

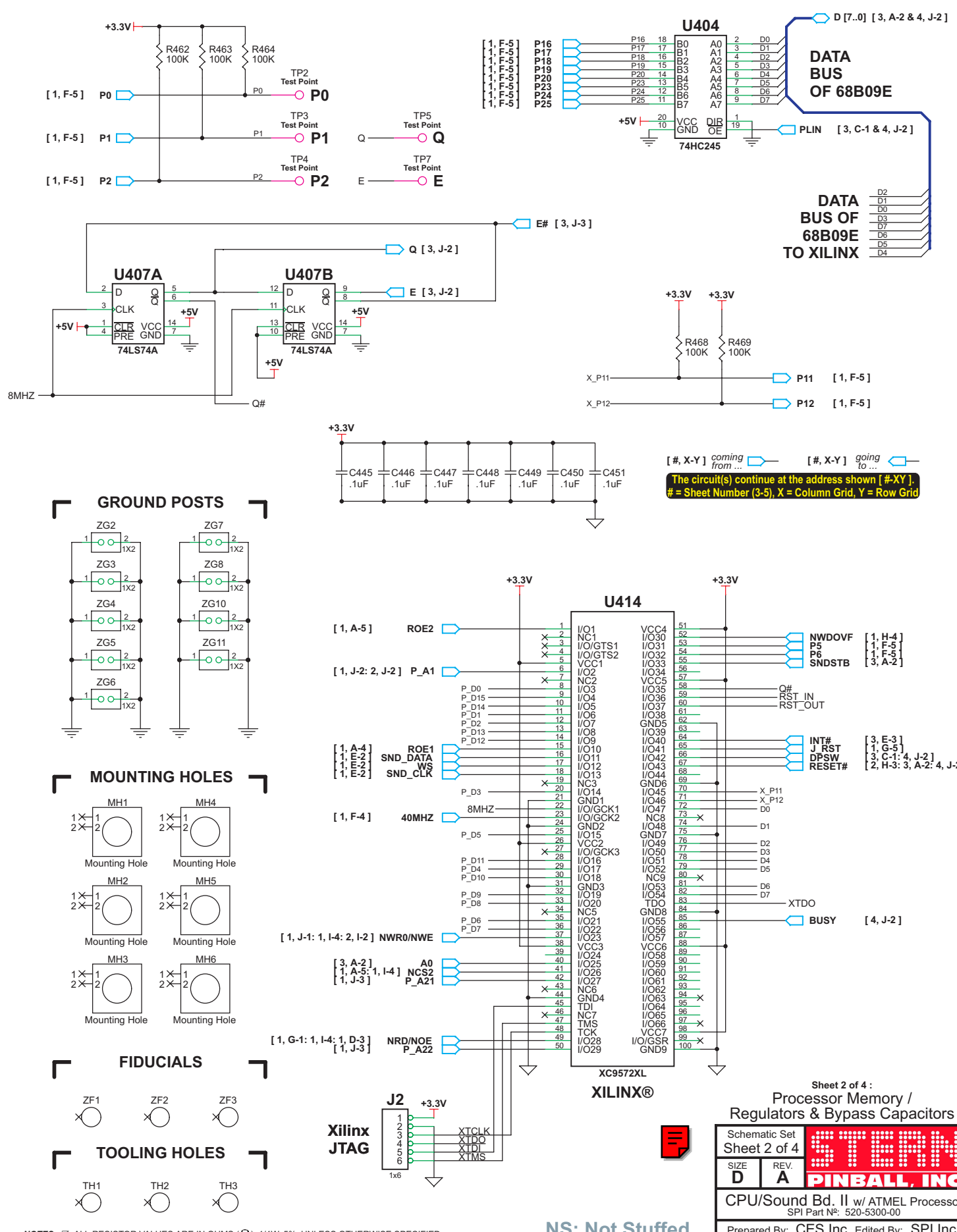
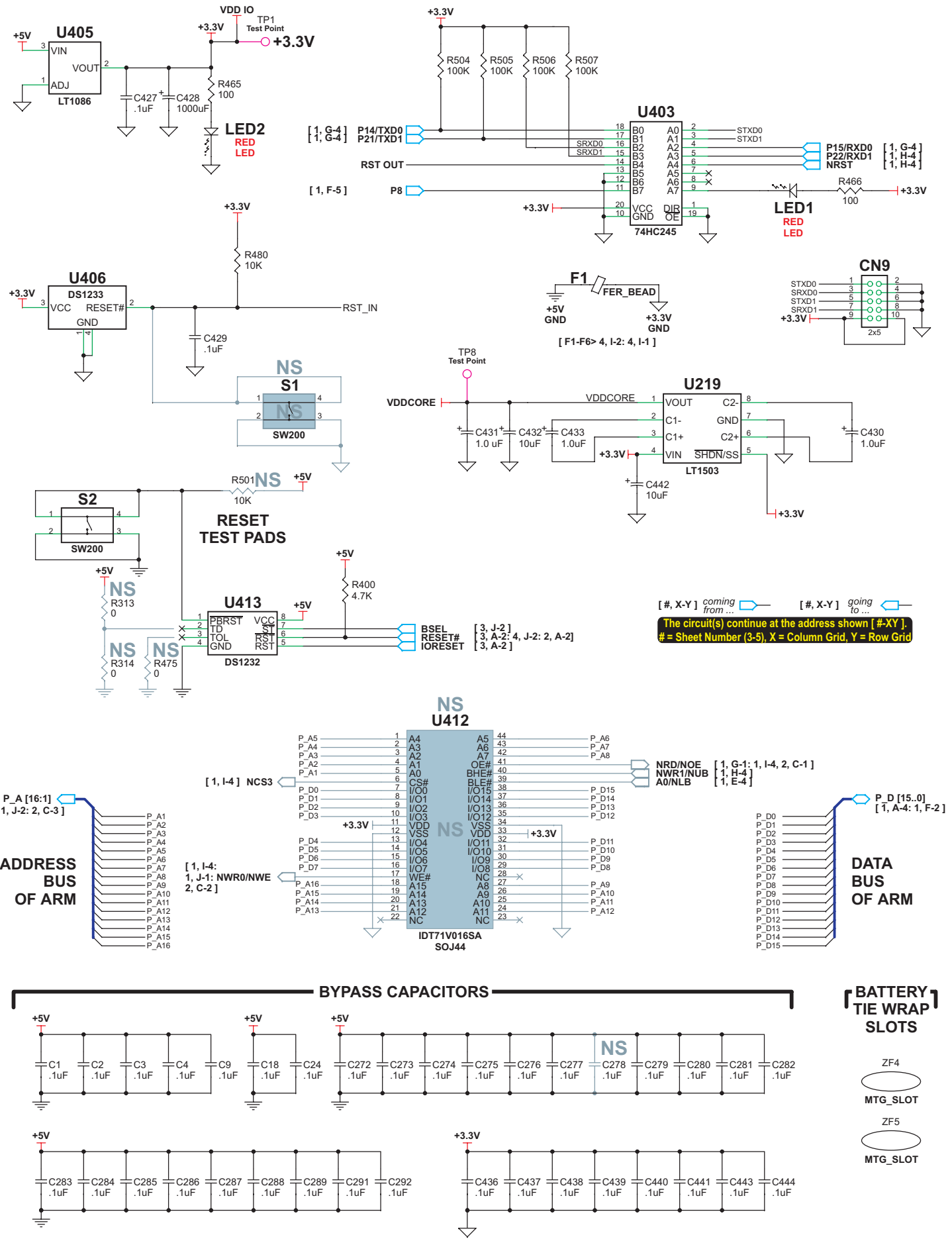
[#, X-Y] coming from ... [#, X-Y] going to ...
 The circuit(s) continue at the address shown [#-XY].
 # = Sheet Number (3-5), X = Column Grid, Y = Row Grid

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NOTES: □ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
 □ ALL CAPACITOR VALUES ARE IN MICROFARADS (μF), UNLESS OTHERWISE SPECIFIED. □ 0.1μF BYPASS CAPACITORS FOR ALL INTEGRATED CIRCUITS (ICs).

NS: Not Stuffed

Sheet 1 of 4:
 Processor / Sound (Microcontroller)
 Schematic Set
 Sheet 1 of 4
 SIZE D REV. A
PINBALL, INC.
 CPU/Sound Bd. II w/ ATMEL Processor
 SPI Part #: 520-5300-00
 Prepared By: CES Inc. Edited By: SPI Inc.
 Model: RHT SCH1008 Dated: 06/13/03



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 [# , X-Y] going to ...
 The circuit(s) continue at the address shown [#-XY]
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Sheet 2 of 4
 Processor Memory /
 Regulators & Bypass Capacitors

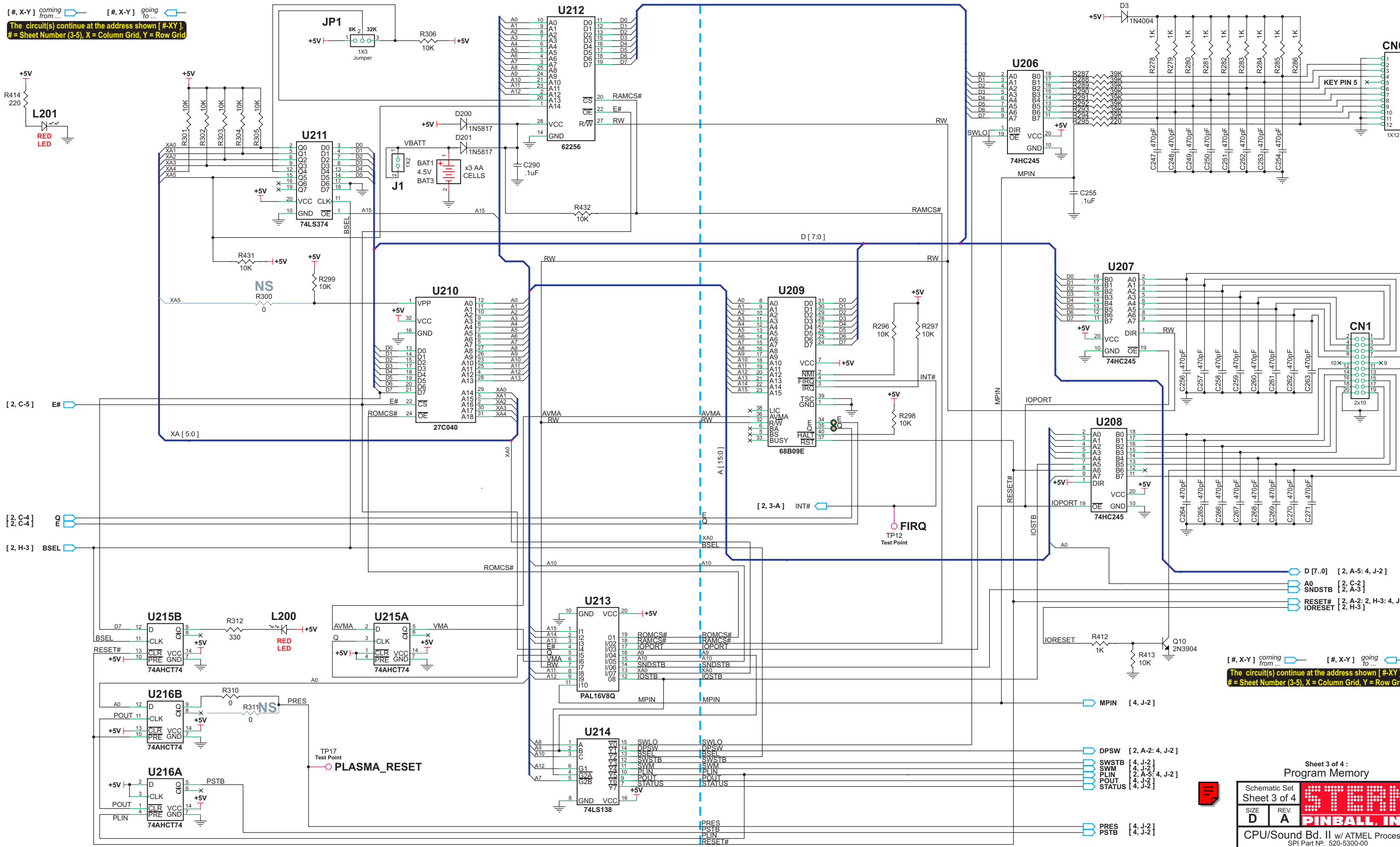
Schematic Set
 Sheet 2 of 4

SIZE D REV. A

AT&P
PINBALL, INC.

CPU/Sound Bd. II w/ AT&P Processor
 SPI Part No: 520-5300-00

Prepared By: CES Inc. Edited By: SPI Inc.
 Model: RHT SCH1008 Dated: 06/13/03



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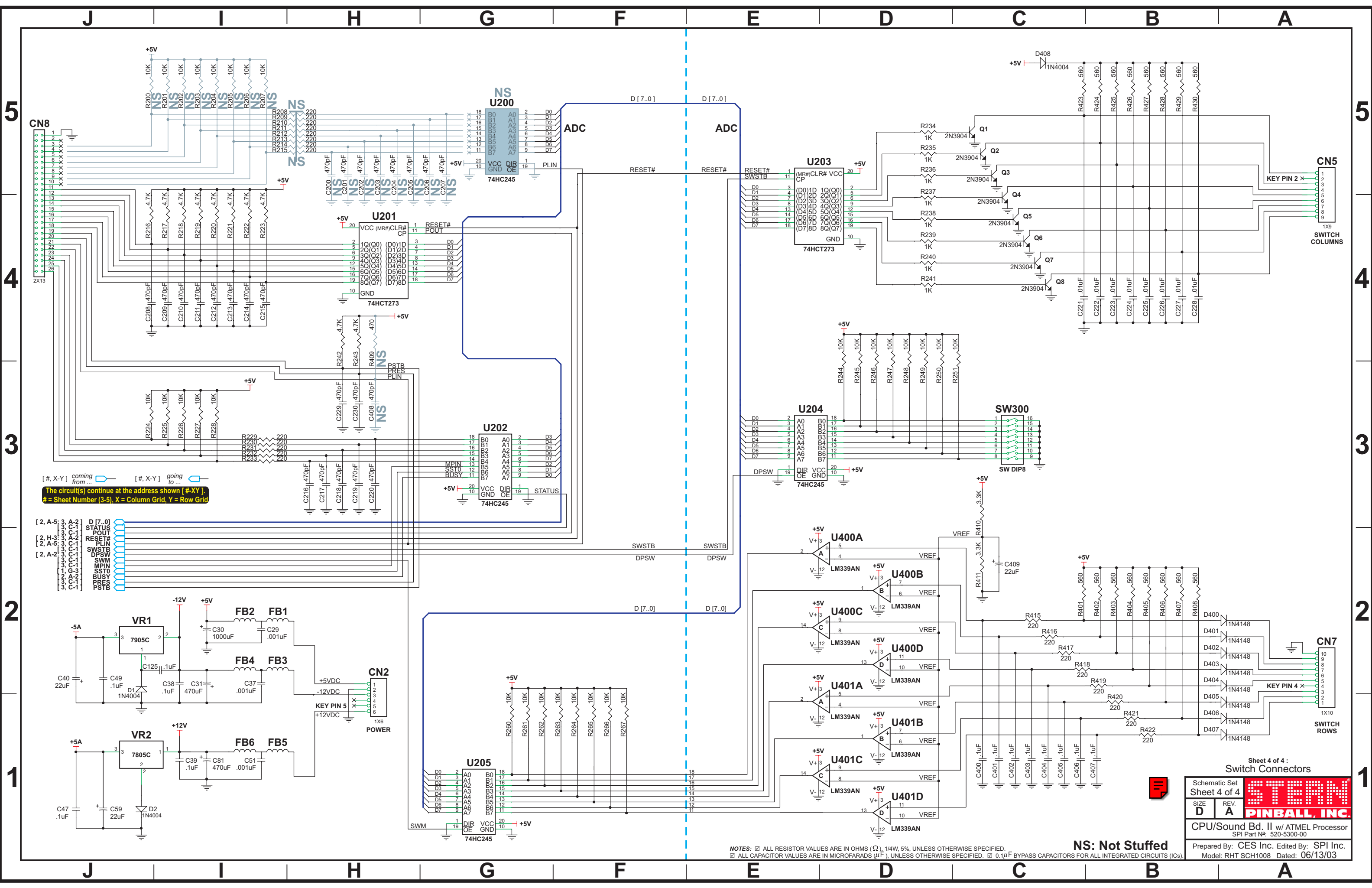
[# , X-Y] coming from ...
 [# , X-Y] going to ...
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- [2, C-5] E#
- [2, C-4] mD
- [2, H-3] BSEL
- [2, A-5: 4, J-2] D [7..0]
- [2, C-2] A0
- [2, A-3] SNDSTB
- [2, A-2: 2, H-3: 4, J-2] RESET#
- [2, H-3] IORESET
- [4, J-2] MPIN
- [2, A-2: 4, J-2] DPSW
- [4, J-2] SWSTB
- [2, A-5: 4, J-2] SWM
- [4, J-2] PLIN
- [4, J-2] POUT
- [4, J-2] STATUS
- [4, J-2] PRES

NOTES: □ ALL RESISTOR VALUES ARE IN OHMS (Ω), 1/4W, 5%, UNLESS OTHERWISE SPECIFIED.
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NS: Not Stuffed

Sheet 3 of 4:
 Program Memory
 Schematic Set
 Sheet 3 of 4
 SIZE D REV. A
PINBALL, INC.
 CPU/Sound Bd. II w/ ATME Processor
 SPI Part #: 520-5300-00
 Prepared By: CES Inc. Edited By: SPI Inc.
 Model: RHT SCH1008 Dated: 06/13/03



[# X-Y] coming from ...
 [# X-Y] going to ...
 The circuit(s) continue at the address shown [#XY].
 # = Sheet Number (3-5), X = Column Grid, Y = Row Grid

[2, A-5: 3, A-2] D[7..0]
 [2, H-3: 3, C-1] STATUS
 [2, A-5: 3, C-1] POUT
 [2, A-5: 3, C-1] RESET#
 [2, A-5: 3, C-1] PLIN
 [2, A-5: 3, C-1] SWSTB
 [2, A-5: 3, C-1] DPSW
 [2, A-5: 3, C-1] SWM
 [2, A-5: 3, C-1] SSTS
 [2, A-5: 3, C-1] BUSY
 [2, A-5: 3, C-1] PPSB

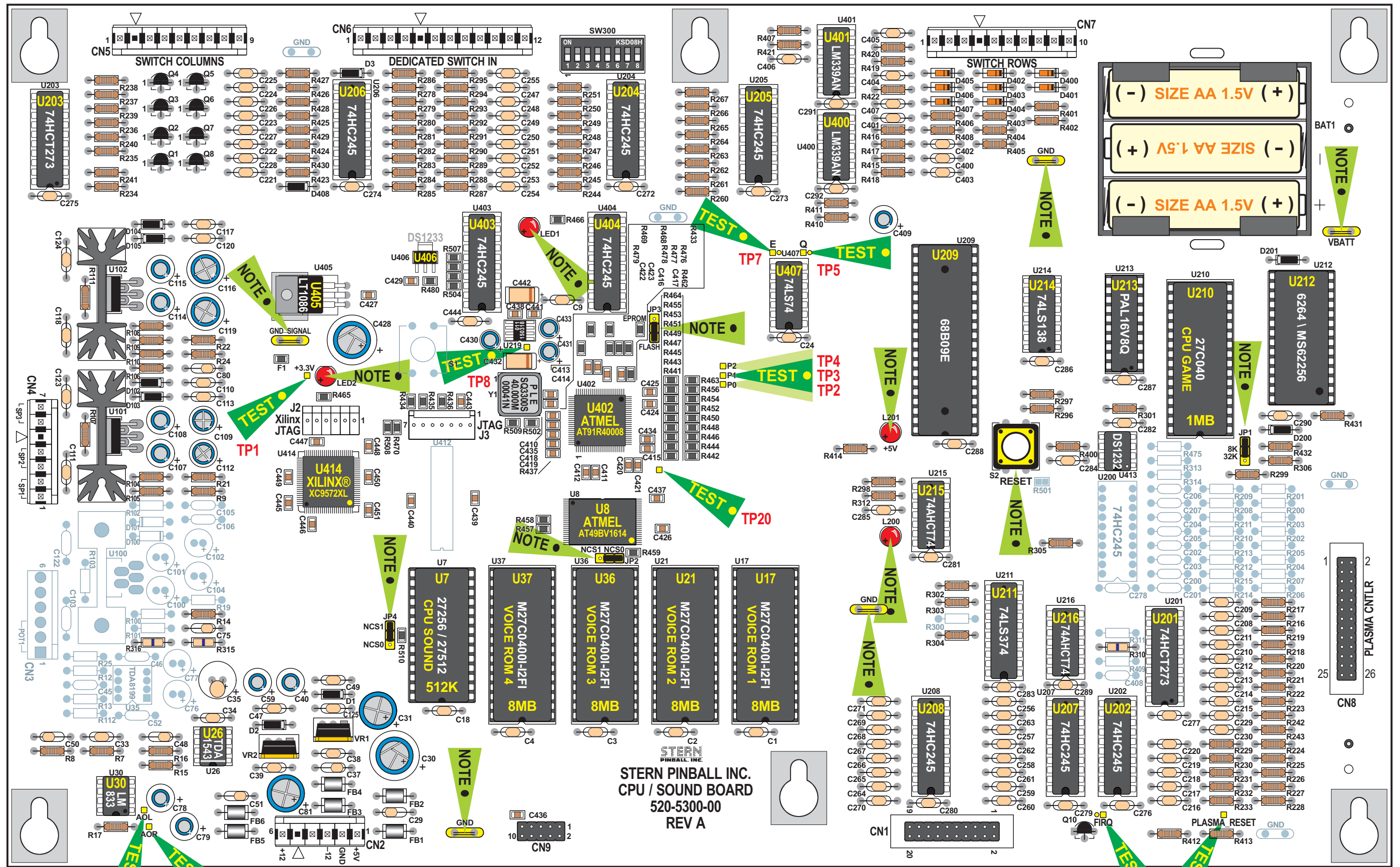
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Sheet 4 of 4 :
 Switch Connectors

Schematic Set	REV.	
Sheet 4 of 4	A	
SIZE	D	
REV.	A	

CPU/Sound Bd. II w/ ATME Processor
 SPI Part No: 520-5300-00
 Prepared By: CES Inc. Edited By: SPI Inc.
 Model: RHT SCH1008 Dated: 06/13/03



STERN PINBALL, INC.
 CPU / SOUND BOARD
 520-5300-00
 REV A

Actual Board Size
 14.67" X 9.125"

TP16 TP11

TP12 TP17



CPU/Sound II Board (with Atmel Processor) Parts

ITEM	QTY	PART NUMBER	REF-DESIGNATOR	DESCRIPTION (NS = Not Stuffed)	
	1	520-5300-00	CPU/Sound II Board (with Atmel Processor)	Complete PCB Assembly	
Connectors	01		JP1, JP2, JP3, JP4	3-Pin Jumper & 2-Pin Cover	
	02		CN2 (Key Pin-5)	6-Pin, 6PKK156	
	03	045-5015-06	J2 JTAG Xilinx®	6-Pin, ## Header	
	04		CN4 (Key Pin-5)	7-Pin, 7PKK156	
	05		J3 JTAG	7-Pin, ## Header	
	06	045-5013-00	CN5 (Key Pin-2)	9-Pin, 9PKK156	
	07		CN9	10-Pin, 0.1 Header	
	08	045-5014-01	CN7 (Key Pin-4)	10-Pin, 10PKK156	
	09	045-5015-00	CN6 (Key Pin-5)	12-Pin, 12PKK156	
	10	045-5015-01	CN1	20-Pin, 0.1 Header	
	11	045-5015-26	CN8	26-Pin, 0.1 Header	
	12	3	125-5043-00	C29, C37, C51	0.001uF (102), Cap.
	13	4	125-5039-00	C48, C50, C75, C80	0.0022uF or 2200pF, (222), Cap.
	14	8	125-5029-00	C221>C228	0.01uF (103), 100v Cap.
	15	52	125-5031-00	C1>C4, C9, C18, C24, C33, C34, C38, C39, C47, C49, C110, C111, C113, C117, C118, C120, C123, C124, C125, C255, C272>C277, C279>C292, C400>C407, C444 (C45, C46, C52, C103, C105, C106, C122, C278: NS)	0.1uF (104), Axial Cer. Cap.
Capacitors*	16	3	C430, C431, C433 (near U403, U404)	1.0uF, ##v, Radial Lytic Cap.	
	17	1	125-5017-00	10uF, 16v, Radial Tant. Cap.	
	18	4	125-5017-00	10uF, 25v-35v, Radial Lytic Cap.	
	19	2	125-5015-00	100uF, 25v, Radial Lytic Cap.	
	20	1	125-5014-00	22uF, 16v, Radial Lytic Cap.	
	21	4	125-5020-00	22uF, 25v, Radial Lytic Cap.	
	22	2	125-5012-00	220uF, 25v, Radial Lytic Cap.	
	23	2	125-5019-00	470uF, 25v, Radial Lytic Cap.	
	24	39	125-5028-00	470pF (471), Cer. Cap.	
	25	2	125-5037-00	C30, C428	1000uF, 16v, Radial Lytic Cap.
	26	17		C427, C429, C436>C441, C443, C445>C451	SMT .1uF Cap.
	27	2		C432, C442 (near U403 & U404)	SMT 10uF Cap.
	28	9		C411, C414, C416, C419, C420, C422, C424, C434, C435	SMT 47pF Cap.
	29	10		C410, C412, C413, C415, C417, C418, C421, C423, C425, C426	SMT 100nF Cap.
	Diodes, & LEDs*	30	7	112-5003-00	D1>D3, D102>D105, D408 (D100, D101: NS)
31		2	112-5008-00	D200, D201	
32		8	112-0054-00	D400-D407	
33		4	165-5099-00	LED1, LED2, L200, L201	
34		3	124-5064-00	R310, R315, R316 (R300, R311, R313, R314, R475: NS)	
35		2	121-5041-00	R107, R111 (R103: NS)	
36		1	121-5009-00	R8, R15, R234>R241, R278>R286, R412	
37		2	121-5018-00	R7	
38		2	121-5043-00	R16, R17 (R25, R112: NS)	
39		12	121-5048-00	R410, R411	
40		36	121-5021-00	R21, R216>R223, R242, R243, R400	
			121-5011-00	R106, R224>R228, R244>R251, R260>R267, R296>R299, R301>R306, R413, R431, R432 (R200>R207, R501: NS)	
			121-5023-00	R9, R14, R104 (R100, R102: NS)	
			121-5022-04	R110	
			121-5045-00	R108, R287>R294	
		121-5032-00	R22, R24		
		121-5014-00	R229>R233, R295, R414>R422 (R208>R215: NS)		
		121-5036-00	R312		
		121-5046-01	R105, R109 (R101, R409: NS)		
		121-5047-00	R401>R408, R423>R430		
			F1		
			R434, R435, R436, R508		
			R480		
			R502, R509		
			R465, R466, R470		
			R433, R437, R441>R459, R462>R464, R468, R469, R476>R479, R504>R507, R510		
		110-0069-00	Q1-Q8, Q10		
			U402		
			U8		
			U414		
			U7		
			U210 (32-Pin, IC Socket, 077-5217-00)		
			U17, U21, U36, U37 (32-Pin, IC Socket, 077-5217-00)		
			U213 (BLUE DOT)		
			U212 (28-Pin, IC Dip Socket, 077-5208-00)		
			U209 (40-Pin, IC Socket, 077-5209-00)		
			U215, U216		
			U202, U204, U205, U206, U207, U208, U403, U404 (U200: NS)		
			U201, U203		
			U407		
			U214		
			U211		
			U406		
		100-5023-00	U413		
			U219		
			U405		
		124-5002-00	VR1		
		124-5001-00	VR2		
		100-0377-00	U400, U401		
		100-0375-00	U30		
		100-5018-00	U26		
		100-5016-20	U101, U102 (U100: NS)		
			Y1		
		181-5002-00	SW300		
		n/a	FB1>FB6		
		535-5000-10	HS2, HS3, (HS1: NS) (over U101, U102)		
			S2 (Reset)		
		545-5685-00	BAT1 HOLDER (Always replace all 3, Size AA 1.5v Cells, with new ones, when required)		
Resistors / Transistors*	41	3	121-5023-00	R9, R14, R104 (R100, R102: NS)	
	42	1	121-5022-04	R110	
	43	9	121-5045-00	R108, R287>R294	
	44	2	121-5032-00	R22, R24	
	45	15	121-5014-00	R229>R233, R295, R414>R422 (R208>R215: NS)	
	46	1	121-5036-00	R312	
	47	2	121-5046-01	R105, R109 (R101, R409: NS)	
	48	16	121-5047-00	R401>R408, R423>R430	
	49	1		F1	
	50	4		R434, R435, R436, R508	
	51	1		R480	
	52	2		R502, R509	
	53	3		R465, R466, R470	
	54	35		R433, R437, R441>R459, R462>R464, R468, R469, R476>R479, R504>R507, R510	
				22K W 1/4W Res.	
			33K Ω 1/4W Res.		
			39K Ω Res.		
			47K Ω 1/4W Res.		
			220 Ω 1/4W Res.		
			330 Ω 1/4W Res.		
			470 Ω 1/4W Res.		
			560 Ω 1/4W Res.		
			SMT xx Res.		
			SMT 1K Ω Res.		
			SMT 10K Ω Res.		
			SMT 33 Ω Res.		
			SMT 100 Ω Res.		
			SMT 100K Ω Res.		
			2N3904, Transistor		
			ATMEL, AT91R40008		
			ATMEL, AT49BV1614		
			XILINX® XC9572XL		
			512K EPROM Sound (27512)		
			1MB EPROM CPU Game (27C040)		
			8MB EPROM Voice 1-4 (M27C0400I-12FI)		
			PAL16V8Q (Programmed) BLUE DOT		
			6264/MS62256 (MS6264A) (28-Pin)		
			68B09E (40-Pin)		
			74AHCT74 (14-Pin)		
			74HC245 (20-Pin)		
			74HCT273 (20-Pin)		
			74LS74 (14-Pin)		
			74LS138 (16-Pin)		
			74LS374 (20-Pin)		
			3.3v Watchdog, DS1233 (3-Pin)		
			5.0v Watchdog, DS1232 (8-Pin)		
			1.8v Volt. Regulator LT1503 (8-Pin)		
			3.3v Volt. Regulator LT1086 (3-Pin)		
			-5v Regulator, LM7905CT		
			+5v Regulator, LM7805CT		
			LM339AN (14-Pin)		
			LM833 (8-Pin)		
			TDA1543 (8-Pin)		
			TDA2030A (5-Pin)		
			40MHz Clock PLE SQ3300S		
			Dip Switch 8-Pos., (KSD08H Black)		
			Ferrite Bead		
			Heat Sink (AAVID 531102)		
			Push-Button Switch (B3F4000)		

Test Point Wire (24ga.) Loops:
 VBATT, GND (near CN7),
 GND (near CN9), GND (near L200),
 GND_SIGNAL (near U405)

Test Point Pads:
 TP1>TP5, TP7, TP8, TP11,
 TP12, TP16, TP17, TP20

If a part is required where a part number is not provided, call Tech. Support (see back of cover).

**CPU Section:**

The **CPU** is a **68B09E (U209)** with up to 8 MBytes of **CPU Code Space (U210)**. The **CPU** code is bank selected by the use of **U211** and each bank consists of 16 KBytes. 8 KBytes of **RAM (U212)** is available to the **CPU**. The **RAM** is battery backed and has a write protected area. Battery back up is accomplished by **3-AA Cells (BAT1)** Battery Pack which has a **TEST POINT (TP): VBATT** to check the battery voltage status. The write protected area consists of 512 Bytes used for storing game settings. This section of **RAM** can only be written to when the coin door is open. The Coin Door switch comes into the **CPU** on **CN6-12** and is fed into the address decoding **PAL U213**. When this memory protect signal is low writes to the protected **RAM** area are prohibited. Address decoding for the system is accomplished by one **PAL U213** and one 1-of-8 decoder **U214**.

A watchdog is used to monitor the **CPU** and the 5v supply. If the 5v supply is below 4.75 the watchdog will hold the **CPU/Sound Board & I/O Board** in *reset*. The watchdog must be fed at a rate of **250ms** or faster. The signal used to feed the watchdog comes from the EPROM Bank select signal used to load **U211**.

The **I/O** Interface **CN1** is buffered by two (2) **HC245** Chips (**U207 & U208**). The **CPU's** reset line is buffered by **Q10** and fed over to the **I/O** through **CN1**. An *I/O Strobe Signal* is fed through **CN1-15** and is used to notify the **I/O** that a valid address is being sent.

Switches:

The Switch Matrix consists of eight (8) **2N3904** Transistors(**Q1-Q8**) which pull one of 8 strobes 'low' to *activate* a Single Column of switches. The *Switch Return Signals* are fed into **CN7** [SWITCH ROWS] and are highly filtered and compared to a 2.5v *reference voltage*. The *Switch Return Voltage* must be below 2.5v to make a *Valid Switch Closure*. If *false switches* are appearing, check that none of the **2N3904** Transistors are permanently pulling the *strobe line low*. Only one strobe from **CN5** [SWITCH COLUMNS] should be *low at any time*. **CN6** [DEDICATED SWITCH IN] is a *Dedicated Bank of Input Switches*. Switches connected to **CN6** are connected to ground instead of a strobe and may be read at any time.

Plasma Interface:

The data path for communication to and from the **Plasma Controller Board** is 8 bits wide. There are separate *Input* and *Output Busses*. Data going out to the controller comes from the **CPU's Data Bus** through **U201** and onto **CN8-Pins 11-18**. Status back from the Plasma Controller comes in on **CN8-Pins 22-26** and is fed into **U202** for input to the **CPU's Data Bus**. Two control signals that go out to the Plasma Controller are **PRES** [TP17: PLASMA RESET] and **CN8-Pin 19 [PSTB - Plasma Strobe]**. The Plasma Reset is software controllable through **U216/B** and also has a test point "Plasma Reset". The *Plasma Strobe Signal* to the controller is generated from **U216/A** and is *used to latch data* into the Plasma Controller.

Other Test Points (TP):

TP 7: E & TP5: Q - The **CPU** signals for both **68B09E** processors. Should be at 2Mhz with **Q** leading **E** by **500 nsec**. **TP2: P0. TP3: P1. TP4: P2. TP20: (near U402). TP8: (near U219). TP1: +3.3V.**