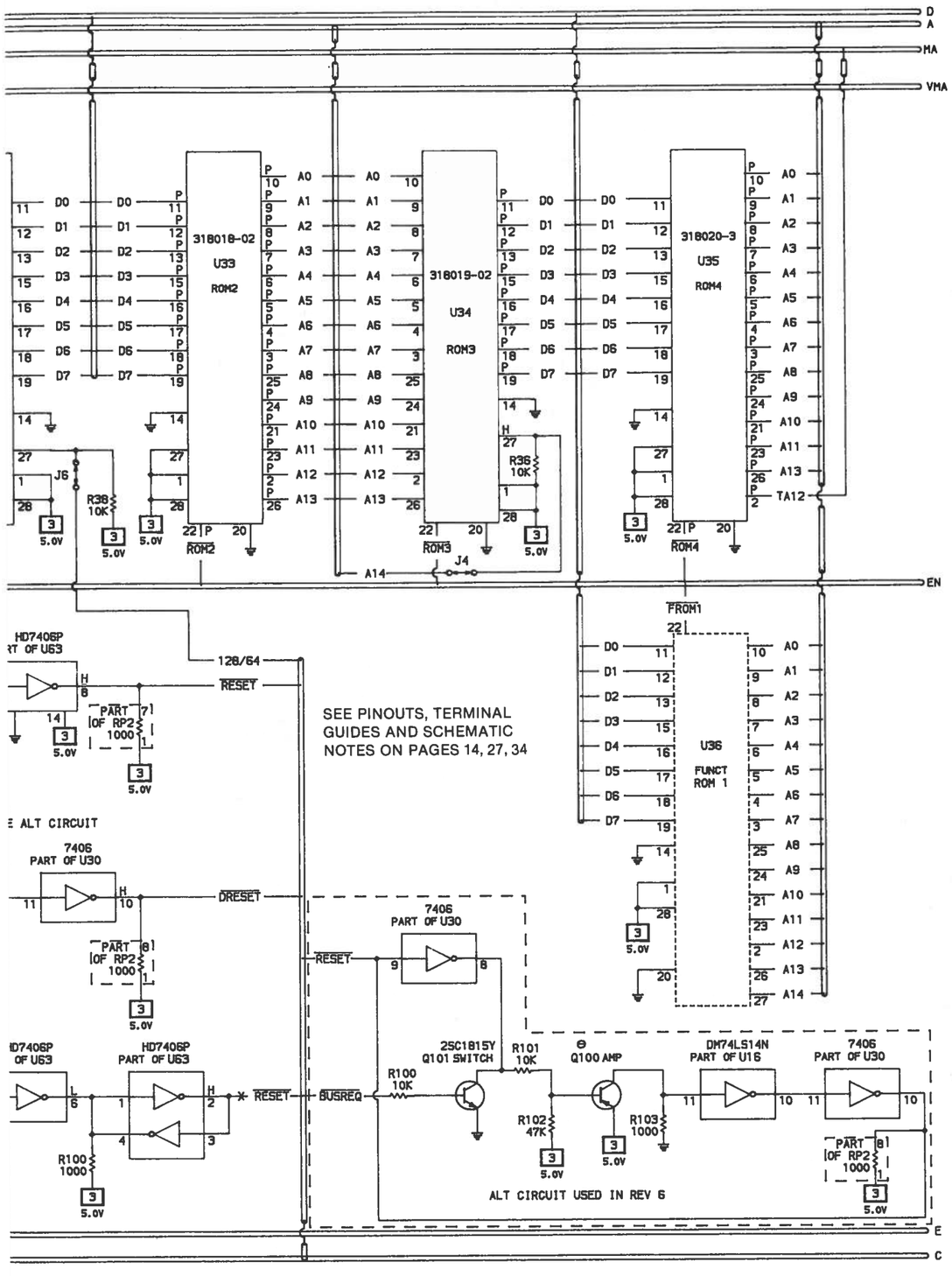

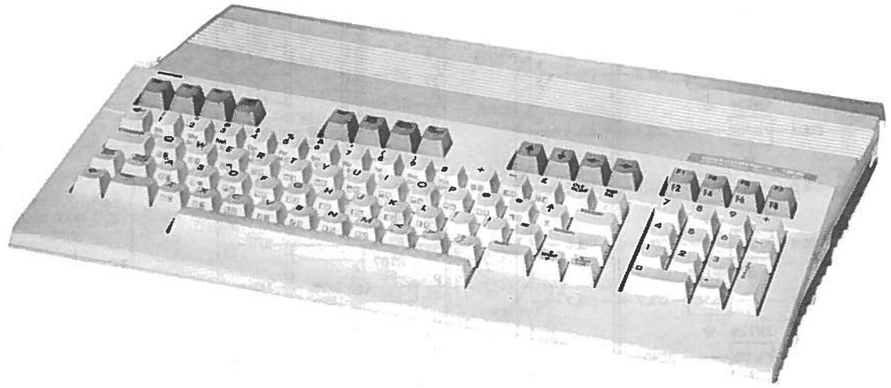

CC18 COMMODORE MODEL C128

CC18 COMMODORE MODEL C128

PRELIMINARY SERVICE CHECKS

ENCLOSED

SAFETY PRECAUTIONS

See Page 32.

INDEX

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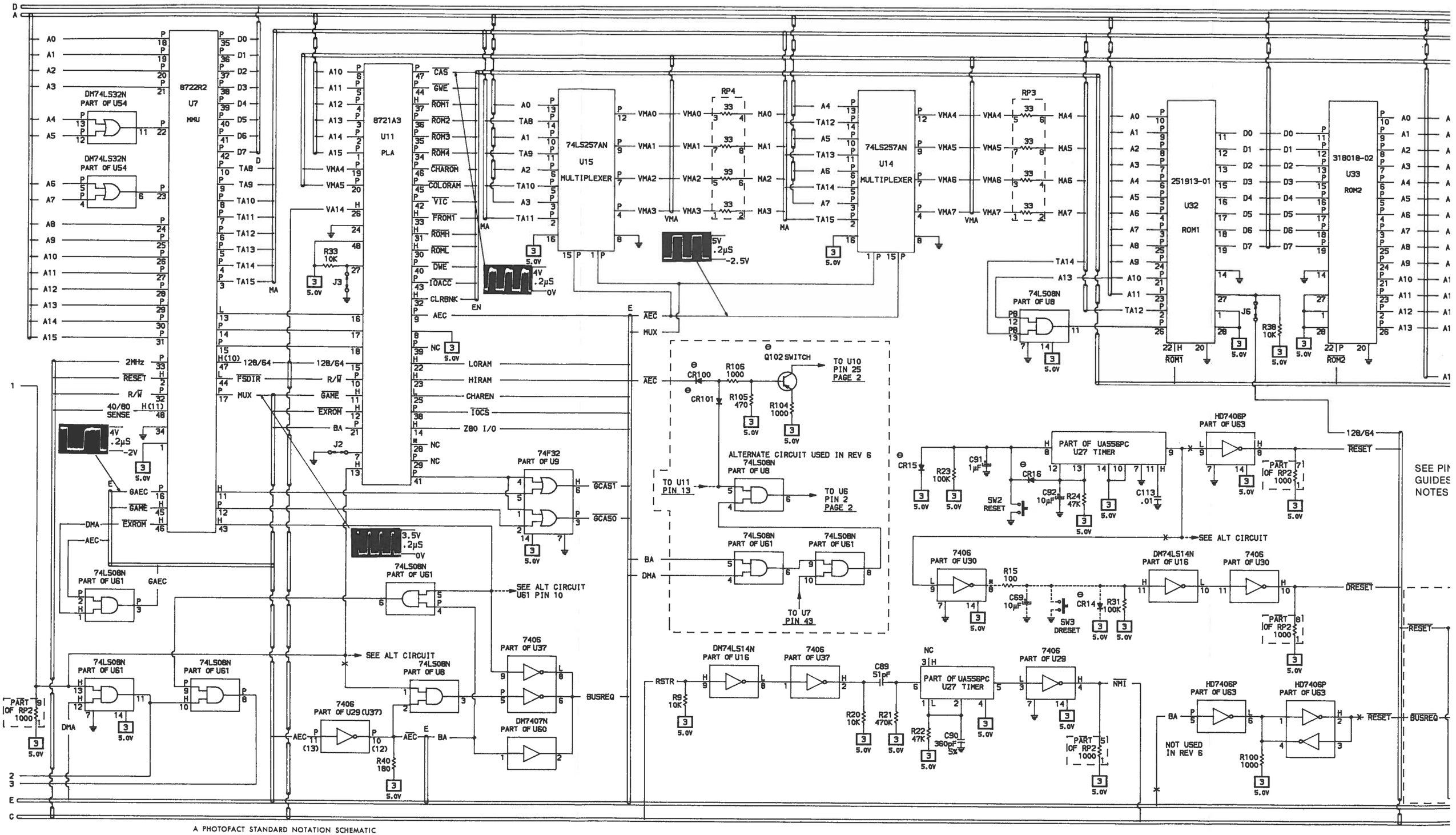

A PHOTOFACT STANDARD NOTATION SCHEMATIC
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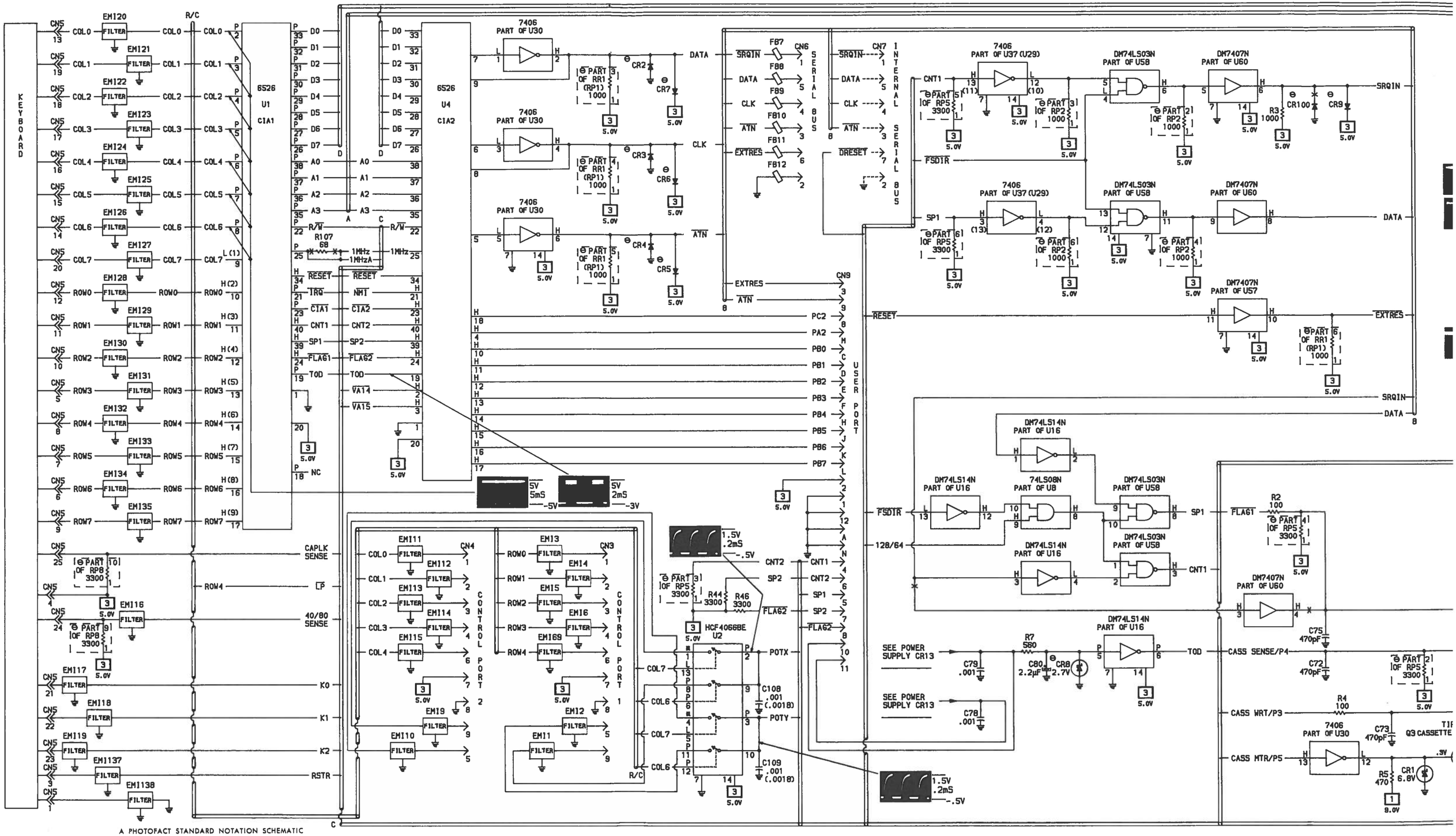

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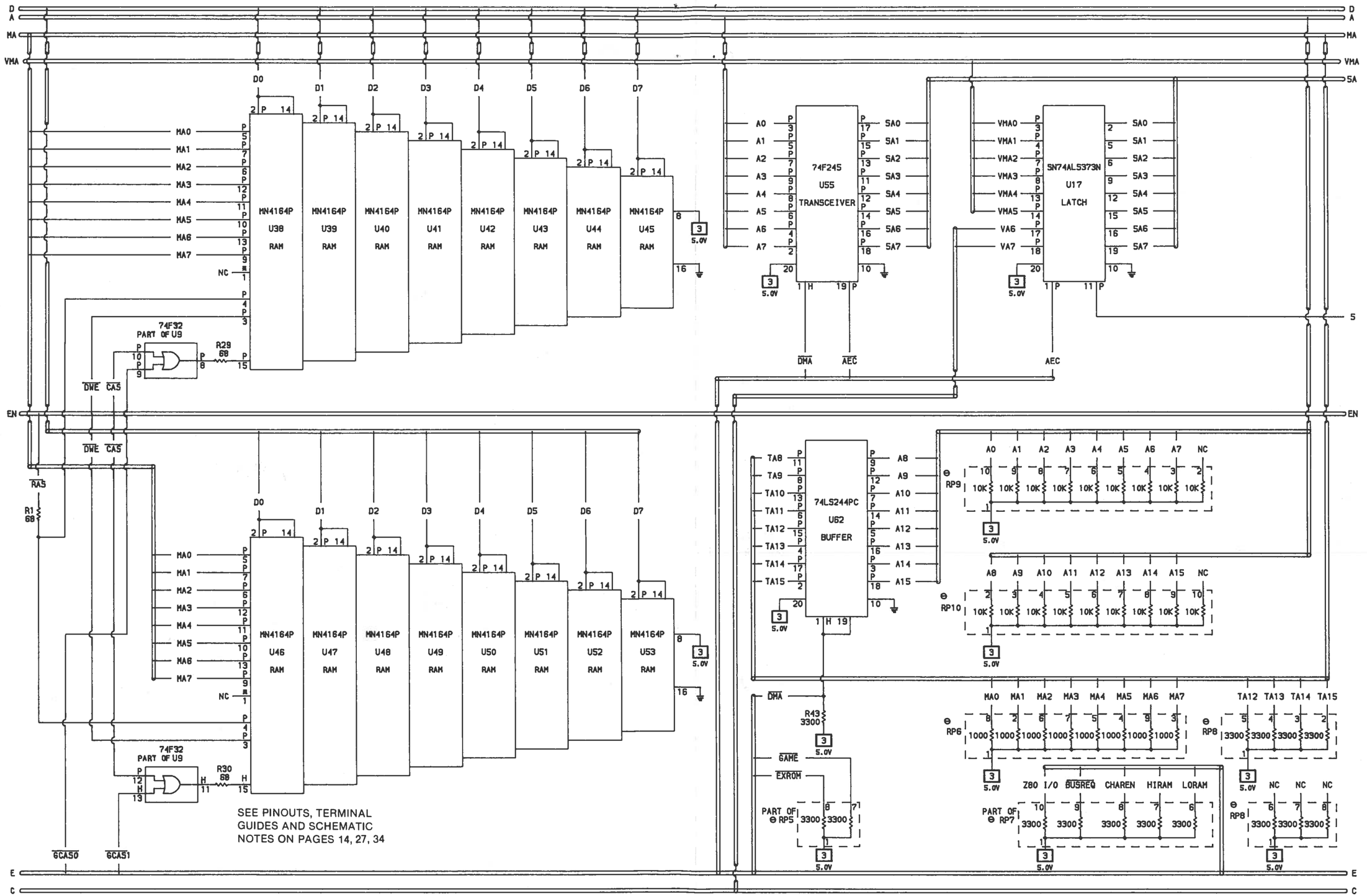
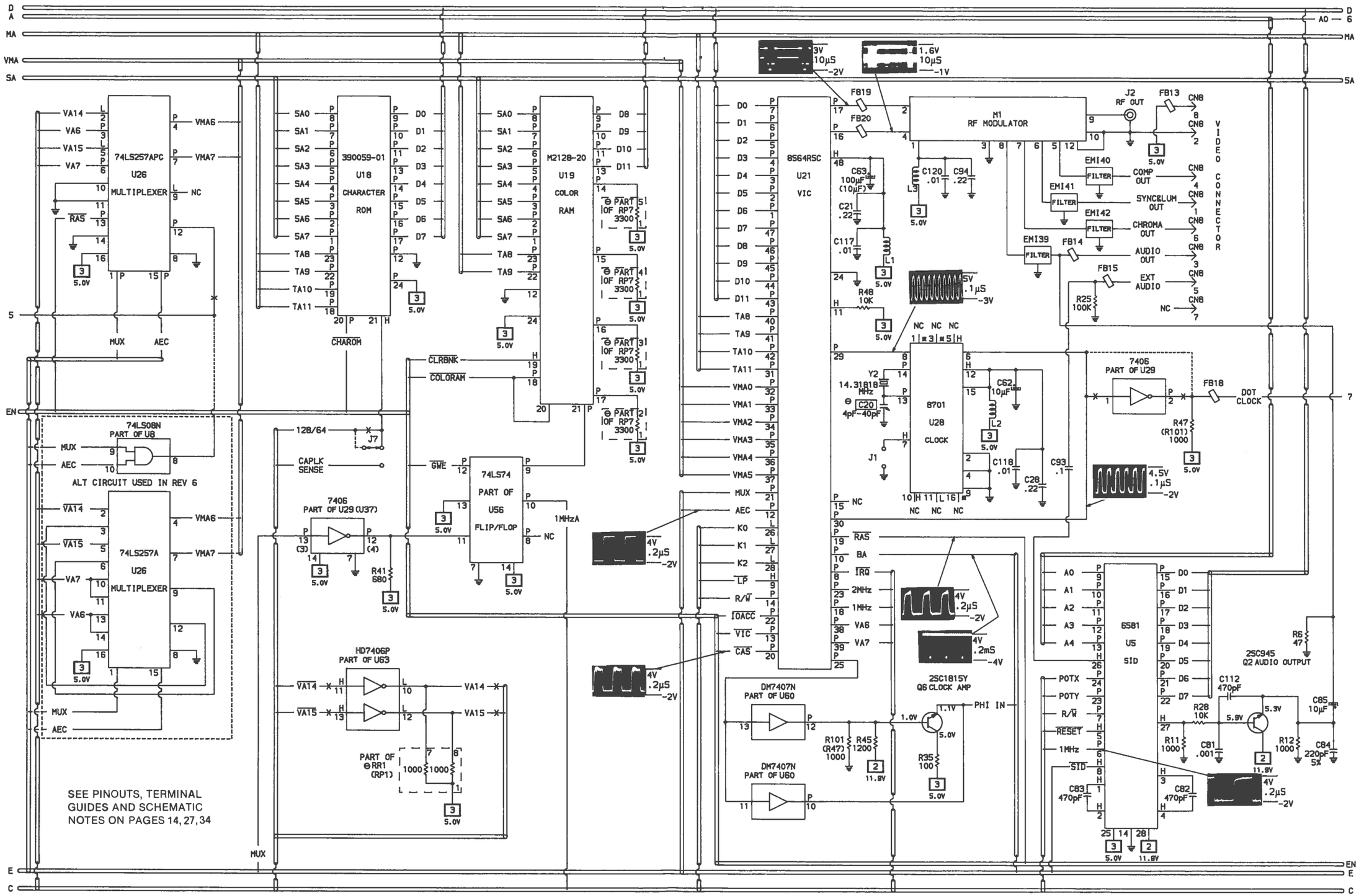
DM74LS03N PART OF U58
DM7407N PART OF U60
SRQIN
DM74LS03N PART OF U58
DM7407N PART OF U60
DATA
DM7407N PART OF U57
EXTRES
SRQIN
DATA
PART OF RP2 1000
R3 1000
CR100
CR9
PART OF RR1 (RP1) 1000
8502A0 U6 MICRO PROCESSOR
74LS373PC U12 LATCH
1MHzA
Z80B U10 MICRO PROCESSOR
74LS244PC U13 BUFFER
EM11, EM12 EM19 THRU EM111 47pF
EM13 THRU EM15 EM19 THRU EM135 EM137, EM138 EM140, EM142 EM169 100pF
EM139 270pF
INTERNAL CIRCUIT FOR EMI'S
5V 5mS -5V
4V .2µS -2V
6V .2mS REF
5V 50µS -5V
CAPLK SENSE
RESET
IRQ
NMI
2MHz
LORAM
HIRAM
CHAREN
R27 4700
CASS MTR/P5
CASS WRT/P3
CASS SENSE/P4
R10 3300
R34 10K
BUSREQ
PHI IN
Z80 I/O
74LS00PC PART OF U31
DM74LS038N U3 DECODER
7406 PART OF U37
IOCS
1MHz
CIA2
CIA1
CS8563
SID
I/O2
I/O1
NC
74LS00PC PART OF U31
R8 3300
PART OF 74LS74 U56 FLIP/FLOP
GAEC
DM74LS03N PART OF U58
DM74LS03N PART OF U58
SP1
CNT1
DM74LS14N PART OF U16
TOD
R2 100
FLAG1
PART OF RP5 3300
DM7407N PART OF U60
C75 470pF
C72 470pF
R4 100
7406 PART OF U30
C73 470pF
TIP29A Q3 CASSETTE SWITCH
R5 470
CR1 6.8V
9.0V
11.5V
74LS08N PART OF U8
DM7407N PART OF U57
DM7407N PART OF U60
R/W
ALT CIRCUIT FOUND IN REV 6
SEE ALT CIRCUIT U8 PIN 6
5V .5mS 0V
5V .2µS 0V
FB1 CN2 B,2
FB6 CN2 D,4
FB3 CN2 F,6
FB2 CN2 A,1
FB4 CN2 E,5
FB5 CN2 C,3
CASSETTE
SEE PINOUTS, TERMINAL GUIDES AND SCHEMATIC NOTES ON PAGES 14, 27, 34

COMMODORE MODEL C128



SEE PINOUTS, TERMINAL GUIDES AND SCHEMATIC NOTES ON PAGES 14, 27, 34



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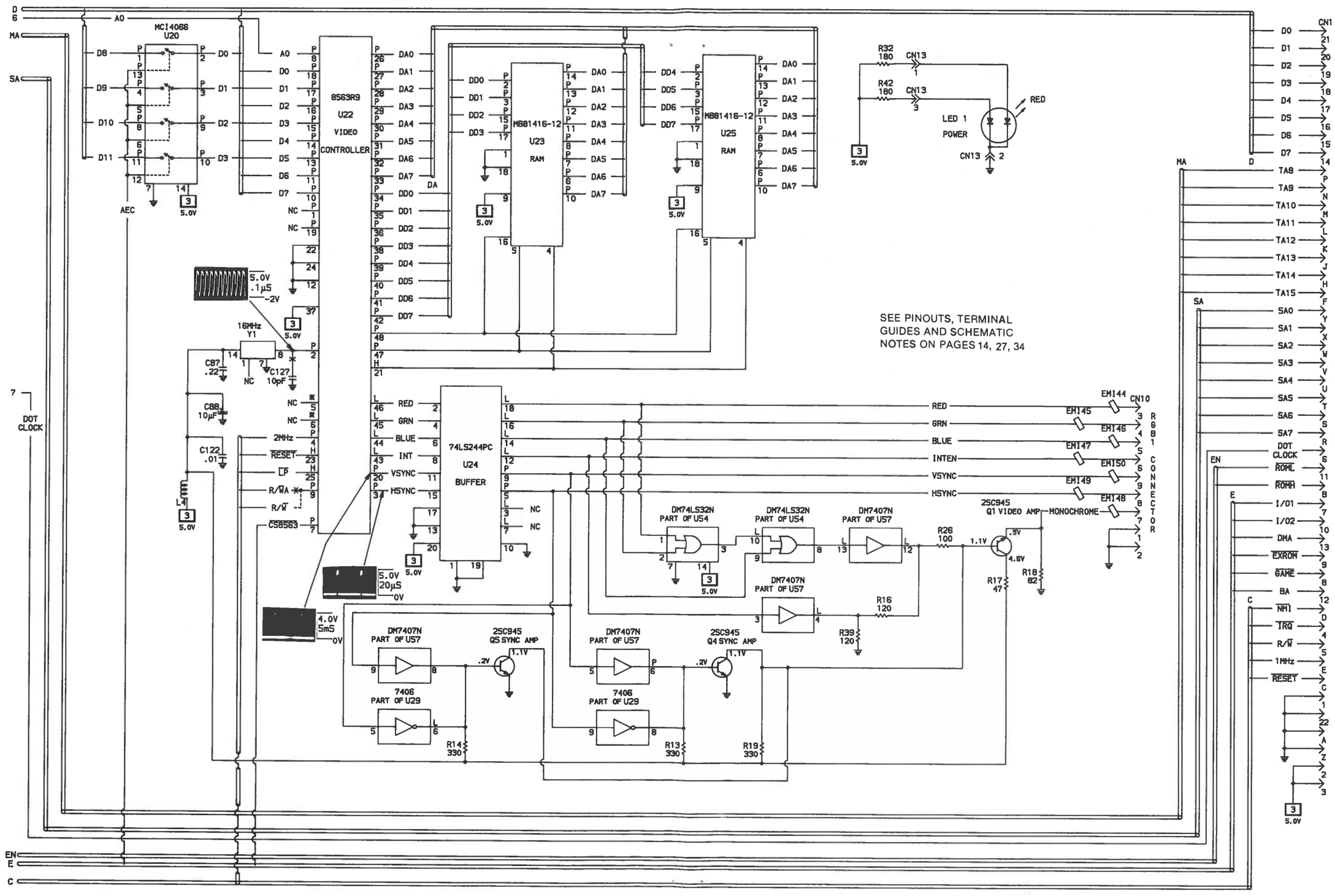

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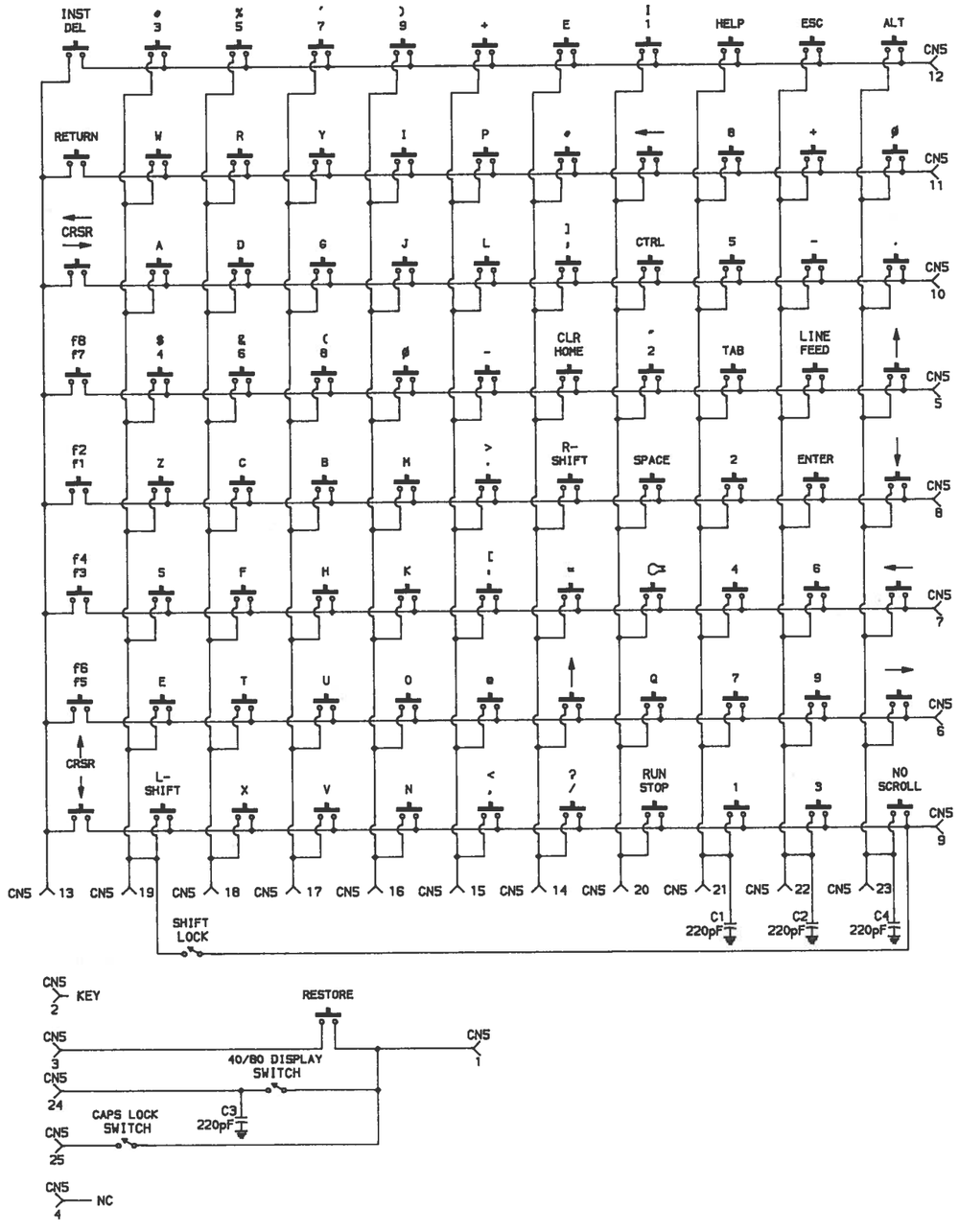
WITH CIRCUITRACE™



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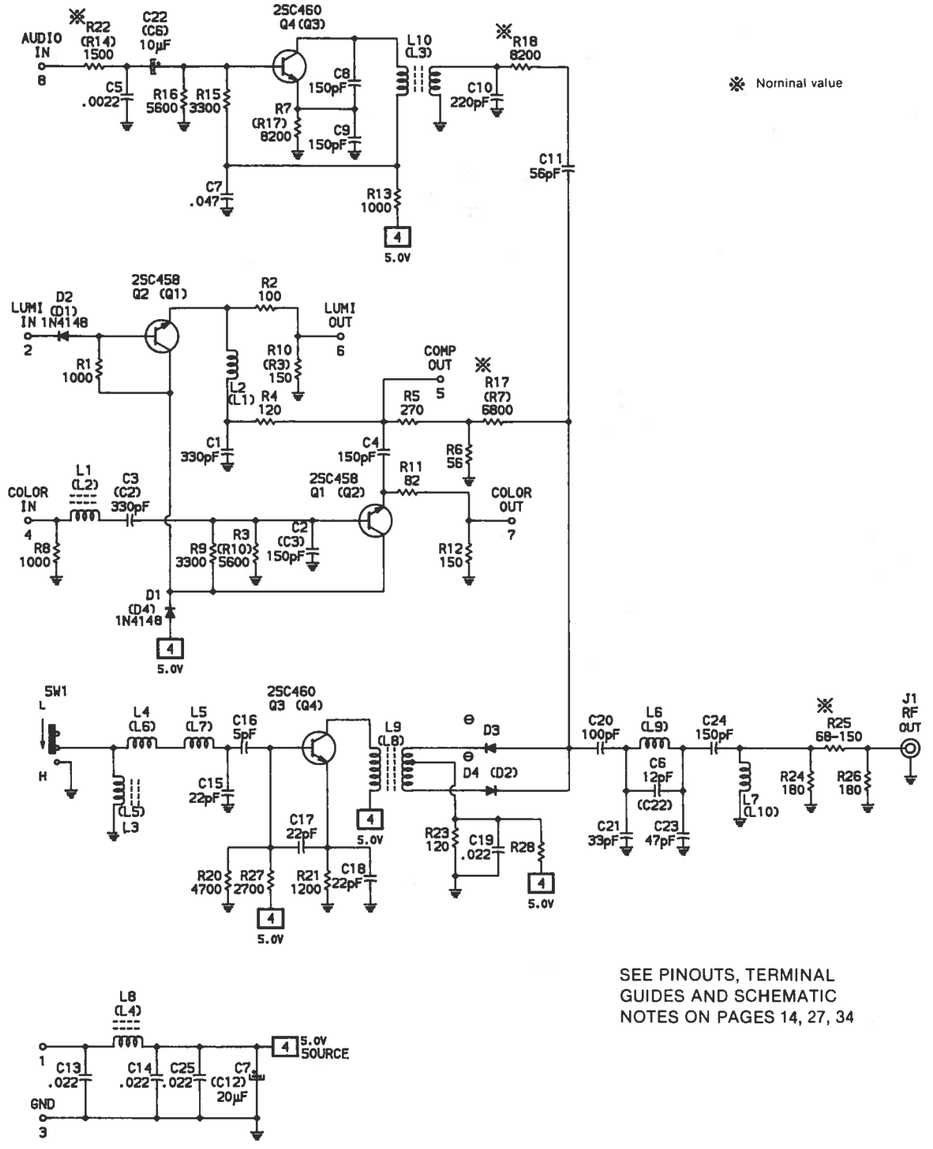
KEYBOARD



SEE PINOUTS, TERMINAL GUIDES AND SCHEMATIC NOTES ON PAGES 14, 27, 34

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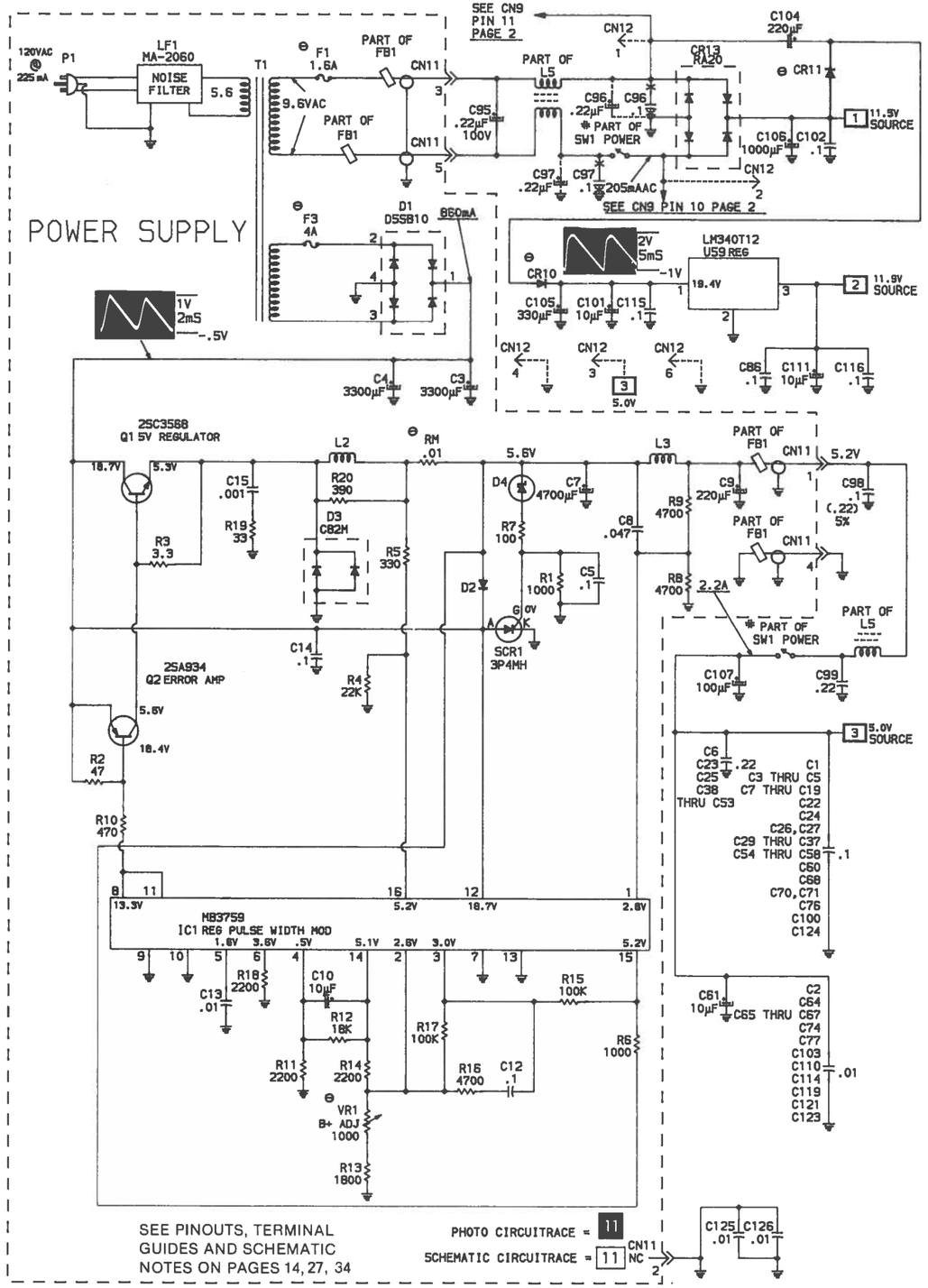
RF MODULATOR

SCHEMATIC NOTES

—x— Circuitry not used in some versions
- - - Circuitry used in some versions
ⓔ See parts list
⏚ Ground
Voltages measured with digital meter.
Waveforms and voltages are taken from ground, unless noted otherwise.
NOTE: Logic probe readings and waveforms taken with computer turned on in C128 mode, no keys pressed, unless otherwise noted.
Waveforms taken with triggered scope and Sweep/Time switch in Calibrate position, scope input set for DC coupling on "0" reference voltage waveforms. Switch to AC input to view waveforms after DC reference is measured when necessary. Each waveform is 7.5cm width with DC reference voltage given at the bottom line of each waveform.
Item numbers in rectangles appear in the alignment/adjustment instructions.
Supply voltage maintained as shown at input.
Controls adjusted for normal operation.
Terminal identification may not be found on unit.
Capacitors are 50 volts or less, 5% unless noted.
Electrolytic capacitors are 50 volts or less, 20% unless noted.
Resistors are ½W or less, 5% unless noted.
Value in ( ) used in some versions.
Measurements taken with switching as shown, unless noted.

Logic Probe Display
L = Low
H = High
P = Pulse
* = Open (No Lights On)
(1) Probe indicates P when any key except RESTORE is pressed.
(2) Probe indicates P when keys 1, 3, 5, 7, 9, +, £, HELP, ESC, ALT, INST/DEL are pressed.
(3) Probe indicates P when keys W, R, Y, I, P, *, —, RETURN and numeric keypad keys 8, +, 0 are pressed.
(4) Probe indicates P when keys A, D, G, J, L, ;, CONTROL, CSR and numeric keypad keys 5, —, . are pressed.
(5) Probe indicates P when keys 2, 4, 6, 8, 0, —, F7, CLR/HOME, TAB, LINE FEED, ↑ are pressed.
(6) Probe indicates P when keys Z, C, B, M, F1, ., R, SHIFT, SPACE, ↓ and numeric keypad keys 2 and ENTER are pressed.
(7) Probe indicates P when keys S, F, H, K, F3, :, =, ↵, — and numeric keypad keys 4 and 6 are pressed.
(8) Probe indicates P when keys Q, E, T, U, O, F5, @, ↓, — and numeric keypad keys 7 and 9 are pressed.
(9) Probe indicates P when keys X, V, N, ,, /, L.SHIFT, RUN/STOP, NO SCROLL, CSR and numeric keypad keys 1 and 3 are pressed.
(10) Probe indicates L in C64 mode.
(11) Probe indicates L in 80 column mode.
(12) Probe indicates P in CP/M mode.



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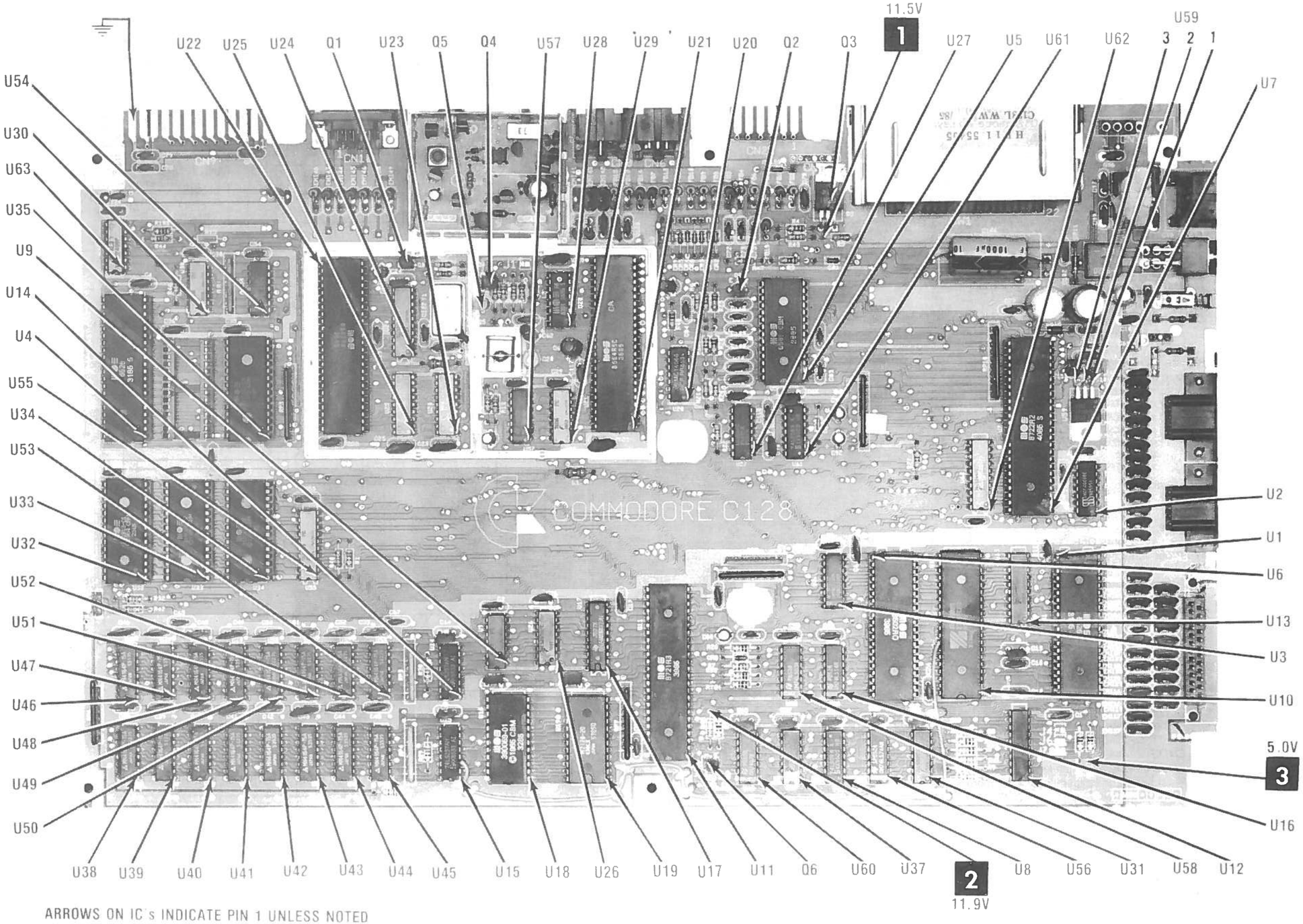
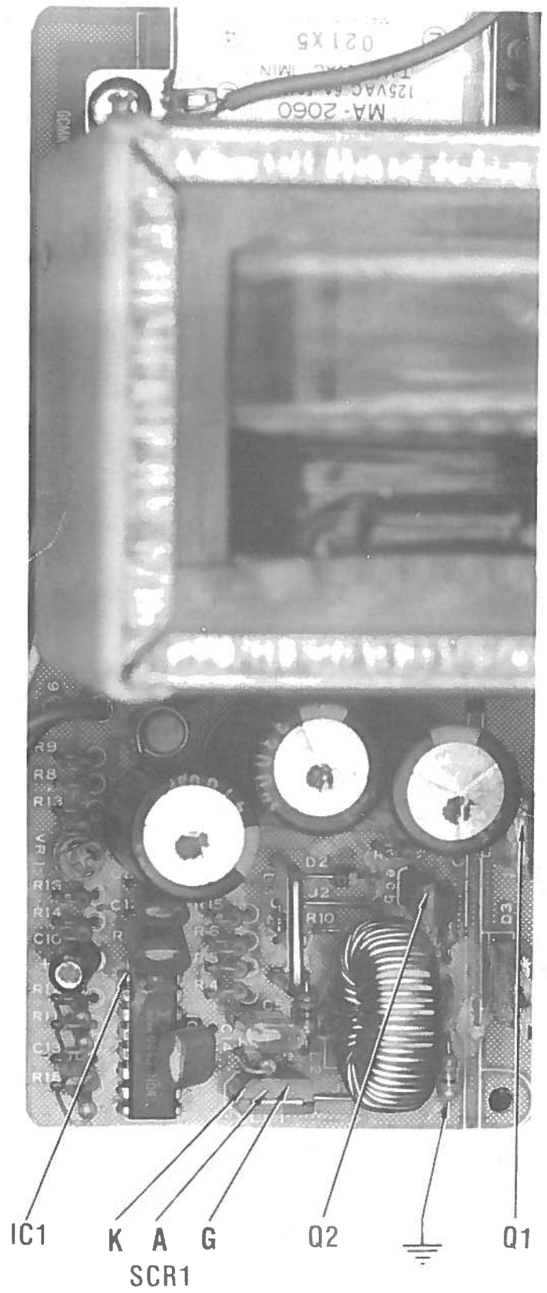


ARROWS ON IC's INDICATE PIN 1 UNLESS NOTED

SAFETY PRECAUTIONS

1. Use an isolation transformer for servicing.
2. Maintain AC line voltage at rated input.
3. Remove AC power from the computer before servicing or installing electrostatically sensitive devices. Examples of typical ES devices are integrated circuits and semiconductor "chip" components.
4. Use extreme caution when handling the printed circuit boards. Some semiconductor devices can be damaged easily by static electricity. Drain off any electrostatic charge on your body by touching a known earth ground. Wear a commercially available discharging wrist strap device. This should be removed prior to applying power to the unit under test.
5. Use a grounded-tip, low voltage soldering iron.
6. Use an isolation (times 10) probe on scope.
7. Do not remove or install boards, floppy disk drives, printers, or other peripherals with computer AC power On.
8. Do not use freon-propelled sprays. These can generate electrical charges sufficient to damage semiconductor devices.
9. This computer is equipped with a grounded three-pronged AC plug. This plug must fit into a grounded AC power outlet. Do not defeat the AC plug safety feature.
10. Periodically examine the AC power cord for damaged or cracked insulation.
11. The computer cabinet is equipped with vents to prevent heat build-up. Never block, cover, or obstruct these vents.
12. Instructions should be given, especially to children, that objects should not be dropped or pushed into the vents of the cabinet. This could cause shock or equipment damage.
13. Never expose the computer to water. If exposed to water, turn the unit off. Do not place the computer near possible water sources.
14. Never leave the computer unattended or plugged into the AC outlet for long periods of time. Remove AC plug from AC outlet during lightning storms.
15. Do not allow anything to rest on AC power cord.
16. Unplug AC power cord from outlet before cleaning computer.
17. Never use liquids or aerosols directly on the computer. Spray on cloth and then apply to the computer cabinet. Make sure the computer is disconnected from the AC power line.



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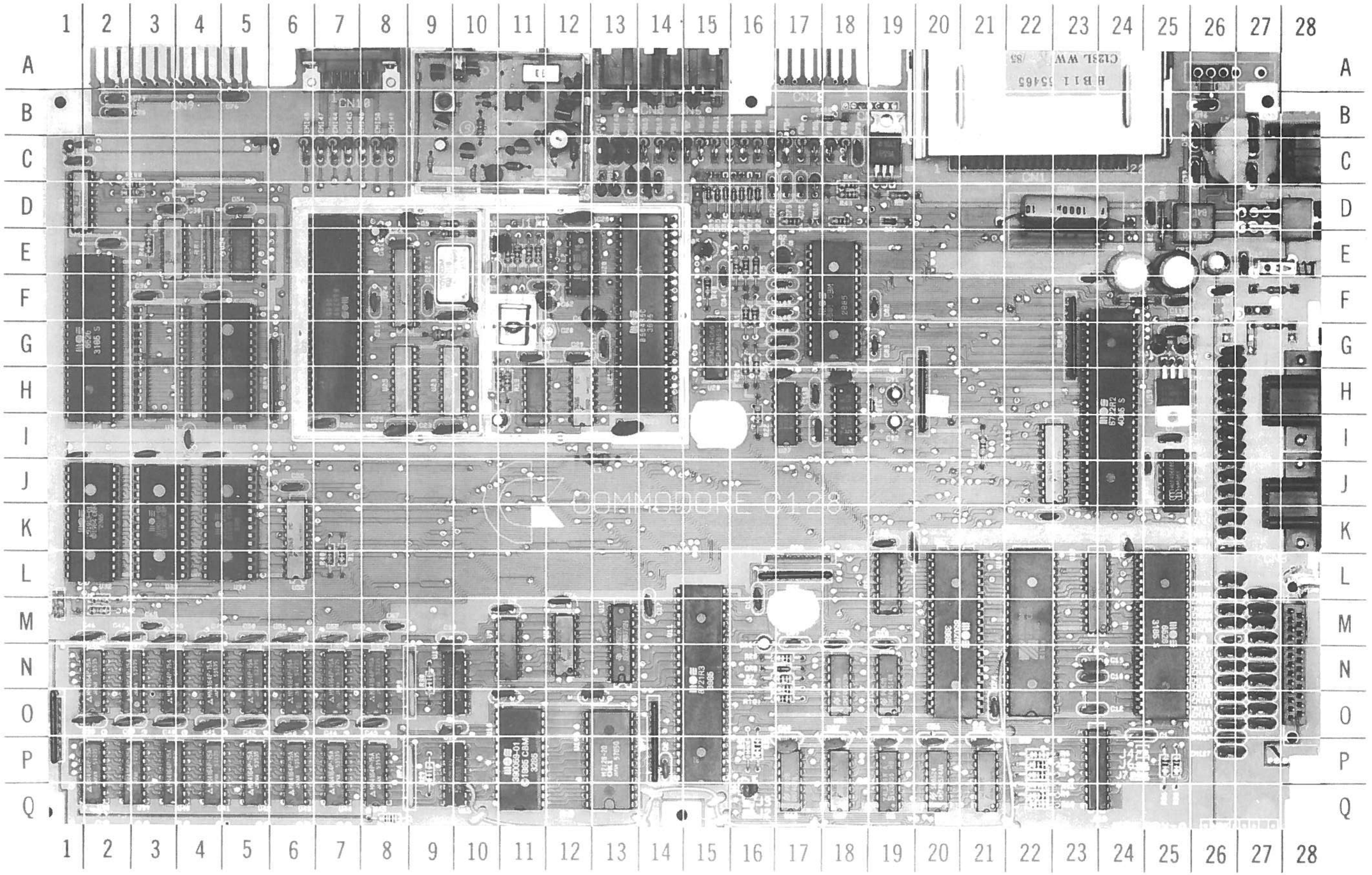
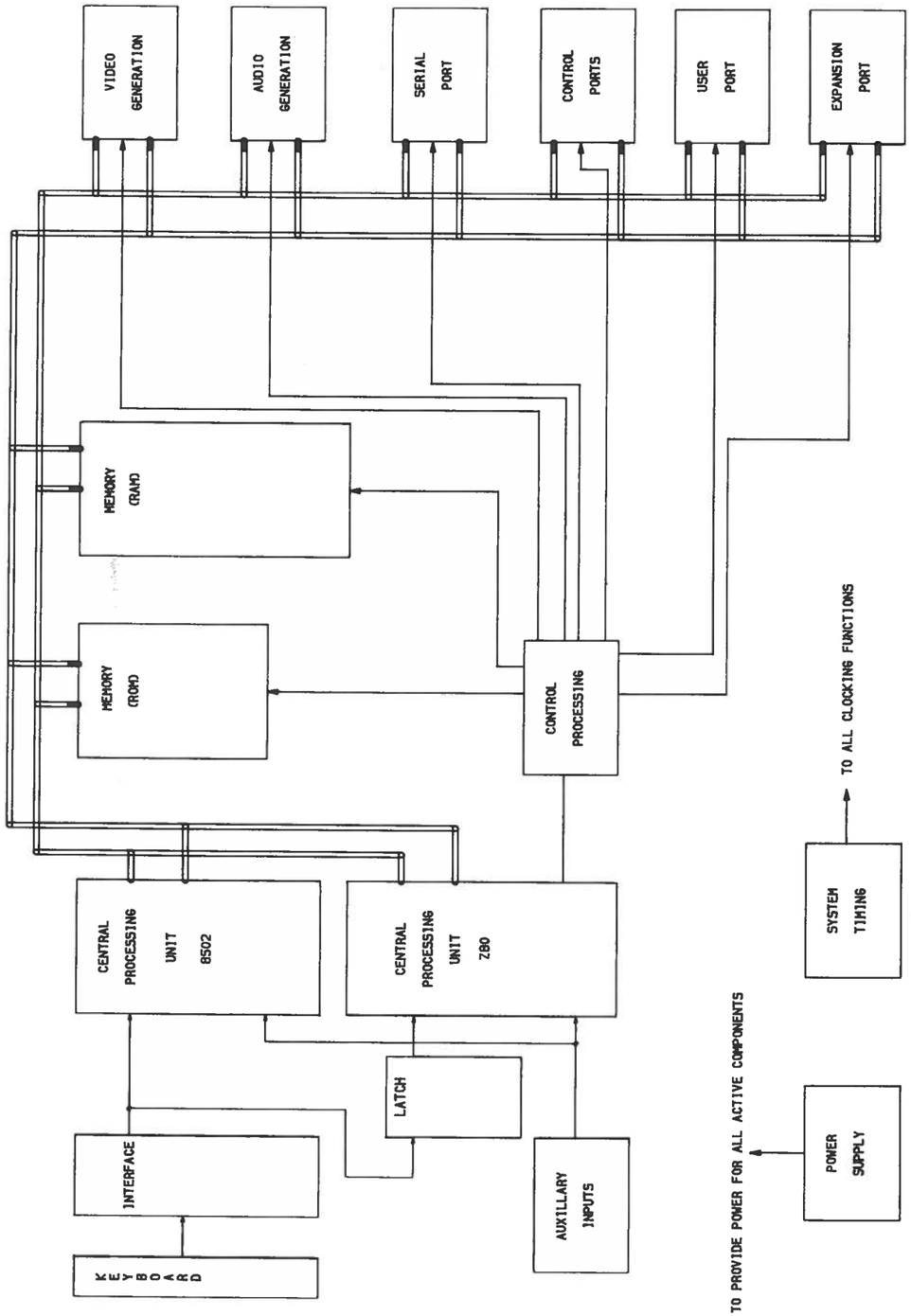
POWER SUPPLY BOARD



MAIN BOARD A Howard W. Sams GRIDTRACE™ Photo

MAIN BOARD



BLOCK DIAGRAM

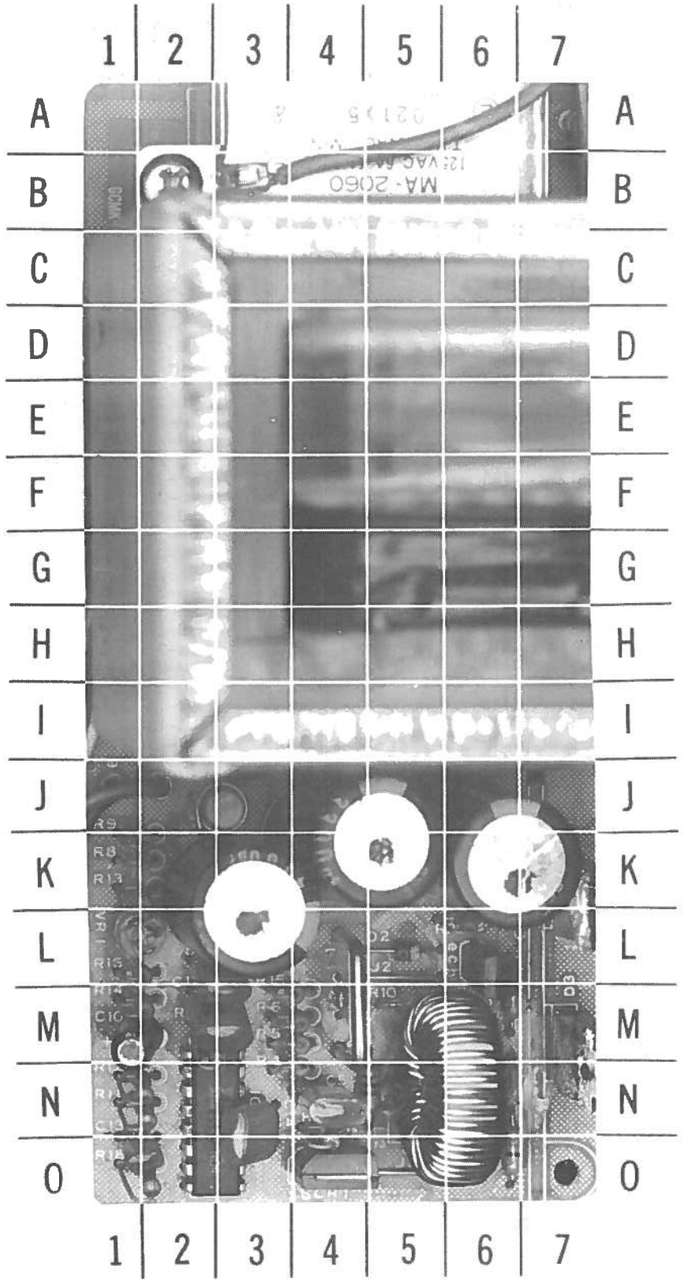
MAIN BOARD GridTrace LOCATION GUIDE

C1	O-25	C77	F-23	CR15	F-25	L1	J-3	U2	J-25
C2	P-14	C78	B-2	CR16	H-19	L2	E-12	U3	L-19
C3	K-19	C79	B-2	CR100	B-18	L3	D-15	U4	H-2
C4	E-2	C80	M-16	EM11	J-26	L4	G-9	U5	G-18
C5	G-17	C81	F-17	EM12	J-26	L5	C-26	U6	L-20
C6	K-20	C82	F-19	EM13	K-26	M1	B-11	U7	J-24
C7	I-25	C83	G-19	EM14	K-26	Q1	D-9	U8	Q-19
C8	P-19	C84	F-15	EM15	J-26	Q2	E-17	U9	M-11
C9	M-11	C85	E-15	EM16	J-26	Q3	C-19	U10	N-22
C10	N-23	C86	G-17	EM19	G-26	Q4	E-11	U11	O-15
C11	M-16	C87	F-9	EM110	H-26	Q5	E-10	U12	P-24
C12	O-23	C88	I-11	EM111	I-26	Q6	Q-16	U13	L-23
C13	N-23	C89	M-17	EM112	I-26	R1	L-7	U14	N-10
C14	M-9	C90	I-17	EM113	H-26	R2	P-22	U15	P-10
C15	O-9	C91	H-19	EM114	H-26	R3	D-18	U16	O-19
C16	M-19	C92	I-19	EM115	I-26	R4	D-18	U17	N-13
C17	M-14	C93	G-17	EM116	O-26	R5	D-19	U18	P-11
C18	O-11	C94	C-14	EM117	O-26	R6	E-16	U19	P-13
C19	O-13	C95	B-27	EM118	O-26	R7	N-17	U20	G-15
C20	G-12	C96	B-26	EM119	O-27	R8	P-22	U21	H-14
C21	I-13	C97	B-26	EM120	O-27	R9	Q-22	U22	H-7
C22	I-7	C98	C-27	EM121	L-26	R10	Q-22	U23	H-9
C23	I-9	C99	C-26	EM122	L-26	R11	F-16	U24	F-8
C24	E-8	C100	F-26	EM123	L-27	R12	E-16	U25	H-8
C25	I-8	C101	G-25	EM124	M-26	R13	H-11	U26	N-12
C26	M-12	C102	D-25	EM125	M-26	R14	H-11	U27	I-17
C27	H-17	C103	E-27	EM126	M-27	R16	E-11	U28	E-12
C28	D-12	C104	E-25	EM127	P-25	R17	D-9	U29	G-12
C29	G-12	C105	E-24	EM128	O-26	R18	E-9	U30	E-3
C30	D-3	C106	D-23	EM129	O-27	R19	E-11	U31	Q-21
C31	P-21	C107	E-26	EM130	N-26	R20	N-17	U32	K-2
C32	I-1	C108	F-17	EM131	N-27	R21	G-16	U33	K-3
C33	I-3	C109	F-17	EM132	N-26	R22	I-16	U34	K-5
C34	I-4	C110	K-24	EM133	N-27	R23	F-27	U35	H-5
C35	F-4	C111	G-25	EM134	N-26	R24	G-16	U37	Q-18
C36	F-3	C112	E-17	EM135	N-27	R25	E-16	U38	P-2
C37	P-18	C113	H-17	EM137	M-27	R26	E-11	U39	P-3
C38	O-2	C114	M-26	EM138	M-27	R27	I-21	U40	P-3
C39	O-2	C115	F-25	EM139	C-13	R28	F-16	U41	P-4
C40	O-3	C116	G-25	EM140	C-13	R29	P-9	U42	P-5
C41	O-4	C117	G-13	EM141	C-13	R30	N-9	U43	P-6
C42	O-5	C118	F-11	EM142	C-13	R31	G-27	U44	P-7
C43	O-6	C119	F-8	EM144	C-7	R32	M-2	U45	P-8
C44	O-7	C120	C-14	EM145	C-7	R33	N-17	U46	N-2
C45	O-8	C121	K-22	EM146	C-7	R34	P-22	U47	M-3
C46	M-2	C122	F-9	EM147	C-7	R35	P-16	U48	M-3
C47	M-2	C123	J-25	EM148	C-6	R36	P-25	U49	M-4
C48	M-3	C124	C-1	EM149	C-8	R38	P-25	U50	M-5
C49	M-4	C125	C-1	EM150	C-8	R39	E-11	U51	M-6
C50	M-5	C126	C-5	EM169	K-26	R40	L-7	U52	M-7
C51	M-6	C127*	E-10	FB1	C-18	R41	Q-22	U53	M-8
C52	M-7	CN1	C-22	FB2	C-18	R42	M-2	U54	E-5
C53	M-8	CN2	A-17	FB3	C-16	R43	D-18	U55	L-6
C54	D-5	CN3	J-28	FB4	C-17	R44	D-3	U56	Q-20
C55	J-6	CN4	H-28	FB5	C-17	R45	P-16	U57	H-11
C56	P-20	CN5	M-28	FB6	C-17	R46	E-3	U58	O-18
C57	G-11	CN6	A-15	FB7	C-15	R47	D-17	U59	H-25
C58	M-18	CN8	A-13	FB8	C-16	R48	F-15	U60	Q-17
C60	P-17	CN9	A-3	FB9	C-16	R100	D-3	U61	H-18
C61	E-8	CN10	A-7	FB10	C-15	R101	O-17	U62	J-23
C62	F-11	CN11	C-28	FB11	C-15	R107*	L-22	U63	D-1
C63	F-13	CN13	M-1	FB12	C-15	RP2	L-17	Y1	E-9
C64	I-4	CR1	D-19	FB13	C-14	RP3	N-9	Y2	G-11
C65	M-3	CR2	D-16	FB14	C-14	RP4	P-9		
C66	Q-8	CR3	D-16	FB15	C-14	RP5	L-17		
C67	M-8	CR4	D-15	FB18	C-17	RP6	O-1		
C68	H-18	CR5	D-15	FB19	D-13	RP7	P-14		
C70	C-18	CR6	D-16	FB20	D-13	RP8	H-20		
C71	G-26	CR7	D-16	J1	D-11	RP9	H-6		
C72	D-16	CR8	N-17	J2	Q-16	RP10	G-23		
C73	D-17	CR9	D-15	J3	Q-16	RR1	E-4		
C74	O-21	CR10	F-24	J4	P-24	SW1	D-28		
C75	D-17	CR11	D-25	J6	P-24	SW2	E-28		
C76	B-5	CR13	D-26	J7	P-24	U1	M-25		

*Located on bottom of board.

POWER SUPPLY BOARD

C3	K-5
C4	K-6
C5	N-4
C7	K-3
C8	M-3
C9	J-3
C10	M-1
C12	M-2
C13	O-2
C14	N-3
C15	N-6
D1	I-6
D2	L-5
D3	M-7
D4	M-4
F3	I-2
IC1	N-3
L2	N-6
L3	J-3
LF1	A-4
Q1	K-7
Q2	L-6
R1	O-4
R2	L-6
R3	M-6
R4	N-4
R5	M-4
R6	M-4
R7	N-5
R8	K-2
R9	K-2
R10	M-5
R11	N-2
R12	N-2
R13	K-2
R14	M-2
R15	M-4
R16	L-2
R17	M-2
R18	Q-2
R19	O-6
R20*	N-5
RM	N-4
SCR1	O-4
T1	F-5
VR1	L-2



POWER SUPPLY BOARD

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LOGIC CHART (Continued)

PIN NO.	IC U57	IC U58	IC U60	IC U61	IC U62	IC U63
1	P	H	P	H	H	L
2	P	L	L	P	P	H
3	L	H	H	P	P	H
4	L	L	H	P	P	L
5	P	L	H	H	P	P
6	P	H	H	P	P	L
7	L	L	L	L	P	L
8	L	H	H	P	P	H
9	P	L	H	P	P	L
10	H	H	P	H	L	L
11	H	H	P	H	P	H
12	L	L	P	H	P	L
13	L	L	P	H	P	H
14	H	H	H	H	P	H
15					P	
16					P	
17					P	
18					P	
19					H	
20					H	

LINE DEFINITIONS

A0 THRU A16 . . . . . Address Lines 0 Thru 16
AEC . . . . . Address Enable Control
ATN . . . . . Attention
AUDIO OUT . . . . . Audio Output
BA . . . . . Bus Available
BUSREQ . . . . . Bus Request
CAPLK SENSE . . . . . Capital Lock Sensor
CAS . . . . . Column Address Strobe
CASS MRT/P5 . . . . . Cassette Motor Control
CASS SENSE/P4 . . . . . Cassette Sense
CHAREN . . . . . Character ROM Enable
CHAROM . . . . . Character ROM Chip Select
CHROMA . . . . . Color Signal
CIA1,CIA2 . Complex Interface Adapter Select Lines 1 and 2
CLK . . . . . Clock
CLOCK . . . . . Clock
CLRBNK . . . . . Color RAM Bank Select
CNT1,CNT2 . . . . . Count Input, Internal Timer Reference
COL0 THRU COL7 . . Keyboard Input Data, Columns 0 Thru 7
COLORAM . . . . . Color RAM Chip Select
CS8563 . . . . . Chip Select 8563
D0 THRU D11 . . . . . Data, Bits 0 Thru 11
DA0 THRU DA7 . . . . . Display Address Bits 0 Thru 7
DD0 THRU DD7 . . . . . Display Data Bits 0 Thru 7
DMA . . . . . Direct Memory Access
DOT . . . . . Dot Clock
DRESET . . . . . Dynamic RAM Reset
DWE . . . . . Dynamic RAM Write Enable
EN . . . . . Enable
EXROM . . . . . External ROM Enable
EXT AUDIO . . . . . External Audio Input
EXTRES . . . . . External Reset
FLAG1,FLAG2 . . . . . Data Transfer Controls 1 and 2
FROM1 . . . . . Function ROM 1 Select
FSDIR . . . . . Fast Serial Direction, Disk Interface
GAME . . . . . Game ROM Enable
GWE . . . . . Graphics Write Enable, Color RAM
I/01,I/02 . . . . . Inputs/Output Selects 1 and 2
IOACC . . . . . Input/Output Access
IOCS . . . . . Input/Output Chip Select, External Decoder
IRQ . . . . . Interrupt Request
LP . . . . . Light Pen Input
MA0 THRU MA11 . . . . . Multiplexed Address Bits 0 Thru 11
MUX . . . . . Address Multiplex Control
NMI . . . . . Non-Maskable Interrupt
PA2 . . . . . Parallel Port A, Bit 2
PB0 THRU PB7 . . . . . Parallel Port B, Bits 0 Thru 7
PHI IN . . . . . Presystem Clock Input, Early Write Translation
POTX . . . . . Game Paddle Control
POTY . . . . . Game Paddle Control
R/W . . . . . Read/Write
RAS . . . . . Row Address Strobe
RESET . . . . . Reset, Initializes Internal Registers
ROM1 THRU ROM4 . . . . . ROM Selects 1 Thru 4
ROMH . . . . . Expansion ROM Chip Select, High Status
ROML . . . . . Expansion ROM Chip Select, Low Status
ROW0 THRU ROW7 . . . Keyboard Input Data, Rows 0 Thru 7
SID . . . . . Sound Interface Device Chip Select
TA12 THRU TA15 . . . . . Translated Address Outputs
VIC . . . . . Video Interface Chip Select
VMA0 THRU VMA7 . . VIC Multiplexed Address Bits 0 Thru 7
Z80 I/O . . . . . Z80 Input Requesting Input/Output Access
ZD0 THRU ZD7 . . . . . Z80 Data Bits 0 Thru 7
128/64 . . . . . C128 or C64 Operating Modes

LOGIC CHART (Continued)

PIN NO.	IC U34	PIN NO.	IC U34	PIN NO.	IC U35	PIN NO.	IC U35	PIN NO.	IC U37	IC U38	IC U39	IC U40	IC U41	IC U42
1	H	21	P	1	H	21	P	1	L	*	*	*	*	*
2	P	22	P	2	P	22	P	2	H	P	P	P	P	P
3	P	23	P	3	P	23	P	3	H	P	P	P	P	P
4	P	24	P	4	P	24	P	4	L	P	P	P	P	P
5	P	25	P	5	P	25	P	5	P	P	P	P	P	P
6	P	26	P	6	P	26	P	6	L	P	P	P	P	P
7	P	27	H	7	P	27	H	7	L	P	P	P	P	P
8	P	28	H	8	P	28	H	8	L	H	H	H	H	H
9	P			9	P			9	H	P	P	P	P	P
10	P			10	P			10	H	P	P	P	P	P
11	P			11	P			11	L	P	P	P	P	P
12	P			12	P			12	L	P	P	P	P	P
13	P			13	P			13	H	P	P	P	P	P
14	L			14	L			14	H	P	P	P	P	P
15	P			15	P			15		P	P	P	P	P
16	P			16	P			16		L	L	L	L	L
17	P			17	P			17						
18	P			18	P			18						
19	P			19	P			19						
20	L			20	L			20						

PIN NO.	IC U43	IC U44	IC U45	IC U46	IC U47	IC U48	IC U49	IC U50	IC U51	IC U52	IC U53	IC U54	IC U55	IC U56
1	*	*	*	*	*	*	*	*	*	*	*	L	H	H
2	P	P	P	P	P	P	P	P	P	P	P	L	P	L
3	P	P	P	P	P	P	P	P	P	P	P	L	P	P
4	P	P	P	P	P	P	P	P	P	P	P	P	P	H
5	P	P	P	P	P	P	P	P	P	P	P	L	P	L
6	P	P	P	P	P	P	P	P	P	P	P	P	P	H
7	P	P	P	P	P	P	P	P	P	P	P	L	P	L
8	H	H	H	H	H	H	H	H	H	H	H	L	P	P
9	P	P	P	P	P	P	P	P	P	P	P	L	P	P
10	P	P	P	P	P	P	P	P	P	P	P	L	L	P
11	P	P	P	P	P	P	P	P	P	P	P	P	P	P
12	P	P	P	P	P	P	P	P	P	P	P	P	P	P
13	P	P	P	P	P	P	P	P	P	P	P	P	P	H
14	P	P	P	P	P	P	P	P	P	P	P	H	P	H
15	P	P	P	H	H	H	H	H	H	H	H		P	
16	L	L	L	L	L	L	L	L	L	L	L		P	
17													P	
18													P	
19													P	
20													H	

GENERAL OPERATING INSTRUCTIONS

POWER UP

When the Computer is turned On, it will come up in C128 mode ready to program in Commodore Basic. See "Cassette Operation" and "Disk Operation" sections for instructions on loading and saving programs. To bring the Computer up in C64 mode, hold the key down when turning the Computer On. If Computer is On, it can be switched from C128 mode to C64 mode by typing GO 64 and then press the RETURN key. When Computer responds "ARE YOU SURE?", type Y and press the RETURN key. To run a Basic program after it is loaded, type RUN and press the RETURN key. Press the RUN/STOP key to stop a program. Pressing the RUN/STOP key and the RESTORE key at the same time will stop the program and return Computer to start condition without losing the program.

Use the following procedure to bring Computer up in the CP/M mode. Turn the Disk Drive On and insert the CP/M system disk in the drive. Press the 40/80 key down. Turn the Computer On.

CASSETTE OPERATION

Plug a Datasette cassette recorder onto the six pin edge Connector (CN2) at rear of Computer. Note: An ordinary cassette recorder will not work with the Commodore C128. To load a program, type LOAD, press the RETURN key and follow the instructions displayed on the Monitor screen.

DISK OPERATION

Connect Disk Drive to Serial I/O Port (CN6) located at rear of Computer. Turn On Disk Drive and insert diskette. To load a program from the disk, type LOAD "PROGRAM NAME," 8. Press the RETURN key and follow the instructions displayed on the Monitor. To save a program to the disk, type SAVE "PROGRAM NAME," 8 and press the RETURN key.

Note: When loading a program from the disk or saving a program to the disk in C128 mode, the commands DLOAD "PROGRAM NAME" or DSAVE "PROGRAM NAME" can also be used. When DLOAD or DSAVE commands are used, you do not need to add the device number (8) after the program name.

DISASSEMBLY INSTRUCTIONS

CABINET TOP REMOVAL

Remove six screws from cabinet bottom. Lift up left side of cabinet top and disconnect Power Indicator Connector. Disconnect keyboard Connector and remove screw in lower right corner of Main Board to free keyboard ground strap. Lift cabinet top and keyboard from cabinet bottom.

KEYBOARD REMOVAL

Remove six Torx screws holding keyboard to cabinet top. Lift keyboard assembly from cabinet top.

MAIN BOARD REMOVAL

Remove five remaining screws holding Main Board to the cabinet bottom. Remove Main Board and shield assembly from cabinet bottom. To remove Main Board from shield assembly, straighten 11 tabs on front and sides of shield assembly. Unsolder top shield from right side of Main Board. Remove screw located just in front of RF Modulator. Remove top and bottom shields from Main Board.

MISCELLANEOUS ADJUSTMENTS

14MHz OSCILLATOR

Connect the input of a frequency counter to pin 8 of IC U28. Adjust Trimmer Capacitor C20 for a frequency of 14.31818MHz at pin 8 of IC U28.

RF MODULATOR

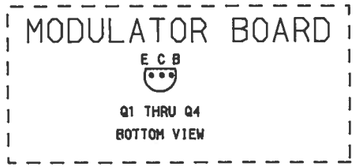
Connect Computer to a TV Monitor. Set TV and Computer Channel Select Switch to Channel 3. Type in and run the following Basic program:

```
10 VOL 5
20 SOUND 1, 5000, 100
30 GOTO 10
```

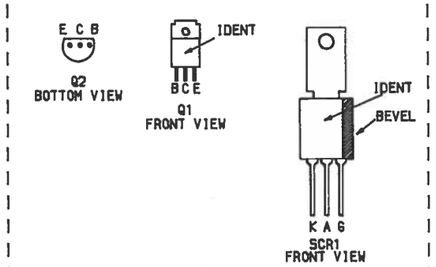
Adjust the sound coil for best sound with minimum noise.

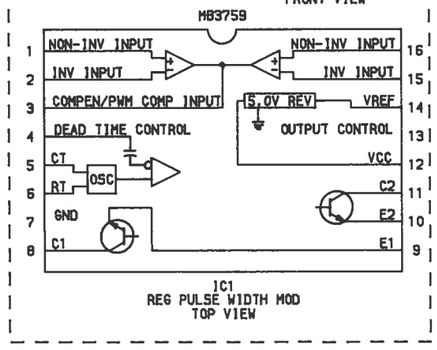
IC PINOUTS & TERMINAL GUIDES

MODULATOR BOARD

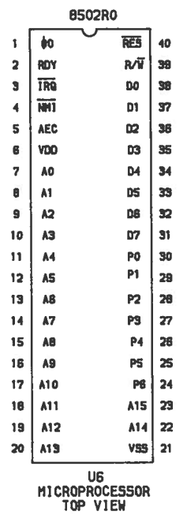


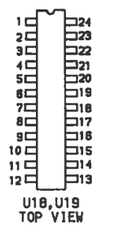
POWER SUPPLY BOARD

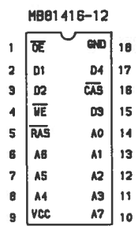


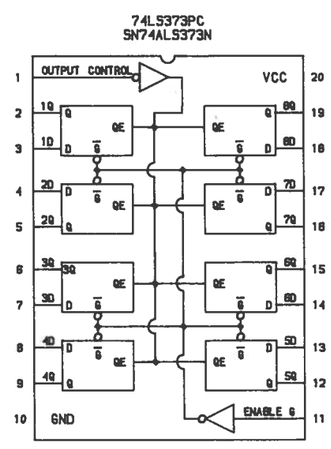


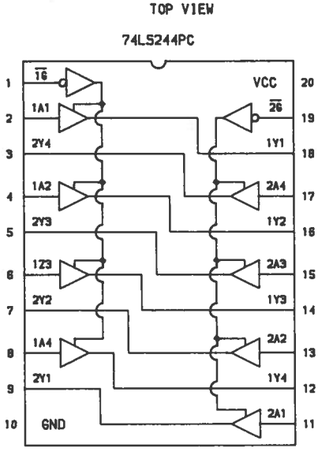
IC1
REG PULSE WIDTH MOD
TOP VIEW

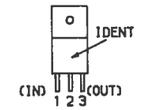


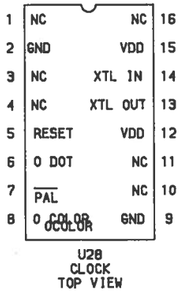


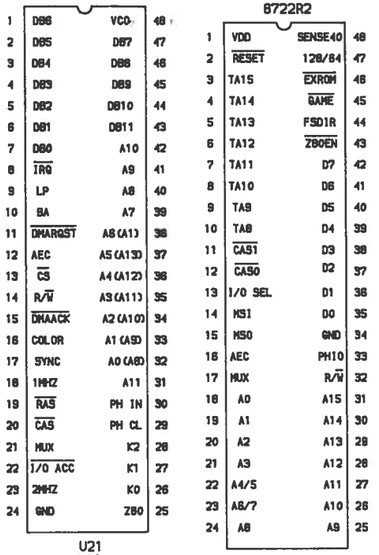


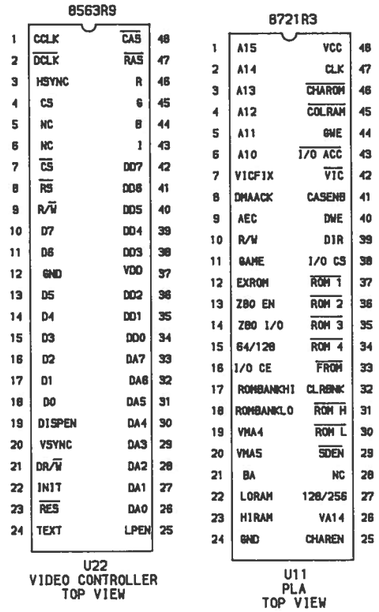


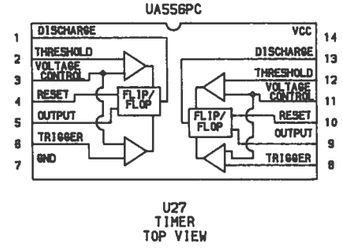


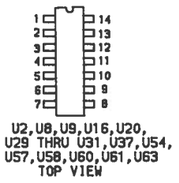


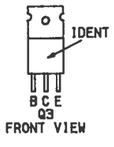


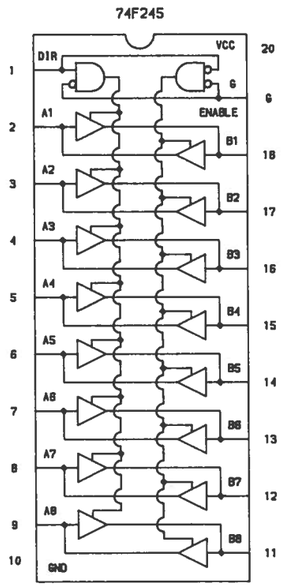


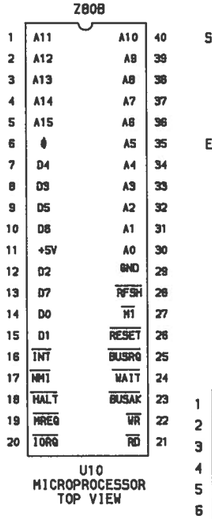


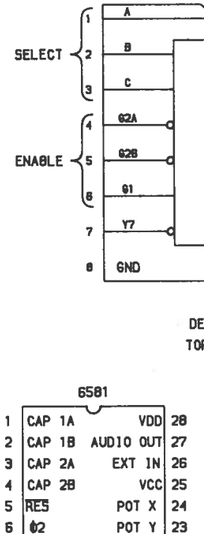


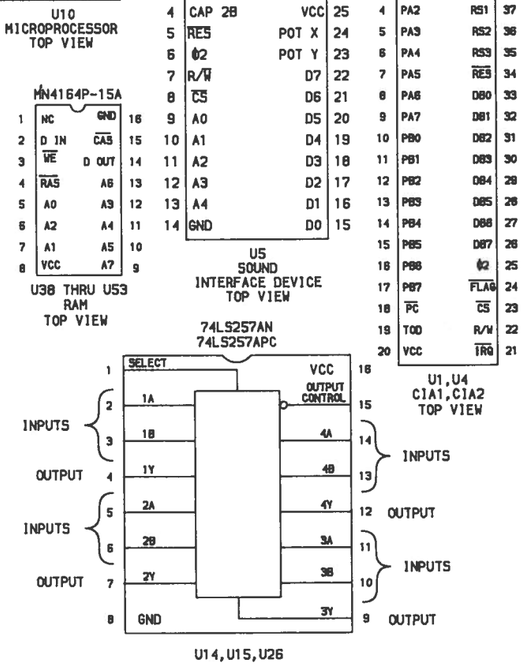












LOGIC CHART (Continued)

PIN NO.	IC U21	PIN NO.	IC U21	PIN NO.	IC U21	PIN PIN	IC U22	PIN NO.	IC U22	PIN NO.	IC U22	PIN NO.	IC U23	IC U24
1	P	21	P	41	P	1	P	21	H	41	P	1	L	L
2	P	22	P	42	P	2	P	22	L	42	P	2	P	L
3	P	23	P	43	P	3	P	23	H	43	L	3	P	L
4	P	24	L	44	P	4	P	24	L	44	L	4	H	L
5	P	25	P	45	P	5	*	25	H	45	L	5	P	P
6	P	26	L	46	P	6	*	26	P	46	L	6	P	L
7	P	27	L	47	P	7	P	27	P	47	P	7	P	L
8	P	28	L	48	H	8	P	28	P	48	P	8	P	L
9	H	29	P			9	P	29	P			9	H	P
10	P	30	P			10	P	30	P			10	P	L
11	H	31	P			11	P	31	P			11	P	P
12	P	32	P			12	L	32	P			12	P	L
13	P	33	P			13	P	33	P			13	P	L
14	P	34	P			14	P	34	P			14	P	L
15	P	35	P			15	P	35	P			15	P	P
16	P	36	P			16	P	36	P			16	P	P
17	P	37	P			17	P	37	H			17	P	L
18	P	38	P			18	P	38	P			18	L	L
19	P	39	P			19	P	39	P			19		L
20	P	40	P			20	P	40	P			20		H

PIN NO.	IC U25	IC U26	IC U27	IC U28	IC U29	IC U30	IC U31	IC U32	PIN NO.	IC U32	PIN NO.	IC U33	PIN NO.	IC U33
1	L	P	L	*	P	L	H	H	21	P	1	H	21	P
2	P	L	L	L	P	H	H	P	22	H	2	P	22	P
3	P	P	H	*	L	L	L	P	23	P	3	P	23	P
4	H	P	H	L	H	H	L	P	24	P	4	P	24	P
5	P	L	L	H	P	L	H	P	25	P	5	P	25	P
6	P	P	H	P	L	H	H	P	26	P	6	P	26	P
7	P	P	L	H	L	L	L	P	27	H	7	P	27	H
8	P	L	H	P	P	*	P	P	28	H	8	P	28	H
9	H	L	L	L	P	L	P	P			9	P		
10	P	L	H	H	P	H	H	P			10	P		
11	P	L	H	L	P	L	H	P			11	P		
12	P	P	L	H	P	L	L	P			12	P		
13	P	P	L	P	P	H	P	P			13	P		
14	P	L	H	P	H	H	H	L			14	L		
15	P	P		H				P			15	P		
16	P	H		*				P			16	P		
17	P							P			17	P		
18	L							P			18	P		
19								P			19	P		
20								L			20	L		

TEST EQUIPMENT

Test Equipment listed by Manufacturer illustrates typical or equivalent equipment used by SAMS' Engineers to obtain measurements and is compatible with most types used by field service technicians.

TEST EQUIPMENT (COMPUTERFACTS)

Equipment Name	B & K Precision Equipment No.	Sencore Equipment No.	
OSCILLOSCOPE	1570A,1590A,1596	SC61	
LOGIC PROBE	DP51		
LOGIC PULSER	DP101		
DIGITAL VOM	2830	DVM37,DVM56,SC61	
ANALOG VOM	277		
ISOLATION TRANSFORMER	TR110,1604,1653,1655	PR57	
FREQUENCY COUNTER	1803,1805	FC71,SC61	
COLOR BAR GENERATOR	1211A,1248,1251,1260	CG25,VA62	
RGB GENERATOR	1260		
FUNCTION GENERATOR	3020		
HI-VOLTAGE PROBE VOM/DMM Accessory probes	HV-44	HP200	
TEMPERATURE PROBE	TP-28		
CRT ANALYZER	467,470	CR70	

TROUBLESHOOTING

POWER SUPPLY (Power Pack)

5V source missing at pin 1 of Power Pack Connector CN11. Check for approximately 18.7V at the collector of 5V Regulator Transistor (Q1). If the voltage is missing at the collector Q1, check Fuse F3. If Fuse F3 is open, check Bridge Rectifier D1 and Electrolytics C3 and C4 for possible shorts. Also check Transistor Q1, Zener Diode D4 and SCR1 for shorts. If Fuse F3 is good, check Power Transformer T1 and the power cord. Also check Bridge Rectifier D1.

If the voltage is present at the collector of Transistor Q1, check for approximately 5.3V at the emitter of Q1. If the voltage is missing at the emitter of Q1, check Transistor Q1 and Error Amp Transistor (Q2). Also check Regulator Pulse Width Modulator (IC1) and associated components. If the voltage is present at the emitter of Q1, check Coils L2 and L3.

9.6VAC missing at pins 3 and 5 of Power Pack Connector CN11. Check Power Transformer T1 and the power cord. Also check Connector CN11 and the output cable.

POWER SUPPLY (Main Board)

12V missing at output of Regulator IC (U59). Check for approximately 19.4V at the input of IC U59. If the voltage is present at the input of IC U59, check IC U59 and associated components. If the voltage is missing at the input of IC U59, check for approximately 9.6VAC at the input of Bridge Rectifier (CR13). If 9.6VAC is present at the input of CR13, check CR13, Diodes CR10 and CR11, and Electrolytics C104 and C106. If 9.6VAC is missing at the input of CR13, check for 9.6VAC at pins 3 and 5 of Connector CN11. If the voltage is missing at pins 3 and 5 of CN11, refer to the "POWER SUPPLY (Power Pack)" section of this Troubleshooting Guide. If 9.6VAC is present at pins 3 and 5 of Connector CN11, check Filter Choke (L5) and Power Switch (SW1).

5V source missing on Main Board. Check for 5V at pin 1 of Connector CN11. If the 5V source is missing at pin 1 of CN11, refer to the "POWER SUPPLY (Power Pack)" section of this Troubleshooting Guide. If the 5V source is present at pin 1 of CN11, check L5 and SW1.

MICROPROCESSOR OPERATION

Computer does not boot up. Power supply checks good. Use a scope or logic probe to check data lines (pins 31 thru 38) and address lines (pins 7 thru 20, 22 and 23) of the 8502 Microprocessor IC (U6) for activity. If there is no activity on the address or data lines, check operation of the reset circuit by observing the logic reading at pin 40 of IC U6. Pin 40 of IC U6 should be Low when the Computer is turned On and then go immediately High. The Logic reading on pin 40 of U6 should also be Low when the Reset button is pressed. If the logic reading is not correct at pin 40 of U6 when the Computer is turned On, check Timer IC (U27) and IC U63, Resistor R24 and Electrolytics C91 and C92. If the Reset Switch (SW2) does not work, check SW2 and Diode CR16.

If the reset circuit works properly, check for the 2MHz clock signal at pin 1 of IC U6. If the 2MHz clock signal is missing, check for the 8.1818MHz clock signal at 6 of the 8701 Clock Generator IC (U28). If the 8.1818MHz signal is missing at pin 6 of IC U28, check IC U28, Crystal (Y2) and associated compnents. If the 8.1818MHz signal is present at pin 6 of IC U28, check the VIC IC (U21).

If the 2MHz clock signal is present at pin 1 of IC U6, check for a logic High at pins 4 and 5 of IC U6. If the logic reading is not correct at either pin, check the components associated with the pin having an incorrect reading. Check for the Z80 clock signal at pin 6 of the Z80 Microprocessor IC (U10). If the clock signal is missing at pin 6 of IC U10, check for the signal at pin 25 of IC U21. If the signal is missing at pin 25 of IC U21, check IC U21. If the clock signal is

TROUBLESHOOTING (Continued)

present at pin 25 of IC U21, check IC U60 and Clock Amp Transistor (Q6). If the Z80 clock signal is present at pin 6 of IC U10, check IC U6, MMU IC (U7) and IC U10. If ICs U6, U7 and U10 check good, check the other devices on the address or data bus for possible shorts.

C128 mode inoperative. If the Computer will not come up in C128 mode when it is turned On with no other key pressed, check ROM ICs (U33 and U34) and IC U7.

C64 mode inoperative. If Computer will not come up in the C64 mode when it is turned On with the C= key pressed, check ROM IC (U32) and IC U7.

CP/M mode inoperative. If CP/M fails to boot with the CP/M system disk in the Disk Drive when Computer is turned On, check IC U7. If IC U7 checks good, check the Disk Drive and the CP/M system disk.
NOTE: Although the Z80 Microprocessor IC (U10) is used only for the CP/M mode, neither the C128 or C64 mode will come up if IC U10 is defective.

VIDEO

No video when using the RF Modulator. Use a scope to check for a video waveform at pin 17 of IC U21. If the video waveform is present at pin 17 of IC U21, check the RF Modulator. If the waveform is missing at pin 17 of IC U21, check IC U21 by substitution.

No video when using a composite monitor. Check for a video waveform at pin 17 of IC U21. If the waveform is present at pin 17 of IC U21, check the Monitor. Also check Connector CN8 for good connections.

No video when using an RGB Monitor. Make sure that the 40/80 DISPLAY Switch is in the 80 column mode. Check for a video waveform at pin 12 of Buffer IC (U24). If the waveform is missing at pin 12 of IC U24, check for a video signal at pin 43 of the 8563 Video Controller IC (U22). If a video signal is present at pin 43 of IC U22, check IC U24. If the waveform is missing at pin 43 of IC U22, check IC U22. If the video waveform is present at pin 12 of IC U24, check the Monitor and Connector CN10.

COLOR

No color when using the RF Modulator or a composite Monitor. Check for a color signal at pin 16 of IC U21. If the color signal is missing at pin 16 of IC U21,check for the color or clock at pin 29 of IC U21. If the color clock signal is missing at pin 29 of IC U21, check IC U28. If the clock signal is present at pin 29 of IC U21, check IC U21 by substitution. If the color signal is present at pin 16 of IC U21, check the RF Modulator. If the RF Modulator checks good and a composite Monitor is being used, check the Monitor and Connector CN8.

One or more colors are missing when using an RGB Monitor. Check for the R, G and B chroma signals at pins 18, 16 and 14 of IC U24. If the chroma waveform is missing at pin 14, 16 or 18 of IC U24, check for the chroma signals at pins 44, 45 and 46 of IC U22. If the chroma signals are present at pins 44, 45 and 46 of IC U22, check IC U24. If the chroma signal is missing at either pin 44, 45 or 46 of IC U22, check for the Video Dot Clock signal at pin 2 of IC U22. If the clock signal is missing at pin 2 of IC U22, check Crystal Oscillator (Y1), Capacitors C87 and C122, Electrolytic C88 and Coil L4. if the clock signal is present at pin 2 of IC U22, check IC U22 by substitution. If the R, G and B chroma signals are present at pins 18, 16 and 14 of IC U24, check the RGB Monitor and Connector CN10.

AUDIO

No sound. Type in and run the following BASIC program:

```
10 VOL 5
20 SOUND 1, 10000, 100
30 GOTO 10
```

Use a scope to check for an audio signal at pin 3 of Connector CN8. If the audio signal is present at pin 3 of CN8 and the RF Modulator output is being used, check the RF Modulator.

If the audio signal is missing at pin 3 of CN8, check for the audio signal at the emitter of Audio Output Transistor (Q2). If the audio signal is present at the emitter of Q2, check Electrolytic C85. If the audio signal is missing at the emitter Q2, check for the audio signal at pin 27 of the 6581 SID IC (U5). If the audio signal is present at pin 27 of IC U5, check Q2 and associated components. If the audio signal is missing at pin 27 of IC U5, check IC U5 by substitution.

KEYBOARD

Keyboard inoperative. Check the waveforms at pins 2 thru 8 of Complex Interface Adapter IC (U1). If any of the waveforms are missing, check IC U1 by substitution. If the waveforms are present, check the operation of the keyboard by observing the logic probe readings on pins 9 thru 17 of IC U1 while pressing the keys associated with the pin being monitored. If any of the logic readings are incorrect, check the Keyboard and Keyboard Connector CN5. If the logic readings are correct on pins 9 thru 17 of IC U1 and the Keyboard does not operate correctly, check IC U1 by substitution.

If the RESTORE key does not work, check for a logic Low at pin 3 of Connector CN5 when the RESTORE key is pressed. If pin 3 of CN5 does not go logic Low when the RESTORE key is pressed, check the Keyboard and Connector CN5.

JOYSTICK

Joystick does not work properly. Check the voltages on pins 2 thru 6 and 10 thru 14 of IC U1 while the appropriate joystick position is activated. Refer to the chart below. The voltage should go from about 5V to less than 0.5V when the joystick position is activated. If any voltage does not change when the appropriate joystick position is activated, check the joystick and Connectors CN3 and CN4. If the voltages are normal on pins 2 thru 6 and 10 thru 14 of IC U1, check IC U1 by substitution.

PORT 1			PORT 2		
IC	PIN	JOYSTICK POSITION	IC	PIN	JOYSTICK POSITION
U1	10	UP	U1	2	UP
U1	11	DOWN	U1	3	DOWN
U1	12	LEFT	U1	4	LEFT
U1	13	RIGHT	U1	5	RIGHT
U1	14	BUTTON	U1	6	BUTTON

LOGIC CHART (Continued)

PIN NO.	IC U10	PIN NO.	IC U10	PIN NO.	IC U11	PIN NO.	IC U11	PIN NO.	IC U11	PIN NO.	IC U12	IC U13	IC U14	IC U15
1	P	21	*(12)	1	P	21	P	41	P	1	*(12)	H	P	P
2	P	22	H	2	P	22	H	42	P	2	*(12)	*(12)	P	P
3	P	23	L	3	P	23	H	43	P	3	P	P	P	P
4	P	24	H	4	P	24	L	44	P	4	P	*(12)	P	P
5	P	25	L	5	P	25	L	45	P	5	*(12)	P	P	P
6	P	26	H	6	P	26	H	46	P	6	*(12)	*(12)	P	P
7	*(12)	27	H	7	L	27	H	47	P	7	P	P	P	P
8	*(12)	28	H	8	H	28	*	48	H	8	P	*(12)	L	L
9	*(12)	29	L	9	P	29	P			9	*(12)	P	P	P
10	*(12)	30	P	10	P	30	H			10	L	L	P	P
11	H	31	P	11	H	31	H			11	P	*(12)	P	P
12	*(12)	32	P	12	H	32	H			12	*(12)	P	P	P
13	*(12)	33	P	13	H	33	H			13	P	*(12)	P	P
14	*(12)	34	P	14	H	34	P			14	P	P	P	P
15	*(12)	35	P	15	H(10)	35	P			15	*(12)	*(12)	P	P
16	P	36	P	16	L	36	P			16	*(12)	P	H	H
17	H	37	P	17	P	37	H			17	P	*(12)		
18	H	38	P	18	P	38	P			18	P	P		
19	*	39	P	19	P	39	P			19	*(12)	H		
20	H(12)	40	P	20	P	40	P			20	H	H		

PIN NO.	IC U16	IC U17	IC U18	PIN NO.	IC U18	PIN NO.	IC U19	PIN NO.	IC U19	PIN NO.	IC U20
1	H	P	P	21	H	1	P	21	P	1	P
2	L	P	P	22	P	2	P	22	P	2	P
3	H	P	P	23	P	3	P	23	P	3	P
4	L	P	P	24	H	4	P	24	H	4	P
5	P	P	P			5	P			5	P
6	P	P	P			6	P			6	P
7	L	P	P			7	P			7	L
8	L	P	P			8	P			8	P
9	H	P	P			9	P			9	P
10	L	L	P			10	P			10	P
11	H	P	P			11	P			11	P
12	H	P	L			12	L			12	P
13	L	P	P			13	P			13	P
14	H	P	P			14	P			14	H
15		P	P			15	P			15	
16		P	P			16	P			16	
17		P	P			17	P			17	
18		P	P			18	P			18	
19		P	P			19	H			19	
20		H	P			20	P			20	

(12) Probe indicates P in CP/M mode.

LOGIC CHART

PIN NO	IC U1	PIN NO.	IC U1	PIN NO.	IC U2	IC U3	IC U4	PIN NO.	IC U4	PIN NO.	IC U5	PIN NO.	IC U5
1	L	21	P	1	*	P	L	21	H	1	H	21	P
2	P	22	P	2	P	P	H	22	P	2	H	22	P
3	P	23	P	3	P	P	H	23	H	3	H	23	P
4	P	24	H	4	*	P	H	24	H	4	H	24	P
5	P	25	P	5	L	P	L	25	P	5	H	25	H
6	P	26	P	6	P	H	L	26	P	6	P	26	H
7	P	27	P	7	L	H	L	27	P	7	P	27	H
8	P	28	P	8	P	H	H	28	P	8	H	28	H
9	L(1)	29	P	9	P	P	H	29	P	9	P		
10	H(2)	30	P	10	P	P	H	30	P	10	P		
11	H(3)	31	P	11	P	P	H	31	P	11	P		
12	H(4)	32	P	12	P	P	H	32	P	12	P		
13	H(5)	33	P	13	L	H	H	33	P	13	P		
14	H(6)	34	H	14	H	H	H	34	H	14	L		
15	H(7)	35	P	15		H	H	35	P	15	P		
16	H(8)	36	P	16		H	H	36	P	16	P		
17	H(9)	37	P	17			H	37	P	17	P		
18	P	38	P	18			H	38	P	18	P		
19	P	39	H	19			P	39	H	19	P		
20	H	40	H	20			H	40	H	20	P		

PIN NO.	IC U6	PIN NO.	IC U6	PIN NO.	IC U7	PIN NO.	IC U7	PIN NO.	IC U7	PIN NO.	IC U8	IC U9
1	P	21	L	1	H	21	P	41	P	1	H	P
2	P	22	P	2	H	22	P	42	P	2	P	P
3	P	23	P	3	P	23	P	43	H	3	P	P
4	H	24	H	4	P	24	P	44	L	4	P	P
5	H	25	H	5	P	25	P	45	H	5	H	H
6	H	26	H	6	P	26	P	46	H	6	P	H
7	P	27	L	7	P	27	P	47	H(10)	7	L	L
8	P	28	L	8	P	28	P	48	H(11)	8	H	P
9	P	29	H	9	P	29	P			9	H	P
10	P	30	H	10	P	30	P			10	H	P
11	P	31	P	11	H	31	P			11	P	H
12	P	32	P	12	P	32	P			12	P	P
13	P	33	P	13	L	33	P			13	P	H
14	P	34	P	14	P	34	L			14	H	H
15	P	35	P	15	P	35	P			15		
16	P	36	P	16	P	36	P			16		
17	P	37	P	17	P	37	P			17		
18	P	38	P	18	P	38	P			18		
19	P	39	P	19	P	39	P			19		
20	P	40	H	20	P	40	P			20		

(1) Probe indicates P when any key except RESTORE is pressed.
(2) Probe indicates P when keys 1, 3, 5, 7, 9, +, £, HELP, ESC, ALT, INST/DEL are pressed.
(3) Probe indicates P when keys W, R, Y, I, P, *, –, RETURN and numeric keypad keys 8, +, 0 are pressed.
(4) Probe indicates P when keys A, D, G, J, L, :, CONTROL, CSR and numeric keypad keys 5, –, . are pressed.
(5) Probe indicates P when keys 2, 4, 6, 8, 0, –, F7, CLR/HOME, TAB, LINE FEED, ↑ are pressed.
(6) Probe indicates P when keys Z, C, B, M, F1, ., R, SHIFT, SPACE, ↑ and numeric keypad keys 2 and ENTER are pressed.
(7) Probe indicates P when keys S, F, H, K, F3, ;, =, ↑, – and numeric keypad keys 4 and 6 are pressed.
(8) Probe indicates P when keys Q, E, T, U, O, F5, @, ↑, – and numeric keypad keys 7 and 9 are pressed.
(9) Probe indicates P when keys X, V, N, ,, /, L.SHIFT, RUN/STOP, NO SCROLL, CSR and numeric keypad keys 1 and 3 are pressed.
(10) Probe indicates L in C64 mode.
(11) Probe indicates L in 80 column mode.

TROUBLESHOOTING (Continued)

Type in and run the following BASIC program to check the operation of the joysticks.

```
10 PRINT PEEK (56321), PEEK (56320)
20 FOR T = 1 TO 400: NEXT T
30 GOTO 10
```

See chart below for appropriate joystick ports and positions.

JOYSTICK POSITION	PORT 1	PORT 2
CENTER	255	127
UP	254	126
DOWN	253	125
LEFT	251	123
RIGHT	247	119
BUTTON	239	111

NOTE: OTHER NUMBERS WILL APPEAR IF TWO SWITCHES ON THE JOYSTICK ARE CLOSED AT THE SAME TIME.

PADDLES

Buttons on paddles do not work. Check the voltages on pins 12 and 13 of IC U1 when using Control Port 1 and pins 4 and 5 of IC U1 when using Control Port 2. The voltage should go from about 5V to 0V when the appropriate button is pressed. If the voltage does not change, check the button switches with an ohmmeter. Also check Connector CN3 (Port 1) and Connector CN4 (Port 2) for bad connections. If the voltages on pins 4, 5, 12 and 13 of IC U1 change when the appropriate button is pressed, check IC U1 by substitution.

Paddle controls do not work. Check the waveform at pins 23 and 24 of IC U5. If the waveforms are missing at pins 23 and 24 of IC U5, check IC U5 by sbustitution. If the waveforms are present at pins 23 and 24 of IC U5, check for pulses at pins 8 and 11 of Quad Bilateral Switch IC (U2). If pulses are missing at pins 8 and 11 of IC U2, check IC U2. If pulses are present at pins 8 and 11 of IC U2, check the Paddle Controls and Connectors CN3 and CN4 for good connections.

SERIAL PORT

Type in and run the following Basic program to check the operation of the Serial Port.

```
10 SCNCLR
20 CHAR, 0, 0
30 POKE 56578,63
40 POKE 56576,255
50 PRINT "A = "; PEEK (56576)
60 POKE 56576,3
70 PRINT "B = "; PEEK (56576)
80 GOTO 10
```

If the Serial Port circuit is working properly, the following display should appear at the top of the screen.

A = 63
B = 195

If the values for A and B are correct, check Serial Port Connector CN6 for good connections. If the correct display is not shown at the top of the screen when the above program is running, check for pulses at pins 5, 6 and 7 of Complex Interface Adapter IC (U4). If the pulses are missing at pins 5, 6 or 7 of IC U4, check IC U4 by substitution. If pulses are present at pins 5, 6, and 7 of IC U4, check for pulses at pins 8 and 9 of U4. If pulses are missing at either pin 8 or 9 of IC U4, check Buffer IC (U30) and IC U4.

CASSETTE PORT

Check for a logic Low at pin 26 of IC U6 while the Datassette recorder is in the Play or Record mode. If pin 26 of IC U6 is not logic Low, check the connection at pin 6 of Connector CN2.

Computer will not save a program to a cassette tape. Check for pulses at pin 27 of IC U6 while attempting to save a program to a tape. If pulses are missing, check IC U6 by substitution. If pulses are present at pin 27 of IC U6, check the connection at pin 5 of Connector CN2.

Computer will not load a program from a cassette tape. Check for pulses at pin 24 of IC U1 while loading a program from tape. If pulses are present at pin 24 of IC U1, check IC U1 by substitution. If the pulses are missing at pin 24 of IC U1, check the connection at pin 4 of Connector CN2.

Datasette cassette motor will not start when the recorder is in Play or Record mode. Check for a logic Low on pin 25 of IC U6 when the cassette recorder is in the Record or Play mode. If pin 25 of IC U6 is logic Low, check for a logic High on pin 12 of IC U30. If pin 12 of IC U30 is not logic High, check IC U30. If pin 12 of IC U30 is logic High, check for approximately 6V on the emitter of Cassette Switch Transistor (Q3). If the voltage is missing at the emitter of Q3, check for approximately 11.5V on the collector of Q3. If the voltage is missing at the collector of Q3, check CR13 and Electrolytic C106. If the voltage is present on the collector of Q3, check Q3 and Zener Diode CR1. If approximately 6V is present at the emitter of Q3, check the connection at pin 3 of Connector CN2.

PARTS LIST AND DESCRIPTION

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA				NOTES
			NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	
MAIN BOARD							
CR1	RD6.8EB		NTE5014A	ECG5014A	SK6A8/5014A	103-Z9009	
CR2 thru	1N914		NTE519	ECG519	SK3100/519	103-131	
CR7	1N4148		NTE519	ECG519	SK3100/519	103-131	
CR8	1N4371		NTE5002A	ECG5002A	SK2A7/5002A	903-454	
CR9	SAME AS CR2						
CR10,1	1N4001		NTE116	ECG116	SK3311	212-76-02	
CR13	BA20		NTE5313	ECG5313	SK3986/5313		
		251026-01	NTE5313	ECG5313	SK3986/5313		
CR15,16, 100	1N914		NTE519	ECG519	SK3100/519	103-131	
CR101	1N914		NTE519	ECG519	SK3100/519	103-131	Used in version 6
Q1,2	(2S)C945		NTE85	ECG85	SK3124A/289A	121-972*	
	2SC1815		NTE85	ECG85	SK3124A/289A	121-Z9065*	
Q3	TIP29A		NTE291	ECG291	SK3440/291	121-Z9047	
	2SD880		NTE152	ECG152	SK3440/291	121-987-03	
Q4,5	SAME AS Q1						
Q6	2SC1815		NTE85	ECG85	SK3124A/289A	121-Z9065*	
Q100	2N4403		NTE159	ECG159	SK3466/159	121-Z9003	Used in version 6
Q101	2SC1815		NTE85	ECG85	SK3124A/289A	121-Z9065*	Used in version 6
Q102	SAME AS Q100						
U1	6526	906108-01					
U2	HCF4066BE		NTE4066B	ECG4066B	SK4066B	905-369	
	4066		NTE4066B	ECG4066B	SK4066B	905-369	
U3	DM74LS138N		NTE74LS138	ECG74LS138	SK7CT138	HE-443-877	
	74LS138		NTE74LS138	ECG74LS138	SK7CT138	HE-443-877	
U4	SAME AS U1						
U5	6581	906112-01					
U6	8502RO						
	8502	315020-01					

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

MISCELLANEOUS

ITEM No.	PART NAME	MFGR. PART No.	NOTES
MAIN BOARD			
EMI1	Filter Network		
EMI2	Filter Network		
EMI3 thru EMI6	Filter Network		
EMI9 thru EMI11	Filter Network		
EMI12 thru EMI35	Filter Network		
EMI37	Filter Network		
EMI38	Filter Network		
EMI39 thru EMI40	Filter Network		
EMI42 thru EMI44	Filter Network		
EMI50 thru EMI69	Ferrite Bead Filter Network		
FB1 thru FB15	Ferrite Bead		
FB18 thru FB20	Ferrite Bead		
LED1	LED	C250754-01	Power, Red
M1	RF Modulator	251917-01	
SW1	Switch	252182-01	Power
SW2	Switch	251260-01	Reset
SW3	Switch		Dreset
Y1	Oscillator	325566-01	16MHz
Y2	Crystal	251467-01	14.31818MHz
	Foot	C2251993-01	RUSSELL Replacement PAD-5012W (4 Used.)
	Keyboard	C310401-01	
POWER SUPPLY BOARD			
FB1	Ferrite Bead		
LF1	Noise Filter		

CABINETS & CABINET PARTS (When ordering specify model, chassis & color)

ITEM	PART No.
Cabinet Top	C251987-01
Cabinet Bottom	C251988-01

ITEM	PART No.

COMMODORE
MODEL C128

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

CAPACITORS

ITEM No.	RATING	MFGR. PART No.
C20	Trimmer 4-40pF	

RESISTORS (Power and Special)

ITEM No.	RATING	REPLACEMENT DATA		
		MFGR. PART No.	NTE PART No.	WORKMAN PART No.
RM	Resistor Metallc (Current Limiter)			
RP1	Resistor Network (1)			
RP2	Resistor Network (2)			
RP3	Resistor Network (3)			
RP4	Resistor Network (3)			
RP5	Resistor Network (4)			
RP6	Resistor Network (2)			
RP7	Resistor Network (5)			
RP8	Resistor Network (5)			
RP9	Resistor Network (6)			
RP10	Resistor Network (6)			

(1) Contains seven (7 ea.) 1000 2%.
(2) Contains eight (8 ea.) 1000 5% 1/8W.
(3) Contains four (4 ea.) 33 2%.
(4) Contains seven (7 ea.) 3300 2%.
(5) Contains nine (9 ea.) 3300 2%.
(6) Contains nine (9 ea.) 10K 2%.

COILS & TRANSFORMERS

ITEM No.	FUNCTION	MFGR. PART No.	OTHER IDENTIFICATION	NOTES
	MAIN BOARD			
L1	RF Choke (2.2uH)			
L2	RF Choke (2.2uH)			
L3	RF Choke (2.2uH)			
L4	RF Choke (2.2uH)			
L5	Filter Choke	251878-01		
	POWER SUPPLY BOARD			
L2	Choke			
L3	Choke			
T1	Power Transformer			

CONTROLS (All wattages 1/2 watt, or less, unless listed)

ITEM NO.	FUNCTION	RESISTANCE	MFGR. PART NO.	NOTES
VR1	+5V Adjust	1000		

FUSE DEVICES

ITEM NO.	DESCRIPTION	MFGR. PART NO.		NOTES
		DEVICE	HOLDER	
F1	1.6A @ 250V Fast Acting			
F2	4A @ 125V Fast Acting			

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA			NOTES
			NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.
U7	8722R2					
	8722-R1	310389-01			SK7CT08	HE-443-780
U8	74LS08N		NTE74LS08	ECG74LS08	SK7CT08	HE-443-780
	74LS08		NTE74LS08	ECG74LS08		
U9	74F32					
U10	Z80B	906150-02				
U11	8721R3					
	8721-R3	315012-01			SK7CT373	HE-443-867
U12	74LS373PC		NTE74LS373	ECG74LS373	SK7CT373	HE-443-867
	74LS373		NTE74LS373	ECG74LS373		
U13	74LS244PC		NTE74LS244	ECG74LS244	SK7CT244	HE-443-791
	74LS244		NTE74LS244	ECG74LS244	SK7CT244	HE-443-791
U14,5	74LS257AN		NTE74LS257	ECG74LS257	SK7CT257	HE-443-802
	74LS257A		NTE74LS257	ECG74LS257	SK7CT257	HE-443-802
U16	DM74LS14N		NTE74LS14	ECG74LS14	SK7CT14	HE-443-872
	74LS14		NTE74LS14	ECG74LS14	SK7CT14	HE-443-872
U17	SN74ALS373N					
	74ALS373	390059-01				
U18			NTE2128	ECG2128		
U19	M2128-20		NTE2128	ECG2128		
	2016					
U20	MC14066		NTE4066B	ECG4066B	SK4066B	905-369
	4066		NTE4066B	ECG4066B	SK4066B	905-369
U21	8564R5C					
	8564-R4	315009-01				
U22	8563R9					
	8563-R7	315014-01				
U23	MB81416-12					HE-443-1165
	4416					HE-443-1165
U24	SAME AS U13					
U25	SAME AS U23					

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA				NOTES
			NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	
U26	74LS257APC		NTE74LS257	ECG74LS257	SK7CT257	HE-443-802	
	74LS257A		NTE74LS257	ECG74LS257	SK7CT257	HE-443-802	
U27	UA556PC		NTE978	ECG978	SK3689/978	221-Z9152	
	556		NTE978	ECG978	SK3689/978	221-Z9152	
U28	8701						
	8701C	251527-03					
U29,30	7406		NTE7406	ECG7406	SK7406	HE-443-698	
U31	74LS00PC		NTE74LS00	ECG74LS00	SK7CT00	HE-443-728	
	74LS00		NTE74LS00	ECG74LS00	SK7CT00	HE-443-728	
U32		251913-01					
U33		318018-02					
U34		318019-02					
U35		318020-03					
U37	SAME AS U29						
U38 thru	MN4164P-15A		NTE4164	ECG2164		HE-443-970	
U53	4164		NTE4164	ECG2164		HE-443-970	
U54	DM74LS32N		NTE74LS32	ECG74LS32	SK74CT32	HE-443-875	
	74LS32		NTE74LS32	ECG74LS32	SK74CT32	HE-443-875	
U55	74F245						
U56	DM74LS74AN		NTE74LS74A	ECG74LS74A	SK7CT74	HE-443-730	
	74LS74		NTE74LS74A	ECG74LS74A	SK7CT74	HE-443-730	
U57	DM7407N		NTE7407	ECG7407	SK7407	HE-443-1020	
	7407		NTE7407	ECG7407	SK7407	HE-443-1020	
U58	DM74LS03N		NTE74LS03	ECG74LS03	SK7CT03	HE-443-745	
	74LS03		NTE74LS03	ECG74LS03	SK7CT03	HE-443-745	
U59	LM340T12		NTE966	ECG966	SK3592/966	HE-442-674	
	7812		NTE966	ECG966	SK3592/966	HE-442-674	
U60	SAME AS U57						
U61	SAME AS U8						
U62	SAME AS U13						
U63	HD7406P		NTE7406	ECG7406	SK7406	HE-443-698	
	7406		NTE7406	ECG7406	SK7406	HE-443-698	

PARTS LIST AND DESCRIPTION (Continued)

When ordering parts, state Model, Part Number, and Description

SEMICONDUCTORS (Select replacement for best results)

ITEM No.	TYPE No.	MFGR. PART No.	REPLACEMENT DATA				NOTES
			NTE PART No.	ECG PART No.	RCA PART No.	ZENITH PART No.	
RF MODULATOR							
D1,2	1N4148		NTE519	ECG519	SK3100/519	103-131	
D3,4			NTE519	ECG519	SK3100/519	103-131	
Q1,2	(2S)C458		NTE85	ECG85	SK3124A/289A	121-Z9065*	
Q3,4	(2S)C460		NTE85	ECG85	SK3122	121-522*	
POWER SUPPLY BOARD							
D1	D5SB10						
D2							
D3	C82M						
D4	5.6B2		NTE5011A	ECG5011A	SK5A6/5011A	103-Z9007	
IC1	MB3759					905-427	
Q1	(2S)C3568						
Q2	(2S)A934		NTE294	ECG294	SK3841/294	121-Z9067*	
SCR1	3P4MH		NTE5457	ECG5457	SK3598/5457		

* Lead configuration may vary from original.

WIRING DATA

Shielded Hook-up Wire	Use BELDEN No.	8401 or 8421 (Single-Conductor) 8208 (Two-Conductor)
General-use Unshielded Hook-up Wire	Use BELDEN No.	8529 (Solid) Available in 13 Colors 8522 (Stranded) Available in 13 Colors
75-Ohm Input Lead	Use BELDEN No.	8241

PRELIMINARY SERVICE CHECKS (Continued)

GENERAL OPERATING INSTRUCTIONS

POWER UP

When the Computer is turned On, it will come up in C128 mode ready to program in Commodore Basic. See "Cassette Operation" and "Disk Operation" sections for instructions on loading and saving programs. To bring the Computer up in C64 mode, hold the C= key down when turning the Computer On. If Computer is On, it can be switched from C128 mode to C64 mode by typing GO 64 and then press the RETURN key. When Computer responds "ARE YOU SURE?", type Y and press the RETURN key. To run a Basic program after it is loaded, type RUN and press the RETURN key. Press the RUN/STOP key to stop a program. Pressing the RUN/STOP key and the RESTORE key at the same time will stop the program and return Computer to start condition without losing the program.

Use the following procedure to bring Computer up in the CP/M mode. Turn the Disk Drive On and insert the CP/M system disk in the drive. Press the 40/80 key down. Turn the Computer On.

CASSETTE OPERATION

Plug a Datasette cassette recorder onto the six pin edge Connector (CN2) at rear of Computer. Note: An ordinary cassette recorder will not work with the Commodore C128. To load a program, type LOAD, press the RETURN key and follow the instructions displayed on the Monitor screen.

DISK OPERATION

Connect Disk Drive to Serial I/O Port (CN6) located at rear of Computer. Turn On Disk Drive and insert diskette. To load a program from the disk, type LOAD "PROGRAM NAME," 8. Press the RETURN key and follow the instructions displayed on the Monitor. To save a program to the disk, type SAVE "PROGRAM NAME," 8 and press the RETURN key.

Note: When loading a program from the disk or saving a program to the disk in C128 mode, the commands DLOAD "PROGRAM NAME" or DSAVE "PROGRAM NAME" can also be used. When DLOAD or DSAVE commands are used, you do not need to add the device number (8) after the program name.

DISASSEMBLY INSTRUCTIONS

CABINET TOP REMOVAL

Remove six screws from cabinet bottom. Lift up left side of cabinet top and disconnect Power Indicator Connector. Disconnect keyboard Connector and remove screw in lower right corner of Main Board to free keyboard ground strap. Lift cabinet top and keyboard from cabinet bottom.

KEYBOARD REMOVAL

Remove six Torx screws holding keyboard to cabinet top. Lift keyboard assembly from cabinet top.

MAIN BOARD REMOVAL

Remove five remaining screws holding Main Board to the cabinet bottom. Remove Main Board and shield assembly from cabinet bottom. To remove Main Board from shield assembly, straighten 11 tabs on front and sides of shield assembly. Unsolder top shield from right side of Main Board. Remove screw located just in front of RF Modulator. Remove top and bottom shields from Main Board.

MISCELLANEOUS ADJUSTMENTS

14MHz OSCILLATOR

Connect the input of a frequency counter to pin 8 of IC U28. Adjust Trimmer Capacitor C20 for a frequency of 14.31818MHz at pin 8 of IC U28.

RF MODULATOR

Connect Computer to a TV Monitor. Set TV and Computer Channel Select Switch to Channel 3. Type in and run the following Basic program:

```
10 VOL 5
20 SOUND 1, 5000, 100
30 GOTO 10
```

Adjust the sound coil for best sound with minimum noise.

PRELIMINARY SERVICE CHECKS

This data provides the user with a time-saving service tool which is designed for quick isolation and repair of computer malfunctions.

Check all interconnecting cables for good connection and correct hook-up before making service checks.

Disconnect all peripherals except the monitor from the computer to eliminate possible external malfunctions. However, problems involving the interaction between computer and a peripheral will require the connection of the device for voltage and logic readings.

Replacement or repair of the keyboard, main board, RF Modulator, or components may be necessary after the malfunction has been isolated.

REPLACEMENT PARTS AND DESCRIPTION

IDENT.	PART NO.	DESCRIPTION
F1		Fuse, 1.6A @ 250V
F3		Fuse, 4A @ 125V
Q2		Transistor, NPN, 2SC945
SW1		Power Switch
U1		IC, 6526
U4		IC, 6526
U5		IC, 6581
U6		IC, 8502
U7		IC, 8722R2
U21		IC, 8564R5C
U22		IC, 8563R9
U28		IC, 8701
U32	251913-01	IC, ROM
U33	318018-02	IC, ROM
U34	318019-02	IC, ROM
U59		Voltage Regulator, LM340T12, 7812
	310401-01	Keyboard
	310416-01	Power Supply
	251917-02	RF Modulator

TEST EQUIPMENT AND TOOLS

TEST EQUIPMENT
Digital Volt/Ohm Meter
Logic Probe
Frequency Counter
TV Monitor

TOOLS
Low Wattage Soldering Iron
Desoldering Equipment
Phillips Screwdriver
Flat Blade Screwdriver
T-10 Torx Screwdriver
IC Insertion and Removal Tools 16, 28, 40 and 48 pin
Alignment Tool GC Electronics 9440

SAMS™ Howard W. Sams & Co.
4300 West 62nd Street, P.O. Box 7092, Indianapolis, Indiana 46206 U.S.A.

Printed in U.S. of America. 86CC14985 DATE 10-86

PRELIMINARY SERVICE CHECKS (Continued)
PREVENTATIVE MAINTENANCE

ENVIRONMENT

Computers perform best in a clean, cool area that is below 80 degrees Fahrenheit and free of dust and smoke particles. Even though home Computers are not affected by cigarette smoke as much as commercial Computers are affected, it is better to maintain a smoke-free area around the Computer. Do not block cabinet vents of any of the Computer system; Computer, Monitor, Printer, or other power devices.

ELECTRICAL POWER

Variations in the line voltage can affect the Computer. Try to avoid these fluctuations by using an AC receptacle that is on a power line not used by appliances or other heavy current demand devices. A power-surge protector, power-line conditioner, or non-interruptable power supply may be needed to cure the problem. **Do not** switch power On and Off frequently.

KEYBOARD

Liquids spilled into the Keyboard can ruin it. Immediately after a spill occurs, disconnect the Computer power plug from AC power outlet. Then, if circuitry or contacts are contaminated, disassemble the Keyboard and carefully rinse the Keyboard printed circuit board with distilled water and let it dry. Use a cotton swab to clean between the keys. Use a non-abrasive contact cleaner and lint-free wipers on accessible connectors and contacts.

DISK DRIVES

Clean the read/write heads of the Disk Drives about once a month or after 100 hours usage. Use only an approved head cleaning kit.

Handle carefully to preserve proper disk head alignment. A sudden bump or jolt to the Disk Drives can knock the disk head out of alignment. If the disk drive must be transported, place an old disk in slot and close door during transport.

Store disks in their protective covers and never touch the disk surface. Observe the disk handling precautions usually found on the back of disk protective covers.

PRINTERS

Carefully vacuum the Printer regularly. Wipe surface areas clean using a light all-purpose cleaner. Do not oil the machine. The oil will collect abrasive grit and dust. The dust will act as a blanket. This can cause components to overheat and fail.

STATIC ELECTRICITY

Static electricity discharge can affect the Computer. In order to minimize the possibility, use anti-static mats, sprays, tools and materials, and maintain good humidity in the Computer environment.

MONITOR

Use an isolation transformer with any Monitor that does not come as part of the system since some Monitors use a HOT chassis (chassis connected to one side of the AC line). The face of the Monitor should never be left on for long periods of time at high brightness level except when pattern is being changed periodically. Use caution when cleaning anti-glare screens, to preserve the glare-reduction feature.

PRELIMINARY SERVICE CHECKS (Continued)
GENERAL OPERATING INSTRUCTIONS

POWER UP

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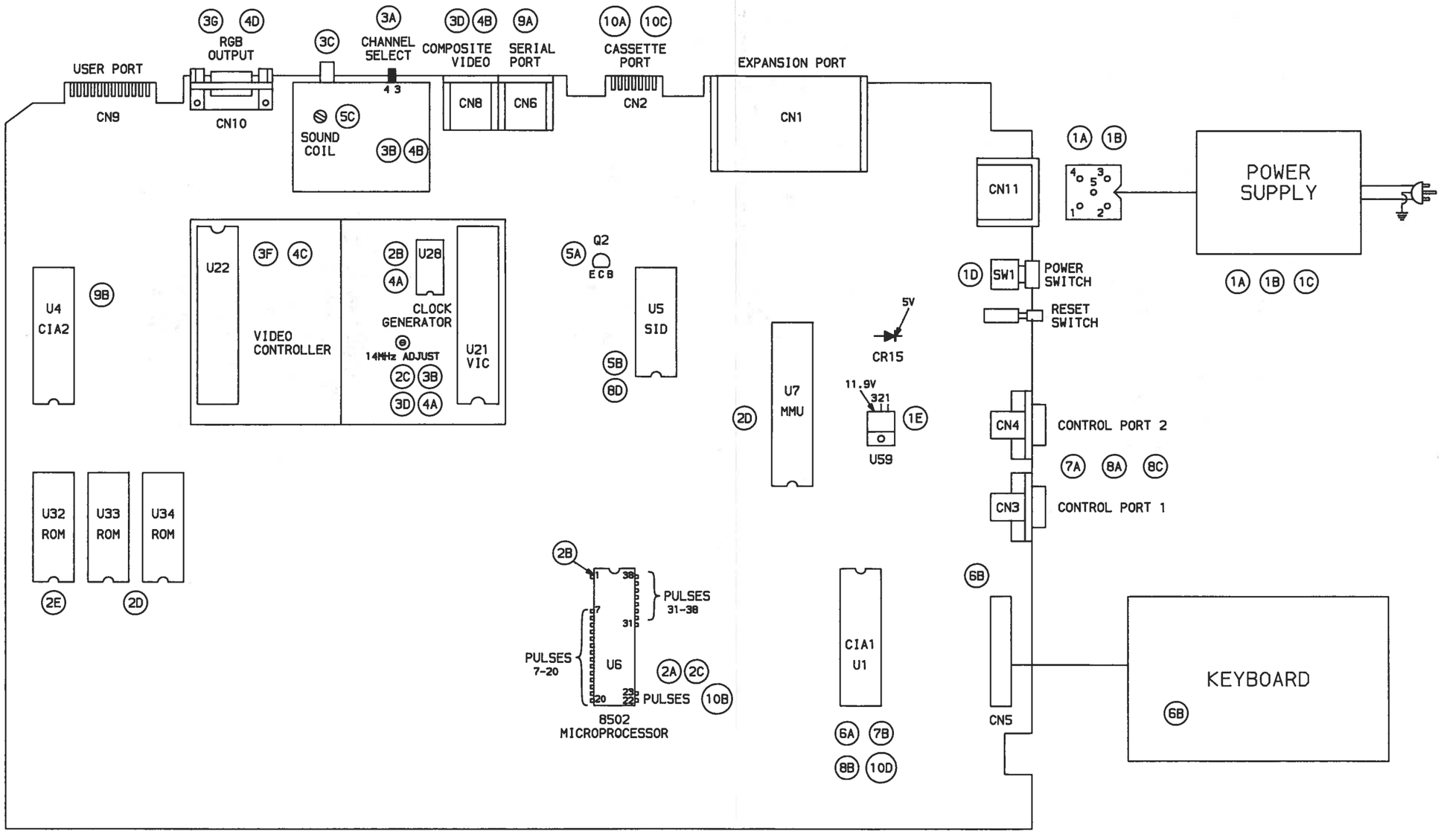
USER PORT
CN9
RGB OUTPUT
CN10
CHANNEL SELECT
SOUND COIL
COMPOSITE VIDEO
CN8
SERIAL PORT
CN6
CASSETTE PORT
CN2
EXPANSION PORT
CN1
POWER SUPPLY
CN11
POWER SWITCH
SW1
RESET SWITCH
U4 CIA2
U22
VIDEO CONTROLLER
U28
CLOCK GENERATOR
14MHz ADJUST
U21 VIC
Q2
ECB
U5 SID
U7 MMU
CR15
5V
11.9V
U59
CN4
CONTROL PORT 2
CN3
CONTROL PORT 1
U32 ROM
U33 ROM
U34 ROM
8502 MICROPROCESSOR
U6
PULSES 31-38
PULSES 7-20
PULSES
CIA1 U1
CN5
KEYBOARD

PRELIMINARY SERVICE CHECKS (Continued)