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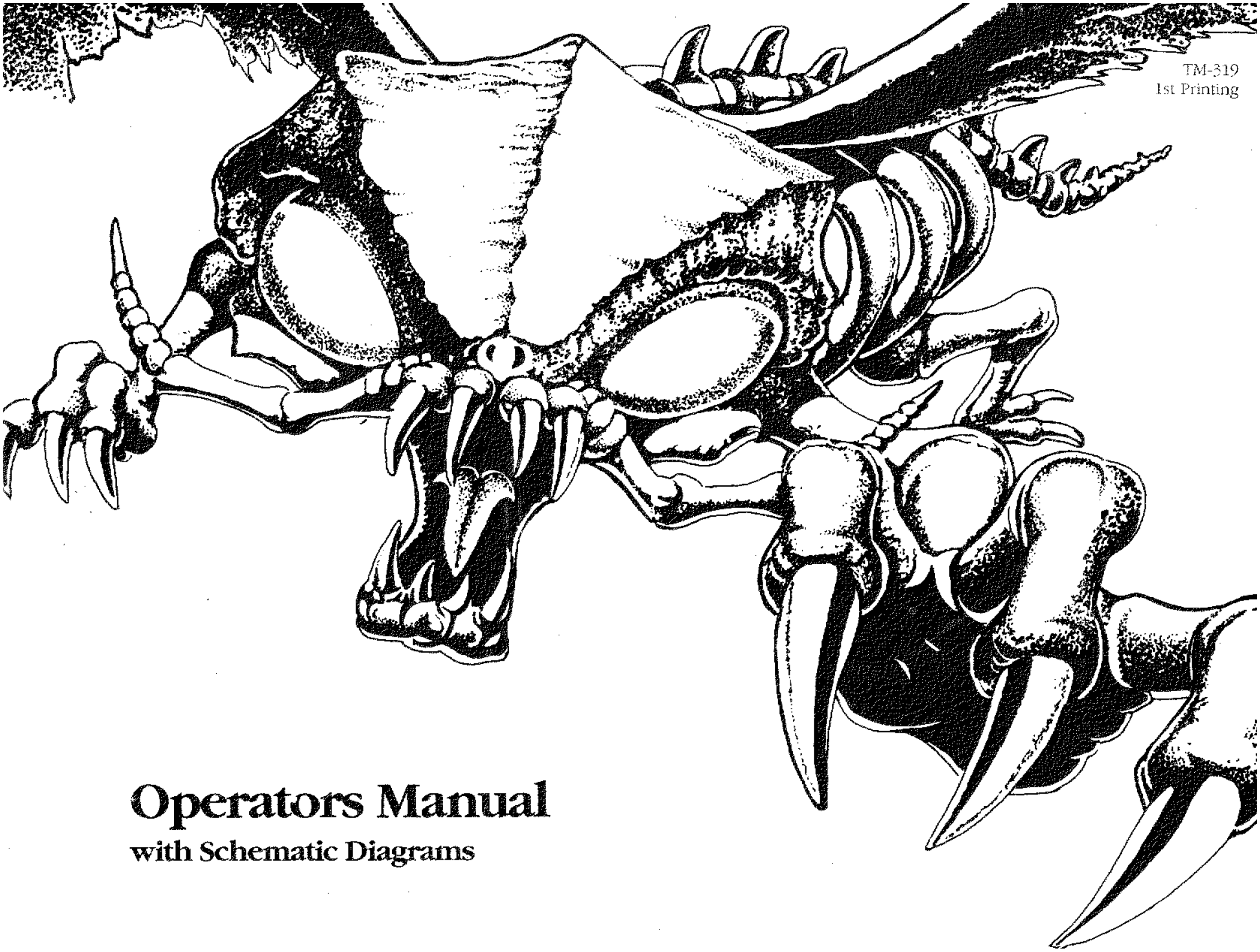

Operators Manual

with Schematic Diagrams

Galaga '88

ATARI®
GAMES

*Galaga '88 is engineered and designed by Namco Ltd.
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Galaga '88*

Operators Manual

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Chapter 1 Set-Up

How to Use This Manual

This manual is written for game operators and service personnel, and provides information for setting up, playing, testing, and maintaining your Galaga '88 game. The manual is divided into the following chapters:

- Chapter 1 contains set-up and game play information.
- Chapter 2 contains self-test procedures.
- Chapter 3 contains conversion procedures.
- Chapter 4 contains the kit parts list and the game PCB parts list.

Table 1 Game Specifications

Characteristic	Specification
Power Consumption	124 V-A at 120 V
Temperature	+5° to +38° C (+37° to +100°F)
Humidity	Not to exceed 95% relative
Line Voltage	102 to 132 VAC, 60 Hz (U.S. games)
Width	26.75 in. (70 cm)
Depth	34.38 in. (87 cm)
Height	70 in. (178 cm)

Game Play

This section of the manual describes the theme of the Galaga '88 game and the game play features.

Introduction

Galaga '88 is an updated version of the old favorite, Galaga, with more invaders and more player firepower. Galaga '88 gives players a chance to once again repel the invaders from the Galagan Kingdom. One or two players can try their hand at fighting the invaders. This time the Galagans have four more allies, each with unique weapons and defenses that a player must overcome.

By destroying special enemies or obstacles the player can get "items." When a player has two items, he can warp to another sector to confront more Galagan ships with new strategies. In the Challenge Rounds, the player shoots down as many invaders as possible as the Galagans dance to a waltz, tango, march or jazz tune.

Attract Mode

In the attract mode, the game cycles through the title screen, the high score screen, and game play screens that give hints for playing Galaga '88.

Game Play

The player selects single or dual ship power. The objective is to destroy all the Galagan foes in each of the 29 sectors of the galaxy, with each sector more difficult than the last.

Unique Features

- **More opponents.** In addition to Boss, Goei and Zago, the orginal Galagan crew, Don, Nin, Ban, and Gan have been added. Each of the Galagans has a unique way of challenging the players.
- **Different types of ships.** Players can choose single or dual ships (if the game option is set for dual and single). When the player retrieves a dual ship from the Boss's tractor beam, it turns into a triple ship with ten times the power of a single ship.
- **Challenge Rounds**. In the Galaga '88 Challenge Rounds the Galagan invaders dance to a waltz, tango, Sousa march or jazz tune, while the player shoots down Galagans to earn bonus points.
- **Warping to a new sector.** By destroying particular enemies or obstacles and capturing two of their items, the player can warp to the next sector.
- **Player challenge.** Each sector has different mix of Galagans with different strategies to be overcome.
- **Win back captured ships.** The player can win back ships captured in the Boss Galaga's tractor beam. When the player destroys the Boss, the ships are released. If the player retrieves them, the ships become dual ships if they were single and triple if they were double.
- **High Score Mode.** Upon completing a game, a player can enter his initials if he is among the top eight scorers on the game.

Maximizing Earnings

The key to maximum earnings is striking a midpoint on game times. Game times must be short enough so that player turnover is high. Conversely, game times must be long enough to give a player a good value and insure repeat play (repeat play is crucial to longevity). Galaga '88 gives the operator the flexibility to tune game difficulty and enough statistics to make adjustments.

If collections seem low or are dropping off, first check all player controls and coin mechanisms for proper operation.

The options below help insure shorter game play time with maximum game revenue, as well as longevity at any location by generating continuous player interest.

- **Game continue option.** Allows the player to continue at the last stage completed at the end of a game.
- **Five difficulty levels of game play.** Select the level you need for your location.
- **Four extended play selections.** Choose at what point level the player is permitted to continue the game.
- **Number of Fighters.** Choose the number of fighters (or lives) the player receives at the beginning of each game.

Chapter 2 Self-Test

The Galaga '88 game has two ways to enter the Self-Test mode. If you turn on the self-test switch, and then turn on the game power, a RAM/ROM test is performed before you enter the Self-Test. If you turn on the self-test switch when the game is in the Attract Mode, you go directly to the Self-Test. If you turn off the self-test switch, the game returns to the Attract mode.

For more information on entering the self-test, the self-test screens and the RAM/ROM tests, see your Pac-Mania* or Dragon Spirit* operator's manual.

The Game Options and the A.D.S. screens have been changed for the Galaga '88 game and are described below.

Game Options Screen

The Game Options, shown in Table 2, indicates the current settings of the coin and game options, and lets you change these settings. This table shows the options and the default (recommended) settings.

A.D.S. Screens

To see the A.D.S. (Auto Data Sampling) Screen, turn DIP switches 3 and 5 on while the game is in the Attract mode.

The game automatically gathers the information for the A.D.S. screens. You do not need to set any switches. The game resets the data screen after each time you leave the A.D.S screens.

The first screen shows the following statistics:

- On Time—The time the game has been turned on in hours, minutes, and seconds.
- Play Time—The time the game has been played in hours, minutes, and seconds.
- Games—Total number of games played. Each game is the time between the first player starting and both players dying, regardless of time or number of quarters inserted.
- 1P Games—Total games played as one-player games.
- 2P Games—Total games played as two-player games.
- High Score—Highest player score.

The second screen shows the length of all games played.

Table 2 Game Option Settings

Option Name	Available Settings
Coins to start (Coin Mech 1)	1♦, 2, 3, 4, 5, 6, 7, 8, 9 Coin(s) for 1♦, 2, 3, 4, 5, 6, 7, 8, 9 Credits
Coins to start (Coin Mech 2)	1♦, 2, 3, 4, 5, 6, 7, 8, 9 Coin(s) for 1♦, 2, 3, 4, 5, 6, 7, 8, 9 Credits
Music in attract mode	Sound On♦ Sound Off
Cabinet type	A B C♦
Video display orientation (flip)	On♦ Off
Fighters (lives)	1, 2, 3♦, 4, 5
Extended play granted at:	A (1st @ 50,000 points; 2nd @ 140,000: 3rd @ 300,000; 4th @ 480,000) B (1st @ 40,000; 2nd @ 120,000); 3rd @ 240,000; 4th @ 360,000) C (1st @ 40,000; 2nd @ 120,000); 3rd @ 240,000)♦ D (1st @ 50,000; 2nd @ 140,000)
Game difficulty (rank)	A (Easiest) B (Easier) C (Medium) D (Harder)♦ E (Hardest)
Game continuation	On♦ Off
Fighter selector	On (Single & Dual)♦ Off (Single Only)

♦ *Manufacturer's recommended settings*

**These games are engineered and designed by Namco Ltd. Manufactured by Atari Games. Trademark © Namco 1987.*

Chapter 3 Game Conversion

Remove the Control Panel

> **WARNING**
>
> To avoid electrical shock, turn off the game before performing any maintenance procedures.

1. Unlock and open the upper coin door.
2. Reach up through the upper coin door opening and release the two spring draw latches located under the control panel on each side of the cabinet.
3. Grasp the control panel on the top edge (next to the display shield) and tilt the panel up slightly. Remove the panel from the front edge of the cabinet. Stand the control panel on its back edge by placing it in the wood slots located under the control panel on each side of the cabinet.
4. Disconnect the control harness connector from the Game PCB and disconnect the green ground wire.
5. Lift the control panel from the cabinet.

Disassemble the Control Panel

1. Disconnect the wiring harness from all of the switches and the joystick.
2. Use a 15/16-inch open-end wrench to remove the stamped nuts holding the pushbutton leaf switches on the control panel.
3. With a 3/8-inch nut driver, remove the lock nuts that hold the joystick assembly on the control panel.
4. Remove the one- and two-player start switches. Hold the black bezel on the player side and turn the switch underneath counterclockwise.

Remove the Decal

1. After you remove the hardware from the control panel, remove the decal.

> **CAUTION**
>
> Do the following procedure on a clean work surface so you do not get dirt on the surface of the control panel.

2. Start heating the decal in one corner with a heat gun or hair dryer. Pull up gently on that corner. Do not melt the decal! By applying heat and gently pulling up on the decal, you should be able to peel the decal off. (You can remove the decal without heating it, but it is more difficult.)

Apply the New Decal

1. Clean the control panel to remove any adhesive that is still on it. Use a lint-free cloth (**not** a paper towel) wetted with isopropyl alcohol to remove the adhesive. Clean the control panel as many times as necessary to remove any remaining adhesive.
2. Position the Galaga '88 decal so that the holes in the decal line up with the holes in the control panel.

> **NOTE**
>
> If you have a Dragon Spirit game, the two 1-3/16-inch holes for the bomb pushbuttons will be covered by the Galaga '88 decal. (See Figure 1.) Hole plugs are provided for these holes, but first install the decal.

3. Start attaching the decal by peeling off the backing on the top long edge of the decal. Keeping the holes lined up, and keeping the top edge straight, press the decal down. Continue peeling off the backing and pressing the decal down on the control panel.

Install Hole Plugs (for Dragon Spirit Games)

1. After the decal is completely attached, turn the control panel over. Use a sharp knife and cut out the decal over the two decal-covered pushbutton holes.
2. Push a hole plug into each hole from the front of the control panel. (See Figure 1.) Bend the tabs in each hole plug until they are flat against the control panel. This will keep the plugs from being pried out.

Install the Control Panel Hardware

1. Put the two pushbutton switches back into the holes. Tighten each stamped nut with a 15/16-inch open-end wrench.

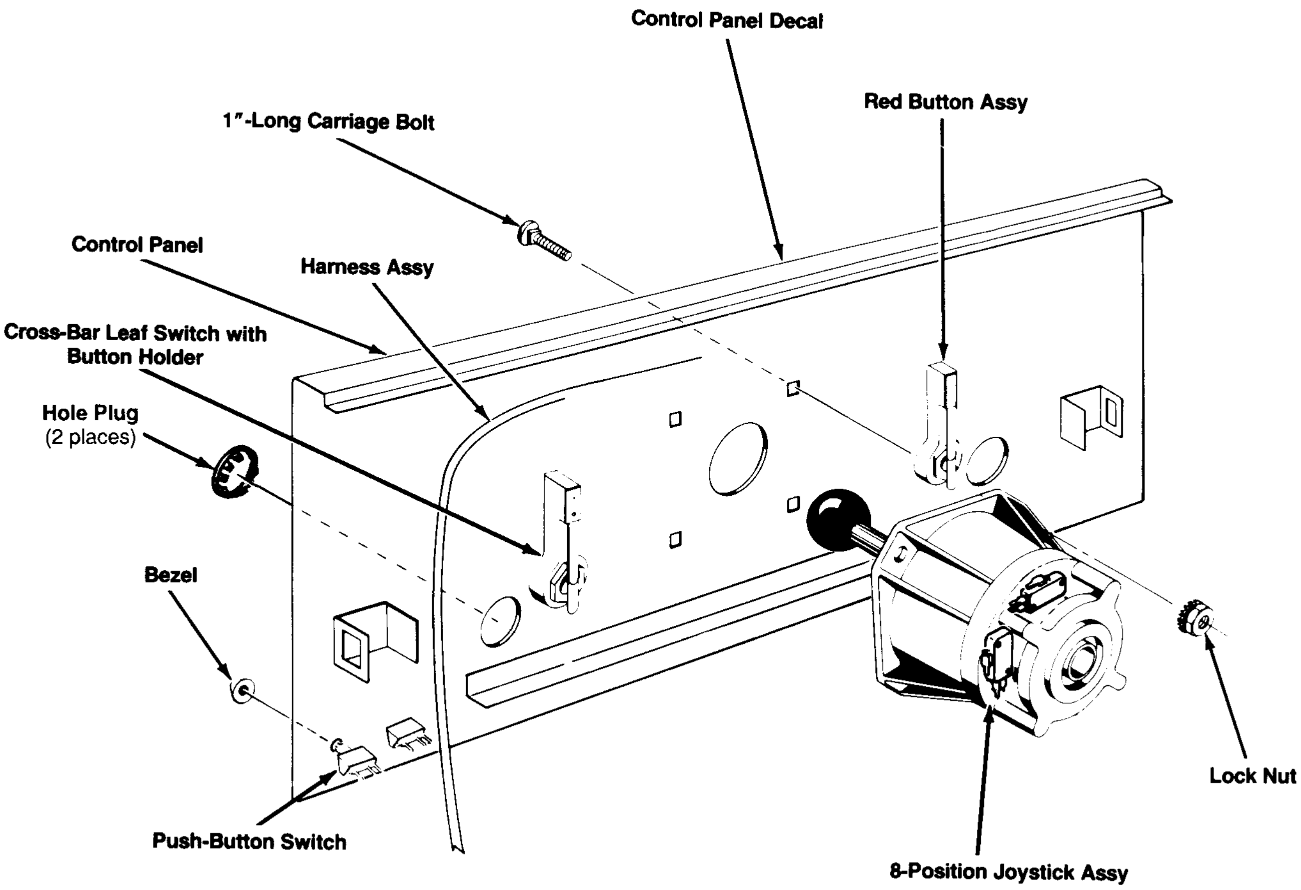

Control Panel Decal
Red Button Assy
1″-Long Carriage Bolt
Control Panel
Harness Assy
Cross-Bar Leaf Switch with Button Holder
Hole Plug (2 places)
Bezel
Push-Button Switch
Lock Nut
8-Position Joystick Assy

Figure 1 Converted Dragon Spirit Control Panel

2. Put the bezels for the 1- and 2-player switches back on the control panel and screw the pushbuttons back into them.
3. Put the joystick back on the control panel, and use a 3/8-inch wrench to tighten the four nuts that hold the joystick on the control panel.
4. Reconnect the harness wiring to the switches and the joystick (**Dragon Spirit games only:** Using tie wraps, tie back the wiring for the two switches you removed.) Reconnect the green ground wire.
5. Put the 24-inch strip of black adhesive-backed tape on the edge of the control panel where the control panel rests against the display shield.

Install the New Bezel

Two bezel pieces are included in your conversion kit. Each piece has covered tape on the back at one end. This tape attaches to the opposite side of the other bezel piece. See Figure 2.

1. Peel the cover off the tape on one bezel piece. Attach the tape the other bezel piece end without tape on it. Connect the other ends.
2. Remove the control panel as described above.
3. Remove the video display shield.
4. Remove the existing bezel from the foam tape that holds it in place.
5. Install the Galaga '88 bezel. Use the pieces of white foam tape in the kit to attach it to the game.
6. Replace the video display shield.
7. Install the control panel.

Change the Attraction Graphics

1. Turn off the game power.
2. Remove the three screws in the retainer on the top of the cabinet. Remove the retainer.
3. Remove the attraction shield. The shield has foam tape on the front and back edges.

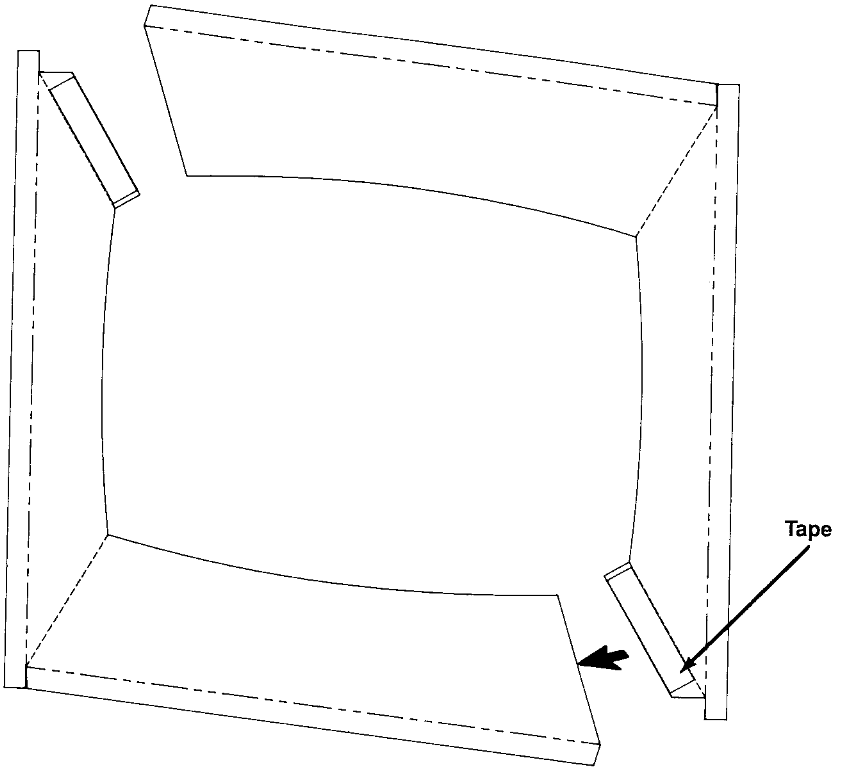


Figure 2 Constructing the Bezel

4. Remove the old attraction graphics film and discard it.
5. **Pac-Mania Games Only:** Discard the Pac-Mania attraction shield and replace it with the shield included in the Galaga '88 kit.
6. Slide the attraction shield into place.
7. Put the Galaga '88 attraction graphics film over the shield.
8. Put on the retainer over the attraction graphics and tighten the the three screws holding the retainer.

Remove the Game PCB

1. Turn the cabinet power off.
2. Unlock and remove the front access panel from the cabinet.
3. Disconnect the harness connectors from the End PCB.

CAUTION

We recommend that only a qualified service technician convert the Game PCB. The PC board and the IC sockets can be easily damaged.

4. Use a Phillips screwdriver to remove the screws and washers holding the Game and End PCBs to the cabinet.
5. Holding the front edge of the Game PCB, slide it forward out of the slotted guide.

Convert the Game PCB

1. Put the game board set on a work bench with the larger ROM PCB (the Game PCB) facing up.

CAUTION

If you reverse the direction of any ROMs you can destroy them and perhaps destroy the PC board as well.

2. Remove the dust accumulated on the PC board by using compressed air or a soft brush.
3. Assemble the ROMs as listed in Table 3.
4. Figure 3 shows what ROMs must be removed, added, and replaced. Pac-Mania board changes are indicated by **R** for replace and **A** for add. Dragon Spirit board changes are indicated by ℛfor replace, 𝒜 for add and 𝒟for delete.
5. Remove the Pac-Mania and Dragon Spirit ROMs indicated in Figure 4. Using the number stamped on the Galaga '88 ROMs, Table 3, and Figure 3, replace and add the Galaga '88 ROMs to the board. Be sure that all the ROMs are oriented the correct way.
6. Insert the ROM from the right end of the socket.

Table 3 Game PC Board ROMs for Galaga '88

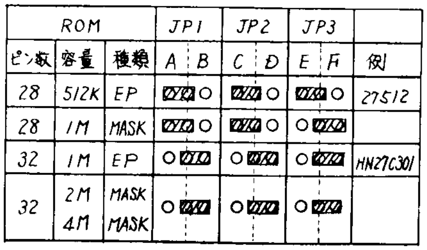
Location	Description	Part No.	Location	Description	Part No.
A4	IC, EPROM, Galaga '88, VOI-0	136062-1119	E9	IC, ROM, Galaga '88, OBJ-2,	136062-1110
B4	IC, EPROM, Galaga '88, VOI-1	136062-1120	F9	IC, ROM, Galaga '88, OBJ-3	136062-1111
E4	IC, EPROM, Galaga '88, VOI-2	136062-1121	H9	IC, ROM, Galaga '88, OBJ-4	136062-1112
F4	IC, EPROM, Galaga '88, VOI-3	136062-1122	K9	IC, ROM, Galaga '88, OBJ-5	136062-1113
H4	IC, EPROM, Galaga '88, VOI-4	136062-1123	A10	IC, EPROM, Galaga '88, SND-0	136062-1106
K4	IC, EPROM, Galaga '88, VOI-5	136062-1124	B10	IC, EPROM, Galaga '88, SND-1	136062-1107
A8	IC, ROM, Galaga '88, CHR-0	136062-1114	F10	IC, Custom, 153	99-090358
B8	IC, ROM, Galaga '88, CHR-1	136062-1115	H10	IC, EPROM, Galaga '88, PRG-0	136062-1101
E8	IC, ROM, Galaga '88, CHR-2	136062-1116	K10	IC, EPROM, Galaga '88, PRG-1	136062-1102
F8	IC, ROM, Galaga '88, CHR-3	136062-1117	P10	IC, EPROM, Galaga '88, PRG-5	136062-1103
U8	IC, ROM, Galaga '88, CHR-8	136062-1118	S10	IC, EPROM, Galaga '88, PRG-6	136062-1104
A9	IC, ROM, Galaga '88, OBJ-0	136062-1108	T10	IC, EPROM, Galaga '88, PRG-7	136062-1105
B9	IC, ROM, Galaga '88, OBJ-1	136062-1109			

When you plug in the ROM, be sure that none of the pins are bent or broken.

7. Check to be sure that the jumpers are oriented as shown in Figure 3.

Replace the Game PCB

1. Before reinstalling the board, check the orientation and location of each ROM to be sure it is inserted correctly.
2. Connect the End and Game PCBs together.
3. Holding the front edge of the Game PCB, slide it into the slotted guide in the cabinet.
4. Connect the harness connectors to the End PCB.
5. Use a Phillips screwdriver to tighten the screws and washers holding the Game and End PCBs to the cabinet.
6. Be sure that the top PCB is fully inserted into the bottom PCB edge connectors and that the ground strap is properly connected to the ground plane.



ROM			JP1	JP2	JP3	
ピン数	容量	種類	A ¦ B	C ¦ D	E ¦ F	例
28	512K	EP	▨▨ ○	▨▨ ○	▨▨ ○	27512
28	1M	MASK	▨▨ ○	▨▨ ○	○ ▨▨	
32	1M	EP	○ ▨▨	○ ▨▨	○ ▨▨	HN27C301
32	2M 4M	MASK MASK	○ ▨▨	○ ▨▨	○ ▨▨	

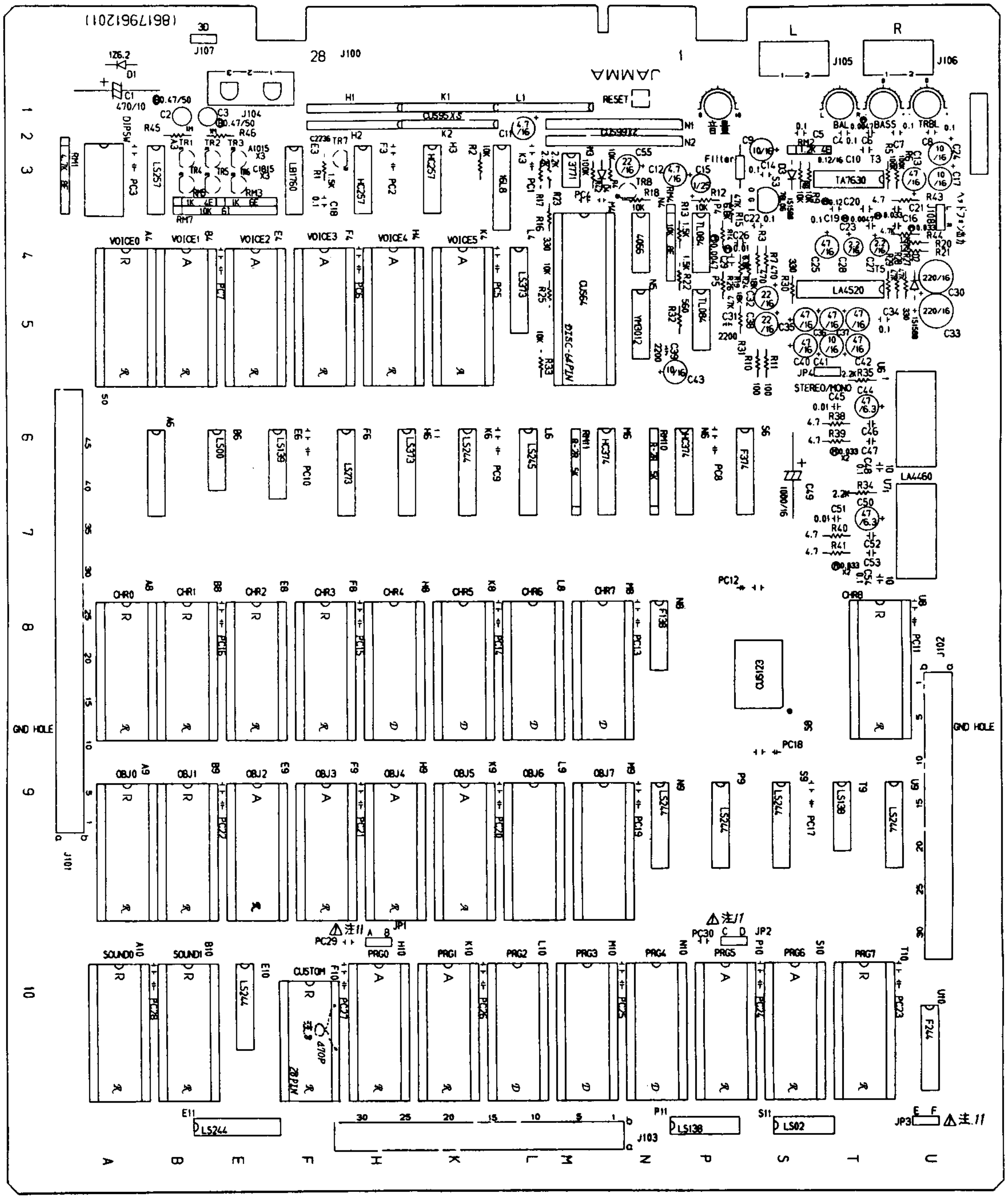
Figure 3 Jumper Orientation

Table 4 RAM/ROM Error Messages

Error Message	Possible Bad Integrated Circuit
ROM 0 Error	ROM at location H10 on the ROM PCB
ROM 1 Error	ROM at location K10 on the ROM PCB
ROM 2 Error	ROM at location L10 on the ROM PCB
ROM 3 Error	ROM at location M10 on the ROM PCB
ROM 4 Error	ROM at location N10 on the ROM PCB
ROM 5 Error	ROM at location P10 on the ROM PCB
ROM 6 Error	ROM at location S10 on the ROM PCB
ROM 7 Error	ROM at location T10 on the ROM PCB
RAM 1 Error*	RAM at location B2, D2, or E2 on the CPU PCB
RAM 2 Error	RAM at location D6 or E6 on the CPU PCB
RAM 3 Error	RAM at location S5 on the CPU PCB
RAM 4 Error	RAM at location H1 on the CPU PCB
RAM 5 Error	RAM at location L5 on the CPU PCB
RAM 6 Error*	RAM at location B2, D2, or E2 on the CPU PCB
RAM 7 Error	RAM at location D6 or E6 on the CPU PCB
I/O Error 64**	RAM at location H1 on the CPU PCB, or the I/O Processor at location M4 on the ROM PCB

**Either of these error messages may be accompanied by a four-digit number. Look at the first of the four lines and ignore the bottom three lines. Also ignore the fact that the entire screen may be upside down. This four-digit number may indicate one specific integrated circuit is bad, as follows:*
If the number is between 0002 and 0802, this indicates location B2.
If ABCD is between 0804 and 1002, this indicates location D2.
If ABCD is between 1004 and 1802, this indicates location E2.

***If this error message is accompanied by a four-digit number, look at its left two digits. If those digits are 02, this indicates the RAM at location H1 is bad. If those digits are not 02, this indicates the I/O Processor at location M4 is bad.*


JAMMA
J100
J101
J102
J103
J104
J105
J106
J107
L
R
RESET
VOICE0
VOICE1
VOICE2
VOICE3
VOICE4
VOICE5
CHR0
CHR1
CHR2
CHR3
CHR4
CHR5
CHR6
CHR7
CHR8
OBJ0
OBJ1
OBJ2
OBJ3
OBJ4
OBJ5
OBJ6
OBJ7
SOUND0
SOUND1
CUSTOM
PRG0
PRG1
PRG2
PRG3
PRG4
PRG5
PRG6
PRG7
GND HOLE
GND HOLE
STEREO/MONO
JP1
JP2
JP3
LA4460
LA4520
TA7630
YM3012
CUS64
A
B
E
F
H
K
L
M
N
P
S
T
U
1
2
3
4
5
6
7
8
9
10

Explanation of Symbols

Letter	Meaning
A	Add ROM to Pac-Mania board.
R	Replace ROM on Pac-Mania board.
𝒜	Add ROM to Dragon Spirit board.
ℛ	Replace ROM on Dragon Spirit board.
𝒟	Delete and remove ROM from Dragon Spirit board.

Figure 4 Game Board Conversion

Chapter 4 Illustrated Parts Lists

Galaga '88 Conversion Kit
(A045166-01)
Parts List

Part No.	Description
038158-01	Product ID Label
044827-01	Attraction Shield
045167-01	Attraction Film with Graphics
045168-01	Control Panel Decal
045169-01	Half Bezel for Video Display
136062-1101	IC, EPROM, Galaga '88, PRG-0, H10
136062-1102	IC, EPROM, Galaga '88, PRG-1, K10
136062-1103	IC, EPROM, Galaga '88, PRG-5, P10
136062-1104	IC, EPROM, Galaga '88, PRG-6, S10
136062-1105	IC, EPROM, Galaga '88, PRG-7, T10
136062-1106	IC, EPROM, Galaga '88, SND-0, A10
136062-1107	IC, EPROM, Galaga '88, SND-1, B10
136062-1108	IC, ROM, Galaga '88, OBJ-0, A9
136062-1109	IC, ROM, Galaga '88, OBJ-1, B9
136062-1110	IC, ROM, Galaga '88, OBJ-2, E9
136062-1111	IC, ROM, Galaga '88, OBJ-3, F9
136062-1112	IC, ROM, Galaga '88, OBJ-4, H9
136062-1113	IC, ROM, Galaga '88, OBJ-5, K9
136062-1114	IC, ROM, Galaga '88, CHR-0, A8
136062-1115	IC, ROM, Galaga '88, CHR-1, B8
136062-1116	IC, ROM, Galaga '88, CHR-2, E8
136062-1117	IC, ROM, Galaga '88, CHR-3, F8
136062-1118	IC, ROM, Galaga '88, CHR-8, U8
136062-1119	IC, EPROM, Galaga '88, VOI-0, A4
136062-1120	IC, EPROM, Galaga '88, VOI-1, B4
136062-1121	IC, EPROM, Galaga '88, VOI-2, E4
136062-1122	IC, EPROM, Galaga '88, VOI-3, F4
136062-1123	IC, EPROM, Galaga '88, VOI-4, H4
136062-1124	IC, EPROM, Galaga '88, VOI-5, K4
99-090358	IC, Custom, 153, F10
178225-001	1-13/16-inch Diameter Control Panel Hole Plug
78-6900402	1/4-Inch-Wide x 1/8-Inch-Thick Foam Tape
TM-319	Galaga '88 Operator's Manual (includes game self-test label and card for ordering side-panel decals)

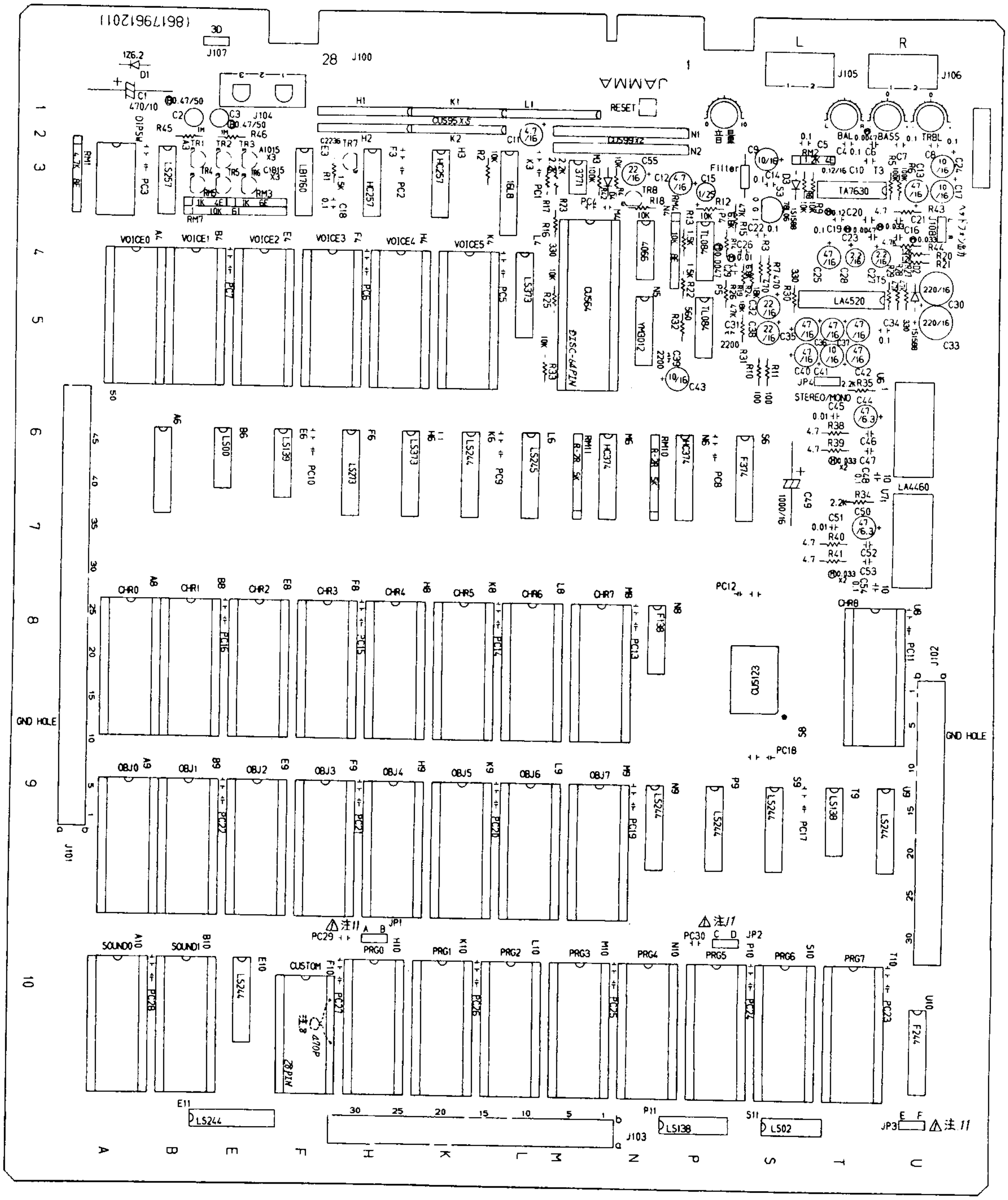

JAMMA
RESET
J100
J101
J102
J103
J104
J105
J106
J107
L
R
BAL
BASS
TRBL
Filter
STEREO/MONO
TA7630
LA4520
LA4460
CUS64
CUS95
CUS99
CUS121
CUS123
YM2012
4066
TL084
LS257
LB1760
HC257
16L8
LS373
LS00
LS139
LS273
LS244
LS245
HC374
F374
F138
LS138
LS502
F244
VOICE0
VOICE1
VOICE2
VOICE3
VOICE4
VOICE5
CHR0
CHR1
CHR2
CHR3
CHR4
CHR5
CHR6
CHR7
CHR8
OBJ0
OBJ1
OBJ2
OBJ3
OBJ4
OBJ5
OBJ6
OBJ7
SOUND0
SOUND1
CUSTOM
PRG0
PRG1
PRG2
PRG3
PRG4
PRG5
PRG6
PRG7
JP1
JP2
JP3
JP4
GND HOLE
A
B
E
F
H
K
L
M
N
P
S
T
U
1
2
3
4
5
6
7
8
9
10

Figure 5 Galaga '88 ROM PCB Assembly
99-090359

Galaga '88 ROM PCB Assembly
Parts List

Part Number	Description
	Integrated Circuits
99-090108	IC, 74LS00
99-090117	IC, 74LS138
99-090118	IC, 74LS139
99-090124	IC, 74LS245
99-090125	IC, 74LS257
99-090126	IC, 74LS273
99-090127	IC, 74LS373
99-090128	IC, 74LS374
99-090132	IC, 74HC257
99-090155	IC, Custom 95
99-090157	IC, Custom 99
99-090158	IC, DAC, YM3012
99-090160	IC, Power Amplifier, LA4460
99-090244	IC, 74LS244
99-090246	IC, 4066
99-090248	IC, Op-Amp, TL084CN
99-090312	IC, 74F02
99-090313	IC, 74F138
99-090314	IC, 74F244
99-090315	IC, 74F374
99-090316	IC, 74HC374
99-090317	IC, Custom 64
99-090318	IC, Custom 123
99-090319	IC, PAL, 16L8B-2
99-090320	IC, 78L06
99-090321	IC, LA4520
99-090322	IC, TA7630
99-090323	IC, LB1760
99-090324	IC, MB3771
99-090358	IC, Custom 153, F10
136062-1101	IC, EPROM, Galaga '88, PRG-0, H10
136062-1102	IC, EPROM, Galaga '88, PRG-1, K10
136062-1103	IC, EPROM, Galaga '88, PRG-5, P10
136062-1104	IC, EPROM, Galaga '88, PRG-6, S10
136062-1105	IC, EPROM, Galaga '88, PRG-7, T10
136062-1106	IC, EPROM, Galaga '88, SND-0, A10
136062-1107	IC, EPROM, Galaga '88, SND-1, B10
136062-1108	IC, ROM, Galaga '88, OBJ-0, A9
136062-1109	IC, ROM, Galaga '88, OBJ-1, B9
136062-1110	IC, ROM, Galaga '88, OBJ-2, E9
136062-1111	IC, ROM, Galaga '88, OBJ-3, F9
136062-1112	IC, ROM, Galaga '88, OBJ-4, H9
136062-1113	IC, ROM, Galaga '88, OBJ-5, K9
136062-1114	IC, ROM, Galaga '88, CHR-0, A8

Galaga '88 ROM PCB Assembly
Parts List, Continued

Part Number	Description
136062-1115	IC, ROM, Galaga '88, CHR-1, B8
136062-1116	IC, ROM, Galaga '88, CHR-2, E8
136062-1117	IC, ROM, Galaga '88, CHR-3, F8
136062-1118	IC, ROM, Galaga '88, CHR-8, U8
136062-1119	IC, EPROM, Galaga '88, VOI-0, A4
136062-1120	IC, EPROM, Galaga '88, VOI-1, B4
136062-1121	IC, EPROM, Galaga '88, VOI-2, E4
136062-1122	IC, EPROM, Galaga '88, VOI-3, F4
136062-1123	IC, EPROM, Galaga '88, VOI-4, H4
136062-1124	IC, EPROM, Galaga '88, VOI-5, K4
	Resistors
99-090185	Resistor, SIP, 4.7KΩ x 8, 1/8W
99-090187	Resistor, 4.7Ω , 5%, 1/4W
99-090189	Resistor, 330Ω , 5%, 1/4W
99-090191	Resistor, 470Ω , 5%, 1/4W
99-090192	Resistor, 560Ω, 5%, 1/4W
99-090194	Resistor, 4.7KΩ , 5%, 1/4W
99-090195	Resistor, 6KΩ, 5%, 1/4W
99-090196	Resistor, 10KΩ, 5%, 1/4W
99-090199	Resistor, 1 MΩ , 5%, 1/4W
99-090200	Resistor, 18 KΩ , 5%, 1/4W
99-090253	Resistor, SIP, 5KΩ, X 8
99-090255	Resistor, 100Ω, 5%, 1/4W
99-090257	Resistor, 2.2 KΩ, 5%, 1/4W
99-090261	Resistor, 47 KΩ, 5%, 1/4W
99-090329	Resistor, 1.5 KΩ, 1/4W, 5%
99-090330	Resistor, 12 KΩ, 1/4W, 5%
99-090331	Resistor, 100 KΩ, 1/4W, 5%
99-090332	Resistor, SIP, 1 KΩ, 1/8W
99-090333	Resistor, SIP, 1.2 KΩ, 1/8W
99-090334	Resistor, SIP, 1 KΩ, 1/8W
99-090335	Resistor, SIP, 10 KΩ, 1/8W
99-090336	Resistor, SIP, 10 KΩ, 1/8W
	Diodes
99-090250	Diode, 1S1588
99-090325	Diode, 1S1885
99-090326	Diode, 1Z6.2
	Capacitors
99-090174	Capacitor, Ceramic, 0.01µF, 25V
99-090175	Capacitor, Ceramic, 0.1µF, 25V
99-090269	Capacitor, Electrolytic, 10µF, 16V
99-090270	Capacitor, Electrolytic, 47µF, 16V
99-090337	Capacitor, Ceramic, 2200PF, 25V
99-090338	Capacitor, .0047µF, 50V
99-090339	Capacitor, .033µF, 50V
99-090340	Capacitor, .12µF, 50V

Galaga '88 ROM PCB Assembly Parts List, Continued

Part Number	Description
99-090341	Capacitor, .01µF, 50V
99-090342	Capacitor, 1µF, 25V
99-090343	Capacitor, Electrolytic, 47µF, 66.3V
99-090344	Capacitor, Electrolytic, 470µF, 10V
99-090345	Capacitor, Electrolytic, 2.2µF, 16V
99-090346	Capacitor, Electrolytic, 4.7µF, 16V
99-090347	Capacitor, Electrolytic, 22µF, 16V
99-090348	Capacitor, Electrolytic, 220µF, 16V
99-090349	Capacitor, Electrolytic, 1000µF, 16V
99-090350	Capacitor, Electrolytic, .47µF, 50V
	Inductor
99-090274	Inductor, 100µH, SP0406-101K
	Transistors
99-090310	Transistor, 2SA1015-Y
99-090327	Transistor, 2SC1815
99-090328	Transistor, 2SC2236-Y
	Miscellaneous
99-090351	Potentiometer, 10K
99-090352	Switch, DIP, 8 Circuit

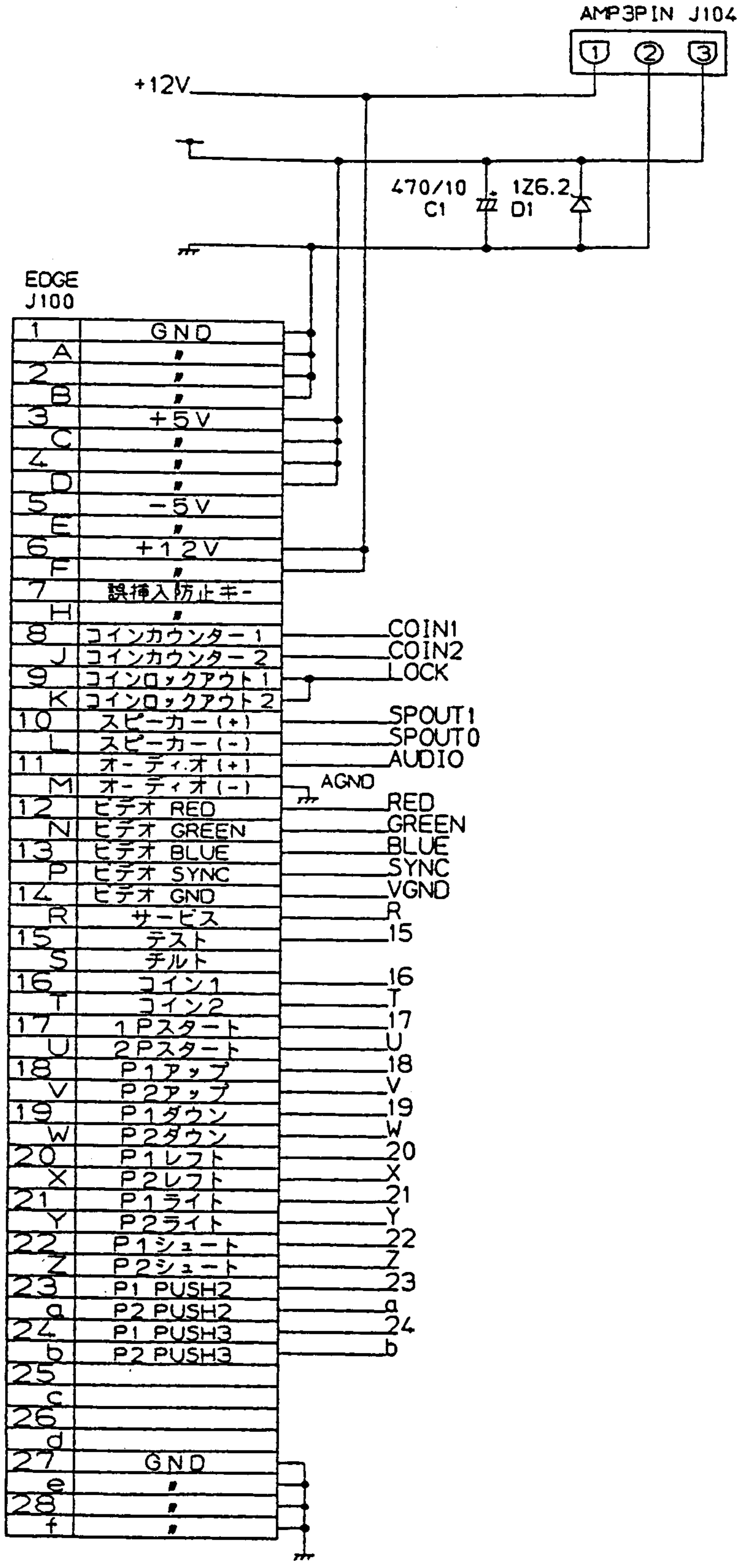

AMP3PIN J104
1
2
3
+12V
470/10
C1
1Z6.2
D1
EDGE
J100
1 GND
A 〃
2 〃
B 〃
3 +5V
C 〃
4 〃
D 〃
5 −5V
E 〃
6 +12V
F 〃
7 誤挿入防止キー
H 〃
8 コインカウンター1 COIN1
J コインカウンター2 COIN2
9 コインロックアウト1 LOCK
K コインロックアウト2
10 スピーカー(+) SPOUT1
L スピーカー(−) SPOUT0
11 オーディオ(+) AUDIO
M オーディオ(−) AGND
12 ビデオ RED RED
N ビデオ GREEN GREEN
13 ビデオ BLUE BLUE
P ビデオ SYNC SYNC
14 ビデオ GND VGND
R サービス R
15 テスト 15
S チルト
16 コイン1 16
T コイン2 T
17 1Pスタート 17
U 2Pスタート U
18 P1アップ 18
V P2アップ V
19 P1ダウン 19
W P2ダウン W
20 P1レフト 20
X P2レフト X
21 P1ライト 21
Y P2ライト Y
22 P1シュート 22
Z P2シュート Z
23 P1 PUSH2 23
a P2 PUSH2 a
24 P1 PUSH3 24
b P2 PUSH3 b
25
c
26
d
27 GND
e 〃
28 〃
f 〃

Figure 6 Galaga '88 Schematic Diagram
Sheet 1 of 8

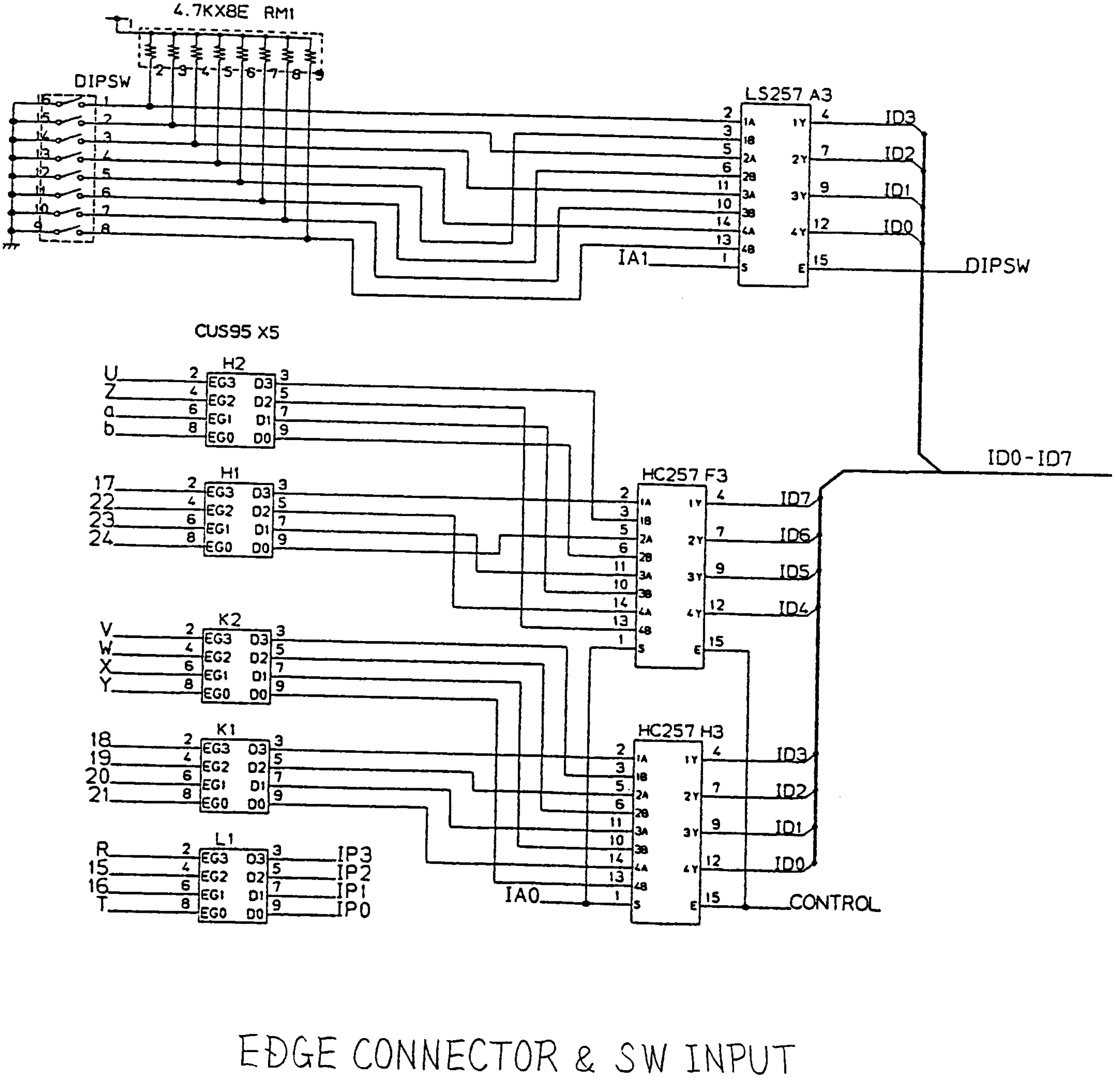

4.7KX8E RM1
DIPSW
LS257 A3
ID3
ID2
ID1
ID0
IA1
DIPSW
CUS95 X5
H2
U
Z
a
b
H1
17
22
23
24
HC257 F3
ID0-ID7
ID7
ID6
ID5
ID4
K2
V
W
X
Y
K1
18
19
20
21
HC257 H3
ID3
ID2
ID1
ID0
L1
R
15
16
T
IP3
IP2
IP1
IP0
IA0
CONTROL
EDGE CONNECTOR & SW INPUT

Figure 6 Galaga '88 Schematic Diagram, Continued
Sheet 1 of 8

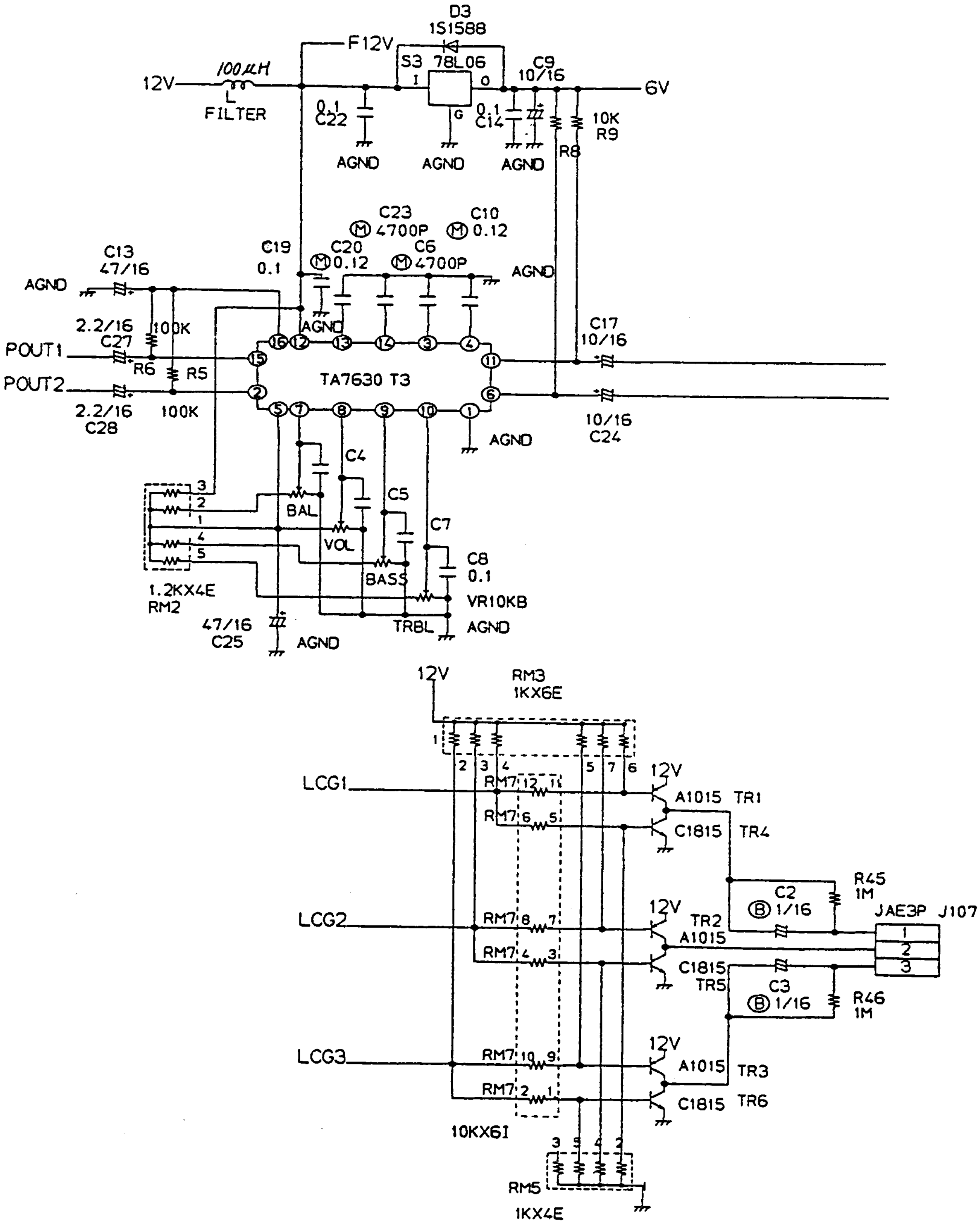
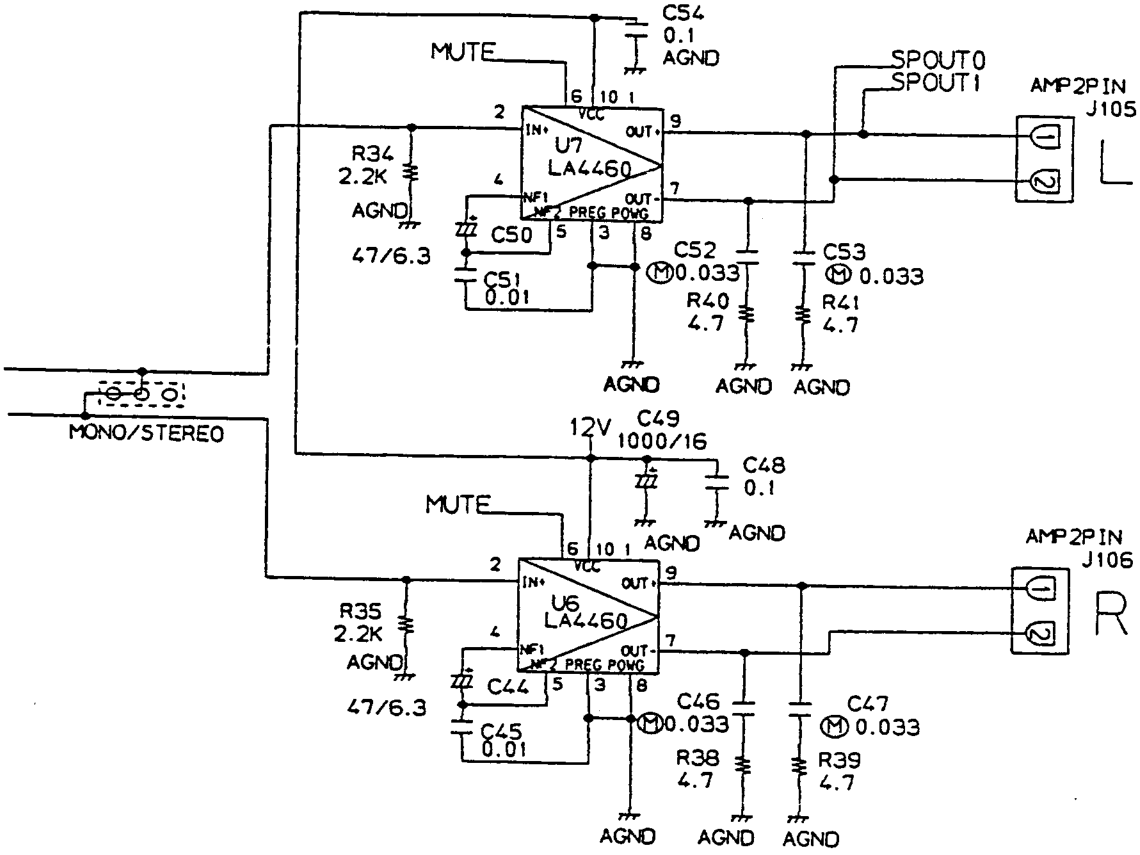

D3
1S1588
F12V
S3 78L06
I
O
G
C9
10/16
6V
12V
100μH
L
FILTER
0.1
C22
0.1
C14
10K
R9
R8
AGND
AGND
AGND
C23
Ⓜ 4700P
C10
Ⓜ 0.12
C19
0.1
C20
Ⓜ 0.12
C6
Ⓜ 4700P
AGND
C13
47/16
AGND
2.2/16
C27
100K
R6
R5
POUT1
POUT2
2.2/16
C28
100K
AGND
C17
10/16
TA7630 T3
16
12
13
14
3
4
15
11
2
6
5
7
8
9
10
1
10/16
C24
AGND
C4
C5
C7
C8
0.1
BAL
VOL
BASS
TRBL
VR10KB
AGND
1.2KX4E
RM2
47/16
C25
AGND
12V
RM3
1KX6E
LCG1
LCG2
LCG3
RM7
12V
A1015 TR1
C1815 TR4
R45
1M
C2
Ⓑ 1/16
JAE3P J107
1
2
3
TR2
A1015
C1815
TR5
C3
Ⓑ 1/16
R46
1M
A1015 TR3
C1815 TR6
10KX6I
RM5
1KX4E

Figure 6 Galaga '88 Schematic Diagram
Sheet 2 of 8


C54
0.1
AGND
MUTE
SPOUT0
SPOUT1
AMP2PIN
J105
L
6
10
1
VCC
2
IN+
U7
LA4460
OUT+
9
R34
2.2K
AGND
4
NF1
NF2
PREG
POWG
OUT-
7
C50
5
3
8
47/6.3
C51
0.01
C52
0.033
C53
0.033
R40
4.7
R41
4.7
AGND
AGND
AGND
MONO/STEREO
12V
C49
1000/16
C48
0.1
MUTE
AGND
AGND
AMP2PIN
J106
R
6
10
1
VCC
2
IN+
U6
LA4460
OUT+
9
R35
2.2K
AGND
4
NF1
NF2
PREG
POWG
OUT-
7
C44
5
3
8
47/6.3
C45
0.01
C46
0.033
C47
0.033
R38
4.7
R39
4.7
AGND
AGND
AGND

AUDIO AMP & 3D GRASS DRIVER

Figure 6 Galaga '88 Schematic Diagram, Continued
Sheet 2 of 8

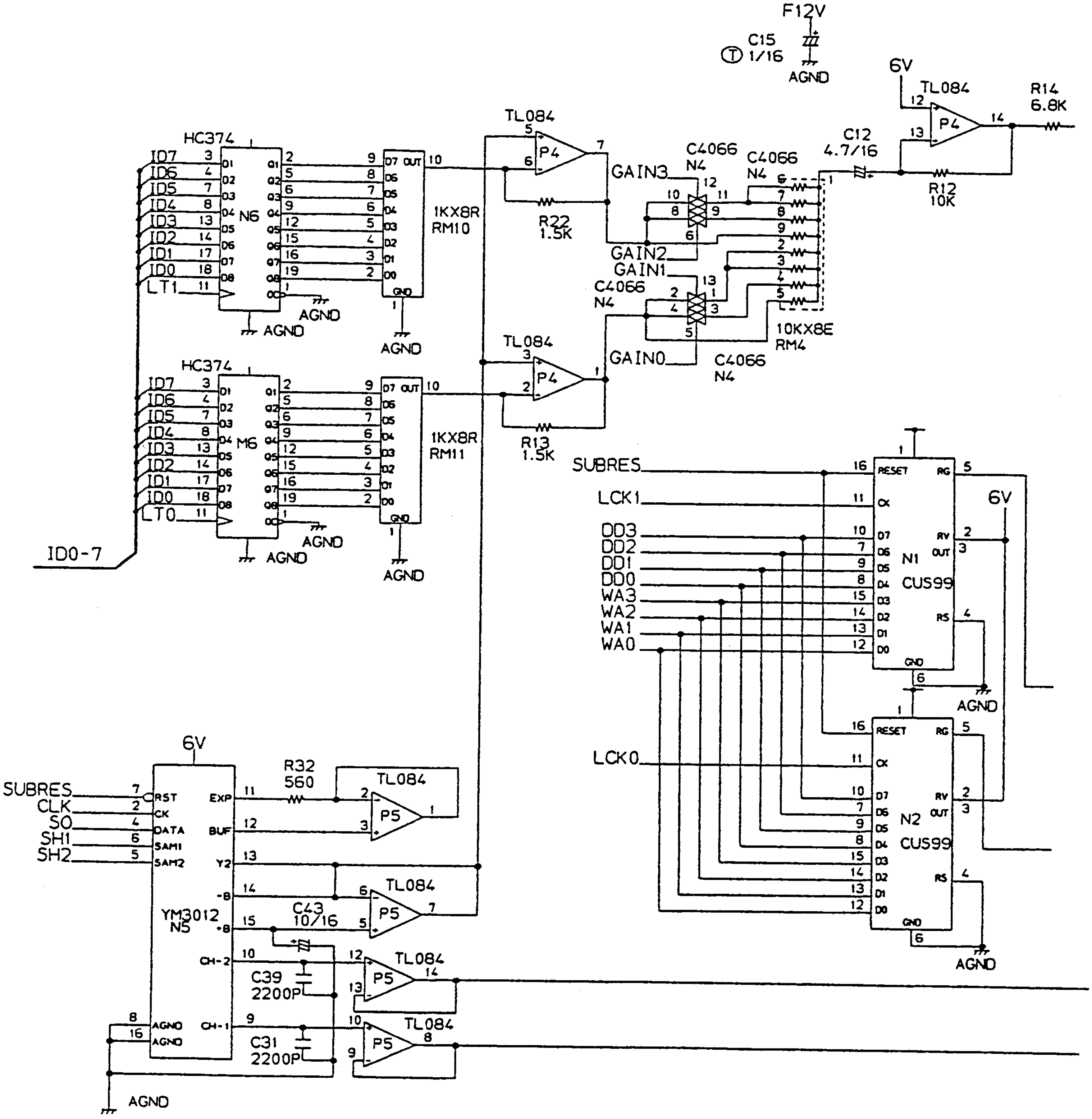
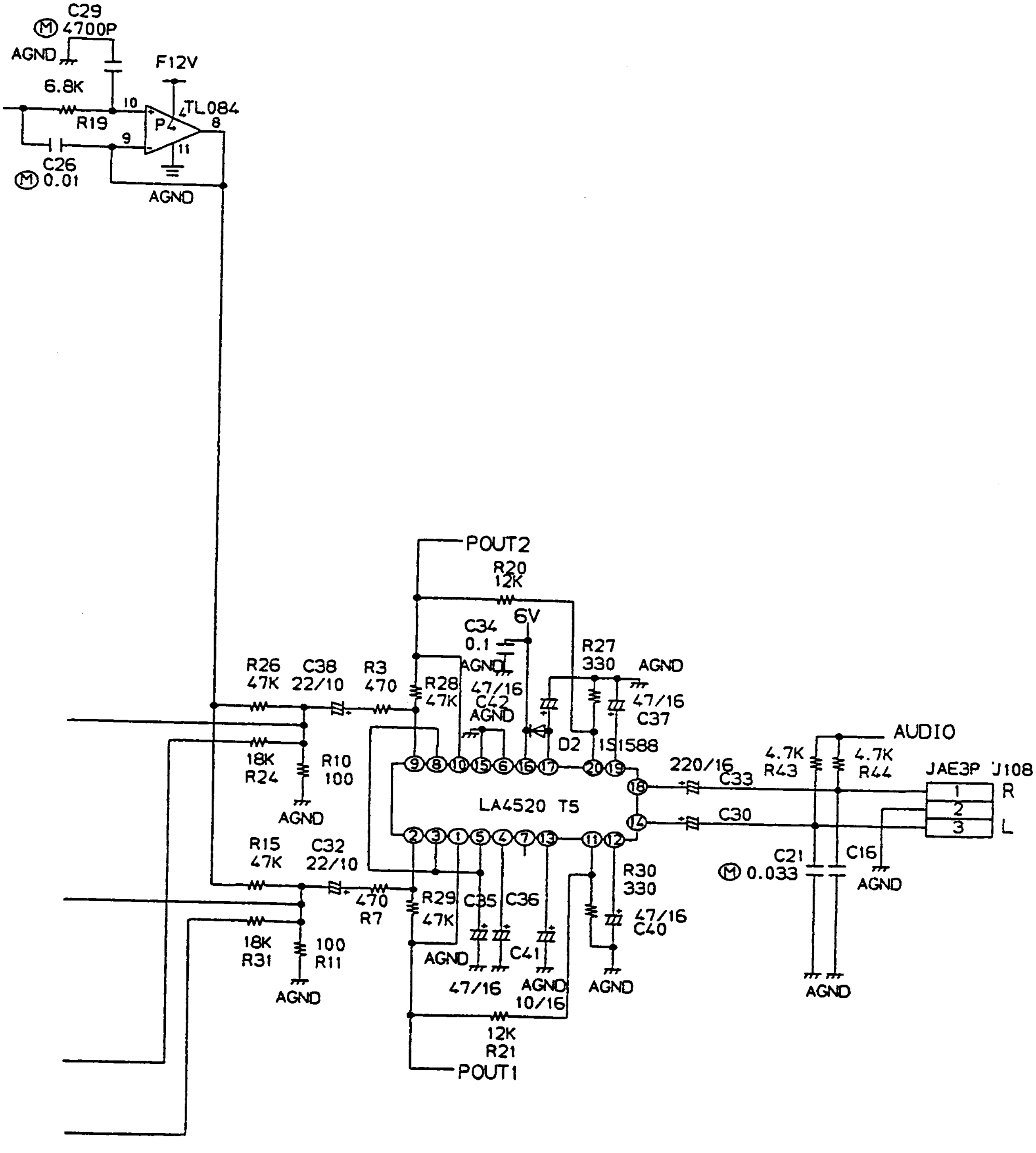

F12V
C15
1/16
AGND
6V
TL084
R14
6.8K
P4
C12
4.7/16
R12
10K
C4066
N4
GAIN3
GAIN2
GAIN1
GAIN0
10KX8E
RM4
TL084
R22
1.5K
R13
1.5K
HC374
N6
M6
ID7
ID6
ID5
ID4
ID3
ID2
ID1
ID0
LT1
LT0
ID0-7
1KX8R
RM10
RM11
AGND
SUBRES
LCK1
LCK0
DD3
DD2
DD1
DD0
WA3
WA2
WA1
WA0
RESET
RG
RV
OUT
RS
GND
N1
N2
CUS99
6V
YM3012
N5
RST
CK
DATA
SAM1
SAM2
EXP
BUF
Y2
-B
+B
CH-2
CH-1
CLK
SO
SH1
SH2
R32
560
TL084
P5
C43
10/16
C39
2200P
C31
2200P

Figure 6 Galaga '88 Schematic Diagram
Sheet 3 of 8


C29
Ⓜ 4700P
AGND
F12V
6.8K
R19
10
9
8
11
P4
TL084
C26
Ⓜ 0.01
AGND
POUT2
R20
12K
C34
0.1
6V
AGND
R27
330
AGND
R26
47K
C38
22/10
R3
470
R28
47K
47/16
C42
AGND
47/16
C37
AUDIO
18K
R24
R10
100
AGND
D2
1S1588
220/16
C33
4.7K
R43
4.7K
R44
JAE3P
J108
R
L
LA4520 T5
C30
R15
47K
C32
22/10
470
R7
R29
47K
C35
C36
C41
C21
Ⓜ 0.033
C16
AGND
R30
330
47/16
C40
18K
R31
100
R11
AGND
AGND
47/16
AGND
10/16
AGND
AGND
12K
R21
POUT1

SOUND MIX & HEAD PHONE AMP

Figure 6 Galaga '88 Schematic Diagram, Continued
Sheet 3 of 8

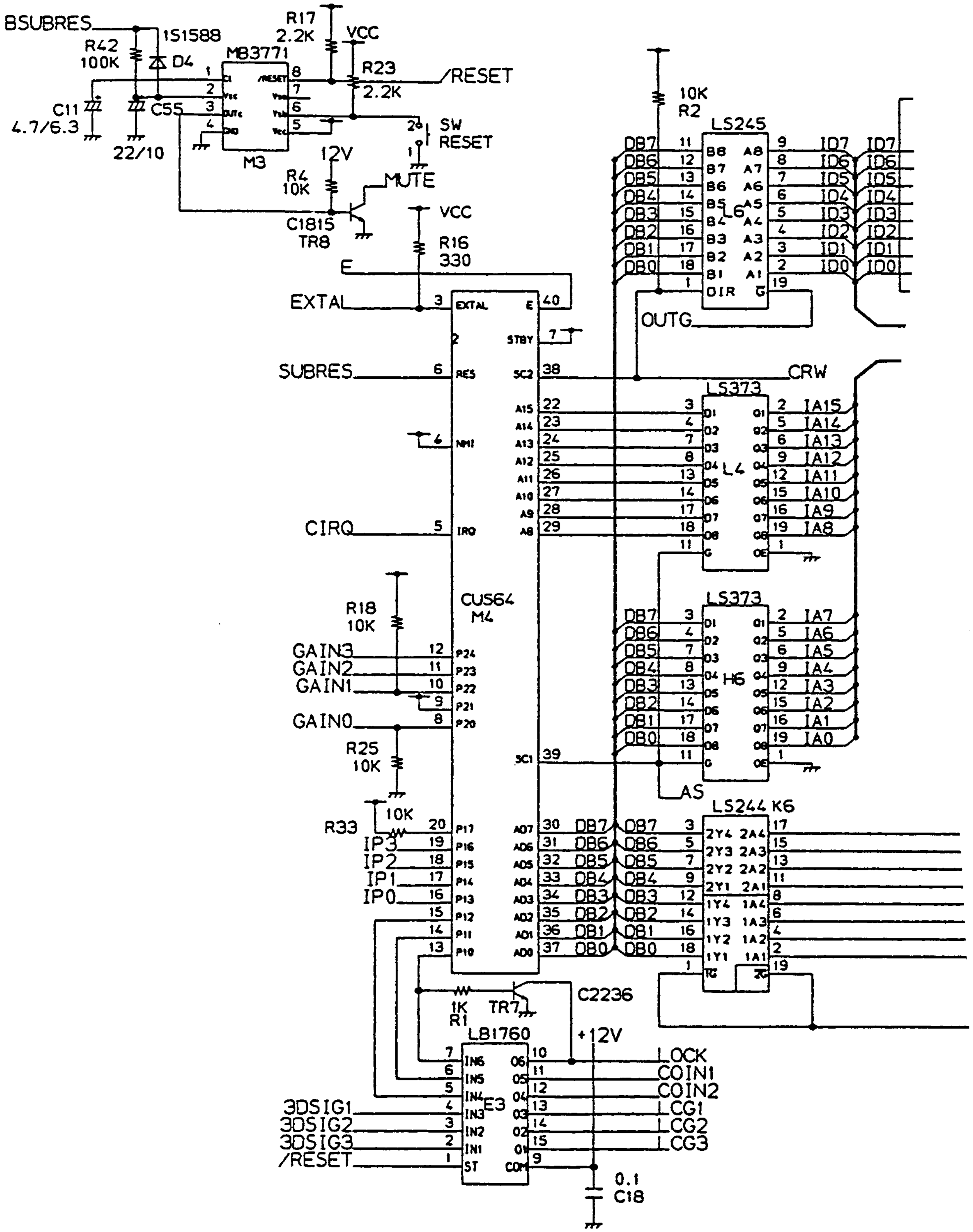
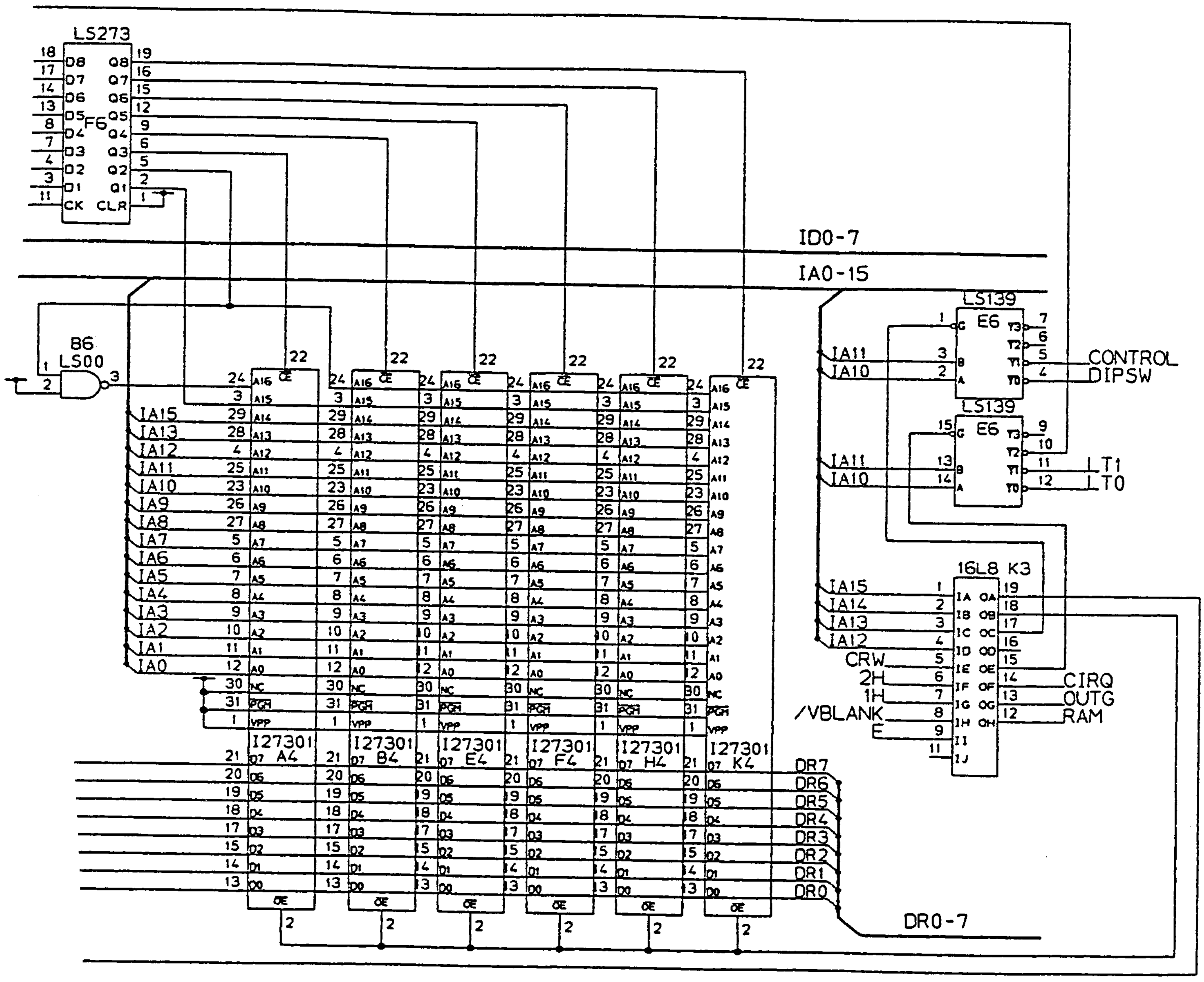

BSUBRES
R42
100K
1S1588
D4
C11
4.7/6.3
C55
22/10
MB3771
M3
/RESET
R17
2.2K
VCC
R23
2.2K
/RESET
SW
RESET
12V
R4
10K
MUTE
C1815
TR8
VCC
R16
330
E
EXTAL
EXTAL
E
STBY
SUBRES
RES
SC2
CRW
NMI
A15
A14
A13
A12
A11
A10
A9
A8
CIRQ
IRQ
CUS64
M4
R18
10K
GAIN3
GAIN2
GAIN1
GAIN0
P24
P23
P22
P21
P20
R25
10K
SC1
R33
10K
IP3
IP2
IP1
IP0
P17
P16
P15
P14
P13
P12
P11
P10
AD7
AD6
AD5
AD4
AD3
AD2
AD1
AD0
DB7
DB6
DB5
DB4
DB3
DB2
DB1
DB0
10K
R2
LS245
L6
DIR
OUTG
ID7
ID6
ID5
ID4
ID3
ID2
ID1
ID0
LS373
L4
IA15
IA14
IA13
IA12
IA11
IA10
IA9
IA8
LS373
H6
IA7
IA6
IA5
IA4
IA3
IA2
IA1
IA0
AS
LS244 K6
1K
R1
TR7
C2236
LB1760
E3
+12V
LOCK
COIN1
COIN2
LCG1
LCG2
LCG3
3DSIG1
3DSIG2
3DSIG3
/RESET
ST
COM
0.1
C18

Figure 6 Galaga '88 Schematic Diagram
Sheet 4 of 8


LS273
F6
D8 D7 D6 D5 D4 D3 D2 D1 CK
Q8 Q7 Q6 Q5 Q4 Q3 Q2 Q1 CLR
ID0-7
IA0-15
B6
LS00
LS139
E6
CONTROL
DIPSW
LT1
LT0
IA15
IA14
IA13
IA12
IA11
IA10
IA9
IA8
IA7
IA6
IA5
IA4
IA3
IA2
IA1
IA0
I27301 A4
I27301 B4
I27301 E4
I27301 F4
I27301 H4
I27301 K4
16L8 K3
CRW
2H
1H
/VBLANK
E
CIRQ
OUTG
RAM
DR7
DR6
DR5
DR4
DR3
DR2
DR1
DR0
DR0-7

RESET, VOICE ROM

Figure 6 Galaga '88 Schematic Diagram, Continued
Sheet 4 of 8

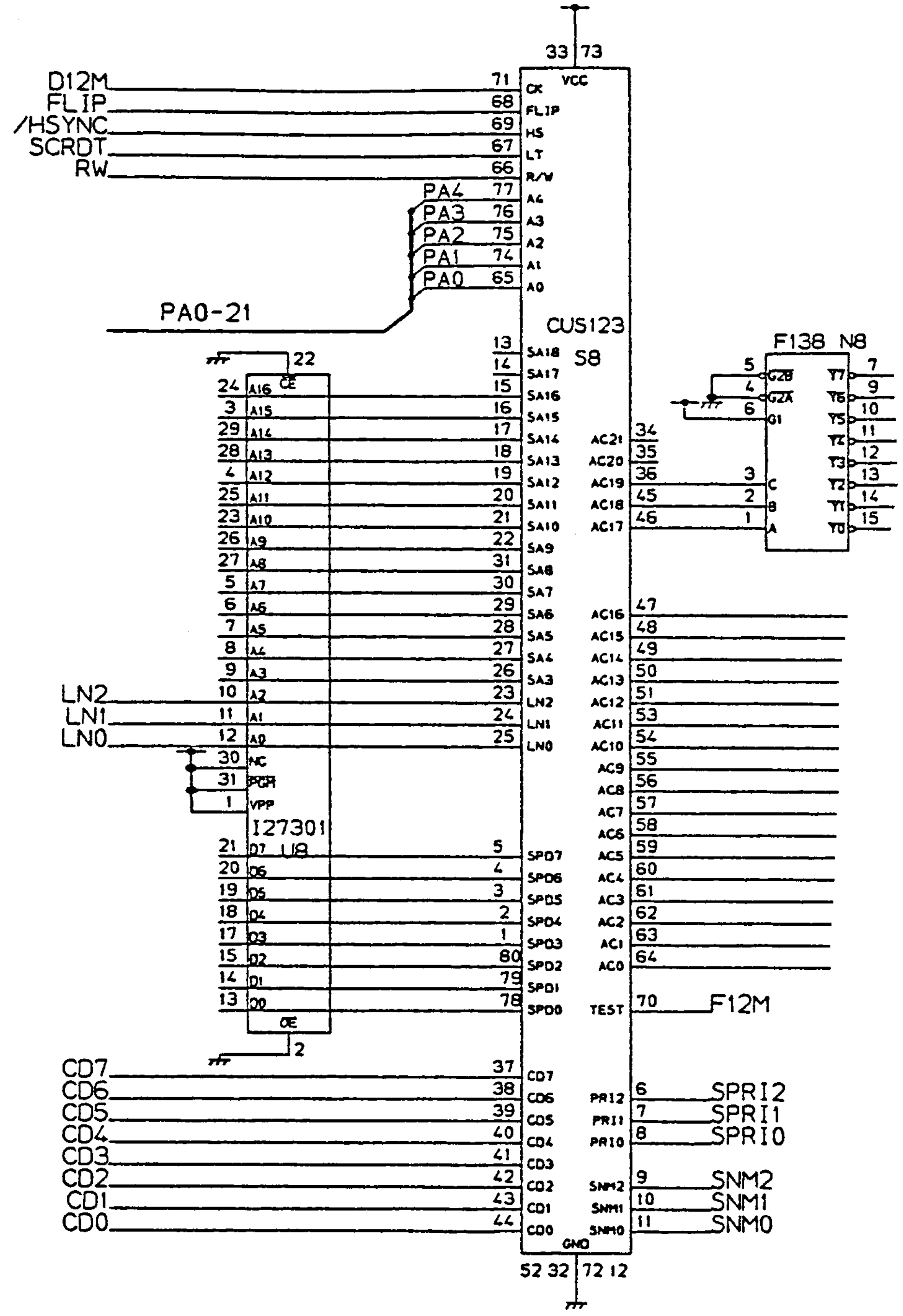

D12M
FLIP
/HSYNC
SCRDT
RW
PA4
PA3
PA2
PA1
PA0
PA0-21
CUS123
S8
VCC
GND
I27301
U8
F138 N8
LN2
LN1
LN0
CD7
CD6
CD5
CD4
CD3
CD2
CD1
CD0
F12M
SPRI2
SPRI1
SPRI0
SNM2
SNM1
SNM0

Figure 6 Galaga '88 Schematic Diagram
Sheet 5 of 8

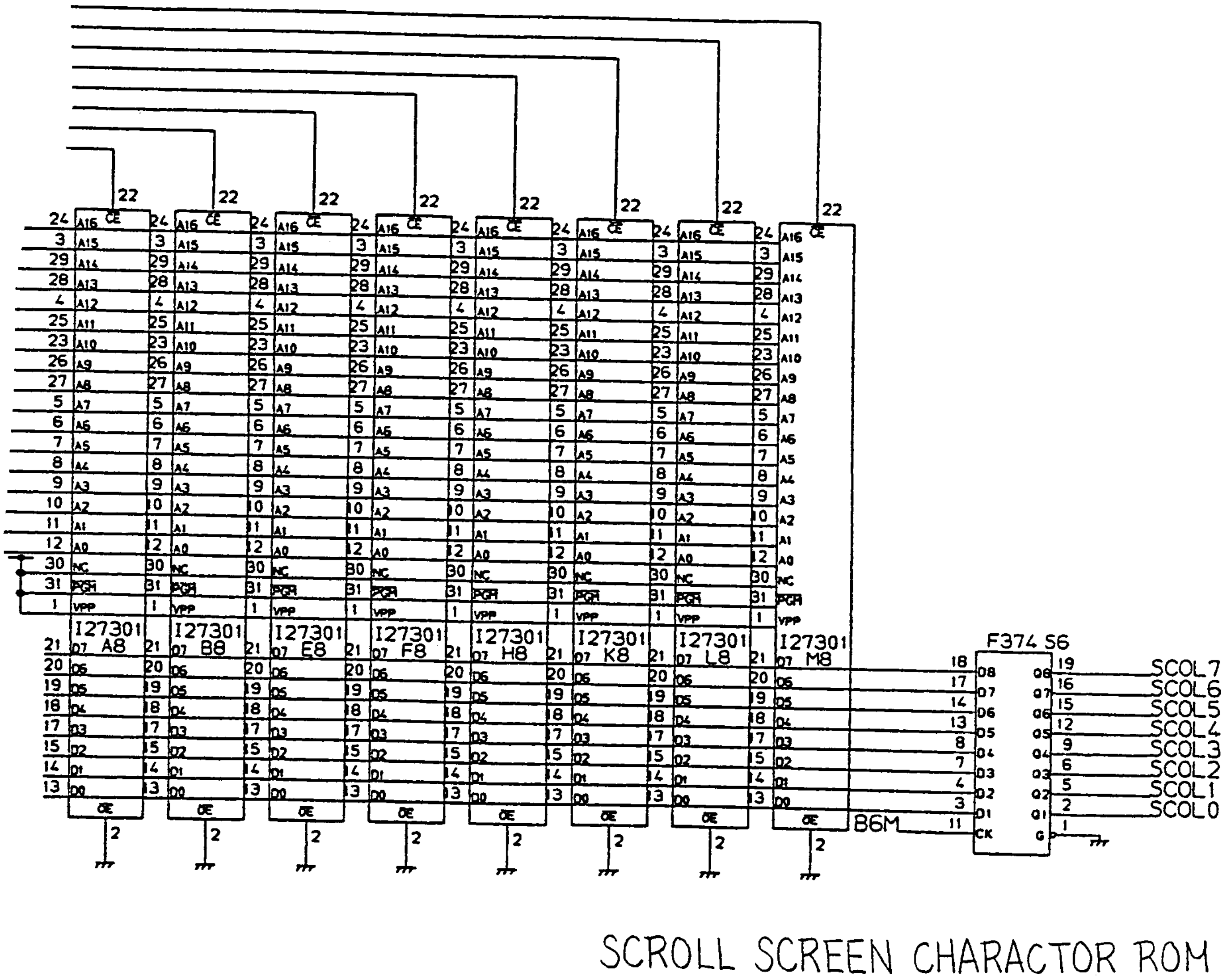

22
24
3
29
28
4
25
23
26
27
5
6
7
8
9
10
11
12
30
31
1
A16
A15
A14
A13
A12
A11
A10
A9
A8
A7
A6
A5
A4
A3
A2
A1
A0
NC
PGM
VPP
CE
I27301 A8
I27301 B8
I27301 E8
I27301 F8
I27301 H8
I27301 K8
I27301 L8
I27301 M8
21
20
19
18
17
15
14
13
O7
O6
O5
O4
O3
O2
O1
O0
OE
2
86M
F374 S6
D8
D7
D6
D5
D4
D3
D2
D1
CK
Q8
Q7
Q6
Q5
Q4
Q3
Q2
Q1
G
SCOL7
SCOL6
SCOL5
SCOL4
SCOL3
SCOL2
SCOL1
SCOL0
SCROLL SCREEN CHARACTOR ROM

Figure 6 Galaga '88 Schematic Diagram, Continued
Sheet 5 of 8

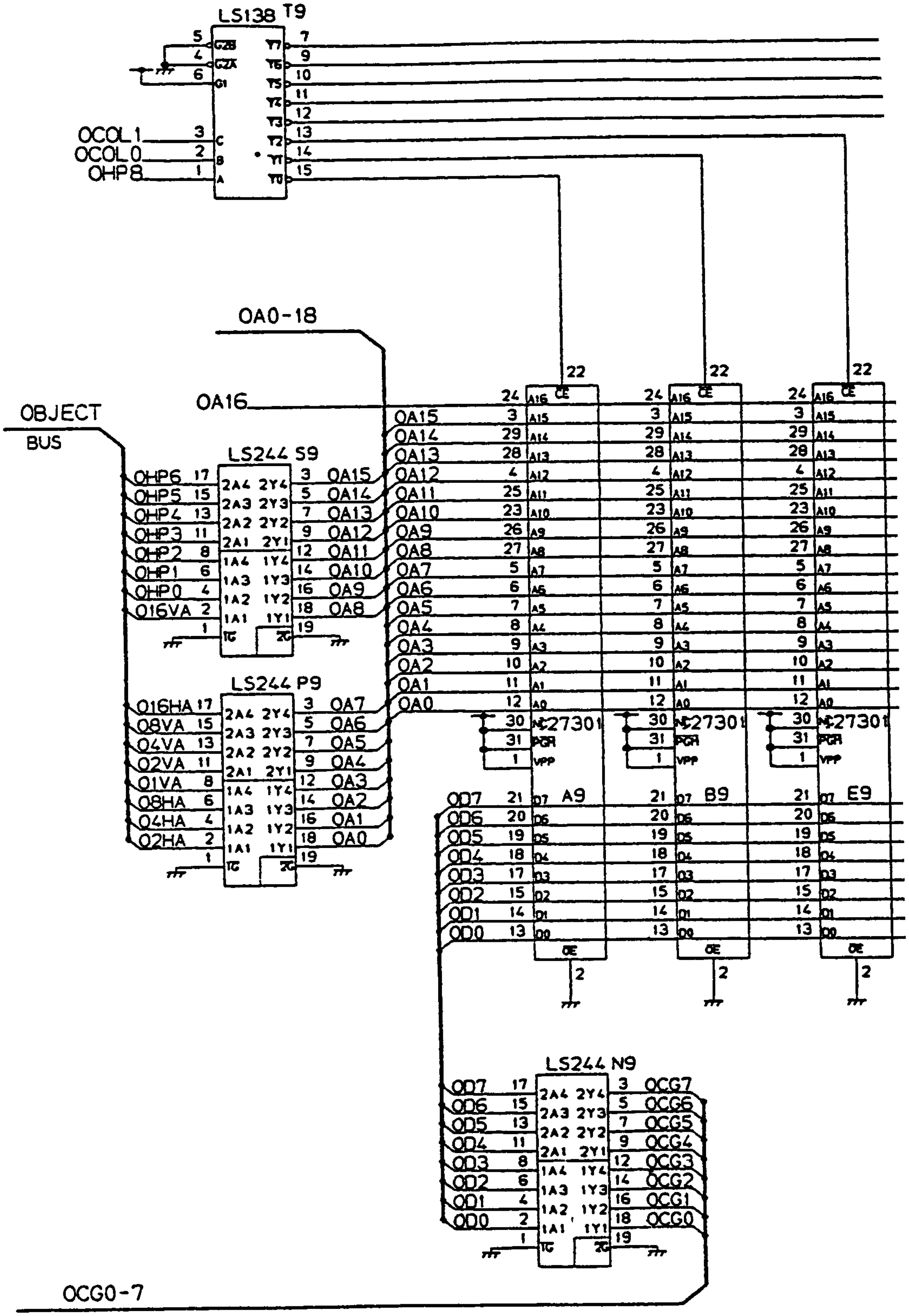

LS138 T9
OCOL1
OCOL0
OHP8
OA0-18
OA16
OBJECT BUS
LS244 S9
LS244 P9
LS244 N9
27301
A9
B9
E9
OCG0-7

Figure 6 Galaga '88 Schematic Diagram
Sheet 6 of 8

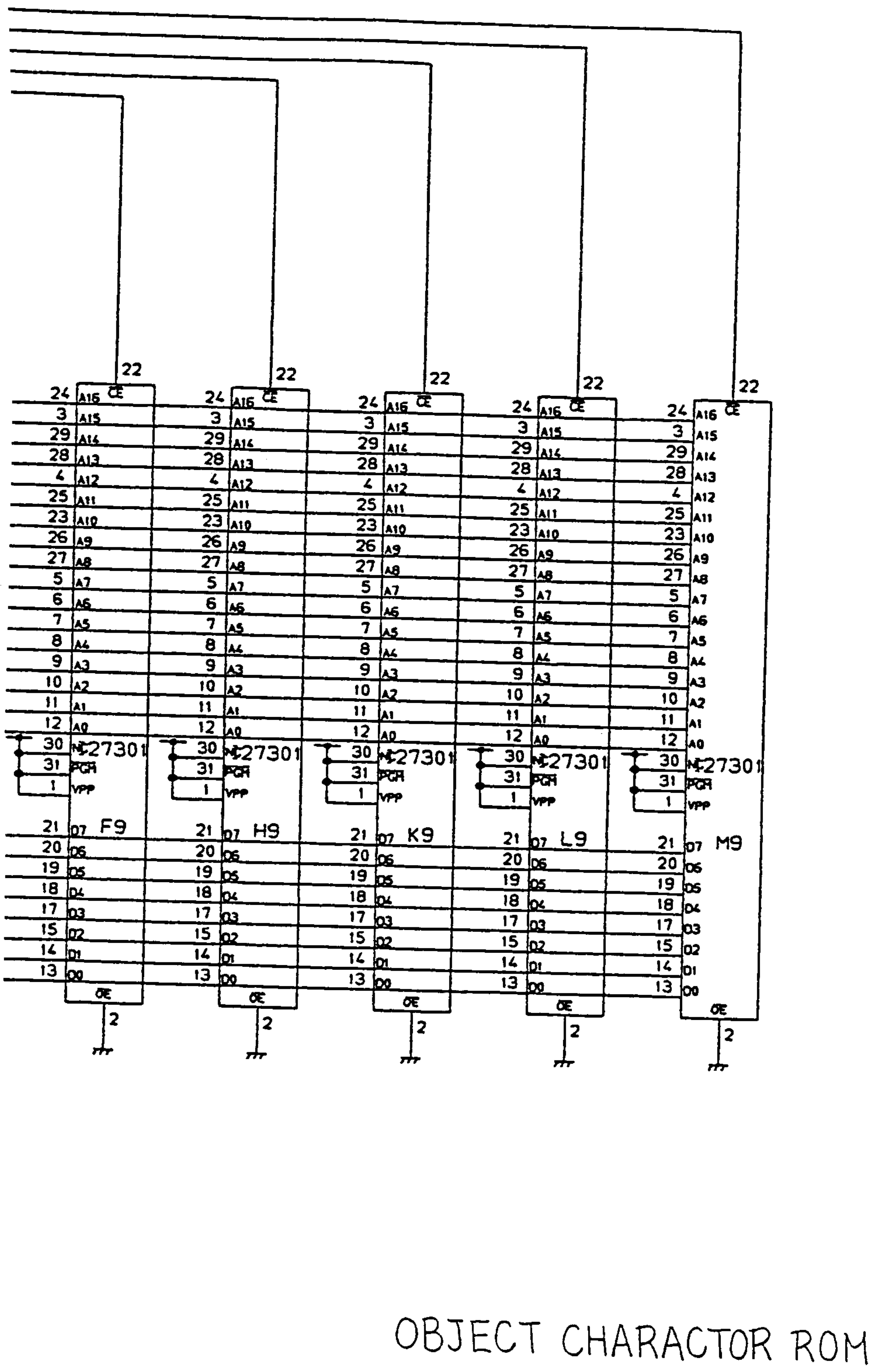

22
24
3
29
28
4
25
23
26
27
5
6
7
8
9
10
11
12
30
31
1
21
20
19
18
17
15
14
13
2
A16
A15
A14
A13
A12
A11
A10
A9
A8
A7
A6
A5
A4
A3
A2
A1
A0
CE
NC
PGM
VPP
O7
O6
O5
O4
O3
O2
O1
O0
OE
27301
F9
H9
K9
L9
M9
OBJECT CHARACTOR ROM

Figure 6 Galaga '88 Schematic Diagram, Continued
Sheet 6 of 8

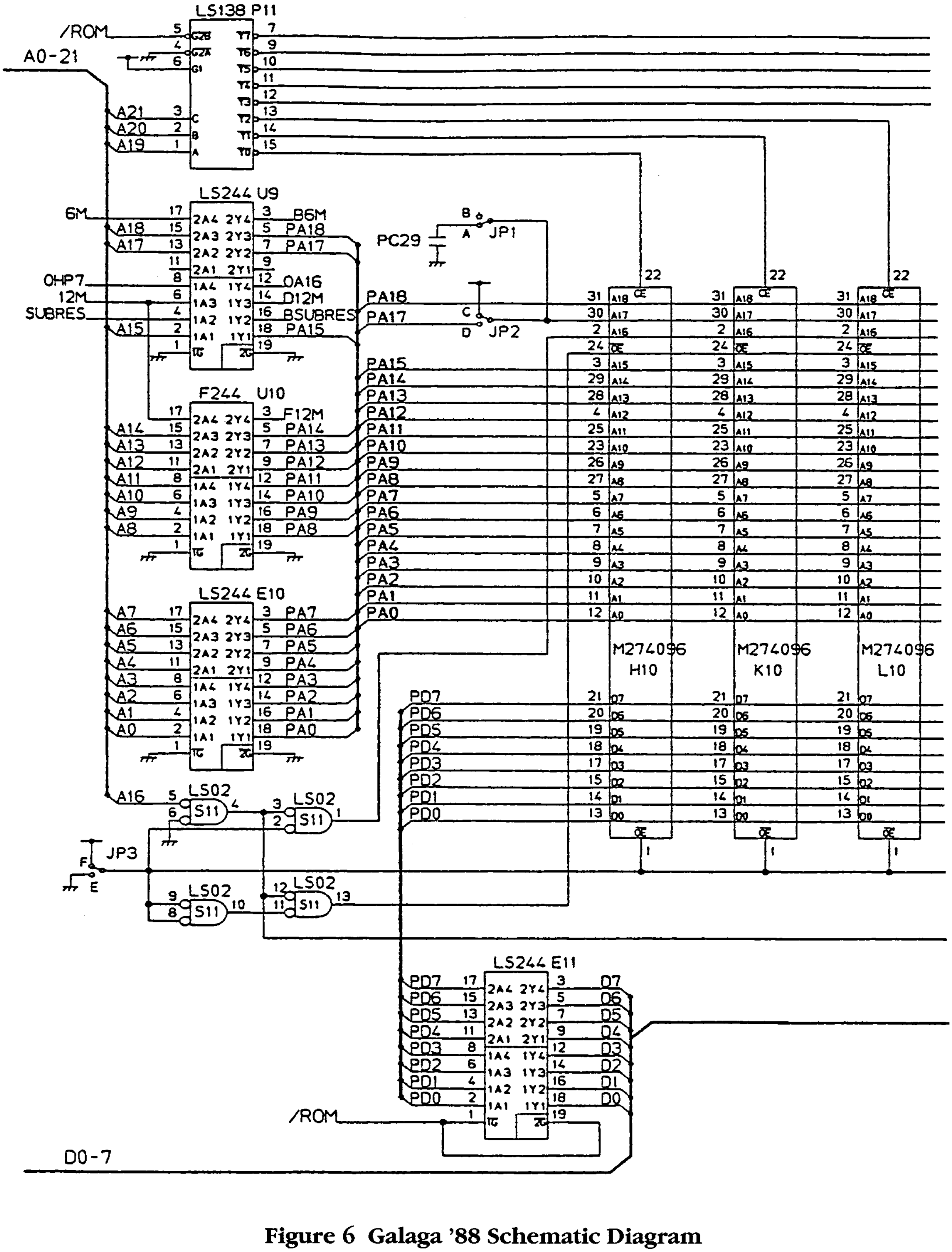
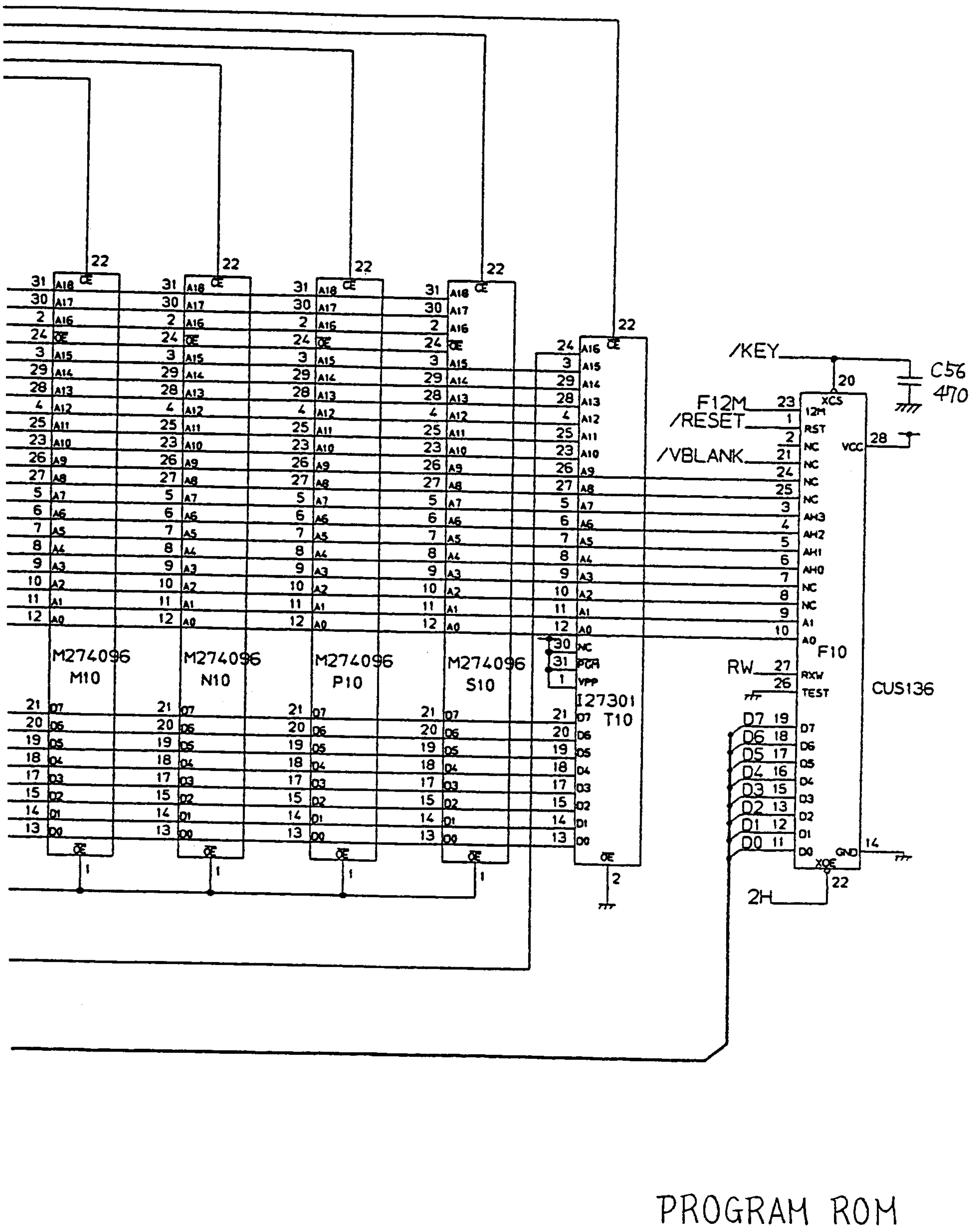

LS138 P11
/ROM
A0-21
A21
A20
A19
G2B
G2A
G1
C
B
A
LS244 U9
6M
A18
A17
0HP7
12M
SUBRES
A15
B6M
PA18
PA17
0A16
D12M
BSUBRES
PA15
F244 U10
F12M
A14
A13
A12
A11
A10
A9
A8
PA14
PA13
PA12
PA11
PA10
PA9
PA8
LS244 E10
A7
A6
A5
A4
A3
A2
A1
A0
PA7
PA6
PA5
PA4
PA3
PA2
PA1
PA0
A16
LS02
S11
JP3
F
E
PC29
B
A
JP1
C
D
JP2
M274096
H10
K10
L10
PD7
PD6
PD5
PD4
PD3
PD2
PD1
PD0
LS244 E11
D7
D6
D5
D4
D3
D2
D1
D0
/ROM
D0-7

Figure 6 Galaga '88 Schematic Diagram
Sheet 7 of 8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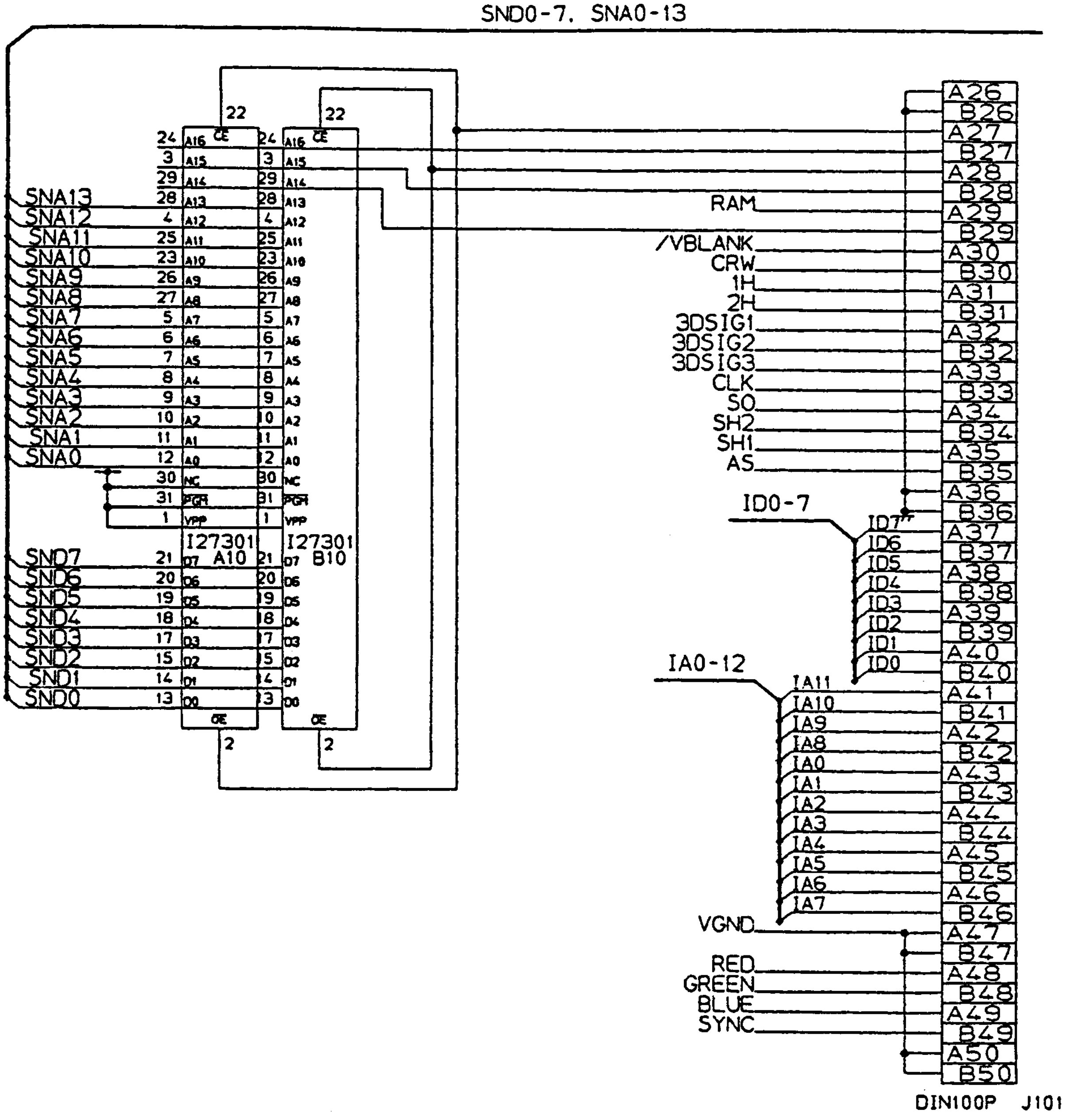
M10
M274096
N10
M274096
P10
M274096
S10
I27301
T10
F10
CUS136
/KEY
F12M
/RESET
/VBLANK
RW
2H
C56
470
PROGRAM ROM

Figure 6 Galaga '88 Schematic Diagram, Continued
Sheet 7 of 8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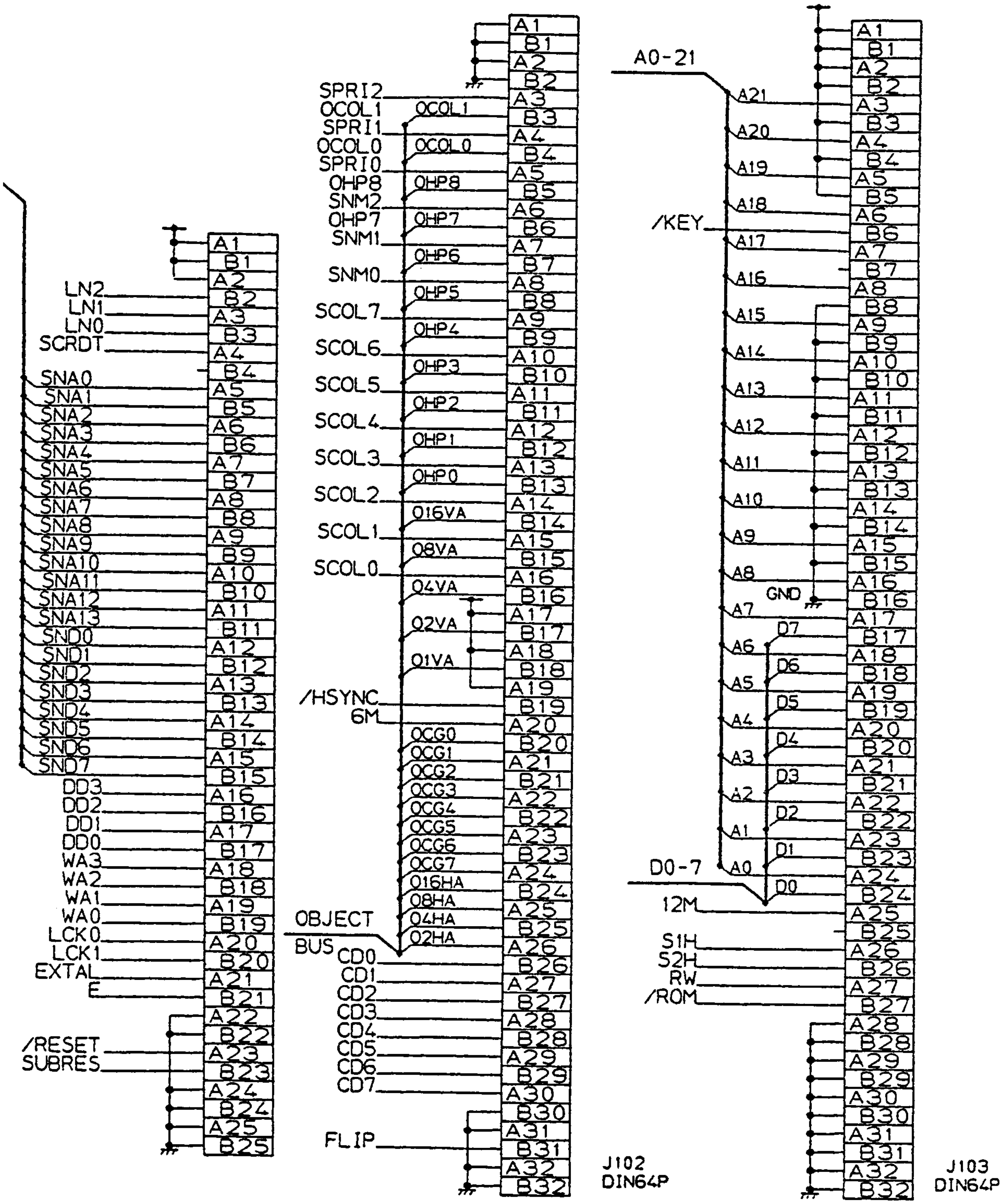
SNA13
SNA12
SNA11
SNA10
SNA9
SNA8
SNA7
SNA6
SNA5
SNA4
SNA3
SNA2
SNA1
SNA0
SND7
SND6
SND5
SND4
SND3
SND2
SND1
SND0
I27301
A10
I27301
B10
RAM
/VBLANK
CRW
1H
2H
3DSIG1
3DSIG2
3DSIG3
CLK
SO
SH2
SH1
AS
ID0-7
ID7
ID6
ID5
ID4
ID3
ID2
ID1
ID0
IA0-12
IA11
IA10
IA9
IA8
IA0
IA1
IA2
IA3
IA4
IA5
IA6
IA7
VGND
RED
GREEN
BLUE
SYNC
DIN100P
J101

Figure 6 Galaga '88 Schematic Diagram
Sheet 8 of 8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LN1
LN0
SCRDT
SNA0
SNA1
SNA2
SNA3
SNA4
SNA5
SNA6
SNA7
SNA8
SNA9
SNA10
SNA11
SNA12
SNA13
SND0
SND1
SND2
SND3
SND4
SND5
SND6
SND7
DD3
DD2
DD1
DD0
WA3
WA2
WA1
WA0
LCK0
LCK1
EXTAL
E
/RESET
SUBRES
SPRI2
OCOL1
SPRI1
OCOL0
SPRI0
OHP8
SNM2
OHP7
SNM1
SNM0
SCOL7
SCOL6
SCOL5
SCOL4
SCOL3
SCOL2
SCOL1
SCOL0
OHP6
OHP5
OHP4
OHP3
OHP2
OHP1
OHP0
O16VA
O8VA
O4VA
O2VA
O1VA
/HSYNC
6M
OCG0
OCG1
OCG2
OCG3
OCG4
OCG5
OCG6
OCG7
O16HA
O8HA
O4HA
O2HA
OBJECT
BUS
CD0
CD1
CD2
CD3
CD4
CD5
CD6
CD7
FLIP
J102
DIN64P
A0-21
A21
A20
A19
A18
/KEY
A17
A16
A15
A14
A13
A12
A11
A10
A9
A8
GND
A7
A6
A5
A4
A3
A2
A1
A0
D7
D6
D5
D4
D3
D2
D1
D0
D0-7
12M
S1H
S2H
RW
/ROM
J103
DIN64P

Figure 6 Galaga '88 Schematic Diagram, Continued
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