TeleVideo 9320 Maintenance Manual

TELEVIDEO®
9320 VIDEO DISPLAY TERMINAL
MAINTENANCE MANUAL

Document 133002-00
August 1988

Copyright

Disclaimer

TeleVideo Systems, Inc. makes no representations or warranties with respect to this manual. Further, TeleVideo Systems, Inc. reserves the right to make changes in the specifications of the product described within this manual at any time without notice and without obligation of TeleVideo Systems, Inc. to notify any person of such revision or changes.

TeleVideo Systems, Inc., 1170 Morse Avenue, P.O. Box 3568, Sunnyvale, California 94088-3568
408/745-7760

Contents

1 Introduction

OVERVIEW 1-1
DESCRIPTION OF THE MODULES 1-2
Logic Circuitry 1-2
Video Circuitry 1-2
Power Supply Circuitry 1-2
Keyboard 1-3
RS-423 SIGNAL ASSIGNMENTS 1-3
SPECIFICATIONS 1-4
Physical 1-4
Electrical 1-5
Display 1-6
Keyboard 1-7
Environmental 1-8
CRT Controller Format 1-9
PC Board 1-10

2 Theory of Operation

INTRODUCTION 2-1
DETAILED DESCRIPTIONS 2-2
System Clocking 2-2
The Gate Array 2-2
CPU System And Control 2-2
Character Generation 2-5
Video Display Generation 2-5
Screen Data Storage 2-6
Communications 2-6

3 Maintenance

VISUAL INSPECTION 3-1
Terminal and Keyboard Exterior 3-1
Terminal and Keyboard Interior 3-1
TESTS AND ADJUSTMENTS 3-1
Height and Width 3-1
Linearity 3-2
Brightness 3-2
Trapezoidal Distortion 3-2
Concave and Convex Distortion 3-2
Display Stability 3-2

Making Adjustments 3-2
TROUBLESHOOTING 3-3
REMOVING THE MODULES 3-5
Opening the Case 3-5
Removing the Circuit Board 3-6
Replacing the Circuit Board 3-6
Closing the Terminal Case 3-8
Opening the Keyboard Case and Removing the Keyboard Circuit 3-8
Replacing the Keyboard Circuit and Closing the Keyboard Case 3-8

4 Parts and Service

ORDERING SPARE PARTS 4-1
SERVICE INFORMATION 4-8
Return Procedure 4-8
Regional Sales Offices 4-8

5 Schematics

A Service Bulletins

Illustrations

1-1 Front View of the 9320 1-1
1-2 Rear View of the 9320 1-2
1-3 Keyboard Layout 1-7
2-1 Block Diagram of the 9320 2-1
2-2 Memory Map for the 9320 2-3
3-1 Discharging Voltages 3-5
3-2 Opening the Terminal Case 3-6
3-3 Removing the Circuit Board 3-7

Tables

1-1 Main Port Assignments for DB-25 1-3
1-2 Main Port Assignments for DECconnect 1-3
1-3 Printer Port Assignments for DB-25 1-3
1-4 Printer Port Assignments for DECconnect 1-3
3-1 Troubleshooting Guide 3-3
4-1 Main Parts List 4-1
4-2 Parts Reference List 4-2
5-1 Circuit Board IC Reference (Logic Board) 5-1

1 Introduction

This manual is intended only for qualified repair personnel. You will find specifications for the 9320 at the end of this Section and detailed circuit descriptions in Section 2.

Using the procedures in Section 3, the schematics in Section 5, and an **Operator's Manual**, you can repair most failures quickly. If difficulty arises, contact your dealer.

If you find that you need parts or service, you will find the information you need in Section 4.

OVERVIEW

TeleVideo's 9320 terminal is an ANSI terminal that emulates the DEC VT320 terminal. The CPU for the 9320 is the 65C816 microprocessor. The CRT controller is the 2672.

Figures 1-1 and 1-2 show front and rear views of the terminal.

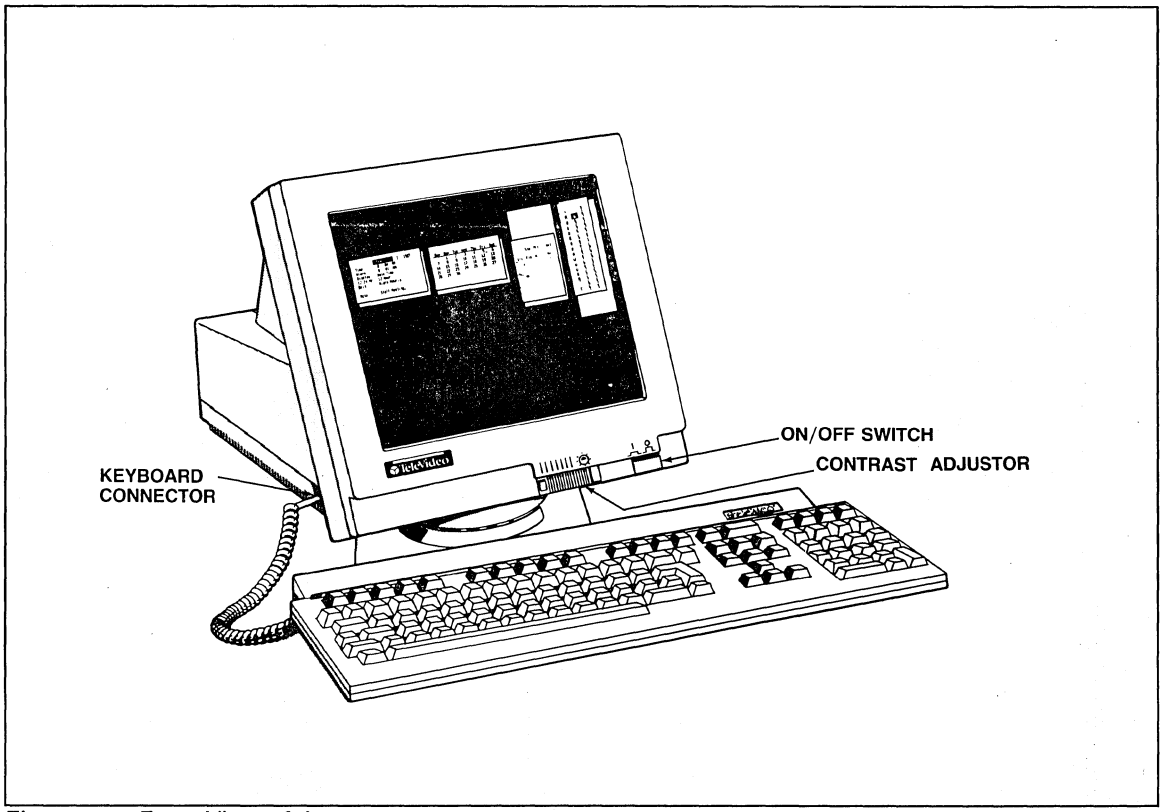


Figure 1-1. Front View of the 9320

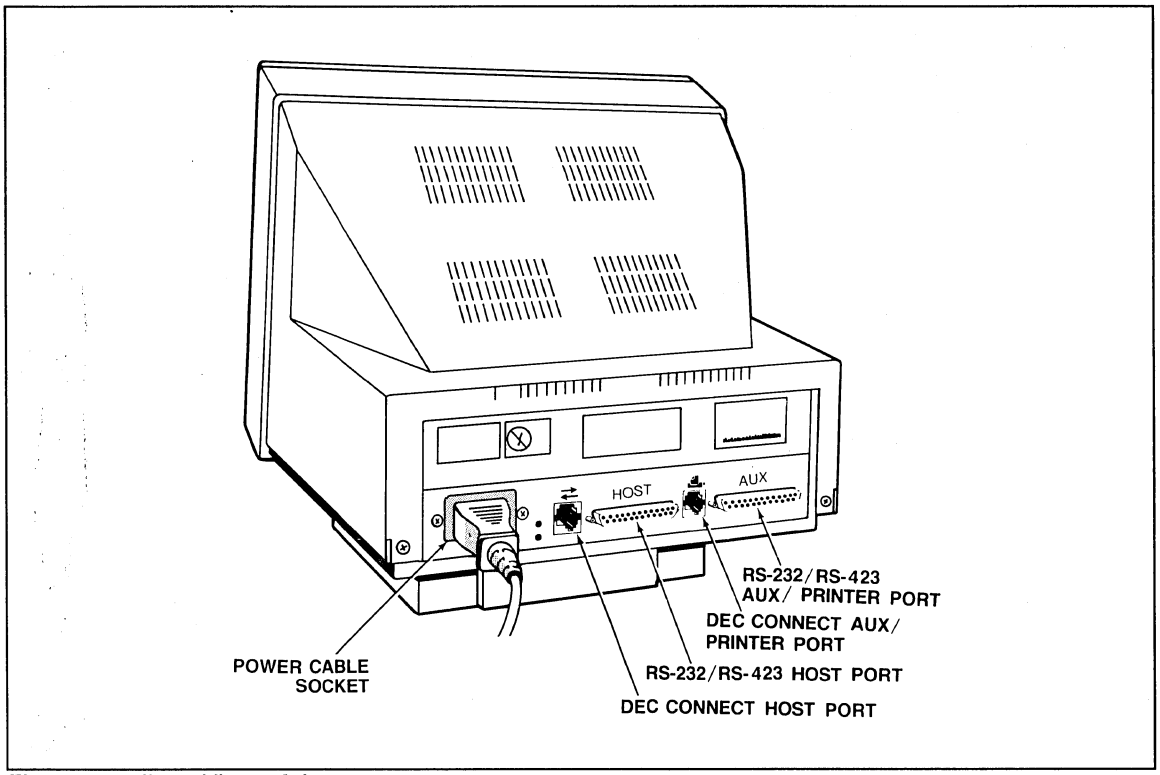


Figure 1-2. Rear View of the 9320

DESCRIPTION OF THE MODULES

The logic, video, and power supply circuitry are all on one board—the circuit board, which is inside the plastic case under the CRT.

Logic Circuitry

The 65C816-based control circuitry on the circuit board generates the video and sync signals needed to display data on the CRT screen. It also processes and stores data to be transmitted or received.

The main logic of the circuit board includes four areas, which are described in detail in Chapter 2 ("Theory of Operation"):

- Main processor (CPU)
- Random access memory (RAM)
- Display processing
- Input/output interface

Video Circuitry

The video circuitry, which is also on the circuit board, takes care of horizontal and vertical sweep and video amplification. It produces a non-interlaced raster display on the screen. The video signals created by this circuitry generate a series of pixels to appear at pre-determined positions on each scan line. To display characters, the video circuitry forms dot matrices that are 10 pixels wide and either 10 or 14 pixels high (10 x 10 or 10 x 14 character cells).

Power Supply Circuitry

The components of a switching power supply are distributed along the right side of the circuit board. The power supply converts input voltage of 90-130 Vac (60 Hz) or 180-260 Vac (50 Hz) to the following:

+5 Vdc for TTL logic on the circuit board

+12 Vdc for the video signals and RS-423 communications

-12 Vdc for RS-423 communications

A user-replaceable fuse near the power plug protects the circuitry from excess current.

Keyboard

The 9320 has a detachable keyboard connected to the terminal by a coiled cable. This keyboard contains an array of keyswitches mounted on a printed circuit board (PCB) that includes an 8049 microcontroller and other components.

The 8049 scans the keyboard matrix, encodes the data, and transmits the appropriate scan codes. Data is transmitted through a 4-wire cable over an asynchronous serial port at 9600 baud to the main logic board.

On the circuit board, the serial data is converted to parallel and decoded by the main processor using decoding firmware.

RS-423 SIGNAL ASSIGNMENTS

Main Port Connectors

The 9320 has two RS-423 main port connectors: one DB 25-pin (labeled HOST) and one DECconnect (labeled ⇄).

Table 1-1. Main Port Assignments for DB-25

Pin	Signal Name	Direction
1	Frame Ground	n/a
2	Transmit Data	Output
3	Receive Data	Input
4	Request to Send	Output
5	Clear to Send	Input
6	Data Set Ready	Input
7	Signal Ground	n/a
8	Data Carrier Detect	Input
20	Data Terminal Ready	Output

Table 1-2. Main Port Assignments for DECconnect

Pin	Signal Name	Direction
1	Data Terminal Ready	n/a
2	Transmit Data	Output
3	Transmit Signal Ground	Input
4	Receive Signal Ground	Output
5	Receive Data	Input
6	Data Set Ready	Input

Printer Port Connectors

The 9320 has two RS-423 printer port connectors: one DB 25-pin (labeled AUX) and one DECconnect (labeled ⮷).

Table 1-3. Printer Port (DCE) Pin Assignments

Pin	Signal Name	Direction
1	Frame Ground	n/a
2	Receive Data	Input
3	Transmit Data	Output
5	Clear to Send	Output
6	Data Set Ready	Output
7	Signal Ground	n/a
8	Data Carrier Detect	Output
20	Data Terminal Ready	Input

Table 1-4. Printer Port Assignments for DECconnect

Pin	Signal Name	Direction
1	Data Terminal Ready	n/a
2	Transmit Data	Output
3	Transmit Signal Ground	Input
4	Receive Signal Ground	Output
5	Receive Data	Input
6	Data Set Ready	Input

SPECIFICATIONS

Physical

VDT Dimensions:	
Height	13.6 inches (34.5 cm)
Width	12.9 inches (32.8 cm)
Depth	13.9 inches (35.4 cm)
VDT Net Weight	17.5 lbs.
Case Foot Print	8.6 inches by 8.0 inches (max.)
Case Features:	
Tilt	-5 to +15 degrees
Swivel	270° left to right
Cooling	Convection system
Connectors	One RS423 communication port (DB25 male and RJ11 DECconnect) One RS423 printer port (DB25 female and RJ11 DECconnect) One RJ11 keyboard port One AC receptacle-type quick disconnect
CRT:	
Diagonal Measure	13.7 inches (34.8 cm)
Phosphor	P134 (amber); P192 (paper white)
Fluorescence	Amber; paper white
Bulb	90° deflection, 60" radius face
Face-plate	Filterglass
Screen	Aluminized
Persistence	Medium short (300us decay time)

Electrical

AC Supply:	
Input Line Voltage (Jumper Selectable)	95V to 130V 180V to 260V
Frequency	50/60 Hertz +/- 3 Hz.
Source Current:	
115V Line	1.0 Amp max.
230V Line	0.5 Amp max.
Phase	Single phase, 3-wire
Wattage	40 VA max.
DC Supply:	
5V	+/- .25V at 1.5 Amp
12V	+/- .24V at 1.6 Amp
-12V	+/- .24V at 150mA
Ripple and Spike Noise	50mV peak to peak +5V 100mV peak to peak +12V; -12V

Display

	80	132
Horizontal Scanning Frequency	26.46 Khz	26.46 Khz
Vertical Scanning Frequency	70 Hz, 80 Hz	70 Hz, 80 Hz
Character Lines	24, 25	24, 25
Columns Per Line	80	132
Cell Size (Character Block):	Dot Matrix	Dot Matrix
Width	10	10
Height	14, 10	14, 10
High Voltage (At Dark Screen)	13.5 KV +/- 500V	13.5 KV +/- 500V
High Voltage Regulation (From Dark Screen to Full Bright)	500V +/- 250V	500V +/- 250V
Picture Brightness at Maximum Contrast Adjustment Equal to or Greater Than	20 ft. Lambert	20 ft. Lambert
Picture Size (Active Display):		
Format	24, 25 lines	24, 25 lines
Width	240 mm	240 mm
Height	180 mm	180 mm
Levels of Gray	Dark, Half Bright, Full Bright	Dark, Half Bright, Full Bright

Keyboard

Style	Low profile
Home Row DIN std.	30 mm untilted
Height	1.5 in (3.8 cm)
Width	19.4 in (49.2 cm)
Depth	7.1 in (18.0 cm)
Net Weight	2.0 kg (4.5 lbs.)
Microcontroller	8049
Layout	See Figure 1-3 below
Operating Life	100 million keystrokes min.

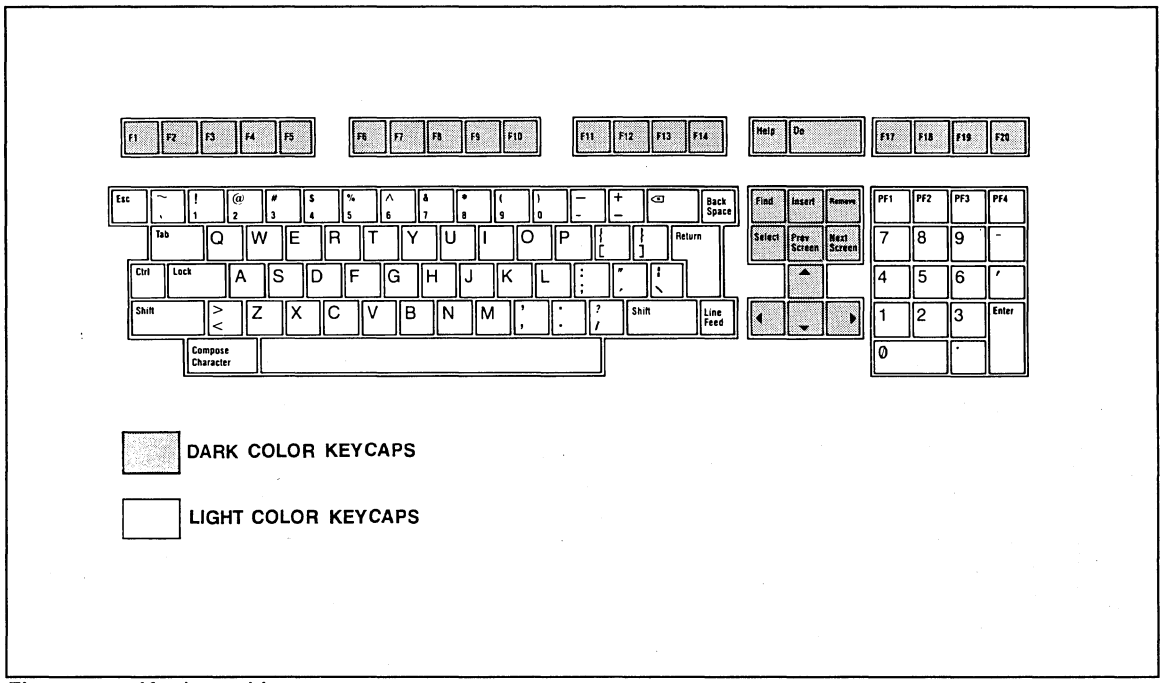


Figure 1-3. Keyboard Layout

Environmental

Operating:	
Temperature	5 to 40° C (41 to 104° F)
Humidity	10 to 85% non-condensing
Altitude	3,000 m (10,000 ft.)
Non-operating:	
Temperature	-40 to 60° C (-40 to 140° F)
Humidity	10 to 85%
Altitude	5,000 m (15,000 ft.)
MTBF	20,000 hours min.
MTTR	15 minutes
Vibration	0.3G, 5 to 100 Hz., operational
Shock	20G, 11ms, 18 shocks
Shipping:	
Girth	108 inches max.
Weight	50 lbs. max.

CRT Controller Format

	80 x 26	132 x 26
Dot Frequency	26.9892 MHz	44.4528 MHz
Character Cell:		
Number of Dots per Character (Width)	10	10
Number of Scan Lines per Character (Height)	10, 14	10, 14
Character Frequency	2.6989 MHz	4.4452 MHz
Screen Format:		
Display Characters per Line	80	132
Total Characters per Line	102	168
Number of Rows per Screen	25	25

PC Board

Main Features:

Type of board	2-sided, includes power and ground
Microprocessor	65C816 (5 MHz)
CRT Controller	2672 (5 MHz)
Communication controller	2681 DUART
Gate Array	P/N 271049-00 (custom)
Battery	3V min. Lithium

Current Load:

Standard	1.2A (5V); 1.5A (12V); 100 mA (-12V)
with Options	1.5A (5V) max.

Memory

System ROM	64K (27512)
System RAM (CMOS)	8K bytes
Display RAM	16K x 2 (character and attribute)
Character generator RAM	8K bytes

Communications:

Main Port	RS423 (P3, P6) (75 - 19.2K bit/sec.)
Printer Port	RS423 (P4, P5) (75 - 19.2K bit/sec.)
Parity	No, Odd, Even, Mark, Space
Data Bits	7 or 8
Handshaking	No, X-on/X-off, DTR, both

2 Theory of Operation

INTRODUCTION

The 9320 logic is based on a 4.45-MHz 65C816 microprocessor, using a 24-bit address bus that allows access to 16 MBytes of memory. A considerable amount of the terminal's functionality has been incorporated into a gate array. Refer to the block diagram (Figure 2-1).

In this chapter, we'll discuss the following topics:

- System clocking
- Gate array
- CPU system and control
- Character generation
- Video display generation
- Screen data storage
- Communications

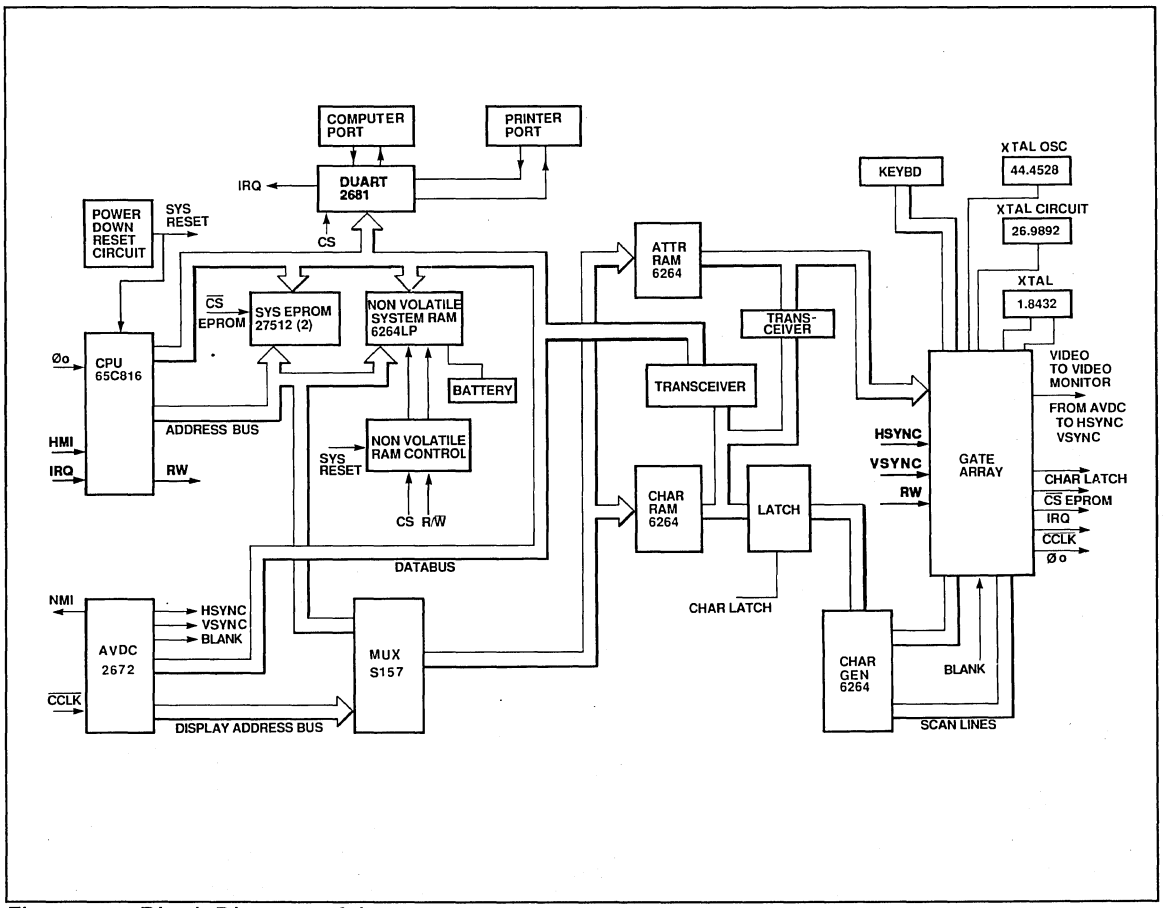


Figure 2-1. Block Diagram of the 9320

DETAILED DESCRIPTIONS

System Clocking

The 9320 displays 10 x 14 character cells in either 80-column or 132-column mode, using a different dot clock for each display mode. Clock oscillator Y2 at 44.4528 MHz serves as the basic clock in 132-column mode. A crystal circuit (Y3), which oscillates at 26.9892 MHz, serves as the basic clock in 80-column mode. (Crystal Y1 serves as a baud rate clock for the communication ports.)

Selection of 80 or 132 column operation is done inside the gate array chip through software programming. The frequency at which the microprocessor operates depends on the mode of operation selected, 80 or 132 column. Oscillator Y2, the dot clock in 132-column mode, serves as a clock to send video data through a shift register inside the gate array, and serves as a processor clock after it is divided by ten. Crystal oscillator Y3, the dot clock in 80 column mode, provides the same two functions.

The Gate Array

The major functions of the gate array include basic timing functions, reading and writing attribute RAM, timing for writing to various areas of memory, control for the character RAM transceiver, font-loading, various scan line functions, keyboard communication, and handling video attributes and the video shift registers. Descriptions are given in the paragraphs that follow.

The CPU clock is stretched in 132 column mode when accessing the EPROM and CRT controller. The system clock is also stretched when accessing I/O ports in both modes. The CRT controller character clock is the inverted system clock. The baud rate clock generator circuit for the I/O ports is also generated inside the gate array.

The gate array controls attribute RAM data read/write operation. The gate array also provides a write pulse for screen RAM and character generator RAM, address decode for EPROMs, screen RAM, I/O ports and other signals. It provides a control signal to control the direction of the character RAM transceiver.

The gate array loads fonts to the character generator. Four of the scan address lines come from the gate array. The scan line counter that controls double width, double height and smooth scrolling is also inside.

In addition, the gate array handles keyboard transmit and receive data, attribute logic, and the video shift register.

The CPU communicates with the gate array using internal registers that are accessed by reading or writing specific locations inside the gate array. One status register (read only) provides the CPU with the status of internal signals like transmit register empty, receiver full, keyboard overflow, and interrupt.

CPU System And Control

The CPU system consists of the following four subsystems (with identifiers from sheet 1 of the schematics in parentheses):

- the 65C816 CPU (U14)
- the system 27512 EPROM (U12)
- the 6264 system RAM (U13)
- the system reset controller (U10)

The CPU is the controller for the entire board, initializing and controlling all of the DUART, the CRT controller, the clock circuits and the gate array. It also processes all of the data received from the keyboard, computer, or printer, and updates the video RAM accordingly.

The CPU address space is divided into 256 banks of 64 Kbytes. It always reads instructions from the EPROM. Data is read from EPROM U12 as from bank 1 and EPROM U11 as from bank 3. Many of the display features, such as smooth scrolling and line lock are controlled by the CPU in conjunction with the CRT controller and gate array.

Each device on the board has a specific address or range of addresses, as shown on the memory map (Figure 2-2). Bank 0 is divided into 8 kbyte blocks inside the gate array. The first 8 kbytes block is for the system RAM. The next blocks are reserved for the CRT controller, gate array and communication ports, respectively. The next two blocks of 16 kbytes are for the character RAM and attribute RAM.

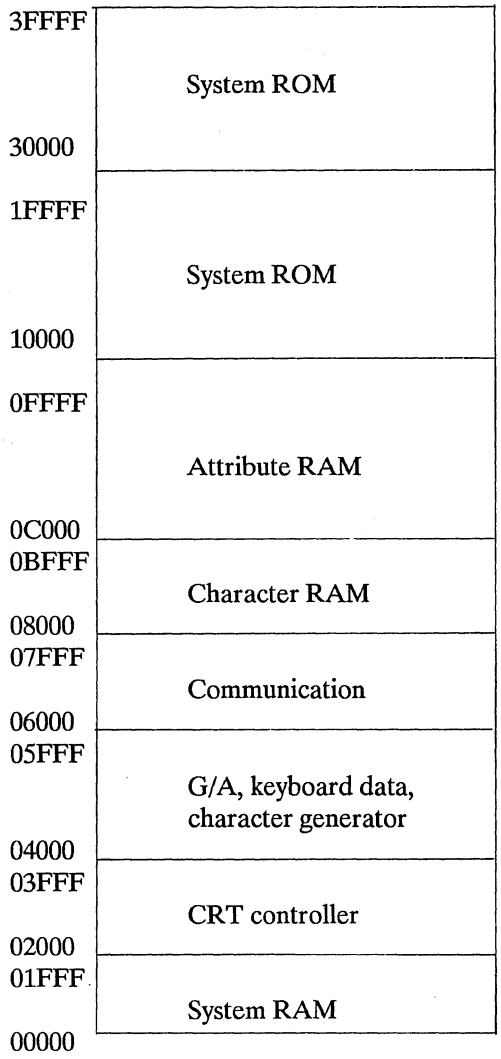


Figure 2-2. Memory Map for the 9320

System RAM serves two purposes in the 9320. Part of the RAM is used by the firmware as the stack and other temporary data, such as input and output buffers. In addition, the RAM is backed up by a battery, thus retaining the data even with power switched off. This allows portions of the RAM to be used for function key programming and to retain initialization parameters.

To retain data, two things must occur: 1) the voltage to the RAM must not fall below 2 volts; and, 2) the RAM must be deselected as power from the power supply discharges.

Voltage is maintained by the battery (BT1). Deselecting the RAM is accomplished by using a transistor (Q2) in series with the chip select signal from the decoder, as described in the next paragraph.

System reset is controlled by the DS1231 power monitor (U10). As it is configured, the DS1231 uses a comparator to monitor $\overline{VCC}$ and outputs the signals RST (pin 5) and $\overline{RST}$ (pin 6) when VCC falls to 4.75 V. Upon power up, these signals are held active for at least 250 ms to allow the power supply to stabilize, and properly initialize the CPU.

With power on, $\overline{\text{SYSTEM RESET}}$ is high, turning Q2 on and allowing the chip select signal to go to the RAM. When power goes away, the $\overline{\text{SYSTEM RESET}}$ signal goes low when +5 volts falls below 4.4 volts. This turns Q2 off, causing pin 20 of the RAM to follow the voltage at the junction of CR7 and R17. This voltage is reached (typically 2.8 to 3 volts), at which time the battery voltage takes over.

The CPU system uses the control latches inside the gate array to give the firmware control over some hardware devices that do not interface with the data bus. There are three of these registers (two available to the user), which contain the following control bits:

Control Register 1:

7	6	5	4	3	2	1	0
80/ 132	Dark/ Light	CharGen 256/512	FontLoad On/Off	DispRAM A14	Reserved	Reserved	Reserved

7. 80 or 132 column mode

6. Dark or light background works on whole screen.

5. Most significant bit indicates the number of different characters in the character generator: 256 (off) or 512 (on).

4. During font load, character font load at the beginning of power on routines, or user defined font load at any time, this bit should be turned on.

3. Controls highest order address of 32Kx8 static RAM, allowing for two 16K blocks of display memory.

2.1.0 Reserved for firmware control.

Control Register 3:

7	6	5	4	3	2	1	0
Control I	Control II	Reserved	Blink Clock	ENTxD IRQ	Screen Mode	Speaker On/Off	DTR

7.6. Controls the baud rate up to 38.4 kbaud for communication ports. Used to control the transmit and receive clock to the computer and printer port UART.

5. Reserved for firmware control.

4. Blink on/off.

3. Enable transmit data IRQ.

2. Screen mode is used by video circuitry. This bit is used along with cell size selection (10 x 10 or 10 x 14) to maintain screen size. This is a latch output.

1. Speaker on/off.

0. Data Terminal Ready. A signal sent to the host computer telling it to stop transmitting data to the 9320.

Character Generation

The 9320 uses character cells, rather than a full bit-mapped display, to produce characters on the screen. In 24-25 row mode, each character cell is 10 pixels wide by 14 pixels high. The screen displays either 3300 character cells in 132-column mode (132 x 25), or 2000 character cells in 80-column mode (80 x 25).

Each of the 512 possible characters is pre-defined and resides in the character generator RAM (U34). (During power-up, the character fonts are copied from EPROM to character generator RAM.) The CPU changes the display by changing the code stored in the screen RAMS at the desired location(s).

The codes written into the screen RAM are read out as the CRT controller refreshes the display (see "Video Display Generation" later in this chapter). As each code is read out, one per character clock cycle, it is latched into the character address latch (U35).

The outputs of the character address latch are used as the high order address lines of the character generator RAM. The low-order addresses are provided by the scan line counter inside the gate array. The 8-bit data from the character generator is transformed into 10-bit words inside the gate array.

In order to load the character generator RAM, the following circuits are provided inside the gate array. The scan line counter is loadable by the CPU via the scan line offset register, which is accessed as one of the registers in the gate array. It is loaded with data present on D0-D3 outputs of the scan line offset register. During normal operation, this counter is clocked by BLANK. During font load, it is clocked by accesses to the character generator data register.

During screen refresh, data is transferred from the scan line offset register to the scan line counter on the rising edge of BLANK from the CRTC. During a font load operation, the transfer does not occur.

Under certain conditions, two of the shift register's inputs are connected to provide a character cell 10 pixels wide without using a special 10-bit wide RAM. In normal text mode, D7 from the character generator is always a low (zero), creating a single dot space on the left side of each character cell.

Video Display Generation

The video monitor requires three signals from the logic board to produce a display on the CRT:

- vertical sync ($\overline{\text{VSYNC}}$)
- horizontal sync (HSYNC)
- video (VIDEO)

$\overline{\text{VSYNC}}$ and HSYNC originate from the CRT controller (U15). They are buffered and connect to the video section of the board. Video comes from the gate array (U26). It goes through a high-current open collector inverter (U20), where DEC and HI outputs are also tied.

HSYNC and $\overline{\text{VSYNC}}$ are timed pulses derived by the CRT controller from internal programmable counters that count CCLK cycles. For example, HSYNC might be a positive-going pulse starting 83 CCLK cycles after the beginning of each scan line and lasting 18 CCLK cycles. The CRT controller's internal counter would reset at the beginning of each scan line, count to 83, set HSYNC high, count 18 more CCLKs and set HSYNC low.

VSYNC is a much slower signal based on scan lines. Another counter inside the CRT controller counts scan lines and toggles VSYNC according to the way the firmware has programmed the internal registers.

As the SCN2672 CRT controller (U15) counts CCLKs, it is also putting out addresses on its display address lines (pins 21-34, DADD0-DADD13). These lines connect to four 74LS157 4-bit, two-way multiplexers (U18, U22-U24). The select inputs of the multiplexers are normally high, allowing the CRT controller's address line to access the data in the screen RAMs.

As data in the screen RAMs is read out, it is latched into the character address latch (U35) for the character data bus and into the gate array for the attribute data bus.

The character generator data that goes into the gate array is shifted from parallel to serial data, and is combined with attribute data, the BLANK output of the CRT controller, the cursor output of the CRT controller, the screen background control (light/dark) and other signals to produce a series of pulses that comes out on the VIDEO output of the gate array.

If the VIDEO output is high, the electron beam in the CRT is turned on, producing a light dot or series of dots on the screen. If VIDEO is low, the screen is dark.

Screen Data Storage

If the CPU needs to access either the character (U36) or attribute (U29) RAMs, the corresponding signal, CHAR RAM WR or ATT RAM WR goes low for half of a CPU cycle. Also, MUX DIR switches the multiplexers to the CPU's address bus.

Character data and attribute data normally go directly into the gate array. The CPU reads and writes character RAM through transceiver U32.

(Signals referred to as "$\overline{\text{SIGNAL}}$" appear on the schematic as \SIGNAL.)

Communications

There are three serial communications channels. Two channels have their own dedicated DUART; the third is inside the gate array. They can send and receive data at speeds ranging from 75 to 19,200 bits per second.

One channel of the DUART (U9) is used for communication to the host computer. It interfaces to a 25-pin D-subminiature connector (P3) and a DECconnector (P6) via TTL to RS-423 level converters 75146 (U4) and MC3488 (U2).

The baud rate is selectable under firmware control and is derived from the crystal across pins 32 and 33 of U9.

The other channel of U9 is dedicated to printer communications. It interfaces to a 25-pin D-subminiature connector (P4) and DECconnector (P5) via a 75146 (U3) and a 3488 (U1).

Since the keyboard's data rate is 9600 baud, the gate array's serial channel operates only at this one rate.

The $\overline{\text{IRQ}}$ outputs for the DUART and the gate array are tied together in a wire-OR configuration. Wheneither device generates an interrupt request (IRQ), the $\overline{\text{IRQ}}$ line goes low, signaling to the CPU that an interrupt has occurred. The CPU then polls the devices to determine which one generated the interrupt, and processes the interrupt as required.

3 Maintenance

VISUAL INSPECTION

A thorough visual inspection often makes the difference between success and failure in a repair attempt. Often a problem can be located just by close visual inspection.

Terminal and Keyboard Exterior

Look for signs of accidental damage, abuse, or neglect. Keyboard failures are often caused by spilled liquids, sprayed cleaning solvents, staples, or paper clips.

Are there any dents or deep scratches on the exterior of the terminal or keyboard? If so, ask the user how and when the damage occurred. It may contribute to the problem with the unit.

Terminal and Keyboard Interior

Open the cases and inspect the keyboard and terminal interiors.

- **Wiring Harness**: Check the condition of the wires and look for crushed insulation, exposed wires, and loose or broken connectors. Unplug the connectors and check that the pins are intact.
- **Circuit Board**: Check for loose chips, bent pins on chips, defective chip sockets, defective components and traces, poor solder joints, open fuses, and signs of overheating and burning. Check that devices are properly installed.
- **Keyboard**: Check for signs of spilled liquids, foreign objects, unplugged devices, defective traces, and signs of overheating and burning. Check the telephone-style connectors.

Remove all defective modules for closer inspection and repair. When you finish the repairs, replace the module(s) and test them.

TESTS AND ADJUSTMENTS

This section describes how to test the 9320's video monitor and how to make internal adjustments.

You can test the display geometry of the video monitor in the following six areas to make sure that it's functioning properly. Be sure to view the screen straight on to avoid parallax errors.

- Height and width
- Linearity
- Brightness
- Trapezoidal distortion
- Concave and convex distortion
- Display stability

For many of these tests, you must call up the alignment test display (a screenful of E characters). To do this, make sure your 9320 is in 9320 emulation mode and block mode; then press **Esc # 8**.

Height and Width

First measure the height and width of the display. Next, switch to reverse video (35 +/-3 fL for amber, 20 +/-fL for white), with the following conditions: 80 columns, normal status line. Then measure the height and width again, using the following criteria:

Height:	174 mm (maximum) 170 mm (minimum)
Width:	239 mm (maximum) 235 mm (minimum)

Linearity

Next call up the alignment test display (screen filled with Es) and measure the horizontal and vertical linearity of the display, using horizontal and vertical slot gauges. Take one reading for at least the first, middle, and last column and for at least the top, middle, and bottom row.

Count ten Es across and find the left edge of the eleventh E. Then count ten Es up and find the bottom edge of the eleventh E. The criteria are as follows:

Horizontal:	29.1 mm (maximum) 26.3 mm (minimum)
Vertical:	33.9 mm (maximum) 30.6 mm (minimum)

Brightness

Next test the brightness with a light meter: switch to inverse video, set the contrast to maximum, clear the screen of all characters, and take five readings (one at the center of the screen and one at each corner). The criteria are as follows:

Center:	35+/-fL
Corner:	Center+/-10%

Trapezoidal Distortion

Measure the height of the display at the left side and at the right side; then measure the width of the display at the top and the bottom. In each case, the pair of measurements must be within 2 mm of each other.

Concave and Convex Distortion

Then test concave and convex distortion (pincushion and barrel): measure the height of the display at the left side, middle, and right side; measure the width of the display at the top, middle, and bottom. In each case, the curvature of the display must not exceed 1.5 mm.

Display Stability

Finally, check display stability for the voltage and line frequencies given below. Conduct each test at the minimum, nominal, and maximum value.

AC Voltage:	127V (maximum) 115V (nominal) 103V (minimum)
	253V (maximum) 230V (nominal) 207V (minimum)
Frequency:	63 Hz (maximum) 60 Hz (nominal) 57 Hz (mimimum)
	53 Hz (maximum) 50 Hz (nominal) 47 Hz (minimum)

Making Adjustments

You can adjust the picture on the 9320's video monitor using one of the following:

Brightness	Pot R510
Focus	Pot R506
Contrast	Pot R401
Height	Pot R304
Vertical Linearity	Pot R308
Horizontal width	Coil L501

TROUBLESHOOTING

This section is a guide to component-level repair of the logic board and keyboard modules. Find the symptoms in Table 3-1 that resemble the problems in the terminal you are repairing. Then locate the suspected defective components. If you are not sure that a component is satisfactory, replace it before proceeding to the next test point. Before replacing a chip or component, check its inputs and outputs for proper levels and signal quality.

Table 3-1. Troubleshooting Guide

Symptom	Component	Location	Schematic Page
Display/Video			
No display, no beep, fails self test	SYS.RAM	U13	1 of 4
	CPU	U14	1 of 4
	Power monitor	U10	1 of 4
	Gate array	U26	4 of 4
	EPROM	U11, U12	1 of 4
	Power supply		
Distorted video	2672	U15	2 of 4
	6264	U13	1 of 4
	Gate array	U26	4 of 4
	Video section		
Incorrect characters	6264	U13	1 of 4
	2681	U9	3 of 4
	Gate array	U26	4 of 4
	Char RAM	U36	2 of 4
	EPROM	U11, U12	1 of 4
	8049 (Kybd)	U2	KYBD
No vertical sync	2672	U15	2 of 4
	7406	U20	2 of 4
No cursor	2672	U15	2 of 4
	Gate array	U26	4 of 4
Loss of attributes	Gate array	U26	4 of 4
	6264	U13	1 of 4

Table 3-1. Troubleshooting Guide (Continued)

Symptom	Component	Location	Schematic Page
Communications			
No full-duplex communication (FDX) at P3	2681	U9	3 of 4
	3488	U2	3 of 4
	75146	U4	3 of 4
No full-duplex communication (FDX) at P4	2681	U9	3 of 4
	3488	U1	3 of 4
	75146	U3	3 of 4
No status signal transmitted (DSR, DCD, CTS, DTR)	3488	U2	3 of 4
	2681	U9	3 of 4
No status signal received (DCD, CTS)	75146	U4	3 of 4
	2681	U9	3 of 4
All keys inoperative	Gate array	U26	4 of 4
	8049 (Kybd)	U2	KYBD
	7414 (Kybd)	U1	KYBD
One key inoperative	Keyswitch		
	8049 (Kybd)	U2	KYBD
SHIFT, CTRL,	EPROM	U11, U12	1 of 4
ALPHA LOCK,	8049 (Kybd)	U2	KYBD
and function keys inoperative			
No keyclick/no beep	Transducer	Speaker	4 of 4
	2N2222	Q1	4 of 4
	Gate array	U26	4 of 4

REMOVING THE PC BOARD

Opening the Case

WARNING

The CRT and capacitors retain high voltages even after power has been turned off. Always discharge the CRT as soon as you open the case.

Without touching any of the metal surfaces, pick up a screwdriver by its insulated handle and slip the tip of the screwdriver under the plastic cap that covers the anode, as shown in Figure 3-1. Then touch the metal frame of the CRT with the shaft of the screwdriver. (You may need a second screwdriver to reach the CRT frame from the anode.)

Use Figure 3-2 as reference for opening and closing the terminal case.

1. Turn off the terminal.

2. Disconnect the power cord and data cable(s) from the back of the terminal; disconnect the keyboard cable from the left side of the terminal.

3. Remove the bezel from the front of the terminal by pressing down on the top section to release it and pulling it away.

4. Remove the two Phillips screws from the rear of the terminal using a size 1 Phillips screwdriver (Xcelite X1010).

5. Remove the cover by releasing the two plastic "gripper" tabs near the top in each side of the CRT and pushing to the rear.

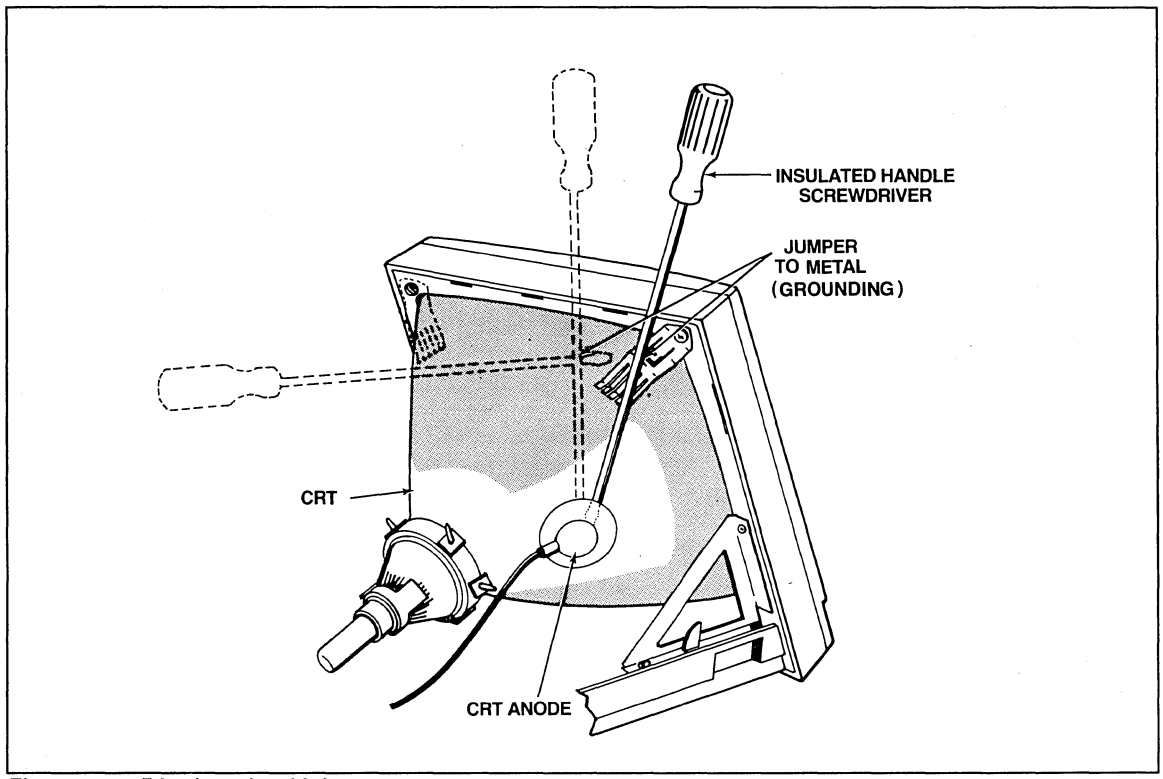


Figure 3-1. Discharging Voltages

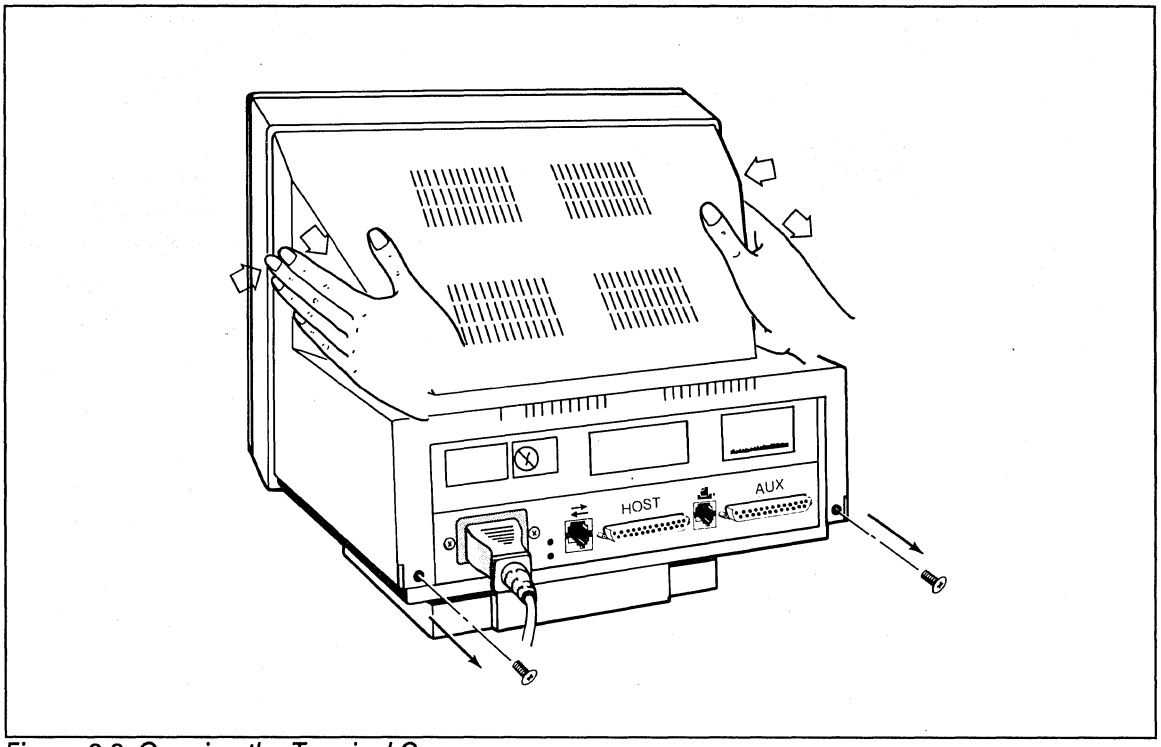


Figure 3-2. Opening the Terminal Case

Removing the Circuit Board

Use Figure 3-3 as reference for removing and replacing the circuit board.

1. Turn off the terminal and remove the cover, as described above.

2. Loosen the two Phillips screws just below the CRT on each side. These will release the two ground wires.

3. Turn the unit around and remove the two Phillips screws that hold the circuit board down, using a size 1 Phillips screwdriver.

4. Disconnect the voltage lead on the anode by gently lifting the rubber cap and unhinging the metal lead. (See **WARNING**, p. 3-5.)

5. Carefully remove the CRT connector (small round connector on the back of the CRT).

6. Remove the yoke connector (blue) from the circuit board.

7. Tilt the CRT forward by loosening the lower screws for the CRT support brackets. These are spring-loaded, and tilt the CRT forward automatically whenever the screws are loosened.

8. Pull the circuit board out through the rear of the chassis.

Replacing the Circuit Board

Use Figure 3-3 as reference for removing and replacing the circuit board.

1. Slide the circuit board in through the rear of the chassis.

2. Move the bezel into position to make sure that the power switch is aligned with its opening through the bezel.

3. Replace the two Phillips screws that hold the circuit board down, using a size 1 Phillips screwdriver.

4. Tilt the CRT back into position by tightening the lower screws for the CRT support bracket.

5. Reconnect the voltage lead to the CRT's anode:

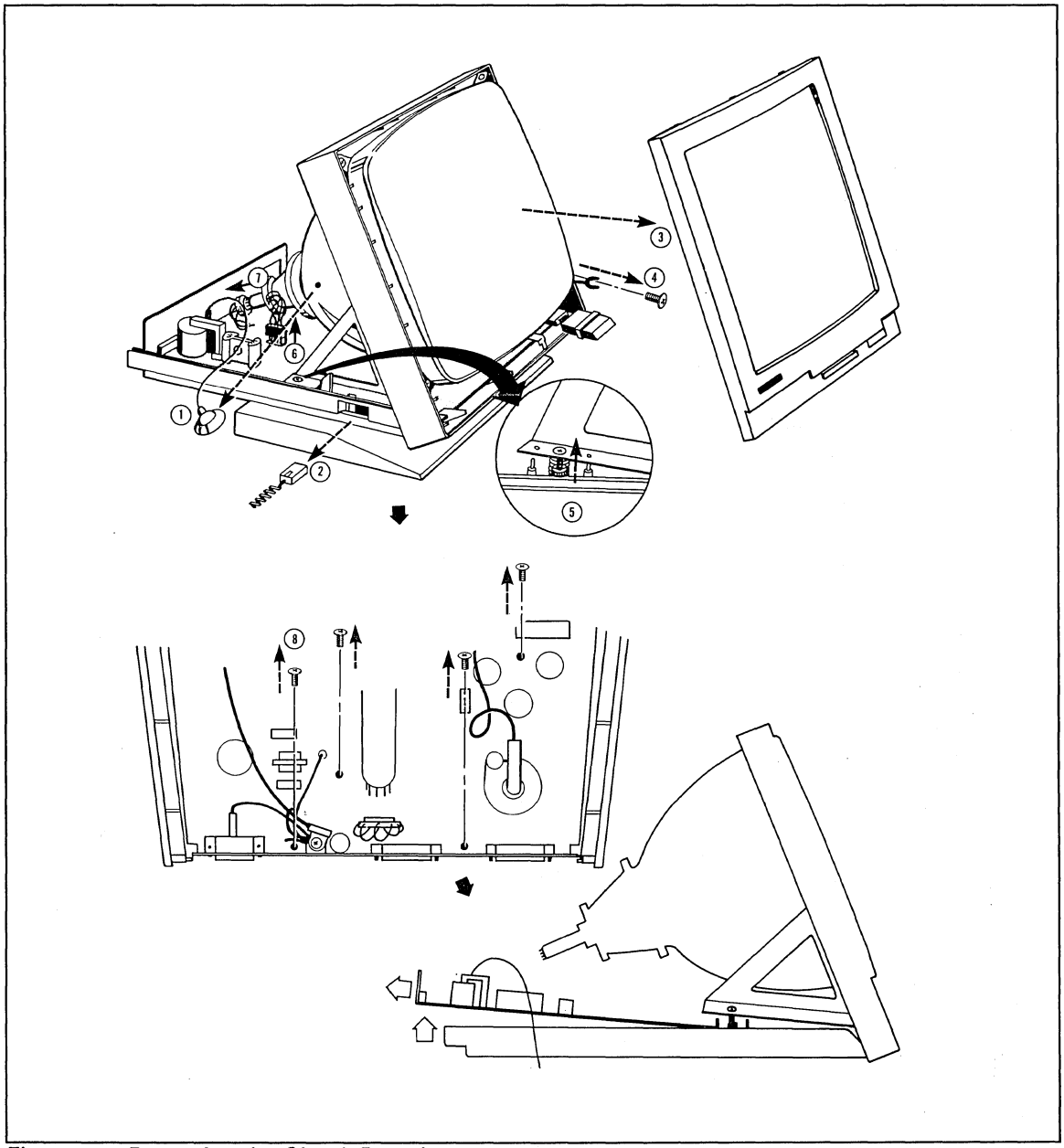


Figure 3-3. Removing the Circuit Board

a. Pull back the rubber umbrella of the anode cap, exposing the metal leads.

b. Pinch the two leads together, insert them into the glass opening on the side of the CRT, and then release them.

c. Smooth the rubber umbrella over the surface of the glass.

6. Replace the CRT connector (small round PC board on the back of the CRT).

7. Replace the yoke connector (blue) from the circuit board.

8. Tighten the two Phillips screws just below the front of the CRT on each side (along with the two ground wires).

Closing the Terminal Case

1. Replace the cover:

   a. Slide the cover into position.

   b. With the seven tabs aligned with their slots, push the cover into the frame until the two tabs snap and the cover is seated.

   c. Replace the two screws that fasten the cover to the back of the chassis.

2. Replace the bezel:

   a. Turn the unit around so that you are facing the screen.

   b. Slide the bezel into position.

   c. Make sure that the power switch is aligned on its opening, the sliding brightness switch is aligned on the plastic tab, and the tabs are aligned on their slots.

CAUTION

Make sure the power switch is aligned with its opening before you snap the bezel into place. Otherwise, the bezel may damage the switch.

   d. Once the power switch, the slide switch, and the three tabs are all aligned, pop the bezel into the frame.

Opening the Keyboard Case and Removing the Keyboard Circuit

1. Disconnect the helical cable from the left side of the terminal.

2. Turn the keyboard upside down and remove the two Phillips screws from the two sides of the housing.

3. Turn the keyboard over again and lift off the top cover, pressing the plastic tabs on the under side as needed.

4. Lift the entire assembly out of the keyboard case.

Replacing the Keyboard Circuit and Closing the Keyboard Case

1. Place the assembly back onto the keyboard case.

2. Replace the top cover, pushing the tabs into their respective slots.

3. Turn the keyboard upside down and replace the two Phillips screws.

4. Reconnect the helical cable to the opening on the left side of the terminal.

4 Parts and Service

ORDERING SPARE PARTS

You can order spare parts by telephone, telex or by written purchase order. (All telephone orders must be followed by a confirming purchase order clearly marked "Confirming Purchase Order.") To place an order, contact the TeleVideo Regional Sales Office in your area, or contact our Corporate Spare Parts Order Entry Department at the following address. All orders are shipped F.O.B. our designated site.

TeleVideo Systems, Inc.
1170 Morse Avenue
P.O. Box 3568
Sunnyvale, CA 94088-3568

Phone: (408) 745-7760
Fax: (408) 734-1927
TWX: (910) 338-7633
Telex: 474-5041 TVISYS

NOTE: The parts listed here in Table 4-1 are the only parts available from TeleVideo; the parts listed in Table 4-2 are for reference only.

Table 4-1. Recommended Parts List

Part Number	Description	List Price
122911-00	Power cord, 6 ft (OPC)	10.00
131386-00	Battery, lithium cylinder	6.00
133110-00	PCB Assembly, 9320	5.00
133043-00	Bezel, front, 9320	10.00
133045-00	Housing, rear, 9320	15.00
133158-00	Carton, shipping, 9320	17.00
132979-00	Shipping styrofoam, left	15.00
132979-01	Shipping styrofoam, right	15.00
134010-00	*Operator's Manual, 9320*	20.00
133002-00	*Maintenance Manual, 9320*	50.00
133049-00	Knob, power	5.00
133059-00	Knob, brightness	5.00
133075-00	Link knob, brightness	5.00
133104-00	Keyboard, 9320	149.00
133076-00	Keyboard cable	15.00
132897-00	Keycap set, 9320 complete	21.00

Table 4-1. Recommended Parts List (Continued)

Part Number	Description	List Price
131158-00	Keyswitch, momentary	5.00
131159-00	Keyswitch, momentary mar, Hitek	5.00
132474-00	Key stoppers (100 per package)	18.00
271045-00	IC, 65C816 microprocessor (U14)	32.00
180003-00	IC, EPROM, system, 9320 (U12)	32.00
271049-00	IC, Gate array (U26), 9320	27.00
271171-00	Transformer, flyback (T503)	14.00
130222-00	IC 2681, dual UART (U9)	27.00
271189-01	Tube, CRT, 14", flat, pro, white	65.00
271189-02	Tube, CRT, 14", flat, pro, amber	65.00
293551-00	Yoke, deflection, DY-2016D	11.00

All prices are subject to change without notice. Minimum spare parts order is $50.00.

NOTE: TeleVideo does not stock any of the following parts--only the parts listed in Table 4-1.

Table 4-2. Parts Reference List

PCB ASSEMBLY

Description	Location
IC 3488 2x line driver	U1, 2
IC 75146 2xDIFF line receiver	U3, 4
IC 2681 dual UART	U9
IC 1231 power monitor	U10
IC system EPROM	U11, 12
IC static RAM 8K x 8 100ns low power	U13
IC 65C816 microprocessor 5 MHz	U14
IC 2672 CRT controller, 5Mz	U15
IC 74S174 6x inverter buffer/driver	U16
IC 74S157 4x 2-to-1 data select	U18, 22-24
IC 7406 6x inverter buffer/driver	U20
IC 74S04 6x inverter	U21
IC gate array	U26
IC 74S32 4x 2-in positive OR gate	U27
IC 74S08 4x 2-in AND gate	U28
IC static RAM 8K x 8 70ns	U29, 36
IC 74ALS245 bus transceiver 3-state	U32, 33
IC static RAM, 8K x 8 100ns	U34
IC 74S374 8x D-type flip-flop	U35

Table 4-2. Parts Reference List (continued)

PCB ASSEMBLY (CONTINUED)

Description	Location
Cry 3.6864 MHz	Y1, 4
Cry osc 44.4528 MHz	Y2
Cry 26.9892 MHz	Y3
Res CF 150 ohm 1/4W 5%	R1
Res CF 47K ohm 1/4W 5%	R2, 6, 7
Res CF 27K OHM 1/4W 5%	R3, 4, 9, 10
Res CF 10K ohm 1/4W 5%	R5, 8
Res CF 4700 ohm 1/2W +/- 5%	R11, 23, 30, 36
Res CF 1000 ohm 1/4W 5%	R12, 13, 24, 28
Res CF 330 ohm 1/4W +/- 5%	R14, 20, 21
Res CF 100 ohm 1/4W 5%	R15
Res CF 120 ohm 1/4W 5%	R16, 22, 35
Res CF 510 ohm 1/4W 5%	R17
Res CF 470 ohm 1/4W 5%	R18, 19, 29
Res CF 2.2M ohm 1/2W 5%	R25
Res CF 47 ohm 1/4W 5%	R26
Res CF 180 ohm 1/4W 5%	R27
Res CF 82 ohm 1/4W 5%	R32, 33
Res PK 4.7K ohm 10-pin sip	RP1
Volt reg, 79L05AC	U38
Tran, 2N2222A metal	Q1
Tran, 2N4264 NPN	Q2, 3
Cap gl pk 0.1uF 25V +80%	C1, 9, 10, 15-26, 28, 30-32, 34, 35, 37-39, 43-46, 49-54, 57-62, 69
Cap gl pk 330pF 25V +/- 20%	C2-8, 11-14
Cap elec 22uF 16V +80%	C27, 64-66
Cap tant 0.68uF 50V 10%	C29
Cap tant 4.7 uF 16V +/-10%	C33, 56
Cap mono 0.01uF 50V 10%	C40
Cap gl pk 100pF 50V 10%	C41
Cap cer 220pF 50V 5%	C42
Cap cer 33pF 100V 10% radial	C47
Cap gl pk 10pF 25V +/-20%	C48
Cap elect 1uF 50V 20% radial	C55
Cap elect 10uF 16V 80%	C63
Cap cer 150pF 50V 10% radial	C67
Cap mica 10pF 50V 5%	C68
Diode zener 1N974B	CR1-4
Diode 1N5817 Schot bar rect 1AC	CR5-7
Diode 1N914	CR8
Diode 1N4001	CR9, 10

Table 4-2. Parts Reference List (continued)

PCB ASSEMBLY (CONTINUED)

Conn 4P modular jk RJ11	P1
Conn 6P modular jk DEC eqv	P3, 4
Conn 25p D-sub fem short pcmt	P5
Conn 25p D-sub male short pcmt	P6
Conn 2phdr str lp	W1-3, 5
Conn 3p hdr str lp	W7, 9, 13-15
Socket 40p IC DIP	U9, 14, 15
Socket 28p IC DIP	U11-13, 29, 30, 34, 36, 37
Socket 84p chip carrier	U26
Transducer, audio	Speaker

PCB ASSEMBLY VIDEO MONITOR

Res CF 4700 ohm 1/4W 5%	R301
Pot trim 330K ohm NVR 83 HDZ	R302, 308, 510
Res CF 100 ohm 1/4W 5%	R303, 305, 318
Pot trim 100K ohm NVR 83 HDZ	R304
Res CF 1000 ohm 1/4W 5%	R306, 513
Res CF 390K ohm 1/4W 5%	R307, 507
Res CF 47K ohm 1/4W 5%	R309, 508, 509
Res CF 220K ohm 1/4W	R310
Res CF 33K ohm 1/4W 5%	R311, 511
Res CF 56K ohm 1/4W	R312
Res CF 10K ohm 1/2W 5%	R313
Res CF 3.3 ohm 1/4W	R314
Res CF 1 ohm 1/2W 5%	R315
Res CF 68K ohm +/-5% 1/4W	R316
Res CF 3.3 ohm 1/2W	R317
Pot trim 470 ohm NVR 83 HDZ	R401
Res CF 68 ohm 1/4W 5%	R402
Res CF 470 ohm 1/4W 5%	R403
Res CF 100 ohm 1/4W 5%	R404, 501
Res CF 2.2K ohm 1/4W 5%	R405
Res CF 330 ohm 1/4W 5%	R406
Res CF 33 ohm 1/2W 5%	R500
Res CF 33 ohm 1/4W 5%	R502
Res CF 10 ohm 1/2W 5%	R503
Res CF 330 ohm 1/2W 5%	R504
Res CF 1M ohm 1/4W +/- 5%	R505
Pot trim 2.2M ohm NVR 83 HDZ	R506
Res CF 10K ohm 1/4W 5%	R 512, 515, 516
Res MOS 1K ohm 2W	R514

Table 4-2. Parts Reference List (continued)

PCB ASSEMBLY VIDEO MONITOR (CONTINUED)

Description	Location
Cap PF 0.1uF 50V	C301-304, 307, 310, 507
Cap cer 470pF 50V	C305
Cap elect 10uF 16V 10% radial	C306, 402
Cap elect 1000uF 16V 10% 13x16mm	C308, 309, 313, 509
Cap cer 220pF 50V 5%	C311, 401, 506
Cap elect 100uF 25V	C312
Cap cer 0.01uF 50V 20%	C403
Cap elect 22uF 16V 20%	C500
Cap elect 4.7uF 16V	C501
Cap PF 0.033uF 50V 5%	C502
Cap PP 0.018uF 400V	C503
Cap MF 0.01pF 630V	C504
Cap elect 100uF 50V	C505
Cap elect 2.2uF 25V 10% NF	C508
Cap MP 0.047uF 630V 10% radial	C510
Cap elect 22uF 100V	C511
Cap elect 100uF 100V radial lds	C512
Cap PF 0.015uF 50V 10%	C513
Cap PF 0.001uF 400V	C514
Tran 2N2222A metal	Q301
Tran 2N2369A	Q401
Tran BF 259	Q402
Tran KTC200Y	Q501
Tran BU407 TO-220 w/mica	Q502
Coil width	L501
Coil linearity fixed	L502
Pot sliding 100K ohm 0.1W	RT1
Spark gap 1.0pF 1KV cer cap	SG1
Conn 4p hdr w/lock blue	Yoke
Socket crt 7p w/hrn CSA5	
Diode 1N4004 mot	D301
Diode 1N4148	D302, 501
Diode zener 1N5234B 6.2V	D401
Diode MR856	D502, 503
Diode BA159	D504-506, 508
Diode FR157	D507
IC vert amp TDA-1170N	IC301
Trans H drive HDI-8224A	T501
Trans focus FT-90010	T502
Trans flyback	T503

Table 4-2. Parts Reference List (continued)

Description	Location
PCB ASSEMBLY POWER SUPPLY	
IC 3524A DIP	U101
Res CF 100K ohm 1/2W 5%	R101, 102
Res MF 180K ohm 1W 5%	R103
Res MOR 22K ohm 2W 5%	R104
Res CF 470K ohm 1/2W 5%	R105
Res MOR 1.8K ohm 2W 5%	R106
Res CF 3300 ohm 1/4W 5%	R107, 112
Res CF 4700 ohm 1/4W 5%	R108, 110, 111
Res CF 18K ohm 1/4W 5%	R109
Res CF 10K ohm 1/4W 5%	R113
Res CF 2.7K ohm 1/4W +/-5%	R114
Res CF 68 ohm 1/4W 5%	R115
Res CF 1000 ohm 1/4W 5%	R116, 206
Res CF 2.2K ohm 1/4W 5%	R117, 119, 205
Res CF 47 ohm 1/4W +/-5%	R118
Res MOR 0.3 ohm 1W 5%	R120, 121
Res CF 390 ohm 1/2W 5%	R201
Res CF 1K ohm 1/2W 5%	R202
Res 39 ohm 1/4W 5%	R203
Res CF 100 ohm 1/2W 5%	R204
Cap m/paper 4700pF 250V Y-type	C101, 102
Cap mp 0.047uF 250V X-type	C103, 104
Cap mp 0.0047uF 250V Y-type	C105, 106
Cap elect 100uF 200V RS	C107, 108
Cap cer 0.01uF 1KV	C109
Cap elect 100uF 35V	C110
Cap cer 470pF 1KV 20%	C111
Cap cer 0.022uF 50V	C112
Cap cer 0.01uF 50V 20%	C113
Cap cer 220pF 50V 5%	C114
Cap elect 47uF 25V 20% radial	C115
Cap cer 0.1uF 50V 10%	C116
Cap mylar 0.022uF 50V 20%	C117
Cap PF 0.1uF 50V 10%	C118
Cap elect 10uF 25V RS	C119
Cap elect 100uF 25V RUF	C201, 202
Cap elect 1000uF 16V RUF	C203, 204
Cap elect 1000uF 10V RUF	C205, 206
Transistor switching MJE 13007A	Q101
Transistor SGS 13003T	Q102
Transistor 2N2222A NPN/silicon	Q103
Transistor KN2907	Q201

Table 4-2. Parts Reference List (continued)

PCB ASSEMBLY POWER SUPPLY (CONTINUED)

Description	Location
Diode bridge RS-205	BD-101
Diode fast recovery FR-105	D101, 103
Diode fast recovery FR-102	D102
Diode 1N4148	D104-107, 204
Diode SR106 Schottky	D201
Heat sink K0150-3	D202, 203
Diode zener 10V 1W	Z101, 102, 203
Diode zener 13V 1/2W	Z201
Diode zener 5.6V 1/2W	Z202
Coil choke 25U	L201, 202
Coil choke 8U	L203
Coil line filter T30-03	T101
Transformer main T30-01	T102
Transformer feedback T30-02	T103
Transformer sync P40-04A	T104
Thyristor TYN-058 50V 8A	SCR201
Thermistor 10.0 ohms 3A	TH101
Pin selector R93-31	115/230V
Label voltage 115V SMPS	115V
Washer M3 flat st zn, nut M3 hex st zn, screw bh m3x10	Q101, ac inlet 2
Fuse 1.6A 125V 5x2Omm SB, clip fuse dia 5	F101
Clip gnd 965 (SN-plate)	PD
Heat sink (BU406) 965, insulating pad 0.125 id 0.150 od	Q101
Sw main smk JP39 965	SW101
Pot trim 5K ohm 1/2W 82MR5K	SFR101
Socket 16p IC DIP	U101

PCB ASSEMBLY KEYBOARD VT-320

IC 7414 6x Schmitt trig	U1
Res CF 10K ohm 1/4W 5%	R10
Res CF 3300 ohm 1/4W 5%	R1-9, 11, 12
Cap tant 22uF 25V +/-10%	C1, 7
Cap tant 4.7 uF 16V +/-20%	C2
Cap cer 0.01uF 16V 20%	C3, 4
Cap mica 10pF 50V 5%	C5, 6
Cry 5.7143 MHz	Y1
Diode 1N4148	CR1-6
Socket 40p IC DIP	U2
Wire 30awg Kynar UL 1423 blue A	W1-16

SERVICE INFORMATION

If your terminal has technical problems that you can't solve on your own, TeleVideo's Technical Support Department will assist you. The phone number is (408) 745-7760. International customers can telex 474-5041. Or you can call your regional sales office, listed in this section.

Return Procedure

TeleVideo products are covered by a limited warranty, found in this section. For service under warranty you must return products to TeleVideo's factory repair facility.

1. To return a terminal or part for service, call Customer Service for a Return Material Authorization (RMA) number.

2. Have the following information ready:

   a. Your name and your company's name, address and telephone number. Give a street address, since freight delivery services do not deliver to a post office box.

   b. Your terminal's model number and serial number.

   c. A brief but accurate description of the problem. If you have more than one problem, list each problem separately. A separate RMA will be issued for each item. TeleVideo can repair only the problems described on an RMA.

3. Tag each item to be returned with the RMA number and your description of the problem. This is especially important if you plan to ship more than one part in the same container. See the *Operator's Manual* for information about packing the terminal for shipment.

4. For fastest service, write the RMA number on the shipping label. If the RMA number is missing, the entire procedure will be delayed considerably.

5. Use the RMA number if you call to ask about your terminal while it is being repaired.

6. If the item is under warranty, it will be returned to you via best way. All express shipments will be at the customer's expense and must be requested when receiving the RMA.

Regional Sales Offices

Corporate
1170 Morse Avenue
P.O. Box 3568
Sunnyvale, CA 94088-3568
(408) 745-7760

Los Angeles
15303 Ventura Blvd., Suite 900
Sherman Oaks, CA 91405
(818) 907-5563
(818) 378-0194 (car phone)

Newport Beach
1200 Quail St., Suite 170
Irvine, CA 92715
(714) 476-0244

Chicago
1002 E. Algonquin Road, Suite 112
Schaumburg, IL 60195
(312) 397-5400

Texas
1431 Greenway Dr., Suite 110
Irving, TX 75038
(214) 550-1060

Atlanta
6075 The Corners Parkway, Suite #208
Norcross, GA 30092
(404) 447-1231

Ohio
Four Commerce Park Square
23200 Chagrin Blvd, Suite 600
Beachwood, OH 44122
(216) 292-8187
216) 464-7609 (FAX)
Telex: 433-2054

Virginia
International Bldg., Suite 1200
8150 Leesburg Pike
Vienna, VA 22180
(703) 893-1663 or 1671
(703) 790-5933 (FAX)

New York
6900 Jericho Turnpike, Suite 100 LL
Syosset, NY 11791
(516) 496-4777

Massachusetts
1601 Trapelo Road
Reservoir Place
Waltham, MA 02154
(617) 890-3282

United Kingdom
The Business Centre
Molly Millars Land
Workingham
Berkshire RG11 2QZ
England
Phone: 011-44-734-771800
FAX: 011-44-734-772461
Telex: 847169

The Netherlands
Saturnusstraat 25
2132 HB Hoofdorp
The Netherlands
Phone: 011-31-2503-35444
Telex: 74615 TLVDO NL

France
3 bis rue leCorbusier
bat. Berne Silic 244
94568 Rungis Cedex, France
Phone: 011-33-1687-34-40
Telex: 205191F
FAX: 011-33-1-4686-0222

Germany
Einsteinstrasse 1
6108 Weiterstadt
Frankfurt, West Germany
Phone: 011-49-6150-14076/78
Telex: 6150912
FAX: 011-49-6150-12971

5 Schematics

Table 5-1 gives a brief description of the ICs on the logic section of the circuit board. Although there is only one circuit board, note that you can read the revision levels of the logic board, video board, and power supply as if they were three separate boards. Find the word "Revision" on the side of the circuit board, followed by three letters (such as "E B D"). These letters indicate the revision levels of each module in the following order:

logic board video board power supply

For example, if you see "Revision E B D" on the side of the board, this means level E (logic board), level B (video board), and level D (power supply).

Table 5-1. Circuit Board IC Reference

Location	Schematic Page	Type/Description
U10	1	IC DS1231 power monitor
U11	1	IC 27512 user EPROM
U12	1	IC 27512 system EPROM
U13	1	IC 6264LP system NVR
U14	1	IC 65C816 microprocessor 5MHz
U15	2	IC 2672 CRT controller 5MHz
U16	2	IC 74S174 hex D flip-flop
U18, 22-24	2	IC 74S157 4x 2-to-1 data sel
U29	2	IC 20256 8k x 8 attribute RAM
U32, 33	2	IC 74S245 bus transceiver 3-state
U36	2	IC 20256 8k x 8 character RAM
U1, 2	3	IC MC3488 4x line driver
U3, 4	3	IC 75146 4x line receiver
U9	3	IC 2681 dual UART
U26	4	IC gate array
U34	4	IC 8k x 8 character generator
U35	4	IC 74S374 8x D-type flip-flop

A Service Bulletins

Installing Additional Display Memory

The standard 9320 terminal is shipped with two pages of memory. However, it's possible to upgrade the display memory to eight pages by installing two RAM chips. The instructions are as follows:

WARNING

Do not open the terminal case unless you are a qualified technician. Opening the case exposes you to hazardous voltages, even after the power is turned off and the cord is disconnected.

Tools required:

- Medium Phillips screwdriver
- Small flat screwdriver (or chip puller)

Parts required:

Two 32K x 8, 70ns static RAM chips (Mitsubishi M5M256AP-70, Sony CXK58256PN-70L, or equivalent)

Procedure:

1. Remove the circuit board, following the steps given in Section 3.

2. Locate the existing 8K x 8 RAM chips (locations U29 and U36). Using a small flat screwdriver (or chip puller), remove the two chips from their sockets, noting the direction of the notches.

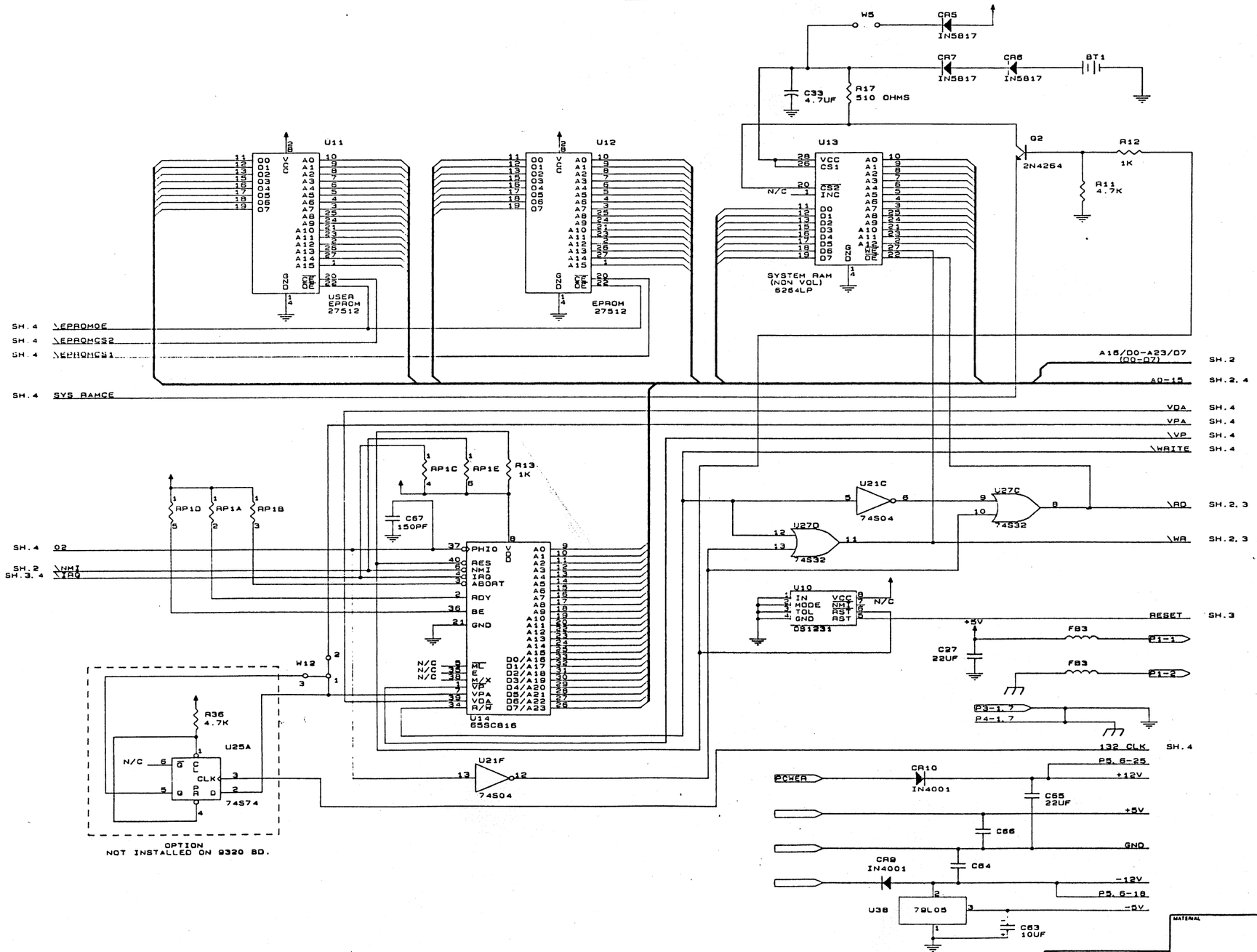
3. Insert the 32K x 8 RAM chips into the two sockets just vacated. Avoid the most common mistakes:
   a. Make sure the notches are facing the right direction.
   b. Make sure the pins are aligned with the openings, and avoid bending any of the pins when inserting the chips.

4. Find the jumpers at locations W6 and W8; lift the jumpers from position 1-2 and replace them on position 2-3.

5. Replace the circuit board, following the steps given in Section 3.

This completes installation. The terminal will now operate with eight pages of display memory.

APPLICATION		REVISION	DESCRIPTION	ECO NO.	DATE	APPROVED
NEXT ASSY	FIRST USED ON					
		A	PROD REL	4087T		
		B	CORR. VIDEO MODULE	4194T		



NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS ARE VALUE IN OHMS +5% AND ARE 1/4W.
2. ALL CACITORS ARE VALUED IN MICROFARADS.
3. THESE FOLLOWING PACKAGE GATES ARE NOT CURRENTLY BEING USED:

4. SPARE POSITION U31
5. DO NOT INSTALL 74S74 - U25, Z1-Z5, CR11, CR12.

MATERIAL
FINISH
REMOVE ALL BURRS AND SHARP EDGES

TOLERANCES UNLESS NOTED
DIMENSION MM / INCH
ANGLES

CONTRACT NUMBER
DES DATE
DR DATE
CHK DATE
ENGR DATE
DESIGN ACTIVITY APPROVAL
CUSTOMER APPROVAL

TeleVideo Systems, Inc.

PCB SCH 9320

SIZE D | CODE IDENT | 133113-00 | REV B

SCALE | SHEET 1 OF 4

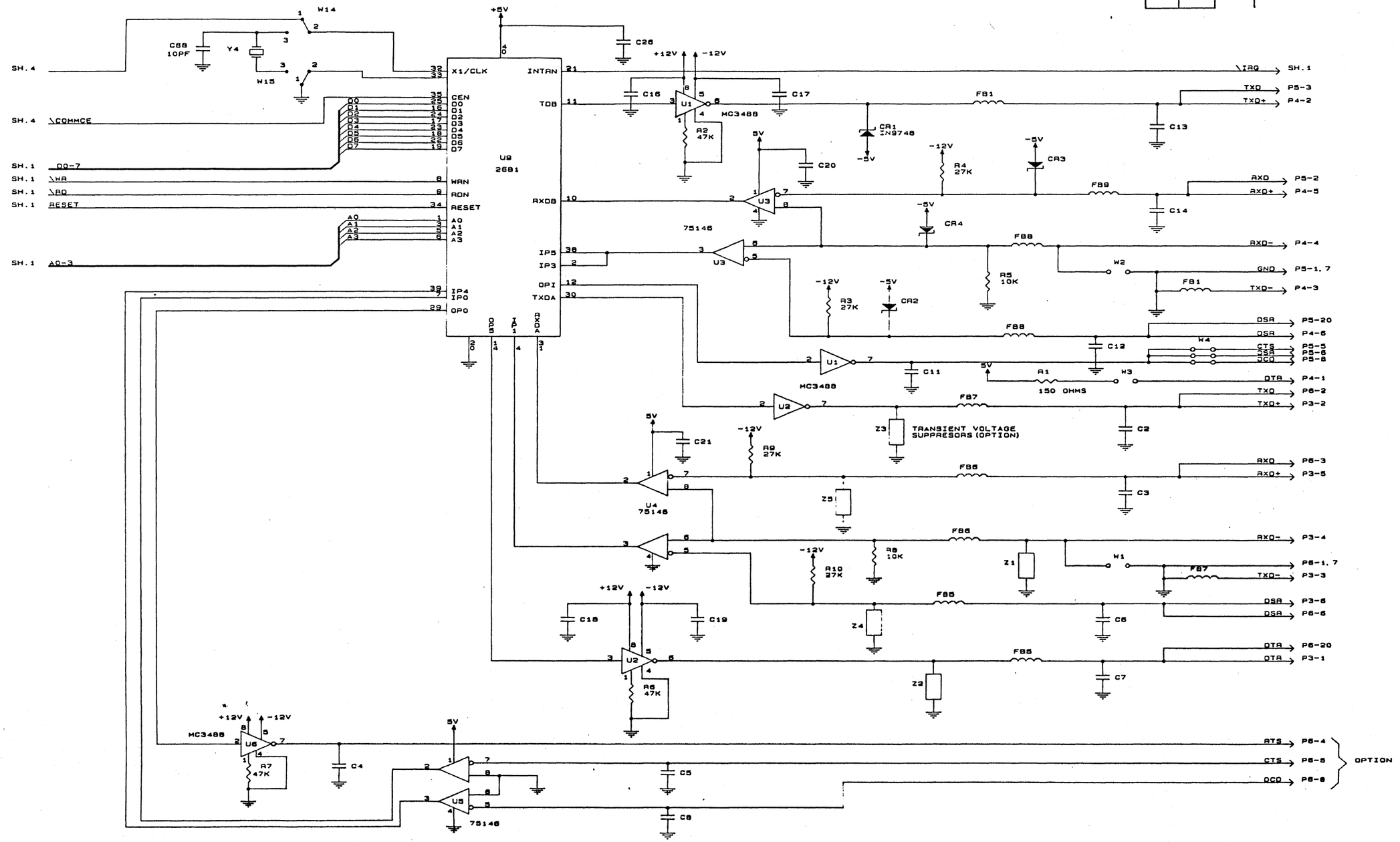
APPLICATION		REVISION	DESCRIPTION	ECO NO.	DATE	APPROVED
NEXT ASSY	FIRST USED ON					
			SEE SH.1			

VIDEO MOD HSYNC
VIDEO MOD VSYNC
R19 470 OHMS
R18 470 OHMS
RP1I
U20E
U20F
U20D
7406
SH.1 D0-D7
U15
2672T 5MHZ
SH.1 A0
SH.1 A1
SH.1 A2
SH.1 A3
SH.4 \CATCE
SH.1 SH.4 \PUTCLK
U28D
74S08
RP1H
W10
W11
U16
74S174
+5V
RP1G
U21E
U28C
W13
U22
U23
U24
U18
74S157
A0'
A1'
A2'
A3'
A4'
A5'
A6'
A7'
A8'
A9'
A10'
A11'
A12'
A13'
SH.1 A0-13
SH.4 MUXDIR
U20B
RP1F
SH.4 ECONOMY
SH.4 CHAR RAM \WR
SH.4 DISAIA
SH.4 ATT RAM \WR
SH.4 TRANCE
SH.4 TRANDIR
A0'-A12'
CHAR U37 OPTION
CD0-CD7
N/C
W8
W7
U36
U28B
20256 CHAR 8K x 8 32K x 8
SH.4 NMI
SH.4 CD0-7
SH.4 ATD0-7
U32
U29
W9
20256 ATTRI 8K x 8 32K x 8
U21B
74S04
U28A
74S08
SH.4 LASTL
SH.4 UNDLN
U33
74LS245
SH.1 D0-7
SH..4 CURSOR
ATTR U39 OPTION
ATD0-ATD7

MATERIAL
FINISH
REMOVE ALL BURRS AND SHARP EDGES
TOLERANCES UNLESS NOTED
DIMENSION
FRACT. INCH
.X ± .5
.XX ± .25
.XXX ± .125
ANGLES ±
CONTRACT NUMBER
DES DATE
DR DATE
CHK DATE
ENGR DATE
DESIGN ACTIVITY APPROVAL
CUSTOMER APPROVAL

TeleVideo Systems, Inc.
PCB SCH 9320
SIZE D
CODE IDENT 133113-00
REV 3
SCALE
SHEET 2 OF 4

APPLICATION		REVISION	DESCRIPTION	ECO NO.	DATE	APPROVED
NEXT ASSY	FIRST USED ON					
			SEE SH.1			



NOTE: P5 = FEMALE CONNECTOR - PRINTER = DCE
P6 = MALE CONNECTOR - HOST = DTE

MATERIAL
FINISH
REMOVE ALL BURRS AND SHARP EDGES

TOLERANCES UNLESS NOTED
DIMENSION / TOL. INCH
X = ±
XX = ±
XXX = ±
ANGLES ±

CONTRACT NUMBER
DES DATE
DR. DATE
CHK. DATE
ENGR. DATE
DESIGN ACTIVITY APPROVAL
CUSTOMER APPROVAL

TeleVideo Systems, Inc.
PCB SCH 9320
SIZE D | CODE IDENT | 133113-00 | REV B
SCALE | SHEET 3 OF 4

APPLICATION		REVISION	DESCRIPTION	ECO NO.	DATE	APPROV
NEXT ASSY	FIRST USED ON					
			SEE SH.1			

Y2 44.4526 MHZ
R35 120 OHMS
+5V
R23 4.7K
Y3 28.9892MHZ
U21D 74S04
R22 120 OHMS
U21A 74S04
132 CLK SH.1
R25 2.2 MOHMS
Y1 3.6864MHZ
C48 10PF
C47 33PF
C41 100PF
R20 330
R21 330
C42 220PF
C40 .01UF
R30 4.7K
PWR UP RST
C55 1UF

U26
GATE ARRAY
271049-00

SH.2 UNDLN
SH.2 \CRTCS
SH.1 SYS RAMCS
SH.2 HSYNC
SH.2 CRT BLANK
SH.2 FAST CLK
SH.1 \WRITE
SH.3 COMMCS
SH.2 CURSOR
SH.2 VSYNC
SH.2 TRANCS
SH.2 TRANDTR
SH.2 HUNDTA
SH.1 \EPROMCS1
SH.1 \EPROMCS2
SH.1 \EPROMOE
SH.3 DTR
N/C
SYSTEM CLOCK 02 SH.1
PVT CLOCK SH.2
COMM CLK2 N/C
MSBCG
VGAD3
VGADR
VGAD1
VGAD0
\CHAR RAM WR SH.2
\ATT RAM WR SH.2
\CHAR GEN WR SH.4
\CS1 SH.2
\CS2 SH.4
CHAR LATCH SH.4
ECONOMY SH.2

SH.2 ATD0-7
SH.1 DD-7
P1-4
FB2
U27A 74S32
CR11
K8D RXD
DEC
HALF INT
VIDEO OUT PUT
MODE
K8DTXD
IRQ
TONE
R29 470
R28 750
U20C 7406
CR8 IN914
R27 180
+5V
-12V
C56 4.7UF
Q3 2N4264
R24 1K
R26 47 OHMS
FB4
VID MON
U27B 74S32
R15 100 OHMS
VIDEO MODULE
FB3
P1-3
SH.1
CR12
+5V
R16 120 OHMS
R14 68 OHMS
C29 .68UF
SPEAKER
Q1 2N2222

SH.1 \VP, VPA, VDA
SH.1 A0-2, A13-15
SH.2 CD0-7
SH.4 CHAR LATCH
SH.4 \CHAR GENWR

U35 74S374
R33 82
N/C
U34 8K x 8 CHAR GEN
R32 82

CONFIDENTIAL
THIS DOCUMENT IS THE PROPERTY OF TELEVIDEO SYSTEMS, INC. AND CONTAINS INFORMATION WHICH IS CONFIDENTIAL AND PROPRIETARY TO TELEVIDEO. NO PART OF THIS DOCUMENT MAY BE COPIED, REPRODUCED OR DISCLOSED TO THIRD PARTIES WITHOUT THE PRIOR WRITTEN CONSENT OF TELEVIDEO SYSTEMS, INC.

MATERIAL
FINISH
REMOVE ALL BURRS AND SHARP EDGES
TOLERANCES UNLESS NOTED
DIMENSION SEE INDIV
ANGLES
CONTRACT NUMBER
DES DATE
DR DATE
CHK DATE
ENGR DATE
DESIGN ACTIVITY APPROVAL
CUSTOMER APPROVAL

TeleVideo Systems, Inc.
PCB SCH 9320
SIZE D | CODE IDENT | 133113-00 | REV B
SCALE | SHEET 4 OF 4

APPLICATION		REVISION	DESCRIPTION	ECO NO.	DATE	APPROVED
NEXT ASSY	FIRST USED ON					
		A	PROD REL	4087T	5/20/83	[illegible]
		B	UPDATE SCH TO MATCH BOM	4144T	7/4/83	[illegible]
		C	PER TVS REV B FAB	4230T	11/4/83	[illegible]

L.
N.
F.G
125V 1.6A
F101
SW101
T101
C103 0.047 250V
C104 0.047 250V
C105 0.0047 250V
C106 0.0047 250V
TH101 10 OHM 3A
BD101 RS205
J1
C107 100 200V
C108 100 200V
R101 100K 1/2W
R102 100K 1/2W
R103 220K 1/2W
R104 22K 2W
R105 22K 2W
Z101 10V 1W
Q102 SGS13003T
C109 0.047 630V
D101 FR105
R123 1K
C120 100 25V
Q102 FR102
C110 100/35V
R115 68 OHMS
R124 3.2K
R125 10K
R126 10K
D104 IN4148
C113 .01U 50V
C112 0.022 50V
SFR101 5K
R107 3.3K
R108 4.7K
R109 18K
C114 220PF
R110 4.7K
R111 4.7K
D105 IN4148
R113 10K
C115 47/25V
R112 3.3K
D106 IN4148
C116 0.1
U101 UC3524A
C117 0.022
R114 2.7K
R116 1K
C118 0.1/50V
C119 10/25V
R118 47 OHMS
Q101 MJE13007A
Z102 10V 1W
Q103 2N2222A
R117 2.2K
R12 0.3 1W
R12 0.3 1W
D107 IN4148
R119 2.2K
T104
T102
D201 SF14
L201
C201 100/25V
C202 100/25V
R201 390 1/2W
-12V 1.5A
R207 470
C207 0.01
D202 SF24
L202
C203 1000/16V
C204 1000 16V
SCR201 TYN-058
R202 1K 1/2W
Z201 13V 1/2W
Z202 5.6V 1/2W
R203 39
+12V 1.6V
R208 10
C208 0.01
D203 SR506
L203
C205 1000 10V
C206 1000 10V
R204 100 1/2W
+5V 1.5A
COM.
C111 470PF 1KV
D103 FR105
R106 1.8K 2W
R205 2.2K
Z203 10V 1W
R206 1K
Q201 KN2907
D204 IN4148
T103
SYNC.

CONFIDENTIAL
THIS DOCUMENT IS THE PROPERTY OF TELEVIDEO SYSTEMS INC. AND CONTAINS INFORMATION WHICH IS CONFIDENTIAL AND PROPRIETARY TO TELEVIDEO. NO PART OF THIS DOCUMENT MAY BE COPIED, REPRODUCED OR DISCLOSED TO THIRD PARTIES WITHOUT THE PRIOR WRITTEN CONSENT OF TELEVIDEO SYSTEMS, INC.

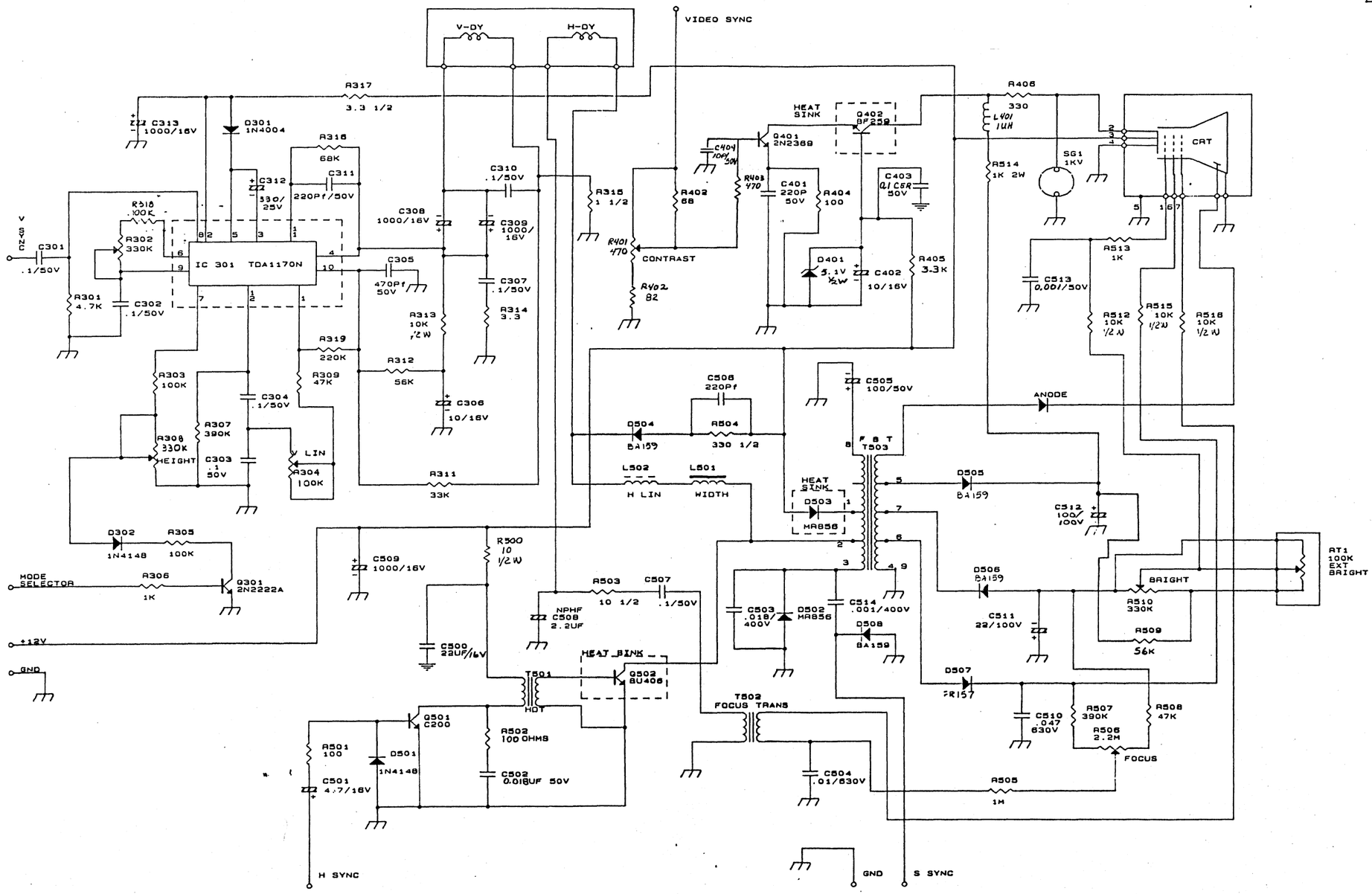
MATERIAL
FINISH
REMOVE ALL BURRS AND SHARP EDGES

TOLERANCES UNLESS NOTED
DIMENSION TYP. INCH
X = ±
XX = ±
XXX = ±
ANGLES ±

CONTRACT NUMBER
DES DATE
DR DATE
CHK. DATE
ENGR. DATE
DESIGN ACTIVITY APPROVAL
CUSTOMER APPROVAL

TeleVideo Systems, Inc.
PCB SCH
POWER SUPPLY 9320
SIZE D | CODE IDENT | 133137-00 | REV C
SCALE | SHEET 1 OF 1

APPLICATION		REVISION	DESCRIPTION	ECO NO.	DATE	APPROVED
NEXT ASSY	FIRST USED ON					
		C	PROD REL	4087T	5/24/	
		D	INCORP PER ECO	4113T	7/11/	
		D1	TVC CORR	4144T	9/13/	
		E	PER TVC REV B FAB	4230T		

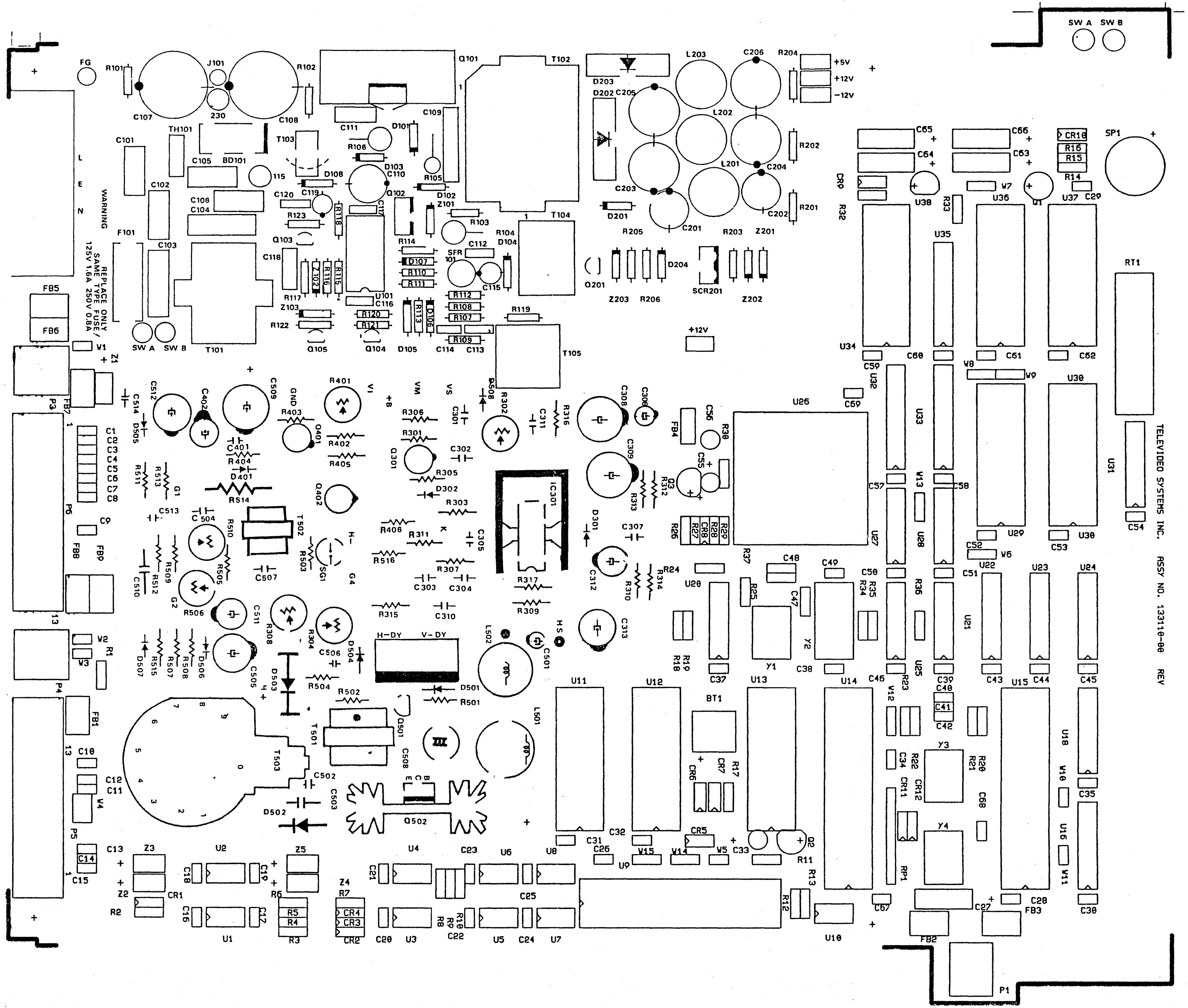


NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS ARE MEASURED IN OHMS, 1/4W AND ± 5% .
2. ALL CAPACITORS ARE MEASURED IN UF .

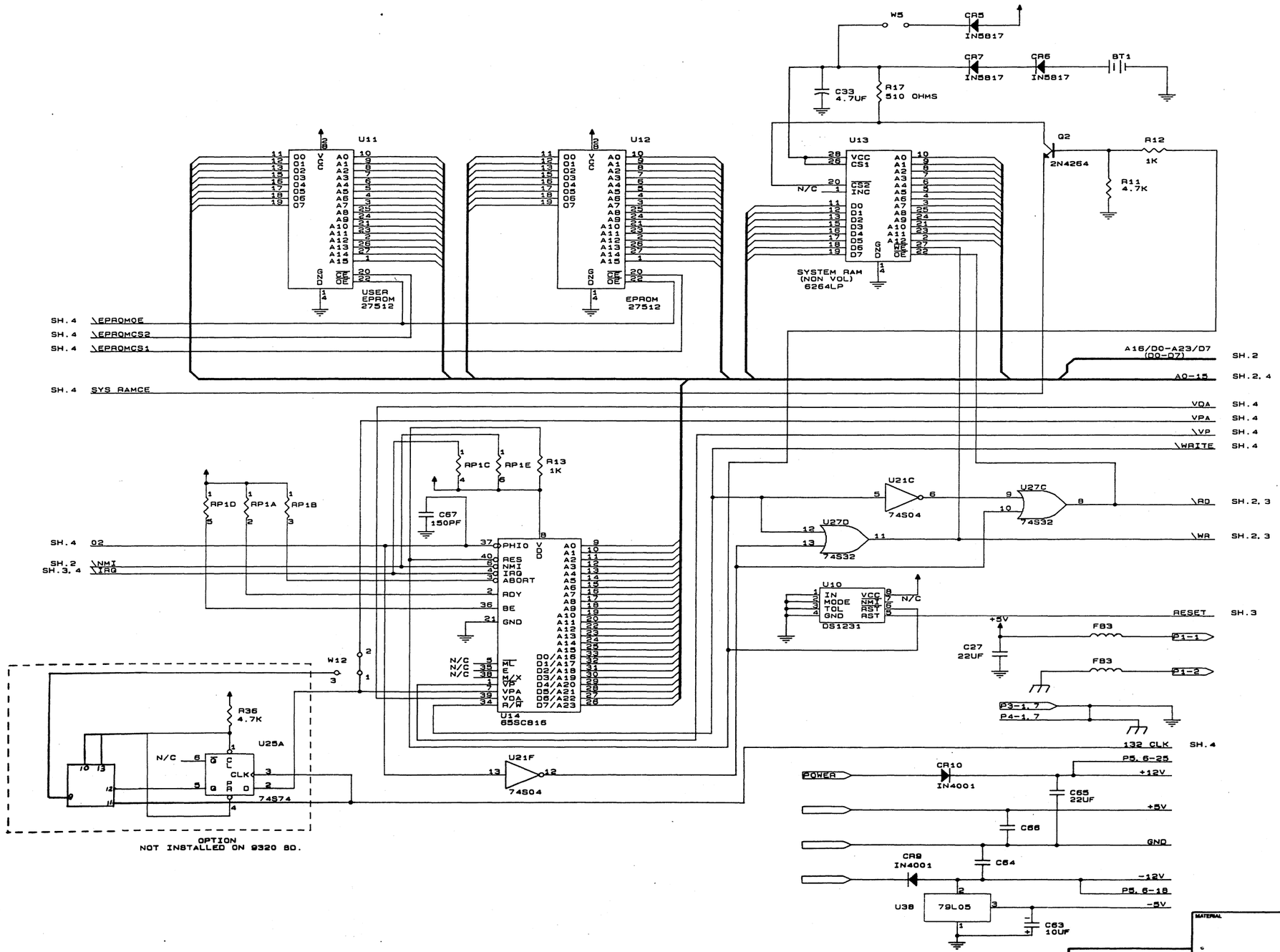
MATERIAL
FINISH
REMOVE ALL BURRS AND SHARP EDGES
TOLERANCES UNLESS NOTED
DIMENSIONS: TWO PLACE ± / THREE PLACE ± / ANGLES °
CONTRACT NUMBER
DES DATE
DR DATE
CHK DATE
ENGR DATE
DESIGN ACTIVITY APPROVAL
CUSTOMER APPROVAL

TeleVideo Systems, Inc.
PCB SCH
VIDEO MONITOR 9320
SIZE D | CODE IDENT | 133139-00 | REV E
SCALE | SHEET 1 OF 1



9320 BOARD

APPLICATION		REVISION	DESCRIPTION	ECO NO.	DATE	APPROVED
NEXT ASSY	FIRST USED ON	A	PROD REL	4087T	4/20/83	R.Pratt
		B	CORR. VIDEO MODULE	4144T	9/29/83	
		C	REL REV C FAB	4250T	6/1/84	R Kabat



NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS ARE VALUE IN OHMS +5% AND ARE 1/4W.
2. ALL CACITORS ARE VALUED IN MICROFARADS.
3. THESE FOLLOWING PACKAGE GATES ARE NOT CURRENTLY BEING USED:

4. SPARE POSITION U31
5. DO NOT INSTALL Z1-Z5, CR11, CR12.

MATERIAL

FINISH

REMOVE ALL BURRS AND SHARP EDGES

TOLERANCES UNLESS NOTED

DIMENSION REF. INCH

X = ±
XX = ±
XXX = ±

ANGLES °

CONTRACT NUMBER

DES. DATE
DR. DATE
CHK. DATE
ENGR. DATE
DESIGN ACTIVITY APPROVAL
CUSTOMER APPROVAL

TeleVideo Systems, Inc.

PCB SCH 9320

SIZE D | CODE IDENT | 133113-00 | REV C

SCALE | SHEET 1 OF 4

APPLICATION		REVISION	DESCRIPTION	ECO NO.	DATE	APPROVED
NEXT ASSY	FIRST USED ON					
			SEE SH.1			

R19 470 OHMS
R18 470 OHMS
RP1I
VIDEO MOD HSYNC
VIDEO MOD VSYNC
U20E 7406
U20F 7406
U20D 7406

SH.1 D0-D7
SH.1 A0
SH.1 A1
SH.1 A2
SH.4 \CATCE
SH.1 \PUTCLK
U28D 74S08
U15 2672T 5MHZ
BLANK
VSYNC
HSYNC
CURSOR
INTR
DADD0
DADD1
DADD2
DADD3/12
DADD4/LA0
DADD5/LA1
DADD6/LA2
DADD7/LA3
DADD8/LNZ
DADD9/LPL
DADD10/UL
DADD11/BL
DADD12/ODD
DADD13/LL
CCLK
LPS
CTRL1
CTRL2
CTRL3
RP1H
W10
W11
U16 74S174
RP1G
+5V
U21E
U28C
W13
U22 74S157
U23 74S157
U24 74S157
U18 74S157
A0
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A0'
A1'
A2'
A3'
A4'
A5'
A6'
A7'
A8'
A9'
A10'
A11'
A12'
A13'
SH.1 A0-13
SH.4 MUXDIR
RP1F
U20B 7406
U21B 74S04
U28A 74S08
SH.4 ECONOMY
SH.4 CHAR RAM \WR
SH.4 DISA14
SH.4 ATT RAM \WR
SH.4 TRANCE
SH.4 TRANDIR

A0'-A12'
U37 CHAR OPTION
CD0-CD7
N/C
U36 20256 CHAR 8K x 8 32K x 8
W8
W7
U288 74S08
U29 20256 ATTRI 8K x 8 32K x 8
W6
W9
U30 ATTR OPTION
ATD0-ATD7
N/C
U32 OPTION
U33 74LS245
CD0-7
ATD0-7
LASTL
UNDLN
D0-7
CURSOR

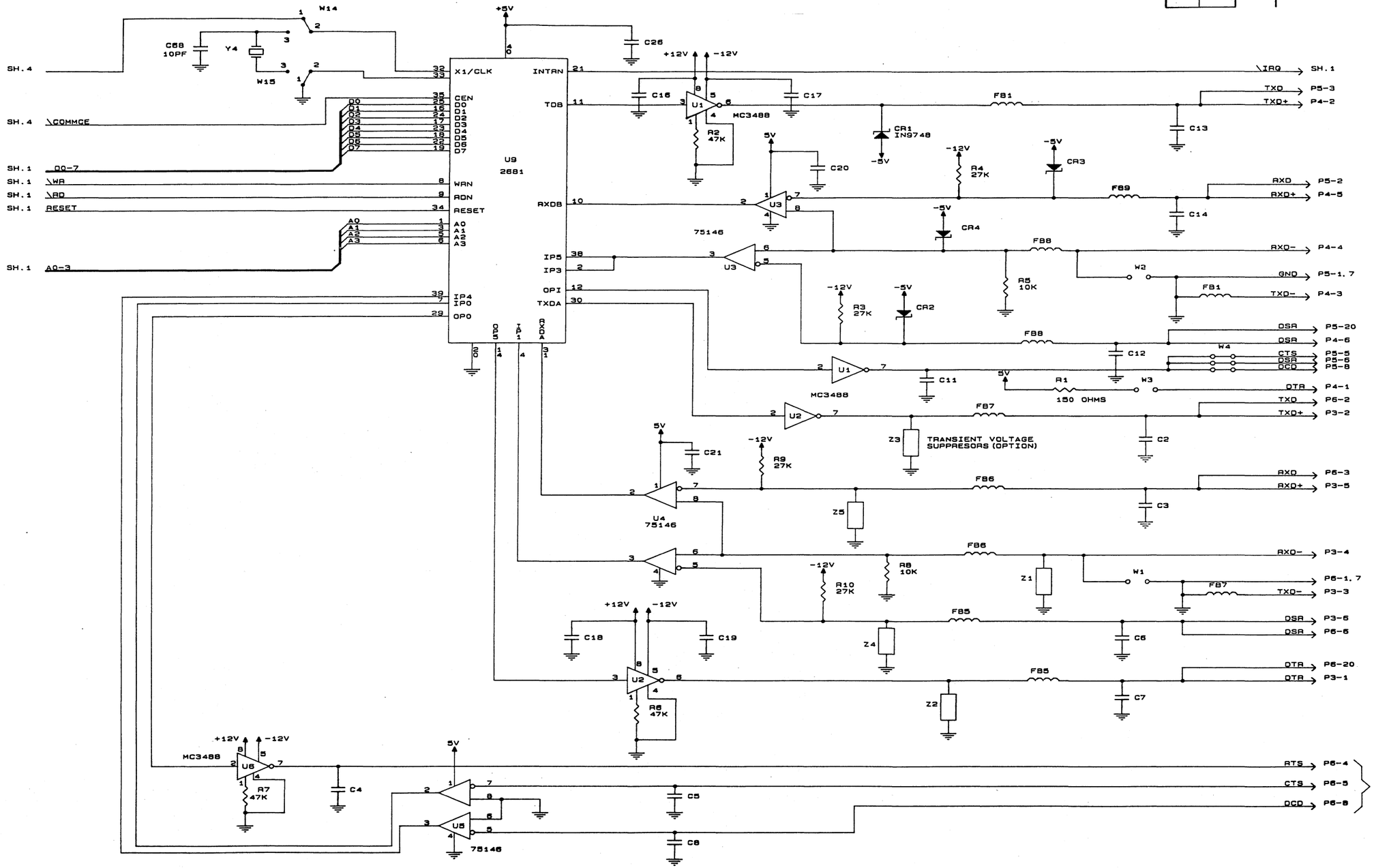
SH.4 NMI
SH.1 NMI
SH.4 CD0-7
SH.4 ATD0-7
SH.4 LASTL
SH.4 UNDLN
SH.1 D0-7
SH.4 CURSOR

MATERIAL
FINISH
REMOVE ALL BURRS AND SHARP EDGES
TOLERANCES UNLESS NOTED
DIMENSION MIL INCH
ANGLES
CONTRACT NUMBER
DSN DATE
MFG DATE
CHK DATE
ENGR DATE
REVISION ACTIVITY APPROVAL
CUSTOMER APPROVAL

TeleVideo Systems, Inc.
PCB SCH 9320
SIZE D
CODE IDENT 133113-00
REV C
SCALE
SHEET 2 OF 4

BETERCK POST REGARDS NO

APPLICATION		REVISION	DESCRIPTION	ECO NO.	DATE	APPROVED
NEXT ASSY	FIRST USED ON					
			SEE SH.1			



NOTE: P5 = FEMALE CONNECTOR - PRINTER = DCE
P6 = MALE CONNECTOR - HOST = DTE

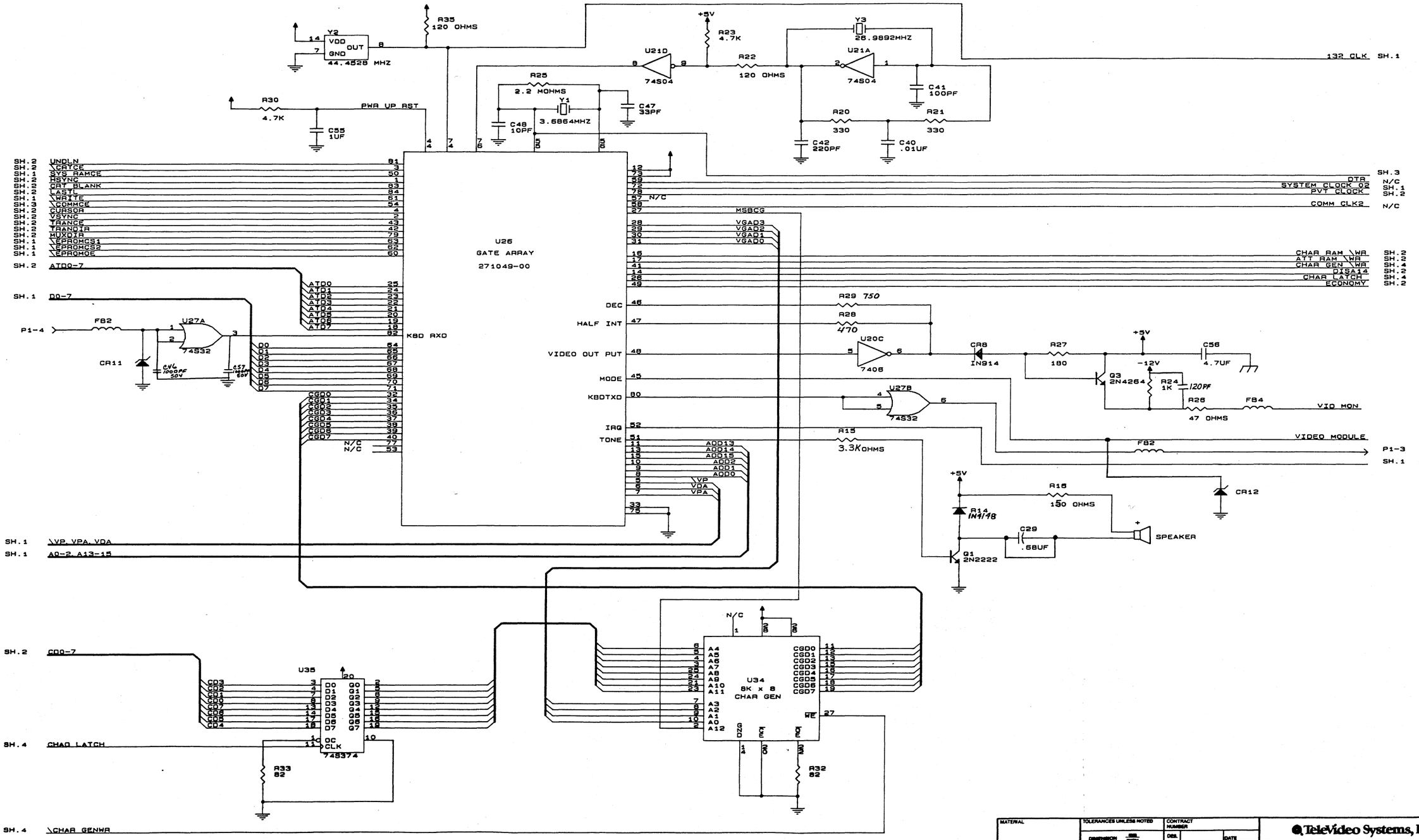
MATERIAL
FINISH
REMOVE ALL BURRS AND SHARP EDGES
TOLERANCES UNLESS NOTED
DIMENSION MM/INCH
ANGLES
CONTRACT NUMBER
DSN.
DR.
CHK.
ENGR.
DATE
DESIGN ACTIVITY APPROVAL
CUSTOMER APPROVAL

TeleVideo Systems, Inc.

PCB SCH 9320

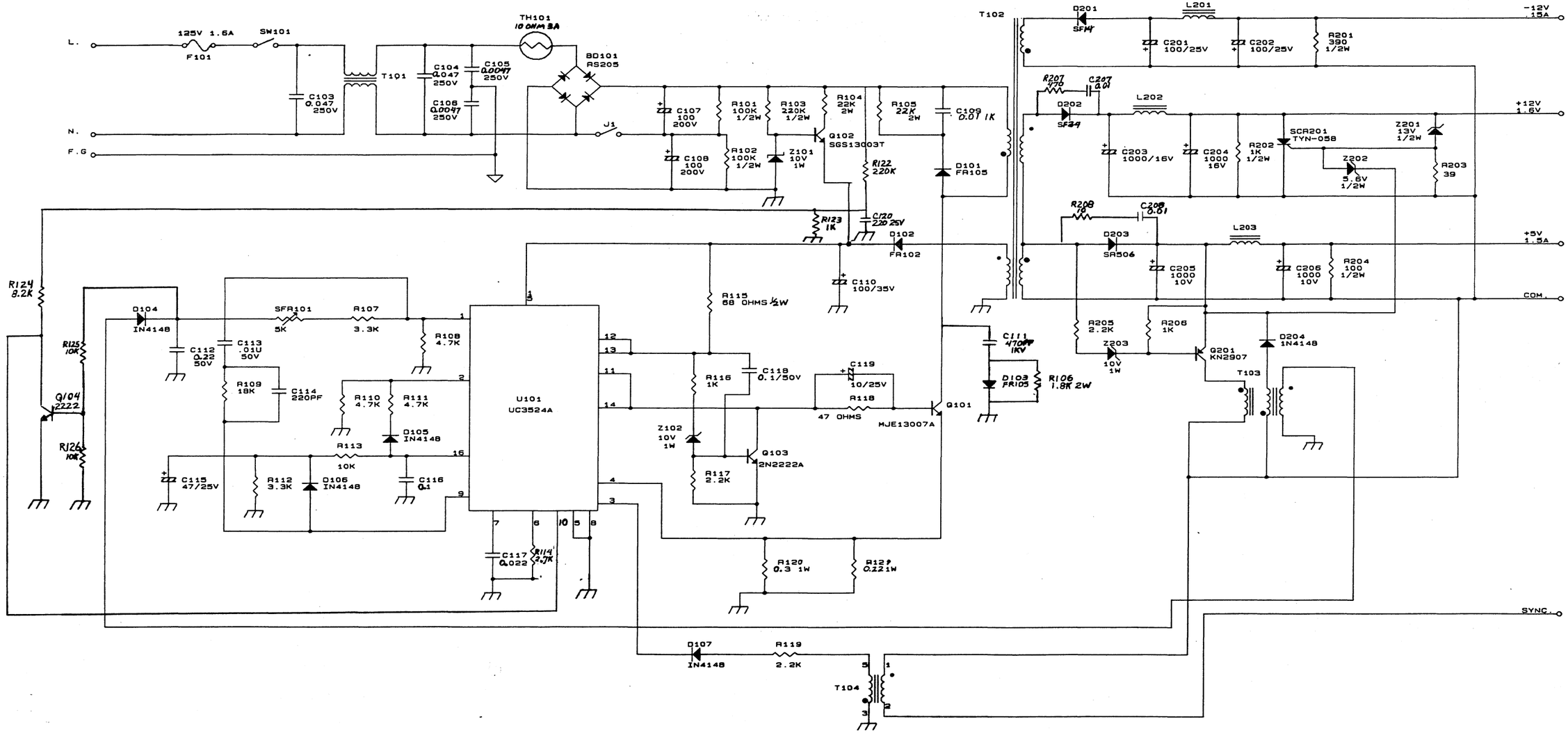
SIZE	CODE IDENT		REV
D		133113-00	C
SCALE		SHEET 3 OF 4	

APPLICATION		REVISION	DESCRIPTION	ECO NO.	DATE	APPROVED
NEXT ASSY	FIRST USED ON					
			SEE SH.1			



MATERIAL	TOLERANCES UNLESS NOTED	CONTRACT NUMBER	TeleVideo Systems, Inc.	
FINISH	DIMENSION MM INCH .X = ± .XX = ± .XXX = ±	DES. DATE DR. DATE CHK. DATE ENGR. DATE DESIGN ACTIVITY APPROVAL CUSTOMER APPROVAL	PCB SCH 9320	
REMOVE ALL BURRS AND SHARP EDGES	ANGLES ±		SIZE D · CODE IDENT 133113-00 · REV C	
			SCALE	SHEET 4 OF 4

APPLICATION		REVISION	DESCRIPTION	ECO NO.	DATE	APPROVED
NEXT ASSY	FIRST USED ON					
		A	PROD REL	4087T	5/21/97	J. R. K. H.
		B	UPDATE SCH TO MATCH BOM	4194T	9/24/97	JD CR
		C	PER TVC REV B FAB	4230T	3/16/98	R. K. H.
		D	PER TVC REV C FAB	4250T	6/1/98	R. K. H.



MATERIAL
FINISH
REMOVE ALL BURRS AND SHARP EDGES

TOLERANCES UNLESS NOTED
DIMENSION — SEE INCH
X = ±
XX = ±
XXX = ±
ANGLES ±

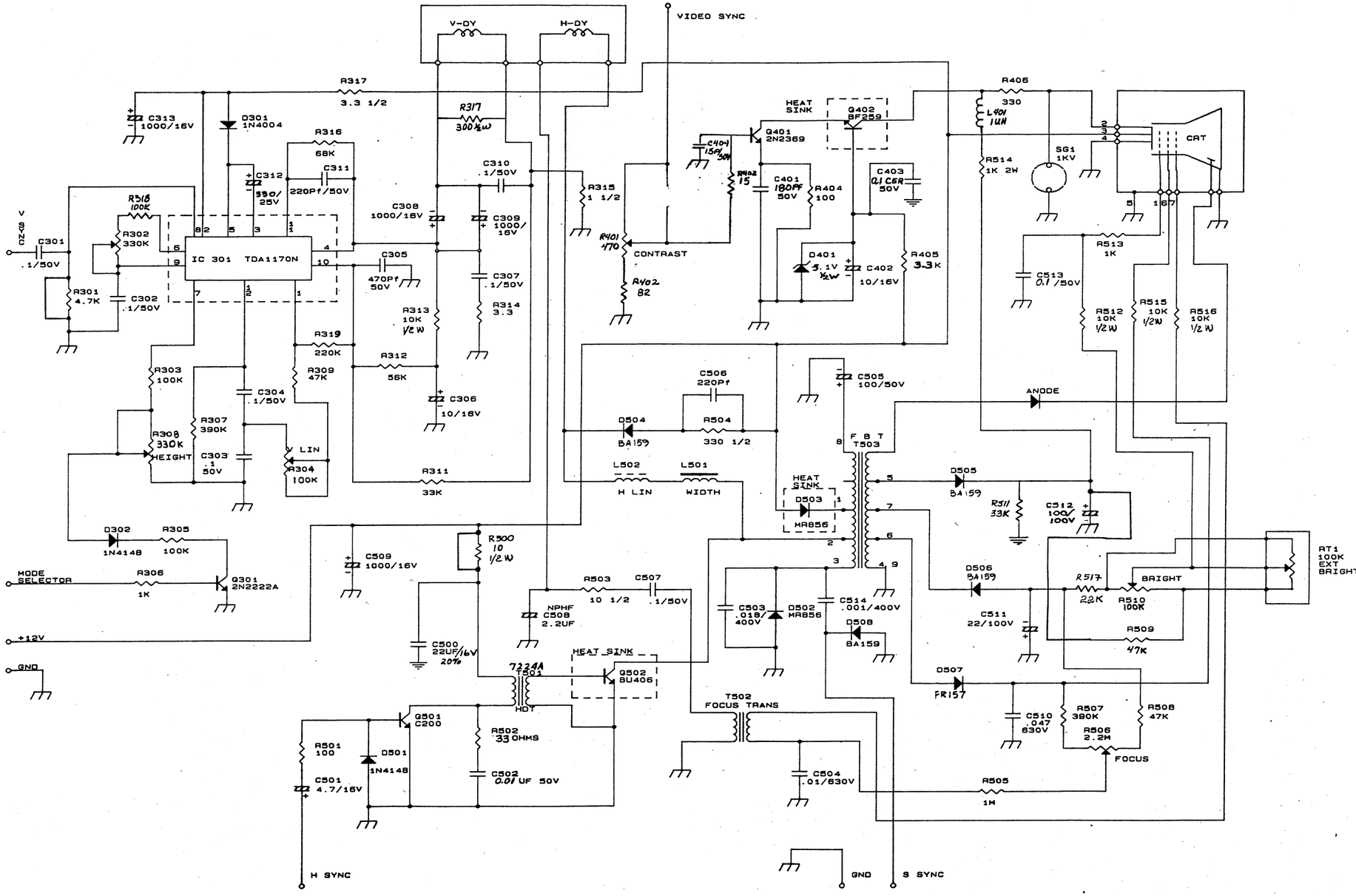
CONTRACT NUMBER
DES. DATE
DR. DATE
CHK. DATE
ENGR. DATE
DESIGN ACTIVITY APPROVAL
CUSTOMER APPROVAL

TeleVideo Systems, Inc.

PCB SCH
POWER SUPPLY 9320

SIZE	CODE IDENT		REV
D		133137-00	D
SCALE		SHEET 1 OF 1	

APPLICATION		REVISION	DESCRIPTION	ECO NO.	DATE	APPROVED
NEXT ASSY	FIRST USED ON	C	PROD REL	4087T	5/20/	J.R. Kot
		D	INCORP PER ECO	4113T	1/5/	
		D1	TVC CORR	4144T	3/23/89	
		E	PER TVC REV B FAB	4230T	3/8/89	R. Cochran
		F	PER TVC REV C FAB	4250T	6/1/89	R. Cochran



NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS ARE MEASURED IN OHMS. 1/4W AND ± 5% .
2. ALL CAPACITORS ARE MEASURED IN UF .

MATERIAL
FINISH
REMOVE ALL BURRS AND SHARP EDGES

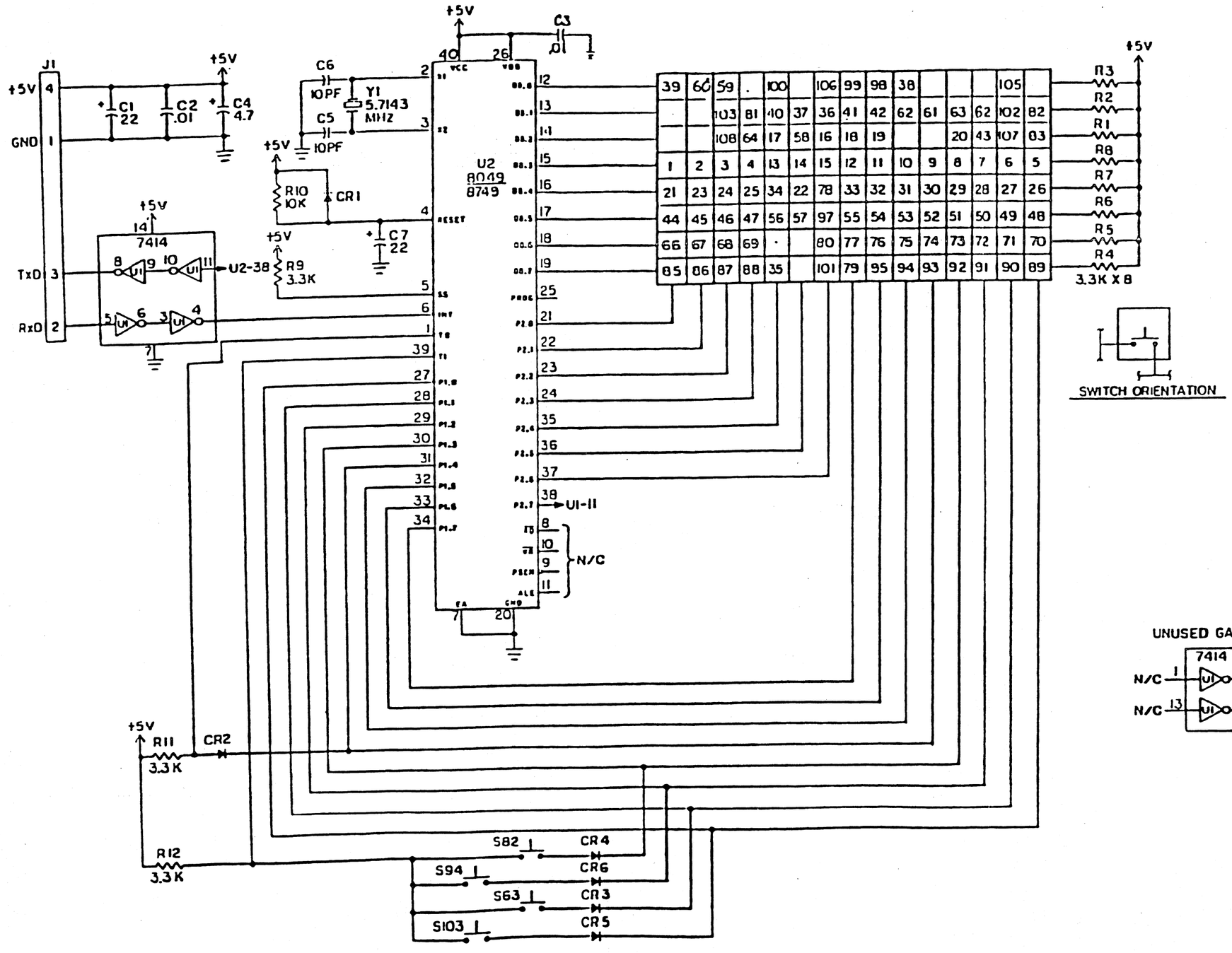
TOLERANCES UNLESS NOTED
DIMENSION DECIMAL / INCH
X = ±
.XX = ±
.XXX = ±
ANGLES ±

CONTRACT NUMBER
DES. DATE
DR. DATE
CHK. DATE
ENGR. DATE
DESIGN ACTIVITY APPROVAL
CUSTOMER APPROVAL

TeleVideo Systems, Inc.

PCB SCH
VIDEO MONITOR 9320

SIZE	CODE IDENT		REV
D		133139-00	F
SCALE		SHEET 1 OF 1	



UNUSED GATES

9320 KEYBOARD SCHEMATIC