

T.M.

**SEGA<sup>®</sup>**

**Preliminary Owner's Manual**

**Manual Part No. 420-0838**

SUPER ZAXXON™

PRELIMINARY OWNER'S MANUAL

MANUFACTURED BY

**SEGA**

TLX 910-335-1621

SUPER ZAXXON™ PRELIMINARY OWNER'S MANUAL

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## INTRODUCTION

SUPER ZAXXON™ is a microprocessor based coin-operated electronic game, that makes extensive use of digital integrated circuitry and television monitor concepts. This manual is designed for the use of the maintenance technicians who possess a general working knowledge of solid-state circuitry and video monitor theory. Any individual NOT knowledgeable in these areas SHOULD NOT attempt repair of the electronic portions of the game.

In addition to this manual and training in electronics, troubleshooting and repair will be facilitated by: access to general electronic type handtools, a multimeter, a 50 to 100 Mhz oscilloscope and a logic probe would be helpful.

The information contained in this manual is preliminary and subject to change before printing of final manual.

Technical assistance is available toll-free by calling:

1-800-854-1938 outside California

1-800-722-8576 inside California

Parts information assistance is available toll-free by calling:

1-800-854-1900 outside California

1-800-722-8575 inside California

Questions or comments concerning SUPER ZAXXON™ or any of our games are welcome and should be directed to:

Customer Service Manager

SEGA Enterprises

16250 Technology Drive

San Diego, CA 92127-1985

## IMPORTANT NOTES

The following note is included in compliance with FCC rules:

WARNING: This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. As temporarily permitted by regulation, it has not been tested for compliance with the limits for Class A computing devices pursuant to Subpart J of Part 15 FCC Rules, which are designed to provide reasonable protection against interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

## OTHER NOTES

NEVER replace any components with anything other than exact replacement parts.

NEVER remove circuit board connections while power is on.

DO NOT replace fuses with anything other than the proper value. A blown fuse indicates an overload condition within the game. Replacing fuses with a higher value can cause severe damage to internal components if an overload occurs.

ALWAYS consult the manual before attempting repairs.

## GAME CONCEPT

SUPER ZAXXON is a unique isometric perspective, in which you find yourself piloting an "attack-shuttle" spacecraft, strafing the enemy's "asteroid city" in an attempt to destroy fuel tanks, gun placements, missiles, fighters and dreaded enemy dragon robots. With the aid of an altimeter that constantly monitors your height, you control your ship with an aircraft-style joystick, barnstorming your way through wall openings, under electronic barriers, dodging rockets, and in a later round, dueling with the insidious enemy dragon robots. A successful attack-run across ZAXXON leads to a tunnel fight with enemy planes and mine-carrying drones.

After successfully negotiating the tunnel, the dragon robot appears spewing fire balls from his mouth. Destruction of the robot requires six direct hits on the robot's mouth, after which the round changes with greater difficulty. Number of player ships and bonus point levels are operator selectable. Game play ends with the loss of your last ship.

Unique and beautiful graphics combined with the challenging new perspective and fast paced game play result in what appears to be another popular and profitable investment from SEGA.

OPTIONS SELECTION

Game Options	<u>Switch 1</u>							
	1	2	3	4	5	6	7	8
Extra Ship @ 10,000	ON	ON	X	X	X	X	X	X
20,000	ON	OFF	X	X	X	X	X	X
30,000	OFF	ON	X	X	X	X	X	X
40,000	OFF	OFF	X	X	X	X	X	X
Free Ships	X	X	X	X	OFF	OFF	X	X
5 Ships	X	X	X	X	OFF	ON	X	X
4 Ships	X	X	X	X	ON	OFF	X	X
3 Ships	X	X	X	X	ON	ON	X	X
Sound On	X	X	X	X	X	X	ON	X
Sound Off	X	X	X	X	X	X	OFF	X
Upright	X	X	X	X	X	X	X	OFF
Cocktail Table	X	X	X	X	X	X	X	ON

Coin Options	<u>Switch 2</u>							
	Coin Mech B				Coin Mech A			
Coin/credit	1	2	3	4	5	6	7	8
4 coins/1 credit	ON	ON	ON	ON	ON	ON	ON	ON
3 coins/1 credit	ON	ON	ON	OFF	ON	ON	ON	OFF
2 coins/1 credit	ON	ON	OFF	ON	ON	ON	OFF	ON
1 coin/1 credit	ON	ON	OFF	OFF	ON	ON	OFF	OFF
1 coin/2 credits	ON	OFF	ON	ON	ON	OFF	ON	ON
1 coin/3 credits	ON	OFF	ON	OFF	ON	OFF	ON	OFF
1 coin/4 credits	ON	OFF	OFF	ON	ON	OFF	OFF	ON
1 coin/5 credits	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF



## SUPER ZAXXON<sup>TM</sup> CIRCUIT DESCRIPTION

SUPER ZAXXON is a microprocessor based, digital-integrated circuit computer video game. The heart of the computer is the CPU (U24), a Z80A located on the 800-3300 Assy IC Board A. The Alpha type chip MUST ALWAYS be used, as the Z80 is not fast enough to run the programs.

Master timing is crystal-driven at 48.66 Hz, (X1, Zone 6-D, Sht. 7, Assy IC Bd. B, 800-3310 or 800-3301) through Q1, Q2, T1, U19, U38, U41 and frequency dividers U1, U2 and U21. CPU timing (1H) is taken from U1 p-14, through U45, U9, applied to Bus Driver U94 p-6 (Zone 8-D, Sht. 8, Assy IC Bd. B, 800-3310 or 800-3301), through P3 p-9 to the A Board (Zone 1-A, Sht. 14, Assy IC Bd. A, 800-3300) is referenced by U25 and Q14 (Zone 8-D, Sht. 14, Assy IC Bd. A, 800-3300) and finally applied to pin-6 of the CPU (U24). Back at U45 (Zone 4-A, Sht. 7, Assy IC Bd. B, 800-3310 or 800-3301) the  $\overline{TH}$  pulse is used to clock the Octal Flip-Flops U16 and U25 (Sht. 6, 800-3310 or 800-3301).

Manual system reset comes from the operator panel through P5 p-L, appears as a LO at U53 p-1 (Zone 4-D, Sht. 13, Assy IC Bd. A, 800-3300) and is then felt at pin-26 of the CPU (Zone 8-C, Sht. 14, 800-3300). Normal program interrupts (INT) are felt at pin-16 of the Z80A (and edge-triggered LO), and are the result of Input/Output activity times with vertical blanking (an approx. 2 msec. instruction interrupt). The WAIT signal is used to synchronize that I/O activity during an interrupt to the CPU. U33 (Zone 6-D, Sht. 14, Assy IC Bd. A) is an address bus controller. Three of the sixteen address lines pass through U33 and subsequently drive the Chip Enable inputs of ROMs 1, 2 and 3 (U27, U28, U29), and RAMs U37 and U38. U81, U82, U86, U87 and U88 (Sht. 13, Assy IC Bd. A, 800-3300) are input ports on the data bus. Connector P5 supplies player input information, CPU reset, service switch, game start and coinage, to the input ports. U101, U66, U84 and U51 input COIN B and U101, U65, U84 and U89 input COIN A, together with Player 1 and 2 start, to data bus buffer U88. U82 accesses/buffers Player 1 and 2 Left/Right data, U81 buffers Player 1 and 2 Up/Down data, U86 buffers Player 1 and 2 Fire data and U87 serves for Option Selection data. SW3 is the self-test switch. When closed, it applied a LO to pin-17 ( $\overline{NMI}$ ) of the Z80A, initiating a systems/function verification as follows: (SW3 is the large red button at the upper right corner of the Board Assembly.)



## SUPER ZAXXON Self-Test

### 1. ROM Test

Both results are displayed simultaneously:

### 2. Work RAM Test

ROM TEST

ROM 1 OK or NG

ROM 2 OK or NG

ROM 3 OK or NG

RAM TEST

RAM 1 OK or NG

RAM 2 OK or NG

- The ROM Test sum-check is made for the 3K bytes which contain a part of this test program, out of 4K bytes in ROM 1 (2532) and for ROM 2 and 3 (2564). The sum-check adds each byte of each ROM, retains only the last 16 bits (hexadecimal 4 digits) and compares this value with the value stored in ROM 1.
- The Work RAM Test is made for two Work RAMs (2K bytes each). Each RAM is loaded with the hexadecimal "55", reads 1 byte at a time and checks if it is a hexadecimal "55", repeating this process with the hexadecimal "A". This test is made to check interference between adjacent bits.

\* - Press the PLAYER 1 START BUTTON to advance each test step.

### 3. Scroll Screen Test

- \* a) No display
- \* b) enemy base entrance wall in the 2nd pattern (7 bricks high)
- \* c) between the 1st wall and 2nd wall (3 bricks high)
- \* d) between the 2nd wall and 3rd wall (5 bricks high)
- \* e) between the 3rd wall and 4th wall (1 brick high)
- \* f) between the 4th wall and 5th wall (3 bricks high)
- \* g) behind the 5th wall
- \* h) hexagonal pattern floor
- \* i) space background: 1 large star
- \* j) space background: 2 large stars
- \* k) enemy base entrance wall in the 1st pattern (7 bricks high)
- \* l) behind the 1st wall: tanks and pipe lines
- \* m) wall in half-way (1 brick high): 5 pipe lines are seen
- \* n) pipe lines are seen with tanks overhead

- \* o) runway entrance
- \* p) middle of runway
- \* q) end of runway
- \* r) exit wall in the 1st pattern
- \* s) space with no star: end of base can be seen at the left

#### 4. Target Pattern Test

- a) Player ship - 12  
Bullet - 4
- \* Enemy Ship - 8
- b) Ship - 1, Rocket - 2, Missile - 2, Target - 1, Explosion - 2,  
Barrier - 1, Wall - 2, Artillery - 1, Tank - 1, Radar - 1,
- \* Enemy Ship - 1, Bullet - 1, Wreck - 1, Explosion - 6
- c) Explosion - 4, Satellite - 1, Building - 8, Score - 3
- \* (200, 500, 1000)

#### 5. Video RAM and Object (Target) RAM Test

VRAM TEST

VRAM OK or NG

ORAM TEST

- \* ORAM OK or NG

-This test is made for the VRAM character pattern display and the ORAM target pattern display. The check method is the same as described in step 2.

#### 6. Input Switch Test

-Press each of the specified switches in the order displayed. Ok is displayed if the switch is operating normally.

INPUT TEST

MAIN (Player 1 input ports)

RIGHT

LEFT

UP

DOWN

FORWARD

SUB (Player 2 input ports)

RIGHT

LEFT

UP

DOWN

FORWARD

1 PLAYER START

2 PLAYER START

COIN A

COIN B

\* SERVICE SWITCH

7. Software Output Port Test

-Tests if signals are sent from the software to the hardware.

OUTPUT TEST

CAEN

CBEN

SVEN

\* CNTA

\* CNTB

\* REVERSE (180° flip is displayed)

\* RETURN (Displays FLIP IS OK)

-Enables are automatically checked at the falling edge of the input signal.

8. DIP Switch Test

-Tests the connection between the DIP switches and the software. Test the two DIP switches both with every other bit on, then tests by reversing ON and OFF. Thus interference between adjacent bits can be checked at the same time.

TEST 1

\* TEST 2

9. Character Pattern Test

-Displays the character patterns and picture patterns in the same ROM.

-Letters, numbers and patterns like A to Z, 0 to 9, and

are displayed.

\* -Changes color.

10. Color Reference Test

-For character patterns and background pictures, check that the color

\* reference changes each time the Player 1 Start button is pressed.

11. Sound Port Test

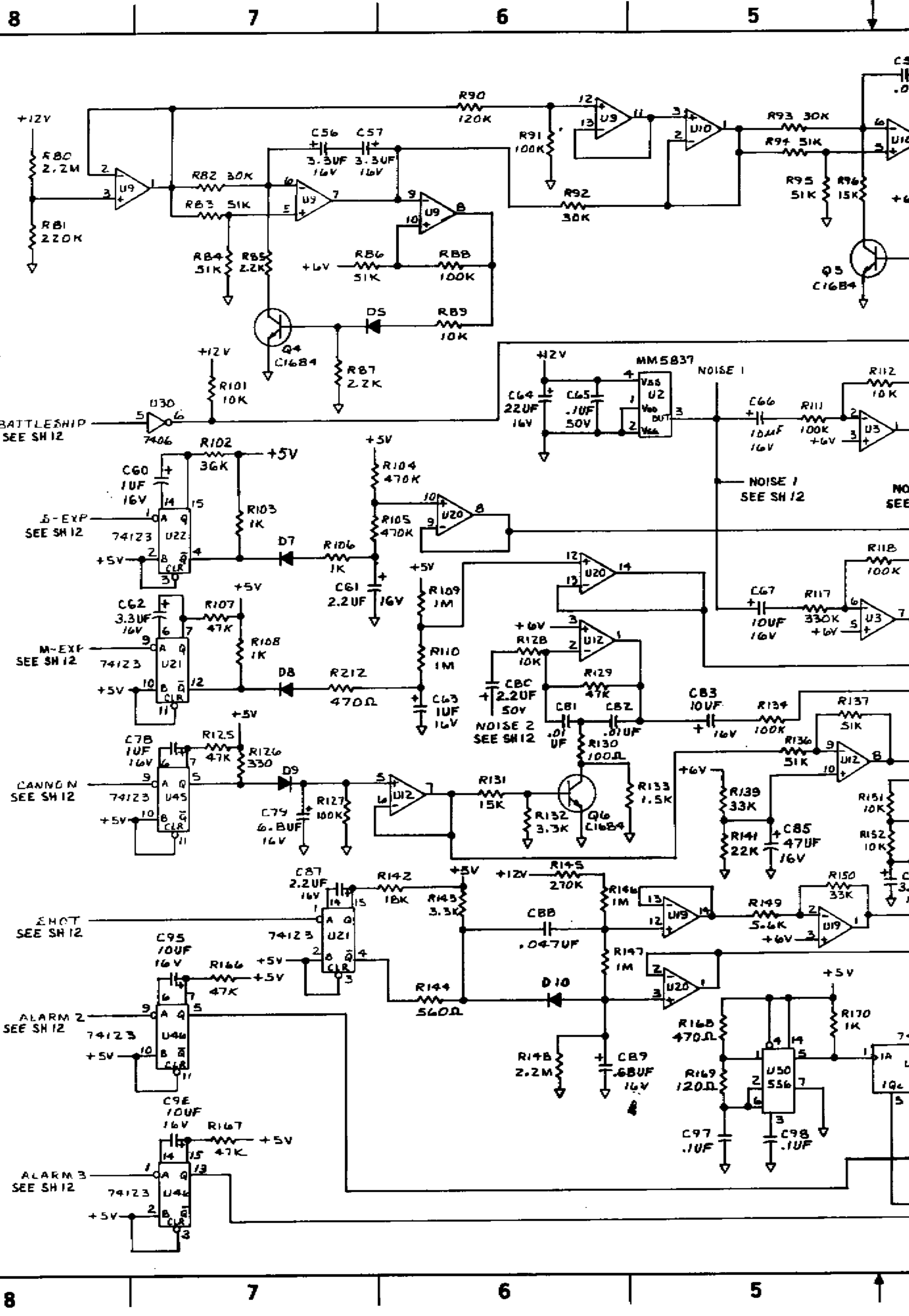
-Verify that sound is emitted each time the \* button is pressed.

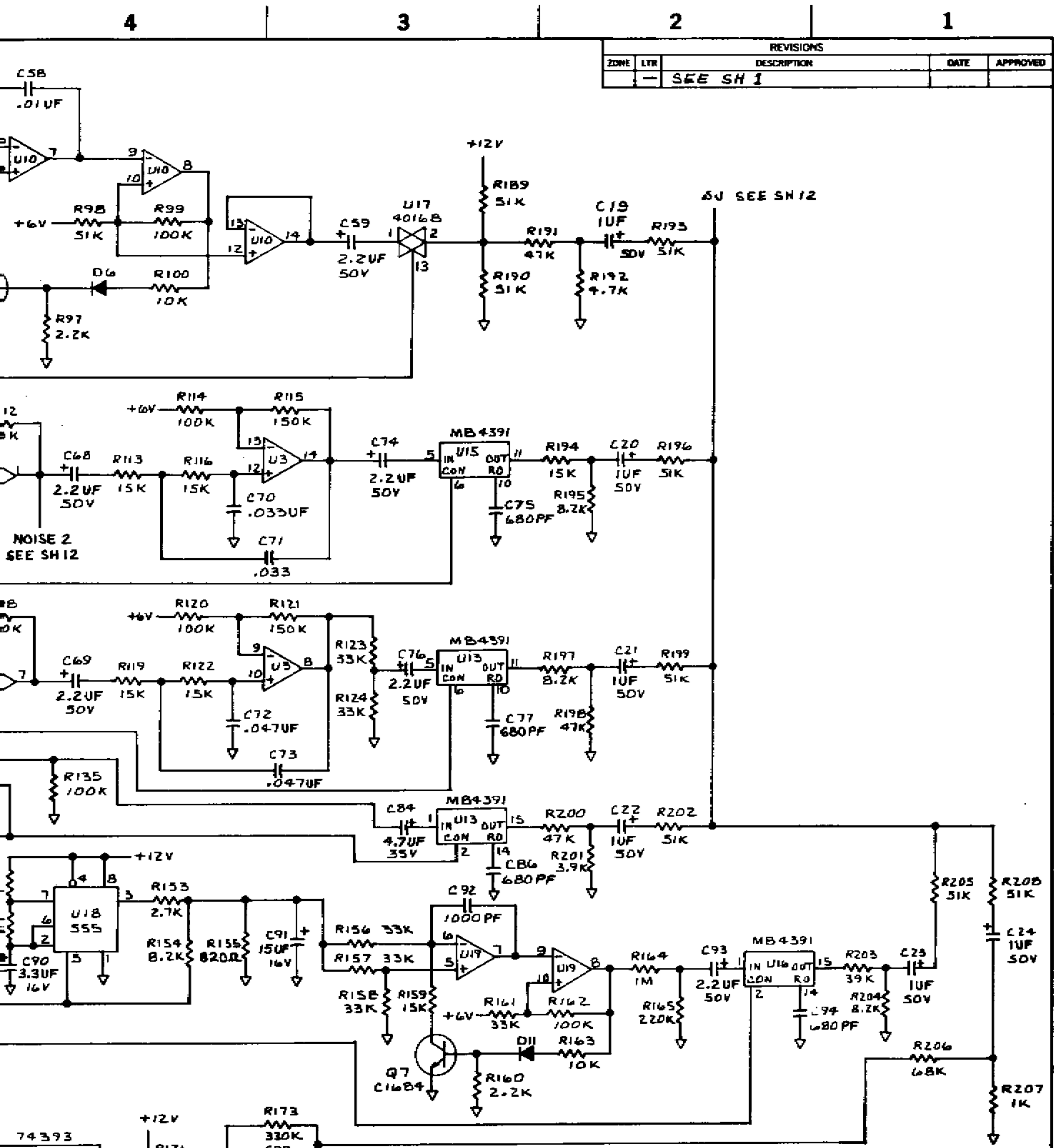
-Bit 1, 2, 3, 9, 10, 11, 12, 15, 18, 21, 22, 23 and 24 does not emit sound.

- \* a) flying sounds (tone changes in a thru e)
- \* b) flying sounds
- \* c) flying sounds
- \* d) flying sounds
- \* e) flying sounds
- \* f) no sound (reset)
- \* g) homing missile
- \* h) missile firing
- \* i) barrier
- \* j) robot
- \* k) explosion (small)
- \* l) explosion (large)
- \* m) firing
- \* n) firing (enemy)
- \* o) target
- \* p) fuel
- \* END SELF-TEST

Due to the striking isometric perspective used in SUPER ZAXXON, memory requirements for background generation are significant. On Assy IC Board B (800-3310 or 800-3301), EPROMs 4-15 contain a total of 672K bits of video character, positioning, color and timing information. Background generation accessible memory is provided by TTL Isoplaner RAMs U42, U64 (Zone 6-B, Sht. 8, Assy IC Bd. B), and U46 (Zone 2-D, Sht. 6, Assy IC Bd. B), in addition to the 1024 x 4 bit RAMs U17 and U36. Composite synchronization is taken from pin-4 of U11 (Zone 2-C, Sht. 7, Bd. B) applied to pin-5 of U93 (Zone 7-A, Sht. 13, Assy IC Bd. A), selectably polarized by switch SW4 and put on pin-20 of P5, for input to the monitor, in addition to W, 19 and X. 180° video FLIP for cocktail models is latched into the data bus by SW1 position 8 through U87 (Zone 3-B, Sht. 13, Assy IC Bd. A).

Just as the microprocessor Z80A is the heart of the game computer, so too is the 8255AC-5 (U23, Zone 8-C, Sht. 12, Assy IC Bd. A) the center of activity in the Sound Area. Called a Sound Generator, U23 interfaces data and address bus, enabling specific sound processing circuits. These circuits consist of individual sounds for Player Ship Flying Sounds, Homing Missile, Base Missile, Barrier, Robot, Small-explosion, Large-explosion,





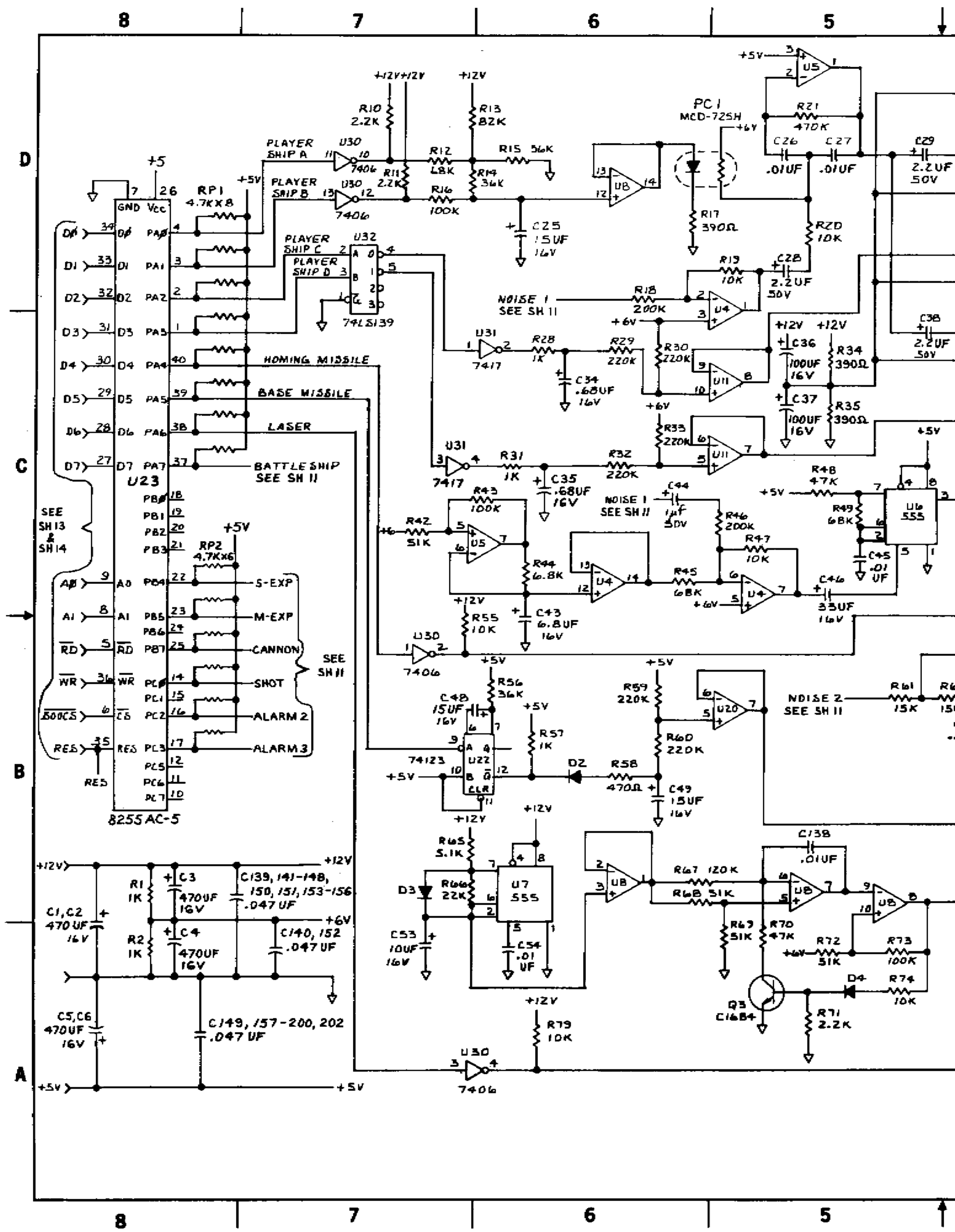
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ZONE	LTR	DESCRIPTION	DATE
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QTY	CODE	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	ITEM NO.
PARTS LIST				
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:			CONTRACT NO.	
FRACTIONS	DECIMALS	ANGLES	APPROVALS	
±	.XX ±	±	DATE	
MATERIAL			DRAWN	
FINISH			CHECKED	
NEXT ASSY			MECH	
USED ON			ELEC	
APPLICATION			MFG	
DO NOT SCALE DRAWING			PROJECT	

**Granlin/SCCA**  
San Diego, California 92123

**IC Board A**

SIZE	CODE	IDENT NO.	DRAWING NO.	REV
D			800-3300	A
SCALE NONE			SHEET 11 OF 16	



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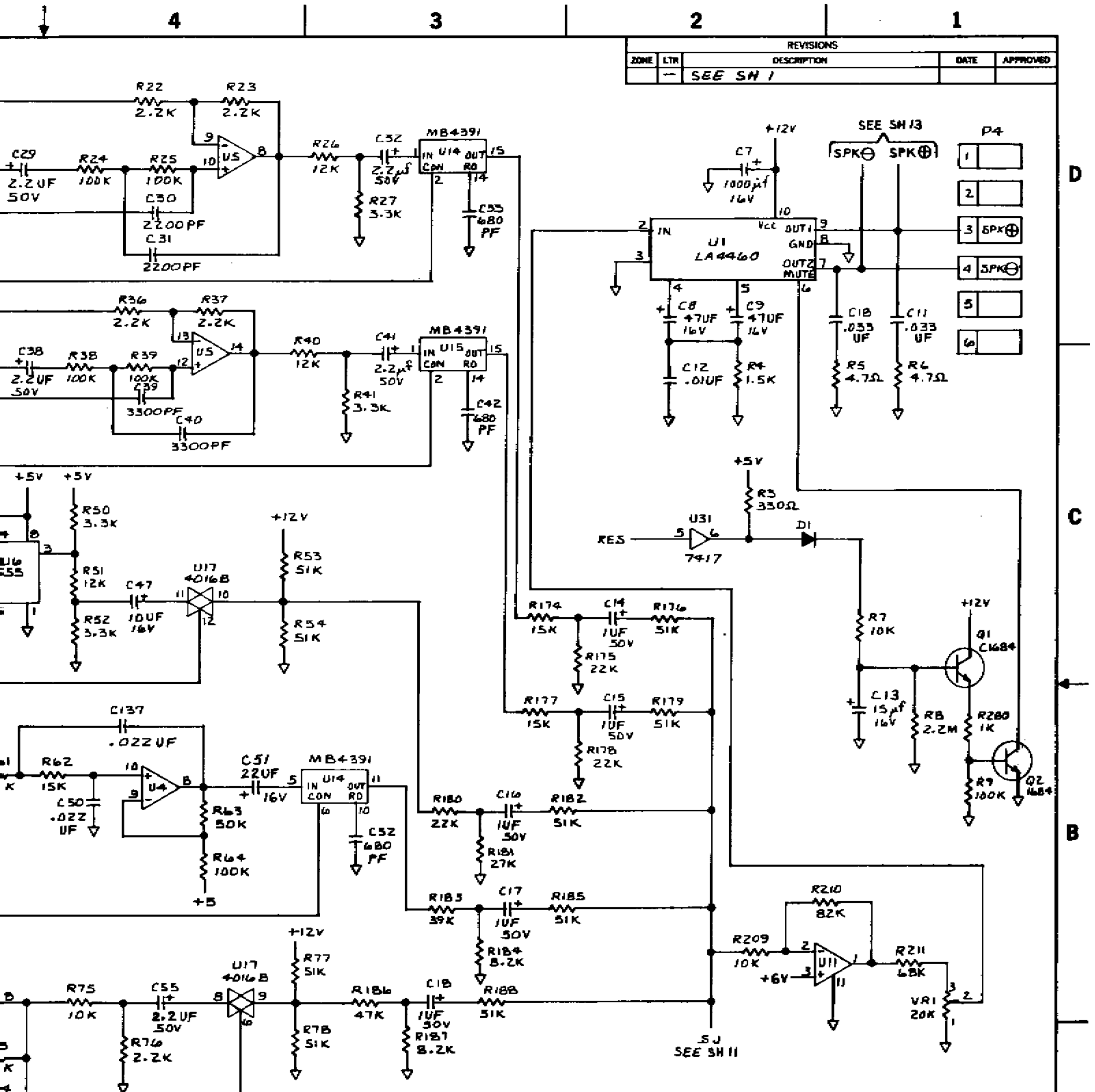
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REVISIONS			
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-	-	SEE SH 1	

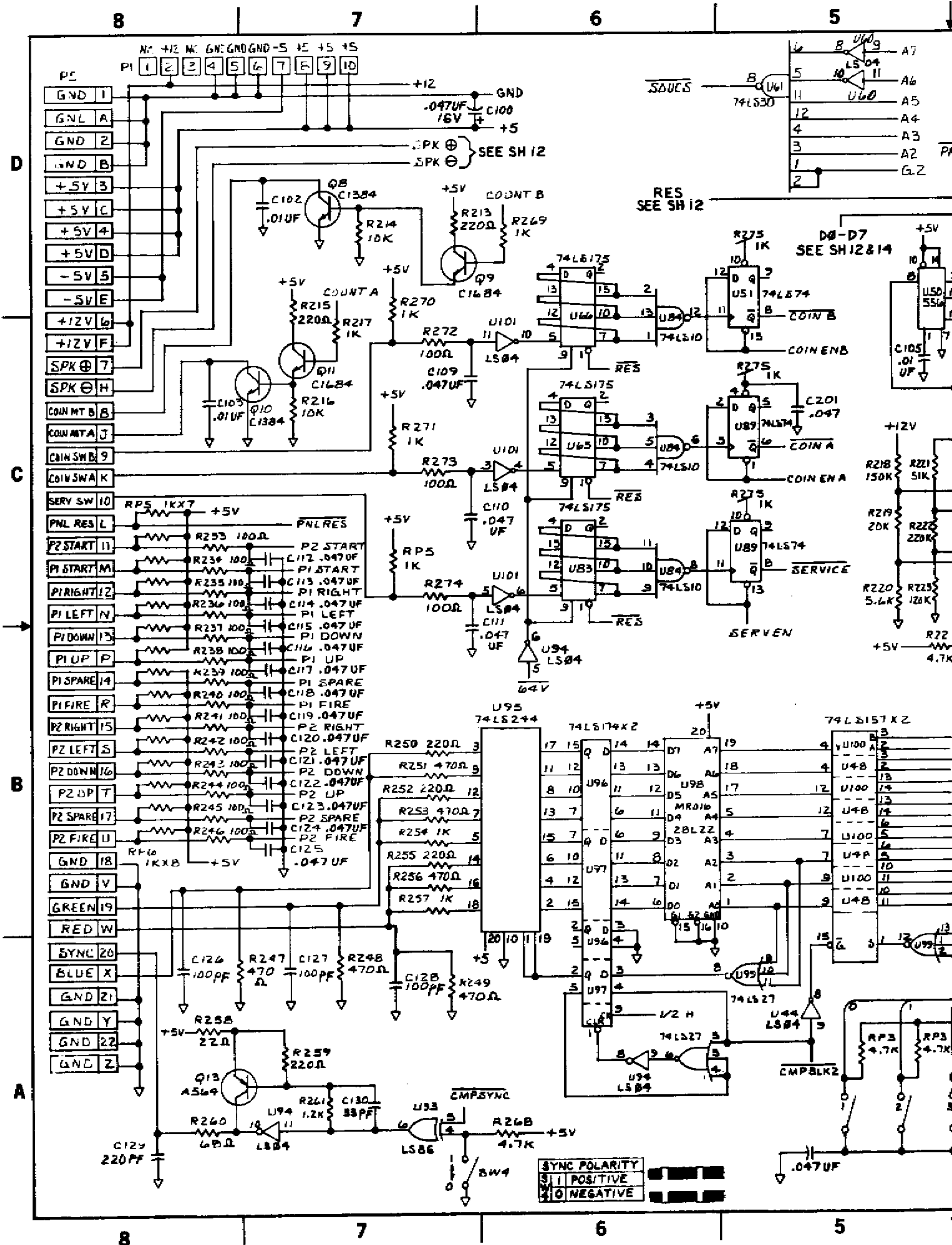


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PARTS LIST					
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FRACTIONS	DECIMALS	ANGLES			
±	.XX ±	±	<b>IC Board A</b>		
MATERIAL	CONTRACT NO.				
FINISH	APPROVALS	DATE			
NEXT ASSY	USED ON	PROJECT			
APPLICATION			DO NOT SCALE DRAWING	SCALE NONE	SHEET 12 OF 16

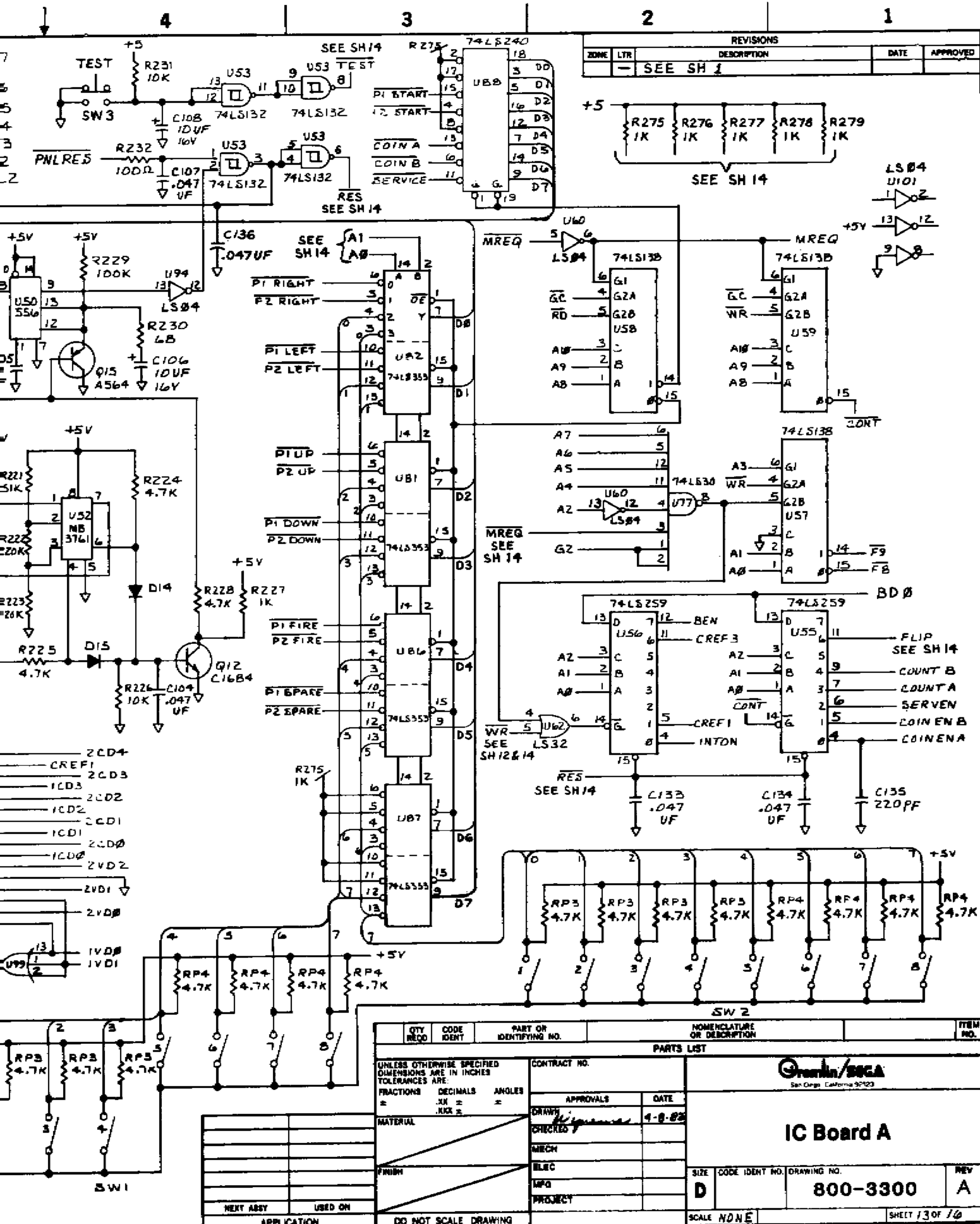
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CHECKED <i>W. GRICE</i>	4-8-82
MECH	
ELEC	
MFG	
PROJECT	

SIZE	CODE IDENT NO.	DRAWING NO.	REV
D		800-3300	A





SYNC POLARITY  
 S I POSITIVE  
 W O NEGATIVE



ZONE	LTR	DESCRIPTION	DATE	APPROVED
		SEE SH 1		

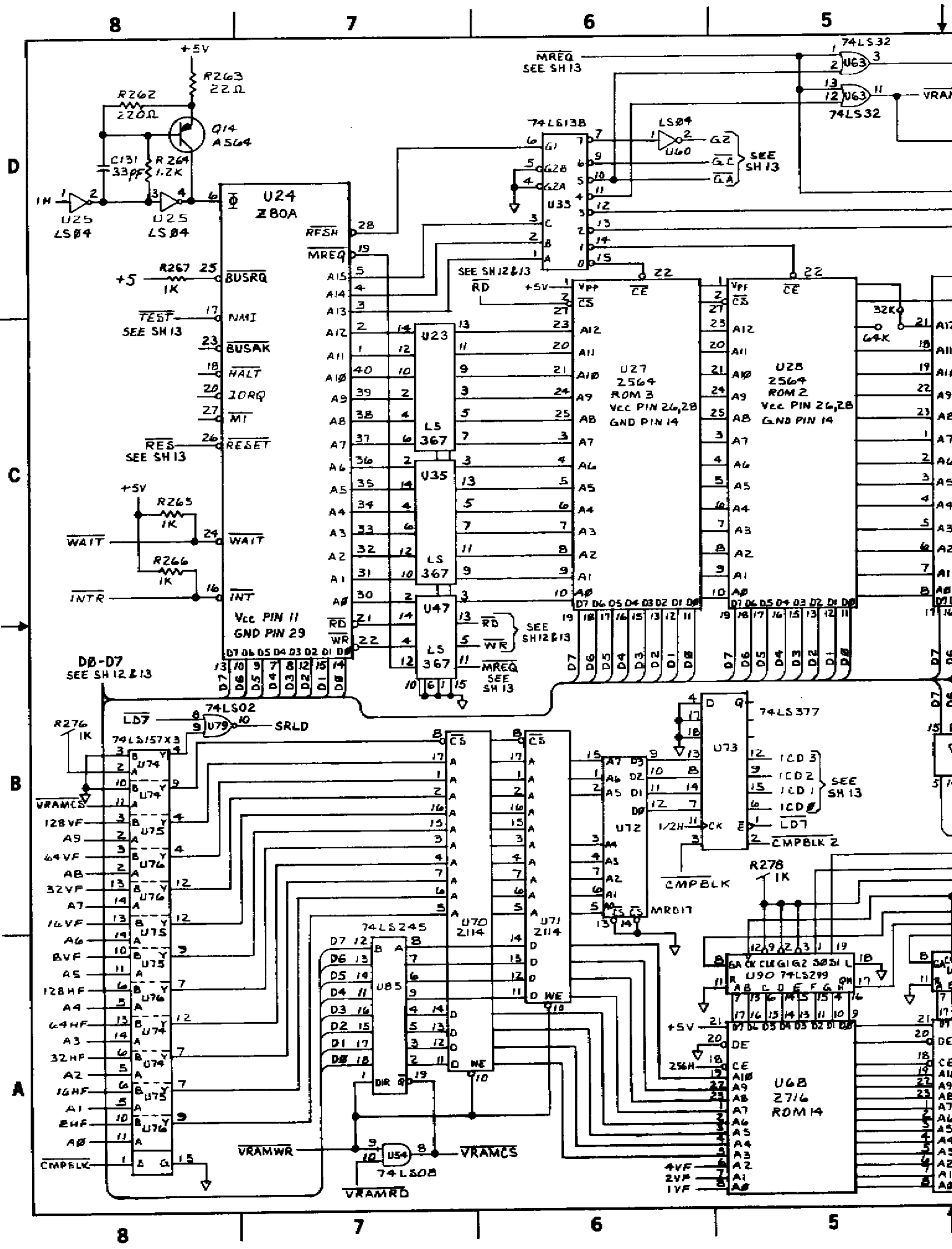
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FRACTIONS	DECIMALS	ANGLES		
±	±	±		
MATERIAL				
FINISH				
NEXT ASSY				
USED ON				
APPLICATION				
DO NOT SCALE DRAWING				

CONTRACT NO.		Franklin/SGCA San Diego, California 92123	
APPROVALS	DATE		
DRAWN	4-8-82		
CHECKED			
MECH			
ELEC			
MFG			
PROJECT			
SIZE	CODE IDENT NO.	DRAWING NO.	REV
D		800-3300	A
SCALE NONE			SHEET 13 OF 16

**IC Board A**

**800-3300**

**A**



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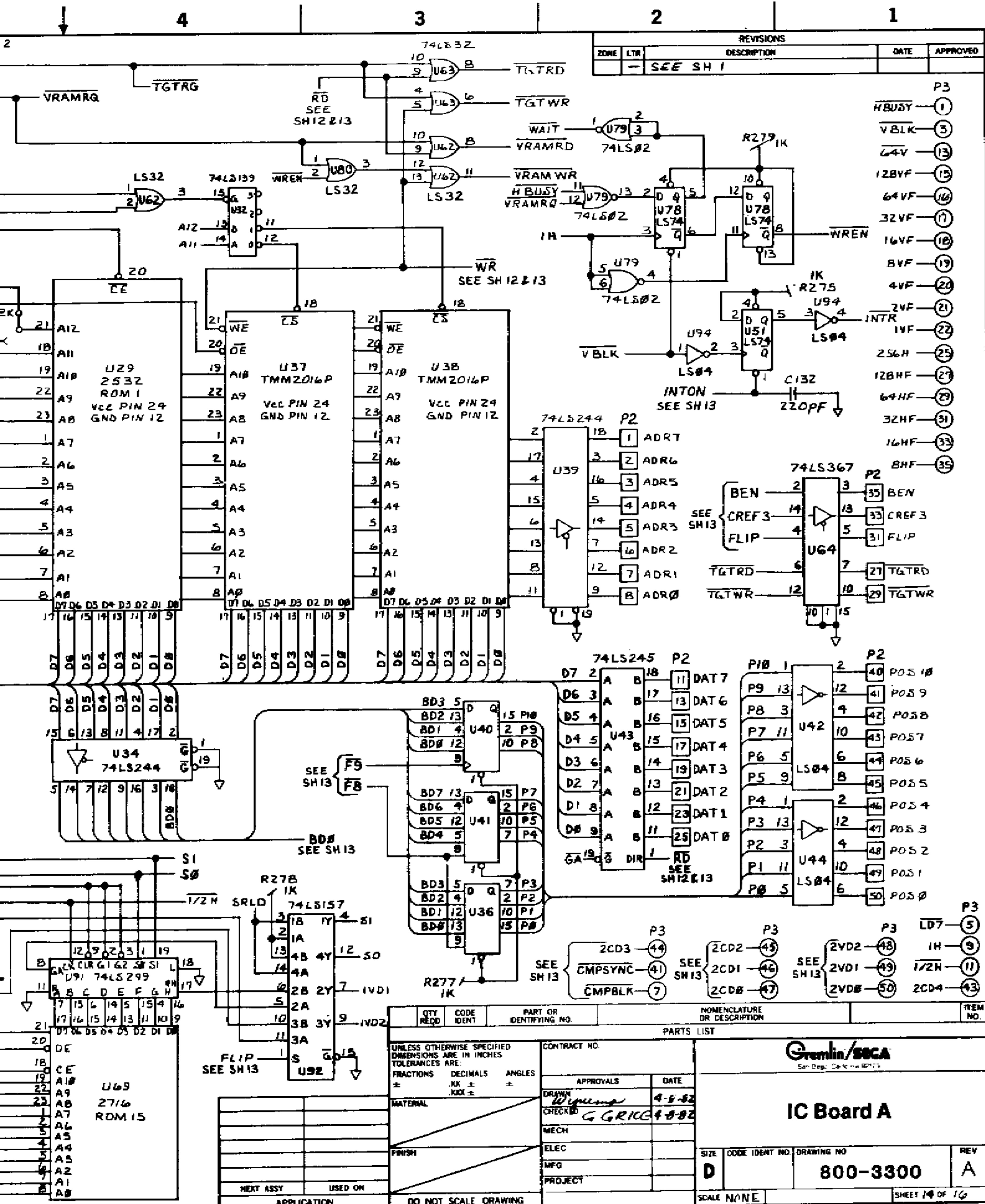
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REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		SEE SH 1		

QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	ITEM NO.
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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:

FRACTIONS	DECIMALS	ANGLES
±	.XX ±	±
	.XXX ±	

MATERIAL: \_\_\_\_\_

FINISH: \_\_\_\_\_

CONTRACT NO. \_\_\_\_\_

APPROVALS: \_\_\_\_\_ DATE: 4-8-82

CHECKED: G. GRIGG 4-8-82

MECH: \_\_\_\_\_

ELEC: \_\_\_\_\_

MFG: \_\_\_\_\_

PROJECT: \_\_\_\_\_

SCALE: NONE

SIZE: D CODE IDENT NO. DRAWING NO. 800-3300 REV. A

SHEET 14 OF 16

**Gremlin/SCCA**  
San Diego, California 92113

**IC Board A**

800-3300

REV. A

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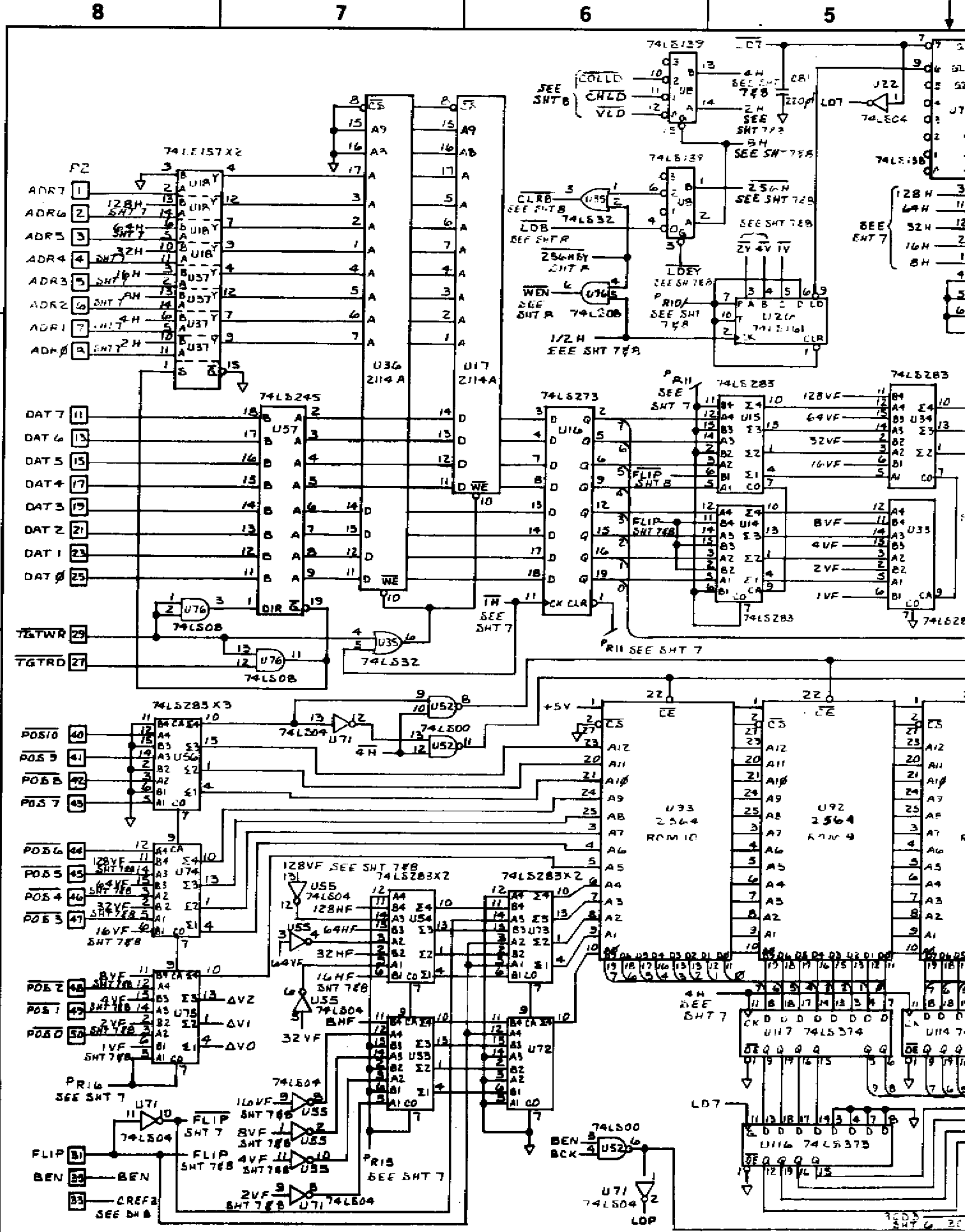
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D

C

B

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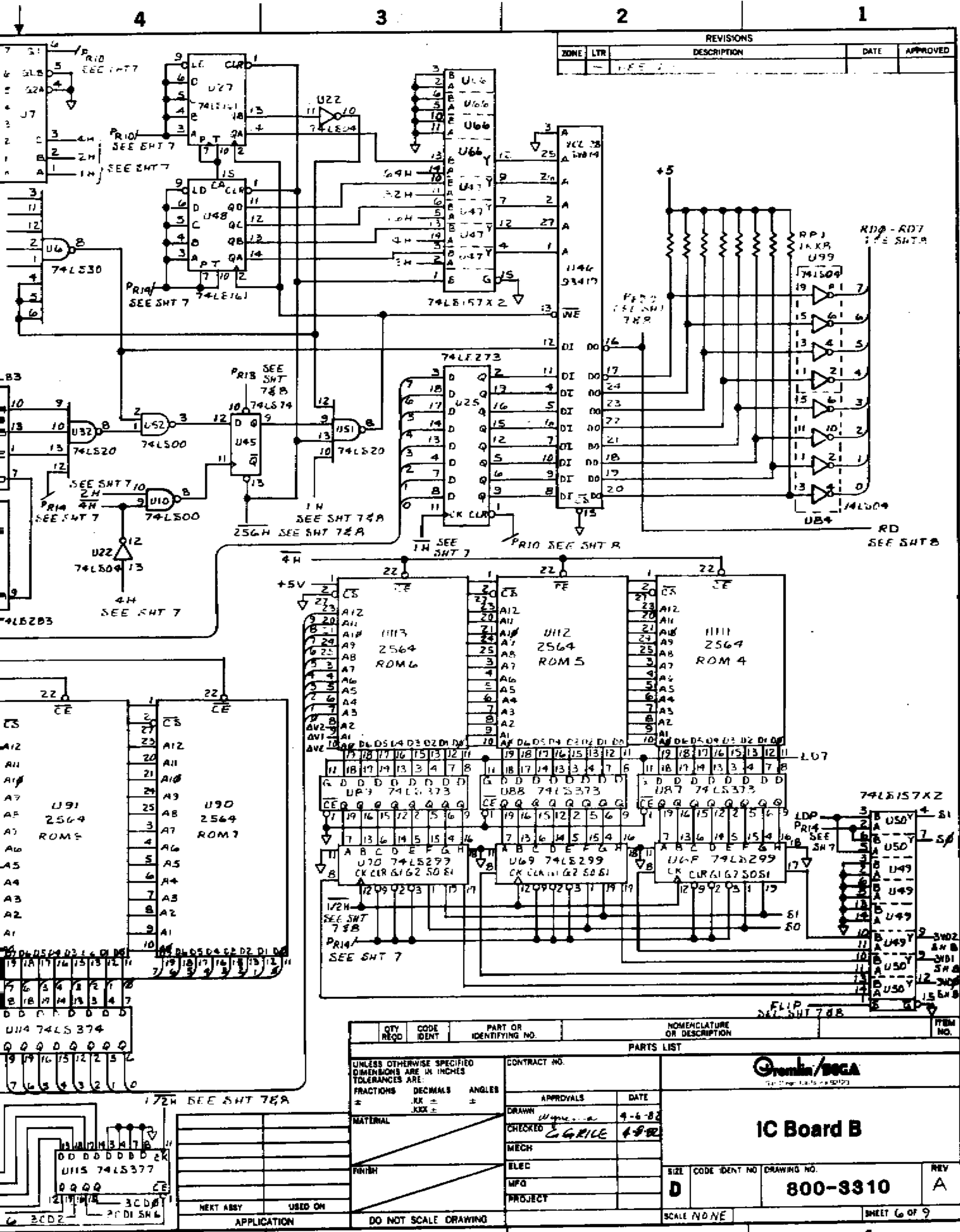


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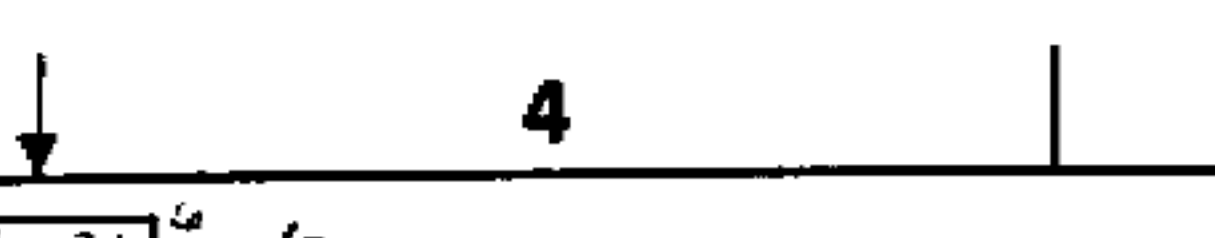
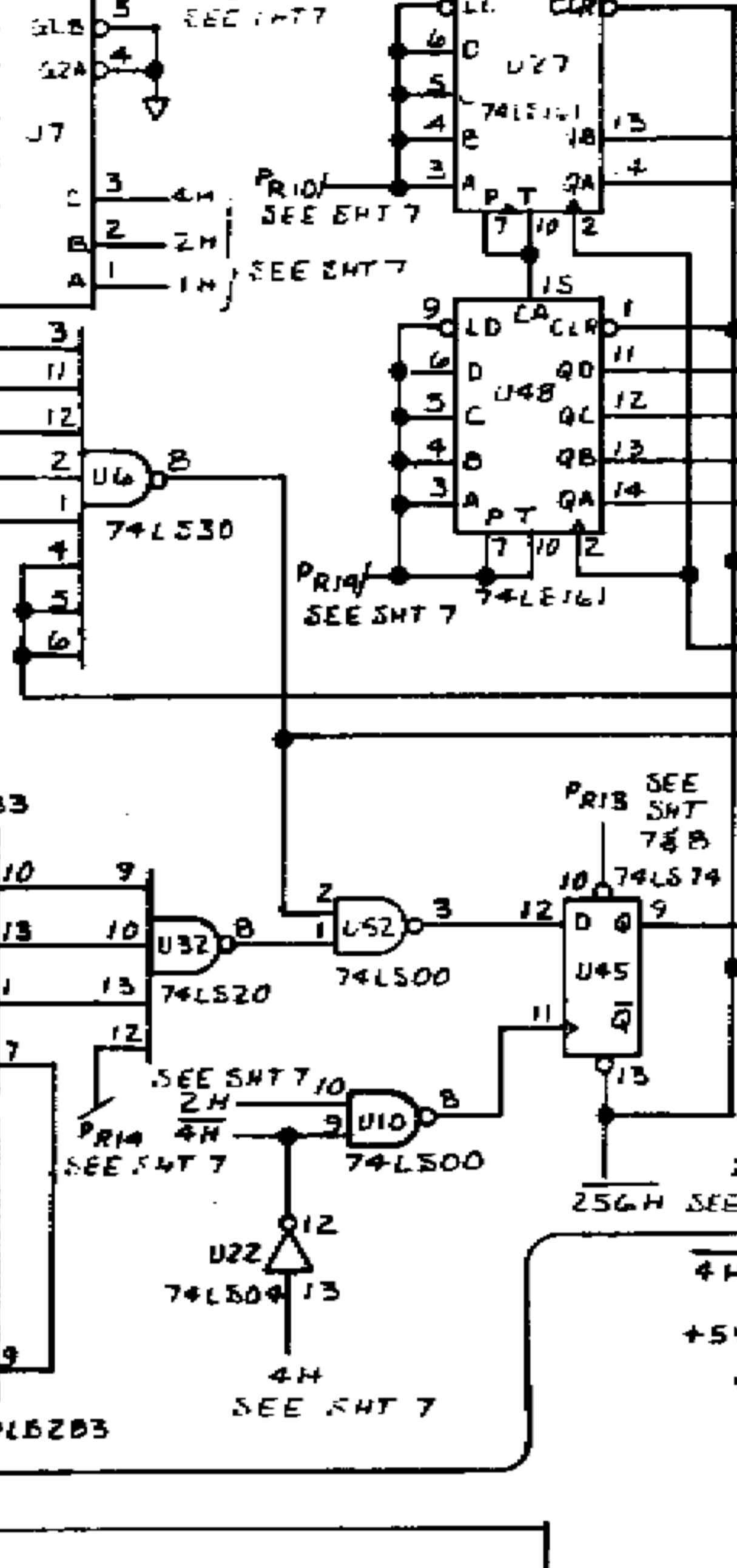
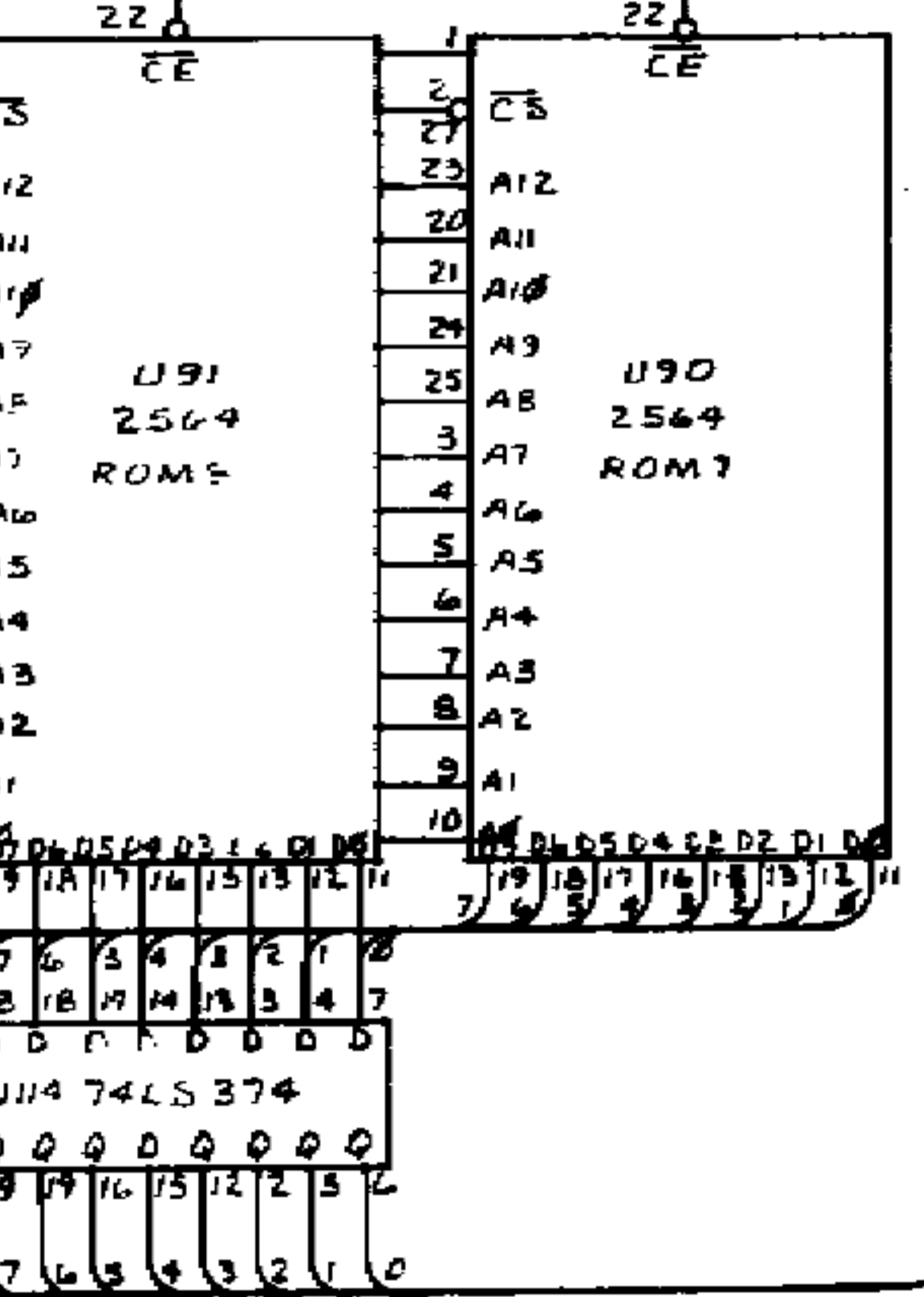
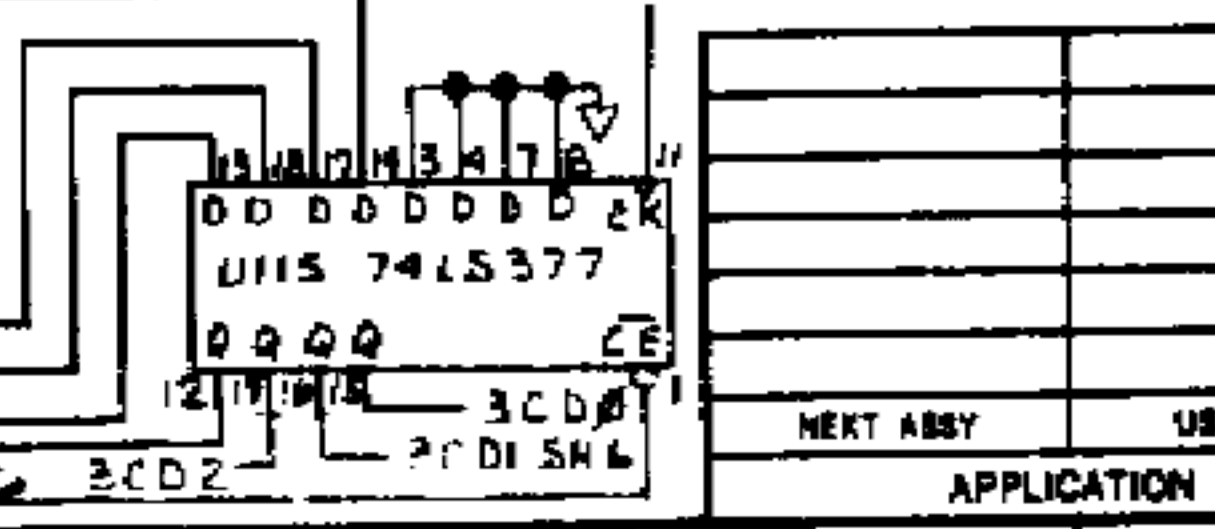
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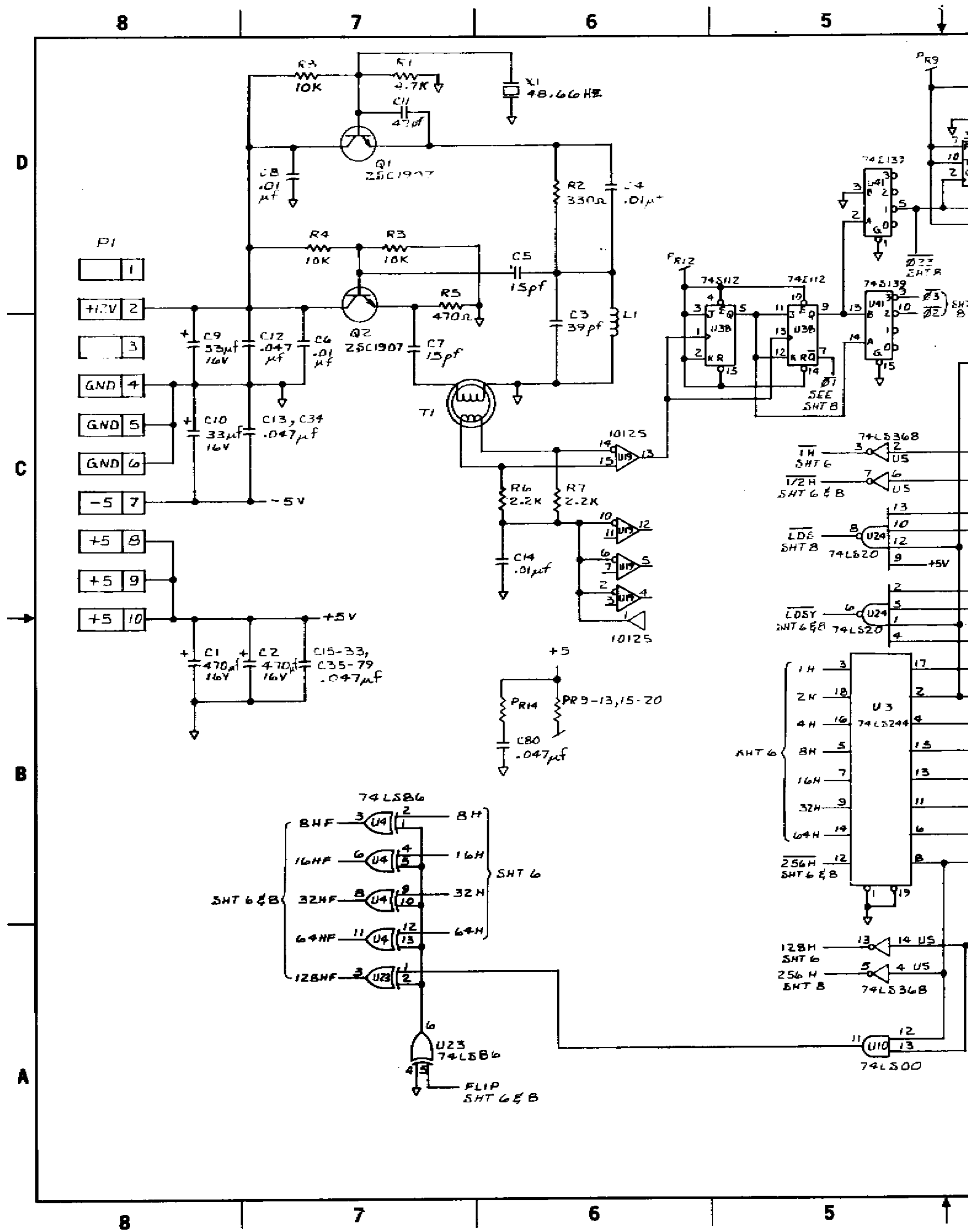
  

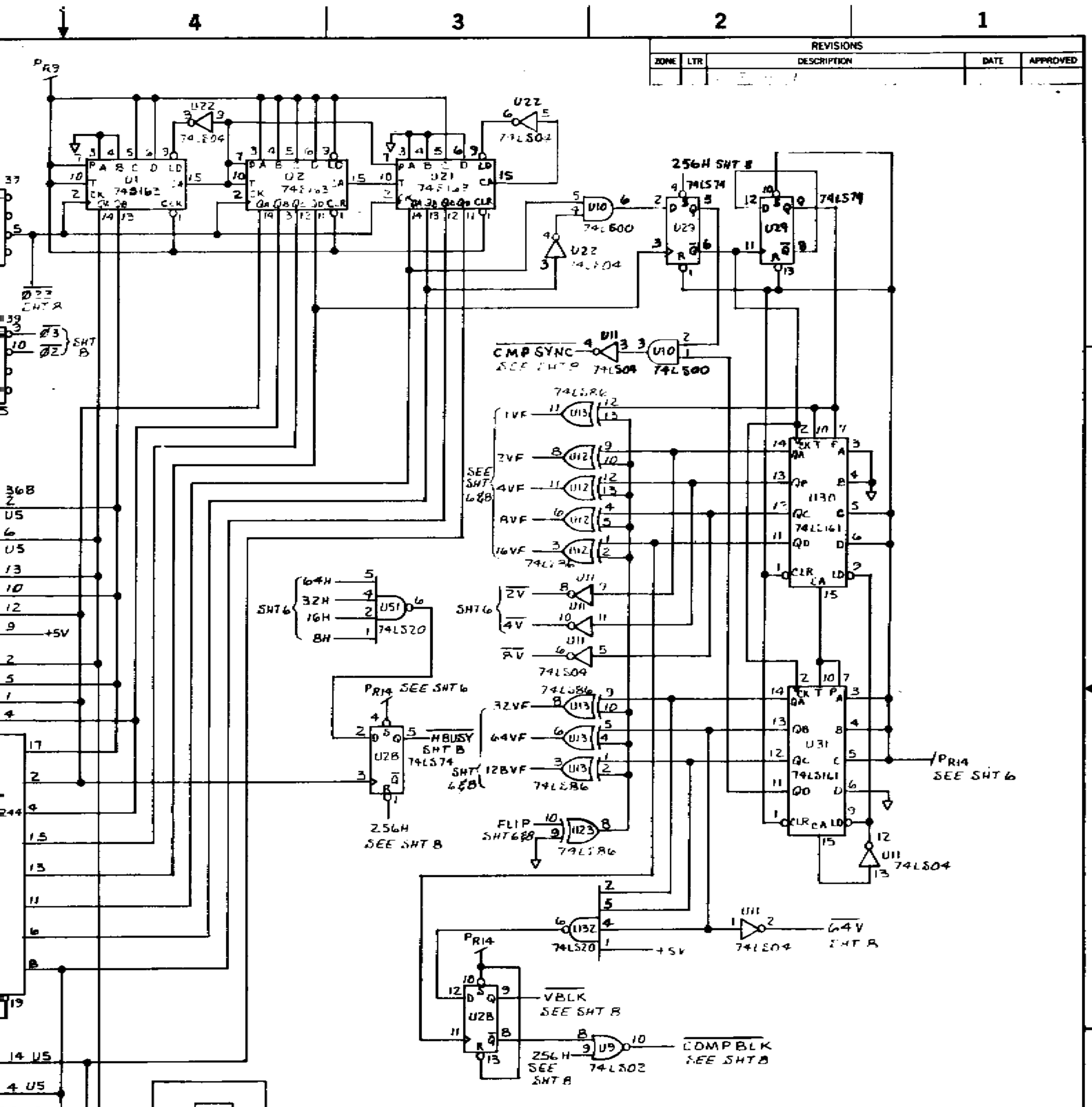
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FRACTIONS	DECIMALS	ANGLES	
±	.XX ±	±	
MATERIAL		APPROVALS	
		DATE	
FINISH		DRAWN <i>W. J. ...</i> 4-6-82	
		CHECKED <i>E. GRILE</i> 4-8-82	
		MECH	
		ELEC	
		MFG	
		PROJECT	

IC Board B		800-3310	
SCALE NONE	D	DRAWING NO.	REV A
SHEET 6 OF 9			







REVISIONS			
ZONE	LTR	DESCRIPTION	DATE

QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	ITEM NO.
PARTS LIST				
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FRACTIONS ±	DECIMALS ±	ANGLES ±	APPROVALS	
			DATE	
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FINISH		CHECKED: <i>[Signature]</i> 4-8-82		
NEXT ASSY		MECH		
USED ON		ELEC		
APPLICATION		MFG		
DO NOT SCALE DRAWING		PROJECT		
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		D 800-3310		A
		SCALE N/C/E		SHEET 7 OF 9

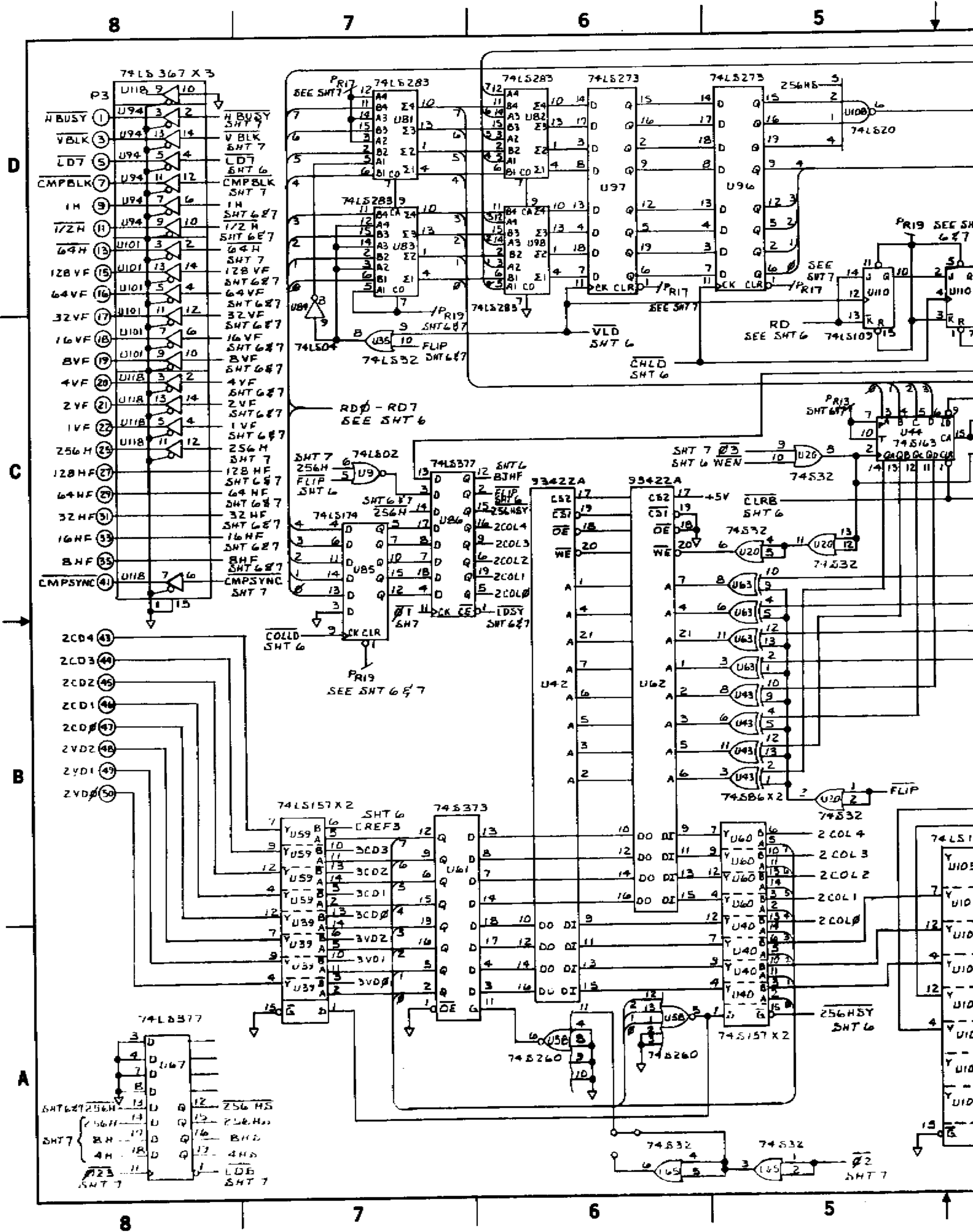
**Gremlin/SCGA**  
San Diego, CA 92161

**IC Board B**

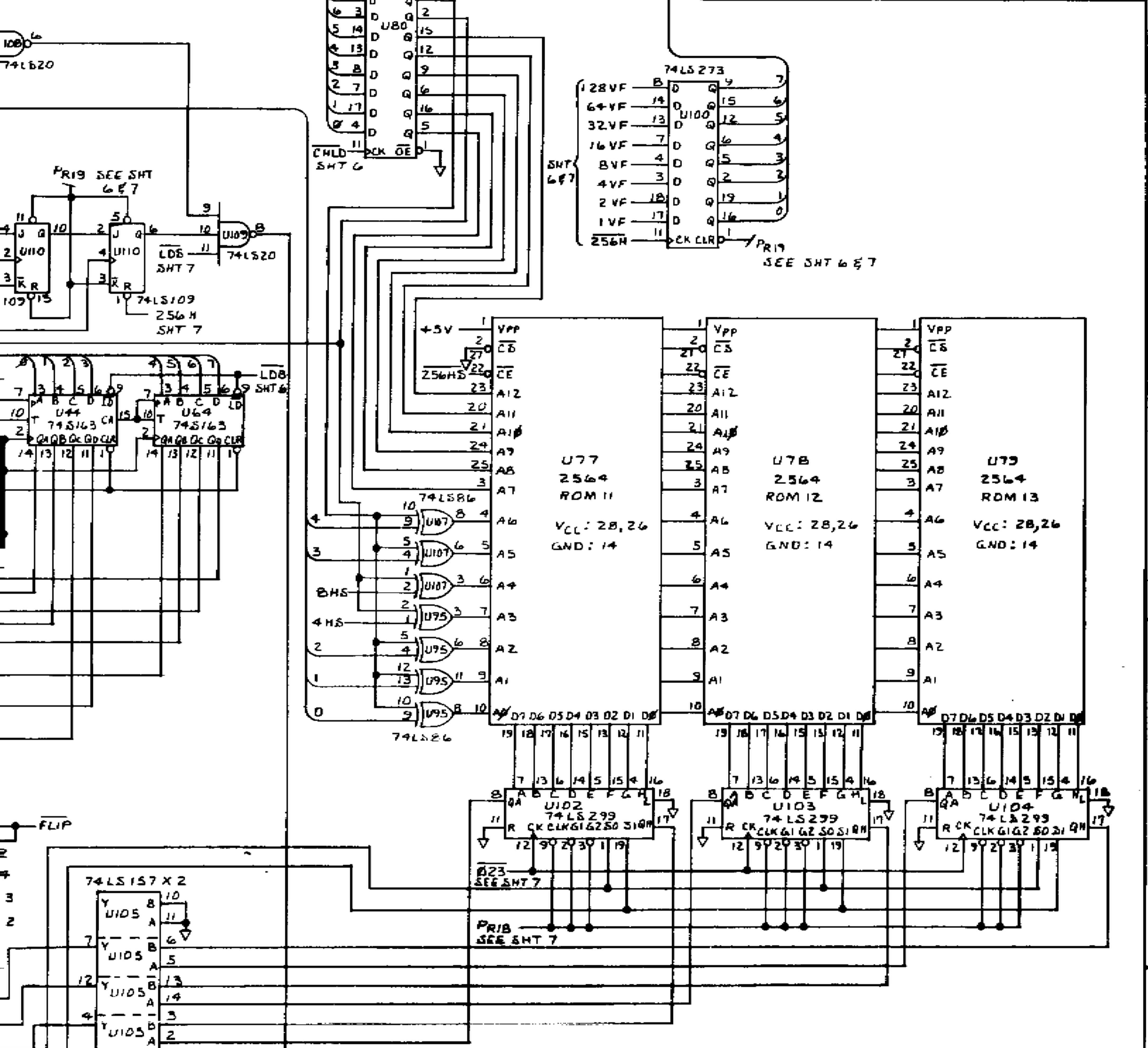
800-3310

REV A

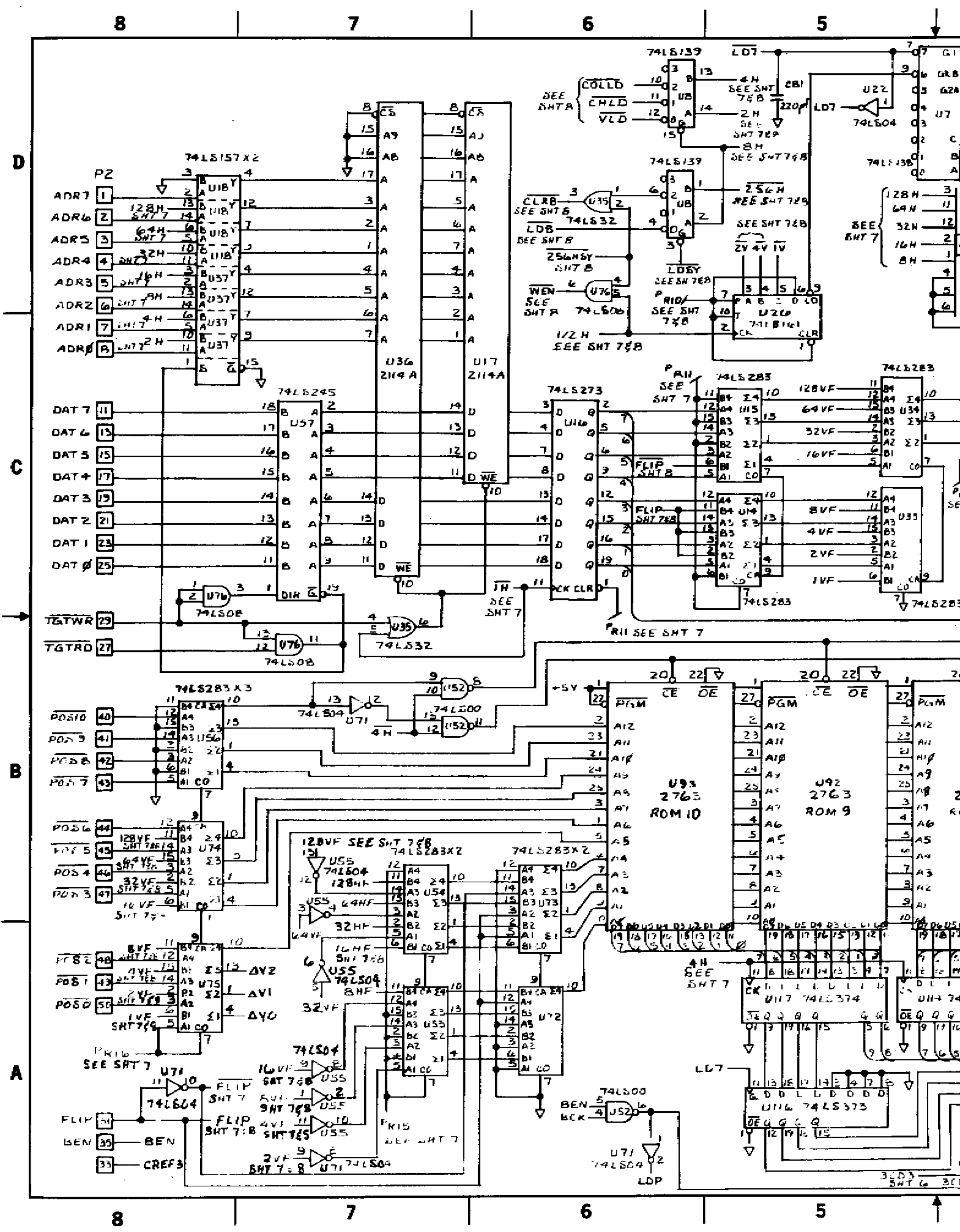




REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		SEE SHT 1		



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PARTS LIST				
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:		CONTRACT NO.		
FRACTIONS	DECIMALS	ANGLES		
±	.XX ±	±		
MATERIAL	APPROVALS		DATE	
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	CHECKED: <i>G. G. RICE</i>		1-8-82	
	MECH			
	ELEC			
	MPB			
	PROJECT			
NEXT ASSY	USED ON	SIZE	CODE IDENT NO	DRAWING NO
		D	800-3310	A
APPLICATION	DO NOT SCALE DRAWING	SCALE	NONE	SHEET 8 OF 9



D

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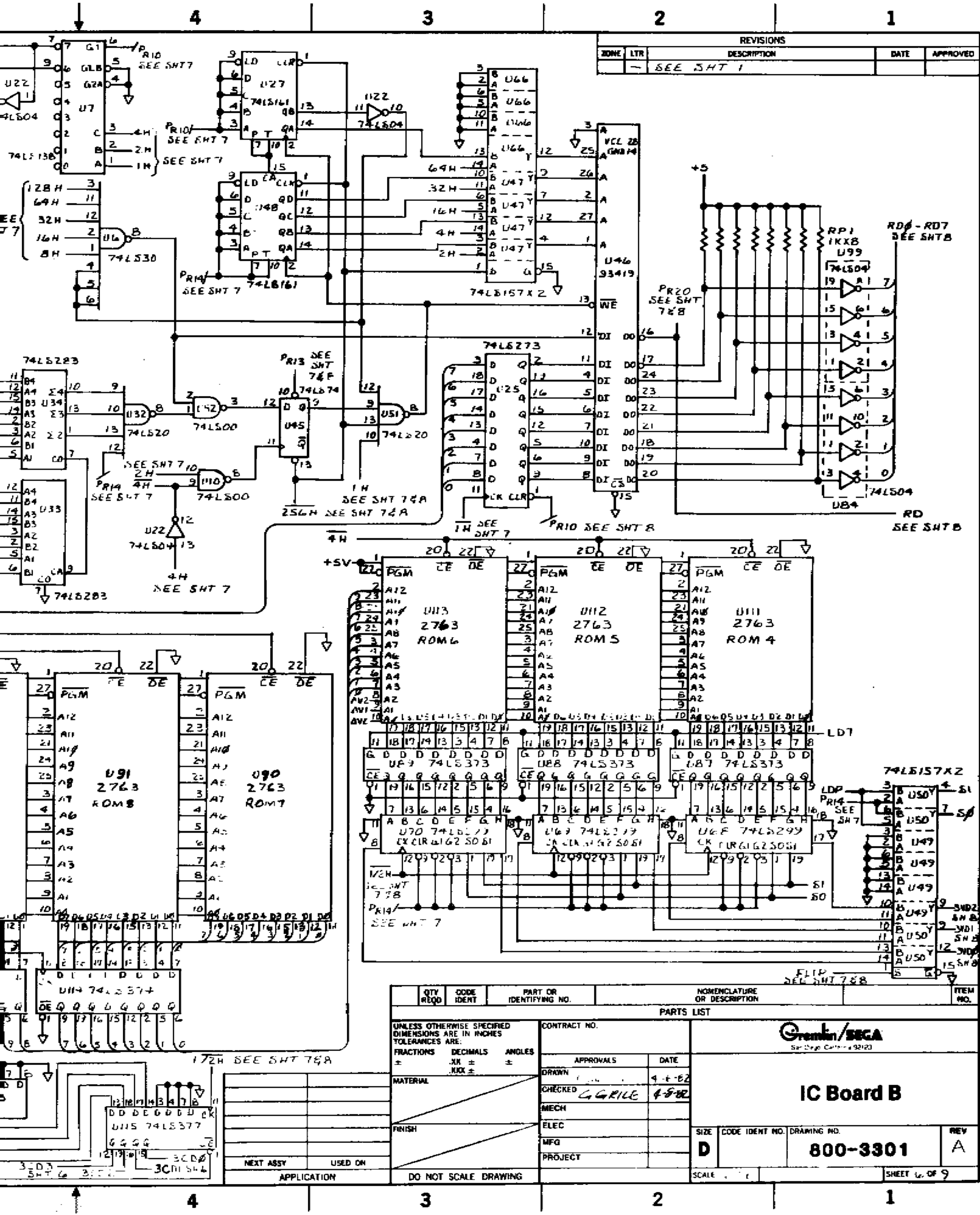
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REVISIONS			
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		SEE SHT 1	

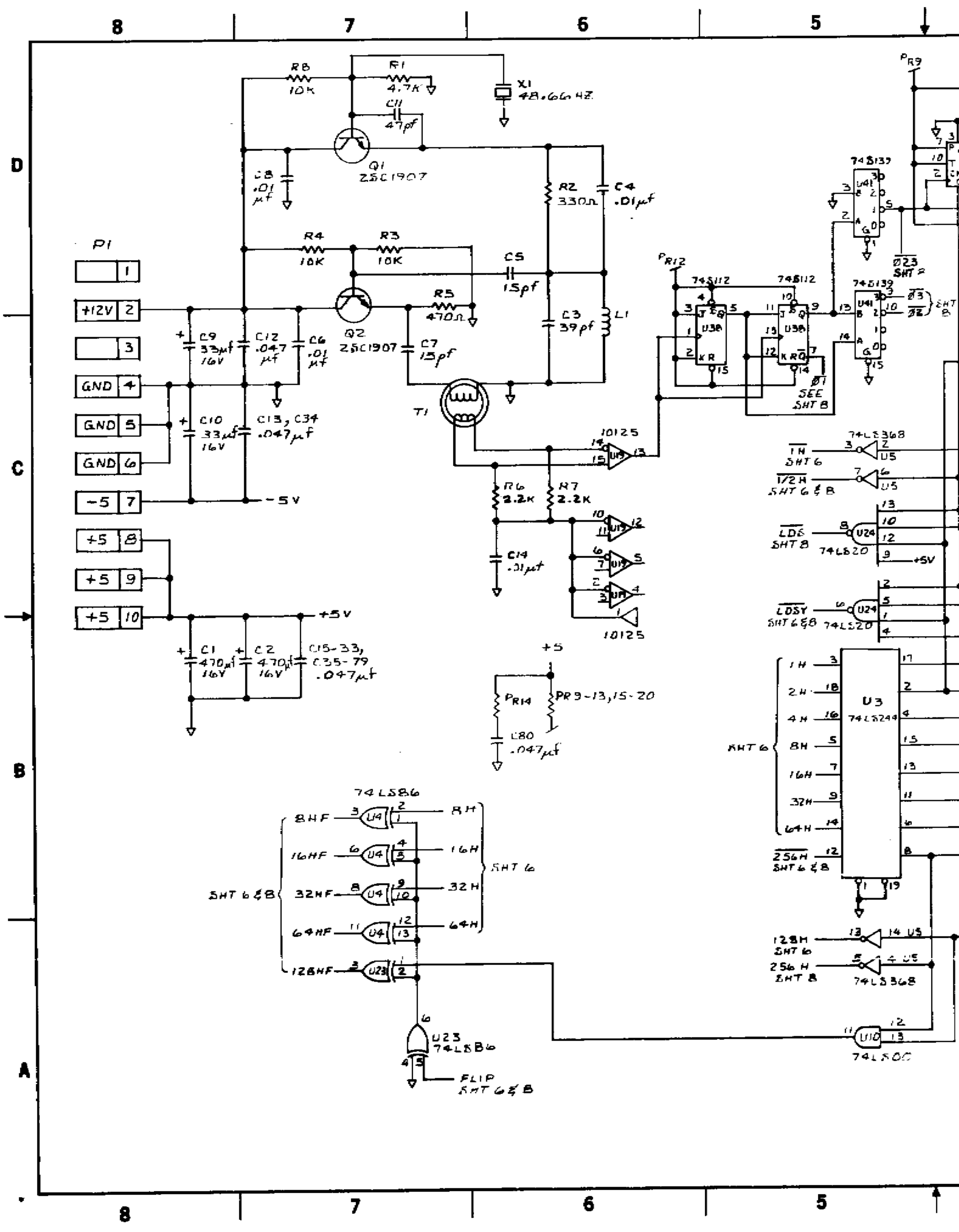
QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	ITEM NO.
PARTS LIST				
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:		CONTRACT NO.		
FRACTIONS	DECIMALS	ANGLES	APPROVALS	
±	.XX ±	±	DATE	
MATERIAL		DRAWN		
FINISH		CHECKED		
NEXT ASSY		MECH		
USED ON		ELEC		
APPLICATION		MFG		
DO NOT SCALE DRAWING		PROJECT		
SCALE		SIZE	CODE IDENT NO.	DRAWING NO.
		D		800-3301
				REV A
				SHEET 6 OF 9

**Grain/SEGA**  
San Diego, California 92123

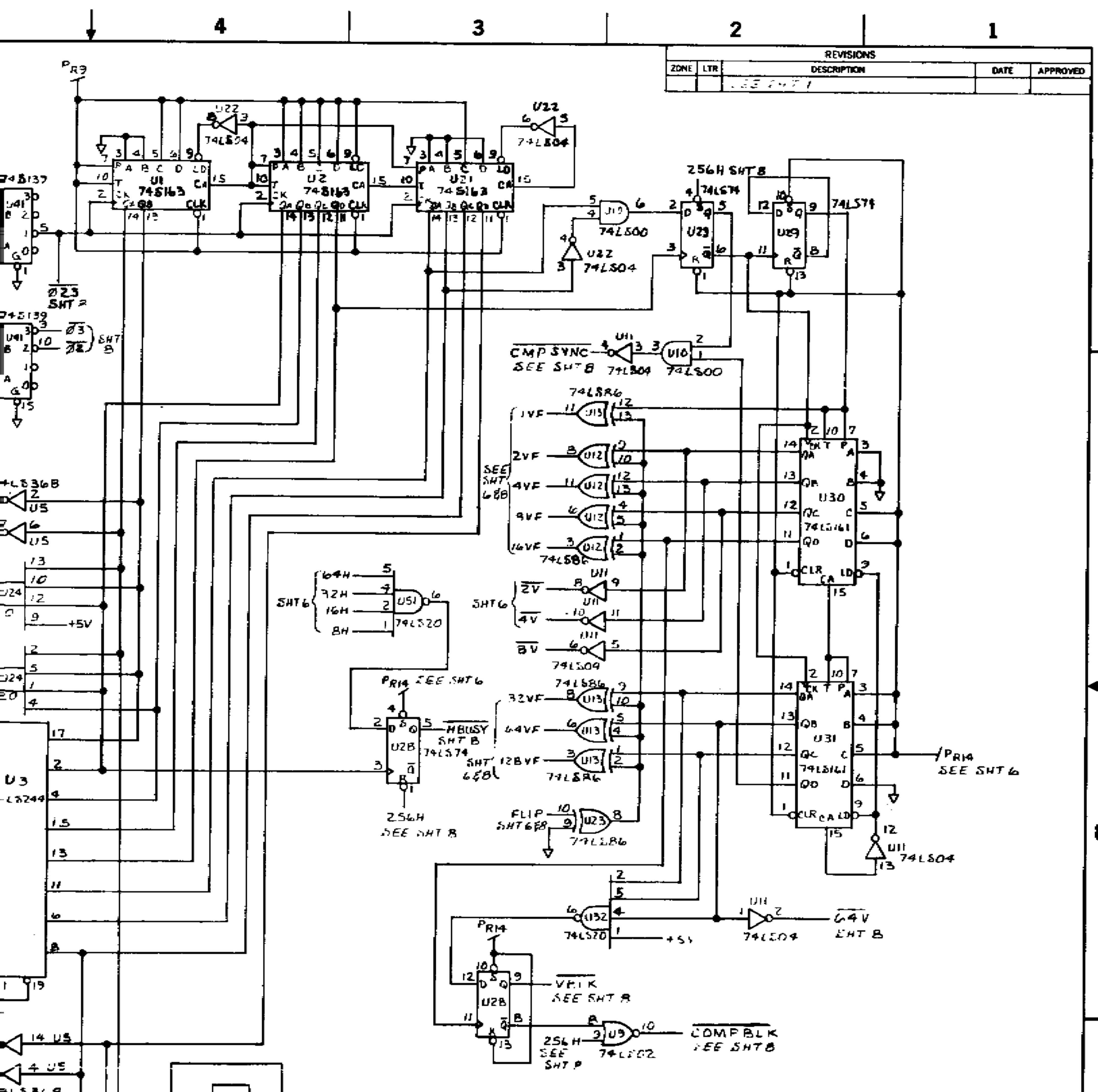
**IC Board B**

**800-3301**

D  
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REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		SEE SHT 1		



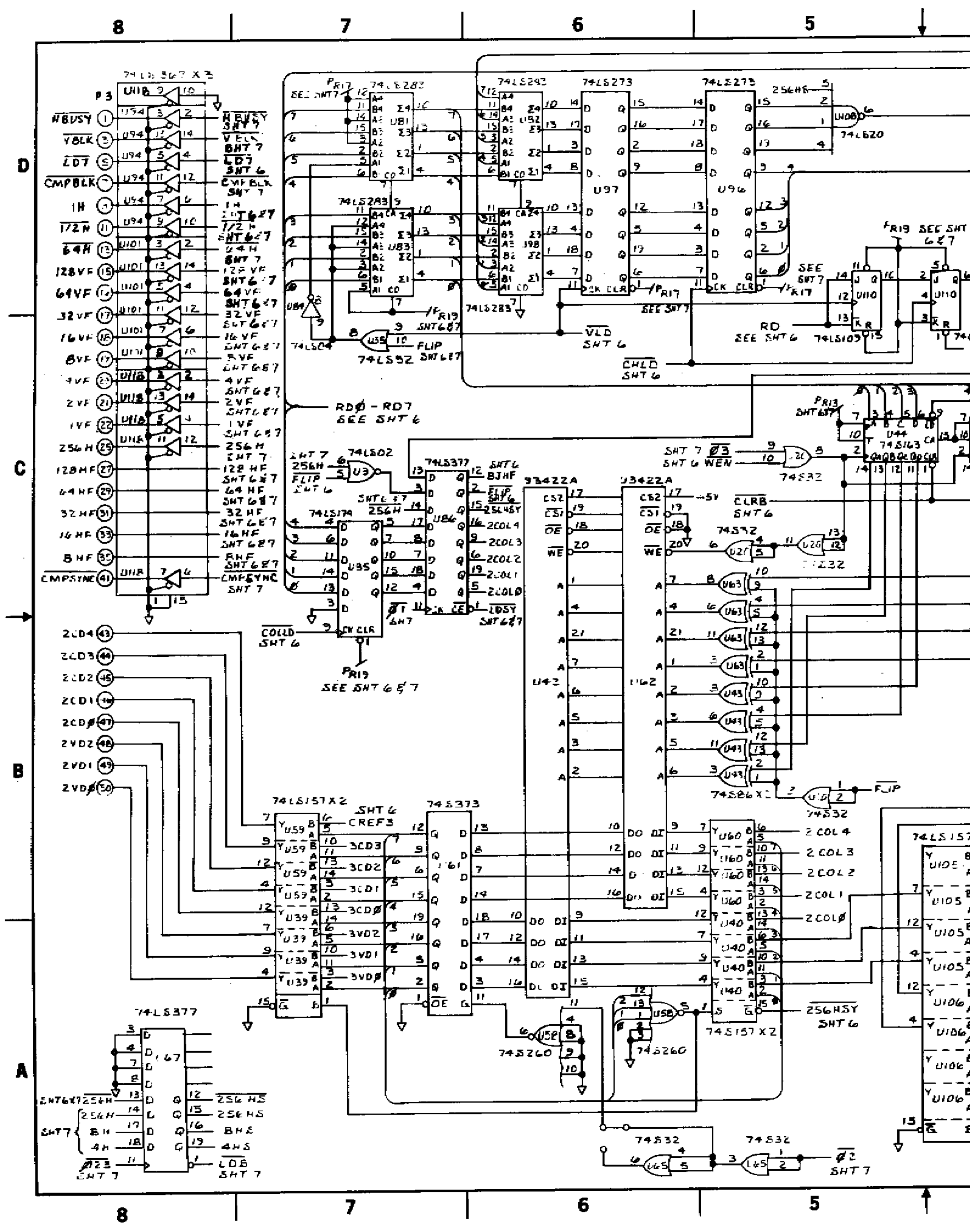
QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	ITBM NO.
PARTS LIST				
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:		CONTRACT NO.		
FRACTIONS	DECIMALS	ANGLES	APPROVALS	
±	±	±	DATE	
	±	±	DRAWN <i>[Signature]</i> 4-6-82	
MATERIAL		CHECKED <i>G. GULE</i> 4-8-82		
FINISH		MECH		
		BLIC		
		MPS		
		PROJECT		
NEXT ASSY		SIZE	CODE IDENT NO	DRAWING NO
APPLICATION		D	800-3301	REV A
DO NOT SCALE DRAWING		SCALE: NONE		SHEET 7 OF 9

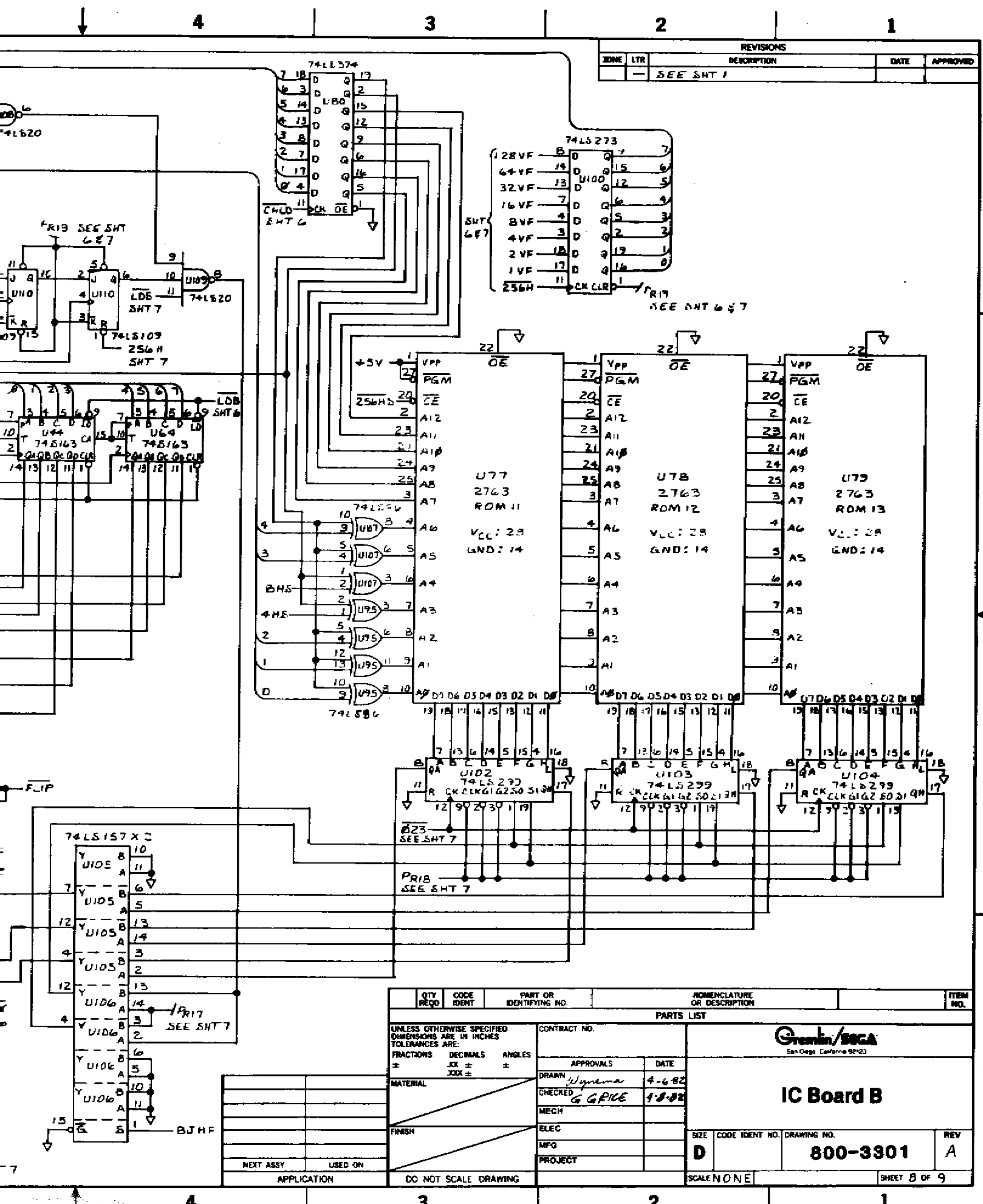


### IC Board B

800-3301

SHEET 7 OF 9





REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
		SEE SHT 1		

QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	ITEM NO.
PARTS LIST				
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:				
FRACTIONS	DECIMALS	ANGLES		
±	±	±		
MATERIAL				
FINISH				
CONTRACT NO.				
APPROVALS		DATE		
DRAWN <i>Wynona</i>		4-6-82		
CHECKED <i>G G PRICE</i>		4-8-82		
MECH				
ELEC				
MFG				
PROJECT				
NEXT ASSY		USED ON		APPLICATION
DO NOT SCALE DRAWING				
SIZE	CODE IDENT NO.	DRAWING NO.	REV	
D		800-3301	A	
SCALE NONE				SHEET 8 OF 9



### IC Board B

800-3301

SHEET 8 OF 9