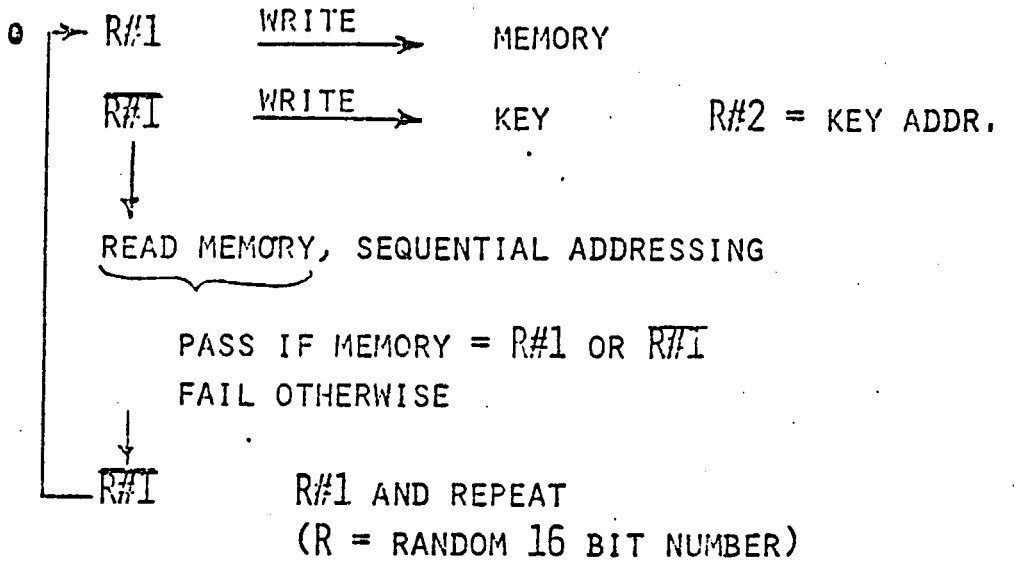
FOR THE 64K,128K,256K MODULES,
THEY ARE REPLACED WITH THE
MK4116P-4 CHIP.

# ALTO MEMORY

- WORD = 16 BITS
- ACCESS → 2 WORDS AT A TIME
  → 32 BITS + 6 BITS EC + PARITY + SPARE = 40 BITS
- 10 BITS/MODULE  80 DRAMS/MODULE
- 4 MODULES/ALTO  320 DRAMS/ALTO



# DMT - DIAGNOSTIC MEMORY TEST




- EVERY OTHER COMPLETE TRIAL IS RUN WITHOUT ERROR CORRECTION AND RESULTS COMPARED.
- NUMBER OF ERRORS IS STORED IN 320 WORDS OF MEMORY (65K ERRORS MAX.).
- ON SCREEN CURSOR JUMPS ONCE EACH TIME THROUGH THE MAIN DMT LOOP.
- S KEY CAUSES STATUS DISPLAY AND TRANSMIT ON NET. AUTO TRANSMIT EVERY 10K PASSES THROUGH DMT.
- PEEK LOOKS AT NET AND STORES ALL DMT TRANSMISSION ON THAT NET.

# ALTO II

## EXTENDED MEMORY LAYOUT

| | BANK 0 | | | | BANK 1 | | | | BANK 2 | | | | BANK 3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BIT | 00000-77777 | | 100000-177777 | | 00000-77777 | | 100000-177777 | | 00000-77777 | | 100000-177777 | | 00000-77777 | | 100000-177777 | |
| | EVEN | ODD | EVEN | ODD | EVEN | ODD | EVEN | ODD | EVEN | ODD | EVEN | ODD | EVEN | ODD | EVEN | ODD |
| 0 | 1-16 | 1-18 | 1-26 | 1-28 | 1-36 | 1-38 | 1-46 | 1-48 | 1-56 | 1-58 | 1-66 | 1-68 | 1-76 | 1-78 | 1-86 | 1-88 |
| 1 | 2-16 | 2-18 | 2-26 | 2-28 | 2-36 | 2-38 | 2-46 | 2-48 | 2-56 | 2-58 | 2-66 | 2-68 | 2-76 | 2-78 | 2-86 | 2-88 |
| 2 | 3-16 | 3-18 | 3-26 | 3-28 | 3-36 | 3-38 | 3-46 | 3-48 | 3-56 | 3-58 | 3-66 | 3-68 | 3-76 | 3-78 | 3-86 | 3-88 |
| 3 | 4-16 | 4-18 | 4-26 | 4-28 | 4-36 | 4-38 | 4-46 | 4-48 | 4-56 | 4-58 | 4-66 | 4-68 | 4-76 | 4-78 | 4-86 | 4-88 |
| 4 | 1-11 | 1-13 | 1-21 | 1-23 | 1-31 | 1-33 | 1-41 | 1-43 | 1-51 | 1-53 | 1-61 | 1-63 | 1-71 | 1-73 | 1-81 | 1-83 |
| 5 | 2-11 | 2-13 | 2-21 | 2-23 | 2-31 | 2-33 | 2-41 | 2-43 | 2-51 | 2-53 | 2-61 | 2-63 | 2-71 | 2-73 | 2-81 | 2-83 |
| 6 | 3-11 | 3-13 | 3-21 | 3-23 | 3-31 | 3-33 | 3-41 | 3-43 | 3-51 | 3-53 | 3-61 | 3-63 | 3-71 | 3-73 | 3-81 | 3-83 |
| 7 | 4-11 | 4-13 | 4-21 | 4-23 | 4-31 | 4-33 | 4-41 | 4-43 | 4-51 | 4-53 | 4-61 | 4-63 | 4-71 | 4-73 | 4-81 | 4-83 |
| 8 | 1-17 | 1-19 | 1-27 | 1-29 | 1-37 | 1-39 | 1-47 | 1-49 | 1-57 | 1-59 | 1-67 | 1-69 | 1-77 | 1-79 | 1-87 | 1-89 |
| 9 | 2-17 | 2-19 | 2-27 | 2-29 | 2-37 | 2-39 | 2-47 | 2-49 | 2-57 | 2-59 | 2-67 | 2-69 | 2-77 | 2-79 | 2-87 | 2-89 |
| 10 | 3-17 | 3-19 | 3-27 | 3-29 | 3-37 | 3-39 | 3-47 | 3-49 | 3-57 | 3-59 | 3-67 | 3-69 | 3-77 | 3-79 | 3-87 | 3-89 |
| 11 | 4-17 | 4-19 | 4-27 | 4-29 | 4-37 | 4-39 | 4-47 | 4-49 | 4-57 | 4-59 | 4-67 | 4-69 | 4-77 | 4-79 | 4-87 | 4-89 |
| 12 | 1-12 | 1-14 | 1-22 | 1-24 | 1-32 | 1-34 | 1-42 | 1-44 | 1-52 | 1-54 | 1-62 | 1-64 | 1-72 | 1-74 | 1-82 | 1-84 |
| 13 | 2-12 | 2-14 | 2-22 | 2-24 | 2-32 | 2-34 | 2-42 | 2-44 | 2-52 | 2-54 | 2-62 | 2-64 | 2-72 | 2-74 | 2-82 | 2-84 |
| 14 | 3-12 | 3-14 | 3-22 | 3-24 | 3-32 | 3-34 | 3-42 | 3-44 | 3-52 | 3-54 | 3-62 | 3-64 | 3-72 | 3-74 | 3-82 | 3-84 |
| 15 | 4-12 | 4-14 | 4-22 | 4-24 | 4-32 | 4-34 | 4-42 | 4-44 | 4-52 | 4-54 | 4-62 | 4-64 | 4-72 | 4-74 | 4-82 | 4-84 |

| | BANK 0 | | BANK 1 | | BANK 2 | | BANK 3 | |
|---|---|---|---|---|---|---|---|---|
| H0 | 1-20 | 1-30 | 1-40 | 1-50 | 1-60 | 1-70 | 1-80 | 1-90 |
| H1 | 2-20 | 2-30 | 2-40 | 2-50 | 2-60 | 2-70 | 2-80 | 2-90 |
| H2 | 3-20 | 3-30 | 3-40 | 3-50 | 3-60 | 3-70 | 3-80 | 3-90 |
| H3 | 4-20 | 4-30 | 4-40 | 4-50 | 4-60 | 4-70 | 4-80 | 4-90 |
| H4 | 1-15 | 1-25 | 1-35 | 1-45 | 1-55 | 1-65 | 1-75 | 1-85 |
| H5 | 2-15 | 2-25 | 2-35 | 2-45 | 2-55 | 2-65 | 2-75 | 2-85 |
| P | 3-15 | 3-25 | 3-35 | 3-45 | 3-55 | 3-65 | 3-75 | 3-85 |

NOTE: 1. Card - Chip location.
2. The Memory Configuration Switch reverses high and low memory within a bank.

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