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User manual

IMS B005 M212 disk processor transputer evaluation board

Contents

Disclaimer

Every effort has been made to test this product and its operation with the transputer development system.

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The IMS B005 board enables the user to evaluate and demonstrate the use of the M212 disk processor transputer.

The board is a member of a family of compatible transputer evaluation boards. It provides standard INMOS link connections and external control of the transputer's Reset and Analyse functions. This allows it to be a component of a larger transputer system.

This manual details the product specific aspects of the IMS B005, and contains all the data necessary to install, power up, test and program the board.

Other information relevant to all transputer products is contained in the occam programming manual (supplied with INMOS software products and available as a separate publication), and the disk processor reference manual (supplied with this board). This board is designed to be used in conjunction with a Transputer Development System (TDS). Reference should be made to the transputer development system user manual (supplied with the development system), for details of how to compile and load programs for a network of boards.

1.1 Introduction

The IMS B005 board has the following functional blocks:

1 The M212 transputer, with two standard links and 64 Kbytes of static RAM.

2 SA400/ST506 standard disk drive interface with buffering.

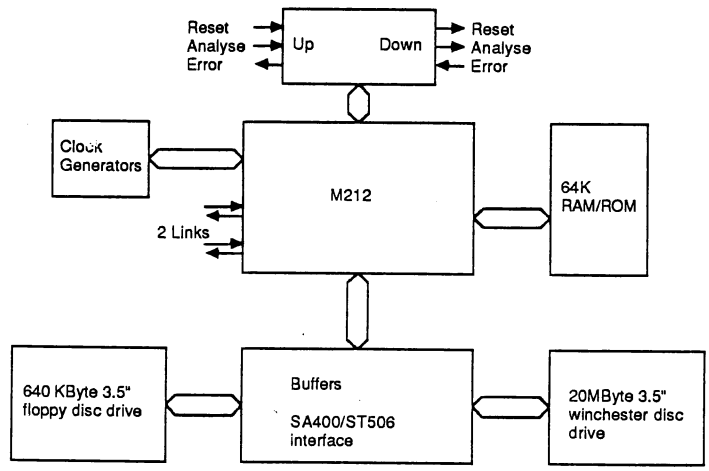
3 20 Mbytes formatted (25 Mbytes unformatted) 3.5 inch winchester disk drive.

4 640 Kbytes formatted (1 Mbyte unformatted) 3.5 inch floppy disk drive.

The M212 is able to control up to four disk drives via the industry standard SA400/ST506 interfaces. Two drives are present on the B005 and provision has been made for connecting other drives if the user so desires, or to change either of the drives on the board (for instance to use **two** winchester drives).

The external memory interface can address up to 62Kbytes of memory space (2 Kbytes of fast static RAM are resident on the M212). This is reduced to a maximum of 58 Kbytes if the internal ROM is enabled. As supplied the external memory is static RAM (two 32K x 8 devices), but it is possible to replace one or both with ROM if required. The external memory interface may be switch programmed for different device speeds.

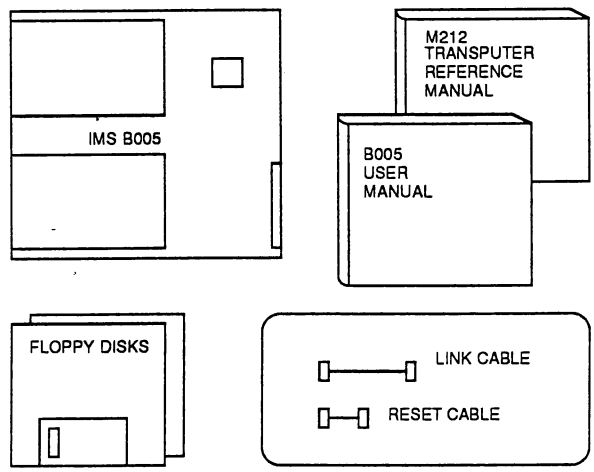
Because of the size and weight of the B005 it is recommended that it be used only within a double extended euro size card frame, such as the INMOS transputer evaluation module (ITEM), and be vertically mounted.



1.2 Opening the box

When you open the box, you will find

1. Some documentation, including this manual
2. Floppy disks which contain some test software.
3. A link cable and a reset cable in a polythene bag
4. An anti-static bag, containing the B005 board.



1.3 Removing the B005 board from its bag

To prevent damage from static charge, certain precautions should be taken when removing the board from its protective bag.

1 While holding the board in one hand, still in its bag, touch any grounded metal part of your machine with the other hand.

2 Carefully remove the board from the bag, holding the board by the edges only. Avoid touching any components or connections.

3 When inserting the board into the card frame, hold the board by its side edges or corners.

1.4 Installing the board

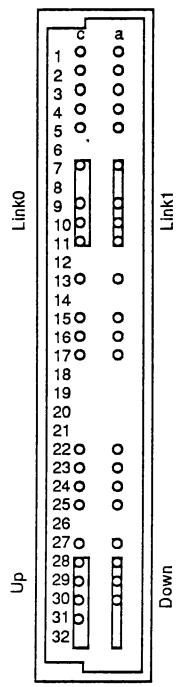
Before installing the board the user may change the switch settings for the test program as detailed in section 3.1. To install the board hold it by the edges, connector to the rear and component side to the right, and slide it into the guides on the top and bottom of the card frame. Push it in until the connector is firmly seated.

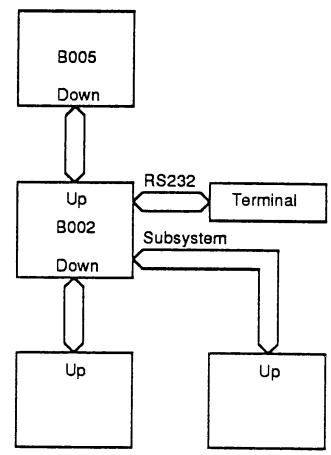
1.5 Connecting multiple boards together

The diagram below shows the rear edge connector of the B005, looking from the rear of the board. As can be seen, there are two columns of pins, and these are grouped into sets of five, suitable for the five way sockets which terminate the various cables supplied.

The link sockets are self explanatory. The Up and Down sockets are concerned with system control, initialisation and error handling. The simplest way to use them is to connect the Down socket of the B005 board to the Up socket of the system master board with the Reset cable provided, and then to connect further boards to the master Down or Subsystem as required. This method ensures that when the user resets the B005 board, all others in the chain are also reset (see the diagram below).

The B005 can be switch programmed to boot from any of its disk drives, which on reset will load the boot program, and propagate the required code to the rest of the system (all other boards set to boot from link).





Example configuration using the IMS B005

1.6 Powering up

Once the board has been fitted correctly, the B005 can be switched on. The two green power LEDs should light and the orange error LED may also light. The winchester disk drive will take several seconds to reach its correct operating speed, and may proceed to perform a startup self test sequence, depending on which make of disk drive has been fitted. The test software provided with the board can be found on the floppy disk which you will have found in the top of the box, along with this manual.

The use of these programs is described in more detail in section 3.

The IMS B005 and other evaluation boards share a common architecture which includes the DIN41612 edge connector pinout, link protocol, and system control functions. The architecture is independent of the type of transputer used, its speed, and of the number of transputers on the board.

The memory map of each board is different, and the memory map for the B005 is given in section 4.1.

2.1 Links

The transputer's links are brought out to the DIN41612 edge connector, allowing the system to be configured by the user. A link cable is supplied with each board, which is suitable for connecting to either of the two links of the transputer.

The two link sockets on the DIN41612 edge connector are:

Link0 pins c7 to c11

Link1 pins a7 to a11

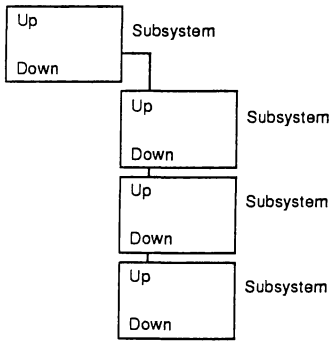
The link sockets and cables are coded to make it difficult to plug link cables into sockets other than link sockets.

2.2 System control

The aim of the system control functions of the evaluation boards is that it should be possible to initialize, and analyse errors in, an arbitrarily large system built with the boards. In particular, one board in a cabinet or a rack must be able to control all the other boards in the rack.

This control is necessarily independent of the serial links between boards.

2.2.1 Plugging boards together

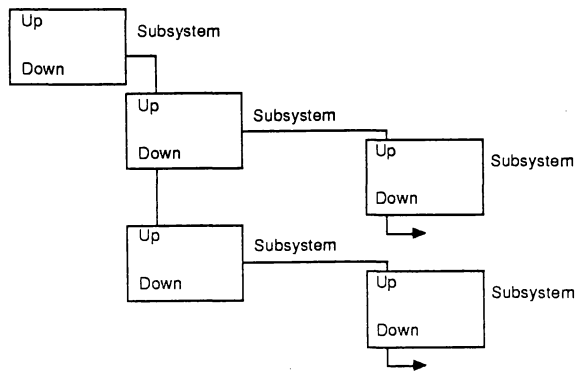


One board controls a subsystem of an arbitrary number of other boards. This is achieved with three sockets which are called Up, Down and Subsystem. The figure on the left shows a board at the top with its Subsystem socket wired to the Up socket of the board below. Subsequent boards are daisy chained by wiring the Down socket of one board to the Up socket of the board below.

The IMS B005 does not have subsystem control logic and so subsequent boards must be connected to the IMS B005 Down socket.

A cable is supplied with each board which may be used to connect the board's Up socket to either the Down socket or the Subsystem socket of the board above.

The Up socket is implemented as edge connector pins c28-32 and the Down socket as pins a28-32.



2.2.2 The signals on the sockets

Each of the sockets includes the signals notReset, notAnalyse and notError.

The notReset and notAnalyse signals flow from the Up port to the Down port. The notError signal flows in the reverse direction from Down to Up, and indicates that an error has occurred on this board or on a board further down from this board. All the inputs are biased so that if a socket is not used, the signals it receives are in their inactive state.

2.2.3 Logic on board to provide system control

The logic relationships between the signals on the sockets and on the transputer are shown below (ignoring logic polarities).

Reset signals

Transputer = Up OR ResetSwitch

Down = Up OR ResetSwitch

Analyse signals

Transputer = Up OR AnalyseSwitch

Down = Up OR AnalyseSwitch

Error signals

Up = Transputer OR Down

2.3 Edge connector pinout

The B005 board uses a group of 5 way connectors, to simplify the location of the various leads for a system.

Pin	c	a
1	GND	GND
2	VDD	VDD
3	+12V	+12V
4	VDD	VDD
5	GND	GND
6	(missing)	(missing)
7	GND	GND
8	(missing)	(missing)
9	Link0Out	Link1Out
10	Link0In	Link1In
11	GND	GND
12	(missing)	(missing)
13	GND	GND
14	(missing)	(missing)
15	nc	nc
16	nc	nc
17	GND	GND
18	(missing)	(missing)
19	(missing)	(missing)
20	(missing)	(missing)
21	(missing)	(missing)
22	nc	nc
23	nc	nc
24	nc	nc
25	GND	GND
26	(missing)	(missing)
27	nc	nc
28	UpNotReset	DownNotReset
29	UpNotAnalyse	DownNotAnalyse
30	UpNotError	DownNotError
31	GND	GND(missing)
32	GND(missing)	GND(missing)

3.1 Testing the board

The B005 is provided with test software on floppy disks which will auto-boot from the floppy disk drive. The switch settings required for this operation are detailed below:

SW1/1 OFF
SW1/2 ON
SW1/3 OFF
SW1/4 ON

SW2/1 ON
SW2/2 OFF
SW2/3 ON
SW2/4 OFF
SW2/5 ON
SW2/6 OFF

Before running these programs check that the board is correctly seated within the card guides. Refer to section 1 for installation details.

After checking these conditions, run the test programs as described in section 3.2.

3.2 Test program

The test programs supplied check the functionality of the memory, and the M212 and its links, before performing a simple format and read/write test on the winchester disk.

Test1: Memory
Insert the disk marked 'Memory test' into the floppy disk drive and press the reset switch on the front of the board. The RAM test is very short and, if successful, will cause the winchester disk select light to flash continuously. If the test fails due to faulty RAM, the floppy select light will flash continuously.

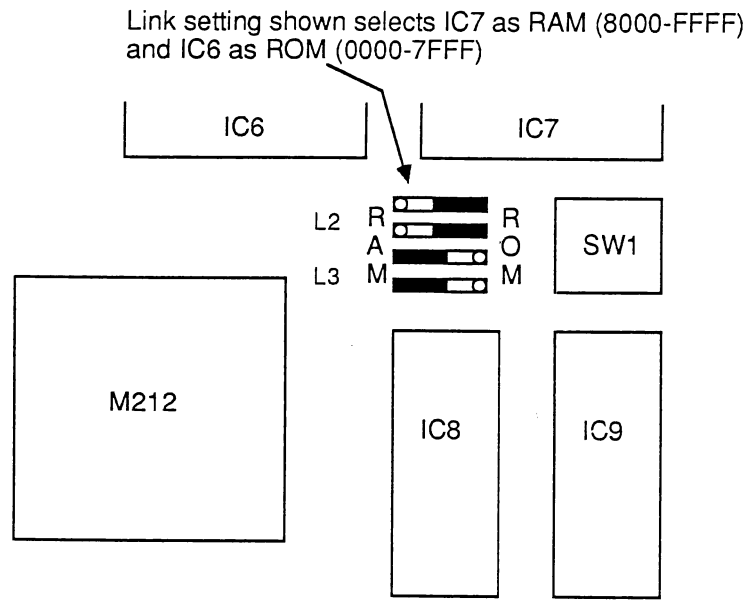
Test2: Disk test
Insert the disk marked 'Disk test' into the floppy disk drive (ensure the disk is not write protected) and press the reset switch on the front of the board. DO NOT remove the test disk from the drive until after the test, otherwise the test will not be completed, and the system will hang. The disk test takes about ten minutes to complete; an indication that the test has begun is a short flash of both floppy and winchester select lights. The disks will be heard to move as the heads are stepped across the tracks. At the end of the test, if it is successful, the winchester select light will flash continuously. If the test fails, the floppy select light will flash continuously.

A more comprehensive set of tests is available for use with the transputer development system (TDS); if this is being used, remember to remove the test disks supplied to prevent them from being overwritten.

4.1 IMS B005 switches and indicators

The front panel has three indicators, two of which are green, and simply show that the correct power supplies have been connected.
The orange LED indicates that a transputer error has occured on the board or has been propagated up from another transputer board.

There are two switches and a set of jumpers on the board. The jumpers are used to select the memory device (RAM or EPROM), as shown in the diagram below.

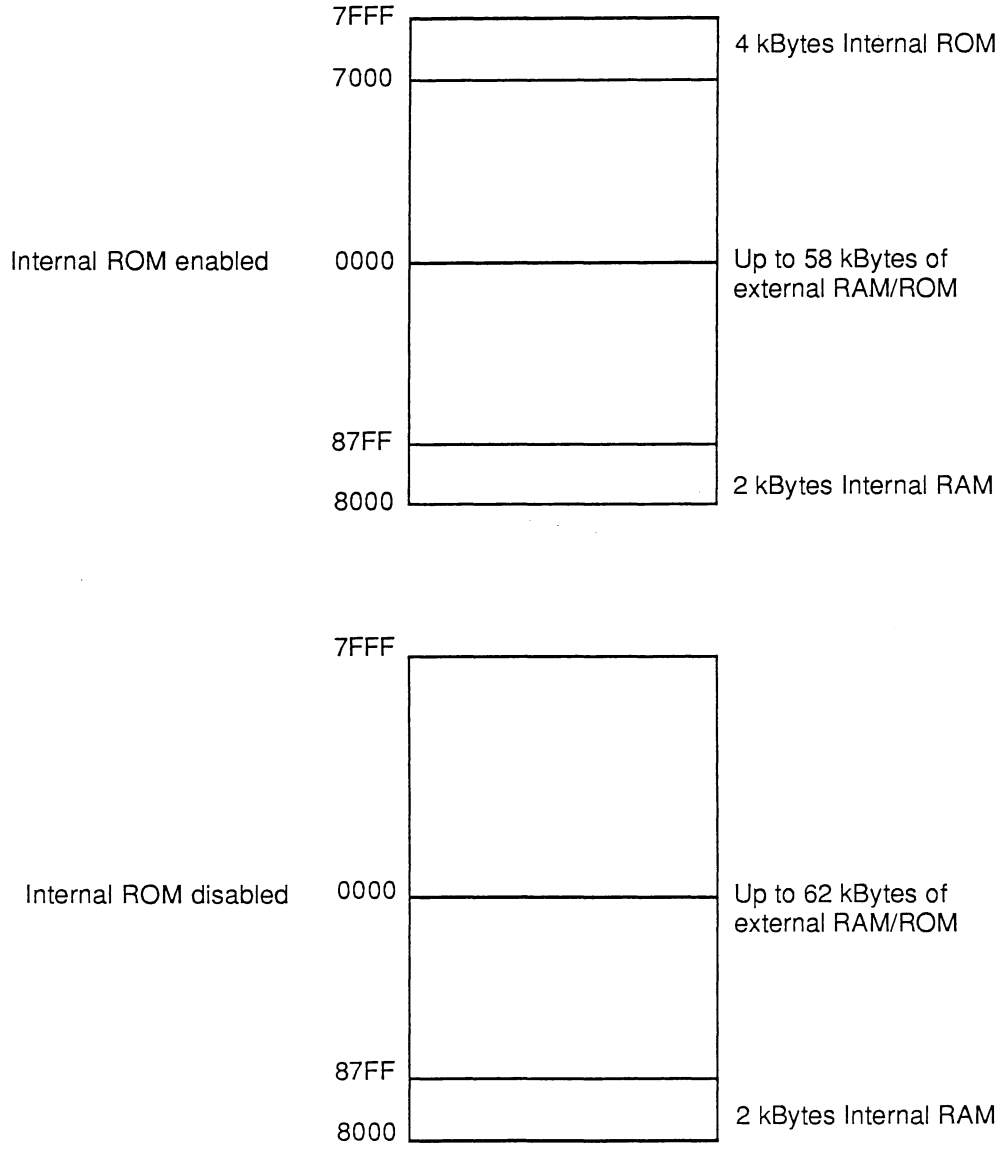


4.1 IMS B005 switches and indicators

The function of the switches is shown in the table below.

Switch	Switch function	OFF	ON
1/1	MemWait 1	add 1 T-state	add 0 T-states
1/2	MemWait 2	add 2 T-states	add 0 T-states
1/3	MemWait 4	add 4 T-states	add 0 T-states
1/4	EnableIntROM	disabled	enabled
2/1	BootFromDisk	no auto-boot	auto-boot
2/2	BootDriveSelect0	add 0 to drive no.	add 1 to drive no.
2/3	BootDriveSelect1	winchester(drive 1)	floppy(drive 3)
2/4	LinkSpeed	20 Mbits/s	10 Mbits/s
2/5	nc	-	-
2/6	BootFromLink	boot from ROM	boot from link

4.2 IMS B005 memory map



4.3 IMS B005 booting options

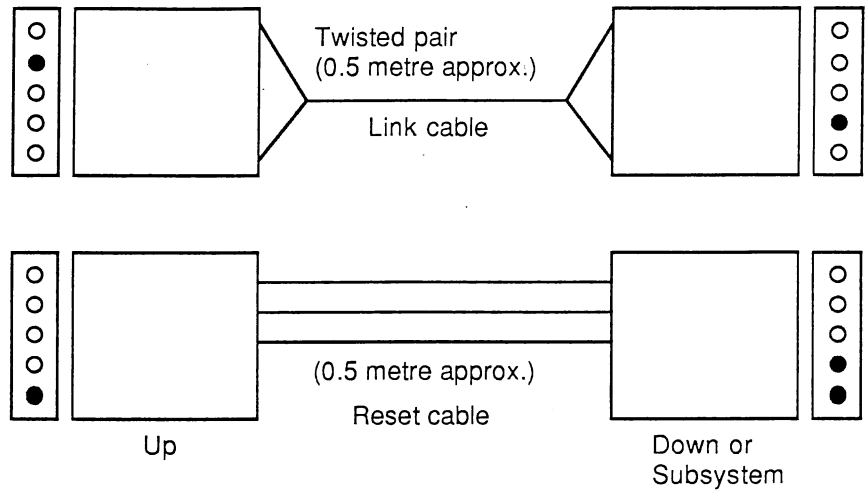
The IMS B005 switches can be configured to allow several different booting modes:

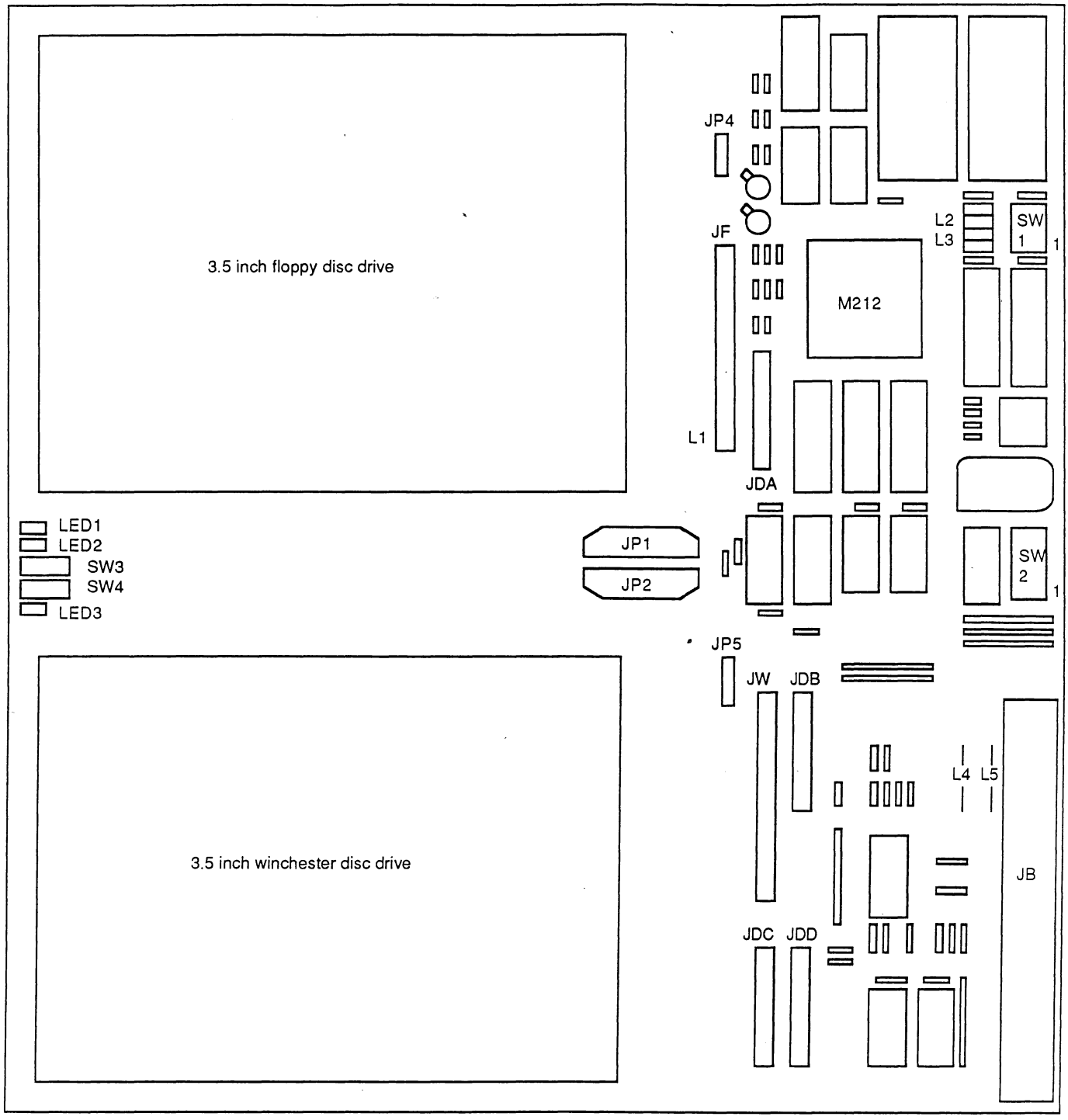
a) Booting from internal ROM.
To use the program supplied in the M212 internal ROM, BootFromLink (SW2/6) should be OFF and EnableInternalROM (SW1/4) should be ON. If the BootFromDisk switch is ON, the M212 will then either re-boot from a program held on one of the disk drives (as selected by the BootDriveSelect0/1 switches), or send that program down Link0 as a boot message to the rest of the system.

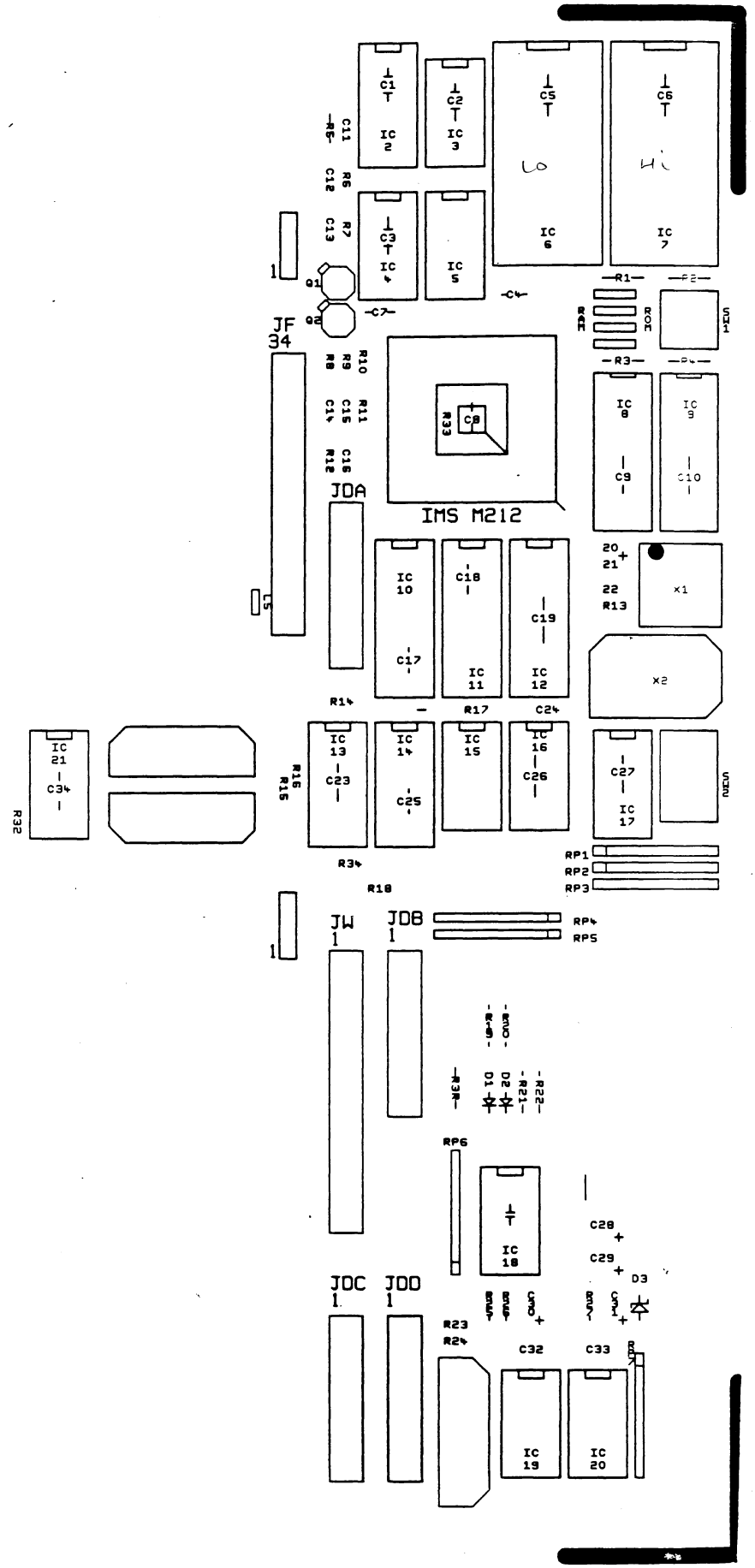
b) Booting from link.
To boot the M212 from a program supplied down either one of its links, the BootFromLink (SW2/6) should be ON.

c) Booting from external ROM.
To boot from a program in external ROM, the BootFromLink (SW2/6) should be OFF and EnableInternalROM (SW1/4) should be OFF.

More detailed information on booting the M212 can be found in the M212 reference manual.


Twisted pair
(0.5 metre approx.)
Link cable
(0.5 metre approx.)
Reset cable
Up
Down or
Subsystem


3.5 inch floppy disc drive
JP4
JF
L1
JDA
M212
L2
L3
SW
1
1
LED1
LED2
SW3
SW4
LED3
JP1
JP2
SW
2
1
JP5
JW
JDB
L4
L5
JB
3.5 inch winchester disc drive
JDC
JDD



IMS B005

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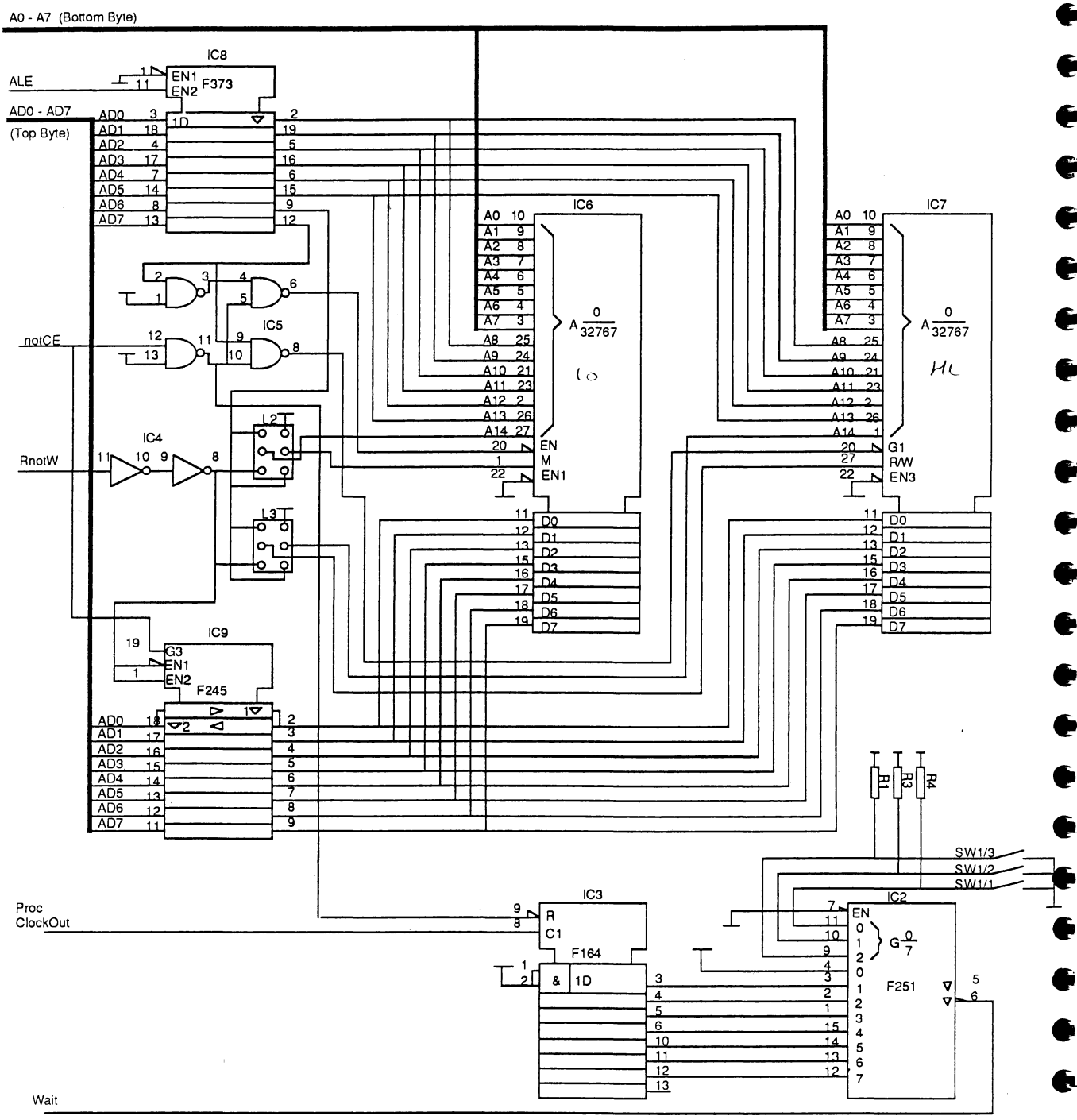
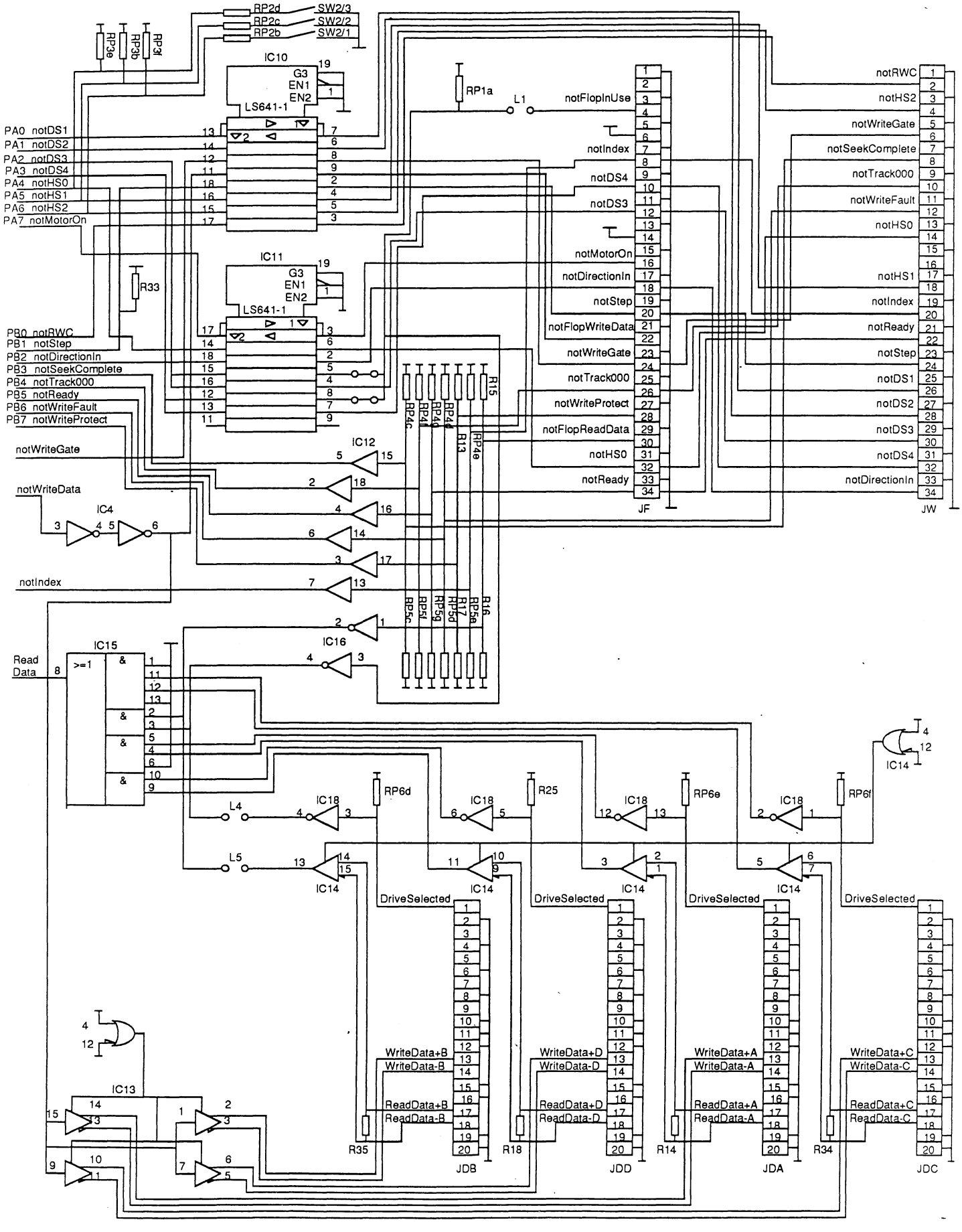
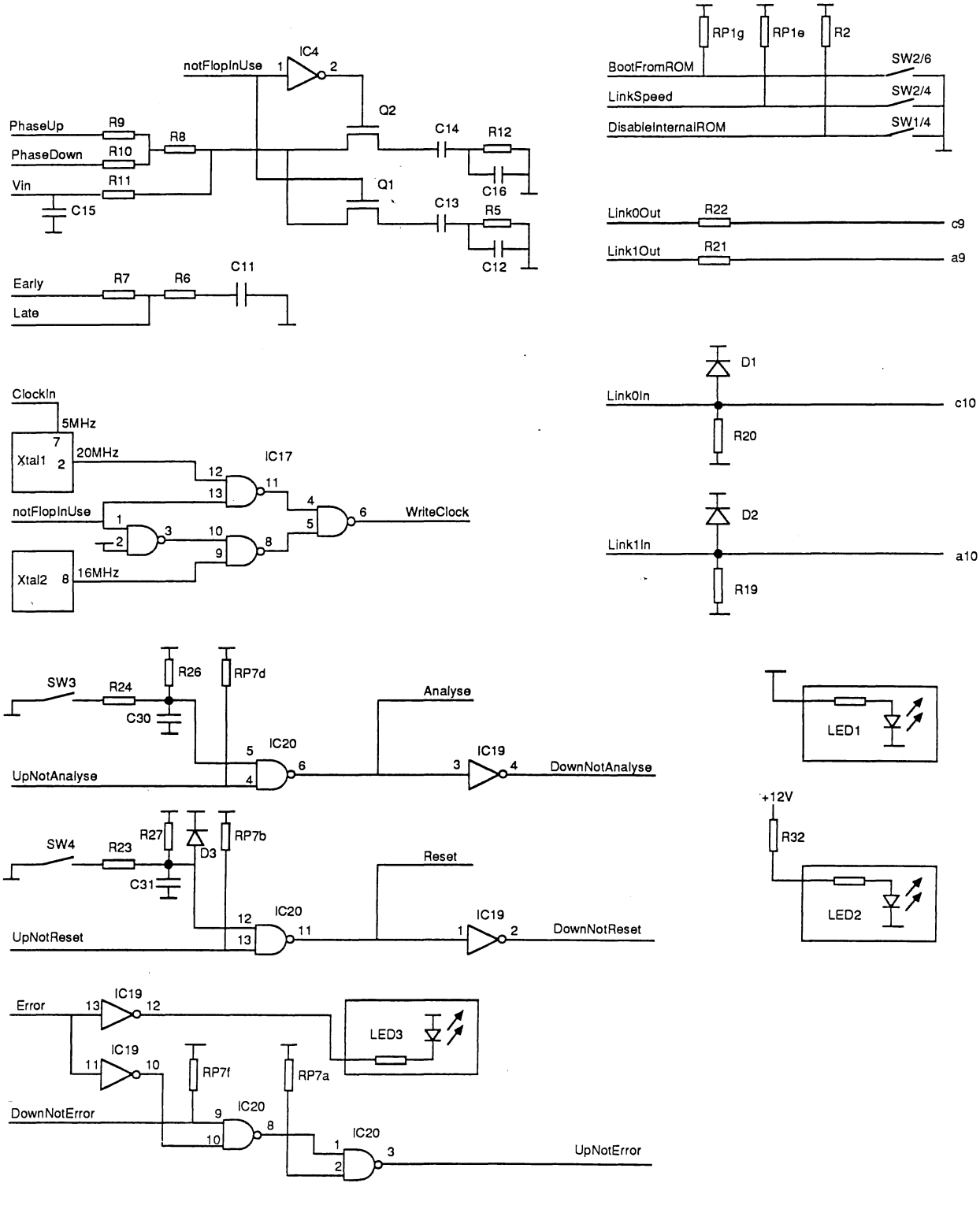
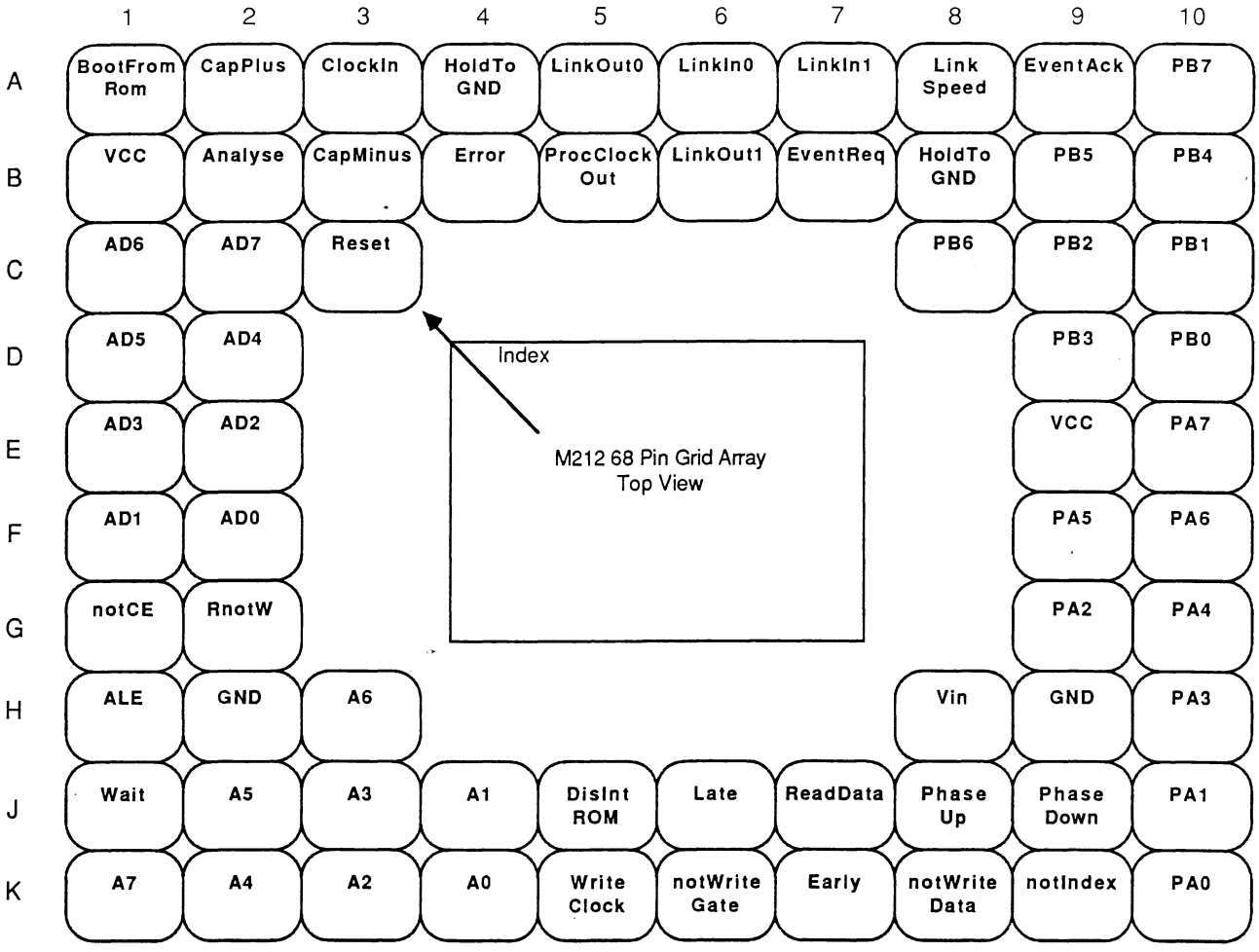
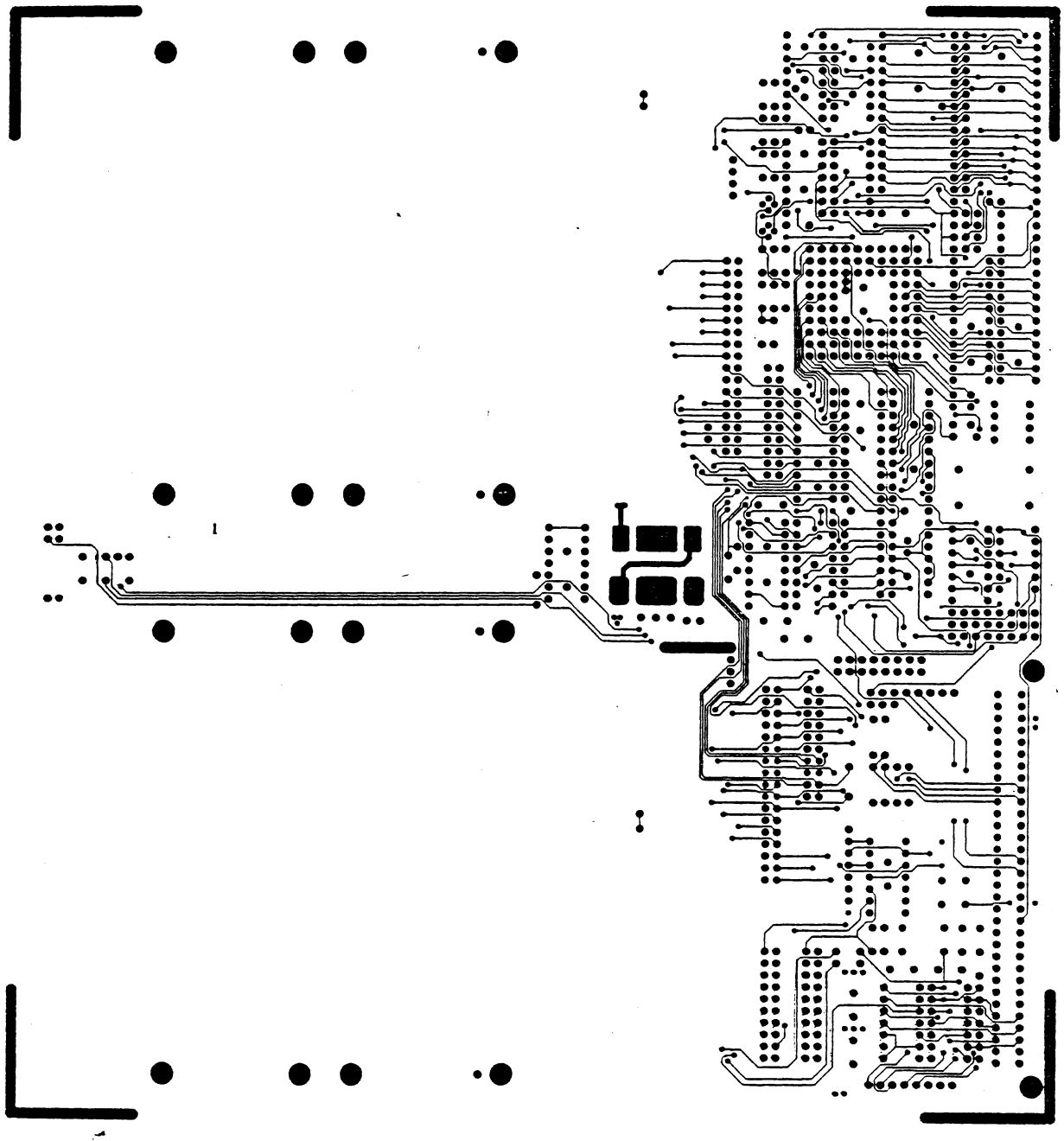

A0 - A7 (Bottom Byte)
IC8
ALE
EN1
EN2
F373
AD0 - AD7
(Top Byte)
AD0
AD1
AD2
AD3
AD4
AD5
AD6
AD7
1D
IC6
IC7
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A 0/32767
EN
M
EN1
G1
R/W
EN3
D0
D1
D2
D3
D4
D5
D6
D7
notCE
IC5
RnotW
IC4
L2
L3
IC9
G3
EN1
EN2
F245
Proc
ClockOut
IC3
R
C1
F164
&
1D
IC2
EN
G 0/7
F251
R1
R3
R4
SW1/3
SW1/2
SW1/1
Wait

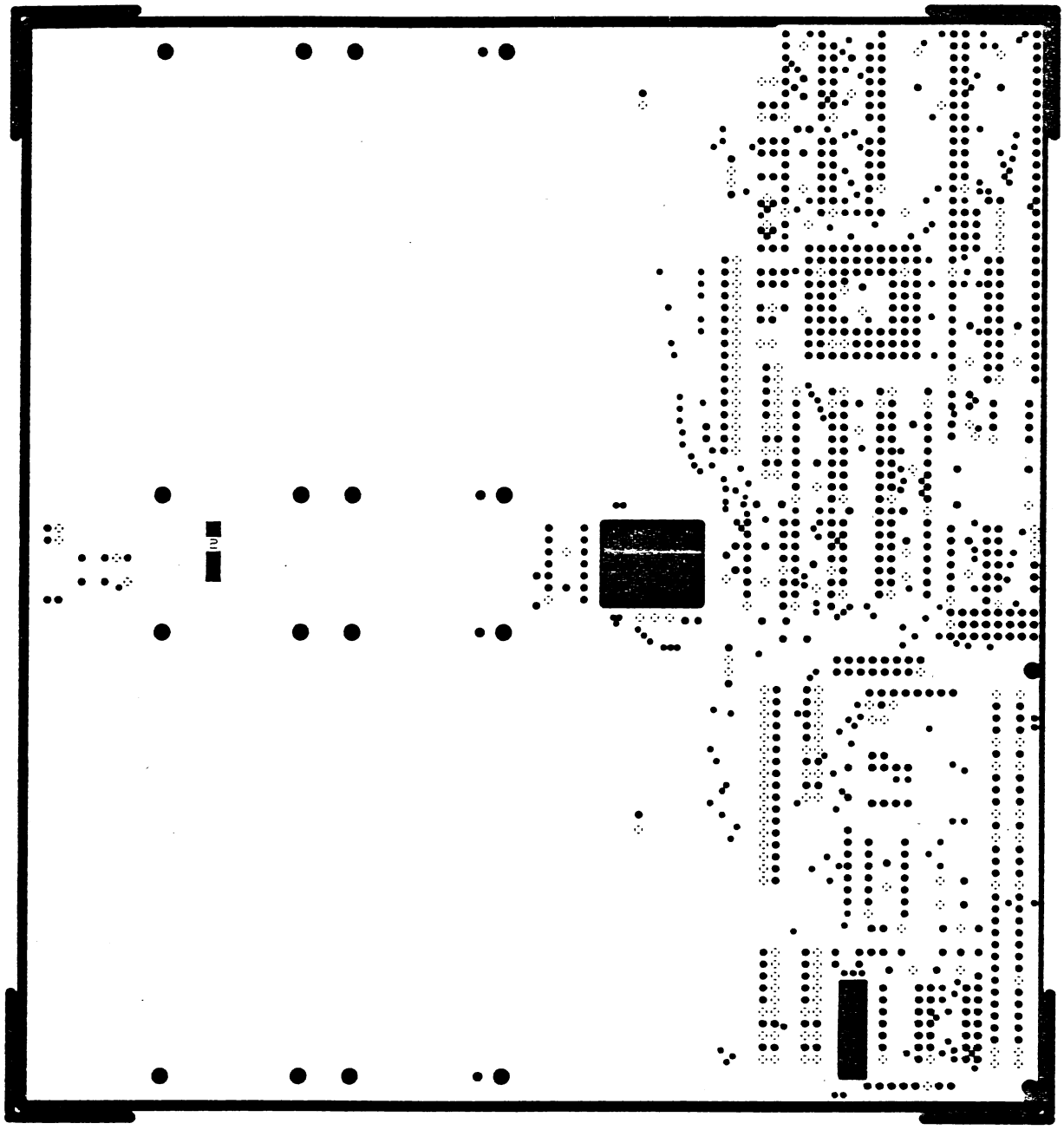

RP2d
RP2c
RP2b
SW2/3
SW2/2
SW2/1
RP3e
RP3b
RP3f
IC10
G3
EN1
EN2
LS641-1
PA0 notDS1
PA1 notDS2
PA2 notDS3
PA3 notDS4
PA4 notHS0
PA5 notHS1
PA6 notHS2
PA7 notMotorOn
IC11
R33
PB0 notRWC
PB1 notStep
PB2 notDirectionIn
PB3 notSeekComplete
PB4 notTrack000
PB5 notReady
PB6 notWriteFault
PB7 notWriteProtect
RP1a
L1
notFlopInUse
notIndex
notDS4
notDS3
notMotorOn
notDirectionIn
notStep
notFlopWriteData
notWriteGate
notTrack000
notWriteProtect
notFlopReadData
notHS0
notReady
JF
notRWC
notHS2
notWriteGate
notSeekComplete
notTrack000
notWriteFault
notHS0
notHS1
notIndex
notReady
notStep
notDS1
notDS2
notDS3
notDS4
notDirectionIn
JW
RP4c
RP4f
RP4g
RP4d
R13
RP4e
R15
notWriteGate
IC12
notWriteData
IC4
notIndex
RP5c
RP5f
RP5g
RP5d
R17
RP5e
R16
IC16
IC15
Read Data
>=1
&
IC14
L4
L5
IC18
RP6d
R25
RP6e
RP6f
DriveSelected
WriteData+B
WriteData-B
ReadData+B
ReadData-B
WriteData+D
WriteData-D
ReadData+D
ReadData-D
WriteData+A
WriteData-A
ReadData+A
ReadData-A
WriteData+C
WriteData-C
ReadData+C
ReadData-C
IC13
R35
R18
R14
R34
JDB
JDD
JDA
JDC


IC4
notFlopInUse
PhaseUp
PhaseDown
Vin
R9
R10
R11
R8
C15
Q2
Q1
C14
R12
C16
C13
R5
C12
Early
Late
R7
R6
C11
RP1g
RP1e
R2
BootFromROM
LinkSpeed
DisableInternalROM
SW2/6
SW2/4
SW1/4
Link0Out
Link1Out
R22
R21
c9
a9
ClockIn
5MHz
Xtal1
20MHz
Xtal2
16MHz
IC17
notFlopInUse
WriteClock
D1
Link0In
R20
c10
D2
Link1In
R19
a10
SW3
R24
C30
R26
RP7d
Analyse
IC20
IC19
UpNotAnalyse
DownNotAnalyse
LED1
+12V
R32
SW4
R23
C31
R27
D3
RP7b
Reset
UpNotReset
DownNotReset
LED2
Error
IC19
LED3
RP7f
RP7a
DownNotError
IC20
UpNotError

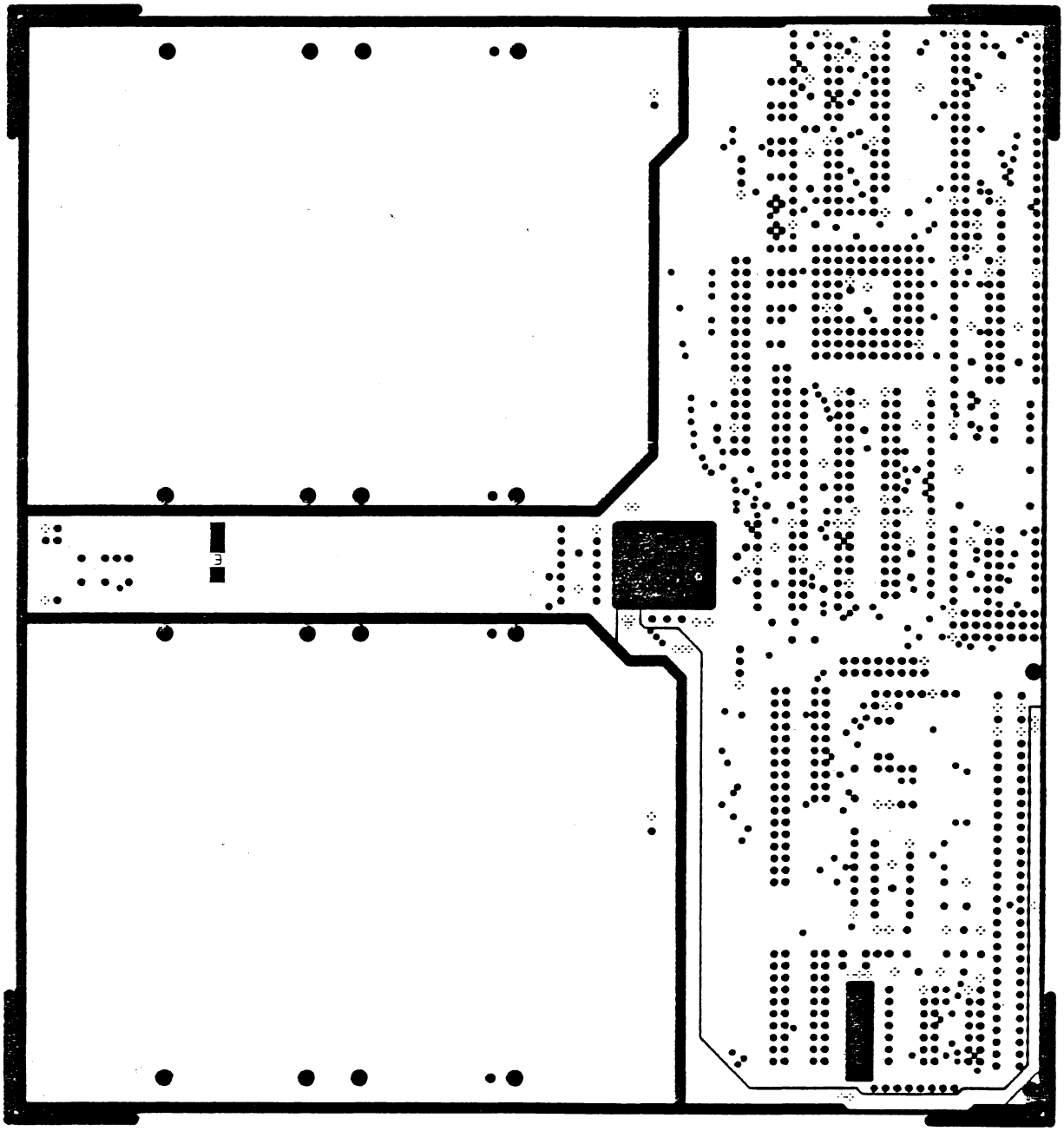

1 2 3 4 5 6 7 8 9 10
A BootFrom Rom | CapPlus | ClockIn | HoldTo GND | LinkOut0 | LinkIn0 | LinkIn1 | Link Speed | EventAck | PB7
B VCC | Analyse | CapMinus | Error | ProcClock Out | LinkOut1 | EventReq | HoldTo GND | PB5 | PB4
C AD6 | AD7 | Reset | PB6 | PB2 | PB1
D AD5 | AD4 | PB3 | PB0
E AD3 | AD2 | VCC | PA7
F AD1 | AD0 | PA5 | PA6
G notCE | RnotW | PA2 | PA4
H ALE | GND | A6 | Vin | GND | PA3
J Wait | A5 | A3 | A1 | DisInt ROM | Late | ReadData | Phase Up | Phase Down | PA1
K A7 | A4 | A2 | A0 | Write Clock | notWrite Gate | Early | notWrite Data | notIndex | PA0
Index
M212 68 Pin Grid Array
Top View



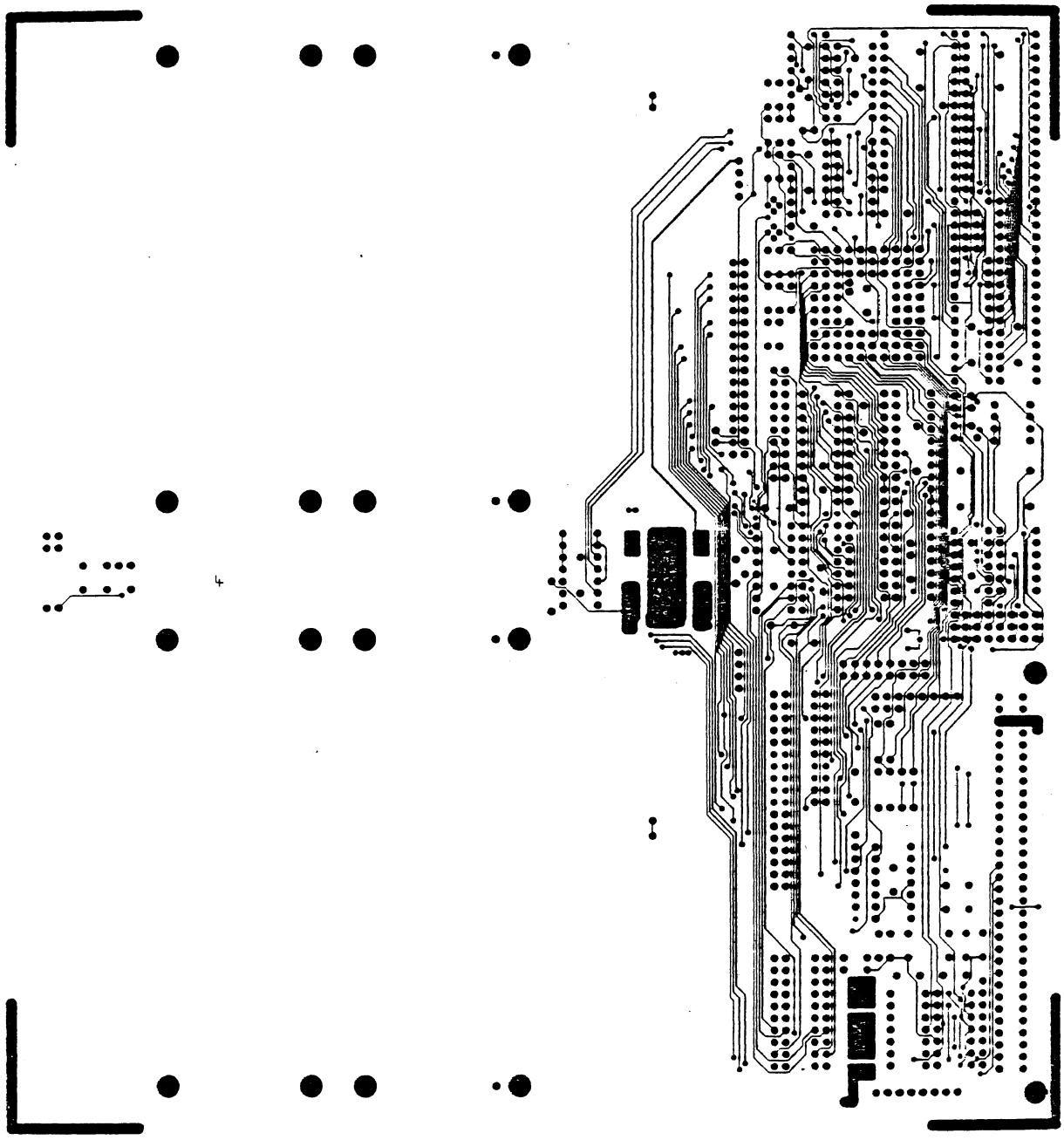
Component side



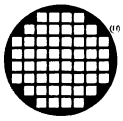
GND plane



VCC plane



Solder side



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