SONY **V7040**

NTSC/PAL Encoder

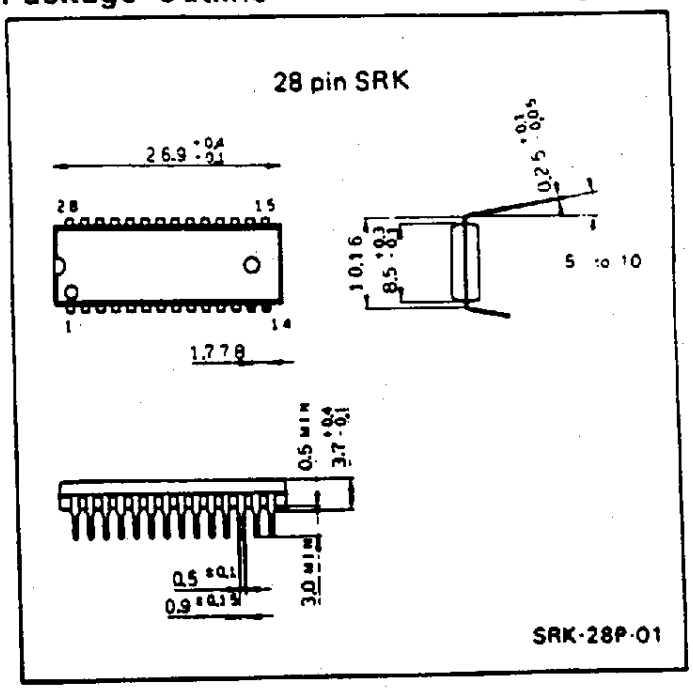
T-77-29

Description

The V7040 is an IC that can operate in both NTSC and PAL modes. It superimposes analog RGB signals and outputs them as such, or as composite video signals. Both types of output can drive the 75Ω load directly.

Package Outline

Unit: mm



Features

- 5 V single supply operation
- Low power consumption (135 mW)
- Built-in 75Ω driver (RGB output, 2 systems of composite video output)
- Compatible with both NTSC and PAL modes
- Superimposition (MIX, half-tone functions)

Functions

- SW circuit for superimposition
- MTX circuit
- R-Y, B-Y MOD circuit
- 75Ω driver for RGB and composite video outputs

Structure

Bipolar silicon monolithic IC

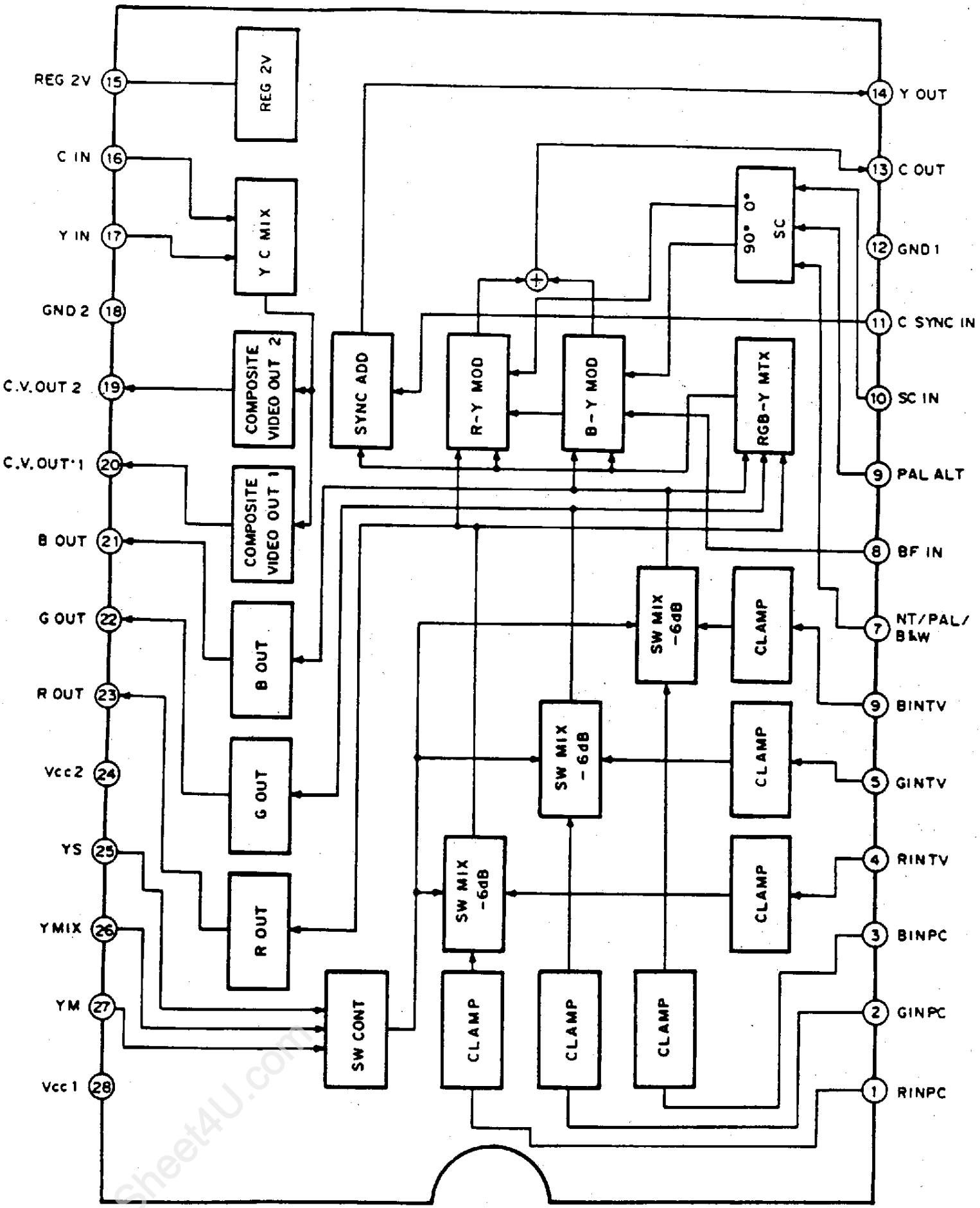
Absolute Maximum Ratings

• Supply voltage	V_{CC}	10	V
• Operating temperature	T_{opr}	−20 to +75	°C
• Storage temperature	T_{stg}	−55 to +150	°C
• Allowable power dissipation	P_D	1250	mW

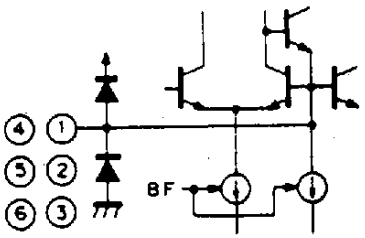
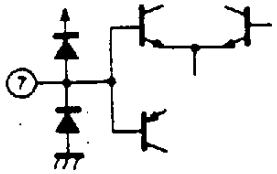
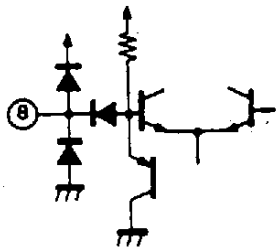
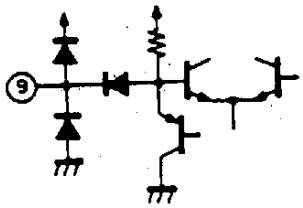
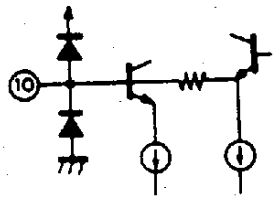
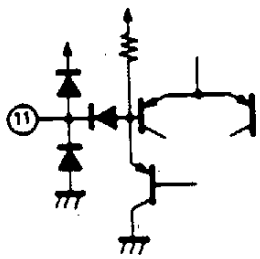
Recommended Operating Condition

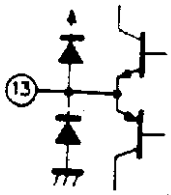
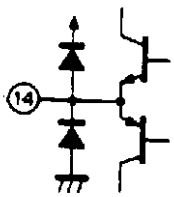
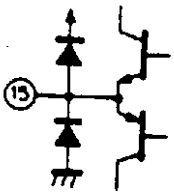
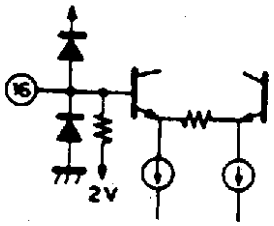
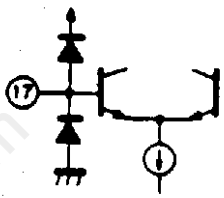
• Supply voltage	V_{CC}	5 ± 0.25	V

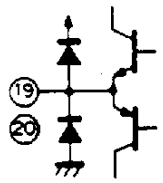
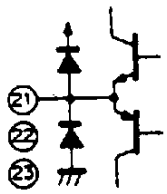
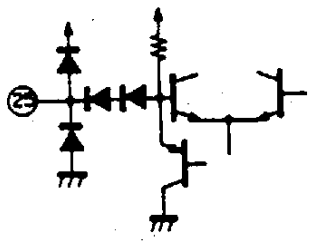
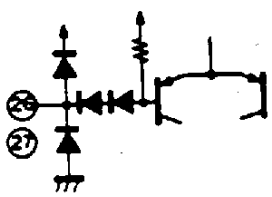
Block Diagram



Pin Description

No.	Symbol	Equivalent circuit	Description
1 2 3 4 5 6	RINPC GINPC BINPC RINTV GINTV BINTV		Inputs an RGB color signal from a PC or a TV. Input must be of sufficiently low impedance to clamp.
7	NT/PAL B&W		Switches the modes of NTSC, PAL, and B&W 4.0 v to V_{CC} NTSC mode 2.0 V to 3.0 V PAL mode 0 V to 0.8 V B&W mode
8	BF IN		Inputs burst flag signal. Clamp is performed by this burst flag signal. L: 0 V to 0.8 V H: 2.0 V to V_{CC} Burst at L.
9	PAL ALT		Inputs the PAL ALT signal and inverts the burst and chroma signal phases in every field in PAL mode. 0 V to 0.8 V Burst at 225° 2.0 V to V_{CC} Burst at 135°
10	SC IN		Inputs the sub-carrier. Input sine wave between 0.4 to 0.8 $V_{P\text{-}P}$.
11	C SYNC IN		Inputs composite SYNC signal. L: 0 V to 0.8 V H: 2.0 V to V_{CC} SYNC at L

No.	Symbol	Equivalent circuit	Description
12	GND1		Ground pin for circuits other than RGB OUT and C.V.OUT circuits. Connect with GND2 of pin 18 at the lowest impedance.
13	C OUT		Outputs chroma signal to BPF.
14	Y OUT		Outputs Y signal to delay line.
15	REG2V		For the inner reference voltage. Ground at 10 μF.
16	C IN		Inputs the chroma signal from which the harmonics are removed by BPF.
17	Y IN		Inputs Y signal which is delayed by delay line.

No.	Symbol	Equivalent circuit	Description
18	GND2		Ground pin for RGB OUT circuit and for C.V OUT circuit. Connect with GND1 of pin 12 at the lowest impedance.
19 20	C.V.OUT2 C.V.OUT1		Outputs a composite video signal encoded from switched RGB signals. The load of 75 Ω can be directly driven.
21 22 23	B OUT G OUT R OUT		Outputs a switched RGB signal as an RGB signal. The load of 75 Ω can be directly driven.
24	V_{CC2}		Power source for RGB OUT circuit and for C.V.OUT circuit. Decoupling should be performed with a very large capacity.
25	YS		Switches TV, PC, MIX and halftone modes. Input at TTL level. **SW mode** YS / YMIX / YM / SW mode 0 / 0 / 0 / TV 0 / 0 / 1 / Half-tone 0 / 1 / 0 / TV 0 / 1 / 1 / Half-tone 1 / 0 / 0 / PC 1 / 0 / 1 / PC 1 / 1 / 0 / MIX 1 / 1 / 1 / MIX
26 27	YMIX YM		
28	V_{CC1}		Power source for circuits other than RGB OUT and C.V.OUT.

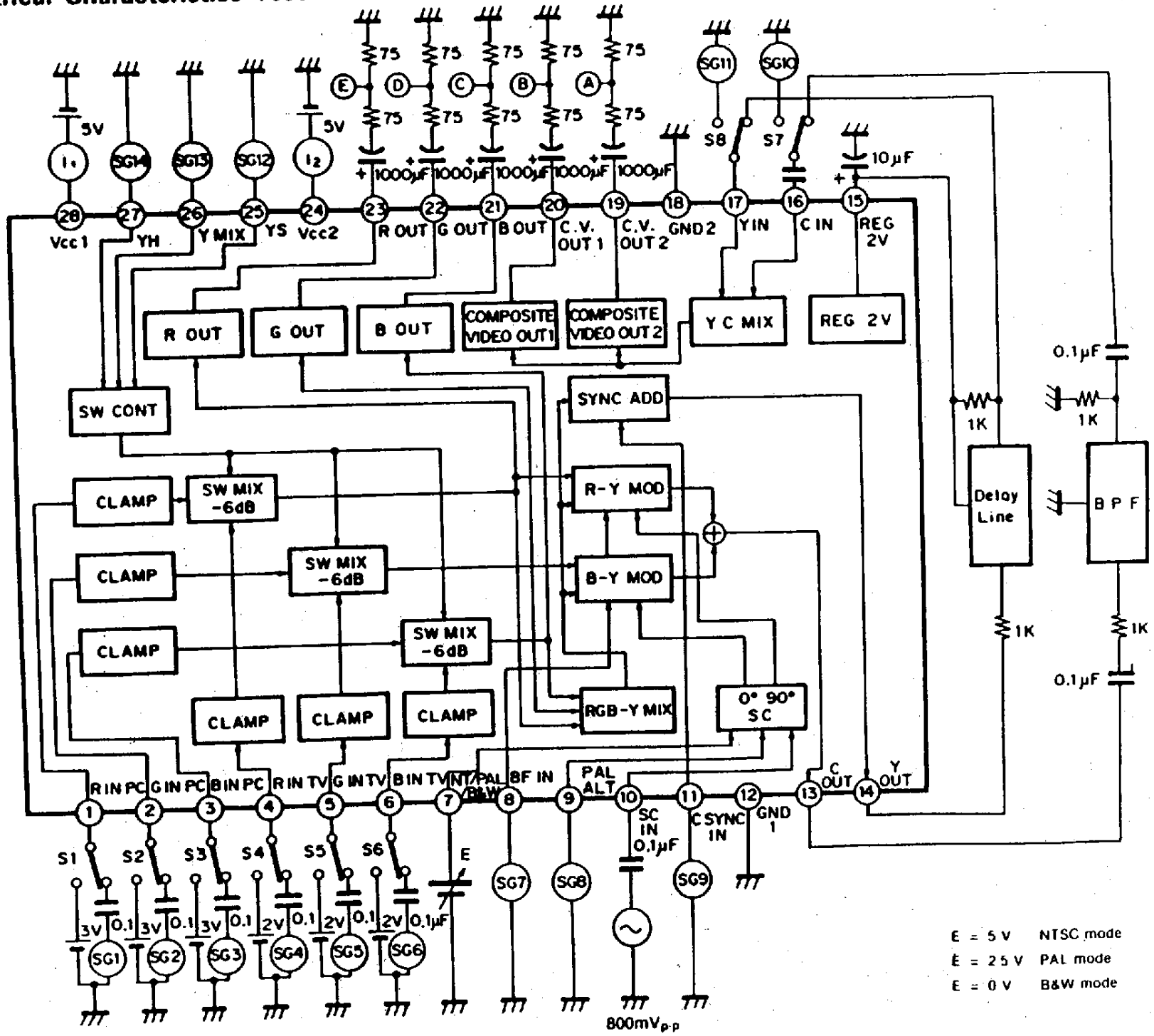
Electrical Characteristics

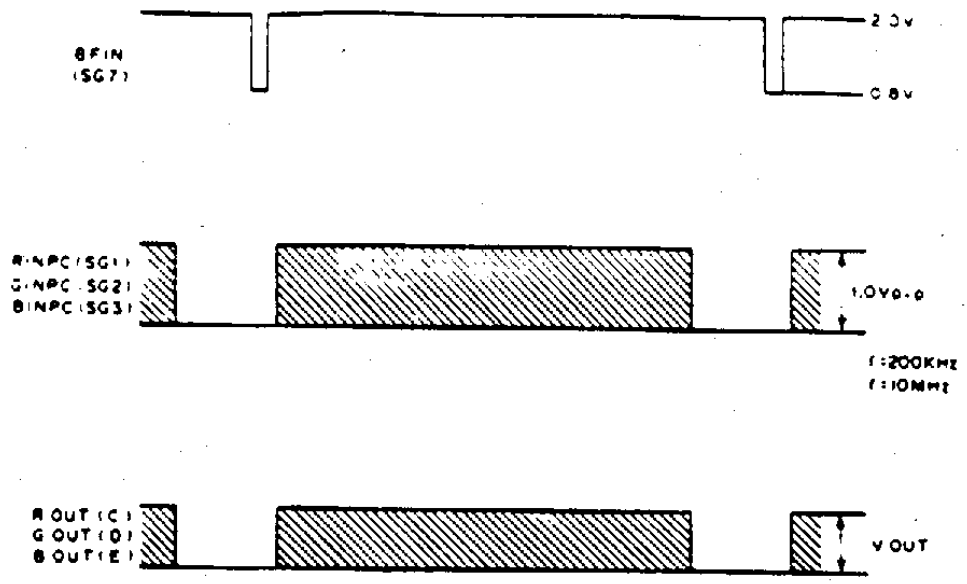
(Vcc=5V Ta=25° See the Electrical Characteristic Test Circuit)

Item	Symbol	Condition		Test point	Min.	Typ.	Max.	Unit
Supply current 1	I_{CC1}	SG1 to SG6 AC 0V SG12 to SG14 DC 0.8V	NTSC mode	I_1	7.0	12.2	17.3	mA
Supply current 2	I_{CC2}			I_2	6.0	14.3	20.0	mA
BW mode supply current 1	I_{BW}	SG7-SG9 DC 2V	BW mode	I_1	4.3	8.1	11.9	mA
R output level	V_R	Fig. 1 RINTV = 1 V_{P-P}, f = 200 kHz		C	0.63	0.71	0.80	V_{P-P}
G output level	V_G	Fig. 1 GINTV = 1 V_{P-P}, f = 200 kHz		D	0.63	0.71	0.80	V_{P-P}
B output level	V_B	Fig. 1 BINTV = 1 V_{P-P}, f = 200 kHz		E	0.63	0.71	0.80	V_{P-P}
RGB frequency characteristic	f_{CRGB}	Fig. 1 RGBINTV = 1 V_{P-P}, f = 10 MHz		CDE	−3			B
RGB crosstalk	CT	Fig. 1 V_{IN} = 1 V_{P-P}, f = 200 kHz		CDE			−40	dB
SW delay time	Td	Fig. 2 SI to S6 On		CDE		40	80	ns
Half-tone level	G_{HT}	Fig. 3 20 log (VM/V)		CDE	−8	−6	−4	dB
MIX level	G_{MIX}	Fig. 3 20 log (VMIX/V)		CDE	−8	−6	−4	dB
Sync level	V_{SYNC}	Fig. 4 Sync level		AB	0.24	0.29	0.34	V
Y level at R 100%	V_{YR}	Fig. 4 Y level at R = 1 V	BW mode	AB	0.18	0.21	0.25	V
Y level at G 100%	V_{YG}	Fig. 4 Y level at G = 1 V		AB	0.37	0.41	0.49	V
Y level at B 100%	V_{YB}	Fig. 4 Y level at B = 1 V		AB	0.05	0.08	0.11	V
Y level at RGB 100%	V_{YW}	Fig. 4 Y level at RGB = 1 V		AB	0.64	0.71	0.82	V
DG	DG	Fig. 5 S7, S8 On		AB			8	%
DP	DP	Fig. 5 S7, S8 On		AB			4	deg
R chroma level	V_{CR}	Fig. 6 R chroma level	NTSC mode	AB	2.53	3.16	3.79	V_{P-P}
R chroma phase	θ_R	Fig. 6 R phase		AB	92	104	116	deg
G chroma level	V_{CG}	Fig. 6 G chroma level		AB	2.36	2.96	3.55	V_{P-P}
G chroma phase	θ_G	Fig. 6 G phase		AB	229	241	253	deg
B chroma level	V_{CB}	Fig. 6 B chroma level		AB	1.79	2.24	2.69	V_{P-P}
B chroma phase	θ_B	Fig. 6 B phase		AB	335	347	359	deg
NTSC burst level	V_{BNT}	Fig. 6 Burst level		AB	0.16	0.29	0.39	V_{P-P}
PAL burst	V_{BPAL}	Fig. 6 Burst level	PAL mode	AB	0.80	1.00	1.20	V_{P-P}
PAL burst phase	θ_{BPAL}	Fig. 6 Burst phase PAL mode	PALALT = 2.0 V	AB	123	135	147	deg
			PALALT = 0.8 V		213	225	237	
Carrier leak	V_{LSC}	Fig. 6 Leak at pedestal		AB			40	mV
Leak at B&W mode	V_{LBW}	Fig. 4 Leak of chroma		AB			30	mV

• All phase reference should be the burst of NTSC = 180°

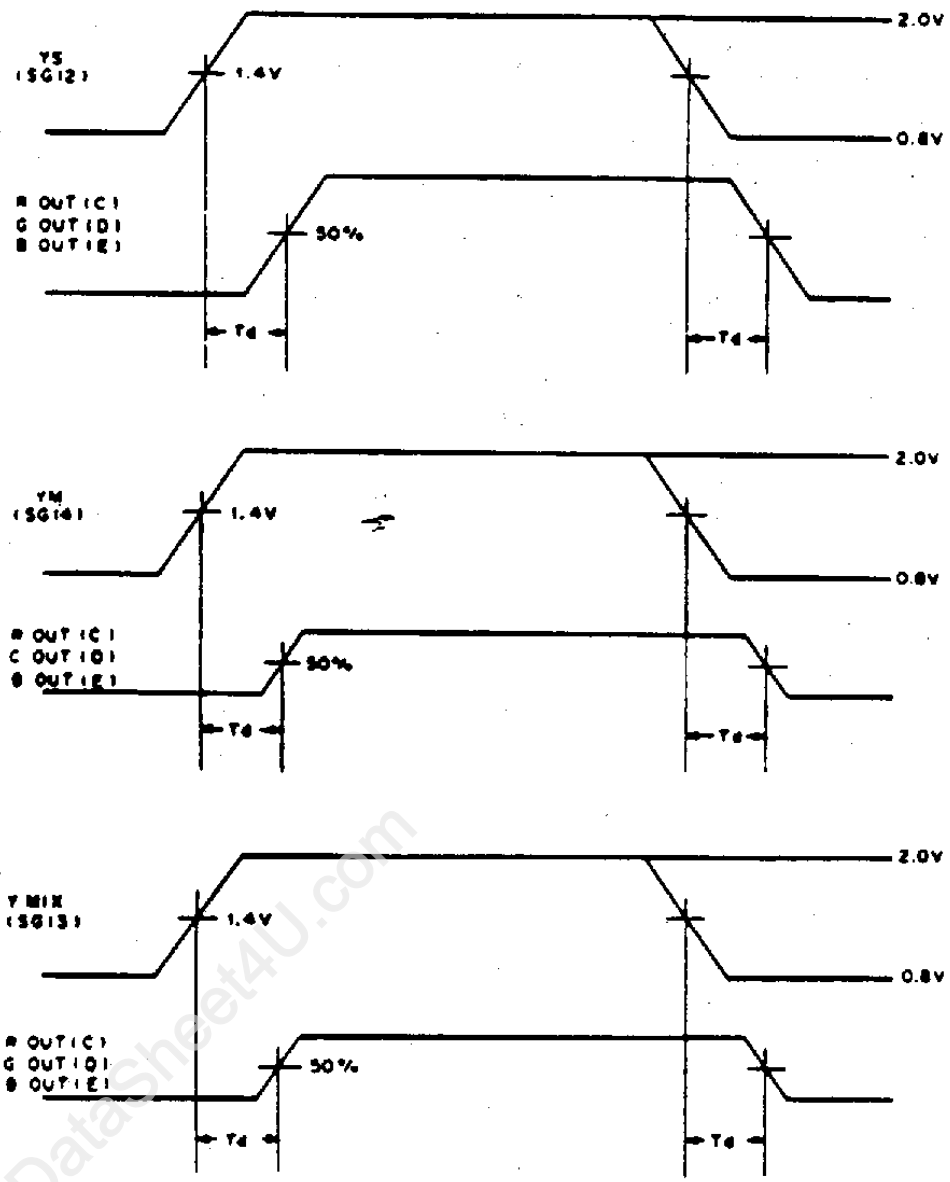
Electrical Characteristics Test Circuit





* YS, YMIX, and YM are 0.8 V (PC mode)

Fig. 1



* RINPC, GINPC, BINPC = 3V
RINTV, GINTV, BINTV = 2V

Fig. 2

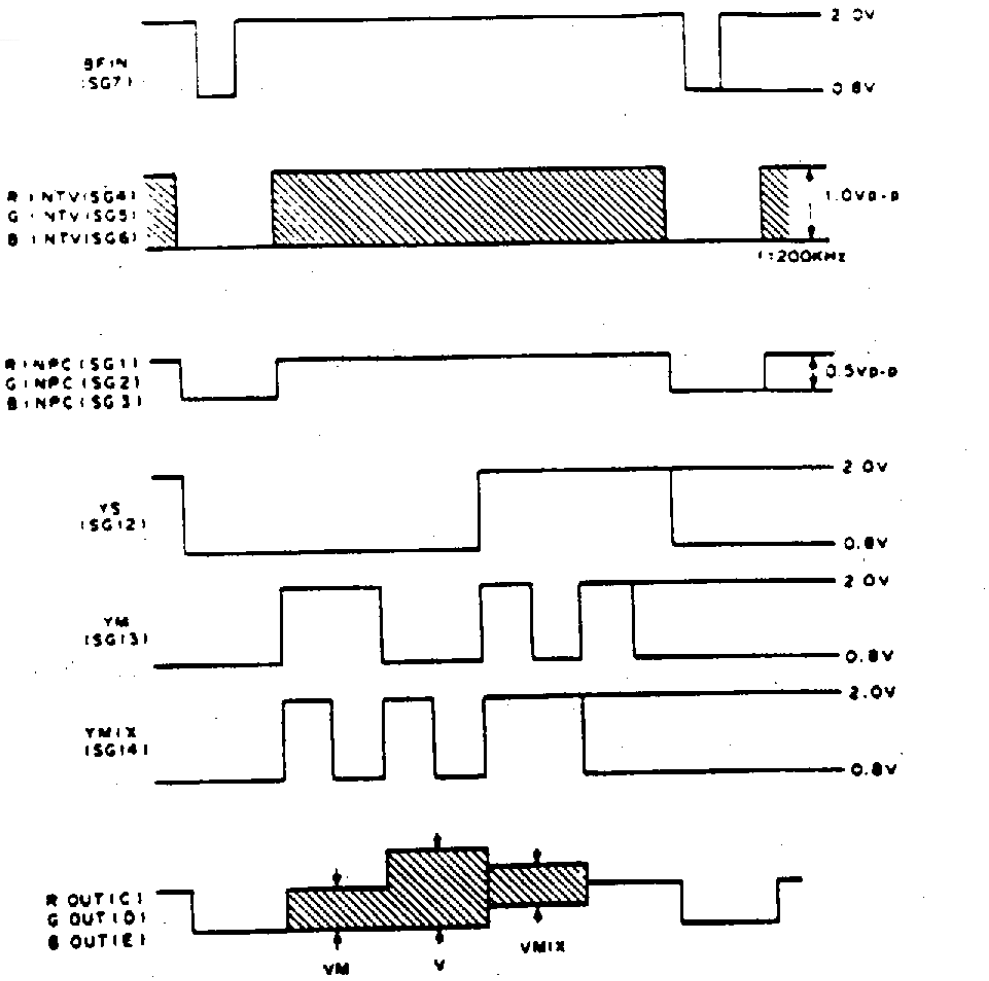
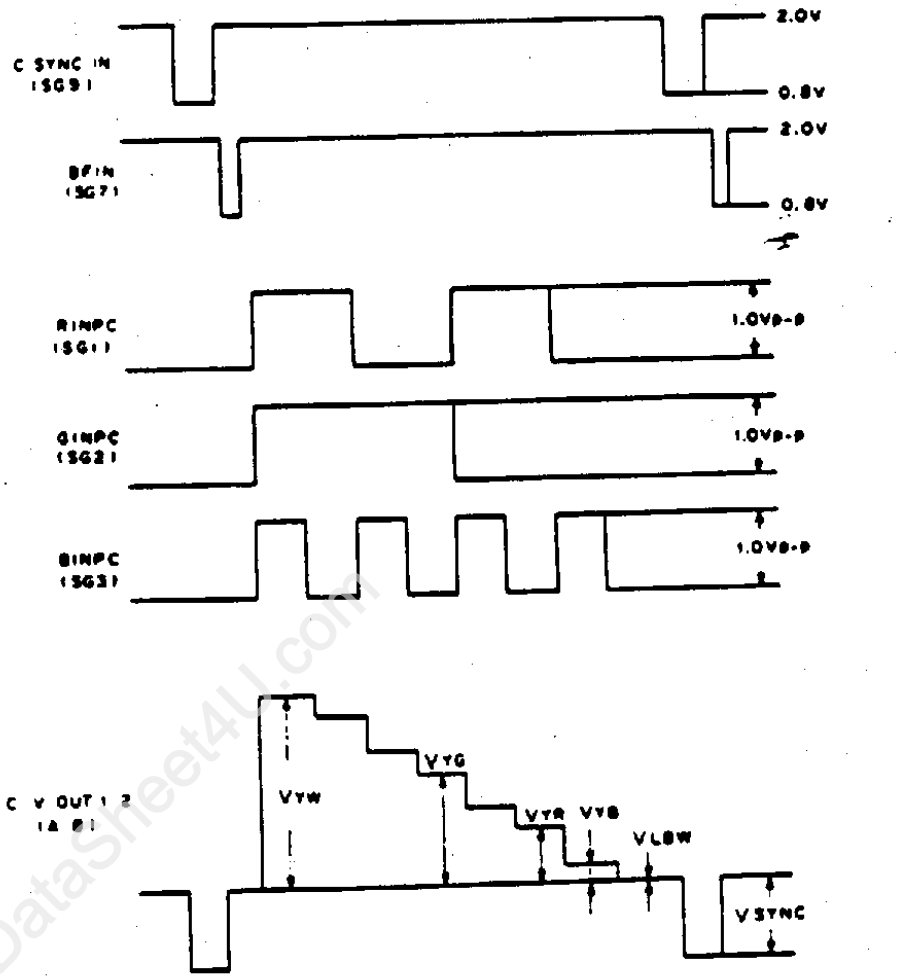


Fig. 3



* YS, YMIX, and YM are 0.8 V (PC model

Fig. 4

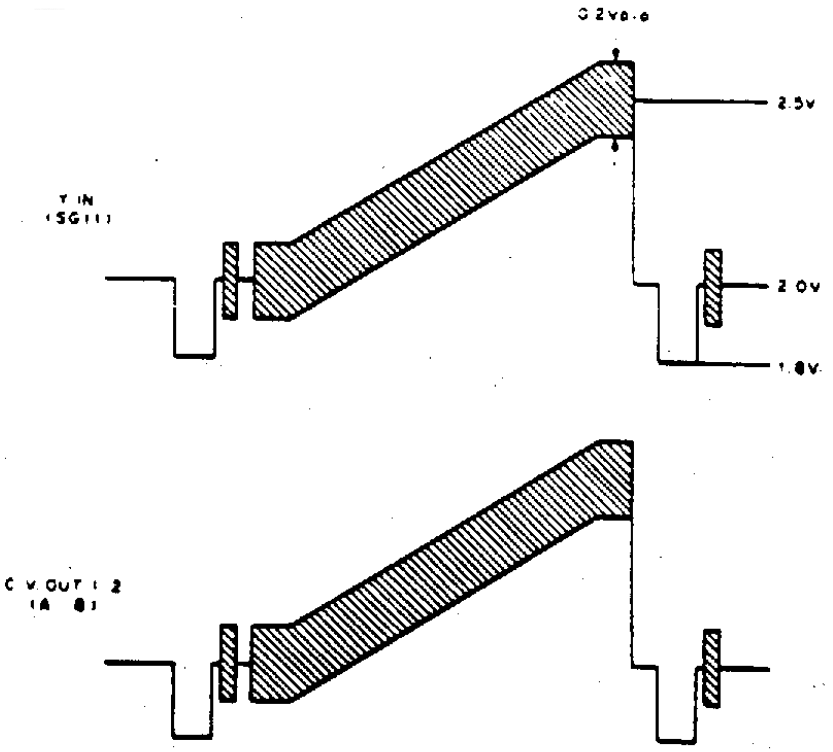
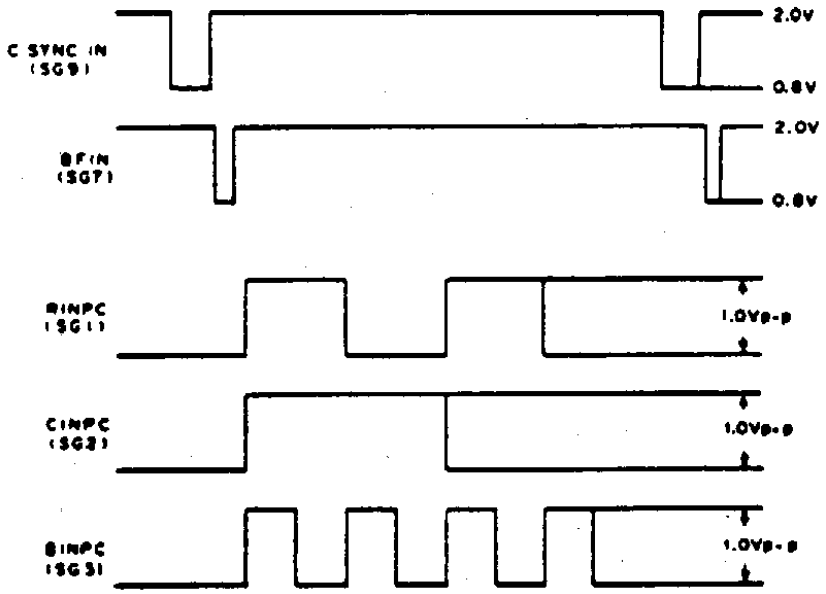
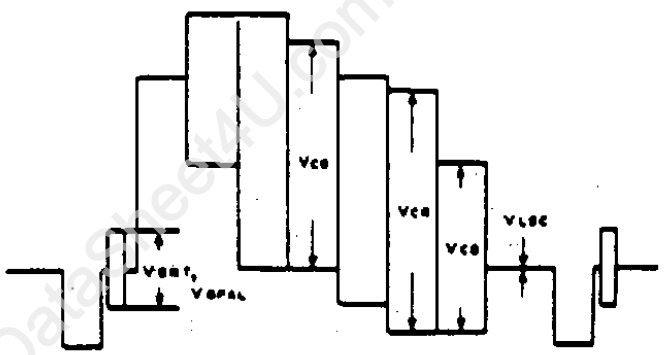


Fig. 5

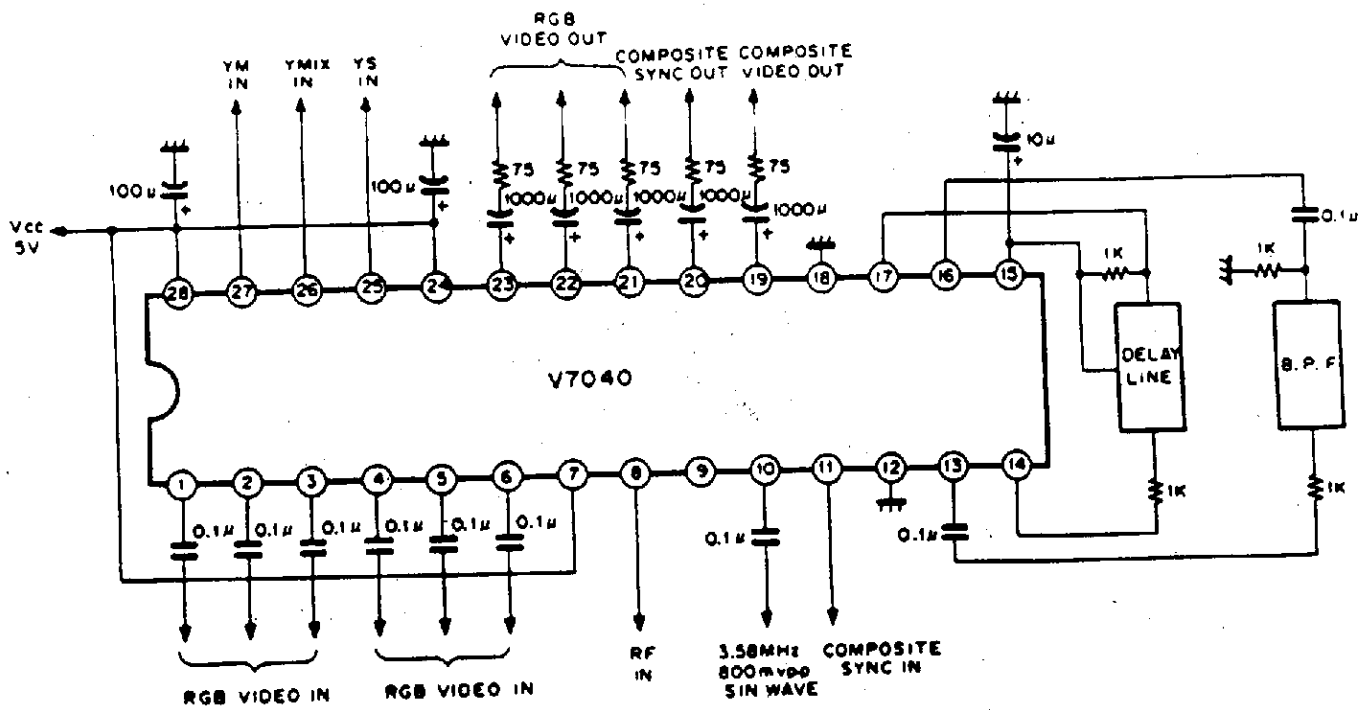




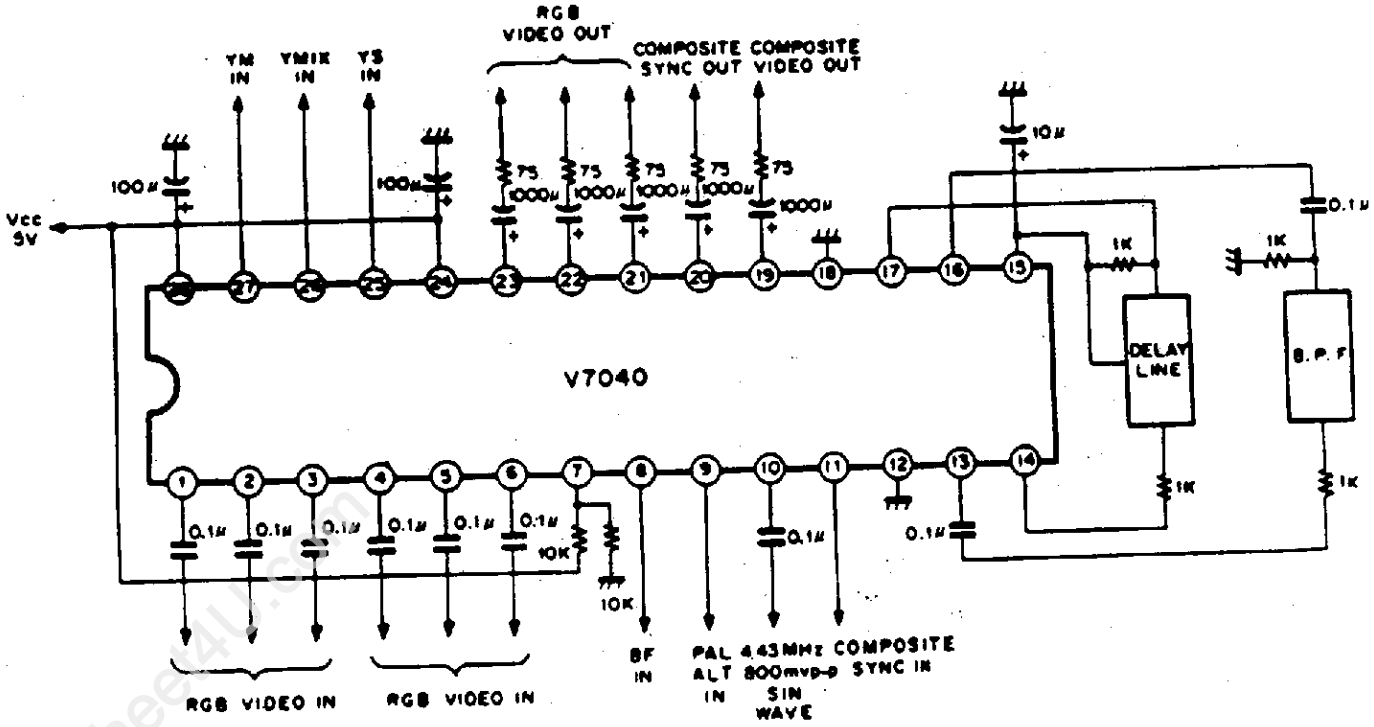
* YS, YMIX, and YM are 0.6 V (PC mode)

Fig. 6

Application Circuit NTSC



Application Circuit PAL



Application Notes

1. RGB signal input

   Input the RGB signal to pins 1 to 3 and 4 to 6 via a clamp capacitor.
   RGB signal is pedestal clamped by means of the burst flag signal input from pin 8. Input with a sufficiently low impedance.

2. SW mode

   RGB signal input from pins 1 to 3 and RGB signal input from pins 4 to 6 are switched into the specified Y mode at the SW circuit. This, by means of the YS, YMIX, YM signals input from pins 25 to 27. The SW mode is in accordance with the following table.

   1 PC mode
   RGB signal input from pins 1 to 3 is output via SW circuit.

   2 TV mode
   RGB signal input from pins 4 to 6 is output via SW circuit.

   3 MIX mode
   RGB signal input from pins 1 to 3 and RGB signal input from pins 4 to 6 are respectively lowered to a level of −6 dB, mixed and output via SW circuit.

   4 Halftone mode
   RGB signal input from pins 4 to 6, lowers −6 dB level and is output. When superimposing, the background can be darkened and the letters made easier to read. For normal superimposing, ground pin 26 YMIX and pin 27 YM. Input superimpose signal to pin 25 YS.

SW Mode

YS	YMIX	YM	SW Mode
Pin 25	Pin 26	Pin 27	
L	L	L	TV
L	L	H	Halftone
L	H	L	TV
L	H	H	Halftone
H	L	L	PC
H	L	H	PC
H	H	L	MIX
H	H	H	MIX

L≦0.8V
H≧2.0V

3. NT/PAL/B & W mode

   By turning pin 7 (NT/PAL/B & W) to 4V and over, NTSC mode is switched on. By turning it to 3 to 2V, PAL mode is switched on. By turning it to 0.8V or under, B & W mode is switched on. In NTSC mode, burst signal, with B-Y shaft at 0°, is output to 180° direction.
   In PAL mode, burst signal, in accordance with PAL ALT signal input from pin 9, is output to 135°, 225° direction. In B & W mode, chroma signal and burst signal are not output. As for V7020, to use in NTSC mode, pin 7 is left open or connected to Vcc.

4. BF signal
In accordance with burst flag signal input from pin 8, the burst signal from the composite video signal, is formed. Also, the clamping of RGB signal is executed in accordance with this burst flag signal.

5. PAL ALT signal
In accordance with PAL ALT signal input from pin 9, the R-Y shaft direction of the modulator from the chroma signal, is inverted. When pin 9 is at "H", (≧2.0V) it is set to normal direction. When it is at "L", it is set to the inverted direction.

6. Subcarrier input
Input the subcarrier through a 0.4 to 0.8 Vp-p sine wave, via pin 10 (SC IN). With the subcarrier input, too many harmonic waves may adversely affect the phase characteristics of the chroma modulator.

7. Vcc, GND
Connect with as low as possible an impedance, pin 12 and GND 1, pin 18 and GND 2. Pin 24 (Vcc 2) and pin 18 (GND 2) are the power supply of 75Ω driver (RGB OUT circuit, C.V.OUT circuit). As large currents flow in, execute decoupling with a sufficiently large capacitor.

8. BPF, DL
Eliminates harmonic waves contained in the chroma demodulator output, at the band-pass filter. Use a delay line matching the band-pass filter delay time.

9. RGBOUT, C.V.OUT
At pins 19 and 20 (V.OUT) a composite video signal of about 2 Vp-p is output. At pins 21 through 23 (RGB OUT), an RGB signal (superimposed or else) of about 1.4 Vp-p is output. For the composite sync signal used together with RGB signal, use the composite video signal of pins 19 and 20.
Both C.V.OUT of pins 19, 20 and RGB OUT of pins 21 through 23, can directly drive a load of 75Ω.

10. Composite sync signal
Through the composite sync signal input from pin 11, sync is added to Y signal. At "H" (≧2.0V) Y signal is activated while at "L" (≦0.8V) sync is activated.

Descriptions of Operation

1. Clamp circuit, SW circuit, SW CONT circuit

RGB signal from PC is input to pins 1 through 3 via a clamp capacitor. In the same way, RGB signal from TV is input to pins 4 through 6. Input RGB signals are pedestal clamped together, by means of the clamp circuit operating in accordance with the burst flag signal. Clamped RGB signals are switched at the SW circuit, in accordance with the 4 modes, specified by YS, YMIX and YM signals, which are input from pins 25 through 27.

RGB signals switched at SW circuit are sent to MTX, MOD and RGB OUT circuits.

2. MTX circuit, MOD circuit, SC phase shift circuit

From RGB signal switched at SW circuit. Y signal is formed by means of MTX circuit.

As for these Y and R signals, B signal goes to R-Y MOD circuit and B-Y MOD circuit. Also, this Y signal is sent to SYNC ADD circuit; composite sync signal input from pin 11 is added to it, and it is sent through pin 14 to delay line.

SC shift phase circuit creates 0°, 90° subcarriers by phase shifting the subcarrier input from pin 10.

0° and 90° subcarriers are respectively sent to B-Y MOD circuit and R-Y MOD circuit. By means of R with Y signals and B with Y signals, they undergo quadrature double phase modulation to become chroma signals. Chroma signals are sent to BPF via pin 13.

3. YC MIX circuit

Chroma signals from which harmonic waves have been eliminated at BPF, and Y signals that have passed through the delay line are sent to YC MIX circuit via pins 17 and 16. They are mixed, become composite video signals and sent to C.V.OUT circuit.

4. COMPOSITE VIDEO OUT circuit (C.V.OUT circuit)

Composite video signals from YC MIX circuit, are amplified at C.V.OUT circuit into about 2 Vp-p video signals, and output through pins 19 and 20. C.V.OUT circuit, from each of pins 19 and 20 can directly drive a load of 75Ω.

5. RGB OUT circuit

Signal RGB switched at SW circuit is amplified to about 1.4 Vp-p by RGB OUT circuit and output via pins 21 through 23. RGB OUT circuit can directly drive a load of 75Ω.

6. REG 2V

The internal reference voltage is obtained through the band gap reference circuit. The reference voltage becomes the standard for the volume of each of the clamp electric potential, the burst and the sync.