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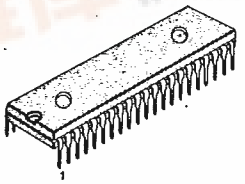
KA2153 LINEAR INTEGRATED CIRCUIT

VIDEO-CHROMA DEFLECTION SYSTEM FOR A COLOR TV (NTSC)

The KA2153 combines the video-chroma sub-system and the deflection combination on a single monolithic integrated circuit to provide a color television video-chroma deflection system.

This device includes a video amplifier, color demodulator that is designed to provide color differential output, and improved sync separator, horizontal oscillator with saw tooth wave type AFC, horizontal pre-driver with X-ray protection circuit, and vertical oscillator, vertical pre-driver in a 42 leads dual in-line type plastic package.

42 DIP



FUNCTIONS

- Inverter-amplifier
- Contrast control
- Pedestal clamp
- Brightness control
- ACC-amplifier
- Tint control
- Uni-color control
- 3.58MHz V_{CO}
- APC
- Color-Killer
- Color demodulator
- Matrix circuit
- Sync-separator (H.V.sync in)
- $2f_H$ horizontal oscillator
- Flip-flop
- Stabilized horizontal V_{CC} by zener diode
- Horizontal pre driver
- Gate pulse generator
- Vertical sync input
- Vertical oscillator
- Ramp generator

FEATURES

Video-Chroma Section

- **Minimum numbers of external parts required.**
- **Stabilized with respect to variation of temperature and supply voltage.**
- **A few initial adjustment required.**

Deflection Section

- **Excellent temperature stability of horizontal oscillator.**
- **Exact 50% duty cycle output due to the 2-f_H oscillator and flip-flop circuit.**
- **Excellent inter-race.**
- **Stable Sync separator with V/H input terminals.**

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BLOCK DIAGRAM

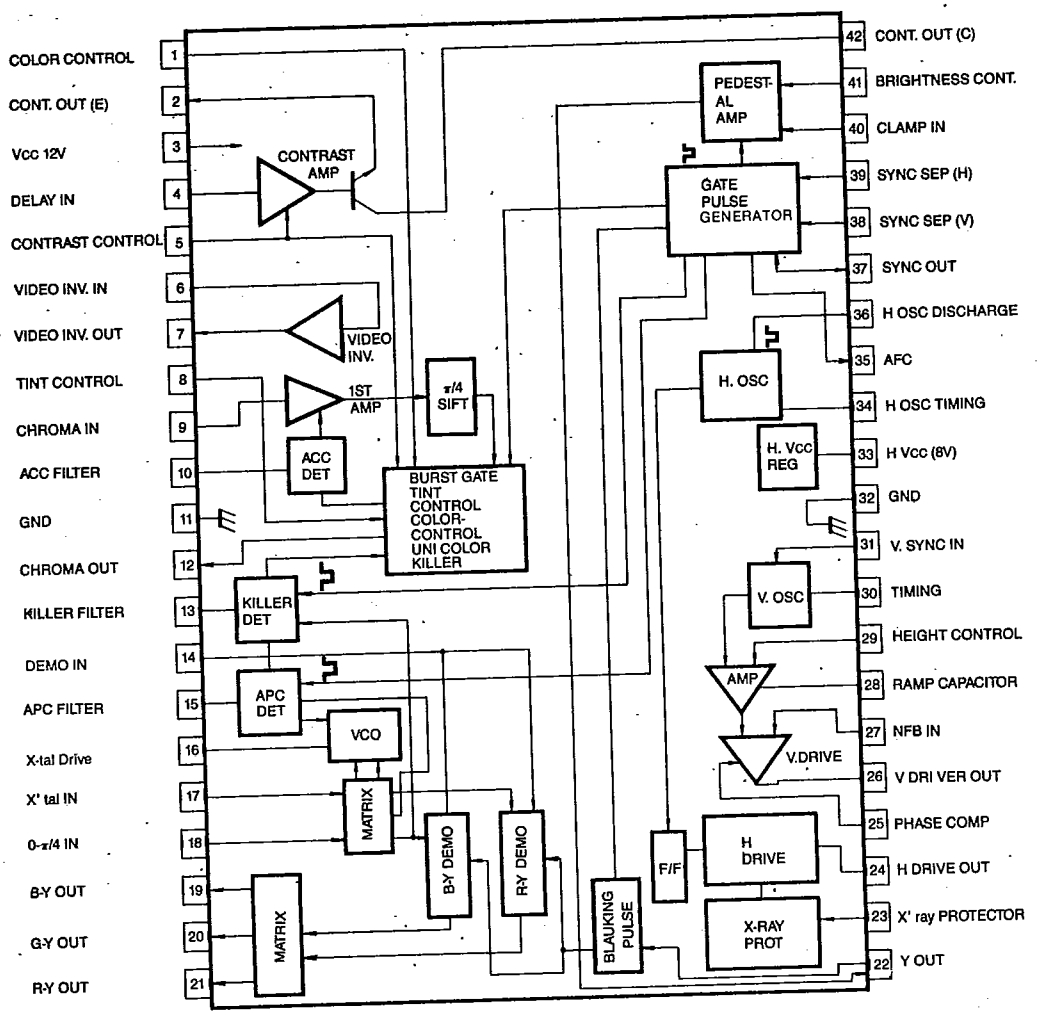

Fig. 1

KA2153 LINEAR INTEGRATED CIRCUIT

MAXIMUM RATINGS (T_a=25°C)

Characteristic	Symbol	Value	Unit
Supply Voltage	V_3 Max	15	V
Supply Current	I_{33} Max	40	mA
Input Signal Level	V_{in}	5	V_{P-P}
Demo. Min. Load Resistance	R_{LD}	1.8	KΩ
Horiz. Drive Peak Current	$-I_{24}$ Max	30	mA
Horiz. Drive Operating Current	$-I_{24}$	15	mA
Vert. Output Current	I_{26} Max	−5	mA
Sync separator Input Level	V_{38} Max V_{39} Max	8	V_{P-P}
Term.7 Max.Operating Current	I_7	5	mA
Term. 2 Max.Operating Current	I_2	4	mA
Power Dissipation (Note)	P_d	2.2	W
Operating Temperature	Topr	−20~65	°C
Storage Temperature	Tstg	−55~150	°C

Note: Derated above T_a=25°C in the proportion of 17.6mW/°C.

ELECTRICAL CHARACTERISTICS
VIDEO SECTION (Unless otherwise specified, V_3=12V, T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
12V Supply Current	I_{CC3}	Measure term. 3 current	60	82	100	mA	1
Video Gain	υ_{22}/υ_6	V_6=4.25V, υ_6: 4.0MHz, 1.0V_{P-P}, V_5=10V, V_B=8.0V	2.0	3.5	5.0	dB	2
Contrast Gain Control Range	ΔG_V	V_6=4.25V, υ_6: 500KHz, 1.0V_{P-P}, V_5: 5~10V 20 log (V_{22} (max)/V_{22} (min))	11.2	12.3	13.4	dB	2
Video Frequency Characteristics	ΔG_{vf}	V_6=4.25V, V_5=10V, V_B=8.0V υ_6=4.0MHz, 0.5MHz 1.0V_{P-P} 20 log (V_{22} (4MHz)/V_{22} (0.5MHz))	−3.5	−1.5	0.5	dB	2
DC Restoration Ratio	K	V_{41}=4.1V Change APL 10% to 90% Measure pedestal level change of term. 22	63	70	77	%	2
Maximum Video Output	υ_V MAX.	Term. 5 open. change V_{40} DC voltage, measure 90% of voltage change at term. 22	5.0	7.5	—	V_{P-P}	2

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ELECTRICAL CHARACTERISTICS
VIDEO SECTION (Unless otherwise specified, V_3=12V, T_a=25°C)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
Video DC Output Therm. Co-effic.	$\partial V_{22}/\partial T$	V_6=3.25V, V_{41}=4.1V T_a=−20 ~ +65°C	−2.5	0	2.5	mV/°C	2
Inverter Amplifier Gain	υ_7/υ_6	V_6=4.25V, υ_6: 4.0MHz, 1.0$V_{p\text{-}p}$, V_5=10V, V_B=8.0V	2.2	3.5	4.6	dB	2
Inverter Amplifier Differential Gain	DG_R	V_6: 3.3 ~ 5.2V υ_6: 3.58MHz, 100m$V_{P\text{-}P}$	—	2.5	10	%	2
Inverter Amplifier Differential Phase	DP_R	The same condition as above	—	3	5	deg	2
Inverter Amplifier Frequency Characteristics	ΔG_{Rf}	V_6=4.25V, V_5=10V, V_B=8.0V, υ_6: 4.0MHz, 500KHz, 1.0$V_{p\text{-}p}$ 20 log υ_7 (4MHz)/υ_7 (0.5MHz)	−3.5	−0.1	0.5	dB	2
Inverter Amplifier 3.58MHz Linearity	L_7	V_6=4.0V, υ_6=3.58MHz	1.6	—	—	$V_{p\text{-}p}$	2

CHROMA SECTION
(Unless otherwise specified. Gate Pulse and Blanking Pulse of TEST CIRCUIT 2 is Applied)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
Maximum Chroma Output	V_{CM}	V_1=12V, V_5=10V, V_8: open υ_9: 120m$V_{P\text{-}P}$ (B:C=1:1) V_G=8V, V_B=15V, measure term. 12	0.5	0.75	1.05	$V_{p\text{-}p}$	3
Burst Output	V_B	The same condition as above	0.45	0.70	0.95	$V_{p\text{-}p}$	3
ACC Characteristics (1)	V_a	V_1=12V, V_5=10V, V_8: open υ_9=15m$V_{p\text{-}p}$ (B:C=1:1) Measure chroma amplitude term. 12	0.16	0.34	—	$V_{p\text{-}p}$	3
ACC Characteristics (2)	A	V_9=100m$V_{p\text{-}p}$, 300m$V_{p\text{-}p}$ (B:C=1:1) Chroma amplitude ratio at term. 12 $A=\frac{V_{12}\,(V_9=300mV_{p\text{-}p})}{V_{12}\,(V_9=100mV_{p\text{-}p})}$	—	1.0	1.3	—	3
Color Control Residual Signal	V_{CS}	V_1=0V, V_5=10V, V_8: open S_1: 1, S_2: 1, V_G=8V, V_B=15V, υ_9=120m$V_{P\text{-}P}$ (B:C=1:1)	—	—	3	m$V_{p\text{-}p}$	3

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CHROMA SECTION
(Unless otherwise specified. Gate Pulse and Blanking Pulse of TEST CIRCUIT 2 is Applied)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
Uni Color Control Gain Range	Δe_{CU}	V_1=12.0V, V_5=5~10V, V_8: open, S_1: 1, S_2: 1, V_G=8V, V_B=15V v_9=120mV$_{P-P}$ (B:C=1:1)	7.5	8.5	9.5	dB	3
Uni Color Control Phase Range	$\Delta\Theta_{cu}$	The same as above. Burst chroma phase change at term. 12	—	4	10	deg	3
HUE Phase Control Range (1)	$\Delta\Theta_{bHI}$	V_1=12V, V_5=10V, V_8=0~12V, v_9=120mV$_{P-P}$, V_G=8V, V_B=15V Burst chroma phase change at term. 12 S_1:1, S_2:1	75	105	—	deg	3
HUE Phase Control Range (2)	$\Delta\Theta_{bH2}$	The same as above. Phase change from V_8 open	37	51	62	deg	3
Color Control Phase Change	$\Delta\Theta_{CC}$	V_1=0~12V, V_5: open, V_8: open v_9=120mV$_{P-P}$ (B:C=1:1) V_G=8V, V_B=15V, S_1:1, S_2:1	—	3	5	deg	3
Burst-Chroma Phase Difference	$\Delta\Theta_{bc}$	V_1: open The same as above	−8	0	8	deg	3
APC Pull-in Range	f_p	$\|v_{14}\|$=0.6V$_{p-p}$ (Burst) Measure term. 16 frequency Difference between f_c and f_o when APC is out	±250	±350	—	Hz	3
Killer Sensitivity	V_{bk}	v_{14} Burst amplitude when V_1=2V S_1:1, S_2:2	18	29	45	mV$_{p-p}$	3
Residual Carrier of Demodulator Output	V_{car} R V_{car} G V_{car} B	v_{14}: AC GND 3.58MHz component at term. 19, 20 and 21. S_1:1, S_2: 2	—	—	300	mV$_{p-p}$	3
Color Difference Signal Output	V_{OR} V_{OG} V_{OB}	S_1:1, S_2:2 v_{14}: 3.56954MHz, 0.2V$_{P-P}$ CW: 3.579545MHz	1.45 0.49 1.55	1.85 0.62 1.95	2.3 0.77 2.42	V$_{p-p}$	3
Color Difference Signal Relative Output	R-Y/B-Y G-Y/B-Y	The same as above	0.85 0.25	0.95 0.31	1.05 0.38	—	3
Color Difference Signal Maximum Output	V_{ORM} V_{OGM} V_{OBM}	S_1:1, S_2:2 v_{14}: 3.56945MHz, 1.2V$_{P-P}$ CW: 3.579545MHz	4.5 1.4 4.5	5.5 1.8 5.5	— — —	V$_{p-p}$	3

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CHROMA SECTION
(Unless otherwise specified. Gate Pulse and Blanking Pulse of TEST CIRCUIT 2 is Applied)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
Relative Phase	Θ_{R-Y}	S_1:, S_2:2, υ_{14}: Burst 0.6V_{P-P} Chroma 0.2V_{P-P}	100	107	112	deg	3
	Θ_{G-Y}		230	240	250		
Demodulator Band Width	f_{BR} f_{BG} f_{BB}	S_1:1, S_2:2 υ_{14}: 10KHz ~ 5MHz, 0.2V_{P-P} −3dB Frequency (0dB; 10KHz)	1.13	1.77	3.16	MHz	3
Blanking Operation Voltage	$V_{\#22B}$	S_1:1, S_2:2 υ_{14}: Burst 0.6V_{P-P}, Chroma 0.2V_{P-P} Blanking pulse height when Demo. output is disappear	10.4	11.1	—	V	3
Demodulator Output DC Voltage	V_{OR} V_{OG} V_{OB}	S_1:1, S_2:2 V_{14}: AC GND	7.00	7.71	8.35	V	1
Demodulator Output Difference Voltage	$V_{O(R-G)}$ $V_{O(R-B)}$ $V_{O(B-G)}$	The same as above	−0.3	—	0.3	V	1
Demodulator DC Output Thermal Co-efficient	$\Delta V_{OR}\theta$ $\Delta V_{OG}\theta$ $\Delta V_{OB}\theta$	The same as above T_a = −20°C ~ 65°C	−3	0	2	mV/°C	1
DC Output Voltage Difference Component Thermal Co-efficient	$\Delta V_{O(R-G)}\theta$ $\Delta V_{O(R-B)}\theta$ $\Delta V_{O(B-G)}\theta$	The same as above	−2	0	2	mV/°C	1
Color Control Terminal Voltage	V_1	Measure term. 1 open circuit voltage	5.4	6.0	6.52	V	1
Uni-color Control Terminal Voltage	V_5	Measure term. 5 open circuit voltage	6.9	7.5	8.02	V	1
HUE Control Terminal Voltage	V_8	Measure term. 8 open circuit voltage	5.4	6.0	6.52	V	1

HORIZONTAL SECTION

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
Horizontal V_{CC}	V_{33}	V_B=20.3V	7.4	8.2	9.0	V	1
Recommendable Supply Current	I_{33}	—	22	26	30	mA	1
Horizontal Frequency	f_H	S_{39}:b, S_{38}:b, S_{35}: on, V_x=4V	15.069	15.569	16.069	KHz	4
f_H Thermal Drift	Δf_{HT}	The same as above T_a=−20~60°C	−70	80	230	Hz	4
AFC Clamping Voltage	V_{CL}	Measure term. 35 open Circuit Voltage S_1: on	3.71	4.20	4.75	V	1
AFC Input Current	I_{IN35}	S_1: on, S_5:2	2.2	3.62	5.1	mA	1
AFC Output Current	I_{O35}	S_1: on, S_5:1	2.4	3.99	5.6	mA	1
Horizontal Drive Saturation Voltage	V_{OL24}	S_1: on, S_3: on measure V_{24}	—	—	0.3	V	1
Horizontal Drive Output Duty Cycle	T_{O24}	S_{39}:b, S_{38}:b, S_{35}: open V_X=4V. $\frac{\text{H Level Period}}{\text{1 Cycle Period}} \times 100$ Measure υ_{24} wave form	45	50	55	%	4
Oscillator Starting Voltage	V_{33} (min)	Minimum V_{33} when output Duty of term. 24 in 50%	—	—	4.0	V	4
Starting Supply Current	I_{33} (min)	V_{33}=4V, Measure I_{33}	5.5	8.8	11.5	mA	4
AFC Pull-in Range	$\Delta f_{H\,PULL}$	S_{38}:a, S_{35}:ON, S_{39}:a Changing V_x, measure Pull-in range	—	±600	—	Hz	4
AFC Hold-in Range	$\Delta f_{H\,HOLD}$	The same as pull-in range. Measure hold-in range.	—	±1000	—	Hz	4
X-ray Protector Voltage Sensitivity	V_{IN23}	Measure V_{23} when V_{24} Output becames L, level. T_a=25°C	0.50	0.88	1.10	V	4
X-ray Protector Current Sensitivity	I_{IN23}	Measure I_{23} when υ_{24} Output becames L level. T_a=25°C	0.060	0.178	1.00	μA	4
X-ray Protector Operating Voltage	$V_{IN23\theta}$	The same as V_{IN23} T_a=−20~65°C	0.30	0.88	1.28	V	4
X-ray Protector Operating Current	$I_{IN23\,\theta}$	The same as I_{IN23} T_a=−20~65°C	0.03	0.178	2.0	μA	4

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SYNC SEPARATOR

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
Syncseparator Sensitivity (1)	I_{IN39}	Term. 38: open Measure I_{39} when V_{37} is L→H.	18.1	35.0	113	μA	4
Syncseparator Sensitivity (2)	I_{IN38}	Term. 39: open Measure I_{38} same as above	13.3	21.4	54.2	μA	4
Sync Output H Level	V_{OH37}	Term. 38: open	7.04	8.19	9.34	V	4
Sync Output L Level	V_{OL37}		0	1.5	2.4	V	4
Sync Clamp Voltage	V_{CL31}	Measure V_{31} at $I_{31}=-1mA$	−0.85	−0.63	−0.5	V	4

VERTICAL (Unless otherwise specified, $V_{CC}=12V$, $T_a=25°C$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
Vert Freerunning Frequency	f_V	S_{31}: ON, measure term. 28	56	60	64	Hz	4
Retrace Time	T_r	Term. 28 output pulse	500	690	850	μs	4
f_V Pull-in Range	$\Delta f_{V\,PULL}$	S_{31}: ON/OFF, term. 30-VR S_{31}: OFF $f_{OSC28}=60Hz$ S_{31}: ON measure f_{OSC28} $\Delta f_{V\,PULL}=f_{OSC}$ 28-60Hz	11.1	12.1	12.9	Hz	4
Ramp Maximum Voltage	V_{O28}	$V_{30}=6V$, measure V_{28}	7.05	7.65	8.25	V	1
Ramp Maximum Current	I_{O28}	$V_{30}=6V$, measure I_{28}, S_6: ON	16.7	26.8	48.4	mA	1
Maximum Common Mode Input Voltage	V_{IH28}	S_{26}, S_{27}: ON, $V_{30}=0V$ V_{28}: 6→12V, measure V_{28} when V_{27} is saturate.	11.9	—	—	V	4
Minimum Common Mode Input Voltage	V_{IL28}	V_{28}: 6→0V The same as above	—	2.86	3.7	V	4
Terminal 28 Input Current	I_{I28}	S_{26}, S_{27}: ON, $V_{30}=0V$. Measure I_{28} at $V_{28}=6V$	0.25	0.98	4.50	μA	4
Terminal 27 Input Current	I_{I27}	The same as above. Measure I_{27} at $V_{28}=6V$	0.18	0.94	6.21	μA	4
Maximum Vertical Output Voltage	V_{OH26}	S_{26}: OFF, S_{27}: ON, $V_{30}=6V$ Measure V_{26}	5.6	6.3	7.2	V	4
Minimum Vertical Output Voltage	V_{OL26}	S_{26}, S_{27}: OFF, $V_{30}=6V$ Measure V_{26}	—	—	0.3	V	4
Terminal 29 Bias Voltage	V_{29}	Measure V_{29} when $I_{29}=-0.2mA$	3.7	3.9	4.1	V	4

KA2153 LINEAR INTEGRATED CIRCUIT

TEST CIRCUIT 1 (DC)

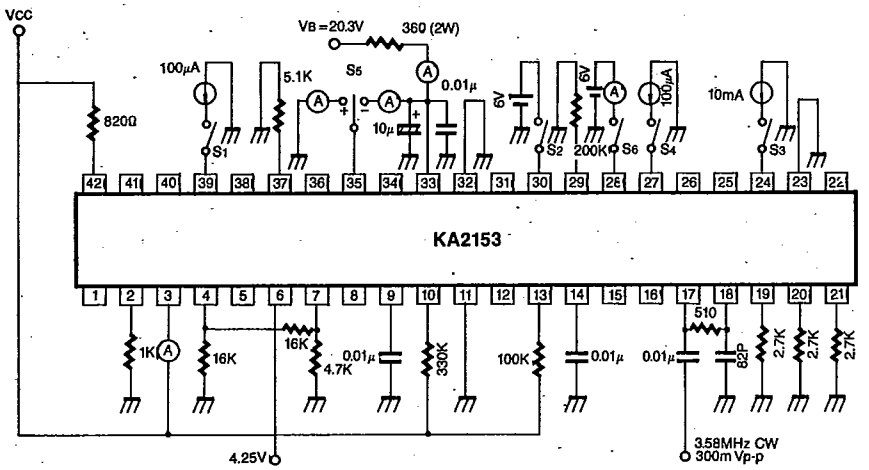


Fig. 2

TEST CIRCUIT 2 (Video)

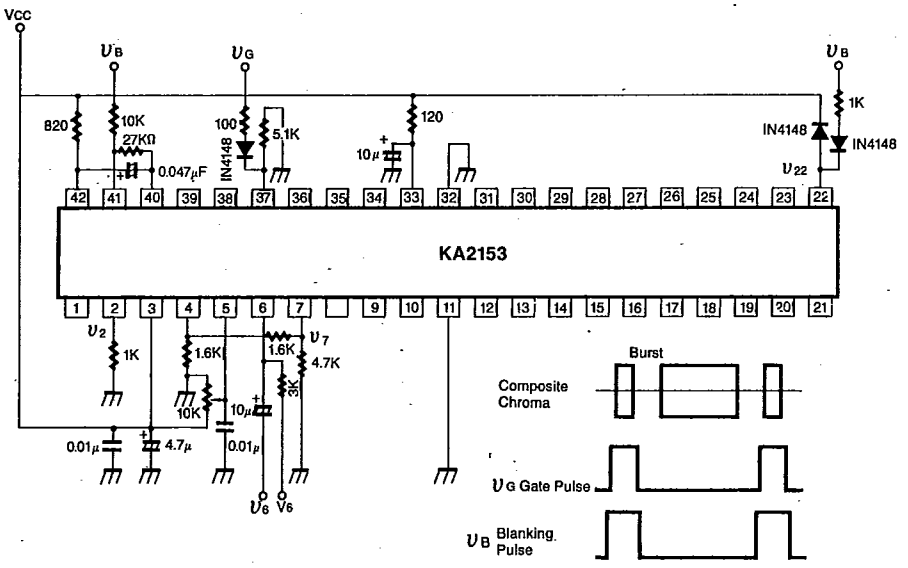


Fig. 3

TEST CIRCUIT 3 (Chroma OSC, Demo.)

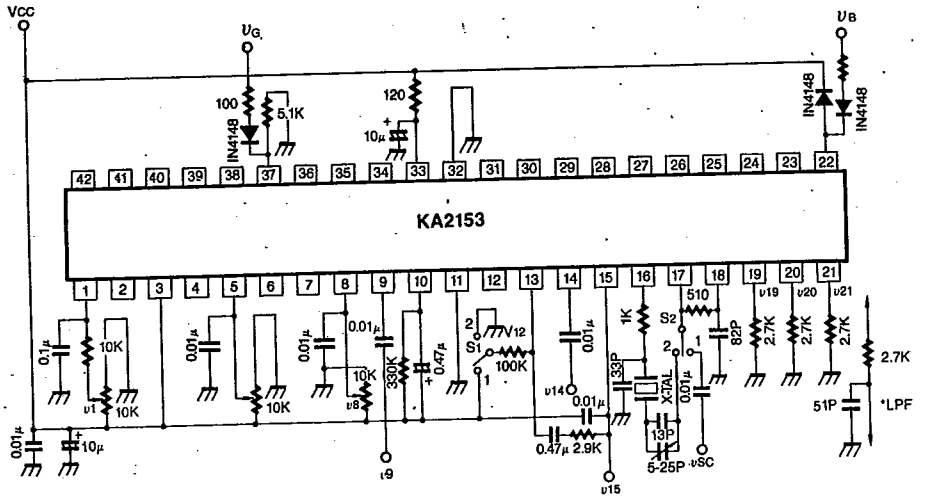
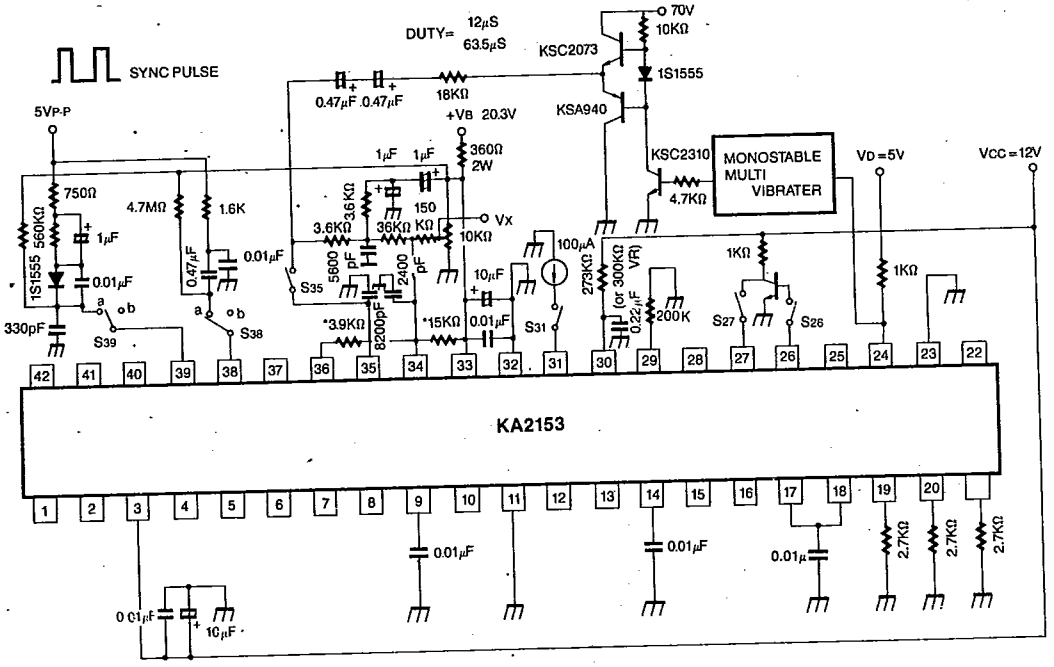
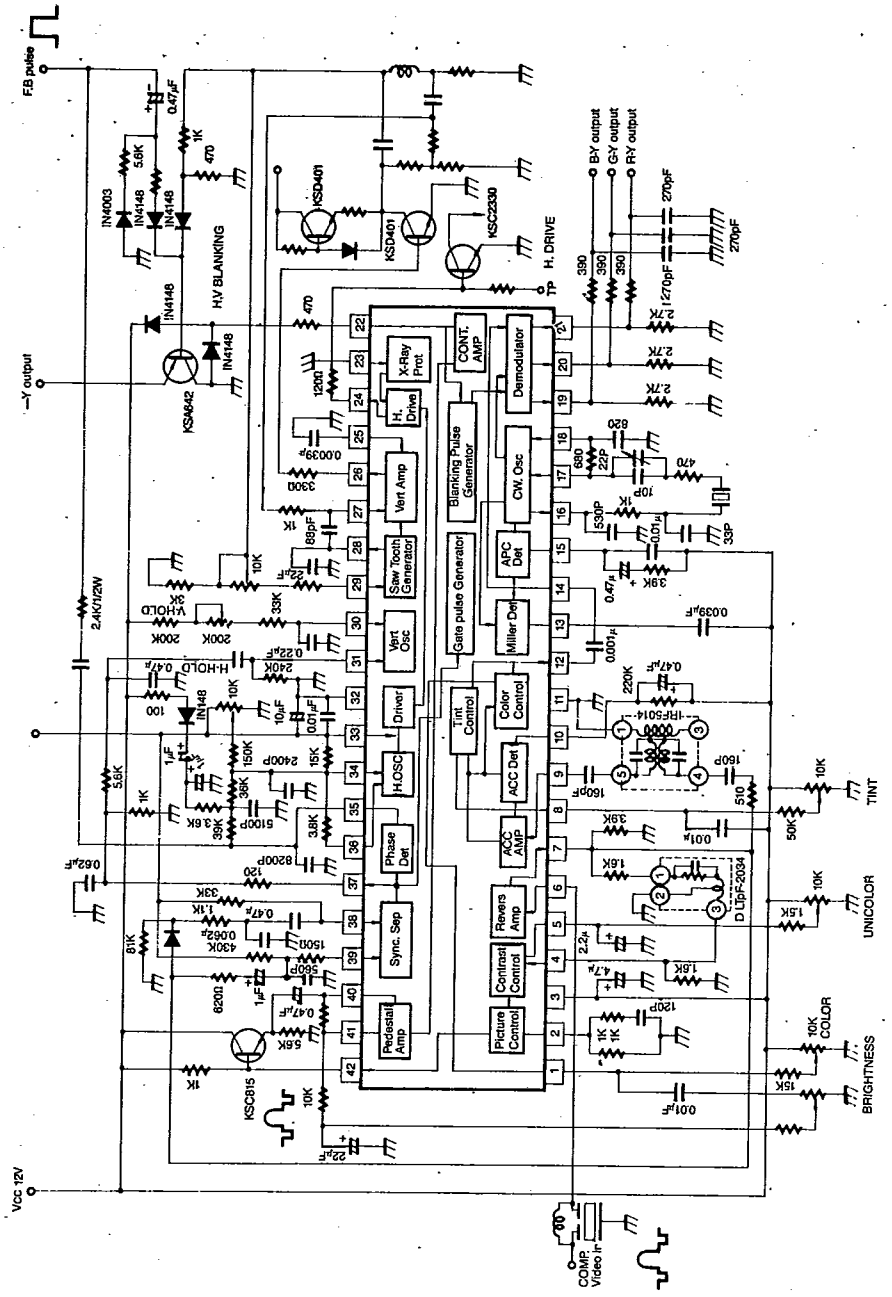


Fig. 4

TEST CIRCUIT 4 (Horizontal, Vertical)



TYPICAL APPLICATION CIRCUIT