

SECTION 14

VIDEO CONTROL MODULE

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14.1 TECHNICAL DESCRIPTION

14.1.1 General Description

The Video Control module performs two primary functions. It amplifies video input signals by multiplying them by the gain signal from the Waveform module. It provides crosshatch and text generation.

Outputs of the Video Control module are fed to the Video Output module.

14.1.2 Circuit Description

14.1.2.1 Clamp Pulse Generator

The 5V HFB signal, generated by IC39, provides the clamp pulse. Q23 amplifies and inverts the HFB signal. C125 and R211 differentiate the collector pulse of Q23; this generates a negative-going spike coincident with the leading edge of the HFB signal. The spike signal feeds the trigger input of monostable multivibrator IC12. When triggered, the output of IC12 goes high for about 2 μ S. The pulse is distributed on the module. It is also sent to the video output modules via PA1 <7.

14.1.2.2 Clamping

In the video control module, the clamp pulse is AC-coupled to the gates of Q8, Q9, Q10, Q17, Q18 and Q19. During scan, the gate-to-source voltage of each FET is about -10V; the drain-to-source channel is open. AC-coupled video is allowed to pass unimpeded. During the clamp pulse the gate-to-source voltage goes positive, causing the drain-to-source channel to turn ON. Video AC-coupled capacitors charge or discharge accordingly to establish the proper black level bias point.

14.1.2.3 Video Switch

IC11 is the video switch. It contains a 3 pole, double throw switch. Video signal levels at IC11's input are about 300 mV p-p. The ENABLE signal (TTL) controls the switch. The -12V supply and shunt regulator IC10 provide the -5V used to operate IC11.

14.1.2.4 Multipliers

The 3 multipliers permit independent gain control of the red, green and blue video signals. Gain signals provided by the waveform module vary from 0 to 5V. Each

multiplier reduces the gain range to 0 to 2V at pin 4. A differential output current is provided between pins 2 and 14. The output current develops a signal across the resistor pairs connected to the filtered and regulated 10V supply (R135 & R136, R134 & R140 and R141 & R142). The small signal generated has to be amplified. Red, green and blue null (R113, R114 & R115) are set to zero contrast for an even raster.

14.1.2.5 High Gain Video Amplifier

Wide band video amplifier, NE592, raises the signal generated across resistor pairs R135 & R136, R134 & R140 and R141 & R142 to 1V p-p. The input to NE592 is biased midway between ground and the 10V supply. The output of NE592 is internally biased.

14.1.2.6 75 Ω Buffer

The output of NE592 is AC-coupled to a two transistor, emitter-follower output stage. This buffer has a gain of 1.5 when terminated with a 75 Ω load. The input to the buffer is clamped to prevent the video duty cycle from adversely affecting its bandwidth.

14.1.2.7 Digital Section

The Video Control module generates all internal video. It also switches external and internal video.

The Video Control module contains two internal video generators, a test pattern generator and a character generator. The test pattern generator provides dot and crosshatch capabilities. These are used during projector set-up. The character generator is used to produce menus and bar charts.

Test Pattern Generator

The test pattern generator circuitry produces horizontal and vertical lines with a dot pattern superimposed.

Vertical line counter, IC32, divides the number of vertical field scan lines by 32. The resulting value is stored in IC34. It is used to load IC23 and IC33 (interval counter). The interval counter uses this value to count down the horizontal crosshatch lines generated by IC29. IC31 (a 74LS593 counter) divides HPLLCLK by 16. Its output is used by IC29 to generate the vertical lines of the crosshatch.

Character Generator

The character generator creates a 32 by 32 character display. The character set, stored in IC26 (a 1K x 8 bit ROM), contains 128 characters. The characters are based on the standard ASCII set. Characters are defined as 5 by 7 bit patterns in 8 by 8 matrices.

The projector display is memory mapped into a 1K address space in IC30 (video RAM). Text can be shown anywhere on the projector display. The generator can also switch external and internal video for any or all memory-mapped locations.

The microprocessor addresses the video RAM through buffers IC38 and IC39. The buffers isolate the external address (A(0) to A(9)) from the character generator address (B(0) to B(9)). IC31 generates the horizontal character count address, B(0) to B(4). IC32 divides the number of scan lines in a vertical frame by 256. The result is the vertical character count address, B(5) to B(9), in IC25.

The value is stored in IC28 and used to load IC22 (line width counter). Line insertion between character rows is performed by IC27 (a programmable logic device) to keep the display uniform. This operation is performed when the number of scan lines is not an integer multiple of 256.

IC30 receives cycling horizontal and vertical count addresses. It outputs the ASCII character code corresponding to the address. This code is latched by IC28. The latched code is the look-up address for IC26 (character PROM). Addresses C(0) to C(2) are the character row count. They select the row in the character's bit pattern. The row of the character's bit pattern is output from PROM storage to IC24 (parallel-in, serial-out shift register), and shifted out by HPLLCLK*.

Video Selection

The test pattern generator and character generator are microprocessor selectable. Select functions are processed by writing data to the external data address (IOSEL2). See Table 14-1.

TABLE 14-1. VIDEO SELECTION

DATA BIT			ACTION
D0	D1	D2	
–	0	0	test pattern/character generator disabled
–	0	1	character generator enabled
0	1	0	dot pattern enabled
0	1	1	dot pattern & char. generator enabled
–	0	0	test pattern/character generator disabled
–	0	1	character generator enabled
1	1	0	crosshatch enabled
1	1	1	crosshatch & char. generator enabled

14.2 SERVICING AND ALIGNMENT

14.2.1 Disassembly and Access

WARNING

STATIC SENSITIVE COMPONENTS
STATIC CONTROLLED WORK STATION REQUIRED

Module Location:

- rear panel card rack

Tools & Equipment Required:

- Phillips screw driver

- Remove the back panel as described in Section 5.2.
- Locate the Video Output module in the rear panel card rack. Using the printed circuit board extractor from the tool pouch, pull the module from the card rack as described in Section 5.2.

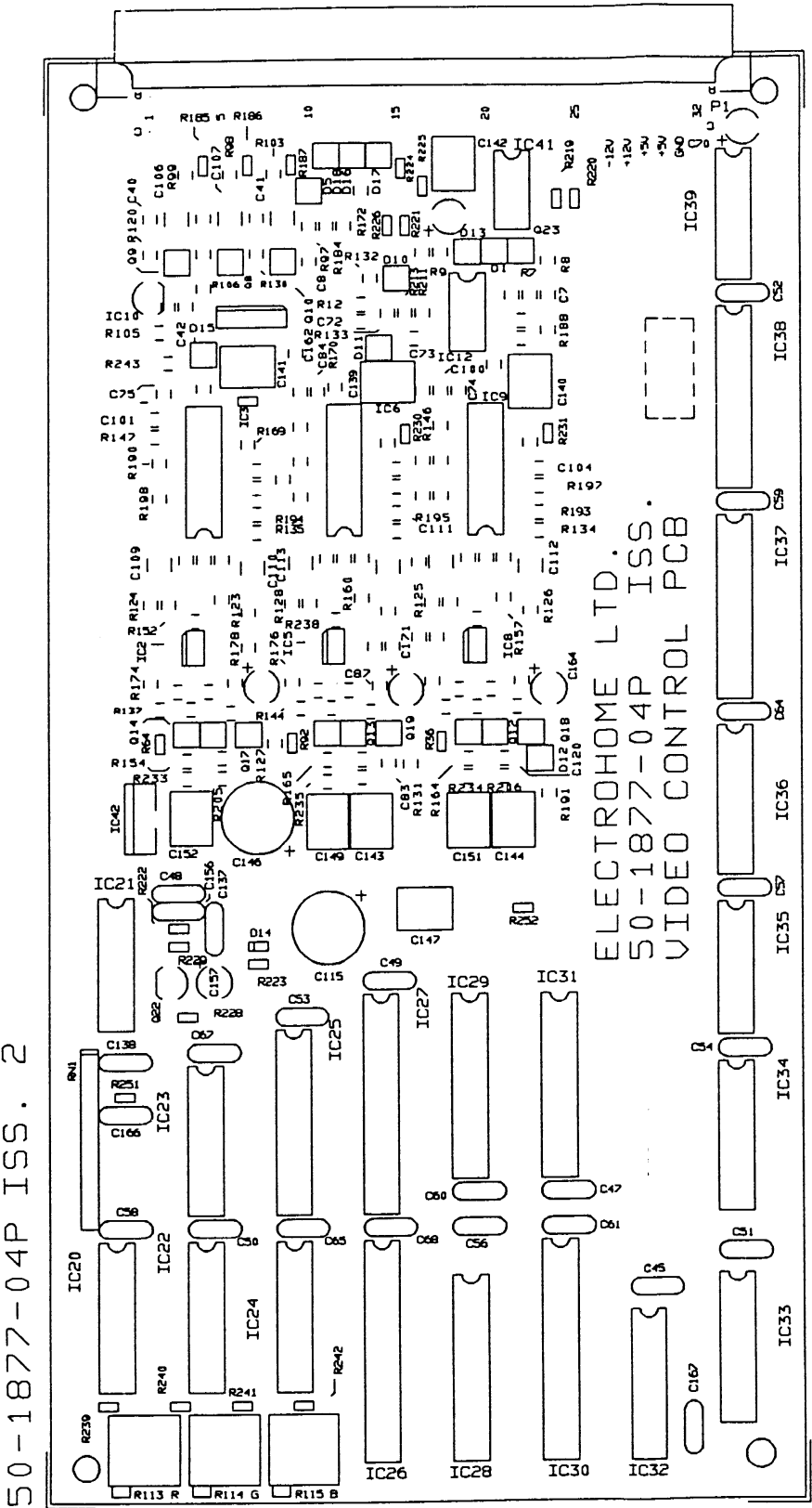
14.2.2 Alignment and Adjustments

Refer to Section 7, *Alignment Procedures*, for Video Amplifier Alignment and Color Balance Set-up.

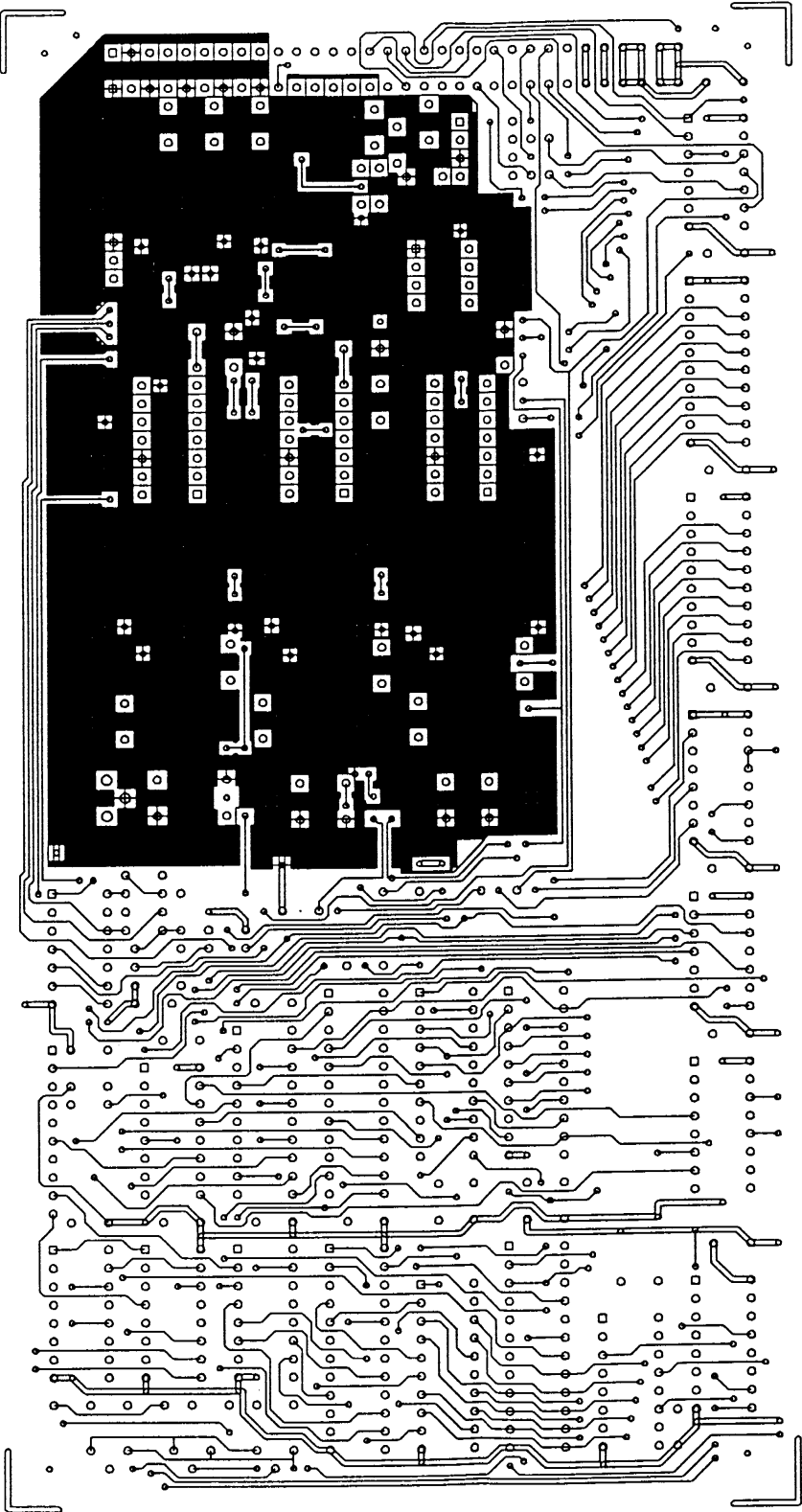
14.3 COMPONENT LAYOUT AND SCHEMATICS

Refer to the following pages for component layouts and schematics of the Video Control Module.

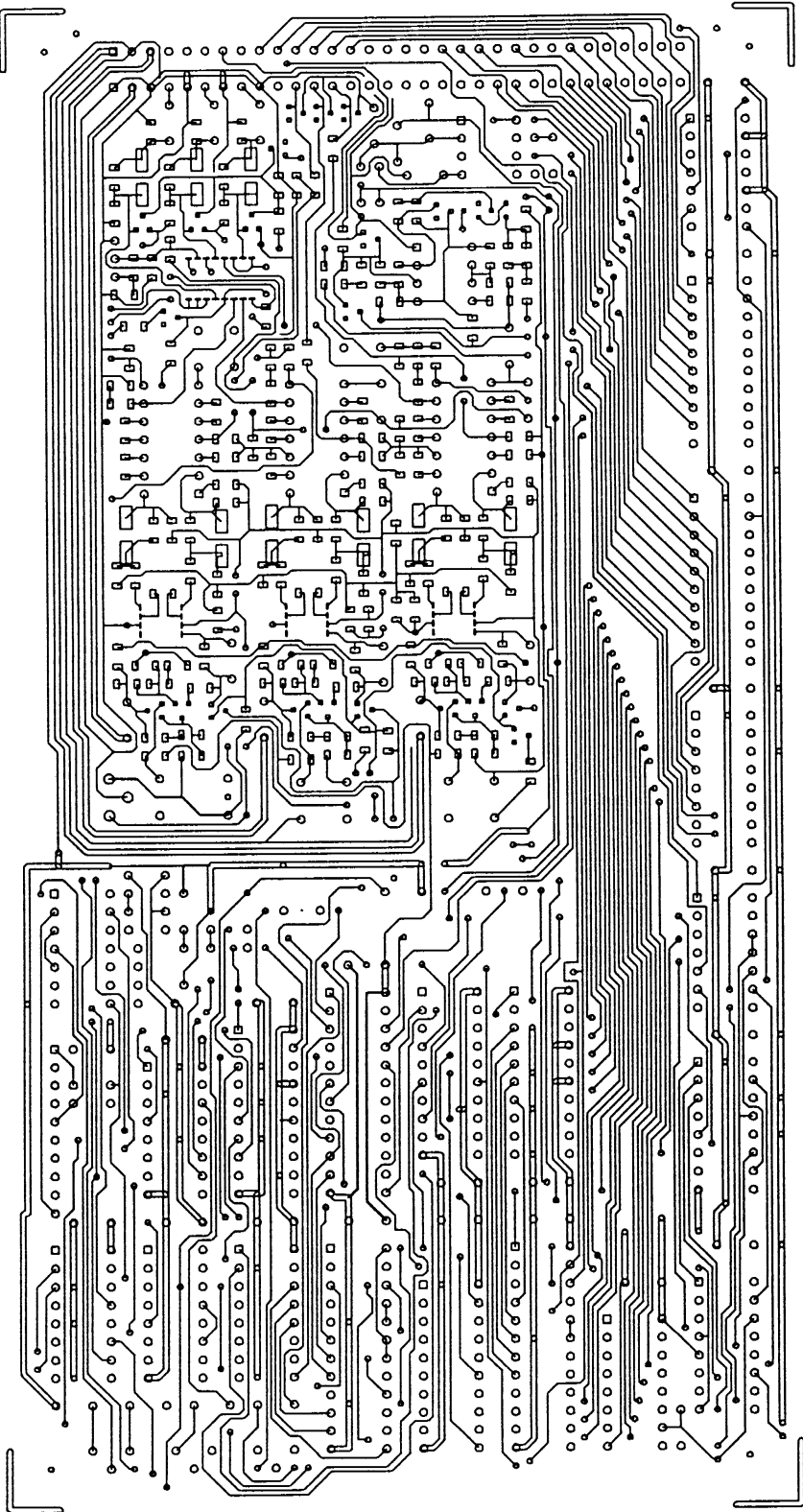
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Component Layout



Solder Side
(Viewed from Component Side)



Component Side

FIGURE 14-1.
Video Control Module Component Layout

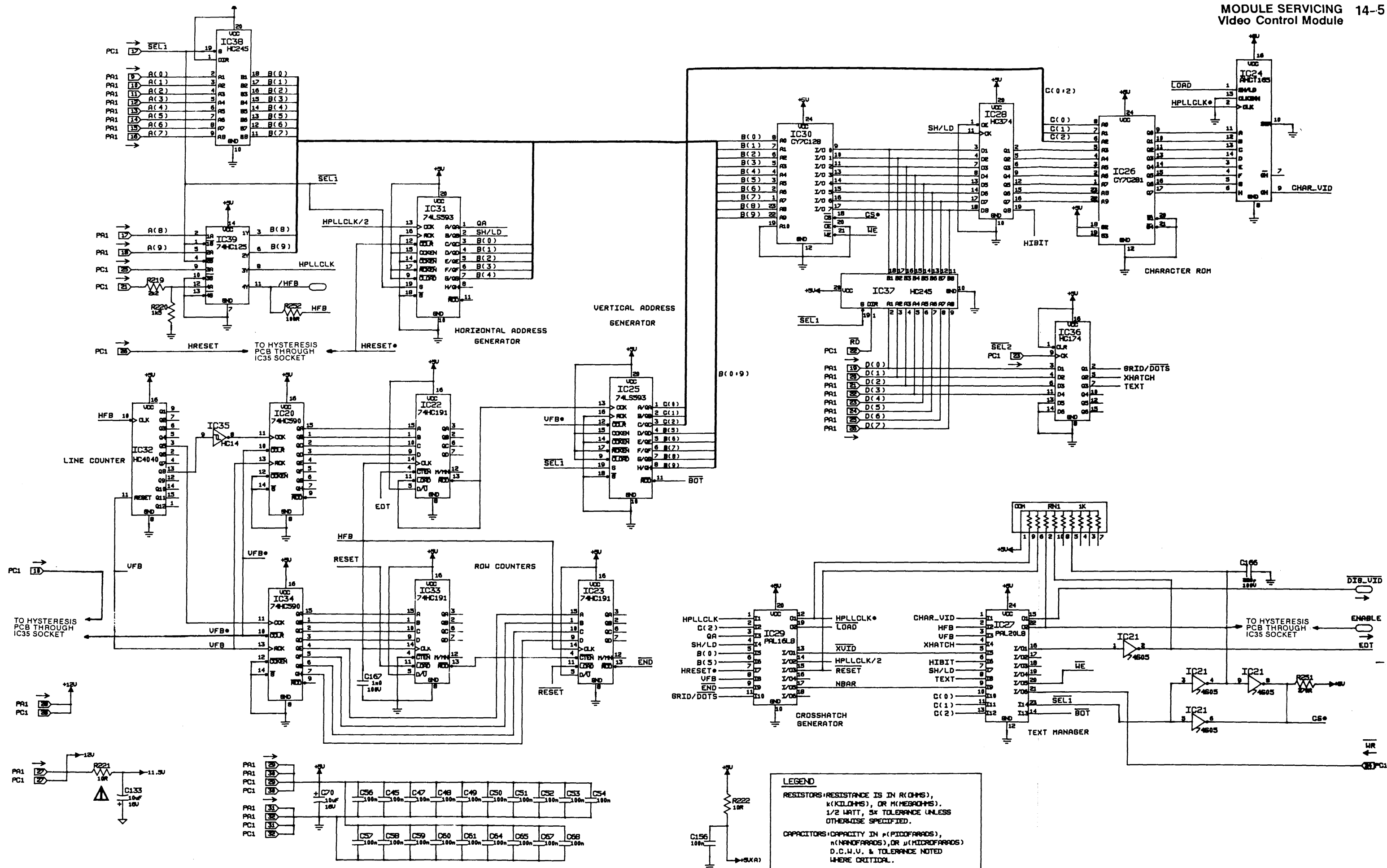
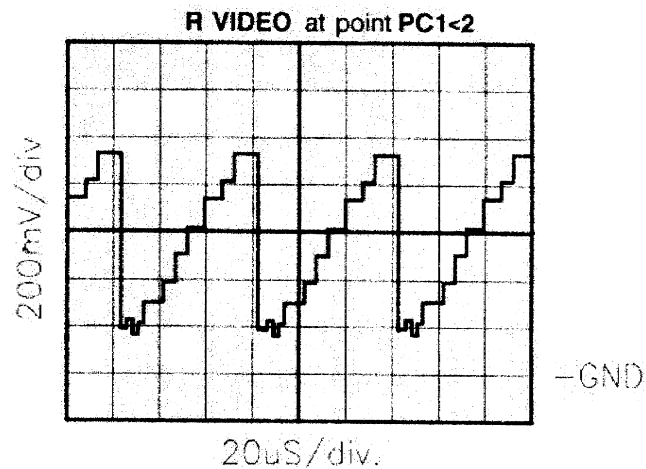
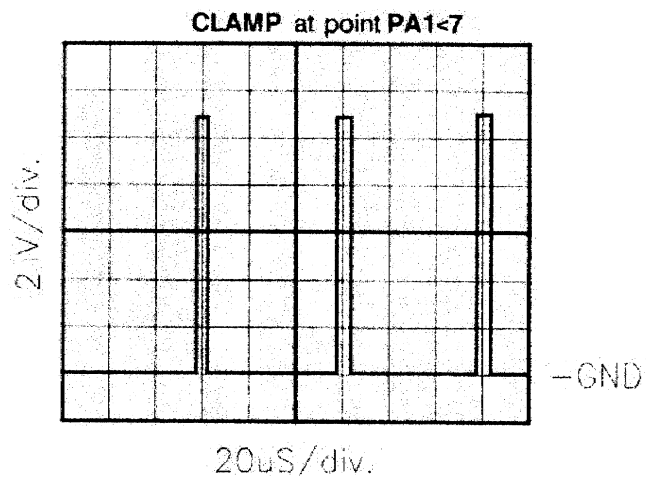
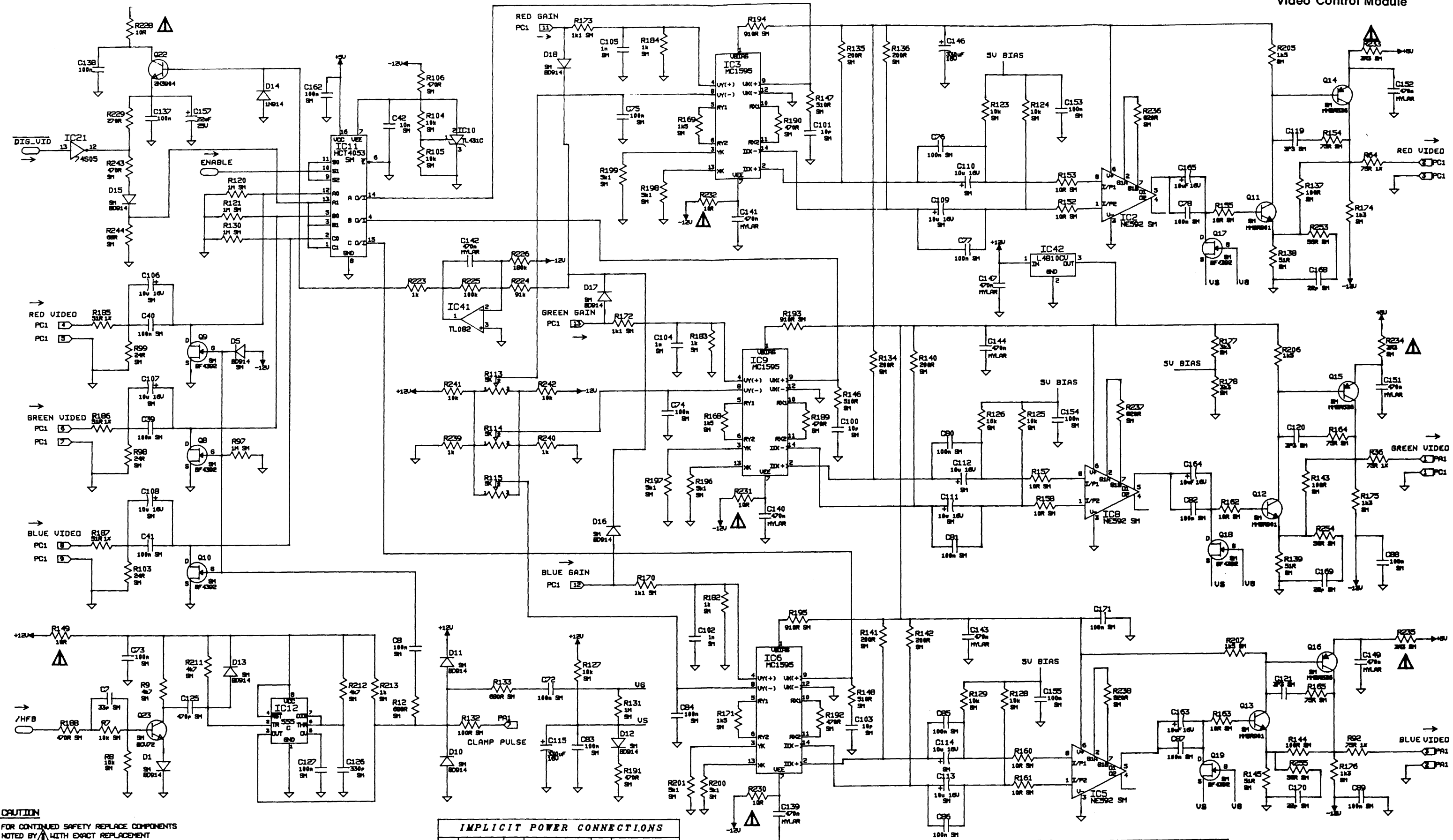


FIGURE 14-2.

SCHEMATIC REFERENCE





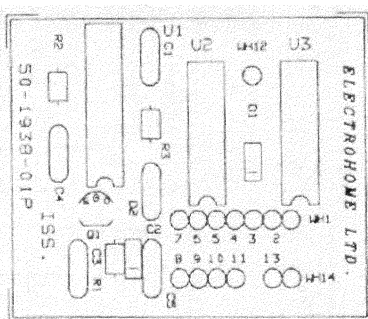
CAUTION
FOR CONTINUED SAFETY REPLACE COMPONENTS
NOTED BY WITH EXACT REPLACEMENT
PARTS ONLY. CONSULT SERVICE MANUAL PARTS
LIST SECTION "SAFETY COMPONENTS".

FIGURE 14-3.
Video Control Module Schematic (Sheet 2 of 2)

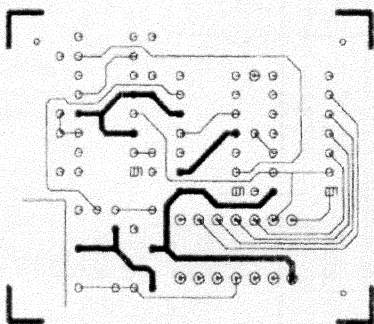
IMPLICIT POWER CONNECTIONS					
IC#	NAME	PIN#	POWER	PIN#	POWER
21	74S05	7	CIRCUIT GND	14	+5V(A)
35	74HC14	7	GND	14	UCC
41	TL082	4	-11.5V	8	+12V

54-7904-02P/54-7904-03P (06/90)
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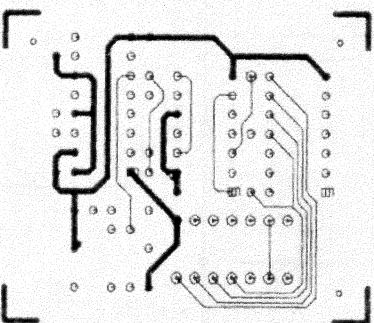
LEGEND
RESISTORS: RESISTANCE IS IN Ω (OHMS),
K(KILOHMS), OR M(MEGAOHMS).
1/2 WATT, 5% TOLERANCE UNLESS
OTHERWISE SPECIFIED.
CAPACITORS: CAPACITY IN p(PICOFARADS),
n(NANOFARADS), OR μ (MICROFARADS)
D.C.W.V. & TOLERANCE NOTED
WHERE CRITICAL.



Component Layout



Solder Side
(Viewed from Component Side :)



Component Side

FIGURE 14-4. *Hysteresis PCB Component Layout*



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14.4 PARTS LIST

14.4.1 Video Control PCB

Item Ref.	Part No.	Description
Integrated Circuits		
IC2,IC5,IC8	72-002002-02P	NE592D8, differential video amplifier
IC3,IC6,IC9	14-002095-01P	MC1595L, linear arithmetic 4-quadrant multiplier
IC10	14-002833-01P	TL431C, precision shunt regulator
IC11	72-A04001-01P	74HC4053, high speed logic
IC12	14-A04069-01P	TLC555C, CMOS timing delay
IC20,IC34	14-A04067-01P	74HC590, 8-bit binary counter
IC21	14-004696-01P	74S05, hex inverter
IC22,IC23,IC33	14-A04066-01P	74HC191, 4 bit sync up/down counter
IC24	14-A04043-02P	74AHCT165, 8 bit shift register
IC25,IC31	14-004689-01P	74LS593, 8 bit counter
IC26	14-A05041-02P	CY7C281, 1024 x 8 bit PROM (programmed)
IC27	14-004699-01P	20L8A, PAL, digital TTL
IC28	14-A04011-01P	74HC374, octal flip flop
IC29	14-004693-02P	16L8B, PAL, digital TTL
IC30	14-A05037-02P	CY7C128 2Kx8 CMOS static ram
IC32	14-A04040-01P	MM74HC4040, CMOS ripple counter
IC36	14-A04047-01P	74HC174, hex D flip flops
IC37,IC38	14-A04042-01P	74HC245, octal bus transceiver
IC39	14-A04078-01P	74HC125, quad bus buffer
IC41	14-002813-09P	TL082BC, linear op-amp
IC42	14-002845-01P	L4810CV, regulator
Transistors and Diodes		
D1,D5,D10-D13, D15-D18	72-000513-01P	MMBD914, surface mount
D14	14-000513-01P	1N914, .075A, 75V
Q8-Q10,Q17-Q19	72-000701-01P	MMBF4392, N channel FET, surface mount
Q11-Q13	72-000561-02P	MMBR901, NPN RF transistor, surface mount
Q14-Q16	72-000561-01P	MMBR536, RF transistor, surface mount
Q22	14-000881-06P	2N3904, NPN, 40V, 0.2A, 0.35W
Q23	72-000561-04P	BCV72, surface mount
Capacitors		
C7	66-433031-05P	33pF, 50V, 2% NPO
C8,C39-C41, C72-C78,C80-C89, C127,C153-C155, C162,C171	66-310411-05P	100nF, 50V, surface mount
C42	66-310311-05P	10nF, 50V, 10%, surface mount

14-12 MODULE SERVICING Video Control Module




14.4 PARTS LIST (cont.)

14.4.1 Video Control PCB (cont.)

Item Ref.	Part No.	Description
Capacitors		
C45,C47-C54, C56-C61,C64,C65, C67,C68,C137, C138,C156	89-000032-03P	100nF,50V
C70,C133, C163-C165	84-410004-01P	10 μ F, 25V
C100,C101,C103	66-410041-05P	10 pF, 50V, 5%, NPO, surface mount
C102,C104,C105	66-410231-05P	1 nF, 50V, 2%, NPO
C106-C114	64-210134-11P	10 μ F, 16V, tantalum, surface mount
C115,C146	44-433103-05P	330 μ F, 16V
C119-C121	66-433801-05P	3.3 pF
C125	66-447141-05P	470 pF, 50V, NPO, surface mount
C126	66-433141-05P	330 pF, 50V, 5%, NPO, surface mount
C157	84-422004-01P	22 μ F, 25V
C139-C144,C147, C149,C151,C152	88-174740-12P	470 nF, 63V, 10%, mylar
C166	86-622151-02P	220 pF, 100V, 10%
C167	86-610252-02P	1 nF, 100V
C168-C170	66-422041-05P	22 pF, 50V, 5%, NPO, surface mount
Resistors		
R7,R8,R104,R105, R123-R129	70-710023-21P	10K, 1/4W, 5%, surface mount
R9,R211,R212	70-747013-21P	4.7K, 1/4W, 5%, surface mount
R12,R133	70-768003-21P	680R, 1/4W, 5%, surface mount
R36,R64,R92	82-375091-29P	75R, 1/3W, 1%
R97,R120,R121,R130, R131	70-710043-21P	1M, 1/4W, 5%, surface mount
R98,R99,R103	70-724093-21P	24R, 1/4W, 5%, surface mount
R106,R188-R192, R243	70-747003-21P	470R, 1/4W, 5%, surface mount
R113-R115	41-000345-05P	5K trimpot, 20 turn
R132,R137,R143, R144	70-710003-21P	100R, 1/4W, 5%, surface mount
R182-R184,R213	70-710013-21P	1K, 1/4W, 5%, surface mount

14.4 PARTS LIST (cont.)

14.4.1 Video Control PCB (cont.)

Item Ref.	Part No.	Description
Resistors (cont.)		
R134-R136, R140-R142	70-720003-21P	200R, 1/4W, 5%, surface mount
R138,R139,R145 R146-R148	70-751093-21P 70-751003-21P	51R, 1/4W, 5%, surface mount 510R, 1/4W, 5%, surface mount
R149,R152,R153, R155,R157,R158,		
 R160-R163	70-7110093-21P	10R, 1/4W, 5%, surface mount SAFETY COMPONENT
R154,R164,R165	70-775093-21P	75R, 1/4W, 5%, surface mount
R168,R169,R171, R205-R207	70-715013-21P	1.5K, 1/4W, 5%, surface mount
R170,R172,R173 R174-R176 R177,R178 R185-R187 R193-R195 R196-R201 R219 R220	70-711013-21P 70-713013-21P 70-733013-21P 82-351191-29P 70-791003-21P 70-751013-21P 80-122015-11P 80-115015-11P	1.1K, 1/4W, 5%, surface mount 1.3K, 1/4W, 5%, surface mount 3.3K 1/4W, 5%, surface mount 51.1R, 1/3W, 1% 910R, 1/4W, 5%, surface mount 5.1K, 1/4W, 5%, surface mount 2.2K, 1/2W, 5%, metal film 1.5K, 1/2W, 5%, metal film
 R221,R222,R228, R230-R232	80-110095-11P	10R, 1/2W, 5%, metal film SAFETY COMPONENT
R223,R239,R240 R224 R225 R226 R229,R251	80-110015-11P 80-191025-11P 80-110035-11P 80-118035-11P 80-127005-11P	1K, 1/2W, 5%, metal film 91K, 1/2W, 5%, metal film 100K, 1/2W, 5%, metal film 180K, 1/2W, 5%, metal film 270R, 1/2W, 5%, metal film
 R233-R235	70-733083-21P	3.3R, 1/4W, 5%, surface mount SAFETY COMPONENT
R236-R238 R241,R242 R244 R252 R253-R255	70-782003-21P 80-110025-11P 70-768093-21P 80-110005-11P 70-756093-21P	820R, 1/4W, 5%, surface mount 10K, 1/2W, 5%, metal film 68R, 1/4W, 5%, surface mount 100R, 1/2W, 5%, metal film 56R, 1/4W, 5%, surface mount
RN1	43-000053-04P	1K resistor network

14-14 MODULE SERVICING
Video Control Module

14.4 PARTS LIST (cont.)

14.4.2 Hysteresis PCB

Note: The Hysteresis PCB mounts in the IC35 socket on the Video Control PCB.

Item Ref.	Part No.	Description
Integrated Circuits		
IC1	14-A04041-01P	MM74HC4538, CMOS multi-vibrator
IC2	14-A04007-01P	74HC74, H-CMOS dual D flip flop
IC3	14-A04073-01P	74HC14, hex schmitt trigger inverter
Transistors and Diodes		
D1,D2	14-000513-01P	1N914, .075A, 75V
Q1	14-A00705-01P	2N7000, TMOS, 60V, 0.2A, 4W
Capacitors		
C1	86-610031-04P	10pF
C2	89-000032-04P	10nF, 50V, 20%
C3,C4	86-647135-11P	470pF, 100V, 2%
C5	89-000032-03P	100pF, 50V
Resistors		
R1	80-147005-11P	470R, 1/2W, 5%, metal film
R2	80-120015-11P	2K, 1/2W, 5%, metal film
R3	80-110015-11P	1K, 1/2W, 5%, metal film

14.5 SPECIFICATIONS

Connector P1, Row A:

Pin 1	analog output G VIDEO amplitude into 75 Ω 1V p-p \pm 10% frequency response 60 MHz - 3 dB
Pin 2	ground GND
Pin 3	analog output B VIDEO amplitude into 75 Ω 1V p-p \pm 10%
Pin 4	ground GND
Pin 7	analog input CLAMP back porch clamping pulse 5 to 10V peak pulse width 1.6 to 2.0 μ S
Pin 9	digital input, address line A(0)
Pin 10	digital input, address line A(1)
Pin 11	digital input, address line A(2)
Pin 12	digital input, address line A(3)
Pin 13	digital input, address line A(4)
Pin 14	digital input, address line A(5)
Pin 15	digital input, address line A(6)
Pin 16	digital input, address line A(7)
Pin 17	digital input, address line A(8)
Pin 18	digital input, address line A(9)
Pin 19	digital in/output, data line D(0)
Pin 20	digital in/output, data line D(1)
Pin 21	digital in/output, data line D(2)
Pin 22	digital in/output, data line D(3)
Pin 23	digital in/output, data line D(4)
Pin 24	digital in/output, data line D(5)
Pin 25	digital in/output, data line D(6)
Pin 26	digital in/output, data line D(7)
Pin 27	-12V power supply -12 VDC
Pin 28	+12V power supply +12 VDC
Pin 29	+5V power supply +5 VDC
Pin 30	connected to Pin 29 +5 VDC
Pin 31	ground GND
Pin 32	connected to Pin 31 GND

Connector P1, Row C:

Pin 1	ground G1
Pin 2	analog output R VIDEO amplitude into 75 Ω 1V p-p \pm 10% frequency response 60 Mhz - 3 Db
Pin 3	ground GND
Pin 4	analog input RED VID amplitude 1V p-p
Pin 5	ground GND
Pin 6	analog input GRN VID amplitude 1 V p-p
Pin 7	ground GND
Pin 8	analog input BLU VID amplitude 1V p-p
Pin 10	digital input VFB signal level 0 to 12V
Pin 11	analog input R GAIN contrast control voltage 0 to 5V
Pin 12	analog input B GA contrast control voltage 0 to
Pin 13	analog input G GAIN contrast control voltage 0 to 5V
Pin 17	digital input SEL1 input/output select 1 TTL
Pin 21	digital input HFB horizontal flyback pulse 0 to 12V
Pin 22	digital input RD read signal TTL
Pin 23	digital input SEL2 input/output select 2 TTL
Pin 24	digital input WR write signal TTL
Pin 25	digital input HPLLCLK horizontal phase lock loop 0 to 5V
Pin 26	digital input HRESET horizontal reset pulse 0 to 5V