

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.

FUNCTIONS

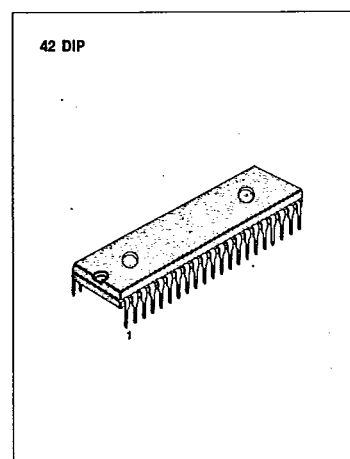
- Inverter-amplifier
- Contrast control
- Pedestal clamp
- Brightness control
- ACC-amplifier
- Tint control
- Uni-color control
- 3.58MHz V_{CC}
- APC
- Color-Killer
- Color demodulator
- Matrix circuit
- Sync-separator (H.V.sync in)
- $2f_H$ horizontal oscillator
- Flip-flop
- Stabilized horizontal 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 $2f_H$ oscillator and flip-flop circuit.
- Excellent inter-race.
- Stable Sync separator with V/H input terminals.



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BLOCK DIAGRAM

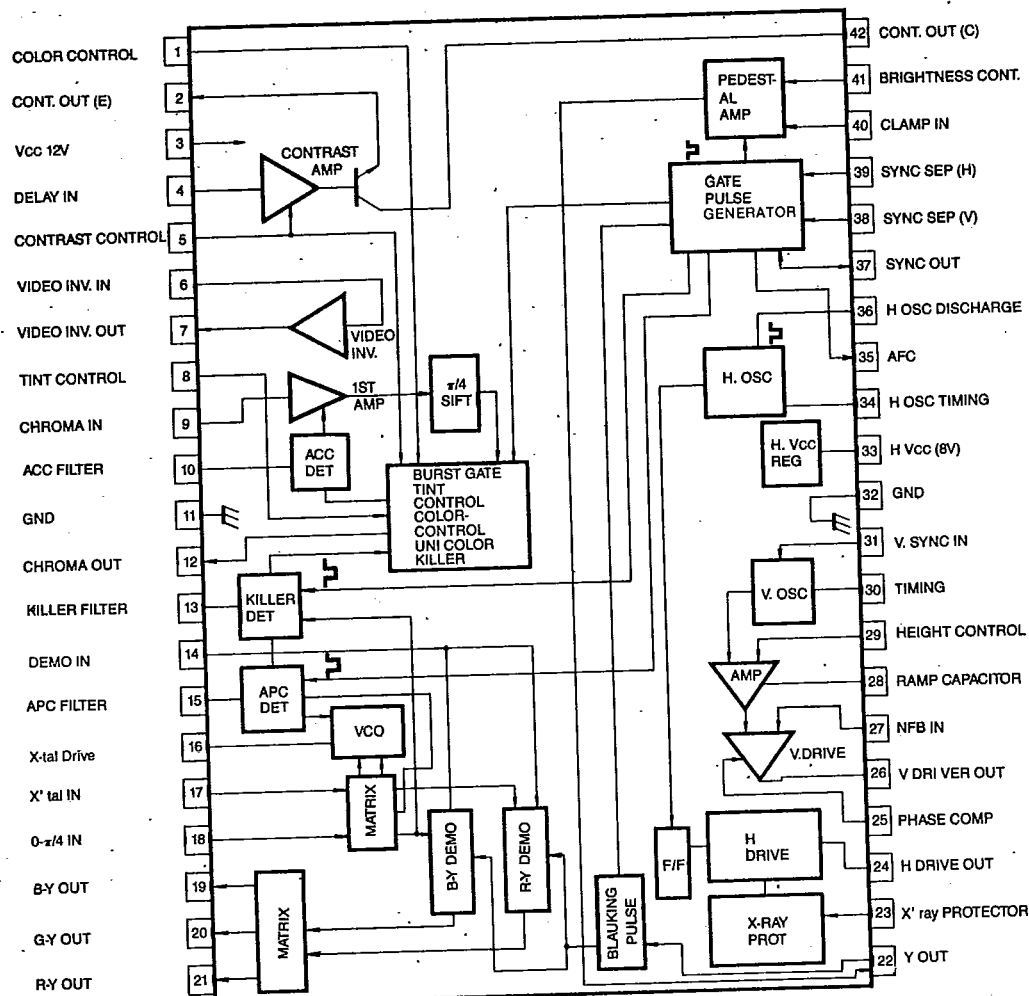


Fig. 1

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LINEAR INTEGRATED CIRCUIT

MAXIMUM RATINGS ($T_a=25^\circ\text{C}$)

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	$K\Omega$
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	T_{opr}	-20 ~ 65	$^\circ\text{C}$
Storage Temperature	T_{stg}	-55 ~ 150	$^\circ\text{C}$

Note: Derated above $T_a=25^\circ\text{C}$ in the proportion of $17.6\text{mW}/^\circ\text{C}$.

ELECTRICAL CHARACTERISTICS

VIDEO SECTION (Unless otherwise specified, $V_3=12\text{V}$, $T_a=25^\circ\text{C}$)

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	U_{22}/U_6	$V_6=4.25\text{V}$, $v_6: 4.0\text{MHz}$, $1.0V_{p-p}$, $V_5=10\text{V}$, $V_B=8.0\text{V}$	2.0	3.5	5.0	dB	2
Contrast Gain Control Range	ΔG_V	$V_6=4.25\text{V}$, $v_6: 500\text{KHz}$, $1.0V_{p-p}$, $V_5: 5\sim 10\text{V}$ $20 \log (V_{22}(\text{max})/V_{22}(\text{min}))$	11.2	12.3	13.4	dB	2
Video Frequency Characteristics	ΔG_{vf}	$V_6=4.25\text{V}$, $V_5=10\text{V}$, $V_B=8.0\text{V}$ $v_6=4.0\text{MHz}$, 0.5MHz $1.0V_{p-p}$ $20 \log (V_{22}(4\text{MHz})/V_{22}(0.5\text{MHz}))$	-3.5	-1.5	0.5	dB	2
DC Restoration Ratio	K	$V_{41}=4.1\text{V}$ Change APL 10% to 90% Measure pedestal level change of term. 22	63	70	77	%	2
Maximum Video Output	U_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, $V_3=12V$, $T_a=25^\circ C$)

Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
Video DC Output Therm. Co-ffic.	$\partial V_{22}/\partial T$	$V_6=3.25V$, $V_{A1}=4.1V$ $T_a=-20 \sim +65^\circ C$	-2.5	0	2.5	mV/ $^\circ C$	2
Inverter Amplifier Gain	v_7/v_6	$V_6=4.25V$, $v_6: 4.0MHz$, $1.0V_{P-P}$, $V_5=10V$, $V_B=8.0V$	2.2	3.5	4.6	dB	2
Inverter Amplifier Differential Gain	DG_R	$V_6: 3.3 \sim 5.2V$ $v_6: 3.58MHz$, $100mV_{P-P}$	—	2.5	10	%	2
Inverter Amplifier Differential Phase	DP_R	The same condition as above	—	3	5	deg	2
Inverter Amplifier Frequency Characteristics	ΔG_{RI}	$V_6=4.25V$, $V_5=10V$, $V_B=8.0V$, $v_6: 4.0MHz$, $500KHz$, $1.0V_{P-P}$ 20 log v_7 (4MHz)/ v_7 (0.5MHz)	-3.5	-0.1	0.5	dB	2
Inverter Amplifier 3.58MHz Linearity	L_7	$V_6=4.0V$, $v_6=3.58MHz$	1.6	—	—	V_{P-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_6 : open $v_9: 120mV_{P-P}$ (B:C=1:1) $V_6=8V$, $V_B=15V$, measure term. 12	0.5	0.75	1.05	V_{P-P}	3
Burst Output	V_B	The same condition as above	0.45	0.70	0.95	V_{P-P}	3
ACC Characteristics (1)	V_a	$V_1=12V$, $V_5=10V$, V_6 : open $v_9=15mV_{P-P}$ (B:C=1:1) Measure chroma amplitude term. 12	0.16	0.34	—	V_{P-P}	3
ACC Characteristics (2)	A	$V_9=100mV_{P-P}$, $300mV_{P-P}$ (B:C=1:1) Chroma amplitude ratio at term. 12 $A = \frac{V_{12}(V_9=300mV_{P-P})}{V_{12}(V_9=100mV_{P-P})}$	—	1.0	1.3	—	3
Color Control Residual Signal	V_{CS}	$V_1=0V$, $V_5=10V$, V_6 : open $S_1: 1$, $S_2: 1$, $V_6=8V$, $V_B=15V$, $v_9=120mV_{P-P}$ (B:C=1:1)	—	—	3	mV_{P-P}	3



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CHROMA SECTION

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Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
Uni Color Control Gain Range	$\Delta\theta_{CU}$	$V_1=12.0V, V_5=5\sim 10V,$ $V_8: \text{open}, S_1: 1, S_2: 1,$ $V_G=8V, V_B=15V$ $v_9=120mV_{P-P} (B:C=1:1)$	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)	$\Delta\theta_{BH1}$	$V_1=12V, V_5=10V,$ $V_8=0\sim 12V, v_9=120mV_{P-P},$ $V_G=8V, V_B=15V$ 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	$\Delta\theta_{CC}$	$V_1=0\sim 12V, V_5: \text{open},$ $V_8: \text{open}$ $v_9=120mV_{P-P} (B:C=1:1)$ $V_G=8V, V_B=15V, S_1:1, S_2:1$	—	3	5	deg	3
Burst-Chroma Phase Difference	$\Delta\theta_{BC}$	$V_1: \text{open}$ 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	$V_{car R}$ $V_{car G}$ $V_{car B}$	$v_{14}: \text{AC GND}$ 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}	$S_1:1, S_2:2$	1.45	1.85	2.3	V_{P-P}	3
	V_{OG}	$v_{14}: 3.56954\text{MHz}, 0.2V_{P-P}$	0.49	0.62	0.77		
	V_{OB}	CW: 3.579545MHz	1.55	1.95	2.42		
Color Difference Signal Relative Output	R-Y/B-Y	The same as above	0.85	0.95	1.05	—	3
	G-Y/B-Y		0.25	0.31	0.38		
Color Difference Signal Maximum Output	V_{ORM}	$S_1:1, S_2:2$	4.5	5.5	—	V_{P-P}	3
	V_{OGM}	$v_{14}: 3.56945\text{MHz}, 1.2V_{P-P}$	1.4	1.8	—		
	V_{OBM}	CW: 3.579545MHz	4.5	5.5	—		



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CHROMA SECTION

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Characteristic	Symbol	Test Conditions	Min	Typ	Max	Unit	Test Fig
Relative Phase	θ_{RY}	$S_1:1, S_2:2, V_{14}$: 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}	$S_1:1, S_2:2$ V_{14} : 10KHz ~ 5MHz; $0.2V_{p-p}$ -3dB Frequency (0dB; 10KHz)	1.13	1.77	3.16	MHz	3
Blanking Operation Voltage	V_{K22B}	$S_1:1, S_2:2$ V_{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 $T_a = -20^\circ\text{C} \sim 65^\circ\text{C}$	-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



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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 $T_a = -20 \sim 60^\circ C$	-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}	$S_{39}:b, S_{38}:b, S_{35}: open$ $V_x = 4V.$ $\frac{H \text{ Level Period}}{1 \text{ Cycle Period}} \times 100$ Measure v_{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	$\Delta f_{H \text{ PULL}}$	$S_{38}:a, S_{35}: ON, S_{39}:a$ Changing $V_x,$ measure Pull-in range	—	± 600	—	Hz	4
AFC Hold-in Range	$\Delta f_{H \text{ HOLD}}$	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 becomes L. level. $T_a = 25^\circ C$	0.50	0.88	1.10	V	4
X-ray Protector Current Sensitivity	I_{IN23}	Measure I_{23} when v_{24} Output becomes L level. $T_a = 25^\circ C$	0.060	0.178	1.00	μA	4
X-ray Protector Operating Voltage	$V_{IN23 \theta}$	The same as V_{IN23} $T_a = -20 \sim 65^\circ C$	0.30	0.88	1.28	V	4
X-ray Protector Operating Current	$I_{IN23 \theta}$	The same as I_{IN23} $T_a = -20 \sim 65^\circ C$	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, $V_{CC} = 12V$, $T_a = 25^\circ C$)

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	Δf_{VPULL}	S_{31} : ON/OFF, term. 30-VR S_{31} : OFF $f_{OSC28} = 60Hz$ S_{31} : ON measure f_{OSC28} $\Delta f_{VPULL} = f_{OSC} 28-60Hz$	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



