The Commodore VIC I and VIC II chips

Albert J. Charpentier
Bil Herd
Stephen A. Edwards

The 1977 Trinity

1980: The Commodore VIC-20

6502 @1.02 MHz

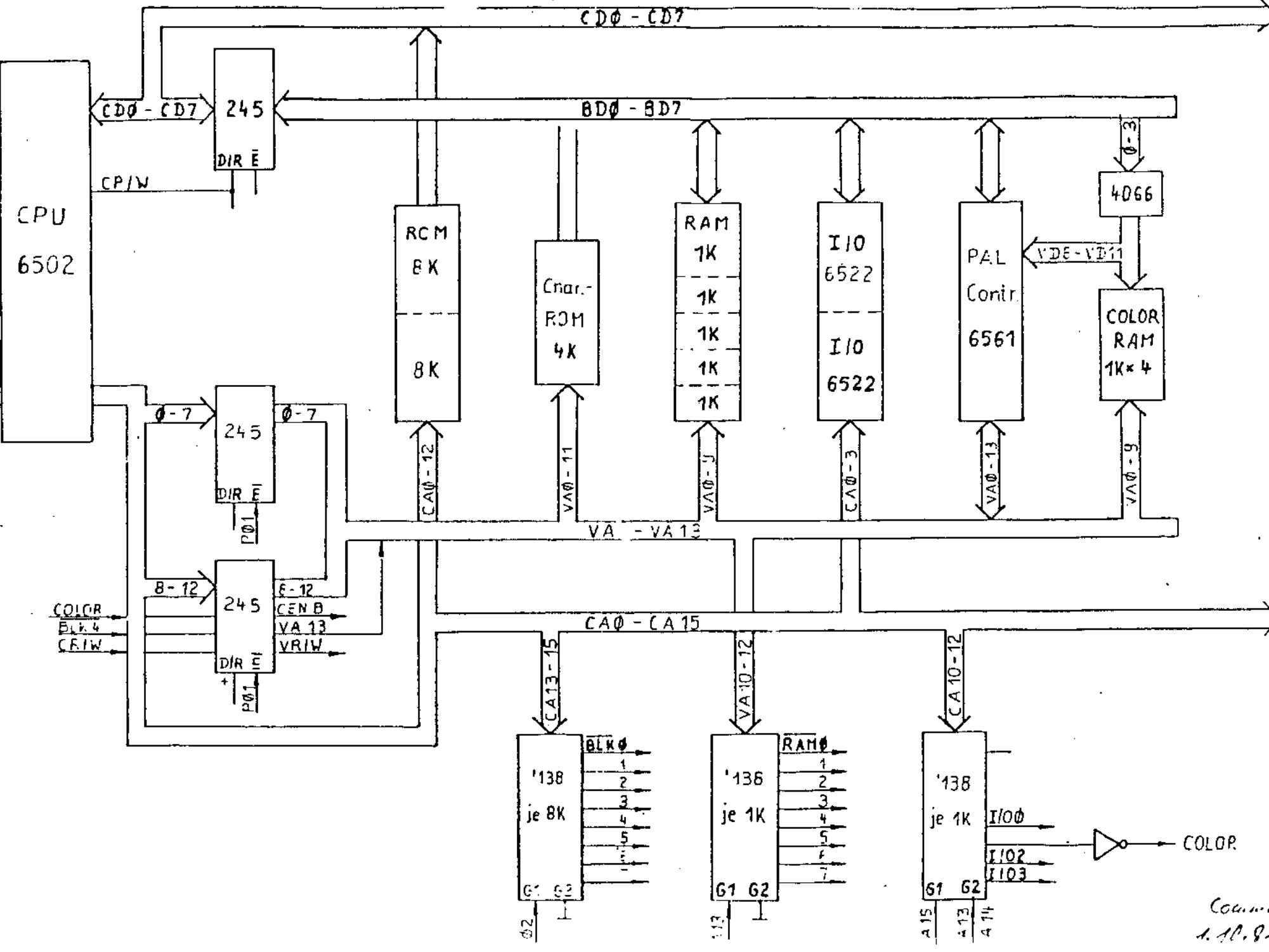
20 KB ROM	5 KB RAM
176×184	16 colors
22 columns $\times$ 23 rows	8×8 pixel characters
Custom character sets	

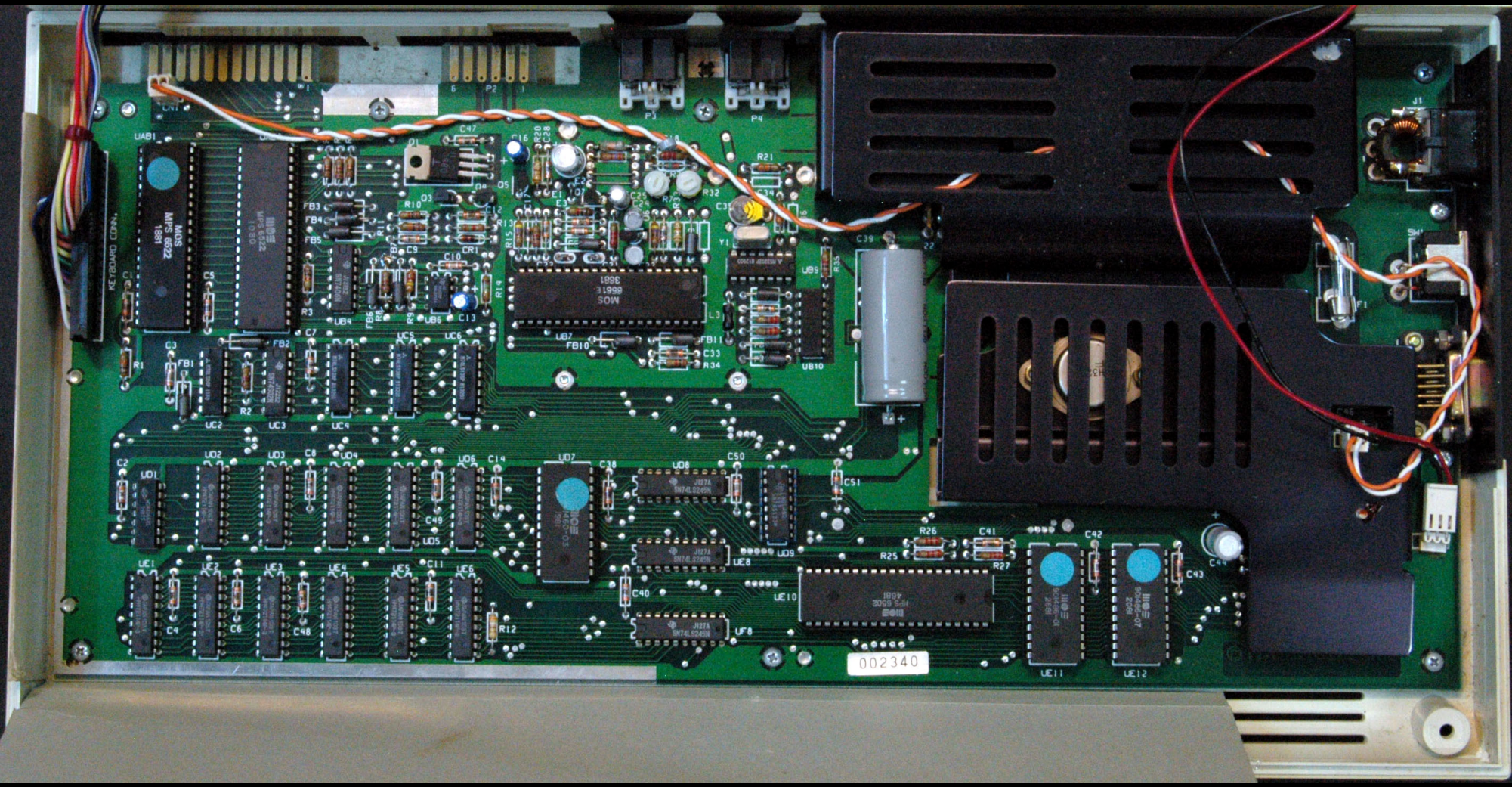
Jelly Monsters (HAL, 1981)

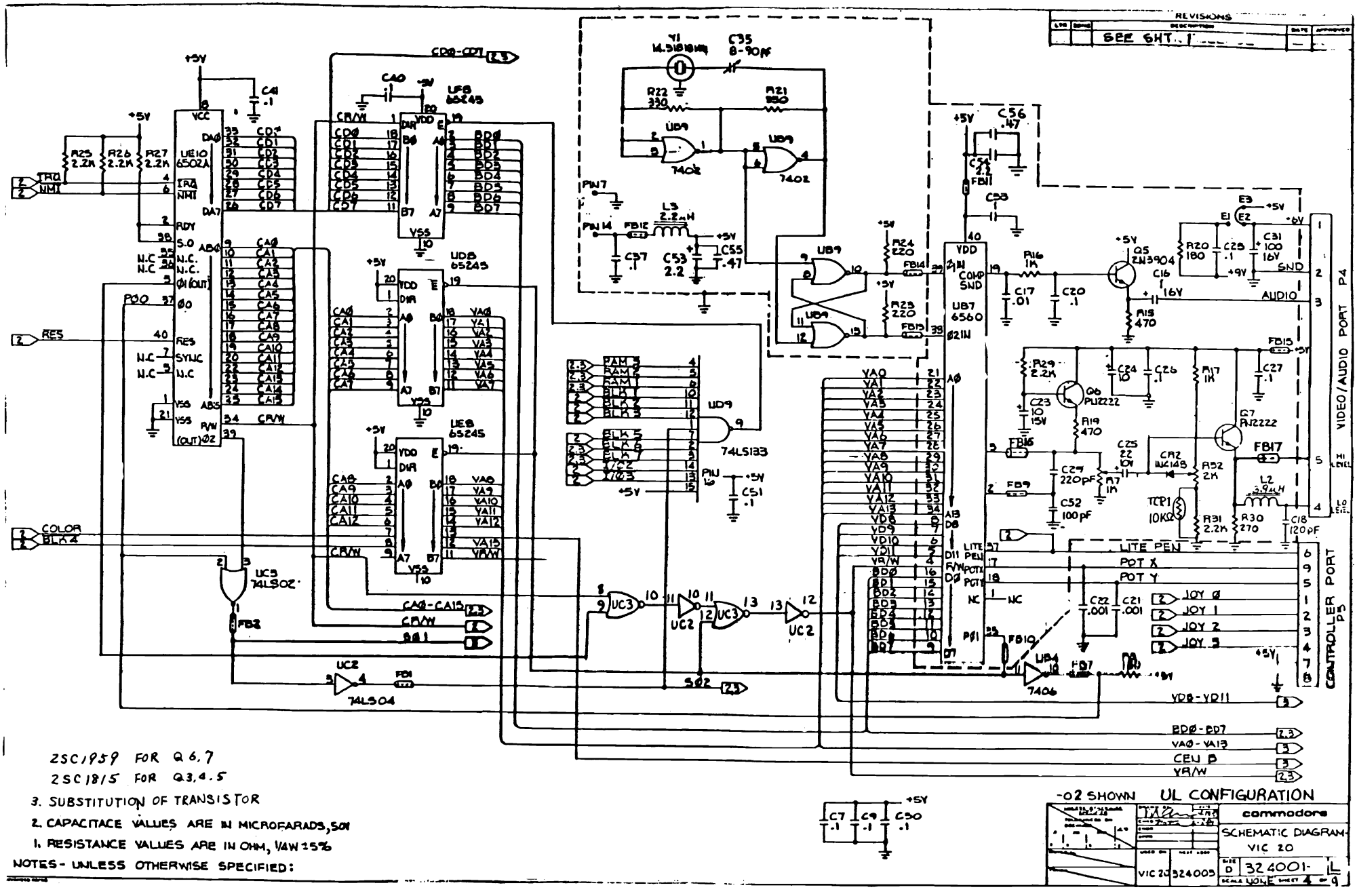
Omega Race (Commodore, 1981)

Sword of Fargoal (Epyx, 1983)

Astro Nell (Chronosoft, 2005)


CD0 - CD7
CPU 6502
CD0 - CD7
245
DIR E
CP/W
BD0 - BD7
RCM 8K
8K
Char.-ROM 4K
RAM 1K
1K
1K
1K
1K
I/O 6522
I/O 6522
PAL Contr. 6561
VDE - VD11
Ø - 3
4066
COLOR RAM 1K × 4
Ø - 7
245
DIR E
Ø - 7
PØ1
CAØ - 12
VAØ - 11
VAØ - 9
CAØ - 3
VAØ - 13
VA - VA 13
B - 12
245
E - 12
CEN B
VA 13
VRIW
DIR E
PØ1
COLOR
BLK 4
CR/W
CAØ - CA 15
CA13 - 15
VA10 - 12
CA 10 - 12
'138 je 8K
BLKØ
'138 je 1K
RAMØ
'138 je 1K
I/OØ
I/O2
I/O3
COLOR
G1 G2
G1 G2
G1 G2


KEYBOARD CONN.
002340



2SC1959 FOR Q6,7

2SC1815 FOR Q3,4,5

3. SUBSTITUTION OF TRANSISTOR

2. CAPACITACE VALUES ARE IN MICROFARADS, 50V

1. RESISTANCE VALUES ARE IN OHM, 1/4W ±5%

NOTES - UNLESS OTHERWISE SPECIFIED:

-02 SHOWN UL CONFIGURATION

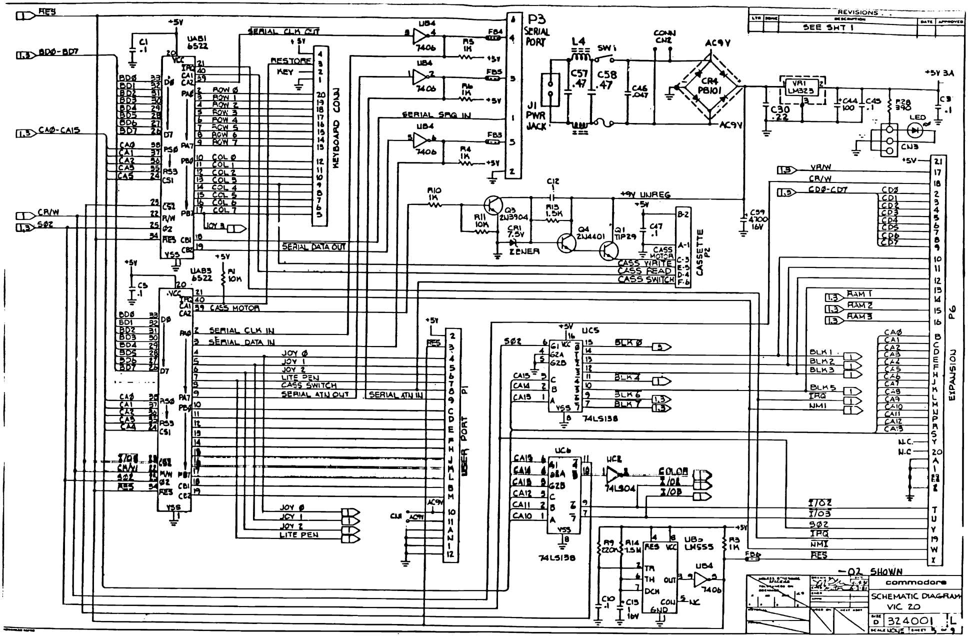
commodore

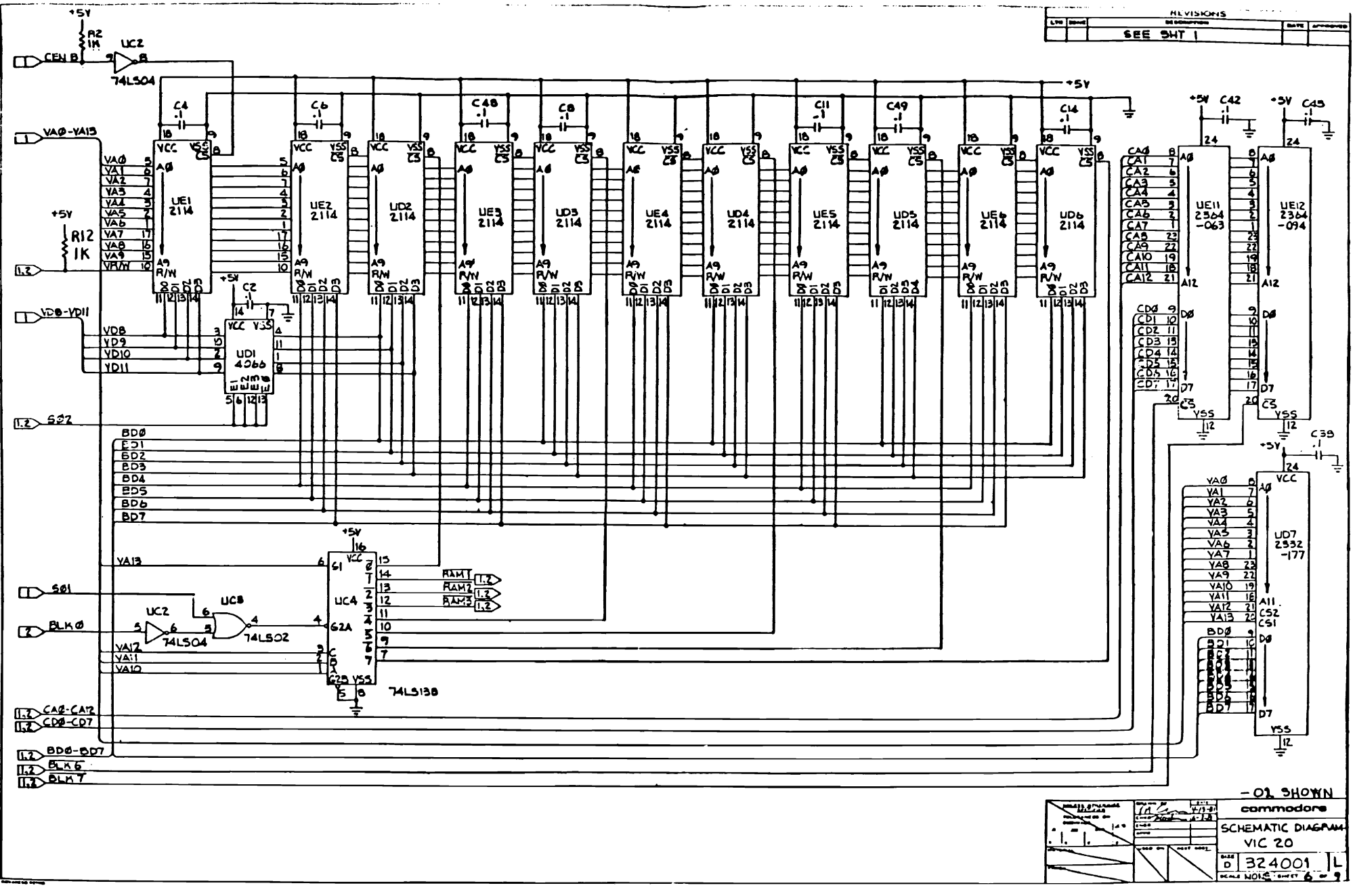
SCHEMATIC DIAGRAM VIC 20

VIC 20 324005

SIZE D 324001- IL

SCALE NONE SHEET 4 OF 9


REVISIONS
SEE SHT 1
P3 SERIAL PORT
SERIAL CLK OUT
SERIAL SRQ IN
SERIAL DATA OUT
SERIAL CLK IN
SERIAL DATA IN
SERIAL ATN OUT
SERIAL ATN IN
UAB1 6522
UAB3 6522
UB4 7406
KEYBOARD CONN
RESTORE KEY
ROW 0 ROW 1 ROW 2 ROW 3 ROW 4 ROW 5 ROW 6 ROW 7
COL 0 COL 1 COL 2 COL 3 COL 4 COL 5 COL 6 COL 7
L4 SW1 C57 .47 C58 .47 C46 .047
J1 PWR JACK
CONN CN2
AC9V
CR4 PB101
VR1 LM323
+5V 3A
C30 .22 C44 100 C45 .1 R28 390 C3 .1 LED CN3
R10 1K R11 10K Q3 2N3904 CR1 7.5V ZENER R13 1.5K Q4 2N4401 Q1 TIP29 C12 C47 .1
+9V UNREG
C59 4700 16V
CASSETTE P2
CASS MOTOR
CASS WRITE
CASS READ
CASS SWITCH
JOY 0 JOY 1 JOY 2 LITE PEN
USER PORT P1
UC5 74LS138
UC6 74LS138
UC2 74LS04
COLOR I/O2 I/O3
BLK 0 BLK 1 BLK 2 BLK 3 BLK 4 BLK 5 BLK 6 BLK 7
RAM 1 RAM 2 RAM 3
VR/W CR/W CD0-CD7
IRQ NMI RES S02
EXPANSION P6
UB5 LM555
R9 220K R14 1.5M R3 1K C10 .1 C15 1 16V
-02 SHOWN
commodore
SCHEMATIC DIAGRAM VIC 20
D 324001 L
SCALE NONE SHEET 5 OF 9


REVISIONS
SEE SHT 1
+5V
R2 1K
CEN B
UC2
74LS04
VA0-VA13
VD0-VD11
R12 1K
R/W
S02
BD0
BD1
BD2
BD3
BD4
BD5
BD6
BD7
UE1 2114
UE2 2114
UD2 2114
UE3 2114
UD3 2114
UE4 2114
UD4 2114
UE5 2114
UD5 2114
UE6 2114
UD6 2114
UD1 4066
UC4
74LS138
UC8
74LS02
S01
BLK0
VA12
VA11
VA10
RAM1
RAM2
RAM3
CA0-CA12
CD0-CD7
BD0-BD7
BLK6
BLK7
UE11 2364 -063
UE12 2364 -094
UD7 2332 -177
-01 SHOWN
commodore
SCHEMATIC DIAGRAM
VIC 20
D 324001 L
SHEET 6 OF 9

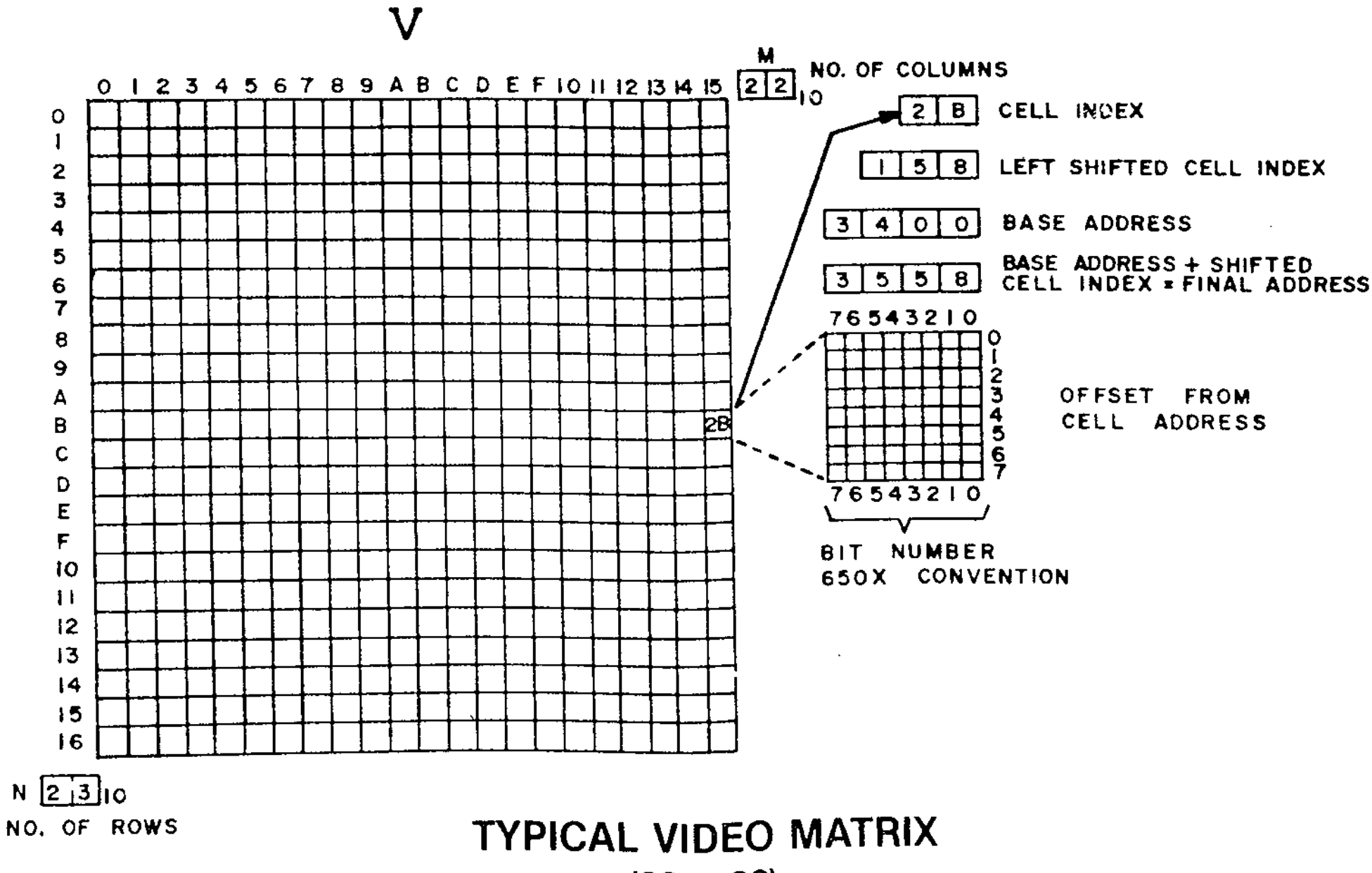
commodore
mos technology
NMOS

950 Rittenhouse Rd., Norristown, PA 19403 • Tel.: 215/666-7950 • TWX: 510/660-4168

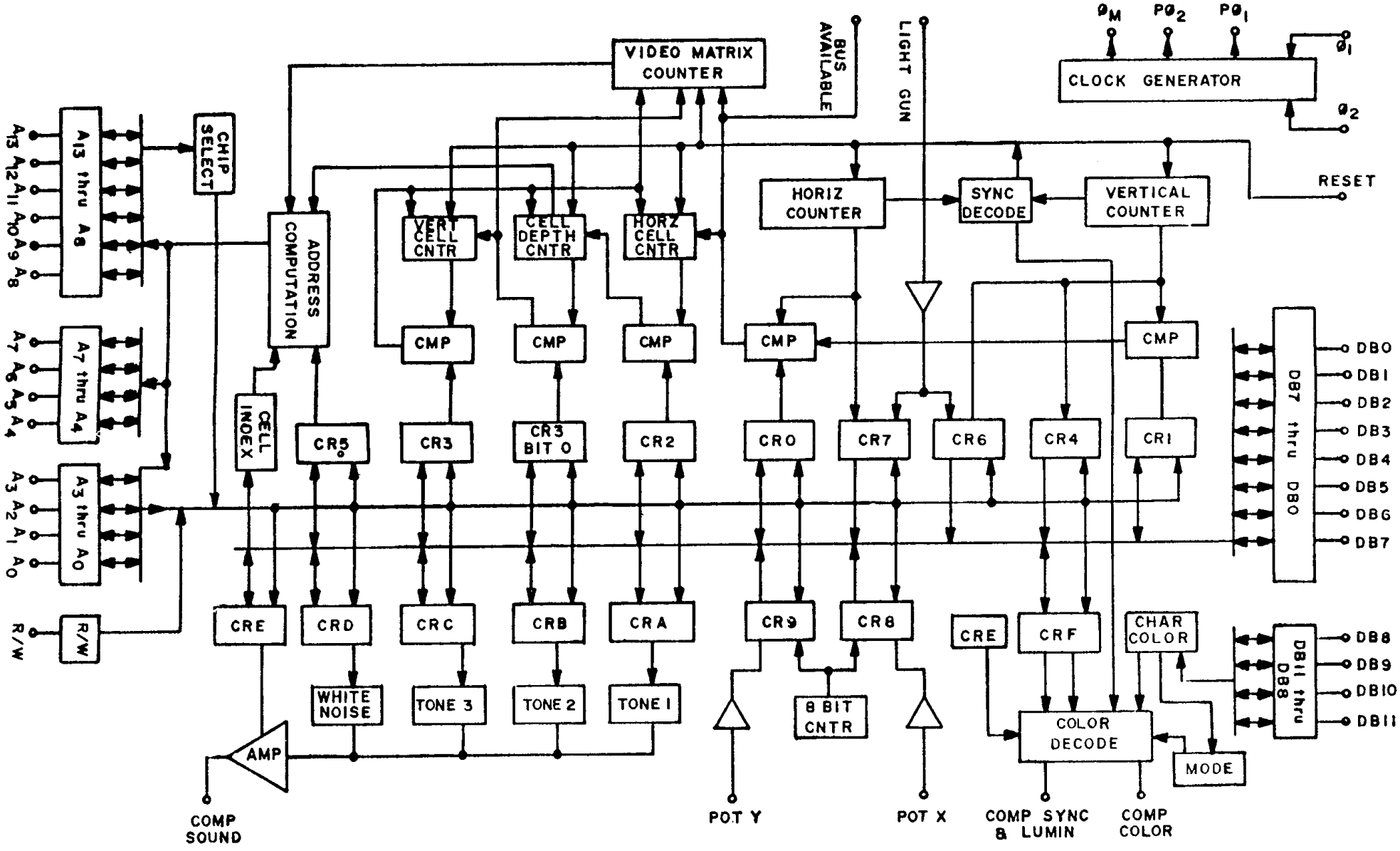
6560/6561 VIDEO INTERFACE CHIP

GENERAL DESCRIPTION

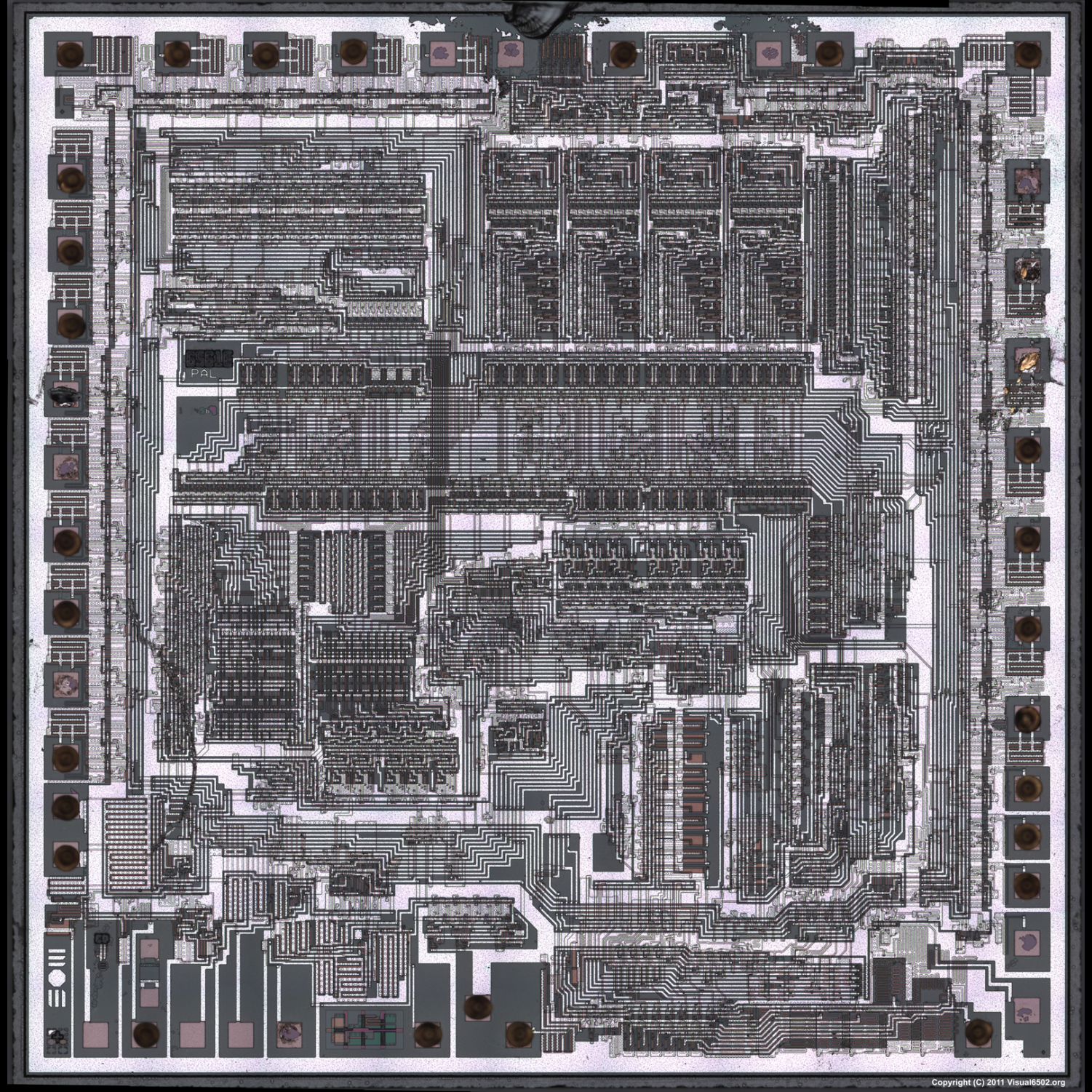
The 6560 Video Interface Chip (VIC) is designed for color video graphics applications such as low cost CRT terminals, biomedical monitors, control system displays and arcade or home video games. It provides all of the circuitry necessary for generating color programmable character graphics with high screen resolution. VIC also incorporates sound effects and A/D converters for use in a video game environment.



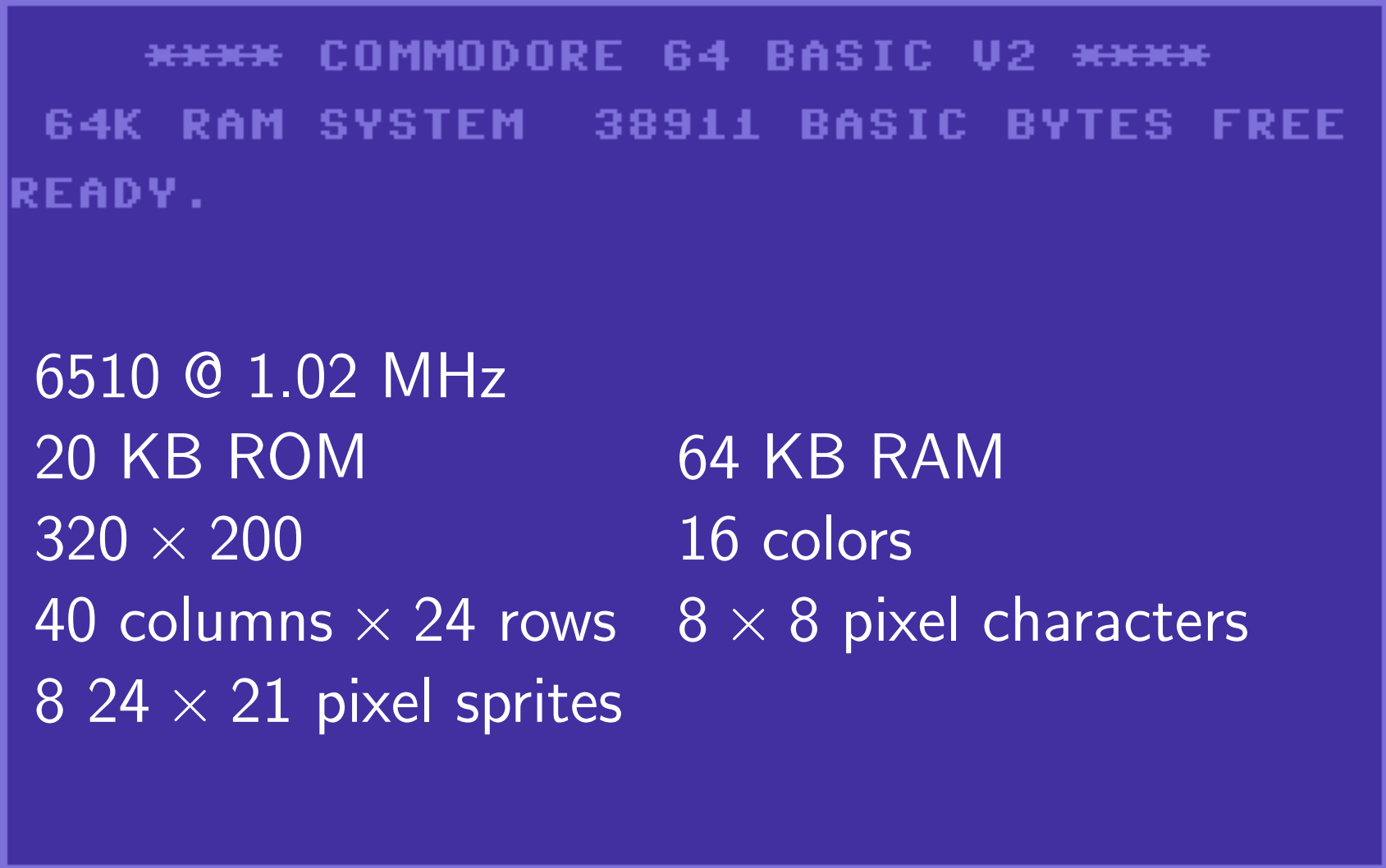
TYPICAL VIDEO MATRIX
(23 x 22)



6560 BLOCK DIAGRAM


PAL
Copyright (C) 2011 Visual6502.org

1982: The Commodore 64



6510 @ 1.02 MHz

20 KB ROM

64 KB RAM

320 × 200

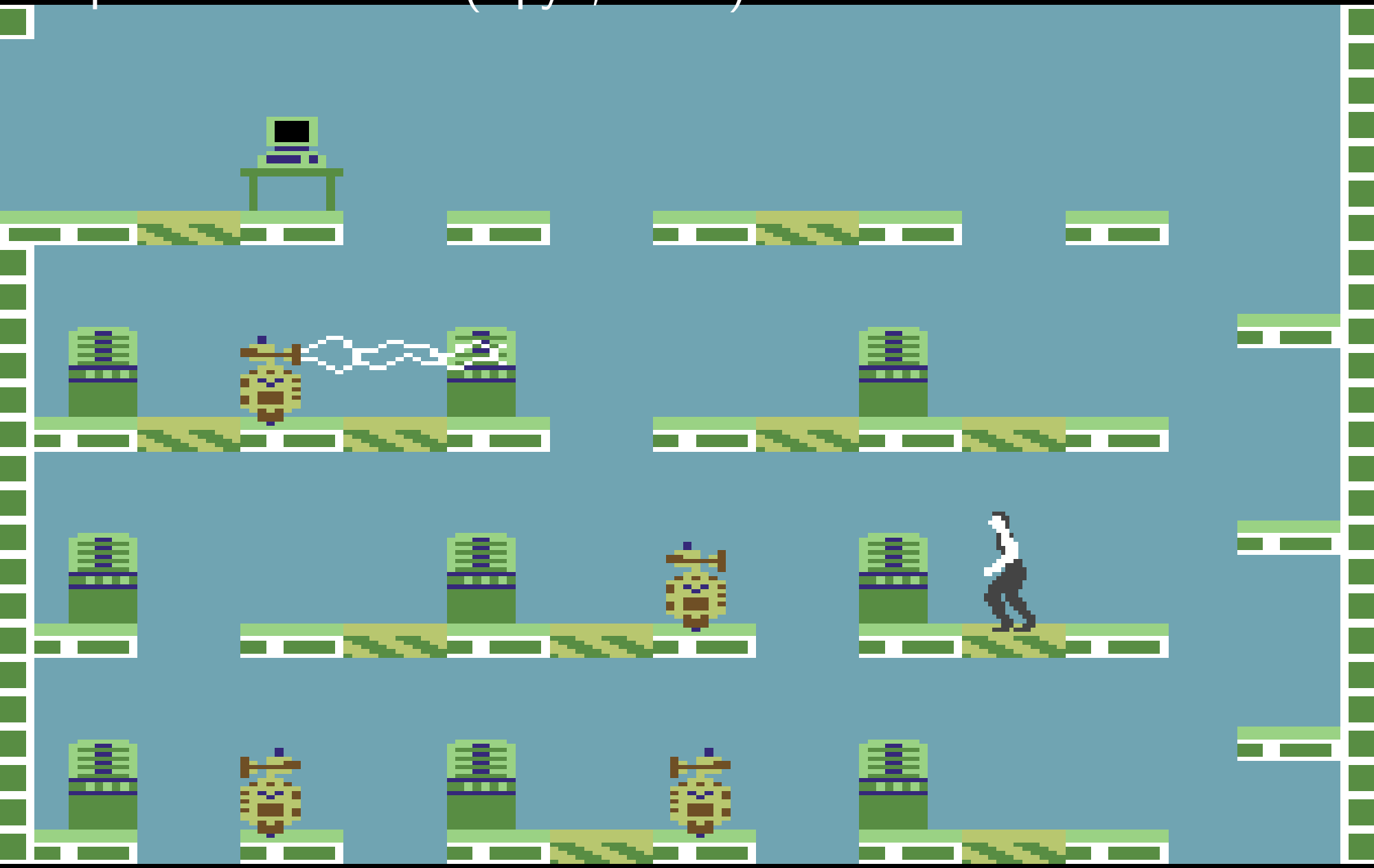
16 colors

40 columns × 24 rows

8 × 8 pixel characters

8 24 × 21 pixel sprites

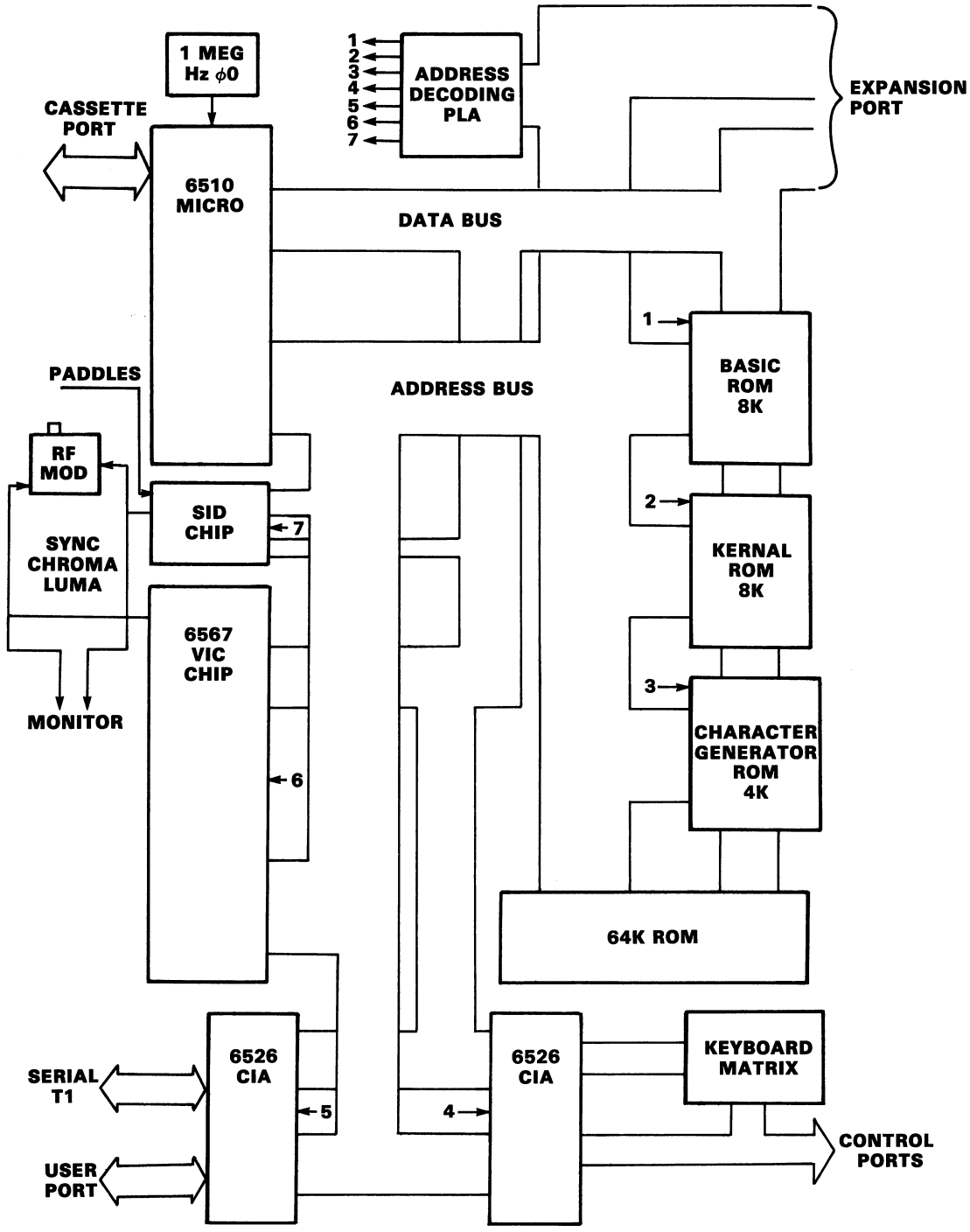
Impossible Mission (Epyx, 1984)

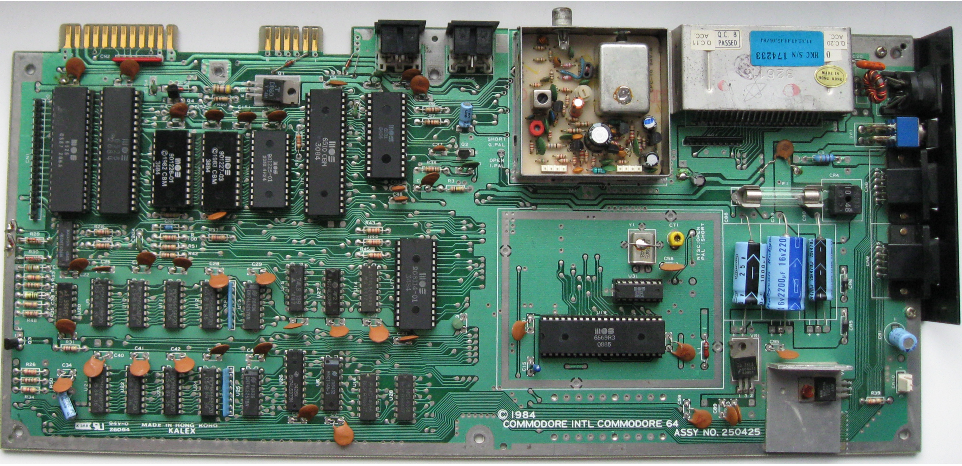


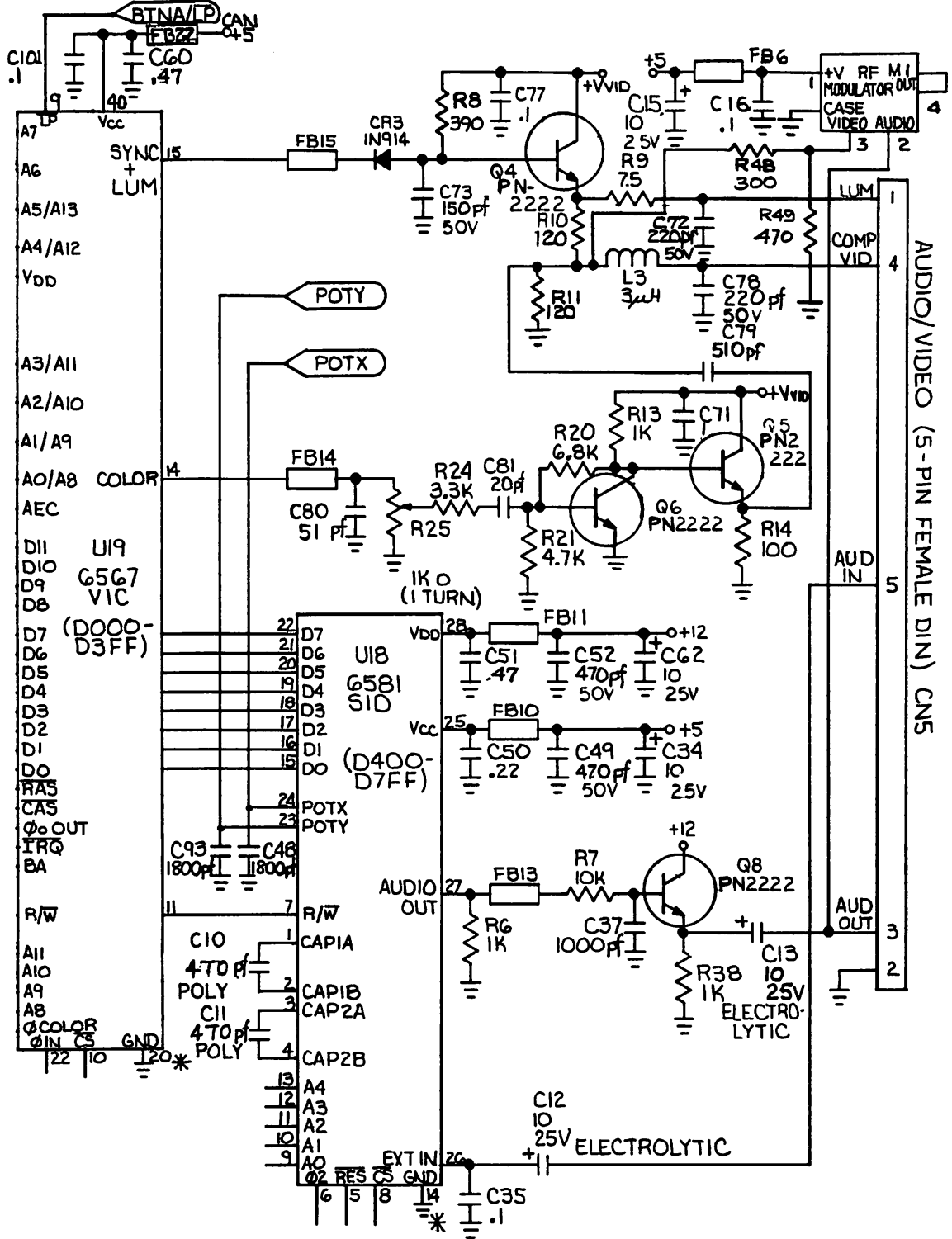
Bubble Bobble (Firebird, 1987)

Wizball (Sensible Software, 1987)

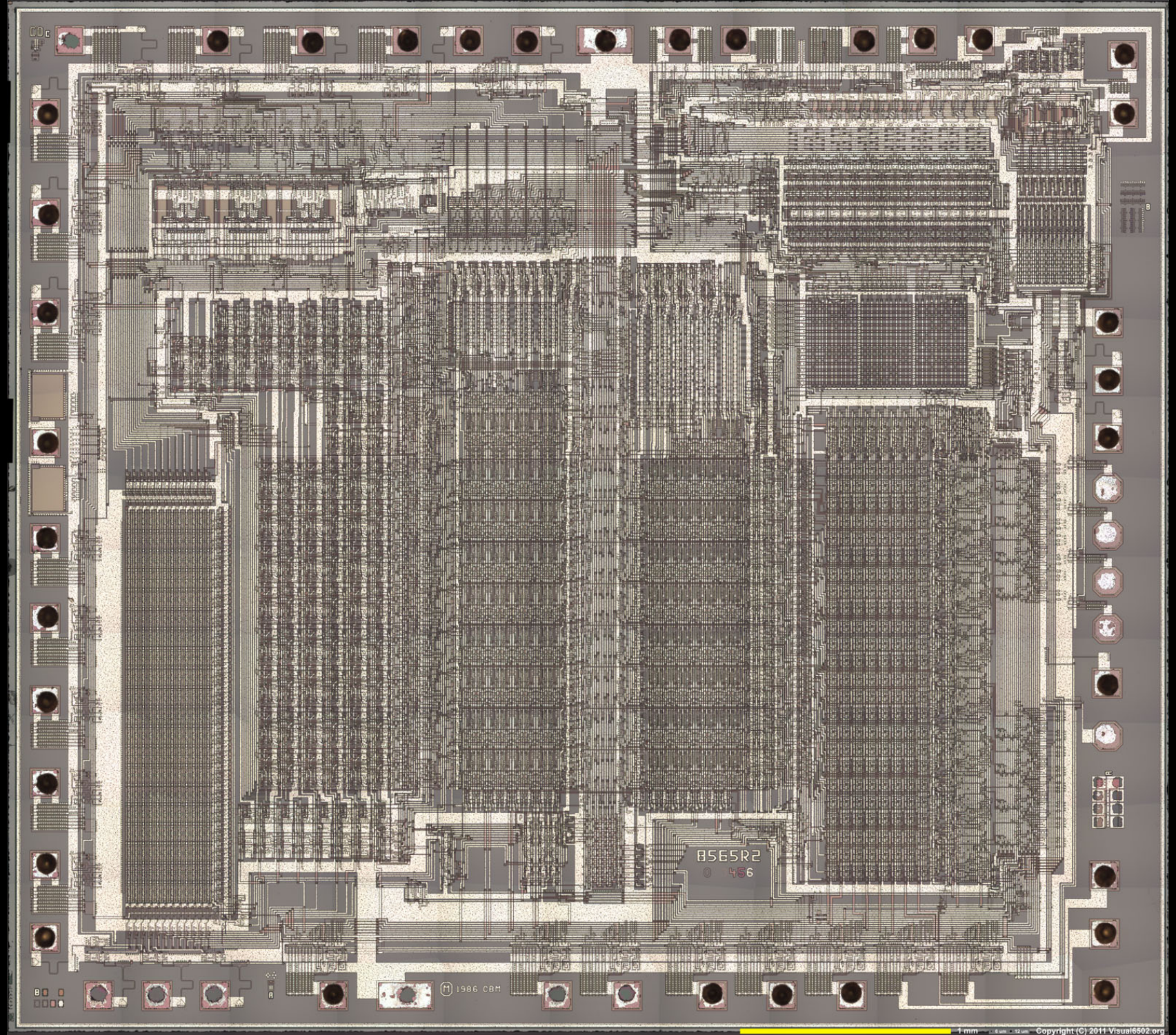
C-64 BLOCK DIAGRAM




© 1984
COMMODORE INTL COMMODORE 64
ASSY NO. 250425
MADE IN HONG KONG
KALEX
HKC S/N 174233
Q.C. 8 PASSED


BTNA/LP
FB22
CAN
C101
.1
C60
.47
U19
6567
VIC
(D000-
D3FF)
U18
6581
SID
(D400-
D7FF)
SYNC
+
LUM
COLOR
POTY
POTX
FB15
CR3
IN914
R8
390
C77
.1
+VVID
Q4
PN-
2222
C73
150pf
50V
R9
7.5
R10
120
R11
120
L3
3μH
C72
220pf
50V
C78
220 pf
50V
C79
510pf
R49
470
R48
300
C15
10
25V
C16
.1
FB6
+5
+V RF MI
MODULATOR OUT
CASE
VIDEO AUDIO
LUM
COMP
VID
AUD
IN
AUD
OUT
AUDIO/VIDEO (5-PIN FEMALE DIN) CN5
R13
1K
C71
.1
Q5
PN2
222
R20
6.8K
R21
4.7K
Q6
PN2222
R14
100
FB14
C80
51 pf
R24
3.3K
C81
20pf
R25
1K Ω
(1 TURN)
FB11
C51
.47
C52
470pf
50V
CG2
10
25V
+12
FB10
C50
.22
C49
470pf
50V
C34
10
25V
+5
C93
1800pf
C46
1800pf
C10
470 pf
POLY
C11
470 pf
POLY
FB13
R6
1K
R7
10K
C37
1000pf
Q8
PN2222
C13
10
25V
ELECTRO-
LYTIC
R38
1K
C12
10
25V
ELECTROLYTIC
C35
.1

		7	6	5	4	3	2	1	0
$D000 (R/W)	M0X	Sprite 0 X-position							
$D001 (R/W)	M0Y	Sprite 0 Y-position							
$D002 (R/W)	M1X	Sprite 1 X-position							
$D003 (R/W)	M1Y	Sprite 1 Y-position							
$D004 (R/W)	M2X	Sprite 2 X-position							
$D005 (R/W)	M2Y	Sprite 2 Y-position							
$D006 (R/W)	M3X	Sprite 3 X-position							
$D007 (R/W)	M3Y	Sprite 3 Y-position							
$D008 (R/W)	M4X	Sprite 4 X-position							
$D009 (R/W)	M4Y	Sprite 4 Y-position							
$D00A (R/W)	M5X	Sprite 5 X-position							
$D00B (R/W)	M5Y	Sprite 5 Y-position							
$D00C (R/W)	M6X	Sprite 6 X-position							
$D00D (R/W)	M6Y	Sprite 6 Y-position							
$D00E (R/W)	M7X	Sprite 7 X-position							
$D00F (R/W)	M7Y	Sprite 7 Y-position							
$D010 (R/W)	M?X8	M7X8	M6X8	M5X8	M4X8	M3X8	M2X8	M1X8	M0X8
$D011 (R/W)	CR1	RST8	ECM	BMM	DEN	RSEL	YSCROLL		
$D012 (R)	RASTER	Raster Counter bits 7-0							
$D012 (W)	RSTCMP	Raster Comparator bits 7-0							
$D013 (R)	LPX	Light Pen X-position							
$D014 (R)	LPY	Light Pen Y-position							
$D015 (R/W)	M?E	M7E	M6E	M5E	M4E	M3E	M2E	M1E	M0E
$D016 (R/W)	CR2	unused [1]		RES	MCM	CSEL	XSCROLL		
$D017 (R/W)	M?YE	M7YE	M6YE	M5YE	M4YE	M3YE	M2YE	M1YE	M0YE
$D018 (R/W)	VM/CB	Screen Pointer (A13-A10)				Bitmap/Charset Pointer (A13-A11)			unused [1]
$D019 (R/W)	IRQST	IRQ	unused [1]			ILP	IMMC	IMBC	IRST
$D01A (R/W)	IRQEN	unused [1]				ELP	EMMC	EMBC	ERST
$D01B (R/W)	M?DP	M7DP	M6DP	M5DP	M4DP	M3DP	M2DP	M1DP	M0DP
$D01C (R/W)	M?MC	M7MC	M6MC	M5MC	M4MC	M3MC	M2MC	M1MC	M0MC
$D01D (R/W)	M?XE	M7XE	M6XE	M5XE	M4XE	M3XE	M2XE	M1XE	M0XE
$D01E (R/W)	M?M	M7M	M6M	M5M	M4M	M3M	M2M	M1M	M0M
$D01F (R/W)	M?D	M7D	M6D	M5D	M4D	M3D	M2D	M1D	M0D
$D020 (R/W)	EC	unused [1]				Border Color			
$D021 (R/W)	B0C	unused [1]				Background Color 0			
$D022 (R/W)	B1C	unused [1]				Background Color 1			
$D023 (R/W)	B2C	unused [1]				Background Color 2			
$D024 (R/W)	B3C	unused [1]				Background Color 3			
$D025 (R/W)	MM0	unused [1]				Sprite Multicolor 0			
$D026 (R/W)	MM1	unused [1]				Sprite Multicolor 1			
$D027 (R/W)	M0C	unused [1]				Sprite 0 Color			
$D028 (R/W)	M1C	unused [1]				Sprite 1 Color			
$D029 (R/W)	M2C	unused [1]				Sprite 2 Color			
$D02A (R/W)	M3C	unused [1]				Sprite 3 Color			
$D02B (R/W)	M4C	unused [1]				Sprite 4 Color			
$D02C (R/W)	M5C	unused [1]				Sprite 5 Color			
$D02D (R/W)	M6C	unused [1]				Sprite 6 Color			
$D02E (R/W)	M7C	unused [1]				Sprite 7 Color			
$D02F (R/W)	KCR [2]	unused [1]					Keyboard Interface [2]		
$D030 (R/W)	FAST [2]	unused [1]						TEST [2]	2 MHz [2]


8565R2
1986 CBM
1 mm
Copyright (C) 2011 Visual6502.org

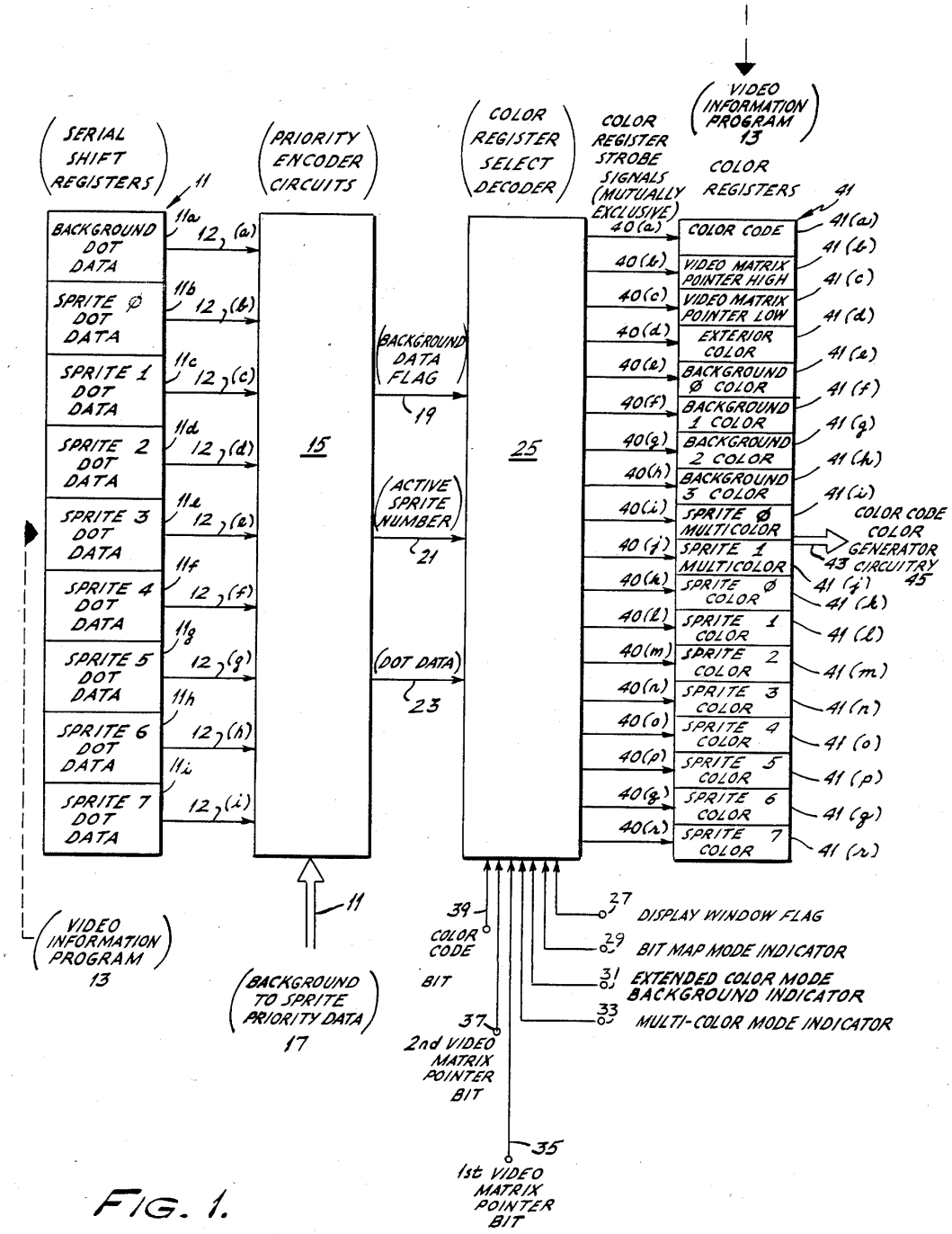
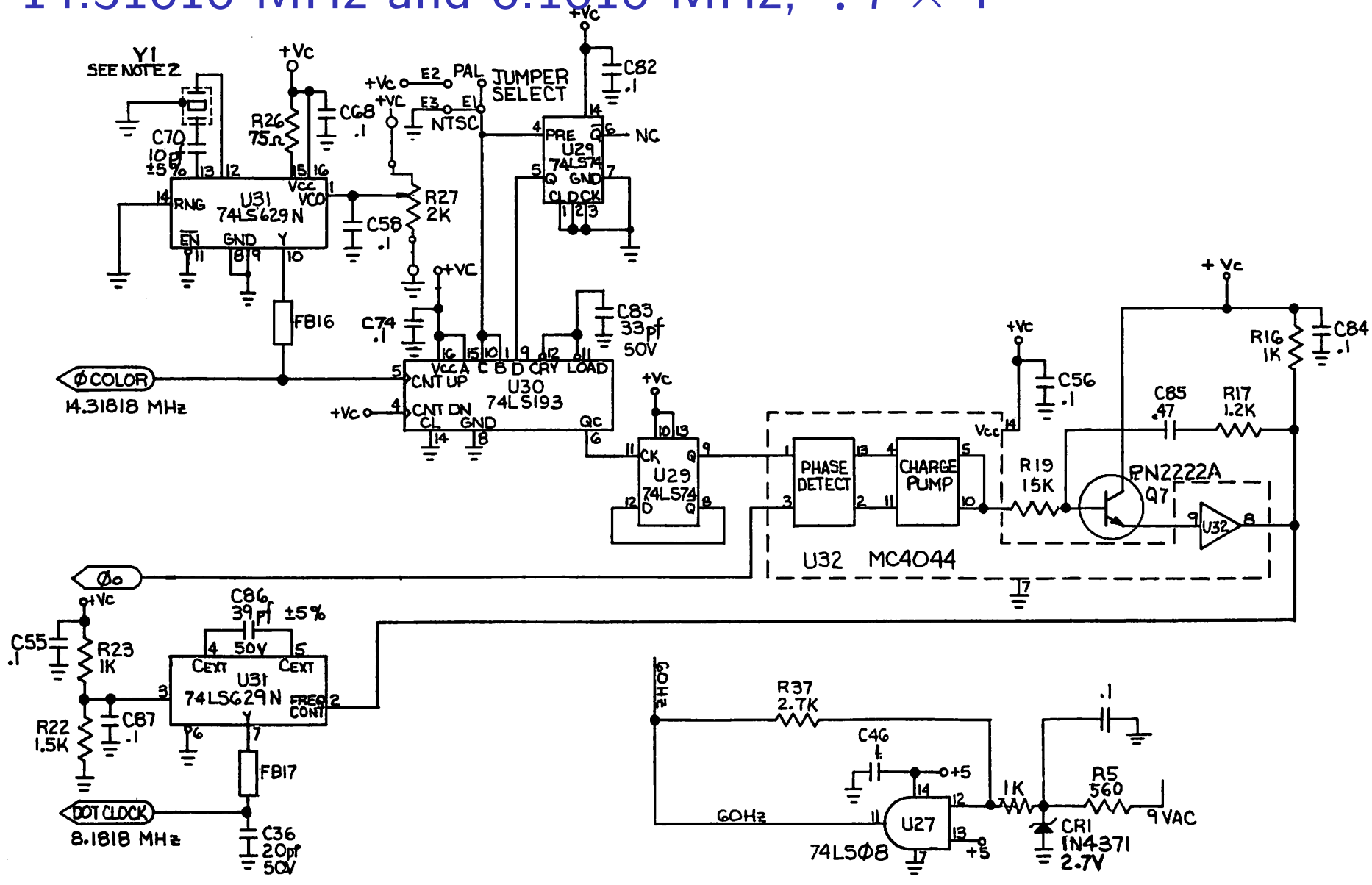

SERIAL SHIFT REGISTERS
PRIORITY ENCODER CIRCUITS
COLOR REGISTER SELECT DECODER
COLOR REGISTER STROBE SIGNALS (MUTUALLY EXCLUSIVE)
VIDEO INFORMATION PROGRAM 13
COLOR REGISTERS
BACKGROUND DOT DATA
SPRITE Ø DOT DATA
SPRITE 1 DOT DATA
SPRITE 2 DOT DATA
SPRITE 3 DOT DATA
SPRITE 4 DOT DATA
SPRITE 5 DOT DATA
SPRITE 6 DOT DATA
SPRITE 7 DOT DATA
15
25
BACKGROUND DATA FLAG
ACTIVE SPRITE NUMBER
DOT DATA
COLOR CODE
VIDEO MATRIX POINTER HIGH
VIDEO MATRIX POINTER LOW
EXTERIOR COLOR
BACKGROUND Ø COLOR
BACKGROUND 1 COLOR
BACKGROUND 2 COLOR
BACKGROUND 3 COLOR
SPRITE Ø MULTICOLOR
SPRITE 1 MULTICOLOR
SPRITE Ø COLOR
SPRITE 1 COLOR
SPRITE 2 COLOR
SPRITE 3 COLOR
SPRITE 4 COLOR
SPRITE 5 COLOR
SPRITE 6 COLOR
SPRITE 7 COLOR
COLOR CODE
COLOR GENERATOR CIRCUITRY 45
43
VIDEO INFORMATION PROGRAM 13
BACKGROUND TO SPRITE PRIORITY DATA 17
COLOR CODE BIT
2nd VIDEO MATRIX POINTER BIT
1st VIDEO MATRIX POINTER BIT
DISPLAY WINDOW FLAG
BIT MAP MODE INDICATOR
EXTENDED COLOR MODE BACKGROUND INDICATOR
MULTI-COLOR MODE INDICATOR

FIG. 1.

14.31818 MHz and 8.1818 MHz, $\div 7 \times 4$



The C64 Clock Circuits.