

SECTION 20

VIDEO OUTPUT MODULE

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20.1 TECHNICAL DESCRIPTION

20.1.1 General Description

The Video Output module amplifies the video signals for output to the cathode of each CRT. There is one Video Output module per CRT; each feeding the G1, G2 and heater voltages. The module consists of a push-pull output stage, driven by a driver stage and a pre-driver stage. The module also permits DC black level biasing of each CRT. The DC operating point is maintained by a keyed sync tip clamp circuit.

20.1.2 Circuit Description

20.1.2.1 Sync Tip Clamp Circuit

The sync tip clamp circuit is built around FET Q1. Resistors R4, R5, R6, R7, R8, R52 and TC3 set the source voltage of the FET. Specifically, trimpot R5 is adjusted to produce a source voltage between 1.3V and 1.6V at 25°C.

The CLAMP input is fed by 10V peak amplitude, 1.8 μ s duration, clamp pulses, originating from the Video Control module. These clamp pulses cause capacitor C1 to charge to 8.5V, and gate voltage of Q1 to increase 0.6V above Q1 source voltage. Q1 turns ON and drain-to-source resistance drops to 2 ohms. This resistance drop allows input capacitor C4 to charge to a value between 1.1V and 1.4V.

During active line time, the zero volts on the CLAMP input keeps D2 reverse biased and gate voltage of Q1 at -8.5V. The FET is OFF and the dc voltage across C4 remains constant.

Other components in the clamp circuit function as follows:

- a) D1 protects the circuit against excessive input voltages,
- b) R2 provides a discharge path for C1,
- c) D4 and TC3 provide temperature compensation, and
- d) R3 compensates the video tilt.

20.1.2.2 Input Amplifier

Input amplifier, Q1 and Q2, is a non-inverting, low output impedance stage. Q2 is a constant current source, Q3 is a varying current source. Q2 base voltage determines the current through R12 and R13, and the output voltage at the collector of Q3.

Zener diode ZD1 with R14, C5 and C7, set Q3's emitter voltage to 6V and base voltage to 5.4V. This sets the collector current of Q2 to a constant value.

The base voltage of Q2 is between 1.0V and 1.4V, its emitter voltage is between 0.5V and 0.8V. The current through R13 is between 5.0mA and 9.0mA. 1mA of this current is supplied by Q2. The output voltage at the collector of Q3, established by the voltage drop across R12, is between 0.8V and 1.3V.

Diode D14 protects the base-emitter junction of Q3. Series RC, R11 and C6, across the base and collector of Q3, prevents high frequency oscillations.

20.1.2.3 Driver Amplifier

The driver stage consists of common emitter amplifier Q4, driving common base high voltage amplifier Q5. The base of Q5 is biased at 6V via ZD2. Its emitter voltage is 5.4V and the current through R18 is 16mA.

The base voltage of Q4 is between 0.8V and 1.3V. Its emitter voltage is between 0.2V and 0.6V. The emitter current through Q4 is between 17mA and 50mA. 16mA are supplied through R18. Up to 30.2mA are supplied by Q5. The voltage at the collector of Q5 is between 150V and 100V.

20.1.2.4 Output Amplifier

The output amplifier is a push-pull stage. It consists of Q6 and Q7.

The stage is dc biased, just OFF, by diode D7. The load is the cathode of the CRT connected through beam current sensors, IC1 and IC2. Trimpot R5 sets the dc voltage on the cathode to 140V when BRIGHTNESS is set to 5 on the function bar graph.

20.1.2.5 Response to Video Input

A video input increase to 0.8V causes the emitter voltage of Q2 to increase to 1.4V. This increases the current in Q5 to 130mA and decreases the voltage at the cathode to 20V.

A video input increase to 1.0V causes the driver stage to just enter saturation. This reduces the cathode voltage to a minimum.

The total voltage gain of all stages is 140.

20.1.2.6 Beam Current Sensors

IC1 and IC2 monitor CRT beam current. They provide outputs I1 and I2 respectively. These outputs are the voltage equivalent of beam current and are used as inputs to the beam current limiter.

WARNING

DO NOT repair the beam current circuitry. X-ray radiation may be emitted when excessive high voltage exists.

20.2 SERVICING AND ALIGNMENT

20.2.1 Disassembly and Access

Module Location:

- projection head

Tools & Equipment Required:

- Phillips screw driver
- 1/4" hex head socket

a) Remove the front and rear top covers as instructed in Section 5.2.

b) If the Video Output module for the green (center) CRT is to be removed, remove the keypad assembly from the projection head as instructed in Section 5.2.

NOTE: disconnection of the keypad cable from the Mother Board is not required.

c) Locate the Video Output module to be removed. Gently pull the Video Output module away from the CRT. Note: the Video Output module is secured to the CRT by a small amount of hot melt glue. The joint between the glue and the CRT should break from the CRT without difficulty.

d) Disconnect the following connectors and leads from the Video Output module:

- focus lead (to Bias module)
- P3 (ground)
- P10 (ground)
- G2 (to Bias module)
- P8
- P9 (video input)

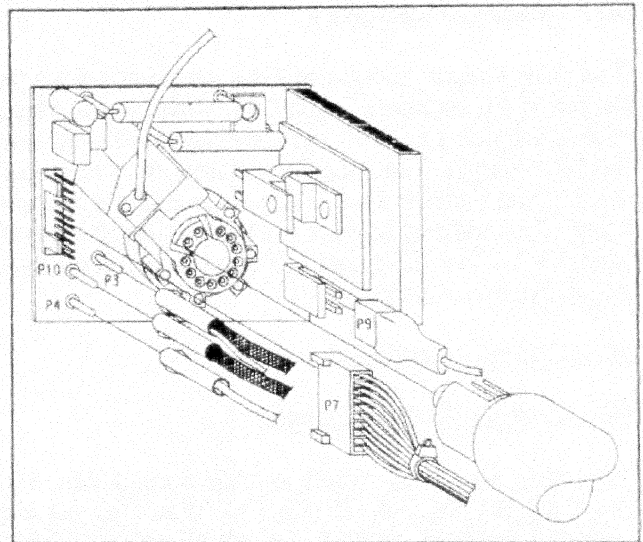


FIGURE 20-1. Video Output Module Removal

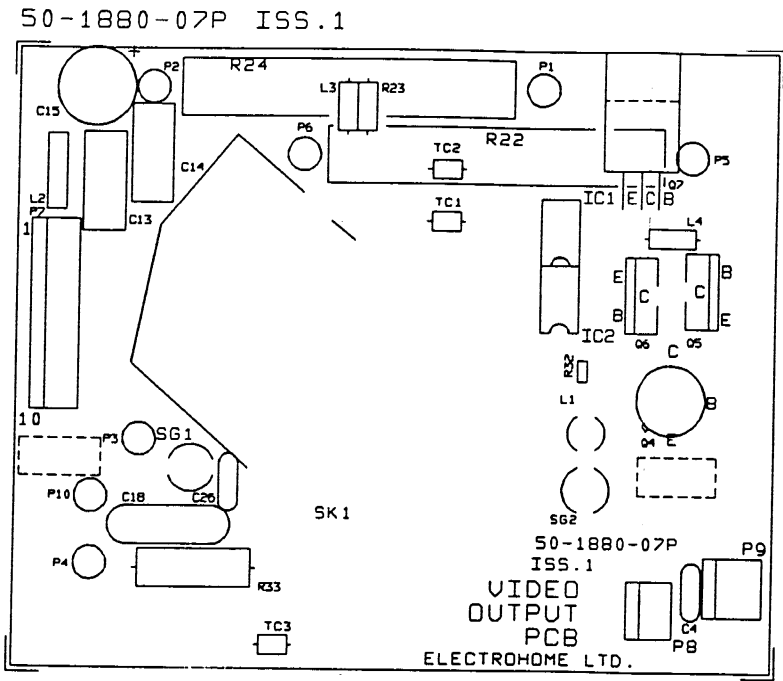
NOTE: Prior to reassembly, pull or scrape off the hardened hot melt glue from the Video Output Module CRT connector. Re-connect the Video Output module to the CRT and apply the same amount of hot melt glue between the CRT connector and the CRT connector terminals.

20.2.2 Alignment and Adjustments

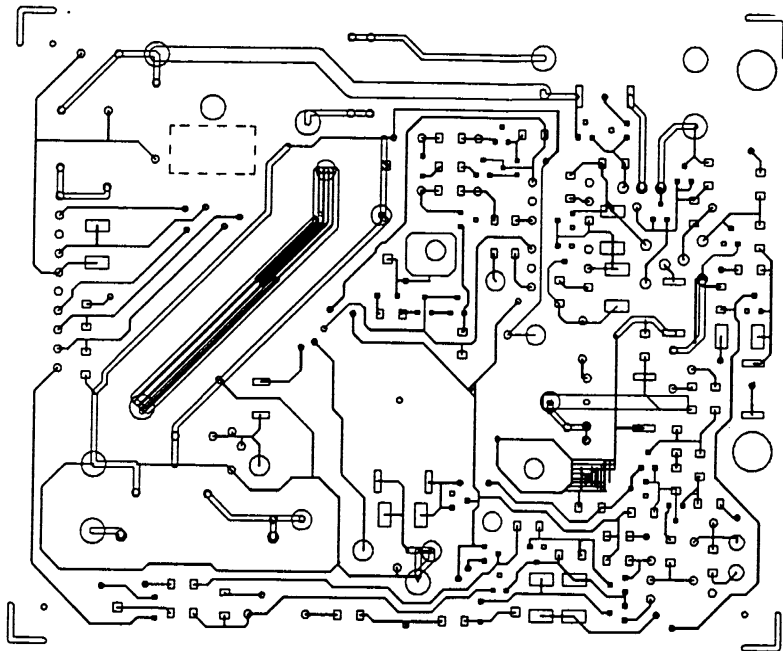
The Video Output module is adjusted during Color Balance Set-up. Refer to Section 7 for the Color Balance set-up procedure.

20.3 COMPONENT LAYOUT AND SCHEMATICS

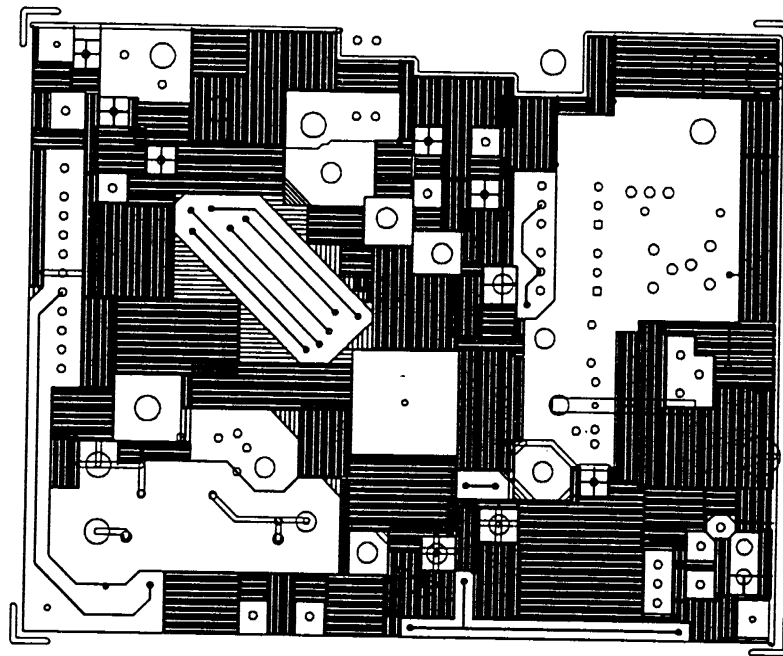
Refer to the following pages for component layouts and schematics of the Video Output Module.



Component Layout



Solder Side
(Viewed from Component Side)



Component Side

FIGURE 20-2.
Video Output Module Component Layout

LEGEND

RESISTORS: RESISTANCE IS IN Ω (OHMS),
K (KILOHMS), OR M (MEGAHMS).
1/2 WATT, 5% TOLERANCE UNLESS
OTHERWISE SPECIFIED.
CAPACITORS: CAPACITY IN P (PICOFARADS),
N (NANOFARADS), OR μ (MICROFARADS).
D.C.V.V. & TOLERANCE NOTED
WHERE CRITICAL.

CAUTION

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

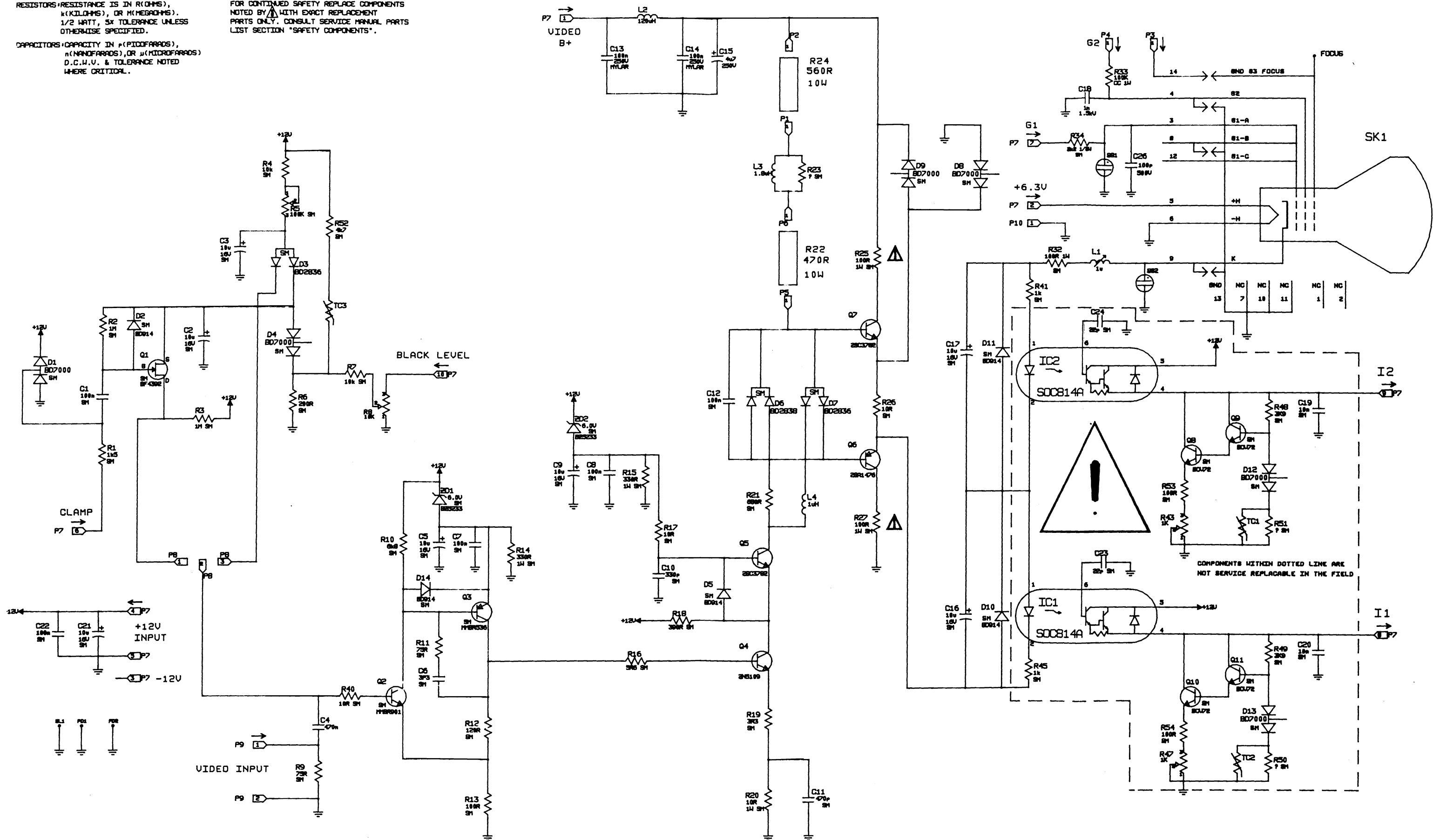
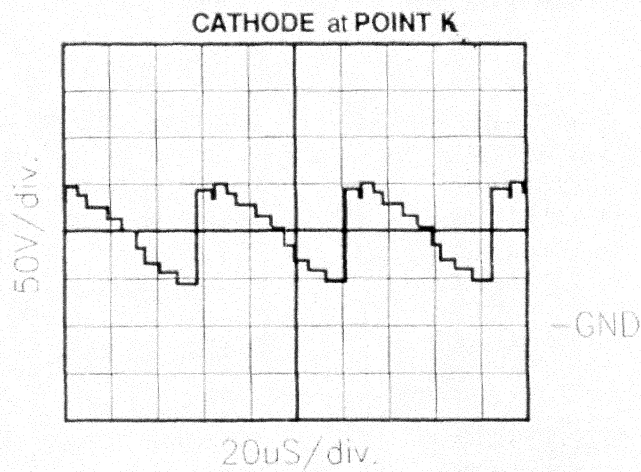


FIGURE 20-3.
Video Output Module Schematic

SCHEMATIC REFERENCE



20.4 PARTS LIST

Item Ref.	Part No.	Description
Transistors and Diodes		
Q1	72-000701-01P	MMBF4392, FET transistor surface mount, NCH, -5V
Q2	72-000561-02P	MMBR901, RF NPN transistor, surface mount
Q3	72-000561-01P	MMBR536, RF PNP transistor, surface mount
Q4	14-000562-02P	2N5109, NPN, 20V, .4A, 2.5W
Q5,Q7	14-000564-06P	2SC3782, NPN
Q6	14-000564-07P	2SA1476, PNP
D1,D4,D8,D9	72-000513-04P	MMBD7000, switching diode, surface mount
D2,D5,D10,D11, D14	72-000513-01P	MMBD914, switching diode, surface mount
D3,D7	72-000513-02P	MMBD2836, switching diode, surface mount
D6	72-000513-03P	MMBD2838, switching diode, surface mount
ZD1,ZD2	72-000531-01P	MMBZ5233, SOT-23, zener diode, 6V, 5%, 1/2W
Capacitors		
C1,C7,C8,C12,C22	66-310411-05P	100 nF, 50V, 10%, X7R, surface mount
C2,C3,C5, C9,C16,C17,C21	64-210134-11P	10 μ F, 16V, surface mount
C4	89-000032-02P	0.47 μ F, 50V, \pm 20%
C6	66-433801-05P	3.3 pF, 50V
C10	66-433141-05P	330 pF, 50V, 5%, NPO, surface mount
C11	66-447141-05P	470 pF, 50V, NPO, surface mount
C13,C14	48-171042-02P	100 nF, 200V, 10%, mylar
C15	44-447510-06P	4.7 μ F, 250V
C18	46-510228-74P	1 nF, 1500V, 20%, Z5U
C26	46-310113-02P	100 pF, 500V, 10%, Z5P
Resistors		
R1	70-715013-21P	1.5K, 1/4W, 5%, surface mount
R2,R3	70-710043-21P	1M, 1/4W, 5%, surface mount
R4	70-756013-21P	5.6K, 1/4W, 5%, surface mount
R5	71-011043-02P	100K, 25%, pot surface mount
R6	70-720003-21P	200R, 1/4W, 5%, surface mount
R7,R52	70-747013-21P	4.7K, 1/4W, 5%, surface mount
R8	71-011033-02P	10K, 25%, pot surface mount
R9,R11	70-775093-21P	75R, 1/4W, 5%, surface mount
R10	70-768013-21P	6.8K, 1/4W, 5%, surface mount
R12	70-712003-21P	120R, 1/4W, 5%, surface mount
R13	70-710003-21P	100R, 1/4W, 5%, surface mount
R14,R15	70-933003-24P	330R, 1W, 5%, surface mount
R16	70-756083-21P	5.6R, 1/4W, 5%, surface mount
R17,R26,R40	70-710093-21P	10R, 1/4W, 5%, surface mount
R18	70-739003-21P	390R, 1/4W, 5%, surface mount

20.4 PARTS LIST (cont.)

Item Ref.	Part No.	Description
Resistors (cont.)		
R19	70-733083-21P	3.3R, 1/4W, 5%, surface mount
R20	70-910093-24P	10R, 1W, 5%, surface mount
R21	70-768003-21P	680R, 1/4W, 5%, surface mount
R22	42-144715-02P	470R, 10W, 5%
R24	42-145615-02P	560R, 10W, 5%
△ R25,R27	70-910003-24P	100R, 1W, 5% SAFETY COMPONENT
R32	40-221015-37P	100R, 1/2W, 5%
R33	40-421045-07P	100K, 1W
R34	70-822013-23P	2.2K, 1/2W, 5%, surface mount
R41	70-710013-21P	1K, 1/4W, 5%, surface mount
Coils and Transformers		
L1	21-001512-01P	0.5 to 1.1 μ H tuneable coil
L2	21-011212-02P	120 μ H 10% peaking coil
L3	21-001185-16P	1.8 μ H inductor
L4	21-001185-13P	1 μ H inductor
Miscellaneous		
SG1,SG2	27-000011-09P	argon lamp (spark gap)
TC3	42-000079-08P	100K precision thermistor

20.5 SPECIFICATIONS

contact K: CRT cathode

Connector P7:

Pin 1 **150 VDC** supply
current range 0 to 140mA
typical current 90mA

Pin 2 Heater supply
signal level 6.3VDC min

Pin 3 **-12 VDC** supply
NOTE: not used

Pin 4 **+12 VDC** supply
current level 80mA max
typical current 60mA

Pin 5 **+12 VDC** supply
current level 80mA max
typical current 60mA

Pin 6 analog input **CLAMP**

Pin 7 G1

NOTE: see Bias module

Pin 8 analog output I1
signal level 5.94 to 6.06 VDC

Pin 9 analog output I2
signal level 5.94 to 6.06 VDC

Pin 10 analog input **BLK LEVEL**
signal level 0 to 7.2 VDC

Connector P9:

Pin 1 analog input **VIDEO INPUT**
NOTE: 1V p-p Into 75Ω max

Connector P4:

Pin 1 G2
NOTE: see Bias module

NOTES